

HAZARDOUS LOCATIONS

STAHL

### Understanding Global Explosion Protection

- *Class and Division System*
- *Class-Zone System*
- *CENELEC Zone System*
- *IEC*

zone 0

zone 1

zone 2

?

Division 2

Class I

IP

?

?

Class II

CEC

Class III

?

NEC

?

## Basics of Explosion Protection

### HAZARDOUS LOCATIONS

Hazardous locations are defined as premises, buildings or parts thereof where fire or explosion hazards may exist due to the presence of flammable gases or vapors, flammable liquids, combustible dusts, or easily ignitable fibers or flyings.

Although, flammable gases, vapors and combustible dusts exist almost everywhere, fortunately, they are present only in minute quantities. Simply because flammable gasses or vapors, or combustible dusts are present, there is not necessarily a hazardous location. The quantities or concentrations must be sufficient to present a potential explosion hazard.

The electrical codes that deal with these types of hazardous locations areas do not deal with materials such as high explosives, such as dynamite, munitions, or fireworks. Other rules and regulations deal with areas involving these materials.

### Understanding “Global” Hazardous Location Requirements

The evolution of hazardous location electrical codes and standards throughout the world has taken two distinct paths. In North America, a “**Class, Division**” System has been used for decades as the basis for area classification of hazardous (classified) locations. Because the hazards and methods of protecting electrical equipment against these hazards differ for different materials, hazardous locations are divided into three Classes, and two Divisions. The Classes are based on the type of hazard and the explosive characteristics of the material with the Divisions being based on the occurrence or risk of fire or explosion that the material presents. While the United States and Canada have some differences in acceptable wiring methods and product standards, their systems are very similar.

In other parts of the world, areas containing potentially explosive atmospheres are dealt with using a “**Zone System**”. Zones are based predominantly on the International Electrotechnical Commission (IEC) and European Committee for Electrotechnical Standardization (CENELEC) standards. Whereas North America deals with multiple types of hazardous atmospheres, the North American Zone System presently addresses only flammable gases and vapors which is the equivalent to North America’s Class I locations. The most significant difference in the Zone system is that the level of hazard probability is divided into three Zones as oppose to two Divisions.

While specific requirements differ, the Unites States and Canada have incorporated the Zone System for Class I, hazardous locations into their recent electrical code updates. Both systems provide effective solutions for electrical equipment used in hazardous locations and both have excellent safety records.

### HAZARDOUS LOCATION BASICS

In North America, hazardous locations are separated into three “Classes” or types based on the explosive characteristics of the materials. The Classes or type of material is further separated into “Divisions” or “Zones” based on the risk of fire or explosion that the material poses. The Zone system has three levels of hazard versus the Division System’s two levels.

Hazardous Materials	Class/Division System	Zone System ①
Gasses or Vapors ①	Class I, Division 1 Class I, Division 2	Zone 0 Zone 1 Zone 2
Combustible Dusts ②	Class II, Division 1 Class II, Division 2	Zone 20 Zone 21 Zone 22
Fibers or Flyings	Class III, Division 1 Class III, Division 2	No Equivalent

① The United States and Canada have adopted Zones for Gasses and Vapors

② Zones for Dust are not yet developed for North America

## HAZARDOUS LOCATIONS

### Class I, Locations

Class I locations are those in which flammable "gases or vapors" are, or may be, present in the air in quantities sufficient to produce explosive or ignitable mixtures. The terms, "gases or vapors" differentiates between materials that are in a gaseous state under normal atmospheric conditions, such as hydrogen or methane, and a vapor that is flashed off from a liquid, under normal atmospheric conditions, such as gasoline.

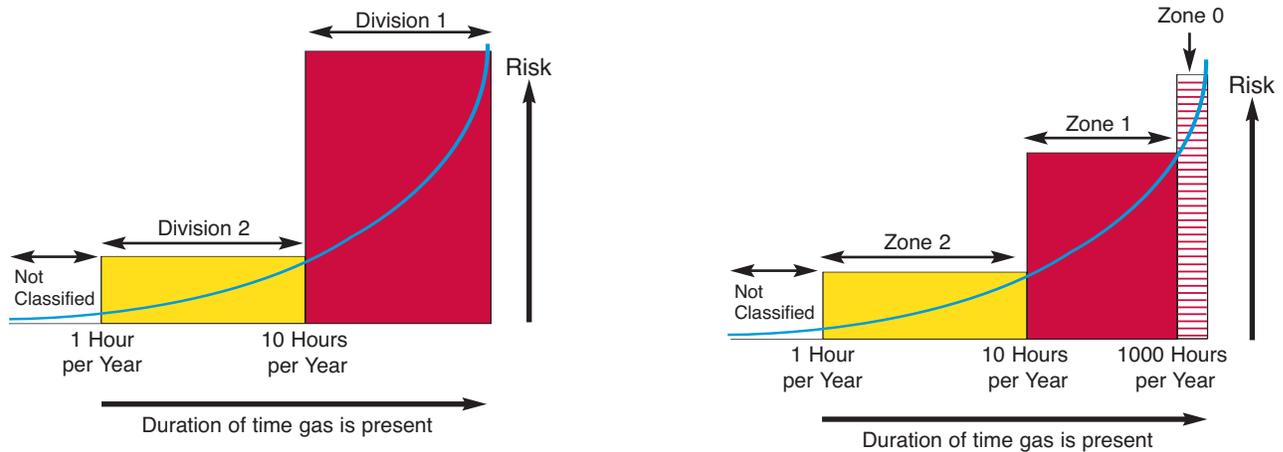
The subdivision of Class I, locations into "Divisions" or "Zones" is based on the probability that an explosive gas atmosphere may be present in a location. If the risk is extremely low, the location is considered non-hazardous. A good example of a low risk area is a single family home with natural gas or propane furnace for heating. The gas could, and does on extremely rare occasions, leak into the home, encounter an ignition source and an explosion occurs, usually with devastating results. However, since the risk is so low, because of the safety systems built into the gas supply and heating equipment, these areas are not "hazardous classified locations".

