



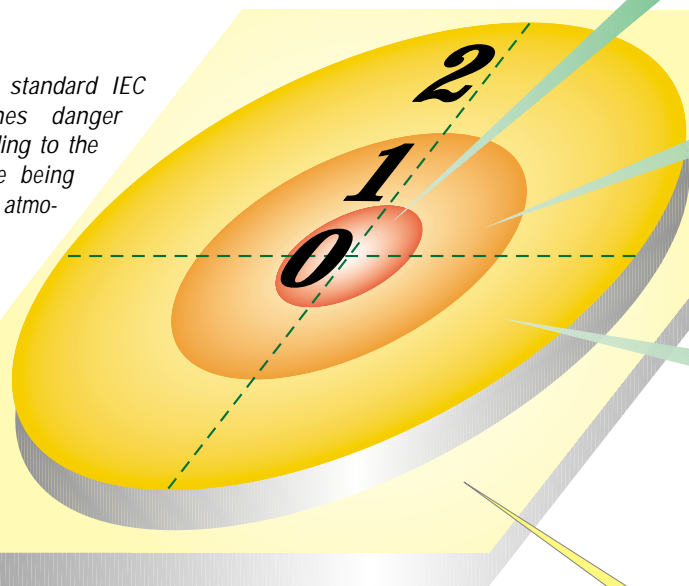
**3-PHASE INDUCTION MOTORS**  
**fixed speed and variable speed**  
**for hazardous locations**





In response to the demands of severe industrial environments where both corrosion and risks of explosion are present, LEROY-SOMER has developed a full range of motors certified by approved laboratories as conforming to European and international standards, guaranteeing complete safety of operation.

International standard IEC 79-10 defines danger zones according to the risk of there being an explosive atmosphere.



ZONE 0 : Location in which a gaseous explosive atmosphere is continuously present for long periods.

PERMANENT DANGER

ZONE 1 : Location in which a gaseous explosive atmosphere is likely to form during normal operation.

POTENTIAL DANGER

ZONE 2 : Location in which a gaseous explosive atmosphere is unlikely to form during normal operation and in which any such atmosphere can only last for a short period.

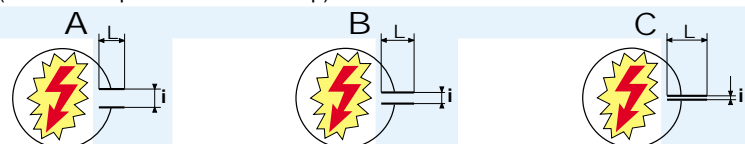
MINIMAL DANGER

#### CLASSIFICATION OF GASES

- 2 groups for **locations** where there is a risk of explosion

- Group I : Gas-prone mines - Group II : Locations other than group I

- 3 subdivisions for **gases** in group II classified according to the MESG (Maximal Experimental Safe Gap)

