

Australian/New Zealand Standard™

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

**Part 14: Selection and installation
(IEC 61241-14, Ed.1.0(2004) MOD)**



AS/NZS 61241.14:2005

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee EL-014, Electrical Equipment in Hazardous Areas. It was approved on behalf of the Council of Standards Australia on 5 April 2005 and on behalf of the Council of Standards New Zealand on 11 February 2005.
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Australian/New Zealand Standard™

Electrical apparatus for use in the presence of combustible dust

Part 14: Selection and installation (IEC 61241-14, Ed.1.0(2004) MOD)

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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 AS/NZS 61241.1.2:2000, *Electrical apparatus for use in the presence of combustible dust*, Part 1.2: *Electrical apparatus protected by enclosures and surface temperature limitation—Selection, installation and maintenance*.

This Standard incorporates Amendment No. 1 (June 2005), Amendment No. 2 (September 2005), Amendment No. 3 (November 2006), Amendment No. 4 (February 2007) and Amendment No. 5 (March 2007). The changes required by the Amendments are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

The objective of this Standard is to provide guidance on the selection and installation of electrical apparatus to be used in areas where combustible dusts are or may be present.

This Standard is an adoption with national modifications and has been reproduced from IEC 61241-14, Ed.1.0(2004), *Electrical apparatus for use in the presence of combustible dust – Part 14: Selection and installation*, and has been varied as indicated to take account of Australian/New Zealand conditions.

The major changes with respect to AS/NZS 61241.1.2, are as follows:

- (a) Installation has changed to align with the changes to the definitions of the zones.
- (b) Requirements for installation of pressurization have been included.
- (c) Layers are no longer restricted to zone 20. Provision for the application of temperature according to layer depth is included.

Variations to IEC 61241-14:2004 are indicated at the appropriate places throughout this standard. Strikethrough (~~example~~) identifies IEC text, tables and figures which, for the purposes of this Australian/New Zealand Standard, are deleted. Where text, tables or figures are added, each is set in its proper place and identified by shading (**example**). Added figures are not themselves shaded, but are identified by a shaded border.

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 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).

The terms 'normative' and 'informative' are used to define the application of the annex to which they apply. A normative annex is an integral part of a standard, whereas an informative annex is only for information and guidance.

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INTRODUCTION

Many types of dust 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 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 this standard
 - 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 of igniting combustible dust;
- any other ignition sources are avoided.

Compliance with this part of **AS/NZS 61241-1:2005** 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.

In this standard, for “protection by enclosure tD” only, two different types of practice, A and B, are specified and are intended to provide an equivalent level of protection.

Both of these practices are in common use and the requirements of each should be followed without mixing either the apparatus requirements or selection/installation requirements of the two practices. They adopt different methodology with the primary differences being:

Practice A	Practice B
Written principally as performance based requirements	Written as both performance and prescriptive based requirements
Maximum surface temperature is determined with 5 mm layer of dust and installation rules require 75 °C margin between the surface temperature and ignition temperature of the particular dust	Maximum surface temperature is determined with 12,5 mm layer of dust and installation rules require 25 °C margin between the surface temperature and ignition temperature of the particular dust
A method of achieving the required dust ingress protection by the use of resilient seals on joints and rubbing seals on rotating or moving shafts or spindles and determining dust ingress according to IEC 60529 – IP Code	A method of achieving the required dust ingress protection by specified widths and clearances between joint faces and, in the case of shafts and spindles, specified lengths and diametrical clearances between moving and stationary parts and determining dust ingress according to the heat cycling test

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard**Electrical apparatus for use in the presence of combustible dust**

Any table, figure or text of the international standard that is struck through is not part of this Standard. Any Australian/New Zealand table, figure or text that is added is part of this Standard and is identified by shading.

1 Scope

This part of **AS/NZS 61241.14-2005** specifies general requirements, additional to those required for basic electrical safety, for the selection of electrical apparatus and instruments and associated equipment, and for the installation of electrical apparatus to ensure safe use in areas where combustible dust may be present in quantities which could lead to a fire or explosion hazard.

