



**INTERNATIONAL ELECTROTECHNICAL COMMISSION SCHEME FOR CERTIFICATION TO STANDARDS RELATING TO EQUIPMENT FOR USE IN EXPLOSIVE ATMOSPHERES (IECEx SCHEME)**

**Title: Draft Operational Document OD xxxD- Specification for Units of Competency Assessment Outcomes**

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**Circulation: IECEx Management Committee (ExMC)**

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**INTRODUCTION**

In line with the Report from WG 12 (ExMC/464/R) this draft Operational Document has been prepared by the ExMC Working Group WG 12 as proposed Specification for Units of Competency Assessment Outcomes as part of the IECEx Personnel Certification Program.

This draft is issued for consideration during the ExMC Paris October 2008 Meeting.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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**Draft IECEx OPERATIONAL DOCUMENT**

**IEC Scheme for Certification of  
Personnel Competency for Explosive Atmospheres –**

**Ex OD 0xxD Version 1 – draft 06**

**Title: Specification for Units of Competency Assessment Outcomes**

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This Draft Operational Document, prepared by the ExMC WG12 Committee, sets out the requirements for Competencies for working with electrical equipment for explosive atmospheres. This document is intended to support certification where competency is required, e.g. Repair & Overhaul Service Facilities, and may be considered for Certification of Persons undertaking the work in various aspects of explosive atmospheres where it may be advantageous to be certified.

The first draft accompanied the AU proposal for a new area of work within IECEx for discussion at the IEC ExMC meeting in Buxton. Following comments at the previous WG12 meeting the document has now been revised to make it simpler to follow and remove repeated information. Other material that has been forwarded earlier is included at the end of the document and may be considered for inclusion if felt appropriate.

At the Amsterdam and Paris meetings additional information was added as a result of some brief discussion. To facilitate discussions at the next meeting, it was vital that members study this draft prior and prepare input to the discussions for the WG12 meeting in Birmingham.

This draft is the result of discussions at the Birmingham meeting and is prepared for further detailed consideration by a smaller task team made up of wg12 members.

Document History

Date	Summary
2005 09	Original Issue (Version 1)
2007 06	Original Issue (Version 1 draft02) for WG12 meeting in Paris
2008 01	Original [revised] issue (Version 1 draft03) for WG12 meeting in Birmingham
2008 04	Original [revised] issue (Version 1 draft04) output of WG12 meeting in Birmingham
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## INTRODUCTION

The objective of this IECEx Operational Document is to set out the generic cross-industry competencies needed for work associated with electrical equipment for hazardous areas; these competencies are intended for use by any industry sector or enterprise with regards to explosion-protection related to the relevant functional areas.

The procedures, systems and methods of assessment as set out in this document are to be followed in assessing an application for competencies for carrying out work associated with Explosive Atmospheres and of Ex equipment.

Competency of personnel working in explosive atmospheres is necessary; the potential for accidents in Ex areas is increased if personnel are not adequately trained. The need for competency is included in many legal documents (legislation), but is often not clearly defined. Competency includes the ability to carry out specific tasks versus prescribed general requirements specified in regulations and installation procedures.

Competence depends on knowledge, skill, experience and training. Measurement of competency is a difficult task and requires specific assessment methods. Competency evolves with years and may deteriorate, so continued training and assessment is necessary.

This document aims at providing basic rules for personnel competency including the content of the required knowledge in relationship with the tasks carried out in explosive atmospheres. Also included are requirements for training, competency evaluation, conditions for delivery of a Ex certificate of competency, and limits of responsibilities between the worker and the employer.

The IEC Scheme for Certification of Personnel involved in the specification, installation, maintenance and repair of equipment for Explosive Atmospheres is voluntary. Countries, industries, trade unions, and specific companies may have specific regulations and training requirements that preclude the use of this Scheme. However, certification of personnel to the Scheme is encouraged, as is the addition of regulation for specific training of personnel involved with Explosive Atmosphere equipment.

The objective of this operational document is to set out the generic cross-industry competencies needed for work associated with electrical equipment for explosive atmospheres; these competencies are intended for use by any industry sector or enterprise with regards to explosion-protection related to the relevant functional areas.

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## FOREWORD

Although various International and National Standards and the relevant statutory/regulatory requirements lay down standard criteria for the manufacture, installation, use and maintenance of explosion-protected electrical equipment in explosive atmospheres, no such reference exists for the competencies needed for work associated with such equipment for explosive atmospheres.

In the context of this specification, 'explosive atmospheres' are areas in which an explosive atmosphere may be present. Unless electrical equipment situated in such areas is constructed, installed and maintained in a special way, it may provide the energy and temperature necessary to ignite the atmosphere, usually with devastating results. The special design features of electrical equipment and systems used for these 'explosive atmospheres' are known as explosion-protection. They form part of the risk management strategies to ensure a safe and healthy working environment.

The development of Competency Standards for electrical equipment for explosive atmospheres is necessary due to the concern with the variability in skills of electrical workers and others dealing with this equipment. Although training has been available, it was usually confined to the technical aspects and there is generally no strategy to provide this specific assessment of competency.

The concern over competence is 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 Competency Standards to be used by any industry sector or enterprise, with regards to explosion-protected equipment for explosive atmospheres.

To meet this need a set of Competency Standards for Electrical Equipment in Explosive atmospheres (EEHA) needs to be developed. Industries (mining and non-mining) concerned with the correct implementation of Competency Standards should ensure representation during the development of the competencies dealing with electrical equipment and installations in hazardous areas, to ensure the appropriateness of and need for a Working Group to overview, endorse and monitor the implementation of such Standards.

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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**Draft IECEx OPERATIONAL DOCUMENT**

**IEC Scheme for Certification of  
Personnel Competency for Explosive Atmospheres –**

**Title: Specification for Competency Standard Units Assessment Outcomes**

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## 1 SCOPE AND GENERAL

This specification specifies the competencies required for work associated with electrical equipment for explosive atmospheres (commonly termed 'Ex' equipment) and the standards to which competency is to be assessed and attributed. It provides guidance to assessing competency based on the knowledge and skills that define the Competency Standard Units.

The competencies specified in this specification are intended as additional competencies to those previously acquired for the specific type of work in non-explosive atmospheres.

Note: Annex A summarizes the specific prerequisite Units and recommended general competencies to achieve Units of Competency in this specification.

The principal application of this specification is to personnel dealing with explosion-protected and associated equipment for explosive atmospheres, covering the following work functions:

- a) Producing, processing or servicing functions in a hazardous area and not directly involved in installing, maintaining or repairing explosion-protected equipment and systems.
- b) Installing and maintaining explosion-protected equipment and systems in the hazardous area.
- c) Overhauling, repairing and modifying explosion-protected equipment.
- d) Developing/designing and maintaining explosion-protection strategies.
- e) Inspecting hazardous area equipment, systems and installations.

The specification sets the minimum requirements for training programs developed by Training Organizations (TOs) and Certifying Bodies who issue Certificate for the competencies described in this specification. However, this specification may also be referenced by—

- i) bodies certifying overhaul and repair workshops; and
- ii) enterprises in establishing the competency of their personnel.

## 2 NORMATIVE REFERENCES

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

IEC 60079 Series, *Equipment for explosive gas atmospheres*

IEC 61241 Series, *Electrical apparatus for use in the presence of combustible dust*

Note: A definitive list of Standards relevant to these Competency Standards is given in Appendix B.

### 3 TERMS AND DEFINITIONS

For the purposes of this document, the following definitions and explanatory information applies.

For the definitions of any other terms, particularly those of a more general nature, reference should be made to IEC 60050(426) or other appropriate parts of the IECV (International Electrotechnical Vocabulary).

#### 3.1

##### **Actions to limit risk of an explosion**

Organizational arrangements for reporting and rectifying defects, shutting down plant or machinery under emergency conditions, evacuating a hazardous area, reporting defects and conditions of plant and machinery, monitoring the hazardous area for presence of an explosive atmosphere and meeting OH&S obligations.

#### 3.2

##### **Appropriate personnel**

Individuals with responsibilities for design, installation, maintenance, production or servicing activities.

Note: Examples of appropriate personnel are Site Managers, Project Managers, Line Managers, Supervisors and Team Leaders.

#### 3.3

##### **Approved, approval**

With the approval of, acceptable to the authority having jurisdiction.

