ELECTRICAL EQUIPMENT FOR HAZARDOUS AREAS [EEHA]

A summary of requirements for selection of electrical equipment for use on hazardous sites oriented towards suppliers of portable electronic equipment.

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Summary

Document Overview

During the reviewing of this document we identified a number of possible issues relating to the interpretation of such a heavily technical document. One of the major issues was that the technical nature of the regulations makes it look like we are trying to police the workplace.

We as vendors are simply offering advice; if the client already has foreign certified equipment and he is happy to use it then that is not an issue for the vendor. Our aim is that as radio industry professionals we give correct advice.

NOTE: Not all areas are hazardous even where fuel or chemical are involved, some chemicals and products like diesel are not considered explosive. Hazardous/explosive areas are often relatively small and usually highly controlled. In an airport for example the only normally applicable hazards are around aircraft re-fuelling points, not the entire tarmac. Hence your engineers, baggage handlers, catering staff and maintenance staff generally don't need certified equipment (confirm this with the client, site rules vary significantly).

A customer may be using foreign certified equipment which may not immediately look to be correctly certified. There are a multitude of reasons for this which may not be immediately apparent to the vendor and it does not mean that it is unsafe. Foreign certified equipment does not have higher failure rates; it is simply not what is defined in regulations in Australia. Customers may have already done risk assessments on this or had it approved by other means.

We are not here to fix the client's site hazards or change his/her way of working. We only want to avoid giving incorrect advice. The key seems to be to ask questions of the client,

- "Does your site have any identified hazardous areas?"
- If so "What are your site hazards?" He/she may have predefined site requirements, a hazardous area classification drawing or a list of hazardous materials: whatever the answer then this document will help you understand the needs and correct protection levels required for the equipment you offer.
- "What are you preferences for levels of protection on electronic equipment?" If the client doesn't know then this document will assist you in advising correctly.

The other issues we are trying to solve are:

- If you have equipment and you don't know if it is suitable for a specific hazard.
- If you sell foreign certified equipment, don't panic many clients will still accept and there are methods of having this accepted on some sites.

The important factor here is that the customer understands what they are accepting or you might find they blame you when the equipment proves unsuitable.

This document will not provide you enough information to re-evaluate the client's hazardous area classification, that is a very specialised field. It will also not give you sufficient knowledge to change risk assessments or equipment categories. You need to work with what the customer gives you and this document is intended to show you how to interpret the information provided by the customer and give him professional sound advice on product selection.

Why is this Necessary?

There are Government regulations and workplace safety requirements designed to ensure that any risk to personnel is minimised and all of the risk factors are controlled. Without adherence to these regulations and associated guidelines there is a possibility of loss of life, loss or destruction of assets and resultant litigation.

Some radio users may need to use communications equipment in hazardous environments. It is important to understand the most hazards require the use of equipment which is certified as being safe for use in those hazards.

The EEHA (Electrical Equipment Hazardous Areas) regulations stem from the likelihood of heat and/or sparks from electrical equipment causing ignition of hazardous substances. There have been a number of methods or techniques developed to either protect against the possibility of ignition or to minimise the risk of ignition.

Australian standards are **ANZEx**; based on, and in many cases identical to the **IECEx** standards. IECEx is a legally accepted form of compliance in Australia. ATEX (European) and US NEC certification, unless also tested to IECEx, is NOT accepted without professional assessment (see "**Authorised use of Foreign Standards' Compliant Equipment**" Page 41)

Identifying the Hazard and Preventing Ignition

There are two (2) distinctly separate issues involved; one is the definition of the hazard and the other is the selection of a suitable protection mechanism to protect against igniting the hazards. The first step is to identify and define the actual hazard.

Area hazards are identified based on an assessment of risk of an explosion. Specific methods for assessment are defined in standards. Assessment is done by hazardous area assessors/inspectors and apparatus to be used in hazardous areas are tested and certified to various levels by laboratories approved under the standards regime.

The site assessors and the test laboratories are two (2) distinctly different entities. Manufacturers cannot test and issue certificates for their own equipment (except in ATEX; however this is NOT acceptable in Australia, more later on this topic).

Hazard Identification

The hazards (gas and/or dust) are identified and grouped relative to their explosivity and ignition temperature.

Hazards Classification is as follows:

Degree of Risk (Zones)

The likelihood or probability of the hazard occurring are defined as Zones (in the US system they are referred to as Divisions). This identifies the likelihood of the hazard occurring, as below.

Zone 0 is an area in which an explosive gas atmosphere is present continuously or for long periods or frequently

Zone 1 is an area in which an explosive gas atmosphere is likely to occur in normal operation occasionally

Zone 2 is an area in which an explosive gas atmosphere is not likely to occur in normal operation but, if it does occur, it will exist for a short period only

Zone 20 is an area in which an explosive dust atmosphere, in the form of a cloud of dust in air, is present continuously, or for long periods or frequently.

Zone 21 is an area in which an explosive dust atmosphere, in the form of a cloud of dust in air, is likely to occur in normal operation occasionally.

Zone 22 is an area in which an explosive dust 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.

Groups

The hazard is then divided into groups with similar attributes as below:

Mining: Group I Underground mines, typically IA as A is the subcategory for Methane (firedamp).

Gas: Group II Above ground Gas which is further subdivided in A, B or C based on explosivity of the hazardous gas.

Dust: Group III Dust which is then also divided into sub-categories A, B or C based on the conductivity of the dust.

The hazardous materials are then further divided into sub-groups.

Gas and Dust Groups

Group IIA	Propane
Group IIB	Ethylene
Group IIC	Hydrogen
Group IIIA	Combustible flyings
Group IIIB	Non-conductive dust
Group IIIC	Conductive dust

Temperature Class

The hazard is then allocated a Temperature Classes.

This temperature group is based on the maximum temperature of equipment before ignition is possible (with a safety margin).

The Temperature classes are as follows:

Temperature class required by the area classification	Ignition temperature of gas or vapour in °C
T1	>450°C
T2	>300°C
T3	>200°C
T4	>135°C
T5	>100°C
T6	>85°C

Note 1: Equipment with a higher "T" rating can be used in areas of lesser risk, e.g. a T6 device (suitable for a hazard ignition temperature of 85C can be used in a T1 area but not the reverse.

Note 2: Dusts are typically described with an actual Temperature, e.g. 135°C instead of a "T" Class.

The resultant hazardous area assessment and classification drawings give us the basis for selecting appropriately safe equipment.

E.g. a Zone 1 risk with above ground gas hazard of Ethylene Group IIB Gas hazard at ignition temperature of say T2 (actual ignition temperature 440°C meets T2 requirements).

Selection of Suitable Product

Select a technique that is suitable for the hazard from the table below. Some techniques are suitable for some hazards and some are not.

Protection Techniques include Intrinsic Safety (I.S.)

There are a number of techniques used to protect electrical equipment in hazardous areas (EEHA) of which Intrinsic Safety (Ex i) or sometimes referred to as "I.S." equipment is only one. Intrinsic safety is common in portable low powered equipment but don't close your eyes to other techniques which are becoming common.

Other Techniques that may be used

Gas

		Zone		
Technique	**Group**	**Zone 0**	**Zone 1**	**Zone 2**
Intrinsically Safe Ex ia	II	√	√	√
Intrinsically Safe Ex ib	II		√	√
Intrinsically Safe Ex ic	II			√
Encapsulation Ex ma	II	√	√	√
Encapsulation Ex mb	II		√	√
Flameproof Ex d	II		√	√
Increased Safety Ex e	II		√	√
Non Incendive Ex n	II			√
Powder Filling Ex q	II		√	√
Oil Immersion Ex o	II		√	√
Pressurised Ex p	II		√	√
Special Protection Ex s	Subject to conditions of Certification – READ the Certificate			

See next page for Dust techniques.

Or for Dust:

		Zone		
Technique	**Group**	**Zone 20**	**Zone 21**	**Zone 22**
Intrinsically Safe Ex iaD	III	√	√	√
Intrinsically Safe Ex ibD	III		√	√
Intrinsically Safe Ex ic	III			√
Encapsulation Ex ma (or Ex mD)	III	√	√	√
Encapsulation Ex mb	III		√	√
Protection by Enclosure Ex tD A20 sometimes shown as “Ex ta”	III	√	√	√
Protection by Enclosure Ex tD A21 sometimes shown as “Ex tb”	III		√	√
Protection by Enclosure Ex tD B21 sometimes shown as “Ex tb”	III		√	√
Protection by Enclosure Ex tD B22 sometimes shown as “Ex tc”	III			√
Protection by Enclosure DIP A20	III	√	√	√
Protection by Enclosure DIP A21	III		√	√
Protection by Enclosure DIP B21	III		√	√
Pressurised Ex pD	III		√	√

Then:

Select product which meets or exceeds ALL of the parameters for the defined hazard, i.e.

- Zone (worst case) 0,1,2,20, 21 and/or 22.
- Above ground gas or dust or mining I, II or III.
- Gas and/or Dust sub-group, e.g. A,B or C.
- Temperature Class “T” rating (surface temperature must be less than ignition temperature for specified hazard T1, T2, T3, T4, T5, T6 or specific actual temperature in °C.

NOTE: Equipment with higher levels of protection can be used in areas needing lesser protection BUT all parameters must meet or exceed those of the hazard.

Example

If Propane is used in an above ground storage and processing facility it will typically (subject to reading of the hazardous area classification document) have some Zone 1 areas and some Zone 2 areas.

The gas is identified as follows:

Propane ($CH_3CH_2CH_3$) is defined as being Group IIA with an ignition temperature class for ignition is “T2” ignition temp 450°Crefer the following standard:

AS/NZS 60079.20.1:2012 IEC 60079-20-1, Ed. 1.0 (2010) Australian/New Zealand Standard Explosive atmospheres Part 20.1: Material characteristics for gas and vapour classification—Test methods and data.

If your product is intrinsically safe Ex i, then minimum product specification will be Ex ib IIC T2 Gb.

Where:

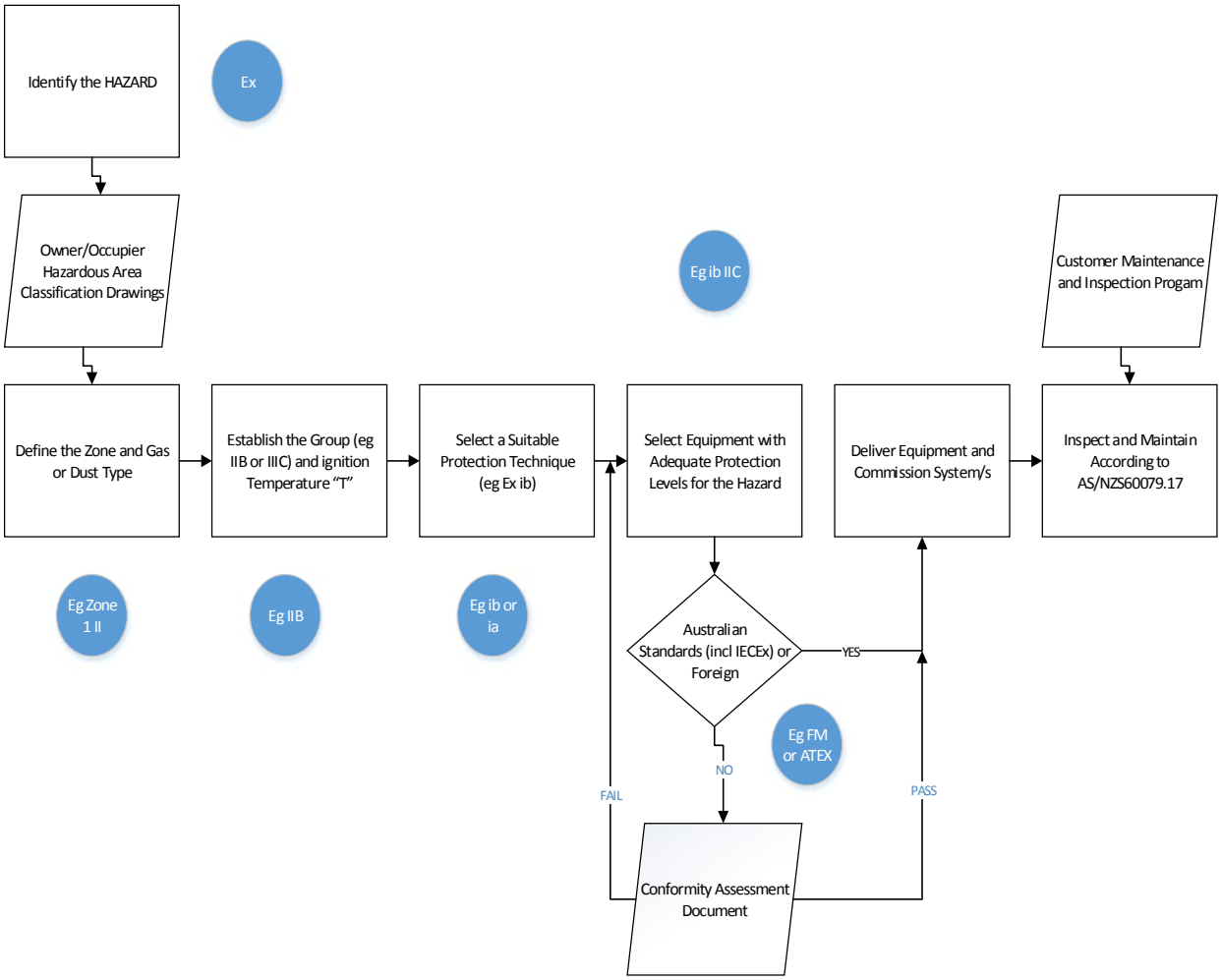
Ex = (Explosion protected) and

ia= Intrinsically Safe (suitable for Zone 0, 1, 2) or ib = Intrinsically safe (suitable for Zone 1 or Zone2)

IIA for Propane above ground.

“T2”Ignitiontemperature 450°C.(NOTE: T1 >450°C not equal to so we must take the higher level of protection.

Flowchart for selection purposes



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Section 1: Why is Electrical Protection Necessary? What Causes Ignition?

When it goes wrong it can cause loss of life, loss of assets and litigation. It is regulated for these reasons.

An example of what happens when it all goes wrong:

PIPER ALPHA RIG NORTH SEA 1988, 167 DIED, $US3.4 BILLION DOLLARS LOST AND THE END OF A MAJOR OIL COMPANY.

Piper Alpha *was a North Seaoil production platform operated by Occidental Petroleum (Caledonia) Ltd. The platform began production in 1976, first as an oil platform and then later converted to gas production. An explosion and the resulting oil and gas fires destroyed it on 6 July 1988, killing 167 men, with only 61 survivors. The death toll included two crewmen of a rescue vessel. The total insured loss was about £1.7 billion (US$3.4 billion). At the time of the disaster, the platform accounted for approximately ten percent of North Sea oil and gas production, and the accident was the worst offshore oil disaster in terms of lives lost and industry impact.*

From Wikipedia, the free encyclopaedia

Overview

The EEHA (Electrical Equipment Hazardous Areas) regulations stem from the likelihood of heat and/or sparks from electrical equipment causing ignition of hazardous substances. There have been a number of techniques developed to either protect against the possibility of ignition or to minimise the risk of ignition. The hazards themselves have been segregated so that those of higher risk of ignition can be identified and adequate protection provided as well as identifying those of lesser risk which may be protected by less expensive means.

The Handbook (HB 13:2007) from Standards Australia defines this as follows:

"Where it is necessary to use electrical apparatus in an environment in which there may be an explosion it is essential that measures are taken to eliminate the likelihood of an explosive atmosphere occurring around any source of ignition or limiting the possibility of an ignition source, (e.g. arcs, sparks or hot surfaces) occurring."

The Australian hazardous area standards for electrical equipment are called ANZEx and are closely based on the international IECEx standards. You will see that the actual Australian and New Zealand standards commonly have a reference to IEC standards, e.g. (IEC 60079-xx, Ed.x.x (20xx) MOD).

The "MOD" indicates the standard is modified from the original IEC document; typically this is due to specific local regulations such as mains power supply voltages. The IEC document is bi-lingual; every second page is in French.

Australia is a member of the IEC and for many years and in fact an Australian, Mr Chris Agius is the secretary of the IECEx scheme.

It is not uncommon to find equipment labelled (marked) with older AUSEx standards and approvals, this can be used indefinitely by the client if purchased prior to the expiry date of the certificate but cannot be sold as compliant by manufacturers or vendors after the expiry of the certificate see Appendix C, Page 50.

Area hazards are regulated and specific standards are applied, assessment is done by hazardous area assessors and apparatus are tested by approved laboratories such as TestSafe and SIMTARS here in Australia, PTB, LCIE, Baseefa and SIRA in Europe, Factory Mutual and Underwriters Labs in the USA (when acting as certified IECEx laboratories) and CSA in Canada (also when acting as an IECEx laboratory).

