LEROY SOMER

Réf. 3256 - 4.33 / e - 07.02

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en

This manual must be sent to the end user

LSPX-FAP 2

Induction motors

for atmospheres containing explosive dust

Installation and maintenance

IMPORTANT

These symbols ⚠ ⚠ appear in this document whenever it is important to take special precautions during installation, operation, servicing or maintenance of the motors.

It is essential that electric motors are installed by experienced, qualified and authorised personnel.

In accordance with the main requirements of EEC Directives, the safety of people, animals and goods should be ensured when fitting the motors into machines.

Particular attention should be given to the equipotential ground or earthing connections.

The noise level of the machines, measured under normal conditions, conforms to the requirements of the standard and does not exceed the maximum value of 85 dB(A) pressure at 1 metre.

⚠ **The following precautions must be taken before working on any stopped device :**

- **mains voltage disconnected and no residual voltage present**
- **careful study of the causes of the stoppage (blocked transmission - loss of phase - cut-out due to thermal protection - lack of lubrication, etc)**

1 - PREFACE : TRAINING

⚠ ⚠

Electric motors are industrial products. Therefore, they must only be installed by qualified experienced and authorised personnel. The safety of people, animals and goods should be ensured when fitting the motors into machines. (please refer to current standards).

Those persons required to work on electrical installations and equipment in zones where there is a risk of explosion must be specially trained in the necessary skills.
In effect, they must be familiar not only with the electrical risks, but also with those that are due to the chemical properties and physical characteristics of products used in the installation (gas, vapour, dust), as well as the environment in which the equipment operates. These elements dictate the risk of fire and explosion.
In particular, they must be informed and aware of the specific safety reasons and requirements in order to adhere to them. For example :
- do not open when powered up
- do not open when powered up in atmospheres containing explosive dust
- do not separate when powered up
- do not manoeuvre when on load
- wait several minutes before opening
- replace the seals tightly to ensure watertightness.

LSPX-FAP 2
3-phase TEFV
cage induction motors

Dear customer,

You have just acquired a LEROY-SOMER motor.

This motor benefits from the experience of one of the largest manufacturers in the world, using state-of-the-art technology in automation, specially selected materials, rigorous quality control. As a result, the regulatory authorities have awarded our motor factories the ISO 9000 international certificate.

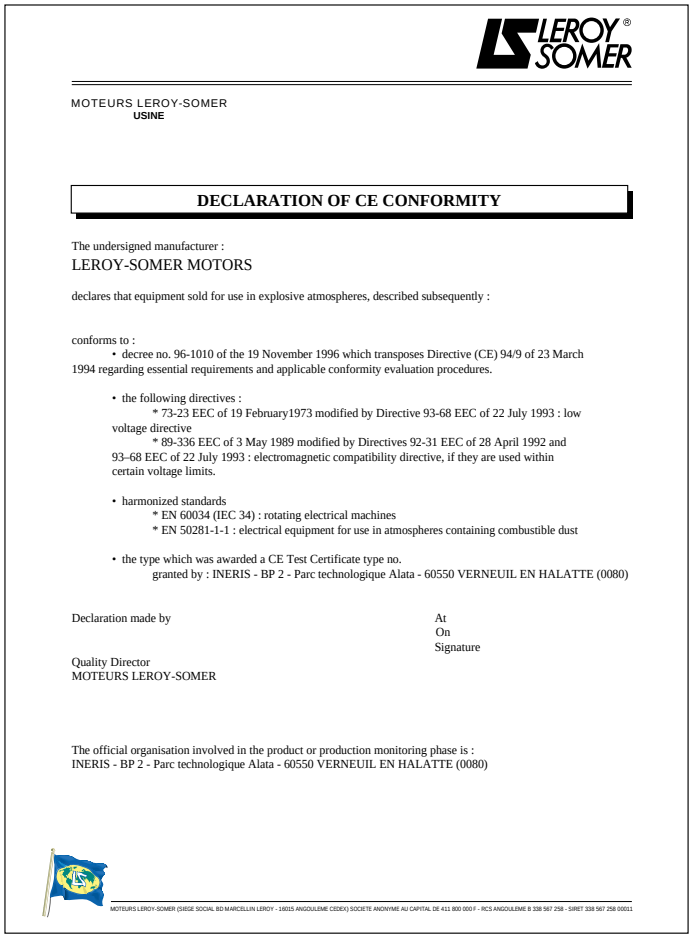
We thank you for making this choice, and would ask you to read the contents of this manual.

By observing a few essential rules, you will ensure problem-free operation for many years.

LEROY-SOMER

en

CE CONFORMITY :
The motors carry the CE mark and therefore conform with the Low Voltage Directive 73/23/EEC modified by Directive 93/68, as well as Directive ATEX 94/9/EC.



MOTEURS LEROY-SOMER
USINE

DECLARATION OF CE CONFORMITY

The undersigned manufacturer :
LEROY-SOMER MOTORS

declares that equipment sold for use in explosive atmospheres, described subsequently :

conforms to :
- decree no. 96-1010 of the 19 November 1996 which transposes Directive (CE) 94/9 of 23 March 1994 regarding essential requirements and applicable conformity evaluation procedures.

- the following directives :
  * 73-23 EEC of 19 February1973 modified by Directive 93-68 EEC of 22 July 1993 : low voltage directive
  * 89-336 EEC of 3 May 1989 modified by Directives 92-31 EEC of 28 April 1992 and 93–68 EEC of 22 July 1993 : electromagnetic compatibility directive, if they are used within certain voltage limits.

- harmonized standards
  * EN 60034 (IEC 34) : rotating electrical machines
  * EN 50281-1-1 : electrical equipment for use in atmospheres containing combustible dust

- the type which was awarded a CE Test Certificate type no.
  granted by : INERIS - BP 2 - Parc technologique Alata - 60550 VERNEUIL EN HALATTE (0080)

Declaration made by

At
On
Signature

Quality Director
MOTEURS LEROY-SOMER

The official organisation involved in the product or production monitoring phase is :
INERIS - BP 2 - Parc technologique Alata - 60550 VERNEUIL EN HALATTE (0080)

MOTEURS LEROY-SOMER (SIEGE SOCIAL BD MARCELLIN LEROY - 16015 ANGOULEME CEDEX) SOCIETE ANONYME AU CAPITAL DE 411 800 000 F - RCS ANGOULEME B 338 567 258 - SIRET 338 567 258 00011

LEROY-SOMER reserves the right to modify its product characteristics at any time to incorporate the latest technological developments. The information contained in this document may therefore be changed without prior warning.

LSPX-FAP 2
3-phase TEFV
cage induction motors

CONTENTS

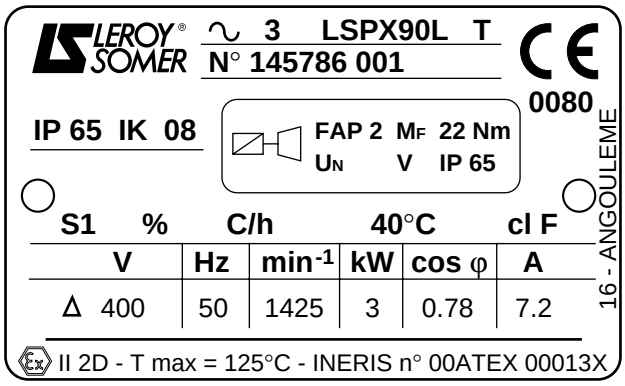
DISMANTLING AND REASSEMBLY PROCEDURES

INDEX

After receiving your motor, check that no damage has been sustained during transit.
If there is any damage, contact the carrier (a claim can be made on their insurance) and after a visual check turn the motor by hand to detect any possible fault.

2 - MARKING

Ensure that the nameplate conforms with the order specifications on receipt of the motor.



▼ ***Additional information to that on the motor nameplate***

CE	**Legal mark indicating that the equipment conforms to the requirements of the European Directives**	**FAP : brake designation** **MF : braking torque** **UN : 3-phase brake supply voltage**

INERIS n° 00ATEX 00013X
only applies to zone 21

Specific ATEX marking

0080 : INERIS identification number (Notified Organisation)
Ex : Special marking
II 2D : Group II, category 2, dust or :
II 3D : Group II, category 3, dust
T max : Maximum surface temperature : 125 °C for example
Ta : Ambient temperature : -25 °C : 40 °C for example
Test no. : CE certificate type test no. issued by INERIS (II.2D group)
FAP 2 : Brake designation
MF : Braking torque
UN : 3-phase brake supply voltage
If relevant : additional marking anticipated in CE test

Motor

MOT 3 ~ : Three-phase A.C. motor
LSPX : Range
225 : Frame size
L : Housing symbol
T : Impregnation index
N° : Motor batch number

IP65 IK08 : Index of protection
S : Duty
% : Duty (operating) factor
...C/h : Number of cycles per hour
40°C : Contractual ambient operating temperature
(I) cl. F : Insulation class F
V : Supply voltage
Hz : Supply frequency
min^{-1} : Revolutions per minute
kW : Rated output power
cos φ : Power factor
A : Rated current
Δ : Delta connection
Y : Star connection

3 - STORAGE

Before commissioning, motors must be :
- sheltered from humidity : for relative humidities greater than 90%, the machine insulation can drop very quickly and become virtually non-existent at around 100%; check the anti-rust protection on unpainted parts.
For a very long storage period, the motor can be placed in a sealed package (eg. heat-sealed plastic) containing dehydrating sachets.
- protected from frequent significant temperature variations to prevent any condensation; during storage, the drain plugs should be removed to allow condensation water to escape.
- in the event of surrounding vibrations, try to reduce the effect of these vibrations by placing the motor on a damping support (eg. rubber plate) and turn the rotor slightly every fortnight to prevent the bearing rings from being marked. Remove and replace the rotor locking device if applicable;
- do not discard the rotor locking device (where there are roller bearings).
Even if the motor has been stored in the correct conditions, certain checks must be carried out before starting up:

Greasing

Bearings which cannot be regreased

Maximum storage : 3 years. After this time has elapsed, replace the bearings, the spigot seals and the shaftway seals (see section 11.3).

