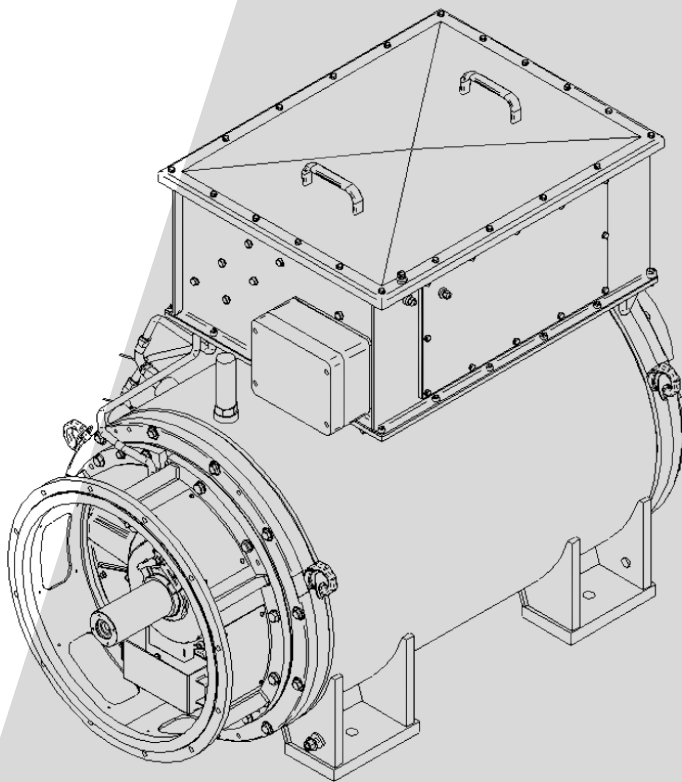




Power



LSPM

Low Voltage Permanent Magnet
Water Jacket Cooled Alternator - 8 poles

Installation and maintenance

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Low Voltage Permanent Magnet Water Jacket Cooled Alternator - 8 poles

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 experienced, qualified and authorized personnel.

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.



Warning symbol for magnetic field danger to people with pacemaker devices.



Warning symbol for strong magnetic field that could cause harm to a person or property.

SAFETY INSTRUCTIONS

Sets of self-adhesive stickers depicting the various warning symbols are included with this maintenance manual. They should be positioned as shown 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 with declared compliant with EC Directives and any other directives that may be applicable.

Particular attention should be paid to equipotential bonding ground or earthing connections.

WARNING

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

- AC voltage disconnected and no residual voltage present
- Careful examination of the causes of the stoppage (jammed transmission - loss of phase - cut-out due to thermal protection - lack of lubrication, etc.)
- Accordingly, before carrying out any work, check carefully that the alternator is not rotating.

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When dismantling the permanent magnet alternator only:



Even when not supplied with power, there is voltage at the terminals of a rotating magnet-alternator.



The alternator rotor contains a magnetic field. If the rotor is separated from the alternator, its field can affect pacemakers or disturb digital devices such as watches, mobile phones, etc.

It must not be assembled or maintained by people with pacemakers or any other implanted medical electronic device.

No magnetized dust must be present in the working environment, which must be kept clean.

WARNING

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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1 - INTRODUCTION

1.1 - LSPM electrical machine

The Leroy-Somer™ LSPM electrical machine has been designed to offer you the best power generation performances. With its meticulous design and optimized architecture, the LSPM strikes the perfect balance between compactness, reliability, performance and longevity.

Whatever your application, the Leroy-Somer™ LSPM electrical machine will meet your needs and will adapt to all situations.

1.2 - Standards and safety measures

The Leroy-Somer™ LSPM electrical machine meets all key international standards and regulations such as IEC 60034, NEMA MG 1.32-33 and ISO 8528-3. EC, UKCA and CMIM declarations and certifications are available for the LSPM.

The standards IEC 61000-6-2, IEC 61000-6-3, IEC 61000-6-4, VDE 0875G, VDE 0875N and EN 55011 allow compliance with group 1 class A for the European zone.

The Leroy-Somer™ LSPM electrical machine is designed, manufactured and marketed in an ISO 9001 and ISO 14001 quality assurance environment.

LSPM can be provided with a marine certificate. Nidec Power can work with most marine certification bodies. See the EC Declaration of Incorporation for your specific marine certification bodies.

1.3 - Inspection

On receipt of your alternator, check that it has not suffered any damage in transit.

If there are obvious signs of shocks, contact the transporter (you may be able to claim on their insurance).

1.4 - Identification

The alternator is identified by means of a nameplate fixed on the machine.

Make sure that the nameplate on the machine conforms to your specific order.

1.5 - Storage

1.5.1 - Machine storage condition

Prior to commissioning, machines should be stored:

- Away from humidity: at relative humidity levels above 90%, the machine insulation can drop very quickly and become virtually non-existent at around 100%.

The state of the anti-rust protection on unpainted parts should be monitored. After a long period of storage, check the machine insulation (see chapters 3.2.1 and 4.6).

For prolonged storage longer than 3 months, place the machine in a sealed waterproof covering (for example heat-shrunk plastic) containing sachets of desiccant corresponding to the volume and relative humidity of the location:

- Away from frequent significant variations in temperature to avoid the risk of condensation. During storage the drain plugs must be removed to allow condensation water to escape (located at the lowest point depending on the operating position).

This location must be dry and protected from harsh weather conditions, cold (temperature between -40°C and +80°C), free from vibration, dust and corrosive gases.

