Australian/New Zealand Standard[™]

Diesel engine systems for underground coal mines

Part 2: Explosion protected





AS/NZS 3584.2:2008

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Australasian Institute of Mining and Metallurgy Australian Chamber of Commerce and Industry Australian Coal Association Bureau of Steel Manufacturers of Australia Chamber of Minerals and Energy of Western Australia Department of Infrastructure, Energy and Resources (Tasmania) Department of Labour, New Zealand Department of Mineral Resources, N.S.W. Department of Minerals and Energy, W.A. Department of Mines and Energy (Qld) Department of Natural Resources and Environment, Vic. Institution of Mining Engineers, Australia Minerals Council of Australia South Australian Chamber of Mines and Energy

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee ME-018, Mining Equipment, to supersede AS/NZS 3584.2:2003.

The objective of this Standard is to promote the safety of explosion-protected diesel engine systems that are used underground in coal mines.

This Standard is one of the following series of Standards:

AS/NZS

3584	Diesel e	engine systems for underground coal mines
3584.1	Part 1:	Fire protected—Heavy duty
3584.2	Part 2:	Explosion protected (this Standard)
3584.3	Part 3:	Maintenance
3584.2 3584.3	Part 2: Part 3:	Explosion protected (this Standard) Maintenance

This edition allows for the implementation of new technology in diesel engine systems, including the use of dry exhaust systems, limiting the emission of diesel aerosol particulates and generally reducing the emission of pollutants. New measures have been included to provide a greater assurance of safety by preventing the propagation of an internal explosion. Its emphasis is to facilitate the implementation of new technology resulting in the increased operational safety of diesel engine systems.

The terms 'normative' and 'informative' have been used in this Standard to define the application of the appendix to which they apply. A 'normative' appendix is an integral part of a Standard, whereas an 'informative' appendix is only for information and guidance.

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

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Australian/New Zealand Standard Diesel engine systems for underground coal mines

Part 2: Explosion protected

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies safety requirements for diesel engine systems that are explosionprotected for use in underground coal mines, including use in explosion-risk zones.

NOTES:

- 1 Compliance to this Standard implies a limited time safe operation in atmospheres containing up to 1% methane, including—
 - (a) the control of surface temperature, to avert ignition of coal dust that could settle on a hot surface;
 - (b) containment or elimination of flames and sparks that could ignite flammable gases and dust that may be present (such as in underground coal mines); and
 - (c) control of diesel emissions.
- 2 This Standard also addresses inadvertent short-term exposure to high methane levels and any consequent abnormal combustion.
- 3 Appendix A gives guidance for demonstrating compliance with this Standard.

1.2 APPLICATION

This Standard is intended for the guidance of manufacturers, users, regulatory authorities, testing authorities and associated interests. It has no legal authority in its own right, but it may acquire legal standing in one or more of the following ways:

- (a) Adoption by a regulatory authority.
- (b) Reference to compliance with the Standard as a contract requirement.
- (c) Claim by a manufacturer or manufacturer's agent of compliance with the Standard.

This Standard nominates the means by which identified hazards may be managed. Alternative technologies or innovations may also provide solutions to the management of these hazards. An alternative technology or innovation may be adopted, provided the alternative meets or exceeds the applicable requirements of this Standard. A formal risk assessment, meeting applicable Standards, shall be required to provide evidence of such compliance.

In addition to the requirements of this Standard, there may be other requirements set by the regulatory authority. Users of this Standard should, therefore, make themselves aware of any such requirements where the diesel engine system will be used.

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1.3 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS 1019	Internal combustion engines—Spark emission control devices
1722 1722.1	Pipe threads of Whitworth form Part 1: Sealing pipe threads
AS 2784	Endless wedge belt and V-belt drives
4024 4024.1 4024.1301 4024.1501 4024.1502 4024.1601	 Safeguarding of machinery Part 1: Safety of machinery (series) Part 1301: Principles of risk assessment Part 1501: General principles Part 1502: Validation Part 1601: Guards—General requirements for the design and construction of fixed and moveable guards
4024.1604	Part 1604 Emergency stop—Principles for design
62061	Safety of machinery—Functional safety of safety-related electrical, electronic and programmable electronic control systems
AS/NZS 1826	Electrical equipment for explosive gas atmospheres - Special protection - Type of protection 's'
4871 4871.1 4871.2 4871.3 4871.4 4871.5 4871.6	Electrical equipment for coal mines, for use underground Part 1: General requirements Part 2: Distribution, control and auxiliary equipment Part 3: Substations Part 4 Mains powered electrical mobile machines Part 5: Battery powered electrical mobile machines Part 6: Diesel powered machinery and ancillary equipment
60079 60079.0	Electrical apparatus for explosive gas atmospheres Part 0: General requirements
ISO 9000	Quality management systems—Fundamentals and vocabulary
ISO 9001	Quality management systems—Requirements
ISO 9004	Quality management systems—Guidelines for performance improvements
ISO 8178 8178-1 8178-4	Reciprocating internal combustion engines—Exhaust emission measurement Part 1: Test-bed measurement of gaseous and particulate exhaust emissions Part 4: Test cycles for different engine applications
ADR 30	[Australian Design Rules] Diesel engine exhaust smoke omissions
ASTM D1298	Standard Test Method for Density, Relative Density (Specific gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method
HB 18 18.28	[Standards Australia handbook] Conformity assessment Guide 28: Guidance on third-party certification scheme for products

