



# ESCOM

ELECTRICAL SAFETY  
COMMITTEE

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## GUIDELINES AND BEST PRACTICES FOR FACTORY HAZARDOUS AREA CLASSIFICATION

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## **What is ESCOM?**

The Safety, Health and Environment National Authority (SHENA) and Autoriti Elektrik Negara Brunei Darussalam (AENBD) established the Electrical Safety Committee or “ESCOM” in January 2023; with the objectives of promoting regulatory compliance and raising electrical safety standards within Brunei Darussalam.

## **Who are the ESCOM members?**

The Electrical Safety Committee (ESCOM) comprises representatives and industry experts drawn from relevant government institutions and private organisations, collectively bringing extensive technical experience in electrical engineering, safety management, and industry practice.

ESCOM is **chaired by a representative from the Safety, Health and Environment National Authority (SHENA)**, with a **Deputy Chairperson appointed in accordance with the Committee’s Terms of Reference**. Subject matter experts from regulatory bodies, utilities, and industry may be invited to participate in specific working groups or provide technical input where required.

<b>ELECTRICAL SAFETY BEST PRACTICES</b>			
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*This document was developed to provide guidance and recommendations, as well as to serve as an industry reference for best practices with the aim of improving electrical safety practices. This Guideline and Best Practices is not a statutory document and does not create or replace any legal obligations under the Workplace Safety and Health Act (Chapter 277) or its subsidiary regulations. In the event of any inconsistency, the provisions of the WSHA and its subsidiary regulations shall prevail. Accordingly, this document should not be construed as implying any liability nor should it be taken to encapsulate all the responsibilities and obligations of the law.*

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## 1 INTRODUCTION

- 1.1 When electrical equipment is used in, around, or near an atmosphere that has flammable gases or vapours, flammable liquids, combustible dusts, ignitable fibres or flying's, there is a potential risk of fire or explosion. Areas in which such explosive atmospheres may occur are referred to as hazardous (or classified) locations or areas. Hazardous area classifications involve categorizing different zones based on the level of risk present.
- 1.2 Hazardous area classifications play a vital role in protecting personnel, equipment, and the surrounding environment in areas where explosive atmospheres may exist.
- 1.3 Hazardous area classifications provide guidance for the selection, installation and use of equipment that is specifically designed to operate safely under the hazardous conditions of each zone.

## 2 DEFINITIONS

- 2.1 "Shall" - indicates a requirement strictly to be followed to conform to the standard and from which no deviation is permitted, unless accepted by all involved parties.
- 2.2 "Should" - make a recommendation to indicate that among several possibilities one is recommended as particularly suitable without mentoring or excluding others, or that a certain course of action is preferred but not necessarily required.
- 2.3 "Can" - used for statements of possibility and capability, whether, physical or causal.
- 2.4 "Could" - used to indicate an allowable course of action within the limits in this standard.
- 2.5 "Hazard" - A process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation.
- 2.6 "Verifying" - make sure or prove that (something) is true, accurate, or justified.

### 3 ACRONYMS AND ABBREVIATIONS

DES	Department of Electrical Services
EIR	Electrical Installation Requirements
IEC	International Electrotechnical Commission
PPE	Personnel Protective Equipment
SHENA	Safety, Health and Environment National Authority
WSHA	Workplace Safety and Health Act
WSH	Workplace Safety and Health

### 4 APPLICABLE STANDARDS AND INDUSTRY GUIDANCE

- 4.1 This guideline cannot be used alone to specify electrical safety in a factory NEITHER can it be applied to hazardous area classification but shall comply with IEC & BS (British Standards) but not limited to following:
- 4.1.1 IEC 60079 Series, General requirements for equipment used in explosive atmospheres (includes Ex d, Ex e, Ex I, etc.).
  - 4.1.2 IEC 60079-10-1, Classification of areas – Explosive gas atmospheres.
  - 4.1.3 IEC 60079-10-2, Classification of areas – Combustible dust atmospheres.
  - 4.1.4 IEC 60079-14, Electrical installations in hazardous areas.
  - 4.1.5 IEC 60079-17, Inspection and maintenance of electrical installations in hazardous areas.
  - 4.1.6 IEC 60079-19, Equipment repair, overhaul and reclamation.
  - 4.1.7 IEC 60079-20-1, Material characteristics – Gas and Vapour Classification - test methods and data.
  - 4.1.8 IEC 60079-20-2, Material characteristics – Combustible dusts test methods.
  - 4.1.9 IEC 60079-31, Equipment dust ignition protection by enclosure “t”.
  - 4.1.10 IEC 60079-37, non-electrical type of protection construction safety “c”, control ignition source “b”, liquid immersion “k”

## 5 TECHNICAL REQUIREMENT FOR FACTORY

### 5.1 Hazardous Area Classification

#### 5.1.1 Explosive Gas Atmospheres (IEC 60079-10-1)

5.1.1.1 Areas where flammable gases or vapours may be present in sufficient quantities to form explosive mixtures with air are classified as gas hazardous areas.

