



TEM

**OPERATION AND
MAINTENANCE
MANUAL**

**“ELETTRIC MOTORS up to 75V
DC” Family**

TEM ELECTRIC MOTORS s.r.l.

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1 INTRODUCTION

This manual contains the information for operation and maintenance of motors / servomotors in direct current (hereafter simply DC), with power supply up to 75 V, hereafter referred to as “electric motors”.

The content of this document reflects the requirements of the directives 2014/35/UE, 768/2008/CE, 2014/30/UE, 2011/65/UE, 2012/19/UE and relevant regulations.

The manual is to be considered an integral part of the motor to which it is attached and must be kept throughout the life of the machine (it is recommended to keep it in a dry and protected place).

The manufacturer reserves the right to make changes, without notice or incurring any penalty, without prejudice to the main technical and safety feature; for any other information, please contact the nearest retailer.



WARNING USE THE MOTOR ONLY AFTER READING THIS MANUAL CAREFULLY

2 GENERAL WARNINGS

This manual contains the instructions that allow maintenance and regular use of the motor avoiding inconveniences that could damage its proper operation. The electric motor is a risk-bearing component primarily of electrical and mechanical origin, therefore, if used improperly, it can create hazardous conditions and cause harm to people, animals and things.

It is recommended that you carefully read the instructions that follow before the motor is commissioning; each installation operation, commissioning, maintenance and protection of the electric motor shall be performed by qualified personnel in compliance with all applicable laws, technical standards and safety requirements for the electrical equipment of machinery as stated by the European standard EN 60204-1.

Please note that this documentation complements and does not replace any legislation or technical regulations or safety requirements relating to the electric motor; the following information provides only practical suggestions for the competent staff responsible for this task. All liability arising from improper use and failure to comply with the applicable Safety Directives concerning electrical equipment shall be waived.

Failure to comply with the warnings and/or any tampering of the motor, raises TEM from any liability in the event of accidents and/or damage to property and persons.

Before starting the motor, the user must carefully read the contents of this manual.

The user must comply with the safety standards in force in their country and as provided in this manual.

3 SCOPE AND DESCRIPTION

Our motors are mainly used in the field of industrial automation but can be used for all those uses where it is necessary to vary the speed and the direction of the organs to which they are connected.

All motors listed below have been designed and constructed in accordance with the requirements of the standards:

CEI EN 50419, EN 60034-1, EN 60034-2, EN 60034-4, EN 60034-5, EN 60034-6, EN 60034-7, EN 60034-8, EN 60034-9, EN 60034-14, EN 60034-16-1, EN 60034-18-1/22/31, EN 60276, EN 60423, EN 60529, EN 61986, CEI 2-19,

and by the regulations:

768/2008/CE, 2014/30/UE, 2011/65/UE e 2012/19/UE.

4 ELECTRIC MOTOR IDENTIFICATION

All motors shall be fitted with a plate in which the data necessary for their identification can be collected. The layout of these data is described below.

- | | |
|-----------------------------------|-------------------------------------|
| 1. Company name and address | 10. Serial number |
| 2. Designation of the series/type | 11. Month and year of construction |
| 3. Revolutions for minute | 12. Power |
| 4. Nominal voltage | 13. Current |
| 5. Protection grade | 14. Brake supply voltage |
| 6. Voltage V/1000 rpm D.T. | 15. Form Factor |
| 7. Torque | 16. CE marking |
| 8. Voltage constant | 17. Ban on dumping into urban waste |
| 9. Service-type | |

