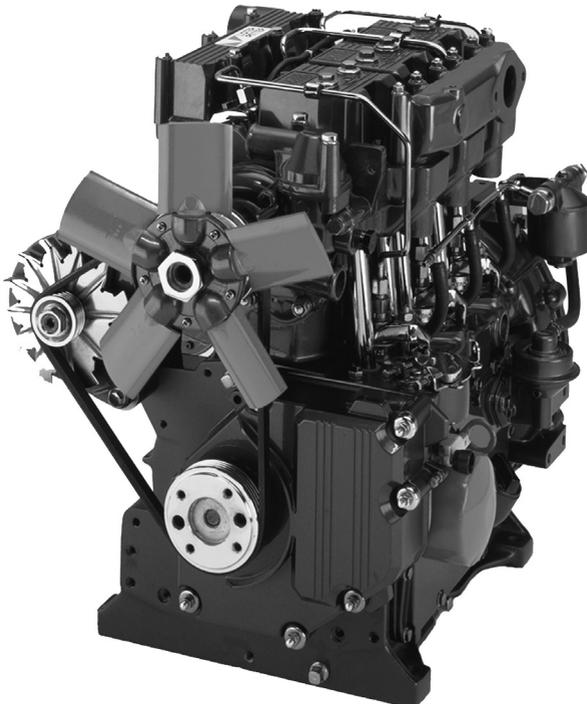




ALPHA Series
NEW ALPHA Series

LPW/LPWS Engine Operators' Handbook



P027-08270

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Associated Publications

Master Parts ManualP027-08041
Workshop ManualP027-08240
Technical Handbook P027-08247

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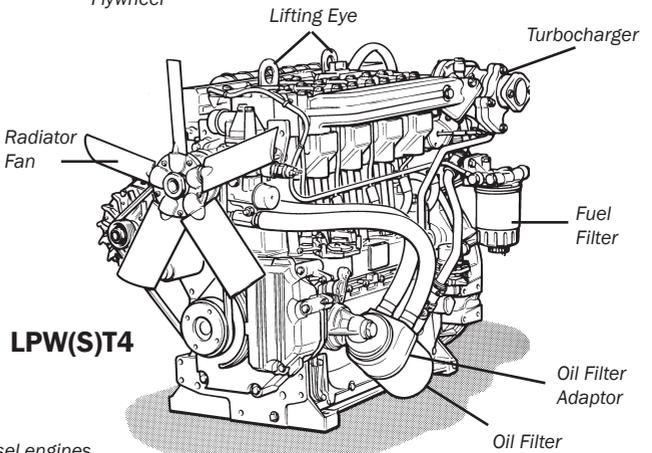
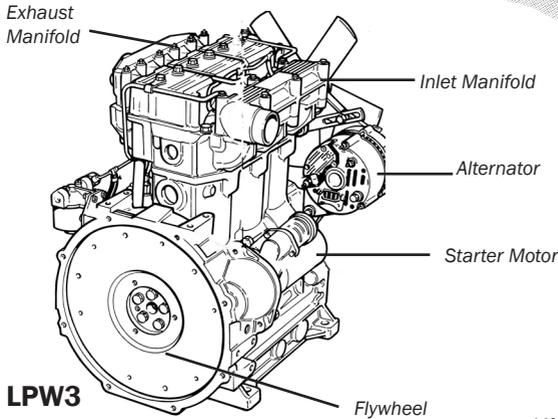
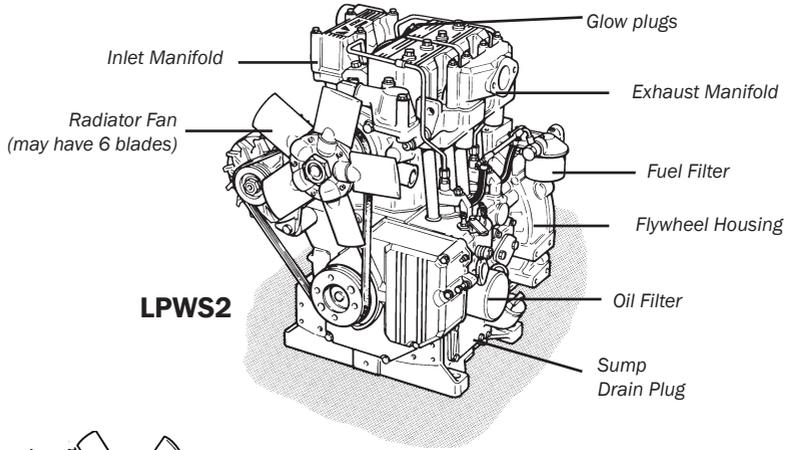
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Contents

Introduction	5	5. Routine Maintenance	16
Engine Identification	5	5.1 Before Starting.....	16
Using this Handbook	5	5.2 Important Instructions	16
Running-in	5	5.3 Maintenance Schedule	16
1. Safety Information	6	How to Service your Engine	16
1.1 General Safety Information		After Servicing	16
Emergency Precautions		5.4 Drive Belt	18
General Precautions		5.5 Cooling System	18
1.2 Personal Safety	6	Draining the Cooling System	18
1.3 Precautions with Chemicals	7	Flushing the Cooling System	18
Fuel and High-Pressure Fluids	7	Filling the Cooling System	18
1.4 Fuel System Precautions	8	Coolant Capacity: Engine Block.....	19
1.5 Precautions with Filters		Coolant Capacity: Radiator	19
and Elements	8	5.6 Lubricating Oil	19
1.6 Precautions with Oil Seals	9	Draining the Oil Sump.....	19
1.7 Precautions with Batteries	9	Refilling the Oil Sump.....	19
1.8 Precautions with Electrical		Changing the Oil Filter.....	20
Systems.....	9	5.7 Fuel System	20
Wiring Cables.....	9	Priming the Fuel System.....	20
Alternator	9	Changing the Agglomerator.....	20
1.9 Waste Disposal Precautions	10	Changing the Fuel Filter	21
1.10 Precautions before Starting ...	10	5.8 Air Cleaner	21
1.11 Lifting Precautions	10	Light-Duty Air Cleaner	21
1.12 Precautions before Maintenance		Cyclonic Air Cleaner	21
10		5.9 Battery	22
2. Technical Data	11	5.10 Long-Term Engine Storage	22
2.1 Combustion Air		Returning the Engine to Service.....	22
2.2 The Cooling System		6. Troubleshooting	23
3. Starting and Stopping	12	6.1 Method of Fault Diagnosis	23
3.1 General Information	12	7. Maintenance Record	25
Start/Stop Control.....	12	Routine Maintenance.....	25
Oil Pressure Switch	12	Non Routine Maintenance	33
Heater and Glow Plugs	12	8. Warranty	37
3.2 Key Start	12	8.1 Standard Warranty Cover	37
Starting LPW2, LPW3 and LPW4.....	12	8.2 Extended Warranty Cover	37
Starting LPWS2, LPWS3, LPWS4	13	8.3 Conditions of Warranty	37
Starting LPWT4	13	8.4 Limitations of Warranty	38
3.3 Failure to Start	13	8.5 Purchase and Registration Details	
3.4 Stopping (All Engines)	13	of your Engine.....	38
4. Engine Fluids	14	8.6 Repairs under Warranty	38
		8.7 Contacting Lister Petter.....	38
		Index	39



2.1 Features of the LPW series diesel engines.

Introduction

This handbook explains the operation and routine maintenance of Lister Petter water-cooled diesel engines in the ALPHA (LPW) and NEW ALPHA (LPWS) series.

Please note that if your engine is part of a generating set, there is a separate operators' handbook for the genset, to explain such features as the control module.

Engine Identification

To identify which model of Lister Petter LPW(S) diesel engine you are using refer to the engine serial number, which is stamped on a plate attached to the engine. It identifies the type and build of the engine (see table below) to enable the correct maintenance procedures to be carried out. Here is a sample serial number:

06 001234 LPWS3 A 402

06 Year code (06 = 2006)

001234 Unique engine number

LPWS3 Engine model

A Anti-clockwise rotation

402 Build number

The illustrations on page 4 show features of the different engine models. When following the instructions in this handbook you will need to be familiar with the parts labelled.

