

HAZARDOUS LOCATION

FUNDAMENTALS



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<p>Hazardous Location Standards are laid out in the following guidelines:</p> <ul style="list-style-type: none">• The NEC (National Electric Code) for the USA• The CEC (Canadian Electric Code) for Canada <p>In both countries these guides are accepted and used by most authorities as the final standard on installation and use of electrical products. These 2 guides with the issuance of the new NEC standard are almost identical.</p>	<p>In the United States of America the government agency responsible is Occupational Safety and Health Administration. OSHA has authorized a group of NRTL (Nationally Recognized Testing Laboratories). At this time the following laboratories are recognized.</p> <ul style="list-style-type: none">• CSA (Canadian Standards Association)• ETL Testing Laboratories Incorporated• Factory Mutual Research Corporation• MET Laboratories• UL (Underwriters Laboratories Inc.)• United States Testing Co. Inc.	<p>In Canada the government agency responsible is the Standards Council of Canada. Standards Council of Canada has authorized a group of testing laboratories to certify equipment. At this time the following laboratories are authorized.</p> <ul style="list-style-type: none">• CSA (Canadian Standards Association)• ETL Testing Laboratories Incorporated• UL (Underwriters Laboratories Inc.)• C-UL (Underwriters' Laboratories of Canada)
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In addition to these two government agencies both countries have state, city and county inspectors that may or may not accept the national standards

Hazardous Locations and The National Electrical Code

ELECTRICAL CODE

The National Electrical Code treats installations in hazardous locations in articles 500 through 516. Hazardous locations are classified by NEC definitions. The following are interpretations of these classifications and applications.

CLASS I LOCATIONS

Class I locations are those in which inflammable gases or vapors are or may be present in sufficient quantities to produce explosive or flammable mixtures.

CLASS I, DIVISION 1

Class I, Division 1 locations are where hazardous atmosphere may be present during normal operations. It may be present continuously, intermittently, periodically or during normal repair or maintenance operations, or those areas where a breakdown in processing equipment releases hazardous vapors with the simultaneous failure of electrical equipment.

CLASS I, DIVISION 2

Class I, Division 2 locations are those in which volatile flammable liquids or gases are handled, processed or used. Normally they will be confined within closed containers or in closed systems from which they can escape only in the case of rupture or deterioration of the containers or systems.

CLASS II LOCATIONS

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

CLASS II, DIVISION 1

Class II, Division 1 locations include areas where combustible dust may be in suspension in the air under normal conditions in sufficient quantities to produce explosive or ignitable mixtures (Dust may be emitted into the air continuously, intermittently or periodically), or where failure or malfunction of equipment might cause a hazardous location to exist and provide an ignition source with the simultaneous failure of electrical equipment, included also are locations in which combustible dust of an electrically conductive nature may be present.

CLASS II, DIVISION 2

Class II, Division 2 locations are those in which combustible dust will not normally be in suspension nor will normal operations put dust in suspension, but where accumulation of dust may interfere with heat dissipation from electrical equipment or where accumulations near electrical equipment may be ignited.

CLASS III LOCATIONS

Class III locations are those considered hazardous due to the presence of easily ignitable fibers or flyings, which are in quantities sufficient to produce ignitable mixtures.

CLASS III, DIVISION 1

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

CLASS III, DIVISION 2

Locations where easily ignitable fibers are stored or handled.

This information is provided as a simplified guide only. For actual installation, use the NEC/CEC code book and IEC/CENELEC approvals and wiring codes as final authority on any installation. For paint booth applications consult NFPA Article 33.