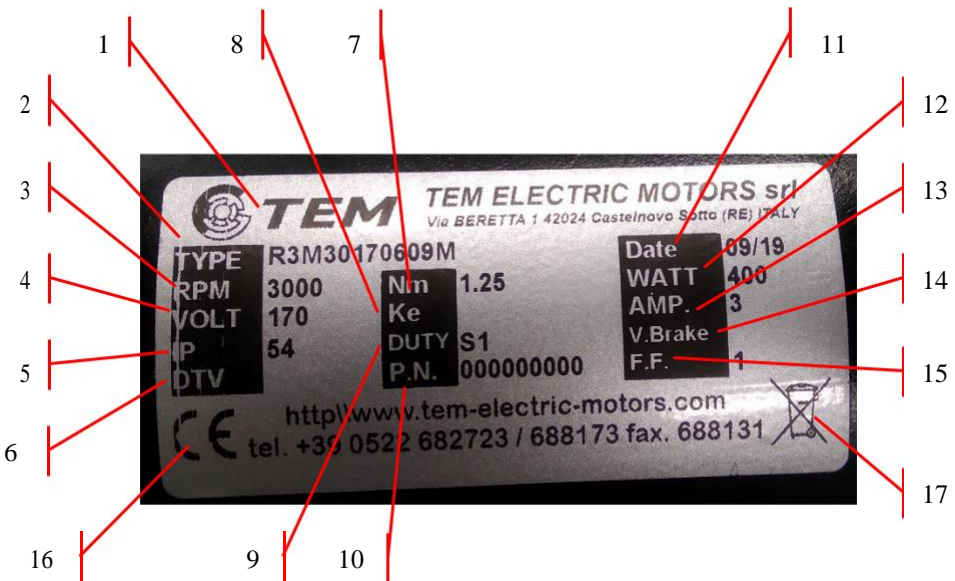


Fig. 1: Identification plate

5 D.C. MOTORS DESCRIPTION

The motors to which this manual refers to the direct current type of 75 – 200 V, with 2-pole ceramic permanent magnet excitation for QUADRIMOT, ROTOMOT, DRIVE2, PMB, PMM, PML, PMX and MP62/2 and 4-poles series DRIVE4, PMR, PMT, MP71/4 and MP80/4. The motors of the DRIVE series are in fact servomotors because they have been designed and built to be able to work in stationary conditions in prolonged torque without being damaged and are available in closed execution without ventilation.

All other series of motors are available in both natural and self-ventilated external version. The basic technical characteristics are given on the motor plate, if the user is in the need to know other parameters not specified can request them from the dealer, consult them or download them from the website: www.tem-electric-motors.com or alternatively request to TEM directly the motor characterization card of which it is in possession, to do this it is sufficient to provide or the full name of the article (see TYPE code of the motor plate) or the serial number (see serial number on box P.N. of the motor plate).

Technical data when not otherwise specified are intended to refer to (tolerance $\pm 5\%$): Ambient temperature 25 °C, Altitude max. 1000m a.s.l., Relative humidity max. 75% in absence of condensation.

6 PROHIBITED SCOPE

The D.C. motors built by us can reach a maximum protection level of IP 55 (only on specific request of the customer) making appropriate constructive changes, therefore their use is not allowed in those cases where greater protection is required, for example:

- Hermetic protection against dust
- Exposure to direct water jets with pressures above 30 KPa and flow rates above 13.2 l/min.
- Partial or total immersion in water, oil, etc...

In the case of standard engines (IP 54 protection for all engines except for MP series which is IP 20) the limitations are extended as required by EN 60034-5.

Uses in oxygen-free and/or radioactive environments are also prohibited.

WARNING:



The motor cannot be used in environments where explosion-proof characteristics are required.

Ensure that the environment in which it is to be installed is not subject to gaseous and poisonous fumes for the maintainer. The use of the engine is allowed to persons over 14 years of age.

7 INSTALLATION

7.1 Mechanical installation

Before installation check that:

- 1) the electric motor is not visibly damaged (damage from transport or storage).
- 2) the registration plate data are consistent with the characteristics of use of the motor and the application for which it is intended; the supply voltage must correspond to the indications on the data plate.
- 3) the environment temperature is within the range 0 ° C to 40 ° C;
- 4) relative humidity is less than 85%;
- 5) the IP protection degree indicated on the electric motor is suitable for the installation environment according to IEC 60034-5;



Before each operation, disconnect the motor and its equipment from the mains. It has dangerous rotating parts, remove the protections only by motor disconnected from the network and with parts not in motion.



