THE 'T' SERIES OPERATORS HANDBOOK

HANDBOOK CONTENTS

1. GENERAL INFORMATION

CONTENTS

1.1 Introduction

The purpose of this handbook is to lay down operating guidelines for the current TS, TR and TX engine ranges.

The specification details given apply to a range of engines and not to any one particular engine, in cases of difficulty the user should consult the local Lister-Petter Distributor or Dealer for further advice and technical assistance.

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, Distributor or 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, and 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.

1.2 How to use this Operators Handbook

It is recommended the individual steps contained in the various maintenance or repair operations are followed in the sequence in which they appear.

When a diesel engine is operating or being overhauled there are a number of associated practices which may lead to personal injury or product damage.

Your attention is drawn to the symbols shown and described below which are applied throughout this publication.

⚠ CAUTION

This caution symbol draws attention to special instructions or procedures which, if not correctly followed, may result in damage to or destruction of equipment.

⚠ WARNING

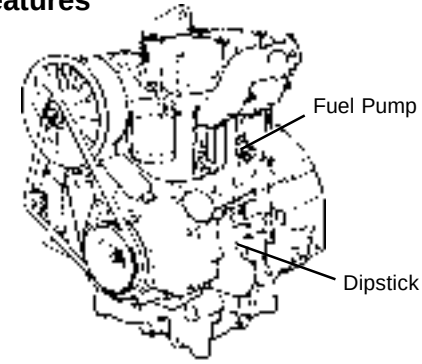
This warning symbol draws attention to special instructions or procedures which, if not strictly observed, may result in personal injury.

⚠ WARNING

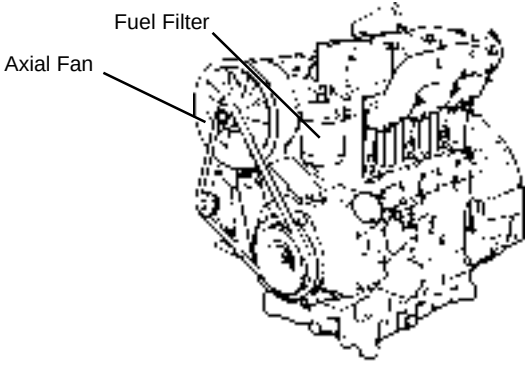
A WARNING SYMBOL WITH THIS TYPE OF TEXT DRAWS ATTENTION TO SPECIAL INSTRUCTIONS OR PROCEDURES WHICH, IF NOT STRICTLY OBSERVED, MAY RESULT IN SEVERE PERSONAL INJURY, OR LOSS OF LIFE.

Note:
A note is used to draw your attention to additional or important information.

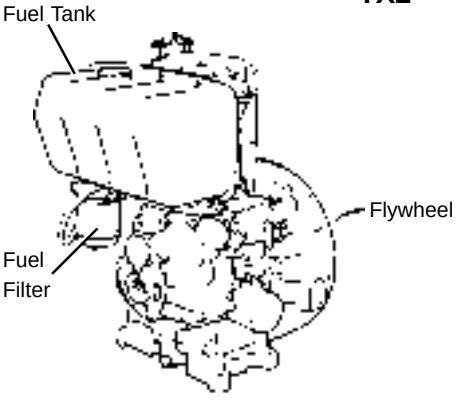
1.3 Engine Features



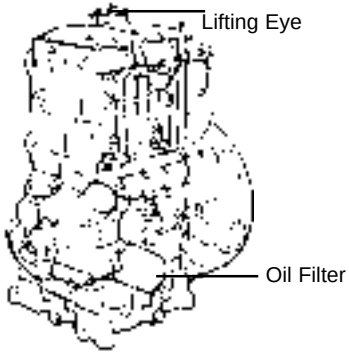
TX2



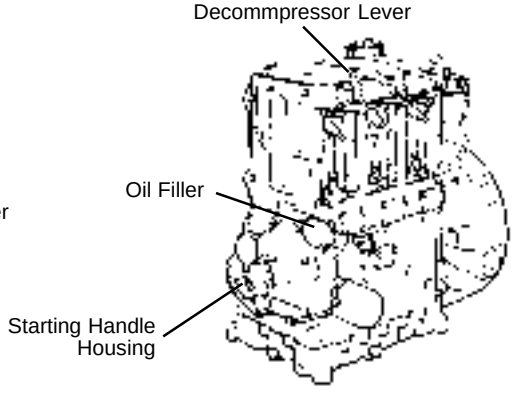
TX3



TS/TR1



TS/TR2



TS/TR3

1.4 Safety Precautions

The following safety precautions are of a general nature more specific precautions appear where they are relevant.

⚠ 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.

1.4.1 Before Starting Precautions

- Ensure 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' or 'max' mark on the dipstick; do not overfill.
- 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.

1.4.2 Alternator Precautions

The following points must be strictly observed when charge windings are fitted otherwise serious damage can be done.

- 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.

  A short circuit or reversal of polarity will ruin diodes and transistors.
- Never connect a battery into the system without checking that the voltage and polarity are correct.
- Never flash any connection to check the current flow.
- Never experiment with any adjustments or repairs to the system.
- The battery and charge windings must be disconnected before commencing any electric welding when a pole strap is directly or indirectly connected to the engine.

⚠ WARNING

Starting engines that are fitted with charge windings which have been disconnected from the battery will cause irreparable damage unless the stator leads from the rectifier/regulator have been removed.

1.4.3 Starter Battery Precautions

- Do not smoke near the batteries.
- Keep sparks and flames away from the batteries.
- Batteries contain sulphuric acid - if the acid has been splashed on the skin, eyes or clothes flush it away with copious amounts of fresh water and seek medical aid.
- Keep the top of the battery well ventilated during charging.
- Disconnect the battery negative (earth) lead first and reconnect last.
- Switch off the battery charger before disconnecting the charger leads.
- Never 'flash' connections to check current flow.
- Never experiment with adjustments or repairs to the system.
- A damaged or unserviceable battery must never be used.

1.4.4 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.
- Keep all safety guards in position.
- Keep the body and clothing clear of all moving or hot parts.
- Never allow any part of the body to come into contact with high pressure fuel oil, for example when testing fuel injection equipment.
- Thoroughly clean any lubricating or fuel oil from the skin as soon as practicable after contact.
- Rectify all fuel and oil leaks as soon as practicable and clean any spillages when they occur.
- Engine lifting eyes must not be used to lift the complete plant.

1.4.5 Lifting Precautions

The following points must be considered before attempting to lift the engine.

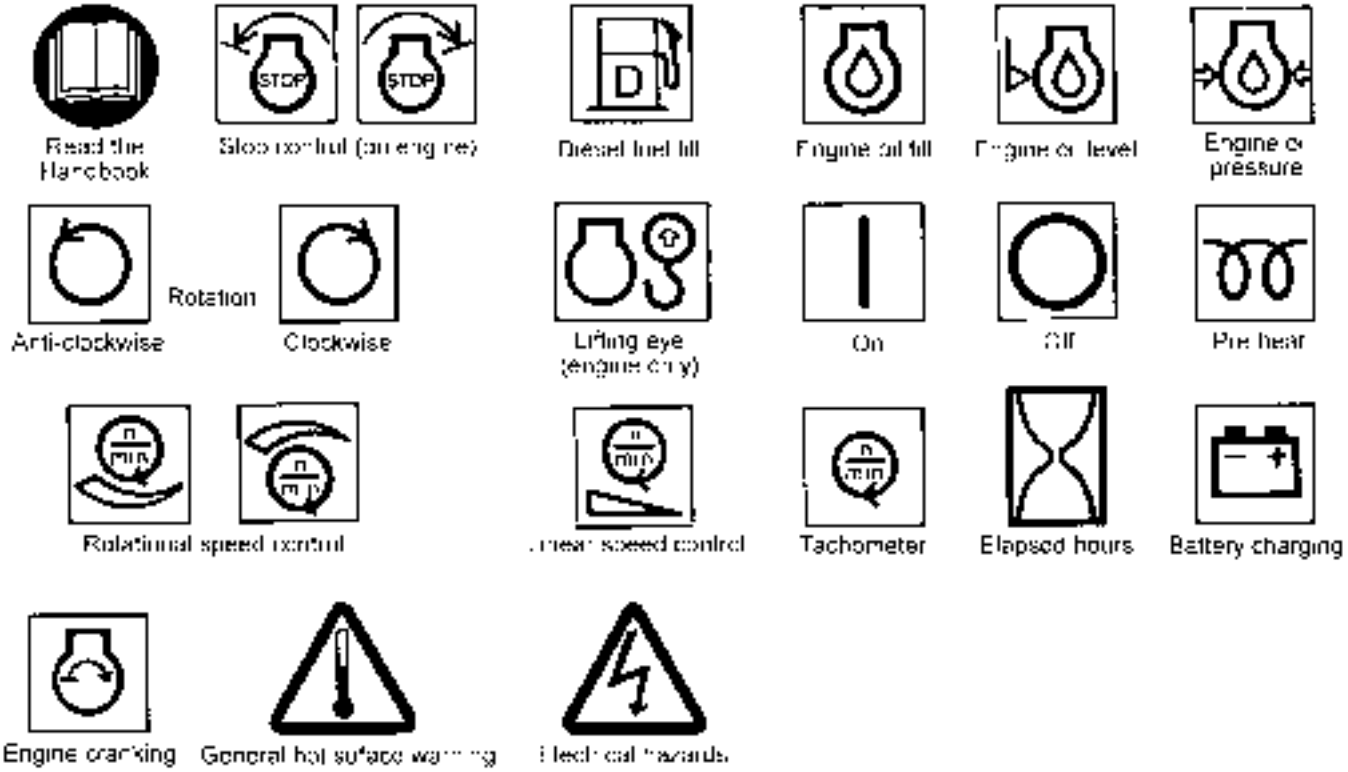
- Ensure the lifting equipment to be used has the correct capacity to lift the engine.
- Single lifting equipment must only be used when a single lifting eye is fitted.
- When two engine lifting eyes are fitted suitable lifting equipment designed to give two vertical lifts from directly above the engine lifting eyes must be used.
- Check that the engine lifting eyes are not damaged and that they are secure.
- To prevent damage to the cylinder head cover ensure that there is clearance between the lifting equipment hooks and the cover.