Using this Handbook

Operating or servicing a diesel engine is potentially dangerous. You must not attempt it unless you have the necessary knowledge and experience.

Read each section thoroughly and carefully, taking note of all the information and instructions given. This is for your safety and to ensure the correct maintenance of your engine. For specific aspects of operation and maintenance, use the table of contents (page 1) or the index (page 39) to find the section you need. Where instructions are numbered in sequence, they **must** be followed in that order. This applies in particular to maintenance and repair procedures (sections 5 and 6).

In cases of difficulty, or to obtain spare parts, please consult your local Lister Petter distributor or dealer.

Running-in

To assist running-in all engines are despatched with an initial fill lubricating oil which must be changed after 100 hours. Your engine does not require gradual light-load running-in. Extended light-load running should be avoided, as this could damage the cylinder bore and allow lubricating oil to enter the exhaust system.

LPW Diesel Engine Models

Model	Characteristic features
LPW2	Two cylinders, water-cooled, naturally aspirated, direct injection
LPW3	Three cylinders, water-cooled, naturally aspirated, direct injection
LPW4	Four cylinders, water-cooled, naturally aspirated, direct injection
LPWT4	Four cylinders, water-cooled, direct injection, turbocharged
LPWS2	Two cylinders, water-cooled, naturally aspirated, indirect injection, emission-compliant
LPWS3	Three cylinders, water-cooled, naturally aspirated, indirect injection, emission-compliant
LPWS4	Four cylinders, water-cooled, naturally aspirated, indirect injection, emission-compliant
LPWST4	Four cylinders, water-cooled, naturally aspirated, indirect injection, turbocharged, emission-compliant

1. Safety Information

Read the information in this section carefully and follow all the advice given. Pay especial attention to the cautions and warnings demonstrated below, which are used throughout this handbook.

CAUTION

This caution draws attention to special information or procedures which must be correctly observed, to avoid damage to, or destruction of, equipment.

WARNING

This warning draws attention to special information or procedures which must be strictly observed. Failure to do so may result in personal injury.

WARNING

THIS WARNING DRAWS ATTENTION TO SPECIAL INFORMATION OR PROCEDURES WHICH MUST BE STRICTLY OBSERVED. FAILURE TO DO SO MAY RESULT IN SERIOUS INJURY OR DEATH.

1.1 General Safety Information

Starting and operating any diesel engine is potentially dangerous. Do not attempt to do so unless you have the necessary knowledge and experience. Ensure that anyone attempting to start and operate your diesel engine has been properly trained and instructed in the correct procedures.

CAUTION

Follow all safety instructions accurately.

Carefully read and follow all safety information and instructions in this manual.

Observe the safety and informative symbols on your engine and equipment.

Emergency Precautions

- Be prepared with suitable equipment and knowledge in case a fire starts.
- Identify a location from which calls to the emergency services can be made if necessary.
- Ensure a third party knows where you are working and when you leave the working area.

General Precautions

- Ensure the engine is securely mounted.
- Ensure that there is a generous supply of cooling and combustion air available.
- Keep the engine and surrounding area clean.
- Some accessories may require guards which must be supplied and fitted by the purchaser. Keep all safety guards in position.
- Do not make any unauthorised modifications as these may affect the safe operation of the engine and put the operator at risk.

1.2 Personal Safety

- Wear personal protective clothing and safety equipment appropriate to the work being done.
- Keep clear of moving parts at all times.

WARNING

KEEP THE BODY AND CLOTHING CLEAR OF MOVING OR HOT PARTS AT ALL TIMES. CONTACT OF MOVING PARTS WITH UNPROTECTED SKIN CAN CAUSE SEVERE BURNS. ENTANGLEMENT WITH ROTATING EQUIPMENT CAN CAUSE SERIOUS INJURY OR DEATH.

- Tie long hair back securely.
- Wear close-fitting clothing.
- Do not wear a necktie, scarf, loose clothing or necklace when working close to a running engine.

- Where possible, remove rings and other jewellery to prevent entanglement in moving parts. These items could also cause a short circuit if any part of the electrical system is being worked on.

WARNING

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

- Wear suitable ear protection against objectionable or uncomfortable loud noise.
- To avoid loss of concentration, do not use music or radio headphones while operating an engine.
- When undertaking maintenance, do not work under any plant that is only held by overhead lifting equipment.
- Where appropriate, make sure that guards are properly fitted.

1.3 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.

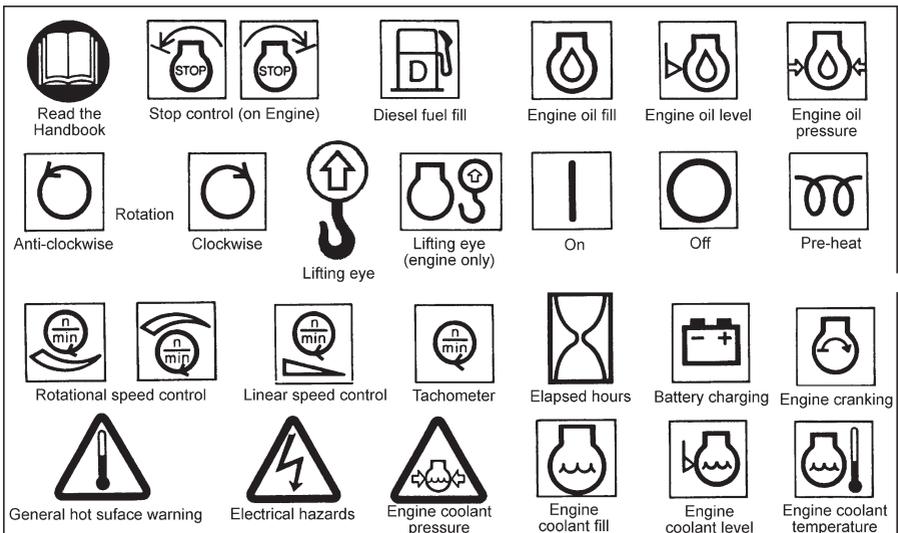
Manufacturers' safety data sheets will provide specific details of the physical and health hazards, safety and emergency procedures and any necessary personal protection equipment required while working with hazardous materials.

- Handle fluids with care at all times.
- Rectify any fuel, coolant or oil leak as soon as is practicable and clean up any spillages when they occur.
- Remove any build-up of grease, oil or debris.
- If any fluid other than lubricating oil comes into contact with the skin, clean off immediately. In the case of lubricating oil, clean off as soon as is practicable.

Fuel and High-Pressure Fluids

- Store fuel and other flammable liquids away from fire hazards.
- Always stop the engine before refuelling.

1. Safety Symbols This figure identifies the ISO 8999 symbols currently used by Lister Petter.



1. Safety Information

- Do not overfill the fuel tank.
- When working with fuel do not smoke or work near to heaters or other fire hazards.
- High-pressure fluids are extremely hazardous. Never allow any part of the body to come into contact with high-pressure fuel oil, compressed air or hydraulic oil, for example when testing fuel injection equipment.

WARNING

Do not expose pressurised containers to heat, and do not incinerate or puncture them.

WARNING

NEVER TOUCH OR INGEST HIGH-PRESSURE FLUIDS SUCH AS HYDRAULIC OIL, COMPRESSED AIR OR FUEL OIL. THIS COULD LEAD TO SERIOUS INJURY, OR DEATH.

1.4 Fuel System Precautions

WARNING

NEVER ALLOW ANY UNPROTECTED SKIN TO COME INTO CONTACT WITH THE INJECTOR SPRAY AS FUEL MAY ENTER THE BLOODSTREAM WITH FATAL RESULTS.