The IECEx system which has been adopted by Australia has certifying bodies around the world. Most certifying bodies are also certifying bodies for other compliance schemes, even here in Australia, so don't take it for granted that a certificate from say TestSafe in Sydney is an IECEx or ANZEx certificate unless the equipment marking carry the IECEx or ANZEx identification).

NOTE 1: There are often references to EEHA inspectors and assessors variously throughout this document. Probably the best term would be "advisors" if these services are used correctly. The qualifications are defined in AS/NZS 4761.1:2008 "*Competencies for working with electrical equipment for hazardous areas (EEHA) - Competency Standards*" and inspectors/assessors/advisors must have competencies in the appropriate tasks to perform the work. The titles are not necessarily relevant.

The Victorian regulators have "H" class inspection qualifications for EEHA which they add as a function (to those qualified) to their mains power electrical inspectors. Most instruments and all portable equipment are low powered equipment and this association with the mains power electrical inspectors has become less relevant.

NOTE 2: Standards are constantly being upgraded please check that you are using the current standard and the latest revisions. Standards detailed in this document are current at the time of writing.

All standards have a suffix indicating the date of publishing, e.g. AS/NZS60079.0:2012 is the current standard; the 2012 suffix indicates the date of publishing. The only way to ensure that you have latest standard (other than subscribing to the system, which is expensive) is to check at the www.saiglobal.com for up to date versions.

Standards are constantly changing and evolving and sometimes these changes can be quite significant. Don't rely on what was used last time as being correct this time. It is important however to note that changes in standards are NOT retrospective; so if the site owner purchased equipment which as correctly certified at the time of purchase then he/she may continue use it. He/she however cannot purchase more of the same and put it into service if it is no longer correctly certified.

In Australia and Europe and in fact all of the 33 IECEx affiliated countries "intrinsic safety" is designated "Ex i". In the past a lot of US companies sold US certified equipment here and little regulation applied to the use of foreign hazardous area electrical equipment and systems. Australia is now far more regulated and generally follows the European based system in fact even the USA has now accepted the European format along with its own unique original system, see NEC 505 Page 33.

Ignition of hazardous materials

With regards safety of equipment there are two (2) distinctly separate issues involved; one is the definition of the hazard and the other is the protection mechanism (called a technique) used to protect the hardware (usually called "apparatus").

A hazardous area is defined as an 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 potential ignition sources.

The explosive atmosphere may be caused by the presence of a flammable liquid, gas or vapour or by the presence of combustible dust in suspension or in layers or a combination of explosive gas and dust atmospheres.

Three basic conditions [1]must be met for a fire or explosion to occur:

1 Flammable or combustible material must be present in sufficient quantities.

2 The material must be mixed with air or oxygen.

3 An ignition source of sufficient energy to raise the combustible material to its ignition temperature must be present.

By removing one or more of these conditions, ignition will not occur. This fact is the basis for all of the explosion protection techniques.

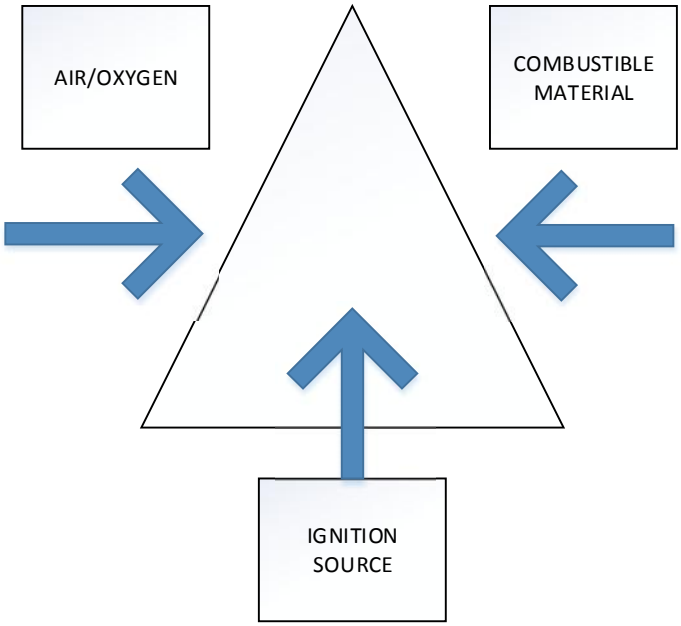


Figure 1: The Infernal Triangle

From an explosion protection perspective if we take away any one of these three (3) items then we remove the possibility of ignition.

All hazardous area protection techniques operate with the ability to exclude or control one or more of these factors.

[1] The exception is Explosives.

Section 2: Classification of Hazardous Areas

For us to control or prevent an explosion or fire we also need to define the area of likely hazard (if any) and the type of explosive material or gas before we can define the level of protection needed and hence select product to operate safely in the specific location.

To do this all major standards, including ANZEx (Australia/New Zealand), IECEx (Global including Australia and New Zealand), NEC (USA), ATEX (European Union) break down the possible ignition sources into groups as below:

Mining:	**Group I**	Underground mines are handled as a separate group. Underground mines have additional unique hazards and are regulated somewhat differently.
Gas:	**Group II**	Above ground gas hazards are then further divided into Groups as defined by their susceptibility to Spark Ignition and Ignition Temperature.
Dust:	**Group III**	Dust is divided into Groups relative to the Conductivity of the dust and Temperature of Ignition.

To this point at least all international protection schemes have the same broad definition.

Factors for Ignition

Explosive limits (UEL/LEL) for gases and vapours

Before an explosion can occur there must be a mixture of the flammable gas or vapour with air. Such a mixture is capable of exploding only when its concentration lies within certain limits.

These limits are known as the lower explosive limit (LEL) and the upper explosive limit(UEL) and are expressed as percentages of the material mixed with air by volume.

Dusts

Dust explosion occur for one of two reasons, accumulation of dust on equipment where heating causes ignition and/or ignition of an explosive dust cloud in a manner similar to the ignition of an explosive gas.

Combustible dusts are those dusts which are combustible or ignitable in mixtures with air in a similar manner as the mix of gas with air (LEL and UEL parameters described above) but with dust these parameters are not so easily defined. Many sources of ignitable dust produce considerable variance in particle size and hence the distribution in air may vary considerably over short periods of time (gravity being a factor).

Therefore dust is not similar to gas in terms of ignitability of the mixture when combined with air. Gas is relatively stable (UEL/LEL parameters) whereas dust changes as the various particle sizes fall out of the concentration due to gravity.

Dust explosions may be initiated by ignition of a cloud of dust. It is not unusual for an explosion to cause the dislodging of dust accumulated on local surfaces, leading to a further dust cloud explosion.

Site owners are responsible for defining the parameters of the substances in the hazardous area assessment documents (not usually within the scope of the normal supply contracts as it is a specialist and technically complex field usually unrelated to the equipment vendor's expertise). It is recommended that the specific dust characteristics are determined by laboratory tests as the size of the particles (which is relevant to the explosivity) will vary due to the way they are processed. Additionally a lot of dust hazards are from agricultural products (grain etc.) which do not have consistent size or moisture content

Since this document is aimed at an industry that largely provides portable or mobile equipment it is important to understand that while dust accumulations on the equipment may not be considered a critical factor as it would be with fixed motors and instruments, the portable apparatus is still a source of ignition for a dust cloud in the same way as it is a source of ignition for gases.

A common request of clients (to assessor/inspectors) is that "dust wont accumulate on my portable equipment therefore it doesn't need certification" this is not valid, the equipment must be certified correctly if it is to be used in a hazardous area.

Portable equipment used in explosive dust atmospheres is still required to meet the same protection levels as fixed equipment, the excuse that the housekeeping[2] is under control is NOT an exclusion to meeting the standard.

In reality portable equipment is more likely to be near a dust cloud as the user of the apparatus may initiate the dust cloud by his/her own physical activity in the plant.

Explosive Dusts

Another issue worthy of mention is that explosive dusts (such as gunpowder, propellant powder and lead styphnate) are not considered in the normal manner as they may explode or ignite (gunpowder for example "burns" and does NOT "explode" as some might assume) without oxygen.

How do we Define Hazardous Areas?

IMPORTANT NOTE: The classification of the hazardous area is the responsibility of the site owner/occupier not the equipment vendor unless he/she has been contracted to perform the task. Hazardous Area Classification can only be done by trained and competent person as per Australian and New Zealand standard AS/NZS4761, as mentioned earlier in this document. The applicable standards are:

GAS:AS/NZS 60079.10.1:2009Australian/New Zealand Standard™ Explosive atmospheres Part 10.1: Classification of areas—Explosive gas atmospheres(IEC 60079-10-1, Ed.1.0 (2008) MOD).

DUST:AS/NZS 60079.10.2:2011 Explosive atmospheres Part 10.2: Classification of areas—Combustible dust atmospheres IEC 60079-10-2 Ed.1.0 (2009).

Suppliers of hardware should ask the site owner/occupier what the hazards are on site and should obtain a clear definition from the purchaser as to the requirements.

Area classification is a method of analysing and classifying the environment where explosive gas atmospheres or combustible or explosive dusts might be present. This is to facilitate the proper selection and installation of equipment to be used safely in that environment. The classification takes into account the ignition characteristics of the gas or vapour or dust/s such as ignition energy (gas/dust group) and ignition temperature (temperature class).

The result is a three (3) dimensional drawing and written description that clearly describes the hazard/s and the level of protection needed to operate safely and any identifiable special conditions including housekeeping, maintenance, process checks and limits.

IECEx/ANZEx System in Australia

It is not uncommon for a site to have both dust and gas hazards in which case BOTH standards apply and electrical apparatus used on the site MUST meet the minimum requirements for ALL hazards.

[2] NOTE: HOUSEKEEPING is the ability of the site owner operator to reduce the build-up of dust layers. Operational procedures are detailed in the hazardous area classification and if the "housekeeping" is adequate then avoidance of dust build-up can reduce risk and therefore reduce the need for use of certified equipment.

Hazardous area classification is a complex technical task and a comprehensive review is considered outside of the scope of this document. A brief overview is included as background information only.

This will assist with understanding why different protection techniques are suitable for different hazards.

Gas

Area of Hazard – Zones(Gas)

Definition of the hazardous area is based on the possible sources of release (vents, flanges, fill points, valves, etc.) and the volume and pressure of release (called a grade of release).

It takes into account the explosivity of the gas as well as the relative density of the gas, i.e. lighter or heavier than air. It then considers the circumstances under which it may be expelled or released from containment under fault conditions AND under normal operating conditions.

The size of the zone/s depends on the estimated or calculated distance over which a hazard exists before it disperses to a concentration in air below its lower explosive limit (LEL) with an appropriate safety factor. Often, if a clearly defined hazard exists in a building or other protected area then the whole area will be classified as a single zone.

The standard defines these zones as follows:

- **Zone 0** is an area in which an explosive gas atmosphere is **present continuously** or for long periods or **frequently.**
- **Zone 1** is an area in which an explosive gas atmosphere is likely to occur in normal operation **occasionally.**
- **Zone 2** is an area in which an explosive gas atmosphere **is not likely to occur in normal operation** but, if it does occur, it will exist for a short period only**.**
- **NH** Non-hazardous. An area where no hazard exists under normal or abnormal operating conditions.

Gas Sub-Groups (Explosivity)

Having defined the actual area of the hazard the assessor then considers the explosivity of the hazardous material/s.

Gas types are listed in AS/NZS 60079.20.1:2012IEC 60079-20-1, Ed. 1.0 (2010)Australian/New Zealand Standard™ Explosive atmospheres Part 20.1: Material characteristics for gas and vapour classification—Test methods and data.

This standard is a schedule of all known flammable gases and liquids and lists the ignition parameters for each product.

AS/NZS60079.20 groups gases into three (3) main groups based on the energy required to ignite them as below:

Group IIA	Propane
Group IIB	Ethylene
Group IIC	Hydrogen

NOTE: The “II” pre-fix indicates that it is above ground and gas (not mining). Mining is “Group I” and the suffix is “A” as methane (firedamp[3]) is the main gas group as shown above.

For example a Group I certified device is NOT suitable for a Group II application unless it has a certification for Group II.

[3] *Firedamp* is a gas that occurs naturally in coal seams. The gas is nearly always methane (CH_4) and is highly inflammable and explosive when present in the air in a proportion of 5 to 14 percent.

Ignition temperature range "T" Rating

Ignition temperature is a factor in the ignition of hazardous gases. In the Australian and IECEx systems gases are grouped under six (6) different temperature ratings or "T" Classes numbered 1 to 6 as shown below:

Relationship between ignition temperature and "T" rating

Temperature class required by the area classification	Ignition temperature of gas or vapour in °C
T1	>450°C
T2	>300°C
T3	>200°C
T4	>135°C
T5	>100°C
T6	>85°C

Dust

Area of Hazard – Zones (Dust)

Dusts forms explosive atmospheres only at concentrations within the explosion range in a similar manner to the LEL/UEL limits of gases BUT while a dust cloud with a very high concentration may not be explosive, the danger exists if the concentration falls, it may enter the explosive range.

The hazards from dusts are twofold, the formation of a dust cloud from any source of release plus the small continuous source of release, in time, is able to produce a potentially hazardous dust layer. The formation of dust layers, which may ignite due to self-heating or exposure to hot surfaces.

Area classification is based on a number of factors including:

- Whether the dust is combustible. Dust combustibility can be confirmed by laboratory tests.
- Material characteristics for the process concerned.
- Nature of release from particular items of plant.
- Operational and maintenance regime for the plant, including housekeeping[4].

Zones for dust (In Australia/NZ) are defined as: Zone 20, zone 21, zone 22 and non-hazardous as below.

- **Zone 20** is an area in which an explosive dust atmosphere, in the form of a cloud of dust in air, is **present continuously**, or for long periods or **frequently**.
- **Zone 21** is an area in which an explosive dust atmosphere, in the form of a cloud of dust in air, is likely to occur in normal operation **occasionally**.

[4]**Housekeeping (DUST):** Is the planned and current cleaning of dust hazard areas to negate or minimise the dust explosion hazard.

Both the regularity or frequency of cleaning and the effectiveness of this cleaning are important.

Thus, the presence and duration of a dust layer depends on the grade of release from the source of the dust, the rate at which it is deposited and the effectiveness of housekeeping (cleaning).

Three levels of housekeeping can be described as follows:

Good: Dust layers are kept to zero or negligible thickness irrespective of the grade of release.

Fair: Dust layers are not negligible the dust is removed before any fire can start.

Poor: Dust layers are not negligible and persist for more than one shift. The fire risk may be high.

- **Zone 22** is an area in which an explosive dust 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.
- **NH** Non-hazardous. An area where no hazard exists under normal or abnormal operating conditions

Dust Sub-Groups (Explosivity)

Due to the infinite number of possibilities with regards, particle size, moisture content and resistivity there is no schedule of dusts as there is with gases. Dusts are assessed by either experience of similar sites or more commonly through laboratory analysis.

The result of this assessment of the hazard the specific dust or dusts is the ability to group them into sub-categories in a similar way to gases, as below:

Group IIIA	Combustible flyings
Group IIIB	Non-conductive dust
Group IIIC	Conductive dust

Temperature "T" Class

For dust Temperature class is usually expressed in actual °C.

Summary of Area Classification

The resultant drawings and supporting information from the Hazardous Area Classification (sometimes called "HAZLOC") are placed in the verification dossier and reviewed and modified as changes are made to the plant over time.

NOTE: These documents are NOT normally negotiable with supplier.

We can therefore define what level of hazard exists on a specific plant and parts thereof.

For Example: An area may be described as Zone 1 and 2 Gas hazard IIB Ethylene T 2. Equipment can then be selected to meet or exceed the requirements for safe use in the defined hazard.

At this point we have identified extent and explosivity of the hazard, for example "IIB T4" or "IIA T6".

Some purchasers will simply state the equipment hazard in this format. Group, Gas & Temperature Class. E.g. Zone 1 and 2 Group IIB T4.

All hazardous locations in Australia will be assessed using the IECEx or equivalent standards. Foreign standards are rarely used for site classification documents and if they are then it is the responsibility of the owner occupier to translate this into Australian terms.

All area classification in Australia is done by local assessors to IECEx and ANZEx standards. Very occasionally a plant design originating from the EU or USA will form part of the site design but this should be translated into the Australian system by a competent hazardous area assessor.

Section 3: Equipment Selection

Hazardous Area Equipment Certification IECEx/ANZEx

The standards bodies or certification bodies (ExCB's, previously called and still commonly referred to as ACB's) appoint test laboratories called ExTL's for the technical testing of equipment to be used in hazardous areas.

The test laboratories follow stringent guidelines on testing and certifying equipment including ongoing monitoring of quality assurance and regular audits of the manufacturing sites to ensure ongoing compliance.

