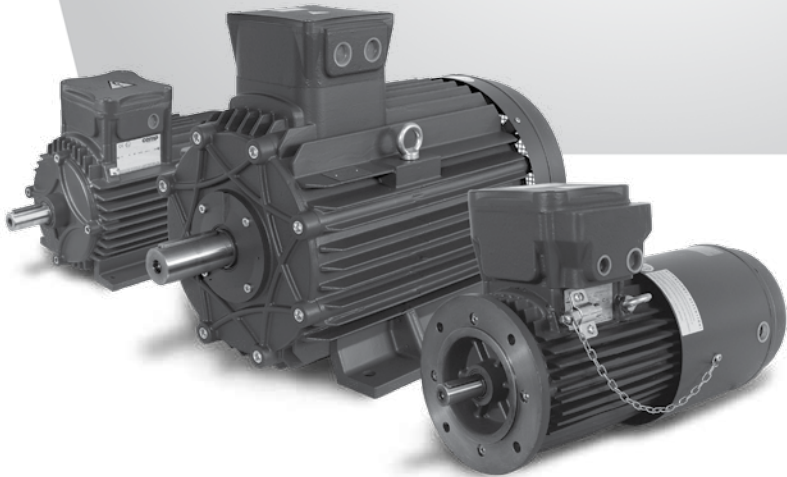


cemp

Flameproof
Motors



Electric Motors

Safety instructions - Ex d; Ex de

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1. Foreword

These safety instructions refer to the installation, operation and maintenance of flameproof motors for use in areas where there is a presence of potentially explosive atmospheres.

This document deals with various aspects of safety which concern motors with construction variants. The pertinent sections are listed in the following table.

Type of flameproof motor	Points in the manual
Motors for Gas	1-2-3-10-11
Without terminal box	1-2-3-4-10-11
Without fan	1-2-3-5-10-11
With forced ventilation	1-2-3-6-10-11
For low temperatures	1-2-3-7-10-11
For inverters	1-2-3-8-10-11
Single-phase motors	1-2-3-9-10-11

The motors considered in these instructions are group II motors for gas.

Group II motors for GAS

The flameproof motors have the following protection types against the risk of explosion:

- Ex d IIB/IIC: flameproof motor and terminal box
- Ex de IIB/IIC: flameproof motor and increased safety terminal box

These “Safety Instructions” must be followed in addition to those provided in the “Instructions and maintenance” manual.

2. Identification of flameproof motors

2.1 Suitability of the motor to the place of installation

The user must check that the motor is suitable for the area classification and the characteristics of the flammable substances present.

The essential safety requirements to prevent any risk of explosion in classified areas are laid down in European directives, national laws, local regulations and classification standards.

2.1.1 Places subject to the presence of inflammable gas, fumes or mists

The classification criteria for areas subject to the risk of explosion are laid down in the 60079-10-1 standard.

The technical requirements for electrical plants located in classified areas are established by the EN IEC 60079-14 standard.



The choice of the type of motor, according to these technical and legislative provisions, must take into account the following factors:

- type of plant: group II surface plant
- zone classification: 0, 1, 2 for which equipment of category 1G, 2G, 3G, respectively are suitable
- characteristics of the flammable substances present in the form of gases, vapours or fumes:
 - sub-group: IIA, IIB, IIC
 - temperature class T1, T2, T3, T4, T5, T6 (defines the ignition temperature of the gases).

2.2 Nameplate safety data

In addition to operating data, the information provided on the nameplate, includes:

- information necessary to select the appropriate type of motor and for the correct installation of the motor itself.
- references to the notified bodies responsible for certification.

MARKING MOTORS FOR GASES	
	Mark of conformity to the applicable European directives
	Community mark specifically indicating explosion protection
II 2G	Motor suitable for above ground plants with the presence of category 2G gases or vapours
Ex d (Ex de)	Flameproof motor with flameproof terminal box Flameproof motor with increased safety terminal box
IIC (IIB)	Enclosure suitable for substances of group IIC (or group IIB)
T3 (T4) (T5) (T6)	Motor temperature class (maximum surface temperature)
Gb	Equipment protection level (EPL)
*** yy ATEX zzzz	***: initials of the body that issued the ATEX certificate yy: year in which the certificate was issued zzzz: type certificate number
0000	Reference number of the notified body that executed the notification of the production system quality

Notes:

- Group IIC motors are also suitable for environments with substances classified as IIA and IIB. The IIB motors are suitable for environments with IIA classified substances.
- 2G motors are also suitable for areas requiring 3G motors.
- Motors with a given temperature class are also suitable for all substances with a higher temperature class (for example: T4 motors are suitable for substances with a T3, T2, T1 temperature class).
- Flameproof motors are normally made to be used at an ambient temperature in the range of $-20\text{ }^{\circ}\text{C} \div +40\text{ }^{\circ}\text{C}$. If the motor has to be employed for operations outside these ambient temperature range, the temperature values must be specified at the time the order is issued and indicated on the nameplate.
- The class of the screws is written on the plate. In case of replacing, screws of the same type must be used (ex: class 8.8 or class 12.9).
- The motor has been designed to operate at the speeds indicated on the identification plate. The information provided in our catalogues must be observed to prevent the motor from overheating.
- The motors are available in various construction solutions based on the type of operation shown on the nameplate. In particular, for motors with brake make sure that:
 - the unventilated motors for intermittent operations (S2 or S4) work following the cycles shown on the nameplate and are not used in continuous operations;
 - the motors for lifting have the indication S3 or S4 on their nameplates and are actually intended for the operation shown in the plate;
 - the moment of inertia of the driven load does not exceed the one shown on the nameplate.

3. Installation

3.1 Power supply connections

Connections to the mains must be performed as shown in the wiring diagrams supplied with the motor.

Connection to the power terminal is made, depending on the type of motor, in the sequence indicated in the figures below (Fig. 1, Fig. 2, Fig. 3).

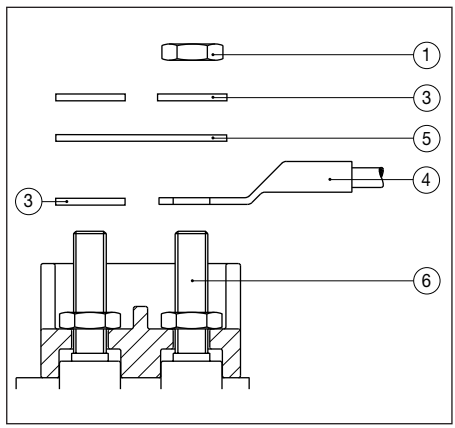


Figure 1 - Connection sequence 56-80 (Aluminium frame)

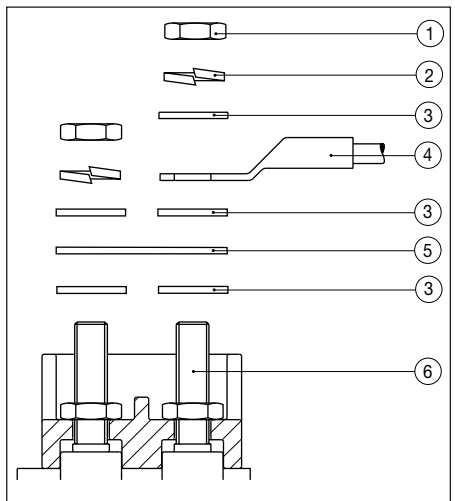


Figure 2 - Connection sequence 63-250 (Cast iron frame)

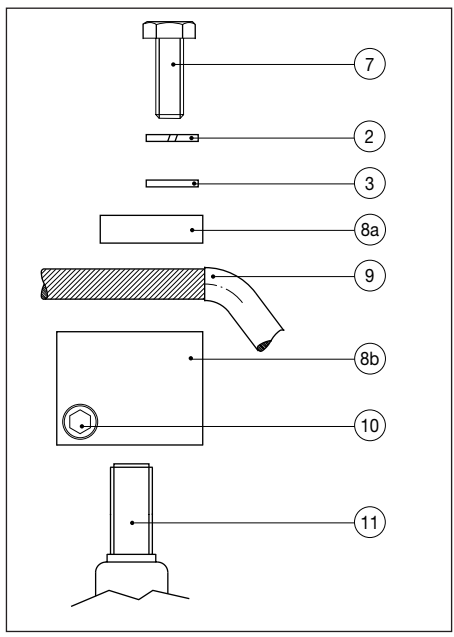


Figure 3 - Connection sequence 280-315 (Cast iron frame)

Figure 1, 2, 3 - Legend:

- 1 - Nut
- 2 - Spring washer
- 3 - Flat washer
- 4 - Insulated cable lug.
- 5 - Connecting plate
- 6 - Pin
- 7 - Locking screw
- 8a/8b - Cable fastener terminal
- 9 - Power cable
- 10 - Hexagon-head screw for locking terminal
- 11 - Through pin

Connections to the main terminals must be executed using the tightening torques indicated below:

SCREW SIZE	TIGHTENING TORQUE MAXIMUM [Nm]
M4	2
M5	3,2
M6	5
M8	10
M10	16
M12	25

POWER CONDUCTORS SECTION [mm ²]		
Terminal	standard	maximum*
M5	1.5-2.5-6	10
M6	6-10-16	16
M10	10-16-25-35	70
M12	25-35-50-70	120

* with special cable lugs

The air insulation distances indicated in the following table must be maintained when connections are made among conductors having different potential:

RATED VOLTAGE - U [V]	MINIMUM DISTANCE IN AIR - L _m [mm]
200 < U ≤ 250	5
250 < U ≤ 320	6
320 < U ≤ 400	6
400 < U ≤ 500	8
500 < U ≤ 630	10
630 < U ≤ 800	12
800 < U ≤ 1000	14

3.2 Auxiliary connections

3.2.1 Thermal protection

In the case of PTC or PT 100 or bi-metallic thermal PTO thermistors used for controlling temperature class, the user, in compliance with the essential safety requirements, must alternatively use:

- use a cut-out in compliance with IEC 61508 standard
- use a cut-out that automatically switches to safety position in case of a failure (fail-safe)
- use a dual protection circuit.

3.2.2 Anti-condensation heater

The anticondensation heaters must be fed from a different line from the motor power supply one. Check that the power voltage matches the one indicated on the nameplate. The heaters must not operate when the motor is powered.

Check the type of auxiliary present on the motor by looking at the “auxiliaries marking diagram”.

3.3 Cable entries

3.3.1 General

The dimensions of the cable entries are shown on the terminal box. During installation, the instructions concerning the type of threads must be followed.

When the cable entry is made using a cable gland, the type of cable gland must be selected correctly in relation to the type of plant and the type of cable. The cable gland must be tightened fully until the seal rings ensure the necessary pressure:

- to prevent transmission of mechanical stress to the motor terminals
- to ensure the mechanical protection (degree) of the terminal box.

Cable entries for Ex d terminal boxes must consist of Ex d devices certified according to the EN IEC 60079-0 and EN IEC 60079-1 standards. They must also have a minimum protection level of IP55 or IP65.

With Ex de terminal boxes, use Ex e cable glands, certified according to EN IEC 60079-0 and EN IEC 60079-7 standards. They must also have a minimum protection level of IP55 or IP65.

The blocking fitting and cable must be selected on the basis of the maximum operating temperature required for the cable, and indicated on the warning plate if over 70°C.

Gaskets must not be added, unless supplied by the manufacturer.

Unused cable entries must be closed with certified caps.

3.3.2 Motors for Gas

Connections must be made via cable entries conforming to the EN IEC 60079-14 standard (cable glands or conduits).

The cable entry must be made without modifying the specific properties of the protection type and following the instructions contained in the standards:

- EN IEC 60079-1 for Ex d motors (explosion proof protection “d”);
- EN IEC 60079-7 for Ex de motors (increased safety protection “e”).

3.4 Earth connection

Flameproof motors are provided with two earthing terminals: one inside the terminal box and the other on the motor frame. Depending on the cross-section of the line conductor, the earthing conductor cross-section must be:

LINE CONDUCTOR SECTION	EARTH CONDUCTOR SECTION
Less than or equal to 16 mm ²	Same section
Between 16 mm ² and 35 mm ²	16
Greater than 35 mm ²	Greater than or equal to 50% of the section

3.5 Further warnings regarding installation

Flameproof motors must be protected against overloads with automatic power supply disconnection by using a countdown protection device or by using a device to control directly the temperature by means of temperature sensors inserted in the windings. It is necessary to ensure that the motor ventilation is not impaired by obstacles positioned in the surrounding area when flameproof motors are installed. For this purpose a minimum distance must be maintained between the motor and any device that is not part of the motor, according to the following table:

SIZE	MINIMUM DISTANCE FROM OTHER DEVICES [mm]
up to 160	40
from 180 to 225	85
≥ 250	125

The terminal board box must always be closed before starting the motor.

