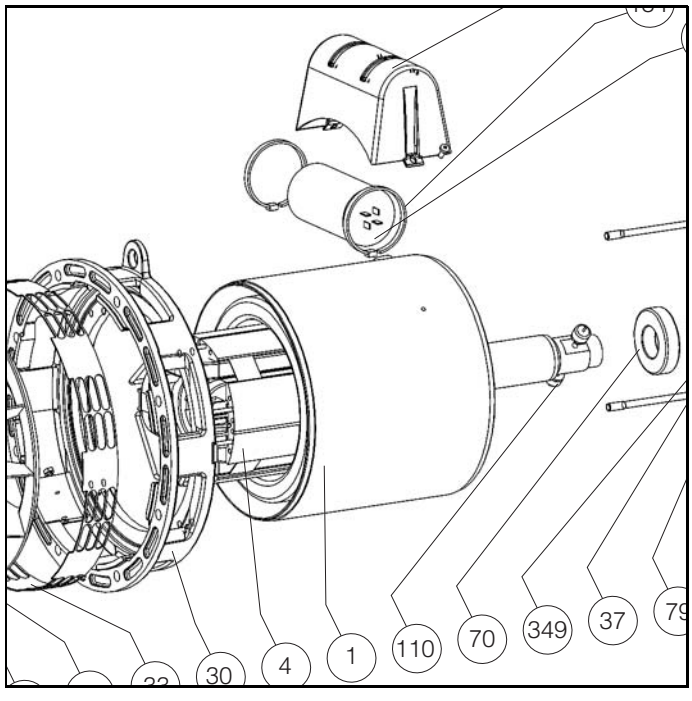
LEROY SOMER

4106 en - 12.2006 / a

This manual is to be given to the end user



LSA 37.2 - 4-POLE - ACC

ALTERNATORS

Installation and maintenance

LSA 37.2 - 4-POLE - ACC
ALTERNATORS

This manual concerns the alternator which you have just purchased.

We wish to draw your attention to the contents of this maintenance manual. By following certain important points during installation, use and servicing of your alternator, you can look forward to many years of trouble-free operation.

SAFETY MEASURES

Before using your machine for the first time, it is important to read the whole of this installation and maintenance manual.

All necessary operations and interventions on this machine must be performed by a qualified technician.

Our technical support service will be pleased to provide any additional information you may require.

The various operations described in this manual are accompanied by recommendations or symbols to alert the user to the potential risk of accidents. It is vital that you understand and take notice of the following warning symbols.

CAUTION

Warning symbol for an operation capable of damaging or destroying the machine or surrounding equipment.

Warning symbol for general danger to personnel.

Warning symbol for electrical danger to personnel.

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.

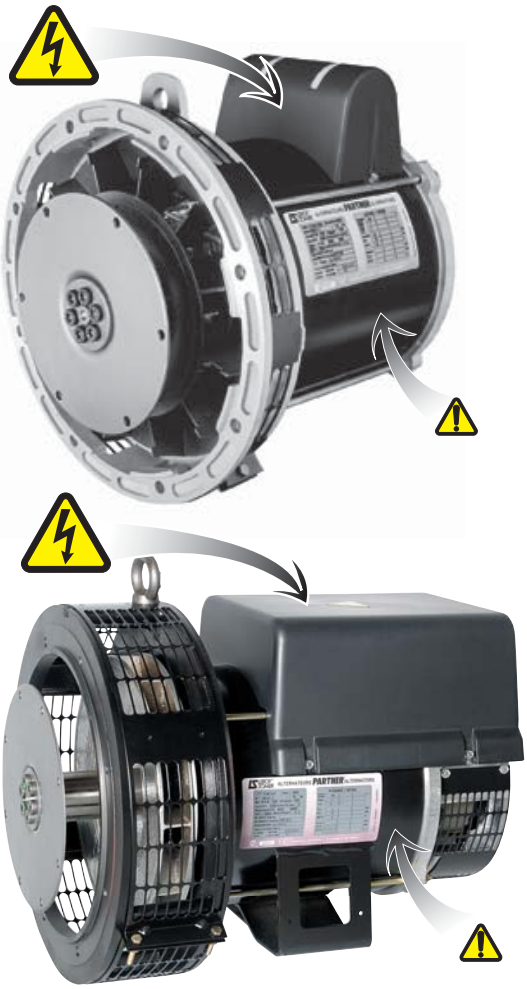
WARNING SYMBOLS

We draw your attention to the following 2 safety measures which must be complied with:

a) During operation, do not allow anyone to stand in front of the air outlet guards, in case anything is ejected from them.

b) Do not allow children younger than 14 to go near the air outlet guards.

A set of self-adhesive stickers depicting the various warning symbols is included with this maintenance manual. They should be positioned as shown in the drawing below once the machine has been fully installed.



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CONTENTS

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ALTERNATORS
RECEIPT

1 - RECEIPT

1.1 - Standards and safety measures

Our alternators comply with most international standards and are compatible with:
- The recommendations of the
International Electrotechnical Commission
IEC 34-1, (EN 60034).
- The recommendations of the
International Standards Organisation ISO 8528/3.
- The European Community directive 89/336/EEC on Electromagnetic Compatibility (EMC).
- The European Community directives
73/23/EEC and 93/68/EEC (Low Voltage Directive).
They are CE marked with regard to the LVD (Low Voltage Directive) in their role as a machine component.