5.1.1.2 These are typically found in industries such as oil and gas, petrochemical, and chemical processing.

5.1.1.3 The classification is divided into zones based on the frequency and duration of the presence of the explosive atmosphere:

5.1.1.3.1 Zone 0: An area in which an explosive gas atmosphere is present continuously or for lengthy periods (more than 1000 hrs/year).

5.1.1.3.2 Zone 1: An area in which an explosive gas atmosphere is likely to occur in normal operation (10-1000 hrs/year).

5.1.1.3.3 Zone 2: An area in which an explosive gas atmosphere is not likely to occur in normal operation, and if it does, it will exist only for a brief time (Less than 10 hrs/year).

#### 5.1.2 Explosive Dust Atmospheres (IEC 60079-10-2)

5.1.2.1 Areas where combustible dust may be present and form explosive mixtures with air are classified as dust hazardous areas.

5.1.2.2 These are common in industries such as grain handling, food production, pharmaceuticals, and woodworking.

5.1.2.3 The zones are defined as:

5.1.2.3.1 Zone 20: An area in which a combustible dust atmosphere is present continuously or for extended periods.

5.1.2.3.2 Zone 21: An area in which a combustible dust atmosphere is likely to occur in normal operation.

5.1.2.3.3 Zone 22: An area in which a combustible dust atmosphere is not likely to occur in normal operation, and if it does, it will exist only for a brief time.

5.1.3 Areas with Ignitable Fibres and Flying's

5.1.3.1 Although not explicitly covered in IEC 60079, areas containing ignitable fibres or flying's materials that can catch fire but are not typically suspended in air in concentrations sufficient to form explosive mixtures, but are recognized in other standards such as electrical codes.

5.1.3.2 These areas are typically found in textile mills, woodworking facilities, and similar environments.

5.1.3.3 While IEC 60079 does not define zones for these materials, similar precautions and assessments may be applied where hybrid mixtures or ignition risks exist.

5.1.3.3.1 Installation of Equipment - IEC 60079-14

5.1.3.3.2 Inspection and Maintenance - IEC 60079-17

5.1.3.3.3 Equipment repair, overhaul and reclamation - IEC 60079-19

## 6 TRAINING AND AWARENESS OF HAZARDOUS AREAS

### 6.1 Scope of Training

Workers shall receive adequate safety and health training, in the form of information and instructions specific to his workstation or job:

6.1.1 On recruitment,

6.1.2 In the event of a transfer or a change of job,

6.1.3 In the event of the introduction of new work equipment or a change in equipment.

6.1.4 In the event of the introduction of any recent technology.

6.1.5 The training shall be:

6.1.5.1 Adapted to take account of new or changed risks, and

6.1.5.2 Repeated periodically if necessary (recommended 3 yearly).

### 6.2 Competent Person

6.2.1 For the purposes of this Guidelines, a Competent Electrical Person, CEP is an individual whom the company has formally assessed and deemed to possess the necessary experience, knowledge, skills, and training to perform electrical work safely on the organization's electrical systems.

6.2.2 Competence is typically demonstrated through relevant formal qualifications such as certification in electrical installation, a degree in electrical engineering, or relevant qualifications in electrical maintenance, combined with successful completion of job-specific training (e.g., DES or equivalent) required for the tasks assigned.

**Table 6-1 Competency Training**

Category	Courses	Candidate
General Worker	Contractors Safety Awareness (CSA). General Safety Awareness, including Tool Safety.	Labourer
E01	Contractors Safety Awareness (CSA). General Safety Awareness, including Tool Safety.	Electrician
	Electrical Installation Regulations (EIR).	
	Wiring of Premises (WP). Domestic & Industrial from Meter to final circuits (1-Phase & 3-Phase).	
E02	Contractors Safety Awareness (CSA). General Safety Awareness, including Tool Safety. DES Electrical Safety Rules & System Operating Regulations.	Electrician Technician
	Road Safety Awareness (RSA).	
	Low Voltage Switching Applications (LVSA). Electrical Installation - Domestic & Industrial LV Main Distributions. Street Lighting – Installation & Maintenance.	
E03	General Safety Awareness, including Tool Safety. Safety Rules & System Operating Regulations.	Engineers
	High Voltage Switching Applications Basic Protection Relays.	

