

Guide to Equipment Certification Requirements for Hazardous Locations



cCSA us

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

Protection Concepts						
Type of Protection	Code	Country	Class	Division / Zone	Standard	Basic Concept of Protection
Electrical Equipment for Flammable Gas, Vapours and Mist - Class I						
General Requirements	AEx Ex	US CA	Class I	Division 1 & 2	FM 3600	No arcs, sparks or hot surfaces
Increased Safety	AEx e Ex e	US CA	Class I	Zone 1	ISA 60079-0	
Non-Incendive	(NI)	US CA	Class I	Zone 1 & 2	ISA 60079-7	
Non-Sparking	AEx nA EX nA	US CA	Class I	Zone 1 & 2	CSA 60079-7	
Explosion Proof	(XP)	US CA	Class I	Division 1	UL 1203 / FM 3615	Contain the explosion and extinguish the flame
Flame Proof	AEx d EX d	US CA	Class I	Zone 1	C22.2 No. 30	
Power Filled	AEx q EX q	US CA	Class I	Zone 1	UL 1203 / FM 3615	Limit energy of sparks and surface temperature
Enclosed Break	AEx nC EX nC	US CA	Class I	Zone 1	ISA 60079-1	
Intrinsic Safety	(IS)	US CA	Class I	Division 1	UL 913 / FM 3610	Limit energy of sparks and surface temperature
	(IS)	US CA	Class I	Division 1	C22.2 No. 157	
	AEx ia	US CA	Class I	Zone 0	ISA 60079-11 / FM 3616	
	AEx ib	US CA	Class I	Zone 1	ISA 60079-11 / FM 3616	
Limited Energy	AEx nC	US CA	Class I	Zone 0	ISA 60079-11	Keep flammable gas out
	Ex nL	US CA	Class I	Zone 1	CSA E60079-11	
	Type X	US CA	Class I	Zone 2	ISA 60079-15	
	Type Y	US CA	Class I	Zone 2	CSA E60079-15	
Pressurised	AEx px	US CA	Class I	Zone 1	ISA 60079-2	Keep flammable gas out
	Ex px	US CA	Class I	Zone 1	CSA E60079-2	
	AEx py	US CA	Class I	Zone 1	ISA 60079-2	
	Ex py	US CA	Class I	Zone 1	CSA E60079-2	
Restricted Breathing	AEx nr	US CA	Class I	Zone 2	ISA 60079-2	Keep flammable gas out
	Ex nr	US CA	Class I	Zone 2	CSA E60079-2	
	AEx ma	US CA	Class I	Zone 0	ISA 60079-18	
	AEx mb	US CA	Class I	Zone 1	ISA 60079-18	
Oil Immersion	AEx o	US CA	Class I	Zone 1	ISA 60079-6	Keep flammable gas out
	EX o	US CA	Class I	Zone 1	CSA E60079-6	

Electrical Equipment for Combustible Dust and Fibres - Class II / Class III						
General Requirements	Ex	US CA	Class II	Division 1 & 2	FM 3600	Limit energy of sparks and surface temperature
Dust Ignition Proof	(DIP)	US CA	Class II	Division 1	UL 1203 / FM 3616	
Dust Protected	(NI)	US CA	Class II	Division 2	ISA 12.12.01 / FM 3611	
Protection by Enclosure	AEx ta AEx tb AEx tc Ex ta Ex tb Ex tc	US CA	Class II	Zone 20 Zone 21 Zone 22	ISA 60079-31	
Fiber & Flying Protection	-	US CA	Class III	Division 1 & 2	UL 1203 / ISA 12.12.01	Keep combustible dust out
Encapsulation	AEx maD AEx mbD	US CA	Class II	Zone 20 Zone 21	ISA 60079-18	
Pressurisation	(PX)	US CA	Class II	Division 1	NFPA 496 (FM 3620)	Limit energy of sparks and surface temperature
	(PY)	US CA	Class II	Division 1	NFPA 496 (FM 3620)	
	(PZ)	US CA	Class II	Division 2	NFPA 496 (FM 3620)	
	(PZ)	US CA	Class II	Division 2	NFPA 496 (FM 3620)	
Intrinsic Safety	(IS)	US CA	Class II	Division 1	UL 913 / FM 3610	Limit energy of sparks and surface temperature
	(IS)	US CA	Class II	Division 1	C22.2 No. 157	
	AEx iaD	US CA	Class II	Zone 0	ISA 60079-11	
	AEx ibD	US CA	Class II	Zone 1	ISA 60079-11	