Bearings which can be regreased

Storage period	Grade 2 grease	Grade 3 grease	
	less than 6 months	less than 1 year	The motor can be commissioned without regreasing
	more than 6 months less than 1 year	more than 1 year less than 2 years	Regrease before commissioning as described in section 11.4.1
	more than 1 year less than 5 years	more than 2 years less than 5 years	Dismantle the bearing - Clean it - Renew the grease totally - Replace the spigot and shaftway seals (see section 11.2.2)
	more than 5 years	more than 5 years	Change the bearing - Regrease it completely - Replace the spigot and shaftway seals

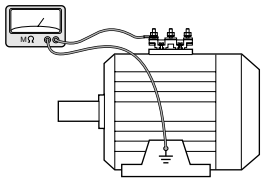
Greases used by LEROY-SOMER
(see nameplate) :
grade 2 : KYODO SRL2 - ELF CHEVRON SRIL2
grade 3 : ESSO UNIREX N 3 - SHELL ALVANIA G3

4 - COMMISSIONING

⚠ Before starting the motor, it is advisable to check the insulation between phases and earth, and between phases for both the motor and the brake.

This check is essential if the motor has been stored for longer than 6 months or if it has been in a damp atmosphere.
This measurement is carried out with a megohmmeter at 500 volts D.C. (do not use a magnetoelectric system).

It is better to carry out an initial test at 30 or 50 volts and if the insulation is greater than 1 megohm, carry out a second test at 500 volts for 60 seconds. Insulation must be at least 10 megohms in cold state.
If this value cannot be reached, and without exception if the motor may have been splashed with water, salt spray, kept in a very humid place or if it is covered in condensation, it is advisable to dehydrate the stator for 24 hours in a drying oven at a temperature of between 110 °C and 120 °C.
If the motor cannot be placed in a drying oven, supply it with D.C. current, with all 3 motor and all 3 brake phases in series, and with the voltage at 1 to 2 % of the rated voltage (use a D.C. generator with independent excitation or batteries for motors less than 22 kW).
- NB : The D.C. current should be monitored via a shunt ammeter. This current must not exceed 60% of the rated current.
Ideally place a thermometer on the motor housing : if the temperature exceeds 70 °C, reduce the indicated voltage or current by 5% of the original value for a 10° deviation.
While drying, all motor orifices must be clear (terminal box, drain holes). Before commissioning, all these covers must be replaced in order that the motor conforms to IP 65 protection. Clean the plugs and orifices before reassembly.



⚠ Warning : If the dielectric test, carried out at the factory before despatch, has to be carried out again, it should be performed at half the standardised voltage ie. : 1/2 (2U+1000V). Make sure that the capacitive effect resulting from the dielectric test is eliminated before connecting the terminals to earth.

⚠ Before commissioning : for all motors:
*** ensure the machine assembly is free of dust**
*** rotate the motor at no load (no mechanical load), for 2 to 5 minutes, checking that there is no abnormal noise; if there is any abnormal noise, see section 11.**

5 - INSTALLATION

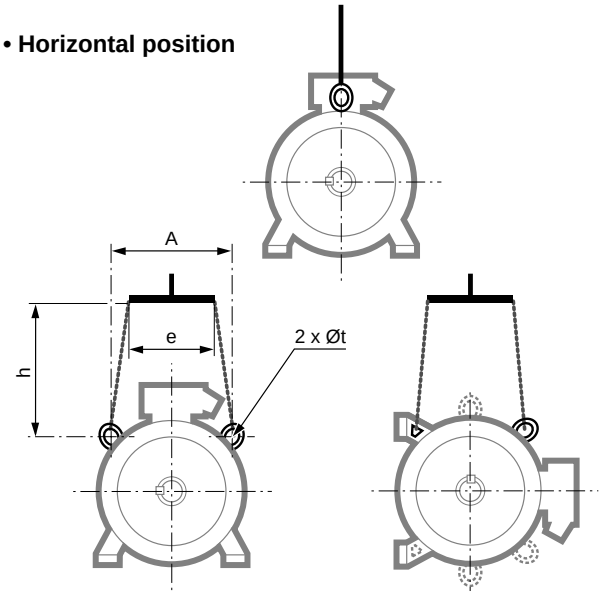
5.1 - Position of the lifting rings

⚠ The lifting rings are intended for lifting the motor only. They must not be used to lift the entire machine once the motor has been installed.

Labour regulations stipulate that all loads above 25 kg should be fitted with lifting devices to facilitate handling.

The positions of the lifting rings and the minimum dimensions of the loading bars are given below in order to help with preparation for handling the motors. Without these precautions, there is a risk of warping or crushing some equipment, such as the terminal box, protective cover and drip cover.

• Horizontal position

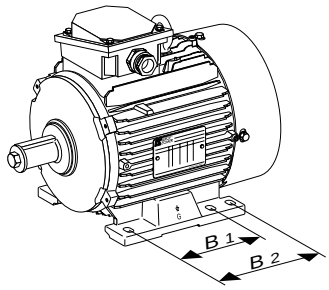


Type	Horizontal position			
	A	e min	h min	Øt
100	120	200	150	9
112	120	200	150	9
132	160	200	150	9

5.2 - Location - ventilation

Our motors are cooled in accordance with method IC 411 (standard IEC 34-6) ie. "machine cooled by its surface, using the ambient fluid (air) flowing along the machine".
A fan between the motor and the brake cools the motor. Air is blown along the motor housing fins.
The motor should be installed in a sufficiently ventilated place, with the air intake and outlet clear by at least a quarter of the shaft height.
Blocking the air intake, even accidentally (clogging-up), is likely to adversely affect motor operation.
It is necessary to check that hot air is not being recycled; otherwise, to prevent the motor from heating abnormally, pipes must be provided for intake of cold air and outlet of hot air.
In this case, and if the air is not being circulated by an auxiliary fan, the pipe dimensions must be such that load losses are negligible compared to those of the motor.

Positioning
The motor should be mounted, in the position specified in the order, on a sufficiently rigid base to prevent distortion and vibration.
Where the motor feet have six fixing holes, it is preferable to use those which correspond either to the standard dimensions for the motor power rating (refer to the technical catalogue for induction motors) or otherwise to those shown at B2.



Provide easy access to the terminal box, the condensation drain plugs and, if appropriate, to the grease nipples.

Use hoisting equipment compatible with the weight of the motor (indicated on the nameplate).

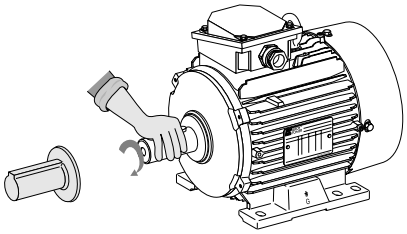
⚠ When the motor is provided with lifting rings, they are only intended for lifting the motor and must not be used to lift the whole of the machine after fixing the motor to it.
Note 1 : When installing a suspended motor, it is essential to provide protection in case the fixing breaks.
Note 2 : Never stand on the motor.

5.3 - Coupling

Preparation

Turn the motor by hand before coupling to detect a possible fault due to handling.

Remove any shaft extension protection. Drain any

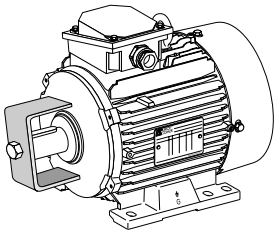


condensation water inside the motor by removing the plugs which block the drain holes. Before start-up, these plugs should be replaced so that the motor conforms to IP65 protection.

Rotor locking device

For made-to-order motors with roller bearings, remove the rotor locking device.

In exceptional circumstances when the motor has to be moved after mounting the coupling device, the rotor must be re-immobilised.



Balancing

Rotating machines are balanced according to the IEC 34-14 standard :

- half-key when the shaft extension is marked H

By special request, the balancing can be set :

- no key when the shaft extension is marked N
- full key when the shaft extension is marked F

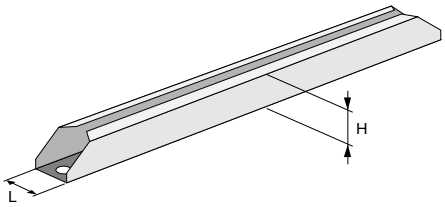
Thus any coupling element (pulley, coupling sleeve, slipring, etc) must be balanced appropriately.

