HAZARDOUS LOCATIONS GUIDE

OPTIMIZE PRODUCTIVITY OF HAZARDOUS LOCATIONS WITH HIGHLY ENGINEERED ELECTRICAL PRODUCTS.

For over 80 years, Appleton's ATX line of electrical products has been the international choice for hazardous and industrial locations. This comprehensive product line is specifically engineered to the strict requirements these locations demand for safe and efficient operations. Our full range of cable glands is no exception, delivering confidence to electrical connections throughout your facility.

BETTER UNDERSTANDING LEADS TO BETTER CHOICE

Appleton developed the Guide to better inform all persons involved in explosionproof selection, such as designers, procurement departments, engineers, site managers, risk or maintenance managers, authorized bodies controlling the security on site, distributors' sales forces, etc...

APPLETON'S ADVICE FOR INSTALLING ELECTRICAL EQUIPMENT IN AREAS WITH EXPLOSION RISKS

Process for installing electrical equipment in areas with explosion risks.

The manager of the installation is solely responsible for :

1- Determine hazardous areas.
2- Defining Zone boundaries - volumes.
3- If necessary, delimiting Zones.
4- Knowing the characteristics of flammable substances present on the site.
5- Defining the temperature class and the explosion group of the equipment.
6- Choosing equipment depending on :
   - the temperature class and the explosion group,
   - environmental constraints specific to the site - corrosion, exposure to UV, mechanical strength
   - protection indexes.
7- Installing equipment.
8- Commissioning.
9- Checking the installation.

Electrical energy plays an important role in your daily life whether you are involved in studying, designing or implementing installations.

This energy can become a danger to daily life. This can occur when energy is used in any industry or warehouse which stores, processes and manufactures products such as : hydrocarbons, gases, paints, varnishes, glues, resins, perfumes, cleaning products, rubber, textiles, plastics, powders, grains, dusts from various origins... There is thus a high explosion risk with serious consequences for personnel, equipment and the environment. We talk about an atmosphere with an explosion hazard.

WHAT CONDITIONS WILL CREATE AN EXPLOSION ?

Three elements are required :

1- Oxygen in the air.

2- An inflammable substance, mixed with air. This substance can be :
- gas (methane, acetylene),
- liquid (petrol, solvent),
- solid (sulphur, wood dust, sugar dust, grains dust...).

3- An ignition source :
- with sufficient energy, an electrical arc or a spark,
- and/or a rise in temperature.

WHAT IS AN EXPLOSIVE ATMOSPHERE ?

An explosive atmosphere results from a mixture of inflammable substances in the form of gas, vapors, mist or dust with air in such proportions that excessive temperature, an electrical arc, spark or any other energy ignition source produces an explosion.

WHAT IS A POTENTIALLY EXPLOSIVE ATMOSPHERE ?

An atmosphere is defined as potentially explosive when its usual composition is not explosive, but due to unforeseen circumstances, it can vary to such an extent that it becomes explosive (the danger exists as a potential state). Foreseeable circumstances are as follows :
- various stages of a manufacturing process,
- incidents or accidents (rupture of a pipe-line, leak, supply loss),
- meteorological conditions (high ambient temperature, air movements).

WHAT IS MINIMUM IGNITION ENERGY ?

The minimum quantity of energy which must be introduced locally (in the form of a flame, spark, shock, friction, etc) to cause ignition of an explosive atmosphere. The majority of industrial ignition sources contain much higher energy levels than this minimum ignition energy, which is always low (from tens of microjoules for gas and vapors to hundreds of millijoules for dusts).

WHAT IS THE SELF-IGNITION TEMPERATURE ?

The self-ignition temperature or spontaneous ignition temperature is the minimum temperature at which an explosive atmosphere can spontaneously ignite. The energy required to start a flame can be changed to thermal form by an increase in the temperature of the mixture.

WHAT IS THE EXPLOSIVE LIMIT OF AN INFLAMMABLE PRODUCT ?

The ignition of a product depends on its concentration in the air. It can be produced within a range between two limits :

1- lower explosive limit (LEL) of a gas, vapor or dust in the air is the minimum concentration above which the mixture could ignite.

2- upper explosive limit (UEL) of a gas, vapor or dust is the maximum concentration under which the mixture could ignite.

WHAT IS THE FLASH POINT OF A LIQUID ?

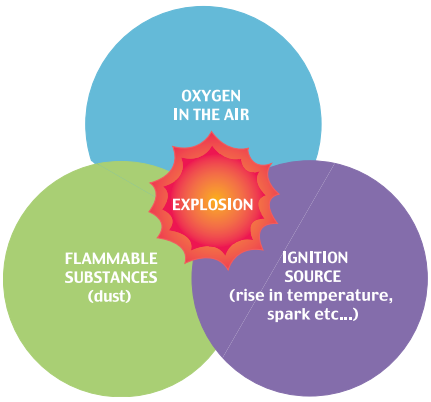
The flash point is the minimum temperature at which an inflammable liquid emits sufficient vapors to reach the LEL in the gaseous phase in equilibrium with the explosive atmosphere.

WHAT TYPES OF SUBSTANCES, GASES, LIQUIDS OR VAPORS CAN PRODUCE AN EXPLOSION ? IN GENERAL, THESE ARE :

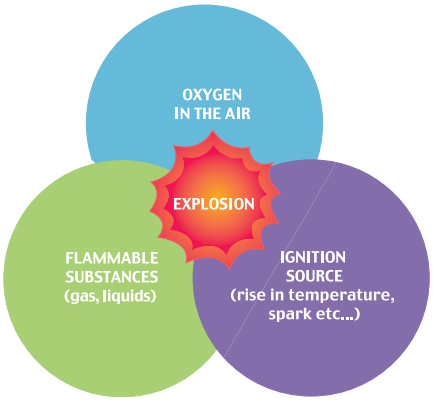
- heating gas,
- hydrocarbons,
- glue and adhesive solvents,
- varnishes and resins,
- manufacturing additives for pharmaceutical products, artificial dyes, aromas and perfumes,
- manufacturing agents for the following materials : plastics, rubbers, man-made textiles and chemical cleaning products,
- products used in the treatment and manufacturing of alcohols and derivatives...

> *Gas and Vapor Classification : see pages G:24-25.*

DUSTS



GAS AND VAPORS



To produce an explosion, three elements are required simultaneously: oxygen in the air, one or several flammable substances and a source of ignition.

WHAT TYPES OF DUSTS CAN PRODUCE AN EXPLOSION ?

Organic and metallic products which create powder and dust form can also in certain conditions become active agents of an explosion. These are powders and dust of :

- magnesium,
- aluminium,
- sulphur,
- cellulose,
- corn starch,
- epoxy resins,
- polystyrenes,
- dust of plastic,
- coal,
- wood,
- medick,
- sugar (icing sugar),
- corn (flour)...

> *Dust classification : See pages G:28-29.*

WHERE MAY EXPLOSIVE ATMOSPHERE FORM ?

Any location where these products are made, stored, and processed may contain a potentially explosive atmosphere.

> *Substances that may form explosive atmospheres : see pages G:21-23.*

WHO KNOWS ?

Local authority who delivers operating permits, "bodies" such as firemen, inspectors from insurance companies are normally aware of the risks of explosion.

OFFSHORE SITE
(APPLETON LIGHTING FIXTURES ON TOTAL GIRASSOL PLATFORM)

CHARACTERISTICS OF FLAMMABLE GAS/VAPORS EXAMPLES

GAS/VAPOR	BOILING TEMPERATURE	FLASH POINT	SELF-IGNITION TEMPERATURE	LEL-UEL (% OF THE MIXTURE WITH AIR)
Benzene	80 °C	-11 °C	498 °C	1,3 - 7,9 %
Ammonia - 33 °C	- 33 °C	gaz	650	15 - 28 %
Methane - 162 °C	- 162 °C	gaz	535	5 - 15 %
Butane	2 °C	gaz	287 °C	1,8 - 8,4 %
Pentane	36 °C	<- 40 °C	260 °C	1,5 - 7,8 %
Octane	126 °C	13 °C	260 °C	1 - 6,5 %

CHARACTERISTICS OF FLAMMABLE DUSTS EXAMPLES

DUSTS	SIZE OF PARTICLES	SELF-IGNITION TEMPERATURE	MINIMAL CONCENTRATION (9/µ3)
Acetylsalicylic acid	400µ	550 °C	60
Ascorbic acid	39µ	490 °C	60
Paracetamol	120µ	—	30
Extract of rosemary	30µ	380 °C	30
Powder of Valerian	78µ	—	100

Following informations are given just as an example to explain the French rules on those subjects : please identify in your country the equivalent and remember, if there is no rule, that gas, vapor and dust have no nationality : the way to explode or protect yourselves are the same everywhere.

Using the description for installations classified for protection of the environment in France, in accordance with the decree of May 20, 1953, modified on December 28, 1999.

Non-exhaustive list extracted from the typical orders for which installations requiring a declaration should satisfy the provisions of the ministerial order of March 31, 1980.

Decree relating to electrical installations in establishments regulated under the legislation governing installations classified as likely to present a risk of explosion.

Many countries produce similar documents.

PREMISES OR LOCATION
Alcohols (production by distillation)
Batteries (charging workshops)
Acetylene (storage or use of)
Acetylene (manufacture of)
Use or storage of toxic substances or preparation
Acids (use or storage of)
Steeping lighters (deposits of)
Flammable amines, storage
Workshops for repair and servicing of motor vehicles
Wood or similar combustible materials (workshops where these are worked on)
Wood, paper, cardboard or similar combustible materials (deposits of)
Candles or other wax objects, etc. (moulding of)
Grinding, crushing, etc., of vegetable substances and all organic products
Polymer processing
Easily flammable solids
Charcoal (deposits or warehouses of)
Heating (processes)
Shoes or leather/skin products (manufacture of)
Oxidising substances (manufacture, use, storage of)
Detergent (manufacture of products)
Fibres of vegetable or animal origin, artificial or synthetic fibres (processing of)
Fruit or vegetables (ripening, degreening, whitening, disinfestation rooms)
Gasometers and compressed gas tanks
Liquefied fuel gases (filling stations, or distribution of)
Tar, pitch, resins, etc. (mixture or hot processing of)
Coal, coke, etc (warehouses and deposits of)
Vegetable oils (extraction of)
Gaseous hydrogen (storage, use of)
Flammable liquids (storage and manufactured tank of)
Flammable liquids (installations for blending, processing or use of)
Flammable liquids (filling or distribution stations)
Leather goods (workshops)
Plastics, plastomers or elastomers (manufacture of)
Ammonium nitrate (deposits of)
Blended ammonium nitrate (deposits of)
Processing of vegetable fibres
Liquid oxygen (deposits of)
Covered car parks
Organic peroxides (use, manufacture, storage of)
Refrigeration or compression (installations)
Sugar factories, sugar refineries, malt houses
Silos and storage installations for cereals, grain, food products or any organic products releasing flammable dust
Textile dyeing and printing
Fabrics, knitted articles, tulles, guipure lace, etc (manufacturing workshops)
Varnishes, paints, primers, glues, rendering (application, baking, drying of)

The worldwide electrotechnical standard for electrical equipment for explosive atmospheres is covered by two major "standards" :

1- IEC/ATEX/CENELEC (common standard following agreement in 1991 on procedures for developing standards)
IEC : International Electrotechnical Commission
ATEX : ATmospheres EXplosibles
CENELEC : European Committee of Electrotechnical Standards

2- NEC, CEC (products approved by UL, FM, CSA...).
NEC : National Electrical Code
CEC : Canadian Electrical Code

Products which conform to IEC/ATEX/CENELEC or NEC standards have identical protection, even though they are designed differently to meet specific installation regulations.

IEC can be considered as the "international standard" accepted in nearly every country.

Since 1996, NEC, Article 505, uses the IEC names of gas groups, equipment temperature classes and area definitions.

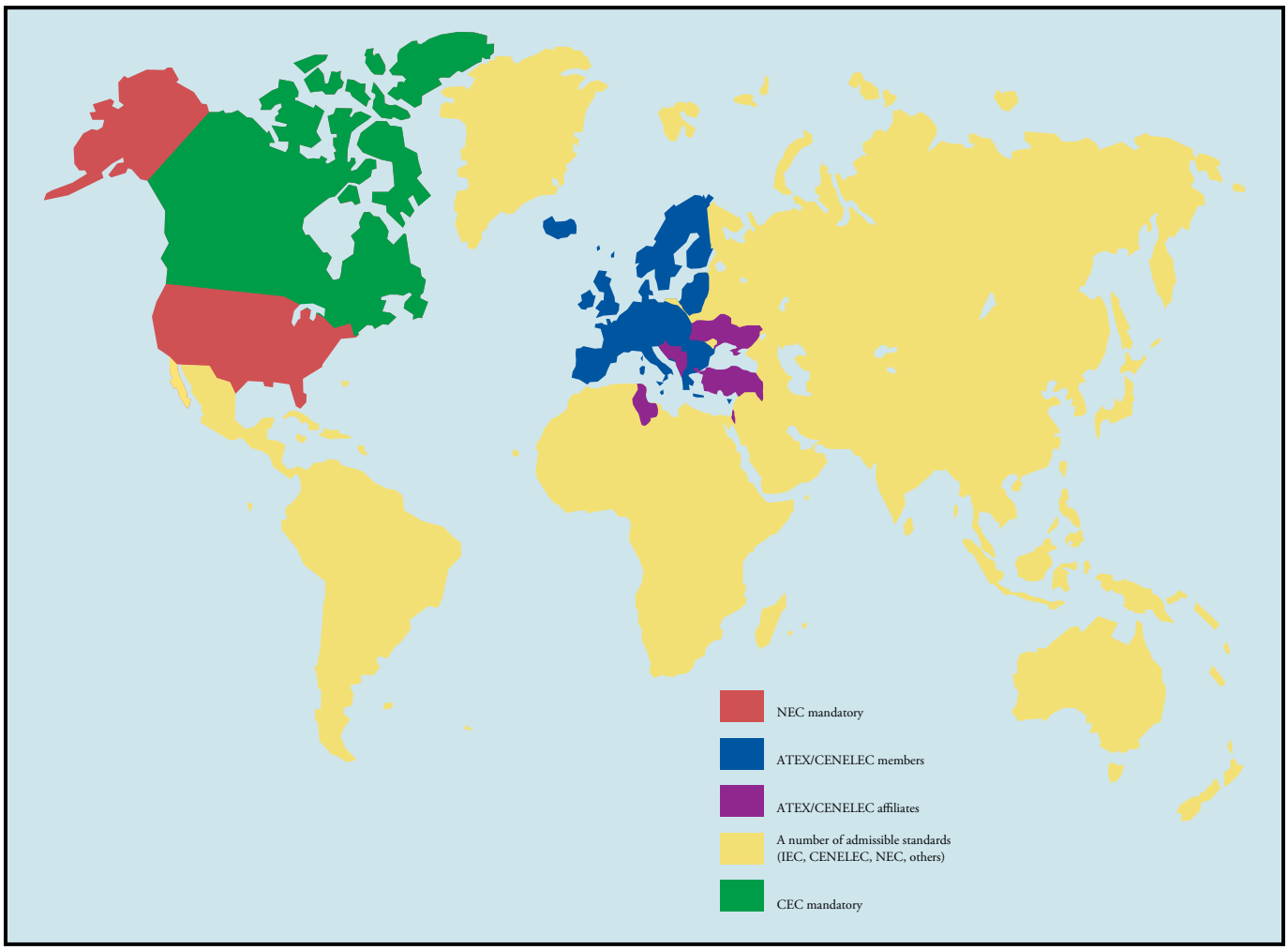
> To obtain more detailed information, contact the national laboratories : LCIE, INERIS , PTB, DEMKO, CSA, UL, KEMA, DNV, LOM.....

IECEx

The aim of the IECEx Scheme is to facilitate international trade in electrical equipment intended for use in explosive atmospheres (Ex equipment) by eliminating the need for multiple national certification while preserving an appropriate level of safety.

The IEC Ex Scheme provides the means for manufacturers of EX equipment to obtain certificates of conformity that will be accepted at national level in all participating countries. A certificate of conformity may be obtained from any certification body accepted in the Scheme. The certificate will attest that the equipment design conforms to the relevant IEC standards and that the product is manufactured under a quality plan assessed by an Accepted Certification Body. Manufacturers holding certificates of conformity may affix the IECEx Mark of Conformity to equipment that thy have verified as complying with the certified design.

An application for a country to participate in the IECEx Scheme is made on a standard by standard basis by the candidate Member Body of the IECEx Scheme for that country. The application is made to the Secretary of the Ex Management Committee. There are currently 17 Accepted Certification Bodies (ACBs) in 22 countries participating in the IECEx Scheme.



INTERNATIONAL ELECTROTECHNICAL COMMISSION (www.iec.ch)

The IEC (International Electrotechnical Commission), created in 1904 in Geneva (Switzerland) establish the IEC regulations.

In 1947, with the creation of the International Standards Organization (ISO) by the United Nations, the IEC became responsible for the organization of the electrical division, while still remaining independent.

The IEC has defined three categories of hazardous Zones *(see page G:11)* :

- Zone 0 : the explosive atmosphere is continuously present.
- Zone 1 : the explosive atmosphere is often present.
- Zone 2 : the explosive atmosphere may accidentally be present.

GAS AND VAPOR CLASSIFICATION

Gases are divided into four groups by the CEC and the NEC (with some additional gases).

The IEC also defines different groups of gases and vapors.

The IEC and North American groups are viewed as fundamentally the same, apart from the fact that there are three groups in the IEC and four for the NEC *(see table below)*.

TEMPERATURE CLASSIFICATION

IEC defined a temperature classification for materials used in hazardous areas.

Following this, CEC and NEC have also been modified to include a temperature classification.
(see table below).

GAS AND VAPOR CLASSIFICATION

GROUP		GAS OR VAPOR
IEC	NEC (NORTH AMERICA)	
II C	A	Acetylene
II C	B	Hydrogen
II B	C	Ethylene
II B	C	Ethyl ether
II B	C	Cyclopropane
II B	C	Butadene 1-3
II A	D	Propane
II A	D	Ethane
II A	D	Butane
II A	D	Benzéne
II A	D	Pentane
II A	D	Heptane
II A	D	Acetone
II A	D	Methyl Ethyl
II A	D	Methyl Alcohol
II A	D	Ethyl Alcohol

TEMPERATURE CLASSIFICATION

TEMPERATURES IN °C	CLASSIFICATION	
	IEC	NEC (NORTH AMERICA)
450	T1	T1
300	T2	T2
280	T2	T2A
260	T2	T2B
230	T2	T2C
215	T2	T2D
200	T3	T3
180	T3	T3A
165	T3	T3B
160	T3	T3C
135	T4	T4
120	T4	T4A
100	T5	T5
85	T6	T6

Group 1 - underground working mine
Group 2 - surface industry

EQUIPMENT TYPES IEC, EN, UL CORRESPONDENCES

EQUIPMENT	IEC	CENELEC	UL (NEC)
Fixed luminaires for general use	• IEC 60079-0 • IEC 60079-1 and/or 60079-7 • IEC 60598-1	• EN 60079-0 • EN 60079-1 and/or 60079-7 • EN 60598-1	• UL 844
Portable equipment			• UL 844 • UL 781
Floodlights and lamps			• UL 844 • UL 783
Luminaires with fluorescent lamps			• UL 844 • UL 1570
Luminaires with incandescent lamps			• UL 844 • UL 1571
Power outlets	• IEC 60079-0 • IEC 60079-1 and/or 60079-7 • IEC 60309-1 (IEC 60309-2)	• EN 60079-0 • EN 60079-1 and/or 60079-7 • EN 60309-1 (EN 60 309-2)	• UL 1010 • UL 1682
Switches	• IEC 60079-0 • IEC 60079-1 and/or 60079-7 • IEC 60947-1 • IEC 60947-3	• EN 60079-0 • EN 60079-1 and/or 60079-7 • EN 60947-1 • EN 60947-3	• UL 508 • UL 98 • UL 1087 • UL 894

INFLAMMABLE MATERIAL	IEC/CENELEC				NEC		
	PROTECTION	ZONE	GROUP	SUBDIVISION	CLASS	DIVISION	GROUP
GASES AND VAPORS							
Acetylene	d - e	1,2	II	C	I	1 - 2	A
Hydrogen	d - e	1,2	II	C	I	1 - 2	B
Propylene Oxide Ethyl oxide Butadiene	d - e	1,2	II	B	I	1 - 2	B
Cyclopropane Ethyl Ether Ethylene	d - e	1,2	II	B	I	1 - 2	C
Acetone Benzene Butane Propane Hexane Paint Solvents Natural Gas	d - e	1,2	II	A	I	1 - 2	D

INFLAMMABLE MATERIAL	IEC/CENELEC		NEC		
	PROTECTION	ZONE	CLASS	DIVISION	GROUP
COMBUSTIBLE DUSTS					
Magnesium Aluminium or metallic dusts with R ≤ 105 Ohms x cm	IEC / CENELEC / NEC Comparison	21-22	II	1	E
Coal	D/DIP	21-22	II	1	F
Floor Non metallic dusts with R > 105 Ohms x cm	D/DIP	21-22	II	2	G
FIBERS AND FLYINGS					
Rayon Cotton Linen Wood Hemp Flax bast Tow Coconut fiber Oakum	IEC / CENELEC / NEC Comparison		III	1 - 2(1)	

(1) Division 1 : manufacturing location
Division 2 : storage location

TWO EUROPEAN DIRECTIVES

On July 1, 2003, two important European directives concerning electrical equipment for potentially explosive atmospheres, introducing part of the new approach, came into force :

- Directive 94/9 CE concerns more specifically manufacturers who are obliged to offer their customers ATEX products from June 30, 2003 onwards.
- Directive 99/92 CE concerns all users (specifiers, investors, contractors, OEMs or distributors) of equipment for potentially explosive atmospheres.

Both of these result from articles 100 A and 118 A of the Treaty of Rome (1957).

1- DIRECTIVE 94/9 EC

Directive 94/9 EC defines the minimum requirements aimed at improving protection, in terms of health and safety, for workers likely to be exposed to risks of potentially explosive atmospheres.

It also defines the equipment capable of ensuring the desired safety and the resources to be employed in selecting, installing, using and maintaining this equipment.

This specifies safety requirements for both electrical and non-electrical equipment, designed for use in hazardous locations as a result of the presence of gas or dust.

