

LSA 43.3 IC7 L7

Low Voltage Alternator - 2 pole Installation and maintenance

LEROY-SOMER™

Nidec
All for dreams

LSA 43.3 IC7 L7

Low Voltage Alternator - 2 pole

**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.

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.

SAFETY INSTRUCTIONS

Sets of self-adhesive stickers depicting the various warning symbols are 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.

The alternator is a sub-assembly delivered without a system of protection against short-circuits. The protection must be provided by the circuit-breaker of the generator, sized to interrupt the fault current.

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Share Capital: 32,239,235 €, RCS Angoulême 338 567 258.

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 authorization.

All brands and models have been registered and patents applied for.

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Disposal and recycling instructions

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1 - RECEIPT

1.1 - Standards and safety measures

Our alternators comply with most international standards.

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).

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 (see sections 3.2 and 4.6). To prevent the bearings from becoming marked, do not store in an environment with significant vibration.

1.5 - Application

This alternator is designed to produce electricity of the on-board network of a train.

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.

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Model	LSA		IC Code:	IC7A1W7	
S/N			Date		
Enclosure			Protection		
Th. Class			Altitude		
Weight			PF		
AVR			Excitation		
Excitation values	No Load		Full Load		
DE bearing					
NDE bearing					

Frequency	Hz						
Speed	min ⁻¹						
Voltage	V						
Phase							
Connection							
Cont. BR 85°C	kVA						
	kW						
	A						
Stand by PR	kVA						
	kW						
	A						



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2 BD MARCELLIN LEROY
16000 ANGOULÊME - FRANCE

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Scan the code or go to
GEN.LS1.DO
to check product data

LSA.000-1-148 a



IEC 60034 - 1 & 5
ISO 8528 - 3
NEMA MG 1 32 & 33

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2 - TECHNICAL CHARACTERISTICS

2.1 - Mechanical characteristics

- Steel frame
- Cast iron end shields
- Protected ball bearings, greased for life
- Mounting arrangement: two-bearing with Rotex coupling and cylindrical shaft extension
- Enclosed machine cooled by heat transfer fluid
- Degree of protection: IP 6K9K
- Cooling of the terminal box by an air flow with a maximum temperature of:
 - 1 to 25°C with minimum 0.8 m³/min flow
 - 50°C with minimum 2 m³/min flow

2.2 - Cooling circuit characteristics

- Cooling method: IC7A1W7
- Type of fluid: water + additive
- Operating temperature: 85°C (±7°C)
- Permitted additives: Glycol-type antifreeze
- Maximum level of additives: 50%
- Operating pressure: 3 bar
- pH of water: 7<pH<8

Glycol (or Ethylene glycol) type antifreeze is a hazardous product which is harmful to health.



SGH07



SGH08



SIMDUT D2A



NFPA 704

Precautions:

- **P260:** Do not breathe fumes/mist/vapours
- **P301:** If swallowed:
- **P312:** Call a poison centre or doctor/physician if you feel unwell
- **P330:** Rinse mouth



Never use methanol or isopropanol-type antifreeze.

2.3 - Electrical characteristics

This alternator is a machine without sliprings or revolving armature brushes, wound as "mixed pitch", 4-wire, with class H insulation and a field excitation system available in Shunt version (see connection diagram on next page and D550 AVR manual).

