metalrota s.r.l.

TECHNICAL MANUAL

Asynchronuos three-phase electric motors
24V to 96V

dal 1965

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GENERAL INDEX

1 INTRODUCTION

1.1 SYMBOLS ADOPTED

IMPORTANT

Read the highlighted information with care, and follow instructions to the letter.

CAUTION

This symbol warns the reader to pay maximum attention to the highlighted information.
Failure to follow instructions can result in serious damage to persons or to the product.

FORBIDDEN

Pay careful attention to the highlighted instructions.

1.2 GENERAL INFORMATION

It is important that all the precautions indicated in the manual are strictly observed. In the event that the expected conditions of use or technical data are not covered by this document, contact Metalrota S.r.l. so that the application can be evaluated.
The purpose of this document is to provide the user with all the information needed to ensure correct selection and proper use of the products described.

	**Products must be used according to the methods described in this document, by persons who are properly trained for the purpose.**
	**Customers are responsible for ensuring correct selection and use of the product on the basis of their industrial and/or business needs. With the state of the art constantly evolving, Metalrota S.r.l. reserves the right to update and improve the content of this literature at any time, making changes which however cannot be regarded as binding. Responsibility for the selection of the product lies ultimately with the Customer, unless otherwise agreed in writing between the parties.**

1.3 GENERAL SAFETY WARNINGS

	Asynchronous three-phase electric motors contain dangerous parts and carry various types of risk; consequently, it is essential to observe all the safety warnings indicated. The electric motor must be used only after proper training has been given and the following instructions have been read. Technicians entrusted with installation, commissioning, inspection, maintenance and repair operations must be suitably qualified and familiar with general safety regulations both in the country of origin and in the country where the product will be installed. They must also have received specific technical training that will enable them to identify and avoid every potential danger. In particular, maximum caution must be exercised in respect of live components, rotating parts and hot surfaces. The electric motor must not be operated in hostile environmental conditions. Be certain to abide by the parameters indicated in this manual. Important: • do not deactivate or tamper with protection devices; if safety systems are tampered with or by-passed, Metalrota S.r.l. will acknowledge no liability for any damage that could occur as a result; • if an electric motor develops a fault and/or is not running smoothly, withdraw it from use and label it officially out of service. If repairs are required, contact Metalrota S.r.l. Technical Assistance.
	An electric motor must not be installed in areas where potentially explosive atmospheres can be created or where there is a high fire risk. Commissioning of the motor must not proceed if the driven machine is found to be at variance with the pertinent directive.
	Always use appropriate items of personal protective equipment, e.g. gloves, safety eyewear, etc..
	Do not run the motor if it has become damaged during transport or assembly; in this instance contact Metalrota S.r.l. for instructions on how to proceed. Use only original replacement parts or accessories, or in any event those authorized by Metalrota S.r.l. If this condition is ignored, claims for repairs or damages will not be recognized. Avoid swallowing oil, grease or other material from the electric motor, and do not dispose of these items irresponsibly. Do not clean or wash the motor with solvents or pressurized water jets. These are actions that could damage the product. Do not clean the electric motor using flammable substances, and never use cleaning compounds that are corrosive or harmful to health. Do not apply paint to the electric motor. If in doubt on any point, contact Metalrota.

1.4 RESIDUAL RICKS

 	**Danger from moving parts** Take particular care to avoid any kind of physical contact with moving parts. Install control components that will allow the motor to be started and stopped both under normal operating conditions and in an emergency. Be careful to stop the motor and wait a few minutes before commencing maintenance operations, making certain that all moving parts have slowed to a complete standstill.
	**Danger from explosion and fire** Do not install the motor outdoors or in hostile environments without first checking the level of protection specified. An asynchronous motor can continue to carry voltage even after the stop control has been operated: after testing the earth system, for example, certain parts may present residual risks of explosion. Make certain live parts are completely safe before working on the motor.
	**Waterless fire extinguishers only** In the event of fire, put out flames only with extinguishers using powder or CO2
	**Danger of burns through contact with motor surfaces** Remember always to wait a few minutes after shutting down the machine before working on the motor, as some hot parts may not cool down immediately. Before starting up the motor, ensure that parts made of plastic or temperature sensitive materials are shielded from sources of excessive heat.

1.5 INTENDED USE

Our electric motors are intended for incorporation into machines, generally for professional use, secured to fixed mountings such as the machine frame or baseplate and designed to cover the widest imaginable range of applications.
Electric motors are not normally designed for use in conditions exposed directly to the elements. If electric motors are to operate in hostile environments with notable levels of dirt, water splash, heat or humidity, they must be equipped with special guards. For applications requiring electric motors equipped with special protective enclosures, contact the Metalrota S.r.l. sales office to ensure these are ordered correctly.

1.6 PROHIBITED USES

The intended use for Metalrota S.r.l. electric motors is as described above. Any other uses not specifically indicated are prohibited.

The following are severely prohibited:

- Tampering with parts of the motor or fitting replacements not supplied by Metalrota S.r.l..
- Use in environments where potentially explosive atmospheres can be expected.
- Connection to power sources and use in conditions other than those described in the technical specifications.

	The electric motor must absolutely not be used in an improper manner and/or operated before it has been definitively installed in and interfaced with the driven machine. Where electric motors are used for unsuitable or unspecified applications, warranty is automatically invalidated and Metalrota S.r.l. will decline liability for any damage that may be caused to persons or property.

1.7 IDENTIFICATION OF OPERATORS

Given that certain activities essential to the use of electric motors involve the exposure of operators to specific risks (e.g. connections at installation), persons entrusted with the operations described in this document, from installation through to maintenance, must be properly trained in accordance with current statutory regulations.

1.8 WARRANTY CONDITIONS

The motors referred to in these instructions are guaranteed for 12 months from the date of consignment by Metalrota S.r.l. Any warranty arrangements of a different nature or duration must be negotiated with Metalrota S.r.l. and included in the agreed contractual conditions. The warranty cover is limited strictly to cases of malfunction deriving from defects of manufacture, in accordance with the indications given in this document. Metalrota S.r.l. acknowledges no liability for damage caused to machinery or systems in which the motor is installed. Warranty covers the repair or replacement only of defective motor parts. Warranty does not cover any defect attributable to installation, maintenance, cleaning or parts replacement procedures that have been performed incorrectly or ineffectively.
Do not remove the motor nameplate or you will lose the guarantee.

If a claim under warranty is acknowledged by Metalrota S.r.l., the defective component will be replaced or repaired by the company's own staff. Warranty does not cover parts subject to normal wear and tear. Warranty claims will not be acknowledged in cases of incorrect installation or maintenance, tampering with the product, improper use, or damage sustained during transport, handling and storage. All transport costs incurred in returning the product to Metalrota S.r.l. and restoring it subsequently to the customer are excluded from the warranty.

