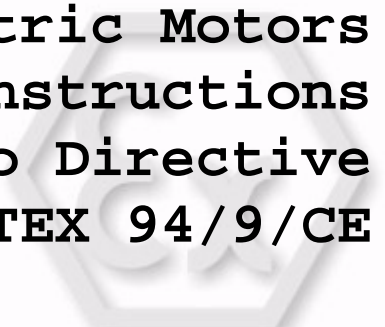




**Ex-d**

**Explosion-Proof Electric Motors  
Safety Instructions  
conforming to Directive  
ATEX 94/9/CE**



**NOTE:**

These instructions must be observed in addition to the warnings shown in the user manual relative to all types of motors.

**1.0 FOREWORD**

Motors for dangerous areas are expressly designed to satisfy the requirements of the official standards relative to environments with a danger of explosion. If these motors are used improperly, incorrectly connected or even marginally modified, their safety and reliability can be seriously compromised. Pay scrupulous attention to the relative standards for connecting and using electrical devices in dangerous areas. Only competent personnel with a perfect knowledge of such standards are authorized to work on such equipment. The motors that are the object of these instructions are equipped with the following protections against the risk of explosion:

- Ex d IIB: explosion-proof motor and terminal box

**2.0 DECLARATION OF CONFORMITY**

All motors from I.S.G.E.V. S.p.A. complies with the following directives:

- EMC directive 89/336/EEC, as amended by 92/31/EEC and 93/68/EEC;

I.S.G.E.V. motors with the CE mark on the name plate complies with ATEX directive 94/9/CE, which provides for the issuance of a certificate of conformity of the prototype and a certificate of the quality control of the production.

**3.0 VALIDITY**

These instructions are valid for the following types of motors when used in dangerous areas:

**Exd IIB explosion-proof series AD 71+132**

**4.0 CONFORMITY**

The motors complies with both the electrical and mechanical requirements for standard motors as well as with the following European standards for motors used in dangerous areas:

- EN 60079-0: General standard related to electrical units in potentially explosive atmospheres;
- EN 60079-1: Standard related to electrical units in potentially explosive atmospheres; enclosure Ex d.
- EN 61241-0-1/61241-1: Standard related to electrical units in presence of combustible dust; dust-proof enclosure.
- EN 60034-5: Classification of the protection degree (IP).

I.S.G.E.V. motors (valid only for group II) can be installed in areas corresponding to the following:

Zone	Category
1 – GAS (IP55)	2 – high protection
21 – DUST (IP65)	2 – high protection

**Atmosphere**

**G** – explosive atmosphere caused by gas, vapour and mist

**D** – explosive atmosphere caused by dust

**5.0 SUITABILITY OF THE MOTOR TO THE PLACE OF INSTALLATION**

In the case of use in areas with danger of explosion, you must verify that the motor is suitable for the area classification and for the characteristics of the inflammable substances present on the system.

The essential safety requirements against the risk of explosion in classified areas are established by the following directives:

- 94/9/CE ATEX for electrical units
- 1999/92/CE for electrical systems

The criteria for classifying areas with risk of explosion are provided by the following standards:

- EN 60079-10 for gas
- EN 61241-10 for dust

The technical requirements for electrical systems in classified areas are provided by the following standard:

- EN 60079-14 for gas
- EN 61241-14 for dust

On the basis of these technical and legislative dispositions, the selection of the type of motor must take into account the following factors:

- type of system: mines (group I), surface systems (group II)
- zone classification: 0, 1, 2 (for which there is suitable equipment of category 1, 2 and 3, respectively)
- characteristics of the inflammable substances present in the form of gas, vapour or mist:
- subgroups: IIA, IIB, IIC
- temperature class: T1, T2, T3, T4, T5, T6 (defines the ignition temperature of the gas)
- characteristics of the inflammable substances present in the form of clouds or layers of dust
- max. surface temperature of the dust
- protection degree IP65 for dust

The standard ambient temperature is between -20/+40 °C; the temperature classes T5-T4-T3 are classified as follows:

Temperature class (T max. surface)	T5 (T100°C)	T4 (135°C)	T3 (150°C)
Ambient temperature	40°C	50°C	60°C

**GAS classifications**

Industry	Gas group	Gas type (examples)
Explosive atmospheres (for surface systems)	IIA	Propane
	IIB	Ethylene
	IIC	Hydrogen/Acetylene

In addition to the functional data, the name plate also contains the following data:

- the information necessary for selecting a suitable motor type and for its correct installation.
- References to the notified organizations responsible for certification.