Note: 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 d [ia] IIC T4.

Note: 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.

Classification of Divisions and Zones			
Type of Area	NEC and CEC*	ATEX and IEC	Definitions
Continuous hazard	Division 1	Zone 0 Cat 1	A place in which an explosive atmosphere consisting of a mixture with air of dangerous substances in the form of gas, vapour or mist is present continuously or for long periods or frequently.
		Zone 20 Cat 1	A place in which an explosive atmosphere in the form of a cloud of combustible dust in air is present continuously, or for long periods or frequently.
Intermittent hazard	Division 1	Zone 1 Cat 2	A place in which an explosive atmosphere consisting of a mixture with air of dangerous substances in the form of gas, vapour or mist is likely to occur in normal operation occasionally.
		Zone 21 Cat 2	A place in which an explosive atmosphere in the form of a cloud of combustible dust in air is likely to occur in normal operation occasionally.
Hazard under abnormal conditions	Division 2	Zone 2 Cat 3	A place in which an explosive atmosphere consisting of a mixture with air of dangerous substances in the form of gas, vapour or mist is not likely to occur in normal operation but, if it does occur, will persist for a short period only.
		Zone 22 Cat 3	A place in which an explosive atmosphere in the form of a cloud of combustible dust in air is not likely to occur in normal operation but, if it does occur, will persist for a short period only.

* On occasion the ATEX and IEC Zones may be used in the corresponding NEC and CEC system

Equipment Groups [ATEX and IECEx]					
Equipment Group	Equipment Category	Equipment Protection Level	Atmosphere	Protection Level	Required Protection Performance & Operation
I (Mines with firedamp)	M1	Ma	Methane & Dust	Very High	Two Faults, Remain energised and functioning
I (Mines with firedamp)	M2	Mb	Methane & Dust	High	Severe normal operation, De-energise in explosive atmosphere
II (all other areas)	1	Ga / Da	Gas, Vapour, Mist, Dust	Very High	Two Faults
II (all other areas)	2	Gb / Db	Gas, Vapour, Mist, Dust	High	One Fault
II (all other areas)	3	Gc / Dc	Gas, Vapour, Mist, Dust	Low	Normal operation

Ingress Protection Codes IPXX			
First Number (protect from solid bodies)	Second Number (protect from water)		
0	No protection	0	No protection
1	Objects > 50mm	1	Vertical drip
2	Objects > 12.5mm	2	Angled drip
4	Objects > 1.0mm	4	Splashing
5	Dust-protected	5	Jetting
6	Dust-tight	6	Powerful jetting
		7	Temporary immersion
		8	Continuous immersion

Enclosure Type Ratings (NEMA / CSA / UL)		
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
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

Gas Groups [ATEX and IECEx]			
(For further information on Gas Groups refer to the Dräger gas list)			
Group	Environment	Location	Typical Substance
I		Coal Mining	Methane (Fire damp)
IIA	Gases, Vapours	Surface and other locations	Acetic acid, Acetone, Ammonia, Butane, Cyclohexane, Ethanol (ethyl alcohol), Gasoline (petrol), Kerosene, Methane (natural gas) (non-mining), Methanol (methyl alcohol), Propane, Propan-2-ol (iso-propyl alcohol), Toluene, Xylene
			Di-ethyl ether, Ethylene, Methyl ethyl ketone (MEK), Propan-1-ol (n-propyl alcohol)
IIIB			Acetylene, Hydrogen
IIIC			Combustible flyings
IIIA			Non-conductive
IIIB			Conductive
IIIC			

