DEFINITIONS

EXPLOSIVE ENVIRONMENTS

Mixture with air, under atmospheric conditions, of flammable substances in the form of gases, vapours, mists or dusts in which, after combustion has occurred, combustion spreads to the entire unburned mixture.

HAZARDOUS AREAS

A hazardous area is an area in which an explosive gas environment is present, or may be expected to be present, in quantities such as to require special precautions for construction, installation and use of electrical apparatus.

INGREDIENTS FOR AN EXPLOSION

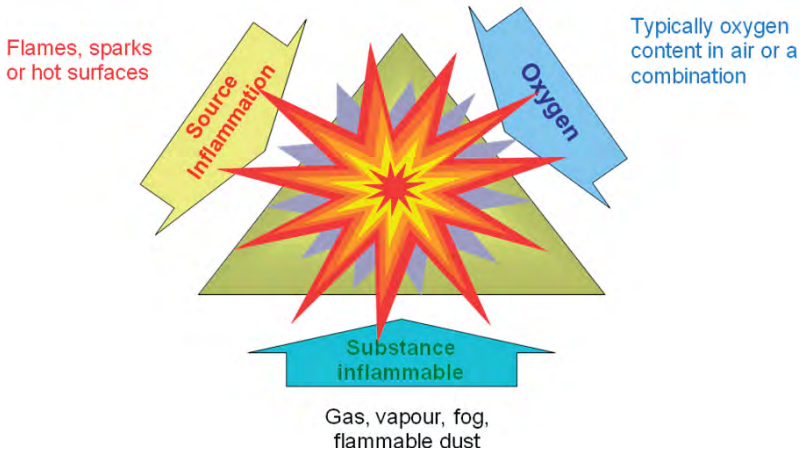
When combustible materials are mixed with air, an explosive mixture is produced. Danger of explosion therefore exists wherever these hazardous materials are handled: such a condition is to be found on the biggest chemical plant as well as at the smallest filling station.

Nowadays with the use of electronic and electrical instrumentation in process control, the risk of combustion by electrical energy has increased sharply.

To protect personnel and expensive equipment special precautions should be taken to prevent combustion of those dangerous substances. Conditions likely to ignite explosive mixtures are as follows:

- When combustible materials are mixed with air, an explosive mixture is produced. Danger of explosion therefore exists wherever these hazardous materials are handled: such a condition is to be found on the biggest chemical plant as well as at the smallest filling station.
- Nowadays with the use of electronic and electrical instrumentation in process control, the risk of combustion by electrical energy has increased sharply.
- To protect personnel and expensive equipment special precautions should be taken to prevent combustion of those dangerous substances. Conditions likely to ignite explosive mixtures are as follows:

Three conditions are enough to occur an explosion



DEFINITIONS

ZONES

The hazardous areas are classified in zones based on the frequency of the occurrence and the duration of an explosive gas environment as follows:

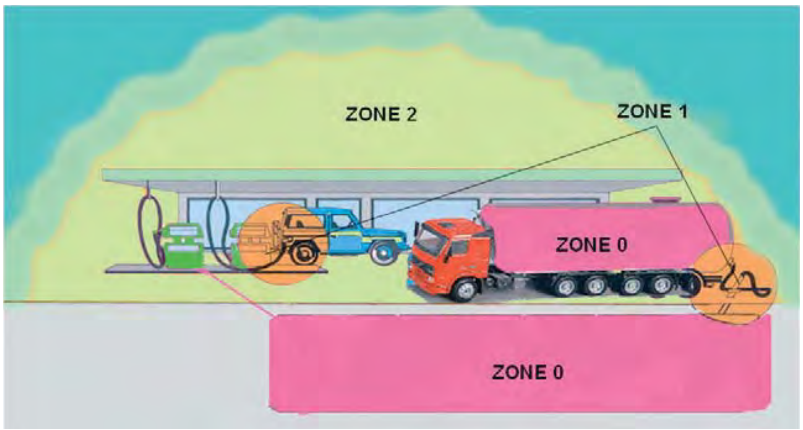
Zone 0 (20)	**Zone 1** (21)	**Zone 2** (22)
An area in wich an explosive **gas** (dust) atmosphere is present CONTINUOUSLY or is present for LONG PERIODS (~1000 h/y).	An area in wich an explosive **gas** (dust) atmosphere is present LIKELY TO OCCUR in normal operation (~10 to 999 h/y).	An area in wich an explosive **gas** (dust) atmosphere is not LIKELY TO OCCUR and if it does occur it will exist for short period only (~1 to 10 h/y).
Mode of protection: **ia** - **ma** - **px** - **...**	Mode of protection: **db** - **eb** - **ib** - **mb** - **px** - **...**	Mode of protection: **n** - **mc** - **ic** - **pz** - **...**

