



GAS and **EQUIPMENT** **CLASSIFICATION.**

Explosion groups

- The **IEC** and the **CENELEC** (European committee of electrotechnics normalisation) drew up a classification of flammable products :
- the **I** group only concerns the equipment used in firedamp mines.
- the **IIB** group includes all gases **except** hydrogen, acetylene, carbon sulphide and nitrile of ethyl
- the **IIC** group includes all gases and vapours.

GROUPS		GAS	Ignition Temp (deg C)
I		Methane (firedamp)	
II	A	acetone	540
		acetic acid	485
		ammonia	630
		ethane	515
		methylene chloride	556
		Methane (firedamp)	595
		carbon monoxide	605
		propane	470
		n-butane	365
	n-butyl	370	
	B	hydrogen sulphide	270
		n-hexane	240
		acetaldehyde	140
		ethyl ether	170
		ethyl nitrite	90
ethylene		425	
C	ethyl oxide	429-440	
	acetylene	305	
	carbon bisulphide	102	
		hydrogen	560

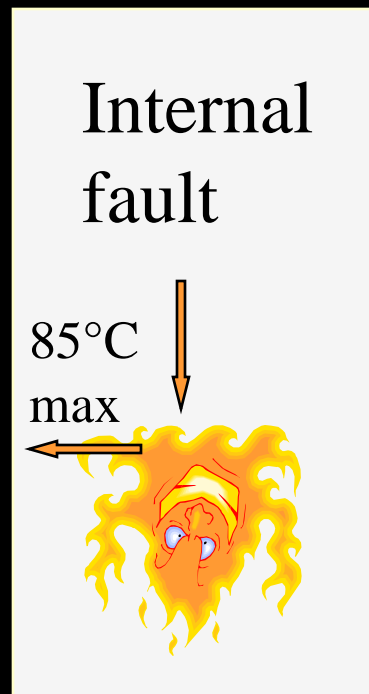
classification of temperatures

- "T" followed by the number from **1** to **6** indicates the class of the maximum temperature of surface that can bear the device, taking care of a security's coefficient : no surface of the equipment in contact with the gas/air mixture should exceed the **MIT** of the gas.
- Each flammable gas or vapour has a specific **Minimum Ignition Temperature**.
- *This classification is relevant to a given surrounding temperature (**40°C**).*

classification of temperatures

- Example: **T6**

Gas
detector-
casing



Gas detected
ignition **T° >85°C**

Temperature classes

- To ease the selection of equipment, six different temperature classes have been created for both gases and equipment.

IEC CENELEC (group II)	T6	T5	T4	T3	T2	T1
maximum temperature of surface	85°C	100°C	135°C	200°C	300°C	450°C

Function of Explosion protection

- *The function of the discipline of explosion prevention is to ensure that there is a negligible probability that a means of ignition and any significant quantity of a potentially explosive atmosphere can occur in the same location at the same time.*
- *Both **mechanical** and **electrical** methods are employed and have been classified under **4** categories:*

4 categories of protection

- **Non-incendive** equipment (comparable with n)

(EN 50021)



- **Flameproof or explosion-proof** equipment (d) (EN 50018)



- **intrinsic safety** equipment (i)

(EN 50020)



- **increased safety** equipment (e) (EN 50019)



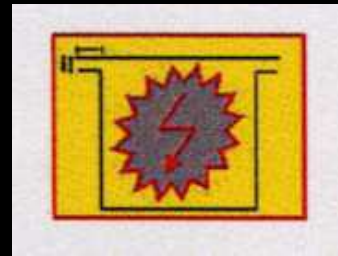
*NON-INCENDIVE EQUIPMENT(**n**)*

- Transmitters « **n** » for zones **2 (gas)** and **22(dusts)**
- In accordance with regulation **CEI 79-15**: minimum protection (non sparking)
- Typical applications: instrumentation, control gear, electronic systems, measurement and control.

EN 50021

FLAMEPROOF or explosion-proof equipment (d) ≡ containment

- Elements sensitive to produce a spark are enclosed in **casings resistant** to an eventual internal explosion.



- *This material is in accordance with the decree of March 28, 1960:*

EN 50018

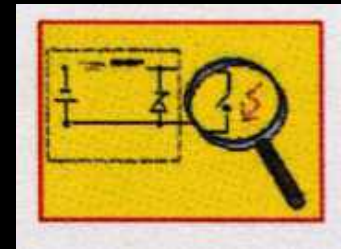
FLAME PROOF TRANSMITTERS: ***spécifications of installation***

- Transmitters « **d** » for zones **1** and **2(gas)** and **21** and **22(dusts)**
- The cable will be mechanically protected
- Transmitter 's body will be connected to the earth
- If connections are in classified area:made in certified housing.
- Typical applications:
switch gear, motors , pumps.



equipment with intrinsic safety (i) ≡ prevention of ignition

- Intrinsic safety aims to limit the level of energy release under any circumstances (MIE !.....)



- *It is the ideal equipment in particular in an atmosphere with **hydrogen**.*

EN 50020

INTRINSIC SAFETY: FAULT CONDITIONS

- The definition of intrinsic safety includes reference to **fault conditions**.
- **Two categories** of intrinsically safe instrument are defined in the standards: **ia** and **ib**.
- **The categories differ in two principal respects:**
 - the number of specified faults which the instrument can sustain without producing a risk of ignition
 - the values of the safety factor which are applied to the ignition data used in the design...