#### 3.4

##### **Assessment of competence**

The process of checking and confirming the ability to carry out specific work activities and/or functions based on evidence that shows a person can carry out such work safely and to requirements.

#### 3.5

##### **Qualifications Framework**

Qualifications Framework described in terms of levels characterized by the outcomes of vocational education and training.

#### 3.6

##### **Authority, regulatory**

A government agency responsible for relevant legislation and its application.

#### 3.7

##### **Certification**

Procedure by which a third party gives written assurance that a product, process or service conforms to specified requirements.

#### 3.8

##### **Classification of explosive atmospheres**

A method of analysing and classifying the environment where an explosive atmosphere may occur to allow the proper selection of equipment, particularly electrical equipment, to be installed and used safely in that environment.



### 3.9

#### Competency

Competency comprises the specification of knowledge and skills and the application of that knowledge and skill to the standards of performance required in the workplace.

Competency includes all aspects of work performance and not only narrow skills. The four components of competency are: task skills; task management skills; contingency management skills and job/role environment skills.

Note: The concept of competency focuses on what is expected of an employee in the workplace rather than on the learning process, and embodies the ability to transfer and apply skills and knowledge to new situations and environments.

### 3.10

#### Competent person

A person who can demonstrate a combination of knowledge and skills to effectively, efficiently and safely carry out activities in explosive atmospheres, covered by this specification. Competency in some cases may be limited to one or more specific types of protection technique, e.g. Ex 'd', Ex 'i', and/or activity (e.g. design, selection, installation, maintenance, testing and inspection).

### 3.11

#### Competency, Unit of

A Unit of Competency is the competency required for a useful work function and which resides with an individual (Description of Units of Competency is given in Section 2 of this specification).

Notes:

- 1) A single Unit of Competency is not to be confused with a job description which will invariably comprise a number of Units of Competency.
- 2) The fields contained in each Unit of Competency are the following:
  - (a) **Scope** A general description of the work function to which the competency applies and the general abilities needed.
  - (b) **Prerequisites** Specific and general competencies expected to have been achieved prior to undertaking training in the unit.
  - (c) **Elements and performance criteria**
    - (i) **Elements** Outcomes which contribute to a unit.
    - (ii) **Performance criteria** Specify the required levels of performance for each element.
  - (d) **Range statement** Range of context and conditions to which performance criteria apply.
  - (e) **Evidence guide** Assists with the interpretation and assessment of the unit.
    - (i) **Critical aspects of evidence** Particular knowledge and skills essential to effective performance.
    - (ii) **Essential knowledge and associated skills** Knowledge that is either explicit or implicit to effective performance.

### 3.12

#### Competency Standards

Competency Standards are the collection of units of competency for a particular industry sector and are an integral part of a Training Package.

### 3.13

#### Defects

Visual damage or corrosion of the explosion-protection aspect of the installation or apparatus.

### 3.14

#### Endorsement

The explosion-protection techniques, or in the case of classification of hazardous areas, the types of hazardous areas (gases/vapours and/or dusts), in which an individual demonstrates competence relevant to a Competency Standard Unit. An endorsement of a Competency Standard Unit is shown by a suffix to the unit title. The available endorsements are given in Annex B

NOTES:

- 1) Other explosion-protection techniques such as encapsulation 'm', oil-immersion 'o', powder filling 'q', ventilation 'v' and special protection 's', may be relevant to a particular workplace.
- 2) Ex 'tD' is equivalent to 'DIP'.

### 3.15

#### Equipment marking

Information with regards to certification that is required to be marked on each item of equipment incorporating an explosion-protection technique.

### 3.16

#### Established procedures

Formal arrangements of an organization, enterprise or statutory authority of how work is to be done and by whom.

Note: Examples of established procedures are documented in quality management systems, safety management systems, work clearance systems, work instructions, reporting systems and arrangements for dealing with emergencies.

### 3.17

#### Explosion properties of hazardous materials

There are two sets of properties—

- a) for gases, vapours, flammable liquids and mists—vapour pressure; boiling point; flashpoint; ignition temperature; explosive limits; relative vapour density; minimum ignition energy
- b) for dusts—layer ignition temperature; cloud ignition temperature; minimum ignition energy.

Notes:

- 1) Explosive limits (lower/LEL and upper/UEL) and flammability limits (lower/LFL and upper/UFL) are deemed to be synonymous. It should be recognized that some particular authorities having jurisdiction may have overriding requirements that dictate the use of one of these sets of terms and not the other.
- 2) Explosion severity is another relevant property for dusts.

### 3.18

#### Explosion-protected equipment

Equipment to which specific measures are applied to avoid ignition of a surrounding explosive atmosphere.

Note: The word 'equipment' includes 'apparatus', as mentioned in many relevant Standards.

### 3.19

#### Explosion-protection techniques

Techniques applied to the design of electrical equipment, components and systems to prevent the electrical energy from becoming an ignition source in the presence of flammable vapours and gases or combustible dusts in explosive atmospheres.

### 3.20

#### Group (of an equipment for explosive atmospheres)

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

Notes:

- 1) Equipment for use in explosive gas atmospheres is divided into two groups—
  - a) Group I: Equipment for mines susceptible to firedamp; and
  - b) Group II (which can be divided into subgroups IIA, IIB, IIC): Equipment for places with an explosive gas atmosphere, other than mines susceptible to firedamp.
- 2) This has also been known as 'gas grouping'.
- 3) Explosive dusts atmospheres will be designated as Group III in the future .

### 3.21

#### **Hazard and risk assessment**

Any recognized methodology of identifying hazards and assessing risks such as 'hazard and operability study' (HAZOP) and 'fault tree analysis' (HAZAN).

### 3.22

#### **Hazardous area**

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

Note: Explosive atmospheres may include a variety of adverse environmental conditions such as those encountered in coal mines, shipping, oil/gas platforms and the like, which commonly require further specifications stated in legislation or regulatory requirements.

### 3.23

#### **Hazardous materials**

In the context of this specification hazardous materials are flammable gases and vapours and combustible dusts.

Note: All vapours of flammable liquids are flammable vapours.

### 3.24

#### **Inspection, close**

An inspection which encompasses those aspects covered by a visual inspection and, in addition, identifies those defects, such as loose bolts, which will be apparent only by the use of access equipment, such as steps (where necessary) and tools. Close inspections do not normally require the enclosure to be opened or the equipment to be de-energized.

### 3.25

#### **Inspection, detailed**

An inspection which encompasses those aspects covered by a close inspection and, in addition, identifies those defects, such as loose terminations, which will only be apparent by opening the enclosure, and using (where necessary) tools and test equipment.

### 3.26 Inspection, initial

An inspection of all electrical equipment, systems and installations before they are brought into service.

### 3.27

#### **Inspection, periodic**

An inspection of all electrical equipment, systems and installations carried out on routine basis.

### 3.28

#### **Inspection, sample**

An inspection of a proportion of the electrical equipment, systems and installations.

### 3.29

#### **Inspection, schedule**

A formal arrangement for conducting inspections which details the extent, grade and frequency of the inspections and the explosion-protected characteristics and compliances to be checked.

### 3.30

#### **Inspection, visual**

An inspection which identifies, without the use of access equipment or tools, those defects, such as missing bolts, which will be apparent to the eye.

### 3.31

#### **Inspector, actions taken by an**

Actions taken by an inspector in relation to defects, non-conformities, faults in a hazardous area installation.

Note: Examples of such actions are: disconnection or non-connection of supply until a defect or fault or non-conformity is rectified, notice of period in which it has to be rectified, other actions within the scope of statutory regulations.

### 3.32

#### **Installation**

In the context of this specification installation includes explosion-protected equipment, wiring and other required items as they are fixed in place and connected as necessary, to operate as intended.

### 3.33

#### **Integrity (of explosion-protected equipment )**

Aspects of the equipment design and use that afford explosion-protection.

### 3.34

#### **Load and duty requirements (of wiring)**

Wiring systems that comply with IEC 60364 and/or National Standards.

### 3.35

#### **Non-conformance**

Equipment that does not satisfy the applicable Standards or requirements.

### 3.36

#### **O H & S policies and procedures**

Arrangements of an organization or enterprise to meet its legal and ethical obligations of ensuring the workplace is safe and without risk to health.

