

Low Voltage Alternators - 4 pole

P.M.G. RANGE

Installation and maintenance

Leroy-Somer™


EMERSON™

P.M.G. RANGE

Low Voltage Alternators - 4 pole

**This manual concerns the PMG 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 the potential risk of accidents. It is vital that you understand and take notice of the different warning symbols used.

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 SYMBOLS

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

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

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

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

WARNING

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

This manual is 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).

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Disposal and recycling instructions



All servicing or repair operations carried out on the PMG and the alternator should be undertaken by personnel trained in the commissioning, servicing and maintenance of electrical and mechanical components; they must wear personal protective equipment appropriate for mechanical and electrical hazards.

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1 - GENERAL INFORMATION

Description

The PMG (Permanent Magnet Generator) is a system which is used to supply the short-circuit current to the alternator.

The PMG produces an AC current proportional to the speed, used as field excitation power by the AVR.

The PMG assembly forms a rotating part which can be fitted at the rear of the alternator as required.

Operating temperature:

- 20°C to + 70°C

Storage temperature:

- 55°C to + 85°C

Identification

There are 8 types of PMG suitable for the LSA range of alternators.

PMG 0 for LSA 42.3

PMG 2 for LSA 46.2 / 46.3 / 47.2

PMG 3 for LSA 49.1

PMG 4 for LSA 51.2 / 53 / 54

PMG 5 for LSA 50.2

PMG 6 for LSA 52.3

PMG 7 for LSA 44.3

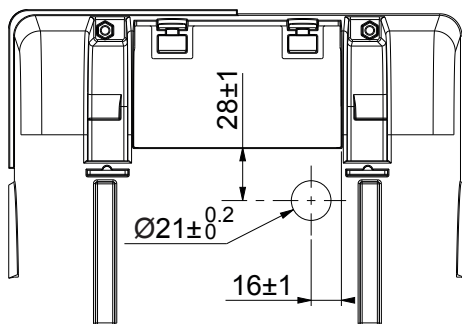
PMG 8 for LSA 49.3

The PMG 0, 2, 3, 4, 5, 6, 7 and 8 kits consist of a housing (A), a dummy shaft extension (B), a PMG rotor (C), a PMG stator (D), a cover plate (E), a spacer housing (F) (PMG 8 only) and a bag of accessories for mounting and electrical connection.

CAUTION

If mounting a PMG 0 on a SHUNT LSA 42.3 alternator, choose a «PMG 0 + R438» kit.

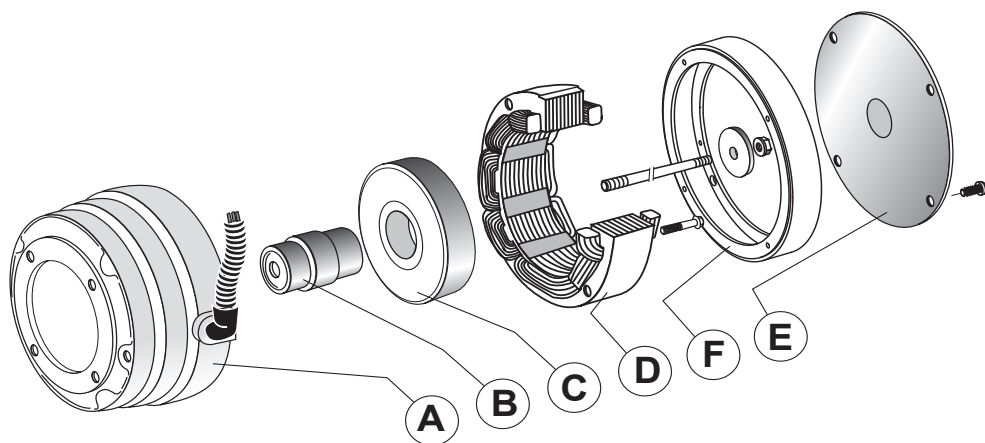
If the voltage is higher than 480 V respect drilling according to the drawing below.



