

5. APPENDIX

5.1 SAFETY CHARACTERISTICS OF FLAMMABLE GASES AND VAPOURS

Table 19: Safety data – Ignition temperature, temperature class and explosion group

Substance designation	Ignition temperature °C	Temperature class	Explosion group
1,2 dichloroethane	440	T 2	II A
Acetaldehyde	155	T 4	II A
Acetone	535	T 1	II A
Acetylene	305	T 2	II C ³
Ammonia	630	T 1	II A
Petrol fuels	220 to 300	T 3	II A
Benzene (pure)	555	T 1	II A
Cyclohexanone	430	T 2	II A
Diesel fuels	220	T 3	II A
Acetic acid	485	T 1	II A
Acetic anhydride	330	T 2	II A
Ethane	515	T 1	II A
Ethyl acetate	470	T 1	II A
Ethanol	400	T 2	II B
Ethyl chloride	510	T 1	II A
Ethylene	440	T 2	II B
Ethylene oxide	435 (self-decomposing)	T 2	II B
Ethyl ether	175	T 4	II B
Ethyl glycol	235	T 3	II B
Fuel oil EL, L, M, S	220 to 300	T 3	II A
i-Amyl acetate	380	T 2	II A
Carbon monoxide	605	T 1	II A
Methane	595	T 1	II A
Methanol	440	T 2	II A
Methyl chloride	625	T 1	II A
Naphthalene	540	T 1	II A
n-Butane	365	T 2	II A
n-Butanol	325	T 2	II B
n-Hexane	230	T 3	II A
n-Propyl alcohol	385	T 2	II B*
Phenol	595	T 1	II A
Propane	470	T 1	II A
Carbon disulphide	95	T 6	II C ¹
Hydrogen sulphide	270	T 3	II B
Toluene	535	T 1	II A
Hydrogen	560	T 1	II C ²

*The explosion group for this substance has not yet been determined.
¹Also explosion group II B + CS₂. ²Also explosion group II B + H₂. ³Also explosion group II B + C₂H₂.

5.2 ENCLOSURE PROTECTION TYPES ACCORDING TO IEC 60529 – IPXX

Table 20: Enclosure protection types according to IEC 60529 – IPXX










Ref-erence	First number Touch protection	Foreign body	Second number Water protection
0	No protection	No protection	No protection
1	Protection from contact with back of hand	Protection from solid foreign bodies 50 mm Ø	Protection from water dripping straight down
2	Protection from contact with fingers	Protection from solid foreign bodies 12.5 mm Ø	Protection from water dripping down at an angle
3	Protection from contact with tools	Protection from solid foreign bodies 2.5 mm Ø	Protection from spray water up to 60°
4	Protection from contact with wire	Protection from solid foreign bodies 1.0 mm Ø	Protection from splash water from all directions
5	Protection from contact with wire	Dust-protected	Protection from hose water (IP x5)
6	Protection from contact with wire	Dustproof	Protection from strong hose water (IP x6)
7			Protection against intermittent immersion in water
8			Protection against continuous immersion in water

5.3 ENCLOSURE PROTECTION TYPES ACCORDING TO NEMA STANDARDS

Table 21: Enclosure protection types according to NEMA standards (Publication No. 250 Enclosures for Electrical Equipment 1000 volts maximum)

Reference	Protection type	Installation site
Type 1	Protection against accidental contact with live parts.	Interior
Type 2	Protection against penetration of dripping water and falling dirt.	Interior
Type 3	Protection against swirling dust, rain and hail. No damage from ice formation on enclosure.	Open air
Type 3R	Protection against penetration of hail, swirling dust and rain. External mechanisms stay operational when iced-over.	Open air
Type 4	Protection against falling rain, splashing water and hose water. No damage from ice formation on enclosure.	Interior or open air
Type 4X	Protection against falling rain, splashing water and hose water. No damage from ice formation on enclosure.	Interior or open air
Type 5	Protection from dust and falling dirt and dripping non-corrosive liquids.	Interior
Type 6	Protection from penetration of dust and hose water and water during temporary submersion. No damage from ice formation on enclosure.	Interior or open air
Type 6P	Protection from penetration of dust and hose water and due to prolonged submersion in water. No damage from ice formation on enclosure.	Interior or open air
Type 7	For installation in hazardous areas classified as Class I, Groups A, B, C or D.	Interior
Type 8	For installation in hazardous areas classified as Class I, Groups A, B, C or D.	Interior or open air
Type 9	For installation in hazardous areas classified as Class II, Groups E, F or G.	Interior
Type 10	Enclosure which complies with the Mine Safety Health Administration requirements.	Mining
Type 11	Protection from the corrosive effects of liquids and gases by oil immersion.	Interior
Type 12, 12K	Protection from penetration of dust, dirt and dripping liquids.	Interior
Type 13	Protection from dust, hose water, oil and non-corrosive liquids.	Interior

