

North America

Typical North American Marking										
Division Scheme				Zone Scheme						
Class I	Division 1	Groups A&B	T4	Class I	Zone 0	AEx	ia	IIC	T4	Ga
Hazard Class	Area Classification	Gas Group	Temperature Class	Hazard Class	Area Classification	Approved to US Standards	Protection Concept Code	Gas Group	Temperature Class	Equipment Protection Level

Protection Concepts [NEC® & CEC®]

Type of Protection	Code (EPL)	Country	Class	Division / Zone	Standard	Basic Concept of Protection	
Electrical Equipment for Flammable Gas, Vapors and Mist - Class I							
General Requirements	AEx	US	Class I	Division 1, 2	FM 3600 ISA 60079-0	No arcs, sparks or hot surfaces	
Increased Safety	AEx e (Gb) Ex e (Gb)	US CA	Class I	Zone 1	CSA C22.2 No. 60079-0 ISA 60079-7 CSA C22.2 No. 60079-7		
Non-Incendive	NI	US CA	Class I	Division 2	ISA 12.12.01/FM 3611 CSA C22.2 No. 213	Contain the explosion and extinguish the flame	
Non-Sparking	AEx nA (Gc) Ex nA (Gc)	US CA	Class I	Zone 2	ISA 60079-15CSA C22.2 No. 60079-15		
Explosion-proof	XP	US CA	Class I	Division 1	UL 1203 CSA C22.2 No. 30	Limit energy of sparks and surface temperature	
Flame-proof	AEx d (Gb) Ex d (Gb)	US CA	Class I	Zone 1	ISA 60079-1 CSA C22.2 No. 60079-1		
Powder Filled	AEx q (Gb) Ex q (Gb)	US CA	Class I	Zone 1	ISA 60079-5 CSA C22.2 No. 60079-5	Keep flammable gas out	
Enclosed Break	AEx nC (Gc) Ex nC (Gc)	US CA	Class I	Zone 2	ISA 60079-15 CSA C22.2 No. 60079-15		
Intrinsic Safety ¹	IS	US CA	Class I	Division 1	UL 913 / FM 3610 CSA C22.2 No. 157	Keep combustible dust out	
	AEx ia (Ga)	US		Zone 0	ISA 60079-11		
	AEx ib (Gb)			Zone 1			
	AEx ic (Gc)			Zone 2			
Limited Energy	Ex nL (Gc)	US CA	Class I	Zone 2	CSA C22.2 No. 60079-15	Keep flammable gas out	
	Type X	US CA	Class I	Division 1	NFPA 496 (FM 3620) NFPA 496		
	Type Y	US CA		Division 2	NFPA 496 (FM 3620) NFPA 496		
	Type Z	US CA		Zone 1	ISA 60079-2 CSA C22.2 No. 60079-2		
AEx px (Gb) Ex px (Gb)	US CA	Zone 2		ISA 60079-2 CSA C22.2 No. 60079-2			
Restricted Breathing	AEx nR (Gc) Ex nR (Gc)	US CA	Class I	Zone 2	ISA 60079-15 CSA C22.2 No. 60079-15	Keep combustible dust out	
	AEx ma (Ga)	US	Class I	Zone 0	ISA 60079-18		
	AEx mb (Gb)			Zone 1			
	AEx mc (Gc)			Zone 2			
Oil Immersion	AEx o (Gb) Ex o (Gb)	US CA	Class I	Zone 1	ISA 60079-6 CSA C22.2 No. 60079-6	Limit energy of sparks and surface temperature	
	Electrical Equipment for Combustible Dust - Class II & Class III						
General Requirements	--	US CA	Class II	Division 1, 2	FM 3600 CSA C22.2 No. 25	Keep combustible dust out	
Dust-Ignition proof	DIP	US CA	Class II	Division 1	UL 1203 CSA C22.2 No. 25		
Dust Protected	NI	US CA	Class II	Division 2	ISA 12.12.01 / FM 3611 CSA C22.2 No. 25	Keep combustible dust out	
Enclosure	AEx ta (Da) AEx tb (Db) AEx tc (Dc)	US	Class II	Zone 20 ² Zone 21 ² Zone 22 ²	ISA 60079-31		
	Ex ta			Class III Class II			Division 1
	Ex tb			Class III Class II			
	Ex tc	Class III	Division 2				
Fiber & Flying Protection	--	US CA	Class III	Division 1, 2	UL 1203 / ISA 12.12.01 CSA C22.2 No. 25	Keep combustible dust out	
Encapsulation	AEx maD AEx mbD	US	Class II	Zone 20 Zone 21	ISA 61241-18		
	Ex ma			Class III Class II			Division 1
	Ex mb			Class III			
	Ex mc	Class II Class III	Division 2				
Pressurization	Type X	US CA	Class II	Division 1	NFPA 496 (FM 3620) NFPA 496		
	Type Y				NFPA 496 (FM 3620) NFPA 496		
	Type Z			Division 2	NFPA 496 (FM 3620) NFPA 496		
	AEx pD			Zone 21	ISA 61241-2		
Intrinsic Safety	IS	US	Class II	Division 1	UL 913 / FM 3610		
	AEx iaD AEx ibD			Zone 20 Zone 21	ISA 61241-11		
	IS			Class III	Division 1	UL 913 / FM 3610	

