GW3, GWT3, GW4, GWT4, GWT6-1A
GWT6-2A, GWTA6 ENGINES
OPERATORS' HANDBOOK

ORIGINAL INSTRUCTIONS
Associated Publications

Master Parts Manual P027-08557
Workshop Manual P027-08220
Technical Handbook P027-08315

⚠️ WARNING ⚠
READ AND UNDERSTAND ALL SAFETY PRECAUTIONS AND WARNING MENTIONED IN THIS MANUAL.

⚠️ WARNING ⚠
IMPROPER OPERATION OR MAINTENANCE PROCEDURES COULD RESULT IN SERIOUS ACCIDENT OR DAMAGE TO THE EQUIPMENT CAUSING INJURY OR DEATH.

⚠️ WARNING ⚠
NON-COMPLIANCE WITH THESE INSTRUCTIONS MAY INVALIDATE THE WARRANTY.

⚠️ WARNING ⚠
MAKE CERTAIN THAT THE ENGINE CANNOT BE STARTED IN ANY WAY BEFORE UNDERTAKING ANY MAINTENANCE, PARTICULARLY IN THE CASE OF AUTOMATICALLY STARTING GENERATING SETS.

Statement of Indemnity
The information, specifications, illustrations, instructions and statements contained within this publication are given with our best intentions and are believed to be correct at the time of going to press.
Our policy is one of continued development and we reserve the right to amend any technical information with or without prior notice.
Whilst every effort is made to ensure the accuracy of the particulars contained within this publication, neither the Manufacturer, the Distributor nor the Dealer shall in any circumstances be held liable for any inaccuracy or the consequences thereof. The information given is subject to the Company’s current Conditions of Tender and Sale; is for the assistance of users; and is based upon results obtained from tests carried out at the place of manufacture. This Company does not guarantee that the same results will be obtained elsewhere under different conditions.
Parts that have not been approved by the Lister Petter Power Systems organisation cannot be relied upon for correct material, dimensions or finish. The Company cannot therefore be held responsible for any damage arising from the use of such parts, and the guarantee will be invalidated.

P027-08199 Copyright © Lister Petter Power Systems
CONTENTS

INTRODUCTION .................................................................................................................. 6
   Engine Identification 6
   Engine lifting 7
   Care of your engine 7
   Service literature 7
   Training 7

1. SAFETY INFORMATION AND PRECAUTIONS ................................................. 8
   1.1 Personal Safety 9
   1.2 General Precautions 9
   1.3 Care with Lubricating Oil 11
   1.4 Precautions with Diesel Fuel 11
   1.5 Precautions with Coolant 11
   1.6 Precautions with Batteries 12
       Battery Charge Alternator 12
   1.7 Care with Electrical Systems 13
       Wiring Cables 13
   1.8 Lifting Precautions 13
   1.9 Care with Filters and Elements 14
   1.10 Waste Disposal 14

2. ENGINE PARTS AND TECHNICAL DATA ..................................................... 15
   2.1 Front and Left Side 15
   2.2 Rear and Right Side 15

3. OPERATING INSTRUCTIONS ............................................................................. 17
   3.1 Starting the Engine 17
       3.1.1 Starting a Warm Engine 17
       3.1.2 Starting a Cold Engine without Starting Aids 17
       3.1.3 Starting a Cold Engine with Starting Aids 18
   3.2 Stopping the Engine 18
   3.3 Adjustment of Engine Speed 18
3.4 Running-In  19
3.5 Altitude  19

4. ENGINE FLUIDS .......................................................................................... 20
   4.1 Fuel Specification  20
      4.1.1 Low Temperature Fuels  20
   4.2 Lubricating Oil Specification  21
   4.3 Coolant Specification  22

5. ROUTINE MAINTENANCE .......................................................................... 23
   5.1 Maintenance Schedule  23
   5.2 Draining the Cooling System  24
   5.3 Checking the Drive Belts  25
      5.3.1 Adjusting the Belt Tension  25
   5.4 Cleaning the Fuel Lift Pump  26
   5.5 Checking the Fuel Pre-Filter  27
   5.6 Renewing the Fuel Filter Element  27
      5.6.1 Renewing a Separate Type Fuel Filter Element  27
      5.6.2 Renewing a Canister Type Fuel Filter Element  28
      5.6.3 Renewing a Quick Release Canister Type Fuel Filter Element  28
   5.7 Renewing a Fuel Injector  30
   5.8 Eliminating Air from the Fuel System  31
      5.8.1 Standard Method  31
      5.8.2 Method Using In-Line PB Type Injection Pump  33
   5.9 Changing the Lubricating Oil  34
   5.10 Replacing the Oil Filter Canister  34
   5.11 Cleaning the Breather system  35
   5.12 Servicing the Air Cleaner  36
      5.12.1 Air Filter  37
      5.12.2 Restriction Indicator  38
5.13 Checking Valve Clearances
5.13.1 Three Cylinder Engines
5.13.2 Four Cylinder Engines
5.13.3 Six Cylinder Engines
5.13.4 Valve Positions

6. FAULT DIAGNOSIS
6.1 Problems and Possible Causes
6.2 Code List of Possible Causes

7. ENGINE STORAGE
7.1 Preparing the Engine for Storage
7.2 Returning the Engine to Service

8. MAINTENANCE RECORD
8.1 Routine Maintenance
8.2 Non-Routine Maintenance

9. WARRANTY
9.1 Standard Warranty Cover
9.2 Conditions of Warranty
9.3 Limitations of Warranty
9.4 Repairs under Warranty
9.4.1 Contact Details

APPENDIX: FUEL PUMPS AND GOVERNORS
PB Pump
Adjustment and Use of the PB Pump
Adjustment of Static Fuel Supply
RSV Governor - PB Pump
Rotary Type Fuel Pumps
Electronic Governor
INTRODUCTION

Your Gamma engine should be correctly operated and serviced in accordance with this handbook. To obtain the best performance and the longest life from your engine you must ensure that maintenance operations are carried out at the intervals indicated in 5. Routine Maintenance. For example, it is essential to renew the filter elements and lubricating oil regularly in order to ensure that the engine components remain clean. If the engine operates in a very dusty environment or other adverse conditions some of the maintenance intervals will be shorter. Ensure that all adjustments and repairs are done by properly trained personnel. Your Lister Petter Power Systems distributor can assist in this matter and will also supply the genuine Lister Petter Power Systems parts needed for your engine. To ensure that you use the correct information for your specific engine type, refer to the section below.

ENGINE IDENTIFICATION

In this handbook the different engine types are indicated by code letters. The meanings of these codes are as indicated below:

<table>
<thead>
<tr>
<th>GAMMA MODELS</th>
<th>Model Number</th>
<th>Cylinders</th>
<th>Aspiration</th>
</tr>
</thead>
<tbody>
<tr>
<td>GW3</td>
<td>3</td>
<td>Natural</td>
<td></td>
</tr>
<tr>
<td>GWT3</td>
<td>3</td>
<td>Turbocharged</td>
<td></td>
</tr>
<tr>
<td>GW4</td>
<td>4</td>
<td>Natural</td>
<td></td>
</tr>
<tr>
<td>GWT4</td>
<td>4</td>
<td>Turbocharged</td>
<td></td>
</tr>
<tr>
<td>GWT6-1A</td>
<td>6</td>
<td>Turbocharged</td>
<td></td>
</tr>
<tr>
<td>GWT6-2A</td>
<td>6</td>
<td>Turbocharged</td>
<td></td>
</tr>
<tr>
<td>GWTA6</td>
<td>6</td>
<td>Turbocharged and Intercooled</td>
<td></td>
</tr>
</tbody>
</table>

The engine number is stamped on a label fastened to the left side (1) or rear (2) of the cylinder block (see figure).

Example of the engine numbers are:

09300158GW40015 or 09300021GWT62A18RP

It is identified as follows:

09 ........................... Year code (09 = 2009)
3 ............................. Factory code
00158 ........................ Unique engine number
GW ............................. Engine model (GWT)
4 ....................................... Number of cylinders
00 ..................................... Reserved for 6 cylinder turbocharged variant 1A or 2A
15 ..................................... Engine speed 1500 r/min or
18 ..................................... Engine speed 1800 r/min or
22 ..................................... Engine speed 2200 r/min
RP .................................... Rotary fuel injection pump

This should be quoted when requesting parts, service or information from your Lister Petter Power Systems distributor.

ENGINE LIFTING
In different applications of the engine the maximum dry weight (without coolant or lubricating oil) will vary. The maximum recommended weight of the engines for lifting is as follows:
3-cylinder engines: 420 kg (925 lb)
4-cylinder engines: 500 kg (1100 lb)
6-cylinder engines: 600 kg (1320 lb)
Before lifting the engine, read 1.8 Lifting Precautions.

CARE OF YOUR ENGINE
Your engine must receive the correct routine maintenance as described in section 5. If faults do occur they can usually be diagnosed and corrected using the information in section 6.
In case of queries about your engine or its installation contact your Lister Petter Power Systems distributor. Your distributor can undertake repairs and will ensure that only the correct parts are fitted and the work is done correctly.

SERVICE LITERATURE
Workshop manuals and other service publications are available from your Lister Petter Power Systems distributor.

TRAINING
Local training for the correct operation, service and overhaul of engines is available at certain Lister Petter Power Systems distributors. If special training is necessary, your distributor can advise you how to obtain it.
Carefully read and follow all safety messages in this manual (some items only apply to specific applications). Familiarise yourself with the safety and informative symbols on your equipment. You must also refer to the local regulations in the country of use.