⚠ WARNING

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

1.5 Safety Symbols

This section identifies the ISO 8999 symbols currently used by Lister-Petter.



1.6 Caring for Your new Engine

This handbook has been supplied with your new engine to help assist you in the correct operation and maintenance of your engine.

To obtain the best performance from your engine you must ensure that all the instructions given in "7.11 Maintenance Schedule" are correctly carried out at the prescribed intervals.

Some maintenance work can only be carried out 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 then this work should not be attempted.

1.7 Running-in

A gradual running-in of a new engine is not necessary. Extended light load running early in the life of the engine may cause detrimental damage to the cylinder bore allowing lubricating oil to enter the exhaust system.

Maximum load can be applied to the engine as soon as it enters service.

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

⚠ WARNING

Starting any diesel engine can be dangerous in the hands of inexperienced people.

Before attempting to start any engine the operator should read the "1.4 Safety Precautions" and be conversant with the use of the engine controls and the correct starting procedures.

1.8 Engine Serial Number

The engine serial number is stamped on a plate attached to the engine. It is necessary to identify the type and build of each engine to enable the correct maintenance procedures, as described later in this publication, to be carried out.

Serial Number Code

49 ..... Year of manufacture code
00123 ..... Consecutive number of engine
TS3 ..... Model
A ..... Anti-clockwise rotation
01 ..... Build of engine

For future reference write your engine serial number in the box below.

1.9 Nomenclature

TS and TR - one, two and three cylinder, direct injection, naturally aspirated flywheel fan air cooled diesel engines.

TX - two and three cylinder, direct injection, naturally aspirated, axial fan air cooled diesel engines.

1.10 Builds

The engines within each range have been assembled to pre-determined configurations. Where the build number is preceded by a 9 this indicates that the engine is either of a non-standard configuration, or contains non-standard parts or accessories.

When new parts are required for such a build it is suggested that reference be made to Lister-Petter to determine the exact engine specification and which parts are non-standard.

1.11 Rotation

The rotation of all engines is anti-clockwise when looking on the flywheel.

1.12 Idling Speed

Variable speed engines should be set to idle at 850r/min.

1.13 Air Cleaner

Medium and heavy duty dry type cleaners are available for all engines and mounted oil bath air cleaners are available for TS and TR engines.

⚠ CAUTION

Under no circumstances must the engine be run without an air cleaner.

1.14 Battery Charging System

A 12 volt system with an engine mounted battery charging facility is available.

A 24 volt option is available on TX engines.

1.15 Lifting the Engine

The lifting plates/eyes fitted to the engine are designed to lift the engine plus fitted accessories and must not be used to lift the complete plant.

1.16 Guards

Special accessories may require special guards which must be supplied and fitted by the purchaser.

1.17 Lubricating Oil Pressure

TS/TR - 2.0 bar (29.9 lbf/in^2).
TX - 1.25 bar (18.0 lbf/in^2) nominal at 1500r/min.

1.18 Fuel Tank Capacity

	litres	pints	US qts
TS/TR1	8.2 13.5	14.5 23.7	8.7 14.2
TS/TR/TX2	13.5	23.7	14.2
TS/TR/TX3	25.0	43.9	26.3

1.19 Exhaust

⚠ WARNING

Unprotected skin and combustible materials must not be allowed to come into contact with the exhaust system.

⚠ WARNING

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

It is important to ensure that exhaust gases are not sucked in by the air cleaner or the cooling fan otherwise premature choking will occur.

1.20 Engine Controls

⚠ WARNING

After prolonged running, metal parts of the stop control may become hot; it is advisable to use suitable hand protection when stopping the engine.

Remote or engine mounted variable, two speed and stop controls are available for all engines.

1.21 Ambient Temperature

From the aspect of engine performance, the temperature of the air entering the engine is the only criterion of ambient temperature.

The power developed by the engine, depends on the temperature of the combustion air measured at the air manifold inlet (or the air cleaner), and the temperature of the cooling air as measured at the cooling air inlet.

The higher of these two temperatures is taken as being the “Ambient Temperature” as far as engine ratings are concerned.

The engines are able to run satisfactorily at Ambient Temperatures up to 25°C (77°F) without derating. Above this temperature the rated power must be reduced in accordance with the relevant ISO, BS or DIN Standards.

The maximum temperature is 52°C (125°F) and if it is desired to run at higher temperatures the local Lister-Petter Distributor or Dealer should be consulted.

2. STARTING AND STOPPING - INDUSTRIAL

CONTENTS

2.1 Preliminary Instructions

The following operating instructions are of a general nature and should be read in conjunction with, or substituted by, the equipment manufacturers instructions.

⚠ WARNING

Starting any diesel engine can be dangerous in the hands of inexperienced people.
Before attempting to start any engine the operator should read "1.4 Safety Precautions" and be conversant with the use of the engine controls and the correct starting procedures.

⚠ CAUTION

ETHER BASED COLD START AIDS IN AEROSOL CANS MUST NOT BE USED UNDER ANY CIRCUMSTANCES.
Systems may be fitted, except on TX engines, to allow a measured quantity to be injected into the inlet manifold, but these must be used in accordance with the manufacturers instructions.

⚠ WARNING

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

2.2 Starting Handle Precautions

A non-limited kick-back handle (A) or limited kick-back handle (B) system may be fitted to the engine.

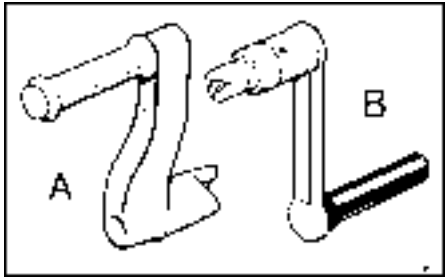


Figure 2.2.1 The Starting Handle

⚠ WARNING

Do not attempt to use a handle if it is damaged in any way.

- The two types of handle are not interchangeable and care must be taken to ensure the correct type is retained with the engine.
- Always use the correct starting handle which has been designed for the engine.
- Ensure there are no burrs on that part of the handle which fits onto the engine.
- Ensure the handle grip is clean, dry and free to turn on its shaft.
- Clean and lightly oil that part of the handle which fits onto the engine.
- Firmly hold the handle grip, **with the thumb on top of the grip**, during the starting procedure.

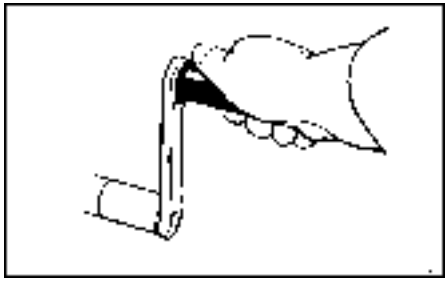


Figure 2.2.2 Holding the Starting Handle

2.3 Automatic Excess Fuel Device

'T Series' engines are fitted with an automatic excess fuel device which becomes operative, ready for the next start, when the engine is stopped.

If the engine stops other than by the operation of the engine control, the control must be turned anti-clockwise to the 'STOP' position and released before the device can operate.

As the engine runs up to speed the excess fuel device will automatically reset to the normal running position.

2.4 Cold Starting Aid - TS/TR

The cold starting aid may be fitted to the combustion air intake ports and is used when the ambient temperature is below -10°C (14°F).

1. With the fuel turned on, turn the engine for up to 20 revolutions to prime the fuel and lubrication systems.
2. Withdraw the plunger (A) and fill one third of the cup (B) with the same type of lubricating oil as used in the engine

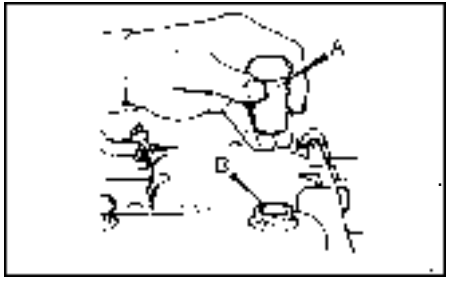


Figure 2.4.1 Cold Start

3. Replace the plunger and inject the oil just before starting the engine.

⚠ CAUTION

The device must not be used more than three times in succession during the same attempt to start the engine.

2.5 Hand Starting

Before attempting to start the engine refer to "2.2 Starting Handle Precautions".

1. Select the excess fuel position by turning the engine control lever anti-clockwise to the 'STOP' position and releasing it.

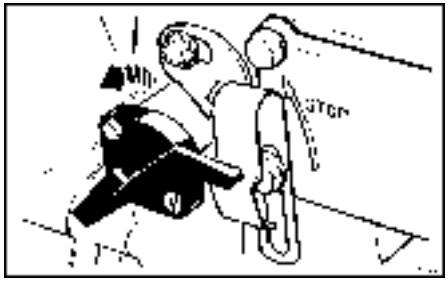


Figure 2.5.1 The Engine Control

2. If a variable speed control lever is fitted move it to the fast position.
3. Move the decompressor lever towards the flywheel.

