

Guide to Hazardous Locations

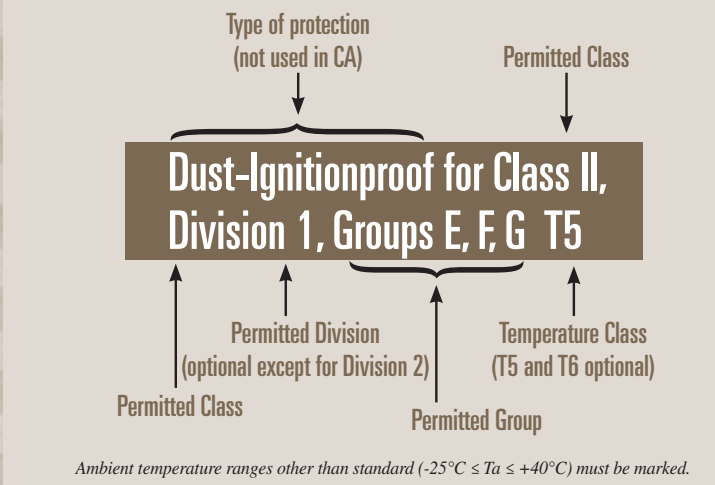
Explosive Dust Atmospheres



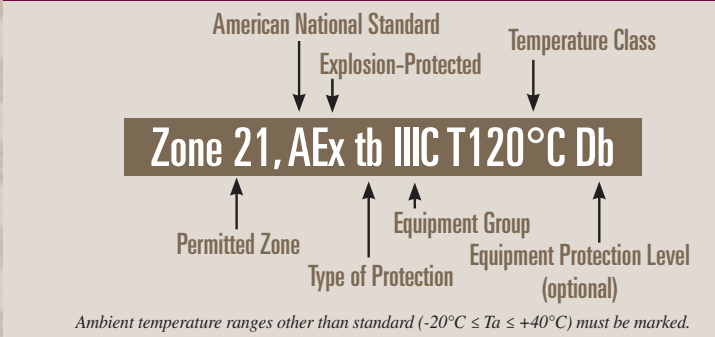
Member of the FM Global Group

Ex Marking

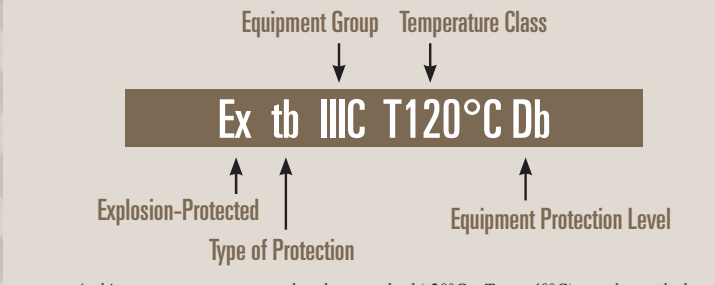
US (NEC® 500) and CA (CE Code Annex J18)



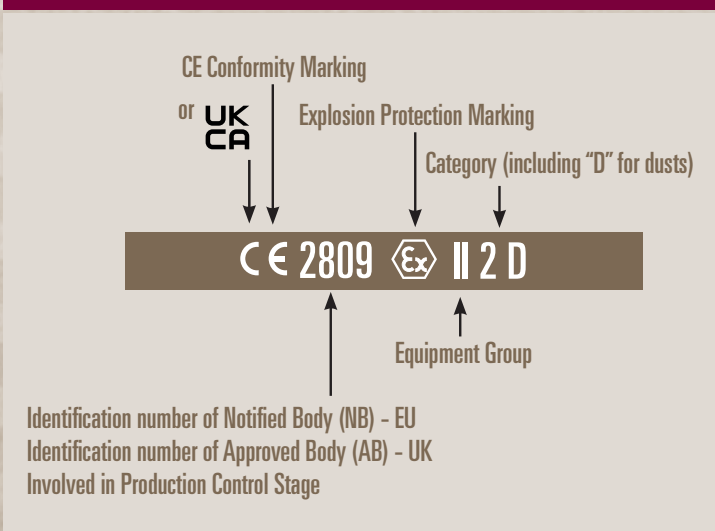
US (NEC® 506 per 60079)



CA (CE Code Sect 18), EU and IEC



Additional EU marking per 2014/34/EU (ATEX) Additional UK marking per SI-2016 No. 1107 (as amended) (UKEX)