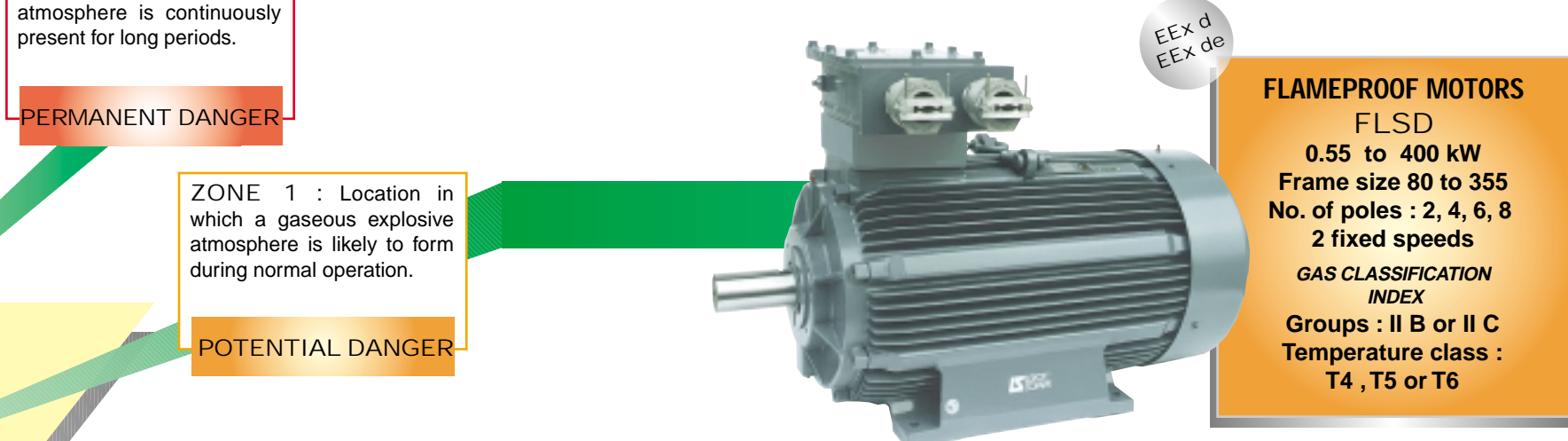


The **risks** following an explosion increase from subdivision A to subdivision C.

- 6 temperature classes

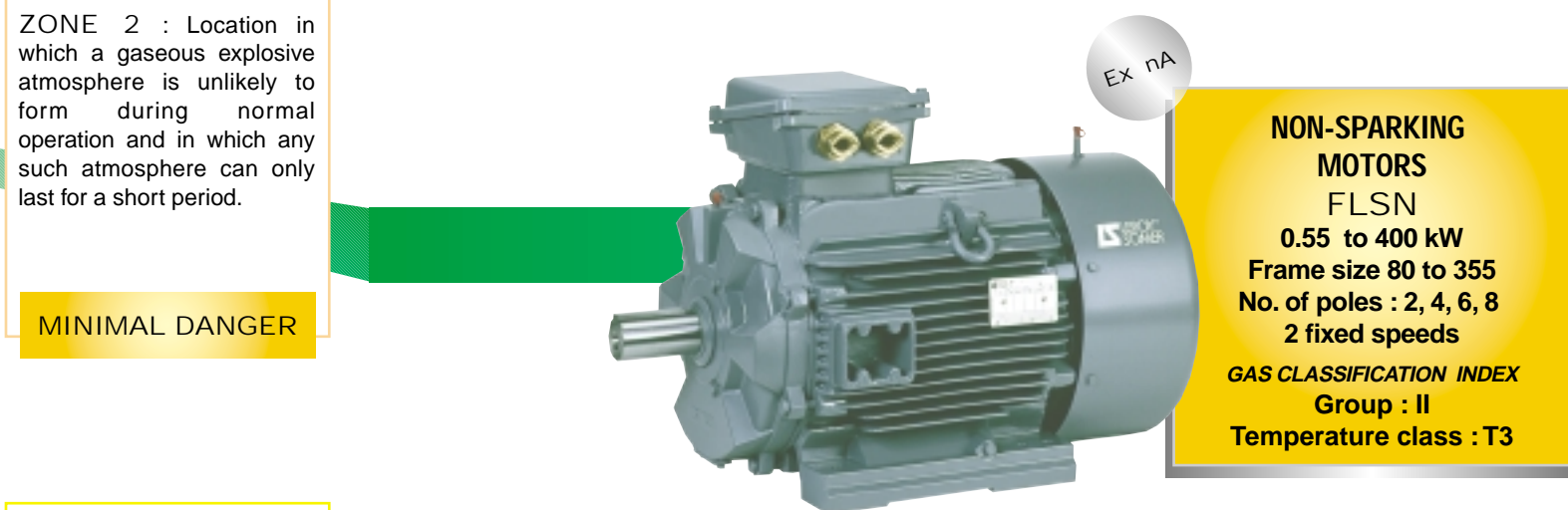
Temperature class	T1	T2	T3	T4	T5	T6
Ignition temperature	> 450 °C	> 300 °C	> 200 °C	> 135 °C	> 100 °C	> 85 °C
Max. permissible surface temperature for the equipment	450 °C	300 °C	200 °C	135 °C	100 °C	85 °C

Gases are characterised by their ignition temperature : the maximum temperature of any part or surface of a piece of electrical equipment must always be lower than the ignition temperature of the gas mixture.



