LSA R/H 49.1
Air/Air or Air/Water heat exchanger

Low Voltage Alternator - 4 pole
Installation and maintenance
This manual concerns the alternator which you have just purchased. We wish to draw your attention to the contents of this maintenance manual.

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 potential risks of accidents. It is vital that you understand and take notice of the following warning symbols.

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.

WARNING

The alternators must not be put into service until the machines in which they are to be incorporated have been declared compliant with EC Directives plus any other directives that may be applicable.

This manual is to be given to the end user.

The range of electric alternators and their derivatives, manufactured by us or on our behalf, comply with the technical requirements of the customs Union directives (EAC).

© - We reserve the right to modify the characteristics of this product at any time in order to incorporate the latest technological developments. The information contained in this document may therefore be changed without notice.

This document may not be reproduced in any form without prior authorisation. All brands and models have been registered and patents applied for.

SAFETY INSTRUCTIONS

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

WARNING

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.
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Disposal and recycling instructions
1 - RECEIPT

1.1 - Standards and safety measures
Our alternators comply with most international standards. See the EC Declaration of Incorporation on the last page.

1.2 - Inspection
On receipt of your alternator, check that it has not suffered any damage in transit. If there are obvious signs of knocks, 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. So that you can identify your alternator quickly and accurately, we suggest you fill in its specifications on the nameplate below.

1.4 - Storage
Prior to commissioning, machines should be stored:
- away from humidity (< 90%); after a long period of storage, check the machine insulation. To prevent the bearings from becoming marked, do not store in an environment with significant vibration.

1.5 - Application
This alternator is mainly designed to produce electricity in the context of applications involving the use of generators.

1.6 - Usage restrictions
Use of the machine is restricted to operating conditions (environment, speed, voltage, power, etc) compatible with the characteristics indicated on the nameplate.
2 - TECHNICAL CHARACTERISTICS

2.1 - Electrical characteristics
This alternator is a machine without sliprings or revolving field brushes, wound as «2/3 pitch»; 6-wire, with class H insulation and a field excitation system available in either AREP (see diagram).

In order to conform to standard EN 61000-6.3, EN 61000-6.2, EN 55011, the R791 interference suppression kit is needed.

AREP system with R450

2.2 - Mechanical characteristic
- Steel frame
- End shields in steel, pipe in cast iron
- Greasable ball bearings
- Mounting arrangement: two-bearing with SAE flange and standard cylindrical shaft extension
- Degree of protection : IP 55

2.3 - Options
- Stator temperature sensors
- PTC or PT100 (1 or 2 per phase)
- Reheating resistors

Warning: the supply is still present when the machine has stopped.

- Bearing detection probe

For example: coupling reheating resistors and PT100 2/phase probes (see diagram page 9).

2.4 - Excitation system
The AREP excitation system is driven by the R450 regulator, or any other compatible model, mounted on the outside of the machine (see corresponding regulator instructions and the electrical diagrams provided with the machine).
3 - INSTALLATION

3.1 - Assembly

All mechanical handling operations must be undertaken using approved equipment. Whilst being handled, the machine should remain horizontal.

- **Handling**
  The generously-sized lifting rings are for handling the alternator alone. They must not be used to lift the genset. Choose a lifting system which respects the positioning of the rings.

- **Double-bearing coupling**
  - Semi-flexible coupling
  Careful alignment of the machines is recommended, checking that the lack of concentricity and parallelism of both parts of the coupling do not exceed 0.1 mm.

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

- **Location**
  The machine must only be used in the environmental conditions which are defined when ordering.

LSA R only:
**Warning:** the ambient temperature cannot exceed 50°C.
Fresh air, free from damp and dust, must be able to circulate freely around the air intake grilles 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 - Checks prior to first use

- **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 2 possible methods for restoring the above minimum values.
  a) Dry out the machine for 24 hours in a drying oven at a temperature of 110 °C (without the regulator).
  b) Blow hot air into the air intake, having made sure that the machine is rotating with the exciter field disconnected.

