

Explosion proof motors
MAK 56 -250 (MAKe 63-250) series
Groups **IIB** and **IIC**
Ex db / Ex db e (EPL) executions Gb or Ex tb IIIC (EPL) Db
II 2 G , II 2D , 2GD

SAFETY

INSTRUCTIONS

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1. INTRODUCTION

These safety instructions refer to the installation, operation and maintenance of explosion-proof electric motors series **MAK 56 ÷ 250** and **MAKe 63 ÷ 250** for use in areas with potentially explosive atmospheres (gases or vapors).

The motors will have the following marking against the risk of explosion:

- **Ex db / Ex db e IIB or IIC “Gb”**
- **II 2G for GAS**
- **II 2D for DUSTS**
- **II 2GD for GAS and DUSTS**

2. INSTALLATION**a) Suitability of the motor to the place of installation**

Employing a motor in areas subject to an explosion hazard, it is necessary to verify the suitability of the enclosure of the motor to the classification area and the characteristics of the flammable substances present in the area.

Standard EN 60079-10-1 for gas and EN 60079-10-2 for dust, state the classification criteria for areas subject to the risk of explosion.

Standard EN IEC 60079-14 for gas and dust state the technical requirements for electrical plants located in classified areas.

Following these technical and legislative provisions, it's necessary to take the following decisive factors into consideration:

- *Type of plant:* Group I (Mines) , Group II (Surface Plants), Group III (plants with presence of combustible dusts)
- *Zone classification :* 0, 1, 2 and 20, 21, 22 (corresponding to 1G, 2G, 3G and 1D, 2D, 3D)
- *Equipment Protection Level (EPL) :* Ga, Gb and Gc
- *Characteristics of flammable substances present in the form of gases or vapors:*
Group IIC, IIB and IIA
- *Characteristics of flammable substances present in the form of dusts:*
Group IIIC, IIIB and IIIA
- *Temperature classes for Gases:* T1, T2, T3, T4, T5 and T6 (they identify the maximum surface temperature to refer to the ignition temperature of gases)
- *Temperature classes for Dusts:* T155°C, T125°C, T100°C, T85°C (they identify the maximum surface temperature to refer to the ignition temperature of dusts)


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

- information necessary for the correct installation and operation
- references to notified bodies responsible of the certification issue

b) **Nameplate safety data**

On the nameplate there will be the following basic data:

- a - **II 2 G** for motors category 2 for surface plants with gas or vapors.
Suitable for Zone 1 and (redundancy) Zone 2
- II 2 D** for motors category 2 for surface plants with dusts.
Suitable for Zone 21 and (redundancy) Zone 22
- II 2 GD** for motors category 2 for surface plants with gas or dusts.
Suitable for Zone 1 and 21 and (redundancy) Zone 2 and 22
- b – **Ex db** motor enclosure and the power supply box enclosures are explosion-proof construction for surface plants with presence of gas
Ex db e motor enclosure is explosion-proof with type of protection "Ex db" and power supply box with increased safety type of protection "Ex e" , for surface plants with presence of gas
Ex tb motors supposed to be used in presence of combustible dusts
- c - **IIB / IIC** enclosures of IIB / IIC groups for gases IIB / IIC group
Zone 1 and (redundancy) Zone 2
- **IIIC** enclosures of IIIC group for dusts of IIIC group (conductive dust)
Zone 21 and (redundancy) Zone 22
- d – **T6, T5, T4, T3** temperature class of enclosures
- **T85°C, T100°C, T125°C, T155°C** superficial temperature of enclosures
- e – **Gb** “EPL” mark that identifies a "high" level of protection of the equipment and will allow the use in explosive atmospheres for the presence of gas

Db “EPL” mark that identifies a "high" level of protection of the equipment and will allow the use in explosive atmospheres with conductive dusts
- f - **IP55 / IP66** enclosures mechanical protection grade
- g-  Community mark specifically indicating explosion protection
- h- **CESI** name of the notified body that released the CE type certificate
- i – **Year** of certificate issue
- l -**number** of the **CE** type certificate
- m- **0722** Reference number of the notified body that executed the notification of the production system quality

c) Important Notes

- I) The group IIC explosion-proof motors are also suitable for areas with gas or vapors of groups IIA and IIB . The group IIB explosion-proof motors are also suitable for areas with gas or vapors of groups IIA. The group IIIC explosion-proof motors are also suitable for areas with gas or vapors of groups IIIA and IIIB.
- II) The certified explosion-proof motors with temperature class T6 , are also suitable for the higher temperature classes (eg T5 , T4 and T3).
- III) The certified explosion-proof motors with temperature class T4, are also suitable for the higher temperature classes (example T3 , etc.).
- IV) The certified explosion-proof motors with superficial temperature max. T85°C, are also suitable for the higher superficial temperatures (example T100°C, T125°C and T155°C).
- V) The locking screws for replacement must be of the minimum strength class 8.8 according to the UNI EN ISO 898-1.
- VI) The special internal screws (terminal box - frame) form a flameproof joint. In case of disassembly must be used the same screws provided by the manufacturer. If in need of replacement, the screws must be requests to manufacturer.
- VII) The motors with anti-condensation heaters are equipped with a special warning plate. The heaters must not be fed when the motor is powered.
- VIII) When the motors are designed for use in ambient temperatures different from standard (-20 to +40 ° C) the nameplate shows the operating range of the motors.
- IX) To ensure mechanical protection degree IP 55 or IP66 , for each removal must restore the joints with grease as shown on the name plate .
- X) For Group IIC motors, with coating thickness greater than 0.2 mm, pay attention to the danger of electrostatic charges. Read the warning plate.
- XI) In the event of application of a fan to the motor, indications of Norm EN 14986 must be followed
- XII) Connections of inner earthing terminals must be performed following the indications of Norm EN 60034-1, which states cables sections.
- XIII) **Motors of group IIC** with coating thickness greater than 0.2 mm, and the motors marked **II 2D** and **II 2GD**, as far as the danger caused by the dust gathering on the surface is concerned, will need special attention, as shown on the nameplate:

ATTENTION :

DANGER OF ELECTROSTATIC CHARGES:
AVOID THE GATHERING OF DUST ON THE MOTOR SURFACE.
CLEAN THE SURFACES WITH A HUMID CLOTH OR ANTI-STATIC PRODUCTS.

2.4 Connection to the power supply

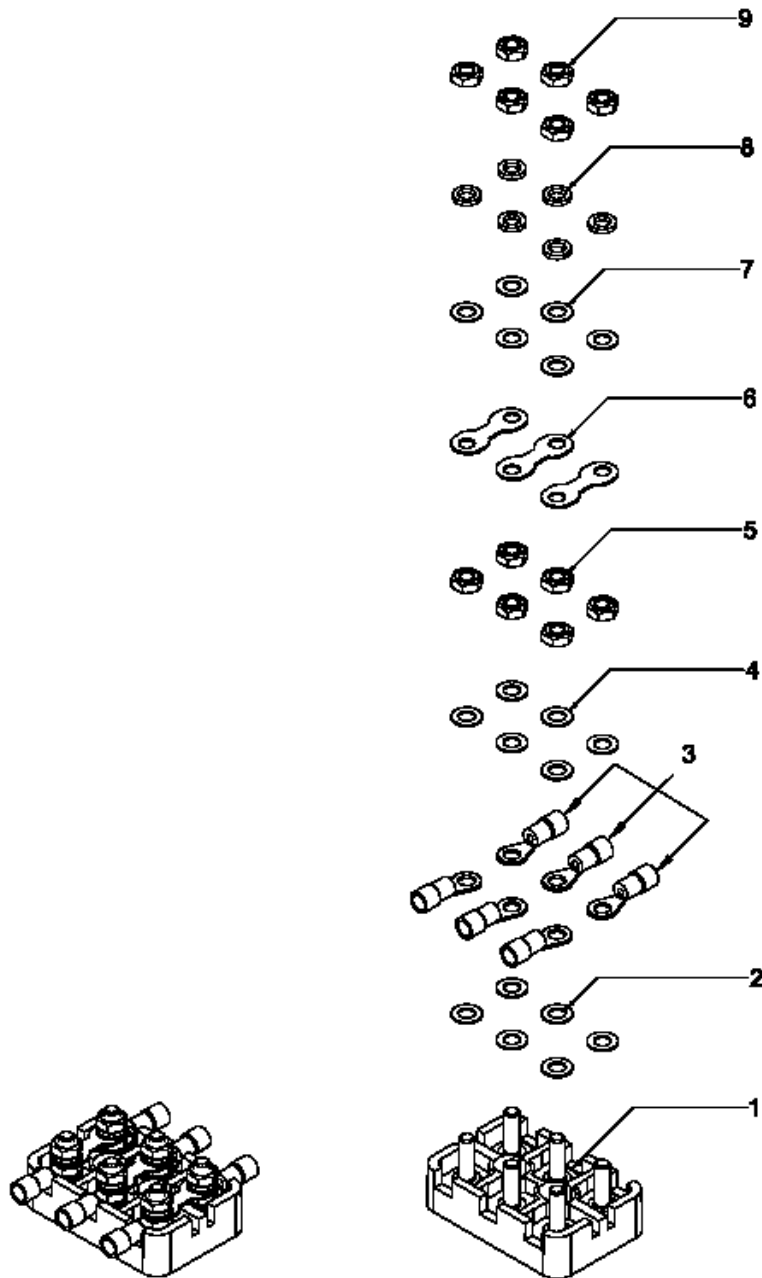
2.4.1. The **MAK** series motors have a terminal board for motor power supply located inside the terminal box. The feeding voltages are:

- Nominal maximum feeding from network: 1000 V.
- Nominal maximum feeding from frequency converter: 1000 V, with peak voltage 1400V

The **MAKe** series motors have “ terminal box “ with ***Increased safety "Ex e"***.