1.2 - Inspection

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

1.3 - Identification

The alternator is identified by means of a nameplate fixed on the machine (see drawing).
Make sure that the nameplate on the machine conforms to your order.
The machine name is defined according to various criteria, for example: LSA 37.2 M7 A 1/4

- LSA : Name used in the PARTNER range
- 37 : Machine type
- M7 : Model
- A : excitation system (ACC)
- 1/4 : Winding number/number of poles

1.3.1 - Nameplate

So that you can identify your machine quickly and accurately, we suggest you write its specifications on the nameplate below.

1.4 - Storage

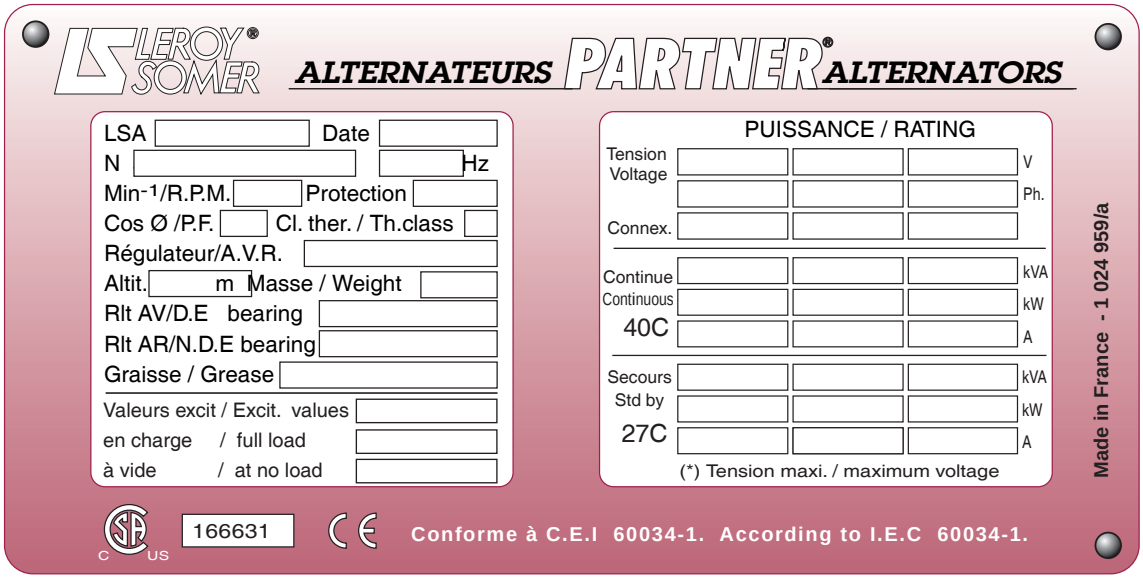
Prior to commissioning, machines should be stored:
- Away from humidity: In conditions of relative humidity of more than 90%, the machine insulation can drop very rapidly, to just above zero at around 100%; monitor the state of the anti-rust protection on unpainted parts. For storage over an extended period, the machine can be placed in a sealed enclosure (heatshrunk plastic for example) with dehydrating sachets inside, away from significant and frequent variations in temperature to avoid the risk of condensation during storage.
- If the area is affected by vibration, try to reduce the effect of these vibrations by placing the generator on a damper support (rubber disc or similar) and turn the rotor a fraction of a turn once a fortnight to avoid marking the bearing rings.

1.5 - Application

These alternators are mainly designed to produce electricity in the context of applications involving the use of generators.

1.6 - Contraindications to use

Use of the machine is restricted to operating conditions (environment, speed, voltage, power, etc) compatible with the characteristics indicated on the nameplate.

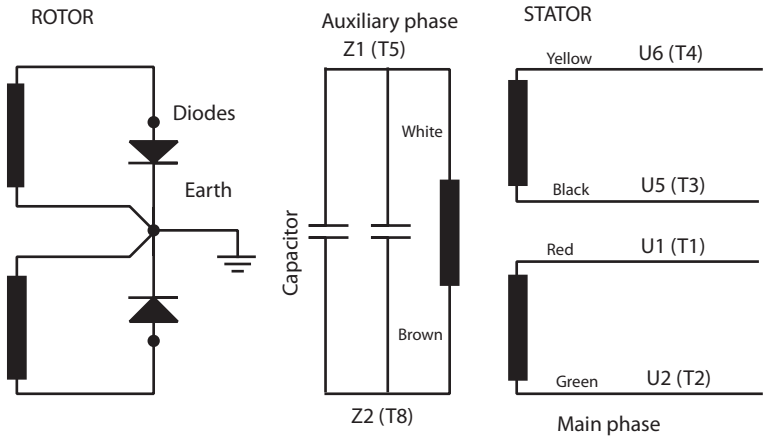


LSA 37.2 - 4-POLE - ACC
ALTERNATORS
TECHNICAL CHARACTERISTICS

2 - TECHNICAL CHARACTERISTICS

2.1 - Electrical characteristics

The PARTNER LSA 37.2 alternator is a machine without slip-rings or brushes. It is self-excited by an auxiliary phase with capacitor (ACC system).



2.2 - Mechanical characteristics

- Steel frame
- Aluminium end shields
- Protected ball bearings, permanently greased
- Mounting arrangement

IM 1201: (MD 35)
Single-bearing with standard feet and SAE flanges/coupling discs
IM 1001: (B 34)
Twin-bearing with SAE flange and standard cylindrical shaft extension
- Open drip-proof machine, self-cooled
- Degree of protection: IP 23

3 - INSTALLATION

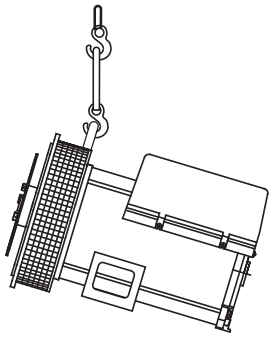
Personnel undertaking the various operations indicated in this section must wear personal protective equipment appropriate for mechanical and electrical hazards.

