

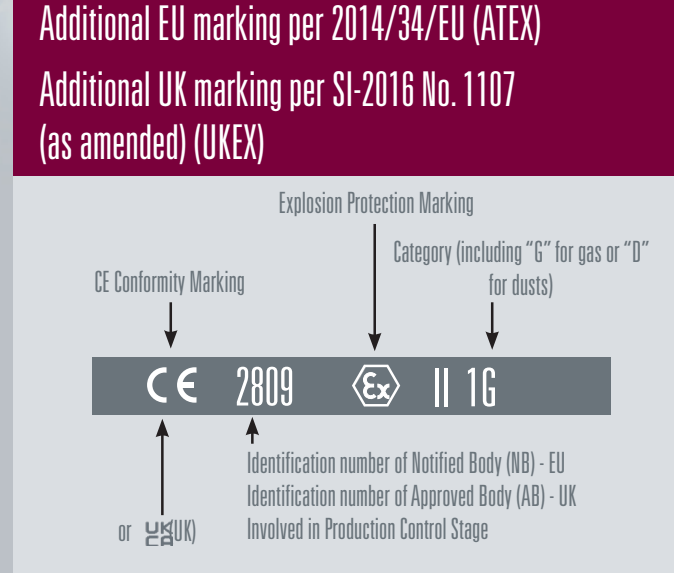
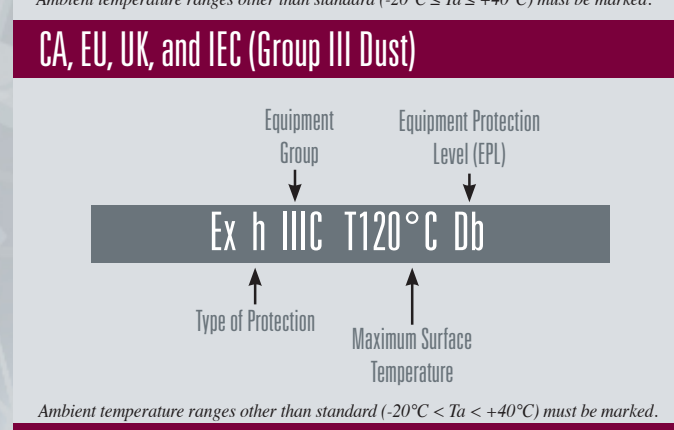
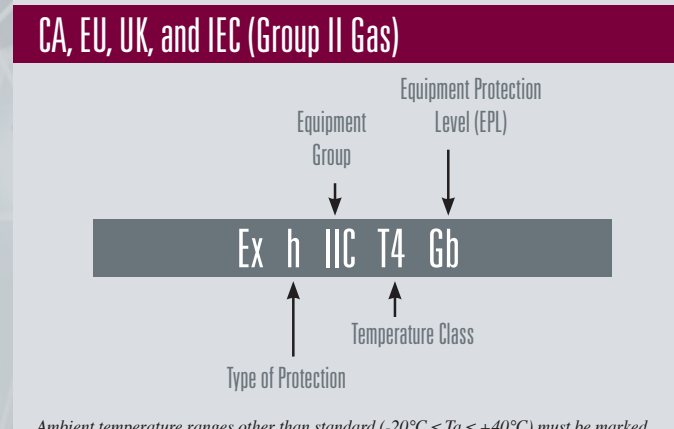
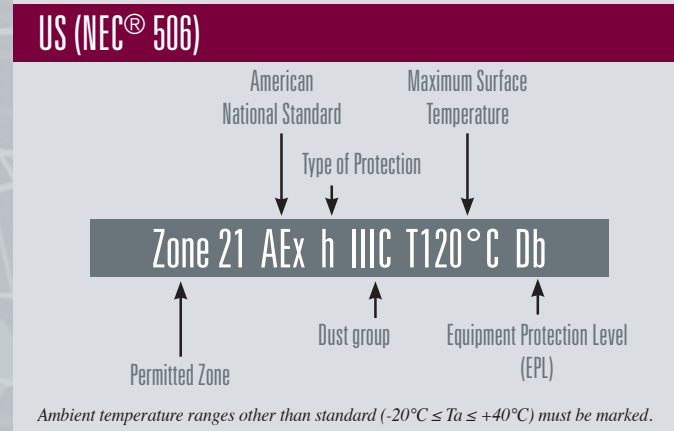
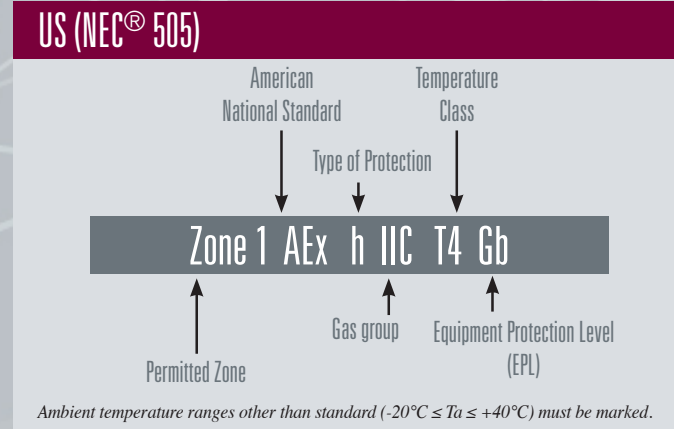
Guide to Hazardous Locations

