SICMEMOTORI
WIND OF INNOVATION

INSTALLATION, USE AND MAINTENANCE INSTRUCTIONS FOR ALTERNATING CURRENT MACHINES VECTOR-SPEED

ACVc-AQ-BQ-AJ-AW SERIES

ATTENTION!

SICMEMOTORI electric machines are used in industrial environments. During functioning they can be a source of serious danger, both for persons and objects. They must therefore be installed correctly, commissioned and maintained and the protections/guards must not be removed or modified.
These instructions cannot cover all possible problems and cases that may occur during use of the electric machines. SICMEMOTORI must be immediately informed of any problem that is not contemplated by these instructions.

Code M-CA-VS-E-10

INDEX

IMPORTANT NOTES

In order to highlight all of the dangers for the operator using the electric rotating machine, the various operations or situations will be written in bold type and/or with successive warnings, depending on their degree of hazard:

DANGER!
Operations and/or situations that can lead to serious physical injury, even death, if the instructions given are not followed scrupulously.

ALARM!
Operations and/or situations that must be scrupulously followed in order to prevent serious injury to persons and/or damage to the surrounding environment.

Caution!
Operations and/or situations that must be scrupulously followed in order to prevent injury to persons, contamination of the surrounding environment and material damage.

ATTENTION!
Operations and/or situations that require particular attention.

SAFETY PROVISIONS

High voltages and rotating parts can cause serious injury and/or fatal wounds. The use of electric machines can therefore be very dangerous. Installation, functioning and maintenance of electric machines must be carried out by qualified staff, in agreement with applicable rules and with the Regulations in force in the various countries.

For the electric machines subject of this manual, it is important to comply with the safety provisions in order to protect staff from possible injury. In particular, the staff must be informed to:

- **avoid contact with live circuits or rotating parts;**
- **not by-pass or make safety circuits or barriers non-operational;**
- **avoid being noisy machines for a long period of time;**
- **move the electric machine using the relevant eye bolts;**
- **use all precautions and procedures during movement, lifting, functioning and maintenance of the plant.**

The electric machines must be transported, commissioned, maintained and repaired exclusively by qualified staff, with the supervision of an expert that checks the correctness of these operations. The qualified staff must be appropriately authorised by the safety manager of the company where the machines are installed. Regarding this point, the International IEC364 Regulations prohibit use by unqualified staff when the machine is live. Before starting any maintenance interventions, check that:

- **The machinery connected to the machine shaft does not cause mechanical rotations;**
- **Machine windings have been disconnected from the electric power supply and this cannot be re-connected accidentally;**
- **All accessory devices associated with machine functioning in the work area have been disconnected from the power supply.**

Failure to comply with earthing the machine can cause death. Machine and plant earthing must be carried out in compliance with the regulations in force in the various countries.

Any modification of the machine must be expressly authorised in writing by SICMEMOTORI.

Only use indicated materials (sealers, oils, greases, solvents, etc.).

1. GENERALITIES

1.1 Applicability and Reference Regulations

These instructions are applied to square-frame AC motors built by SICMEMOTORI, when they are installed in industrial environments.
This manual is not valid for alternating current motors installed in environments with the risk of explosion.
This manual is drawn up in compliance with the 2006/42/CE Machinery Directive and UNI EN292-1 and 292-2 Standards.

1.2 Identification of the Manufacturer and the machine

Every AC machine produced by SICMEMOTORI has an identification plate realised in conformity with IEC 60034-8 Regulations, as shown in figure 1.

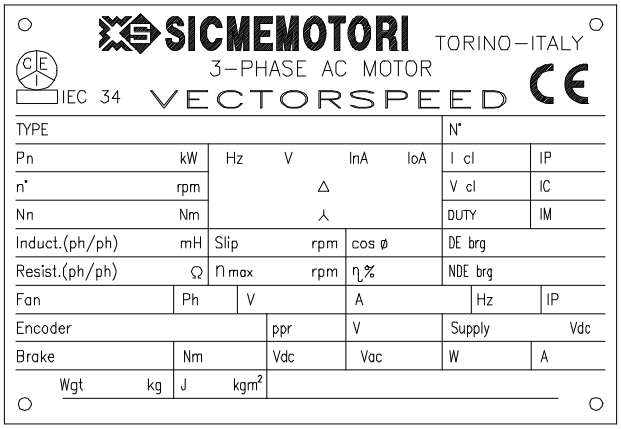


Fig. 1

Meaning of the symbols:

Type	Type of motor
Cd	Motor code
N°	Serial number
n_n	Nominal speed
P_n	Nominal power
M_n	Nominal torque
Hz	Nominal frequency
VΔ	Nominal voltage (delta)
V⅄	Nominal voltage (star)
In Δ	Nominal current (delta)
In ⅄	Nominal current (star)
I_0 Δ	Magnetising current (delta)
I_0 ⅄	Magnetising current (star)
Eff.(η%)	Full load efficiency
IP	Level of protection
I cl	Class of insulation
V cl	Class of balancing
Induct.	Inductance of the windings
Resist.	Windings resistance
Slip	Full load slip
Cos φ	Power factor
n_{max}	Maximum speed allowed
Wgt	Weight of motor
IM	Construction form
DE brg	DE bearing
NDE brg	NDE bearing
Fan	Type of electric fan and features
Encoder	Type of encoder and features
Brake	Type of brake and features

1.3 Declaration of Conformity

The motors described in this catalogue satisfy the essential requisites of the following Directives:
-72/23/EEC Low Voltage Directive

Reference has also been made to the following directives, specifically for the reasons listed as follows:
- EMC 89/336/EEC (Electromagnetic Compatibility) Directive
- Machine Directive 2006/42/CE
The electric motors/generators are components that are incorporated into other machines, systems and plants and therefore the resulting EMC behaviour is under the responsibility of the Manufacturer of the machine or plant incorporating the motor/generator.

With reference to the 2006/42/EC Directive, it must be specified that the motors/generators must be installed in compliance with the installation instructions and cannot be put into service until the machine in which they are incorporated has been declared in compliance with the 2006/42/EC Machinery Directive.

1.4 Use and preservation of this manual. Limits of use

This manual has been realised in order to make the use of this product easy and safe for the operator. The operator must be:

- Expert in the use of products destined exclusively to industrial and professional use;
- Informed regarding the dangers that can occur through the use of electric rotating machines for power supply voltages up to 1000 V.

SICMEMOTORI is available, on specific written request, to provide training for the Client's staff (or final user) regarding the correct use and maintenance of the products, both at the installation site and at the SICMEMOTORI establishment. For further information contact SICMESERVICE.

This manual must always be available to the staff using the motors/generators and a copy must be kept (by the user) for future reference

Other copies and updates can be requested directly from:

SICME MOTORI srl
Strada del Francese 130
10156 Torino – Italia
tel. 011-4076311
fax 011-4500047
e-mail: sicmeservice@sicmemotori.com
or they can be downloaded from the SICMEMOTORI web site www.sicmemotori.com.

SICMEMOTORI reserves the right to make any necessary variations to this manual, without updating any previous manuals.

1.5 Assistance networks

SICMEMOTORI has created a capillary network of authorised workshops for assistance and repairs in the main Countries of the World, which the User can contact if necessary.
The list of these workshops, which is constantly updated, is published on the SICMEMOTORI web site www.sicmemotori.com, and can be easily downloaded.

1.6 Sicmeservice

SICMESERVICE offers itself for maintenance services aimed at optimising production processes, which enclose all electric motors.

The services offered are:

Preventive maintenance
Preventive maintenance allows to evaluate the motors and plan any precautionary maintenance on occasion of programmed plant standstill.

Precautionary maintenance
The precautionary maintenance is carried out at SICMEMOTORI workshops, and consists in a series of services that restore the original state of the motors.

Extraordinary maintenance
Allows to highlight the necessity for more resolutory interventions. The SICMEMOTORI technical offices can carry out an exact evaluation of that necessary for the restoration of complete functionality.
In the case of uneconomical repair, the technical office can carry out correct dimensioning for the replacement of **any type of motor of any mark** with one more technologically advanced.

For information regarding the service, contact:

Mr. A. Dolfi
Tel. +39-011-4076464
Fax +39-011-4500047
Cell. +39-348-2716623
e-mail: service@sicmemotori.com

1.7 Liability of the Manufacturer

SICMEMOTORI assumes liability for injury to persons or damage to objects attributed to defective products by accordance with the Italian law Presidential Decree 224 dated 24-05-1988 (implementing the EEC Directive 85/374) and any successive variants, on condition that they are known and in force at the time of placing the order, with essential specification that the liability is forfeited if it results that the provisions of these instructions have not been respected or if the products have been tampered with, for repairs or any other causes, by third parties that are not explicitly authorised in writing by SICMEMOTORI.

1.8 Warranty conditions

SICMEMOTORI guarantees its products for 12 months from the date of delivery. The warranty exclusively concerns manufacturing defects ascribable to SICMEMOTORI, which may decide to replace or repair the defective product or the piece as seen fit. The cost and the risk of transport of the faulty product from the Client to SICMEMOTORI are the responsibility of the former. The warranty is voided in the case of tampering or interventions that are not authorised by SICMEMOTORI and does not extend to parts of the

product that are normally subject to wear (e.g.: bearings, filters). The warranty also becomes void in the case of failure to comply with the provisions indicated in the INSTALLATION, USE AND MAINTENANCE INSTRUCTIONS, available to the Client on request, an extract of which is contained inside the terminal boxes of all machines supplied by SICMEMOTORI. If a part must be replaced or repaired, the warranty is renewed solely for that part. The Client cannot withhold payment to SICMEMOTORI on the grounds that the warranty is not satisfactory.
However, the Client forfeits the warranty whenever he omits the relative complaint for the purpose and effects of art. 1495 1st paragraph of the Civil Code.

1.9 Important warnings

For correct use of the machines built by SICMEMOTORI the following warnings must be kept in mind:

Planning and construction. They are carried out in compliance with IEC 60034 Standard, according to table a) indicated below:

IEC	CEI	Title
60034-1	**EN 60034-1**	Rating and performance
60034-2	**EN 60034-2**	Methods for determining losses and efficiency
60034-5	**EN 60034-5**	Classification of degrees of protection (IP code)
60034-6	**EN 60034-6**	Methods of Cooling (IC code)
60034-7	**EN 60034-7**	Classification of Types of Construction, Mounting Arrangements and Terminal Box Position (IM code)
60034-8	**EN 60034-8**	Terminal markings and direction of rotation
34-9	**EN 60034-9**	Noise limits
60034-14	**EN 60034-14**	Mechanical vibration of rotating parts
72-1	**72-1**	Dimensions and power of rotating machines
1293	**16-8**	Marking of electric appliances
IEC 60034-17		Cage induction motors when fed from converters - Application guide
UNI ISO 2768/1-2		General tolerances
UNI 9321		Shaft ends
73/23/EEC		Low voltage Directive
89/336/EEC (EMC)		Electromagnetic Compatibility Directive
2006/42/CE		Machinery Directive

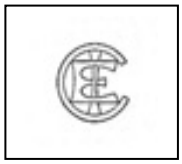


Table a)

Tests. All alternating current machines produced by SICMEMOTORI undergo a complete inspection at the Company Test chamber, where compliance with contractual requisites is verified.

Quality assurance. The entire production procedure is managed by the internal Quality Assurance System, which is responsible for the correct compliance to the procedures and construction, control, test and inspection instructions issued by the internal Quality System.
The internal Quality System is certified and controlled by the QCS (*) in compliance with ISO 9001-2000 European Standards.
(*) The Quality Certification System QCS is managed by the IMQ in collaboration with CESI, and is part of the CISQ (Italian Quality System Certification) and adheres to the international EQNET agreement.

1.10 Limits of use

The alternating current machines built by SICMEMOTORI can be used in industrial environments, for application in plants such as (but not only) steel products, plastic materials, rubber, working of ferrous and non-ferrous materials, cables, plants for the transport of persons (cable-cars, chair lifts, etc.) or for handling goods (crane, conveyor belts, etc.), cement, in the food industry, paper and printing, mining industry (exclusively in environments without the presence of an explosive atmosphere), etc.. **Therefore these products are reserved exclusively for professional use.**

Installation environment. The machine is generally envisioned to function in dry, clean environments. The presence of high humidity (or installation outside), and/or agents or aggressive powders in the atmosphere, must be communicated on placing the order; the constructive arrangement to be adopted in order to obtain acceptable functioning in these conditions must be agreed upon and indicated in the order confirmation. Finally, the machine is designed, unless different agreements are made with the Client:

- For environmental temperatures of –15 +40°C
- For maximum heights above sea level of 1000 m.

Different temperature or installation height conditions, normally lead to variations for the nominal performance values (contact SICMEMOTORI). See point 1.12 for lifting problems when the environmental temperature is very low.

Power supply. The machine is envisioned to supply contractual performance (power – torque - velocity) if powered in nominal conditions as stated on the plate. Incorrect power supply can lead to the impossibility of supplying contractual performance or to faults due to breakdown or intervention of the protections.

Protections. The machine must be permanently protected against unacceptable power supply or load situations and against the occurrence of breakdowns. SICMEMOTORI is always available for collaboration in order to identify the most suitable protections for

each particular case. The lack of or incorrect calibration or inefficiency of the necessary protections consequently exclude SICMEMOTORI from any liability in the case of faults or breakdown.

A Electrical protections

The machines are normally supplied with some protections of an electrical nature, which must be connected and whose functioning must be verified **before the machine is commissioned**.

The machines must also be **earthed** before being commissioned (see par. 4.2).

B Mechanical protections

Before commissioning the machines, the User must check that all mechanical protections on the machine are operational. In particular, **the machine must not be used** if:

- The machine has not been adequately fixed to its base (see par.2.2);
- The machine hatches have not been correctly closed;
- The main terminal box lid (and auxiliaries if existing) has not been closed correctly using its screws, in order to prevent accidental contact with live parts;
- The fan does not have the filter mounted (if existing) or if missing, a protective net in order to prevent accidental contact with the rotors of the fan.

As well as the mechanical protections inherent to the machine, the User must also check that all components coupled to the machines themselves and in movement (joints, pulleys, transmission belts, etc.) are adequately protected from accidental contact.

C Protection from heat risk

During functioning the external surfaces of the AC machine can reach very high values (heat risk). For this reason, warning plates are applied to the machine surfaces themselves indicating this risk. The User must place protective barriers around the machine if it is installed in areas with the risk of even accidental contact with the operators.

D Protections against acoustic level

Before starting up the machine, the User must assure that all protections against the noise emitted by the machine are functioning. SICMEMOTORI is available to supply its experience in this field.

1.11 Machine noise

The noise of the machine expressed in "sound pressure" is detected using a sound level meter in empty functioning, with nominal power supply and with the fan system functioning (IEC Regulation 34-9). The sound level meter is positioned at the centre of the 4 sides of the AC machine being tested and in correspondence of the entry of air into the fan (or the asynchronous fan motors if the machines are cooled using heat exchangers) at a distance of about 1 m. The average value among those obtained is the noise level adopted by SICMEMOTORI.

The noise values of SICMEMOTORI machines are stated in table 1.11 below.

Motor	Sound pressure (dBA) AQCa-BQCp IC416	Sound pressure (dBA) BQAr-BQCr IC06 - IC416	Sound pressure (dBA) ACVc IC416	Sound pressure (dBA) AJ IC06	Sound pressure (dBA) AW IC9W7
71	---	---	75	---	---
80	---	---	75	---	---
90	---	---	75	---	---
100	69	---	---	---	75
132	74	71	---	---	75
160	81	84.5	---	---	75
180	79	84.5	---	84.5	75
225	---	85	---	84.5	75
280	---	85	---	85	---
355	---	83 (IC86W)	---	---	---
355	---	85 (IC06))	---	---	---

Table 1.11

The values in this table make reference to the values emitted by the machines, and not necessarily to the values to which the workers will b e exposed. The latter, in fact, also depend on the presence of other machines, on the place of installation, the type of working, etc. The User must decide if the values stated above lead to the necessity to install relevant noise protection barriers.

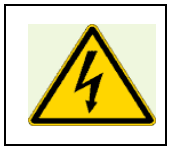
1.12 Transport, receipt and handling of the machine

The machines are delivered from the factory ready for installation, except for particular cases that are to be agreed upon. The machine is not packaged for delivery unless specifically requested at the time the order is made.

ATTENTION:

At the destination, it is recommended to examine the state of the machine in order to check that it has not undergone damage during transport. If damage has occurred, contact the carrier immediately in order not to lose the warranty. The claim must arrive at SICMEMOTORI within 8 days from receipt of the goods!

During handling, the machines must be lifted by attaching them to the relevant eye bolts positioned on the surfaces of the machine. **Never use the eye bolts positioned on the machine's cooling system (electric fans, heat exchangers, etc.) to move the machine.** If the load is unbalanced due to joints or particular realisations, it must be balanced using additional ropes.

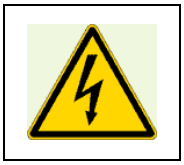


Lifting using the eye bolts must be avoided when the environmental temperature is lower than –15°C.

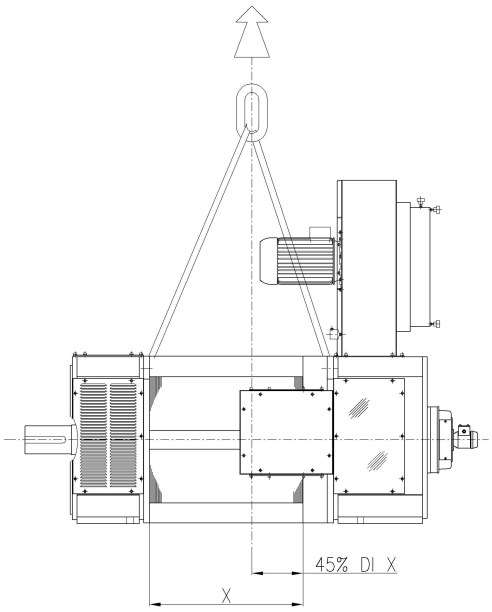
The following table supplies machine weights, complete with cooling system. Remember that the weights are also stated on the main plates on the machines themselves.

Motor	Weight (kg) AQCa-BQCp IC416	Weight (kg) BQAr-BQCr IC06 - IC416	Weight (kg) ACVc IC416	Weight (kg) AJ IC06	Weight (kg) AW IC9W7
71B	---	---	8,2	---	---
71L	---	---	9,5	---	---
80B	---	---	12	---	---
90S	---	---	16	---	---
90L	---	---	19	---	---
90P	---	---	24	---	---
100S	37	---	---	---	---
100M	45	---	---	---	60
100L	54	---	---	---	75
100P	61	---	---	---	---
100X	71	---	---	---	90
132S	94	99	---	---	95
132M	109	114	---	---	---
132L	122	127	---	---	120
132P	135	140	---	---	130
132X	157	162	---	---	150
160S	201	208	---	---	---
160M	220	229	---	---	215
160L	247	260	---	---	240
160P	276	285	---	---	265
160X	---	---	---	---	325
180S	370	385	---	370	---
180M	460	475	---	460	420
180L	515	530	---	520	480
180P	---	---	---	560	---
180X	---	---	---	---	540
225S	---	740	---	---	---
225M	---	820	---	800	---
225L	---	900	---	880	760
225P	---	1030	---	1000	860
225X	---	1185	---	---	1000
280S	---	1230	---	1300	---
280M	---	1420	---	1450	---
280MX	---	---	---	1580	---
280L	---	1680	---	1650	---
280P	---	1830	---	1800	---
280PX	---	---	---	1950	---
355S	---	2300	---	---	---
355M	---	2700	---	---	---
355L	---	3100	---	---	---

In order to lift the motor, check the weight on the plate and use lifting devices with a greater capacity.



ATTENTION: unloading and handling of the machine must be carried out be export staff (slingers, crane operators, fork truck drivers, etc.); it is recommended that a person on the round helps with these operations by giving signals.



Position of the centre of gravity – "X" is the length of the magnetic stator pack

1.13 Storing the machine

If the machines are not used immediately, they must be stored in a covered, clean, dry environment. **The minimum storage temperature must not be lower than –30°C** . If the machine must be stored at temperatures lower than –30°C, agreements must be made with SICMEMOTORI on placing the order. If storage is to be for a long period of time (several months) or extended periods of inactivity are envisioned the following further precautions must be taken:

- Periodically check the insulation resistance (see par. 4.3). The isolation must be protected from humidity;
- Turn the shaft several times at least once every two months in order to prevent damage to the bearing tracks;
- It is recommended to check the state of the protective paint on the end of the shaft in order to prevent corrosion and oxidisation. If required, re-treat with anti-corrosion paints or grease.

The bearings do not require any maintenance because sufficient grease is introduced in order to keep them lubricated.

2 INSTALLATION

2.1 Machine installation

The position of machine installation must be such that the lateral hatches are always easily accessible. Install the machine with respect to the construction form and IM assembly, type of cooling IC and level of protection IP established on ordering and specified on the plate.
If the User does not have the machine's dimensions drawing, it can be requested, by communicating the serial number embossed on the main plate, to the SICMEMOTORI technical office.

2.2 Positioning

For the machines with IM 1001 construction form (B3, horizontal axis with feet), fixing must be carried out using 4 screws with an adequate diameter for the hole in the feet (see table 2.a).
The rest surface must be level, with tolerance such that the maximum difference between the feet is not greater than 0.1 mm (if necessary, use alignment thickness) and must be able to support the torques generated by the electrical machines (see table 2.c).
In the case of machine with flange and horizontal axis (IM3001 B5 construction form) or vertical axis (IM3011 - V1 construction form), fixing to the counter flange must be carried out using screws according to table 2.b and using a number corresponding to the holes in the flange. The surface of the counter flange must be accurately worked, in order to guarantee planarity and perpendicularity to the axis of the controlled machine, with tolerance that at least corresponds to the normal class according to DIN 42955. Alignment thicknesses are not allowed.
The support surface and/or the application counter-flange must be rigid, not deformed and without vibrations.
The machines with IM 2001 construction form and derivatives (with shaft and flange) must be installed making reference to table 2.a regarding the feet screw fasteners and to table 2.b for the flange screw fasteners.

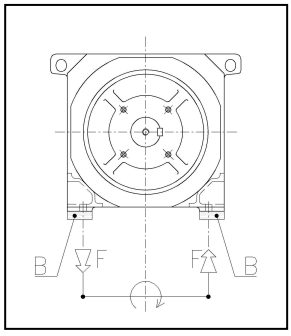
Motor	Screws *	Coupling torque (Nm) **
71		
80		
90		
100	M10x40	50
132	M10x40	50
160	M12x40	85
180	M12x40	85
225	M16x40	200
280	M20x60	400
355	M24x70	700

Table 2.a – Screw dimensions for fixing motor onto the base and coupling torques
***The length of the screw is to be intended as the maximum length for the hexagonal screws inserted from the feet towards the base**
**** The torques indicated are for metric screws with large pitch, material 8G**

Flange holes centre distance diameter	Screws *	Coupling torque (Nm) **
165	M10X30	50
215	M12X35	85
265	M12X35	85
300	M16X45	200
350	M16X45	200
400	M16X50	200
500	M16X50	200
600	M20X65	400
740	M20X65	400

Table 2.b – Screw dimensions for fixing motor onto the counter-flange and coupling torques
*** The length of the screw is to be intended as the maximum length for the hexagonal screws inserted from inside the motor towards the counter-flange**
**** The torques indicated are for metric screws with large pitch, material 8G**

Table 2.c supplies the short circuit dynamic load value in N for every size of motor, necessary to calculate the foundations and relative anchorage.



