

Issue #69 - Autumn 2014

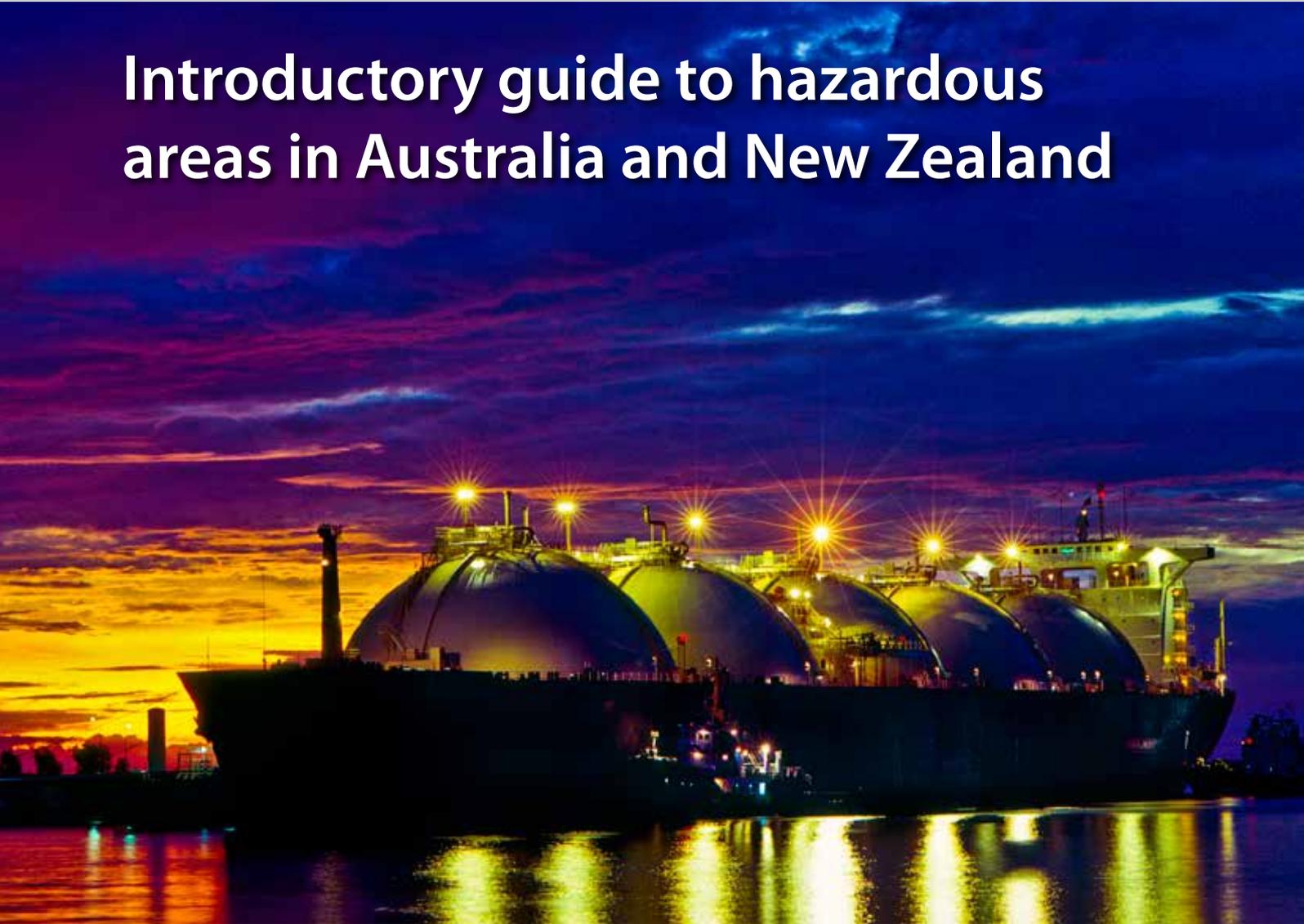
(updated May 2015)

