EXPLOSION PROTECTION

EUROPEAN AND INTERNATIONAL MARKING

Marking in accordance with EU Directive 2014/34/EU (ATEX) | **Marking in accordance with EN 60079 and IEC 60079**

Ex	II	3	G	Ex ec	IIC	T6	Gc
Explosive area	Device group	Equipment category	Type of explosive substance	Ignition Protection Type	Group	Temperature Class	Equipment Protection Level

Device group

I	Underground mining
II	Various areas

Equipment category

Explosive area			
Mine gas/dust	M1	Continued operation in the event of firedamp	Mining at risk of firedamp
	M2	Shutdown in the event of firedamp	
Gas	1	Permanent, long periods, frequent	Zone 0
	2	Occasionally	Zone 1
	3	Not normally, only briefly	Zone 2
Dust	1	Permanent, long periods, frequent	Zone 20
	2	Occasionally	Zone 21
	3	Not normally, only briefly	Zone 22

Type of explosive substance

G	Gas, steam, mist
D	Dust, fibers, lint

Ignition Protection Type

see

Group

	Typical gas	Ignition energy [µJ]
I	Methane	>280
IIC	Hydrogen	>20
	Acetylene	>20
IIB	Ethylene	60 ... 180
IIA	Propane	>180

	Typical dust	Dust type
IIIC	Conductive dust	Carbonaceous dust
		Metal dust
IIIB	Non-conductive dust	Non-carbonaceous dust
IIIA	Flammable lint	

Temperature Class

T6	≤85 °C
T5	≤100 °C
T4	≤135 °C
T2	≤200 °C
T2	≤300 °C
T1	≤450 °C

Maximum surface temperature

Equipment Protection Level

Ma	Very high protection level
Mb	High protection level
Ga	Very high protection level
Gb	High protection level
Gc	Enhanced protection level
Da	Very high protection level
Db	High protection level
Dc	Enhanced protection level

NORTH AMERICAN MARKING

Marking in accordance with NEC 500 to 506 / CEC sect. 18 | **Marking in accordance with UL / FM / CSA 60079**

Class I, Zone 2	AEx ec	IIC	T4	Gc
Explosive area	Class and Zone	Ignition Protection Type	Group	Temperature Class	Equipment Protection Level

Class and Zone

	NEC 501	NEC 505 Classification of the potentially explosive areas	Temporary occurrence of the explosive substance
Gas	Class I	Zone 0	Permanent, long periods, frequent
		Zone 1	Occasionally
		Zone 2	Not normally, only briefly

	NEC 502 NEC 503	NEC 506 Classification of the potentially explosive areas	Temporary occurrence of the explosive substance
Dust	Class II Class III	Zone 20	Permanent, long periods, frequent
		Zone 21	Occasionally
		Zone 22	Not normally, only briefly

Ignition Protection Type

UL / FM: AEx ec
CSA: Ex ec

see

Group

NEC 505 Group	Class	NEC 505, NEC 506 Typical gas	Ignition energy [µJ]
IIC	Hydrogen		>20
	Acetylene		>20
IIB	Ethylene		60 ... 180
IIA	Propane		>180

NEC 506 Group	Typical dust	Dust type
IIIC	Conductive dust	Carbonaceous dust
		Metal dust
IIIB	Non-conductive dust	Non-carbonaceous dust
IIIA	Flammable lint	

Temperature Class

Maximum surface temperature

T6	≤85 °C
T5	≤100 °C
T4	≤135 °C
T2	≤200 °C
T2	≤300 °C
T1	≤450 °C

Equipment Protection Level

Ga	Very high protection level
Gb	High protection level
Gc	Enhanced protection level
Da	Very high protection level
Db	High protection level
Dc	Enhanced protection level