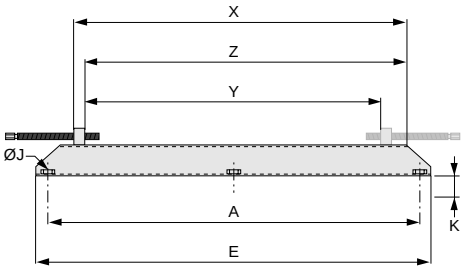
Motor with 2 shaft extensions :

If the second shaft extension is not used, in order to maintain the correct balancing, the key or half-key must be fixed firmly in the keyway so that it is not thrown out during rotation (H or F balancing) and to protect it from any direct contact.

5.4 - Fixing on slide rails

Option : the motor can be mounted on standard slide rails (conforming to the NFC 51-105 standard)
These steel slide rails are supplied with tension screws and 4 nuts and bolts for fixing the motor onto the slide rails, but without slide rail fixing bolts.





Motor frame size	Type of slide rail	Dimensions									Weight per pair of slide rails (kg)
		A	E	H	K	L	X	Y	Z	Ø J	
71	-	-	-	-	-	-	-	-	-	-	-
80	G 90/8 PM	355	395	40	2,5	50	324	264	294	13	3
90	G 90/8 PM	355	395	40	2,5	50	324	264	294	13	3
100	G 132/10 PM	480	530	49,5	7	60	442	368	405	15	6
112	G 132/10 PM	480	530	49,5	7	60	442	368	405	15	6
132	G 132/10 PM	480	530	49,5	7	60	442	368	405	15	6

6 - ELECTRICAL PARAMETERS LIMIT VALUES

6.1 - Maximum power of motors supplied directly (kW) from the mains

This extract from the NFC 15.100 standard indicates the limits tolerated for D.O.L. starting of a motor connected to the A.C. supply.

Types of motor	Single-phase	3-phase 400 (380) V	
Location	230 (220) V	D.O.L. starting	other starting modes
Residential areas	1.4	5.5	11
*Other locations **			
Overhead power line	3	11	22
Underground supply	5.5	22	45

** "Other locations" include premises such as in the service industry, the industrial sector, general services to housing and the agricultural sector, etc.*
Prior inspection by the energy distributor is necessary for motors driving a machine with high inertia, motors with time-delay starting, and brake motors or reversers using reverse current.

6.2 - Limiting problems caused by motor starting

In order to preserve the installation, any significant temperature rise in the cabling conduits must be prevented, whilst ensuring that the protective devices do not intervene during starting.
Problems affecting the operation of other devices connected to the same source are due to the drop in voltage caused by the starting current, which may be several times greater than the current consumed by the motor at full load (approximately 7 times); refer to the LEROY-SOMER induction motor technical catalogue.
Even though mains supplies increasingly allow D.O.L. starts, there are installations where the starting current must be reduced.
Jolt-free operation and soft starting ensure greater ease of use and an increased lifespan for the machines being driven.
Cage induction motor starting is characterised by two essential values :
- starting torque
- starting current

The starting torque and the resistive torque determine the starting time.
Depending on the load, it is possible to adapt the torque and current to the machine starting time and to the possibilities of the A.C. supply.
The five essential modes are :
- D.O.L. starting
- star / delta starting
- soft starting with autotransformer
- soft starting with resistances
- electronic soft starting

The "electronic" starting modes control the voltage at the motor terminals during the whole starting phase and enable jolt-free and very soft starting.

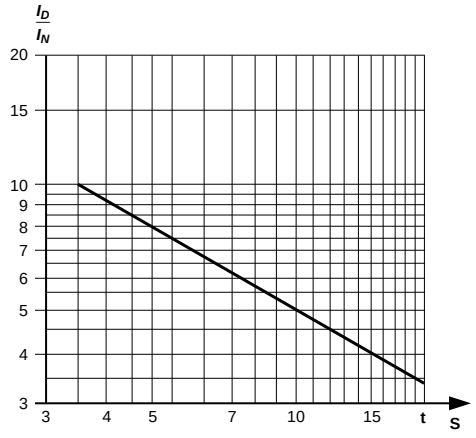
6.3 - Supply voltage

The rated voltage is indicated on the nameplate.

We guarantee a maximum surface temperature (see section 8) of our motors with a power supply at rated voltage ± 10%.

6.4 - Starting times

Starting times must remain within the limits shown below, on condition that the number of starts over the course of an hour is 6 or less.
Three successive cold starts and 2 consecutive warm starts are allowed. Under these conditions, the maximum surface temperatures (see section 8) are guaranteed.



Permissible motor starting times as a function of the ratio I_D / I_N for cold starts.

6.5 - Supply by a frequency inverter

See page 42.

Note : the brake must be directly supplied with the rated voltage regardless of the starting mode.

6.6 - Operation in S4 intermittent duty

The different starting times and driven loads may lead to excessive temperature rise in the brake-motor. Select the motor which gives $Z_o \geq Z_{oc}$ (Z_o starting frequency of the brake-motor).

Z_{oc} EQUIVALENT CYCLE STARTING FREQUENCY — h^{-1}

$$Z_{oc} = Z_c \frac{J_m + J_c}{J_m}$$

Z_c	cycle starting frequency	h^{-1}
J_m	moment of inertia of the motor	kgm^2
J_c	moment of inertia of the driven load	kgm^2

Z_c CYCLE STARTING FREQUENCY — h

$$Z_c = \frac{n}{t_c}$$

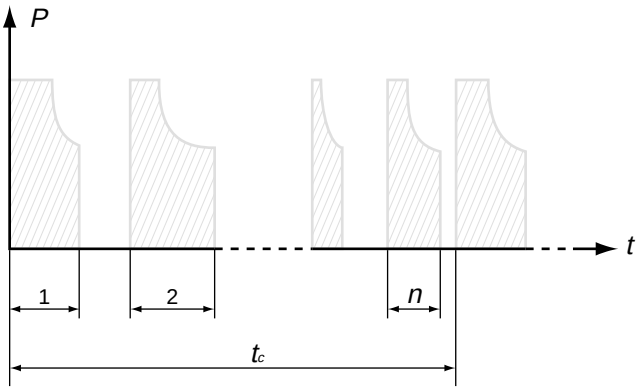
n	number of starts in the cycle during t_c	
t_c	total cycle time	h

F_M OPERATING FACTOR — %

$$FM = \frac{t_m}{t_c} \times 100$$

t_m	motor running time in the cycle	h
t_c	total cycle time	h

Typical S4 duty cycle



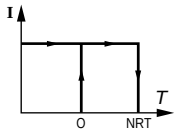
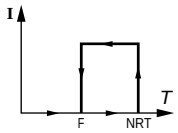
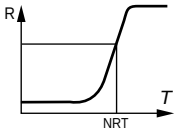
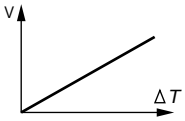
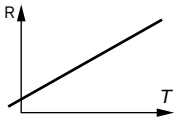
For each type of brake-motor, the values of Z_c are given for operating factors *FM* 25 %, 40 %, 60 %. These starting frequencies assume that the motor is supplied at its rated power and that J_c = 0. They correspond to the standard brake-motor.
Higher starting frequencies can be obtained in a number of ways :
– early brake release
– motor derating
– special versions
Please consult Leroy Somer.

Starting frequency Z_o
for 4, 6 or 8 poles expressed in h^{-1}.

Motor F. size	Operating factor		
	25 %	50 %	60 %
71 to 90	1200	1000	800
100-112	1000	900	700
132	1000	900	700

7 - USE

Thermal protection (see section 9) and space heaters

Type	Operating principle	Operating curve	Breaking capacity (A)	Protection provided	Mounting Number required*
Normally closed thermostat **PTO**	bimetallic strip, indirectly heated, with N/C contact 		2.5 at 250 V with cos φ 0.4	general surveillance for non-transient overloads	Mounted on control circuit 2 or 3 in series
Normally open thermostat **PTF**	bimetallic strip, indirectly heated, with N/O contact 		2.5 at 250 V with cos φ 0.4	general surveillance for non-transient overloads	Mounted on control circuit 2 or 3 in parallel
Positive temperature coefficient thermistor **PTC**	Variable non-linear resistor, indirectly heated 		0	general surveillance for transient overloads	Mounted with associated relay on control circuit 3 in series
Thermocouples ***T*** (*T*<150°C) Constantan copper **K** (*T*<1000°C) Copper-Nickel	Peltier effect		0	continuous surveillance at hot spots at regular intervals	Mounted on control panels with associated reading device (or recording device) 1 per hot spot
Platinum resistance thermometer **PT 100**	Variable linear resistor, indirectly heated		0	high accuracy continuous surveillance at key hot spots	Mounted on control panels with associated reading device (or recording device) 1 per hot spot

- N.R.T. : nominal running temperature
- The N.R.T.s are chosen according to the position of the sensor in the motor and the class of temperature rise.

* The number required affects the protection of the windings.

Alarm and early warning

All protective equipment may be backed up by another type of equipment (with a different N.R.T.). The first device will then act as an "early warning" system (light or sound signals given without shutting down the power circuits), and the second device will be the actual alarm, shutting down the power circuits.

Protection against condensation : Space heaters

Identification : 1 red label

A glass fibre flexible resistor is fixed on 1 or 2 coil end turn(s) which heats the machines when stopped and therefore prevents any condensation inside the machines.

Power supply : 230V single phase unless otherwise requested by the customer.

The drain plugs underneath the motor should be opened approximately every six months. They should then be replaced to ensure IP65 motor protection.

