

# Guide for hazardous areas

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## Hazardous areas according to ATEX and IECEx zones

**Zones - define the type of explosive atmosphere as well as the likelihood of an explosive atmosphere being present**

- 0** - Explosive gas atmosphere present continuously or for long periods
- 1** - Explosive gas atmosphere likely to occur in normal operation
- 2** - Explosive gas atmosphere not likely to occur in normal operation but may be present for short periods
- 20** - Explosive dust atmosphere present continuously or for long periods
- 21** - Explosive dust atmosphere likely to occur in normal operation
- 22** - Explosive dust atmosphere not likely to occur in normal operation but may be present for short periods

**In Canada** new installations must now use the ATEX / IECEx system of Zones instead of Divisions. Existing installations may use either system.

## Hazardous locations according to North American classes and divisions

**Classes - define the type of explosive atmosphere:**

- I** - A location made hazardous by the presence of flammable gas or vapor that may be present in the air in quantities sufficient to produce an explosive or ignitable mixture
- II** - A location made hazardous by the presence of combustible or electrically conductive dust
- III** - A location made hazardous by the presence of easily ignitable fibers or flyings in the air, but not likely to be in suspension in quantities sufficient to produce ignitable mixtures

**Divisions - define the likelihood of an explosive atmosphere being present**

- 1** - A location where a classified hazard exists or is likely to exist under normal conditions
- 2** - A location where a classified hazard does not normally exist but is possible to appear under abnormal conditions

**In the USA**, all installations can use either the Class / Zone or the Class / Division system.

ATEX equipment group	ATEX equipment category and environment type	Zone classification ATEX / IECEx	Required equipment protection level (EPL)	Class / Zone classification US / Canada	Class / Division classification US / Canada
I	M1	N/A	Ma	N/A	Mining
	M2		Mb		
II	1G	Zone 0	Ga	Class I, Zone 0	Class I, Division 1
	2G	Zone 1	Gb	Class I, Zone 1	
	3G	Zone 2	Gc	Class I, Zone 2	Class I Division 2
	1D	Zone 20	Da	Class II, Zone 20	Class II, Division 1
	2D	Zone 21	Db	Class II, Zone 21	
	3D	Zone 22	Dc	Class II, Zone 22	Class II, Division 2, Class III

# Gas and dust groups

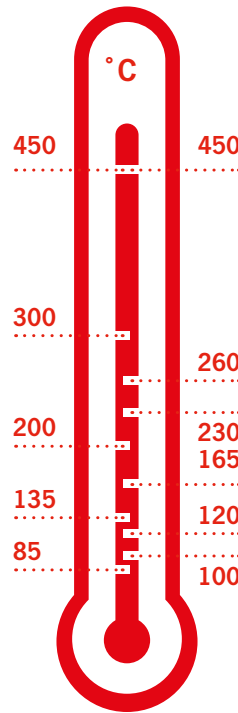
## ATEX, IECEx and US / Canada zones system

## US / Canada class / division system

Gas / dust group	Typical substances	Gas / dust group	Typical substances
IIC	Acetylene	Class I, Group A	Acetylene
IIB + H <sub>2</sub>	Hydrogen	Class I, Group B	Hydrogen
IIB	Ethylene	Class I, Group C	Ethylene
IIA	Propane	Class I, Group D	Propane
IIIC	Conductive Dust	Class II, Group E	combustible Metal Dust
IIIB	Non-conductive Dust	Class II, Group F	combustible carbonaceous dust
		Class II, Group G	combustible dusts not in group E or F
IIIA	Combustible Flyings	Class III	combustible fibres and flyings

Group II & III

Maximum surface temperature of equipment (°C)	Temperature class	Ignition temperature of gas/dust (°C)
450	T1	>450
300	T2	>300 - 450
200	T3	>200 - 300
135	T4	>135 - 200
100	T5	>100 - 135
85	T6	>85 - 100



Class I, II & III

Maximum surface temperature of equipment (°C)	Temperature class	Ignition temperature of gas/dust (°C)
450	T1	>450
300	T2	>300 - 450
280	T2A	>280 - 300
260	T2B	>260 - 280
230	T2C	>230 - 260
215	T2D	>215 - 230
200	T3	>200 - 215
180	T3A	>180 - 200
165	T3B	>165 - 180
160	T3C	>160 - 165
135	T4	>135 - 160
120	T4A	>120 - 135
100	T5	>100 - 120
85	T6	>85 - 100

Note: For Group I mining applications, apparatus has rigid 150°C coal dust and 450°C methane limits rather than T classes.

