HAZARDOUS LOCATIONS

EQUIPMENT CERTIFICATION REQUIREMENTS NICOR HAZOC

NORTH AMERICA

Турі	Typical North American Marking								
Divis	ion Schen	ne		Zone So	cheme (Ga	as)			
Class I	Division 1	Groups A, B,C,	, D T4	Class I	Zone 0	<mark>A</mark> Ex i	a I	IIC T4	Ga
					1	1			
Hazard Class	Area Classification	Gas Group	Temperature Class	Hazard Class C	Area Ex P lassification S	rotection Prote cheme Conce	ection (pt Code G	Gas Temperatu roup Class	re Equipment Protectection Level (EPL)
	Zone Equivalency Scheme Zone Scheme (Dust)								
Zone	e Equivale	ncy Scheme		Zone So	cheme (Di	ust)			
Zone Class I	Equivale	Groups IIA, IIB, II	IC T4	Zone So Zone 20	cheme (Du AEx	u st) ta	IIIC	T90 C	Da
Class I	Zone 1	Groups IIA, IIB, II	IC T4	Zone So Zone 20	cheme (Du AEx	ta		т90 С	Da
Class I Lazard Class	Zone 1	Groups IIA, IIB, II Groups IIA, IIB, II Gas Group	IC T4	Zone So Zone 20	AEx AEx Ex Protection Scheme	ta Protection Concept Code	IIIC Lust Group	T90 C Temperature	Da Equipment Protectection Level (EPL)

Protection Concepts [NEC®& CEC®]¹

Electrical Equipment - Zone "Ex" Scheme

NORTH AMERICA/ATEX/IECEX

Substance	Hazard Class	Division Groups	Zone Groups
Acetylene		Group A	IIC
Hydrogen		Group B	IIB + H2
Ethylene	Class I Flammable Gases	Group C	IIB
Propane		Group D	IIA
Methane		Group D	IIA ⁶
Combustible Metal Dusts		Group E ²	IIIC
Combustible Carbonaceous Dusts	Class II Combustible Dusts	Group F	IIIB
Combustible Dusts not in Group E or F (Flour, Grain, Wood, Plastics, Chemicals)	1	Group G	IIIB
Combustible Fibers and Flyings	Class II Combustible Dusts	Not Applicable	IIIA

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 de ned and assigned to the system. The standard is also the basis for ATEX-related safety devices, EN 50495.

Protection Concepts [ATEX and IECEx]

Type of Protection	Ex Code	EPL	Zone(s)	IEC/EN Standard	Basic Concept of Protection
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Type of Protection	Ex Code	EPL	Zone ²	North American Standard ISA/UL/CSA	Basic Concept of Protection	
General Requirements	-	Ga Da Gb Db Gc Dc	0,1,2,20,21,22	60079-0	General requirements for all Ex equipment	
	ia	Ga Da	0, 20			
Intrinsic Safety ³	ib	Gb Db	1, 21	60079-11	Limit energy of sparks & surface temperature	
	ic	Gc Dc	2, 22			
Increased Safety	eb	Gb	1	60079-7		
increased safety	ec	Gc	2	00079-7	No arcs, sparks or hot surfaces	
Non-Sparking	nA	Gc	2	60079-15		
	da	Ga	0			
Flame-Proof	db	Gb	1	60079-1	Contain the explosion	
	dc	Gc	2		and extinguish the	
Powder-Filled	q	Gb	1	60079-5	flame	
Enclosed Break	nC	Gc	2	60079-15		
	рх	Gb	1			
Duran and Drassuringtion ⁴	ру	Gb	1	60079-2		
Purge and Pressunzation	pz	Gc	2			
	рD	-	21, 22	ISA 61241-0 & ISA 61241-2		
	ma	Ga Da	0, 20			
Encapsulation	mb	Gb Db	1, 21	60079-18	Prevent ingress of explosive atmosphere	
	mc	Gc Dc	2, 22		and limit surface temperature	
Restricted Breathing	nR	Gc	2	60079-15		
Sealed Device	nC	Gc	2	60079-15		
Oil Immercien ⁵	ob	Gb	1	60079-6		
	ос	Gc	2	00079.0		
	ta	Da	20			
Dust-Protected	tb	Db	21	60079-31		
	tc	Dc	22			
	op pr	Gb Db	1, 21		Protection against release of optical energy	
Optical Radiation ⁶	op is	Ga Da	0, 20	ISA 60079-28	Limitation of optical energy	
	op sh	Ga Da	0, 20		Optical system interlocking	