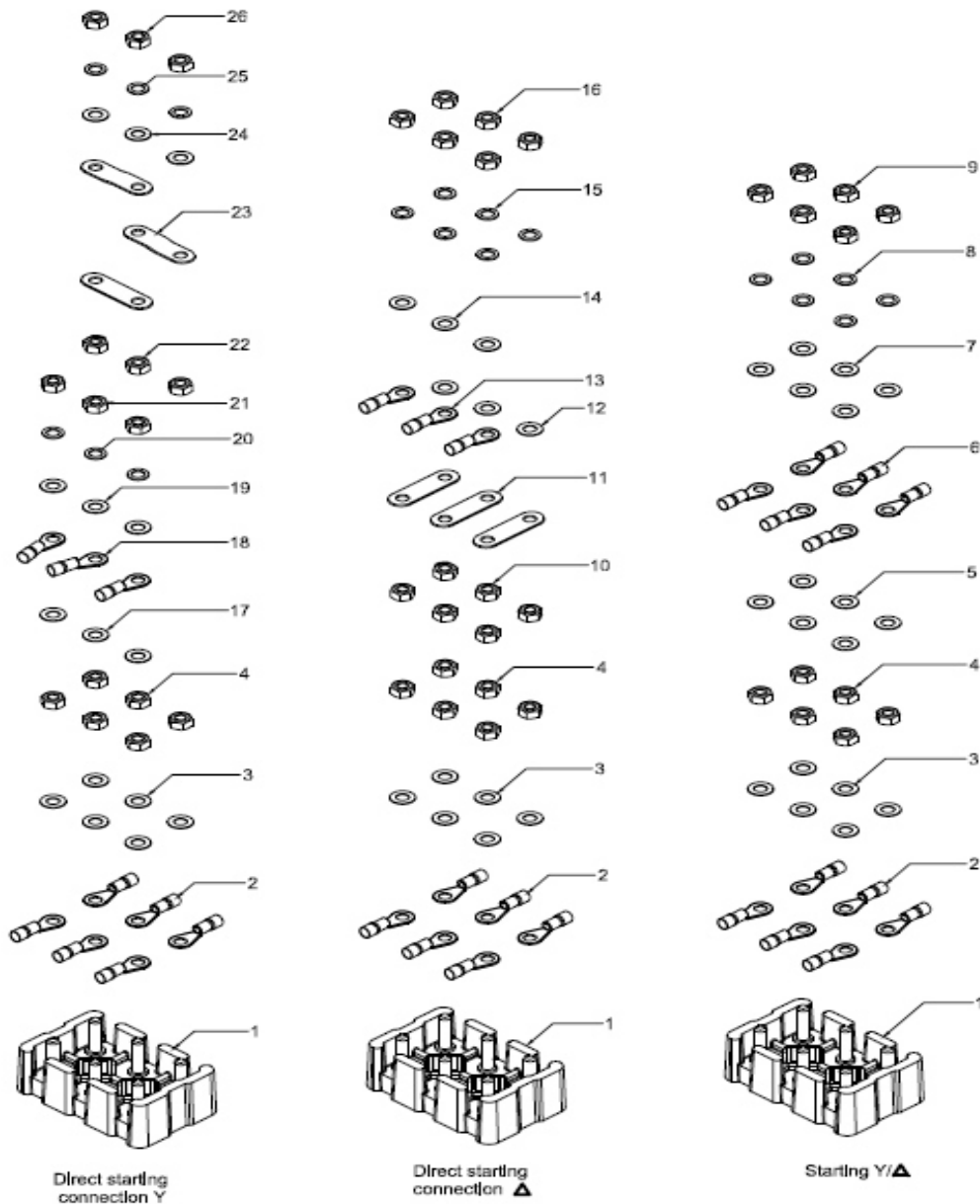
To maintain the safety parameters, it is important to correctly perform all the operation described by the manufacturer. To connect the power cables to the terminal board, it is compulsory the use of cable lugs on the terminal board as follows:

Motors series MAKe 63 and 71 ,
use the 3 cable lugs marked with the numbers "3"
maximum conductors section 2,5 mm²



Complete assembly kits (connecting plates, washers, nuts) scrupulously as indicated in the figure below:

for motors series MAKE 80 ÷ 180



use the 3 cable lugs
marked with
the numbers "18"

use the 3 cable lugs
marked with
the numbers "13"

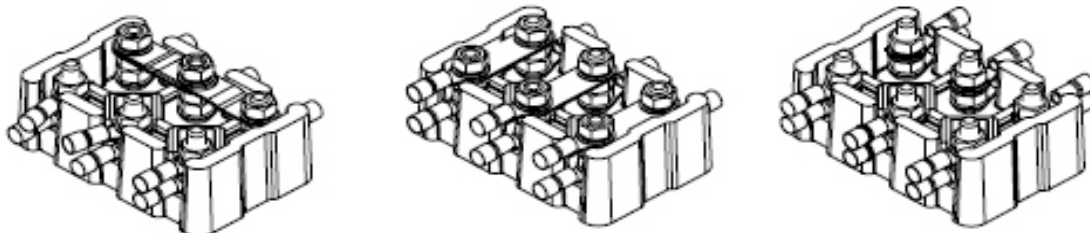
use the 6 cable lugs
marked with
the numbers "6"

Complete assembly kits (connecting plates, washers, nuts) scrupulously as indicated in the figure:

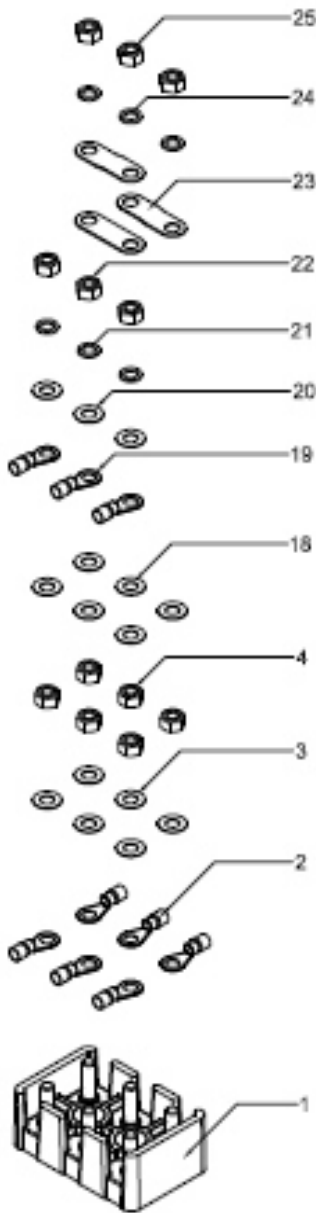
Direct starting
connection Y

Direct starting
connection Δ

Starting Y/Δ



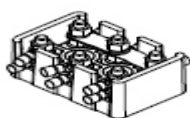
for motors series MAKE 200, 225, 250



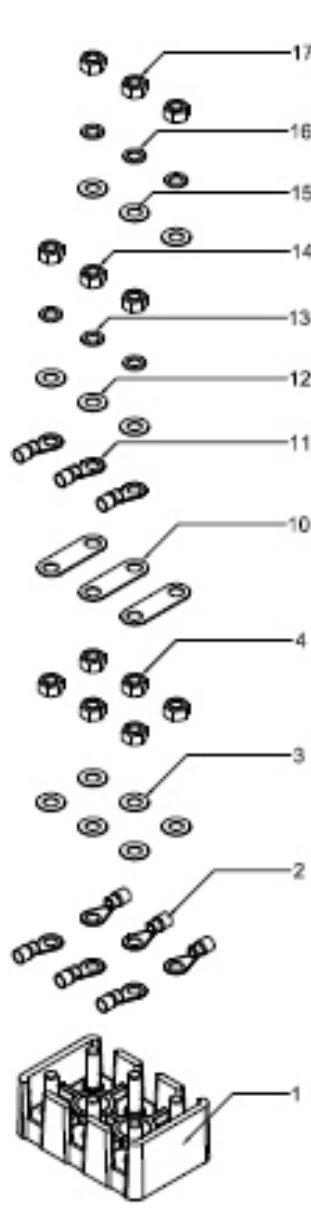
Direct starting connection Y

use the **3 cable lugs** marked with the numbers "19"

Complete assembly kits (connecting plates, washers, nuts) scrupulously as indicated in the figure below:

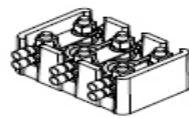


Direct starting connection Y

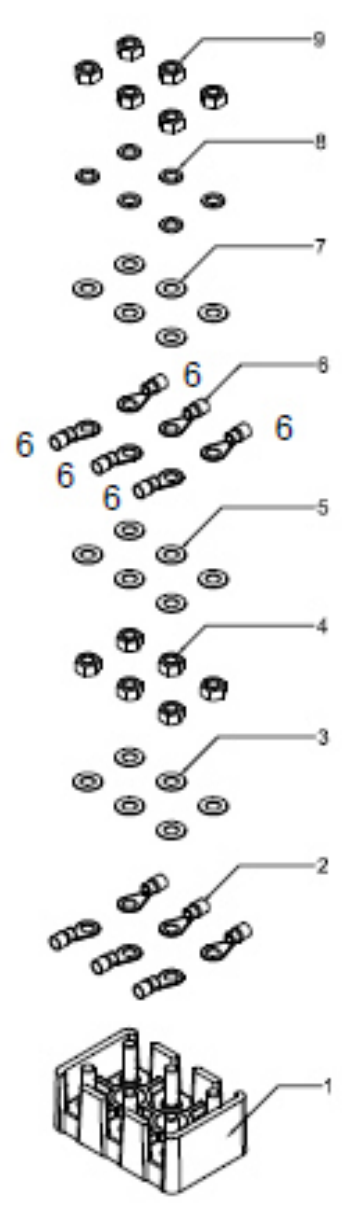


Direct starting connection Δ

use the **3 cable lugs** marked with the numbers "11"