3.1 - Assembly

All mechanical handling operations must be undertaken using approved equipment and the machine must be horizontal. Check how much the machine weighs (see 4.5.5.) before choosing the lifting tool.

3.1.1 - Handling

The generously-sized lifting rings are for handling the alternator alone. They must not be used to lift the genset. The choice of lifting hooks or handles should be determined by the shape of these rings. Choose a lifting system which respects the integrity and the environment of the alternators.



During this operation, do not allow anyone to stand under the load.

3.1.2 - Coupling

3.1.2.1 - Single-bearing alternator

Before coupling the machines, check that they are compatible by:
- Undertaking a torsional analysis of the transmission on the genset
- Checking the dimensions of the flywheel and its housing, the flange, coupling discs and offset

CAUTION

When coupling the alternator to the prime mover, do not use the fan to turn the alternator rotor. The holes of the coupling discs should be aligned with the flywheel holes by turning the engine flywheel.
Make sure the alternator is securely bedded in position during coupling.

Tighten the coupling disc screws to the recommended torque (see section 4.6.2) and check that there is lateral play on the crankshaft.

3.1.2.2 - twin-bearing alternator

- Semi-flexible coupling

Careful alignment of the machines is recommended, checking that the concentricity and parallelism of both parts of the coupling does not exceed 0.1 mm.

CAUTION

This alternator has been balanced with a 1/2 key.

3.1.3 - Location

Ensure that the ambient temperature in the room where the alternator is placed cannot exceed 40°C for standard power ratings (for temperatures > 40°C, apply a derating coefficient). Fresh air, free from damp and dust, must be able to circulate freely around the air intake guards on the opposite side from the coupling. It is essential to prevent not only the recycling of hot air from the machine or engine, but also exhaust fumes.

3.2 - Inspection prior to first use

3.2.1 - Electrical checks

Under no circumstances should an alternator, new or otherwise, be operated if the insulation is less than 1 megohm for the stator and 100,000 ohms for the other windings.
There are two possible methods for restoring these minimum values.
a) Dry out the machine for 24 hours in a drying oven at a temperature of approximately 110°C (without the AVR).
b) Blow hot air into the air inlet, having made sure that the machine is rotating with the exciter field disconnected.
Note: After an extended downtime, in order to avoid these problems, we recommend the use of space heaters, as well as turning over the machine from time to time. Space heaters are only really effective if they are working continuously while the machine is stopped.

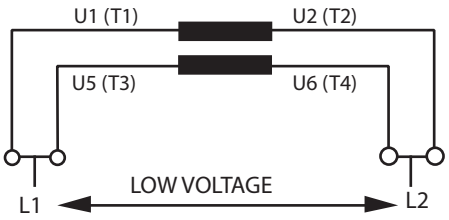
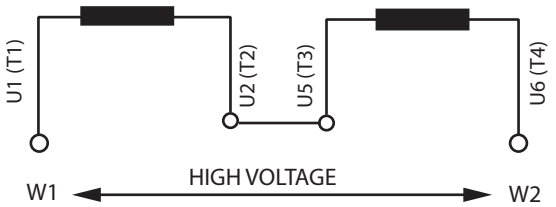
3.2.2 - Mechanical checks

Before starting the machine for the first time, check that:
- The winding connection corresponds to the site operating voltage (see section 3.3)
- The fixing bolts on the feet are tight
- The cooling air is drawn in freely
- The protective guards and housing are correctly in place

3.3 - Terminal connection diagrams

To modify the connection, change the position of the cables on the customer cabinet terminals. The winding code is specified on the nameplate.

Any intervention on the alternator during reconnection or checks should be performed with the machine stopped.

PARALLEL CONNECTION	SERIAL CONNECTION
115 V - 50 Hz /120 V - 60 Hz	230 V - 50 Hz /240 V - 60 Hz
	

3.3.1 - Connection checks

Electrical installations must comply with the current legislation in force in the country of use.
Check that:
- The residual circuit-breaker, in compliance with the legislation on protection of personnel in force in the country of use, has been correctly installed on the alternator power output as close as possible to the alternator.
- The machine has been connected with the busbar separating the terminals as shown in the terminal connection diagram.
- Any protection devices in place have not been tripped.
- There is no short-circuit between phase or phase-neutral between the alternator output terminals and the genset control cabinet (part of the circuit not protected by circuit-breakers or relays in the cabinet).

3.4 - Commissioning

The machine can only be started up and used if the installation is in accordance with the regulations and instructions defined in this manual.

The machine is tested and set up at the factory. When first used with no load, make sure that the drive speed is correct and stable (see the nameplate).

On application of the load, the machine should achieve its rated speed and voltage; however, in the event of abnormal operation, a search for the fault must be instigated (see section 4.4).

3.5 - Setting up

The various adjustments during tests must be made by a qualified engineer. Take care that the drive speed specified on the nameplate is reached before commencing adjustment. After operational testing, replace all access panels or covers.

4 - SERVICING/MAINTENANCE

4.1 - Safety measures

Servicing or troubleshooting must be carried out strictly in accordance with instructions so as to avoid the risk of accidents and to maintain the machine in its original state.