Motor size	Short circuit maximum dynamic load (*) (N)	Motor size	Short circuit maximum dynamic load (*) (N)	Motor size	Short circuit maximum dynamic load (*) (N)
71B	145	**132S**	4050	**225S**	15100
71L	215	**132M**	4700	**225M**	18100
80B	410	**132L**	5200	**225L**	18800
90S	500	**132P**	6020	**225P**	21300
90L	750	**132X**	7500	**225X**	25500
90P	930	**160S**	8300	**280S**	28400
100S	875	**160M**	9000	**280M**	33700
100M	1190	**160L**	10100	**280MX**	35500
100L	1625	**160P**	11200	**280L**	38400
100P	2000	**160X**	12400	**280P**	42200
100X	2410	**180S**	9500	**280PX**	45000
		180M	13600	**355S**	41200
		180L	16300	**355M**	48000
		180P	19300	**355L**	55000

(*) on each area B. The voltage of the compression load (+) or traction (-) is linked to the electro-dynamic reaction and depends on the direction of rotation.

Tab. 2.c – Short circuit dynamic loads

Caution!
The machine base, whether it be in iron or cement grout, must be made by experts in this section.

IMPORTANT: in the case of AW motors it is indispensable that the fixing surface is perfectly flat in order to prevent deformations and/or breakage of the shields with consequent friction between the rotor and the stator and/or loss of the refrigerant liquid.

3. COUPLING TO THE MACHINE IN USE

The coupling component and the type of transmission are chosen and designed on the basis on the particular conditions of use. The responsibility for the choice and planning is the Client's responsibility: SICMEMOTORI is responsible for the correctness of the technical data of its competence, which is supplied to the Client on request. Before assembly of the coupling component, it is necessary to use a relevant solvent to remove the protective paint that covers the end of the shaft. Do not use emery paper. The working tolerance of the hole must be that corresponding to the nominal diameter of the shaft indicated on the dimensions drawings with tolerance of the ISO system.

3.1 Keying of the transmission components (keyed shafts)

SICMEMOTORI motors are always balanced with half key (except if a different request was made on placing the order). Therefore the transmission components must also be balanced with half key.
Flush the transmission component making reference to the detailed instructions supplied by the Manufacturer of the component itself.

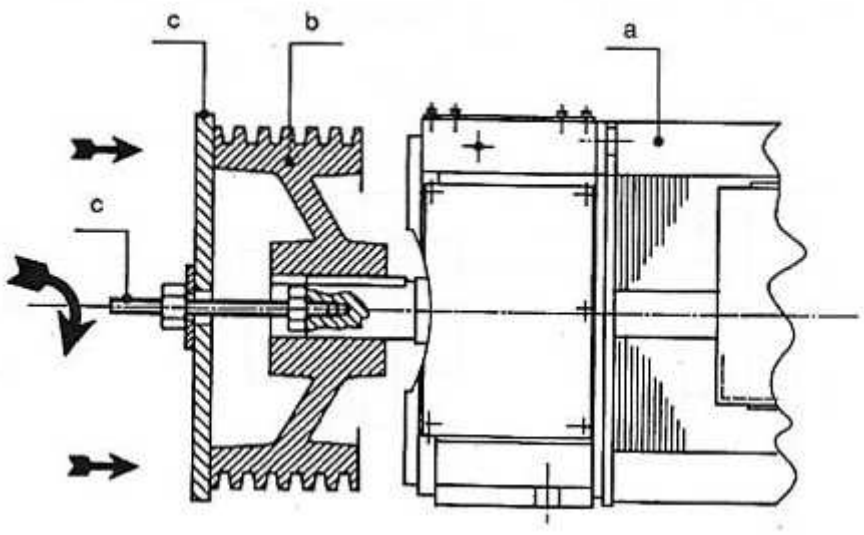


Fig. 3.a – Example of keying of transmission components using the threaded hole on the end of the motor shaft

a) Motor
b) Transmission component
c) Assembly tool

3.2 Shrinking on of transmission components (non-keyed shafts)

Make sure that the coupling joint has been balanced WITHOUT a key.
Before proceeding with the operation, check the coupling material.
The sizes of the shaft and the hub hole must be in compliance to those indicated on the dimension drawings (tolerance of the ISO System).
The oil holes for future extractions must be clean and without the presence of any working residues.

- Heat the hub in order to obtain the play necessary for assembly; this can be carried out in an oil bath at about 220 °C (the normal ignition point for oils is about 270 °C; check this value for the oil that is being used!). if higher temperatures are required, the hub must be heated by induction or put into an air circulation furnace.
- To be certain that hub assembly on the shaft takes place easily, check the internal diameter of the hub using a micrometer, before starting shrinking operations.

Shrink-on the transmission component making reference to the detailed instructions of the supplier of the component itself.

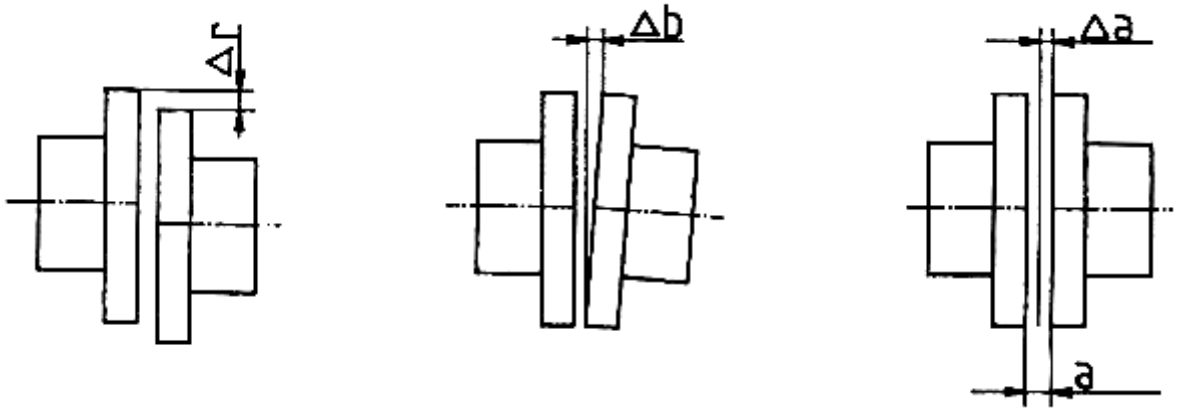
Caution
If the surface of the end of the shaft and/or the hole in the hub are damaged, this damage must be eliminated BEFORE assembly using Indian stone.

3.3 Direct coupling

The use of flexible couplings is recommended as they prevent transmission of any axial thrust to the bearings.
Good alignment requires the use of a comparator and a feeler gauge for the following operations:

- Mount the two half-joints onto the motor and onto the coupled machine, position the two machines aligning them roughly. Tighten the feet screw fasteners.
- Apply the comparator onto the two half-joints and measure radial alignment. Repeat the measurement after having turned the two shafts 45°, 90° and 180° together.
- Introduce a feeler gauge between the faces of the half-joints and measure their distance. Repeat the measurement at 90°, 180°, 270°.
- Correct the alignment errors met in the operations described by inserting thicknesses between the base and the feet.
- Tighten the screw fasteners fully home, repeat the measurements and if alignment is accurate, apply the registration pins between the motor and the base.

For approximate values of radial and axial tolerance see fig. 3.c.
Remember that there must be sufficient play between the transmission components to allow axial dilation due to heating.
It is however recommended to carry out coupling operations using new generation lasers if possible (contact SICMEMOTORI).



Radial tolerance
Δr ≤ 0.1mm

Angular axial tolerance
Δb ≤ 0.1mm

Axial tolerance
Δa = 2-3mm

Fig. 3.c Approximate tolerance values for coupling

3.4 Coupling using belts and pulleys

In order to contain radial stress on the motor bearing, the driving pulley with the maximum diameter compatible with the reduction ration requested and with the maximum diameter acceptable for the driven pulley should be chosen. The diameter selected in first order must be verified by calculating the pull deriving and comparing it with the acceptable pull (see point 5.6 for normal working machines). If the check is negative, the diameter of the pulley must be increased, or pass to roller bearings, if ball bearings were initially envisioned, or increase the diameter of the shaft (contact SICMEMOTORI).
In order to keep the pull on the shaft equal to the torque increase the driving pulley angle enclosed by the belts (increase the interaxis between the two pulleys – to contain the reduction ratio).
In order to couple the belts well, there must be good parallelism between the shafts and there must be an easy safe system for tensioning the belts.

3.5 Coupling to hollow shaft reducer

For this application it is advised to request the execution of the motor flange with a level of increased precision "extra-precisa" in order to contain the errors and misalignments.

To assemble the motor correctly on the reducer it is indispensable to align the motor shaft, reducer hollow shaft and the two coupling flanges exactly.

Any vibrations and irregularities in rotation are indications of imprecise alignment that cause functioning anomalies and breakage of the motor shaft.

Also consult the paragraph relative to the recommended assembly positions and particularly to assembly in B5 construction form + support (par. 3.6).

1 Position the reducer with the hollow shaft for coupling to the motor (high speed shaft) facing upwards. The reducer must not be connected to any load and the slow shaft must be free to turn.

2 Check the la perpendicularity and the concentricity of the reducer flange with respect to the hollow shaft using a mechanical comparator.

3 Fix the comparator's magnetic base onto the reducer hollow shaft.

4 Rest the comparator's feeler on the surface of the reducer flange.

5 Turn the reducer shaft very slowly (if possible by acting on the slow shaft) and check that the flange is perfectly perpendicular with respect to the reducer shaft. With the complete rotation of 360° the maximum accepted error is 0. 05mm. Use a marker to pen to indicate the two points measured on the flange (maximum and minimum).

6 Rest the comparator's feeler on the reducer flange stroke.

7 Turn the reducer shaft very slowly (if possible by acting on the slow shaft) and check that the flange is perfectly concentric with respect to the reducer shaft. With the complete rotation of 360° the maximum accepted error is 0.05mm.

8 Remove the key from the motor shaft and check that it moves easily in the reducer shaft seat. The key must run when pressed but must not have any play.

9 Reposition the key in the motor shaft. Check that the distance existing between the surface of the reducer flange and the base of the hollow shaft is greater than the total length of the motor shaft with respect to the surface of the motor flange.

10 Lubricate the inside of the reducer hollow shaft using a specific grease for this assembly (prevent the formation of rust and contact oxide). Normal oil and/or bearing greases are not suitable.

11 Lift the motor and position it with the shaft facing downwards. For this operation use the holes in the rear feet and relevant eye bolts paying attention not to ruin the fan and terminal box.

12 Slowly insert the motor shaft inside the reducer hollow shaft by a few millimetres. Check that there is a minimum distance between the upper part of the motor key and the reducer shaft hollow (the upper part of the key must not apply force).

13 Slowly insert, but not completely, the motor shaft inside the hollow reducer shaft (stop a few millimetres before the flanges come into contact). If the shaft blocks during insertion do not force it and DO NOT use a hammer. In this case, remove the motor and check the surface of the motor shaft key in order to check for signs of forcing.

14 Insert calibrated thicknesses between the reducer flange and that of the motor in the previously marked minimum quota position in a way to restore a perfect surface between the flanges. Send the two flanges into stroke making sure the thicknesses do not escape.

15 Insert the bolts that fix the motor flange to the reducer flange but do not tighten them. Screw them manually until they are partially tightened.
16 Power the motor and make it run (if possible at low speed). During this phase, the reducer could be without lubricant. Limit the test to a few minutes.
17 Check there are no vibrations, movements and/or strange noises.
18 While the motor is rotating gradually tighten all flange fixing bolts at180°.
19 Check there are no vibrations and/or strange noises in the two directions of rotation.
20 Install the unit on the machine and re-control the noises and vibrations.

For phases 4 and 6, see figures nr. 1 and nr. 2

Pay maximum attention during phases 12, 13, 14, 15. If the motor falls the operator's hands and fingers could be crushed between the two flanges with serious consequences.

Pay maximum attention during phases 16, 17, 18, 19. The motor is powered electrically and may not have its protections assembled. The operator's hands are near to rotating mechanical and live parts.

Never turn the uncoupled motor with the key engaged in the shaft. If required, attach it using adhesive tape.

3.6 Assembly in construction form B5 + support

Some motors cannot be used with assembly realised by means of just one flange (see previous tables) as the length of the motor and the relative weight can cause flexing in the structure and cause vibrations and/or resonances.
For this reason, the motors that do not allow assembly in B5 construction form, must be installed:
- Using B35 construction form that envisions resting on the entire base of the motor + fixing by means of the flange.
- Using B5 construction form + a rear support that acts as a support for the unrestrained part of the motor.

For correct installation of the motor it is indispensable prevent the support from excessively loading the rear part of the motor forcing it upwards and creating flexion of the flange and shaft.
The support must not be rigid but must have Belleville springs or compressible rubber supports.
Normally these supports are realised using well-sized bolts, fixing counter-nuts and Belleville springs (or anti-vibrating in rubber).
The ideal thrust that the support must exercise can be quantified at 50% of the total weight of the motor.
A smaller thrust cannot prevent flexion of the structure.
A greater thrust causes the opposite effect by loading the motor flange and misaligning the shaft with respect to the bearing seats.
For correct assembly follow the instructions below.

1 Fix the motor to the machine structure using the flange. (for coupling with direct engagement reducer, also see relative paragraph).
2 Position the support in the rear part of the motor. The Belleville springs must only push on the rear cover in proximity of the fixing holes (feet area). This point is reinforced and is therefore the most appropriate area to realise the thrust. Do not position the Belleville springs in the central area of the motor (on the stator) as it could be deformed.
3 Tighten the thrust bolts manually until the Belleville springs rest on the rear cover of the motor.
4 Tighten the bolts until the correct thrust is obtained.
During this phase it is necessary to check the compression of the springs and accurately dose the force to apply to the key. Given the screw pitch and the force that the key arm applies, it is very easy to exceed the ideal thrust without realising.
The thrust to be applied can be calculated and controlled using a dynamometric wrench and the formula stated below.
5 Fix the bolts using the counter-nuts and mark the reference point for any future assembly disassembly.
6 While the motor is turning, check that there are no vibrations and/or strange noises.

$$M = F * h / 628$$

F = thrust force to be applied in [kg] -(must be 50% of the weight of the motor).
h = screw pitch in [mm]
M = calibration torque of the dynamometric wrench in [Nm]

Fig. 1

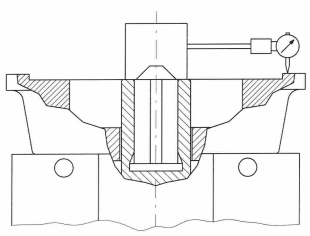
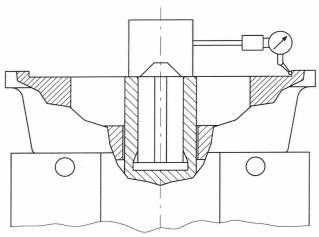


Fig. 2



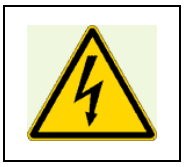
4. COMMISSIONING

4.1 Electric connections

All machines are normally supplied with cable boxes complete with terminal boards. The cables are marked with the letters stated in the diagram attached to the machine.
The terminals are marked according to IEC 60034-8 Regulations.
For the connections refer to par 4.10, connecting the machine in the envisioned direction of rotation.
The direction of rotation can be clockwise or anti-clockwise indifferently.

On request, when placing the order, sometimes free cables can be supplied instead of terminal boards. The length of these labels must be agreed upon. Also for this case, the considerations regarding marking of the terminals and the connection diagrams are valid.

4.2 Earth connection



DANGER!

The machine must always be connected to the establishment's earth plant.
A screw with anti-flattening washer is prepared in a visible position for earthing on the stator along with a screw in the terminal box, both complete with plate and marking. Both screws must be connected to the earth plant.
Make sure that there is no paint between the screws and the surface of the machine. If necessary, remove the paint before carrying out the connection.

4.3 Inspection before start-up

Before commissioning the machine or after a long period of inactivity, it is a recommended to perform the following checks:

- Use a 500 V Megger to control isolation towards the earth of the stator windings. The value detected must not be lower than 1.5 MΩ for motors with size up to 280, at 7MΩ for larger motors. **The operation must be performed with the power supply cables disconnected.**

ALARM!

During and immediately after measurement of the isolation resistance, the machine terminals are potentially dangerous and must not be touched. Check that there are no voltage residues.

If this condition does not exist, the causes and the solutions could be the following:
a) *Presence of dust*. Non-greasy dust can be removed using a clean dry cloth or even better using a suction device. Dust forming on inaccessible parts can be eliminated by cleaning the inside of the machine using a blow of clean, dry air at a pressure between 2-3.5 bar. Before this operation, remove the inspection or closure hatches. Repeat the isolation test.
b) *Presence of grease or oil*. Clean using a cloth dampened (not soaked) in dielectric solvent. If the problem persists, disassemble the machine and wash and dry the interested parts in an oven for 3 or 4 hours at a temperature of 100-120°C.
Repeat the isolation test before re-using the motor.

- Check that the asynchronous motors of any electrical fans (or heat exchangers) are prepared to be powered correctly from the mains by available alternating current (number of phases, voltage, frequency) and to turn in the indicated direction.
- For motors with air-water heat exchanger, check that the water circuit functions correctly.
- For liquid-cooled motors (AW series motors):
  - Fill the cooling circuit and make all air present escape (see Appendix D);
  - Check correct functioning of the cooling system and check that the fluid circulates in the circuit;
  - Check the real capacity and the maximum pressure of the circuit.
- Ensure that the protection relay contacts for ventilation faults (pressure switch), switch with the fan in function. In the case of ventilation with pipes ensure that the quality of the air and the capacity and pressure data respond to the prescribed values and check the direction of the ventilation air.
- Check that the power supply frequency and voltage are the same as those stated on the plate.
- Check that all accessories and/or protection devices have been correctly connected and are functioning.
- For motors with brake:
  - Check functioning
  - Check there is no friction when the brake is activated (released)

DANGER!

Work can only be carried out on electrical machines if it is certain that the machine is not connected to the mains.

4.4 Recommended protection devices

All transmission components must be adequately protected using sumps in order to prevent contact with moving parts.

4.5 Cooling of AW motors

Refer to the notes in Appendix D.

4.6 Mains power supply

ATTENTION: the motors envisioned for power supply from inverter can be powered directly from the mains only in determined conditions, but direct start-up from the mains is not envisioned.
Before connecting one of these motors directly to the mains contact the SICMEMOTORI Technical Office for instructions.

4.7 Power supply from inverter

Below are several instructions for adjustment of the inverter in relation to the basic parameters of the coupled motor.
These instructions do not replace those supplied by the Manufacturer of the inverter, which must always be consulted on commissioning the plant, but they supply a general guide for the user.

4.7.1 Voltage and speed adjustment

Characteristic functioning curves

The data and the characteristic curves stated in the technical specifications refer to motors powered by inverter with voltage and frequency that correspond to nominal values. The type of inverter control and relative adjustment can influence the features and functioning of the motor, allowing to obtain more or less wider fields of adjustment.
It is very important to combine the correct nominal voltage of the motor with the effective output voltage of the inverter.
In the presence of power supply voltage fluctuations between ± 5% of the nominal value mutations of motor performance are obtained, which is however able to function without significant problems.
In some conditions, the flux vector control inverter (in particular, with closed-loop adjustment), supplies an output voltage (V-out) lower with respect to the power supply (V-in).
Normally the motor is manufactured following Client specifications, which often make reference to the line value (V-in) and not the real inverter output value (V-out).
In order to prevent loss of motor performance, overheating and limitations of the constant power functioning range, it is essential that the maximum inverter output voltage (V-out max) is not lower than the nominal voltage of the motor (Vn).
If the maximum inverter output voltage (V-out max) should be lower than the motor nominal voltage (Vn) the nominal values must be re-adjusted and it is possible to solve this problem as follows:

- By increasing the value of the inverter power supply voltage (V-in) placing a boost transformer between the line and the inverter (example A).
- By combining a motor with nominal voltage (Vn) lower than the line voltage (V-in) and however equal to the real output voltage supplied by the inverter (V-out max) (example B)

By parameterising the inverter in a way to obtain a wave form for the output voltage (V-out max) deformed "almost square wave" with RMS value equivalent to the nominal value of the motor (Vn) (example C). However this condition causes the motor functioning temperature to increase.

Note: if the voltage value (V-out max) is lower than the motor nominal value (Vn), the loss of performance is detected in proximity of the nominal speed and in the entire constant power functioning range only if the setting of the V/f ratio of the inverter corresponds to the nominal value, e.g. 360 V / 45.9 Hz (corresponding to the nominal value of the motor 400 V / 51 Hz). If a different ratio is set, e.g. with value of 360 V / 51 Hz, the loss of performance can be detected in the entire speed range.

Example a)

Power supply line (V-in)	400V
Maximum output voltage (V-out max)	360V
Motor nominal voltage (Vn)	400V

Place a transformer on the line that increases the voltage (V-in) up to 440-450V.
The size of the inverter and the motor current do not change.

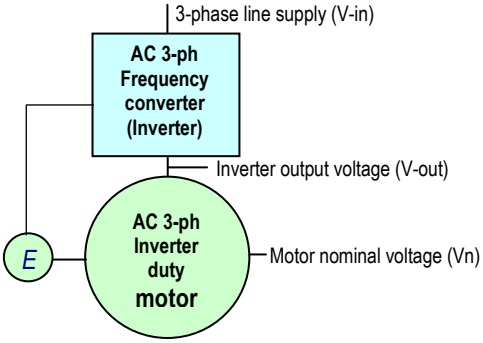
Example b)

Power supply line (V-in)	400V
Maximum output voltage (V-out max)	360V
Motor nominal voltage (Vn)	330V
Parameterize the inverter using motor data	330V

The size of the inverter and the motor current increase in proportion to the voltage decrease Vn (In x 400 / 330).

Example c)

Power supply line (V-in)……..400V
Maximum output voltage (V-out max)…. 360V
Motor nominal voltage (Vn)…….400V
Parameterize the inverter with the almost square wave function active



4.7.2 Voltage adjustment

STANDARD APPLICATIONS (make reference to the voltage/frequency diagram A)

Adjustment field with constant torque (0 –f_n)

In this part of the curve, the inverter output voltage increases proportionally to the input frequency (from 0 to basic speed f_n)

Adjustment field at constant power (f_n – f_{max})

In this part the voltage remains unvaried and corresponds to the maximum value of the inverter output (V-out max) while the frequency is increased up to its maximum value ($f_{max.}$).

APPLICATIONS WITH ADJUSTMENT FIELD WITH EXTENDED CONSTANT POWER (refer to voltage-frequency diagram B)

Adjustment field with constant torque (0 –f_n)

In this part of the curve, the voltage supplied by the inverter (V-out) increases proportionally with the power supply frequency (from 0 to basic speed f_n).

Adjustment field at constant power (f_n – f_{max})

In this part of the curve the voltage supplied by the inverter (V-out) increases non-proportionally with respect to the frequency until reaching the maximum value that can be supplied from the inverter (V-out max).