The test laboratories issue test reports to the ExCB's and if the equipment meets the requirements of the appropriate standards the ExCB's issue Certificates of Conformity (CofC's).

All ANZEx and IECEx certificates are in English.

Copies are available on line for ANZEx www.anzex.com.au for a fee and from IECEx, www.iecex.com free of charge.

The certificate contains a considerable amount of valuable information including the level of protection and any special conditions of use including in many cases the acceptability of connecting accessories and/or various equipment options. Make sure you get the latest revisions. This is easy with ANZEx and IECEx as all of the revisions are shown and you simply select the latest in the series if multiples are available.

Selecting Equipment

Methods of Avoiding Ignition

If we go back to the ignition triangle we can see that by removing one of the factors needed to cause ignition then we can eliminate the risk of explosion or fire.

The different methods of protection can be summarized as follows:

Exclusion: This method involves the exclusion of the hazardous material, either gas or dust, from the apparatus so that a spark or hot surface inside the apparatus cannot cause ignition. Encapsulation (Ex m) is an exclusion technique.

Explosion containment: This method aims to contain an explosion, if it does occur, in the apparatus. A flameproof enclosure is probably the best known and most widely used of all techniques, but it is only appropriate for gas hazards and only occasionally seen in portable equipment. Popular and effective in electric motors but suitable only for Zone 1 and 2 Gas only.

Energy limitation: Flammable gases and combustible dusts have minimum ignition energies, below which it is not possible for an arc or spark to cause an explosion.

If the energy in an electrical circuit can be maintained below these levels, it cannot cause an explosion and is considered intrinsically safe, Ex i.

Dilution: This method involves dilution of a hazardous gas atmosphere below the LEL[5] by ventilation. It is not appropriate for combustible dust areas. Ventilation (Ex v) is a technique using this method mainly for site buildings.

[5] LEL Lower Explosive Limit

Avoidance of ignition source: This method aims to prevent an ignition source from occurring. The most common technique is increased safety. This is used for apparatus, or parts of apparatus such as terminal boxes, that will not arc or spark in normal service. Increased safety (Ex e) is a common technique using this method but limited to Gas only and Zones 1 and 2.

Types of Protection Techniques

These methods are the basis for the various explosion protection techniques. While intrinsic safety is only one of the techniques it is the most common in terms of portable electronic equipment. It is a misnomer to call all explosion protected equipment "intrinsically safe" or "IS" and may lead to confusion.

Each technique, see "Other Valid Techniques for Explosion Protection" Page 20, has a descriptor; "Ex i", "Ex n" "Ex d", etc. This is important as the selection of equipment fit for the specific hazard relies on the selection of the correct technique for the type of hazard/s.

Not all techniques are suitable for all types of hazards. Some techniques are limited to Zone 2 or Zone 1 and 2 and would not be suitable in a Zone 0 environment. Some techniques are suitable for dust (Group III) and not gas (Group II) and vice versa.

Multiple techniques may be used on an apparatus. This is common and acceptable only if the certificate of compliance identifies the technique suitable for the application and the marking describes it as such.

What is "intrinsic safety" (I.S.)

This protection technique is based on limiting the amount of electrical energy in the "apparatus" (and includes interconnecting wiring exposed to the hazardous atmosphere) to below that which can cause ignition.

An Intrinsically safe "circuit" (commonly used for control and monitoring of instruments in hazardous areas) is a circuit in which any spark or thermal effect under normal operation and specified fault conditions, cannot cause ignition of a specified explosive atmosphere.

Intrinsically safe "associated" apparatus are generally located in a safe area but are used to control (protect) remote intrinsically safe devices. They protect the hazardous area circuit from exposure to harmful voltages and/or currents from sources in safe areas, i.e. prevent inadvertently connecting say a mains voltage to a hazardous area instrument.

"Associated apparatus" are usually barriers or isolators and have little relation to portable equipment except in the connection of accessories to the intrinsically safe portable device.

There are parameters for intrinsically safe "circuits" and "interconnecting cables" which are identified on the apparatus certificate and the associated apparatus certificate. These parameters are critical to the safe operation of the apparatus and its associated circuitry. A competent person can assess these parameters and advise as to the suitability. The parameters MUST be adhered to for safety reasons.

Intrinsically safe equipment is divided into three (3) sub-categories based on the fault tolerance, i.e. the number of faults which can be applied before the protection technique fails, as below:

Ex ia	Suitable for	Zones 0, 1 and 2
Ex ib	Suitable for	Zones 1 and 2
Ex ic	Suitable for	Zone 2 ONLY

Intrinsic safety must also be separately identified if it is suitable for Dust. This is a new requirement and it is still common to intrinsically safe apparatus (Ex i) not specifically dust certified in dust hazard areas.

On the basis that the standards are NOT retrospective these products may remain in service until end of life but the owner operate cannot purchase more for installation as new equipment.

Dust certified Ex i, intrinsically safe equipment MUST now have a "D" suffix added to the equipment technique, e.g. Ex iaD or Ex ibD.

Simple Apparatus

AS/NZS 60079.11 allows the following apparatus to be considered simple apparatus:

- Passive components, for example switches, junction boxes, resistors and simple semiconductor devices.
- Sources of stored energy with well-defined parameters, for example capacitors or inductors, whose values must be considered when determining the overall safety of the system.
- Sources of generated energy, for example thermocouples and photocells, which do not generate more than 1.5V, 100mA and 25mW.

NOTE: This does NOT exempt these devices from meeting the general requirements of AS/NZS60079.0 in terms of static discharge, dielectric strength, etc.

If you need to go down this path I suggest you get some professional advice, it's not a "Simple" as the title may indicate.

Special Conditions:

Intrinsically safe apparatus, like all other explosion protected equipment MUST adhere to any and all "special conditions" on the certificate.

Equipment which has special conditions which must be met have an "X" **suffix** in their certificate number.

Some examples of possible special conditions on portable equipment are as follows:

- Must use leather carry case
- Must not be charged in hazardous areas
- Battery must NOT be removed in hazardous areas

Whatever the conditions are, they must be met. The condition will be written clearly in English on the certificate of compliance.

Qualified service and repair by approved workshops and ongoing inspections are mandatory; see Service and Repair Requirements, Page 42.

Other Valid Techniques for Explosion Protection

As mentioned above, "Intrinsic Safety" is only one of a number of prescribed techniques for protecting electrical equipment in hazardous areas. Obviously it is technically difficult (or impossible) to design a high powered electric motor for example using energy limitation techniques. The descriptions below are summaries only due to space constraints; contact any EEHA assessor for further details.

Ex d Flameproof

This is a containment technique based on an enclosure which can withstand the pressure developed during an internal explosion the pressure form which will escape through the specially designed flanges where it is cooled so as to have insufficient heat to ignite the surrounding atmosphere.

It is a technique suitable for gas only and is subject to some considerable installation rules.

Ex e – Increased Safety

The Ex e technique is one of avoidance of arcs or sparks or hot surfaces. This protection technique applies measures 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.

Ex m – Encapsulation

Parts 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.

Encapsulation is an exclusion technique in that it prevents flammable gases from reaching a potential source of ignition within the encapsulated apparatus. The surface temperature of the encapsulated apparatus must not exceed the certified temperature classification.

The requirements for encapsulation compounds are very stringent and take into account all possible failure points for the encapsulants, i.e. heat, cold, water and fluids ingress, impact, etc.

Encapsulated apparatus may be used in Group I or II or III.

This is a technique that is likely to be found in portable equipment.

Ex n – Non-Sparking

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

It has no fault tolerance so is limited to Zone 2 areas only.

Only permitted in Zone 2 areas where the probability of a coincidence of an explosive mixture of gas and a fault in the apparatus is considered to be acceptably low.

Non-sparking is really a collection of various techniques and is slowly being replaced by other forms of protection. At one time Ex n had energy limited options but that has now been replaced by intrinsic safety Ex ic (Zone 2, no fault tolerance) although some old equipment marked Ex nL still exists in the field.

This technique is sometimes found in portable radio equipment.

Ex o –Oil Immersion

A technique in which the electrical apparatus, or parts thereof, are immersed in a protective liquid.

Ex p –Pressurised Rooms and Enclosures

Enclosure in a protective gas maintained at a pressure greater than that of the external atmosphere.

Ex q –Powder Filling

Protection technique in which the parts capable of igniting a hazardous atmosphere are fixed in position and completely surrounded by filling material; typically quartz or solid glass particles to prevent the ignition of an external explosive atmosphere.'

Ex s –Special Protection

This is a concept more so than a technique which has been adopted to permit the assessment and testing of electrical apparatus which for technical, operational or functional reasons do not comply with the constructional or other requirements specified for apparatus with other types of protection. Not common and highly unlikely technique for portable equipment.

Ex v - Ventilation

Naturally or mechanically ventilated area where uncontaminated air is continuously introduced in sufficient quantity to prevent formation of an explosive gas-air mixture.

Ex tD Protection by Enclosure Ex 'tD' (DIP) – Dust Ignition Protection

An Ex 'tD' previously called DIP (Dust Ignition Protection) is an enclosure sealed against dust and the surface temperature must be maintained below the cloud or layer ignition temperatures of the dust.

Other Certifications

Component Certificates

The symbol "U" suffix to the certificate number indicates that the item is a component part that is incomplete and needs further evaluation prior to incorporation in Ex equipment. An apparatus with a certificate with the "U" suffix cannot be used in a hazardous area without further approval.

Associated Apparatus

Associated apparatus are usually located in a safe non-hazardous area (although they may have their own certification as well) and are used to control intrinsically safe circuits where they connect to outside equipment or power sources.

They are marked with square brackets e.g. [ia] which means suitable for connection to Zone 0 (including Zone 1 and 2) hazardous area circuits but does NOT mean that it can be located in any hazard, i.e. it must be installed in a safe area.

General Requirements

All explosion protected equipment regardless of the technique used must meet the general conditions defined in AS/NZS60079:0. Each unique technique is then detailed in the appropriate standard defining the technical parameters of that technique.

Following are some of the general requirements specified in AS/NZS 60079.0:

- Enclosures made of plastic including the requirements for threaded holes in plastic.
- Avoidance of ignition due to static discharges.
- Light alloy enclosures including restrictions on the use of light alloys.
- Fasteners including special fasteners, designed to deter unauthorized access to enclosures.
- Earthing requirements.
- Specific requirements for rotating electrical machines.
- Plugs and socket outlets.
- Marking – The marking or Labelling on the certified equipment is critical, see above.
- Impact and drop tests.
- Ingress Protection requirements (IP Ratings).
- Torque tests.
- Temperature-rise tests.
- Thermal shock test.
- Insulation resistance of plastics parts.
- Non-metallic enclosures or parts, resistance to heat, cold, light, chemicals (Group 1).

Mixed Techniques

It is common for more than one technique to be used on a single apparatus. For example flameproof apparatus are often designed to also meet Ex 'tD' (DIP[6]) requirements by including gaskets in such a way that they do not affect the flame paths.

What Equipment is Suitable for Defined Hazard/s

A summary below shows which equipment protection technique is suitable for which hazard.

From our hazardous area assessment we know the zone and gas group and temperature class of the location and hazard, now we can select suitable techniques from the list relative to the zone classification. For example, if we have Zone 0 hazard we are (ignoring "Ex s" as it is not common) we are able to select from "Ex ia" or "Ex ma".

The equipment MARKING (which is critical to the device and must be correct and legible) will show Ex for explosion protected.

Then the code for the technique, e.g. "ib" for zone 1 intrinsic safety.

Then the Group e.g. II for above ground GAS

Then sub-group GAS: say group B Ethylene

Then the "T" Class or maximum ignition temperature T1 to T6 OR the actual temperature e.g.T135°C.

So as an example a portable radio might have marking showing "Ex ib IIC T4" this means:

Explosion protected using intrinsic safety to Zone 1 and Zone 2 (not Zone 0) suitable for above ground gas in the Hydrogen category (highest level and suitable for all below it) up to an ignition temperature of 135°C.

This product could NOT be used (unless there is additional marking) in a dust hazard or coal mining operation or in a chemical plant where say Carbon Disulphide (a T6 gas) exists.

[6] Dust Ignition Protection" an old technique now replaced by Ex tD. A lot of equipment is still in service in old silos and grain storage facilities.

Table 1: Equipment Protection Techniques vs GAS Zone Hazard

		Zone		
Technique	**Group**	**Zone 0**	**Zone 1**	**Zone 2**
Intrinsically Safe Ex ia	II	√	√	√
Intrinsically Safe Ex ib	II		√	√
Intrinsically Safe Ex ic	II			√
Encapsulation Ex ma	II	√	√	√
Encapsulation Ex mb	II		√	√
Flameproof Ex d	II		√	√
Increased Safety Ex e	II		√	√
Non Incendive Ex n	II			√
Powder Filling Ex q	II		√	√
Oil Immersion Ex o	II		√	√
Pressurised Ex p	II		√	√
Special Protection Ex s	Subject to conditions of Certification – READ the Certificate			

Table 2: Equipment Protection Techniques vs DUST Zone Hazard

		Zone		
Technique	**Group**	**Zone 20**	**Zone 21**	**Zone 22**
Intrinsically Safe Ex iaD	III	√	√	√
Intrinsically Safe Ex ibD	III		√	√
Intrinsically Safe Ex ic	III			√
Encapsulation Ex ma or Ex mD	III	√	√	√
Encapsulation Ex mb	III		√	√
Protection by Enclosure Ex tD A20 sometimes shown as “Ex ta”	III	√	√	√
Protection by Enclosure Ex tD A21 sometimes shown as “Ex tb”	III		√	√
Protection by Enclosure Ex tD B21 sometimes shown as “Ex tb”	III		√	√
Protection by Enclosure Ex tD B22 sometimes shown as “Ex tc”	III			√
Protection by Enclosure DIP A20	III	√	√	√
Protection by Enclosure DIP A21	III		√	√
Protection by Enclosure DIP B21	III		√	√
Pressurised Ex pD	III		√	√

EPL Risk Assessment System

The recent concept of Equipment Protection Levels (EPL's) for hazardous area electrical equipment was introduced in the 2009 editions of AS/NZS60070.10.0, AS/NZS60079.14 and AS/NZS60079.17.

It provides a mechanism for a site owner or hazardous area assessor to do a risk assessment on the level of protection provided by equipment.

Historically, as described in detail elsewhere in this document, equipment suitable for specific zone applications was based on the actual technique being used, some are deemed suitable for some zones and some are not, the system is/was quite rigid. The EPL system allows sufficiently competent persons to include a risk assessment taking into account likelihood of ignition vs possible outcomes.

Risk adjustments for EPL are only to be applied by where a formal risk management and operational framework have been established.

This use of ELP's is a means of applying a risk assessment to operations which may not fit rigidly with the conventional system. It is mentioned here as the EPL markings are now commonly shown on the marking for recently certified equipment and the terminology needs to be understood.

The normal relationship between EPL's and Zone hazards is as follows:

Relationship between EPL's and Conventional Zones

Zone	Equipment Protection Level (EPL)
0	Ga
1	Ga or Gb
2	Ga or Gb or Gc
20	Da
21	Da or Db
22	Da or Db or Dc

EPL's can only be used to change these zone requirements if the site /owner can formally sign off the variation.

Other Factors

RF Radiation

RF transmissions from portable equipment are not considered dangerous within the parameters allowable under the power limitations governing intrinsically safe portable equipment, see, "Radio Transmission, Ignition?"Page58.

Purpose of Certificates

As quoted by the IEC website

"Certificates are used by different people for different reasons. The following is intended to capture all major uses:

1. By potential purchasers, to search the IECEx Database for a suitable product.
2. By the purchaser, to satisfy local regulatory bodies and insurers regarding an installation.
3. By the manufacturer, to satisfy local regulatory authorities regarding compliance of a product.

4. By the manufacturer, to satisfy his insurer regarding steps taken to avoid product liability claims (however expressed in different countries).
5. By the manufacturer, as a marketing aid.
6. By the manufacturer, to identify which products are covered by the certificate.
7. By the certifier, to identify which products are covered by the certificate.
8. By the IECEx Scheme, to promote the scheme.
9. By the IECEx Scheme, as a source of revenue.
10. By the manufacturer, purchaser, installer and user of the equipment to transfer specific information needed for installation and use."

Ref: Operational document No. IECEx OD 034

INTERNATIONAL ELECTROTECHNICAL COMMISSIONIEC SCHEME FOR CERTIFICATION TO STANDARDS FOR ELECTRICAL EQUIPMENT FOR EXPLOSIVE ATMOSPHERES (IECEx System)

Marking

IMPORTANT: While there is considerable similarity between a lot of ATEX equipment and IECEx equipment they are not interchangeable in terms of compliance. Some equipment is certified to both schemes and this IS acceptable within the normal selection criteria. If in doubt the label (called marking) is the means of determining the approval.

