

Australian/New Zealand Standard™

**Electrical apparatus for use in the
presence of combustible dust**

Part 0: General requirements



AS/NZS 61241.0:2005

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Australian/New Zealand Standard™

Electrical apparatus for use in the presence of combustible dust

Part 0: General requirements

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-014, Electrical Equipment in Hazardous Areas to supersede, in part, AS/NZS 61241.1.1:1999.

This Standard incorporates Amendment No. 1 (July 2005). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

This Standard is identical with, and has been reproduced from IEC 61241-0, Ed. 1 (2004), *Electrical apparatus for use in the presence of combustible dust – Part 0: General requirements*.

The objective of this Standard is to specify general requirements for the design, construction and testing of electrical apparatus to be used in areas where combustible dusts are or may be present.

This first edition of AS/NZS 61241.0, together with AS/NZS 61241.1, cancels and replaces AS/NZS 61241.1.1:1999.

This Standard (and other parts within this Series) was developed to align protection methods associated with electrical apparatus for use in the presence of combustible dust and those similar protection methods associated with the AS/NZS 60079 series of Standards, where possible.

AS/NZS 61241 consists of the following parts under the general title: *Electrical apparatus for use in the presence of combustible dust*:

Part 0:	General requirements
Part 1:	Protection by enclosures ‘tD’
Part 2:	Type of protection ‘pD’*
Part 10:	Classification of areas where combustible dusts are or may be present
Part 11:	Protection by intrinsic safety ‘iD’†
Part 14:	Selection and installation
Part 17:	Inspection and maintenance of electrical installations in hazardous areas (other than mines)†
Part 18:	Protection by encapsulation ‘mD’
Part 20:	Test methods‡
Part 20.1:	Methods for determining the minimum ignition temperatures of dust
Part 20.2:	Method for determining the electrical resistivity of dust in layers
Part 20.3:	Method for determining minimum ignition energy of dust/air mixtures

As this Standard is reproduced from an International Standard, the following applies:

- Its number does not appear on each page of text and its identity is shown only on the cover and title page.
- In the source text ‘this international standard’ should read ‘this Australian/New Zealand Standard’.
- A full point should be substituted for a comma when referring to a decimal marker.

* To be published (to supersede current AS/NZS 61241.4).

† To be published.

‡ Under consideration (to supersede current Parts 2.1, 2.2 and 2.3).

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INTRODUCTION

Many dusts that are generated, processed, handled and stored, are combustible. When ignited they can burn rapidly and with considerable explosive force if mixed with air in the appropriate proportions. It is often necessary to use electrical apparatus in locations where such combustible materials are present, and suitable precautions must therefore be taken to ensure that all such apparatus is adequately protected so as to reduce the likelihood of ignition of the external explosive atmosphere. In electrical apparatus, potential ignition sources include electrical arcs and sparks, hot surfaces and frictional sparks.

Areas where dust, flyings and fibres in air occur in dangerous quantities are classified as hazardous and are divided into three zones according to the level of risk.

Generally, electrical safety is ensured by the implementation of one of two considerations, i.e. that electrical apparatus be located where reasonably practicable outside hazardous areas, and that electrical apparatus be designed, installed and maintained in accordance with measures recommended for the area in which the apparatus is located.

Combustible dust can be ignited by electrical apparatus in several ways:

- by surfaces of the apparatus that are above the minimum ignition temperature of the dust concerned. The temperature at which a type of dust ignites is a function of the properties of the dust, whether the dust is in a cloud or layer, the thickness of the layer and the geometry of the heat source;
- by arcing or sparking of electrical parts such as switches, contacts, commutators, brushes, or the like;
- by discharge of an accumulated electrostatic charge;
- by radiated energy (e.g. electromagnetic radiation);
- by mechanical sparking or frictional sparking or heating associated with the apparatus.