Note: Ensuring a workplace is safe will include hazard identification and risk assessment mechanisms, implementation of safety regulations, safety training, safety systems incorporating work clearance procedures, isolation procedures, use of protective equipment and clothing and use of codes of practice.

### 3.37

#### **Other items**

Items that are not in themselves explosion-protected but have an influence on the integrity of the explosion-protection technique used. For example, an overload device for a motor or associated equipment in the case of intrinsic safety technique.

### 3.38

#### **Pre-commission testing**

Tests specified, such as, performance and setting of protection devices and systems, earth loop impedance, insulation resistance, and earth continuity equipment connection and operation tests.

### 3.39

#### **Prerequisites**

Specific Competency Standard Units (AUS) and other vocational competencies to be achieved before deeming that competency has been demonstrated in a particular unit.

### 3.40

#### **Process specialist personnel**

Responsible persons with expertise in the technical aspects of the activities that produce the explosive hazard and include chemical engineers, process engineers, mining engineers, safety managers, and the like.

### 3.41

#### **Re-certification/ Supplementary approval**

Submission of previously certified/approved equipment to accredited certifying body or authority, to determine whether the equipment complies with the relevant Standards after modification or where original certification/approval is not fully known.

### 3.42

#### **Requirements**

Those to which equipment and procedures and their outcomes shall conform and include statutory obligations and regulations and Standards called-up by legislation or regulations.

Note: Requirements may include codes of practice, job specifications, Standards called up in specifications, procedures and work instructions and quality management systems.

### 3.43

#### **Servicing**

Maintaining, fault finding and repair of equipment, plant machinery and installations.

### 3.44

#### **Special tools, equipment and testing devices**

Tools for the removal of enclosure covers and connecting conductors, measuring devices such as feeler gauges and micrometer, gas and vapour sensors, electrical testing devices approved for use in a particular hazardous area.

### 3.45

#### **Specifications**

All those attributes that define accurately the nature of the involved hazards, materials/products, processes, equipment and installation design.

Note: Examples of specifications are design and manufacturer specifications defining all the necessary parameters and tolerances, process flow diagrams, explosive characteristics and technical data sheets for hazardous materials and products, and the like.

### 3.46

#### **Standards**

Technical documents which set out specifications and other criteria for equipment, materials and methods, to ensure they consistently perform as intended. The Standards referred to in this specification are those published by International Electrotechnical Commission.

Notes:

- 1) Competency in the use of other technical Standards may be required in industries not restricted to IEC requirements. For example, shipping and off-shore petroleum industries are subject to Standards agreed to by underwriters and enterprises or some other international conventions.
- 2) A list containing Standards available relevant to these Competency Standards is given in Annex C.

### 3.47

#### **Temperature classification**

System of classification by which electrical equipment is allocated one of six temperature classes according to its maximum surface temperature.

### 3.48

#### **Training Package**

A Training Package is a set of nationally endorsed specifications and qualification for recognising and assessing peoples skills.

Note: A training package specifies the outcome of training and does not prescribe how an individual should be trained.

### 3.49

#### **Verification dossier**

A set of documents showing the compliance of electrical equipment and installations.

Note: The information in a 'Verification Dossier' is subject to audit under a formal inspection process.

### 3.50

#### **Wiring system**

Permitted wiring and accessories for power, measurement, control or communications purposes.

### 3.51

#### **Zones, hazardous**

The zones into which explosive atmospheres are classified based upon the frequency of the appearance and duration of an explosive atmosphere.

### 3.52

#### **Zones in explosive gas atmospheres**

See IEC 60079-10 for the definitions of Zones 0, 1 and 2.

### 3.53

#### **Zones in explosive dusts atmospheres**

See IEC 61241-10 for the definitions of Zones 20, 21 and 22.

## 4 UNITS OF COMPETENCY

### 4.1 SCOPE

This Section describes the Units of Competency for working with electrical equipment for explosive atmospheres and to ensure the risk of any explosion hazard in such areas has been minimized. The specific Units of Competency are described in detail in Clauses 4.2 to 4.12 and a list of such Units is shown in Table 4.1.

**TABLE 4.1**  
**LIST OF COMPETENCY STANDARD UNITS**

Reference	Title	Endorsement <sup>a)</sup>
Unit Ex 001 - Basic philosophy of protection in explosive atmospheres		Not applicable
Unit Ex 005— Carry out overhaul and repair of explosion-protected equipment (operative)		1
Unit Ex 006 - Overhaul and repair explosion-protected equipment (responsible person)		1

Endorsement by:

1. Explosion-protection technique or
2. Explosive atmospheres classification
3. Group
- 4.

## 4.2 Unit Ex 001 - Basic philosophy of protection in explosive atmospheres

### 4.2.1 Scope

This Competency Standard Unit covers the explosion-protection aspects of plant and machinery operation or maintenance. It requires the ability to visually identify any damage or deterioration of explosion-protected equipment, monitor equipment and plant in relation to changes in the explosion hazard and to follow procedures to limit the risk of an explosion.

### 4.2.2 Application

Typically this unit would be used in management, plant operation, maintenance and engineering job functions

### 4.2.3 Prerequisites

Competence in this unit shall be assessed in combination with, or after the gaining of, other competencies required by a given industry or enterprise for plant or machinery operation or installations, maintenance or service functions. (see Annex A).

Note: Annex A sets out the specific prerequisite Units and the recommended general competencies and level assumed to be held by a person before undertaking training/assessment to achieve a Unit of Competency.

### 4.2.4 Elements and performance criteria

Elements		Performance criteria	
001.1	Prepare to work in hazardous area	001.1.1	Nature of the explosion hazard in the area and risks are known and the status of the explosion hazard is ascertained through established procedures.
		001.1.2	Operation and condition of plant and machinery, with regards to explosion-protection, is ascertained through established procedures.
		001.1.3	Established procedures for use of the plant and machinery, with regards to explosion-protection techniques used in the area, are followed.
001.2	Observe condition of explosion-protection system area	001.2.1	OHS policies and procedures, with regards to explosion-protection, are followed.
		001.2.2	Performance of plant and machinery is monitored to identify faults that may affect the integrity of the explosion-protected equipment and wiring system.
		001.2.3	Observations of explosion-protected equipment and wiring are made during normal operations and visual and audible non-conformances that may affect the integrity of the explosion-protection technique are identified.
		001.2.4	Explosion hazard monitoring equipment is observed and a dangerous state of the hazard is identified (e.g. by using gas detectors).
001.3	Take actions to limit risk of an explosion	001.3.1	Variations outside normal operating conditions are reported and documented in accordance with established procedures.
		001.3.2	Established procedures are followed in the event of a potential or immediate hazardous condition arising from any non-conformance identified in equipment/wiring or changes in the explosion hazard to a dangerous state.

### 4.2.5 Range statement

Competency shall be demonstrated in relation to any classified hazardous area.



Critical aspects of evidence	Essential knowledge and associated skills
<p>Evidence of competency in this unit shall show:</p> <p>Competent performance associated with each element of competence by employing the techniques, procedures, information and resources available in the workplace and encompassing the following aspects:</p> <p>Following work permits and clearance procedures. 001.1.1 001.1.2 001.2.1</p> <p>Monitoring hazards and following evacuation procedures. 001.2.2 001.2.4</p> <p>Correctly operating plant and machinery. 001.1.2 001.1.3</p> <p>Following plant and electrical isolation procedures. 001.3.2</p> <p>Identifying visual damage or deterioration of explosion-protected equipment. 001.2.3</p> <p>Reporting visual defects. 001.3.1</p> <p>Applying relevant contingency management skills.</p>	<p>The extent of the essential knowledge and skills required is given under the following clauses in 5:</p> <p>5.2.1 Explosive atmospheres and explosion-protection principles            5.2.2 Explosion-protected equipment - Principles.            5.2.24 Explosion-protection visual checks</p>

#### 4.2.6 Evidence guide - *Critical aspects of evidence*

Evidence of competency in this unit shall show—

- a) proficient performance associated with each element of competence by employing the techniques, procedures, information and resources available in the workplace and encompassing the following aspects:
  - i) Following work permits and clearance procedures.
  - ii) Monitoring hazards and following evacuation procedures.
  - iii) Correctly operating plant and machinery.
  - iv) Following plant and electrical isolation procedures.
  - v) Identifying visual damage or deterioration of explosion-protected equipment.
  - vi) Reporting visual defects.
- b) an understanding of the knowledge and associated skills essential to performance as outlined in Clause 4.13.