Recent editions of the *NEC*<sup>®</sup> (National Electrical Code) and *CEC*<sup>®</sup> (Canadian Electrical Code) have incorporated the international definitions for "Zones" for Class I, locations. The two codes continue to address the "Division" system although the methods are somewhat different.

The frequency of occurrence determines the level of hazard for a location. Simply stated, the longer the material is present, the greater the risk.

Frequency of Occurrence	Division System	Zone System
Continuous	Class I, Division 1	Zone 0
Intermittent Periodically		Zone 1
Abnormal Condition	Class I, Division 2	Zone 2

The charts below compare the Division and Zone systems in terms of risk assessment.



The abnormal conditions of occurrence, or lower risk areas, in the Zone and Division system are basically identical. However, in areas where a hazard is expected to occur in normal operation, the Zone system deals with highest risk areas separately, and risk associated with the remaining location is considered lower. The Division system tends to be less specific in its consideration of Division 1. The Division system treats all areas where a hazard is expected to occur in normal operation the same.

The following chart illustrates the differences between the various Zones.

Grade of Release	Zone	Flammable Mixture Present
Continuous	0	1000 hours per year or more (10%)
Primary	1	Between 10 and 1000 hours per year or more (0.1% to 10%)
Secondary	2	Less than 10 hours per year (0.01% to 0.1%)
Unclassified	-	Less than 1 hour per year (Less than 0.01%) <sup>①</sup>

This is a combination of Tables 2 and 3 from API RP505

① The 1-hour per year used in API RP505 is considered to be high by some industry experts. Conservative estimates of this figure should be 0.01 hours per year.

Class I locations are further divided into Groups based on the explosive properties of the materials present. North America has traditionally used four groups while the IEC and CENELEC use three.

The chart below compares the two systems.

Typical Gas	Class/Division Gas Groups	Zone Gas Groups
Acetylene	A	II C
Hydrogen	B	
Ethylene	C	II B
Propane	D	II A

(The US has added a "IIB + hydrogen" group to address certain construction limitations.)

**Class II Locations**

Class II locations are those which are hazardous due to the presence of combustible or electrically conductive dusts. The dust must be present in sufficient quantities for a fire or explosion hazard to exist. The fact that there is some combustible dust present does not mean a Class II hazardous location exists.

Class II substances are divided into three groups for similar reasons to those of Class I materials: equipment design and area classification. Class II groups are based on different characteristics than those of Class I, given the requirements for an explosion to occur and the protection methods required for equipment. In Class II locations the ignition temperature, the electrical conductivity, and the thermal blanketing effect of the dust are critical when dealing with heat-producing equipment, such as lighting fixtures and motors. It is these factors which are the deciding factors in determining the Class II groups.

Groups	Type of Material	Examples
E	Electrically Conductive Dusts	Powdered Metals such as Aluminum or Magnesium
F	Carbonaceous Dusts	Carbon Black, Coal Dust or Coke Dust
G	Agricultural Dusts	Grain, Flour, Sugars, Spices and certain Polymers

(The IEC has developed Zones for atmospheres containing combustible dusts, which again separates areas in to three Zones 20, 21 and 22.)

**Zone 20, 21 and 22 Locations**

The IEC has recently introduced the three-Zone system for combustible dust locations. These have not been included in North American codes yet. The definitions are as follows:

**Zone 20** - an area in which a combustible dust, as a cloud, is present continuously or frequently during normal operations in sufficient quantities to produce an explosive mixture.

**Zone 21** - an area in which a combustible dust, as a cloud, is likely to occur during normal operations in sufficient quantities to produce an explosive mixture.

**Zone 22** - an area in which combustible dust clouds may occur infrequently and persist for only short periods of time or in which accumulations or layers may be present under abnormal conditions.

**Class III Locations**

Class III locations are those which are hazardous due to the presence of easily ignitable fibers or flyings. However, the material is not suspended in the air in quantities sufficient to produce ignitable mixtures.

Easily ignitable fibers and flyings present a serious fire risk, not normally an explosion hazard. The greater danger with Class III materials is that if a layer forms throughout a facility, an ignition will cause a flash fire which moves at near explosive speeds.

