CEEAMA™
Consulting Electrical Engineers Association of Maharashtra

CEEAMA LiveWire

E-NEWSLETTER

Published by Consulting Electrical Engineers Association of Maharashtra

Topic for February 2025

ELECTRICS IN HAZARDOUS AREA

Read more about Electric Equipment in Hazardous Areas inside.

Electrical Consultants Newsletter
Volume No. 4 Issue #47
February 2025

CEEAMA Governing Council
Directors

Mr. Veejhay Limaaye
Hon. President

Mr. Chidambar Joshi
Hon. Secretary

Mr. Ulhas Vajre
Hon. Treasurer

Directors

Mr. Narendra Duvedi

Mr. Mohan Kelkar

Mr. Anil Bhandari

Mr. Krishna S. Chandavar

Mr. Subhash L. Bahulekar
Chief Editor - CEEAMA LIVEWIRE

From the Editors Desk,

Nobody is above law!

Trump took oath as the next president of USA (for second time), and he thought the entire world will be at his feet. But he forgot the importance of collaborative behaviour in today's globalised world! Most of his restrictions are being challenged and the Supreme court is mediating and sending corrective orders!!

Hope minimum Indians are affected by his orders (& over-rulings)!

January 2025 will be remembered for: **Dip@Kumbh, Dip in portfolio, & Deepseek.** First cleaned the sins, second cleaned the investors and third cleaned the AI.

Deepseek, talk of the town: AI outdating AI - the chatbot that wiped $1 trillion from Nasdaq Composite on Monday, 27th Jan. According to reports, DeepSeek's R1 model demonstrates capabilities comparable to OpenAI's GPT-4, Meta's Llama, and Google's Gemini, but with significantly lower development costs.

Meta, Microsoft, and Tesla–companies that have poured billions of dollars into AI infrastructure and have written cheques for NVIDIA's chips–reported quarterly results on 29th Jan. 2025 showing a mixed bag!

Elsewhere, the race to harness nuclear fusion has just got hotter. See the picture below…

In India, with the Union Budget around the corner, founders, investors, and analysts in India's burgeoning ecommerce sector expect Finance Minister Nirmala Sitharaman to announce proposals to improve regulatory and physical infrastructure for the sector's growth.

Stakeholders are seeking more tax liberties for consumers to boost spending, and investments in infrastructure to improve logistics networks.

India's technology industry, valued at over $250 billion-plus, is hopeful that the upcoming Union Budget will introduce essential tax reforms and announce measures to boost investments in R&D.

At CEEAMA, learning and up-skilling never stops. Glad to share that one of our directors, Mr. Indranil Ghosh have become proud member of the Indian Green Building Council (IGBC)! Hearty Congratulations!

Enjoy this month's issue on the subject of **Electrics in Hazardous Area!** Stay safe!!! (Editorial reference image on page 28)

Subhash L. Bahulekar

Chief Editor – CEEAMA

From the President's desk:

Dear friends,

As we step into February, the anticipation builds for the monumental Kumbh mela of Electrical Engineering. India is set to host the grand Elecrama 2025 in Delhi, marking the largest electrical exhibition of the year. The enthusiasm is palpable, and I'm thrilled to share this journey with you all.

In our upcoming February Livewire edition, we delve into a crucial yet often overlooked topic - hazardous areas. The spotlight shines on Electrical Safety, a paramount concern in today's landscape, especially in hazardous zones such as Refineries, Chemical Plants, and Gas handling stations. Adhering to a multitude of regulations like CEA Regulations 2023, Petroleum Act, and Explosives Act is imperative. Crafting systems that align with these standards and ensure full compliance is key to averting any untoward incidents. This edition aims to unravel the complexities surrounding this subject, offering clarity and insights.

Looking forward, mark your calendars for ELECRAMA 2025 in Noida from 22nd to 26th February. An event not to be missed!

Warm regards

Mr. Veejhay Limaaye

Hon. President

CEEAMA

DISCLAIMER

The information in all the articles of CEEAMA LiveWire is compiled using references from various sources. Although every attempt has been made to ensure the accuracy of this material, neither CEEAMA nor any of its contributors to this publication assumes responsibility for any inaccuracies or omissions in the data presented. For use in practice, we strongly advise that, information utilized from this publication should be verified from the relevant sources and to use document of actual standard published by respective institution.

From the Secretary's desk:

Dear Friends,

We are in the midst of the last quarter of this financial year and busy meeting the targets. Hope we hit all of them and surpass some with great performance.

This month we focus in the LiveWire on Electrical Equipment in Hazardous Area. Electrical equipment in Hazardous Areas is different from equipment in non-hazardous areas due to the risk of fire, explosion, or ignition caused by flammable gases, vapors, dust, or fibers present in the environment. In hazardous areas (like refineries, chemical plants, and metro railway tunnels with fuel vapors), flammable gases, vapors, or dust can mix with air, forming an explosive atmosphere. A small electrical spark or heat from regular equipment can ignite this mixture, leading to an explosion. Electrical equipment in hazardous areas is designed with safety features that prevent ignition, explosion, or fire, ensuring the protection of people, property, and infrastructure. Using standard equipment available in the market in such environments could lead to catastrophic failures. That's why compliance with zone classifications, protection techniques, and standards is crucial.

Temperature classification in hazardous environments refers to the maximum surface temperature that an electrical device can reach under normal or fault conditions without igniting the surrounding flammable gases, vapors, or dust. It ensures that equipment operates safely in explosive atmospheres. More on this will be covered in the LiveWire in this edition.

I earnestly request all the readers to contribute with their articles and share their experiences on their projects. The LiveWire is a perfect platform to share your technical papers for a wider learning and a large audience.

ELECRAMA 2025 is round the corner and I am sure many of you will be visiting the venue for the "World's Largest Electrical and Allied Electronics Show". This 16th edition will redefine innovation, collaboration, and global engagement in the electrical industry. ELECRAMA 2025 is expected to host over 1,100+ exhibitors from India and overseas, 10+ country pavilions, and a footfall of over 4 lakh business visitors. Electrical expos like ELECRAMA 2025 are a goldmine of opportunities for electrical consultants. These events bring together the latest technologies, industry leaders, and emerging trends in the electrical and power sector. ELECRAMA 2025 is expected to highlight how innovations enhance efficiency, sustainability, and resilience, shaping the future of energy in India. India is advancing in sustainability, targeting 500 GW of renewable energy by 2030. For electrical consultants, ELECRAMA 2025 is more than an expo — it is a learning hub, networking opportunity, and business accelerator. Whether you're working on metro projects, industrial electrification, or smart infrastructure, attending will keep you ahead of the curve!

See you at ELECRAMA 2025.

Mr. Chidambar Joshi

Hon. Secretary

CEEAMA

Selection of Electrical Equipment in Hazardous Area

In the context of electrical and process safety engineering, the term “Hazardous Area” refers to locations where a potentially explosive atmosphere may occur due to the presence of flammable gases, vapors, mists, or combustible dusts. This can happen within a process, an operating area, a piece of equipment, an apparatus, or in a room.

Hazardous area classification is essential to ensure the safety of people, equipment, and the environment in areas where explosive atmospheres may be present. Here are some key reasons why it’s required:

Identifying Risks and Protecting the Equipment

Area classification helps in identifying the presence and extent of hazardous substances, such as flammable gases, vapors, or dust, and the likelihood of their release in a given environment, thus, helping in selection and maintenance of equipment that can safely operate in hazardous conditions without causing ignition hazard.

Ensuring Safety

By classifying hazardous areas, appropriate safety measures for equipment and auxiliaries can be selected and implemented to prevent ignition sources and reduce the risk of damage to installations and personnel. Proper classification and corresponding precautions minimize the risk of accidents, injuries, and fatalities in workplaces where explosive atmospheres are present.

Compliance with Standards

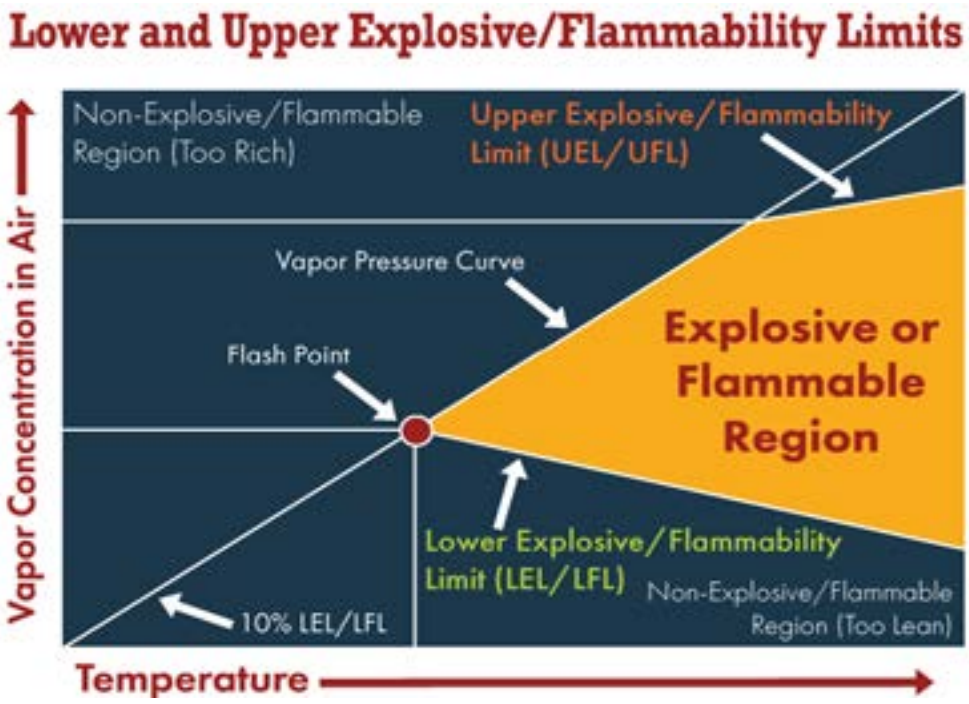
Selection based on this classification ensures compliance with international standards and regulations, such as IEC 60079 Series, ATEX Directives, NEC and several others depending on applicable local laws and compliance conditions which mandate specific requirements for equipment and practices in hazardous environments.