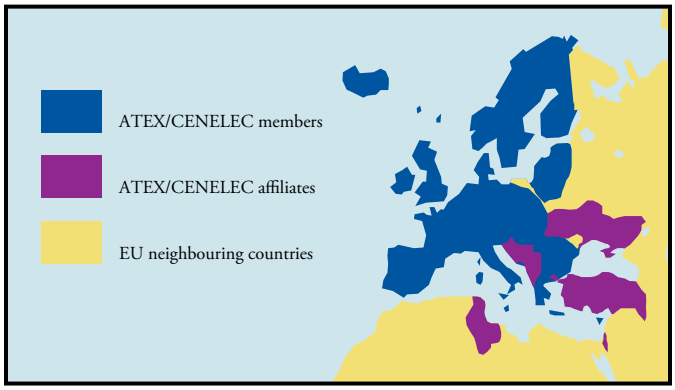
As of July 1, 2003, all electrical equipment for potentially explosive atmospheres sold within the European area must have ATEX certification, as a result, they must bear the standard ATEX marking on the product certification plate, in accordance with the new European classification of products.

2- DIRECTIVE 99/92 EC

From July 1, 2003, it is mandatory to comply with the minimum safety regulations described in the directives which need to be followed routinely in hazardous locations.

The obligations on the employer or site manager are mainly :

- risks of explosion analysis; identification, assessment and record keeping (article 8),
- classification of hazardous areas (or Zones),
- training of workers,
- validation of the conformity of the installation,
- procedure for maintenance of the installation,
- procdure in case of Alert and Evaluation.



ATEX EQUIPMENT CLASSIFICATION

Directive 94/9 CE defines a new of hazardous Zones, with a distinction between gas (G) or dust (D) atmospheres. As a result, it introduces the existence of Zones 20, 21 and 22 corresponding to dust environments and the concept of categories 1, 2 and 3 for equipment.

ATEX PRODUCT MARKING

As of July 1, 2003, all electrical equipment for potentially explosive atmospheres sold within the European area must have "ATEX" certification and, as a result, bear the standard ATEX marking on the product nameplate, in accordance with the new European product classification.

ATEX CLASSIFICATION

ZONES	0	20	1	21	2	22
TYPE OF ATMOSPHERE	G	D	G	D	G	D
Potentially explosive atmosphere	Continuous presence		Intermittent presence		Occasional presence	
Equipment category	1		2		3	

CHARACTERISTICS OF PRODUCT MARKINGS (FOR EXAMPLE, FLUORESCENT CAT. NO FEB236BUSN)

ENVIRONMENT	GAS	DUST
Marking	CE 0081 Ex II2G	CE 0081 Ex II2D
ATEX/IEC marking	Ex de IIC	Ex tD A 21 T 75 °C
Temperature class	T4 or T5	
EC type-examination certificate	LCIE 07 ATEX 6017	
IEC certificate	IECEx LCI 04.0017	
Ambient temperature	-40°C≤ Ta ≤ 55 °C	
Protection index	IP66/67 / IK10	

EXAMPLES OF MARKING

LABEL FOR "e" FLUORESCENT LAMP CAT. NO. FEB236BUSN

Appleton A.T.X.
Amiens - FRANCE
CE 0081 Ex II 2 GD

Type FLe
LCIE 07 ATEX 6017
Ex de IIC T4 - Ex tD A21 IP66/67
IECEx LCI 04.0017 imax=0.65A

FEB236BUSN
(091655) - (096555)
-40°C≤ Ta ≤ +55°C
T = 75 °C

E.O.L Approved
F IK10

110 / 254V +/-10% 0-50-60Hz G13/Fa6 T5 (-40°C≤ Ta ≤ +40°C)

AVERTISSEMENT - WARNING
APRES MISE HORS TENSION, ATTENDRE 60 MINUTES AVANT L'OUVERTURE
(Uniquement pour Zone poussière)
AFTER DE-ENERGIZING, WAIT 60 MINUTES BEFORE OPENING
(only for dust areas)

WHAT IS SAID IN OFFICIAL TEXTS ?

The IEC international regulation (standard IEC/EN 60079/10) makes a distinction between the following hazardous Zones :

- Zone 0,
- Zone 1,
- Zone 2.

THREE TYPES OF ZONE

Since July 1, 2003, with the new Directives ATEX, there are three types of Zone :

- Zone 0 - 20,
- Zone 1 - 21,
- Zone 2 - 22.

ZONE 0 - 20

Zone in which an explosive mixture of gas, vapor or dust is continuously present (the gaseous phase inside a receptacle or a closed-off chamber constitutes a Zone "0").

ZONE 1 - 21

Zone in which an explosive mixture of gas, vapor or dust is likely to occur during normal operation.

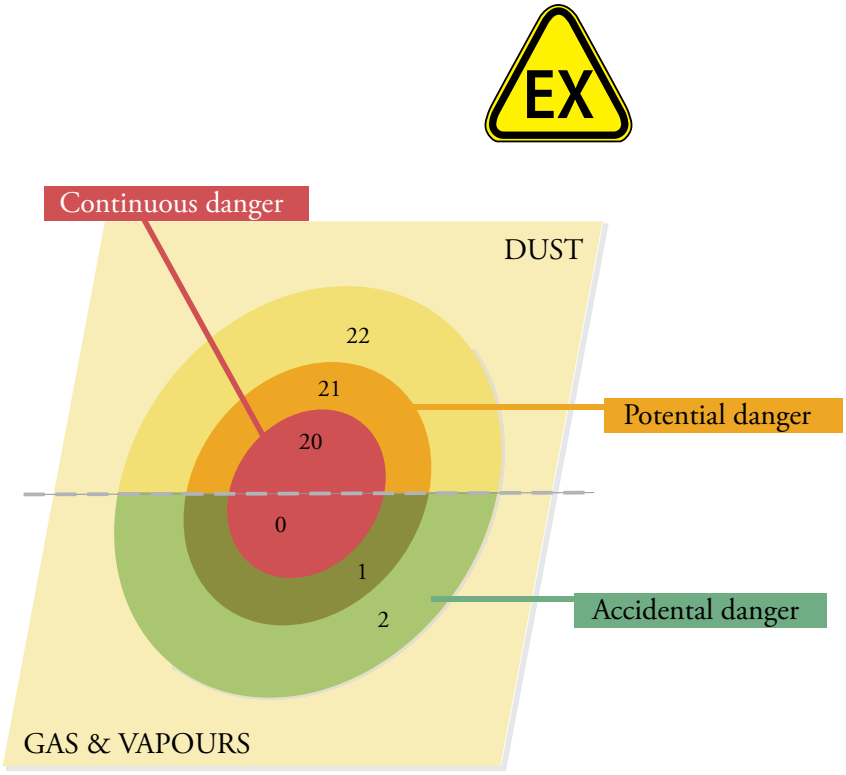
ZONE 2 - 22

Zone in which an explosive mixture is not likely to occur in normal operation, and if it occurs will only exist for a short time (leaks or negligent use).

FRONTIERS BETWEEN ZONES

These Zones are geographic, but the frontiers between them are never precisely determined, because a Zone can move for several reasons : product warm-up, faulty ventilation of the room, climate variations, handling mistake, air movement.

THE THREE TYPES OF ZONE



HOW TO DETERMINE THE ZONES ?

The plant manager or his employees, controlled by external accredited advisers, are the only people authorized to determine hazardous areas in a location where gas and vapor are present.

To determine these Zones, 4 essential questions have to be solved.

1- WHAT IS THE EMISSION LEVEL OF MY RELEASE SOURCE ?

These are the emission points of inflammable substances into the atmosphere.

Three levels of release source can be distinguished :

1- CONTINUOUS EMISSION LEVEL.

The release source is the surface of an inflammable liquid :

- In an enclosed receptacle,
- In an open receptacle,
- Inside enclosed manufacturing or mixing equipment.

2- FIRST LEVEL EMISSION.

Release during normal operation. The main release sources are the following :

- Open manufacturing or mixing equipment,
- Vents on enclosed receptacles,
- Hydraulic guard venting holes,
- Extremities of articulated loading arms for tankers and containers,
- Apparatus loading bungs and emptying valves,
- Sampling and venting valves,
- Pump and compressor gaskets, where leaks persist (example: cable gland operating leaks),
- Non-watertight switches and conduits.

2- SECOND LEVEL EMISSION.

Release during abnormal operation. The main release sources are the following :

- Flanges, connections, vents and pipe joints,
- Glass inspection holes or level indicators,
- Gaskets in pumps or compressors, designed to prevent leaks,
- Fragile apparatus such as glass, ceramic, graphite, etc...,
- Breathing holes in pressure reduction valve membranes,
- Retaining sumps.

2- WHAT TYPE OF OPENING DO I HAVE ?

All openings (doors, windows, ventilation outlets, etc) between two geographical locations should be considered as possible release sources.

The release level depends on the following :

- The type of Zone of the adjoining geographical area,
- The frequency and duration of opening,
- The pressure difference between the geographical areas,
- The effectiveness of the gaskets or joints.

There are 4 types of opening :

1- TYPE A OPENINGS.

- Open passages : conduits, piping through walls, ceilings and floors,
- Fixed ventilation outlets installed in rooms and buildings, opened frequently or for long periods.

2- TYPE B OPENINGS.

- Normally closed (example : automatic closing), rarely open, and difficult to adjust.

3- TYPE C OPENINGS.

- Type B openings, with watertightness in addition to that, equipped with independent automatic closing,
- Two type B opening in series.

4- TYPE D OPENINGS.

- Can only be opened using a special device or in an emergency,
- Completely weatherproof openings,
- Combination of a type B and a type C opening, in series (joined together).

3- WHAT IS THE VENTILATION AVAILABILITY ?

The efficiency of ventilation in dispersing or maintaining the explosive atmosphere depends on its quality and level, as well as its design. An artificial ventilation system is therefore :

VERY GOOD

- Operates almost continuously and therefore backed up.

GOOD

- Operated while the site is operating.

POOR

- Does not operate continuously or during normal site operation, it operates without any interruption for long periods.

4- WHAT LEVEL IS THE VENTILATION ?

Evaluation of the ventilation level requires a knowledge of the maximum gas or vapor release rate at the release source, either by controlled tests, by calculation, or by established hypotheses. There are three levels of ventilation :

HIGH

- Ventilation reduces the concentration at the release source and reduces it to a level below the LEL value (lower explosive limit).

AVERAGE

- Ventilation controls the concentration, leading to a stable situation.

WEAK

- Ventilation cannot control the concentration during release and/or cannot prevent the explosive atmosphere continuing after release is over.

APPLETON ADVICE FOR DESIGNING A VENTILATION SYSTEM

Here are the important points to remember for designing a ventilation system * :

- Air for ventilation should be taken from a non hazardous area.
- Artificial ventilation should be controlled and monitored.
- As gases and vapors often have different densities to that of air, they have a tendency to accumulate where air movement is likely to be reduced.
- Obstacles can reduce the movement of air. Therefore the « topography » of geographical locations should be taken into account (inside and/or outside).

** See standards IEC 60079-10.*

DOWNSTREAM EFFECT ON THE DEGREE OF RELEASE OF THE OPENING

PROBABLE ZONES IN UPSTREAM OF THE OPENING	TYPES OF OPENINGS			
	A	B	C	D
Zone 0	Continuous	(Continuous) First	Second	No release
Zone 1	First	(First) Second	(Second) No release	No release
Zone 2	Second	(Second) No release	No release	No release

Note : for the release emission levels between parenthesis, it is advised to consider the opening frequency of the doors when at the design stage.

Continuous emission release usually leads to classification as Zone 0	First level emission release usually leads to classification as Zone 1	Second level emission usually leads to classification as Zone 2

SUMMARY TABLE FOR GAS AND VAPORS

The table below corresponds to IEC standard 60079-10 which can determine the type of Zone according to three criteria : the release emission level, the ventilation level and the ventilation availability.

RELEASE EMISSION LEVEL	VENTILATION LEVEL						
	WEAK	AVERAGE			HIGH		
	VENTILATION AVAILABILITY						
	GOOD OR VERY GOOD	POOR	POOR GOOD	VERY GOOD	POOR	GOOD	VERY GOOD
CONTINUOUS	Zone 0	Zone 0	Zone 0	Zone 0	Zone 1	Zone 2	Zone 0 (NE)*
		Zone 1	Zone 2				Non-hazardous
FIRST	Zone 0	Zone 1	Zone 1	Zone 1	Zone 2	Zone 2	Zone 1 (NE)*
	Zone 1	Zone 2	Zone 2				Non-hazardous
SECOND	Zone 0	Zone 2	Zone 2	Zone 2	Zone 2	Non-hazardous	Zone 2 (NE)*
	Zone 1						Non-hazardous

Zones in which "e" increased safety (page G:38) or flameproof "d" (page G:36) material can be installed.
** NE = negligible extent*

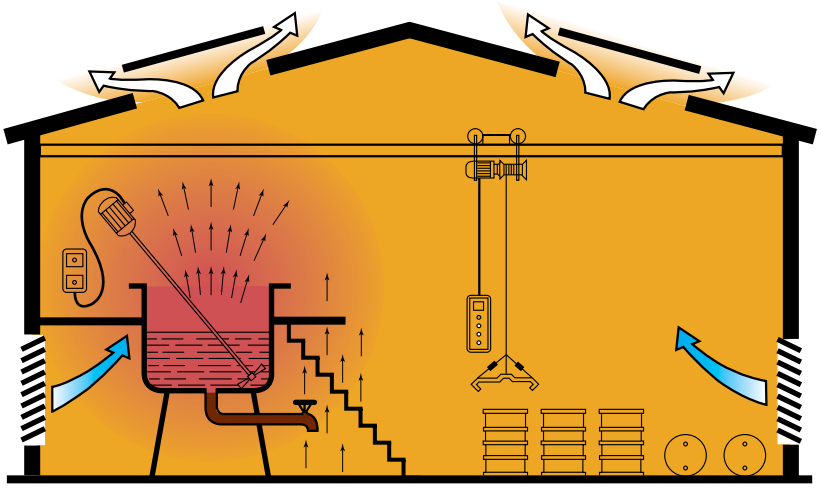
APPLETON ADVICE FOR INSTALLING ELECTRICAL EQUIPMENT IN AREAS WITH EXPLOSION RISKS

Process for installing electrical equipment in areas with explosion risks.

The manager of the installation is solely responsible for :

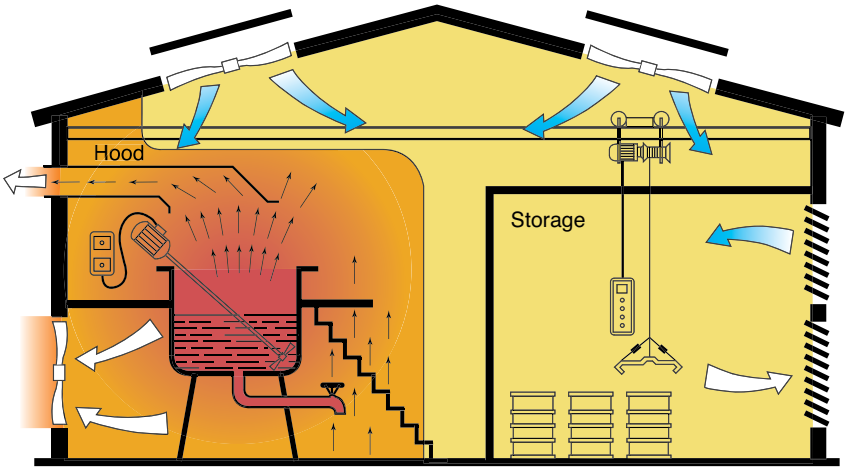
1- Determine hazardous areas.
2- Defining Zone boundaries - volumes.
3- If necessary, delimiting Zones.
4- Knowing the characteristics of flammable substances present on the site.
5- Defining the temperature class and the explosion group of the equipment.
6- Choosing equipment depending on :
   - the temperature class and the explosion group,
   - environmental constraints specific to the site - corrosion, exposure to UV, mechanical strength,
   - protection indexes.
7- Installing equipment.
8- Commissioning.
9- Checking the installation.

MODIFICATIONS OF ZONES RELATED TO APPROPRIATE EQUIPMENT



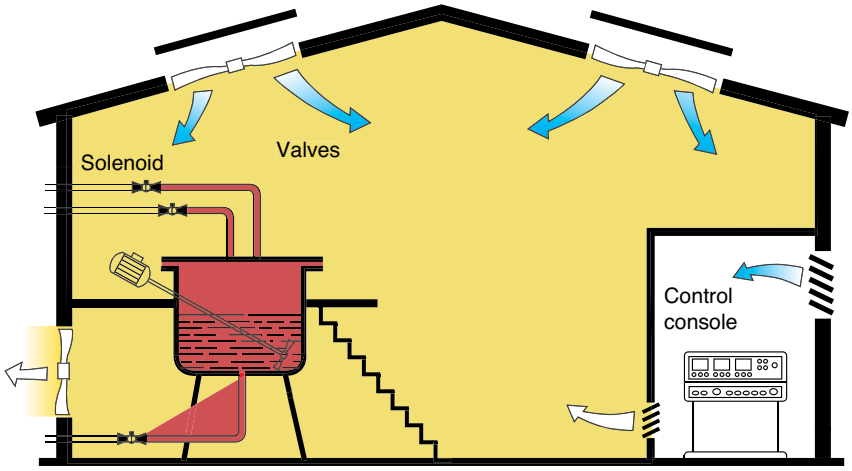
EXAMPLE 1

- The mixing tank is in the open air.
- The room is not ventilated mechanically.
- The products are always present in the workshop.
- All operations are manual.



EXAMPLE 2

- A hood has been fitted above the tank.
- The room is ventilated.
- The products in stock are separated from the rest of the workshop.
- Part of the work is manual.



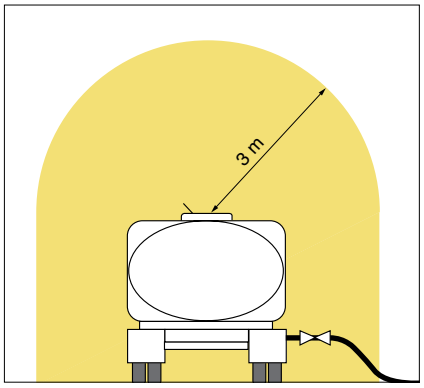
EXAMPLE 3

- The tank is closed off.
- The room is ventilated mechanically
- The products are stored outside.
- All operations are controlled via a console outside the Zone.
  - — The only risk that remains is when tank is opened for inspection or maintenance.

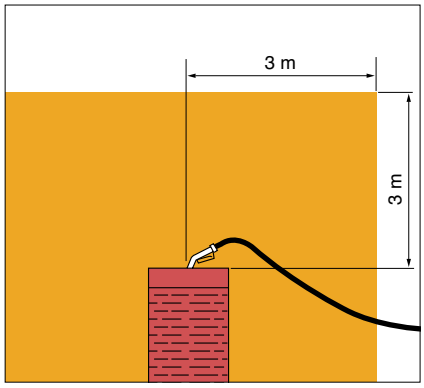
ZONE 0 | ZONE 1 | ZONE 2 | NON-HAZARDOUS ZONE

Definition of Zones : see page G13.

TYPICAL GUIDE FOR LIQUID HYDROCARBON STORAGE



TANKER TRUCK UNLOADING STATION.



MOBILE TANK FILLING DEVICE

COMPULSORY PROTECTION MEASURES

The risk of explosion must be safe guarded by the concurrent use of specific protection measures :

- Internal overpressure in the room,
- Continuous dilution,
- Intake at the source.

The latter two measures are only possible when the maximum discharge flow is known accurately.

Measures must be taken to compensate for a possible failure in the particular measures used :

- Light and/or sound alarm,
- Measures necessary to repair and restart the protection device as quickly as possible,
- Automatic power off device controlled by :
  - A tester that checks that overpressure, dilution or ventilation devices are working correctly,
  - Or an atmosphere tester (fixed explosion meter with continuous operation) that switches power off at a control threshold set to 25% of the LEL (lower explosive limit) if no personnel are present and 10% of the LEL if there are personnel present.

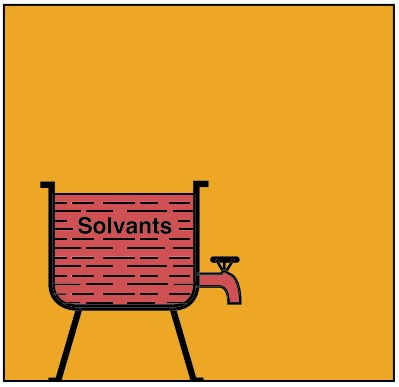
APPLETON ADVICE

The additional measures are difficult and expensive, so that Zone 1 equipment is frequently used over entire sites.

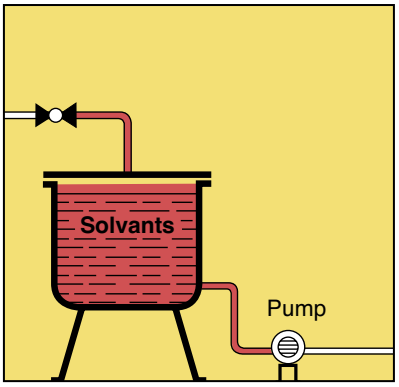
This equipment covers explosion risks at all times, regardless of uncontrollable environmental variations.

This position was adapted by same significant oil companies.

BEFORE PROTECTION



AFTER PROTECTION



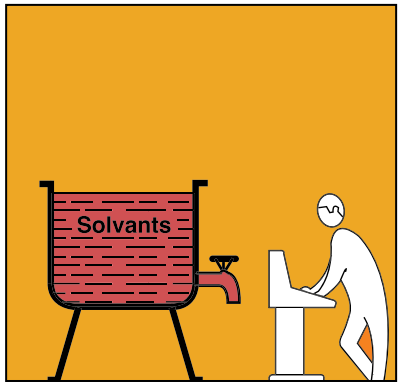
THE WORKSHOP CLASSIFIED AS ZONE 1 BECOMES ZONE 2 BY INSTALLING A CLOSED CIRCUIT PROCESS : USING A CLOSED TANK SUPPLYING REAGENTS AND EMPTYING THE FINISHED PRODUCT VIA PIPING.

PROTECTION BY CLOSED CIRCUIT OPERATION

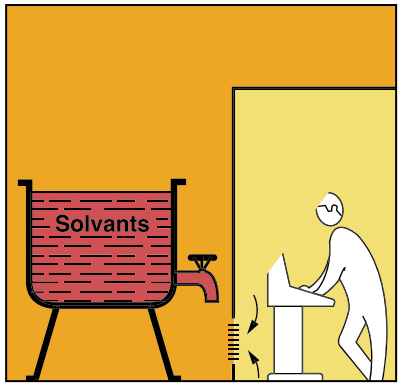
When this method can be used it is the safest way to limit risks. The explosive atmosphere is confined to the interior of one or several storage receptacles.

The electrical equipment can easily be installed outside.

BEFORE PROTECTION



AFTER PROTECTION



THE CONTROL STATION OF A WORKSHOP CLASSIFIED AS ZONE 1 CAN BE DERATED TO ZONE 2 BY INSTALLING AN OVER-PRESSURE CUBICLE.