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CLASS I AREA CLASSIFICATIONS

CLASS I - FLAMMABLE GASES, VAPORS OR LIQUIDS

Class I Area Classifications		Class I Groups
<p>Division 1: Where ignitable concentrations of flammable gases, vapors or liquids can exist all of the time or some of the time under normal operating conditions.</p> <p>Division 2: Where ignitable concentrations of flammable gases, vapors or liquids are not likely to exist under normal operating conditions.</p>	<p>Zone 0: Where ignitable concentrations of flammable gases, vapors or liquids can exist all of the time or for long periods of time under normal operating conditions.</p> <p>Zone 1: Where ignitable concentrations of flammable gases, vapors or liquids can exist some of the time under normal operating conditions.</p> <p>Zone 2: Where ignitable concentrations of flammable gases, vapors or liquids can exist some of the time under normal operating conditions.</p>	<p>Division 1 & 2 A (acetylene) B (hydrogen) C (ethylene) D (propane)</p> <hr/> <p>Zone 0, 1 & 2 IIC (acetylene & hydrogen) IIB (ethylene) IIA (propane)</p>

Class I Temperature Codes		Class I, Division 1 and 2 Protection Methods			
<p>Division 1 & 2 T1 (≤450°C) T2 (≤300°C) T2A, T2B, T2C, T2D (≤280°C, ≤260°C, ≤230°C, ≤215°C) T3 (<200°C) T3A, T3B, T3C (≤180°C, ≤165°C, ≤160°C) T4 (≤135°C) T4A (≤120°C) T5 (≤100°C) T6 (≤85°C)</p>	<p>Zone 0, 1 & 2 T1 (≤450°C) T2 (≤300°C) T3 (≤200°C) T4 (≤135°C) T5 (≤100°C) T6 (≤85°C)</p>	<p>Area</p>	<p>Protection Methods</p>	<p>Applicable Certification Standards</p> <p>U.S.</p> <p>Canada</p>	
		Div. 1	<ul style="list-style-type: none"> Explosion proof Intrinsically safe (2 fault); Purged/pressurized (Type X or Y) 	<p>ANSI/UL 1203</p> <p>ANSI/UL 913</p> <p>ANSI/NFPA 496</p>	<p>CSA-30</p> <p>CSA-157</p> <p>ANSI/NFPA 496</p>
		Div. 2	<ul style="list-style-type: none"> Nonincendive Non-sparking device Purged/pressurized (Type Z) Hermetically sealed Any Class I, Div. 1 method 	<p>UL 1604</p> <p>UL 1604</p> <p>ANSI/NFPA 496</p> <p>UL 1604</p> <p>----</p>	<p>CSA-213</p> <p>CSA-213</p> <p>ANSI/NFPA 496</p> <p>CSA-213</p> <p>----</p>

Class I, Zone 0, 1 and 2 Protection Methods					
Area	Protection Methods	Applicable Certification Standards			
		U.S.	Canada	IEC	EUROPE
ZONE 0	<ul style="list-style-type: none"> Intrinsically safe, 'ia' (2 fault); Class I, Div. 1 intrinsically safe (2 fault method) 	<p>UL 2279, Pt. 11</p> <p>ANSI/UL 913</p>	<p>CSA-E79-11</p> <p>CSA-157</p>	<p>IEC 79-11</p> <p>----</p>	<p>EN 50020</p> <p>----</p>
ZONE 1	<ul style="list-style-type: none"> Encapsulation, 'm' Flameproof 'd' Increased safety, 'e' Intrinsically safe 'ib' (1 fault) Oil immersion 'o' Powder filling 'q' Purged/pressurized 'p' Any Class I, Zone 0 method Any Class I, Div. 1 method 	<p>UL 2279, Pt. 18</p> <p>UL 2279, Pt. 1</p> <p>UL 2279, Pt. 7</p> <p>UL 2279, Pt. 11</p> <p>UL 2279</p> <p>UL 2279</p> <p>UL 2279, Pt. 2</p> <p>----</p> <p>----</p>	<p>CSA-E79-18</p> <p>CSA-E79-1</p> <p>CSA-E79-7</p> <p>CSA-E79-11</p> <p>CSA-E79-6</p> <p>CSA-E79-5</p> <p>CSA-E79-2</p> <p>----</p> <p>----</p>	<p>IEC 79-18</p> <p>IEC 79-1</p> <p>IEC 79-7</p> <p>IEC 79-11</p> <p>IEC 79-6</p> <p>IEC 79-5</p> <p>IEC 79-2</p> <p>----</p> <p>----</p>	<p>EN 50028</p> <p>EN 50018</p> <p>EN 50019</p> <p>EN 50020</p> <p>EN 50015</p> <p>EN 50017</p> <p>EN 50016</p> <p>----</p> <p>----</p>
ZONE 2	<ul style="list-style-type: none"> Nonincendive 'nC' Non-sparking device 'nA' Restricted breathing, 'nR' Hermetically sealed 'nC' Any Class I, Zone 0 or 1 method Any Class I, Div. 1 or 2 method 	<p>UL 2279, Pt. 15</p> <p>UL 2279, Pt. 15</p> <p>UL 2279, Pt. 15</p> <p>UL 2279, Pt. 15</p> <p>----</p> <p>----</p>	<p>CSA-E79-15</p> <p>CSA-E79-15</p> <p>CSA-E79-15</p> <p>CSA-E79-15</p> <p>----</p> <p>----</p>	<p>IEC 79-15</p> <p>IEC 79-15</p> <p>IEC 79-15</p> <p>IEC 79-15</p> <p>----</p> <p>----</p>	<p>prEN 50021</p> <p>prEN 50021</p> <p>prEN 50021</p> <p>prEN 50021</p> <p>----</p> <p>----</p>

