HAZARDOUS LOCATIONS

EQUIPMENT CERTIFICATION REQUIREMENTS

NICOR® | HAZLOC®

NORTH AMERICA

Typical North American Marking

Division Scheme				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 Protectection Level (EPL)

Zone Equivalency Scheme				Zone Scheme (Dust)					
Class I	Zone 1	Groups IIA, IIB, IIC	T4	Zone 20	AEx	ta	IIIC	T90 C	Da
Hazard Class	Area Classification	Gas Group	Temperature Class	Area Classification	Ex Protection Scheme	Protection Concept Code	Dust Group	Surface Temperature	Equipment Protectection Level (EPL)

Items in Red are US Only. For Canada any new installations must be classed using the Zone system, while existing installations may either use Division or be re-classed to Zone. US installations may use either Division or Zone.

Protection Concepts [NEC®& CEC®][1]

Electrical Equipment - Zone "Ex" Scheme

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
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	1	60079-7	No arcs, sparks or hot surfaces
	ec	Gc	2		
Non-Sparking	nA	Gc	2	60079-15	
Flame-Proof	da	Ga	0	60079-1	Contain the explosion and extinguish the flame
	db	Gb	1		
	dc	Gc	2		
Powder-Filled	q	Gb	1	60079-5	
Enclosed Break	nC	Gc	2	60079-15	
Purge and Pressurization[4]	px	Gb	1	60079-2	Prevent ingress of explosive atmosphere and limit surface temperature
	py	Gb	1		
	pz	Gc	2		
	pD	-	21, 22	ISA 61241-0 & ISA 61241-2	
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	
Sealed Device	nC	Gc	2	60079-15	
Oil Immersion[5]	ob	Gb	1	60079-6	
	oc	Gc	2		
Dust-Protected	ta	Da	20	60079-31	
	tb	Db	21		
	tc	Dc	22		
Optical Radiation[6]	op pr	Gb Db	1, 21	ISA 60079-28	Protection against release of optical energy
	op is	Ga Da	0, 20		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	I, II III I -	Division 2 Division 1, 2 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	I I	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
Purge and Pressurization	I, II I	Division 1 Zone 1	X	NFPA 496, FM 3620	Prevent ingress of explosive atmosphere and limit surface temperature
	I, II I	Division 1 Zone 1	Y		
	I, II I	Division 2 Zone 2	Z		
Dust-Tight	II -	Division 2 Zone 22	-	ISA 12.12.01 CSA No. 213 UL 844, CSA C22.2 No 137	
	III -	Division 1, 2 Zone 22			
Dust Ignition-Proof	II -	Division 1 Zone 20, 21	-	UL 1203, CSA No. 25, FM 3615, FM 3616 UL 844, CSA C22.2 No 137	
Intrinsic Safety	I II, III I -	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

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 ®]

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

NORTH AMERICA/ATEX/IECEX

Enclosure Type Ratings [NEC ® & CEC ®]

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		Group D	IIA[6]
Combustible Metal Dusts	Class II Combustible Dusts	Group E[2]	IIIC
Combustible Carbonaceous Dusts		Group F	IIIB
Combustible Dusts not in Group E or F (Flour, Grain, Wood, Plastics, Chemicals)		Group G	IIIB
Combustible Fibers and Flyings	Class II Combustible Dusts	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-mining applications

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 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

Temperature Classification[7]

Max. Surface Temperature	NEC® 50 0 / C EC®	NEC® 505 / IEC - Group II
450º C (842ºF)	T1	T1
300º C (572ºF)	T2	T2
280º C (536ºF)	T2A	
260º C (500ºF)	T2B	
230º C (446ºF)	T2C	
215º C (419ºF)	T2D	
200º C (392ºF)	T3	T3
180º C (356ºF)	T3A	
165º C (329ºF)	T3B	
160º C (320ºF)	T3C	
135º C (275ºF)	T4	T4
120º C (248ºF)	T4A	
100º C (212ºF)	T5	T5
85º C (185ºF)	T6	T6

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

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 Protectection Level (EPL)

*ATEX only (ATEX 2014/34/EU)

Equipment Categories & Protection Levels[10]