NHP

Technical News

Industrial Electrical and Automation Products, Systems and Solutions

Introductory guide to hazardous areas in Australia and New Zealand



Written by James Davis

Product Manager - Hazardous Area Equipment



nhp.com.au | nhp-nz.com



INTRODUCTION

In electrical engineering, a hazardous area is defined as an environment that consists of any concentrations of flammable gases, vapours or combustible dusts. In these instances, all electrical equipment that is to be installed in such environments is specially designed and tested to meet a range of requirements that together ensure the safety of personnel and avoid potentially dangerous situations resulting from interaction between the equipment and its surroundings.

Applications that involve the processes of production, transformation, delivery and stocking of flammable substances commonly produce potentially explosive environments. Chemical and petrochemical, mining, oil and gas, food processing and grain handling all involve the use of flammable materials. When these come into contact with the oxygen in the air, they can create an explosive atmosphere. If this atmosphere is triggered, the resulting explosion can cause serious damages to people and the environment.

In the following Technical Newsletter we provide an Introductory Guide to hazardous areas in Australia and New Zealand to help those involved in Ex environments navigate the standards and regulations of relevant bodies. This document will also be useful in raising awareness of the risks surrounding hazardous areas and developing work safe practices.

SELECTION OF ELECTRICAL EQUIPMENT

In order to select electrical apparatus for use in hazardous areas it is necessary to have the following information:

1. Area Classification
2. Gas, vapour or combustible dust group
3. The "T" rating or the ignition temperature of the hazard
4. The required IP rating of the apparatus

1. Area Classification

The areas are classified into ZONES, and these zones are based on the frequency of the appearance of an explosive atmosphere and the duration for which it can last.

Summarised in the table below:

Gases and Vapours

Zone 0	Area in which an explosive gas-air mixture is continuously present or present for long periods.
Zone 1	Area in which an explosive gas-air mixture is likely to occur for short periods in normal operation.
Zone 2	Area in which an explosive gas-air mixture is not likely to occur, and if it occurs it will only exist for a very short time due to an abnormal condition.

Typical hazardous area industries:

Gases and Vapours

- Oil refineries & Chemical plants
- Offshore drilling rigs
- Spray booths
- Sewerage treatment plants
- Oxygen & acetylene
- Aircraft hangers
- LNG plants
- Wharves for petroleum & LNG vessels
- Paint manufacturers
- Distilling
- Laboratory & fume cupboards

Dust

- Food manufacturing
- Grain handling & storage
- Chemicals / fertilizer
- Plastics
- Wood / pulp / paper
- Milk powder
- Flour Mills
- Pharmaceuticals
- Metal processing
- Recycling operations
- Fiberglass manufacturing
- Explosive factories

Dust

Zone 20	Area in which an explosive dust-air mixture is continuously present or present for long periods.
Zone 21	Combustible or conductive dusts are present and are likely to occur for short periods in normal operation.
Zone 22	Area in which an explosive dust mixture is not likely to occur, and if it occurs it will only exist for a very short time due to an abnormal condition.

2. Gas, vapour or combustible dust group

Gases and vapours are divided into three groups:

Group I		Group II		Group III	
Mining		Explosive Gas Atmosphere		Explosive Dust Atmosphere	
M1	M2	Sub-Division	Ignition Energy	Sub-Division	Explosive Atmosphere
		IIA (eg: Propane)	260 Micro-joules	IIIA	Combustible flyings
		IIB (eg: Ethylene)	95 Micro-joules	IIIB	Non-conductive dust
		IIC (eg: Acetylene and Hydrogen)	18 Micro-joules	IIIC	Conductive dust

The hazard level of the gases and dusts increases from gas groups IIA to IIC and dust groups IIIA to IIIC. The most severe in both cases being IIC and IIIC.

3. Temperature or “T” rating for explosive gas atmospheres.

The source of ignition in a hazardous area can be an arc or a spark or even a hot surface.