Electrical Equipment - Division Scheme and Zone Equivalency

Type of Protection	Class	Division & Zone Type		North American Standard	Basic Concept of Protection	
General Requirements	I, II, III I -	Division 1, 2 Zone 0, 1, 2 Zone 20, 21, 22	-	FM 3600	Required for all equipment evaluated to FM Standards	
Non-Arcing / Non-Incendive	-Arcing / Non-Incendive I, II Division 2 III Division 1, 2 I Zone 2 - Zone 22		-	ISA 12.12.01, CSA No. 213, FM 3611 UL 844, CSA C22.2 No 137	Energy Limitation, Non-arcing/sparking, Sealing, and Ingress Protection	
Explosion-Proof		Division 1 Zone 1	-	UL 1203, CSA No. 30, FM 3615 UL 844, CSA C22.2 No 137	Contain the explosion and extinguish the flame	
	l, II I	Division 1 Zone 1	Х			
Purge and Pressurization	l, II I	Division 1 Zone 1	Y	NFPA 496, FM 3620		
	l, 	Division 2 Zone 2	Z		Prevent ingress of	
Duct Tight	 -	Division 2 Zone 22		ISA 12.12.01	and limit surface temperature	
Dust-fight	-	Division 1, 2 Zone 22	-	UL 844, CSA C22.2 No 137		
Dust Ignition-Proof	 -	Division 1 Zone 20, 21	-	UL 1203, CSA No. 25, FM 3615, FM 3616 UL 844, CSA C22.2 No 137		
Intrinsic Safety	 , -	Division 1 Division 1 Zone 0 Zone 20	-	ISA/UL/CSA 60079-11 UL 913, CSA No. 157, FM 3610	Limit energy of sparks and surface temperature	

Other Useful Standards		
Standard Types	IEC Standards	US & CAN 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

Other Useful S	Standards		
Hazard Level	Division Scheme	Zone Scheme Gas/Dust	Type of Explosive Atmosphere
Continuous Hazard	Division 1	IEC 60079-10-1	Continually present
Intermittent Hazard		IEC 60079-10-2	Likely to occur during normal operations
Hazard Under Abnormal Conditions	Division 2	IEC 60079-14	Not likely to occur during normal operations, but may occur for short periods

emperature Classific	cation ⁷	
Max. Surface Temperature	NEC [®] 50 0 / C EC [®]	NEC [®] 505 / IEC - Group II
450° C (842°F)	T1	T1
300° C (572°F)	T2	
280° C (536°F)	T2A	
260° C (500°F)	T2B	Т2
230º C (446ºF)	T2C	
215º C (419ºF)	T2D	
200° C (392°F)	T3	
180º C (356ºF)	ТЗА	ТЗ
165º C (329ºF)	ТЗВ	
160° C (320°F)	T3C	
135° C (275°F)	T4	T4
120° C (248°F)	T4A	1 14
100° C (212°F)	T5	Т5
85° C (185°F)	T6	T6

	рх	Gb,Gc Db,Dc	1,2 21,22			
Purged and Pressurization ¹²	ру	Gb,Gc Db,Dc	1,2 21,22	60079-13	Keep the gas / con dust out	flammable nbustible of room
	pz	Gc Dc	2, 22			
Note 12: a. The product should not have Category 2 Non electrical equipment, an b. Refer "ATEX 2014/34/EU Guidelines, 1s c. Refer "ANNEX II of Regulation (EC) No 7	the number of a d for any volun t Apr 2016, Page 765/2008" for "C	a Notifed Bo tary certifca e 235″ for He E″ Marking f	ody affxed, if falling ur tion. exagon Ex drawing de orm.	nder Category 3 (other etails.	than Unit verif	cation), as well as
Electrical Equipment						
General Requirements	-	All ¹²	0,1,2,20, 21,22	60079-0	General I for all Ex	requirements equipment
	ia	Ga Da Ma	0, 20			
Intrinsic Safety	ib	Gb Db Mb	1, 21	60079-11	Limit ene & surface	ergy of sparks e temperature
	ic	Dc	2, 22			
Intrinsic Safety	eb	Gb Mb	1	60079-7	No arcs.	sparks or
·	ec	Dc	2, 22		hot surfa	ces
Non-Arcing	nA	Gc	2	60079-15		
	da	Ga Gb	0	60070 1		
Flame-Proof	db	Mb		60079-1	Contain	the explosion and
Dourdor Filled	uc	Gb	2 1	60070 5	Filled fla	me
	Ч (Mb	1	00079-5	-	
Enclosed Break	nC	Gc	2	60079-15		
Sealed Device	nC	GC Gb	2	60079-15	-	
Durge and Dressurization	рхр	Mb	1,21	60070 2		
Purge and Pressurization	рус	GC	1, 21	60079-2		
	pzc ma	Gc Ga Da	0, 20		-	
Encapsulation	mb	Ma Gb Db	1, 21	60079-18 Prevent in explosive limit surfa	ngress of	
	mc	Mb Gc	2,22		limit surf	rface temperature
Restricted Breathing	nR	Dc Gc	2	60079-15	-	
Liquid Immersion	ob	Gb	- 1	60079-6	-	
Liquid Immersion	oc	Gc	2	60079-6	-	
	ta	Da	20		-	
Dust-Protected	tb	Dd	21	60079-31		
Dastriotected	tc	Dc	22			
	oppr	Gb	1 21		Protectio	on against
Optical Radiation		Db	1,21	60079-28	release o	f optical energy
	op is	Da	0, 20	0007720	Limitatio	n of optical energy
	op sh	Da	0, 20		Optical s	ystem interlocking
Electrical Equipment						
Type of Protection	IECEx Code/ ATEX Code	EPL	Zone(s)	ISO/IEC Standard (IECEx)	EN Standard (ATEX)	Basic Concept of Protection
General Requirements	h -	All ¹³	0,1,2,20,21,22	60079-13	13463-1	Basic methods & All requirements
Flow-Restricted Enclosure	- fr	Gc Dc	2, 22	-	13463-2	Relies on tight seals, closely machined joints, and tough
Flame-Proof Enclosure	- d	All ¹³	1, 21	-	13463-3	enclosures to restrict the breathing of the enclosure
Constructional Safety	ch -	All	0,1,2,20,21,22	80079-37	13463-5	Ignition hazards mitigated by good engineering methods
Control of Ignition Sources	bh b	All	0,1,2,20,21,22	80079-37	13463-6	Control equipment fitted to detect malfunctions
Liquid Immersion	kh k	All	0,1,2,20,21,22	80079-37	13463-8	Enclosure uses liquid to prevent contact with explosive atmospheres
Purge & Pressurization	р	Gb,Gc Db,Dc	1,2,21,22	60079-2	60079-2	Prevent ingress of explosive atmosphere & limit surface temp.
Ignition Hazards & Risk Assessment	-	All	0,1,2,20,21,22	80079-36	1027-1	Basic concepts and methodology, & ignition hazard assessment