WARNING

Never make unauthorised adjustments to the emission-compliant fuel injection pumps. This could be dangerous and invalidates warranty claims. In the USA unauthorised adjustment of emission critical components is prohibited by Federal Law, incurring civil penalty.

- When priming or checking the fuel injection pump timing, care must be taken to wipe any spilled fuel from the outside of the engine.
- Always fit a new joint when a union has been disturbed.
- Special care must be taken to see that there is no leakage from the joints of the

fuel pipe connection to the pump.

- When tightening or loosening fuel injection pump delivery connections use two spanners to prevent un-sealing of fuel pump delivery valve holders.
- When refitting the fuel pipe from the pump to the injector, the connection to the injector must be tightened before the connection to the fuel pump. This procedure will ensure that there is no leakage from these joints.
- It is most important that all fuel joints are tight and leak proof.
- Always fill the fuel tank through a fine strainer. It is best to do this at the end of the engine work period so that any sediment stirred up has time to settle before the engine is used again, and the risk of condensation contaminating the fuel is minimised. If using a can, avoid tipping out the last few drops.
- Funnels are very difficult to keep clean in dusty conditions. Wash them before and after use and wrap them up when not required, or fill the tank direct from a small-mouthed screw-capped can.
- The fuel injection equipment is manufactured to very accurate limits and the smallest particle of dirt will destroy its efficiency.

CAUTION

Keep the fuel free from water and contaminants.

1.5 Precautions with Filters and Elements

- 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, wash your hands thoroughly.

WARNING

Do not allow fuel or new or used lubricating oil to come into contact with unprotected skin. It is dangerous and could cause skin irritation.

WARNING

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

1.6 Precautions with Oil Seals

Some engines may be fitted with seals or 'O' rings manufactured from Viton or a similar material. When these substances are exposed to abnormally high temperatures, in excess of 400 °C (752 °F), an extremely corrosive acid is produced.

WARNING

IF AN OIL SEAL CONTAINING VITON (OR SIMILAR MATERIAL) DEGENERATES, IT PRODUCES AN EXTREMELY CORROSIVE ACID THAT CANNOT BE REMOVED FROM THE SKIN. IF YOU SEE SIGNS OF DECOMPOSITION, OR ARE IN DOUBT, WEAR DISPOSABLE HEAVY-DUTY GLOVES.

- If in any doubt about an oil seal, always wear disposable heavy-duty gloves.

1.7 Precautions with Batteries

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

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

WARNING

Take especial care with batteries, which contain highly corrosive sulphuric acid which is poisonous, will burn skin and clothing, and 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 fresh water and seek medical aid.

1.8 Precautions with Electrical Systems

- Ensure that the battery is of sufficient capacity to start the engine down to 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 the engine 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 so as to avoid any possibility of chafing taking place.

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.
- Never disconnect the battery unless the

1. Safety Information

engine has stopped and all switches are 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 to check the current flow.
- 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.

1.9 Waste Disposal Precautions

- Extreme care must be taken to ensure that waste oil, fuel, filter elements, coolant concentrate, battery electrolyte, solvents or other toxic wastes are disposed of in accordance with local regulations to prevent contamination.

WARNING

To avoid contamination and personal injury, never dispose of toxic or other waste except in accordance with official regulations.

1.10 Precautions before Starting

WARNING

Starting any diesel engine can be dangerous in the hands of inexperienced people. Engine operators must be instructed in the correct procedures before attempting to start any engine.

- Ensure that the engine is free to turn without obstruction.
- Check that the lubricating oil level is correct. The oil sump must be filled to the 'full' mark on the dipstick; do not overfill.
- Check that the radiator is filled to within 13-25 mm (0.5-1.0 in) below the neck of the radiator filler.

- Check that the fuel supply is adequate and the system is primed.
- Ensure that the battery is connected, fully charged and serviceable.
- Where possible, disengage the driven equipment while starting.

1.11 Lifting Precautions

Engine lifting eyes are fitted to ALPHA and NEW ALPHA engines. The following points must be considered before attempting to lift the engine.

- Ensure any lifting equipment to be used has the correct capacity to lift the engine.
- Ensure that the lifting equipment is designed to give a vertical lift from directly above the engine lifting eye.
- Check that the engine lifting eyes are not damaged and that they are secure.
- The engine lifting eyes are suitable for lifting the engine and accessory assemblies originally fitted by Lister Petter.

WARNING

Engine lifting eyes must not be used to lift the complete plant.

WARNING

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

1.12 Precautions before Maintenance

- Understand the service procedures before commencing any work.
- Ensure all starting devices are removed or isolated before beginning any work on engine or plant.
- Ensure the work area is clean, dry, well ventilated and has adequate lighting.
- Ensure that all persons using equipment or processes in connection with the maintenance of plant and machinery have received adequate and suitable training.

2. Technical Data

Table 2 gives technical data for all the engines in the Lister Petter ALPHA (LPW) and NEW ALPHA (LPWS) range.

2.1 Combustion Air

Engine performance is affected by **ambient temperature**, which is taken to mean the temperature of the air entering the engine.

The temperature of the combustion air is measured at the air inlet manifold, or the air cleaner, and the temperature of the cooling air is measured at the radiator fan inlet. The higher of these two temperatures is taken as being **ambient temperature** as far as engine ratings are concerned.

Every effort should be taken to ensure that the air cleaner draws in combustion air at a consistent ambient temperature.

Lister Petter LPW, LPWT, LPWS and LPWST engines are able to run satisfactorily at ambient temperatures up to the standard engine reference condition of 25 °C (77 °F) without derating. If the combustion air temperature rises above this temperature, the rated power must be reduced in accordance with the relevant standard:

LPW/LPWT ISO 3046

LPWS ISO 14396

Generating Sets ISO 8528

The maximum permitted ambient temperature is 52 °C (125 °F).

2.2 The Cooling System

Cooling is by a radiator with water circulation being assisted by an engine mounted, centrifugal, belt driven water pump using a single belt.

2. Technical data for Lister Petter LPW and LPWS engines.

Technical Data				
LPW series model		LPW2, LPW3, LPW4	LPW(S)T4	LPWS2, LPWS3, LPWS4
Rotation		Anticlockwise (when looking on the flywheel)		
Type of injection		Direct		Indirect
Firing order:	2 cylinders	1 - 2	n/a	1 - 2
	3 cylinders	1 - 2 - 3	n/a	1 - 2 - 3
	4 cylinders	1 - 3 - 4 - 2	1 - 3 - 4 - 2	1 - 3 - 4 - 2
Electrical system		12v negative earth		
Starter battery charging		12v engine-mounted alternator		
Oil pressure	at idle	1.0 bar (14.5 lbf in ²)		
	3000 r/min ¹	2.0 bar (29.0 lbf in ²)	2.5 bar (36.3 lbf in ²)	2.0 bar (29.0 lbf in ²)
Oil sump capacity		Refer to table 5.6.3a: Sump Capacity (page 19).		
Coolant capacity		Refer to table 5.5: Engine Block Coolant Capacity (page 18).		

Note: 1. Oil Pressure at 3000 r/min is with the oil at 110 °C (230 °F).

3. Starting and Stopping

The following information is of a general nature and should be read in conjunction with the manufacturers' instructions for any other equipment you are using.

⚠ WARNING

Do not attempt to start or operate a diesel engine unless you have been properly trained. Read the safety information in section 1 and the information below on controls and the starting procedures.

⚠ CAUTION

DO NOT USE ETHER-BASED COLD-START AIDS UNDER ANY CIRCUMSTANCES.

⚠ WARNING

DO NOT BREATHE EXHAUST GASES. THEY CONTAIN CARBON MONOXIDE, A COLOURLESS, ODOURLESS GAS THAT CAN CAUSE UNCONSCIOUSNESS AND DEATH.

⚠ CAUTION

On LPWT4 engines, ensure that the turbocharger housing is full of oil. Failure to do so can result in serious damage to the bearing. Run on 'no load' after starting for 30 seconds, to ensure an adequate oil supply to the turbocharger, and for 30 seconds before stopping to allow the heat from the bearing to dissipate.