1.9 DECLARATION OF CONFORMITIY AND INCORPORATION

The manuacturer:
Metalrota S.r.l., with registered office at via Bulgaria 46, 41122 – Modena (MO) – Italy,
in the person of its Legal Rapresentative Mr Federzoni Valter

Declares under its own responsability that products manufactered by the company under the name:

Asynchronous three-phase electric motors

To which this declaration relates, are in conformity where applicable with the following directives:

- 2006/95 (low voltage),
- 2004/106 (electomagnetics compatibility),
- 2014/30/CE (electomagnetics compatibility)
- 2006/42/CE (machinery) insofar as they meet applicable safety requirements and are capable of being incorporated into a machine

The electics motors are also in conformity with the followig technical standards:

EN 60034-1
EN 60034-5
EN 60034-7

Furthermore:

- The tecnical file is held by Metalrota S.r.l. with registered office at via Bulgaria 46, 41122 – Modena (MO) – Italy, in the person of its legal rapresentative,
- Metalrota S.r.l. undertakes to transmit information regarding its products, in response to any reasonable request from the national authorities. This undertaking is given in respect of the method of transmission and without prejudice to the intellectual property rights retained by the manufacturer of the product,
- **Electric motors must not be commissioned until the system or the machine into which they will be incorporated have been declared as being in conformity with the delle requirements of applicable directives.**

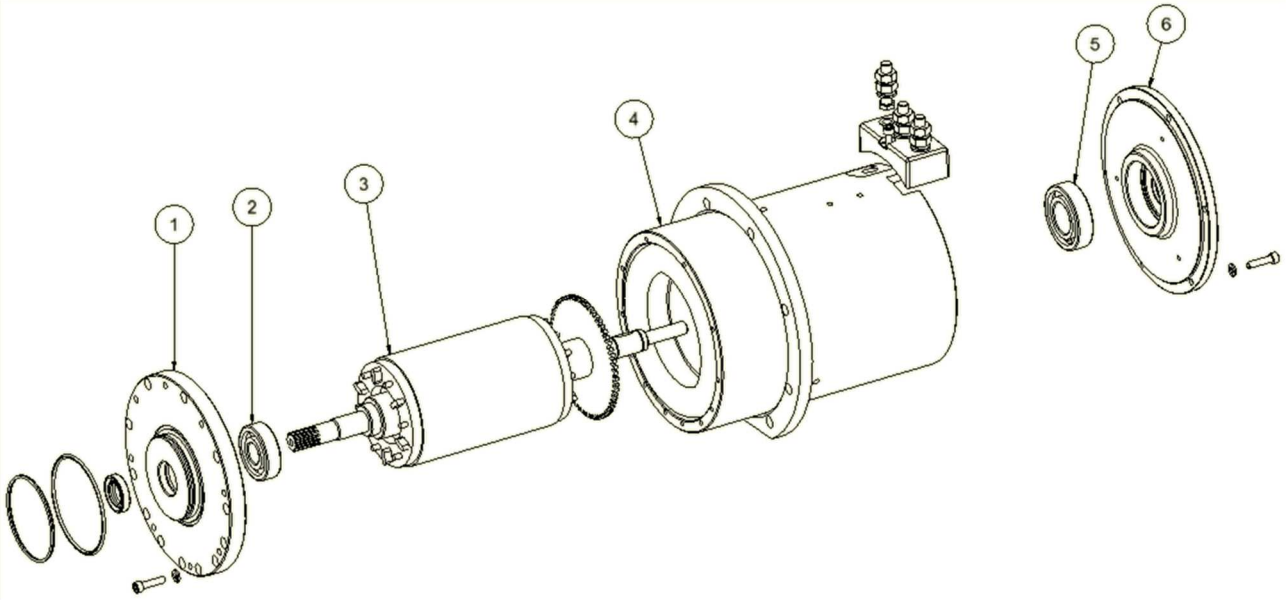
Modena, 03/10/2016 Signed

……
Federzoni Valter
(Legal Rapresentative of Metalrota S.r.l.)

2 ASYNCHRONOUS MOTORS

2.1 DESIGN

These are asynchronous three-phase electric motors operating off a low voltage a.c. power supply, designed for general use in industrial applications.



Rif.	Description	Rif.	Description
1	HEAD FRONT	4	CASE
2	BEARING	5	BEARING
3	INDUCED	6	HEAD BACK

Main parts of the motor:

- **Case:** can be made in aluminium or steel.
- **Flanges and end cover:**: can be made of aluminium, cast iron or steel.
- **Morot shaft:** always steel, with both male and female output configuration at the coupling end and at the end opposite. Special shafts can be supplied if requested by the customer.
- **Bearings:** these are double-shielded, grease lubricated radial ball bearings designed specifically for electric motors. Efficient lubrication is guaranteed at operating temperatures up to 100 °C maximum.
- **Stator winding:** the material used for all our motors is double-enamelled copper wire, insulation class H. Careful separation of phase windings (slots and end rings), safe insulation of “braid” (phase lead wires).

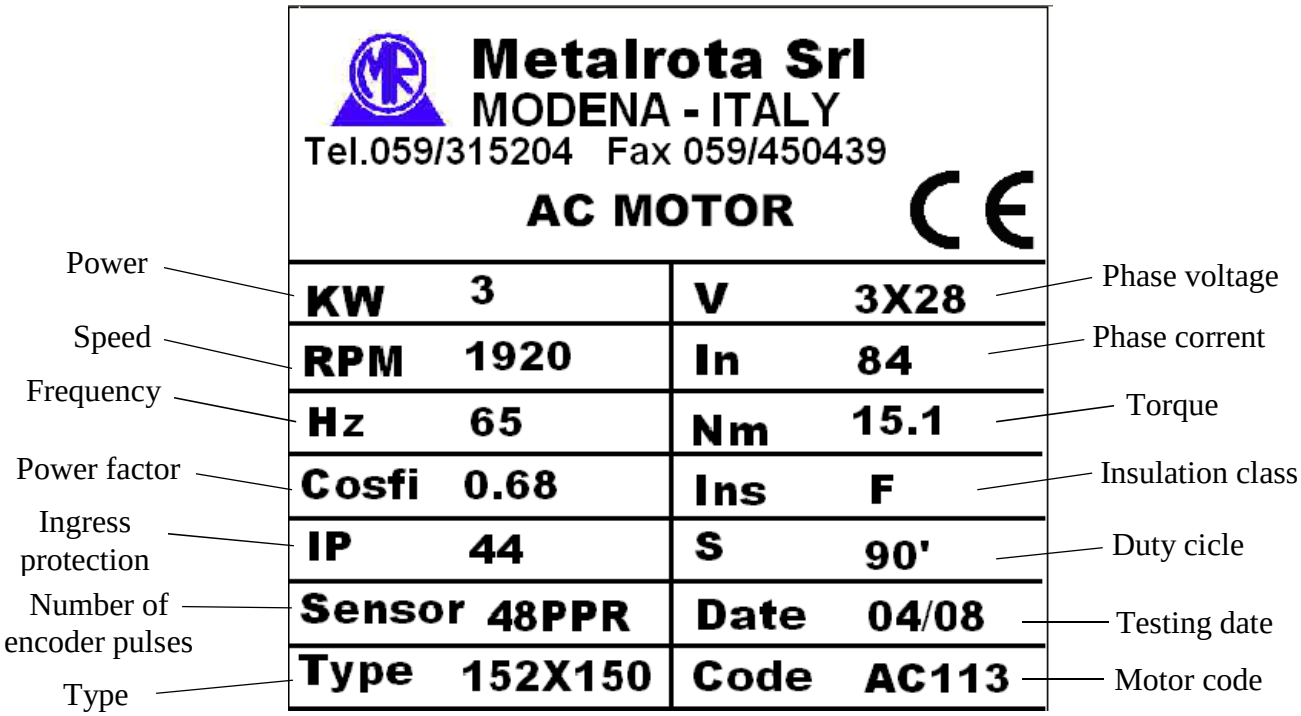
- **Rotor:** pressure diecast aluminium squirrel cage type; all rotors are balanced to eliminate vibration and noise.
- **Motor enclosure rating**: ingress protection from IP 00 to IP 66, on request.
- **Terminal box enclosure rating:** motors can be supplied with terminal box or exit cables having ingress protection from IP 00 to IP 66