**Note:** Prolonged standstill
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.

**WARNING**
Ensure that the alternator has the degree of protection matching the defined environmental conditions.

- **Mechanical checks**
  Before starting the machine for the first time, check that:
  - all fixing screws are tight,
  - the length of screw and the tightening torque are correct,
  - the cooling air is drawn in freely,
  - the protective grilles and housing are correctly in place,
  - the standard direction of rotation is clockwise as seen from the shaft end (phase rotation in order 1 - 2 - 3).
  For anti-clockwise rotation, swap 2 and 3.
  - the winding connection corresponds to the site operating voltage (see section 3.3).
3.3 - Terminal connection diagrams

**TERMINALS CONNEXION**

**STANDARD**

4 TERMINALS

**OPTION**

6 TERMINALS

**R 791 - OPTIONAL**

---**T1** - **T2** - **T3** : black

---**N** : blue
• A.V.R. connection

Utilization

THREE PHASE ALTERNATOR AREP

Desenergizing

Optional: Remote voltage adjustment (remove ST4)

CT connexion for clockwise direction of rotation
For anticlockwise, transpose secondary outputs

I. Max. in all wires: 10A

TI04 - CT // OPTIONAL
TI04 In 1A - 5VA - C11
CT connexion for clockwise direction of rotation
For anticlockwise, transpose secondary outputs

Desenergizing

Open E 01 for desenergizing

E 01 NOT SUPPLIED BY LS

Leafllet Ref. 4531
3.4 - Internal coupling

- Standard terminal connection: 6-wire

In no case should the internal connections in the terminal box be subjected to stresses due to cables connected by the user.

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

### Connection code

<table>
<thead>
<tr>
<th>D</th>
<th>3 PH</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1(U)</td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td></td>
</tr>
<tr>
<td>T4</td>
<td></td>
</tr>
<tr>
<td>T5</td>
<td></td>
</tr>
<tr>
<td>T6</td>
<td></td>
</tr>
<tr>
<td>T2</td>
<td></td>
</tr>
<tr>
<td>L3(W)</td>
<td></td>
</tr>
<tr>
<td>L2(V)</td>
<td></td>
</tr>
</tbody>
</table>

### Voltage L.L

<table>
<thead>
<tr>
<th>Winding</th>
<th>50 Hz</th>
<th>60 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 S</td>
<td>380 - 415</td>
<td>440 - 480</td>
</tr>
</tbody>
</table>

A.V.R. terminal: 0. 380V

### STATOR TERMINAL BOX

**STATOR**

- Resistor heating

**PT 100 STATOR**

- (Alarme)

**PT 100 STATOR**

- (Réserve)
• Connection checks

Electrical installations must comply with the current legislation in force in the country of use.
Check that:
- The residual circuit-breaker conforms to legislation on protection of personnel, in force in the country of use, and has been correctly installed on the alternator power output as close as possible to the alternator. (In this case, disconnect the wire of the interference suppression module linking the neutral).
- Any protection devices in place have not been tripped.
- If there is an external AVR, the connections between the alternator and the cabinet are made in accordance with the connection diagram.
- There is no short-circuit phase-phase or phase-neutral between the alternator output terminals and the generator set control cabinet (part of the circuit not protected by circuitbreakers or relays in the cabinet).
- The machine should be connected with the busbar separating the terminals as shown in the terminal connection diagram.

- The alternator earth terminal inside the terminal box is connected to the electrical earth circuit
- The earth terminal is connected to the frame.
The connections inside the terminal box must never be subjected to stress due to cables connected by the user.

3.5 - 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). With the regreaseable bearing option, we recommend greasing the bearings at the time of commissioning (see section 4.5).
On application of the load, the machine should achieve its rated speed and voltage; however, in the event of abnormal operation, the machine setting can be altered (follow the adjustment procedure in section 3.6). If the machine still operates incorrectly, the cause of the malfunction must be located (see section 4.8).

3.6 - Setting up

The various adjustments during tests must be made by a qualified engineer. Ensure that the drive speed specified on the nameplate is reached before commencing adjustment.
After operational testing, replace all access panels or covers.
The AVR is used to make any adjustments to the machine.

<table>
<thead>
<tr>
<th>Diameter</th>
<th>M6</th>
<th>M8</th>
<th>M10</th>
<th>M12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Torque</td>
<td>4 Nm</td>
<td>10 Nm</td>
<td>20 Nm</td>
<td>35 Nm</td>
</tr>
<tr>
<td>Tolerance</td>
<td>± 15%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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.

Warning: During and after running, the alternator will reach temperatures hot enough to cause injury, such as burns.

4.2 - Routine maintenance

• 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.

4.3 - Air/air heat exchanger

• Primary circuit (hot air)
The air to be cooled flows through the machine and through the exchanger in a closed system. The air circulation is generally ensured by a ventilator locked onto the machine axle and situated on the front bearing side. In particular cases (variable speed ...) the air circulation is ensured by a motoventilator mounted on the exchanger casing.

