

Fundamentals of Hazardous Locations

Introduction

A hazardous location is defined as an area where a potential for fire or explosion exists due to the presence of flammable gases, liquids or vapors, combustible dusts or fibers and flyings in sufficient quantities to produce an explosion or ignitable mixture.

These hazards may exist during normal manufacturing or handling processes, or in case of accidental rupture or breakdown of storage containers or systems, or abnormal operation of equipment.

Ignition can result from the normal operation of switches, motors and receptacles as contacts open and close, or from heat producing equipment such as lighting fixtures and motors where operating temperatures exceed the ignition temperature of the surrounding atmosphere. Another source is the electrical system, either through faulty connections causing arcs and sparks, or faults due to insulation failure.

The National Electrical Code

To insure safe electrical systems in hazardous locations, standards for electrical installations have been established by the National Electrical Code (NEC), sponsored by the National Fire Protection Association (NFPA). The NEC establishes minimum standards for the design and installation of electrical products, found in Articles 500 through 516.

Class I Locations

Locations in which flammable gases or vapors may be present in the air in quantities sufficient to produce explosive or ignitable mixtures. These locations would be classified Division I when the gases or vapors exist continuously or periodically under normal operating conditions or Division II if they are handled in closed containers or systems and are present under abnormal conditions.

Class I Groups

Class I gases and vapors are divided into four Groups by the NEC: A, B, C and D. The gases and vapors are designated for

each group according to explosive pressure, ignition temperature, flammable characteristics and other variables. Class I groups are typified by some of the following:

Group A: Acetylene

Group B: Hydrogen, Butadiene, Ethylene oxide, etc.

Group C: Ethylene, Cyclopropane, Carbon monoxide, etc.

Group D: Gasoline, Acetone, Butane, Propane, Alcohol, Natural gas (Methane), etc.

Class I Divisions

Class I locations are further subdivided into divisions. There are two divisions that may be classified in a Class I location.

Class I, Division 1: Locations in which the gases or vapors exist continuously or periodically under normal operating conditions.

Class I, Division 2: Locations in which the gases or vapors are handled in closed containers or will exist only under abnormal conditions.

International Electrotechnical Commission

The NEC also addresses the IEC method of classification of Class 1 hazardous locations. This method can be found in NEC Article 505.

Class I gases and vapors under this method are divided into three groups by the IEC: IIC, IIB and IIA. The gases and vapors are designated for each group according to the maximum experimental safe gap, minimum igniting current, or both. (For further information refer to IEC publication 79-1A, 79-12 and UL Technical Report No. 58 (1993).

Group IIC: Acetylene, Hydrogen or gases or vapors of equivalent hazard.

Group IIB: Acetaldehyde, Ethylene or gases or vapors of equivalent hazard.

Group IIA: Propane or gases or vapors of equivalent hazard.

The IEC method of classification of Class I hazardous locations is also sub-divided. There are three zones that

may be classified in a Class I location. These are Zone 0, Zone 1 and Zone 2. Refer to NEC Article 505 for specific Zone classification and application.

Typical Class I Locations:

Petrochemical plants
Petroleum refining facilities
Aircraft hangers and fuel servicing areas
Spray finishing areas
Dry cleaning plants
Solvent plants
Gas manufacturing facilities

Class II Locations

Locations where the presence of combustible dusts are in the air in sufficient quantities to ignite or explode. These locations would be classified Division I when the dusts are suspended in air continuously or periodically and where equipment failure or abnormal operation may cause ignition of the explosive mixtures. A Division II location exists where dust is not in suspension, but accumulates in quantities sufficient to prevent the dissipation of heat from electrical equipment or may be ignited by sparks, arcs or burning material from the equipment.

Class II Groups

Class II locations comprise both conductive and non-conductive dusts and are divided into three groups by the NEC. They are arranged into groups E, F and G according to their ignition temperature and electrical resistivity.

Group E: Contains metal dusts regardless of resistivity and dusts with similar hazardous characteristics with a resistivity of less than 10^5 ohm-centimeter, e.g., metals, aluminum, magnesium, and chemical dusts.

Group F: Contains carbon black, charcoal, coal or coke dusts which have more than 8% total volatile material (carbon black per ASTM D1620, charcoal, coal and coke dusts per ASTM D271) or atmospheres containing these dusts sensitized by other materials so that they present an explosion hazard, and having resistivity greater than 10^2 ohm-centimeter but equal to or less than 10^8 ohm-centimeter.