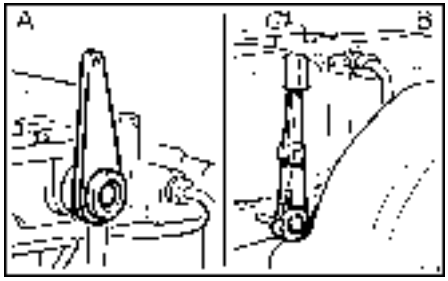


Figure 2.5.2 Decompressor Lever
A - TS/TR
B - TX

4. If the ambient temperature is below -10°C (14°F) refer to "2.4 Cold Starting Aid - TS/TR".

5a. **If using a non-limited kick-back handle:**
Insert the correct handle, refer to 'A' in 'Figure 2.2.1', into the starting housing.

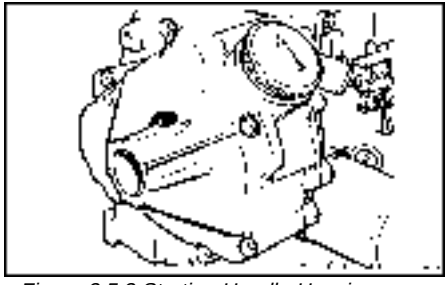


Figure 2.5.3 Starting Handle Housing

Slowly rotate the handle in the direction of cranking until it fully engages.

5b. **If using a limited kick-back handle:** Swivel the starting handle housing cover (A) to one side and insert the the correct handle, refer to 'B' in 'Figure 2.2.1', into the housing.

Slowly rotate the handle in the direction of cranking until it fully engages.

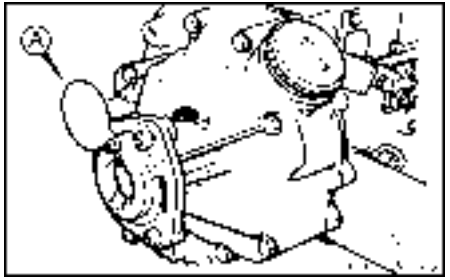


Figure 2.5.4 Starting Handle Housing

6. If the cold starting aid was not used turn the engine slowly for up to 20 turns to prime the combustion chamber and lubricating oil system.
7. Firmly hold the handle grip, with the thumb on top of the grip as shown in 'Figure 2.2.2', and crank the engine really fast, when sufficient speed is obtained move the decompressor lever towards the gear end and continue to crank until the engine fires.

Retaining a firm grip on the handle remove the handle from the housing.

⚠ WARNING

Do not pull the starting handle away from the engine while cranking.

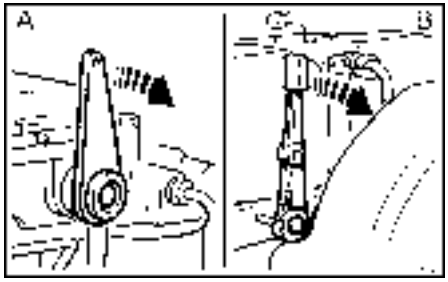


Figure 2.5.5 Decompressor Lever
A - TS/TR
B - TX

8. If a variable speed control is fitted reduce the speed as required.

2.6 Electric Starting

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

If the engine fails to start within 30 seconds, release the key, or start button, and attempt to restart after allowing sufficient time for all moving parts to stop.

1. Check that the decompressor lever, if fitted, is towards the gear end.

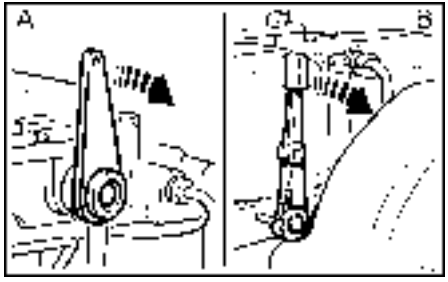


Figure 26.6.1 Decompressor Lever
A - TS/TR
B - TX

2. Turn the engine control lever anti-clockwise to the 'STOP' position and release it.

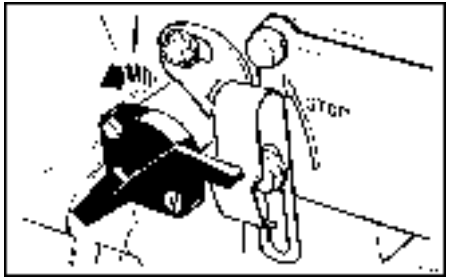


Figure 2.6.2 The Engine Control

3. If a variable speed control lever is fitted move it to the fast position.
4. If the ambient temperature is below -10°C (14°F) refer to items 2. and 3. in "2.4 Cold Starting Aid - TS/TR".

5a. **If a start key is being used:**
Turn the start key clockwise and hold it at position '3', until the engine fires and then release it immediately.

Figure 2.6.3 Start Key

5b. **If a starter button is being used:**
Press the starter button until the engine fires and then release it immediately.

6. Turn the engine control lever anti-clockwise to the 'RUN' position.
7. If a variable speed control is fitted reduce the speed as required.

2.7 Stopping the Engine

1. On engines not fitted with a fuel control solenoid, turn the engine control anti-clockwise to the 'STOP' position and hold it there until the engine comes to rest.

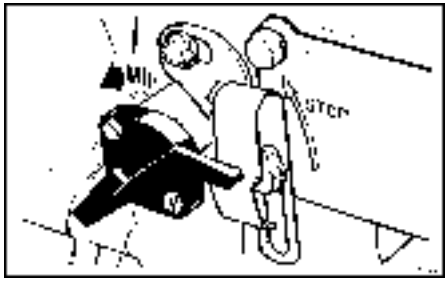


Figure 2.7.1 The Engine Control

After the engine has stopped turn the start key, if fitted, to the OFF position.

⚠ CAUTION

Turning the start key to the 'OFF' position will not stop the engine unless an optional fuel control solenoid is fitted.

2. On engines fitted with a fuel control solenoid turn the key to the 'OFF' position.

⚠ CAUTION

Never stop the engine by operating the decompressor lever or valve damage may occur.

3. STARTING AND STOPPING - MARINE

CONTENTS

3.1 Preliminary Instructions

The following operating instructions are of a general nature and should be read in conjunction with, or substituted by, the equipment manufacturers instructions.

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Before attempting to start any engine the operator should read "1.4 Safety Precautions" and be conversant with the use of the engine controls and the correct starting procedures.

⚠ CAUTION

ETHER BASED COLD START AIDS IN AEROSOL CANS MUST NOT BE USED UNDER ANY CIRCUMSTANCES.
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⚠ WARNING

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3.2 Starting Handle Precautions

A non-limited kick-back handle (A) or limited kick-back handle (B) system may be fitted to the engine.

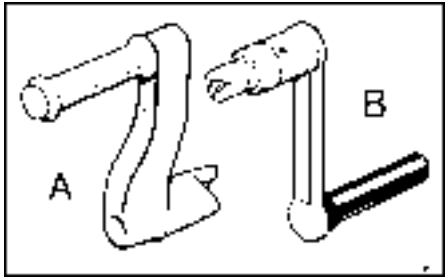

Figure 3.2.1 The Starting Handle

⚠ WARNING

Do not attempt to use a handle if it is damaged in any way.

- The two types of handle are not interchangeable and care must be taken to ensure the correct type is retained with the engine.
- Always use the correct starting handle which has been designed for the engine.
- Ensure there are no burrs on that part of the handle which fits onto the engine.
- Ensure the handle grip is clean, dry and free to turn on its shaft..
- Clean and lightly oil that part of the handle which fits onto the engine.
- Firmly hold the handle grip, **with the thumb on top of the grip**, during the starting procedure.

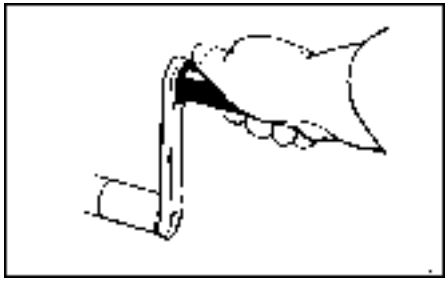

Figure 3.2.2 Holding the Starting Handle

3.3 Automatic Excess Fuel Device

'T Series' engines are fitted with an automatic excess fuel device which becomes operative, ready for the next start, when the engine is stopped.

If the engine stops other than by the operation of the engine control, the control must be turned anti-clockwise to the 'STOP' position and released before the device can operate.

As the engine runs up to speed the excess fuel device will automatically reset to the normal running position.

3.4 Cold Starting Aid - TS/TR

The cold starting aid may be fitted to the combustion air intake ports and is used when the ambient temperature is below -10°C (14°F).

1. With the fuel turned on, turn the engine for up to 20 revolutions to prime the fuel and lubrication systems.
2. Withdraw the plunger (A) and fill one third of the cup (B) with the same type of lubricating oil as used in the engine.

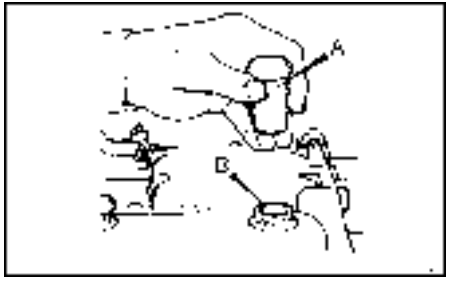

Figure 3.4.1 Cold Start

3. Replace the plunger and inject the oil just before starting the engine.

⚠ CAUTION

The device must not be used more than three times in succession during the same attempt to start the engine.

3.5 Start/Stop Control

A 'T' shaped start/stop control handle is usually fitted. This handle must be pushed in before attempting to start, and when the engine is running.

The handle is pulled out to stop the engine.