- If the surrounding area vibrates, try to reduce the effect of these vibrations by placing the alternator on a damping support (rubber plate or similar).

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Rotate the rotor a fraction of a turn once a fortnight to prevent the bearing rings from becoming marked.

- Do not remove the rotor locking device (if there are roller bearings).

Even if the alternator has been stored in the correct conditions, certain checks must be carried out before it is started up:

1.5.2 - Bearing storage

Non-regreasable bearings

Maximum storage: 3 years. After this time, replace the bearings.

Regreasable bearings

Storage period	
Less than 1 year	Alternator can be commissioned without regreasing
More than 1 year, less than 2 years	Regrease before commissioning as described in chapter 4.3
More than 2 years, less than 5 years	Dismantle the bearing: - Clean it - Replace the grease completely
More than 5 years	Change the bearing - Regrease it completely

Only use greases used and approved by Nidec Power: see chapter 4.3 for details.

1.6 - Applications

This alternator is mainly designed to produce electrical power for propulsion, traction, pumps, diesel driven machine and variable speed generators (Marine application).

1.7 - 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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2 - TECHNICAL CHARACTERISTICS

2.1 - Electric characteristics

- Class H insulation
- Stator design to be connected to power electric converter
- Insulation system compliant up to IVIC Class C (IEC60034-18-41)
- 3 phase system
- Voltage range: up to 690V

2.2 - Electrical options

- Space heater
- Stator winding temperature sensor (PT100)
- DE/NDE bearing temperature sensors (PT100)
- Water jacket temperature inlet/outlet sensors (PT100)
- Leakage detector
- Speed encoder

2.2.1 - Space heater

Moisture or water accumulating inside the alternator can cause corrosion or lead to machine failure. This typically occurs in high-humidity environments, such as marine settings, especially when the machine is not under operation.

To prevent moisture or water from forming inside the alternator, activate the anti-condensation heater(s) present on the NDE side of the machine when the machine is in standstill.

WARNING

Do not operate the alternator when a space heater is in use.

2.2.2 - Temperature sensor

Stator winding temperature sensors:

Temperature sensors are located in the zone assumed to be the hottest part of the machine. The sensors are connected to the terminal box.

Depending on the temperature rise of the machine, the temperature of the sensors should not exceed a maximum of:

Temp. rise class	Alarm		Trip	
	< 5000	> 5000	< 5000	> 5000
Power (kVA)				
B	130 °C	125 °C	135 °C	130 °C
F	155 °C	150 °C	160 °C	155 °C
H	175 °C	170 °C	180 °C	175 °C

To improve the machine protection, we recommend setting the alarm point following effective site conditions:

Alarm temperature (*) = Highest recorded temp + 10°K

Trip temperature () = Alarm temperature + 5°K**

(*) Highest recorded temp.: Temperature measured at site in worst temperature condition at the stator temperature sensor

(**) Do not exceed values present in the above table.

Bearings temperature sensors:

As an option, the bearing may be equipped with RTD or PTC sensors to detect eventual overheating. For special use in warm surroundings where the temperature of the bearings exceeds the authorized limit (for a bearing known to be in good condition), contact us.

Bearing; Alarm points and shutdown:

- Alarm: 90°C (194°F)
- Shutdown: 95°C (203°F)

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To improve the machine protection, we recommend setting the alarm point following effective site conditions:

Alarm temperature (*) = Highest recorded temp + 15°K

E.g.: At site the common bearing temperature is 60°C. Set the alarm temperature to 75°C instead of 90°C as indicated in the previous paragraph.

Water jacket temperature inlet and outlet sensors:

A temperature sensor may be installed into the water inlet and outlet flow of the water jacket.

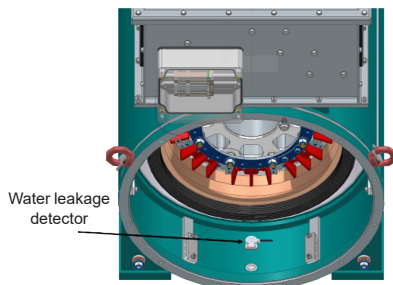
Proposal of adjustment of the water inlet sensor:

Alarm temperature (*) = Water site temp. max + 5 °K

Trip temperature (*) = Alarm temperature + 5 °K

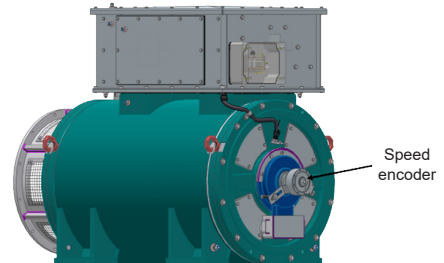
2.2.3 - Leakage detector

A leakage detector is installed at the bottom inside the machine frame in order to detect potential leakage of water jacket fluid or condensation which can alter the alternator condition (see picture below).



2.2.4 - Speed encoder

The speed encoder mounted at the non-drive end side of the machine (see picture below).



It provides high-precision measurement of the permanent magnet alternator's rotational speed, delivering critical feedback for system monitoring, protective functions, and performance control.

For any further technical details regarding the speed encoder, please contact Nidec Power after-sales service team.

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2.3 - Electrical diagram

The phase-sequence is carried out using the IEC 34-8 standard. An arrow located on the stator indicates the direction of rotation.

A specific marking plate indicates the specific generator phase sequence.

