



**SEIPEE S.p.A.**  
41011 CAMPOGALLIANO (MO) - ITALY  
SEDE LEGALE VIOTTOLO CROCE 1  
SEDE OPERATIVA VIA S. FERRARI 4  
TEL. +39 059 850108  
FAX +39 059 850128  
Email: [seipee@seipee.it](mailto:seipee@seipee.it)



Rev.02 11/2016

## Warnings and Instructions for Use, Installation and Maintenance



**CAUTION!** Read all warnings and instructions given below before proceeding with any operation of transport, installation, start-up, maintenance or repair of the motor and related auxiliary components, if any (brake, probes, etc.).

### 1. General warnings

This Manual describes the warnings of law and the activities for the installation of three-phase, single-phase, double polarity, brake asynchronous motors and is an integral part thereof, as such, **it must always be kept with the utmost care**. The electric motors that are designed and manufactured for use in industrial plants comply with the **Low Voltage 2014/35/EU Directive** and therefore bear the **EC** marking on the nameplate. In the event of use of the electrical machines outside of the European Community the specific rules of that Country must be met. The appropriate laws and all applicable rules regarding safety and correct installation and the information reported in the following Manual must be observed. Improper procedure **can cause** death or serious physical injury and possible damage to property, people and animals and cancels the effects of the guarantee. In case of uncertainties or misinterpretations, immediately stop the operations and **contact** our Technical and/or After-Sales Office. Compliance with these warnings, instructions, conditions and methods of installation, commissioning, use and maintenance of the electrical motor cannot be controlled by the Manufacturer.

The three-phase, single-phase, dual polarity and brake asynchronous motors **are not to be used** at the state of supply but are intended to be incorporated into an equipment or a machine. Therefore, the motor **cannot** be commissioned until the product, where it will be incorporated, has been declared in compliance with directive **2006/42/EU** "Machinery Directive" or directive **2014/35/EU** "Low Voltage Directive" according to the related applicability.

#### お 1.1 Safety Rules

##### 1.1 Safety Rules

To ensure personal safety and to prevent property damage, observe the warnings and comply with the current safety rules: the personnel working on live parts must be appropriately qualified.







**Always** remove power from the motor, the brake and the auxiliary components, if any (such as, for example, the anti-condensation heater). Make sure against the voltage re-insertion.

Check absence of voltage. Carry out earthing and short-circuiting.






Cover or protect adjacent live parts, if any.

At the end of the work restore the initial conditions by proceeding in reverse order, from the last to the first rule.

## 1.2 Qualified personnel

	<p>Any action on the machine must be carried out <b>exclusively</b> by qualified personnel.</p>
	<p>By <b>qualified personnel</b> is intended those persons who, by their training, experience and instruction, and their knowledge of the related Standards, regulations, prescriptions, provisions for the prevention of accidents and operating conditions, are capable of recognising the dangers associated with their activities. The personnel must be appropriately trained and instructed on the performance of works on the machines.</p>
	<p>The symbols shown on the left indicate respectively an operator, a lifting and handling operator, a mechanical maintenance technician and finally an electrical maintenance technician.</p>
	

## 1.3 Safety warnings

	<p><b>All transport, installation, commissioning, maintenance and repair operations must be performed by qualified personnel</b> and under the control of the plant Managers.</p>
	<p><b>The rotating electrical machines in low voltage contain parts under voltage, rotating or moving parts, surface and internal parts with temperatures over 50 °C under normal operation.</b></p>
	
	<p>Improper use of electric motors and/or removal or disconnection of the protection devices <b>can cause</b> serious damage to people, animals and property.</p>
	

Therefore, any liability is disclaimed in the event of accidents and/or damage due to negligence and/or failure to follow the described warnings and instructions, and the general safety rules or use in conditions other than those indicated on the nameplate.

It is also disclaimed any liability for damage caused by improper use of the motors and/or for the removal or disconnection of the electrical and mechanical protections.

All information contained in this document can be subject to modifications and may be subject to changes so that this Company **disclaims** any liability for damage resulting from the incorrect use of such information or from use of non updated versions.

The instructions contained in this document **cannot**, for reasons of clarity, contain in detail all the information on the possible manufacture variants, nor any single case of assembly, service or maintenance. For special manufactures before any action, check the type of model and if in doubt **always** contact our Technical and/or After-Sales Office.