Common flammable gases, vapours and dust types

Gas vapour	Temperature class	Apparatus group	Typical ignition temperature (°C)	Dusts	Apparatus group	Typical ignition temperature cloud (°C)	Typical ignition temperature layer (°C)
Acetic acid	T1	IIA	427	Aluminium	IIIC	590	>450
Acetone	T1	IIA	465	Coal dust (lignite)	IIIB	380	225
Acetylene	T2	IIC	305	Flour	IIIB	490	340
Ammonia	T1	IIA	651	Grain dust	IIIB	510	300
Butane	T2	IIA	405	Methyl cellulose	IIIB	420	320
Carbon Disulphide	T6	IIC	95	Phenolic resin	IIIB	530	>450
Cyclohexane	T3	IIA	245	Polythene	IIIB	420	(melts)
Di-ethyl ether	T4	IIB	160	PVC	IIIB	700	>450
Ethanol (ethyl alcohol)	T2	IIA	365	Soot	IIIB	810	570
Ethylene	T2	IIB	490	Starch	IIIB	460	435
Gasoline (petrol)	T3	IIA	280	Sugar	IIIB	490	460
Hydrogen	T1	IIC	500				
Kerosene	T3	IIA	295				
Methane (natural gas) (non-mining)	T1	IIA	580				
Methanol (methyl alcohol)	T2	IIA	470				
Methyl ethyl ketone (MEK)	T2	IIB	505				
Propane	T1	IIA	470				
Propan-1-ol (n-propyl alcohol)	T2	IIB	371				
Propan-2-ol (iso-propyl alcohol)	T2	IIA	399				
Toluene	T1	IIA	535				
Xylene	T1	IIA	463				

Gas Groups	
IIA	Propane
IIB	Ethylene
IIC	Hydrogen/Acetylene

Dust Groups	
IIIA	Combustible
IIIB	Non-conductive
IIIC	Conductive

Symbol	Type of protection	Basic concept of protection	Suitable for Zones											Typical EPL	EN / IEC Standard				
			0	1	2	20	21	22	Ga	Gb	Gc	Da	Db			Dc			
e	Increased safety	No arcs, sparks or hot surfaces, enclosure IP54 or better	•	•									•					60079-7	
	Type 'n' (non sparking)				•										•				60079-15
n	Type 'n' (closed-break)	Containment of the explosion			•										•				
	Type 'n' (sealed and hermetically sealed)	Keep the flammable substance out			•										•				
	Type 'n' (restricted breathing)					•										•			
d	Flameproof	Containment of the explosion	•	•									•					60079-1	
q	Powder filled	Quenching of the flame	•	•									•					60079-5	
ia	Intrinsic safety	Limitation of spark energy and surface temperatures	•	•	•	•	•	•	•						•			60079-11	
ib				•	•		•	•			•						•		
ic					•			•				•							
px	Pressurised enclosure	Keep the flammable substance out	•	•									•					60079-2	
py				•	•									•					
pz					•										•				
ma	Encapsulation	Keep the flammable substance out	•	•	•	•	•	•	•						•			60079-18	
mb				•	•		•	•			•						•		
mc					•			•				•							
o	Oil immersion		•	•									•					60079-6	
Op pr	Optical radiation	Inherently safe, protected by shutdown		•	•								•					60079-28	
Op sh				•	•	•					•								
Op is				•	•	•						•							
ta	Dust ignition protection by enclosure	Dust-tight enclosure				•	•	•								•		60079-31	
tb							•	•									•		
tc									•										
pd	Pressurised enclosure	Keep the flammable substance out					•	•									•	61241-4	
								•										•	

Electrical equipment for flammable gases, vapors and mist

US code	CAN code	Type of protection	Basic concept of protection	Class I Div		Class I Zone		US Standard	CA Standard		
				1	2	0	1			2	
AEx e	Ex e	Increased safety	No arcs, sparks or hot surfaces				•	•	ISA 60079-7	CSA E60079-7	
(NI)	(NI)	Non-incendive			•					ISA 12.12.01 / FM 3611	C22.2 No. 213
AEx nA	EX nA	Non-sparking			•					ISA 60079-15	CSA E60079-15
(XP)	(XP)	Explosion proof	Contain the explosion and extinguish the flame	•	•				UL 1203 / FM 3615	C22.2 No. 30	
AEx d	Ex d	Flame proof					•	•	ISA 60079-1 / UL 1203 / FM 3615	CSA 60079-1	
AEx q	Ex q	Powder filled					•	•	ISA 60079-5	CSA E60079-5	
AEx nC	Ex nC	Enclosed break						•	ISA 60079-15	CSA E60079-15	
(IS)	(IS)	Intrinsic safety	Limit energy of sparks and surface temperature	•	•				UL 913 / FM 3610	C22.2 No. 157	
AEx ia	EX ia					•	•	•	ISA 60079-11 / FM 3616	CSA E60079-11	
AEx ib	Ex ib						•	•			
AEx nL	Ex nL	Limited energy					•	ISA 60079-15	CSA E60079-15		
Type X	Type X	Pressurised	Keep flammable gas out	•	•				NFPA 496 (FM 3620)	NFPA 496	
Type Y	Type Y				•						
Type Z	Type Z				•						
AEx px	Ex px							•	•	ISA 60079-2	CSA E60079-2
AEx py	Ex py							•	•		
AEx pz	Ex pz								•		
AEx nR	Ex nR	Restricted breathing					•	ISA 60079-15	CSA E60079-15		
AEx m	Ex m	Encapsulated				•	•	ISA 60079-18	CSA E60079-18		
AEx ma	N/A					•	•		N/A		
AEx mb						•	•				
AEx o	EX o	Oil immersion				•	•	ISA 60079-6	CSA E60079-6		