Furthermore, on request, we can provide the following accessories:

- **Electromagnetic brakes:** generally we provide negative electromagnetic brake so it's open if the circuit is fed otherwise they still closed; on request we can supply brake with IP65 protection.
- **Thermal protection:** generally we supply thermalcouple on/off or thermal sensor, with cable housed on terminals motor zone.
- **Ventilation of traction motor:** in case of wanting to have a longer service of the motor for intese duty cycle or heavy load.
- **Encoder:** vast is the availabilty of this componet, incremental or absolute, mono and multiturns, connected directly with motor shaft (traction or steering, or fixed on the steering plate.
- **Tacho generator:** generally 10V-1000rpm, connected directl y with the motor shaft (traction or steering)
- **Bimetal thermal sensor:** normally closed or normally open, with temperature thresholds of 90 °C, 110 °C, 140 °C. used to protect the motor from excessively high temperatures Items supplied on request when ordering.
- **Mounting feet:** fixing feet can be supplied for certain types of motor.
- **Painting:** motors can be supplied with special paint finishes, if requested
- **Operation**: motors operate generally with electronic control systems, which signifies almost invariably that the motor will be fitted with an encoder, and with a specific thermal sensor for monitoring the temperature level. The thermal sensor must be of a type compatible with the electronic controller.

2.2 MOTOR IDENTIFICATION AND DATA PLATE

All motors made by the company are identified by a data plate, as illustrated below:



	Many items of technical data on the plate are self-explanatory. For further information, refer to drawings supplied with the accompanying documentation, or contact Metalrota S.r.l. direct

2.3 NOMINAL OPERATING CHARACTERISTICS

Unless otherwise indicated, the operating characteristics refer to:

- Duty cycle (see indication on the motor data plate).
- ambient temperature: 0 °C ... + 40 °C.
- maximum altitude 1000 m above sea level.
- power input at nominal voltage and frequency; maximum permissible voltage fluctuation ammessa ±5%. ±5%. For maximum and minimum power input values, assume a further ±5% (e.g. a motor rated 48 V is suitable for nominal mains voltages from 45 V to 50 V).

	The efficiency of a motor can be reduced if the voltage and/or frequency of the power input deviate from the nominal rated values.

2.4 TYPE OF DUTY

Duty cycles are explained in the following summary of the reference standards and the definitions adopted.

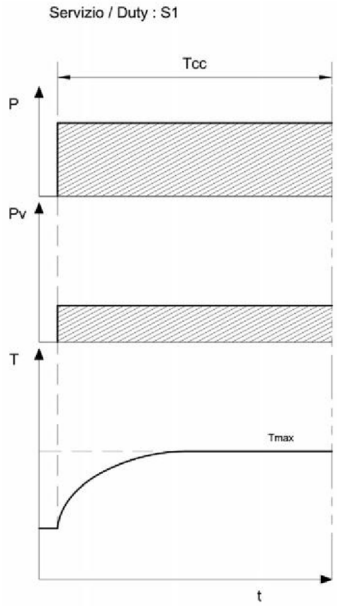
- **Load:** the combined values of electrical and mechanical quantities that characterize the requirements placed on a rotating machine by an electrical circuit or by a mechanical device, at a given moment.
- **Duty:** the definition of the load, or loads, to which the machine is subject, which include (if applicable) starting, electric braking, no-load and idle periods, as well as their duration and their sequence over time.

EN 60034-1 standards define different types of duty. Those of interest for Metalrota S.r.l. products are:

Continuous Duty – S1

Operation at constant load for a duration sufficient to reach thermal equilibrium.

Conditions of continuous duty, equating to maximum perfoermance.



P = Load.

Pv = Elettric losses

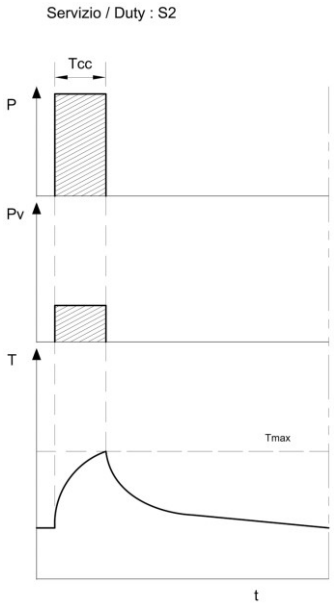
T = Temperature

t = Time

Tcc = Time period of operation at constant load

Tmax = Maximum temperature recorded

Short time duty – S2



Operation at constant load for a given period of time less than that required to reach thermal equilibrium, followed by an idle period of duration sufficient to re-establish equality between the temperature of the machine and the temperature of the cooling fluid with a tolerance of 2°K.

Example: S2-60 min

The motor operates continuously under nominal rated conditions for 60 min, then remains idle for a duration sufficient to return to ambient temperature.

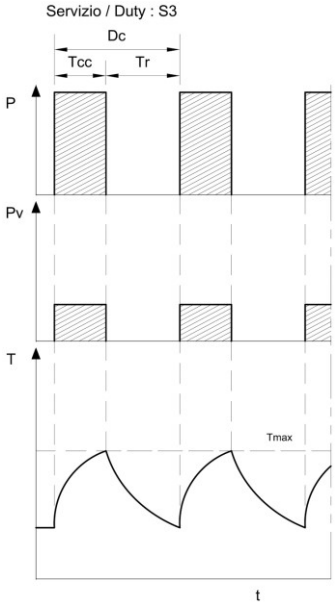
P = Load

Pv = Electic losses
T = Temperature
t = Time
Tcc = Time period of operation at constant load
Tmax = Maximum temperature recorded

Servizio intermittente periodico – Servizio S3

Sequence of identical operating cycles, each comprising a period of operation at constant load and an idle period.

