

General Information

Classification of Hazardous Atmospheres



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Hazardous (Classified) Locations and the National Electrical Code ®

Hazardous locations are those locations where fire or explosion hazards may exist due to flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers or flyings.

The definitions below are extracted from Article 500 of NFPA 70, National Electrical Code (2002 edition).

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, Division 1

These are locations where

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

Class I, Division 2

These are locations where

1. 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 equipments ; or
2. 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. 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.

Class II Locations

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

Class II, Division 1

These are locations where

1. combustible dust is in the air under normal operating conditions in quantities sufficient to produce explosive or ignitable mixtures ; or
2. 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
3. combustible dusts of an electrically conductive nature may be present in hazardous quantities.

Class II, Division 2

These are locations where

1. 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. 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.

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

These are locations in which easily ignitable fibers or materials producing combustible flyings are handled, manufactured, or used .

Class III, Division 2

These are locations in which easily ignitable fibers are stored or handled other than in process of manufacture.

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General Information

Classification of Hazardous Atmospheres

Group Classifications

The explosion characteristics of air mixtures of gases, vapors, or dusts vary with the specific material involved, therefore, the equipments be approved not only for the class but also for the specific group of gas, vapor or dust that will be present.

Class I Locations,

Flammable gases and vapors are divided into four groups, Groups A, B, C and D. The classification involves determinations of maximum explosion pressure, and maximum safe clearance between parts of a clamped joint in an enclosure.

Group A : Atmospheres containing acetylene.

Group B : Atmospheres containing hydrogen, fuel and combustible process gases containing more than 30 percent hydrogen by volume, or gases or vapors of equivalent hazard such as butadiene, ethylene oxide, propylene oxide, and acrolein.

Group C : Atmospheres such as ethyl ether, ethylene, or gases or vapors of equivalent hazard.

Group D : Atmospheres such as acetone, ammonia, benzene, butane, cyclopropane, ethanol, gasoline, hexane, methanol, methane, natural gas, naphtha, propane, or gases or vapors of equivalent hazard.

Class II Locations,

Combustible dusts are divided into three groups, Groups E, F, and G. The classification involves the tightness of the joints of assembly and shaft openings to prevent the entrance of dust in the dust - ignitionproof enclosure, the blanketing effect of layers of dust on the equipment that may cause overheating, and the ignition temperature of the dust.

Group E : Atmospheres containing combustible metal dusts, including aluminum, magnesium, and their commercial alloys, or other combustible dusts whose particle size, abrasiveness, and conductivity present similar hazards in the use of electrical equipment.

Group F : Atmospheres containing combustible carbonaceous dusts, including carbon black, charcoal, coal, or dusts that have been sensitized by other materials so that they present an explosion hazard.

Group G : Atmospheres containing combustible dusts not included in Group E or F, including flour, grain, wood, plastic, and chemicals.

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Marking

The equipment shall be marked to show the class, group, and operating temperature or temperature class referenced to a 40°C ambient. Exception for the equipment of the non-heat - producing type, such as junction boxes, conduit, fittings, and equipment of the heat - producing type having a maximum temperature not more than 100°C (212°F) shall not be required to have a marked operating temperature or temperature class.

The temperature class, if provided, shall be indicated in using the temperature class (T codes) as shown in the table below.

Classification of Maximum Surface Temperature

Maximum Temperature (°C)	Temperature Class (T Code)
450	T1
300	T2
280	T2A
260	T2B
230	T2C
215	T2D
200	T3
180	T3A
165	T3B
160	T3C
135	T4
120	T4A
100	T5
85	T6

General Information

Classification of Hazardous Atmospheres



Group Classification and Autoignition Temperature of Selected Flammable Gases and Vapors of Liquids having Flash Points below 100 °F (37.8 °C)

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Material	Autoignition Temperature (°C)
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Group A - Atmospheres

Acetylene * 305

Group B - Atmospheres

Acrolein (inhibited) * ① 235

1, 3 - Butadiene * ② 420

Ethylene Oxide * ① 429

Formaldehyde (Gas) 429

Hydrogen * 520

Manufactured Gas (containing more than 30% H₂ by volume) * -

Propylene Oxide * ① 449

Propyl Nitrate * 175

Group C - Atmospheres

Acetaldehyde * 175

Allyl Alcohol * 378

Butyl Mercaptan -

n - Butyraldehyde * 218

Carbon Monoxide * 609

Crotonaldehyde * 232

Dicyclopentadiene 503

Diethyl Ether * 160

Diethylamine * 312

Di - isopropylamine 316

Dimethylamine 400

1, 4 - Dioxane 180

Di - n - propylamine 299

Epichlorohydrin * 411

Ethylene * 450

Ethylenimine * 320

Ethyl Mercaptan * 300

n - Ethyl Morpholine -

Hydrogen Cyanide * 538

Hydrogen Selenide -

Hydrogen Sulfide * 260

Isobutyraldehyde 196

Isopropyl Glycidyl Ether -

Methylacetylene * -

Methylacetylene-Propadiene (stabilized) -

Methyl Ether * 350

Methyl Formal * 238

Material	Autoignition Temperature (°C)
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Group C - Atmospheres (continued)

