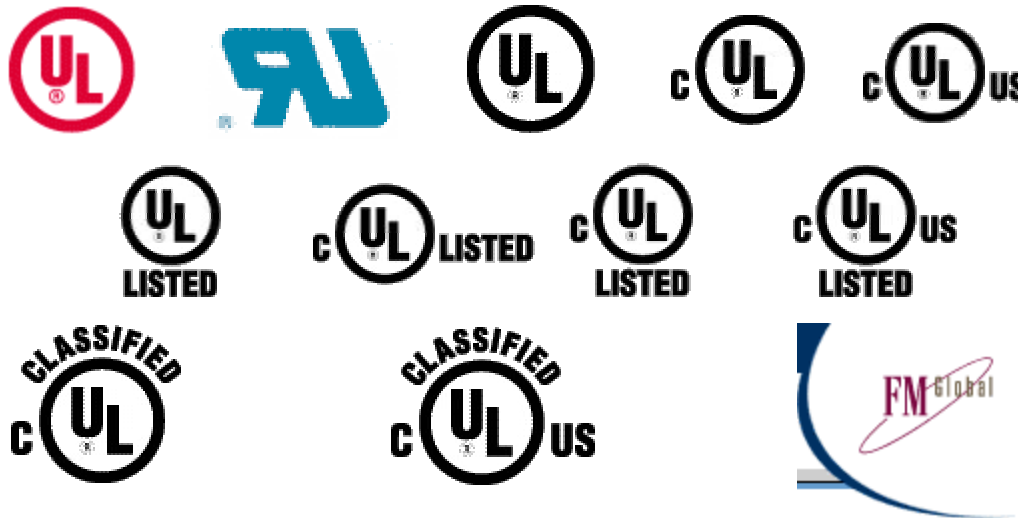


## How to Choose Electrical Equipment for Hazardous Locations

### Summary

*The National Electric Code (NEC) provides definitive classification of hazardous areas where special electrical equipment must be used. The electrical equipment used for these locations must be Underwriters Laboratories (UL) listed or Factory Mutual approved for that particular location and hazard. Equipment labeled for one hazard class area may not be installed in another hazard area unless it is so marked on the label. The information provided in this Data Sheet is to be used, as a guide only, to assist you in choosing the correct electrical equipment for hazardous locations. It must be stressed, however, that the user should consult NFPA #70 for updates and changes that may not appear on this data sheet.*

The following are samples of the Underwriters Laboratory (UL) and Factory Mutual (FM) markings.



Electrical apparatus considered safe for ordinary applications can be completely unfit for installation where flammable gases or vapors, dust and other easily ignitable materials are present. These materials can ignite as a result of electrical causes when two conditions co-exist:

1. **The fuel-air mix is right** -The proportion of flammable substance to the amount of oxygen must permit ignition and the mixture must be present, in sufficient quantity, to provide an ignitable atmosphere in the vicinity of the electrical equipment.
2. **There is a source of ignition** - An electric arc, flame escaping from an ignited substance in an enclosure, or heat from some other sources must be present at a temperature equal to or greater than the ignition point of the flammable mixture.

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## Hazardous Locations Classifications

### 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. Class I locations shall include those specified in the NEC definition:

*A **Class I, Division 1** location is one:*

- 1. In which ignitable concentrations of flammable gases or vapors can exist under normal operating conditions, **or***
- 2. In which ignitable concentrations of such gases or vapors may exist frequently because of repair or maintenance operations **or** because of leakage, **or***
- 3. 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.*

**Note No. 1:** This definition usually includes the following locations:

1. Where volatile flammable liquids or liquefied flammable gases are transferred from one container to another
2. Interiors of spray booths and areas in the vicinity of spraying and painting operations where volatile flammable solvents are used
3. Locations containing open tanks or vats of volatile flammable liquids
4. Drying rooms or compartments for the evaporation of flammable solvents
5. Locations containing fat and oil extraction equipment using volatile flammable solvents
6. Portions of cleaning and dyeing plants where flammable liquids are used
7. Gas generator rooms and other portions of gas manufacturing plants where flammable gas may escape
8. Inadequately ventilated pump rooms for flammable gas or for volatile flammable liquids
9. The interiors of refrigerators and freezers in which volatile flammable materials are stored in open, lightly stoppered, or easily ruptured containers
10. All other locations where ignitable concentrations of flammable vapors or gases are likely to occur in the course of normal operations

**Note No. 2:** In some Division 1 locations, ignitable concentrations of flammable gases or vapors may be present continuously or for long periods of time. Examples include the following:

1. The inside of inadequately vented enclosures containing instruments normally venting flammable gases or vapors to the interior of the enclosure
2. The inside of vented tanks containing volatile flammable liquids
3. The area between the inner and outer roof sections of a floating roof tank containing volatile flammable fluids
4. Inadequately ventilated areas within spraying or coating operations using volatile flammable fluids
5. The interior of an exhaust duct that is used to vent ignitable concentrations of gases or vapors

Experience has demonstrated the prudence of avoiding the installation of instruments or other electric equipment in these particular areas altogether. Where it cannot be avoided because it is essential to the process, and other locations are not feasible, using electric equipment or instrumentation approved for the specific application or consisting of intrinsically safe systems.