Category	Courses	Candidate
	Medium Voltage Switching Applications. HV Electrical Work – Transmission & Distribution System.	
E05	General Safety Awareness, including Tool Safety. Cable Jointing & Terminations (CJT).	Electrician Technician Engineers
Hazardous Area Environment	Contractors Safety Awareness (CSA). General Safety Awareness, including Tool Safety.	Electrician Technician Engineers
	Electrical Installation Regulations (EIR).	
	Wiring of Premises (WP). Domestic & Industrial from Meter to final circuits (1-Phase & 3-Phase).	
	CEHA-Certified Equipment for Hazardous Area/CompEx/IECEX CoPC.	

6.2.3 Refer to DES approved courses.

6.3 Unqualified personnel

6.3.1 Unqualified personnel (e.g., office workers, administrative staff) who may encounter but not work directly with electrical systems, require general awareness training on avoiding electrical hazards in their environment.

6.4 Emergency response training

6.4.1 Adequate no. of persons who are required to work on, with or near, an electrical installation shall be provided with training and information so that they are able to give appropriate first aid treatment for electric shock and/or burns.

**7 SIGNAGES**

7.1 Specific Explosive Atmosphere warning sign “Ex” as depicted in Figure 7-1.

7.1.1 “Ex” sign features an explosive atmosphere / hazardous area warning symbol inscribed with Black text "EX" inside a yellow triangle with a black border.

7.1.2 These signs are used in workplaces to indicate potentially explosive atmospheres or hazardous areas and are often required to comply with ATEX regulations.

- 7.1.3 Ex signs help identify areas where flammable gases, vapours or dust particles could create an explosive mixture with air.



**Figure 7-1 Ex Warning Sign**

- 7.1.4 “Ex” signs shall be installed at the entry points of areas especially in confined spaces where potential explosive atmospheres or hazardous areas are identified by the plant, factory or safety personnel/operator, such as those found in industries like oil and gas, manufacturing or chemical processing, and pharmaceuticals etc.
- 7.1.5 These signs are to alert workers and users to the presence of potential explosive atmospheres or hazardous areas and to remind them to take necessary precautions, such as wearing appropriate PPE, avoiding ignition sources, and using only equipment with “Ex” marking.

## 7.2 Signage for equipment used in Explosive Atmosphere

- 7.2.1 The "Ex" symbol, which is an internationally recognized symbol, often depicted within a hexagon, signifies that such device or equipment is designed and certified for use in potentially explosive atmospheres is shown in Figure 7-2.
- 7.2.2 It indicates that the equipment meets certain official certification processes for use in hazardous environments, specific safety standards, like ATEX/ IECEx, and is suitable for installation and operation in hazardous locations.



**Figure 7-2 Ex Warning Symbol**

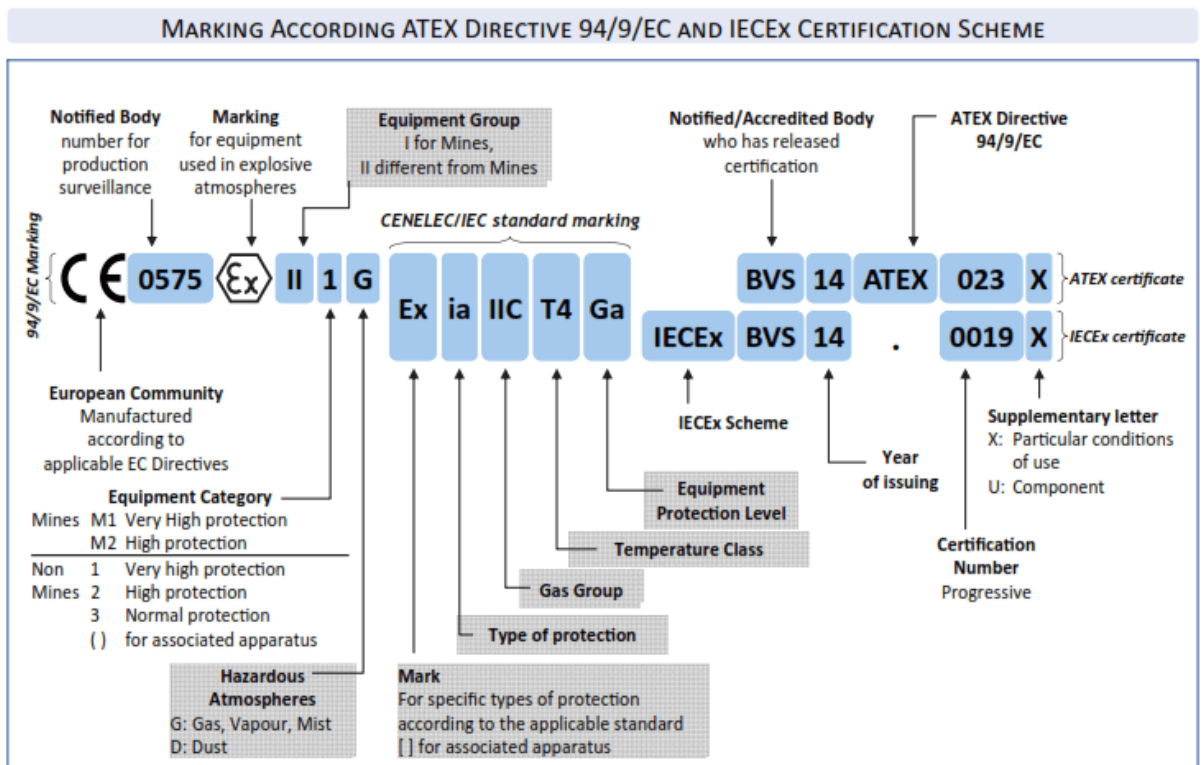
- 7.2.3 Ex certified equipment is essential for the safe operation of electrical systems in hazardous areas where flammable substances like gases, vapours, or dusts may be or are present.
- 7.2.4 These certifications ensure the product is designed to prevent sources of ignition, thereby minimising the risk of explosions.

