GUIDE FOR EXPLOSION PROTECTION

Equipment and products operating in hazardous areas are required to meet stringent criteria. They must be “protected” to avoid the possibility of them becoming a source of ignition.

If the danger of explosion cannot be completely or only partly avoided by measures of preventing the formation of an hazardous explosive atmosphere, then measures must be taken that avoid the ignition of the explosive atmosphere.

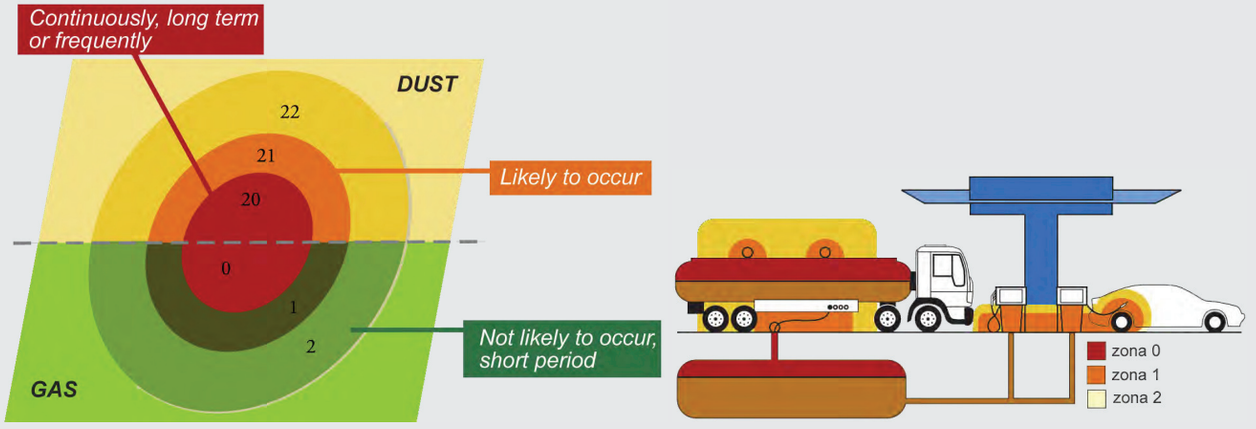
Integrated explosion protection

PRIMARY
Preventing the formation of an explosive atmosphere

SECONDARY
Avoidance of the ignition of an explosive atmosphere

TERTIARY
Mitigation of the effects of an explosion to an acceptable extent

EXAMPLES OF ZONES CLASSIFICATION



ZONE

Zone 0
An area in which an explosive atmosphere consisting of a mixture of air with flammable substances in the form of gas, vapour or mist is present continuously or for long periods or frequently.

Zone 20
An area in which an explosive atmosphere in the form of a cloud of combustible dust in air is present continuously or for long periods or frequently.

Zone 1
An area in which an explosive atmosphere consisting of a mixture of air with flammable substances in the form of gas, vapour or mist is likely to occur in normal operation occasionally.

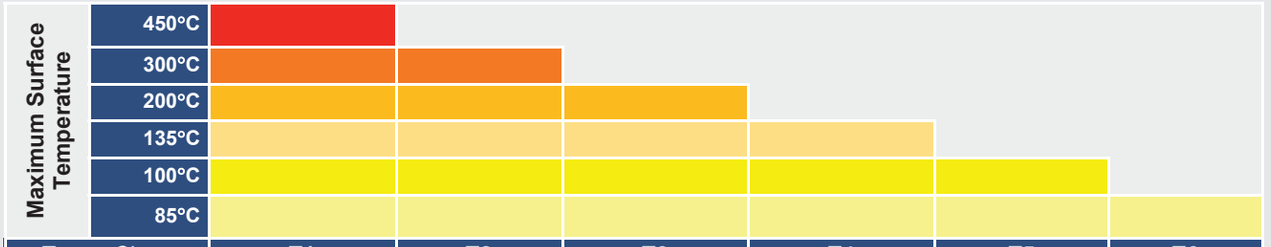
Zone 21
An area in which an explosive atmosphere in the form of a cloud of combustible dust in air is likely to occur occasionally in normal operation.

Zone 2
An area in which an explosive atmosphere consisting of a mixture of air with flammable substances in the form of gas, vapour or mist is not likely to occur in normal operation, but if it does occur, will persist for a short period only.

Zone 22
An area in which an explosive atmosphere in the form of a cloud of combustible dust in air is not likely to occur in normal operation, but, if it does occur, will persist for a short period only.

