Guide to Equipment Certification Requirements for Hazardous Locations

CSA Group

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cCSAus

Typical North American Marking (CSA)

Class I, Division 1, Groups A,B,C,D T4

Hazard Class | Area Classification | Gas Group | Temperature Class

Class II, Division 1, Groups E,F,G

Hazard Class | Area Classification | Dust Group

Class I, Zone 0, AEx ia IIC T4

Hazard Class | Area Classification | Approved to US Standards | Protection Concept Code | Gas Group | Temperature Class

Protection Concepts

Type of Protection	Code	Country	Class	Division / Zone	Standard	Basic Concept of Protection
Electrical Equipment for Flammable Gas, Vapors and Mists - Class I						
General Requirements	AEx Ex	US CA US CA	Class I Class I Class I Class I	Division 1 & 2 Division 1 & 2 Zone 1 & 2 Zone 1 & 2	FM 3600 - ISA 60079-0 CSA 60079-0	
Increased Safety	AEx e Ex e	US CA	Class I Class I	Zone 1 Zone 1	ISA 60079-7 CSA C22.2 No. 60079-7	No arcs, sparks or hot surfaces
Non-Incendive	(NI) (NI)	US CA	Class I Class I	Division 2 Division 2	ISA 12.12.01 / FM 3611 C22.2 No. 213	
Non-Sparking	AEx nA Ex nA	US CA	Class I Class I	Zone 2 Zone 2	ISA 60079-15 CSA C22.2 No. 60079-15	
Explosion Proof	(XP) (XP)	US CA	Class I Class I	Division 1 Division 1	UL 1203 / FM 3615 C22.2 No. 30	Contain the explosion and extinguish the flame
Flameproof	AEx d AEx d Ex d	US US CA	Class I Class I Class I	Zone 1 Zone 1 Zone 1	ISA 60079-1 UL 1203 / FM 3615 CSA 60079-1	
Powder Filled	AEx q Ex q	US CA	Class I Class I	Zone 1 Zone 1	ISA 60079-5 CSA C22.2 No. 60079-5	
Enclosed Break	AEx nC Ex nC	US CA	Class I Class I	Zone 2 Zone 2	ISA 60079-15 CSA C22.2 No. 60079-15	
Intrinsic Safety	(IS) (IS) AEx ia AEx ib EX ia Ex ib	US CA US US CA CA	Class I Class I Class I Class I Class I Class I	Division 1 Division 1 Zone 0 Zone 1 Zone 0 Zone 1	UL 913 / FM 3610 C22.2 No. 157 ISA 60079-11 / FM 3610 ISA 60079-11 / FM 3610 CSA C22.2 No. 60079-11 CSA C22.2 No. 60079-11	Limit energy of sparks and surface temperature
Limited Energy	AEx nC Ex nL	US CA	Class I Class I	Zone 2 Zone 2	ISA 60079-15 CSA C22.2 No. 60079-15	