Ensure that you are familiar with the safety symbols used by Lister Petter Power Systems (Figure 1).

Take especial care when handling potentially hazardous chemicals. These include lubricants, fuel, coolant concentrate, battery acid (see section 1.4 Precautions with Batteries), paint and adhesives.

Manufacturers’ safety data sheets will provide specific details of the physical and health hazards, safety and emergency procedures and any necessary personal protection equipment required while working with hazardous materials.

**CAUTION**

*Follow all safety instructions accurately.*

1. **SAFETY INFORMATION AND PRECAUTIONS**

1. **Safety Symbols** This figure identifies the ISO 8999 symbols currently used by Lister Petter Power Systems (Figure 1).

1. **Precautions with Chemicals** Protect yourself from exposure to hazardous chemicals at all times, as this can cause serious injury. Potentially hazardous chemicals include lubricants, fuel, coolant concentrate, battery acid, paint and adhesives.

Manufacturers’ safety data sheets will provide specific details of the physical and health hazards, safety and emergency procedures and any necessary personal protection equipment required while working with hazardous materials.
1.1 PERSONAL SAFETY

- Ensure that you have access to fire extinguishers and have knowledge of emergency procedures.
- Identify a location from which calls to the emergency services can be made if necessary.
- Ensure that someone knows where you are working and is informed when you leave the working area.
- Wear personal protective clothing and safety equipment appropriate to the work being done.
- Ensure that guards are properly fitted.
- Keep your body and clothing clear of all moving or hot parts.

**WARNING**

*Be aware that the fan cannot be seen clearly while the engine is running.*

- Tie long hair close to your head.
- Do not wear loose clothing or jewellery.

**WARNING**

*KEEP CLEAR OF ALL ROTATING PARTS. DO NOT WEAR A NECKTIE, A SCARF, LOOSE CLOTHING OR A NECKLACE WHEN WORKING CLOSE TO A RUNNING ENGINE. ENTANGLEMENT WITH ROTATING PARTS COULD CAUSE SERIOUS INJURY OR DEATH.*

- Remove rings and other jewellery if working on any part of the electrical system, to avoid causing a short circuit.
- Wear ear protection against loud noise.

**WARNING**

*Prolonged exposure to loud noise can cause impairment or loss of hearing.*

- To avoid loss of concentration, do not use music earphones while working.

1.2 GENERAL PRECAUTIONS

Engine operators must be instructed in the correct procedures before attempting to start any engine.

**WARNING**

*It is dangerous to permit an inexperienced person to start any diesel engine.*
• Use these engines only in the type of application for which they have been designed.
• Ensure the engine is securely mounted.
• Ensure that the area around the engine is well ventilated.

**WARNING**

*LACK OF VENTILATION CAN RESULT IN THE BUILD-UP OF TOXIC, AND POTENTIALLY FATAL, EMISSIONS.*

• Only one person must control the engine.
• Other persons must be kept at a safe distance while the engine or equipment is in operation.
• Ensure that the engine is operated only from the control panel or from the operator's position.
• Ensure that the control lever of the transmission drive is in the "out-of-drive' position before the engine is started.
• Fit guards on any accessories that require them (these must be supplied and fitted by the purchaser). Keep all safety guards in position.
• Never attempt to change the specification of the engine as this could affect its safe operation and put the operator at risk.
• Never work under any plant that is only held by overhead lifting equipment.
• Check that the brakes are in good condition before moving mobile equipment.
• While the engine is running never attempt to clean it, add fuel or lubricating oil, or adjust it in any way.
• Keep the engine and surrounding area clean.

**WARNING**

*NEVER ALLOW ANY PART OF THE BODY TO COME INTO CONTACT WITH HIGH PRESSURE FUEL OIL, COMPRESSED AIR OR HYDRAULIC OIL. CONTACT WITH, OR INGESTION OF, THESE SUBSTANCES CAN CAUSE SERIOUS INJURY OR DEATH.*

• Handle fluids with care at all times.
• Rectify any fuel, coolant or oil leak as soon as is practicable and clean up any spillages immediately.
• Remove any build-up of grease, oil or debris.
• Wear gloves or use suitable barrier creams when doing anything that could soil your hands.

**WARNING**

*Diesel fuel and lubricating oil can damage the skin.*
**WARNING**

*Do not expose pressurised containers to heat. Do not incinerate or puncture them.*

- Fit only genuine Lister Petter Power Systems parts.

### 1.3 CARE WITH LUBRICATING OIL

- Wear gloves or barrier cream.
- Clean up any spillages.
- Do not wear clothing that is contaminated by lubricating oil. Do not put material that is contaminated with oil into your pockets.
- To prevent environmental contamination, always discard used lubricating oil strictly in accordance with local regulations. Preferably take to a recycling site.

### 1.4 PRECAUTIONS WITH DIESEL FUEL

- Store fuel and other flammable liquids away from sources of ignition.
- Always switch off the engine before adding fuel.
- Never smoke when you are filling the tank with fuel.
- Do not handle fuel near to heaters or other sources of ignition.
- Do not overfill the fuel tank.
- Clean up any spillages.

**WARNING**

*Material that has been contaminated by diesel must be kept away from all sources of ignition and safely disposed of.*

- Never attempt to adjust the fuel system while the engine is running or still hot.
- If skin comes into contact with high pressure fuel, obtain medical assistance immediately.

**WARNING**

*HIGH PRESSURE FUEL CAN CAUSE SERIOUS INJURY OR DEATH.*

### 1.5 PRECAUTIONS WITH COOLANT

- Do not remove the filler cap of the cooling system while the engine is hot and while the coolant is under pressure, because dangerous hot coolant can be discharged.
- Do not use salt water or any other coolant which can cause corrosion in the closed cooling circuit.
1.6 PRECAUTIONS WITH BATTERIES

Batteries contain hazardous sulphuric acid.
Great care therefore needs to be taken when using them.

**WARNING**

*BATTERY ACID IS HIGHLY CORROSIVE AND POISONOUS, AND WILL BURN SKIN AND CLOTHING. IT WILL CAUSE PERMANENT DAMAGE, INCLUDING BLINDNESS, IF SPLASHED INTO THE EYES.*

- If acid accidentally comes into contact with skin, eyes or clothes, flush it away with copious amounts of water and seek medical aid.

**WARNING**

*The electrolyte gases are highly flammable.*

- Do not smoke near batteries and keep sparks and flames away from them.
- Do not work near to heaters or other fire hazards.
- Disconnect the main battery terminals before making any repair to the electrical system.
- Keep the top of the battery well ventilated during charging.
- Do not attempt to charge a frozen battery; it may explode. Instead, warm the battery to 16°C (60°F).
- Switch off the battery charger before connecting or disconnecting the charger leads. The negative (earth) battery lead must be disconnected first and reconnected last.
- Never use a damaged battery.

**Battery Charge Alternator**

The following points must be strictly observed when an alternator is fitted, otherwise serious damage can be done.

- Never connect a battery into the system without checking that the voltage and polarity are correct.
- Never remove any electrical cable while the battery is connected in the circuit.
- Only disconnect the battery with the engine stopped and all switches in the off position.
- Always ensure that cables are fitted to their correct terminals.

**CAUTION**

*A short circuit or reversal of polarity will ruin diodes and transistors.*
• Never ‘flash’ any connection.
• Never experiment with any adjustments or repairs to the system.
• Always disconnect the battery and alternator before commencing any electric welding when a pole strap is directly or indirectly connected to engine.

1.7 CARE WITH ELECTRICAL SYSTEMS
• Ensure that the battery is of sufficient capacity to start the engine at its minimum operating temperature, taking into account any drag that may be imposed on the engine by the type of transmission that is attached to it.
• Ensure that the battery and all engine wiring cables are of sufficient size to carry the currents required.
• Check that the engine-mounted alternator is of sufficient output to cope with the total electrical load required by the machine to which it is fitted.

Wiring Cables
Ensure that wiring cables are:
• Bound together in a loom and adequately supported.
• Routed to avoid any hot surfaces, particularly the exhaust system.
• Not in contact with any rough surfaces or sharp corners to avoid chafing.

1.8 LIFTING PRECAUTIONS
The engine lifting eyes are suitable for lifting only the engine and accessory assemblies originally fitted by Lister Petter Power Systems. They must not be used to attempt to lift an entire generating set.

1.8 Lifting a Gamma series engine using overhead lifting eyes.

⚠️ WARNING
Do not attempt to lift the complete plant using the engine lifting eyes.
Preparations required before lifting an engine:
• Check that the lifting eyes or lugs are not damaged and ensure they are secure.

Note:
The torque setting for the lifting eyes is 44 Nm (33 ft lb or 4.5 kgf m).

• Use the correct type of lifting appliance with the correct lifting capacity. The lifting appliance shown in Figure 1.8 is recommended for use when lifting vertically and should be connected directly to the lifting eyes.
• In order to protect the rocker cover, ensure there is clearance between the lifting equipment and the cover.

⚠️ WARNING
DO NOT WORK UNDER ANY PLANT THAT IS HELD ONLY BY OVERHEAD LIFTING EQUIPMENT.

1.9 CARE WITH FILTERS AND ELEMENTS
• The combustion material of some components of the engine (for example certain seals) can become extremely dangerous if burned. Never allow burnt material to come into contact with the skin or eyes.

