ATEX certified instrumentation from Endress+Hauser

ATEX Marking

Marking example: CE XXXX Ex II 2G EEx ia IIC T4 (unchanged)

- CE marking
- identification code of notified body
- Ex mark
- Equipment group
- Category of protection: Gas, vapors
- Protection method: EEx
- Apparatus group/Gas group: ia, IIC
- Temperature classification: T4

Approval number EC

KEMA 01 ATEX 1234 X

- Notified body i.e. KEMA, PTB, CESI, TÜV, DMT, etc.
- Year of issue: 01
- ATEX directive: ATEX
- Consecutive number: 1234
- Special conditions: X

II 2G

Category of Equipment

ATEX directive divides equipment into groups and additional into categories:

Group I (Mines)		Group II (Surface (non-mining) equipment)		
Subdivided into categories	Category	subdivided into		Zone
M1 Equipment remains functional with an explosive atmosphere present	1G (gas)	Equipment with a very high level of protection		0 (gas)
	1D (dust)			20 (dust)
	2G (gas)	Equipment with a high level of protection		1 (gas)
	2D (dust)			21 (dust)
M2 Equipment to be de-energized in the event of an explosive atmosphere	3G (gas)	Equipment with a normal level of protection		2 (gas)
	3D (dust)			22 (dust)

Note: category 2D apparatus required for Zone 22 (conductive dust).

Examples of Category marking:
1/2G for equipment interfacing Zone 0 and Zone 1 areas
1/3D for equipment interfacing Zone 20 and Zone 22 areas
(1) for associated apparatus with intrinsically safe output into Zone 0

ATEX

ATEX Directives

ATmosphère EXplosible

Old directives
specify the European standards

New directives
specify the so called Essential Health and Safety Requirements

Dust-Ex hazardous areas are regulated first time in EC.

At this moment there are three directives for equipment intendedfor use in Hazardous Area:

82/139/EEC(Mines)
Will be valid until June 30, 2003
Only Electrical Equipment

76/117/EEC (Surface Industries)
Will be valid until June 30, 2003
Only Electrical Equipment

New directive
94/9/EC (ATEX) valid since March 1,1996 mandatory July 1, 2003
All Equipment, Protective Systems and Components

Summary of changes:
Categorisation of equipment matching area classifications.
Categorisation based upon Essential Safety Requirements (ESR):
- Consider electrical and non-electrical equipment,also dust-Ex hazardous areas
- Influencing equipment design with respect to
  - Protective method
  - Choice of materials
  - Equipment marking
  - Safety instructions included
  - Environmental and atmospheric conditions
  - Software included

It will be mandatory to re-certify equipment certified under the old directives if you want to sell this equipment after July 1, 2003.

T4

Temperature Classification

Maximum Surface Temperature		Temperature Classification	
Degree C	Degree F	IEC/European	North American*1
450	842	T1	T1
300	572	T2	T2
280	536		T2A
260	500		T2B
230	446		T2C
215	419		T2D
200	392	T3	T3
180	356		T3A
165	329		T3B
160	320		T3C
135	275	T4	T4
120	248		T4A
100	212	T5	T5
85	185	T6	T6

*1 for comparison only

EEx ia

Protection Method

Summary of protection methods against explosion

General Principles	IEC / European Practice	Zone	Cenelec EN	American*1 Practice	Division	Principle Characteristics
Explosion Containment	Explosion-proof Ex »d«	1, 2	50018	Explosion-proof	1, 2	Relatively easy to be applied, but with specific mechanical requirements. Maintenance and checks are more time consuming.
Segregation	Pressurization Ex «p«	1, 2	50016	Purging	1, 2	Suitable for cabinets and motors. Requires specific monitoring alarm systems.
	Encapsulation Ex «m«	1, 2	50028	Not recognized		Suitable for sensors, small circuits and solenoid valves. Maintenance practically impossible.
	Oil-immersion Ex »o«	1, 2	50015	Oil-immersion	1, 2	Suitable for transformers and where there aremoving parts. Generally not widely used.
	Powder filling Ex «q«	1, 2	50017	Not recognized	-	Suitable where there are no moving parts. Present maintenance difficulty. Not widely used.
Prevention	Increased safety Ex »e«	1, 2	50019	Not recognized	-	Suitable for non-sparking apparatus during normal functioning (terminals, connections, lamp sockets, motors). Particular construction requirements.
	Intrinsic safety Ex »ia«	0, 1, 2 (20, 21, 22)*	50020 50039 50284	Intrinsic safety	1, 2	Suitable for process instrumentation. Economical and easy installation, maintenance and checks. Limited to low power circuits.
	Intrinsic safety Ex »ib«	1, 2 (21, 22)*	50020 50039	Not recognized	-	Similar to Ex «ia« except for the number of faults to be considered.
	Type n Ex »n«	2	50021	Non incendive	2	Alternative to standardized types of protection for zone 2 and division 2. No certificate required in Europe.
Special requirement for category 1 equipment		0 (1, 2)*	50284	Not recognized	-	Additional requirements for equipment protected by standardized types of protection.
Dust Ex Protection	Protection by enclosure and temperature limitation	20, 21, 22	50281	NEC Section 90-4	1, 2	Special requirements for equipment in dust explosion hazardous areas.

