

# **White Papers**

## **Explosion Proof Knowledge**



**SURREAL TECHNOLOGY LIMITED**

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# Definition of Explosion Proof

## Explosion Formation

Explosion takes place in the conditions of the following factors:



There are three factors will make it possible for a real explosion, even through we can take some measures to avoid the formation of explosive atmospheres, the leaked combustible substance still present probably, so Combustible substances, such as gas, vapor, mist and dust may exist, besides, we are impossible to avoid Air (oxygen) in any environment, so what we can only do to avoid explosion is only to control Ignition source.

Since there inherently exists electrical power for all electrical products used in oil and gas projects. The electrical circuit may probably produce high temperature, electrical sparks and even visible fire in case of short circuit, over-current and any other failure of the whole circuit, in that case, the electrical circuit will become Ignition source to make it possible for a real explosion.

Thus, we must use explosion proof products to avoid the formation for the Ignition Source to ensure the safety.

# Explosion Protection

In order to avoid explosions and consequential dangers, the operator must incorporate effective explosion proof protection precautions.

- **Avoid the formation of explosive atmospheres**
- **Avoid the ignition of hazardous explosive atmospheres**
- **Confining explosion impact to a negligible extent**

## Principle of Explosion Proof

All explosion-proof electrical products mainly have three measure to stop electrical circuit to be an ignition source outside the enclosure below:

- 1. Isolate the electrical circuit between inside the enclosure and outside the enclosure to avoid the explosion escape from the inside to the outside of the enclosure even through electrical circuit can become an ignition source inside the enclosure.**

Ex-mark	Types	Diagram	Illustration
Ex d	Flame proof		The enclosures are constructed so that the internal explosions can not be transmitted to the external atmosphere.

### —What is “d” ?

"Ex d" is called "flame proof" type which means electrical circuit probably produce electrical spark or high temperature, at the same time, combustible substances, such as gas, vapor, mist and dust will enter into the electrical circuits enclosure, thus we can not avoid forming the ignition source inside the enclosure, then it means we can not avoid explosion inside the enclosure, but we can put all electrical circuit in a specialized designed metal enclosure, normally aluminum alloy, when electrical circuit inside the enclosure become the ignition source, the internal space inside the enclosure will form an explosion, after explosion occurs inside the enclosure, we have designed an special flameproof path for all heat and impact to escape from inside the enclosure to outside the enclosure, when the heat and impact escape to the outside enclosure:

No. 1: The heat energy could be reduced to a negligible energy automatically to avoid this heat to be the ignition source outside the enclosure, then no explosion will form outside the enclosure to protect the life and building safety.

No. 2: The impact could be reduced to a negligible energy automatically to damage the life and building safety outside the enclosure.

**2. Limit the energy of electrical circuit to avoid the electrical circuit to be an ignition source, such as control the temperature, limit the sparks, eliminate the fire.**

Ex-mark	Types	Diagram	Illustration
Ex e	Increased Safety		Prevention to ignition sources, only simple electrical components
Ex i	Intrinsic Safety		Limitation of energy stored in the electrical circuits

**—What is “e” ?**

"Ex e" type is called "increased safety" type which means all circuits are safe normally but we make some measures to increase the safety level to ensure no arcs sparks or hot surfaces.

In some case, when the electrical circuits operate normally, that electrical circuit inside will not produce any electrical sparks and dangerous high temperature, but we will take some other measures to make sure the higher safety such as use high quality electrical insulating material to limit the temperature rise, extend the electrical clearance and creepage distance to increase safety for electrical circuit.

**—What is “i” ?**

"Ex i" type is called "intrinsic safety" type which means are circuits are safe normally but we change the circuit layout to limit the electrical current to limit the sparks energy and surface temperature. "Ex i" type normally could be used in Extra-low Voltage(ELV) ,Extra-low Current such as remoter, instrument, telecommunications, alarm related products.

**3. Isolate the electrical circuit between inside the enclosure and outside the enclosure to avoid the electrical circuit to be an ignition source inside the enclosure.**

Ex-mark	Types	Diagram	Illustration
Ex o	Oil Immersion		Electrical parts are submerged in oil
Ex m	Encapsulation		Electrical parts are encapsulated in a specific resin
Ex q	Power Filling		Electrical parts are submerged in a quartz powder
Ex p	Pressurized		Electrical parts are purged and pressurized with a protective gas
Ex n	"n" Protection		No ignition source in normal operation, no sparks, no hot surfaces

**—What is “o” ?**

"Ex o" type is called "oil immersion" type which means electrical circuit probably is unsafe but we use special explosion-proof oil to immerse the electrical circuits to isolate the electrical circuits from combustible substances outside the enclosure.

**—What is “m” ?**

"Ex m" type is called "encapsulation" type which means electrical circuit probably is unsafe but we use special explosion-proof glue to seal the electrical circuits to isolate the electrical circuits from combustible substances outside the enclosure.

**—What is “q” ?**

"Ex q" type is called "powder filling" type which means electrical circuit probably is unsafe but we use special explosion-proof powder to seal the electrical circuits to isolate the electrical circuits from combustible substances outside the enclosure.

**—What is “p” ?**

"Ex p" type is called "pressurization" type which means electrical circuit probably is unsafe but we aerate inactive gas, such as Nitrogen: N<sub>2</sub> into the inside enclosure (electrical circuit is inside the enclosure) to make sure the air pressure inside the enclosure is higher than standard atmospheric pressure outside the enclosure, as a result, the combustible gas or dust can not enter into internal space inside the enclosure to isolate the electrical circuits from combustible substances.

**—What is “n” ?**

"Ex n" type is called "restrict breathing" type which means electrical circuits are safe normally but we melt, extrude and glue the complete enclosure to restrict breath inside the enclosure to isolate the electrical circuit inside the enclosure to prevent combustible gas outside the enclosure entering into internal space inside the enclosure. This is the lowest level explosion-proof measure to make sure the safety because combustible substances probably enter into the internal space of enclosure in case, so "Ex n" could be used in "Zone 2" / "Class I Division 2".

# Classifications of Explosion Proof

## Classifications for Group/Class, Zones/Divisions

Hazardous locations are classified into different Group/Class, Zones/Divisions depending on the composition and presence frequency of flammable substances.

