

# Hazardous Locations

## C.E.C. Classifications

### C.E.C. Code Changes

In 1998, the Canadian Electrical Code® (C.E.C.) adopted the International Electrotechnical Commission's (IEC) "Three Zone Area" Classification System for Class I hazardous locations. The Zone System is an alternate classification for Class I hazardous locations and was adopted to promote harmonization with international standards.

The Division System for Class I hazardous locations continues to be used for existing facilities and is expected to remain in use at least for the next few editions of the C.E.C. For this reason, this catalogue's certification information for Class I hazardous locations includes both the pre-1998 Division System and the new I.E.C. Zone System.

The following pages provide an overview of C.E.C. hazardous location classifications.

### Classes

The Canadian Electrical Code (C.E.C.), Part I, Section 18 - Hazardous Locations, identifies three classes of hazardous locations:

- Class I - Gas and Vapour Environments
- Class II - Dust Environments
- Class III - Fibers and Flyings Environments

### The 1998 revisions to the C.E.C. affect only Class I - Gas and Vapour Environments.

**Hazardous location** is defined by the C.E.C. as premises, buildings or parts thereof in which there exists the hazard of fire or explosion due to highly flammable gases and/or flammable, volatile liquid mixtures that are manufactured, used or stored in other than the original containers.

This definition can also be extended to include combustible dust and easily ignitable fibers that are likely to be present in sufficient quantities to produce an explosive mixture.

### Class I — Gas and Vapour Environments

Locations which are deemed hazardous due to the presence of gases or vapours that are present in the air in a sufficient quantity to produce explosive or ignitable mixtures.

Locations identified as Class I require that enclosures and connectors be explosion-proof.

Class I hazardous locations are further subdivided into :

- **Divisions** (pre-1998 version of the C.E.C.), or
- **Zones** (I.E.C. Classification – 1998 C.E.C.)

The Division System may still be used for the maintenance and repair of existing facilities. All new construction must use the I.E.C. Zone Classification.

### Divisions

- **Division 1** — a Class I location where the hazardous atmosphere is expected to be present during normal operations on a continuous, intermittent or periodic basis.
- **Division 2** — a Class I location in which volatile flammable liquids or gases are handled, processed or used but in which they would normally be confined within closed containers or closed systems from which they can escape only in the event of an accidental rupture or breakdown of the containers or systems.

### Zones

- **Zone 0** — Class I locations in which explosive gas atmospheres are present continuously or are present for long periods.
- **Zone 1** — Class I locations in which:
  - i. explosive gas atmospheres are likely to occur in normal operation; or
  - ii. explosive gas atmospheres may exist frequently because of repair or maintenance operations or because of leakage; or
  - iii. the location is adjacent to a Class I, Zone 0 location, from which explosive gas atmospheres could be communicated.

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- **Zone 2** — Class I locations in which:
  - iv. explosive gas atmospheres are not likely to occur in normal operation and if they do occur they will exist for a short time only; or
  - v. flammable volatile liquids, flammable gases or vapours are handled, processed, or used, but in which liquids, gases or vapours are normally confined within closed containers or closed systems from which they can escape only as a result of accidental rupture or breakdown of the containers or systems or the abnormal operation of the equipment by which the liquids or gases are handled, processed or used; or
  - vi. explosive gas atmospheres are normally prevented by adequate ventilation by which may occur as a result of failure or abnormal operation of the ventilation system; or
  - vii. the location is adjacent to a Class I, Zone 1 location from which explosive gas atmospheres could 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.

### Area Classification — Divisions vs. Zones

Continuous Hazard	Intermittent Hazard	Hazard Under Abnormal Conditions
Zone 0	Zone 1	Division 2
Division 1		Division 2

### Class I Equipment

Electrical equipment that is approved for use in Class I Hazardous Location Areas (HLAs) is referred to as explosion-proof or flame-proof. This designation means that the equipment has been designed and manufactured to ensure that it will not become a source of ignition when used in a Class I, Gas and Vapour HLA.

All explosion proof equipment is clearly identified by either:

- a «Class I Location» marking (Division System); or
- a «Type of protection “d”» marking (IEC Zone System).

### Gas Group Designations

Two systems of groupings for gases are included in the 1998 C.E.C: the pre-1998 Division Gas Groups consisting of Groups A, B, C and D; and the IEC System consisting of Groups IIA, IIB and IIC.

Both systems are accepted by the C.E.C.

