



Assets Planning and Delivery Group
Engineering

HA-ST-03

Electrical Equipment in Hazardous Areas (EEHA) Selection and Installation Standard

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REVISION 2

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FOREWORD

Electrical Equipment in Hazardous Area (EEHA) Standards are prepared to ensure that the Water Corporation’s staff, consultants and contractors are informed as to the Water Corporation’s EEHA standards and recommended practices. EEHA standards are intended to promote uniformity so as to simplify selection, installation and maintenance practices; their ultimate objective is to provide safe and functional plant, at minimum whole of life cost.

The Water Corporation EEHA standards and recommended practices described in this EEHA standard have evolved over a number of years as a result of capital project delivery, plant operation and maintenance experience gained through the selection, installation and maintenance of electrical equipment in our hazardous area facilities.

Deviation, on a particular project, from the EEHA standards and recommended practices maybe permitted in special circumstances but only after consultation with and endorsement by the Senior Principal Engineer, Mechanical and Electrical Assets, Engineering.

Nothing in this Design Standard diminishes the responsibility of designers and constructors for applying the requirements of WA OSH Regulations 1996 (Division 12, Construction Industry – consultation on hazards and safety management) to the delivery of Corporation assets. Information on these statutory requirements may be viewed at the following web site location:

https://www.slp.wa.gov.au/legislation/statutes.nsf/law_s4665.html

Users are invited to forward submissions for continuous improvement to the Senior Principal Engineer, Mechanical and Electrical Assets, who will consider these for incorporation into future revisions.

Head of Engineering

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REVISION STATUS

The revision status of this standard is shown section by section below:

REVISION STATUS						
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HA-ST-03

Electrical Equipment in Hazardous Areas (EEHA) Selection and Installation Standard

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1 INTRODUCTION

1.1 Scope

This Standard specifies the general requirements for the selection and installation of electrical equipment at Water Corporation facilities to ensure its safe use in hazardous areas (HA). The intention of this Standard is to expand upon the requirements of AS/NZS60079.14, and to specify additional Water Corporation requirements. It shall be read in conjunction with Water Corporation Design Standards DS28 (Water and Wastewater Treatment Plants – Electrical), DS40-09 (Field Instrumentation), DS26-06 (Type Specification for Standard Cage Induction Motors and DS26-07 (Type Specification for Electrical Installations).

This Standard applies to the design and installation of all modifications and upgrades to the existing Water Corporation facilities, and the design and construction of new facilities. It does not apply to existing electrical installations. However, the act of introducing other than like-for like equipment in an existing electrical installation (e.g. replacement of a motor with one of a different power rating) could cause that installation to be deemed ‘new’ and therefore compliance with this Standard will be required.

1.2 Exclusions

With the exception of intrinsically safe (IS) barriers, and other associated apparatus, this Standard does not cover the selection and installation of explosion-protected electrical equipment that is located in non-hazardous areas.

NOTE: Ex equipment may be chosen for use in non-hazardous areas due to availability, commonality of spare, or other economic or operational reasons.

1.3 Abbreviations

- AIT Auto Ignition Temperature
- EEHA Electrical Equipment in Hazardous Areas
- GD Gas Detector
- HA Hazardous Areas
- IP Ingress Protection
- IS Intrinsically Safe
- SIL Safety Integrity Level
- TIC Technical Integrity Custodian

1.4 Technical Integrity Custodian

The Technical Integrity Custodian (TIC) for this Standard is the Senior Principal Electrical Engineer, Mechanical & Electrical Assets, Engineering.

1.5 Referenced Documents

The following documents are referenced in this Standard. If a referenced standard has been superseded, the user shall notify the TIC and utilize the latest edition of the standard unless advised otherwise in writing by the TIC.