• Electrical accessories

- Stator temperature detection sensors

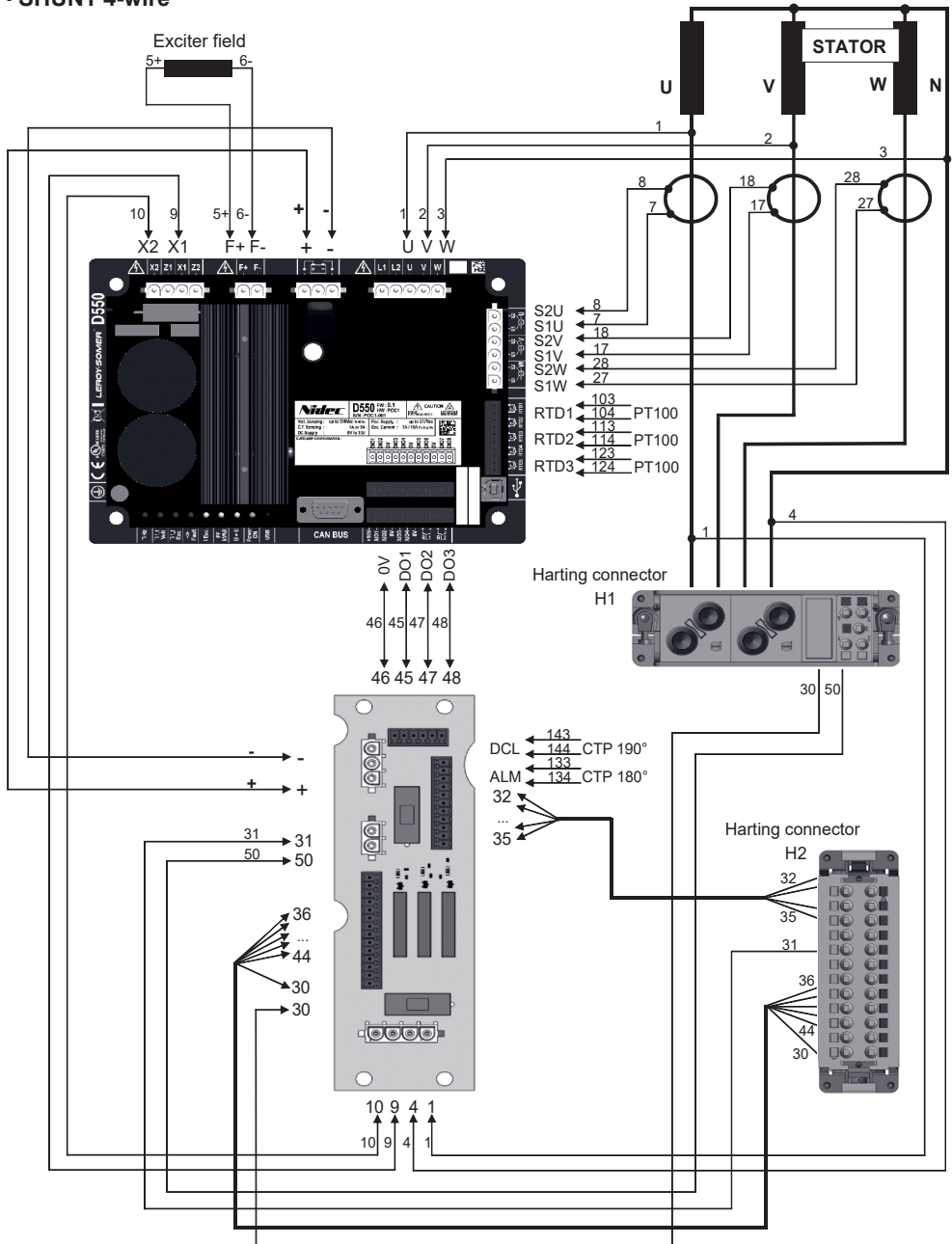
Risks:

- **H302:** Harmful if swallowed
- **H373:** May cause damage to organs through prolonged or repeated exposure

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• SHUNT 4-wire



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3 - INSTALLATION

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

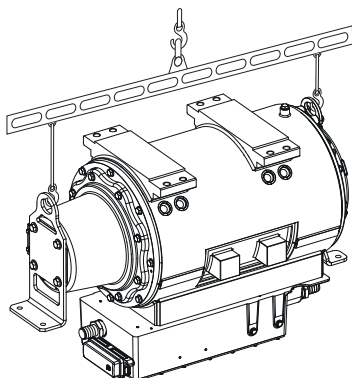
3.1 - Assembly



All mechanical handling operations must be undertaken using suitable equipment and the machine must be horizontal. Check how much the machine weighs before choosing the lifting tool. During this operation, do not allow anyone to stand under the load.

