

Hazardous Locations & Explosive Atmospheres

Guide to Equipment Certification Requirements



Valued Quality. Delivered.

NORTH AMERICA

Typical North American Marking			
Division Scheme		Zone Scheme	
Class I	Division 1	Groups A&B	T4
↑	↑	↑	↑
Hazard Class	Area Classification	Gas Group	Temperature Class
		Class I	Zone 0
		↑	↑
		Hazard Class	Area Classification
		AEx	ia
		↑	↑
		Approved to US Standards	Protection Concept Code
		IIC	T4
		↑	↑
		Gas Group	Temperature Class
		Ga	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 Ex	US CA	Class I Class I	Division 1 & 2 Division 1 & 2	FM 3600 ISA 60079-0 CSA C22.2 No. 60079-0	
Increased Safety	AEx e (Gb) Ex e (Gb)	US CA	Class I Class I	Zone 1 Zone 1	ISA 60079-7 CSA C22.2 No. 60079-7	
Non-Incendive	NI	US CA	Class I Class I	Division 2 Division 2	ISA 12.12.01/FM 3611 CSA C22.2 No. 213	No arcs, sparks or hot surfaces
Non-Sparking	AEx nA (Gc) Ex nA (Gc)	US CA	Class I Class I	Zone 2 Zone 2	ISA 60079-15 CSA C22.2 No. 60079-15	
Explosion-proof	XP XP	US CA	Class I Class I	Division 1 Division 1	UL 1203 CSA C22.2 No. 30	
Flame-proof	AEx d (Gb) Ex d (Gb)	US CA	Class I Class I	Zone 1 Zone 1	ISA 60079-1 CSA C22.2 No. 60079-1	Contain the explosion and extinguish the flame
Powder Filled	AEx q (Gb) Ex q (Gb)	US CA	Class I Class I	Zone 1 Zone 1	ISA 60079-5 CSA C22.2 No. 60079-5	
Enclosed Break	AEx nC (Gc) Ex nC (Gc)	US CA	Class I Class I	Zone 2 Zone 2	ISA 60079-15 CSA C22.2 No. 60079-15	
Intrinsic Safety ¹	IS IS AEx ia (Ga) AEx ib (Gb) AEx ic (Gc) Ex ia (Ga) Ex ib (Gb)	US CA US US US CA CA	Class I Class I Class I Class I Class I Class I Class I	Division 1 Division 1 Zone 0 Zone 1 Zone 1 Zone 2 Zone 0 Zone 1	UL 913 / FM 3610 CSA C22.2 No. 157 ISA 60079-11 ISA 60079-11 ISA 60079-11 CSA C22.2 No. 60079-11 CSA C22.2 No. 60079-11	Limit energy of sparks and surface temperature
Limited Energy	Ex nL (Gc)	CA	Class I	Zone 2	CSA C22.2 No. 60079-15	
Pressurized	Type X Type X Type Y Type Y Type Z Type Z AEx px (Gb) Ex px (Gb) AEx py (Gb) Ex py (Gb) AEx pz (Gc) Ex pz (Gc)	US CA US CA US US US CA CA US CA CA	Class I Class I Class I Class I Class I Class I Class I Class I Class I Class I Class I Class I	Division 1 Division 1 Division 1 Division 1 Division 2 Division 2 Zone 1 Zone 1 Zone 1 Zone 1 Zone 2 Zone 2	NFPA 496 (FM 3620) NFPA 496 NFPA 496 (FM 3620) NFPA 496 NFPA 496 (FM 3620) NFPA 496 CSA C22.2 No. 60079-2 CSA C22.2 No. 60079-2 CSA C22.2 No. 60079-2 CSA C22.2 No. 60079-2 CSA C22.2 No. 60079-2 CSA C22.2 No. 60079-2	Keep flammable gas out
Restricted Breathing	AEx nR (Gc) Ex nR (Gc)	US CA	Class I Class I	Zone 2 Zone 2	ISA 60079-15 CSA C22.2 No. 60079-15	
Encapsulation	AEx ma (Ga) AEx mb (Gb) AEx mc (Gc) Ex m	US US US US	Class I Class I Class I Class I	Zone 0 Zone 1 Zone 2 Zone 1	ISA 60079-18 ISA 60079-18 ISA 60079-18 CSA C22.2 No. 60079-18	