⚠️ WARNING
The materials used in the manufacture and treatment of some filters and elements may cause irritation or discomfort. If they come into contact with the eyes or mouth, and they may give off toxic gases if they are burnt.

• Used filters and elements contain some of the filtered liquid and should be handled and disposed of with care.
• After handling new or used elements, hands should be thoroughly washed.

1.10 WASTE DISPOSAL
Ensure that waste oil, fuel, filter elements, coolant concentrate, battery electrolyte, solvents and other toxic wastes are disposed of in accordance with official regulations to prevent contamination.
2. ENGINE PARTS AND TECHNICAL DATA

Lister Petter Power Systems engines are built for many applications. The views which follow do not necessarily match your engine specification.

2.1 FRONT AND LEFT SIDE
1. Filler cap for lubricating oil
2. Fuel filter
3. Lubricating oil cooler
4. Fuel injection pump
5. Lubricating oil dipstick
6. Lubricating oil filter
7. Drain plug for lubricating oil
8. Crankshaft pulley
9. Drive belt
10. Water pump
11. Fan
12. Water outlet
13. Front lift bracket
14. Injector

2.2 REAR AND RIGHT SIDE
15. Turbocharger
16. Exhaust manifold
17. Radiator
18. Alternator
19. Bracket
20. Lubricating oil sump
21. Starter motor
22. Flywheel housing
23. Flywheel
24. Air filter
25. Rear lift bracket
26. Induction manifold

2.1 Engine type GWT6: front and left side
### TECHNICAL DATA

<table>
<thead>
<tr>
<th>General Engine Data</th>
<th>Engine cycle</th>
<th>4-stroke</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinder arrangement</td>
<td>Inline</td>
<td></td>
</tr>
<tr>
<td>Direction of rotation</td>
<td>Anti clockwise viewed from flywheel end</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Induction System</th>
<th>GW3, GW4</th>
<th>Naturally aspirated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GWT3, GWT4, GWT6</td>
<td>Turbocharged</td>
</tr>
<tr>
<td></td>
<td>GWTA6</td>
<td>Turbocharged and Intercooled</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Combustion System</th>
<th>Bore (nominal)</th>
<th>100 mm (3.94 in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stroke</td>
<td>127 mm (5 in.)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Compression Ratio</th>
<th>GW3, GW4</th>
<th>16.5:1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GWT3, GWT4, GWT6, GWTA6</td>
<td>17.5:1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cubic Capacity</th>
<th>3-cylinder engines</th>
<th>2.99 litres (183 in³)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4-cylinder engines</td>
<td>3.99 litres (243 in³)</td>
</tr>
<tr>
<td></td>
<td>6-cylinder engines</td>
<td>5.99 litres (365 in³)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Firing Order</th>
<th>3-cylinder</th>
<th>1 - 2 - 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4-cylinder</td>
<td>1 - 3 - 4 - 2</td>
</tr>
<tr>
<td></td>
<td>6-cylinder</td>
<td>1 - 5 - 3 - 6 - 2 - 4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Valve Clearance</th>
<th>Inlet</th>
<th>0.20 mm (0.008 in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Exhaust</td>
<td>0.45 mm (0.018 in.)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lubricating Oil Pressure (min. when at max. speed and normal engine temperature)</th>
<th>Engine without piston cooling jets</th>
<th>207 kN/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Engine with piston cooling jets</td>
<td>280 kN/m²</td>
</tr>
</tbody>
</table>
3. OPERATING INSTRUCTIONS

3.1 STARTING THE ENGINE

Several factors affect engine start, for example:

- Battery power
- Starter motor performance
- Lubricating oil viscosity
- Cold start system installation

Diesel engines need a cold start aid in very cold conditions. Normally, your vehicle or your machine will be fitted with the correct equipment for your region of operation.

Lister Petter Power Systems engines can be equipped with various cold starting systems. For the Gamma engine range these systems are:

- **Fuel Start Aid**: An electrically operated device which ignites a specific amount of diesel fuel in the induction manifold in order to heat the induction air.

![Diagram of starting key positions](image)

3.1.1 Starting a Warm Engine

1. If the engine is equipped with a manual stop control, ensure that it is in the run position (R).
2. Adjust the engine speed control to the quarter open position.
3. Turn the key to the start position (HS/S) to engage the starter motor (*Figures 3.1.1 and 3.1.2*).
4. Allow the start key to return to position R as soon as the engine starts. Always ensure that the engine and starter motor are stationary before the starter motor is engaged again.

3.1.2 Starting a Cold Engine without Starting Aids

1. If the engine is equipped with a manual stop control, ensure that it is in the run position (R).
2. Adjust the engine speed control to the maximum speed position.
3. Turn the start key to the start position (S) to engage the starter motor (Figure 3.1.2). Allow the key to return to position R when the engine starts. Adjust the speed control to get an even idle speed.

4. If the engine does not start in 30 seconds, allow the start key to return to the R position for another 30 seconds. Then engage the starter motor again for a maximum period of 30 seconds.

3.1.3 Starting a Cold Engine with Starting Aids

1. If the engine is equipped with a manual stop control, ensure that it is in the run position.

2. Turn the start key to position H and leave there for 15 seconds (Figure 3.1.1).

3. Adjust the engine speed control to the maximum speed position.

4. Turn the start key to position HS to engage the starter motor (Figure 3.1.1). Allow the start key to return to position R as soon as the engine starts. Adjust the speed control to get an even idle speed.

5. If the engine does not start in 15 seconds, turn the start key to the H position and hold it there for 10 seconds then engage the starting motor again.

⚠️ CAUTION

_A short circuit or reversal of polarity will ruin diodes and transistors._

3.2 STOPPING THE ENGINE

According to the equipment fitted, either turn the start key to position 0 or operate the manual stop control. If a manual stop control is used, ensure that the control returns to the run position after the engine has stopped. Also, ensure that the engine start key is turned to the 0 position.

⚠️ CAUTION

_It is recommended that a turbocharged engine is run at approximately 1000 r/min at a reduced load for 2-3 minutes before it is shut down. This allows the turbocharger to cool._

3.3 ADJUSTMENT OF ENGINE SPEED

The idle or maximum speed setting must not be changed by the engine operator as this may damage the engine or transmission.

The warranty of the engine is invalidated if the seals on the fuel injection pump are broken during the warranty period by a person who is not approved by Lister Petter Power Systems.
3.4 RUNNING-IN

A gradual running-in of a new engine is not necessary.

⚠️ CAUTION

*Prolonged operation at fight load during the early life of the engine can cause lubricating oil to enter the exhaust system.*

Maximum load can be applied to a new engine as soon as the engine is put into service and the coolant temperature has reached a minimum of 60°C (140°F). The engine will benefit if the load is applied as soon as possible after the engine is put into service.

⚠️ CAUTION

*Do not operate the engine at high speeds without load.*

⚠️ CAUTION

*Do not overload the engine.*

3.5 ALTITUDE

If the naturally aspirated engine is to run at an altitude above 600 m (2000 ft) the fuel delivery can be changed to reduce fuel consumption and smoke. Lister Petter Power Systems can give the percentage of fuel reduction necessary if details of engine application and ambient conditions are provided. Information for turbocharged engines can be obtained from Lister Petter Power Systems. Changes to the settings of the fuel injection pump must be made by a Lister Petter Power Systems distributor or by an approved distributor for the fuel injection pump.
4. ENGINE FLUIDS

4.1 FUEL SPECIFICATION
To get the correct power and performance from your engine, use good quality fuel. The recommended fuel specification for Lister Petter Power Systems engines is indicated below.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cetane Number</td>
<td>50 minimum</td>
</tr>
<tr>
<td>Viscosity</td>
<td>2.0 / 4.5 centistoke at 40°C</td>
</tr>
<tr>
<td>Density</td>
<td>0.835-0.855 kg/litre</td>
</tr>
<tr>
<td>Sulphur</td>
<td>0.2% of mass maximum</td>
</tr>
<tr>
<td>Distillation</td>
<td>85% at 350°C</td>
</tr>
</tbody>
</table>

- **Cetane Number**
  This indicates ignition performance. A fuel with a low cetane number can cause starting problems and affect combustion.

- **Viscosity**
  Engine performance can be affected if viscosity (resistance to flow) is outside the given limits.

- **Density**
  A low-density fuel reduces engine power. A high density fuel increases engine power and exhaust emissions

- **Sulphur**
  A high sulphur content (not normally found in Europe, North America or Australasia) can cause engine wear. Where only high sulphur fuels are available, it is necessary to use highly alkaline lubricating oil or to renew the lubricating oil more frequently (see sections 5.1 and 5.9).

- **Distillation**
  This is an indication of the mixture of different hydrocarbons in the fuel. A high ratio of lightweight hydrocarbons can affect the combustion characteristics.

4.1.1 Low Temperature Fuels
Special winter fuels may be available for engine operation at temperatures below 0°C. These fuels have a lower viscosity and also limit the wax formation in the fuel at low temperatures. If wax formation occurs, this could stop the fuel flow through the filter.
CAUTION
The quality of the fuel affects the type of lubricating oil required. See 4.1 above.