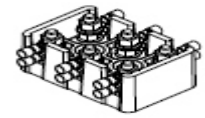


Direct starting connection Δ



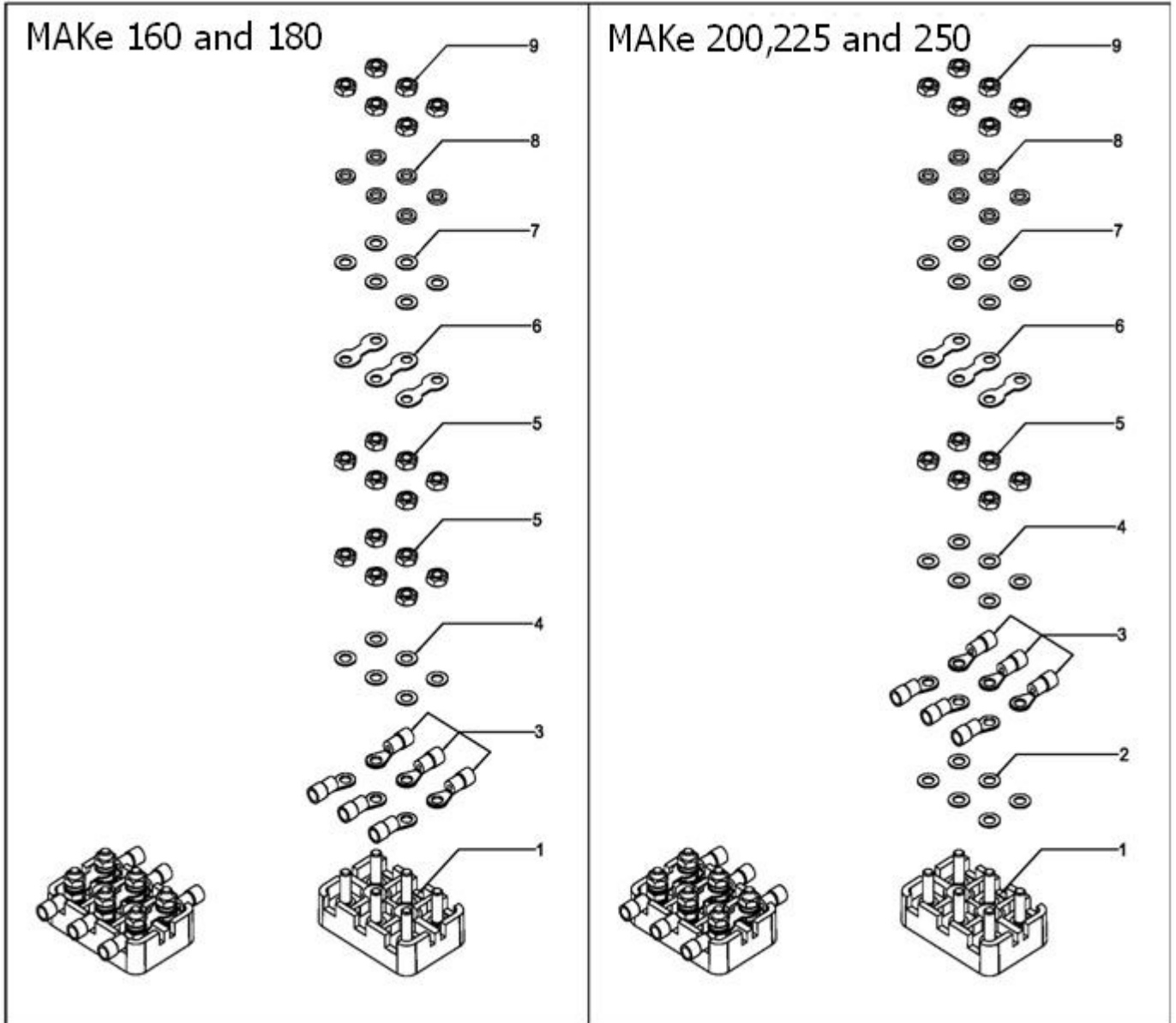
Starting Y / Δ

use the **6 cable lugs** marked with the numbers "6"



Starting Y/Δ

For motors series **MAKe 160 ÷ 250**
with connection “Y” or “Δ” inside motor ,
use the **3 cable lugs marked with the numbers “3”**



Complete assembly kits (connecting plates, washers, nuts) scrupulously as indicated in the picture.

Maximum conductor cross section motor supply:

- 16 mm² for series **MAKe 160 and 180**
- 16 mm² for series **MAKe 200 ÷ 250**

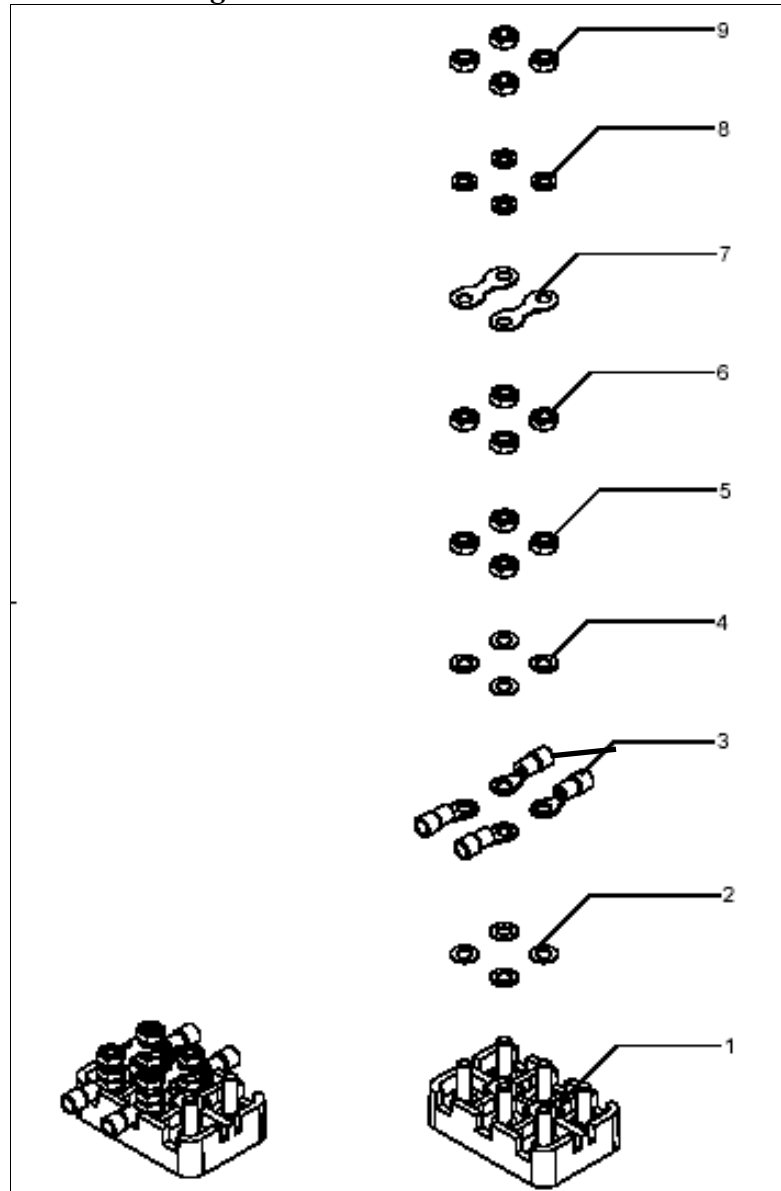
Maximum conductor cross section auxiliary supply:

- 1,5 mm² for series **MAKe 160 and 180**
- 0,5 mm² for series **MAKe 200 ÷ 250**

The network connections of any auxiliaries, such as temperature sensors or anti-condensation heaters, must be made by means of the dedicated terminal, located inside the terminal box, according to the connection diagram provided with the motor.

In case of auxiliary supply with terminal board type M4, please refer to the following wiring diagram:

use the cable lugs marked with the numbers "3"



Complete assembly kits (connecting plates, washers, nuts) scrupulously as indicated in the picture.

Tightening torques:

- Main motor power terminal block
 - For motors series **MAKe 180**: **3 Nm**
 - For motors series **MAKe 200÷ 225**: **6 Nm**
- Auxiliary supply terminal board **M4**, **1.2 Nm**

Execute correct installation of all the components supplied with the terminal board it is important to maintain the type of protection "Exe" of terminal box.

By not executing correctly all the operations described for the motor connection, immediately invalidates the manufacturer's responsibility about everything that the "Increased Safety" implies.

Tightening torques:

- Series **MAKe 63 and 71: 1,2 Nm**
- Series **MAKe 80 ÷ 100: 2 Nm**
- Series **MAKe 112 ÷ 180: 3 Nm**
- Series **MAKe 200 ÷ 250: 6 Nm**
- **Auxiliaries terminal board M4: 1,2 Nm**

Maximum nominal voltage admitted with uncovered terminal board fixing screws:

Series	Maximum net feeding voltage	Maximum inverter feeding voltage
MAKe 63 and MAKe 71	V.400	V.320
MAKe 80,90 and 100	V.630	V.500
MAKe 112 and 132	V.630	V.500
MAKe 160 and 180	V.800	V.630
MAKe 200 ÷ 250	V.1000	V.800
Terminals for auxiliary	Terminal CABUR: V.250	-----
	Terminal BARTEC: V.400	
	Terminal M4: V.400	

The minimum admissible in-air distances within the terminal box, must scrupulously respect the Norm EN 60079-7:

- Series **MAKe 63 and 71:** 6 mm
- Series **MAKe 80 ÷ 132:** 10 mm (net); 8 mm (under inverter)
- Series **MAKe 160 and 180:** 12 mm (net); 10 mm (under inverter)
- Series **MAKe 200 ÷ 250 :** 14 mm

Maximum nominal voltage admitted with sealed terminal board fixing screws:

Series	Maximum net feeding voltage	Maximum inverter feeding voltage
MAKe 80,90 and 100	V.800	v.630
MAKe 112 and 132	V.800	v.630
MAKe 160 and 180	V.1000	v.800
Terminals for auxiliary	Terminal CABUR: V.250	-----
	Terminal BARTEC: V.400	
	Terminal M4: V.400	

The minimum admissible in-air distances within the terminal box, must scrupulously respect the Norm EN 60079-7:

- Series **MAKe 80 and 132**: 12 mm (net); 10 mm (under inverter)
- Series **MAKe 160 and 180**: 14 mm (net); 12 mm (under inverter)

2.5 Protection against overload

All electric motors to be installed in hazardous areas must be protected from overload loads as prescribed in the standards IEC 60074-14.

2.6 Earthing connection

Enclosures of flameproof motors are equipped with earthing terminals:

- an external earthing terminal located on the frame:
this terminal must be connected – with spade lug - to the plant general earthing system by a line conductor with a cross section $\geq 4 \text{ mm}^2$.
- an earthing connection inside the terminal box:
this terminal must be connected - with spade lug - to the plant general earthing system by a line conductor with cable having the same cross-section of the line conductors.

2.7 Cable entries for motors marked II 2G

(motors marked II 2D and II 2GD please see paragraph 9)

The terminal box is an integral part of the motor enclosure.

The terminal box is provided with one, two or three threaded holes for main and auxiliary connections. Types and sizes of threaded holes are identified by plates located on terminal box. When installing the cable entry device the indications of the thread type must be respected.