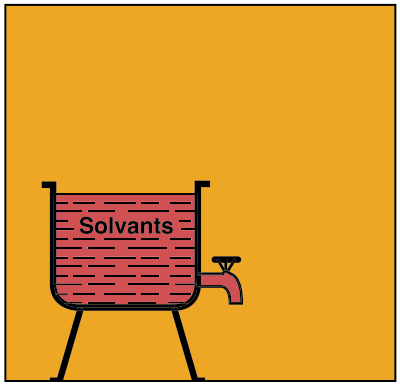
PROTECTION BY OVER-PRESSURE

The entry of inflammable gases or vapors into an enclosure containing ordinary electrical equipment or any other ignition source, is prevented by maintaining, in this enclosure, a gas pressure (usually air) higher than the pressure outside (e.g. in the control room).

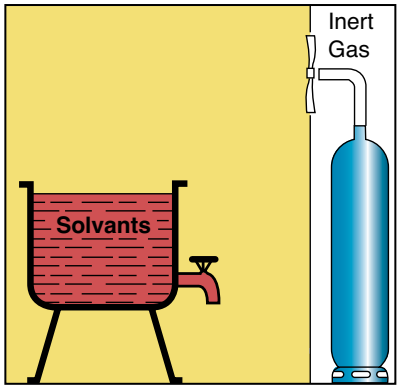
Over-pressure may be static after the initial sweep, the apertures in the enclosure are closed and the air flow provides simple counteraction to natural leaks.

Over-pressure may also be of a dynamic nature : an air-flow is deliberately created across apertures of a chosen cross-section.

BEFORE PROTECTION



AFTER PROTECTION



THE WORKSHOP BECOMES ZONE 2 BY INTRODUCING AN INERT GAS WHICH PREVENTS THE FORMATION OF AN EXPLOSIVE ATMOSPHERE.

PROTECTION BY INERT GAS

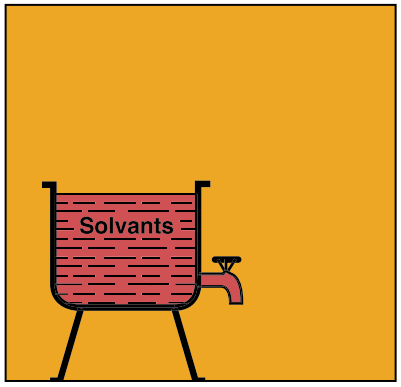
By adding an inert gas, the oxygen content of the air in an enclosure is reduced to such a weak value that the atmosphere would no longer be explosive, whatever the concentration of inflammable gases and vapors.

The inert gas generally used is nitrogen, but carbon dioxide is used on some occasions.

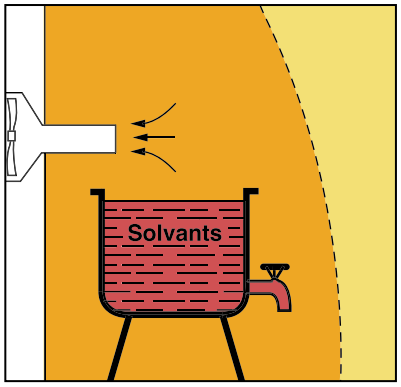
ZONE 0 | ZONE 1 | ZONE 2 | NON-HAZARDOUS ZONE

Definition of Zones : see page G:11.

BEFORE PROTECTION



AFTER PROTECTION



A ZONE 1 CLASSIFIED WORKSHOP BECOMES ZONE 1 (IN PART) AND ZONE 2 (FOR THE REMAINDER) BY INSTALLING A SUCTION DEVICE AT SOURCE.

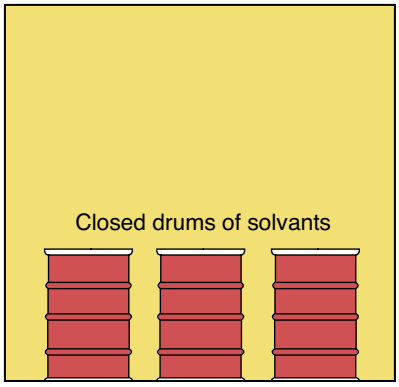
PROTECTION BY SUCTION AT SOURCE

The creation of a localized depression by means of ducting diverts the inflammable gases and vapors to a Zone carrying no risk of explosion when in operation.

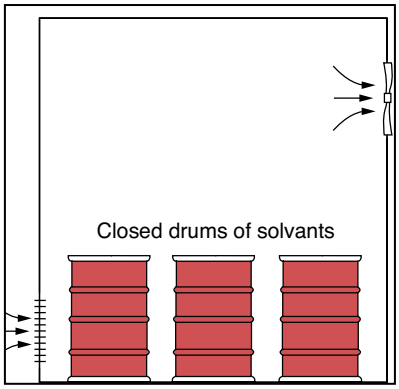
This type of protection is essentially used in workshops where there are few discharge points.

Inside the suction Zone safety type electrical equipment should be used.

BEFORE PROTECTION



AFTER PROTECTION



A ZONE 2 CLASSIFIED WAREHOUSE CAN BECOME A NON HAZARDOUS ZONE BY INSTALLING A VERY GOOD QUALITY GENERAL FORCED VENTILATION SYSTEM.

PROTECTION BY GENERAL SUCTION

The inflammable gas and vapor content is maintained at a level below that of the lower explosive limit in a large Zone by a general suction device.

This type of protection is very delicate to operate because hazardous concentrations of inflammable gases and vapors generally remain at their point of discharge and in dead Zones.

PROTECTION BY UNDER-PRESSURE

The diffusion of inflammable gases or vapors outside an enclosure is prevented by the maintenance therein of a pressure lower than that of the surrounding Zone.

The surrounding Zone, which is not hazardous, can also contain without risk conventional electrical equipment or any other inflammable sources.

PROTECTION BY CONTINUOUS DILUTION

The inflammable gas and vapor content is reduced to a value below that of the lower explosive limit(1) by adding a protective gas which is continuously fed into the required Zone. The protective gas is, in general, air.

** Switch-off threshold set at 25% of the LEL. if personnel are absent and at 10% if personnel are present.*

APPLETON ADVICE

What should be done in order to prevent if possible failure in one of the types of protection ?

These types of protection use equipment that is often very complex (inerting, over-pressure, suction devices, etc), which could malfunction. If a malfunction occurs, the room reverts to its initial classification.

It is therefore necessary, for each device, to define additional safety measures to be taken, to guarantee, in the event of failure, the safety of workers.

For example : the disruption of energy sources (such as electricity, water, inert gas, etc) can cause a failure in the mode of protection. It is therefore necessary to study the room from the start, to provide for built-in backup energy circuits to ensure total safety.

CRITERIA OF SELECTION OF EQUIPMENT

The criteria of selection are the following :

- Gas and vapors classification,
- Protection indexes,
- Protection modes,
- Industrial environment (corrosion).

The table below indicate the equipment groups which can be used depending on the gas and vapor subdivision.

WHICH EQUIPMENT GROUP SHOULD BE CHOSEN ?

This table indicates the equipment groups which can be used depending on the gas and vapor classification *(see page G:19)*.

A distinction is made between two groups of electrical equipment :

GROUP I

- Electrical equipment intended for underground work in mines with explosive atmospheres.

GROUP II

- Electrical equipment designed for surface industry.

ELECTRICAL EQUIPMENT WHICH CAN BE USED

GAS/VAPOR SUBDIVISION	EQUIPMENT GROUPS WHICH CAN BE USED		
	INCREASED SAFETY "e"	FLAMEPROOF "d"	ASSOCIATED PROTECTION MODES "d" + "e"
A	II	IIA - IIB - IIC	IIA - IIB - IIC
B	II	IIB - IIC	IIB - IIC
C	II	IIC	IIC

WHICH TEMPERATURE GROUP SHOULD BE CHOSEN ?

According to the spontaneous ignition temperature of the gases, this table indicates the temperature class of the equipment which can be used *(see page G:20-23)*.

- The temperature class of the equipment must always be lower than the spontaneous ignition temperature of the gases.
- Equipment must never be used in an atmosphere capable of ignition at the temperature indicated on the marking (temperature class).

TEMPERATURE CLASS OF THE EQUIPMENT

SPONTANEOUS IGNITION TEMPERATURE OF THE GASES (T°)	TEMPERATURE CLASS OF THE EQUIPMENT					
	T6 (85°)	T5 (100°)	T4 (135°)	T3 (200°)	T2 (300°)	T1 (450°)
85°≤ T° ≤100 °C						
100° < T° ≤ 135 °C						
135° < T°≤ 200 °C						
200° < T°≤ 300 °C						
300° < T° ≤ 450 °C						
450 °C < T°						

Danger : explosion — *Equipment which can be used.*

Acetaldehyde spontaneous ignition temperature 175 °C ⟷ *Class of equipment which can be used : T4, T5 or T6.*

The various regulations have taken into account a certain number of the most widely used gases.

The following table can be used to determine gases which may be present, their subdivision and self-ignition temperature, for each type of site. The classification of the equipment to be used can thus be determined.

Note : Temperatures in this table are given in °C. Gas mixtures are given for information only.

- *See pages G:20-23 for list of substances likely to create an explosive atmosphere.*

HOW TO READ THIS TABLE ?

Consider the example of a varnish making workshop. Dots in the following table indicate the presence of acetone, ethyl acetate, benzene, ethyl/methyl ketone, methyl acetate, n-butyl acetate, amyl acetate, butanol and ethylene oxide.

Knowing that the most dangerous gas is the gas with the lowest ignition temperature, in this case butanol (343 °C), we can deduce that the electrical equipment installed on this site must be kept at a temperature below 343 °C, and therefore should be in class T2, T3, T4, T5 or T6.

The most explosive gas is ethylene oxide (subdivision B). The installed electrical equipment should be at least class II or IIB.

APPLICATION AREA OF THE SITE (1)	SELF-IGNITION TEMPERATURE OF THE SITE °C	SUBDIVISION		GAS AND VAPORS (WITH SELF-IGNITION TEMPERATURE, ACCORDING, TO THE IRNS DOCUMENT)	SUBDIVISIONS
Cleaning product industry	245	II or II B	T3		
Pharmaceutical industry	90	II or II C	T6		
Dye industry	385	II or II A	T2		
Artificial rubber industry	300	II or II C	T3		
Perfumery	375	II or II A	T2		
Spirits	375	II or II A	T2		
Artificial fruit flavourings	90	II or II A	T6		
Artificial textile manufacture	90	II or II C	T6		
Paint manufacture	343	II or II B	T2		
Varnish manufacture	343	II or II B	T2		
Grease solvent	465	II or II A	T1		
Resin solvent	343	II or II A	T2		
Plastic manufacture	300	II or II C	T3		
Hydrocarbons	90	II or II C	T6		
Gas used as a fuel	300	II or II C	T3		
Fertiliser manufacture	500	II or II C	T2		
				465 °C	Acetone
				535 °C	Industrial methane
				425 °C	Ethyl acetate
				385 °C	Methanol
				287 °C	Butane
				450 °C	Propane
				223 °C	Hexane
				650 °C	Ammoniac
				605 °C	Carbon monoxide
				260 °C	Pentane
				204 °C	Heptane
				530 °C	Iso-octane
				205 °C	Decane
				498 °C	Benzene
				460 °C	Xylene
				245 °C	Cyclohexane
				510 °C	Ethyl/Methyl ketone
				454 °C	Methyl acetate
				450 °C	n-propyl acetate
				420 °C	n-butyl acetate
				360 °C	Amyl acetate
				343 °C	Butanol
				90 °C	Ethyle nitrate
				450 °C	Ethylene
				420 °C	Butadene 1.3
				425 °C	Ethylene oxide
				500 °C	Hydrogen
				90 °C	Carbon disulphide
				300 °C	Acetylene

GAS SUBSTANCES LIKELY TO FORM EXPLOSIVE ATMOSPHERES

It is important to be familiar with inflammability characteristics of substances that could form explosive atmospheres - this includes the flash point and self-ignition temperature in °C for gases, self-ignition temperature in layers or in clouds for dust. Furthermore, the practical safety guide published by the CNPP contains lists of all data sheets for dangerous products.

The table opposite indicates the flash points, the self- ignition temperatures and the inflammability limits in the air of the usual gas and vapors.

Gas and vapor inflammability characteristics (limits of concentration, flash points, inflammation temperatures) differ depending on the method used to determine them. Therefore, slightly different values (flash points, inflammability limits) or significantly different values (inflammation temperatures) may be found in other sources.

Flash points were determined in a closed dish, unless mentioned otherwise (open dish "O.D.").

SUBSTANCES	FLASH POINT	SELF-IGNITION TEMPERATURE IN °C	INFLAMMABILITY LIMITS BY VOLUME % MIXED WITH AIR	
			LOWER	UPPER
1 - Bromobutane	18	265	0,6(at 111 °C)	5,8(at155 °C)
1 - Bromopentane	32	-	-	-
1 - Butanol	29	343	1,4	11,2
1 - Butene	gaz	380	1,6	10
1,1,1-Trichloroethane	diff. infl.	537	7,5	12,5
1,1-Dichloroethane	-6	-	5,6	-
1,1-Dichloroethylene	-28	565	6,5	15,5
1,1-Diethoxyethane	-21	230	1,6	10,4
1,1-Dimethylhydrazine	-15	249	2	95
1,2,3-Propanetriol	199	370	-	-
1,2,4-Trichlorobenzene	105	571	2,5(at 150 °C)	6,6(at 150 °C)
1,2,4-Trimethylbenzene	44	500	0,9	6,4
1,2-Diaminopropane	33 O.D.	416	-	-
1,2-Dichlorobenzene	66	645	2,2	9,2
1,2-Dichloroethane	13	410	6,2	16
1,2-Dichloroethylene	2	460	5,6	12,8
1,2-Dichloropropane	15	555	3,4	14,5
1,2-Propanediol	98	370	2,6	12,5
1,3 - Benzenediol	127	608	1,4(at 200 °C)	-
1,3 - Butadiene	gaz	420	2	12
1,3,5-Trioxan	45 O.D.	414	3,6	29
1,3-Diaminopropane	24 O.D.	-	-	-
1,3-Dioxolanne	1 O.D.	-	-	-
1,4 - Benzenediol	165	515	-	-
1,4-Dichlorobenzene	65	-	-	-
1,4-Dioxanne	12	180	2	22
175 °C and 275 °C	> 70	254	0,58	4,45
185 °C and 330 °C	> 70	259	0,52	4,09
1-Chloro-1,2,2-trifluoroethylene	gaz	-	8,4	16
1-Chloro-2 methylpropane	< 21	-	2	8,8
1-Chloro-2,3-epoxypropane	31 O.D.	411	3,8	21
1-Chloro-4 nitrobenzene	127	-	-	-
1-Chlorobutane	-9	240	1,8	10,1
1-Chloropentane	12,8 O.D.	260	1,6	8,6
1-Chloropropane	<- 18	520	2,6	11,1
1-Chloropropene	<- 6	-	4,5	16
1-Hexene	<- 7	253	-	-
1-Naphtylamine	157	-	-	-
1-Nitropropane	36	420	2,2	-
1-Octene	21 O.D.	230	-	-
1-one	84	460	0,8	3,8
1-Pentanol	32	300	1,2	10 (at 100 °C)
1-Pentene	- 18 O.D.	275	1,5	8,7
1-Phenylethanone	77	570	-	-
1-Propanol	15	370	2,1	13,5
2 - Aminoethanol	85	410	-	-
2 - Butanone	-9	404	1,4(at93 °C)	11,4(at93 °C)
2 - Butene	gaz	320	1,7	9
2 - Butene-1-ol	27	349	4,2	35,3
2,2',2"-Nitrilotriethanol	196	-	-	-
2,2,4-Trimethylpentane	-12	415	1,1	6
2,2,5-Trimethylhexane	13 O.D.	-	-	-
2,2-Dimethylbutane	-47	405	1,2	7

Classified on first number

APPLETON ADVICE

Following informations are given just as an example to explain the French rules on those subjects : please identify in your country the equivalent and remember, if there is no rule, that gas, vapor and dust have no nationality: the way to explode or protect yourselves are the same everywhere.

SUBSTANCES	FLASH POINT	SELF-IGNITION TEMPERATURE IN °C	INFLAMMABILITY LIMITS BY VOLUME % MIXED WITH AIR	
			LOWER	UPPER
2,2-Dimethylpropane	gaz	450	1,4	7,5
2,2'-Iminodiethanol	172 O.D.	660	-	-
2,3-Dimethylbutane	-29	405	1,2	7
2,3-Dimethylhexane	7 O.D.	435	-	-
2,3-Dimethylpentane	< - 7	335	1,1	6,7
2,4- Toluylene diisocyanate	127	-	0,9	9,5
2,4,4-Trimethyl-1-pentene	-5	390	0,8	4,8
2,4,4-Trimethyl-2-pentene	2 O.D.	305	-	-
2,4,6-Trimethyl-1,3,5-trioxanne	35	235	1,3	-
2,4-Dimethylhexane	10 O.D.	-	-	-
2,4-Dimethylpentane	-12	-	-	-
2,4-Pentanedione	33	340	-	-
2,5-heptadiéee-4-one	85 O.D.	-	-	-
2,5-Hexanedione	78	499	-	-
2,6-Dimethyl-4-heptanol	74	-	0,8(at 100 °C)	6,1(at 100 °C)
2,6-Dimethyl-4-heptanone	49	396	0,8(at 93 °C)	7,1(at 93 °C)
210 °C and 365 °C	> 70	263	0,45	3,71
2-Chloro-1,1-dimethoxyethane	43	232	-	-
2-Chloro-1,3-butadiene	-20	-	4	20
2-Chloro-2-butene	-19	-	2,3	9,3
2-Chloroethanol	60	425	4,9	15,9
2-Chlorophenol	64	-	-	-
2-Chloropropane	-32	590	2,8	10,7
2-Ethoxyethanol	43	235	1,7(at 93 °C)	15,6(at 93 °C)
2-éthoxyéthyle acetate	47	380	1,7	-
2-Furaldehyde	60	315	2,1	19,3
2-Hexanone	25	423	-	8
2-hydroxybenzoïc acid	157	540	1,1(at 200 °C)	-
2-Methyl-1,3-butadiene	-54	395	1,5	8,9
2-Methyl-1-pentanal	20 O.D.	-	-	-
2-Methylacrylaldehyde	1 O.D.	-	-	-
2-Methylbutane	<- 51	420	1,4	7,6
2-Methylfuranne	-30	-	-	-
2-Methylhexane	<- 18	-	1	6
2-Methylpentane	<- 29	264	1	7
2-Methylpropanal	-18	196	1,6	10,6
2-Methylpropene	gaz	465	1,8	9,6
2-Methylpyridine	38 O.D.	535	-	-
2-Naphtol	152	-	-	-
2-Nitropropane	24	428	2,6	11
2-Octanone	52	-	-	-
2-Pentanone	7	452	1,5	8,2
2-Phenylpropene	58	489	0,7	11
2-Propanol	11	395	2	12
2-Propene-1-ol	21	375	2,5	18
2-Propenylamine	-29	370	2,2	22
3 - Bromo - 1 - propéne	-1	295	4	7,3
3 - Butene-2-one	-7	491	2,1	15,6
3,6-Diazaoctane-1,8-diamine	135	335	-	-
3-Azapentane-1,5-diamine	98	358	2	6,7
3-Chloropropene	-32	485	2,9	11,1
3-Hexanone	35 O.D.	-	~1	~8
3-Methyl-1-butene	<- 7	365	1,5	9,1

SUBSTANCES	FLASH POINT	SELF-IGNITION TEMPERATURE IN °C	INFLAMMABILITY LIMITS BY VOLUME % MIXED WITH AIR	
			LOWER	UPPER
3-Pentanone	12	450	1,6	-
4-Heptanone	49	-	-	-
4-Hydroxy-4-methyl-2-pentanone	64	600	1,8	6,9
4-Methyl-1,3-pentadiene	-34	-	-	-
4-Methyl-2-pentanol	41	-	1	5,5
4-Methyl-2-pentanone	16	448	1,2(at 93 °C)	8(at 93 °C)
4-Methylpyridine	56 O.D.	-	-	-
4-Nitrotoluene	106	-	-	-
Acetaldehyde	-37	175	4	60
Acetanilide	169 O.D.	530	-	-
Acétic acid	39	463	4	20
Acetic anhydride	49	315	2,7	10,3
Acetone	-20	465	2,6	13
Acetonitrile	2	520	3	16
Acetyle chloride	4	390	-	-
Acetylene	gaz	300	2,5	81
Acrolein	-26	220	2,8	31
Acrylic acid	49 O.D.	438	2,4	8
Acrylonitrile	0 O.D.	480	3	17
Adipic acid	196	420	-	-
Allyl and vinyl oxide	< 20 O.D.	-	-	-
Ammonia	gaz	650 (*)	15	28
Aniline	70	615	1,3	11
Anthracene	121	540	0,6	-
Anthraquinone	185	-	-	-
a-Pinene	32	255	-	-
Benzaldehyde	63	190	-	-
Benzene	-11	498	1,3	7,9
Benzoic acid	121	570	-	-
Benzoyl chloride	72	-	-	-
Benzyl acetate	90	460	-	-
Benzyl chloride	67	585	1,1	-
Biphenyl	112	540	0,6(at 111 °C)	5,8(at 155 °C)
Bis (2-hydroxyethyl) oxide	123	224	-	-
Bromobenzene	51	565	-	-
Bromomethane	diffic. inflam.	510	6,7	11
Butane	gaz	287	1,8	8,4
Butyl and vinyl oxide	- 9 O.D.	255	-	-
Butylamine	-12	310	1,7	9,8
Butylbenzene	71 O.D.	410	0,8	5,8
Butyraldehyde	-22	218	1,9	12,5
Butyric acid	72	443	2	10
Camphor (oil)	47	-	-	-
Carbon disulphide	-30	90	1,3	50
Carbon oxide	gaz	605	12,5	74
Carbon oxysulphide	gaz	-	12	29
Castor (Oil)	229	445	-	-
Chlorobenzene	28	593	1,3	9,6
Chlorodinitrobenzene	194	-	2	22
Chloroethane	-50	515	3,8	15,4
Chloromethane	gaz (- 50)	630	8,1	17,4
Crotonaldehyde	12	230	2,1	15,5
Crotonic acid	87 O.D.	396	-	-