Attention the motor can reach in the external surfaces in contact with the operator, high temperatures. Handle only with cold motor.



Attention the motor has sharp parts that can cause injuries. Use special protective gloves.

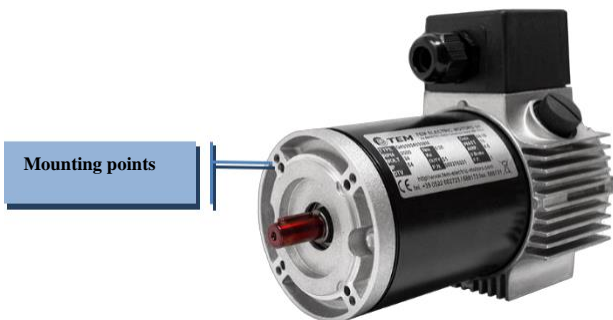
Attention the thin thickness of the plate bearing the electrical data can be sharp. Beware the keyless motor drive shaft has sharp edges.

Preliminary work:

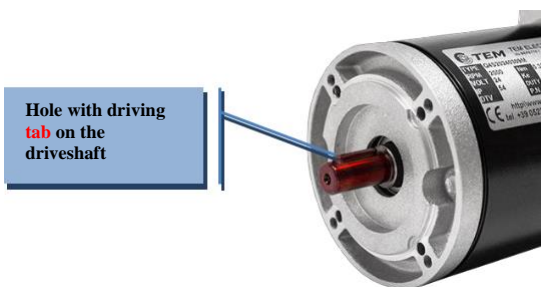
- 1) remove any blockages or protections or packaging used for transport (e.g. motor shaft end protection) and check that the driveshaft rotates freely in its seat.
- 2) verify, in particular after a long storage period, that the motor is not wet or with rust.

Motor installation:

- 1) it is recommended that the electric motor be secured adequately by means of the anchorage points on the flange and/or its carcass;

**Fig. 2: Mounting points of the electric motor**

- 2) perform the installation of the motor on a flat, rigid, vibration-free, deformation-resistant base;
- 3) carefully align the motor and the controlled machine to avoid unacceptable stresses on the crankshaft, respecting the maximum permissible radial and axial loads; misalignment may cause abnormal overheating and/or mechanical breakage during operation and may endanger safety;
- 4) during assembly avoid damage to the motor; do not subject the shaft end to impact or shock;
- 5) ensure that the parts to be connected to the driveshaft are suitable.

**Fig. 3 : Driveshaft**

- 6) if possible, the motor shall be so fixed as to allow the reading of the plate data.

-
- 7) Adequate ventilation shall be ensured, avoiding bottlenecks in air passages and the entry of swarf, dust or liquids and all cases that compromise the smooth operation of the motor and/or heat disposal.

In case the motor to be installed is in version B3, that is equipped with feet for fixing, proceed as described:

- Make sure that the motor rests on a flat surface then secure each hole on the foot using appropriate screws.
- In the case of a flange-mounted motor, perform the following operations:
- Check that the coupling flange is of the same size and design as that of the motor.
- Clean the flange contact areas, remove the protection on the driveshaft and ensure that the key is in the correct position.
- Perform the coupling between the motor and the transmission gear taking care to tighten all the screws on the flange holes.