In order to avoid ignition hazards it is necessary that

- the temperature of surfaces, on which dust can be deposited, or which would be in contact with a dust cloud, is kept below the temperature limitation specified in this standard;
- any electrical sparking parts, or parts having a temperature above the temperature limit specified in IEC 61241-14
 - are contained in an enclosure which adequately prevents the ingress of dust, or
 - the energy of electrical circuits is limited so as to avoid arcs, sparks or temperatures capable to ignite combustible dust;
- any other ignition sources are avoided.

Compliance with this standard will only provide the required level of safety if the electrical apparatus is operated within its rating and is installed and maintained according to the relevant codes of practice or requirements, for example in respect of protection against over-currents, internal short-circuits, and other electrical faults. In particular, it is essential that the severity and duration of an internal or external fault be limited to values that can be sustained by the electrical apparatus without damage.

Several techniques are available for the explosion protection of electrical apparatus in hazardous areas. This standard describes the safety features of these types of explosion-protection techniques and specifies the installation procedures to be adopted. It is most important that the correct selection and installation procedures be followed to ensure the safe use of electrical apparatus in hazardous areas.

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard**Electrical apparatus for use in the presence of combustible dust**
Part 0: General requirements

1 Scope

This part of IEC 61241 specifies general requirements for the design, construction, testing and marking of electrical apparatus protected by any recognized safeguard technique for use in areas where combustible dust may be present in quantities that could lead to a fire or explosion hazard.

This standard is supplemented or modified by the following parts of IEC 61241 concerning specific types of protection:

- Part 1: Protection by enclosures 'tD'
- Part 2: Protection by pressurization 'pD' (under consideration)
- Part 11: Intrinsically safe apparatus 'iD'
- Part 18: Protection by encapsulation 'mD'

NOTE IEC 61241 gives guidance on the selection and installation of the apparatus. Apparatus within the scope of this standard may also be subjected to additional requirements in other standards – for example, IEC 60079-0.

The application of electrical apparatus in atmospheres which may contain explosive gas as well as combustible dust, whether simultaneously or separately, requires additional protective measures.

This standard does not specify requirements for safety, other than those directly related to the explosion risk.

Where the apparatus has to meet other environmental conditions, for example, protection against ingress of water and resistance to corrosion, additional methods of protection may be necessary. The method used is not to adversely affect the integrity of the enclosure.

This standard does not apply to dusts of explosives that do not require atmospheric oxygen for combustion, or to pyrophoric substances.

This standard is not applicable to electrical apparatus intended for use in underground parts of mines as well as those parts of surface installations of such mines endangered by fire damp and/or combustible dust.

This standard does not take account of any risk due to an emission of flammable or toxic gas from the dust.

2 Normative references

The following referenced documents are indispensable for the application of this document.

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

References to international standards that are struck through in this clause are replaced by references to identical Australian or Australian/New Zealand Standards that are listed immediately thereafter and identified by shading.

IEC 60034-5:2000, *Rotating electrical machines – Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code) – Classification*

~~IEC 60079-0:2004, *Electrical apparatus for explosive gas atmospheres – Part 0: General requirements*~~

AS/NZS 60079.0:2005, *Electrical apparatus for explosive gas atmospheres, Part 0: General requirements* (identical to IEC 60079-0:2004)

~~IEC 60079-7:2001, *Electrical apparatus for explosive gas atmospheres – Part 7: Increased safety 'e'*~~

AS/NZS 60079.7:2002, *Electrical apparatus for explosive gas atmospheres, Part 7: Increased safety 'e'* (identical to IEC 60079-7:2001)

~~IEC 60079-11:1999, *Electrical apparatus for explosive gas atmospheres – Part 11: Intrinsic safety 'i'*~~

AS/NZS 60079.11:2000, *Electrical apparatus for explosive gas atmospheres—Intrinsic safety 'i'* (identical to IEC 60079-11:1999)

IEC 60086-1:2000, *Primary batteries – Part 1: General*

IEC 60095 (all parts), *Lead-acid starter batteries*

IEC 60192:2001, *Low-pressure sodium vapour lamps – Performance specifications*

IEC 60216-1:2001, *Electrical insulating materials – Properties of thermal endurance – Part 1: Ageing procedures and evaluation of test results*

