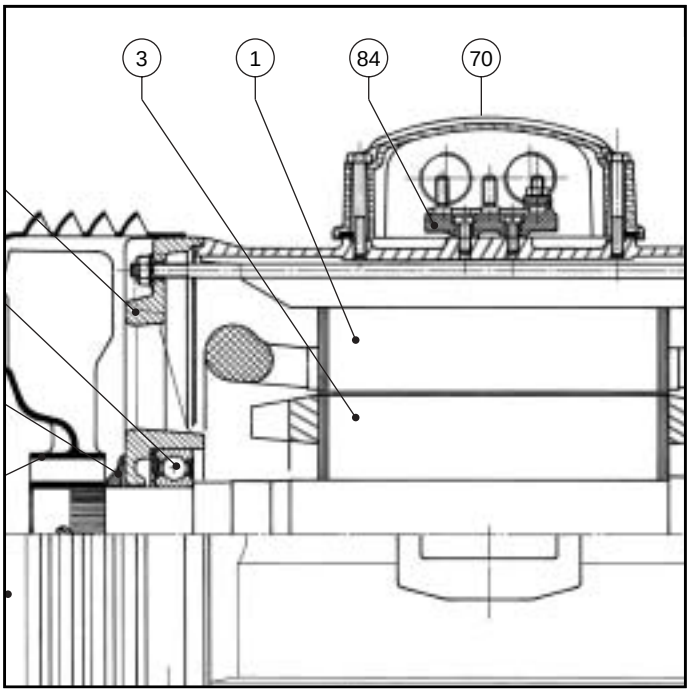
LEROY SOMER

2197 en - 02.2006 / b

This manual is to be given to the end user

(Addition to specific manual ref. 1889, included with the motor)



Drip-proof 3-phase induction motors

Installation and maintenance

Drip-proof 3-phase induction motors

IMPORTANT

These symbols ⚠ ⚠ appear in this document whenever it is important to take special precautions during installation, operation, maintenance or servicing 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 property should be ensured when fitting the motors into machines.

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

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

- **Mains voltage disconnected and no residual voltage present**
- **Careful examination of the causes of the stoppage (jammed transmission - loss of phase - cut-out due to thermal protection - lack of lubrication, etc.)**

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 and rigorous quality control. As a result, the regulatory authorities have awarded our motor factories the ISO 9000 - Edition 2000 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.

ISO 9001 DNV SYSTEME QUALITE CERTIFIE

LEROY-SOMER

NOTE:
LEROY-SOMER reserves the right to modify the characteristics of its products at any time in order to incorporate the latest technological developments. The information contained in this document may therefore be changed without notice.

Drip-proof 3-phase induction motors

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ABBREVIATIONS

D.E = "Drive End"

N.D.E = "Non Drive End"

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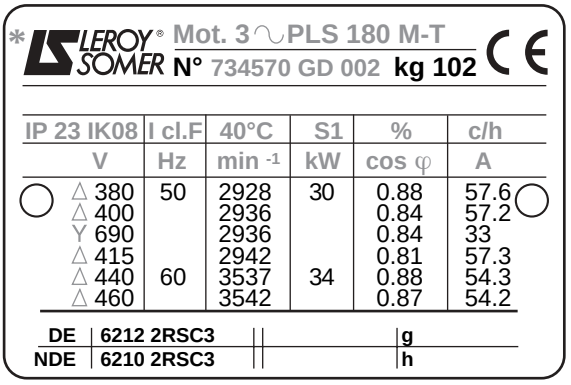
RECEIPT

1 - RECEIPT

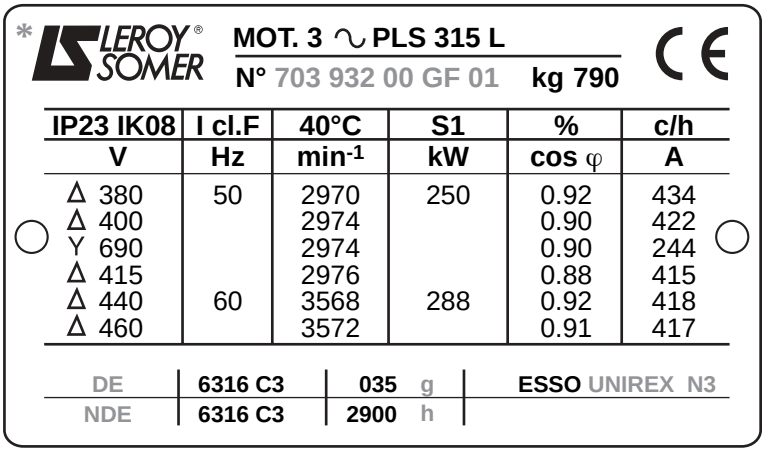
On receipt of your motor, check that it has not suffered any damage in transit.
If there are obvious signs of knocks, contact the carrier (you may able to claim on their insurance) and after a visual check, turn the motor by hand to detect any malfunction.

1.1 - Marking

As soon as you receive the motor, check that the nameplate on the machine conforms to your order.



*Other logos may be used as an option, but only by agreement BEFORE ordering.



Definition of symbols used on nameplates:

CE **Legal mark of conformity of product to the requirements of European Directives.**

MOT 3 ~ : Three-phase A.C. motor
PLS : Series
180 : Frame size
M : Housing symbol
T : Impregnation index

Motor number

734570 : Motor batch number
G : Year of production
D : Month of production
002 : Serial number

70393200: Motor batch number
G : Year of production
F : Month of production
01 : Serial number

kg : Weight
IP23 : Index of protection
IK08 : Shock resistance index
I cl. F : Insulation class F
40°C : Maximum ambient temperature for operation (IEC 60034-1)
S : Duty
% : Operating factor
c/h : Number of cycles per hour
V : Supply voltage
Hz : Supply frequency
min-1 : Revolutions per minute (rpm)
kW : Rated output power
cos φ: Power factor
A : Rated current
Δ : Delta connection
Y : Star connection

Bearings

DE : "Drive end" Drive end bearing
NDE : "Non drive end" Non drive end bearing
g : Quantity of grease at each regreasing (in g)
h : Regreasing interval (in hours)
UNIREX N3: Type of grease

Drip-proof 3-phase induction motors

ASSEMBLY

1.2 - Storage

Prior to commissioning, machines should be stored:
- Away 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 very long storage periods the motor can be placed in a sealed package (for example heat-shrunk plastic) containing sachets of desiccant.
- Protected from frequent significant temperature variations to prevent any condensation during storage.
- If the area is subject to vibration, try to reduce the effect of this vibration by placing the motor on a damping support (rubber plate or similar) and turn the rotor a fraction of a turn once a fortnight to prevent the bearing rings from becoming marked.
- Do not remove 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 it is started up:

Greasing
Bearings which cannot be regreased
Maximum storage: 3 years. After this time, replace the bearings (see section 6.1).
Bearings which can be regreased
Greases used by LEROY-SOMER

Storage period	Grease grade 2	Grease grade 3	
	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 3.1
	more than 1 year less than 5 years	more than 2 years less than 5 years	Dismantle the bearing - Clean it - Replace the grease completely
	more than 5 years	more than 5 years	Change the bearing - Regrease it completely

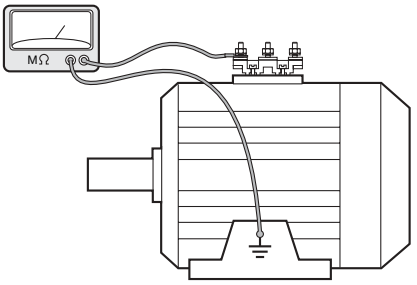
The motor nameplate indicates the type and quantity of grease (in g) to be used at each regreasing, as well as the regreasing intervals (in hours) (see p. 4 and 15).
PLS motors are lubricated with ESSO UNIREX N3 grease used as standard.

Electric motors are industrial products. They must therefore be installed by qualified, experienced personnel.
The safety of people, animals and property must be ensured when fitting or building the motors into a machine: please refer to current standards.

2 - ASSEMBLY

2.1 - Checking the insulation

Before starting the motor, it is advisable to check the insulation between the phases and earth, and between phases.
This check is essential if the motor has been stored for longer than 6 months or if it has been kept in a damp atmosphere.
This measurement must be carried out using a megohmmeter at 500 V DC (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. The insulation value must be at least 10 megohms in cold state.
If this value cannot be achieved, or if the motor may have been splashed with water or salt spray, or kept for a long period in a very humid place or if it is covered with condensation, it is advisable to dry the stator for 24 hours in a drying oven at a temperature of between 110°C and 120°C.
If it is not possible to place the motor in a drying oven:
- Switch on the motor, with the rotor locked, at 3-phase A.C. voltage reduced to approximately 10% of the rated voltage, for 12 hours (use an induction regulator or a reduction transformer with adjustable outlets).
- Or supply the 3 phases in series with a D.C. current, with the voltage at 1 to 2% of the rated voltage (use a D.C. generator with independent excitation or batteries for motors of less than 22 kW).
- NB: The A.C. current must be monitored using a clamp ammeter, and the D.C. current using a shunt ammeter. This current must not exceed 60% of the rated current.
It is advisable to 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 every 10° difference.
While it is drying, all the motor orifices must be open (terminal box).



Warning: If the high voltage test, carried out at the factory before despatch, needs to be repeated, it should be performed at half the standard voltage, ie: 1/2 (2U+1000V).

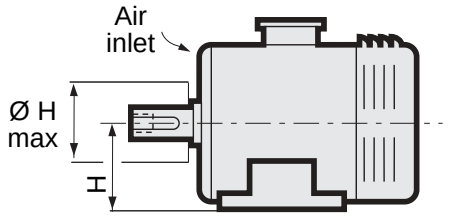
Prior to commissioning for all motors:
Rotate the motor at no load (no mechanical load) for 2 to 5 minutes, checking that there is no abnormal noise. If there is any abnormal noise, see section 5.

Drip-proof 3-phase induction motors

ASSEMBLY

2.2 - Location - ventilation

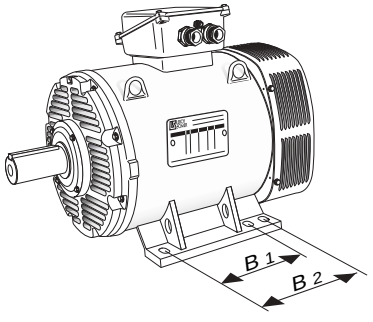
Our motors are cooled in accordance with method IC 01 (standard IEC 34-6), ie. "machine cooled by means of the ambient fluid (air) circulating inside the machine".
A fan at the non-drive end cools the motor. Air is sucked in at the front of the motor and blown along the fan cover to ensure thermal equilibrium of the motor whatever the direction of rotation.



The motor must be installed in a ventilated place, with clearance for the air inlet and outlet.
Obstruction (clogging) - even accidental - of the ventilation circuit has an adverse effect on motor operation.
It is also necessary to check that the hot air is not being recycled. If it is, pipes must be provided for the intake of cold air and expulsion of hot air, in order to prevent abnormal motor temperature rise.
In this case, if the air is not circulated by an auxiliary fan, the dimensions of the pipes must be such that the pressure losses are negligible compared to those of the motor.

Positioning
The motor must be mounted in the position specified on the order, on a base which is rigid enough to prevent distortion and vibration.

Where the motor feet have six fixing holes, it is preferable to use those which correspond to the standard dimensions for the motor power rating (refer to the induction motors technical catalogue), or, failing that, to those shown at B2.



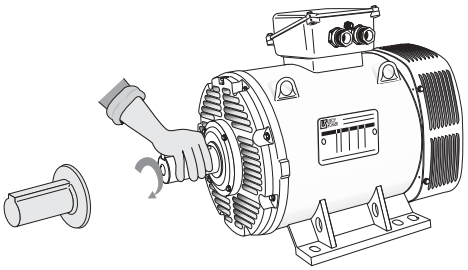
Ensure there is easy access to the terminal box and, if appropriate, to the grease nipples.

Use lifting equipment which is compatible with the weight of the motor (indicated on the nameplate).