CLASSIFICATION OF HAZARDOUS LOCATION

Explosive Environment	**Continuous Presence**	**Intermittent Presence** (normal operation conditions)	**Occasional Presence** (abnormal operation)
IEC	**Zone 0** (gas) **Zone 20** (dust)	**Zone 1** (gas) **Zone 21** (dust)	**Zone 2** (gas) **Zone 22** (dust)
Europe	**Zone 0** (gas) **Zone 20** (dust)	**Zone 1** (gas) **Zone 21** (dust)	**Zone 2** (gas) **Zone 22** (dust)
Canada (CEC)[1] **USA** (NEC) [2]	**Cl. I Div. 1** (gas) **Cl. II Div. 1** (dust) **Cl.III Div. 1** (fibres)	**Cl. I Div. 1** (gas) **Cl. II Div. 1** (dust) **Cl.III Div. 1** (fibres)	**Cl. I Div. 2** (gas) **Cl. II Div. 2** (dust) **Cl.III Div. 2** (fibres)

[1] (CEC): Code Canadien d'Electricité / [2] (NEC): National Electrical Code

Example:



DEFINITIONS

CLASSIFICATION OF HAZARDOUS LOCATION

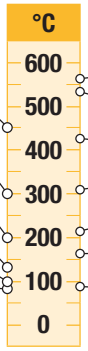
Category	Fault protection	Atmosphere	Zone	Example of protections
EC Type examination by Notified Body ⟶ annex III				
1 Very high level	2 types of protection or 2 indépendant faults	**G** (Gas)	**0**	"ia", "ma", "px" or "ia-ma", "db/eb"
		D (Dust)	**20**	
EC Type examination by Notified Body ⟶ annex III				
2 High level	One type of protection	**G** (Gas)	**1**	One type of protection
	Habitual frequent malfunction	**D** (Dust)	**21**	Ib, db, mb, eb, py, o,…
Internal production inspection ⟶ EC declaration of conformity				
3 Normal	Required level of protection	**G** (Gas)	**2**	n, ic, pz, … A, C, L, P, R
		D (Dust)	**22**	

Classification of Hazardous Location

Group	Gas Reference
I	Methane
IIA	Propane
IIB	Ethylene
IIC	Hydrogen / Acethylene

Surface Temperature Classes

Class Temperature	Max. Temperature
T1	450°C
T2	300°C
T3	200°C
T4	135°C
T5	100°C
T6	85°C



Gas & Ignition Temperature	
560°C Hydrogen	T1
537°C Methane	T1
425°C Ethylene	T2
305°C Acetylene	T2
210°C Kerozene	T3
160°C Ethylether	T4
95°C Carbon disulphide	T6

MODE OF PROTECTION USED BY PARKER LUCIFER®

MODES DE PROTECTION

Concept	Code		Zones	
	Gas	Dust	Gas	Dust
Flameproof enclosure	**db**	**tb**	1/2	21/22
Encapstulation	ma / **mb** / **mc**	tb / tc	0/1/2	20/21/22
Increased Safety	**eb**	-	1/2	-
Intrinsic Safety	**ia** / ib / ic	ta / tb / tc	0/1/2	20/21/22
Pressurized apparatus	**px** / py / pz	pD	1/2	21/22
Concept Cat. 3 apparatus	**nA** nL nR nC	- - - -	2 2 2 2	- - - -