If mounting a PMG 2 on a SHUNT LSA 46.2 or LSA 47.2 alternator, choose a «PMG 2 + R450» kit and on a SHUNT LSA 46.3 alternator, choose a «PMG 2 + R450M» kit.

If mounting a PMG 7 on a SHUNT LSA 44.3 alternator, choose a «PMG 7 + R438» kit.

The «Regreaseable bearing» + «PMG» options are not compatible on LSA 44.3 (PMG 7).



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2 - OPERATION

PMG excitation system

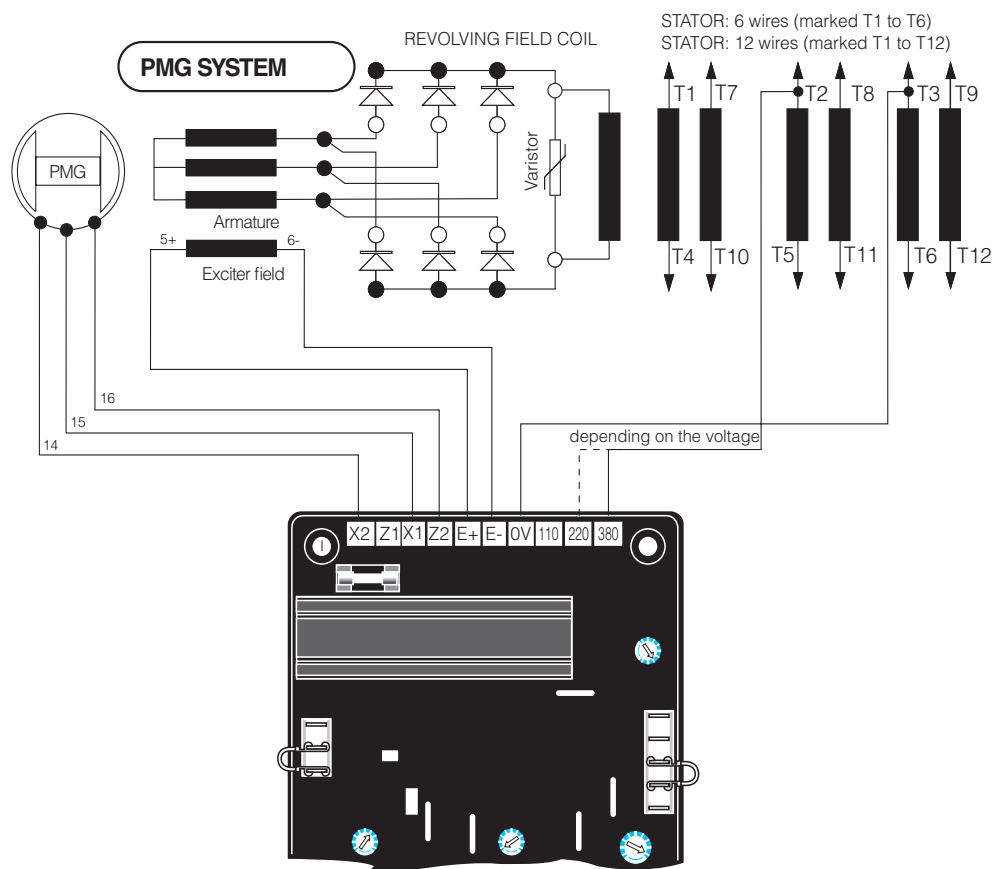
With PMG excitation, the permanent magnet generator (PMG) added to the alternator supplies the AVR with voltage which is independent of the main alternator winding. It is fitted at the rear of the machine and connected to the AVR (the ST9 jumper must be disconnected).

As a result the machine has a short-circuit current capacity of 3 IN for 10 s.

The AVR monitors and corrects the alternator output voltage by adjusting the excitation current.

CAUTION

The PMG only works with R438, R450, R449 or D510C (incompatible with the R220 and the R250).



