



# Recognised Standard 01

## Underground electrical equipment and electrical installations

*Coal Mining Safety and Health Act 1999*

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**

**Purpose of recognised standards**

71. 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.

**Recognised standards**

- 72.(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.

**Use of recognised standards in proceedings**

73. 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 2001*, the Act or Regulation takes precedence.

**This recognised standard is issued under the authority of the Minister for Mines and Energy**

**[Gazetted]**

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**RECOGNISED STANDARD 01  
UNDERGROUND ELECTRICAL EQUIPMENT AND ELECTRICAL INSTALLATIONS**

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# RECOGNISED STANDARD 01 UNDERGROUND ELECTRICAL EQUIPMENT AND ELECTRICAL INSTALLATIONS

## GENERAL REQUIREMENTS FOR ELECTRICAL EQUIPMENT AND ELECTRICAL INSTALLATIONS IN AN UNDERGROUND COAL MINE

### 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 3000:2000 Electrical Installations (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.

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**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 AND CONSEQUENTIAL AMENDMENTS of the latter Act.

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

**4.5 Protection Techniques**

<b>PROTECTION TECHNIQUES FOR ELECTRICAL EQUIPMENT AND ELECTRICAL INSTALLATIONS IN EXPLOSION RISK ZONES</b>		
<b>Description of protection technique</b>	<b>Relevant Australian/IEC Standard and designated symbol</b>	<b>Remarks</b>
<b>EXPLOSION RISK ZONE 0 (ERZ0)</b>		
Intrinsically safe	AS/NZS 60079.11 Ex ia	
Special protection	AS/NZS 1826 Ex s	In accordance with the requirements for Australian Standard Zone 0
Caplights for use in mines susceptible to firedamp	AS/NZS 62013.1 Ex l	
<b>EXPLOSION RISK ZONE 1 (ERZ1)</b>		
Intrinsically safe	AS/NZS 60079.11 Ex ib	
Special protection	AS/NZS 1826 Ex s	In accordance with the requirements for Australian Standard 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 accordance with the requirements for Australian Standard Zone 1
Increased safety	AS/NZS 60079.7 Ex.e	Additional mechanical protection may be required
Ventilation	AS 1482 Ex v	In accordance with the requirements for Australian Standard 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 2001.

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## 4.6 Nationally Accredited Testing Stations

The following organisations are nationally accredited testing stations:

- (1) Safety In Mines Testing And Research Station  
Simtars  
2 Smith Street  
REDBANK QLD 4301
- (2) Testsafe Australia  
919 Londonderry Road  
LONDONDERRY NSW 2573
- (3) International Testing and Certification Services  
ITACS  
4 - 6 Second Street  
BOWDEN SA 5007

## 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:

- (a) The equipment should be housed in a room, recess or area set aside for the purpose.
- (b) The room, recess or area should be constructed to provide adequate height and working space.
- (c) Flammable material should not be stored in any location adjacent to electrical equipment.
- (d) 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.
- (e) The room, recess or area should be adequately ventilated, having regard to the type of equipment and its use.
- (f) The room, recess or area should have adequate lighting.

## 4.8 Liquid Filled Electrical Transformers and Switchgear

### 1) Installation

- (a) A formal risk assessment must be undertaken prior to the installation and operation of liquid filled electrical transformers and switchgear.
- (b) 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.
- (c) 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.
- (d) 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.
- (e) 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.

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### 2) Operation

- (a) 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.
- (b) 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

#### 1) Routine testing

- (a) 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.
- (b) Routine testing of the electrical equipment and electrical installations including earthing systems must be carried out by competent persons using appropriate testing equipment.
- (c) The following routine inspections and tests of electrical equipment and electrical installations should be carried out:-
  - (i) An inspection of all electrical equipment including the enclosure, doors and covers of all electrical switchgear used at the mine, and all earthing conductors.
  - (ii) 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.
  - (iii) 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.
  - (iv) Inspections of electrical equipment in explosion risk zones must be carried out in accordance with **AS 2290.1 – 2005 Electrical equipment for coal mines – Introduction and maintenance – For hazardous areas.**

#### 2) Recording of tests

The results of the tests and examinations prescribed in (1) above must be recorded.