NOTE Various parts of the **AS/NZS 61241.14-2005** series specify requirements for the design, construction and testing of electrical apparatus. Apparatus within the scope of this standard may also be subjected to additional requirements in other standards.

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 which are not within the scope of this standard.

This standard includes several types of protection that protect either from ingress of dust or have insufficient energy to cause ignition and provide surface temperature limitation.

The principles of this standard may also be followed when combustible fibres or flyings cause a hazard.

Where the apparatus is required 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 should not adversely affect the integrity of the enclosure. The requirements of this standard apply only to the use of electrical apparatus under normal or near normal atmospheric conditions. For other conditions, additional precautions may be necessary. For example, most flammable materials and many materials which are normally regarded as non-flammable might burn vigorously under conditions of oxygen enrichment. Other precautions might also be necessary in the use of electrical apparatus under conditions of extreme temperature and pressure. Such precautions are beyond the scope of this standard.

This standard does not apply to dust from explosives which do not require atmospheric oxygen for combustion; neither does it apply to pyrophoric substances.

This standard is not applicable to electrical apparatus intended for use in underground parts of mines, nor those parts of surface installations of such mines endangered by firedamp 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.

The requirements specified in this standard are supplementary to and not alternative to any requirements that would apply to apparatus and installations in non-hazardous areas (**AS/NZS 3000**).

Equipment and installations where hazardous areas exist are required to comply with the applicable regulations of New Zealand or the applicable Australian State or Territory. It should be borne in mind that an installation can come under the jurisdiction of several authorities with different areas of responsibility, e.g. mining, electrical safety, handling and transport of flammable materials and occupational health and safety.

Notwithstanding application of the installation requirements of this Standard to new installations, the requirements for inspection shall be applied to all electrical equipment and installations irrespective of age and date of installation. (Refer to Annex ZA for further details).

NOTE - Further information about handling combustible dusts can be found in AS/NZS 4745:2004, *Code of practice for handling combustible dusts*.

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 Australian or Australian/New Zealand Standards that are listed immediately thereafter and identified by shading. Any Australian or Australian/New Zealand Standard that is identical to the International Standard it replaces is identified as such.

AS 2236, **(superseded)** *Electrical equipment for explosive atmospheres—Dust-excluding ignition-proof (DIP) enclosure*

AS 2431, *Electrical equipment for explosive atmospheres—Encapsulated apparatus—Type of protection ‘m’*

AS/NZS 1020, *The control of undesirable static electricity*

AS/NZS 2053.1, *Conduits and fittings for electrical installations—General requirements*

AS/NZS 2053.2, *Conduits and fittings for electrical installations—Rigid plain conduits and fittings of insulating material*

AS/NZS 2053.5, *Conduits and fittings for electrical installations—Corrugated conduits and fittings of insulating material*

AS/NZS 2053.7, *Conduits and fittings for electrical installations—Rigid metal conduits and fittings*

AS/NZS 2053.8, *Conduits and fittings for electrical installations—Flexible conduits and fittings of metal or composite material*

AS/NZS 2381.1, *Electrical equipment for explosive atmospheres—Selection, installation and maintenance—General requirements*

AS/NZS 4761, *Competencies for working with electrical equipment for hazardous areas (EEHA)*

AS/NZS 60079.11, *Electrical apparatus for explosive gas atmospheres—Intrinsic safety ‘i’*

AS/NZS 61241.1.1, *Electrical apparatus for use in the presence of combustible dust—Electrical apparatus protected by enclosures and surface temperature limitation—Specification for apparatus*

ISO/IEC Guide 65, *General requirements for bodies operating product certification systems*

ISO/IEC Guide 67, *Conformity assessment—Fundamentals of product certification*

IEC 60364 (all parts), *Electrical installations of buildings*

IEC 60364-4-41, *Electrical installations of buildings – Part 4-41: Protection for safety – Protection against electric shock*

AS/NZS 3000, *Electrical installations (known as the Australian/New Zealand Wiring Rules)*