4.2 LUBRICATING OIL SPECIFICATION
Use only a good quality lubricating oil, to the relevant specification, as shown in the following table:

<table>
<thead>
<tr>
<th>Engine Type</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>API CF4</td>
<td>API CF-4</td>
</tr>
<tr>
<td>Naturally Aspirated</td>
<td></td>
</tr>
<tr>
<td>Engines in Heavy Duty Applications</td>
<td></td>
</tr>
<tr>
<td>Earthmoving Equipment</td>
<td></td>
</tr>
<tr>
<td>Turbocharged</td>
<td></td>
</tr>
</tbody>
</table>

Note 1: Not recommended during the first 40 hours of operation, nor for light load applications.

Always ensure that the correct viscosity grade of lubricating oil is used for the ambient temperature range in which the engine will run as shown in Figure 4.2. For advice on adjustments to an engine setting or to the lubricating oil change periods which may be necessary because of the standard of available fuel, consult your nearest Lister Petter Power Systems distributor.

4.2 Oil viscosity
4.3 COOLANT SPECIFICATION

The quality of coolant used affects the efficiency and life of the cooling system. The recommendations in the table below will help to maintain the cooling system in good condition and to protect it against frost and/or corrosion.

<table>
<thead>
<tr>
<th>Description</th>
<th>Ethylene (% volume)</th>
<th>Water (% volume)</th>
<th>Solidifying Point (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antifreezing Fluid</td>
<td>60</td>
<td>40</td>
<td>-55</td>
</tr>
<tr>
<td></td>
<td>55</td>
<td>45</td>
<td>-40</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>50</td>
<td>-30</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>60</td>
<td>-22</td>
</tr>
</tbody>
</table>

- If possible, use clean soft water in the coolant mix.

If an antifreeze mixture other than that recommended by Lister Petter Power Systems is used, it must be ethanediol (ethylene glycol) based with a corrosion inhibitor. It is recommended that the corrosion inhibitor is of the sodium nitrite/sodium benzoate type. The antifreeze mixture must be an efficient cool ant at all ambient temperatures and it must provide protection against corrosion.

It must also have a specification at least as good as the requirement of the standard BS6580: MOD AL39. Lister Petter Power Systems antifreeze exceeds the requirements of this standard. The quality of antifreeze coolant must be checked at least once a year, for example, at the beginning of the cold period. The coolant must be renewed every two years. The antifreeze mixture must contain equal quantities of antifreeze and water. Concentrations of more than 50% antifreeze must not be used as this can affect the performance of the coolant adversely. When frost protection is not necessary, it is still an advantage to use an approved antifreeze mixture because this gives protection against corrosion and also raises the boiling point of the coolant.

⚠️ CAUTION

Failure to follow the correct coolant specification and procedures may lead to damage by frost or corrosion.

If an antifreeze mixture is not used, add the correct mixture of corrosion inhibitor to the water. Renew the mixture of water and corrosion inhibitor every six months or check it according to the inhibitor manufacturer's recommendations.

⚠️ CAUTION

Certain corrosion inhibitor mixtures can cause damage to some engine components. It is recommended that you consult the service department at Lister Petter Power Systems if a corrosion inhibitor is to be used.
5. ROUTINE MAINTENANCE

5.1 MAINTENANCE SCHEDULE

Routine maintenance should be undertaken regularly at the intervals stated in Figure 5.1.1. Engines with long daily running times require more frequent maintenance than those with average running times. The intervals are therefore expressed both as running hours and as months. You should undertake the work at whichever limit is reached first.

<table>
<thead>
<tr>
<th>MAINTENANCE SCHEDULE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every day or every 8 hours, whichever is sooner</td>
</tr>
<tr>
<td>First service at 40 hours</td>
</tr>
<tr>
<td>Every 200 hours or every six months, whichever is sooner</td>
</tr>
<tr>
<td>Every 400 hours or every 12 months, whichever is sooner; see note (3)</td>
</tr>
<tr>
<td>Every 2000 hours</td>
</tr>
<tr>
<td>● Check the amount of coolant</td>
</tr>
<tr>
<td>● Check the drive belt(s)</td>
</tr>
<tr>
<td>● Check for water in the fuel pre-filter (1)</td>
</tr>
<tr>
<td>● Check the idle speed and adjust if necessary (2)</td>
</tr>
<tr>
<td>● Clean the sediment chamber and the strainer of the fuel-lift pump</td>
</tr>
<tr>
<td>● Renew the fuel filter element(s)</td>
</tr>
<tr>
<td>● Check the atomisers (2)</td>
</tr>
<tr>
<td>● Check the amount of lubricating oil in the sump</td>
</tr>
<tr>
<td>● Check the lubricating oil pressure at the gauge (1)</td>
</tr>
<tr>
<td>● Renew the engine lubricating oil (3) (4)</td>
</tr>
<tr>
<td>● Renew the canister(s) of the lubricating oil filter (3)</td>
</tr>
<tr>
<td>● Clean the air cleaner or empty the dust bowl of the air filter (very dusty conditions)</td>
</tr>
<tr>
<td>● Clean the air cleaner or empty the dust bowl of the air filter (normal conditions)</td>
</tr>
<tr>
<td>● Clean or renew the air filter element if this has not been indicated earlier</td>
</tr>
<tr>
<td>● Clean the closed breather system (1)</td>
</tr>
<tr>
<td>● Clean the turbocharger impeller and the turbocharger compressor casing (if applicable) (2)</td>
</tr>
<tr>
<td>● Check the valve clearances, and adjust if necessary (2)</td>
</tr>
<tr>
<td>● Check the alternator and starter motor (2)</td>
</tr>
</tbody>
</table>

(1) If fitted (2) By a competent person
(3) The lubricating oil and the filter canister(s) must be renewed every 250 hours or 12 months for applications where the engine normally runs at full load for periods of more than 20 minutes e.g. generating sets or water pumps.
(4) The oil change interval will vary according to the sulphur content of the fuel (see table 5.1.2 and section 4.1 Fuel Specification).

The interval for changing the canister of the lubricating oil filter is not affected.

5.1.1 Maintenance Schedule
The intervals apply only to engines operating under normal conditions and using fuel and lubricating oil that conform to the specifications given in this handbook. If the engine is running in dusty or otherwise adverse conditions, the maintenance intervals must be more frequent. Check also the maintenance periods recommended by the manufacturer of the equipment in which the engine is installed. If these intervals are shorter, you should observe them.

<table>
<thead>
<tr>
<th>Fuel sulphur content (%)</th>
<th>Oil change period</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 0.5</td>
<td>normal</td>
</tr>
<tr>
<td>0.5 - 1.0</td>
<td>0.75% of normal</td>
</tr>
<tr>
<td>&gt; 1.0</td>
<td>0.50% of normal</td>
</tr>
</tbody>
</table>

**5.1.2 The effect of sulphur content on oil change periods**

If there are local regulations affecting the operation of the engine, it may be necessary to adapt the maintenance periods accordingly. It is advisable to check for leakage and loose components at each service.

**5.2 DRAINING THE COOLING SYSTEM**

1. Ensure that the engine is on level ground and that it has had time to cool down.

**WARNING**

Never drain the coolant while the engine is still hot and the system is under pressure. This is dangerous and could cause injury from discharged coolant.

2. Remove the filler cap of the cooling system.
3. Remove the drain plug from the side of the cylinder block (there are two possible locations; see Figure 5.2) in order to drain the engine. Ensure that the drain hole is not restricted.
4. Open the tap or remove the drain plug at the bottom of the radiator in order to drain the radiator. If the radiator does not have a tap or a plug, disconnect the hose at the bottom of the radiator.
5. If necessary, flush the system with clean water.
6. Fit the drain plugs and the filler cap. Close the radiator tap or connect the radiator hose.

5.3 CHECKING THE DRIVE BELTS

Always renew a belt if it is worn or damaged.
If twin belts are fitted, they must be renewed together.
To ensure maximum belt life, it is recommended that a belt tensioner gauge is used to check the belt tension. Fit the gauge (Figure 5.3) at the centre of the longest free length and check the tension. If a Burroughs gauge is used, the correct tension is 355N (80 lbf or 36 kgf). If the tension is below 220N (50 lbf or 22 kgf) adjust to 355N as indicated below.

5.3.1 Adjusting the Belt Tension
Refer to Figure 5.3.1 below.
1. Loosen the pivot fasteners of the alternator (1) and also the adjustment link fasteners (2).
5.3 CHECKING THE DRIVE BELTS

Always renew a belt if it is worn or damaged. If twin belts are fitted, they must be renewed together.

To ensure maximum belt life, it is recommended that a belt tensioner gauge is used to check the belt tension. Fit the gauge (Figure 5.3) at the centre of the longest free length and check the tension. If a Burroughs gauge is used, the correct tension is 355N (80 lbf or 36 kgf). If the tension is below 220N (50 lbf or 22 kgf) adjust to 355N as indicated below.

5.3.1 Adjusting the Belt Tension

Refer to Figure 5.3.1 below.

1. Loosen the pivot fasteners of the alternator (1) and also the adjustment link fasteners (2).

2. Change the position of the alternator to give the correct tension, tighten the pivot fasteners of the alternator and the adjustment link fasteners.

3. Check the belt tension again to ensure that it is still correct. If a new belt is fitted, the belt tension must be checked again.

5.4 CLEANING THE FUEL LIFT PUMP

Refer to Figure 5.4.

1. Remove the fuel lift pump and place into clean fuel.

2. Carefully wash all sediment from the lift pump body.

3. Clean the gauze strainer, joint and cover.

4. Assemble the lift pump. Ensure that the lift pump body and the cover are fitted together correctly because leakage at this point will let air into the fuel system. If fitted, refit the heat shield.
5. Eliminate the air from the fuel system through the filter vent point (see section 5.8).

