

Classification of Hazardous Locations

Protecting electrical equipment in hazardous locations requires special considerations. Options include traditional dust ignition-proof designs, Ex systems designed to avoid an explosion, and enclosures that incorporate purging/pressurization solutions.



Traditional dust ignition-proof NEMA Type 9 enclosure.

A hazardous location can be an industrial or commercial environment specifically defined in the National Electrical Code (NEC) in which flammable or explosive gases, liquids, or dusts may be present. These explosive agents may be present at all times, only during abnormal operations, or only when components or processes fail.

The two classification systems for hazardous locations are the NEC Division Classification system and the IEC Zone Classification system.

NEC Division Classification System (NEMA Type 9 Class/Division)

Article 500 of the NEC classifies hazardous locations according to the properties of the flammable vapors, liquids or gases, or according to the combustible dusts or fibers which may be present and the likelihood that a flammable or combustible concentration or quantity is present.

Class I Locations

Class I locations are defined by the NEC as those locations 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 are divided into groups determined by the specific gas or vapor involved: Group A, Group B, Group C, or Group D. These locations are further classified as to whether hazardous concentrations of flammable gases or vapors are likely to occur in the course of normal operations (Division 1) or only in the case of an accident or some unusual operating condition (Division 2).

Enclosures that can be used for Class I locations:

CLASS I, DIVISION 1

- NEMA Type 7 enclosures (Hoffman does not manufacture any of these enclosures)
- Purged general-purpose enclosures (subject to approval by the inspection authority having jurisdiction)

CLASS I, DIVISION 2

- Same as those listed for Class I, Division 1
- General-purpose enclosures [such enclosures are permitted for some applications by Article 501 of the NEC if the equipment does not constitute a source of ignition under normal operating conditions]

Class II Locations

Class II locations are defined by the NEC as those locations that are hazardous due to the presence of combustible dusts.

Class II locations are grouped according to the specific dust involved: Group E combustible metal dusts or other combustible dusts having resistivity of less than 105 ohm-centimeters; Group F combustible dusts such as carbon black, charcoal, and coal or coke dusts having resistivity greater than 102 ohm-centimeters or less than 108 ohm-centimeters; and Group G containing grain dusts or other combustible dusts having resistivity of 105 ohm-centimeters or greater. Class II locations are further classified as to whether combustible dusts may be present in the air under normal operating conditions (Division 1) or whether combustible dusts are not normally in the air but which may accumulate on or near electrical equipment (Division 2).

Enclosures that can be used for Class II locations:

CLASS II, DIVISION 1

- NEMA Type 9 enclosures
- Pressurized enclosures (subject to approval by the inspection authority having jurisdiction)

CLASS II, DIVISION 2

- Same as those listed for Class II, Division 1
- Dust-tight enclosures listed for use in hazardous locations. Tests for hazardous location dust-tight enclosures are contained in ISA 12.12.01 and UL 1604. General purpose dust-tight enclosure types as defined by UL 50 and NEMA 250 are Types 3, 4, 4X, 12, 12K, and 13.
- General-purpose enclosures (such enclosures are permitted for some applications by Paragraph 502 of the National Electrical Code if the equipment does not constitute a source of ignition under normal operating conditions)

Class III Locations

Class III locations are defined by the NEC, in Article 503, as those locations that are hazardous because of the presence of easily ignitable fibers or flyings, but not in quantities sufficient to produce ignitable mixtures. Class III locations are locations in which ignitable fibers or materials producing combustible flyings are handled, manufactured, or used (Division 1) or locations in which ignitable fibers are stored or handled but where no manufacturing processes are performed (Division 2).

Enclosures that can be used for Class III locations:

- Dust-tight Enclosures. As defined by UL 50 and NEMA 250, dust-tight enclosures are Types 3, 4, 4X, 12, 12K, and 13.