SAE

- J 244 Measurement of intake air or exhaust gas flow of diesel engines
- J 255 Diesel engine smoke measurement
- J 1003 Diesel engine emission measurement procedure, recommended practice

1.4 DEFINITIONS

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

1.4.1 Abnormal combustion

Unintended or uncontrolled combustion in the engine.

NOTES:

- 1 Abnormal combustion may be caused by induced flammable gas, liquid or vaporized hydrocarbons.
- 2 Abnormal combustion may cause intake flashbacks, high exhaust temperature or high surface temperatures or catastrophic engine failure, engine overspeed, uncontrollable engine running and/or render the explosion protection system ineffective.
- 3 Abnormal combustion may not be apparent to an operator except for a marginal change of power and/or emissions.

1.4.2 Catalytic converter

Equipment that modifies the constituents of an exhaust gas stream by means of a catalyst.

1.4.3 Designated safe area

A place in which there is a minimum possibility of an explosive atmosphere being present in such quantities that would require special precautions while a diesel engine is operated, serviced or maintained.

NOTES:

- 1 The management of fire and explosion hazards is of particular importance to the safety of underground coal mines.
- 2 It cannot be assumed that areas of a mine that are not classified as being explosion-risk zones are designated safe areas.
- 3 Legislation, regulations or requirements by the relevant statutory authority may define designated safe areas in greater detail.
- 4 The statutory authority may require the use of risk-analysis techniques, to identify designated safe areas. Such techniques may require safe areas to be enclosed by barriers, even where the probability of an occurrence is considered to be very low, or where events having a maximum reasonable consequence of a fatality exist.
- 5 Where a consequence could be catastrophic, the mathematical product of risk and consequence may not be appropriate for the risk assessment decision-making process.

1.4.4 Engine safety shutdown system

A protection system that automatically causes an engine to stop in the event of an unsafe condition occurring.

1.4.5 Emergency safety shutdown system

A system fitted to stop the diesel engine in the event of the failure of the other systems to stop the engine.

1.4.6 Explosion-protected diesel engine system

A diesel engine that is designed, manufactured and maintained so it will not propagate or generate flame or sparks, which could initiate an explosion of the surrounding atmosphere. The diesel engine system includes—

(a) inlet systems and inlet flametrap;

- (b) exhaust systems and exhaust flametrap;
- (c) combustion chamber;
- (d) cooling systems;
- (e) starting systems;
- (f) shutdown and protection systems; and
- (g) other ancillary equipment attached to or driven by the engine, including electrical systems that start the engine, or are associated with the engine operation or engine control.

NOTE: Equipment driven from the output side of a diesel engine flywheel should not be considered to be part of any explosion-protected diesel engine system.

1.4.7 Explosion-risk zone

A place where during the normal course of events there is a possibility that there may be an accumulation of flammable or explosive gas that could create a hazard for the operation, servicing or maintenance of a diesel engine system.

NOTE: Legislation for underground coal mines may define certain parts of the mine as explosion-risk zones and may use the term 'hazardous area' to describe an explosion-risk zone.

1.4.8 Fire protection

Design features that will prevent the diesel engine system from igniting flammable material or substances.

NOTE: Such features are not necessarily intended to prevent the ignition of flammable or explosive gas.

1.4.9 Flametrap

A device that prevents the propagation of an explosion of gas from a diesel engine to the outside atmosphere.

NOTE: Flametraps may be dry (not relying on water for effectiveness) or wet (relying on the retention or presence of water).

1.4.10 Gland

A device for attachment to an electrical enclosure, which allows for the entry of cables, including flexible cables and cords, without detriment to the explosion-protected characteristics of the enclosure.

1.4.11 High-idle speed

The maximum governed speed of an engine with minimal output power from the engine and the ancillary equipment.

1.4.12 Low-idle speed

The minimum governed speed of an engine with minimal output load from the engine and the ancillary equipment.

1.4.13 Particulate filter

A filter that removes particulates from an exhaust gas stream.

1.4.14 Rated power

The maximum continuous power output at rated speed of an engine, as determined by the testing authority in accordance with this Standard.

1.4.15 Rated speed

The speed of an engine while producing rated power.