

AS/NZS 60079.14:2022



Australian/New Zealand Standard™

Explosive atmospheres

Part 14: Design selection, erection and initial inspection (IEC 60079-14:2013 (ED.5.0) MOD)



AS/NZS 60079.14:2022

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- Australian Petroleum Production and Exploration Association
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Australian/New Zealand Standard™

Explosive atmospheres

Part 14: Design selection, erection and initial inspection (IEC 60079-14:2013 (ED.5.0) MOD)

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Preface

This Standard was prepared by the Standards Australia Committee EL-014, Equipment for Explosive Atmospheres, to supersede AS/NZS 60079.14:2017.

Both the previous edition and this edition of AS/NZS 60079.14 adopt edition 5.0 of the IEC document. This revision of the document is to incorporate some amended text and to transition to the national variation box format described below. The revision of this document does not contain changes to technical content from the previous revision, only changes in presentation of the content.

The objective of this document is to set out the requirements for the design, selection, erection, and initial inspection of electrical installations in, or associated with, explosive atmospheres.

This document is an adoption with national modifications, and has been reproduced from, IEC 60079-14:2013, *Explosive atmospheres – Part 14: Electrical installations design, selection and erection*. The modifications are set out in national variations boxes which give instructions where the IEC text is to be modified for use in Australia and New Zealand.

The major changes in this edition are as follows:

- (a) Addition of the national variation box format. These variations are implemented as follows:
 - (i) Where a variation deletes and replaces an entire element it is located before the element with “Delete [element] and *replace* with the following:”.
 - (ii) Where a variation makes a minor modification to an element it is located after the element with “in the preceding [element], *delete* [element part] and *replace* with:”.
 - (iii) Where a variation adds new content to an existing element it is located after the element with “After the preceding [element], *add* the following:”.
- (b) Addition of guidance for installation of equipment marked with levels of protection “eb”, “ec”, “db”, “ob”, and “oc”.
- (c) Addition of guidance on pollution degrees and related definitions for electrical spacings.
- (d) Reinstatement of requirements for cable jointing from IEC 60079-14:2007 Ed 4.
- (e) Clarification of requirements for terminal boxes containing intrinsically safe circuits.

The variations shown address issues including the following:

- (i) The title is revised as: *Explosive atmospheres, Part 14: Design selection, erection and initial inspection*.
- (ii) Identification of Australian and Australian/New Zealand Standards that are modified adoptions of IEC normative references and are required to be used in place of the IEC documents.
- (iii) Inclusion of requirements for Group I.
- (iv) Identification of acceptable standards and acceptable certification for equipment.
- (v) Additional requirements for using intrinsic safety with dusts.
- (vi) Clarification of the ambient temperature marking and IP rating requirements for equipment.
- (vii) Expansion of the detail for the types of wiring systems required.
- (viii) Expansion of the requirements for conduit systems and inclusion of specific conduit requirements for Group III.
- (ix) Clarification for the selection of cable glands.
- (x) Addition of requirements for protection by ventilation Ex “v”.

- (xi) Deletion of [Annex A](#), as the subject is covered by AS/NZS 4761.1, *Competencies for working with electrical equipment for hazardous areas (EEHA), Part 1: Competency Standards*.
- (xii) Addition of [Appendix ZA](#) for options related to specific applications.
- (xiii) Addition of [Appendix ZB](#) for New Zealand-only requirements for verification of installations.
- (xiv) Addition of [Appendix ZC](#) for explanation of equipment certification systems.
- (xv) Addition of [Appendix ZD](#) for guidance on conformity assessments for equipment without ANZEx or IECEX certification.
- (xvi) Addition of [Appendix ZE](#) for requirements to adjust EPLs from default values.

As this document has been reproduced from an International Standard, the following applies:

- (A) In the source text “this part of the IEC 60079 series” should read “this Australian Standard or Australian/New Zealand Standard”.
- (B) A full point substitutes for a comma when referring to a decimal marker.

Australian or Australian/New Zealand Standards that are identical adoptions of international normative references may be used interchangeably. Refer to the online catalogue for information on specific Standards.

The conformity assessment requirements in the variations to [Clause 4.4](#) of the source document were approved by the Standards Australia Standards Development Accreditation Board (SDAC) on 2 February 2017 in order to include national certification options provided by the ANZEx and AUSEX schemes.

The terms “normative” and “informative” are used in Standards to define the application of the appendices to which they apply. A “normative” appendix is an integral part of a Standard, whereas an “informative” appendix is only for information and guidance.

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Introduction

Preventive measures to reduce the explosion risk from flammable materials are based on three principles, which are normally applied in the following order:

- 1) substitution
- 2) control
- 3) mitigation

Substitution involves, for example, replacing a flammable material by one which is either not flammable or less flammable.

Control involves, for example:

- a) reducing the quantity of flammables;
- b) avoiding or minimising releases;
- c) controlling the release;
- d) preventing the formation of an explosive atmosphere;
- e) collecting and containing releases; and
- f) avoiding ignition sources.

NOTE 1 With the exception of item f), all of the above are part of the process of hazardous area classification.

Mitigation involves, for example:

- 1) reducing the number of people exposed;
- 2) providing measures to avoid the propagation of an explosion;
- 3) providing explosion pressure relief;
- 4) providing explosion pressure suppression; and
- 5) providing suitable personal protective equipment.

NOTE 2 The above items are part of consequence management when considering risk.

Once the principles of substitution and control (items a) to e)) have been applied, the remaining hazardous areas should be classified into zones according to the likelihood of an explosive atmosphere being present (see IEC 60079-10-1 or IEC 60079-10-2). Such classification, which may be used in conjunction with an assessment of the consequences of an ignition, allows equipment protection levels to be determined and hence appropriate types of protection to be specified for each location.

For an explosion to occur, an explosive atmosphere and a source of ignition need to co-exist. Protective measures aim to reduce, to an acceptable level, the likelihood that the electrical installation could become a source of ignition.

By careful design of the electrical installation, it is frequently possible to locate much of the electrical equipment in less hazardous or non-hazardous areas.

When electrical equipment is installed in areas where explosive concentrations and quantities of flammable gases vapours or dusts may be present in the atmosphere, protective measures are applied to reduce the likelihood of explosion due to ignition by arcs, sparks or hot surfaces, produced either in normal operation or under specified fault conditions.

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 equipment in locations where such materials are present, and suitable precautions should therefore be taken to ensure that all such equipment is adequately protected so as to reduce the likelihood of ignition of the external explosive atmosphere. In electrical equipment, potential ignition sources include electrical arcs and sparks, hot surfaces and frictional sparks.

Dust can be ignited by equipment in several ways:

- by surfaces of the equipment 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 equipment.

In order to avoid dust ignition hazards it is important 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 dust;
- any other ignition sources are avoided.

Several types of protection are available for electrical equipment in hazardous areas (see IEC 60079-0), and this standard gives the specific requirements for design, selection and erection of electrical installations in explosive atmospheres.

This part of the IEC 60079 series is supplementary to other relevant IEC standards, for example IEC 60364 series as regards electrical installation requirements. This part also refers to IEC 60079-0 and its associated standards for the construction, testing and marking requirements of suitable electrical equipment.

NATIONAL VARIATIONS

Delete the above paragraph and replace with the following:

This document is supplementary to other relevant Australian/New Zealand and IEC Standards, and AS/NZS 3000 as regards electrical installation requirements. This document also refers indirectly to IEC 60079-0 (AS/NZS IEC 60079.0) via its associated Standards for the construction, testing and marking requirements of suitable electrical equipment.

NOTE 3 It is not always the case that Australian/New Zealand Standards are mandated for use. Therefore when implementing Standards, practices and specifications including those published by International or National Standards Organizations it must be understood that the regional, national, state and local statutes (Acts and Regulations, licences and lease conditions) will always take precedence. This would not preclude the use of the 60079 series.

(continued)

EXAMPLE 1 In Australia, the *Offshore Petroleum Act 2006* is the governing statute under which the respective state and territory regulations are implemented. The Offshore Petroleum Act 2006 provides an enforcement mechanism for offshore requirements within the Petroleum (Submerged Lands) Act and state/territory specific requirements.

EXAMPLE 2 New Zealand legislation applies to the fixed installations offshore but as the legislation is performance based it does not mandate AS/NZS 3000. In most cases, it allows for other solutions such as the API codes.

EXAMPLE 3 Individual companies operating within an approved Safety Management Case/Safety Management Plan that is accepted by the applicable regulator having jurisdiction, may opt for use of alternate specifications or Standards.

This standard provides the specific requirements for the design, selection, erection and the required initial inspection of electrical equipment in hazardous areas. This standard is also based on manufacturer's instructions being followed. On-going inspection, maintenance and repair aspects also play an important role in control of hazardous area installations and the user's attention is drawn to IEC 60079-17, IEC 60079-19 and manufacturer's instructions for further information concerning these aspects.

NATIONAL VARIATIONS

After "IEC 60079-17, IEC 60079-19" add:

, AS/NZS 3800

In any industrial installation, irrespective of size, there may be numerous sources of ignition apart from those associated with electrical equipment. Precautions may be necessary to ensure safety from other possible ignition sources, but guidance on this aspect is outside the scope of this standard.

NOTES

Australian/New Zealand Standard

Explosive atmospheres

Part 14: Design selection, erection and initial inspection (IEC 60079-14:2013 (ED.5.0) MOD)

1 Scope

This part of the IEC 60079 series contains the specific requirements for the design, selection, erection and initial inspection of electrical installations in, or associated with, explosive atmospheres.

Where the equipment is required to meet other environmental conditions, for example, protection against ingress of water and resistance to corrosion, additional protection requirements may be necessary.

The requirements of this standard apply only to the use of equipment under standard atmospheric conditions as defined in IEC 60079-0. For other conditions, additional precautions may be necessary, and the equipment should be certified for these other conditions. For example, most flammable materials and many materials which are normally regarded as non-flammable might burn vigorously under conditions of oxygen enrichment.

NOTE 1 The standard atmospheric conditions defined in IEC 60079-0 relate to the explosion characteristics of the atmosphere and not the operating range of the equipment i.e.

- Temperature: -20°C to 60°C ;
- Pressure: 80 kPa (0,8 bar) to 110 kPa (1,1 bar); and
- air with normal oxygen content, typically 21 % v/v.

These requirements are in addition to the requirements for installations in non-hazardous areas.

NOTE 2 For voltages up to 1 000 V a.c. or 1 500 V d.c. requirements of this standard are based on installation requirements in the IEC 60364 series, but other relevant national requirements can apply.