Thermal magnetic protection

The motor must be protected by a thermal magnetic device, sited between the isolating switch and the motor. These protective devices safeguard motors fully from non-transient overloads.

This device can be fitted with a fused circuit-breaker.

Built-in direct thermal protection

For low rated currents, bimetallic strip-type protection may be used. The line current passes through the strip, which shuts down or restores the supply circuit as necessary. The design of this type of protection allows for manual or automatic reset.

Built-in indirect thermal protection

The motors can be equipped with optional heat sensors; these sensors can be used to monitor temperature rises at "hot spots" :

- overload detection
- cooling check
- monitoring strategic points for installation maintenance.

It must be emphasized that these sensors cannot ever be used to directly control the motor operating cycles.

8 - SPECIAL OPERATING CONDITIONS

- Thermal protection (see sections 7 & 9)

- Space heaters (see section 7)

- Temperatures : storage and ambient

Note : Ta = Ambient temperature

If it has been stored at a temperature lower than -10°C, heat the motor (see section 4) and turn the shaft manually before operating the machine.

If used at a temperature lower than -25°C, the motor does not require a temperature sensor to be fitted. It can be fitted with thermocouples.

Our standard motors are intended to operate at an ambient temperature between -25°C and 40°C.

If -25°C > Ta ≥ -40°C, the shaftway seals must be silicon and the fan must be metal.

If -25°C > Ta ≥ -40°C or (and) if 50°C < Ta ≤ 60°C, the terminal box flat seals must be created using silicon or polyurethane mastic.

- Surface temperature

As standard, the maximum surface temperature of our motors is 125°C with a maximum ambient temperature of ≤ 40°C. Without derating the motor, the maximum surface temperature will be :

- 135°C if 40°C ≤ Ta ≤ 50°C
- 145°C if 50°C ≤ Ta ≤ 60°C

- Installation zones

Our motors conform to IP 65 protection and we guarantee their surface temperature. They are therefore intended for use in atmospheres containing explosive dust - group II - Category 2 (zone 21) or Category 3 (zone 22).

- Connection

Particular attention must be paid to the nameplate so as to choose the correct type of connection for the supply voltage.

- Earthing

Earthing the motor is compulsory and must be performed in accordance with existing regulations (protection of workforce).

- Seals

After removing the drain plugs, replace them in order to ensure that the motor conforms to IP 65 protection. Replace the removed seals with new seals of the same type. Clean the orifices and plugs before replacing.

On removal, and at least once a year, replace seals on the shaftway, the shield spigots and the terminal box cover with new seals of the same type, after cleaning the parts. The shaftway seals must be fitted using grease of the same type as the bearings.

- Workforce safety

Protect all rotating devices before power-up.

If running a motor without fitting a coupling device, carefully immobilise the key in its location.

All measures must be taken to ensure protection from the risks presented by rotating parts (sleeve, pulley, belt, etc.).
Beware of backdriving when the motor is switched off. It is necessary to take appropriate precautions :
- pumps, install a non-return valve, for example.

- LEROY-SOMER "Digistart" electronic starter

This is a multi-function electronic system with a microcontroller, which is used with all 3-phase cage induction motors.
It ensures motor soft starting with :
- reduced starting current
- jolt-free gradual acceleration, obtained by controlling the current consumed by the motor.

After starting, the DIGISTART performs additional motor management functions in its other operating phases : steady state and deceleration.

- 9 to 500 kW models
- Power supply : 220 to 700 V - 50/60 Hz

DIGISTART is economical to install as a fuse switch is the only additional device needed.

The "Digistart" electronic starter associated with the motor must be installed outside danger zones (outside zones 20, 21 and 22).

- Contactors - isolators

In all cases, the contactors, isolators, etc. must be installed and connected in an enclosure offering a degree of protection and surface temperature compatible with the installation zone, or outside danger zones (outside zones 20, 21 and 22).

- Shock resistance

The motor can stand a weak mechanical shock (IK 08 according to EN 50-102). The user must provide additional protection if there is a risk of greater mechanical shock.

- Variable speed

Special precautions need to be taken when these motors are powered by a frequency inverter or voltage controller :

The reference voltage (drive output or motor input) is 400 V at 50 Hz. The drive should deliver a constant voltage/frequency signal to the motor.

The operating range is limited to 25 to 50 Hz for 50 Hz supplies and for 50 Hz motors designed with natural cooling.

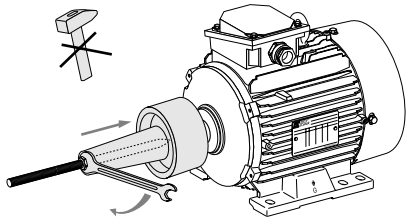
The drives and probe connection devices must be installed outside danger zones (outside zones 20, 21 and 22).

Regardless of the number of poles, the speed must never exceed 3,600 min^{-1}.

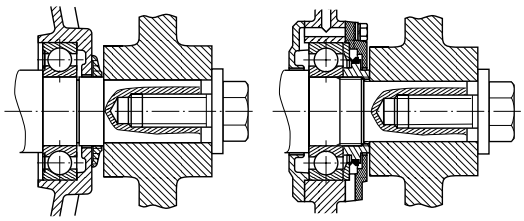
Motors supplied by a frequency inverter must be fitted with winding sensors and a sensor on the DE shield if appropriate. These sensors must be connected to a motor cut-off device placed outside the explosive zone, so that the maximum surface temperature (indicated on the device) is never reached (see sections 7 and 9).

9 - ADJUSTMENT

Tolerances and adjustments
Standard tolerances apply to the values of the mechanical characteristics published in the catalogues. These conform with the requirements of the IEC 72-1 standard.
- Comply strictly with the instructions of the transmission device supplier.
- Avoid impacts which might damage the bearings.
Use a spanner and the tapped hole of the shaft extension with a special lubricant (eg. molykote grease) to make it easier to fix the coupling.



The hub of the transmission device must be :
- in contact with the shoulder of the shaft or if this is missing, against the metal stop ring which forms a labyrinth seal and thus locks the bearing in place (do not break the seal).
- longer than the shaft extension (2 to 3 mm) so it can be tightened with a screw and washer; otherwise, a locking ring must be inserted without cutting the key (if this ring is large, it must be balanced).



Applied to the shoulder of the shaft

Applied to stop ring

When there is a second shaft extension, it must only be used for direct coupling and the same advice must be followed.

⚠ **The 2nd shaft extension may also be smaller than the main one and under no circumstances can it supply torques greater than half the rated torque.**

The inertia handwheels must not be mounted directly onto the shaft extension, but installed between end shields and connected by a coupling sleeve.

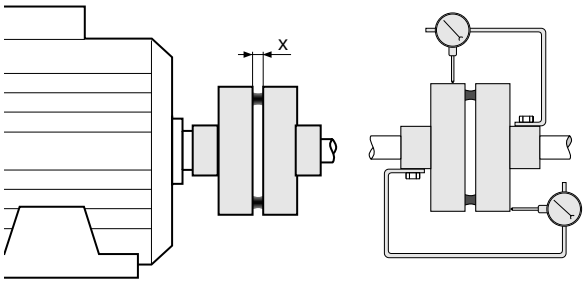
Direct coupling onto the machine
When mounted directly onto the motor shaft extension of the mobile device (pump or fan turbine), check that this device is perfectly balanced and that the radial force and the axial thrust are within the limits indicated in the catalogue for maintaining the bearings.

Direct coupling using a coupling sleeve
Selection of the coupling sleeve should take account of the rated torque to be transmitted and the safety factor dependent on the starting conditions of the electric motor.

The machines must be aligned carefully, so that the concentric and parallel deviations of both coupling halves are compatible with the recommendations of the coupling sleeve manufacturer.

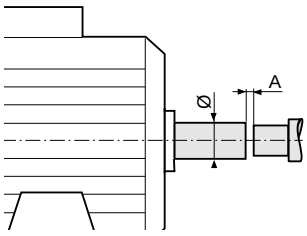
Both coupling halves should be provisionally assembled to assist their movement in relation to one another.

Adjust the parallel plane of the two shafts using a gauge. Measure the distance at one point of the circumference between the two coupling surfaces; turn them by 90°, 180°, and 270° in relation to this initial position and measure each time. The difference between the two extremes of the value of "x" must not exceed 0.05 mm for standard couplings.



To perfect this adjustment and at the same time check the coaxial relation of the two shafts, fit 2 gauges as shown in the diagram and turn both shafts slowly.
The deviations registered by one or other will indicate the need for either an axial or radial adjustment if the deviation exceeds 0.05 mm.

Direct coupling using a rigid coupling sleeve
Both shafts must be aligned so as to adhere to the tolerances of the coupling sleeve manufacturer.
Maintain the minimum distance between the shaft extensions to allow for expansion of the motor shaft and the load shaft.



Ø (mm)	A (mm) min
9 to 38	1

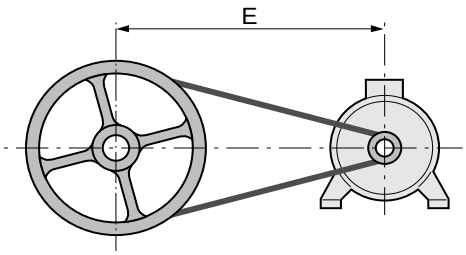
Transmission via belt pulleys

The user can choose the diameter of the pulleys.
Cast iron pulleys with a diameter of more than 315 are not recommended for rotation speeds of 3000 min^{-1}.
Flat belts cannot be used for rotation speeds of 3000 min^{-1} or more.