**5.1 NAME PLATE DATA REGARDING SAFETY**

The motor name plate show the following marking:

<b>CE</b> 0722 <b>Ex</b> <b>CESI ATEX 051 / 052X</b> II 2G Ex d IIB -T5-T4-T3-IP55 II 2GD Ex d IIB-T5-T4-T3 Ex Td A21 IP65 –T100°C –T1 35°C –T150°C
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<b>CE</b>	Marking in compliance with directive 94/9/CE and the pertinent technical European standards	
<b>0722</b>	Number of the organization (CESI) (notified for ATEX surveillance)	
<b>Ex</b>	Distinctive European Union mark	
<b>II 2 GD</b>	<b>I</b> Mining	Motor for surface systems, group II. Category 2 suitable for zone 1 with presence of gas (G) IP55 or for zone 21 with presence of dust (D) IP65
	<b>II</b> Non-Mining	
	<b>1</b> extremely high protection	
	<b>2</b> high protection	
	<b>3</b> normal protection	
	<b>G</b> Type of explosive gas atmosphere (zone 1)	
	<b>D</b> type of explosive dust atmosphere (zone 21)	
<b>IIB</b>	<b>II</b> non-mining	Group IIB enclosure suitable for substances (gases) of group IIB (ethylene)
	<b>B</b> gas group	
<b>Ex d</b>	Explosion-proof motor with explosion-proof terminal box	
<b>Ex tD A21</b>	Dust proof enclosure suitable for method "A" for zone 21 or 22 with conductive dust.	
<b>T5 (T100°C)</b> <b>T4 (T135°C)</b> <b>T3 (T150°C)</b>	Temperature class of the motor (maximum surface temperature) suitable for the corresponding temperature class of the inflammable substance.	
<b>IP55</b> <b>IP65</b>	Mechanical protection IP: IP55 for gas; IP65 for dust	
<b>CESI 03</b> <b>ATEX</b> <b>ooo / oooX</b>	Name of the laboratory that issued the CE type certificate, year of issue of the certificate and number of the type certificate.	

**Notes:**

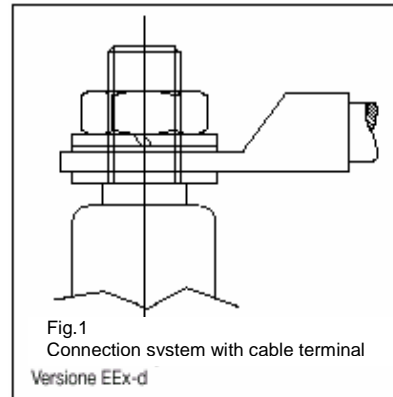
- a) Group IIB motors are also suitable for IIA environments.
- b) Motors with temperature class data are also suitable for all substances with a higher temperature class (for example, T5 motors are suitable for substances of temperature class T4 and T3).
- c) Explosion-proof motors are normally required for service with ambient temperature in the range of -20 °C to +40 °C, maximum altitude of 1000 m above sea level. Different ambient temperatures and altitudes have to be specified on order and, if possible, will be shown on the name plate.
- d) Special working conditions are indicated with the symbol "X" on the certificate.

**5.2 POWER, AUXILIARY AND GROUND CONNECTIONS**

Power supply and auxiliary connections must be made as indicated in the connection diagrams provided with the motor.

Table 1 on the last page of this manual shows the most common wiring diagrams.

For protection mode Ex-d, the connection to the main



terminal has to be made by an eyelet terminal (fig. 1).