IGNITION PROTECTION TYPES FOR ELECTRICAL APPARATUS

Ignition Protection Type		Pressure-resistant enclosure	Pressurised enclosure	Powder filling	Liquid immersion	Increased safety	Intrinsic safety	Intrinsically safe systems	Non-sparking apparatus	Sparking apparatus	Vapour tightness	Encapsulation	Optical radiation	Protection by enclosure	Constructive explosion protection
Identifier	Zone	da d, db d, dc	px, pxb py, pyb pz, pzc	q, qb qc	o, ob oc	e, eb ec	ia ib ic	ia ib ic	previously nA, nAc now ec	nC, nCc	nR, nRc	ma mb mc	op, opa op, opb op, opc	ta tb tc	h
		Zone 0 Zone 1 / Mb Zone 2 / Mb	Zone 1 / 21 / Mb Zone 1 / 21 Zone 2 / 22	Zone 1 / Mb Zone 2	Zone 1 Zone 2	Zone 1 / Mb Zone 2	Zone 0 / 20 / Ma Zone 1 / 21 / Mb Zone 2 / 22	Zone 0 / 20 / Ma Zone 1 / 21 / Mb Zone 2 / 22	Zone 2	Zone 2	Zone 2	Zone 0 / 20 / Ma Zone 1 / 21 Zone 2 / 22	Zone 0 / 20 Zone 1 / 21 Zone 2 / 22	Zone 20 Zone 21 Zone 22	Zone 0 / 20 Zone 1 / 21 Zone 2 / 22
Symbol			$P_i > P_o$												
Protection principle		Protection by pressure-resistant enclosure	Protection through higher internal pressure than external pressure	Protection by surrounding filler	Protection by surrounding liquid (e.g. oil)	Protection by preventing high temperatures, sparks and light arcs	Protection by energy limitation	Protection by energy limitation	Protection by preventing high temperatures, sparks and light arcs	Protection by pressure-resistant enclosure	Protection by enclosure	Protection by surrounding casting compound	Protection by limiting/preventing energy transfer of optical radiation	Protection by excluding a potentially explosive area within the enclosure	Exclusion of sources of ignition by design
Standards		IEC 60079-1 EN 60079-1 UL / FM / CSA 60079-1	IEC 60079-2 EN 60079-2 UL / FM / CSA 60079-2	IEC 60079-5 EN 60079-5 UL / FM / CSA 60079-5	IEC 60079-6 EN 60079-6 UL / FM / CSA 60079-6	IEC 60079-7 EN 60079-7 UL / FM / CSA 60079-7	IEC 60079-11 EN 60079-11 UL / FM / CSA 60079-11	IEC 60079-25 EN 60079-25 UL / FM / CSA 60079-25	IEC 60079-15 EN 60079-15 UL / FM / CSA 60079-15	IEC 60079-15 EN 60079-15 UL / FM / CSA 60079-15	IEC 60079-15 EN 60079-15 UL / FM / CSA 60079-15	IEC 60079-18 EN 60079-18 UL / FM / CSA 60079-18	IEC 60079-28 EN 60079-28 UL / FM / CSA 60079-28	IEC 60079-31 EN 60079-31 UL / FM / CSA 60079-31	ISO 80079-36 ISO 80079-37
Application		Switching and command systems, heating, lights, motors and switch cabinets	Switching, control and analysis devices	Transformers, relays, safety fuses, switches	Transformers, resistors, switchgear	Terminal and junction boxes, enclosures, terminals	Measurement and control technology, sensors, actuators	Measurement and control technology, sensors, actuators	All electrical devices for Zone 2			Relays, sensors, solenoid valves	Optoelectronic devices	Terminal and junction boxes, motors, switchgear and switching systems, lights	Non-electrical apparatus: Mechanical switches, gland seal, mechanical seal, seals, coupling units

EX MARKING FOR ASSOCIATED APPARATUS

	II	(2)	G	[Ex ib Gb]	IIC

(*) Device category in **round brackets**

[Ex *] Ignition Protection Type and device protection level in **square brackets**

Apparatus with Ignition Protection Type Ex i 'intrinsic safety' and simple electrical apparatus require a associated apparatus to limit the electrical energy. Associated apparatus are highlighted by round and square brackets in the marking. The marking indicates the areas into which the associated apparatus may work.

EX MARKING OF DIFFERENT APPARATUS

Marking for	Application	Example in accordance with EN 60079 and IEC 60079	Example in accordance with UL / FM 60079
Apparatus	Use in the area at risk of explosion	Ex ec IIC T4 Gc	AEx ec IIC T4 Gc
Associated Apparatus	Use outside the area at risk of explosion with effect in the Ex area	[Ex ib Gb] IIC	[AEx ib Gb] IIC
Simple Electrical apparatus	Use of simple components that do not impair the intrinsic safety (see Ignition Protection Types) of the circuit	Approval is not required as there is no source of ignition. A marking may not be applied.	

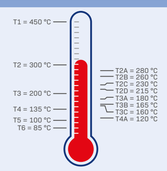
PERMISSIBLE SURFACE TEMPERATURE

In the event of mining at risk of firedamp (coal mining)

Gas (example)	Ignition temperature	Group I
Methane	150 °C	With coal dust deposits on apparatus
	450 °C	Without coal dust deposits on apparatus

Other applications

Gas (example)	Ignition temperature	Group II CENELEC / IEC / NEC505
Amonia	630 °C	
Hydrogen	560 °C	
Propane	470 °C	
Ethylene	425 °C	
Butane	365 °C	
Acetylene	305 °C	
Cyclohexane	259 °C	
Diethyl ether	170 °C	
Carbon disulphide	95 °C	



MARKING IN ACCORDANCE WITH NEC 500

Class I, Division 2	Group A	T4
Explosive area	Class and Division	Group	Temperature Class