3.1 General Information Start/Stop Control

The basic engine has a plastic knob fitted to the control. Other variants for automatic or remote operation are available.

Engines not fitted with a fuel control solenoid have a spring clip to hold the engine control in the stop position.

⚠ WARNING

Use suitable hand protection when stopping the engine, as the stop control may be hot after prolonged running.

Oil Pressure Switch

If an oil-pressure switch bypass button is fitted it must be depressed during engine cranking, and until the engine attains full speed.

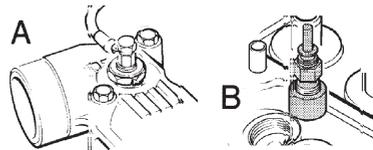
Heater and Glow Plugs

LPW: a 345 W heater plug (A) may be fitted to the inlet manifold.

LPWT4: a 696 W heater plug (A) is fitted in the inlet manifold.

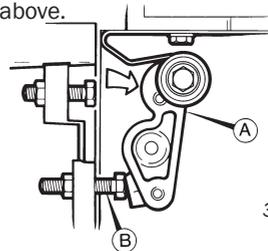
LPWS: a 12v glow plug (B) is fitted in each cylinder and a 696 W heater plug (A) is also fitted in the inlet manifold as standard.

3.1 Heater and glow plugs. A: Manifold heater plug. B: Cylinder glow plug.



3.2 Key Start

Before starting your engine read the cautions, warnings and the general information above.

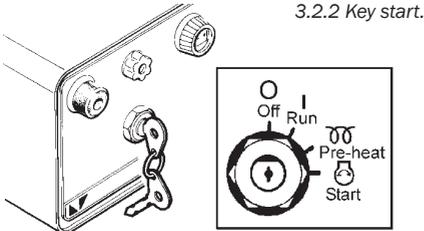


3.2.1 Start control.

Starting LPW2, LPW3 and LPW4

1. With reference to figure 3.2.1, move the engine control lever (A) clockwise until it is against the stop screw (B).
2. On variable speed engines move the speed control to the fast position.
3. Turn the key clockwise to the **start** position. Immediately the engine starts the key must be turned anticlockwise to the **run** position.

3. Starting and Stopping



3.2.2 Key start.

4. On variable speed engines reduce the engine speed as necessary.

Starting LPWS2, LPWS3, LPWS4

1. With reference to figure 3.2.1, move the engine control lever (A) clockwise until it is against the stop screw (B).
2. On variable speed engines move the speed control to the fast position.
3. For ambient starting temperatures above -10°C (14°F) turn the key clockwise and hold it in the **preheat** position for 5 to 10 seconds before turning it to the **start** position.
For ambient starting temperatures below -10°C (14°F) turn the key clockwise to the **preheat** position for 15 to 20 seconds before turning the key to the **start** position.
Immediately the engine starts the key must be turned anticlockwise to the **run** position.
4. On variable speed engines reduce the engine speed as necessary.

Starting LPWT4

1. With reference to figure 3.2.1, move the engine control lever (A) clockwise until it is against the stop screw (B).
2. On variable speed engines move the speed control to the fast position.
3. For ambient starting temperatures above -10°C (14°F) turn the key clockwise and hold it in the **preheat** position for 10 to 15 seconds before turning it to the **start** position.
For ambient starting temperatures below -10°C (14°F) turn the key clockwise to the **preheat** position for 15 to 20 sec-

onds before turning the key to the **start** position.

Immediately the engine starts the key must be turned anticlockwise and held in the **preheat** position until the engine has attained full speed.

4. When the engine has attained full speed turn the key anticlockwise to the **run** position.
5. On variable speed engines reduce the engine speed as necessary.

3.3 Failure to Start

Should the engine fail to start within 30 seconds, release the key and, after allowing sufficient time for all moving parts to stop, attempt to restart.

3.4 Stopping (All Engines)

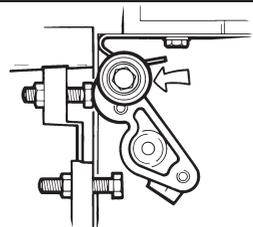
CAUTION

It is recommended that LPWT4 engines run on 'no load' for 30 seconds before stopping to allow the heat from the turbocharger bearing to dissipate.

1. If possible, remove the load from the engine.
2. If a variable speed control is fitted reduce the engine speed.
3. On engines fitted with a fuel control solenoid turn the key to the **off** position.
On engines not fitted with a fuel control solenoid move the engine control lever anticlockwise into the **stop** position (figure 3.4) and turn the key to the **off** position.

CAUTION

Turning the key to the off position alone will not stop the engine unless a fuel control solenoid is fitted.



3.4 Stop control.

4. Engine Fluids

4.1 Fuel Specification

The engine must be used only with diesel fuel oil that conforms to one of the following:

- BS 2869:1988 Class A2;
- BS EN590:1995 Class A1;
- USA Specification ASTM D-975-77 Grades 1-D and 2-D;
- BSMA 100 Class M1 for marine use.

The fuel must be a distillate and not a residual oil or blend.

Vaporising oils are not suitable as fuels for Lister Petter engines.

4.1.1 LPWS Bio

LPWS Bio is a specially developed engine range that will run on B100 (100% biofuel) as well as on those fuels specified above.

CAUTION

Although the engines may operate on fuels outside the above specifications, such operation may result in excessive wear and damage.

CAUTION

It is of the utmost importance to keep fuel free from water and other contaminants. The fuel injection equipment is manufactured to very accurate limits, and the smallest particle of dirt will destroy its efficiency.

4.2 Oil Specification

To assist running-in, all engines are despatched with an initial fill lubricating oil which must be changed, with the filter, after the first 100 hours.

All subsequent oil changes must be as specified in 5. *Routine Maintenance*.

- The temperatures cited in figure 4.3 are the ambient temperatures at the time when the engine is started (see 2.2

Combustion Air). If monograde oils are used and running ambient temperatures are significantly higher than starting temperatures, a higher viscosity oil should be selected, subject to satisfactory starting performance. Multigrade oils may be used to overcome the problem.

- Where ambient temperatures are variable and it is not practical to continually change oils accordingly, a suitable multigrade oil is recommended to ensure adequate starting performance at the lowest temperature likely to be encountered.
- The engines must be run on heavy-duty lubricating oils. Straight mineral oils are not suitable, neither are oils of less detergency than specified.
- API CF-4, API CG-4, API CH or API CI oils must be used in all engines.
- For engines in long-running installations Lister Petter should be consulted.

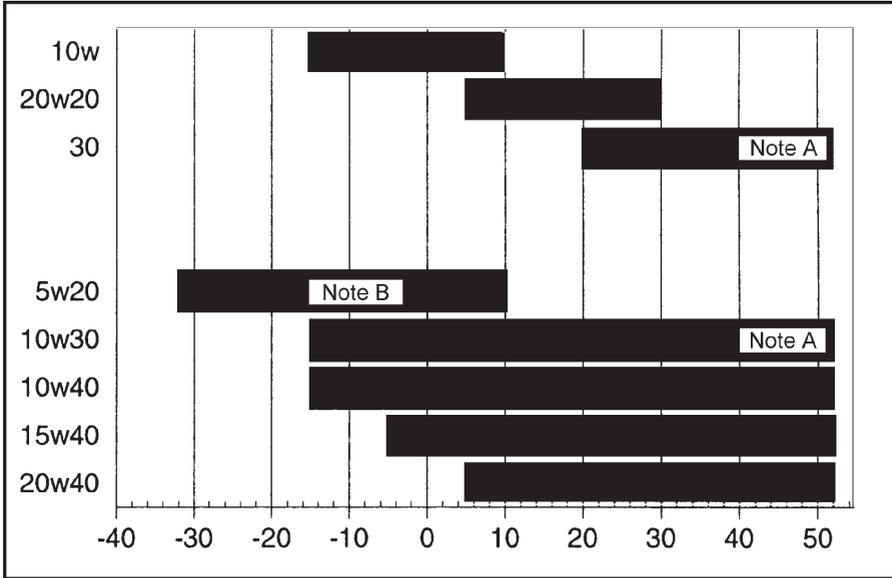
Oil Viscosity

Figure 4.3 shows the recommended oil viscosity ranges for various °C ambient temperatures from cold start to maximum running.