Comparison of Hazardous Location Gas Group Designations From Most Restrictive to Least Restrictive

### Division Gas Groups

Typical Gas Hazard	Division Gas Groups	1998 CEC and IEC Gas Groups
Acetylene	A	IIC
Hydrogen	B	
Ethylene	C	IIB
Propane	D	IIA

- **Group A** acetylene
- **Group B** butadiene, ethylene oxide, hydrogen, manufactured gases containing more than 30% hydrogen (by volume), propylene oxide.
- **Group C** acetaldehyde, cyclopropane, diethyl, ether, thylene, unsymmetrical dimethyl hydrazine (UDMH 1, 1-dimethyl hydrazine).
- **Group D** acetone, acrylonitrile, alcohol, ammonia, benzene, benzine, benzol, butane, 1-butanol, 2-butanol, butyl acetate, isobutyl acetate, ethane, ethanol, ethyl acetate, ethylene dichloride, gasoline, heptanes, hexanes, isoprene, methane, methanol, 3-methyl-1-butanol, methyl ethyl ketone, 2-methyl-1-propanol, 2-methyl-2-propanol, naphtha, natural gas, petroleum naphtha, octanes, pentanes, 1-pentanol, propane, 1-propanol, 2-propanol, propylene, styrene, toluene, vinyl acetate, vinyl chloride, xylenes, I.E.C. Zone Gas Groups

- **Group IIC**  
acetylene, butadiene, propylene oxide, carbon disulphide, hydrogen or other gases or vapour of equivalent hazard
- **Group IIB**  
cyclopropane, diethyl ether, ethylene, ethylene oxide, hydrogen sulfide, unsymmetrical dimethyl hydrazine (UDMH) or other gases or vapour of equivalent hazard
- **Group IIA**  
acetaldehyde, acetone, acrylonitrile, alcohol, ammonia, benzene, benzol, butane, ethylene dichloride, gasoline, hexane, isoprene, lacquer solvent vapours, naphtha, natural gas, propane, propylene, styrene, vinyl acetate, vinyl chloride, xylenes or other gases or vapour of equivalent hazard

### Comparison of Division and I.E.C. Zone Systems

Class 1	Division System	I.E.C. Zone System	Notes
Gases and Vapours	Division 1	Zone 0	Zone 0 locations are a small percentage of all hazardous locations.
		Zone 1	While the wiring practices and acceptable products differ, Class I, Division 1 locations encompass both Zones 0 and 1
	Division 2	Zone 2	Zone 2 and Division 2 are essentially the same.

### Class II — Dust Environments

Locations which are deemed hazardous due to the presence of combustible or electrical conducting dusts.

Class II locations normally require that enclosures and connectors be dust tight.

### Class II — Divisions

Class II locations are further divided in two divisions as follows:

- **Division 1** — In which combustible dust is or may be in suspension in air continuously, intermittently or periodically under normal operating conditions.
- **Division 2** — In which combustible dust may be in suspension in the air as a result of infrequent malfunctioning.

### Class II — Group Designations

The Canadian Electrical Code (C.E.C.), Part 1 Section 18 - Hazardous Locations defines various groups which have been established for the purpose of testing and approval.

- **Group E** — Comprising atmospheres containing metal dust including aluminum, magnesium, and their commercial alloys, and other metals of similarly hazardous characteristics.
- **Group F** — Comprising atmospheres containing carbon black, coal or coke dust.
- **Group G** — Comprising atmospheres containing flour, starch or grain dust, and other dusts of similarly hazardous characteristics.

### Class III — Fibers and Flying Environments

Locations which are deemed hazardous due to the presence of easily ignitable fibers or flyings, but in which such fibers or flyings are not likely to be in suspension in the air in sufficient quantities to produce ignitable mixtures.

Class III locations normally require that enclosures and connectors be constructed to minimize the entry of fibers or flyings.

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Class III locations are further divided in two divisions as follows:

- **Division 1** — In which readily ignitable fibres or materials producing combustible flying are handled, manufactured or used.
- **Division 2** — In which readily ignitable fibres other than those in process of manufacture are stored or handled.

Although IP is mainly a European rating system, it is referred to more and more in North America, especially for lighting fixtures needing a wet location label.

The first number of an IP rating represents the degree of protection against penetration of solids and the second number, the degree of protection against penetration of water. So, for example, a wall sconce that is rated IP65 is completely protected against penetration of dust particles and against jets of water.

### Degree of protection

#### FIRST IDENTIFICATION NUMBER

Degree of protection against penetration of solids.

- 0 Not Protected
- 1 Protected against penetration of solids larger than 2"
- 2 Protected against penetration of solids larger than 1/2"
- 3 Protected against penetration of solids larger than 3/32"
- 4 Protected against penetration of solids larger than 1/32"
- 5 Protected against penetration of dust
- 6 Completely protected against penetration of dust

#### SECOND IDENTIFICATION NUMBER

Degree of protection against penetration of water.

- 0 Not Protected
- 1 Protected against vertical fall of water drops
- 2 Protected against the fall of water at a maximum angle of 15°
- 3 Protected against rain
- 4 Protected against splashes
- 5 Protected against jets of water
- 6 Protected against waves
- 7 Protected against the effects of immersion
- 8 Protected against the effects of prolonged immersion