In specific applications (spindle, winders etc.) and in general when high a adjustment ratio is requested between maximum speed and basic speed of the motor, together with good capacity for maximum load also in the constant power functioning area, the maximum output inverter voltage (V-out max) must exceed the nominal value of the motor (Vn).

The increase in voltage must only take place in the constant power functioning field (defluxing) as indicated in the graphics below.

In these conditions (V_n) will be the nominal value of the motor and (V-out max) the maximum output voltage of the inverter.

It is recommended to maintain a margin of about 20% between the nominal voltage of the motor and the maximum output voltage of the inverter. Greater margins will allow higher overload in the constant power functioning field.

In order to allow this type of adjustment different nominal values for the windings are available that allow combination to the various power supply voltages and inverter output voltages.

☞ Note: The nominal voltage value of the motor most used for these applications is 330V. For the correct calculation of the nominal voltage of the motor (Vn) it is also necessary to consider that stated in the previous paragraph. The choice of the motor with nominal voltage of 330Vn is only indicated if the real output voltage of the inverter is400V-out max. If the maximum output voltage of the inverter (V-out max) is less than 400V the nominal values must be restores in order to obtain a voltage gain of about 70V between Vn and V-out max.

DIAGRAMMA TENSIONE-FREQUENZA
VOLTAGE - FREQUENCY DIAGRAM A)

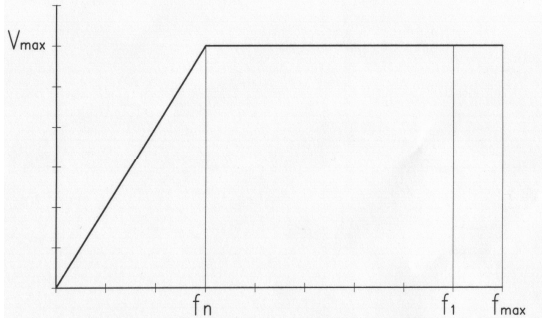


DIAGRAMMA TENSIONE-FREQUENZA
VOLTAGE / FREQUENCY DIAGRAM B)

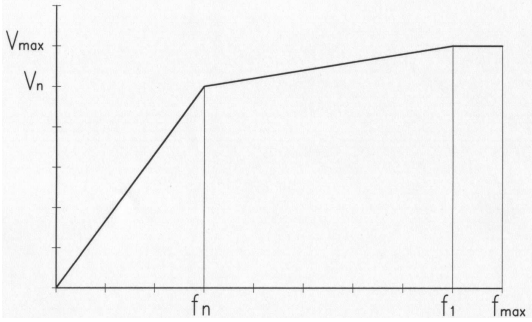


DIAGRAMMA DI POTENZA - *POWER DIAGRAM*

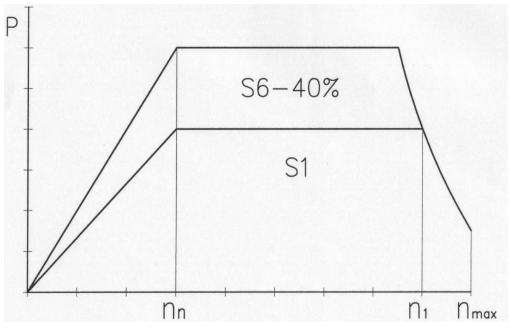
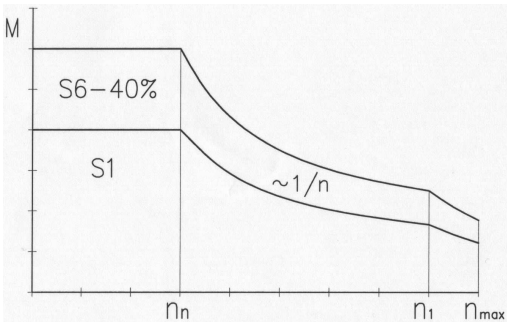


DIAGRAMMA DI COPPIA - *TORQUE DIAGRAM*



Note The speed n_1 with functioning at constant power (P_n) can only be obtained with an increase of the voltage from the inverter of at least 70V between n_n and n_1 (f_n and f_1).

A) Functioning at limited constant power (70% di n_1)
B) Functioning at extended constant power (P_n @ n_1)

☞ *Note*

With some inverters it is not possible to set two different output voltage values (Vn and V-out max) and for this reason the voltage adjustment as indicated in diagram B) cannot be realised.

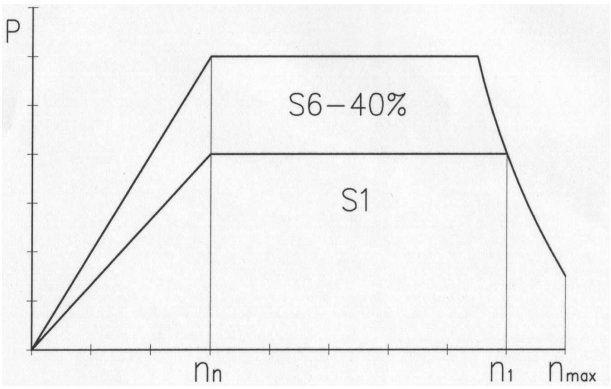
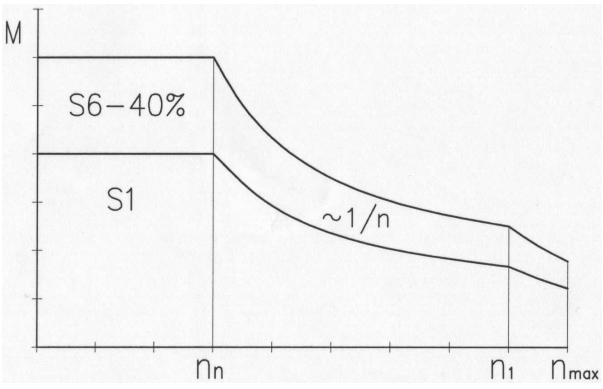
To solve this problem, it is possible to set the value Vn equal to the value V-out max in the inverter and re-proportion the frequency value Fn.

Example:

Motor 330Vn 50Hz 1500rpm - Inverter 400V-out max.
Parameterization of the inverter:
Motor nominal voltage 400Vn (no longer 330Vn)
Motor nominal frequency 60.6Hz (no longer 50Hz) – calculation (50Hz x 400 / 330V)
Motor nominal speed 1818rpm (no longer 1500rpm) – calculation (1500rpm x 60.6 / 50Hz)

4.7.3 Speed adjustment

Adjustment field with constant torque (0 – n_n)
In this part of the curve, the motor torque remains constant (nominal torque) until the nominal speed is reached n_n. The motor power increases proportionally with the number of revs.
Adjustment field with constant power (n_n – n_1)
In this part the motor power remains constant (nominal power) until the maximum speed at constant power is reached n_1The motor torque decreases with increase of the number of revs.
Adjustment field with decreasing power (n_1 – n_{max})
In this part the motor power decreases appreciably (reduced power) until the maximum mechanical speed is reached n_{max}. The motor torque consequently decreases.
Formula:
In order to calculate the torque or the power of the motor at the desired speed:
(P = kW) – (M = Nm) – (n = rpm)
Power = M x n / 9550 = P
Torque = P / n x 9550 = M

DIAGRAMMA DI POTENZA - *POWER DIAGRAM*	DIAGRAMMA DI COPPIA - *TORQUE DIAGRAM*
	

Note Speed n_1 with functioning at constant power (P_n) can only obtained with an increase of the voltage supplied from the inverter minimum 70V between n_n and n_1 (f_n and f_1).
A) Functioning at limited constant power (70% of n_1)
B) Functioning at extended constant power (P_n @ n_1)

	Description
n_n	Nominal rotation speed
n_1	Maximum rotation speed at constant power (P_n)
n_{max}	Maximum rotation speed at reduced power.
P_n	Nominal mechanical power at the shaft for service factor S1
M_n	Nominal torque at the shaft
V_n	Motor nominal voltage
V_{max}	Maximum voltage supplied by the inverter
f_n	Nominal frequency
f_1	Frequency at speed n_1
f_{max}	Maximum frequency
S1	Operation area for continuous service factor S1
S6	Operation area at overload for intermittent operation

4.7.4 Basic parameters of the motor

MOTOR BASIC PARAMETERS to be used for programming the INVERTER
The correct functioning of the motor is strictly connected to the parameterization of the inverter to which it is connected. Accurate calibration allows to obtain nominal performance of the motor with minimum energy consumption and completely exploiting the capacities of the motor + inverter system.
On the contrary, rough or incorrect calibration leads to a notable loss of performance, overheating, irregular functioning and in many cases the impossibility to exploit the potentiality of the product.
For this reason it is very important to parameterise the inverter by introducing the nominal parameters of the motor to which it is connected.
All of the fundamental parameters that must be used for calibration are indicated on the motor plate; moreover further data can be requested directly from the Manufacturer of the motor.
Paragraphs 4.0 and 4.1 show the motor plate with all necessary parameters.
During introduction of the data pay particular attention to the motor value on the plate and correspondence of the relative inverter parameter.

Check that the value (Hz) and (V) are effectively relative to the voltage:frequency ratio of the inverter. With the use of closed-loop inverter it is very important to introduce the correct nominal frequency, speed and running values. The introduction of an incorrect value determines a notable loss of torque (even exceeding 50%).

a) Example of programming with value (n_n) and (Hz) synchronous (Slip) to subtract.
Motor data: n_n 1500rpm - 50Hz – 400V – slip 55rpm
Programming:
Motor nominal speed parameter…….1445rpm (1500 – 55rpm)
Motor nominal frequency parameter ……..50Hz
Motor nominal voltage parameter ……..400V

b) Example of programming with value (n_n) and (Hz) asynchronous and (Slip) NOT to be considered.
Motor data: n_n 1500rpm – 51,5Hz – 400V –
Programming:
Motor nominal speed parameter ……..1500rpm
Motor nominal frequency parameter ……..51.5Hz
Motor nominal voltage parameter ……..400V
Note:
Some inverters do not accept the introduction of the frequency nominal value with a decimal point
In this case it is also necessary to re-proportion the nominal speed.
51.5Hz 1500rpm…new programming….51Hz 1485rpm (1500rpm * 51 / 51.5Hz).
The examples given above are also valid for all other frequency and speed nominal values available.

4.7.5 Connection to the inverter

It is noted that the length of the cable between the inverter and motor must be as short as possible, in order to limit stress deriving from the voltage peaks that may form at the motor terminal board and that can lead to an appreciable shortening of its life.

ATTENTION!
It is recommended to introduce relevant filters, connected directly to the motor clamps. Consult the Manufacturer of the inverter and if in doubt, contact the SICMEMOTORI technical office.

However, the connection cables between the motor and inverter and between the encoder/revolver and inverter **must be** shielded.
It is also recommended to pay attention to the layout of the cables; if in doubt, contact the SICMEMOTORI technical office.

4.8 Start-up

Before starting up the machine, as well as the operations stated in the previous paragraphs, check that:

- **It can turn freely;**
- **The rotor earth brushes, if present, are connected to the plant's earth system;**
- **Parameterizations and adjustments have been performed on the inverter;**
- **The safety devices used for transport (if present) have been removed.**

ALARM!
The alternating current machine must not function without ventilation, as it would overheat excessively and eventually burn. Pay attention that the fans function correctly and that the cooling water in the heat exchangers (where envisioned) or the cooling liquid (for AW motors) circulates with the amount and pressure indicated on the heat exchanger plates themselves.

When the machine is used for the first time, it is a good idea to check that there are no visible signs of malfunctioning, such as strange noises, vibrations etc. It is also convenient to allow the machine to run for a period of time in the empty condition, before applying the load. If problems occur, consult par. 7 and contact SICMESERVICE if necessary.

4.9 Inspection after start-up

After start-up of the machine (within the first 100 functioning hours) the following checks must be performed:
a) Check that the temperature of the bearings does not exceed 80°C in normal working conditions.
Overheating of the bearings is normally due to one of the following causes:

- Bad alignment with consequent vibrations and tendency for seizure;
- Excessive axial or radial thrust;
- Excessive quantity of grease. In this case stop the motor, disassemble the grease-guard/s and eliminate the excess grease using a brush; then remount the grease-guard/s.

b) Check that the current absorbed is less than or equal to that stated on the plate.

ALARM!
Working temperature
The maximum over-temperature accepted by the IEC Standards for the stator is 125°C if the machine is in class H (105°C if in class F, 80°C if in class B).
Even they normally have much lower over-temperature values, our machines however require *adequate protection against accidental contact*. Moreover, never leave highly-inflammable materials in contact with functioning machines.

4.10 Connection wiring diagrams

All motors are supplied complete with wiring diagrams for connection.

If they are missing or lost, request a copy from SICMEMOTORI, stating the serial number embossed on the electrical machine's plate.

DANGER!

Do not connect or start the machine-up in the absence of the wiring diagram!

4.11 Terminal board nuts coupling torque

If not specifically stated the coupling torques of the terminal board nuts are the following:

	M4	M5	M6	M8	M10	M12	M14	M16
Nm (+/- 10%)	1.2	2.4	4	8	12	20	30	40

4.12 Voltage at motor clamps

Check that the voltage peaks and the voltage derived (ΔV/Δt) at the motor clamps are within the limits set by the IEC 60034-17 Standard.
They can be reduced using a reactor, a filter ΔV/Δt or a sinusoidal filter; it is necessary to consult the Manufacturer of the inverter.

DANGER!

Always check that the plant is ready to function, there is no unauthorised staff working on the plant, everyone has been informed of the imminent start-up and all safety measures have been taken.
Also consult any additional information supplied by the Manufacturer regarding the plant and check that there are no contrasts with other installed products inherent to the control and start-up procedures.

5. MAINTENANCE

An accurately prepared preventive maintenance programme can reduce breakdown to a minimum, so reducing running costs through time.
The maintenance programme must be studied by competent technicians, who consider the features of the electrical machine used, the particular use for which the machine is destined and the environment in which it must operate.
Use of the machine means the more or less the strategic role that is assigned to it in the context of the entire plant, from which the accuracy and frequency of control operations and preventive maintenance (to be programmed) will depend.
Environment considers temperature, humidity, vibrations exceptional mechanical stress, as well as the presence of aggressive chemical agents, to which the machine can be exposed in the place of installation. The type and frequency of preventive maintenance will also depend on the environment as a whole.
Finally, every maintenance operation must be performed by sufficiently export staff, and surely informed regarding the content of these instructions, which must always be at immediate disposal.
SICMEMOTORI recommends that the user prepares a specific maintenance card for each electrical machine installed and that it is constantly updated by the expert staff.
After interruptions due to interventions of the protection devices or for any other reason, an in-depth inspection of the machine is necessary and if required, also of machine components. The cause of the interruptions must be made clear BEFORE starting the machine up again.

DANGER!
Before carrying out any interventions on the machine disconnect the mains power supply!

5.1 Programmed maintenance

Table 5.a indicates a programme–type of programmed maintenance; it must be intended that this programme must be adapted to the Client's requirements and that SICMEMOTORI is available for collaboration to study the most appropriate adaptations on commissioning and during the first working period.

Table 5.a – Programmed maintenance – programme type

Component	Operations	Interval (H)	See point
Complete machine	Check the vibrations and noise on the bearing seats. ISO 3945 Standard reference values **(a)**	annual	5.4
	Detection of any strange noises (blows, friction, etc.) **(a)**	weekly	
	Visual check of cleanliness inside the machine	monthly	
Windings	Measure the insulation resistance (with casing temperature of about 25℃) **(a)**	900-1200 (300-600)*	4.3
	General cleaning of the windings	3500-4000	4.3
Power supply cables	Check tightness of the cables at the motor clamps. Tighten them if necessary.	annual	2.2
Bearings	Temperature measurement **(h) (i)**	1200	
	Re-lubrication and application of grease (excluding self-lubricating bearings) **(h) (j) (k)**	See motor plate	5.9
	Complete replacement of bearing grease	3 years or 6000 hours	5.1/
	Check for presence of rust on bearings **(g)**	3 years	
Insulation	Check insulation resistance value using the 500V Megger	900-1200 (300-600)*	4.3
Filters	Check if filters are blocked	weekly	5.13
Air-water and air-air heat exchangers	See Appendix		
Liquid cooling (only for AW series motors)	Check functionality of the external recirculation circuit; check if filters are blocked		
Fixing screws and nuts	Check for loosening (the check is relevant most of all for electric connections of the terminal board as insufficient contacts can lead to localised overheating)	1800-2200	2.2 4.11
Coupling joints	Check the state of machine-load alignment and record the measurement **(f)**	Every two years and at every disassembly	3
	Carry out maintenance of the coupling joint according to the instructions of the Manufacturer of the joint	-	
Electric fan	Check for any rust or dirt	Every 6 months	

Component	Operations	Interval (H)	See point
	If envisioned, grease the asynchronous motor bearings **(g)**		
Various accessories	Control their correct functionality	annual	
Earth brush (if present)	Check that it runs freely in its brush-holder. Clean the contact surfaces between the brushes and shaft with very fine sand paper **(a) (b)**	annual	5.18

* Humid environments

(a) Compare with previous measurements and observations
(b)
(c) Remove any rust using oilstone and then cover the surface with an anticorrosion substance
(d) Depends on contamination of environmental air
(e) Depends on contamination of the water
(f) If the vibrations increase, inspect immediately or shorten the intervals between inspections
(g) Remove the rust.
(h) For bearings lubricated with grease
(i) Compare with previous measurements
(j) Comply with the lubrication intervals indicated on the AC machine's plate. Machines that are at a standstill for long periods of time require re-lubrication at least once a year (as the grease may age or condensation may be formed inside the bearing)
(k) As soon as vibrations, over-temperatures or noises occur or, when required, the machine must be disassembled. Experience tells us that problems with bearings are mainly caused due to wear, rather than material fatigue. However, consumption also depends on functioning conditions.

Particular instructions are given below for maintenance relative to bearings and air filters.

5.2 Bearings

In the following paragraphs DE means *driving end* and NDE means *non driving end*.
The machines in this range are normally envisioned with bearings. The type of bearing is indicated on the motor plate.
Normally, the NDE bearing is a ball bearing; the DE bearing can be either ball or roller
In 355 size motors the NDE bearing is isolated in order to eliminate the damaging effects caused on the bearings by eventual shaft currents. The isolated bearing is also available for other sizes. Consult SICMEMOTORI.
The types of bearings used are indicated in table 5.f and on the motor plate. In the case of inconsistency, the information on the plate is to be considered valid.

5.3 Useful life of the bearings

SICMEMOTORI selects the bearings used on the basis of supplier catalogue data and the type of coupling, and forecasts a minimum theoretical life of 20,000 hours.
The *theoretical life* is calculated in *normal* working conditions, i.e. for normal service (continuous service with load lower than or equal to the nominal load, without sudden overloads or inversions of direction) with *normal direct coupling* by means of flexible coupling or indirect coupling by means of pulley and belts with diameter of the driving pulley, pull of the belts with centre of gravity of the pull itself within the prescribed limits, (see point 5.6), in *normal environments* (without vibrations or blows, dry, clean, with maximum environmental temperature of 40°C). The theoretical life cannot be subject to warranty (as it is a statistic value that cannot be used without caution in the individual case) and is transmitted by SICMEMOTORI to the Client on the basis of the information received from the supplier. The *effective useful life* of the bearing depends largely on the particular service and the more or less efficient maintenance. The establishment o a reasonable value of the effective useful life, to be considered for a programmed maintenance plan, is entrusted to the user's Maintenance Service and must be based on the constant and systematic control of the machine.

5.4 Inspection of the bearings

The inspections must be subject to a precise programmed maintenance plan, with the scope of keeping the following under control:

- Over-temperature, which must never exceed 70°C in normal working conditions. A higher over-temperature generally denotes a deterioration of the coupling conditions with unacceptable radial or axial stress;
- Noise. No blows should be heard. Any blows are a symptom of deterioration of one or more rolling elements. On the appearance of strange noises, the state of the bearing must be checked carefully (wear of the tracks, consumption of the cage, play between the external ring and seat, external thrust, etc.) with the machine at a standstill and disassembled or using adequate measuring instruments.

If the mentioned phenomenon should worsen or at the first suspicion of a fault regarding the bearing, immediate replacement must be programmed, to prevent the danger of serious damage to the machine (see point 6.8).

5.5 General bearing data (standard machines)

The indications that follow (from par. 5.6 to 5.12) are supplied to ease the drawing up of a programmed maintenance plan.

5.6 Types of bearings and accepted radial loads (standard machines)

The types of bearings used and the accepted radial loads on the end of the shaft of normal machines manufactured by SICMEMOTORI are indicated in table 5.f. However, reference must always be made to the types of bearings indicated on the AC machine plate. In the case of inconsistency, those embossed on the plate must e considered valid.

Motor size ACVc-BQ-AJ	DE Bearing		NDE Bearing	
	Type		Type	
71	Ball	6203-ZZ	Ball	6203-ZZ
80	Ball	6205-ZZ	Ball	6205-ZZ
90S-L	Ball	6205-ZZ	Ball	6205-ZZ
90P	Ball	6006-Z	Ball	6205-ZZ
100S-M	Ball	6207-ZZ	Ball	6306-ZZ
100L-P-X	Ball	6209-ZZ	Ball	6306-ZZ
132	Ball	6309-ZZ-C3	Ball	6209-ZZ
160	Ball	6312-ZZ-C3	Ball	6311-ZZ-C3
180	Ball	6314-ZZ-C3	Ball	6214-2Z-C3
225	Ball	6318-C3	Ball	6315-C3
280	Ball	6222-C3	Ball	6222-C3
355	Roller	NU326-C3	Ball	6324-C3 (isolated)

Motor size AW	DE Bearing		NDE Bearing	
	Type		Type	
100	Ball	6308-ZZ	Ball	6207-ZZ
132	Ball	6309-ZZ	Ball	6209-ZZ
160	Ball	6312-ZZ	Ball	6311-C3
180	Ball	6314-ZZ	Ball	6312-C3
225	Ball	6318-ZZ	Ball	6315-C3

Table 5.f

The maximum radial loads accepted, expressed in Newtons, on the ends of the normal shaft of SICMEMOTORI motors are stated in the tables below.