Categories / Protection levels / Zones

AREAS	CATEGORIES	EPL	ZONES	EXPLOSIVE ATMOSPHERE
Mining - I	M1	Ma	/	>1,5% CH4
	M2	Mb		<1,5% CH4
Other than mines - II	1G, 1D	Ga, Da	0, 20	Continuously, long term or frequently
	2G, 2D	Gb, Db	1, 21	Likely to occur
	3G, 3D	Gc, Dc	2, 22	Not likely to occur, short period



Temp. Class		T1	T2	T3	T4	T5	T6
Gas Groups	I	methane					
	IIA	ammonium, ethane, propane, benzene, methanol	ethyl n-butanol, n-butyl alcohol	benzine, kerosene , n-hexane, diesel fuel	etileter, acetilaldehid, benzaldehyde, dibutileter, diheksileter	-	-
	IIB	LPG mix	ethylene	hydrogen sulphide	etileter, dietileter	-	-
	IIC	hydrogen	acetylene	-	-	-	carbon disulphide

Dust Groups	
IIIA	Combustible flyings
IIIB	Non-conductive dust
IIIC	Conductive dust

Dust	Flash point [°C] *layer*	*cloud*	Minimum ignition energy *(cloud)* [mJ]	Lower Explosion Limit *(cloud)* [g/m^3]
Cellulose	270	480	80	55
Sugar	400	370	30	45
Starch	380	400	25	25
Wheat	220	500	60	65
Sawdust	260	470	40	35
Aluminum powder	490-700	550-800	15-160	40-140
Zinc	540	690	960	460
Asphalt	550	510	40	35

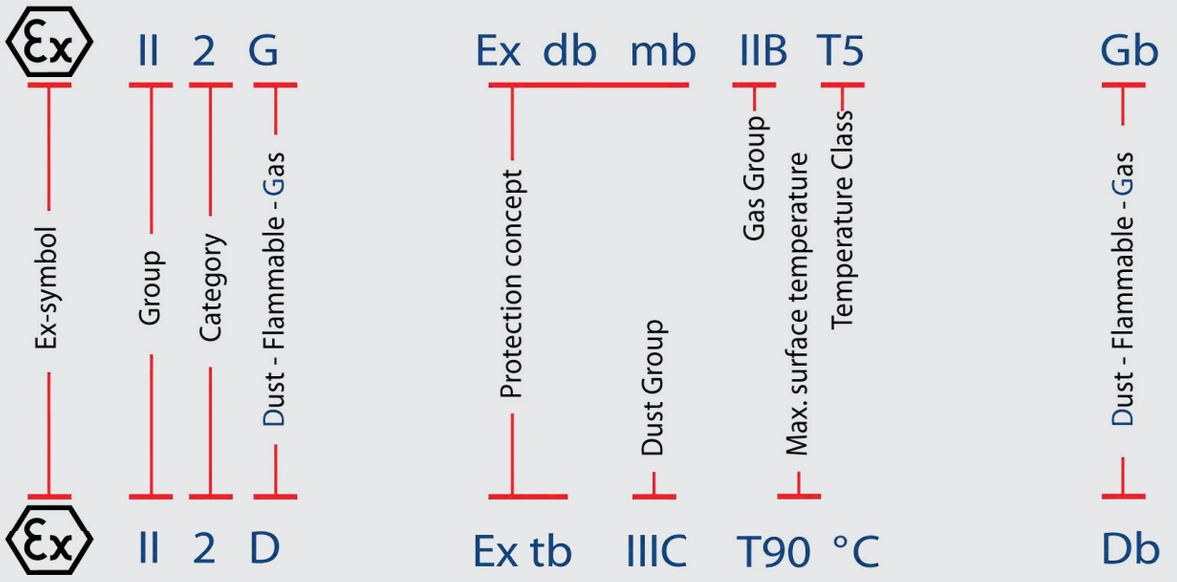
EQUIPMENT PROTECTION LEVELS (EPL)