INTRINSIC SAFETY: FAULT CONDITIONS

- **Category « ia »:**
- *instruments of this category must be incapable of causing ignition in **normal operation** or with a **single fault** or with **any two independent faults**. A safety factor of 1.5 must be applied to relevant ignition data for normal operation or for a single fault and a safety factor of 1.0 for the two-fault condition.*
- *Intrinsic safety category « **ia** » is the only method of protection approved for zone « **0** or **20** ».*

INTRINSIC SAFETY: FAULT CONDITIONS

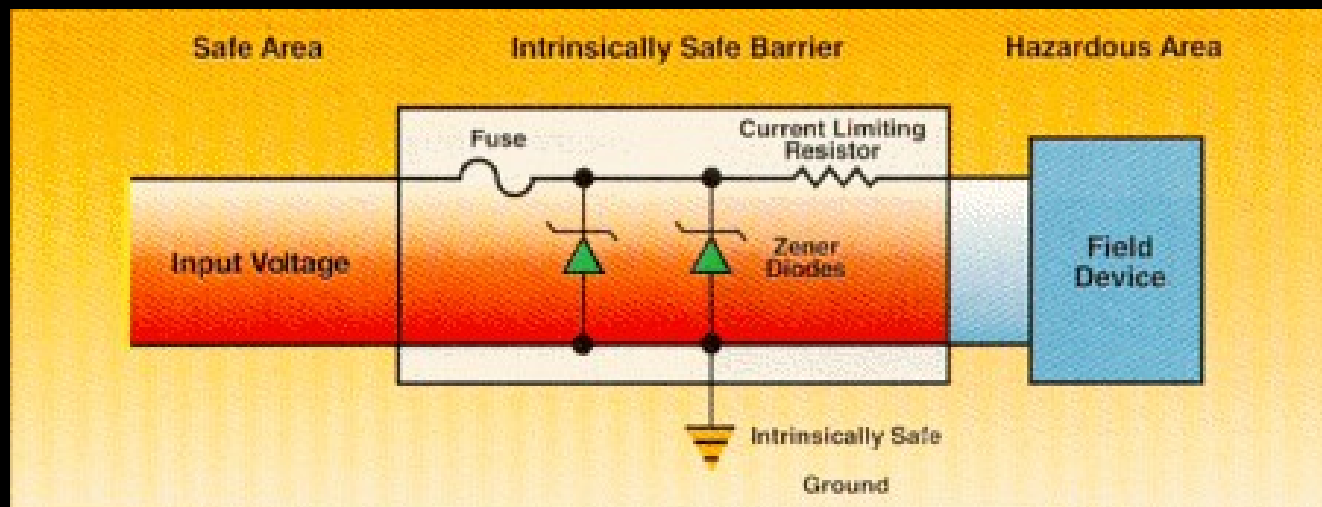
- **Category « ib »:**
- *instruments of this category must be incapable of causing ignition in **normal operation** or with a **single fault** . A safety factor of 1.5 must be applied to relevant ignition data for normal operation or for a single fault.*
- *Intrinsic safety category « **ib** » is generally approved for zone « **1** or **21** ».*

Intrinsic safety TRANSMITTERS: *spécifications of installation*

- Transmitters for zones 0,1 or 2(gas) and 20,21 and 22(dusts)
- Obligatory powered by an **intrinsic source:28V/300 ohms**
- *If connections are in classified area:made in certified housing.*
- *Typical applications: instrumentation, control gear, electronic systems, measurement and control.*

Intrinsically-Safe Systems

- I.S. systems require installation of power-limiting barriers**
- Barriers will ground the system power supply**
- Ground-fault monitoring systems are incompatible**



equipment with increased safety (e)

- Transmitters « **e** » for zones 1 and 2(gas) and 21 and 22(dusts).
- This material is realised so that the occurrence of **accidental sparks** is **highly improbable**

EN 50019



- *protection by insulator : the whole equipment is dipped in a resin or a liquid to be totally separated from the ambient atmosphere.*

equipment with increased safety spécifications of installation

- Transmitters « **e** » for zones **1** and **2(gas)** and **21** and **22(dusts)**
- The cable will be mechanically protected
- Transmitter 's body will be connected to the earth
- If connections are in classified area:made in certified housing.
- Typical applications: motors, light fittings.

Types of protection: symbols and zones

Type of PROTECTION		OG/20D	1G/21D	2G/22D
Non-incendive	n			X
<i>immersion in oil</i>	o			
<i>internal under pressure</i>	p			
<i>pulverulent filling</i>	q			
flameproof casing	d		X	X
increased safety	e		X	X
intrinsic safety	i _(a/b)	X _(« a » only)	X	X

Index of protection



- Dust, water and impacts damage the equipment. Device's casing is protected against this outside parameters.
- So the IEC defined a list of **different degrees** of protection and a numeration

Degree of protection

IP xxx = degree of protection of casings of electric equipment

against solids		against liquids		mechanical protection	
0	no special protection	0	No special protection	0	No special protection
1	larger than 50 mm.	1	Protected against dripping water	1	Impact energy = 0,225 joule
2	larger than 12 mm.	2	dripping water falling vertically any angle up to 15°	2	Impact energy= 0,375 joule
3	larger than 2,5 mm.	3	rain falling vertically any angle up to 60°	3	Impact energy= 0,5 joule
4	larger than 1 mm.	4	splashing water, splashed from any direction	5	Impact energy= 2 joules
5	Dust protected	5	water projected from a nozzle against the equipment from any direction	7	Impact energy = 6 joules
6	Dust- tight	6	heavy seas or powerful water jets	9	Impact energy = 20 joules
		7	immersion under defined conditions		
		8	submersion		