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

AS 60529, *Degrees of protection provided by enclosures for electrical equipment (IP Code) (identical to IEC 60529)*

IEC 60742, *Short-circuit temperature limits of electric cables with rated voltages of 1 kV ($U_m = 1,2$ kV) and ($U_m = 3,6$ kV)*

~~IEC 61024-1, *Protection of structures against lightning – Part 1: General principles*~~

~~IEC 61024-1-1, *Protection of structures against lightning – Part 1: General principles – Section 1: Guide A – Selection of protection levels for lightning protection systems*~~

AS/NZS 1768(Int), *Lightning protection*

~~IEC 61241-0, *Electrical apparatus for use in the presence of combustible dust – Part 0: General requirements*~~

AS/NZS 61241.0, *Electrical apparatus for use in the presence of combustible dust – Part 0: General requirements*

~~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 61241-10, *Electrical apparatus for use in the presence of combustible dust – Part 10: Classification of areas where combustible dusts are or may be present*~~

AS/NZS 61241.10, *Electrical apparatus for use in the presence of combustible dust – Part 10: Classification of areas where combustible dusts are or may be present*

~~IEC 61241-18, *Electrical apparatus for use in the presence of combustible dust – Part 18: Protection by encapsulation “mD”*~~

AS/NZS 61241.18, *Electrical apparatus for use in the presence of combustible dust – Part 18: Protection by encapsulation ‘mD’*

IEC 61558-1:1997, *Safety of power transformers, power supply units and similar – Part 1: General requirements and tests*

BS 7361-1, *Cathodic protection. Code of practice for land and marine applications*

AS 2832, *Cathodic protection of metals*

3 Terms and definitions

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

3.1

area

three-dimensional region or space

3.2

bushing

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

3.3

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 Accepted Certification Body (ExCB), a National Certification Body, or an authorized person.

3.4

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

3.5

conductive dust

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

3.6

dust

small solid particles 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)

3.7

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.

3.8

dust-tight enclosure

enclosure capable of preventing the ingress of all observable dust particles

3.9

dust excluding enclosure “tD”

dust-tight enclosure capable of preventing the ingress of all observable dust particles or a dust-protected enclosure in which the ingress of dust is not totally prevented but dust 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.

3.10

electrical apparatus

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

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

3.11**encapsulation “mD”**

type of protection whereby parts that are capable of igniting an explosive atmosphere by either sparking or heating are enclosed in a compound in such a way as to avoid ignition of a dust layer or cloud

3.12**equipotential bonding**

electrical connection of exposed metal parts so that they are at substantially the same voltage under normal and fault conditions

3.13**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

3.14**explosion-protection**

technique of protection that is applied to apparatus or part of apparatus to prevent the ignition of combustible dusts in hazardous areas

3.15**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 60426-02-4, modified]

3.16**hazardous area**

area in which combustible dust in cloud form is, or can be expected to be, present in quantities such as to require special precautions for the construction and use of equipment in order to prevent ignition of an explosive dust/air mixture

NOTE Hazardous areas are divided into zones based upon the frequency and duration of the occurrence of explosive dust/air mixtures.

3.17**ignition source**

source of energy which may comprise naked flames, hot surfaces, exposed incandescent material, incendive sparks or hot particles, sufficient to ignite an explosive atmosphere

3.18**intrinsic safety “iD”**

type of protection based on the restriction of electrical energy within apparatus and of interconnecting wiring exposed to the potentially explosive atmosphere to a level below that which can cause ignition by either sparking or heating effects

NOTE Because of the method used by which intrinsic safety is achieved, it is necessary to ensure that not only the electrical apparatus exposed to the potentially explosive atmosphere but also other electrical apparatus to which it is interconnected is suitably structured

3.19**instrument**

apparatus for the measurement, control or computation of physical or chemical quantities

3.20**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

[See 3.3 of IEC 61241-20-1, modified]

3.21**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

[See 3.5 of IEC 61241-20-1, modified]

3.22**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 test conditions. Increasing the layer thickness can increase this temperature due to the thermal insulation properties of dust.