→ Group/Class

Locations	Group		Class
	EU-ATEX	IEC-IECEX	US NEC500 UL/CSA
Methane under mine	Group I	Group I	M
Hazardous gas and vapour	Group II	Group II	Group I
Hazardous dust		Group III	Class II
Hazardous fiber			Class III

⚠ **Dangerous Level:** Group I> Group II> Group III  
M>Class I>Class II>Class III

→ Division/Zone

Gas and Vapour			
Presence Frequency	Flammable Substances		
	Present Continuously	Present Intermittently	Present Abnormally
EU-ATEX IEC-IECEX	Zone 0	Zone 1	Zone 1
US NEC500 UL/CSA	Division 1		Division 2

⚠ **Dangerous Level:** Zone 0>Zone 1>Zone 2  
Division 1> Division 2

Dust and Fiber			
Presence Frequency	Flammable Substances		
	Present Continuously	Present Intermittently	Present Abnormally
EU-ATEX IEC-IECEX	Zone 20	Zone 21	Zone 22
US NEC500 UL/CSA	Division 1		Division 2

**⚠ Dangerous Level:** Zone 0>Zone 1>Zone 2  
Division 1> Division 2

## Classifications for Flammable Substances

Flammable substances are classified into different groups depending on how easy the exact flammable substances could be ignited.

Gas and Vapor		
Typical Gas and Vapor	Flammable Substances	
	EU-ATEX IEC-IECEX	NEC500 UL/CSA
Acetylene C <sub>2</sub> H <sub>2</sub>	IIC	Class I/Group A
Hydrogen H <sub>2</sub>	IIB+H <sub>2</sub>	Class I/Group B
Ethylene C <sub>2</sub> H <sub>4</sub>	IIB	Class I/Group C
Propane C <sub>3</sub> H <sub>8</sub>	IIA	Class I/Group D
Methane CH <sub>4</sub>	I	Mining

**⚠ Dangerous Level:** I > IIC > IIB+H<sub>2</sub> > IIB > IIA  
Mining > Class I/Group A > Class I/Group B >  
Class I/Group C > Class I/Group D

Dust and Fiber		
Typical Dust and Fiber	Flammable Substances	
	EU-ATEX IEC-IECEX	NEC500 UL/CSA
Metal dusts	IIC	Class II/Group E
Carbonaceous dusts	IIB	Class II/Group F
Non-conductive dusts	IIB	Class II/Group G
Fibers and flyings	IIA	Class III

**⚠ Dangerous Level:** IIIC > IIB > IIA

Class II/Group E > Class II/Group F > Class II/Group G > Class III

## Classifications for Temperature

Explosive temperature is the highest temperature of a surface of an explosion-proof electrical products when this explosion-proof electrical products work normally. As we know, explosion-proof electrical products is still an electrical products which will produce heat when normal operated, but if the temperature of surface of explosion-proof electrical products is higher than spontaneous ignition temperature of the outside combustible gas or dust, this electrical products will ignite the combustible gas or dust outside the enclosure directly, in a word, explosion-proof electrical products have become an ignition source itself even electrical circuits inside the enclosure are explosion-proof type. So the temperature group may be classified into different groups.

Note: When we intended to install an explosion-proof electrical products in an gas or dust atmosphere where the spontaneous ignition temperature is 100°C (T5), so we could exactly install explosion-proof electrical products whose temperature group is 85°C (T6) but we could not install explosion-proof electrical products whose temperature group is 135°C (T4).

In a word, as for temperature group of explosion-proof electrical products, the

lower, the better! because lower temperature group could be used for wider scope of combustible gas or dust.

Marking	EU-ATEX IEC-IECE <sub>x</sub>	US NEC500 UL/CSA
450°C	T1	T1
300°C	T2	T2
280°C		T2A
260°C		T2B
230°C		T2C
215°C		T2D
200°C	T3	T3
180°C		T3A
165°C		T3B
160°C		T3C
135°C	T4	T4
120°C		T4A
100°C	T5	T5
85°C	T6	T6

# Class 1 Div 1

## What is a Class 1 Div 1 area?

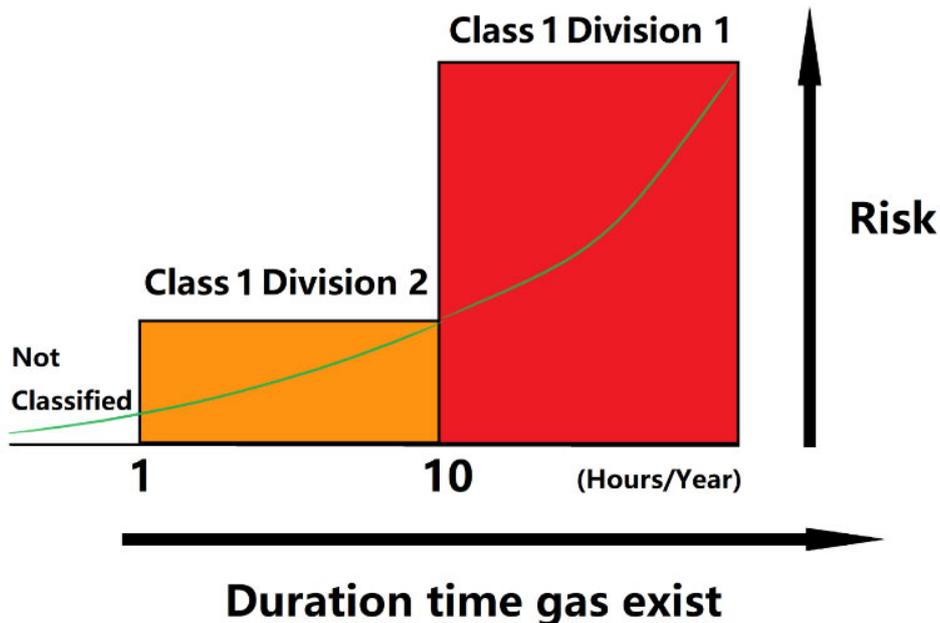
### Class 1 Div 1 Definition

#### In Simple Word

Class 1 Div 1 location, C1D1 for short, Class 1 Division 1 for full name, means ignitable concentrations of hazards, such as flammable vapors and gases, exists under normal operation conditions, and/or where hazard is caused by frequent maintenance or repair work or frequent equipment failure.

#### In Quantitative Measurement

Class 1 Div 1 location means ignitable concentrations of hazards, such as flammable vapors and gases, present more than 10 hours every year.