• Secondary circuit (cold air)
Ambiant air is usually used for cooling. The circulation through tubes is ensured; either by a turbine mounted overhanging the back of the machine on a bearing extension or by a moto-ventilation mounted on the exchanger. In order to prevent excessive overheating caused by the tubes clogging up, it is advisable that the stator coil be monitored with thermal detection probes (PTC or PT100).

• Performances
We guarantee that the performance of the exchanger complies with the definitions agreed upon. (ambient temperature, power to be evacuated, environmental conditions, loss of charge etc.).

• Manufacture of the exchanger
The exchanger casing is made from steel sheets. The network of tubes is generally composed of aluminium alloy or steel tubes. The ends of the tubes are fitted to steel panels.

• Exchanger maintenance
If the coolant is used in a clean atmosphere it can run for several years with no maintenance. If the atmosphere is polluted (dust, sand, greasy vapours etc.) the tubes must be cleaned regularly. Clogging of the tubes becomes noticeable when the thermal exchange performances are reduced and the air in the primary circuit overheats causing the machine to also overheat; therefore, machine overheating indicates that the exchanger is probably dirty.
### 4.4 - Air/water heat exchanger

#### Description of the cooler

Losses (mechanical, ohmic...). The exchanger is located on the top of the machine.

Normal operation:

The air is pulsed by a fan fixed to the synchronous machine shaft. The air goes through the exchanger, rendering its calories.

**AIR / WATER double tube exchanger:**

The double-tube technique keeps the cooling circuit from being affected by possible water leakage. The double tube provides a high safety level. In case of leakage, the water goes from the inside of the internal tube to the coaxial space between the two tubes. The water is drained axially to a leakage chamber where it may activate a sensor.

An exchanger is comprised of a fin-tube block containing:
- a steel frame,
- a fin-tube block cramped mechanically onto the tubes.

The tube bundle is roll-expanded in the end plates (parts 3 and 4).

The water distribution in the tubes is provided by two removable water boxes (part 5). A water box is equipped with collars for fitting the inlet and outlet lines. Neoprene seals ensure the watertightness between the water boxes and the end plates.

**AIR / WATER single tube exchanger:**

An exchanger is comprised of a fin-tube block containing:
- a steel frame,
- a fin-tube block cramped mechanically onto the tubes.

The tube bundle is roll-expanded in the end plates.

The water distribution in the tubes is provided by two removable water boxes. One water box is equipped with collars for fitting the inlet and outlet water lines. Neoprene seals provide watertightness between the water boxes and the end plates.

#### Maintenance of the water-cooler

The frequency of cleaning operations depends essentially on the purity of the water used. We recommend a minimum of one inspection per year.

Stop the machine.

Cut off the power supply by isolating the inlet and outlet lines, and drain the water.

Disconnect the leak sensor (option with double-tube cooler), and make sure that there are no leaks.

Remove the water boxes on each side of the machine.

Rinse and brush each water box.

Note: do not use a hard wire brush as this will remove the protective oxidation layer which has formed on the surfaces of the water boxes.

Clean each tube with a metal scraper; rinse in soft water.

Keep the leakage chamber dry (double-tube water-cooler only).

#### Leak detection for a double-tube exchanger

If a leak is detected, it is necessary to ascertain its origin immediately and repair it.

Remove the two water boxes, apply a slight positive pressure in the leakage chamber, thus between the two tubes (only concerns the double-tube coolers).

If a tube is damaged: plug it at BOTH ends.

Use a tapered plug.

The plug should preferably be made of salt-water resistant aluminium bronze or of a synthetic material.
**LSA R/H 49.1 Low Voltage Alternator - 4 pole**

- **Servicing the water-cooler**
  
  **Cooler removal:**
  The cooler unit is slid into the box caisson. It is possible to remove the cooler from the caisson without removing the water boxes. The cooler is fastened to the caisson via a series of screws on the water box. Remove the supply and return pipes. Provide two supports to hold the cooler when it comes out of its housing. Remove the cooler using slings that can be attached to the connecting flanges.

  **Cooler re-assembly:**
  Carry out the operations of the «Cooler removal» chapter in the reverse order. Be careful to push the cooler completely into its housing before tightening the fastening screws of the cooler to the caisson.

- **Cooler protection devices (depending on option)**

  **Leak detection (float system):**
  A magnet float activate a switch located into the float guiding rod.

  **Leak detection (electrode system):**
  The REDOX 69 system measures the apparent resistance of the fluid whose leakage is to be checked. By apparent resistance is meant the resistance between the electrodes of the system when they are immersed in their receptacle. The current which circulates is used to activate a relay.