## Electrical Equipment for combustible Dust

US code	CAN code	Type of protection	Basic concept of protection	Class II						US Standard	CA Standard		
				Div		Class III	Zone						
				1	2	0	20	21	22				
(DIP)	(DIP)	Dust ignition proof	Keep combustible dust out	•	•	•				UL 1203 / FM 3616	CSA C22.2 No. 25		
(NI)	(NI)	Dust protected			•	•				ISA 12.12.01 / FM 3611	CSA C22.2 No. 25		
AEx ta	Ex ta	Protection by enclosure						•	•	•	ISA 60079-31	CSA C22.2 No. 60079-31	
AEx tb	Ex tb								•	•			
AEx tc	Ex tc									•			
N/A	N/A	Fiber & flying protection				•					UL 1203 / ISA 12.12.01	CSA C22.2 No. 25	
AEx maD	N/A	Encapsulation						•	•	•	ISA 60079-18	N/A	
AEx mbD										•			•
(PX)	(PX)	Pressurisation			•	•	•				NFPA 496 (FM 3620)	NFPA 496	
(PY)	(PY)				•	•	•						
(PZ)	(PZ)				•	•							
AEx pD	N/A							•		ISA 61241-2			N/A
(IS)	(IS)	Intrinsic Safety	Limit energy of sparks and surface temperature	•	•	•				UL 913 / FM 3610	CSA C22.2 No. 157		
AEx iaD	N/A								•	•	•	ISA 60079-11	N/A
AEx ibD										•	•		

## IP Ratings and NEMA enclosure types

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### IP ratings according to EN / IEC 60529

First numeral	Protection from solid objects	Second numeral	Protection from water ingress
0	No special Protection	0	No special Protection
1	Objects > 50mm diameter	1	Vertically dripping water
2	Objects > 12.5mm diameter	2	Vertically dripping water when enclosure tilted by 15°
3	Objects > 2.5mm diameter	3	Sprayed water up to 60°
4	Objects > 1.0 mm diameter	4	Sprayed water from all directions
5	Dust protected	5	Water jets
6	Dust-tight	6	Powerful water jets
		7	Temporary submersion to a depth of 1m
		8	Extended submersion to a depth of > 1m

## Enclosure types according to NEMA 250

		Type of enclosure															
		1	2	3	3X	3R	3RX	3S	3SX	4	4X	5	6	6P	12	12K	13
Indoor use		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Outdoor use				•	•	•	•	•	•	•		•	•				
Protection against	Access to hazardous parts	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	Ingress of solid foreign objects (falling dirt)	•	•							•	•	•	•	•	•	•	
	Ingress of solid foreign objects (windblown dust, lint, fibres and flyings)			•	•			•	•	•	•		•	•			
	Ingress of water (dripping and light splashing)		•							•	•	•	•	•	•	•	
	Ingress of solid foreign objects (circulating dust, lint, fibres and flyings)									•	•		•	•	•	•	
	Ingress of solid foreign objects (settling airborne dust, lint, fibres and flyings)									•	•	•	•	•	•	•	
	Ingress of water (hosedown and splashing water)									•	•		•	•			
	Oil and coolant seepage														•	•	•
	Oil or coolant spraying and splashing																•
	Corrosive agents				•		•		•		•			•			
	Ingress of water (occasional temporary submersion)												•	•			
	Ingress of water (occasional prolonged submersion)													•			
	Ingress of water (rain, snow and sleet)			•	•	•	•	•	•	•	•		•	•			
	External mechanisms operable when ice laden							•	•								
	Approximate IP rating equivalent		20	22	55	55	24	24	55	55	66	66	52	67	68	54	54