The cable glands or conduit sealing devices applied to the threaded holes must be certified according to the following standards:

- IEC 60079-0 , IEC 60079-1 for series **MAK** with type of protection “**Ex db** “
- IEC 60079-0 , IEC 60079-7 for series **MAKe** with type of protection “**Ex db e** “
and guarantee the degree and the same level protection of the motor (minimum IP55)

Unused holes shall be closed with plugs certified according to applicable standards as above.

The connections of the devices must be made in accordance with the standards IEC 60079-14 . The choice of devices and cable must be made based on the eventual operating temperature of the cable shown on the label warning.

For parallel threads, the coupling between the accessory and terminal box must be locked against loosening by using a sealant for threaded parts type “Loctite 270” or similar.

Cable glands will be coupled to the threaded hubs of the terminal box with a minimum of:

- 5 threads in type NPT or GK
- At least 7 threads gripping in metric type .

The cable glands must be coupled to the threaded hubs of the terminal box so as not to alter the type of protection of the motor, as prescribed by the standard IEC 60079-1.

For the protection mode “**Ex db e**” cable glands must respect the minimum mechanical **IP55** protection.

3. SINGLE-PHASE MOTOR series MAK-M

When capacitor-holder enclosures are present, these are considered part of the motor.
These boxes must not be manipulated or removed.

When the capacitor (s) is (are) not directly connected by means of proper enclosures, they have to be certified according to the installation zone, and according to one of the protection methods listed in the Norm EN 60079-0; otherwise they must be put in a safe area.

The electrical features of the capacitor(s) are listed on the motor's nameplate.

4. MOTOR SUPPLIED BY MEANS OF FREQUENCY CONVERTER

When the motor is supplied by means of frequency converter the electrical operating characteristics of the motor are specified on the additional nameplate.

The motors supplied by means of frequency converter are provided with thermal detectors (PTC thermistors, PT100 or bimetallic sensor) inserted into stator winding (at least one on each phase). The thermal protectors PTC thermistors and bimetallic sensors cut-off the power supply at the following temperatures:

130°C for T3 class (T 155°C)

120°C for T4 class (T 125°C)

The PT100 devices must have a signaling system, at care of the user, giving the alarm and automatically cutting-off the power supply at the following temperatures:

130°C for T3 class (T 155°C)

120°C for T4 class (T 125°C)

The intervention of the thermal detectors must assure the release of the power supply; the re-setting of the power must not be automatic.

The sensors are connected in the terminal box with dedicated terminal block.

The temperature of intervention is indicated on a warning plate.

The performances guaranteed with this type of duty are shown on a separate nameplate.

In case these are missing, then the user needs to refer to the manufacturer.

5. MOTORS WITH FORCED VENTILATION

The motors with forced ventilation are provided with thermal detectors (PTC thermistors, PT100 or bimetallic sensor) inserted into stator winding (at least one on each phase).

The thermal protectors PTC thermistors and bimetallic sensors cut-off the power supply at the following temperatures:

130°C for T3 class (T 155°C)

120°C for T4 class (T 125°C)

The PT100 devices must have a signaling system, by the user, giving the alarm and automatically cut-off the power supply at the following temperatures:

130°C for T3 class (T 155°C)

120°C for T4 class (T 125°C)

The intervention of the thermal detectors must assure the release of the power supply; the re-setting of the power must not be automatic.

The sensors are connected in the terminal box with dedicated terminal block.

The temperature of intervention is indicated on a warning plate.

When the Motor is with forced ventilation, the main motor must be equipped with a device that releases the working of the main motor without the ventilation (or ventilation of auxiliary motor). In the forced ventilation the operation of the primary motor shall be interlocked to the correct operation of the auxiliary motor.

The main motor can't work if the auxiliary motor is not into operation.

6. MOTORS WITHOUT FAN

The motors without fan (natural cooling or impeller mounting IC 418) are provided with thermal detectors (PTC thermistors, PT100 or bimetallic sensor) inserted into stator winding (one on each phase).

The thermal protectors PTC thermistors and bimetallic sensors cutting-off the power supply at the following temperatures:

130°C for T3 class (T 155°C)

120°C for T4 class (T 125°C)

The PT100 devices must have a signaling system, at care of the user, giving the alarm and automatically cutting-off the power supply at the following temperature:

130°C for T3 class (T 155°C)

120°C for T4 class (T 125°C)

The intervention of the thermal detectors must assure the release of the power supply; the re-setting of the power must not be automatic.

The sensors are connected in the terminal box with a dedicated terminal block.

The temperature of intervention is indicated on a warning plate.

The performances allowed with this type of service are indicated on main plate.

In case these are missing, then the user needs to refer to the manufacturer.

In the event of a fan application, the requirements of EN 14986 Norm must be respected

The fan must guarantee the motor's cooling. It is user's responsibility to verify the motor temperature's class.

7. ACCESSORIES

Motors with anti-condensation heaters

The motors with anti-condensation heating resistances inserted inside motor (maximum power 80 or 200W, depending on size), are provided with an additional warning plate with the marking:

“Caution – space heaters inside”.

Space Heaters can be fed only with motor switched-off or standstill, or not powered.

Motors with drain valve

The motors equipped with drain valve are provided with an additional warning plate with the marking:

"Motors with drain valves. Keep closed the drainage devices during operation of the motor“.