<table>
<thead>
<tr>
<th>Contact</th>
<th>Electrodes submerged</th>
<th>Electrodes dry Relay not excited</th>
</tr>
</thead>
<tbody>
<tr>
<td>01-01</td>
<td>open</td>
<td>closed</td>
</tr>
<tr>
<td>F1-F1</td>
<td>closed</td>
<td>open</td>
</tr>
</tbody>
</table>

**4.5 - Bearings**

The bearings are greasable. It is advisable to lubricate the machine during operation. The lubrication characteristics are given in the table below.

<table>
<thead>
<tr>
<th>Bearings</th>
<th>6322/C3</th>
<th>6320/C3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity of grease: gr or cm³</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>Lubrication interval: hours</td>
<td>4500</td>
<td>4500</td>
</tr>
</tbody>
</table>

Lubrication intervals are given for grease type: LITHIUM - standard - NLGI 3
The factory lubrication is performed with grease: ESSO UNIREX N3
Before using another grease, check for compatibility with the original one. Monitor the temperature rise in the bearings, which should not exceed 60°C above the ambient temperature. Should this value be exceeded, the machine must be stopped and checks carried out.

- **Electrical servicing**

  Cleaning product for the windings

**WARNING**

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
The insulating components and the impregnation system are not at risk of damage from solvents (see the above 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.

• Mechanical servicing

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.

4.6 - 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 protective devices are fitted correctly,
- the connections comply with diagrams in the manuals supplied with the machine,
- the speed of the unit is correct (see nameplate).
Repeat the operations defined in section 3.

4.7 - Mechanical defects

<table>
<thead>
<tr>
<th>Fault</th>
<th>Action</th>
</tr>
</thead>
</table>
| Bearing | Excessive overheating of one or both bearings (bearing temperature 80°C above the ambient temperature) | - If the bearing has turned blue or if the grease has turned black, change the bearing  
- Bearing not fully locked (abnormal play in the bearing cage)  
- End shields incorrectly aligned |
| Abnormal temperature | Excessive overheating of alternator frame (more than 40°C above the ambient temperature) | - Air flow (inlet-outlet) partially clogged or hot air is being recycled from the alternator or engine  
- Alternator operating at too high a voltage (>105% of Un on load)  
- Alternator overloaded |
| Vibrations | Too much vibration | - Misalignment (coupling)  
- Defective mounting or play in coupling  
- Rotor balancing fault (Engine - Alternator) |
| Abnormal noise | Excessive vibration and humming noise coming from the machine | - Phase imbalance  
- Stator short-circuit |
| Alternator damaged by a significant impact, followed by humming and vibration | | - System short-circuit  
- Misparralleling  
Possible consequences  
- Broken or damaged coupling  
- Broken or bent shaft end  
- Shifting and short-circuit of main field  
- Fan fractured or coming loose on shaft  
- Irreparable damage to rotating diodes/AVR, surge suppressor |
# 4.8 - Electrical faults

<table>
<thead>
<tr>
<th>Fault</th>
<th>Action</th>
<th>Effect</th>
<th>Check/Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>No voltage at no load on start-up</td>
<td>Connect a new battery of 4 to 12 volts to terminals E- and E+, respecting the polarity, for 2 to 3 seconds</td>
<td>The alternator builds up and its voltage is still correct when the battery is removed</td>
<td>- Lack of residual magnetism</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The alternator builds up but its voltage does not reach the rated value when the battery is removed</td>
<td>- Check the connection of the voltage reference to the AVR</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Faulty diodes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Armature short-circuit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The alternator builds up but its voltage disappears when the battery is removed</td>
<td>- Faulty AVR</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Field windings disconnected</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Main field winding open circuit (check the resistance)</td>
</tr>
<tr>
<td>Voltage too low</td>
<td>Check the drive speed</td>
<td>Correct speed</td>
<td>Check the AVR connections (AVR may be faulty)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Field windings short-circuited</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Rotating diodes burnt out</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Main field winding short-circuited</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Check the resistance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Speed too low</td>
<td>Increase the drive speed (Do not touch the AVR voltage pot. (P2) before running at the correct speed)</td>
</tr>
<tr>
<td>Voltage too high</td>
<td>Adjust AVR voltage potentiometer</td>
<td>Adjustment ineffective</td>
<td>- Faulty AVR</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- 1 faulty diode</td>
</tr>
<tr>
<td>Voltage oscillations</td>
<td>Adjust AVR stability potentiometer</td>
<td>If no effect : try normal / fast recovery modes (ST2)</td>
<td>- Check the speed : possibility of cyclic irregularity</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Loose connections</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Faulty AVR</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Speed too low when on load (or LAM set too high)</td>
</tr>
<tr>
<td>Voltage correct at no load and too low when on load</td>
<td>Run at no load and check the voltage between E+ and E- on the AVR</td>
<td>Voltage between E+ and E- AREP / PMG &lt; 10V</td>
<td>- Check the speed (or LAM set too high)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Faulty rotating diodes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Short-circuit in the main field (check the resistance)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Faulty exciter armature</td>
</tr>
<tr>
<td>Voltage disappears during operation</td>
<td>Check the AVR, the surge suppressor, the rotating diodes, and replace any defective components</td>
<td>The voltage does not return to the rated value</td>
<td>- Exciter winding open circuit</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Faulty exciter armature</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Faulty AVR</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Main field open circuit or short-circuited</td>
</tr>
</tbody>
</table>
• Checking the winding
You can check the winding insulation by performing a high voltage test. In this case, you must disconnect all AVR wires.