Oil Immersion	AEx o (Gb) Ex o (Gb)	US CA	Class I Class I	Zone 1 Zone 1	ISA 60079-6 CSA C22.2 No. 60079-6	
Electrical Equipment for Combustible Dust - Class II & Class III						
General Requirements	– – – Ex	US CA US US	Class II Class II Class III –	Division 1 & 2 Division 1 & 2 Division 1 Zone 20, 21, 22	FM 3600 CSA C22.2 No. 25 FM 3600 ISA 60079-0	
Dust-Ignition proof	DIP	US CA	Class II Class II	Division 1 Division 1	UL 1203 CSA C22.2 No. 25	
Dust Protected	NI	US CA	Class II Class II	Division 2 Division 2	ISA 12.12.01 / FM 3611 CSA C22.2 No. 25	
Enclosure	AEx ta (Da) AEx tb (Db) AEx tc (Dc) Ex ta Ex ta Ex tb Ex tb Ex tc Ex tc	US US US CA CA CA CA CA CA CA	Class II Class II Class II Class III Class II Class II Class III Class II Class II Class III	Zone 20 ² Zone 21 ² Zone 22 ² Division 1 Division 1 Division 1 Division 1 Division 2 Division 2	ISA 60079-31 ISA 60079-31 ISA 60079-31 CSA C22.2 No. 60079-31 CSA C22.2 No. 60079-31 CSA C22.2 No. 60079-31 CSA C22.2 No. 60079-31 CSA C22.2 No. 60079-31 CSA C22.2 No. 60079-31	Keep combustible dust out
Fiber & Flying Protection	– –	US CA	Class III Class III	Division 1 & 2 Division 1 & 2	UL 1203 / ISA 12.12.01 CSA C22.2 No. 25	
Encapsulation	AEx maD AEx mbD Ex ma Ex ma Ex mb Ex mb Ex mc Ex mc	US CA CA CA CA CA CA CA	Class II Class II Class II Class III Class II Class II Class II Class III	Zone 20 Zone 21 Division 1 Division 1 Division 1 Division 1 Division 2 Division 2	ISA 61241-18 ISA 61241-18 CSA C22.2 No. 60079-18 CSA C22.2 No. 60079-18 CSA C22.2 No. 60079-18 CSA C22.2 No. 60079-18 CSA C22.2 No. 60079-18 CSA C22.2 No. 60079-18	
Pressurization	Type X Type X Type Y Type Y Type Z Type Z Type Z AEx pD	US CA CA CA CA CA CA CA	Class II Class II Class II Class II Class II Class II Class II Class II	Division 1 Division 1 Division 1 Division 1 Division 2 Division 2 Division 2 Zone 21	NFPA 496 (FM 3620) NFPA 496 NFPA 496 (FM 3620) NFPA 496 NFPA 496 (FM 3620) NFPA 496 NFPA 496 ISA 61241-2	
Intrinsic Safety	IS AEx iaD AEx ibD IS	US US US US	Class II Class II Class II Class III	Division 1 Zone 20 Zone 21 Division 1	UL 913 / FM 3610 ISA 61241-11 ISA 61241-11 UL 913 / FM 3610	Limit energy of sparks and surface temperature
Note 1: For associated intrinsically safe apparatus suitable for installation in a hazardous location, the symbol for the type of protection "ia" or "ib" are enclosed within square brackets on the marking, e.g. AEx ia [IIC] T4. For intrinsically safe apparatus not suitable for installation in a hazardous location, both the symbol "Ex" or "AEx" and the symbol for the type of protection "ia" or "ib" are enclosed within the same square brackets on the marking, e.g. (AEx ia) IIC; in this case, a temperature class is not included. Note 2: Zones 20-22 are not currently classified in the Canadian Electric Code (CEC®).						