All such operations performed on the alternator should be undertaken by personnel trained in the commissioning, servicing and maintenance of electrical and mechanical components, who must wear personal protective equipment appropriate for mechanical and electrical hazards.
Before any intervention on the machine, ensure that it cannot be started by a manual or automatic system and that you have understood the operating principles of the system.

4.2 - Regular maintenance

4.2.1 - Checks after start-up

After approximately 20 hours of operation, check that all fixing screws on the machine are still tight, plus the general state of the machine and the various electrical connections in the installation.

4.2.2 - Cooling circuit

It is advisable to check that circulation of air is not reduced by partial blocking of the air intake and outlet guards: mud, fibre, soot, etc. and to check whether the ventilation guards are corroded or scratched.

4.2.3 - Bearings

The bearings are permanently greased: approximate life of the grease (depending on use) = 20,000 hours or 3 years. Monitor the temperature rise in the bearings, which should not exceed 50°C. Should this value be exceeded, the machine must be stopped and checks carried out.

4.2.4 - Electrical servicing

Cleaning product for the windings

CAUTION

Do not use: trichlorethylene, perchlorethylene, trichloroethane or any alkaline products.

Certain strictly defined pure volatile degreasing agents can be used, such as:
- Normal petrol (without additives); inflammable
- Toluene (slightly toxic); inflammable
- Benzene (or benzine, toxic); inflammable
- Ciclohexare (non toxic); inflammable

Cleaning of the stator, rotor, exciter and diode bridge

These operations must be performed at a cleaning station, equipped with a vacuum system that collects and flushes out the products used.

The insulating components and the impregnation system are not at risk of damage from solvents (see the list of authorised products).
Avoid letting the cleaning product run into the slots. Apply the product with a brush, sponging frequently to avoid accumulation in the housing. Dry the winding with a dry cloth. Let any traces evaporate before reassembling the machine.

4.2.5 - Mechanical servicing

CAUTION

Cleaning the machine using water or a high-pressure washer is strictly prohibited.
Any problems arising from such treatment are not covered by our warranty.
The machine should be cleaned with a degreasing agent, applied using a brush. Check that the degreasing agent will not affect the paint.
Compressed air should be used to remove any dust.
If filters have been added to the machine after manufacture and do not have thermal protection, the service personnel should clean the air filters periodically and systematically, as often as necessary (every day in very dusty atmospheres).
These can be washed in water if it is dry dust or in a bath containing soap or detergent if it is greasy dust. Petrol or chloroethylene can also be used.
After cleaning the alternator, it is essential to check the winding insulation (see section 4.5.1).

4.3 - Fault detection

If, when commissioned, the alternator does not work normally, the source of the malfunction must be identified.
To do this, check that:
- The protection devices are set correctly
- The connections comply with the diagrams in the manuals supplied with the machine
- The genset speed is correct (see section 1.3)

Repeat the operations defined in section 3.

4.4 - Mechanical defects

Fault		Causes
Bearing	Excessive overheating of one or both bearings (temperature > 50°C on the bearing retainers with or without abnormal noise)	- If the bearing has turned blue or if the grease has turned black, change the bearing. - Bearing not properly seated. - End shields misaligned (flanges not properly fitted)
Abnormal temperature	Excessive temperature rise of alternator frame (more than 40°C above the ambient temperature)	- Air flow (intake/outlet) partially clogged or hot air is being recycled from the alternator or engine - Alternator operating at too high voltage (> 105% of Un on load) - Alternator overloaded
Vibrations	Too much vibration	- Misalignment (coupling) - Defective mounting or play in coupling - Rotor balancing fault
	Excessive vibration and humming noise coming from the machine	- Alternator operating in single-phase mode (single-phase load or faulty contactor or installation fault) - Stator short-circuit
Abnormal noise	Alternator damaged by a significant impact, possibly followed by humming and vibration	- System short-circuit - Mis-paralleling - Broken or damaged coupling - Broken or bent shaft end - Shifting and short-circuit of revolving field coil - Fan fractured or coming loose on shaft - Irreparable damage to rotating diodes

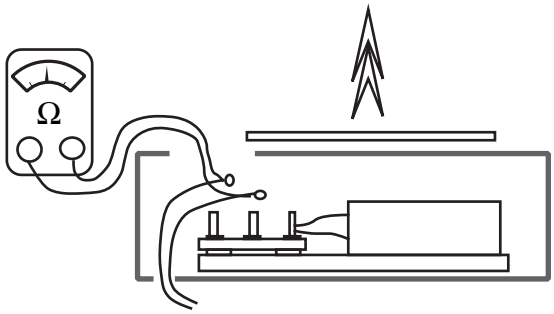
4.5 - Electrical faults

Fault	Action	Effect	Check/Cause
No voltage at no load on start-up	Apply 6 V DC to one of the capacitors for 1 second	The alternator builds up and its voltage is still correct when the battery is removed	- Lack of residual magnetism - Check the capacitor voltage (approximately 10 to 15 V at the auxiliary winding terminals, with the capacitor disconnected)
		The alternator builds up but its voltage does not reach the rated value when the battery is removed	- Check whether there is a break in the capacitor circuit or one of the capacitors
		The alternator builds up but its voltage disappears when the battery is removed	- If the voltage is too low, the diodes are faulty.
		The voltage does not rise	- Disconnection of the auxiliary winding - Rotating diodes burnt out - Main field winding open circuit - Check the resistance
Voltage too high	Reduce the speed		Genset speed too high
Voltage correct at no load and too low when on load			- Speed drop too great when on load - Check the speed - Genset overloaded - Short-circuit in the revolving field coil. Check the resistance

4.5.1 - Measurement of STATOR winding resistances

During this procedure, make sure that the alternator is disconnected from any external load.