3.23**maximum permissible surface temperature**

highest temperature that 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. For details see 6.3.

3.24**type of protection “pD” (pressurization)**

technique of applying a protective gas to an enclosure in order to prevent the formation of an explosive dust atmosphere inside the enclosure by maintaining an overpressure against the surrounding atmosphere

3.25**pyrophoric**

substance that takes fire spontaneously on exposure to air (e.g. phosphorus) or water (e.g. potassium or sodium)

3.26**source of release**

point or location from which a flammable material may be released into the atmosphere so that an explosive atmosphere can form

3.27**type of protection**

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

3.28**verification dossier**

set of documents showing the compliance of electrical apparatus and installations

3.29**wiring, open**

system of wiring in which unsheathed cables are installed without further protection

3.30**"X" symbol**

suffix to a certificate reference to denote special conditions for safe use

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

3.31**"U" symbol**

suffix to a certificate reference to denote an Ex component

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

3.32**zones**

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

3.33**zone 20**

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

3.34**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

3.35**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

4 General requirements for all types of protection

In addition to the requirements of AS/NZS 3000:2008/IEC 60364 for installations in areas free of combustible dust, further requirements for installation for use in the presence of combustible dust are described below.

Where electrical apparatus is installed in zone 20, special consideration shall be given to the selection of apparatus.

4.1 Access for inspection

Installations should be designed and apparatus and materials installed with a view to providing safe and easy access for inspection and maintenance (Refer to Annex C) (IEC 61241-17).

4.2 Associated equipment located in non-hazardous areas

Consideration shall be given to the specification and installation of apparatus associated with hazardous area apparatus, but which is located in a non-hazardous area, e.g. protection devices, variable speed controllers, fuses etc.

4.3 Segregation

The ultimate level of safety can only be assured when the hazardous materials are segregated. Where practicable, electrical apparatus generally, and switchgear and controlgear particularly, should be installed in a non-hazardous area.

The apparatus may be installed in a non-hazardous area in open air, segregated in a room or compartment that is non-hazardous or, in some instances, behind an impervious barrier that separates the apparatus from the hazardous area.

4.4 Electrical rating

Electrical apparatus and materials shall be installed, used and maintained for use only within their electrical ratings. These ratings include power, voltage, current, frequency, duty and temperature.

4.5 Protection from mechanical damage and environmental injury

All electrical apparatus shall be selected and installed, and the installation designed to prevent or withstand damage which might reasonably be expected to result from mechanical damage and environmental influences likely to be encountered. Both the effect of the material causing the area to be classified as a hazardous area and the effect of the environment shall be taken into account.

4.6 Documentation

It is necessary to ensure that all installations comply with the appropriate certification documents as well as with this standard, in addition to any other requirements specific to the installations covered by this standard.

~~NOTE To achieve this result, a verification dossier should be prepared for every plant and be either kept on the premises or stored in another location in which case a document should be left on the premises indicating who the owner, or owners, are and where that information is kept, so that when required, copies may be obtained. This verification dossier should contain the information detailed in the appropriate parts of this IEC 61241 series for the types of protection concerned.~~