Non-Electrical Equipment for Explosive Atmospheres



Member of the FM Global Group

EX MARKING



EQUIPMENT PROTECTION LEVEL (EPL) / CATEGORY

Definition	IEC		EU (ATEX)		Typical Zone of Application
	EPL	Group	Category	Group	
Mines, "very high" level of protection	Ma	I	M1	I	N/A
Mines, "high" level of protection	Mb		M2		
Gas atmospheres, "very high" level of protection	Ga	II	1G	II	0
Gas atmospheres, "high" level of protection	Gb		2G		1
Gas atmospheres, "enhanced" level of protection	Gc		3G		2
Dust atmospheres, "very high" level of protection	Da	III	1D	II	20
Dust atmospheres, "high" level of protection	Db		2D		21
Dust atmospheres, "enhanced" level of protection	Dc		3D		22

Level of protection assigned to equipment based on its likelihood of becoming a source of ignition

PROTECTION CONCEPTS

Type of Protection	Code	Market	Application	Standard
Basic method & General requirements Ignition Hazard Assessment (IHA)	AEx h	US	Zone 0, 1, 2, 20, 21, or 22 depending on EPL of equipment	ANSI/UL 80079-36
	Ex h	CA		CSA C80079-36
	Ex h	EU / UK		EN ISO 80079-36
Constructional safety Control of ignition source Liquid immersion	AEx h	US	Zone 0, 1, 2, 20, 21, or 22 depending on EPL of equipment	ANSI/UL 80079-37
	Ex h	CA		CSA C80079-37
	Ex h	EU / UK		EN ISO 80079-37
	Ex h	IEC		ISO 80079-37

COMMON EQUIPMENT STANDARDS

Type of Protection	Code	Market	Application	Standard
Vacuum cleaners for EPL Dc	AEx 62784	US	EPL Dc	ANSI/UL 62784*
	Ex 62784	CA		CSA C22.2 No. 62784*
	Ex 62784	EU / UK		EN 62784
	Ex 62784	IEC		IEC 62784
Flame arrestors		US	EPL Gb Category 2G	FM 6061
		CA		ISO 16852
		EU / UK		EN ISO 16852
Reciprocating engines	Ex 80079-41	IEC	EPL Gb EPL Gc	ISO/IEC 80079-41*
		EU / UK	Category 2G or 3G	EN 1834-1
		EU / UK	Category M2 Category 2D or 3D	EN 1834-2 EN 1834-3
Industrial trucks		US	Category 2G, 3G, 2D, or 3D	ANSI/UL 558, ANSI/UL 2267
		CA		
		EU / UK		EN 1755
Explosion venting devices	EN 14797	US	Category II G or II D Category II G or II D	FM 7730
		CA		
		EU / UK		EN 14797 EN 16009
		IEC		ISO 80079-50*

* Standards are currently in development

MAXIMUM SURFACE TEMPERATURE / TEMPERATURE CLASS

Maximum Surface Temperature			
Group II Marking		US NEC 505 / CA CE Code Section 18 / IEC / EU	
Maximum surface temperature	Temperature class	For Group II equipment subjected to type testing for maximum surface temperature, the temperature or temperature class marked on the equipment does not exceed the measured maximum surface temperature, less 5 K for temperature classes T6, T5, T4 and T3 (or marked temperatures ≤ 200 °C), and less 10 K for temperature classes T2 and T1 (or marked temperatures > 200 °C).	
450 °C	T1		
300 °C	T2		
200 °C	T3		
135 °C	T4		
100 °C	T5		
85 °C	T6	For Group II equipment subjected to routine testing for maximum surface temperature, the temperature or temperature class marked on the electrical equipment does not exceed the measured maximum surface temperature.	
Group III Marking	US NEC 506 / CA CE Code Sect 18		IEC / EU / UK - EPL Dc ¹
T _{max} °C (With no dust layer) Maximum surface temperature in degrees Celsius preceded by a "T" e.g. T120 °C	Temperature is determined with a maximum dust layer thickness¹ on the equipment. For installation, the marked maximum surface temperature must not be greater than the dust layer or dust cloud ignition temperature.		Temperature is determined with no dust layer on the equipment. For installations with layers up to 5 mm thick, that maximum surface temperature must be at least 75 K below the dust layer ignition temperature. For installations with layers up to 50 mm thick, IEC/EN 60079 14 provides information on reduction of temperature class.
T _{max} °C (With no dust layer) and T _{max} °C (With specified dust layer) Maximum surface temperature in degrees Celsius preceded by a "T _{max} " with a dust layer of "xxx" where "xxx" is the dust layer thickness in mm. e.g. T ₁₉₀ 320 °C	Not recognized	The maximum surface temperature with no dust layer must be no more 2/3 of the dust cloud ignition temperature. Maximum surface temperature is determined with specified layer thickness¹ (> 50 mm) on all sides of the equipment. That maximum surface temperature must be at least 75 K below the dust layer ignition temperature.	
T _{max} °C (With no dust layer) and T _{max} °C (With maximum dust layer thickness ¹) Maximum surface temperature in degrees Celsius preceded by a "T _{max} " indicating that the equipment has been tested with a maximum dust layer thickness l in a specified orientation. ² e.g. T ₁₉₀ °C	The T ₁ marking is not currently recognized by the NEC or CE Code, but the T ₁ surface temperature determination does align with US / CA practice	The maximum surface temperature with no dust layer must be no more 2/3 of the dust cloud ignition temperature. Maximum surface temperature is determined with a maximum dust layer thickness¹ on the equipment in a specified orientation. ² The marked maximum surface temperature must be at least 75 K below the dust layer ignition temperature.	