## HAZARDOUS LOCATIONS

### TEMPERATURE CLASSES

Ignition temperature or auto-ignition temperature (ATI) is the minimum temperature of a surface at which an explosive atmosphere ignites. Flammable vapors and gases can be classified into temperature classes according to their ignition temperature. The maximum temperature of a piece of equipment must always be lower than the ignition temperature of the gas - air mixture or vapor - air mixture in which it is placed. Equipment shall be marked to show the operating temperature or temperature class referenced to a +40°C (+104°F) ambient. The temperature class (T code) is indicated on the manufacturers nameplate and is based on the table below.

### AMBIENT TEMPERATURE

The ambient temperature is the surrounding temperature of the environment in which a piece of equipment is installed, whether it is indoors or outdoors. The standard temperature range for equipment design is -20°C to +40°C; for this range no ambient temperature marking is required on the product. Electrical equipment that is designed for use in a range of ambient temperature other than -20°C to +40°C the actual ambient temperature range shall be marked on the equipment nameplate.

The R. STAHL product lines, in most cases, exceed the -20°C to +40°C requirement. Refer to the appropriate catalog pages for the product-specific “Ambient Temperature Range”. Any ranges outside -20°C to +40°C are marked on the product nameplate.

Applications requiring product with extreme ambient temperature ranges outside those standard ranges stated under the heading “Ambient Temperature Range” are specified under the heading of “Special Ambient Temperature Range”. Only products with this additional catalog information can be customized for extreme temperature applications. Please consult factory for your special needs.

North American Temperature Code	IEC/CENELEC/NEC 505 Temperature Classes	Maximum Temperature	
		°C	°F
T1	T1	450°C	842°F
T2	T2	300°C	572°F
T2A	-	280°C	536°F
T2B	-	260°C	500°F
T2C	-	230°C	446°F
T2D	-	215°C	419°F
T3	T3	200°C	392°F
T3A	-	180°C	356°F
T3B	-	165°C	329°F
T3C	-	160°C	320°F
T4	T4	135°C	275°F
T4A	-	120°C	248°F
T5	T5	100°C	212°F
T6	T6	85°C	185°F

### EQUIPMENT DESIGN AND CONSTRUCTION

There are a number of methods of protecting electrical equipment, which prevent an explosion when used in a flammable gas atmosphere, in the presence of combustible dust or easily ignited fibers.

Three elements are required for an explosion to occur - fuel, oxygen and a heat or ignition source must be present. The fuel and oxygen must be in the correct mixture. Too little fuel, or a lean mixture, or too much fuel, a rich mixture cannot ignite. These explosive limits are defined as the “Lower Explosive Limit” (LEL) and the “Upper Explosive Limit” (UEL).

Each method of protection addresses the Fire Triangle in some manner. Either by containing an internal explosion or eliminating one or more of the components necessary for an explosion to occur.

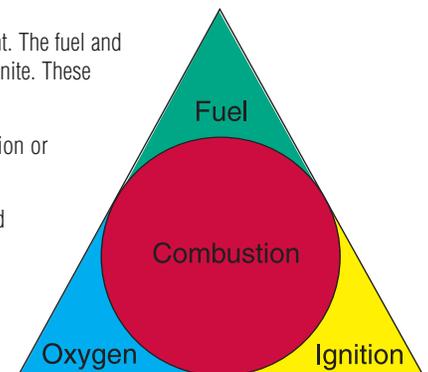
The most common North American methods of protection are explosionproof equipment for Class I locations, and dust-ignition proof equipment for Class II locations. R. STAHL produces a wide range of equipment for use in hazardous locations using various methods of protection.

#### Flameproof Type of Protection “d”- or Explosionproof Equipment

Although the North American term “explosionproof” and IEC term “flameproof” are identical concepts, the requirements in the product standards are different. Explosionproof is a Div. 1 technology which can be used in a NEC or CEC defined Zone 1 environment. Flameproof is a Zone 1 technology and can not be used in a Div. 1 environment.

Since flammable gases and vapors are expected inside an enclosure, the equipment must be capable of withstanding an explosion caused by sparking contacts of devices, high temperatures, or an electrical fault. The enclosure is designed so that hot gases generated during an internal explosion are cooled below the ignition temperature of the surrounding flammable atmosphere as they escape through the joints of the unit.

In addition, the external surfaces of the enclosure must not become hot enough to ignite the surrounding atmosphere due to heat energy within the unit. This heat energy may be the result of normal operation of heat-producing equipment, or the result of an electrical arc to the enclosure from an arcing ground fault. Safety factors are applied to all testing of this type of enclosure to ensure the unit will not rupture as a result of an internal explosion.



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**Encapsulation - Type of Protection “m”**

Encapsulation is a type of protection in which the parts that can ignite an explosive atmosphere are enclosed in a resin. The resin must be sufficiently resistant to environmental influences so that the explosive atmosphere cannot be ignited by either sparking or heating, which may occur within the device. This is typically used with electronic devices.

**Increased Safety - Type of Protection “e”**

Type of protection applied to electrical equipment that does not produce arcs or sparks in normal service and under specified abnormal conditions, in which additional measures are applied so as to give increased security against the possibility of excessive temperatures and of the occurrence of arcs and sparks.

