

USE OF ELECTRIC HEATERS

In Hazardous Locations

Introduction

Hazardous locations are those areas where a potential for explosion and fire exists due to the presence of flammable gases, vapors, pulverized dusts or ignitable fibers in the atmosphere. Hazardous locations are created from the normal processing of volatile chemicals, gases, coal, grains, etc., or from the accidental failure of storage systems for these materials.

Open flames are not permitted in these locations. The use of electric heating equipment is permitted with two major restrictions: 1) The surface temperature of the equipment cannot exceed the ignition temperature of the hazardous atmosphere and 2) all arc and spark producing devices must be isolated from the atmosphere in an appropriate enclosure.

Both people and equipment in hazardous locations can be heated safely and economically with electric heat. Electric heating is typically much less expensive to install and maintain than comparable remote oil or gas fired heating systems.

National Electrical Code Classification

Articles 500 through 516 of the National Electrical Code deal with the definition of hazardous areas and the use or design of electrical equipment used in these locations. Electric heating equipment for hazardous areas is specified based on the NEC class, division, group and ignition temperature or the alternate class and zone classification.

Class

Hazardous locations are divided into the three general classes of vapors/gases, dusts and fibers.

Class I – Locations where the potential for explosion and fire exists due to the presence of flammable gases or vapors in the air. Typical Class I locations include oil or natural gas drilling rigs, petroleum refining or pumping facilities, petrochemical plants, wastewater/sewage treatment plants, solvent extraction plants, paint spraying booths, locations where open tanks or vats of combustible liquids are present and storage areas for flammable materials.

Class II – Locations where the potential for explosion exists because of finely pulverized flammable dusts suspended in the atmosphere. Typical locations would include coal fired power plants, coal preparation/coal handling facilities, coal mines, grain elevators, flour and feed mills, packaging and handling of pulverized sugar and processing and storage of magnesium and aluminum powder.

Class III – This third classification is primarily a fire hazard where fibers or flyings suspended in the air create a hazard. This would include small pieces of thread-like fiber, sawdust, lint, etc. Typical applications would include textile mills, woodworking plants, cotton gins, cotton seed mills and flax producing plants.

Division

Class I, Class II and Class III areas are further defined in terms of when the hazard occurs. Division 1 and Division 2 occurrences are summarized below.

Division 1 – If the hazard is expected to be present under normal conditions, such as a production or processing facility, the occurrence is designated Division 1. The hazardous atmosphere may be present continuously, intermittently, periodically, or during normal repair or maintenance operations. Division 1 occurrences also include locations where a breakdown in the operation of processing equipment results in the release of hazardous vapors.

Division 2 – If the hazardous material is normally expected to be contained within a closed area, system or container, and would enter the ambient atmosphere only under an abnormal failure, then it is referred to as a Division 2 occurrence.



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Group

The nature and explosive characteristics of the hazardous material are defined by the NEC group to which it is assigned.

Class I – Hazardous vapors/gas locations include chemicals and other materials that have been divided into four groups based on their ignition temperature and explosive characteristics. (Groups A, B, C and D)

Class II – Hazardous dust locations are divided into three groups based on their ignition temperature and electrical conductivity of the suspended particles.

Group E – Atmospheres containing metal dust, such as aluminum or magnesium.

Group F – Atmospheres containing coal, charcoal or coke dust.

Group G – Atmospheres with grain, flour, starch, combustible plastics or chemical dust.

Class III – Locations have no group definitions.

Ignition Temperature

All electrical equipment is designed not to exceed the ignition temperature of the hazardous atmosphere. The maximum surface temperature for electric heaters is defined by the NEC.

Maximum Surface Temperature of Heater		NEC Ignition Temperature Code
°F	°C	
842	450	T1
572	300	T2
536	280	T2A
500	260	T2B
446	230	T2C
419	215	T2D
392	200	T3
356	180	T3A
329	165	T3B
320	160	T3C

Class and Zone Classifications

Class I, Zone 0 – Locations in which ignitable concentrations of flammable gases or vapors are present continuously or for long periods.

Class I, Zone 1 – Locations in which ignitable concentrations of flammable gases or vapors are likely to exist, may exist frequently or exist as a result of equipment breakdown or faulty operation. Applies to locations adjacent to a Class I, Zone 0 location.

Class I, Zone 2 – Locations in which ignitable concentrations of flammable gases or vapors are not likely to occur under normal operation, exist only for a short period or exist only as a result of accidental failure, such as rupture or breakdown of the container or system, abnormal operation of equipment, failure or abnormal operation of the ventilation equipment. Applies to locations adjacent to a Class I, Zone 1 location.

Material Groups

Group IIC – Atmospheres containing acetylene or hydrogen. Equivalent to a combination of Class I, Group A and Class I, Group B as described in NEC Article 500.

Group IIB – Atmospheres containing acetaldehyde. Equivalent to Class I, Group C as described in NEC Article 500.