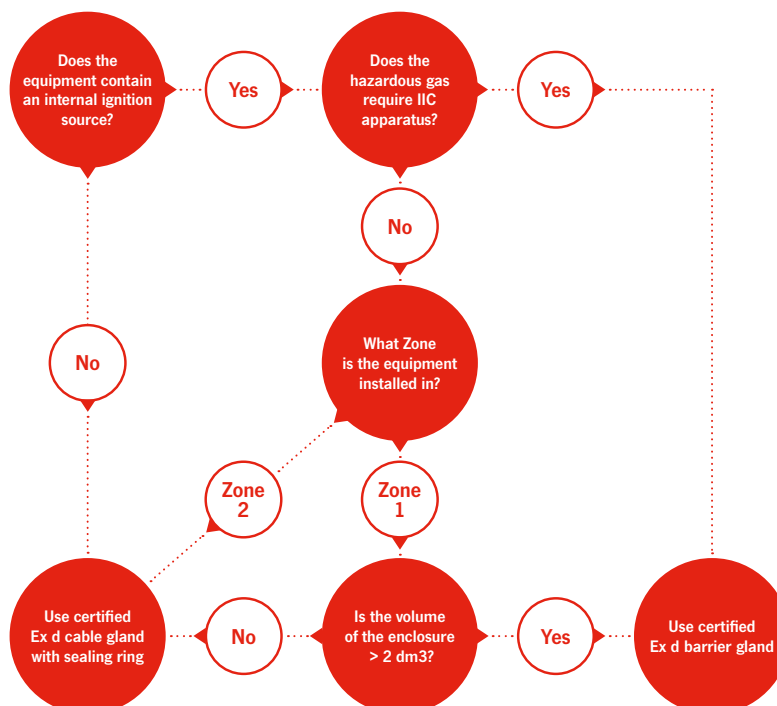
### Ingress protection / enclosure types

EN and IEC standard 60529 defines a two-digit IP code. The first number the protection against solid objects and dust, the second number protection against water ingress.

NEMA enclosure types follow a different system and cannot be directly converted. NEMA enclosure types can approximately converted to IP rating, but IP rating can't be converted to NEMA enclosure types. Equipment may carry several NEMA ratings.

## Cable gland selection for Ex d equipment

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For further information please refer to standard IEC60079-14 Electrical installations in hazardous areas (other than mines).

**ATEX / IECEx**

**Equipment group and category**

Specific marking of explosion protection

**Type of explosive atmosphere**

G - gases, vapours or mists  
D - dust

CE Mark and number of notified body responsible for quality audit

CAT 1 & 2 electrical  
CAT 1 non-electrical

**IP Rating**

**Protection concepts**

**Apparatus group**

**T class (Gas)**  
Temperature shown for dust

**GNExS2 Alarm Sounder**

GNExS2AC230.....

Voltage Range: 100 - 260V ac  
Nominal Voltage: 115V ac 230V ac  
Nominal Current: ...mA ...mA

**Ex** Ex d IIC T4 Gb Ta. -60°C to +50°C  
Ex d IIC T3 Gb Ta. -60°C to +58°C

**CE** 0518 Ex d IIB T6 Gb Ta. -60°C to +50°C  
Ex d IIB T5 Gb Ta. -60°C to +58°C

IP66

Year / Serial No.: 13 / rGS23000001

SIRA 13ATEX1139X  
IECEX SIR 13.0029X

WARNINGS - DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT  
ELECTROSTATIC HAZARD - CLEAN ONLY WITH A DAMP CLOTH  
M20x1.5 ENTRIES - IF TEMPERATURE EXCEEDS 70° C AT ENTRY OR 80° C AT BRANCHING POINT USE SUITABLY RATED CABLE AND CABLE GLANDS

**e2s** European Safety London www.e2s.com  
Systems Ltd. W3 7QH UK

Series of type designation

Ambient temperature

Certificate number ATEX

Certificate number IECEx

**US / Canada**

**Class / division classification**

**T class**

**E2xS121UL SOUNDER**

Voltage: 48V DC Current: 215mA

MAX. OPER. TEMP. / CODE AT +55°C AMBIENT

Class I Division 2 ABCD T3C (160°C)  
Class II Division 2 FG T6 (85°C)  
Class III Division 1 T6 (85°C)

MAX. OPER. TEMP. / CODE AT +40°C AMBIENT

Class I Division 2 ABCD T4 (135°C)

Audible Signal Appliance  
For Use In Hazardous Locations

Date / Serial No. 11 /

**UL** US LISTED  
7KA1

Type 4 / 4X / 13

**e2s** european safety systems ltd.  
London UK Tel: +44(0)20 8743 8880  
sales@e2s.com www.e2s.com

Ambient temperature

UL Mark for products listed for Canada and US

Enclosure type



E2S offers an extensive range of intrinsically safe, explosion & flameproof and non-sparking audible and visual signals, PA loudspeakers and manual callpoints for hazardous areas.



• **BEx Range**  
Zones 1, 2, 21 & 22



• **IS Range**  
Zone 0, Class I Division 1



• **E2x Range**  
Class I Division 2



• **GNEx Range**  
Zones 1 & 2



• **E2x Range**  
Class I Division 2



• **GNEx Range**  
Zones 1 & 2



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