Explosion protection basics

Ex-tech

Ex-tech Group is located at Forus in Stavanger, Norway, one of the world's top Centers of Excellence within knowledge and technology related to the Oil and Gas industry.

Our main office has all oil majors and NOC is located in close proximity.

Our engineers, with experience from the oil and gas industry, are used to the strictest demands and specifications.

The group consist of three fully owned subsidiaries, each with different competence and skills, enabling the group to be a complete and preferred supplier and partner in the **Ex** market.

Ex-tech Solution is our French subsidiary.

The company (formerly Schneider Electric) has for more than 40 years been manufacturing a wide range of Ex components, equipment and solutions for the Oil & Gas onshore market.

From small Ex switches and lamps to large Ex d enclosures for complex systems. A close and fruitful collaboration with French industry and local sub-suppliers.

Ex-tech Signalling is our second subsidiary in France.

The company represents the groups center of excellence related to audio and visual signalling equipment, used mainly for signalling in combination with Fire & Gas as well as Telecom systems.

Ex-tech System is our subsidiary in Norway, representing the center of Excellence within systems & solutions for the Oil & Gas offshore market.

The company is offering a wide range of components and enclosures to complex Ex systems, including a close collaboration with sub-suppliers.

In addition the company has a long tradition and experience in converting industrial electrical and combustion machines to be used in explosive atmospheres.

Control stations and signalling units

The XAW control stations are equipped with our extensive range of our wide control and signalling units HarmAtex

They combine the functions start and stop for motors, as fans, pumps, ... and they can be provided with measuring instruments for current control, voltage or other physical quantities.

Motor starters, motor switches

The 3 poles motor starters in protection modes Ex d IIB or Ex IIC meet all your needs for from 0.37 up to 37 kW.

The wide range of enclosures combined with a wide range of contractors, thermal relays, allows real flexibility to adapt.

The disconnector switches in increased safety Ex e, easy to implement, provides range of switching capacity from 20 A to 63 A and operating temperatures from -50 °C to +60 °C.

Systems and panels for control and monitoring

The flameproof enclosures are designed for control, monitoring, automation, distribution board, motor starters or any other application.

Made in carbon steel, aluminium or stainless steel for gas groups IIB or IIB+H2 or IIC with a wide range of sizes: up to 1590 x 940 mm for a dissipated power of 2000 W, they are suitable for the design of complex systems.

Junction boxes

The junction boxes are provided in flameproof protection mode Ex d IIB or IIC or in increased safety Ex e IIC.

Made in GRP, aluminium, cast iron or stainless steel, they are suitable for environments with the presence of chemical agents, corrosion resistants, operating temperatures from -50 °C to +60 °C/+75 °C.

They are equipped with terminals or push buttons, switches, pilot lights and measuring instruments.

Luminaires

A range of lighting fixtures 100% encapsulated, maintenance-free requiring only a visual inspection, designed with a body seawater resistant in anodized aluminium (in accordance with NORSOK 121), very easy and quick to install.

They are condensation free and have a tempered glass with very high impact resistance IK 20 and warranted 10 years.

Limit switches, photocells, pressure switches

The range of limit switches and pressure switches (from 0.1 to 500 bars) to control in a safe way movements, fluids in hazardous areas. The range is one of the most extensive in the market.

With a footprint of only 30 mm in diameter, our photocells are pre-wired and certified ATEX Ex d.

Audible and visual signalling devices

A full range of Sounders, Beacons, Call-point, or Junction box, well adapted to your applications.

Each range is available with housing in stainless steel or GRP, full range of voltage supply exist.

Explosion protection basics

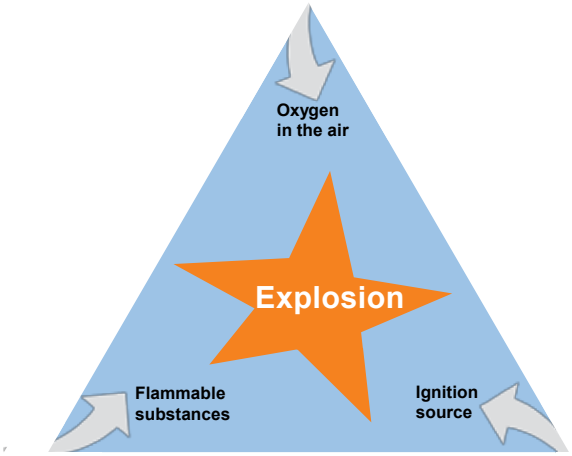
1. General information

An explosive atmosphere is a result of the mixture with air, under atmospheric conditions and flammable substances in the form of gas, vapours, dusts, fibers which, once ignited, allow the combustion process to spread and permits self-sustaining propagation.