Positioning the belts

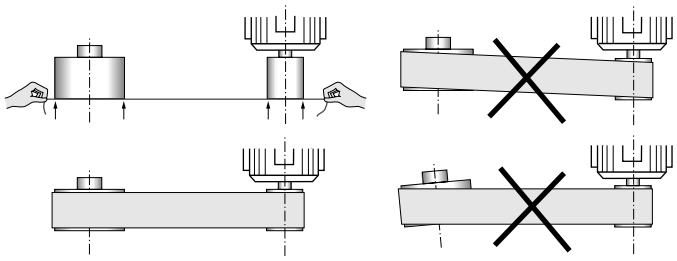
> ⚠ **The belts must be anti-static and flame-resistant.**

So that the belts can be correctly positioned, allow for possible adjustment of approximately 3% with respect to the calculated distance E.
Force should never be used when mounting the belts.
For notched belts position the notches in the pulley grooves.



Aligning the pulleys

Check that the motor shaft is completely parallel with that of the receiving pulley.



Adjusting the tension of the belts

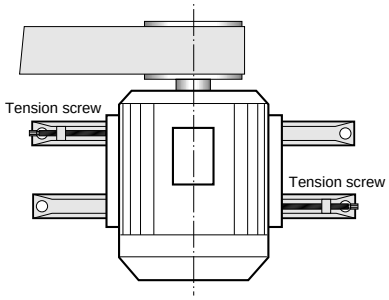
The tension of the belts should be adjusted very carefully in line with the recommendations of the belt supplier and the calculations made when the product was specified.
Reminder :
- tension too great = unnecessary force on the end shields which can wear out the bearing unit (end shield-bearings) prematurely and eventually break the shaft.
- tension too weak = vibration (wearing of bearing unit).

Fixed distance between centres :

place a belt tensioning pulley on the slack side of the belts :
- smooth pulley on the outside of the belt;
- grooved pulley on the inside of the belts when using V-belts.

Adjustable distance between centres

The motor is usually mounted on slide rails, enabling optimum adjustment of the pulley alignment and the belt tension.
Place the slide rails on a perfectly horizontal baseplate.
Lengthways, the position of the slide rails is determined by the length of the belt, and crossways by the pulley of the driven machine.
Mount the slide rails firmly with the tension screws in the direction shown in the diagram (the slide rail screw on the belt side is between the motor and the driven machine).
Fix the slide rails to the baseplate, adjust the belt tension as before.



Thermal protection

> ⚠ **Caution : whatever the type of protection , (PTO or PTF), its N.R.T. must not exceed :**
> **• 150°C max for the stator and 120°C max for the shields if the maximum surface temperature = 125°C.**
> **• 160°C max for the stator and 130°C max for the shields if the maximum surface temperature = 135°C.**
> **• 170 °C max for the stator and 140°C max for the shields if the maximum surface temperature = 145°C.**
>
> **If using sensors with variable resistances or thermocouples, the associated equipment must stop the motor at a temperature of :**
> **• 150°C max for the stator and 120°C max for the shields if the maximum surface temperature = 125°C.**
> **• 160°C max for the stator and 130°C max for the shields if the maximum surface temperature = 135°C.**
> **• 170°C max for the stator and 140°C max for the shields if the maximum surface temperature = 145°C.**

Line protection

Setting the thermal protective device (see section 7)

This must be set at the level of current shown on the motor nameplate for the voltage and frequency of the connected mains supply.

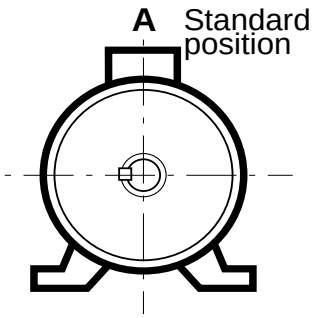
10 - SUPPLY CONNECTION

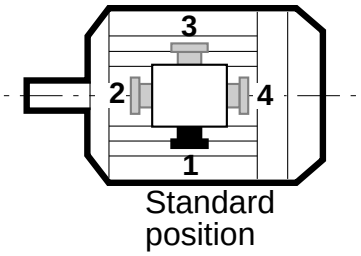
10.1 - Terminal box

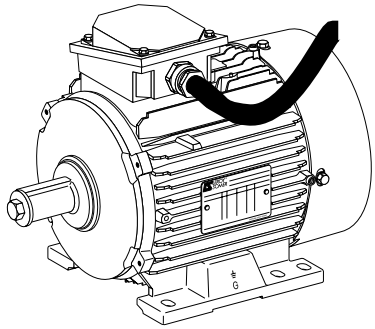
Placed as standard on the top of the motor near the drive end, the terminal box has IP 55 protection and is fitted with a cable gland.
Caution : even for flanged motors, the position of the terminal box cannot easily be modified as the condensation drain holes must remain at the bottom.

Cable gland (NFC 68 311 and 312 standards)
The standard position of the cable gland (1) is on the right, seen from the motor drive end.
When the non-standard position of the cable gland has not been correctly specified in the order, or is no longer suitable, the symmetrical construction of the terminal box enables it to be placed in any of the 4 directions except position 2 on flange-mounted motors (B5).
A cable gland must never be opened upwards.

Ensure that the cable radius of curvature prevents water from entering via the cable gland.

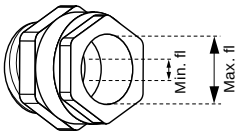






Tightening capacity

⚠ Adapt the cable gland and its reducer or amplifier if fitted to the diameter of the cable being used.



In order to preserve the motor's original IP 65 protection, it is essential to ensure the seal between the rubber ring and the cable by tightening the cable gland correctly (so that it cannot be unscrewed by hand).
Unused cable glands must be replaced with threaded plugs.
Unused orifices must also be covered by threaded plugs. It is essential that the cable gland devices or plugs are fitted with the aid of a Perbunan, silicon or polyurethane mastic seal between the cable glands, the plugs, the reducers or (and) the amplifiers, the support or terminal box.

⚠ The installer is responsible for ensuring that the cable path is sealed to IP 6X.

Tightening capacity of the cable glands and tapping diameter of the cable gland baseplates

Type of cable gland *	Min cable Ø (mm)	Max cable Ø (mm)
CMDEL PG 9	6	11
CMDEL PG 11	6	11
CMDEL PG 16	12.5	18
CMDEL PG 21	12.5	18
CMDEL PG 21	17.5	23.5

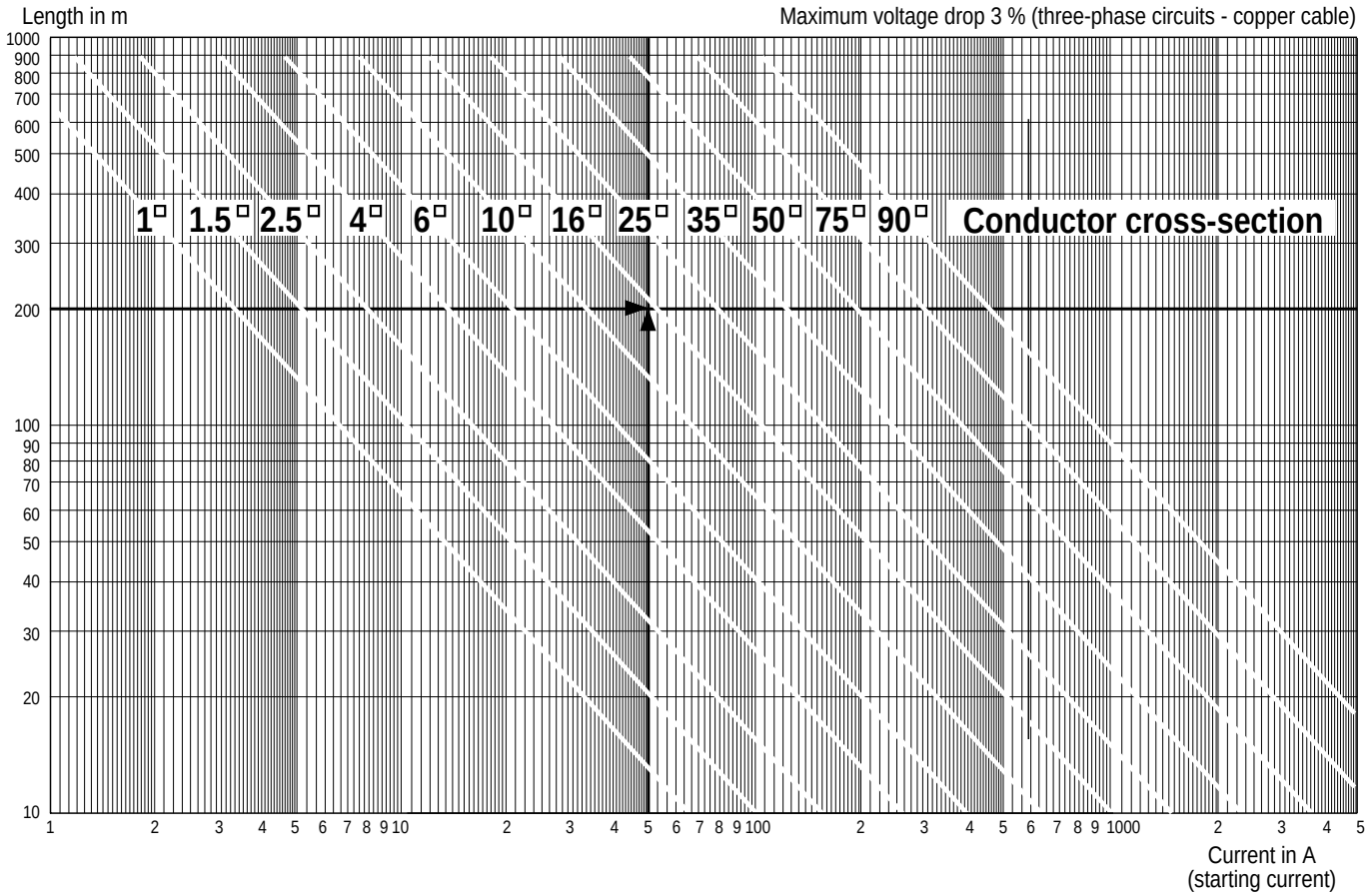
*** Cable gland certified EExe with cable anchoring supplied as standard**

Until 30/06/2003, motors on the market will be fitted with cable glands certified conforming to CENELEC standards in relation to electrical equipment for use in group II explosive atmospheres. Motors sold after this date should be fitted with a cable gland conforming to directive 94/9/CE and which possess a CE-type test certificate.