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CLASS II AREA CLASSIFICATIONS



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CLASS II - COMBUSTIBLE DUSTS

Class II Area Classifications	
<p>Division 1: Where ignitable concentrations of combustible dusts can exist all of the time or some of the time under normal operating conditions.</p>	<p>Division 2: Where ignitable concentrations of combustible dusts are not likely to exist under normal operating conditions.</p>

CLASS II Groups
Division 1 & 2 E (metals) F (coal) G (grain)

Class II Temperature Codes
Division 1 & 2 T1 ($\leq 450^{\circ}\text{C}$) T2 ($\leq 300^{\circ}\text{C}$) T2A, T2B, T2C, T2D ($\leq 280^{\circ}\text{C}$, $\leq 260^{\circ}\text{C}$, $\leq 230^{\circ}\text{C}$, $\leq 215^{\circ}\text{C}$) T3 ($< 200^{\circ}\text{C}$) T3A, T3B, T3C ($\leq 180^{\circ}\text{C}$, $\leq 165^{\circ}\text{C}$, $\leq 160^{\circ}\text{C}$) T4 ($\leq 135^{\circ}\text{C}$) T4A ($\leq 120^{\circ}\text{C}$) T5 ($\leq 100^{\circ}\text{C}$) T6 ($\leq 85^{\circ}\text{C}$)

Class II, Division 1 and 2 Protection Methods			
Area	Protection Methods	Applicable Certification Standards	
		U.S.	Canada
Div. 1	• Dust-ignition	ANSI/UL 1203	CSA-25 or CSA-E1241-1-1
	• Intrinsically safe	ANSI/UL 913	CSA-157
	• Pressurized	ANSI/NFPA 496	ANSI/NFPA 496
Div. 2	• Dust tight	UL 1604	CSA-157 or CSA-E1241-1-1
	• Nonincendive	UL 1604	----
	• Non-sparking	UL 1604	----
	• Pressurized	ANSI/NFPA 496	ANSI/NFPA 496
	• Any Class II, Div. 1 method	----	----

Hazardous Location Markings

Class I, II & III, Division 1 & 2 (U.S. & Canada) - This marking would include: Class(es), Division(s), Gas/Dust Group(s), Temperature Code
 Example: Class I, Division 1, Group C & D, T4A

Class I, Zone 0, 1 and 2 (U.S. & Canada) - This marking would include:

Method A: For Zone Listings based on UL 2279 or the CSA-E79 Series Class, Zone(s), Ex, Protection Method(s), Gas Group, Temperature Code

Example: Class I, Zone 1, Ex de IIB T4

Method B: For Zone Listings based on UL or CSA Division Standards Class, Zone(s), Gas Group, Temperature Code