- Unscrew the 6 cover fixing screws.
- Disconnect the capacitor wires in order to read the auxiliary phase resistance.
- Disconnect the terminal block wires in order to read the main phase resistance.



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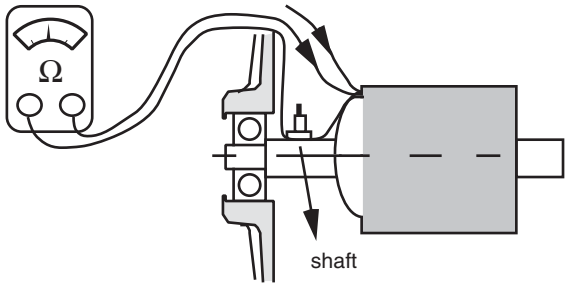
SERVICING/MAINTENANCE

Resistances (ohms) 4 P stator	Main phase		Auxiliary phase	
	50 Hz	60 Hz	50 Hz	60 Hz
	230 V	240V	110V	120V
LSA 37.2 M6	0.8	0.6	2.8	1.5
LSA 37.2 M7	0.4	0.3	1.4	0.7
LSA 37.2 L5	0.3	0.2	0.9	0.6
LSA 37.2 L8	0.24	0.17	0.8	0.5

4.5.2 - Measurement of ROTOR winding resistances

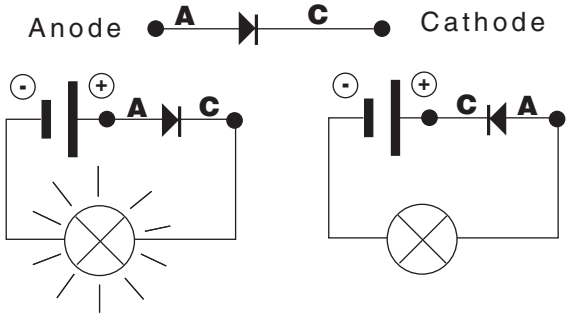
During this procedure, make sure that the alternator is disconnected from any external load.
- Unscrew the 6 cover fixing screws.
- Remove the DE shield
- Unsolder the wires on the diodes in order to read the resistance of each winding.



Resistances (ohms) 4 P rotor	1 Pole	Total
LSA 37.2 M6	0.5	2
LSA 37.2 M7	0.8	3.2
LSA 37.2 L5	0.925	3.7
LSA 37.2 L8	1	4

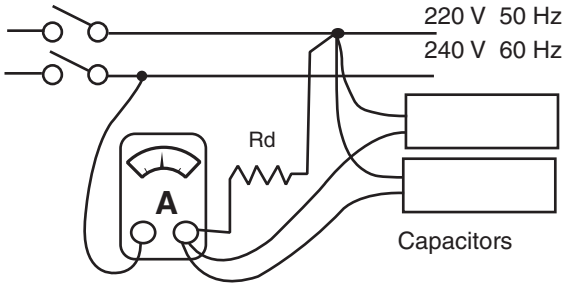
4.5.3 - Checking the diode bridge

- Proceed in the same way as for reading the rotor resistance by unsoldering a single side of the diodes.
A diode in good working order should allow the current to flow only in the anode-to-cathode direction.



4.5.4 - Checking the capacitors

During this procedure, make sure that the alternator is disconnected from any external load.
- Unscrew the 6 cover fixing screws.
- Disconnect the capacitor wires and connect it to an AC supply in series with a switch and an ammeter.



Rd: discharging resistor (5000 ohms - 20 W)
The currents are indicated with ±10% tolerance

Capacitor (...µF-450V - 3000H)				
	50 Hz	220 V	60 Hz	240 V
4 poles	µF	I (A)	µF	I (A)
LSA 37.2 M6	50	9.6	70	12.5
LSA 37.2 M7	100	16.4	100	17.6
LSA 37.2 L5	120	20.5	130	25
LSA 37.2 L8	130	22.2	200	34.5

4.5.5 - Weight tables

Type	Total weight (kg)
LSA 37.2 M6	72
LSA 37.2 M7	87
LSA 37.2 L5	92
LSA 37.2 L8	112

4.6 - Dismantling, reassembly (see sections 5.3.1, 5.3.2 & 5.3.3)

During the warranty period, this operation should only be carried out in a LEROY-SOMER approved workshop or in our factory, otherwise the warranty may be invalidated.

CAUTION

Whilst being handled, the machine should remain horizontal (rotor not locked when moved).
Check how much the machine weighs (see 4.5.5.) before choosing the lifting tool. The choice of lifting hooks or handle should be determined by the shape of the lifting rings.