## 4.6 Unit Ex 005— Carry out overhaul and repair of explosion-protected equipment (operative)

NOTE: This unit is endorsed for each of the explosion-protection techniques in which competency is demonstrated. Designation for each endorsement is given in Appendix B.

### 4.6.1 Scope

This Competency Standard Unit covers the explosion-protection aspects of overhauling and repairing explosion-protected equipment at a craftsperson level. It requires the ability to identify and select authorized components, follow repair specifications to effect the overhauled/repaired of equipment and complete repair documentation.

### 4.6.2 Application

Typically this unit would be used in electrical, electronic, and/or mechanical equipment repair job function.

### 4.6.3 Prerequisites

Competence in this unit shall be assessed only after competencies in the overhaul and repair of general electrical, electronic and/or mechanical equipment have been achieved. (see Annex A).

### 4.6.4 Elements and performance criteria

Elements		Performance criteria	
005.1	Prepare for overhaul/repair of equipment	005.1.1	Specifications and instructions for the overhaul/repair work are received and expected outcomes of the work confirmed with the responsible person*.
		005.1.2	Equipment to be overhauled or repaired is identified by its markings and certification documentation.
		005.1.3	Special tools, equipment and testing devices needed to carry out the overhaul or repair work are obtained and checked for correct operation, safety and currency of calibration certification.
005.2	Carry out the overhaul or repair work	005.2.1	OHS policies and procedures for carrying out the overhaul/repair are followed.
		005.2.2	Specifications and instructions for the overhaul/repair work are followed in accordance with established procedures.
		005.2.3	Replacement parts and components used in the overhaul or repair are identified as being authorized by the equipment manufacturer.
		005.2.4	Overhaul/repair of equipment is done in a manner that does not reduce the type of protection afforded by the equipment design.
		005.2.5	Quality checks are made to ensure that the overhaul/repair of the equipment complies with the overhaul/repair specifications and instruction.
005.3	Document overhaul/repair work	005.3.1	Overhaul/repair work carried out is documented in accordance with established quality procedures.
		005.3.2	The responsible person* is notified of the completion of the work in accordance with established quality procedures.

\* Responsible person, in this context, is a person with Competency Standard Unit Ex 006 - Overhaul and repair explosion-protected equipment (responsible person)

#### 4.6.5 Range statement

Competency shall be demonstrated in relation to any classified hazardous area and explosion-protection techniques. This unit shall be endorsed for each technique in which competency is demonstrated.

NOTE: The designations for unit endorsements are given in Annex B.

Critical aspects of evidence	Essential knowledge and associated skills
<p>Evidence of competency in this unit shall show:</p> <p>Competent performance associated with each element by employing the techniques, procedures, information and resources available in the workplace and encompassing the following aspects in relation to each explosion-protection technique for which competency is sought:</p> <p>Following OHS procedures. 019.2.1</p> <p>Confirming the expected outcomes of the overhaul/repair work. 019.1.1</p> <p>Identifying equipment form its marking and certification documentation. 019.1.2</p> <p>Checked for correct operation, safety and currency of calibration certification. 019.1.3</p> <p>Following overhaul/repair specifications and instructions. 019.2.2 019.2.4</p> <p>Identifying replacement parts and components as being authorized by the equipment manufacturer. 019.2.3</p> <p>Documenting overhaul/repair work. 019.3.1 019.3.2</p> <p>Using quality systems. 019.2.5</p> <p>Applying relevant contingency management skills All</p>	<p>The extent of the essential knowledge and skills required is given under the following clauses in 5:</p> <p>5.2.1 Explosive atmospheres and explosion-protection principles.</p> <p>5.2.2 Explosion-protected equipment - Principles.</p> <p>5.2.4 Flameproof (Ex 'd') explosion-protection technique.</p> <p>5.2.5 Increased safety (Ex 'e') explosion-protection technique.</p> <p>5.2.6 Non-sparking (Ex 'n') explosion-protection technique.</p> <p>5.2.7 Intrinsic safety (Ex 'i') explosion-protection technique.</p> <p>5.2.8 Pressurization (Ex 'p') explosion-protection technique.</p> <p>5.2.9 Dust protection by enclosures (Ex 't') explosion-protection technique.</p> <p>5.2.10 Common characteristics of explosion-protection techniques.</p> <p>5.2.15 Explosion-protected equipment overhaul and repair - General requirements.</p> <p>5.2.16 Explosion-protected equipment overhaul and repair specific to each technique</p>

#### 4.6.6 Critical aspects of evidence

Evidence of competency in this unit shall show:

- a) competent performance associated with each element by employing the techniques, procedures, information and resources available in the workplace and encompassing the following aspects in relation to each explosion-protection technique for which competency is sought:
  - i) Following OHS procedures.
  - ii) Confirming the expected outcomes of the overhaul/repair work.
  - iii) Identifying equipment form its marking and certification documentation.
  - iv) Checking for correct operation, safety and currency of calibration certification.
  - v) Following overhaul/repair specifications and instructions.
  - vi) Identifying replacement parts and components as being authorized by the equipment manufacturer.
  - vii) Documenting overhaul/repair work.
  - viii) Using quality systems.
  - ix) Applying relevant contingency management skills.
- b) An understanding of the knowledge and associated skills essential to performance as outlined in Clause 4.13

#### 4.7 Unit Ex 006 - Overhaul and repair explosion-protected equipment (responsible person)

Note: This unit is endorsed for each of the explosion-protection techniques in which competency is demonstrated. Designation for each endorsement is given in Annex B.

##### 4.7.1 Scope

This Competency Standard Unit covers the explosion-protection aspects of overhauling and repairing explosion-protected equipment and act as the responsible person for verifying compliance after such overhaul and/or repair. It requires the ability to establish and document the level of work required, arranging for the overhaul/repair to be carried out, verify compliance of overhauled/repared equipment and complete the necessary documentation.

##### 4.7.2 Application

Typically this unit applies to electrical, electronic, and/or mechanical equipment repair workshop supervisory job function.

##### 4.7.3 Prerequisite units

Competence in this unit shall be assessed only after competencies in the overhaul and repair of general low-voltage or extra-low-voltage electrical/electronic equipment have been achieved (see Annex A).

##### 4.7.4 Elements and performance criteria

Elements		Performance criteria	
006.1	Prepare for overhaul/repair of equipment	006.1.1	Instructions on overhaul and/or repair are received and expected outcomes of the work confirmed with appropriate personnel.
		006.1.2	Certification documents for the equipment are sought and received in order to check that the equipment complies with the certification.
006.2	Establish the level of overhaul required	006.2.1	Measurements, tests and inspections are carried out on the equipment in accordance with OHS and other established procedures.
		006.2.2	The extent of work to be done is determined from measurement, test and inspection results and their correspondence with original certification and the requirements of Standards.
		006.2.3	Specifications and instructions for the overhaul/repair work are documented in accordance with requirements.
006.3	Arrange overhaul/repair work	006.3.1	Arrangements are made for the overhaul/repair work to be done in accordance with established procedures.
		006.3.2	A copy of overhaul/repair specifications and instructions is provided to personnel responsible for carrying out the work.
006.4	Verify that equipment complies with original certification	006.4.1	Level of testing required to verify that overhauled/repared equipment complies with original certification specifications is determined in accordance with requirements.
		006.4.2	Verification tests are conducted in accordance with established procedures.
006.5	Document overhaul/repair work	006.5.1	Equipment marking is checked and marked where applicable, in accordance with original certification.

Elements		Performance criteria	
		006.5.2	Overhaul/repair work is documented in accordance with requirements stating that the equipment complies with the original certification.
		006.5.3	Documentation of the repair work is retained, and a copy is issued with the equipment for inclusion in the verification dossier.

#### 4.7.5 Range statement

Competency shall be demonstrated in relation to any classified hazardous area and explosion-protection techniques. This unit shall be endorsed for each technique in which competency is demonstrated.

NOTE: The designations for unit endorsements are given in Annex B.