IEC 60216-2:1990, *Guide for the determination of thermal endurance properties of electrical insulating materials – Part 2: Choice of test criteria*

IEC 60243-1:1998, *Electrical strength of insulating materials – Test methods – Part 1: Tests at power frequencies*

IEC 60285:1993, *Alkaline secondary cells and batteries – Sealed nickel-cadmium cylindrical rechargeable single cells**

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*

IEC 60623:2001, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Vented nickel-cadmium prismatic rechargeable single cells*

IEC 60662:1980, *High-pressure sodium vapour lamps*

~~IEC 60947-3:1999, *Low voltage switchgear and controlgear – Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units*~~

* Cancelled and replaced by IEC 61951-1 (2003).

AS/NZS 3947.3:2001, *Low-voltage switchgear and controlgear—Switches, disconnectors, switch-disconnectors and fuse-combination units* (identical to IEC 60947-3:1999)

IEC 61056 (all parts), *General purpose lead-acid batteries (valve-regulated types)*

IEC 61150:1992, *Alkaline secondary cells and batteries – Sealed nickel-cadmium rechargeable monobloc batteries in button cell design*

~~IEC 61241-1, *Electrical apparatus for use in the presence of combustible dust – Part 1: Protection by enclosures* “tD”~~

AS/NZS 61241.1, *Electrical apparatus for use in the presence of combustible dust, Part 1: Protection by enclosures* “tD”

IEC 61241-14, *Electrical apparatus for use in the presence of combustible dust – Part 14: Selection and installation*

ISO 48:1994, *Rubber, vulcanized or thermoplastic – Determination of hardness (hardness between 10 IRHD and 100 IRHD)*

ISO 178:2001, *Plastics – Determination of flexural properties*

ISO 179 (all parts), *Plastics – Determination of Charpy impact properties*

ISO 262:1998, *ISO general-purpose metric screw threads – Selected sizes for screws, bolts and nuts*

ISO 273:1979, *Fasteners – Clearance holes for bolts and screws*

~~ISO 286-2:1988, *ISO system of limits and fits – Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts*~~

AS 1654.2—1995, *ISO system of limits and fits, Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts* (identical to ISO 286-2:1988)

~~ISO 527 (all parts), *Plastics – Determination of tensile properties*~~

AS 1145 (all parts), *Determination of tensile properties of plastics materials* (identical to ISO 527 (all parts))

ISO 965 (all parts), *ISO general-purpose metric screw threads – Tolerances*

ISO 1818:1975, *Vulcanized rubbers of low hardness (10 to 35 IRHD) . Determination of hardness*⁷*

~~ISO 4014:1999, *Hexagon head bolts – Product grades A and B*~~

AS 1110.1—2000, *ISO metric hexagon bolts and screws—Product grades A and B—Bolts* (identical to ISO 4014:1999)

* Withdrawn standard.

~~ISO 4017:1999, Hexagon head screws—Product grades A and B~~

AS 1110.2—2000, *ISO metric hexagon bolts and screws—Product grades A and B—Screws* (identical to ISO 4017:1999)

ISO 4026:2003, *Hexagon socket set screws with flat point*

ISO 4027:2003, *Hexagon socket set screws with cone point*

ISO 4028:2003, *Hexagon socket set screws with dog point*

ISO 4029:2003, *Hexagon socket set screws with cup point*

~~ISO 4032:1999, Hexagon nuts, style 1—Product grades A and B~~

AS 1112.1—2000, *ISO metric hexagon nuts—Style 1—Product grades A and B* (identical to ISO 4032:1999)

~~ISO 4762:1997, Hexagon socket head cap screws~~

AS 1420—2001, *ISO metric hexagon socket head cap screws* (identical to ISO 4762:1997)

ISO 4892 (all parts), *Plastics – Methods of exposure to laboratory light sources*

3 Terms and definitions

For the purposes of this document, the following definitions apply.

