

Hazardous Locations & Explosive Atmospheres



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North America

Typical North American Marking				Zone Scheme (Gas)						
Class I	Division 1	Groups A,B,C,D	T4	Class I	Zone 0	AEx	ia	IIC	T4	Ga
↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
Hazard Class	Area Classification	Gas Group	Temperature Class	Hazard Class	Area Classification	Ex Protection Scheme	Protection Concept Code	Gas Group	Temperature Class	Equipment Protection Level (EPL)
Zone Equivalency Scheme				Zone Scheme (Dust)						
Class I	Zone 0	Groups IIA,IIB,IIC	T4	Zone 20	AEx	ta	IIC	T90 C	Da	
↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	
Hazard Class	Area Classification	Gas Group	Temperature Class	Area Classification	Ex Protection Scheme	Protection Concept Code	Dust Group	Surface Temperature	Equipment Protection Level (EPL)	

Items in Blue are US Only. For Canada any new installations must be classified using the Zone system, while existing installations may either use Division or be re-classified to Zone. US installations may use either Division or Zone. Intertek has the ability to issue combined ETL certification for the US and Canada, offering efficiency and speed to market for global manufacturers entering North America. Contact Intertek for more information.

Protection Concepts [NEC & CEC] ¹					
Type of Protection	Ex Code	EPL	Zone ²	North American Standard ISA/UL/CSA	Basic Concept of Protection
Electrical Equipment - Zone "Ex" Scheme					
General Requirements	-	Ga Da Db Dc	0,1,2,20,21,22	60079-0	General requirements for all Ex equipment
Intrinsic Safety ³	ia	Ga Da	0, 20	60079-11	Limit energy of sparks & surface temperature
	ib	Gb Db	1, 21		
	ic	Gc Dc	2, 22		
Increased Safety	eb	Gb Db	1, 21	60079-7	No arcs, sparks or hot surfaces
	ec	Gc Dc	2, 22		
Non-Sparking	nA	Gc	2	60079-15	Contain the explosion and extinguish the flame
Flame-Proof	da	Ga	0	60079-1	
	db	Gb	1		
	dc	Gc	2		
Powder-Filled	q	Gb	1	60079-5	Prevent ingress of explosive atmosphere and limit surface temperature
Pressurization	px	Gb	1, 21	60079-2	
	py	Gb	1, 21		
	pz	Gc	2, 22		
Encapsulation	ma	Ga Da	0, 20	60079-18	
	mb	Gb Db	1, 21		
	mc	Gc Dc	2, 22		
Restricted Breathing	nR	Gc	2	60079-15	Prevent ingress of explosive atmosphere and limit surface temperature
Sealed Device	nC	Gc	2	60079-15	
Liquid Immersion	ob	Gb	1	60079-6	
Dust-Protected	ta	Da	20	60079-31	Protection against release of optical energy
	tb	Db	21		
	tc	Dc	22		
Optical Radiation ⁴	op pr	Gb Db	1, 21	60079-28	Limitation of optical energy
	op is	Ga Da	0, 20		
	op sh	Ga Da	0, 20		

Electrical Equipment - Division Scheme and Zone Equivalency					
Type of Protection	Class	Division & Zone	Type	North American Standard	Basic Concept of Protection
Non-Arcing / Non-Incendive	I, II III I	Division 2 Division 1, 2 Zone 2 Zone 22	-	UL121201, CSA C22.2 No. 213	Energy Limitation, Non-arcing/sparking, Sealing, and Ingress Protection
Explosion-Proof	I I	Division 1 Zone 1	-	UL 1203, CSA C22.2 No. 30	Contain the explosion and extinguish the flame
Purge and Pressurization	I, II I	Division 1 Zone 1	X	NFPA 496	Prevent ingress of explosive atmosphere and limit surface temperature
	I, II I	Division 2 Zone 2	Y		
Dust-Tight	II III -	Division 2 Zone 22	-	UL121201, CSA C22.2 No. 213	Prevent ingress of explosive atmosphere and limit surface temperature
Dust Ignition-Proof	II -	Division 1 Zone 20, 21	-	UL 1203, CSA C22.2 No. 25	
Intrinsic Safety	I II, III I -	Division 1 Zone 0 Zone 20	-	ISA/UL/CSA C22.2 No 60079-11, UL 913, CSA C22.2 No. 157	

