Hazardous Locations: Definitions of Classes, Groups and Divisions

Hazardous locations are areas where the potential for fires or explosions exists because of gases, dust, or easily ignitable fibers or particles in the atmosphere.

In North America, hazardous areas are separated by **classes**, **groups and divisions** to define the level of safety required for equipment installed in these locations. *Classes* define the general form of the flammable materials in the atmosphere. *Groups* classify the exact flammable nature of the material. *Divisions* define the probability of the presence of flammable materials.

SUMMARY OF CLASS I, II, and III HAZARDOUS LOCATIONS			
CLASSES	**GROUPS**	**DIVISIONS**	
		1	**2**
I Gasses, Vapors and Liquids (Art. 501)	A. Acetylene B. Hydrogen, etc. C. Ether, Etc. D. Hydrocarbons, Fuels, Solvents, etc.	Normally explosive and hazardous	Not normally present in an explosive concentration (but may accidentally exist.)
II Dusts (Art. 502)	E. Metal Dusts (conductive and explosive) F. Carbon Dusts (Some are conductive* and all are explosive) G. Flour, Starch, Grain, Combustible Plastic or Chemical Dust (explosive)	Ignitable quantities of dust that is normally or may be, in suspension or conductive dust may be present.	Dust not normally suspended in an ignitable concentration (but may accidentally exist). Dust layers are present.
III Fibers and Flyings (Art. 503)	H. Textiles, Woodworking, etc. (easily ignitable, but not likely to be explosive)	Handled or used in manufacturing.	Stored or handled in storage (exclusive of manufacturing).
*NOTE: Electrically conductive dusts are dusts with a resistivity less than 105 OHM-centimeter.			

In Europe and countries outside of North America, classification of hazardous locations is accomplished differently. The International Electrotechnical Commission (IEC) uses a series of zones rather than classes and divisions to classify hazardous areas. The table below compares the U.S./NEC classifications to the equivalent IEC/EU and CA/CEC classifications.

AREA CLASSIFICATION (Comparison of IEC/EU, US and CA)			
	Flammable Material Present Continuously	**Flammable Material Present Intermittently**	**Flammable Material Present Abnormally**
IEC/EU	Zone 0	Zone 1	Zone 2
U.S. NEC® 505	Zone 0	Zone 1	Zone 2
NEC® 500	Division 1		Division 2
CA CEC Section 18 CEC Annex J	Zone 0	Zone 1	Zone 2
	Division 1		Division 2
IEC classification per IEC 60079-10 EU classification per EN 60079-10 US classification per ANSI/NF PA 70 National Electrical Code® (NEC®) Article 500 or Article 505 CA Classification per CSA C22.1 Canadian Electrical Code (CEC) Section 18 or Annex J.			

APPARATUS GROUPING		
Typical Gas	**US (NEC® 505) CA (CEC Section 18) EU IEC**	**US (NEC 500) CA (CEC Annex J)**
Acetylene	Group IIC	Class I/Group A
Hydrogen	(Group IIB + H_2)	Class I/Group B
Ethylene	Group IIB	Class I/Group C
Propane	Group IIA	Class I/Group D
Methane	Group I*	Mining*
*Not within scope of NEC®. Under jurisdiction of MSHA. Not within scope of CEC.		

INGRESS PROTECTION (IP) CODES		
First Characteristic Numeral		**Second Characteristic Numeral**
Protection Against Solid Bodies		***Protection Against Liquid***
0	No protection	No protection
1	Objects greater than 50 mm	Vertical (90°) dripping water
2	Objects greater than 12 mm	75° to 90° dripping water
3	Objects greater than 2.5 mm	Sprayed water
4	Objects greater than 1 mm	Splashed water
5	Dust-protected	Water jets
6	Dust-tight	Heavy seas
7		Effects of immersion
8		Indefinite immersion

Approximate U.S. Enclosure Type (NEMA) Equivalent to IPXX

Type ⟶	**IP**	**Type ⟶**	**IP**	**Type ⟶**	**IP**
1	10	3S	54	6 and 6P	67
2	11	4 and 4X	55	12 and 12K	52
3	54	5	52	13	54
3R	14				

Common Classifications

Some classifications are not shown here. For further detailed information, see specific standards published by approval organizations.