Methyl Mercaptan -

Monomethyl Hydrazine 194

Nitroethane 414

Nitromethane 418

1 - Nitropropane 421

2 - Nitropropane * 428

Propionaldehyde 207

n - Propyl Ether 215

Tetrahydrofuran * 321

Triethylamine * -

Unsymmetrical Dimethyl Hydrazine

(UDMH) * 249

Valeraldehyde 222

Group D - Atmospheres

Acetone * 465

Acetonitrile 524

Acrylonitrile * 481

Allyl Chloride 485

Ammonia * ③ 498

n - Amyl Acetate 360

sec - Amyl Acetate -

Benzene * 498

Butane * 288

1 - Butanol (Butyl Alcohol) * 343

2 - Butanol (Secondary Butyl Alcohol) * 405

n - Butyl Acetate * 421

iso - Butyl Acetate * 421

sec - Butyl Acetate -

Butylamine 312

Butylene 385

Chlorobenzene 593

Chloroprene -

Cumene 424

Cyclohexane 245

Cyclohexene 244

Cyclopropane * 503

1, 1 - Dichloroethane 438

1, 2 - Dichloroethylene 460

1, 3 - Dichloropropene -

Di - isobutylene * 391



General Information

Classification of Hazardous Atmospheres

Group Classification and Autoignition Temperature (Continued)

Material	Autoignition Temperature (°C)
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Group D - Atmospheres (continued)

Ethane *	472
Ethanol *	363
Ethyl Acetate *	427
Ethyl Acrylate (inhibited) *	372
Ethylamine *	385
Ethyl Benzene	432
Ethyl Chloride	519
Ethylenediamine *	385
Ethylene Dichloride *	413
Ethyl Formate	455
Gasoline *	280 - 471
Heptane *	204
Heptene	260
Hexane *	225
2 - Hexanone	424
Hexenes	245
Isoamyl Acetate	360
Isobutyl Acrylate	427
Isoprene *	220
Isopropyl Acetate	460
Isopropylamine	402
Isopropyl Ether *	443
Liquefied Petroleum Gas	405 - 450
Mesityl Oxide *	344
Methane *	537
Methanol *	385
Methyl Acetate	454
Methyl Acrylate	468
Methylamine	430
Methylcyclohexane	250
Methyl Ethyl Ketone *	404
Methyl Formate	449
Methyl Isobutyl Ketone *	449
Methyl Isocyanate	534
Methyl Methacrylate	422
2 - Methyl - 1 - Propanol *	416
2 - Methyl - 2 - Propanol *	478
Naphtha (Petroleum) *④	288
Nonane	205
Nonene	-
Octane *	206
Octene	230

Material	Autoignition Temperature (°C)
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Group D - Atmospheres (continued)

Pentane *	243
1 - Pentanol *	300
2 - Pentanone	452
1 - Pentene	275
Propane *	450
1 - Propanol *	413
2 - Propanol	399
n - Propyl Acetate	450
Propylene *	455
Propylene Dichloride	557
Pyridine *	482
Styrene *	490
Toluene *	480
Turpentine	253
Vinyl Acetate *	402
Vinyl Chloride *	472
Vinylidene Chloride	570
Xylenes *	464 - 529

(FPN) : For additional information on group classification, see The Classification of Gases, Vapors and Dusts for Electrical Equipment in Hazardous (Classified) Location, NFPA 497.

Note :

* Material has been classified by test.

- ① **Group C** equipment shall be permitted for this atmospheres if such equipment is isolated by sealing all conduit 1/2 in. (12.7 mm.) or larger, in accordance with Article 501.5 (A) of NFPA 70, National Electrical Code.
- ② **Group D** equipment shall be permitted for this atmospheres if such equipment is isolated by sealing all conduit 1/2 in. (12.7 mm.) or larger, in accordance with Article 501.5 (A) of NFPA 70, National Electrical Code.
- ③ For classification of areas involving ammonia, see Safety Code for Mechanical Refrigeration, ANSI/ASHRAE 15, and Safety Requirements for the Storage and Handling of Anhydrous Ammonia, ANSI/CGA G2.1.
- ④ Petroleum naphtha is a saturated hydrocarbon mixture whose boiling range is 20°C to 135°C. It is also known as benzine, ligroin, petroleum ether, and naphtha.

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