Non-synthetic oils at very low temperatures will suffer from wax crystallisation, so synthetic oils are recommended for these conditions.

SAE 5W-20 oils are recommended on the basis that they are fully synthetic and are technically suitable for use up to 25 °C (77 °F). (Monograde SAE 5W is not normally available as a synthetic oil therefore does not appear in the chart.)

SAE 30 and 10W-30 oils may be used at up to 52 °C (126 °F), but oil consumption may be affected. 10W-40, 15W-40 and 20W-40 multigrades are recommended for continuous full-load operation at this temperature. (Monograde SAE 40 oils are not recommended.)



4.2 Recommended oil viscosity grades for different temperature ranges.

Note A: intermittent running; note B: synthetic oils only. NB. The formula for conversion from degrees Fahrenheit to degrees Centigrade is $^{\circ}\text{F} = (1.8 \times ^{\circ}\text{C}) + 32$.

In order to maintain the cold-starting characteristics of any recommended grade it is essential that oil changes are made within the Lister Petter recommendations (see 5. Routine Maintenance).

An oil change is recommended immediately if the engine fails to reach its normal cold-start cranking speed owing to excessive oil viscosity.

CAUTION

Dilution of the lubricating oil with fuel will adversely affect cold starting and will increase oil consumption.

4.3 Coolant* Mixture Concentration

To determine the amount of coolant concentrate to be added, first calculate the total coolant capacity by adding together the engine and radiator volumes (see 5.5.4 Coolant Capacity).

A 50% concentration of coolant additives by volume must be maintained under all operating conditions. If a component fails due to an incorrect coolant concentration being used it will not be covered by the LP warranty.

When topping up coolant please ensure that the "top up" is of the correct concentrate mix and not just water.

The specification of the coolant concentrate should comply with one of the following:

- BS6580 : 1985;
- MIL-A-11755D;
- MIL-A-46153/B.

* Coolant defined as the combination of water, corrosion inhibitor and antifreeze.

5. Routine Maintenance

This section is designed primarily for use by trained technicians but it does contain sufficient information, illustrations and detail to allow the operator to perform basic maintenance work.

WARNING

Routine maintenance must be performed by qualified personnel who are conversant with the hazards of oil, fuel, electricity and machinery.

This work can be carried out only if the necessary hand and service tools are available. When the user has insufficient tools, experience or ability to carry out adjustments, maintenance and repairs this work should not be attempted.

Where accurate measurements or torque values are required they can only be made using calibrated instruments.

CAUTION

Under no circumstances should makeshift tools or equipment be used, as their use may adversely affect safe working procedures and engine operation.

These recommendations and instructions cover several engine models, therefore they are of a general nature.

The engine may include optional equipment not specifically covered in this book.

5.1 Before Starting

Before starting any dismantling procedure read *1. Safety Information and Precautions*. Consider the following:

- Do you know and understand the engine and all the related systems?
- Do you have sufficient electrical and mechanical knowledge and skills to understand the symptoms?
- Do you have suitable electrical diagnostic equipment available?
- Do you have, or have access to, the necessary Lister Petter spare parts?

5.2 Important Instructions

- Remove the battery before carrying out any maintenance work on an engine.
- Disconnect the battery and alternator before commencing any electric welding when a pole strap is directly or indirectly connected to the engine.
- Fuel pumps and injectors can only be checked and set off the engine using suitable specialist test equipment.

5.3 Maintenance Schedule

The table on page 17 sets out the frequency with which maintenance and servicing tasks should be performed. This is the minimum frequency required to keep your engine running at peak performance with trouble-free operation.

The instructions are based on average operating conditions. Air cleaners, lubricating oil and fuel filters will require more frequent attention if conditions are very dusty. Decarbonising may be required more often if the engine has been running on light loads for long periods.

How to Service your Engine

Instructions are given in the remaining sections of this chapter.

After Servicing

- It is essential to ensure that nuts and bolts are tightened to the torques specified in the Workshop Manual.
- When re-assembling an engine lubricate all moving parts with engine oil.
- Renew nuts and bolts that have been taken from high-stress locations. In particular nuts and/or bolts from the connecting rods should be renewed.

CAUTION

Long periods of light or 'no load' running early in the engine's life may lead to cylinder bore glazing and high oil consumption.

Maintenance Schedule

At all times

Continuously monitor engine performance.

Observe the correct oil and filter change periods as specified below.

1. Oil and Filter Change Periods (hrs=hours)

Ambient temperature	LPWS(T)	LPWT	LPW
	Every:	Every:	Every:
Above 35°C (95°F)	125 hrs	125 hrs	250 hrs
Up to 35°C (95°F)	250 hrs	250 hrs	500 hrs

Every Day

Check the level and condition of lubricating oil.

Check the coolant level.

Check the level and supply of fuel.

Examine the cooling fan for damage.

Clean the air cleaner if the engine is operating under very dusty conditions.

After the first 100 hours

Marine propulsion engines: check idling speed and reset if necessary.

Change the initial fill lubricating oil¹.

Renew the oil filter.

Every 125 hours¹

Do all the above, and the following:

Clean the air cleaner if the engine is operating under moderately dusty conditions.

Check for fuel, coolant and oil leaks.

Check the serviceability of the battery.

Every 250 hours¹

Do all the above, and the following:

Check the condition and tension of the radiator drive belt.

Check the radiator fins for contamination or blockage.

Clean the fuel injector nozzles if exhaust is dirty.

Renew the fuel filter element if the fuel is not perfectly clean.

Every 500 hours

Do all the above, and the following:

Renew the fuel filter element.

Renew the air cleaner element.

Check the air induction systems for leaks, damage and restrictions.

Change the lubricating oil¹.

Renew the oil filter¹.

LPWT4: Clean the crankcase breather canister and hoses.

Every 1000 hours

Do all the above, and the following:

Check all external nuts, bolts and unions for tightness.

Ensure that all guards are firmly attached and are not damaged.

Replace the fuel-lift pump diaphragm.²

Every 2000 hours

Do all the above, and the following:

Drain and clean the engine-mounted fuel tank, if fitted.

Check the engine and speed controls for free movement.

Clean and check, and if necessary replace, the fuel injector nozzles.

Check the radiator fins and radiator fan blades for damage.

Replace the radiator fan drive belt, irrespective of its condition.

Check the lubricating oil pressure.

Renew the air cleaner element.

Every year

Drain, flush and refill the cooling system, adding new coolant concentrate to a 40% concentration.

Drain and replace the lubricating oil and filter, irrespective of their condition, if the engine has run for less than 250 hours in the preceding twelve months.

On marine engines, change the air cleaner element if it was not changed at the prescribed intervals.

Every two years

Replace the coolant hoses, irrespective of their condition.

When necessary

Undertake a decade/major overhaul.

1. See also Table 1 above. 2. Inspect more frequently if fuel is contaminated. Inspect regularly on engines in low-duty cycle applications, for example, stand-by generating sets.

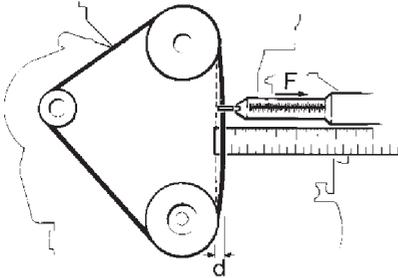
5. Routine Maintenance

5.4 Drive Belt

The tension of the drive belt (see figure 5.4) must be checked:

1. After the first 50 hours;
 2. Every 250 hours;
 3. After an overhaul when the belt is refitted or replaced.
 4. The drive belt must be replaced every 2000 hours, irrespective of its condition.
- When a new belt is correctly fitted and tensioned, a force (F) of 31.0–33.5 N (7.0–7.5 lbf) is required to deflect it a distance (d) of 3.5 mm (0.14 in).