STANDARDS AND TYPE OF PROTECTION

APPARATUS FOR EXPLOSIVE GAS ATMOSPHERES EQUIPMENT GROUP II

EPL	Standards EN / IEC	Protection	Title
	60079-0	-	General requirements
Ga	60079-11	ia	Intrinsic safety
	60079-18	ma	Encapsulation
	60079-26		Equipment with equipment protection level (EPL) Ga (Zone 0)
	60079-28	op is	Protection of equipment and transmission systems using optical radiation
Gb	60079-1	db	Flameproof enclosures
	60079-2	p, px, py	Pressurized enclosures
	60079-5	q	Powder filling
	60079-6	o	Oil immersion
	60079-7	eb	Increased safety
	60079-11	ib	Intrinsic safety
	60079-18	mb	Encapsulation
	60079-25		Intrinsically safe systems
	60079-27		Fieldbus intrinsically safe concept (FISCO)
	60079-28	op is op pr op sh	Protection of equipment and transmission systems using optical radiation
Gc	60079-11	Ic	Intrinsic safety
	60079-18	mc	Encapsulation
	60079-15	nA	Non sparking
	60079-15	nR	Restricted breathing enclosure
	60079-15	nL	Limited energy (only old edition)
	60079-15	nC	Equipment producing operational sparks
	60079-2	pz	Pressurized enclosures
	60079-27		Concept de réseau de terrain de sécurité intrinsèque (FISCO)
	60079-28	op is op pr op sh	Protection of equipment and transmission systems using optical radiation

EPL = **E**quipement **P**rotection **L**evel

STANDARDS AND TYPE OF PROTECTION

ELECTRICAL EQUIPMENT FOR USE IN AREAS WITH COMBUSTIBLE DUST - EQUIPMENT GROUP III

EPL	Standards EN / IEC	Protection	Title
	60079-0	-	General requirements
Da	60079-31	ta	Protection by enclosure
	60079-11	ia	Protection by intrinsic safety (iaD IEC/EN 61241-11)
	61241-18	ma	Protection by encapsulation
Db	60079-31	tb	Protection by enclosure
	60079-11	ib	Protection by intrinsic safety (ibD IEC/EN 61241-11)
	60079-18	mb	Protection by encapsulation
	IEC 61241-4	pD	Type of protection "pD"
Dc	60079-31	tc	Protection by enclosure
	60079-11	ic	Protection by intrinsic safety
	60079-18	mc	Protection by encapsulation
	IEC 61241-4	pD	Type of protection "pD"

EPL = **E**quipement **P**rotection **L**evel

NON ELECTRICAL EQUIPMENT FOR USE IN POTENTIALLY EXPLOSIVE ATMOSPHERE

Standards	Protection	Title
EN 13463-1	-	Basic method and requirements
EN 13463-2	fr	Protection by flow restricting enclosure
EN 13463-3	db	Protection by flameproof enclosure
EN 13463-5	c	Protection by constructional safety
EN 13463-6	b	Protection by control of ignition source
EN 13463-7	p	Protection by pressurized enclosure
EN 13463-8	k	Protection by liquid immersion

ZONES AND EQUIPEMENT PROTECTION LEVEL (EPL)

Gas		Dust	
Zone	EPL	Zone	EPL
0	Ga	20	Da
1	Ga and Gb	21	Da and Db
2	Ga, Gb and Gc	22	Da, Db and Dc

CATEGORIES AND EQUIPEMENT PROTECTION LEVEL (EPL)

Categories	Gas	Dust	Safety
1	Ga	Da	Very high
2	Gb	Db	High
3	Gc	Dc	Normal

EXAMPLES OF MARKING

ELECTRICAL APPARATUS FOR EXPLOSIVE GAS ATMOSPHERES EQUIPMENT GROUP II

Ex de IIC T5 Gb

Equipment Groups (Dust)	
IIA	Aceton, ethane, benzene, petrol, butane, propane, methane
IIB	Ethylene, town gas
IIC	Hydrogen, acetylene

Temperature Class	Ignition Temperature of Gas or Vapour	Maximum admissible surface temperature for permanently hot surfaces
T1	> 450°C	440°C
T2	> 300°C	290°C
T3	> 200°C	195°C
T4	> 135°C	130°C
T5	> 100°C	95°C
T6	> 85°C	80°C

Zone	Equipment Protection Level (EPL)
0	Ga
1	Gb and Ga
2	Gc, Gb and Ga

ELECTRICAL EQUIPMENT FOR USE IN AREAS WITH COMBUSTIBLE DUST - EQUIPMENT GROUP III

Surface Temperature Max.