UNDERSTANDING HOW A HAZARDOUS AREA IS IDENTIFIED

The ‘fire triangle’ is a fundamental model in fire safety that illustrates the three essential elements required for a fire to occur: fuel, heat, and oxygen. Fuel refers to any material that can burn, such as wood, paper, or gas. Without fuel, there’s nothing to sustain the fire. Heat is necessary to raise the material to its ignition temperature, and sources can include sparks, flames, or friction. Oxygen is required for the combustion reaction. Understanding the fire triangle helps in identifying ways to prevent or extinguish fires by removing one of these elements. These principles are applied in classification of hazardous area equipment for ensuring safety in various operating environments.

So, some of the questions that need to be addressed for identification of risks and classification of hazardous areas are:

- Do the chemicals used emit flammable vapors OR will powders or dust be released during the process? What is the ‘flammable range’ (refers to the concentration range of a gas or vapor in the air that can ignite or explode if an ignition source is present) of the chemical?
- Will heating be involved or created during the process and is the apparatus designed to contain or release materials from the process?
- Will equipment operate within the manufacturer’s certified limits and not create a fire / explosion hazard?
- Are the areas well-ventilated? What is the ‘density ratio’ of the gas or vapour to the density of air (whether the gas / vapour will tend to settle down and spread or rise upwards and dissipate)? what measures are in place for accidental releases or spills?



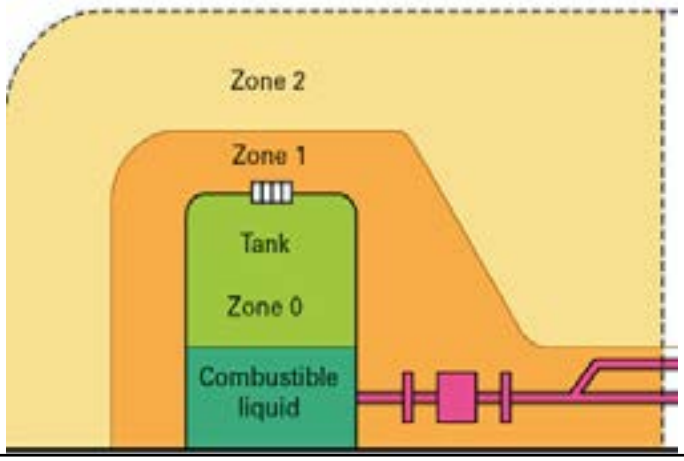
The answers to these and similar questions that are appropriate to the actual process will help identify if there is the potential for an explosive atmosphere to exist. This requires a good knowledge of the process, the equipment or apparatus used, the chemicals used, and the materials produced or generated.

CLASSIFICATION, ZONING AND GROUPING

Typically, the hazardous areas are classified into three environmental categories in class system:

Class	Class I	Class II	Class III
Typical Environment	Oil Refineries, Chemical Plants, etc. 	Coal Mines, Grain silos, etc. 	Paper or Textile Mills, Wood Factories, etc. 

The duration for each zone classification in hazardous areas is critical for defining the appropriate safety measures. These classifications are based on how frequently and for how long an explosive atmosphere may be present.

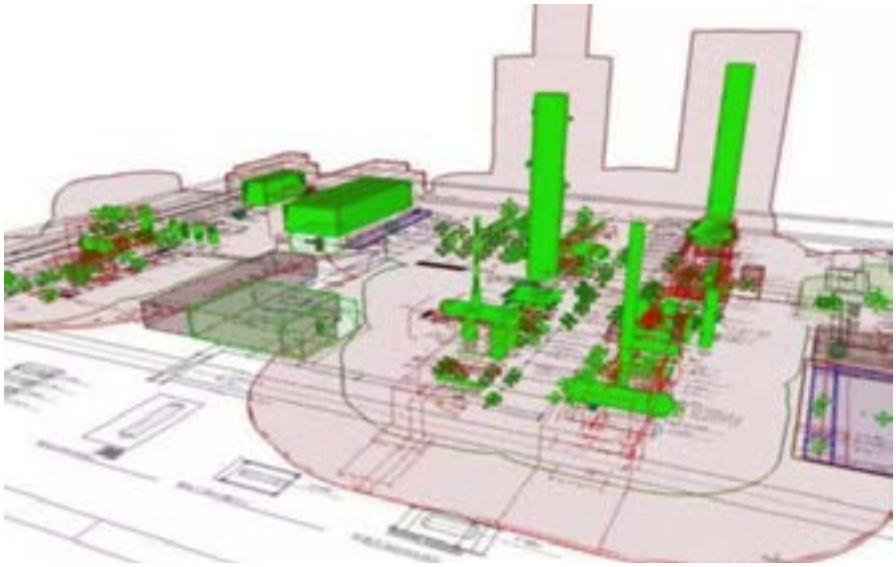


Zone 0

It is an area where an explosive atmosphere is present continuously or for long periods, quantified as more than 1000 hours per year. Area akin to inside storage tanks or vessels and near vents where flammable gases are consistently released. These areas require stringent safety measures due to the persistent presence of explosive atmospheres.

Zone 1

It describes areas where an explosive atmosphere is likely to occur occasionally during normal operations, typically between 10 and 1000 hours per year. It includes areas around pumps, tanks, valves, equipment where leaks might occur, and sampling outlets. These zones require careful monitoring and robust safety protocols to manage the risk of occasional explosive atmospheres.



Zone 2

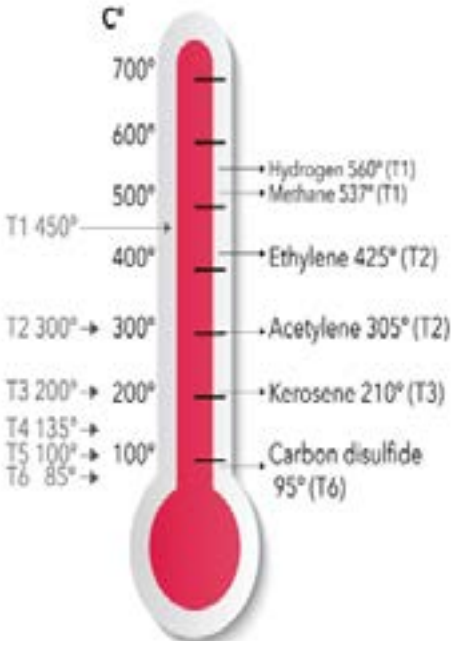
Refers to areas where an explosive atmosphere is unlikely to occur during normal operations, and if it does, it will last for a short period only, usually less than 10 hours per year. This classification will include areas around fuel pumps where small amounts of flammable vapor might be released during refuelling, locations around equipment or piping handling flammable materials occasionally, and places where flammable solvents are used in small quantities with infrequent release. While these areas present a lower risk, appropriate safety measures are still essential to manage the rare presence of explosive atmospheres.

Gases and dusts are further grouped for identification or selection of equipment installations as per the type of explosive atmosphere present in a hazardous area. These Gas / Dust groups help in selecting the appropriate equipment to prevent ignition and ensure safety in such environments. The following table gives a glimpse of the same; a detailed classification can be referred from IEC 60079-12:

Group	Environment	Location	Typical Substance
I	Gases, Vapours	Coal Mining	Methane (Fire damp)
IIA		Surface and other locations	Acetic acid, Acetone, Ammonia, Butane, Cyclohexane, Gasoline (petrol), Kerosene, Methane (non-mining), Methanol (methyl alcohol), Propane, Propan-2-ol (iso-propyl alcohol), Toluene, Xylene
IIB			Di-ethyl ether, Ethylene, Methyl ethyl ketone (MEK), Propan-1-ol (n-propyl alcohol), Ethanol (ethyl alcohol)
IIC			Acetylene, Hydrogen, Carbon disulphide
IIIA	Combustible Dusts	Surface and other locations	Combustible flyings (e.g. Textile fibres)
IIIB			Non-conductive (e.g. Grain / plastic dust)
IIIC			Conductive (e.g. Metallic Dust)

Further, in hazardous area classification, Temperature Classes (often referred to as T classes) are used to determine the maximum surface temperature that equipment can reach in potentially explosive atmospheres. Refer following table:

Temperature Class	Max Surface Temperature of Apparatus in °C	Ignition Temperature of the Flammable Substance in °C
T1	450	>450
T2	300	>300<=450
T3	200	>200<=300
T4	135	>135<=200
T5	100	>100<=135
T6	85	>85<=100



Ingress Protection (IP) ratings are a way of showing the effectiveness of electrical enclosures in blocking foreign bodies such as dust, moisture, liquids, and accidental contact.

Ingress Protection (IP) rating is defined by the International Electrotechnical Commission (IEC) standard IEC 60529.

The IP rating consists of two digits in IP XX format:

- First digit: Indicates the level of protection against solid particles (e.g. dust).
- Second digit: Indicates the level of protection against liquids (e.g. water)

First Digit	Protection Against Solids	Second Digit	Protection Against Liquids
0	No protection	0	No protection
1	Objects > 50 mm (e.g., hand)	1	Vertically dripping water
2	Objects > 12.5 mm (e.g., fingers)	2	Dripping water when tilted up to 15 degrees
3	Objects > 2.5 mm (e.g., tools, wires)	3	Spraying water up to 60 degrees from vertical
4	Objects > 1 mm (e.g., wires, screws)	4	Splashing water from any direction
5	Dust protected (limited ingress)	5	Water jets from any direction
6	Dust tight (no ingress)	6	Powerful water jets
		7	Immersion in water up to 1 meter for 30 minutes
		8	Continuous immersion in water under conditions specified by manufacturer
		9K	High-pressure, high-temperature water jets

PROTECTION CONCEPTS- ELECTRICAL EQUIPMENT

Protection concepts such as 'Ex' markings on electrical equipment are crucial for ensuring safety in hazardous environments. Key protection symbology listed as below are used for identification of equipment in hazardous areas.