After having restored the original layer of grease (for example Molyduval, Bariplex, Avio type), refit the terminal box lid and tighten the fastening screws.

TIGHTENING TORQUES [Nm]						
Aluminium frame						
Steel class	M4	M5	M6	M8		
8.8 (A4-80)	2	3.2	5	12		
12.9	3	4.8	7.5	18		
Cast iron frame						
Steel class	M4	M5	M6	M8	M10	M12
8.8 (A4-80)	2.9	5.6	10	23	35	80

3.6 Warnings regarding electrostatic charges

For flameproof motors that have IIC markings, the risk of electrostatic charges must be considered: keep the surfaces of the motor clean using a damp cloth.

3.7 Special operating conditions

The certificate number contains the letter "X" for the following reasons:

- The dimensions of the joints are different from those indicated in the reference standards. Consult chapter 11 if repairs are needed.
- The temperature class is guaranteed in a voltage variation range of +/-5%
- Due to the possible presence of electrostatic charges in IIC enclosures with special paint (thickness exceeding 0.2mm), consult chapter 3.6.

4. Motors without terminal box with cable leading out of cover plate

When the motor comes without a terminal box, the motor's enclosure is closed with a plate with the power supply cable leading out of it. To install correctly, the user must follow the instructions below.

4.1 Version with plate, armoured cable and cable gland

An armoured cable leads out of the motor plate clamped by an appropriate cable gland. Free cables lead out of the motor plate featuring the clamping coupling, and are used to supply the motor. The user must protect power supply cables from potential damage arising from mechanical stress, and must connect ends of cables according to one of the safety methods provided for by standard EN IEC 60079-0, in conformity with engineering rules in force for the place where the motor is to be used.

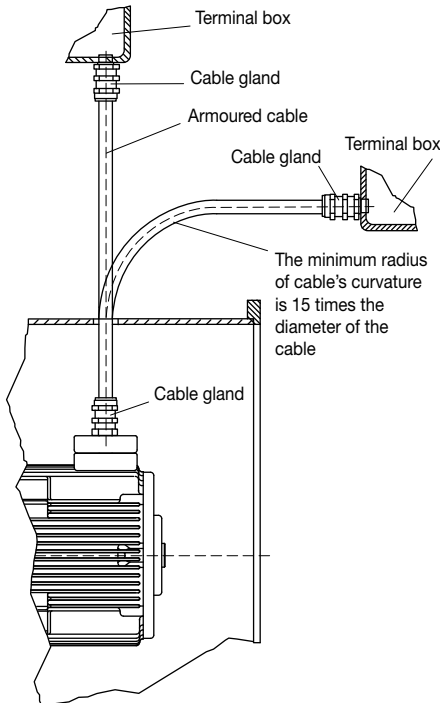


Fig. 4 - Cable exit version with cable gland

4.2 Version with plate and conduit

In this case, the closure of the motor enclosure consists of a sealing joint which is fixed to the cable exit plate of the motor.

A conduit, of length determined at the time of order, leads off from the sealing joint and ends with another sealing joint; the power cables of the motor pass inside this tube.

The user is required to route the terminals of the cables directly onto the terminal blocks housed in a terminal box.

If this box is located in a classified area, it must be selected on the basis of one of the protection types envisaged in the EN60070-0 standard.

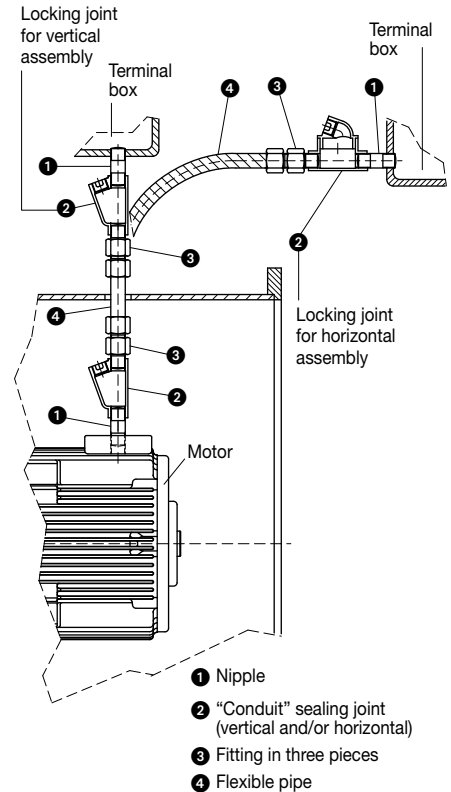


Fig. 5 - Cable exit version with conduit

4.3 Version with plate and free cables

In this case the case securing accessories are applied by the installer, who will have to use versions that match the protection type and ambient temperature of the plant.