Classified on first letter

GAS SUBSTANCES LIKELY TO FORM EXPLOSIVE ATMOSPHERES

SUBSTANCES	FLASH POINT	SELF-IGNITION TEMPERATURE IN °C	INFLAMMABILITY LIMITS BY VOLUME % MIXED WITH AIR	
			LOWER	UPPER
Cumene	36	424	0,9	6,5
Cyanogene	gaz	-	6,6	32
Cyclohexane	-20	245	1,3	8
Cyclohexanol	67	300	-	-
Cyclohexanone	43	420	1,1(at100 °C)	9,4
Cyclohexene	< - 7	244	-	-
Cyclohexyl acetate	57	330	-	-
Cyclohexylamine	31	290	-	-
Cyclopentane	< - 7	361	1,5	-
Cyclopentanone	26	-	-	-
Cyclopropane	gaz	495	2,4	10,4
Decahydronaphtalene	57	250	0,7(at100 °C)	4,9(at100 °C)
Deuterium	gaz	-	5	75
Di (2-ethylhexyl) phtalate	215 O.D.	390	0,3(at 245 °C)	-
Diallyl oxide	- 7 O.D.	-	-	-
Dibutyl oxidee	25	194	1,5	7,6
Dibutyl phtalate	157	400	0,5(at 235 °C)	-
Dibutyl Sebacate	178 O.D.	365	0,4(at 243 °C)	-
Dichlorine oxide	gaz	-	23,5	100
Dichloromethane	diffic. inflam.	556	13	22
Diesel Fuel	70-120	250-280	0,6	-
Diethyl oxide	-45	160	1,9	3
Diethyl phtalate	163 O.D.	-	-	-
Diethylacetaldehyde	21 O.D.	-	1,2	7,7
Diethylamine	-23	310	1,8	10,1
Diethylcyclohexane	48	240	0,8(at 60 °C)	6(at110 °C)
Diisopropylbenzene	76 O.D.	445	0,9	5,6
Dimethoxymethane	- 32 O.D.	235	2,2	13,8
Dimethyl phtalate	146	490	0,9(at 180 °C)	-
Dimethyl sulphide	<- 18	205	2,2	19,7
Dimethylamine	gaz	400	2,8	14,4
Dimethylsulfoxyde	95 O.D.	215	2,6	42
Dimthyl oxide	gaz	350	3,4	27
Dipentyl oxide	57	170	-	-
Diphenyl oxide	112	615	0,8	1,5
Diphenylamine	152	630	-	-
Diphenylmethane	130	485	-	-
Dipropyl oxide	21	188	1,3	7
Dipropylamine	17 O.D.	299	-	-
Disopropyl oxide	-28	440	1,4	7,9
Disulphur Dichloride	118	230	-	-
Divinyl oxide	<- 30	360	1,7	27
Divinylbenzene	76 O.D.	-	1,1	6,2
Dodecane	73	203	0,6	-
Ethane	gaz	472	3	12,5
Ethanethiol	<- 18	295	2,8	18
Ethanol	12	363	3,3	19
Ethyl acetate	-4	425	2	11,5
Ethyl acrylate	9	372	1,4	14
Ethyl and Methyl oxide	-37	190	2	10,1
Ethyl and propenyl oxide	<- 7 O.D.	-	-	-
Ethyl and Vinyl oxide	<- 46	200	1,7	28
Ethyl butyrate	24	460	-	-

SUBSTANCES	FLASH POINT	SELF-IGNITION TEMPERATURE IN °C	INFLAMMABILITY LIMITS BY VOLUME % MIXED WITH AIR	
			LOWER	UPPER
Ethyl formate	-20	455	2,8	16
Ethyl lactate	46	400	1,5(at 100 °C)	-
Ethyl nitrite	-35	90(dÉcomp.)	4	50
Ethyl propionate	12	440	1,9	11
Ethylamine	<- 18	380	3,5	14
Ethylbenzene	15	430	1	6,7
Ethylcyclobutane	<- 16	210	1,2	7,7
Ethylcyclohexane	35	238	0,9	6,6
Ethylcyclopentane	< 21	260	1,1	6,7
Ethylene	gaz	450	2,7	36
Ethylene oxide	- 17,8 O.D.	425	3	100
Ethyleneglycol	111	398	3,2	28
Formaldehyde	gaz	424	7	73
Formamide	154 O.D.	-	-	-
Formic acid	46,5	480	14,3	34
Fuels distilling between :				
Furane	< 0	-	2,3	14,3
Furfurylic alcohol	65	490	1,8	16,3
Hexanoïc acid	101	380	-	-
Hydrazine	38	23-270(*)	2,9	100
Hydrogen	gaz	500	4	75
Hydrogen cyanide	-17	535	6	41
Hydrogen sulphide	gaz	260	4	44
Isobutane	gaz	460	1,8	9,8
Isobutanol	27	415	1,7(at 51 °C)	10,6(at 94 °C)
Isobutyl acetate	17	420	1,3	10,5
Isobutylamine	-9	375	-	-
Isobutylbenzene	55	425	0,8	6
Isopentanol	42	345	1,2	9(at 100 °C)
Isopentyl acetate	25	360	1 (at 100 °C)	7,5
Isopropyl acetate	2	460	1,8	8
Isopropyl and vinyl oxide	-32	270	-	-
Isopropyl formate	-6	485	-	-
Isopropylamine	- 37 O.D.	400	-	-
Jet engine fuel JP1 (TRO)	38	255	0,67	4,96
Jet engine fuel JP3 (TR3)	-20	251	0,9	6,15
Jet engine fuel JP4 (TR4)	-20	249	0,8	5,63
Jet engine fuel JP5 (TR5)	58	246	0,6	4,53
Kerosene (lamp oil)	43-72	210	0,7	5
Limonene	45	235	0,7(at 150 °C)	6,1(at150 °C)
Linseed (oil)	220	340	-	-
Lubricating oil	150-225	260-370	-	-
Maleic anhydride	102	475	1,4	7,1
Mesityl oxide	30	344	1,4	7,2
Methane	gaz	535	5	15
Methanol	11	385	6,7	36
Methoxylbenzene	52 O.D.	475	-	-
Methyl acetate	-10	454	3,1	16
Methyl acrylate	-3	468	2,8	25
Methyl formate	-19	449	4,5	23
Methyl lactate	49	385	2,2(at 100 °C)	-
Methyl metacrylate	10 O.D.	-	1,7	8,2
Methyl propionate	-2	465	2,5	13

SUBSTANCES	FLASH POINT	SELF-IGNITION TEMPERATURE IN °C	INFLAMMABILITY LIMITS BY VOLUME % MIXED WITH AIR	
			LOWER	UPPER
Methylamine	gaz	430	4,9	20,7
Methylcyclohexane	-4	250	1,2	6,7
Methylcyclopentadiene	48	445	1,3(at 100 °C)	7,6(at 100 °C)
Methylcyclopentane	<- 7	258	1	8,3
Methyldichlorosilane	-9	316	6	55
Methylhydrazine	-8	194	2,5	92
Metyl butyrate	13	-	-	-
Mixed with water (10% alcohol)	49	-	-	-
Mixed with water (20% alcohol)	36	-	-	-
Mixed with water (30% alcohol)	29	-	-	-
Mixed with water (40% alcohol)	26	-	-	-
Mixed with water (5% alcohol)	62	-	-	-
Mixed with water (50% alcohol)	24	-	-	-
Mixed with water (60% alcohol)	22	-	-	-
Mixed with water (70% alcohol)	21	-	-	-
Mixed with water (80% alcohol)	20	-	-	-
Mixed with water (95% alcohol)	17	-	-	-
m-or p-Cresol	86	555	1,1(at150 °C)	-
Morpholine	37 O.D.	290	1,4	11,2
m-Xylene	27	525	1,1	7
N,N-Diethylaniline	85	630	-	-
N,N-Dimethylaniline	62	370	-	-
N,N-Dimethylformamide	57	445	2,2(at 100 °C)	15,2
Naphtalene	78	525	0,9	5,9
n-butyl acetate	22	420	1,7	7,6
N-butyle formate	17	320	1,7	8,2
n-Decane	46	205	0,8	5,4
n-Heptane	-5	204	1,05	6,7
n-Hexane	-22	223	1,2	7,4
Nicotine	-	240	0,7	4
Nitrobenzene	87	480	1,8(at 93 °C)	-
Nitroethane	27	414	3,4	-
Nitromethane	35	415	7,3	-
Nonane	31	205	0,8	2,9
n-pentyl acetate	16	360	1,1	7,5
n-propyl acetate	13	450	1,7(at 100 °C)	8
N-propyl formate	-3	455	-	-
N-propyl nitrate	20	175	2	100
o-Cresol	81	595	1,4(at149 °C)	-
Octane	13	206	1	6,5
Octyl acetate	71	268	0,7	8
Olive (oil)	225	340	-	-
o-Toluidine	85	480	-	-
o-Xylene	32	460	1	7
Paraformaldehyde	70	300	7	73
Peanut oil	282	445	-	-
Pentaboron			0,4	-
Pentane	<- 40	260	1,5	7,8
Pentanol	12 O.D.	222	-	-
Pentylamine	-1	-	2,2	22
Petrol (octane number 100)	-38	456	1,4	7,4
Petrol (octane number 115 at 145)	-46	440	1,2	7,1
Petrol (octane number 50 at 60)	-43	280	1,4	7,6

SUBSTANCES	FLASH POINT	SELF-IGNITION TEMPERATURE IN °C	INFLAMMABILITY LIMITS BY VOLUME % MIXED WITH AIR	
			LOWER	UPPER
Petrol A	< 0	230-240	1	6,5
Petrol B	< 0	245	1	6,5
Petrol C	< 0	230-260	1	6,5
Petrol E	< 0	230-260	1	6,5
Petrol F	< 0	230-260	1	6,5
Petrol G (ether petrol)	< 0	245	1	6,5
Petrol H	< 0	230-260	1	6,5
Phenol	79	715	1,8	-
Phenylhydrazine	88	-	-	-
Phosphoru trihydride	gaz	100	2	-
Phtalic anhydride	151	570	1,7	10,5
Pinane	-	273	0,7(at 160 °C)	7,2(at 160 °C)
Piperidine	16	-	-	-
p-Isopropyltoluene	47	435	0,7(at 100 °C)	5,6
Propane	gaz	450	2,2	10
Propanol	-30	205	2,6	17
Propene	gaz	455	2	11,1
Propionic acid	52	465	2,9	12,1
Propionic anhydride	63	285	1,3	9,5
Propionyl chloride	12	-	-	-
Propylamine	-37	315	2	10,4
Propylbenzene	30	450	0,8	6
Propylene oxide	-37	449	2,3	37
p-Xylene	27	525	1,1	7
Pyridine	20	480	1,8	12,4
Silane	gaz			
Soya (Oil)	280	440	-	-
Stéaric acid	196	395	-	-
Styrene	31	490	1,1	7
Tartric acid	210 O.D.	425	-	-
Tetradecane	100	200	0,5	-
Tetrahydrofuranne	-14	320	2	11,8
Tetrahydronaphtalene	71	380	0,8(at 100 °C)	5(at 150 °C)
Tetrahydropyranne	-20	-	-	-
Tetramethylpentane	< 21	430	0,8	4,9
Toluene	4	480	1,2	7,1
Tributyl Phosphate	146 O.D.	-	-	-
Tributylamine	86 O.D.	-	-	-
Trichloroethylene	diff. infl.	410	8(at 25 °C)	10,5(at 25 °C)
Triethylamine	- 7 O.D.	249	1,2	8
Triethyleneglycol	176 O.D.	370	0,9	9,2
Trimethylamine	gaz	190	2	11,6
Tri-o-tolyl phosphate	225	385	-	-
Tripentylbenzene	132 O.D.	-	-	-
Triphenyl phosphate	220	-	-	-
Tripropylamine	40	-	-	-
Turpentine	35	250	0,8	-
Vinyl acetate	-8	402	2,6	13,4
Vinyl butyrate	20 O.D.	-	1,4	8,8
Vinyl chloride	gaz	470	3,6	33
Vinyl propionate	1 O.D.	-	-	-
White-spirit	30-65	230-260	1,1	6,5

EN/IEC 60079-12 STANDARDS

These gases or vapors are classified in three subdivisions : A, B and C, depending on their experimental safety gap (IEMS) and their minimum inflammation current (CMI).

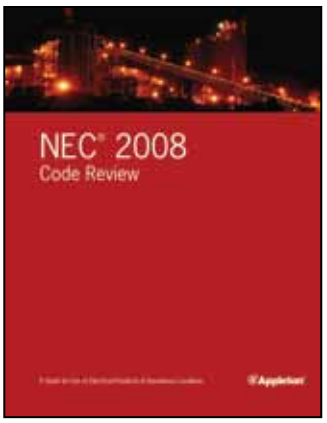
SUBDIVISION A			SUBDIVISION B
HYDROCARBONS	**COMPOUNDS CONTAINING OXYGEN**	**COMPOUNDS CONTAINING HALOGENS**	**HYDROCARBONS**
ALKANES :	**ACIDS :**	**COMPOUNDS WITH NO OXYGEN :**	Allylene (Propyn)
Butane	Acetic acid	Bromoethane	Butadiene
Cyclobutane	**ALCOHOLS ET PHENOLS :**	Bromobutane	Cyclopropane
Cycloheptane	Butanol	Chlorobenzene	Ethylene
Cyclohexane	Cresol	Chlorobutane	**COMPOUNDS CONTAINING NITROGEN :**
Cyclopentane	Cyclohexanol	Chloroethane	Hydrocyanidric acid
Decahydronaphtalene	Diacetone-alcohol	Chlorethylene	Acrylonitrile
(decaline)	Ethanol	(Vinyl chloride)	Isopropyl nitrate
Decane	Heptanol	Chloromethane	**COMPOUNDS CONTAINING OXYGEN :**
Ethane	Hexanol	Chloropropane	Acrolein
Ethylcyclobutane	Methanol	Allyl chloride	Ethyl acrylate
Ethylcyclohexane	Methylcyclohexanol	Benzyl chloride	Methyl acrylate
Ethylcyclopentane	Monanol	Methylene chloride	Tetrahydrofurfuryl alcohol
Heptane	Octanol	Dichlorobenzene	Crotonaldehyde
Hexane	Pentanol	Dichloroethane	Dioxalan
Methane	Phenol	Dichloroethylene	Dioxan
Methylcyclobutane	Propanol	Dichloropropane	Epoxy-propane
Methylcyclohexane	**ALDEHYDES :**	Benzyl trifluoride	Butyl ether of hydroxyacetic acid
Methylcyclopentane	Acetic Aldehyde	**COMPOUNDS CONTAINING OXYGEN :**	Butyl ether
Nonane	Metaldehyde	Chloroethanol	Ethylic ether
Octane	**KETONES :**	Acetyl chloride	Ethyl méthyl ether
Pentane	Acetone	**COMPOUNDS CONTAINING SULPHURS :**	Méthylic ether
Propane	Amyl-methyl-ketone	Ethyl mercaptan	Furane
ALKANES :	Butyl-methyl-ketone	Propyl-mercaptan	Ethylene oxide (epoxyethane)
Propene (propylene)	Cyclohexanone	Tetrahydrothiophene	Tétrahydrofuran
Aromatic	Ethyl-methyl-ketone	Thiophene	Trioxane
HYDROCARBONS :	2,4 - Pentanedione	**COMPOUNDS CONTAINING SULPHURS :**	Mixtures
Methylstyrene	(acetylacetone)	Ammonia	Gas from a coke furnace
Styrene	Propyl-methyl-ketone	Acetonitrile	**COMPOUNDS CONTAINING HAOGENS :**
Benzenic	**ESTERS :**	Nitroethane	Propane, 1 chloro, 2,3 epoxy
HYDROCARBONS :	Methyl acetate	Nitromethane	(épichlorhydrin)
Benzene	Ethyl acetate	**AMINES :**	Tétrafluorethylene
Cumene	Propyl actate	Amphetamine	
Cymene	Butyl acetate	Aniline	**SUBDIVISION C**
…thylbenzene	Amyl acetate	Butylamine	Acetylene
Naphtalene	Vinyl acetate	Cyclohexylamine	Carbon disulphide
Toluene	Ethyl Acetylacetate	Diaminoethane	Hydrogen
Trimethylbenzene	Methyl formate	Diethylamine	Ethyl nitrate
Xylene	Ethyl formate	Diethylaminoethanol	
MIXTURES OF HYDROCARBONS :	Ethyl methacrylate	Dimethylamine	
Benzol for cars	Methyl methacrylate	Dimethylaniline	
Gas-oil	**OXIDES (INCLUDED ETHERS) :**	Methylamine	
Kerosene	Dipropyl ether	Mono-ethanolamine	
Fuel oil	Carbon monoxide (2)	Propylamine	
Industrial methane (1)		Pyridine	
Oil naphta		Toluidine	
Petroleum naphta		Triethylamine	
Petroleum (included		Trimethylamine	
petroleum spirits)			
Dry cleaning solvents			
Turpentine			

STANDARD NEC 500

ACCORDING TO NEC 500	
CLASS I	**CLASS II**
GROUP A	**GROUP E, F, G**
Acetylene	Combustible Dusts
GROUP B	
Butadiene	**CLASS III**
Hydrogen	Fibers and Flyings
Ethylene oxyde	
Propylene oxyde	
GROUP C	
Acetaldehyde	
Cyclopropane	
Diethyl ether	
Ethylene	
Dimethyl hydrazine	
GROUP D	
Acetane ethyl	
Butyl acetate	
Vinyl acetate	
Isobutyl acetate	
Acetone	
Acrylonitrile	
Amyl alcohol	
Butylalcohol	
Tertiary butyl alcohol	
Butyl-2 alcohol	
Ethyl alcohol	
Isoamyl alcohol	
Isobutyl alcohol	
Isopropyl alcohol	
Propyl alcohol	
Benzene	
Butane	
Ethylene Chloride	
Vinyl chloride	
Petrol	
Ethane	
Ammonia gas	
Heptane	
Hexane	
Isoprene	
Methane	
Methanol	
Methylisobutyl ketone	
Petroleum naphta	
Octane	
Pentane	
Propane	
Propylene	
Styrene	
Toluene	
Xylene	

Appleton is our premium line of industrial electrical products under EGS Electrical Group, a division of Emerson Industrial Automation.

Every three years the National Fire Protection Association (NFPA) updates the standards in the National Electrical Code. The NEC covers installation of electrical products in the United States and their applications.

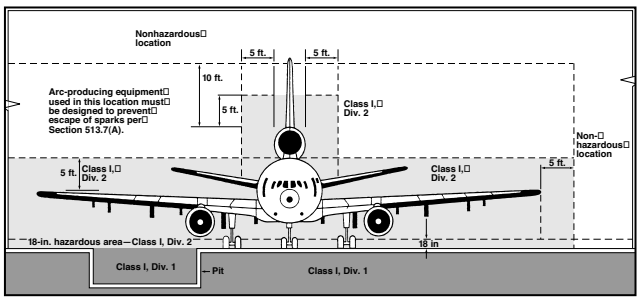


"NEC 2008 CODE REVIEW" BY APPLETON ELECTRIC, LLC

Appleton published the "Appleton NEC 2008 Code Review" in English, which, in line with the ATX Guide on IEC and CENELEC standards, aims to provide a better understanding of North American standards (National Electric Code).

This detailed technical reference covers the use of electrical products and the changes made in the NEC covering the hazardous location Articles applicable to Appleton products. All the information required to study and set up electrical installations in an industrial context is contained in this document, including hazardous areas and their classifications, with strict adherence to NEC 2008 standards with useful explanations helping you select the right material for each application.

The NEC 2008 Code Review is considered a reference worldwide, and is available on request. For more information, contact your local representative or visit the website at www.appletonelec.com.



EXTRACTS FROM APPLETON GUIDE

EXTRACT FROM THE "SILO GUIDE" *

From 30th July 1985, a specific heading has been devoted to silos for storing cereals, grain, food products or any organic product which releases flammable dust :

IN SILO OR STORAGE INSTALLATION

a) If the storage volume is more than 15,000 m3, requirement of authorization (previous classes 1 and 2) in 3 Km radius area where notification of the hazard is mandatory.
b) If the total storage volume is more than 5,000 m3, but no more than 15,000 m3, requirement of declaration (previous class 3).

UNDER AN INFLATABLE STRUCTURE OR IN A TENT

a) If the total volume of the inflatable structure or the tent is more than 100,000 m3: requirement of authorization (old classes 1 and 2), display radius 3 km.
b) If the total volume of the inflatable structure or the tent is more than 10,000 m3 but no more than 100,000 m3: requirement of declaration (previous class 3).

THE FOLLOWING PROCEDURE SHOULD BE OBSERVED :

- The end-user draws up the inventory of fixed machines involved in the operation of installations with an indication of the power rating for each one. He systematically identifies those which perform:

a) Operations directly related to product storage (conveyors, elevators, etc)
b) Work on products (grinding, cleaning, sieving, etc)
c) Packaging of products (weighing, bagging, pulverizing, etc)
d) Ventilation of storage cubicles and bins in addition to suction of dust-filled gases for purification prior to discharge and suction of dust-free gases prior to discharge into the atmosphere.

On the basis of this inventory, the combined power ratings at b) and c), wherever they are located within the facilities, should then be taken into account.

HAZARDOUS ZONES IN SILOS

The Guide provides a useful insight into the determination of hazardous locations in atmospheres containing potentially explosive dust.

ZONE 20

- Location where a potentially explosive atmosphere in the form of a cloud of combustible dust is continuously present in the air for long periods or on frequent occasions.

ZONE 21

- Location where a potentially explosive atmosphere in the form of a cloud of combustible dust may occur occasionally during normal operation.

ZONE 22

- Location where a potentially explosive atmosphere in the form of a cloud of combustible dust is not likely to occur during normal operation or, if it does occur, only lasts for a short time.

ZONE CLASSIFICATION

ELECTRICAL INSTALLATIONS	ZONE CLASSIFICATION
Filters - Pipes for dust-filled air	20
Elevators	20 or 21
Grain dispenser onto conveyor belt (alongside the spout) (the efficiency of suction is critical here)	21 or 22
Chain conveyor system: where the grain is discharged only	21
Chain conveyor system: in the conveyor body	22
Cleaner-separator and similar appliances	20 or 21
Receiving tank: in the tank, above the grille behind the grain chute (if it is a confined space)	22
Closed cubicles during filling (due to possible deposits of dust)	21 or 22
Bottom of boxes or cubicles during drainage by ventilation. The other parts of the silo should not be classified as Zones at risk of explosion. For example: open areas during filling, conveyor belts (except during grain feed). Top of silo: tops of open cubicles, gangways, unconfined external receiving tanks."	21 or 22

Depending on its location in the silos, the appropriate electrical equipment should be classified Zone 20, 21 or 22.

APPLETON ADVICE

Following informations are given just as an example to explain the French rules on those subjects : please identify in your country the equivalent and remember, if there is no rule, that gas, vapor and dust have no nationality: the way to explode or protect yourselves are the same everywhere.

* *Guide produced in France by the members of the FFCAT technical commission and various authorities (Apave, Véritas, INRS, Groupama, CRAM, etc), summarizing standards EN 50281-1-1 and 2.*

These tables define the types of product required in premises where potentially explosive dust is present.

APPLETON'S RECOMMENDATION

It is essential to select ATEX-certified equipment for Zones 21 and 22 to prevent any likelihood of risks of explosion in premises where potentially explosive dust is present.