A. For Gases, Vapours and Mists(G)

Type of Protection	Symbol	Typical IEC EPL	Typical Zone(s)	IEC Standard	Basic Concept of Protection
General Requirements	-	-	-	IEC 60079-0	-
Optical Radiation	Op pr	Gb	1, 2	IEC 60079-28	Protection against ignitions from optical radiation
	Op sh	Ga	0, 1, 2		
	Op is	Ga	0, 1, 2		
Increased Safety	eb	Gb	1, 2	IEC 60079-7	No arcs, sparks or hot surfaces. Enclosure IP54 or better. In the New Addition of IEC 60079-7 Ex nA is replaced by Ex ec and Ex e has been replaced with Ex eb.
	ec	Gc	2		
Flameproof	da	Ga	0, 1, 2	IEC 60079-1	Contain the explosion, quench the flame
	db	Gb	1, 2		
	dc	Gc	2		
Type 'n' (enclosed break)	nC	Gc	2	IEC 60079-15	
Quartz / Sand Filled	q	Gb	1, 2	IEC 60079-5	Quench the flame
Intrinsic Safety	ia	Ga	0, 1, 2	IEC 60079-11	Limit the energy of sparks and surface temperatures
	ib	Gb	1, 2		
	ic	Gc	2		
Pressurized	px	Gb	1, 2	IEC 60079-2	Keep the flammable gas out
	py	Gb	1, 2		
	pz	Gc	2		
Type 'n' (sealing & hermetic sealing)	nC	Gc	2	IEC 60079-15	
Type 'n' (restricted breathing)	nR	Gc	2	IEC 60079-15	
Encapsulation	ma	Ga	0, 1, 2	IEC 60079-18	
	mb	Gb	1, 2		
	mc	Gc	2		
Oil Immersion	ob	Gb	1, 2	IEC 60079-6	
	oc	Gc	2		

B. For Combustible Dust (D)

Type of Protection	Symbol	Typical IEC EPL	Typical Zone(s)	IEC Standard	Basic Concept of Protection
General Requirements	-	-	-	IEC 60079-0	-
Optical Radiation	Op pr	Db	21, 22	IEC 60079-28	Protection against ignitions from optical radiation
	Op sh	Da	20, 21, 22		
	Op is	Da	20, 21, 22		
Enclosure	ta	Da	20, 21, 22	IEC 60079-31	Standard protection for dusts, rugged tight enclosure
	tb	Db	21, 22		
	tc	Dc	22		
Intrinsic Safety	ia	Da	20, 21, 22	IEC 60079-11	Limit the energy of sparks and surface temperatures
	ib	Db	21, 22		
	ic	Dc	22		
Encapsulation	ma	Da	20, 21, 22	IEC 60079-18	Protection by encapsulation of incendive parts
	mb	Db	21, 22		
	mc	Dc	22		
Pressurized	pD	Db	20, 21, 22	IEC 61241-4	Protection by pressurization of enclosure
		Dc	21, 22		

Ex d

Ex e

Ex i

Ex nC

Ex p

Ex q

Ex o

MAJOR CERTIFYING AGENCIES AND MARKING CRITERIA

Some of the major certifying agencies that inspect, test and classify the electrical equipment with specific Nomenclature and markings are:

ATEX

ATEX stands for ATmosphères EXplosibles. This is a European directive aimed at harmonizing safety standards

within the European Union for equipment used in potentially explosive atmospheres. It covers both equipment and protective systems.

NEC (National Electrical Code)

The NEC are standards used in the United States, for electrical installations, including those in hazardous areas. They classify hazardous areas into Classes and Divisions (or Zones in the case of NEC). The protection methods and requirements for electrical equipment in these areas are outlined in these codes.

IECEx

The IECEx (International Electrotechnical Commission System for Certification to Standards Relating to Equipment for Use in Explosive Atmospheres) is a global certification system. It ensures that equipment and services used in explosive environments meet international safety standards; it is accepted in 36 member states.

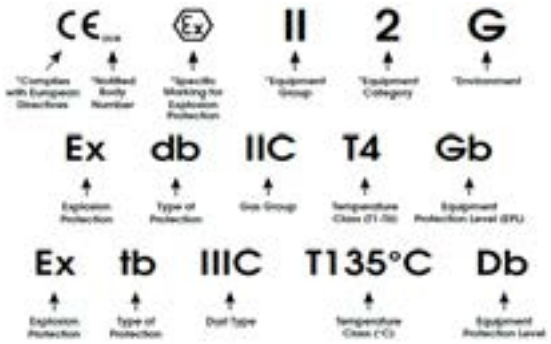
Typically, all products that require IECEx or ATEX certification also require a PESO registration in India.

Below is a tabulation of major certification directives and standards and their relative markings applicable to electrical equipment based in area of installation.

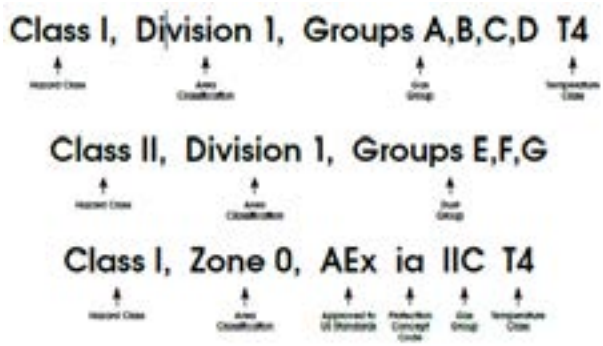
Feature	ATEX	NEC (National Electrical Code)	IEC (International Electrotechnical Commission)
Geographic Coverage	European Union	United States	Global
Regulatory Framework	Mandatory	Established by NFPA	Voluntary, based on IEC standards
Certification	Notified Bodies issue certificates	Based on classification system	IECEx Certificate of Conformity (CoC)
Markings	CE mark, NB number, explosion protection symbol, ATEX coding string	Marked based on Classes, Divisions, and Groups	Marked with IECEx standards
Classification	Zones (e.g., Zone 0, 1, 2)	Classes (I, II, III), Divisions (1, 2), and Groups (A-G)	International standards
Gas Groups	IIA, IIB, IIC	Groups A, B, C, D for Class I	IIA, IIB, IIC

Feature	ATEX	NEC (National Electrical Code)	IEC (International Electrotechnical Commission)
Relationship	Zone 0/20 (Div 1), Zone 1/21 (Div 2)	Class I, Div 1 (Zone 0, 1), Class I, Div 2 (Zone 2)	Aligns with ATEX
Marking Example	Ex II 2 G Ex d IIB T4	Class I, Div 1, Groups B, C, D, T4	N.A.

ATEX and IECEx Markings



NEC Markings



A thorough understanding of applicable standards and classification based on local laws and applicable standards (NEC NFPA, IECEx, etc.) is required for identification and selection of electrical equipment in a classified hazardous area.

REFERENCES

60079-SERIES	Explosive Atmospheres
NEC NFPA 70	Standard for Electrical Safety in the Workplace.
IS 5572	Classification of Hazardous Areas (Other Than Mines) Having Flammable Gases and Vapours for Electrical Installation

Contrubuted By

Akhil Ashok Kumar Jain

L&T Technology Services

Classification of Hazardous Areas having flammable gases and vapours for Electrical Installations

Hazardous Area Classification plays an important role in ensuring the Safety of personnel, equipment and surrounding environment in areas where explosive atmosphere is present.

National Electrical Code of India, NEC 2023, Part 7 also provides guidelines for electrical installations and equipment in locations where an hazardous atmosphere is likely to be present, with a view to maximize electrical safety.

Petroleum Rules 2002, Rule No. 104, mandates Classification of Hazardous Areas.

Hazardous Area Classification report is the basis of Design and Selection of electrical equipment within hazardous areas in Chemical, and Petrochemical plants. Installation of improper equipment which is unsuitable for particular hazardous area, can lead to disasters.

So let's explore the concept of Classification of Hazardous Areas in detailed.

What is Hazardous Area?

Hazardous Area - An area in which an explosive gas/dust atmosphere is present, or likely to be present, in quantities such as to require special precautions for the construction, installation and use of electrical apparatus.

What is the Objective of Classification of Hazardous Areas?

The objective of area classification is the notional division of a plant into zones within which the likelihood of the existence of an explosive gas/dust mixture is judged to be high, medium, low or so low as to be regarded as negligible.

The objective of the c1assitication procedure is to enable electrical apparatus to be selected, installed, operated and maintained safely in these environments.

An area classification established in this way provides a basis for the selection of electrical apparatus that is protected to a degree appropriate to the risk involved. The type of protection of the apparatus selected shall be such that the likelihood of it being a source of ignition, during the time when the surrounding atmosphere is explosive, is accepted as being small.

What is Explosive Gas Atmosphere?
A mixture with Air, under normal atmospheric conditions, of flammable materials in the form of gas, vapour, or mist, in which, after ignition, combustion spreads throughout the unconsumed mixture.

Zones - Hazardous areas are classified in zones based upon the frequency of the appearance and the duration of an explosive gas atmosphere as follows:

***Zone* 0 - An area place in which an explosive atmosphere is present continuously or for long periods or frequently.**

Examples : vapour space above closed process vessels, storage tanks or closed containers, areas containing open tanks of volatile, flammable liquid.