Motor ACVc-BQ-AJ	X (mm)	Speed 1500g/min
71	20	450
80	25	800
90	25	900
100S-M	40	1200
	80	1000
100L-P-X	40	1700
	80	1500
132	55	2600
	110	2200
160	55	4300
	110	3800
180	70	6600
	140	5900
225S-M-L*	70	7000
	140	6000
280	105	7600
	210	7000
355	105	28000
	210	25000

Motor AW	X (mm)	Speed 1500g/min
100	40	1700
	80	1500
132	55	2600
	110	2200
160	55	4300
	110	3800
180	70	6600
	140	5600
225	70	7000
	140	6000

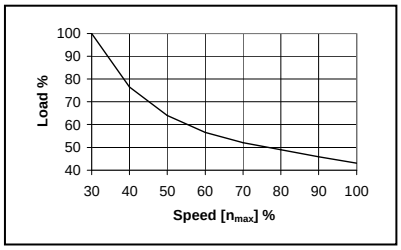


Table 5.g.1 – maximum radial loads with standard bearings

* for 225P-X ask SICMEMOTORI

Motor	X (mm)	Speed 1500g/min
71	20	---
80	25	---
90	25	---
100S-M	40	2400
	80	2000
100L-P-X	40	3100
	80	2700
132	55	4900
	110	4300
160	55	7000
	110	6000
180	70	8500
	140	7000
225s-m-l*	70	12000
	140	11000
280	105	7600
	210	7000
355	105	28000
	210	25000

Motor AW	X (mm)	Speed 1500g/min
100	40	3100
	80	2700
132	55	4900
	110	4300
160	55	7000
	110	6000
180	70	9800
	140	7000
225	70	12000
	140	11000

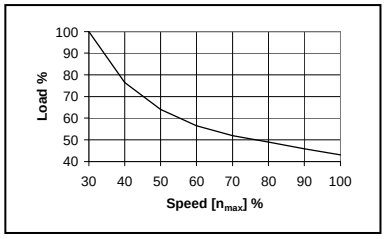


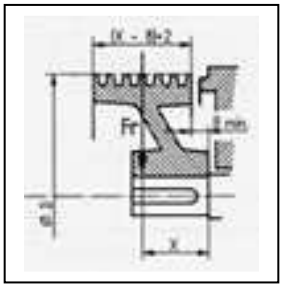
Table 5.g.2 – maximum radial loads with roller bearings

* for 225P-X ask SICMEMOTORI

The radial load F_r is calculated using the following formula:

$$F_r = \frac{19.1 \times P \times K \times 10^6}{D_p \times n}$$

where:
F_r = radial load on the shaft in N
P = motor nominal power in kW
n = motor nominal speed in rpm
D_p = pulley diameter in mm
K = belt voltage coefficient, approximate to:
K = 1 for notched belts
K = 2.35 for trapezoid belts
K = 3.75 for normal flat belts



The application point X of the radial load F_r on the shaft depends on the type and number of the belts used and, in the case of trapezoid belts, can be determined using table 5.g.3.
For motors not included in the table, consult SICMEMOTORI.

Number of belts	Section of the trapezoid belt					
	SPA-A	SPB-B	SPC-C	D	5V	8V
	X	X	X	X	X	X
2	26	30	38	50	30	41
3	33	40	50	69	39	56
4	40	49	63	88	47	70
5	48	59	76	106	56	84
6	56	68	89	125	65	99
7	63	78	102	145	74	113
8	70	87	114	165	83	127
9	78	97	127	181	91	142
10	85	106	140	199	100	156
11	93	115	153		109	170
12	100	125	166		117	184
13	108	135	179		126	199
14	115	144	192		135	213
15	123	153	205		144	
16	130	163			153	
17	138	172			161	
18	145	182			170	
19	153	191			178	
20	160	201			187	
21	168	210			196	
22	175				205	
23	183					
24	190					
25	198					
26	205					
27	212					

Table 5.g.3

The quota B must therefore always be:

< 30 mm for motor type 71
< 40 mm for motor type 80
< 50 mm for motor type 90S-L
< 60 mm for motor type 90P
< 60 mm for motor type 100S-M
< 80 mm for motor type 100L-P-X
< 110 mm for motor type 132-160
< 140 mm for motor type 180-225S-M-L
< 170 mm for motor type 225P-X
< 210 mm for motor type 280-355

If in doubt and for sizes not included in the list above, always contact SICMEMOTORI.

N.B.1 – Range 355 – Only direct coupling is normally envisioned for these machines, without appreciable radial or axial loads. Machines in this range must therefore not be used with coupling that leads to radial and/or axial stress, without having first received a favourable opinion from SICMEMOTORI.

N.B.2 – Vertical axis machines with axis height of 200 or over – The eventual use with coupling such as to cause appreciable radial loads must always undergo preliminary examinations by SICMEMOTORI.

5.7 Accepted axial loads

See table 5.7 (values in Newton).
For greater loads or vertical machines or if in doubt, always consult SICMEMOTORI.

Type of motor	Speed
	1500g/min
71	350
80	400
90S-L	400
90P	450
100	1100
132	1500
160	1800
180	2000
225	3000
280	4000
355	5000

Tab. 5.7 – Maximum axial loads accepted

5.8 Lubrication programmes

A periodical lubrication plan for the bearings must be previously established by the Client's Maintenance Service for every machine.
For the bearings that require lubrication, plates are applied in proximity of the bearings that indicate the quantity of grease necessary and the lubrication intervals.
It is highly recommended to follow the indicated amounts scrupulously: an excessive quantity can lead to breakdown.
The grease must be replaced entirely every 6000 working hours (see point 5.10).

5.9 Lubrication – Specific instructions

This operation must be carried out with the machine in movement. Apply the pump to the greasing nipple and remove the grease outlet plug to allow the oil coming from the deteriorated grease to flow out. Add the amount of grease envisioned on the AC machine plate. Remove the pump and re-position the plug.
The positions of the greasing nipple and the outlet plug are indicated by relevant plates.

ATTENTION!
Do not apply an excessive amount of grease. Excess grease overheats the bearings and can damage them. The excess grease tends to escape along the shaft. Do not mix different types of grease as they could be incompatible.

In normal conditions (in particular with environmental temperatures that do not exceed 40°C) the grease to be used must have the following features:

- Soap-base: lithium or polyurea
- Drop point: 180-190°C
- Consistency: N° 3NLGI with penetration values between 220 and 250 tenths of mm;
- Working temperature: -25 to +120°C.

Table 5.m shows some types of grease used in normal conditions.
For *use in difficult conditions* (and particularly when environmental temperature exceeds 50°C) special greases with high thermal stability must be used, which have the following features:

- Organic base: urea or complex calcium salts;

- Drop point: 220-250°C;
- Consistency: with penetration values between 240 and 270 tenths of mm;
- Working temperature: -30 to +150°C.

Table 5.m some types of grease for difficult conditions.

Product name	Supplier
Athesia Gr3	IP
Mobilux 3	Mobil
Exxon Beacon	Exxon
Alvania 3	Shell

Table 5.m – Some types of grease used in normal conditions

Product name	Supplier
SRI 2	Chevron
Mobilplex 48	Mobil
Aeroshell 12	Shell

Table 5.n – Some types of grease for difficult conditions

5.10 Complete replacement of the grease

Must be carried out by qualified staff.
Protect the electric windings during the operation.
For indications and procedures, please contact SICMESERVICE.

5.11 Bearings for special machines

Machines in special mechanical use (e.g. with shaft end that has a diameter different from normal, or due to high speed) may have special bearings.
Be sure of this by the comparison of the types of bearings indicated on the plate and those indicated in the Catalogue or corresponding Technical Folder (if in doubt contact the Sales Network).

5.12 Bearing replacement

This must be envisioned, in coincidence with the machine's general programmed maintenance operations, when approaching the effective useful life envisioned for the bearings (see point 5.3). See points 6.8 and 6.9 for the relative operations.

5.13 Air filter

When present, the filtering panel must be checked weekly in order to prevent blocking and cause excessive pressure drop and reduction of the capacity to unacceptable values.
The panel can be cleaned using mechanical means (beating and/or suction) or by washing in water.
The panel must be replaced after a certain amount of washing cycles.

5.14 No ventilation control device

Normally, the no ventilation control device is positioned in the upper part of the heat exchangers or flushed onto the electric fan auger screws.
The no ventilation control device must never be tampered with; calibration must be carried out by qualified staff, if its incorrect functioning manifests itself as:

- Too frequent interventions, with continuous interruption of the service; in this case, it is prohibited to short circuit the device in Delayed interventions, with no intervention even when the dirtiness of the filter would request it In this case, there is a great risk of a serious out of order condition of the protected machine.

In exceptional cases, for example during maintenance or for its replacement, if calibration must be performed, follow the instructions below

ATTENTION!
If in doubt always contact SICMESERVICE.

Instruments: Analogical Tester or Digital Tester

Modalities:

- Prepare the tester on the ohmic capacity
- Position the tips at the top of the Pressure gauge contacts identified with the numbers 1 and 3 (fig 5.p).
- Completely tighten differential adjustment screw "A" (screws not sealed).
- Check that the tester pointer moves (contact closure).
- Slowly loosen screw "A" so that the tester pointer returns to the rest position (contact opening).
- Loosen screw "A" by a further 1/4 of a turn.
- Loosen the adjustment screw "B" so that the tester pointer moves (contact closure).
- Slowly tighten screw "B" so that the tester pointer returns to the rest position (contact opening).
- Tighten screw "B" by a further 1/2 of a turn.
- Activate the fan and check that the tester pointer moves (contact closure).
- Deactivate the fan and check that the tester pointer returns to the rest position (contact opening).

By deactivating and activating the fan two switches must occur.

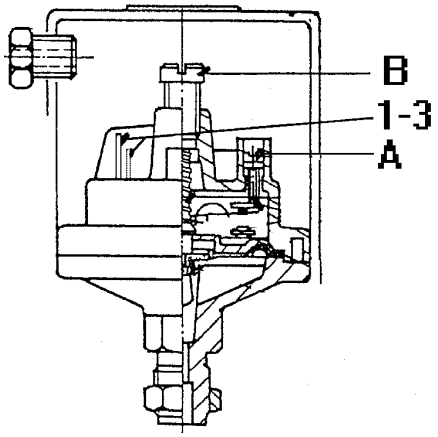


Fig. 5.p

5.15 Tachogenerator

Refer to the Manufacture's maintenance regulations

ATTENTION: before mounting and/or connecting the tachogenerator, read the Manufacturer's instructions carefully. The warranty is forfeited immediately if these instructions are not respected or if the dynamo is tampered with and/or repaired by unauthorised staff.

The assembly and/or connection of the tachogenerator must be performed by qualified staff. If in doubt, consult SICMESERVICE.

5.16 Impulse generator (encoder)

Refer to the Manufacture's maintenance instructions.

ATTENTION: before mounting and/or connecting the encoder read the following instructions carefully. The warranty is forfeited immediately if the instructions are not respected or if the encoder is tampered with and/or repaired by unauthorised staff.

The assembly and/or connection of the encoder must be performed by qualified staff. If in doubt, consult SICMESERVICE.

Operations that MUST NOT be carried out regarding the tachometer (dynamo and/or encoder)

MECHANICAL

DO NOT disassemble the instrument, in order not to lose the warranty; repairs are only accepted under warranty for appliances sent to SicmeMotori

DO NOT connect the small shaft to using parts using rigid joints, only flexible joints must be used. Incorrect assembly drastically reduces the life of the bearings and excludes any type of warranty.

DO NOT strike the instruments: it is possible to break internal components, excluding any type of warranty**. In particular, pay attention when mounting coupling components onto the motor shaft to which the tachometer is coupled: DO NOT use mallets or other means to flush on the transmission components!**

DO NOT carry out any work on the shaft; this can cause the disk to break, deterioration of the bearings and loss of warranty

DO NOT exert abnormal pressure, flexions and torsions onto the shaft of the instrument.

DO NOT assemble differently to that envisioned.

During re-assembly of the flexible joint, pay attention not to close the pins with the joint itself compressed or extended as it would be prevented from compensating lengthening due to heating of the motor shaft.

ELECTRICAL

DO NOT use power supply sources with an auto-transformer that does not assure galvanic isolation of the power supply network

DO NOT allow the cable to run near to and/or parallel to the high voltage power supply line or join the cables in the same channel. This precaution must e complied with scrupulously in order to prevent malfunctioning due to inductive interference.

DO NOT use longer cables than necessary. Try and keep the length of the cable as short as possible, in order to prevent the influence of disturbances of an electrical nature.

DO NOT carry out connections if there are doubts regarding them (see connection diagram on the instrument's label). Incorrect connections can cause faults to the internal circuits of the instrument.

DO NOT connect the instrument's shielded cable to a 0 Volt circuit

The cable shield MUST BE connected to earth (GND). DO NOT leave it disconnected! The shield must be connected to earth only from the motor power supply side; in some cases, depending on the type of plant, the shield may have to be connected both from the power supply side and on the instrument side female connector.

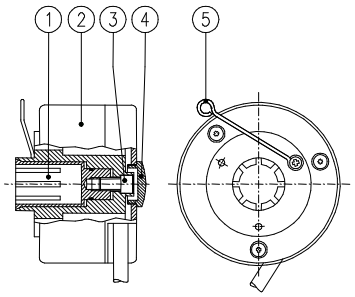
DO NOT opt for NPN or PNP electronics with connections longer than 6 m. In this case the use of the line-driver output is recommended, or complemented. To extend the cable, use the twisted shield cable and a line-receiver compatible with RS422A in the receiver circuit.

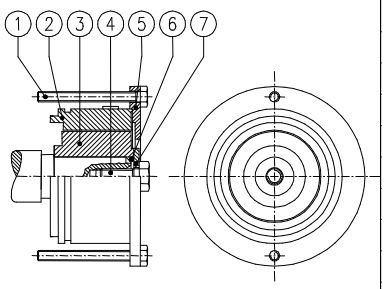
DO NOT opt for a power supply voltage of 24 Vdc if a high frequency response is received. Opt for a voltage of 5 Vdc and line-driver electronics.

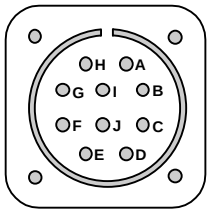
Encoder electrical connection layout

The standard encoder is supplied complete with male connector (from panel) with 10 pins wired according to the standard connection layout shown in figure 5.21. The free female connector with contacts to be welded is supplied loose.

TRANSDUCER			
ENCODER TI58HS / DHS-66	RESOLVER MR 55	10 PINS CONNECTOR	CONNECTIONS







PIN	ENCODER	RESOLVER
A	(A)	EX +
B	(Z)	EX -
C	(B)	COS -
D	--	COS +
E	*SHIELD*	SIN +
F	(+….Vdc)	SIN -
G	(GND)	
H	(A-)	
I	(Z-)	
J	(B-)	

Fig. 5.21

ATTENTION!
Always check the connection layout supplied with the AC motor. In the case of inconsistency, the latter is valid.

5.17 Centrifugal relay

Refer to the Manufacturer's maintenance regulations. If in doubt, consult **SICMESERVICE**.

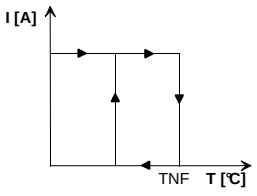
5.18 Earthing brush

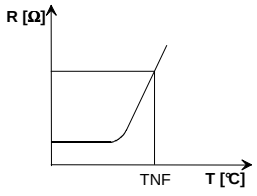
If rotor earthing brushes are present, check their functionality periodically (wear, contact with the rotor). Replace them if necessary.

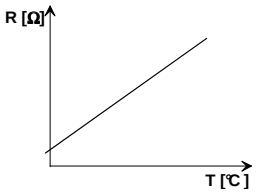
5.19 Thermo-protectors

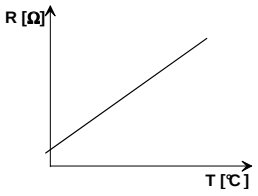
Table 5.22 represents the features of the most common thermo-protectors installed on the motors.

PTO (thermo-protector)	PTC (thermistor)	KTY 83 – KTY 84	PT 100 (heat detector)





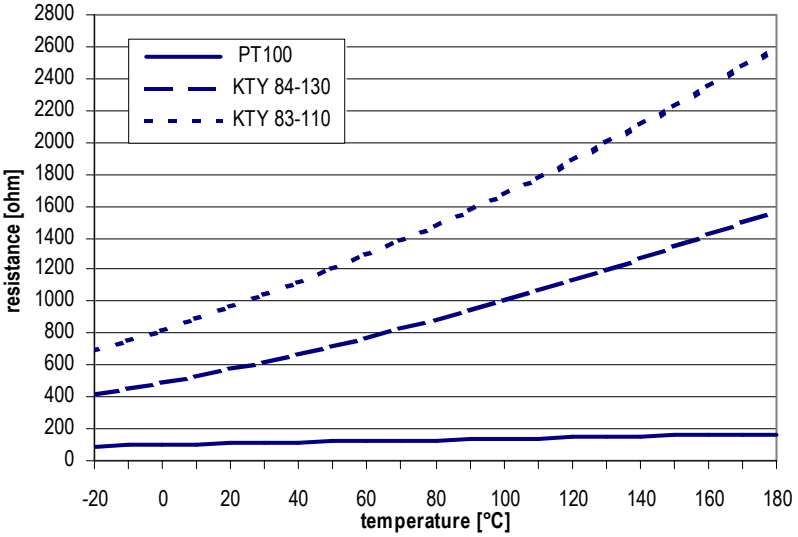




	PTO	PTC	KTY – PT 100
Type of protection	Slow overloads, no ventilation,	Fast overloads, no ventilation.	Monitoring of the temperature
Temperature measurement	No	No	Yes
Type of signal	Contact normally closed	Non-linear resistance	Variable linear resistance
Intervention temperature	150 ℃	150 ℃.	-
Resistance *@ 20℃*	< 1 Ω	20 ÷ 750 Ω	*See table*
Resistance at the intervention temperature	< 1 Ω	≤ 1300 Ω	*See table*
Resistance after intervention	∞	≥ 4000 Ω	*See table*
Nominal power supply voltage	110Vac	≤ 2.5 Vdc	-
Max. power supply voltage	250 Vac – 60Vdc	25 Vdc	-
Maximum current	AC = 2.5 A – DC = 1 A	2 mA	2 mA
Reset temperature	85 ÷ 95 ℃	-	-

Temp.	PT 100	KTY 84-130	KTY 83-110
°C	Ω	Ω	Ω
-20	92.16	419	691
-10	96.09	455	754
0	100	493	820
10	103.9	533	889
20	107.79	576	962
30	111.67	621	1039
40	115.54	668	1118
50	119.4	718	1202
60	123.24	769	1288
70	127.07	824	1379
80	130.89	880	1472
90	134.7	939	1569
100	138.5	1000	1670
110	142.29	1063	1774
120	146.06	1129	1882
130	149.82	1197	1993
140	153.58	1268	2107
150	157.31	1340	2225
160	161.04	1415	2346
170	164.76	1493	2471
180	168.46	1572	2590

Temperature/resistance values

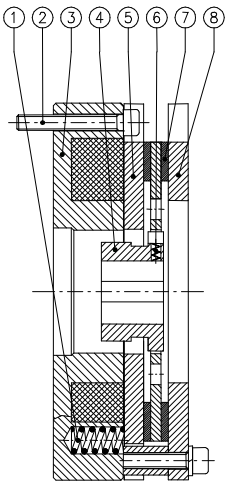


Tab. 5.22

5.20 Electromagnetic brakes – adjustment of the air gap due to wear

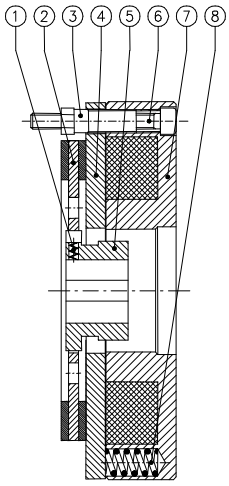
The friction material applied to the brake is destined to be worn on the basis of the number of insertions, the braking torque and the time required to stop the motor. This wear leads to the progressive moving apart of the counter-magnet until it reaches the limit distance, therefore brake functioning is compromised. It is therefore a good idea to periodically check the distance between the two magnetic nuclei (electro-magnet and counter-magnet), which must be within 0.5 mm. If the distance exceeds this value, the correct air gap must be restored acting as indicated below for some types of brake.

R-type brake



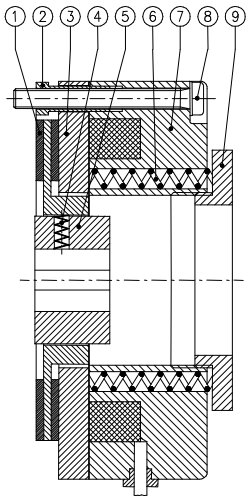
1	Springs
2	Screw fasteners
3	Electro-magnets
4	Pinion
5	Counter-magnets
6	Anti-vibration spring
7	Brake disk
8	Counter-plate

Rr-type brake



1	Springs
2	Electro-magnets
3	Screw fasteners
4	Pinion
5	Counter-magnets
6	Adjusters
7	Brake disk
8	Anti-vibration spring

K-type brake



1	Brake disk
2	Adjusters
3	Counter-magnets
4	Anti-vibration spring
5	Pinion
6	Springs
7	Electro-magnets
8	Screw fasteners
9	Setting head

Motors with R-type brake

1 Remove the encoder/resolver following the previously-stated indications.
2 Mark and remove the brake cover cotter pin
3 Check the air gap existing between the electro-magnets and the counter-magnets, which must not exceed 0.5 mm.
4 Mark and remove the flange counter-plate.
5 Remove the spacer bushes and the calibrated washers used to determine the air gap
6 Mark and remove the brake pad only if necessary and if the friction material is worn. In this case replace the worn components with new and original spare parts.

7 Re-assemble everything carrying out the procedure in the opposite way and introducing the calibrated washers in a way to restore the correct air gap.
8 Check the air gap existing between the electro-magnets and the counter-magnets, which must be between 0.2 and 0.3 mm.
9 Check that the circumference of the air gap is uniform.
10 Power the brake and check that the disk is not blocked or scrapes during manual rotation of the motor axis.
11 Power the brake and check that there is no friction between the disk and the counter-magnet.

Motors with Rr-K-type brake
1 Remove the encoder/resolver following the previously-stated indications.
2 Mark and remove the brake cover cotter pin
3 Check the air gap existing between the electro-magnets and the counter-magnets, which must not exceed 0.5 mm.
4 Loosen the electro-magnet screws.
5 Regulate the air gap using the relevant adjusters and block the electro-magnet screw fasteners.
6 Check the air gap existing between the electro-magnets and the counter-magnets, which must be between 0.2 and 0.3 mm.
7 Check that the circumference of the air gap is uniform.
8 Power the brake and check that the disk is not blocked or scrapes during manual rotation of the motor axis.
9 Power the brake and check that there is no friction between the disk and the counter-magnet.
10* Mark and remove the electro-magnet, the counter-magnet and the brake disk only if necessary and if the friction material is worn. In this case replace the worn components with new and original spare parts.
11* Re-assemble everything following the procedure in the opposite direction starting from point 5).
* Perform only if necessary

Adjustment of the braking torque (only for K-type brakes)
It is possible to adjust the braking torque by acting on the setting head.
Check correct functioning of the brake and the braking torque must not exceed the nominal value.
Check the static torque of the brake before starting the motor.

For other types of brakes, refer to the brake Manufacturer's maintenance regulations. If in doubt, consult SICMESERVICE.

ATTENTION!
Do not lubricate internal brake parts, in particular the disk and the friction surfaces. Rotate the motor only if the brake is powered and released.
Never remove a self-braking motor before having mechanically assured the load and transmission components.

5.21 Air-air and air-water heat exchangers
See appendix.

6. DISASSEMBLY AND RE-ASSEMBLY OF THE MACHINE

For details and nomenclature refer to paragraph 10 – "layout diagrams and nomenclature".

DANGER!

Before carrying out any work on the electrical machine, ensure that it is disconnected from the mains!

6.1 Operations preliminary to disassembly

After mechanical uncoupling (opening of the joint or equivalent operation, see point 6.2), remove the screws that block the feet and/or the flange and remove the reference pins. Moreover:

- ACVc, ACVa, AQCa, AQCp, BQCa, BQCp, BQAr, BQCr MACHINES: remove the screws from the connections, the hatches if present and the electric fan.
- CBARH-CBARO (BQCw) MACHINES: remove the cooling unit from the motor.

6.2 Disassembly. The same operations for all machines.

Disconnect the machine from all electric cables.