**5.5 CHECKING THE FUEL PRE-FILTER**

Some engines are fitted with a pre-filter of the same main type as the fuel filter element (see 5.6 below). This will normally be fitted between the fuel tank and the engine and is connected to the main filter but before the fuel lift pump. Both elements must be removed at the same time.

Check the fuel bowl for water at regular intervals and drain as necessary.

**5.6 RENEWING THE FUEL FILTER ELEMENT**

There are three fuel filter element types in use (see Figure 5.6).

1. **Separate Type**
   - The filter element is held between the filter head and the bottom cover.

2. **Canister Type**
   - The filter element has an internal thread at the top and is fastened to a threaded adaptor in the filter head.

3. **Quick Release Canister Type**
   - This has been introduced on certain engines.

---

**CAUTION**

It is important that only genuine Lister Petter Power Systems fuel filter elements are used. The wrong element can damage the fuel injection pump.

---

**5.6.1 Renewing a Separate Type Fuel Filter Element**

Refer to Figure 5.6.1.

The filter can have one or two elements.

When twin elements are fitted both the elements must be renewed at the same time.
2. Carefully wash all sediment from the lift pump body.
3. Clean the gauze strainer, joint and cover.
4. Assemble the lift pump. Ensure that the lift pump body and the cover are fitted together correctly because leakage at this point will let air into the fuel system. If fitted, refit the heat shield.
5. Eliminate the air from the fuel system through the filter vent point (see section 5.8).

5.5 CHECKING THE FUEL PRE-FILTER

Some engines are fitted with a pre-filter of the same main type as the fuel filter element (see 5.6 below). This will normally be fitted between the fuel tank and the engine and is connected to the main filter but before the fuel lift pump. Both elements must be removed at the same time.

Check the fuel bowl for water at regular intervals and drain as necessary.

5.6 RENEWING THE FUEL FILTER ELEMENT

There are three fuel filter element types in use (see Figure 5.6).

1. Separate Type. The filter element is held between the filter head and the bottom cover.
2. Canister Type. The filter element has an internal thread at the top and is fastened to a threaded adaptor in the filter head.
3. Quick Release Canister Type. This has been introduced on certain engines.

CAUTION It is important that only genuine Lister Petter fuel filter elements are used. The wrong element can damage the fuel injection pump.

5.6.1 Renewing a Separate Type Fuel Filter Element

Refer to Figure 5.6.1.

1. Clean the outside surfaces of the fuel filter assembly. If a drain tap is fitted to the bottom of the filter bowl, drain the fuel from the filter.
2. Hold the bottom cover of the filter element and release the setscrew which is fitted through the filter head above the centre of each element.
3. Lower the bottom cover of the filter.
4. Remove the element and discard it.
5. Clean the inside surfaces of the filter head and cover.
6. Renew the seals and lightly lubricate them with clean fuel.
7. Put the bottom cover under the new element and hold the element square to the filter head. Ensure the element is fitted in the centre against the joint in the filter head. With the assembly in this position, engage and tighten the setscrew.
8. Eliminate the air from the fuel filter (see Section 5.8).

5.6.2 Renewing a Canister Type Fuel Filter Element

Refer to Figure 5.6.2.

1. Clean the outside surfaces of the fuel filter assembly.
2. Loosen the drain device at the bottom of the filter and allow the water/fuel to drain into a suitable container.
3. Use a strap wrench or similar tool to loosen the filter canister and remove the canister.
4. Ensure that the threaded adaptor is secure in the filter head and that the inside of the head is clean.
5. Lubricate lightly the top seals between the new canister and the filter head (1, 2) and tighten by hand only.
6. Eliminate the air from the fuel filter (see Section 5.8).
5.6.3 Renewing a Quick Release Canister Type Fuel Filter Element
Refer to Figure 5.6.3.

1. Clean the outside surfaces of the fuel filter assembly.
2. Loosen the drain device at the bottom of the filter and allow the water / fuel to drain into a suitable container.
3. Turn the sediment bowl (if fitted) to the left, and remove.
4. Turn the clamp ring to the left and remove.
5. Remove the canister from the filter head (1) by pulling directly downwards. Discard the old canister.
6. Ensure the filter head is clean and push the new canister fully into the filter head (see arrow).
7. Fit the clamp ring and turn it fully to the right to fasten the canister to the filter head.
8. Remove the cover of the sediment bowl and clean thoroughly.
9. Check the two 'O' ring seals of the sediment bowl cover for damage, and replace if necessary.
10. Clean the threads of the sediment bowl fastener. To secure the bowl to the canister, turn the bowl fully to the right. Tighten by hand only.
11. Eliminate the air from the fuel filter (see Section 5.8).

5.7 RENEWING A FUEL INJECTOR

Refer to Figure 5.7.

1. Remove the fuel leak-off pipe.
2. Remove the union nuts of the high-pressure pipe from the injector and from the fuel injection pump. Do not bend the pipe. If necessary, remove the pipe clamps.
3. Remove the injector flange setscrews and remove the flange, the injector and the seat washer (Figure 5.7, numbers 1, 2 and 3). Remove the dust seal and spacer (4 and 5) and fit the spacer and a new dust seal to the injector.
4. Put the new injector in position with its spacer, a new dust seal and a new seat...
washer. Ensure the fuel leak-off connection is not toward the engine. Fit the flange and engage the flange setscrews. Ensure the injector is not tilted and tighten the flange setscrews evenly and gradually to 12 Nm (9 lbf ft or 1.2 kgfm).

**CAUTION**

*Do not tighten the nuts of the high-pressure pipes more than the recommended torque. If there is leakage from the union nut, ensure that the pipe is correctly aligned with the injector inlet. Do not tighten the union nut more, as this can cause a restriction at the end of the pipe which in turn will affect the fuel delivery to the engine.*

5. Fit the high pressure fuel pipe and tighten the union nuts to 22 Nm (16 lbf ft or 2.2 kgfm). If necessary, fit the pipe clamps.
6. Renew the aluminium washers and fit the leak-off pipe.
7. Operate the engine and check for air or fuel leaks.

### 5.8 ELIMINATING AIR FROM THE FUEL SYSTEM

If air enters the fuel system, it must be eliminated before the engine can be started. Air can enter the system if:

- The fuel tank is drained during normal operation.
- The low pressure fuel pipes are disconnected or damaged / broken.
- A part of the low pressure fuel system leaks during engine operation.

To eliminate air from the fuel system, use one of the following procedures depending on the fuel system vent set up on your engine.

#### 5.8.1 Standard Method

Refer to *Figure 5.8.1.*

1. Loosen the vent plug on top of the twin element fuel filter, or, if there is only one fuel filter element the banjo bolt which is fitted on the top of the fitter (1).
2. Operate the priming lever on the fuel lift pump until air free fuel flows from the filter venting point (2). Tighten the vent plug of the banjo connection bolt If the drive cam of the fuel lift pump is at point of maximum cam lift it will not be possible to operate the priming lever. In this situation, the crankshaft must be turned one revolution.
3. Ensure that the manual stop control is in the run position. If an electrical stop control is used turn the start key to the R position.
4. For engine codes AA and VA, loosen the vent screw in the lock screw of the hydraulic head and the vent screw on the governor cover of the fuel injection pump.
5. Operate the priming lever of the fuel lift pump until fuel flows from the vent screws, then retighten the vent screws.
6. Loosen the union nut (3) at the fuel start aid (*Figure 5.8.1b*) and operate the lift pump until fuel freely flows from the connection. Retighten the union nut.
7. Loosen the union nuts (4) of the high pressure pipes at two of the injectors (Figure 5.8.1c). Operate the starter motor until air free fuel flows from these connections, and re-tighten.

5.8.1 Standard method of eliminating air from the fuel system

(1) The banjo bolt on top of the fuel filter.

(2) Operating the priming lever on the fuel lift pump.

(3) The union nut of the fuel start aid.

(4) The union nuts of the high pressure pipes at two of the injectors.

CAUTION

Do not tighten the nuts of the high pressure pipes more than the recommended torque. If there is a leakage from the union nut, ensure that the pipe is correctly aligned with the injector inlet. Do not tighten the union nut more, as this can cause a restriction at the end of the pipe which in turn will affect the fuel delivery to the engine.

8. The engine is now ready to start. If the engine runs correctly for a short time and then stops or runs roughly, check for air in the fuel system. If there is air in the fuel system, there is probably a leak in the low pressure section of the fuel system.
5.8.2 Method Using In-Line PB Type Injection Pump

Refer to Figure 5.8.2 and to the Appendix.

1. Loosen the vent plug on the top of the fuel filter (1) by turning it two or three turns. Operate the fuel lift pump until fuel flows without air. Retighten the plug.

2. Loosen the connecting screw on the housing at the driving side (2). Operate the fuel lift pump until fuel flows without air from the loosened joint. Re-tighten the connecting screws.

3. Loosen the connecting nut on the fuel start aid (3). Operate the fuel lift pump until air free fuel flows from the loosened joint. Re-tighten the connecting nut. Use a spanner to prevent the connecting nut from moving (4).

4. Ensure that the stop controller is in the run position and the speed controller is at the maximum speed position. Operate the starter motor. After starting the engine, decrease the engine speed. If after a short period of normal running the engine stops or runs roughly it may be because there is a leak in the low pressure section of the fuel system. Check this and rectify if necessary.