**Hermetically Sealed**

A common type of hermetically sealed equipment is a contact block or reed switch. In this method, the arcing components of the switch are encased in a glass tube. The connecting wires are fused to the glass sealing the unit to prevent any ingress of flammable gases. Hermetically sealed equipment is suitable for Class I, Division 2 or Zone 2 only.

**Intrinsically Safe Equipment - Types of Protection “i”, “ia” and “ib”**

North America now identifies three versions of this protection method. Types “i” (NEC 504) and “ia” (NEC 505) are identical since type “i” is based on the IEC 60 079-11 Standard. In Zone 0 the only acceptable type of equipment is types “i” and “ia”. Type “ib” is acceptable in Zone 1 and 2 locations.

(For further details refer to R. STAHL Inc’s Catalog RST-49.)

**Oil Immersion - Type of Protection “o”**

Type of protection where electrical equipment is immersed in a protective liquid in such a way that an explosive atmosphere that may be above the liquid or outside the enclosure cannot be ignited.

**Purged And Pressurized - Type of Protection “p”**

This type of protection prevents the surrounding atmosphere from entering an enclosure by maintaining a positive pressure within the unit. Clean air or inert gas is used to maintain a higher pressure than the surrounding atmosphere. In purging, the electrical equipment is interlocked with a system which cycles clean air within the unit to remove explosive gases before start up.

North America Identifies three types of pressurization as follows;

Type	Explanation
X	Changes the area within the unit from Class I, Division 1 to non-hazardous
Y	Changes the area within the unit from Class I, Division 1 to Class I, Division 2
Z	Changes the area within the unit from Class I, Division 2 to non-hazardous

\*Similar purging methods are found in the IEC, GENELEC and NEC 505.

**Powder Filling - Type of Protection “q”**

Type of protection where electrical parts capable of igniting an explosive atmosphere are fixed in position and completely surrounded by filling material (glass or quartz powder) to prevent the ignition of an external explosive atmosphere.

**CLASS II EQUIPMENT**

Dusttight equipment is designed to exclude dust from entering the enclosure, to prevent hot particles, arcs, sparks or heat generated inside of the enclosure from igniting an exterior accumulation or atmospheric suspension of dusts on or in the vicinity of the enclosure. Nonmetallic enclosures must also prevent the accumulation of static charges on the enclosure itself.

The primary function of the joints of these enclosures is to seal dust out and keep the hot particles etc. inside, therefore, typically the joints are gasketed.

Since this protection method keeps the combustible dusts outside, the enclosure is not expected or designed to contain an internal explosion. The design must be sufficient though to withstand mechanical abuse.

The ignition temperature of dusts is usually lower than that of gases and vapors, and therefore the control of external surface temperatures is more rigorous for Class II equipment than for Class I equipment. Dust layers on the equipment can act as insulation for the heat generated inside the equipment, which in turn can increase the surface temperature of the unit even under normal operating conditions.

The NEC defines "Dust-ignition proof" as the protection for Class II, Division 1 and 2 locations for which it is approved, and "Dusttight" as a type of enclosure that is constructed so that dusts will not enter the enclosing case under specific test conditions. In the NEC, some applications for Class II, Division 1 require Dust-ignition proof enclosures.

### HAZARDOUS LOCATIONS

#### ENVIRONMENTAL PROTECTION

##### NEMA and CSA Type Enclosure

**NEMA or CSA Type 1 Enclosures** are intended for indoor use primarily to provide a degree of protection against limited amounts of falling dirt. This type is not specifically identified in the CSA Standard.

**NEMA or CSA Type 2 Enclosures** are intended for indoor use primarily to provide a degree of protection against limited amounts of falling water and dirt.

**NEMA or CSA Type 3 Enclosures** are intended for outdoor use primarily to provide a degree of protection against rain, sleet, windblown dust; and damage from external ice formation.

**NEMA or CSA Type 3R Enclosures** are intended for outdoor use primarily to provide a degree of protection against rain, sleet; and damage from external ice formation, and must have a drain hole.

**NEMA or CSA Type 3S Enclosures** are intended for outdoor use primarily to provide a degree of protection against rain, sleet, windblown dust; and to provide for operation of external mechanisms when ice laden.

**NEMA or CSA Type 4 Enclosures** are intended for indoor or outdoor use primarily to provide a degree of protection against windblown dust and rain, splashing water, hose directed water; and damage from external ice formation.

**NEMA or CSA Type 4X Enclosures** are intended for indoor or outdoor use primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water, hose directed water; and damage from external ice formation.

**NEMA or CSA Type 5 Enclosures** are intended for indoor use primary to provide a degree of protection against settling airborne dust, falling dirt, and dripping non-corrosive liquids.

**NEMA or CSA Type 6 Enclosures** are intended for indoor or outdoor use primarily to provide a degree of protection against hose-directed water, the entry of water during occasional temporary submersion at a limited depth; and damage from external ice formation.

**NEMA or CSA Type 6P Enclosures** are intended for indoor or outdoor use primarily to provide a degree of protection against hose-directed water, the entry of water during prolonged submersion at a limited depth; and damage from external ice formation.

**NEMA or CSA Type 12 Enclosures** are intended for indoor use primarily to provide a degree of protection against circulating dust, falling dirt, and dripping non-corrosive liquids.