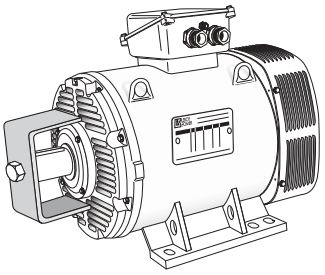
⚠ When the motor is fitted with lifting rings, they are for lifting the motor on its own and must not be used to lift the whole machine after the motor has been fitted to it.
Note 1: When installing a suspended motor, it is essential to provide protection in case the fixing breaks.
Note 2: Never stand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

2.3 - Coupling

Preparation
Turn the motor by hand before coupling to detect any possible fault due to handling.
Remove any protection from the shaft extension.



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 the coupling device has been fitted, the rotor must be re-immobilised.



Balancing
Rotating machines are balanced in accordance with standard ISO 8821:
- Half-key when the shaft extension is marked H: standard
- 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 accordingly.

⚠ The key must be modified if the coupling element does not cover the whole length of the key.

Motor with 2 shaft extensions:
If the second shaft extension is not used, in order to comply with the balancing class, 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 must be protected against direct contact.

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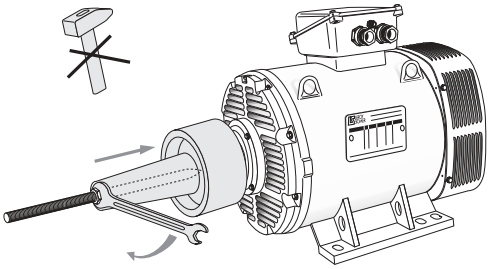
Precautions
All measures must be taken to ensure protection against the risks which arise when there are rotating parts (coupling sleeve, pulley, belt etc).

⚠ If a motor is started up without a coupling device having been fitted, carefully immobilise the key in its location.

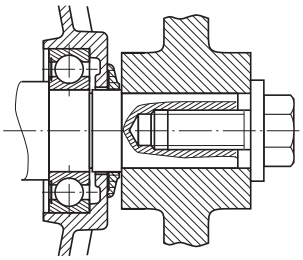
Beware of backdriving when the motor is switched off. The appropriate precautions must be taken:
- On pumps: install a non-return valve.
- On mechanical devices: install a backstop or a holding brake.
- Etc.

Tolerances and adjustments
The standard tolerances are applicable to the mechanical characteristics given in our catalogues. They comply fully with the requirements of IEC standard 72-1.
- Users must adhere strictly to the instructions provided by the transmission device supplier.
- Avoid impacts which could damage the bearings.

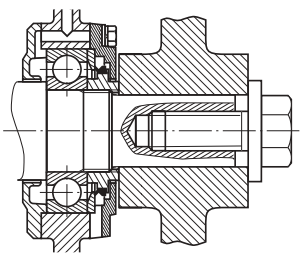
Use a spanner and grease the tapped hole of the shaft extension with a special lubricant (e.g. molykote grease) to make it easier to fit the coupling.



The hub of the transmission device must be:
- Fully 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 crush the seal).
- Longer than the shaft extension (2 to 3 mm) so that it can be tightened using a screw and washer. If it is not, a spacer ring must be inserted without cutting the key (if this ring is large, it must be balanced).



Applied to shoulder of shaft



Applied to stop ring

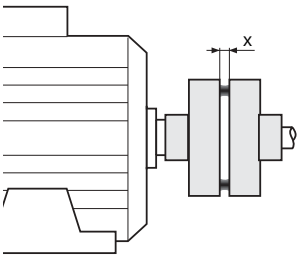
If there is a second shaft extension, it must only be used for direct coupling and the same recommendations must be followed.

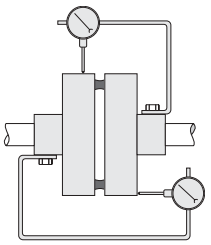
⚠ Warning: If the 2nd shaft extension is smaller than the main one, do not exceed half the rated torque.

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

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

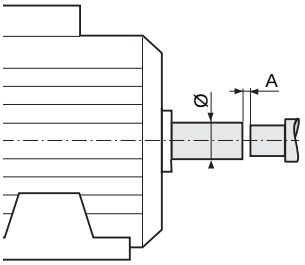
Direct connection using a coupling sleeve
Selection of the coupling sleeve should take account of the rated torque to be transmitted and the safety factor dependent on the starting conditions for the electric motor.
The machines must be carefully aligned, so that any lack of concentricity and parallelism in the two coupling halves is compatible with the recommendations of the coupling sleeve manufacturer.
Both coupling halves should be provisionally assembled to assist moving them in relation to one another.
Adjust the parallel plane of both shafts using a gauge. Measure the distance between the two coupling surfaces at one point on the circumference. Rotate them 90°, 180° and 270° in relation to this initial position, and measure each time. The difference between the two extremes of the value "x" must not exceed 0.05 mm for standard couplings.





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

Direct connection 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.
If this is not possible, consult LEROY-SOMER.



Ø (mm)	A (mm)
9 to 55	1
60	1.5
65	1.5
75	2
80	2

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Transmission via belt pulleys

The user can choose the diameter of the pulleys.

Cast iron pulleys with a diameter over 315 are not recommended for rotation speeds of 3000 min^{-1} or more.

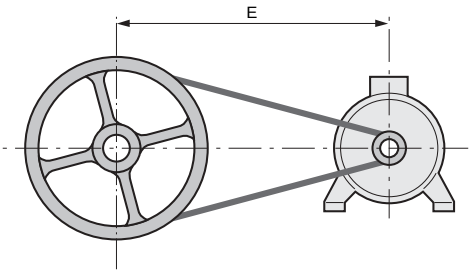
Flat belts cannot be used for rotation speeds of 3000 min^{-1} or more.

Positioning the belts

So that the belts can be correctly positioned, allow for possible adjustment of approximately 3% with respect to the calculated distance E.

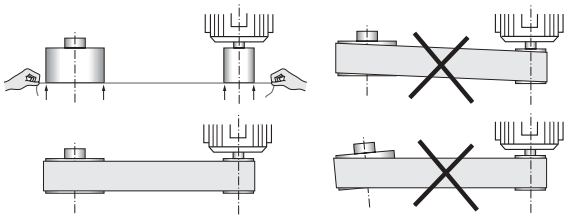
Force must never be used when fitting the belts.

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

Adjusting the tension of the belts must be carried out very carefully in line with the recommendations of the belt supplier.

Reminder:

- Tension too great = unnecessary force on the end shields which could lead to premature wear of the bearing unit (end shield-bearings) and eventually break the shaft.
- Tension too weak = vibration (wearing of the 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.

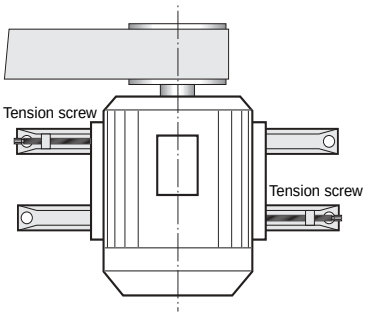
Adjustable distance between centres

The motor is usually mounted on slide rails, which enables 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 machine being driven.

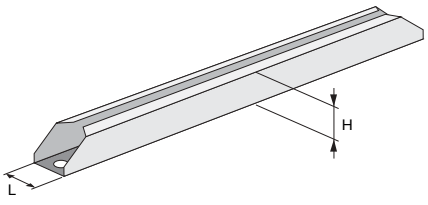
Mount the slide rails firmly with the tension screws in the direction shown in the diagram (slide rail screw on the belt side between the motor and the machine being driven).

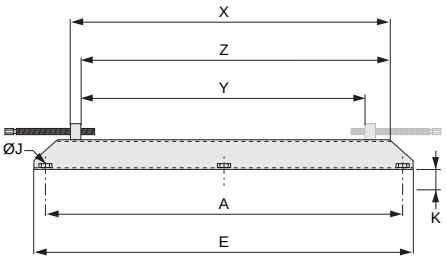
Fix the slide rails to the baseplate and adjust the belt tension as before.



Option: Standard slide rails (conforming to standard NFC 51-105)

These steel slide rails are supplied with tension screws and 4 nuts and bolts for fixing the motor onto the slide rails, but the fixing bolts for the slide rails are not supplied.





MOTOR FRAME SIZE	TYPE OF SLIDE RAIL	DIMENSIONS									SLIDE RAIL WEIGHT PER PAIR (kg)
		A	E	H	K	W	X	Y	Z	Ø J	
80 and 90	G 90/8 PM	355	395	40	2.5	50	324	264	294	13	3
100, 112 and 132	G 132/10 PM	480	530	49.5	7	60	442	368	405	15	6
160 and 180	G 180/12 PM	630	686	60.5	7	75	575	475	525	19	11
200 and 225	G 225/16 PF	800	864	75	28.5	90	-	623	698	24	16
250 and 280	G 280/20 PF	1000	1072	100	35	112	-	764	864	30	36
315 and 355	G 355/24 PF	1250	1330	125	36	130	-	946	1064	30	60

For larger frame sizes, please consult LEROY-SOMER before ordering.

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ASSEMBLY

2.4 - Electrical guidelines

Maximum power for D.O.L. motors (kW)

This extract from standard NFC 15-100 indicates the limits tolerated for D.O.L. starting of a motor connected to the mains power supply.

Type of motor / Location	Single-phase 230 (220) V	3-phase 400 (380) 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 those in the service sector, the industrial sector, general housing services, the agricultural sector, etc.*
For motors driving a high inertia machine, motors with long starting times, brake motors or change of direction by current reversal, the electricity supply company must carry out all the necessary checks before installation.

Limiting problems caused by motor starting

For the installation to remain in good working order, any significant temperature rise in the cabling conduits must be prevented, while making sure that the protection devices do not interrupt starting.

Operating problems in other equipment connected to the same supply are due to the voltage drop caused by the current demand on starting, which can be many times greater than the current absorbed by the motor at full load: approximately 7 times; see the LEROY-SOMER induction motor technical catalogue.

Even though mains supplies increasingly allow D.O.L. starting, the current inrush must be reduced for certain installations.

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, the resistive torque and the total driven inertia determine the starting time.
Depending on the load being driven, these values can be adjusted to adapt the torque and current to the machine starting time and to the possibilities of the mains power supply.

The five essential modes are:
- D.O.L. starting
- Star/delta starting
- Soft starting with autotransformer
- Soft starting with resistances
- Electronic starting

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

LEROY-SOMER "Digistart" electronic starter

This is a multi-function electronic system with an 8-bit microcontroller, which is used with all 3-phase cage induction motors.

It allows motor soft starting with:
- Reduction of the starting current
- Gradual, jolt-free acceleration, achieved by controlling the current consumed by the motor.

After starting, the DIGISTART performs additional motor control functions in its other operating phases: steady state and deceleration.
- 2.2 to 500 kW models
- Power supply: 220 to 700 V - 50/60 Hz

DIGISTART is economical to install, as only an additional fuse switch is needed.

Other control systems

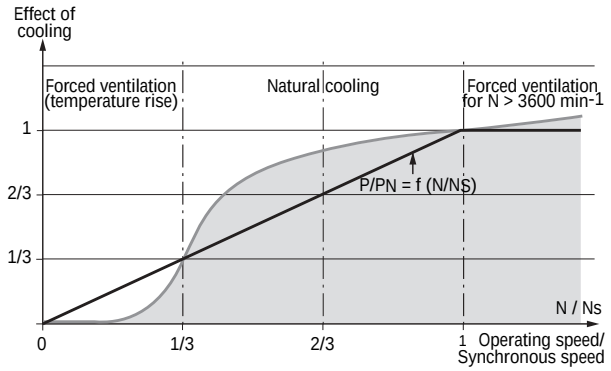
Frequency inverters, flux vector control, etc.

Special precautions need to be taken when standard induction motors are being used for variable speed control, powered by an inverter or voltage controller:

See page 10 of the enclosed motors manual.

During prolonged operation at low speed, cooling efficiency is greatly diminished. It is therefore advisable to install a forced ventilation unit that will produce a constant flow of air independently of the motor speed.

During prolonged operation at high speed, the fan may make excessive noise. It is again advisable to install a forced ventilation unit.



Drip-proof 3-phase induction motors

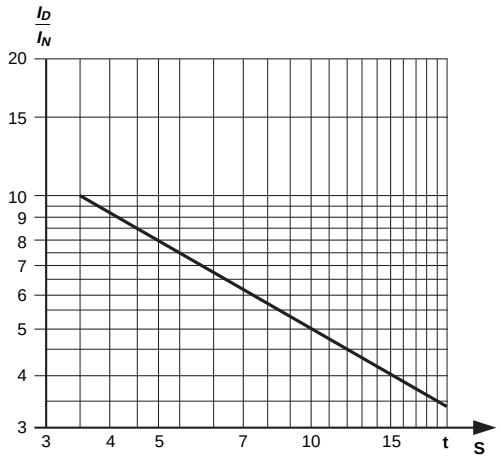
ASSEMBLY

Earthing
It is essential to earth the motor in order to protect workers.
Conform to the current standards and legislation when connecting the earth wires.