Duration of cycle 10 minutes.



In this duty cycle, the sequence is such that the starting current has no significant effect on temperature rise. The nature of periodic duty dictates that thermal equilibrium is never reached during the on-load period.

Example: S3-70%

The motor runs for 7 minutes and remains idle for 3 minutes.

P = Load

Pv = Electic losses
T = Temperature
t = Time
Dc = Duration of single cycle (10 min)

Tcc = Time period of operation at constant load

Tr = Idle period
Tmax = Maximum temperature recorded

Intermittent ratio = Tcc / (Tcc+Tr)* 100%

3 HANDLING AND TRASPORT

3.1 PRELIMINARY WARNINGS

All Metalrota products are prepared for shipment packed in wooden crates or steel containers, or boxed on pallets, as appropriate for the weight and dimensions of the particular item.
Special packing can be provided on request; in this instance, contact the sales department when placing the order

	In the case of models that cannot be handled manually, the choice of suitable lifting gear (straps, slings, chains, eyebolts) will depend primarily on the weight of the electric motor. Handling, transport and installation procedures must be carried out by persons properly trained and instructed for the purpose, in accordance with current regulations on health and safety in the workplace
	If any pack received from a carrier has been seriously damaged, the best policy is to indicate PROVISIONAL ACCEPTANCE, check immediately that the actual product has not been damaged, photographing it if necessary, then provide a written account of the situation and the condition of the product. The product must not be used until written authorization is received from Metalrota S.r.l. If any parts or components are found to be defective or damaged, contact the Engineering - Sales Department. Should the data plate be damaged, a duplicate must be requested in writing from the Engineering department. Make certain that there are no parts of the packing such as fragments of cardboard, staples etc., occluding or obstructing motor ventilation holes. If electric motors are not going to be used immediately, they must be stored in clean, dry, temperate surroundings, protected from vibration, sheltered from the weather, and preferably covered in such a way that the case cannot be penetrated by dust and debris. Before using a motor, check that all parts are in serviceable condition, especially the shaft, bearings and flanges, and all electrical contacts. Test the insulation of the winding, or windings, using the appropriate instrument. Do not touch the terminals either during tests or immediately afterwards, as they can remain live for a certain duration.
	The materials in which electric motors and relative components are packed must be suitably disposed of at authorized collection sites.

3.2 HANDLING OF MOTORS

Small motors can be handled manually, without lifting gear.

Motors that cannot be man-handled are provided with a threaded hole into which an eyebolt of suitable capacity can be screwed.

If necessary, the motor can be cradled using straps or slings of suitable capacity looped around the case at the appropriate points; in any event, be sure to observe current accident prevention regulations.

	Do not added further loads to the motor when lifting. Do not lift a motor by its output shaft or fan cowl, or by plastic parts, terminals or power cables.

4 INSTALLATION AND COMMISSIONING

4.1 ACCEPTANCE AND STORAGE

	Check that the motor is exactly as ordered, and has not been damaged during transport. Eyebolts that may already be fitted to the case must be used only for lifting the motor itself. If the required operating parameters are different to those indicated in the technical specifications, contact the Metalrota S.r.l. engineering department before proceeding.

4.2 INSTALLATION AND COMMISSIONING

4.2.1 PRELIMINARY WARNINGS

	When installing the motor, the machine must be at a standstill, and disconnected from the electrical power supply.

Motors can be installed in any of the mounting positions covered by EN/IEC 60034-7.

The mounting position of the motor must be selected in such a way that:

- The motor can be properly secured, with all threaded fasteners properly tightened.
- In the case of a ventilated motor, there is sufficient clearance between the fan and the frame of the machine to allow a free flow of air.
- All power cables for encoders, thermal sensors, electromagnetic brakes and any other components (accessories) supplied with the motor can be fastened securely between nuts and lock nuts or with connectors. In addition, power cables must not be pressed or pinched against other parts (machine frame, flanges, etc...) and must be long enough to ensure they can be connected without difficulty, in other words free of any tensile stress that could place strain on terminals and connections.

	When tightening cables to the relative terminals, always use two wrenches as illustrated. Hold the bottom nut stationary to prevent the terminal from turning, then, with the cable termination lug in position on the post, tighten the top nut to obtain a secure and durable contact.

Use the appropriate special tools for assembly purposes.

To find out the permissible axial or radial loads, always ask for and refer to literature originated by Metalrota S.r.l..

	During the installation procedure, ensure that fixing screws or bolts do not penetrate internally of the motor, as these could damage the electrical windings.
	Do not install near heat sources. Bearing in mind the required ingress protection, install the motor in such a way that foreign matter cannot penetrate the frame, or obstruct the ventilation holes if any. Make certain that water or other liquids cannot infiltrate the motor. Make sure the motor cannot be damaged when the machine is moved for whatever reason. Check that the data plate remains clearly visible once the motor is installed. If the case includes drain holes, check that these are correctly positioned in such a way that condensate can run off freely

When tightening cables to the relative terminals, always use two wrenches as illustrated. Hold the bottom nut stationary to prevent the terminal from turning, then, with the cable termination lug in position on the post, tighten the top nut to obtain a secure and durable contact.

Once in position on the driven machine, all motors must be connected mechanically to the machine pivot so that rotation can be transmitted.
The connections most frequently used are:

- Direct coupling to another component (gear unit, differential, pump…),
- Indirect coupling, by way of pulleys, drive couplings or pinions.

Before coupling the motor, clean and lubricate contact surfaces to prevent any risk of seizing.

If the motor is bolted to a bed or baseplate, ensure that the mounting surface is sufficiently thick, with a flatness tolerance of less than 0.03 mm.

Avoid mounting components in such a way as to create overhung loads, and ensure that chains or belts are not tensioned to the point of affecting bearing life, or even causing failure of the motor shaft (see illustration alongside).

	Make certain there is no way that elements coupled to the motor can cause damage to parts of the machine or injury to persons. Ensure that parts of the motor likely to reach high temperatures are suitably protected against possible bodily contact. The coupling component and the type of transmission are selected and designed to suit the particular operating conditions. Selection and design are the responsibility of the customer: the responsibility of Metalrota S.r.l. srl is limited to the reliability of such technical data as the company can be expected to provide to the customer, on request.