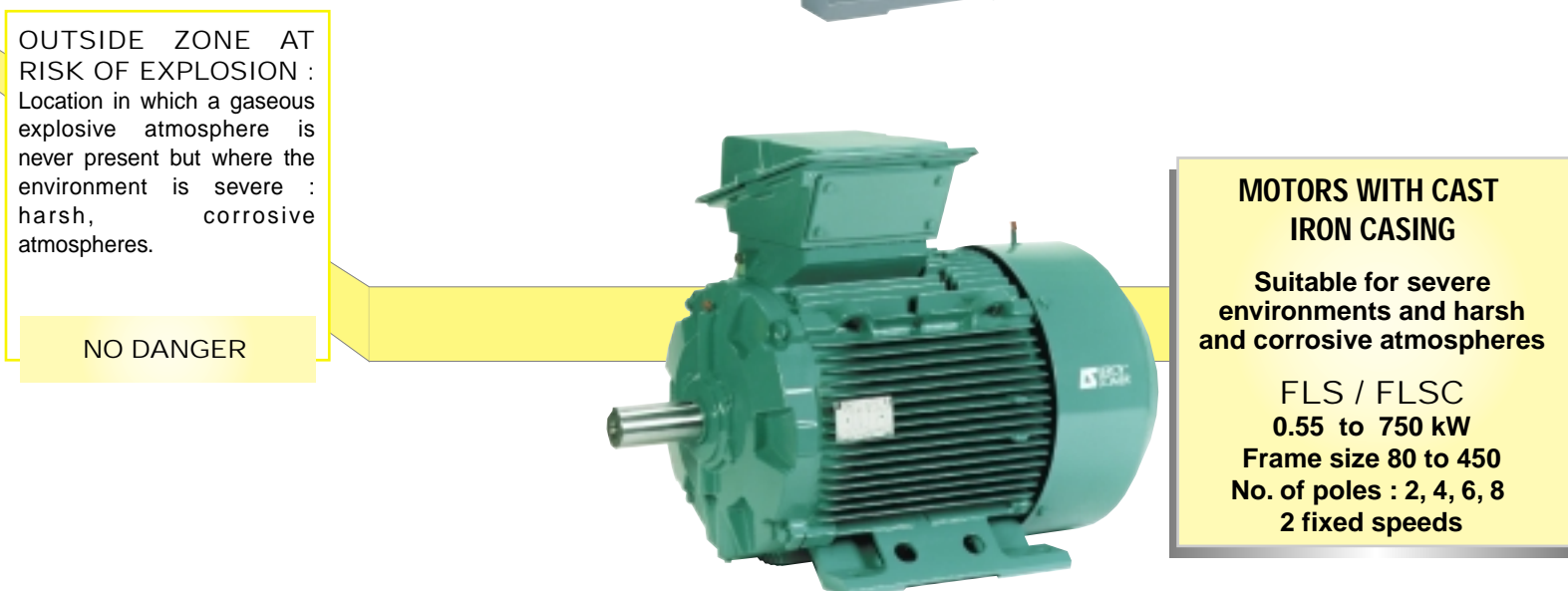
#### FLAMEPROOF MOTORS FLSD

0.55 to 400 kW  
Frame size 80 to 355  
No. of poles : 2, 4, 6, 8  
2 fixed speeds  
GAS CLASSIFICATION INDEX  
Groups : II B or II C  
Temperature class : T4 , T5 or T6



#### NON-SPARKING MOTORS FLSN

0.55 to 400 kW  
Frame size 80 to 355  
No. of poles : 2, 4, 6, 8  
2 fixed speeds  
GAS CLASSIFICATION INDEX  
Group : II  
Temperature class : T3