Thermal magnetic protection
The motors must be protected by a thermal magnetic device located between the isolating switch and the motor. These protection devices provide total protection of the motor against non-transient overloads.
This device can be accompanied by fused circuit-breakers.

Permissible starting times and locked rotor 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.

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



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

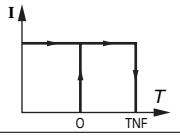
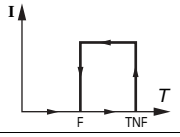
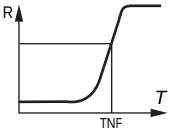
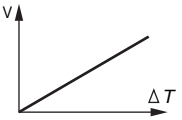
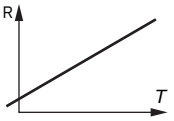
Drip-proof 3-phase induction motors

ASSEMBLY

Built-in thermal protection
The motors can be equipped with optional heat sensors; these sensors can be used to monitor temperature rises at "hot spots" in order to detect an overload or faulty cooling (or at strategic points) and thus safeguard the installation.
It must be emphasized that these sensors cannot be used to carry out direct adjustments to the motor operating cycles.

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

Type	Symbol	Operating principle	Operating curve	Breaking capacity	Protection provided	Number of devices
Normally closed thermostat	PTO	Bimetallic strip, indirectly heated, operates on opening (NC)		2.5 A at 250V with Cos φ 0.4	General surveillance for non-transient overloads	2 or 3 in series
Normally open thermostat	PTF	Bimetallic strip, indirectly heated, operates on closing (NO)		2.5 A at 250V with Cos φ 0.4	General surveillance for non-transient overloads	2 or 3 in parallel
Positive temperature coefficient thermistor	PTC	Variable non-linear resistor, indirectly heated		0	General surveillance for transient overloads	3 in series
Thermocouples	*T* (*T*<150°C) Constantan copper K (*T*<1000°C) Copper Copper-Nickel	Peltier effect		0	Continuous surveillance at hot spots at regular intervals	1 per hot spot
Platinum resistance thermometer	PT 100	Variable linear resistor, indirectly heated		0	High accuracy continuous surveillance at key hot spots	1 per hot spot

- NRT: nominal running temperature
- The NRTs are chosen according to the position of the sensor in the motor and the temperature rise class.

Fitting thermal protection
- PTO or PTF, in the control circuits
- PTC, with relay, in the control circuits
- PT 100 or Thermocouples, with reading equipment or recorder, in the control board of the installation for continuous surveillance.

Alarm and Safety
All protective equipment may be backed up by another type of protection (with a different NRT). The first device will then act as an alarm (light or sound signals given without shutting down the power circuits), and the second device will be the safety system (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 turns. This resistor heats the machines when stopped and thus prevents condensation inside the machines.
Power supply: 230V single-phase unless otherwise specified by the customer.

See ⚠ page 12 of the enclosed motors manual.

Drip-proof 3-phase induction motors

ASSEMBLY

2.5 - Mains connection

Terminal box

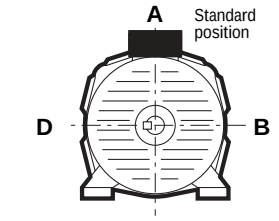
Placed as standard on the top of the motor near the drive end, the terminal box is made up of IP 55 components and is fitted with a cable gland in accordance with the table below.
The standard position of the cable gland is on the right, seen from the drive end but, owing to the symmetrical construction of the box, it can usually be placed in any of the 4 directions, except for:
- position **2** for flange mounted motors.
- positions **2** and **4** for PLS 315 MG/LG/VLG/VLGU, PLS 355 and PLS 400 motors.

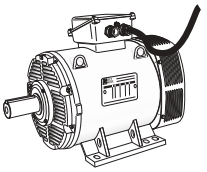
If required, the terminal box may be fitted in a different position (on the left or right as seen from the drive end).

Cable gland

Check that the cable entry radius of curvature prevents water from entering the cable gland.

▼ *Terminal box positions in relation to the motor shaft extension (motor in position IM 1001)*





▼ *Cable gland positions in relation to the motor shaft extension*

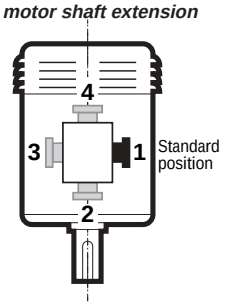


Table of terminal blocks and type of cable gland for PLS 160 to 400 motors

Power kW	2 Poles				4 and 6 Poles			
	230/400 V		400 V Δ		230/400 V		400 V Δ	
11	M6	2 x ISO 25	M6	2 x ISO 25	M6	2 x ISO 25	M6	2 x ISO 25
15	M6	2 x ISO 25	M6	2 x ISO 25	M6	2 x ISO 25	M6	2 x ISO 25
18.5	M6	2 x ISO 25	M6	2 x ISO 25	M8	2 x ISO 32	M6	2 x ISO 25
22	M8	2 x ISO 32	M6	2 x ISO 25	M8	2 x ISO 32	M6	2 x ISO 25
30	M8	2 x ISO 32	M6	2 x ISO 25	M8	2 x ISO 32	M6	2 x ISO 25
37	M8	2 x ISO 32	M8	2 x ISO 32	M10	2 x ISO 40	M8	2 x ISO 32
45	M10	2 x ISO 40	M8	2 x ISO 32	M10	2 x ISO 40	M8	2 x ISO 32
55	M10	2 x ISO 40	M8	2 x ISO 32	M10	2 x ISO 40	M8	2 x ISO 32
75	M12	2 x ISO 50	M10	2 x ISO 40	M12	2 x ISO 50	M10	2 x ISO 40
90	M12	2 x ISO 50	M10	2 x ISO 40	M12	2 x ISO 50	M10	2 x ISO 40
110	M16	2 x ISO 63	M12	2 x ISO 50	M16	2 x ISO 63	M12	2 x ISO 50
132	M16	2 x ISO 63	M12	2 x ISO 50	M16	2 x ISO 63	M12	2 x ISO 50
160	M16	2 x ISO 63	M12	2 x ISO 50	M16	2 x ISO 63	M12	2 x ISO 50
200	M16	2 x ISO 63	M16	2 x ISO 63	M16	2 x ISO 63	M16	2 x ISO 63
250	M16	2 x ISO 63	M16	2 x ISO 63	M16	2 x ISO 63	M16	2 x ISO 63
280	M16	*	M16	*	M16	*	M16	*
315	M16	*	M16	*	M16	*	M16	*

* These motors are supplied with a removable undrilled cable gland support plate.

Frame size	2 Poles				4, 6 and 8 Poles			
	230/400 V		400 V Δ		230/400 V		400 V Δ	
PLS 315 MG/LG	M12	**	M12	**	M12	**	M12	**
PLS 315 VLG/VLGU	M12	**	M12	**	M12	**	M12	**
PLS 355/400	M14	**	M14	**	M14	**	M14	**

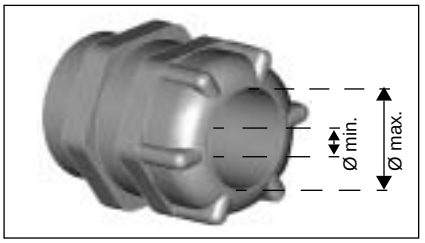
** From the PLS 315 MG upwards, the cable gland mounting plates are supplied without cable glands, nozzles or drill holes.

Tightening torque for the nuts on the terminal blocks ▶

Terminal	M4	M5	M6	M8	M10	M12	M14	M16
Torque N.m	2	3.2	5	10	20	35	50	70

Tightening capacity of cable glands

Type of cable gland	Tightening capacity	
	Min. cable Ø (mm)	Max. cable Ø (mm)
ISO 16	5	10
ISO 20	9.5	15
ISO 25	13	19
ISO 32	15	25
ISO 40	21	32
ISO 50	26	38
ISO 63	31	44



Standard cable gland material = plastic (brass on request).

⚠ Adapt the cable gland and its reducer if present to the diameter of the cable being used.
In order to preserve the motor terminal box's original IP55 protection, it is essential to tighten the cable gland seal correctly (so that it cannot be unscrewed by hand).
When there are several cable glands and some are not being used, ensure that they are always covered and tighten them so that they also cannot be unscrewed by hand.

Drip-proof 3-phase induction motors

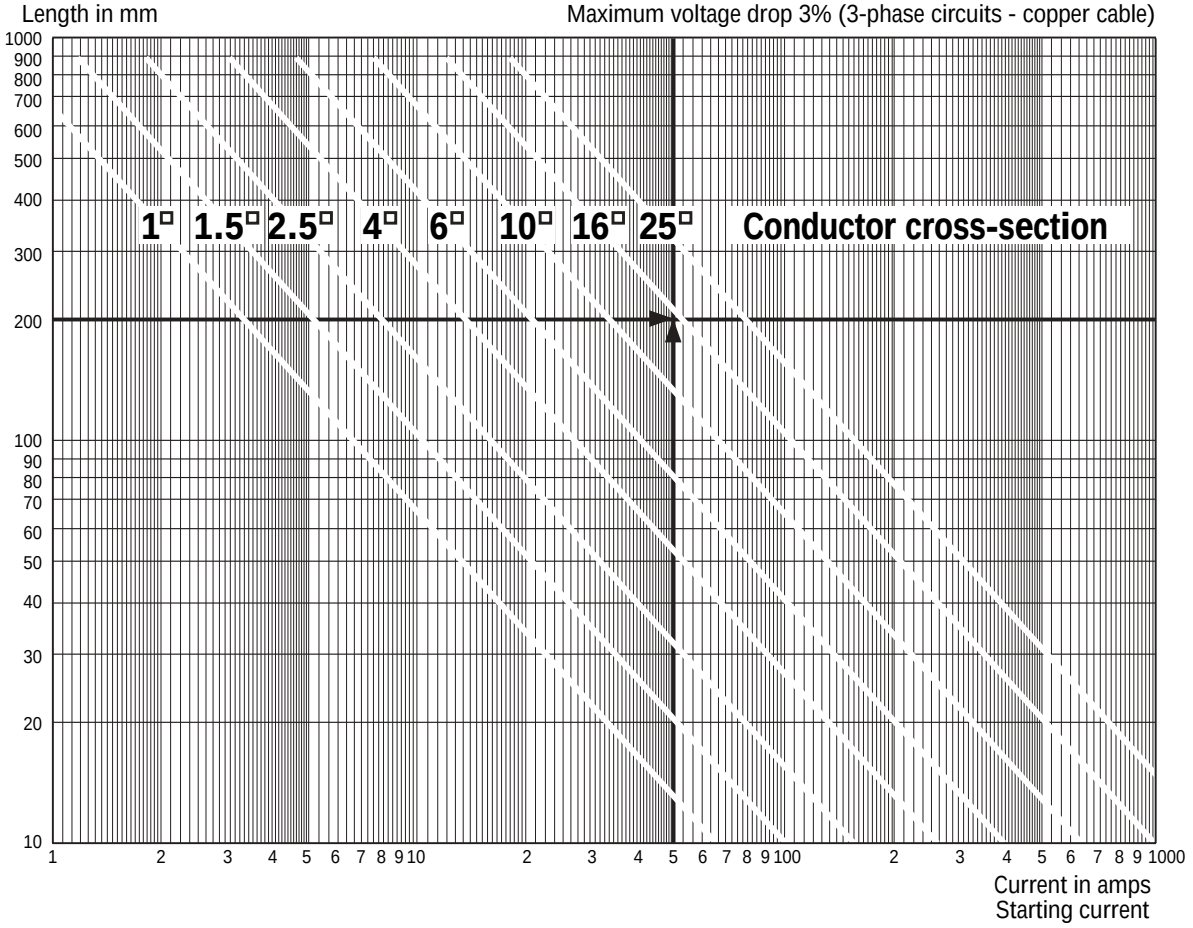
ASSEMBLY

Cross-section of the power supply cables

The higher the current, the greater the voltage drop will be (C 15.100 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 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 cables and the starting current, in order to limit the voltage drop to 3% maximum.

