

Recognised standard 01

Underground electrical equipment and electrical installations

October 2018

Coal Mining Safety and Health Act 1999

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Recognised Standards

This document is issued in accordance with PART 5—RECOGNISED STANDARDS and Section 37(3) of the *Coal Mining Safety and Health Act 1999*.

PART 5 - RECOGNISED STANDARDS

71 Purpose of recognised standards

A standard may be made for safety and health (a “recognised standard”) stating ways to achieve an acceptable level of risk to persons arising out of coal mining operations.

72 Recognised standards

- (1) The Minister may make recognised standards.
- (2) The Minister must notify the making of a recognised standard by gazette notice.
- (3) The chief executive must keep a copy of each recognised standard and any document applied, adopted or incorporated by the recognised standard available for inspection, without charge, during normal business hours at each department office dealing with safety and health.
- (4) The chief executive, on payment by a person of a reasonable fee decided by the chief executive, must give a copy of a recognised standard to the person.

73 Use of recognised standards in proceedings

A recognised standard is admissible in evidence in a proceeding if—

- (a) the proceeding relates to a contravention of a safety and health obligation imposed on a person under part 3; and
- (b) it is claimed that the person contravened the obligation by failing to achieve an acceptable level of risk; and
- (c) the recognised standard is about achieving an acceptable level of risk.

PART 3- SAFETY AND HEALTH OBLIGATION

37. How obligation can be discharged if regulation or recognised standard made

- 37(3) if a recognised standard states a way or ways of achieving an acceptable level of risk, a person discharges the person’s safety and health obligation in relation to the risk only by—
- (a) adopting and following a stated way; or
 - (b) adopting and following another way that achieves a level of risk that is equal to or better than the acceptable level.”

Where a part of a recognised standard or other normative document referred to therein conflicts with the *Coal Mining Safety and Health Act 1999* or the *Coal Mining Safety and Health Regulation 2017*, the Act or Regulation takes precedence.

This recognised standard is issued under the authority of the Minister for Natural Resources, Mines and Energy.

[Gazetted October 2018]

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1 Purpose

The purpose of this standard is to establish the minimum standards for the selection, installation, maintenance and operation of electrical equipment and electrical installations in an underground coal mine.

2 Scope

This standard applies to electrical equipment and electrical installations below ground in an underground coal mine and electrical equipment and electrical installations on the surface directly associated with the underground operations of a coal mine. This standard does not apply to the general surface of an underground coal mine.

3 Application Framework

The electrical equipment and electrical installations in an underground coal mine require high standards of design, installation and maintenance, particularly in the hazardous areas of the mine – referred in this standard as “explosion risk zones”. To this end reliance on *standard or normal* electrical equipment and electrical installations is not sufficient to achieve the necessary levels of risk. This standard indicates the additional requirements that may be necessary to achieve an acceptable level of risk.

NOTE: RECOGNISED STANDARDS ARE NOT MANDATORY

Recognised standards are not mandatory; but when followed provide a way of meeting safety and health obligations. A person may adopt another way of managing that risk; however, in the event of an incident the person may be required to show that the method adopted was equivalent to the method in the recognised standard.

4 Technical Guidance

4.1 General

Electrical installations should be of a design and standard in accordance with **AS/NZS 3000:2007** Electrical Installations (known as Australian/New Zealand Wiring Rules) where applicable.

4.2 Hazard Assessment

Assessment of the potential hazards of the operation of electrical equipment and installations must be taken into account to ensure that the risk to the safety and health of persons is minimised.

4.3 Isolation of Equipment

Electrical equipment and cable connectors, other than IS and ELV circuits, must be provided with facilities for locking the electrical supply in a safe or isolated position.

4.4 Electrical Equipment in an Explosion Risk Zone (ERZ)

Fixed, mobile and transportable electrical equipment, other than electrical equipment associated with hot work or live testing, installed or operated in an ERZ must be suitably certified by a nationally accredited testing station and constructed, installed and operated in accordance with the relevant standards published by Standards Australia: The status of electrical equipment which was approved under the *Coal Mining Act 1925* immediately before to commencement of the *Coal Mining Safety and Health Act 1999* is outlined in Part 20 – Transitional provisions and repeals, of the latter Act.