Clockwise rotation viewed from the shaft drive end	Counterclockwise rotation viewed from the shaft drive end
The phases are marked: U1, V1, W1	The phases are marked: U1, V1, W1
Viewed when facing the terminal box door the terminals are: U1, V1, W1	Viewed when facing the terminal box door the terminals are: U1, V1, W1
The installer connects: L1 --> U1 L2 --> V1 L3 --> W1	The installer connects: L3 --> U1 L2 --> V1 L1 --> W1

2.4 - Mechanical characteristics

- Steel frame
- Cast iron flanges and end shields
- Insulated regreasable ball bearings on DE/ NDE side
- Shaft end: cylindrical shaft
 - Optional cylindrical shaft end with key according to DIN748-3 (key is included)
- Mounting arrangement: SAE flange and standard cylindrical shaft extension
- Shaft grounding system
- Rotation direction: bidirectional
- Degree of protection: IP 54

2.5 - Cooling circuit characteristics

- Nominal altitude (IEC 60034): <1000m
- Cooling method: IC71W: water jacket cooled machine
- Cooling liquid: clean fresh water with

appropriate corrosive inhibitor and antifreeze additive (Ethylene glycol (Gly< santin G48 recommended))

- Minimum cooling liquid temperature: -10°C
- Maximum cooling liquid temperature: 65°C
- Minimum ambient temperature: -10°C
- Maximum ambient temperature: 50°C
- Maximum level of additives: 50%
- Operating pressure: 4 bar (8 bar maximum)
- pH of fresh water: 7<pH<8

2.5.1 - Cooling fluid safety

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



SGH07



SGH08



SIMDUT D2A



NFPA 704

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Risks:

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

Precautions:

- **P260:** Do not breathe fumes/mist/vapors
- **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.

2.5.2 - Water jacket

The alternator is equipped with cooling system IC71W, a steel water jacket filled with liquid construction directly in contact with the stator to efficiently dissipate the machine heat.

Water jacket has inlet and outlet connection bores for water-glycol mixture to pass through (example: size G3/4") in which temperature sensors are embedded.

WARNING

Water-cooled jacket should only be used with a closed freshwater circuit with the appropriate amount of glycol (check chapter 2.5).

Only use appropriate and high-quality fittings and seals when connecting the alternator to the cooling system.

Check the connections for any possible leaks after connection.

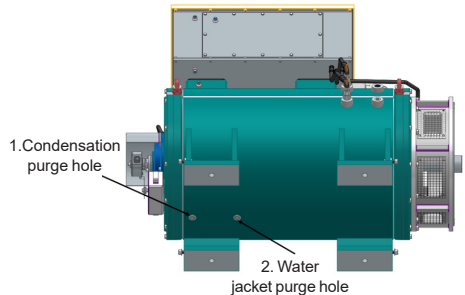
Draining the cooling circuit:

- Leave the machine stationary for 6 hours before draining the cooling circuit (operating temperature 70°C).
- The cooling circuit must be drained using a fluid recovery system.

WARNING

At the first start-up or after an extended shutdown, allow the machine to be purged through the 2 purge holes: the

first one for condensation inside the machine and second one to purge the water jacket fluid.



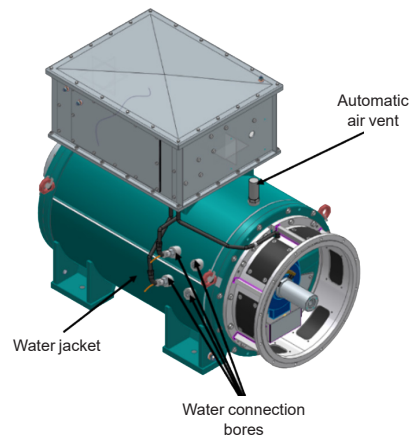
Toxic risk. The coolant can contain up to 50% glycol-type antifreeze, which represents a risk to health.

2.5.3 - Automatic air vent

Mounted directly on top of the carcass water jacket, right next to the terminal box is the automatic air vent or breather pipe.

Its goal is to remove air from hydronic heating and cooling systems.

It is mounted on a G1/2" M bore and can withstand freshwater-glycol mix up to 50%.




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3 - INSTALLATION

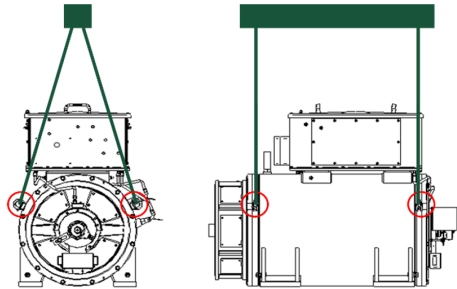
Personnel undertaking the various operations indicated in this section must wear personal protective equipment appropriate for mechanical and electrical hazards.

3.1 - Machine assembly installation

 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.

3.1.1 - Machine lifting

The four lifting eyes are for handling the alternator only. They must not be used to lift the genset. Choice of lifting hooks should be determined by the shape of the lifting eyes. Choose a lifting system (beam, hooks) which respects the integrity of the machine, please lift as shown in the picture below.



3.1.2 - Fitting the coupling (double-bearing machine only)

The coupling must be balanced separately before assembly on the machine shaft. The complete rotor has been balanced according to ISO8221 standard in order to obtain a residual imbalance less than what is specified for gen set assemblies: Class G2.5.

The shaft end is cold stamped to indicate the type of balancing (as per ISO8221):

- H: balancing with Half-key carried out as standard
- F: balancing with Full key (done on request)
- N: balancing without key (done on request)

The balancing is carried out in two planes:

- The first is on the Drive-End side
- The second is at the Non-Drive End side

The coupling must be balanced to fit the generator rotor balancing.