Extract the coupling half-joint using a relevant tool when cold, if the end of the shaft has the key (see fig.6.a) or refer to the manufacturer's instructions regarding the transmission component if the end of the shaft is smooth.

Remove the encoder or the tachogenerator (see 6.2.1 and 6.2.2) and/or other accessories, remove the hatches and the lateral closure devices on the DE and on the side opposite coupling.

For the sizes where the grease-guard is present, remove the screws that fix the internal grease-guards on the DE and on the side opposite coupling.

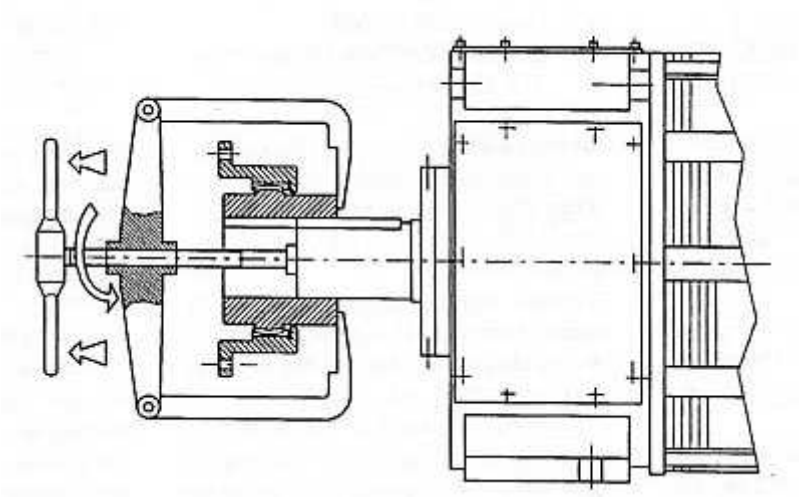
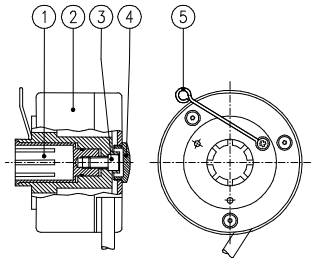


Fig. 6.a – Cold extraction of the half-joint

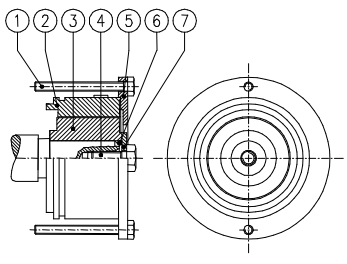
6.2.1 Disassembly of the encoder/revolver

Encoder tipo HG 660 ANK - *Encoder type HG 660 ANK*



1 Inserto - *Insert*
2 Encoder
3 Vite - *Screws*
4 Coperchio - *Cover*
5 Braccio di reazione *Reaction arm*

Resolver tipo MR 55 - *Resolver type MR 55*



1 Viti - *Screws*
2 Statore - *Stator*
3 Rotor - *Rotor*
4 Vite - *Screws*
5 Flangia di fissaggio *Fixing flange*
6 O-ring - *O-ring*
7 Rondella - *Washer*

Fig. 6.21 – Disassembly of the encoder

For motors envisioned with hollow shaft transducer, as well as the instructions described in the previous paragraphs relative to disassembly of the motor, it is also necessary to follow the instructions stated below in order to disassemble the transducer correctly.
For motors with special or different transducers, the specific technical sheets must be consulted.

1 Loosen and remove the screws from the transducer cover, if installed.
2 Mark and remove the transducer cover.
3 Loosen the radial pins or the screw fastener of the encoder to the motor shaft.
4 Loosen and remove the screw fastener from the reaction arm or the blocking screws from the revolver stator.
5 Remove the resolver encoder/rotor taking care that the rotors do not undergo blows or damage.
6 Place the transducer in a clean dry place that is protected from dust and blows.
7 For assembly, follow the procedure in the opposite direction.

ATTENTION!
The encoders and other speed/position transducers are sensitive to the electric discharges, which could irreversibly damage the electronic circuits. Before proceeding with disassembly, ascertain that the work position is put to earth and touch a conductive object before operating on the transducer in order to prevent the transmission of any discharges.

6.2.2 Disassembly of the tachogenerator

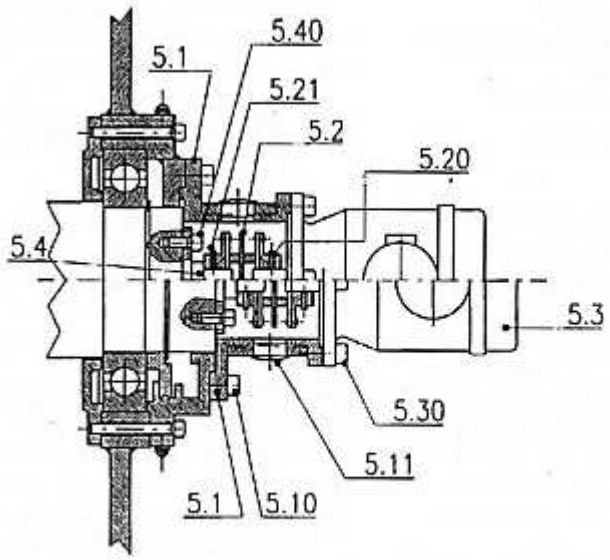
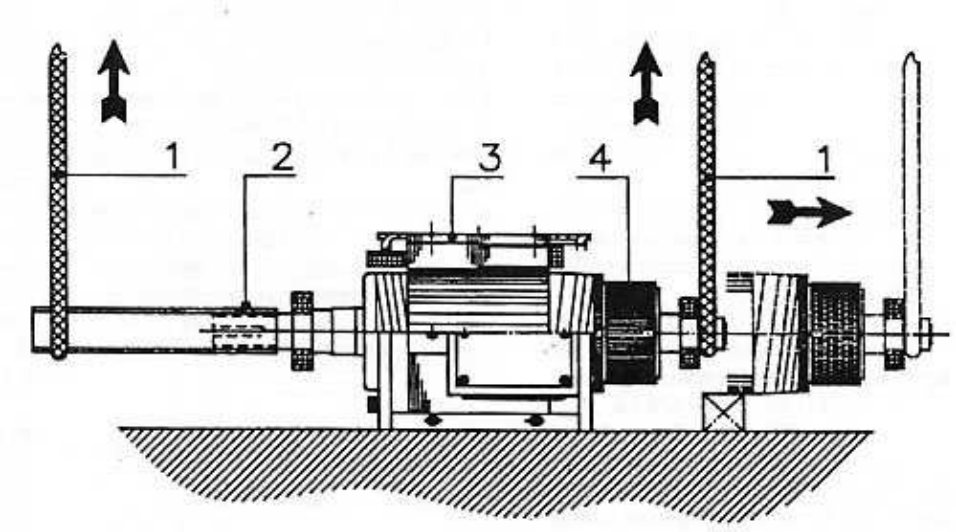


Fig. 6.2.2 – Disassembly of the tachogenerator

Remove the cover in 5.11 from support 5.1 to access joint 5.2.
Loosen the threaded pin 5.20 from the half-joint on the tachogenerator side and screws 5.30 and remove the tachogenerator 5.3.
If the end of the main shaft must be made accessible on the commutator side, the following operations must be carried out:

- Remove support 5.1 loosening the screws 5.10;
- Loosen the screws 5.40 and remove the chuck 5.4 with the flexible joint 5.2

At this point the commutator side main shaft end is accessible.
During re-assembly of the flexible joint pay attention not to close the pins with the joint itself compressed or extended as it would be prevented from compensating lengthening due to heating of the motor shaft.



1 – Lifting rope
2 – Shaft extension
3 – Complete stator
4 – Rotor

Fig. 6.c – Disassembly of the rotor

6.3 Disassembly and re-assembly of ACVc71-80-90 motors (diagram 10.1)

Select the sectional drawing from the following pages containing the nomenclature of the components and check that it corresponds to the type of motor where maintenance is to be performed.
Disassemble the transmission component (joint, pulley, etc.) using an extractor avoiding blows that would damage the bearings and any accessories (encoder, resolver, brakes, etc.).

1 Loosen and remove the screw fasteners from the electric fan unit.
2 Mark and remove the electric fan unit
3 Loosen and remove DE and NDE grease-guard flange/bearing block screw fasteners
4 Loosen and remove the screws or cover fixing tie-rods.
5 Mark the covers and remove them using an extractor or levers inserted between the cover fixing catches and the casing. If the bearings are damaged and therefore to be replaced it is possible to use a lead mallet to strike a front end of the shaft.
6 Mark and slide the rotor out from the frame carefully, avoiding touching and damaging the windings.
7 Extract the bearings using a relevant extractor and replace them with just as many of the same type and dimension. Use the relevant instrument to assemble the new bearings or proceed with hot mounting (max. 100°C). Do not use a mallet.
8 Clean the motor, the cover strokes and the inside of the windings using dry cloths.
9 Re-assemble following the procedure in the opposite direction.
10 Check that the motor is not to earth and there are no short circuits in the windings
11 Try the motor, possibly with reduced voltage, following all regulations and arrangements described above regarding protections and safety.

6.4 Disassembly and re-assembly of AQCa100, BQCp132-160-180, BQAr-BQCr132-160 motors (diagram. 10.2 – 10.2.1 - 10.3)

1 Select the sectional drawing from the following pages containing the nomenclature of the components and check that it corresponds to the type of motor where maintenance is to be performed.
2 Remove the motor from the machine/plant.
3 Mark and remove the transmission component (joint, pulley, etc.) using an extractor avoiding blows that would damage the bearings and any accessories (encoder, resolver, brakes, etc.).
4 Loosen and remove the screw fasteners on the base of the transducer connector, if installed.
5 Introduce the base of the connector inside the fan.
6 Loosen and remove the screw fasteners from the fan.
7 Mark and remove the fan.
8 Loosen and remove the screws from the transducer cover, if installed.
9 Mark and remove the transducer cover.
10 Remove the transducer, marking the position and being very careful. See paragraph 12.0 for further details.
11 Loosen and remove the NDE bearing support hub screw fasteners.
12 Loosen and remove any screws on the DE/NDE hub and use to block the bearing.
13 Extract the key from the DE shaft and also any sealing rings.
14 Remove the bearing support hub complete with rotor from the rear part of the motor paying attention not to damage the windings.
15 Mark and extract any elevation thickness.
16 Proceed with the controls and cleaning of the windings' cooling channels (AQA/BQA motors) if necessary.
17 Re-assemble following the procedure in the opposite direction.
18 Check that the motor is not to earth and there are no short circuits in the windings.
19 Try the motor, possibly with reduced voltage, following all regulations and arrangements described above regarding protections and safety.

20 Follow that indicated in paragraphs 4.3 and 4.8 and all other relevant notes.

6.5 Disassembly and re-assembly of BQAr-BQCr-AJ180-225-280-355 motors (diagram 10.4-10.5)

1 Select the sectional drawing from the following pages containing the nomenclature of the components and check that it corresponds to the type of motor where maintenance is to be performed.
2 Remove the motor from the machine/plant.
3 Mark and remove the transmission component (joint, pulley, etc.) using an extractor avoiding blows that would damage the bearings and any accessories (encoder, resolver, brakes, etc.).
4 Loosen and remove the screw fasteners on the base of the transducer connector, if installed.
5 Introduce the base of the connector inside the fan (size 355 excluded).
6 Loosen and remove the screw fasteners from the fan.
7 Mark and remove the fan.
8 Loosen and remove the screws from the transducer covers, if installed.
9 Mark and remove the transducer covers.
10 Remove the transducer, marking the position and taking great care. See paragraph 6.2.1 for further details.
11 Loosen and remove the DE cover screw fasteners.
12 Loosen and remove any screws on the NDE cover and use to block the bearing.
13 Extract the key from the shaft control side and any sealing rings.
14 Remove the DE cover complete with rotor from the front part of the motor paying attention not to damage the windings
15 Mark and extract any elevation thickness.
16 Proceed with the controls and cleaning of the windings' cooling channels if necessary.

17 Re-assemble following the procedure in the opposite direction.
18 Check that the motor is not to earth and there are no short circuits in the windings
19 Try the motor, possibly with reduced voltage, following all regulations and arrangements described above regarding protections and safety.
20 Follow that indicated in paragraphs 4.3 and 4.8 and in all other relative notes.

6.6.1 Disassembly and re-assembly of AW motors (diagram 10.7)

1 Select the sectional drawing from the following pages containing the nomenclature of the components and check that it corresponds to the type of motor where maintenance is to be performed.
2 Remove the motor from the machine/plant.
3 Mark and remove the transmission component (joint, pulley, etc.) using an extractor avoiding blows that would damage the bearings and any accessories (encoder, resolver, brakes, etc.).
4 Mark and remove the transducer covers.
5 Remove the transducer, marking the position and taking great care. See paragraph 6.2.1 for further details.
6 Loosen and remove the bearing block flange screw fasteners (where present).
7 Loosen and remove the tie-rod fixing nuts positioned on the NDE shield.
8 Extract the key from the DE shaft and any sealing rings.
9 Remove the DE cover delicately hitting the front flange.
10 Mark and extract any elevation thickness.
11 Extract the rotor from the stator paying attention not to strike the windings.
12 Proceed with the controls and cleaning of the cooling channels and windings if necessary.
13 Replace the bearings
14 Clean the casing and both shields (all contact surfaces) removing any sealant present.
15 Check the state of the O-rings and replace them if necessary.
16 Introduce the rotor into the stator (paying attention not to strike the windings), apply the elevation thickness, if previously removed, mount the covers and tighten the bolts.
17 Re-assemble the other components following the procedure in the opposite direction.
18 Check that the motor is not to earth and there are no short circuits in the windings
19 Try the motor, possibly with reduced voltage, following all regulations and arrangements described above regarding protections and safety.
20 Follow that indicated in paragraphs 4.3 and 4.8 and in all other relative notes.

ALARM!
Do not loosen the tie-rods used to bock the covers. Do not remove the covers from the stator. If the motor must be rewound, contact the Manufacturer before proceeding.

The instructions and diagrams may not coincide perfectly with the effective construction of the motor. Particular accessories and special executions cannot be contemplated in the following instructions.
For the motors complete with transducer it is also necessary to follow that stated in paragraph 6.2.1.or.6.2.2.
For the motors complete with brake it is also necessary to follow that stated in paragraph 5.20.
For the replacement of bearings it is also necessary to follow that stated in paragraph 6.8.

ATTENTION!
The instructions and diagrams may not coincide perfectly with the effective construction of the motor. Particular accessories and special executions cannot be contemplated in the following instructions.

6.7 Disassembly of the rotor

After the shields have been removed, slide the rotor out and clean or repair. Follow the disassembly indications in figure 6.c.

6.8 Bearing replacement

The disassembly and assembly of bearings must always be carried out carefully, paying particular attention not to ruin the bearings seat on the shaft.
The used bearings are removed using a relevant extractor (fig. 6.d). The new bearings must be the same as those removed: Particular attention to the play (check the indications on the machine plate).
Proceed as follows to mount new bearings:
Clean the bearings, the relative flush on seats and the internal grease-guard chamber carefully. Heat the bearing to 80-100℃ by induction, placing it in an oven or in an oil bath. Flush it onto the shaft and hold it against the thrust block for 60-90 seconds.
Eliminate the pressure applied and check the internal ring does not turn on the shaft.
With reference to the types of grease to be used refer to tables 5.m – 5.n in point 5.9.

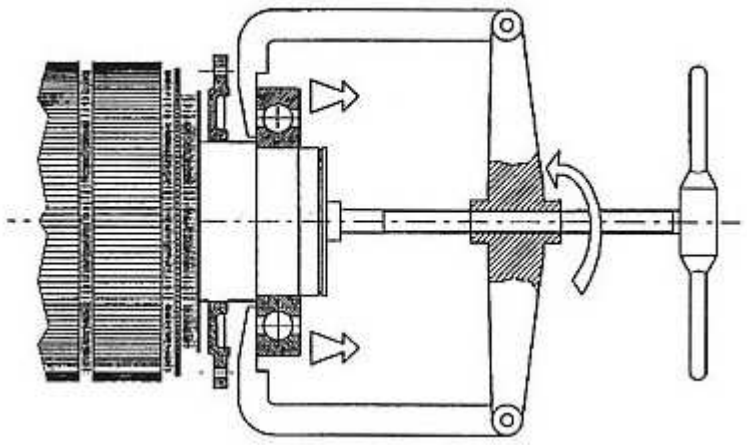


Fig. 6.d – NDE bearing extraction

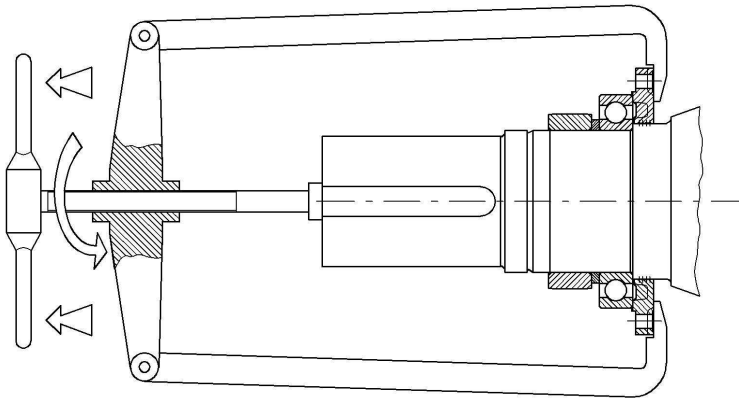


Fig. 6.e – DE bearing extraction

- -NDE end fig. 6.f. Use a manual or hydraulic extractor positioned at the back of the internal roller bearing ring and remove the internal ring itself.

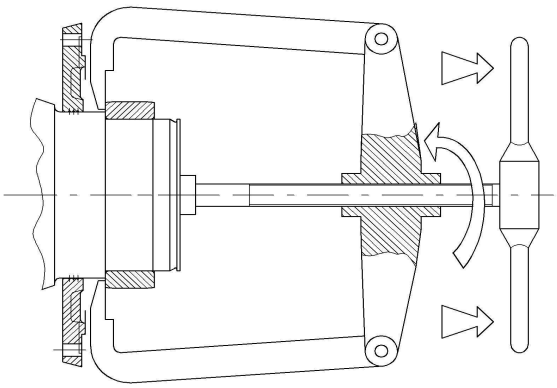


Fig. 6.f – NDE bearing extraction

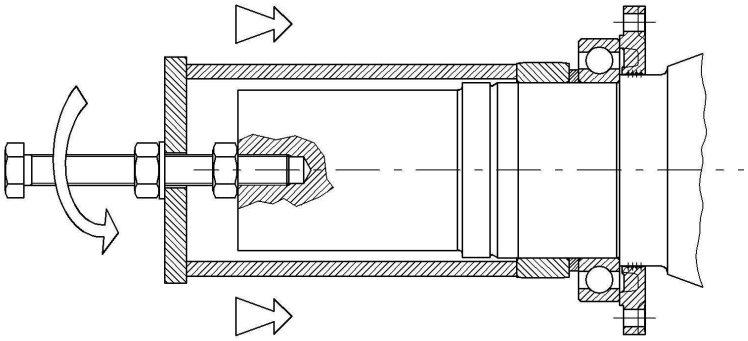


Fig. 6.g – Keying DE bearings

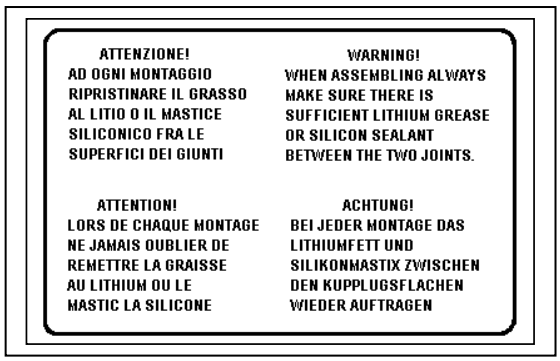
6.9 Re-assembly of the machine

Proceed in the opposite way to disassembly

6.10 Moving the terminal box

When particular installation requirements make it necessary to position the terminal box on a different side to that initially forecasted, the operation must be carried out by qualified staff.

Contact SICMESERVICE for information.



7. TROUBLESHOOTING

If abnormal phenomenon should occur during working or start-up of the machine, the cause must be searched for immediately and eliminated.
Some probable anomalies, their cause and solutions are examined below, (tab. 7.1 – 7.2 – 7.3.1 – 7.3.2).
For phenomenon not mentioned in the tables or not well-identified, please contact SICMEMOTORI.

DANGER!
Before carrying out any interventions on the machine disconnect the mains power supply!