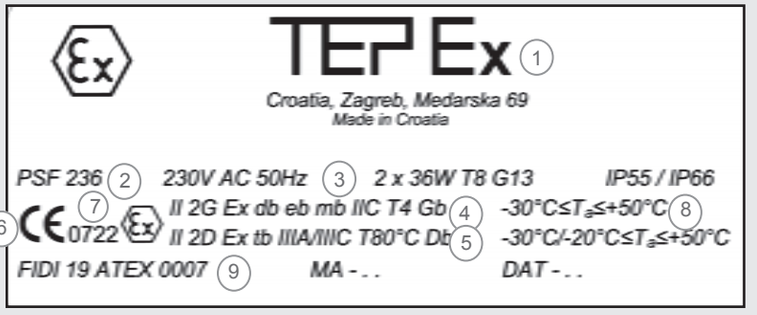
Group I (Mining)	**Ma**	An apparatus for installation in a coal mine with possible presence of firedamp, with a level of protection “very high”, which ensures a sufficient safety on the fact that it is not able to become a source of ignition during normal operation, during planned or malfunctions when subject to rare malfunctions even in the case where it is left electrically powered in the presence of a gas leak.
	Mb	An apparatus for installation in a coal mine with possible presence of firedamp, with a security level “high”, which ensures a sufficient safety on the fact that it is not able to become a source of ignition during normal operation or during malfunctions envisaged in connection with interval of time that elapses between when there is a release of gas and when the equipment is, as a result of this, interrupted the power supply.
Group II (Gas)	**Ga**	An apparatus for potentially explosive atmospheres for the presence of gas, with a level of protection “very high”, which is not a source of ignition during normal operation, during expected malfunctions or when subject to rare malfunctions.
	Gb	An apparatus for potentially explosive atmospheres for the presence of gas, with a security level “high”, which is not a source of ignition during normal operation or during malfunctions provided.
	Gc	An apparatus for potentially explosive atmospheres for the presence of gas, with a level of protection “increased”, which is not a source of ignition during normal operation and which presents some additional protective measures to ensure that it remains a source of ignition is not activated in the event of expected events regularly (for example, to the failure of a lamp).
Group III (Dust)	**Da**	An apparatus for potentially explosive atmospheres for the presence of combustible dust, which presents a protection level “very high”, which does not constitute a source of ignition in normal operation, during expected malfunction, or when subject to rare malfunctions.
	Db	An apparatus for potentially explosive atmospheres for the presence of combustible dust, which presents a security level “high”, which does not constitute a source of ignition in normal operation or when subject to possible failures.
	Dc	An apparatus for potentially explosive atmospheres for the presence of dust, with a level of protection “increased”, which does not constitute a source of ignition during normal operation and which may have additional protections to ensure that it remains a source of ignition inactive in the case of expected events regularly (for example the failure of a lamp).

GUIDE FOR EXPLOSION PROTECTION

Types of protection for explosive atmosphere of flammable gases, vapors, mists or dusts EN/IEC 60079-0 - General Requirements					
Type of protection	**Standard**	**Concept**	**Symbol**	**Category**	**EPL**
Flameproof	EN/IEC 60079-1		d	2G M2	Gb Mb
Increased safety	EN/IEC 60079-7		e	2G M2	Gb Mb
Pressurized	EN/IEC 60079-2		px, py, pz	M2, 2G, 3G 2D, 3D	Mb, Gb, Gc Db, Dc
Intrinsic safety	EN/IEC 60079-11		ia, ib, ic	M1, M2, 1G, 2G, 3G 1D, 2D, 3D	Ma, Mb, Ga, Gb, Gc Da, Db, Dc
Type of protection “n”	EN/IEC 60079-15		nA nC nR	3G	Gc
Powder filling	EN/IEC 60079-5		q	M2, 2G	Mb, Gb
Oil - immersion	EN/IEC 60079-6		o	M2, 2G	Mb, Gb
Encapsulation	EN/IEC 60079-18		ma mb Mc	M1, M2, 1G, 2G, 3G 1D, 2D, 3D	Ma, Mb, Ga, Gb,Gc Da, Db, Dc
Protection by enclosures	EN/IEC 60079-31		tD ta, tb, tc	1D, 2D, 3D	Da, Db, Dc
Optical radiation	EN/IEC 60079-28		op _a op _b op _c	1G, 2G, 3G	Ga, Gb, Gc
Type of protection for non-electrical equipment EN 13463-1 / IEC 80079-36					
Flow restricting	EN 13463-2		fr	3G, 3D	/
Flameproof	EN 13463-3		d	M2, 2G	/
Constructional safety	EN 13463-5 prIEC 80079-37		c	M2, 1G, 2G, 3G 1D, 2D, 3D	Mb, Ga, Gb, Gc Da, Db, Dc
Control of ignition sources	EN 13463-6 prIEC 80079-37		b	M2, 1G, 2G, 3G 1D, 2D, 3D	Mb, Ga, Gb, Gc Da, Db, Dc
Liquid immersion	EN 13463-8 prIEC 80079-37		k	M1, M2, 1G, 2G, 3G 1D, 2D, 3D	Ma, Mb, Ga, Gb, Gc Da, Db, Dc
Pressurized	EN/IEC 60079-2		p	M2, 2G, 2D 3G, 3D	/

Typical Electrical Equipment Marking According to 2014/34/EU





No	Description
1	Manufacturer's name and address
2	Product identification
3	Technical data
4	Indication of the Equipment Category and Hazardous Atmosphere
5	Marking of explosion protection
6	Conformity symbol , EU symbol CE
7	Notified body
8	Standard ambient temperature (-20 ÷ +40° C), unless otherwise stated on label
9	Certificate number and product number