This table does not allow the installer to dispense with checking the protective systems.



Drip-proof 3-phase induction motors

ASSEMBLY

Terminal block wiring diagram

All motors are supplied with a wiring diagram in the terminal box*.

The connector links required for coupling can be found inside the terminal box.

Single-speed motors are fitted with a block of 6 terminals complying with standard NFC 51 120, with the terminal markings complying with IEC 34 - 8 (or NFC 51 118).

⚠ Particular attention must be paid to the information on the nameplate in order to choose the correct type of connection for the supply voltage.

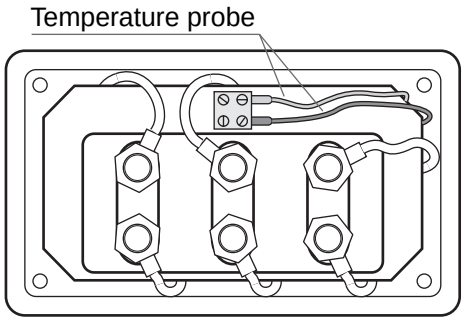
Direction of rotation

When the motor is powered by U1, V1, W1 or 1U, 1V, 1W from a direct mains supply L1, L2, L3, it turns clockwise when seen from the drive end.

If 2 phases of the power supply are changed over, the motor will run in an anti-clockwise direction (make sure the motor has been designed to run in both directions of rotation).

Warning: motor with backstop: starting in the wrong direction destroys the backstop (see arrow on motor housing).

If the motor is fitted with accessories (thermal protection or space heater), these should be connected on screw dominos or terminal blocks with labelled wires (see section 2.4).



Earth terminal

This is situated inside the terminal box; in some cases, the earth terminal may be situated on one of the feet or on one of the cooling fins (round motors).

It is indicated by the symbol: ⏚

⚠ The motor must be earthed, and conform to current regulations (protection of people).

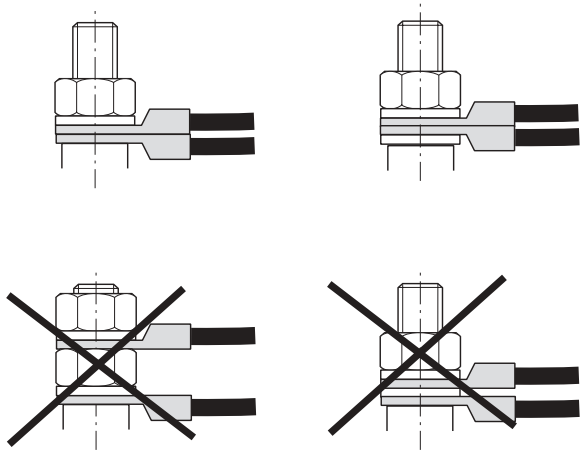
* If necessary, this diagram should be requested from the supplier, specifying the motor type and number as shown on the motor nameplate.

Mains connection

The cables must be fitted with connectors suitable for the cable cross-section and the terminal diameter.

They must be crimped in accordance with the connector supplier's instructions.

Connection must be carried out with connector resting on connector (see diagrams below):



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

Terminal	M4	M5	M6	M8	M10	M12	M14	M16
Steel	2	3.2	5	10	20	35	50	70
Brass	1	2	3	6	12	20	35	50

If using cables without connectors, attach some calipers.

If any nuts on the brass terminal block are lost, they must be replaced by brass nuts, not ordinary steel ones.

When closing the box, ensure that the seal is correctly positioned.

⚠ As a general rule, check that no nut, washer or other foreign body has fallen into or come into contact with the winding.

Drip-proof 3-phase induction motors

ROUTINE MAINTENANCE

3 - ROUTINE MAINTENANCE

Checks after start-up
After approximately 50 hours' operation, check that the screws fixing the motor and the coupling device are still tight. In the case of chain or belt transmission, check that the tension is correctly adjusted.

Ventilation
To ensure correct motor operation, take steps to prevent dust and foreign bodies from clogging the cover and DE shield grilles and the housing fins.
Precaution: check that the motor is totally sealed (terminal box, etc) before carrying out any cleaning operation.
Dry cleaning (vacuuming or compressed air) is recommended. Wet cleaning (water hose or high pressure cleaner) is to be avoided at all cost.

⚠ **Cleaning must always be carried out at low pressure to avoid dust and particles getting under the seals.**

3.1 - Greasing

Permanently greased bearings
For **motors ≤ frame size 200**, the bearings defined offer long grease life and therefore lubrication for the lifetime of the machines.

Bearings with grease nipples
The bearings are lubricated in the factory
For motors ≥ frame size 225, the bearings are fitted with grease nipples.

The chart below shows the regreasing intervals, depending on the type of motor, for standard bearing assemblies, operating at an ambient temperature of 25°C on a horizontal shaft machine.

Motors operating at an ambient 40°C need more frequent lubrication. The intervals between greasing will be about half of those shown in the table.

⚠ **The table below is valid for motors lubricated with ESSO UNIREX N3 grease, which is used as standard.**
The regreasing intervals, quantity and quality of grease, are indicated on the nameplates attached to the motor.

Motor type	Regreasing intervals in hours			
	3000 min^{-1}	1500 min^{-1}	1000 min^{-1}	750 min^{-1}
PLS 160	} Permanently greased bearings (motors supplied without grease nipple)			
PLS 180				
PLS 200				
PLS 225	7,400	15,000	15,000	-
PLS 250	5,200	12,600	17,600	-
PLS 280	5,200	12,600	17,600	-
PLS 315 S / M/L / SU / MU	5,800	9,800	15,800 except S4: 12 500	-
PLS 315 LD	5,200	9,000	14,400	-
PLS 315 MG / LG / VLG / VLGU	3,400	9,000	18,000	27,000
PLS 355	3,400	7,400	16,000	24,000
PLS 400	-	4,600	12,000	20,000

Drip-proof 3-phase induction motors

ROUTINE MAINTENANCE

The interval between successive regreasings can depend on additional parameters:
- Environment: Motors operating at an ambient 40°C need more frequent lubrication. The regreasing intervals are approximately half of those shown in the table.
- Type of grease, if not ESSO UNIREX N3 (check compatibility).

⚠ Even in the event of prolonged storage or downtime, the interval between 2 greasing operations should never exceed 2 years.

Note: In all cases and particularly for special assemblies (motors fitted with drive end roller bearings or other assemblies) the instructions for maintaining the bearings are shown on the machine nameplate.

Type of grease

When the bearings are not greased for life, the type of grease is indicated on the nameplate.

As standard this grease is ESSO UNIREX N3 and we recommend that it is used for subsequent lubrication. **Avoid mixing greases.**

Bearings without grease nipples

Dismantle the motor (see section 6.1); remove the old grease and clean the bearings and accessories with degreasing agent.

Fill with new grease according to the quantities defined in section 6.3.

Bearings with grease nipples

Our motor grease nipples are M8 x 125 Tecalemit-Hydraulic.

Always begin by cleaning the waste grease channel

When using the grease shown on the nameplate, remove the covers and clean the grease nipple heads.

Efficient greasing only really occurs with the motor running, which ensures that the new grease is well distributed in the bearing.

If greasing cannot be carried out with the motor running, (mainly for safety reasons):
- stop the motor
- inject only half the amount of grease shown on the nameplate
- turn the motor for a few minutes
- add more grease until the quantity indicated is reached.

Note: When using a different type of grease to that indicated but of similar quality, the motor must be dismantled and the bearings and accessories cleaned (carefully clean the grease inlet and outlet channels) to remove the old grease before regreasing. Then proceed as indicated in paragraph 6 (corrective maintenance).

Warning:

Too much grease causes the bearing to overheat (statistics show that more bearings are damaged through too much grease than too little grease).

Important note:

The new grease must be recently manufactured and must not contain any impurities (dust, water, etc).

3.2 - Checking the bearings

As soon as you detect any of the following on the motor:
- A noise or abnormal vibration
- Abnormal heating of the bearing when it is correctly greased, 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 equipment being driven.

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

The seals should be changed routinely when the bearings are changed.

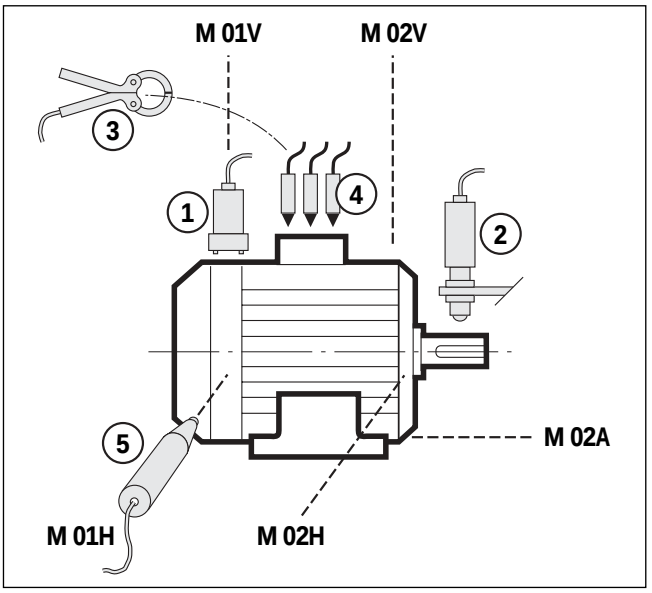
The non drive end (N.D.E.) bearing must be freely mounted to allow for expansion of the rotor shaft.

Drip-proof 3-phase induction motors

PREVENTIVE MAINTENANCE

4 - PREVENTIVE MAINTENANCE

Please consult LEROY-SOMER who, in its continuous search for ways to help customers, has evaluated numerous methods of preventive maintenance.
The diagram and table below give the recommended equipment to use and the ideal positions to take measurements of all parameters which can affect the operation of the machine, such as eccentricity, vibration, state of bearings, structural problems, electrical problems, etc.



Detector		Measurement	Measurement points								
			M 01V	M 01H	M 02V	M 02H	M 02A	Shaft	E01	E02	E03
①	Accelerometer	For measuring vibrations	●	●	●	●	●				
②	Photo-electric cell	For measuring speed and phase (balancing)						●			
③	Clamp ammeter	For measuring current (D.C. and 3-phase A.C.)							●	●	●
④	Voltage probe	A.C. and D.C. voltages							●	●	●
⑤	Infra-red probe	For measuring temperature	●		●						

Drip-proof 3-phase induction motors

TROUBLESHOOTING GUIDE

5 - TROUBLESHOOTING GUIDE

Incident	Possible cause	Remedy
Abnormal noise	Originating in motor or machine being driven?	Uncouple the motor from the equipment being driven and test the motor on its own
Noisy motor	**Mechanical cause:** if the noise persists after switching off the power supply	
	- Vibration	- Check that the key conforms to the type of balancing (see section 2.3)
	- Damaged bearings	- Change the bearings
	- Mechanical friction: ventilation, coupling	- Check
	Electrical cause: if the noise stops after switching off the power supply	- Check the power supply at the motor terminals
	- Normal voltage and 3 phases balanced	- Check the connection of the terminal block and the tightening of the connectors
	- Abnormal voltage	- Check the power supply line
	- Phase imbalance	- Check the winding resistance
Motor heats up abnormally	- Faulty ventilation	- Check the environment - Clean the fan cover and the cooling fins and D.E. grille - Check that the fan is correctly mounted on the shaft
	- Faulty supply voltage	- Check
	- Terminal connection fault	- Check
	- Overload	- Check the current consumption against that indicated 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 power supply line	When switched off: - Check that the shaft rotates freely by hand - Check the fuses, electrical protection, starting device
	On load - Phase imbalance	When switched off: - Check the direction of rotation (phase order) - Check the resistance and continuity of the windings - Check the electrical protection

Drip-proof 3-phase induction motors

CORRECTIVE MAINTENANCE

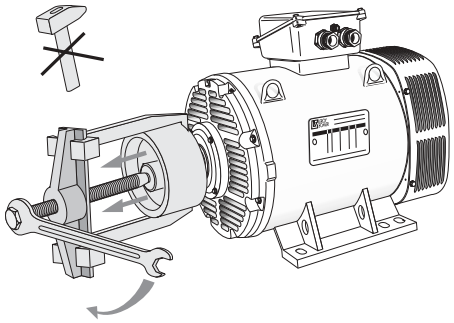
6 - CORRECTIVE MAINTENANCE

6.1 - General information

First switch off and lock the power supply.