Ex tb IIIC T95°C Db

Ex tb IIIC T95°C

Equipment Groups (Dust)	
IIIA	Fibres
IIIB	Non-conductive dust
IIIC	Conductive dust

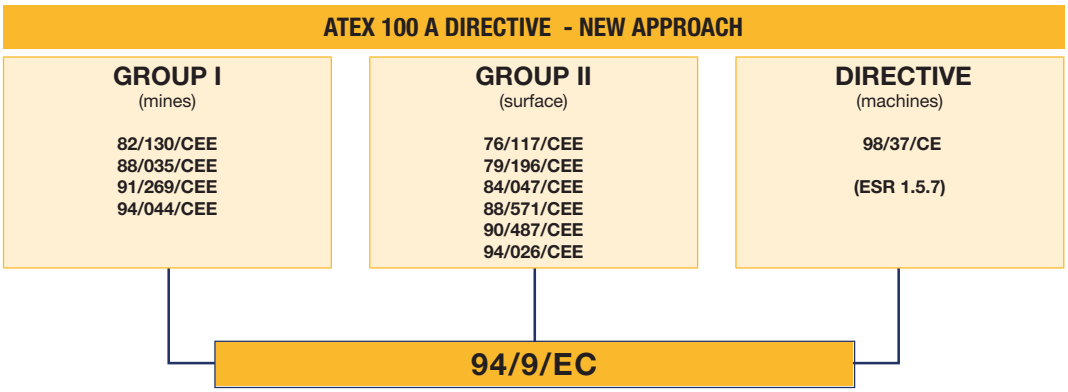
Zone	Equipment Protection Level (EPL)
20	Da
21	Db and Da
22	Dc, Db and Da

WHAT ABOUT THE DIRECTIVE ?
(94/9/EC - 1994-03-23)

WHAT ABOUT THE DIRECTIVE ? (94/9/EC - 1994-03-23)

In keeping with the **"new approach"**, the new directive lays down the framework for a total harmonization of regulations covering this field.

It makes no direct references to standards but sets out the essential health and safety requirements to be met and introduces the **CE** marking.



THE FRAMEWORK OF THE DIRECTIVE

The main principles of the new directive can be summarized as follows:

- It applies to **electric** and **non-electric** equipment.
- It defines **essential health and safety requirements**.
- It takes into consideration **all potential hazards** equipment may cause, in particular at design and production level.
- **The one directive** applies to both **mines** susceptible to fire damp and **surface industries**.
- It stresses the importance of equipment being **used in accordance with its intended purpose**.
- It recognises The European Standards Committee **CEN** and the European Committee for Electrotechnical Standardisation **CENELEC** as competent bodies to fix the required harmonised standards.
- It provides for the **contribution of labour and management**.
- It defines **procedures for assessing conformity** to essential requirements, on the basis of modules which qualify equipment to carry the **CE** mark of conformity.

APPLICATIONS

The directive applies to the industrial field and concerns the following equipment:

- **Equipment** (machines, apparatus, etc.)
- **Protective systems** (discharge devices, explosion suppression devices, etc.)
- **Components** (parts with no autonomous function, terminals, etc.)
- **Safety devices, controlling devices and regulating devices** intended for use outside potentially explosive environments but required for safety with respect to explosions (relays, barriers, pressure switches, thermostats, etc.)

WHAT ABOUT THE DIRECTIVE ?
(94/9/EC - 1994-03-23)

EXCLUDED FROM THE SCOPE OF THE NEW DIRECTIVE

The following equipment falls outside the scope of the new directive:

- Medical devices intended for use in a medical environment.
- Equipment and protective systems relating only to the risk of explosion of unstable chemical substances (explosives, etc.)
- Equipment intended for use in domestic and non-commercial environments.
- Personal protective equipment covered by directive 89/686/EC.
- Seagoing vessels and mobile offshore units.
- Means of transport, except for vehicles intended for use in a potentially explosive environment.

APPLICATION DATES

ATEX 100A DIRECTIVE - NEW APPROACH	
94/9/EC	
Application dates	
• Transposition to national law	1/9/1995
• Application (optional)	1/3/1996
• Application (total)	1/7/2003

POTENTIAL IGNITION SOURCES AND OTHER HAZARDS TO BE CONTROLLED

The following all represent potential hazards:

- Various sources of ignition, such as sparks, flames, electric arcs, high surface temperature, acoustic energy, optical radiation or electromagnetic waves.
- Static electricity.
- Pressure compensation operations.
- Disturbance from external sources, such as changing environmental conditions, extraneous voltage, humidity, vibration or contamination.