- **Class I, Division 1**
- **Class I, Division 2**
- **Class I, Zone 0**
- **Class I, Zone 1**
- **Class II, Division 1**
- **Class II, Division 2**
- **Class III, Division 1**
- **Class III, Division 2**

Class I, Division 1

A Class I, Division 1 location is a location where ignitable concentrations of flammable gases, vapors or liquids:

- can exist under normal operating conditions;
- may exist frequently because of repair or maintenance operations or because of leakage; or
- may exist because of equipment breakdown that simultaneously causes the equipment to become a source of ignition.

Equipment intended for use in a Class I, Division 1 area is usually of the *explosion-proof*, *intrinsically safe*, or *purged/pressurized* type. Below is a definition of each of these types:

Explosion-proof apparatus
"Apparatus enclosed in a case that is capable of withstanding an explosion of a specified gas or vapor that may occur within it and of preventing the ignition of a specified gas or vapor surrounding the enclosure by sparks, flashes, or explosion of the gas or vapor within and that operates at such an external temperature that a surrounding flammable atmosphere will not be ignited thereby." (See NFPA 70)

Intrinsically safe apparatus
"Apparatus in which all the circuits are intrinsically safe." (See UL 913)

Intrinsically safe circuit
"A circuit in which any spark or thermal effect is incapable of causing ignition of a mixture of flammable or combustible material in air under prescribed test conditions." (See UL 913)

Purging
"The process of supplying an enclosure with a protective gas at a sufficient flow and positive pressure to reduce the concentration of any flammable gas or vapor initially present to an acceptable level." (See NFPA 496)

Pressurization
"The process of supplying an enclosure with a protective gas with or without continuous flow at sufficient pressure to prevent the entrance of a flammable gas or vapor, a combustible dust, or an ignitable fiber." (See NFPA 496)

Class I, Division 2

A Class I, Division 2 location is a location:

- where volatile flammable liquids or flammable gases or vapors exist, but are normally confined within closed containers;
- where ignitable concentrations of gases, vapors or liquids are normally prevented by positive mechanical ventilation; or
- adjacent to a Class I, Division 1 location, where ignitable concentrations might be occasionally communicated.

Equipment intended for use in a Class I, Division 2 area is usually of the nonincendive, non-sparking, purged/pressurized, hermetically sealed, or sealed device type.

Nonincendive circuit
"A circuit in which any arc or thermal effect produced under intended operating conditions of the equipment is not capable, under the test conditions specified, of igniting the specified flammable gas- or vapor- air mixture."(See UL 1604)

Nonincendive component
"A component having contacts for making or breaking an incendive circuit and the contacting mechanism shall be constructed so that the component is incapable of igniting the specified flammable gas- or vapor-air mixture. The housing of a nonincendive component is not intended to:

- exclude the flammable atmosphere, or
- contain an explosion." (See UL 1604)

Nonincendive field circuit
"A circuit that enters or leaves the equipment enclosure and that under intended operating conditions is not capable, under the test conditions specified, of igniting the specified flammable gas- or vapor-air mixture or combustible dust." (See UL 1604)

Non-sparking apparatus
"Apparatus that has no normally arcing parts or thermal effects capable of ignition. Examples of normally arcing parts are relays, circuit breakers, servo-potentiometers adjustable resistors, switches, non-latching type connectors and motor brushes. (See UL 1604)

Purging
See definition under Class I, Division 1

Pressurization
See definition under Class I, Division 1

Hermetically sealed component
"A component that is sealed against entrance of an external atmosphere and in which the seal is made by fusion, such as soldering, brazing, welding, or the fusion of glass to metal." (See UL 1604)

Sealed device
"A device that is constructed so that it cannot be opened, has no external operating mechanisms, and is sealed to restrict entry of an external atmosphere without relying on gaskets. The device may contain arcing parts or internal hot surfaces." (See UL 1604)

Class I, Zone 0

A Class I, Zone 0 location is a location where ignitable concentrations of flammable gases, vapors or liquids:

- are present continuously; or
- are present for long periods of time.

Equipment intended for use in a Class I, Zone 0 area is usually of the intrinsically safe, "ia," type.

Intrinsically safe
See definitions under Class I, Division 1

Class I, Zone 1

A Class I, Zone 1 location is a location where ignitable concentrations of flammable gases, vapors or liquids:

- are likely to exist under normal operating conditions;
- may exist frequently because of repair or maintenance operations or leakage; or
- may exist because of equipment breakdown that simultaneously causes the equipment to become a source of ignition; or
- are adjacent to a Class I, Zone 0 location from which ignitable concentrations could be communicated.