WARNING:



- **The user is responsible for compliance with local regulations regarding safety, installation and use.**
- **All transportation, installation, use, ordinary and extraordinary maintenance of the motor must be carried out exclusively by specialised and competent operators.**
- **Operator means the person or persons responsible for installing, operating, adjusting, repairing and transporting the motor.**

7.2 Electrical connection and commissioning

- 1) Do not start the engine with free shaft.
- 2) Before the connection, check the correct tightening of the motor conductors on the terminal block; the choice of the cable gland must be congruent to the external diameter of the cable used.
- 3) Power cables shall comply with the applicable rules and regulations by choosing suitable cables and conductors for range and insulation; the wiring of the connections and the section of the cables shall comply with EN 60204-1.
- 4) Before putting into service, check the direction of rotation of the motor; if the motor must run in the opposite direction to the default, simply switch the connection run.
- 5) Safety rules: the electric motor must be installed and used by qualified personnel who are aware of the safety requirements; safety equipment necessary for the prevention of accidents during the installation and operation of the motor on the machine or equipment must comply with the applicable safety rules.
- 6) Connect the motor to its power supply by means of a suitable terminal block.
- 7) The motor shall be protected by a suitable fuse.

7.3 Electrical connection

- The electrical connection must be made by a qualified technician.
- Check the integrity of the power cord before connecting it.
- Verify that the driver to which the motor is connected is of appropriate power to the characteristics of the motor.
- Ensure that the motor supply system is grounding.
- Size the power supply system appropriately so that it cannot be able to deliver currents higher than the peak motor current.
- Carefully connect grounding and shielding (at least one for each metre of cable).
- Engine plate data are supplied with a form factor of 1 (power from batteries).
- If the power supply is of a different type, it will be necessary to downgrade these values as well as if the motor works under conditions other than those of the test (Temperatures above 40 °C, height above 1000m a.s.l. Type of service other than S1 and for ventilated motor also speed adjustment coefficient).
- Formulas and graphs to quantify the above quantities are available on request at our technical office.
- In the next page are reported the connection diagrams:

Q4 / Q7 MOTOR CONNECTION	
POSITIVE MOTOR (+)	L
NEGATIVE MOTOR (-)	N
POSITIVE D.T. (+)	BLUE CABLE
NEGATIVE D.T. (-)	RED CABLE

PMM, PML, PMX, D2 MOTOR CONNECTION	
POSITIVE MOTOR (+)	L / RED CABLE
NEGATIVE MOTOR (-)	N / BLACK CABLE
POSITIVE D.T. (+)	BLUE CABLE
NEGATIVE D.T. (-)	RED CABLE

R3 / R6 MOTOR CONNECTION	
POSITIVE MOTOR (+)	U1
NEGATIVE MOTOR (-)	V1
POSITIVE D.T. (+)	W2
NEGATIVE D.T. (-)	U2

PMR, PMT, D4 MOTOR CONNECTION	
POSITIVE MOTOR (+)	W2
NEGATIVE MOTOR (-)	U1
POSITIVE D.T. (+)	V1
NEGATIVE D.T. (-)	U2

PMB MOTOR CONNECTION	
POSITIVE MOTOR (+)	RED / PIN 1
NEGATIVE MOTOR (-)	BLACK / PIN 2
POSITIVE D.T. (+)	BLUE CABLE
NEGATIVE D.T. (-)	RED CABLE

MP62 / MP71 / MP80 MOTOR CONNECTION	
POSITIVE MOTOR (+)	RED CABLE
NEGATIVE MOTOR (-)	BLACK CABLE
POSITIVE D.T. (+)	BLUE CABLE
NEGATIVE D.T. (-)	RED CABLE

COLLEGAMENTO ALTERNATORE E/O FRENO
ALTERNATOR: it is possible to connect both positive and negative poles.
STANDARD BRAKE (SPRING NEGATIVE): it is possible to connect both positive and negative poles without distinction.
POSITIVE AND PERMANENT MAGNET BRAKE: Follow the connection diagram attached to the motor.



NB: All motors are equipped with a clamp or screw for grounding highlighted by the symbol:

The direction of rotation of the motor is the conventional one (clockwise rotation seen power side) according to EN 60034-8.

WARNING:



- Verify that the transformers used are safe according to IEC 14/6.
- Ensure that connections to electrical sockets are protected from flooding and moisture.
- For motor connections and accessories use cables of

appropriate size, with shielding and ground conductor.