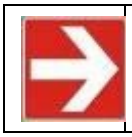
The recommended tightening torques for threaded fasteners are:

Bolt size	**Tightening torque for typical rated strengths**		
	8,8	**10,9**	**12,9**
	[Nm]	**[Nm]**	**[Nm]**
M4	3	4	5
M5	6	9	10
M6	10	15	18
M8	25	35	41
M10	50	70	85
M12	90	120	145
M16	210	295	355
M20	450	580	690
M24	750	1.000	1.200

Tolerance of +/- 8% is permissible on the above values

4.2.2 KEYING

Metalrota motors are always balanced with a half-key fitted to the shaft (unless specified otherwise when ordering). Accordingly, transmission components must also be balanced using a half-key.
For special keying requirements, refer to the detailed instructions provided by the supplier of the component and by Metalrota S.r.l.

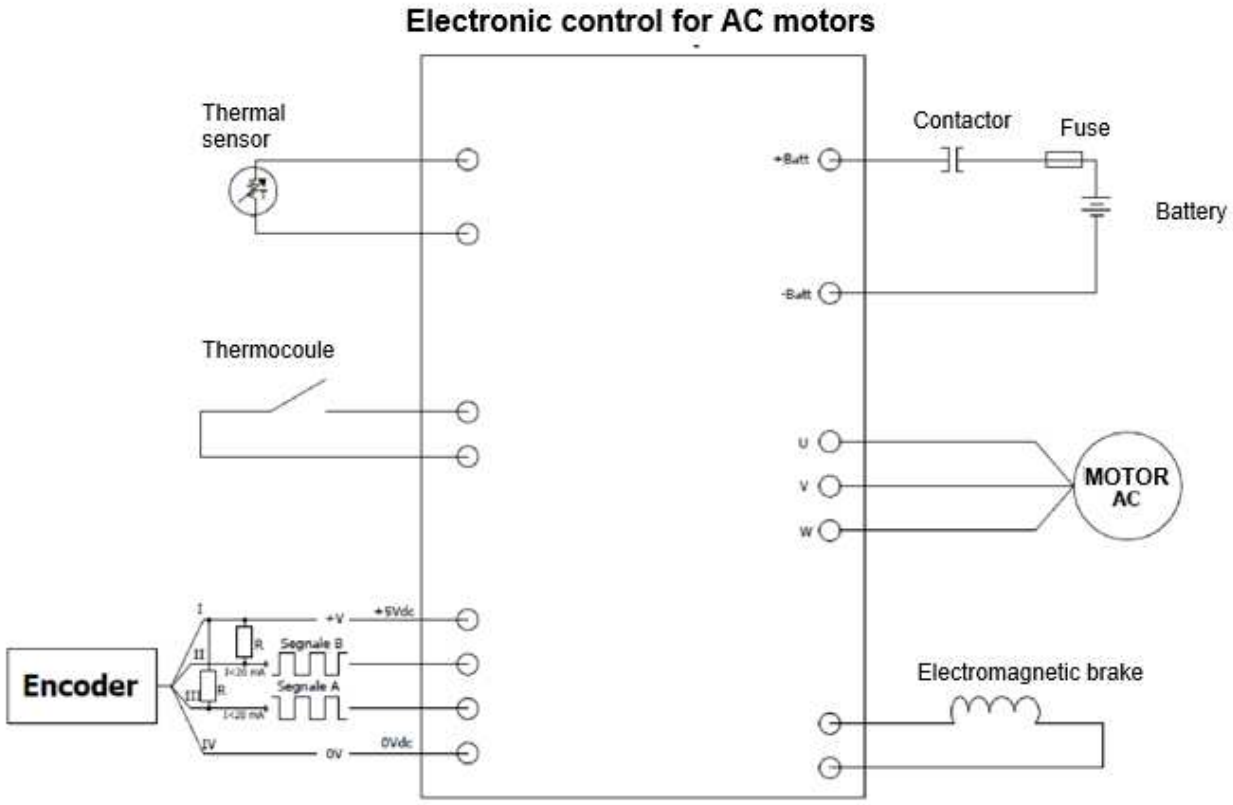
	If the end face of the shaft end and/or the hole in the hub are damaged, the defect must be rectified BEFORE proceeding with assembly.

4.2.3 ELECTRICAL CONNECTIONS

Metalrota S.r.l. can supply different types of motors, consequently it is important that each one should be wired according to the instructions provided. If the motor is operated by an electronic control or other device, compatibility between the motor winding and the control must be verified.

	Before making the electrical connection, make certain that the power supply matches the values indicated on the data plate. Make the electrical connections to the motor and to auxiliary items when the machine is idle, with the motor isolated from the mains power supply
	Use cables of section large enough to prevent overheating and/or excessive voltage drop at the motor terminals. Remove the key from the keyway before starting the motor with the shaft uncoupled, otherwise it could be flung out with considerable force.
	Generally speaking, all Metalrota S.r.l. asynchronous three-phase motors have windings with 1 or 2 coils per slot; the phases can be wired internally adopting star or delta configuration, but in either case there are 3 terminals or 3 cables, and the connection can be made using either of the 2 methods indicated below.
	Before disconnecting the cables to invert the direction of rotation, make certain that the motor is isolated from the power supply
	Motors can rotate in either direction, left or right: if the direction of rotation is not as required, invert the connections of the two outer phases U and V, leaving the central phase (V) in place

Example of connection between asynchronous motor with accessories, and electronic control.

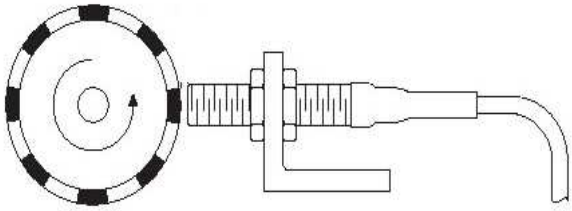


4.2.4 CONNECTION OF ENCODERS

Electronic control systems require a variety of feedback devices to ensure the correct operation of asynchronous three-phase motors; these include encoders.
Metalrota S.r.l. can provides encoder types “phonic wheel” o bearing sensorized” of which the following are the technical characteristics.

Type Phonic wheel: This type of encoder has two main components: a toothed wheel having a suitably sized module, mounted internally of the motor, and a Hall effect sensor inserted through the case from the outside.
The sensor generates two square wave signals,channel A and channel B, phase shifted by 90°.

The number of pulses per revolution (generally 48,64,80 pulse/rev) is determined by the encoder wheel and can vary with the size of the motor. The sensor is readily accessible and easy to replace; the cable can be connectorized if requested.



	It is advisable that the speed should not exceed 6000 rpm. In the event of the RT encoder being replaced, re-utilize the metal shims of the discarded encoder so as to guarantee the same distance (gap) between the sensor and the toothed wheel.