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### 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:

- The history of previous faults and failures,
- Equipment usage,
- Age,
- History of operation of protection systems,
- Manufacturer's recommendations, and
- Backup protection.

#### 4.13 Operation of portable electrical equipment

##### 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 AND CONSEQUENTIAL AMENDMENTS of the latter Act.

##### 2) The use of uncertified portable electrical equipment in an ERZ

###### **a) Uncertified portable electrical equipment must not be operated in an ERZ0.**

- b) 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.
- c) 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.
- d) Only persons authorised in writing by the underground mine manager and the electrical engineering manager must operate the equipment.
- e) Prior to taking the equipment underground it must be inspected by an electrician or electrical supervisor authorised by the Manager and must not be dismantled for adjustment of internal circuitry or repaired underground.
- f) After use the equipment must be withdrawn from the mine.

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- (a) 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.
- (b) Any batteries used by the equipment must not be replaced in an ERZ1.
- (c) 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.
- (d) Should any defect on the equipment be detected at any time, the equipment must be immediately withdrawn from underground.
- (e) Persons authorised under subclause (c) 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 (a) to (h) have been fulfilled.
- (f) 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:

- **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 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* 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 Appendix 1).

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:

- **AS 1299 - 1993 – Electrical equipment for coal mines – Flameproof restrained plugs and couplers**
- **AS 1300 – 1989 – Electrical equipment for coal mines – Bolted flameproof cable coupling devices**

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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**

- (a) 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.
- (b) Electrical systems, metallic piping arrangements and metallic structures must be designed to prevent build up of static electricity.
- (c) Electrical systems, metallic piping arrangements and metallic structures entering the mine must be designed to prevent any adverse affects 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**

1. **General.** The equipment must comply with the requirements of **AS/NZS 4871.5:2002 Electrical equipment for coal mines, for use underground Part 5: Battery powered electrical mobile machines**
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'**.
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.

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4. **Control and protection.** Every battery operated vehicle must be provided with-
  - a. Suitable enclosed fuses or circuit breakers where required;
  - b. An ampere hour meter which must at all times indicate the condition of charge of the battery.
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.

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 AND CONSEQUENTIAL AMENDMENTS of the latter Act.

#### **4.23 Power transformers**

1. **General.** The equipment must comply with the requirements of **AS/NZS 4871.3:2002 Electrical equipment for coal mines, for use underground Part 3: Substations.**
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**

1. A pressurised room must not be installed in an ERZ0 or ERZ1.
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.
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. Adequate portable fire fighting equipment must be installed adjacent to all exits to the room.
5. A temperature initiated automatic fire suppression system must be installed inside the room.
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.
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.
8. The rooms must have a degree of protection similar to a rating of at least IP55.

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9. The intake ducting to the pressurising equipment must not pass through or draw air from an ERZ0 or ERZ1.
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.
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%.
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.
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%.
14. Any battery charging in the room must be carried in accordance with a risk assessment under clause 4.2 of this standard.
15. All electrical power supplies to the equipment installed and operated in the room must be protected by 30mA earth leakage protection.
16. Any back-up batteries installed in electronic equipment installed in the room must be intrinsically safe, category **Ex ia**.

## **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.

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**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/NZS 4360:2004 Risk management**.

**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 1299 - 1993** Electrical equipment for coal mines – Flameproof restrained plugs and couplers

**AS 1300 – 1989** Electrical equipment for coal mines – Bolted flameproof cable coupling devices

**AS 1482 – 1985** 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 – 2006** 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 2081.1 – 2002** Electrical equipment for coal and shale mines – Electrical protection devices – General requirements

**AS/NZS 2081.2 – 2002** Electrical equipment for coal and shale mines – Electrical protection devices – Earth-continuity monitoring devices

**AS/NZS 2081.3 – 2002** Electrical equipment for coal and shale mines – Electrical protection devices – Earth-leakage protection devices for use on earth-fault current limited systems (IT systems)

**AS/NZS 2081.4 – 2002** Electrical equipment for coal and shale mines – Electrical protection devices – Lock-out earth-fault protection devices