TYPES OF PRODUCT ACCORDING TO ZONES

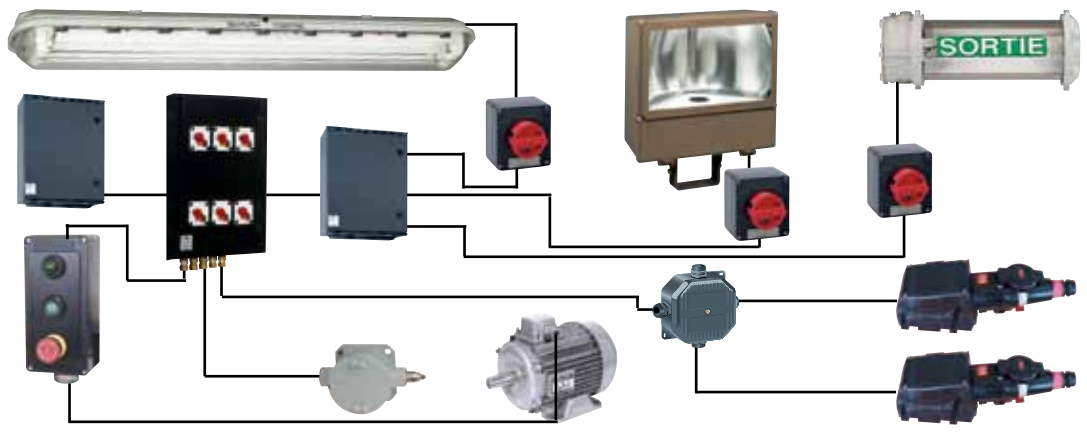
TYPE OF ZONE	ZONE 20	ZONE 21 OR ZONE 22 WITH CONDUCTING DUST (3)	ZONE 22
Group (surface- mounted appliance)	II	II	II
Product categories 1,2,3 dust D for dust	1D (4)	2D (4)	3D (4)
Identification in accordance with Directive 94/9/EC	II 1 D	II 2 D	II 3 D
CE marking	CE xxx	CE xxx	CE xxx
Protection index	IP 6x	IP 6x	IP 5x
Surface temperature (1) (2)	to be checked according to product or dust		

SELF-IGNITION TEMPERATURES

DUST	SELF-IGNITION TEMPERATURE °C		MINIMUM EXPLOSION CONCENTRATION (CLOUD) (G/M3)	MAXIMUM PRESSURE BUILD-UP SPEEDS (BAR/S)
	LAYER	CLOUD		
Peanuts (husks)	380	400	45	560
Cocoa	240	510	75	85
Unprocessed cotton	520	–	190	30
Cork	210	460	35	500
Malt	250	400	55	300
Rice	450	510	85	50
Soya (flour)	340	550	60	55

(1) Note for France : Value given by the Silo Guide cereal producers: + 125 °C.
(2) For all dust products, refer to the INRS tables: Manual due to be reprinted. 1st half of 2004.
(3) Conductive dust = R ≤ 103 Ω m.
(4) with non-conductive dust

APPLETON : A COMPLETE RANGE FOR ZONES 21 & 22



Following informations are given just as an example to explain the French rules on those subjects : please identify in your country the equivalent information.

DUST	SELF-IGNITION TEMPERATURE °C		MINIMUM IGNITION ENERGY (CLOUDS) (MJ)	MINIMUM EXPLOSION CONCENTRATION (CLOUDS) (G/M3)
	LAYER	CLOUD		
AGRICULTURAL DUST				
Cellulose	270	480	80	55
Cocoa	240	510	100	75
Cork	210	460	35	35
Corn starch	-	380	30	40
Dextrin	390	410	40	40
Flour/wheat	440	440	60	50
Malt	250	400	35	55
Milk powder	200	490	50	50
Peanuts (husks)	210	460	50	45
Rice	450	510	100	85
Soya (flour)	340	550	100	60
Starch (wheat)	380	400	25	25
Sugar	400	370	30	45
Unprocessed cotton	520	-	100	190
Wheat (bulk)	220	500	60	65
Wood/pine (sawdust)	260	470	40	35
METALLIC DUST				
Aluminium flakes (*)	400 to 900	600 to 700	10 to 100	40 to 60
Aluminium powder (*)	490 to 700	550 to 800	15 to 160	40 to 140
Antimony	330	415	1 900	420
Cadmium	250	570	4 000	-
Copper	-	900	-	-
Electrolytic chromium	400	580	40	230
Ferro-silicon (88% Si)	-	860	400	425
Ferro-titanium	400	370	80	140
Ground aluminium (*)	460 to 900	550 to 700	50 to 120	45 to 120
Ground magnesium	430	560	40	30
Iron pentacarbonyl	310	320	20	105
Iron reduced with hydrogen	290	320	80	120
Magnesium-aluminium				
(Dow metal)	480	430	80	20
Manganese	240	460	305	125
Pulverised lead	270	710	-	-
Silicon	950	780	96	160
Thorium	280	270	5	75
Thorium (hydride)	20	260	3	80
Tin	430	630	80	190
Titanium	510	330	25	45
Titanium (hydride)	540	480	60	70
Uranium	100	20	45	60
Uranium (hydride)	20	20	5	60
Vanadium	490	500	60	220
Zinc	540	690	960	460
Zirconium	300	350	120	45
Zirconium (hydride)	270	350	60	85
CHEMICALS				
1,4-benzenediamine	430	380	15	20
2,2' -Azobis (isobutyronitrile)	350	430	25	15
2,6-Di-tert-butyl-4-cresol	-	470	20	20
Acetylsalicylic acid				
(aspirin)	melts	660	25	50
Adipic acid	-	550	60	35
Benzoic acid	melts	620	20	30
Biphenyl	-	630	20	15
Bisphenol A	-	570	15	20
Diallyl phthalate	-	480	20	30
Dicumyl peroxide	180	560	30	45
Dimethyl isophthalate	-	580	15	25
Fumaric acid	-	520	35	85
Hexamethylenetetramine	-	410	10	15
Hydroxyethylcellulose	-	410	40	25
Mannitol	-	460	40	65
Pentaerythritol	-	450	10	30
Phenyl-ß-naphthylamine	-	680	25	25
Phthalic anhydride	-	650	15	15
Soap	500	640	120	83
Sulphur	220	190	15	35
Terephthalic acid	-	680	20	50
Vitamin B1 nitrate	-	360	60	35
Vitamin C (ascorbic acid)	280	460	60	70
Zinc stearate	melts	510	10	20

DUST	SELF-IGNITION TEMPERATURE °C		MINIMUM IGNITION ENERGY (CLOUDS) (MJ)	MINIMUM EXPLOSION CONCENTRATION (CLOUDS) (G/M3)
	LAYER	CLOUD		
CARBONATED MATERIALS				
Asphalt	550	510	40	35
Bituminous coal	180	610	30	50
Charcoal	180	530	20	140
Coal (anthracite)	-	730	100	65
Reference coal (Pittsburgh)	170	610	60	55
Tar	-	630	25	45
Carbon black	900	no ignition	-	-
Graphite	580		-	-
Lignite	200	450	30	30
Smoke black	-	730	-	-
PLASITCS, RUBBERS				
Polycarbonate	-	710	25	25
Polyvinyl butyral	-	390	10	20
Polyvinyl chloride	400	660	flame on hot surface	
A.B.S. (Acrylonitrile Butadiene Styrene)	-	480	20	25
Carboxymethylcellulose	310	460	140	60
Cellulose acetate	-	420	15	40
Rubber containing chlorine	290	940		
			flame on hot surface	
Ethylcellulose	350	370	10	25
Ground polystyrene	-	560	40	15
Methylcellulose	340	360	-	30
Methyl polymethacrylate	-	480	20	30
Nylon				
(hexamethylene polyadipamide)	430	500	20	30
Poly-2-propylene-1-ol	-	510	20	35
Poly-2-propylene-1-ol + glass fiber	-	540	1 600	345
Polyacrylonitrile	460	500	20	
Polyester (styrene-glass fibre)	360	440	50	45
Polyethylene	380	450	30	20
Polyformaldehyde	-	440	20	35
Polypropylene	-	420	30	20
Polystyrene (latex)	500	500	15	20
Shellac	-	390	10	15
Styrene-acrylonitrile				
copolymer	-	500	30	35
Styrene-butadiene copolymer	-	440	35	25
Styrene maleic anhydride				
copolymer	490	470	20	30
Synthetic rubber (33% sulphur)	-	320	30	30
Unprocessed rubber	-	350	50	25
Vinyl polyacetate	-	550	160	40
Vinyl polyacetochloride	-	690	no ignition	flame on hot surface
Coumarin-indene resin	-	550	10	15
Flameproof polyurethane foam	390	550	15	25
Formic				
melamine-aldehyde resin	-	810	320	85
Formic				
phenol-aldehyde resin	-	580	15	25
Ground alkyl resin	270	500	120	155
Ground formic urea-aldehyde				
resin	-	460	80	85
Non-flameproof polyurethane foam	440	510	20	30
Petroleum resin (blown				
asphalt)	500	510	25	25
Phenol-2-furaldehyde resin	-	530	10	25
Pure epoxy resin	-	540	15	20
Sodium resinate	220	350	60	40
Viscose (rayon)	250	520	240	55

RULES FOR TEMPERATURE LIMITATION

a) Cloud of dust
Temperature limitation due to the presence of a cloud of dust.
The maximum surface temperature of the equipment must not exceed two-thirds of the ignition temperature, in degrees Celsius, of the dust/air mixture under consideration :
T°max = 2/3 Tci.
- Tci being the ignition temperature of a cloud of dust.

b) Layer of dust
Temperature limiting due to the presence of a layer of dust of less than 5 mm :
T°max = 5 mm - 75 K.
- 5 mm being the ignition temperature of a layer of dust no more than 5 mm thick.
- 75 K being the safety factor equal to + 75 °C.

c) If the layer is more than 5 mm thick, the maximum permissible surface temperature should be reduced.

DUST IGNITION CHARACTERISTICS

		CLOUD OF DUST		5 MM LAYER OF DUST		
	AVERAGE PARTICLE SIZE µm	SELF-IGNITION TEMPERATURE °C (T1)	MAXIMUM SURFACE TEMPERATURE °C OF THE EQUIPMENT (2/3 OF T1)	SELF-IGNITION TEMPERATURE °C (T2)	MAXIMUM SURFACE TEMPERATURE °C OF THE EQUIPMENT (T2-75 °C)	MAXIMUM SURFACE TEMPERATURE °C
Unprocessed cotton	< 75	–	–	+ 520	+ 445	–
Rice	< 75	+ 510	+ 340	+ 450	+ 375	+ 340
Wheat flour	< 75	+ 440	+ 293	+ 440	+ 365	+ 293
Dextrin	< 75	+ 410	+ 273	+ 390	+ 315	+ 273
Starch (wheat)	< 75	+ 400	+ 267	+ 380	+ 305	+ 267
Soya (flour)	< 75	+ 550	+ 367	+ 340	+ 265	+ 265
Corn starch	< 75	+ 380	+ 253	–	–	–
Sugar	< 75	+ 370	+ 247	+ 400	+ 325	+ 247
Cellulose	< 75	+ 480	+ 320	+ 270	+ 195	+ 195
Wood/pine (sawdust)	< 75	+ 470	+ 313	+ 260	+ 185	+ 185
Malt (Barley)	< 75	+ 400	+ 267	+ 250	+ 175	+ 175
Cocoa	< 75	+ 510	+ 340	+ 240	+ 165	+ 165
Wheat (bulk)	< 75	+ 500	+ 333	+ 220	+ 145	+ 145
Cork	< 75	+ 460	+ 307	+ 210	+ 135	+ 135
Peanuts (husks)	< 75	+ 460	+ 307	+ 210	+ 135	+ 135
Milk powder	< 75	+ 490	+ 327	+ 200	+ 125	+ 125

Important: the characteristics may vary according to the humidity and the grading size of the sample under consideration.
The optimum values must therefore be taken into account when calculating the maximum surface temperature.

APPLETON ADVICE

Following informations are given just as an example to explain the French rules on those subjects : please identify in your country the equivalent and remember, if there is no rule, that gas, vapor and dust have no nationality: the way to explode or protect yourselves are the same everywhere.

SELECTING EQUIPMENT IN DUST ENVIRONMENT

The various regulations have taken account of a certain number of dusts, most commonly found in clouds or layers. The tables on these two pages can be used to determine, for each type of site, the type of dust likely to be present and their self-ignition temperatures. This will enable you to determine the equipment classification to be used.

TABLE OF FOOD PROCESSING DUST

FIELD OF APPLICATION OF PREMISES	DUST		STARCH	PEANUTS	WHEAT	WOOD/PINE (SAWDUST)	COCOA	UNPROCESSED COTTON	CELLULOSE	DEXTRIN	WHEAT FLOUR	CORN STARCH	MILK POWDER	COK	MALT	RICE	SOYA (FLOUR)	SUGAR
	SELF-IGNITION TEMPERATURE °C	L	380	210	220	260	240	520	270	390	440	-	200	210	250	450	340	400
		C	400	460	500	470	510	-	480	410	440	380	490	460	400	510	550	370
Heading 2160: Silos and Installations for storage of cereals, grain, food products or any organic products, etc	125	L	X	X	X		X				X	X	X			X	X	
Heading 2225: Sugar factories, sugar refinery, malt house	175	L													X			X
Heading 2410: Wood or similar material	185	L				X												
Heading 2271: Manufacture of dextrin	315	L								X								
Heading 2311: Processing of vegetable fibres, etc	195	C						X	X									
Heading 2226: Starch mill	305	C	X									X						

"L" = layer
"C" = cloud

Highest temperature of the installation including the equipment *(according to the calculation on page G:29).*

If any of the elements are not present in the installation, use the most restrictive that is actually present.

TABLE OF DUST FOUND IN THE PHARMACEUTICAL INDUSTRY

DUST	PARTICLE SIZE	SELF-IGNITION TEMPERATURE	MINIMUM CONCENTRATION (9/µ3)
Acetylsalicylic acid	400µ	550 °C	60
Ascorbic acid	39µ	490 °C	60
Paracetamol	120µ	–	30
Extract of rosemary	30µ	380 °C	30
Valerian powder	78µ	–	100

Tests conducted in a laboratory are used to assess the risks of explosion of products used in the pharmaceutical industry.

PRODUCT SELECTION CRITERIA ACCORDING TO THE TYPE OF DUST

DUST	SELF-IGNITION TEMPERATURE °C OF DUST IN A LAYER	MAX. SURFACE TEMPERATURE °C = T-75°	SELF-IGNITION TEMPERATURE °C OF DUST IN A CLOUD	MAX. SURFACE TEMPERATURE °C = 2/3 T°
Starch (Wheat)	+ 380	+ 305	+ 400	+ 267
Wheat (bulk)	+ 220	+ 145	+ 500	+ 333
Wood/Pine (sawdust)	+ 260	+ 185	+ 470	+ 313
Cellulose	+ 270	+ 195	+ 480	+ 320
Flour/wheat	+ 440	+ 365	+ 440	+ 293
Corn starch	–	+ 125	+ 380	+ 253
Milk powder	+ 200	+ 125	+ 490	+ 327
Sugar	+ 400	+ 325	+ 370	+ 247

Important: for dust, the temperature is clearly indicated according to the type of dust and whether it is in clouds or layers.

PROTECTION AGAINST ELECTRIC SHOCKS

This relates to the risk of so-called indirect contact as a result of a fault in the insulation between the active parts and the earth of the load.

The EN/IEC 61140 standard defines the following four classes :

CLASS 0

- Single functional insulation, no possibility of connecting metal earths to a protective conductor (this kind of equipment is prohibited even in non hazardous Zones).

CLASS 1

- Single functional insulation, obligatory presence of an ear thing terminal for the earths.

CLASS 2

- Double insulation or reinforced insulation identified by two concentric squares (international symbol) ⧈

CLASS 3

- Equipment supplied at a voltage not exceeding the limits of extra low voltage (ELV) and not having any internal or external circuits operating at a voltage above these limits.

Moreover, article 15 of the EN/IEC 60079-0 standard stipulates, for all equipment for explosive atmospheres, at least one connection element for the protective conductor or the conductor for the equipotential earth connection.

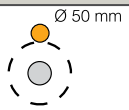
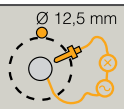
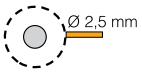
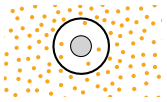
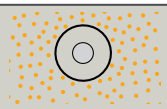
NB : classes 2 and 3 do not provide any additional protection with regard to the risk of explosion.

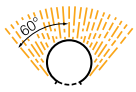
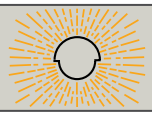
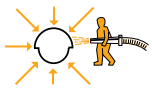
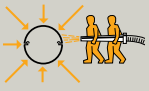
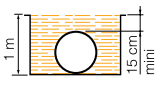
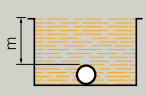
ELECTRICAL CLASSES

CLASS	PROTECTION
Class 0	Insulation by construction without connection to earth
Class 1	Double insulation without connection to earth
Class 2	Adapted to extra low voltage (< 50V)

The electrical class defines the protection of people against indirect electrical contacts

PROTECTION INDEXES FOR ELECTRICAL ENCLOSURES IN ACCORDANCE WITH EN/IEC 60529 STANDARDS

1ST FIGURE: PROTECTION AGAINST SOLID BODIES		
IP	TESTS	
0		No protection
1		Protected against solid bodies larger than 50 mm (e.g. accidental contact with the hand)
2		Protected against solid bodies larger than 12.5 mm (e.g. finger of the hand)
3		Protected against solid bodies larger than 2.5 mm (tools, wires)
4		Protection against solid bodies larger than 1mm (fine tools, small wires)
5		Protected against dust (no harmful deposit)
6		Completely protected

2ND FIGURE: PROTECTION AGAINST LIQUIDS		
IP	TESTS	
0		No protection
1		Protected against vertically-falling drops of water (condensation)
2		Protected against drops of water falling at up to 15° from the vertical
3		Protected against drops of rainwater at up to 60° from the vertical
4		Protected against projections of water from all directions
5		Protected against jets of water from all directions
6		Completely protected against jets of water of similar force to heavy seas
7		Protected against the effects of temporary immersion
8		Protected against effects of prolonged immersion under specified conditions

IP LETTER	DESCRIPTION
H	High voltage apparatus
M	Motion during water test
S	Stationary during water test
W	Weather conditions

PROTECTION AGAINST MECHANICAL SHOCKS

The table below gives the impact (in joules) for Group II equipment. It is an extract from the EN/IEC 60079-0 standard.

N.B. : When an item of electrical equipment is subjected to tests corresponding to a low risk of mechanical danger, it must be marked with the symbol « X » in accordance with article 26.4.2 and 29.2i.

The indication « X » placed at the end of the certificate number can also indicate particular conditions of use.

ATX products are designed and certified to resist to high mechanical shock.

GROUP II EQUIPMENT	SHOCK ENERGY (IN JOULES)	
RISK OF MECHANICAL DANGER	HIGH	LOW
1. Grids, protective covers, protective caps for fans, cable entries	7	4
2. Plastic enclosures	7	4
3. Lightweight alloy or cast-iron enclosures	7	4
4. Enclosures of a material other than with walls 3 mm thick - less than 3 mm for Group I - less than 1 mm for Group II	7	4
5. Translucent parts without protective device	4	2
6. Translucent parts with grid (tests to be carried out without the grid)	2	1

IK TABLE

IK CODE	IK 00	IK 01	IK 02	IK 03	IK 04	IK 05	IK 06	IK 07	IK 08	K 09	IK 10
Shock energy (in joules)	0	0.15	0.20	0.35	0.50	0.70	1	2	5	10	20

By way of comparison : protection against mechanical shocks in accordance with article 4.2 of EN/IEC 62262.

With respect to EMC (Electromagnetic compatibility), equipment must comply with the EMC Directive 89/336 EC, modified by directives 92/3, 93/68 and 93/97 EC, which stipulate 2 main requirements :

1- EMISSION

The appliance must not emit interference or disturbance likely to affect other equipment.

2- IMMUNITY

The appliance must be resistant to the effects of surrounding electrical equipment (for example, starting of motors or pumps, variable speed drives, etc.).

DIRECTIVES 89/336, 92/31, 93/68 AND 93/97 CE

EMISSION
IN ACCORDANCE WITH NF EN 50081-2
EMISSION TESTS
EN/IEC 55015
Insertion loss (C)
Conducted interference (C)
Radiated interference (R)

IMMUNITY
IN ACCORDANCE WITH NF EN 50082-2
IMMUNITY TESTS
EN/IEC 61547
EN/IEC 61000-4-2 Electromagnetic discharges (C)
EN/IEC 61000-4-3 Immunity to radiated fields (R)
EN/IEC 61000-4-8 Power frequency magnetic fields (C)
EN/IEC 61000-4-4 Fast transient/burst (C)
EN/IEC 61000-4-6 Induced conducted interference (C)
EN/IEC 61000-4-5 Lighting surges (C)
EN/IEC 61000-4-11 Voltage dips and interruptions (C)

(C) ==> Conduction
(R) ==> Radiated

There are several protection modes recognized by the IEC.

ZONE	IDENTIFICATION LETTERS	EN/IEC STANDARDS	PROTECTION METHODS
GAS AND VAPORS			
Zone 0	ia	60079-11	Intrinsically safe
	ma	60079-18	Encapsulated
	op Is	60079-28	Intrinsically safe optical radiation
Zone 1	d	60079-1	Flameproof
	e	60079-7	Increased safety
	ib	60079-11	Intrinsically safe
	mb	60079-18	Encapsulated
	o	60079-6	Immersed in oil
	p	60079-2	Internal over-pressure
	q	60079-5	Filled with powder
Zone 2	ic	60079-11	Intrinsically safe
	mc	60079-18	Encapsulated
	nA	60079-15	Non sparking equipment
	nC	60079-15	Equipment glittering sparks but contacts protected by enclosure other than nR, nL or nZ
	nL	60079-15	Equipment with limited energy
	nR	60079-15	Enclosure with restricted breathing
	nZ	60079-15	Enclosure with simple internal over-pressure
DUSTS			
Zone 21	iD	61241-11	Intrinsically safe
	mD	61241-11	Encapsulated
	pD	61241-4	Over pressurization
	lD	61241-1	Protection by enclosure

DEFINITION

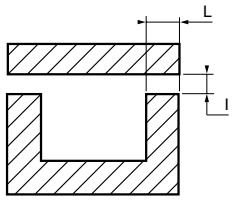
A flameproof enclosure must be able to fulfil three criteria :

- Contain an internal explosion without permanent distortion.
- Guarantee that the explosion cannot be transmitted to the surrounding atmosphere.
- Exhibit a temperature at all points on the surface which is lower than the spontaneous ignition temperature of the surrounding gases or vapors.