Provision is also made for specific requirements governing devices used to provide additional equipment safety.

These requirements necessitate detailed analysis to asses the operational reliability of such devices and their interaction with other components connected with the equipment.

GUIDANCE CHART FOR IS-BARRIERS

Manufacturer	Reference	Ex	IS Standard Electrical Parts							IS Booster Electrical Parts		
			Ex ia IIC T6 488650.01/02 488660,01 488670,01 LCIE/AUS	Ex ia IIC T6 490885 490890 (490895) LCIE/FM/CSA	Ex ia IIC T6 483580.01/03 483960.01/03 LCIE/AUS	Ex ia 490880 (493997) LCIE/FM/CSA	Ex ia IIB T6 482160,01 LCIE	Ex ia IIC T6 482870,01 LCIE	Ex ia 492335 LCIE/FM/CSA	Ex ia IIC T6 492965.01/02 LCIE	Ex ia IIC T6 496565 LCIE	Ex ia IIC T6 495910 LCIE
A puissance 3	NAEV 22-140	ia	●	-	●	-	●	●	-	●	●	●
	NAEV 26-100	ia	●	-	●	-	●	●	-	●	●	●
ABB	V171132-54	ib	●	-	●	-	●	●	-	●	●	●
	V171132-55	ib	●	-	-	-	●	●	-	●	●	●
	V171132-61	ia	●	-	-	-	●	●	-	●	●	●
	DO 890	ib	●	-	●	-	●	●	-	●	●	●
	S900-DO4-EX	ib	●	-	●	-	●	●	-	●	●	●
BRADLEY	FEX-EX 24V	ia	●	●	●	●	●	●	-	●	●	●
COOPER	LB 2101	ia	●	●	●	●	●	●	●	●	●	●
	LB 2105	ia	●	●	●	●	●	●	●	●	●	●
	LB 2112	ia	●	●	●	●	●	●	●	●	●	●
ELCON	1881 / 1882	ia	●	●	●	●	●	●	●	●	●	●
	471 / 472	ia	●	●	●	●	●	●	●	●	●	●
	2871/2872	ia	●	●	●	●	●	●	●	●	●	●
	2874/2875/2876	ia	●	●	●	●	●	●	●	●	●	●
GEORGIN	AVB 122	ia	●	-	●	-	●	●	-	●	●	●
	AVB 125	ia	●	-	●	-	●	●	-	●	●	●
	AVB 128	ia	●	-	●	-	●	●	-	●	●	●
Hima	F3328A	ib	●	-	●	-	●	●	-	●	●	●
	F3335	ib	●	-	-	-	●	●	-	●	●	●
	H4007	ib	●	-	●	-	●	●	-	●	●	●
MTL	728P, 7128P, 7728P	ia	-	-	-	-	●	-	-	●	●	●
	728, 7028, 7128, 7728	ia	●	●	●	●	●	●	●	●	●	●
	3021, 4021, 4021S	ia	●	-	●	-	●	●	-	●	●	●
	3022	ia	-	-	-	-	●	-	-	-	-	-
	4023	ia	-	-	-	-	●	-	-	-	-	-
	4024	ia	●	-	●	-	●	●		●	●	●
	4025	ia	●	●	●	●	●	●	●	●	●	●
	5021, 5023, 5024	ia	●	-	●	-	●	●	-	●	●	●
	5025	ia	●	-	●	-	●	●	●	●	●	●
	4521 / 4523 / 4524	ia	●	-	-	-	●	●	●	●	●	●
	5521 / 5523 / 5524	ia	●	-	-	-	●	●	●	●	●	●
Pepperl & Fuchs	Z 728	ia	●	●	●	●	●	●	●	●	●	●
	Z 779	ia	●	●	●	●	●	●	●	●	●	●
	EGA-041-3	ia	-	●	●	●	●	●	●	●	●	●
	KFD2-SD-EX1.36	ia	-	-	-	-	-	●	-	-	-	-
	KFD2-SL-EX1.36	ia	-	-	-	-	-	●	-	-	-	-
	KFD2-SD-EX1.48	ia	-	●	-	●	-	●	●	●	●	●
	KFD2-SL-EX1.48	ia	-	●	-	●	-	●	●	●	●	●
	KFD2-SL-EX1.48.90A	ia	-	-	-	-	-	-	-	●	●	●
	KFD2-SL-EX1.48.90A	ia	-	-	-	-	-	-	-	●	●	●
	KFD2-SL2-EX1.LK	ia	-	●	-	●	-	●	●	●	●	●
	KFD2-SL2-EX2	ia	-	●	-	●	-	●	●	●	●	●
	KSD2-BO-EX	ia	-	●	●	●	●	●	●	●	●	●
	RSD-BO-EX4	ib	-	●	-	●	-	●	●	●	●	●
	RSD-VO-EX8	ib	-	-	-	-	-	-	-	●	●	●