# Class 1 Division 1 Electrical Requirements

## In Accordance with NEC Article 500

### Class 1 Division 1

#### A Class 1, Division 1 location is a location:

- In which ignitable concentrations of flammable gases, flammable liquid-produced vapors, or combustible liquid-produced vapors can exist under normal operating conditions, or
- In which ignitable concentrations of such flammable gases, flammable liquid-produced vapors, or combustible liquids above their flash points may exist frequently because of repair or maintenance operations or because of leakage, or
- In which breakdown or faulty operation of equipment or processes might release ignitable concentrations of flammable gases, flammable liquid-produced vapors, or combustible liquid-produced vapors and might also cause simultaneous failure of electrical equipment in such a way as to directly cause the electrical equipment to become a source of ignition

**C1D1**

**UL/Intertek**

**Nema 4X+**

## FAQ for Class 1 Div 1

### 1. Does Class 1 Div 1 require explosion-proof?

Yes, Class 1 Div 1 require explosion proof. Based on Class 1 Div 1 definition, Class 1 Div 1 is the most stringent safety grade among all explosion proof grades since the existing frequency of hazardous gas is very high, the lighting fittings should be able to contain the explosion through a high impact resistance enclosed housing, Class 1 Div 1 MUST require explosion proof.

### 2. What is a Class 1 Division 1 hazardous location? What is C1D1 certification?

C1D1 is the abbreviation of Class 1 Division 1, class i division 1. Class i Division 1 hazardous locations have serious possibility to form an explosive environment asking for forced explosion proof protection for electrical device.

C1D1 certification involves in UL certified and other issue body such as Intertek certificated in accordance with C1D1 classification from the same NEC article 500 standard.

### **3. What is the difference between Class 1 Div 1 and Div 2?**

#### **What is the difference between C1D1 and C1D2?**

Class 1 Div 1 equals to C1D1, Class 1 Div 2 equals to C1D2. Both Class 1 Div 1 and Class 1 Div 2 belong to the Class 1 hazards, flammable gas , vapors according to class 1 division 1 electrical requirements and class 1 division 2 electrical requirements, the main difference is only the existing frequency of hazards, C1D1 present for more than 10 hours every year, C1D2 present ranges from 1 hour to 10 hours every year.

### **4. Does ethanol extraction require C1D1?**

No, ethanol extraction require C1D2 only. Even ethanol is a kind of volatile and flammable liquid, it is not classified into typical hazards within class 1 group and can be considered “Not Very Hazardous” to be easily ignited under normal processing procedures, you can still require C1D1 for ethanol extraction, but it is not mandatory, ethanol extraction require C1D2 in practical application.

### **5. What is a Class 1 hazardous location?**

A “Class I” hazardous location may form under the presence of flammable gases or vapors in the air in sufficient concentration to be explosive or ignitable. When these materials appear in this so-called “Class 1 environment”, a potential for explosion exists if an electrical or other source of ignition is present. Electrical classification class 1 covers Class 1 Division 1 rating and Class 1 Division 2 rating.

## Class 1 Div 2

### What is a Class 1 Div 2 area?

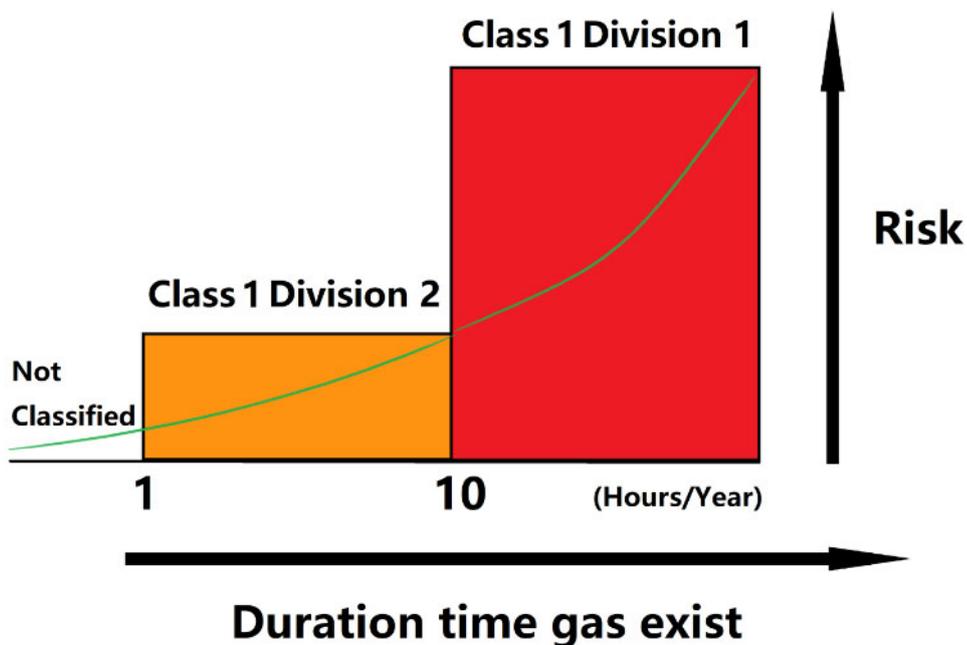
#### Class 1 Div 2 Definition

##### In Simple Word

Class 1 Div 2 location, C1D2 for short, Class 1 Division 2 for full name, means ignitable concentrations of hazards, such as flammable vapors and gases, exists under abnormal operation conditions.

##### In Quantitative Measurement

Class 1 Div 2 location means ignitable concentrations of hazards, such as flammable vapors and gases, present from 1 hour to 10 hours every year.



## Class 1 Division 2 Electrical Requirements

### In Accordance with NEC Article 500

#### Class 1 Division 2

##### A Class 1, Division 2 location is a location:

- In which volatile flammable gases, flammable liquid-produced vapors, or combustible liquid-produced vapors are handled, processed, or used, but in which the liquids, vapors, or gases will normally be confined within closed containers or closed systems from which they can escape only in case of accidental rupture or breakdown of such containers or systems or in case of abnormal operation of equipment, or
- In which ignitable concentrations of flammable gases, flammable liquid-produced vapors, or combustible liquid-produced vapors are normally prevented by positive mechanical ventilation and which might become hazardous through failure or abnormal operation of the ventilating equipment, or
- That is adjacent to a Class 1, Division 1 location, and to which ignitable concentrations of flammable gases, flammable liquid-produced vapors, or combustible liquid-produced vapors above their flash points might occasionally be communicated unless such communication is prevented by adequate positive-pressure ventilation from a source of clean air and effective safeguards against ventilation failure are provided.