- Failure to comply with the requirements may cause significant damage to the motor

8 PREPARING FOR USE

8.1 Warnings before starting up

Make sure you have run the electrical connections as described in CAP 7.2 / 7.3 and as indicated in the operation and maintenance manual of the drive.

Avoid operating the motor outside the values shown on the plate.



WARNING:

Ensure, before putting the motor into service, that the machinery in which it is incorporated has been declared in compliance with Machinery Directive 2006/42/EC.

8.2 Starting and stopping

- For starting/stopping operations, follow the instructions in the operation and maintenance manual.
- Check that noise, vibration, and supply voltage are correct.
- For motors equipped with brake read carefully the warnings in the following paragraphs.

PREMISE: The motors equipped with standard brake provide a spring brake, this is static brakes with reverse action that the braking force is applied in the absence of tension.

9 ELECTRIC MOTOR PROTECTION

All electrical equipment must be protected against damage resulting from failure or abnormal operation; the phenomena to be taken into account are:

- overcurrents from short-circuit;
- overload current;
- interruption or decrease of supply voltage;
- excessive speed of machine elements.

In the interests of safety, protection shall also be provided against direct contact with live and indirect parts with normally non-live parts but which may be removed by the occurrence of insulation failure.

• Overcurrents from short-circuit

Protection can be provided by: fuses, maximum current relays or thermal relays.

The fuses directly interrupt the circuit, the relays of maximum current and the thermal relays control the opening of the protected circuits acting on automatic switches or contactors. The overcurrent protection device shall be fitted upstream of the conductors to be protected.

The protection against overloads and short circuits can be achieved by means of: automatic circuit breaker with enough interrupting power to interrupt the short circuit current, capable of protecting itself against overloads as well as against short circuits; or by means of a switch capable of intervening in the event of overloads, but which does not have sufficient power of interruption for short circuits, in this case the relative protection is entrusted to fuses inserted further upstream, delayed type (suitable for motors) to take into account the overcurrents expected to start.

• Overload currents.

Overload protection shall be provided for all motors, usually in continuous service, with an output exceeding 0.5 kW; this protection shall also be recommended for all other motors. Protection is normally obtained by thermal relays, inserted on all active conductors, except neutral.

The time constant of the protective structure shall be as close as possible to that of the motor to be protected; this condition, which is not readily achievable, may render the protection inefficient or untimely, especially in the case of motors with intermittent service or subject to a large number of manoeuvres (starts, stops, reversals); in this case the protection can be entrusted to thermal sensors incorporated in the motor (thermistors of type PTC or bimetallic thermoprotectors) able to interrupt the power supply if the internal motor temperature exceeds a set value; this type of protection is also recommended in cases of reduced cooling of the machine and in all those situations where thermal protection does not intervene because there is no prolonged current overload, but which can still excessively heat the motor.

Keep in mind that this protection alone may not be sufficient to protect the motor in locked rotor conditions; it is therefore useful to couple it to the thermal one on the phases.

In general, the equipment must be designed in such a way as to exclude the possibility, after the intervention of the thermal protection, of automatic adjustment of the motor. In certain production cycles, sudden motor shutdown may be detrimental, especially if not coordinated

with other motor that may be present in the cycle; in such cases, the thermal protection may initially send an audible or visual signal to the operator, and only at a later stage, if the operator has not intervened, can it be stopped. Naturally, intervention levels and delay times should be chosen in such a way as to exclude possible hazardous conditions.

In the case of motors powered by converters (e.g. inverters), protection may also be provided by limiting the current consumption; this limitation, however, is generally set at a value higher than the rated current in order to allow the motor to withstand any peak load and have sufficient starting torque. Therefore it must be coupled to another device able to intervene in the case of over a certain time of overload conditions for the motor.

- **Interruption or decreasing of the supply voltage.**

Where a voltage drop or interruption is likely to cause a malfunction of the electrical equipment, a minimum voltage device shall be provided to ensure appropriate protection (for example, the interruption of the machine's power supply) at a predetermined voltage level. If the operation of a machine can withstand an interruption or a voltage reduction for a short period, a delayed minimum voltage device may be provided. The operation of the minimum voltage device must not impair the operation of any machinery stop control.

