

Australian/New Zealand Standard™

**Electrical equipment for mines and
quarries**

**Part 4: Mains powered electrical mobile
machines**



AS/NZS 4871.4:2010

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 13 April 2010 and on behalf of the Council of Standards New Zealand on 23 April 2010. This Standard was published on 25 May 2010.

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 Primary Industries, Mineral Resources, NSW
Electrical Apparatus Service Association
Electrical Regulatory Authorities Council
Mining Electrical and Mining Mechanical Engineering Society
Ministry of Economic Development, New Zealand
National Association of Testing Authorities Australia
Simtars (Department of Mines and Energy, Qld)
Solid Energy, New Zealand
University of Newcastle
WorkCover New South Wales

Keeping Standards up-to-date

Standards are living documents which reflect progress in science, technology and systems. To maintain their currency, all Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued. Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments which may have been published since the Standard was purchased.

Detailed information about joint Australian/New Zealand Standards can be found by visiting the Standards Web Shop at www.saiglobal.com.au or Standards New Zealand web site at www.standards.co.nz and looking up the relevant Standard in the on-line catalogue.

For more frequent listings or notification of revisions, amendments and withdrawals, Standards Australia and Standards New Zealand offer a number of update options. For information about these services, users should contact their respective national Standards organization.

We also welcome suggestions for improvement in our Standards, and especially encourage readers to notify us immediately of any apparent inaccuracies or ambiguities. Please address your comments to the Chief Executive of either Standards Australia or Standards New Zealand at the address shown on the back cover.

This Standard was issued in draft form for comment as DR 09038.

Australian/New Zealand Standard™

Electrical equipment for mines and quarries

Part 4: Mains powered electrical mobile machines

Originated as part of AS 2595.1—1983.
Jointly revised, amalgamated and redesignated as AS/NZS 4871.4:2002.
Second edition 2010.

COPYRIGHT

© Standards Australia/Standards New Zealand

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher.

Jointly published by Standards Australia, GPO Box 476, Sydney, NSW 2001 and Standards New Zealand, Private Bag 2439, Wellington 6140

ISBN 978 0 7337 9588 6

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/NZS 4871.4:2002, *Main powered electrical mobile machines*.

The objective is to set out requirements for the design, construction and testing of electrical powered mobile machines for use in mines and quarries.

This Standard is Part 4 of the series AS/NZS 4871, *Electrical equipment for mines and quarries*.

The AS/NZS 4871 series comprises the following parts:

Part 1: General requirements

Part 2: Distribution, control and auxiliary equipment

Part 3: Substations

Part 4: Main powered electrical mobile machines (this Part)

Part 5: Battery powered electrical mobile machines

Part 6: Diesel powered machinery and ancillary equipment

CONTENTS

	<i>Page</i>
SECTION 1 SCOPE AND GENERAL	
1.1 SCOPE	4
1.2 APPLICATION	4
1.3 REFERENCED DOCUMENTS	4
1.4 DEFINITIONS	4
1.5 EXISTING EQUIPMENT	4
SECTION 2 COMMON REQUIREMENTS	
2.1 GENERAL	5
2.2 ELECTRICAL ISOLATION	5
2.3 ISOLATION FOR MECHANICAL MAINTENANCE	5
2.4 LIGHTING SYSTEMS.....	5
2.5 AUTOMATIC GAS MONITORING SYSTEM	5
2.6 MACHINE CONTROLS	6
2.7 MACHINE SAFETY INTERLOCKS.....	7
2.8 MACHINE MOTORS	7
2.9 MACHINE CABLING	8
2.10 CABLE REELS	8
2.11 MACHINE INTERLOCK CONTROLS	9

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard
Electrical equipment for mines and quarries

Part 4: Mains powered electrical mobile machines**S E C T I O N 1 S C O P E A N D G E N E R A L****1.1 SCOPE**

This Standard specifies requirements for the design, construction and testing of electrical powered mobile machines used in association with mining and quarrying activities.

