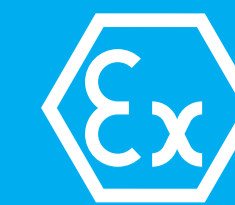




UNDERSTANDING HAZARDOUS LOCATIONS



AREA CLASSIFICATION

What safety level shall the equipment reach to be installed in hazardous area?
What type of substance creates the hazard and for how long?

ATEX AND IECEx						
Protection level	Definition	Explosive atmosphere	99/92/EC (ATEX for employers)	2014/34/EU (ATEX for manufacturers)	IECEx	
			Area classification	Group	Equipment Category	Group EPL
Very high two independent means of protection or one protection allowing two independent faults	Place where an explosive atmosphere is frequently or for long periods or continuously present	Coal mine	-	I	M1	I Ma
		Gas	Zone 0	II	1G	II Ga
		Dust	Zone 20	II	1D	III Da
High single mean of protection allowing only one fault	Place where an explosive atmosphere is occasionally present during normal operation	Coal mine	-	I	M2	I Mb
		Gas	Zone 1	II	2G	II Gb
		Dust	Zone 21	II	2D	III Db
Normal safe during normal operation	Place where an explosive atmosphere is not present during normal operation, and eventually for short periods	Gas	Zone 2	II	3G	II Gc
		Dust	Zone 22	II	3D	III Dc

NORTH AMERICA				
Explosive atmosphere	Class	Division *	Zone **	Area classification
Gas	Class I	Div. 1	Zone 0	Continuous Hazard
			Zone 1	Intermittent Hazard
			Zone 2	Abnormal Conditions Hazard
Dust	Class II	Div. 1	Zone 20	Continuous Hazard
			Zone 21	Intermittent Hazard
			Zone 22	Abnormal Conditions Hazard
Fiber	Class III	Div. 1	Zone 20	Continuous Hazard
			Zone 21	Intermittent Hazard
			Zone 22	Abnormal Conditions Hazard

* according to North America Divisions system
** according to IEC/North America Zones system

GROUPS

How dangerous is the potentially explosive substance?

Explosive atmosphere	Class	Group *	Group **	Representative element
Gas	Class I	-	Group I	Methane
		Group D	Group IIA	Propane
		Group C	Group IIB	Ethylene
		Group B	Group IIC (except C ₂ H ₂)	Hydrogen
		Group A	Group IIC	Acetylene
Dust	Class II	Group G	Group IIIB	Non-conductive dusts
		Group F	Group IIIB	Carbonaceous dusts
		Group E	Group IIIC	Metal dusts
		-	Group IIIA	Fibers or flyings

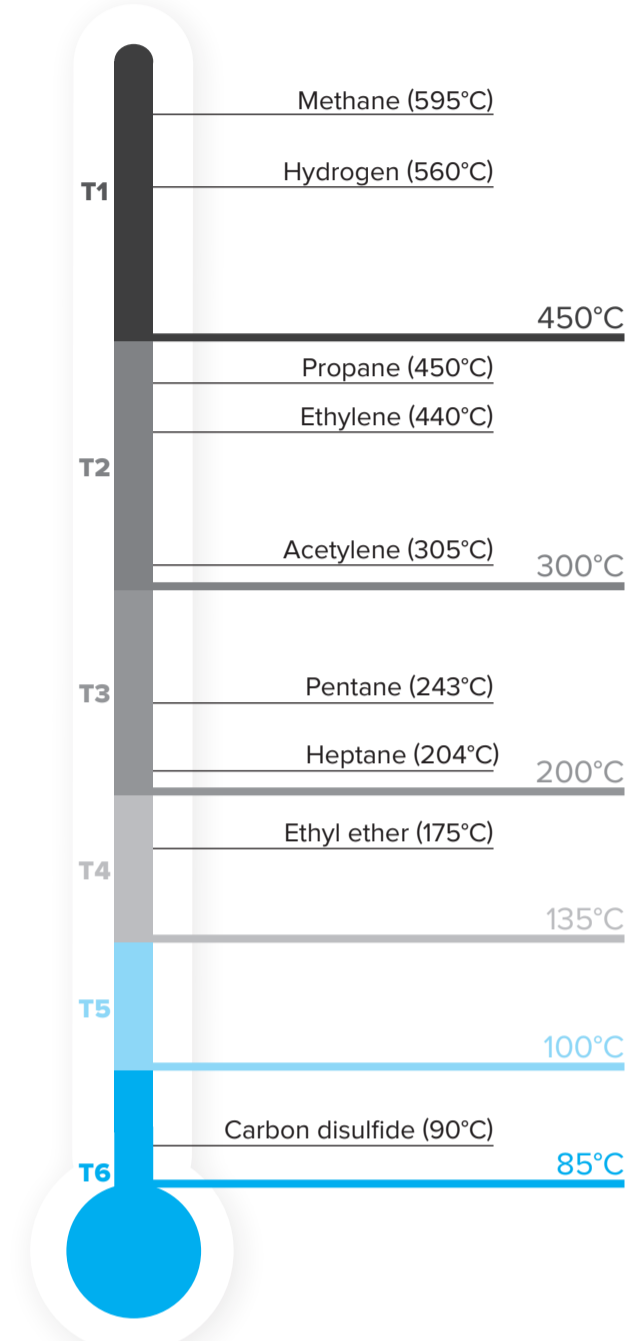
* according to North America Divisions system
** according to IEC/North America Zones system