Pressurised	Type X Type X Type Y Type Y Type Z Type Z AEx px Ex px AEx py Ex py AEx pz Ex pz	US CA US CA US CA US CA US CA US CA	Class I Class I Class I Class I Class I Class I Class I Class I Class I Class I Class I Class I	Division 1 Division 1 Division 1 Division 1 Division 2 Division 2 Zone 1 Zone 1 Zone 1 Zone 1 Zone 2 Zone 2	NFPA 496 (FM 3620) NFPA 496 NFPA 496 (FM 3620) NFPA 496 NFPA 496 (FM 3620) NFPA 496 ISA 60079-2 CSA C22.2 No. 60079-2 ISA 60079-2 CSA C22.2 No. 60079-2 ISA 60079-2 CSA C22.2 No. 60079-2	Keep flammable gas out
Restricted Breathing	AEx nR Ex nR	US CA	Class I Class I	Zone 2 Zone 2	ISA 60079-15 CSA C22.2 No. 60079-15	
Encapsulated	AEx ma AEx m Ex m AEx mb	US US CA US	Class I Class I Class I Class I	Zone 0 Zone 1 Zone 1 Zone 1	ISA 60079-18 ISA 60079-18 CSA C22.2 No. 60079-18 ISA 60079-18	
Oil Immersion	AEx o Ex o	US CA	Class I Class I	Zone 1 Zone 1	ISA 60079-6 CSA C22.2 No. 60079-6	
Electrical Equipment for Combustible Dust and Fibres - Class II / Class III						
General Requirements	Ex	US CA US CA US	Class II Class II Class III Class III -	Division 1 & 2 Division 1 & 2 Division 1 & 2 Division 1 & 2 Zone 20, 21, 22	FM 3600 CSA C22.2 No.0 FM 3600 CSA C22.2 No.0 ISA 60079-0	
Dust Ignition Proof	-	US CA	Class II Class II	Division 1 Division 1	UL 1203 / FM 3616 CSA C22.2 No. 25	
Dust Protected	-	US CA	Class II Class II	Division 2 Division 2	ISA 12.12.01 / FM 3611 CSA C22.2 No. 25	
Protection by Enclosure	AEx ta AEx tb AEx tc Ex ta Ex tb Ex tc	US US US CA CA CA	Class II Class II Class II Class II Class II Class II	Zone 20 Zone 21 Zone 22 Zone 20 Zone 21 Zone 22	ISA 60079-31 ISA 60079-31 ISA 60079-31 CSA C22.2 No. 60079-31 CSA C22.2 No. 60079-31 CSA C22.2 No. 60079-31	Keep combustible dust out
Fiber & Flying Protection	- -	US CA	Class III Class III	Division 1 & 2 Division 1 & 2	UL 1203 / ISA 12.12.01 CSA C22.2 No. 25	
Encapsulation	AEx maD AEx mbD	US US	- -	Zone 20 Zone 21	ISA 60079-18 ISA 60079-18	
Pressurisation	(PX) (PX) (PY) (PY) (PZ) (PZ) AEx pD	US CA US CA US CA US	Class II Class II Class II Class II Class II Class II -	Division 1 Division 1 Division 1 Division 1 Division 2 Division 2 Zone 21	NFPA 496 (FM 3620) NFPA 496 NFPA 496 (FM 3620) NFPA 496 NFPA 496 (FM 3620) NFPA 496 ISA 61241-2	
Intrinsic Safety	(IS) (IS) AEx iaD AEx ibD (IS) (IS)	US CA US US US CA	Class II Class II - - Class III Class III	Division 1 Division 1 Zone 20 Zone 21 Division 1 Division 1	UL 913 / FM 3610 CSA C22.2 No. 157 ISA 60079-11 ISA 60079-11 UL 913 / FM 3610 CSA C22.2 No. 157	Limit energy of sparks and surface temperature