IIC

Apparatus Group and Gas/Dust Group

Hazard Categories	Apparatus Classification Europe	North America*1	Min. Ignition Energy
Mines	Group I	Group D (gaseous mines)	
Acetylene	Group IIC	Class I, Group A	20 µJ
Hydrogen	Group IIC	Class I, Group B	20 µJ
Ethylene	Group IIB	Class I, Group C	60 µJ
Propane	Group IIA	Class I, Group D	180 µJ
Metal dust	–	Class II, Group E	More easily ignitable
Coal dust	–	Class II, Group F	
Grain dust	–	Class II, Group G	
Fibers	–	Class III	

Certified Instrumentation from Endress+Hauser for North America

Markings for Canada (Marking Examples)

Option A: Zones — Ex ia IIC T4

Means:		Means:	
Ex	Explosion protected		
ia	Protection method (Intrinsic Safety)		
IIC	Gas group (acetylene & hydrogen)		
T4	Temperature class		

Option B: Divisions — Class I, Division 1, Groups A,B,C&D T4

Means:		Means:	
Class I	Flammable gas or vapor		
Division 1	Area classification (explosive atmosphere may exist under normal operating conditions)		
Group A,B,C&D	Gas groups		
T4	Temperature code		

Markings for the United States (Marking Examples)

Option A: Zones — Class I, Zone 0, AEx ia IIC T4

Means:		Means:	
Class I	Flammable gas or vapor		
Zone 0	Area classification (explosive atmosphere present continuously)		
A	Conformity to US requirements		
Ex	Explosion protected		
ia	Protection method (Intrinsic Safety)		
IIC	Gas group (acetylene & hydrogen)		
T4	Temperature class		

Option B: Divisions — IS Class I, Division 1, Groups A,B,C&D T4

Means:		Means:	
IS	Protection method (Intrinsic Safety)		
Class I	Flammable gas or vapor		
Division 1	Area classification (explosive atmosphere may exist under normal operating conditions)		
Group A,B,C&D	Gas groups		
T4	Temperature code		

Special Purpose Enclosures

Enclosure Type US (NEMA 250) and Canada (CSA Std. C22.2 No. 94)	Approximate equivalent IP-Code (IEC 60529)	Protection against
1	→ IP10	incidental contact with the enclosed equipment
2	→ IP11	dripping and light splashing of liquids
3	→ IP54	windblown dust, rain, sleet, snow and external formation of ice
3R	→ IP14	rain, sleet, snow and external formation of ice
3S	→ IP54	windblown dust, rain, sleet, snow and external mechanism(s) remain operable when ice laden
4	→ IP56	windblown dust, rain, sleet, snow, splashing water, hose-directed water
4X	→ IP56	windblown dust, rain, sleet, snow, splashing water, hose-directed water and corrosion
5	→ IP52	settling airborne dust, lint, fibers, flyings, dripping and light splashing of liquids
6	→ IP67	hose-directed water, entry of water during occasional temporary submersion at limited depth
6P	→ IP67	hose-directed water, entry of water during prolonged submersion at limited depth