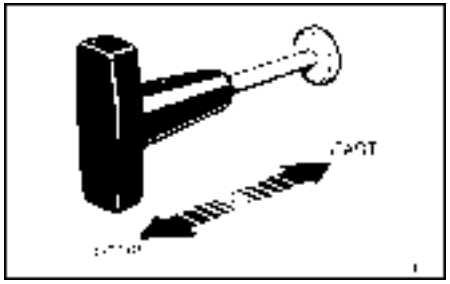

Figure 3.5.1 The Stop/Start Control

Note:
If the engine is fitted with a fuel control solenoid a start/stop control handle will not be fitted.

3.6 Gear and Speed Control

With the engine running and the control lever in the centre position the gearbox is in 'Neutral' and the engine will be idling.

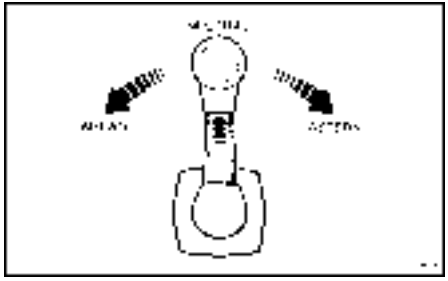

Figure 3.6.1 The Gear and Speed Control

As the control is moved anti-clockwise from 'Neutral' the gearbox engages 'Ahead', further progressive movement of the control increases the speed.

When the control is moved clockwise from 'Neutral' the gearbox engages 'Astern', further progressive movement of the control increases the speed.

The gearbox drive can be disengaged by pressing the button in the centre of the control lever boss.

3.7 Hand Starting

Before attempting to start the engine refer to "3.2 Starting Handle Precautions".

To ensure smoother operation and contribute to a longer engine life it is advisable to allow the engine to warm up for several minutes, with the gearbox disengaged, at a speed of approximately 1100-1500r/min before moving off.

1. On engines not fitted with a fuel control solenoid ensure the stop control; see "3.5 Start/Stop Control", is pushed in.
2. Move the gear/speed control lever to 'Neutral'; see "3.6 Gear and Speed Control".

   On some types of gear/speed control lever the gearbox ahead/astern selector can be disengaged by pressing a button in the centre of the lever.
3. With the gearbox disengaged move the gear/speed control towards 'Ahead' to approximately half throttle.
4. Select the excess fuel position by turning the engine control lever anti-clockwise to the 'STOP' position and releasing it.

Figure 3.7.1 Engine Control

5. Move the decompressor lever towards the flywheel.

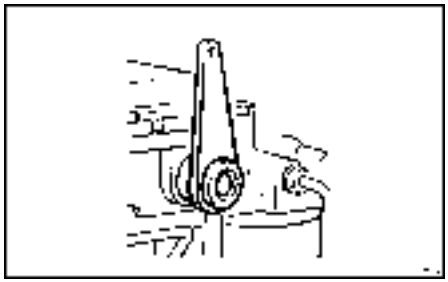

Figure 3.7.2 Decompressor Lever

6. If the ambient temperature is below -10°C (14°F) refer to "3.4 Cold Starting Aid".

7a. **If using a non-limited kick-back handle:**
Insert the correct handle, refer to 'A' in 'Figure 3.2.1', into the starting housing.

Slowly rotate the handle in the direction of cranking until it fully engages.

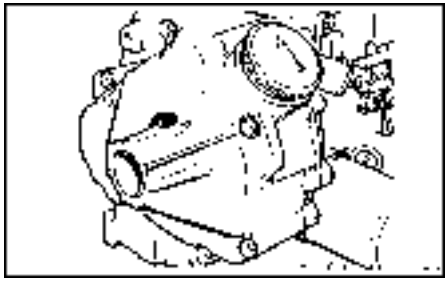

Figure 3.7.3 Starting Handle Housing

7b. **If using a limited kick-back handle:** Swivel the starting handle housing cover (A) to one side and insert the correct handle, refer to 'B' in 'Figure 3.2.1', into the housing.

Slowly rotate the handle in the direction of cranking until it fully engages.

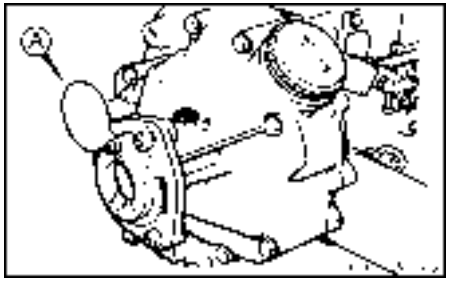

Figure 3.7.4 Starting Handle Housing

8. If the cold starting aid was not used turn the engine slowly for up to 20 turns to prime the combustion chamber and lubricating oil system.
9. Firmly hold the handle grip, with the thumb on top of the grip as shown in 'Figure 3.2.2', and crank the engine really fast, when sufficient speed is obtained move the decompressor lever towards the gear end.

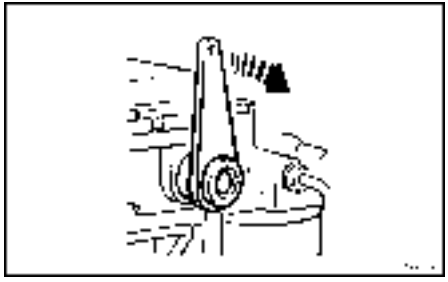

Figure 3.7.5 Decompressor Lever

Continue to crank until the engine fires.

Retaining a firm grip on the handle remove the handle from the housing.

WARNING

Do not pull the starting handle away from the engine while cranking.

10. Reduce the speed as required.

3.8 Raised Hand Starting

The raised hand start assembly is fitted to the top of the cylinder heads and the starting handle can be used at either end of the shaft.

Before attempting to start the engine refer to "3.2 Starting Handle Precautions"

To ensure smoother operation and contribute to a longer engine life it is advisable to allow the engine to warm up for several minutes, with the gearbox disengaged, at a speed of approximately 1100-1500r/min before moving off.

1. On engines not fitted with a fuel control solenoid ensure the stop control, see "3.5 Start/Stop Control", is pushed in.
2. Move the gear/speed control lever to 'Neutral'; see "3.6 Gear and Speed Control".

   On some types of gear/speed control lever the gearbox ahead/astern selector can be disengaged by pressing a button in the centre of the lever.
3. With the gearbox disengaged move the gear/speed control towards 'Ahead' to approximately half throttle.
4. Select the excess fuel position by turning the engine control lever anti-clockwise to the 'STOP' position and releasing it.

Figure 3.8.1Engine Control

5. Move the decompressor lever towards the flywheel.

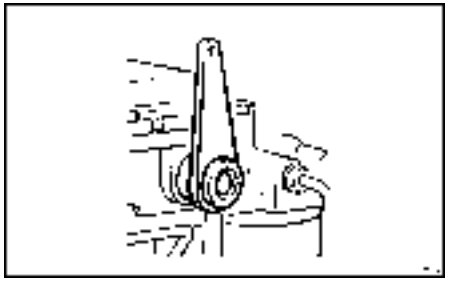

Figure 7.8.2 Decompressor Lever

6. If the ambient temperature is below -10°C (14°F) refer to "3.4 Cold Starting Aid".
7. Fit the correct handle onto the starting shaft and slowly rotate the handle in the direction of cranking until it fully engages.

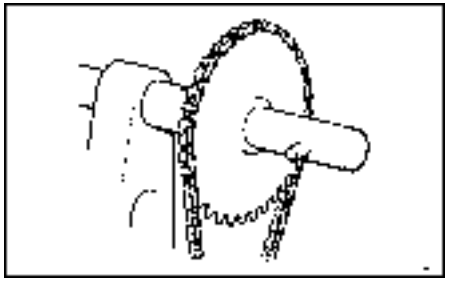

Figure 3.8.3 Starting Handle Shaft

8. If the cold starting aid was not used turn the engine slowly for up to 20 turns to prime the combustion chamber and lubricating oil system.

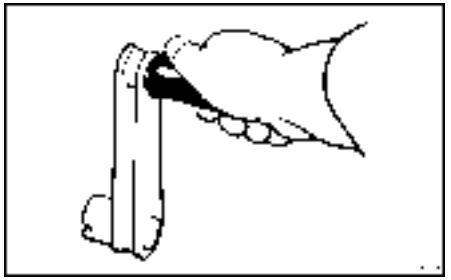

Figure 3.8.4 Holding the Starting Handle

9. Firmly hold the handle grip, **with the thumb on top of the grip,** as shown in 'Figure 3.8.4', and crank the engine really fast, when sufficient speed is obtained move the decompressor lever towards the gear end and continue to crank until the engine fires.

⚠ WARNING

Do not pull the starting handle away from the engine while cranking.

Retaining a firm grip on the handle remove the handle from the shaft.

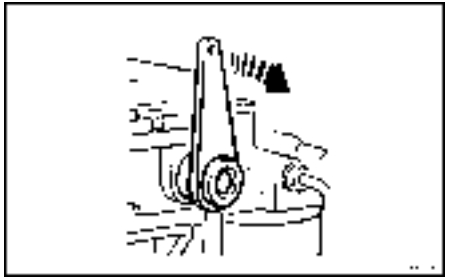

Figure 3.8.5 Decompressor Lever

10. Reduce the speed as required.

3.9 Start/Alarm Panel

Lister-Petter offer two start panels:

a. Basic panel.

b. Standard panel.