This standard applies to all electrical equipment including fixed, portable, transportable and personal, and installations, permanent or temporary.

NATIONAL VARIATIONS

1. *Delete* the first dash point in the list below.
2. *Delete* NOTE 3.

This standard does not apply to

- electrical installations in mines susceptible to firedamp;

NOTE 3 This standard can apply to electrical installations in mines where explosive gas atmospheres other than firedamp can be formed and to electrical installations in the surface installation of mines.

- inherently explosive situations and dust from explosives or pyrophoric substances (for example explosives manufacturing and processing);
- rooms used for medical purposes;
- electrical installations in areas where the hazard is due to flammable mist.

NOTE 4 Additional guidance on the requirements for hazards due to hybrid mixtures of dust or flyings and flammable gas or vapour is provided in [Annex M](#).

No account is taken in this Standard of the toxic risks that are associated with flammable gases, liquids and dusts in concentrations that are usually very much less than the lower explosive limit. In locations where personnel may be exposed to potentially toxic concentrations of flammable material, appropriate precautions should be taken. Such precautions are outside the scope of this Standard.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NATIONAL VARIATIONS

1. After the paragraph above, *add* the following:

The Australian or Australian/New Zealand Standards listed below are modified adoptions of, or not equivalent to, the IEC normative references and are required for the application of this document. All references in the source text to those IEC normative references shall be replaced by references to the corresponding Australian or Australian/New Zealand Standards.

Australian or Australian/New Zealand Standards that are identical adoptions of international normative references may be used interchangeably.

2. Delete “IEC 60034-1, *Rotating electrical machines – Part 1: Rating and performance*” and replace with the following:

AS 60034.1, *Rotating electrical machines Part 1: Rating and performance*

Delete “IEC 60079-10-1, *Explosive atmospheres – Part 10-1: Classification of areas - Explosive gas atmospheres*” and replace with the following:

AS/NZS 60079.10.1, *Explosive atmospheres — Part 10.1: Classification of areas—Explosive gas atmospheres*

Delete “IEC 60079-13, *Explosive atmospheres – Part 13: Equipment protection by pressurized room “p”*” and replace with the following:

AS/NZS 60079.13, *Explosive atmospheres, Part 13: Equipment protection by pressurized room ‘p’ and artificially ventilated room ‘v’*

Delete “IEC 60079-17, *Explosive atmospheres – Part 17: Electrical installations inspection and maintenance*” and replace with the following:

AS/NZS 60079.17, *Explosive atmospheres Part 17: Electrical installations inspection and maintenance*

IEC 60034-1, *Rotating electrical machines – Part 1: Rating and performance*

IEC 60060-1, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60079 (all parts), *Explosive atmospheres*

IEC 60079-0, *Explosive atmospheres – Part 0: Equipment – General requirements*

IEC 60079-1, *Explosive atmospheres – Part 1: Equipment protection by flameproof enclosures “d”*

IEC 60079-6, *Explosive atmospheres – Part 6: Equipment protection by oil immersion “o”*

IEC 60079-7, *Explosive atmospheres – Part 7: Equipment protection by increased safety “e”*

- IEC 60079-10-1, *Explosive atmospheres – Part 10-1: Classification of areas – Explosive gas atmospheres*
- IEC 60079-10-2, *Explosive atmospheres – Part 10-2: Classification of areas – Combustible dust atmospheres*
- IEC 60079-11, *Explosive atmospheres – Part 11: Equipment protection by intrinsic safety “i”*
- IEC 60079-13, *Explosive atmospheres – Part 13: Equipment protection by pressurized room “p”*
- IEC 60079-15, *Explosive atmospheres – Part 15: Equipment protection by type of protection “n”*
- IEC/TR 60079-16, *Electrical apparatus for explosive gas atmospheres – Part 16: Artificial ventilation for the protection of analyzer(s) houses*
- IEC 60079-17, *Explosive atmospheres – Part 17: Electrical installations inspection and maintenance*
- IEC 60079-18, *Explosive atmospheres – Part 18: Equipment protection by encapsulation “m”*
- IEC 60079-19, *Explosive atmospheres – Part 19: Equipment repair, overhaul and reclamation*
- IEC 60079-26, *Explosive atmospheres – Part 26: Equipment with equipment protection level (EPL) “Ga”*
- IEC 60079-28, *Explosive atmospheres – Part 28: Protection of equipment and transmission systems using optical radiation*
- IEC 60079-29-1, *Explosive atmospheres – Part 29-1: Gas detectors – Performance requirements of detectors for flammable gases*
- IEC 60079-29-4, *Explosive atmospheres – Part 29-4: Gas detectors – Performance requirements of open path detectors for flammable gases*
- IEC 60079-30-1, *Explosive atmospheres – Part 30-1: Electrical resistance trace heating – General and testing requirements*
- IEC 60243-1, *Electrical strength of insulating materials – Test methods – Part 1: Tests at power frequencies*
- IEC 60332-1-2, *Tests on electric and optical fibre cables under fire conditions – Part 1-2: Test for vertical flame propagation for a single insulated wire or cable – Procedure for 1 kW premixed flame*
- IEC 60364 (all parts), *Low-voltage electrical installations*
- IEC 60364-4-41:2005, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock*
- IEC 60950 (all parts), *Information technology equipment – Safety*
- IEC 61010-1, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements*
- IEC 61285, *Industrial process control – Safety of analyser houses*
- IEC 61558-2-6, *Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V – Part 2-6: Particular requirements and tests for safety isolating transformers and power supply units incorporating safety isolating transformers*
- IEC 62305-3:2010, *Protection against lightning – Part 3: Physical damage to structures and life hazard*

NATIONAL VARIATIONS

After “IEC 62305-3:2010” add the following:

AS 2290.1, *Electrical equipment for coal mines — Introduction and maintenance, Part 1: For hazardous areas*

(continued)

AS 2380.4, *Electrical equipment for explosive atmospheres—Explosion-protection techniques — Part 4: Pressurized rooms for pressurized enclosures*

AS/NZS 1299, *Electrical equipment for mines and quarries—Explosion-protected three-phase restrained plugs and receptacles for working voltages up to and including 3.3 kV*

AS/NZS 1300, *Electrical equipment for mines and quarries—Bolted explosion-protected three-phase cable coupling devices*

AS/NZS 1802, *Electric cables—Reeling and trailing—For underground coal mining purposes*

AS/NZS 1826, *Electrical equipment for explosive gas atmospheres—Special protection—Type of protection ‘s’*

AS/NZS 2053.1, *Conduits and fittings for electrical installations — Part 1: General requirements*

AS/NZS 2053.2, *Conduits and fittings for electrical installations — Part 2: Rigid plain conduits and fittings of insulating material*

AS/NZS 2053.5, *Conduits and fittings for electrical installations — Part 5: Corrugated conduits and fittings of insulating material*

AS/NZS 2053.7, *Conduits and fittings for electrical installations — Part 7: Rigid metal conduits and fittings*

AS/NZS 2053.8, *Conduits and fittings for electrical installations — Part 8: Flexible conduits and fittings of metal or composite material*

AS/NZS 2229, *Fuel dispensing equipment for explosive atmospheres*

AS/NZS 2243.8, *Safety in laboratories — Part 8: Fume cupboards*

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

AS/NZS 3191, *Electric flexible cords*

AS/NZS 3800, *Electrical equipment for explosive atmospheres — Repair and overhaul*

AS/NZS 4114, *Spray painting booths, designated spray painting areas and paint mixing rooms*

AS/NZS 4761.1, *Competencies for working with electrical equipment for hazardous areas (EEHA) — Competency Standards*

AS/NZS 4871, (all parts) *Electrical equipment for mines and quarries*

AS/NZS IEC 60079.25, *Explosive atmospheres, Part 25: Intrinsically safe electrical systems*

AS/NZS 60079.27, *Explosive atmospheres, Part 27: Fieldbus intrinsically safe concept (FISCO)*

AS/NZS 60079.33, *Explosive atmospheres, Part 33: Equipment protection by special protection ‘s’*

AS/NZS ISO/IEC 17067, *Conformity assessment — Fundamentals of product certification and guidelines for product certification schemes*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60079-0, as well as the following apply.

NOTE Additional definitions applicable to explosive atmospheres can be found in IEC 60050-426.

3.1 General 3.1.1

NATIONAL VARIATIONS

Delete “competent body” including definition, and *replace* with the following:

competent person

individual that can demonstrate appropriate technical knowledge and relevant skills to make the necessary assessments of the safety aspect under consideration

competent body

individual or organization which can demonstrate appropriate technical knowledge and relevant skills to make the necessary assessments of the safety aspect under consideration

3.1.2

verification dossier

set of documents showing the compliance of electrical equipment and installations

3.1.3

electrical equipment

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

Note 1 to entry: These include, amongst others, items for the generation, transmission, distribution, storage, measurement, regulation, conversion and consumption of electrical energy and items for telecommunications.

3.2

Hazardous areas

3.2.1

hazardous area

area in which an explosive atmosphere is present, or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of equipment

Note 1 to entry: For the purposes of this standard, an area is a three-dimensional region or space.

3.2.2

non-hazardous area

area in which an explosive atmosphere is not expected to be present in quantities such as to require special precautions for the construction, installation and use of equipment

3.2.3

group <of electrical equipment for explosive atmospheres>

classification of electrical equipment related to the explosive atmosphere for which it is to be used

Note 1 to entry: Electrical equipment for use in explosive atmospheres is divided into three groups:

- Group I: electrical equipment for mines susceptible to firedamp;
- Group II (which can be divided into subgroups): electrical equipment for places with an explosive gas atmosphere, other than mines susceptible to firedamp (see [5.5](#));
- Group III (which can be divided into subgroups): electrical equipment for places with an explosive dust atmosphere (see [5.5](#)).

3.2.4

hybrid mixture

mixture of a flammable gas or vapour with a combustible dust

Note 1 to entry: According IEC 60079-10-2 the term “dust” is defined as including both dust and flyings.

3.2.5

maximum permissible surface temperature

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

Note 1 to entry: This definition does not apply to gases. The maximum permissible surface temperature will depend upon the type of dust, whether as a cloud or layer, including layer thickness and the application of a safety factor (see [5.6.3](#)).