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3 - TECHNICAL CHARACTERISTICS

Electrical characteristics

Type	PMG 0
Stator phase/phase resistance at 20°C	0.77 ohms
No-load voltage at 1500 min ⁻¹	85 V
No-load voltage at 1800 min ⁻¹	105 V

Type	PMG 2
Stator phase/phase resistance at 20°C	2.1 ohms
No-load voltage at 1500 min ⁻¹	125 V
No-load voltage at 1800 min ⁻¹	150 V

Type	PMG 3
Stator phase/phase resistance at 20°C	2.1 ohms
No-load voltage at 1500 min ⁻¹	125 V
No-load voltage at 1800 min ⁻¹	150 V

Type	PMG 4
Stator phase/phase resistance at 20°C	1.4 ohms
No-load voltage at 1500 min ⁻¹	204 V
No-load voltage at 1800 min ⁻¹	245 V

Type	PMG 5
Stator phase/phase resistance at 20°C	0.87 ohms
No-load voltage at 1500 min ⁻¹	130 V
No-load voltage at 1800 min ⁻¹	156 V

Type	PMG 6
Stator phase/phase resistance at 20°C	1.4 ohms
No-load voltage at 1500 min ⁻¹	204 V
No-load voltage at 1800 min ⁻¹	245 V

Type	PMG 7
Stator phase/phase resistance at 20°C	0.77 ohms
No-load voltage at 1500 min ⁻¹	73 V
No-load voltage at 1800 min ⁻¹	88 V

Type	PMG 8
Stator phase/phase resistance at 20°C	0.72 ohms
No-load voltage at 1500 min ⁻¹	146 V
No-load voltage at 1800 min ⁻¹	175 V

CAUTION

The «Regreasable bearing» and «PMG» options are not compatible on LSA 44.3 (PMG 7).

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4 - INSTALLATION - COMMISSIONING



Before working on the alternator, ensure that it cannot be started by a manual or automatic system by isolating the power (disconnection of all electrical, mechanical power, etc) in any cabinets and that you have understood the system operating principles.

Mounting the PMG 0, 2, 3 and 7

CAUTION

Make sure the bevel washers are fitted the right way round.

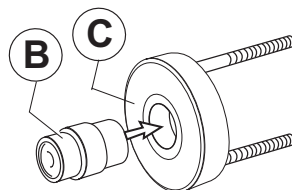


- Remove the alternator NDE shield seal.
- Mount the PMG housing assembly [A] on the shield, take care to position the cable through-holes at 9 o'clock as seen from the non-drive end, and tighten the 4 HM6 screws to a torque of 8.3 Nm (PMG 0, self-tapping screws tightened to 10 Nm).
- Put a coating of anti-vibration adhesive on the tie rod and screw it tight on the alternator shaft extension.
- Mount the magnetised rotor [C] on the shaft adapter [B].



WARNING: magnetic force (risk of pinching).

- Using 2 M10 threaded rods screwed into the rotor, slide the assembly onto the tie rod.



- Once the rotor is in position, remove the M10 tie rods.
- Mount the cable gland washer.
- Lock the assembly with the M10 nut (PMG 0, 7) to a torque of 30 Nm or the M16 nut (PMG 2 and 3) to a torque of 116 Nm.
- Pierce the cover (Ø 21 hole) or remove the plastic plug on the NDE panel.
- Fit the plastic sheath and its two ferrules, while inserting the 3 PMG wires.
- Close the PMG with the cover [E].

Electrical connection of a PMG on a Shunt machine.

CAUTION

If mounting a PMG 0, the R220 must be replaced by R438.

If mounting a PMG 2, the R250 must be replaced by R450.

If mounting a PMG 7, the R250 must be replaced by R438.

- Disconnect the connection wires from the R220 or R250 and remove the AVR.
- Take out both the voltage reference wires, marked 2 and 3, by removing them from the terminals (T8 and T11) in which they are inserted.
- Use these same wires for voltage sensing on the R450/R438 by inserting them in terminals T2 (wire 2) and T3 (wire 3).
- Fit the AVR support plate fitted with the R450/R438 (2 HM6 screws tightened to 10 Nm / PMG 0, 4M5 self-tapping screws tightened to 6 Nm).
- In the terminal box, stick the self-adhesive bases on the NDE shield and on the terminal block to bring the PMG wires into the AVR.
- Next, attach the sheath with the PMG wires to the self-adhesive bases using plastic clamps.