Standards by Product Types

Product Category	Standard(s)	Class & Division
Luminaires	UL 844 "Luminaires for use in Hazardous (Classified) Locations"	Class I, Divisions 1, 2 Class II, Divisions 1, 2 Class I, Zones 1, 2 Class II, Zones 20, 21, 22 Class III
	CSA C22.2 No. 137 "Electric Luminaires for use in hazardous locations"	Class I, Divisions 1, 2 Class II, Divisions 1, 2
Motors and Generators (Explosion-proof & Dust-ignition proof)	UL 674 "Electric motors and generators for use in hazardous (classified) locations" ³	Class I, Division 1, Groups B, C, D Class II, Division 1, Groups IIA, IIB, IIB + H2 Class III, Division 1, Groups E, F, G
	CSA C22.2 No. 145 "Electric motors and generators for use in hazardous (classified) locations" ³	Class I, Division 1, Groups E, F, G Class II, Zones 20, 21
Industrial Control Panels	UL 698A "Industrial control panels relating to hazardous (classified) locations"	Associated apparatus for the following hazardous (classified) locations: Class I, Division 1 Class II, Division 1 Class III, Division 1 Class II, Zone 20, 21
	CSA C22.2 No. 14 "Industrial control equipment - Section 4.18"	Control panels located in ordinary locations with intrinsically safe barriers: Class I, Division 1 Class II, Division 1 Class I, Zone 0, 1 Class II, Division 1
Flashlights	UL 783 "Electric flashlights and lanterns for use in hazardous (classified) locations"	Class I, Divisions 1, 2 Class II, Divisions 1, 2 Class I, Zones 1, 2
Heaters	UL 823 "Electric heaters for use in hazardous (classified) locations"	Class I, Divisions 1, 2 Class II, Divisions 1, 2 Class III, Divisions 1, 2 Class I, Zones 1, 2 Class II, Zones 20, 21, 22
Fuel Dispensing Equipment	UL 87 "Power-operated dispensing devices for petroleum products"	Areas classified for fuel dispensing equipment per national and local codes
	UL 87A Dispensers for gasoline and ethonol blends, EO to E85	
	UL 87B Dispensers for diesel fuel, bio diesel blends to B20, kerosene and fuel oil	
	UL 87C Dispensers for diesel exhaust fluids	
	UL 1238 "Control equipment for use with flammable liquid dispensing devices"	
	CSA C22.2 No. 22 "Electrical equipment for flammable and combustible fuel dispensers"	

Note 3: UL 674 and CSA 145 are harmonized standards.

North America, Atex & IECEx

Substance	Hazard Class	Division Groups	Zone Groups
Acetylene	Class I Flammable Gases	Group A	IIC
Hydrogen		Group B	
Ethylene		Group C	IIB
Propane		Group D	IIA IIA ⁵
Methane	Class II Combustible Dusts	Group E ⁴	IIIC ⁶
Combustible Metal Dusts		Group F	IIIB ⁶
Combustible Carbonaceous Dusts		Group G	
Combustible Dusts not in Group E or F (Flour, Grain, Wood, Plastics, Chemicals)	Class III Fibers and Flyings	Not Applicable	IIIA ⁶
Combustible Fibers and Flyings			

Note 4: Group E is applicable to Class II, Division 1 only.
Note 5: Methane is a Group IIA Gas for non-mining applications.
Note 6: Groups IIA, IIB and IIIC have not been adopted by the Canadian Electrical Code.