If the marking does NOT say IECEx then it is **NOT** IECEx, regardless of whether the manufacturer says it is or not. **The Marking is critical**.

The marking must describe the certificate Issuer, certificate number and the technique/s, group and temperature class. THIS IS NOT OPTIONAL regardless of what the vendor or manufacturer says.

It is not uncommon for equipment to be certified to multiple standards and under multiple schemes; for example the NEC system AND the ATEX system AND the IECEx system, (this is entirely legal and acceptable).

If however the "marking" on the equipment says, for example ATEX and doesn't show IECEx then it is NOT IECEx even though the manufacturer may say it is identical to the IECEx version. This is one of the most common issues EEHA assessors find. Importers bring in the wrong model (identical in terms of specifications) and then try to pass it off as acceptable, this is NOT permissible and if the radio does NOT have the correct marking it is NOT approved.

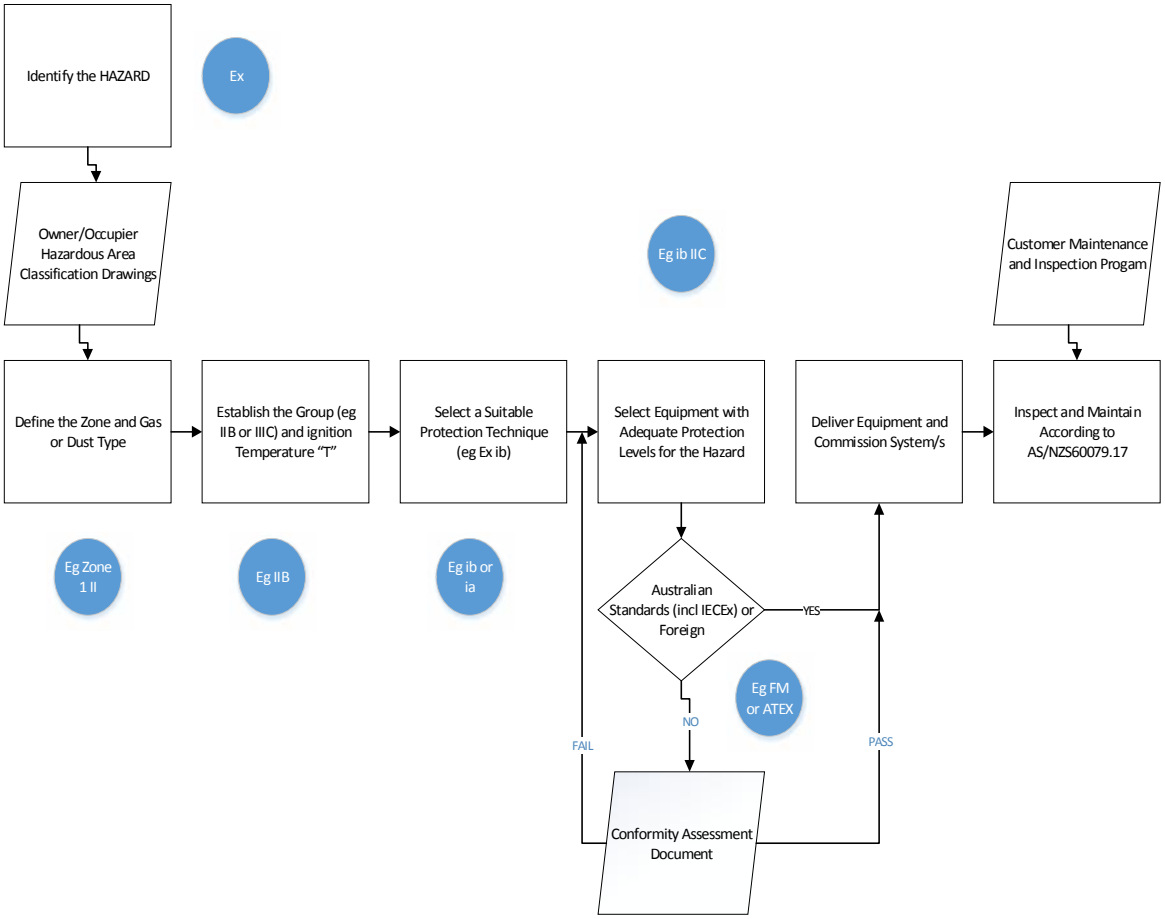
Full details of the marking requirements as quoted from AS/NZS60079.0 as show in APPENDIX A - Marking, Page 44.

Select the Right Equipment

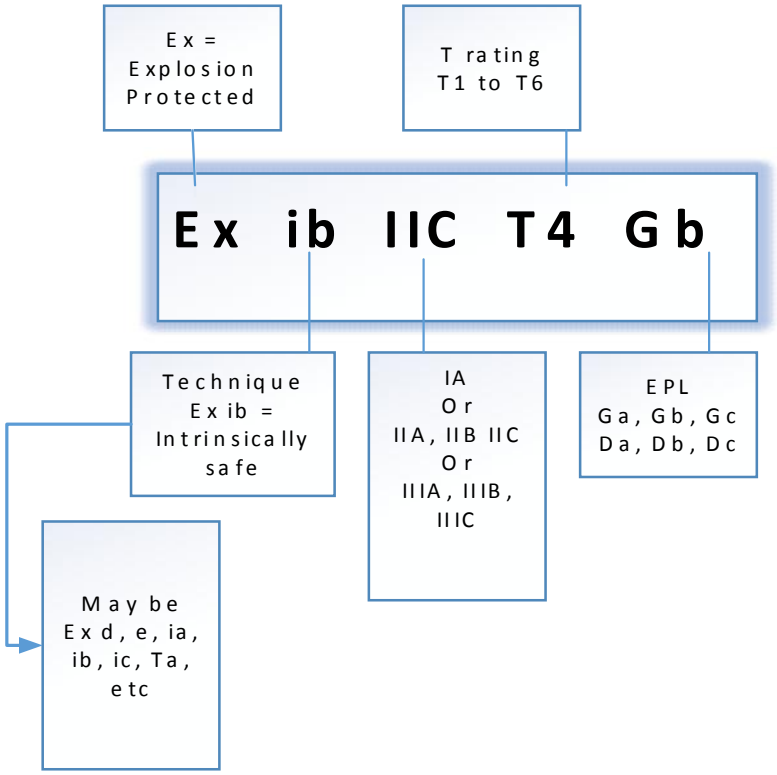
1. Identify the hazard and Zone from Hazardous area Classification drawings
   and
2. Select a suitable technique for the hazard type from the gas and dust tables
   and
3. select product with a protection level which meets or exceeds the hazard
   and
4. Abide by any conditions on the certificate of compliance
   and
5. Maintain and inspect it regularly.

See flowchart next page.

How to Select the Right Equipment



Reading the Marking ANZEx/IECEx



Is the Equipment Suitable?

We've discussed all the attributes of various techniques and the levels of protection offered including variables such as gas or dust, groups, above or below ground, coal mining and temperature class and how to identify the risks that may exist on a site, now most importantly we must translate this into selecting the correct equipment.

If it is ANZEx or IECEx then it is relatively easy by reading the marking and certificate we can then easily identify if a product is suitable for a defined hazard.

For example A plant with open areas where portable equipment are being used may be predominantly Zone 2, IIA (above ground Propane) with a "T" rating of T3 (200°C ignition temperature) with some areas in close proximity to the process plant as Zone 1.

Equipment therefore must meet, as a minimum "Zone 1 IIA T3" (higher levels of protection are suitable, e.g. IIB or IIC are acceptable, T4, T5 or T6 are also acceptable.

If it's a foreign certified device then you will need professional help and the agreement of the site owner/occupier to sign off an acceptance if the conformity assessment if it is positive.

If it fails then the only avenue is to ask an Ex TL (test lab) to certify it, cost can be around $100,000 and takes up to a year. You will also need all of the manufacturer's drawings and test data which very few will part with anyway. You will also need ongoing quality assurance audits at around $5,000-$10,000 per visit, twice annually. Not generally a good option.

Section 4: The Global Standards Systems

You will see below that there are considerable differences between the various systems especially between the US system and the two European based systems (IECEx and ATEX). While all have historically proven safe it is sometimes difficult to make direct comparison between equipment from various compliance regimes.

Fortunately most global instrument companies manufacture goods which are certified to all global standards. The communications industry has been slower to catch up but change has largely been forced by the fact that it is illegal to use anything not ATEX certified in Europe. This is totally controlled in Europe. The US, while not accepting ATEX has moved to accept IECEx to bridge the gap. We are closer to a global system than ever before.

Australia/New Zealand and others *(IECEx and ANZEx)*

ANZEx is based closely on the IECEx scheme and the changes are largely those based on local domestic electrical supply rules such as main power voltages. The exception is the Australian and New Zealand have opted for a separate standard for

Servicing and Repair (see page 57), i.e. AS/NZS 3800 and competencies of personal are based on AS/NZS4761.

IECEx

Figure 2: IECEx Logo

See IECEx brochure "IECEx International Certification: The way to safety compliance in hazardous areas"

The quoted objective of the IECEx system is as follows:

"IECEx System Objective

The objective of the IECEx System is to facilitate international trade in equipment and services for use in explosive atmospheres, while maintaining the required level of safety:

- reduced testing and certification costs to manufacturer reduced time to market
- international confidence in the product assessment process
- one international database listing
- maintaining International Confidence in equipment and services covered by IECEx Certification"

There are currently 33 countries as members of the IECEx scheme, see "

APPENDIX B IECEx Member Bodies", Page 45.

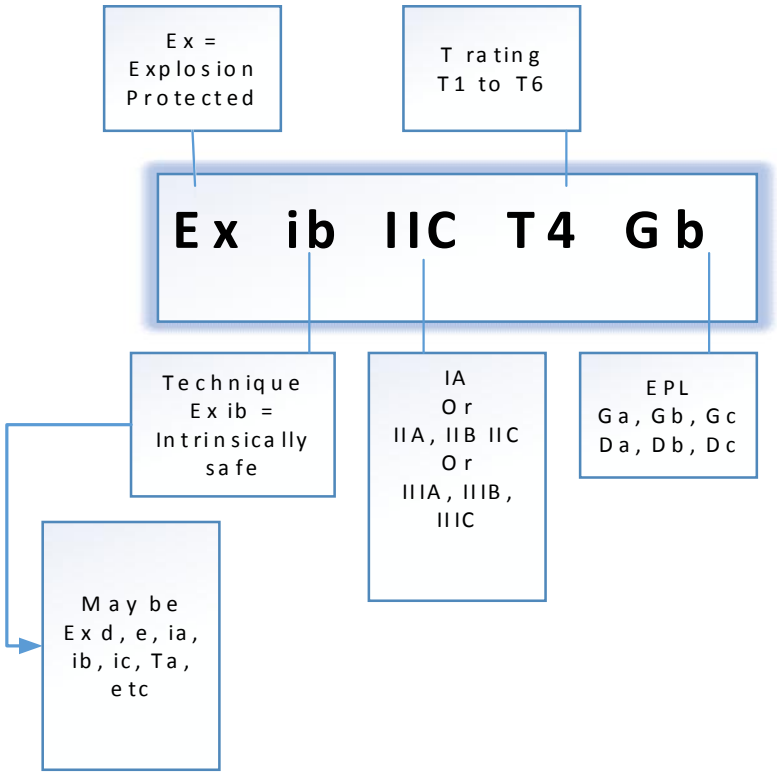
All of the applicable standards are shown in APPENDIX C: Standards, Page 50

Australia's own national system ANZEx is based on the IECEx scheme. See www.anzex.com.au . ANZEx accepts the IECEx technical standards and certificates issue by IECEX ACB's. The IECEx scheme, as mentioned earlier has minor technical modifications (the standard has "MOD" on the title to reflect this) and the issue of an ANZEx certificate will include these country specific items.

Copies of certificates are, like IECEx certificates available but at a cost of $27.00 from www.anzex.com.au. The certificate description is available at no cost provides a means of checking the validity of the certificate but unfortunately does not include details or any special conditions which are mandatory as part of the compliance.

The ANZEx site does provide some access to old certificates and certificates issued under the previous scheme, AUSEx for those working on older systems.

Reading the Marking ANZEx/IECEx



Is the Equipment Suitable?

US Classification System

USA (NEC 500/NEC505, UL, FM, IECEx, CSA, Others)

Figure 3: NEC Logo

Factory Mutual, Underwriter's Laboratories Inc, CSA Labs and Intertek Testing Services NA, Inc. are all ExCB's (Approved Certifying Bodies) under the IECEx scheme and can issue IECEx certificates in the same manner as Australian IECEx certifying bodies. However the US retains its original country specific standards as below.

National Electrical Code (NEC) does not have specific standards for hardware or other apparatus it relies on "Nationally Recognised Test Laboratories" (NRTL's) such as Factory Mutual and Underwriters Laboratories to test to their own standards and accept IECEx standards as well.

Equipment certified under the USA NEC 50 and NEC505 standards is not accepted here in Australia and will require a conformity assessment from a competent assessor if he or she will issue a positive report and if the site owner accepts it (See 41 "**Authorised use of Foreign Standards' Compliant Equipment**", Page 41).

The NEC system is regulated by the United States Department of Labor Occupational Safety & Health Administration.

These private sector organisations perform certification for defined products to ensure that they meet their specific published technical requirements. Each NRTL has their own test standards. These are used as the basis for testing and issuing certificates of compliance.

The following standards are recognised by OHSA for use in hazardous areas as well as the IECEx standards defined elsewhere in this document.

OSHA's Nationally Recognized Testing Laboratory (NRTL) Program

FM 3600	Electrical Equipment for Use in Hazardous (Classified) Locations, General Requirements
FM 3610	Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II and III, Division 1 Hazardous (Classified) Locations
FM 3611	Electrical Equipment for Use in Class I, Division 2; Class II, Division 2; and Class III, Division 1 and 2 Hazardous Locations
FM 3615	Explosion-proof Electrical Equipment, General Requirements
FM 3620	Purged and Pressurized Electrical Equipment for Hazardous (Classified) Locations
ISA 12.12.01	Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations
UL 698A	Industrial Control Panels Relating to Hazardous (Classified) Locations
UL 674	Electric Motors and Generators for Use in Hazardous (Classified) Locations
UL 783	Electric Flashlights and Lanterns for Use in Hazardous Locations, Class I, Group C & D
UL 823	Electric Heaters for Use in Hazardous (Classified) Locations
UL 844	Electric Lighting Fixtures for Use in Hazardous (Classified) Locations
UL 913	Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division I, Hazardous (Classified) Locations
UL 1203	Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations

USA NEC Article 500 (article 506 is the actual area classification standard) is the original and still currently used **CLASS/DIVISION** system for hazardous area classification for equipment selection.

More recently (1996) the USA made a major shift towards global standardisation to more closely align to the rest of the world by introducing NEC Article 505 which introduces the European **ZONE** system of area classification.

Note that as mentioned in the overview, this is NOT related to the equipment testing laboratories, this is related to the regulations and the assessment of the **hazard**.

NEC 500 and NEC 505 hazard definitions are defined and updated by the US National Fire Protection Authority (NFPA).

US Hazardous Classification under NEC500 (NEC506 Area) is as follows:

Class: Explosive Atmosphere

Class I – GAS

Class II – DUST

Class III – FLYINGS

Division: Degree of Hazard

Division 1

Where under **normal** operating conditions one or more of the following conditions are met:-

- Ignitable concentrations of flammable gases, vapours or liquids are present continuously or frequently.
- Ignitable concentrations of combustible dusts are present.
- Easily ignitable fibres or materials producing combustible flyings are present.

Division 2

Where under **abnormal** operating conditions one or more of the following conditions are met:-

- Ignitable concentrations of flammable gases, vapours, or liquids are present within the atmosphere.
- Ignitable concentrations of combustible dust are present within the atmosphere.
- Easily ignitable fibres or materials producing combustible flyings are present within the atmosphere.

Group (Gas or Dust) **NOTE 1:** The groups are **NOT** the same as IECEx.

Group A	Acetylene
Group B	Hydrogen H_2
Group C	Ethylene
Group D	Propane
Group E	Metal Dusts
Group F	Carbonaceous Dusts
Group G	Combustible Dusts

NOTE 2: BE CAREFUL this is almost the **REVERSE** of the IECEx system Where "C" is the most dangerous and "A" is the lesser.

Temperature Class

Temperature class required by the area classification	Ignition temperature of gas or vapour in °C
T1	>450°C
T2	>300°C
T2A	>280°C
T2B	>260°C
T2C	>230°C
T2D	>215°C
T3	>200°C
T3A	>180°C
T3B	>165°C
T3C	>160°C
T4	>135°C
T4A	>120°C
T5	>100°C
T6	>85°C

Relationship between ignition temperature and "T" rating

This is the same for both NEC500 and NEC505 marking

US Hazardous Classification under NEC 505

The US NEC 505 scheme allows alignment of the US and IECEx (ANZEx) and ATEX Systems.