***Zone* I - An area in which an explosive atmosphere is likely to occur in normal operation occasionally.**

Normal Operation - The situation when the plant equipment is operating within its design parameters.

Zone I locations may be distinguished when any of the following conditions exits :

a) Flammable gas or vapour concentration is likely to exist in the air under normal operating conditions;

b) Flammable atmospheric concentration is likely to occur frequently because of maintenance, repairs or leakage;

c) Failure of process, storage or other equipment is likely to cause an electrical system failure simultaneously with the release of flammable gas Or liquid;

d) Flammable liquid or vapour piping system (containing valves, meters or screwed or flanged fittings) is in an inadequately ventilated area; and

e) The area below the surrounding elevation or grade is such that flammable liquids or vapours may accumulate therein.

This classification typically includes:

a) Imperfectly fitting peripheral seals on floating roof tanks;

b) Inadequately ventilated pump rooms for flammable gas or for volatile, flammable liquids;

c) Interiors of refrigerators and freezers in which volatile flammable materials are stored in lightly stoppered or easily ruptured containers;

d) API separators;

e) Oily waste water sewer/basins:

f) LPG cylinder filling and cylinder evacuation area; and

g) Areas in the immediate vicinity of vents and filling hatches.

***Zone* 2 - An area in which an explosive atmosphere is not likely to occur in normal operation but, if it does occur, will persist for a short period only**.

NB: Minor releases of flammable material may be part of normal operation. For example, releases from seals which rely on wetting by the fluid being pumped are considered to be minor releases.

Failures (such as the breakdown of pump seals, flange gaskets or spillages caused by accidents) which involve urgent repair or shutdown are not considered to be part of normal operation nor are they considered to be catastrophic.

Normal operation includes start-up and shutdown conditions .

Zone 2 locations may be distinguished when any one of the following conditions exist:

a) The system handling flammable liquid or vapour is in an adequately ventilated area and is so designed and operated that the explosive or ignitable liquids, vapours or gases will normally be confined within closed containers or closed systems from which they can escape only during abnormal conditions such as accidental failure of a gasket or packing:

b) The flammable vapours can be conducted to the location as through trenches, pipes or ducts:

c) Locations adjacent to zone I areas: and

d) In case of use of positive mechanical ventilation, as the failure or abnormal operation of ventilating equipment can permit atmospheric vapour mixtures to build up to flammable concentrations.

Areas not Classified

In general, the following locations are considered safe from the point of view of electrical installation:

a) Areas where the piping system is without valves, fittings, flanges or similar appurtenances;

b) Areas where flammable liquids or vapours are transported only in suitable containers or vessels:

c) Areas where permanent ignition sources are present, like area where combustion gases are present, for example flare tips, flare pits, other open flames and hot surfaces;

d) Enclosed premises in which a plenum or purging stream of safe atmosphere is continuously maintained, so that no opening therein may be a point of ingress of gases or vapours coming from an external source of hazard;

e) Gas turbine installation: In order to classify the turbine room as non-hazardous, both the following requirements should be fulfilled:

1) The turbine room should be adequately ventilated that is at least 12 air changes per hour with proper ventilation patterns. The ventilation system should be arranged so that an over-pressure of at least 50 Pa (0.5 mbar) is maintained in the turbine room with respect to the inside of the turbine hood and any surrounding classified areas with openings to the turbine room. A pressure switch should be installed in order to give an alarm if the differential pressure drops below 50 Pa (0.5 mbar); and

2) The fuel gas pipe to each turbine hood should have no more than one pair of flanges inside the turbine room. All other equipment as valves, connections, filters, drip pot, etc., must be located either,

i) outside the turbine room; or

ii) inside an enclosure separately ventilated; or

iii) inside the turbine hood provided a special ventilation of turbine hood; or

iv) inside turbine hood, provided a special fuel gas supply arrangement is made. The combination of ventilation, fuel gas system arrangement, temperature on exposed surfaces, electrical equipment inside the turbine hood, etc., should be considered to evaluate the safety of the turbine hood. The safety principles will be elucidated by some of the most common turbine/turbine hood designs.

The turbine room may be classified as Zone I or Zone 2, if the arrangement is not in compliance with the requirements stated above or due to other sources of hazard outside the turbine hood. The turbine or any associated equipment including exhaust piping, should not have a surface temperature above 200°C or above 80 percent of the ignition temperature for the actual gas/air mixture in the classified area without special precautions.

f) Rooms/sheds for housing internal combustion engines, having adequate ventilation; and

g) Oil/gas fired boilers installations. Consideration should be given, however to potential leak sources in pumps, valves, etc., or in waste product and fuel lines feeding flame or heat producing equipment to avoid installing electrical devices which could then become primary ignition sources for such leaks.

Notes:

i) A protected fired vessel is not considered a source of ignition and the surrounding area is classified the same as for a hydrocarbon pressure vessel.

ii) The area around the fired components and exhaust outlets of unprotected fired vessels need not be classified from the stand point of installation of electrical equipment.

iii) The area around an arc tip or flare pit need not be classified from the stand point of installation of electrical equipment. However, the area classification for the associated equipment (for example: knock out drum, blow down pump, etc.) located at grade level shall he followed as applicable.

iv) Lack of classification around unprotected fired vessels and flare tips does not imply the safe placement of fired vessels and flare tips in the proximity to other production equipment because those are themselves sources of ignition.

v) Electrical equipment may be exposed to flammable gas during a purge cycle of a fired heater or furnace.

The area classification shall also take into consideration gas group and temperature classification, depending on the properties of material handled.

Equipment grouping

Electrical equipment for explosive atmospheres is divided into the following groups:

Group I

Electrical equipment of Group I is intended for use in mines susceptible to firedamp.

NOTE: The types of protection for Group I take into account the ignition of both firedamp and coal dust along with enhanced physical protection for equipment used underground.

Electrical equipment intended for mines where the atmosphere, in addition to firedamp, may contain significant proportions of other flammable gases (i.e. other than methane), shall be constructed and tested in accordance with the requirements relating to Group I and also to the subdivision of Group II corresponding to the other significant flammable gases. This electrical equipment shall then be marked appropriately (for example, “Ex d I/IIB T3” or “Ex d I/II (NH_3)”).

Group II

Electrical equipment of Group II is intended for use in places with an explosive gas atmosphere other than mines susceptible to firedamp.

Electrical equipment of Group II is subdivided according to the nature of the explosive gas atmosphere for which it is intended.

Group II subdivisions

- IIA, a typical gas is propane
- IIB, a typical gas is ethylene
- IIC, a typical gas is hydrogen

NOTE 1 - This subdivision is based on the maximum experimental safe gap (MESG) or the minimum ignition current ratio (MIC ratio) of the explosive gas atmosphere in which the equipment may be installed.

NOTE 2 - Equipment marked IIB is suitable for applications requiring Group IIA equipment. Similarly, equipment marked IIC is suitable for applications requiring Group IIA or Group IIB equipment.

Group III

Electrical equipment of Group III is intended for use in places with an explosive dust atmosphere other than mines susceptible to firedamp.

Electrical equipment of Group III is subdivided according to the nature of the explosive dust atmosphere for which it is intended.

Group III subdivisions:

- IIIA: combustible flyings
- IIIB: non-conductive dust
- IIIC: conductive dust

NOTE - Equipment marked IIIB is suitable for applications requiring Group IIIA equipment. Similarly, equipment marked IIIC is suitable for applications requiring Group IIIA or Group IIIB equipment.

Equipment for a particular explosive atmosphere:

The electrical equipment may be tested for a particular explosive atmosphere. In this case, the information shall be recorded on the certificate and the electrical equipment marked accordingly.

Temperature Classification:

The electrical equipment shall be so selected that its maximum surface temperature will not reach the ignition temperature of any gas or vapour which may be present.

Symbols for the temperature classes which may be marked on the electrical equipment have the meaning indicated in Table I

Table- I Classification of maximum surface temperatures for Group II electrical equipment

Temperature class required by the Area Classification	Maximum surface temperature $^{0}_{C}$	Ignition Temperature of Gas or Vapour $^{0}_{C}$	Allowable Temperature Classes of equipment
T1	450	>450	T1-T6
T2	300	>300	T2-T6
T3	200	>200	T3-T6
T4	135	>135	T4-T6
T5	100	>100	T5-T6
T6	85	>85	T6

EFFECT OF VENTILATION ON HAZARDOUS AREA CLASSIFICATION:

Effect of Air Currents

Air currents may substantially alter the outline of the limits of potential hazard. A very mild breeze may serve to extend the area in those directions to which vapours might normally be carried. However, a stronger breeze may so accelerate the dispersion of vapours that the extent of potentially hazardous area would be greatly reduced .

Ventilation comprises of the movement of air within and through a volume to achieve the introduction of fresh air into, and removal of contaminated air from the volume, and the mixing of air and contaminants within the volume.

Gas or vapour released to the atmosphere will eventually be diluted by dispersion in free air until it's concentration is at a safe limit (below LFL). The time taken for this to occur and the size and spatial location of the gas cloud depends upon the nature of the release, the vapour properties such as density relative to air, the movement of the air and the presence of turbulence to promote mixing. Where the release is not into completely free air (that is not into an open area) then the air flow, or ventilation, is also a factor in determining the rate of gas or vapour dispersion. However, it is important to also consider, in a sheltered or obstructed open area or enclosed area, whether any recirculating motions may lead to a gradual accumulation of gas or vapour over time.

Source and Grade of Release

For the purpose of area classification a **source of release is defined as a point from which a flammable gas, vapour or liquid may be released into the atmosphere.**

Three grades of release are defined in terms of their likely frequency and duration:

a) ***Continuous grade release*** - A release that is continuous or nearly so, or that occurs frequently and for short periods.

b) ***Primary grade release*** - A release that is likely to occur periodically or occasionally in normal operation, that is, a release which, in operating procedures, is anticipated to occur.

c) ***Secondary grade release*** - A release that is unlikely to occur in normal operation and, in any event, will do so only infrequently and for short periods, that is, a release which, in operating procedures, is not anticipated to occur.