**NEMA or CSA Type 12K Enclosures** with knockouts are intended for indoor use primarily to provide a degree of protection against circulating dust, falling dirt, and dripping non-corrosive liquids.

**NEMA or CSA Type 13 Enclosures** are intended for indoor use primarily to provide a degree of protection against dust, spraying of water, oil, and non-corrosive coolant.

#### Definitions Referring To NEMA Requirements for Hazardous Location

The following NEMA type enclosures occasionally appear on specifications and product literature

**NEMA 7** Enclosures are intended for indoor use in locations classified as Class I, Groups A, B, C, or D, as defined in the NEC.

**NEMA 8** Enclosures are for indoor or outdoor use in locations classified as Class I, Groups A, B, C, or D, as defined in the NEC.

**NEMA 9** Enclosures are intended for indoor use in locations classified as Class II, Groups E, F, and G, as defined in the NEC.

**NEMA 10** Enclosures are constructed to meet the applicable requirements of the Mine Safety and Health Administration. (MSHA)

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**Comparison of Specific Applications of Enclosures for Indoor Non-Hazardous Locations**

Provides A Degree Of Protection Against The Following Environmental Conditions	Type of Enclosure									
	1*	2*	4	4x	5	6	6P	12	12K	13
Incidental contact with the enclosed equipment	X	X	X	X	X	X	X	X	X	X
Falling dirt	X	X	X	X	X	X	X	X	X	X
Falling liquids and light splashing	-	X	X	X	X	X	X	X	X	X
Circulation dust, lint, fibers, and flyings**	-	-	X	X	-	X	X	X	X	X
Settling airborne dust, lint, fibers, and flyings**	-	-	X	X	X	X	X	X	X	X
Hosedown and splashing water	-	-	X	X	-	X	X	-	-	-
Oil and coolant seepage	-	-	-	-	-	-	-	X	X	X
Oil and coolant spraying and splashing	-	-	-	-	-	-	-	-	-	X
Corrosive agents	-	-	-	X	-	-	-	-	-	-
Occasional temporary submersion	-	-	-	-	-	X	X	-	-	-
Occasional prolonged submersion	-	-	-	-	-	-	-	-	-	-

\* These enclosures may be ventilated. However, Type 1 may not provide protection against small particles of falling dirt when ventilation is provided in the enclosure top.

\*\* These fibers and flyings are nonhazardous materials and are not considered as Class III type ignitable fibers or combustible flyings. For Class III type ignitable fibers or combustible flyings see the National Electrical Code®, Article 500.

**Comparison of Specific Applications of Enclosures for Outdoor Non-Hazardous Locations**

Provides A Degree Of Protection Against The Following Environmental Conditions	Type of Enclosure						
	3*	3R***	3S	4	4X	6	6P
Incidental contact with the enclosed equipment	X	X	X	X	X	X	X
Rain, snow, sleet*	X	X	X	X	X	X	X
Sleet**	-	-	X	-	-	-	-
Windblown dust	X	-	X	X	X	X	-
Hosedown	-	-	-	X	X	X	-
Corrosive agents	-	-	-	-	X	-	-
Occasional temporary submersion	-	-	-	-	-	X	-
Occasional prolonged submersion	-	-	-	-	-	-	X

\* External operating mechanisms are not required to operate when the enclosure is ice covered.

\*\* External operating mechanisms are operable when the enclosure is ice covered.

\*\*\*These enclosures may be ventilated.

**Comparison of Specific Applications of Enclosures for Indoor Hazardous (Classified) Locations**

Provides a Degree of Protection Against Atmospheres Typically Containing Hazardous Gases, Vapors, and Dusts***	Type of Enclosure: NEMA 7 & 8, Class I Groups**					NEMA 9 & 10, Class II Groups**		
	Class	A	B	C	D	E	F	10
Acetylene	I	X	-	-	-	-	-	-
Hydrogen, manufactured gases	I	-	X	-	-	-	-	-
Diethyl ether, ethylene, cyclopropane	I	-	-	X	-	-	-	-
Gasoline, hexane, butane, naphtha, propane, acetone								
Toluene, isoprene	I	-	-	-	X	-	-	-
Metal dusts	II	-	-	-	X	-	-	-
Carbon black, coal dust, coke dust	II	-	-	-	-	X	-	-
Flour, starch, grain dust	II	-	-	-	-	-	X	-
Fibers, flyings	III	-	-	-	-	-	X	-
Methane with or without coal dust	MSHA	-	-	-	-	-	-	X

\* Due to the characteristics of the gas, vapor, or dust, a product suitable for one Class or Group may not be suitable for any other Class or Group unless so marked on the product.

\*\* For Class III type ignitable fibers or combustible flyings refer to the National Electrical Code® Article 500.

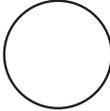
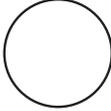
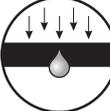
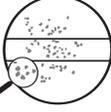
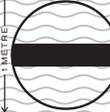
\*\*\*For a complete listing of flammable liquids, gases, or vapors refer to NFPA 497 - 1997 (Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas and NFPA 325 - 1994 (Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids). Reference also NFPA 499 -1997 Classifications of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas.