AS/NZS60079.14-2022

Explosive atmospheres Part 14: Electrical installations design, selection and erection

HA-ST-04	Electrical Equipment in Hazardous Areas (EEHA) – Competency Standard
HA-ST-11	Electrical Equipment in Hazardous Areas (EEHA) – Assessment of non-ANZ/IEC/AUSEx Equipment Standard
DS40-09	Field Instrumentation
DS26-06	Type Specification for Standard Cage Induction Motors
DS26-07	Type Specification for Electrical Installations
DS28	Water and Wastewater Treatment Plants – Electrical

2 GENERAL

Electrical equipment selected and installed in a hazardous area on the Water Corporation facilities shall comply with the requirements of AS/NZS60079.14, and this Standard. In addition, the installation shall comply with any other relevant electrical Water Corporation Standards.

Similar to DS79 section 3.3, Water Corporation does not apply AS61508/AS61511 to the design of its Ex certified installations as a possible risk mitigation option (risk reduction approach) due to the complexities in managing Functional Safety Systems/Safety Instrumented Systems. However, HA Design may choose to use Functional Safety Systems/Safety Instrumented Systems (such as safety relays) for special cases such as Conditions of Control as specified in AS/NZS 60079.14 clause 4.1.

3 SELECTION AND DESIGN

3.1 Preferred Techniques

For most hazardous area electrical installations, more than one explosion-protection technique will be suitable for a particular situation. For example, in a Zone 2 area an Ex n, Ex d, Ex e, or Ex p motor may be suitable. In these instances, Appendix A of this Standard shall be used to select the preferred explosion protection technique.

Although Appendix A is not all encompassing, it provides sufficient guidance to identify preferences for the Water Corporation’s facilities. These preferences shall be followed whenever possible.

Any deviation from Appendix A shall have TIC written approval.

3.2 Non-Hazardous Requirements

Electrical equipment selected for use in a non-hazardous area does not have to be explosion-protected. Where explosion-protected equipment is used in a non-hazardous area for commonality of spares, or convenience, etc. it does not have to be selected and/or installed in accordance with this Standard.

3.3 Ambient Temperature

AS/NZS60079.14 clause 5.6.1 requires that if the ambient temperature (T_{amb}) is outside the certification range, or there is a temperature effect from other factors (e.g. solar radiation or process temperature), the effect of the temperature on the equipment shall be considered and documented.

The assumed maximum T_{amb} at the Water Corporation's facilities is 50°C. Therefore, all explosion-protected equipment shall be certified for a T_{amb} of at least 50°C. TIC written approval shall be obtained prior to using equipment not certified for a T_{amb} of at least 50°C.

To reduce the effect of solar radiation, all electrical equipment shall be protected from direct exposure to solar radiation by location, sunshields, etc. unless its T_{amb} rating is at least 70°C, or a specific assessment deems that the equipment is suitable. Additionally, electrical equipment should be located away from heat from process equipment when this can cause excessive temperatures.

3.4 Acceptable Certification

3.4.1 Certification

Whenever practicable, electrical equipment located in a hazardous area shall be either IECEx, ANZEx or AUSEx certified.

Note: Equipment whose certificate of conformity issued under the AUSEx scheme has expired shall not be purchased. However, equipment whose certificate of conformity issued under the AUSEx scheme has expired may remain installed, or may be installed 'as new' from stores.

When electrical equipment with IECEx, ANZEx or AUSEx certification is not practicably available, AS/NZS60079.14 clause 4.4 allows the use of electrical equipment with other explosion-protection certification provided that this be justified by the party in control of the facility. The method of assessment and justification shall be in accordance with the Water Corporation [Electrical Equipment in Hazardous Areas \(EEHA\) – Assessment of non- ANZ/IEC/AUSEx Equipment Standard: HA-ST-11](#).

A listing of non-AUS/ANZ/IECEx equipment whose use has been justified by the Water Corporation is contained in the HA Verification Dossier.

