

Session 9:
**Training Competencies for Electrical Equipment in
Hazardous Areas**

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Introduction

Within industry, there is much confusion, as whether it is a requirement to have nationally accredited competencies for any electrical work carried out with Electrical Equipment in Hazardous Areas (EEHA).

The legislation in Western Australia calls up the Australian / New Zealand Standard 60079 series. AS/NZS Standard 60079-14 requires, anyone carrying out work in the areas of design, classification, installation, inspections and maintenance, be competent to the requirements of AS/NZS 4761:2008

Even though these standards clearly require certain competences to be able to carry out works in hazardous areas, there are many organisations that do not understand or don't care to have their personnel correctly trained to these standards. It is also a requirement to have awareness training for anyone (non electrical) who is working in the hazardous area.

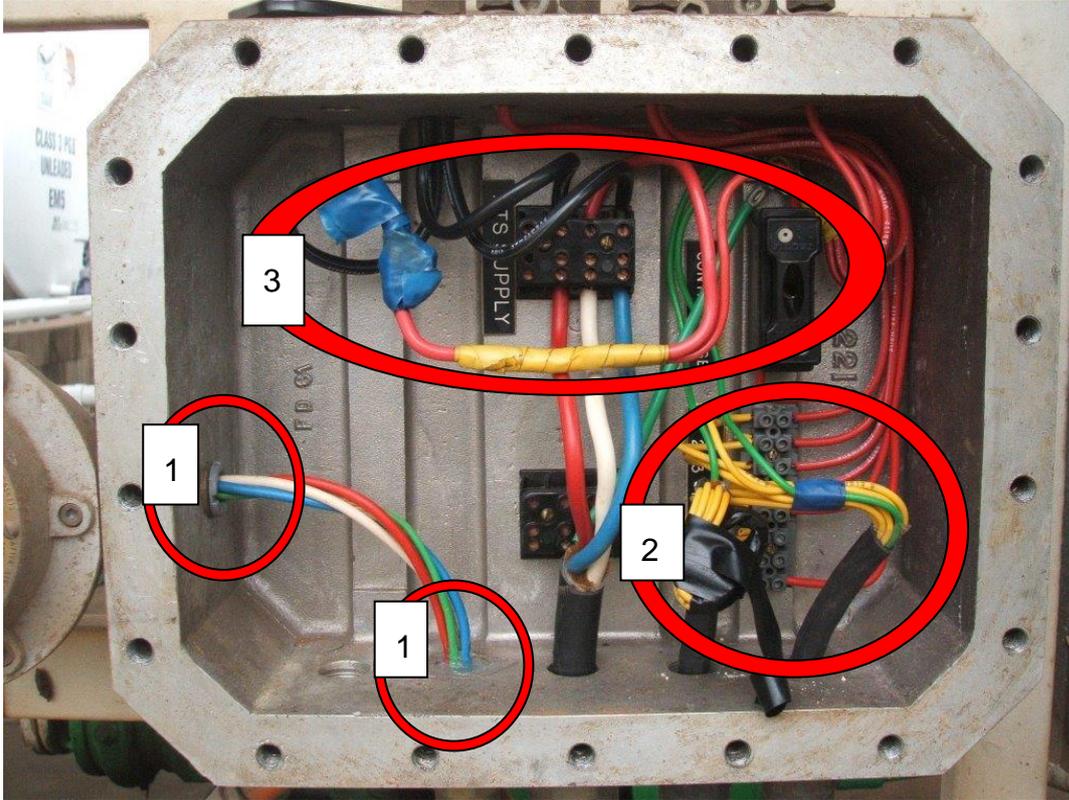
There is also the issue of just obtaining the minimum required competencies, as this is often not enough. Further mentoring and milestone achievements are often required before a person can truly be deemed competent to carry out work in these areas.

This presentation highlights the requirements for all training required and what training needs to be undertaken, to demonstrate competency in EEHA design, classification, installation, inspection and maintenance.

What can happen when Competencies are not to Standard

Incorrect Classification, Design, Maintenance, Installation and Workmanship can be costly and dangerous. Some examples are:

Installation and Maintenance



Incorrect installation and workmanship.