The equipment must be suitable for use in an underground coal mine.

4.5 Protection Techniques

Protection techniques for electrical equipment and electrical installations in explosion risk zones		
Description of protection technique	Relevant Australian Standard and symbol	Remarks
Explosion risk zone 0 (ERZ0)		
Intrinsically safe	AS/NZS 60079.11 Ex ia	
Special protection	AS/NZS 1826 Ex s	In accord with Australian Standards for Zone 0
Caplights for use in mines susceptible to firedamp	AS/NZS 62013.1 Ex l	
Explosion risk zone 1 (ERZ1)		
Intrinsically safe	AS/NZS 60079.11 Ex ib	
Special protection	AS/NZS 1826 Ex s	In accord with Australian Standards for Zone 1
Flameproof enclosure	AS/NZS 60079.1 Ex d	
Encapsulated	AS/NZS 60079.18 Ex m	
Pressurized rooms or enclosures	AS 2380.4 / AS/NZS 60079.2 Ex p	In accord with Australian Standards for Zone 1
Increased safety	AS/NZS 60079.7 Ex e	Additional mechanical protection may be required
Ventilation	AS 1482 Ex v	In accord with Australian Standards for Zone 1

Equipment suitable for use in ERZ0 can also be used in ERZ1. Equipment suitable for use in an ERZ1 can also be used in a Negligible-Explosion Risk Zone (NERZ). ERZ0, ERZ1 and NERZ are as defined in the *Coal Mining Safety and Health Regulation 2017*.

4.6 Nationally Accredited Testing Stations

The following organisations are nationally accredited testing stations:

- 4.6.1 Simtars
2 Smith Street
REDBANK QLD 4301
- 4.6.2 TestSafe Australia
919 Londonderry Road
LONDONDERRY NSW 2573
- 4.6.3 Ex Testing and Certification Pty Ltd
30 Kennington Drive
TOMAGO NSW 2322
- 4.6.4 Mine Safety Technology Centre
8 Hartley Drive
THORNTON NSW 2322

4.7 Location of Electrical Equipment

The installation of electrical equipment, other than portable or mobile equipment, signalling equipment or telephones and accessories, should be subject to the following requirements:

- 4.7.1 The equipment should be housed in a room, recess or area set aside for the purpose.
- 4.7.2 The room, recess or area should be constructed to provide adequate height and working space.
- 4.7.3 Flammable material should not be stored in any location adjacent to electrical equipment.
- 4.7.4 The room, recess or area should be constructed so as to protect the equipment from damage by falls of ground or from passing traffic, and must be kept clean of all debris.
- 4.7.5 The room, recess or area should be adequately ventilated, having regard to the type of equipment and its use.
- 4.7.6 The room, recess or area should have adequate lighting.

4.8 Liquid Filled Electrical Transformers and Switchgear

4.8.1 Installation

- 4.8.1.1 A formal risk assessment must be undertaken prior to the installation and operation of liquid filled electrical transformers and switchgear.
- 4.8.1.2 Electrical transformers and switchgear containing combustible liquid should not be installed within 25 metres of any shaft bottom, or within 25 metres of where any roadway, drive, drift or other passage opens into the shaft.
- 4.8.1.3 A transformer of the liquid immersed type should be placed in or above a specially prepared sump or container capable of containing the liquid content of the transformer.
- 4.8.1.4 There should be no combustible material exposed or stored in any roadway, room or recess that is used for housing electrical equipment containing combustible liquid.
- 4.8.1.5 The location of electrical transformers and switchgear containing combustible liquid should be ventilated with provision for short-circuiting to return airway the products of combustion if a fire occurred.

4.8.2 Operation

- 4.8.2.1 Over-temperature protection should be provided on liquid immersed transformers for liquid and windings. In the event of a high temperature being detected the power to the transformer must be automatically disconnected.
- 4.8.2.2 The liquid contained in electrical equipment should be such that infrequent contact will not result in long-term health problems.