The drain valves not correctly closed, do not guarantee:

- the minimum IP55 grade for motors marked **II 2G**;
- the IP66 grade and the protection mode **Ex tb** for motors marked **II 2D** and **II 2GD**

8. MOTORS SUITABLE TO OPERATE WITHIN AN AMBIENT TEMPERATURE RANGE FROM -21°C TO -55°C

These motors are made on request and are subject to different requirements as follows:

- At every disassembly, restore the joints with grease type " OPTIMOL OPTITEMP TT1 - 1EP " or

similar suitable for temperatures of -55°C.

- Use screws A4 - 80 in accordance with UNI EN ISO 3506-1:2000
- The special internal screws in stainless steel (coupling frame – terminal box) form a lamination joint - In case of disassembly, the same screws provided by the manufacturer must be used. In case of replacement, these must be requested at the manufacturers.
- Aluminum fans, terminal boards and stainless steel fan covers, must be replaced with components of the same material supplied by the manufacturer.
- The sealing rings are of special type, and must be replaced with the same provided by the manufacturer.
- The power cables and devices for the cable entries must be suitable for the special range of ambient temperature and for the temperature of the motor operation at load.

9. MOTORS SUITABLE TO BE INSTALLED IN ZONE WITH PRESENCE OF COMBUSTIBLE DUSTS marked II 2D and II 2GD

Those are manufactured on demand and are subject to following prescriptions:

Frame 56 to 160:

- The flat seals within frame/shield (where present) contribute to protection mode “**Ex tb** “ and to mechanical protection **IP66**. In case of disassembly the same need to be re-used. If necessary they need to be replaced with identical ones provided by the manufacturer.
- The seals “O-Ring” between
 - Frame / terminal box
 - Frame / shields
 - Terminal box / terminal box cover
 - External bearing cap / front shield (only MAK 160 series)
 - Screws tightening the external cap / front shield (only MAK 160 series)

Frame 180 to 250:

- Frame / shields
- Frame / terminal box
- Terminal box / terminal box cover
- External bearing cap / front shield
- Screws tightening the external cap / front shield contribute to protection mode “**Ex tb** “ and to mechanical protection **IP66**. In case of disassembly the same need to be re-used. If necessary they need to be replaced with identical ones provided by the manufacturer.

- The seal rings are of a special type and contribute to protection mode “**Ex tb**” and to mechanical protection **IP66**. In case of disassembly the same need to be re-used. If necessary they need to be replaced with identical ones provided by the manufacturer
- The special internal screws seals (frame/terminal box coupling) contribute to protection mode “**Ex tb**” and to mechanical protection **IP66**. In case of disassembly the same need to be re-used. If necessary they need to be replaced with identical ones provided by the manufacturer.
- The internal screws (frame/terminal box coupling) are coupled, in their threaded part, with the use of a strong glue type *Araxons System 52A72* to avoid unscrewing. In the event of dismantling the same product or one with similar features must be used.
- Cable entries devices need to be certified according to following norms:
 - for **2D** to Norms EN 60079-0 and EN 60079-31 and guarantee an IP66 protection grade
 - for **2GD** to Norms EN 60079-0, EN 60079-1 (or EN 60079-7) and EN 60079-31 and guarantee an IP66 protection grade

In the event of multiple cable entries, it will be at user’s care to plug the unused ones with plugs certified according to following norms:

- for 2D to Norms EN 60079-0 and EN 60079-31 and guarantee an IP66 protection grade
- for 2GD to Norms EN 60079-0, EN 60079-1 and EN 60079-31 and guarantee an IP66 protection grade

The connections of the devices must be made in accordance with the standards IEC 60079-14 .
The choice of devices and cable must be made based on the eventual operating temperature of the cable shown on the label warning.

For motors having shields, the user must protect the drive end seal ring with the suitable device, provided by manufacturer.

ATTENTION: at every disassembly, restore the joints with grease type "OPTIMOL OPTITEMP TT1 - 1EP " or “Long Time PD” or similar not containing silicone; greases with silicone might damage the silicon sealings.

9. INSPECTION AND MAINTENANCE

All the inspections and maintenances of flameproof motors must be executed in compliance with IEC 60079-17 standards.

It's particularly necessary to pay attention to the following:

- All screws used must be fully tightened
- The internal special screws (coupling box-frame) form a flameproof joint. In case of removal should be used the same screws provided by the manufacturer. If they require replacement, must be request to manufacturer
- The surfaces of flameproof joints (terminal box cover/terminal box; terminal box/frame, shields/frame and joints for the shaft)

DO NOT HAVE TO BE MACHINED OR PAINTED

- These surfaces must be kept clean and, against corrosion and to prevent the water from entering, protected with a thin layer of grease (see point 2 par. VIII).
- The replacement of parts subject to wear (e.g. shaft seals, bearings, terminal) must be made with components identical to those supplied by the manufacturer to ensure the maintenance the flameproof, the increased safety and degree of protection.

10. REPAIR OF EXPLOSION PROOF MOTOR

Repairs of explosion-proof motors with must be performed as required in [EN 60079-19](#), and

can be performed only by the manufacturer

or

authorized workshops by the manufacturer.

The maintenance or repair not authorized by the manufacturer, immediately invalidates the manufacturer's responsibility about everything that the guarantee and responsibility of **flameproof** and **increased safety** imply.