Explosive atmosphere can be encountered, as result of technical processing sequences, in several industries such as: petrochemical, mills and silos generating combustible dust, in mining by the methane gas and coal dust. Further areas can develop explosive atmosphere like: paint industry, recycling industry, production of biogas.

2. Explosion

The conditions for creating an explosion are: air, flammable substances and ignition source.



There are two main principles to avoid an explosion: primary and secondary precautions.

The primary explosion protections are the measures to take to prevent the creation of an explosive atmosphere:
- Measures using natural or forced ventilation to limit the explosive concentration
- Measures avoiding flammable substances
- Measures using inert gas in the atmosphere (e.g. Nitrogen)

The secondary explosion protections are the measures to prevent the ignition of an explosive atmosphere.

Type of Ignition Sources
- Hot surfaces
- Flames and hot gases
- Mechanically produced sparks
- Electrical equipment
- Transient currents
- Static electricity
- Lightning strikes
- Electromagnetic waves
- Optical radiation
- Ultrasound
- Chemical reactions
- People (indirectly)

The techniques of equipment protection for use in explosive atmospheres are just a matter of controlling (eliminating) possible ignition sources (secondary explosion protection)

3. Explosive atmosphere

Where do we find explosive atmospheres?

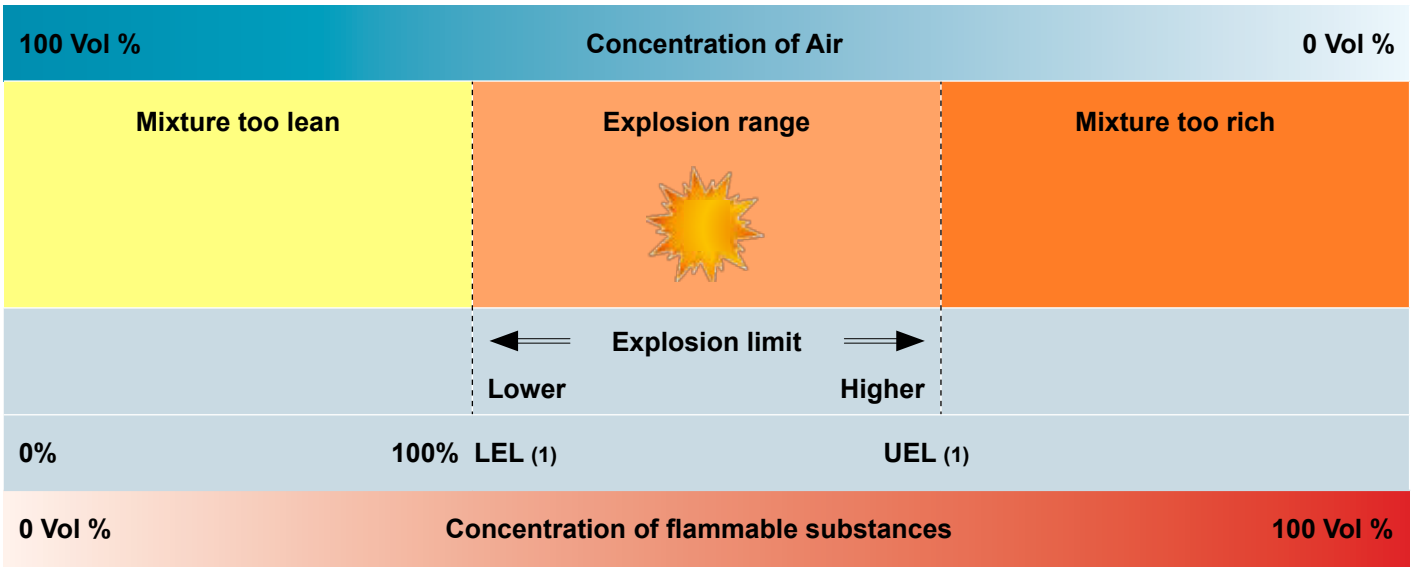
- Metal surface grinding, especially aluminium dust and particles
- Oil refineries, rigs and processing plants
- Gas pipelines and distribution centres
- Printing industries, paper and textiles
- Aircraft refuelling and hangars
- Chemical processing plants
- Grain handling and storage
- Sewage treatment plants
- Surface coating industries
- Underground coal mines
- Woodworking areas
- Sugar refineries
- Vessels/ships
- Power plants

Where a potential explosive atmosphere can occur, certain safety levels need to be taken into account regarding the possible danger of an explosion in this area. The areas therefore need to be divided into zones according to presence of the flammable substances.