The motor enclosure must be closed using a sealing joint certified according to the EN IEC 60079-0 and 60079-1 standards. The free wires leading out of the motor plate are used to supply power to the motor and must be protected against potential damage caused by mechanical stresses. Users will have to connect the cable terminals using one of the protection types specified in standard EN 60070-0.

5. Motors without fans

5.1 Cooling method IC 418

In this construction variant, ventilation is supplied by a fan directly coupled to the motor. Ensure that the motor ventilation is not impaired in all operating conditions and that the temperature limits allowed by the insulation category B are complied with.

Fans must comply with the product standards for ventilator fans, and must guarantee motor cooling. The fan must be positioned no less than 5 mm from all fixed parts of the motor.

5.2 Cooling method IC 410

In this construction variant, the motor does not have a fan and the following limitations must be observed.

- For “S1” operation, the motor power output is derated by 50% to comply with the limits allowed by insulation class B.
- For “S2” operation, regular power output can be used provided the motor does not work long enough for it to reach the temperature limits of insulation class B. Said time limits are indicated on the plate.

6. Motors with forced ventilation

6.1 Cooling method IC 416

Cooling is assured by ventilation provided by an auxiliary flameproof motor, covered by separate certification, fitted on the back of the main motor.

The user must have a safety device fitted enabling the main motor to be started only once the auxiliary motor is running.

In addition, motors must be equipped with PTC or PT100 thermal probes, which must be connected with a cut-out disconnecting the motor's power supply. This cut-out must have a manual reset.

7. Motors for low temperatures

Motors designed for use at low temperatures (from -20°C to -50°C) must be fitted with anti-condensation heaters.

For correct use of these motors, the electrical system must be designed to raise the temperature of the motors to an ambient temperature higher than -20°C before powering up the motor.

The powers of the anti-condensation heaters are:

size 63-100: 50 W

size 112-160: 100 W

size 180-315: 200 W

- Auxiliary devices (preheating resistances) must be powered when the motor is not in operation.
- Fixings are in A480 STAINLESS STEEL and if, replaced, they must be replaced with fixings of the same quality.
- The fan guards are made of stainless steel and the cooling fans of aluminium. If replaced, these must be replaced with components with the same qualities.
- The terminal blocks / connections used are suitable for use at these temperatures, and must be replaced only with original components.
- The grease used to protect the joints must be suitable for the temperature fluctuation ranges experienced in the plant (e.g. "Aereo 92" type).
- The cables used to power the motors and the cable glands on the terminal board box must be suitable for the ambient temperatures. The insulation materials in particular must be suitable for the temperature fluctuation ranges the motors are subject to, both as a result of seasonal changes in the ambient temperature, and due to temperature increases brought about by the motor running while loaded.

8. Motors powered by inverter

For operation with inverter power supply, motors are equipped with temperature control PTC or PT100 or bi-metallic thermal PTO thermistors inserted in the winding and capable of guaranteeing that the limits of the temperature class are maintained.

The user must connect the PTC or PT100 or bi-metallic thermal PTO terminals to a tripping relay (cut-out) capable of ensuring that the power supply is cut off whenever a dangerous temperature is reached.

The reset of said cut-out must be performed manually only, and not automatically.

In observance of the standards the user must:

- use a cut-out in compliance with the principles of the IEC 61508 standard (Fail Safe type)
- use a dual protection circuit.

When temperature class T5 or T6 the condition for use is indicated on the certificate.

Inverter motors have an auxiliary plate. Before starting the motor, check the ratings (kW - Hz - torque) indicated on the auxiliary plate. The user must contact the manufacturer if this information is not provided.

When the motor comes with forced ventilation provided by an auxiliary motor, motors with IC416 cooling, the user must follow instructions given in point 6.1 (Cooling method IC416).

Rated performance relating to operation at mains power frequency cannot be maintained if powered by an inverter. In particular, power output could be significantly reduced to maintain the assigned temperature class and to avoid damage caused by overheating.

