

A Guide to Hazardous Locations & Product Certification

Reference: EN 60079-10

Intermittent Hazard

PFA = Potentially Flammable Atmosphere

280

200

GAS & DUST GROUPS

Methane

Propane

Ethylene

Hydrogen

TEMPERATURE CLASSIFICATION

Gas Group II - Covers surface and other locations Dust Group III - Covers surface and other locations

T2A

T2B

T2C

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				
Т4	Temperature classification				

0, 1, 2

UL 60079-0

CSA 60079-0

CSA 60079-7

UL 60079-15

CSA 60079-15

UL 60079-1

UL 60079-15

CSA 60079-15

CSA 60079-5

UL 60079-11

CSA 60079-11

UL 60079-2

CSA 60079-2

UL 60079-18

CSA 60079-18

CSA 60079-6

UL 60079-28

CSA 60079-28

UL 60079-31

CSA 60079-31

UL 60079-18

CSA 60079-18

UL 60079-2

CSA 60079-2

CSA 60079-11

Energy limitation

in sparks and hot

To prevent ignition

CSA 60079-28 or plasma means

Applies to all protection

surfaces, Enclosure IP 54

Contain the explosion and quench the flame.

*applies to catalytic

sparks and hot surfaces

Keep the flammable

To prevent ignition by

or plasma means

CAN

USA USA

CAN CAN CAN

USA

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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.

20, 21, 22

20, 21, 22

20, 21, 22 21, 22 20, 21, 22

0, 1, 2

0, 1, 2 1, 2 0, 1, 2

USA 20, 21, 22 UL 60079-0

CAN 20, 21, 22 CSA 60079-0

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.

AEx ec

AEx nC

Ex nC

AEx q

Ex q

AEx ia AEx ib

AEx ic

AEx pxb

AEx pzc Ex pxb Ex pyb

AEx ma AEx mb

Ex mb

AEx oc

AEx nR

Ex nR

AEx op pr

AEx op sh

Ex op is

Ex op sh

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

Zones System Class II (Dusts)

AEx tb AEx tc

AEx ma AEx mb

Ex mb Ex mc

AEx pxb

AEx pyb

Ex pyb Ex pzc

AEx ia

AEx ic

Ex ia

AEx op is

AEx op sh

Ex op is

Ex op pr

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 <u>not</u> in a Zone 20 Equipment suitable for use in a Zone 22 is **not** permitted in either a Zone 20 or Zone 21

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

Ex op pr

. Radiation

Protection by

Intrinsic Safety

AEx nA USA

Zones System Class I (Gas, Vapour & Mists)

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, general safety
Non-Incendive	NI NI	USA CAN	2	UL 121201 FM 3611 CSA No 213	No arcs, sparks or hot surfaces
Explosion-proof	XP XP	USA CAN	1	UL 1203 FM 3615 CSA No 30	Contain the explosion and quench the flame
Intrinsic Safety	IS IS	USA CAN	1	UL 913 FM 3610 CSA 60079-11	Energy limitation in sparks and hot surfaces
Pressurized	Type X Type Y Type Z Type X Type Y Type Y	USA USA USA CAN CAN	1 1 2 1 1 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)

STANDARDS ELECTRICAL

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

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

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 no operating conditions.					

DIVISION 2	operating conditions.		
	Groups		
CLASSI	CLASS II	CLASS III	
A - Acetylene	E – Metal Dust		
B - Hydrogen	F - Coal Dust		
C - Ethylene	G - Grain Dust	- None Specified	
D - Propane			
		<u> </u>	

MATERIAL GROUPINGS

Division	System	Zone S	system	
Material	Class/Group	Material	Group	
Acetylene	Class I, Group A Acetylene			
Hydrogen	Class I, Group B	Hydrogen	IIC	
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	IIIC	
Coal Dusts	Class II, Group F	Non Conductive Dusts	IIIB	
Grain Dusts	Class II, Group G	Non Conductive Dusts	ШВ	
Fibers/Flyings Class III		Combustible Flyings	IIIA	

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

Material Ex Classifications

Ignition Temp °C	Apparatus Group	Temperature Class
630	IIA	T1
560	IIC	T1
537	IIA	T1
450	IIA	T2
425	IIB	T2
372	IIA	T2
305	IIC	T2
259	IIA	Т3
210	IIA	Т3
160	IIB	T4
90	IIC	T6
	630 560 537 450 425 372 305 259 210 160	630 IIIA 560 IIC 537 IIA 450 IIIA 425 IIB 372 IIA 305 IIC 259 IIA 160 IIB

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	

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

Zones System (IECEx/ATEX/Canada & US)

Correlation Between Divisions & Zones

A potentially flammable atmosphere is present continuously or for long periods or frequently.

A potentially flammable atmosphere is likely to occur in normal

A potentially flammable atmosphere is not likely to occur in normal operation but, if it does occur, will persist for a short period only.

A place in which a PFA is continuously present

A place in which a PFA is not likely to occur in normal operation, but may occur for short periods.

Dust Groups

IIIA

IIIB

IIIC

Combustible flyings

Non-conductive dust

Conductive dust

Zones

Т3

T5

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

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ATEX & IECEX









Example of Standards Marking - Gas

	Examples of ATEX Directive Marking
	(Ex) 1 2 G
CE	Denotes that a product complies with all the relevant European Directives
0518	Notified Body Number (Sira Certification Service)
⟨£x⟩	Specific marking for explosion protection
Ш	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)
	C € ₀₅₁₈
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.
Type n (non-sparking)	nA	Gc	3	2	60079-15	Enclosure IP 54 or better
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	pxb pyb pzc	Gb Gb Gc	2 2 3	1 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
Type n (sealing & hermetic sealing)	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 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 <u>not</u> in a Zone 0 Equipment suitable for use in a Zone 2 is <u>not</u> permitted in either a Zone 0 or Zone 1

ATEX & IECEX Zones System (Dusts)

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

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

	` `						
	Ex	db	IIC	T4	Gb		
Ex			Denotes 6	explosion p	protection		
db	Denotes	type of pr	otection (s	ee protect	ion concepts fo	or alternatives)	
IIC	[Denotes g	as group (see gas gro	oups for alterna	atives)	
T4	Denotes tem	perature	classificati	on (see ter	mp classificatio	on for alternatives)	
Gb	EPL - E	quipment	Protection	n Level (se	e EPL table for	alternatives)	
	Example o (Marking de	f Stal	ndard m the EN	s Mar and/or IE	king – D EC standards	ust)	
	Г.,	I	шС	T12 F 0/	0 Dk		

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

STANDARDS NON-ELECTRICAL

ATEX & IECEX Zones System

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			
Flameproof Enclosure	d	N/A	2, 3	1, 2 21, 22	EN 13463-3	joints and rugged enclosures.			
Constructional Safety	С	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			
	Nev	v Non-Ele	ectrical stan	dards for ATE	X 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			
Constructional Safety		Ga, Da Gb, Db		,					Ignition hazard eliminated by good engineering practices
Control of Ignition Source	Ex h		1, 2, 3	0, 20 1, 21	80079-37	Control equipment fitted to detect malfunctions			
Liquid Immersion		Gc, Db		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 <u>not</u> 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)					

Note 1 (see Zone 1, 21 from the above) - Technical File Contents
General description of the equipment
Ignition Hazard Assessment
Design and manufacturing drawings
Description of the purpose and functionality of the equipment
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					
1, 21	Certificate of Conformity and QAR (Quality Assurance Report)				
2 22					