TECHNICAL DATA

CLASSIFICATION OF HAZARDOUS LOCATIONS

Safety is always a consideration when using electrical equipment.

The growth of complex industrial processes created a need for standards and certifications in potentially explosive environments. Today the various classifications of hazardous locations continue to evolve towards harmonized standards.

A hazardous area can be defined as " An area in which flammable substance in the form of gas, vapor, dust or fiber when mixed with the air, is present in such proportions that it can explode when in contact with an ignition source. This approach is used by the United States (Through the National Electrical Code. NEC). Canada (The Canadian Electrical code. CEC). Europe (CENELEC). And the rest of the world (International Electrical Code. IEC)

Hazardous locations are broken down into Divisions, Zones, Classes and Groups. This enables the manufacturer to specify exactly the type of hazardous location the product has been certified.

In both Canada and the United States The Hazardous Locations are divided into Classes.

Class I Hazardous due to the presence of flammable substances such as gases or vapors

Class I I Hazardous due to the presence of flammable substances such as dust or powders

Class I I I Hazardous due to the presence of flammable substances in a fiber or flyings

Class 1
Hazardous Locations due to flammable substances such as Gases & Vapors (Class 1) is handled differently by the various certification organizations. The rest of the world does not use class designations, but independent of how this area is designated, it is how this area is divided that makes the major difference.

The United States is generally using the Division Method on identifying the levels of Class I Locations that is:

Division 1 Danger can be present during normal functioning, during repair or maintenance, or where a fault may cause the simultaneous failure of electrical equipment.

Division 2 Combustible material is present but confined to a closed container or system, is normally vented or is in an area adjacent to a division 1 location.

Europe and other parts of the world are using the Zone Method to identify the levels of hazardous locations due to the presence of flammable substances such as gases and vapors. The United States does recognize the Zone Method as per article 505 of the NEC but their preference is the Division Method as per article 500 of the NEC.

Canada has been much more aggressive in the pursuit to harmonize to the international requirements and has thus opted to now use the Zone Method for all new installations.

The IEC rules advanced the NEC logic to a new level.

The IEC recognized the NEC divisions were based more on whether the hazard was present under either normal or abnormal conditions, instead of on the duration of the hazard.

Therefore the IEC established three divisions or Zones, that are based on how often the hazard is present rather than upon normal versus abnormal conditions.

The three Zones break the NEC's Division 1 into two distinct zones, one of which (Zone 0) is for those locations that are the most hazardous because they remain hazardous for a long time. Separating Zone 0 from the remainder of what is Division 1 in the NEC system permits a more refined treatment of the hazards of the two zones. It restricts methods of protection in Zone 0 while permitting more relaxed method of protection in Zone 1 locations.

Temperature is also a factor. Equipment shall not be installed in an area where vapors and gases are present that have an ignition temperature less than the maximum external temperature of the equipment.

The Hazardous Location for Gases and Vapors can be summarized as per Table 1

Table 1 :
HAZARDOUS LOCATION CLASSIFICATIONS

CLASSIFICATION	IEC, CENELEC NEC 505, NEW CEC INSTALLATION CODES	NEC 500, OLDER EXISTING CEC INSTALLATIONS CODES
MATERIAL PRESENCE		
Continuously Present	Zone 0	Division 1
Intermittently present	Zone 1	Division 1
Abnormally Present	Zone 2	Division 2
APPARATUS GAS & VAPORS		
Acetylene	Group II C	Class I / Group A
Hydrogen	Group II B	Class I / Group B
Ethylene	Group II B	Class I / Group C
Propane	Group II A	Class I / Group D
Methane	Group I	N/A
MAX SURFACE TEMPERATURE		
450 C	T 1	T 1
300 C	T 2	T 2
280 C	—	T 2A
260 C	—	T 2B
230 C	—	T 2C
215 C	—	T 2D
200 C	T 3	T 3
180 C	—	T 3A
165 C	—	T 3B
160 C	—	T 3C
135 C	T 4	T 4
120 C	—	T 4A
100 C	T 5	T 5
85 C	T 6	T 6

Notes: 1) Group 1 of the IEC & Cenelec Codes is for mining (underground locations) This application does not fall within the scope of the NEC & CEC.
2) The NEC has 14 levels for surface temperature whereby the IEC & Cenelec has only 6.

Class I I & Class I I I

Hazardous Locations due to flammable substances such as dust or powders (Class I I) and fibers. (Class I I I) is handled the same way in both Canada and the U.S. by using the Class and Division method. The type of dust is also a factor.
The IEC uses the zone method, which is based on how often the hazard is present. The type of dust or powder is not a consideration nor are fibers treated as a separate hazard.