Classification of Divisions and Zones

Hazard Level	Division Scheme	Zone Scheme	Definitions
Continuous Hazard	Division 1	Zone 0 / Zone 20	A place in which an explosive atmosphere is continually present
Intermittent Hazard		Zone 1 / Zone 21	A place in which an explosive atmosphere is likely to occur in normal operation
Hazard Under Abnormal Conditions	Division 2	Zone 2 / Zone 22	A place in which an explosive atmosphere is not likely to occur in normal operation, but may occur for short periods

Atmosphere Groups

Max. Surface Temperature	NEC® 500 CEC®	NEC® 505 / IEC - Group II
450° C (842°F)	T1	T1
300° C (572°F)	T2	T2
280° C (536°F)	T2A	
260° C (500°F)	T2B	
230° C (446°F)	T2C	
215° C (419°F)	T2D	T3
200° C (392°F)	T3	
180° C (356°F)	T3A	
165° C (329°F)	T3B	T4
160° C (320°F)	T3C	
135° C (275°F)	T4	T4
120° C (248°F)	T4A	
100° C (212°F)	T5	T5
85° C (185°F)	T6	T6

Note 7: For Group I applications (ATEX and IECEx only), electrical apparatus has fixed temperature limits of 150°C (where layers of coal dust can form) and 450°C (where coal dust is not expected to form a layer).

Other CE Directives That May Be Applicable

Electromagnetic Compatibility (EMC)	Directive 2004/108/EC
Machinery	Directive 2006/42/EC
Pressure Equipment	Directive 97/23/EC
Low Voltage (excludes equipment for use in explosive atmospheres - see ATEX Annex II 1.2.7)	Directive 2006/95/EC
Radio Equipment and Telecommunications Terminal Equipment (R&TTE)	Directive 1999/5/EC

Additional Market Access: IECEx Scheme

Manufacturers of Ex equipment can obtain certificates of conformity that will be accepted at a national level in all countries that participate in the IECEx Scheme. A certificate of conformity may be obtained from any certification body accepted into the Scheme. The certificate will attest that (1) the equipment design conforms to relevant IEC Standards and (2) the product is manufactured under a quality plan assessed by an Approved IECEx Certification Body (Ex CBs). Manufacturers holding certificates of conformity may affix the IECEx Mark of Conformity to equipment they have verified complies with the certified design.

Atex & IECEx

Typical ATEX and IECEx Marking										
CE	0167	Ex	II	2	G	Ex	d	IIC	T4	Gb
Complies with European Directive*	Notified Body Number*	Specific Marking for Explosion Protection*	Equipment Group*	Equipment Category*	Environment*	Explosion Protection	Type of Protection	Gas Group	Temperature Class (T1 - T6)	Equipment Protection Level (EPL)

* Atex only

Protection Concepts [NEC® & CEC®]

Type of Protection	Symbol	Typical IEC EPL	Typical Zone(s)	IEC Standard	Basic Concept of Protection
Electrical Equipment for Gases, Vapors and Mists (G)					
General Requirements	--	--	0, 1, 2	IEC 60079-0	Inherently safe protected by shutdown
Optical Radiation	Op pr Op sh Op is	Ga	0, 1, 2	IEC 60079-28	
Increased Safety Type 'n' (Non-Sparking)	e	Gb	1, 2	IEC 60079-7	No arcs, sparks or hot surfaces Enclosure IP54 or better
Flame-proof	nA	Gc	2	IEC 60079-15	
Type 'n' (Enclosed Break)	d	Gb	1, 2	IEC 60079-1	Contain the explosion, quench the flame
Quartz / Sand Filled	nC	Gc	2	IEC 60079-15	
Intrinsic Safety	ia ib ic	Ga Gb Gc	0, 1, 2	IEC 60079-11	Limit the energy of sparks and surface temperatures
Purged / Pressurized	px py pz	Gb Gc	1, 2	IEC 60079-2	
Type 'n' (Sealing & Hermetically Sealed) Type 'n' (Restricted Breathing)	nC nR	Gc	2	IEC 60079-15	Keep the flammable gas out
Encapsulation	ma mb mc	Ga Gb Gc	0, 1, 2	IEC 60079-18	
Oil Immersion	o	Gb	1, 2	IEC 60079-6	
Electrical Equipment for Combustible Dusts (D)					
General Requirements	--	--	20, 21, 22	IEC 60079-0	Standard protection for dusts, rugged tight enclosure
Enclosure	ta tb tc	Da Db Dc	20 21 22	IEC 60079-31	
Intrinsic Safety	ia ib ic	Da Db Dc	20 21 22	IEC 60079-11	
Encapsulation	ma mb mc	Da Db Dc	20 21 22	IEC 60079-18	Protection by encapsulation of incendive parts
Pressurized	pD	Db Dc	21, 22 22	IEC 61241-4	
Non-Electrical Equipment					
General Requirements	--	--	0, 1, 2 20, 21, 22	EN 13463-1	Low potential energy
Flow Restricted Enclosure	fr	--	2, 22	EN 13463-2	Relies on tight seals, closely matched joints and tough enclosures to restrict the breathing of the enclosure
Flame-proof Enclosure	d	--	1, 2, 21, 22	EN 13463-3	Ignition hazards eliminated by good engineering methods
Constructional Safety	c	--	0, 1, 2 20, 21, 22	EN 13463-5	Ignition hazards eliminated by good engineering methods
Control of Ignition Sources	b	--	0, 1, 2 20, 21, 22	EN 13463-6	Control equipment fitted to detect malfunctions
Purged / Pressurized	p	--	1, 2 21, 22	EN 60079-2 EN 61241-4	Enclosure is purged and pressurized to prevent ignition sources from arising
Liquid Immersion	k	--	0, 1, 2 20, 21, 22	EN 13463-8	Enclosure uses liquid to prevent contact with explosive atmosphere