Relationship between Grade of Release and Class of Zone

There is, in most cases, under unrestricted 'open air' conditions a direct relationship between the grade of release and the type of zone to which it gives rise; that is,

a. Continuous grade normally leads to Zone 0;

b. Primary grade normally leads to Zone 1; and

c. Secondary grade normally leads to Zone 2.

Heavier-than-Air Gases and Vapours (Relative Density > 0.75)

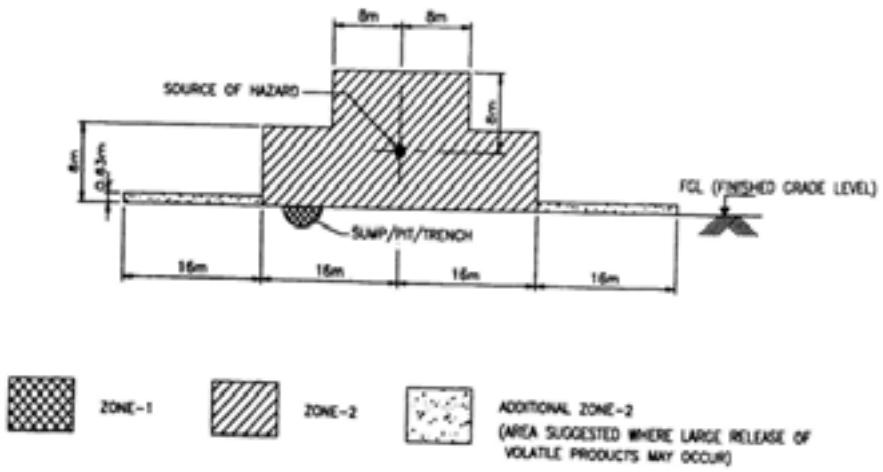


FIG. H1 FREELY VENTILATED PROCESS AREA (HEAVIER-THAN-AIR GASES OR VAPOURS) (SOURCE OF HAZARD LOCATED NEAR GROUND LEVEL)

Open-Air Situations

a) Figures HI and H2 illustrate the situation when a source of hazard which may give rise to a hazardous atmosphere only under abnormal conditions is located in the open air. The hazardous area should in this case be classified as Zone 2.

If the source of hazard gives rise to a hazardous atmosphere under normal operating conditions, the area described in Fig. HI and Fig. H2 Zone 2 should be classified as Zone 1.

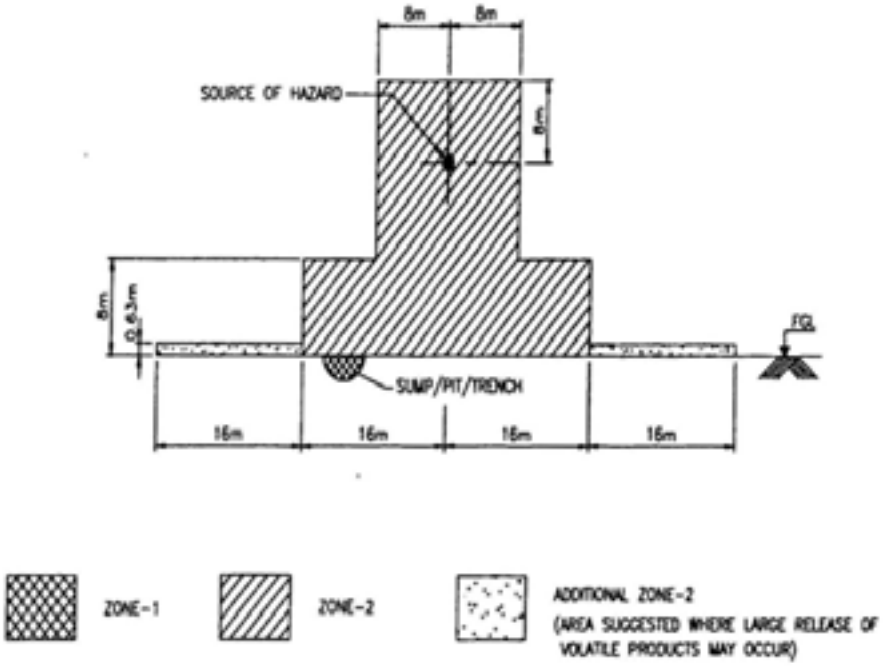


FIG. H2 FREELY VENTILATED PROCESS AREA (HEAVIER-THAN-AIR GASES OR VAPOURS) (SOURCE OF HAZARD LOCATED ABOVE GROUND LEVEL)

b) In case of petroleum pipelines where well-maintained valves, fittings, and meters of a pipeline system transporting petroleum (crude oil, products, and gases) are installed in well- ventilated situations or in a pit, the extent of the Zone 2 area above ground may be reduced to 3 m in all directions from the possible source of hazard, although the pit itself should be classified as Zone 1 area.

Enclosed Premises and Surrounding Areas

Figures H3 and H4 illustrates the situation when a source of hazard which may give rise to a hazardous atmosphere under abnormal conditions is located within enclosed premises.

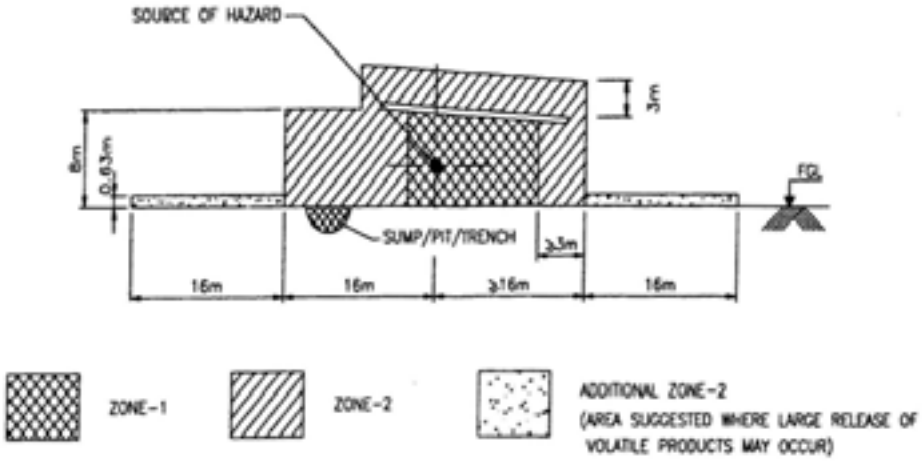


FIG. H3 PROCESS AREA WITH RESTRICTED VENTILATION

If the source of hazard within the enclosed premises gives rise to hazardous atmosphere under normal conditions, the area within the building as Zone 2 in Fig. H4 should be classified as Zone I.

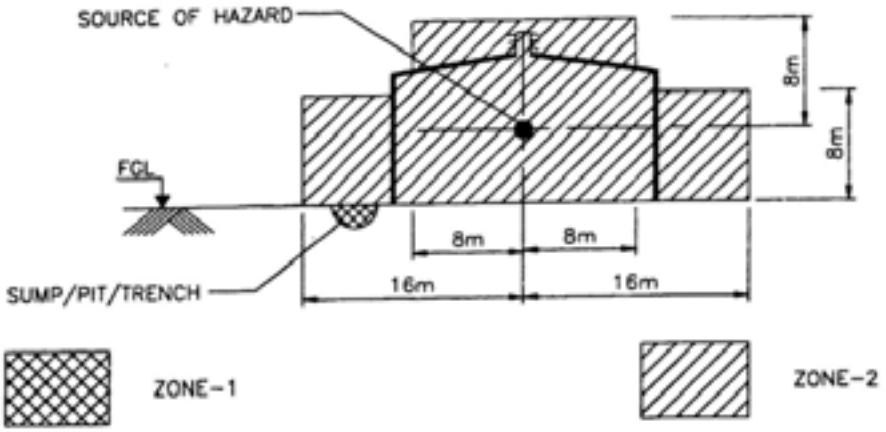


FIG. H4 WELL VENTILATED INDOOR AREA (HEAVIER-THAN-AIR GASES OR VAPOURS)

Atmospheric Storage Tanks

Figures H5, H6 and H7 illustrates the classification of the area surrounding floating-roof tank, fixed roof tank with and without nitrogen blanketing in offsite storage areas under normal operating conditions.