Group IIA – Atmospheres containing acetone, ammonia, ethyl alcohol, gasoline, methane or propane. Equivalent to Class I, Group D as described in NEC Article 500.

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Special Requirements for Electric Heating Equipment used in Hazardous Areas

Electric heating equipment can be economically designed and safely used in hazardous areas if the following special requirements are observed.

- The surface temperature of the electric heating equipment cannot exceed the ignition temperature of the hazardous atmosphere. To insure that the proper heater has been selected, it is essential that the correct NEC Ignition Temperature Code be specified.

If the temperature code selected is too high, the electric heating system may operate above the ignition point of the application, creating a potentially hazardous condition.

- All arc and spark-producing control devices must be isolated from the hazardous atmosphere. If it is not economically feasible to locate the control devices in the non-hazardous area, they must be housed in an enclosure that will withstand the pressure of a potential explosion from within the enclosure.
- All electrical supply connections must be made according to the latest NEC and local code requirements for hazardous locations. This includes the requirement that conduit entering the enclosures must be provided with seals at the enclosure.

CLASS I - HAZARDOUS GAS ATMOSPHERES					CLASS I - HAZARDOUS GAS ATMOSPHERES				
Group	Material	Ignition Temp.		NEC Code	Group	Material	Ignition Temp.		NEC Code
		°F	°C				°F	°C	
A	Acetylene	581	305	T2	D	Methyl Isobutyl Ketone	840	448	T2
B	Acrolein (Inhibited)	428	220	T2D		2-Methyl-1-Propanol (Isobutyl Alcohol)	780	415	T2
	Butadiene	788	420	T2		Petroleum Naptha	550	288	T2A
	Ethylene Oxide	804	429	T2		Pyridine	900	482	T1
	Hydrogen	932	500	T1		Octanes	403	206	T3
	Propylene Oxide	840	449	T2		Pentanes	500	260	T2B
	Propyl Nitrate	347	175	T3B		1-Pentanol (Amyl Alcohol)	650	343	T2
C	Acetaldehyde	347	175	T3B		Propane	842	450	T1
	Allyl Alcohol	713	378	T2		1-Propanol (Propyl Alcohol)	775	412	T2
	Carbon Monoxide	1128	609	T1		2-Propanol (Isopropyl Alcohol)	750	399	T2
	Cyclopropane	928	498	T1		Propylene	851	455	T1
	Ethylene	842	450	T1		Styrene	914	490	T1
	Hydrogen Cyanide	1000	538	T1		Toluene	896	480	T1
	Hydrogen Sulfide	500	260	T2B		Vinyl Acetate	756	402	T2
	2-Nitropropane	802	428	T2		Vinyl Chloride	882	472	T1
	Tetrahydrofuran	610	321	T2		Xylenes	867-984	463-528	T1
D	Acetic Acid (Glacia)	867	463	T1					
	Acetone	869	465	T1	CLASS II - HAZARDOUS DUST ATMOSPHERES				
	Ammonia, Anhydrous	1204	651	T1			Ignition Temp.		NEC
	Benzene	928	498	T1	Group	Material	°F	°C	Code
	Butane	550	287	T2A	E	Aluminum, A422 Flake	608	320	T2
	1-Butanol (Butyl Alcohol)	650	343	T2		Calcium Silicide	1004	540	T1
	2-Butanol (Secondary Butyl Alcohol)	761	405	T2		Manganese	464	240	T2C
	Ethane	882	472	T1		Magnesium, Grade B, Milled	806	430	T2
	Ethanol (Ethyl Alcohol)	685	363	T2	F	Charcoal	356	180	T3A
	Ethyl Acetate	800	427	T2		Coal, Kentucky Bituminous	356	180	T3A
	Ethylene Dichloride	775	413	T2		Coal, Pittsburgh Experimental	338	170	T3B
	Gasoline (56-60 Octane)	536	280	T2A		Pitch, Petroleum	1166	630	T1
	Gasoline (100 Octane)	853	456	T1	G	Alkyl Ketone Dimer Sizing Compound	320	160	T3C
	Heptanes	399	204	T3		Corn	482	250	T2C
	Hexanes	437	235	T2D		Corn Starch, Modified	392	200	T3
	Isoprene	428	220	T2D		Polyurethane Foam, Fire Retardant	734	390	T2
	Isopropyl Ether	830	443	T2		Shellac	752	400	T2
	Methane (Natural Gas)	900-1170	482-632	T1		Soy Flour	374	190	T3A
	Methanol (Methyl Alcohol)	867	454	T1		Sugar, Powdered	698	370	T2
	3-Methyl-1-Butanol (Isoamyl Alcohol)	662	350	T2		Sulfur	428	220	T2D
	Methyl Ethyl Ketone	759	404	T2		Wheat	428	220	T2D
						Wood Flour	500	260	T2B

The materials given are found in NFPA 497, 1991 and NFPA 325, 2001.