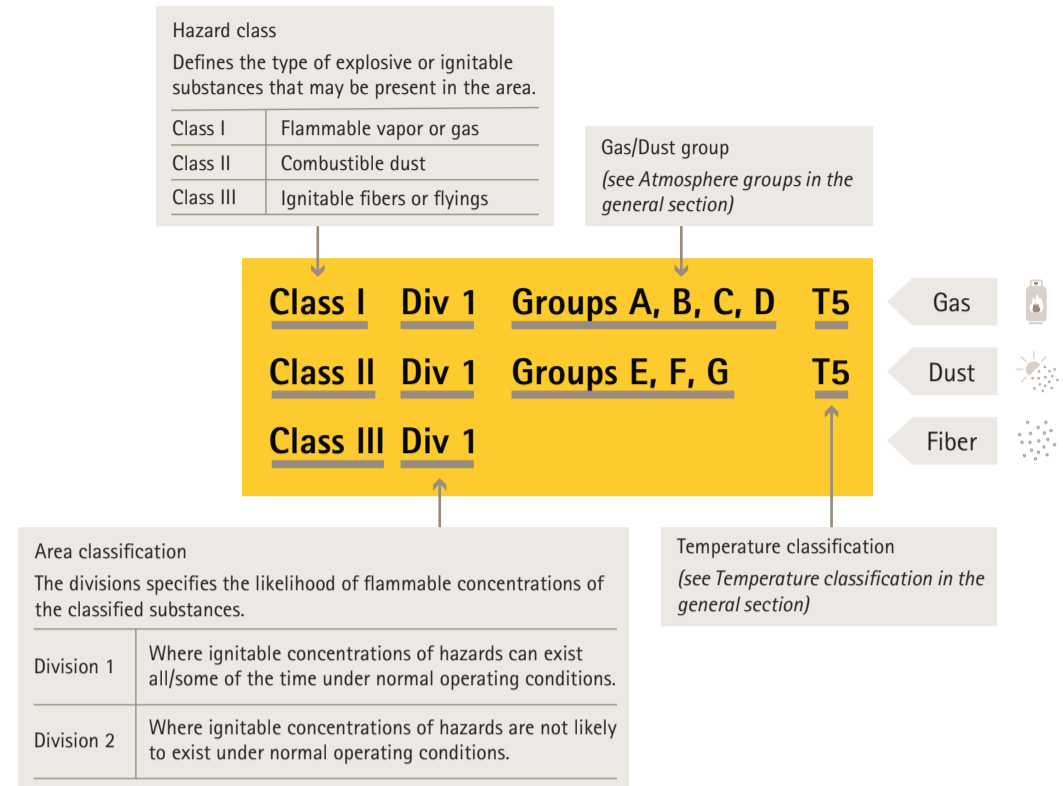


Certifications for explosion protected products – Standards electrical

North American marking Division system

Reference: NFPA70 (National Electric Code) 500-503 (US)
Reference: CSA C22.1 Appendix J (CA)



Standards - North American marking, Division system

Type of protection	Country	Permitted division	Standard FM, UL CSA C22.2	Definition
General requirements	USA	1, 2	FM 3600	Applies to all protection concepts, general safety
	CAN	1, 2	CSA No 0	
Non-incident	USA	2	FM 3611 UL 121201	No arcs, sparks or hot surfaces
	CAN	2	CSA No 213	
Explosion-proof	USA	1	FM 3615 UL 1203	Contain the explosion and quench the flame
	CAN	1	CSA No 30	
Intrinsic safety	USA	1	FM 3610 UL 913	Energy limitation in sparks and hot surfaces
	CAN	1	CSA 60079-11	
Pressurized	USA	1	FM 3620 NFPA 496	Exclude the flammable gas
	USA	2		
	CAN	1, 2	NFPA 496	