7.1 Mechanical faults

Anomaly	Possible causes	Solutions	See point
Vibrations in uncoupled machine	Faulty bearings	Replace the bearings	6.8
	Unbalanced half-joint	Balance the machine with half-joint	5.4
	Foundation bolts loosened	Tighten and block bolts	2.2
Vibrations in coupled machine	Machine coupled or unbalance joint	Check balance	5.4
	Alignment fault	Check coupling	3
	Faulty bearings	Check the bearings	5.4
	Power supply fault (inverter badly calibrated) or fault in coupled machine	Check activation, control, the commanded machine and alignment	4.7
	Motor foundation bolts or alignment components loosened	Tighten and block bolts	2.2
	Faulty speed transducer	Check and replace the speed transducer if required	5.15 – 5.16 6.2.1 6.2.2
Anomalous heating of the bearings immediately after start-up or greasing	Excessive amount of grease	Remove the excess grease	
	Excessive axial load	Check axial load	5.7
Anomalous heating of the bearing after a long functioning period	Friction of the grease-guard of the bearing on the shaft	Replace the bearing sealing ring and rework the grease-guard	6.8
Whistling at the bearings, noisy bearings	Not enough grease	Grease	5.9
	Faulty bearing	Replace the bearing	6.8
	Noisy cage	Leave the machine to work under tight control	*
Excessive bearing consumption	Excessive load on bearing	Reduce radial load, eliminate axial load	5.6 – 5.7
Bearing track marked, with machine in service (burns)	Bearings passed by Eddy-currents	Stop the machine and contact SICMEMOTORI	
Noise and vibrations coming from the brake, motor has difficulty reaching max. speed**	Air gap too big, brake not powered correctly	Check the air gap and brake power supply	5.20
Leaks from the cooling circuit (for AW series motors)	Incorrectly tightened corrections, cooling liquid supply pressure too high, assembly of motor n base not perfectly level, deformation of the motor structure	Check tightness of the connections. If the leak does not stop, return the motor to SICMEMOTORI. Consult SICMESERVICE. **DO NOT START-UP!**	
Long braking, little braking torque, noises and vibrations**	Wear of friction material	Check if it is necessary to replace worn components	5.20

* The cages tend to adapt with time
** For motors with brake

Table 7.1 – Mechanical faults

7.2 Electrical faults

Anomaly	Possible causes	Solutions	See point
Motor doesn't start-up unloaded	No power supply voltage	Check the power supply	4.1
	Phase missing	Check the power supply	4.1
	Interruption of a winding	Repair the winding	
	Motor phases sequence not in agreement with those of the inverter/encoder	Check the connections	4.1
	Inverter calibrated incorrectly	Check inverter calibration	4.7
	Motor parameters incorrect or not introduced	Check inverter parameterization	4.7
	Transducer not functioning, incompatible or incorrectly connected	Check connections with the transducer, replace it if necessary	
	Brake not released*	Release the brake (check the power supply)	5.20
Motor that turns with jumps (not desired)	????		
Motor does not start when coupled	Excessive load	Check the current absorbed and eliminate the overload	
	See "Motor doesn't start-up unloaded"	See "Motor doesn't start-up unloaded"	
	Brake not released*	Release the brake (check the power supply)	5.20
	Low power supply voltage	Check the power supply	4.1
Motor functions slowly only in one direction and does not adjust speed	Connection of the motor phases not in compliance with inverter specifications	Check the electric connections	4.1 – 4.3
	Motor phases sequence not in agreement with those of the inverter/transducer	Check phase sequence	4.1
	Transducer not functioning, connected incorrectly or not compatible with the inverter	Check connections with the transducer, replace it if necessary	
	Brake not released*	Release the brake (check the power supply)	5.20
Motor does not stabilise itself at pre-selected speed	Connection of the motor phases not in compliance with inverter specifications	Check electric connections	4.1 – 4.3
	Transducer not functioning, connected incorrectly or not compatible with the inverter	Check connections with the transducer, replace it if necessary	
	Inverter parameters incorrect, speed ring not adjusted, incorrect gain	Check inverter parameterization	4.7
	Speed ring not adjusted, incorrect gain	Check inverter calibration	4.7
Excessive heating (heat probe intervention)	Excessive overload	Check voltage and current	
	Incorrect power supply, inverter broken or incorrectly calibrated	Check phase absorption check inverter functionality	4.1 – 4.7
	Transducer not functioning	Check the transducer and replace it if necessary	5.15 - 5.16 6.2.1 – 6.2.2
	Insufficient ventilation	Check if filters are blocked, remove any obstacles to air passage, clean the air adduction pipe, check the direction of rotation of the electric fans	5.13
	Temperature of the heat exchanger cooling air or water too high	Check the ventilation circuits and clean if necessary. Use air or cooling water at the temperature indicated by SICMEMOTORI	Appendix
	Environmental temperature too high	Suspend the service. Consult SICMEMOTORI	
	Inspection hatches open or closed incorrectly	Fasten the hatches	
	Brake not released*	Release the brake (check the power supply)	5.20
Excessive heating (only for AW series motors)	Cooling liquid not present, insufficient or not circulating	Check the cooling liquid power supply circuit	

Anomaly	Possible causes	Solutions	See point
	Air bubbles	Check the cooling liquid power supply circuit	
	Liquid input temperature too high	Check the cooling liquid power supply circuit	
	Liquid filter blocked, lime scale and/or impurities, discharge blocked liquid	Clean the cooling circuit and filter	
Transducer functioning incorrectly	Insufficient or incorrect power supply	Check transducer power supply	5.16
	Anomalous connections or with false contacts	Check the connections	2.2
	Transducer electrical data not compatible with the inverter	Replace the transducer	6.2.1 – 6.2.2
Low insulation resistance	Condensation, humidity, water, oil, oil vapours, present inside the motor	Clean the motor; take in cooling air from a clean environment.	
	Insulation deteriorated	Rewind the motor. Consult SICMESERVICE	
Motor to earth or in short circuit	Condensation, humidity, water, oil, oil vapours, present inside the motor contamination from chemical agents	Clean the motor; take in cooling air from a clean environment. If this is not enough, consult SICMESERVICE	4.3
	Excessive windings temperature	Check functioning parameters. Consult SICMESERVICE	2
	Excessive vibrations	Check alignment to the load; check the base; check any vibrations coming from the controlled machine, check the power supply. Consult SICMESERVICE	2
	Insulation in hollow or of the wire deteriorated or damaged mechanically	Rewind the motor. Consult SICMESERVICE	

* For motors with brake

Table 7.2 – Electrical faults

8. INSTRUCTIONS FOR ELECTRICAL REPAIRS

When the repairs consist in rewinding the stator coils, contact an adequately equipped export repair workshop.
On request, SICMEMOTORI will send an updated list of approved workshops.
Particular attention must be given to the materials to be used. Specific indications for each machine, together with layouts and winding instructions, will b e put at disposal by SICMEMOTORI on request, using the fastest means.
Some general indications are given, which must always be kept in mind:

Component	Recommended material	Class
Wires	Enamelled copper	H; H+
Slides	Enamelled copper, double glass turn + enamel	H; H+
Insulation towards earth	Nomex	H
Insulating flanges	Polyester	H
Windings impregnation	Oven-dry phenolic resin	H
Windings surface protection	Transparent bicomponent resin	-
Other materials	Ask SICMESERVICE	

Table 8 – Materials recommended for electrical repairs

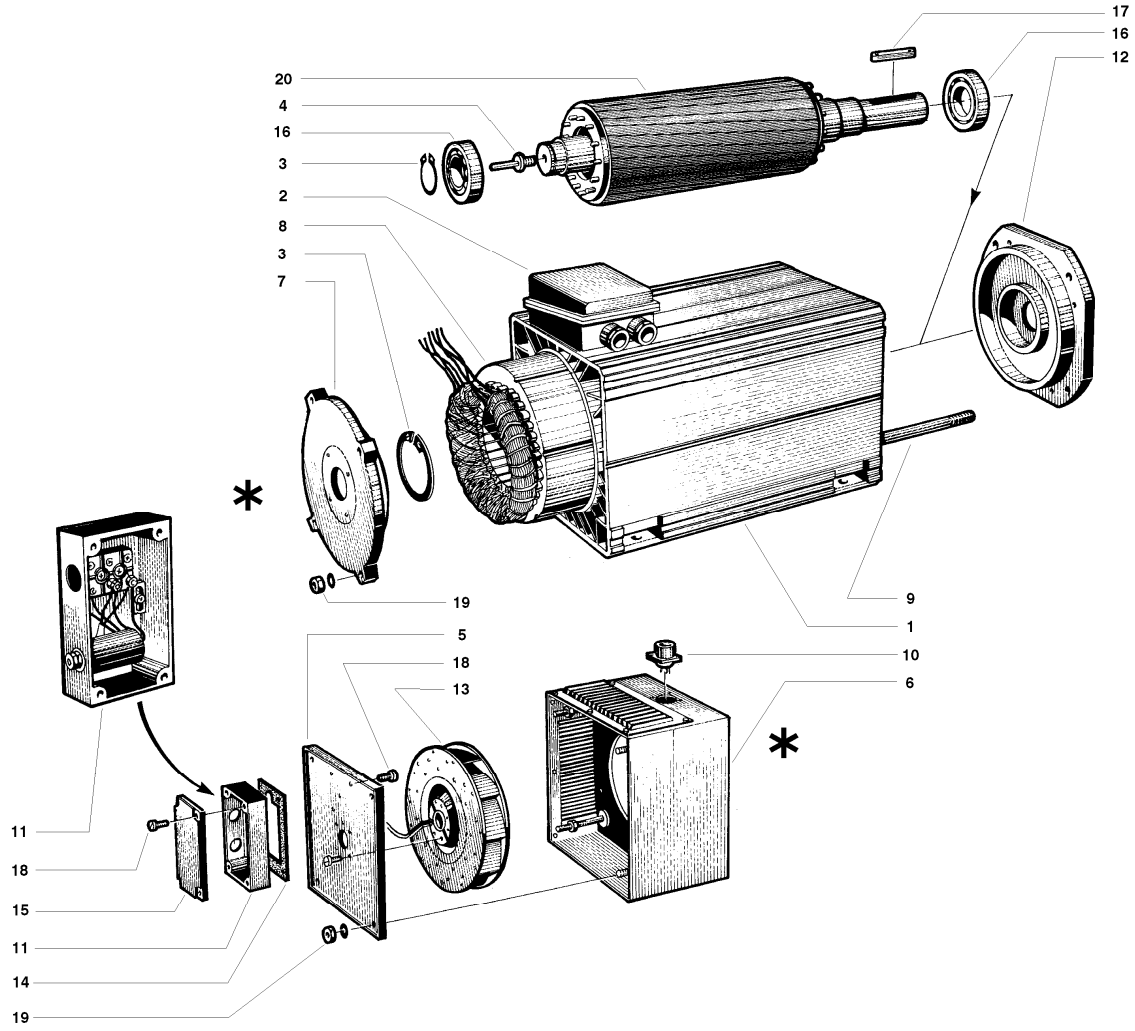
9. RECOMMENDED SPARE PARTS

An appropriate stock of spare parts allows to ensure continuity of service to the plant and solve standstills due to faults as quickly as possible. When ordering spare parts it is always necessary to indicate the type of machine, the serial number and plate data.
The amount of spare parts to be kept at disposal depends on the amount of the same machines used and the importance attributed to standstill time. Table 9 indicates the minimum amount to be kept in stock:

Spare parts	Same machines in service			
	1	2-3	4-6	=>7
Filter	1	2	3	4
Complete electric fan	-	-	1	2
Bearing pack	1	1	1	2
Rotor	-	1	1	1
Speed transducer	-	1	1	2
Complete machine	-	-	1	1

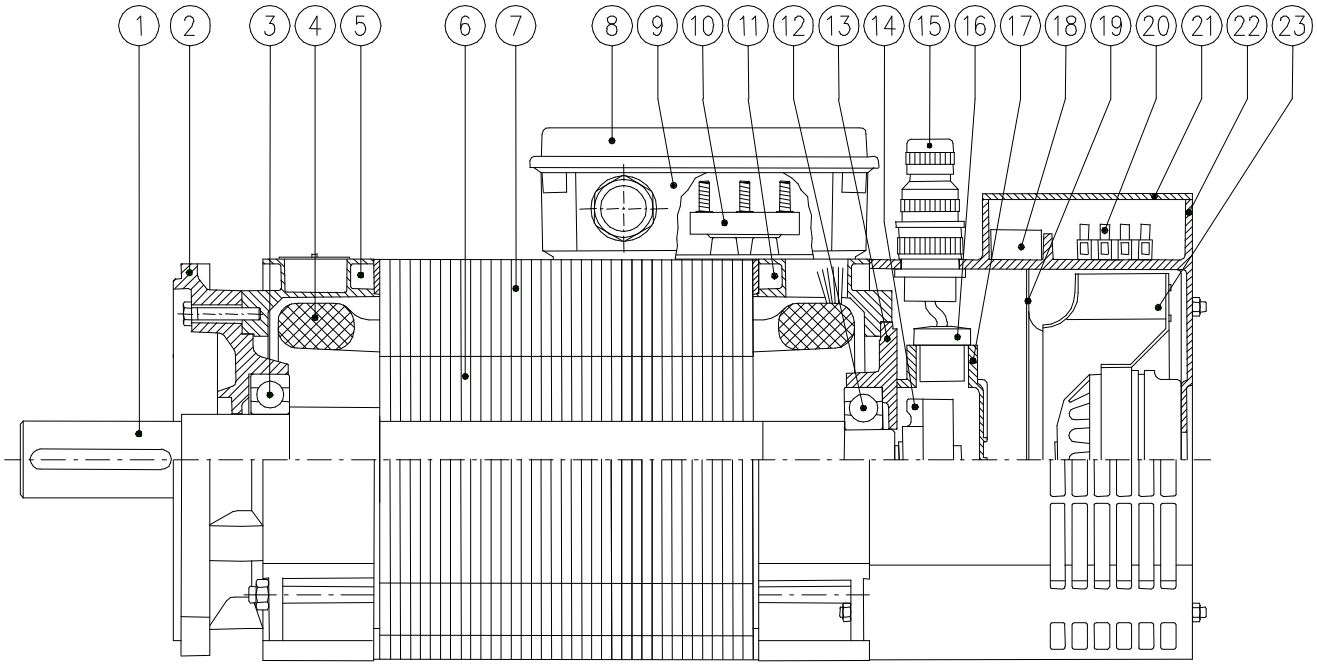
Table 9 – Recommended spare parts

10. LAYOUT DIAGRAMS AND NOMENCLATURE



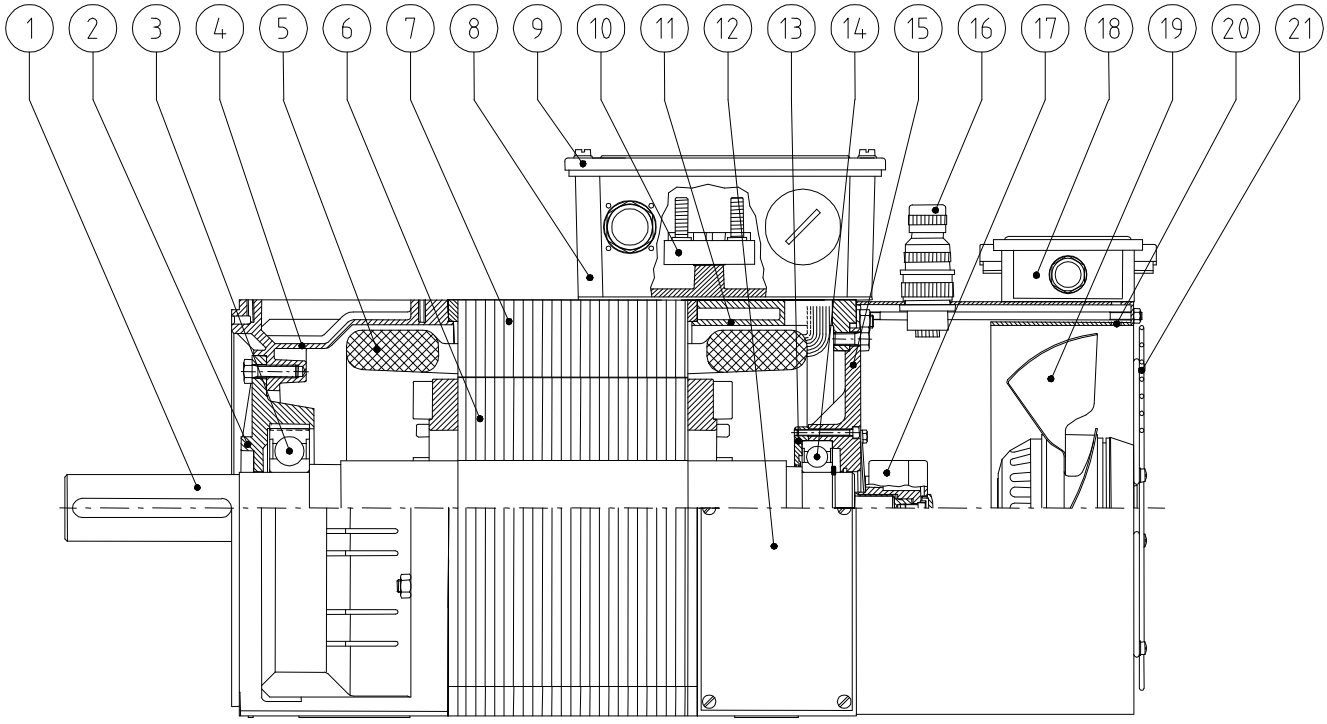
1	Extruded motor casing
2	Motor clamp
3	Seeger
4	Transducer support pin
5	Fan support
6	Fan-transducer module
7	DE Cover opposite
8	Wound stator
9	Tie-rod for motor cover
10	Encoder-resolver connector
11	Fan terminal board cover
12	DE flanged cover
13	Electric fan
14	Seal
15	Fan terminal board cover
16	Bearing
17	DE key
18	Screw fasteners
19	Fixing nuts
20	Rotor unit

Fig. 10.1 - ACVc71-90 motors layout diagram



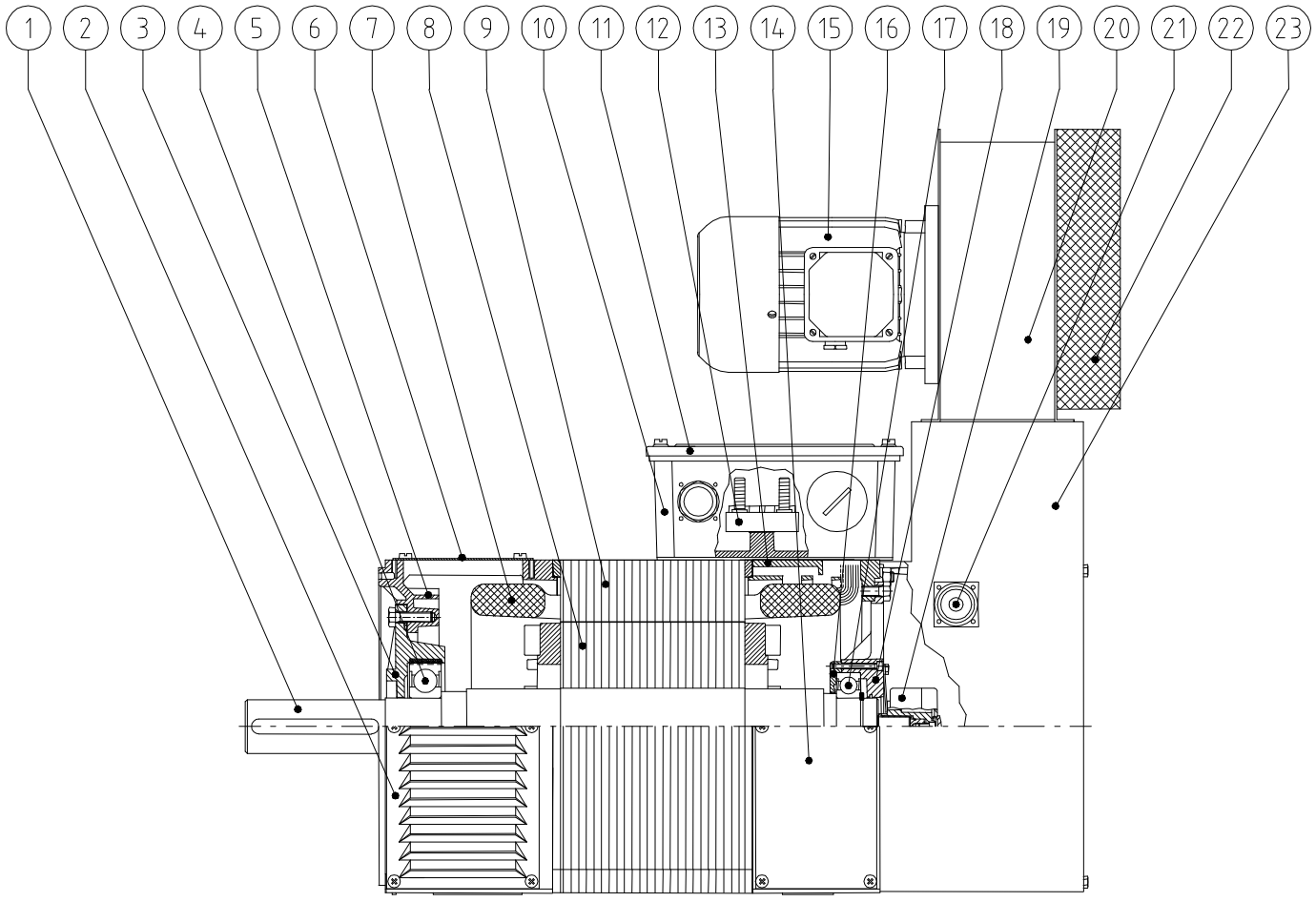
1	Shaft
2	Flange
3	DE bearing
4	Winding
5	DE cover
6	Rotor
7	Stator
8	Terminal board cover
9	Terminal board-holder
10	Terminal board
11	NDE Cover
12	NDE Bearing
13	NDE Bearing support
14	Transducer
15	Transducer connector
16	Sealing ring
17	Transducer cover
18	Condenser
19	Fan membrane
20	Electric fan terminal board
21	Electric fan terminal board cover
22	Fan-holder
23	Electric fan

Fig. 10.2 - AQCa100 motors layout diagram



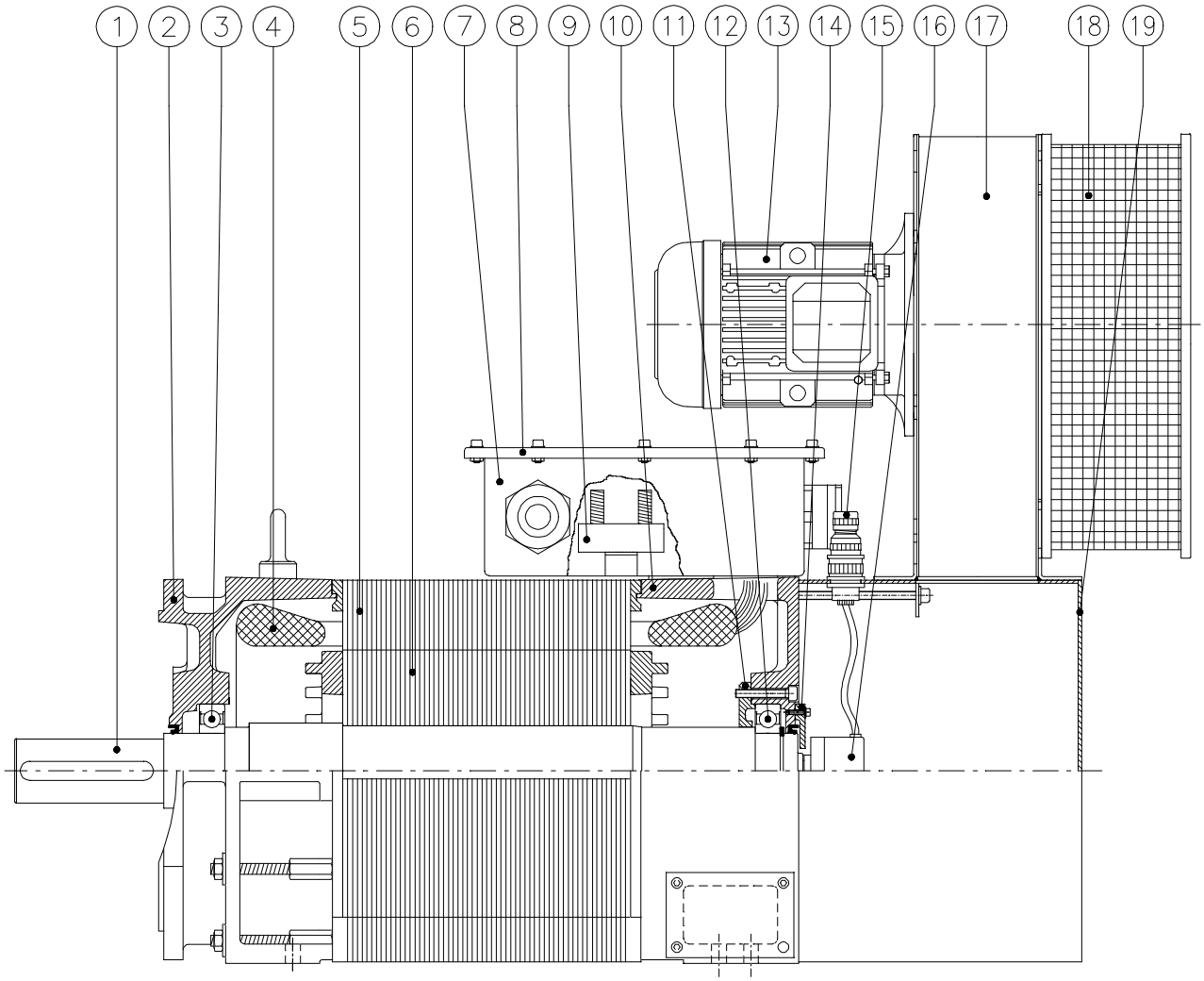
1	Shaft
2	DE bearing support
3	DE bearing
4	DE cover
5	Winding
6	Rotor
7	Stator
8	Terminal board holder
9	Terminal board cover
10	Terminal board
11	Cover side opposite coupling
12	Door closed side opposite coupling
13	Grease-guard flange/bearing block
14	NDE Bearing
15	NDE Bearing support
16	Transducer connector
17	Transducer
18	Electric fan terminal board holder
19	Electric fan
20	Fan-holder
21	Electric fan grid