- **Excessive speed of machine elements.**

Any over-speed of the motor may occur in the case of power supply by means of converters, following a failure or abnormal operation of the converter itself, or in the case of dragging by the load, in the case of absence or insufficiency of braking action. Protection, which is essential when over-speed can cause dangerous conditions, can be obtained by preventing such abnormal operations, for example by the use of devices sensitive to motor speed (centrifugal switches or voltage relays connected to tachymetric dynamos), interrupting the power supply of the motor, possibly including braking devices, in the event that the power failure is not able to stop the controlled load (e.g.: uplift).

- **Protection against direct contact.**

To avoid direct contact, the active parts of the motor (which are normally live) are placed inside the casing (motor casing) and the opening of the terminal box, which makes them accessible, and made possible only through the use of a tool. The removal of the terminal box must be carried out, in case of maintenance, only by qualified experienced personnel with visibly sectioned power supply network, including auxiliary circuits (e.g. for anti-condensation trends) so as not to have accessible live parts.

In the case of active parts capable of maintaining the voltage, such as mains capacitors visibly disconnected, drain the capacitors before performing any other intervention

- **Protection against indirect contacts.**

The protection against indirect contacts, that is, the contacts due to the manifestation of faults in the insulation which thus bring the external metallic masses in contact with active parts under tension, is mainly achieved by connecting all accessible masses to a protective conductor, which in turn is connected to the ground, and by using protective devices which act by disconnecting the power supply when, due to the fault in the winding, the passage of currents towards the ground occurs.

The basic principle of such protection shall be that, in the event of failure, it shall not occur between a part accessible to the ground or between two parts which are simultaneously accessible, a tension sufficient to cause a risk of harmful physiological effects in a person who comes into contact. They are distinguished:

- Protection connection made according to the system with protection conductor connected to the ground in an autonomous way compared to the power supply; the protection can be performed by means of a switch of maximum current or differential switch;
- protection connection made according to the system with neutral conductor connected to the ground at the origin and used as protection conductor (in this case it is not possible to use the differential protection and therefore the switches of maximum current must intervene).

Consult the specific regulations.

The coordination and selectivity of all the protections must be guaranteed, in order to adequately protect lines and equipment; the automatic restoration of the protections after they have intervened is always prohibited, in so far as this may result in an unsafe condition; in addition, the intervention of trained personnel for the manual restoration of the system, of which the electric motor is a major part or part, is mandatory. When present

10 MOTOR MAINTENANCE AND REPAIR

10.1 Cleaning the motor

The motor does not require any special cleaning.

In order not to impair the efficiency of the cooling air, the motor should be periodically (at least once a year in dusty locations) cleaned. Usually just blow away with compressed air free of water and oil. Openings for ventilation and spaces between the fins shall be kept clean in particular. The carbon dust of the brushes deposited due to the natural abrasion inside the machine or in the spaces between the blades of the collector, must be removed regularly. It is recommended to include electric motors in regular overhauls of the machine in which the motor will be inserted.

**WARNING:**

During operation the external structure of the motor can reach a temperature close to 90 °C, then wait for it to cool before performing manual operations.

**WARNING:**

- **Disconnect the motor electrically before starting any operation on it.**
- **Inner and outer parts may have sharp edges, so handle with caution.**
- **If the motor is tested before being mechanically connected, make sure that the key cover is on the shaft to avoid release of the key at high speeds.**
- **Ensure that the motor body is locked so as to avoid hazards to staff.**
- **the motor can only be disassembled and repaired by qualified technicians, failure to comply with this rule will result in the total loss of the guarantee.**