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Group G: Contains non-conductive dusts having a resistivity of 10^5 ohm-centimeter or greater, e.g., flour, starch, grain, combustible plastics, and chemical dusts.

Class II Divisions

Class II locations are further subdivided into divisions. There are two divisions that may be classified in a Class II location.

Class II, Division 1: Locations in which the dusts are suspended in air continuously or periodically and where equipment failure or abnormal operation may cause ignition of the explosive mixtures.

Class II, Division 2: Locations in which the dust is not suspended in air, but accumulates in quantities sufficient to prevent the dissipation of heat from electrical equipment or may be ignited by sparks, arcs or burning material from the equipment.

Typical Class II Locations:

Flour and feed mills
Grain elevators
Fireworks manufacturing facilities
Sugar and cocoa processing plants
Magnesium and aluminum manufacturing facilities
Confectionary producers
Coal handling facilities
Pharmaceutical plant
Starch processing plants

Class III Locations

Locations in which easily ignitable fibers or flyings are present but, are not likely to be in suspension in the air in quantities sufficient to produce ignitable mixtures. These locations would be classified Division I where ignitable fibers or materials producing combustible flyings are manufactured, used or handled, or Division II where ignitable fibers are handled or stored, but no manufacturing processes are performed.

There are no Group designations for Class III Hazardous Locations.

Class III, Division 1: Locations in which easily ignitable fibers or materials producing combustible flyings are

handled, used or manufactured.

Class III, Division 2: Locations in which easily ignitable fibers are stored or handled other than in the manufacturing process.

Typical Class III Locations:

Textile mills
Woodworking plants
Cotton mills
Flax processing plants
Clothing manufacturing plants
Thread and yarn mills

Equipment Design

In hazardous locations, there exists a potential for fire and explosions due to the flammable or combustible nature of the materials that may be present. As a result, precautions must be taken to guard against the ignition of the atmosphere. Three basic conditions must be present for a fire or explosion to occur:

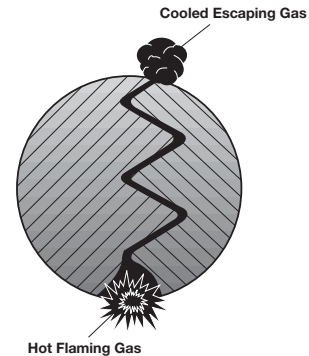
1. Sufficient amounts of flammable liquid, vapors or combustible dust present.
2. Correct mixture of air with the flammable liquids and vapors or combustible dusts.
3. A source of ignition.

Conduit systems in Class I locations are not "gas-tight". Combustible vapors normally accumulate within the electrical system, and will explode with the proper mixture of fuel, air and ignition. Equipment for Class I locations is "Explosion-Proof," that is, designed to contain the internal explosion while allowing the hot gases to cool and vent so as not to ignite the surrounding atmosphere.

Equipment for use in Class II locations would be "Dust-Ignition Proof," and designed with close fitting and/or gasketed parts, to preclude the entry of dusts into the enclosure. Consideration must also be given to the heat build up that could occur, due to the layer of dust that may settle on the equipment.

Enclosures for Class III installations must preclude the entrance of fibers and flyings, and must have no openings to allow sparks or burning material to escape. This equipment must also operate at a temperature lower than the point of combustion of the hazardous material.

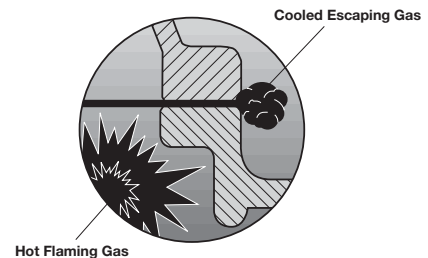
Typical O-Z/Gedney product Type GUA Outlet Box



Threaded Joint

The use of threaded joint construction also allows the gases to be vented and cooled. The gases travel from inside the enclosure over the threads and the temperature is reduced to below the ignition point of the surrounding atmosphere.

Typical O-Z/Gedney product Type YE Hazardous Location Junction Box



Flat-Ground Joint

One means of venting the hot gases is to have them travel between two accurately machined, close-fitting metal surfaces. This allows the gases to be cooled to a temperature below the ignition point of the surrounding atmosphere.

Conduit Unions

Type UNF

Female/Female

Type UNY

Male/Female

Use:

For joining conduits, or conduit to enclosures or other devices, without rotation of conduits, etc. Allows future access and removal of system components.