3.2.6

zones

hazardous areas classified into zones based upon the frequency of the occurrence and duration of an explosive atmosphere

3.2.7

Zone 0

place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas or vapour is present continuously or for long periods or frequently

3.2.8

Zone 1

place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas or vapour is likely to occur in normal operation occasionally

3.2.9

Zone 2

place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas or vapour is not likely to occur in normal operation but, if it does occur, will persist for a short period only

3.2.10

Zone 20

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

3.2.11

Zone 21

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

3.2.12

Zone 22

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

3.3

Flameproof enclosure

3.3.1

flameproof enclosure “d”

type of protection in which the parts capable of igniting an explosive gas atmosphere are provided with an enclosure which can withstand the pressure developed during an internal explosion of an explosive mixture and which prevents the transmission of the explosion to the explosive gas atmosphere surrounding the enclosure

3.3.2

pressure-piling

increased pressure resulting from an ignition, in a compartment or subdivision of an enclosure due to a gas mixture being pre-compressed, e.g. due to a primary ignition in another compartment or subdivision

Note 1 to entry: This may lead to a higher maximum pressure than would otherwise be expected.

3.4

Increased safety

3.4.1

increased safety “e”

type of protection applied to electrical equipment in which additional measures are applied so as to give increased security against the possibility of excessive temperatures and of the occurrence of arcs and sparks in normal service or under specified abnormal conditions

3.4.2

initial starting current

I_A

highest r.m.s. value of current absorbed by an a.c. motor at rest or by an a.c. magnet with its armature clamped in the position of maximum air gap, when supplied at the rated voltage and rated frequency

3.4.3

starting current ratio

I_A/I_N

ratio between initial starting current I_A and rated current I_N

3.4.4

time

t_E

time taken for an a.c. rotor or stator winding, when carrying the initial starting current I_A , to be heated up to the limiting temperature from the temperature reached in rated service at the maximum ambient temperature

3.5

Intrinsic safety

3.5.1

intrinsic safety “i”

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

3.5.2

associated apparatus

electrical apparatus which contains both intrinsically safe circuits and non-intrinsically safe circuits and is constructed so that the non-intrinsically safe circuits cannot adversely affect the intrinsically safe circuits

Note 1 to entry: Associated apparatus may be either:

- a) electrical equipment which has another type of protection listed in IEC 60079-0 for use in the appropriate explosive atmosphere, or
- b) electrical equipment not so protected and which, therefore, is not normally used within an explosive atmosphere, for example a recorder which is not itself in an explosive atmosphere, but is connected to a thermocouple situated within an explosive atmosphere where only the recorder input circuit is intrinsically safe.

3.5.3

intrinsically safe apparatus

electrical apparatus in which all the circuits are intrinsically safe

3.5.4

galvanic isolation

arrangement within an item of intrinsically safe apparatus or associated apparatus which permits the transfer of signals or power between two circuits without any direct electrical connection between the two

Note 1 to entry: Galvanic isolation frequently utilizes either magnetic (transformer or relay) or opto-coupled elements.

3.5.5

simple apparatus

electrical component or combination of components of simple construction with well-defined electrical parameters which is compatible with the intrinsic safety or energy-limited safety of the circuit in which it is used

3.5.6

intrinsically safe circuit

circuit in which any spark or any thermal effect produced in the conditions specified in IEC 60079-11, which include normal operation and specified fault conditions, is not capable of causing ignition of a given explosive atmosphere

Note 1 to entry: The circuit may also contain associated apparatus.

3.5.7

intrinsically safe electrical system

assembly of interconnected items of electrical equipment, described in a descriptive system document, in which the circuits or parts of circuits intended to be used in an explosive atmosphere are intrinsically safe

3.5.8

intrinsically safe sub-circuit

part of an intrinsically safe circuit which is galvanically isolated from another part or other parts of the same intrinsically safe circuit

3.6

Intrinsic safety parameters

3.6.1

maximum external inductance to resistance ratio

L_o/R_o

maximum value of ratio of inductance to resistance that can be connected to the external connection facilities of the electrical apparatus without invalidating intrinsic safety

3.7

Pressurization

3.7.1

pressurization “p”

technique of guarding against the ingress of the external atmosphere into an enclosure by maintaining a protective gas therein at a pressure above that of the external atmosphere

3.7.2

continuous dilution

continuous supply of a protective gas, after purging, at such a rate that the concentration of a flammable substance inside the pressurized enclosure is maintained at a value outside the explosive limits at any potential ignition source (that is, outside the dilution area)

Note 1 to entry: The dilution area is an area in the vicinity of an internal source of release where the concentration of a flammable substance is not diluted to a safe concentration.

3.7.3

leakage compensation

flow of protective gas sufficient to compensate for any leakage from the pressurized enclosure and its ducts

3.7.4

static pressurization

maintenance of an overpressure within a pressurized enclosure without the addition of protective gas in the hazardous area

3.8

Type of protection “n”

3.8.1

type of protection “n”

type of protection applied to electrical equipment such that, in normal operation and in certain specified abnormal conditions, it is not capable of igniting a surrounding explosive atmosphere

Note 1 to entry: Additionally, the requirements of the equipment standard are intended to ensure that a fault capable of causing ignition is not likely to occur.

Note 2 to entry: An example of a specified abnormal condition is a luminaire with a failed lamp.

3.8.2

energy-limited apparatus

electrical equipment in which the circuits and components are constructed according to the concept of energy limitation

3.8.3

associated energy-limited apparatus

electrical equipment which contains both energy-limited and non-energy-limited circuits and is constructed so that the non-energy-limited circuits cannot adversely affect the energy-limited circuits

3.9

oil-immersion “o”

type of protection in which the electrical equipment or parts of the electrical equipment are immersed in a protective liquid in such a way that an explosive gas atmosphere which may be above the liquid or outside the enclosure cannot be ignited

3.10

powder filling “q”

type of protection in which the parts capable of igniting an explosive gas atmosphere are fixed in position and completely surrounded by filling material to prevent the ignition of an external explosive atmosphere

Note 1 to entry: The type of protection may not prevent the surrounding explosive gas atmosphere from penetrating into the equipment and components and being ignited by the circuits. However, due to the small free volumes in the filling material and due to the quenching of a flame which may propagate through the paths in the filling material, an external explosion is prevented.

3.11

encapsulation “m”

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 that the explosive atmosphere cannot be ignited under operating or installation conditions

3.12

protection by enclosure “t”

type of protection whereby all electrical equipment is protected by an enclosure to avoid ignition of a dust layer or cloud

3.13**Electrical supply systems****3.13.1****protective extra-low voltage system****PELV**

electric system in which the voltage cannot exceed the value of extra-low voltage:

- under normal conditions, and
- under single fault conditions, except earth faults in other electric circuits

[SOURCE: IEC 60050-826:2004, 826-12-32]

3.13.2**safety extra-low voltage system****SELV**

electric system in which the voltage cannot exceed the value of extra-low voltage:

- under normal conditions and
- under single fault conditions, including earth faults in other electric circuits

[SOURCE: IEC 60050-826:2004, 826-12-31]

3.14**Equipment****3.14.1****fixed**

equipment fastened to a support, or otherwise secured in a specific location when energized

3.14.2**transportable**

equipment not intended to be carried by a person nor intended for fixed installation which can be moved when energized

NATIONAL VARIATIONS

After the above definition, *add* the following:

Note 1 to entry: For Group I applications, AS/NZS 4871 series Standards define transportable and mobile machines. For the purposes of this document, Group I applications should read transportable as being equivalent to the definition of “transportable” in AS/NZS 4871 and includes mobile machines.

3.14.3**portable**

equipment intended to be carried by a person which can be moved when energized

3.14.4**personal**

equipment intended to be supported by a person's body during normal use

3.15**radio frequency identification****RFID**

data collection technology that uses electronic tags for storing data

Note 1 to entry: The tag, also known as an “electronic label”, “transponder” or “type plate” is made up of an RFID chip attached to an antenna. Transmitting in the kilohertz, megahertz and gigahertz ranges, tags may be battery powered or derive their power from the RF waves coming from the reader.

Note 2 to entry: This note applies to the French language only.

NATIONAL VARIATIONS

1. *Delete* "Note 2 to entry" above.
2. After [definition 3.15](#) *add* the following:

3.16**spacings, electrical**

separation distances between conductive parts at different electrical potentials

[SOURCE: IEC 60079-0:2017, 3.81]

3.16.1**clearance**

shortest distance in air between two conductive parts

[SOURCE: IEC 60079-0:2017, 3.81.1]

3.16.2**creepage distance**

shortest distance along the surface of a solid insulating material, in contact with air, between two conductive parts

[SOURCE: IEC 60079-0:2017, 3.81.2]

3.17**pollution**

<of an electrical system> any condition of foreign matter, solid, liquid or gaseous (ionized gases), that can affect dielectric strength or surface resistivity

[SOURCE: IEC 60664-1:2020, 3.1.24]

3.17.1**micro-environment**

<of an electrical system> ambient conditions which immediately influences the dimensioning of the clearance and creepage distances

[SOURCE: IEC 60664-1:2020, 3.1.23]

3.17.2**pollution degree**

numeral characterizing the expected pollution of the micro-environment

Note 1 to entry: Pollution degrees 1, 2, 3 and 4 are used, refer to IEC 60664-1.

[SOURCE: IEC 60079-0:2019, 3.65]

3.17.3**macro-environment**

environment of the room or other location in which the equipment is installed or used

[SOURCE: IEC 60664-1:2020, 3.1.22]

4 General

4.1 General requirements

NATIONAL VARIATIONS

Delete the first paragraph and *replace* with the following:

Hazardous areas are classified into Groups I, II and III. Group II is further classified into Zones 0, 1 and 2 for gases and vapours according to AS/NZS 60079.10.1, and Group III is further classified into Zones 20, 21 and 22 for dusts according to AS/NZS 60079.10.2 in order to facilitate the selection of appropriate electrical equipment and the design of suitable electrical installations.

Hazardous areas are classified into Zones 0, 1 and 2 for gases and vapours according to IEC 60079-10-1, and into Zones 20, 21 and 22 for dusts according to IEC 60079-10-2 in order to facilitate the selection of appropriate electrical equipment and the design of suitable electrical installations.

Electrical equipment should, as far as is reasonably practicable, be located in non-hazardous areas. Where it is not possible to do this, it should be located in an area where an explosive atmosphere is least likely to occur.

Electrical installations in hazardous areas shall also comply with the appropriate requirements for electrical installations in non-hazardous areas. However the requirements for non-hazardous areas are insufficient for installations in hazardous areas.