### 1.4 Field of application and operating conditions

The instructions given in the following Manual refer to three-phase, mono-phase, double polarity and brake asynchronous motors complying with the CEI EN 60034 Standards.



These motors are designed to be used at room temperature -15 °C to +40 °C and with a maximum altitude of 1,000 m above sea level. Tolerance for supply voltage  $\pm 5\%$  and for frequency  $\pm 2\%$  in accordance with IEC 60034-1 Standard. Any conditions other than those described above, are indicated on the nameplate.

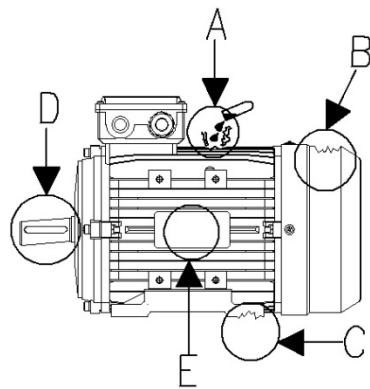
Pay attention to the values placed on the nameplate since the conditions of use must correspond to the data shown on the nameplate thereof.

This Manual refers to three-phase, single-phase, double polarity and brake asynchronous motors for which **it is not permitted** their use in atmospheres with risk of explosion.

### 1.5 Reception, checking and identification of the goods

In the event of damage, notify immediately the problem to the carrier and supplier.

Avoid commissioning damaged motors.



Checking at reception, before installation:  
 A) Corrosion;  
 B) Damage to the fan cover;  
 C) Damage to the foot/feet of the motor;  
 D) Damage to the shaft motor;  
 E) Checking/identification of the nameplate data with respect to the specific requirements when ordering.  
 Below are indicated the nameplate characteristics.

Example of nameplate on the motor

		IEC 60034 -1	
N° (1)		Date (2)	
Mot. (3) ~ Type (4)			
(5) kg	I.CL. (6)	IP (7)	S (8)
Execution (10) (11)			(9) mF
Eff. (12)			
(19) V (19)	Hz (21)	(19) A (19)	kW (23)
(20)	(21)	(22)	(24)
min <sup>-1</sup> (24)	cos $\phi$ (25)	100% (26)	75% (27)
50% (28)			
Brake (13)	Nm (14)	V~ (15)	A (16)
		### (17)	V= (18)

1) **Series – serial-number;**  
 2) Year; 3) Number of phases;  
 4) Type of motor /size/number of poles/mounting arrangement designation; 5) Motor mass; 6) Insulation Class; 7) Protection Grade;  
 8) Service; 9) Condenser capacity;  
 10) Auxiliary capacitor capacity;  
 11) Any special executions and auxiliary components; 12) Any efficiency Class; 13) Brake designation; 14) Braking torque;  
 15) A.C. power brake rated voltage;  
 16) Brake power consumption;  
 17) Rectifier code (only brake in the D.C.); 18) Brake supply rated voltage in D.C.; 19) Connection of phases; 20) Rated voltage; 21) Rated frequency; 22) Rated electrical current; 23) Rated power; 24) Rated speed; 25) Power factor; 26-27-28) Performances to the various loads.

### 1.6 Lifting, storing and handling

All heavy motors above 25kg are equipped with lifting eye-bolts (and anyhow are always present from motor size  $\geq 100$ ).

**Lifting: always** use appropriate safety Personal Protective Equipment (PPE = gloves, shoes, etc.). Use **always** the lifting eye-bolts for handling the motor. Before lifting the motor, make sure that the lifting eyes-bolts are not damaged.

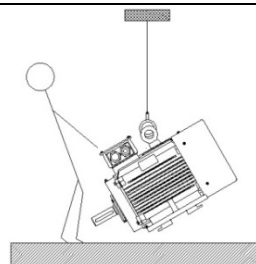
**Always** make sure that appropriate lifting equipment are used and that the sizes of the lifting hooks comply with the eye-bolts on the motor.

During lifting operations, pay attention not to damage the auxiliary equipment and the connecting cables to the motor.