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- Make a bridge around the shield spigot to avoid the sheath quickly becoming damaged and the risk of a short-circuit.
- Connect the 3 PMG wires (14/15/16), the 2 exciter field wires (5/6) and the 2 previously mentioned voltage sensing wires (2/3) according to the internal connection diagram in the alternator maintenance manual.
- Modify the connection by replacing the single jumper on the connector located on the terminal box rear panel with 2 jumpers (except PMG 0).

CAUTION

With PMG excitation, check that the ST9 jumper on the AVR is open.
After operational testing, replace all access panels or covers.

Electrical connection of a PMG on an AREP machine

- In the terminal box, stick the self-adhesive bases on the NDE shield and on the terminal block to bring the PMG wires into the AVR.
- Next, attach the sheath with the PMG wires to the self-adhesive bases using plastic clamps.
- Make a bridge around the shield spigot to avoid the sheath quickly becoming damaged and the risk of a short-circuit.
- Connect the 3 PMG wires (14/15/16), to terminals X1, X2, Z2 on the AVR. The 4 auxiliary winding wires X1.X2.Z1.Z2 should be isolated using the domino fitting supplied with the kit. Both the field wires (5/6) and the voltage sensing wires (2/3) remain in place.

CAUTION

When using a PMG as an AREP alternator, a modification of the instability adjustment (regulator stab potentiometer) may be necessary.

Check that the ST9 jumper on the AVR is open.

After operational testing, replace all access panels or covers.

Mounting the PMG 4

CAUTION

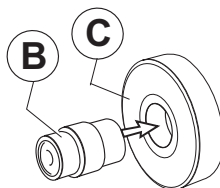
For initial assembly, provide the mounting flange and the spacer (see spare parts).
Make sure the bevel washers are fitted the right way round.



- Remove the air intake grille from the alternator NDE shield.
- Put a coating of anti-vibration adhesive on the tie rod and screw it tight on the alternator shaft extension.
- Mount the magnetised rotor [C] on the shaft adapter [B].



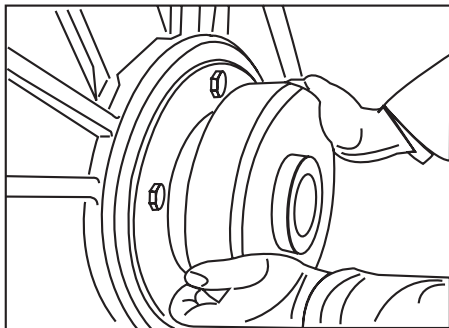
WARNING: magnetic force (risk of pinching).



- Position the assembly on the alternator NDE shaft extension.
- Mount the cable gland washer.
- Lock the assembly with the M20 nut (torque of 254 Nm).
- Mount the stator in the PMG housing and tighten the HM 6 screws to a torque of 8 Nm.
- Fit the PMG stator assembly on the alternator NDE shield.
- Tighten the five HM 10 stator assembly screws to a torque of 20 Nm.
- Finally, fit the air intake grille.

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Electrical connection

- In the terminal box, stick the self-adhesive bases on the NDE shield and on the terminal block to bring the PMG wires into the AVR.
- Next, attach the sheath with the PMG wires to the self-adhesive bases using plastic clamps.
- Make a bridge around the shield spigot to avoid the sheath quickly becoming damaged and the risk of a short-circuit.
- Connect the 3 PMG wires (14/15/16), to terminals X1, X2, Z2 on the AVR. The 4 auxiliary winding wires X1.X2.Z1.Z2 should be isolated using the domino fitting supplied with the kit. Both the field wires (5/6) and the voltage sensing wires (2/3) remain in place.

