



# Competence in explosion protected crane technology

Electrical equipment						
ATEX		II (1)2 G	Ex	d [ia Ga]	IIC	T4 Gb*
IEC/CENELEC			Ex	d [ia Ga]	IIC	T4 Gb*
NEC 505		Class I, Zone 1	AEx	d [ia]	IIC	T4
IEC/CENELEC (old)			Ex	d [ia]	IIC	
IEC/CENELEC (alternate)			Ex	db [ia]	IIC	
IEC/CENELEC (dust)			Ex	tb	IIIC	Db*
NEC 500		Class I, Division 1			Group C,D	

\* When using the alternate symbols, the EPL can be left out.

Non-electrical equipment						
ATEX		II 2 G		ck	IIC	T6

Types of protection for electrical equipment in explosive gas atmospheres						
Type of protection	Symbol standard alternate	Zone	Diagram	Main application	Standard	
increased safety	e eb	1		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 ISA 60079-7	
flameproof enclosures	d db	1		switchgears, control stations, indicating equipment, control systems, motors, transformers, heating equipment, light fittings	IEC 60079-1 EN 60079-1 ISA 60079-1	
pressurized enclosures	px py pz pxb pyb pzb	1 1 2		switchgear and control cabinets, analysers, large motors	IEC 60079-2 EN 60079-2 ISA 60079-2	
intrinsic safety	ia ia	0		instrumentation technology, fieldbus technology, sensors, actuators [Ex ib] = associated electrical apparatus - installation in the safe area	IEC 60079-11 EN 60079-11 ISA 60079-11	
	ib ib	1				
	ic ic	2				
				intrinsically safe systems	IEC 60079-25 EN 60079-25	
				FISCO: fieldbus intrinsically-safe concept	IEC 60079-27 EN 60079-27 ISA 60079-27	
oil immersion	o ob	1		transformers, starting resistors	IEC 60079-6 EN 60079-6 ISA 60079-6	
powder filling	q qb	1		sensors, display units, electronic ballasts, transmitters	IEC 60079-5 EN 60079-5 ISA 60079-5	
encapsulation	ma ma	0		switchgear with small capacity, control and signalling units, display units, sensors	IEC 60079-18 EN 60079-18 ISA 60079-18	
	mb mb	1				
	mc mc	2				
type of protection "n"	nA nAc	2		all electrical equipment for Zone 2 nA = non-sparking device nC = sparking devices and components nR = restricted breathing enclosures	IEC 60079-15 EN 60079-15 ISA 60079-15	
	nC nCc	2				
	nR nRc	2				
optical radiation	op_ op_a	0		op is = inherently safe optical radiation op pr = protected optical radiation op sh = optical radiation interlock	IEC 60079-28 EN 60079-28	
	op_ op_b	1				
	op_ op_c	2				
Types of protection for electrical equipment in explosive dust atmospheres						
protection by enclosures	ta ta	20		switchgear, control stations, junction boxes, control boxes, motors, light fittings <i>old identification:</i> tD A21 = under procedure A for Zone 21 tD B21 = under procedure B for Zone 21	IEC 60079-31 EN 60079-31	
	tb tb	21				
	tc tc	22				
pressurization	p pb	21		switchgear and control cabinets, motors <i>old identification:</i> pD21, pD22	IEC 61241-4 EN 61241-4 ISA 61241-2	
	pc pc	22				
intrinsic safety	ia ia	20		instrumentation technology, fieldbus technology, sensors, actuators [Ex ib] = associated electrical apparatus - installation in the safe area <i>old identification:</i> iaD = for use in Zone 20, 21, 22 ibD = for use in Zone 21, 22	IEC 60079-11 EN 60079-11	
	ib ib	21				
	ic ic	22				
encapsulation	ma ma	20		switchgear with small capacity, control and signalling units, display units, sensors <i>old identification:</i> maD = for use in Zone 20, 21, 22 mbD = for use in Zone 21, 22	IEC 60079-18 EN 60079-18 ISA 61241-18	
	mb mb	21				
	mc mc	22				

Equipment category and Equipment protection level (EPL)				
acc. to EU-directive 94/9/EG (ATEX)		acc. to IEC and CENELEC		Sufficient security
Group	Equipment category	EPL		
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
I	3D	Dc	Zone 22	in normal operation

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

Types of protection for non-electrical equipment in gas and dust atmospheres				
Type of protection	Diagram	Main application	Standard	
constructional safety	c	couplings, pumps, gear drives, chain drives, belt drives	EN 13463-5	
flameproof enclosures	d	brakes, couplings	EN 13463-3	
pressurized pumps	p	pumps	EN 60079-2	
control of ignition sources	b	pumps, beld drives	EN 13463-6	
liquid immersion	k	submerged pumps, gears	EN 13463-8	
flow restricting enclosure	fr	equipment only for Zone 2 or Zone 22	EN 13463-2	

Groups			
IEC/CENELEC/NEC 505		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/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

\* acc. to IEC (2007) and CENELEC (2009)

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