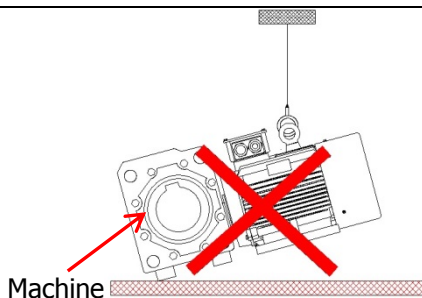
Pesi lordi massimi indicativi dei motori																		
Grandezza	56	63	71	80	90	100	112	132	160	180	200	225	250	280	315	355	400	450
kg	4.5	7.5	10	15	22.5	30	45	75	125	225	325	385	480	800	1240	2700	3500	5200

Pesi lordi massimi indicativi dei motori = Indicative maximum gross motor weights

Grandezza = Size



**Caution:** for vertical lifting avoid an uncontrolled rotation





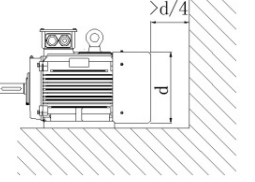
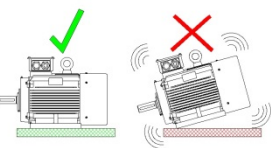
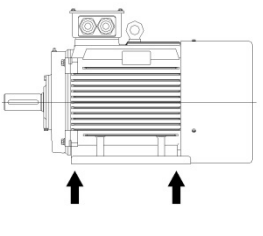

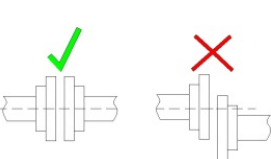
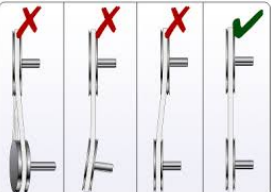
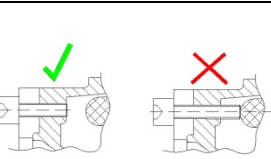
**Caution:** the lifting eyebolts are sized for lifting only the motor, brake and auxiliary components, if any, therefore **they must not** be used for lifting the motor when it is connected to other machines.

	<p><b>Storing and Handling:</b></p>	
	<p><b>&gt;-20 °C</b>                      <b>&lt;40 °C</b></p> <p><b>Storing in a closed room</b></p>	<p><b>&lt;-20 °C</b>                      <b>&gt;40 °C</b></p> <p><b>Storing in the open</b></p>
<ul style="list-style-type: none"> <li>• During transport and storing avoid shocks, falls and <b>always</b> use appropriate safety Personal Protective Equipment (PPE = gloves, shoes, etc.).</li> <li>• The motor must be placed away from moisture, since, in its presence, the machine insulation can drop very rapidly until it becomes almost nil.</li> <li>• Machined and unprotected surfaces, such as flanges and shaft ends must be treated with anti-corrosion products.</li> <li>• The motors fitted with cylindrical roller bearings and/or angular contact must <b>always</b> have the shaft stopped during transport.</li> </ul>		

### 1.7 Installation for commissioning and connections


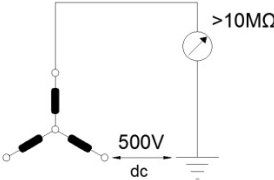



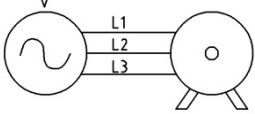

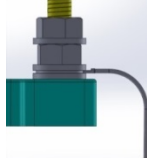
	<p><b>General notes: always disconnect the motor from the electrical power supply before working on it or on the equipment connected to it.</b></p>
	<p>The electrical motors are <b>industrial products</b>, therefore their installation and commissioning must be carried out by <b>qualified personnel</b>, as indicated in section 1.2.</p>
	<p>Improper use of the above mentioned electrical motors and/or removal or disconnection of the protection devices <b>can cause</b> serious damage to people and property.</p>
	<p>The safety equipment (PPE = gloves, shoes, etc.) necessary for the prevention of accidents during installation, connections and commissioning, must <b>always</b> be used in accordance with the local safety regulations in force in the Country.</p>
	<p>When there is the possibility that a brake malfunction <b>can cause</b> damage to persons and property, use of only the brake motor does <b>not</b> ensure an adequate level of safety, and it is necessary to <b>always</b> provide adequate additional safety measures.</p>

