Low Voltage Alternators - 4 pole
Installation and maintenance
This manual concerns the P.M.G. 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.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="warning.png" alt="Symbol" /></td>
<td>Warning symbol for an operation capable of damaging or destroying the machine or surrounding equipment.</td>
</tr>
<tr>
<td><img src="general.png" alt="Symbol" /></td>
<td>Warning symbol for general danger to personnel.</td>
</tr>
<tr>
<td><img src="electrical.png" alt="Symbol" /></td>
<td>Warning symbol for electrical danger to personnel.</td>
</tr>
</tbody>
</table>

### SAFETY INSTRUCTIONS

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 to be given to the end user.

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

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

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

1.1 - 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

1.2 - Identification
There are 8 types of PMG suitable for the LSA and TAL ranges of alternators.

<table>
<thead>
<tr>
<th>Type</th>
<th>PMG</th>
<th>Standard AVR</th>
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<tbody>
<tr>
<td>LSA 42.3</td>
<td>0</td>
<td>R438</td>
</tr>
<tr>
<td>LSA 44.3</td>
<td>7</td>
<td>R438</td>
</tr>
<tr>
<td>LSA 46.2</td>
<td>2</td>
<td>R450</td>
</tr>
<tr>
<td>LSA 46.3</td>
<td>2</td>
<td>R450 M/T</td>
</tr>
<tr>
<td>LSA 47.2</td>
<td>2</td>
<td>R450</td>
</tr>
<tr>
<td>LSA 49.1</td>
<td>3</td>
<td>R450</td>
</tr>
<tr>
<td>LSA 49.3</td>
<td>8</td>
<td>R450 M/T</td>
</tr>
<tr>
<td>LSA 50.2</td>
<td>5</td>
<td>R450</td>
</tr>
<tr>
<td>LSA 51.2</td>
<td>4</td>
<td>R449</td>
</tr>
<tr>
<td>LSA 52.3</td>
<td>8</td>
<td>D510 C</td>
</tr>
<tr>
<td>LSA 53.2</td>
<td>4</td>
<td>D510 C</td>
</tr>
<tr>
<td>LSA 54.2</td>
<td>4</td>
<td>D510 C</td>
</tr>
<tr>
<td>TAL 042</td>
<td>0</td>
<td>R180</td>
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<tr>
<td>TAL 044</td>
<td>7</td>
<td>R180</td>
</tr>
<tr>
<td>TAL 046</td>
<td>9</td>
<td>R180</td>
</tr>
<tr>
<td>TAL 047</td>
<td>2</td>
<td>R180</td>
</tr>
<tr>
<td>TAL 049</td>
<td>8</td>
<td>R180</td>
</tr>
</tbody>
</table>

D510C or D350 digital regulators are compatible with all types of PMG. Other regulators can be associated with our PMGs, consult us.

WARNING

When mounting on an alternator SHUNT LSA 42.3 or TAL 42, if the voltage is higher than 480V respect drilling according to the drawing below.

It is not possible to associate these options: «regreasable bearing + PMG» for LSA 42.3 and LSA 44.3.

The regreasable bearing option is not available for TAL.

The PMG 0, 2, 3, 4, 5, 7, 8 and 9 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.
2 - OPERATION

2.1 - 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 is 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.

**WARNING**

The PMG only works with R180, R438, R449, R450, R450M/T or D510C (incompatible with the R120, R121, R150, R220, R221 and R250 AVRs).
### P.M.G. range
Low Voltage Alternators - 4 pole