Since electrical equipment generates heat in normal operation we need to ensure that a hot surface on electrical apparatus cannot ignite a surrounding explosive gas atmosphere or a dust cloud or layer.

All hazardous materials have what is known as an “Ignition Temperature”, this is the minimum temperature at which the hazardous material when mixed with air will ignite and sustain combustion, without an ignition source (auto-ignition or spontaneous ignition).

For explosive gas atmospheres a “T” rating is given. For example, a T6 rated product will not exceed 85 °C and a T3 will not exceed 200 °C. While in service in hazardous area equipment for explosive dust atmospheres are given a maximum surface temperature rather than a “T” rating. This is so dust build up, or layers can be accounted for via de-rating calculations.

T Rating	Maximum Temperature
T1	450 °C
T2	300 °C
T3	200 °C
T4	135 °C
T5	100 °C
T6	85 °C

SELECTION OF TEMPERATURE RATING FOR HAZARDOUS DUSTS

Dusts pose additional problems when dealing with temperature. Dust can settle on equipment and ledges to form layers. Because of this we have to consider dusts in two forms:

- 1) As a cloud mixed with air
- 2) As layers settled on surfaces

Dust as a cloud and dust in layers will have different ignition temperatures and we need to consider the lowest of these two.

Dust in the form of a layer on electrical equipment can impair heat dissipation and cause increased temperatures to the equipment.

Temperature increase as a result of layers can also cause the dust to dry out and give rise to spontaneous combustion of the dust in the layers.

Disturbance of the dust layers can cause it to rise and mix with air to form an explosive cloud.

Pressure wave from a relatively small dust explosions have historically converted dust layers on sites into clouds, giving rise to much more serious secondary explosions.

a) For Dust Clouds

You must select equipment with a T rating that is two thirds that of the ignition temperature of the dust hazard.

e.g. if the ignition temperature of the hazardous dust is 150 °C then the equipment T rating must not exceed 100 °C or T5

b) For Dust Layers

You must select equipment with a T rating that is 75 °C less than the ignition temperature of a layer on the surface of the equipment.

e.g. if the ignition temperature of the dust layer is 275 °C then the equipment T rating must not exceed 200 °C or T3.

The thickness of dust layers is critical to the whole operation and this is the main reason for good housekeeping. If the layers are going to be more than 5 mm then testing must be carried out on the individual hazardous dust at the specified thickness to obtain the layer ignition temperature at that layer thickness.

EQUIPMENT PROTECTION LEVELS (EPLs)

EPLs were introduced to Hazardous area classifications at the same time optional risk assessments were introduced. Rather than define the probability an explosive atmosphere will exist (Hazardous Zones) EPLs consider the consequence of an explosion, and a protection level is assigned based on its ignition risk.

A risk based approach to Hazardous Area classification is used to ensure that equipment manufactured for or installed in a Hazardous area will not become a source of ignition, even in a failed state.

During classification, a risk based approach of consequences of an explosion, can be used to determine if equipment used can be of a higher or lower level of protection, beyond the nominally used zone/equipment selection criteria.

EPL Ga/Da: Equipment having a **very high** level of protection, which will not act as a source of ignition in normal operation, expected faults or when subject to rare faults.

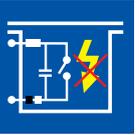
EPL Gb/Db: Equipment having a **high** level of protection, which will not act as a source of ignition in normal operation or during expected faults.

EPL Gc/Dc: Equipment having an **enhanced** level of protection which will not act as a source of ignition in normal operation and reduce the likelihood of acting as an ignition source during expected faults, e.g an indicator lamp failure.