**C1D2**

**UL/Intertek**

**Nema 4X+**

### FAQ for Class 1 Div 2

#### 1. Does Class 1 Div 2 require explosion proof?

Yes, Class 1 Div 2 require explosion proof. According to Class 1 Div 2 requirements, considering the existing frequency of ignitable gas of Class 1 Div 2 is not higher than Class 1 Div 1, led lighting should at least be constructed properly as “explosion proof” to limit the energy or isolate the ignition sources physically to prevent future explosion from happening, let alone the spreading of explosion.

## **2. What is a Class 1 Division 2 hazardous area? What is a C1D2 room?**

Class 1 Division 2 hazardous area produce flammable vapors or gases which are further divided into Class 1 Division 2 Groups A-D. Hazardous material come out in abnormal conditions, such as system or container failures, leaks or ruptures and do not expected to always exist, only under unusual conditions. C1D2 room should install electrical device abide by electrical rating class 1 division 2.

## **3. Is NEMA 4X good for Class 1 Div 2?**

Yes, when you intend to use electrical enclosure or panel in hazardous location, it is crucial to keep any combustible substances such as gases, vapors from entering into the confined housing and influencing the working of the electrical components inside. NEMA 4 and NEMA 4X protection rating lay the rational foundation for anti-explosion performance of nema 4x class 1 division 2 explosion proof enclosure.

## **4. What is a Class 1 Div 2 enclosure?**

Class 1 Division 2 Enclosure is used in facilities that flammable gases, vapors, and liquid materials are unlikely to present. Different from Class 1 Div 1 enclosure, Class 1 Div 2 enclosure should be factory sealed with at least Nema 4X rated standard as “nema explosion proof”, housed by glass reinforced plastic, stainless steel or aluminum alloy material control the potential to bring about ignition source via restrain high heat, temperature of electrical parts.

## **5. Does Class 1 Div 2 require seal offs?**

Yes, no matter what kind of outlets from such as conduit system, cables, cable entries of light fixtures, boxes, receptacles, switches, when the environment meet the electrical rating class 1 division 2 or flammable gas or vapors spread through any space or gaps within the whole system, sealing off for any bonding surface is essential to reduce the risk for concentration of hazards subject to class 1 div 2 seal off requirement.

# Class 2 Div 1

## What is a Class 2 Div 1 area?

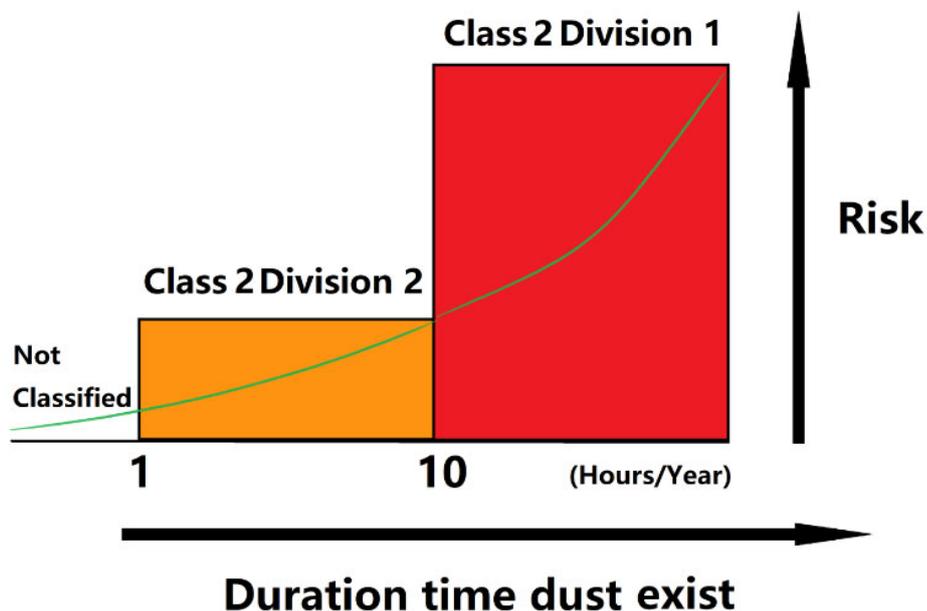
### Class 2 Div 1 Definition

#### In Simple Word

Class 2 Div 1 location, C2D1 for short, Class 2 Division 1 for full name, means ignitable concentrations of hazards, such as flammable dust, exists under normal operation conditions and/or where hazard is caused by frequent maintenance or repair work or frequent equipment failure.

#### In Quantitative Measurement

Class 2 Div 1 location means ignitable concentrations of hazards, such as flammable dust, present more than 10 hours every year.



## Class 2 Division 1 Electrical Requirements

### In Accordance with NEC Article 500

#### Class 2 Division 1

##### A Class 2, Division 1 location is a location:

- In which combustible dust is in the air under normal operating conditions in quantities sufficient to produce explosive or ignitable mixtures, or
- Where mechanical failure or abnormal operation of machinery or equipment might cause such explosive or ignitable mixtures to be produced, and might also provide a source of ignition through simultaneous failure of electrical equipment, through operation of protection devices, or from other causes, or
- In which Group E combustible dusts may be present in quantities sufficient to be hazardous in normal or abnormal operating conditions.

**C2D1**

**UL/Intertek**

**Nema 4X+**

### FAQ for Class 2 Div 1

#### 1. Does Class 2 Div 1 require explosion proof?

Yes, Class 2 Div 1 require explosion proof. The hazardous dusts are easily to be ignored the dangerous grade but they are also can be ignited to form an explosion, particularly the concentration of combustible dust is high in Class 2 Division 1 location, causing the similar explosion potential compared with flammable gases in Class 1 Div 1 location, electrical boxes should be housed in confined space to restrain the explosion transmitting to surrounds, so Class 2 Div 1 should require explosion proof.

#### 2. What is a Class II Division 1 location?

Class II Division 1, so-called Class 2 Division 1, Class II Div 1 location is a place where combustible dusts like metal dusts, carbonaceous dusts, non-conductive dusts exist when normal operation, in order to make sure the safety, all electrical devices including lighting fixtures, control box, receptacle should be explosion proof to resist any mechanical impact and limit the explosive factors.

#### 3. What is a Class 2 enclosure?

Class 2 enclosure is explosion proof enclosure for usage in Class 1 hazardous location where flammable dust present under normal or abnormal condition. Any electrical parts should be put inside Class 2 enclosure to isolate the ignition source or prevent the heat from being the ignition source to be worked as explosion proof electrical equipment, it is widely applied for grain processing, flour and feed mills industry.