- 7.2.4.1 Controlling sparks and arcs: Ex-certified equipment is designed to prevent the generation of sparks or arcs that could ignite flammable substances.
- 7.2.4.2 Limiting surface temperatures: Equipment is designed to operate below the auto-ignition temperatures of surrounding flammable materials.
- 7.2.4.3 Energy limitation - **Intrinsically safe circuit** - A circuit in which any spark or any thermal effect produced in the conditions specified in IEC 60079-11, including normal operation and specified fault conditions, cannot cause ignition of a given explosive gas atmosphere.
- 7.2.4.4 Containing explosions: Some Ex-certified equipment, like flameproof enclosures (Ex d), are designed to contain an internal explosion and prevent it from spreading.

### 7.3 Ex equipment marking schemes

- 7.3.1 Ex equipment marking schemes are used to identify equipment certified for use in explosive atmospheres, ensuring safety by preventing ignition sources.
- 7.3.2 The marking provides crucial information about the equipment's protection type, suitability for specific hazardous areas, and temperature ratings.
- 7.3.3 Key elements of Ex equipment marking are depicted in Figure 7-3.
  - 7.3.3.1 **Ex symbol:** Indicates that the equipment is designed for use in explosive atmospheres
  - 7.3.3.2 **Equipment Protection Level (EPL):** Specifies the level of protection provided by the equipment, with categories like 'a' (extremely high), 'b' (high), and 'c' (enhanced).
  - 7.3.3.3 **Gas/Dust Group:** Indicates the type of explosive atmosphere the equipment is designed for (e.g., Group I for mining, Group II for other flammable gases and vapours).
  - 7.3.3.4 **Temperature Class:** Specifies the maximum surface temperature of the equipment to prevent ignition of surrounding flammable materials.
  - 7.3.3.5 **Type of Protection:** Indicates the specific method used to prevent ignition (e.g., flameproof enclosure 'd', increased safety 'e').

- 7.3.3.5.1 Increased Safety (Ex e): Focuses on preventing excessive temperatures and sparks through design enhancements like improved insulation and creepage distances.
- 7.3.3.5.2 Intrinsic Safety (Ex i): Limits the electrical energy within circuits to prevent ignition, even under fault conditions.
- 7.3.3.5.3 Flameproof Enclosure (Ex d): Encloses equipment in a robust housing capable of containing an internal explosion.
- 7.3.3.5.4 Pressurization (Ex p): Purges equipment with inert gas to prevent flammable substances from entering.
- 7.3.3.6 **Manufacturer's Information:** Includes the manufacturer's name, product code, and serial number.
- 7.3.3.7 **Certification Body Information:** Provides details about the certification body and the certificate number.
- 7.3.3.8 **Other markings:** May include additional information like ambient temperature range, special conditions of use (X suffix), or component approval (U suffix).



**Figure 7-3 Marking Directive**

Source: IECEX, International Electrotechnical Commission System for Certification to Standards Relating to Equipment for Use in Explosive Atmosphere

## **8 REFERENCES**

- 8.1 Workplace Safety and Health Act, Chapter 277
- 8.2 Workplace Safety and Health (Construction) Regulations
- 8.3 IEC 60079 Series – Explosive Atmospheres