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One of the Hoffman purging/pressurization products

International Electro-Technical Code (IEC) Zone Classification System

The zone classification is defined by the International Electro-Technical Commission (IEC). Hazardous locations are classified depending on the properties of the flammable vapors, liquids, or gases that may be present and the likelihood that a flammable or combustible concentration is present. A version of the IEC zone system was adapted by the NEC as article 505. Included here is a brief discussion of the zone classification system. Refer to the latest edition of IEC 60079, or the NEC Handbook for complete information.

Zone 1

This classification includes areas or zones in which ignitable concentrations of flammable gases are likely to exist under normal operating conditions.

Enclosures that can be used for Zone 1 locations:

- Flameproof “d” rated enclosures (very similar to NEMA type 7 enclosures)
- Increased safety “e” rated enclosures where the electrical equipment does not produce arcs, sparks, or excessive temperature under normal operation
- Purged and/or pressurized equipment for Zone 1 or Zone 2

Zone 2

Includes equipment in which ignitable concentrations of flammable gases or vapors are present only in abnormal situations or are not likely to occur in normal operation, and if they do occur, will exist only for a short period.

Enclosures that can be used for Zone 2 locations:

- Same as for Zone 1

Enclosure Types Hazardous Locations

Type	National Electrical Manufacturers Association (NEMA Standard 250) and Electrical and Electronic Mfg. Association of Canada (EEMAC)	Underwriters Laboratories Inc. (UL698, 877, 886, and 894)	Canadian Standards Association (Standard C22.2 No. 25)
9	Enclosures constructed for indoor use in hazardous locations classified as Class II, Division 1, Groups E, F, or G as defined in NFPA 70.	Class II, Division 1, Groups E, F, or G – Indoor Hazardous Locations	Not specifically defined.

Purge/Pressurization Systems

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. Purge/pressurization accessories are attached to an enclosure to prevent explosions in hazardous locations by purging combustible gases or dust and then maintaining a positive pressure with clean dry air, or other inert gas.

Purged and Pressurized Enclosures

Purging is defined as the process of supplying an enclosure with clean air or an inert gas, at sufficient flow and positive pressure to reduce to an acceptable safe level the concentrations of any flammable gases or vapors initially present, and to maintain this safe level by positive pressure with or without continuous flow.

Pressurizing is similar to purging except that pressurizing is used to prevent the entrance of hazardous dusts and cannot be used to clean out dust that already exists inside an enclosure.

Purged or pressurized enclosures are acceptable alternatives for use in hazardous location as permitted by Article 500 of the National Electrical Code and the inspection authority having jurisdiction provided that the requirements and safeguards specified by NFPA 496, “Purged and Pressurized Enclosures for Electrical Equipment in Hazardous Locations” are strictly followed.

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Purged or pressurized enclosures are acceptable alternatives for use in hazardous location as permitted by Article 500 of the National Electrical Code and the inspection authority having jurisdiction provided that the requirements and safeguards specified by NFPA 496, “Purged and Pressurized Enclosures for Electrical Equipment in Hazardous Locations” are strictly followed.

ATEX Directive and Classification System

Since 2003, manufacturers across the European Union (EU) have been obliged to comply with strict new EU directives governing safety in explosive atmospheres. Called ATEX (from the French *ATmosphères EXplosives*), ATEX Directive 94/9/EC has an impact not only on European manufacturers, but also on non-European makers of industrial equipment wishing to sell in Europe.

Two of the most common classification systems for hazardous locations are the NEC Division Classification system and the Zone Classification system used by the European Union (EU) and the International Electrotechnical Commission (IEC).

Article 500 of the NEC also classifies hazardous locations according to the properties of the flammable vapors, liquids or gases, or according to the combustible dusts or fibers that may be present and the likelihood that a flammable or combustible concentration or quantity is present. Articles 505 and 506 of the NEC refer to zone classifications.

NOTE: Hoffman’s ATEX enclosures are not intended for use in explosion-proof or flame-proof (Ex d) applications.

NEC Divisions and IEC Zones

Frequency of Hazard Occurrence	NEC Division Classification System	EU and IEC Zone Classification System
Continuous Hazard	Division 1	Zone 0
Intermittent, Periodic Hazards	Division 1	Zone 1
Abnormal Condition Hazard	Division 2	Zone 2