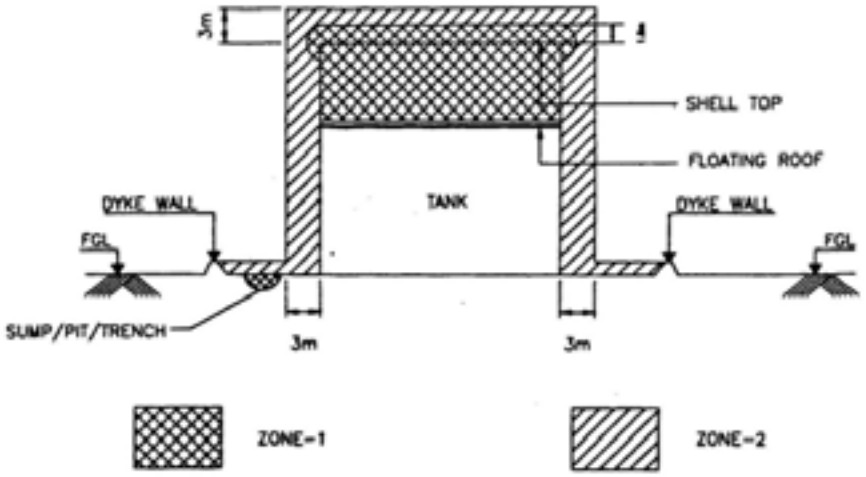


FIG. H5 TANK WITH FLOATING ROOF WITH OR WITHOUT PROTECTIVE CONE ROOF

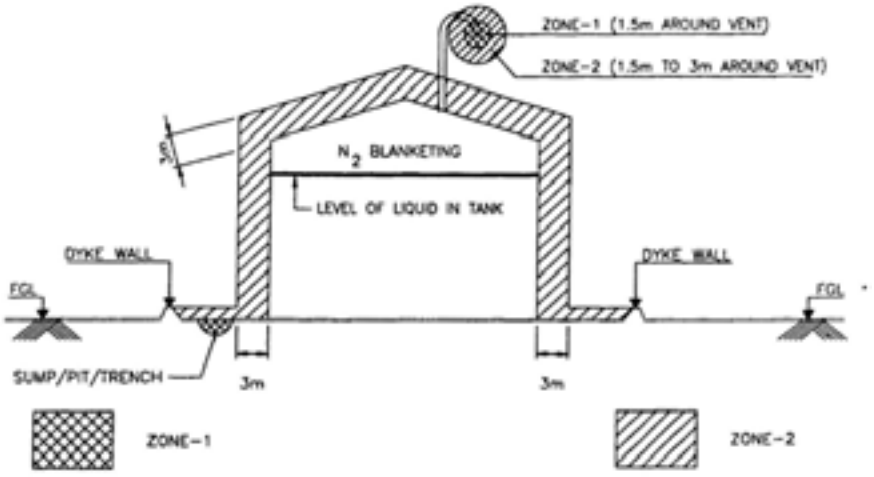


FIG. H6 FIXED ROOF TANK (WITH N_2 BLANKETING)

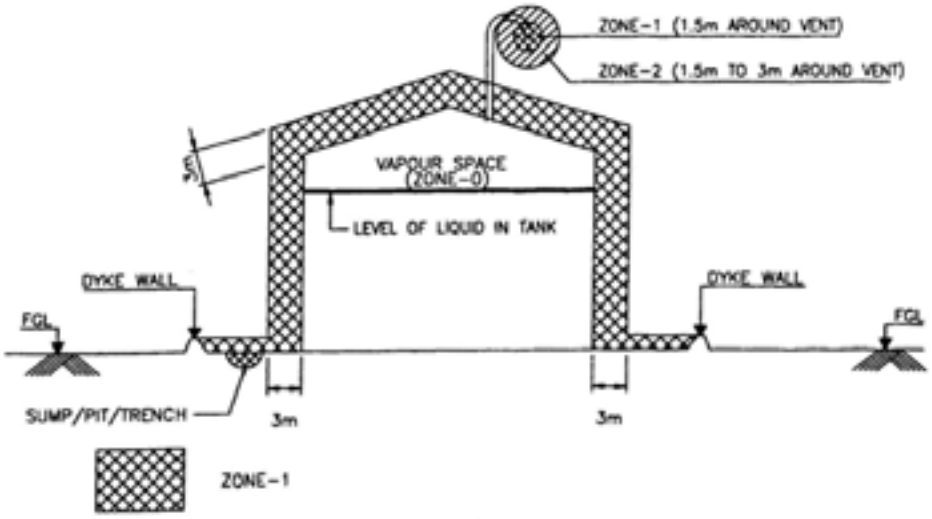


FIG. H7 FIXED ROOF TANK (WITHOUT N_2 BLANKETING)

Pressure Storage Vessels

Figures H8 and H9 illustrates the classification of the area surrounding pressure storage (spheres and bullets) under normal operating conditions.

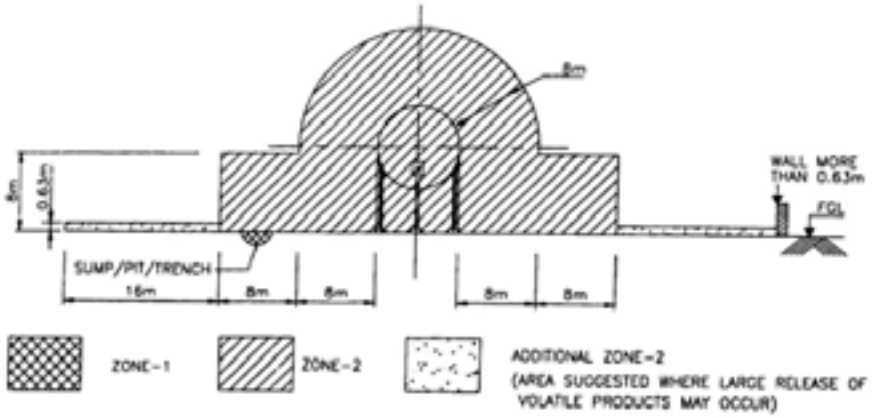


FIG. H8 PRESSURE STORAGE TANK (SPHERE) (HEAVIER-THAN-AIR GASES OR VAPOUR)

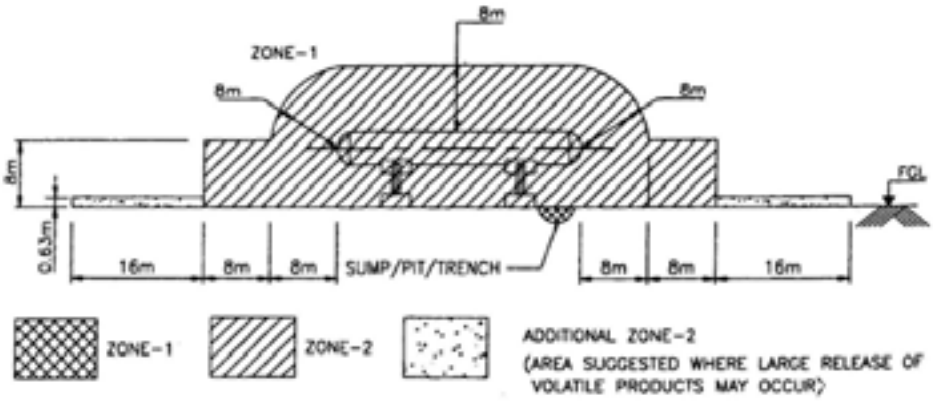


FIG. H9 PRESSURE STORAGE TANK (BULLET) (HEAVIER-THAN-AIR GASES OR VAPOUR)

Mounded Storage

The underground mounded storage shall not be considered as a source of hazard for the purpose of area classification. However, the area extending to 3 m. in all directions surrounding the associated appurtenances (valves, fittings, meters, etc.) located above ground shall be classified as Zone 2 area.

Lighter-than-Air Gases and Vapours

Where a substantial volume of gas or vapour is released into the atmosphere from a localized source, a vapour density less than one, that is, lighter-than-air, for the combustible indicates the gas or vapour will rise in a comparatively still atmosphere. A vapour density greater than one, that is heavier-than-air, indicates the gas or vapour will tend to sink and may thereby spread some distance horizontally and at a low level. The latter effects will increase with compounds of greater vapour density.

In process industries, the boundary between compounds which may be considered lighter-than-air is set at a vapour density of 0.75. This limit is chosen so as to provide a factor of safety for these compounds whose densities are close to that of air. and where movement may not therefore, be predicted without a detailed assessment of local conditions.

Open Air Situations

a. Figure L1 illustrates the situation when a source of hazard which may give rise to a hazardous atmosphere only under abnormal conditions is located in the open air. The hazardous area should in this case be classified as Zone 2. If the source of hazard gives rise to a hazardous atmosphere under normal operating conditions, the area described in Fig. Ll as Zone 2 should be classified as Zone I.

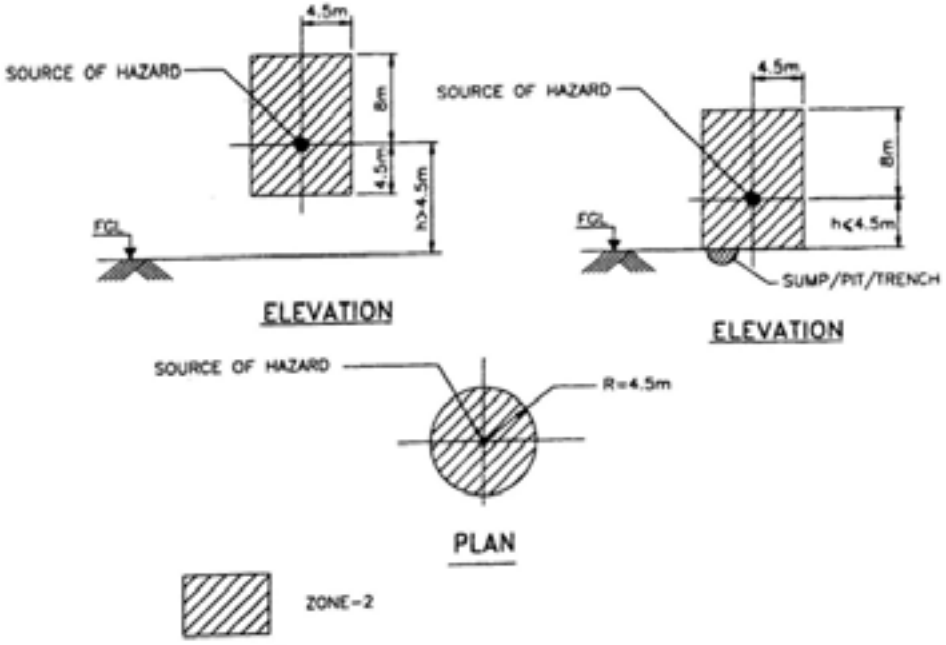


Fig. L1 Freely Ventilated Process Area (for Lighter-than-Air Gases or Vapours)

b. In case of petroleum pipelines where well maintained valves, fittings and meters of a pipeline system transporting gases are installed in well-ventilated situations or in a pit, the extent of the Zone 2 area above ground may be reduced to 3 m in all directions from the possible source of hazard.

