

Appendix M. Hazardous locations

The ANSI/NFPA 70 "National Electrical Code" (NEC) defines the Hazardous Locations as locations where fire or explosion hazards may exist due to flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers or flyings. The NEC pays attention to the hazardous locations because the electrical equipment can become source of ignition in these volatile areas. Articles 500 through 504, and 510 through 517 provide classification and installation standards for the use of electrical equipment in these locations.

Hazardous locations are classified in three ways: location types, danger condition and nature of the material in the location.

There are three types of hazardous locations.

The first type of location, Class I, is an area where flammable gases or vapours in the air are present in concentrations suitable to produce, which could be ignited if an electrical or other source of ignition is present.

The second type of location, Class II, is the area made hazardous by the presence of combustible dust, suspended in the atmosphere, which can cause an explosion.

The third type of location, Class III, is the area where there are easily-ignitable fibers or flyings present, due to the types of materials being handled, stored or processed. In this case the fibers or the flyings can collect around machinery where heat, a spark or hot metals parts can ignite them.

In addition to the types of hazardous locations, the NEC concerns itself with the kind of conditions under which the hazard is present. The hazardous materials may exist in several different kinds of conditions which, for simplicity, the NEC describe as normal conditions, Division 1, and abnormal conditions, Division 2. In the normal condition, the hazard would be expected to be present in everyday production operations or during frequent repair and maintenance activity. While, when the hazardous material is expected to be confined within closed systems (e.g. containers) and is present in the atmosphere only through accidental rupture, breakage or unusual faulty operation, the situation could be called abnormal.

Finally, the NEC defines the nature of the hazardous materials which are present in the location, grouping them according to the ignition temperature, the explosion pressure and other flammable characteristics (Group A, B, C, D, E, F, G).

An example: how would we classify a storage area where LP gas is contained in closed containers? LP gas is a Class I substance; the gas would be present in the atmosphere only if a leakage or an accidental rupture of one or more containers occurred, so it is an abnormal condition, Division 2. Finally, the material, liquid petroleum gas, belongs to Group D material, as shown in the following table.

In Europe the hazardous locations are classified by EN 60079-10 standard, and in Canada by the Canadian Electrical Code.

Table M.1. Hazardous locations according to Art. 500 of NFPA 70 (NEC) - Ed. 2008/2011

Type of location	Hazardous condition	Nature of the material	Examples
Class I (Art. 501 of NEC) Locations in which flammable gases or vapors are or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures.	Division 1 Locations in which ignitable concentrations of flammable gases or vapors can exist under normal operating conditions. Or in which ignitable concentrations of such gases or vapors 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 or 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. Division 2 Locations in which volatile flammable liquids or flammable gases 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 gases or 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 I, Division 1 location, and to which ignitable concentrations of gases or vapors 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.	Group A Atmospheres containing acetylene. Group B Atmospheres containing hydrogen or other materials with similar characteristics. Group C Atmospheres containing ethylene or other materials with similar characteristics. Group D Atmospheres containing butane, gasoline, natural gas and propane.	Within this classifications there are the petroleum refineries, petrol pumps and storages; plants for dry cleaning where could be present vapours coming out from the cleaning fluids; hangars for airplanes and petrol stations; areas for the stowage and distribution of LP gas or natural gas. All these areas require special equipments and components homologated in Class I.
Class II (Art. 502 of NEC) Locations hazardous because of the presence of combustible dust.	Division 1 Locations 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 electric 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. Division 2 Locations 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.	Group E Atmospheres containing metal dusts such as aluminium or magnesium dust. Group F Atmospheres containing explosive dusts such as carbon dust. Group G Atmospheres containing flour, starch, grain and similar materials.	Within this classification are transport systems for grain, mills, system for flour production; systems for the production, the use of the storage of aluminium or magnesium dusts; machinery for the manufacturing of plastics, medicinal, fireworks; systems for sweets production and sugar processing; plants for carbon treatment and transformation.

Type of location	Hazardous condition	Nature of the material	Examples
Class III (Art. 503 of NEC) Locations hazardous because of 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 quantities sufficient to produce ignitable mixtures.	Division 1 Locations in which easily ignitable fibers or materials producing combustible flyings are handled, manufactured, or used. Division 2 Locations in which easily ignitable fibers are stored or handled other than in the process of manufacture.	No group.	Within this classifications are included the systems for the production of fabrics or for cotton processing; machinery for wood processing or cutting and for the production of sawdust or fiber glass.

With explicit reference to the chapter concerning the degrees of protection of the enclosures, the standards concerning the hazardous locations define the TYPE of enclosures which can be used for such locations.

Table M.2. NEMA classification of enclosures to be used in the hazardous locations

Type	Type of enclosures for indoor use in hazardous locations
NEMA 7	Enclosures for indoor use in locations classified as Class I, Division 1, Group A, B, C or D. Enclosures constructed to contain internal explosions without causing external damages.
NEMA 8	Enclosures for indoor or outdoor use in locations classified as Class I, Division 1, Group A, B, C or D. Enclosures constructed to prevent the combustion through the use oil-immersed equipment.
NEMA 9	Enclosures for indoor or outdoor use in locations classified as Class I, Division 1, Group A, B, C or D. Enclosures constructed to prevent the combustion through the use oil-immersed equipment.
NEMA 10	Enclosures meeting the requirements of the Mine Safety and Health Administration, 30 CFR, Part. 18. Enclosures constructed to contain internal explosions without causing external damages.