

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
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	1,2	FM 3600	Applies to all protection concepts
		CAN	1,2	CSA No 0	
Non-incendive	NI	USA	2	UL 121201 FM 3611	No arcs, sparks, or hot surfaces
	NI	CAN	2	CSA No 213	
Explosion-proof	XP	USA	1	UL 1203 FM 3615	Contain the explosion & quench the flame
	XP	CAN	1	CSA No 213	
Intrinsic Safety	IS	USA	1	UL 913 FM 3610	Energy limitation in sparks & hot surfaces
	IS	CAN	1	CSA 60079-11	
Pressurized	Type X	USA	1	FM 3620 NFPA 496	Exclude the flammable gas
	Type Y	USA	1		
	Type Z	USA	2		
	Type X	CAN	1	NFPA 496	
	Type Y	CAN	1		
	Type Z	CAN	2		

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	1,2	FM 3600	Applies to all protection concepts
		CAN	1,2	CSA No 0	
Dust Ignition Proof	–	USA	1	UL 1203 FM 3616	Keep the combustible dust out
	–	CAN	1	CSA No 25	
Dust Protected	–	USA	2	UL 121201 FM 3611	
	–	CAN	2	CSA No 213	
Intrinsic Safety	IS	USA	1	UL 913 FM 3610	Energy limitation in sparks & hot surfaces
	IS	CAN	1	CSA 60079-11	
Pressurized	PX	USA	1	FM 3620 NFPA 496	Keep the combustible dust out
	PY	USA	1		
	PZ	USA	2		
	PX	CAN	1	NFPA 496	
	PY	CAN	1		
	PZ	CAN	2		

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	1, 2	FM 3600	Applies to all protection concepts
	–	CAN	1, 2	CSA No 0	
Fibre & Flying Protection	–	USA	1, 2	UL 121201	Keep the ignitable fibres & flyings out
	–	CAN	1, 2	CSA No 213	
Intrinsic Safety	IS	USA	1	UL 60079-11	Energy limitation in sparks & hot surfaces
	IS	CAN	1	CSA 60079-11	

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 Division	Standard FM, UL CSA C22.2	Definition
General Requirements	AEx	USA	0,1,2	UL 60079-0	Applies to all protection concepts
	Ex	CAN	0,1,2	CSA 60079-0	

Increased Safety	AEx eb	USA	1	UL 60079-7	No arcs, sparks, or hot surfaces. Enclosure IP 54 or better.	
	AEx ec	USA	2			
	Ex eb	CAN	1	CSA 60079-7		
	Ex ec	CAN	2			
Non-sparking	AEx nA	USA	2	UL 60079-15		
	Ex nA	CAN	2	CSA 60079-15		
Flameproof	AEx da	USA	0*	UL 60079-1		Contain the explosion and quench the flame. *applies to catalytic sensors only
	AEx db	USA	1			
	AEx dc	USA	2			
	Ex da	CAN	0*	CSA 60079-1		
	Ex db	CAN	1			
	Ex dc	CAN	2			
Enclosed Break	AEx nC	USA	2	UL 60079-15		
	Ex nC	CAN	2	CSA 60079-15		
Powder Filled	AEx q	USA	1	UL 60079-5		
	Ex q	CAN	1	CSA 60079-5		
Intrinsic Safety	AEx ia	USA	0	UL 60079-11	Energy limitation in sparks & hot surfaces	
	AEx ib	USA	1			
	AEx ic	USA	2			
	Ex ia	CAN	0	CSA 60079-11		
	Ex ib	CAN	1			
	Ex ic	CAN	2			
Pressurized	AEx pxb	USA	1	UL 60079-2		Keep the flammable gas out
	AEx pyb	USA	1			
	AEx pzc	USA	2			
	AEx pxb	CAN	1	CSA 60079-2		
	AEx pyb	CAN	1			
	AEx pzc	CAN	2			
Encapsulation	AEx ma	USA	0	UL 60079-18	Keep the flammable gas out	
	AEx mb	USA	1			
	AEx mc	USA	2			
	Ex ma	CAN	0	CSA 60079-18		
	Ex mb	CAN	1			
	Ex mc	CAN	2			
Oil Immersion	AEx ob	USA	1	ISA 60079-6		Keep the flammable gas out
	AEx oc	USA	2			
	Ex ob	CAN	1	CSA 60079-6		
	Ex oc	CAN	2			
Restricted Breathing	AEx nR	USA	2	UL 60079-15		
	Ex nR	CAN	2	CSA 60079-15		