Where additional protection is required to meet other environmental conditions, for example, protection against ingress of water and resistance to corrosion the method used shall not adversely affect the integrity of the equipment. Electrical equipment and materials shall be installed and used within their electrical ratings for power, voltage, current, frequency, duty and such other characteristics where non-conformity might jeopardize the safety of the installation. In particular, care shall be taken to ensure that the voltage and frequency are appropriate to the supply system with which the equipment is used and that the temperature classification has been established for the correct voltage, frequency and other parameters.

Products for use in hazardous areas are commonly designed for IEC standard voltages according to IEC 60038. If a supply voltage is outside of these standardized voltages, then equipment should be specially selected and certified.

All electrical equipment and wiring in hazardous areas shall be selected and installed in accordance with [Clauses 5 to 13](#) inclusive and the additional requirements for the particular type of protection ([Clauses 14 to 23](#)).

Installations should be designed and equipment and materials installed with a view to providing ease of access for inspection and maintenance (IEC 60079-17).

NATIONAL VARIATIONS

1. After “IEC 60079-17” in the above paragraph, *add* the following:

or for Group I, AS 2290.1

2. *Delete* the two paragraphs below, and *replace* with the following:

For Group II or III installations only, equipment and systems used in exceptional circumstances, where explosion protected equipment is not available, need not meet the requirements of this document. In such cases it is only by the application 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

(continued)

devices, such as gas detectors, or 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 or more of the following conditions as appropriate:

- (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.

In addition, the measures or conditions of control shall be documented by a competent person who—

- (i) is familiar with the requirements for this, and any other relevant Standards and codes of practice concerning the use of electrical equipment and systems for use in hazardous areas, and,
- (ii) has access to all information necessary to carry out the assessment.

Examples of specific applications are provided in [Appendix ZA](#). Such applications may be treated from first principles to meet the requirements of this document or may follow the requirements identified in [Appendix ZA](#). Specific applications include:

- (A) fuel dispensers;
- (B) fixed electrostatic equipment;
- (C) electrostatic hand spray guns;
- (D) powder coatings;
- (E) laboratory fume cupboards; and
- (F) secondary batteries in buildings.

Equipment and systems used in exceptional circumstances, for example research, development, pilot plant where explosion protected equipment is not available, need not meet the requirements of this standard, provided that the installation is under the supervision of a competent body and one or more of the following conditions, as appropriate, are met:

- measures are taken to ensure that an explosive atmosphere does not occur; or
- measures are taken to ensure that this equipment is disconnected before an explosive atmosphere occurs, in which case ignition after disconnection, e.g. due to heated parts, shall be prevented also; or
- measures are taken to ensure that persons and the environment are not endangered by fires or explosions.

In addition, the measures or conditions or control shall be documented by a competent body who:

- is familiar with the requirements for this, and any other relevant standards and code of practice concerning the use of electrical equipment and systems for use in hazardous areas, and,
- has access to all information necessary to carry out the assessment.

4.2 Documentation

It is necessary to ensure that any installation complies with the relevant equipment certificate (see also [Clause 5](#)) as well as with this standard and any other requirements specific to the plant on which the installation takes place. To achieve this result, a verification dossier shall be prepared for every installation and shall be either kept on the premises or stored in another location. In the latter case,

a document shall 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.

NOTE The verification dossier can be kept as hard copy or in electronic form. Methods accepted by legislation in each country can have an impact on the form in which the documentation will be legally accepted.

In order to correctly install or extend an existing installation, the following information, additional to that required for non-hazardous areas, is required as part of the verification dossier, where applicable:

SITE

- area classification documents (see IEC 60079-10-1 and IEC 60079-10-2) with plans showing the classification and extent of the hazardous areas including the zoning (and maximum permissible dust layer thickness if the hazard is due to dust);
- optional assessment of consequences of ignition (see [5.3](#));
- where applicable, gas, vapour or dust classification in relation to the group or subgroup of the electrical equipment;
- temperature class or ignition temperature of the gas or vapour involved;
- where applicable, the material characteristics including electrical resistivity, the minimum ignition temperature of the dust cloud, minimum ignition temperature of the dust layer and minimum ignition energy of the dust cloud;
- external influences and ambient temperature (see [5.9](#)).

NATIONAL VARIATIONS

1. After the above SITE list, *add* the following:

- any use of conditions of control for exceptional circumstances (see [4.1](#)).

2. *Delete* the EQUIPMENT list below, and *replace* with the following:

EQUIPMENT

- manufacturer's instructions for selection, installation and initial inspection;
- documents for electrical equipment with conditions of use, e.g. for equipment with certificate numbers which have the suffix "X";
- descriptive system document for the intrinsically safe system (see [16.2.4.2](#));
- details of any relevant calculation, e.g. for purging rates for instruments or analyser houses;
- for Group I and New Zealand, manufacturer's/qualified person's declaration of conformity where applicable (see [4.4.2](#)).

Consideration should be given to obtaining information for maintenance and repair to meet the requirements of AS/NZS 60079.17 and IEC 60079-19 or AS/NZS 3800 respectively.

EQUIPMENT

- manufacturer's instructions for selection, installation and initial inspection;
- documents for electrical equipment with conditions of use, e.g. for equipment with certificate numbers which have the suffix "X";
- descriptive system document for the intrinsically safe system (see [16.2.4.2](#));

- details of any relevant calculation, e.g. for purging rates for instruments or analyser houses;
- manufacturer's/qualified person's declaration (see [4.4.2](#)).

Consideration should be given to obtaining information for maintenance and repair to meet the requirements of IEC 60079-17 and IEC 60079-19 respectively.

INSTALLATION

- necessary information to ensure correct installation of the equipment provided in a form which is suitable to the personnel responsible for this activity (see IEC 60079-0, Instructions);
- documentation relating to the suitability of the equipment for the area and environment to which it will be exposed, e.g. temperature ratings, type of protection, IP rating, corrosion resistance;
- the plans showing types and details of wiring systems;
- records of selection criteria for cable entry systems for compliance with the requirements for the particular type of protection;
- drawings and schedules relating to circuit identification; – records of the initial inspection ([Annex C](#)).
- installer's/qualified person's declaration (see [4.5](#))

NOTE Records of inspection for assemblies or pre-installed items can be accepted as part of initial inspection records.

NATIONAL VARIATIONS

1. After the INSTALLATION list above, *add* the following:

- in New Zealand, the Hazardous Area Statement of Periodic Verification on completion of a periodic inspection comprising the information shown on the form in [Appendix ZB](#).

2. After the clause above, *add* the following:

The person(s) in control of the installation or parts thereof should ensure that the relevant information is produced but the preparation of the documentation may be delegated to a competent person.

4.3 Initial inspection

Equipment shall be installed in accordance with its documentation. It shall be ensured that replaceable items are of the correct type and rating. On completion of the erection and prior to first use, initial detailed inspection of the equipment and installation shall be carried out in accordance with [Annex C](#), which is based on the “detailed” grade of inspection in IEC 60079-17.

NOTE IEC 60079-17 includes further information relevant to the initial inspection.

NATIONAL VARIATIONS

After “IEC 60079-17” in the paragraph above, *add* the following:

, or for Group I, AS 2290.1

4.4 Assurance of conformity of equipment

NATIONAL VARIATIONS

Delete [Clause 4.4](#) and replace with the following:

4.4 Assurance of conformity of equipment

4.4.1 General

Electrical equipment, other than simple apparatus installed within an intrinsically safe circuit, to be installed in a hazardous area, and any associated apparatus, shall conform to the requirements of [Clauses 4.4.2](#) or 4.4.4, as applicable.

NOTE Regulatory authorities may specify additional requirements for acceptance of electrical equipment that does not have a certificate in accordance with Clause 4.4.2.1.

Equipment deemed to be simple apparatus may be used within an intrinsically safe circuit without conforming to the requirements of [Clause 4.4](#). The assessment of the equipment as simple apparatus shall be made by a competent person and shall be included in the verification dossier.

Assemblies of equipment with a certificate covering the assembly shall conform to the requirements of [Clause 4.4.3](#).

For Group I installations in Australia, only electrical equipment with a certificate in accordance with Clause 4.4.2.1 is acceptable to relevant authorities.

For Ex “v” installations and where Ex “p” is applied to rooms, and the like, that are assembled and/or installed on-site, a statement of assessment by a competent person shall be prepared.

The scope of this document does not cover non-electrical equipment. Therefore the requirements of this clause are applicable only to electrical equipment, including assemblies of equipment with a certificate covering the assembly.

4.4.2 Equipment

4.4.2.1 Equipment with certificates issued under the IECEx, ANZEx and AUSEx Schemes

Equipment conforming to a Standard listed in [Table 2](#) is acceptable when selected and installed in accordance with this standard and meets any of the following certification criteria:

- (a) The equipment has a current certificate under the IECEx or the ANZEx schemes.
- (b) The equipment has a cancelled or suspended IECEx or ANZEx certificate and it can be demonstrated that the equipment was manufactured while the certificate was current.
- (c) The equipment was issued with a certificate issued under the AUSEx Scheme and the equipment was manufactured within the certificate validity period.

NOTE The status of an IECEx or ANZEx certificate may be verified on the website of the IECEx scheme (www.iecex.com) or the ANZEx scheme (www.anzex.com.au) respectively.

Equipment conforming to IEC 60079.15 Ed. 2, or parts of the AS 2380 and AS/NZS 2380 series not listed in [Table 2](#) and with a current certificate under the IECEx or the ANZEx schemes shall not be accepted unless reviewed successfully according to Clause 4.4.2.3.1.

4.4.2.2 Equipment with certificate according to IEC Standards or AS/NZS Standards, but not issued under the IECEx, ANZEx or AUSEx schemes

(continued)

Equipment with a certificate not conforming to 4.4.2.1 but issued according to hazardous areas Standards published as AS/NZS Standards, IEC Standards or AS Standards in accordance with [Table 2](#), is acceptable when covered by a Certificate of Conformity which—

- (a) is issued in accordance with a Scheme type 5; and

NOTE Recommendations in AS/NZS ISO/IEC 17067 should be followed.

- (b) is issued by an organization accredited by signatories to the International Laboratory Accreditation Cooperation (ILAC) through their Mutual Recognition Agreement (MRA) covering product certification of explosion protected equipment; and
- (c) is issued by a Certification Body or agency with current accreditation or acceptance by way of independent assessment conforming to AS/NZS ISO/IEC 17067 The accreditation or acceptance showing Ex certification for an ISO Type 5 system in the Ex field, as part of their capability; and
- (d) the certification system comprises—
- (i) testing of samples for conformity in accordance with [Table 2](#) and other relevant IEC Standards or Australian/New Zealand Standards;
 - (ii) assessment and audit of manufacturers by the relevant authority, for conformity of their quality system in accordance with a relevant scheme, e.g. ANZEx or IECEx; and
 - (iii) on-going surveillance audits of manufacturers, in accordance with a relevant scheme, e.g. ANZEx or IECEx, by the relevant authority, responsible for issuing the certificate.