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

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



Dismantling the motor

Refer to the detailed instructions for the relevant motor range (see following pages).

It is advisable to mark the shields in relation to the stator and the direction in which the rotor fan is mounted.

Before reassembling

Stator:

- Any dust must be removed from the stator:

if the winding needs to be cleaned, a suitable liquid must be used: dielectric and inert on the insulation and the external finish.

- Check the insulation (see section 2.1) and if necessary, dry it out.
- Clean the spigots thoroughly, and remove all traces of impact on the mating surfaces if necessary.

Rotor:

- Clean and check the bearing running surfaces. If there is any damage, renew the running surfaces or change the rotor.
- Check the condition of the threads, keys and their housing.

End shields:

- Clean off any traces of dirt (old grease, accumulated dust, etc).
- Clean the bearing housings and the spigot.
- If necessary, apply anti-flash varnish inside the end shields.
- Clean the grease caps and the grease valves carefully.

Mounting the bearings on the shaft

The reference numbers for the bearings to be used are indicated on the motor nameplate.

This operation is extremely important, as the slightest indentation of a ball on the bearing tracks would cause noise and vibration.

Lightly lubricate the running surfaces of the shaft.

There are a number of ways of mounting the bearings correctly:

- Cold state: The bearings must be mounted without any impact, using a spanner (do not use a hammer). The force applied must not be transferred to the bearing track. You should therefore use the internal cage for support (taking care not to press on the seal shield for dust and damp protected bearings).
- Hot state: Heat the bearing to between 80 and 100°C: in a dryer, an oven or on a heating plate.

(A blowtorch must never be used for heating, just as an oil bath must not be used for heating permanently greased bearings).

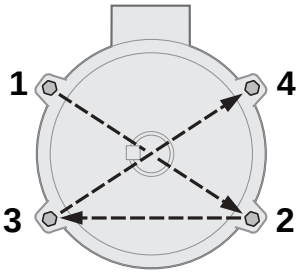
See the detailed instructions for the relevant motor range in the following pages.

Reassembling the motor

Be careful to replace the stator in its original position, so that the stack of laminations is centred correctly (generally with the terminal box facing forward) and the water drain holes are positioned correctly if they are on the housing.

Tightening the tie rods

These must be tightened diagonally, to the torque indicated (see below).



Tightening torque of the tie rods or screws

Type	Rod or screw Ø	Tightening torque N. m ± 5%
PLS 160 M	M8	18
PLS 160 MG/L	M8	18
PLS 180 M/L	M8	18
PLS 180 LG	M10	25
PLS 200 M/LP	M10	25
PLS 200 L	M10	25
PLS 225 MR	M10	25
PLS 250 SP/MP	M12	44
PLS 280 SC/MC/MD	M12	44
PLS 315 S/SU	M10	25
PLS 315 M/MU	M10	25
PLS 315 L/LD	M10	25
PLS 315 MG/LG	M12	44
PLS 315 VLG/VLGU	M12	44
PLS 355 L	M12	44
PLS 400 L	M10	25

Reassembling the terminal box

Reconnect all the power supply wires in accordance with the diagram or markings made before dismantling.

It is advisable to test 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.

Drip-proof 3-phase induction motors

CORRECTIVE MAINTENANCE

6.2 - PLS 160 M/MG/L, PLS 180 M/L motors

Dismantling

- Remove the screws (27) and then take off the cover (13).
- Pull out the fan (7) using a hub remover or 2 diametrically opposed levers, using the shield (6) for support, then remove the fan pin.
- Take out the key (21) and remove the seals (39) and (54).
- Unscrew the tie rods (14) then remove them.
- Unscrew the inner bearing retainer (33) fixing screws (40) when using a flange mounted motor or if the drive end bearing is locked, or the NDE bearing retainer (53) screws (62) when using a drive end roller bearing.
- Using a bronze drift, remove the shields (5 and 6) by tapping gently on the shield bosses. Recover the preloading washer (59).
- Remove the circlip (38) if necessary (flange mounted motor).
- Remove the circlip (60) if necessary (motor with roller bearings).
- Remove the rotor (3) from the stator (1) at the drive end, taking care not to touch the winding.
- Take out the bearings (30) and (50) using a bearing remover, while protecting the end of the shaft end with a washer. Take care not to knock the running surfaces of the shaft.

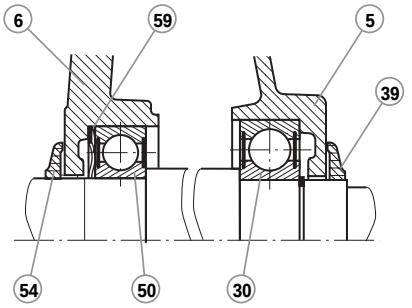
Reassembly

- See section 6.1 before reassembly.
- If necessary, insert the inner bearing retainer (33) at the rotor drive end and the inner bearing retainer (53) at the non drive end, then mount new bearings on the shaft, see section 6.1 mounting bearings.
- Mount the circlip (38) for flange mounted motors.
- Mount the circlip (60) for motors with roller bearings.
- Insert the rotor (3) in the stator (1) taking every precaution not to knock the winding.
- If there is a bearing retainer (33), screw a rod with the same thread diameter as the screws (40) into one of the tapped holes of the bearing retainer to maintain its angular position when refitting the DE shield (5).
- If there is a bearing retainer (53), screw a rod with the same thread diameter as the screws (62) into one of the tapped holes of the bearing retainer to maintain its angular position when refitting the NDE shield (6).
- Position the preloading washer (59) with a small amount of grease at the back of the bearing cage of the NDE shield (6), then remount the NDE shield (6) by positioning it on the stator.
- Refit the shield (5) taking care to allow for the positioning of a bearing retainer if used.
- Place the tie rods (14) in position and tighten the nuts diagonally up to the recommended torque (see section 6.1).
- If necessary, fix the bearing retainer (33) with its own screws.
- If necessary, fix the bearing retainer (53) with its own screws.
- Mount the shield seals with grease: (54) for the non drive end, (39) for the drive end.
- Install the fan pin.
- Mount the fan (7) using a drift to bed it into position.

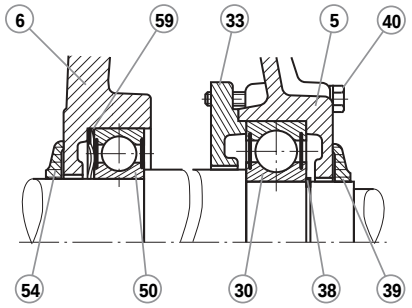
MAKE SURE it is facing the right way!

- Check that the rotor turns freely by hand (that there is no axial play if there is a locked end shield).
- Replace the cover (13) and fix it with the screws (27).
- Replace the key (21).

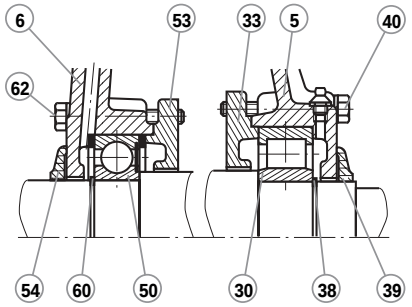
PLS 160 M/MG/L - PLS 180 M/L
not flange mounted (except V6)
Standard bearing



PLS 160 M/MG/L - PLS 180 M/L
flange mounted or V6
Standard bearing



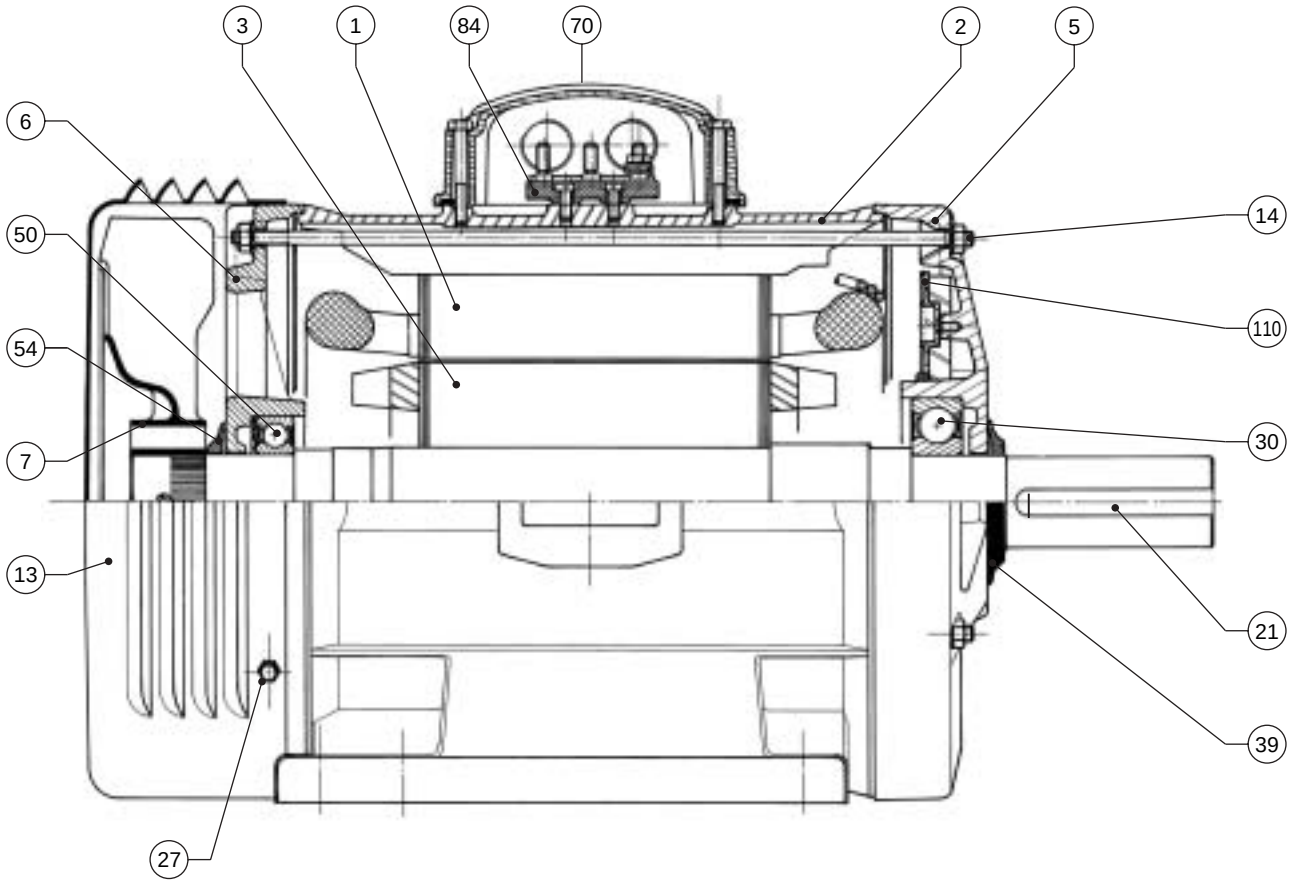
PLS 160 M/MG/L - PLS 180 M/L
Drive end roller bearing



Drip-proof 3-phase induction motors

CORRECTIVE MAINTENANCE

FRAME SIZES: 160 M/MG/L
180 M/L



Ref.	Description	Ref.	Description	Ref.	Description
1	Wound stator	**13**	Fan cover	**50**	Non drive end bearing
2	Frame	**14**	Tie rods	**54**	Non drive end seal
3	Rotor	**21**	Key	**59**	Preloading (wavy) washer
5	DE shield	**27**	Fan cover screw	**70**	Terminal box
6	NDE shield	**30**	Drive end bearing	**84**	Terminal blocks
7	Fan	**39**	Drive end seal	**110**	Protective grille

Drip-proof 3-phase induction motors

CORRECTIVE MAINTENANCE

6.3 - PLS 180 LG, PLS 200 M/L/LP and PLS 225 MR motors

Dismantling

- Remove the screws (27) and grease nipple (64), then take off the cover (13).
- Pull out the fan (7) using a hub remover or 2 diametrically opposed levers, using the shield (6) for support, then remove the fan key or pin.
- Take out the key (21).
- Unscrew the tie rods (14) then remove them.
- Unscrew the DE bearing retainer (33) fixing screws (40) and NDE bearing retainer (53) fixing screws (62), and remove them.
- Using a bronze drift, remove the shields (5 and 6) by tapping gently on the shield bosses. Recover the preloading washer (59).
- Remove the circlip (38) and if necessary the circlip (60) (motor with roller bearing).
- Remove the rotor (3) from the stator (1) at the drive end, taking care not to touch the winding with the inner bearing retainer. Take out the bearings (30) and (50) using a bearing remover, while protecting the end of the shaft extension with a washer. Take care not to knock the running surfaces of the shaft.
- The bearings are removed either separately or with the bearing retainers; to avoid damaging the bearing retainers, heat the inner bearing retainer to make it easier to dismantle (the bearing should be discarded).