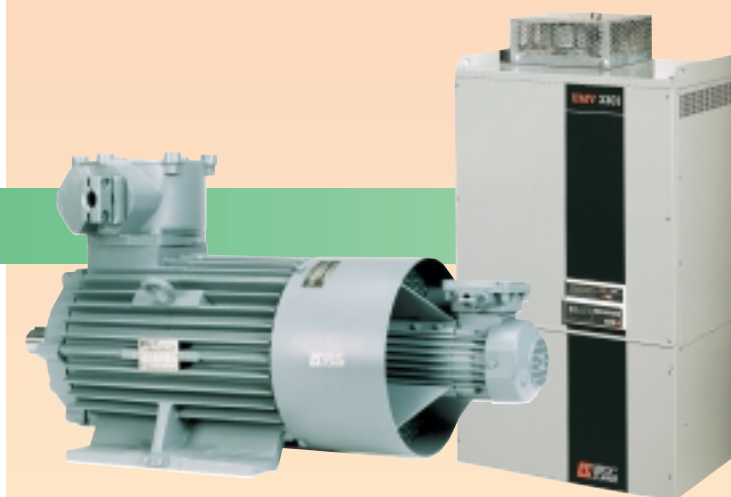
#### MOTORS WITH CAST IRON CASING

Suitable for severe environments and harsh and corrosive atmospheres

FLS / FLSC  
0.55 to 750 kW  
Frame size 80 to 450  
No. of poles : 2, 4, 6, 8  
2 fixed speeds

## VARIABLE SPEED AND SAFETY

**What are the risks ?** Any frequency inverter imposes non-sinusoidal waveforms on the motor : these carry harmonics which cause additional losses and increase the motor temperature. In addition, depending on the application and the operating cycle, the motor can be used with reduced ventilation, leading to restricted dissipation of motor losses. The main risk is that the gas ignition temperature will be reached following an increase in motor temperature (either internal or surface temperature depending on the mode of protection). Both the motor manufacturer and the user must ensure that reliable protective devices for monitoring the motor temperature are installed which have been approved by the certifying body.



**CONSTRAINTS** : The **motor surface temperature** must always be lower than the certified temperature class irrespective of the conditions of use.

**SOLUTIONS** : to monitor the surface temperature :

- thermal probes are incorporated in the coils of motors with frame sizes less than 225.
- thermal probes are incorporated in the coils and endshields of motors with frame sizes greater than 250.

**CERTIFICATION** : Flameproof motors are certified for use at variable speeds irrespective of the inverter or application.

**RESPONSIBILITY OF THE USER** :

- Connect the thermal protection to a device which switches off power to the motor and ensure that the equipment is operating correctly.
- With an auxiliary ventilation system operating, the user must ensure that ventilation is present and must stop operation of the main motor in the event of a failure in the ventilation system.
- Place the inverter outside zones where a risk of explosion exists.



**CONSTRAINTS** : The temperature at **any point on the motor** must always be lower than the rated temperature class irrespective of the conditions of use.

**SOLUTIONS** : Since the rotor is the hottest point on the motor, effective, reliable monitoring of the motor internal temperature during operation requires complex methods of measurement. The temperature is determined during performance testing and the operating limits are specified with the certifying body.

**CERTIFICATION** : Non-sparking motors may be approved for a given application and specific inverter characteristics : in this case the operating limits are indicated on the conformity certificate and indicated on the motor name plate.

**RESPONSIBILITY OF THE USER** :

- Ensure that the motor is always used in conformance with approvals.
- Place the inverter outside zones where a risk of explosion exists.



**CONSTRAINTS** : Even with the motor outside a zone where the risk of explosion exists, it must be established whether it is suitable for use at variable speeds.