~~Up-to-date information typically required is as follows:~~

- ~~1. Where applicable, a statement of the identity of the person(s) having legal ownership of the installation or parts thereof and where the verification dossier is located.~~
- ~~2. Plans showing the classification and extent of the hazardous areas, as specified in IEC 61241-10, including the zoning and maximum permissible layer thickness.~~
- ~~3. Material characteristics including electrical resistivity, the minimum ignition temperature of the combustible dust cloud, minimum ignition temperature of the combustible dust layer and minimum ignition energy of the combustible dust cloud should be recorded.~~
- ~~4. Apparatus installation instructions.~~
- ~~5. Documentation and/or certification for electrical apparatus, including those items with special conditions, for example, apparatus with certificate numbers that have the suffix 'X'.~~
- ~~6. Descriptive system document for the intrinsically safe system.~~
- ~~7. Documentation relating to the suitability of the apparatus for the area and environment to which it will be exposed, e.g. temperature ratings, Ex type, IP rating, corrosion resistance.~~
- ~~8. Documentation that the apparatus is rated for the voltages and frequency applied during normal operation.~~
- ~~9. Declaration by the installer that the installation of the apparatus conforms to the requirements of this standard.~~
- ~~10. Records sufficient to enable the explosion-protected apparatus to be maintained in accordance with its type of protection (for example, list and location of apparatus, spares, technical information).~~
- ~~11. Plans showing types and details of wiring systems.~~
- ~~12. Records of selection criteria for cable entry systems for compliance with the requirements for the particular explosion-protection technique.~~
- ~~13. Drawings and schedules relating to circuit identification.~~

~~It is the responsibility of the person(s) having legal ownership of the installation or parts thereof to ensure that the relevant information is produced but the preparation of the document may be delegated to expert bodies/organizations.~~

~~The verification dossier may be kept as hard copy or in electronic form.~~

~~Methods accepted by legislation in each country may vary the form in which the documentation will be legally accepted.~~

To achieve this result, a verification dossier shall be prepared for every plant and be either kept on the premises or stored in another location in which case a document should be left on the premises indicating who the owner, or owners, are and where that information is kept, so that when required, copies may be obtained. This verification dossier should contain the information detailed in the appropriate parts of this AS/NZS 61241 series for the types of protection concerned.

Up-to-date information typically required is as follows:

- 1) Where applicable, a statement of the identity of the person(s) having legal ownership of the installation or parts thereof and where the verification dossier is located.
- 2) Plans showing the classification and extent of the hazardous areas, as specified in AS/NZS 61241.10, including the zoning and maximum permissible layer thickness.
- 3) Material characteristics including electrical resistivity, the minimum ignition temperature of the combustible dust cloud, minimum ignition temperature of the combustible dust layer and minimum ignition energy of the combustible dust cloud should be recorded.
- 4) Apparatus installation instructions.
- 5) Documentation and/or certification for electrical apparatus, including those items with special conditions, for example, apparatus with certificate numbers that have the suffix 'X'.
- 6) Descriptive system document for the intrinsically safe system.
- 7) Documentation relating to the suitability of the apparatus for the area and environment to which it will be exposed, e.g. temperature ratings, Ex type, IP rating, corrosion resistance.
- 8) Documentation that the apparatus is rated for the voltages and frequency applied during normal operation.
- 9) Declaration by the installer that the installation of the apparatus conforms to the requirements of this standard.
- 10) Records sufficient to enable the explosion-protected apparatus to be maintained in accordance with its type of protection (for example, list and location of apparatus, spares, technical information).
- 11) Plans showing types and details of wiring systems.
- 12) Records of selection criteria for cable entry systems for compliance with the requirements for the particular explosion technique.
- 13) Drawings and schedules relating to circuit identification.
- 14) Documentation on the use of any additional tagging or labelling system used in addition to or substitute for the original markings on the Ex Rated Equipment.
- 15) In New Zealand the Hazardous Area Statement of Periodic Verification on completion of a periodic inspection.

It is the responsibility of the person(s) having legal ownership of the installation or parts thereof to ensure that the relevant information is produced but the preparation of the document may be delegated to expert bodies/organizations.

The verification dossier may be kept as hard copy or in electronic form.

Methods accepted by legislation may vary the form in which the documentation will be accepted.

4.7 Qualifications of personnel

The design and construction of installations covered by this standard shall be carried out only by competent persons whose training has included instruction on the various types of protection and installation practices, relevant rules and regulations and on the general principles of area classification. The competency of the person shall be relevant to the type of work to be undertaken.

Appropriate continuing education or training should be undertaken by personnel on a regular basis.

Competency may be demonstrated in accordance with AS/NZS 4761 or equivalent training and assessment framework.