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 Division	Standard FM, UL CSA C22.2	Definition
General Requirements	AEx	USA	0,1,2	UL 60079-0	Applies to all protection concepts
	Ex	CAN	0,1,2	CSA 60079-0	
Intrinsic Safety	AEx ia	USA	0	UL 60079-11	Energy limitation in sparks & hot surfaces
	AEx ib	USA	1		
	AEx ic	USA	2		
	Ex ia	CAN	0	CSA 60079-11	
	Ex ib	CAN	1		
	Ex ic	CAN	2		
Pressurized	AEx pxb	USA	21	UL 60079-2	Keep the combustible gas out
	AEx pyb	USA	21		
	AEx pzc	USA	22		
	AEx pxb	CAN	21	CSA 60079-2	
	AEx pyb	CAN	21		
	AEx pzc	CAN	22		
Encapsulation	AEx ma	USA	20	UL 60079-18	To prevent ignition by thermal, photochemical or plasma means
	AEx mb	USA	21		
	AEx mc	USA	22		
	Ex ma	CAN	20	CSA 60079-18	
	Ex mb	CAN	21		
	Ex mc	CAN	22		
Optical Radiation	AEx op is	USA	20, 21,22	UL 60079-28	To prevent ignition by thermal, photochemical or plasma means
	AEx op pr	USA	21, 22		
	AEx op sh	USA	20, 21, 22		
	Ex op is	CAN	20, 21,22	CSA 60079-28	
	Ex op pr	CAN	21, 22		
	Ex op sh	CAN	20, 21, 22		

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

Equipment suitable for use in a Zone 22 is not permitted in either a Zone 20 or Zone 21

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.

INGRESS PROTECTION CODES [IEC 60529]

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	Powerful jetting
		7	Temporary immersion
		8	Continuous immersion
		9	High pressure and temperature water jet

General

AREA CLASSIFICATION

Class & Division 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		

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

MATERIAL GROUPINGS

Division System		Zone System	
MATERIAL	CLASS/GROUP	MATERIAL	GROUP
Acetylene	Class I, Group A	Acetylene	IIC
Hydrogen	Class I, Group B	Hydrogen	
Ethlene	Class I, Group C	Ethlene	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	IIIC
Coal Dusts	Class II, Group F	Non-conductive Dusts	IIIB
Grain Dusts	Class II, Group G		
Fibers/Flyings	Class III	Combustive 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	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

Dust Typical Ignition Temperatures		
DUST	CLOUD (°C)	LAYER (°C)
Aluminum	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

GAS & DUST GROUPINGS

Gas Groups		Dust Groups	
GAS GROUP	TYPICAL GAS	DUST GROUP	TYPE
I	Methane	IIIA	Combustible flyings
IIA	Propane	IIIB	Non-conductive dust
IIB	Ethylene	IIIC	Conductive dust
IIC	Hydrogen		

Group I – Covers mining applications
Gas Group II – Covers surface and other locations
Dust Group III – Covers surface and other locations

TEMPERATURE CLASSIFICATION

Maximum Surface Temperature (°C)	Divisions	Zones
450	T1	T1
300	T2	T2
280	T2A	–
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)	T3	T3
Mining Application (Equipment to be de-energised when flammable atmosphere is detected – firedamp)	T3A	–

G = Gas, D = Dust, M = Mining

ATEX & IECEx

Examples of ATEX Directive Marking	
	Denotes that a product complies with all the relevant European Directives
	Notified Body Number (Sira Certification Service)
	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)
M1	Mining applications (M1 = equipment remains energised, M2 = de-energised)

Example of Standards Marking - Gas (Marking derived from the EN and/or IEC standards)	
Ex db IIC T4 Gb	
Ex	Denotes explosion protection
db	Denotes type of protection (see protection concepts for alternatives)
IIC	Denotes gas group (see gas groups for alternatives)
T4	Denotes temperature classification (see temp classification for alternatives)
Gb	EPL – Equipment Protection Level (see EPL table for alternatives)

Example of Standards Marking - Dust (Marking derived from the EN and/or IEC standards)	
Ex tb IIIC T135°C Db	
Ex	Denotes explosion protection
tb	Denotes type of protection (see protection concepts for alternatives)
IIIC	Denotes dust group (see gas groups for alternatives)
T135°C	Denotes temperature classification (see temp classification for alternatives)
Db	EPL – Equipment Protection Level (see EPL table for alternatives)