Critical aspects of evidence		Essential knowledge and associated skills	
Evidence of competency in this unit shall show: Competent performance associated with each element of competence by employing the techniques, procedures, information and resources available in the workplace and encompassing the following aspects in relation to each explosion-protection technique for which competency is sought: Following OHS procedures.		The extent of the essential knowledge and skills required is given under the following clauses in 5: 5.2.1 Explosive atmospheres and explosion-protection principles. 5.2.2 Explosion-protected equipment - Principles. 5.2.3 Explosion-protected equipment - Ex certification schemes. 5.2.4 Flameproof (Ex 'd') explosion-protection technique. 5.2.5 Increased safety (Ex 'e') explosion-protection technique. 5.2.6 Non-sparking (Ex 'n') explosion-protection technique. 5.2.7 Intrinsic safety (Ex 'i') explosion-protection technique. 5.2.8 Pressurization (Ex 'p') explosion-protection technique. 5.2.9 Dust protection by enclosures (Ex 't') explosion-protection technique. 5.2.10 Common characteristics of explosion-protection techniques. 5.2.15 Explosion-protected equipment overhaul and repair - General requirements. 5.2.16 Explosion-protected equipment overhaul and repair specific to each technique.	
	006.2.1		
Interpreting certification documentation and Standards.	006.1.1 006.1.2		
Measuring, testing and inspecting equipment for compliance with certification and Standards.	006.1.2 006.2.2 006.4.1 006.4.2		
Specifying overhaul/repair work.	006.2.3 006.3.1 006.3.2		
Documenting overhaul/repair work.	006.5.2 006.5.3		
Using quality systems.	All		
Applying relevant contingency management skills.	All		

#### 4.7.6 Critical aspects of evidence

Evidence of competency in this unit shall show—

- a) competent performance associated with each element of competence by employing the techniques, procedures, information and resources available in the workplace and encompassing the following aspects in relation to each explosion-protection technique for which competency is sought:
- i) Following OH&S procedures.
  - ii) Interpreting certification documentation and Standards.
  - iii) Measuring, testing and inspecting equipment for compliance with certification and Standards.
  - iv) Specifying overhaul/repair work.
  - v) Documenting overhaul/repair work.
  - vi) Using quality systems.

- vii) Applying relevant contingency management skills
- b) an understanding of the knowledge and associated skills essential to performance as outlined in Clause 4.13.

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#### 4.13 SUMMARY OF ESSENTIAL KNOWLEDGE AND ASSOCIATED SKILLS FOR EACH UNIT OF COMPETENCY

Unit of Competency	Clauses specifying the 'Essential knowledge and associated skills'
Unit Ex 001 - Basic philosophy of protection in explosive atmospheres	5.2.1 Explosive atmospheres and explosion-protection principles 5.2.2 Explosion-protected equipment - Principles. 5.2.24 Explosion-protection visual checks.
Unit Ex 005— Carry out overhaul and repair of explosion-protected equipment (operative)	5.2.1 Explosive atmospheres and explosion-protection principles. 5.2.2 Explosion-protected equipment - Principles. 5.2.4 Flameproof (Ex 'd') explosion-protection technique. 5.2.5 Increased safety (Ex 'e') explosion-protection technique. 5.2.6 Non-sparking (Ex 'n') explosion-protection technique. 5.2.7 Intrinsic safety (Ex 'i') explosion-protection technique. 5.2.8 Pressurization (Ex 'p') explosion-protection technique. 5.2.9 Dust protection by enclosures (Ex 't') explosion-protection technique. 5.2.10 Common characteristics of explosion-protection techniques 5.2.15 Explosion-protected equipment overhaul and repair - General requirements. 5.2.16 Explosion-protected equipment overhaul and repair specific to each technique.
Unit Ex 006 - Overhaul and repair explosion-protected equipment (responsible person)	5.2.1 Explosive atmospheres and explosion-protection principles. 5.2.2 Explosion-protected equipment - Principles. 5.2.3 Explosion-protected equipment - Ex certification schemes. 5.2.4 Flameproof (Ex 'd') explosion-protection technique. 5.2.5 Increased safety (Ex 'e') explosion-protection technique. 5.2.6 Non-sparking (Ex 'n') explosion-protection technique. 5.2.7 Intrinsic safety (Ex 'i') explosion-protection technique. 5.2.8 Pressurization (Ex 'p') explosion-protection technique. 5.2.9 Dust protection by enclosures (Ex 't') explosion-protection technique. 5.2.10 Common characteristics of explosion-protection techniques. 5.2.15 Explosion-protected equipment overhaul and repair - General requirements. 5.2.16 Explosion-protected equipment overhaul and repair specific to each technique.



## 5 ESSENTIAL KNOWLEDGE AND ASSOCIATED SKILLS

### 5.1 GENERAL

Knowledge and understanding are essential to competent performance. Critical aspects of knowledge required by each unit of competency are detailed in Clauses 5.2.1 to 5.2.25.

A summary of essential knowledge and associated skills for each Unit of Competency is set out in 4.13.

### 5.2 DESCRIPTION OF ESSENTIAL KNOWLEDGE AND ASSOCIATED SKILLS

#### 5.2.1 Explosive atmospheres and explosion-protection principles

Evidence shall show an understanding of explosive atmospheres and explosion-protection principles to an extent indicated by the following aspects:

- a) Properties of combustible substances and their potential to create an explosive hazard encompassing—
  - i) condition in the workplace that will lead to an explosion;
  - ii) the terms 'combustion', 'ignition' and 'propagation';
  - iii) explosive range of substances encountered in the workplace i.e. LEL/UEL;
  - iv) explosive parameters of substances as given in tables of substance characteristics, i.e., properties of combustible materials - gases, vapours (from liquids), and Dusts; flash point.
  - v) the difference between gases and vapours; and
  - vi) the toxic nature of gases and vapours and potential harmful consequences.
- b) The nature of explosive atmospheres encompassing—
  - i) the Standards definition of a 'hazardous area';
  - ii) the recommended methods for classifying the type and degree of explosion hazard in an area;
  - iii) hazardous area classifications as defined by Standards; and
  - iv) factors that are considered when a hazardous area is classified.
- c) The basics of how explosion-protection is achieved by the methods of exclusion, containment, energy limitation, dilution, avoidance of ignition source.
- d) Occupational Health and Safety responsibilities related to explosive atmospheres encompassing—
  - i) the main features and purpose of a 'clearance to work' system (includes hot work permit system);
  - ii) typical safety procedures that should be followed before entering a hazardous area;
  - iii) the purpose of gas detectors and their limitations;
  - iv) effects of temperature on gas and vapour detection;
  - v) frequency of monitoring for presence of gas or vapours, i.e. effects of temperature rise;
  - vi) factors affecting the accuracy of gas detectors, for example, contamination, condensation, temperature;
  - vii) safety in use of gas detectors, for example, 'read and run concept';
  - viii) the safety precautions to be taken when working in a hazardous area.

- e) The roles of the parties involved in the safety of explosive atmospheres encompassing—
- i) Regulations related to the safety of explosive atmospheres and the Authorities responsible for their implementation;
  - ii) where assistance and further information can be obtained to assist persons with hazardous area responsibilities, for example, Standard bodies, experienced consultants; and
  - iii) the hazardous area responsibilities of the owner of premises in which a hazardous area exists; the occupier of premises in which a hazardous area exists; enterprises and personnel engaged in installation and/or maintenance of explosion-protection systems; enterprises and personnel engaged in the classification of explosive atmospheres and/or design of explosion-protection systems; enterprises and personnel engaged in the overhaul, modification and/or assessment of explosion-protected equipment; enterprises and personnel engaged in the inspection of explosion-protection installations; manufacturers of explosion-protected equipment; designated authorities; insurers.

### 5.2.2 Explosion-protected equipment - Principles

Evidence shall show an understanding of the principles of the following explosion-protection techniques: Flameproof (Ex 'd'); Increased safety (Ex 'e'); Non-sparking (Ex 'n'); Intrinsic safety (Ex 'i') and Pressurization (Ex 'p') for gas atmospheres and Protection by enclosures-Dusts (Ex 'tD'); Pressurization-Dusts (Ex 'pD'); Encapsulation-Dusts (Ex 'mD'); and Intrinsic safety-Dusts (Ex 'iD'). The following aspects indicate the extent of understanding required:

- a) The principles of each explosion-protection technique, the methods used and how each technique works.
- b) How explosion-protected equipment is identified by the 'Ex' symbol marked on the equipment, including old equipment and equipment certified in another country.
- c) Visible conditions or actions that would void the explosion-protection provided by a particular technique.