• Handling

The parts intended for lifting are largely dimensioned and allow the manipulation of 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 the parts. Choose a lifting system which respects the integrity and the environment of the machine.



• 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 location where the alternator is placed must be ventilated to ensure that the ambient temperature cannot exceed 90°C.

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 is possible method for restoring the above minimum values, dry out the machine for 24 hours in a drying oven at a temperature of 110 °C.

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:

- the cooling circuit of water is done,
- all fixing dismantled bolts are tight, and that there are no leaks on the water inlet and outlet,
- the length and tightening torque of the added bolts are correct.

WARNING

At the first start-up or after an extended shutdown, allow the machine to be purged.

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3.3 - Terminal connection



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

• Connection checks



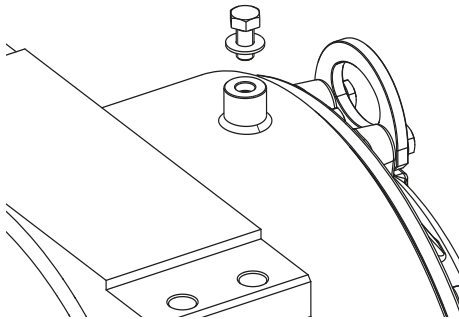
Electrical installations must comply with the current legislation in force in the country of use.

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,
- any protection devices in place have not been tripped.



- The alternator earth terminal is located on the frame of the machine.
- The earth terminal is connected to the frame.



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.

If the machine still operates incorrectly, the cause of the malfunction must be located (see section 4.6).

3.5 - 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.

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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.

Also check that no liquid is leaking from the cooling circuit.



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.

• Electrical servicing

Commercially-available volatile degreasing agents can be used.

WARNING

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



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. 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

Check regularly that no liquid is leaking from the cooling circuit.

Degreasing: Use a brush and detergent (suitable for paintwork).

Dusting: Use an air gun.

If the machine is fitted with air inlet and outlet filters, the maintenance personnel should clean them routinely at regular intervals. In the case of dry dust, the filter can be cleaned using compressed air and/or replaced if it is clogged.

After cleaning the alternator, it is essential to check the winding insulation (see sections 3.2 and 4.6).

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4.3 - Bearings

The bearings are permanently greased	Approximate life of the grease (depending on use) = 20,000 hours
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4.4 - Cooling circuit

Composition	Water, anticorrosion oxygen inhibitor, glycol-type antifreeze up to 50%
Maintenance	- Coolant change interval = 20,000 hours or 2 years maximum (the first of two who is reached) - pH of water = 7<pH<8

4.5 - Mechanical defects

Fault		Action/Cause
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)	- 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)
	Excessive vibration and humming noise coming from the machine	- Phase imbalance - Stator short-circuit
Abnormal noise	Alternator damaged by a significant impact, followed by humming and vibration	- System short-circuit 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

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4.6 - Electrical faults

Fault	Action/Cause
No voltage at no load on start-up	<ul style="list-style-type: none"> - Connect a new battery of 4 to 12V to terminals E- and E+, respecting the polarity, for 2 to 3 seconds. <p>Restart the system and check if the problem is fixed. If the problem is still present, follow the actions associated with the fault below.</p>
<ul style="list-style-type: none"> - Voltage too low or too high - Voltage disappears during operation 	<ul style="list-style-type: none"> - Check the speed - Check the presence of 24V on the AVR - Check for the presence of an AVR fault (overload, overspeed or overvoltage) <p>If none of the above actions corrected the problem, reset the AVR by shutting down the machine and turning off the 24V supply to the AVR for 20 seconds. Restart the system and check if the problem is fixed.</p> <p>If the problem is still present:</p> <ul style="list-style-type: none"> - Check the fuses - Check the wiring (see section 2.3) - Measure the exciter winding, exciter armature, revolving field coil, stator resistances and check the insulation - Check diodes and surge suppressor <p>If no cause of the failure is detected, contact us.</p>

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• Checking the winding

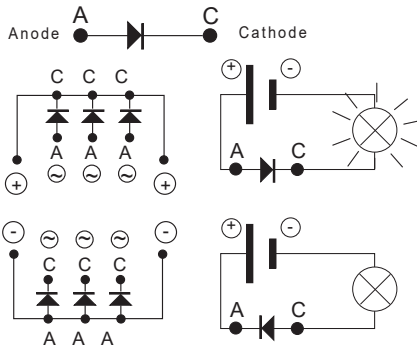
You can check the winding insulation by performing a high voltage test. In this case, you must disconnect all AVR wires.