**Mechanical installation:**

 	<p>The foundation must be flat and rigid to support stresses from short-circuits and must not transmit vibrations to the motor.</p>	
		<p>Ensure adequate ventilation and that there is enough space to ensure a correct air circulation (at least <math>\frac{1}{4}</math> of the opening diameter of the inlet air).</p> <p>Avoid proximity to sources of high heat.</p>
	<p>For fixing motors and connection of terminal box nuts use appropriate torque, according to the material, holes and related threading.</p>	
		<p>Balancing of the motors is carried out by using a half key.</p> <p>The other components that are coupled to the motor must be balanced with the same criterion.</p>
		<p>Motors with condensation drain holes:</p> <ul style="list-style-type: none"> <li>• they must always be facing downwards;</li> <li>• in the case of wet and possible condensation environments, it is recommended to open the holes regularly by acting on the screws located at the bottom of the casing;</li> <li>• in the case of dusty environments, it is necessary to close the holes with the relevant screws</li> </ul>
	<p>Do not get on, and do not lean on, the motor</p>	
		<p>Pay attention to all rotating parts of the motor.</p> <p>In particular, a commissioning or respectively a test with the key fixed only by means of the shaft protection cap is <b>strictly prohibited</b> as the key may be projected due to the centrifugal force</p>
	<p><b>Do not</b> open the terminal boxes while the supply is in progress.</p>	
	<p>Comply with the axial and radial load on the bearings given in the technical catalogue.</p>	
		<p>A correct alignment is essential to avoid bearing failures, vibrations and possible shaft failures.</p> <p>Direct coupling or with joint, be sure of the motor alignment with respect to the coupled machine axis. If necessary apply an elastic or flexible joint to prevent bearing failures, vibrations and shaft failures.</p>
	<p><b>Belt coupling:</b></p> <p>The motor axis must be parallel to the coupled machine axis. The pulley overhang must be as minimum as possible.</p> <p>An excessive tension of the belts damages the bearings and <b>can cause</b> failure of the shaft motor.</p>	
	<p>In motors for mounting arrangement B14 and B34 the useful depths of screwing of the screws in the flange holes <b>must never exceed</b> twice the thread diameter to prevent damaging the motor winding (for example, M5 thread flange = screwing useful depth 10 mm max.).</p>	
<p><b>Caution:</b> it is <b>always</b> the task of the end user to ensure, after the end of assembly of the motor to the respective machine, protection of the moving parts, in order to operate in safe conditions.</p>		



**Electrical installation:**

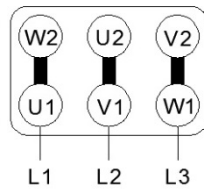
		<p><b>All works must be performed only when it is made sure that the motor is without the power supply and secured against accidental start-up</b> (see safety rules under point 1.1).</p>
		<p>Before commissioning and when forming of dampness is suspected in the windings, it is essential to <b>check the insulation resistance among the windings and towards earthing</b>. The measurement must be made with a special "megaohm-meter" tool by using a test voltage of 500V<sub>dc</sub>.</p> <p>Strictly follow the instructions for use of the tool before performing the insulation measurement.</p> <p>The insulation value must be &gt; 10MΩ at cold.</p> <p>There are dangerous voltages on the terminals immediately after measuring. Therefore, at the end of the test, <b>always</b> discharge towards earth the motor phases.</p>
		<p><b>Always perform earthing of the motor before connecting it to the mains supply.</b></p> <p>The marked terminal is placed inside the terminal box (use a cable of adequate section). If available, it is possible to use the earthing marked terminal, placed outside the casing.</p>
		<p>Before commissioning, make sure that the electrical power supply corresponds to the electrical data shown on the nameplate.</p> <p>The indications given on the nameplate <b>must be</b> absolutely observed. Always check the connection diagram of the motor, brake and auxiliary equipment, if any.</p>
		<p>Once carried out the wiring, check that the electrical power cables of the motor are not too tensioned; tighten thoroughly <b>all</b> the electrical connections; check that the inside of the terminal box is clean and no terminal nut or washer has dropped into the motor and that it is in contact with the winding.</p>
<p>The electric power supply cables and the respective section must be selected by taking into consideration the rated current and the operating conditions (for example, room temperature, type of cable installation, etc.). Use suitable wire terminals while for auxiliary devices it is possible to connect directly to the terminals.</p>		
<p>Before opening the terminal box, make sure that the motor shaft is stopped and cannot rotate. A rotation induces a voltage proportional to the motor shaft speed.</p>		
<p>Close the terminal box paying attention that the sheathings are not damaged and that they are well positioned in their seat so as to guarantee the degree of protection indicated on the nameplate</p>		
<p>All motors are equipped with cable glands or arranged for possible assembly. Those not used must be closed to protect the motor against any dropping of solids, liquids and moisture. The cable glands must be thoroughly tightened around the cable and the arrival radius of curvature of the cables must not allow inlet of water.</p>		
<p><b>Terminals and rotation direction:</b> it is <b>necessary</b> to check the rotation direction of the motors before coupling to the user machine, as this <b>may cause damage</b> to people and/or property. For <b>single polarity three-phase</b> motor the shaft motor rotates clockwise as viewed from the control side when the phase sequence L1, L2, L3 is connected to terminals U1, V1, W1. To reverse the rotation direction, interchange the connections of any two electrical power supply cables. The star-delta (Y/Δ) start-up is possible only when the mains voltage corresponds to the delta (Δ) value.</p>		
<p>For connections to the inverter, if any, <b>always</b> refer to the specific Manuals of the suppliers depending on the used inverter.</p>		