Class and Division

	NEC 500	NEC 500 Classification of the potentially explosive areas	Temporary occurrence of the explosive substance
Gas	Class I	Division 1	Permanent, long periods, frequent
		Division 1	Occasionally
		Division 2	Not normally, only briefly

	NEC 500	NEC 500 Classification of the potentially explosive areas	Temporary occurrence of the explosive substance
Dust	Class II Class III	Division 1	Permanent, long periods, frequent
		Division 1	Occasionally
		Division 2	Not normally, only briefly

Group

NEC 500 Group	Class	NEC 505, NEC 506 Typical gas	Ignition energy [µJ]
Group A	Class I	Acetylene	>20
Group B	Class I	Hydrogen	>20
Group C	Class I	Ethylene	60 ... 180
Group D	Class I	Propane	>180

NEC 500 Group	Class	NEC 505, NEC 506 Typical dust	Dust type
Group E	Class II	Conductive dust	Metal dust
Group F	Class II	Conductive dust	Carbonaceous dust
Group G	Class II	Non-conductive dust	Non-carbonaceous dust
	Class III	Flammable lint	

Temperature Class

T1	≤450 °C	T3A	≤180 °C
T2	≤300 °C	T3B	≤165 °C
T2A	≤280 °C	T3C	≤160 °C
T2B	≤260 °C	T4	≤135 °C
T2C	≤230 °C	T4A	≤120 °C
T2D	≤215 °C	T5	≤100 °C
T3	≤200 °C	T6	≤85 °C

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SCHMERSAL
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EXPLOSION PROTECTION
COMPACT

MARKING FOR AREAS AT RISK OF EXPLOSION DUE TO GAS

Marking in accordance with EU Directive 2014/34/EU (ATEX)				Marking in accordance with EN 60079 and IEC 60079			
Ex	II	3	G	Ex ic	IIC	T6	Gc
Explosive area	**Device group**	**Device category** [1]	**Type of explosive substance**	**Ignition Protection Type** [1]	**Group**	**Temperature Class**	**Equipment Protection Level**
Gas	II	1 Permanent, long periods, frequent – Zone 0 2 Occasionally – Zone 1 3 Not normally, only briefly – Zone 2	G Gas, steam, mist	Pressure-resistant enclosure: da, d, db, dc – 0, 1, 2 Increased safety: e, eb, ec – 1, 2 Intrinsic safety: ia, ib, ic – 0, 1, 2 Encapsulation: ma, mb, mc – 0, 1, 2 Optical radiation: op, opa, opb, opc – 0, 1, 2 Constructive explosion protection: h – 0, 1, 2	IIC Hydrogen >20; Acetylene >20 IIB Ethylene 60 … 180 IIA Propane >180	T6 ≤85 °C T5 ≤100 °C T4 ≤135 °C T2 ≤200 °C T2 ≤300 °C T1 ≤450 °C	Ga Very high protection level Gb High protection level Gc Enhanced protection level

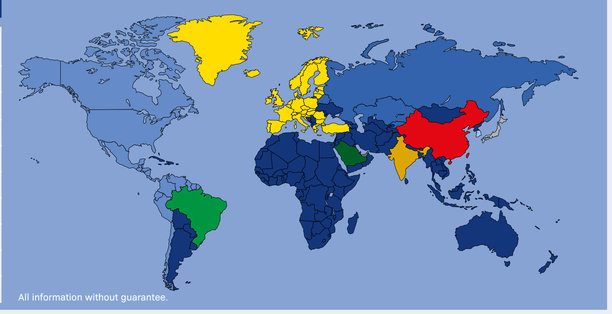
MARKING FOR POTENTIALLY EXPLOSIVE AREAS DUE TO DUST

Marking in accordance with EU Directive 2014/34/EU (ATEX)				Marking in accordance with EN 60079 and IEC 60079			
Ex	II	3	D	Ex tc	IIIC	T90°C	Dc
Explosive area	**Device group**	**Device category** [1]	**Type of explosive substance**	**Ignition Protection Type** [1]	**Group**	**Temperature Class**	**Equipment Protection Level**
Dust	II	1 Permanent, long periods, frequent – Zone 20 2 Occasionally – Zone 21 3 Not normally, only briefly – Zone 22	D Dust, fibers, lint	Intrinsic safety: ia, ib, ic – 20, 21, 22 Encapsulation: ma, mb, mc – 20, 21, 22 Optical radiation: op, opa, opb, opc – 20, 21, 22 Protection by enclosure: ta, tb, tc – 20, 21, 22 Constructive explosion protection: h – 20, 21, 22	IIIC Conductive dust; Carbonaceous dust; Metal dust IIIB Non-conductive dust; Non-carbonaceous dust IIIA Flammable lint	Maximum surface temperature	Da Very high protection level Db High protection level Dc Enhanced protection level

1) Markings in round or square brackets are markings for associated apparatus.