Source of Hazard Located Inside Enclosed Premises

Figures L2 to L6 illustrates the situation when a source of hazard which may give rise to a hazardous atmosphere under abnormal conditions is located within enclosed premises. If the source of hazard within the enclosed premises gives rise to hazardous atmosphere under normal conditions, the area within the building as Zone 2, in Fig. L2 to L6 should be classified as Zone I.

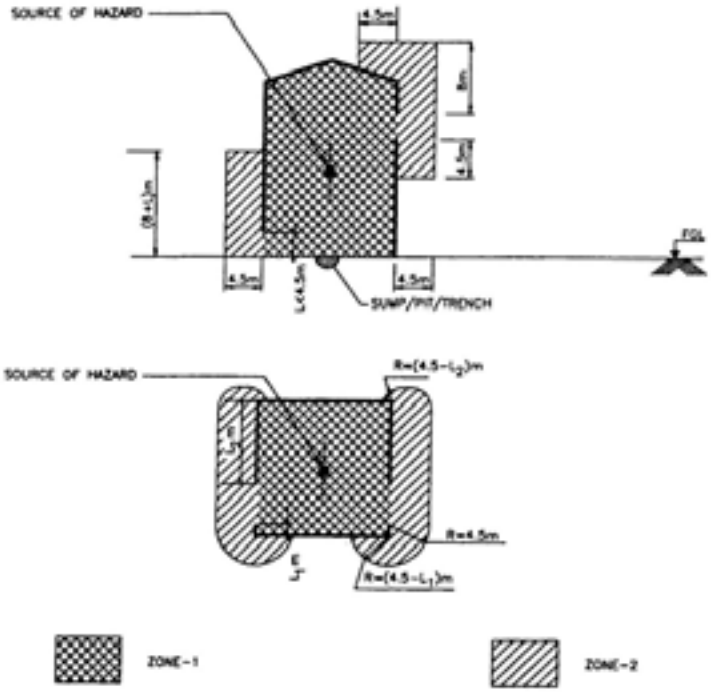


FIG. L2 SOURCE OF HAZARD LOCATED INSIDE ENCLOSED PREMISES WITH RESTRICTED VENTILATION (OPENINGS ON TOP AND BOTTOM) (LIGHTER-THAN-AIR GASES OR VAPOURS)

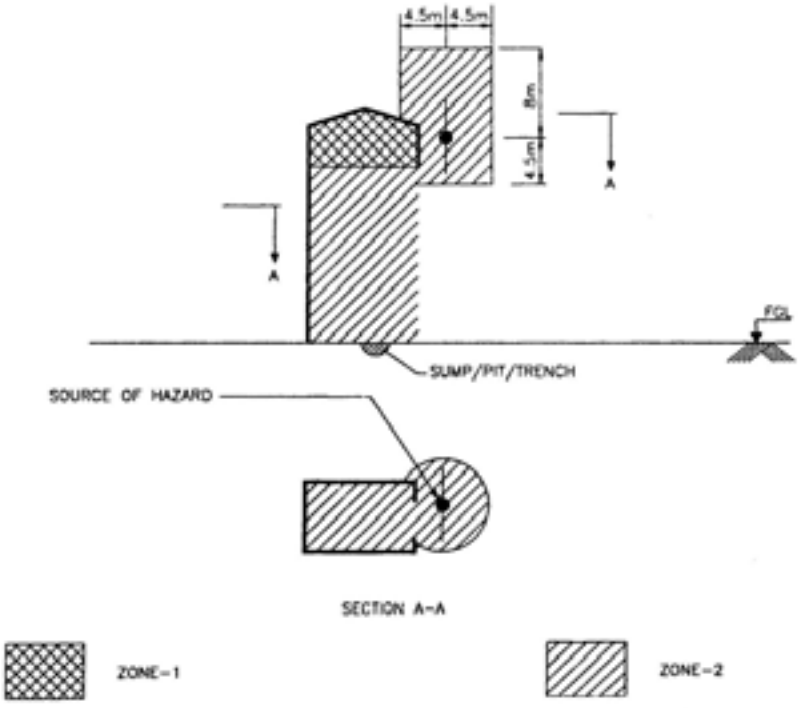


FIG. L3 SOURCE OF HAZARD LOCATED OUTSIDE THE ENCLOSURE WITH ONE SIDE OPEN (LIGHTER-THAN-AIR GASES OR VAPOURS)

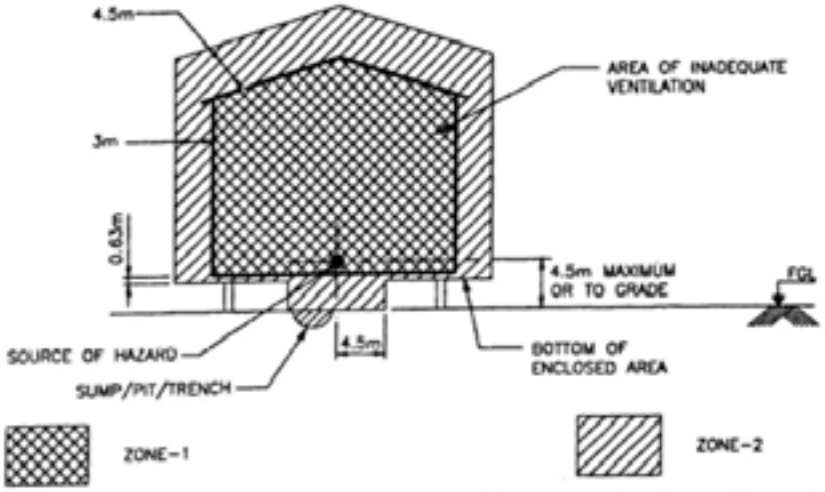


FIG. L4 INADEQUATELY VENTILATED COMPRESSOR SHELTER (LIGHTER-THAN-AIR GASES OR VAPOURS)

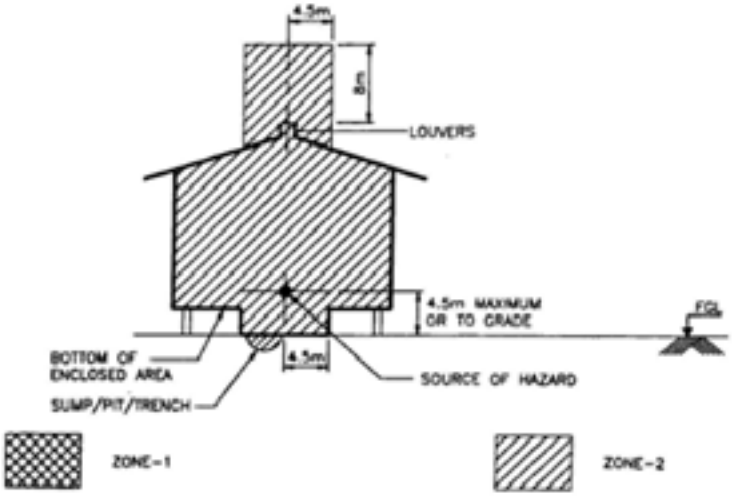


FIG. L5 ADEQUATELY VENTILATED COMPRESSOR SHELTER (LIGHTER-THAN-AIR GASES OR VAPOURS)

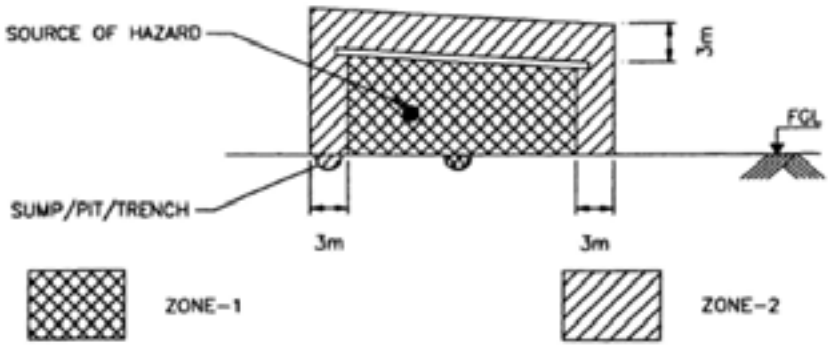


FIG. L6 PROCESS AREA WITH RESTRICTED VENTILATION (LIGHTER-THAN-AIR GASES OR VAPOURS)

Relationship Between Gas/Vapour Subdivision and Apparatus Subgroup

Sr. No. (1)	Location Gas/Vapour sub division (2)	Permitted Apparatus Group or Subgroup (3)
i)	II A	II, II A, II B, or II C
ii)	II B	II, II B, or II C
iii)	II C	II, or II C

HAZARDOUS AREA CLASSIICATION FOR FLAMMABLE LIQUIDS

Class vide I.S. 5572, as per Flash Point	Class vide PESO, Petroleum Code	LIQUIDS
Class A, Flammable liquids having flash point below 23°C	Dangerous Petroleum	Gasoline, Aviation Petrol, Alcohols, Naphtha(Low FP), Benzene, oxyline, chlorobenzene, etc.
Class B, Flammable liquids having flash point 23°C and above but below 65°C	Non-Dangerous petroleum	Kerosene, Diesel, Naphtha (high FP), turpentine, Styrene, edible oil, Non-chlorobenzene etc
Class C, Flammable liquids having flash point 65°C and above but below 93°C	Non Dangerous Heavy Petroleum	Furnace Oil, Residential fuel oil, Aniline, Naphthalene, Phenol, Oil of creosote etc.