#### **4. What is the difference between Class 2 Div 1 and Div 2**

##### **hazardous area?**

Class 2 hazardous area define the same explosive or ignitable substance-combustible dusts in the environment, the significant difference between Class 2 Div 1 and Class 2 Div 2 is durable time of the combustible dust present, Class 2 Div 1 may present for more than 10 hours, instead, Class 2 Div 2 only present for one to ten hours, thus, Class 2 Div 1 condition is harsher and more dangerous than Class 2 Div 2.

#### **5. Can equipment approved for a Class I hazardous location be used in a Class II hazardous location?**

No, Equipment only approved for Class I hazardous location can NOT be used in Class II, besides, equipment only approved for Class II hazardous location can NOT be used in Class I. Class I and Class II are applied with different explosion proof technology. Class I approved equipment are normally designed with flame proof, increased safety explosion proof structure to use in combustible dust hazardous location, instead, Class II approved equipment are commonly designed with housing protection explosion proof structure.

## Class 2 Div 2

### What is a Class 2 Div 2 area?

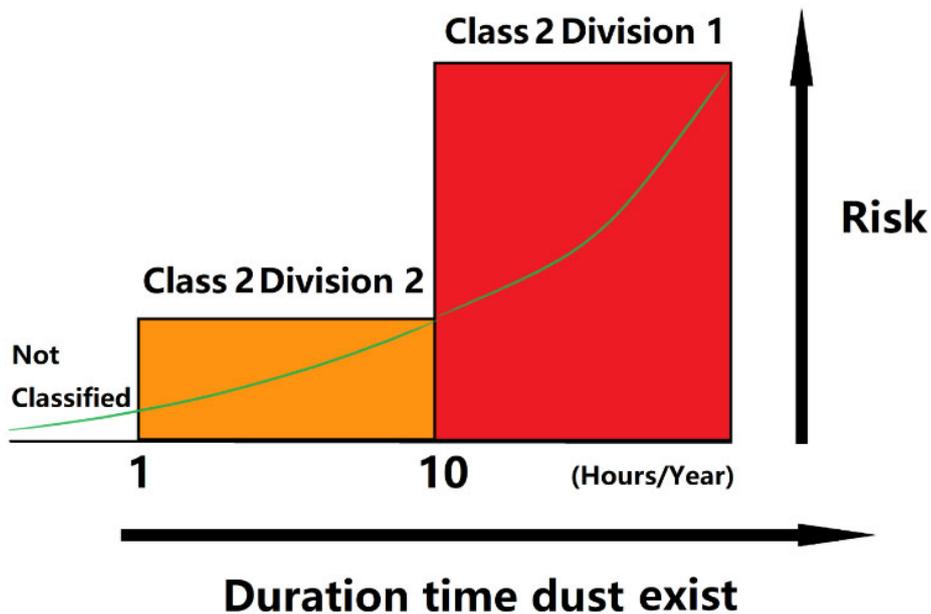
#### Class 2 Div 2 Definition

##### In Simple Word

Class 2 Div 2 location, C2D2 for short, Class 2 Division 2 for full name, means ignitable concentrations of hazards, such as flammable dust, exists under abnormal operation conditions.

##### In Quantitative Measurement

Class 2 Div 2 location means ignitable concentrations of hazards, such as flammable dust, present from 1 hour to 10 hours every year.



## Class 2 Division 2 Electrical Requirements

### In Accordance with NEC Article 500

#### Class 2 Division 2

##### A Class 2, Division 2 location is a location:

- In which combustible dust due to abnormal operations may be present in the air in quantities sufficient to produce explosive or ignitable mixtures; or
- Where combustible dust accumulations are present but are normally insufficient to interfere with the normal operation of electrical equipment or other apparatus, but could as a result of infrequent malfunctioning of handling or processing equipment become suspended in the air; or
- In which combustible dust accumulations on, in, or in the vicinity of the electrical equipment could be sufficient to interfere with the safe dissipation of heat from electrical equipment, or could be ignitable by abnormal operation or failure of electrical equipment.

**C2D2**

**UL/Intertek**

**Nema 4X+**

### FAQ for Class 2 Div 2

#### 1. Does Class 2 Div 2 require explosion proof?

Yes, Class 2 Div 2 require explosion proof. Flammable dust do not always exist in Class 2 Div 2 locations, it seems it looks not that hazardous, anyway, some explosion proof measures such as restrict the energy of electrical circuit and control the temperature rise range still need to applied for any electrical box to be explosion proof.

#### 2. What is Class II and Class III in hazardous location?

**What is a Class 2 hazardous location?**

**What is a Class 3 hazardous location?**

Class II hazardous location, also called Class 2 hazardous location, are those in which combustible dust may be easily found, Class III hazardous location, also called Class 3 hazardous location, are those which ignitable fibers or

flyings may be frequently produced. In practical modern explosion proof industry, when a light fixture or enclosure is designed to be used in class 2 hazardous location including class 2 div 1 and class 2 div 2, it can be also used in Class III hazardous location.

### **3. What is a Class 2 Div 2 area?**

Class 2 area is made of location where combustible dusts may exist that have the potential to become flammable or ignitable. Class 2 Div 2 area is one division of Class 2 area and is classified as an area where the explosive or flammable combustible dusts mentioned above are not likely to exist during regular operation. Class 2 Div 2 areas include grain elevators, flour and feed mills, metal powder plants, and coal plants.

### **4. Can I use a piece of equipment approved for use in a Division 1 hazardous location in a Division 2 hazardous location?**

Yes, Class 1 covers Class 1 Div 1 and Class 1 Div 2, Class 2 covers Class 2 Div 1 and Class 2 Div 2, the explosive substance in Div 1 of Class 1 or Class 2 exist more frequently than ones in Div 2 of Class 1 or Class 2. Thus, equipment approved for Class 2 Division 1 hazardous location can be used in Class 2 Division 2, equipment approved for Class 2 Division 1 hazardous location can be used in Class 2 Division 2.

### **5. What class and division is explosion proof?**

Hazardous location is classified into three class, Class 1, Class 2 and Class 3, and two division, Division 1 and Division 2. Class 1 locations consist of areas where flammable

gases, vapors exist, Class 2 locations consist of areas where flammable dusts exist, Class 3 locations consist of areas where fibers and flyings exist. Division 1 is classified as an area where flammable substances mentioned above can exist under normal, everyday operating conditions. Division 2 is classified as an area where flammable substances mentioned above are not likely to exist during regular operation.