3.4.2 Conditions of Control

In some rare instances, certified explosion-protected electrical equipment is not available. AS/NZS 60079.14 allows 'conditions of control' to be used where it is not practicable to comply with the certification requirements of AS/NZS 60079.14.

Specifically, AS/NZS 60079.14 clause 4.1 states:

In certain 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 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 of the following:

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

NOTE Conditions of control would apply where it is not practicable to comply with other requirements of this Standard.

'Conditions of control' shall only be considered for Water Corporation facilities when suitable Ex certified electrical equipment is not available in the market. 'Conditions of control' shall not be used when suitable Ex certified electrical equipment is practicably available. The application of 'conditions of control' shall comply with Appendix D of this Standard.

3.5 Process Fluid Migration

Electrical equipment that relies upon a single seal, diaphragm, or tube to prevent flammable process fluid entering the electrical enclosure shall not be used on Water Corporation facilities.

3.6 Additional Selection Requirements

3.6.1 Ex p Pressurisation

The factors listed in this Section should be considered when selecting pressurisation, Ex p, as an explosion-protection technique.

3.6.1.1 Availability of Utilities

Ex p equipment should be chosen taking into account the availability of a suitable pressurisation medium. When a suitable pressurisation medium is not readily available, the cost of providing a pressurisation source may make the cost of an Ex p installation prohibitively high.

3.6.1.2 Action on Loss of Pressure

The impact upon facility operations resulting from the automatic isolation of the Ex p equipment on loss of pressurisation, may make the use of Ex p electrical equipment unsuitable in Zone 1 situations.

3.6.1.3 Pressurising Medium

Instrument air shall be used as the pressurisation medium unless the certification documentation specifies that an inert gas shall be used.

When an inert gas is used, consideration shall be given to the potential risk of asphyxiation of personnel after opening of enclosures.

Inert gas should be avoided when pressurising large panels that personnel can enter, or equipment inside enclosed areas where leaking pressurisation gas could displace the external atmosphere.

3.6.2 Ex e Increased Safety

The factors listed in this Section should be considered when selecting increased safety, Ex e, as an explosion-protection technique.

3.6.2.1 Maximum Power Dissipation

The maximum power dissipation calculation for an Ex e enclosure shall be performed using the rating of the protection device, not the rating of the cable. Conductors inside an Ex e enclosure shall be sized per the certification documents, or when not detailed in the certification documents they shall be sized in accordance with AS/NZS3008.1.1 as if they are ‘three conductors in conduit in air’.

Calculations are not required for instrument junction boxes due to the low currents (e.g. 4-20mA) creating minimal power dissipation.

3.7 Competency of Designers

All persons selecting electrical equipment for hazardous areas and designing hazardous area installations shall comply with the relevant requirements of the Water Corporation’s [Electrical Equipment in Hazardous Areas \(EEHA\) - Competency Standard: HA-ST-04](#).

3.8 Equipment Located in a Non-Hazardous but Connected to Zone 2

In the absence of any specific guidance in AS/NZS60079.14, electrical equipment located external to process equipment in a non-hazardous area whose process connections are wetted by a Zone 2 hazardous area inside the process equipment shall be assessed as detailed in Appendix B to determine if it has to be explosion-protected.

This scenario typically occurs when the internal gaseous space of odour ducts, inlet screens, grit tanks, primary sedimentation tanks, etc. have been classified as a Zone 2 area.

If the assessment determines that the equipment does not have to be explosion-protected, general purpose electrical equipment can be utilised, or explosion-protected equipment can be de-certified (refer to section 3.9)

The assessment shall be recorded on [HA-FM-06](#) and filed in the HA Verification Dossier.

3.9 De-certification

Explosion-protected electrical equipment is sometimes installed in non-hazardous areas due to: changes in zoning, commonality of spares, or for other reasons. This equipment is not required to be explosion-protected. Therefore, to reduce life-cycle costs, whenever practicable, it shall be ‘de-certified’ in accordance with the requirements stated in this Standard.