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- AS/NZS 2081.5 – 2002** Electrical equipment for coal and shale mines – Electrical protection devices – Earth-fault current limiters
- AS/NZS 2211.1:2004** Laser safety – Equipment classification, requirements and user's guide
- AS 2290.1 – 2005** Electrical equipment for coal mines – Introduction 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** Electrical equipment for explosive atmospheres – Explosion protection techniques – General requirements
- AS 2380.4 – 1994** Electrical equipment for explosive atmospheres – Explosion protection techniques – Pressurised rooms or enclosures
- AS 2380.9 - 1991** Electrical equipment for explosive atmospheres – Explosion protection techniques – Type of protection n – Non-sparking
- AS/NZS 2381.1:2005** Electrical equipment for explosive gas atmospheres – Selection, installation and maintenance – General requirements
- AS/NZS 2381.2 - 2006** Electrical equipment for explosive atmospheres – Selection, installation and maintenance – Flameproof enclosure 'd'
- AS 2381.6 – 1993** Electrical equipment for explosive atmospheres – Selection, installation and maintenance – Increased safety e
- AS 2381.7 – 1989** Electrical equipment for explosive atmospheres – Selection, installation and maintenance – Intrinsic safety i
- AS/NZS 3000:2000** Electrical Installations (Australian/New Zealand Wiring Rules)
- AS/NZS 3800 – 2005** Electrical equipment for explosive atmospheres – Repair and overhaul
- AS/NZS 4240:1994** Remote controls for mining equipment
- AS 4242 – 1994** Earth-moving machinery and ancillary equipment for use in mines—Electrical wiring systems at extra-low voltage
- AS/NZ 4360:2004** Risk management
- AS/NZS 4871.1:2002** Electrical equipment for coal mines, for use underground Part 1: General requirements
- AS/NZS 4871.2:2002** Electrical equipment for coal mines, for use underground Part 2: Distribution, control and auxiliary equipment
- AS/NZS 4871.3:2002** Electrical equipment for coal mines, for use underground Part 3: Substations
- AS/NZS 4871.4:2002** Electrical equipment for coal mines, for use underground Part 4: Mains powered electrical mobile machines
- AS/NZS 4871.5:2002** Electrical equipment for coal mines, for use underground Part 5: Battery powered electrical mobile machines
- AS/NZS 60079.0:2005** Electrical apparatus for explosive gas atmospheres – General requirements
- AS/NZS 60079.1:2005** Electrical apparatus for explosive gas atmospheres – Flameproof enclosure (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 60079.11:2006** Explosive atmospheres - Equipment protection by intrinsic safety 'i'

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## UNDERGROUND ELECTRICAL EQUIPMENT AND ELECTRICAL INSTALLATIONS

**AS/NZS 60079.18:2005** Electrical apparatus for explosive gas atmospheres - Construction, test and marking of type of protection encapsulation 'm' electrical apparatus.

**AS 61508.1 – 1999** Functional safety of electrical/electronic/programmable electronic safety-related systems – General Requirements

**AS 61508.2 – 2001** Functional safety of electrical/electronic/programmable electronic safety-related systems – Requirements for electrical/electronic/programmable electronic safety-related systems

**AS 61508.3 – 1999** Functional safety of electrical/electronic/programmable electronic safety-related systems – Software requirements

**AS 61508.4 – 1999** Functional safety of electrical/electronic/programmable electronic safety-related systems – Definition and abbreviations

**AS 61508.5 – 1999** Functional safety of electrical/electronic/programmable electronic safety-related systems – Examples of methods for the determination of safety integrity levels

**AS 61508.6 – 2001** Functional safety of electrical/electronic/programmable electronic safety-related systems – Guidelines on the application of AS 61508.2 and AS 61508.3

**AS 61508.7 – 2001** Functional safety of electrical/electronic/programmable electronic safety-related systems

**AS/NZS 61779.1:2000** Electrical apparatus for the detection and measurement of flammable gases – General requirements and test methods

**AS/NZS 61779.2:2000** Electrical apparatus for the detection and measurement of flammable gases – Performance requirements for group 1 apparatus indicating a volume fraction up to 5 % methane in air

**AS/NZS 61799.3:2000** Electrical apparatus for the detection and measurement of flammable gases – Performance requirements for group 1 apparatus indicating a volume fraction up to 100 % methane in air

**AS/NZS 61799.6:2000** Electrical apparatus for the detection and measurement of flammable gases – Guide for the selection, installation, use and maintenance of apparatus for the detection and measurement of flammable gas