# Zone 1

## What is Zone 1?

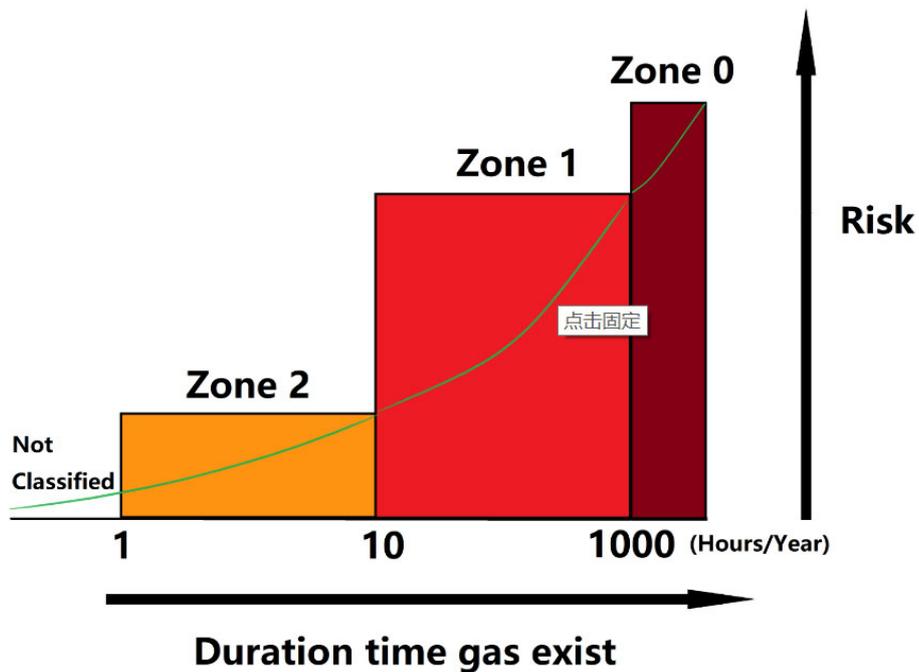
### Zone 1 Definition

#### In Simple Word

Zone 1 area means ignitable concentrations of hazards, flammable gases, vapors, or liquids, are likely to exist under normal operating conditions.

#### In Quantitative Measurement

Zone 1 area means ignitable concentrations of hazards, flammable gases, vapors, or liquids, present from 10 hours to 1,000 hours every year.



## Area Classification Zone 1

### In Accordance with ATEX IEC60079

#### Zone 1

Where ignitable concentrations of flammable gases, vapors, or liquids:

- Are likely to exist under normal operating conditions
- May exist frequently because of repair, maintenance operations or leakage

**Zone 1**

**ATEX/IECEx**

**IP66+**

### FAQ for Zone 1

#### What is a Zone 1 area? What is the meaning of Zone 1?

Zone 1 area is a location where an explosive atmosphere containing a mixture with air or flammable substances such as gas, vapor or liquid is likely to occur in normal operation or under presenting frequency from 10 hours to 1.000 hours every year. Zone 1 is the area of high risk for the presence of gas or vapor potentially explosive, All sources of ignition related to electrical, static, mechanical, heat are protected so that the equipment can operate safely within potentially flammable atmospheres.

#### What is ATEX Zone 1 certification?

Within Europe, when any kinds of electrical equipment is intended for use in a potentially hazardous area, the equipment must be ATEX certified as per the EU directive 60079- 2014/34 standard. ATEX Zone 1 certification for electrical equipment is certified issued by ATEX authorized body to indicate the users that the electrical equipment comply with requirements of zone 1 in the EU directive 2014/34 standard and can be permitted to be used in Zone 1.

#### What is the difference between Zone 1 and Zone 2?

Zone 1 contains a hazardous gas and air mixture under normal operating conditions. Zone 2 contains a hazardous gas and air mixture only under abnormal operating conditions, that is say hazardous gas exist for a long time for Zone 1, and short time for Zone 2. Among all zones, Zone 1 is already a serve environment with high risk, Zone 2 is a safer area with middle risk

compared with Zone 1, thus a zone 1 electrical equipment can be also used in Zone 2 environment.

### **What is Zone 1 in oil and gas?**

Oil and gas industry inherently easily produce any flammable substance including flammable gas, vapor, mist considering the whole process from exploitation, transportation and refinery. Zone 1 in oil and gas means location where the mixture of oxygen and flammable substance mentioned above likely to occur in all kinds of plants related to crude oil, nature gas, LNG, LPG, explosion proof zone 1 electrical equipment should be installed to protect the safety.

### **What is a Zone 0 location?**

Zone 0 is an area in which an explosive atmosphere is present continuously for long periods of time normally more than 1,000 hours every year or will frequently occur. Zone 0 is the most risky area within all zones, in order to limit the heat and energy at utmost to avoid the ignition source, only some low current instrument, such as remote controller, display front panel, instrument board can be used with intrinsic safety Ex i explosion proof technology.

# Zone 2

## What is Zone 2?

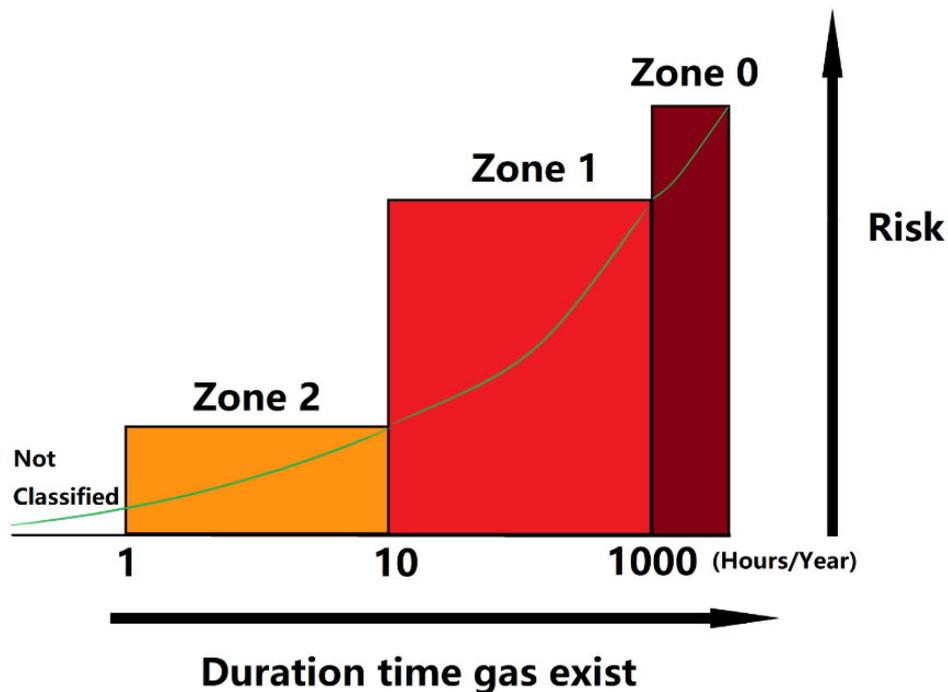
### Zone 2 Definition

#### In Simple Word

Zone 2 area means ignitable concentrations of hazards, flammable gases, vapors, or liquids, are not likely to exist under normal operating conditions.