1.2 APPLICATION

All mains powered mobile machines shall comply with the requirements of AS/NZS 4871.1 and the requirements of this Standard.

1.3 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS/NZS	
4240	Remote control systems for mining equipment (series)
4871	Electrical equipment for coal mines, for use underground
4871.1	Part 1: General requirements

1.4 DEFINITIONS

For the purpose of this Standard the definitions in AS/NZS 4871.1 apply.

1.5 EXISTING EQUIPMENT

In recognition of changes made to this edition of this Standard, existing equipment should be assessed for risk and interim control measures should be implemented where necessary.

Compliance improvements should be made within a time frame that takes into consideration the associated risk levels.

S E C T I O N 2 C O M M O N R E Q U I R E M E N T S

2.1 GENERAL

Machines and accessories shall be of rugged construction and be designed in a manner that will facilitate inspection and maintenance. They shall be well constructed, based on sound engineering principles and suitable for their intended use.

2.2 ELECTRICAL ISOLATION

Every machine shall be provided with an isolating facility by means of which all power to the machine can be isolated for the purpose of carrying out electrical work.

The main switching device shall be manually operated and capable of being locked in the isolated position.

The isolator shall be either in a separate compartment or remote from the machine to isolate the supply cable.

The main isolating device shall isolate all electrical circuits within the confines of the machine unless such circuits are ELV or for equipment operating in hazardous areas, all circuits are classified as intrinsically safe.

2.3 ISOLATION FOR MECHANICAL MAINTENANCE

Every machine shall be equipped with an isolating device by means of which all power to the machine can be isolated for the purposes of carrying out non-electrical work on the machine. The main isolating device shall isolate all electrical power circuits that may effect movement.

On the load side of the isolating device, functional switching devices may be used for individual drives or groups of drives.

2.4 LIGHTING SYSTEMS

Machines shall be provided with a lighting system that is appropriate for the machines operation.

2.5 AUTOMATIC GAS MONITORING SYSTEM

Where an explosive gas monitoring system is provided, the following requirements and recommendations apply:

- (a) The trip mechanism should isolate the power supply to the machine.
- (b) The monitor should give a visual warning that a predetermined concentration of explosive gas has been reached.
- (c) The monitor should be configured to cease operation of parts of the machine when the explosive gas concentration setpoint has been reached.
- (d) A lockout mechanism that will prevent the restoration of power to a machine until the trip mechanism is reset should be fitted. Following an explosive gas trip it should not be possible to apply power to the machine until the explosive gas concentration has fallen to safe levels.
- (e) There should be a visual indication of the gas level.

- (f) A system to override the trip mechanism may be provided to allow the safe withdrawal of the machine for repair and maintenance. Only functions necessary for the safe withdrawal shall be enabled.
- (g) Access to the override or reset mechanism should be restricted to authorised personnel.

NOTES:

- 1 The relevant regulatory authority may require gas monitoring systems to be fitted to the machine.
- 2 Some regulatory authorities may require audible and visual warning when a predetermined gas level is reached.

2.6 MACHINE CONTROLS

2.6.1 General

Controls on all machines shall be located so they are within easy reach of the operator.

Consideration should be given to sound ergonomic principles for location and means of operation.

Where dual-driving cabs are fitted to machines, a control direction device shall be fitted and set to give control to one driving cab and to immobilize the controls in the second driving cab.

Where two or more machines are connected together to operate in tandem—

- (a) one machine shall be the master from which all controls (for all machines) are to be centralized—other controls not required for safety shall be neutralized;
- (b) the control system shall be designed to fail-to-safety; and
- (c) the emergency braking in each machine shall operate all machines connected in tandem.

Where more than one control station is fitted to a machine, or where multiple machines are connected together, the operating logic between each of the control stations shall be subject to a risk management process.

2.6.2 Emergency stop device

Machines shall have an accessible emergency stop device(s) located for easy access during all modes of operation.

Emergency stop devices shall comply with the requirements of AS/NZS 4871.1.

2.6.3 Dead man control

Where ‘dead man control’ is required its operation shall stop travel movement and bring the machine safely to rest. The dead man system shall be subject to functional safety analysis, refer to AS/NZS 4871.1.