4.6.1 - Tools required

To fully dismantle the machine, we recommend using the tools listed below:
- 1 ratchet spanner + extension
- 1 torque wrench
- 1 set of flat spanners
- 1 socket set
- 1 set of Allen keys
- 1 set of TORX bits
- 1 puller

4.6.2 - Screw tightening torque

IDENTIFICATION	Screw Ø	Torque (Nm)
Diode nut	1/4 - 28 threads	3
Tie rod	M8	23
Disc/shaft screw	M10	66
Cover screws	M5	5

4.6.3 - Access to diodes

- Unscrew the 6 cover fixing screws (only on L version)
- Remove the NDE shield and access the diodes (110)

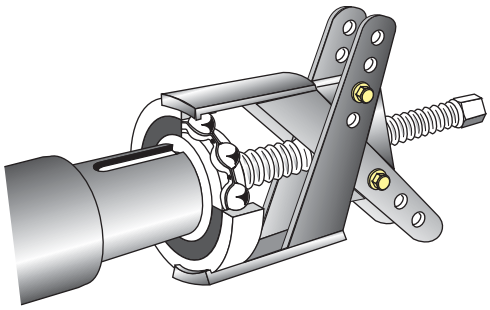
4.6.4 - Access to connections and capacitors

Unscrew the 6 fixing screws (49), then remove the cover (48)

4.6.5 - Dismantling

4.6.5.1 - Replacing the NDE bearing on single-bearing machines

- Remove the rotor (4) assembly from the stator (take care with the windings and the diodes).
- Take out the ball bearing (70) using a puller with a central screw.



4.6.6 - Replacing the bearings on twin-bearing machines

- Remove the fixing screws from the DE shield (411).
- Remove the rotor assembly from the stator (take care with the windings and the diodes).
- Remove the circlip (284).
- Extract the bearing assembly (410) + (60) from the rotor (4).
- Knock out the bearing (60) from the shield (410).
- Take out the ball bearing (70) using a puller.

4.6.7 - Complete dismantling

- Remove the fixing screws (270) from the DE shield (410) (only on twin-bearing machine).
- Remove the rotor assembly from the stator (take care with the windings and the diodes).
- Remove the 6 fixing screws (49) from the cover (48) (on L version).
- Disconnect and mark the connections (twin bearing).
- Undo the 4 nuts (38).
- Separate the shields (30) and (36) on the stator (1).

4.6.8 - COMPLETE REASSEMBLY

- Simply reverse the dismantling procedure.
(Check that the preloading wavy washer (79) is positioned correctly in the NDE shield).

CAUTION

NOTE: If intervention is required on the revolving field coil (rewinding, replacement of components), the rotor assembly must be rebalanced.

5 - SPARE PARTS

5.1 - First maintenance parts

Emergency repair kits are available as an option.
They contain the following items:

Ref.	Description	Qty	LSA 37.2	Code
110	Diodes	2	80 A - 700 V	ESC 070 DC 001
183	Capacitor	-	-	-

5.1.1 - Bearing designations

Ref.	Description	Qty	LSA 37.2	Code
60	DE bearing	1	6208 2Z/C3	RLT 040 HV 020
70	NDE bearing	1	6207 2Z/C3	RLT 035 HV 020

5.2 - Technical support service

Our technical support service will be pleased to provide any additional information you may require.

When ordering spare parts, you should indicate the complete machine type, its serial number and the information given on the nameplate.

Adress your enquiry to your usual contact.

CAUTION

Part numbers should be identified from the exploded views and their description from the parts list.
Our extensive network of service centres can dispatch the necessary parts without delay.
To ensure correct operation and the safety of our machines, 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.

5.3 - Parts list, exploded view

No.	Nbr	Description
1	1	Stator assembly
4	1	Rotor assembly
15	1	Fan
18	1	Balancing disc
21	1	Lifting ring
22	1	Key
30	1	DE shield
33	1	Protective guard
34	2	Fixing screw
36	1	NDE shield
37	4	Tie rod
38	4	Nut
43	1	Cable gland
48	1	Cover top panel
53	1	Plug
60	1	DE bearing
70	1	NDE bearing
79	1	Spring washer
110	2	Direct diode
124	1	Terminal block
183	-	Capacitor
184	-	Clamp
185	-	Sticker (only on L version)
188	1	Capacitor support
265	1	Flange adaptor
266	4	Fixing screw
284	1	Circlip
322	1	Coupling disc
323	6	Fixing screw
324	1	Clamping washer
349	1	'O' ring seal
410	1	DE end shield