#### In Quantitative Measurement

Zone 2 area means ignitable concentrations of hazards, flammable gases, vapors, or liquids, present from 1 hour to 10 hours every year.



## Area Classification Zone 2

### In Accordance with ATEX IEC60079

#### Zone 2

Where ignitable concentrations of flammable gases, vapors, or liquids:

- Are not likely to exist under normal operating conditions
- Occur for only a short period of time
- Become hazardous only in case of an accident or some unusual operating condition

**Zone 2**

**ATEX/IECEx**

**IP66+**

### FAQ for Zone 2

#### 1. What is ATEX zone 2?

Zone 2 is a place in which an explosive atmosphere is not likely to occur in normal operation, but, if it does occur, it will only persist for a short period. These areas only become hazardous in case of an accident or some unusual operating condition. Since zone 2 mostly is classified subject to ATEX 60079 article, it can be called as ATEX zone 2 in this case.

#### 2. What is Zone 2 area classification?

Fundamentally, for an explosion to take place, flammable or explosive gases, vapors, mists will be present. Then, the level of risk of an explosion is based on the frequency and duration of the occurrence of an explosive atmosphere. Zone 2 is classified for 1 hour to 10 hours every year for the frequency and duration.

#### 3. Is Zone 2 safe area?

No, Zone 2 is NOT safe area. Even combustible gases or vapors do not exist for longer time compared with Zone 1 area, it still do exist, there is a potential for explosive mixtures with air and combustible gases or vapors so that the possibility of ignition sources can be eliminated thoroughly, zone 2 can be only considered as a middle risky and hazardous area, not a safe area.

#### 4. What is Zone 2 offshore?

Offshore industry involves oil and gas platforms, surface and subsea development and production systems, oil and gas handling facilities, cranes,

electrical supply equipment and systems, fuel and water storage and piping, all of which are located offshore. Zone 2 offshore indicate offshore facility have a large possibility to produce flammable gas or vapors for short time classified into Zone 2 hazardous locations.

### **5.Is Zone 2 the same as Division 2?**

Yes, considering the definition, Division 2 is the same as Zone 2, but Division 1 include both Zone 0 and Zone 1. Division is defined on the basis of NEC500 standard, Zone is defined on the basis of ATEX or IECEx standard. Even Division 2 is equivalent to Zone 2, the electrical equipment approved for zone 2 with ATEX or IECEx certificate can be not used as one approved for Division 2 with UL certificate because the test procedures and standard are different.

# Zone 21

## What is Zone 21?

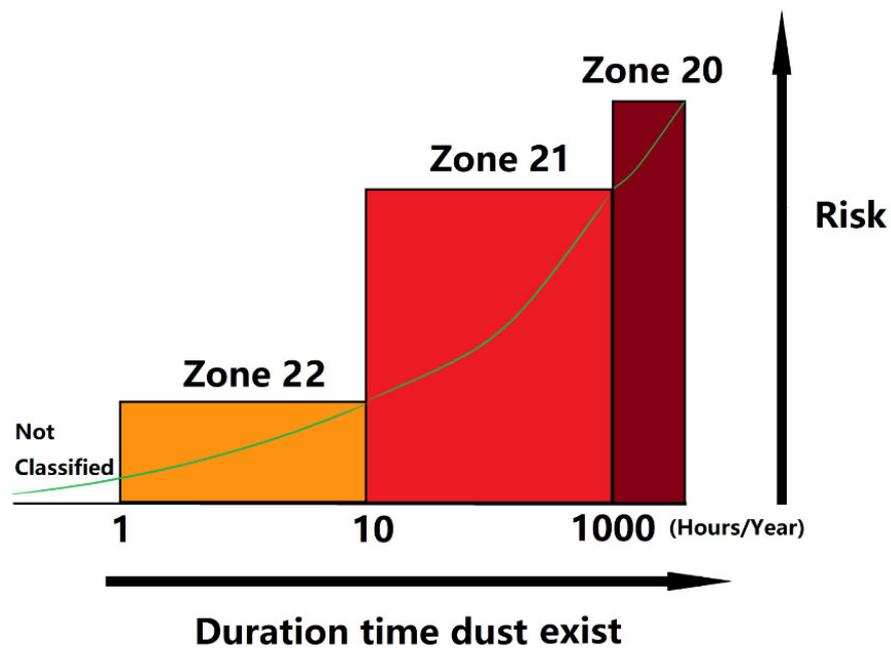
### Zone 21 Definition

#### In Simple Word

Zone 21 area means ignitable concentrations of hazards, flammable dust, are likely to exist under normal operating conditions.

#### In Quantitative Measurement

Zone 21 area means ignitable concentrations of hazards, flammable dust, present from 10 hours to 1,000 hours every year.



## Area Classification Zone 21

### In Accordance with ATEX IEC60079

#### Zone 21

Where ignitable concentrations of flammable dust:

- Are likely to exist under normal operating conditions
- May exist frequently because of repair, maintenance operations or leakage

**Zone 21**

**ATEX/IECEx**

**IP66+**

### FAQ for Zone 21

#### 1. What is Zone 21 ATEX?

Zone 21 ATEX is a place in which an explosive atmosphere, in the form of a cloud of combustible dust in air, is likely to occur occasionally in normal operation based on EN60069 standard. For example, bagging points and inspection point of flammable dusts are frequently opened. In the open air, dust clouds are unlikely to persist for more than a brief period, and any zoning is likely to be very limited in extent, in this case, we classify this location as Zone 21 ATEX.

#### 2. What is the difference between Zone 21 and Zone 22?

The typical difference between Zone 21 and Zone 22 is the duration time of flammable dusts in the environment. Flammable dusts last from 1 hour to 10 hours in 365 days in Zone 22, but from 10 hours to 1000 hours in 365 days in Zone 21. Thus, Zone 21 is more dangerous than Zone 22. Electrical equipment certified for Zone 21 can be also used in Zone 22, but electrical equipment certified for Zone 22 can be NOT used in Zone 21.