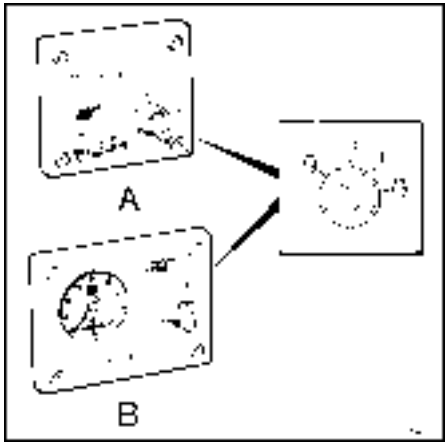

Figure 3.9.1 Start/Alarm Panels

3.10 Audible Alarm

Both panels are fitted with an audible alarm which will sound with the start key in the 'I' and 'STOP' positions, or if an alarmed fault occurs on the engine.

3.11 Electric Starting

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

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

To ensure smoother operation and contribute to a longer engine life it is advisable to allow the engine to warm up for several minutes, with the gearbox disengaged, at a speed of approximately 1100-1500r/min before moving off.

1. On engines not fitted with a fuel control solenoid ensure the stop control; see "3.5 Start/Stop Control", is pushed in.
2. Move the gear/speed control lever to 'Neutral'; see "3.6 Gear and Speed Control".

   On some types of gear/speed control lever the gearbox ahead/astern selector can be disengaged by pressing a button in the centre of the lever.
3. With the gearbox disengaged move the gear/speed control towards 'Ahead' to approximately half throttle.
4. Ensure the decompressor lever is towards the flywheel.

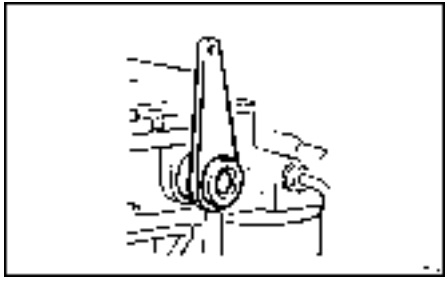

Figure 3.11.1 Decompressor Lever

5. Turn the start key to the 'ENGINE CRANKING' position to energise the starter motor and release it immediately the engine starts.

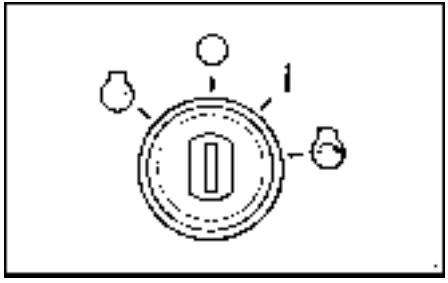

Figure 3.11.2 Key Start

6. Reduce the speed as required.

3.12 Stopping the Engine

1. Move the gear/speed control lever to 'Neutral'.

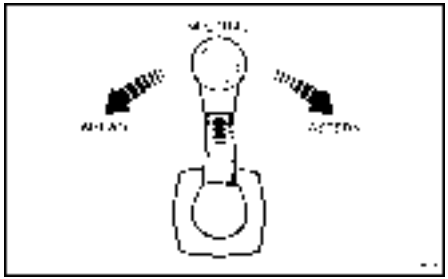

Figure 3.12.1 The Gear and Speed Control

2. On engines not fitted with a fuel control solenoid pull the start/stop handle out.

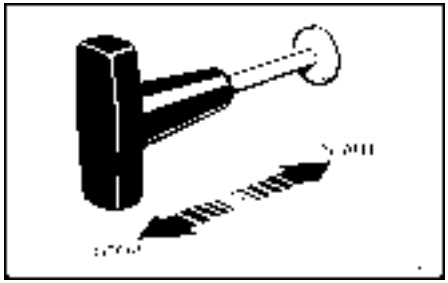

Figure 3.12.2 The Stop/Start Control

3. Turn the start key anti-clockwise to the 'STOP' position.

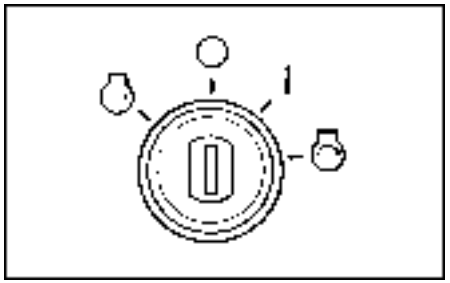

Figure 3.12.3 Key Start

4. When the engine has stopped turn the start key clockwise to the 'O' position.

⚠ CAUTION

Never stop the engine by operating the decompressor lever or valve damage may occur.

⚠ CAUTION

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

4. THE NEWAGE GEARBOX

CONTENTS

4.1 The Newage Gearbox

This information is included and intended to be used as a guide for the user.

The gearbox manufacturers publication should be consulted for additional information on operating and routine maintenance procedures.

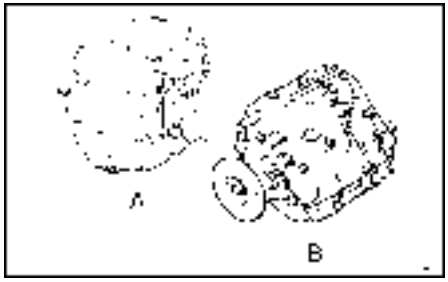

Figure 4.1.1 The Gearbox
A - PRM 150
B - PRM 260

4.1.1 Gearbox Serial Number

The serial number of the gearbox is stamped on a plate attached to the top half of the gearbox; a specimen number is shown below.

123456 A1234
160D3

123456 A1234 .. Serial number
160D ..... Type of gearbox
3 ..... Reduction

4.2 Lubricating Oil Specification

The gearbox is filled with Shell Rotella SAE 10W/30 prior to despatch and this oil has been approved as being suitable over the full range of operating conditions in ambient temperatures up to 52°C (125°F).

4.3 Oil Precautions

⚠ WARNING

New or used lubricating oil may cause skin irritation.

⚠ WARNING

Using the gearbox with insufficient oil may lead to low oil pressure, unsatisfactory operation, overheating and possible failure.
Using the gearbox with too much oil may lead to overheating and oil leaks.

⚠ WARNING

Care must be taken to ensure that all used oil is disposed of in accordance with all the relevant regulations of the country concerned.

4.4 Lubricating Oil Capacity

The capacities given are approximate figures and are given for guidance. The oil level should be topped up to the 'full' mark on the dipstick.

	litre	pint	US qt
PRM 150	1.4	2.50	1.48
PRM 260	1.0	1.76	1.05

4.5 Emergency Operation

The gearbox is fitted with a device enabling it to be locked in the 'ahead' position should there be an hydraulic failure.

4.5.1 PRM 150 Gearbox

1. Remove the nine bolts securing the rear manifold to the gearcase.

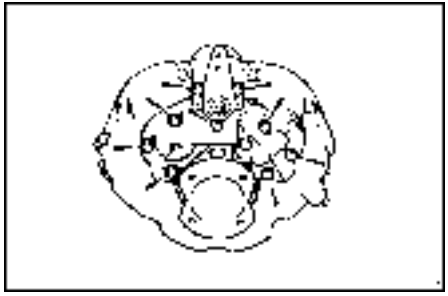

Figure 4.5.1 PRM 150 Gearbox

2. Taking care not to lose the small Allen

key located inside, remove the manifold complete with oil pump.

3. Rotate the gearbox input shaft until two socket screws in the clutch gear align with the two holes in the rear of the gearcase.
4. Lock up the clutch plates by inserting the Allen key through the two holes and tightening each screw in turn.
5. Refit the rear manifold and torque the nine bolts to 30.0Nm (22.0lbf ft).
6. Ensure sufficient oil remains in the gearbox to avoid further damage.

4.5.2 PRM 260 Gearbox

1. Remove the top cover located alongside the valve block.
2. Rotate the shaft until one of the grooves on the outer edges of the clutch end plate is uppermost.
3. Using one of the cover setscrews, screw it tightly into the threaded hole in the clutch plate directly beneath the groove to clamp the clutch and provide drive.
4. Check that the dipstick does not foul the head of the bolt that was used. If it does, remove the dipstick and plug the hole.
5. Ensure sufficient oil remains in the gearbox to avoid further damage.
6. Refit the top cover and torque the bolts to 30.0Nm (22.0lbf ft).

4.6 Oil Change Periods

The oil should be changed annually or at the same intervals as the engine oil changes.

If the oil becomes contaminated by water or suffers mechanical damage the gearbox, oil cooler and hoses must be flushed and the gearbox refilled with new oil to the correct specification.

4.7 Checking the Oil Level

1. Run the engine and gearbox for a few minutes to ensure that there is oil in the oil cooler circuit.
2. Stop the engine.
3. Remove the dipstick (A) by unscrewing it and wipe the blade.

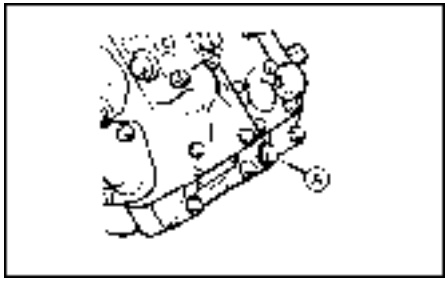

Figure 4.7.1 Dipstick/Oil Filler

4. Replace the dipstick taking care to ensure it is fully screwed down.
5. Remove the dipstick and check the oil level.
6. Add more oil, of the correct specification, if necessary.
7. Replace the dipstick taking care to ensure it is fully screwed down.

4.8 Control Linkage Adjustment

Care must be taken to ensure the linkage moves the gearbox operating lever approximately 2.0mm (0.078in) before the lever stop, in both the forward and backward travel.

4.9 Maintenance Periods

After the First 25 Hours Running

1. Run the engine until the gearbox reaches operating temperature.
2. Stop the engine.
3. Drain the gearbox and oil cooler system.
4. Refill the gearbox with oil.
5. Run the engine for a few minutes and follow the instructions in “4.7 Checking the Oil Level”.

