



# A Guide to Hazardous Locations & Product Certification

## North America



### EXAMPLES OF NORTH AMERICAN MARKING

Division System	
Class I, Division 1, Groups A, B, C, D T4	
Class I	Hazard class
Division 1	Area classification
Groups A, B, C, D	Gas group
T4	Temperature classification
Class II, Division 1, Groups E, F, G	
Class II	Hazard class
Division 1	Area classification
Groups E, F, G	Dust group

Zone System	
Class I, Zone 0, AEx ia IIC T4	
Class I	Hazard class
Zone 0	Area classification
AEx	Approved to US standards (Ex - Canadian standards)
ia	Protection concept (example is intrinsic safety)
IIC	Gas group
T4	Temperature classification

### STANDARDS ELECTRICAL

#### Division System, Class I (Gas, Vapour & Mists)

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

Note: The standards listed above deal with Hazardous Locations (HazLoc) approvals only. North American approvals require both HazLoc and Ordinary Locations (OrdLoc) approvals before certification is complete.

#### Division System, Class II (Dusts)

Type of Protection	Code	Country	Permitted Division	Standard FM, UL, CSA C22.2	Definition
General Requirements	USA CAN	USA CAN	1, 2 1, 2	FM 3600 CSA No 0	Applies to all protection concepts
Dust Ignition Proof	—	USA CAN	1 1	UL 1203 FM 3616 CSA No 25	—
Dust Protected	—	USA CAN	2 2	UL 121201 FM 3611 CSA No 213	Keep the combustible dust out
Pressurized	PX PY PZ	USA CAN CAN	1 1 2	FM 3620 NFPA 496 NFPA 496	—
Intrinsic Safety	IS	USA CAN	1 1	UL 913 FM 3610 CSA 60079-11	Energy limitation in sparks and hot surfaces

Note: The standards listed above deal with Hazardous Locations (HazLoc) approvals only. North American approvals require both HazLoc and Ordinary Locations (OrdLoc) approvals before certification is complete.

#### Division System, Class III (Fibres & Flyings)

Type of Protection	Code	Country	Permitted Division	Standard FM, UL, CSA C22.2	Definition
General Requirements	—	USA CAN	1, 2 1, 2	FM 3600 CSA No 0	Applies to all protection concepts
Fibre & Flying Protection	—	USA CAN	1, 2 1, 2	UL 121201 CSA No 213	Keep the ignitable fibres & flyings out
Intrinsic Safety	IS	USA CAN	1 1	UL 60079-11 CSA 60079-11	Energy limitation in sparks and hot surfaces
Optical Radiation	AEx op is AEx op pr AEx op sh	USA USA CAN	20, 21, 22 20, 21, 22 20, 21, 22	UL 60079-28 UL 60079-28 CSA 60079-28	To prevent ignition by thermal, photochemical or plasma means

Note: The standards listed above deal with Hazardous Locations (HazLoc) approvals only. North American approvals require both HazLoc and Ordinary Locations (OrdLoc) approvals before certification is complete.

#### Zones System Class I (Gas, Vapour & Mists)

Type of Protection	Code	Country	Permitted Zone	Standard UL, CSA C22.2	Definition
General Requirements	AEx Ex	USA CAN	0, 1, 2 0, 1, 2	UL 60079-0 CSA 60079-0	Applies to all protection concepts, general safety
Increased Safety	AEx eb AEx ec AEx ed	USA CAN CAN	1 2 2	UL 60079-7 CSA 60079-7	No arcs, sparks or hot surfaces. Enclosure IP 54 or better
Non-sparking	AEx nA	USA CAN	2 2	UL 60079-15 CSA 60079-15	—
Flameproof	AEx da AEx db AEx dc AEx dd	USA CAN CAN CAN	0* 1 1 2	UL 60079-1 UL 60079-1	Contain the explosion and quench the flame.
Enclosed Break	AEx nC	USA CAN	2 2	UL 60079-15 CSA 60079-15	*Applies to catalytic sensors only
Powder Filled	AEx q Ex q	USA CAN	1 1	UL 60079-5 CSA 60079-5	—
Intrinsic Safety	AEx ia AEx ib AEx ic Ex ia Ex ib Ex ic	USA USA USA CAN CAN CAN	0 1 1 0 1 1	UL 60079-11 UL 60079-11 CSA 60079-11	Energy limitation in sparks and hot surfaces
Pressurized	AEx pb AEx pbz AEx pbz Ex pb Ex pbz	USA USA CAN CAN CAN	1 2 2 1 1	UL 60079-2 UL 60079-2 CSA 60079-2	—
Encapsulation	AEx mb AEx mc Ex ma Ex mb Ex mc	USA USA CAN CAN CAN	0 1 1 1 1	UL 60079-18 UL 60079-18 CSA 60079-18	Keep the flammable gas out
Oil Immersion	AEx ob AEx oc Ex ob Ex oc	USA USA CAN CAN	1 2 1 2	ISA 60079-6 CSA 60079-6	—
Restricted Breathing	AEx nR Ex nR	USA CAN	2 2	UL 60079-15 CSA 60079-15	—
Optical Radiation	AEx op is AEx op pr AEx op sh Ex op is Ex op pr Ex op sh	USA USA CAN CAN CAN CAN	0, 1, 2 0, 1, 2 0, 1, 2 1, 2 1, 2 1, 2	UL 60079-28 UL 60079-28 CSA 60079-28	To prevent ignition by thermal, photochemical or plasma means