When equipment is to be de-certified, the assessment shall be recorded on [HA-FM-07](#) and filed in the HA Verification Dossier.

The following applies to all de-certified equipment:

- If possible, the Ex details shall be removed from the equipment via removal of labels or engraving/scratching off the details.
- A Water Corporation “De-certified tag” shall be affixed with stainless steel wire. The tag shall be stainless steel, circular, at least 25mm diameter, without sharp edges, and with the words “Ex : De-certified” clearly engraved upon it.
- De-certified equipment shall be removed from the ‘Ex-register’ and all documents and records affected by the de-certification shall be updated.

NOTE: Careful analysis must be undertaken when considering de-certifying IS equipment due to the segregation requirements between IS and non-IS circuits, to ensure that the de-certification will not affect other circuits that must remain as IS (e.g. when de-certification would result in IS and de-certified circuits being in the same cable, or clearances between IS and de-certified circuits not complying with the standards). When colour coding or signage of cables, ducts, terminals, etc. are used to identify IS circuits, the colour/signage shall be changed if the circuits are de-certified and are thus no longer IS. Similarly, de-certification of IS loops will usually require removal of the associated IS barrier and possibly cable re-routing, therefore loop sheets, wiring diagrams etc. may require updating.

4 INSTALLATION

Explosion-protected equipment shall be installed in accordance with AS/NZS60079.14, and the requirements of this section.

4.1 General

4.1.1 Cable Glands

Cable glands used on equipment located in hazardous areas shall be certified to the following techniques.

Table 1: Cable gland certification techniques

EQUIPMENT CERTIFICATION	GLAND CERTIFICATION
Ex d Flameproof	Ex d (See note)
Ex ia, Ex ib and Ex ic	Any non-certified, or any certified gland that maintains IP rating etc.
Any other Ex technique	Any Ex certified gland that maintains the Ex integrity (e.g. IP rating)

NOTE: Due to the unknown ‘compactness’ of cable, to ensure integrity is maintained, flameproof equipment shall only use Ex d barrier glands. Ex d compression glands shall not be used on Ex d enclosures.

For parallel threads, an IP washer shall be fitted to the gland's male thread to ensure an adequate IP rating is maintained between the gland and the enclosure. For flameproof enclosures, the IP washer shall only be used if 5 threads are fully engaged after fitment of the seal.

When equipment is supplied with an integral gland, which is part of the certified electrical equipment, this shall be used.

Shrouds shall not be used on cable glands.

4.2 Flameproof (Ex d)

4.2.1 Compounds on Flamepaths

The grease used on flamepaths shall be the type specified on the equipment's certification documentation. When no specific type is specified, the following greases shall be used:

- Dow Corning No.4 silicone grease
- Lanotec Type A grease
- STL-8 grease from Crouse-Hinds
- Any grease tested with IIC gas and certified as being suitable for use on flamepaths by a certification body that certifies Ex d equipment.

Silicon grease shall not be used on gas detectors using pellistors as the silicone could poison the sensor. Caution is required when using silicone grease so that tools do not become contaminated and inadvertently poison the pellistors.

4.2.2 Fittings and Adaptors

All flameproof fittings shall be of the non-running type. Their construction shall be such that their length engagement is restricted. For example: nipples shall have a hexagonal section in their middle to ensure that adequate threads are engaged at both ends; plugs shall have a lip at the end of the thread that prevents the plug from being able to pass fully through the wall of the enclosure.

4.3 Encapsulation (Ex m)

4.3.1 Termination of Flying-Leads

An increased safety Ex e junction box shall be used for the termination of flying-leads of Ex m equipment. The IP rating of the encapsulated equipment housing and the method of joining it to the Ex e enclosure shall not compromise the IP rating of the Ex e enclosure. The auxiliary junction box shall be close coupled to the encapsulated equipment with an Ex certified nipple.