Daily
Check the oil level.
Check for oil leaks, especially around the output shaft oil seal and from all gaskets.

Annually
Check the oil cooler hoses and connections.
Check the propeller shaft alignment. The maximum misalignment is 0.05mm (0.002in).
Check that the operating linkage is correctly adjusted.

4.10 Spanner Sizes

	Gearbox	
	PRM 150	**PRM 260**
Dipstick	18mm	18mm
Drain Plug	15mm	15mm
Case Bolts	8mm	9/16" AF
Manifold	8mm	-
Cover Plate Bolts	-	1/2" AF
Control Block	-	1/2" AF

4. THE HURTH GEARBOX

CONTENTS

5.1 The Hurth Gearbox

This information is included and intended to be used as a guide for the user.

The gearbox manufacturers publication should be consulted for additional information on operating and routine maintenance procedures.

Figure 5.1.1 The Gearbox

5.1.1 Gearbox Serial Number

The serial number of the gearbox is stamped on a plate attached to the top of the gearbox; a specimen number is shown below.

HBW100-R2
15-60145

HBW100 ..... Type
R2 ..... Reduction
15-60145 ..... Serial number

5.2 Lubricating Oil Specification

The gearbox is filled with Shell Donax TA prior to despatch. This oil has been approved as being suitable over the full range of operating conditions in ambient temperatures up to 52°C (125°F).

5.3 Oil Precautions

WARNING

New or used lubricating oil may cause skin irritation.

WARNING

Using the gearbox with insufficient oil may lead to low oil pressure, unsatisfactory operation, overheating and possible failure.
Using the gearbox with too much oil may lead to overheating and oil leaks.

WARNING

Care must be taken to ensure that all used oil is disposed of in accordance with all the relevant regulations of the country concerned.

5.4 Lubricating Oil Capacity

The capacities given are approximate figures and are given for guidance.

The oil level should be topped up to the 'full' mark on the dipstick.

	litre	pint	US qt
HBW 50	0.30	0.53	0.32
HBW 100	0.35	0.62	0.37
HBW 125	0.55	0.97	0.58
HBW 150	0.55	0.97	0.58

5.5 Sailing and Moving in Tow

Rotation of the propeller without load while the boat is sailing, being towed or anchored in a river will have no detrimental effect on the gearbox; neither will operating the engine with the propeller stopped.

CAUTION

When the boat is sailing with the engine stopped, the gear lever must be in the 'zero' position.
The gear lever must NEVER be put into the position corresponding to the direction of travel.

5.6 Oil Change Periods

The oil should be changed for the first time after 25 hours then at least annually, or at the same intervals as the engine oil changes.

5.7 Checking the Oil Level

1. Run the engine and gearbox for a few minutes to ensure there is oil in the oil cooler circuit.
2. Stop the engine.
3. Remove the dipstick (A) by unscrewing it and wipe the blade.

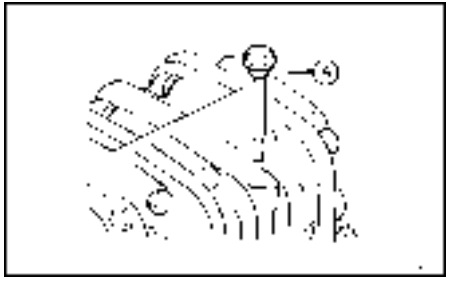

Figure 5.7.1 Dipstick/Oil Filler

4. Replace the dipstick taking care to ensure it is not screwed into the gearbox casing.
5. Remove the dipstick and check the oil level.
6. Add more oil, of the correct specification, if necessary.
7. Replace the dipstick taking care to ensure it is fully screwed down.

5.8 Control Linkage Adjustment

The control cable or rod should be arranged at right angles to the actuating lever in the 'Neutral' position.

It is important to ensure the operating lever on the control console coincides with the 'Neutral' position of the gearbox operating lever.

Care must be taken to ensure the linkage moves the gearbox operating lever at least 35.00mm (1.38in) for the outer pivot point (A) and at least 30.0mm (1.18in) for the inner pivot (B) in both the forward and backward travel from the 'Neutral' position.

The operating lever clamping screw (C) should be torqued to 18.0Nm (13.3lbf ft).

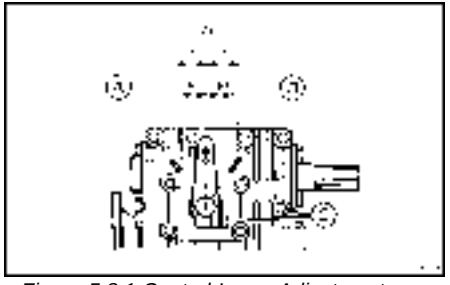

Figure 5.8.1 Control Lever Adjustments

⚠ CAUTION

It is important to ensure the clearance between the lever (D) and the lever cover plate (E) is a minimum of 0.5mm (0.02in). The position of the cover plate is factory adjusted and no attempt should be made to change it.

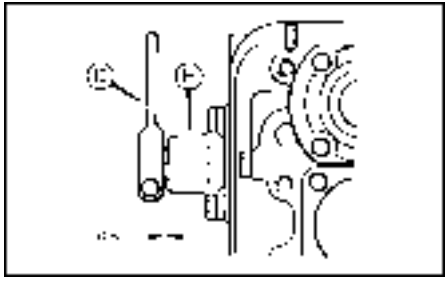

Figure 5.8.2 Control Lever Adjustments

6. OIL AND FUEL SPECIFICATIONS

CONTENTS

6.1 Oil Specification

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

All subsequent oil changes must be as specified in "7.11 Maintenance Schedule".

⚠ CAUTION

Some of the following classifications may not be available in your country. In cases of difficulty, it is suggested contact be made with a reputable oil supplier or any Lister-Petter Distributor.

Note:
Also refer to '"6.2 Engine Oil Classification System"'.

1. The temperatures mentioned in the tables are the ambient temperatures at the time when the engine is started. However, 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.
2. Where it is not practical to continually change oils to suit varying ambient temperatures, a suitable multigrade oil is recommended to ensure adequate starting performance at the lowest temperature likely to be encountered.
3. 'T' Series engines must be run on heavy duty lubricating oils that at least meet the requirements of one of the following:

API CC	MIL-L-46152B
DEF2101D	MIL-L-2104B

   Straight mineral oils are not suitable, neither are oils of less detergency than specified.

Note:
Higher specification oils meeting API CD, API CE and API CF-4 are more commonly available than API CC. The use of these oils in new engines is acceptable for topping up the 'first fill' and following the first 100 hours when running-in has been completed.
These oils are particularly suited to engines running at a high load factor, or in conjunction with high ambient temperatures. They must also be used where the sulphur content of the fuel exceeds 0.5%.

⚠ CAUTION

API CD, API CE, API CF-4 or MIL-L-2104C/D/E oils can inhibit the running-in process in new or reconditioned engines and are not suitable for engines running on low duty cycles.

4. The oil must be suitable for 250 hour oil changes without undue degradation, with sump temperatures reaching 150°C (302°F) under severe tropical conditions, and 120°C (248°F) under normal conditions.
5. For engines in long running installations Lister-Petter should be consulted.

6.2 Engine Lubricating Oil Classification System

The information contained in this section has been extracted from "Lubricant and Fuel Performance", with the permission of 'The Lubrizol Corporation'.

⚠ CAUTION

Some of the following classifications may not be available in your country. In cases of difficulty, it is suggested contact be made with a reputable oil supplier or any Lister-Petter Distributor.

Note:
US 'S' grade oils are for gasolene engines and are not recommended for Lister-Petter diesel engines.

Past and current US API grade oils are described below.

API Service Category CA:

Service typical of diesel engines operated in mild to moderate duty with high-quality fuels; occasionally has included gasoline engines in mild service.

Oils designed for this service provide protection from bearing corrosion and ring-belt deposits in some naturally aspirated diesel engines when using fuels of such quality that they impose no unusual requirements for wear and deposit protection.

They were widely used in the 1940s and 1950s but should not be used in any engine unless specifically recommended by the equipment manufacturer.

API Service Category CB:

Service typical of diesel engines operated in mild to moderate duty, but with lower quality fuels, which necessitate more protection from wear and deposits; occasionally has included gasoline engines in mild service.

Oils designed for this service were introduced in 1949. They provide necessary protection from bearing corrosion and from high-temperature deposits in naturally aspirated diesel engines with higher sulphur fuels.

API Service Category CC:

Service typical of certain naturally aspirated diesel engines operated in moderate to severe-duty service, and certain heavy-duty gasoline engines.

Oils designed for this service provide protection from high-temperature deposits and bearing corrosion in diesel engines, and also from rust, corrosion, and low-temperature deposits in gasoline engines. These oils were introduced in 1961.

API Service Category CD:

Service typical of certain naturally aspirated, turbocharged or supercharged diesel engines where highly effective control of wear and deposits is vital, or when using fuels with a wide quality range (including high-sulphur fuels).

Oils designed for this service were introduced in 1955 and provide protection from high-temperature deposits and bearing corrosion in these diesel engines.

API Service Category CD-11:

Severe duty two-stroke

Service typical of two-stroke cycle diesel engines requiring highly effective control of wear and deposits.

Oils designed for this service also meet all performance requirements of API Service Category CD.

API Service Category CE - 1983:

Service typical of certain turbocharged or supercharged heavy-duty diesel engines, manufactured since 1983 and operated under both low speed, high load and high speed, high load conditions.

Oils designated for this service may also be used when API Service Category CD is recommended for diesel engines.

API Service Category CF-4 -1990:

Service typical of high-speed, four-stroke cycle diesel engines.