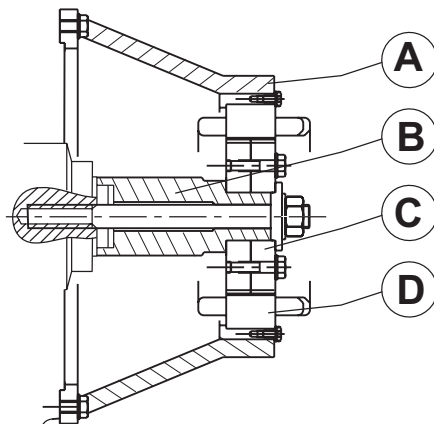
CAUTION

When using a PMG as an AREP alternator, a modification of the instability adjustment (regulator stab potentiometer) may be necessary.

Check that the ST9 jumper on the AVR is open.

After operational testing, replace all access panels or covers.

Sectional diagram of the PMG 4



Mounting the PMG 5

CAUTION

Make sure the bevel washers are fitted the right way round.



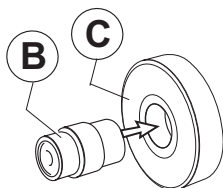
- Remove the alternator NDE shield seal.
- Mount the magnetised rotor [C] on the shaft adapter [B].



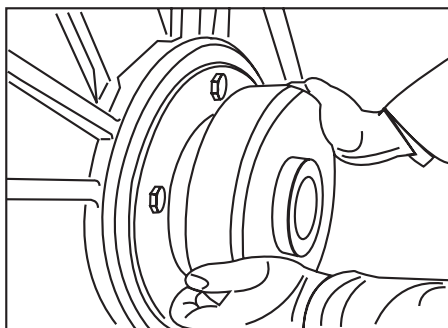
WARNING: magnetic force (risk of pinching).

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- Position the assembly on the alternator NDE shaft extension.



- Position the large cable gland washer on the two rotor pins.
- Tighten the M16 screw with its serrated washer to a torque of 170 Nm.
- Screw two 200 mm long M6 threaded rods into the alternator NDE shield on the opposite side.
- Slide and position the PMG housing assembly [A] on the NDE shield spigot, turning the cable exit hole to 9 o'clock as seen from the alternator non-drive end.
- Slide the PMG stator onto the threaded rods, taking care to orient the flying leads opposite the hole in the housing.



WARNING: magnetic force (risk of pinching).

- Once the stator has been brought close and correctly oriented, screw two M6x90 screws with the bevel washers and unscrew the M6 tie rods, then finish mounting with the other two M6x90 screws.
- Tighten the four M6 screws in a cross to a torque of 8.3 Nm, taking care to bring the stator close first.
- Remove the plastic plug on the NDE panel.
- Fit the plastic sheath and its two ferrules while inserting the 3 PMG wires.
- Close the PMG with the cover [E].

Electrical connection

- In the terminal box, stick the self-adhesive bases on the NDE shield and on the terminal block to bring the PMG wires into the AVR.
- Next, attach the sheath with the PMG wires to the self-adhesive bases using plastic clamps.
- Make a bridge around the shield spigot to avoid the sheath quickly becoming damaged and the risk of a short-circuit.
- Connect the 3 PMG wires (14/15/16), to terminals X1, X2, Z2 on the AVR. The 4 auxiliary winding wires X1.X2.Z1.Z2 should be isolated using the domino fitting supplied with the kit. Both the field wires (5/6) and the voltage sensing wires (2/3) remain in place.

CAUTION

When using a PMG as an AREP alternator, a modification of the instability adjustment (regulator stab potentiometer) may be necessary.

Check that the ST9 jumper on the AVR is open.