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

**AS/NZS 62013.2:2001** Caplamps 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 Guidelines for the Construction of Electrical Powered Shuttle Cars for Use in Coal Mines

**RECOGNISED STANDARD 01  
UNDERGROUND ELECTRICAL EQUIPMENT AND ELECTRICAL INSTALLATIONS**

**8 APPENDIX 1**



**Safety and Health, Mines Inspectorate**

**Brisbane - Head Office**

P.O. Box 15216, CITY EAST QLD 4002

Phone: (07) 3237 1041, Fax: (07) 3237 1242

Vision: Our Industries Free of Safety and Health Incidents

## Directive

**I John Kabel, an Inspector appointed under Section 125, of the *Coal Mining Safety and Health Act 1999* issue a Directive to reduce risk, pursuant to Section 166 of the *Coal Mining Safety and Health Act 1999*.**

Subject: <b>Electrical Equipment</b>
File No.: «File_No»
Mine Name: «Mine_»
Mine Operator: «Operator»

<b>Title: Flameproof Diesel Vehicles Electrical Circuits.</b>
<b>Observation:</b> <p>The design, installation and maintenance of electrical circuits on mobile diesel machinery at an underground coal mine must provide for reliable circuit interruption under fault conditions. In recent incidents however, electric faults due to damage to electric lighting cables on explosion protected diesel machines have proven difficult to isolate. Regimes of increased inspection and improved mechanical protection have not prevented further incidents occurring.</p> <p>Additional protection in the form of enhanced over-current and earth fault protection is required to provide reliable circuit interruption under fault conditions, including where fault current and load current are difficult to distinguish between. Alternator based protection systems incorporating this type of fault protection are now being manufactured and have been proven in service.</p>
<b>Directive Given:</b> <p>I direct that enhanced over-current and earth fault protection devices are installed 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.</p>
<b>References:</b> <p><i>Coal Mining Safety and Health Act 1999</i> Section 166 <i>Coal Mining Safety and Health Regulation 2001</i> Sections 23, 29</p>

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**A person to whom a directive is given must comply with the directive as soon as reasonably practicable. Risk to a person resulting from a hazard at the mine must be within acceptable limits at all times.**

Reasonable Time for Compliance – Due Date for Directive 01/07/2006
Completion Date:
Reassigned Due Date:, by, on

**Directive –**

If an inspector or inspection officer reasonably believes a risk from coal mining operations may reach an unacceptable level, the inspector or officer may give a directive to any person to take stated corrective or preventative action to prevent the risk reaching an unacceptable level. The directive may be given orally or by notice.

If the directive is given orally, the person giving the directive must confirm the directive by notice to the person in control of the mine or part of the mine to affected by the directive and to the relevant site senior executive.

Failure to comply with subsection (3) does not affect the validity of the directive.

**Method of Giving Directive –**

This directive in writing was posted on 30/11/2005

*Note: For directives given orally - List the name of all persons the directive is given to, or all classes of person at the mine the directive is given to.*

**Directive Given To –**

This directive is given to the operator of the mine.

**Method of identification Used –**

In issuing this directive I identified myself as a person appointed under Section 125 of the Coal Mining Safety and Health Act 1999.

I will produce my identity card for the other person's inspection at the first reasonable opportunity (it not being practicable to produce or display the identity card at the time of exercising the power).

**Part of mine affected by directive –**

Whole of Mine

**A copy of the directive was posted to -** the site senior executive of the mine affected by the directive (posted on 30/11/2005).

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**In giving this directive I reasonably believe that a risk from operations may reach an unacceptable level.**

The reason for my belief or suspicion is based upon the following -

Recent incidents have shown that electric faults from damaged electric lighting cables on explosion protected diesel machines are difficult to reliably isolate, and could have produced arcs and sparking on a machine in an underground coal mine. Regimes of increased inspection and improved mechanical protection have not prevented further incidents occurring. Additional protection in the form of enhanced over-current and earth fault protection is required to provide reliable circuit interruption under fault conditions, including where fault current and load current are difficult to distinguish between.

**John Kabel:** .....

**Date Issued:** ...../...../.....

**Warning** - Failure to comply with this directive is an offence. If you disagree with this directive, you may apply for a review of the directive. A summary of the review provisions is provided below.