**WARNING**
Damage caused to the AVR in such conditions is not covered by our warranty.

• Checking the diode bridge
A diode in good working order should allow the current to flow only in the anode-to-cathode direction.

• Checking the windings and rotating diodes using separate excitation

During this procedure, make sure that the alternator is disconnected from any external load and inspect the terminal box to check that the connections are fully tightened.

1) Stop the unit, disconnect and isolate the AVR wires.
2) There are two ways of creating an assembly with separate excitation.

Assembly A: Connect a 12 V battery in series with a rheostat of approximately 50 ohms - 300 W and a diode on both exciter field wires (5+) and (6-).

**ASSEMBLY A**

Assembly B: Connect a “Variac” variable power supply and a diode bridge on both exciter field wires (5+) and (6-). Both these systems should have characteristics which are compatible with the field excitation power of the machine (see the nameplate).

3) Run the unit at its rated speed.
4) Gradually increase the exciter field current by adjusting the rheostat or the variac and measure the output voltages on L1 - L2 - L3, checking the excitation voltage and current at no load (see the machine nameplate or ask for the factory test report). When the output voltage is at its rated value and balanced within 1% for the rated excitation level, the machine is in good working order. The fault therefore comes from the AVR or its associated wiring (ie. sensing, auxiliary windings).
4.9 - Dismantling, reassembly
During the warranty period, this operation should only be carried out in an approved workshop or in our factory, otherwise the warranty may be invalidated. Whilst being handled, the machine should remain horizontal.

• 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: 9 mm, 10 mm, 18 mm
- 1 socket set: 10, 13, 17, 18, 19, 24 mm,
- 1 puller (U35) / (U32/350)
- 1 hexagonal wrench 6 mm - 10 mm

• Screw tightening torque

<table>
<thead>
<tr>
<th>IDENTIFICATION</th>
<th>screw Ø</th>
<th>Torque N.m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exciter screw</td>
<td>M6</td>
<td>8.3</td>
</tr>
<tr>
<td>Diode / Star bridge</td>
<td>M6</td>
<td>10</td>
</tr>
<tr>
<td>Diode nut</td>
<td>M6</td>
<td>3</td>
</tr>
<tr>
<td>DE shield / frame screw</td>
<td>M12</td>
<td>70</td>
</tr>
<tr>
<td>NDE shield / frame screw</td>
<td>M12</td>
<td>70</td>
</tr>
<tr>
<td>Bush / casing</td>
<td>M12</td>
<td>70</td>
</tr>
<tr>
<td>Earth screw</td>
<td>M12</td>
<td>35</td>
</tr>
<tr>
<td>Grille screws</td>
<td>M6</td>
<td>4</td>
</tr>
<tr>
<td>Cover screws</td>
<td>M6</td>
<td>5</td>
</tr>
<tr>
<td>Stator connection nut</td>
<td>M12</td>
<td>35</td>
</tr>
</tbody>
</table>

• Access to diodes
- Remove the diode access door (140).
- Disconnect the diodes.
- Check 12 diodes using an ohmmeter or a battery lamp.
If the diodes are faulty:
- Remove the surge suppressor (347).
- Remove the 6 «H» mounting nuts for the diode assembly on the support.
- Change the fitted caps, respecting the polarity.

• Access to connections and the regulation system
Access is easy after the hood has been removed (132).

• Replacing the NDE bearing
- Remove the terminal block cover (132).
- Unplug (+ et -) field system.
- If bearing probe, unplug at the terminal, break the network circlips up to the bearing.
On LSA R:
- Dismantle the air intake grid (50).
- Dismantle the air turbine (118).
- Dismantle the air turbine cover (117).
- Remove the V-Ring gasket (249).
On LSA H: Remove external cap (71).
- Remove the inner hood bearing screws (78).
- Remove the rear flange (82).
- Remove the ball bearing (70) using a puller with a central screw (see fig. below).