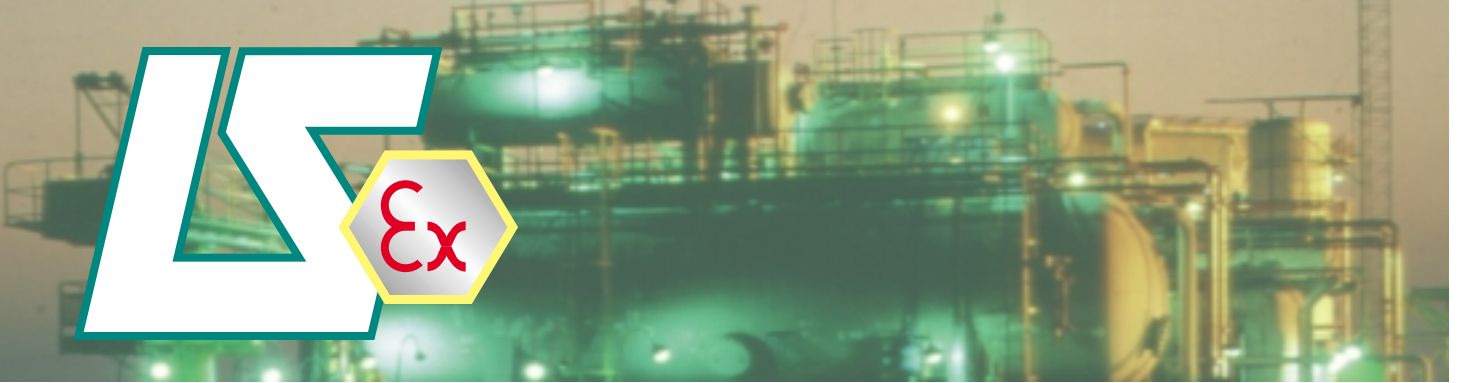
**SOLUTIONS** : Standard or customised motors are offered depending on the application : *quadratic torque or constant torque* and the operating mode : *speed range, operating cycle and type of inverter*.

**CERTIFICATION** : FLS/FLSC motors meet the essential requirements of the Low Voltage Directive 73-23-EEC and thus receive C € marking.

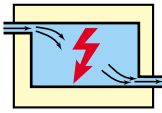
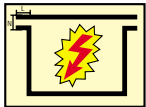

**OPTIONS** :

Thermal probes, auxiliary ventilation, encoder.



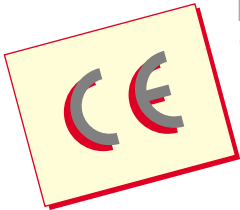


European standards define the specific manufacturing regulations for the electrical equipment to be used in zone 1 according to the selected mode of protection.  
Each mode of protection, characterised by a lower case letter, is subject to a specific standard in addition to standard EN 50014 governing general safety regulations.  
Three modes of protection are used for electric motors :

Symbol	Mode	CENELEC	Principle of protection	
p	Internal pressure surge	EN 50016	• Prevents the explosive atmosphere from penetrating the motor by maintaining a protective gas at a higher pressure than the surrounding atmosphere.	
d	Flameproof enclosure	EN 50018	• Resists internal explosion. • Prevents transmission of flames. • Limits surface temperature.	
e	Increased safety	EN 50019	• Avoids electric arcs. • Avoids sparks. • Incorporates overcurrent monitoring to limit temperature at any point on the motor during all operating phases.	

All equipment for use in **zone 1** can by definition be used in **zone 2**.  
A special mode of protection is defined for electric motors :

Symbol	Mode	STANDARD	Principle of protection
nA	Non-Sparking	IEC 79-15	• Avoids electric arcs • Avoids sparks • Limits temperature at any point on the motor except in transient states

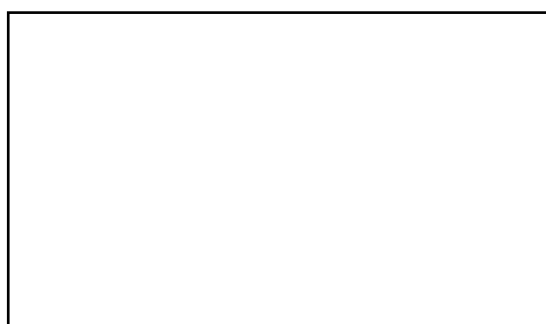


From 1 July 2003, motors marketed within the EEC which are designed to operate in zones with a risk of explosion must be certified in conformity with the ATEX 94/9/EC directive, called "Protective devices and systems designed for use in explosive atmospheres".

**All the LEROY-SOMER motors concerned will meet the essential requirements of the ATEX directive and will thus receive CE marking.**

**The operator of an establishment containing electrical installations which are classified as presenting a potential risk of explosion must :**

- **define the areas** in which **explosive atmospheres** are likely to occur
- **select electrical equipment** suitable for the areas defined above
- **ensure adequate conditions of installation, operation and maintenance** for the equipment



MOTEURS LEROY-SOMER 16015 ANGOULEME CEDEX-FRANCE