Figure 5.8.2 Eliminating air from the fuel system using an in-line PB type injection pump.
CAUTION

Any waste fuel must be collected and disposed of in a responsible manner and in accordance with local authority guidelines.

5.9 CHANGING THE LUBRICATING OIL

Refer to Figure 5.9.
1. Operate the engine until it is warm.
2. Stop the engine, remove the sump drain plug (Figure 5.9) and O-ring and drain the lubricating oil from the sump.
3. Ensure the O-ring is not damaged. Fit the O-ring and drain plug back into the sump and tighten to a torque of 34 Nm (25 lbf ft or 3.5 kgfm).
4. Fill the sump to the MAX mark on the dipstick (Figure 5.9) with new, clean lubricating oil of an approved grade (see 4.Engine Fluids).

Figure 5.9 The oil sump, showing drain plug (1) and dipstick (2).

5.10 REPLACING THE OIL FILTER CANISTER

Refer to Figure 5.10.
The filter can have a single or double canister. If two canisters are fitted they must both be replaced at the same time.

CAUTION

The canister contains a valve and special tube to ensure that lubricating oil does not drain from the filter. Therefore, ensure that the correct Lister Petter Power Systems canister is used.
1. Place a tray under the filter to collect spilt lubricating oil.
2. Remove the filter canister with a strap wrench or similar tool. Ensure that the adaptor (Figure 5.10) is secure in the filter head, and then discard the canister.
3. Clean the filter head.
4. Add clean lubricating oil to the new canister. Allow the oil enough time to pass through the filter element.
5. Lubricate the top of the canister seal with clean lubricating oil.
6. Fit the new canister and tighten it by hand only. Do NOT use a strap wrench.
7. Ensure that there is lubricating oil in the sump. On turbocharged engines, ensure that the engine will not start and operate the starter motor until oil pressure is obtained. To ensure that the engine will not start, either put the manual stop control in the stop position or disconnect the electrical stop control of the fuel injection pump. Oil pressure is indicated when the warning light is extinguished or by reading a gauge.
8. Operate the engine and check for leakage from the filter. When the engine has cooled, check the oil level on the dipstick and put more oil into the sump if necessary.

5.11 CLEANING THE BREATHER SYSTEM

Refer to Figure 5.11.
1. Release the hose clip and remove the breather cover (1).

*Note: It is necessary to remove the breather body in the rocker cover so that a strainer can be put into it.*

2. Remove the plastic strainer (2) and wash it with clean kerosene.
3. Wash the breather body with clean kerosene.
4. If necessary, renew the O-ring (3).
5. Check that the inside of the upper pipe is clean. If the pipe is not clean, release the flange setscrews and remove the pipe. Wash the pipe with kerosene and dry with low pressure air.

6. Fit the breather cover onto the body and ensure that it is fitted firmly.

7. Fit the upper pipe and tighten the hose clip.

**Note:** The breather body is fixed on the cover with screws. If it is necessary to remove the breather assembly, use a spanner to clamp the flange on the bottom before loosening the screws.

### 5.12 SERVICING THE AIR CLEANER

A typical wet type air cleaner is shown in Figure 5.12. The wet type air cleaner must be drained regularly.

1. The container and element (1) must be cleaned with kerosene or with another suitable fluid. Do NOT use gasoline.
2. Check that the seal (2) is not damaged. Renew it if necessary.
3. Fill to the indicated level (3) with clean engine lubricating oil.

---

**Figure 5.11** Cleaning the breather system. (1) breather cover; (2) plastic strainer; (3) O-ring

**Figure 5.12** A typical wet type air cleaner.
5.12.1 Air Filter

Environmental conditions have an important effect on the frequency at which the air filter needs service. Refer to Figure 5.12.1.

![Figure 5.12.1 The air filter, showing the dust bowl (1) and element (2)](image)

Certain air filters have a separate dust bowl (1) which must be cleaned at intervals. Do not let dust completely fill the bowl as this will reduce the life of the filter element (2). The amount of dust in the bowl indicates whether it has been removed early enough for the conditions of operation.

Certain air filters have automatic dust valves through which dust is expelled from the filter (Figure 5.12.2). The rubber dust valve (1) must be kept clean. Ensure that the sides of the valves close completely together and that they can separate freely.

![Figure 5.12.2 Air filter with dust valve (1)](image)

If a restriction indicator is fitted (see below) it will indicate precisely when the air filter element needs servicing. This prevents the premature removal of the filter, which is an unnecessary expense, or late removal which can cause loss of power. The filter element must be cleaned or renewed according to the manufacturer's recommendations.
5.12.2 Restriction Indicator
The restriction indicator for these engines must work at a pressure difference of 508 / 558 mm (20/22 in) of water gauge. It is fitted on the outlet pipe of the air cleaner. Refer to Figure 5.12.3. When the red warning light (1) is seen through the clear panel (2) after the engine has stopped, the air filter element must be removed for service. After a clean element has been fitted, press the rubber bottom (3) of the button (4) of the restriction indicator to reset the red warning indicator.

![Figure 5.12.3 Restriction indicator: (1) warning light; (2) clear panel; (3) rubber base; (4) button]

5.13 CHECKING VALVE CLEARANCES
The valve clearances are checked between the top of the valve stem and the rocker lever (Figure 5.13) with the engine hot or cold.

![Figure 5.13 Checking valve clearances]

The correct clearances are 0.20 mm (0.008 in) for inlet valves and 0.45 mm (0.018 in) for exhaust valves.

*Note: Number 1 cylinder is at the front of the engine.*

5.13.1 Three Cylinder Engines
1. Remove the cover plate in the window of the flywheel housing
2. Rotate the crankshaft until the T.D.C. line on the flywheel is in the centre of the
window and No.1 piston in the compression stroke (both valves fully closed).
3. Check and adjust clearance as specified.
4. Repeat the procedure for the remaining valves following the firing order (3 cylinder engines have firing order 1 - 2 - 3).
5. Replace the rocker cover ensuring that the rocker cover gasket is in good condition and is correctly positioned.

5.13.2 Four Cylinder Engines
The sequence of valves from number 1 cylinder is shown in the table below: Number 1 cylinder is at the front of the engine (fan and gear end).

<table>
<thead>
<tr>
<th>VALVE POSITIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinder and Valve Number</td>
</tr>
<tr>
<td>---------------------------</td>
</tr>
<tr>
<td>1 2 3 4 5 6 7 8</td>
</tr>
<tr>
<td>Valve: I=Inlet; E=Exhaust</td>
</tr>
</tbody>
</table>

The valve positions are shown in Figure 5.13.2.

1. Rotate the crankshaft in the normal direction of rotation until the inlet valve (8) of number 4 cylinder has just opened and the exhaust valve (7) of the same cylinder has not closed completely. Check the clearances of the valves (1 and 2) of number 1 cylinder and adjust them, if necessary.
2. Set the valves (3 and 4) of number 2 cylinder as indicated above for number 4 cylinder. Then check and adjust the clearances of the valves (5 and 6) of number 3 cylinder.
3. Set the valves (1 and 2) of number 1 cylinder. Then check and adjust the clearances of the valves (7 and 8) of number 4 cylinder.
4. Set the valves (5 and 6) of number 3 cylinder. Then check and adjust the clearances of the valves (3 and 4) of number 2 cylinder.
5.13.3 Six Cylinder Engines
The sequence of valves from number 1 cylinder is shown in the table below. Number 1 cylinder is at the front of the engine (fan and gear end).

<table>
<thead>
<tr>
<th>Cylinder and Valve Number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Valve: I=Inlet; E=Exhaust</td>
<td>I</td>
<td>E</td>
<td>E</td>
<td>I</td>
<td>I</td>
<td>E</td>
</tr>
</tbody>
</table>

5.13.4 Valve Positions
The valve positions are shown in Figure 5.13.4.

Figure 5.13.4 The valve positions (GWT6-1A, GWT6-2A, GWTA6)

1. Rotate the crankshaft in the normal direction of rotation until the inlet valve (12) of number 6 cylinder has just opened and the exhaust valve (11) of the same cylinder has not closed completely. Check the clearances of the valves (1 and 2) of number 1 cylinder and adjust them, if necessary.
2. Set the valves (4 and 3) of number 2 cylinder as indicated above for number 6 cylinder. Then check and adjust the clearances of the valves (9 and 10) of number 5 cylinder.
3. Set the valves (8 and 7) of number 4 cylinder. Then check and adjust the clearances of the valves (5 and 6) of number 3 cylinder.
4. Set the valves (1 and 2) of number 1 cylinder. Then check and adjust the clearances of the valves (11 and 12) of number 6 cylinder.
5. Set the valves (9 and 10) of number 5 cylinder. Then check and adjust the clearances of the valves (3 and 4) of number 2 cylinder.
6. Set the valves (5 and 6) of number 3 cylinder. Then check and adjust the clearances of the valves (7 and 8) of number 4 cylinder.
## 6. FAULT DIAGNOSIS