Features:

- Threaded for Rigid Conduit or IMC
- Tapered threads (NPT)
- ½" - 1" Raintight
- UNY style supplied with removable close nipple

Material/Finish:

Types UNF/UNY

½" - 1" Steel/Zinc Electroplated

1¼" - 6" Malleable Iron/Zinc Electroplated

Types UNF-A/UNY-A

½" - 6" Copper Free Aluminum

Optional Material: (½"-1")

Stainless Steel. Add suffix "SS" to base catalog number. Example: UNF-50SS.

Contact your local representative for pricing and availability.

Optional Finish: (1¼"-6" Iron)

Hot Dip or Mechanical Galvanize. Add Suffix "G" to Malleable Iron catalog number. Contact your local representative for pricing and availability.

Third Party Certification:



UL Listed: E-34997

½" to 1" UL Listed for:

Class I, Div. 1, 2, Groups A, B, C, D

Class I, Zone 1, 2, Groups IIA, IIB, IIC

Class II, Div. 1, 2, Groups E, F, G

Class III

1¼" to 6" UL Listed for:

Class I, Div. 1, 2, Groups B, C, D

Class I, Zone 1, 2, Groups IIA, IIB + H₂

Class II, Div. 1,2, Groups E, F, G

Class III



CSA Certified: 009795

(Specific items where noted are not CSA Certified)

Applicable Third Party Standards:

UL Standard: 886

CSA Standard: C22.2 No. 30

NEC Articles 500-503 & 505

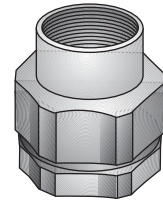
Mil. Spec: Mil-F28675

Trade Size (inches)	Catalog Number	Dimension in Inches	
		Overall Lgth	Max. Dia.
Steel			
½	UNF-50S	1¼	1½
¾	UNF-75S	1¾	1⅞
1	UNF-100S	2	2⅛
Malleable Iron			
1¼	UNF-125	2¼	2¾
1½	UNF-150	2½	3⅛
2	UNF-200	2⅞	3¼
2½	UNF-250	3⅞	4¼
3	UNF-300	3⅞	5
3½	UNF-350	4½	5½
4	UNF-400	4½	6⅞
5	UNF-500	4½	8¼
6	UNF-600	4½	9½
Copper Free Aluminum			
½	UNF-50A	1¼	1½
¾	UNF-75A	1¾	1 ²⁹ / ₃₂
1	UNF-100A	2	2⅛
1¼	UNF-125A	2¼	2¾
1½	UNF-150A	2½	3⅛
2	UNF-200A*	2⅞	3⅞
2½	UNF-250A*	3⅞	4¼
3	UNF-300A*	3⅞	5
3½	UNF-350A*	4½	5⅞
4	UNF-400A*	4½	6⅞
5	UNF-500A	4½	8¼
6	UNF-600A	4½	9½

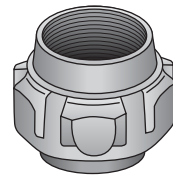
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Malleable Iron			
1¼	UNY-125	3⅞	2¾
1½	UNY-150	3⅞	3⅛
2	UNY-200	3¾	3¾
2½	UNY-250	4⅞	4¼
3	UNY-300	5	5
3½	UNY-350	5½	5½
4	UNY-400	5½	6⅞
5	UNY-500	6⅞	8¼
6	UNY-600	6⅞	9½
Copper Free Aluminum			
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1¼	UNY-125A	3⅞	2¾
1½	UNY-150A	3⅞	3⅛
2	UNY-200A*	3¾	3⅞
2½	UNY-250A*	4⅞	4¼
3	UNY-300A*	5	5
3½	UNY-350A*	5½	5⅞
4	UNY-400A*	5½	6⅞
5	UNY-500A	6⅞	8¼
6	UNY-600A	6⅞	9½

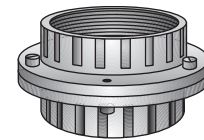
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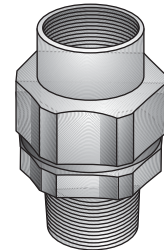
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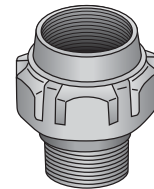
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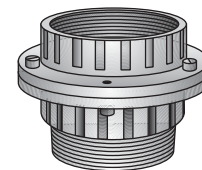
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Type UNY-50S— Type UNY-100S



Type UNY-125— Type UNY-400



Type UNY-500— Type UNY-600