STANDARDS ELECTRICAL

ATEX & IECEx

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

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		
		Gc	3	2		
Increased Safety	eb ec	Gb	2	1	60079-7	No arcs, sparks, or hot surfaces. Enclosure IP 54 or better.
		Gc	3	2		
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. *applies to catalytic sensors only
Type n (enclosed break)	nC	Gc	3	2	60079-15	
Quartz/Sand Filled	q	Gb Gc	2 3	1 2	60079-5	
Intrinsic Safety	ia ib ic	Ga Gb Gc	1 2 3	0 1 2	60079-11	Energy limitation in sparks & hot surfaces
Pressurized	pxb pyb pzc	Gb Gb Gc	2 2 3	1 1 2	60079-2	Keep the flammable gas out
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	
Type n (sealing & hermetic sealing)	nC	Gc	3	2	60079-15	
Type n (restrictive breathing)	nR	Gc	3	2	60079-15	
Optical Radiation	Op is Op sh Op pr	Ga Ga Gb	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

ATEX & IECEx

Zones System, Class II (Dusts)

Type of Protection	Symbol	IECEx EPL	ATEX Category	Permitted Zone	Standard EN-ATEX ICE-IECEx	Definition
General Requirements	N/A	Da Db Dc	1 2 3	20 21 22	60079-0	Applies to all protection concepts
Intrinsic Safety	ia ib ic	Da Db Dc	1 2 3	20 21 22	60079-11	Energy limitation in sparks & hot surfaces
Enclosure	ta tb tc	Da Db Dc	1 2 3	20 21 22	60079-31	Prevents dust coming into contact with electrical parts
Pressurized	pxb pyb pzc	Db Db Dc	2 2 3	21 21 22	60079-2	
Encapsulation	ma mb mc	Ga Gb Gc	1 2 3	20 21 22	60079-18	

Optical Radiation	Op is Op sh Op pr	Da Da Db	1 1 2	20 20 21	60079-28	To prevent ignition by thermal, photochemical or plasma means
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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
 Equipment suitable for use in a Zone 22 is not permitted in either a Zone 20 or Zone 21

STANDARDS NON-ELECTRICAL

ATEX & IECEx

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

Type of Protection	Symbol	IECEx EPL	ATEX Category	Permitted Zone	Standard EN-ATEX IEC-IECEx	Definition
General Requirements	N/A	N/A	1 2 3	0, 1, 2, 20, 21, 22	EN 13463-1	Applies to all protection concepts
Flow Restricted Enclosure	fr	N/A	3	2 22	EN 13463-2	Relies on tight seals, closely matched joints and rugged enclosures.
Flameproof Enclosure	d	N/A	2, 3	2	EN 13463-3	
Constructional Safety	c	N/A	1 2 3	0, 1, 2, 20, 21, 22	EN 13463-5	Ignition hazard eliminated by good engineering practices
Control of Ignition Source	b	N/A	1 2 3	0, 1, 2, 20, 21, 22	EN 13463-6	Control equipment fitted to detect malfunctions
Liquid Immersion	k	N/A	1 2 3	0, 1, 2, 20, 21, 22	EN 13463-8	Enclosure filled with liquid to prevent contact with explosive atmosphere

New Non-Electrical standards for ATEX and IECEx

General Requirements	N/A	Ga Da Gb Db Gc Db	1 2 3	0, 20 1, 21 2, 22	80079-36	Applies to all protection concepts
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Constructional Safety						Ignition hazard eliminated by good engineering practices
Control of Ignition Source	Ex h	Ga Da	1	0, 20	80079-37	Control equipment fitted to detect malfunctions
		Gb Db	2	1, 21		
Liquid Immersion		Gc Db	3	2, 22		Enclosure filled with liquid to prevent contact with explosive atmosphere

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
 Equipment suitable for use in a Zone 22 is not permitted in either a Zone 20 or Zone 21

ATEX Compliance Routes for Non-Electrical Equipment	
Zone	Procedure
0, 20	EU Type Examination (Annex III) and Conformity to type (Annex VI) or Product QA (Annex VII - QAN)
1, 21	Lodge a Technical File ¹ with a Notified Body and Internal Control of Production (Annex VIII)
2, 22	Internal Control of Production (Annex VIII)

Notes 1 (see Zone 1, 21 from the above) - Technical File Contents
General description of the equipment
Ignition Hazard Assessment
Design and manufacturing drawings
Procedure for the safe installation, operation and repair of the equipment
Assessments against the relevant ATEX standards or EHSR's (Essential Health & Safety Requirements)
Calculations and test results where applicable

IECEx Compliance Routes for Non-Electrical Equipment	
Zone	Procedure
0, 20	Certificate of Conformity and QAR (Quality Assurance Report)
1, 21	
2, 22	