Class Explosive Atmosphere:

Class I = Gas or Vapour.

Class II = Dust environments.

Zones (as Per IECEx)

Zones 0, 1, 2, 20, 21, 22, see Area of Hazard – Zones(Gas) Page 15 and Area of Hazard – Zones (Dust)Page 16.

Gas Group (Similar to IECEx)

Mines are designated separately Group 1A as per IECEx and ATEX.

Acetylene	Group IIC
Hydrogen	Group IIB+H_2
Ethylene	Group IIB
Propane	Group IIA
Methane	Group I Mining

Above Ground as per NEC 506

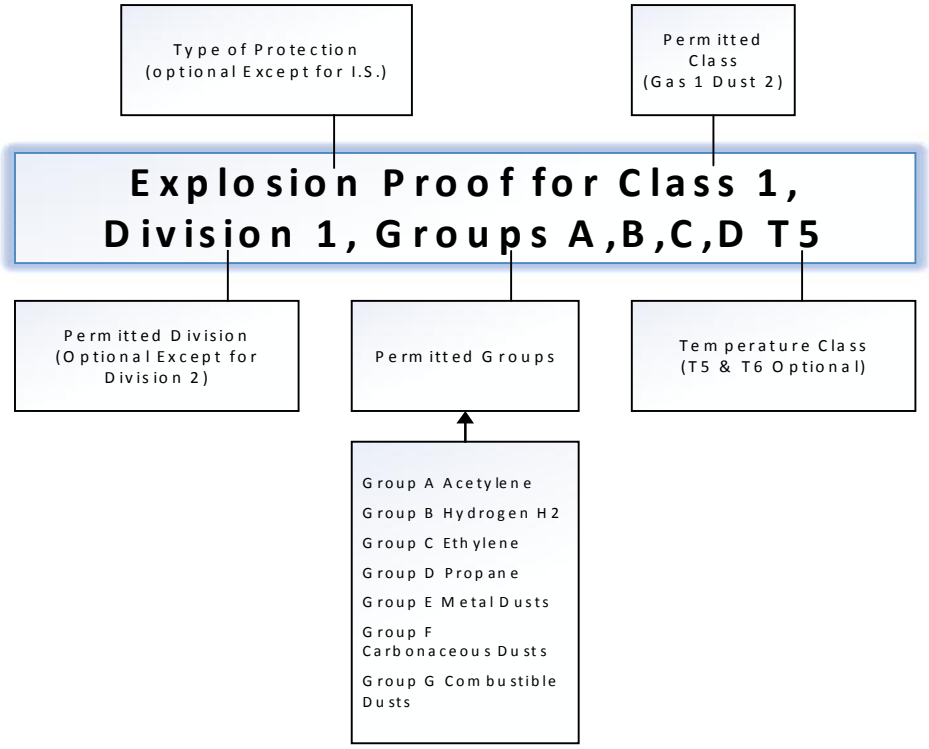
Temperature

As per temperature class table above.

Same as IECEx and ATEX but with additional sub-categories.

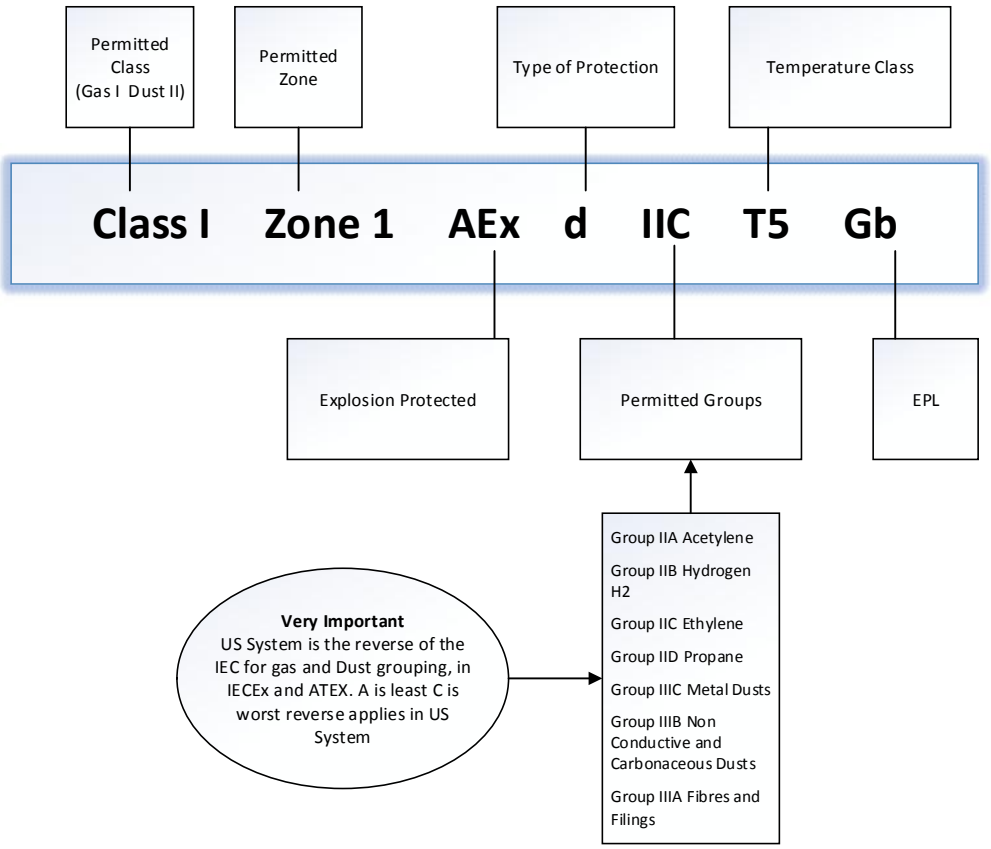
USA System of Marking

The NEC 500 is considerably different and does not directly translate to the Australian system



USA NEC 500 Equipment Marking

NEC 505/506 systems are more closely related to IECEx/ANZEx



US NEC 505/506 Equipment Marking

FM (Factory Mutual) and UL (Underwriters Laboratories) and Canadian Standards Associations (CSA) NEC 500 vs IECEx

NOTE that FM Approvals (or UL or CSA) in this instance refers to testing to the USA National Electric Code (NEC) standards ONLY.

Where FM Global or CSA or UL issue IECEx certificates of compliance then they are totally acceptable as IECEx certified devices.

It must be remembered that these labs are approved under both schemes.

It is the testing of NEC 500/505 schemes equipment vs the testing of IECEx certified equipment which his different. FM, CSA and UL are approved IECEx certifying bodies (ExCB's) in the IECEx scheme. Their certificates for IECEx certified equipment are acceptable in the same way as a certificates from say TestSafe or SIMTARs are acceptable here. In this instance they are no different to any other IECEx ExCB.

Europe (ATEX ONLY)

ATEX is an abbreviation from French'**AT**mosphères **EX**plosibles'.

Until 1976 the European Union (EU) applied the Cenelec[7] standards for technical compliance in what is now called the "Old Approach".

Manufacturers of electrical equipment for use in explosive atmospheres followed a voluntary product compliance and certification procedure based on the European Community directives 76/117/EEC, 79/196/EEC and 82/130/EEC.

It was the responsibility of each EU country to implement the necessary regulations and to appoint test laboratories known as "Notified Bodies" to undertake the conformity assessment procedures specified in the directives.

The directives were amended a number of times after 1976 to introduce new Harmonised European standards reflecting the state-of-the-art in the design and construction of explosion protected electrical equipment.

The distinctive mark was applied to the product to indicate that it could be sold within the EU without further controls.

ATEX Logo

Surveillance(Quality Audits)

The directives required that ongoing quality inspections of manufacture be undertaken periodically to ensure that the certified product continued to comply with the directive and manufactured in accordance with the Certificate of Conformity.

[7] CENELEC is the European Committee for Electrotechnical Standardization and is responsible for standardization in the electrotechnical engineering field. CENELEC prepares voluntary standards, which help facilitate trade between countries, create new markets, cut compliance costs and support the development of a Single European Market.
CENELEC creates market access at European level but also at international level, adopting international standards wherever possible, through its close collaboration with the International Electrotechnical Commission (IEC), under the Dresden Agreement.

The surveillance requirements were not interpreted uniformly among the various states and hence cannot be relied upon to equate to the IECEx standards applied here in Australia.

'New Approach'

In 1985 the European Community agreed to a 'New Approach' to the certification of products in order to facilitate free movement of goods within the European Union and overcome the discrepancies between individual states resulting from different interpretations of the ongoing quality assurance and manufacturing inspections.

Assessment procedures include the CE marking as well as addressing separately the issues related to underground mining equipment (Group I) and included dust as a separate compliance area.

This is one of the differences, ATEX include mechanical and RFI regulations whereas the US and IECEx systems are generally limited to electrical characteristics and anti-static.

The Compliance Deadline In July 2003 for meeting the requirements of Directive 94/9/ (ATEX 100a, now called ATEX 95) all equipment used in hazardous areas was mandated to be compliant with the New Approach. Equipment could no longer be placed on the market with a Certificate of Conformity issued under the 'old approach'.

The ATEX approach is to define Essential Health and Safety Requirements (EHSRs) and not specific standards although there are "harmonised standards" which are acceptable. Application of harmonised standards or other technical specifications remain voluntary, and manufacturers are free to choose any technical solution that provides compliance with the EHSR's.

This vague definition of technical standards and the use laboratories for testing which may not be part of our acceptance scheme is the major issue with regards acceptance of these compliance certificates. We, in the Australian system cannot accept the testing to an undefined or unrecognised standard.

Fortunately the "EN" (European Normative) versions of the IEC60079.xxxx series standards are the same as the standards used here in Australia (through IECEx) and a large percentage of the equipment certified to ATEX has taken the path of compliance using standards which are acceptable to us in Australia. This DOES NOT gain compliance but gives an assessor something to work with in terms of supporting evidence for a CAD document.

Acceptance of ATEX standards requires an assessment from a qualified EEHA assessor in Australia. Note that acceptance is NOT guaranteed and opinions vary. Some assessors won't accept foreign standards at all.

The use of ATEX certified equipment in Australia therefore needs a Conformity Assessment Document (CAD) from a qualified HA Inspector.

Vendors should be made aware that many laboratories certifying ATEX equipment are also IECEx ExCB's and often both compliance test can be carries out at the same time to save time and money.

Some other very notable differences apply to use of ATEX equipment, for example Zone 2 equipment under ATEX is approved for use with a manufacturer's declaration and this is NOT accepted here in Australia where third party testing is a mandatory part of compliance.

Area Classification System

This additional label information is often confusing when selecting equipment (be careful of the interpretation) although ATEX uses the same EPL risk assessment system for selection of equipment.

Note the categorisation of Zones….

Category 1 = Zone 0

Category 2 = Zone 1

Category 3 = Zone 2

One of the reasons for this additional marking is that equipment technical compliance and quality assurance procedures are not necessarily based on harmonised or IECEx standards.

ATEX Equipment Certification

The ATEX system is similar to the IECEx system in this regard except that the products carry additional labelling.

All ATEX EC-Type Examination Certificates are issued in respect of conformity with the European Union "Essential Health and Safety Requirements"(EHSRs). Some approved certifying bodies of ATEX equipment (called "Notified Bodies") are partners in the IECEx scheme, some are not.

Certain standards are designated as "harmonised" and this includes almost the entire IECEx 60079.xx series standards we use.

The ATEX system of product marking and identification is almost identical to the IECEX system but with additional information which is sometime confusing.

There are several issues with acceptance of ATEX certified equipment for use in Australia:

- NOT all equipment is certified to what are called "harmonised" standards. There are other methods of obtaining technical conformity to ATEX and the other methods may NOT be acceptable in Australia as they MAY NOT be the same as our technical compliance requirements.
- ATEX allow self-assessment for Zone 2 products which is NOT acceptable in Australia or under the IECEx/ANZEx guidelines.
- Not all ATEX test laboratories are affiliated with the IECEx scheme. If a test laboratory is not part of the IECEx system (including ANZEx) we limited ability to assess the laboratories' capabilities, expertise and/or quality systems.

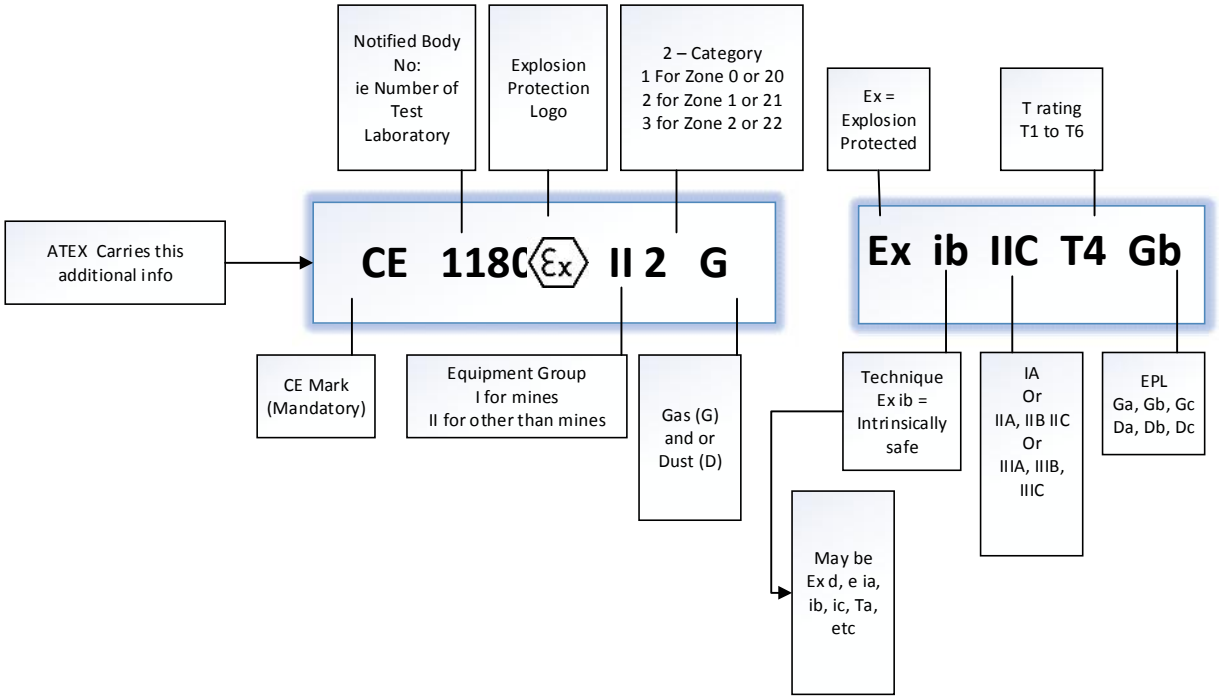
ATEX certified devices are therefore not immediately accepted as suitable here in this country.

Product labelling (marking) on ATEX equipment has additional information including some which can be confusing to the inexperienced person selecting equipment, see drawing on the next page.

The area classification system and zone, gas, group and temperature class information is the same as IECEX and ANZEx.

ATEX - Similar to IECEx but not quite the same.

ATEX Equipment Marking



Comparison of Global Area Classification Systems

IECEx &ATEX Zone versus USA NEC Division Area Classification

	Flammable Material Present Regularly	Flammable Material Present Intermittently	Flammable Material Present abnormally
IECEX	Zone 0	Zone 1	Zone 2
ATEX	Category 1, Zone 0	Category 2, Zone 1	Category 3, Zone 2
USA NEC 500	Division 1		Division 2
USA NEC 505/506	Zone 0	Zone 1	Zone 2

Comparison of International Standards

JUST REMEMBER: IECEx Zone 0, 1 and 2, USA NEC 500 Division 1 and 2, ATEX Categories 1, 2, and 3.

ATEX ≠IECEX = ANZEx

NOTE: The US system described Zone 2 as “hazard being present abnormally or under abnormal conditions where IECEx system describes it as “an area in which an explosive gas atmosphere is not likely to occur in normal operation but, if it does occur, it will exist for a short period only”. The difference is in terminology not necessarily the meaning.

Section 4: Australian Regulatory Framework

Installations in hazardous areas in Australia are controlled and legislated under the various state electricity acts as part of legislation controlling the installation of electrical equipment. The main technical reference for electrical installation in Australia is the Australian and New Zealand standard AS/NZS3000 which encompasses the hazardous area electrical installation requirements for explosive environments.

Some electricity suppliers will not connect mains power to the site if there is no current, complete Verification Dossiers (see "Verification Dossiers" below): see Energy Australia Customer Installation Advice No. 1050 B 7/7/2006, copy attached.