4.9 Maintenance and overhaul of explosion protected equipment

The maintenance and overhaul of electrical equipment installed and/or operated or intended to be installed and/or operated in an ERZ0 or ERZ1 should be in accordance with the relevant Australian Standards.

4.10 Maintenance of electrical equipment and electrical installations

A system of planned maintenance, including the maintenance of relevant records, must be instituted for all electrical equipment and electrical installations.

4.11 Inspection and testing

4.11.1 Routine testing

4.11.1.1 The frequency with which the routine inspections and tests of the electrical equipment and electrical installations at the mine are to be carried out must be developed and recorded.

4.11.1.2 Routine testing of the electrical equipment and electrical installations including earthing systems must be carried out by competent persons using appropriate testing equipment.

4.11.1.3 The following routine inspections and tests of electrical equipment and electrical installations should be carried out:-

4.11.1.3.1 An inspection of all electrical equipment including the enclosure, doors and covers of all electrical switchgear used at the mine, and all earthing conductors.

4.11.1.3.2 A test of the insulation of every electrical lighting and power circuit below ground, including all electrical equipment forming part of, or in connection with such circuits, either collectively or in parts.

4.11.1.3.3 A test of the electrical conductance of all earthing conductors and metallic coverings if used as such as well as a test of the insulation resistance of each conductor of every trailing cable.

4.11.1.3.4 Inspections of electrical equipment in explosion risk zones must be carried out in accordance with **AS/NZS 2290.1:2014** Electrical equipment for coal mines – Introduction, inspection and maintenance – For hazardous areas.

4.11.2 Recording of tests

The results of the tests and examinations prescribed in 4.11.1 above must be recorded.

4.11.3 New equipment

All new electrical equipment and electrical installations, including that re-erected in a new position in the mine, must be examined and tested before being put into service.

4.12 Routine Testing of high voltage installations

Routine testing of all high voltage apparatus and cables must be carried out at intervals indicated by factors including:

4.12.1 The history of previous faults and failures,

4.12.2 Equipment usage,

4.12.3 Age,

4.12.4 History of operation of protection systems,

4.12.5 Manufacturer's recommendations, and

4.12.6 Backup protection.

4.13 Operation of portable electrical equipment

4.13.1 The use of certified portable electrical equipment in an ERZ

Portable electrical equipment operated in an ERZ should be suitably certified by a nationally accredited testing station, and constructed and operated in accordance with the relevant Australian Standards. The use of certified portable electrical equipment in an ERZ is not a

trivial exercise, and apparatus shall only be used in this application where it is required for the functioning of the mine.

The status of electrical equipment which was approved under the *Coal Mining Act 1925* immediately before to commencement of the *Coal Mining Safety and Health Act 1999* is outlined in Part 20 – Transitional provisions and repeals, of the latter Act.

4.13.2 The use of uncertified portable electrical equipment in an ERZ

- 4.13.2.1 Uncertified portable electrical equipment must not be operated in an ERZ0.
- 4.13.2.2 Uncertified portable electrical equipment must not be used in an ERZ1 if certified equipment is available that is equally suitable for the task. Even then, the use of portable uncertified electrical equipment in an ERZ1 is not a trivial matter and should only be undertaken where it is required for the functioning of the mine.
- 4.13.2.3 A formal risk assessment must be undertaken prior to the use of uncertified portable electrical equipment in an ERZ1. The results of the risk assessment must be documented and an operating procedure developed there from.
- 4.13.2.4 Only persons authorised in writing by the underground mine manager and the electrical engineering manager must operate the equipment.
- 4.13.2.5 Prior to taking the equipment underground it must be inspected by appropriately qualified electrical personnel authorised by the Manager and must not be dismantled for adjustment of internal circuitry or repaired underground.
- 4.13.2.6 After use the equipment must be withdrawn from the mine.
- 4.13.2.7 The Manager must ensure that the equipment is not to be used in any location where the percentage of methane in the general body of air exceeds 0.5% by volume.
- 4.13.2.8 Any batteries used by the equipment must not be replaced in an ERZ1.
- 4.13.2.9 The equipment must be accompanied at all times by a person trained in the use of and must have in his possession a certified continuously reading methanometer with its methane alarm preset to activate at 0.5% by volume. The ERZ controller must be advised of the presence of the equipment in his section.
- 4.13.2.10 Should any defect on the equipment be detected at any time, the equipment must be immediately withdrawn from underground.
- 4.13.2.11 Persons authorised under subclause 4.13.2.4 of this standard must make a full report on the use of this equipment. The report must be kept at the mine and must record as a minimum the date, time the equipment was underground, and a signed statement confirming that subclauses 4.13.2.1 to 4.13.2.9 have been fulfilled.
- 4.13.2.12 Upon failure of the mine ventilation system in the area where the equipment is being used, the equipment must be withdrawn from that area of the mine immediately.