Equipment suitable for use in a Zone 0 is permitted in a Zone 1 or 2

Equipment suitable for use in a Zone 1 is permitted in a Zone 2, but not in a Zone 0

Equipment suitable for use in a Zone 2 is not permitted in either a Zone 0 or Zone 1

Note: The standards listed above deal with Hazardous Locations (HazLoc) approvals only. North American approvals require both HazLoc and Ordinary Locations (OrdLoc) approvals before certification is complete.

#### Zones System Class II (Dusts)

Type of Protection	Code	Country	Permitted Zone	Standard UL, CSA C22.2	Definition
General Requirements	AEx Ex	USA CAN	20, 21, 22 20, 21, 22	UL 60079-0 CSA 60079-0	Applies to all protection concepts
Protection by Enclosure	AEx ta AEx tb AEx tc Ex ta Ex tb Ex tc	USA USA CAN CAN CAN CAN	20 20 20 20 20 20	UL 60079-31 UL 60079-31 CSA 60079-31	—
Encapsulation	AEx ma AEx mb AEx mc Ex ma Ex mb Ex mc	USA USA CAN CAN CAN CAN	20 21 22 20 21 22	UL 60079-18 UL 60079-18 CSA 60079-18	Keep combustible dust out
Pressurization	AEx pb AEx pbz AEx pbz Ex pb Ex pbz	USA USA CAN CAN CAN	21 21 22 21 21	UL 60079-2 UL 60079-2 CSA 60079-2	—
Intrinsic Safety	AEx ia AEx ib AEx ic Ex ia Ex ib Ex ic	USA USA USA CAN CAN CAN	20 21 22 20 21 22	UL 60079-11 UL 60079-11 CSA 60079-11	Energy limitation in sparks and hot surfaces
Optical Radiation	AEx op is AEx op pr AEx op sh Ex op is Ex op pr Ex op sh	USA USA CAN CAN CAN CAN	20, 21, 22 20, 21, 22 20, 21, 22 20, 21, 22 20, 21, 22 20, 21, 22	UL 60079-28 UL 60079-28 CSA 60079-28	To prevent ignition by thermal, photochemical or plasma means

Equipment suitable for use in a Zone 20 is permitted in a Zone 21 or 22

Equipment suitable for use in a Zone 21 is permitted in a Zone 22, but not in a Zone 20

Note: The standards listed above deal with Hazardous Locations (HazLoc) approvals only. North American approvals require both HazLoc and Ordinary Locations (OrdLoc) approvals before certification is complete.

## General

### AREA CLASSIFICATION

Class & Divisions System (Canada & US Only)	
Class I	Flammable gases, vapours or liquids *
Class II	Combustible dusts *
Class III	Ignitable fibres and flyings *

Division 1	Where ignitable concentrations of * can exist all of the time or some of the time under normal operating conditions.
Division 2	Where ignitable concentrations of * are not likely to exist under normal operating conditions.

Groups		
CLASS I	CLASS II	CLASS III
A - Acetylene	E - Metal Dust	None Specified
B - Hydrogen	F - Coal Dust	
C - Ethylene	G - Grain Dust	
D - Propane		

### MATERIAL GROUPINGS

Division System		Zone System	
Material	Class/Group	Material	Group
Acetylene	Class I, Group A	Acetylene	IIC
Hydrogen	Class I, Group B	Hydrogen	IIB
Ethylene	Class I, Group C	Ethylene	IIB
Propane	Class I, Group D	Propane	IIA
Methane (Mines)	N/A (see note 1)	Methane (Mines)	I
Metal Dusts	Class II, Group E	Conductive Dusts	IIC
Coal Dusts	Class II, Group F	Non-Conductive Dusts	IIB
Grain Dusts	Class II, Group G		
Fibers/Flyings	Class III	Combustible Flyings	IIIA

Note 1: Mines are not within the scope of the Division system (Canada & US)

#### Material Ex Classifications

Gas	Ignition Temp (°C)	Apparatus Group	Temperature Class
Ammonia	630	IIA	T1
Hydrogen	560	IIC	T1
Methane	537	IIA	T1
Propane	450	IIA	T2
Ethylene	425	IIB	T2
Butane	372	IIA	T2
Acetylene	305	IIC	T2
Cyclohexane	259	IIA	T3
Kerosene	210	IIA	T3
Di-ethyl Ether	160	IIB	T4
Carbon Disulphide	90	IIC	T6

#### Material Ex Classifications

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

## Contact Us

When you need confidence in the equipment you use in hazardous environments, trust the leader in hazardous locations testing & certification. CSA Group issues more hazardous locations certifications worldwide than any other certification agency. Certify your hazardous locations equipment and connect to global markets fast with the marks you and your customers can trust.