Power and auxiliary connections must be made with the tightening torques indicated here below according to the type of screw:

Screw size	Tightening torque [Nm]
M4	0.8÷1.2
M5	1.8÷2.5
M6	2.7÷4.0
M8	5.5÷8.0
M10	9.0÷13
M12	15.5

**5.3 AUXILIARY CONNECTIONS**

- a) Thermal protection: verify the type of protection installed before making the connection. In case of a PTC or PT 100 thermistors an appropriate relay has to be used.
- b) Heating elements: in the event the motor is provided with heating elements, these must be separately supplied by using the relative terminal clamps housed in the terminal box. Since the single-phase power supply voltage has a different value than that of the motor, verify that the voltage corresponds to the voltage indicated on the name plate. Pay attention not to supply the heating elements when the motor is running.

**5.4 CABLE ENTRANCES**

The connections must be realized through the cable entries or pipe conduit conforming to the EN 60079-14 standard.

The cable entries must be realized in such a way as not to alter the specific properties of the protection mode, as indicated in the EN 60079-1 standard for Ex-d motors (explosion-proof protection mode). When the cable entry is made with a cable gland, this must correctly selected in relation to the type of system and the type of cable. The cable gland must be tight enough that the seal rings exert the necessary pressure:

- a) to prevent the transmission of mechanical stresses to the motor terminal clamps.

b) to prevent the entrance of dust and to guarantee the mechanical protection (IP grade) of the motor. For Ex-d terminal boxes, the cable entries must be realized with locking fittings or Ex-d certified cable glands in conformity with the EN 60079-0/1 for gas and EN 61241-0/1 for dust.

CABLE OUTPUT			
motor	standard	On request	On request
AD 71	NTP 1/2"	Gk 1/2"	M20x1.5
AD 80	NTP 1/2"	Gk 1/2"	M20x1.5
AD 90	NTP 1/2"	Gk 1/2"	M20x1.5
AD 100	NTP 3/4"	Gk 3/4"	M25x1.5
AD 112	NTP 3/4"	Gk 3/4"	M25x1.5
AD 132	NTP 1"	Gk 1"	M32x1.5

AUXILIARY CABLE OUTPUT			
motor	standard	On request	On request
AD 71-80-90- AD 100-112-132	NTP 1/2"	Gk 1/2"	M20x1.5

In addition:

the choice of the locking gland and cable must be made on the basis of the maximum operating temperature required for the cable and indicated (if > 90 °C) on a warning plate, if any;

- do not add any gaskets not provided by the manufacturer;
- when reassembling the terminal box body, the contact surface has to be sealed by a layer of anaerobic grease type AREXONS 35A10 code 4734.

Every motor must be provided with an overload protection or equivalent device. The surfaces of joints must not be painted, lacquered, damaged or further worked; they must be kept clean as metal surfaces. Use a light layer of oil or waterproof grease to protect against rust. Do not introduce gaskets in places not destined for that purpose. Damaged fixing screws must be promptly replaced with new screws made with resistance to traction that is not less than the original screws. The original screws are marked with the minimum breaking load on their head or shaft. In the event that these parts turn out to be defective or are damaged, they must be promptly replaced. The motors are normally provided for direct coupling. In the event of coupling by means of pulleys or belts, they must be made of materials that do not accumulate electrostatic charges. The power indicated on the name plate is referred to a power supply at nominal voltage and frequency, an ambient air temperature not higher than 40 °C and an altitude not higher than 1,000 m above sea level. Under these conditions, the outside surface temperature of the enclosure will not exceed the ignition temperature of the gas for which the enclosure was provided. We recommend periodically checking the outside ventilation circuit to make sure it is not obstructed, even partially, as that could cause an increase in the temperature of the motor due to insufficient cooling.

### 5.5 GROUND CONNECTION

In addition to the ground connection in the terminal box provided for all motors, explosion-proof motors are provided with a second ground plug located on the outside of the terminal box on the body of the motor. It must be connected to the general system ground using a wire of adequate section. As a function of the section S of the line wire, the section of the ground wire must be:

Section of the phase wires of the system S (mm <sup>2</sup> )	Minimum section of the corresponding protection wire S <sub>p</sub> (mm <sup>2</sup> )
S ≤ 16	S <sub>p</sub> = S
16 < S ≤ 35	16
S > 35	S <sub>p</sub> = $\frac{S}{2}$

### 5.6 OTHER INSTALLATION NOTICES

Explosion-proof motors are protected against overloads by the automatic disconnection of the power supply by means of an inverse time protection device or through a device for the direct control of the temperature with a thermal probe inserted in the windings.