Enclosure Type Ratings [NEC® & CEC®]		
Type	Area	Brief Definition
1	Indoor	General Purpose
2	Indoor	Protection against angled dripping water
3, 3R, 3S	Indoor / Outdoor	Protection against rain, snow
4, 4X	Indoor / Outdoor	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	Indoor / Outdoor	Protection against prolonged submersion
12, 12K	Indoor	Protection against circulating dust, fibers, flyings
13	Indoor	Protection against circulating dust, fibers, flyings, seepage

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 I, Zone 1, Groups IIA, IIB, IIB+H2 Class II, Division 1, Groups E,F,G Class II, Zones 20, 21
	CSA C22.2 No. 145 "Electric motors and generators for use in hazardous (classified) locations" ³	
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 I, Zone 0 and Zone 1 Class II, Division 1 Class III, Division 1 Class II, Zone 20 and Zone 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 I, Zone 0 and Zone 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, Zone 1 Class II, Zones 20, 21, and 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 ethonal blends, E0 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 and ATEX & IECEx

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

Temperature Classification ⁷		
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	
200° C (392°F)	T3	T3
180° C (356°F)	T3A	
165° C (329°F)	T3B	
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).		

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.	
Intertek is an IECEx Testing Laboratory and has IECEx Accepted Certification Body status. For more information on the IECEx Scheme, contact us at icenter@intertek.com or visit www.IECEx.com.	

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

ATEX & IECEx

Typical ATEX and IECEx Marking									
CE	0359	Ex	II	2	G	Ex	d	IIC	T4 Gb
↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
Complies with European Directive*	Notified Body Number*	Specific Marking for Explosion Protection*	Equipment Group*	Environment*	Explosion Protection	Type of Protection	Gas Group	Temperature Class (T1-T6)	Equipment Protection Level (EPL)
*ATEX only									

Protection Concepts [ATEX and IECEx]					
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	
Optical Radiation	Op pr Op sh Op is	Gb Ga Ga	1,2 0,1,2 0,1,2	IEC 60079-28 IEC 60079-28 IEC 60079-28	Inherently safe protected by shutdown
Increased Safety Type 'n' (Non-Sparking)	e nA	Gb Gc	1,2 2	IEC 60079-7 IEC 60079-15	No arcs, sparks or hot surfaces Enclosure IP54 or better
Flame-proof Type 'n' (Enclosed Break)	d nC	Gb Gc	1,2 2	IEC 60079-1 IEC 60079-15	Contain the explosion, quench the flame
Quartz/Sand Filled	q	Gb	1,2	IEC 60079-5	Quench the flame
Intrinsic Safety	ia ib ic	Ga Gb Gc	0,1,2 1,2 2	IEC 60079-11 IEC 60079-11 IEC 60079-11	Limit the energy of sparks and surface temperatures
Purged / Pressurized	px py pz	Gb Gb Gc	1,2 1,2 2	IEC 60079-2 IEC 60079-2 IEC 60079-2	
Type 'n' (Sealing & Hermetically Sealed)	nC	Gc	2	IEC 60079-15	Keep the flammable gas out
Type 'n' (Restricted Breathing)	nR	Gc	2	IEC 60079-15	
Encapsulation	ma mb mc	Ga Gb Gc	0,1,2 1,2 2	IEC 60079-18 IEC 60079-18 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	
Enclosure	ta tb tc	Da Db Dc	20 21 22	IEC 60079-31	Standard protection for dusts, rugged tight enclosure
Intrinsic Safety	ia ib ic	Da Db Dc	20 21 22	IEC 60079-11	Similar to enclosure, but with some relaxations if circuit inside is intrinsically safe
Encapsulation	ma mb mc	Da Db Dc	20 21 22	IEC 60079-18	Protection by encapsulation of incandescent parts
Pressurized	pD	Db Dc	21,22 22	IEC 61241-4	Protection by pressurization of enclosure
Non-Electrical Equipment					
General Requirements	-	-	0,1,2, 20,21,22	EN 13463-1	Low potential energy
Flow Restricted Enclosure Flame-proof Enclosure	fr d	- -	2,22 1,2,21,22	EN 13463-2 EN 13463-3	Relies on tight seals, closely matched joints and tough enclosures to restrict the breathing of the enclosure
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]		Atmosphere Groups [ATEX & IECEx]			
First Number (protect from solid bodies)	Second Number (protect from water)	Group	Environment	Location	Typical Substance
0 No Protection	0 No protection	I	Gases, Vapors and Mists	Coal Mining	Methane (Fire damp)
1 Objects > 50mm	1 Vertical drip	IIA		Surface and Other Locations	Methane, Propane, etc.
2 Objects > 12.5mm	2 Angled drip	IIB			Ethylene
3 Objects > 2.5mm	3 Spraying	IIC			Hydrogen, Acetylene, etc.
4 Objects > 1.0mm	4 Splashing	IIIA	Combustible Dusts	Surface and Other Locations	Combustible flyings
5 Dust-Protected	5 Jetting	IIIB			Non-conductive
6 Dust-Tight	6 Powerful jetting	IIIC			Conductive
	7 Temporary immersion				
	8 Continuous immersion				
	9 High pressure and temperature water jet				

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