2.6.4 Reversing alarm

Reversing alarms are required, except for machines generally driven equally in both directions. Reversing alarms shall be audible and sound continuously while the vehicle is in reverse mode. In addition, visual alarms may be required, based on a risk management process.

2.6.5 Pre-start alarms

A pre-start alarm shall be fitted and operate prior to machine starting. The alarm shall be audible and sound for a time determined by a risk management process before any movement occurs. Other audible alarms may be required to indicate hazardous movement subject to risk management process. In addition visual alarms may be required based on a risk management process.

Pre-start warning alarms shall be operational regardless of what form of control has been selected.

2.7 MACHINE SAFETY INTERLOCKS

2.7.1 General

The following interlocks are not all required on all machines, but the information provides a guide to what may be required on individual machines. The need for any particular safety interlock shall be determined by risk management process.

2.7.2 Doors

Where driver compartments are fitted with hinged access doors, an interlocking device shall be fitted to stop the machine movement while the doors are open, and apply the brakes to prevent machine 'run away'.

2.7.3 Water flow

Where a flow of water is required, e.g. dust suppression, pick ignition and cooling, a flow monitoring device shall be fitted to prevent machine operation unless a predetermined flow of water is available on the machine.

NOTE: Some machines may require a pressure switching device in addition to the above.

2.7.4 Roof bolting

Where a machine is fitted with roof bolting equipment, an interlocking device shall be fitted to stop all hazardous movements of the machine before the roof bolting can commence or to stop the roof bolting when machine movement is required. This switching device shall be within easy reach of the bolter operator.

2.7.5 Control-mode

Where control-mode is selectable, the selected mode of control shall be visible and clearly marked. Emergency stops shall shut down all control functions irrespective of the control mode selected. Other safety stops shall shut down all associated control functions.

2.7.6 Remote control

Remote control modes shall comply with AS/NZS 4240.

2.7.7 Pendant control (umbilical cord)

Pendant control shall comply with AS/NZS 4240.

2.7.8 Traction control systems

Traction control systems shall be designed in accordance with the principles in the risk management requirements of AS/NZS 4871.1.

2.8 MACHINE MOTORS

Motors manufactured for use on machines should take into consideration the following features:

- (a) Accessible connections to motor leads or terminals, including earth connection.

- (b) Locking device for screw type inspection covers.
- (c) Lifting lugs or eye bolt locations to facilitate handling on and off the machine.
- (d) Adequate mounting fixings or supports, with reasonable access to all fasteners, which is required for routine inspection and maintenance.
- (e) Avoidance of entries that will allow water to enter the motor enclosure during normal operating conditions.

NOTE: It may be necessary to consider protection in the machine design to prevent a direct fall of water on the motor.

2.9 MACHINE CABLING

2.9.1 Cable arrangements

All external cables installed on a mobile machine shall be—

- (a) arranged clear of moving parts;
- (b) provided with short-circuit protection that will adequately protect the smallest CSA cable that it is protecting;
- (c) protected from hot surfaces that may adversely affect the insulation of cables and moving parts;
- (d) arranged so as to prevent excessive bending or twisting;
- (e) clamped in place to prevent undue movement;
- (f) protected from mechanical damage by being correctly positioned within the body of the machine;
- (g) protected from hydraulic lines and abrasions; and
- (h) of the same temperature rating as the environment in which they are installed.

2.9.2 Cable construction

All non-IS cables shall comply with AS/NZS 4871.1.

2.10 CABLE REELS

2.10.1 General

Where cable reels are fitted to machines, the driven reel shall maintain positive tension of the trailing cable during reeling and unreeling operations, within the cable manufacturers' specified operating tensions for the cables under all operating conditions.

2.10.2 Cable reel bearings

Cable reel bearings shall not be an integral part of a circuit for transmitting electrical energy nor form part of the earthing circuit.