- Change the «O» ring (349).
- Fit the new bearing, after heating it by induction at approximately 80°C.

[WARNING]

Replace the dismantled bearing with a new one.

• Replacing the DE bearing
- If bearing probe, unplug at the terminal, break the network clips up to the bearing.
- Remove the V-Ring gasket (247).
- Remove the inner hood bearing screws (68).
- Remove the rear flange (410).
- Take out the circlips (284).
- Remove the ball bearing (60) using a puller with a central screw.
- Fit the new bearing, after heating it by induction at approximately 80°C.

**WARNING**

Replace the dismantled bearing with a new one.

- **Complete dismantling**
  - Take out the NDE bearing following the instructions in section above.
  - Take out the DE bearing following the instructions in section above.
  - Remove the access plates (140).
  - Remove the lubricating tubes (77).
  - Dismantle the mill tube case (116) on LSA R or exchanger (11h + 11s LSA H).
  - Dismantle the front bush (30).
  - Support the rotor (4) on the interconnection side using a belt or a bracket.
  - Using a mallet gently hit the end of the shaft on the opposite side of the interconnection.
  - As the rotor moves adjust the belt to compensate for shift in weight.

- **Complete reassembly**
  - Place the «O» ring seal (349) and the preloading wavy washer (79) in the bearing seat (36).
  - Mount and fix the rear flange (82) on the rear base (36).
  - Mount the rotor (4) in the stator (1).
  - Mount and fix the front bush (30).
  - Remount the tube casings (116).
  - Remount the front and rear tubes (77) in the inner bearing caps.
  - Remount the access plates (140).
  - Remount and fix the the front flange (410).
  - Fix the inner cap (68).
  - Remount the V-Ring gasket (247).
  - Remount the V-Ring gasket (249).
  - Remount the turbine cover (117).
  - Remount the turbine (118).
  - Remount the air intake grid (51).
  - Reconnect the field system and close the terminal box.

### 4.10 - Table of characteristics

Table of average values.
Alternator - 4 poles - 50 Hz - Standard winding No. 6
(400V for the excitation values)
The voltage and current values are given for no-load operation and operation at rated load with separate field excitation. All values are given at ± 10% and may be changed without prior notification (for exact values, consult the test report).

- **Resistances of main windings at 20°C (Ω)**

<table>
<thead>
<tr>
<th>Type</th>
<th>Stator L/N</th>
<th>Rotor</th>
<th>Field</th>
<th>Armature</th>
</tr>
</thead>
<tbody>
<tr>
<td>L6</td>
<td>0.0029</td>
<td>0.38</td>
<td>12</td>
<td>0.08</td>
</tr>
<tr>
<td>L9</td>
<td>0.0021</td>
<td>0.43</td>
<td>12</td>
<td>0.08</td>
</tr>
</tbody>
</table>

- **Field excitation current i exc (A)**

<table>
<thead>
<tr>
<th>Type</th>
<th>No load</th>
<th>At rated load</th>
</tr>
</thead>
<tbody>
<tr>
<td>L6</td>
<td>0.5</td>
<td>2.2</td>
</tr>
<tr>
<td>L9</td>
<td>0.9</td>
<td>2.2</td>
</tr>
</tbody>
</table>

- **Voltage of auxiliary windings at no load**

<table>
<thead>
<tr>
<th>Type</th>
<th>X1, X2</th>
<th>Z1, Z2</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 Hz</td>
<td>70 V</td>
<td>10 V</td>
</tr>
<tr>
<td>60 Hz</td>
<td>85 V</td>
<td>12 V</td>
</tr>
</tbody>
</table>

For 60 Hz machines, the «i exc» values are approximately 5 to 10% lower.
5 - SPARE PARTS

5.1 - First maintenance parts
Emergency repair kits are available as an option. They contain the following items:

<table>
<thead>
<tr>
<th>Emergency kit AREP</th>
<th>ALT 491 KS 001</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVR R450</td>
<td>-</td>
</tr>
<tr>
<td>Diode bridge assembly</td>
<td>-</td>
</tr>
<tr>
<td>Surge suppressor</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Single-bearing kit</td>
<td>ALT 491 KB 002</td>
</tr>
<tr>
<td>Non drive end bearing</td>
<td>-</td>
</tr>
<tr>
<td>«O» ring</td>
<td>-</td>
</tr>
<tr>
<td>Preloading (wavy) washer</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Double-bearing kit</td>
<td>ALT 491 KB 001</td>
</tr>
<tr>
<td>Non drive end bearing</td>
<td>-</td>
</tr>
<tr>
<td>Drive end bearing</td>
<td>-</td>
</tr>
<tr>
<td>«O» ring</td>
<td>-</td>
</tr>
<tr>
<td>Preloading (wavy) washer</td>
<td>-</td>
</tr>
</tbody>
</table>