### 5.2.3 Explosion-protected equipment - Ex certification schemes

Evidence shall show an understanding of Ex certification schemes to accepted standards to an extent indicated by the following aspects:

- a) Purpose and scope of certification schemes.
- b) Certification Schemes commonly used Internationally like IECEx, ATEX, UL, FM etc.
- c) Processes for having equipment certified under the acceptable Ex schemes encompassing—
  - i) scheme procedures;
  - ii) quality management requirements;
  - iii) conformance testing and assessment; and
  - iv) requirements for on going certification.

### 5.2.4 Flameproof (Ex 'd') explosion-protection technique

Evidence shall show an understanding of the characteristics and application of Flameproof (Ex 'd') explosion-protection technique to an extent indicated by the following aspects:

- a) The purpose and characteristics of the design features of apparatus and circuits protected by the flameproof (Ex 'd') technique.

NOTE: Examples of characteristics and design features are flame paths, integrity under pressure, pressure piling, and enclosure entries.

- b) Typical situations where the flameproof explosion-protection technique is used.

- c) Actions or conditions that would void the protection provided by the Flameproof technique.
- d) The use of Standards in determining the requirements to which the design of the flameproof explosion-protected apparatus shall comply.

#### **5.2.5 Increased safety (Ex 'e') explosion-protection technique**

Evidence shall show an understanding of the characteristics and application of Increased safety (Ex 'e') explosion-protection technique to an extent indicated by the following aspects:

- a) The purpose and characteristics of the design features of apparatus and circuits protected by the Increased safety (Ex 'e') technique.

Note: Examples of characteristics and design features are temperature rise, maximum power dissipation, protection devices, certified components, creepage and clearance distances, absence of sparking contacts and enclosure entries.

- b) Typical situations where the Increased safety explosion-protection technique is used.
- c) Actions or conditions that would void the protection provided by the Increased safety technique.
- d) The use of Standards in determining the requirements to which the design of the Increased safety explosion-protected apparatus shall comply.

#### **5.2.6 Non-sparking (Ex 'n') explosion-protection technique**

Evidence shall show an understanding of the characteristics and application of Non-sparking (Ex 'n') explosion-protection technique to an extent indicated by the following aspects:

- a) The purpose and characteristics of the design features of apparatus and circuits protected by the Non-sparking (Ex 'n') technique.

NOTE Examples of characteristics and design features are creepage and clearance distances and restricted breathing.

- b) Typical situations where the Non-sparking explosion-protection technique is used.
- c) Actions or conditions that would void the protection provided by the Non-sparking technique.
- d) The use of Standards in determining the requirements to which the design of the Non-sparking explosion-protected apparatus shall comply.

#### **5.2.7 Intrinsic safety (Ex 'i') explosion-protection technique**

Evidence shall show an understanding of the characteristics and application of Intrinsic safety (Ex 'i') explosion-protection technique to an extent indicated by the following aspects:

- a) The purpose and characteristics of the design features of apparatus and circuits protected by the Intrinsic safety (Ex 'i') technique.

NOTE: Examples of characteristics and design features are field devices, cables, safe area devices, earthing, entity versus integrated system concept, simple devices and interface devices and their parameters, segregation, infallible components, current and voltage limiting, creepage and clearance distances.

- b) Typical situations where the Intrinsic safety explosion-protection technique is used.
- c) Actions or conditions that would void the protection provided by Intrinsic safety.
- d) The use of Standards in determining the requirements to which the design of the Intrinsic safety explosion-protected apparatus shall comply.

#### **5.2.8 Pressurization (Ex 'p') explosion-protection technique**

Evidence shall show an understanding of the characteristics and application of Pressurization (Ex 'p') explosion-protection technique to an extent indicated by the following aspects:

- a) The purpose and characteristics of the design features of apparatus and circuits protected by the Pressurization (Ex 'p') technique.

Note: Examples of characteristics and design features are exclusion and dilution, purge periods, controlled shut down, monitoring and sources of internal release.

- b) Typical situations where the pressurization explosion-protection technique is used.
- c) Actions or conditions that would void the protection provided by the pressurization technique.
- d) The use of Standards in determining the requirements to which the design of the pressurization explosion-protected apparatus shall comply.

### 5.2.9 Dust protection by enclosures (Ex 't') explosion-protection technique

Evidence shall show an understanding of the characteristics and application of Enclosures (Ex 't') for Dusts explosion-protection technique. The following aspects indicate the extent of understanding required:

- a) The purpose and characteristics of the design features of apparatus and circuits protected by the techniques for dusts.

Note: Examples of characteristics and design features are for Enclosures; Pressurization; Encapsulation; and Intrinsic safety.

- b) Typical situations where dust explosion-protection technique is used.
- c) Actions or conditions that would void the protection provided by protection by enclosure technique.
- d) The use of Standards in determining the requirements to which the design of the dust explosion-protected enclosure shall comply.

### 5.2.10 Common characteristics of explosion-protection techniques

Evidence shall show an understanding of the common characteristics of explosion-protection techniques to an extent indicated by the following aspects:

- a) The purposes of 'temperature classification' and 'gas grouping/apparatus grouping'.
- b) Compliance plate markings.
- c) Limitations of non-metallic or specific alloy enclosures.
- d) The purpose and use of conformity and certification/approval for equipment used in explosive atmospheres.
- e) Environmental conditions that may impact on explosion-protection techniques.
- f) The principles and applications of other and mixed explosion-protection techniques.

Note: Other techniques include encapsulation Ex 'm'; oil-immersion Ex 'o'; powder-filling Ex 'q', ventilation Ex 'v' and special protection Ex 's'.

### 5.2.15 Explosion-protected equipment overhaul and repair - General requirements

Evidence shall show an understanding of overhaul and repair procedures of explosion-protected equipment to an extent indicated by the following aspects:

- a) The scope and limitations for overhaul and repair of explosion-protected equipment encompassing—
  - i) the requirements for competency of a workshop;
  - ii) the requirements of a 'competent person' for a registered workshop engaged in the overhaul/repair of explosion-protected equipment; and
  - iii) the scope and limitations of work permitted under workshop registration.
- b) Overhaul and repair (technical) Standard encompassing—
  - i) the documentation/information required to enable overhauls/repairs to be undertaken;
  - ii) categories of work, for example, overhaul; no repair; overhaul-repair;
  - iii) modifications that are, and are not, permitted within the equipment certification; and

- iv) the requirements for overhaul/repair processes relevant to the type of protection and equipment.
- c) Requirements for documentation and identification of overhauled/repared explosion-protected encompassing—
  - i) overhaul/repair report document; and
  - ii) requirements for distribution of overhaul/repair reports.
- d) Quality management systems as covered by international Standards encompassing—
  - i) documentation regime of a quality management system;
  - ii) principle of document and data control covering both internally and externally generated documents and data; and
  - iii) principles of process control as applied to the overhaul and repair of explosion-protected equipment.

#### **5.2.16 Explosion-protected equipment overhaul and repair specific to each technique**

Evidence shall show an understanding of overhaul and repair for specific explosion-protection techniques to an extent indicated by the following aspects:

- a) The use of Standards in determining the requirements to which the design of explosion-protected apparatus shall comply.
- b) The level of overhaul/repair required encompassing—
  - i) Standards and their use for determining the requirement for a specific explosion-protection technique;
  - ii) measurement/tests and equipment required to determine whether an item of equipment meets the certification requirements;
  - iii) requirements for maintaining the accuracy/calibration of measuring/test equipment;
  - iv) measurement/test procedures for determining whether an item of equipment meets the certification requirements;
  - v) level of overhaul/repair required from comparisons of test results and requirements specified in the original certification; and
  - vi) specifying overhaul/repair work required to restore an item of explosion-protected equipment to conform with the original certification.
- c) Measurement/tests procedures to verify that an item of equipment meets the original certification requirements

#### **5.2.24 Explosion-protection visual checks**

Evidence shall show an understanding of visible conditions of explosion-protection equipment that indicate the protection is void and changes in the nature of the explosion hazard that may render the explosion-protection unsafe. The following aspects indicate the extent of understanding required.