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

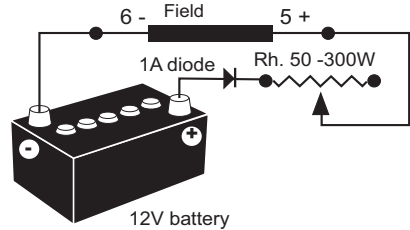


During this procedure, make sure that the alternator is disconnected from any external load and inspect the terminal box to check that the connections are fully tightened.

- 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



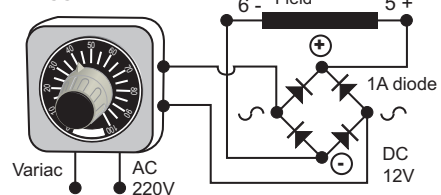
Assembly B: Connect a "Variac" variable power supply and a diode bridge on both exciter field wires (5+) and (6-).

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).

ASSEMBLY B



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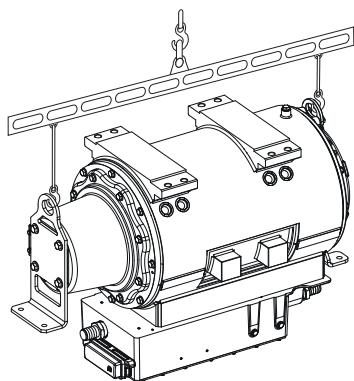
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4.7 - Dismantling, reassembly

WARNING

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 (rotor not locked when moved). Check how much the machine weighs before choosing the lifting method.



• Tools required

To fully dismantle the machine, we recommend using at least the tools listed below:

- 1 ratchet spanner + extension
- 1 torque wrench
- 1 set of flat spanners: 7, 8, 10, 12 mm
- 1 socket set: 8, 10, 13, 16, 18, 21, 22, 24 mm
- 1 Allen key: size 5 (eg. Facom: ET5), size 6 (ET6), size 10 (ET10), size 14 (ET14)
- 1 socket TORX bit T20 and T30
- 1 puller (U35)/(U32/350)

• Screw tightening torque

See section 5.4.

• Draining the cooling circuit

- Leave the machine stationary for 6 hours before draining the cooling circuit (operating temperature 85°C).

- The cooling circuit must be drained using a fluid recovery system.



Toxic risk

The coolant can contain up to 50% glycol-type antifreeze, which represents a risk to health.

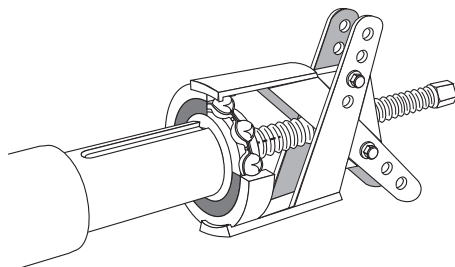
• Access to diodes

- Place the machine vertically.
- Remove the coupling bell (31).
- Remove the washer (8).
- Remove the DE bracket (30) screws.
- Fix an M16 shackle on the shaft.
- Remove the rotor assembly (4).
- The diodes (110) are now accessible.

• Replacing the NDE bearing

Dismantling

- Remove the NDE bracket (36) screws.
- To remove the NDE bracket (36), use 2 M6 screws in the threaded hole provided.
- Remove the NDE bearing (70) using a screw puller.



Reassembly

- Heat the inner slipping of a new bearing by induction or in a drying oven at 110°C (do not use an oil bath) and fit it to the machine.
- Place the preloading wavy washer (79) in the NDE bracket (36).