EXPLOSION GROUP OF A FLAMEPROOF ENCLOSURE

Experimental studies of explosions has shown that there are values for the flange width (L) and for the gap (i) which make it impossible for an explosion to spread outside an enclosure which is not perfectly tight.

These values are directly linked to the explosive capacity of the atmosphere in question, and are classed in 4 groups :
I, II A, II B or II C *(see « Marking »)*.



- For example, the value of the gap « i» for a flange 12.5 mm long and for a volume < 100 cm3, dependent on the explosion group, is as follows :
  I : ≤ 0.4 mm (flanged path)
  II A : ≤ 0.3 mm (flanged path)
  II B : ≤ 0.2 mm (flanged path)
  II C : ≤ 0.15 mm (spigot path)

All the values for the gap « i » as a function of the seal « L » are given in the EN/IEC 60079-1 standard.

TEMPERATURE CLASS

The flameproof enclosure must not exhibit temperatures on its external surface which are capable of becoming sources of spontaneous ignition. Equipment is therefore classified according to their maximum external temperature. There are six temperature classes : T1, T2, T3, T4, T5, T6 *(see « Marking »)*.

MARKING

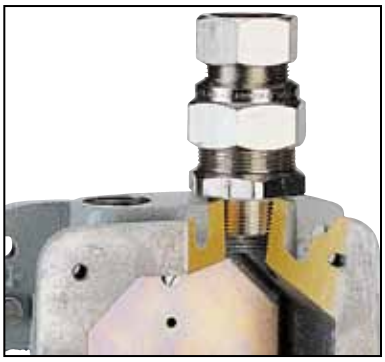
The marking of flameproof « d » must bear the information stipulated by the 94/9 CE ATEX Directive for Europe and IEC 60079-0 for the rest of the world.

TEMPERATURE CLASS	MAXIMUM SURFACE TEMPERATURE °C (MST)
T1	450
T2	300
T3	200
T4	135
T5	100
T6	85

CABLE ENTRIES

It is necessary to lubricate the thread and to ensure that at least 5 threads are engaged for metric thread and at least 3.5 threads are engaged for NPT threads.

Holes which are not used for cable entries must be blanked using the appropriate blanking plugs.



II2G Ex d IIB T6	
II	Surface industry.
2	Category 2 corresponding to Zone 1.
G	Gas.
Ex	Equipment designed to operate in an explosive atmosphere. (Products certified ATEX are marked EEx and marked Ex for the products certified IEC).
d	This letter designates the mode of protection by flameproof enclosure. The construction of this enclosure must be such that it withstands the pressure of a possible internal explosion and prevents it from spreading to the exterior. It is characterized in particular by the dimensions of its seals and gaps.
II	This is the electrical equipment group according to its destination. There are two groups : • **Group I** Electrical equipment intended for underground work in mines with explosive atmospheres. • **Group II** Electrical equipment intended for surface work.
B	Subdivision of gases *(see page G:24)* taken into account for the dimensions of flamepath.
T6	It is the temperature class of the equipment. It indicates the maximum surface temperature during operation (while respecting a safety margin in the event of an accident involving the air-conditioning or ventilation). • There are six temperature classes *(see chart left)*.

CONNECTION TERMINALS

The certificate of conformity does not stipulate the type of terminals to be used in a flameproof enclosure. Only the connection precautions given in the technical data sheets need to be followed.

LIGHTING

In lighting equipment use only lamps of the type and power specified for that equipment.

LUBRICATION OF FLAMEPATH

The equipment is supplied with the joint flanges lubricated. When the equipment is installed, the path must be lubricated to keep them in good condition. Use a non-hardening, anti-corrosive grease.

- For the flange and spigot path on boxes and enclosures : multi-purpose grease, for use at temperatures - 30 to + 130 °C, such as Antar multi-purpose, ELF multi, ELF epexelf, Loctite GR 125.
- For the flange and spigot path on the luminaires : silicone paste, for use at temperatures - 40 to + 200 °C, such as RhÙne-Poulenc Rhodorsil 408 etc.
- For threaded path : graphitic mineral grease, for use at temperatures - 30 to + 150 °C, such as : Loctite GR 135, Molydal M 03.

RECOMMENDATIONS FOR ASSEMBLY

In order to successfully retain the flameproof character of the equipment :

- Care must be taken before starting up to ensure that all the screws for closing the covers and cable entries are firmly tightened.
- Modification of the original predrilled holes is prohibited.

MAINTENANCE

Extract from article 4 in the December 20, 1988 order, modified by the January 10, 1992 order (Interval between inspections is fixed at one year in rooms and work positions at which there are risks of degradation fire or explosion, etc...)

APPLETON ADVICE

- Always read the installation and user's instructions provided with the equipment before starting installation work.
- Always use Appleton original spare parts for repair work, in order to keep the equipment in good working condition and to maintain the protection mode.
- For a good maintenance, keep the technical data sheets and the EC declarations of conformity.

DEFINITION

Method of protection applicable to electrical equipment such as light fittings, sockets, switches, etc, which consists of preventing the occurrence of any accidental ignition.

The construction principles for increased safety « e » equipment are as follows :

- Use of high-quality insulation materials
- Specially dimensioned air line leakage distance and creepage distance
- Electrical connection which cannot become loose
- Minimum IP54 weatherproof protection of the enclosure
- Respect of the temperature classes
- Conformity of cable entries
- Labelling.

USE

All increased safety « e » equipment is designed such that it does not cause arcs or excessive temperatures capable of likely to ignite an explosive atmosphere. It is therefore suitable for all gas groups (A, B and C). These groups do not appear on the equipment labelling.

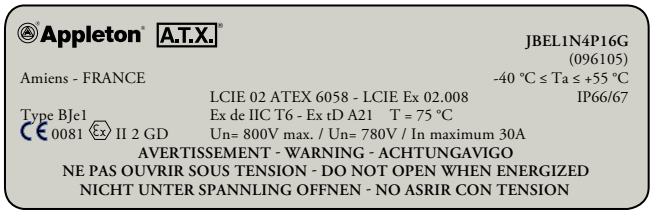
TEMPERATURE CLASS

For increased safety « e » equipment, the temperature to be taken into account is that of the hottest point of the equipment as a whole, and not the external temperature.

There are six temperatures classes: T1, T2, T3, T4, T5, T6 *(see « Marking »)*.

MARKING

The marking of increased safety « e » equipment must bear information stipulated by the 94/9 CE ATEX Directive for Europe and IEC 60079-0 for the rest of the world.



TEMPERATURE CLASS	MAXIMUM SURFACE TEMPERATURE (MST)
T1	450 °C
T2	300 °C
T3	200 °C
T4	135 °C
T5	100 °C
T6	85 °C

CABLE ENTRIES

These are created by screwing the cable gland directly onto the enclosure or, for untapped holes, by fixing with a locknut. Holes which are not used for cable entries must be blanked using the appropriate blanking plugs.

CABLE ENTRY BY SCREWING DIRECTLY ONTO ENCLOSURE.

II2G Ex e II T6	
II	Surface industry.
2	Category 2 corresponding to Zone 1.
G	Gas.
Ex	Equipment designed to operate in an explosive atmosphere. (Products certified ATEX are marked EEx and marked Ex for the products certified IEC).
e	This letter refers to the increased safety protection mode.
II	This is the electrical equipment group according to its destination. There are two groups : • **Group I** Electrical equipment intended for underground work in mines with explosive atmospheres. • **Group II** Electrical equipment intended for surface work.
T6	It is the temperature class of the equipment. It indicates the maximum surface temperature during operation (while respecting a safety margin in the event of an accident involving the air-conditioning or ventilation). • There are six temperature classes (see chart left).

WEATHERPROOF SEAL

The equipment has a protection index of at least IP 54 ; it is therefore important to ensure that the weatherproof seal is in good condition when the product is installed.

Defective seals must be systematically replaced.

WEATHERPROOF SEAL

CONNECTION TERMINALS

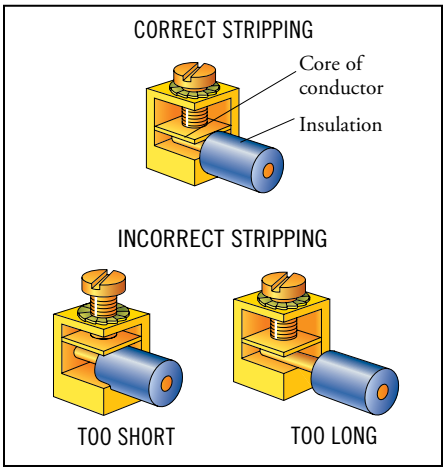
Each certificate of conformity indicates the type of terminals to be used in each type of junction box.

The connection must be performed according to current regulations and any additional instructions in the product documentation, such as :

- Maximum current density,
- Maximum connection capacity.

STRIPPING AND CONNECTION

The conductors should only be stripped back to the edge of the metal part of the terminal connection, to ensure correct insulation.



PRODUCTS MARKED « de »

Certain appliances such as power sockets, switches, etc, whose design creates arcs and sparks in normal operation, cannot be produced with protection mode « e » only.

Protection modes therefore have to be combined. « d » and « e » technologies are the most commonly used.

1) The part where the electric arc is produced is enclosed in a small flameproof chamber.

2) The connection terminals are « e » increased safety.

3) The assembly is mounted in an « e » increased safety enclosure and has a certificate of conformity with CENELEC standards.

4) Appliances marked « de » demonstrate the subdivision of gases (A, B, or C) which is linked to the « d » part of the equipment.

APPLETON ADVICE

- Always read the installation and user's instructions provided with the equipment before starting installation work.
- Always use Appleton original spare parts for repair work, in order to keep the equipment in good working condition and to maintain the protection mode.
- For a good maintenance, keep the technical data sheets and the EC declarations of conformity.

REQUIREMENTS IN STANDARDS

Standard A 91-011 defines three different types of atmospheric environments :

TROPICAL ENVIRONMENT

- An environment corresponding, as the definition suggests, to the most severe conditions of heat and humidity - regions known as « tropical » and « equatorial ».
  This environment concerns products to be dispatched all over the world. This environment implies the strongest protection against corrosion currently in use for a metallic finish.

INDUSTRIAL ENVIRONMENT

- An environment corresponding to factory and related atmospheres but without these atmospheres having a particular character requiring special protection, the main increase in corrosion arising from a substantial sulphur content in the atmosphere.

MARINE ENVIRONMENT

- An environment corresponding to atmospheres on the coast or at sea, excluding actual attack by sea water, the main increase in corrosion arising from the continuous presence of high relative humidity and of a certain content of sea salt in the air.

TREATMENT AT SOURCE TO WITHSTAND THE 3 ATMOSPHERIC ENVIRONMENTS

In order to ensure the most efficient corrosion resistant treatment possible, Appleton has chosen to carry out on all products in this catalogue a treatment that satisfies all three atmospheric environments :

- 672 hours saline mist test in accordance with IEC 60068-2-11, Ka test.

The test corresponds to a period of 4 weeks at a saline concentration of 5 %.

In addition to the saline mist test the products undergo climatic tests defined by the IEC 60068-2-30 standard, that is 5 climatic cycles of 24 hour from 25 °C to 55 °C with a relative humidity of 50 to 95 %.

COMPOSITION OF MATERIALS USED IN THE CONSTRUCTION OF ENCLOSURES

All ATX plastic enclosures (polyester, polycarbonate, polyamid), used in the construction of enclosures are conform to the article 7 of the EN/IEC 60079-0 standard.

All main alloys are conform to the AFNOR french codification.

SALINE MIST CORROSION TEST IN OUR LABORATORIES.

CORROSION ON A NON-TREATED PRODUCT.

PRODUCT TREATED AGAINST CORROSION.

APPLETON ADVICE

Care should be taken to ensure that the materials chosen for the equipment are compatible with your industrial environment.

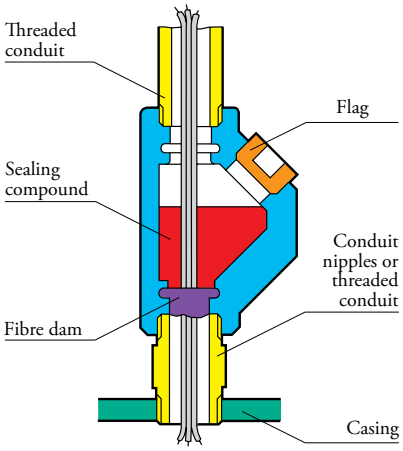
Example : polyester in the presence of benzene.

PREDOMINANT IN : UNITED STATES, CANADA, PART OF SOUTH AMERICA, MIDDLE EAST, FAR EAST

CONDUCTORS PLACED IN A RIGID THREADED CONDUIT : CONNECTION VIA A FIRE BARRIER.

This installation method is widely used by specifiers, investors and installers in the USA and Canada, as well as part of South America and the Middle and Far East, where the National Electrical Code NEC is used.

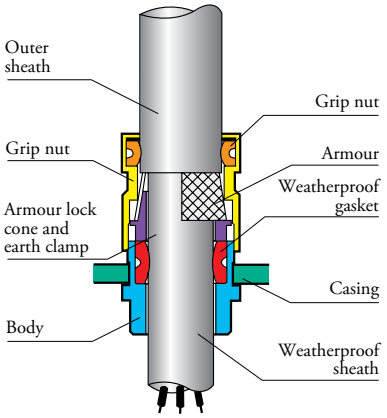
Special seals are required, known as fire barrier connections which are filled with an appropriate « compound ».



PREDOMINANT IN : UNITED KINGDOM, COMMONWEALTH COUNTRIES, SPAIN AND OFFSHORE APPLICATIONS

ARMOURED BRAID, WIRE OR STEEL TAPE CABLE : CONNECTION VIA CABLE GLAND EARTH CONTINUITY.

This installation method is widely used by specifiers, investors and installers in the United Kingdom and Commonwealth countries where the « British influence » and wiring practice is used.

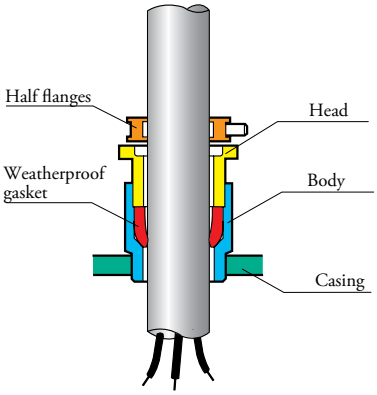


PREDOMINANT IN : FRANCE, GERMANY, ITALY, EASTERN EUROPE COUNTRIES, PART OF AFRICA, MIDDLE EAST, FAR EAST

NON ARMOURED CABLE : CONNECTION VIA CABLE GLAND.

This installation method is used when there is little risk of mechanical damage and earth continuity is not compulsory.

Design engineers, investors and contractors mainly used this due to its flexibility.



SELECTION OF CABLES INTENDED FOR USE IN HAZARDOUS AREAS

Cables come in a wide variety of shapes and sizes and new designs, e.g. those with optical fibres, are regularly being introduced.

The issue of correctly sealing these cables as they enter hazardous area electrical equipment is a worldwide problem, and not confined purely to local conditions in any one particular place.

Although there are no IEC construction standards for the cables intended for use in flammable atmospheres, according to IEC 60079-14, 10.4.2(b), if a cable gland with an elastomeric flameproof sealing ring is to be used, when connecting cables to Ex d equipment enclosures, the cable should be :

i. Substantially compact and circular (i.e. especially the part of the cable entering the enclosure),
ii. Have an extruded bedding (without any gaps),
iii. Have fillers, if any are used, which are Non-Hygroscopic.

Effectively, the cable should be physically assessed, taking into account the protection method and configuration of the equipment, to verify its suitability, before any cable gland with an elastomeric sealing ring can be selected.

ITS USE

External or internal. In normal service, a cable exhibits a rise in temperature on the surface which must be taken into account in Zones where there is a risk of explosion. This rise in temperature stems from a Joule effect of the current passing through the cable. In normal use, the maximum permissible current must therefore be limited to 85 % of the permissible intensity for the Zones without explosion risks (required in NF C 15-100 standard, IEC 60364).

ITS METHOD OF INSTALLATION

Overhead, underground, in cable ducts or guttering.

In fixed installation (rigid cable), for mobile equipment (flexible cable).

ITS CHARACTERISTICS

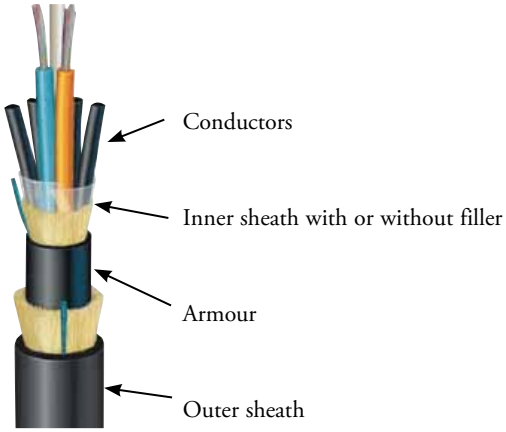
The use of category C1 and CR1 is even recommended :

- Flexible cables, series H07 RNF.
- Non-armoured rigid cables, series U 1000 RO 2V.
- Rigid armoured cables, series U1000 RGP FV.

All these cables can be used for voltages up to 1000 V, except flexible cables whose operating voltage is limited to 750 V.

TYPICAL IEC CABLE TYPES

ARMOURED			UNARMOURED
Steel tape armoured (STA)	Wire braided armoured (SWB)	Single wire armoured (SWA)	Normal unarmoured
			



AN EXPLANATION OF CABLE GLAND TYPES AND INSTRUCTIONS FOR PROPER SELECTION

EQUIPMENT SELECTION PROCESS

Generally, electrical safety is ensured by the implementation of one of two considerations, i.e. that electrical apparatus be located where reasonably practicable outside hazardous areas, and that electrical apparatus be designed, installed and maintained in accordance with measures recommended for the area in which the apparatus is located.

The selection of equipment for use in hazardous areas will depend upon a number of variable factors including but not limited to the Zone of Use, the Hazard Category, the Gas Group or Combustible Dust data, the rating of equipment for the operating conditions, the Temperature Classification requirement of the equipment (determined by the T Rating of the flammable mixture), any construction material considerations including reliability against chemical attack, the Ingress Protection Rating required, the protection against possible damage from vibration, reduction in the risk of thermite sparking, the possibility of static charge formation, and perhaps several other factors related to the electrical characteristics of the installation.

In order to ensure that the preferred type of equipment is used on a plant or project, the responsible engineers may prefer to specify the apparatus by make and model or generic type. Bearing in mind that the most progressive and forward thinking manufacturers are continuously developing their products the task of specification must also be a continuous process.

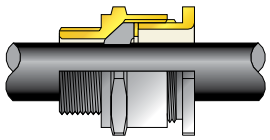
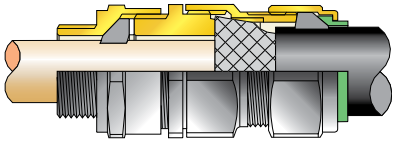
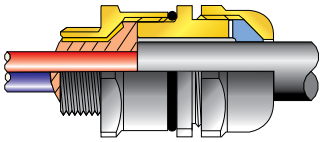
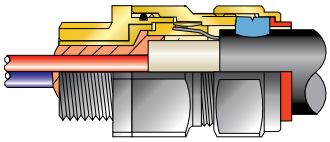
Here are a few of the basic factors which may affect specification of electrical equipment for hazardous areas :

- Clear definition of the acceptable form(s) of certification,
- Acceptable Certification Standards,
- Acceptable Gas Groups,
- Zone of Use requirement,
- Form of Protection preferred,
- Temperature Classification,
- Any environmental conditions,
- Any particular material requirements,
- Minimum Ingress Protection,
- Additional Deluge Test Certification, if required,
- Additional Marine approvals, if required,
- Minimum and Maximum Ambient Temperature rating.

Prior to selection being finalised and equipment being earmarked for purchase the relevant engineering personnel should review the availability of the preferred or specified equipment, verifying that it has the necessary hazardous area certification to meet the conditions prevailing. This review of certification should cover any special conditions for safe use that may be included in the certification documents to avoid subsequent non-conformities arising when the equipment is ready to be installed, commissioned, operated, inspected or maintained.

CABLE GLANDS FOR HAZARDOUS AREAS

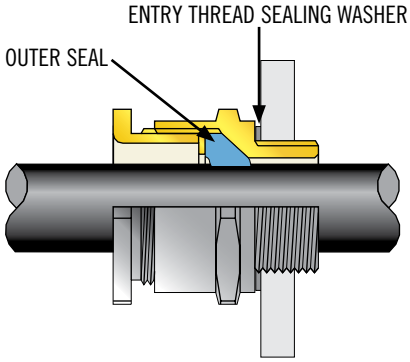
Under EN/IEC Standards (EN/IEC 60079-0 & EN/IEC 60079-1) three main types of cable glands exist for hazardous area applications, for either armoured or non-armoured cables.

FORM OF EQUIPMENT PROTECTION/CABLE TYPE	NON-ARMOURED CABLES	ARMOURED CABLES
Increased Safety – Ex e (EN/IEC 60079-7) Flameproof – Ex d (EN/IEC 60079-1) Zone 2 – Ex n (EN/IEC 60079-15)		
Flameproof Compound Barrier – Ex d (EN/IEC 60079-1)		

When it comes to Zone 2 equipment form of protection Type « n » , the picture is not so clear as it may first appear. As there are special requirements which apply to the sealing of cables entering form of protection type « nR » (Restricted Breathing Enclosure) apparatus, it should not automatically be assumed that cable glands with Ex d or Ex e certification can be used.

AN EXPLANATION OF CABLE GLAND TYPES AND INSTRUCTIONS FOR PROPER SELECTION

IEC PROTECTION CONCEPTS Ex d, Ex e, Ex n — CABLE GLAND FOR CABLES ENTERING Ex e APPARATUS



THE MINIMUM REQUIREMENTS FOR Ex e CABLE GLANDS

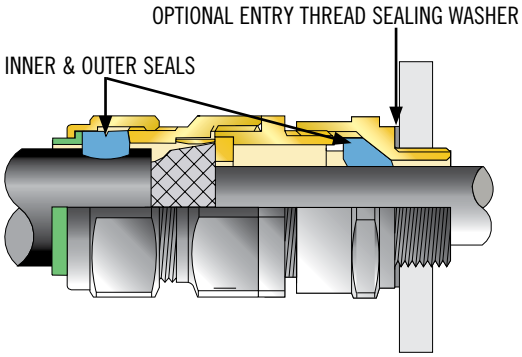
- Impact Strength – 7 Joules,
- I.P. Rating – IP54 Gas / Vapor – IP6X Dust,
- Sealing Washer at Cable Entry Interface is Recommended,
- Single (Outer) Seal as a Minimum,
- Trend is to Use Double (Inner/Outer) Seal.

