Guide to Equipment Certification Requirements for Hazardous Locations

NORTH AMERICA

Typical North American Marking

NEC® 500	NEC® 505
Class I, Division 1, Groups A&B T4	Class I, Zone 0, AEx ia IIC T4

Hazard Class; Area Classification; Gas Group; Temperature Class; Hazard Class; Area Classification; Approved to US Standards; Protection Concept Code; Gas Group; Temperature Class

Protection Concepts

Type of Protection	Code	Cty	Class	Division/Zone	Standard	Basic Concept of Protection
Electrical Equipment for Flammable Gas, Vapors and Mist - Class I						
General Requirements		US	Class I	Division 1 & 2	FM 3600	
		CA	Class I	Division 1 & 2		
	AEx	US	Class I	Division 1 & 2	ISA 60079-0	
	Ex	CA	Class I	Division 1 & 2	CSA 60079-0	
Increased Safety	AEx e	US	Class I	Zone 1	ISA 60079-7	no arcs, sparcs or hot surfaces
	Ex e	CA	Class I	Zone 1	CSA E60079-7	
Non-Incendive	(NI)	US	Class I	Division 2	ISA 12.12.01/FM 3611	
	(NI)	CA	Class I	Division 2	C22.2 No. 213	
Non-Sparking	AEx nA	US	Class I	Zone 2	ISA 60079-15	
	EX nA	CA	Class I	Zone 2	CSA E60079-15	
Explosion Proof	(XP)	US	Class I	Division 1	UL 1203	Contain the explosion and extinguish the flame
	(XP)	CA	Class I	Division 1	C22.2 No. 30	
Flame Proof	AEx d	US	Class I	Zone 1	ISA 60079-1	
	Ex d	CA	Class I	Zone 1	CSA 60079-1	
Power Filled	AEx q	US	Class I	Zone 1	ISA 60079-5	
	Ex q	CA	Class I	Zone 1	CSA E60079-5	
Enclosed Break	AEx nC	US	Class I	Zone 2	ISA 60079-15	
	Ex nC	CA	Class I	Zone 2	CSA E60079-15	
Intrinsic Safety	(IS)	US	Class I	Division 1	UL 913 / FM 3610	Limit energy of sparks and surface temperature
	(IS)	CA	Class I	Division 1	C22.2 No. 157	
	AEx ia	US	Class I	Zone 0	ISA 60079-11	
	AEx ib	US	Class I	Zone 1	ISA 60079-11	
	EX ia	CA	Class I	Zone 0	CSA E60079-11	
	Ex ib	CA	Class I	Zone 1	CSA E60079-11	
Limited Energy	AEx nC	US	Class I	Zone 2	ISA 60079-15	
	Ex nL	CA	Class I	Zone 2	CSA E60079-15	
Pressurized	Type X	US	Class I	Division 1	NFPA 496 (FM 3620)	Keep flamable gas out
	Type X	CA	Class I	Division 1	NFPA 496	
	Type Y	US	Class I	Division 1	NFPA 496 (FM 3620)	
	Type Y	CA	Class I	Division 1	NFPA 496	
	Type Z	US	Class I	Division 2	NFPA 496 (FM 3620)	
	Type Z	CA	Class I	Division 2	NFPA 496	
	AEx px	US	Class I	Zone 1	ISA 60079-2	
	Ex px	CA	Class I	Zone 1	CSA E60079-2	
	AEx py	US	Class I	Zone 1	ISA 60079-2	
	Ex py	CA	Class I	Zone 1	CSA E60079-2	
	AEx pz	US	Class I	Zone 2	ISA 60079-2	
	Ex pz	CA	Class I	Zone 2	CSA E60079-2	
Restricted Breathing	AEx nR	US	Class I	Zone 2	ISA 60079-15	
	Ex nR	CA	Class I	Zone 2	CSA E60079-15	
Encapsulated	AEx ma	US	Class I	Zone 0	ISA 60079-18	
	AEx m	US	Class I	Zone 1	ISA 60079-18	
	Ex m	CA	Class I	Zone 1	CSA E60079-18	
	AEx mb	US	Class I	Zone 1	ISA 60079-18	
Oil Emmersion	AEx o	US	Class I	Zone 1	ISA 60079-6	
	EX o	CA	Class I	Zone 1	CSA E60079-6	
Electrical Equipment for Combustible Dust - Class II & Class III						
General Requirements		US	Class II	Division 1 & 2	FM 3600	
		CA	Class II	Division 1 & 2		
		US	Class III	Division 1 & 2	FM 3600	
		CA	Class III	Division 1 & 2		
	Ex	US		Zone 20, 21, 22	ISA 60079-0	
Dust Ignition Proof	(DIP)	US	Class II	Division 1	UL 1203	Keep combustible dust out
		CA	Class II	Division 1	CSA C22.2 No. 25	
Dust Protected	(NI)	US	Class II	Division 2	ISA 12.12.01 / FM 3611	
		CA	Class II	Division 2	CSA C22.2 No. 25	
Protection by Enclosure	AEx tD	US		Zone 21	ISA 60079-31	
	(DIP) A21	CA	Class II	Division 1	CSA E61241-1-1	
	(DIP) A22	CA	Class II	Division 2	CSA E61241-1-1	
Fiber & Flying Protection		US	Class III	Division 1 & 2	UL 1203 / ISA 12.12.01	
		CA	Class III	Division 1 & 2	CSA C22.2 No. 25	
Encapsulation	AEx maD	US		Zone 20	ISA 61241-18	
	AEx mbD	US		Zone 21	ISA 61241-18	
Pressurization	(PX)	US	Class II	Division 1	NFPA 496 (FM 3620)	
	(PX)	CA	Class II	Division 1	NFPA 496	
	(PY)	US	Class II	Division 1	NFPA 496 (FM 3620)	
	(PY)	CA	Class II	Division 1	NFPA 496	
	(PZ)	US	Class II	Division 2	NFPA 496 (FM 3620)	
	(PZ)	CA	Class II	Division 2	NFPA 496	
	AEx pD	US		Zone 21	ISA 61241-2	
Intrinsic Safety	(IS)	US	Class II	Division 1	UL 913 / FM 3610	Limit energy of sparks and surface temperature
	(IS)	CA	Class II	Division 1	CSA C22.2 No. 157	
	AEx iaD	US		Zone 20	ISA 61241-11	
	AEx ibD	US		Zone 21	ISA 61241-11	
	(IS)	US	Class III	Division 1	UL 913 / FM 3610	
	(IS)	CA	Class III	Division 1	CSA C22.2 No. 157	