Equipment Protection Levels (EPLs)

Protection level	Zone	EPL
Very High	Zone 0	Ga
	Zone 20	Da
High	Zone 1	Gb
	Zone 21	Db
Enhanced	Zone 2	Gc
	Zone 22	Dc

TYPES OF PROTECTION FOR ELECTRICAL APPARATUS IN HAZARDOUS AREAS - EXAMPLES

Type of protection	Diagram	Description	Standard
Flame proof enclosure Ex d		Ex d - "Flameproof Enclosure – type of protection for electrical equipment in which the enclosure will withstand an internal explosion of a flammable mixture which has penetrated into the interior without suffering damage and without causing ignition".	AS/NZS 60079-1
Increased safety Ex e		Ex e - "Increased safety – type of protection applied to electrical equipment that does not produce arcs and sparks in normal service in which additional measures are applied so as to give increased security against the possibility of excessive temperatures and the occurrence of arcs and sparks".	AS/NZS 60079-7
Intrinsic safety Ex i		Ex i - "Intrinsically safe circuit – a circuit in which any spark or any thermal effect produced in the test conditions prescribed in the standard (which include normal and specified fault conditions) is INCAPABLE of causing ignition of a given explosive atmosphere".	AS/NZS 60079-11
Non-sparking Ex n		Ex n - "Type of Protection `n` – type of protection applied to electrical equipment such that, in normal operation, it is not capable of igniting a surrounding explosive gas atmosphere and a fault capable of causing ignition is not likely to occur."	AS/NZS 60079-15
Protection by enclosure Ex t		Ex t - "An enclosure which excludes dust, and which will not permit arcs, sparks or heat otherwise generated or liberated inside the enclosure to cause ignition of exterior accumulations or atmospheric suspensions of a specified dust on or in the vicinity of the enclosure".	AS/NZS 60079-31

EX HAZARDOUS AREA STANDARDS AND LEGISLATION FLOW CHART



ELECTRICAL LEGISLATION-GENERAL

Within Australian states and territories there is an Act or Regulation of parliament that requires electrical installations to comply with AS/NZS 3000 - Wiring rules. The exact requirements vary State to State, however generally it is the responsibility of the electrical worker or contractor to ensure that the installation complies with regulations (including those referenced in AS/NZS 3000). There are serious penalties for non-compliance, including loss of license, fines and jail terms. Although there are often exclusion to the legislated applicability of the wiring rules for places like mines, quarries and petroleum leases, we generally find in such cases that the

rules are called up in site safety management plans or contract documents, so compliance is still required, just via a slightly different mechanism.

Section 7.7 of AS/NZS 3000:2007 sets out the requirements for electrical installation in hazardous areas. AS/NZS 3000:2007 Amendment 2 requires compliance with these “harmonized” standards, the AS/NZS 60079 series.

The relevant clauses of Amendment 2 are reproduced below with some added commentary:

RESPONSIBILITY FOR CLASSIFICATION OF A HAZARDOUS AREA

AS/NZS 3000:2007 - 7.7.2.1

The responsibility for classification of a hazardous area rests with the persons or parties in control of the installation. The requirements are contained in AS/NZS 60079.10.1 for gas or vapor and AS/NZS 60079.10.2 for combustible dust.

Commentary: The critical take-away from the above, is the acknowledgment of responsibility that rests with the owner or occupier of the premises that houses the hazardous area in question – a responsibility that is consistent with standard OHS legislation. While this person is not expected to perform the classification itself, he/she is obligated to identify the potential for a hazardous area and engage a competent person (see page 7 for further explanation of competency requirements) to do so.

ELECTRICAL EQUIPMENT

Selection

AS/NZS 3000:2007 - 7.7.2.4.1

Electrical equipment selected for use in hazardous areas shall comply with the appropriate requirements as specified in AS/NZS 60079.14.

Installation

AS/NZS 3000:2007 - 7.7.2.4.2

Electrical equipment shall be installed in accordance with the installation requirements of AS/NZS 60079.14.

Commentary: What is essential to understand here, is that to comply with AS/NZS 3000:2007, electrical equipment that is selected and installed in a hazardous area environment must be compliant to AS/NZS 60079.14.