Fig. 10.2.1 - BQCp132-160-180 motors layout diagram



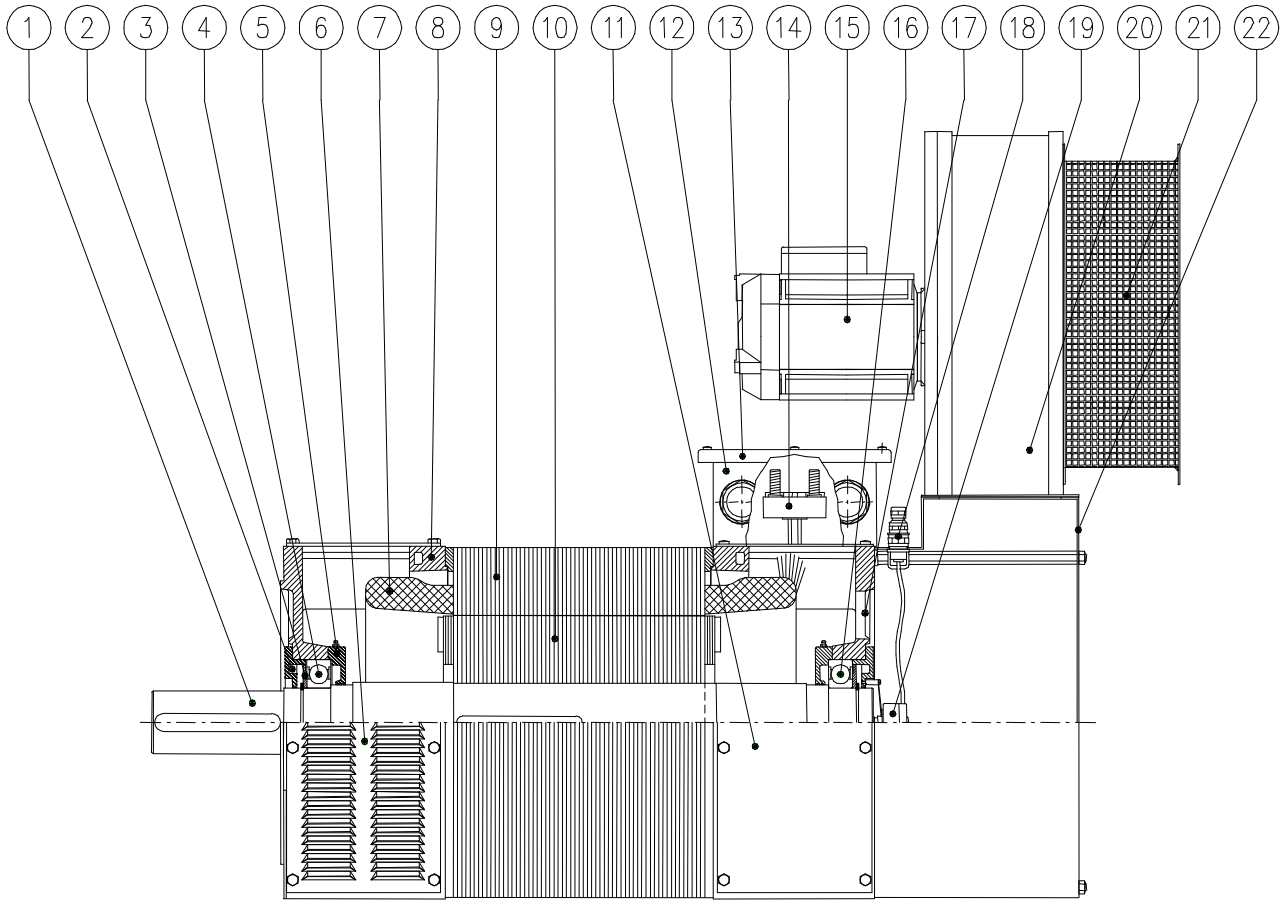
1	Shaft
2	DE door closed
3	DE bearing support
4	DE cover
5	DE bearing
6	Electric fan
7	Winding
8	Fan motor
9	Stator
10	Rotor
11	Terminal board-holder
12	Terminal board-holder cover
13	Terminal board
14	NDE Grid door
15	Side opposite coupling cover
16	Grease-guard flange/bearing block
17	NDE Bearing
18	NDE Bearing support
19	Transducer connector
20	Transducer
21	Transducer cover
22	Closure cotter pin

Fig. 10.3 –BQAr-BQCr132-160 motors layout diagram



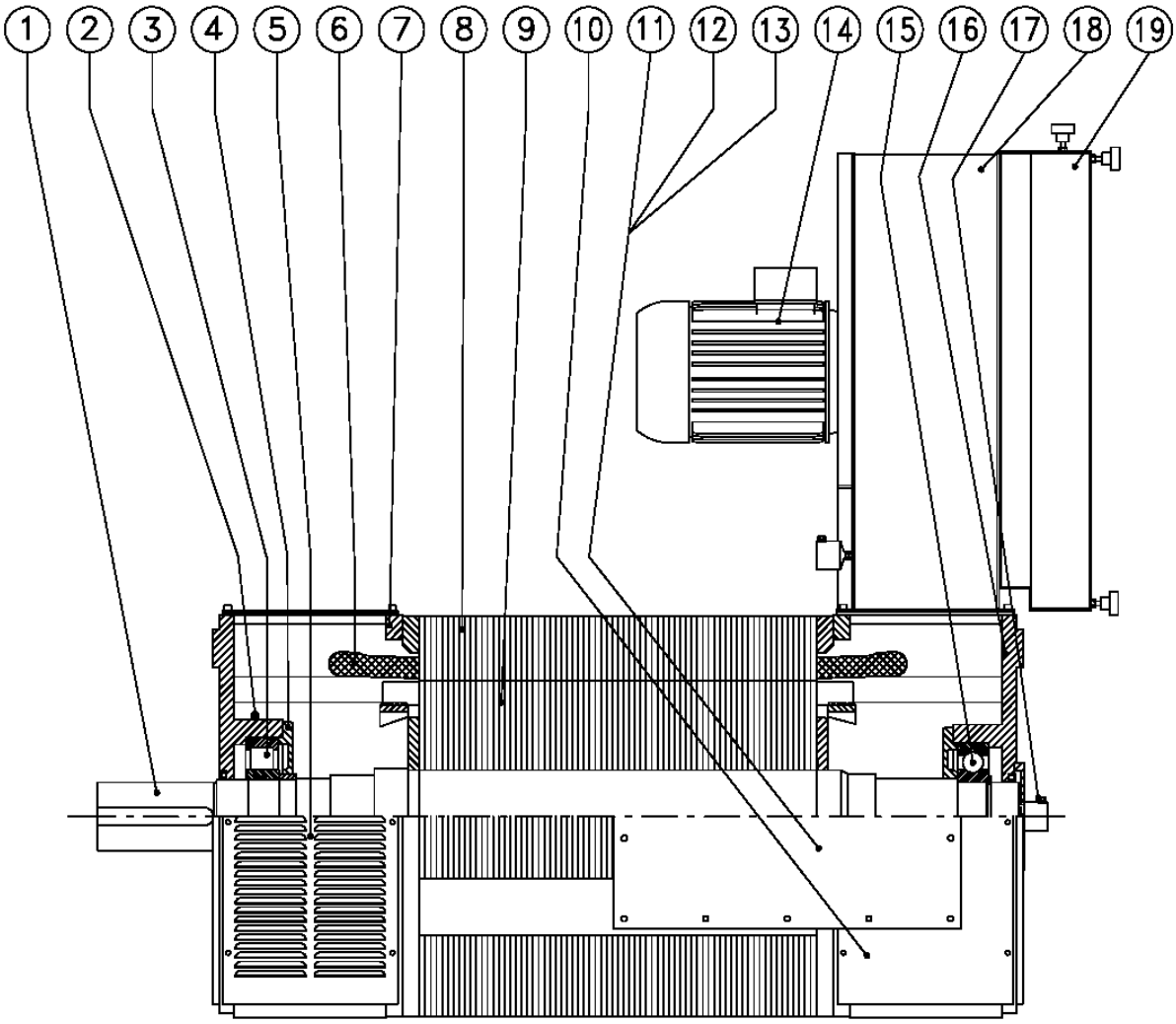
1	Shaft
2	DE cover
3	DE bearing
4	Winding
5	Stator
6	Rotor
7	Terminal board-holder
8	Terminal board cover
9	Terminal board
10	NDE Cover
11	Grease-guard flange/bearing block
12	NDE Bearing
13	Electric fan motor
14	Rear grease-guard flange
15	Transducer connector
16	Transducer
17	Fan
18	Air filter
19	Fan-holder

Fig. 10.4 –BQAr-BQCr-AJ180-225 motors layout diagram



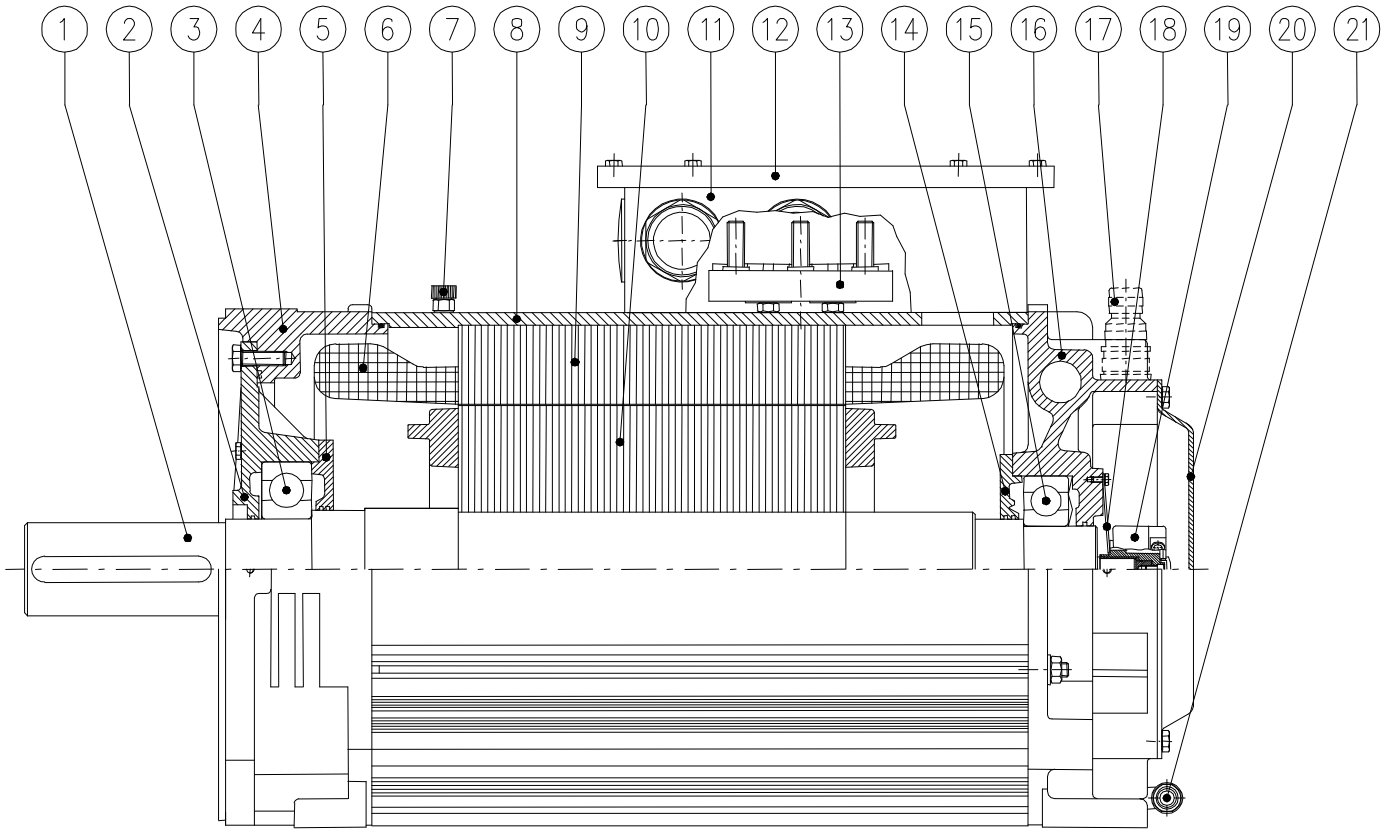
1	Shaft
2	Bearing blocking flange
3	Grease valve
4	DE bearing
5	Grease-guard flange
6	DE Grid door
7	Winding
8	DE cover
9	Stator
10	Rotor
11	NDE Door closed
12	Terminal board-holder
13	Terminal board cover
14	Terminal board
15	Electric fan motor
16	NDE Bearing
17	NDE Cover
18	Transducer connector
19	Transducer
20	Fan
21	Air filter
22	Fan-holder

Fig. 10.5 –BQAr-BQCr-AJ280 motors layout diagram



1	Shaft
2	Grease valve
3	DE bearing
4	Grease-guard flange
5	DE Grid door
6	Winding
7	DE cover
8	Stator
9	Rotor
10	NDE Door closed
11	Terminal board-holder
12	Terminal board cover
13	Terminal board
14	Electric fan motor
15	NDE Bearing
16	NDE Cover
17	Transducer connector
18	Transducer
19	Fan
20	Air filter

Fig. 10.6 - BQ355 motors layout diagram



1	Shaft
2	Bearing support flange
3	Command side bearing
4	Command side cover
5	Grease-guard flange
6	Winding
7	Air valve
8	Casing
9	Stator
10	Rotor
11	Terminal board-holder
12	Terminal board cover
13	Terminal board
14	Grease-guard flange
15	NDE Bearing
16	NDE Cover
17	Transducer connector
18	Reaction arm transducer
19	Transducer
20	Transducer cover
21	Liquid refrigerant input/output

Fig. 10.7 – AW motors layout diagram

APPENDIX

B AIR-AIR HEAT EXCHANGER

Normally the air-air heat exchanger is mounted on the upper part, which is totally enclosed.

b.1 Description of the air-air heat exchanger

The exchanger is composed of the following main components (see fig 1).

Casing (2.0)
Air filter (3.0)
Tubes (4.0)
Internal circuit electric fan (5.0)
External circuit electric fan (6.0)
Terminal box (7.0)
Control appliances

Figure 1 highlights internal and external air flow

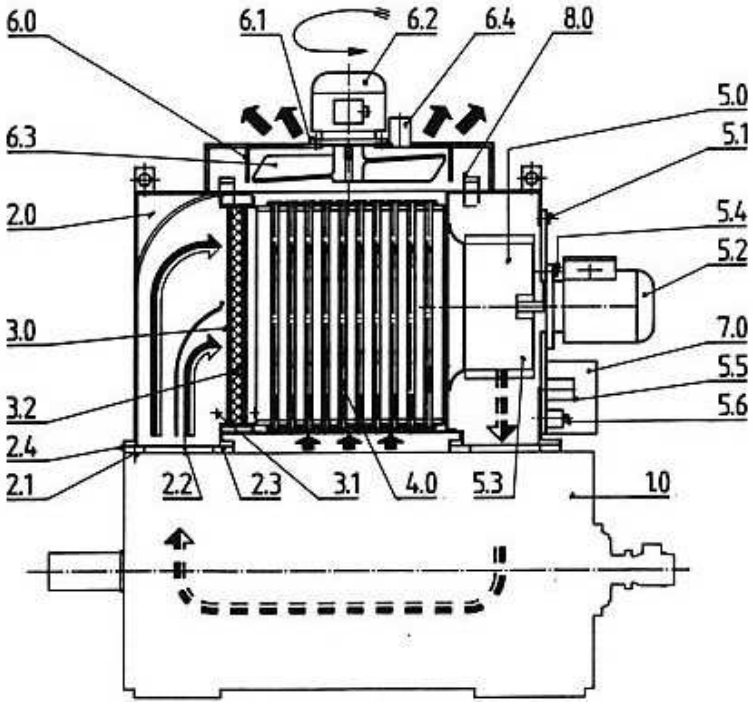


Fig. 1 – Air-air heat exchanger

External circuit – environmental air

Internal circuit – hot air coming from the machine

Internal circuit – cold air coming from the exchanger

AC machine
2.0 Casing
2.1 Screw fasteners fixing plate to machine
2.2 Screw fasteners fixing exchanger to the plate
2.3 Plate
2.4 Seal
3.0 Filtering unit
3.1 Filter cover fixing nuts
3.2 Filtering panel
4.0 Tubes
5.0 Internal circuit electrical fan unit
5.1 Electrical fan unit fixing nuts
5.2 Internal circuit asynchronous motor
5.3 High pressure impeller
5.4 Asynchronous motor fixing nuts
5.5 Internal circuit air pressure gauge
5.6 Internal circuit air thermostat
6.0 External circuit electrical fan unit
6.1 Asynchronous motor fixing nuts
6.2 External circuit asynchronous motor
6.3 Axial fan
6.4 External circuit pressure gauge
7.0 Heat exchanger terminal box
8.0 Adjustable hook closure

Fig. 3 – Nomenclature relative to figure 1

b.2 Casing
The casing 2.encloses and protects the filter 3.0, the cooling battery with tubes 4.0 and the electric fan 5.0 for the circulation of cooling air inside the machine 1.0. An attachment flange with two openings for air inlet outlet, for closed cycle circulation, is envisioned for mounting on the machine. It is connected to the motor using screws 2.1 with the positioning of a frame 2.3 for quick removal and connected to the exchanger using screws 2.2. The chloroprene rubber seals 2.4 obtain sufficient tightness.

b.3 Air filter
The filter for the internal air 3.0 is mounted at the entry to the tubes in the internal ventilation circuit. It is removable, can be regenerated and is self-extinguishing.

b.3.1 Extraction of the filter
Loosen the nuts 3.1 and remove the cover of the filtering unit; extract the filter using the relevant extraction holes.

b.3.2 Regeneration of the filtering cloth
The filtering panel 3.2 can be regenerated and does not need to be replaced if not only after a certain number of washing cycles. The filter is cleaned by blowing it with pressurised air, beating or suction, or rinsing it in warm water up to 40℃ using a mild detergent. Petrol can be used in extreme cases. Do not wring after washing. Allow the filter to dry before re-mounting. When the operation has been completed, re-introduce the filter into the casing and tighten the nuts 3.1 on the cover. Check the filter for blocking periodically, to prevent excessive load loss in the ventilation circuit if the pressure gauge 5.5 (see point b.8) should be incorrectly calibrated or broken.

b.4 Cooling battery
The battery 4.0 is made up of a tubes realised with aluminium pipes chucked onto longitudinal slotted plates. It is treated with resins in order to ensure tightness.

b.4.1 Cleaning the tubes
Release the hook closing device levers 8.0 that block the cooling circuit unit outside of the casing 2.0 and lift this unit to expose the pipe entry. Clean the tubes by blowing with clean, dry pressurised air (2-3 bar).

b.5 Internal circuit electric fan
The internal circulation of the closed cycle air for cooling the DC machine takes place by means of an electric fan. This is composed of an asynchronous three-phase motor 5.2 and high pressure impeller 5.3. After filtering, the hot air goes back into circulation, cooling down on passage through the tubes. The correct direction of fan rotation is indicated by an arrow. It is important to make sure the impeller is clean, as the present of dirt and deposits can cause unbalancing, with consequent vibrations.

b.5.1 Cleaning internal air circuit impeller
Loosen nuts 5.1 that block the electric fan unit to the casing 2.0 and slide the motor-impeller from the casing. Clean the blades using a jet of pressurised air and eventually by brushing or washing. Re-mount the electric fan and tighten the nuts 5.1.

b.6. External circuit electric fan
The environmental air is made to circulate inside the cooling battery tubes. The air circulation takes place by means of the electric fan 6.0 that sucks in the air from below and upwards by means of the axial fan 6.3 activated by the three-phase asynchronous motor 6.2. The correct direction of rotation is indicated by an arrow.

b.6.1 Cleaning external air circuit impeller

To check the state of cleanliness of the impeller release the hook closing device levers 8.0 that block the unit to the casing 2.0 and lift it to make the fan accessible. Clean using a jet of pressurised air and eventually by brushing or washing. Re-mount and attach the hook closing device levers 8.0.

b.7 Air-air heat exchanger terminal box

The exchanger has a terminal box 7.0 for the connection of all control devices and for the power supply of the asynchronous motors.

b.8 Control appliances (see layout in fig. 5)

The exchanger has two pressure gauges 5.5 and 6.4 to indicate any anomalies (excessive pressure drops) in the internal or external air circuits. A thermostat 5.6 is also envisioned in the internal circuit, in order to signal excessive air temperature on entry to the machine. The pressure gauge 5.5 and the thermostat 5.6 are mounted inside the terminal box 7.0.

DANGER!