Visit [csagroup.org](http://csagroup.org) today to put our industry-leading knowledge and experience to work for your products.

Zones System (IECEX/ATEX/Canada & US)		
Hazardous areas are classified into Zones based upon the frequency of the occurrence and duration of an explosive gas/dust atmosphere, as follows:		
ZONE	Gas	Dust
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.

Reference: EN 60079-10

Correlation Between Divisions & Zones			
Type of Area	Divisions	Zones	Definition
Continuous Hazard	1	0, 20	A place in which a PFA is continuously present
Intermittent Hazard	1	1, 21	A place in which a PFA is likely to occur in normal operation.
Abnormal Hazard	2	2, 22	A place in which a PFA is not likely to occur in normal operation, but may occur for short periods.

Both Canada and the US are making greater use of the Zone system

PFA = Potentially Flammable Atmosphere

### GAS & DUST GROUPS

Gas Groups		Dust Groups	
Gas Group	Typical Gas	Dust Group	Type
I	Methane	IIIA	Combustible flyings
IIA	Propane	IIIB	Non-conductive dust
IIB	Ethylene	IIC	Conductive dust
IIC	Hydrogen		

### TEMPERATURE CLASSIFICATION

Maximum Surface Temperature (°C)	Divisions	Zones
450	T1	T1
300	T2	T2
280	T2	—
260	T2B	—
230	T2C	—
215	T2D	—
200	T3	T3
180	T3A	—
165	T3B	—
160	T3C	—
135	T4	T4
120	T4A	—
100	T5	T5
85	T6	T6

### CORRELATION BETWEEN ZONES/EQUIPMENT PROTECTION LEVEL (EPL)/ATEX CATEGORIES

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

G = Gas, D = Dust, M = Mining

## ATEX & IECEx



### Examples of ATEX Directive Marking

CE	0518	Ex	II 2 G
CE	Denotes that a product complies with all the relevant European Directives		
0518	Notified Body Number (Sira Certification Service)		
Ex	Specific marking for explosion protection		
II	Equipment group (Could be I for mining or II for surface industry)		
2	Equipment category (Could be 1, 2, 3 depending upon Zone of intended use)		
G	Type of flammable atmosphere (G = Gas, D = Dust)		
CE	0518	Ex	I M1
M1	Mining applications (M1 = equipment remains energised, M2 = de-energised)		

### STANDARDS ELECTRICAL

#### ATEX & IECEx

##### Zones System (Gas, Vapour & Mists)

Type of Protection	Symbol	IECEX EPL	ATEX Category	Permitted Zone	Standard EN-ATEX IEC-IECEX	Definition
General Requirements	N/A	Ga Gb Gc	1 2 3	0 1 2	60079-0	Applies to all protection concepts
Increased Safety	eb ec	Gb Gc	2 3	1 2	60079-7	No arcs, sparks or hot surfaces. Enclosure IP 54 or better
Type n (non-sparking)	nA	Gc	3	2	60079-15	—
Flameproof	da db dc	Ga* Gb Gc	1* 2 3	0* 1 2	60079-1	Contain the explosion and quench the flame.
Type n (enclosed break)	nC	Gc	3	2	60079-15	*Applies to catalytic sensors only
Quartz/Sand Filled	q	Gb Gc	2 3	1 2	60079-5	Quench the flame
Intrinsic Safety	ia ib ic	Ga Gb Gc	1 2 3	0 1 2	60079-11	Energy limitation in sparks and hot surfaces.
Pressurised	pb pbz pbz	Gb Gc	2 3	1 2	60079-2	—
Encapsulation	ma mb mc	Ga Gb Gc	1 2 3	0 1 2	60079-18	—
Oil Immersion	ob oc	Gb Gc	2 3	1 2	60079-6	Keep the flammable gas out.
Type n (sealing & hermetic sealings)	nC	Gc	3	2	60079-15	—
Type n (restricted breathing)	nR	Gc	3	2	60079-15	—
Optical Radiation	Op is Op sh Op pr	Ga Gb Gc	1 1 2	0 0 1	60079-28	To prevent ignition by thermal, photochemical or plasma means

Equipment suitable for use in a Zone 0 is permitted in a Zone 1 or 2

Equipment suitable for use in a Zone 1 is permitted in a Zone 2, but not in a Zone 0

Equipment suitable for use in a Zone 2 is not permitted in either a Zone 0 or Zone 1