Reassembly

- See section 6.1 before reassembly.
- Insert the inner bearing retainer (33) at the rotor drive end and the inner bearing retainer (53) at the non drive end.
- Fit the new bearings on the shaft, see section 6.1 on mounting bearings.
- Insert the rotor (3) in the stator (1) taking every precaution not to knock the winding.
- Screw a rod with the same thread diameter as the screws (40) and (62) into one of the tapped holes of the bearing retainers (33) and (53) to maintain the position of the grease nipple when refitting the shields (5 and 6).
- Position the preloading washer (59) with a small amount of grease at the back of the bearing cage of the NDE shield (6), then remount the NDE shield (6) by positioning it on the stator.
- Fit the shield (5) taking care to position the bearing retainer (33) correctly.
- Place the tie rods (14) in position and tighten the nuts diagonally up to the recommended torque (see section 6.1).
- Fix the bearing retainers (33) and (53) with their own screws (40) and (62).
- Mount the shield seals with grease: (54) for the non drive end, (39) for the drive end.
- Install the fan key or pin.
- Mount the fan (7) using a drift to bed it into position.

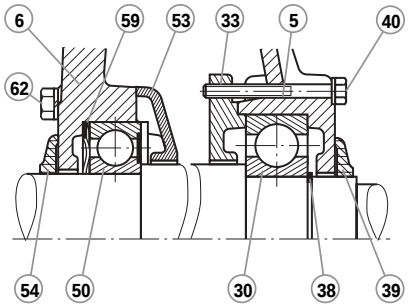
MAKE SURE it is facing the right way!

- Check that the rotor turns freely by hand (that there is no axial play if there is a locked end shield).
- Replace the cover (13) and fix it with the screws (27).
- Replace the grease nipple (64).
- Fill with new grease: the quantity is indicated in the table opposite.

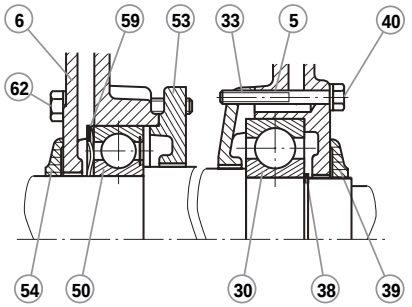
Turn the shaft by hand during greasing.

- Replace the key (21).

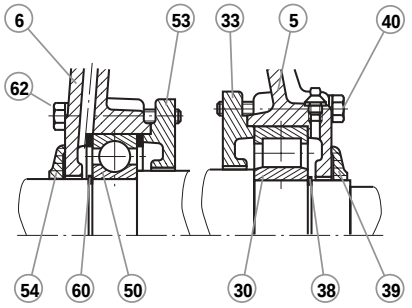
PLS 180 LG - PLS 200 M/L/LP
Standard bearing



PLS 225 MR
Standard bearing



PLS 180 LG - PLS 200 M/L/LP
PLS 225 MR
Drive end roller bearing



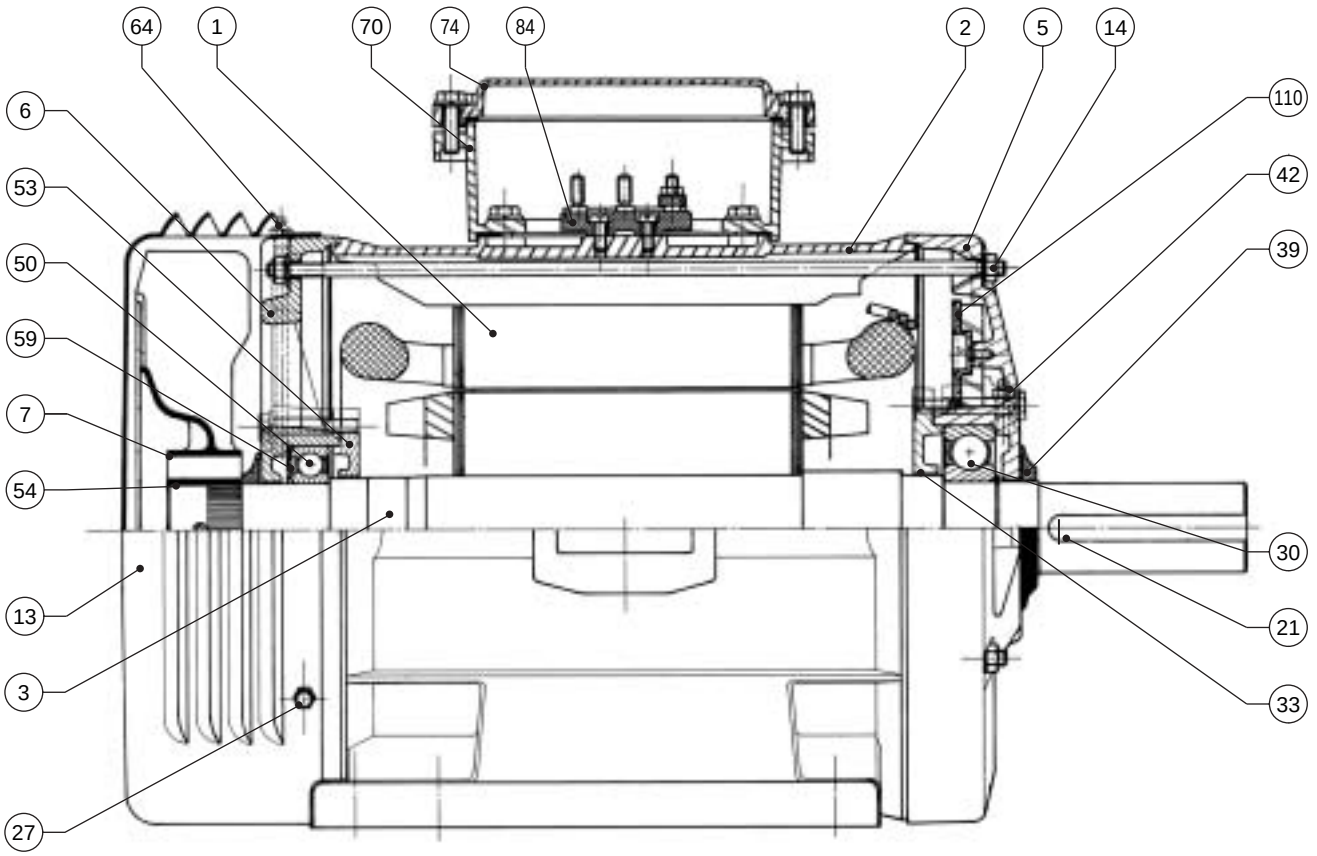
Bearing	g
6212 Z	31
6214	60
6312 or NU312	90
6313 or NU313	93
6314 or NU314	140

(Weight valid for ESSO UNIREX N3 grease with immaculately clean grease track + bearing seat + drain holes).

Drip-proof 3-phase induction motors

CORRECTIVE MAINTENANCE

FRAME SIZES: 180 LG
200 M/L/LP
225 MR



Ref.	Description	Ref.	Description	Ref.	Description
1	Wound stator	**21**	Key	**54**	Non drive end seal
2	Frame	**27**	Fan cover screw	**59**	Preloading (wavy) washer
3	Rotor	**30**	Drive end bearing	**64**	Grease nipple
5	DE shield	**33**	Inner DE bearing retainer	**70**	Terminal box
6	NDE shield	**39**	Drive end seal	**74**	Terminal box lid
7	Fan	**42**	Grease nipple	**84**	Terminal block
13	Fan cover	**50**	Non drive end bearing	**110**	Protective grille
14	Tie rods	**53**	Inner NDE bearing retainer		

Drip-proof 3-phase induction motors

CORRECTIVE MAINTENANCE

6.4 - PLS 250 and PLS 280 SC/MC/MD motors

Dismantling

- Remove the screws (27), the grease nipple (64) and its extension (65), then take off the cover (13).
- Pull out the fan (7) using a hub remover or 2 diametrically opposed levers, using the shield (6) for support, then remove the fan key.
- Take out the key (21).
- Unscrew the tie rods (14) then remove them.
- Unscrew the DE bearing retainer (33) and (32) fixing screws (40) and NDE bearing retainer (52) and (53) fixing screws (62), and remove them.
- Unscrew the "Hc" screw of the mobile valve (35) then unscrew the valve using a hook key or a conical bronze drift; unscrew the valve by hand and remove it. The valve holds the seal (39) and its support (386) in place.
- Using a bronze drift, remove the shields (5 and 6) by tapping gently on the shield bosses. Recover the preloading washer (59).
- Remove the circlip (60).
- Remove the rotor (3) from the stator (1) at the drive end, taking care not to touch the winding with the inner bearing retainer.
- Take out the bearings (30) and (50) using a bearing remover, while protecting the end of the shaft end with a washer. Take care not to knock the running surfaces of the shaft.
- The bearings are removed either separately or with the bearing retainers; to avoid damaging the bearing retainers, heat the inner bearing retainer to make it easier to dismantle (the bearing should be discarded).

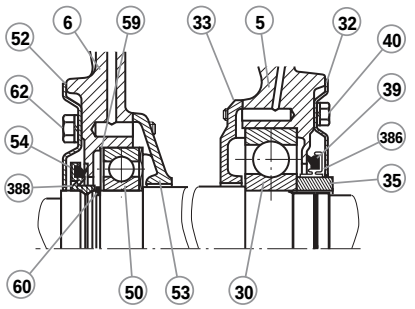
Reassembly

- See section 6.1 before reassembly.
- Insert the inner bearing retainer (33) at the rotor drive end and the inner bearing retainer (53) at the non drive end.
- Fit the new bearings on the shaft, see section 6.1 on mounting bearings.
- Mount the circlip (60).
- Insert the rotor (3) in the stator (1) taking every precaution not to knock the winding.
- Screw a rod with the same thread diameter as the screws (40) and (62) into one of the tapped holes of the bearing retainers (33) and (53) to maintain the position of the grease nipple when refitting the shields (5 and 6).
- Position the preloading washer (59) with a small amount of grease at the back of the bearing cage of the NDE shield (6), then remount the NDE shield (6) by positioning it on the stator.
- At the non drive end fit the seal (54) and its support (388), insert the bearing retainer (52) and the locking screws (62) for the bearing retainers (52) and (53).
- At the drive end fit the shield (5) taking care to position the bearing retainer (33) correctly.
- Mount the mobile valve (35) by either screwing it or locking it having carefully mounted the seal (39) and its support (386).
- Mount the shield seals with grease: (54) for the non drive end, (39) for the drive end.
- Mount the outer bearing retainer (32) with the bearing retainer locking screws (40), making sure that the grease drain hole is at the bottom.
- Put the tie rods (14) in place, not forgetting the feet of the protective cover (380), tighten the nuts diagonally without locking them so that the feet of the protective cover can be positioned when it is mounted.
- Install the fan key.
- Mount the fan (7) using a drift to bed it in position or by heating the hub of the aluminium fan to approximately 100°C. MAKE SURE it is facing the right way!
- Check that the motor turns freely by hand and that there is no axial play.
- Replace the protective cover (13) and fix it with the screws (27), replace the grease nipple (64) and its extension (65).
- Tighten the rod nuts (14), always diagonally, up to the torque recommended in section 6.1.
- Fill with new grease: the quantity is indicated in the table below.

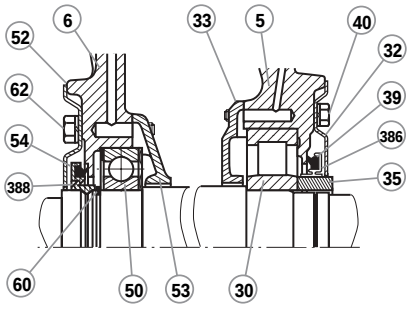
Turn the shaft by hand during greasing.