10.2 - Cross-section of the power supply cables

The higher the current, the greater the voltage drop will be (NFC 15.100 standard or end user's national standard). The voltage drop should therefore be calculated for the **starting current** to see if this is suitable for the application. If the most important criterion is the starting torque (or the starting time), the voltage drop should be limited to 3 % maximum (the equivalent of a loss of torque of around 6 to 8 %).

The chart below can be used to select the conductors according to the length of the supply cable and the starting current, in order to limit the voltage drop to 3 % maximum.



⚠ **The cable should never be used for handling the motor.**

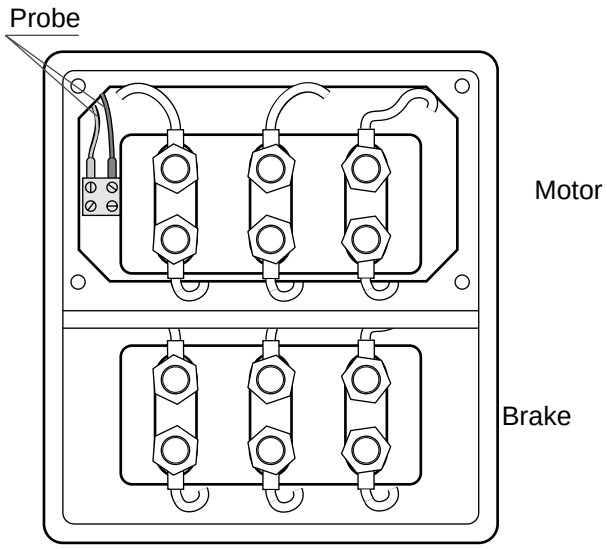
10.3 - Wiring diagram for terminal block or isolators

All motors are supplied with a wiring diagram placed in the terminal box. If necessary, this diagram should be obtained from your supplier (specify the motor type and number on the motor nameplate).
All connectors required to make connections can be found inside the terminal box.
Single speed brake motors are fitted with 2 blocks with 6 terminals conforming to the NFC 51 120 standard (frame size 80 to 112), identified in line with the IEC 34-8 (or NFC 51 118) standard.

10.4 - Direction of rotation

When the motor is powered by U1, V1, W1 or 1U, 1V, 1W from a direct supply L1, L2, L3, it turns clockwise when seen from the main drive end.
If any two of the phases are changed over, the motor will run in an anti-clockwise direction. (Make sure that the motor has been designed to run in both directions).
If the motor is fitted with thermal protection or space heaters, these should be connected on mini-terminals.

Motor fitted with terminal block



10.5 Earth terminal

The motor must be earthed conforming to current regulations (protection of workers).

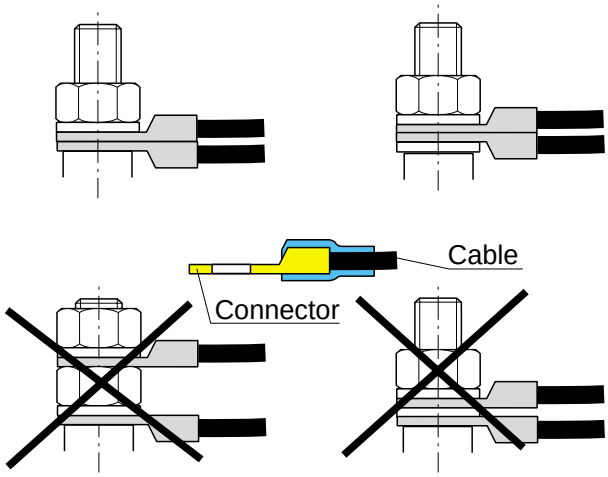
One is situated inside the terminal box ; another outside the enclosure. They are indicated by the sign : ⏚

They must be ensured against self-release by a lock washer, locknut or anti-vibration adhesive.

The selection of the cables must conform with the EN 50-281-1-1 standard.

10.6 - Connection of power supply cables to the terminal block

Cables must be fitted with connectors suitable for the cable cross-section and the terminal diameter.
They must be crimped as instructed by the connector supplier.
Connection must be carried out with connector resting on connector (see diagrams below) :



Tightening torque (N.m) on the terminal block or isolator nuts.

Terminal	M4	M5	M6
Steel	2	3.2	5
Brass	1	2	3

The fixing screws used for connecting the cables must be the same type as the terminals : for example, do not fit steel fixing screws on brass terminals.
When closing the box, check that the seal is correctly positioned.

As a general rule, check that no nut, washer, nor any other foreign body has either fallen in or come into contact with the winding.

11 - MAINTENANCE

11.1 - General information

11.1.1 - Frequent monitoring

This monitoring, generally carried out by the operators, is intended :

- to monitor, as a preventive measure, the state of the equipment (cables, cable-gland, etc.) taking account of the environmental conditions (temperature, humidity, etc.)

- to detect potentially dangerous anomalies such as cable ducts destroyed by abrasion as early as possible

- to ensure staff are trained fully regarding risks and means of prevention.

⚠ **The accumulation of dust between the fins or (and) against the fan intake grille leading to a rise in surface temperature indicates that the unit should be cleaned.**

11.1.2 - Repairs

Actual repairs to the electrical equipment for use in zones 21 or 22 should result in identical equipment. It is essential that equipment is returned to its original state, adhering precisely to the original motor configuration. Disregarding this may affect the safety of the equipment (for example, a protection index not conforming to IP 65) or the surface temperature (for example, rewinding the motor). Written authorization from the manufacturer is necessary, in order to disclaim any responsibility.

CAUTION :

without written agreement from the manufacturer, any work which may affect the safety of the motor is undertaken at the operator's own risk.

Service centres are trained and approved by Leroy-Somer to ensure that motors can be maintained and repaired in complete safety.

11.1.3 - Replacement parts

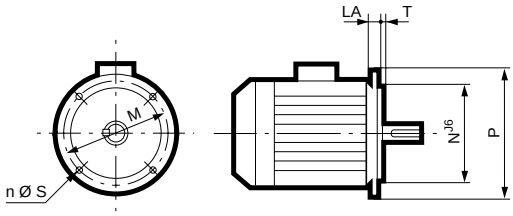
All orders for replacement parts must quote the complete motor type, its number and the information given on the nameplate (see section 2).

The part numbers can be found on the exploded views and their description in the parts list (section 12).

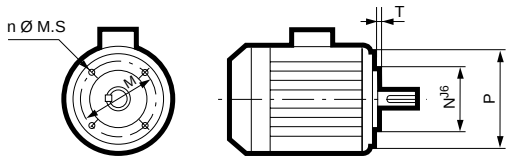
Routine maintenance kits can be supplied by our After Sales Service.

In the case of flange mounted motors, indicate the type of flange and its dimensions (see below).

Flange mounted motor



Face mounted motor



Our network of service stations can provide necessary replacement parts quickly.

In order to ensure the safety and good working order of our motors, we recommend the use of original manufacturer replacement parts.

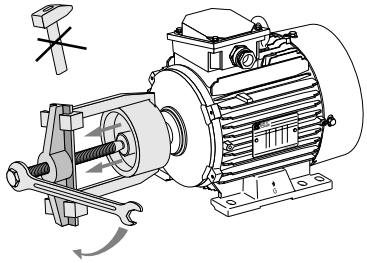
If this advice is not followed, the manufacturer cannot be held responsible for any subsequent damage.

11.2 - Corrective maintenance : general information

⚠ **First switch off and lock the power supply.**

- Open the terminal box, mark the wires and their position
- Disconnect the power supply wires
- Uncouple the motor from the driven equipment

Always use an extractor to remove any devices mounted on the shaft end of the motor.



11.2.1 - Dismantling the motor

See the detailed instructions on the following pages.
It is advisable to mark the shields in relation to the stator and the direction in which the rotor fan is mounted.

11.2.2 - Before reassembly

Stator :

- Any dust must be removed from the stator : if the winding needs to be cleaned, suitable liquid must be used : dielectric and inert on the insulation and the external finish
- Check the insulation (see section 4) and if necessary, dry it out
- Clean the flanges carefully, remove all traces of knocks and mastic sealant on the mating surfaces if necessary.