5.4 MARKING OF ELECTRICAL EQUIPMENT

Type of protection	Symbol alternative	Zone	Main application	Standard
 Increased safety "e"	eb ec	1 2	Terminals and terminal boxes, squirrel cage rotors, lights	IEC 60079-7 EN 60079-7
 Flameproof enclosure "d"	da db dc	0 1 2	Switchgear and control gear, command and display devices, motors	IEC 60079-1 EN 60079-1
 Pressurised enclosure "p"	pxb pyb pzc	1, 21 1, 21 2, 22	Switchgear and control cabinets, large motors	IEC 60079-2 EN 60079-2
 Intrinsic safety "i"	ia ib ic	0, 20 1, 21 2, 22	Instrumentation and control technology, fieldbus technology, sensors, actors [Ex ib] = associated electrical equipment in safe area	IEC 60079-11 EN 60079-11
 Liquid immersion "o"	ob oc	1 2	Transformers	IEC 60079-6 EN 60079-6
 Powder filling "q"	qb	1	Sensors, electronic components, electronic ballasts	IEC 60079-5 EN 60079-5
 Encapsulation "m"	ma mb mc	0, 20 1, 21 2, 22	Sensors, electronic components	IEC 60079-18 EN 60079-18
 Protection type "n"	nAc nCc nRc	2 2 2	Electrical equipment for Zone 2	IEC 60079-15 EN 60079-15
 Protection via enclosure "t"	ta tb tc	20 21 22	Switchgear and control gear, control, connection, and terminal boxes, motors, lights	IEC 60079-31 EN 60079-31

Type of protection



Firedamp-endangered areas		
Group I		Methane
Gas explosion hazardous areas		
Group II	IIA IIB IIC	Propane Ethylene Hydrogen
Dust explosion hazardous areas		
Group III	IIIA IIIB IIIC	Combustible lint Non-conductive dust Conductive dust

Gas explosion hazardous areas: Temperature classes	
Group I	Methane
Gas explosion hazardous areas	
450 °C	T1
300 °C	T2
200 °C	T3
135 °C	T4
100 °C	T5
85 °C	T6
Dust explosion hazardous areas: Surface temperature	
T ... °C (Example: T 80°C)	

ATEX marking







Equipment group I: mining; Equipment group II: other areas

Classification	Zone 0	Zone 20	Zone 1	Zone 21	Zone 2	Zone 22	Mining
Hazardous explosive atmosphere	Constantly, frequently or long-term		Occasionally		Seldom and short-term		
Equipment category	1G	1D	2G	2D	3G	3D	M1 or M2

Equipment category and equipment protection level (EPL)

Classification	Zone 0	Zone 20	Zone 1	Zone 21	Zone 2	Zone 22	Mining
EPL (IEC/EN 60079-0)	Ga	Da	Gb	Db	Gc	Dc	Ma or Mb

5.5 MARKING OF NON-ELECTRICAL EQUIPMENT

Type of protection	Symbol Standard	Zone	Main application	Standard
 Constructional safety "c"	h	0, 1, 2 20, 21, 22	Couplings, pumps, gear drives, conveyor belts	ISO 80079-37 EN ISO 80079-37
 Flameproof enclosure "d"	h	1, 2	Brakes, couplings	IEC 60079-1 EN 60079-1
 Pressurised enclosure "p"	h	1, 2 21, 22	Pumps	IEC 60079-2 EN 60079-2
 Liquid immersion "k"	h	0, 1, 2 20, 21, 22	Submerged pumps, gears,	ISO 80079-37 EN ISO 80079-37
 Control of ignition source "b"	h	0, 1, 2 20, 21, 22	Pumps, conveyor belts	ISO 80079-37 EN ISO 80079-37
 Protection via enclosure "t"	h	20, 21, 22	Equipment exclusively for dust explosion hazardous areas	IEC 60079-31 EN 60079-31

Type of protection

Ex II 2G Ex h IIC T6 Gb

Firedamp-endangered areas		
Group I		Methane
Gas explosion hazardous areas		
Group II	IIA IIB IIC	Propane Ethylene Hydrogen
Dust explosion hazardous areas		
Group III	IIIA IIIB IIIC	Combustible lint Non-conductive dust Conductive dust

Max. surface temperature

Gas explosion hazardous areas: Temperature classes

450 °C	T1
300 °C	T2
200 °C	T3
135 °C	T4
100 °C	T5
85 °C	T6

Dust explosion hazardous areas: Surface temperature

T ... °C (Example: T 80°C)

ATEX marking

Equipment group I: mining; Equipment group II: other areas

Classification	Zone 0	Zone 20	Zone 1	Zone 21	Zone 2	Zone 22	Mining
Hazardous explosive atmosphere	Constantly, frequently or long-term		Occasionally		Seldom and short-term		
Equipment category	1G	1D	2G	2D	3G	3D	M1 or M2

Equipment category and equipment protection level (EPL)

Classification	Zone 0	Zone 20	Zone 1	Zone 21	Zone 2	Zone 22	Mining
EPL (IEC/EN 60079-0)	Ga	Da	Gb	Db	Gc	Dc	Ma or Mb