- Replace the key (21).

PLS 250 SP/MP - PLS 280 SC/MC/MD
Standard bearing



PLS 250 - PLS 280
Drive end roller bearing



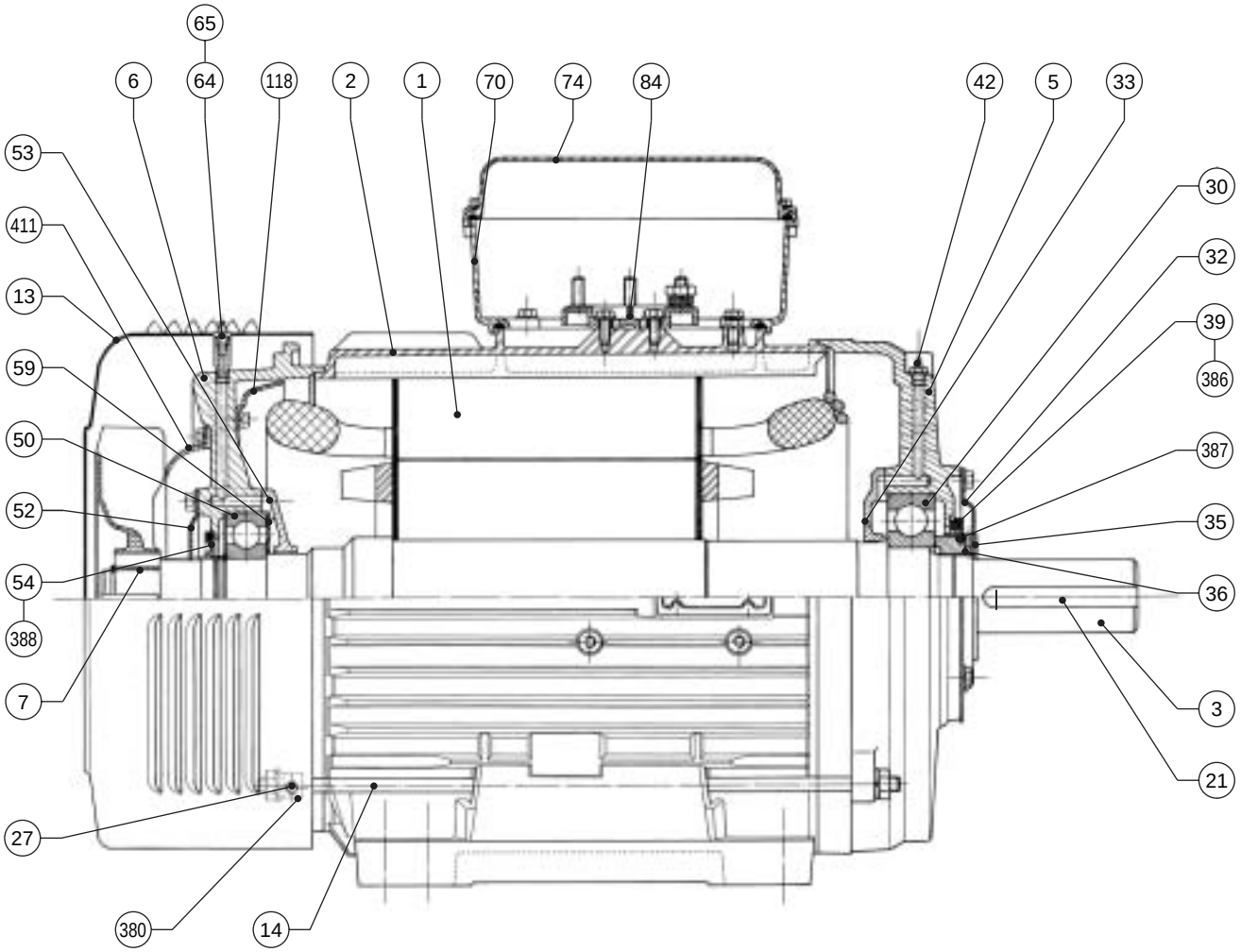
Bearing	g
6314	105
6315	140
6317 or NU317	180
6318 or NU318	220

(Weight valid for ESSO UNIREX N3 grease with immaculately clean grease track + bearing seat + drain holes).

Drip-proof 3-phase induction motors

CORRECTIVE MAINTENANCE

FRAME SIZES: 250
280



Ref.	Description	Ref.	Description	Ref.	Description
1	Wound stator	**32**	Outer DE bearing retainer	**65**	Extension for grease nipple
2	Frame	**33**	Inner DE bearing retainer	**70**	Terminal box
3	Rotor	**35**	DE mobile grease valve	**74**	Terminal box lid
5	DE shield	**39**	Drive end seal	**84**	Terminal block
6	NDE shield	**42**	Grease nipple	**118**	Internal deflector
7	Fan	**50**	Non drive end bearing	**380**	Protective cover feet
13	Fan cover	**52**	Outer NDE bearing retainer	**386**	DE seal support
14	Tie rods	**53**	Inner NDE bearing retainer	**388**	NDE seal support
21	Key	**54**	Non drive end seal	**411**	External deflector
27	Fan cover screw	**59**	Preloading (wavy) washer		
30	Drive end bearing	**64**	Grease nipple		

Drip-proof 3-phase induction motors

CORRECTIVE MAINTENANCE

6.5 - PLS 315 motors

Dismantling

- Remove the screws (27), the grease nipple (64) and its extension (65), then take off the cover (13).
- Pull out the fan (7) using a hub remover or 2 diametrically opposed levers, using the shield (6) for support; for an aluminium fan, heat the hub to approximately 100°C before removing it.
- Take out the key (21).
- Unscrew the mounting screws (14) then remove them.
- Unscrew the DE bearing retainer (32) and (33) fixing screws (40) and NDE bearing retainer (52) and (53) fixing screws (62), and remove them.
- Unscrew the "Hc" screws of the mobile valves (35 and 56) then unscrew the valves using a pin spanner; unscrew the valves by hand and remove them.

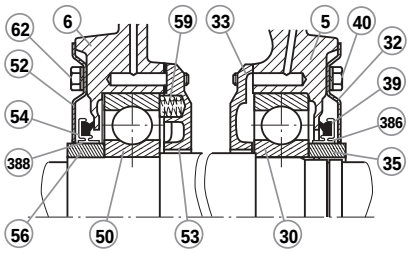
The valves hold the supports (386) and (388) for the seals (39 and 54) in place.

- Using a bronze drift, remove the shields (5 and 6) by tapping gently on the shield bosses.
- Check that the bearing retainer (53) is smaller in diameter than the stator, otherwise remove the bearing (50) as per the following instructions.
- Remove the rotor (3) from the stator (1) at the drive end, taking care not to touch the winding with the inner bearing retainer if there is no internal turbine. Take out the bearings (30) and (50) using a bearing remover, while protecting the end of the shaft end with a washer. Take care not to knock the running surfaces of the shaft.
- The bearings are removed either separately or with the bearing retainers (33 and 53); to avoid damaging the bearing retainers, heat the inner bearing ring (the bearing should be discarded).
- Recover the preloading washer or springs (59) from the bearing retainer (53).

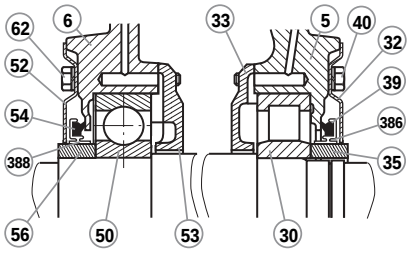
Reassembly

- See section 6.1 before reassembly.
- Insert the inner bearing retainer (33) at the rotor drive end and the inner bearing retainer (53) at the non drive end, not forgetting to insert the preloading springs (59) with a little grease.
- Fit the new bearings (30 and 50) on the shaft, see section 6.1 on mounting bearings.
- Insert the rotor (3) in the stator (1) taking every precaution not to knock the winding.
- Screw a rod with the same thread diameter as the screws (40) and (62) into one of the tapped holes of the bearing retainers (33) and (53) to maintain the position of the grease nipple when refitting the shields (5 and 6).
- Check that the preloading springs are properly installed.
- Mount the NDE shield (6) by positioning it on the stator.
- Mount the mobile valve (56) by either screwing it or locking it, having carefully installed the seal (54) with its support (388).
- Mount the outer bearing retainer (52) with the bearing retainer locking screws (62), making sure that the grease drain hole is at the bottom.
- Mount the DE shield (5) by positioning it on the stator.
- Mount the mobile valve (35) by either screwing it or locking it, having carefully installed the seal (39) with its support (386).
- Mount the shield seals with grease: (54) for the non drive end, (39) for the drive end.
- Mount the outer bearing retainer (32) with the bearing retainer locking screws (40), making sure that the grease drain hole is at the bottom.
- Put the tie rods (14) and the feet of the protective cover (380) in place, tighten the nuts diagonally without locking them so that the feet of the protective cover can be positioned when it is mounted.
- Install the fan key.
- Mount the fan (7) using a drift to bed it in position or by heating the hub of the aluminium fan to approximately 100°C. MAKE SURE it is facing the right way!
- Check that the motor turns freely by hand and that there is no axial play.
- Replace the protective cover (13) and fix it with the screws (27), replace the grease nipple (64) and its extension (65).
- Fill with new grease: the quantity is indicated in the table below. Turn the shaft by hand during greasing.
- Tighten the nuts (14), always diagonally, up to the torque recommended in section 6.1.
- Replace the key (21).

PLS 315
Standard bearing



PLS 315
Drive end roller bearing



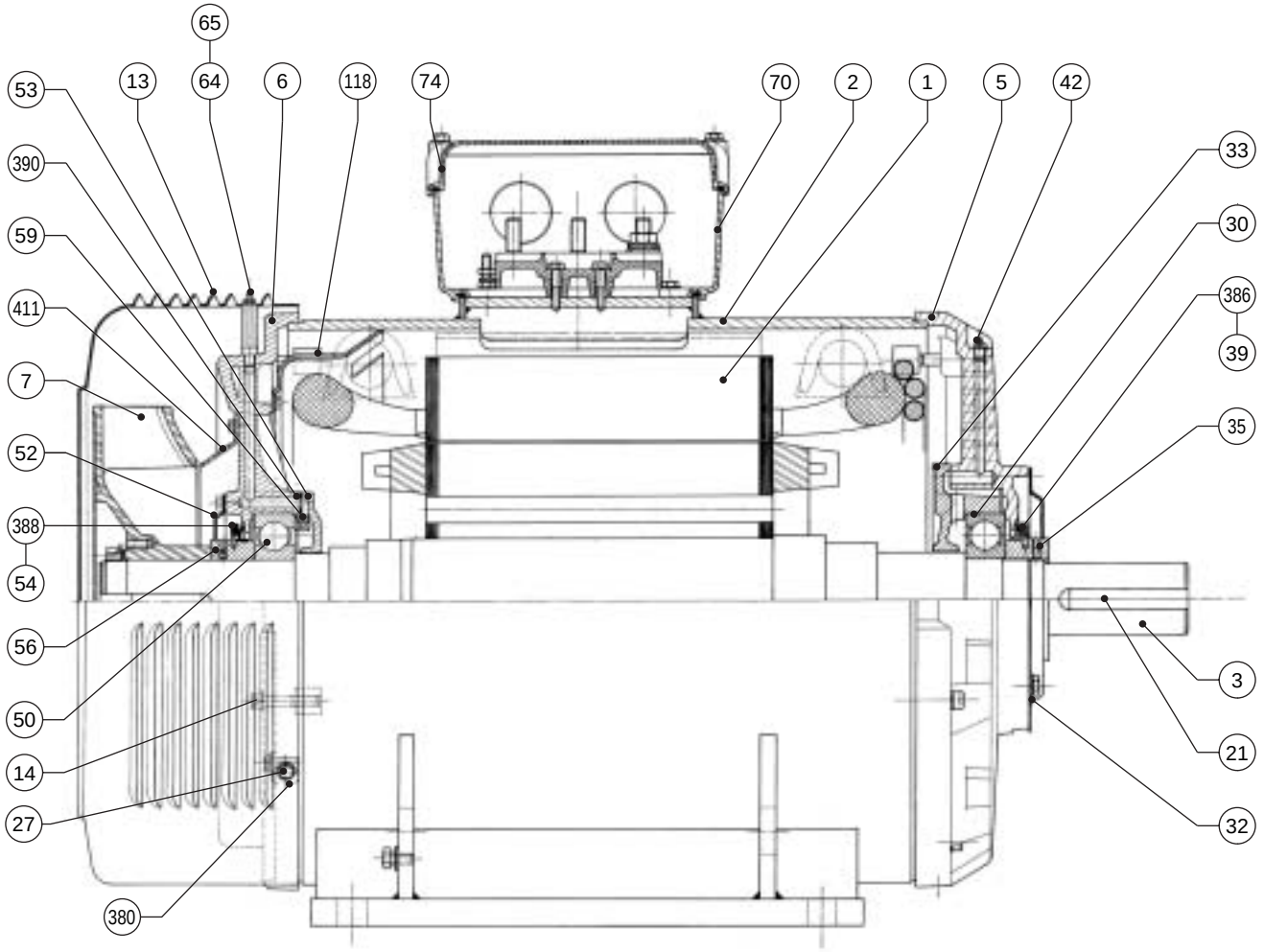
Bearing	g
6316	160
6320	385
NU320	385
6219	215
6224	244

(Weight valid for ESSO UNIREX N3 grease with immaculately clean grease track + bearing seat + drain holes).