If TIC approval is given to use a flameproof junction box to terminate the leads, a conduit seal must be installed between the auxiliary junction box and the encapsulated equipment to maintain the integrity of the flameproof junction box.

The connection of cables to the auxiliary junction box shall be performed in accordance with the requirements for the protection technique of the junction box.

4.4 Pressurisation (Ex p)

4.4.1 Wiring Systems

Wiring systems connected to Ex p electrical equipment shall be of a type which will not allow the migration of the pressurisation medium along the internals of the cables. The ability to prevent migration should be inherent in the cable design. Conduit seals should not be needed to prevent migration along the cables. In addition, the cables shall be chemically compatible with the pressurisation medium.

4.5 Increased Safety (Ex e)

4.5.1 Cable Installation

Ex e junction and marshalling boxes for instrument cables carrying currents which are significantly less than the rated capacity of the cable (e.g. 4-20mA) can be loomed together inside ducting within the junction/marshalling box.

The conductors of electrical power cables in Ex e junction and marshalling boxes shall be as short as possible to minimise heat dissipation. The average conductor length shall not exceed the diagonal length of the enclosure.

NOTE: AS/NZ60079.14 states that the cable length shall not exceed the diagonal length; however it should be noted that the power calculations are based on half the diagonal length.

4.6 Intrinsic Safety (Ex ia/ib/ic)

4.6.1 Minimum Cable Size

Cabling for IS circuits shall have copper conductors and a minimum conductor size of 0.5mm².

4.6.2 Cable Sheath Colour

Cables for IS circuits shall have a blue sheath. TIC approval is required to use an alternative sheath colour when blue sheathed cable is not available.

4.6.3 Invasion

Cables containing IS circuits shall not be run in the same conduit, ducting or tray as other cables unless either the IS cable or all of the other cables are armoured or metal sheathed. Alternatively, the cables can be segregated on the tray or duct using earthed metal or insulating barrier that would prevent IS cables from being able to contact the other cables if the cables were damaged.

Inside equipment rooms, or other such locations where personnel access is restricted and the risk of cable damage is slight, IS and other cables can be run in the same conduit, duct or tray provided that both types of cable are insulated and sheathed.

4.6.4 Multi-core Cables

Regardless of the location of the cable, IS multi-core cables shall not contain non-IS circuits unless specifically allowed by the certification documentation for a specific item of equipment.

4.6.5 Fibre Optic Cable

Unless proven to be safe, all fibre optic cable, even those without electrical conductors, shall be deemed to be potentially ignition capable if cut, and shall therefore be installed as if it is non-IS wiring, in accordance with the requirements of AS/NZS60079.14.

4.7 Competency of Installers

All persons installing electrical installations in hazardous areas shall comply with the relevant requirements of Water Corporation's [Electrical Equipment in Hazardous Areas \(EEHA\) - Competency Standard: HA-ST-04](#).

APPENDIX A: LIST OF PREFERRED Ex TECHNIQUES

This Appendix details the preferred explosion-protection techniques to be used whenever possible on Water Corporation facilities.

Table 2: Preferred explosion protection techniques

Equipment	Preferred Techniques	
	Zone 1	Zone 2
LV Motors	Ex e	Ex n
Local Control Stations	Ex ed	Ex ed
HID Luminaries	Ex de	Ex de (Ex nR shall not be used)
Fluorescent Luminaries	Ex e	Ex n (Ex nR shall not be used)
Transmitters (4-20mA)	Ex i	Ex i
I/P Converters	Ex i	Ex i
Solenoids	Ex i	Ex i
Process Switches	Ex i	Ex i
Analysers	No preference	No preference

APPENDIX B: Selection of Electrical Equipment Located in a Non-Hazardous but Connected to Zone 2

This Appendix details the assessment criteria for electrical equipment located external to process equipment in a non-hazardous area whose process connections are wetted by a Zone 2 hazardous area inside the process equipment. This scenario typically occurs when the internal gaseous space of odour ducts, inlet screens, grit tanks, primary sedimentation tanks, etc. have been classified as a Zone 2 area.