1. Incorrect cable entries.
2. Out of standard core colours.
3. Poor workmanship by use of insulation tape.

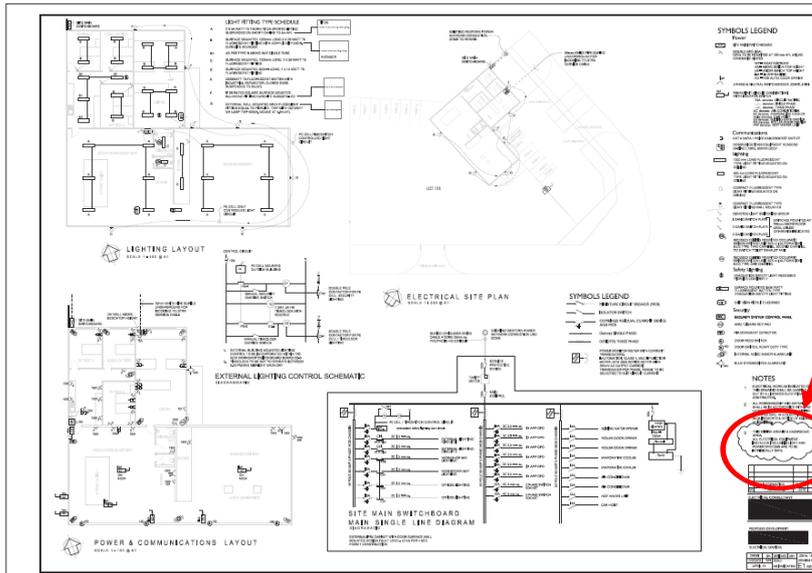
This installation also simple did not comply with the Wiring Rules (AS/NZS 3000)

Design and installation



In this case the correct Ex outlets were removed and replaced with standard IP 66 - 3 pin outlets

Classification and design



3 THIS ENTIRE AREA IS A HAZARDOUS AREA. ALL ELECTRICAL EQUIPMENT INSTALLED INCLUDING LIGHT AND POWER SYSTEMS ARE TO BE INTRINSICALLY SAFE

Having correct designs and classifications is a legal requirement. Poorly designed EEHA installations and the incorrect terminology will create a dangerous situation.

Why is EEHA Training Required?

The development of Competency Standards for electrical equipment for hazardous areas arose (in the mid nineties) from concern with the variability in skills of electrical workers and others dealing with this equipment. Although training was available, it was usually confined to the technical aspects and there was no national strategy to provide this specific training. The concern over competence was heightened by the trend away from prescriptive regulations towards performance-based regulations. The performance-based approach places the 'duty of care' responsibilities on enterprises and individuals which, in turn, is said to promote self-monitored quality assurance. This results in greater compliance with requirements than is the case with the inspectoral methods that accompany prescriptive regulations.

Since the early 1990s industries have expressed the need for a set of National Competency Standards to be used by any industry sector or enterprise, with regards to explosion protected equipment for hazardous areas.

To meet this need a set of National Competency Standards for Electrical Equipment in Hazardous Areas (EEHA) was developed in 1996 through the National Utilities and Electro-technology Industry Training Advisory Board

(NUEITAB) with support from the Australian National Training Authority (ANTA: now ASQA). Standards Australia was an active participant in the preparation of these Competency Standards, which were endorsed by ANTA in December 1996.

The Longford (Victoria) Explosion and Fire

Another contributor to the EEHA standards and training stems from the Longford disaster (Victoria Australia) in 1998. There are many lessons that can be learnt from Longford in regards to training.

As a result of the initial explosion and subsequent fire, the Longford plant was shut down immediately, and the state of Victoria was left without its primary gas supplier. Within days, the Victorian Energy Network Corporation shut down the state's entire gas supply. The resulting gas supply shortage was devastating to Victoria's economy, crippling industry and the commercial sector (in particular, the hospitality industry which relied on natural gas for cooking). Loss to industry during the crisis was estimated at around A\$1.3 billion.

A Royal Commission was called into the explosion and fire at Longford. The Commission sat for 53 days, commencing with a preliminary hearing on 12 November 1998 and concluding with a closing address by Counsel Assisting the Royal Commission on 15 April 1999.

Esso blamed the accident on worker negligence, in particular one of the panel workers on duty on the day of the explosion.

The findings of the Royal Commission, however, cleared the workers of any negligence or wrongdoing. Instead, the Commission found Esso fully responsible for the accident:

The causes of the accident on 25 September 1998 amounted to a failure to provide and maintain so far as practicable a working environment that was safe and without risks to health. This constituted a breach or breaches of Section 21 of the Occupational Health and Safety Act 1985.

Other findings of the Royal Commission included:

- the Longford plant was poorly designed, and made isolation of dangerous vapours and materials very difficult;
- **inadequate training of personnel in normal operating procedures of a hazardous process;**
- excessive alarm and warning systems had caused workers to become de-sensitised to possible hazardous occurrences;
- the relocation of plant engineers to Melbourne had reduced the quality of supervision at the plant;
- poor communication between shifts meant that the pump shutdown was not communicated to the following shift.