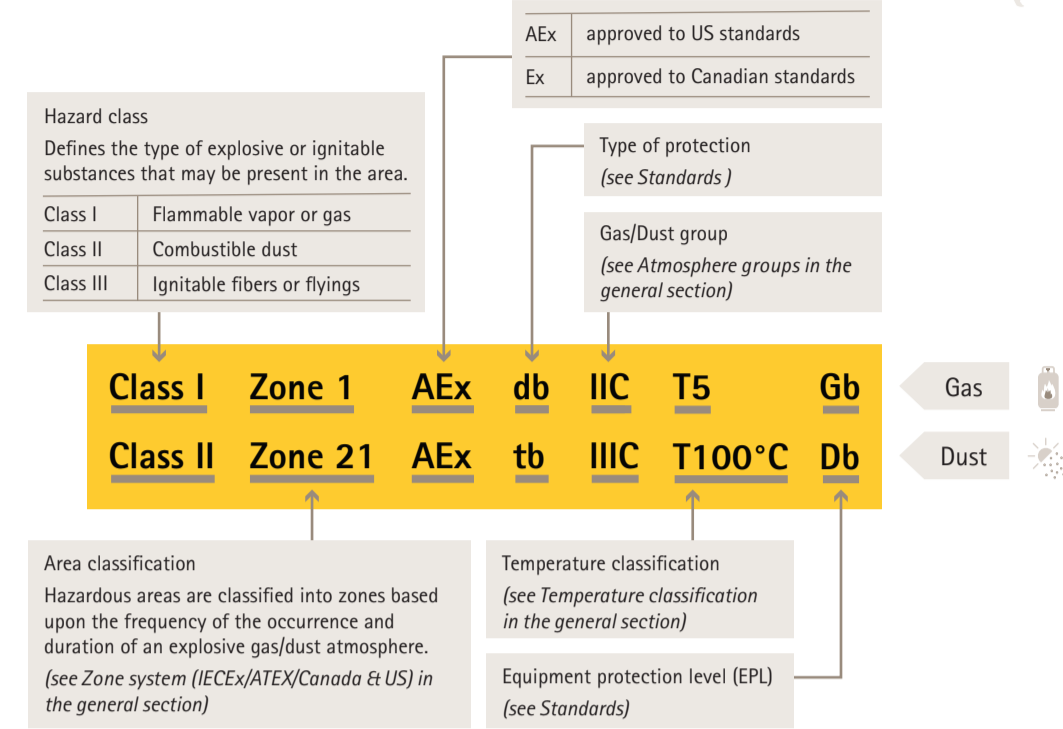
Type of protection	Country	Permitted division	Standard FM, UL CSA C22.2	Definition
General requirements	USA	1, 2	FM 3600	Applies to all protection concepts
	CAN	1, 2	CSA No 0	
Dust ignition proof	USA	1	FM 3616 UL 1203	Keep the combustible dust out
	CAN	1	CSA No 25	
Dust protected	USA	2	FM 3611 UL 121201	Keep the combustible dust out
	CAN	2	CSA No 213	
Pressurized	USA	1	FM 3620 NFPA 496	Keep the flammable gas out
	USA	2		
	CAN	1, 2	NFPA 496	
Intrinsic safety	USA	1	FM 3610 UL 913	Energy limitation in sparks and hot surfaces
	CAN	1	CSA 60079-11	

Type of protection	Country	Permitted division	Standard FM, UL CSA C22.2	Definition
General requirements	USA	1, 2	FM 3600	Applies to all protection concepts
	CAN	1, 2	CSA No 0	
Fiber and flying protection	USA	1, 2	UL 121201	Keep the ignitable fibers & flyings out
	CAN	1, 2	CSA No 213	
Intrinsic safety	USA	1	UL 60079-11	Energy limitation in sparks and hot surfaces
	CAN	1	CSA 60079-11	

Notice!
The standards listed in the tables regarding North America deal with Hazardous Locations (HazLoc) approvals only. North American approvals require both HazLoc and Ordinary Locations (OrdLoc) approvals before certification is complete.

North American marking Zone system

Reference: NFPA70 (National Electric Code) 500-506 (US)
Reference: CSA C22.1 818 (CA)