The shrinking of the half coupling onto the electrical machine shaft end must be chosen, by the gen-set manufacturer, in such way as it should be removable for maintenance. Before coupling, check the compatibility between the alternator and the engine. Check that there is lateral play on the crankshaft.

- For 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. For shaft with key slot, the alternator has been balanced with a 1/2 key.

WARNING

Make sure the machine is securely bedded in position during coupling.

3.1.3 - Machine alignment

The alignment aims to obtain the driving shaft and the driven shaft coaxial when operating at the nominal conditions (machine rotating, at its operating temperature). The machine must be aligned according to the Nidec Power standard and adhere to the manufacturer's alignment standard for the drive machine. When heating the machine has its shaft line which grow up. Between stop and rotation, the shaft axis location inside its bearing is different.

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The total axis height elevation is composed of the thermal elevation and of the bearing elevation.



The alignment must be done taking in consideration of the shaft thermal growth correction.

The correct locating of the parts must be obtained by inserting shims under the machine feet.

The double-bearing machines are mounted with bearings. The anti friction-bearing machines with a positioning bearing (standard machine) do not have axial play. The machines are delivered with the rotor mechanically centered (axially and radially) in relation to the stator.

3.1.4 - Location

The location where the alternator is placed and mounted must be ventilated to ensure that the ambient temperature cannot exceed the data on the nameplate. This can lead to machine overheating which can damage the alternator isolation or lifespan.

3.2 - Checks prior to first use

3.2.1 - Electrical checks and dielectric tests

Disconnect the three phases at the generator terminals.

WARNING

All accessories must be disconnected. Refer to the electrical schematics to identify the accessories to disconnect.

The measurements must be taken between one phase and neutral. The reading is taken after 1 minute of test.

	Test voltage (VDC)	Criteria (MΩ ; 40°C)
Stator: U ≤ 1 kV	500	5
Heating element (space heater)	500	5
Temperature sensors (PT100)	500	5

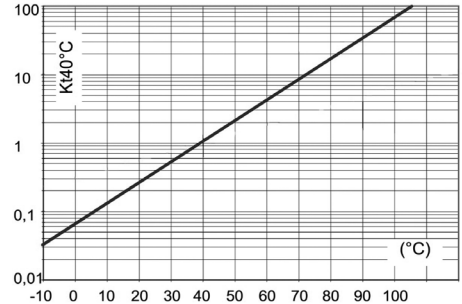
IEEE 43 recommendations

If the insulation resistance is not measured with a tested element at 40°C, a corrective factor must be used.

$$R_m 40^\circ\text{C} = R_t \times K_{t40}$$

R_t --> Measured insulation resistance

K_{t40} --> Corrective factor



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.

3.2.2 - Mechanical checks

Before starting the machine for the first time, check that:

- The machine is connected properly to the cooling circuit using connectors attached to the inlet/outlet bores (ex: G3/4").
- There is water in the cooling circuit before starting the machine.
- The length and tightening torque of the added bolts are correct, and that there are no leaks on the water inlet and outlet connections.
- The length and tightening torque of the added bolts are correct.
- Protective grids and housings are correctly in place.
- The standard direction of rotation is clockwise as seen from the drive end (phase rotation in order 1 - 2 - 3).

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- For anticlockwise rotation, swap 2 and 3. - the winding connection corresponds to the site operating voltage (see chapter 2.3).

3.3 - Terminal connection diagram

The winding code is specified on the nameplate.



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

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

For specific electrical diagram, refer the S4 diagram corresponding to your machine serial number.

3.3.1 - Connection checks




Electrical installations must comply with current legislation enforced 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.

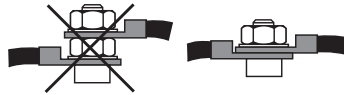
- There is no short-circuit phase-phase or phase-neutral between the alternator output terminals and the generator set control cabinet (part of the circuit not protected by circuit breakers or relays in the cabinet).

- The machine should be connected to 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 (check pictures below).



Diameter	M6	M8	M10	M12
Torque	4 Nm	10 Nm	20 Nm	35 Nm
Tolerance	± 15%			

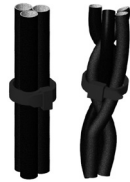
Important points for all reconnection operations:

- Use polyamide plastic clamps 105°C minimum, 550N minimum

- Group the cables: three maximum

- Do not cross cables if possible

- Leave enough space to allow cooling



3.4 - Machine 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 (check the nameplate). With the regreasable bearing option, we recommend greasing the bearings at the time of commissioning (see chapter 4.3).

When machine is under operation in load, it should achieve its rated speed and voltage; however, in the event of abnormal operation, machine settings can be altered (follow the adjustment procedure in chapter 3.5). If the machine still operates incorrectly, the cause of the malfunction must be located (see chapter 4.6).

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3.5 - Setting up

3.5.1 - Accessories

- Counterflange for engine coupling:

A bolted counterflange is installed on the drive-end side of the machine, on the drive end shield. It provides a rigid and reliable interface for mechanical coupling while ensuring correct shaft alignment and effective torque transmission. Depending on the client interface requirements, the counterflange may be manufactured according to SAE standards or designed as a specific custom interface.

- Speed encoder:

Perform a run-out check to verify the condition of the speed encoder's inner bore and ensure its correct and safe mounting on the machine shaft. After installation, confirm that the encoder rotates without abnormal vibration or eccentricity when mounted on the machine shaft.

- Leakage detector:

Leakage detector is connected to DC power supply, please use a regulated power supply for leakage sensor connection.