Equipment conforming to IEC 60079-15 Ed. Two shall not be accepted unless reviewed successfully according to 4.4.2.3.1.

4.4.2.3 Equipment with third party certificate but not according to IEC Standards or AS/NZS Standards

4.4.2.3.1 General

The selection of equipment which has a certificate issued by a third party that is not in accordance with 4.4.2.1 or 4.4.2.2, shall be restricted to circumstances where suitable equipment with a certificate in accordance with 4.4.2.1 or 4.4.2.2 is not practical.

The justification for the use of such equipment shall be made by the person(s) in control of the installation, or their nominee, and include the selection, installation and operational requirements. Any assessment of the equipment to support this justification shall be carried out by a competent person.

The justification shall be included as part of the verification dossier. Justification may be demonstrated in the form of a Conformity Assessment Document. Guidance for the preparation of a Conformity Assessment Document can be found in [Appendix ZD](#).

4.4.2.3.2 For New Zealand

As an alternative to the requirements of 4.4.2.3.1, for New Zealand, proof of conformity may be demonstrated with one of the following regimes of conformance (including any marking requirements):

- (a) European Council Directive 2014/34/EU on Hazardous Area Equipment.
- (b) For battery powered equipment without integrated chargers—
- (i) approvals issued by FM Approvals of the United States of America to either the IEC or ANSI/UL 60079 (all parts); or
 - (ii) certified by Underwriters Laboratories (UL) of the United States of America to either the IEC or ANSI/UL 60079 (all parts).

(continued)

The acceptance of ATEX equipment, particularly for Category 3 having an EU declaration of conformity, shall be verified as suitable for the application by a competent person and the details placed in the verification dossier.

NOTE A manufacturer's declaration of conformity is not sufficient as, in order to conform to AS/NZS IEC 60079.0, it is necessary for all equipment to be provided with a certificate.

All the requirements applying to the supplier/sponsor/manufacturer under these regimes or systems, shall be met by a person or organization located in New Zealand who is responsible for the supply of product in New Zealand. The person or organization in New Zealand may at times be a company importing the product directly for their own use.

4.4.3 Assemblies of equipment with certificates for the assembly

4.4.3.1 General

Certificates for assemblies that may comprise a number of items of certified equipment or components may be prepared under the IECEx scheme, the ATEX directive (EC Type Examination Certificates), or other certification schemes.

The certificate for an assembly shall be considered as valid only for the initial installation of the assembly on-site. Once installed, the assembly certificate may be considered as non-binding and the assembly shall be managed as part of the site installation. In all cases, the introduction of an assembly to site shall be treated as a site installation and be subject to any regulatory inspections or other requirements for site installations.

NOTE A certificate for an assembly is intended to facilitate arrangements between manufacturers of assemblies or sub-assemblies with end users.

4.4.3.2 Assemblies of equipment with an IECEx or ANZEx certificate

Since the requirements of IEC 60079-14 differ from the requirements of this document, a certificate under the IECEx or ANZEx scheme for an assembly comprising more than one item of electrical equipment is not accepted unless either:

- (a) The certificate is validated as including the requirements of the latest edition of AS/NZS 60079.14, or
- (b) The assembly is independently inspected in accordance with this document for conformity to the latest edition of AS/NZS 60079.14.

In addition, each individual item of equipment used on the assembly shall conform to the requirements of [4.4.2](#) and the documentation and inspection requirements in accordance with [Clauses 4.2](#) and [4.3](#) respectively and shall be identified on the certificate.

4.4.3.3 Assemblies of equipment with a third party certificate not issued under the IECEx or ANZEx scheme

A third party certificate not issued under the IECEx or ANZEx scheme for an assembly comprising more than one item of electrical equipment is not accepted.

For the assembly to be accepted:

- (a) Each individual item of equipment used on the assembly shall conform to the requirements of [4.4.2](#), and
- (b) The assembly shall be independently inspected in accordance with this document for conformity to the latest edition of AS/NZS 60079.14.

In addition, each individual item of equipment used on the assembly shall conform to the documentation and inspection requirements in accordance with [Clauses 4.2](#) and [4.3](#) respectively.

(continued)

4.4.4 Selection of repaired, second hand or existing certified equipment

When it is intended that existing, second hand or repaired certified equipment is to be installed in a new installation, it shall only be reused if all of the following apply:

- (a) it can be verified that the equipment is unmodified and is in a condition that meets the content of the original certificate (including any repair or overhaul);
- (b) any changes to equipment standards relevant to the item considered do not require additional safety precautions; and
- (c) the basis used for the certification of that product does not conflict with the requirements for installation given in this document.

The act of introducing equipment where specifications are not identical to an existing installation may cause that installation to be deemed “new”.

In the situation where equipment is dual certified (e.g. as intrinsically safe apparatus and independently as flameproof equipment) care should be taken that the type of protection used for its new intended location has not been compromised by the way in which it was originally installed and subsequently maintained. Different protection concepts have different maintenance requirements. In the above example: equipment originally installed as flameproof should only be used as flameproof unless it can be determined that there has been no damage to the safety components within the intrinsically safe circuit on which safety depends by, for example, an over-voltage at the supply terminals or if it was originally installed as intrinsically safe then a check is required to ensure that there has been no damage to the flame paths before it can be used as flameproof.

4.4.1 Equipment with certificates according to IEC standards

4.4.1.1 General

Equipment with certificate according to the IEC 60079 series or the IEC 61241 series, meets the requirements for hazardous areas, when selected and installed in accordance with this standard.

4.4.1.2 IEC standards

The requirements given in this standard are based on the current editions of the IEC standards in the IEC 60079 series. If equipment is not certified in accordance with current editions of the IEC 60079 series it may not be compatible with the requirements given in this standard. It may be required that additional measures should be applied to ensure safe operation.

NOTE Information about the current editions of IEC standards, either for product safety or for equipment for explosive atmospheres, can be found on the IEC website. Information about the changes related to the previous editions is given in the foreword of the standards.

4.4.2 Equipment without certificates according to IEC standards

Apart from simple apparatus used within an intrinsically safe circuit, the selection of equipment for use in a hazardous area, which either has no certificate at all or it has a certificate but not in accordance with one of the standards listed in [4.4.1](#), shall be restricted to circumstances where equipment with suitable certification is not obtainable. The justification for the use of such equipment, along with the installation and marking requirements, shall be made by the user, manufacturer or third party and be recorded in the verification dossier. The following requirements of this standard, under these conditions, may not be applicable.

4.4.3 Selection of repaired, second hand or existing equipment

When it is intended that existing, second hand or repaired equipment is to be installed in a new installation, it shall only be reused if:

- it can be verified that the equipment is unmodified and is in a condition that meets the content of the original certificate (including any repair or overhaul). If there is doubt that the equipment is unmodified the original manufacturer should be contacted,
- any changes to equipment standards relevant to the item considered do not require additional safety precautions, and
- the basis used for the certification of that product does not conflict with the requirements given in this standard.

The act of introducing equipment where specifications are not identical to an existing installation may cause that installation to be deemed “new”.

In the situation where equipment is dual certified (e.g. as intrinsically safe apparatus and independently as flameproof equipment) care should be taken that the type of protection used for its new intended location has not been compromised by the way in which it was originally installed and subsequently maintained. Different protection concepts have different maintenance requirements. In the above example: equipment originally installed as flameproof should only be used as flameproof unless it can be verified that there has been no damage to the safety components within the intrinsically safe circuit on which safety depends by, for example, an over-voltage at the supply terminals or if it was originally installed as intrinsically safe then a check is required to ensure that there has been no damage to the flame paths before it can be used as flameproof.

4.5 Qualifications of personnel

NATIONAL VARIATIONS

Delete [Clause 4.5](#) and replace with the following:

4.5 Competence of personnel

The design of the installation, the selection of equipment, the erection and inspections covered by this document should be carried out only by 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 level of competence and instruction shall also be relevant to the role of the operative concerned. For example, basic work may be carried out under the supervision of a senior person with a higher level of competence.

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

Competency may be demonstrated in accordance with the IECEx CoPC scheme with ANZ endorsement or AS/NZS 4761.1, Competencies for working with electrical equipment for hazardous areas (EEHA) or an equivalent training and assessment framework.

Competency may also be obtained or demonstrated without formal training or assessment, for example, through “on the job training” and by completion of compliant installations.

The design of the installation, the selection of equipment and the erection covered by this standard shall be carried out only by 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 (see [Annex A](#)).

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

NOTE Competency can be demonstrated in accordance with a training and assessment framework relevant to national regulations or standards or user requirements.

5 Selection of equipment

5.1 Information requirements

In order to select the appropriate electrical equipment for hazardous areas, the following information is required:

- classification of the hazardous area including the equipment protection level requirements where applicable;
- where applicable, gas, vapour or dust classification in relation to the group or subgroup of the electrical equipment;
- temperature class or ignition temperature of the gas or vapour involved;
- minimum ignition temperature of the dust cloud and minimum ignition temperature of the dust layer;
- intended application of the equipment;
- external influences and ambient temperature.

NATIONAL VARIATIONS

After the list above, *add* the following:

- the equipment certificate including any specific conditions of use.

It is recommended that the equipment protection levels (EPL) requirements are recorded on the area classification drawing. This should also apply even if consequences have not been subjected to risk assessment (see [5.3](#)).

NATIONAL VARIATIONS

After the above paragraph, *add* the following:

Equipment for use in hazardous areas may also require specific conditions to be met for either the initial installation or for ongoing use. Such conditions may be part of the manufacturer's instructions or may be marked on certification documents, e.g. IECEx certificates with an "x" indicate conditions of use apply. When selecting equipment with conditions of use any conditions for initial installation shall be applied and any conditions requiring controls beyond the initial installation shall be verified as acceptable by the end user for the application of the equipment.

5.2 Zones

Hazardous areas are classified into zones. Zoning does not take account of the potential consequences of an explosion.

NOTE Editions of this standard prior to IEC 60079-14:2007 (edition 4) allocated types of protection to zones, on a statistical basis such that where there was a more frequent probability of the occurrence of an explosive atmosphere, then a greater level of safety against the possibility of an ignition source was applied.

5.3 Relationship between equipment protection levels (EPLs) and zones

Where only the zones are identified in the area classification documentation, then the relationship between EPLs and zones from [Table 1](#) shall be followed.