10.2 Troubleshooting

	CAUSE	RIMEDI
THE MOTOR IS NOT WORKING	<ul style="list-style-type: none"> - No current to the motor - Incorrect electrical connections - Worn brushes 	<ul style="list-style-type: none"> Restore the mains voltage Check the correct operation of the driver Check the links Replace brushes
THE MOTOR RUNS AWAY	<ul style="list-style-type: none"> - Damaged Tachymetric dynamo or encoder - Incorrect electrical connections - Damaged driver 	<ul style="list-style-type: none"> - Contact the retailer - Check the links - Check the correct operation of the driver
THE MOTOR VIBRATES AND/OR MAKES EXCESSIVE NOISE	<ul style="list-style-type: none"> - Worn bearings - Incorrect coupling or assembly - Incorrect type of power supply 	<ul style="list-style-type: none"> - Contact the retailer - Check coupling and/or assembly - Verify power supply system

10.1 Replacement of brushes

Every 1000 hours of normal motor operation it is good to check the wear of the brushes and if necessary replace them. On MP80/4 motor a horizontal line on the brushes indicates the wear limit.

Every 2 replacements of brushes is also recommended the revision of the collector, which must be performed only at authorized workshops.

NOTE: Make sure that the new brushes are of the same type and size as the old ones. The quality of the brush is printed on it, if it is impossible to read this initials it is recommended to contact the nearest dealer.

At the end of the operation it is good to remove the inspection cap and with compressed air let out the accumulated dust.

10.2 Compliance Electromagnetic Compatibility

All motor described in this manual comply with EN61000-6-2 Electromagnetic Compatibility 2014/30/EU.

With regard to compliance with EN61000-6-4, it is necessary to use for the electrical connection of the motor shielded cables equipped with ferrite type "FAIR-RITE-0444164181".

For further information on radio frequency disturbances, please contact our technical department; if additional filtering devices are required, TEM will be able to meet all your needs upon customer's request.

11 STANDARDS FOR ENVIRONMENT PROTECTION

At the end of the operating life the motor must not be thrown as common waste, but must be scrapped in a special container for the recycling of electrical and electronic material; this is highlighted by the symbol of the barred trash can placed on the plate of the motor itself.

Depending on its intrinsic characteristics, the materials that make up the motor could be recyclable, it is therefore recommended in case of demolition to differentiate the parts according to their nature and in any case to comply with the relevant local directives.

Waste recycling and other forms of electrical and electronic material management make an important contribution to environment protection. To obtain information on the nearest collection point it is advisable to contact the relevant bodies.



12 WARRANTY

12.1 Information on technical assistance

In case of motor problems, not traceable to the table "TROUBLESHOOTING" contact your nearest retailer.



12.2 Maintenance of minimum requirements

The manufacturer shall ensure that the minimum safety requirements are maintained for 10 (ten) years from the year of manufacture.

12.3 Limits to warranty

- The manufacturer guarantees the motor described in this booklet, for 24 (twenty-four) months from the date reported on the motor plate and within that period undertakes to repair or replace the defective parts, provided that they have been used under the conditions shown on the plate.
- Parts subject to wear and tear are not covered by warranties.
- TEM will only cover the repair costs, any other costs (withdrawal, replacement, transport, etc.) including any damage to property and persons, and shall be borne by the customer, who for no reason shall be entitled to claim TEM itself.
- The warranty is not recognised in cases of poor maintenance, abnormal use of the motor and tampering thereof.
- Claims for damage incurred during transport can only be forwarded when the damage is ascertained and confirmed upon delivery of the goods.
- Any dispute is due to the territorial jurisdiction of the judicial authority of Reggio Emilia.
- In order to ensure the fastest possible repair, in the event of a warranty claim, send the defective product in free port together with the duly completed warranty certificate.

12.4 Certificate of warranty

	<p>CERTIFICATE OF WARRANTY TEM ELECTRIC MOTORS srl</p>	
Item:		
Series Number (P.N.) :		
Purchase date :		
Anomaly :		
Stamp and signature of the user :		

NB: Keep the warranty certificate carefully. Your loss extinguishes your warranty right.