Contributed By

ULHAS VAJRE

C. ENG (I), DEE, AMIE, BE, MIE, FIV, FISLE, MIIE, CEM, CEA, FIAEMP, FCEEAMA.

- Member National Safety Council, NSC, Mumbai, Ministry of Labour, Govt. of India.
- Authorized Chartered Electrical Safety Engineer, by CEI, IE&L Department, Govt. of Maharashtra.
- Empanelled Fire & Life Safety Auditor, MCGM
- Member Fire & Security Association of India, FSAI.
- Recognized Competent Person under Petroleum Rules 2002, by Petroleum and Explosives Safety Organization, PESO, Ministry of Commerce & Industries, Govt. of India.
- Certified Energy Auditor by Bureau of Energy Efficiency, BEE, Ministry of Power, Govt. of India.
- Chartered Engineer & Life Member – Institution of Engineers (India), IE (I).
- Life Fellow Member – Indian Society of Lighting Engineers, ISLE.
- Life Member – Indian Institution of Industrial Engineering, IIIE.
- Fellow Institution of Valuers, IV
- Life Fellow Member Indian Association of Energy Management Professionals, IAEMP.
- GEM Certified Professional by ASSOCHAM GEM Sustainability Council

Courtesy: PESO, Petroleum Rules 2002, IS 5572/IEC 60079-P1...P30


PRABHA
ENTERPRISES
DIGITAL MARKETING
IT & SOFTWARE
CONTENT CREATION
grow your Digital Presence with us!!
Software Development
Business Process Automation / Re-engineering
Windows Application Development
Microsoft Technology Asp.Net, Win Forms, MS Access.
Website design & development
Android App development
Digital media marketing
People Networking
Marketing
Business Development
Team Building and management
Graphic designing
Brand designing
Visual and spatial consultancy
Print media content creation
Digital content creation
Photography and Videography Services
Contact Us:
+91 9765150066
prabhaenterprises09@gmail.com
www.prabhaenterprises.com

Reference : Editorial February 2025 Issue

A reactor vessel (left) and plasma injector (right) come together for General Fusion’s debut in February.

WINNERS OF QUIZ
JANUARY 2025

SUHAS L PATIL

VINAY YADAV

SHRINIVAS K. JOSHI

Congratulations

QUIZ FEBRUARY 2025

1. HRSG:
   A. High Resonating Signal Generator
   B. Hydrogen Residue Source Gain
   C. Heat Recovery Steam Generator
   D. Heavy Residue Steam Gain

2. The second major commercial energy consuming sector in the country is:
   A. Industry
   B. Agriculture
   C. Residential
   D. Transport

3. The Ozone layer exists in:
   A. Stratosphere
   B. Troposphere
   C. Atmosphere
   D. At Sea Level

4. The benchmark for energy performance parameter for air conditioning equipment is:
   A. kW/kg of refrigerant handled
   B. kW/ton of refrigeration
   C. kcal/m3 of chilled water
   D. kWh/ton of refrigeration

5. The power requirement of the DG set is determined by:
   A. Base Load
   B. Maximum Load
   C. Partial Load
   D. Zero Load

6. Designed Power factor of a DG set is generally at:
   A. 1.0
   B. 0.8
   C. 0.9
   D. 1.1

7. The choice of fan type for a given application depends on:
   A. Flow
   B. Static pressure
   C. Both A & B
   D. Neither A nor B

8. If the reactive power drawn by a particular load is zero, it means the load is operating at:
   A. Lagging power factor
   B. Leading power factor
   C. Unity power factor
   D. All of the above

9. Smart meters are digital devices that measure and record ___ consumption in real time:
   A. Electricity
   B. Gas
   C. Water
   D. All the above

10. Lighting or illumination is the deliberate use of:
A. Artificial light sources
B. Natural illumination
C. Both A & B
D. None of the above

Rules for the QUIZ:

- The Quiz will be open for 10 days from the date of EMAIL.
- Each correct answer received on DAY 1 will get 100 points
- Next days the points will reduce as 90 – 80 – 70 and on 10th day points will be ZERO even if the
- answer is correct.
- All participants will receive E certificate signed by CEEAMA President with the points earned
- mentioned on the same.

Please use following google form link to participate in the QUIZ.

https://forms.gle/R6cJ8RgesQfzHoHw7

"Thank you all for the overwhelming response to the E-NEWS in general and E-Quiz in particular. MCQ based quiz is always tricky and surprisingly can take us aback when we realise our conceptions (misconceptions) about the subject / system / product.

The aim of the feature was to create inquisitiveness in your mind and help you check your technical quotient

quickly. The response will also help us to present articles and webinars on subjects which are important, but which

lack enough awareness / knowledge in general.

It can open a pandora box for our discussions and arguments and probable solutions. Engineering evolves with conception. It gets fuelled with community discussions and capitalist actions. All stakeholders start realising the need to take a closer look and help improve standards as we have seen in the past century. Surely it makes the world a better place.

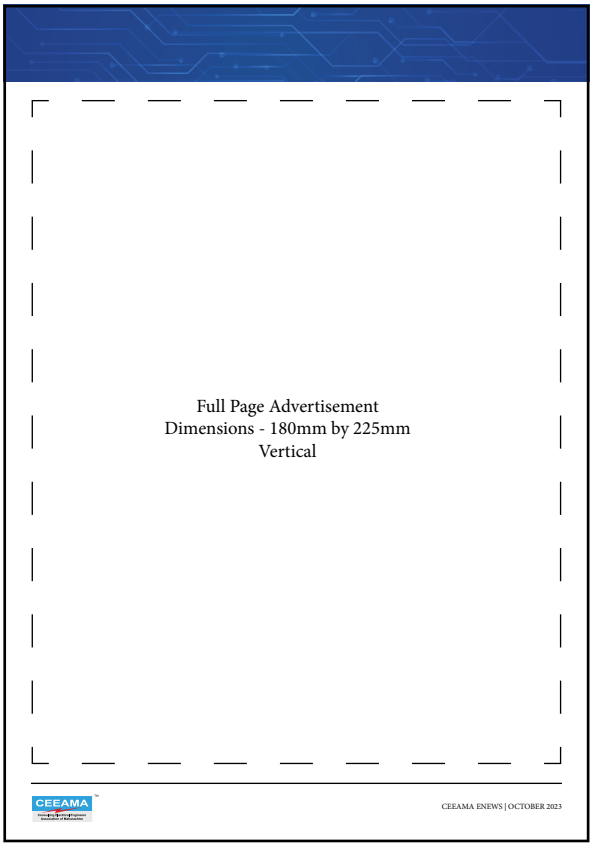
Wish you all a better luck this time.

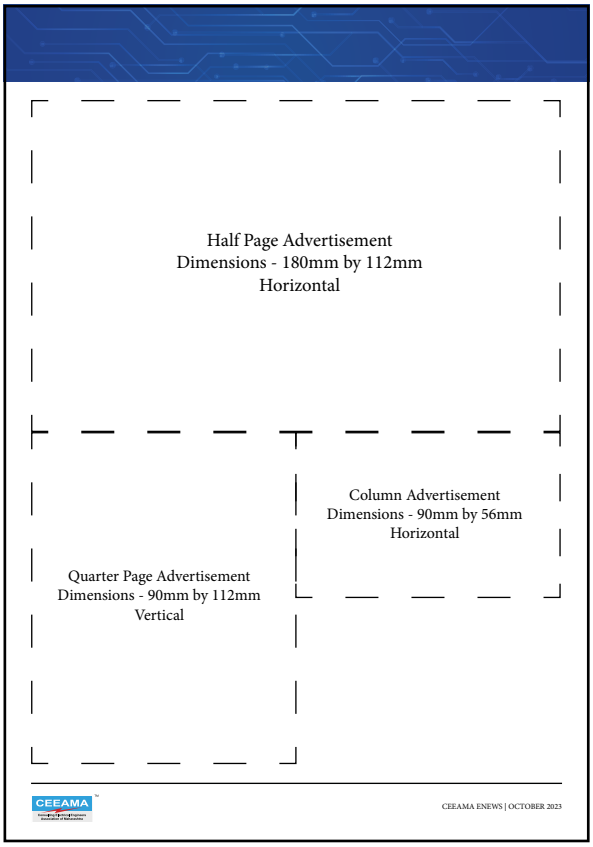
Do spread the word.

January 2025 Quiz Answers

1. C. Asynchronous slip ring Induction motor
2. B. 1996
3. D. All of the above
4. D. All of the above
5. A. IEC 62351
6. A. Auto Cluster, Chinchwad, Pune
7. D. All of the above
8. B. Insulation deterioration
9. C. IEC: 60947-4-1
10. B. Porcelain Insulator

ADVERTISEMENT RATES





Above given layouts are only for understanding the advertisement sizes. Actual positions of ads may vary as per space available in the issues.
Below given rates are for advertisement size and number of issues published monthly.

E-Newsletter Ad	3 months	6 months	9 months	12 months
Full Page Ad	INR 1000/-	INR 2000/-	INR 2700/-	INR 3300/-
Half Page Ad	INR 800/-	INR 1600/-	INR 2200/-	INR 2800/-
Quarter Page Ad	INR 600/-	INR 1200/-	INR 1600/-	INR 2100/-
Column Ad	INR 400/-	INR 800/-	INR 1000/-	INR 1400/-
Website Ad	INR 1000/-	INR 2000/-	INR 2700/-	INR 3300/-

GST @18% will be additional on all the above rates.

Please send the E-Newsletter Advertisement in PDF or JPG format ONLY.
Please send the Website Advertisement in JPG or PNG format ONLY.

CEEAMA™

Consulting Electrical Engineers Association of Maharashtra

CEEAMA *LiveWire*

E-NEWSLETTER

Published by Consulting Electrical Engineers Association of Maharashtra

Electrical Consultants Newsletter
Volume No. 4 Issue #47
FEBRUARY 2025

A-103. Sanpada Railway Station Building, 1st floorSanpada East, Navi Mumbai – 400705
Email: admin@ceeama.org