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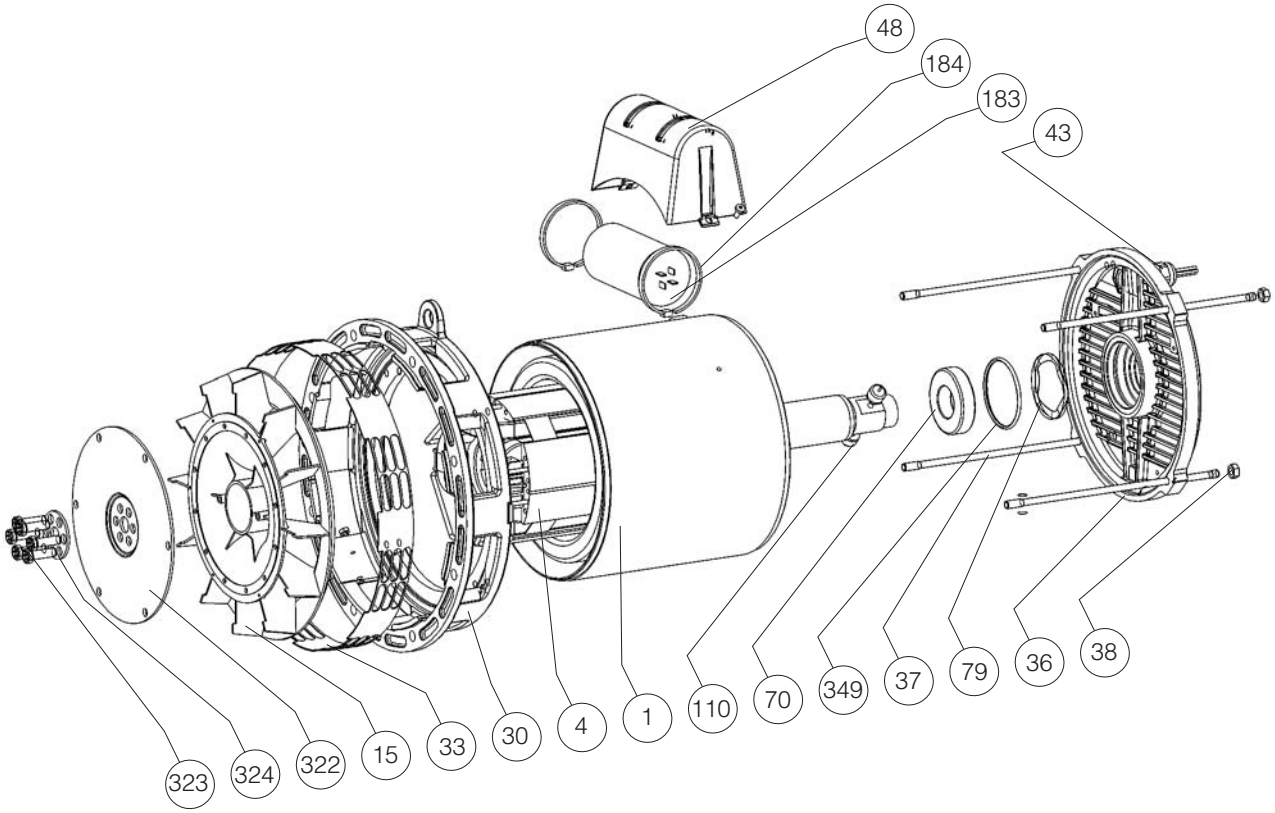
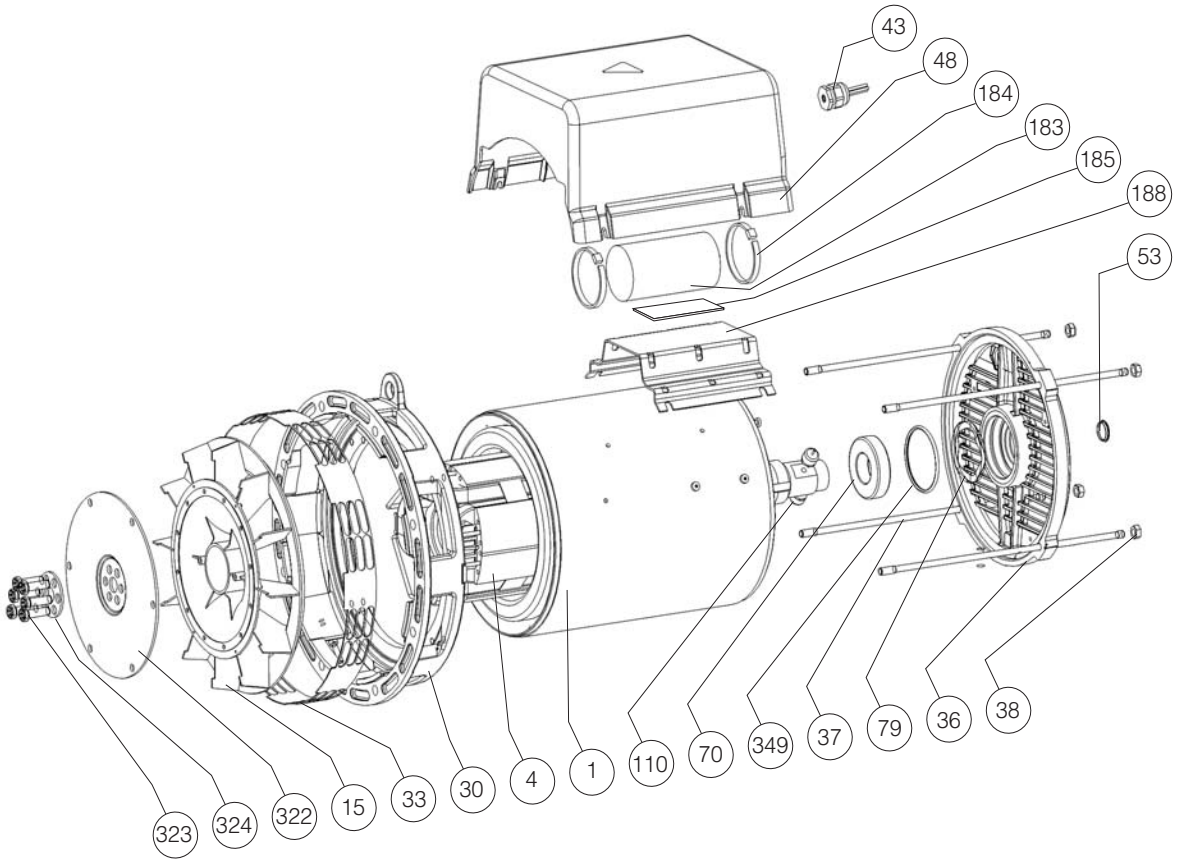
SPARE PARTS