### 6.1 PROBLEMS AND POSSIBLE CAUSES

See table below, in conjunction with 6.2 Code List of Possible Causes opposite.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>The starter motor turns the engine too slowly</td>
<td>Check by Operator: 1, 2, 3, 4; Checks by Workshop Personnel: None</td>
</tr>
<tr>
<td>The engine does not start</td>
<td>Check by Operator: 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 17; Checks by Workshop Personnel: 33, 34, 35, 36, 37, 41, 42, 43</td>
</tr>
<tr>
<td>The engine is difficult to start</td>
<td>Check by Operator: 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 19; Checks by Workshop Personnel: 33, 35, 36, 37, 39, 41, 42, 43</td>
</tr>
<tr>
<td>Not enough power</td>
<td>Check by Operator: 8, 9, 10, 11, 12, 13, 16, 17, 18, 19, 20, 21, 31; Checks by Workshop Personnel: 33, 35, 36, 37, 38, 41, 42, 43, 60, 62, 63</td>
</tr>
<tr>
<td>Misfires</td>
<td>Check by Operator: 8, 9, 10, 12, 13, 15, 20, 22; Checks by Workshop Personnel: 33, 35, 36, 37, 38, 39, 40, 42</td>
</tr>
<tr>
<td>High fuel consumption</td>
<td>Check by Operator: 11, 13, 15, 17, 18, 19, 21, 22; Checks by Workshop Personnel: 33, 35, 36, 37, 38, 39, 40, 42, 62</td>
</tr>
<tr>
<td>Black exhaust smoke</td>
<td>Check by Operator: 11, 13, 15, 17, 19, 21, 22; Checks by Workshop Personnel: 33, 35, 36, 37, 38, 39, 40, 43, 42, 43, 60, 62</td>
</tr>
<tr>
<td>Blue or white exhaust smoke</td>
<td>Check by Operator: 4, 15, 21, 23, 31; Checks by Workshop Personnel: 35, 36, 37, 38, 41, 43, 44, 51, 52, 61</td>
</tr>
<tr>
<td>Low lubricating oil pressure</td>
<td>Check by Operator: 4, 24, 25, 26; Checks by Workshop Personnel: 45, 46, 47, 49, 50, 58</td>
</tr>
<tr>
<td>The engine knocks</td>
<td>Check by Operator: 9, 13, 15, 17, 20, 22, 23; Checks by Workshop Personnel: 35, 36, 39, 41, 43, 45, 51, 52, 59</td>
</tr>
<tr>
<td>The engine turns erratically</td>
<td>Check by Operator: 7, 8, 9, 10, 11, 12, 13, 15, 16, 18, 20, 22, 23; Checks by Workshop Personnel: 33, 37, 39, 40, 43, 51, 59</td>
</tr>
<tr>
<td>Vibration</td>
<td>Check by Operator: 13, 18, 20, 27, 28; Checks by Workshop Personnel: 33, 37, 39, 40, 43, 51, 53</td>
</tr>
<tr>
<td>High lubricating oil pressure</td>
<td>Check by Operator: 4, 25; Checks by Workshop Personnel: 48</td>
</tr>
<tr>
<td>High engine temperature</td>
<td>Check by Operator: 11, 13, 15, 19, 27, 29, 30, 32; Checks by Workshop Personnel: 33, 35, 36, 38, 39, 51, 54, 55, 56, 63</td>
</tr>
</tbody>
</table>
6.2 CODE LIST OF POSSIBLE CAUSES

Checks by the Operator
1. Battery of low capacity
2. Bad electrical connections
3. Fault within the starter motor
4. Wrong grade of lubricating oil
5. Starter motor turning engine too slowly
6. Fuel tank empty
7. Fault in stop control
8. Restriction in fuel pipe
9. Fault in fuel lift pump
10. Dirty fuel filter element
11. Restriction in air filter / cleaner or induction system
12. Air in fuel system
13. Fault in injector or incorrect type of fuel injector
14. Cold start system used incorrectly
15. Fault in cold start system
16. Restriction in fuel tank vent
17. Wrong type or grade of fuel used
18. Restricted movement of engine speed control
19. Restriction in exhaust pipe
20. Engine temperature too high
21. Engine temperature too low
22. Incorrect valve clearance
23. Too much (or wrong type of) oil used in a wet-type air cleaner
24. Not enough lubricating oil in sump
25. Defective gauge
26. Dirty lubricating oil filter element
27. Fan damaged
28. Fault in engine mounting of flywheel housing
29. Too much lubricating oil in sump
30. Restriction in air or water passages of radiator
31. Restriction in breather pipe
32. Insufficient coolant in system

Checks by Workshop Personnel
33. Fault in fuel injection pump
34. Broken drive on fuel injection pump
35. Timing of fuel injection pump is incorrect
36. Valve timing is incorrect
37. Bad compression
38. Cylinder head gasket leaks
39. Valve stem sticking
40. Wrong high-pressure pipes
41. Worn cylinder bores
42. Leakage between valves and seats
43. Piston rings are not free or are worn or broken
44. Valve stems and/or guides are worn
45. Crankshaft bearings are worn or damaged
46. Lubricating oil pump is worn
47. Relief valve does not close
48. Relief valve does not open
49. Relief valve spring is broken
50. Fault in suction pipe of lubricating oil pump
51. Piston is damaged
52. Piston height is incorrect
53. Flywheel housing or flywheel is not aligned correctly
54. Fault in thermostat, or incorrect type
55. Restriction in coolant passages
56. Fault in water pump
57. Valve stem seal (if fitted) is damaged
58. Restriction in sump strainer
59. Valve spring is broken
60. Turbocharger impeller is damaged or dirty
61. Lubricating oil seal of turbocharger leaks
62. Induction system leaks (turbocharged engines only)
63. Turbocharger waste-gate (if fitted) does not work correctly
7. ENGINE STORAGE

If the engine is to be withdrawn from service for a prolonged period you must follow the procedures below to ensure that damage does not occur.

7.1 PREPARING THE ENGINE FOR STORAGE

1. Completely clean the outside of the engine.
2. When a preservative fuel is to be used, drain the fuel system and fill it with the preservative fuel. If preservative fuel is not used, the system can be kept full with normal fuel but the fuel must be discarded at the end of the storage period together with the fuel filter element(s).
3. Operate the engine until warm then correct any leakage of fuel, oil or air. Stop the engine and drain the lubricating oil from the sump.
4. Renew the canister(s) of the lubricating oil filter.
5. Fill the sump to the mark on the dipstick with new, clean lubricating oil.
6. Drain the cooling system (see 5.2). In order to protect the cooling system from corrosion fill it with an approved antifreeze mixture.
7. Operate the engine for a short period in order to circulate the lubricating oil and coolant in the engine.
8. Clean the engine breather pipe.
9. Remove the air filter. If necessary, remove the pipe(s) installed between the air filter and induction manifold or turbocharger. Seal the manifold with waterproof tape.
10. Seal the exhaust manifold and air pipe of the fuel tank with waterproof tape.
11. Disconnect the battery. Put the battery into safe storage in a fully charged condition and protect the terminals against corrosion.
12. Remove the drive belts and put them into storage.

If the above procedure is carried out correctly, there should be no damage due to corrosion. Lister Petter Power Systems are not responsible for damage which may occur when an engine is in storage after a period of service.

7.2 RETURNING THE ENGINE TO SERVICE

After a period in storage, before the engine is started, operate the starter motor with the engine stop control in the stop position until oil pressure is indicated (oil pressure can be indicated either by a gauge or when a low pressure warning light is extinguished). If a solenoid stop control is used on the fuel injection pump it must be disconnected for this operation.
8. MAINTENANCE RECORD

Your Lister Petter Power Systems engine must be properly maintained using the intervals and procedures described in this manual. You must be familiar with the routine tasks set out in 5. Routine Maintenance, and their correct frequency set out in 5.1 Maintenance Schedule. Details of the maintenance work carried out on the engine during the warranty period (the first 5000 hours or first two years, whichever is sooner), except the daily checks, must be recorded in the spaces allocated in this section: pages 35-39 for routine maintenance and pages 40-44 for non-routine maintenance (see 9.3 Conditions of Warranty). If you purchase an extended warranty you must keep records for the entire period of the warranty. It is also recommended that you continue to keep records beyond the warranty period, to enable you to keep track of work that has been done on the engine.

8.1 ROUTINE MAINTENANCE

<table>
<thead>
<tr>
<th>Hours run</th>
<th>Work done by</th>
<th>Details of service</th>
<th>Distributor / Dealer Stamp</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hours run</td>
<td>Work done by</td>
<td>Details of service</td>
<td>Distributor / Dealer Stamp</td>
<td>Date</td>
</tr>
<tr>
<td>-----------</td>
<td>--------------</td>
<td>--------------------</td>
<td>-----------------------------</td>
<td>------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hours run</td>
<td>Work done by</td>
<td>Details of service</td>
<td>Distributor / Dealer Stamp</td>
<td>Date</td>
</tr>
<tr>
<td>-----------</td>
<td>--------------</td>
<td>--------------------</td>
<td>-----------------------------</td>
<td>------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hours run</td>
<td>Work done by</td>
<td>Details of service</td>
<td>Distributor / Dealer Stamp</td>
<td>Date</td>
</tr>
<tr>
<td>-----------</td>
<td>--------------</td>
<td>--------------------</td>
<td>----------------------------</td>
<td>------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## 8.2 NON-ROUTINE MAINTENANCE

<table>
<thead>
<tr>
<th>Hours run</th>
<th>Work done by</th>
<th>Details of service</th>
<th>Distributor / Dealer Stamp</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hours run</td>
<td>Work done by</td>
<td>Details of service</td>
<td>Distributor/Dealer Stamp</td>
<td>Date</td>
</tr>
<tr>
<td>-----------</td>
<td>--------------</td>
<td>--------------------</td>
<td>--------------------------</td>
<td>------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hours run</td>
<td>Work done by</td>
<td>Details of service</td>
<td>Distributor/Dealer Stamp</td>
<td>Date</td>
</tr>
<tr>
<td>-----------</td>
<td>--------------</td>
<td>--------------------</td>
<td>--------------------------</td>
<td>------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hours run</td>
<td>Work done by</td>
<td>Details of service</td>
<td>Distributor/Dealer Stamp</td>
<td>Date</td>
</tr>
<tr>
<td>-----------</td>
<td>--------------</td>
<td>--------------------</td>
<td>--------------------------</td>
<td>------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
9. WARRANTY

On receipt of your engine please fill in the section on page 53. This information will be required in the event of a claim under warranty, according to the conditions set out below.