The choice of the type of frequency converter must be made taking into account that the motor must not be subjected to voltage peaks exceeding 2.8 times the nominal voltage which would significantly reduce the life of the windings insulation. It is necessary to consider in this respect that the voltage peaks value is also influenced by the length of the power supply cable.

When power is supplied by a frequency converter, the installer bears responsibility for checks and any measures required to comply with immunity and emission limits as laid down by the standards.

9. Single-phase motors

Asynchronous motors may be available in a single phase version. This series with single phase windings requires a start-up condenser. The condenser is located inside a terminal block of suitable dimensions.

When the condenser is separate from the motor, the user must install it in a safe area or in an explosion proof enclosure having a suitable category and protection type for the zone classification (for gas).

The electrical characteristics and the type of condenser are indicated on the nameplate of the motor.

The condenser must be permanently connected to the terminals of the windings, and it discharges instantaneously when the motor stops after power has been turned off.

Changing the condenser may modify the electrical behaviour of the motor.

10. Inspection and maintenance of motors for classified areas

Inspections and maintenance on motors for classified areas must be carried out in compliance with the criteria laid down in the EN IEC 60079-17 standard.

The electrical connection terminals must be tightened fully to avoid high contact resistances and consequential overheating.

Care must be taken to ensure that the insulation distances in air and on the surfaces between the conductors are maintained, as established by the standards.

All bolts used to secure both motor and terminal box must be tightened using the torque values as indicated in the table TIGHTENING TORQUES par. 3.5. All screws utilised to seal the motor and the terminal board shall be tightened fully.

The bearings must be replaced frequently, at least as indicated by the following schedule:

- 20,000 hours for 2-pole motors
- 40,000 hours for motors with 4 or more poles

For motors with lubricators, follow the instructions on the additional plate.

Replacement of gaskets and cable entry parts shall be executed using components that are identical to the components supplied by the manufacturer to ensure the protection degree is maintained.

The surfaces of flameproof joints must not be machined and sealing gaskets different from those supplied by the manufacturer must not be inserted. These surfaces must be maintained in a clean condition.

A thin layer of non-hardening grease must be used against corrosion and to prevent water from entering. This grease layer must be renewed at every disassembly.

11. Repairs on motors for classified areas

Repairs made to flameproof motors Ex d/de or Ex tD shall be executed in compliance with the criteria specified by EN IEC 60079-19 standard, by the certifications and by this manual.

Joints dimensions evaluation involves the producer, when it is necessary address to him (see Fig. 6).

If repairs are not executed by the manufacturer, they must be carried out at workshops which have the necessary equipment and with adequate technical expertise concerning the motor protection methods and must be supervised by qualified and authorized personnel.

If repair work involves parts that influence the protection against explosions, the motor construction data must not be changed (for example: dimensions of joints, winding characteristics, method of ventilation, etc.) and if parts have to be replaced, this must be done with original components.

Norm EN IEC60079-19 foresees various typologies of intervention that have different impacts on the integrity of the equipment submitted to maintenance; the possible activities are synthesized below.

- 1 - Repair:** Action to restore a faulty apparatus to its fully serviceable condition and in compliance with the relevant standard (relevant standard means the standard to which the apparatus was originally designed).
- 2 - Overhaul:** Action to restore to a fully serviceable condition an apparatus which has been in use or in Storage for a period of time but which is not faulty
- 3 - Maintenance:** Routine actions taken to preserve the fully serviceable condition of the installed apparatus.
- 4 - Reclamation:** Means of repair involving, for example, the removal or addition of material to reclaim component parts which have sustained damage, in order to restore such parts to a serviceable condition in accordance with the relevant standard.
- 5 - Modification:** Change to the design of the apparatus which affects material, fit, form or function.

Producer supports the activities of:

1 - Repairation

2 - Overhaul

3 - Maintenance

but doesn't authorize interventions of:

4 - Reclamation

5 - Modification.

Possible constructive modifications can be performed, in the respect of the ties of the certificate, only by the manufacturer.

When it is necessary to verify the flameproof joints, the scheme furnished in Figure 6 must be applied.

It is not always necessary to make the control of the flameproof joints (for instance when doing an activity type 2-Overhaul on a new motor withdraw from stock).

A written report must be prepared by repairer with the detailed indication of the work carried out.