The Hazardous Location for Dust, Powders and Fibers can be summarized as per Table 2

Table 2 :
HAZARDOUS LOCATION CLASSIFICATIONS

CLASSIFICATION	IEC, CENELEC CODES	NEC 500, CEC CODES
MATERIAL PRESENCE		
Continuously Present	Zone 20	Division 1
Intermittently present	Zone 21	Division 1
Abnormally Present	Zone 22	Division 2
APPARATUS DUST & POWDERS		
Metal	—	Class I I / Group E
Coal	Group I I	Class I I / Group F
Grain	Zones 20,21,22	Class I I / Group G
Fibers (all)	—	Class I I I

<table>
<tr>
<td><u>Methods of Protection</u>
There are generally three methods of protection that are used to reduce the risk of explosion.</td>
<td colspan="2">Guidelines for using the most popular Methods of Hazardous Protection</td>
<td><u>Intrinsic Method</u>
This method of protection has three levels. They are: " ia ", " ib ", " ic ". The " ia " being the highest level.</td>
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<tr>
<td><u>Prevention</u>
This is a method that limits both the electrical and thermal energy to safe levels under both normal operation and fault conditions. Intrinsic safety is the most representative choice for this method.</td>
<td><u>The first step</u>
is to know the classification of the hazardous area under consideration. Almost every type of area has already been classified by the various governing bodies.</td>
<td><u>The second step</u>
is to choose the various types of equipment along with the method of protection that is suitable for the intended hazardous location.</td>
<td><u>" ia "</u>
intrinsic safety system offers the highest level of protection of all other protection methods. It is the safest method of protection for Zone 0 applications. That is all applications whereby there is a continuous hazardous presence. Some applications of Division 1 fall into this category.</td>
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<tr>
<td><u>Segregation</u>
This method attempts to physically separate or isolate the electrical parts or hot surfaces from the explosive mixture. This method includes several different techniques such as purge & pressurization, Encapsulation, etc.</td>
<td colspan="2" rowspan="2">* Notice that every piece of equipment or method of protection that is available to increase the safety in a hazardous location should have an applicable certification indicating the Class, Group, Division or Zone to which the product has been certified to. If a product has been certified to a certain standard of protection it can then be used in any standard that requires a lesser degree of protection.</td>
<td><u>" ib "</u>
intrinsic safety system offers protection for Zone 1 applications. That is all applications whereby there is intermittent hazardous presence. Some applications of Division 1 fall into this category.</td>
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<td><u>Explosion containment</u>
This is the only method that allows the explosion to occur, but confines it to a well defined area, thus avoiding it spreading to the surrounding atmosphere. Explosion-proof enclosures are based on this method. Example NEMA 7 type enclosures.</td>
<td><u>" ic "</u>
intrinsic safety system offers protection for Zone 2 applications. That is all applications whereby it is abnormal for a hazard to be present. Applications of Division 2 fall into this category.</td>
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</table>

Purge & Pressurization Method

North America has standardized on three levels of protection for Purge and Pressurization methods. They are Type X,Y & Z. The Type X offering the highest level of protection. The European standards have been revised to include three new protection methods of px, py, and pz. These methods are similar to the North American counterparts. Purge / Pressurization systems allow the use of general purpose enclosures in hazardous locations as an alternative to NEMA Type 7 or 9 enclosures or those rated for zone classification. The NFPA 496 recognizes these three type of purge systems for Class I locations where hazards are continually present: types X, Y, and Z.

Type " X " purging reduces the area classification inside the enclosure from Division 1 to non hazardous. Type X purging requires that if the enclosure pressure is lost, the electrical supply is automatically disconnected on loss of purge pressure and a re-purge is required before the electrical supply is restored. General purpose equipment can be operated within the protected enclosure. These type X systems could be applied in Class I Division 1, Zone 1 and Zone 21 applications.

Type " Y " purging reduces the area classification inside the enclosure from Division 1 to Division 2. Type Y purging does not require electrical supply disconnection upon loss of pressure but the equipment in the purged enclosure must be suitable for Division 2.The type Y systems could be applied in Class I Division 1, Zone 1 and Zone 21 applications.

Type " Z " purging reduces the area classification inside the enclosure from Division 2 to non-hazardous. Type Z purging, because of the lower level risk in Division 2, requires only an indication of loss purged pressure. General purpose equipment can be operated within the protected enclosure. The type Z systems could be applied to Class I division 2, Zone 2 and Zone 22 applications.

Notes:

1) There are strict guidelines regarding the sequence of operation that must be performed upon inital start up and subsequent restarting for each type of purge/pressurizing system.

2) All three types of purging are commercially available as prepackaged kits.

Explosion Containment

An Explosion Proof (or Flame Proof, as classified in IEC and Cenelec standards) device is an electrical device designed with an enclosure capable of withstanding, without damage, an explosion within it of a specific gas, fiber or dust. In addition, it prevents ignition of these same materials surrounding the enclosure by a spark or flame from the explosion within. The material used to build the explosion proof enclosure is generally metallic (aluminum, cast iron, welded steel, etc.) Plastic or non-metallic materials can be used for enclosures with a small internal volume of less than 3 cu. Dm.

The NEC approach is to use NEMA rated enclosures.

NEMA 7 These enclosures are classified for Class I Division 1 applications.

NEMA 9 These enclosures are constructed for indoor use in hazardous locations. They are classified for Class I , Division 1, Groups E, F, or G as defined by NFPA 70.

The IEC and Cenelec follow a different approach.

They follow the ATEX Directive 94/9/EC and the harmonized standard EN 60079-1. This standard applies to explosive atmospheres. It covers equipment protected by flameproof enclosures " d ".
Ex " d " An enclosure with this rating are for use in Zones 1 and Zone 2.

- A sample rating of **IEC** applica tion would be Ex d IIC T6.
- A sample rating of **Cenelec** ap plication would be EEx d IIC T6.
- **The Ex & Eex** indicate that it is explosion protected.
- **The " d "** indicates the method of protection, in the case it is by a flameproof enclosure.
- **The IIC** indicates the gas group, in this case it is Acetylene.
- **The T6** Indicates the maximum surface temperature, which in this case is 85 C.