The equipment shall be assessed via one of the following 4 categories to determine if it has to be certified for use in the Zone 2 area. The assessment shall be recorded on the relevant form ([HA-FM-06](#)) by a qualified EEHA Designer in accordance with the relevant Water Corporation procedures.

1. Equipment with robust mechanical separation

Electrical equipment with robust mechanical separation, located external to such process equipment in a non-hazardous area is not required to be explosion-protected, provided that:

- The electrical equipment is separated from the Zone 2 area by a solid mechanical element (eg. a thermocouple inside a thermowell, or a magnetically coupled float switch) that is rated for the process pressure and whose material of construction is fully compatible for continuous use with the process medium, or
- The electrical equipment's electronic circuitry is separated from the Zone 2 by a liquid filled capillary seal that is rated for the process pressure and whose process wetted surface material is fully compatible for continuous use with the process medium.

Electrical Equipment with robust mechanical separation not meeting the above requirements shall be suitably explosion-protected for the Zone 2 area.

2. Equipment with flexible pressure transmitting diaphragms

Flow, level, pressure, or differential pressure transmitters/switches with flexible pressure transmitting diaphragms, or similar, located in a non-hazardous area external to process equipment, whose process connections are wetted by a Zone 2 hazardous area inside the process equipment, either directly or via impulse tubing, is not required to be explosion protected, provided that:

- There is no electrical circuitry exposed directly to the Zone 2 area, and
- When the electrical equipment utilises a thin flexible diaphragm to prevent the monitored process fluid from contacting the electrical circuitry on the other side of the diaphragm (eg. a typical pressure transmitter without a capillary seal), the following requirements are satisfied:
 - The diaphragm or membrane is metallic or ceramic, and
 - The diaphragm or membrane material of construction is fully compatible for continuous use with the process medium (i.e. not prone to failure due to corrosion or erosion due to contact with the process fluid), and
 - The diaphragm or membrane is protected by its location from mechanical damage (eg. the diaphragm of a pressure transmitter connected via an impulse line is protected by the transmitter body and cannot be struck by particulate matter in the process fluid), and
 - The diaphragm or membrane is designed to withstand a minimum of 1.5 times the maximum possible pressure that can occur.

Electrical Equipment with flexible pressure transmitting diaphragms not meeting the above requirements shall be suitably explosion-protected for the Zone 2 area.

3. Equipment transmitting radiation into the process equipment

Electrical equipment located in a non-hazardous area that transmits electromagnetic (including optical) radiation into the Zone 2 area inside the process equipment shall be suitably explosion-protected for the Zone 2 area. Examples include, radar level gauges, radiation density meters, etc.

4. Other Equipment

Electrical equipment other than those listed in 1 to 3 above, shall be assessed on a case-by-case, basis using the philosophies stated above, to determine the probability of the equipment being able to create an ignition source exposed to the Zone 2 area under normal operation and realistic failures. Examples of this equipment include vortex flowmeters, thermal mass flowmeters, etc.

APPENDIX C: SPECIFIC APPROACH SCENARIOS

1. [SEPARATION REQUIREMENTS FOR INTRINSICALLY SAFE AND NON-INTRINSICALLY SAFE ELV CIRCUITS](#)
2. [WET WELL GAS MONITORING REQUIREMENT](#)

APPENDIX D: CONDITIONS OF CONTROL

BACKGROUND

In accordance with AS/NZS60079.14 clause 4.1, 'conditions of control' may be used to enable non-Ex certified electrical equipment to be used in hazardous areas when equipment with explosion-protection certification is not practicably available.

SCOPE

This Appendix provides guidance on the use of the 'conditions of control' methodology, and details the Water Corporation's specific requirements.