- a) Occupational, health and safety procedures encompassing—
  - i) occupational, health and safety procedures to be followed before entering explosive atmospheres; and
  - ii) occupational, health and safety procedures to be followed while conducting close inspection.
- b) Visible defects in explosion-protected equipment and wiring.
- c) Conditions that may indicate a change in a given explosion hazard.
- d) Reporting defects in explosion-protected equipment and wiring encompassing—
  - i) the purpose of a verification dossier; and

- ii) various ways for reporting defects in explosion-protected equipment and wiring.
- e) Procedures to be followed in the event of a change in the explosion hazard.

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## **6 ASSESSMENT**

### **6.1 GENERAL**

#### **6.1.1 Attributing competency**

Competencies shall be attributed on evidence showing that the person, so deemed competent, is able to undertake the responsibilities for all safety measures, care of plant and equipment, and care of the environment, directly related to the work function for which such competencies are required.

Note: Sufficient sources of evidence of competency will be required where the consequences of unjustifiably or mistakenly deeming a person competent carries a risk of injury to persons, or damage to property and/or the Environment.

#### **6.1.2 Sufficiency of evidence**

In all instances competency shall be attributed on evidence sufficient to show that a person—

- a) has the necessary skills required for the scope of work;
- b) can act competently across the specified range of activities; and
- c) has the knowledge and understanding underpinning competency.

#### **6.1.3 Currency of evidence**

Evidence shall be appropriately recent being suitable for making decisions about what a person knows and can do now and in the immediate future.

Note: The deeming of competence at a point in time does not mean that competence exists for all time; competency must be maintained by use and/or retraining.

#### **6.1.4 Authenticity**

Evidence shall be genuine and relate to the person being assessed, and no one else.

### **6.2 SOURCES OF EVIDENCE**

#### **6.2.1 General**

Competency shall be judged on evidence of essential knowledge underpinning performance and from evidence gathered across the whole range of performance activities relevant to the unit for which competency is to be attributed.

#### **6.2.2 Evidence of essential knowledge**

##### **6.2.2.1 Assessment methods**

Structured assessment methods, such as written, practical and oral tests/technical interviews shall be used to gather evidence that a person has the knowledge necessary to support competent performance.

##### **6.2.2.2 Assessment criteria**

Assessment of essential knowledge shall be based on the extent of subject matter specified by Clauses 5.2.1 to 5.2.25, for each Unit of Competency.

### 6.2.2.3 Recognition of prior learning/current competencies

Evidence of essential knowledge gained through prior learning shall comply with the requirements of Clause 6.2.3.4.

Minimum requirements for assessment of existing workers are given in **TBA**.

### 6.2.3 Evidence of competent performance

Evidence of competent performance shall be gathered by one or more of the methods described in Clauses 6.2.3.1 to 6.2.3.4. The criteria against which the work performance shall be assessed is given in 4, as applicable to each Unit of Competency.

Note: Assessment should take into account variations between particular industry sectors and different enterprises. For example equipment used in underground coal mining will be different in some respects from that used in a petrochemical plant.

#### 6.2.3.1 Gathering evidence of performance in a simulated work environment

In this method the simulated work environment shall include equipment relevant to the competencies to be assessed and arrangement in a manner similar to a real work place. Assessment activities shall be as close as practicable to real work situations and include real work decisions by the person being assessed.

#### 6.2.3.2 Gathering evidence of performance directly in the workplace

In this method a qualified assessor shall gather the evidence through direct observation of relevant work activities on multiple occasions and situations.

Note: Direct assessment of work activities may not be acceptable in some work places as it is disruptive to productivity and may require further safety measures.

#### 6.2.3.3 Gathering evidence of performance, from indicators in relevant work experience

In this method evidence shall be gathered through a daily or weekly log of work experience indicators, relevant to the unit(s) of competency being assessed; this shall be verified by a qualified responsible person. Such evidence shall be used to form a profile of competency development showing sufficient exposure to work activities and indicating when a final decision about competency can be made.

Note: Assessors will need to analyse log entries to evaluate the evidence when making assessment decisions. Computerized log systems provide automated analysis of entries that assists assessors in making consistent assessment decisions. In addition computerized log systems can provide progress reports that assist in managing the work experience to which a learner should be exposed.

#### 6.2.3.4 Recognition of prior learning/current competencies

Evidence of competent performance gained through prior work experience and formal or informal learning, shall comply with the Clauses in 4, as applicable to each Unit of Competency.

## 6.3 ASSESSMENT PROCESSES

### 6.3.1 Conducting and managing assessment

Assessment shall be conducted and managed in accordance with .....  
..... **[to be established]**.



### 6.3.2 Qualification of assessors

Persons undertaking assessment of competency as specified in this specification shall be qualified in accordance with .... [to be established].

DRAFT

## **7 EVIDENCE OF COMPETENCY**

### **7.1 General**

Assessing competency is a process of making a judgement on whether a person is competent based on evidence of how well they perform to the standards set down in one or more Competency Standard Units. Judging a person competent requires reliable evidence that shows they have the necessary skills required for the scope of work, they can act competently across the specified range of activities and they have the knowledge and understanding essential to the competency.

### **7.2 Tables of Evidence of Competency**

The evidence of competency for each Competency Standard Unit should be based on that specified in the critical aspects of evidence and in the bounds specified by the range statement. The critical aspects of evidence include reference to the performance criteria and the essential knowledge and associated skills.

## 8 ASSESSING COMPETENCY

### 8.1 General

Competency is something that is inferred rather than proven. The purpose of assessment is to make a judgement on balance of the evidence whether an individual can perform to the standards expected in the workplace.

### 8.2 Sources of evidence

Competency is judged on evidence of essential knowledge underpinning performance and from evidence gathered across the whole range of performance activities relevant to the unit for which competency is to be attributed. Acceptable sources of evidence are described in 6. In summary these are:

- a) Evidence of essential knowledge gathered from structured assessment instruments, such as written, practical and oral tests/technical interviews.
- b) Evidence of competent performance gathered from any of the following methods:
  - i) From a simulated work environment.
  - ii) Directly in the workplace.
  - iii) From indicators in relevant work experience.
  - iv) From relevant prior work experience and formal or informal learning.

### 8.3 Assessment Activities

#### 8.3.1 Environment

Environment-based assessment activities should include the following:

- a) Assessment should take into account variations between particular industry sectors and different enterprises. For example equipment used in underground coal mining will be different in some respects from that used in a petrochemical plant.
- b) Simulation should include equipment relevant to the competencies to be assessed and arrangement in a manner similar to a real workplace. Assessment activities should be as close as practicable to real work situations and include real work decisions by the person being assessed.

#### 8.3.2 Workplace evidence

Workplace-based assessment activities should include the following methods:

- a) Gather the evidence through direct observation of relevant work activities on multiple occasions and situations. This is likely to involve arrangements between a qualified assessor and workplace supervisor. Direct assessment of work activities may not be acceptable in some work places as it is disruptive to productivity and may require further safety measures.
- b) Gather evidence from indicators of relevant work activities. This requires assessors to analyse daily logbook entries to evaluate the evidence when making assessment decisions. Computerized log systems provide automated analysis of entries that assists assessors in making consistent assessment decisions. In addition computerized log systems can provide progress reports that assist in managing the work experience to which a learner should be exposed.

### **8.3.3 Evidence of relevant prior work experience and learning**

Generally evidence of prior learning and current competencies will be used in combination with other sources of evidence in order to have sufficient evidence to deem a person competent

NOTE: Do not assume competency based on a candidate's qualifications or stated experience. For example, a qualified electrician may not be competent in terminating all types of cables.

## **8.4 MAKING JUDGEMENTS ON COMPETENCY**

### **8.4.1 Sufficiency of evidence**

In all instances competency should be attributed on evidence sufficient to show that a person—

- has the necessary skills required for the scope of work;
- can act competently across the specified range of activities; and
- has the knowledge and understanding underpinning competency.
- The evidence must also be current and authentic.

### **8.4.2 Selecting assessment methods**

Selecting assessment methods is influenced by factors such as the extent of the assessment, the most effective locations for the assessment activities to take place, access to physical resources, safety measures necessary when working with electricity, explosion-protected equipment and in hazardous areas that add to the critical nature of the competencies being assessed. Sources of evidence need to be as comprehensive as possible in order to minimise error and inconsistency in judgment. Activities associated with normal everyday work contribute to the 'richness' of the evidence data.