Note 1: In the United States, suitability for equipment in mining applications is per approval by the Mine Safety and Health Administration (MSHA). Intertek can test and evaluate equipment to Alternative Case Resolution Initiative (ACRI) standards or equivalent, per US National Standards, providing test reports for your submission to MSHA.
 Note 2: For US Zone Ex Scheme: Zone 0, 1 and 2 "Ex" markings are preceded by "Class I" and "Ex" is preceded by "A."
 Note 3: For associated intrinsically safe apparatus suitable for installation in a hazardous location, the symbol for the type of protection ("ia" or "ib") is enclosed within square brackets on the marking, e.g., "AEx d [ia] IIC T4". For intrinsically safe apparatus not suitable for installation in a hazardous location, both the symbol "Ex" or "AEx" and the symbol for the type of protection, "ia" or "ib", are enclosed within the same square brackets on the marking, e.g., (AEx ia) IIC in this case, a temperature class is not included.
 Note 4: Neither optical protection nor optical radiation is addressed by the NEC[®] or CEC[®].

Enclosure Type Ratings [NEC & CEC]		
Type	Area	Brief Definition
1	Indoor	General purpose
2	Indoor	Protection against angled dripping water
3, 3S	Indoor / Outdoor	Protection against rain, sleet, dirt, snow and windblown dust
3R	Indoor / Outdoor	Protection against rain, sleet, dirt and snow
4, 4X	Indoor / Outdoor	Protection against rain, snow, hose directed water and corrosion
5	Indoor	Protection against angled dripping water, dust, fibers, flyings
6	Indoor / Outdoor	Protection against temporary submersion
6P	Indoor / Outdoor	Protection against prolonged submersion
12,12K	Indoor	Protection against circulating dust, fibers, flyings
13	Indoor	Protection against circulating dust, fibers, flyings, seepage

North America/ATEX/IECEx

Atmosphere Groups			
Substance	Hazard Class	Division Groups	Zone Groups
Acetylene	Class I Flammable Gases	Group A	IIC
Hydrogen		Group B	IIB + H2
Ethylene		Group C	IIB
Propane		Group D	IIA
Methane	Class II Combustible Dusts	Group D	IIA ⁶
Combustible Metal Dusts		Group E ⁵	IIIC
Combustible Carbonaceous Dusts		Group F	IIIB
Combustible Dust not in Group E or F (Flour, Grain, Wood, Plastics, Chemicals)		Group G	IIIB
Combustible Fibers and Flyings		Not Applicable	IIIA

Note 5: Group E is applicable to Class II Division 1 only.
 Note 6: Methane is a group IIA Gas for non-mixing applications.

Classification of Divisions and Zones			
Hazard Level	Division Scheme	Zone Scheme Gas/Dust	Type of Explosive Atmosphere
Continuous Hazard	Division 1	Zone 0 / Zone 20	Continually present
		Zone 1 / Zone 21	Likely to occur during normal operations
Intermittent Hazard	Division 2	Zone 2 / Zone 22	Not likely to occur during normal operations, but may occur for short periods

Temperature Classification ⁷		
Max. Surface Temperature	NEC 500/ CEC	NEC 505/ IEC - Group II
450°C (842°F)	T1	T1
300°C (572°F)	T2	T2
280°C (536°F)	T2A	T3
260°C (500°F)	T2B	
230°C (446°F)	T2C	
215°C (419°F)	T2D	
200°C (392°F)	T3	T4
180°C (356°F)	T3A	
165°C (329°F)	T3B	
160°C (320°F)	T3C	
135°C (275°F)	T4	T5
120°C (248°F)	T4A	
100°C (212°F)	T5	
85°C (185°F)	T6	T6

Note 7: For Group I applications (ATEX and IECEx only), electrical apparatus has fixed temperature limits of 150°C (where layers of coal dust can form) and 450°C (where coal dust is not expected to form a layer).

Other Useful Standards		
Standard Types	IEC Standards	US & CA standards
Area Classification - Gases, Vapors and Mists	IEC 60079-10-1	NFPA 497
Area Classification - Combustible Dusts, Fibers, Flyings	IEC 60079-10-2	NFPA 499
Electrical Equipment Installation	IEC 60079-14	NFPA 70 (NEC)/CSA C22.1 [CEC]
Electrical Equipment Inspection and Maintenance	IEC 60079-17	NFPA 70B
Electrical Equipment Repair and Overhaul	IEC 60079-19	-
Material Characteristics for Gas and Vapor Classification	IEC 60079-20-1	NFPA 497
Material Characteristics for Dust Classification	IEC 60079-20-2	NFPA 499
Application of Quality Systems for Equipment Manufacture	ISO/IEC 80079-34	-
Quality Management Systems	ISO 9001	ISO 9001

ATEX and IECEx

ATEX Directive 2014/34/EU
 Intertek has the ability to issue ATEX Notified Body certificates, offering efficiency and speed to market for global manufacturers entering Europe, the UK, and beyond. Contact Intertek for more information.