COMPETENCY OF PERSONNEL

AS/NZS 3000: 7.7.2.4.2

Refers to competency requirements in AS/NZS 60079.14. The relevant clause in that standard is 4.4, reproduced below:

AS/NZS 60079.14 – 4.4

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

Competency may be demonstrated in accordance with AS/NZS 4761, Competencies for working with electrical equipment for hazardous areas (EEHA), or equivalent training and assessment framework.”

Commentary: Without exception, persons who intend to work with EEHA are to be appropriately competent to a level that is relevant to the particular works that are being undertaken – regardless of its position in the project cycle. In essence, whether a person is involved in the design, installation or maintenance stage, they must be able to demonstrate competency to ensure utmost safety measures are ensured. It is also important to note that as standards and regulations change and the various technologies involved advance, it is expected that persons continue to educate themselves to maintain their competency levels.

NHP MAKE HAZARDOUS AREAS EASIER...

At NHP our aim is to provide a world class range of hazardous area solutions for the hazardous market and to ensure this is the case, we provide a range of value-add tools for our customers. From product selection through to expert advice, NHP make engineering a solution that meets your requirements easier than ever before.

For your next HAE project, experience the NHP difference.

Hazardous Area Training

To ensure you and your colleagues are competent in working within Hazardous Areas, NHP also offer a range of training packages from 'lunch and learn' sessions to single day tailored awareness courses, and 5 day training courses with nationally recognised competencies. With the flexibility to offer courses both on site and at one of our 50+ branch locations throughout Australia, you can trust NHP to work with you to find a training option that works for you.

IECEX certified Hazardous Area Workshop

NHP supplies not only a range of hazardous area equipment, but equally important, customer specific systems via our certified manufacturing and assembly workshop located at Laverton. In this workshop, accredited staff design, construct and inspect the Cortem range according to the requirements of IECEx certification. This allows for flexibility to produce custom solutions to suit your HAE requirements.

NHP Training University (NTU)

If you want to increase your skill set but avoid lengthy lectures and the cost of further education, NTU (NHP Training University) is for you! With valuable training modules introduced regularly, NTU is FREE and designed to further your key industry knowledge.

The latest module looks at Hazardous Area Equipment and explains the basic principle of explosion protection from zone classification and explosion groups, to temperature classes and the different types of protection available.

HAE Technology Specialist Team

Our Hazardous Area specialists have the experience and knowledge to apply HAE best practice across a broad range of industries including Food Manufacturing, Grain, Oil and Gas. The NHP Ex team have the 'know how' to develop and recommend solutions that provide value to our customers utilising NHP's ability to offer complete IEC Ex solutions delivered in industry best time frames.

If you'd like to speak to NHP's HAE Technology Specialist Team, simply call 1300 NHP NHP (Australia) or 0800 NHP NHP (New Zealand).

To experience how NHP makes Hazardous Areas easier, scan the QR code.



If you would like previous copies of Technical News, simply visit www.nhp.com.au/media and navigate to 'Catalogues & Literature' or download the NHP eCatalogues App by scanning the QR code below.

Editorial content: Please address all enquiries to marketing@nhp.com.au.



NHP Electrical Engineering Products Pty Ltd
A.B.N. 84 004 304 812
NTNL69 04/15
© Copyright NHP 2015

AUSTRALIA
nhp.com.au
SALES
1300 NHP NHP

Melbourne
Laverton
Albury/
Wodonga
Dandenong
Hobart
Launceston
Sydney*
Newcastle*
Wollongong*

Canberra
Brisbane*
Townsville
Rockhampton
Toowoomba*
Cairns
Adelaide
Perth
Darwin

NEW ZEALAND
nhp-nz.com
SALES
0800 NHP NHP

Auckland
Hamilton
Napier
Wellington
Christchurch
Dunedin

* Rockwell Automation products not available from these locations



For more information, scan to download the NHP Catalogues App offering exclusive video content, catalogues and literature!