Zone 0	Zone 1	Zone 2
A place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapour or mist is present continuously or for long periods or frequently.	A place in which an explosive atmosphere consisting of a mixture with air or flammable substances in the form of gas, vapour or mist is likely to occur in normal operation occasionally.	A place in which an explosive atmosphere consisting of a mixture with air of 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.
Explosive atmosphere for more than 1000 h/yr.	Explosive atmosphere for more than 10, but less than 1000 h/yr.	Explosive atmosphere for less than 10 h/yr
Zone 20	**Zone 21**	**Zone 22**
A place in which an explosive atmosphere in the form of cloud of combustible dust in air is present continuously, or for long periods or frequently.	A place in which an explosive atmosphere in the form of a cloud of combustible dust in air is likely to occur in normal operation occasionally.	A place 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.

4. Criteria of flammable substances

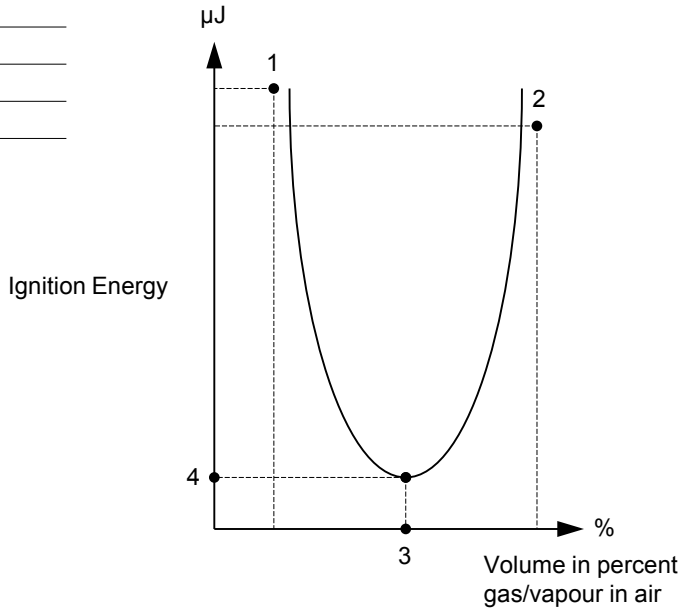
Examples of the criteria for the mixture of flammable substances (gas) towards air in such a way that an explosion can occur are:



(1) LEL (**L**ower **E**xplosive **L**imit)
UEL (**U**pper **E**xplosive **L**imit)

Typical concentration of gas/vapours in the air where an explosion can appear (% vol. of gas in air):

	LEL	Explosion	UEL
Methane	4.4%	→	16.5%
Propane	1.7%	→	10.6%
Butane	1.4%	→	9.3%



1. LEL (**L**ower **E**xplosion **L**imit)
2. UEL (**U**pper **E**xplosion **L**imit)
3. Optimum mixture
4. MIE (**M**inimum **I**gnition **E**nergy)

5. ATEX Directives

- Product Directive 1994/9/EC
- New product Directive 2014/34/EU
- User Directive 1999/92/EC

5.1 Equipment Directive 1994/9/EC

This directive has been mandatory in Europe from 01.07.2003, and covers the regulations concerning equipment and protective systems for use in potentially explosive atmospheres. This directive has four chapters which are subdivided into 16 articles. In each chapter it is made reference to the Annex I to XI, which include 7 modules.

For full info visit http://ec.europa.eu/enterprise/atex/internationaldevelopment.htm

Content of directive 94/9/EC		
Main part		
Chapter	Article	Heading
I	1 - 7	Scope of application, placed in service and free movement of goods
II	8 - 9	Conformity assessment procedures
III	10 - 11	CE marking of conformity
IV	12 - 16	Concluding provisions
Annexes		
I	Criteria determining the classification decision of equipment groups in categories	
II	Essential safety and health requirements for the design and construction of equipment and protective systems for use in potentially explosive atmospheres	
III	Module: EC-type examination	
IV	Module: Production Quality assurance	
V	Module: Product verification	
VI	Module: Conformity to type	
VII	Module: Product Quality assurance	
VIII	Module: Internal control of production	
IX	Module: Unit verification	
X	CE marking and contents of the EC declaration of conformity	
XI	Minimum criteria to be taken into account by member states for the notification of bodies	

5.2 Groups and categories

The directive 1994/9/EC is dividing the equipment into groups and categories.