Example: Class I, Zone 1, Group IIB, T4

Note: For Canadian Zone Listings based on the CSA-E79 Series, the "Class" and "Zone" elements of the markings string are optional

Zone 0, 1 and 2 (IEC only) - This marking would include: Ex, Protection Method(s), Gas Group, Temperature Code Example: Ex de IIB T4

Zone 0, 1 and 2 (Europe only) - This marking would include: EEx, Protection Method(s), Gas Group, Temperature Code Example: EEx de IIB T4

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CLASS III AREA CLASSIFICATIONS

CLASS III - IGNITABLE FIBERS AND FLYINGS

Class III Area Classifications	
<p>Division 1: Where ignitable concentrations of ignitable fibers and flyings can exist all of the time or some of the time under normal operating conditions.</p>	<p>Division 2: Where ignitable concentrations of ignitable fibers and flyings are not likely to exist under normal operating conditions.</p>

CLASS III Groups
Division 1 & 2
NONE

Class III Temperature Codes
Division 1 & 2
T1 ($\leq 450^{\circ}\text{C}$)
T2 ($\leq 300^{\circ}\text{C}$)
T2A, T2B, T2C, T2D ($\leq 280^{\circ}\text{C}$, $\leq 260^{\circ}\text{C}$, $\leq 230^{\circ}\text{C}$, $\leq 215^{\circ}\text{C}$)
T3 ($< 200^{\circ}\text{C}$)
T3A, T3B, T3C ($\leq 180^{\circ}\text{C}$, $\leq 165^{\circ}\text{C}$, $\leq 160^{\circ}\text{C}$)
T4 ($\leq 135^{\circ}\text{C}$)
T4A ($\leq 120^{\circ}\text{C}$)
T5 ($\leq 100^{\circ}\text{C}$)
T6 ($\leq 85^{\circ}\text{C}$)

Class III, Division 1 and 2 Protection Methods			
Area	Protection Methods	Applicable Certification Standards	
		U.S.	Canada
Div. 1	<ul style="list-style-type: none"> Dust tight Intrinsically safe 	ANSI/UL 1604	CSA-157
		ANSI/UL 913	CSA-157
Div. 2	<ul style="list-style-type: none"> Dust tight Any Class II or III Div. 1 method 	UL 1604	CSA-157
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Hazardous Location Markings

ANSI/UL 674	Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations
ANSI/UL 698	Industrial Control Equipment for Use in Hazardous (Classified) Locations
ANSI/UL 781	Portable Electric Lighting Units for Use in Hazardous (Classified) Locations
ANSI/UL 783	Electric Flashlights and Lanterns for Use in Hazardous (Classified) Locations
ANSI/UL 823	Electric Heaters for Use in Hazardous (Classified) Locations
ANSI/UL 844	Electric Lighting Fixtures for Use in Hazardous (Classified) Locations
ANSI/UL 877	Circuit Breakers and Circuit-Breaker Enclosures for Use in Hazardous (Classified) Locations
ANSI/UL 886	Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations
ANSI/UL 894	Switches for Use in Hazardous (Classified) Locations
ANSI/UL 913	Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II and III, Division 1, Hazardous (Classified) Locations
ANSI/UL 1002	Electrically Operated Valves for use in Hazardous (Classified) Locations
ANSI/UL 1010	Receptacle-Plug Combinations for Use in Hazardous (Classified) Locations
ANSI/UL 1067	Electrically Conductive Equipment and Materials for Use in Flammable Anesthetizing Locations
ANSI/UL 1203	Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations
ANSI/UL 1207	Sewage Pumps for Use in Hazardous (Classified) Locations
UL 1604	Electrical Equipment for Use in Class I and II, Division 2, and Class III Hazardous (Classified) Locations
UL 2208	Solvent Distillation Units
UL 2225	Metal-Clad Cables and Cable-Sealing Fittings for Use in Hazardous (Classified) Locations
UL 2279	Electrical Equipment for use in Class I, Zone 0, 1 and 2 Hazardous (Classified) Locations