4.14 Selection, installation and use of cables

The selection, installation and use of cables in an underground coal mine should be in accordance with the following Australian Standards:

- 4.14.1 **AS/NZS 1747:2003** Reeling, trailing and feeder cables used for mining – Repair, testing and fitting of accessories
- 4.14.2 **AS/NZS 1802:2003** Electric cables – Reeling and trailing – For underground coal mining purposes
- 4.14.3 **AS/NZS 1972:2006** Electric cables – Underground coal mines - Other than reeling and trailing

4.15 Protection of circuits on mobile diesel equipment

The design, installation and maintenance of electrical circuits on mobile diesel machinery at the mine shall provide for the reliable circuit interruption under fault conditions.

(Note that a Directive to reduce risk, pursuant to Section 166 of the *Coal Mining Safety and Health Act 1999*, was issued on 30 November 2005 to underground coal mines. It requires the use of enhanced over-current and earth fault protection devices on flameproof diesel vehicles electrical circuits to provide reliable circuit interruption under fault conditions, including where fault current and load current are difficult to distinguish between - see http://mines.industry.qld.gov.au/assets/mines-pdf/directive_3.pdf. A detailed inspection schedule shall be formulated with reference to relevant standards, and shall ensure that cables are secure and free from damage. Particular focus should be given to machine articulation points and areas where cables are exposed to risk of damage).

4.16 Selection, installation and use of cable plugs, receptacles, couplings and glands

The selection, installation and use of cable plugs, receptacles, couplings and glands in explosion risk zones must be in accordance with the following Australian Standards:

- 4.16.1 **AS/NZS 1299:2009** Electrical equipment for mines and quarries – Explosion-protected three-phase plugs and receptacles for working voltages up to and including 3.3 kV
- 4.16.2 **AS/NZS 1300:2009** Electrical equipment for mines and quarries – Bolted explosion-protected three-phase cable coupling devices

All cable plugs, receptacles, couplings and glands must be suitably certified in accordance with the relevant Australian Standard.

4.17 Prevention of ignition of flammable gas, combustible dust or combustible material

The design, construction, installation and use of cables must be such as to reduce the risk of causing an ignition of any flammable gas, combustible dust or material within the mine or initiating detonators due to the effects of electromagnetic or electrostatic fields.

4.18 Protection of cables in shafts

All cables used in shafts must be adequately supported, protected and restrained.

4.19 Protection against extraneous voltages

- 4.19.1 Electrical systems, metallic piping arrangements and metallic structures must be designed to prevent the conductance of the adverse effects of lightning and/or voltage surges into the mine.
- 4.19.2 Electrical systems, metallic piping arrangements and metallic structures must be designed to prevent build-up of static electricity.
- 4.19.3 Electrical systems, metallic piping arrangements and metallic structures entering the mine must be designed to prevent any adverse effects from electrical faults on incoming electrical circuits and any electrical circuits traversing the mine, and any touch potential rise must be limited to acceptable levels.

4.20 The control of undesirable static electricity

The control of undesirable static electricity in an underground coal mine should be in accordance with **AS/NZS 1020:1995** The control of undesirable static electricity.