Legislation

AS/NZS 3000:2007Australian/New Zealand Standard™ Electrical installations(known as the Australian/New Zealand Wiring Rules) is referenced in law in all parts of Australia under the various electrical acts and work safety regulations. The standard defines the methods, rules, regulations and technical parameters for electrical installations in Australia and New Zealand.

Clause 7.7 HAZARDOUS AREAS (EXPLOSIVE GAS OR COMBUSTIBLE DUSTS), of AS/NZS 3000:2007states:

> *7.7.1 Scope*
>
> *The particular requirements of this Clause 7.7 apply to the selection of electrical equipment and its Installation to ensure safe use in areas where flammable or combustible materials are produced,*

Clause 7.7.2.4.1 Selection goes on to state:

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

AS/NZS 60079.14:2009 states:

> *"The objective of this Standard is to set out the requirements for the design, selection and erection of electrical installations in hazardous areas associated with explosive atmospheres; these requirements are in addition to the requirements for electrical installations in nonhazardous areas."*

The Standard's handbook HB-13:2007 (a good reference document for issues relating to explosion protection of electrical equipment without the need to reference the long and complex individual *standards) says:*

"It is important to establish early in the process of classification of an area and selection of apparatus who bears the responsibility for making the correct choices. It is the owner/occupier since the owner of the property may not be the occupier. The owner/occupier may delegate the responsibility for classifying an area, but the owner/occupier must ensure that the delegated person is competent to carry out the task.

Any legal responsibility in Australia and New Zealand stems from an Act of Parliament. The responsibility may be spelt out in the Act, or in associated Regulations, or in a document called up by the Act or Regulations.

Each Act may have a set of associated Regulations and provision for these Regulations is generally made in the Act. Regulations are generally drawn up by the department administering the Act."

"For hazardous areas, the relevant Acts and Regulations fit very definitely into two areas: underground coal mining and other industries. For both areas the Occupational Health and Safety Act of the various States may be the overarching legislation.

2.2 UNDERGROUND COAL MINING

Regulations covering coal mining are the responsibility of the State in which the mining is undertaken. The object of the Regulations is to require mine and plant managers to develop and implement systems to ensure that the workplace is safe and a safe system of working is employed.

The Regulations are no longer prescriptive but are performance based. They set out responsibilities and requirements of employers and employees, and may call up Australian Standards, such as the apparatus Standards."

Site requirements – Equipment Records

Verification Dossiers

A file called a verification dossier is compiled for all hazardous sites. It is a listing all of the parameters of all of the hazardous area electrical equipment including interconnection drawings, protective barriers (where used) hazardous area classification drawings for the entire site and maintenance records for all inspections and repairs.

This verification dossier is the responsibility of the site owner/occupier and must be available for inspection by regulatory bodies. It is not the responsibility of the vendor unless he elects to do this as part of his/her contract of supply.

Clause 4.2 of AS/NZS60079.14 states:

"4.2 Documentation

It is necessary to ensure that any installation complies with the appropriate certificates 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."

Installation (and Supply) Records

The periodic inspections should be done by someone other than the installer and the regularity of these inspections is based on the number of failures found in previous inspections.

Inspection sheets can only be completed by someone competent under AS/NZS60079.17 (the actual competencies are described in AS/NZS 4761).

Do NOT service or repair equipment if not deemed competent to do so or the compliance of the equipment will be compromised and the certification for that apparatus will be invalid.

If the equipment is certified under a foreign certificate then the CAD document approving its use should be referred to in the inspection sheet.

Inspection Sheets

Electrical equipment used in hazardous areas must be inspected regularly and after being serviced or repaired. Copies of sample inspection sheets are attached for reference and greater detail can be found in AS/NZS60079:17, the relevant inspection details for intrinsically safe equipment as found in Page 20 Table 2 – Inspection schedule for Ex "i", "iD" and "nL" installations.

There are three (3) types of inspections; “Visual”, “Close” and “Detailed” as described in the standard. Many of the inspection requirements are not relevant to portable equipment but inspections are nonetheless important and mandatory.

Authorised use of Foreign Standards’ Compliant Equipment

Conformity Assessment Documents (CAD’s) sometimes this is referred to as a “Letter of NO Objection” are documents prepared by a competent hazardous area inspector/assessor who assesses the conformity of the foreign certified equipment against the local standard.

The assessor, when writing the report, will consider the local site hazards and area classification. He/she will also compare testing regimes between the foreign certifying body and the local regulations under AS/NZS60079.14 and AS/NZS60079.0 (including any specific requirements relating to the explosion protection technique). The assessor may apply a risk assessment using the EPL system where definitions are inconclusive.

NOTE 1: Conformity assessments are site and hazard specific; there is NO blanket conformity assessment. General equipment certification for multiple sites and applications would require laboratory testing and the issuing of a new certificate of compliance.

NOTE 2: A reason for using the foreign certified equipment must be shown and it cannot be cost. If there is a suitably certified piece of equipment meeting the functional needs and operational requirements of the site it should be used. The use of CAD’s is meant to meet the site needs where no other types of equipment are suitable.

Regulators –

See “APPENDIX D: Regulatory Authorities, Page51

Who is Responsible?

Site Owner/Occupier

The entity legally responsible is described as the owner/occupier and is the operator of the site with management function for the plant’s operations

Plant Designers and Maintenance Staff

Electrical equipment and installations in hazardous are designed to make them safe for operation in such atmospheres. It is essential for reasons of safety that these safety features are not compromised. They therefore require initial inspection and either:

- Maintenance and regular periodic inspections or continuous supervision [8]by skilled personnel in accordance with the standard are mandatory.

Installers

Persons working with electrical equipment in or on hazardous area sites must have competencies as defined in AS/NZS4761 for the specific hazardous area work.

[8]Continuous supervision is quoted as “frequent attendance, inspection, service, care and maintenance of the electrical installation by skilled personnel who have experience in the specific installation and its environment in order to maintain the explosion protection features of the installation in satisfactory condition.”

What are the ongoing compliance requirements?

Inspections

AS/NZS 60079.17 Clause 4.4.3 Moveable equipment, states

"Movable electrical equipment (hand-held, portable, and transportable) is particularly prone to damage or misuse and therefore the interval between periodic inspections may need to be reduced. Movable electrical equipment shall be submitted to a close inspection at least every 12 months. Enclosures which are frequently opened (such as battery housings) shall be given a detailed inspection at least every 6 months. In addition, the equipment shall be visually checked by the user, before use, to ensure that the equipment is not obviously damaged."

Service and Repair Requirements

ANZEx certified equipment technically must be serviced and repaired by an AS/NZS3800 compliant workshop. The manufacturer must also have this accreditation to repair the equipment if he/she is to perform the repair work. The common acceptance of IECEx rules effectively means that we accept the IECEx standard which in this case is not the same. The Australian and New Zealand Standard is AS/NZS3800 while the IECEX standard is IEC 60079.19.

Quote from IECEx website as below:

"IECEx Certificates of Conformity are issued by approved IECEx Certification Bodies (ExCBs). An IECEx Certificate of Conformity attests that a Service Facility, described on the Certificate, has been independently assessed and found to have appropriate equipment, competent staff and operate procedures that provide confidence that the repair, overhaul or modification work complies with IECEx requirements, including IEC 60079-19. It also attests that the Service Facility's site has been audited to verify that the Service Facility's quality system meets IECEx requirements, specified in IECEx Operational Document OD 014."

A list of accredited workshop can be found at http://iecex.iec.ch/iecex/iecexcsf.nsf/welcome

If equipment is serviced outside of the approved workshops it will compromise the certificate of compliance. Repaired equipment should also be given a "**detailed**[9]" inspection as per the requirements of AS/NZS60079.17 and IEC 60079.17 as per clause 4.3 Inspections, 4.3.1 General.

Therefore we can safely assume that the use of either AS/NZS3800 OR IEC 60079.19 applies to servicing but whichever way we look at it DON'T service equipment without competency to do so under at least one of the applicable standards.

[9] There are three (3) type of inspections defined in AS/NZS60079.17, "Visual", "Close" and "Detailed".

Section 5: Handy Hints

Most customers will appreciate a simple assessment of the hazard (typically quoted from their document) and how you have identified the correctly certified equipment as part of your proposal.

A simple form based on one we use is shown below:

Client	[*Sample Client Pty Ltd*]	Project/Job	[*Your Ref*]
Area Hazard	[*eg Oil Terminal using Propane and Petrol, IIA*]	"T" Class	[*Eg T2*]

Ref: [Refer to customer/client HAC Dwgs or notes]

Document Ref: Quote_Hazloc Rev#4

Special Considerations
[*Add in any comments or considerations, e.g. if the ambient temperature is high as in the North of WA then put it in here. If there are special accessories needed, mention them here and take them all into account when you define the level of protection offered with your equipment.*]

EQUIPMENT

Equipment documentation is appropriate to the requirements of the location YES/NO
Equipment compliance level [e.g. Ex ib IIC T4]
Does equipment exceed hazard requirements [in this case YES]
Is it certified to IECEx or ANZEx YES/NO

If YES quote certificate No: _____

If NO, which standard? _____

If NO above then has a Conformity Assessment been carried out for this location? YES/NO
If YES is the CAD signed and accepted by the site owner YES/NO
Attach CAD if applicable to this sheet

If Equipment is not certified sufficiently to meet the requirement to operate safely in this hazard then what steps are being taken to negate the risk? [This could be "a clearly defined operational procedure for areas of greater hazard where equipment use will be prohibited" e.g.

"Areas referenced on GHAC Drawing Ref xxx, dated, xx ,rev X indicates a Zone 0 area around xxx processes and plant yyy and these areas are to clearly marked with Yellow paint and signage to insure that Ex ib IIB apparatus will not be carried into his area. Site operational procedures Ref xx have also been included in the safety inductions for all staff to reflect this"]

Certainly a vendor would be foolish not to note their acceptance of the site hazard. If in doubt in the first instance ask the customer what is acceptable, most major sites have their own site OH&S rules.

If in doubt refer to a hazardous area assessor for comment.

Some small sites in particular have been loose in the application of EEHA standards but enforcement and acceptance of the rules is becoming more common every day. What the client thought was OK last year might be different this year when an insurance assessor refuses re-insurance (this is common source of work for EEHA assessors) or WorkCover is called to an injury (most assessor's don't want to get their work from this).

If in doubt ask…most assessors charge nothing for a few minutes on the phone, it can save you a lot of $.

Section 6: Appendices

APPENDIX A - Marking

AS/NZS60079.0 Clause 29.3 General States

"The marking shall include the following:

a) the name of the manufacturer or his registered trade mark;

b) the manufacturer's type identification;

c) a serial number

e) if it is necessary to indicate specific conditions of use, the symbol "X" shall be placed after the certificate reference. An advisory marking may appear on the equipment as an alternative to the requirement for the "X" marking;

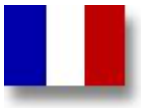
f) the specific Ex marking for explosive gas atmospheres, and/ or for explosive dust atmospheres. The Ex marking for explosive gas atmospheres and explosive dust atmospheres shall be separate and not combined.

APPENDIX B IECEx Member Bodies

(from IECEx website, www.iecex.com)

IECEx Member Bodies

Country	National Member Body	Contact
Australia (AU) 	Standards Australia Ms Alisa Nasic Ms Ashwini Sharma Level 10, 20 Bridge St Sydney NSW 2000 GPO Box 476 Sydney NSW 2001	Tel: +61 2 9237 6171 Free call within Australia: 1800 035 822
Brazil (BR) 	COBEI – COMITÊ BRASILEIRO DE ELECTRICIDADE, ELETRÔNICA, ILUMINAÇÃO E TELECOMUNICAÇÕES Mr José Sebastião Viel Avenida Paulista no 1439 - 11o andar, conj. 114 CEP 01311-200 - São Paulo Brazil	
Canada (CA) 	Canadian National Committee (CANC/IEC) Mrs. Lynne Gibbens Standards Council of Canada Program Manager, IEC and CANC/IEC Secretary International Standards Development, Standards Solutions Branch 600-55 Metcalfe Street, Ottawa ON K1P 6L5 CANADA	Tel: +1 613 238-3222, Ext. 452 Fax: +1 613 569 7808
China (CN) 	Certification and Accreditation Administration of the People's Republic of China (CNCA) Chinese National Committee of the IEC Ms. Du Chunjing Deputy Director General Department for International Cooperation, CNCA. 9 Madian East Road, Haidian District, Beijing 100088 PEOPLE'S REPUBLIC OF CHINA and Ms. Fang Yan Director for Multilateral affairs Department for International Cooperation, CNCA	Ms Du Chunjing Tel: 86-10-8226 2669 Fax:86-10-8226 0819 and Ms. Fang Yan Tel: +86-10-8226 2810 Fax: +86-10-8226 0741
Croatia (HR) 	Ex-Agency (Agency for explosive atmospheres) On behalf of: Croatian Standards Institute Mr. Stipo Derek Bastijanova bb 10000 Zagreb	Tel: +385 1 3667 260/112 Fax: +385 1 3667 262

	CROATIA	
Czech Republic (CZ) 	Physical technical Testing Institute Mr Jaromir Hruby Pikartska 7 CZ 71607 Ostrava-Radvanice CZECH REPUBLIC	Ph: +420 596232715 Fx: +420 596232672
Denmark (DK) 	Fonden Dansk Standard | Danish Standards Foundation Mr R Nielsen Portland Towers Göteborg Plads 1 DK-2150 Nordhav	Tel: +45 3996 6153 Mob +45 5151 4319
Finland (FI) 	SESKO Standardization in Finland Mr Risto Sulonen VTT Expert Services Ltd Otakaari 7B, Espoo P.O. Box 134 (Särkiniementie 3), FI-00211	Tel: +358 20 722 6415 Fax: +358 20 722 7042
France (FR) 	LCIE by delegation from the IEC NATIONAL COMMITTEE of FRANCE Ms Marie-Elisabeth d'Ornano 33 avenue du Général Leclerc BP 8 F 92266 FONTENAY-AUX-ROSES FRANCE	Tel: +33 1 40 95 5519 Fax: +33 1 40 95 5401
Germany (DE) 	Deutsches Komitee der IEC DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE Dr. Gerhard Imgrund Stresemannallee 15 DE-60596 Frankfurt am Main GERMANY	Tel: + 49 69 6308 300 Fax: +49 69 6308 9300
Hungary (HU) 	ExVÁ Testing Station for Explosion Proof Equipment Company Limited by delegation from MAGYAR SZABVÁNYÜGYI TESTÜLET (MSZT) Mr. János Müllner H 1037 BUDAPEST MIKOVINY S.u. 2-4 HUNGARY	Tel: +36 1 250 1720 Fax:+36 1 250 1720
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India (IN)	Bureau of Indian Standards Mr S M Shahid 9 Bahadur Shah Zafar Marg NEW DELHI	Tel/Fax: +91 11 23231903

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Ministry of Economy, Trade and Industry (METI)
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Norsk Elektroteknisk Komite (NEK)
Mr Birger Hestnes
Manager Director
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0283 Oslo

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Fax: +47 67 83 31 01

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Romania (RO) 	INSEMEX PETROSANI Mr Constantin LUPU Str. General Vasile Milea nr.32-34 Petrosani 2675 ROMANIA	Tel: +40 2 54546277 Fax:+40 2 54546277
Russia (RU) 	Federal Agency on Technical Regulating and Metrology (GOST) Mr A Zazhigalkin 9 Leninsky Prospect Moscow B-49 GSP-1 119991 RUSSIA	Tel: +7 499 236 0553 Fax:+7 499 236 4395
Singapore (SG) 	Spring Singapore Mr Jason Low Singapore National Committee of IEC Solaris 1 Fusionopolis Walk #01-02 South Tower, Solaris (Level 13) Singapore 138628	Tel: +65 6279 1813 Fax:+65 6659 0639
Slovenia (SI) 	Slovenian Institute of Quality and Metrology Igor Likar Trzaska cesta 2 SI-1000 Ljubljana SLOVENIA	Tel: +386 1 4778 100 Fax: +386 1 4778 444
South Africa (ZA) 	South African Flameproof Association On behalf of South African National Committee of the IEC Mr. Paul Meanwell 12 Commercial Road Wadeville, 1428 South Africa	Tel: +27 11 323 7012
Spain (ES) 	LOM (Official Laboratory José María de Madariaga) On behalf of: AENOR (Spanish Association for Standardization and Certification) Mr Carlos Fernández Ramón (Managing Director) C/ Eric Kandel, 1 (Tecnogetafe) 28906 Getafe (Madrid) Spain	Tel: + 34 91 442 13 66 Fax: + 34 91 441 99 33
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APPENDIX C: Standards