API CF-4 oils exceed the requirements for the API CE category, providing improved control of oil consumption and piston deposits.

These oils should be used in place of API CE oils. They are particularly suited for on-highway, heavy-duty truck applications. When combined with the appropriate 'S' category, they can also be used in gasoline and diesel powered personal vehicles - i.e., passenger cars, light trucks, and vans - when recommended by the vehicle or engine manufacturer.

API Service Category CF:

Indirect injection

Service typical of indirect-injected diesel engines and other diesel engines that use a broad range of fuel types, including those using fuel with high sulphur content; for example, over 0.5% weight.

Effective control of piston deposits, wear and copper-containing bearing corrosion is essential for these engines, which may be naturally aspirated, turbocharged or supercharged.

Oils designated for this service have been in existence since 1994 and may be used when API Service Category CD is recommended.

API Service Category CF-2:

Severe duty, two-stroke cycle

Service typical of two-stroke cycle diesel engines requiring highly effective control over cylinder and ring-face scuffing and deposits.

Oils designed for this service have been in existence since 1994 and may also be used when API Engine Service Category CD-11 is recommended.

These oils do not necessarily meet the requirements of API CF or CF-4 unless they pass the test requirements for these categories.

API Service Category CG-4 - 1994:

Severe duty

API Service Category CG-4 describes oils for use in high-speed fourstroke-cycle diesel engines used in both heavy-duty on-highway (0.05% weight sulphur fuel) and off-highway (less than 0.5% weight sulphur fuel) applications.

CG-4 oils provide effective control over high-temperature piston deposits, wear, corrosion, foaming, oxidation stability, and soot accumulation.

These oils are especially effective in engines designed to meet 1994 exhaust emission standards and may also be used in engines requiring API Service Categories CD, CE, and CF-4. Oils designed for this service have been in existence since 1994.

6.2.1 European Oil Specifications

ACEA specifies the following:

Gasolene Engines
A1-96, A2-96, A3-96.

Light Duty Diesel Engine Operation
B1-96, B2-96, B3-96.

Heavy Duty and Commercial Vehicle Diesel Engine Operation
E1-96, E2-96, E3-96.

6.3 Oil Viscosity

The following chart shows the correct oil viscosities at various °C ambient temperature ranges for cold start to maximum running.

Before selecting a viscosity grade refer to Notes:

Notes:

A Intermittent running.

B. Synthetic oils only.

°F = (1.8 x °C) + 32.

1. *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). Non synthetic oils at very low temperatures will suffer from wax crystallisation.*
   Monograde SAE 5W is not normally available as a synthetic oil and therefore is not quoted.
2. *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.*
   An oil change is recommended immediately if the engine fails to reach its normal cold start cranking speed due to excessive oil viscosity.
   Fuel dilution of the lubricating oil will adversely affect cold starting and oil consumption.
3. *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.
4. *Monograde SAE 40 oils are not recommended.*

⚠ CAUTION

The fuel injection equipment is manufactured to very accurate limits and the smallest particle of dirt will destroy its efficiency.

Fuel, free from water and contaminants is of the utmost importance.

6.4 Fuel Specification

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

a. BS 2869:1988 Class A2.

b. BS EN590:1995 Class A1.

c. USA Specification ASTM D-975-77 Grades No.1-D and 2-D.

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 these diesel engines.

The user is cautioned that although the engines may operate on fuels outside the above specifications, such operation may well result in excessive wear and damage.

CAUTION

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

6.5 Low Temperature Fuels

Special winter fuels are often available for use at ambient temperatures below 0°C (32°F).

These fuels have a lower viscosity and limit the formation of wax at low ambient temperatures.

CAUTION

Wax formation can rapidly reduce the flow of fuel through the fuel filter element.

7. ROUTINE MAINTENANCE - ENGINE

CONTENTS

7.1 Preliminary Instructions

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

The engines are assembled to pre-determined builds and individual engines may include optional equipment not specifically covered in this book.

More detailed information can be found in the Workshop Manual, 027-08221, or any Lister-Petter Distributor or Dealer may be consulted.

The handbook is designed primarily for use by qualified technicians with mechanical experience.

This work can only be carried out 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.

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

- The engine should receive regular attention during the first 50 hours of its life from new and after a major overhaul.
- Long periods of light or 'no load' running early in the engine's life may lead to cylinder bore glazing and high oil consumption.
- The instructions given in "7.11 Maintenance Schedule" are based on average operating conditions and cover the minimum requirements to keep an engine running at peak performance with trouble free operation.
- Under very dusty conditions, air cleaners, lubricating oil and fuel filters will require more frequent attention.
- Decarbonising may be required more often if the engine has been running on light loads for long periods.
- Before carrying out any maintenance work on an engine it is advisable to remove the battery.

  The battery and charge windings must be disconnected before commencing any electric welding when a pole strap is directly, or indirectly connected to the engine.
- It is essential to ensure that nuts and bolts are tightened to the torques specified in the Workshop Manual, 027-08221.
- The fuel injector can only be checked and set off the engine using suitable specialist test equipment.
- A Hurth or Newage gearbox may be fitted to the engine and the gearbox manufacturers publication should be consulted for information on operating and routine maintenance procedures.

  Basic information for these gearboxes can be found in Sections 4 and 5.

⚠ WARNING

ON NO ACCOUNT ALLOW ANY UNPROTECTED SKIN TO COME INTO CONTACT WITH THE INJECTOR SPRAY AS THE FUEL MAY ENTER THE BLOOD STREAM WITH FATAL RESULTS.

⚠ WARNING

SOME ENGINES MAY BE FITTED WITH SEALS OR 'O' RINGS MANUFACTURED FROM 'VITON' OR A SIMILAR MATERIAL.

WHEN EXPOSED TO ABNORMALLY HIGH TEMPERATURES, IN EXCESS OF 400°C (752°F), AN EXTREMELY CORROSIVE ACID IS PRODUCED WHICH CANNOT BE REMOVED FROM THE SKIN.

IF SIGNS OF DECOMPOSITION ARE EVIDENT, OR IF IN DOUBT, ALWAYS WEAR DISPOSABLE HEAVY DUTY GLOVES.

7.2 Precautions for Filters and Elements

- Particular attention is drawn to the instructions given later in this section for replacing filters.
- Used liquid filters and elements contain some of the filtered liquid and should be handled and disposed of with care.
- After handling new or used elements, the users hands should be thoroughly washed, particularly before eating.

⚠ WARNING

Fuel and new or used lubricating oil may cause skin irritation.

⚠ 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.

⚠ WARNING

Care must be taken to ensure that waste fuel, oil, filter elements and acid, where applicable, are disposed of in accordance with local regulations to prevent contamination.

7.3 Initial Attention

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

It is recommended that the following receive attention after the engine has run 25 hours and again after 250 hours.

- Adjust the valve clearances if necessary.
- Check and tighten nuts, bolts and unions paying particular attention to the fuel system.
- Check the lubricating oil level and top up if necessary.
- Observe the exhaust at the normal full load. The exhaust must be free from soot. A black exhaust means that the engine is overloaded or that the injection equipment is out of order.

  Do not allow the engine to run with a dirty exhaust without investigating the cause as this may result in an engine breakdown.
- Following the initial attention, the normal routine maintenance must be carried out as given in "7.11 Maintenance Schedule".

7.4 Changing the Oil Filter

A strap wrench is required to remove the filter from the engine but it must not be used to fit a replacement.

Before changing the filter read "7.2 Precautions for Filters and Elements".

1. Using a suitable strap wrench, unscrew and remove the old filter.
2. Thoroughly clean the crankcase filter housing face.
3. Apply a small amount of clean engine oil to the oil filter sealing joint.
4. Screw on the new oil filter, by hand, until the sealing joint is just touching the crankcase and tighten a further half turn.

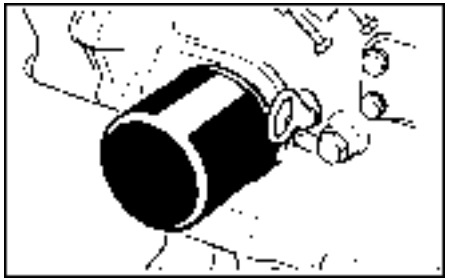

Figure 7.4.1 Changing the Oil Filter

5. Run the engine and check for any oil leaks.
6. Stop the engine, allow the oil to settle and check the level on the dipstick.
7. Add more oil if necessary.

7.5 Draining and Filling the Oil Sump

Before draining the oil read "7.2 Precautions for Filters and Elements".

⚠ CAUTION

Do not overfill with lubricating oil as this may have a detrimental effect on engine performance.

1. If possible run the engine immediately before draining the oil.
2. Place a suitable container under the drain plug.
3. Remove the drain plug (A) and drain the sump.

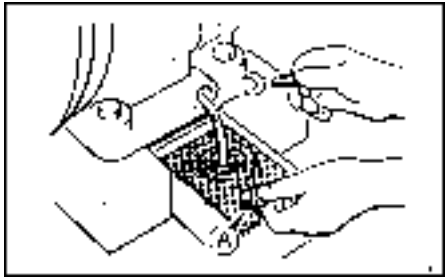

Figure 7.5.1 Oil Drain

4. Clean and coat the threads of the drain plug with Hylomar PL32/M or Three Bond 1110B.
5. Replace the drain plug taking care not to overtighten it.
6. Fill the sump through the oil filler to the top mark on the dipstick (B).