9.1 STANDARD WARRANTY COVER

The standard warranty includes 2 year / 2000 hour cover for all non-serviceable components, parts and labour, beginning on the date of delivery to the original retail purchaser, and is transferable. It is subject to the conditions set out below in 9.3 Conditions of Warranty and the limitations set out in 9.4 Limitations of Warranty.

9.2 CONDITIONS OF WARRANTY

For the warranty to be valid, servicing must be carried out in accordance with 5. Routine Maintenance and with the timings set out in 5.3 Maintenance Schedule. Detailed records of servicing must be kept; see 8. Maintenance Record. Servicing must be by approved dealers or competent engineers.

- The maintenance record must be completed.
- Oils and other fluids must be to the specifications/grades given in 4. Engine Fluids or as instructed in the Workshop Manual.
- Only genuine Lister Petter Power Systems service parts must be used.
- When Lister Petter Power Systems parts are purchased from a dealer, this must be noted, with the dealer's stamp, in 8. Maintenance Record, and receipts for the parts must be retained. The dealer is authorised to stamp the maintenance record only following the sale of genuine parts, to a competent engineer, intended to be used on the warrantable Lister Petter Power Systems engine.
- Evidence will be required of engine hours run and should be entered in 8. Maintenance Record. Evidence of equipment used to record engine hours may be requested in the event of a warranty claim. If no hour recorder is fitted, twelve hours per calendar day will be used as a basis for the hours-run calculation.
- The installation should be in accordance with data supplied by the Lister Petter Power Systems Applications Department.
- Long term light load and cold engine running will invalidate the warranty.

Notes:
1. Serviceable items (unless defective) include, but are not limited to: air filters, fuel filters, oil filters, injector nozzles, drive belts and lubricants and coolants (unless used on an authorised repair).
2. The term 'core engine' excludes the radiator/heat exchanger, starter motor and starting systems, alternator, water pump, exhaust, fan belts, oil seals and fuel injection equipment.
3. This warranty gives the purchaser specific legal rights; the purchaser may also have other rights, which vary by country or state.
9.3 LIMITATIONS OF WARRANTY

• The seller does not accept responsibility for any business costs or other losses which may result from the warrantable failure.
• The seller is not responsible for failures resulting from misapplication, abuse or neglect, including: operating with inadequate cooling; the use of non-approved or contaminated fuels or lubricants; lack of, or incorrect, maintenance; incorrect repair; improper storage; incorrect starting, stopping or operating procedures; the use of non-approved parts; fair wear and tear; and serviceable items (see note 1).

9.4 REPAIRS UNDER WARRANTY

Lister Petter Power Systems must be contacted and authorisation given before any warrantable work is commenced.

9.4.1 Contact Details

Head Office
Lister Petter Power Systems Limited Unit 14 Estuary Court
Broadmeadow Industrial Estate Teignmouth
TQ14 9FA
T: +44(0)1285 702211

Production Facility
Lister Petter Power Systems Limited
Units 13-15 Quadrant Distribution Centre
Hardwicke
Gloucester
GL2 2RN
sales@listerpetter.com
www.listerpetter.com

Engine Serial Number: ............................................................................................................
Purchased from: ...................................................................................................................
Purchase Date: ...................................................................................................................
Plant Type: .........................................................................................................................
Plant Number: .....................................................................................................................
PB fuel pumps, RSV governors and electronically controlled governors are applied on certain of the diesel engines manufactured for the Gamma engine series.

PB PUMP

Characteristics of PB fuel pumps are:
1. Plunger and barrel assembly (pumping element) for each cylinder.
2. Camshaft is integrated into the aluminium pump housing.
3. Fuel supply pump to deliver fuel from the tank.
ADJUSTMENT AND USE OF THE PB PUMP

1. Important adjustment of the pump should only be carried out on a special test bench by trained personnel.

ADJUSTMENT OF STATIC FUEL SUPPLY

Advanced Angle of Inline Pump

1. Determine the mark position when the piston of number 1 cylinder is at TDC on the compression stroke. The mark should be stamped on both the timing case cover and the pulley.

2. Remove the high pressure pipe of number 1 cylinder, pull the throttle control lever to the maximum position of fuel supply, turn the crankshaft clockwise from the front and set the piston of number 1 cylinder to TDC on the compression stroke.

3. Turn the crankshaft anti clockwise from the front to an angle of more than 60 degrees then turn back clockwise slowly. Observe for the fuel overflow from the valve seat, when the fuel level fluctuation just appears it indicates the fuel supply is beginning at number 1 cylinder. At this point stop turning the crankshaft and check for a difference between the angle on the timing case cover and the pulley, thus the fuel supply advanced angle can be determined. At this moment, if the mark on the pulley is ahead of that on the timing case cover it indicates that the fuel supply is in advance (and vice versa).

4. If the fuel supply advance angle fails to meet the requirement, loosen the nut on the pump bracket and the flange at the side of the pump and adjust with the kidney hole on the flange. When moving the pump body close to the cylinder block it can increase the fuel supply advance angle (or vice versa).

5. The periphery of the flange on the pump body to be turned for 1 mm of arc length, the fuel supply advance angle can increase or decrease by 1 degree or crankshaft rotation angle.

6. After the fuel pump supply advanced angle has been set, the nuts on the flange at the side of the pump and the screws on the pump bracket should be tightened to the correct torque.

7. Repeat the third step of the operation and check.

Note:
The arc length opposite to 1 degree of rotation angle of the crankshaft = \( \pi D/360 \) (mm) where
\( D \) is the diameter of the pulley in mm.
RSV GOVERNOR - PB PUMP

The RSV governor (see figure) is of the mechanically eccentric type. The governor drawbar device can be simplified into a crank block device, and the break device can be simplified into a rolling guide road device. The load of the spring can be varied by rotating the spring lever via the governor lever, thus changing the speed range. When adjusting the speed, the torque generated by the load of the governor spring on the governor lever is equal to the torque of the centrifugal force at the specified speed. The stroke of the governor hand lever and flyweight can be transmitted to the toothed bar through the lever device. The total fuel quantity limit screw and calibrator are mounted in the governor body. The idle speed stabilising device is mounted in the rear housing. The adjusting screw on the spring lever is used to change the speed governing rate within a certain range.
ROTARY TYPE FUEL PUMPS

Stanadyne rotary pumps DB2 and DB4 are used on certain engine models within the Gamma range. These have mechanical governing (except GWTA6 engines) and incorporate an electrical shut off solenoid.

Characteristics of the DB2 / DB4 pump are:
1. Built in automatic advance system.
2. Electric shut off system.
3. Mechanical governing to 3% regulation.
4. Peak injection pressure to 800 bar (11600 lbf/in²).
ELECTRONIC GOVERNOR

The figure below gives a basic illustration on the principle of electronic speed governing. The solenoid actuator is an actuator of the electronic governor which can control the output displacement of the actuator through controlling a coil current in the solenoid actuator. The electronic actuator drives directly the high pressure fuel pump rack on the engine, thus controlling fuel delivery to the engine and hence controlling engine speed. The speed controller is a full electronic device which can control the engine speed with a rapid and accurate response to the instantaneous load variation.

Electronically controlled governor
OVERVIEW

The G Build engine is specifically designed as a Power generating engine suitable for use in unregulated emissions territories. It is durable, reliable and easy to maintain with oil & filter changes up to 500 hours, dependant on operational conditions. It is designed for continuous operation in ambient temperatures up to 52° (122°F) and a cold start capability down to -32° (-25.6°F).

Note: This engine does not comply with Harmonised International Regulated Emissions Limits.

BASIC ENGINE CHARACTERISTICS

▪ diesel fuelled and approved for operation on biodiesel, that conforms with ASTM D6751 and EN14214, concentrations of up to 20%
▪ direct fuel injection
▪ 4 cylinders
▪ liquid cooled
▪ naturally aspirated

DESIGN FEATURES AND EQUIPMENT

▪ inlet and exhaust manifolds*
▪ fuel lift pump
▪ mechanical governing
▪ self-vent fuel system with individual
▪ fuel Injection pumps
▪ fuel /filter/agglomerator
▪ thermostatically controlled cooling system with belt
▪ driven coolant pump
▪ radiator with pusher fan and belt guard*
▪ gear driven positive displacement type
▪ lubricating oil pump
▪ spin on full flow lubricating oil filter
▪ high inertia flywheel to SAE J620: 7.5" *
▪ SAE 5 flywheel housing *
▪ 12V Starter motor *
▪ 12V battery charge alternator *
▪ oil pressure and coolant temperature switches *
▪ fuel control solenoid (energised to run)*
▪ skid base packing
▪ operators hand book (English)*

OPTIONAL ITEMS

A range of options are available that allows you to select a specification that matches your requirements; Please consult you Lister Petter Power Systems distributor.