When installing explosion-proof motors, you must take care that the motor ventilation is not obstructed by obstacles located in the immediate vicinity.

The distance between the motor air intake and the wall or another machine must be at least ¼ the diameter of the opening of the air intake itself. Cold air passes from the rear side towards the front side. Air exiting from the motor must not be sucked in again by the fan. The air intakes and outputs must be kept clean.

### 5.7 MOTOR WEIGHTS

The following table shows the type of motor in relation to the maximum weight in kg; in the case of motors with forced ventilation, the weight of the ventilation motor has to be added.

AD 71	AD 80	AD 90	AD 100	AD 112	AD 132
12.5	20.5	30	48	57	95

### 6.0 MOTORS WITHOUT FAN

#### 6.1 COOLING METHOD IC 418

When the ventilation is provided by the directly coupled fan. In this case, you must make sure that motor ventilation is never impeded under all operating conditions and that the temperature limits allowed by the insulation class B are respected.

The fans must respect the requirements according to the EN 1127-1 and EN 61241-0/1 standard for dust and any other standard regarding products for ventilators.

#### 6.2 COOLING METHOD IC 410

When the motor is not provided with a fan, the following limitations must be observed.

For "S1" services, the power output of the motor is declassified by 50% so as to respect the allowed temperature limits.

### 7.0 MOTORS WITHOUT TERMINAL BOX AND WITH OUTPUT CABLE

When the motor is supplied without a terminal box, the motor case is closed by a plate from which a power supply cable emerges. The user must follow these instructions for a correct installation:

- An armored cable emerges from the motor plate, tightened by a suitable cable gland.
- The user has to connect the cable in accordance with one of the protection modes required by the EN 60079-0 standard and conforming to the current plant engineering rules for the installation place of the motor.
- In the event that an armored cable is not used, the user has to protect the cable against damage caused by mechanical stresses (such as by inserting the cable in a conduit).

Motors with plate, cable and cable gland are covered by certificate: **CESI 03 ATEX 052 X**

## 8.0 MOTORS WITH FORCED VENTILATION

### 8.1 COOLING METHOD IC 416

In these cases cooling is assured by the ventilation supplied by an auxiliary explosion-proof motor mounted on the rear of the main motor, which is subject of a different certification.

The motor for the forced ventilation takes part of the main motor.

In order to respect the essential safety requirements described by point 1.5 of the ATEX Directive, the user must provide a safety device that allows starting the main motor only when the auxiliary ventilation motor is working. In addition, PTC, PT 100 probes or bimetallic protectors are inserted in the winding.

The user must connect these thermal detectors to a relay that will cut off the power supply from the motor. This relay must have a manual reset.

### 9.0 MOTORS POWERED BY INVERTERS

For motors supplied by inverter a temperature control by means of PTC thermistors or bimetallic contact has to be inserted in the winding.

When the temperature class of the motor is T4, the user is required to connect the terminals of the PTC, PT 100 or bimetallic protectors in the terminal box to a suitable device (cut off relay) capable of assuring that the power supply will be cut off when a dangerous temperature is reached. The reset of this relay must only be manually and not automatically.

In observing the essential safety requirements of European Directive 94/9CE, the user must:

- use a cut off device conforming to the principles of the IEC61508 standard

or

- use a cut off device able to take itself to a safety position in the case of breakdown (fail-safe)

#### Attention

- a) The nominal characteristics of service at an industrial frequency can vary in the case of power supply by a frequency converter. In particular, the power could be significantly reduced to maintain the assigned temperature class and to avoid damage due to overheating. Before putting the motor into operation, check that the characteristics (power – frequency – torque) indicated on the auxiliary name plate are compatible with the application. In the absence of such indications, the user must consult the documentation provided by the manufacturer.
- b) Asynchronous three-phase motors with mains power supply respect the immunity and emission limits required by the regulations relative to electromagnetic compatibility. In the case of power supplied by an inverter, the installer is responsible for verifications and any precautions that may be necessary to respect the relative standards.
- c) The choice of the type of inverter must be made taking into account that the motor must not be subjected to peak voltages greater than 1000 V and  $dV/dt \leq 500V/\mu s$ , that would significantly reduce the life expectancy of the winding insulation. In this regard, you must keep in mind that the value of voltage peaks is also influenced by the length of the power supply cable.
- d) Motors with IC416 cooling: when the motor is equipped with forced ventilation by an auxiliary motor, the instructions previously given in point 8.1 (Cooling method IC416) must be observed.