Dati tecnici:	
Imput voltage:	5 ÷ 24 V_{DC}
Frequency range:	0,1 ÷ 20 kHz
Operating temperature:	-10 ÷ +120°C
IP ingress protection:	IP 65
Current:	5V 7.6mA. 17mA
	12V 7.8mA …17 mA
	24V 8mA.. 18 mA
Cable diameter (4 wires)	0.34 mm^2
Red	+5V……+24V
Black	Negative
White	Channel A
Blue	Channel B

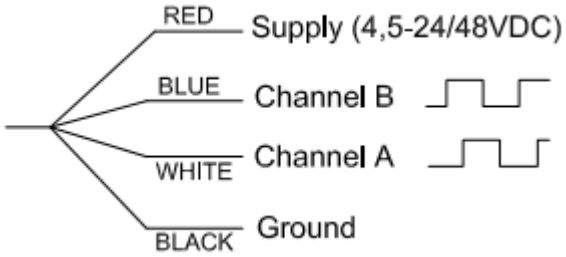
Type bearing sensorized: This type of encoder is also known as a sensor bearing, it is in fact a bearing on which the electrical part is mounted. It has the great advantage of not requiring space, it is mounted as a standard bearing that supports the armature. In this case, however, for any replacement is required to be able to open the engine: this operation must be entrusted to Metaltota S.r.l. approved technicians.

Likewise in this instance, the encoder generates two square wave signals (channel A and channel B) phase shifted by 90°.

The number of pulses generated will depend on the size of the bearing.

	Extreme care must be taken over the installation of this encoder. When fitted onto a shaft or in the recess of a flange, special tools must be used, and every precaution taken to avoid damaging the electronics. If force is required for installation purposes, this can be applied only to the inner ring of the encoder bearing. The sensor bearing can be seriously damaged if exposed to: • an input voltage higher than 24V, • incorrect installation, • excessive overheating, • short circuit between power cables, • electrostatic charges: the sensor is highly sensitive and must be handled with care. • avoid contact between power conductors and signal wires. The output cable can be connectorized if requested. Fitting this type of encoder is always a highly delicate operation, which must be entrusted to an expert technician and performed using the proper equipment.

Technical data:	
Input voltage:	5 ÷ 24 VDC
Operating temperature	-10 ÷ +90°C
Current	5V - 270 ohm
	12V - 680 ohm
	24V - 1470 ohm
Frequency range	0.1Hz … 9KHz
ESD - IEC61000-4-2	contact 4 KV- air 8 KV
ETF - IEC61000-4-4	4000V
Cable diameter (4 wires)	0.32mm2
Red	5 ÷ 24VDC
Black	Negative
White	Channel A
Blue	Channel B



4.2.5 CONNECTION OF THERMAL SENSOR

Asynchronous motors generally need to be equipped with a temperature detection device; Metalrota S.r.l. motors are fitted with Philips KTY84-130 sensors, but can be supplied with other types if requested.
The sensor serves to indicate the temperature of the winding (range -40 °C up to +300°C), and is connected to the electronic control circuit. The two electrical terminals emerge from the motor case on the exit side of the terminal box; see the "maintenance" heading for replacement instructions.

	Failure to connect the thermal sensor (when installed) will automatically invalidate the motor warranty

The encoder and thermal sensor can be supplied already connectorized.

4.2.6 ACCESSORIES

Various accessories requiring an electrical connection can be installed on the motor, if requested.

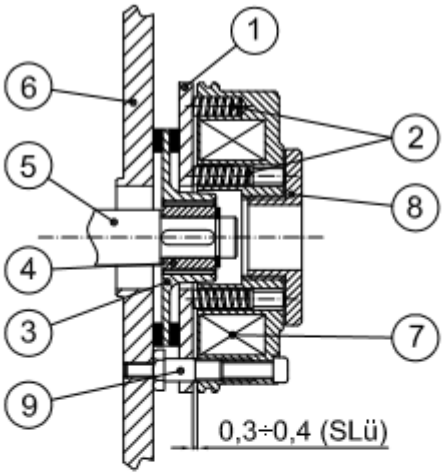
Thermal overload protections

Motors used for heavy duty applications can be protected against excessive overheating by means of a bimetal thermal sensor. This protection device must be specified when ordering the motor.
Metalrota S.r.l. supplies 3 different thermal overload sensors with temperature thresholds of: 90 °C, 110 °C and 140 °C (+/- 8 °C); different thresholds are available on request.
The thermal sensor is generally embedded in the winding, with two relative wires emerging from the motor; these must be connected as indicated in the wiring diagram

TERMOCOPPIA TIPO S 01 CON REINSERZIONE AUTOMATICA E CAVO DI ALLACCIAMENTO	
Switching method	breaker contact
Switching temperature threshold	90°C, 110°C, 140°C
Tolerance	+/- 5 °K
Measurement current / n° cycles	2.5 A / 10 000, 5A / 3000
Standard connection	Cable of 0.25 mm2 section

Electromagnetic brake

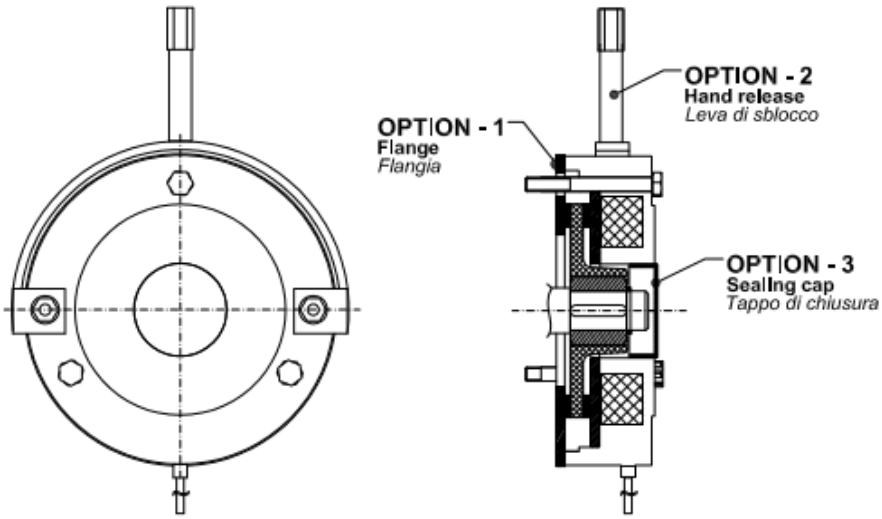
STANDARD BRAKE / *FRENO STANDARD*



1 - **Pressure disk** - *Disco di spinta*
2 - ***Springs*** **-** *Molle*
3 - **Brake disk** - *Ferodo*
4 - **Hub** - *Mozzo*
5 - **Shaft** - *Albero*
6 - **Braking flange** - *Controdisco freno*
7 - **Electro-magnet** - *Bobina*
8 - **Ring nut** - *Ghiera regolazione coppia*
9 - **Air gap regulation screw** - *Vite di registro*
SLü - **Air gap** - *Fessura d'aria*