Zone/Division

Area Classification

IEC		Flammable Material Present Continuously (> 1000 h/y)	Flammable Material Present Intermittently (10…1000 h/y)	Flammable Material Present Abnormally (< 10 h/y)
CENELEC	Gas	Zone 0	Zone 1	Zone 2
CENELEC	Dust	Zone 20	Zone 21	Zone 22
NEC & CEC (North America)	Gas, Dust and Fibers	Division 1	Division 1	Division 2
	Gas	Zone 0	Zone 1	Zone 2

IIC/Groups

Hazardous Locations Groups

Typical Hazard	North America CEC Section 18, NEC Article 500	CENELEC/IEC CENELEC EN50014, IEC 60079
Acetylene	Class I/Group A or IIC	IIC
Hydrogen	Class I/Group B or IIC	IIC
Ethylene	Class I/Group C or IIB	IIB
Propane	Class I/Group D or IIA	IIA
Methane	Group D (gaseous mines) or I	I
Metal Dust	Class II/Group E	—
Coal Dust	Class II/Group F	—
Grain Dust	Class II/Group G	—
Fibers	Class III	—

Ex/AEx

Protection Concepts

Method of Protection	Code	Permitted Use	Standard US (FM)	Standard Canada (CSA)	Protection Principle
Increased Safety	AEx e	Class I, Zone 1	FM 3600* (ISA S12.16.01)		No arcs, sparks or hot surfaces
	Ex e	Zone 1	IEC 60079-7	CSA Std. E79-7	
Non-incendive	(NI)	Class I, Div 2	FM 3611	CSA Std. C22.2 No. 213 and CEC, Part I, App. J	
Non-sparking	Ex nA	Zone 2	IEC 60079-15	CSA Std. E79-15	
Explosionproof	(XP)	Class I, Div 1	FM 3615	CSA Std. C22.2 No. 30	
Flameproof	AEx d	Class I, Zone 1	FM 3600* (ISA S12.22.01)		Contain the explosion and quench the flame
	Ex d	Zone 1	IEC 60079-1	CSA Std. E79-1	
Powder Filled	AEx q	Class I, Zone 1	FM 3600* (ISA S12.25.01)		
	Ex q	Zone 1	IEC 60079-5	CSA Std. E79-5	
Enclosed Break	Ex nC	Zone 2	IEC 60079-15	CSA Std. 79-15	
Intrinsic Safety	(IS)	Class I, Div 1	FM 3610†	CSA Std. C22.2 No. 157	
	AEx ia	Class I, Zone 0	FM 3610†		Limit energy of sparks and surface temperature
	AEx ib	Class I, Zone 1	FM 3610†		
	Ex ia	Zone 0	IEC 60079-11	CSA Std. C22.2 No. 157/ CSA Std. E79-11	
	Ex ib	Zone 1	IEC 60079-11	CSA Std. E79-11	
	Ex nA	Zone 2	IEC 60079-15	CSA Std. E79-15	
Limited Energy	Ex nL	Zone 2	IEC 60079-15	CSA Std. E79-15	
Pressurized	Type X	Class I, Div 1	FM 3620		
	Type Y	Class I, Div 1	FM 3620		
	Type Z	Class I, Div 2	FM3620		
	Ex p	Zone 1		CSA Std. E79-2	Keep flammable gas out
	Ex px	Zone 1	IEC 60079-2		
	Ex py	Zone 1	IEC 60079-2		
	Ex pz	Zone 2	IEC 60079-2		
	Ex nZ	Zone 2	IEC 60079-15	CSA Std. E79-15	
Restricted Breathing	Ex nR	Zone 2	IEC 60079-15	CSA Std. E79-15	
Encapsulation	AEx m	Class I, Zone 1	FM 3600* (ISA S12.23.01)		
	Ex m	Zone 1	IEC 60079-18	CSA Std. E79-18	
Oil Immersion	AEx o	Class I, Zone 1	FM 3600* (ISA S12.26.01)		
	Ex o	Zone 1	IEC 60079-6	CSA Std. E79-6	

*Also shall comply with ISA S12.00.01 †Based on ISA S12.02.01

T4

Temperature Code and Temperature Class

Maximum Surface Temperature [°C]	North American Temperature Code	CENELEC/IEC Temperature Class
450	T1	T1
300	T2	T2
280	T2A	
260	T2B	
230	T2C	
215	T2D	
200	T3	T3
180	T3A	
165	T3B	
160	T3C	
135	T4	T4
120	T4A	
100	T5	T5
85	T6	T6