Standards - North American marking, Zone system

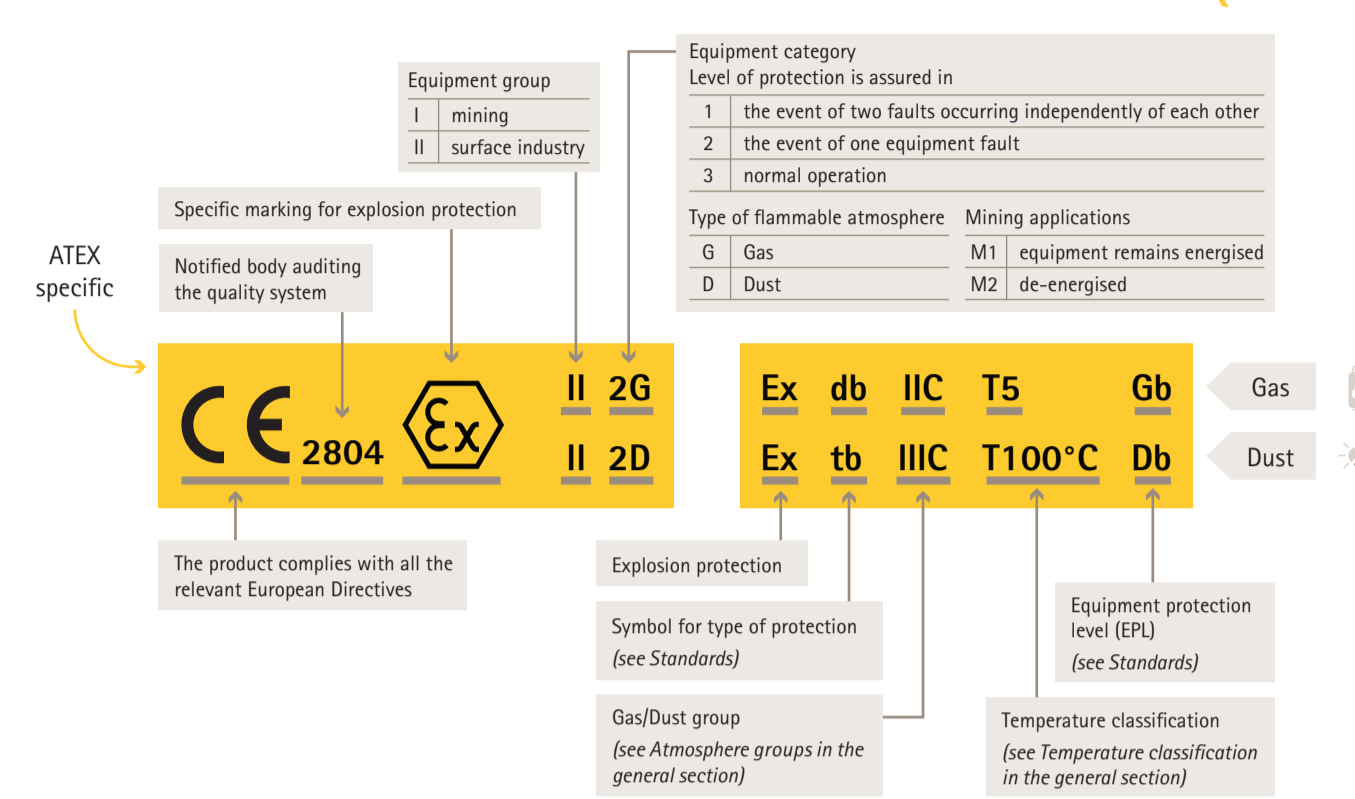
Type of protection	Symbol	EPL	Country	Permitted zone	Standard UL CSA C22.2	Definition
General requirements	AEx	Ga, Gb, Gc	USA	0, 1, 2	UL 60079-0	Applies to all protection concepts, general safety
	Ex	Ga, Gb, Gc	CAN	0, 1, 2	CSA 60079-0	
Increased safety	AEx eb	Gb	USA	1	UL 60079-7	No arcs, sparks or hot surfaces. Enclosure IP 54 or better
	Ex eb	Gb	CAN	1	CSA 60079-7	
Non-sparking	AEx na	Gc	USA	2	UL 60079-15	No arcs, sparks or hot surfaces. Enclosure IP 54 or better
	Ex na	Gc	CAN	2	CSA 60079-15	
Flameproof	AEx da	Ga*	USA	1	UL 60079-1	Contain the explosion and quench the flame
	AEx db	Gb	USA	1	UL 60079-1	
Enclosed break	AEx nc	Gc	USA	2	UL 60079-15	*applies to catalytic sensors only
	Ex nc	Gc	CAN	2	CSA 60079-15	
Powder filled	AEx q	Gb	USA	1	UL 60079-5	Energy limitation in sparks and hot surfaces
	Ex q	Gb	CAN	1	CSA 60079-5	
Intrinsic safety	AEx ia	Ga	USA	0	UL 60079-11	Energy limitation in sparks and hot surfaces
	Ex ia	Ga	CAN	0	CSA 60079-11	
Pressurized	AEx pxb	Gb	USA	1	UL 60079-2	Keep the flammable gas out
	AEx pyb	Gb	CAN	1	CSA 60079-2	
Liquid immersion	AEx oc	Gc	USA	2	UL 60079-6	Energy limitation in sparks and hot surfaces
	Ex oc	Gc	CAN	2	CSA 60079-6	
Restricted breathing	AEx nr	Gc	USA	2	UL 60079-15	To prevent ignition by thermal, photochemical or plasma means
	Ex nr	Gc	CAN	2	CSA 60079-15	
Optical radiation	AEx op is	Ga, Gb, Gc	USA	0, 1, 2	UL 60079-28	To prevent ignition by thermal, photochemical or plasma means
	AEx op sh	Ga, Gb, Gc	USA	0, 1, 2	UL 60079-28	
Optical radiation	Ex op is	Ga, Gb, Gc	CAN	0, 1, 2	CSA 60079-28	To prevent ignition by thermal, photochemical or plasma means
	Ex op sh	Ga, Gb, Gc	CAN	0, 1, 2	CSA 60079-28	