#### 3 - TECHNICAL CHARACTERISTICS

#### 3.1 - Electrical characteristics

<table>
<thead>
<tr>
<th>Type</th>
<th>PMG 0</th>
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<th>PMG 7</th>
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<td>Stator phase/phase resistance at 20°C</td>
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<td>0.77 ohms</td>
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<td>No-load voltage at 1500 min⁻¹</td>
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<td>No-load voltage at 1500 min⁻¹</td>
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<td></td>
<td>85 V</td>
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<td>85 V</td>
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<td></td>
<td>No-load voltage at 1800 min⁻¹</td>
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</tr>
<tr>
<td></td>
<td>105 V</td>
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<td>105 V</td>
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<tr>
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<th>PMG 8</th>
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<tr>
<td></td>
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<td></td>
<td>Stator phase/phase resistance at 20°C</td>
</tr>
<tr>
<td></td>
<td>2.1 ohms</td>
<td></td>
<td>0.72 ohms</td>
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<td></td>
<td>No-load voltage at 1500 min⁻¹</td>
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<td></td>
<td>125 V</td>
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<td>146 V</td>
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<tr>
<td></td>
<td>150 V</td>
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<td>175 V</td>
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<th>PMG 9</th>
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<td>No-load voltage at 1500 min⁻¹</td>
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<td>No-load voltage at 1500 min⁻¹</td>
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<td>125 V</td>
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<td>152.5 V</td>
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<td>No-load voltage at 1800 min⁻¹</td>
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<tr>
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<td>150 V</td>
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<td>183 V</td>
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<table>
<thead>
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<th>Type</th>
<th>PMG 4</th>
<th>Type</th>
<th>PMG 5</th>
</tr>
</thead>
<tbody>
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<td>Stator phase/phase resistance at 20°C</td>
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<td>130 V</td>
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<tr>
<td></td>
<td>No-load voltage at 1800 min⁻¹</td>
<td></td>
<td>No-load voltage at 1800 min⁻¹</td>
</tr>
<tr>
<td></td>
<td>245 V</td>
<td></td>
<td>156 V</td>
</tr>
</tbody>
</table>
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.

4.1 - Mounting the PMG 0, 2, 3, 7 and 9

**WARNING** 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].

4.1.1 - Electrical connection of a PMG on a Shunt machine

**WARNING**

If mounting a PMG, replace the following regulators.

**For the LSA range:**
PMG 0: replace R220 by R438
PMG 7: replace R220 by R438
PMG 2: replace R250 by R450 or R450M/T
- 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).

**For the TAL range:**
PMG 0: replace R120 by R180
PMG 7: replace R120 by R180
PMG 2, 8, 9: replace R150 by R180
- Disconnect the connection wires from the R120 or R150 and remove the AVR.
- Take out the 3 voltage and power supply reference wires (yellow / green / blue), by removing them from the terminals (T1, T2 and T5) in which they are inserted.
- Fit the AVR support plate fitted with the R180 (4M5 self-tapping screws tightened to 6 N.m).
- Rewire the 2 red wires on T2 and T3 for the voltage detection then reconnect the wires of excitation and power supply of the PMG, according to the diagram of the alternator maintenance manual.
For the LSA and TAL ranges:
- 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), 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.

**WARNING**

With PMG excitation, check that the ST9 jumper on the AVR is open.

After operational testing, replace all access panels or covers.

4.1.2 - 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), 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.

**WARNING**

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.

4.2 - Mounting the PMG 4

**WARNING**

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.
**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.

**WARNING**
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.

**4.3 - Mounting the PMG**

**WARNING**
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).
- 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.

- 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.

**WARNING**

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.
4.4 - Mounting the PMG 8 for LSA 49.3 or TAL 049

- 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).
4.5 - Mounting the PMG 8 for LSA 52.3
- Remove the protection cover plate on the NDE shield seal.
- Mount the shaft adapter [B] onto the alternator shaft with the tie rod M20 [I] (torque: 313 N.m) and anti-vibration adhesive.

- Heat the PMG housing [A] at 100°C.
- Slide the PMG stator [D] into the housing while protecting the stator output wires, and lock using the 4 M10 screws (torque: 37.7 N.m).

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

WARNING: magnetic force (risk of pinching).

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

- Mount the PMG stator assembly onto the alternator NDE shield seal.
- Screw the nut and washer onto the tie rod to lock the PMG rotor assembly onto the alternator’s shaft.

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

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

**Mounting on auxiliaries side**

- Electical 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.
5 - SPARE PARTS

5.1 - Designation

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<th>Code</th>
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<td>ALT423KP002</td>
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<td>PMG 0 + R180</td>
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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 closest contact, whom you will find at www.lrsm.co/support indicating the type and the code number of the PMG.

WARNING

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.
Disposal and recycling instructions
We are committed to limiting the environmental impact of our activity. We continuously monitor our production processes, material sourcing and product design to improve recyclability and minimise our environmental footprint.

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

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

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

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

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

The oil and grease from the lubrication system should be treated as hazardous waste and must be treated in accordance with local legislation.
<table>
<thead>
<tr>
<th>Electric Power Generation</th>
<th>Installation and maintenance</th>
<th>4211 en - 2018.09 / k</th>
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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.

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  - Maintenance contracts

- **Life Extension**
  - Reconditioning
  - System upgrade

- **Start-up**
  - Commissioning
  - Training

- **Optimisation**
  - Monitoring
  - System audit

- **Operation**
  - Genuine spare parts
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