EPL/Category

Definition	IEC		EU (ATEX) UK (UKEX)		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	
		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	
	AEx	US	Zone 20, 21, & 22	ANSI/UL 60079-0	
	Ex	CA	EPL Da, Db, & Dc	CSA C22.2 No. 60079-0	
	Ex	EU	Category 1D, 2D, & 3D	EN IEC 60079-0	
	Ex	IEC	EPL Da, Db, & Dc	IEC 60079-0	
Dust-Ignitionproof	(DIP)	US	Class II, Division 1	FM 3616	
		CA	Class II, Division 1	CSA C22.2 No. 25	
Dust-Protected	(NI)	US	Class II, Division 2	FM 3611	
		CA	Class II, Division 2	CSA C22.2 No. 213	
Protection by Enclosure	AEx ta	US	Zone 20	ANSI/UL 60079-31	
	Ex ta	CA	EPL Da	CSA C22.2 No. 60079-31	
	Ex ta	EU	Category 1D	EN 60079-31	
	Ex ta	IEC	EPL Da	IEC 60079-31	
	AEx tb	US	Zone 21	ANSI/UL 60079-31	
	Ex tb	CA	EPL Db	CSA C22.2 No. 60079-31	
	Ex tb	EU	Category 2D	EN 60079-31	
	Ex tb	IEC	EPL Db	IEC 60079-31	
	AEx tc	US	Zone 22	ANSI/UL 60079-31	
	Ex tc	CA	EPL Dc	CSA C22.2 No. 60079-31	
	Ex tc	EU	Category 3D	EN 60079-31	
	Ex tc	IEC	EPL Dc	IEC 60079-31	
Fibers + Flyings Protection	(DIP)	US	Class III, Division 1 & 2	FM 3611	Keep combustible dust out
		CA	Class III, Division 1 & 2	CSA C22.2 No. 213	
Encapsulation	AEx ma	US	Zone 20	ANSI/UL 60079-18	
	Ex ma	CA	EPL Da	CSA C22.2 No. 60079-18	
	Ex ma	EU	Category 1D	EN 60079-18	
	Ex ma	IEC	EPL Da	IEC 60079-18	
	AEx mb	US	Zone 21	ANSI/UL 60079-18	
	Ex mb	CA	EPL Db	CSA C22.2 No. 60079-18	
	Ex mb	EU	Category 2D	EN 60079-18	
	Ex mb	IEC	EPL Db	IEC 60079-18	
	AEx mc	US	Zone 21	ANSI/UL 60079-18	
	Ex mc	CA	EPL Dc	CSA C22.2 No. 60079-18	
	Ex mc	EU	Category 2D	EN 60079-18	
	Ex mc	IEC	EPL Dc	IEC 60079-18	
Pressurization	(PX)	US	Class II, Division 1	FM 3620 (NFPA 496)	
	(PY)	US	Class II, Division 1	FM 3620 (NFPA 496)	
	(PZ)	US	Class II, Division 2	FM 3620 (NFPA 496)	
	(PX)	CA	Class II, Division 1	NFPA 496	
	(PY)	CA	Class II, Division 1	NFPA 496	
	(PZ)	CA	Class II, Division 2	NFPA 496	
	Ex pxb	EU	Category 2D	EN 60079-2	
	Ex pxb	IEC	EPL Db	IEC 60079-2	
	AEx pxb	US	Zone 21	ANSI/UL 60079-2	
	Ex pxb	CA	EPL Db	CSA C22.2 No. 60079-2	
	Ex pyb	EU	Category 2D	EN 60079-2	
	Ex pyb	IEC	EPL Db	IEC 60079-2	
	AEx pyb	US	Zone 21	ANSI/UL 60079-2	
	Ex pyb	CA	EPL Db	CSA C22.2 No. 60079-2	
	Ex pzc	EU	Category 3D	EN 60079-2	
	Ex pzc	IEC	EPL Dc	IEC 60079-2	
	AEx pzc	US	Zone 22	ANSI/UL 60079-2	
	Ex pzc	CA	EPL Dc	CSA C22.2 No. 60079-2	
Intrinsic Safety	(I.S.)	US	Class II, Division 1	FM 3610	Limit energy of sparks and surface temperature
	(I.S.)	CA	Class II, Division 1	CSA C22.2 No. 60079-11 or CSA C22.2 No. 157	
	AEx ia	US	Zone 20	ANSI/UL 60079-11	
	Ex ia	CA	EPL Da	CSA C22.2 No. 60079-11	
	Ex ia	EU	Category 1D	EN 60079-11	
	Ex ia	IEC	EPL Da	IEC 60079-11	
	AEx ib	US	Zone 21	ANSI/UL 60079-11	
	Ex ib	CA	EPL Db	CSA C22.2 No. 60079-11	
	Ex ib	EU	Category 2D	EN 60079-11	
	Ex ib	IEC	EPL Db	IEC 60079-11	
	AEx ic	US	Zone 22	ANSI/UL 60079-11	
	Ex ic	CA	EPL Dc	CSA C22.2 No. 60079-11	
	Ex ic	EU	Category 3D	EN 60079-11	
	Ex ic	IEC	EPL Dc	IEC 60079-11	
	(I.S.)	US	Class III, Division 1	FM 3610	
	(I.S.)	CA	Class III, Division 1	CSA C22.2 No. 60079-11 or 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 "ia," or "ib" are enclosed within square brackets (e.g., Zone 21 AEx ia [ia] IIIC T135°C Db).

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 "ia," or "ib" are enclosed within the same square brackets (e.g., [AEx ia Da] IIIC); in this case, a temperature class is not included.