NATIONAL VARIATIONS

In [Table 1](#) below, above row “0”, *add* the following:

Group I- 0, 1	“Ma”
Group I- 1	“Ma” or “Mb”

Table 1 — Equipment protection levels (EPLs) where only zones are assigned

Zone	Equipment protection levels (EPLs)
0	“Ga”
1	“Ga” or “Gb”
2	“Ga”, “Gb” or “Gc”
20	“Da”
21	“Da” or “Db”
22	“Da”, “Db” or “Dc”

Where the EPLs are identified in the area classification documentation, those requirements for selection of the equipment shall be followed.

As an alternative to the relationship given in [Table 1](#) between EPLs and zones, EPLs can be determined on the basis of a risk, i.e. taking into account the consequences of an ignition. This may, under certain circumstances, require a higher EPL or permit a lower EPL than that defined in [Table 1](#). Refer to IEC 60079-10-1 and IEC 60079-10-2.

NATIONAL VARIATIONS

Delete the last sentence of the above paragraph and *replace* with the following:

See [Appendix ZE](#) of this document.

5.4 Selection of equipment according to EPLs

5.4.1 General

For new installations or equipment use, conformity of equipment shall be verified according to 4.4.

5.4.2 Relationship between EPLs and types of protection

NATIONAL VARIATIONS

Delete [Clause 5.4.2](#) and [Table 2](#) and *replace* with the following:

5.4.2 Relationship between EPLs and types of protection

The recognized types of protection according to IEC standards have been allocated default EPLs according to [Table 2](#). Where the equipment is marked with a type of protection code and an EPL that

(continued)

differs from [Table 2](#) then the equipment EPL marking shall take precedence. [Table 2](#) applies to all editions of the Standards listed.

Table 2 — Default relationship between types of protection and EPLS

EPL	Type of protection	Code	According to Standard	Comments
"Ma"	Intrinsically safe	"ia"	AS/NZS 60079.11	
			IEC 60079-11	
	Encapsulation	"ma"	AS/NZS 60079.18	
			IEC 60079-18	
	Special protection	"s" "sa"	AS/NZS 1826	Where certified for use in Zone 0
			AS/NZS 60079.33	
			IEC 60079-33	
"Mb"	Intrinsically safe	"ib"	AS/NZS 60079.11	
			IEC 60079-11	
	Flameproof	"d" "db"	AS/NZS 60079.1	
			IEC 60079-1	
	Increased safety	"e"	AS/NZS 60079.7	
			IEC 60079-7	
	Pressurized enclosures	"p" "px" "pxb"	AS/NZS 60079.2	
			IEC 60079-2	
			AS 2380.4	
	Encapsulation	"m" "mb"	AS/NZS 60079.18	
			IEC 60079-18	
	Powder filling	"q"	AS/NZS 60079.5	
			IEC 60079-5	
	Special protection	"s" "sb"	AS/NZS 1826	Where certified for use in Zone 1
			AS/NZS 60079.33	
			IEC 60079-33	
"Ga"	Flameproof	"da"	AS/NZS 60079.1	
			IEC 60079-1	
	Intrinsically safe	"ia"	AS/NZS 60079.11	
			IEC 60079-11	
	Encapsulation	"ma"	AS/NZS 60079.18	
			IEC 60079-18	
	Two independent types of protection each meeting EPL "Gb"	"Ga"	AS/NZS 60079.26	
			IEC 60079-26	
	Fieldbus intrinsically safe concept (FISCO)	"ia"	AS/NZS 60079.27	
			AS/NZS IEC 60079.25	
			IEC 60079-27	
			IEC 60079-25	

Table 2 (continued)

(continued)

EPL	Type of protection	Code	According to Standard	Comments
	Protection of equipment and transmission systems using optical radiation	"op is"	AS/NZS 60079.28 IEC 60079-28	
	Special protection	"s" "sa"	AS/NZS 1826 AS/NZS 60079.33 IEC 60079-33	Where certified for use in Zone 0
"Gb"	Flameproof enclosures	"d" "db"	AS/NZS 60079.1 IEC 60079-1	
	Increased safety	"e" "eb"	AS/NZS 60079.7 IEC 60079-7	
	Intrinsically safe	"ib"	AS/NZS 60079.11 IEC 60079-11	
	Encapsulation	"m" "mb"	AS/NZS 60079.18 IEC 60079-18	
	Oil immersion	"o" "ob"	AS/NZS 60079.6 IEC 60079-6	
	Pressurized enclosures	"p" "px" "py" "pxb" "pyb"	AS/NZS 60079.2 IEC 60079-2	
	Powder filling	"q"	AS/NZS 60079.5 IEC 60079-5	
	Fieldbus intrinsically safe concept (FISCO)	"ib"	AS/NZS 60079.27 AS/NZS IEC 60079.25 IEC 60079-27 IEC 60079-25	
	Protection of equipment and transmission systems using optical radiation	"op is" "op sh" "op pr"	AS/NZS 60079.28 IEC 60079-28	
	Special protection	"s" "sb"	AS/NZS 1826 AS/NZS 60079.33 IEC 60079-33	Where certified for use in Zone 1
"Gc"	Flameproof enclosures	"dc"	AS/NZS 60079.1 IEC 60079-1	
	Oil immersion	"oc"	AS/NZS 60079.6 IEC 60079-6	
	Increased safety	"ec"	AS/NZS 60079.7 IEC 60079-7	
	Intrinsically safe	"ic"	AS/NZS 60079.11 IEC 60079-11	

Table 2 (continued)				(continued)
EPL	Type of protection	Code	According to Standard	Comments
	Encapsulation	"mc"	AS/NZS 60079.18	
			IEC 60079-18	
	Non-sparking	"n" "nA"	AS/NZS IEC 60079.15	
			IEC 60079-15	2nd edition (2001) of IEC 60079-15 not accepted unless reviewed according to 4.4.2.3.1.
	Restricted breathing	"nR"	AS/NZS IEC 60079.15	See Note
			IEC 60079-15	2nd edition (2001) of IEC 60079-15 not accepted unless reviewed according to 4.4.2.3.1. See also Note.
	Energy limitation	"nL"	AS/NZS IEC 60079.15	
			IEC 60079-15	2nd edition (2001) of IEC 60079-15 not accepted unless reviewed according to 4.4.2.3.1.
	Sparkling equipment	"nC"	AS/NZS IEC 60079.15	
			IEC 60079-15	2nd edition (2001) of IEC 60079-15 not accepted unless reviewed according to 4.4.2.3.1.
	Pressurized enclosures	"p" "pz" "pzc"	AS/NZS 60079.2	
			IEC 60079-2	
	Fieldbus intrinsically safe concept (FISCO)	"ic"	AS/NZS 60079.27 AS/NZS IEC 60079.25	Where certified for use in Zone 2
			IEC 60079-27 IEC 60079-25	Where certified for use in Zone 2
	FNICO	"nL"	AS/NZS 60079.27	
			IEC 60079-27	
	Protection of equipment and transmission systems using optical radiation	"op is" "op sh" "op pr"	AS/NZ 60079.28	Where certified for use in Zone 2
			IEC 60079-28	
	Special protection	"s" "sc"	AS/NZS 1826	Where certified for use in Zone 2
			AS/NZS 60079.33	
			IEC 60079-33	
"Da"	Encapsulation	"ma"	AS/NZ 60079.18	
			IEC 60079-18	
	Protection by enclosure	"ta"	AS/NZS 60079.31	
			IEC 60079-31	
	Intrinsically safe	"ia" or "iaD"	AS/NZS 60079.11	
			AS/NZS 61241.11	

Table 2 (continued)

(continued)

EPL	Type of protection	Code	According to Standard	Comments
			IEC 60079-11	
			IEC 61241-11	
	Special protection	"sa"	AS/NZS 60079.33	
			IEC 60079-33	
"Db"	Encapsulation	"mb"	AS/NZS 60079.18	
			IEC 60079-18	
	Protection by enclosure	"tb" "tD"	AS/NZS 60079.31	
			AS/NZS 61241.1	
			IEC 60079-31	
			IEC 61241-1	
	Pressurized enclosures	"pxb" "pyb" "pD"	AS/NZS 60079.2	
			AS/NZS 61241.2	
			IEC 60079-2	
			IEC 61241-4	
	Intrinsically safe	"ib" "ibD"	AS/NZS 60079.11	
			AS/NZS 61241.11	
			IEC 60079-11	
			IEC 61241-11	
	Special protection	"sb"	AS/NZS 60079.33	
			IEC 60079-33	
"Dc"	Encapsulation	"mc"	AS/NZS 60079.18	
			IEC 60079-18	
	Protection by enclosure	"tc" "tD"	AS/NZS 60079.31	
			AS/NZS 61241.1	
			IEC 60079-31	
			IEC 61241-1	
	Pressurized enclosures	"pzc" "pD"	AS/NZS 60079.2	
			AS/NZS 61241.2	
			IEC 60079-2	
			IEC 61241-4	
	Intrinsically safe	"ic"	AS/NZS 60079.11	
			IEC 60079-11	
	Special protection	"sc"	AS/NZS 60079.33	
			IEC 60079-33	

NOTE Restricted-breathing "nR" enclosures is normally considered as only suitable for installation in a Zone 2 hazardous area even if a risk assessment has deemed that equipment providing EPL Gc is suitable for other zones. The safety of restricted-breathing "nR" enclosures is dependent upon explosive atmospheres only being present for short-durations (i.e. Zone 2).

The recognized types of protection according to IEC standards have been allocated default EPLs according to [Table 2](#). Where the equipment is marked with a type of protection code and an EPL that differs from [Table 2](#) then the equipment EPL marking shall take precedence.