If the motori s equipped with an electromagnetic brake, this must also be connected to the electrical circuit. Before motor and drive wheel starting, verify that electromagnetic brake is unlocked when it is fed. Especially after a long period of stop, if this doens't happen, the brake lining could be glued (pos 3) to the friction brake plate (pos 1). In this case, with the brake still fed, try to move the brake lining (pos 3) using a screwdriver very carefully and without ruin the contact surface. To increase the braking torque, screw the regulation ferrule (pos 8) (clockwise). To have the opposite effect, unscrew the ferrule (counterclockwise)
N.B: brakes are already regulated during the mounting phase of drive wheels or motor with standard braking.
Torque, power requirement and maximum air gap values are indicated in the following table:

IP65 ENCLOSURE BRAKE SELF-REGULATED / *FRENO CON PROTEZIONE IP65 AUTO-REGOLATO*



Normal braking torque	Power at 20°C	Smax
[Nm]	[W]	[mm]
4	20	0.3
5	22	0.3
8	25	0.3
10	26	0.3
16	30	0.3
20	36	0.3
32	40	0.5
40	40	0.5
60	50	0.5
75	52	0.5

Smax indicates the maximum permissible air gap, beyond which the brake must be recalibrated and, if necessary, the brake disc replaced.

4.2.7 CONNECTION OF AN EXTERNAL ENCODER

An external encoder can be fitted to the motor, if requestedby the costumer.

The external encoder is not essential for control of the actual motor, but will be used to increase the resolution of speed and position signals utilized in monitoring the performance of the driven machine. If requested by the customer, Metalrota S.r.l. will prepare the motor shaft to accept the installation of any encoder selected and installed subsequently by the customer

	An external encoder must not be connected to the electronic control governing the motor, but to the electronic control governing the driven machine as a whole.
	All wiring of encoders, thermal sensors and accessories must be entrusted to an expert installation/service technician and undertaken with maximum care. Metalrota S.r.l. recommends users to procure the proper connectorization tools for the various cables.
	For further information on encoders, contact the engineering department at Metalrota S.r.l..

4.3 REMINDERS ON INCORPORATION PROCEDURES

During the process of installing the motor in the driven machine, all of the various controls must be included: start, stop, emergency stop devices if applicable, and machine safety devices. The motor must be protected permanently against unacceptable power input or loading situations, and against malfunction or breakdown. Metalrota S.r.l. can assist in identifying the most suitable protection systems for particular cases. Where the requisite protection systems are omitted or incorrectly calibrated or found to be ineffective, Metalrota S.r.l. will decline all liability in respect of faults or failures

Electrical protections

Motors are not supplied with any kind of electrical protection installed (e.g. fuses, thermal-magnetic breakers...); it is the responsibility of the user to ensure that protections against short-circuit and overvoltage are provided.

Mechanical protections

Before machines are commissioned, the user must make certain that all moving parts are suitably protected; in particular, the machine must not be commissioned if:

- The motor has not been suitably fixed,
- The cover of the terminal box, if specified, has not been properly fitted and secured with its screws, to prevent accidental contact with live parts
- Power cables have not been suitably connected and protected against accidental contact with live parts,
- The cowl of the cooling fan, if specified, has not been correctly fitted,
- Motors presenting accessible moving parts have not been properly protected,

In addition to mechanical protections associated specifically with motors, the user must also make certain that all components connected to the driven machine and set in motion (couplings, pulleys, driver belts, etc.) are suitably protected against accidental contact.

Protections against thermal risk

The outer surfaces of motors can reach particularly high temperatures.
The user must deploy suitable guards that will prevent operators from coming into contact with hot parts, whether intentionally or unintentionally.

5 MAINTENANCE

	All maintenance operations must be carried out by skilled service technicians. **If in doubt, or in need of any information on the use of electric motors, always contact Metalrota S.r.l. technical assistance.**
	Any maintenance operation on the motor must be carried out with the machine at standstill and disconnected from the power supply (including auxiliary circuits). Irregularities or abnormalities discovered during an inspection must be remedied without delay. Do not carry out maintenance work when the electric motor is running or connected to the power supply. Make certain that the motor has been disconnected from the power supply and always wait a few minutes after it has been shut down, as there are parts that may still be hot. When work is completed, replace guards and protections that have been removed. Take every precaution during maintenance operations to ensure that the motor cannot be started up by unauthorized persons.
	If the electric motor needs to be painted, contact Metalrota S.r.l. srl for instructions **To ensure maintenance is performed correctly, it is always advisable that the electric motor should be removed from the machine in which it is installed.**
	During maintenance work, wear suitable items of personal protective equipment; wait for a few minutes until the electric motor has cooled down sufficiently and come to a complete standstill.
	Do not release or dispose of residual matter into the surrounding environment when carrying out maintenance. Always observe statutory regulations on waste disposal.

The frequency of inspections will depend mainly on the number of hours the motor has been running and on ambient conditions; in any event, current regulations on the servicing of machinery must be observed.

5.1 GENERAL MAINTENANCE

Asynchronous motors do not have parts in direct or sliding contact; nonetheless, inspection and maintenance are importance for the smooth running and durability both of the motor and of the driven machine.

Checks to be carried out at installation and at least once a year

- Check that there are no traces of debris, oil or water on the motor, and that these have caused no damage to any parts of the motor, especially wiring components. Clean all components if necessary, and before reassembly, test the insulation of the stator.
- Check that the entire cooling circuit (case, fan cowl air inlet vents, motorized fan unit if any) is free of dust, oil and any process waste, in order to ensure that the motor will not overheat due to the normal flow of cooling air being impeded.
- Check that all connections — whether cables secured to terminals or connectorized cables — are clean, neatly arranged and properly tightened. If connections are damaged, they must be renewed or replaced.
- Check that the motor runs free of vibration and without abnormal noise. If vibrations are detected, check that the motor is fastened securely and that the driven machine is properly balanced.
- Where drive belts are in use, check that these are correctly tensioned, as a belt that is too tight can significantly reduce the life of motor bearings and even cause failure of the shaft extension.
- Where O-rings, seals and other protection devices are installed, check their condition and replace if necessary with identical components.
- Check that any additional components fitted to the motor, such as contactors, thermal sensors or external fan units, are operating as they should and calibrated as per specification.

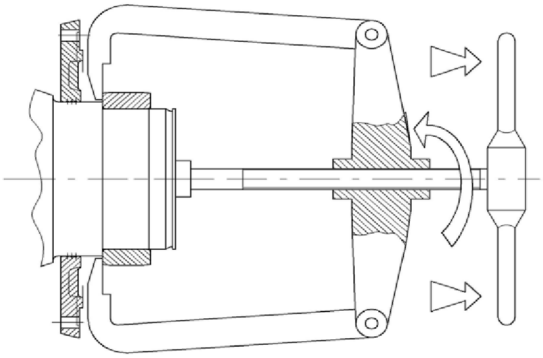
Inspection of bearings: at least once a year

All bearings used by Metalrota S.r.l. are designed specifically for electric motors, with double seals and grease lubrication, and do not require any special maintenance; all the same, it is good policy to check on a regular basis that they are functioning correctly when in operation.
Bearing life can vary to a considerable extent depending on the nature of the loads applied to the motor and the starting cycles adopted, also on temperature and humidity levels in the operating environment. Excessive bearing noise will generally indicate the need for replacement If the motor has been commissioned only recently, the first area to check is the coupling (rectify any possible misalignment or check the tension of drive belts, if in use; see also heading 4.2). If bearing noise persists after remedial action has been taken, this means the bearings are already impaired and must be replaced.

5.2 MAJOR SERVICING

Replacement of bearings

Always remove bearings with the aid of a puller, taking care not to deface or damage the motor shaft.



Removal of bearing turning the handle of the puller

Before bearings are fitted, make certain the relative seats have been thoroughly cleaned. Bearings should be fitted using a press, taking care not to damage the ball races. Check that the bearing rings are correctly abutted against the shoulders of the shaft and of the relative flanges, also that the replacement bearings are of the same type as the original components, or equivalent. Where shaft seals are fitted, these should always be renewed throughout.

	When replacing an encoder bearing, refit the new bearing with maximum care and observing the position of the wiring components. Take particular care to ensure that no stresses are applied to the electrical cable. When removing and replacing motor components installed with protective mastic and/or silicone sealant, make certain that the same level of protection is reinstated following reassembly.

Replacement of motor:

	All operations must be entrusted to expert service technicians and carried out in accordance with current regulations, using the requisite items of Personal Protective Equipment. Before commencing any removal steps, the motor and any accessories installed should be disconnected completely from the power supply.

It is always preferable, where possible, to remove the motor from the machine and position it on a work bench.
Proceed to strip down the motor, following the steps described:

- If the motor has a fan, remove the fan cowl, and the propeller,
- Disconnect the cables from the terminals,

- The motor shaft (rotor) is always retained at one of the two flanges by a circlip preventing axial movement; remove the circlip, proceed to remove the two flanges, and the rotor can then be separated from the case.

	Take care not to damage the rotor or the stator winding when separating one from the other.

- Proceed to remove the bearings, which may be force fitted to the motor shaft or to the flanges in either case, use the appropriate pulling tools or drivers, being careful not to damage the seats.

Metalrota S.r.l. will undertake the overhaul and repair of motors at its own premises. In any event, the work must be entrusted only to expert service technicians who are able to guarantee that the motor will be returned to its faultless original condition.
When carrying out an overhaul or repair, always use original replacement parts, or at least parts approved in writing by Metalrota S.r.l..
To obtain correct information on the product, indicate.

- Motor designation code
- Serial number
- Date of manufacture

In the case of maintenance, it always advisable that bearings and shaft seals should all be replaced. Following the removal steps, conduct a visual inspection to verify the mechanical integrity and functional efficiency of all components, replacing any that are found to be defective or worn (e.g. shaft). Measure the insulation resistance of the stator applying a test voltage of at least 1000 V, and if correct, the serviced or repaired motor can be reassembled.

	Before installing the reassembled motor on the machine: • test the insulation again between phase and earth; • secure the motor to the bench and, before connecting to the power supply check that there are no parts incorrectly or insufficiently tightened, liable to injure the operator or damage the motor, or parts connected to the motor; • connect the motor and any accessories (e.g. electromagnetic brake) to the power supply, following the relative instructions; • supply the correct voltage to the motor and to components (e.g. brake) checking that the shaft rotates in the required direction and there is no vibration or noise; • check that the current draw is correct, on the basis of data plate values This done, the motor can be installed on the machine.

5.3 DECOMMISSIONING

With regard to the correct handling of Waste Electrical and Electronic Equipment, remember that:

1. waste electrical material must not be disposed of as household refuse, but properly sorted in accordance with local regulations;
2. this item of equipment may contain hazardous substances: improper use or incorrect disposal could have negative effects on human health and on the environment.

Incorrect disposal of WEEE materials is punishable by law.

6 TROUBLESHOOTING

The following table shows a list of abnormal situations that could arise, together with possible remedies and an indication of the person authorized to remedy them.
If a given problem does not appear in the table, contact the Metalrota S.r.l. engineering department.

Problem	Causes	Remedy	Competency
Electric motor does not start.	No electrical power reaching the motor	Check that the power supply is correct and reaching the contactor or the electronic control (if installed) and that voltage is registering at the motor	Routine maintenance technician
	Incorrect electrical connection	Restore the correct connection	Routine maintenance technician
	Electronic control (if installed)	Check that the control is working and correctly configured. Check whether or not there are alarms tripped; if so, remove the cause to restore normal operation of the electronic control	Routine maintenance technician
	Electromagnetic brake (if installed) not releasing	Check that the electronic control or the dedicated brake control device are working correctly and able to release the brake	Routine maintenance technician
	Motor damaged	Contact the Metalrota S.r.l. engineering department	Metalrota S.r.l. approved service technician
	Mains voltage too high or too low	Check the a.c. mains power supply	Routine maintenance technician
	Resisting torque too high	Disconnect the drive coupling and test the motor under noload conditions	Routine maintenance technician

Problem	Causes	Remedy	Competency
Motor emits vibration or noise when tested under no-load conditions.	motor malfunctioning	Check that there is no foreign matter inside the motor. Check that the motor shaft bearings are not damaged	Routine maintenance technician
	Misalignment and/or incorrect assembly	Check that all components are securely and firmly fastened and there are no bolts loose	Routine maintenance technician
	Rotor and stator touching	Contact Metalrota S.r.l.	Metalrota S.r.l. approved service technician
	Damaged, defective or worn bearings	Replace the bearings	Routine maintenance technician
	Fan touching the cowl or other fixed parts of the motor	Locate the point of contact and eliminate	Routine maintenance technician
Excessive power consumption	Possible motor fault	Check that the motor is not damaged. Check that the brake (if installed) is fully released. Check that there is no mechanical component of the motor seized or damaged, or that there is no misalignment	Routine maintenance technician
	Workload too high	Check that the load factor for the machine is the same as used for selection of the motor size	Routine maintenance technician
Motor overheating	Fan cowl or ventilation holes occluded or obstructed	Clean thoroughly to restore cooling air flow	Routine maintenance technician
	Input voltage too high or too low	Check the voltage against the data plate	Routine maintenance technician

	The manual cannot possibly inform the user as to every potential danger situation that might arise during the operation or maintenance of these asynchronous electric motors. Accordingly, a sound technical knowledge of the product and of the precautions indicated in this manual — and careful observance of the basic rules regarding safety — can certainly help in anticipating and resolving many danger situations. Our aim is to help the user adopt and develop safe working procedures, and put them into practice. Remember: safety is in your interests, and is your responsibility