Motor connections:

Single polarity three-phase motor

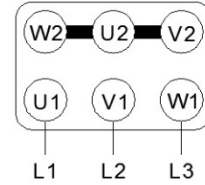
Minimum voltage

$\Delta$



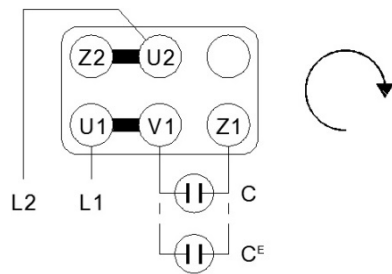
Maximum voltage

Y

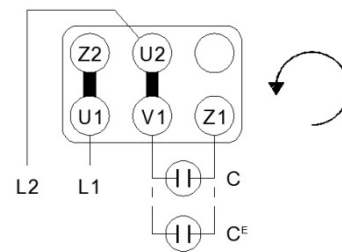


Mono-phase motor

Clockwise rotation



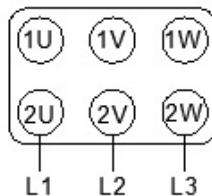
Anti-clockwise rotation



Dual polarity three-phase motor, separate windings

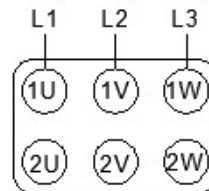
High speed

Y



Low speed

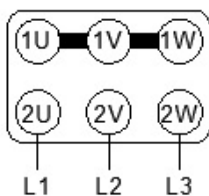
Y



Dual polarity three-phase motor, single winding

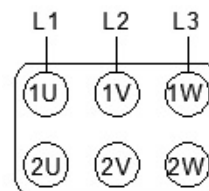
High speed

YY



Low speed



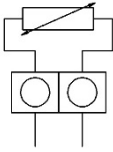
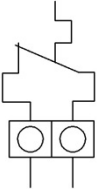
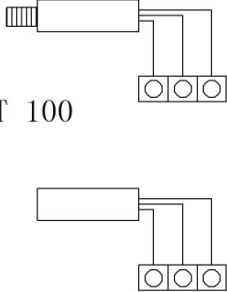
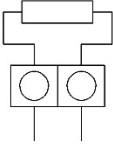
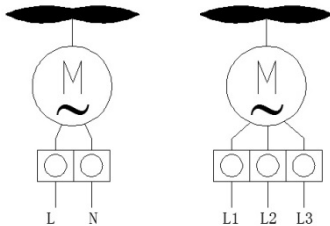
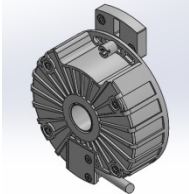
Y



**Caution:** for three-phase, mono-phase and dual polarity motor with special connections other than those indicated above, **always** refer to the diagrams supplied with the motor.