The standards relevant to the technical requirements of Explosion Protected Electrical Equipment (EEHA) under the IECEx and ANZEx schemes are as follow, please NOTE: the Prefix “IEC” is replaced with “AS/NZS” for the ANZEx equivalent:

IEC 60079-0 Part 0: Equipment - General requirements (GAS)
IEC 60079-1 Part 1: Equipment protection by flameproof enclosures 'd'
IEC 60079-2 Part 2: Equipment protection by pressurized enclosures 'p'
IEC 60079-5 Part 5: Equipment protection by powder filling 'q'
IEC 60079-6 Part 6: Equipment protection by oil immersion 'o'
IEC 60079-7 Part 7: Equipment protection by increased safety 'e'
IEC 60079-13 Part 13:Equipment protection by pressurised room
IEC 60079-11 Part 11: Equipment protection by intrinsic safety 'i'
IEC 60079-15 Part 15:Construction, test and marking of type of protection "n" electrical apparatus
IEC 60079-18 Part 18: Construction, test and marking of type of protection encapsulation "m" electrical apparatus
IEC 60079.-19 Explosive Atmospheres Part 19: Equipment repair, overhaul and reclamation
AS/NZS 3800:xxxx Electrical equipment for explosive atmospheres - Overhaul and Repair
AS/NZS 4761 Competencies for working with electrical equipment for hazardous areas (EEHA)
4761.1 Part 1: Competency Standards 4761.2 Part 2 Guide to assessing competency
IEC 60079-25 Part 25: Intrinsically safe systems
IEC 60079-26 Part 26: Equipment with equipment protection level (EPL) Ga
IEC 60079-27 Part 27: Field bus intrinsically safe concept (FISCO)
IEC 60079-31 Part 31: Equipment dust ignition protection by enclosure "t"
IEC 60079-35-1 Part 35-1: Cap lights for use in mines susceptible to firedamp - General requirements - Construction and testing in relation to the risk of explosion
AS/NZS 3800:1997 Electrical equipment for explosive atmospheres - Overhaul and repair
IEC 61241-0 Part 0: General requirements (DUST)
IEC 61241-1 Part 1: Protection by enclosures 'tD'
IEC 61241-1-1 Part 1-1: Electrical apparatus protected by enclosures and surface temperature limitation - Section 1 - Specification for apparatus
IEC 61241-4 Part 4: Protection by enclosures "tD"
IEC 61241-11 Part 11: Protection by intrinsic safety 'iD'
IEC 61241-18 Part 18: Protection by encapsulation "mD"
IEC 62013-1 Cap lights for use in mines susceptible to firedamp - Part 1: General requirements - Construction and testing in relation to the risk of explosion

APPENDIX D: Regulatory Authorities

NSW

Workcover	www.workcover.nsw.gov.au/health-and-safety/manage-workplace-safety/your-responsibilities
Department Trade and Investment; Division of Resources and Energy	www.resourcesandenergy.nsw.gov.au/
NSW Fair Trading	www.fairtrading.nsw.gov.au

VIC

Worksafe	www.worksafe.vic.gov.au
Energy Safe Victoria	www.esv.vic.gov.au

QLD

WorkCover QLD	https://www.worksafe.qld.gov.au/
QLD Electrical Safety Office	www.eso.qld.gov.au
QLD Department of Mines and Energy	www.dme.qld.gov.au

TAS

Workcover	www.workcover.tas.gov.au
TAS Department of Justice	www.justice.tas.gov.au

SA

SA Office of the Technical Regulator	www.technicalregulator.sa.gov.au
SafeWork	www.safework.sa.gov.au
SA Office of Consumer & Business	www.ocba.sa.gov.au

WA

Energy Safety WA	www.energysafety.wa.gov.au
Workcover	www.workcover.wa.gov.au

NT

WorkSafe	www.worksafe.nt.gov.au

ACT

WorkSafe	www.worksafe.act.gov.au

The National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA)

NOPSEMA is a Commonwealth statutory agency regulating the health and safety, structural integrity, and environmental management of all offshore petroleum facilities in Commonwealth waters, and in coastal waters where state powers have been conferred.

Contact details: www.nopsema.gov.au

APPENDIX E: Old Standards and Certificates

Equipment which was compliant at the time of purchase by the end user is allowed to continue in service without a time limit. Vendors however are not allowed to sell new equipment as compliant after the expiry of the original certificate. Older AUSEx certificates were issued with an expiry date newer IECEx and ANZEx certificates do not have expiry dates as they are subject to ongoing quality audits by the standards body.

The original AUSEx standards we not required to have ongoing quality audits.

Similarly where the rules change, e.g. the requirement for intrinsically safe equipment to be dust rated with a "D" suffix; the original equipment if purchased prior to the change in rules is allowable indefinitely subject to changes in the site hazard or another external factors but new equipment with the now incorrect marking and certification cannot be used, even if it is the same model without a comprehensive risk assessment..

AS/NZS 2381.1:2005
Electrical equipment for explosive gas atmospheres - Selection, installation and maintenance - General requirements with amendments through to 2007 was replaced by AS/NZS60079.14.

AS 2381.7-1989
Electrical equipment for explosive atmospheres - Selection, installation and maintenance - Intrinsic safety was first issued in 1980 as part of a series of Standards on explosion-protection techniques and was based on IEC 60079-0. The third edition of AS 2380.1, published in 1989, is similar to the corresponding requirements contained in AS/NZS 60079.0 and AS/NZS60079.14 and from there on Australia totally adopted the IEC equivalent standard.

Some other standards which might be found in the system, all replaced now with the IECEx scheme standards.

- Ex s (Special Protection) Apparatus Standards: AS/NZS 1826(Int) and AS 1076.8
- Ex d (Flameproof)Apparatus Standard AS 2380.2 Installation Standards AS/NZS 2381.2 Electrical equipment for explosive atmospheres - Selection, installation and maintenance - Flameproof enclosure 'd'
- Ex e (Increased Safety)Apparatus Standards AS 2380.6 Installation Standards AS2381.6
- Ex p (Pressurisation)-when installed to Zone 1 requirements apparatus Standard AS2380.4
- Ex v (Ventilation. Apparatus Standards AS 1482
- Ex n (Non-incendive) Apparatus Standard AS1076.7

AS/NZS 2430.X series standards were the predecessors of the hazardous area classification standards AS/NZS60079.10.1 (GAS) and AS/NZS60079.10.2 (DUST).

APPENDIX F: Frequently Asked Questions (FAQ's)

Intrinsic Safety

QUESTION: What does "I.S." or "intrinsically safe" mean in terms of a description for electrical equipment?

Answer:

Intrinsic safety "Ex i" is one of a number of a hazardous area protection techniques. Not all equipment uses this technique.

It is a protection method based on the restriction of electrical energy within the device (apparatus) and of any interconnecting wiring to a level below that which can cause ignition by either sparking or heating effects.

Equipment using this technique is "intrinsically safe" in the true definition of the phrase, i.e. It is safe under any specified condition because it does NOT have enough energy or heating effect to ignite the gas or dust (Ex ia/b/cD) even under fault conditions.

Zones

QUESTION: What is the difference between the zones in the Australian hazardous area classification system?

Answer:

Zone 0:an area in which an explosive gas atmosphere is present continuously or is present for long periods.

Zone 1:an area in which an explosive gas atmosphere is likely to occur periodically in normal operation.

Zone 2:an area in which an explosive gas atmosphere is not likely to occur in normal operation and if it does occur it will exist for a short period only.

Zone 20: An area in which combustible dust, as a cloud, is present continuously or frequently, during normal operation, in sufficient quantity to be capable of producing an explosive concentration of combustible dust mixed with air, and/or where layers of dust of uncontrollable and excessive thickness can be formed.

Zone 21: An area in which combustible dust, as a cloud, is likely to occur during normal operation, in sufficient quantities to be capable of producing an explosive concentration of combustible dust mixed with air.

Zone 22: Areas in which combustible dust clouds may occur infrequently, and persist for only a short period, or in which accumulations or layers of combustible dust may be present under abnormal conditions and give rise to combustible mixtures of dust in air.

QUESTION: How big are the actual hazardous areas?

Answer:

Sometime quite small 1-2 metres but for ease of management a site owner and those defining the hazard often include whole areas. Typically inside of building where the gas or dust is contained will be given a "blanket" allocation. If in doubt ask the site owner.

US Equipment Label (Marking)

QUESTION: The certified versions of the portable radios I wish to use are described as being:

"Intrinsically Safe for Class I, II, III Division 1, Groups C, D, E, F, and G hazardous (classified) locations and suitable for Class I, Division 2, Groups A, B, C and D hazardous (classified) locations. Temperature "T" rating T3C."

What does this actually mean?

Answer: Intrinsic safety is the technique applied to protect the device (apparatus)

Division 1 (in the US NEC 500 scheme) is similar in definition to IECEx/ANZEx Zone 0 and Zone 1.

Under the Australian scheme however Zone 0 carries a few more conditions. Therefore it can only be considered as comparable to Zone 1 (subject to a more detailed specific assessment of the product/s and hazard/s).

Class I – GAS, Class II – DUST, Class III – FLYINGS. The handset therefore is suitable for all US defined "Classes" or in Australian terms: Gas and Dust (but not underground mining).

Group C, Ethylene (Australian Group IIB) Group D, Propane (Australian Group IIA), Group E, Metal Dusts (Australian Group IIIC), Group F, Carbonaceous Dusts and Group G, Combustible Dusts. Note Group F and G are not related to the Australian dust grouping system which is based on electrical conductivity.

US NEC 500 Temperature class T3C is 160°C which is a lower (better) surface temperature than our Australian T3 temperature rating of 200°C in the IECEx and ANZEx schemes.

- **This equates to Zone 1 IIB T3 and Zone 2 IIC T3 (T3 is worst case) in the ANZEx and IECEx schemes.**

And in Division 2 (Zone 2) it is tested as safe in NEC Groups A and B (Acetylene and Hydrogen)

- **This equates to Zone 2 IIC T160°C in the IECEx and ANZEx schemes.**

This is only for comparison purposes it cannot be put into service in Australia without a formal conformity assessment provided by a competent hazardous area assessor.

NOTE: The NEC 500 system allows different gas and dust groups in each Zone (Division) whereas IECEx and ANZEx do not.

IECEX/ANZEx Marking/Labelling

QUESTION: How can I identify whether the device is certified?

Answer:

The equipment label called the marking MUST include the following:

- name of the manufacturer or his registered trade mark;
- manufacturer's type identification;
- serial number, except for connection accessories and very small electrical equipment on which there is limited space;
- the name or mark of the certificate issuer and the certificate reference in the following form: the last two figures of the year of the certificate followed by a "." followed by a unique four character reference for the certificate in that year;
- If there are specific conditions of use, the symbol "X" shall be placed after the certificate reference. An advisory marking may appear on the equipment as an alternative to the requirement for the "X" marking;
- Check IECEx certificates at www.iecex.com and ANZEx at www.anzex.com.au

Label and Certificate not the same?

The label on the FM approved radio states it is only suitable for Division 1 whereas the certificate says Division 2 as well, is this right?

Answer: YES

In the Australian system under IECEx or ANZEx the marking (i.e. label) on the product must show the exact details of the protection levels applicable (as well as other info, see "Marking" Page26) with some minor exemptions where the label is not sufficiently large enough to show all of the details. The US and Canadian NEC 500 system allows the description to be abbreviated.

IMPORTANT that you check and be sure that the certified device is the one actually on the certificates; this means the part number MUST be completely itemised in the certificate, not a "close enough" number or a digit different, it MUST be exactly as shown on the compliance papers or it is NOT certified (regardless of what the vendor or manufacturer says). If it has been added after the original certificate has been issued then there WILL be a document from the certifying body proving that.

Fixed Radio System Equipment

QUESTION: Do base stations and other fixed equipment need hazardous area compliance?

Answer: Only if they are installed in a hazardous area (This is unlikely and would be highly unusual).

Typically mains powered equipment is not installed in hazardous areas unless it is absolutely necessary, e.g. with motors driving pumps necessary to the operation of the plant and where location is not flexible. The cost of certifying these electrically high powered devices is very high and requires specialised techniques (generally not including intrinsic safety). Similarly with battery chargers; rarely will you find mains power outlets in hazardous areas and if so they are strictly controlled. Charging is limited to being done in NON hazardous areas such as plant room and security gate houses.

It is possible that the building will be certified using some form or protection (ventilation or pressurisation are common) and this will make the interior a NON hazardous area.

The site owner should be able to define safe areas for installation of non-certified equipment, if in doubt refer to the site hazardous area classification drawings.

Change Batteries on Portable Equipment

QUESTION: Can I change batteries in a hazardous environment?

Answer: Generally NO.

It is common for the "Special Conditions" on the certificate to include a statement like" Batteries must not be removed or charged in hazardous areas" If in doubt then NO.

Engrave or label equipment

QUESTION: Can I engrave the housing of a portable device with serial number or plant details?

Answer: No.

Impact testing is a mandatory part of the compliance testing for all equipment. The housing, if made of nonconductive materials (e.g. plastics of whatever form) must meet the defined requirements for such enclosures and altering the characteristics in any way (static charge build up, surface area, impact resistance) may compromise this testing. It is normally acceptable to have a glued plastic label less than 50mm x 50mm (for a Group IIB Environment) attached to the handset. Refer: AS/NZS60079.0 Table 6 for more info.

Similarly PAINTING of the handsets is not acceptable as it may compromise the electrostatic discharge characteristics of the enclosure.

Regular Inspections

QUESTION: Do portable radios and similar portable equipment need regular re-inspection?

Answer: YES

The Applicable standard AS/NZS60079.17 states:

"Clause 4.4.3 Moveable equipment

Movable electrical equipment (hand-held, portable, and transportable) is particularly prone to damage or misuse and therefore the interval between periodic inspections may need to be reduced. Movable electrical equipment shall be submitted to a close inspection at least every 12 months. Enclosures which are frequently opened (such as battery housings) shall be given a detailed inspection at least every 6 months. In addition, the equipment shall be visually checked by the user, before use, to ensure that the equipment is not obviously damaged."

Experience though indicates that annual inspections are most common and they appear adequate for most sites.

Foreign Certified Equipment

QUESTION: If the equipment is certified to a foreign standard does it need to meet the Australian requirements for inspections?

Answer: YES

A Conformity Assessment allowing use of foreign standard equipment is simply an assessment of the foreign standard against the Australian compliance rules; it is not an exemption for any of the normal operating safety requirements.

QUESTION: Is it Illegal to Supply Foreign Certified Equipment?

Answer: NO providing as you do not supply product that is unsafe or unfit for the purpose intended.

Approval for Foreign Equipment, site specific

QUESTION: Can I use a Conformity Assessment Document (CAD) or Letter of No Objection from a regulatory body to use the equipment on similar hazardous site?

Answer: NO

Conformity assessments compare the product certification to the Australian regulations in term of the identified risk on that specific site. CAD's (and letters of no objection) are site and product specific. Approval for use on one site has no relevance and is invalid on another site even if the hazards are same or similar.

Repairers and Inspectors

QUESTION: Do repairers need to be qualified as inspectors?

Answer: NO.

Under AS/NZS3800 the repairer is qualified to inspect for return to service and will provide documentation to that effect. If the equipment is foreign certified it will need to be re-inspected prior to being returned to service.

Servicing and Repair

QUESTION: Who can service hazardous area equipment?

Answer:

Australian and IECEx certified equipment must be serviced by workshops suitable qualified and certified to AS/NZS3800. IECEx certified equipment must be serviced and repaired under IECEX rules as defined in IEC60079.19.

Foreign certified equipment must be serviced/repaired in accordance with the rules applied by the foreign certifying body or if it can be achieved by use of an AS/NZS3800 approved workshop. Note that most manufacturers will not provide sufficient service and repair data for 3rd party repairers to meet the demands of the standard.

FM Approvals have a mandatory requirement for workshops servicing and repairing FM Approved communications equipment. The Standard is described as "Class Number 3605" and the workshop/s is/are subject to external audit as with the ANZEx scheme. See below:

The FM 3600 standard is quoted as below:

1.1 Purpose

This standard serves as the basis for FM Approval of independently owned facilities that repair FM Approved communication equipment for hazardous (classified) locations.

1.2 Scope

This standard does not apply:

- *when modifications are made to the equipment;*
- *when an FM Approval label is applied to equipment not shipped from the original manufacturer as FM Approved;*
- *to repairs made by facilities owned by the original manufacturer.*

The manufacturer's repair facilities are covered by the Approval Agreement for the listed product. That Agreement requires the manufacturer to provide adequate facilities for repair of the listed product.

