



# Competence in explosion protected crane technology

## Electrical equipment

ATEX	II (1)2 G	Ex	db [ia Ga]	IIC	T4	Gb
IECEX		Ex	db [ia Ga]	IIC	T4	Gb
NEC 505	Class I, Zone 1	AEx	db [ia Ga]	IIC	T4	Gb
IECEX (dust)		Ex	tb	IIIC	T90°C	Db
NEC 506	Zone 21	AEx	tb	IIIC	T90°C	Db
NEC 500	Class I, Division 1			Group C, D	T4	

## Non-electrical equipment

ATEX	II 2 G	Ex	h	IIC	T6	Gb
IECEX		Ex	h	IIC	T6	Gb
EN 13463-1	II 2 G		c k	IIC	T6	

ATEX: Explosion protection for Europe  
 IECEX: International explosion protection  
 NEC: Explosion protection for USA

### Types of protection for electrical equipment in explosive atmospheres

Type of protection	Symbol	Zone	Diagram	Main application	Standard
general requirements					IEC 60079-0 EN 60079-0 UL 60079-0
increased safety	e, eb, ec	1 2		terminal and junction boxes, control stations for installing Ex components (with a different type of protection), squirrel-cage motors, light fittings	IEC 60079-7 EN 60079-7 UL 60079-7
flameproof enclosures	da, db, dc	0 1 2		switchgears, control stations, indicating equipment, control systems, motors, transformers, heating equipment, light fittings	IEC 60079-1 EN 60079-1 UL 60079-1
pressurized enclosure	px, pxb, py, pyb, pz, pzc	1 21 1 21 2 22		switchgear and control cabinets, analysers, large motors <i>former identification for dust pD21, pD22</i>	IEC 60079-2 EN 60079-2 UL 60079-2
intrinsic safety	ia, ib, ic	0 20 1 21 2 22		instrumentation technology, fieldbus technology, sensors, actuators [Ex ib] = associated electrical apparatus – installation in the safe area <i>former identification for dust: iaD = for use in Zone 20, 21, 22 ibD = for use in Zone 21, 22</i>	IEC 60079-11 EN 60079-11 UL 60079-11
				intrinsically safe systems	IEC 60079-25 EN 60079-25 UL 60079-25
liquid immersion	o, ob, oc	1 2		transformers, starting resistors	IEC 60079-6 EN 60079-6 UL 60079-6
powder filling	q, qb	1		sensors, display units, electronic ballasts, transmitters	IEC 60079-5 EN 60079-5 UL 60079-5
encapsulation	ma, mb, mc	0 20 1 21 2 22		switchgear with small capacity, control and signalling units, display units, sensors <i>former identification for dust: maD = for use in Zone 20, 21, 22 mbD = for use in Zone 21, 22</i>	IEC 60079-18 EN 60079-18 UL 60079-18
type of protection nC	nC, nCc, nR, nRc	2 2		all electrical equipment for Zone 2 nC = sparking equipment in which the contacts are suitably protected nR = restricted breathing enclosures	IEC 60079-15 EN 60079-15 UL 60079-15
optical radiation	op, op, op	0 20 1 21 2 22		op is = inherently safe optical radiation op pr = protected optical radiation op sh = optical radiation interlock	IEC 60079-28 EN 60079-28
protection by enclosure	ta, tb, tc	20 21 22		switchgear, control stations, junction boxes, control boxes, motors, light fittings <i>former identification: tD A21 = under procedure A for Zone 21 tD B21 = under procedure B for Zone 21</i>	IEC 60079-31 EN 60079-31 UL 60079-31 IEC 61241-1 EN 61241-1 ISA 61241-1

### Equipment category and equipment protection level (EPL)

According to EU directive 2014/34/EU (ATEX)		According to IEC and CENELEC	
Group	Equipment category	EPL	Sufficient safety
Mines susceptible to firedamp			
I	M1	Ma	during rare malfunctions
I	M2	Mb	until de-energizing of the equipment
Explosive gas atmosphere			
II	1G	Ga	Zone 0 during rare malfunctions
II	2G	Gb	Zone 1 during expected malfunctions
II	3G	Gc	Zone 2 in normal operation
Explosive dust atmosphere			
II	1D	Da	Zone 20 during rare malfunctions
II	2D	Db	Zone 21 during expected malfunctions
II	3D	Dc	Zone 22 in normal operation

(1) G associated apparatus – installation in non-hazardous area

### Types of protection for non-electrical equipment in explosive atmospheres

Type of protection	Symbol	Diagram	Main application	Standard
basic methods and requirements				ISO 80079-36 EN ISO 80079-36
constructional safety >c<	h		couplings, pumps, gear drives, chain drives, belt drives <i>former marking according to EN 13463-5: c</i>	ISO 80079-37 EN ISO 80079-37
control of ignition sources >b<	h		pumps, belt drives <i>former marking according to EN 13463-6: b</i>	ISO 80079-37 EN ISO 80079-37
liquid immersion >k<	h		submerged pumps, gears <i>former marking according to EN 13463-8: k</i>	ISO 80079-37 EN ISO 80079-37
flameproof enclosures >d<	h		brakes, couplings <i>former marking according to EN 13463-3: d</i>	IEC 60079-1 EN 60079-1
protection by enclosure >t<	h		equipment for explosive dust atmospheres	IEC 60079-31 EN 60079-31
pressurized enclosure >p<	h		pumps	IEC 60079-2 EN 60079-2

### Groups

IEC/CENELEC/NEC 505/NEC 506		NEC 500	
Group I	Mines susceptible to firedamp	—	
	methane		
Group II	Explosive gas atmosphere	Class I	
Subdivisions	Typical gas	Subdivisions	
IIA	propane	propane	Class I, Group D
IIB	ethylene	ethylene	Class I, Group C
IIC	hydrogen	hydrogen	Class I, Group B
	acetylene	acetylene	Class I, Group A
Group III	Explosive dust atmosphere	Class II, Class III	
Subdivisions	Typical dust	Subdivisions	
IIIA	combustible flyings	fibers/flyings	Class III
IIIB	non-conductive dust	non-conductive dust	Class II, Group G
IIIC	conductive dust	carbonaceous dust	Class II, Group F
		combustible metal dust	Class II, Group E

### Temperature classification

Maximum surface temperature	Gas temperature classes		Maximum surface temperature	Gas temperature classes	
	Equipment marking NEC 500	CENELEC/IEC/NEC 505		Equipment marking NEC 500	CENELEC/IEC/NEC 505
450°C	T1	T1	200°C	T3	T3
300°C	T2	T2	180°C	T3A	
280°C	T2A		165°C	T3B	
260°C	T2B		160°C	T3C	
230°C	T2C		135°C	T4	T4
215°C	T2D		120°C	T4A	
Dust: indication of the max. surface temperature in °C			100°C	T5	T5
			85°C	T6	T6

### Zones

Dangerous explosive atmosphere		Continuously, long-term or frequently	Occasionally	Not likely to occur and for short period only
Gas	CENELEC/IEC/NEC 505	Zone 0	Zone 1	Zone 2
	NEC 500 (Class I)	Division 1		Division 2
Dust	CENELEC/IEC/NEC 506	Zone 20	Zone 21	Zone 22
	NEC 500 (Class II, III)	Division 1		Division 2

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