THE MOST IMPORTANT GLOBAL APPROVALS FOR EXPLOSION PROTECTION

Pos.	Registrations	Country / Region	Logo	Responsible body
	ATEX	European Economic Area, European Free Trade Association, Switzerland and Turkey	Ex	Notified body, e.g. TÜV
	IECEX	International	IECEx	Notified body, e.g. TÜV
	NEC, CEC	USA, Canada	UL, INMETRO, SASO	e.g. UL, cUL, FM, CSA
	CCC	China	CCC	e.g. NEPSI
	PESO	India	PESO	PESO
	INMETRO	Brazil	INMETRO	INMETRO
	EAC EX	Eurasian Economic Union	EAC Ex	
	KC	South Korea	KC	KOSHA
	TIIS	Japan	TIIS	TIIS
	SASO	Saudi Arabia	SASO	SASO



All information without guarantee.

INSTALLATION EXAMPLES IN EX ZONES

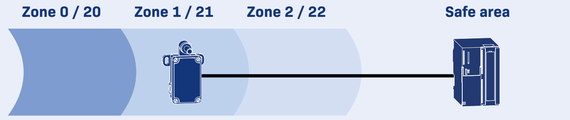
① Apparatus Ex ia, cat. 1 G/D or Simple electrical apparatus

② Associated apparatus [Ex ia] and Apparatus Ex ec or Ex nA

③ Apparatus Ex ib, cat. 2 G/D or Simple electrical apparatus

④ Associated apparatus [Ex ib]

⑤ Ex ec, cat. 3 G
Ex tc, cat. 3 D
or other Ignition Protection Type (except Ex i)



⑥ Ex mb, cat. 2 G/D or other Ignition Protection Type (except Ex i)

⑦ Ex tb, cat. 2 D or other Ignition Protection Type (except Ex i) (see Ignition Protection Types for dust atmospheres)

⑧ Ex db, cat. 2 G or other Ignition Protection Type (except Ex i) (see Ignition Protection Types for gas atmospheres)

Example	Product in accordance with EX consideration	Examples for Ex markings	Description
①	Intrinsically safe apparatus	Ⓔx II 1 G Ex **ia** IIC T6 Gb	Intrinsically safe apparatus for Zone 0/20, 1/21, 2/22
	Simple electrical apparatus	No marking	Simple electrical apparatus do not require Ex marking or certificate. However, the equipment must be evaluated according to ATEX and IECEx for suitability as simple electrical equipment.
②	Associated apparatus (required for intrinsically safe circuits)	Ⓔx II (1) G [Ex **ia** Ga] IIC Ⓔx II (1) D [Ex **ia** Da] IIIC	Without additional Ignition Protection Type: Installation outside the hazardous area. Marking into which Zone the associated apparatus may work – identifiable by the brackets. Circuits in Zone 0, 1, 2 Circuits in Zone 20, 21, 22
		Ⓔx II 3 G Ex **ec** nC IIC T5 Gc	Installation area of the associated apparatus itself as far as into Zone 2.
③	Apparatus for area at risk of explosion	Ⓔx II 2 G Ex **ib** IIC T6 Gb	Intrinsically safe apparatus for Zone 1, 21
	Simple electrical apparatus	No marking	Simple electrical apparatus do not require Ex marking or certificate. However, the equipment must be evaluated according to ATEX and IECEx for suitability as simple electrical equipment.
④	Associated apparatus (required for intrinsically safe circuits)	Ⓔx II (2) G [Ex **ib** Gb] IIC Ⓔx II (2) D [Ex **ib** Db] IIIC	Without additional Ignition Protection Type: Installation outside the hazardous area. Marking into which Zone the associated apparatus may work – identifiable by the brackets. Circuits in Zone 1, 2 Circuits in Zone 21, 22
⑤	Apparatus for area at risk of explosion	Ⓔx II 3 G Ex **ec** IIC T6 Gc	Increased safety – Zone 2
		Ⓔx II 3 D Ex **tc** IIIC T 90 °C Dc	Protection by enclosure – Zone 22
⑥	Apparatus for area at risk of explosion	Ⓔx II 2 G Ex **mb** IIC T6 Gb	Encapsulation – Zone 1
		Ⓔx II 2 D Ex **mb** IIIC T80°C Db	Encapsulation – Zone 21
⑦	Apparatus for area at risk of explosion	Ⓔx II 2 D Ex **tb** IIIC T80°C Db	Protection by enclosure – Zone 21
⑧	Apparatus for area at risk of explosion	Ⓔx II 2 G Ex **db** IIC T6 Gb	Pressure-resistant enclosure – Zone 1

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