Atmosphere Groups (US / CAN)				
Substance	Hazard Class	NEC 500	NEC 505	
Acetylene	Class I Flammable Gases	Group A	IIC	
Hydrogen		Group B	IIC	
Ethylene		Group C	IIIB	
Propane		Group D	IIA	
Methane (mining)		Group D	-	
Combustible Metal Dusts	Class II Combustible Dusts	Group E	-	
Combustible Carbonaceous Dusts		Group F	-	
Combustible Dusts not in Group E or F (Flour, Grain, Wood, Plastics, Chemicals)		Group G	-	
Combustible Fibers and Flyings	Class III Fibers and Flyings	-	-	

ATEX & IECEx

Typical ATEX & IECEx Marking [*ATEX only]					
CE	XXXX	Ex	II	2	G
*Complies with European Directive	*EN Certifying Body ID Code	*Mark for Explosion Protection	*Equipment Group	*Equipment Category	*Environment
Ex	d	IIC	T4	Gb	
Explosion Protection	Type of Protection	Gas Equipment / Sub Group	Temperature Classes	Equipment Protection Level	
Ex	tb	IIIC	T135°C	Db	(-50°C to +40°C)
Explosion Protection	Type of Protection	Dust Type	Temperature Class (°C)	Equipment Protection Level	Ambient Temperature

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, vapours and mists (G)					
General Requirements	-	-	0,1,2	IEC 60079-0	-
Optical Radiation	Op pr Op sh Op is	Gb Ga Gc	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
Flameproof	d	Gb	1,2	IEC 60079-1	Contain the explosion, quench the flame
Type 'n' (enclosed break)	nC	Gc	2	IEC 60079-15	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 1,2	IEC 60079-11 IEC 60079-11 IEC 60079-11	Limit the energy of sparks and surface temperatures
	px py pz	Gb Gb Gc	1,2 1,2 2	IEC 60079-2 IEC 60079-2 IEC 60079-2	Keep the flammable gas out
	Type 'n' (sealing & hermetic sealing) Type 'n' (restricted breathing)	nC nR	Gc Gc	2 2	
Encapsulation	ma mb mc	Ga Gb Gc	0,1,2 1,2 2	IEC 60079-18 IEC 60079-18 IEC 60079-18	Protection by encapsulation of incandescent parts
	Oil immersion	o	Gb	1,2	
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	
Encapsulation	ma mb mc	Da Db Dc	20 21 22	IEC 60079-18	Protection by encapsulation of incandescent parts
Pressurised	pD	Db Dc	21,22	IEC 61241-4	Protection by pressurisation of enclosure
			22		
Non-Electrical equipment					
General Requirements	-	-	0,1,2, 20,21,22	EN 13463-1	Low potential energy
Flow restricted enclosure flameproof enclosure	fr d	-	2,22	EN 13463-2 EN 13463-3	Relies on tight seals, closely matched joints and tough enclosures to restrict the breathing of the enclosure
			1,2,21,22		
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 to detect malfunctions
Pressurisation	p	-	1,2, 20,21,22	EN 60079-2 EN 61241-4	Enclosure is purged and pressurised to prevent ignition sources from arising
			21,22		
Liquid immersion	k	-	0,1,2, 20,21,22	EN 13463-8	Enclosure uses liquid to prevent contact with explosive atmosphere

Dusts Typical Ignition Temperatures (°C)		
Dusts	Cloud	Layer
Aluminium	590 °C	>450 °C
Coal dust (lignite)	380 °C	225 °C
Flour	490 °C	340 °C
Grain dust	510 °C	300 °C
Methyl cellulose	420 °C	320 °C
Phenolic resin	530 °C	>450 °C
Polythene	420 °C	(melts) °C
PVC	700 °C	>450 °C
Soot	810 °C	570 °C
Starch	460 °C	435 °C
Sugar	490 °C	460 °C