- *Items not considered as repairs are those in which an action is performed on a unit which does not require the outer casing of the unit to be opened in a manner which exposes the internal electrical circuits of the unit. The following is a partial list of examples which are not considered to be repairs:*
- *replacement of an antenna,*
- *changing an external accessory,*
- *changing/replacement of a battery pack,*
- *software loaded into the unit,*
- *a control knob,*
- *escutcheon, or,*
- *belt clip"*

Damaged Equipment

QUESTION: What should a user of say a handset that is physically damaged do?

Answer:

Any certified hazardous area equipment showing signs of damage must be immediately removed from the hazardous environment and not returned to service until after repairs and re-inspection are carried out.

It does not need an inspector to identify broken housings, display screens, battery assemblies or antenna. If its damaged it's not safe and must be removed from service.

Inspectors

QUESTION: Who can inspect hazardous area equipment?

Answer:

Only those persons deemed competent under the rules of AS/NZS60079.17 and tested against the competencies listed in AS/NZS4761.

Radio Transmission, Ignition?

QUESTION: Can Radio transmissions ignite hazardous materials?

Answer: The standards define the maximum RF parameters as follows:

From AS/NZS60079.0 Clause 6.6.1 Radio frequency sources

Quote "The threshold power of radio frequency (9 kHz to 60 GHz) for continuous transmissions and for pulsed transmissions whose pulse durations exceed the thermal initiation time shall not exceed the values shown in Table 4. Programmable or software control intended for setting by the user shall not be permitted." Unquote

Radio frequency power thresholds

Gas Group	Power in Watts	Thermal Initiation Time
Group1 (Mining)	6.0W	200µSecs
Group IIA (Propane)	6.0W	100 µSecs
Group IIB (Ethylene)	3.5W	80 µSecs
Group IIC (Hydrogen)	2.0W	20 µSecs
Group III (Dust)	6.0W	200 µSecs

Device (Apparatus) Certificate with a "U" Suffix

QUESTION: I have a device with a certificate with a "U" Suffix, can I use it?

Answer: NO.

An Ex component certificate, identified by the symbol "U" suffix to the certificate number is for parts of equipment that are incomplete and require further evaluation prior to incorporation in Ex equipment. It is NOT a fully certified device.

Device (Apparatus) Certificate with an "X" Suffix

QUESTION: I have a device with a certificate with a "X" Suffix, can I use it?

Answer: YES.

The "X" indicates "special conditions" which will be identified on the certificate of compliance, if you meet the "Special conditions" and the apparatus is suitable in all other aspect then YES you can use it. "X" suffix is common on portable equipment, e.g. conditions may include mandatory use of leather carry cases or define where a device can be charged, Read the conditions and follow them, they are NOT negotiable.

Power Limitation on Radios

QUESTION: I've heard that IECEx radios must be limited to 1 watt. Is this true?

Answer: NO.

This is not a specific factor in the compliance and if this condition is relevant to the handset/s you are using then it will either be dictated by the model number or a special condition on the certificate.

A lot of products are limited to this power output level but the limitation is the result of other tested parameters. If the handset uses excessive power which may cause ignition (power=heat=ignition) at higher output level then it may be necessary to limit the device to meet the other parameters in testing.

Let's assume a highly efficient radio can transmit at say 3 watts and a less efficient radio uses the same source power to generate 1 watt then the lesser efficient handset may well be controlled to the lower output power as part of its technical requirement to meet the testing parameters.

FM approved equipment has often higher RF output level than IECEx and ATEX (European) certification because FM has different source power levels for the same level of protection.

This in one of the reasons why a detailed conformity assessment is needed. The standards are simply not the same.

Site Examples

NOTE: PLEASE TREAT THIS WITH CAUTION. Site rules override general assumptions; the site owner has the right to vary these classifications. Do not assume this is correct for the specific site on which you are working. Some sites have chemicals used in the process which may well exceed the explosivity levels of the end product they produce.

Do not underestimate the dangers of explosive dusts.

Assessment should always be done in reference to the customer's site specific hazardous area classification drawings or at a minimum ask the customer or refer to an EEHA Assessor.

The Australian (and IEC) standard for defining specific ignition factors for all chemicals is AS/NZS 60079.20.1:2012 or IEC 60079-20-1, Ed. 1.0 (2010)Explosive atmospheres Part 20.1: Material characteristics for gas and vapour classification—Test methods and data.

Fuel terminal that handles petroleum fuels only (including petrol and diesel) will normally be IIA T3, BUT for various reasons which we cannot argue some fuel operators demand IIB T3, their choice. Ask the customer,

LNG plant of storage is typically Propane IIA T2 with a minimum ignition temp of 450C

Airport refuelling operations including JET A1 and Avgas, usually IIA T3.

Grain Processing for oils such as canola and biodiesel usually (not always) uses Hexane at IIA T3.

Crude oil refining, ask, if a refinery in this country doesn't have a clear definition of its risks it won't have a licence to operate.

Mistakes

Example Carbonyl Sulphide is IIA T3 is NOT the same Carbon Disulfide is IIC T6

Carbon disulphide has an auto ignition temp of 90°C and a spark ignition level of 9 mJoules.

Carbonyl sulphide has an auto ignition temperature of 209°C and a spark ignition level of 260 mJoules.

Typical Drawings

The following drawings are for reference only and specific conditions relating to unique sites, vehicles or machinery have not been taken into account. The drawings are conceptual only provide an indication of what a typical hazard might look like. The second two (2) drawings are copied from the old (now replaced) Australian standards AS/NZS 2430.3.3.2:2004 and AS/NZS 2430.3.3:2004.

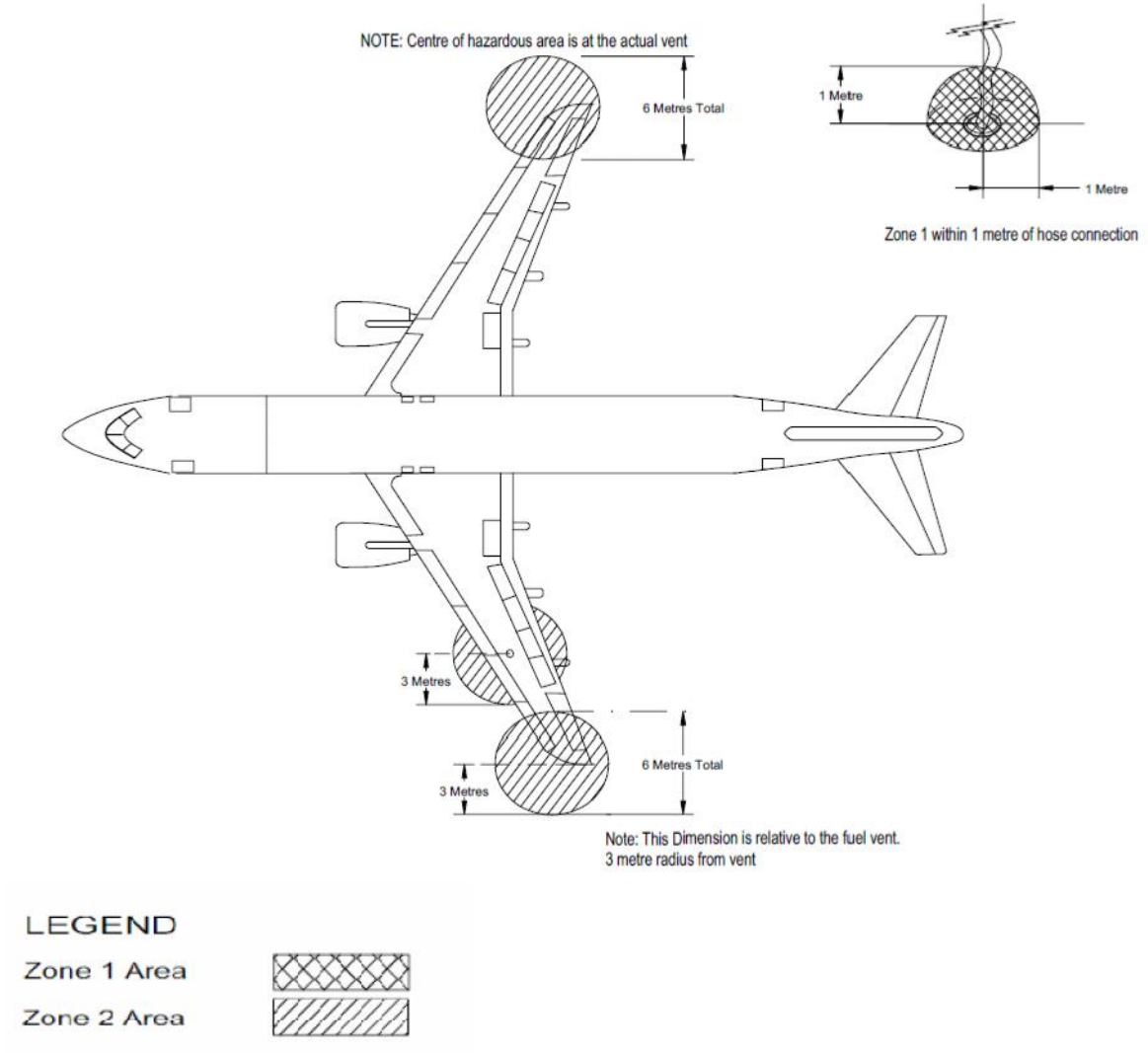

Figure 4: Typical Plan View of Aircraft Re-Fuelling Operation

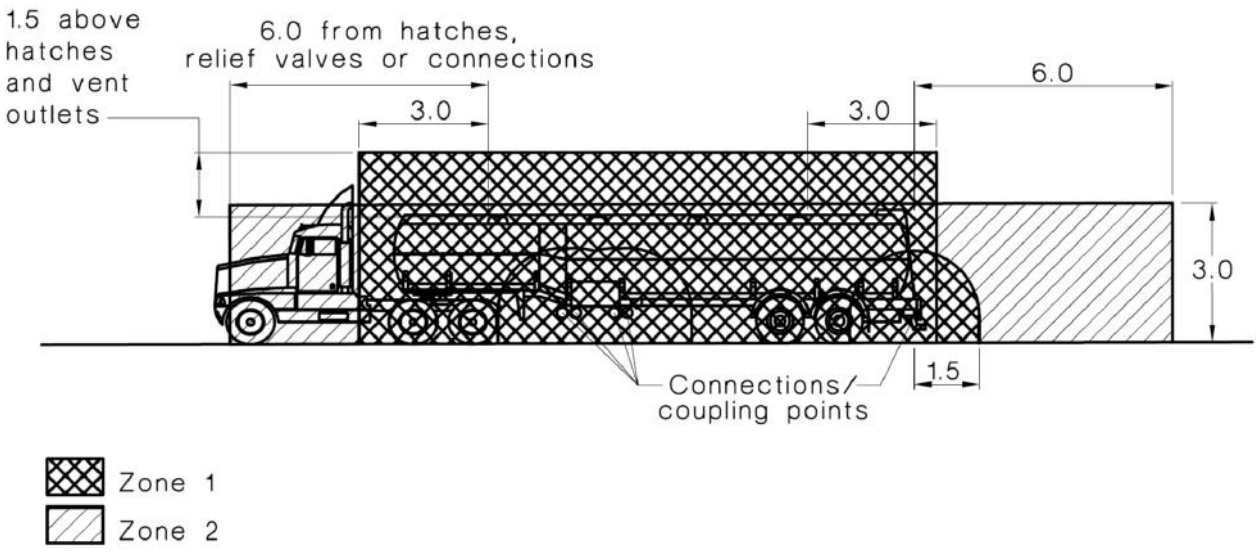

Figure 5: Road or Rail Tanker Loading Without Vapour Recovery (Example ONLY)

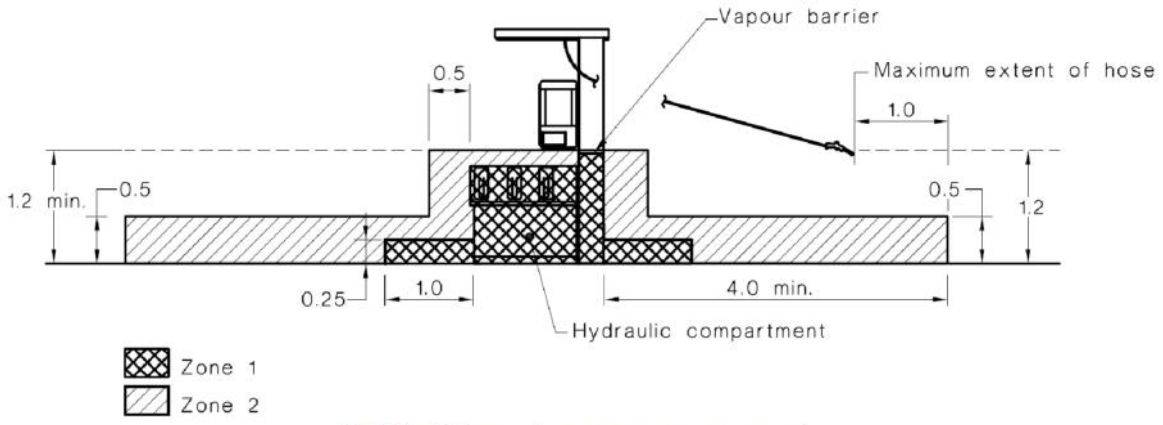

Figure 6: Exterior of Fuel Dispensing unit in Adequately Ventilated Area (Example ONLY)

Where do you find EEHA Assessors?

Most clients already have established relationships with an EEHA assessor. This is the best option; he/she should already know the site rules and hazards and much time and money will be saved by utilising this expertise and experience.

Some small sites will have no established assessor relationship, many are new to the regulations and most commonly companies who preferred to limit their involvement in this area are now forced to act as the regulatory system becomes more onerous. Many site owners are wary of having a new assessor/inspector on site in fear that he/she might find some major works needs immediate and expensive attention. Some consider the assessor may take problem to WorkCover, this would rarely happen unless a disaster was imminent in which case it would be their best option anyway. Assessors make a living out of fixing problems not reporting clients to regulatory authorities.

The internet will provide names and contacts. The controlling factor is whether the assessor has the correct qualifications as prescribed in AS/NZS 4761.1:2008 “Competencies for working with electrical equipment for hazardous areas (EEHA) - Competency Standards“.

Any people who have the competences prescribed AS/NZS4761: can do the work. Most electricians working in hazardous areas can do inspections. Most however limit themselves to doing installation of electrical equipment and have limited exposure to portable equipment.

Most electricians working in hazardous areas have some of the competencies necessary to advise you whether you are using the correct equipment.

The following was obtained from the web and this is not a recommendation only a guide as to who advertise suitable services:

DCA Extech
PO Box 605 Albury, NSW 2640 - Mobile: 0407 254 975 Fax: 0260 210208

Explosion Protection Technology
8 Kirkfell Court, Berwick,VIC 3806 - Tel/Fax: 0397073110

E-x Solutions International Pty Ltd
PO Box 2010, Forest Hill VIC 3131Tel: 0882702177 - Mobile 0433 232 013

Texeco
Address: Unit 20 / 87 McLarty Ave, Joondalup WA6027 - Phone: 08 9409 1130, Mobile: 0438 000 512

Also most large electrical contracting companies have EEHA assessors either on staff or as regular contractors including Downers, Electrical Design and Construction (EDC), Sage Consulting, Consoft Automation.

History

The author was originally trained as a radio technician with the Defence Department, later moving into sales roles in number of major two-way radio companies.

The late 1980's brought about a demand for major upgrades to most of the Australian oil refineries and the author's technical background and supply knowledge of the radio communications industry afforded opportunities to become a part of this exciting work. While most of us involved did not recognise this at the time, this was to be the last of major investment in oil refining in Australia. SE Asia very quickly dominated the downstream supply of petroleum products in the 1990's and the high operating costs and environmental constraints here in Australia made the domestic industry less and less viable.

However the late 1980's was a boom time and a lucrative contract as a communications consultant with Caltex Refining Australia in Australia and then the Sydney Petroleum Pipeline, led to over a decade of small contracts on the same type with Shell Refining at Clyde and Geelong. The most exciting part was overseas contracts in the USA, with Caltex Services Corporation as a consultant on the Star Petroleum Refining Project in Thailand and an upgrade of an old refinery at Betangas in the Philippines. Little did we know but we were building and upgrading some of the refineries which would ultimately displace the Australian refineries.

Ultimately reductions in refinery work led to opportunities in equipment design and proudly the development of the first certified intrinsically safe mobile telephone in 2004. This led to a career change; since then have been active in design of various certified apparatus. This work still continues today.

Part of the process needed to fully understand the design requirements for intrinsically safe equipment led to completion of the EEHA inspection course through NSW TAFE in 2004. This education process is continuing as it must do in the fast moving world of electronics. Currently I have enrolled to upgrade my qualifications to gain the latest required competencies for conformity assessment of foreign certified equipment for both gas and dust environments.

The document was prepared by Gary Devlin, DCA-Extech.

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