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

For all spare parts orders or technical support requests, send your request to service.epg@leroy-somer.com or your nearest contact, whom you will find at www.lrsm.co/support indicating the complete type of machine, its number and the information indicated on the nameplate.

Part numbers should be identified from the exploded views and their description from the parts list.

To ensure that our products 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.

After operational testing, it is essential to replace all access panels or covers.
5.3 - Exploded view: air/air heat exchanger
### 5.4 - Parts list

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Qty</th>
<th>Description</th>
<th>Ref.</th>
<th>Qty</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Stator assembly</td>
<td>100</td>
<td>1</td>
<td>Exciter armature</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>Rotor assembly</td>
<td>107</td>
<td>1</td>
<td>Diode assembly support</td>
</tr>
<tr>
<td>15</td>
<td>1</td>
<td>Primary circuit turbine</td>
<td>116</td>
<td>1</td>
<td>Air tube casing</td>
</tr>
<tr>
<td>18</td>
<td>1</td>
<td>Balancing disc</td>
<td>117</td>
<td>1</td>
<td>Air ventilation casing</td>
</tr>
<tr>
<td>22</td>
<td>1</td>
<td>End shaft key</td>
<td>118</td>
<td>1</td>
<td>Secondary circuit turbine</td>
</tr>
<tr>
<td>28</td>
<td>4</td>
<td>Earth terminal</td>
<td>120</td>
<td>1</td>
<td>Terminal support</td>
</tr>
<tr>
<td>30</td>
<td>1</td>
<td>Bush interconnection side</td>
<td>132</td>
<td>1</td>
<td>Terminal box</td>
</tr>
<tr>
<td>36</td>
<td>1</td>
<td>Bush exciter side</td>
<td>140</td>
<td>2</td>
<td>Diode access door</td>
</tr>
<tr>
<td>50</td>
<td>1</td>
<td>Air intake grille</td>
<td>172</td>
<td>-</td>
<td>Isolator</td>
</tr>
<tr>
<td>60</td>
<td>1</td>
<td>DE bearing</td>
<td>247</td>
<td>1</td>
<td>DE «O» ring</td>
</tr>
<tr>
<td>68</td>
<td>1</td>
<td>Front inner cap</td>
<td>249</td>
<td>1</td>
<td>NDE «O» ring</td>
</tr>
<tr>
<td>70</td>
<td>1</td>
<td>NDE bearing</td>
<td>284</td>
<td>1</td>
<td>Circlips</td>
</tr>
<tr>
<td>77</td>
<td>2</td>
<td>Lubricating tube</td>
<td>343</td>
<td>1</td>
<td>Diode bridge assembly</td>
</tr>
<tr>
<td>78</td>
<td>1</td>
<td>Rear inner cap</td>
<td>347</td>
<td>1</td>
<td>Protection varistor (+ C.T.)</td>
</tr>
<tr>
<td>79</td>
<td>1</td>
<td>Preloading wavy washer</td>
<td>349</td>
<td>1</td>
<td>«O» ring</td>
</tr>
<tr>
<td>82</td>
<td>1</td>
<td>Rear flange bearing</td>
<td>410</td>
<td>1</td>
<td>Front flange</td>
</tr>
<tr>
<td>90</td>
<td>1</td>
<td>Exciter field</td>
<td>411</td>
<td>8</td>
<td>Fixing screws for front flange</td>
</tr>
<tr>
<td>91</td>
<td>4</td>
<td>Field fixing screws</td>
<td>474</td>
<td>-</td>
<td>Departure band</td>
</tr>
</tbody>
</table>
5.5 - Exploded view: air/water heat exchanger
### 5.6 - Parts list