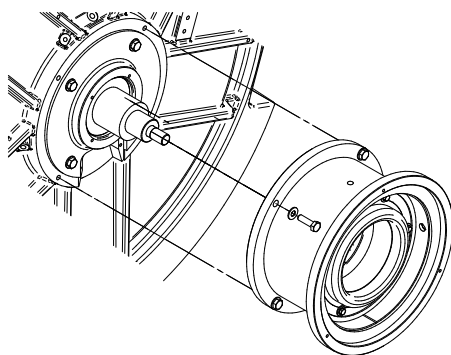
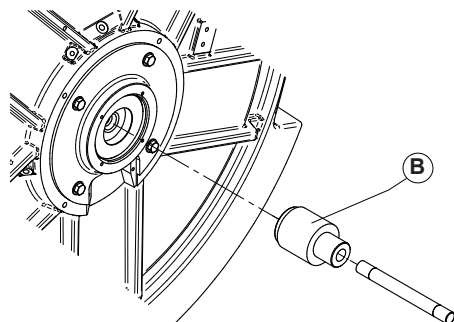
After operational testing, replace all access panels or covers.

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4.4 - Mounting the PMG 6

- Remove the protection cover plate on the NDE shield seal.
- Mount the shaft adapter [B] onto the alternator shaft with the tie rod and anti-vibration adhesive.

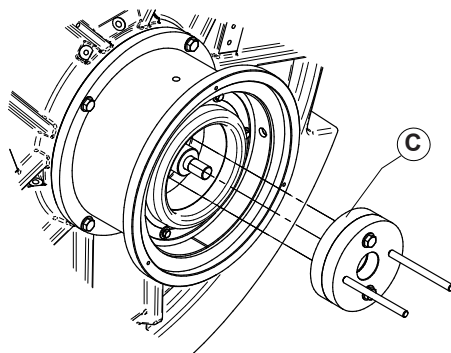
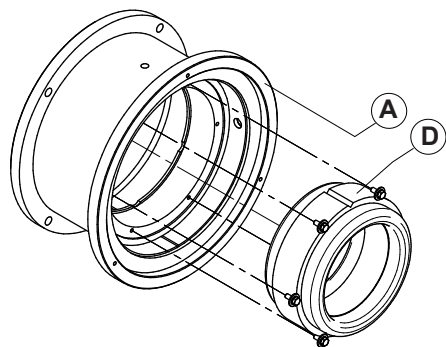


- Screw the 2 tie rods onto the PMG rotor [C] to facilitate assembly.



WARNING: magnetic force (risk of pinching).

- Heat the PMG housing [A] at 100°C.
- Slide the PMG stator [D] into the housing while protecting the stator output wires, and lock with the screws.



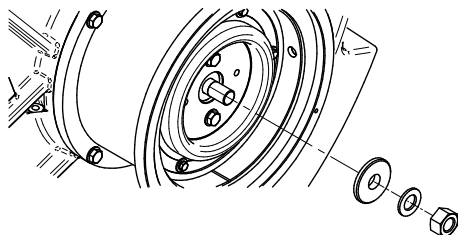
- Mount the PMG stator assembly onto the alternator NDE shield seal.

- Insert the PMG rotor [C] onto the shaft adapter [B] and finish the assembly by fitting the centring washer.

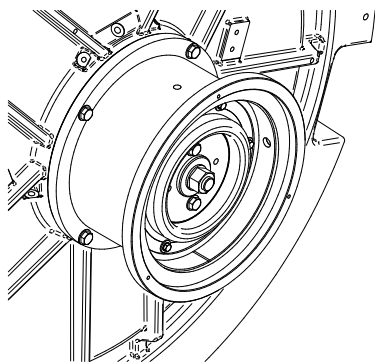
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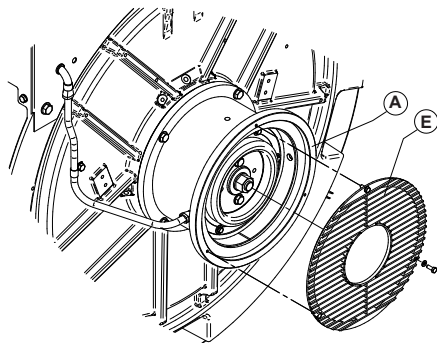
- Screw the nut and washer onto the tie rod to lock the PMG rotor assembly onto the alternator's shaft.



CAUTION, inspect the assembly: prevent any contact between the magnetised stator and rotor.