TEMPERATURE CLASS

What temperature can be reached without igniting the gas?

Max surface temperature	T class *	T class **
450 °C	T1	T1
300 °C	T2	T2
280 °C	T2A	
260 °C	T2B	
230 °C	T2C	
215 °C	T2D	
200 °C	T3	T3
180 °C	T3A	
165 °C	T3B	
160 °C	T3C	
135 °C	T4	T4
120 °C	T4A	
100 °C	T5	T5
85 °C	T6	T6

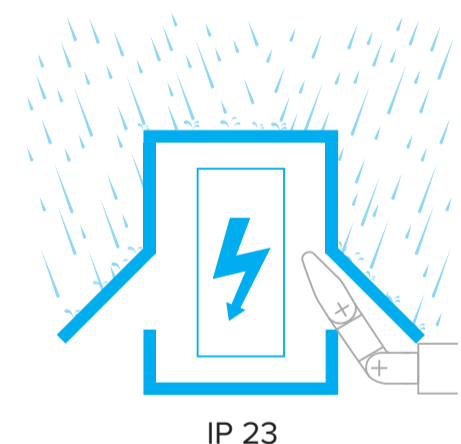
* according to North America Divisions system
** according to IEC/North America Zones system
Temperature data taken from IEC 60079-20-1



PROTECTION DEGREE

How much is the equipment mechanically and environmentally protected?

INTERNATIONAL (IEC 60529)			
Solid		Water	
0	No protection	0	No protection
1	Greater than 50 mm	1	Vertical dripping
2	Greater than 12,5 mm	2	Angled dripping (15°)
3	Greater than 2,5 mm	3	Spraying
4	Greater than 1 mm	4	Splashing
5	Dust protected	5	Jetting
6	Dust tight	6	Powerful jetting
		7	Temporary immersion
		8	Continuous immersion



NORTH AMERICA (NEMA 250)

Type	Application	Protection against
1	Indoor	General purpose
2	Indoor	Dripping water, falling dust
3, 3R, 3S	Outdoor	Rain, snow, windblown dust
4, 4X	Indoor / Outdoor	Hose-Directed water, Corrosion (X)
5	Indoor	Angled dripping water, settling dust
6	Indoor / Outdoor	Temporary Submersion
6P	Indoor / Outdoor	Prolonged Submersion
7	Indoor	Hazardous Location Class I
8	Indoor / Outdoor	Hazardous Location Class I
9	Indoor	Hazardous Location Class II
12, 12K	Indoor	Dripping non-corrosive liquid, Dust
13	Indoor	Water, oil, dust, seepage



MARKING

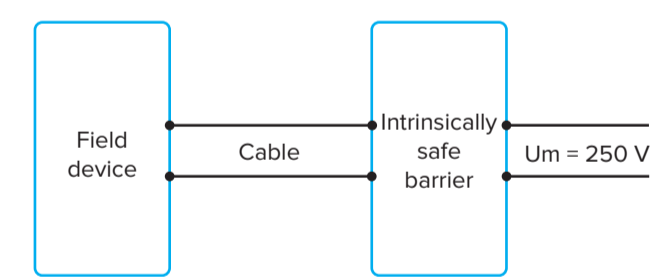
What does an explosion protection related marking stand for?

ATEX AND IECEx						
Directive marking			Standard marking			
CE 0575	Ex	II 1 G	Ex ia IIC T4 Ga			
Notified Body for surveillance	Equipment group	Equipment category	Hazardous atmospheres	Mark	Type of protection	Gas Temperature class
Equipment Group I for Mines, II different from Mines	Equipment Category	Hazardous Atmospheres		EPL		
	Mines	M1 Very High protection M2 High protection	G: Gas, Vapour, Mist D: Dust		EPL (Equipment Protection Level) Ga, Gb, Gc: Gas, Vapour, Mist Da, Db, Dc: Dust	
	Non Mines	1 Very high protection 2 High protection 3 Normal protection () for associated apparatus				
ATEX Certificate		BVS 14	ATEX 023	X		
IECEx Certificate		IECEx BVS 14	.	0019	X	
Notified/Accredited Body who has released certification	Supplementary letter	Notified/Accredited Body	Year of issuing	Progressive certification number	Supplementary letter	
NORTH AMERICA						
Gas Group						
Division System		Class 1 Div 1	Groups A, B, C, D	T4		
Zone System		Class 1 Zone 0	A Ex ia IIC	T4		
Gas, Vapor or Fiber	Area classification	US conformity	Explosion protection method	Gas group	Temperature class	

I.S. VERIFICATION EXAMPLE

How to verify that I.S. barrier and field device can be correctly combined into an I.S. circuit?

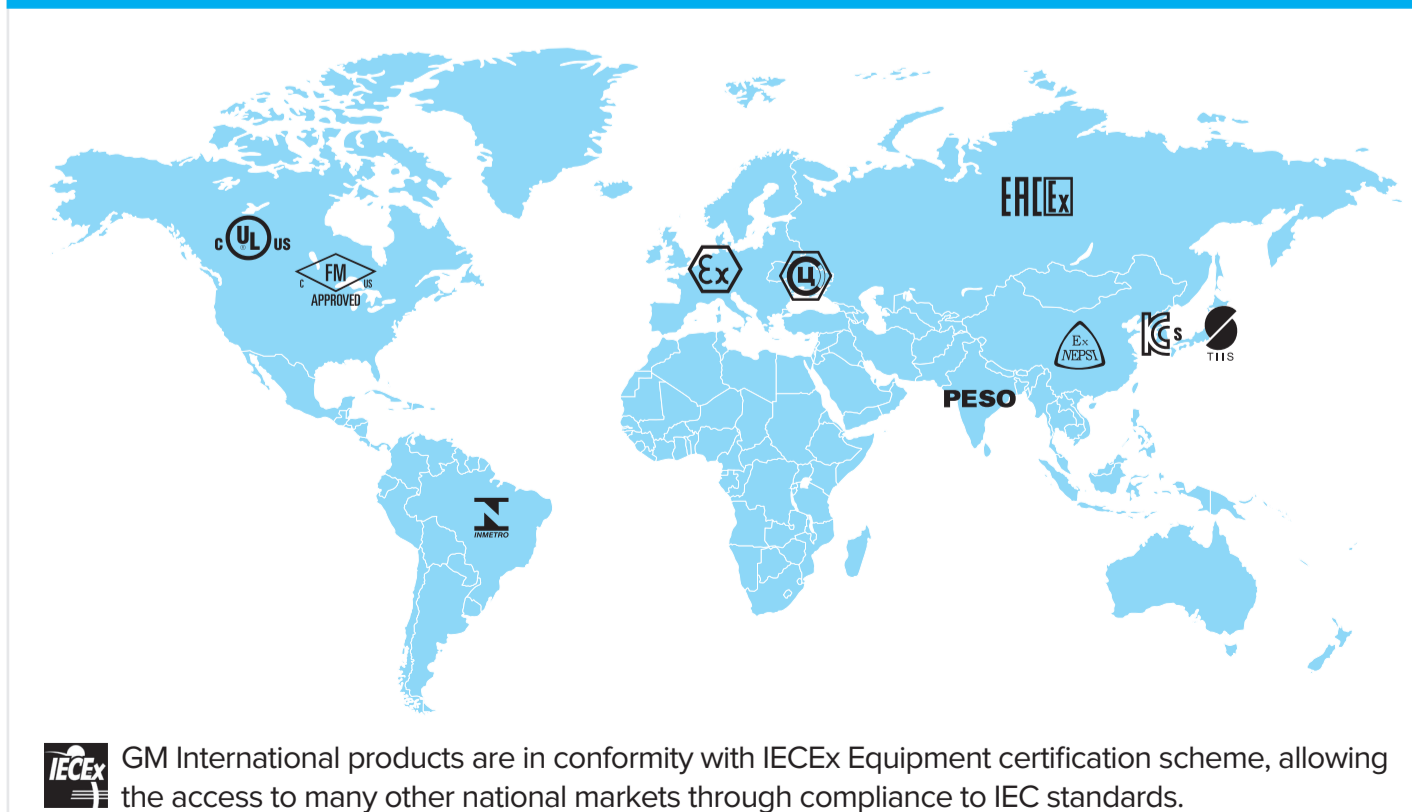
Field device	Cable	Ok if	I.S. barrier
Ui = 30 V		≥	Uo = 28 V
Ii = 120 mA		≥	Io = 93 mA
Pi = 1 W		≥	Po = 650 mW
CI = 3 nF	+ Cc = 80 nF	≤	Co = 83 nF
Li = 10 µH	+ Lc = 1 mH	≤	Lo = 4.2 mH



The level of protection of the intrinsically safe circuit is the lowest level of any of the apparatus forming that circuit.

Concerning GM International products, try our online tool on our website: www.gminternational.com. Further information about more complex cases is provided in IEC 60079-14 and IEC 60079-25.

CERTIFICATIONS WORLDWIDE



TYPES OF PROTECTION

What is the best type of protection for my application?

Concept	Type of protection	Code	Maximum installation Zone	IEC/EN standard	Maximum installation Division	US standard
GAS						
Energy limitation	Intrinsic safety	Ex i	Zone 0	60079-11	Division 1	FM3610/UL913
	Intrinsically safe systems	Ex i	Zone 0	60079-25	-	-
Non-sparking	Flameproof / Expl. proof	Ex d	Zone 1	60079-7	Division 1	FM3615/UL1203
	Powder filling	Ex q	Zone 1	60079-5	-	-
Explosion containment	Type n (enclosed break)	Ex nC	Zone 2	60079-15	-	-
	Encapsulation	Ex m	Zone 0	60079-18	-	-
Separation of explosive atmosphere from ignition	Type n (sealed/hermetically sealed)	Ex nC	Zone 2	60079-15	Division 2	FM3611/UL12101
	Pressurization	Ex p	Zone 1	60079-2	Division 1	FM3620/NFPA 496
	Oil immersion	Ex o	Zone 1	60079-6	-	-
Energy limitation	Type n (restricted breathing)	Ex nR	Zone 2	60079-15	-	-
	DUST					
Energy limitation	Intrinsic safety	Ex i	Zone 20	60079-11	Division 1	FM3610/UL913
	Dust ignition proof	Ex t	Zone 20	60079-31	-	FM3616/UL1203
Separation of explosive atmosphere from ignition	Dust tight	Ex t	Zone 22	60079-31	-	FM3611/UL12101
	Encapsulation	Ex m	Zone 20	60079-18	-	-
	Pressurization	Ex pD	Zone 21	60079-2	-	NFPA 496
	Sealed/Hermetically sealed/Non-incendive	-	-	-	Division 2	FM3611/UL12101

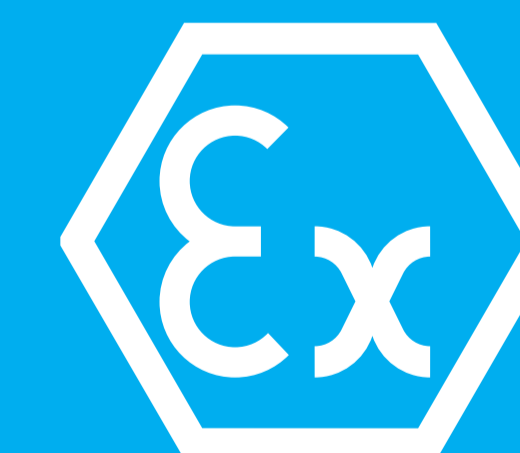
MINIMUM SIL FOR ATEX

How can a SIL device reduce the ignition risk?
The ignition risk for each source can be properly reduced applying an appropriate type of protection and the fault tolerance of equipment can be enhanced by the control with an appropriate safety device. When the complete type of protection does not cover a source of ignition, a suitable safety device can mitigate the risk under an acceptable level, applying EN 50495.

Fault Tolerance of Equipment (number of single faults that cause the apparatus to fail)	Combined equipment desired category		
	1 / M1	2 / M2	3
2	-	-	-
1	HFT 0 SIL 1	-	-
0	HFT 1 SIL 2	HFT 0 SIL 1	-

*,** means that no safety device is required.
SIL 1 or *SIL 2* is required Safety Integrity Level of safety related device according to EN/IEC 61508.





Understanding Hazardous Locations