Drip-proof 3-phase induction motors

CORRECTIVE MAINTENANCE

FRAME SIZES: 315



Ref.	Description	Ref.	Description	Ref.	Description
1	Wound stator	**32**	Outer DE bearing retainer	**64**	Grease nipple
2	Frame	**33**	Inner DE bearing retainer	**65**	Extension for grease nipple
3	Rotor	**35**	DE mobile grease valve	**70**	Terminal box
5	DE shield	**39**	Drive end seal	**74**	Terminal box lid
6	NDE shield	**42**	Grease nipple	**84**	Terminal block
7	Fan	**50**	Non drive end bearing	**118**	Internal deflector
13	Fan cover	**52**	Outer NDE bearing retainer	**380**	Protective cover feet
14	Tie rods	**53**	Inner NDE bearing retainer	**386**	DE seal support
21	Key	**54**	Non drive end seal	**388**	NDE seal support
27	Fan cover screw	**56**	NDE mobile grease valve	**390**	NDE inner bearing retainer strut
30	Drive end bearing	**59**	Preloading (wavy) washer	**411**	External deflector

Drip-proof 3-phase induction motors

CORRECTIVE MAINTENANCE

6.6 - PLS 355 and PLS 400 motors

Dismantling

- Take off the shield strap(s) (114) after removing the screws.
- Take out the shaft extension key (21).
- Unscrew the DE and NDE shield (5) and (6) fixing screws.
- Unscrew the inner bearing retainer (33) and (53) fixing screws.
- Unscrew the labyrinth seal (257) fixing screws and dismantle it.

If necessary, apply some gentle heat to it.

- Using a bronze drift and a lifting block to support the assembly, take off the shields (5) (6), and recover the preloading washers (59) or springs depending on the mounting arrangements.

Note: There are tapped holes on some shields to make it easier to remove them using screws.

If the motors are equipped with end shield probes, before removing the shields, switch off the terminal box probes and push the wires into the motors, then as the end shield comes out, pull on the wires.

- Lift the tabs off the DE and NDE brake nut and unscrew the lock nuts.
- Remove the deflectors from the DE and NDE grease valves (35) (56).
- Take out the bearings using an extractor, either separately or with the bearing retainers (33) (53); to avoid damaging the bearing retainers, heat the inner bearing ring (the bearing should be discarded).
- Remove the rotor with its fan from the stator at the non drive end, taking care not to touch the winding.
- To dismantle the fan (7) (if this proves necessary): first lift the tab off the brake nut and unscrew the nut, then heat the fan hub and pull it out either manually or by means of threaded rods placed in the tapped holes on the hub.

Reassembly

- Heat the fan (7) and fit it on the shaft, then fit the brake nut, lock it and push down the tab.

Rebalance the rotor (3) and fan (7) assembly if a new fan has been installed.

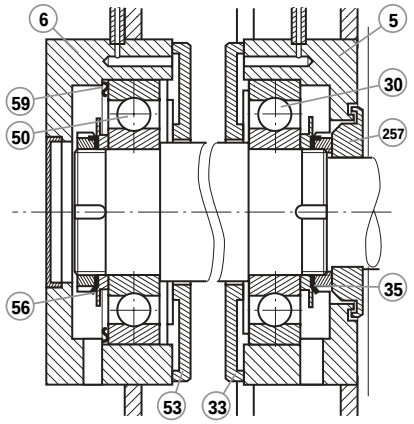
- Insert the rotor in the stator taking care not to touch the winding.
- Fit the inner bearing retainers (33) (53).
- Fit the new bearings (30) (50) (heated to 100-110° by: bearing heater, oven, oil bath).
- Mount the deflectors (35) (56) then the nuts and brakes, lock them and push down the tabs.
- Grease the bearings according to the following table:

Bearing	cm^3	g
6317	200	180
6324	570	510
6328	850	770
NU322	440	400
NU324	570	510
NU328	850	770

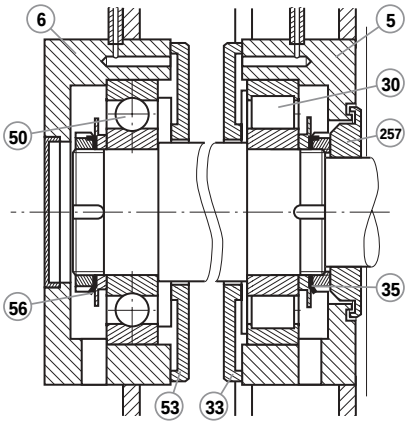
(Weight valid for ESSO UNIREX N3 grease with immaculately clean grease track + bearing seat + drain holes).

- Before fitting the shields (5) (6), screw a threaded rod on to one of the tapped holes of the inner bearing retainers (33) (53) to maintain the position of the grease nipple hole. If the motors are equipped with end shield probes, use a guide wire to pass the wires back into the terminal box. Replace the shields with the preloading washers or springs (59) held with a little grease. Tighten the shield screws and inner bearing retainer (33) (53) screws.
- Fit the labyrinth seal (257), lock it with its screws and ensure that the rotor turns freely.
- Fit the shield (5) (6) strap(s) (114).
- Replace the key (21).

PLS 355 - PLS 400
Standard bearing



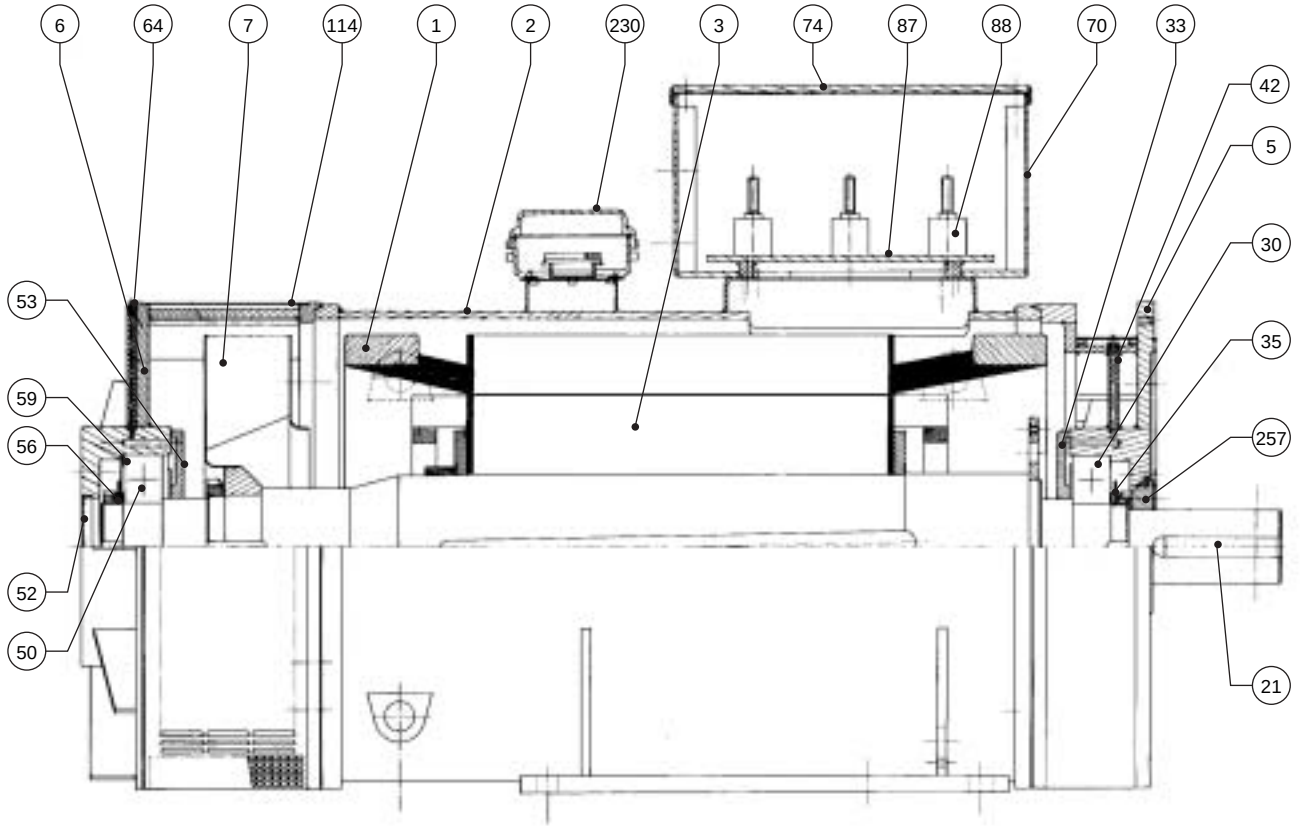
PLS 355 - PLS 400
Roller bearing



Drip-proof 3-phase induction motors

CORRECTIVE MAINTENANCE

FRAME SIZES: 355
400



Ref.	Description	Ref.	Description	Ref.	Description
1	Wound stator	**33**	Inner DE bearing retainer	**64**	NDE grease nipple
2	Housing	**35**	Moving part of DE grease valve	**70**	Stator terminal box
3	Rotor	**42**	DE grease nipple	**74**	Stator terminal box lid
5	Drive end shield (DE)	**50**	NDE bearing	**87**	Isolator support
6	Non-drive end shield (NDE)	**52**	Outer NDE bearing retainer	**88**	Isolators
7	Fan	**53**	Inner NDE bearing retainer	**114**	NDE end shield strap
21	Shaft extension key	**56**	Moving part of NDE grease valve	**230**	Cast iron terminal box for ipsotherms
30	Drive end bearing	**59**	NDE preloading (wavy) washer	**257**	Labyrinth seal

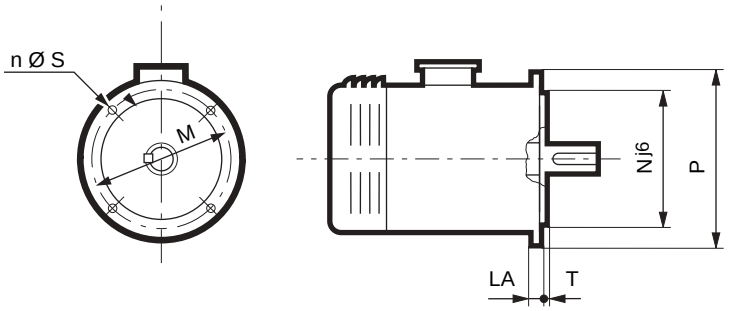
7 - SPARE PARTS

When ordering spare parts, you must indicate the complete motor type, its serial number and the information given on the nameplate (see section 1).

Part numbers can be found on the exploded views and their descriptions in the parts list (section 6).

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

IM 3001 (IM B5)



Our extensive network of service centres can dispatch the necessary parts without delay.

To ensure that our motors operate correctly and safely, we recommend the use of original manufacturer spare parts.

In the event of failure to comply with this advice, the manufacturer cannot be held responsible for any damage.

MOTEURS LEROY-SOMER 16015 ANGOULÊME CEDEX - FRANCE

338 567 258 RCS ANGOULÊME
S.A. au capital de 62 779 000 €

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