4.21 Unattended equipment

A person operating a mobile machine must not leave the controls of the machine while it is working and must before leaving the working place ensure that the electrical power is cut off from the machine.

4.22 Battery powered mobile equipment

- 4.22.1 General. The equipment must comply with the requirements of **AS/NZS 4871.5:2010** Electrical equipment for mines and quarries - Battery powered electrical mobile machines
- 4.22.2 Construction of batteries. The construction of the terminal arrangement for batteries other than those classified as intrinsically safe must be in accordance with **AS/NZS 60079.7:2006** Explosive atmospheres - Equipment protection by increased safety 'e'.
- 4.22.3 Construction of battery boxes. Battery boxes and the covers thereof must be so constructed as to minimise accidental or unauthorised interference with the battery, but must be efficiently ventilated. The covers must be kept securely locked except when in the charging or repair station.
- 4.22.4 Control and protection. Every battery operated vehicle must be provided with-
 - 4.22.4.1 Suitable enclosed fuses or circuit breakers where required;
 - 4.22.4.2 An ampere hour meter which must at all times indicate the condition of charge of the battery.
- 4.22.5 Battery operated vehicles in an ERZ1. Battery operated vehicles operated in an ERZ1 must be suitably certified by a recognised testing authority and be in accordance with the relevant Australian Standards.
- 4.22.6 The status of electrical equipment which was approved under the *Coal Mining Act 1925* immediately before to commencement of the *Coal Mining Safety and Health Act 1999* is outlined in Part 20 – Transitional provisions and repeals, of the latter Act.

4.23 Power transformers

- 4.23.1 General. The equipment must comply with the requirements of **AS/NZS 4871.3:2010** Electrical equipment for mines and quarries - Substations.
- 4.23.2 Power transformers in an ERZ1. Power transformers operated in an ERZ1 must be suitably certified by a recognised testing authority and be in accordance with the relevant Australian Standards.

4.24 Control of electromagnetic radiation

The use of equipment, which may emit ionising and non-ionising radiation, should be in accordance with the relevant Australian Standards and British Standards.

4.25 Pressurised room

- 4.25.1 A pressurised room must not be installed in an ERZ0 or ERZ1.
- 4.25.2 The walls, floors and ceilings of the pressurised room must be of such material that any fire inside the room must not be able to be propagated outside the room within 30 minutes.
- 4.25.3 The room must be monitored for excessive temperature via a proven method; the temperature monitor must initiate alarms both locally and at the surface.
- 4.25.4 Adequate portable fire-fighting equipment must be installed adjacent to all exits to the room.
- 4.25.5 A temperature initiated automatic fire suppression system must be installed inside the room.
- 4.25.6 There must be a reliable and continuous flow of air into the room which maintains a positive pressure of 25 Pa (0.25 mbar) above the outer atmosphere: the quality of the pressurising air must comply with the requirements of section 359 of *Coal Mines Safety and Health Regulation 2001*.
- 4.25.7 The minimum overpressure of 25 Pa with respect to the outer atmosphere must be maintained at all points inside the room and its associated ducts at which leaks are liable to occur, all doors and windows being closed.
- 4.25.8 The rooms must have a degree of protection similar to a rating of at least IP55.
- 4.25.9 The intake ducting to the pressurising equipment must not pass through or draw air from an ERZ0 or ERZ1.
- 4.25.10 Fail-safe pressure-activated devices must be provided for the operation of alarms, and electrical trip devices in the event of the overpressure of the room falling below 25 Pa with respect to the outer atmosphere. Upon failure of the pressurisation system it must disconnect the electrical supply to the room within 10 minutes of the loss of pressure.
- 4.25.11 Before energising the electrical supply to the equipment in the room upon start-up or after shutdown the room and associated ducts must be purged with fresh air, sufficient to reduce the concentration of methane to a level below 0.25%.
- 4.25.12 The pressurisation system must be capable of ensuring a sufficient outward air speed of 0.3 m/sec through all the openings of the room when all these openings are open at the same time.
- 4.25.13 A methane detector must be provided in the room to automatically disconnect the electrical supplies to the room if the concentration of methane exceeds 0.25%.
- 4.25.14 Any battery charging in the room must be carried in accordance with a risk assessment under clause 4.2 of this standard.
- 4.25.15 All electrical power supplies to the equipment installed and operated in the room must be protected by 30mA earth leakage protection.
- 4.25.16 Any back-up batteries installed in electronic equipment installed in the room must be intrinsically safe, category Ex ia.