### Class I, Division 2

*A **Class I, Division 2** location is one:*

1. 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**

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2. 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**
3. 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.

**Note No. 1:** This classification usually includes locations where volatile flammable liquids or flammable gases or vapors are used but, in the judgment of the authority having jurisdiction, would become hazardous only in case of an accident or of some unusual operating condition. The quantity of flammable material that might escape in case of accident, the adequacy of ventilating equipment, the total area involved, and the record of the industry or business with respect to explosions or fires are all factors that merit consideration in determining the classification and extent of each location.

**Note No. 2:** Piping without valves, checks, meters, and similar devices would not ordinarily introduce a hazardous condition even though used for flammable liquids or gases. Depending on factors such as the quantity and size of the containers and ventilation, locations used for the storage of flammable liquids or liquefied or compressed gases in sealed containers may either be considered hazardous (classified) or unclassified locations. [See Flammable and Combustible Liquids Code, NFPA 30-1996, and Liquefied Petroleum Gas Code, NFPA 58-1998.]

## Class II Locations

Class II locations are those that are hazardous because of the presence of combustible dust.

### **Class II, Division 1.**

A Class II, Division 1 location is one:

1. In which combustible dust is in the air under normal operating conditions in quantities sufficient to produce explosive or ignitable mixtures, **or**
2. 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, operation of protection devices, or from other causes, **or**
3. In which combustible dusts of an electrically conductive nature may be present in hazardous quantities.

**Note:** Combustible dusts that are electrically nonconductive include dusts produced in the handling and processing of grain and grain products, pulverized sugar and cocoa, dried egg and milk powders, pulverized spices, starch and pastes, potato and wood-flour, oil meal from beans and seed, dried hay, and other organic materials that may produce combustible dusts when processed or handled.

Only Group E dusts are considered to be electrically conductive for classification purposes. Dusts containing magnesium or aluminum are particularly hazardous, and the use of extreme precaution will be necessary to avoid ignition and explosion.

### **Class II, Division 2**

A Class II Division 2 location is one:

1. Where combustible dust is not normally in the air in quantities sufficient to produce explosive or ignitable mixtures, and dust accumulations are normally insufficient to interfere with the normal operation of electrical equipment or other apparatus, but combustible dust may be in suspension in the air as a result of infrequent malfunctioning of handling or processing equipment **and**
2. Where combustible dust accumulations on, in, or in the vicinity of the electrical equipment may be sufficient to interfere with the safe dissipation of heat from electrical equipment or may be ignitable by abnormal operation or failure of electrical equipment.

**Note No. 1:** The quantity of combustible dust present and the adequacy of dust removal systems are factors that merit consideration in determining the classification and may result in an unclassified area.

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**Note No. 2:** Where products such as seed are handled in a manner that produces low quantities of dust, the amount of dust deposited may not warrant classification.

### Class III Locations

Class III locations are those that are 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.

#### **Class III, Division 1**

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

**Note No. 1:** Such locations usually include some parts of rayon, cotton, and other textile mills; combustible fiber manufacturing and processing plants; cotton gins and cotton-seed mills; flax-processing plants; clothing manufacturing plants; woodworking plants; and establishments and industries involving similar hazardous processes or conditions.

**Note No. 2:** Easily ignitable fibers and flyings include rayon, cotton (including cotton linters and cotton waste), sisal or henequen, istle, jute, hemp, tow, cocoa fiber, oakum, baled waste kapok, Spanish moss, excelsior, and other materials of similar nature.

#### **Class III, Division 2**

A Class III, Division 2 location is one in which easily ignitable fibers are stored or handled other than in the process of manufacture.

### Terms Frequently Misused

- **Explosion-Proof** - this equipment is not designed to prevent an explosion within the equipment, nor to prevent a hazardous atmosphere from entering the equipment. It is, designed to contain an explosion within the equipment and prevent the explosion from entering the surrounding atmosphere from super-heated gases or vapors or from sparks and flashes.
- **Vapor-Tight, or “enclosed and gasketed”** - these terms are used to designate the same equipment. These fixtures may be used in Class I and Class II, Division 2 locations. They are intended to prevent the entrance of moisture and non-combustible dust to the inside of the device and to prevent the fall of sparks if the bulb or some internal part becomes defective.
- **Dust Ignition-Proof** - This is essentially the same equipment as Vapor-tight except with regard to dust instead of vapors.

### Related Information:

(If viewed electronically and there is an Internet connection, the underlined blue colored words are Internet links to their respective sites)

[Underwriters Laboratories](#)

[Factory Mutual Global](#)

*NFPA #70, The National Electric Code 1999*

*NFPA #30, Flammable and Combustible Liquids Code, 1996.*

*NFPA #58, Liquefied Petroleum Gas Code -1998.*

*NFPA #33, Standard for Spray Application Using Flammable or Combustible Materials 2000 Edition*

*The information and suggestions contained in this data sheet have been developed from sources believed to be reliable. However, we accept no legal responsibility for the correctness or completeness of this material or its application to specific factual situations. Internet links to manufacturers and distributors are listed as the information provided best represents the content of this data sheet. Please report non-functioning links to [ccampbel@harleysvillegroup.com](mailto:ccampbel@harleysvillegroup.com)*

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