⚠ **Replace the seals on the shaftways and on the shield spigots with new seals of the same type after cleaning the parts. The shaftway seals must be mounted using the same type of grease as the bearings.**

Rotor :

- Clean and check the bearing running surfaces; if there is any damage, renew the running surfaces or replace the rotor
- Check the threads, the keys and their housing

End shields :

- Clean any traces of dirt (old grease, gathered dust, mastic sealant)
- Clean the bearing housings and the spigot
- If required, apply some antiflash varnish inside the end shields
- Clean the bearing caps and the grease valves carefully

11.2.3 - Mounting the bearings on the shaft

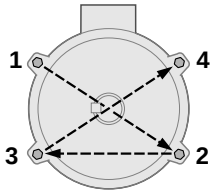
This operation is very important, as the slightest indentation on the bearing tracks would cause noise and vibration
Lightly lubricate the running surfaces of the shaft.

They can be mounted correctly in different ways :

- cold state : bearings must be fitted without impact, using a spanner (a hammer should not be used) ; the force required must not be transferred to the bearing track. Therefore, hold onto the internal cage (do not press on the seal shield for dust and damp proof bearings).

- hot state : heat the bearing from 80° to 100 °C : in a dryer, in an oven or on a heating plate.
(A blowtorch should never be used for heating, nor should an oil-bath).
After a bearing has been dismantled and reassembled, all the spaces between the seals and labyrinth seals should be filled with grease in order to keep dust out and prevent the rusting of machined parts.
See the detailed instructions for the relevant motor range in the following pages.

11.2.4 - Reassembling the motor



Tightening torque of the flange or shield fixing rods or screws

Type	screw/ rod Ø	Tightening torque N. m ± 5%
71	M4	3
80	M5	6
90	M5	6
100	M5 or M6	6 or 10.5
112	M5 or M6	6 or 10.5
132	M6	10.5

Be careful to replace the stator in its original position. It is as important to centre the stack of laminations (generally with terminal box facing forward) as to position the drain holes correctly if they are on the housing.

Tightening the tie rods

These should be tightened diagonally to the torque indicated (see above).

11.2.5 - Reassembling the terminal block

Reconnect all the power supply wires according to the diagram or marking carried out before dismantling and check that the seals are correctly inserted before closing. Ensure that all the terminal box components are tightened correctly.

Note : It is advisable to carry out a test of the motor at no load

- If necessary, repaint the motor.
- Mount the transmission device on the motor shaft extension and reinstall the motor on the machine to be driven (see section 5.3).

11.3 - Safety regulations

⚠ Before any work is carried out on the motor or in the cubicle, ensure that the equipment is no longer powered up (check the voltage at the power terminals and any auxiliaries).

⚠ Before any work is carried out on the motor or in the cubicle, ensure that the cosine φ compensation capacitors are isolated and/or discharged (read the voltage at the terminals).

⚠ Before any work is carried out on the terminal box or in the cubicle, ensure that the space heaters are powered down.

⚠ Depending on the type of thermal protection, the motor can remain powered up. Ensure the mains is disconnected before any work is carried out on the motor or in the cubicle.

11.4 - Normal maintenance

Checking after commissioning
After approximately 50 hours of operation, check that the motor fixing screws and the coupling device are tightened; and for chain or belt transmissions, check that the tension is correctly adjusted.

Cleaning
To ensure the motor can operate correctly, take steps to prevent dust and foreign bodies from clogging the air intake and the housing fins.
Precautions : check the motor is totally sealed (terminal box, drain holes, etc) before carrying out any cleaning operation.
Dry cleaning (vacuuming or compressed air) is always preferable to wet cleaning.

⚠ Cleaning must always be carried out at a pressure of less than 10 bars, from the centre of the motor outwards, to avoid dust and particles getting under the shaft seals.

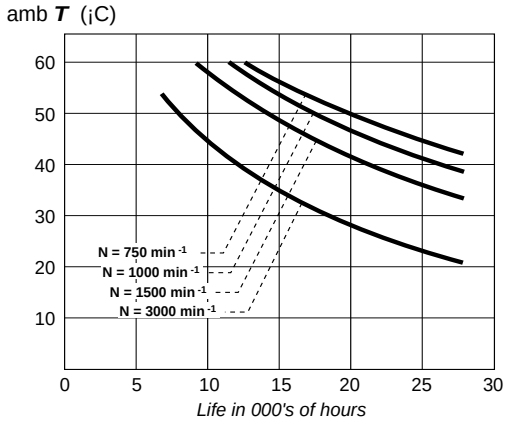
Draining condensation water
Variations in temperature cause condensation to be formed inside the motor, which must be removed before it affects motor operation.
Condensation drain holes, situated underneath the motors with regard to their operating position, are sealed with plugs which must be removed every six months then replaced.

Note : When there is high humidity and significant temperature variation, we recommend a shorter period.

⚠ Replace the drain hole covers to ensure IP 65 protection for the motor. Replace used seals with new seals of the same type. Clean the orifices and plugs before reassembly.

11.4.1 - Greasing

11.4.1.1 - Shields with permanently greased bearings
For LSPX motors of frame size 180 or below, the bearings defined enable long grease life and therefore lubrication for the lifetime of the machine. The grease life according to speed of rotation and ambient temperature is shown on the following chart.



11.5 - Bearing maintenance

11.5.1 - Checking bearings

When you detect on the motor :
- a noise or abnormal vibration
- abnormal temperature rise in the bearing even though it is lubricated correctly

the state of the bearings must be checked.

Damaged bearings must be replaced as soon as possible to prevent worse damage to the motor and the driven equipment.

When one bearing needs to be replaced, **the other bearing must also be replaced.**

The free bearing allows the rotor shaft to expand (make sure it is identified during dismantling).

11.5.2 - Reconditioning end shields

Bearings without grease nipples

Dismantle the motor (see section 11.1) ; remove the old grease (if the bearings are not sealed) and clean the bearings and accessories with a degreasing agent.

Fill 50 % of the space available in the shield with new grease.

11.6 - IP 65 protection for the motor

⚠ **Whenever the motor is dismantled, during on-site preventive maintenance, replace the seals for the shaftways, shield spigots, the terminal box cover (if mastic) with new seals of the same type, after cleaning the parts. The shaftway seals must be reassembled using grease of the same type as used on the bearings.**

⚠ **Whenever the drain plugs are removed, they must be replaced to ensure IP 65 protection for the motor. Replace used seals with new seals of the same type. Clean the orifices and plugs before reassembly.**

⚠ **After removing the terminal box cover, replace the seal with a new seal of the same type after cleaning the parts if its state no longer guarantees the required degree of protection.**

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11.7 - Troubleshooting guide

Incident	Possible cause	Action
Abnormal noise	Originating in motor or driven machine ?	Uncouple the motor from the driven equipment and test the motor on its own test the brake release system
Noisy motor	**Mechanical cause :** if the noise persists after switching off the electrical power supply	
	- vibration	- check that the key conforms with the type of balancing (see section 11.3)
	- damaged bearings	- change the bearings
	- mechanical friction : ventilation, brake disk, coupling	- check
	Electrical cause : if the noise stops after switching off the electrical power supply	- check the power supply at the motor terminals
	- normal voltage and 3 phases balanced	- check terminal block connection and tightening of the connectors
	- abnormal voltage	- check the power supply line
	- phase imbalance	- check the winding resistance and the supply (voltage) balancing
Motor heats up abnormally	- faulty ventilation	- monitor the environment - clean the fan cover and the cooling fins - check the fan is correctly mounted on the shaft
	- faulty supply voltage	- check
	- terminal connection fault	- check
	- overload	- check the current consumption against the current shown on the motor nameplate
	- partial short-circuit	- check the electrical continuity of the windings and/or the installation
	- phase imbalance	- check the winding resistance
Motor does not start	**no load** - mechanical locking - broken supply line	Release the brake, and with the motor switched off : - check the shaft rotates freely by hand - check fuses, electrical protection, starting device, electrical continuity
	on-load - phase imbalance	When switched off : - check the direction of rotation (phase order) - check the resistance and the continuity of the windings - check electrical protection

Troubleshooting guide

Incident	Possible cause	Action
The brake does not release	Insufficient supply voltage :	The maximum permissible voltage drop is 15 % of the rated voltage
	Single phase power supply :	Phase missing ; check the power supply
	Springs excessively compressed :	Slacken adjustment nuts 26 as instructed
The brake releases but the electromagnet is very noisy :	Unequal pressure on the 3 springs :	With the motor running, exert manual pressure on each spring on the armature : if the noise lessens when you push towards the motor, tighten the corresponding spring slightly if the noise lessens when you push away from the motor, loosen the corresponding spring slightly
		The armature and electromagnet surfaces are not in parallel, or are too far apart ; readjust nuts 24 and 31 (see instructions for adjusting the air gap)
	Air gap irregular, or too large :	Dismantle if necessary and clean
	Foreign body in the air gap :	
Short-circuit on switching on, phase imbalance, excessive current consumption :	Stator, brake :	Check the brake and stator terminal connections Check the connection to the motor (and to the brake if necessary)
The brake releases but braking is insufficient	Insufficient pressure on springs :	Adjust springs (see instructions)
	Correct pressure on springs :	Check for wear on the linings Check the surface condition of the ring and the brake shield Blow away any friction dust

12 - LSPX MOTORS

⚠ **Caution : before commencing work on the brake, the brake motor must be disconnected.**

Adjusting the air gap

Once the brake fails to release normally, it is necessary to adjust the air gap. The air gap is measured with the motor stopped and switched off. Ideally, it should be between 5 and 7/10 millimetres (the brake should release with an audible click and the armature should remain fixed in position without any abnormal vibration).