On subsequent checking and adjustment a force (F) of 22.0–24.0 N (5.0–5.4 lbf) is required to deflect it a distance (d) of 3.5 mm (0.14 in).



5.4 Checking drive-belt tension. F denotes force and d denotes distance.

5.5 Cooling System

Draining the Cooling System

⚠ WARNING

The cooling system is pressurised and extreme care must be taken when removing the radiator cap if the engine is hot.

1. Place a suitable container under the radiator bottom hose if the coolant is to be retained.
2. Slacken the clips of the hose and slide the hose off.
3. Remove the radiator filler cap.
4. Allow sufficient time for the system to drain.

Flushing the Cooling System

1. With the bottom hose removed, flush the radiator through the filler with clean fresh water, preferably using a hose pipe, until clean water emerges.
2. With the top and bottom hoses removed from the engine, flush the engine through the top hose with clean fresh water, preferably using a hose pipe, until clean water emerges.
3. Replace the hoses.

Filling the Cooling System

⚠ CAUTION

Under some circumstances an air lock can occur when filling the system, causing a false level indication.

1. Ensure the hoses have been replaced.
2. Refill the system with clean fresh water and coolant concentrate to a 40% concentration while bleeding air from the system at a suitable point. The radiator should be filled to within 13.0–25.0 mm (0.5–1.0 in) below the neck of the radiator filler.
3. Run the engine for a short time and check the coolant level.

Coolant Capacity: Engine Block

Table 5.5.

Engine Block Coolant Capacity			
	LPW2 LPWS2	LPW3 LPWS3	LPW4 LPWT4 LPWS(T)4
litres	2.1	2.5	3.0
pints	3.7	4.4	5.3
US gallons	0.55	0.66	0.79

Coolant Capacity: Radiator

There are a number of radiator options available for LPW, LPWT and LPWS engines, including some which may not have been originally fitted by Lister Petter.

For these reasons it is advisable to ascertain the radiator capacity which must

then be added to that given in the table above under *Engine Block* before determining the amount of coolant concentrate to be added to maintain a 40% concentration.

The capacity of hoses on remote radiator applications must also be taken into consideration.

5.6 Lubricating Oil

Check the lubricating oil daily using the dipstick, and top up when necessary with oil of the correct type and specification (see section 4.2 *Oil Specification*). Table 5.6.3b gives the capacity between the dipstick marks of all engines in the LPW range.

Capacity Between Dipstick Marks			
	LPW2 LPWS2	LPW3 LPWS3	LPW4 LPWT4 LPWS(T)4
All builds except 28, 51, 52, 57, 58, 59			
litres	0.90	0.95	1.20
pints	1.58	1.67	2.11
US gallons	0.24	0.25	0.32
Builds 28, 51, 52, 57, 58, 59			
litres	1.50	1.75	2.20
pints	2.64	3.08	3.87
US gallons	0.39	0.46	0.58

Table 5.6.1.

Change the lubricating oil and filter for the first time at 100 hours and then as specified in 5.3. *Maintenance Schedule* (table 1).

CAUTION

Continuous operation under heavy loads in ambient temperatures above 35 °C (95 °F) causes the oil to deteriorate more quickly.

Draining the Oil Sump

Before draining the oil read 1.5 *Precautions with Filters and Elements* and 1.6 *Precautions with Oil Seals*.

The oil sump drain plugs are located on the oil filter side and the gear end of the crankcase. It is better if the engine has been run immediately before draining, as the warm oil will drain more quickly.

1. Remove the oil filler cap.
2. Remove the drain plug and allow the oil to run into a suitable retainer.
3. Clean the drain plug threads and coat them with Hylomar PL32/M, Loctite 572 or Hylogrip 760.
4. Replace the plug and tighten it.

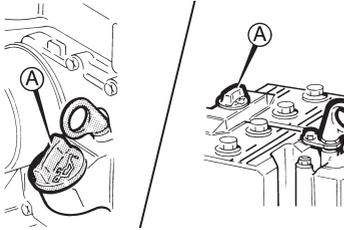
Refilling the Oil Sump

Table 5.6.3a gives the sump capacity (excluding the filter) of all engines in the LPW range.

Sump Capacity			
(Figures exclude the filter)			
	LPW2 LPWS2	LPW3 LPWS3	LPW4 LPWT4 LPWS(T)4
All builds except 28, 51, 52, 57, 58, 59			
litres	3.00	3.75	5.50
pints	5.28	6.60	9.68
US gallons	0.79	0.99	1.45
Builds 28, 51, 52, 57, 58, 59			
litres	5.85	8.25	11.5
pints	10.29	14.52	20.23
US gallons	1.55	2.18	3.03

Table 5.6.3.

5. Routine Maintenance



5.6.1 The oil filler (A) and dipstick handle.

1. Ensure the new oil meets the correct specification and viscosity, as given in 4.2 *Oil Specification*.
2. Fill the sump through the oil filler (A) to the upper mark on the dipstick.
3. Start the engine and run it for a few minutes to circulate the oil.
4. Stop the engine and allow time for the oil to drain down. Check the level on the dipstick.
5. Add more oil if necessary.

CAUTION

Do not overfill with oil. If a cylinder-head oil filler is fitted the oil must only be poured into the filler at a rate which enables it to drain into the crankcase. If the oil is poured in too quickly it can flood the crankcase breather holes and escape into the inlet manifold and cylinders.

Changing the Oil Filter

The full-flow filter is a spin-on cartridge type located on the crankcase door.

Only approved filters should be used, as these have high-temperature-resistant joints, adequate filter paper characteristics and a rigid case. Other filters may have the same external dimensions and thread as the genuine one but may fail in service.

Before changing the filter read 1.5 *Precautions with Filters and Elements*.

1. Use a band-type gripping tool to remove the filter from the engine.
2. Lightly grease or oil the face of the rubber joint on the new filter.

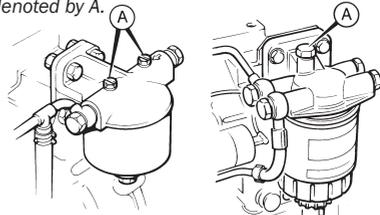
3. Screw the new filter onto the crankcase filter adaptor, or filter mounting bracket facing, until the rubber joint just makes contact with the crankcase facing of mounting bracket.
4. Screw the filter on a further quarter to half a turn.
5. Start the engine and run it for a few minutes to circulate the oil.
6. Stop the engine and allow time for the oil to drain down and check the level on the dipstick.
7. Add more oil if necessary.

5.7 Fuel System

Priming the Fuel System

1. Ensure there is sufficient fuel.
2. Figure 5.7.1 shows the two types of filter. Release the bleed screws (A) on the filter and re-tighten when no further air bubbles are expelled.
3. On variable speed engines move the speed control to the fast position.
4. Move the engine **stop/run** control from the **stop** to the **run** position (figure 3.3.2, page 13).
5. Operate the fuel-lift pump by hand.

5.7.1 Priming the fuel filter: the bleed screws are denoted by A.



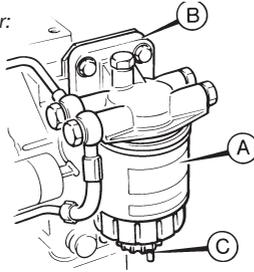
Changing the Agglomerator

Before starting, read 1.5 *Precautions with Filters and Elements* and study figure 5.7.2.

1. Before removing the agglomerator cartridge (A) from the agglomerator head (B) you should first drain the water from the agglomerator by unscrewing the drain tap (C).
2. Using a suitable strap wrench, unscrew the cartridge (A) from the head (B).