REQUIREMENTS OF THE AUSTRALIAN STANDARDS

As per the relevant hazardous area classification reports and drawings, specific areas are classified as HA Zone 0/1/2. As such, electrical and instrumentation equipment installed within these areas are required to conform to Water Corporation and Australian HA Standards.

In nearly all cases, the Water Corporation use certified explosion-protected equipment in a hazardous area. The hierarchy of certification is:

1. IECEx, ANZEx or AUSEx certified
2. Third party certification to other standards, and production managed by a monitored Quality Management System (QMS). A Conformity Assessment Document (CAD), or similar justification, shall be provided to demonstrate that the 'alternative' certification and manufacturing system can be accepted by Water Corporation as providing the same level of safety as IECEx, ANZEx or AUSEx certification.

AS/NZS 60079.14 allows 'conditions of control' to be used where it is not practicable to comply with the certification requirements of AS/NZS 60079.14. Specifically, AS/NZS 60079.14 clause 4.1 states:

In certain 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 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 of the following:

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

NOTE Conditions of control would apply where it is not practicable to comply with other requirements of this Standard.

Details of the 'conditions of control' to be taken 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,

Has access to all information necessary to carry out the assessment

WATER CORPORATION'S REQUIREMENTS WHEN USING 'CONDITIONS OF CONTROL'

'Conditions of control' shall only be considered when suitable Ex certified electrical equipment is not available in the market. They shall not be used when suitable Ex certified electrical equipment is practicably available.

'Conditions of control' shall only be used when specifically approved in writing by the Water Corporation's TIC for that application.

The system designer shall prepare a detailed justification for using 'conditions of control' for TIC consideration. The justification shall include:

- an explanation as to why Ex certified equipment is not being used;
- details of the frequency and size of potential flammable atmospheres that could exist, and the consequences of ignition;
- details of all potential ignition sources associated with the non-Ex certified equipment, and how each ignition source will be mitigated by the 'conditions of control';
- a formal risk assessment demonstrating the suitability of the 'conditions of control'. The risk assessment can be performed by an independent competent consultant.

When using 'conditions of control', the following points shall always be considered as they could affect the suitability of the controls:

1. What is the probability that a flammable atmosphere could be present? In Zone 2 this is low, so lesser controls might suffice.
2. What could be the size of the flammable atmosphere that could be created and ignited. For example, if you have non- Ex certified electrical equipment in the remote corner of a compressor room and sense gas local to the equipment, then the whole room could be full of a flammable atmosphere before you detect it, so if there is ignition a large explosion could occur.
3. What are the consequences of ignition? Flammable atmospheres in indoor areas will tend to accumulate into large flammable atmospheres and ignition can result in high overpressures and building damage. Flammable atmospheres in open air will often be smaller and will create smaller explosions due to lack of confinement? What is the probability that personnel will be in the area if an explosion occurs? Could the explosion create escalation?
4. What is the probability the non-Ex certified electrical equipment could create an ignition source? Does it 'normally' spark or generate temperatures above the auto ignition temperature (AIT)? Do the spark have high current (i.e. more likely to cause ignition)?
5. If the equipment is hotter than the AIT in normal operation how will the controls prevent gas accessing these hot items? Even if you electrically isolate upon confirmed gas you still have residual ignition source.
6. Similar to 5, if you have electrical residual energy after isolation this too needs to be considered.
7. If gas detection is to be used to detect a flammable atmosphere as part of the conditions of control the gas detectors (GDs) need to be located so that they will detect gas early enough to safely isolate potential ignition sources. GD location is critical.
8. If GD are used, how many will be needed to adequately detect gas? Is voting required to improve availability, and reduce nuisance trips? How often does the GD need to be calibrated and challenged?
9. What is the consequence of the 'conditions of control' not working?
10. How often do the 'conditions of control' need to be tested?
11. Does the protection circuit used need a specific safety integrity level (SIL) rating?

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