PROFESSIONAL TESTING

Bringing Products to Market

Explosive Atmospheres
IECEx/ATEX Reference Guide

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Possible Ignition Sources

Hot Surfaces	Mechanically Generated Sparks	Stray Electric Current	Static Electricity	Exothermic Reactions

Flames & Hot Gases	Electrical Generated Sparks	Equalizing Current	Adiabatic Compression & Shock Waves	Radiation

Ingress Protection IEC 60529

	Solid Foreign Objects
0	Non-protected
1	Objects ≥ 50 mm Ø
2	Objects ≥ 12.5 mm Ø
3	Objects ≥ 2.5 mm Ø
4	Objects ≥ 1.0 mm Ø
5	Dust-protected
6	Dust-tight

	Water with Harmful Effects
0	Non-protected
1	Vertically dripping
2	Dripping (15° tilted)
3	Spraying
4	Splashing
5	Jetting
6	Powerful jetting
7	Temporary immersion
8	Continuous immersion
9	High pressure/ temperature water jet

Environment ◆

Environment	
G	Gas
D	Dust
GD	Gas & Dust

Applicable Standards

Type	Standard	Title
Gas Area Classification	IEC/EN 60079-10-1	Part 10-1: Classification of areas - Explosive gas atmospheres
Dust Area Classification	IEC/EN 60079-10-2	Part 10-2: Classification of areas - Explosive dust atmospheres
Installation	IEC/EN 60079-14	Part 14: Electrical installations design, selection, and erection
Maintenance	IEC/EN 60079-17	Part 17: Electrical installations, inspections, and maintenance
Material Characteristics - Gas	IEC/EN 60079-20-1	Part 20-1: Material characteristics for gas and vapor classification
Material Characteristics - Dust	IEC/EN 60079-20-2	Part 20-2: Material characteristics for dust classification
Quality in Manufacturer	IEC/EN 80079-34	Part 34: Application of quality systems for equipment manufacturer
QMS	ISO 9001	Quality Management System

CE Marking CE

European Union Compliance Directives
EMC - Electromagnetic Compatibility Directive
Machinery Directive
LVD - Low Voltage Directive
RED - Radio Equipment Directive
PED - Pressure Equipment Directive
MDD - Medical Devices Directive
*Note: CE marking required by the ATEX Directive

Atmospheric Groups

Equipment Grouping	Category	EPL	Zones	Zone Access	Malfunctions
Group I	M1	Ma	N/A	N/A	Rare Malfunctions - 2 Faults
	M2	Mb	N/A	N/A	Normal Operation Only
Group II	1G	Ga	0	0, 1, 2	Rare Malfunction - 2 Faults
	2G	Gb	1	1, 2	Expected Faults - 1 Faults
	3G	Gc	2	2	Normal Operation Only
Group III	1D	Da	20	20, 21, 22	Rare Malfunction - 2 Faults
	2D	Db	21	21, 22	Expected Faults - 1 Faults
	3D	Dc	22	22	Normal Operation Only

Group Subdivisions ▲

Group II Subdivisions		Can Access
Propane	IIA	IIA
Ethylene	IIB	IIB, IIA
Hydrogen	IIC	IIC, IIB, IIA
Group III Subdivisions		**Can Access**
Combustible Flyings	IIIA	IIIA
Non-Conductive Dust	IIIB	IIIB, IIIA
Conductive Dust	IIIC	IIIC, IIIB, IIIA

Temperature Classification ■

Temperature Class	Can Access	AIT (°C)	Max Surface Temp (°C)	Example Fuel
T1	T1	>450	450	Methane
T2	T2, T1	>300 <450	300	Acetylene
T3	T3, T2, T1	>200 <300	200	Hydrogen Sulfide H_2S
T4	T4, T3, T2, T1	>135 <200	135	Diethyether
T5	T5, T4, T3, T2, T1	>100 <135	100	No Known Gases
T6	T6, T5, T3, T2, T1	>85 <100	85	Carbon Disulfide

Flammability Limits

Fuel Gas	Lower Flammability Limit (% by volume of air)	Upper Flammability Limit (% by volume of air)
Acetylene	2.5	81
Ethylene	2.75	28.6
Hydrogen	4	77
Diesel	0.6	7.5
Methane	5	15
Propane	2.1	10.1
H_2S	4	44

*Note: Any value between the LFL and UFL represents a flammable mixture of fuel and O_2 (% by volume of air)

Fuel Auto Ignition Temperatures (AIT)

Fuel Gas	AIT (°C)	AIT (°F)
Acetylene	305	581
Ethylene	490	914
Hydrogen	560	1040
Diesel	210	410
Methane	580	1076
Propane	470	878
H_2S	260	500
Carbon Disulfide	90	194

Electrical Methods of Protection IECEx/ATEX ⬢

Method of Protection	Ex Code	Zones	IEC/EN Standard	Title
General Requirements	-	0, 1, 2, 20, 21, 22	60079-0	Part 0: Equipment - General Requirements
Exclusion	pxb	1, 21	60079-2	Part 2: Equipment protection by pressurized enclosures 'p'
	pyb	1, 21		
	pzc	2, 22		
	qb	1	60079-5	Part 5: Equipment protection by powder filling 'q'
	qc	2		
	ob	1	60079-6	Part 6: Equipment protection by oil immersion 'o'
	oc	2		
	px	1, 21	60079-13	Part 13: Equipment protection by pressurized rooms 'p'
	py	1, 21		
	pz	2, 22		
	ma	0, 20	60079-18	Part 18: Equipment protection by encapsulation 'm'
	mb	1, 21		
	mc	2, 22		
	ta	20	60079-31	Part 31: Equipment dust ignition protection by enclosure 't'
	tb	21		
	tc	22		
	nR	2	60079-15	Part 15: Equipment protection by type of protection 'n'
	nC	2	60079-15	
Energy Limitation	nA	2	60079-15	
	nC	2	60079-15	
	eb	1, 21	60079-7	Part 7: Equipment protection by increased safety 'e'
	ec	2, 22		
	ia	0, 20	60079-11	Part 11: Equipment protection by increased safety 'i'
	ib	1, 21		
	ic	2, 22		
	op is	0, 20	60079-28	Part 28: Protection of equipment and transmission systems using optical radiations
Containment	op pr	1, 21		
	op sh	1, 21		
	nC	2	60079-15	Part 15: Equipment protection by type of protection 'n'
	da	0	60079-1	Part 1: Equipment protection by flameproof enclosures 'd'
	db	1		
	dc	2		

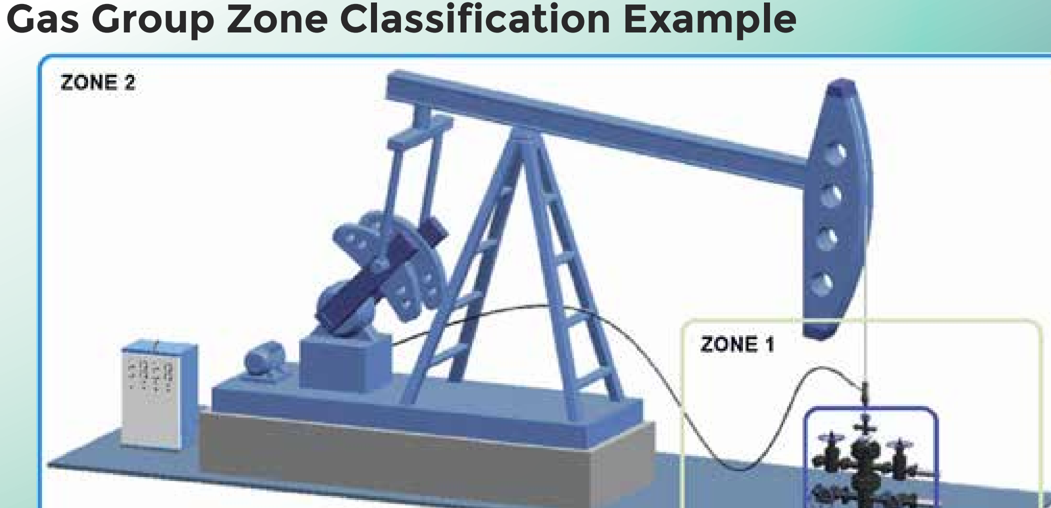
Non-Electrical Methods of Protection ⬢

Method of Protection	Ex Code	Zones	ISO/IEC/EN Standard	Title
General Requirements	h	0, 1, 2, 20, 21, 22	80079-36	Part 36: Non-electrical equipment for explosive atmospheres - Basic method and requirements
Constructional Safety	ch		80079-37	Part 37: Non-electrical equipment for explosive atmospheres - Non electrical type of protection constructional safety "c", control of ignition source "b", liquid immersion "k"
Control of Ignition Source	bh			
Liquid Immersion	kh			
Exclusion	pxb	1, 21	60079-2	Part 2: Equipment protection by pressurized enclosures 'p'
	pyb	1, 21		
	pzc	2, 22		

Classification of Zones

Explosive Atmosphere Condition	Area Classification ⬟	Equipment Category ★	Zones: Gas	Zones: Dust	EPL ● : Gas	EPL ● : Dust
Energized	I	M1	N/A		Ma	
Not Energized	I	M2	N/A		Mb	
Always Present	II	1	0	20	Ga	Da
Present Regularly	II	2	1	21	Gb	Db
Rarely Present	II	3	2	22	Gc	Dc

Gas Group Zone Classification Example



Markings and Ratings

TÜV SÜD

CE 0123 Ex II 2 GD Ex d e IIB T4 Gb (-40°C ≤ Tamb ≤ 50°C)

- CE – EU Compliance
- 0123 – Notified Body ID
- Ex – ATEX Symbol
- II – Area Classification ⬟
- 2 – Equipment Category ★
- GD – Environment ◆
- Ex – Explosion Protection
- d e – Method(s) of Protection ⬢
- IIB – Group Subdivision ▲
- T4 – Temperature Classification ■
- Gb – EPL ●
- (-40°C ≤ Tamb ≤ 50°C) – Ambient Temperature Rating