**Auxiliary equipment connections:**

 		<p><b>Thermistor thermal probes (PTC):</b> The terminals are placed inside the motor terminal box.</p> <p>They must <b>always</b> be connected to a special relay, a release or inverter device capable of interrupting the electrical power supply (a task by the motor's purchaser).</p>
		<p><b>Bimetallic thermal probes (PTO):</b> The terminals are placed inside the motor terminal box.</p> <p>Characteristics: <math>V_N</math>, max. 250V - <math>I_N</math>, max. 1.6A</p> <p>They must <b>always</b> be connected to special equipment (a task by the motor's purchaser).</p>
	<p>PT 100</p> 	<p><b>Temperature sensor PT 100:</b> in winding: the terminals are placed inside the terminal box of the motor.</p> <p>On the bearings: the terminals are placed inside an auxiliary box integral with the casing of the engine.</p> <p>They must <b>always</b> be connected to special equipment (a task by the motor's purchaser).</p>
		<p><b>Anti-condensation heater:</b> the terminals are placed inside the terminal box of the motor.</p> <p>Characteristics: 230V.A.C. <math>\pm</math> 10% 50/60Hz.</p> <p>The anti-condensation heater <b>must not</b> be power supplied during the motor operation.</p>
		<p><b>Axial independent cooling fan:</b> The power supply terminals are placed within an auxiliary terminal box integral with the fan cover. Before connection and commissioning <b>always</b> check all the characteristics given on the adhesive nameplate placed on the box and related connection diagram placed inside the box.</p>
		<p><b>Encoder:</b> supplied with the connection cable equipped with military-type male connector attached to the motor. The female connector and the Manufacturer's Manual are also supplied (<b>always</b> read carefully the Manual and the related connection diagrams before commissioning).</p>
	<p><b>Caution:</b> for special auxiliary equipment other than those mentioned above, <b>always</b> refer to the diagrams provided with the motor.</p> <p><b>Failure to connect at least one probe between PTC and/or PTO (if any) will void the guarantee of the motor.</b></p>	

**Brake connections:**






 	<p><b>A.C. brake</b></p> <div style="display: flex; justify-content: space-around;"> <div style="width: 45%;"> <p style="text-align: center;"><b>Minimum voltage</b></p> <p style="text-align: center;"><math>\Delta</math></p> <p style="text-align: right;">* Brake</p> </div> <div style="width: 45%;"> <p style="text-align: center;"><b>Maximum voltage</b></p> <p style="text-align: center;"><math>Y</math></p> <p style="text-align: right;">* Brake</p> </div> </div>
	<p><b>D.C. brake</b></p> <div style="display: flex; justify-content: space-around;"> <div style="width: 45%;"> <p style="text-align: center;"><b>Fig. A</b></p> <p style="text-align: right;">* Brake ** Rectifier</p> </div> <div style="width: 45%;"> <p style="text-align: center;"><b>Fig. B</b></p> <p style="text-align: right;">* Brake ** Rectifier</p> </div> </div>
	<p>1) These motors are supplied with the rectifier connected to the auxiliary terminal box (Fig. A) or to the terminal integrated to the rectifier (Fig. B).</p> <p>At request, connection of the rectifier to the motor terminal block.</p> <p>2) Fast brake (only for Fig. B and by fitter's care). The brake power supply contactor must work in parallel with the motor power supply contactor; the contacts must be suitable to open very inductive loads.</p>
	<p><b>Caution:</b> for special brakes with connections other than those mentioned above, <b>always</b> refer to the additional diagrams provided with the motor.</p> <p>In the case of self-braking motor powered by inverter, follow correctly the wiring instructions of the inverter's Manufacturer and power supply the brake separately and directly from the network mains.</p>

## 1.8 Maintenance



The maintenance, inspection and overhaul operations must be carried out by qualified personnel and in compliance with the current safety provisions as outlined under point 1.2.

- **Any action on the motor must be carried out only after having cut power to the motor, to any auxiliary circuits** (such as, for example, anti-condensation heaters, external fans, brakes, etc.), to the possible frequency converter and having made sure to prevent accidental start-up.
- The capacitor in single-phase motor can retain a charge that appears between the terminals of the motor even when it stops, therefore it must always discharge towards earth.
- Before opening the terminal box, make sure that the motor shaft is stopped, locked and cannot rotate.
- Inspect the motor at regular intervals, at least annually. In harsh and humid environments intervals must be reduced according to the environmental condition.
- Check that the motor works noiselessly or without abnormal vibrations. If they appear, check the foundation of the motor and the balancing of the coupled machine.
- Make sure that ventilation is not obstructed to avoid overheating and possible breakage; keep the motor clean from dust, oil, water and residues of machining.
- Check that the motor power cables, brake and auxiliary equipment show no signs of deterioration and that the connections are firmly tightened; check the equipotential and the integrity thereof and the earthing cables.
- Check that the motor mounting screws and the coupling system are correctly fastened without showing cracks or damage.
- Check the tension of any belts (a high tension reduces considerably the bearings life and could also cause breakage of the shaft end).
- Check the condition of the seals and grease them regularly since these components work in contact with moving parts and are subject to wear. Once worn, they must be replaced by using components identical to the originals so as not to alter the protection degree.
- Check the insulation resistance as described in the "Electrical Installation".
- Make sure that thermal protections have not been cut off and are calibrated correctly.
- Open and clean regularly the condensate drain holes, if any, to discharge any moisture formed inside.
- Check the state of the bearings: those shielded or sealed, lubricated for life, which do not require lubrication, are replaced at the end of their lives. The unshielded bearings are equipped with greasers and require lubrication at regular intervals (for intervals, types and