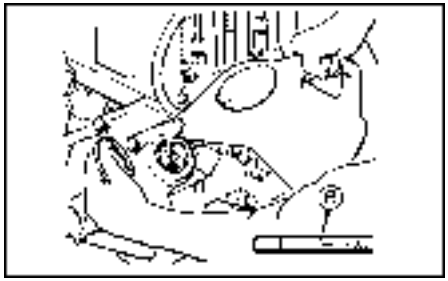

Figure 7.5.2 Oil Filler

Oil Sump Capacity

	litres	pints	US qts
TS/TR1	2.7	4.7	2.8
TS/TR/TX2	4.0	7.0	4.2
TS/TR/TX3	6.0	10.5	6.3

7. Start the engine, run it for a few minutes and check the drain plug does not leak.
8. Stop the engine, allow the oil to settle and check the level on the dipstick.
9. Add more oil if necessary.

7.6 Changing the Fuel Tank Filter

The fuel filter is an essential part of the engine and it must never be run without a filter and 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 element read "7.2 Precautions for Filters and Elements".

1. Remove the retaining plug (A).
2. Remove the old element (B) and the joints (C).

Figure 7.6.1 Fuel Tank Internal Filter

3. Fit a new element and new joints.
4. Replace and tighten the retaining plug (A).
5. Prime the fuel system.

7.7 Cartridge Agglomerator

The cartridge agglomerator is an essential part of the engine and should be renewed every 500 hours, or more frequently if for any reason the fuel is known to be dirty. Water is drained from the agglomerator by unscrewing the drain tap (C) sufficiently to allow the water to drain.

A strap wrench is required to remove the agglomerator from the engine but it must not be used to fit a replacement.

Before changing the agglomerator read "7.2 Precautions for Filters and Elements".

1. Using a suitable strap wrench unscrew the cartridge (A) from the head (B).
2. Screw a new cartridge onto the head and hand tighten it.

Figure 7.7.1 The Cartridge Agglomerator

7.8 Valve Clearance Adjustment

The valve clearance for both inlet and exhaust valves must be set with the engine cold.

		GO	NOT GO
TS/TR	mm	0.15	0.20
	in	0.006	0.008
TX	mm	0.10	0.15
	in	0.004	0.006

1. Remove the cylinder head cover.
2. Ensure the cylinder head nuts are correctly tightened.
3. Turn the engine until the piston is at TDC position on the firing stroke for the cylinder being worked on.
4. Slacken the locknut (A) and adjust the screw (B) until the correct clearance has been obtained.

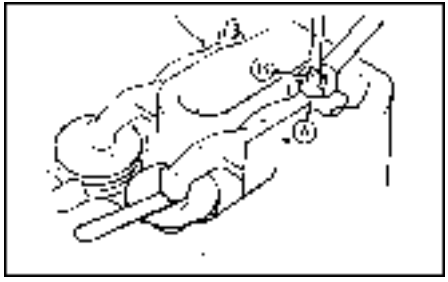

Figure 7.8.1 Setting the TS/TR Valve Clearance

5. Tighten the locknut whilst restraining the adjusting screw and re-check to ensure that the clearance is correct.
6. Repeat for the remaining valve.
7. Replace the rocker cover taking care to ensure the decompressor lever, if fitted, is vertical.

7.9 Decompressor Adjustment

This adjustment should only be made when the valve clearance is correctly adjusted.

After the decompressor has been set on TX engines the maximum valve lift must not exceed 0.76mm (0.030in).

1. Remove the cylinder head cover.
2. Turn the engine until the piston is at T.D.C. firing stroke for the cylinder being worked on.

TS and TR Engines

3. Slacken the locknut (A) and adjust the screw (B) until it just touches the exhaust valve rocker when the lever is vertical.

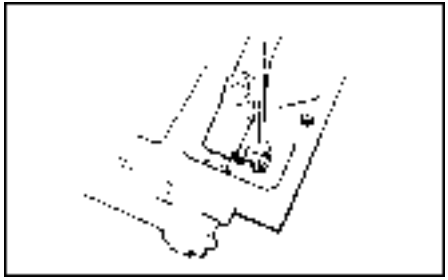

Figure 7.9.1 Setting the TS/TR Decompressor Lever

4. Turn the screw half a turn clockwise so that it travels towards the rocker.
5. Tighten the locknut whilst restraining the adjusting screw.

TX Engines

6. Place the decompressor lever in the vertical position.
7. Slacken the decompressor pin locknut and adjust the pin to take up the valve clearance.
8. Turn the pin a further half a turn and tighten the locknut.

All Engines

9. Replace the rocker cover taking care to ensure the decompressor lever is vertical.

7.10 Checking the Battery

1. Wear protective gloves and goggles.
2. Clean the top of the battery filler plug area.
3. Remove the filler plugs and check that the electrolyte level is 6.0-9.0mm (0.25-0.37in) 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.

⚠ WARNING

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

7.11 Maintenance Schedule

Change the lubricating oil for the first time after 100 hours and then as specified below.

Daily
Check the fuel and lubricating oil levels.
Check for fuel and oil leaks.
Clean or replace the air cleaner element under very dusty conditions.

Every 125 Hours

The above and the following items.
Check the condition of the battery, if fitted.
Clean or replace the air cleaner element under moderately dusty conditions.
On TX engines operating above 35°C (95°F) drain the sump, refill with new oil and renew the oil filter element.

Every 250 Hours

The above and the following items.
Drain the sump and refill with new oil.
Renew the oil filter element.
Clean or replace the injectors if the exhaust is dirty.
Renew the fuel filter element if the fuel being used is not perfectly clean.
Check the TX axial fan drive belt tension.

Every 500 Hours

The above and the following items.
Replace the air cleaner element.
Examine the exhaust and induction systems for leaks, damage or restrictions.
Renew the fuel filter element.
Check the battery charge winding system; refer to the Workshop Manual.

Every 1000 Hours

The above and the following items.
Check the valve clearances.
Decarbonise if the engine performance has deteriorated...
Check the TX axial fan drive belt condition; replace if necessary.

Every 2000 Hours

The above and the following items.
Decarbonise
Replace the TX axial fan drive belt irrespective of its condition.
Check the fuel pump timing.
Clean and check the TX axial fan for damage.

Every 6000 Hours

The above and carry out a major overhaul.

Every Year - Marine

Change the lubricating oil, oil filter and air cleaner elements if these were not changed at the prescribed intervals.

7.12 Fault Finding

This section is intended as a guide only and any rectification of faults should be in accordance with the Workshop Manual or after consulting the local Lister-Petter Distributor or Dealer.

Difficult Starting
Stop/start lever in the wrong position.
Decompressor lever in the wrong position.
Incorrect type of fuel or oil.
No fuel in the tank.
Choked fuel filter or air cleaner.
Air lock in the fuel system.
Incorrect decompressor clearance.
Battery not serviceable.
Loose electrical connection.
Load not disconnected.
Turning the crankshaft the wrong way.

Engine Stops
Lack of fuel.
Air in the fuel system.
Choked fuel filter.
Excessive overload.
Overheating.
Loss of compression.
Loss of oil.

Loss of Power
Incorrect tappet clearance.
Choked air cleaner or fuel filter.
Choked exhaust system.

Failure to Attain Normal Speed
Engine started on overload.
Fuel system not correctly primed.
Insufficient fuel.

Knocking
Loose coupling or pulley.
Engine loose on its mounting.
Incorrect specification of fuel.

Exhaust Smoke
White smoke - generally as a result of water in the fuel.
Faint blue smoke - appears with light load.
Heavy blue smoke - caused by lubricating oil passing the piston rings due to stuck, worn or broken rings or a worn cylinder.
Black smoke due to incomplete combustion of the fuel can be caused by overload, chiked air filter, inlet air temperature too high or incorrect specification of fuel.

Overheating
Air inlet obstructed.
Overload
Lubricating oil level too low.

Hunting
Air in the fuel system.

7.13 Laying-up Procedure

The following routine should be carried out when it is known that the engine will not be required for some months.

If the procedure is not carried out the engine should be run on full load for approximately 45 minutes once a month.

CAUTION

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

a. Replace the fuel in the tank with a small supply of suitable inhibition fluid.

b. Drain the lubricating oil from the sump and refill with new oil.

c. 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.

d. Stop the engine 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.

e. Seal all openings on the engine with tape.

f. Remove the batteries and store them fully charged after coating the terminals with petroleum jelly.

g. Grease all external bright metal parts and the speed control linkage.

h. Tie labels on the engine clearly stating what steps have been taken to inhibit the engine during storage.

8. PARTS AND SERVICE

CONTENTS

8.1 Associated Publications

Master Parts Manual
- TS,TR 027-08030
- TX 027-08029

Workshop Manual 027-08221
Technical Information 027-09212
Arrangement Drawings 027-08035

Various wall charts and technical/sales leaflets are available.

Please contact Lister-Petter for details.

8.2 Data on CD Rom

The Master Parts Manual, Technical Bulletins, issued since June 1988, and parts information is available on CD Rom.

Please contact Lister-Petter for details.

8.3 Training

Comprehensive training in the correct operation, service and overhaul procedures of engines is available at the Lister-Petter International Product Training Centre.

Please contact Lister-Petter for details.

8.4 If Problems Occur

If problems occur with your engine, or any of the Lister-Petter approved accessories fitted to it, your local Lister-Petter Distributor should be consulted.

There are Lister-Petter Distributors in most countries of the world and details for these can be obtained from any one of the companies listed.

8.5 The Importance of Using Genuine Parts

Parts that have not been approved by the Lister-Petter organisation cannot be relied upon for correct material, dimensions or finish.

This Company cannot therefore, be responsible for any damage arising from the use of such parts and the guarantee may be invalidated.

When purchasing parts or giving instructions for repairs users should, in their own interests, always specify Genuine Lister-Petter Parts.

8.6 Lister-Petter Companies

United Kingdom

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

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Fax: +1 913 764-5493
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