Note 1: In the United States, suitability for equipment in mining applications is per approval by the Mine Safety and Health Administration (MSHA). NICOR can test and evaluate equipment to ACRI standards or equivalent, per US National Standards, providing test reports for your submittal 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: CSA C22.2 No 60079-2:2016 covers dust (pD, Zone 21 and 22); ANSI/ISA 60079-2-2010 (R2015) 5th ed/ ANSI/UL 60079-2 5th Ed does not cover dust.

Note 5: CAN/CSA-C22.2 No. 60079-6:11 does not recognize "oc"/ "Hc"

Note 6: Neither optical protection nor optical radiation is addressed by the NEC[®] or CEC[®].

Enclosure Type Ratings [NEC [®] & CEC [®]]

Туре	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 temporary submersion
12, 12K	Indoor	Protection against circulating dust, fibers, flyings
13	Indoor	Protection against circulating dust, fibers, flyings, seepage

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).

ATEX AND IECEX

Typical ATEX & IECEx Marking										
CE	0359	Æx>	П	2	G	Ex	db	IIC	T 4	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 Protectection Level (EPL)

Equip Prote	oment (ction L	Categories & evels ¹⁰	ATEX Categories vs Zones of Use ¹⁰				
ATFX	Equipment	Typical Equipment	Equipment	Zone of Use			
Category	Protection Level	Zone Suitability	Category ATEX 2014/34/EU	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	Category 2	Zone 1 & 2	Zone 21 & 22		
2 G	Gb	Zones 1, 2	Category 3	Zone 2	Zone 22		
2 D	Db	Zones 21, 22					
3 G	Gc	Zone 2	Note 10: Unless the explosion protection risk assessment states otherwise				
3 D	Dc	Zone 22					
M1	Ma	Very high level of protection for mines					
M2	Mb	High level of protection for mines					

Note 13: Evaluation per EN 50303 is additionally required for ATEX, Category M1

Ing [IE	gress Protec C 60529]	tic	on Codes 14	Atmosphere Groups [ATEX & IECEx]				
First Number (protect			Second Number (protect		Environment	Location	Typical Substance	
0	No Protection	0	No Protection	I.		Coal Mining	Methane (Firedamp)	
1	Objects > 50mm	1	Vertical drip	IIA	Gases, Vapors and	Surface and Other Locations	Methane, Propane, etc.	
2	Objects > 12.5mm	2	Angled drip	IIB	Mists		Ethylene	
3	Objects > 2.5mm	3	Spraying	IIC			Hydrogen, Acetylene, etc.	
4	Objects > 1.0mm	4	Splashing	IIA			Combustible Flyings	
5	Dust-Protected	5	Jetting	IIB	Combustible Dusts		Non-Conductive	
6	Dust-Tight	6	Powerful jetting	IIC			Conductive	
		7	Temporary immersion					
		8	Continuous immersion	Note 14: Refer to IEC 60034-5 for Ingress Protection of rotating electrical machines				
		9	High pressure and temperature water jet					

Other Useful Standards									
Equipment Group	ATEX Equipment Category	Atmosphere	Equipment Protection Level (EPL)	Required Protection Performance & Operation					
l (Mines with Firedamp)	M1	Methane & Dust	Very High Ma	Two faults, Remain energized and functioning					
l (Mines with Firedamp)	M2	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 faults					
II (All Other Areas)	3G, 3D	Gas, Vapor, Mist, Dust	Low	Normal operation					