

# Certified Instrumentation from Endress+Hauser for North America

## Markings for Canada (Marking Examples)

Option A: Zones

Option B: Divisions

**Ex ia IIC T4** **Class I, Division 1, Groups A,B,C&D T4**

**Means:**

Ex	Explosion protected	Class I	Flammable gas or vapor
ia	Protection method (Intrinsic Safety)	Division 1	Area classification (explosive atmosphere may exist under normal operating conditions)
IIC	Gas group (acetylene & hydrogen)	Group A,B,C&D	Gas groups
T4	Temperature class	T4	Temperature code

## Markings for the United States (Marking Examples)

Option A: Zones

Option B: Divisions

**Class I, Zone 0, AEx ia IIC T4** **IS Class I, Division 1, Groups A,B,C&D T4**

**Means:**

Class I	Flammable gas or vapor	IS	Protection method (Intrinsic Safety)
Zone 0	Area classification (explosive atmosphere present continuously)	Class I	Flammable gas or vapor
A	Conformity to US requirements	Division 1	Area classification (explosive atmosphere may exist under normal operating conditions)
Ex	Explosion protected	Group A,B,C&D	Gas groups
ia	Protection method (Intrinsic Safety)	T4	Temperature code
IIC	Gas group (acetylene & hydrogen)		
T4	Temperature class		

## Ex/AEx

### Protection Concepts

Method of Protection	Code	Permitted Use	Standard US (FM)	Standard Canada (CSA)	Protection Principle
<b>Increased Safety</b>	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	
<b>Non-incendive</b>	(NI)	Class I, Div 2	FM 3611	CSA Std. C22.2 No. 213 and CEC, Part I, App. J	
<b>Non-sparking</b>	Ex nA	Zone 2	IEC 60079-15	CSA Std. E79-15	
<b>Explosionproof</b>	(XP)	Class I, Div 1	FM 3615	CSA Std. C22.2 No. 30	
<b>Flameproof</b>	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	
<b>Powder Filled</b>	AEx q	Class I, Zone 1	FM 3600* (ISA S12.25.01)		
	Ex q	Zone 1	IEC 60079-5	CSA Std. E79-5	
<b>Enclosed Break</b>	Ex nC	Zone 2	IEC 60079-15	CSA Std. 79-15	
<b>Intrinsic Safety</b>	(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		
<b>Limited Energy</b>	Ex nL	Zone 2	IEC 60079-15	CSA Std. E79-15	
<b>Pressurized</b>	Type X	Class I, Div 1	FM 3620		Keep flammable gas out
	Type Y	Class I, Div 1	FM 3620		
	Type Z	Class I, Div 2	FM3620		
	Ex p	Zone 1		CSA Std. E79-2	
	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	
	Ex nR	Zone 2	IEC 60079-15	CSA Std. E79-15	
<b>Restricted Breathing</b>	Ex nR	Zone 2	IEC 60079-15	CSA Std. E79-15	
<b>Encapsulation</b>	AEx m	Class I, Zone 1	FM 3600* (ISA S12.23.01)		
	Ex m	Zone 1	IEC 60079-18	CSA Std. E79-18	
<b>Oil Immersion</b>	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

## Zone/Division

### Area Classification

		Flammable Material Present Continuously (> 1000 h/y)	Flammable Material Present Intermittently (10...1000 h/y)	Flammable Material Present Abnormally (< 10 h/y)
IEC	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

## 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

## 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	→ IP62	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

## 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	—

# ATEX certified instrumentation from Endress+Hauser

## ATEX Marking

## Type of Protection

## Approval number EC

Marking example:



### Category of Equipment

ATEX directive divides equipment into groups and additional into categories:

#### Group I (Mines)

Subdivided into categories

**M1** Equipment remains functional with an explosive atmosphere present

**M2** Equipment to be de-energized in the event of an explosive atmosphere

#### Group II (Surface (non-mining) equipment)

Category	subdivided into	Zone
1G (gas) 1D (dust)	Equipment with a very high level of protection	0 (gas) 20 (dust)
	Equipment with a high level of protection	1 (gas) 21 (dust)
3G (gas) 3D (dust)	Equipment with a normal level of protection	2 (gas) 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

**II**  
**2G**

### ATEX Directives

AT<sub>mosphere</sub> EX<sub>possible</sub>

**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 intended for 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, 1998 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.

**ATEX**

### Temperature Classification

#### Maximum Surface Temperature

Degree C	Degree F
450	842
300	572
280	536
260	500
230	446
215	419
200	392
180	356
165	329
160	320
135	275
120	248
100	212
85	185

#### Temperature Classification

IEC/European	North American**
T1	T1
T2	T2
	T2A
	T2B
	T2C
	T2D
T3	T3
	T3A
	T3B
	T3C
T4	T4
	T4A
T5	T5
T6	T6

\*\* for comparison only

**T4**

### Protection Method

Summary of protection methods against explosion

General Principles	IEC / European Practice		Cenelec EN	American** Division		Principle Characteristics
	Practice	Zone		Practice	Division	
Explosion Containment	Explosion-proof	1, 2	50018	Explosion-proof	1, 2	Relatively easy to be applied, but with specific mechanical requirements. Maintenance and checks are more time consuming.
	Ex -d-					
Segregation	Pressurization	1, 2	50016	Purging	1, 2	Suitable for cabinets and motors. Requires specific monitoring alarm systems.
	Ex -p-					
	Encapsulation	1, 2	50028	Not recognized	-	Suitable for sensors, small circuits and solenoid valves. Maintenance practically impossible.
	Ex -m-					
Oil-immersion	Oil-immersion	1, 2	50015	Oil-immersion	1, 2	Suitable for transformers and where there are moving parts. Generally not widely used.
	Ex -o-					
	Powder filling	1, 2	50017	Not recognized	-	Suitable where there are no moving parts. Present maintenance difficulty. Not widely used.
Increased safety	Ex -q-	1, 2	50019	Not recognized	-	Suitable for non-sparking apparatus during normal functioning (terminals, connections, lamp sockets, motors). Particular construction requirements.
	Ex -e-					
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	1, 2 (21, 22)*	50020/50039	Not recognized	-	Similar to Ex -ia- except for the number of faults to be considered.
	Ex -ib-					
Type n	Type n	2	50021	Non incendive	2	Alternative to standardized types of protection for zone 2 and division 2. No certificate required in Europe.
	Ex -n-					
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.

**EEx**

**ia**

**IIC**

### Apparatus Group and Gas/Dust Group

#### Hazard Categories

Hazard Categories	Apparatus Classification		Min. Ignition Energy
	Europe	North America**	
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	