IECEx Scheme
 Manufacturers of Ex equipment can obtain certificates of conformity, accepted at a national level for all countries participating in the IECEx Scheme.

A certificate of conformity may be obtained from any certification body accepted into the Scheme. The certificate will attest (1) the equipment design conforms to relevant IEC Standards, and (2) the product is manufactured under a quality control program assessed and registered through a Quality Assessment Report (QAR) by an accredited IECEx Certification Body (IECExCB).

The US Coast Guard (USCG) published final rule 80 FR 16980 in March 2015, applicable to Mobile Offshore Drilling Units (MODU), floating Outer Continental Shelf (OCS) facilities, and vessels, other than offshore supply vessels regulated under 46 CFR Subchapter L, constructed after April 2, 2018, that engage in OCS activities. The rule implication is that any equipment installed after April 2, 2018, on rigs, MODUs or OSVs in the US Outer Continental Shelf must be certified or listed in accordance with either National Regulations by an approved agency (e.g., a third-party certification body), or the IECEx Scheme. The USCG does NOT permit the use of equipment certified solely under the ATEX Directive.

Intertek has IECEx Testing Laboratories (ExTLs) across North America, Europe, and Asia, and is an IECEx Certification Body (IECExCB). For more information visit www.iecex.com.

Other CE Directives That May Apply ⁸		
Electromagnetic Compatibility (EMC)	2014/30/EU	
Low Voltage ⁹	2014/35/EU	
Machinery Directive	2006/42/EC	
Medical Devices Directive	93/42/EEC	
Pressure Equipment Directive (PED)	97/23/EC	
Radio Equipment Directive (RED)	2014/53/EU	
Restriction of Hazardous Substances (RoHS)	2002/95/EC	

Note 8: Intertek is a provider of evaluation and certification to these directives and their Harmonized Standards, where applicable.
 Note 9: Excludes equipment for use in explosive atmospheres - see ATEX Annex II 1.2.7.

Functional Safety [IEC 61508 Safety Systems] ¹¹	
Standard	Title/Scope
IEC/EN 61508-1	Functional Safety of electrical/electronic/programmable electronic safety-related systems - Part 1: General Requirements
IEC/EN 61508-2	Functional Safety of electrical/electronic/programmable electronic safety-related systems - Part 2: Requirements for electrical/electronic/programmable electronic safety-related items
IEC/EN 61508-3	Functional Safety of electrical/electronic/programmable electronic safety-related systems - Part 3: Software Requirements
IEC/EN 61508-4	Functional Safety of electrical/electronic/programmable electronic safety-related systems - Part 4: Definitions and Abbreviations
IEC/EN 61508-5	Functional Safety of electrical/electronic/programmable electronic safety-related systems - Part 5: Examples of methods for the determination of safety integrity levels
IEC/EN 61508-6	Functional Safety of electrical/electronic/programmable electronic safety-related systems - Part 6: Guidelines on the application of IEC 61508-2 and IEC 61508-3
IEC/EN 61508-7	Functional Safety of electrical/electronic/programmable electronic safety-related systems - Part 7: Overview of techniques and measures

Note 11: The IEC/EN 61508 series of standards sets out the requirements for electrical, electronic, and programmable safety-related systems, covering the design, implementation, operation, and maintenance as necessary for the assigned Safety Integrity Level (SIL).
 According to the system application, four SILs are defined and assigned to the system. The standard is also the basis for ATEX-rated safety devices, EN 50495.

ATEX and IECEx

Typical ATEX & IECEx Marking										
CE	0359	Ex	II	2	G	Ex	db	IIC	T4	Gb
↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
Complies with European Directive*	Notified Body Number*	Specific Marking for Explosion Protection*	Equipment Group*	Equipment Category*	Environment*	Explosion Protection	Protection Type	Atmosphere Group	Temperature Class	Equipment Protection Level (EPL)

*ATEX only (ATEX 2014/34/EU)

Equipment Categories & Protection Levels ¹⁰			ATEX Categories vs Zones of Use ¹⁰		
ATEX Category	Equipment Protection Level	Typical Equipment Zone Suitability	Equipment Category ATEX 2014/34/EU	Zone of Use	
				Gas, Vapors, & Mist	Dust
1 G	Ga	Zones 0, 1, 2	Category 1	Zone 0, 1 & 2	Zone 20, 21 & 22
1 D	Da	Zones 20, 21, 22		Zone 1 & 2	Zone 21 & 22
2 G	Gb	Zones 1, 2		Zone 2	Zone 22
2 D	Db	Zones 21, 22	Category 2		
3 G	Gc	Zone 2			
3 D	Dc	Zone 22			
M1	Ma	Very high level of protection for mines	Category 3		
M2	Mb	High level of protection for mines			