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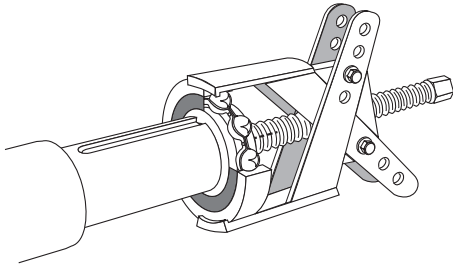
WARNING

When dismantling the brackets, you will need to change the antifriction bearings and the preloading (wavy) washer.

• Replacing the DE bearing

Dismantling

- Remove the Rotex coupling (16) with a puller.
- Remove the gamma seal (7) that needs to be replaced.
- Remove the inner bearing retainer (68) screws.
- Remove the DE bracket (30) screws.
- To remove the DE bracket (30), use 2 M6 screws in the threaded hole provided.
- Remove the DE bearing (60) using a screw puller.



Reassembly

- Heat the inner slipping of a new bearing by induction or in a drying oven at 110°C (do not use an oil bath) and fit it to the machine.

• Accessing the revolving field coil and stator

Dismantling

- Follow the procedure for accessing the diodes.

Reassembling the revolving field coil

- Follow the dismantling procedure in reverse order.
- Take care not to knock the windings when refitting the rotor in the stator.
- Use Dowsil™ 7093 silicone to seal.

4.8 - Table of characteristics

Table of average values:

Alternator - 2 pole - 50 Hz - Standard winding
No. 6S (4-wire)

The voltage and current values are given for no-load operation and operation at rated load with separate field excitation.

All values are given to within $\pm 10\%$ and may be changed without prior notification (for exact values, consult the test report).

• Three-phase: 2 pole Shunt excitation Resistances at 20 °C (Ω)

Type	Stator L/N	Rotor	Exciter field	Exciter armature
L7	0.0465	0.661	4.23	0.160

Field excitation current i_{exc} (A) 400V - 50 Hz

" i_{exc} ": excitation current of the exciter field

Type	No load	At rated load
L7	0.49	2.4

• Table of weights

(maximum values given for information only)

Type	Total weight (kg)	Rotor (kg)
L7	365	90



After operational testing, it is essential to replace all access panels or covers.

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5 - SPARE PARTS

5.1 - First maintenance parts

Here is the list of parts:

Two-bearing kit	5324582
Drive end bearing 40062343	
Non drive end bearing 40062340	
Preloading (wavy) washer	
Relay card kit	40062351
Complete crescents equipped with diodes	4061237
Diodes: 3 direct + 3 reverse	
Surge suppressor	4691056
AVR D550	5157122

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.lrsom.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 - Accessories

• Temperature sensors with thermistors (PTC)

These are thermistor triplets with a positive temperature coefficient installed in the stator winding (1 per phase). There are 2 triplets in the winding (at 2 levels: warning and trip).