4.26 Intrinsically safe power circuits

- 4.26.1 Fires can occur in certified intrinsically safe power circuits. The heat generated from a series resistive fault has been shown, under certain conditions, to ignite flammable materials.
- 4.26.2 Australian Standard AS/NZS 60079.11 specifies the construction and testing of intrinsically safe apparatus intended for use in an explosive atmosphere and for associated apparatus which is intended for connection to intrinsically safe circuits which enter such atmospheres.

- 4.26.3 Australian Standard AS/NZS 60079.14 contains the specific requirements for the design, selection and erection of electrical installations in hazardous areas associated with explosive atmospheres, this includes intrinsically safe equipment.
- 4.26.4 Australian Standard AS/NZS 60079.17 covers factors directly related to the inspection and maintenance of electrical installations within hazardous areas.
- 4.26.5 Australian Standard AS/NZS 60079.25 contains the specific requirements for construction and assessment of intrinsically safe electrical systems, type “i”.
- 4.26.6 Whilst all these standards are applicable to intrinsically safe power circuits they do not currently provide comprehensive information/warnings in relation to potential issues surrounding resistive type faults which may generate enough heat to cause a fire. Although they do define intrinsic safety “i” as a type of protection based on the restriction of electrical energy within equipment and of interconnecting wiring exposed to the explosive atmosphere to a level below that which can cause ignition by either sparking or heating effects.
- 4.26.7 AS/NZS 60079.14 states that a fundamentally different type of protection philosophy has to be recognised in the installation of intrinsically safe circuits. In comparison with all other types of installations, where care is taken to confine electrical energy to the installed system as designed so that a hazardous environment cannot be ignited, the integrity of an intrinsically safe circuit has to be protected from the intrusion of energy from other electrical sources so that safe energy limitation in the circuit is not exceeded, even when breaking, shorting or earthing of the circuit occurs. As a consequence of this principle, the aim of the installation rules for intrinsically safe circuits is to maintain separation from other circuits. It also states that, in relation to section 7 Electrical Protection, the requirements of this clause are not applicable to intrinsically safe circuits. One of the requirements of section 7 is that short-circuit and earth fault protection devices shall be such that auto-reclosing under fault conditions is prevented.
- 4.26.8 Intrinsically safe power supplies typically do not have earth fault detection nor do they have a function to require a manual reset if an overload condition occurs.
- 4.26.9 In relation to intrinsically safe circuits at underground coal mines, the following should be considered as part of the sites risk management processes.
 - 4.26.9.1 Ascertain the energy levels available from intrinsically safe electrical circuits.
 - 4.26.9.2 Ascertain the electrical protection systems in place for intrinsically safe electrical circuits.
 - 4.26.9.3 Review the energy levels and protection systems and determine if additional controls are required for intrinsically safe electrical circuits. Additional controls could include, but are not limited to, earth fault monitoring, overload protection requiring manual reset, increased mechanical protection of cables and equipment, and increased inspection regimes for intrinsically safe circuits (this may include visual as well as insulation testing).
 - 4.26.9.4 Ensure that all personnel are made aware of potential hazards in relation to intrinsically safe electrical circuits and that appropriate care and management is taken in relation to these circuits.

5 Definitions

Air lock – An airtight entranceway designed to maintain the internal pressure of a room in order to prevent the entry of a surrounding, potentially explosive atmosphere.

Electrical equipment – Electrical equipment is any item used for such purposes as generation, conversion, transmission, distribution or utilisation of electrical energy, such as machines,

transformers, apparatus, measuring instruments, protective devices, equipment for wiring systems, appliances.