## HAZARDOUS LOCATIONS

### Ingress Protection (IP)

The IEC uses the term “Ingress Protection” to identify the environmental protection of a device.

This is defined in IEC Standard 60 529 and the following chart illustrates the two-digit code used.

<b>IP</b> The IP classification system designates, by means of a number, the degree of protection provided by a device against ingress of dust and water.		<b>SECOND NUMBER</b> Degree of protection against water	
<b>FIRST NUMBER</b> Degree of protection against solid objects		0 	Non-protected.
0 	Non-protected.	1 	Protected against water dripping vertically, such as condensation.
1 	Protected against a solid object greater than 50mm such as a hand.	2 	Protected against dripping water when tilted up to 15°.
2 	Protected against a solid object greater than 12mm, such as a finger.	3 	Protected against water spraying at an angle of up to 60°.
3 	Protected against a solid object greater than 2.5mm, such as wire or a tool.	4 	Protected against water splashing from any direction.
4 	Protected against a solid object greater than 1.0 mm, such as wire or thin strips.	5 	Protected against jets of water from any direction.
5 	Dust-protected. Prevents ingress of dust sufficient to cause harm.	6 	Protection against heavy seas or powerful jets of water.
6 	Dust tight. No dust ingress.	7 	Protected against harmful ingress of water when immersed between a depth of 150mm to 1 meter.
		8 	Protected against submersion. Suitable for continuous immersion in water.

### EQUIPMENT CERTIFICATION

Equipment for use in hazardous locations must be certified to an appropriate National Standard and marked as such by an accredited third party testing organization. Follow-up inspection to ensure conformance is part of the program. Products may carry multiple markings for multiple countries. The following is a brief description of the National Requirements.

#### Important Listing Information

The specific requirements for product certification vary from country to country. While UL, FM and CSA are similar in their approach, subtle differences still exist.

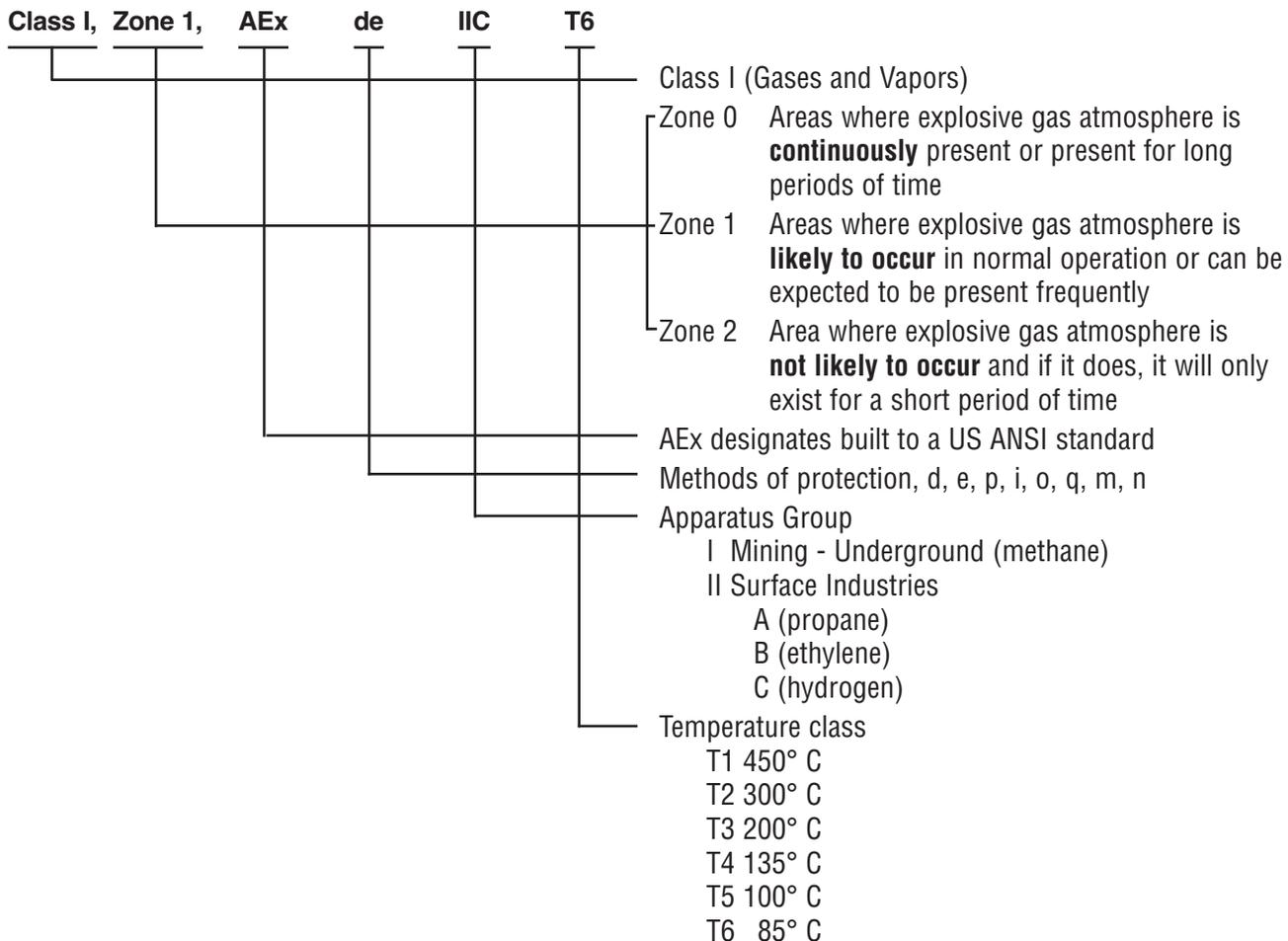
North American certifications permit conduit or cable entries to be field installed provided appropriate bonding and grounding requirements are followed.