Note : Whilst the minimum Ingress Protection rating is said required to achieve Ex e certification under EN/IEC 60079-7 is IP54, it should be considered that the cable gland is required to maintain the integrity of the equipment enclosure which is invariably higher.

It can also be noted that EN/IEC 60079-14, section 11.3 states that threaded cable entry devices connected into threaded cable entry plates or enclosures of 6 mm or greater thickness need no additional sealing between the cable entry device and the entry plate or enclosure, providing the axis of the cable entry device is perpendicular to the external surface of the cable entry plate or enclosure.

However we recommend the use of an ATX Entry Thread Sealing Washer, which when installed at the cable entry interface, between the equipment enclosure and the cable entry device offers I.P. protection in excess of IP66. These components have been independently 3rd party tested in Ingress Protection tests to EN/IEC 60529.

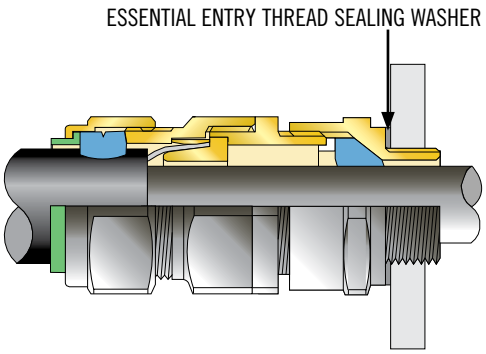
CABLE GLAND FOR ARMOURED CABLES ENTERING Ex d APPARATUS



THE MINIMUM REQUIREMENTS FOR Ex d CABLE GLANDS

- Screwed Entry Threads Must Maintain Flameproof Path,
- Minimum 5 Full Thread Engagement With Mating Equipment,
- Inner Seal Must be Flameproof & Gas Tight,
- Trend Has Been to Use Dual Certified Ex d / Ex e,
- Limitations Of Safe Use Usually Exist,
- Users Must Also Carefully Follow EN/IEC 60079-14.

CABLE GLAND FOR ARMOURED CABLES ENTERING Ex n APPARATUS



THE MINIMUM REQUIREMENTS FOR Ex n CABLE GLANDS

- Cable Gland / Equipment Interface Seal is Essential,
- Restricted Breathing Enclosure Features Must be Maintained – Apparatus Maker Responsibility,
- Special Test Under EN/IEC 60079-15 Applies For Ex nR Apparatus & Cable Entry,
- Some Flameproof Cable Glands Do Not Comply,
- Inner Seal Must be Air Tight in Two Directions.

AN EXPLANATION OF CABLE GLAND TYPES AND INSTRUCTIONS FOR PROPER SELECTION

SELECTION PROCESS FOR HAZARDOUS AREA CABLE GLANDS ACCORDING TO IEC

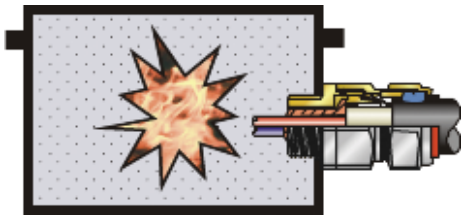
SELECTION OF CABLE GLANDS FOR FLAMEPROOF TYPE d ENCLOSURES TO EN/IEC 60079-14

Concerning the subject of cable glands to maintain integrity of type of protection Flameproof Enclosures "d" using direct cable entry into the flameproof enclosures, special selection criterions have to be considered as defined in Section 10 of EN/IEC Standard EN/IEC 60079-14 "Electrical apparatus for explosive gas atmospheres Part 14: Electrical installations in hazardous areas (Other than mines)".

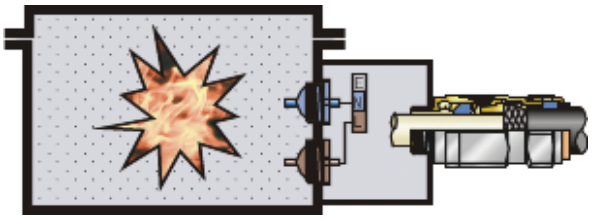
In order to achieve compliance with the prevailing Installation Code of Practice and in particular EN/IEC 60079-14, it is necessary to evaluate the function of the equipment, the cable gland, and the cable, and in order to satisfy the conditions of the applicable standards compatibility of all three with each other must be verified. Section 10 of EN/IEC 60079-14 "Additional requirements for type of protection "d" - Flameproof enclosures" for the selection of cable glands is required to be followed, and this sets out some specific rules to ensure integrity and safe operation of the installed equipment.

CABLE ENTRIES INTO EX d ENCLOSURES

Two situations can be considered, direct cable entry and indirect cable entry:



DIRECT CABLE ENTRY – EX d



INDIRECT CABLE ENTRY – EX de

INDIRECT CABLE ENTRIES INTO EX d ENCLOSURES

In the case of indirect cable entry, this may be achieved by a separate terminal chamber, where the cable entries can be found and only the (looping) cable conductors are terminated in the terminal block, where no source of ignition exists in this terminal chamber. The terminal chamber may offer Ex d or Ex e form of protection, and is separated from the main enclosure, with the internal wiring passing through line barriers or bushings before connecting to the equipment side of the terminal block. The termination and wiring of the incoming field cables would thereby not normally require the adoption of compound sealing cable glands in this case, unless there is a risk of gas migration through the interstices of the cable and the transmission of gas to the opposite end of the cable needs to be prevented. An example of this type of equipment configuration is shown in the photograph to the left.

SELECTION PROCESS – ACCORDING TO EN/IEC 60079-14

The following flow chart can only be followed as part of the EN/IEC selection process after physical evaluation of the cable 10.4.2 Selection

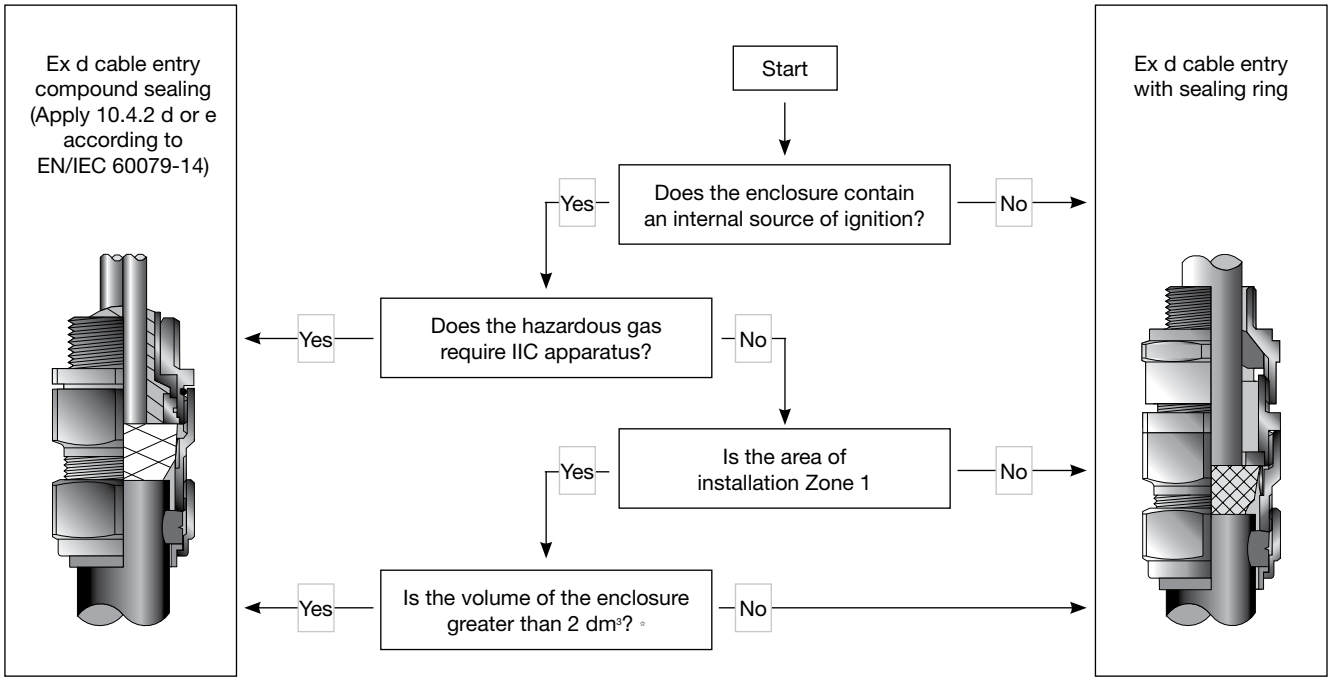
THE CABLE ENTRY SYSTEM SHALL COMPLY WITH THE FOLLOWING:

a) Cable entry device in compliance with EN/IEC 60079-1 "Construction and verification test of flameproof enclosures of electrical apparatus" and particular type of cable intended for use with that device,

b) thermoplastic, thermosetting or elastomeric cable which is substantially compact and circular, has extruded bedding and fillers, if any, are non-hygroscopic, may utilize flameproof cable entry devices, incorporating a sealing ring selected in accordance with below selection guide.

SELECTION GUIDE

Selection of cable entry for Ex d flameproof enclosure according to electrical installations EN/IEC 60079-14.



On condition the cable gland is not certified as part of the equipment but tested and certified as a separate component and the used cable is substantially compact and circular the selection chart above taken from section 10 of EN/IEC 60079-1 can be used.

1- GENERAL REQUIREMENTS

Electrical installations must comply with the requirements concerning installations in both non hazardous and hazardous locations :

- NF C15-100, with condition BE3, for France, (ß 512-2-20),
- CEI 60364, internationally.

2- EQUIPMENT SELECTION (EXCEPT CABLE ENTRIES)

- Equipment for use in Zone 0 :
  - ia Intrinsic safety.
- Equipment for use in Zone 1 :
  - d protection mode,
  - p protection mode,
  - q protection mode,
  - o protection mode,
  - e protection mode,
  - i protection mode,
  - m protection mode.
- Equipment for use in Zone 2 :
  - Equipment with specific protection mode (EN/IEC 60079-15) *(see page G:35)*.

3. SELECTION AS A FUNCTION OF THE EQUIPMENT GROUP

- Protection modes e, m, o, p and q are marked "Group II" and may be used in all subgroups A, B, C.
- Protection modes d and i are marked "Group IIA, IIB or IIC" and must not be used in subgroups higher than marked. IIB must not be used in IIC but can used in IIA.

4- EXTERNAL INFLUENCES

- The material must be selected and installed so that it is protected against external, chemical, mechanical, thermal and electrical influences, vibrations, humidity, etc., which are likely to counteract the protection modes provided.

5- PROTECTION AGAINST DANGEROUS SPARKS

Limitation of earth fault currents. It is difficult to cover all systems, but the following methods represent general cases.

These systems can be used in Zones 1 and 2 up to 1 000 V-/1 500 V... (DBT Directive 73/23/CEE modified by Directive 93/68/CEE).

SCHEME TYPE TN

- The earthing system must be connected to the source of energy directly earthed by protective conductors (PE*), which have to be earthed near each energy transformer.
- The source of energy directly earthed and the neutral conductor are the same.
- Any permanent phase to earth fault current becomes a short circuit current.

SCHEME TN. C

- The neutral conductor (PE*) and the protective conductor are the same.

SCHEME TN. S

- The neutral conductor (PE*) and the protective conductor are separate.
- In dangerous area the scheme TN. S must be used.
- Whenever there is a transition from TN. C to TN. S (non-hazardous Zone to a hazardous Zone), the PE conductor must be connected to the equipotential connection system in the non-hazardous location.

SCHEME TYPE TT

A system having one point of the source of energy directly earthed, the exposed conductive parts of the installation being connected to earth electrodes, electrically independent of the earth electrodes of the source.

The intensity of the phase to earth fault current is less than the intensity of the short circuit current, but may be sufficient to cause dangerous voltages.

- It must be protected by a residual current device if it is used in Zone 1 hazardous locations.

SCHEME TYPE IT

- The source of the supply is either connected to earth through a deliberately introduced earthing impedance or is isolated from earth. Exposed conductive parts of the installation are connected directly to earth at the consumer end of the installation.
- Current resulting from a single phase to earth fault has a sufficient low intensity so that it is impossible to develop a dangerous contact voltage.
- Monitoring device must be provided in hazardous Zones to indicate the first fault.

6- EQUALIZATION OF POTENTIALS

- In TN, TT and IT schemes, all exposed conductive parts and all extraneous metallic parts must be connected to the equipotential connection system.
- The connection system may comprise protective conductors, metal pipes in metal cable ducts and metallic structural elements, but must not include the neutral conductor.
- It must be impossible for connections to come loose by themselves.

7- CABLES

- Cables and accessories should be installed such that they are not exposed to mechanical damage and corrosive or chemical influences, for example due to solvents, and the effects of heat.
- When this type of exposure is inevitable, protective measures must be taken to install or to select appropriate cables. For example, in France, the risk of mechanical damage can be minimized by using reinforced cables with shielding inside a seamless aluminium conduit, or cables with a mineral insulation casing or a semi-rigid metal casing.
- When cable or conduit systems are subject to vibrations, they must be designed to resist these vibrations without damage.
- It is also important to take precautions to avoid damage to materials making up the insulation or casings of PVC cables installed in Zones in which temperatures may drop below -5 °C.

8- CABLE JOINTING

- Whenever possible, complete cable lengths shall be installed in hazardous locations. Where this is impossible, a cable joint must be made to the mechanical, electrical or chemical constraints ; it must also be enclosed in an enclosure in which the protection mode is appropriate for the Zone.

** Protective Earth*

9- WIRING SYSTEMS FOR ZONES 1 AND 2

CABLE FOR EQUIPMENT INSTALLED IN FIXED POSITION

- Cables with thermoplastic sheaths, or thermosetting sheaths, or elastomer sheaths or metallic sheaths with mineral insulation may be used.

CABLE FOR PORTABLE AND REMOVABLE MATERIAL

- Portable and removable equipment must be equipped with cables with a high strength polychloroprene or equivalent synthetic elastomer casing, cables with high strength rubber casings, or cables with an equally robust construction.
- Conductors must have a minimum cross-sectional area of 1.0 mm2.
- If the cable includes a flexible metal shield or reinforcement, this cable must not be used as the only protective earth conductor.

FLEXIBLE CABLES

Flexible cables must be selected from the following cable types :

- Flexible cables with an ordinary tough rubber sheath,
- Flexible cables with an ordinary polychloroprene sheath,
- Flexible cables with a high strength rubber sheath,
- Cables with a high strength polychloroprene sheath,
- Insulated plastic cables with a construction as robust as flexible cables with high strength rubber sheath.

USE OF CABLES

The surface temperature of a cable increases during normal service, and an allowance should be made for this increase in Zones with a risk of explosion. This temperature increase is due to the Joule effect caused by the passage of currents.

Therefore during normal conditions, the maximum allowable current should be limited to 85% of the acceptable intensity for Zones in which there is no explosion risk :

The December 19, 1988 French ministerial order taken in application of the November 14, 1988 decree, imposes the use of category C2 cables according to NEC 32070 for Zones with risks of explosion. These cables do not propagate flames when taken separately and ignited. It is even recommended that category C1 and CR1 cables are used :

- Flexible cables, series H07 RNF,
- Rigid non-reinforced cables, series U 1000 R0 2V,
- Reinforced rigid cables, series U 1000 RGP FV.

All these cables may be used at a voltage of up to 1000 V, except for the flexible cables that may not be used at more than 750 V.

CONDUIT SYSTEMS (TUBES)

- Conduit must be equipped with a fire break if used less than 450 mm from any enclosure containing a source of ignition during normal operation.
- The thickness of the filling material in the fire break must be at least equal to the inside diameter of the conduit, but never less than 16 mm.
- Cables with one or more insulated conductors without a casing may be used in conduit.

However when the conduit contains at least three cables, the cross-section of these cables shall not exceed 40% of the inside cross-section of the conduit.

10- ADDITIONAL REQUIREMENTS ABOUT PROTECTION MODE « d » EXPLOSIONPROOF ENCLOSURES

SOLID OBSTACLES

When installing equipment, make sure that the flamepath exit is placed at a distance exceeding the distance defined below from any solid object that does not form part of the equipment, such as steel reinforcement, walls, protection devices against the weather, installation supports, tubes or other electrical equipment, unless the equipment has actually been tested at smaller distances.

GAS-VAPOR SUB-GROUP	MINIMUM DISTANCE (MM)
IIA	10
IIB	30
IIC	40

COMMENTS

- Enclosures in the CF type range are certified with smaller distances.

PROTECTION OF FLAMEPATH SURFACES

- Flamepaths must be protected against corrosion.
- The flame flange must be protected against water penetration.
- The use of sealing materials are only accepted when specified in equipment specification documents.
- Flamepaths must not be treated by substances that harden during use.
- The protection indexes given for the products are guaranteed when greases specified in our Guide *(page G:37)* are used.

CONDUIT SYSTEMS

- Conduits must be chosen from the following options :
  a) Threaded high strength, drawn or continuous welded steel conduit according to IEC 60614-2-1 or
  b) Metal or composite flexible conduit, for example metal conduit with a plastic or elastomer sheath, for which the mechanical strength is classified as "high" or "very high" according to IEC standard 60614-2-5.
- A minimum of five threads must be provided on the conduit so that the five threads can be engaged between the conduits and the explosion proof enclosure or between the conduits and the connector (5 threads engaged for metric threaded, 3.5 threads engaged for NPT).
- Fire breaks must be provided for distances defined by the EN/IEC 60079-14 standard.
- A single fire break is sufficient for coupling of two « d » enclosures, using conduit.

11. ADDITIONAL REQUIREMENTS FOR INCREASED SAFETY PROTECTION MODE « e »

- The degree of protection of enclosures containing active bare parts shall at least be equal to IP54.

CABLE ENTRIES

- Cable entries shall also respect « e » protection mode and must incorporate an appropriate sealing element in order to obtain a minimum degree of protection at least equal to IP54 at the enclosure connection.

NOTES :

1) In order to satisfy the IP54 requirement, it is sometimes necessary to seal the cable entry and the enclosure, for example using a seal.
2) cable entries screwed onto 6 mm thick, or thicker, enclosures do not require any additional seal between the cable entry and the enclosure, provided that the cable entry is perpendicular to the drilled surface.

CONDUCTOR ENDS

- Some terminals such as split type terminals, can accommodate several conductors.
- When several conductors are connected to the same terminal, care must be taken that each conductor is correctly attached.
- Unless authorized by the documentation supplied with the equipment, two conductors with different diameters must not be connected to the same terminal, unless they have firstly been fixed by means of a single compression sleeve.

COMMENTS

- The insulation of each conductor must be maintained as far as the terminal metal, to prevent the risk of short circuits between adjacent conductors in each terminal block.

NOTE :

- When a single collar clamping screw is used with a single conductor, the conductor should be wound in a "U" around the screw.

COMBINATION OF TERMINALS AND CONDUCTORS IN CONNECTION BOXES AND JUNCTION BOXES

- Make sure that heat dissipated in the enclosure cannot increase temperatures above the required temperature class for the equipment.

This can be done by :

a) following the instructions in the drilling Guide (www.egsatx.com) about the number of allowable terminals, as a function of the size of the conductors and the maximum intensity, or
b) checking that the calculated dissipated power is less than the maximum rated dissipated power. In this case, refer to our curves and the instructions in the drilling guide.

CHOOSE APPLETON'S ATX BRAND

Choosing Appleton means :

- Total conformity with the standards.
- Anti-corrosion treatment and climatic protection for each product.
- Increased protection against mechanical shocks.
- A technical sheet with each item of equipment.
- Equipment with a high level of fire resistance.

TOTAL CONFORMITY WITH THE STANDARDS

Appleton electrical equipment for explosive atmospheres is designed and manufactured in the strictest conformity with IEC and CENELEC standards.

ANTI-CORROSION TREATMENT AND CLIMATIC PROTECTION FOR EACH PRODUCT

When the manager of a hazardous area project has to determine in advance the anti-corrosion treatment and climatic protection of the products he is specifying, he is often faced with a difficult decision.

Appleton has tried to reduce this problem to a minimum.

INCREASED PROTECTION AGAINST MECHANICAL SHOCKS

Items of « e » and « d » equipment are classed and constructed for « increased risk of mechanical danger » *(see page G:33)*. They can therefore be installed in all work and development sites without any additional precautions.

A TECHNICAL SHEET AND AN EC DECLARATION OF CONFORMITY FOR EACH ITEM OF EQUIPMENT.

All currently sold equipment is supplied with technical data explaining assembly and giving instructions for operation, precautions for operation and a copy of the EC Declaration of Conformity. The EC Declaration of Conformity guarantees the conformity of the product linked to the samples tested or presented by the Notified body.

EQUIPMENT WITH A HIGH LEVEL OF FIRE RESISTANCE

As well as meeting the requirements of EN/IEC 60079-0-7, Appleton equipment has a level of fire resistance defined by the EN/IEC 60695-2 standard. It is resistant to incandescent wire from 650 °C to 960 °C.

ENDURANCE

The durability of products depends on their suitability for repeated operation. Appleton tests its products within temperature ranges that can vary from - 40 °C to + 60 °C, whereas specific standards only impose these checks at an ambient temperature of - 20 °C to + 40 °C.

AGEING

Most products on the market are now made of plastic. Therefore, the long term behavior of these materials should be checked.

Most of their degradation is caused by heat generated by operation, the temperature being equal to the ambient temperature plus temperature rises caused by electrical parameters for each product.

Depending on the equipment type, our test rooms can check the reliability of products by means of accelerated tests that combine voltages up to 270V and temperatures up to + 180 °C.

Plastic enclosures exposed to sunlight are artificially aged by exposure to UV radiation for 1000 hours with a xenon lamp, according to ISO international standard ISO 4892-2.

PROTECTION INDEX

In their scope, all product standards require that a protection index (protection of equipment against penetration of liquid and solid bodies) should be defined, selected from a classification system - EN/IEC 60529.

Therefore, all electrical equipment enclosures are provided with a protection index IP which defines the correspondence between the place of installation and the protection offered by products.

PHOTOMETRY

The Appleton photometry laboratory is unique in France and is one of the most modern in Europe. Equipment is tested in it at all stages of its design.

This is how better lighting performances are achieved. Tests are carried out according to standard NF C 71-120 (recommended methods for photometry of lamps and for light fittings).

RIGOROUS CHECKS ARE PERFORMED AT EACH STAGE OF THE MANUFACTURE OF ATX EQUIPMENT. HERE, AN INDIVIDUAL OVER-PRESSURE TEST ON A FLAMEPROOF « d » ENCLOSURE IS BEING PERFORMED ON THE PRODUCTION LINE.

CLIMATIC TESTS -50 °C UP TO + 200 °C.
WITH 0 UP TO 100 % OF RELATIVE HUMIDITY.

IP X6 TEST

PHOTOMETRY ROOM.

WHAT ARE PHOTOMETRIC UNITS AND QUANTITIES ?