4.8 Additional considerations

4.8.1 Light metals as construction materials

Particular consideration shall be given to the location of apparatus that incorporate light metals in their external construction, as it has been well established that such materials give rise to sparking that is incensive under conditions of frictional contact.

Suitable precautions shall therefore be taken to ensure that such frictional contact is avoided. (see Annex B.)

4.8.2 Non-electrical ignition sources

In any installation, irrespective of size, there may be numerous sources of ignition apart from those associated with electrical apparatus. Adequate precautions should be taken in these circumstances to ensure safety. Such precautions are beyond the scope of this standard.

NOTE – Refer to AS/NZS 4745 for further guidance on non-electrical ignition sources.

4.8.3 Electromagnetic radiation

In the design of electrical installations, steps shall be taken to reduce to a safe level the effects of electromagnetic radiation.

~~NOTE – In the absence of IEC standards on protection against electromagnetic radiation, national or other standards should be followed.~~

NOTE - For radio and radar transmitters reference should be made to BS 6656 and BS 6657.

4.8.4 Portable apparatus and test equipment

Portable apparatus should be used in hazardous areas only when its use cannot reasonably be avoided.

Portable apparatus should have a type of protection appropriate to the zone(s) of use. During use, such apparatus should not be transferred from a zone of lower risk to a zone of higher risk unless it is suitably protected for the higher risk. In practice, however, such a limitation may be difficult to enforce so it is recommended that all portable apparatus meet the requirements of the highest risk. Similarly, the surface temperature requirements should be appropriate for all the combustible dusts in which the apparatus may be used.

Ordinary industrial portable apparatus should not be used in a hazardous area unless the specific location has been assessed to ensure that potentially combustible dust is absent during the period of use (“dust-free” situation). If plugs and sockets are present in a hazardous area, they should be suitable for use in the particular zone and have mechanical and/or electrical inter-locking to prevent an ignition source occurring during insertion or removal of the plug. Alternatively, they should only be energized in a “dust-free” situation.

If electrical testing, for example continuity testing, is necessary to facilitate the installation of hazardous area electrical apparatus, care should be taken to ensure that the testing operation is safe for the hazardous area. This may be achieved in various ways including the appropriate use of test equipment that is certified for hazardous area use. Alternately, testing shall be carried out in a “dust-free” situation.

NOTE 1 Whenever portable electrical apparatus is used in a hazardous area, extreme care should be taken to avoid unnecessary risks. Unless specifically permitted by the certification documents for portable electrical apparatus, or unless other suitable precautions are taken, spare batteries should not be taken into the hazardous area.

NOTE 2 Items of personal apparatus which are battery or solar operated (e.g. electronic wrist watches, hearing aids, car alarm remote controls, key ring torches, calculators, etc.) are sometimes carried by personnel and inadvertently taken into or left in a hazardous area. The risk with electronic watches is small and their use in a hazardous area is generally acceptable.

All other personal battery or solar apparatus (including electronic wrist watches incorporating a calculator) should be either assessed for use in the hazardous area or should only be taken into the hazardous area after a certificate guaranteeing a dust free situation has been issued or other procedural controls or instructions are in place to adequately control risks. An increased risk is associated with lithium batteries which may be used to power personal electronic apparatus and their use should be assessed as described in the paragraph above.

4.8.5 Toxic and health risks

No account is taken in this Standard of the toxic or health risks which may be associated with the materials. In locations where personnel may be exposed to potentially toxic or health risks appropriate precautions, which are outside the scope of this Standard, should be taken.

4.8.6 Other risks

Powder coating, plasma spraying and similar operations may present both combustible dust risks and flammable vapour risks. All relevant standards shall be applied accordingly.

4.9 Prevention of explosion

4.9.1 General

Preventive measures aimed at the elimination of the risk of a simultaneous occurrence of a source of ignition and an explosive atmosphere in the area under consideration may be used.

The problem may be approached in any one of the following ways, each of which has its own appropriate field of application:

- a) suppression or avoidance of the hazardous condition;
- b) use of explosion-protected electrical apparatus;
- c) conditions of control applied to procedural, automatic or manual means by which the simultaneous occurrence of an explosive atmosphere together with a source of ignition is prevented.

Although each method of prevention can be a complete solution to a particular problem in itself, it is permissible and sometimes advantageous to use a combination of techniques to obtain the required degree of safety.

4.9.2 Suppression or avoidance

4.9.2.1 Explosion-protected electrical apparatus

Various techniques of explosion-protection may be applied to apparatus or parts of apparatus to provide an assurance of safety. The types of protection considered in this standard are detailed in 6.1.

Where more than one explosion-protection technique is used, each relevant part of the apparatus or system shall maintain the properties of that particular technique.

4.9.2.2 Conditions of control

In certain cases, it is only by the addition of methods or conditions of control that the required degree of safety can be obtained. Such methods may include the use of procedures and/or the use of monitoring devices such as pressure, temperature or flow devices. Depending on the degree and type of hazard involved, the associated conditions of control initiated by the monitoring device may include one of the following:

- a) automatic disconnection of the power supply;
- b) automatic initiation of an alarm followed by an associated manual procedure to restore the integrity of the system;
- c) a manual procedure, whereby one or other of the parameters necessary for an explosive condition is retained under continuous control.

5 Area classification

The degree of dust protection of the apparatus needs to be matched to the environmental conditions likely to be encountered. A three zone system has been adopted.

See **AS/NZS 61241.10**~~IEC 61241-10~~ for details regarding classification of areas where combustible dusts are, or may be, present.

6 Selection of electrical apparatus

6.1 Permitted apparatus

Electrical apparatus selected for use in a combustible dust hazardous area shall be protected by one or a combination of the following types of explosion-protection to ensure the safety of electrical apparatus:

- ~~a) dust excluding, ignition proof enclosures (Ex tD); enclosures complying with IEC 61241-1;~~

- a) Ex tD enclosures complying with AS/NZS 61241.1; or DIP A21 apparatus in accordance with AS/NZS 61241.1.1; or DIP apparatus certified to AS 2236 which are deemed to be equivalent to DIP A21 apparatus in accordance with AS/NZS 61241.1.1.

- b) encapsulated apparatus (Ex mD) ~~encapsulated apparatus~~ complying with **AS/NZS 61241.18**~~IEC 61241-18~~;

- c) intrinsically safe apparatus (Ex iD) complying with **AS/NZS 61241.11**~~IEC 61241-11~~;

- d) pressurized enclosures (Ex pD) ~~pressurized enclosures~~ complying with the requirements for dust hazardous areas, specified in IEC 61241.2*.

A3

- e) Intrinsically safe apparatus complying with AS/NZS 60079.11 are permitted, provided that the following conditions are satisfied:

- i) The apparatus is—

- A) Ex ia for Zone 20; or
- B) Ex ib for Zones 21 or 22.

- ii) The apparatus is—

- A) Group IIA, IIB or IIC and the minimum dust cloud ignition energy to which the equipment will be exposed is higher than 15 mJ; or
- B) Group IIB or IIC, and the minimum dust cloud ignition energy to which the equipment will be exposed is higher than 1 mJ; or
- C) Group I, and coal dust is the only hazard present.

* Yet to be published to replace IEC 61241-4:2001. AS/NZS 61241.4:2002 is identical to IEC 61241-4:2001.

- iii) Associated safe area equipment is not installed in a Zone 20, 21 and 22 area unless protected by an appropriate protection technique.

NOTE - Associated safe area equipment is identified by the inclusion of brackets in the marking, e.g. Ex (ia), Ex (ib), (Exia), (Exib).

- iv) The apparatus is either encapsulated or protected by an enclosure complying with at least the degree of protection IP5X given in AS 60529.

- A3 | f) Encapsulated equipment complying with AS 2431 or AS/NZS 60079-18 is permitted. Such encapsulated equipment can be used in Zones 21 and 22.