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.

Atmosphere Groups

Substance:	Hazard Class:	NEC 500:	NEC 505:
Acetylene	Class I Flammable Gases	Group A	IIC
Hydrogen		Group B	IIC
Ethylene		Group C	IIB
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		

Temperature Classification

Max. Surface Temperature	NEC® 500 CEC®	NEC® 505	IEC - Group II
450° C (842°F)	T1	T1	T1
300° C (572°F)	T2	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	T3
180° C (356°F)	T3A		
165° C (329°F)	T3B		
160° C (320°F)	T3C		
135° C (275°F)	T4	T4	T4
120° C (248°F)	T4A		
100° C (212°F)	T5	T5	T5
85° C (185°F)	T6	T6	T6

Note: For Group I (ATEX/IEC) applications, electrical apparatus has fixed temperature limits i.e., 150° C and 450°C.

Classification of Divisions and Zones

Type of Area	NEC and CEC*	ATEX and IEC	Definitions
Continous hazard	Division 1	Zone 0 / Zone 20	A place in which an explosive atmosphere is continually present
Intermittent hazard	Division 1	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

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

Enclosure Type Ratings

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

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 IEC Ex Certification Body (Ex CBs).

Manufacturers holding certificates of conformity may affix the IECEx Mark of Conformity to equipment that 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 or visit www.IECEx.com.