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SIEMENS	5RD00-0AB0	ib	-	-	-	-	-	-	-	●	-	-
	7RD00-0AB0	ia	-	-	-	-	-	-	-	●	●	●
	7RD01-0AB0	ia	-	-	-	-	-	-	-	●	●	●
	7RD10-0AB0	ia	-	-	-	-	-	-	-	●	●	●
	7RD11-0AB0	ia	-	-	-	-	-	-	-	●	●	●
	7RD20-0AB0	ia	-	-	-	-	-	-	-	●	●	●
	7RD21-0AB0	ia	-	-	-	-	-	-	-	●	●	●
STAHL	9001/01-252-100-14	ia	●	●	27 V	27 V	●	●	●	●	●	●
	9001/01-280-100-10	ia	●	●	24 V	24 V	●	●	●	●	●	●
	9001/01-280-110-10	ia	●	-	24 V	-	●	●	-	●	●	●
	9002/13-280-100-04	ia	24 V	24 V	27 V	27 V	24 V	24 V	24 V	17 V	17 V	17 V
	9311/52-11-10	ia	-	●	●	25 V	25 V	●	●	15 V	15 V	15 V
	9111/63-11-00	ia	-	●	●	25 V	25 V	●	●	15 V	15 V	15 V
	9351/10-15-10	ia	-	●	●	-	-	●	●	●	●	●
	9351/10-16-10	ia	-	●		●	-	●	●	●	●	●
	9351/10-17-10	ia	-	-	-	-	-	●	-	-	-	-
	9381/10-187-050-10	ib	-	●	●	●	●	●	●	●	●	●
	9381/10-246-055-10	ib	-	●	●	●	●	●	●	●	●	●
	9381/10-246-070-10	ib	-	●	●	●	●	●	●	●	●	●
	9465/12-04-11	ib	-	●	●	-	-	●	●	●	●	●
	9475/12-04-21	ia/ib	-	●	-	●	-	●	●	●	●	●
	9475/12-04-31	ia/ib	-	-	-	-	-	-	-	●	●	●
	9475/12-08-41	ia/ib	-	-	-	-	-	-	-	-	-	-
	9475/12-08-51	ib	-	-	-	-	-	-	-	-	●	●
	9475/12-08-61	ia/ib	-	-	-	-	-	-	-	-	●	●
Turck	MK72-S01-EX	ib	-	-	-	-	●	●	-	●	●	●
	MK72-S02-EEX	ib	-	-	-	-	●	●	-	●	●	●
	MK72-S04-EEX	ib	●	-	●	-	●	●	-	●	●	●
	MK72-S05-EEX	ib	●	-		-	●	●	-	●	●	●
	MK72-S06-EEX	ib	●	-	●	-	●	●	-	●	●	●
	MK72-S07-EEX	ib	●	-		-	●	●	-	●	●	●
	MK72-S09-EEX	ia		-		-			-	-	-	-
	MK72-S12-EEX	ia	●	-	●	-	●	●	-	●	●	●
	MC72 - 41	ia	●	-	●	-	●	●	-	●	●	●
	MC72 - 43	ia	●	-	●	-	●	●	-	●	●	●
	MC72 - 44	ia		-	-	-			-	●	●	●
BARTEC	07-7331-2301/1000	ia	●	-	-	-	●	●	-	●	-	-
	07-7331-2301/1100	ia	●		●		●	●		●	-	-