Electrical installation – Electrical installation is an assembly of associated electrical equipment to fulfil a specific purpose or purposes and having co-ordinated characteristics.

Equipment involved in live testing – Is the electrical equipment and electrical installation which may become electrically alive, and includes the electrical testing equipment which supplies the electrical energy to liven up the equipment being tested.

Feeder cable - A flexible cable intended primarily for use between a transportable or mobile substation, and associated electrical equipment supplied from such substation

Informative – Refers to a standard or document that is only for information and guidance.

Liquid filled electrical equipment – Electrical equipment which has liquid as an insulating and/or cooling medium.

Live - An object must be deemed to be live when a difference of electrical potential exists or would exist between it and earth.

Live testing – The testing of electrical equipment and electrical installations when the electrical power is switched on and live conductors may be exposed. Live testing does not include testing and proving dead as part of an isolation procedure.

Normative – Refers to a standard or document that forms an integral part of the recognised standard in which it is mentioned.

Portable electrical equipment – Electrical equipment which is moved while in operation or which can easily be moved by a person or persons without mechanical assistance from one place to another while connected to the supply.

Pressurisation – The technique of guarding against the ingress of the external atmosphere, which may be explosive, into a room by maintaining fresh air therein at a pressure above that of the external atmosphere.

Reeling cable – A flexible cable normally providing electrical connection between a mobile machine and a fixed point or points in the electrical system and capable of being wound onto a reeling drum.

Risk assessment – The overall process of risk analysis and risk evaluation and the process should be in accordance with **AS/NZ ISO 31000:2009** Risk management – Principles and guidelines.

Trailing cable – A flexible cable normally providing electrical connection between a mobile or portable machine and a fixed point or points in the electrical system or between transportable equipment.

6 References - Normative Standards

The following documents are referred to, directly or indirectly, in this standard:

AS/NZS 1020:1995 The control of undesirable static electricity

AS 1147.1 – 1989 Electrical equipment for coal mines – Insulating materials – Materials for insulating power conducting components

AS/NZS 1299:2009 Electrical equipment for mines and quarries – Explosion-protected three-phase plugs and receptacles for working voltages up to and including 3.3 kV

AS/NZS 1300:2009 Electrical equipment for mines and quarries – Bolted explosion-protected three-phase cable coupling devices

AS 1482 – 1985 (R2013): Electrical equipment for explosive atmospheres – Protection by ventilation – Type of protection v

AS/NZS 1747:2003 Reeling, trailing and feeder cables used for mining – Repair, testing and fitting of accessories

AS/NZS 1802:2003 Electric cables – Reeling and trailing – For underground coal mining purposes

AS/NZS 1826:2008 Electrical equipment for explosive atmospheres – Special protection – Type of protection ‘s’

AS 1915 – 1992 Electrical equipment for explosive atmospheres – Battery operated vehicles

AS/NZS 1972:2006 Electric cables – Underground coal mines - Other than reeling and trailing

AS/NZS 2081:2011 Electrical protection devices for mines and quarries

AS/NZS 2290.1:2014 Electrical equipment for coal mines – Introduction, inspection and maintenance – For hazardous areas

AS 2290.3 – 1990 Electrical equipment for coal mines – Maintenance and overhaul – Maintenance of gas detecting and monitoring equipment

AS 2380.1 – 1989 (R2013): Electrical equipment for explosive atmospheres – Explosion protection techniques – General requirements

AS 2380.4 – 1994 (R2013): Electrical equipment for explosive atmospheres – Explosion protection techniques – Pressurized rooms or pressurized enclosures

AS/NZS 3000:2007 Electrical Installations (known as Australian/New Zealand Wiring Rules)

AS/NZS 3800:2012 Electrical equipment for explosive atmospheres – Repair and overhaul

AS/NZS 4240.1:2009 Remote control systems for mining equipment – Design, construction, testing, installation and commissioning

AS/NZS 4240.2:2009 Remote control systems for mining equipment – Operation and maintenance for underground metalliferous mining