3.1

dust

small solid particles including fibres and flyings in the atmosphere which settle out under their own weight, but which may remain suspended in air for some time (includes dust and grit as defined in ISO 4225)

3.2

combustible dust

dust, fibres or flyings that can burn or glow in air and could form explosive mixtures with air at atmospheric pressure and normal temperatures

3.3

conductive dust

dust, fibres or flyings with electrical resistivity equal to or less than $10^3 \Omega \cdot m$

3.4

explosive dust atmosphere

mixture with air, under atmospheric conditions, of flammable substances in the form of dust, fibres or flyings in which, after ignition, combustion spreads throughout the unconsumed mixture

[IEV 426-02-04, modified]

3.5

minimum ignition temperature of a dust layer

lowest temperature of a hot surface at which ignition occurs in a dust layer of specified thickness on this hot surface

[3.3 of IEC 61241-2-1]

3.6**minimum ignition temperature of a dust cloud**

lowest temperature of the hot inner wall of a furnace at which ignition occurs in a dust cloud in air contained therein

[3.5 of IEC 61241-2-1, modified]

3.7**electrical apparatus**

items applied as a whole or in part for the utilization of electrical energy

NOTE These include, amongst others, items for the generation, transmission, distribution, storage, measurement, regulation, conversion and consumption of electrical energy and items for telecommunications.

3.8**rating**

set of rated values and operating conditions

3.9**enclosure**

all the walls, doors, covers, cable entries, rods, spindles, shafts, etc. which contribute to the type of protection of and/or the degree of protection (IP) of the electrical apparatus

3.10**dust-tight enclosure**

enclosure capable of preventing the ingress of all observable dust particles

3.11**dust-protected enclosure**

enclosure in which the ingress of dust is not totally prevented but does not enter in sufficient quantity to interfere with the safe operation of the equipment

NOTE Dust should not accumulate in a position within the enclosure where it is liable to cause an ignition hazard.

3.12**type of protection**

specific measures applied to electrical apparatus to avoid ignition of a surrounding explosive atmosphere by such apparatus

3.13**maximum surface temperature**

highest temperature which is attained by any part of the surface of electrical apparatus when tested under the defined dust-free or dust layer conditions at the specified maximum ambient temperature

NOTE This temperature is attained under the test condition. Increasing the layer thickness can increase this temperature due to the thermal insulation properties of dust.

3.14**maximum permissible surface temperature**

highest temperature a surface of electrical apparatus is allowed to reach in practical service to avoid ignition

NOTE The maximum permissible surface temperature will depend upon the type of dust, whether as a cloud or layer; if a layer, its thickness, and the application of a safety factor (see IEC 61241-14, Clause 6).

3.15**zones**

areas classified for explosive dust atmospheres are divided into zones based upon the frequency and duration of the occurrence of explosive dust/air atmospheres

3.16**Zone 20**

place in which an explosive atmosphere in the form of a cloud of combustible dust in air is present continuously, or for long periods or frequently

3.17**Zone 21**

place in which an explosive atmosphere in the form of a cloud of combustible dust in air is likely to occur, occasionally, in normal operation

3.18**Zone 22**

place in which an explosive atmosphere in the form of a cloud of combustible dust in air is not likely to occur in normal operation but, if it does occur, will persist for a short period only

3.19**cable entry***

device permitting the introduction of one or more electric and/or fibre optics cables into an electrical apparatus so as to maintain the relevant type of protection

3.20**conduit entry**

means of introducing a conduit into an electrical apparatus so as to maintain the relevant type of protection

3.21**compression element**

element of a cable entry acting on the sealing ring to enable the latter to fulfil its function

3.22**clamping device**

element of a cable entry for preventing tension or torsion in the cable from being transmitted to the connections

3.23**sealing ring**

ring used in a cable or conduit entry to ensure the sealing between the entry and the cable or conduit

3.24**terminal compartment**

separate compartment or part of a main enclosure, communicating, or not, with the main enclosure, and containing connection facilities

3.25**connection facilities**

terminals screws and other parts, used for the electrical connection of conductors of external circuits

3.26**bushing**

insulating device carrying one or more conductors through an internal or external wall of an enclosure

* It should read 'cable gland' as in definition 3.5 of IEC 60079-0:2004.