When choosing assessment methods and developing assessment instruments, assessors need to take into consideration that some skills are more critical to safety and operational requirements, i.e. risk control measures, than others and some skills are practised more or less frequently.

## Annex A

### **SPECIFIC PREREQUISITE UNITS AND RECOMMENDED GENERAL COMPETENCIES FOR ACHIEVEMENT OF EACH UNIT OF COMPETENCY**

(Informative)

The Units of Competency in this specification have been developed to complement competencies/qualifications in the general functions of production, installation, maintenance, overhaul/repair, design, inspection and/or related management that have been previously acquired.

For persons who have not acquired the competencies related to the general functions, the quantum of education and training will be much greater than that indicated in Clause **Error! Reference source not found.** and Clause **Error! Reference source not found.** of this specification.

Table A1 shows the specific prerequisite units and the recommended general competencies and level assumed to be held by a person before undertaking training/assessment to achieve Units of Competency in this specification.



**TABLE A 1**

**SUMMARY OF PREREQUISITE UNITS AND RECOMMENDED GENERAL COMPETENCIES**

Unit of Competency	Specific prerequisite Units	Previously attained competency	
		Description	Minimum recommended Qualification level
Unit Ex 001 - Basic philosophy of protection in explosive atmospheres		Competencies in plant or machinery operation or installations, maintenance or service functions	II
Unit Ex 005— Carry out overhaul and repair of explosion-protected equipment (operative)		Competencies in the overhaul and repair of general electrical, electronic and/or mechanical equipment	
Unit Ex 006 - Overhaul and repair explosion-protected equipment (responsible person)		Competencies in overhaul and repair of general low-voltage or extra-low voltage electrical/electronic equipment	III
IECEX 002— <i>Area Classification of hazardous areas</i>		Competencies in gathering and analysing technical data and using this data for risk assessment	
IECEX 010—Design electrical installations in or associated with hazardous areas		Competencies in designing electrical systems and installations	

## Annex B THE DESIGNATIONS FOR UNIT ENDORSEMENTS

(Normative)

The endorsement of Competency Standard Units in this Operational Document shall be shown as a suffix to the unit code as follows:

Unit endorsement suffix	That for which competence is demonstrated
Ex 'd'	Flameproof
Ex 'e'	Increased safety
Ex 'n'	Non-sparking
Ex 'i'	Intrinsic safety
Ex 'p'	Pressurization
Ex 't' (DIP & Ex 'tD')	Protection by enclosure–dusts
'I'	Group I equipment only
'Gases'	Gas hazards only
'Dusts'	Dust hazards only
'ELV'	For equipment and systems operating at extra-low voltage.

## Annex C LIST OF IEC STANDARDS RELEVANT TO THE UNITS OF COMPETENCY

(Informative)

Other national standards may also apply in which case the competency MUST be endorsed accordingly.

Other Standards may be required in industries not restricted to IEC requirements. Examples of these industries are shipping and off-shore petroleum industries.

### Explosive atmospheres Standards

IEC  
60079-10 Classification of explosive atmospheres

This section to be completed

### Explosion-Protection Standards

Equipment  
IEC  
60079 Electrical equipment for explosive gas atmospheres  
60079-0 Part 0: General requirements  
60079-1 Part 1: Flameproof enclosure 'd'  
60079-2 Part 2: Pressurized enclosures

This section to be completed

### Installation and maintenance

IEC  
60079-14 Electrical equipment for explosive gas atmospheres—Selection and installation  
61241-14 Electrical equipment for use in the presence of combustible dust—Selection and installation

This section to be completed

### Coal Mining Standards

This section to be completed

### Gas Detection Standards

IEC  
61779 Electrical apparatus for detection and measurement of flammable gases  
61779-1 Part 1: General requirements and test methods  
61779-2 Part 2: Performance requirements for Group I apparatus indicating a volume fraction up to 5% methane in air  
61779-3 Part 3: Performance requirements for Group I apparatus indicating a volume fraction up to 100% methane in air  
61779-4 Part 4: Performance requirements for Group II apparatus indicating a volume fraction up to 100% lower explosive limit  
61779-5 Part 5: Performance requirements for Group II apparatus indicating a volume fraction up to 100% gas  
61779-6 Part 6: Guide for the selection, installation, use and maintenance of apparatus for the detection and measurement of flammable gases





**Equipment Repair & Overhaul**

IEC

60079-19

Equipment Repair & Overhaul

This section to be completed

## **Annex D**

### **ASSESSMENT OF EXISTING WORKERS**

(Normative)

#### **D.1 SCOPE**

This Appendix sets out the minimum requirements for enterprises/businesses to assess employees who currently practice skills described in the Units of Competency in Clause 4.

#### **D.2 EXTENT OF RECOGNITION**

##### **D.2.1 General**

These requirements shall apply only to the assessment of persons who are currently working in an industry, on explosion-protected equipment and installations for the purpose of showing that they are competent to carry out such work.

##### **D.2.2 Minimum level of recognition**

Although it is desirable that existing workers achieve competency in complete units they may be deemed competent for skills, including the relevant essential knowledge, that are part of a Unit of Competency. The skills so recognized shall be those in which the worker has previous experience.

Note: It is recommended that such persons undertake the necessary gap training to achieve the relevant Units of Competency.

##### **D.2.3 Assessment methodology**

Assessment processes and methods shall be in accordance with Clause 6.

## Annex E

### Guide to Assessment Methods and Instruments

(Informative)

Assessment method	Appropriate instruments	Valid purposes or use	Conditions and numbers	Time constraints	Repeat assessments possible
Written objective tests	True/false Multiple choice Matching Completion	Confirming essential factual knowledge, principles Assessing deduction, transfer of knowledge Complementing other methods	Controlled classroom High level supervision Large numbers	Moderate	Many
Written responses, short and extended answers	Calculations Definitions, explanations Essays	Assessing use of information Application of knowledge General ideas and solutions Research, organization and expression of concepts or ideas	Test condition as above Minimal supervision, and assistance	Moderate	Many
Oral test/ technical interview	Set question Scenarios	Assessing depth and breadth of knowledge Application of knowledge relative to experience	Interview condition One-on-one	Moderate	Many
On the job or workplace assessment	Observation, checklist Product assessment Questioning to complement observations	Identifying mastery or competence of practical task, technical skill or interpersonal skill in real or simulated setting Identifying gaps in education and training	Normal working conditions Moderate level supervision One-on-one Avoid expensive or hazardous situations	High	Nil to many depending on assessment of product or process
Practical/ Exercises	Stimulated work exercises Structured practical exercises Fault finding exercises	Demonstrating mastery or competence of a practical task, technical skill, or subset of performance in a simulated work setting	Controlled environment or field setting High level supervision 4 - 5	Low	Several
Practical projects	Research task or investigation Product or process development Individual learning contract	Assessing integration and application of a number of work related skills to solve a given problem Assessing individual approaches, innovation, creativity Assessing interaction with others	Access to laboratory, workshop or workplace Little supervision 10 to 15	Low	Several
Assignments	Resource life Case studies Poster presentation Reports of video or speaker presentations	Confirming competence to research, analyse and synthesise information Assessment of application of knowledge, skills and attitudes where practical testing is not feasible Assessment of	Moderate of level control Non-test conditions Little supervision 10 to 15	Low	Several

Assessment method	Appropriate instruments	Valid purposes or use	Conditions and numbers	Time constraints	Repeat assessments possible
	Reports of laboratory/field work, excursions Individual learning contracts Writing simple manuals or procedures	communication skills			
Personal appraisal	Checklists or criteria which enable peer or self assessment	Establishing readiness for summative assessments Assessment of an individual's performance within a team effort	Non-test conditions Little supervision Small numbers	Low	Many
Verbal assessment	Oral exposition or lecture Seminar, presentation and group discussion Oral/aural tests Interviews	Confirming understanding of principles underpinning performance Supplement to other assessment methods Verification of learner's submitted work.	Moderate level of control High level of supervision One-on-one	Low	Several
Profiling <sup>1</sup>	Structure manual or computer-based log.	Tracks competency development against the industry standard profile specified by CSUs Identifies when remedial action is required during development period	Real work conditions under workplace supervision Off-job assessment events Any number	Low/Medium	Ongoing

\* A valid profile is based on periodic collection of relevant data over the duration of a competency development training program.