#### 3. What does ATEX stand for?

ATEX is the most recognized standard for explosion proof equipment all over the world. ATEX stands for Atmosphères Explosibles. It's a European Union directive from the European Committee for Standardization that covers "equipment and protective systems intended for use in potentially explosive

atmospheres.” An atmosphere can be explosive for several reasons, including flammable gases, mists or vapors, or combustible dust.

All equipment and protective systems intended for this type of use in the EU must meet ATEX health and safety requirements.

#### **4.Which area classification zone is the most hazardous?**

Zone 0 and Zone 20 area are respectively the most hazardous in flammable gases and dusts areas. Zone 0 and Zone 20 are areas in which a combustible gases or dusts, as a cloud, present continuously or frequently during normal operations in sufficient quantities to produce an explosive mixture, usually more than 1000 hours every year.

#### **5.What is IECEx certificate?**

IECEx certificate stands for certificate of International Electrotechnical Commission Explosive, is widely recognized by users in the world excluding in Europe and North America, provides a means for manufacturers, regulators and users of equipment used in hazardous areas to address the risk of fires or explosions from flammable gases or dusts. The objective of the IECEx System is to facilitate international trade in equipment and services for use in explosive atmosphere, maintaining International Confidence in equipment, personnel, and services.

# Zone 22

## What is Zone 22?

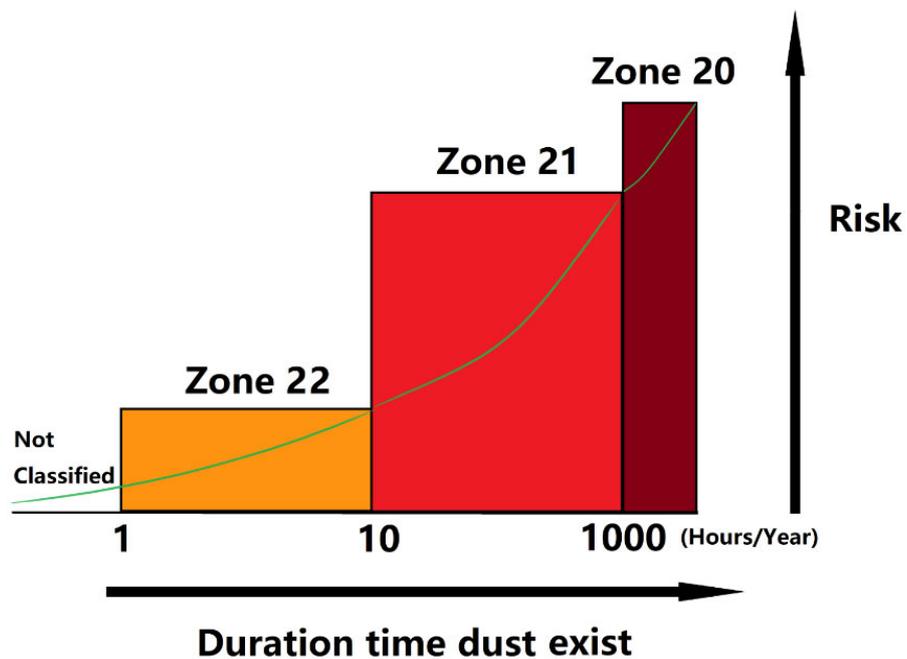
### Zone 22 Definition

#### In Simple Word

Zone 22 area means ignitable concentrations of hazards, flammable dust, are unlikely to exist under normal operating conditions.

#### In Quantitative Measurement

Zone 22 area means ignitable concentrations of hazards, flammable dust, present from 1 hour to 10 hours every year.



## Area Classification Zone 22

### In Accordance with ATEX IEC60079

#### Zone 22

Where ignitable concentrations of flammable dust:

- Are not likely to exist under normal operating conditions
- Occur for only a short period of time
- Become hazardous only in case of an accident or some unusual operating condition

**Zone 22**

**ATEX/IECEx**

**IP66+**

### FAQ for Zone 22

#### 1. What is Zone 22 ATEX?

ATEX Zone 22 means that there is high possibility where do not exist hazardous dusts, but if there exist, it is for less than 10 hours a year and in low concentration. Zone 22 is the safest zone among all dust zones hazardous area, but it is not safe. In general, electrical equipment may be used in Zone 22 with the explosion proof protection measures like non-incendive Ex n, restricted breathing Ex nR, non-sparking Ex nA, energy limited Ex nL and hermetically sealed Ex nC subject to EN 60079 articles.

#### 2. What are ATEX zones? How many ATEX zones are there?

ATEX zone can be divided into several zones, zone 0, zone 1, zone 2, zone 20, zone 21, zone 22. each with its own specific risks and regulations for the use of equipment. Zone 0, zone 1 and zone 2 are gas zones where explosive gases, vapors may present with the duration time for more than 1000 hours every year, 10 to 1000 hours every year and 1 to 10 hours every years respectively. Zone 20, zone 21 and zone 22 are dust zones where explosive dust may present with the duration time for more than 1000 hours every year, 10 to 1000 hours every year and 1 to 10 hours every years respectively.

#### 3. What is the difference between IECEx and ATEX?

ATEX and IECEx are very similar. The name ATEX comes from the French Atmosphères Explosible, describing the equipment and use of a product to be located in an explosive atmosphere. The ATEX certification is mandatory across Europe based on Directive 2014/34/EU and involves all stages from the manufacturing, through to the installation and use of the equipment. IECEx stands for International Electrotechnical Commission Explosive. While ATEX is a mandatory application limited to Europe, IECEx is an international certification accepted in several countries to help build confidence in the safety of Ex equipment

#### **4. Is ATEX Applicable in North America?**

No, ATEX certification is a certification of equipment intended for use in potentially explosive atmospheres in the European Union. Equipment intended for use in potentially explosive atmospheres in the United States must have the specific mark of one of the NRTLs recognized to test such as UL, Intertek certificate. Equipment intended for use in potentially explosive atmospheres in Canada must have the specific mark of CSA certificate.

#### **5. Is IECEx Applicable in Europe?**

Yes, IECEx standard is accepted by most countries since it is a international recognized standard. IECEx certified equipment scheme is a voluntary compliance system designed to assess and certify multiple aspects of potentially hazardous environments. More than 30 countries currently participate, including the U.S., China, Japan, Korea, Australia and Brazil, as well as parts of EU countries, but IECEx is not applicable for all countries in Europe.