Note: For associated intrinsically safe apparatus suitable for installation in a hazardous location, the symbol for the type of protection "ia" or "ib" are enclosed within square brackets on the marking, e.g. AEx d (ia) IIC T4.

Note: 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.

ATEX & IECEx Certificate Number

SIRA 13 ATEX 1234

Name of Notified Body performing EC-type examination | Year of Certification | Reference to ATEX 95 Directive | Serial Number

IECEx CSA 13.1234

Reference to IECEx Scheme | Name of Body Performing IECEx Certification | Year of Certification | Serial Number

Suffixes: U – component certification X – special conditions for safe use apply

Classification of Divisions and Zones

Type of Area	NEC and CEC*	ATEX and IEC	Definitions
Continous hazard	Division 1	Zone 0 / Zone 20 Cat 1	A place in which an explosive atmosphere is continuously present
Intermittent hazard	Division 1	Zone 1 / Zone 21 Cat 2	A place in which an explosive atmosphere is likely to occur in normal operation
Hazard under abnormal conditions	Division 2	Zone 2 / Zone 22 Cat 3	A place in which an explosive atmosphere is not likely to occur in normal operation, but may occur for short periods

* On occasion the ATEX and IEC Zones may be used in the corresponding NEC and CEC system

Equipment Groups (ATEX and IECEx)

Equipment Group	Equipment Category	Equipment Protection Level	Atmosphere	Protection Level	Required Protection Performance & Operation
I (Mines with firedamp)	M1	Ma	Methane & Dust	Very High	Two Faults, Remain energised and functioning
I (Mines with firedamp)	M2	Mb	Methane & Dust	High	Severe normal operation, De-energise in explosive atmosphere
II (all other areas)	1	Ga / Da	Gas, Vapour, Mist, Dust	Very High	Two Faults
II (all other areas)	2	Gb / Db	Gas, Vapour, Mist, Dust	High	One Fault
II (all other areas)	3	Gc / Dc	Gas, Vapour, Mist, Dust	Low	Normal operation

Ingress Protection Codes

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

Enclosure Type Ratings (NEMA / CSA / UL)

Type	Area	Brief Definition
1	Indoor	General purpose
2	Indoor	Protection against angled dripping water
3, 3R, 3S	Indoor / Outdoor	Protection against rain, snow
4, 4X	Indoor / Outdoor	Protection against rain, snow, hose directed water
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

Apparatus Groups (ATEX and IECEx)

Group	Environment	Location	Typical Substance
I	Gases, Vapours	Coal Mining	Methane (Fire damp)
IIA		Surface and other locations	Acetic acid, Acetone, Ammonia, Butane, Cyclohexane, Gasoline (petrol), Kerosene, Methane (natural gas) (non-mining), Methanol (methyl alcohol), Propane, Propan-2-ol (iso-propyl alcohol), Toluene, Xylene
IIB			Di-ethyl ether, Ethylene, Methyl ethyl ketone (MEK), Propan-1-ol (n-propyl alcohol), Ethanol (ethyl alcohol)
IIC			Acetylene, Hydrogen, Carbon disulphide
IIIA	Combustible Dusts	Surface and other locations	Combustible flyings
IIIB			Non-conductive
IIIC			Conductive

Apparatus Groups (US / CAN)

Substance	Hazard Class	NEC 500	NEC 505
Acetylene	Class I Flammable Gases	Group A	IIC
Hydrogen		Group B	IIC
Ethylene		Group C	IIB
Propane		Group D	IIA
Methane (mining)		Group D	-
Combustible Metal Dusts	Class II Combustible Dusts	Group E	-
Combustible Carbonaceous Dusts		Group F	-
Combustible Dusts not in Group E or F (Flour, Grain, Wood, Plastics, Chemicals)		Group G	-
Combustible Fibers and Flyings	Class III Fibers and Flyings	-	-

C US

ATEX & IECEx

Typical ATEX & IECEx Marking (*ATEX only)

CE 0518 | Ex | II | 2 | G

*Complies with European Directives | *Notified Body Number | *Specific Marking for Explosion Protection | *Equipment Group | *Equipment Category | *Environment

Ex d IIC T4 Gb

Explosion Protection | Type of Protection | Gas Group | Temperature Class (T1-T6) | Equipment Protection Level (EPL)

Ex tb IIIC T135°C Db

Explosion Protection | Type of Protection | Dust Type | Temperature Class (°C) | Equipment Protection Level

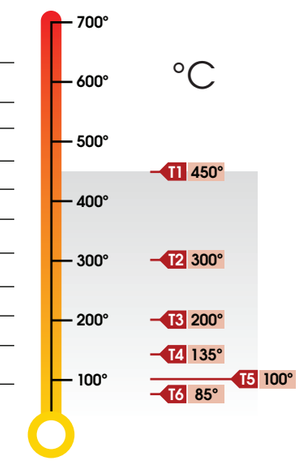
Protection Concepts (ATEX and IECEx)