After the repair work has been properly completed, an additional nameplate shall be affixed to the motor (without removing the original one) showing the following marks:

- symbol **R**
- name or trademark of the repairer
- reparation number by the repairer
- date of repair

In case the reparation modify relevant aspects concerning protection against explosions and motor does not comply with the certificate, the original nameplate must be removed and the motor can no longer be used in areas where there is danger of explosion.

Unless of re-examination and approval by a competent certification body.

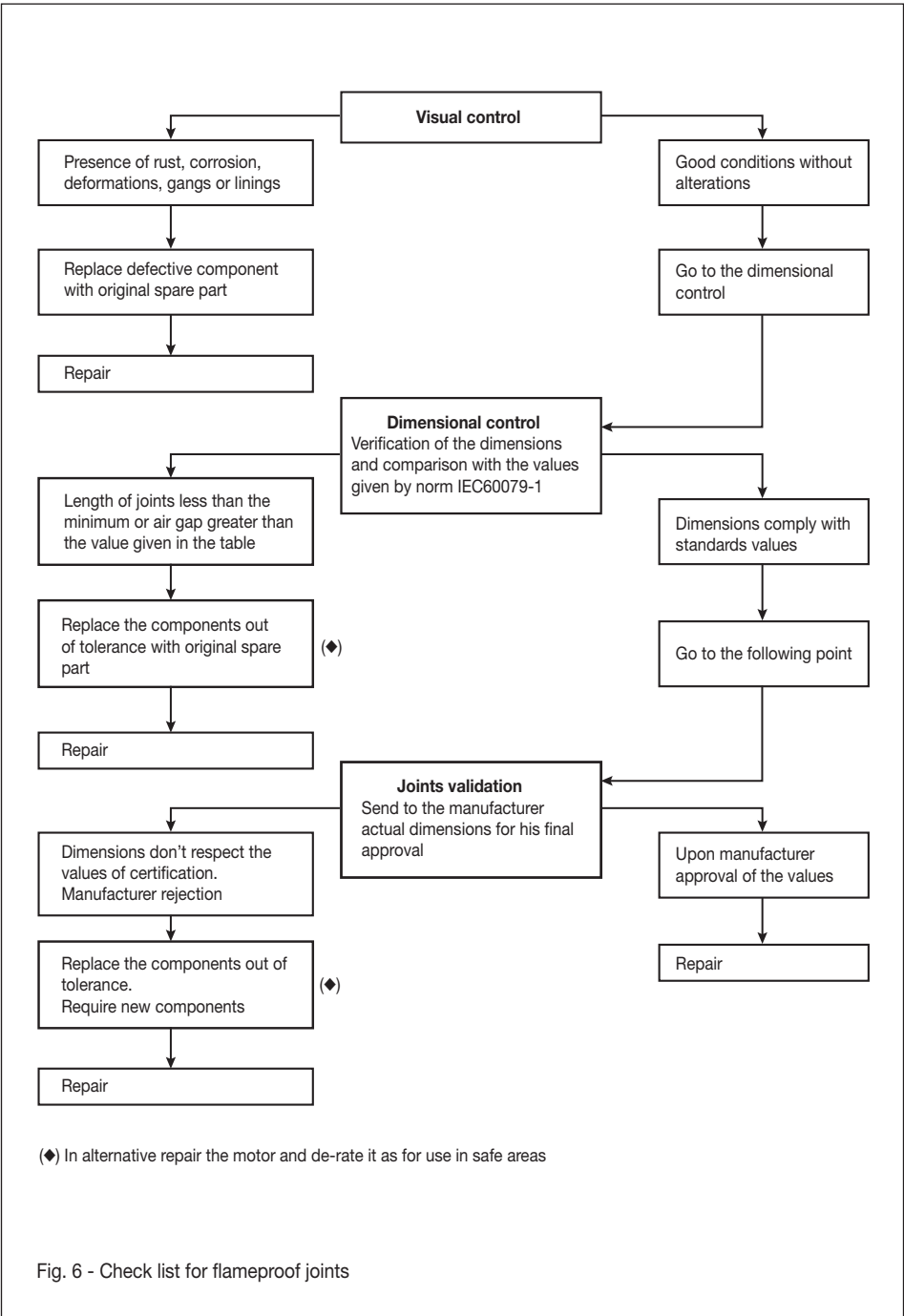


Fig. 6 - Check list for flameproof joints

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