AS/NZS 4240.3:2013 Remote control systems for mining equipment – Operation and maintenance for underground coal mining

AS 4242 – 1994 Earth-moving machinery and ancillary equipment for use in mines—Electrical wiring systems at extra-low voltage

AS/NZS 4871.1:2012 Electrical equipment for mines and quarries - General requirements

AS/NZS 4871.2:2010 Electrical equipment for mines and quarries - Distribution, control and auxiliary equipment

AS/NZS 4871.3:2010 Electrical equipment for mines and quarries - Substations

AS/NZS 4871.4:2010 Electrical equipment for mines and quarries - Mains powered electrical mobile machines

AS/NZS 4871.5:2010 Electrical equipment for mines and quarries - Battery powered electrical mobile machines

AS/NZ ISO 31000:2009 Risk management – Principles and guidelines

AS/NZS 60079.0:2012 Explosive atmospheres – Equipment - General requirements

AS/NZS 60079.1:2007 Explosive atmospheres – Equipment protection by flameproof enclosures ‘d’

AS/NZS 60079.2:2007 Explosive atmospheres - Equipment protection by pressurized enclosure ‘p’

AS/NZS 60079.7:2006 Explosive atmospheres - Equipment protection by increased safety 'e'

AS/NZS 60079.11:2011 Explosive atmospheres - Equipment protection by intrinsic safety ‘i’

AS/NZS 60079.14:2009 Explosive atmospheres – Electrical equipment for explosive gas atmospheres – Selection, installation and maintenance – General requirements

AS/NZS 60079.17:2009 Explosive atmospheres – Electrical installations inspection and maintenance

AS/NZS 60079.18:2011 Explosive atmospheres - Equipment protection by encapsulation ‘m’

AS/NZS 60079.29.1:2008 Explosive atmospheres – Gas detectors – Performance requirements of detectors for flammable gases

AS/NZS 60079.29.2:2008 Explosive atmospheres – Gas detectors – Selection, installation, use and maintenance of detectors for flammable gases and oxygen

AS/NZS IEC 60825.1:2011 Safety of laser products – Equipment classification and requirements

AS/NZS IEC 60825.14:2011 Safety of laser products – A user’s guide

AS 61508.1 – 2011 Functional safety of electrical/electronic/programmable electronic safety-related systems – General Requirements

AS 61508.2 – 2011 Functional safety of electrical/electronic/programmable electronic safety-related systems – Requirements for electrical/electronic/programmable electronic safety-related systems

AS 61508.3 – 2011 Functional safety of electrical/electronic/programmable electronic safety-related systems – Software requirements

AS 61508.4 – 2011 Functional safety of electrical/electronic/programmable electronic safety-related systems – Definition and abbreviations

AS 61508.5 – 2011 Functional safety of electrical/electronic/programmable electronic safety-related systems – Examples of methods for the determination of safety integrity levels

AS 61508.6 – 2011 Functional safety of electrical/electronic/programmable electronic safety-related systems – Guidelines on the application of IEC 61508-2 and IEC 61508-3

AS 61508.7 – 2011 Functional safety of electrical/electronic/programmable electronic safety-related systems – Overview of techniques and measures

AS/NZS 62013.1:2001 Caplights for use in mines susceptible to firedamp – General requirements – Construction and testing in relation to the risk of explosion

AS/NZS 62013.2:2001 Caplights for use in mines susceptible to firedamp – Performance and other safety-related matters

BS 6656:2002 Assessment of inadvertent ignition of flammable atmospheres by radio-frequency radiation. Guide

PD CLC/TR 50426:2004: Assessment of inadvertent initiation of bridge wire electro-explosive devices by radio-frequency radiation. Guide

7 References – Informative Standards

The following documents (from the NSW Department of Primary Industries / Minerals), may be of assistance in determining the best practice for electrical equipment and electrical installations:

MDG 1 Guideline for Free Steered Vehicles

MDG 9 Design Guideline for the Construction of Electrical Powered Shuttle Cars for Use in Coal Mines