Type of Protection	Symbol	Typical IEC EPL	Typical Zone(s)	IEC Standard	Basic Concept of Protection
Electrical equipment for Gases, Vapours and Mists (G)					
General Requirements	-	-	-	IEC 60079-0	-
Optical Radiation	Op pr Op sh Op is	Gb Ga Ga	1,2 0,1,2 0,1,2	IEC 60079-28	Protection against ignitions from optical radiation
Increased Safety Type 'n' (non-sparking)	e nA	Gb Gc	1,2 2	IEC 60079-7 IEC 60079-15	No arcs, sparks or hot surfaces. Enclosure IP54 or better
Flameproof	d	Gb	1,2	IEC 60079-1	Contain the explosion, quench the flame
Type 'n' (enclosed break)	nC	Gc	2	IEC 60079-15	
Quartz / Sand Filled	q	Gb	1,2	IEC 60079-5	Quench the flame
Intrinsic Safety	ia ib ic	Ga Gb Gc	0,1,2 1,2 2	IEC 60079-11	Limit the energy of sparks and surface temperatures
Pressurised	px py pz	Gb Gb Gc	1,2 1,2 2	IEC 60079-2	Keep the flammable gas out
Type 'n' (sealing & hermetic sealing) Type 'n' (restricted breathing)	nC nR	Gc Gc	2 2	IEC 60079-15	
Encapsulation	ma mb mc	Ga Gb Gc	0,1,2 1,2 2	IEC 60079-18	
Oil Immersion	o	Gb	1,2	IEC 60079-6	
Electrical equipment for Combustible Dusts (D)					
General Requirements	-	-	-	IEC 60079-0	-
Enclosure	ta tb tc	Da Db Dc	20 21 22	IEC 60079-31	Standard protection for dusts, rugged tight enclosure
Intrinsic Safety	ia ib ic	Da Db Dc	20 21 22	IEC 60079-11	Limit the energy of sparks and surface temperatures
Encapsulation	ma mb mc	Da Db Dc	20 21 22	IEC 60079-18	Protection by encapsulation of incendive parts
Pressurised	pD	Db Dc	21,22 22	IEC 61241-4	Protection by pressurisation of enclosure
Non-Electrical equipment					
General Requirements	-	-	-	EN 13463-1	Low potential energy
Flow Restricted Enclosure Flameproof Enclosure	fr d	- -	2,22 1,2,21,22	EN 13463-2 EN 13463-3	Relies on tight seals, closely matched joints and tough enclosures to restrict the breathing of the enclosure
Constructional Safety	c	-	All, See EPL	EN 13463-5	Ignition hazards eliminated by good engineering methods
Control of Ignition Sources	b	-	All, See EPL	EN 13463-6	Control equipment fitted to detect malfunctions
Pressurisation	p	-	1,2, 21,22	EN 60079-2 EN 61241-4	Enclosure is purged and pressurised to prevent ignition sources from arising
Liquid Immersion	k	-	All, See EPL	EN 13463-8	Enclosure uses liquid to prevent contact with explosive atmosphere

Temperature Classification

Classification of maximum surface temperatures for Group II Electronic Equipment (T Class).

IIA	T1	Ammonia	630°
IIC	T1	Hydrogen	560°
IIA	T1	Methane	537°
IIA	T1	Propane	470°
IIB	T2	Ethylene	425°
IIA	T2	Butane	372°
IIC	T2	Acetylene	305°
IIA	T3	Cyclohexane	259°
IIA	T3	Kerosene	210°
IIB	T4	Di-ethyl Ether	160°
IIC	T6	Carbon Disulphide	95°



Dusts Typical Ignition Temperatures (°C)

Dusts	Cloud	Layer
Aluminium	590 °C	>450 °C
Coal dust (lignite)	380 °C	225 °C
Flour	490 °C	340 °C
Grain dust	510 °C	300 °C
Methyl cellulose	420 °C	320 °C
Phenolic resin	530 °C	>450 °C
Polythene	420 °C	(melts) °C
PVC	700 °C	>450 °C
Soot	810 °C	570 °C
Starch	460 °C	435 °C
Sugar	490 °C	460 °C

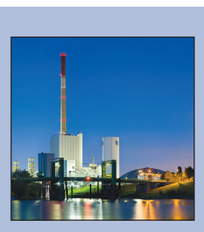
Quality Assurance

Quality Assurance is concerned with the continued monitoring of systems and processes in relation to manufacturers of Ex products, and is concerned mainly with post-compliance activities.