### Marking

#### Typical North American Marking to NEC 500

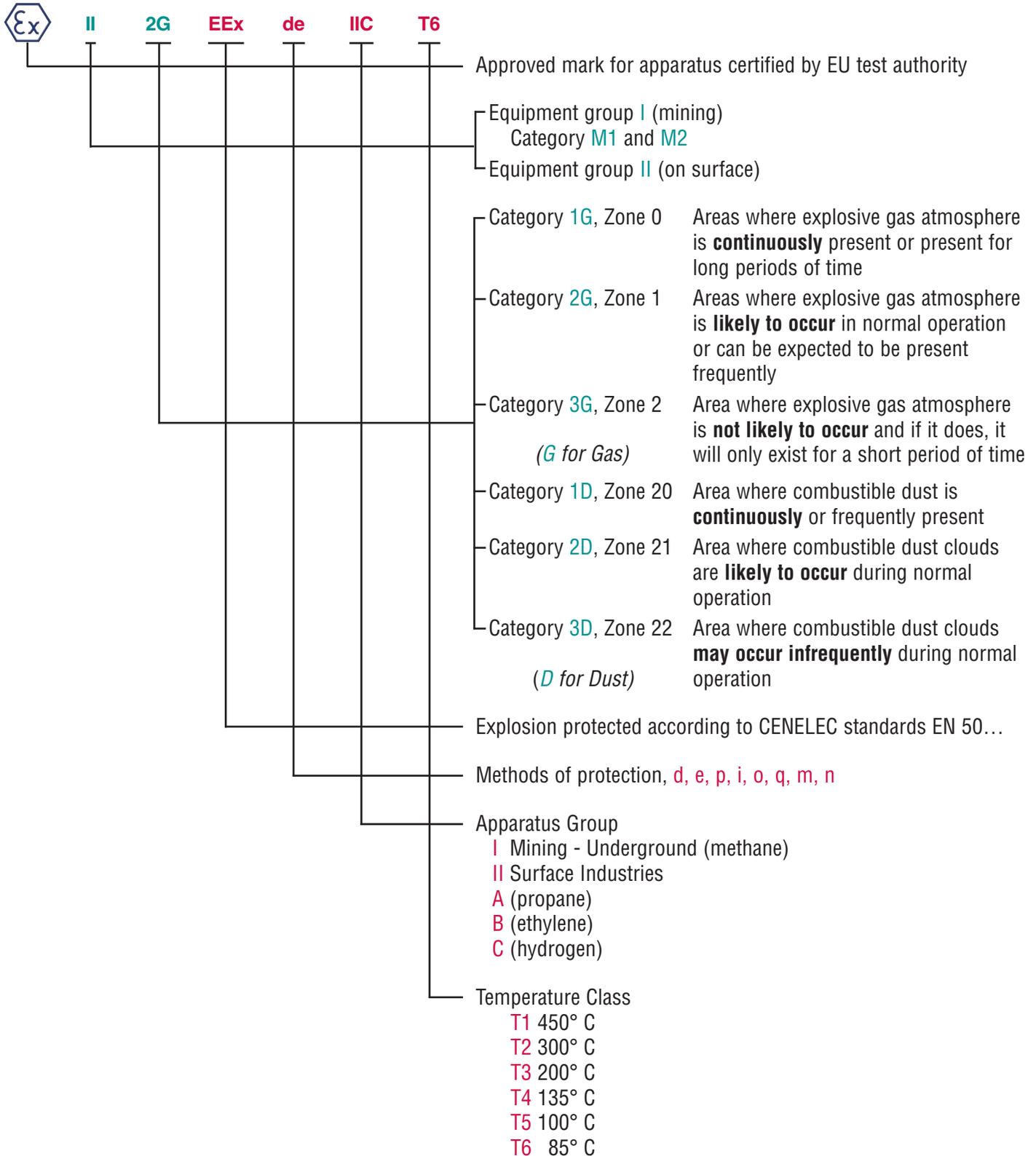
Class I, Divisions 1 or 2, Groups A, B, C & D, T4 (T-Code)  
 Class II, Divisions 1 or 2, Groups E, F & G, T4 (T-Code)  
 Class III,  
 Enclosure type 3, 4, 4X

#### Typical North American Marking to NEC 505



### HAZARDOUS LOCATIONS

#### Typical European ATEX/CENELEC Marking



**ATEX Directive**

The ATEX Directive 94/9/EC is a directive adopted by the European Union (EU) to facilitate free trade in the EU by aligning the technical and legal requirements in the Member States for products intended for use in potentially explosive atmospheres.