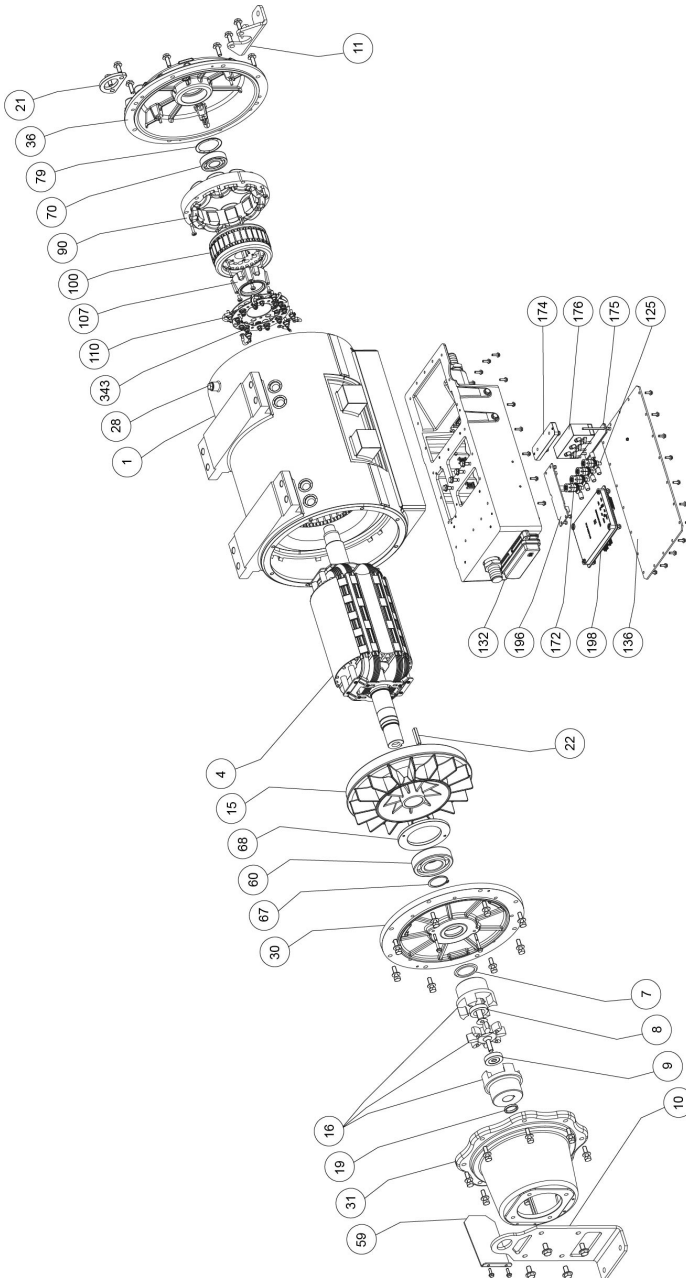
These sensors must be linked to adapted sensing relays (supplied optionally).

Cold resistance of cold thermistor sensors: 100 to 250 Ω per sensor.

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5.4 - Exploded view, parts list and tightening torque



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Ref.	Qty	Description	Screw Ø	Torque N.m	Ref.	Qty	Description	Screw Ø	Torque N.m
1	1	Stator assembly	-	-	67	1	Circlips	-	-
4	1	Rotor assembly	-	-	68	1	Inner bearing retainer	M6	8
7	1	Gamma seal	-	-	70	1	Non drive end (NDE) bearing	-	-
8	1	Washer	M16	170	79	1	Preloading (wavy) washer	-	-
9	1	Washer	M12	69	90	1	Exciter field (stator)	M6	8
10	1	DE lifting support	M12	69	100	1	Exciter armature (rotor)	-	-
11	1	Handling support	M10	40	107	1	Diode bridge support	M5	5
15	1	Fan	-	-	110	6	Diode	1/4"	4
16	1	Rotex coupling	-	-	125	4	Connection terminal	M8	10
19	1	Spacer	-	-	132	1	Terminal box body	M5	5
21	1	Lifting eye	M10	40	136	1	Terminal box cover	M5	5
22	1	Shaft extension key	-	-	172	4	Isolator	M8	20
28	1	Earth terminal	M10	20	174	1	Support	M6	8
30	1	Drive end (DE) bracket	M10	40	175	1	Cover	M5	5
31	1	Coupling bell	M10	40	176	1	Current transformer	-	-
36	1	Non drive end (NDE) bracket	M10	40	196	1	Auxiliary circuit board	M5	5
59	1	Inspection door	M6	8	198	1	Voltage regulator (AVR)	M6	8
60	1	Drive end (DE) bearing	-	-	343	3	Diode bridge	M6	8

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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 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 coolant, oil and grease from the lubrication system should be treated as hazardous waste and must be treated in accordance with local legislation.

Our alternators have a specified lifetime of 20 years. After this period, the operation of the product should be stopped, regardless of its condition. Any further operation after this period will be under the sole responsibility of the user.

Service & Support

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

EMEA: +33 238 609 908

Asia Pacific: +65 6250 8488

China: +86 591 8837 3010

India: +91 806 726 4867



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 service.epg@leroy-somer.com

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