3.27**cell**

assembly of electrodes and electrolyte that constitutes the smallest electrical unit of a battery

3.28**primary cell or battery**

electrochemical system capable of producing electrical energy by chemical reaction

3.29**secondary cell or battery**

electrically rechargeable electrochemical system capable of storing electrical energy and delivering it by chemical reaction

3.30**open cell or battery**

secondary cell, or battery, having a cover provided with an opening through which gaseous products may escape

[IEC 486-01-18, modified]

3.31**sealed valve-regulated cell or battery**

cell or battery which is closed under normal conditions, but which has an arrangement which allows the escape of gas if the internal pressure exceeds a predetermined value

NOTE The cell cannot normally receive an addition to the electrolyte.

[IEV 486-01-20, modified]

3.32**sealed gas-tight cell or battery**

cell or battery which remains closed and does not release either gas or liquid when operated within the limits of charge or temperature specified by the manufacturer

[IEV 486-01-21, modified]

NOTE 1 Such cells and batteries may be equipped with a safety device to prevent dangerously high internal pressure. The cell or battery does not require addition to the electrolyte and is designed to operate during its life in its original sealed state.

NOTE 2 The above definition is taken from EN 50020. It differs from IEC definitions 486-01-20 and IEC 486-01-21 by virtue of the fact it applies to either a cell or battery.

3.33**battery**

assembly of two or more cells electrically connected to each other to increase the voltage or capacity

NOTE Where the terms "cell" or "cells" are used, the text refers to individual single cells. Where the terms "battery" or "batteries" are used, the text refers to both cells and batteries.

3.34**capacity**

quantity of electricity or electric charge, which a fully charged battery can deliver under specified conditions

3.35**nominal voltage** (of a cell or battery)

voltage specified by the manufacturer

3.36**maximum open circuit voltage** (of a cell or battery)

voltage which is the maximum attainable voltage under normal conditions, that is, from either a new primary cell, or a secondary cell just after a full charge

NOTE See Table 3 and Table 4 which show the maximum open circuit voltage for acceptable cells.

3.37**charging**

act of forcing current through a secondary cell or battery in the opposite direction to the normal flow to restore the energy stored originally

3.38**reverse charging**

act of forcing current through either a primary cell or secondary cell in the same direction as the normal flow

NOTE For example, in an expired battery.

3.39**deep discharge**

event which reduces a cell voltage below that recommended by the cell or battery manufacturer

3.40**inherently safe (ihs) cell (or battery)**

primary cell or battery in which the short-circuit current and maximum surface temperature are limited to a safe value by its internal resistance

3.41**Ex component**

part of electrical apparatus for potentially explosive atmospheres, which is not intended to be used alone in such atmospheres and requires additional certification when incorporated into electrical apparatus or systems for use in potentially explosive atmospheres

3.42**"X" symbol**

symbol used as a suffix to a certificate reference to denote special conditions for safe use

3.43**"U" symbol**

symbol used as a suffix to a certificate reference to denote an Ex component

NOTE The symbols "X" and "U" should not be used together.

3.44**certificate**

document confirming that the apparatus is in conformity with the requirements, the type tests and, where appropriate, the routine tests in the standard referred to therein

NOTE 1 A certificate can relate to Ex apparatus or an Ex component.

NOTE 2 A certificate may be produced by the manufacturer, the user, or a third party, for example, an IEC Ex Accepted Certification Body, a national certification body, or an authorized person.

4 Construction**4.1 General**

Electrical apparatus for use in potentially explosive dust atmospheres shall comply with the requirements of this standard.

NOTE If the electrical apparatus has to withstand particularly adverse service conditions (for example rough handling, humidity effects, ambient temperature variations, effects of chemical agents, corrosion), these should be specified to the manufacturer by the user and are not the responsibility of the testing station.