Type of protection	Symbol	EPL	Country	Permitted zone	Standard UL CSA C22.2	Definition
General requirements	AEx	Da, Db, Dc	USA	20, 21, 22	UL 60079-0	Applies to all protection concepts
	Ex	Da, Db, Dc	CAN	20, 21, 22	CSA 60079-0	
Protection by enclosure	AEx ta	Da	USA	21	UL 60079-31	Keep combustible dust out
	AEx tb	Db	USA	21	UL 60079-31	
	AEx tc	Dc	USA	21	UL 60079-31	
	Ex ta	Da	CAN	21	CSA 60079-31	
Encapsulation	AEx ma	Da	USA	21	UL 60079-18	Keep combustible dust out
	AEx mb	Db	USA	21	UL 60079-18	
	AEx mc	Dc	USA	21	UL 60079-18	
	Ex ma	Da	CAN	21	CSA 60079-18	
Pressurization	AEx pxb	Db	USA	21	UL 60079-2	Energy limitation in sparks and hot surfaces
	AEx pyb	Db	CAN	21	CSA 60079-2	
	AEx pzc	Dc	USA	21	UL 60079-2	
	Ex pxb	Db	CAN	21	CSA 60079-2	
Intrinsic safety	AEx ia	Da	USA	21	UL 60079-11	Energy limitation in sparks and hot surfaces
	AEx ib	Db	USA	21	UL 60079-11	
	AEx ic	Dc	USA	21	UL 60079-11	
	Ex ia	Da	CAN	21	CSA 60079-11	
Optical radiation	AEx op is	Da, Db, Dc	USA	20, 21, 22	UL 60079-28	To prevent ignition by thermal, photochemical or plasma means
	AEx op sh	Da, Db, Dc	USA	20, 21, 22	UL 60079-28	
	Ex op is	Da, Db, Dc	CAN	20, 21, 22	CSA 60079-28	
	Ex op sh	Da, Db, Dc	CAN	20, 21, 22	CSA 60079-28	

Notice!
The standards listed in the tables regarding North America deal with Hazardous Locations (HazLoc) approvals only. North American approvals require both HazLoc and Ordinary Locations (OrdLoc) approvals before certification is complete.

ATEX and IECEx directive marking Zone system

Reference: ATEX Directive 2014/34/EU



Standards - ATEX and IECEx directive marking, Zone system

Type of protection	Symbol	IECEx EPL	ATEX category	Permitted zone	Standard EN - ATEX IEC - IECEx	Definition
General requirements	N/A	Ga	1	0	60079-0	Applies to all protection concepts
		Gb	2	1	60079-0	
		Gc	3	2	60079-0	
Increased safety	eb	Gb	2	1	60079-7	No arcs, sparks or hot surfaces. Enclosure IP 54 or better
	ec	Gc	3	2	60079-15	
Type n (non-sparking)	na	Gc	3	2	60079-15	Contain the explosion and quench the flame
Flameproof	da*	Ga*	1*	0*	60079-1	*applies to catalytic sensors only
	db	Gb	2	1	60079-1	
	dc	Gc	3	2	60079-15	
Type n (enclosed break)	nc	Gc	3	2	60079-15	Quench the flame
Quartz/Sand filled	q	Gb	2	1	60079-5	Energy limitation in sparks and hot surfaces
		Gc	3	2	60079-5	
Intrinsic safety	ia	Ga	1	0	60079-11	Keep the flammable gas out
	ib	Gb	2	1	60079-11	
	ic	Gc	3	2	60079-11	
Pressurized	pxb	Gb	2	1	60079-2	Energy limitation in sparks and hot surfaces
	pyb	Gb	2	1	60079-2	
Encapsulation	ma	Ga	1	0	60079-18	To prevent ignition by thermal, photochemical or plasma means
	mb	Gb	2	1	60079-18	
Liquid immersion	oc	Gc	3	2	60079-6	To prevent ignition by thermal, photochemical or plasma means
	nc	Gc	3	2	60079-15	
Type n (restricted breathing)	nr	Gc	3	2	60079-15	
Optical radiation	Op is	Ga	1	0	60079-28	To prevent ignition by thermal, photochemical or plasma means
	Op sh	Ga	1	0	60079-28	
	Op pr	Gb	2	1	60079-28	