    	<p>quantity of grease see label placed <b>always</b> on the motor or consult our technical catalogue). The bearing life varies greatly depending on the types of loads, start-ups applied to the motor, the temperatures and humidity of the working environment. The excessive noise usually indicates absence of grease, or the need to replace the bearings. If start-up was made recently, it is necessary to check the coupling and correct misalignments or check the tension of any belts. If the bearings continue being noisy, it means that they have already been compromised and must be replaced. During replacement of the bearings, when from the stator is extracted the shaft from the rotor, much attention must be paid not to damage the windings. For disassembly operations of the bearings from their seat on the shaft, it is necessary to use a special puller. For assembly of new bearings use a press with an adequate sleeve leaning on the inner ring, or preheat the bearing itself at about 100 °C and place it rapidly in place. Make sure that the inner ring is properly leaning on the shaft shoulder and that the replaced bearings are of the same type or equivalent to the originals (in the technical catalogue are shown acronyms and sizes of the bearings). It is recommended to replace always the seals on the shaft whenever the bearings are replaced.</p> <ul style="list-style-type: none"> <li>• Regular checks to be performed to the self-braking motors for the proper operation in time:             <ol style="list-style-type: none"> <li>a) adjustment of the brake air gap that must be included within the values indicated on the technical catalogue;</li> <li>b) check that the brake disc thickness must not be less than the minimum value given in the technical catalogue;</li> <li>c) check the play of the release lever, if any, which must be within the limits indicated in the technical catalogue. Always remove and separate from the motor the grip of the lever release lever, once completed the operations.</li> </ol> </li> </ul>
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### 1.9 Spare parts

 	<p>For any type of spare part, consult the supplier by mentioning <b>always the series of the serial-number and the initials of the motor on the nameplate.</b></p> <p>(Table point 1.5).</p>
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### 2.0 Noise levels

  	<p>In the greater part of the motors the noise level will not exceed 82 dB(A). The specific values of the motors are reported in the technical catalogue.</p> <p>Follow the current local legislation for use of any Personal Protective Equipment (PPE).</p>
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## 2.1 Guide for resolution of problems addressed exclusively to qualified personnel

Problem	Possible causes	Remedy
<b>The motor does not start-up</b>	Burned fuses	○ Replace with adequate fuses by type and capacity
	The overload trips	○ Check and reset the switches
	Not enough available power	○ Check whether the power corresponds to what is indicated on the motor nameplate
	Connection in the terminal box	○ Check that the connection in the terminal box is coherent with the motor parameters inserted in the drive.
	Mechanical failure	○ Check manually, with the electrical power supply disconnected, that the motor shaft is free to rotate. ○ Decouple the motor from the charge and carry out vacuum operation tests. ○ Check the bearings and the lubricant.
	Stator in short circuit	○ The motor must be rewound ○ Remove the shields and identify the failure
	Defective rotor	○ Check that there are no broken head bars or rings
	Overload	○ Reduce the applied charge. ○ The inverter is undersized for the applied charge at start-up. ○ Check the size of the inverter depending on the application and the applied charge.
<b>The motors accelerates too slowly and/or consumes too much current</b>	Low voltage at start-up	○ Check that there is no excessive resistance and that the cables are correctly sized.
	Defective rotor	○ Check the conditions of the cage, and if necessary replace the rotor.
	Applied voltage too low	○ Correct the electrical power supply.
<b>The motors vibrates</b>	Not aligned motor	○ Align the motor to the controlled machine by using any possible comparator
	Weak support	○ Reinforce the base
	Joints or pulleys not balanced	○ Balance the coupling element
	Coupled machine unbalanced	○ Balance the coupled machine
	Defective bearings	○ Replace the bearings
	Different balancing of the rotor and of the joint (half key-entire key)	○ Balance the joint or the motor
	Motor operating with an interrupted phase	○ Check the phases and restore the three-phase system
	Excessive bearings play	○ Replace the bearings and/or the shields ○ Add thickness in the bearing seat
<b>Opening of the protection device</b>	The motor could have an interrupted phase	○ Check whether there is an interrupted phase among the lines
	Erroneous connection	○ Observe the electrical diagram of the connections and the nameplate with the data on the performances
	Overload	○ Compare with the data of the nameplate; reduce the charge if the current absorptions are higher
	Open circuit	○ Burned fuses, check the overcharge relay, the stator and the buttons