Equipment intended for use in a Class I, Zone 1 area is usually of the flameproof, purged/pressurized, oil immersed, increased safety, encapsulated or powder filled type.

Flameproof

"The enclosure of the equipment will withstand an internal explosion, and prevent passage of flame to the surrounding atmosphere. Care must be taken to maintain the length and clearance (gap) of flameproof joints in service." (See UL 2279)

Purged/pressurized

See definitions under Class I, Division I.

Oil immersion

"Arcing contacts are immersed in a protective liquid." (See UL 2279)

Increased safety

"The equipment contains no normally arcing parts, and additional measures (such as larger spacings among wiring connections) are taken to prevent the possibility of high temperatures or sparks. A minimum IP rating of IP 54 is required."
(See UL 2279)

Encapsulation

"Arcing contacts are completely surrounded by an encapsulating material."
(See UL 2279)

Powder filling

"Arcing contacts are surrounded by a filling material (glass or quartz powder)." (See UL 2279)

Class I, Zone 2

A Class I, Zone 2 location is a location:

- where ignitable concentrations of flammable gases, vapors or liquids are not likely to occur in normal operation or, if they do occur, will exist only for a short period;
- where volatile flammable liquids, or flammable gases or vapors exist, but are normally confined within closed containers
- where ignitable concentrations of gases, vapors, or liquids are normally prevented by positive mechanical ventilation;
- adjacent to a Class I, Zone 1 location from which ignitable concentrations could be communicated.

Equipment that is intended for use in a Class I, Zone 2 area is usually of the nonincendive, non-sparking, restricted breathing, hermetically sealed or sealed device type.

Nonincendive

See definitions under Class I, Division 2

Non-sparking

See definition under Class I, Division 2

Restricted breathing

"The enclosure relies on tight seals and gaskets to prevent diffusion of the explosive atmosphere into the equipment enclosure. Provision for checking that the restricted breathing properties of the enclosure are maintained is provided." (See UL 2279)

Hermetically sealed

See definition under Class I, Division 2

Sealed device

"A device that is constructed so that it cannot be opened and is sealed to restrict entry of an external atmosphere. The device may contain arcing parts or internal hot surfaces." (See UL 2279)

Class II, Division 1

A Class II, Division 1 location is a location where:

- ignitable concentrations of combustible dust can exist in the air under normal operating conditions;
- ignitable concentrations of combustible dust may exist because of equipment breakdown that simultaneously causes the equipment to become a source of ignition; or
- electrically conductive combustible dusts may be present in hazardous quantities.

Equipment intended for use in a Class II, Division 1 area is usually of the dust-ignition-proof, intrinsically safe, or pressurized type.

Dust-ignition-proof
"Enclosed in a manner that will exclude dusts and, where installed and protected in accordance with the NEC, will not permit arcs, sparks or heat otherwise generated or liberated inside of the enclosure to cause ignition of exterior accumulations or atmospheric suspensions of a specified dust on or in the vicinity of the enclosure." (See NFPA 70)

Intrinsically safe
See definitions under Class I, Division 1.

Pressurization
See definition under Class I, Division 1.

Class II, Division 2

A Class II, Division 2 location is a location where:

- combustible dust is not normally in the air in ignitable concentrations;
- dust accumulations are normally insufficient to interfere with normal operation of electrical equipment;
- dust may be in suspension in the air as the result of infrequent malfunctioning of equipment; or
- dust accumulation may be sufficient to interfere with safe dissipation of heat or may be ignitable by abnormal operation.

Equipment intended for use in a Class II, Division 2 area is usually of the dust-tight, nonincendive, non-sparking, or pressurized types.

Dust-tight
"Constructed so that dust will not enter the enclosing case under specified test conditions. An example of such conditions would be a UL Type 12 enclosure." (See NFPA 70)

Nonincendive
See definitions under Class I, Division 2

Non-sparking
See definition under Class I, Division 2

Pressurization
See definition under Class I, Division 1.

Class III, Division 1

A Class III, Division 1 location is a location where easily ignitable fibers or materials producing combustible flyings are handled, manufactured or used.

Equipment intended for use in a Class III, Division 1 area is usually of the dust-tight or intrinsically safe type (both previously defined).

Class III, Division 2

A Class III, Division 2 location is a location where easily ignitable fibers are stored or handled.

Equipment intended for use in a Class III, Division 1 area is usually of the dust-tight or intrinsically safe type (both previously defined).

Contact IVC

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