Table 2 — Default relationship between types of protection and EPLs

EPL	Type of protection	Code	According to
“Ga”	Intrinsically safe	“ia”	IEC 60079-11
	Encapsulation	“ma”	IEC 60079-18
	Two independent types of protection each meeting EPL “Gb”		IEC 60079-26
	Protection of equipment and transmission systems using optical radiation	“op is”	IEC 60079-28
	Special protection	“sa”	IEC 60079-33
“Gb”	Flameproof enclosures	“d”	IEC 60079-1
	Increased safety	“e”	IEC 60079-7
	Intrinsically safe	“ib”	IEC 60079-11
	Encapsulation	“m” “mb”	IEC 60079-18
	Oil immersion	“o”	IEC 60079-6
	Pressurized enclosures	“p”, “px”, “py”, “pxb” or “pyb”	IEC 60079-2
	Powder filling	“q”	IEC 60079-5
	Fieldbus intrinsically safe concept (FISCO)		IEC 60079-27
	Protection of equipment and transmission systems using optical radiation	“op is” “op sh” “op pr”	IEC 60079-28
	Special protection	“sb”	IEC 60079-33
“Gc”	Intrinsically safe	“ic”	IEC 60079-11
	Encapsulation	“mc”	IEC 60079-18
	Non-sparking	“n” or “nA”	IEC 60079-15
	Restricted breathing	“nR”	IEC 60079-15
	Energy limitation	“nL”	IEC 60079-15
	Sparkling equipment	“nC”	IEC 60079-15
	Pressurized enclosures	“pz” or “pzc”	IEC 60079-2
	Protection of equipment and transmission systems using optical radiation	“op is” “op sh” “op pr”	IEC 60079-28
	Special protection	“sc”	IEC 60079-33
“Da”	Encapsulation	“ma”	IEC 60079-18
	Protection by enclosure	“ta”	IEC 60079-31
	Intrinsically safe	“ia” or “iaD”	IEC 60079-11 or IEC 61241-11
	Special protection	“sa”	IEC 60079-33
“Db”	Encapsulation	“mb”	IEC 60079-18
	Protection by enclosure	“tb” or “tD”	IEC 60079-31 IEC 61241-1
	Pressurized enclosures	“pD”	IEC 61241-4
	Intrinsically safe	“ib” or “ibD”	IEC 60079-11 or IEC 61241-11

Table 2 (continued)

EPL	Type of protection	Code	According to
	Special protection	“sb”	IEC 60079-33
“Dc”	Encapsulation	“mc”	IEC 60079-18
	Protection by enclosure	“tc” or “tD”	IEC 60079-31 IEC 61241-1
	Pressurized enclosures	“pD”	IEC 61241-4
	Intrinsically safe	“ic”	IEC 60079-11
	Special protection	“sc”	IEC 60079-33
New protection marking codes with identification of EPLs may be introduced in the future.			

5.4.3 Equipment for use in locations requiring EPL “Ga” or “Da”

NATIONAL VARIATIONS

Delete the above Clause title and *replace* with the following:

5.4.3 Equipment for use in locations requiring EPL “Ma”, “Ga” or “Da”

Electrical equipment and circuits can be used in locations requiring EPL “Ga” or “Da” if the equipment is either marked as EPL “Ga” or “Da” respectively or uses a type of protection listed in [Table 2](#) as meeting the requirements of EPL “Ga” or “Da” respectively. The installation shall comply with the requirements of this standard as appropriate to the type of protection employed. When “Ga” is marked in accordance with IEC 60079-26 for combined types of protection, the installation shall simultaneously comply with the requirements of this standard as appropriate to the types of protection employed.

NATIONAL VARIATIONS

After the above paragraph, *add* the following:

Electrical equipment and circuits may be used in locations requiring EPL “Ma” if the equipment is either marked as EPL “Ma” or uses a type of protection listed in [Table 2](#) as meeting the requirements of EPL “Ma”. The combination of two independent types of protection each meeting EPL “Mb”, may also be used to achieve EPL “Ma”. In this case the combination shall, in conjunction with associated cables, have a safety performance (explosion protection) availability of at least 0.999 or an ignition risk reduction factor of at least 1 000.

NOTE 1 In determining the safety availability or risk reduction factor one of the following should be used: AS 61508 (all parts), AS IEC 61511 (all parts) or AS 62061. This does not preclude the use of equivalent methods.

NOTE 2 For Group I, equipment marked as EPL “Ma” is the only equipment allowed to be kept energized when the gas concentration in the general body of air exceeds 25 % of the LEL.

5.4.4 Equipment for use in locations requiring EPL “Gb” or “Db”

NATIONAL VARIATIONS

Delete the above Clause title and *replace* with the following:

5.4.4 Equipment for use in locations requiring EPL “Mb”, “Gb” or “Db”

Electrical equipment and circuits can be used in locations requiring EPL “Gb” or “Db” if the equipment is either marked as EPL “Ga” or “Gb” and “Da” or “Db” respectively or uses a type of protection listed in [Table 2](#) as meeting the requirements of EPL “Ga” or “Gb” and “Da” or “Db” respectively. The installation shall comply with the requirements of this document as appropriate to the type of protection employed.

Where equipment meeting the requirements of EPL “Ga” or “Da” is installed in a location which only requires equipment to EPL “Gb” or “Db” respectively, it shall be installed in full accordance with the requirements of all the types of protection employed except as varied by the additional requirements for the individual protection techniques.

NATIONAL VARIATIONS

After the above paragraph, *add* the following:

For Group I, equipment marked as EPL “Mb” is only allowed to be kept energized when the gas concentration in the general body of air does not exceed 25 % of the LEL.

5.4.5 Equipment for use in locations requiring EPL “Gc” or “Dc”

Electrical equipment and circuits can be used in locations requiring EPL “Gc” or “Dc” respectively if the equipment is either marked as EPL “Ga” or “Gb” or, “Gc” and “Da” or “Db” or “Dc” respectively, or uses any type of protection listed in [Table 2](#). The installation shall comply with the requirements of this standard as appropriate to the type of protection employed.

Where equipment meeting the requirements of EPL “Ga” or “Gb” and “Da” or “Db” respectively is installed in a location which only requires equipment to EPL “Gc” or “Dc” it shall be installed in full accordance with the requirements of all the types of protection employed except as varied by the additional requirements for the individual protection techniques.

NATIONAL VARIATIONS

After the clause above, *add* the following:

5.4.6 Additional installation requirements for using intrinsic safety with dusts

Intrinsically safe apparatus that is not marked with the EPL for dusts and conforming to AS/NZS 60079.11 and IEC 60079-11 are permitted, provided that the following conditions are satisfied.

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 III; or
- (d) Group I, and coal dust is the only hazard present.
- (e) The equipment is either encapsulated or protected by an enclosure conforming to at least the degree of protection IP5X given in AS 60529 or IEC 60529.

5.4.7 Installation requirements for new levels of protection

Since the publication of IEC 60079-14 in 2013, several developments have occurred in the 60079 series, including the replacement of type of protection “nA” and some aspects of type of protection “nC” in

(continued)

IEC 60079-15 with level of protection “ec” in IEC 60079-7 and level of protection “dc” in IEC 60079-1 respectively.

Equipment marked with new level of protection designations shall be applied in accordance with the requirements of this document based on the following points and [Table 2](#):

- (a) Ex “eb” shall be treated as equivalent to Ex “e”.
- (b) Ex “ec” shall be treated as equivalent to Ex “nA”.
- (c) Ex “db” shall be treated as equivalent to Ex “d”.

NOTE Level of protection “dc” is typically only used to protect component parts of complete equipment and is unlikely to apply to complete equipment or to connection facilities.

- (i) Ex “ob” shall be treated as equivalent to Ex “o”.
- (ii) Ex “oc” requirements should be based on Ex “o” requirements but is only suitable for EPL Gc.

5.5 Selection according to equipment grouping

Electrical equipment shall be selected in accordance with [Table 3](#).

NATIONAL VARIATIONS

In [Table 3](#) below, above row IIA, *add* the following:

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Table 3 — Relationship between gas/vapour or dust subdivision and equipment group

Location gas/vapour or dust subdivision	Permitted equipment group
IIA	II, IIA, IIB or IIC
IIB	II, IIB or IIC
IIC	II or IIC
IIIA	IIIA, IIIB or IIIC
IIIB	IIIB or IIIC
IIIC	IIIC

Where electrical equipment is marked indicating suitability with a particular gas or vapour, it shall not be used with other gases or vapours without a thorough assessment being carried out by a competent body and the assessment results showing that it is suitable for such use.

NATIONAL VARIATIONS

In the paragraph above, *delete* “competent body” and *replace* with “competent person”.

5.6 Selection according to the ignition temperature of the gas, vapour or dust and ambient temperature

5.6.1 General

The electrical equipment shall be so selected that its maximum surface temperature will not reach the ignition temperature of any gas, vapour or dust which may be present.

If the marking of the electrical equipment does not include an ambient temperature range, the equipment is designed to be used within the temperature range $-20\text{ }^{\circ}\text{C}$ to $40\text{ }^{\circ}\text{C}$. If the marking of the electrical equipment includes an ambient temperature range, the equipment is designed to be used within this range.

NATIONAL VARIATIONS

After the paragraph above, *add* the following:

NOTE Equipment certified to older editions of the equipment standards might not have been intended to be restricted to an ambient range of $-20\text{ }^{\circ}\text{C}$ to $40\text{ }^{\circ}\text{C}$ if it was not marked.

If the ambient temperature is outside the temperature range, or if there is a temperature influence from other factors, e.g. the process temperature or exposure to solar radiation, the effect on the equipment shall be considered and measures taken documented.

Cable glands normally do not have a temperature class or ambient operating temperature range marking. They do have a rated service temperature and unless marked, the service temperature is by default in a range of $-20\text{ }^{\circ}\text{C}$ to $80\text{ }^{\circ}\text{C}$. If different service temperatures are required, care should be taken, that the cable gland and the associated parts are suitable for such applications.

5.6.2 Gas or vapour

Symbols for the temperature classes marked on the electrical equipment have the meaning indicated in [Table 4](#).

Table 4 — Relationship between gas or vapour ignition temperature and temperature class of equipment

Temperature class required by the area classification	Ignition temperature of gas or vapour in $^{\circ}\text{C}$	Allowable temperature classes of equipment
T1	> 450	T1 – T6
T2	> 300	T2 – T6
T3	> 200	T3 – T6
T4	> 135	T4 – T6
T5	> 100	T5 – T6
T6	> 85	T6

5.6.3 Dust

5.6.3.1 General

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 equipment 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 61241-2-1 (ISO/IEC 80079-20-2, under consideration) for both, dust cloud and layer.

NATIONAL VARIATIONS

At the end of the above paragraph, *add* the following:

For Group I applications, the surface temperature shall be limited to 150 °C.

For installations where the layer thickness is greater than 5 mm, 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 L](#).