5.3.1 - LSA 37.2 M6, M7- single-bearing



5.3.2 - LSA 37.2 L5, L8 - single-bearing



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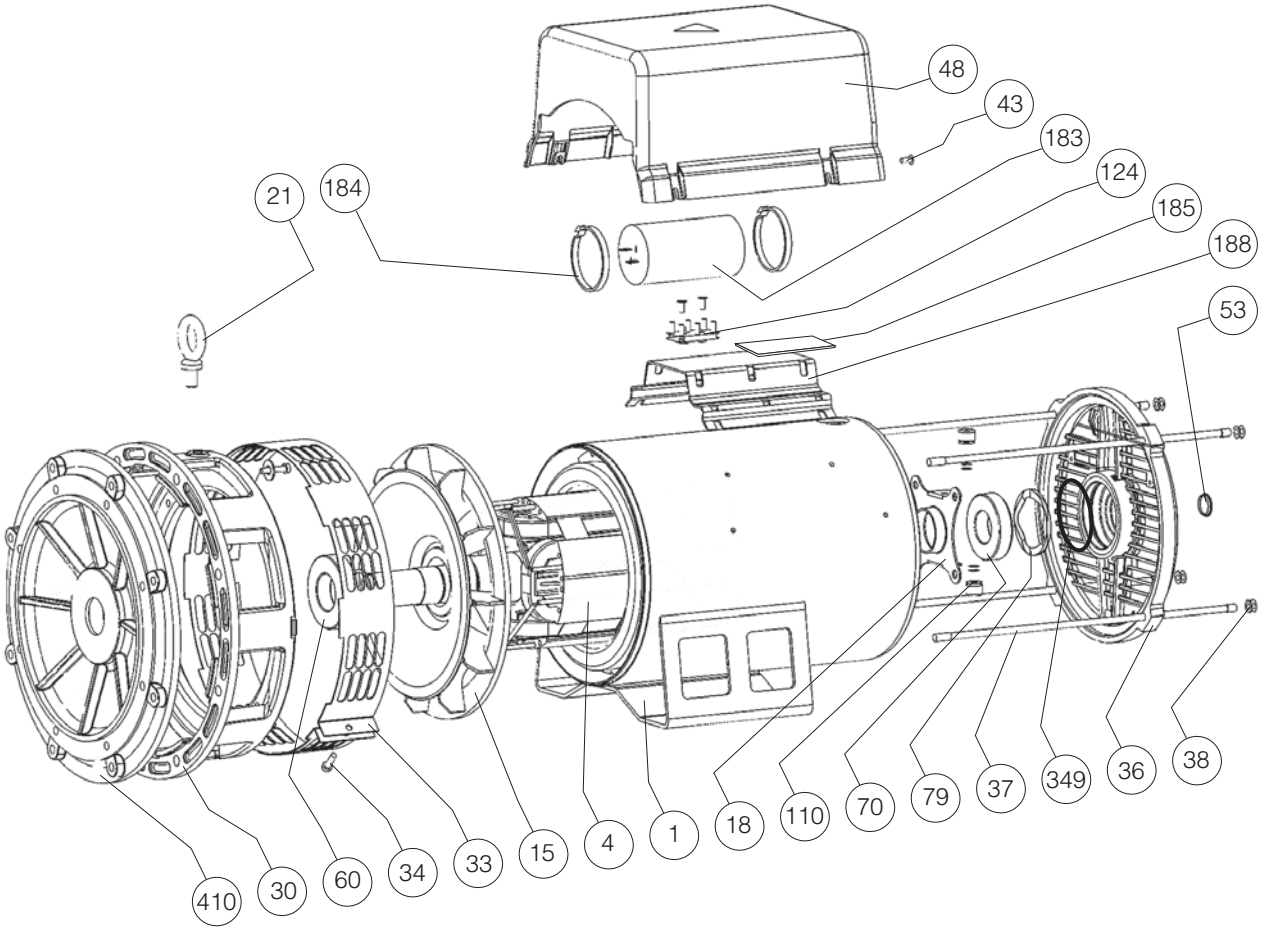
SPARE PARTS

5.3.3 - LSA 37.2 - Twin-bearing



Alternator Division

6 June 2007

EC DECLARATION OF INCORPORATION

Concerns electric generators designed to be incorporated in machines subject to Directive no. 98/37/EC.

The manufacturer : Moteurs LEROY-SOMER
Boulevard Marcellin Leroy
16015 ANGOULEME (France)

Herein declares that the electric generators in the PARTNER range (low voltage) and those series based on them conform to the following standards and directives:

- EN and IEC 60034-1 and 60034-5

- ISO 8528-3 (Design of alternators for generator applications)

- Low Voltage Directive no. 73/23/EC dated 19 February 1973, modified by Directive no. 93/68/EC dated 22 July 1993

These generators are designed to be used in complete power generating sets which must comply with the following standards and directives:

- Machinery directive no. 98/37/EC

- EMC directive no. 89/336/EC modified by Directives nos. 92/31 EC dated 28 April 1992 and 93/68/EC dated 22 July 1993, concerning the intrinsic characteristics of emission and immunity levels.

- Standard EN 60204-1 (Electrical Equipment of Industrial Machines)

WARNING:

The above-mentioned generators must not be commissioned until the machines in which they are to be incorporated have been declared as conforming to Directives nos. 98/37/EC and 89/336 EC and any other directives that may be applicable.

Ref : 4152 en – 06.2007/a

ALTERNATOR DIVISION

LEROY-SOMER 16015 ANGOULÊME CEDEX - FRANCE

RCS ANGOULÊME N° B 671 820 223
S.A. au capital de 62 779 000 €

www.leroy-somer.com