6.2 Selection according to dust characteristics and zones

In order to select appropriate electrical apparatus for use in a zone 20, 21 and 22 hazardous area, the following information is required:

- a) The classification of the area, i.e. the zone.
The layer ignition temperature of the combustible dust involved or the lowest layer ignition temperature if more than one combustible material might be present. If the installation is likely to be subjected to excess layers, then the layer ignition temperature for the maximum layer depth of the combustible dust(s) will be required. Examples of excessively thick dust layers can be found in Annex A.
- b) The cloud ignition temperature of the combustible dust involved or the lowest value of cloud ignition temperature if more than one combustible material might be present.
- c) Where applicable, the minimum cloud ignition energy of the dust involved or the lowest minimum ignition energy if more than one combustible material might be present (see 6.3.3).
- d) Electrical resistivity (conductivity).

The type of explosion-protection shall be selected according to the area classification (see AS/NZS 61241.10 ~~IEC 61241-10~~).

6.3 Selection according to temperature

6.3.1 Ambient temperature range

Electrical apparatus for zones 20, 21 and 22 is intended for use in an ambient temperature within the range -20°C to $+40^{\circ}\text{C}$, unless marked accordingly.

6.3.2 Ambient temperature consideration

Where apparatus is installed in an area where the local ambient temperature is likely to be outside the specified range -20°C to $+40^{\circ}\text{C}$, precautions shall be taken to ensure that the apparatus operates within its specified range. Examples of such sources might include solar heating, an electric heater or a boiler.

When apparatus is to be located where its ambient temperature is not within its specified range, then the justification for this decision shall be documented. This decision should take into account the rating of components and the possible deterioration of enclosures and insulation and any other factors which adversely affect the method of protection. Consultation with the manufacturer and, where appropriate, the certifying authority for the apparatus so as to make an informed decision, will normally be necessary.

6.3.3 Temperature limitation

Dust layers exhibit two properties as layer thickness increases: a reduction in minimum ignition temperature and an increase in thermal insulation.

The maximum permissible surface temperature for apparatus is determined by the deduction of a safety margin from the minimum ignition temperature of the dust concerned, when tested in accordance with the methods specified in IEC 61241-20-1 for both dust clouds and layer thickness of up to 5 mm for type of protection “tD”, practice A and all other types of protection, and 12,5 mm for type of protection “tD” practice B.

For installations where the layer thickness is greater than the values given above, the maximum surface temperature shall be determined with particular reference to the layer thickness and all the characteristics of the material(s) being used. Examples of excessively thick dust layers can be found in Annex A.

6.3.3.1 Enclosure protection – Practice A and practice B

For type of protection “tD”, two different types of practice are specified in this standard, both intended to provide an equivalent level of protection against ignition (see the introduction and also Clause 12).

6.3.3.1.1 Enclosures for Practice A and all other apparatus

Temperature requirements are as follows:

- minimum ignition temperatures of a dust layer determined as specified in IEC 61241-20-1;
- maximum surface temperature measured under dust-free conditions as specified in 23.4.5.1 of AS/NZS 61241.0 ~~IEC 61241-0~~;
- maximum permissible surface temperature for apparatus having dust layers up to 5 mm thickness calculated as specified in 6.3.3.3.1.

NOTE Additional detail is given in 12.2.

6.3.3.1.2 Enclosures for Practice B only

Temperature requirements are as follows:

- minimum ignition temperature of a dust layer determined as specified in IEC 61241-20-1;
- maximum surface temperatures measured under dust blanket conditions as specified in 8.2.2.2 of AS/NZS 61241.1 ~~IEC 61241-1~~;
- maximum permissible surface temperature for apparatus having dust layers up to 12,5 mm thickness calculated as specified in 6.3.3.3.2.

NOTE Additional detail is given in 12.3.

6.3.3.2 Temperature limitations because of the presence of dust clouds

The maximum surface temperature of the apparatus shall not exceed two-thirds of the minimum ignition temperature in degrees Celsius of the dust/air mixture concerned:

$$T_{\max} = 2/3 T_{\text{CL}}$$

where T_{CL} is the minimum ignition temperature of the cloud of dust.