Type of protection	Symbol	IECEx EPL	ATEX category	Permitted zone	Standard EN - ATEX IEC - IECEx	Definition
General requirements	N/A	Da	1	20	60079-0	Applies to all protection concepts
		Db	2	21	60079-0	
		Dc	3	22	60079-0	
Enclosure	ta	Da	1	20	60079-31	Prevents dust coming into contact with electrical parts
	tb	Db	2	21	60079-31	
	tc	Dc	3	22	60079-31	
	Ex ta	Da	1	20	60079-31	
Pressurized	pxb	Db	2	21	60079-2	Energy limitation in sparks and hot surfaces
	pyb	Db	2	21	60079-2	
	pzc	Dc	3	22	60079-2	
	Ex pxb	Db	2	21	60079-2	
Encapsulation	ma	Ga	1	20	60079-18	To prevent ignition by thermal, photochemical or plasma means
	mb	Gb	2	21	60079-18	
	mc	Gc	3	22	60079-18	
	Ex ma	Da	1	20	60079-18	
Intrinsic safety	ia	Da	1	20	60079-11	Energy limitation in sparks and hot surfaces
	ib	Db	2	21	60079-11	
	ic	Dc	3	22	60079-11	
	Ex ia	Da	1	20	60079-11	
Optical radiation	Op is	Da	1	20	60079-28	To prevent ignition by thermal, photochemical or plasma means
	Op sh	Da	1	20	60079-28	
	Op pr	Db	2	21	60079-28	
	Ex op is	Da	1	20	60079-28	

Correlation between EPL, ATEX category, and zones

EPL	Category	Zone
Ga	1G	0
Gb	2G	1
Gc	3G	2
Da	1D	20
Db	2D	21
Dc	3D	22
Ma	M1	Mining Application (Equipment can remain energised in the presence of flammable atmosphere - firedamp)
Mb	M2	Mining Application (Equipment to be de-energised when flammable atmosphere is detected - firedamp)

Higher tiers cover lower tiers. E.g., equipment suitable for EPL Ga is also permitted for Gb and Gc.

General

Zone system (IECEx/ATEX/Canada and US)

Zone	Gas	Dust	Definition
0	20		A potentially flammable atmosphere is present continuously or for long periods or frequently.
1	21		A potentially flammable atmosphere is likely to occur in normal operation occasionally.
2	22		A potentially flammable atmosphere is not likely to occur in normal operation but, if it does occur, will persist for a short period only.

Higher tiers cover lower tiers, e.g., equipment suitable for use in Zone 0 is also permitted in Zone 1 and 2.

Correlation between divisions and zones

Type of area	Division	Zone Gas	Zone Dust	Definition
Continuous hazard	1	0	20	A place in which a potentially flammable atmosphere is continuously present.
		1	21	Division 1 >10h/year Zone 0, 20 >1000h/year
Intermittent hazard	1	1	21	A place in which a potentially flammable atmosphere is likely to occur in normal operation.
		2	22	Division 1 >10h/year Zone 1, 21 >10h/year
Abnormal hazard	2	2	22	A place in which a potentially flammable atmosphere is not likely to occur in normal operation, but may occur for short periods.
		2	22	Division 2 <10h/year Zone 2, 22 <10h/year

Higher tiers cover lower tiers. E.g., equipment suitable for use in Division 1 is also permitted in Division 2.

Atmosphere groups

Substance	Hazard class	Division groups	Zone groups
Acetylene	Class I flammable gases	Group A	IIC
Hydrogen		Group B	IIC or IIB + H2*
Ethylene		Group C	IIB
Propane		Group D	IIA
Methane	Class II combustible dusts	Group E***	IIA**
Combustible metal dusts		Group F	IIC
Combustible carbonaceous dusts		Group G	IIB
Combustible dusts not in Group E or F (flour, grain, wood, plastics, chemicals)			IIIB
Combustible fibers and flyings	Class III fibers and flyings	Not applicable	IIIA

* Hydrogen is a group IIC gas but a test for H2 can be added in the IIB approval.
** Methane is a group IIA gas for non mining applications.
*** Group E is applicable to Class II Division 1 only.

Temperature classification

Maximum surface temperature (°C)	Division system	Zone system
450	T1	T1
300	T2	
280	T2A	
260	T2B	T2
230	T2C	
215	T2D	
200	T3	
180	T3A	
165	T3B	T3
160	T3C	
135	T4	
120	T4A	T4
100	T5	T5
85	T6	T6