**Provisions of the Coal Mining Safety and Health Act 1999 in Relation to Directives**

**Directives**

**174.(1)** If an inspector, inspection officer, or industry safety and health representative has given a directive, the inspector, officer or representative—

- (a) must enter it in the mine record as soon as reasonably practicable after giving it; and
- (b) must state the reason for the directive in the mine record.

**(2)** A person to whom a directive is given must comply with the directive as soon as reasonably practicable.

Maximum penalty—800 penalty units or 2 years imprisonment.

**(3)** The site senior executive must enter in the mine record the action taken to comply with the directive as soon as practicable after the action is taken.

Maximum penalty—40 penalty units.

**(4)** The site senior executive must make copies of directives available for inspection by coal mine workers.

Maximum penalty—40 penalty units.

**(5)** A directive remains effective until—

- (a) for a directive by an industry safety and health representative—it is withdrawn in writing by the representative or an inspector; or
- (b) for a directive by the chief inspector - it is withdrawn in writing by the chief inspector; or
- (c) for a directive by an inspector other than the chief inspector—it is withdrawn in writing by the inspector or another inspector; or
- (d) for a directive of an inspection officer—it is withdrawn in writing by the inspection officer or an inspector; or
- (e) for a directive by an industry safety and health representative, an inspection officer or an inspector and not otherwise withdrawn—the chief inspector varies or sets aside the directive after reviewing it under subdivision 4; or
- (f) the Industrial Court stays, varies or sets aside the directive.

**Subdivision 4—Review of directives**

# RECOGNISED STANDARD 01

## UNDERGROUND ELECTRICAL EQUIPMENT AND ELECTRICAL INSTALLATIONS

### Application for review

175. A person who is given a directive from an inspector (other than the chief inspector), inspection officer or industry safety and health representative may apply under this division for the directive to be reviewed.

### Procedure for review

176.(1) The application must—

- (a) be made in writing to the chief inspector; and
  - (b) be supported by enough information to allow the chief inspector to decide the application.
- (2) The application must be made to the chief inspector within—
- (a) 7 days after the day on which the person received the directive; or
  - (b) the longer period, within 2 months after the day, the chief inspector in special circumstances allows.
- (3) The chief inspector must consider the application within 7 days after receiving it and immediately advise the applicant in writing whether the chief inspector considers the applicant has complied with subsection (1).
- (4) If the chief inspector does not consider the application is supported by enough information to allow the chief inspector to decide the application, the chief inspector must advise the applicant what further information the chief inspector requires.
- (5) When the chief inspector is satisfied the applicant has complied with subsection (1), the chief inspector must immediately advise the applicant in writing of that fact.

### Review of directive

177.(1) The chief inspector must, within 14 days after giving the advice mentioned in section 176(5), review the directive and make a decision (the “**review decision**”)—

- (a) to confirm the directive appealed against; or
  - (b) to vary or set aside the directive appealed against.
- (2) The chief inspector may give a directive in substitution for a directive the chief inspector decides to set aside.
- (3) Within 7 days after making the review decision, the chief inspector must give notice of the decision to the applicant.
- (4) The notice must—
- (a) include the reasons for the review decision; and
  - (b) if the notice does not set aside the directive, tell the applicant of the applicant’s right of appeal against the decision.
- (5) If the chief inspector does not—
- (a) review the directive within the time allowed under subsection (1); or
  - (b) having reviewed the directive, advise the applicant of the review decision within the time allowed under subsection (3); the applicant may appeal against the directive under part 14. 22 Part 14 (Appeals)

### Stay of operation of directive

178.(1) If a person applies under this division for a directive to be reviewed, the person may immediately apply to the Industrial Court for a stay of the directive.

- (2) The court may stay the directive to secure the effectiveness of the review and any later appeal to the court.
- (3) A stay—
- (a) may be given on conditions the court considers appropriate; and
  - (b) operates for the period fixed by the court; and
  - (c) may be revoked or amended by the court.

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- (4) The period of a stay must not extend past the time when the chief inspector reviews the directive and any later period the court allows the person to enable the person to appeal against the decision.
- (5) An application made for a review of a directive affects the directive, or the carrying out of the directive, only if the directive is stayed.
- (6) However, a directive under section 167. 23. must not be stayed.

23 Section 167 (Directive to suspend operations for unacceptable level of risk)

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