2.10.3 Cable reel dimensions

Cable reel drums should be designed to prevent undue bending of cables outside the cable manufacturers' specified operating bending radius for continuous reeling and sheathing duty.

2.10.4 Cable reel interlock limit

Cable reels shall be fitted with a protective device to stop the machine travel. The functionality of the protection device shall be determined by the risk management process.

The protective devices shall operate in the event of the following—

- (a) the cable exceeds the maximum safe limit of cable on the reel (over fill limit); or

- (b) the machine exceeds the minimum safe limit of cable on the reel (run out limit).

The above mentioned device shall—

- (i) automatically cause the machine to stop and apply the brakes; and
- (ii) be part of a control circuit so arranged that resetting of the device does not automatically restart the machine.

2.10.5 Cable reel motion detection

Consideration should be given to the inclusion of cable reel motion detection and indication.

2.11 MACHINE INTERLOCK CONTROLS

2.11.1 Conveyor reversing

The reversing of a machine conveyor shall be controlled by a switching device so the reverse operation will not occur inadvertently.

2.11.2 Cable interlock

For applications where the trailing cable machine anchor point may not be directly supervised by an operator or has a risk of overtension (such as with shearers on longwall applications), the supply cable shall be prevented from being over tensioned by a system that automatically stops any dangerous motion associated with the over tension.

2.11.3 Trailing cable attachments

Attachments should be provided for anchoring trailing cables where the cable attaches to the machine.

The design should allow for all machine movements to minimize the risk of cable damage.

Where the cable is secured to allow reeling of the cable, means should be provided to reduce shock loading on the cable in excess of the safe working load of the cable.

2.11.4 Pilot control

Where pilot control switching is fitted on a machine, the switch device shall be spring return from the 'start' position to the 'run' position. Trip functions may be connected in the pilot circuit. The pilot circuit should not allow restoration of power unless it is in a healthy state. For example, if there is no power on a machine and the switch is stuck in RUN, then the pilot relay should not operate.

Refer to Clause 3.2.1.4 of AS/NZS 4871.1 for hazardous zone applications.

2.11.5 Electrical braking

Electrical dynamic braking, where fitted, shall not be used for safety or parking brake applications.

2.11.6 Over-speed protection

Where it is possible for the operator of the machine to inadvertently over-speed a mobile machine, an over-speed protection device shall be provided.

NOTES

NOTES

NOTES

Standards Australia

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

Standards New Zealand

The first national Standards organization was created in New Zealand in 1932. The Standards Council of New Zealand is the national authority responsible for the production of Standards. Standards New Zealand is the trading arm of the Standards Council established under the Standards Act 1988.

Australian/New Zealand Standards

Under a Memorandum of Understanding between Standards Australia and Standards New Zealand, Australian/New Zealand Standards are prepared by committees of experts from industry, governments, consumers and other sectors. The requirements or recommendations contained in published Standards are a consensus of the views of representative interests and also take account of comments received from other sources. They reflect the latest scientific and industry experience. Australian/New Zealand Standards are kept under continuous review after publication and are updated regularly to take account of changing technology.

International Involvement

Standards Australia and Standards New Zealand are responsible for ensuring that the Australian and New Zealand viewpoints are considered in the formulation of international Standards and that the latest international experience is incorporated in national and Joint Standards. This role is vital in assisting local industry to compete in international markets. Both organizations are the national members of ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission).

Visit our web sites

www.standards.org.au

www.standards.co.nz

www.standards.com.au



GPO Box 476 Sydney NSW 2001
Phone (02) 9237 6000
Fax (02) 9237 6010
Email mail@standards.org.au
Internet www.standards.org.au
SAI Global Customer Service
Phone 13 12 42
Fax 1300 65 49 49
Email sales@saiglobal.com



Level 10 Radio New Zealand House
155 The Terrace Wellington 6011
(Private Bag 2439 Wellington 6140)
Phone (04) 498 5990
Fax (04) 498 5994
Customer Services (04) 498 5991
Information Service (04) 498 5992
Email snz@standards.co.nz
Internet www.standards.co.nz

This page has been left intentionally blank.