The IECEx Scheme can help you obtain these and other certification marks for countries around the world:

Brazil Russia China Korea

Other Applicable CE Directives

Electromagnetic Compatibility (EMC)	Directive 2004/108/EC
Machinery	Directive 2006/42/EC
Pressure Equipment	Directive 97/23/EC
Low voltage (exludes 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 [*ATEX only]

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; *Equipment Category; *Environment; Explosion Protection; Type of Protection; Gas group; Temperature Class (T1-T6); Equipment Protection Level

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	Gb	1,2	IEC 60079-28	Inherently safe protected by shutdown
	Op sh	Ga	0,1,2	IEC 60079-28	
	Op is	Ga	0,1,2	IEC 60079-28	
Increased safety	e	Gb	1,2	IEC 60079-7	No arcs, sparks or hot surfaces. Enclosure IP54 or better
Type 'n' (non-sparking)	nA	Gc	2	IEC 60079-15	
Flameproof	d	Gb	1,2	IEC 60079-1	Contain the explosion, quench the flame
Type 'n' (enclosed break)	nC	Gc	2	IEC 60079-15	
Quartz/sand filled	q	Gb	1,2	IEC 60079-5	Quench the flame
Intrinsic safety	ia	Ga	0,1,2	IEC 60079-11	Limit the energy of sparks and surface temperatures
	ib	Gb	1,2	IEC 60079-11	
	ic	Gc	2	IEC 60079-11	
Pressurized	px	Gb	1,2	IEC 60079-2	Keep the flammable gas out
	py	Gb	1,2	IEC 60079-2	
	pz	Gc	2	IEC 60079-2	
Type 'n' (sealing & hermetic sealing)	nC	Gc	2	IEC 60079-15	
Type 'n' (restricted breathing)	nR	Gc	2	IEC 60079-15	
Encapsulation	ma	Ga	0,1,2	IEC 60079-18	
	mb	Gb	1,2	IEC 60079-18	
	mc	Gc	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	
Enclosure	ta	Da	20	IEC 60079-31	Standard protection for dusts, rugged tight enclosure
	tb	Db	21		
	tc	Dc	22		
Intrinsic safety	iaD	Da	20	IEC 61241-11	Similar to enclosure, but with some relaxations if circuit inside is intrinsically safe
	ibD	Db	21		
	icD	Dc	22		
Encapsulation	ma	Da	20	IEC 60079-18	Protection by encapsulation of incendive parts
	mb	Db	21		
	mc	Dc	22		
Pressurized	pD	Db	21,22	IEC 61241-4	Protection by pressurisation of enclosure
		Dc	22		
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
flameproof enclosure	d	-	1,2,21,22	EN 13463-3	
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
Pressurization	p	-	1,2, 21,22	EN 60079-2 EN 61241-4	Enclosure is purged and pressurised 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

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
3	Objects > 2.5mm	3	Spraying
4	Objects > 1.0mm	4	Splashing
5	Dust-protected	5	Jetting
6	Dust-tight	6	Powerful jetting
		7	Temporary immersion
		8	Continuous immersion

Atmosphere Groups [ATEX and IECEx]

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

Equipment Groups [ATEX and IECEx]

Equipment Group	Equipment Category	Atmosphere	Protection Level	Required Protection Performance & Operation
I (Mines with firedamp)	M1	Methane & Dust	Very High	• Two Faults, Remain energised and functioning
I (Mines with firedamp)	M2	Methane & Dust	High	• Severe normal operation, De-energise in exp. atm.
II (all other areas)	1	Gas, Vapour, Mist, Dust	Very High	• Two Faults
II (all other areas)	2	Gas, Vapour, Mist, Dust	High	• One Fault
II (all other areas)	3	Gas, Vapour, Mist, Dust	Low	• Normal operation

Equipment Categories & Protection Levels

ATEX Category	Equipment Protection Levels	Typical Zone Suitability
1 G	Ga	Equip. suitable for Zones 0,1,2
1 D	Da	Equip. suitable for Zones 20,21,22
2 G	Gb	Equip. suitable for Zones 1,2
2 D	Db	Equip. suitable for Zones 21,22
3 G	Gc	Equip. suitable for Zone 2
3 D	Gd	Equip. suitable for Zone 22

ATEX Categories v Zones of Use

Equipment Category ATEX 94/9/EC	Zone of Use: Gas, Vapours, & Mist	Zone of Use: Dust
Cat 1	Zone 0, 1 & 2	Zone 20, 21 & 22
Cat 2	Zone 1 & 2	Zone 21 & 22
Cat 3	Zone 2	Zone 22

Note: Unless the explosion protection risk assessment states otherwise.

Contact Intertek with questions about Hazardous Locations testing and certification:

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