

Guide to Hazardous Locations

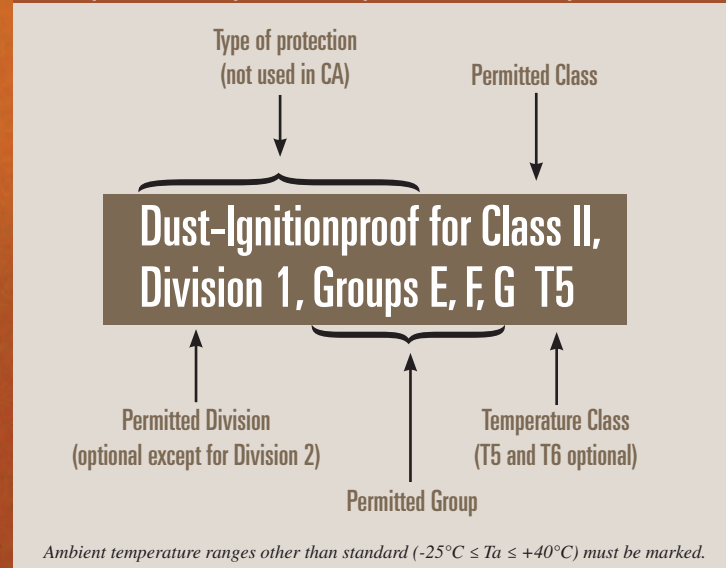
Explosive Dust Atmospheres



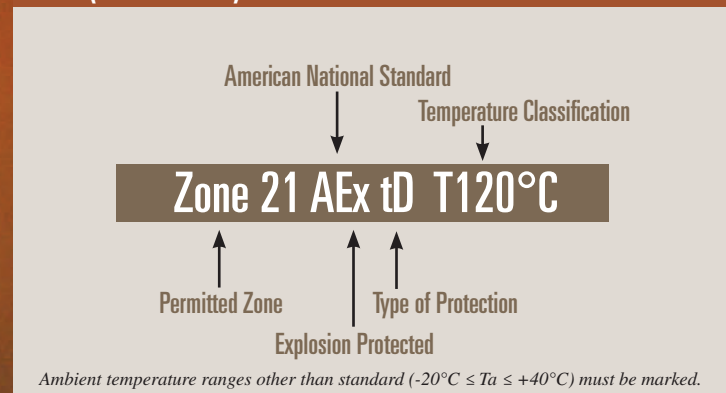
Member of the FM Global Group

Ex Marking

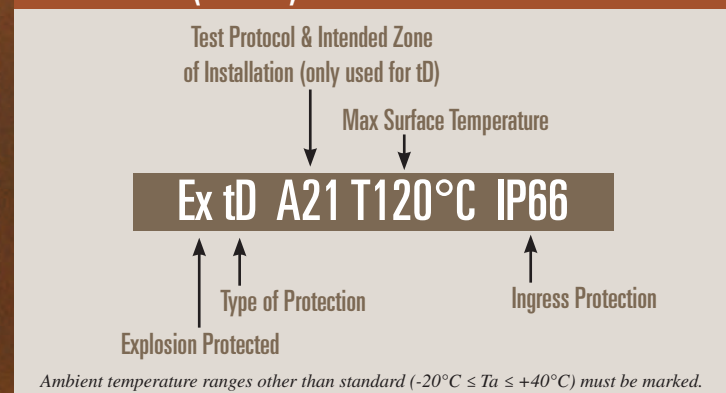
US (NEC® 500) and CA (CEC Section 18)



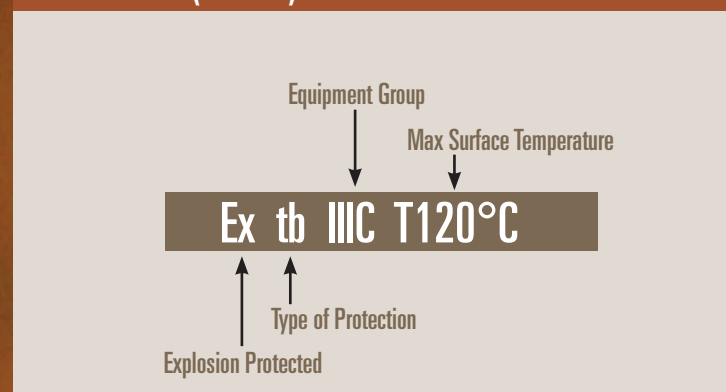
US (NEC® 506)