## 10.0 CHECKING AND MAINTAINING EXPLOSION-PROOF MOTORS

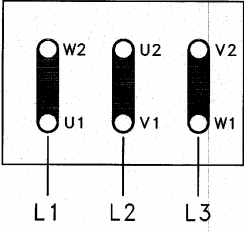
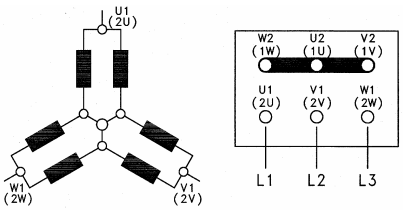
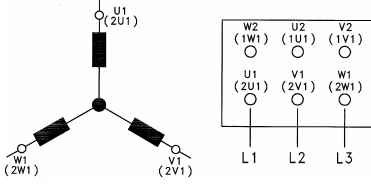
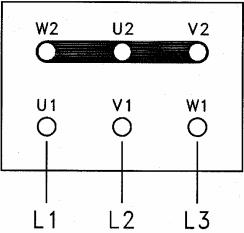
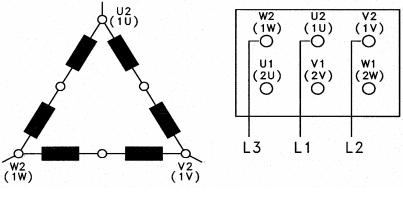
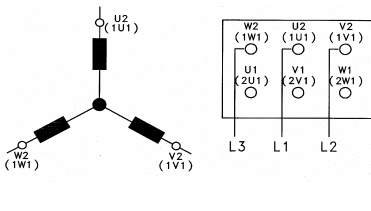
Checking and maintaining explosion-proof motors must be carried out in accordance with the criteria of the EN 60079-17 and EN 61241-17.

- The electrical terminal connection must be well tightened to avoid high contact resistance and consequent overheating.
- All the screws used for closing the motor and terminal box must be fully tightened.
- The replacement of gaskets and cable-entry parts must be performed with identical components to those provided by the manufacturer to guarantee that the protection will be maintained.
- The surfaces of explosion-proof joints (such as: joints for terminal board/terminal cover, terminal board/motor body and motor body/shields and shaft/inside bottom) must not be worked, nor should sealing gaskets be introduced that were not provided by the manufacturer. Such surfaces must be kept clean. A thin layer of anaerobic grease type AREXONS 35A10 code 4734 can be used to prevent corrosion and the entry of water. Such grease must be refreshed every time the surfaces mentioned above are disassembled.

### 11.0 REPAIRS TO EXPLOSION-PROOF MOTORS

Repairs to explosion-proof motors must be made by I.S.G.E.V. After the repair intervention, a supplementary plate will be applied to the motor (without removing the original plate) bearing the following marks:

- symbol **R**
- serial number of the intervention.

TABLE 1 – WIRING DIAGRAMS		
Single speed motors	Double speed motors	
	Single winding in Dahlander or PAM connection	Two separate windings
 <p style="text-align: center;">Δ Connection</p>	 <p style="text-align: center;">High speed connection</p>	
 <p style="text-align: center;">Y Connection</p>	 <p style="text-align: center;">Low speed connection</p>	

**Direction of rotation**

Standard motors can function in either of the two directions of rotation, indifferently. If you connect a normal right-hand triad, L1, L2, L3 to terminal clamps U, V, W, as shown in the scheme, the direction of rotation of the motor will be clockwise, looking from the control side. You reverse the direction of rotation by reversing two terminals (connection of L1, L2, L3 to V, U, W or to U, W, V or W, V, U).

*The descriptions and/or technical characteristics of this catalogue are not binding. I.S.G.E.V. S.p.A. reserves the right and the power to make changes at any time without advance notice.*