Ingress Protection Codes [IEC 60529]

First Number (protect from solid bodies)	Second Number (protect from water)
0 No Protection	0 No protection
1 Objects > 50 mm	1 Vertical drip
2 Objects > 12.5 mm	2 Angled drip
3 Objects > 2.5 mm	3 Spraying
4 Objects > 1.0 mm	4 Splashing
5 Dust-Protected	5 Jetting
6 Dust-Tight	6 Powerful jetting
	7 Temporary immersion
	8 Continuous immersion
	9 High pressure and temperature water jet

Atmosphere Groups [ATEX & IECEx]

Group	Environment	Location	Typical Substance
I	Gases, Vapors and Mists	Coal Mining	Methane (Fire damp)
IIA		Surface and Other Locations	Methane, Propane, etc.
IIB			Ethylene, Acetylene, etc.
IIC	Combustible Dusts	Surface and Other Locations	Combustible flyings
IIIB			Non-conductive
IIIC			Conductive

Equipment Groups [ATEX]

Equipment Group	ATEX Equipment Category	Atmosphere	[EPL] Equipment Protection Level	Required Protection Performance & Operation
I (Mines with Firedamp)	M1	Methane & Dust	Very High Ma	Two faults, Remain energized and functioning
	M2		High Mb	Severe normal operation, De-energize in exp. atmosphere
II (All Other Areas)	1G, 1D 2G, 2D 3G, 3D	Gas, Vapor, Mist, Dust	Very High	Two faults
			High	One fault
			Low	Normal operation

Equipment Categories & Protection Levels^a

ATEX Category	Equipment Protection Levels	Typical Equipment Zone Suitability
1 G	Ga	Suitable for Zones 0, 1, 2
1 D	Da	Suitable for Zones 20, 21, 22
2 G	Gb	Suitable for Zones 1, 2
2 D	Gc	Suitable for Zones 21, 22
3 G	Gb	Suitable for Zone 2
3 D	Dc	Suitable for Zone 22

ATEX Categories vs. Zones of Use^a

Equipment Category ATEX	Zone of Use	
	Gas, Vapors & Mist	Dust
Category 1	Zone 0, 1, 2	Zone 20, 21, 22
Category 2	Zone 1, 2	Zone 21, 22
Category 3	Zone 2	Zone 22

Note 8: Unless the explosion protection risk assessment states otherwise

Enclosure Type Ratings [NEC® & CEC®]

Type	Area	Brief Definition
1	Indoor	General Purpose
2		Protection against angled dripping water
3, 3R, 3S	Indoor / Outdoor	Protection against rain, snow
4, 4X		Protection against rain, snow, hose directed water and corrosion (X only)
5	Indoor	Protection against angled dripping water, dust, fibers, flyings
6	Indoor / Outdoor	Protection against temporary submersion
6P		
12, 12K	Indoor	Protection against circulating dust, fibers, flyings
13		Protection against circulating dust, fibers, flyings, seepage

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