5. Routine Maintenance

5.7.2. The agglomerator: cartridge (A); head (B); drain tap (C).



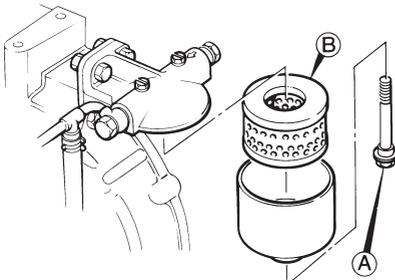
3. Screw a new cartridge onto the head and hand-tighten it.

Changing the Fuel Filter

The element should be renewed every 500 hours, or more frequently if for any reason the fuel is known to be dirty.

Before changing the filter read *1.5 Precautions with Filters and Elements*.

1. Isolate the fuel supply or drain the tank.
2. Unscrew the centre bolt (A) of the filter assembly.
3. Discard the old element (B) and fit a replacement.
4. Fill the fuel tank and prime the system (see 5.7.1 *Priming the Fuel System*).
5. Run the engine and check to see that no fuel is leaking from the filter.



5.7.3 Changing the fuel filter. The centre bolt is denoted by A and the old element by B.

5.8 Air Cleaner

Every effort should be taken to ensure that the air cleaner draws in combustion air at the prevailing ambient temperature.

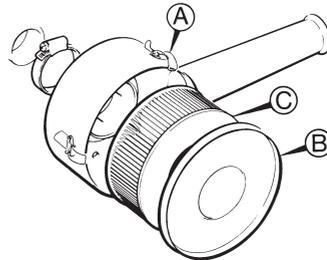
Any increase in combustion air tempera-

ture above the standard engine reference condition of 25°C (77°F) will incur an engine derate factor.

Light-Duty Air Cleaner

The snout is normally fitted lying horizontally and pointing towards the gear end, although the cleaner itself can be rotated through 360°.

1. Release the three cover clips (A).
2. Lift off the cover (B).
3. Lift out the element (C).
4. Fit a new element.
5. Replace the cover and clips.

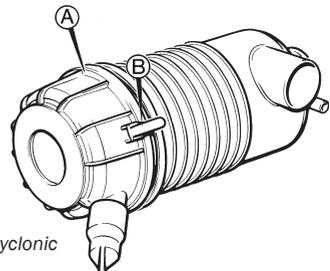


5.8.1 The light-duty air cleaner.

Cyclonic Air Cleaner

A cyclonic air cleaner can be remote or engine-mounted over the flywheel housing. In either case it is connected to the engine by a moulded rubber hose secured by jubilee clips.

1. Regularly remove the dust cap (A) and empty out all the dust.
2. Gain access to the paper element by undoing the two over-centre clips (B).
3. Remove the element.



5.8.2 The cyclonic air cleaner.

5. Routine Maintenance

4. Clean the element by directing a low-pressure compressed-air nozzle up and down the pleats from inside the element.
5. Inspect the element for damage by placing a suitable light source inside it. If the element is found to have any holes it must be replaced.

5.9 Battery

Check the battery as follows.

1. Wear protective gloves and goggles.
2. Clean the top of the filler-plug area.
3. Remove the filler plugs and check that the electrolyte level is 6.0–9.0 mm (0.25–0.37 in) above the tops of the separators.
4. If necessary, top up with distilled water. In cold weather distilled water should only be added immediately before running the engine.
5. Replace and tighten the filler plugs.
6. Check that the terminal connections are tight; petroleum jelly will help to protect them from corrosion.



CAUTION

BATTERIES CONTAIN SULPHURIC ACID WHICH CAN CAUSE SEVERE BURNS AND PRODUCE EXPLOSIVE GASES. IF ACID IS SPLASHED ON THE SKIN, EYES OR CLOTHES FLUSH WITH COPIOUS AMOUNTS OF FRESH WATER AND SEEK IMMEDIATE MEDICAL AID.

5.10 Long-Term Engine Storage

If the engine is not required for a period of a few weeks it should be run on full load for approximately 45 minutes once a month.

If the engine will not be required for some months, prepare it for storage as follows.

CAUTION

As a direct result of combustion the lubricating oil may contain harmful acids and therefore it should not be left in the sump if it is known that the engine will not be used for extended periods.

1. Replace the fuel in the tank with a small supply of suitable inhibition fluid.
2. Drain the lubricating oil from the sump and refill with new oil.
3. Run the engine for a period to circulate the oil through the system and to ensure the inhibition fluid is passed through the fuel pumps and injectors.
4. Stop the engine, drain the cooling system and drain the lubricating oil from the sump.
The crankshaft should **not** be turned until the engine is again required for service.
The inhibition fluid should be left in the fuel system.
5. Seal all openings on the engine with tape.
6. Remove the batteries and store them fully charged after coating the terminals with petroleum jelly.
7. Grease all external bright metal parts and the speed control linkage.
8. Tie labels on to the engine, clearly stating what steps have been taken to inhibit the engine during storage.

Returning the Engine to Service

Refer to the appropriate sections for the relevant detailed instructions necessary to complete this work.

1. Remove the tie-on labels and all the protective coverings from openings and apertures.
2. Check the drive belt for deterioration and correct tension.
Check to ensure that the drive-belt pulley grooves are free from corrosion.
3. Fill the fuel tank.
4. Refill the cooling system, adding new coolant to a 40% concentration.
5. Refill the oil sump with new oil of the correct specification and viscosity.
6. Remove the batteries from store and recharge them if necessary. Reconnect them to the engine.
Coat the terminals with petroleum jelly.
7. Start the engine and check for coolant, fuel and oil leaks before applying load.

6. Troubleshooting

When an engine does not operate as expected it can be difficult to diagnose the cause. The table in this chapter suggests a number of possible causes of various problems, together with recommended solutions. The operator should check carefully which of these applies in a particular case. Many of the suggested solutions can be carried out by the operator, guided by section 5. *Routine Maintenance*. Where indicated¹ you should seek assistance from an experienced engineer (who must refer to the Workshop Manual). The list is of a general nature as it covers the basic engine; your particular application may be different.

Before starting any maintenance procedure please read 1. *Safety Information and Precautions*, taking especial note of 1.8.

6.1 Method of Fault Diagnosis

1. Diagnose the problem by checking and eliminating the easiest causes first. In the case of electrical problems always check the battery first.
2. Double-check your observations.
3. Carry out the recommended solution, or request an engineer to do this.

A comprehensive list of problems and the methods of correction is given in the Workshop Manual. If you are in any doubt, contact your Lister Petter distributor.

Troubleshooting		
Problem	Cause	Solution
Difficulty starting or failure to start	Incorrect starting procedure.	Refer to section 3.
	Unsuitable lubricating oil or fuel.	Refer to section 4.
	No fuel in the tank or the filter is choked.	Refill the tank and prime the fuel system or replace the filter.
	Air in the fuel system.	Prime the fuel system.
	Water or dirt in the fuel system.	Drain, flush, refill and prime the fuel system.
	Faulty injector or pump.	Replace the injector or pump or have it serviced.
	Discharged battery or poor battery connections.	Recharge or replace the battery. Check the terminals are tight.
Starter motor does not operate	Fuel control solenoid not energised.	Check the shutdown devices of the electrical system. ¹
	Loose or corroded connections.	Clean and tighten the connections.
	Worn out battery.	Replace the battery.
Battery will not charge	Faulty starter panel or connections.	Adjust the connections and/or replace the panel.
	Loose or corroded connections.	Clean and tighten the connections.
	Worn-out battery.	Replace the battery.
Engine speed unstable	Loose alternator drive belt.	Replace or re-tension the drive belt.
	Poor quality fuel.	Drain, flush, refill and prime the fuel system.
	Fuel system restriction.	Replace fuel filter.
	Restriction in induction system.	Replace air cleaner element.
	Fault in fuel lift pump.	Replace diaphragm and/or pump. ¹