Mounting on auxiliaries side



- Mount the connectors, sheath and plastic nut, the offset loop flange, nut and screw, and the plastic cap before electrical wiring.

Electrical connection

- In the terminal box, stick the self-adhesive bases on the NDE shield and on the terminal block to bring the PMG wires into the AVR.
- Next, attach the sheath with the PMG wires to the self-adhesive bases using plastic clamps.
- Make a bridge around the shield spigot to avoid the sheath quickly becoming damaged and the risk of a short-circuit.
- Connect the 3 PMG wires (14/15/16), to terminals X1, X2, Z2 on the AVR. The 4 auxiliary winding wires X1.X2.Z1.Z2 should be isolated using the domino fitting supplied with the kit. Both the field wires (5/6) and the voltage sensing wires (2/3) remain in place.
- Finish the assembly with the cover plate [E] onto the PMG housing [A].



When using a PMG as an AREP alternator, a modification of the instability adjustment (regulator stab potentiometer) may be necessary.
Check that the ST9 jumper on the AVR is open.



After operational testing, replace all access panels or covers.

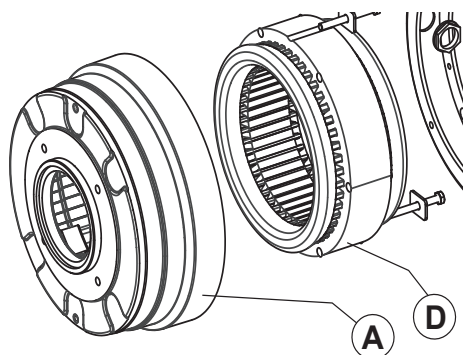
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4.5 - Mounting the PMG 8

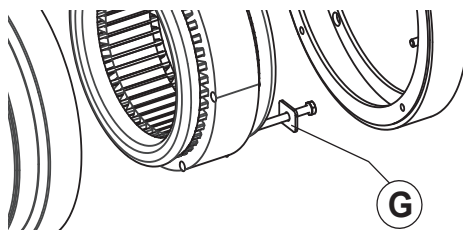
- Remove the protection cover from the rear flange of the alternator (4 hexagonal screws).

- Fit the housing [A] into the rear flange, then fasten it using the 4 M6 hexagonal screws (torque: 8.3 N.m).

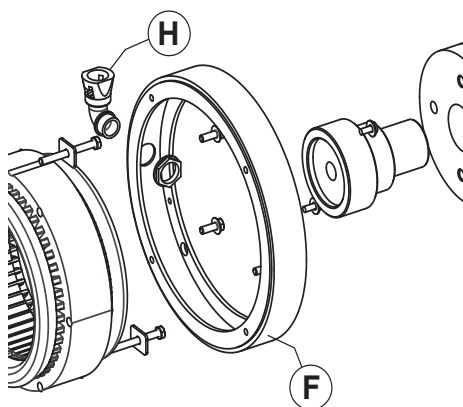


- Slide the PMG stator [D] into the housing [A].

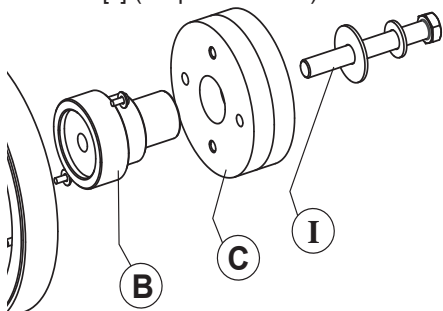
- Fasten the stator using M6 screws + washers [G] (torque: 8.3 N.m).



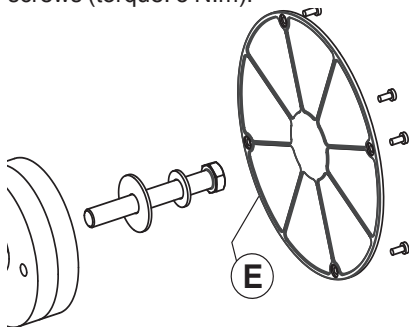
- Position the spacer housing [F] while inserting the stator output wires through the duct [H], then fasten the spacer housing using the 4 M5 screws (torque: 5 N.m).