Problem	Possible causes	Remedy
<b>Motor overheated abnormally during the charge operation</b>	Defective ventilation	<ul style="list-style-type: none"> <li>○ Clean the fan cover and the cooling fins.</li> <li>○ Check the room temperature and the temperature of the motor external casing.</li> <li>○ Check the assembly of the fan on the shaft.</li> <li>○ Free the ventilation holes and check that there is a continuous air flow from the motor</li> </ul>
	Overcharge	<ul style="list-style-type: none"> <li>○ Reduce the charge</li> </ul>
	The motor could have an interrupted phase	<ul style="list-style-type: none"> <li>○ Check that all cables are connected tightly and correctly.</li> </ul>
	Winding in earthing	<ul style="list-style-type: none"> <li>○ Check the winding and eliminate the failure.</li> </ul>
	Voltage at terminals not balanced	<ul style="list-style-type: none"> <li>○ Check that there are no failures with the conductors, connections, or transformers.</li> </ul>
<b>Erroneous rotation direction</b>	Incorrect sequence of the phases	<ul style="list-style-type: none"> <li>○ Invert the connections on the motor or on the control board</li> </ul>
<b>Rubbing noise</b>	Fan rubbing on the shield or on the fan cover	<ul style="list-style-type: none"> <li>○ Eliminate the contact</li> </ul>
	Loosened base	<ul style="list-style-type: none"> <li>○ Fasten the fixing bolts</li> </ul>
	Defective bearings	<ul style="list-style-type: none"> <li>○ Replace the bearings</li> </ul>
	Unbalanced rotor	<ul style="list-style-type: none"> <li>○ Balance the motor</li> </ul>
<b>Bearings too hot</b>	Erroneous assembly of the motor	<ul style="list-style-type: none"> <li>○ Check that the mounting arrangement of the motor is adequate to the carried out assembly</li> </ul>
	Bent or broken shaft	<ul style="list-style-type: none"> <li>○ Rectify or replace the shaft</li> </ul>
	Excessive traction of the belt	<ul style="list-style-type: none"> <li>○ Reduce the tension of the belt</li> </ul>
	Pulleys too far from the shaft stop	<ul style="list-style-type: none"> <li>○ Move closer the pulley to the stop of the motor shaft</li> </ul>
	Pulley diameter too small	<ul style="list-style-type: none"> <li>○ Use larger pulleys</li> </ul>
	Incorrect alignment	<ul style="list-style-type: none"> <li>○ Correct the motor and coupled machine alignment</li> </ul>
	Not enough grease	<ul style="list-style-type: none"> <li>○ Keep the correct quality and quantity of grease in the bearing</li> </ul>
	Deterioration of the grease or contamination of the lubricant	<ul style="list-style-type: none"> <li>○ Remove the old grease, wash accurately the bearings and replace with fresh grease</li> </ul>
	Excess of lubricant	<ul style="list-style-type: none"> <li>○ Reduce the quantity of grease, the bearing must be full only up to half</li> </ul>
	Overcharge of the bearing	<ul style="list-style-type: none"> <li>○ Check the alignment any possible radial and/or axial thrusts</li> </ul>
	Ruined balls and bearings track	<ul style="list-style-type: none"> <li>○ Replace the bearing</li> </ul>
<b>The motor does not reach the rated speed</b>	Fall of voltage on line	<ul style="list-style-type: none"> <li>○ Check the connections and the section of the cables</li> <li>○ Use a higher tension</li> </ul>
	Excessive charge at start-up	<ul style="list-style-type: none"> <li>○ Check the motor charge at start-up</li> </ul>
	Defective rotor	<ul style="list-style-type: none"> <li>○ Check the conditions of the rotor cage, if necessary replace the rotor</li> </ul>
	Primary circuit open	<ul style="list-style-type: none"> <li>○ Identify the failure with the tester and repair</li> </ul>