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Qty</th>
<th>Description</th>
<th>Ref.</th>
<th>Qty</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Stator assembly</td>
<td>91</td>
<td>4</td>
<td>Fixing screws</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>Rotor assembly</td>
<td>100</td>
<td>1</td>
<td>Exciter armature</td>
</tr>
<tr>
<td>15</td>
<td>1</td>
<td>Turbine</td>
<td>107</td>
<td>1</td>
<td>Diode assembly support</td>
</tr>
<tr>
<td>18</td>
<td>1</td>
<td>Balancing disc</td>
<td>114</td>
<td>1</td>
<td>Cooling system</td>
</tr>
<tr>
<td>22</td>
<td>1</td>
<td>End shaft key</td>
<td>115</td>
<td>1</td>
<td>Cooling system box</td>
</tr>
<tr>
<td>30</td>
<td>1</td>
<td>Bearing interconnection side</td>
<td>120</td>
<td>1</td>
<td>Terminal support</td>
</tr>
<tr>
<td>36</td>
<td>1</td>
<td>Bearing exciter side</td>
<td>132</td>
<td>1</td>
<td>Terminal box</td>
</tr>
<tr>
<td>60</td>
<td>1</td>
<td>DE bearing</td>
<td>140</td>
<td>2</td>
<td>Diode access door</td>
</tr>
<tr>
<td>68</td>
<td>1</td>
<td>Inner cap</td>
<td>172</td>
<td>1</td>
<td>Terminal</td>
</tr>
<tr>
<td>70</td>
<td>1</td>
<td>NDE bearing</td>
<td>284</td>
<td>1</td>
<td>Circlips</td>
</tr>
<tr>
<td>71</td>
<td>1</td>
<td>External cap</td>
<td>343</td>
<td>1</td>
<td>Diode bridge assembly</td>
</tr>
<tr>
<td>77</td>
<td>2</td>
<td>Lubrication</td>
<td>347</td>
<td>1</td>
<td>Protection varistor (+ C.T.)</td>
</tr>
<tr>
<td>78</td>
<td>1</td>
<td>Inner cap</td>
<td>349</td>
<td>1</td>
<td>«O» ring</td>
</tr>
<tr>
<td>79</td>
<td>1</td>
<td>Preloading wavy washer</td>
<td>410</td>
<td>1</td>
<td>DE bearing housing</td>
</tr>
<tr>
<td>82</td>
<td>1</td>
<td>Rear flange bearing</td>
<td>411</td>
<td>8</td>
<td>Fixing screws</td>
</tr>
<tr>
<td>90</td>
<td>1</td>
<td>Exciter field</td>
<td>474</td>
<td>3</td>
<td>Departure band</td>
</tr>
</tbody>
</table>
LSA R/H 49.1
Low Voltage Alternator - 4 pole
Disposal and recycling instructions
We are committed to limiting the environmental impact of our activity. We continuously monitor our production processes, material sourcing and product design to improve recyclability and minimise our environmental footprint.

These instructions are for information purposes only. It is the user’s responsibility to comply with local legislation regarding product disposal and recycling.

Recyclable materials
Our alternators are mainly constructed from iron, steel and copper materials, which can be reclaimed for recycling purposes.

These materials can be reclaimed through a combination of manual dismantling, mechanical separation and melting processes. Our technical support department can provide detailed directions on how to dismantle products on request.

Waste & hazardous materials
The following components and materials require special treatment and must be separated from the alternator before the recycling process:
- electronic materials found in the terminal box, including the automatic voltage regulator (198), current transformers (176), interference suppression module (199) and other semi-conductors.
- diode bridge (343) and surge suppressor (347), found on the alternator rotor.
- major plastic components, such as the terminal box structure on some products. These components are usually marked with information concerning the type of plastic.

All materials listed above need special treatment to separate waste from reclaimable materials and should be entrusted to specialist recycling companies.

The oil and grease from the lubrication system should be treated as hazardous waste and must be treated in accordance with local legislation.
<table>
<thead>
<tr>
<th>Electric Power Generation</th>
<th>Installation and maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LSA R/H 49.1</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Low Voltage Alternator - 4 pole</strong></td>
<td></td>
</tr>
</tbody>
</table>
Our worldwide service network of over 80 facilities is at your service.

This local presence is our guarantee for fast and efficient repair, support and maintenance services.

Trust your alternator maintenance and support to electric power generation experts. Our field personnel are 100% qualified and fully trained to operate in all environments and on all machine types.

We have a deep understanding of alternator operation, providing the best value service to optimise your cost of ownership.

Where we can help:

Contact us:
**Americas:** +1 (507) 625 4011  
**Europe & Rest of the world:** +33 238 609 908  
**Asia Pacific:** +65 6250 8488  
**China:** +86 591 88373036  
**India:** +91 806 726 4867  
**Middle East:** +971 4 5687431

Scan the code or go to:  
**service.epg@leroy-somer.com**  
**www.lrsm.co/support**