CSA Group offers the full range of QA services including ATEX & IECEx Product & Production Quality Assurance, Certification of Service Facilities involved in repair and overhaul of Ex Equipment and technical auditing services.

The routes to market for ATEX and IECEx:

- ATEX QAN (Quality Assurance Notification): Quality system certification for the manufacture of category 1 and category 2 electrical equipment (refer IEC/ISO 80079-34 and ATEX Directive Annexes IV / VII).
- IECEx QAR (Quality Assessment Report): Required together with the ExTR (test report) to enable issue of an IECEx Certificate of Conformity (refer IEC/ISO 80079-34 and IECEx Scheme Rules).
- ATEX Conformity-to-Type Notification: Certification for the manufacture of category 2 electrical equipment (refer ATEX Directive Annexes VI).
- ATEX Product Verification: Certification for the manufacture of category 1 equipment - 100% verification by the Notified Body (refer ATEX Directive Annexes V).
- ATEX or IECEx Unit Verification: Certification covering design and manufacture of equipment - 100% verification by the Notified Body (refer ATEX Directive Annexes IX and IECEx Scheme Rules).



ATEX & IEC Training & Competence

CSA Group has been at the forefront of hazardous area training for over 25 years, utilising the skills and experience of our highly specialised engineers and lecturers to 'transfer knowledge'.

This detailed knowledge and vast experience allows us to offer a comprehensive range of training courses and competence schemes that can be delivered as part of our 'open' training programme or tailored to your needs and delivered on-site at your premises.

- Hazardous Area Training (ATEX, DSEAR & IEC)
- Functional Safety Training
- Environmental & MCERTS Training
- Competence Certification (CoPC)
  - IECEx Certification of Personnel Competence Scheme
  - MCERTS Personnel Competence Scheme

For further details please contact CSA Group on: + 44 1244 670 900
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Functional Safety

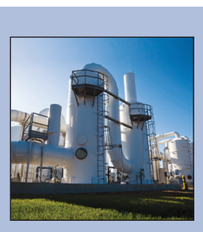
CSA Group is a leading provider of functional safety certification. IEC 61508 is the international standard for electrical, electronic and programmable electronic safety (E/E/PE) related systems. It sets out the requirements for ensuring that systems are designed, implemented, operated and maintained to provide the required safety integrity level (SIL). Four SILs are defined according to the risks involved in the system application, with SIL4 being used to protect against the highest risks. The standard specifies a process that can be followed by all links in the supply chain so that information about the system can be communicated using common terminology and system parameters.

The standard consists of the following parts:

IEC 61508-1 General requirements. **IEC 61508-2** Requirements for E/E/PE safety-related systems. **IEC 61508-3** Software requirements. **IEC 61508-4** Definitions and abbreviations. **IEC 61508-5** Examples and methods for the determination of safety integrity levels. **IEC 61508-6** Guidelines on the application of IEC 61508-2 and IEC 61508-3. **IEC 61508-7** Overview of techniques and measures.

Sector specific standards related to IEC 61508 include:

IEC 61511 Process industries. **IEC 61513** Nuclear power plants. **IEC 62061** Machinery sector and ISO 13849. **IEC 61800-5-2** Power drive systems. **EN 50272 and EN 50402** Functional safety requirements for portable and fixed gas detection systems. **EN 50495** safety devices requirements for safe operation of equipments with respect to explosion risks.



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