ATEX Category	Equipment Protection Level	Typical Equipment Zone Suitability
1 G	Ga	Zones 0, 1, 2
1 D	Da	Zones 20, 21, 22
2 G	Gb	Zones 1, 2
2 D	Db	Zones 21, 22
3 G	Gc	Zone 2
3 D	Dc	Zone 22
M1	Ma	Very high level of protection for mines
M2	Mb	High level of protection for mines

ATEX Categories vs Zones of Use[10]

Equipment Category ATEX 2014/34/EU	Zone of Use	
	Gas, Vapors, & Mist	Dust
Category 1	Zone 0, 1 & 2	Zone 20, 21 & 22
Category 2	Zone 1 & 2	Zone 21 & 22
Category 3	Zone 2	Zone 22

Note 10: Unless the explosion protection risk assessment states otherwise

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
Purged and Pressurization[12]	px	Gb,Gc Db,Dc	1,2 21,22	60079-13	Keep the flammable gas / combustible dust out of room
	py	Gb,Gc Db,Dc	1,2 21,22		
	pz	Gc Dc	2, 22		

Note 12: a. The product should not have the number of a Notifed Body affxed, if falling under Category 3 (other than Unit verifcation), as well as Category 2 Non electrical equipment, and for any voluntary certifcation.
b. Refer "ATEX 2014/34/EU Guidelines, 1st Apr 2016, Page 235" for Hexagon Ex drawing details.
c. Refer "ANNEX II of Regulation (EC) No 765/2008" for "CE" Marking form.

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		
Intrinsic Safety	eb	Gb Mb	1	60079-7	No arcs, sparks or hot surfaces
	ec	Gc Dc	2, 22		
Non-Arcing	nA	Gc	2	60079-15	
Flame-Proof	da	Ga	0	60079-1	Contain the explosion and extinguish the Powder-Filled flame
	db	Gb Mb	1		
	dc	Gc	2		
Powder-Filled	q	Gb Mb	1	60079-5	
Enclosed Break	nC	Gc	2	60079-15	
Sealed Device	nC	Gc	2	60079-15	Prevent ingress of explosive atmosphere and limit surface temperature
Purge and Pressurization	pxb	Gb Mb	1, 21	60079-2	
	pyc	Gc	1, 21		
	pzc	Gc	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	
Liquid Immersion	ob	Gb	1	60079-6	
Liquid Immersion	oc	Gc	2	60079-6	
Dust-Protected	ta	Da	20	60079-31	
	tb	Dd	21		
	tc	Dc	22		
Optical Radiation	op pr	Gb Db	1, 21	60079-28	Protection against release of optical energy
	op is	Ga Da	0, 20		Limitation of optical energy
	op sh	Ga Da	0, 20		Optical system 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 enclosures to restrict the breathing of the enclosure
Flame-Proof Enclosure	- d	All[13]	1, 21	-	13463-3	
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	p	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 13: Evaluation per EN 50303 is additionally required for ATEX, Category M1

Ingress Protection Codes [14] [IEC 60529]

First Number (protect from solid bodies)		Second Number (protect from water)	
0	No Protection	0	No Protection
1	Objects > 50mm	1	Vertical drip
2	Objects > 12.5mm	2	Angled drip
3	Objects > 2.5mm	3	Spraying
4	Objects > 1.0mm	4	Splashing
5	Dust-Protected	5	Jetting
6	Dust-Tight	6	Powerful jetting
		7	Temporary immersion
		8	Continuous immersion
		9	High pressure and temperature water jet

Atmosphere Groups [ATEX & IECEx]

Group	Environment	Location	Typical Substance
I	Gases, Vapors and Mists	Coal Mining	Methane (Firedamp)
IIA		Surface and Other Locations	Methane, Propane, etc.
IIB			Ethylene
IIC			Hydrogen, Acetylene, etc.
IIA	Combustible Dusts		Combustible Flyings
IIB			Non-Conductive
IIC			Conductive

Note 14: Refer to IEC 60034-5 for Ingress Protection of rotating electrical machines

Other Useful Standards

Equipment Group	ATEX Equipment Category	Atmosphere	Equipment Protection Level (EPL)	Required Protection Performance & Operation
I (Mines with Firedamp)	M1	Methane & Dust	Very High Ma	Two faults, Remain energized and functioning
I (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