1. Requires an experienced engineer.

6. Troubleshooting

Troubleshooting		
Problem	Cause	Solution
Overheating	Radiator fan belt too slack.	Adjust belt tension.
	Overload.	Reduce the load.
	Lubricating oil level too low.	Refill the sump.
	Recirculation of exhaust gases or cooling air.	Redesign exhaust and ventilation system. ¹
	Radiator cooling fins blocked.	Clean the fins of all obstruction.
	Low level of coolant.	Check for leaks and refill.
	Cooling system obstructed.	Drain, flush and refill the system.
Engine stops	Lack of fuel.	Check the system. ¹ Refill the tank.
	Air in the fuel system.	Prime the fuel filter.
	Water in the fuel system.	Drain, flush, refill and prime the fuel system.
	Choked fuel filter.	Replace the filter.
	Choked air filter.	Dismantle and clean the cap and element.
	Overload.	Reduce the load.
	Overheating.	See Overheating section.
	Loss of compression.	Check the piston rings and the valves. ¹
	Loss of electrical supply to the fuel pump solenoid.	Check the electrical feed. ¹
Automatic shutdown, if protective devices are fitted.	Investigate the cause and rectify. ¹	
Lack, or loss, of power	Loss of compression.	Check the piston rings and the valves. ¹
	Choked air filter.	Dismantle and clean the cap and element.
	Poor quality fuel.	Drain, flush, refill and prime the fuel system.
	Choked exhaust system.	Dismantle and clean. ¹
	Overload.	Reduce the load.
	Choked fuel filter.	Replace the filter.
	Worn engine.	Give the engine a major overhaul. ¹
Undercharging	Excessive electrical load from added accessories.	Remove accessories or fit higher output alternator. ¹
	Poor electrical connections to alternator or battery.	Inspect, clean and rectify the cause.
	Faulty battery.	Test and recharge or replace.
	Faulty alternator.	Test and if necessary replace.
Overcharging	Faulty alternator.	Test and if necessary replace.
Battery requires excessive amounts of water	Battery case leaking.	Clean surrounding area and replace the battery.
	Defective battery.	Test or replace the battery.
	Battery charging rate is too high.	Check the alternator output and battery charging system. ¹

7. Maintenance Record

Your Lister Petter engine must be properly maintained using the timings and procedures described in this manual. You must be familiar with the routine tasks set out in 5. *Engine Servicing*, and their correct frequency as described in 5.3 *Maintenance Schedule*. Details of the maintenance work carried out on the engine during the first 5000 hours, except the daily checks, must be recorded in the spaces allocated in this section: pages 21-5 for routine maintenance and pages 26-8 for records of non-routine maintenance.

7.1 Routine Maintenance

Hours run	Work done by	Details of service	Distributor/Dealer Stamp	Date

7. Maintenance Record: Routine Maintenance

Hours run	Work done by	Details of service	Distributor/Dealer Stamp	Date

7. Maintenance Record: Routine Maintenance

Hours run	Work done by	Details of service	Distributor/Dealer Stamp	Date

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7. Maintenance Record: Routine Maintenance

Hours run	Work done by	Details of service	Distributor/Dealer Stamp	Date

7. Maintenance Record: Routine Maintenance

Hours run	Work done by	Details of service	Distributor/Dealer Stamp	Date

7.2 Non-Routine Maintenance

Hours run	Work done by	Details of non-routine service	Distributor/Dealer Stamp	Date

7. Maintenance Record: Non-Routine Maintenance

Hours run	Work done by	Details of non-routine service	Distributor/Dealer Stamp	Date

7. Maintenance Record: Non-Routine Maintenance

Hours run	Work done by	Details of non-routine service	Distributor/Dealer Stamp	Date

7. Maintenance Record: Non-Routine Maintenance

Hours run	Work done by	Details of non-routine service	Distributor/Dealer Stamp	Date

8. Warranty

On receipt of your engine please fill in the section on page 38. This information will be required in the event of a claim under your two-year warranty, according to the conditions set out below.

8.1 Standard Warranty Cover

The standard warranty includes two-year/5000-hour cover for all non-serviceable¹ 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 8.3 *Conditions of Warranty* and the limitations set out in 8.4 *Limitations of Warranty*.

8.2 Extended Warranty Cover

In order to extend the warranty period beyond the initial two-year period you must register the engine with a Lister Petter dealer within 28 days of receipt. A list of dealers is available at www.lister-petter.co.uk.

The extended warranty gives five-year/5000-hour cover, beginning on the date of delivery to the original retail purchaser, and is transferable. It includes the following:

Years 1 and 2: all non-serviceable¹ components, parts and labour.

Year 3: core engine², parts and labour.

Year 4: core engine, parts and labour.

Year 5: core engine, parts only.

8.3 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 7. *Maintenance Record*. Servicing must be by approved dealers or competent engineers. The conditions of warranty are:

- 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 service parts must be used.
- When Lister Petter parts are purchased from a dealer, this must be noted, with the dealer's stamp, in 7. *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 engine.
- Evidence will be required of engine hours run and should be entered in 7. *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.

Continued

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.*

8. Warranty

- The installation should be in accordance with data supplied by the Lister Petter Applications Department.
- Long-term light-load and cold-engine running will invalidate the warranty.

8.4 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).

8.5 Purchase and Registration Details of your Engine

Please fill in the section below with your purchase and registration details. This information will be required in the case of a claim under warranty.

8.6 Repairs under Warranty

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

8.7 Contacting Lister Petter

Lister Petter Limited, Dursley GL11 4HS, England; telephone +44 (0)1453 546732; website www.lister-petter.co.uk.

Engine Serial Number:

Purchased from:

.....

.....

Purchase Date:

Date Registered with Lister Petter:

Plant Type:

Plant Number:

Index

agglomerator	20-1	filter element	8, 21	sump, draining/filling..	19-20
air cleaner		priming	20	viscosity	15
cyclonic	21-2	glow plugs	12	problem-solving.....	23-4
light-duty	21	heater plug	12	running-in	2
ambient temperature.....	13	key parts	3	safety precautions	6-10
battery	9, 22, 23, 24	lubricating oil.....	See oil	safety symbols	7
belt tension	18	maintenance		serial number	5
cold start	15	routine servicing	16-22	servicing, routine.....	16-22
coolant capacity	11, 18-19	schedule	17	starting	
cooling system	11, 18-19	record	23-36	LPW	12-13
dipstick	19, 20	models	2, 4, 5	LPWS	12-13
filling	18	oil		LPWT4	12-13
flushing	18	change periods	19	stopping	13
drive-belt tension	18	filter	8, 19	storage	22
failure to start	13, 23	filter change periods	19	technical data	11
fuel specification	14	pressure switch	12	temperature, ambient	13
fuel system	20-21	specification	14-15	troubleshooting	23-4
agglomerator	20-21	sump capacity	19	warranty	37-8

CALIFORNIA

Proposition 65 Warning

Engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

**ALPHA (LPW and LPWS including LPWS Bio)
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UK

Lister Petter Limited, Dursley, Gloucestershire GL11 4HS England
Tel: +44 (0)1453 544141; Fax: +44 (0)1453 546732
E-mail: sales@lister-petter.co.uk <http://www.lister-petter.co.uk>

USA

Lister Petter Americas Inc. 815 E. 56 Highway, Olathe, Kansas 66061 USA
Tel: +1 913 764-3512; Fax: +1 913 764-5493
E-mail: info@lister-petter.com; <http://www.lister-petter.com>

FRANCE

Lister Petter France, 17 Avenue de l'Escouvrier, Zone d'Activites,
95842 Sarcelles Cedex, France
Tel: +33 (0)1 39330420; Fax: +33 (0)1 34195760
E-mail: commercial@lister-petter-france.fr

INDIA

Lister Petter Private Limited, 102 Beaver Gradeur, Baner, Pune 411045 India
Tel: +91 20 729 3284; Fax: +91 20 729 3287

CHINA

Lister Petter China, Jinan Fuqiang Power Co. Ltd,
Shandong Zhangqiu Industrial Area, Jinan 250220, P.R. China
Tel: +86 531 8558 4852; Fax: +86 531 8558 4820