LUMINOUS FLUX : SYMBOL F
The amount of light emitted in one second by a luminous source.
- Unit : lumen (lm).
  (See luminous flux charts page G53).

LUMINOUS INTENSITY : SYMBOL I
The quantity of luminous flux propagated in a given direction.
- Unit : Candela (cd). Values on photometric curves are given in candela.

ILLUMINANCE : SYMBOL E
The quantity of light falling on a unit area.
- Unit : lux (lx) = 1 lm/m2.

LUMINANCE : SYMBOL L
The value characterizing the luminous aspect of an area lit by a lighting source or device, in a given direction.
- Unit : Candela per square metre (cd/m2).

EFFICIENCY :
It is the ratio of light emitted by a luminaire to light emitted by a lamp.

LUMINOUS EFFICIENCY :
Qualifies the efficacy of a luminous source. It is a quotient of flux propagated over the power consumed.
- Unit : lumen per Watt (lm/W).

COLOR RETENTION INDEX : SYMBOL CRI
The degree to which the colored aspect of an object lit by a given light source corresponds to the aspect under a controlled luminous source. The CRI is a number between 0 and 100 (on this scale, 50 it is a mediocre color retention level, while 80/90 is a good retention level).
- Unit : Ra.

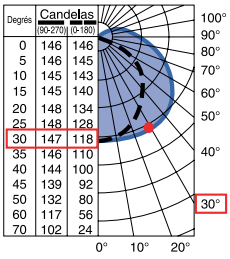
COLOR TEMPERATURE :
Complex idea of cold and hot light, linked to the chromatic properties of light and to vision of the human eye.
- Unit : Kelvin (K).
- Example : 2700 K for hot-light incandescent lamps, 8000 K for metal halide discharge lamps (a colder type of light).

WHAT IS A DEPRECIATION CORRECTION FACTOR ?
In order to compensate for the decrease in the luminous flux, due to the ageing of the lamps and to the accumulation of dust in the area. The level of lighting (E) should be increased by multiplying it by the depreciation coefficient (d).

Example of a value for d :
- Dust accumulation :
  - Low 1,25
  - Medium 1,35
  - High 1,50

WHAT IS A PHOTOMETRIC CURVE ?
The photometric curve shows the luminous intensity distribution of a lighting device. Values are given in candelas (cd).

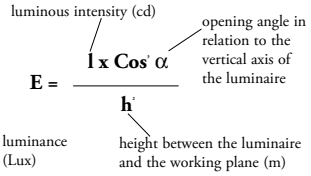
In order to make a comparison between the different types of lighting devices, this curve is drawn for a 1000 lumen flux.
- Example : for a point placed at 30° from the luminaire's vertical axis, the luminous intensity is 147 cd in the lamps transverse direction and 118 cd in the lamps longitudinal direction.
- Note : the curve « integrates » the efficiency, it is therefore not necessary to make corrections after having read the intensity. However, it is necessary to multiply it by the coefficient to obtain the actual flux of the chosen source.

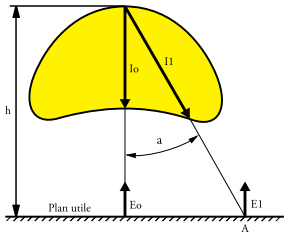


Degrés	Candelas (90-270)	Candelas (0-180)
0	146	146
5	146	145
10	145	143
15	145	140
20	148	134
25	148	128
30	147	118
35	146	110
40	144	100
45	139	92
50	132	80
60	117	56
70	102	24

POLAR PHOTOMETRIC CURVE, FOR A LIGHTING FIXTURE WITH WIDE BEAM

RELATIONSHIP BETWEEN LUMINOUS INTENSITY AND LUMINANCE
In order to determine the luminance at a given point - A , the following formula can be used :



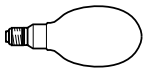
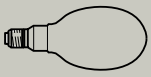


WORKING PLANE : CONVENTIONALLY, FOR INTERIOR LIGHTING, THE WORKING PLANE IS 0.85 M FROM GROUND LEVEL.

REFLECTANCE FACTOR ACCORDING TO COLOR VARIATION (1)

80 %	70 %	50 %	30 %	10 %
80 %	70 %	50 %	30 %	10 %
80 %	70 %	50 %	30 %	10 %
80 %	70 %	50 %	30 %	10 %
80 %	70 %	50 %	30 %	10 %

(1) THE SURFACE REFLECTION FACTOR IS THE RELATIONSHIP BETWEEN REFLECTED LIGHT AND INSTANT LIGHT

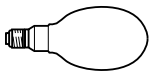
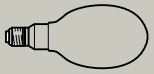
LIGHT SOURCES		APPLETON LUMINAIRES				
DESCRIPTION	CHARACTERISTICS	CAP	POWER (W)	FLUX (LM)	DESCRIPTION	CERTIFIED TYPE
 Incandescent lamps	• Life time : 1,000 hours • Luminous efficiency : between 11 and 19 lm/W	E 27	40	415	Emergency lighting « d »	FLd - BRI40
			60	715	Tank inspection vessel light « d »	HRCd
					Oval bulkhead lamp « d »	HBOd
				780	Bulkhead « dust »	HBP
			75	950	Handlamp « d »	BLd
					Tank inspection vessel light « d »	HRCd
				1055	Bulkhead « dust »	HBP
			100 *	1350	Oval bulkhead lamp « d »	HBOd
					Tank inspection vessel lights « d »	HRCd
					Round bulkhead lamp « d »	HBRd
				1470	Bulkhead « dust »	HBP
					Wellglass luminaire « dust »	Ln
			150 *	2160	Round bulkhead lamp « e »	HBe150
					Round bulkhead lamp « Zone 2 »	HBn150
					Bulkhead « dust »	HBP
					Wellglass luminaire « dust »	Ln
			200 *	3100	Round bulkhead lamp « d »	HBRd
					Wellglass luminaire « d »	LTd
			300 *	???	Wellglass luminaire « d »	LTd
		E 40	500 *	8400	Wellglass luminaire « d »	LTd
 Tubular Halogen lamps	• Life time : 2,000 hours • Luminous efficiency : between 17 and 20,5 lm/W	G 14	20	—	Tank inspection vessel lights « d »	HRC 20WH
		BA 15 d	50	—	Tank inspection vessel lights « d »	HRC50
		Pk22S	70	—	Portable floodlight « d »	PJ70
				—	Floodlight « d »	PJd
		E27	71	7000	Wellglass luminaire « Zone 2 »	Ln
			150	2500	Wellglass luminaire « d »	LTd
		E40	500	10250	Floodlight « d »	PJd
			1000	80000	Floodlight « d »	PJd
 Egg-shaped Mixed discharge lamps	• Life time : 6,000 hours • Luminous efficiency : between 11 and 16 lm/W • Re-ignition time : 5 min • Color temperature : 3,500 to 3,800 K • CRI : 50 to 60 • Operating position : 30° (E27 cap), 45° (E40 cap)	E 27	100	1100	Round bulkhead lamp « e »	HBC150
					Round bulkhead lamp « e »	HBC150
					Round bulkhead lamp « Zone 2 »	HBn150
					Bulkhead « dust »	HBP
			160	3150	Round bulkhead lamp « d »	HBRd
					Wellglass luminaire « d »	LTd
		E 40	250	5300	Wellglass luminaire « d »	LTd
 Egg-shaped Mercury vapor discharge lamps  Tubular	• Life time : 16,000 to 24,000 hours • Luminous efficiency : between 50 to 56 lm/W • Min. ignition temperature : - 25° C • Re-ignition time : 10 min • Color temperature : 3,000 to 4,000 K • CRI : 40 to 46 • Operates in all positions	E 27	80 Egg-shaped	3700	Round bulkhead lamp « Zone 2 »	HBn150
			125 Tubular	5700	Wellglass luminaire « Zone 2 »	Ln
			125 Egg-shaped	6700	Wellglass luminaire « Zone 2 »	Ln
					Wellglass luminaire « d »	LTd
					Round bulkhead lamp « d »	HBRd
		E 40	250 Egg-shaped	14200	Floodlight « d »	PJd
					Lantern « d »	LTd
					Floodlight « dust »	PJP
			250	14200	Floodlight « Zone 2 »	PJn
				33200	Wellglass luminaire « Zone 2 »	Ln
			400 Tubular	24200	Floodlight	PJd
			400		Wellglass luminaire « Zone 2 »	Ln
					Floodlight « Zone 2 »	PJn

Lamp data : Osram, Philips, GE Sylvania, Eye.

◆ *Ignitor built into lamp*

** After September 1, 2009, incandescent lamps over 100 watts will no longer be available in the European Union according to the Directive EUP 2005 32/EC.*

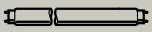
SELECTION TABLE FOR ATX LUMINAIRES DEPENDING ON LAMP TYPE

LIGHT SOURCES		APPLETON LUMINAIRES				
DESCRIPTION	CHARACTERISTICS	CAP	POWER (W)	FLUX (LM)	DESCRIPTION	CERTIFIED TYPE
 Egg-shaped HP sodium discharge lamps  Tubular	• Life time : 12,000 to 24,000 hours • Luminous efficiency : between 65 to 140 lm/W • Min. ignition temperature : - 25° C • Re-ignition time : 1 to 10 min • Color temperature : 2,000 to 2,200 K • Operates in all positions	E 27	70 Egg-shaped	5800	Cylindrical fluorescent luminaire « d »	FLd
			70◆ Egg-shaped	5800	Round bulkhead lamp « d »	HBRd
					Wellglass luminaire « d »	LTd
			70 Tubular	6500	Floodlight « Zone 2 »	PJn
					Floodlight « dust »	PJP
					Wellglass luminaire « Zone 2 »	Ln
					Floodlight « Zone 2 »	PJn
		E 40	100 Tubular	10000	Wellglass luminaire « Zone 2 »	Ln
			150 Egg-shaped	15500	Wellglass luminaire « d »	LTd
					Wellglass luminaire	LTd
					Floodlight	PJd
			150 Tubular	15500 - 17200	Floodlight « Zone 2 »	PJn
					Floodlight « dust »	PJP
					Floodlight « d »	PJd
					Wellglass luminaire « Zone 2 »	Ln
					Floodlight « Zone 2 »	PJn
			250 Egg-shaped	30000	Wellglass luminaire « d »	LTd
					Floodlight « Zone 2 »	PJn
					Floodlight « dust »	PJP
					Wellglass luminaire « Zone 2 »	Ln
			250 Tubular	33000	Floodlight « Zone 2 »	PJn
					Floodlight « d »	PJd
					Floodlight « dust »	PJP
			400 Egg-shaped	48000	Wellglass luminaire « d »	LTd
				54000	Floodlight « Zone 2 »	PJn
					Floodlight « dust »	PJP
					Wellglass luminaire « Zone 2 »	Ln
			400 Tubular	55500	Wellglass luminaire « d »	LTd
					Floodlight « Zone 2 »	PJn
					Floodlight « d »	PJd
			600 Tubular	90000	Floodlight « d »	PJd
			1000 Egg-shaped	120000	Floodlight « Zone 2 »	PJn
			1000 Tubular	130000	Floodlight « Zone 2 »	PJn
 Egg-shaped Metal halide discharge lamps (halogen lamps)  Tubular	• Life time : 2,000 to 6,000 hours • Luminous efficiency : between 68 and 78 lm/W • Min. ignition temperature : - 25° C • Re-ignition time : 15 min • Color temperature 4,000 to 4,500 K • CRI : 65 to 70 • Operating position : all position restriction may apply based on wattage and/or brand of lamp	E 40	150 Egg-shaped	14200	Wellglass luminaire « Zone 2 »	Ln
					Floodlight « Zone 2 »	PJn
					Floodlight « d »	PJd
			150 Tubular	14500	Wellglass luminaire « Zone 2 »	Ln
					Floodlight « Zone 2 »	PJn
					Floodlight « d »	PJd
			250 Egg-shaped & Tubular	24500	Floodlight « Zone 2 »	PJn
					Floodlight « dust »	PJP
					Wellglass luminaire « Zone 2 »	Ln
					Floodlight « d »	PJd
			400 Egg-shaped	34000	Floodlight « Zone 2 »	PJn
			400 Tubular	35000		
				35000	Floodlight « d »	PJd
					Wellglass luminaire « d »	LTd
					Wellglass luminaire « Zone 2 »	Ln
			1000 Tubular	130000	Floodlight « Zone 2 »	PJn

Lamp data : Osram, Philips, GE Sylvania, Eye.

◆ *Ignitor built into lamp*

** After September 1, 2009, incandescent lamps over 100 watts will no longer be available in the European Union according to the Directive EUP 2005 32/EC.*

LIGHT SOURCES		APPLETON LUMINAIRES					
DESCRIPTION	CHARACTERISTICS	CAP	LENGTH (MM)	POWER (W)	FLUX (LM)	DESCRIPTION	CERTIFIED TYPE
 Compact fluorescent lamps with integral power supply	• Life time : 8,000 hours • Luminous efficiency : between 40 and 65 lm/W • Color temperature : 2 700 K • CRI : 85	E 27	137	7	320	Oval bulkhead lamps « d »	HBOd
				11	600		
				8	800	Round bulkhead lamps « d »	HBRd
				15		Round bulkhead lamps « d »	HBRd
				18	900	Wellglass luminaire « d »	LTd
			178	23	1500	Emergency lighting « d »	FLd
						Round bulkhead lamps « d »	HBRd
						Wellglass luminaire « d »	AB14
 Cylindrical compact fluorescent lamps	• Life time : 6,000 to 9,000 hours • Luminous efficiency : between 41 and 87 lm/W • Color temperature : 2 700 K • CRI : 85 • Operates in all positions (PLL), Mazda (Eureka L) and others	2 G 11	217	18	1200	Cylindrical fluorescent luminaires « d »	FLd
			417	36	2900	Cylindrical fluorescent luminaires « d »	FLd
			568	80	6000	Fluorescent luminaires « Zone 2 »	FLn
 Tubular fluorescent lamps	• Lamps 26 mm dia. • Life time : 6,000 to 9,000 hours • Luminous efficiency : between 64 and 83 lm/W • Color temperature : 4,000 K • CRI : 62 • Power supply : conventional or electronic ballast • Operates in all positions	G 13 26 mm dia.	590	18	1150 to 1400	Bi-pin fluorescent and recessed luminaires « e »	FLe - Re
						Cylindrical fluorescent luminaires « d »	FLd
						Bi-pin self-contained fluorescent and recessed luminaires « e »	FLe - Re
						Fluorescent luminaires« Zone 2 »	FLn - EFn
			1200	36	3000 to 3400	Bi-pin fluorescent and recessed luminaires « e »	FLe - Re
						Cylindrical fluorescent luminaires « d »	FLd
						Bi-pin self-contained fluorescent and recessed luminaires « e »	FLe - Re
						Fluorescent luminaires« Zone 2 »	FLn - EFn
			1500	58	3600 to 5400	Bi-pin fluorescent and recessed luminaires « e »	FLe - Re
						Cylindrical fluorescent luminaires « d »	FLd
						Fluorescent luminaires« Zone 2 »	FLn - EFn
	• Luminous efficiency • 26 mm dia. : between 81 & 96 lm/W • 38 mm dia. : between 50 & 74 lm/W • Color temperature : 4 200 K • CRI : 85 • Instant start	Fa6 26 mm dia.	590	18	1450	Mono-pin fluorescent luminaires	FLe
			1200	36	3450	Mono-pin fluorescent luminaires	FLe
			1500	58	5400	Mono-pin fluorescent luminaires	FLe
		Fa6 38 mm dia.	590	20	1000	Mono-pin fluorescent luminaires	FLe
			1200	40	2500	Mono-pin fluorescent luminaires	FLe
			1500	65	4800	Mono-pin fluorescent luminaires	FLe

Lamp data : Osram, Philips, GE Sylvania, Eye.

◆ *Ignitor built into lamp*

** After September 1, 2009, incandescent lamps over 100 watts will no longer be available in the European Union according to the Directive EUP 2005 32/EC.*

ELECTRICAL INSTALLATIONS IN EXPLOSIVE GAS ATMOSPHERES IN ACCORDANCE WITH STANDARD EN 60079-17

Standard EN/IEC 60079-17 stipulates strict provisions concerning the maintenance of electrical installations in hazardous Zones:

- An initial inspection before they are commissioned.
- Regular inspections in time.
- Continuous supervision.

FREQUENCY OF INSPECTION

The time interval between inspections should be set taking into account likely deterioration due to corrosion, the presence of chemicals or solvents, the accumulation of dirt or dust, the risk of water penetration, exposure to abnormal ambient temperatures or vibrations, whether the electrical equipment is removable or portable, but in any case this interval must not be more than 12 months.

DEGREE OF INSPECTION

- Visual inspection: faults directly visible such as missing buttons.
- Close inspection: visual inspection and in addition detection faults.

Close inspection does not normally require the enclosure to be opened, nor the equipment switched off.

- Detailed inspection: such as loose connections, detected after opening the enclosure.

EQUIPMENT Ex « d », Ex « e » AND Ex « n »

	Ex "d"	Ex "e"	Ex "n"
EQUIPMENT			
Equipment is appropriate to the Zone category	•	•	•
Correct group equipment	•	•	•
Correct equipment temperature class	•	•	•
Correct identification of equipment circuit	•	•	•
Identification of equipment circuit available	•	•	•
Enclosure, glass parts, gaskets and/or sealing equipment satisfactory	•	•	•
No unauthorized modification	•	•	
Bolts, cable entry devices (direct and indirect) and protection elements of correct type, complete and tightened	•	•	•
Flat sealing surfaces clean, undamaged and any gaskets satisfactory	•		
Gaps in flat gaskets conforming to maximum authorised values	•		
Rated characteristics, type and position of lamps correct	•	•	•
Electrical connections tight		•	•
State of enclosure gaskets satisfactory		•	•
INSTALLATION			
Appropriate type of cable	•	•	•
No apparent cable damage	•	•	•
Satisfactory closing of bays, trunking and/or conduits	•	•	•
Stop boxes and cable boxes filled correctly	•		
Integrity of conduit systems and interface with mixed systems maintained	•	•	•
Connections to earth satisfactory, plus any additional connections satisfactory. Example: connections tight and conductors with large enough cross-section	•	•	•
Automatic electrical protection devices correctly set (automatic reset not allowed in Zone 1)	•	•	•
Special conditions of use (if appropriate) complied with	•	•	•
Cable ends not in use correctly protected	•	•	•
ENVIRONMENT			
Equipment adequately protected against corrosion, inclement weather, vibrations and other harmful factors	•	•	•
No abnormal accumulation of dirt and/or dust	•	•	•

CABLE ENTRIES

INCREASED SAFETY « e » ENCLOSURES

Cable entries are created by screwing the cable gland directly onto the enclosure, or for clearance holes, securing with a locknut.

Holes which are not used for cable entries must be blanked using the appropriate blanking plugs.

FLAMEPROOF « d » ENCLOSURE

Cable entries are created by screwing the cable gland directly onto the enclosure. The thread must be greased and the gland screwed-in to ensure that at least 5 threads are engaged for metric threaded and 3.5 threads engaged for NPT.

Unused entries must be plugged using the appropriate certified blanking plug.

SEALS

INCREASED SAFETY « e » ENCLOSURES

The equipment has a protection index of at least IP 54. It is therefore important to ensure that the weatherproof seal is in good condition when the product is installed. Defective seals must be systematically replaced.

FLAMEPROOF « d » ENCLOSURE

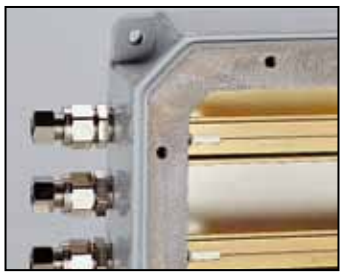
This equipment is supplied with the flamepath greased. Once the equipment is installed, the flamepath must be greased to keep them in good condition.

Use a non-hardening anti-corrosive multi-purpose grease.

Do not allow silicon-based products to come into contact with the threads, as they may stick.

- Do not modify any original entry or add entries as this is prohibited and will forfeit certification of the product.

TERMINAL CONNECTIONS



INCREASED SAFETY « e » ENCLOSURES

Each approval certificate indicates the type of terminals to be used in each type of junction box.

The connection must be performed according to current regulations and any additional stipulations on the certificate, such as :

- Maximum current intensity
- Maximum capacity
- Tightening torque

FLAMEPROOF « d » ENCLOSURE

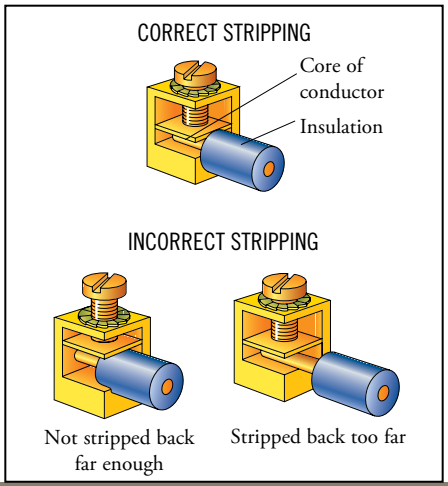
The approval certificate does not stipulate the type of terminal to be used, it only states that the connection precautions given in the technical sheet should be followed.

STRIPPING AND CONNECTIONS

The conductors should only be stripped back to the edge of the metal part of the terminal connection, to ensure correct isolation.

MAINTENANCE

Extract from article in the October 10, 2000 order. (Interval between inspections is fixed at one year.)



ROOM SIZE (IN METRES)

Length	
Width	
Height	

LUMINAIRES MOUNTING HEIGHT (IN METRES)

Height	

WORKING PLANE HEIGHT (IN METRES)

Height	

SURFACE REFLECTANCE FACTOR (SEE G:52)

Ceiling	
Walls	
Ground	

LIGHTING LEVEL REQUIRED (SEE G:52)

Lux number	

COLOR RETENTION INDEX- CRI (SEE G:52)

Index digit	

DEPRECIATION CORRECTION FACTOR (SEE G:52)

Low	
Medium	
High	

PERSONAL DETAILS

Company :

Name and surname :

Address :

City :	Postal Code :
Country :	Phone :
Fax :	e-Mail :

LIGHTING DEVICE TYPE (INDICATE «e» OR «d») OR ATX CAT. NO.

Bi-pin fluorescent luminaire «e»	
Mono-pin fluorescent luminaire «e»	
Fluorescent luminaire «d»	
Compact Fluorescent luminaire «d»	
Incandescent wellglass luminaire	
HP sodium wellglass luminaire	
HP mercury vapor wellglass luminaire	
Mixed wellglass luminaire	
Halogen floodlight	
HP mercury vapor floodlight	
HP sodium floodlight	
Metal halide floodlight	

WORKING AREA DESCRIPTION (SHORT DESCRIPTION)

GAS GROUP

Temperature class	
Other characteristics	

Visit our Website for simple on-line lighting designs www.egsatx.com