Position the rotor [C] on the out-of-round on the shaft [B], insert the assembly into the PMG, and then tighten with the screws and washers [I] (torque: 115 N.m).



- Fasten the cover plate [E] using the 4 M5 screws (torque: 5 N.m).



Electrical connection (see § PMG 4)

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5 - SPARE PARTS

Designation

Description	Code
PMG 0	ALT 423 KP 001
PMG 0 + AVR R438	ALT 423 KP 002
PMG 2	ALT 461 KP 001
PMG 2 + AVR R450	4323791
PMG 3	ALT 491 KP 001
PMG 4	ALT 050 KP 001
Mounting flange PMG 4	PUS 050 AD 001
Spacer PMG 4	PMS 050 DI 001
PMG 5	ALT 050 KP 003
PMG 6	4978551
PMG 7	ALT 443 KP 001
PMG 7 + AVR R438	ALT 443 KP 003
PMG 8	5026424

CAUTION

To ensure correct operation and the safety of our machines, we recommend exclusive use of our original manufacturer spare parts.

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

Technical support service

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

When ordering spare parts, you should indicate the AVR type and code number.

Address your enquiry to your usual contact.

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

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Disposal and recycling instructions

We are committed to limit the environmental impact of our activity. We continuously survey our production processes, material sourcing and products design to improve recyclability and diminish our footprint.

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

The oil and grease from the lubrication system should be considered as a hazardous waste and has to be handled according to local legislation.

Recyclable materials

Our alternators are mainly built out of 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 products dismantling upon request.

Waste & hazardous materials

The following components and materials need a special treatment and need to 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 plastic type information.

All materials listed above need special treatment to separate waste from reclaimable material and should be handed to specialized disposal companies.

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Service & Support

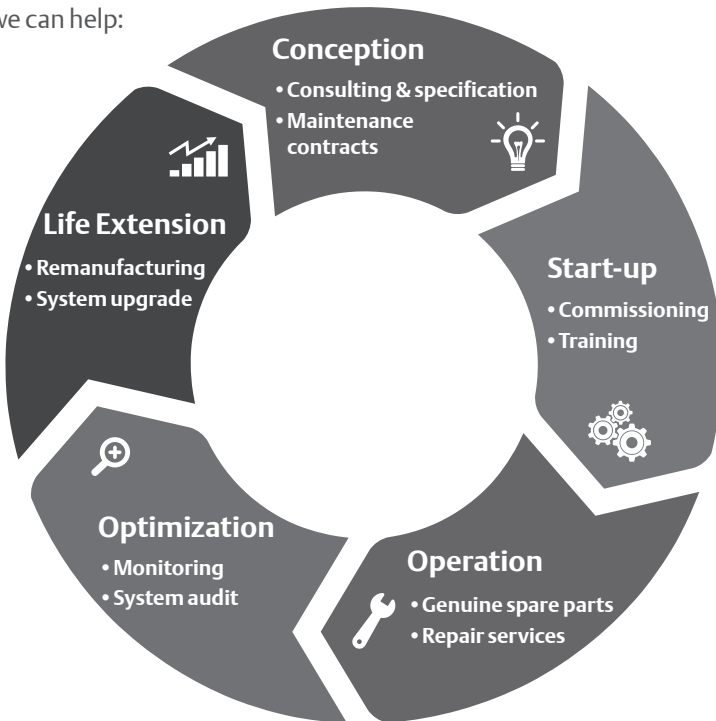
Our worldwide service network of over 80 facilities is at your service.

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 know alternators operation inside out, providing the best value service to optimize your cost of ownership.

Where we can help:



Contact us:

Americas: +1 (507) 625 4011

Europe & International: +33 238 609 908

Asia Pacific: +65 6263 6334

China: +86 591 88373036

India: +91 806 726 4867

✉ service.epg@leroy-somer.com



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