Note 10: Unless the explosion protection risk assessment states otherwise

Protection Concepts [ATEX and IECEx]						
Type of Protection	Ex Code	EPL	Zone(s)	IEC/EN Standard	Basic Concept of Protection	
Electrical Equipment						
General Requirements	-	All ¹²	0,1,2,20,21,22	60079-0	General requirements for all Ex equipment	
Intrinsic Safety	ia	Ga Da Ma	0, 20	60079-11	Limit energy of sparks & surface temperature	
	ib	Gb Db Mb	1, 21			
	ic	Gc Dc	2, 22			
Increased Safety	eb	Gb Db Mb	1, 21	60079-7	No arcs, sparks or hot surfaces	
	ec	Gc Dc	2, 22			
Flame-Proof	da	Ga	0	60079-1	Contain the explosion and extinguish the flame	
	db	Gb Mb	1			
Powder-Filled	q	Gb Mb	1	60079-5	Prevent ingress of explosive atmosphere and limit surface temperature	
Sealed Device	nC	Gc	2	60079-15		
Pressurization	pxb	Gb Db Mb	1, 21	60079-2		
	pyc	Gb Db	1, 21			
	pzc	Gc Dc	2, 22			
Encapsulation	ma	Ga Da Ma	0, 20	60079-18		
	mb	Gb Db Mb	1, 21			
	mc	Gc Dc	2, 22			
Restricted Breathing	nR	Gc	2	60079-15	Prevention against release of optical energy	
Liquid Immersion	ob	Gb Mb	1	60079-6		
	oc	Gc	2			
	ta	Da	20			
Dust-Protected	tb	Db	21	60079-31	Prevention against release of optical energy	
	tc	Dc	22			
	op pr	Gb Db Mb	1, 21			
Optical Radiation	op is	Ga Da Ma	0, 20	60079-28	Limitation of optical energy	
	op sh	Ga Da Ma	0, 20			Optical system interlocking

Non-Electrical Equipment					
Type of Protection	ATEX and IECEx Code	EPL	Zone	ISO/IEC and EN Standard (IECEx and ATEX)	Basic Concept of Protection
General Requirements	h	All ¹²	0,1,2,20,21,22	80079-36	Basic methods & requirements
Constructional Safety	h	All	0,1,2,20,21,22	80079-37	Ignition hazards mitigated by good engineering methods
Control of Ignition Sources	h	All	0,1,2,20,21,22	80079-37	Control equipment fitted to detect malfunctions
Liquid Immersion	h	All	0,1,2,20,21,22	80079-37	Enclosure uses liquid to prevent contact with explosive atmospheres

Note 12: Evaluation per EN 50303 is additionally required for ATEX, Category M1

Ingress Protection Codes ¹³ [IEC 60529]				Atmosphere Groups [ATEX & IECEx]			
First Number (protect from solid bodies)	Second Number (protect from water)	Group	Environment	Location	Typical Substance		
0 No Protection	0 No Protection	I	Gases, Vapors and Mists	Surface and Other Locations	Methane (Firedamp)		
1 Objects > 50mm	1 Vertical drip	IIA			Methane, Propane, etc.		
2 Objects > 12.5mm	2 Angled drip	IIB				Ethylene	
3 Objects > 2.5mm	3 Spraying	IIC	Combustible Dusts	Surface and Other Locations	Hydrogen, Acetylene, etc.		
4 Objects > 1.0mm	4 Splashing	IIIA			Combustible Flyings		
5 Dust-Protected	5 Jetting	IIB			Non-Conductive		
6 Dust-Tight	6 Powerful jetting	IIC	Conductive				
	7 Temporary immersion						
	8 Continuous immersion						
	9 High pressure and temperature water jet						

Note 13: Refer to IEC 60034-5 for Ingress Protection of rotating electrical machines

Equipment Groups [ATEX]				
Equipment Group	ATEX Equipment Category	Atmosphere	Equipment Protection Level (EPL)	Required Protection Performance & Operation
I (Mines with Firedamp)	M 1	Methane & Dust	Very High Ma	Two faults, Remain energized and functioning
I (Mines with Firedamp)	M 2	Methane & Dust	High Mb	Severe normal operation, De-energize in exp. atm.
II (All Other Areas)	1G, 1D	Gas, Vapor, Mist, Dust	Very High	Two faults
II (All Other Areas)	2G, 2D	Gas, Vapor, Mist, Dust	High	One fault
II (All Other Areas)	3G, 3D	Gas, Vapor, Mist, Dust	Low	Normal operation