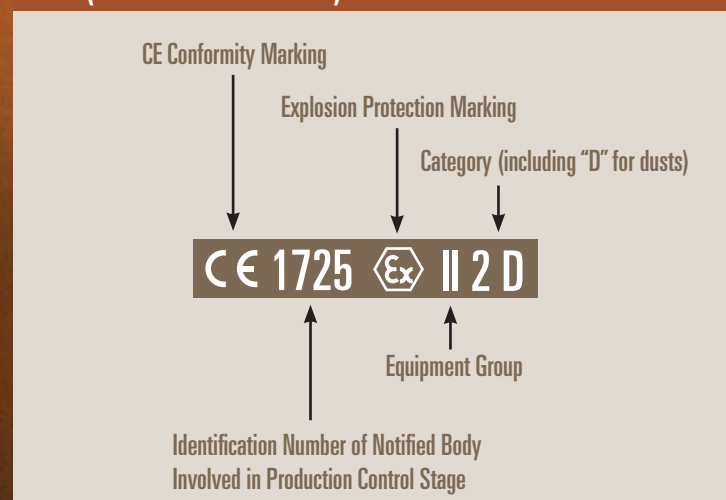
EU and IEC (61241)



EU and IEC (60079)



EU (Directive 94/9/EC) ATEX



EPL/Category

Definition	IEC		EU (ATEX)		Typical Zone of Application
	EPL	Group	Category	Group	
Dust atmospheres, "very high" level of protection	Da		1D		20
Dust atmospheres, "high" level of protection	Db	III	2D	II	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	Protection Principle	
General Requirements						
		US	Class II, Division 1 & 2	FM 3600	Keep combustible dust out	
		CA	Class II, Division 1 & 2	CSA C22.2 No. 0		
		US	Class III, Division 1 & 2	FM 3600		
		CA	Class III, Division 1 & 2	CSA C22.2 No. 0		
	Ex	US	Zone 20, 21, & 22	ISA 61241-0		
	Ex	EU	Category 1D, 2D, & 3D	EN 61241-0 or EN 60079-0		
	Ex	IEC	Zone 20, 21, 22	IEC 61241-0 or IEC 60079-0		
		US	Class II, Division 1	FM3616		
		CA	Class II, Division 1	CSA C22.2 No. 25		
		US	Class II, Division 2	FM3611		
		CA	Class II, Division 2	CSA C22.2 No. 25		
Protection by Enclosure						
	AEx tD	US	Zone 21	ISA 61241-1	Limit energy of sparks and surface temperature	
	DIP A21	CA	Class II, Division 1	CSA E61241-1-1		
	DIP A22	CA	Class II, Division 2	CSA E61241-1-1		
	Ex tD	EU	Category 2D	EN 61241-1		
	Ex tD	IEC	EPL Db	IEC 61241-1		
	Ex ta	EU	Category 1D	EN 60079-31		
	Ex ta	IEC	EPL Da	EN 60079-31		
	Ex tb	EU	Category 2D	EN 60079-31		
	Ex tb	IEC	EPL Db	EN 60079-31		
	Ex tc	EU	Category 3D	EN 60079-31		
	Ex tc	IEC	EPL Dc	EN 60079-31		
Fiber & Flying Protection						
	(DIP)	US	Class III, Division 1 & 2	FM3611	Keep combustible dust out	
		CA	Class III, Division 1 & 2	CSA C22.1		
Encapsulation						
	AEx maD	US	Zone 20	ISA 61241-18	Limit energy of sparks and surface temperature	
	Ex maD	EU	Category 1D	EN 61241-18		
	Ex maD	IEC	EPL Da	IEC 61241-18		
	AEx mbD	US	Class II, Zone 21	ISA 61241-18		
	Ex mbD	EU	Category 2D	EN 61241-18		
	Ex mbD	IEC	EPL Db	IEC 61241-18		
Pressurization						
	(PX)	US	Class II, Division 1	FM3620 (NFPA 496)		Limit energy of sparks and surface temperature
	(PX)	CA	Class II, Division 1	NFPA 496		
	(PY)	US	Class II, Division 1	FM3620 (NFPA 496)		
	(PY)	CA	Class II, Division 1	NFPA 496		
	(PZ)	US	Class II, Division 2	FM3620 (NFPA 496)		
	(PZ)	CA	Class II, Division 2	NFPA 496		
	AEx pD	US	Zone 21	ISA 61241-2		
	Ex pD	EU	Category 2D	EN 61241-4		
	Ex pD	IEC	EPL Db	IEC 61241-4		
Intrinsic Safety						
	(IS)	US	Class II, Division 1	FM3610	Limit energy of sparks and surface temperature	
	(IS)	CA	Class II, Division 1	CSA C22.2 No. 157		
	AEx iaD	US	Zone 20	ISA 61241-11		
	Ex iaD	EU	Category 1D	EN 61241-11		
	Ex iaD	IEC	EPL Da	IEC 61241-11		
	AEx ibD	US	Zone 21	ISA 61241-11		
	Ex ibD	EU	Category 2D	EN 61241-11		
	Ex ibD	IEC	EPL Db	IEC 61241-11		
	(IS)	US	Class III, Division 1	FM3610		
	(IS)	CA	Class III, Division 1	CSA C22.2 No. 157		

Note 1: For associated intrinsically safe apparatus suitable for installation in a hazardous location, the symbol for the type of protection "iaD" or "ibD" are enclosed within square brackets, e.g. AEx d [iaD] IIC T4.