Please check if the function of the sensor is normal after installment. Under normal conditions, the switch output remains ON, and the LED lights up green. When a leak is detected, the switch output turns OFF, and the LED changes to red.

- Temperature sensors (PT100):

Inside this alternator are temperature sensors placed at different positions: stator winding, bearings and water jacket inlet and outlet bores.

Tests should be performed to verify the correct operation of the temperature sensors. Both a temperature response check and an electrical resistance measurement should be carried out.

A temperature response test is performed by gradually heating the sensor and confirming that its resistance or output

signal changes smoothly according to the expected temperature curve.

As for the resistance test, a measuring device must be connected across the two sensor leads; the expected resistance value should be approximately 100 Ω . A measured value of zero, or no measurable value at all, indicates a potential failure of the temperature sensor.

- Space heater:

Depending on the heating element type (heating cable, finned tubular heater, etc.), a resistance test should be performed check the good condition of the heater. Connect a measurement device between the 2 heater terminals.

The measured resistance value should be around 1 k Ω . Measuring no value, or zero value, indicates a possible failure in the heater element.



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

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4 - SERVICING - MAINTENANCE

4.1 - Safety measures

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



All such operations performed on the alternators 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.



Even when not supplied with power, there is voltage at the terminals of a rotating magnet-alternator.



Warning symbol for magnetic field danger to people with pacemaker devices.

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

4.2.1 - Checks after start-up

After approximately 48 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 - 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.

- 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.

4.2.3 - Mechanical servicing

WARNING

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.

- 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 chapters 3.2 and 4.6).

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Low Voltage Permanent Magnet Water Jacket Cooled Alternator - 8 poles

4.3 - Bearings

4.3.1 - Bearings characteristics

Insulated regreased bearings	- Bearings life (depending on use): 50,000 hours or 5 years (grease life)		
	- Grease: “ Mobil Polyrex EM Grade NLGI 2 ” or equivalent:		
	- Viscosity at 40°C = 115 mm ² /s		
	- Viscosity at 100°C = 12.2mm ² /s		
	- Amount of grease:		
	Machine type	Amount of grease DE/NDE	Lubrication interval
	LSPM 48	37g	>1000hrs (exact lubrication interval are project specific)
	LSPM 49	41g	
	LSPM 50	51g	

4.3.2 - Wear checking

Carry out a visual check of the wear condition of all bearing parts. The following graph provides information on the parts that must be replaced in case of wear. The right evaluation of the wear condition, especially the running surfaces of the bearing inner shell, implies a lot of experience. If in doubt, replace the worn part with new ones.

Part	Wear condition	Maintenance proceedings
Shell	Scoring	Bearing temperature before inspection: - not increased: no new shells - increased: new shells
	White metal lining damaged	New shell
	Bow wave ridges	New shells

4.4 - Cooling circuit

Composition	Fresh water, anticorrosion oxygen inhibitor, glycol-type antifreeze up to 50%
Maintenance	- Coolant change interval: 16,000 hours or 2 years maximum (the first of two who is reached) - pH of fresh water: 7<pH<8

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4.5 - Mechanical defects

Fault		Action/Cause
Bearing	Excessive overheating of one or both bearings (bearing temperature 105°C above the ambient temperature)	<ul style="list-style-type: none"> - 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 45° C above the ambient temperature)	<ul style="list-style-type: none"> - Alternator operating at too high a voltage (> 105% of Un on load) - Alternator overloaded
Vibrations	Too much vibration	<ul style="list-style-type: none"> - Misalignment (coupling) - Defective mounting or play in coupling - Rotor balancing fault (Engine - Alternator)
	Excessive vibration and humming noise coming from the machine	<ul style="list-style-type: none"> - Phase imbalance - Stator short-circuit
Abnormal noise	Alternator damaged by a significant impact, followed by humming and vibration	<ul style="list-style-type: none"> - System short-circuit - Misparalleling Possible consequences: <ul style="list-style-type: none"> - Broken or damaged coupling - Broken or bent shaft end - Shifting and short-circuit of main field

4.6 - Electrical faults

Fault	Effect	Possible cause	Action/Remedy
No voltage at no load on start-up	Still no voltage on star-up	<ul style="list-style-type: none"> - Winding is in short-circuit - Permanent magnets are demagnetized 	Check stator connection
Voltage too low	Correct speed	<ul style="list-style-type: none"> - Field windings short-circuited - Permanent magnets are demagnetized 	Check the drive speed
	Speed too low	Increase the drive speed	
Voltage too high	Adjustment ineffective	Stator winding connections is not correctly set	Check the stator connection / electrical coupling
Voltage correct at no load and too low when on load	-	-	Run at no load and check the converter regulation
Voltage disappears during operation	-	-	Check the stator connections

4.6.1 - Checking the winding

You can check the winding insulation by performing a high voltage test. In this case, you must disconnect the stator phases (open circuit).

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4.7 - Dismantling, reassembly of machine parts

WARNING

Dismantling of the whole machine must be performed by a qualified and authorized Nidec Power technician. Because of the strong magnetic pull, full dismantling of the machine (rotor extraction, stator re-winding, magnet extraction, etc.) must be done while disconnected from the engine and 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.



Even when not supplied with power, there is voltage at the terminals of a rotating magnet-alternator.



Dismantling must be performed by a qualified technician. Individuals with pacemakers must not be near the machine during this process. Due to the strong magnetic pull of the permanent-magnet rotor, handling metallic/magnetic objects near the rotor should be minimized and carried out from as great a distance as possible to ensure safe dismantling.