Before carrying out any maintenance operations ensure that the electrical machine and the heat exchanger fans are disconnected from the mains.

b. 9 Recommended maintenance cycle

Component	Operation	Frequency (hours)
Filter	Check for blockage and cleaning	750
Cooling battery	Cleaning the tubes	4000
Internal and external circuit electric fans	Cleaning the impeller	8000
Control appliances	Check appliance efficiency and check tightness of electrical connections	2500
Sealing ring	Replacement of all seals	15000
Screws	Check for any loosening	2500

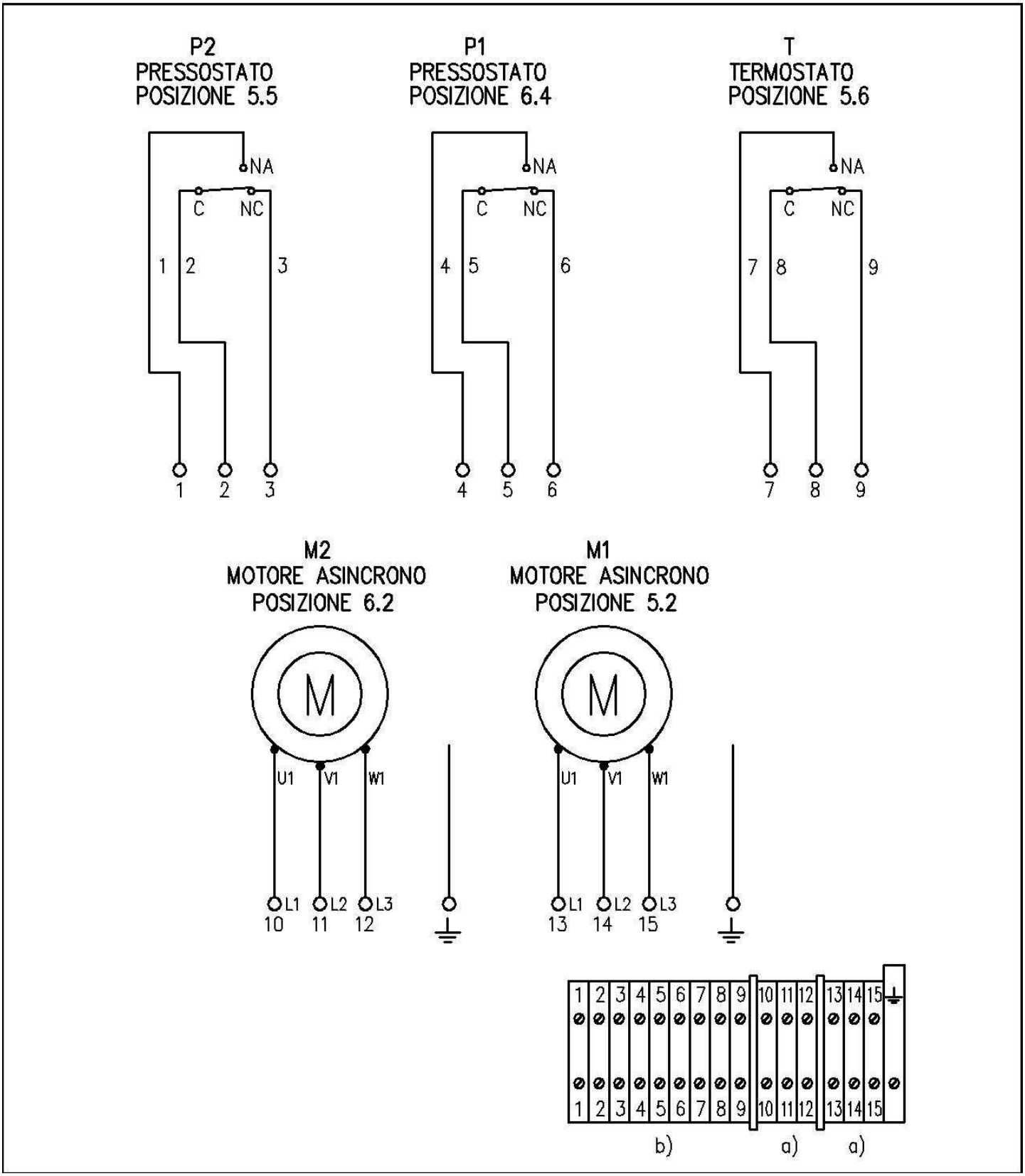


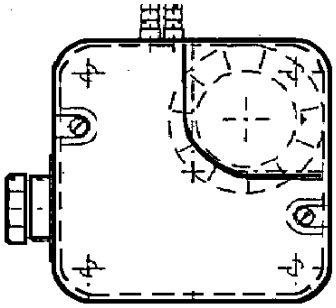
Fig. 5 – Air-air heat exchanger wiring diagram

Power supply from three-phase line (400 V – 50 Hz except for different indications)
Power supply from single-phase line (230 V - 50 Hz except for different indications)

b.10 Calibration of control appliances

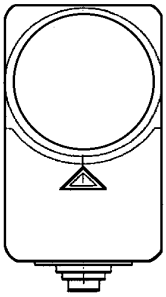
-Internal air pressure gauge:
The internal air pressure gauge is calibrated in our test chambers. In the case of replacement or anomalous functioning of the pressure gauge, follow the instruction below for calibration.

1) Position the relative knob in proximity of the minimum calibration value.
2) Activate ventilation.
3) Turn the knob slowly in a clockwise direction until the contact switches.
4) Turn the knob **in an anti-clockwise** direction again for a few (≅ 0.2 - 0.3 mbar).
5) Deactivated the ventilation and check, much before the fan is at a complete standstill that the contact returns to the rest position.



-Internal air thermostat:
The internal air thermostat is calibrated in our test chambers. If it is replaced or functions abnormally, follow the instructions below to re-calibrate.

1) Turn the relevant knob in proximity of the environmental temperature.
2) Check that the contact switches.
3) Turn the knob again, setting it in proximity of the temperature of 45/55°C. If the machine is installe d in a place where the environmental temperature is not within–20°C ÷ +40° C, consult SICMEMOTORI.
4) Check the contact returns to the rest position.



C AIR-WATER HEAT EXCHANGER

Normally the air-water heat exchanger is mounted on the upper part of the motor, which is totally enclosed.

c. 1 Description of the exchanger

The air-water exchanger is composed of (see fig. 6):

Casing (2.0)
Air filter (3.0)
Air-water cooling battery (4.0)
Electric fan (5.0)
Exchanger terminal box (6.0)
Control appliances

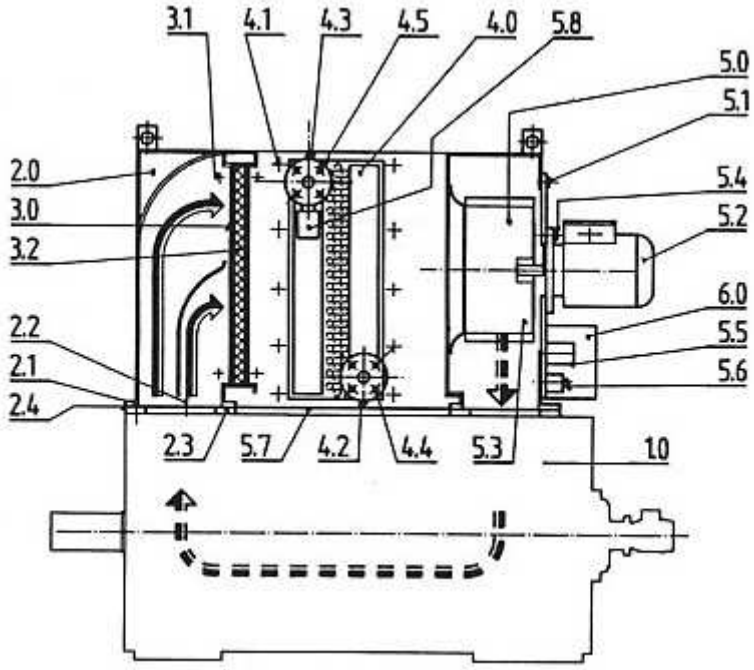


Fig. 6 – Air-water heat exchangers

Hot air coming from the machine

Cold air coming from the exchanger

1.0 AC machine.
2.0 Casing
2.1 Screw fasteners fixing plate to machine
2.2 Screw fasteners fixing exchanger to the plate
2.3 Plate
2.4 Seal
3.0 Filtering unit
3.1 Filtering unit cover nuts
3.2 Filtering cloth
4.0 Air-water cooling battery
4.1 Cooling battery screw fasteners
4.2 Plug on delivery pipe
4.3 Plug on discharge pipe
4.4 Flange on delivery pipe
4.5 Flange on discharge pipe
5.0 Electric fan
5.1 Electric fan screw fasteners
5.2 Asynchronous motor
5.3 Impeller
5.4 Asynchronous motors screw fasteners
5.5 Pressure gauge
5.6 Thermostat
5.7 Water leak indicator
5.8 Flow meter
6.0 Heat exchanger terminal box

Fig. 8 - Nomenclature relative to figure 6

c.2 Casing

The casing 2.0 encloses and protects the filter 3.0, the cooling battery 4.0 and the electric fan 5.0 An attachment flange with two openings for air inlet outlet, for closed cycle circulation, is envisioned for mounting on the machine.. It is connected to the motor using screws 2.1 with the positioning of a frame 2.3 for quick removal and connected to the exchanger using screws 2.2. The chloroprene rubber seals 2.4 obtain sufficient tightness.

c.3 Air filter

The filter 3.0 is mounted at the entry to the cooling battery. It is removable, can be regenerated and is self-extinguishing.

c.3.1 Extraction of the filter

Loosen the nuts 3.1 and remove the cover of the filtering unit; extract the filter using the relevant extraction holes.

c.3.2 Regeneration of the filtering cloth

The filtering panel 3.2 can be regenerated and does not need to be replaced if not only after a certain number of washing cycles. The filter is cleaned by blowing it with pressurised air, beating or suction, or rinsing it in warm water up to 40°C using a mild detergent. Petrol can be used in extreme cases. Do not wring after washing. Allow the filter to dry before re-mounting. Re-mount and tighten the nuts 3.1. Check the filter for blocking periodically, to prevent excessive load loss in the ventilation circuit

c.4 Cooling battery

The battery 4.0 is made up of copper tubes within an aluminium foil core. Water passes through the pipes. The air washes against the aluminium foil, which removes the heat and transmits it by conduction to the pipes. Attention to the features of the water: except on different agreements, the exchangers are envisioned for industrial or rural freshwater, without substances in suspension and dimensioned for water entering at the maximum temperature of 26°C and maximum pressure of 7 bar. The tubes end with normalised flanges 4.4 and 4.5 for attachment of the water delivery and discharge pipes. Plug 4.2 is mounted on the delivery pipe for drainage. Plug 4.3 is mounted on the return pipe for bleeding.

c.4.1 Cleaning inside the pipes

Close the gate valve (not included in our supply), positioned upstream from the delivery flange in order to interrupt the distribution of water. Remove plug 4.2 on the delivery pipe in order to completely empty the battery of water, remove plug 4.3 and introduce a jet of pressurised air inside the copper pipes, in order to eliminate dirt and deposits. If necessary, wash using a descaling agent. In order to reduce the danger of the formation of deposits inside the pipes, use suitable detergents periodically.

c.4.2 Cleaning outside of the tubes

Loosen the screws 4.1 that block the battery onto the casing. Remove the battery from the casing and clean the tubes using a jet of pressurised air or by washing to eliminate any dust deposits. Re-mount the battery and fasten the screws 4.1.

c.5 Electric fan

The electric fan 5.0 circulates the air in the machine-exchanger closed cycle; is made up of a three-phase asynchronous motor 5.2 and the impeller 5.3. The correct direction of rotation is indicated by an arrow.

c. 5.1 Cleaning the fan impeller

To check the status of cleaning of the impeller loosen screws 5.1 that block the electric fan unit onto the casing and remove the motor-impeller from the casing. Deposits on the impeller can cause unbalancing, with consequent vibrations. Clean using a jet of pressurised air, by brushing or washing. Re-mount the electric fan and tighten the screws 5.1.

c.6 Air-water heat exchanger terminal box

The exchanger has a terminal box 6.0 for the connection of all control appliances and for the power supply of the asynchronous motor.

c.7 Control appliances (see layout in fig. 9)

in the standard version the exchanger has:

- a pressure gauge 5.5 on the air circuit to signal any abnormal drops in pressure.
- a thermostat 5.6 to signal excessive air temperature on entry to the machine.
- a flow meter 5.8 to signal an excessive reduction of the water capacity.
- a water leak indicator 5.7 (limited to the exchangers for machines in the 225 range and above).

The pressure gauge 5.5 and the thermostat 5.6 are mounted inside the terminal box 6.0.

DANGER!

Before carrying out any maintenance operations ensure that the electrical machine and the heat exchanger fans are disconnected from the mains.
Also ensure that the cooling water gate valves are closed.

c. 8 Recommended maintenance cycle

Component	Operation	Frequency (hours)
Filter	Check for blockage and cleaning	750
Cooling battery	Cleaning the outside of the tubes	4000
	Complete cleaning	8000
Electric fan	Cleaning the impeller	8000
Control appliances	Check appliance efficiency and check tightness of electrical connections	2500
Sealing ring	Replacement of all seals	15000
Screws	Check for any loosening	2500

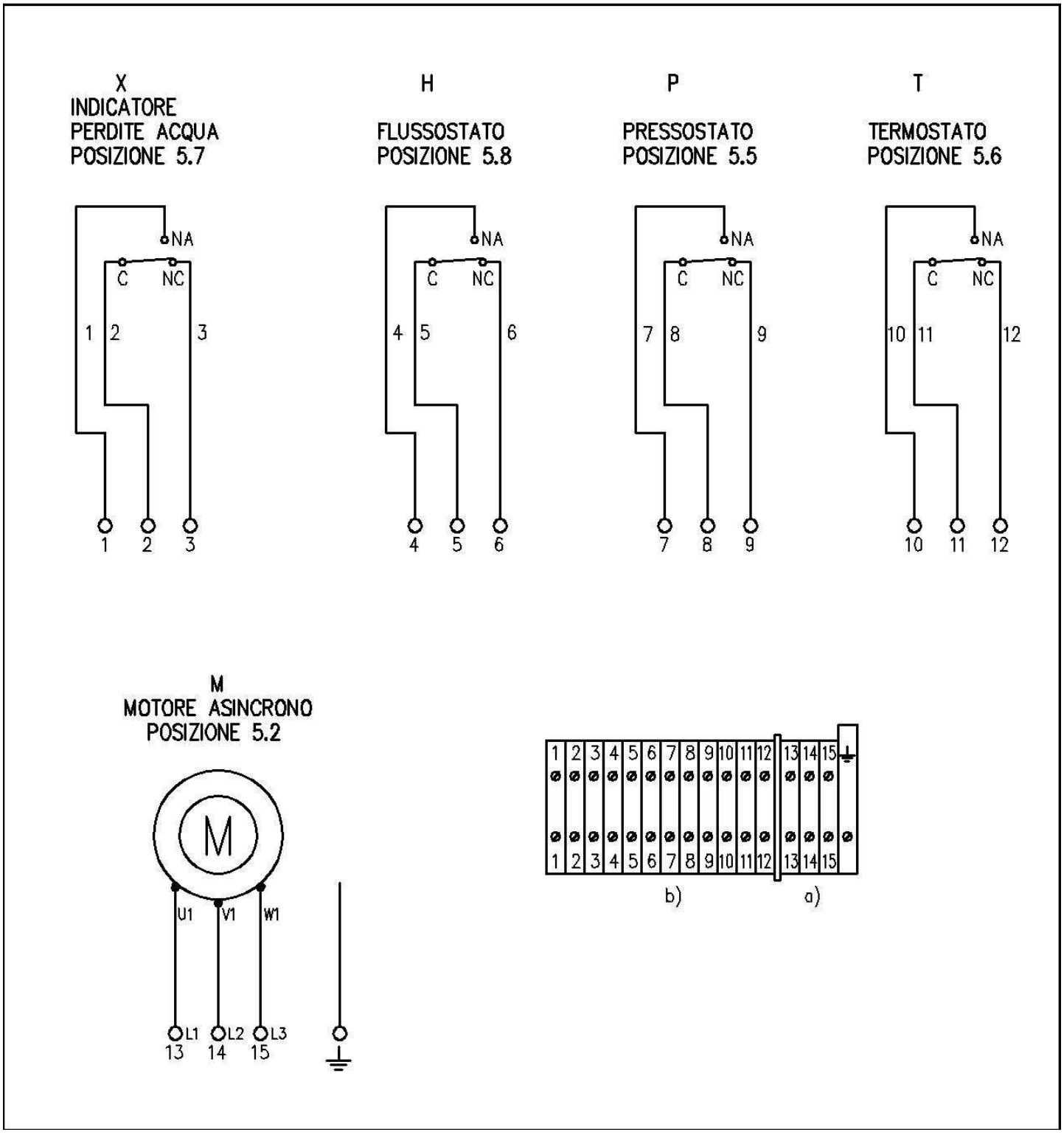


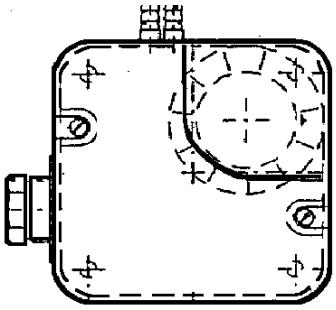
Fig. 9 – Air-water heat exchanger wiring diagram

b) power supply from three-phase line (400 V – 50 Hz except for different indications)
c) power supply from single-phase line (230 V – 50 Hz except for different indications)

c.9 Calibration of control appliances

- Pressure gauge:
The pressure gauge is calibrated in our test chambers. In the case of replacement or anomalous functioning of the pressure gauge, follow the instruction below for calibration.

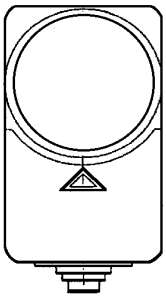
1) Position the relative knob in proximity of the minimum calibration value.
2) Activate ventilation.
3) Turn the knob slowly in a clockwise direction until the contact switches.
4) Turn the knob **in an anti-clockwise** direction again for a few (≅ 0.2 - 0.3 mbar).
5) Deactivated the ventilation and check, much before the fan is at a complete standstill that the contact returns to the rest position.



-Thermostat:
The thermostat is calibrated in our test chambers. If it is replaced or functions abnormally, follow the instructions below to re-calibrate.

1) Turn the relevant knob in proximity of the environmental temperature.
2) Check that the contact switches.
3) Turn the knob again, setting it in proximity of the temperature of 45/55°C. If the machine is installe d in a place where the environmental temperature is not within–20°C ÷ +40° C, consult SICMEMOTORI.

Check the contact returns to the rest position.



D IMPORTANT NOTES REGARDING LIQUID-COOLED AW SERIES MOTORS

These notes integrate the information contained in the main part of this manual and must be read with the same attention.

d.1 Cooling of AW series motors

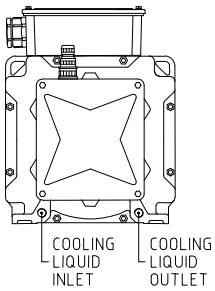
d.1.1 Cooling

The motors of the AW series have a water-tight circuit in which the cooling liquid circulates.
This circuit must be powered with a capacity and pressure suitable for the size and type of motor.
For data relative to the individual sizes, consult the technical catalogue and plate data.
The ideal temperature of the cooling liquid is between 16°C and 20°C.
Liquid temperatures lower than 16°C can cause the condensation of the air inside the motor with consequent serious damage for the electrical insulation and the internal mechanical parts.
Liquid temperatures exceeding 20°C determine a decrease in motor performance. Consult the power and heating paragraph.
The refrigerant liquid must always be put into circulation before the motor is powered and must never be stopped during machine functioning.
Make the liquid circulate for at least 10 min. after the motor has been switched off in order to prevent the accumulation of internal temperature and the possibility of the liquid boiling.
Envision a device that prevents the start-up and/or functioning of the motor when the liquid is not circulating or the temperature is too high/low.
The maximum supply pressure accepted and indicated in the catalogue must never be exceeded. Envision a purge valve calibrated at maximum pressure.
If the motor is installed in environments where the temperature could reach values below zero a suitable additive must be added to the refrigerant liquid in order to prevent freezing (solution at 20% max).
We recommend the use of a common product such as that used for the cooling circuit of cars.
Do not make holes or perform mechanical jobs on the structure of the motor.
The quality of the refrigerant liquid is very important for the life of the motor. The presence of limestone and/or impurities in the liquid determine a decrease in motor performance and can cause irreparable damage.
Always use deionised water, do not use tap water as it could be rich in limestone.
To prevent the cooling system from blocking it is essential that a filter, with filtering capacity of 100µm, is applied onto the refrigerant liquid delivery pipe.
AW series motors are delivered without cooling liquid. Before putting into service, it is essential to fill the cooling circuit with liquid and eliminate all air present.
Any air bubbles inside the circuit and/or the lack of filling cause loss of performance and damage to the motor.
Proceed as follows to introduce the liquid into the circuit:

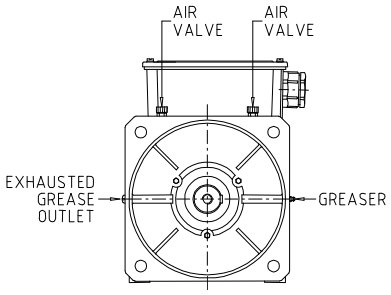
- Connect the liquid delivery pipe and leave the return pipe disconnected.
- Slowly introduce the liquid and make the air escape from the discharge connection and the purge valve positioned above the motor.
- Stop introduction when the liquid escapes from the discharge and the valve, connect the discharge pipe, make the liquid circulate for a few minutes and bleed the air again through the valve.

If the cooling circuit has an air valve, periodically check and bleed any air present.

View from opposite shaft side



View from shaft side



d.1.2 Discharging condensation

The motors have holes (M6 or M8), realised in the lower part of the motor casing for the discharge of condensation.
To maintain the level of protection of the motors unaltered these holes must be connected to the condensation discharge pipe (responsibility of the user).

d.1.3 Cooling systems

To maintain the temperature of the cooling liquid entering the motor constant and within the established limits, an external system is necessary that adjusts the temperature. These systems can be summarised as follows:
- Direct liquid introduction
- Air/water or water/water heat exchangers.
- De-calcified water contained in cooling towers.
- Refrigerant unit with compressor and heat exchanger.

- Direct liquid introduction:
The refrigerant liquid coming from cooling towers/tanks is introduced directly into the motor's cooling circuit.

- Air/water heat exchanger:
It is composed of a radiator for liquids and an electric fan that disposes of the heat accumulated on the surface of the radiator itself.

- Water/water heat exchanger:
It is made up of two separate circuits in which the motor cooling liquid and the primary liquid from the tower or tank circulates. An electric pump is necessary to make the liquid circulate in the motor circuit.

- Refrigerant unit with compressor and heat exchanger.
It is made up of a system complete with compressor, radiator, pump, electric fan and thermostat. Maintains the temperature of the cooling liquid constant independently of the environmental temperature.

For further details consult the table below.

Features	Direct introduction	Air/water heat exchanger [1)]	Water/water heat exchanger [1)]	Refrigerant unit
Possibility of controlling the temperature of the cooling liquid.	N	N	N	Y
Necessity for frequent checks of the temperatures of the liquids.	Y	Y	Y	N
Possibility for use with air or water temperatures below 15°C.	N	Y	Y	Y
Possibility for use with air or water temperatures up to 60°C.	Y [2)]	Y [2)]	Y [2)]	Y
Motor performance influenced by the environmental temperature	-	Y	-	N
Motor performance influenced by the temperature of the cooling liquid.	Y	-	Y	N
Possibility of formation of lime scale and/or deposits inside the motor circuit.	Y	N	N	N
Possibility of formation of condensation inside the motor.	Y	N	N	N
Possibility of using anti-freeze.	N	Y	Y	Y

1) With thermostatic adjustment
2) With reduction of motor performance

USER COMMENTS REGARDING THIS MANUAL

In order to make this manual as complete as possible and with all information necessary to ease the work of the technicians in charge of the maintenance of our products, any suggestions, observations and criticism, will be a source of continuous improvement for SICMEMOTORI.

User's name	Date	If necessary, how can we contact you?
Name and address of the company	Manual code	Fax
		Tel
What does the company do/Reason for using this manual		E-mail

General opinion

	Excellent	Good	Average	Bad	Comments
Content	O	O	O	O	
Organisation	O	O	O	O	
Technical accuracy	O	O	O	O	
Clearness of text	O	O	O	O	
Completeness	O	O	O	O	
Diagrams/Figures	O	O	O	O	
Tables	O	O	O	O	
References	O	O	O	O	
Readability	O	O	O	O	

Specific suggestions (corrections, information that requires more space, etc.)

Page N°. Comments

Other comments (what would you like, what could be added, how to improve the manual, etc.)

In comparison with similar manuals produced by Manufacturers of similar products, what is your opinion of this manual?

O better O the same O worse O I don't know O comments

Send a copy of this form via fax to:

Sicme Motori srl
Strada del Francese 130
10156 Torino – Italia
fax +39-011-4500047
Attn. Manager of Quality System Management

SICMEMOTORI

SICME MOTORI S.r.l.
Str. Del Francese, 130 - 10156 Torino - Italia
Tel. +39 011 4076311 Fax +39 011 4500047 / 4500367
sicmemotori.com - sicmemotori@sicmemotori.com