Note 2: For associated 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 "iaD" or "ibD" are enclosed within the same square brackets, e.g. [AEx iaD] IIC; in this case, a temperature class is not included.

Acronyms

ATEX	Atmosphère explosible	IEC	International Electrotechnical Commission
CA	Canada	I.S.	Intrinsic Safety
CEC	Canadian Electrical Code (CSA C22.1)	NFPA	National Fire Protection Association
CENELEC	European Committee for Electrotechnical Standardization	NEC	National Electrical Code (NFPA 70)
EPL	Equipment Protection Level	US	United States of America
EU	European Union		

FM Approvals is your global conformity assessment solution

Market	Recognized product certification marks	
US		
Canada		
EU (ATEX)		

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

Area Classification

IEC / EU	Combustible Dust Present Continuously	Combustible Dust Present Intermittently	Combustible Dust Present Abnormally
		Zone 20	Zone 21
US NEC 506	Zone 20	Zone 21	Zone 22
US NEC 500	Division 1		Division 2
CA CEC Section 18	Division 1		Division 2

US area classification per ANSINFPAs 70 National Electrical Code® (NEC®) Article 500 or Article 506
CA area classification per CSA C22.1 Canadian Electrical Code (CEC) Section 18
EU area classification per EN 61241-10
IEC area classification per IEC 61241-10

Equipment Grouping

Typical material	EU (60079-0)	IEC (61241-0)	US (NEC 506)	US (NEC 500)
	IEC (60079-0)	IEC (61241-0)	IEC (61241-0)	CA (CEC Section 18)
Metal dusts	IIIC	N/A	D	Class II, Group E
Carbonaceous dusts	IIIB	D	D	Class II, Group F
Non-conductive dusts	IIIB	D	D	Class II, Group G
Fibers and flyings	IIIA	D	D	Class III

Temperature

Marking	US NEC 500 Class II or III	CA CEC Sect 18 Class II or III	
T1	450°C	For Class II, the temperature class is determined with a <u>maximum dust layer*</u> on the equipment. For installation, that temperature class must not be greater than the dust layer or dust cloud ignition temperature. For organic dusts that may dehydrate or carbonize, temperature classes greater than "T3B" (165°C) are not permitted.	
T2	300°C		
T2A	280°C		
T2B	260°C		
T2C	230°C		
T2D	215°C		
T3	200°C		
T3A	180°C		
T3B	165°C		
T3C	160°C		
T4	135°C	For Class III, the temperature is determined with a <u>maximum dust layer*</u> on the equipment. The temperature must not be greater than 120°C for equipment that can be overloaded and 165°C for equipment not subject to overloading.	
T4A	120°C		
T5	100°C		
T6	85°C		
No temperature marking			The temperature must not be greater than 120°C for equipment that can be overloaded and 165°C for equipment not subject to overloading.
Marking	US NEC 506	EU/IEC	
T ₁ °C		Temperature is determined with <u>no dust layer</u> on the equipment.	
Temperature class in degrees Celsius preceded by a "T" e.g. T120°C	Temperature is determined with a <u>maximum dust layer*</u> on the equipment. For installation, that temperature must not be greater than the dust layer or dust cloud ignition temperature.	For installations with layers up to 5mm thick, that temperature must be at least 75K below the dust layer ignition temperature and no more 2/3 of the dust cloud ignition temperature. For installations with layers up to 50mm thick, IEC/EN 61241-14 provides information on reduction of temperature.	
T _L °C		Temperature is determined with specified layer depth (> 50 mm) on all sides of the equipment. That temperature must be at least 75K below the dust layer ignition temperature and no more 2/3 of the dust cloud ignition temperature.	
Temperature class in degrees Celsius preceded by a "T _L " with a dust layer of "L" where "L" is the layer depth in mm e.g. T ₅₀₀ 120°C	Not recognized		

* A maximum dust layer is a layer or blanket of wheat flour, corn flour, or grain dust that results from the equipment being covered with dust until no more will stay on the equipment.

Ingress Protection (IP) Codes

First characteristic Numeral	Second characteristic Numeral
Protection against solid bodies	
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
Protection against liquid	
0	No protection
1	Vertical (90°) dripping water
2	70° to 90° dripping water
3	Sprayed water
4	Splashed water
5	Water jets
6	Heavy seas
7	Effects of immersion
8	Indefinite immersion

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		

FM Approvals
1151 Boston-Providence Turnpike, Norwood, MA 02062-9102
Phone: +1 (1)781 255 4851 Fax: +1 (1)781 762 9375
E-mail: approvals@fmglobal.com

In the United Kingdom:
1 Windsor Dials, Windsor, Berkshire SL4 1RS
Phone: +44 (0)1753 750 476 Fax: (0)1753 868 700
E-mail: atex@fmapprovals.com

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