Note 3: Marking for Intrinsic Safety may be supplemented by "FISCO"

Note 4: Marking for Intrinsic Safety may be supplemented by "2-WISE" (IEC TS 60079-47)

Area Classification

	Combustible Dust Present Continuously	Combustible Dust Present Intermittently	Combustible Dust Present Abnormally
IEC / EU / UK	Zone 20	Zone 21	Zone 22
US (NEC® 506)	Zone 20	Zone 21	Zone 22 Group IIIA or IIIB only
US (NEC® 500)	Division 1		Division 2
CA (CE Code Section 18)	Zone 20	Zone 21	Zone 22
CA (CE Code Annex J18)	Division 1		Division 2

Equipment Grouping

Typical material	IEC / EU / UK US (NEC 506) CA (CE Code Sect 18)	US (NEC 500) CA (CE Code Annex J18)
	III C	Class II, Group E
Metal dusts		
Metal combustible fibers/flyings		
Carbonaceous dusts	IIIB	Class II, Group F
Nonconductive dusts	IIIB	Class II, Group G
Ignitable fibers / flyings	IIIA	Class III
Non-metal combustible fibers / flyings	IIIA	Class III

Maximum Surface Temperature

Marking	US NEC 500/CA CE Code Annex J18
Maximum surface temperature 450°C	T1
300°C	T2
280°C	T2A
260°C	T2B
230°C	T2C
215°C	T2D
200°C	T3
180°C	T3A
165°C	T3B
160°C	T3C
135°C	T4
120°C	T4A
100°C	T5
85°C	T6

No maximum surface temperature or temperature class marking. However, the temperature must not be greater than 120°C for equipment that can be overloaded and 165°C for equipment not subject to overloading.

For Class II, Division 1, the maximum surface temperature or temperature class is determined with a **maximum dust layer thickness**¹ on the equipment.

For Class II, Division 2, the maximum surface temperature or temperature class is determined with **no dust layer** on the equipment.

For installation, the marked maximum surface temperature or temperature class must not be greater than the dust layer or dust cloud ignition temperature.

For organic dusts or non-metal combustible fibers/flyings that may dehydrate or carbonize, maximum surface temperatures or temperature classes greater than 165°C (T3B) are not permitted.

For Class III, Division 1, the temperature is determined with a **maximum dust layer thickness**¹ on the equipment.

For Class III, Division 2, the temperature class is determined with **no dust layer** on the equipment.

Marking	US NEC 506/CA CE Code Sect 18	IEC / EU / UK EPL Db
T ____ °C Maximum surface temperature in degrees Celsius preceded by a "T" (e.g., T120 °C)	Temperature is determined with a maximum dust layer thickness ¹ on the equipment.	Temperature is determined with no dust layer on the equipment.
T ____ °C (With no dust layer) and T ____ °C (With specified dust layer) Maximum surface temperature in degrees Celsius preceded by a "T" with a dust layer of "xxx" where "xxx" is the dust layer thickness in mm. (e.g., T150 320 °C)	For installation, the marked maximum surface temperature must not be greater than the dust layer or dust cloud ignition temperature.	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 and no more than 2/3 of the dust cloud ignition temperature.
T ____ °C (With no dust layer) and T1 ____ °C (With maximum dust layer thickness) Maximum surface temperature in degrees Celsius preceded by a "T1" indicating that the equipment has been tested with a maximum dust layer thickness ² in a specified orientation ³ (e.g., T1 190 °C).	Not recognized	Maximum surface temperature is determined with specified layer thickness, (> 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 ____ °C (With no dust layer) and T1 ____ °C (With maximum dust layer thickness) Maximum surface temperature in degrees Celsius preceded by a "T1" indicating that the equipment has been tested with a maximum dust layer thickness ² in a specified orientation ³ (e.g., T1 190 °C).	The T1 marking is not currently recognized by the NEC® or CE Code, but the T1 surface temperature determination does align with US/CA practice	The maximum surface temperature with no dust layer must be no more than 2/3 of the dust cloud ignition temperature.
		Maximum surface temperature is determined with a maximum dust layer thickness ¹ 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. The IEC and EU, 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.

Ingress Protection (IP) Codes

First Characteristic Numeral	Second Characteristic Numeral
Protection against solid bodies	Protection against liquid
0 No protection	No protection
1 Objects greater than 50mm	Vertical (90°) dripping water
2 Objects greater than 12mm	75° to 90° dripping water
3 Objects greater than 2.5mm	Sprayed water
4 Objects greater than 1mm	Splashed water
5 Dust-protected	Water jets
6 Dust-tight	Heavy seas
7	Temporary immersion
8	Continuous immersion
9	High pressure/temperature water jet

Approximate US 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 is your global conformity assessment solution

Market	Recognized product certification marks
US	FM APPROVED
Canada	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.

Acronyms

2-WISE	2 Wire Intrinsically Safe Ethernet	IEC	International Electrotechnical Commission
ATEX	Explosion Protection for EU	I.S.	Intrinsic Safety
CA	Canada	NFPA	National Fire Protection Association
CE Code	Canadian Electrical Code (CSA C22.1)	NEC®	National Electrical Code® (NFPA 70)
EPL	Equipment Protection Level	UKEX	Explosion Protection for UK
EU	European Union	UK	United Kingdom
FISCO	Fieldbus Intrinsically Safe Concept	US	United States of America