4.7.1 - Tools required

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

- 1 ratchet spanner + extension
- 1 torque wrenching key set
- 1 set of flat spanners: 6, 7, 8, 10, 12 mm
- 1 socket set: 6, 8, 10, 12, 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) / (U310)
- SKF lock nut spanner
- Clean cleaning cloth

4.7.2 - Screw tightening torque in steel tapping

If no torque value is specified into the concerned chapter, the following values can be used for fixation of parts metal onto metal.

Bolt: Steel / Steel (with medium strength thread locker)			
Ø nominal (mm)	Torque (N.m)	Ø nominal (mm)	Torque (N.m)
3	1.0	18	222
4	2.3	20	313
5	4.6	22	430
6	7.9	24	540
8	19.2	27	798
10	37.7	30	1083
12	64.9	33	1467
14	103	36	1890
16	160		

4.7.3 - Plug tightening torque

If no torque value is specified into the concerned chapter, the following values can be used for plugs tightening.

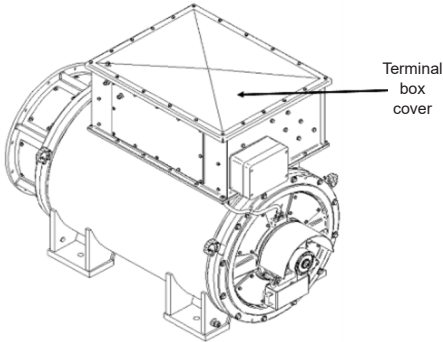
Steel and copper alloy Plugs (medium strength thread locker)			
Ø nominal (inches)	Torque (N.m)	Ø nominal (inches)	Torque (N.m)
G3/8	30	G1 ¼	160
G1/2	40	G1 ½	230
G3/4	60	G2	320
G1	110	G2 ½	500

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4.7.4 - Access to connections

Access to the terminal box connection is obtained directly after removing terminal box cover (see picture below). Inside are connection bars for voltage reconnection.



WARNING

For a more detailed view of the terminal box connections, check terminal box drawing for your specific machine.

4.7.5 - NDE bearing replacement

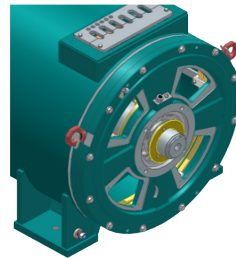
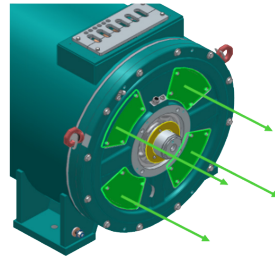


Dismantling must be performed by a qualified technician. Individuals with pacemakers must not be near the machine during this process.

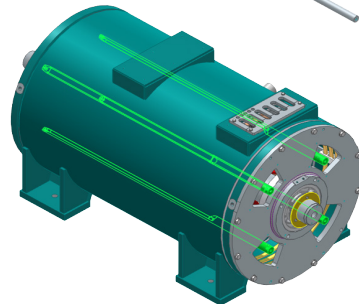
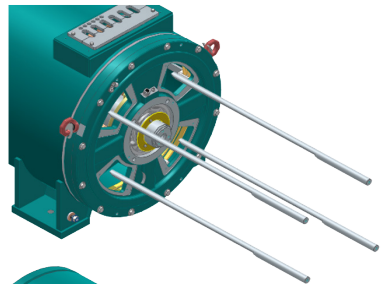
Due to the strong magnetic pull of the permanent-magnet rotor, handling metallic/magnetic objects near the rotor should be minimized and carried out from as great a distance as possible to ensure safe dismantling.

1. Remove incremental encoder assembly (encoder, shaft extension and protection), fixed by CHC and HM screws.
2. Remove grease trap from the NDE end shield (held by 2 magnets).
3. Remove outer bearing cage fixed by CHC screws.

4. Unscrew each of the 4 end shield traps by removing HM screws (see pictures below).



5. Insert interpole/airgap tooling through each of the four traps to support rotor inside stator during dismantling (see pictures below).



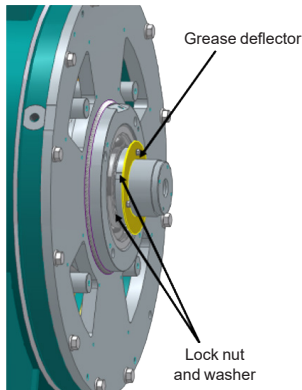
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6. Unscrew inner bearing cage fixed by CHC screws and push it away from the bearing, towards the polar wheel to free the NDE end shield.

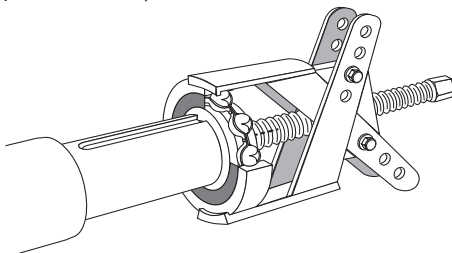
7. Remove the grease deflector from lock nut connected with HM screws.

8. Remove lock nut and lock washer with appropriate tools (see picture below).



9. Remove the NDE end shield by unscrewing HM screws and lifting with crane (minimum 50kg) and be careful to the 4 interpole tooling while dismantling the end shield.

10. Remove the NDE bearing using a bearing puller: Eg. U.32-350 - 310 (see picture below).



11. Remove the preload washer by sliding it on the shaft.

4.7.6 - NDE bearing reassembly



Reassembly must be performed by a qualified technician. Individuals with pacemakers must not be near the machine during this process.