This particular incident does highlight critical aspects of employers' duties: Most of the OH&S Acts state that "*employees must take reasonable care of their own health and safety and of others who may be affected by their actions*". This is a very general statement which is often misunderstood and **should not be confused** with a tendency to blame workers for accidents and injuries that could have been prevented by better workplace training, design and practices.

What is the legal requirement for training in Western Australia?

The Electrical (Licencing) Regulations 1991 Clause 49.1 refers to Schedule 2 which designates the AS/NZS 60079 -10.1 & AS/NZS 60079 - 14 standards as mandatory requirements.

AS/NZS 60079-14 states:

4.4 **Competency** ~~Qualifications of personnel~~

The design of the installation, the selection of equipment and the erection covered by this Standard shall be carried out only by persons whose training has included instruction on the various types of protection and installation practices, relevant rules and regulations and on the general principles of area classification. The competency of the person shall be relevant to the type of work to be undertaken ~~(see Annex F).~~

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

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

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

E-Oz has recently advised that:

- EEHA courses MUST be delivered by a Registered Training Organisation, and
- A Statement of Attainment for the relevant EEHA must be held by the Competent Person carrying out any works in electrical:
 - Classification and Design
 - Installation
 - Maintenance and Inspections

How is Competency in EEHA Determined?

The main training system for EEHA training is Competency Based Training and Assessment (CBT&A), where the candidate demonstrates their ability by way of theoretical and practical assessments. There is no pass or fail in CBT&A, the success is based on finally (sometimes after a number of attempts) correctly answering a question and/or successfully completing a practical task. On completion of this EEHA training, people are considered to be competent when they are able to apply their knowledge and skills to successfully complete the selected work activities.

CBT&A is currently the basis for accurately determining and measuring the ability of a candidate to carry out a specific task. National training packages and CBT&A have become the mandated framework of course delivery in Australia's education and training systems. CBT&A also forms the basis for the determination of achievement of units of competency. It is imperative, when carrying out CBT&A a number of requirements must be met, to ensure accuracy; consistency and fairness for all candidates.

In constructing units of competency, the assessments and training need to contain process of collecting evidence and making judgments on whether the required level competency has been achieved. To establish whether key competencies have actually been achieved can be a very complex and involved process. Competency Based Training and Assessment (CBT&A) must be explicit and provide measurable standards of performance which actually reflect the expectations in a work role.

Adequate time must be allowed to carry out the initial training and to let the candidate carry out the assessment in a comfortable stress free and quiet environment. Either sufficient time must be allowed to carry out the required CBT & A process or the assessment instrument needs to be designed to work well within the allotted time.

For a person to be deemed competent, within CBT &A, they must be able to demonstrate the ability to successfully complete a task with absolutely no errors in the process. The assessment process needs to collect evidence which is clear, current and from the person attaining the competency. Adequate time must be allowed for a candidate to successfully complete the assessment without being under pressure. Verbal and written feedback should occur and be conducted with the assessor and candidate in a comfortable environment.

To achieve competency, there are a number of requirements which are critical within the process of CBT & A and must be included in the total learning and assessment strategy. By not including all critical aspects within the training assessment process, it can jeopardise the assessor's ability to gather correct evidence and therefore affect judgments about the candidate.

CBT & A relies on assessors complying with the components of the unit of competency and the candidate's performance must meet these requirements so an assessor is able to say that the unit of competency has been met.

Other aspects of training to be considered

To be successful, training ideals need to be embedded into the company's mission statement and be supported by high level management to have any real effect. Often training is linked to KPI's and presented as an afterthought to patch holes in an already leaking ship.

Selection of the correct training organisation and the trainers are a critical aspect of success.

The training carried out for each person needs to be meticulously recorded (as part of a learning management system) as to what they have done and when refresher or additional training is recorded. The Learning Management System (LMS) must be kept up to date and managed by an experience person or external organization.

While the CBT&A process achieves a result, there are ongoing issues for this type of training and assessment:

- When a person is deemed competent, what level of competency was achieved?
- Is the person competent or highly competent?

After a candidate has successfully completed any training in the EEHA disciplines it cannot be assumed a person is ready to take on the full responsibilities of classification, design, installation, inspections and maintenance. It is considered by many, the follow on is almost an apprenticeship.

For this reason (aside for the requirements of legislation and standards), there is critical additional follow-up training / mentoring is required.

Follow up evaluation also needs to be considered so as to ensure maximum benefit is obtained from the training.

Mentoring

Where a participant who has completed an EEHA course and been deemed competent for the first time, the course content is often daunting and can be overwhelming.

After course instruction and **mentoring** from experienced personnel is often required. This needs to be considered to ensure a person who has achieved competency in an EEHA course develops a full understanding of the requirements.

When selecting people to be mentored they need to have certain qualities. These qualities can be effectively assessed for and are critical for the program success. Equally, the mentor also needs to be a person who is able to equip others with the required skills and fulfil their mentoring commitment.

To implement a successful mentoring program, the candidates need to be professionally assessed for their aptitude and the mentors must be properly trained to carry out their role.

Training Evaluation

Training is only effective if it produces results. When the desirable result is achieved this will improve individual performance, which in turn leads to improved organisational performance.

There are four areas in which training outcomes can be measured.

- Level One - Reaction: Did the trainee enjoy the learning experience?
- Level Two - Learning: Did the trainee achieve the learning outcomes?
- Level Three - Behaviour: Did the learning transfer? Did the trainee show improved on-the-job performance?
- Level Four - Results: Did this improved performance impact on the organisation's performance?

Evaluation is not the only factor. Other important issues, such as Return on Investment, need to be considered, for example; the cost of training or not training as compared to the loss of revenue (production) due to mistakes, fines for not complying with legislation and compensation for injuries due to accidents.

Evaluation is critical for any training success and can be carried out by suitably qualified persons.

In Summary

- Poor skills in the EEHA discipline can cause costly mistakes or have disastrous consequences (death and/or injury).
- In WA there is a legal requirement for the correct training.
- High level management support and understanding needs to exist.
- Training Management Systems need to be in place to ensure effective training systems are in place and accurate records are kept.
- To obtain the ideal results from training there needs to be a planned and systematic program in place.

The EEHA training system must be planned for, not done as an ad-hoc arrangement.

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The Situation

A spray painting booth 10 by 12 metres at a panel beating workshop requires fluorescent lighting (6 @ 2x36w)

An ethylene based spray paint is used in the spray painting booth during normal operation,

The spray painting booth has special paint drying heaters where the room is heated to 60°C immediately after painting

What critical information would you give to a supplier to determine which Ex type fluorescent light fitting can be used?

When they came back to you, would you select a fitting?

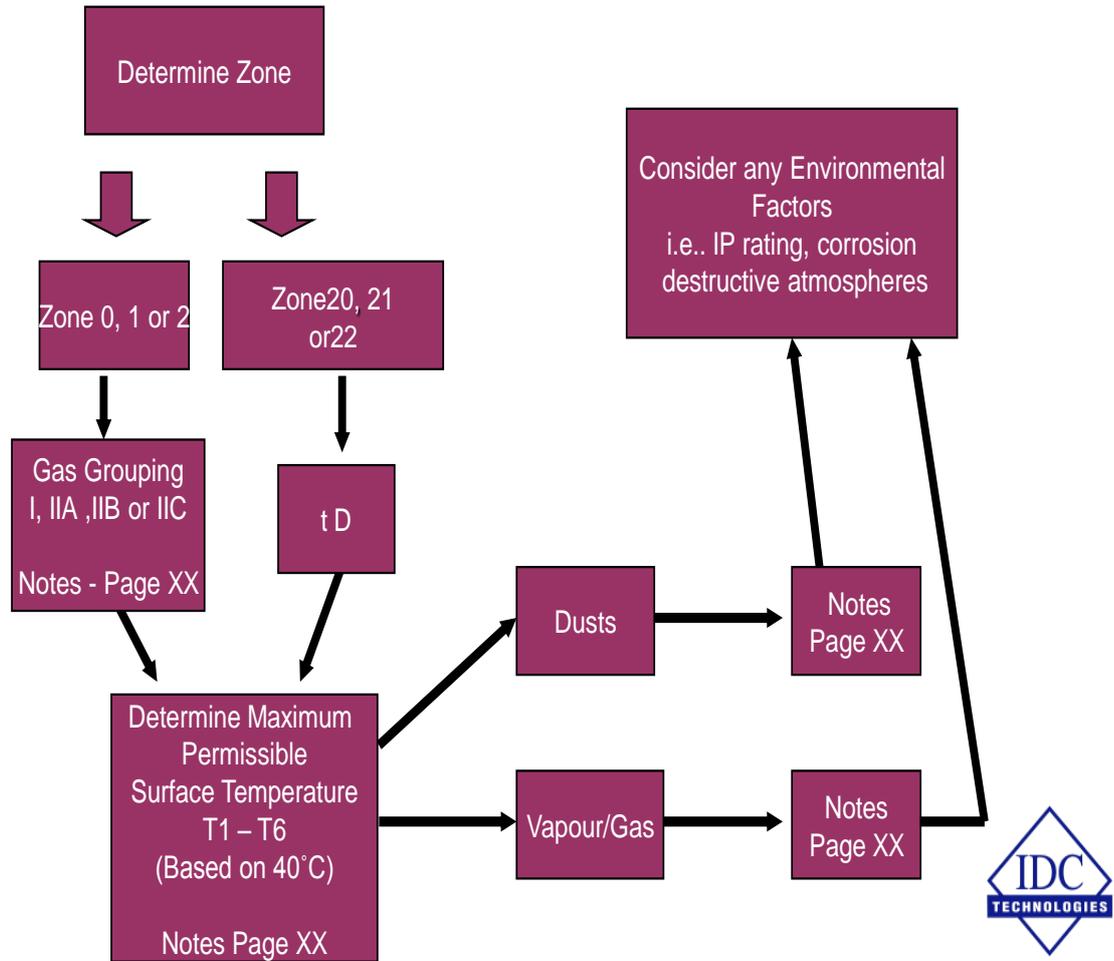
At \$ 800 – Ex e II Gb T3 IP 66

Or

At \$1800 – Ex d IIC Gb T3 IP 66



Activity



Material Properties for Some Common Gases and Liquids											
Material Name	Chemical Structure	Information Source	Rho Air =1	Flash Point	Boiling Temp. °C 1 ATM	Melting Temp. °C	Auto ignition Temp.	LEL %	UEL %	Material Group	T Rating
Hydrogen	H ₂	MSDS	0.07	GAS	-253	N/R	560	4.0	77	IIC	
Methane	CH ₄	MSDS	0.55	GAS	-162	N/R	600	4.4	17	IIA	
Ethylene	CH ₂ =CH ₂	MSDS	0.97	GAS	-104	N/R	440	2.3	36	IIB	
Benzene	C ₆ H ₆	MSDS	2.7	-11	80	6	498	1.2	8.6	IIA	
Ethanol	CH ₃ CH ₂ HO	MSDS	1.59	12	78	-114	400	3.1	19	IIB	
Ammonia	NH ₃	MSDS	0.59	GAS	-33	-78	630	15	33.6	IIA	
Acetylene	CH=CH	Standards	0.9	GAS	N/A	N/A	305	2.3	100	IIC	

Temperature class

Temperature Class required by area classification	Ignition temperature of Dust in °C	Allowable equipment temperature classes
T1	450	T1 - T6
T2	300	T2 - T6
T3	200	T3 - T6
T4	135	T4 - T6
T5	100	T5 - T6
T6	85	T6

Protection Technique Selection

Protection Technique	Australian Standard and designated symbol	Requirements
Zone 0 - Typically EPL Ga		
Intrinsic safety	AS/NZ 60079.11 Ex ia	Ex ia only
Encapsulated	AS/NZS 60079.18 Ex ma	
Special protection	AS 1826 Ex s	For Zone 0
Optical radiation	AS/NZS 60079.28	For Zone 0
Two independent Gb methods	AS/NZS 60079.26	
Zone 1- Typically EPL Gb		
Intrinsic safety (I.S)	AS/NZS 60079.11 Ex i	Ex ib
Field-bus I.S concept (FISCO)	AS/NZS 60079.27: 2008	
Special protection	AS 1826 Ex s	For Zone 1
Flameproof enclosure	AS/NZS 60079.1 Ex d	For Zone 1
Encapsulated	AS 2431 Ex m or AS/NZS 60079.18 Ex mb	For Zone 1
Pressurised enclosure	AS 2380.4 and AS/NZS 60079.2 Ex p	
Increased safety	AS/NZS 60079.7 Ex e	
Optical Radiation	AS/NZS 60079.28	For Zone 1
Ventilation	AS 1482 Ex v	For Zone 1
Powder Filling	AS/NZS 60079.5 Ex q	For Zone 1
Oil Immersion	AS/NZS 60079.6 Ex o	
Zone 2 - Typically EPL Gc		
Intrinsic safety/Energy limited	AS/NZ 60079.11 Ex i	Ex ic / Ex nL
Special protection	AS 1826 Ex s	For Zone 2
Non-sparking	AS 2380.9 Ex n and AS/NZS 60079.15	
Ventilation	AS 1482 Ex v	For Zone 2
Pressurised enclosure	AS/NZS 60079.2 Ex p	For Zone 2
Encapsulated	AS 2431 Ex m AS/NZS 60079.18 Ex mc	
Optical radiation	AS/NZS 60079.28	For Zone 2
Fieldbus non-incendive (FINCO)	AS/NZS 60079.27 FINCO	