5.6.3.2 Temperature limitations because of the presence of dust clouds

The maximum surface temperature of equipment when tested in the dust-free test method in accordance with IEC 60079-0 shall not exceed two-thirds of the minimum ignition temperature in degrees Celsius of the dust/air mixture concerned:

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

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

5.6.3.3 Temperature limitation because of presence of dust layers

Where the equipment is not marked with a dust layer thickness as part of the T rating, a safety factor shall be applied taking the dust layer thickness into account as:

- up to 5 mm thickness:

The maximum surface temperature of the equipment when tested in the dust-free test method in accordance with IEC 60079-0 shall not exceed a value of 75 °C below the minimum ignition temperature for the 5 mm layer thickness of the dust concerned:

$$T_{\max} \leq T_{5 \text{ mm}} - 75 \text{ °C}$$

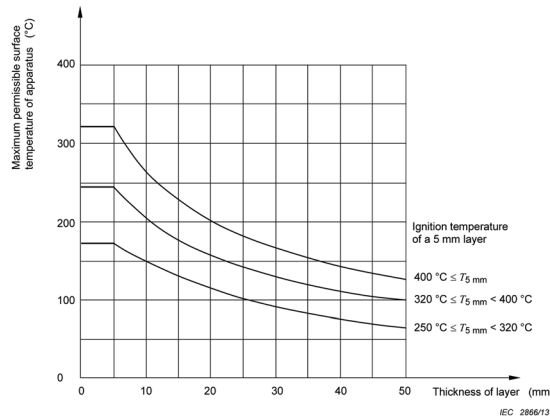
where $T_{5 \text{ mm}}$ is the minimum ignition temperature of the 5 mm layer of dust.

- above 5 mm up to 50 mm thickness:

Where there is a possibility that dust layers in excess of 5 mm may be formed on equipment, the maximum permissible surface temperature shall be reduced. For guidance, examples of the reduction in maximum permissible surface temperature of equipment used in the presence of dust having minimum ignition temperatures in excess of 250 °C for a 5 mm layer are shown in the graph below ([Figure 1](#)) for increasing depth of layers.

- For dust layers above 50 mm, see [5.6.3.4](#)

Before applying the information in [Figure 1](#), reference should be made to IEC 61241-2-1.



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Figure 1 — Correlation between the maximum permissible surface temperature and depth of dust layers

Laboratory verification shall be carried out for equipment where the ignition temperature of a 5 mm layer is below 250 °C, or where there is any doubt concerning the application of the graph (see 5.6.3.4).

5.6.3.4 Unavoidable dust layers

Where it cannot be avoided that a dust layer forms around the sides and bottom of equipment, or where equipment is totally submerged in dust, because of the insulation effect a much lower surface temperature may be necessary. If equipment protection level “Da” is required in such situations, all specific requirements for EPL “Da” shall be fulfilled.

For installations where the layer depth is greater than 50 mm, the maximum surface temperature of equipment may be marked with the maximum surface temperature T_L as reference to the permitted layer depth. Where the equipment is marked T_L for a layer depth, the ignition temperature of the dust, at layer depth L , shall be applied in place of $T_{5\text{ mm}}$. The maximum surface temperature of the equipment T_L shall be at least 75 °C lower than the ignition temperature of the dust, at layer depth L . Examples of excessively thick dust layers can be found in Annex L.

5.7 Selection of radiating equipment

5.7.1 General

The output parameters of lasers or other continuous wave sources of electrical equipment of EPL “Ga”, “Da”, “Gb” or “Db” shall not exceed the following values:

- 5 mW/mm² or 35 mW for continuous wave lasers and other continuous wave sources, and
- 0,1 mJ/mm² for pulse lasers or pulse light sources with pulse intervals of at least 5 s.

The output parameters of lasers or other continuous wave sources of electrical equipment of EPL “Gc” or “Dc” shall not exceed the following values:

- 10 mW/mm² or 35 mW for continuous wave lasers and other continuous wave sources, and
- 0,5 mJ/mm² for pulse lasers or pulse light sources.

NOTE 1 Radiation sources with pulse intervals of less than 5 s are regarded as continuous wave sources.

NOTE 2 These values are from IEC 60079-0.

For equipment installed outside, but radiating into the hazardous area, the requirements of [5.7.1](#) shall be applied.

For equipment located outside of a hazardous area, or certified to an edition of IEC 60079-0 or IEC 60079-28 where this requirement is not specified, these values may be confirmed by the equipment manufacturer.

5.7.2 Ignition process

Radiation in the optical spectral range, especially in the case of focusing, can become a source of ignition.

Sunlight, for example, may initiate an ignition if objects concentrate the radiation (for example, concave mirror, lenses, etc.).

The radiation from high intensity light sources, e.g. photo flash lamps or some LEDs is, in certain circumstances, absorbed by particles, such that these particles may become an ignition source.

NOTE Lighting equipment with divergent continuous light sources is normally considered to be not a hazard.

In the case of laser radiation (for example, signalling, telemeters, surveying, range-finders) the energy or power density even of the unfocused beam at long distances may be so great that ignition is possible. Here, too, the heating is mainly caused by the effect of the laser beam on dust layers or by absorption in particles in the atmosphere. Particularly intense focusing may cause temperatures far in excess of 1 000 °C at the focal point.

Consideration shall be given to the possibility that the equipment itself producing the radiation (for example, lamps, electric arcs, lasers, etc.) may be an ignition source.

5.8 Selection of ultrasonic equipment

5.8.1 General

For equipment installed in hazardous area, or installed outside, but radiating into the hazardous area, the output parameters from ultrasonic sources of electrical equipment of EPL “Ga”, “Gb”, “Gc”, “Da”, “Db”, or “Dc” shall not exceed the following values:

- 0,1 W/cm² and 10 MHz for continuous sources,
- average power density 0,1 W/cm² and 2 mJ/cm² for pulse sources.

NOTE These values are from IEC 60079-0.

For equipment located outside of a hazardous area, or certified to an edition of IEC 60079-0 where this requirement is not specified, these values may be confirmed by the equipment manufacturer.

5.8.2 Ignition process

When ultrasonics are applied, large proportions of the energy released by the sound transducer are absorbed by solid or liquid materials. Heating can occur in the material affected and, in extreme cases, may heat the material beyond the minimum ignition temperature.

5.9 Selection to cover external influences

Electrical equipment shall be selected and/or installed so that it is protected against external influences which could adversely affect the explosion protection. Some examples are:

- extremely low or high temperatures;
- solar radiation;

- pressure conditions;
- corrosive atmosphere;
- vibrations, mechanical impacts, friction or abrasion;
- wind;
- painting processes;
- chemicals;
- water and moisture;
- dust;
- plants, animals, insects.

External influences shall be identified as part of the installation design and selection of equipment for the installation and measures applied for control shall be documented and included in the verification dossier.

NOTE 1 Further information can be found in IEC 60364-5-51.

Where equipment is subject to prolonged humidity and wide temperature variations that may lead to condensation affecting the type of protection the equipment should be provided with suitable measures to ensure satisfactory prevention of condensation or draining of any condensate.

Precautions shall be taken, without affecting designed ventilation conditions, to prevent foreign bodies falling vertically into the ventilation openings of vertical rotating electrical machines.

The integrity of electrical equipment may be affected if it is operated under temperature or pressure conditions outside those for which the equipment has been constructed. In these circumstances, further advice shall be sought (see also [5.6](#)).

Where risks can arise from high pressure process fluids entering equipment, (e.g. pressure switches or canned electric motor pumps) under fault conditions, (e.g. a diaphragm or can failure), the fluid may cause any or all of the following to occur:

- rupture of the equipment enclosure;
- risk of immediate ignition;
- transmission of the fluid along the inside of the cable or conduit.

Where equipment is at risk it should be selected so that process fluid containment is reliably separated from the electrical equipment (e.g. by use of a primary seal for the main process interface and a secondary seal internal to the equipment in case of primary seal failure). Where this is not achieved, the equipment should be vented (via a suitably explosion protected vent, drain or breather) and/or the wiring system shall be sealed to prevent the transmission of any fluid. Failure of the primary seal should also be annunciated e.g. by visible leak, self-revealing failure of the equipment, audible sound or electronic detection.

Potential wiring system sealing methods include: the use of a special sealing joint, or a cable gland incorporating a seal around the individual conductors, or a length of mineral-insulated metal-sheathed (MIMS) cable, or an “epoxy” joint should be introduced into the cable run. It should be noted that the application of a cable sealing device may only mitigate the rate of vapour transmission and additional attenuation measures may be necessary. Venting systems should be arranged so that the occurrence of any leaks will become apparent.

NATIONAL VARIATIONS

Delete the following two paragraphs and Note 2 and *replace* with the following:

Installation of equipment shall not reduce the IP rating below the minimum required for the protection technique. When selecting enclosures with a higher degree of ingress protection (IP) than required by the type of protection (perhaps to make it suitable for an adverse environment), the IP rating of the enclosure shall be maintained to the IP rating requirement of the location.

In the absence of IEC standards on process sealing for electrical equipment, national or other applicable standards such as IEC 61010-1 should be followed. IEC 61010-1 includes some information relative to process connections.

NOTE 2 IEC TS 60079-40 for process sealing is under consideration

When selecting enclosures with a higher degree of ingress protection (IP) than required by the type of protection (perhaps to make it suitable for an adverse environment), the IP rating of the enclosure should be maintained to the IP rating requirement of the location or that required by the type of protection whichever is the higher. Where the IP rating assigned to the equipment is not maintained, this should be identified in the verification dossier.

NATIONAL VARIATIONS

At the end of [Clause 5.9](#), add the following new clause:

5.9.1 Selection for pollution degree

Some equipment, typically intrinsically safe equipment, utilizes reduced separation distances which are reliant on the installation limiting the amount of dust or moisture which could enter an enclosure and impair these distances, described by a pollution degree. The certificate for such equipment will include the suffix “X” and a Specific Condition of Use will detail how this is to be achieved.

NOTE Pollution degrees 1 through 4 are established in IEC 60664-1 and are descriptive of the micro-environment within equipment. Refer to IEC 60664-1.

Where the equipment manufacturer’s documentation requires the installation to provide a pollution degree 2 environment, but does not include specific instructions to achieve the required pollution degree, the following examples may be considered to achieve this:

- Equipment used or installed in a room that provides a clean environment, such as a pharmaceutical clean room or hygiene controlled food production area.
- Equipment installed in an enclosure offering at least IP54 and other protection against condensation, such as anti-condensation heaters.

5.10 Selection of transportable, portable and personal equipment

5.10.1 General

Due to the demand of the application and enhanced flexibility for use, transportable, portable or personal equipment may be required to be used in differing areas. Equipment of a lower EPL shall not be taken into an area requiring a higher EPL, unless it is otherwise protected.

In practice, however, such a limitation may be difficult to enforce – particularly with portable or personal equipment. It is recommended, therefore, that all equipment meet the requirements of the location to