• Tighten nuts (24) and slacken nuts (31) by a few turns.
• Push back the electromagnet (9) against the nuts (31).
• Insert a flat 5/10 gauge into the resulting enlarged air gap.
• Place the electromagnet (9) against the armature (11) (with gauge in-between) and undo the nuts (24) equally, until they are in contact with the electromagnet (9).
• Remove the gauge, check that the air gap is correct all round the electromagnet. Tighten and lock the nuts (31).

Adjusting the braking torque

• Excessive braking

Undo the 3 adjustment nuts (26) by 1/2 turn each. Test the result; if the braking torque is still excessive, repeat the procedure.

• Insufficient braking

Tighten the 3 adjustment nuts (26) by 1/2 turn each. Test the result; if the braking torque is still insufficient, repeat the procedure.

Dismantling

• Switch off the power supply. Open the terminal box, mark the wires and their respective positions (motor and brake power supply, probes, etc).
• Disconnect the power supply wires. Dismantle the brake motor with the appropriate tools (hub remover, bearing remover, leather or plastic mallets, adjustable spanners and screwdrivers, circlip pliers, etc).
• Undo the fixing screws (41) on the cover (39) and remove it.
• Undo and remove the 3 fixing nuts (31) and the "Nylstop" nut (25).
• Remove the electromagnet (9), the nuts (24) and (26), springs (28) and the armature (11).
• The disk (15) can then be taken out (mark the mounting direction).
• Clean the parts :
  - by simply blowing on electric parts (do not use solvents or liquids) ;
  - with white spirit or similar for mechanical parts ;
  - by scraping the spigots ;
  - if necessary, degrease the friction surfaces and linings.
• Change the seals and check the state of the bearings.
• Check the stator insulation (> 5 megohms).
• Make a note of all defective parts so that replacement parts can be ordered.

Reassembly

• Lightly grease the shafts and bearing cages.
• Coat the waterproof lipseals with grease and replace carefully (use a protective sleeve on the keyway groove).
• The spigots need to be watertight and should be coated with a thin layer of sealant.
• Refit the disk (15) in the correct mounting direction. Slide on the armature (11), and the 3 springs (28).
• Tighten nuts (26), then (24).
• Insert the brake power supply cable in the hole.
• Slide on the electromagnet (9), the brake washers (32) followed by the nuts (31) and the "Nylstop" nut (25).
• Connect the cables to the terminal block, matching the colours.
• Adjust the air gap and the braking torque (see instructions above).
• Reconnect all the power supply wires in accordance with the marking undertaken prior to dismantling.

Check the unit works correctly before refitting on the machine.

Dismantling the motor

After dismantling the brake :

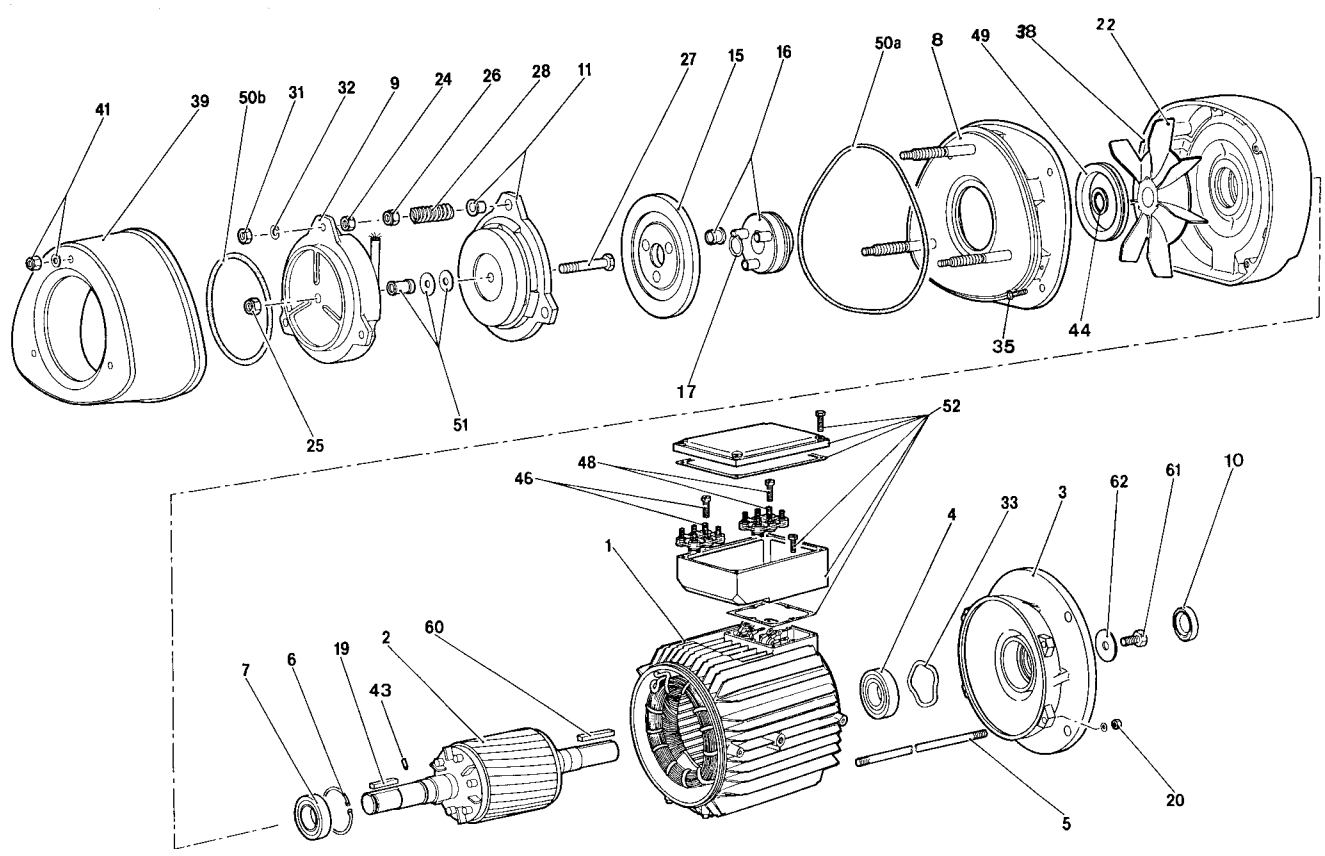
• Remove the inner circlip (17).
• Remove the hub (16).
• Undo the 4 fixing screws (35).
• Using a wooden mallet, remove the brake shield (8).
• Remove the seal on the brake end.
• Take out the fan (22) using a hub remover.
• Remove the tie rods (5).
• Remove the keys (60) and (19) as well as the pin (43).
• Remove the DE shield (3).
• Recover the preloading washer (33).
• Take out the rotor shaft and the NDE shield, taking care not to knock the winding.
• Remove the inner circlip (6).
• Remove the NDE shield.

To take out the bearings, use a bearing remover and avoid knocking the running surfaces of the shaft.

Reassembling the motor

• Fit the bearings on the motor shaft (don't forget the circlip (6)).
• Fit the NDE shield and insert the circlip.
• Insert the rotor in the stator taking great care not to knock the winding.
• Fit the DE shield after fitting the preloading washer in the bearing cage.
• Fit the tie rods and tighten them diagonally.
• Refit the fan.
• Grease and refit the brake end seal.
• Refit the brake shield and the 4 fixing screws, and tighten correctly.
• Refit the hub and its supporting circlip.

FAP 2 brake motor for LSPX 71 to 132



FAP 2 parts list

No.	Description	Qty	No.	Description	Qty	No.	Description	Qty
1	Housing and wound stator	1	**19**	Keys	2	**39**	Brake cover	1
2	Rotor shaft	1	**20**	Assembly nuts	4	**41**	"Nylstop" nuts + washers	3
3	DE shield	1	**22**	Fan	1	**43**	Fan pin (or key)	1
4	Shaft end bearing	1	**24**	Air gap adjustment nuts	3	**44**	Fan lock	1
5	Tie rods	4	**25**	Release nut	1	**46**	Brake terminal block	1
6	Inner circlip	1	**26**	Torque (Mf) adjustment nuts	3	**48**	Motor terminal block	1
7	Brake end bearing	1	**27**	Release rod	1	**49**	Brake end seal	1
8	Brake shield	1	**28**	Pressure springs	3	**50**	Waterproof seals (a and b)	2
9	Electromagnet	1	**31**	Electromagnet assembly nuts	3	**51**	Rod sealing component	1
10	Seal	1	**32**	Brake washers	3	**52**	Motor terminal box	1
11	Armature	1	**33**	Flexible washer (Borelly)	1	**60**	Shaft extension key	1
15	Brake disk	1	**35**	Fixing screw	4	**61**	Shaft extension screw	1
16	Hub	1	**38**	Adapter flange	1	**62**	Shaft extension washer	1
17	Inner circlip	1						