- Equipment Group I apply for mining.
  This group is subdivided into categories M1 & M2
- Equipment Group II applies for all others (surface) areas.
  This group is subdivided into categories 1, 2 and 3

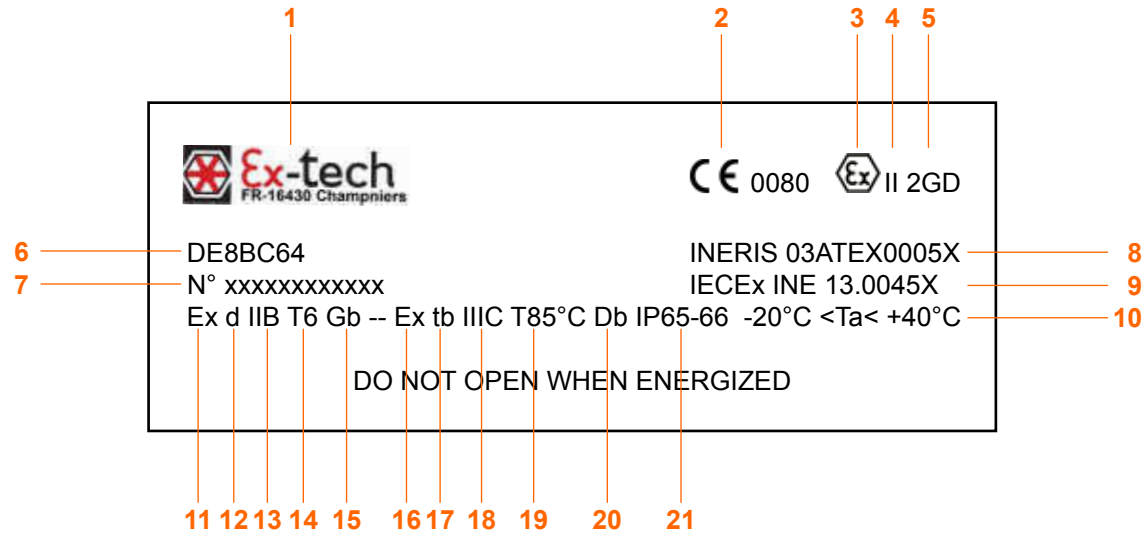
NOTE: Equipment group III for dust according to EN/IEC 60079-0

Group Mining Industries		Group Regular Industries (Gas and Dust areas)		
Category M1	**Category M2**	**Category 1**	**Category 2**	**Category 3**
Very high level of protection (safe with 2 faults) Must remain functional under specific explosive atmosphere concentrations	High level of protection (safe with 1 fault) De-energized under specific explosive atmosphere	Very high level of protection (safe with 2 faults)	High level of protection (safe with 1 fault)	Normal level of protection (safe during normal operation)
Marking				
I MI	I M2	II 1 G (Gas) II 1 D (Dust)	II 2 G (Gas) II 2 D (Dust)	II 3G (Gas) II 3D (Dust)

Electrical equipment			
Aera Zone	**Equipment Category**	**How to comply**	**Production requirements**
2	3	The manufacturer must evaluate the equipment according to valid standard/Directives, and create a technical file and subsequently issuing an EC D.O.C (Declaration of Conformity)	The manufacturer needs to insure a production quality
1	2	EC-type examination certificate from Notified Body like: DNV, Nemko, INERIS	The manufacturer needs to have a production quality system and obtain a Production Quality
0	1	EC-type examination certificate from Notified Body like: DNV, Nemko, INERIS	

Non electrical equipment		
Aera Zone	**Equipment Category**	**How to be in accordance with the ATEX directive**
2	3	To be verified by the manufacturer and submit a Technical File Manufacturer to issue EC D.O.C.
1	2	To be verified by manufacturer and submit technical file to Notified Body (Nemko, DNV, INERIS e.g.) Manufacturer to issue EC D.O.C.
0	1	To be certified by NB, EC-type examination certificate from Notified Body, DNV, Nemko, INERIS e.g.) Manufacturer to issue EC D.O.C.