¹ A maximum dust layer thickness is a layer or blanket of dust on the equipment, covered with dust until no more will stay on the enclosure. For the US and CA, wheat flour, corn flour, or grain dust is used. For the IEC / EU / UK, a dust with a thermal conductivity of no more than 0.10 W/(m x K) measured at (100 ± 5) °C.
² The orientation is specified as a Specific Condition of Use.
³ Equipment with EPL Da is always tested with a 200 mm dust layer thickness on all sides of the equipment. Dust depth layer thicknesses of more than 200 mm do not give rise to a further temperature increase that would need to be taken into account. Equipment with EPL Dc is not tested with a dust layer

FM APPROVALS IS YOUR GLOBAL CONFORMITY ASSESSMENT SOLUTION

Market	Recognized product certification marks
US	FM APPROVED, FM APPROVED
Canada	FM APPROVED, FM APPROVED
EU (ATEX)	FM APPROVED, Ex, CE
UK (UKEX)	FM APPROVED, Ex, UK CA

FM Approvals can also issue IECEx Test Reports, Quality Assessment Reports and Certificates of Conformity.

AREA CLASSIFICATION

	Flammable Material Present Continuously	Flammable Material Present Intermittently	Flammable Material Present Abnormally
IEC / EU / UK	Zone 0	Zone 1	Zone 2
US (NEC 505)			
CA (Section 18)			
IEC / EU / UK	Zone 20	Zone 21	Zone 22
US (NEC 506)			
CA (Section 18)			

IEC Area Classification per IEC 60079-10-1 (gases) or IEC 60079-10-2 (dusts)
EU / UK Area Classification per EN 60079-10-1 (gases) or EN 60079-10-2 (dusts)
US Area Classification per NFPA 70 National Electrical Code® (NEC®) Article 505 (gases) or 506 (dusts)
CA Area Classification per CSA C22.1 Canadian Electrical Code (CE Code) Section 18

EQUIPMENT GROUPING

Typical material	IEC / EU / UK (60079-0) US (NEC 505) CA (CE Code Sect 18)	IEC / EU / UK (60079-0) US (NEC 506) CA (CE Code Sect 18)
Methane / Firedamp	I*	-
Acetylene	IIC	-
Hydrogen	(IIB + H ₂)	-
Ethylene	IIB	-
Propane	IIA	-
Metal dusts		
Metal Combustible fibers/flyings	-	IIIC
Carbonaceous dusts	-	IIIB
Non-conductive dusts	-	IIIB
Ignitable fibers / flyings	-	IIIA
Non-metal combustible fibers/flyings	-	IIIA

* Not within the scope of NEC (NFPA 70) or CE Code (CSA C22.1). Under jurisdiction of MSHA in the US

INGRESS PROTECTION (IP) CODES

First characteristic Numeral	Second characteristic Numeral
Protection against solid bodies	Protection against liquid
0	No protection
1	Objects greater than 50mm
2	Objects greater than 12mm
3	Objects greater than 2.5mm
4	Objects greater than 1mm
5	Dust-protected
6	Dust-tight
7	
8	
9	

Approximate U.S. enclosure type equivalent to IPXX

Type → IP	Type → IP	Type → IP
1 10	3S 54	6 and 6P 67
2 11	4 and 4X 55	12 and 12K 52
3 54	5 52	13 54
3R 14		

ACRONYMS

ATEX	Explosion protection for EU
CA	Canada
CE Code	Canadian Electrical Code (CSA C22.1)
EPL	Equipment Protection Level
EU	European Union
IEC	International Electrotechnical Commission
ISO	International Organization for Standardisation
MSHA	Mine Safety and Health Administration
NFPA	National Fire Protection Association
NEC	National Electrical Code (NFPA 70)
US	United States of America
UKEX	Explosion Protection for UK
UK	United Kingdom

FM Approvals

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