Due to the strong magnetic pull of the permanent-magnet rotor, handling metallic/magnetic objects near the rotor should be minimized and carried out from as great a distance as possible to ensure safe reassembly.

1. Heat the inner slipping of a new bearing in a drying oven at 80°C (do not use an oil bath).

2. Place the new preload wavy washer on the shaft, next to the inner bearing cage.

3. Press fit the heated insulated bearing in place on the shaft, to compress the preload washer.

4. To facilitate inner bearing cage mounting, screw two threaded rods into inner bearing cage holes to ensure proper positioning on shaft.

5. Mount the NDE end shield on the bearing with a crane (≈50kg) and screw it in the carcass with HM screws, be careful of the 2 threaded rods keeping the inner bearing cage in place and the four interpole tooling still present at this stage.

6. Screw the two hollow holes of the inner bearing cage first and then unscrew the two threaded rods and put the two other screws in place to finish inner cage assembly.

7. Place the lock washer and lock nut to block the inner ring of the bearing.

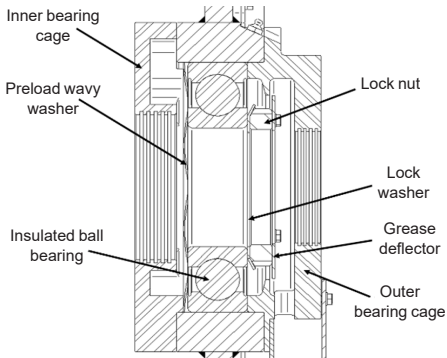
8. Place a new grease deflector on the lock nut and screw it in place with HM screws.

9. Mount the outer bearing cage on the end shield and screw it back up with CHC screws.

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10. Mount the speed encoder assembly back onto the shaft with HM and CHC screws (encoder, shaft extension and protection).



When dismantling the NDE end shield, you will need to change the antifriction bearings, the preloading (wavy) washer, the lock nut and lock washer.

4.7.7 - DE bearing replacement



Dismantling must be performed by a qualified technician. Individuals with pacemakers must not be near the machine during this process.

Due to the strong magnetic pull of the permanent-magnet rotor, handling metallic/magnetic objects near the rotor should be minimized and carried out from as great a distance as possible to ensure safe dismantling.

1. Remove the couplings from the DE side of the machine (end shaft coupling and SAE flange coupling and translate the machine further away from the engine to ensure enough space for dismantling).
2. Unscrew HM screws and remove the counter flange connected to the DE end shield by crane (minimum 30kg).
3. Remove grease trap from the NDE end shield (held by 2 magnets).

4. Remove and unscrew the 2 grounding brushes for the shaft from the outer bearing cage.

5. Remove outer bearing cage fixed by CHC screws.

6. Unscrew each of the 4 end shield traps by removing HM screws (check NDE bearing dismantling step 4).

7. Insert interpolate tooling through each of the four traps to support rotor inside stator during dismantling (check NDE bearing dismantling step 5).

8. Remove the grease deflector from lock nut connected with HM screws.

9. Remove lock nut & lock washer with appropriate tools (check NDE bearing dismantling step 8).

10. Remove the DE end shield by unscrewing HM screws and lifting with crane (minimum 50kg) and be careful to the 4 interpolate tooling while dismantling the end shield.

11. Remove the NDE bearing using a bearing puller: eg. U.32 - 350 - 310 (check NDE bearing dismantling step 10).

4.7.8 - DE bearing reassembly



Reassembly must be performed by a qualified technician. Individuals with pacemakers must not be near the machine during this process.

Due to the strong magnetic pull of the permanent-magnet rotor, handling metallic/magnetic objects near the rotor should be minimized and carried out from as great a distance as possible to ensure safe reassembly.

1. Heat the inner slipping of a new bearing in a drying oven at 80°C (do not use an oil bath).
2. Press fit the heated insulated ball bearing in place on the shaft.

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3. To facilitate inner bearing cage mounting, screw two threaded rods into inner bearing cage holes to ensure proper positioning on shaft.

4. Mount the DE end shield on the bearing with a crane ($\approx 50\text{kg}$) and screw it in the carcass with HM screws, be careful of the 2 threaded rods keeping the inner bearing cage in place and the four interpole tooling still present at this stage.

5. Screw the two hollow holes of the inner bearing cage first and then unscrew the two threaded rods and put the two other screws in place to finish inner cage assembly.

6. Place the lock washer and lock nut to block the inner ring of the bearing.

7. Place a new grease deflector on the lock nut and screw it in place with HM screws.

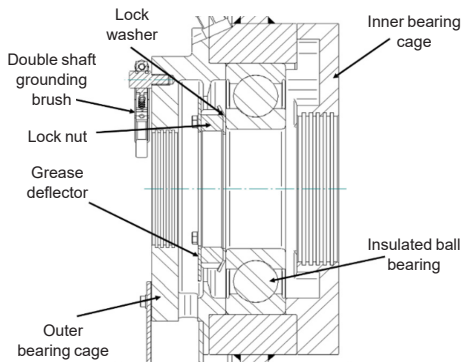
8. Mount the outer bearing cage on the end shield and screw it back up with CHC screws.

9. Screw the double shaft grounding brushed on the outer bearing cage.

10. Mount the counter flange on the DE end shield and screw it down with HM screws.

11. Replace the grease trap on the bottom of the DE end shield.

When dismantling the DE end shield, you will need to change the antifriction bearings, the lock nut and lock washer.