5.3 Marking



1 Manufacturer name
2 Conformity mark with identification number of the Notified Body
3 Ex mark
4 Equipment group II
5 Equipment category 2 - Gas/Vapours and Dust
6 Product code
7 Product serial number
8 Certificate number according to ATEX standards
9 Certificate number according to IECEx standards
10 Ambient temperature range

Marking for Gas/Vapours

11 Electrical apparatus to be installed in hazardous location
12 Type of protection: flameproof enclosure
13 Explosion gas group IIB
14 Temperature class T6
15 Equipment protection level Gb (high protection level) - Use in zone 1 and 2

Marking for Dust

16 Electrical apparatus to be installed in hazardous location
17 Type of protection: protection by enclosure
18 Explosion dust group IIIC (conductive types of dust)
19 Maximum surface temperature 85 °C
20 Equipment protection level Db (high protection level) - Use in zone 1 and 2
21 IP protection

Note:

The equipment also needs to be marked with the conventional protection mode (Ex…) according to EN/IEC 60079-0 (EN/IEC 61241-0 (60079-31 for dust atmospheres or 80079-36 for non-electrical).

The operating instructions manual of the manufacturer must clearly define the intended use of the equipment by the operator. The minimum requirements for the operating instruction are amongst others:

- Information about safety aspects
- Installation, putting into service, use
- Assembling and dismantling, maintenance (servicing and emergency repair)
- Adjustment

5.4 Manufacturer's Declaration of conformity

Equipment and protective systems can be placed on the market, only if marked with the CE mark and complete with operating instructions and the manufacturer's Declaration of Conformity. The CE conformity marking and the issued Declaration of Conformity confirm that the equipment complies with all requirements and assessment procedures specified in the EC Directives. Essential in the EC DOC is the harmonized standards ref; http://eurlex.europa.eu/legalcontent/EN/TXT/PDF/?uri=uriserv:OJ.C_.2014.445.01.0005.01.ENG

Note:
According to Directive 94/9/EC the mandatory evidence of complying with this is given in the EC D.O.C.and the marking plate on the products including the operating instructions.

5.5 New ATEX Directive 2014 applicable from the 20th of April 2016

The new ATEX Directive 2014/34/EU on equipment and protective systems intended for use potentially explosive atmospheres is aligned with the "New Legislative Framework" and will be applicable from 20 April 2016.

There is no change to the Essential Requirements of Health and Safety as defined in Annex II. There is also no change in the various evaluation procedures. The terms of Annexes of the Directive, however, are modified.

Key changes against the old 94/9/EC directive:

- The directive also requires traceability of a product to be ensured throughout the whole supply chain. Therefore this directive clarifies requirements for manufacturers, authorized representatives, importers and distributors to make sure that products they place on the market comply with this directive
- From 20 April 2016 all products placed on the marked need to comply with 2014/34/EU and a EU DOC (Declaration Of Conformity) need to be issued. Also the user instruction need to be revised by referring to the new directive
- All new certificates issued after 19 April 2016 will be named EU-Type Examination Certificate

Note:
All certificates issued according to 94/9/EC will still be valid if the products comply with 2014/34/EU (state of the art) and a EU DOC (Declaration Of Conformity) is issued before they are placed on the marked. The New directive will not apply for products already placed on the marked.

You will find further information on: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32014L0034

5.6 User Directive 1999/92/EC

This directive gives the minimum requirement for improving the safety and health protection of workers potentially at risk from explosive atmospheres.

The main issues to be addressed:

- Assessment of explosion risk
- Zone classification
- Explosion protection documents (including requirements for personnel to do engineering, equipment selection, installation, maintenance, repair, etc.)

5.7 Structure Directive 1999/92/EC

Ruling part		
Section	**Article**	**Heading**
I	1 - 2	General provisions
II	3 - 9	Obligations of the employer
	3	Prevention of and protection against explosions
	4	Assessment of the explosion risks
	5	General obligations
	6	Duty of coordination
	7	Places where explosive atmosphere may occur
	8	Explosion protection document
	9	Special requirements for work equipment and workplaces
III	10- 15	Other requirements
Annexes		
I		Classification of places where explosive atmospheres may occur 1. Places where explosive atmospheres may occur 2. Classification of hazardous places
II	A	Minimum requirements for the improvement of the safety and health protection of employees who could be endangered by explosive atmospheres 1. Organizational measures 2. Explosion protection measures
	B	Criteria for the selection of equipment and protective systems
III		Warning signs for marking areas in which explosive atmospheres can occur

For further information (Directive 1999/92/EC and user guide) please visit:
http://ec.europa.eu/employment_social/health_safety/legislation_en.htm

6. Ignition sources

6.1 Classification of ignition sources for gas and vapours

6.2 Temperature class

Temperature class	Maximum surface temperature at ambient temperature
T1	450 °C
T2	300°C
T3	200°C
T4	135°C
T5	100°C
T6	85°C

6.3 Energy class

Minimum ignition energy	European groups	USA / Canada Groups	Gas e.g.
< 20 µ Joules	C	A	Acetylene, Carbon disulfide
< 20 µ Joules		B	Hydrogen
< 60 µ Joules	B	C	Ethyl ether, Ethylene
< 180 µ Joules	A	D	Acetone, Butane, Ethanol, Gasoline, Hexane, Methanol, Methane, Naphta, Propane

7. Standards

7.1 Standards valid for gas

Electrical Apparatus for Explosive Gas Atmospheres		
	EN (old)	EN / IEC (Current)
General requirements	EN 50 014	EN 60079-0
Flameproof enclosures “d”	EN 50 018	EN 60079-1
Pressurized enclosures “p“	EN 50 016	EN 60079-2
Powder filling “q“	EN 50 017	EN 60079-5
Oil immersion “o”	EN 50 015	EN 60079-6
Increased safety “e”	EN 50 019	EN 60079-7
Intrinsic safety “i”	EN 50 020	EN 60079-11
Type of protection “n”	EN 50 021	EN 60079-15
Encapsulation “m”	EN 50 028	EN 60079-18
Intrinsically safe systems		EN 60079-25
Electrical equipment for Zone 0	EN 50 284	EN 60079-26
Intrinsically safe field bus systems		EN 60079-27
Optical radiation “op”		EN 60079-28

7.2 Standards valid for dust

Standard EN (IEC)	Protection name	Protection method
EN (IEC) 60079-31	t	Equipment , Dust ignition protection by enclosures “t”
61241-4	pD	Protected by pressurization

7.3 Standards valid for non-electrical equipment

Protection type	EN 13463-	Marking letter	New coming standards
Basic methods and requirements	-1		(EN) ISO/ IEC - 80079-36
Flow restriction	-2	fr	
Flameproof	-3	d	
Construction	-5	c	(EN) ISO/ IEC - 80079-37
Controlled ignition	-6	b	
Protected by oil	-8	k	

7.4 Standards valid for internal combustion motors

EN 1834-1	Gas, group II
EN 1834-2	Mines, group I
EN 1834-3	Dust, group II

7.5 Standards valid for safety industrial truck

EN 1755
Operation in potentially explosive atmosphere

8. Type of protection

8.1 Applicable type protection

Ex e - Increased safety

For electrical components that do not spark under normal working conditions but where measures are applied to prevent high temperatures and the occurrence of arcs and sparks internally.

Ex d - Flameproof enclosure

Parts, which can ignite a potentially explosive atmosphere, are surrounded by an enclosure, which are designed to withstand the pressure of an internal explosion and to prevent the propagation of the explosion to the atmosphere surrounding the enclosure.

Ex m - Encapsulation

Parts that could ignite a potentially explosive atmosphere by means of heat or sparks are embedded in a sealing compound such that the potentially explosive atmosphere cannot be ignited. The compound is resistant to physical, electrical, thermal and chemical influences.

Ex p - Pressurized enclosure

The formation of a potentially explosive atmosphere inside an enclosure is prevented by maintaining a positive internal pressure of protective gas in relation to the surrounding atmosphere and, where necessary, by supplying the inside of the enclosure with a constant flow of protective gas which dilutes any combustible mixtures.

Ex o - Oil immersion

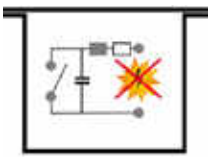
Electrical equipment or parts of electrical equipment are immersed in a protective fluid (e.g. oil) in such a way that a potentially explosive atmosphere existing above the surface or outside of the encapsulation cannot be ignited.

Ex q - Powder filling

Filling the enclosure of electrical equipment with a fine grained packing material has the effect of making it impossible for an electric arc created in the enclosure under normal operating conditions to ignite a potentially explosive atmosphere surrounding the enclosure. Ignition must neither be caused by flames nor by elevated temperatures on the enclosure surface.

Ex i - Intrinsic safety

This protection providing measures to prevent the possibility of undue high temperatures developing and the occurrence of sparks or arcs inside or on outer parts of electrical equipment, which will not occur during regular operation, by an increased level of safety



Protection Ex n

This protection only applies to electrical equipment of the 3G category, the intent being that during regular operation and certain abnormal conditions, the potential of this equipment igniting a surrounding explosive atmosphere is eliminated. This type of protection aims at finding an economical compromise between the “normal” industrial standard and the high technical safety requirements of the types of protection for equipment of the 2G category.

Ex t - Protection by enclosure

The enclosure is enough seal so that no flammable dust can penetrate inside. The external surface temperature of the housing is limited.

8.2 Equipment Protection Level (EPL) according to IEC/EN 60079-xx series OD standards

Definition:

The level of protection assigned to equipment based on its risk of becoming a source of ignition, and distinguishing the differences between explosive gas atmospheres, explosive dust atmospheres, and the explosive atmospheres which may exist in coal mines.

8.2 Link between ATEX and EPL

EN 60079-0			Directive 94-9-EC Product directive (Atex 100)		EN60079-10X	Directive 99/92/EC User directive (Atex 137)	
EPL	Group	Level of protection	Equipment group	Equipment category	Zones	Hazardous quantities	Extent of protective measure (risk)
Ma	I	Very high	I	M1	N/A	Without specific methane concentration	Safe with 2 faults, rare and foreseen
Mb		High		M2		With specific methane concentration	Safe with 1 fault, foreseen
Ga	II	Very high	II	1G	0	Often/longer periods	Safe with 2 faults, rare and foreseen
Gb		High		2G	1	Occasionally	Safe with 1 fault, foreseen
Gc		Enhanced		3G	2	Rear/most likely never	Normal
Da	III	Very high		1D	20	Often/longer periods	Safe with 2 faults, rare and foreseen
Db		High		2D	21	Occasionally	Safe with 1 fault, foreseen
Dc		Enhanced		3D	22	Rear/most likely never	Normal

8.3 Why EPL (ATEX categories)

Historically it has been acceptable to install equipment into specific zones based on the type of protection.

In some cases it has been shown that the type of protection may been divided into different levels of protection that can be correlated against each Zone. A better risk assessment would consider all factors.

When using a risk assessment approach instead of the inflexible approach of the past linking equipment to Zones the inherent ignition risk of the equipment is clearly indicated, no matter what type of protection is used.

An example using a risk assessment approach:
Plant operators often make intuitive decisions on extending (or restricting) their Zones in order to compensate for this inflexibility. A typical example is the installation of “Zone 1 Type” navigation equipment in Zone 2 areas of offshore oil production platforms, so that the navigation equipment can remain functional even in the presence of a totally unexpected and prolonged gas release.
On the other hand, it is reasonable for the owner of a remote, well secured, small pumping station to drive the pump with a “Zone 2 Type” motor, even in Zone 1, if the total amount of gas available to explode is small and the risk to life and property from such as explosion can be discounted.

The situation became more complex with the publication of the first edition of IEC 60079-26 which introduced additional requirements to be applied for equipment intended to be used in Zone 0. Prior to this, Ex ia was considered to be the only technique acceptable in Zone 0.

It has been recognized that it is beneficial to identify and mark all products according to their inherent ignition risk. This makes equipment selection easier and a risk assessment approach, more appropriate.

9. New marking for Ex equipment

9.1 New marking for Gas equipment

ATEX	Old Gas atmosphere	New IEC 60079-0:2011/EN 60079-0:2012
Ex II 2 G	Ex d IIB T6	Ex d IIB T6 Gb or Ex db IIB T6*
Ex II 2(1) G	Ex d [ia IIC] IIB T6	Ex d [ia IIC Ga] IIB T6 Gb or Ex db [ia IIC] IIB T6*
Ex II 2 G	Ex ib IIC T4	Ex ib IIC T4 Gb or Ex ib IIC T4*
Ex II 2 G	Ex e II T4	Ex e IIC T4 Gb or Ex eb IIC T4*

*IEC alternate marking

Protection principles and marking for explosive gas atmosphere	Marking according to EN (IEC) 60079-1: 21012			Alternative marking and coming marking		
Equipment protection level (EPL)	Ga	Gb	Gc	Ga	Gb	Gc
Flameproof enclosure		d		da	db	dc
Increased safety		e			eb	ec
Intrinsic safety	ia	ib	ic	ia	ib	ic
Encapsulation	ma	mb	mc	ma	mb	mc
Non-sparking			nA			nAc
Protected sparking			nC			nCc
Restricted sparking			nR			nRc
Oil immersion		o			ob	oc
Pressurization		px py	pz pv		pxb pyb	PVC pzv
Powder filling		q			qb	

9.1 New marking for Dust equipment

ATEX	Old Dust atmosphere	New IEC 60079-0:2011/EN 60079-0:2012
Ex II 2 D	Ex tD A21 IP65 T120°C	Ex tb IIIC T120°C Db or Ex tb IIIC T120°C*
Ex II 2(1) D	Ex tD [iaD] A21 IP65 T120°C	Ex tb [ia Da] IIIC T120°C Db or Ex tb [ia] IIIC T120°C*
Ex II 2 D	Ex iaD A20 IP65 T120°C	Ex ia IIIC T120°C Da or Ex ia IIIC T120°C*

*IEC alternate marking

Protection principles and marking for explosive dust atmosphere	Marking according to EN (IEC) 60079-1: 21012			Alternative marking and coming marking		
Equipment protection level (EPL)	Da	Db	Dc	Da	Db	Dc
Protected by enclosure	ta	tb	tc	ta	tb	tc
Intrinsic safety	ia	ib		ia	ib	ic
Encapsulation	ma	mb		ma	mb	mc
Pressurization		p	p		pb	pc

The Ex marking for explosive gas and dust atmospheres shall be separate and not combined:

II 1 G - Ex ia IIB T4 Ga
II 1 D - Ex ia IIIC T120°C Da

alternatively

II 1 GD
Ex ia IIB T4 Ga
Ex ia IIIC T120°C Da

or

II 1 GD
Ex ia IIB T4
Ex ia IIIC T120°C

10. IP protection

IP code according to IEC/EN standard 60529

First digit: protection against solid particules		Second digit: protection against liquid ingress	
IP	Protected against	IP	Protected against
0	No protection	0	No protection
1	Protected against a solid object 50 mm or greater	1	Protected against vertically dripping water
2	Protected against a solid object 12.5 mm or greater	2	Protected against vertically dripping water, when tilted 15 degrees
3	Protected against a solid object 2.5 mm or greater	3	Protected against water spraying at an angle up to 60 degree
4	Protected against a solid object 1 mm or greater	4	Protected against water splashing from any direction
5	Dust protected	5	Protected against jets of water from any directions
6	Dust tight	6	Protected against powerful jets of water from any directions
		7	Protected against temporary immersion into water up to 1 meter
		8	Protected against prolonged immersion into water beyond 1 meter
		9K	Protected against powerful high temperature water jets

11. IK protection

IK code according to EN 62252

IK	Impact energy (joules)	Protected against
00	Unprotected	No test
01	0.15	Drop of 200 g object from 7.5 cm height
02	0.2	Drop of 200 g object from 10 cm height
03	0.35	Drop of 200 g object from 17.5 cm height
04	0.5	Drop of 200 g object from 25 cm height
05	0.7	Drop of 200 g object from 35 cm height
06	1	Drop of 500 g object from 20 cm height
07	2	Drop of 500 g object from 40 cm height
08	5	Drop of 1.7 kg object from 29.5 cm height
09	10	Drop of 5 kg object from 20 cm height
10	20	Drop of 5 kg object from 40 cm height

Ex-tech Solution
22, impasse de la Volute - ZA Les montagnes
BP 20708 - 16430 Champniers - France
Tél: + 33 5 45 93 01 10 - Fax: + 33 5 45 93 01 15
email: sales.solution@ex-tech.no

Ex-tech System
Maskinveien 12, p.o.box 256 forus,
4066 Stavanger - Norway
Tél: + 47 51 63 00 70 - Fax: + 47 51 63 00 72
email: post@ex-tech.no

Ex-tech Signalling
355, rue de la Génoise - ZA Les montagnes
16430 Champniers - France
Tél: + 33 5 45 61 81 68 - Fax: +33 5 45 23 29 46
email: sales.signalling@ex-tech.no

Ex-tech Group AS
Maskinveien 12, p.o.box 256 forus,
4066 Stavanger, Norway
Tél: + 47 51 63 00 70 - Fax: + 47 51 63 00 72
email: post@ex-tech.no

www.ex-tech.no

Ex-tech