This Directive applies to electrical and non-electrical equipment/components and protective systems. The ATEX Directive became mandatory on July 1, 2003.

Equipment located outside potentially explosive atmospheres are also covered by the ATEX Directive under the following conditions:

- The equipment is a safety device, controller or regulatory device; and
- The equipment is required for the safe function of equipment or protective systems with respect to the risk of explosion.

All equipment under its scope is required to bear the European CE Marking as verification of compliance with the Directive (the CE Marking will not appear on components defined by this Directive). The ATEX Directive specifically defines procedures for the evaluation of a product's design and production based on Equipment Groups and Categories. This is briefly outlined below.

**Equipment Group I Overview**

Equipment intended for use in underground parts of mines, and to those parts of surface installations of such mines, liable to be endangered by firedamp and/or combustible dust.

Equipment Category	Protection	Comparison To Current IEC Classification
M1	2 levels of protection; or 2 independent faults	Group I
M2	1 level of protection based on normal operation	Group I

**Equipment Group II Overview**

Equipment intended for use in other than Equipment Group I places that are liable to be endangered by explosive atmospheres.

Equipment Category	Protection	Comparison To Current IEC Classification
1G 1D	2 levels of protection; or 2 independent faults	Group II, Zone 0 (gas) Zone 20 (dust)
2G 2D	1 level of protection based on frequent disturbances; or equipment faults	Group II, Zone 1 (gas) Zone 21 (dust)
3G 3D	1 level of protection based on normal operation	Group II, Zone 2 (gas) Zone 22 (dust)

### HAZARDOUS LOCATIONS

#### **ATEX Marking**

The marking of the equipment with the category will help the end-user with their selection of the equipment in that it identifies which Zone it can safely be installed in. This is a major improvement over the old cryptic marking system that only listed the protection concepts used in the design of the equipment. This meant that the user of the equipment had to be familiar with all eight recognized protection concepts and furthermore had to know which of them was suitable for a particular type of Zone.

#### **Differences Between the Old and New Directives**

The main differences are:

- The inclusion of non-electrical equipment
- The inclusion of dust atmospheres
- Requirements for safety related devices (flame arrestors, suppression systems etc) and safe area equipment
- Additional quality system requirements
- The need to produce a 'Technical File'

#### **Products Covered**

The Directive includes equipment and safety or control devices installed outside the potentially explosive area but having an explosion protection function. A wide range of products comes within the definition of equipment, including electric motors, compressors, diesel engines, lighting fittings, control and communication devices and monitoring and detection equipment, to name but a few. "Protective Systems" are also included, and include items that prevent an explosion that has been initiated from spreading or causing damage. They include flame arrestors, quenching systems, pressure relief panels and fast-acting shut-off valves to name but a few.

#### **Product Exclusions**

The Directive, however, does exclude the following product types:

- Medical devices
- Products for use in the presence of explosives
- Products for domestic use
- Sea-going vessels and mobile offshore units
- Military equipment
- Personal protective equipment covered by directive 89/686/EEC
- Means of transport by air or on road or rail or water networks. Vehicles intended for use in an explosive atmospheres are not excluded.

For more info about ATEX, visit [www.europa.eu.int/comm/enterprise/atex/](http://www.europa.eu.int/comm/enterprise/atex/)

#### **CE Marking**

The CE mark is a mandatory European marking for certain product groups to indicate conformity with the essential health and safety requirements set out in European Directives. The letters 'CE' are an abbreviation of Conformité Européenne, French for European conformity. The CE mark must be affixed to a product if it falls under the scope of the so called 'New Approach' Directives. Without the CE marking, and thus without complying with the provisions of the Directives, the product may not be placed in the market or put into service in the fifteen member states of the European Union and Norway, Iceland and Liechtenstein. However, if the product meets the provisions of the applicable European Directives, and the CE mark is affixed to a product, these countries may not prohibit, restrict or impede the placing in the market or putting into service of the product. Thus, CE marking can be regarded as the products trade passport for Europe.

For more info about CE marking, visit [www.eurunion.org/legislat/standard/standard.htm](http://www.eurunion.org/legislat/standard/standard.htm)



#### **Scheme**

The objective of the IECEx Scheme is to facilitate global trade in electrical equipment intended for use in explosive atmospheres by eliminating the need for multiple national certification.

The IECEx Scheme provides the means for manufacturers of Ex equipment to obtain certificates of conformity that will be accepted at national level in all participating countries. A certificate of conformity may be obtained from any certification body accepted into the Scheme. The certificate will attest that the equipment design conforms to the relevant IEC Standards. The final objective of the IECEx Scheme is world-wide acceptance of one standard, one certificate and one mark.

For the IECEx Scheme to achieve its long term objective, every national Standard for which application is made by participating countries will need to be identical to the corresponding IEC Standard.

For countries whose national Standards are not yet identical to the IEC Standards, a transitional period will be necessary to allow time for participating IECEx Scheme member countries to adjust their national standards to the IEC standards and work toward national acceptance of IECEx Certificates of conformity and the IECEx mark.

For more info about IECEx Scheme, visit [www.IECEx.com](http://www.IECEx.com)