LSPM**Low Voltage Permanent Magnet Water Jacket Cooled Alternator - 8 poles****4.8 - Alternator start up checklist (TO BE PRINTED AND FILLED OUT)**

TYPE SERIAL N°

Voltage V Frequency Hz Speed rpm

Output Power kVA Power Factor

STATIC CHECKS**Mechanical checks:**

- Direction of Rotation (refer to chapter 2.4) **Clockwise** or **Anti-clockwise**
- Mechanical Fixing of the generator (refer to chapter 4.2) _____
- Coupling - Alignment to the engine (refer to chapter 3.3) _____
- Cooling: Coolant flow (refer to chapter 2.5) _____
- Water jacket connections (inlet/outlet) (refer to chapter 3.2.2) _____
- **Bearing lubrication:**
 - Anti-friction Bearings Greasing (refer to chapter 4.3.1) _____
 - Temperature sensors (correct readings) (refer to chapter 2.2.2) _____
 - Space Heaters _____

Electrical connections between alternator and main panel:

- Output power cables connections following phase order (refer to chapter 2.1) _____
- Terminal box connections _____
- Supply power _____
- Command signals (equalization and sync) _____
- Protective devices: (Bearing grease level detectors; Temperature sensors, etc.) _____
- External accessories (e.g. remote potentiometer) _____

Windings insulation

	Winding temp:..... °C	Voltage	1 minute (MΩ)	10 minutes (MΩ)	Polarisation index
Static parts	3 Phases / Ground				
	"U" / Ground				
	"V" / Ground				
	"W" / Ground				
	"U" / "V"				
	"U" / "W"				

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All works must be performed by a qualified and authorized technician. Individuals with pacemakers must not be near the machine during this process. Due to the strong magnetic pull of the permanent-magnet rotor, handling metallic/magnetic objects near the rotor should be minimized and carried out from as great a distance as possible to ensure safe reassembly.

ROTATING CHECKS

AT NO LOAD CONDITIONS

- Verification of the bearing temperature (refer to chapter 2.2.2) °C
- Voltage check vs Speed
- **FAULTY SYNCHRONISING CAN BE ORIGIN OF DAMAGES (HIGH MECHANICAL OVER-TORQUE)**
- Maximum acceptable values for synchronization to the mains:
- Maximum frequency shift 0.1 Hz
- Maximum Phase offset 10°
- Maximum voltage (P.N.) difference 5% of Un

AT LOAD CONDITIONS

Take the load gradually from 0 to 100% in steps of 25%

Record for each step:

- Electrical output (KW)
- POWER FACTOR
- Voltage (V)
- Current (A)
- Winding temperature (PT100)

Time	KW	pf	Volts	I (A)	U1 (°C)	V1 (°C)	W1 (°C)

- Bearings temperature

Time	DE Radial (°C)	NDE Radial (°C)

- Water inlet/outlet temperature (PT100)
- Bearing greasing checked
- Bearings vibrations (mm/s)

DE-V	DE-H	DE-A	NDE-V	NDE-H	NDE-A

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5 - SPARE PARTS

5.1 - First maintenance parts

Here is the list of parts:

Two-bearing kit

- Drive end & non drive end insulated regreasable bearing (same Ref)
- 1 Preloading (wavy) washer: D190
- 1 Lock nut & 1 lock washer
- 1 Grease deflector



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

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.

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6 - 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 minimize 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.

6.1 - 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.

6.2 - Waste and 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.
- Permanent magnets (NdFeB) embedded in the alternator rotor.
- Major plastic and fiberglass 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 use.

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The contractual EC Declaration of compliance and incorporation can be obtained from your contact on request.

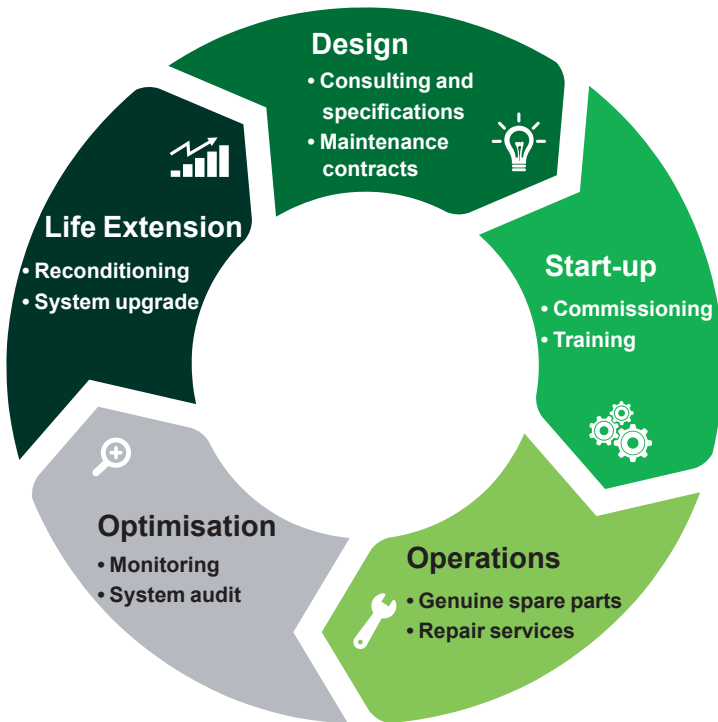
Service & Support

Our worldwide service network of over 80 facilities is at your service. Our local presence is your 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 alternators operations, providing the best value service to optimize your cost of ownership.

How can we 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

 service.epg@leroy-somer.com



Scan the code or go to:
www.lrsn.co/support



www.nidecpower.com

Connect with us at:

