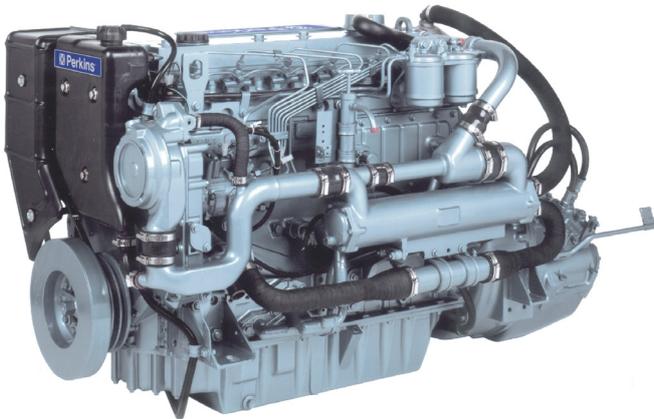


# User's Handbook

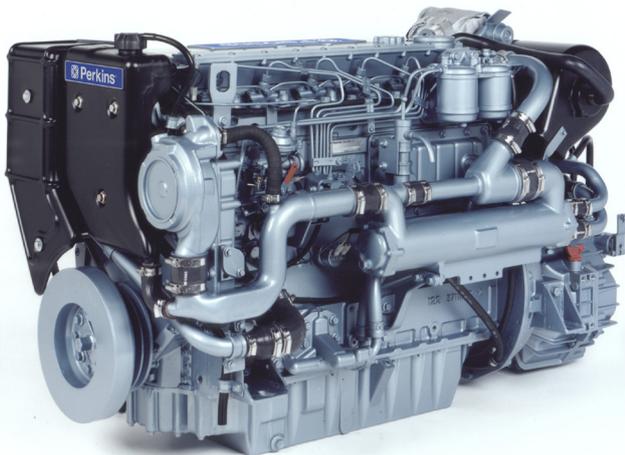
**M130/M135**



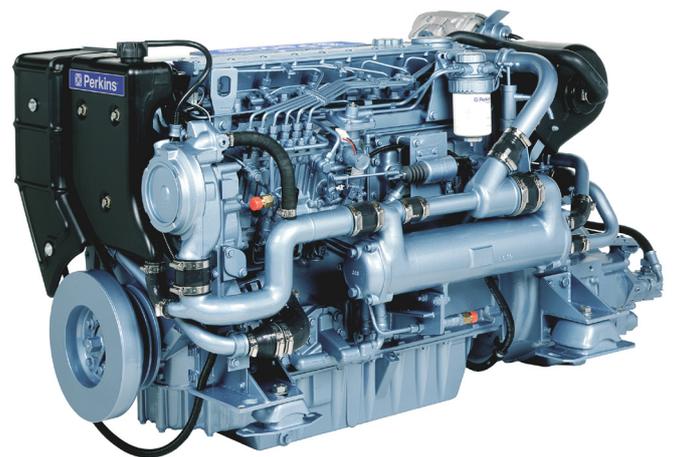
**M185**



**M215C/M225Ti**



**M265Ti/M300Ti**





# Perkins M130C to M300Ti Marine Engines

Models YA and YD

## User's handbook

<b>M300Ti</b>	6 cylinder, turbocharged, intercooled, diesel engines for
<b>M265Ti</b>	pleasure boat applications
<b>M225Ti</b>	
<b>M135</b>	6 cylinder naturally aspirated diesel engine for pleasure boat applications
<b>M215C</b>	6 cylinder, turbocharged, intercooled, diesel engines for
<b>M185C</b>	commercial applications
<b>M130C</b>	6 cylinder naturally aspirated diesel engine for commercial applications automotive applications

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**Tel:**+44(0)1202 796000 **Fax:** +44(0)1202 796001 **E-mail:** Marine@Perkins.com

[www.perkins.com/Marine](http://www.perkins.com/Marine)

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## General information

### Introduction

The Perkins range of marine engines are the latest developments from the Perkins Group of Companies together with Wimborne Marine Power Centre. There are engines designed for use in pleasure craft and for commercial craft.

Over sixty years of diesel production experience, together with the latest technology, have been applied to the manufacture of your engine to give you reliable and economic power.

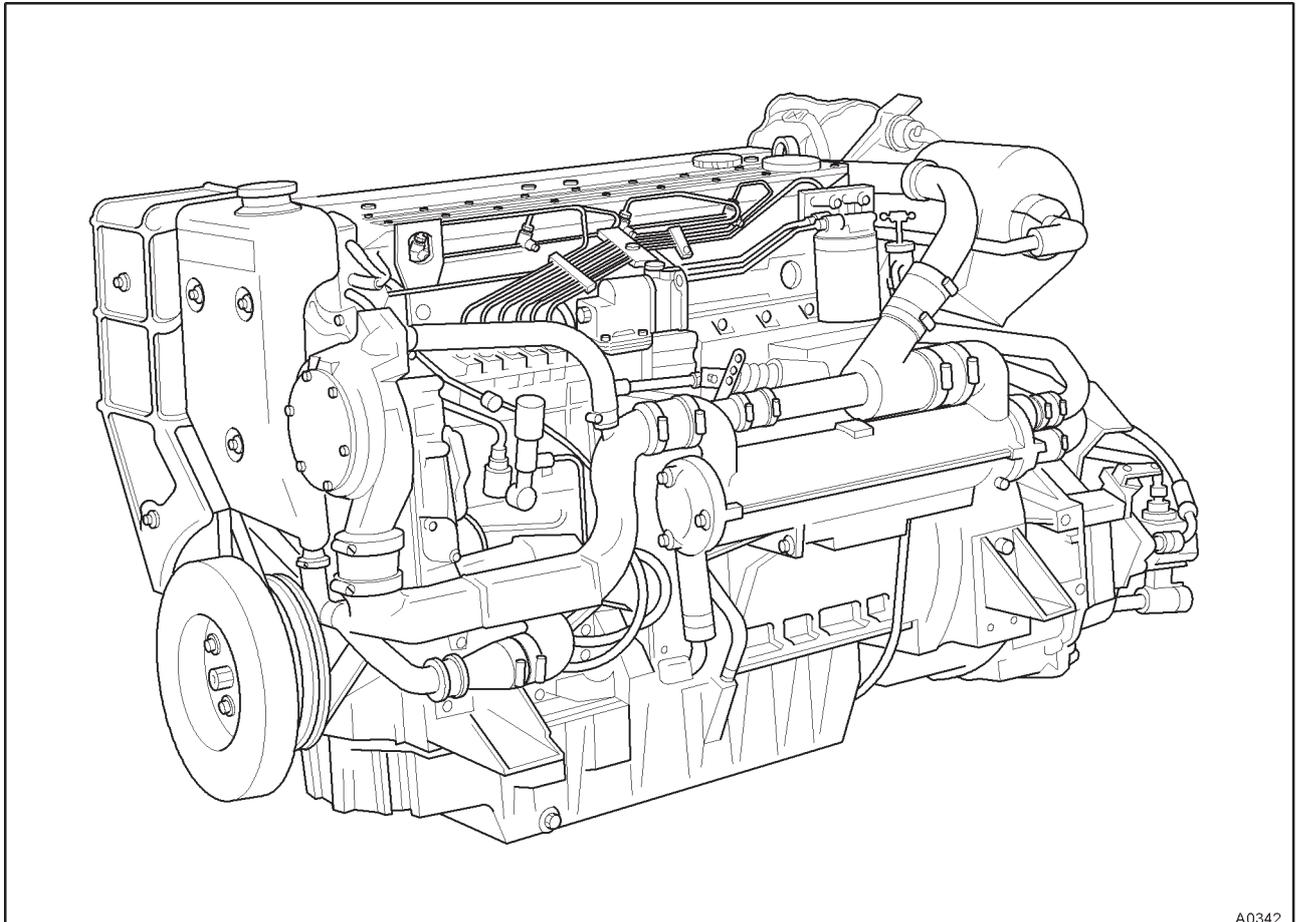
To ensure that you use the relevant information for your specific engine type, see 'Engine identification' on page 5

Danger is indicated in the text by two methods:

**Warning!** This indicates that there is a possible danger to the person.

**Caution:** This indicates that there is a possible danger to the engine.

**Note:** Is used where the information is important, but there is not a danger.



A0342

## How to care for your engine

**Warning!** Read the “Safety precautions” and remember them. They are given for your protection and must be applied at all times.

**Caution:** Do not clean an engine while it runs. If cold cleaning fluids are applied to a hot engine, certain components on the engine may be damaged.

This handbook has been written to assist you to maintain and operate your engine correctly. The purchase of a workshop manual is recommended before the boat is operated at sea.

To obtain the best performance and the longest life from your engine, you must ensure that the maintenance operations are done at the correct intervals, see Schedules on page 26. If the engine works in a very dusty environment or other adverse conditions, certain maintenance intervals will have to be reduced. Renew the filter canisters and lubricating oil regularly in order to ensure that the inside of your engine remains clean.

Ensure that all adjustments and repairs are done by personnel who have had the correct training. Personnel with this training are available at your Perkins distributor. You can also obtain parts and service from your Perkins distributor. If you do not know the address of your nearest distributor, enquire at Wimborne Marine Power Centre, on page 12.

When reference is made to the “left” or “right” side of the engine, this is as seen from the flywheel end of the engine.

## General safety precautions

These safety precautions are important. You must refer also to the local regulations in the country of use. Some items only refer to specific applications.

- Only use these engines in the type of application for which they have been designed.
  - Do not change the specification of the engine.
  - Do not smoke when you put fuel in the tank.
  - Clean away fuel which has been spilt. Material which has been contaminated by fuel must be moved to a safe place.
  - Do not put fuel in the tank while the engine runs (unless it is absolutely necessary).
  - Do not clean, add lubricating oil, or adjust the engine while it runs (unless you have had the correct training; even then extreme care must be used to prevent injury).
  - Do not make adjustments that you do not understand.
  - Ensure that the engine does not run in a location where it can cause a concentration of toxic emissions.
  - Other persons must be kept at a safe distance while the engine, auxiliary equipment or boat is in operation.
  - Do not permit loose clothing or long hair near moving parts.
  - Keep away from moving parts during engine operation.
- Warning!** *Some moving parts cannot be seen clearly while the engine runs.*
- Do not operate the engine if a safety guard has been removed.
  - Do not remove the filler cap or any component of the cooling system while the engine is hot and while the coolant is under pressure, because dangerous hot coolant can be discharged.
  - Do not use salt water or any other coolant which can cause corrosion in the closed circuit of the cooling system.
  - Do not allow sparks or fire near the batteries (especially when the batteries are on charge) because the gases from the electrolyte are highly flammable. The battery fluid is dangerous to the skin and especially to the eyes.
  - Disconnect the battery terminals before a repair is made to the electrical system.
  - Only one person must control the engine.
  - Ensure that the engine is operated only from the control panel or from the operators position.
  - If your skin comes into contact with high-pressure fuel, obtain medical assistance immediately.
  - Diesel fuel and lubricating oil (especially used lubricating oil) can damage the skin of certain persons. Protect your hands with gloves or a special solution to protect the skin.
  - Do not wear clothing which is contaminated by lubricating oil. Do not put material which is contaminated with oil into the pockets of clothing.
  - Discard used lubricating oil in accordance with local regulations to prevent contamination.
  - Ensure that the control lever of the transmission drive is in the "out-of-drive" position before the engine is started.
  - Use extreme care if emergency repairs must be made at sea or in adverse conditions.
  - The combustible material of some components of the engine (for example certain seals) can become extremely dangerous if it is burned. Never allow this burnt material to come into contact with the skin or with the eyes.
  - Always close the seacock before the removal of any component of the raw water circuit.
  - Wear a face mask if the glass fibre cover of the turbocharger is to be removed or fitted.
  - Always use a safety cage to protect the operator when a component is to be pressure tested in a container of water. Fit safety wires to secure the plugs which seal the hose connections of a component which is to be pressure tested.
  - Do not allow compressed air to contact your skin. If compressed air enters your skin, obtain medical help immediately.

- Turbochargers operate at high speed and at high temperatures. Keep fingers, tools and debris away from the inlet and outlet ports of the turbocharger and prevent contact with hot surfaces.
- The latest marine engines have a cover fitted to give some protection from the alternator fan and the drive belt. Ensure that this cover is fitted before the engine is started.
- Do not clean an engine while it runs. If cold cleaning fluids are applied to a hot engine, certain components on the engine may be damaged.
- Fit only genuine Perkins and Wimborne Marine Power Centre parts.

### **Engine guarantee**

If a claim under guarantee is necessary, the boat owner should make a guarantee claim on the nearest Perkins marine distributor or an approved dealer.

If it is difficult to find a Perkins distributor or an approved dealer, consult the Technical Services Department of Wimborne Marine Power Centre, telephone 01202 796000.

### Engine identification

Identification of the engine model is by a label fitted to the front of the header tank for the engine coolant system.

Models M135 and M130C engines are naturally aspirated with an engine number that starts with YA.

Models M185C, M215C, M225Ti, M265Ti and M300Ti engines are turbocharged / intercooled with an engine number that starts with YD.

If you need parts, service or information for your engine, you must give the complete engine number to your Perkins distributor.

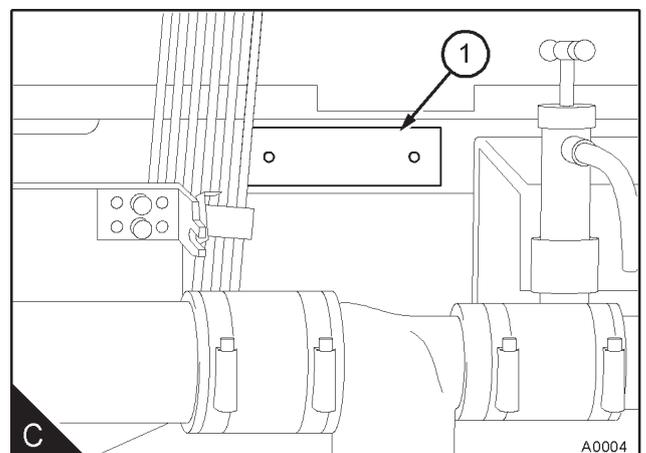
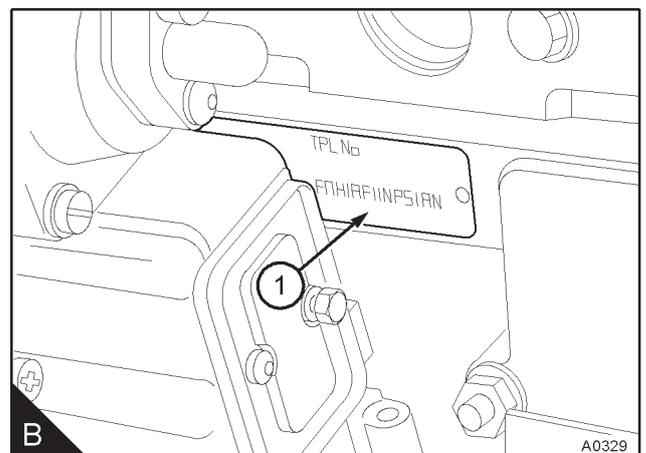
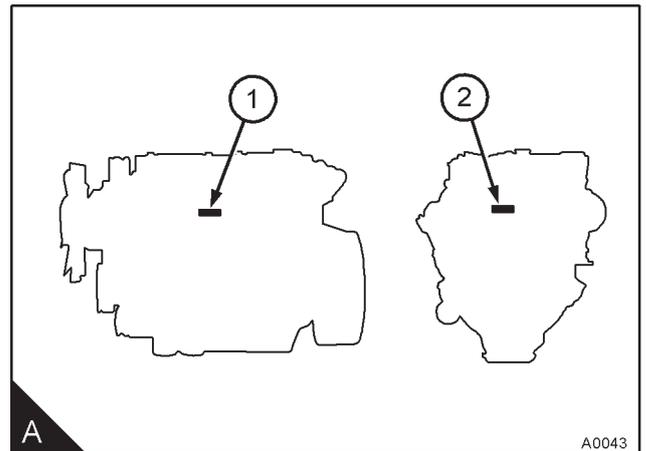
The correct identification of the engine is by the full engine number.

The engine number is stamped on a label which is fastened to the left side of the cylinder block (A1). An example of the engine number is:

**YD50555U12345D**

The label for the M265Ti and M300Ti engines is behind the fuel injection pump. The label for the rest of the range is shown in (C) .

The marine build number and the CFL number are stamped on a label which is fastened to the rear of the cylinder block (A2). An example of the marine build number is, YD30198. An example of the CFL number is S0001, this number and the marine build number must also be given to your Perkins distributor



**Perkins main dealers****Australia**

Allight Pty Ltd (Sydney Office),  
41 York Road,  
Ingleburn, NSW 2565, Australia.  
Telephone: [61](2) 9765 6800  
Fax: [61](2) 9765 6899  
Email: valcenteno@allight.com  
www.alight.com

**France**

Secodi,  
Rue de la Scierie  
17000 LA ROCHELLE,  
France.  
Telephone: [33] (5) 4645 1313  
Fax: [33](5) 46 41 83 26  
Email: secodilr@secodi.fr  
www.secodi.fr

**Germany**

BU Power Systems GmbH & Co. KG,  
Perkinsstraße 1,  
49479 Ibbenbüren,  
Germany.  
Telephone: [49] 5451 5040-0  
Fax: [49] 5451 5040-100  
Email: service@bu-perkinssabre.de  
www.bu-power-systems.de

**Italy**

Scan Diesel s.r.l.,  
Via Colorado, 14,  
28069 TRECATE (NO)  
Italy.  
Telephone: [39] (0321) 777880  
Fax: [39] (0321) 777959  
Email: info@scandiesel.it  
www.scandiesel.it

**Japan**

Perkins Engines, Inc.,  
Sanno Grand Bldg, 8th Floor,  
2-14-2 Nagatacho, Chiyoda-ku,  
TOKYO 100-0014, Japan.  
Telephone: [81] (3) 5157 0571  
Fax: [81] (3) 5157 0572

**Singapore**

Multico Power Drive Pte Ltd  
11 Tuas View Crescent  
Multico Building  
Singapore 637643  
Telephone: [65] 6 863 2863  
Fax: [65] 6 863 6819  
Email: mpd@multicorporation.net  
www.multicorporation.net

**United Kingdom**

Perkins Engines Company Ltd,  
Eastfield, Peterborough PE1 5NA,  
England.  
Telephone: 0044 (0) 1733 58 3000  
Telex: 32501 Perken G  
Fax: 0044 (0) 1733 582240  
www.perkins.com

**United States of America**

Perkins Pacific Inc.,  
7215 South 228th Street,  
Kent, Washington  
WA 98032  
USA  
Telephone: [1](253) 854 0505  
Fax: [1](253) 850 2631  
www.pacificdda.com

Perkins Power Corp,  
55 Industrial Loop North,  
Orange Park,  
Florida 32073  
U.S.A.  
Telephone: [1](904) 278 9919  
Fax: [1](904) 278 8088  
www.perkinspower.com

**The managers of the marine business for Perkins are:****Wimborne Marine Power Centre**

Ferndown Industrial Estate  
Wimborne  
Dorset  
BH21 7PW  
England  
Telephone: 0040 (0) 1202 796000  
Fax: 0040 (0) 1202 796001  
www.Perkins.com/Marine

\*This is just a small selection of Perkins dealers. For a more comprehensive list, please see [www.Perkins.com/Marine](http://www.Perkins.com/Marine)

Engine views

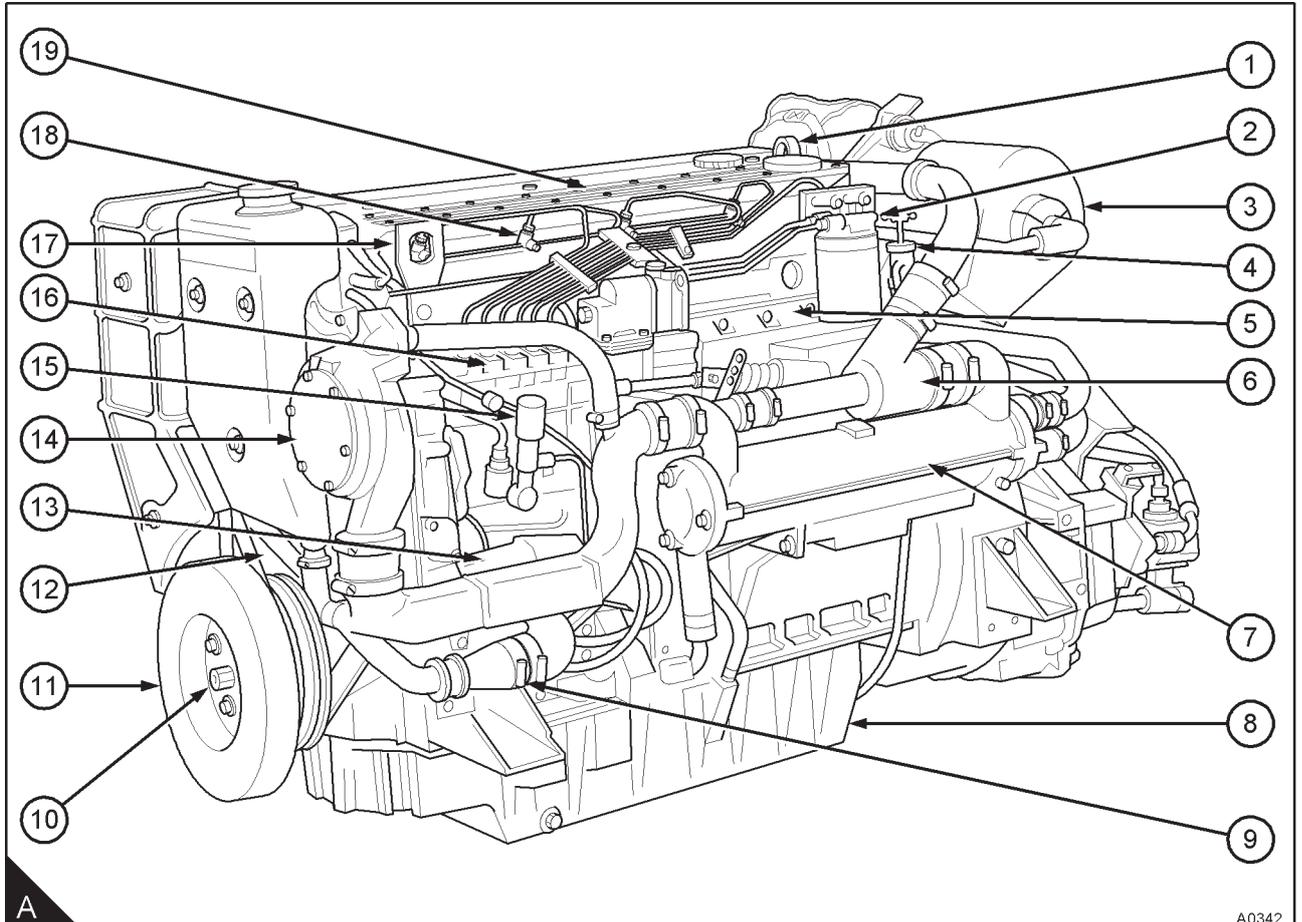
Introduction

Perkins engines are built for specific applications and the views which follow do not necessarily match your engine specification.

Location of engine parts

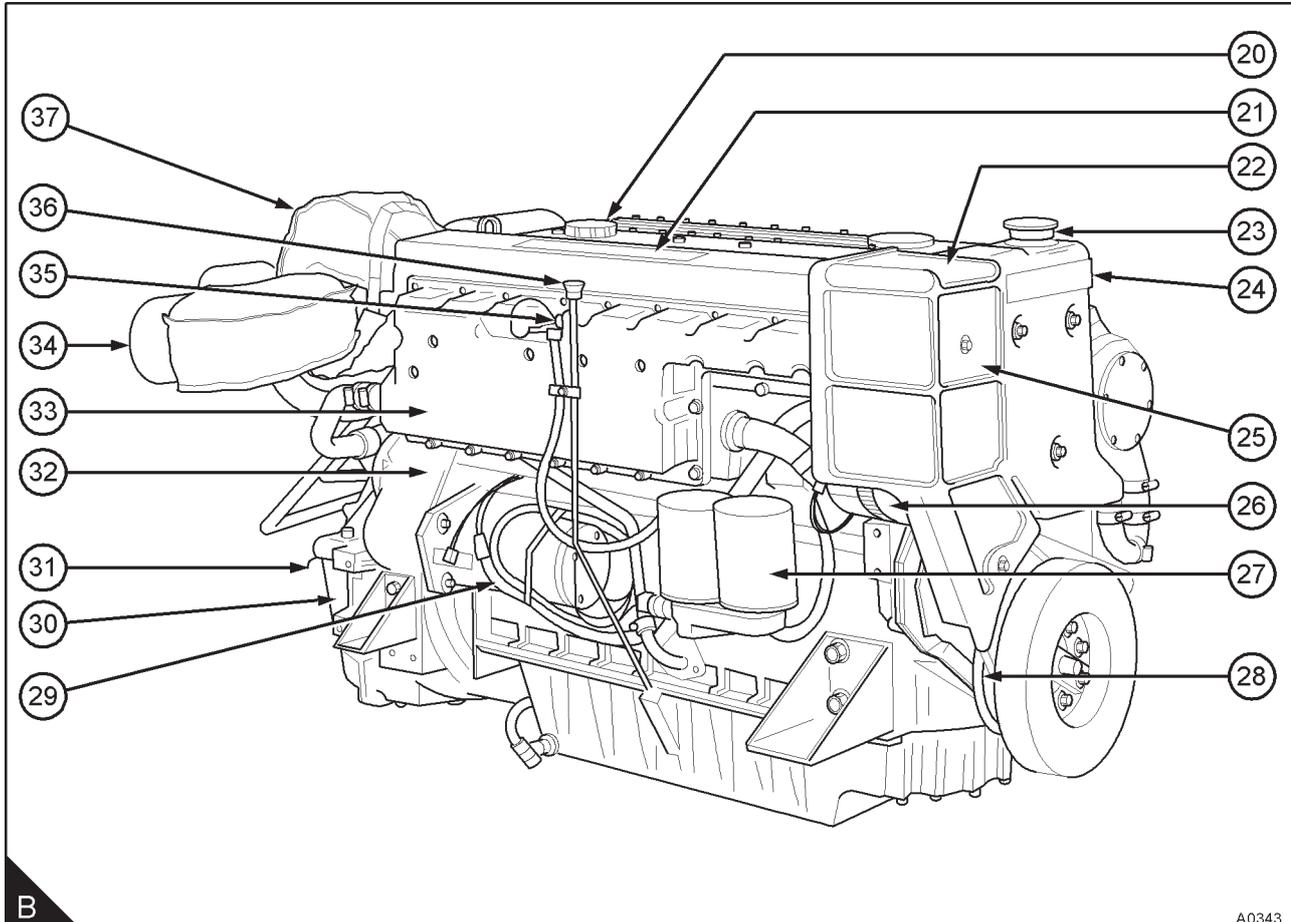
Front and left side view of a turbocharged, intercooled, engine

- |  |   |
|--|---|
| 1. Rear lift bracket                             | 11. Crankshaft damper   |
| 2. Fuel filter                                   | 12. Drive belt for alternator   |
| 3. Air filter                                    | 13. Raw water pump  |
| 4. Drain pump for the engine lubricating oil     | 14. Coolant pump for the closed circuit                                     |
| 5. Cooler for the engine lubricating oil         | 15. Fuel lift pump  |
| 6. Thermostat housing                            | 16. In-line fuel injection pump with an electrically operated stop solenoid |
| 7. Heat exchanger for the closed circuit coolant | 17. Front lift bracket  |
| 8. Sump for the engine lubricating oil           | 18. Atomiser  |
| 9. Strainer for the raw water pump               | 19. Crankcase breather  |



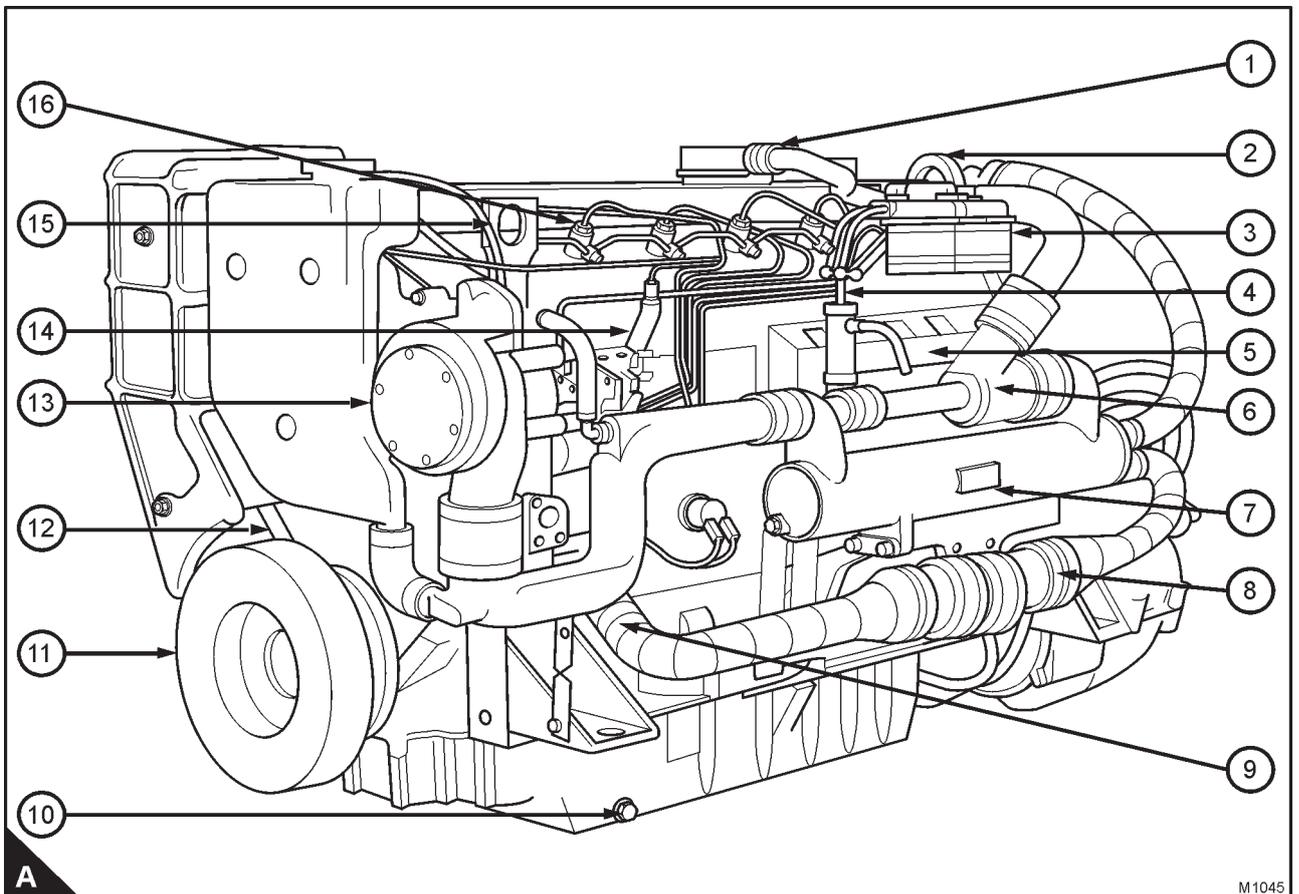
## Front and right side view of a turbocharged, intercooled, engine

- |   |  |
|---|--|
| 20. Filler cap for the engine lubricating oil | 29. Starter motor                                    |
| 21. Cooled manifold assembly                  | 30. Reverse gearbox                                  |
| 22. Electrical housing                        | 31. Lubricating oil dipstick for the reverse gearbox |
| 23. Filler cap for the coolant header tank    | 32. Lubricating oil cooler for the reverse gearbox   |
| 24. Coolant header tank                       | 33. Air charge cooler assembly                       |
| 25. Cover for drive belt                      | 34. Exhaust outlet                                   |
| 26. Alternator                                | 35. Fuelled starting aid                             |
| 27. Lubricating oil filter                    | 36. Dipstick for the engine lubricating oil          |
| 28. Crankshaft pulley                         | 37. Turbocharger                                     |



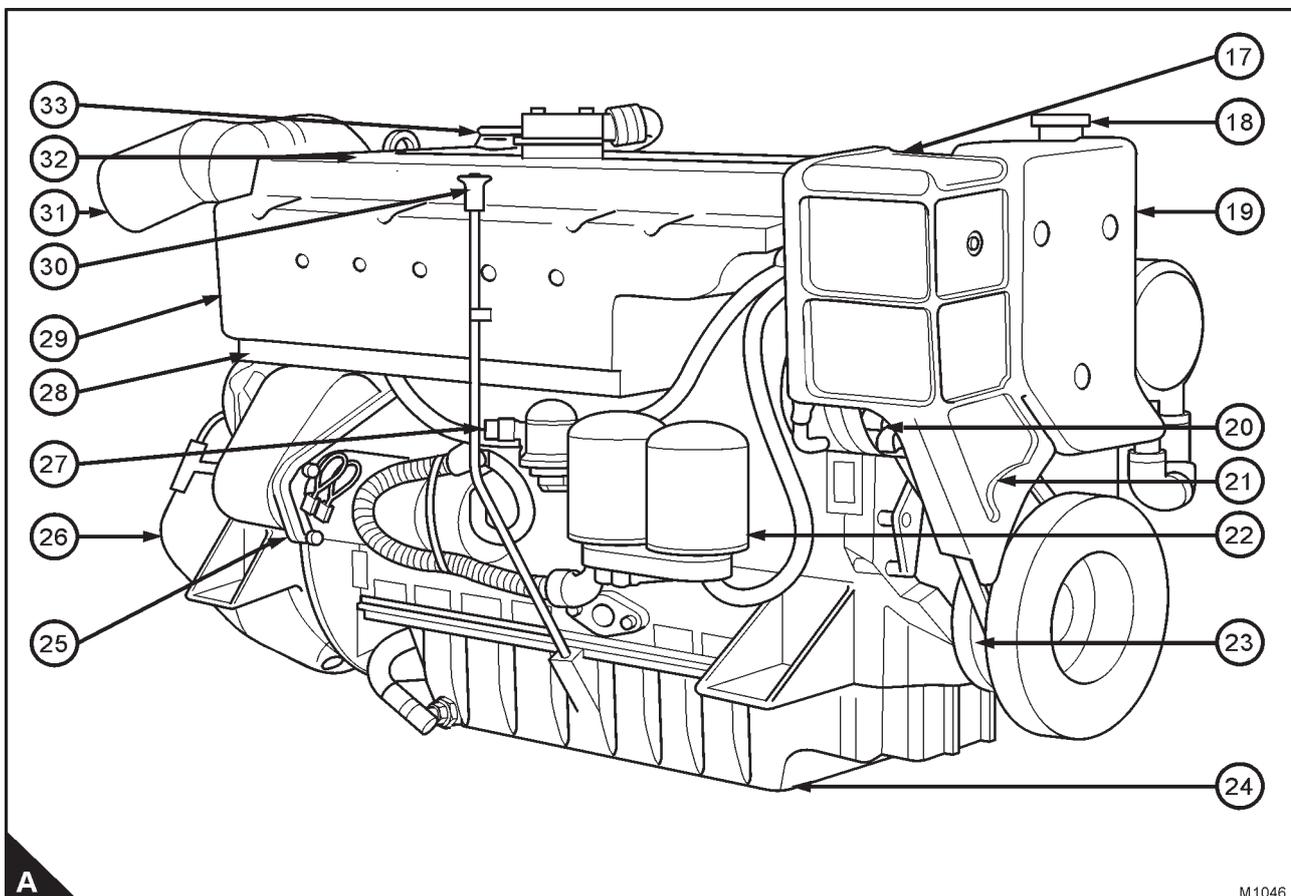
**Front and left side of a naturally aspirated engine**

- |   |  |
|---|--|
| 1. Crankcase breather                             | 10. Drain plug for the engine lubricating oil                              |
| 2. Rear lift bracket                              | 11. Crankshaft damper  |
| 3. Fuel filter                                    | 12. Drive belt for alternator  |
| 4. Drain pump for the engine lubricating oil      | 13. Coolant pump for the closed circuit                                    |
| 5. Cooler for the engine lubricating oil          | 14. Rotary fuel injection pump with an electrically operated stop solenoid |
| 6. Thermostat housing                             | 15. Front lift bracket   |
| 7. Heat exchanger for the closed circuit coolant  | 16. Atomiser   |
| 8. Lubricating oil cooler for the reverse gearbox |  |
| 9. Raw water pump                                 |  |



**Front and right side of a naturally aspirated engine**

- |   |   |
|---|---|
| 17. Electrical housing                  | 26. Reverse gearbox                           |
| 18. Filler cap for coolant header tank  | 27. Fuel lift pump                            |
| 19. Coolant header tank                 | 28. Air filter pads                           |
| 20. Alternator                          | 29. Induction manifold                        |
| 21. Cover for drive belt                | 30. Dipstick for the engine lubricating oil   |
| 22. Lubricating oil filter              | 31. Exhaust outlet                            |
| 23. Crankshaft pulley                   | 32. Cooled exhaust manifold                   |
| 24. Sump for the engine lubricating oil | 33. Filler cap for the engine lubricating oil |
| 25. Starter motor                       |   |



A

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## Operation Instructions

### How to use the control panel

The main control panel for single and twin engine installations is shown in figure A. The switches are protected from the entry of water, but if the control panel is in an exposed location, it should be protected by a cover when not in use.

Below is a description of the instruments and switches on the main panel.

**Panel illumination:** the gauges are always illuminated, when the ON switch (A5) is in the ON position. Press the button (A1) to adjust the level of illumination.

**Engine electrical system / stop switch (A5)**, which has two positions:

- OFF: Move the switch lever up to switch off the electrical system
- ON: Move the switch lever down to energise the electrical system.

**Heat / start switch (A4)**, which is held up to energise the cold start aid (if one is fitted), or held down to energise the starter motor.

**Stop button (A6)** press to stop the engine.

**Warning lamp (A2)** to indicate that there is no electrical charge from the alternator.

**Voltmeter (A3)** to indicate the condition of the batteries and of the alternator.

**Warning lamp (A10)** for high coolant temperature

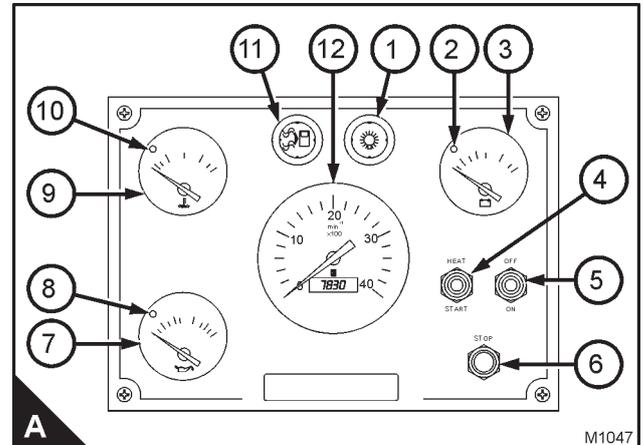
**Gauge (A9)** to indicate high coolant temperature.

**Tachometer (A12)** to indicate the engine speed. The tachometer also has an hourmeter, this can be used to ensure that the engine is maintained at the correct intervals.

**Warning lamp (A8)** for low lubricating oil pressure.

**Gauge (A7)** to indicate the lubricating oil pressure of the engine.

**Warning lamp (A11)** for water in the fuel. This will operate only if an optional device to find water in the fuel is fitted to the fuel pre-filter. If this device is fitted, the lamp will also be illuminated for approximately 10 seconds when the warning system operates.



**Audible warning device** which operates if the engine has low lubricating oil pressure or high coolant temperature. The audible warning device is situated behind the control panel.

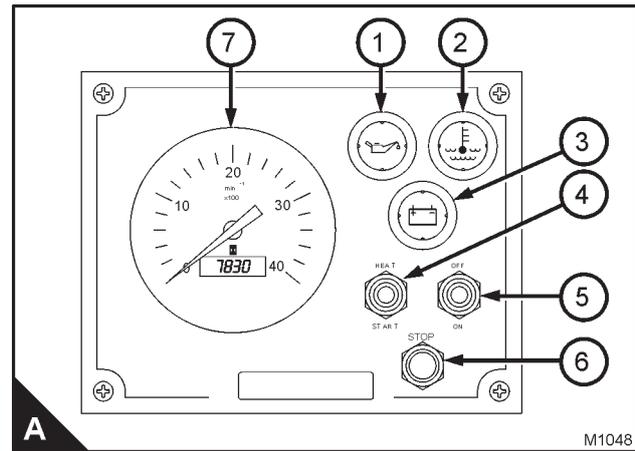
**Caution:** If the audible warning device operates, the warning light(s) on the relevant main panel will indicate the engine affected. Reduce the speed of the engine affected to idle and, if necessary, stop the engine, see page 16. Find the fault, see chapter 6.

## Auxiliary control panel

The auxiliary control panel shown in figure A is used on craft which have an extra control point. The switches are protected from the entry of water, but if the control panel is in an exposed location, it should be protected by a cover when not in use.

Below is a description of the instrument and switches on the auxiliary panel.

**Caution:** *If the audible warning device operates, the warning light(s) on the relevant main panel will indicate the engine affected. Reduce the speed of the engine affected to idle and, if necessary, stop the engine, see page 16. Find the fault, see chapter 6.*



**Audible warning device**, which operates if the engine has low lubricating oil pressure or high coolant temperature.

**Engine electrical system / stop switch (A5)**, which has two positions:

- OFF: Move the switch lever up to switch off the electrical system
- ON: Move the switch lever down to energise the electrical system.

**Tachometer (A7)** to indicate the engine speed.

**Heat / start switch (A4)**, which is held up to energise the cold start aid (if one is fitted), or held down to energise the starter motor.

**Stop button (A6)** press the button to stop the engine.

**Warning lamp (A3)** to indicate that there is no electrical charge from the alternator.

**Warning lamp (A2)** for high coolant temperature.

**Warning lamp (A1)** for low lubricating oil pressure.

### Fuse panel

**Cautions:**

- Always fit the correct fuse. Damage to the wiring loom may occur if a higher rated fuse is fitted.
- Always find the cause of a fuse failure and correct the fault. If in doubt, consult an electrician at your nearest Wimborne Marine Power Centre distributor.

An improved wiring loom, which includes a fuse panel to protect the wiring from damage by a short circuit, has been fitted to your engine.

The fuse panel (A) is below the induction manifold (A1) and is fitted with the fuses listed in the table:

Illustration reference	Fuse description	Fuse rating (amperes)	Part number
(A2)	Start circuit	40	33860
(A3)	Heat circuit	25	33859
(A4)	Stop circuit	25	33859
(A5)	Panel circuit	10	33858

The fuses (A10) are pushed into the fuse holder (A2) and protected from contamination by a water proof cover (A9).

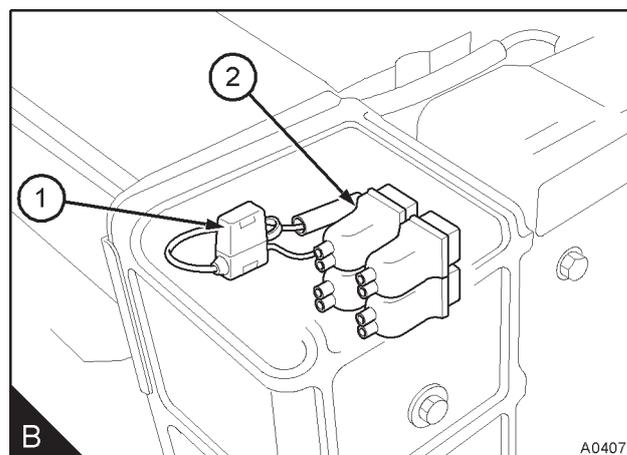
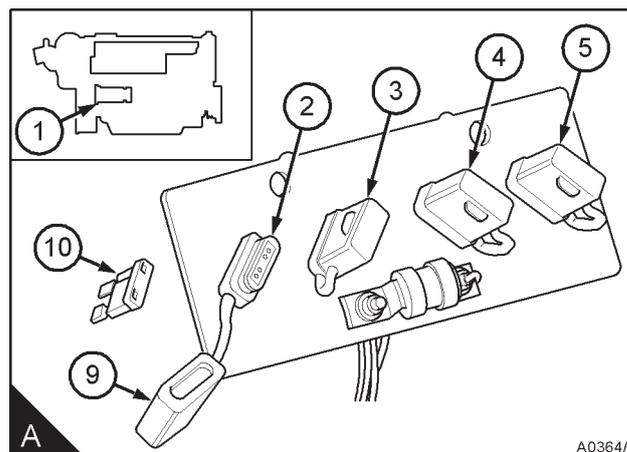
To renew a fuse remove the water proof cover and pull the fuse out of the holder.

**Negative fuse (-ve)**

**Caution:** If failure of the negative fuse (B1) occurs in service, the fuse and the negative earth relay (B2) must be renewed.

The negative fuse, part number 33859, rated at 25 amperes, is fitted to prevent damage to the engine wiring loom if the positive cable or connection comes into contact with the cylinder block and passes the electric current to earth through the negative earth relay. The negative fuse is behind the belt cover.

New fuses can be obtained from your Wimborne Marine Power Centre distributor. It is recommended that an extra set of fuses is retained on-board



**Negative earth relay (-ve)**

The negative earth relay (B2) is at the front of the engine, behind the belt cover. If failure of the negative fuse occurs in service, the fuse and negative earth relay must be renewed.

12V or 24V electrical systems are fitted to engines. Ensure that the correct negative earth relay is fitted:

Relay description	Relay rating (Volatge)	Part number
Negative earth relay	12V	19739
Negative earth relay	24V	19740

## How to start the engine

Several factors affect engine start, for example:

- The power of the batteries
- The performance of the starter motor
- The viscosity of the lubricating oil
- The installation of a cold start system

Diesel engines need a cold starting aid if they are to start in very cold conditions. The cold start aid fitted to these engines is a fuelled starting aid. This electrically operated device ignites a specific amount of diesel fuel in the induction manifold in order to heat the induction air.

## Preparations for an engine start

1. Ensure that there is more than enough fuel in the tank for the voyage.
2. Ensure that the fuel supply control (if fitted) is in the open position.
3. Check that the seacock strainer is clean.
4. Open the seacock.
5. Check the amount of coolant in the header tank.
6. Check the amount of lubricating oil in the sump, and in the reverse gearbox.
7. Ensure that the control lever for the reverse gearbox is in the neutral position.

**Caution:** *If the engine has not run for a long period (four weeks or more), ensure that there is lubricating oil at the turbocharger. To do this, hold the stop switch (see page 16/A6) in the "STOP" position; operate the starter motor until the oil warning light goes out or a pressure is indicated on the oil pressure gauge.*

## Start retard mechanism

(turbocharged engines only)

The fuel injection pump has electrical start retard mechanism that retards the injection timing from the fully advanced position, for starting, to the normal operating condition as the engine warms. The start retard mechanism begins to operate at a coolant temperature of 55 °C (131 °F).

## How to start a cold engine with the fuelled starting aid

**Note:** Use this method when the ambient temperature is below 0 °C (32 °F).

1. Switch on the electrical system (see page 11/A5).
2. Check that the reverse gearbox is in neutral.  
Adjust the engine speed control to just above the minimum speed position.
3. Hold the heat switch (see page 11/A4) in the down position for 10 seconds. Press the start switch (see page 11/A4) to engage the starter motor. When the engine starts, release the heat switch. Adjust the engine speed control to give an even idle speed.
4. If the engine does not start in 15 seconds, hold the heat switch down for 10 seconds and engage the starter motor again. When the engine has started, release the heat switch. Adjust the engine speed control to get an even idle speed. Check that water comes out of the end of the exhaust pipe or out of the separate discharge outlet.

Always ensure that the engine and starter motor are stationary before the starter motor is engaged again.

**Caution:** *Ether type starting aids must not be used at the same time as the fuelled starting aid.*

## How to start a warm engine

1. Switch on the electrical system (see page 11/A5).
2. Check that the reverse gearbox is in neutral.  
Adjust the engine speed control to the minimum speed position.
3. Press the start switch (see page 11/A4) to engage the starter motor. When the engine starts, adjust the engine speed control to give an even idle speed. Check that water comes out of the end of the exhaust pipe or out of the separate discharge outlet.

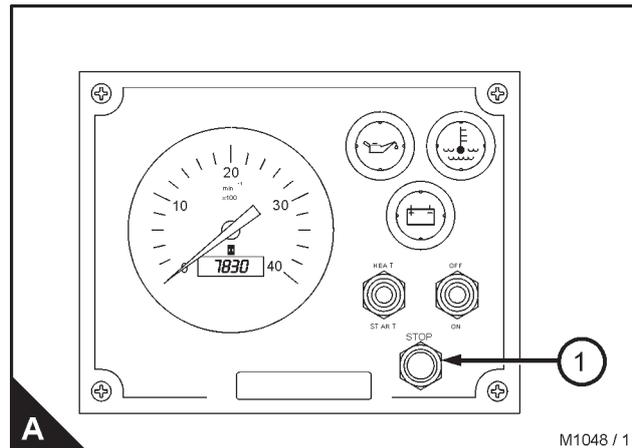
Always ensure that the engine and starter motor are stationary before the starter motor is engaged again.

## How to stop the engine

1. Adjust the engine speed control to the minimum speed position. Ensure that the control lever for the reverse gearbox is in the neutral position. If the engine has operated at high load for a long period of time, allow the engine to cool for one to two minutes.

2. Hold the stop switch (A1) in the up position until the engine stops. Release the stop switch.

**Note:** A mechanical stop lever is fitted to the fuel injection pump of all engines. This lever can be operated manually.



## Adjustment of the engine speed range

The idle or maximum speed settings must not be changed by the engine operator, because this can damage the engine or the transmission. The warranty of the engine can be affected if the seals on the fuel injection pump are broken during the warranty period by a person who is not approved by Perkins.

## Running-in

A gradual running-in of a new engine is not necessary. Prolonged operation at light loads during the early life of the engine can cause lubricating oil to enter the exhaust system. Maximum load can be applied to a new engine as soon as the engine is put into service and the coolant temperature has reached a minimum of 60 °C (140 °F).

### Cautions:

- The engine will benefit if the load is applied as soon as possible after the engine is put into service.
- Do not operate the engine at high speeds without a load.
- Do not overload the engine.

## Angle of tilt

For yachts with auxiliary engines, it may be necessary to use the engine during operation against the wind. In these conditions, an angle of tilt up to 30° is permissible if the boat is changed to an upright position at regular intervals to ensure correct lubrication.

### Free rotation of the propeller shaft or “trailing”

The propeller shaft of the ZF IRM 220A, Newage PRM 1000D and the Hurth reverse gearboxes can be allowed to turn continuously with the control lever in the neutral position. The recommendations of the manufacturer of the reverse gearbox must be followed.

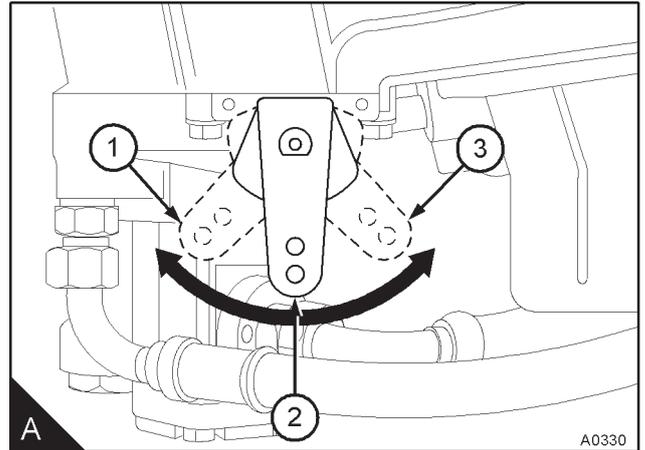
**Operation of the lever for gear selection**

**ZF IRM 220A reverse gearbox (A)**

For the drive shaft to rotate in the opposite direction to engine rotation, move the lever away from the front of the engine, to the position (A1).

To put the gearbox into neutral, move the lever to the centre position (A2).

For the drive shaft to have the same direction of rotation as the engine, move the lever towards the front of the engine, to the position (A3).

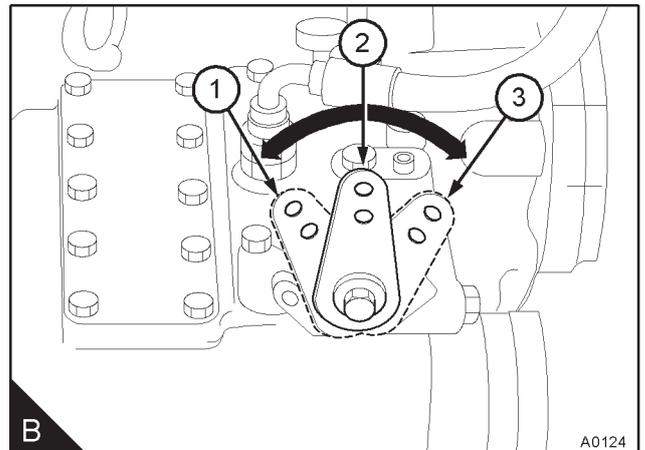


**Newage PRM 1000D and PRM 500D reverse gearboxes (B)**

For the drive shaft to rotate in the opposite direction to engine rotation, move the lever away from the front of the engine, to the position (B3).

To put the gearbox into neutral, move the lever to the centre position (B2).

For the drive shaft to have the same direction of rotation as the engine, move the lever towards the front of the engine, to the position (B1).

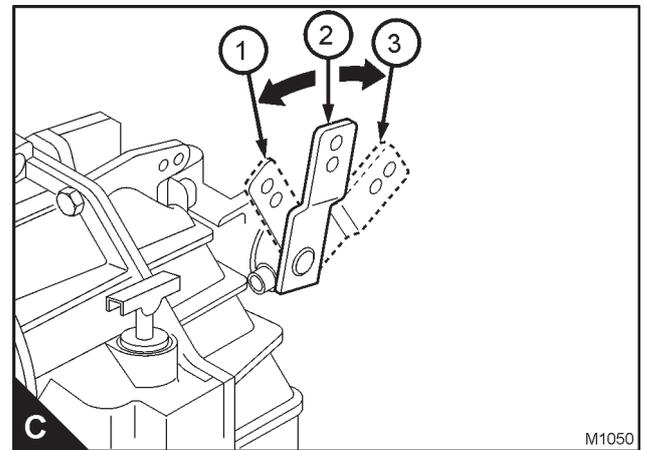


**Newage PRM 1000A reverse gearbox (B)**

For the drive shaft to rotate in the opposite direction to engine rotation, move the lever to the position (B1).

To put the reverse gearbox into neutral, move the lever to the centre position (B2).

For the drive shaft to have the same direction of rotation as the engine, move the lever to the position (B3).



**Hurth HSW 630A / 630H reverse gearboxes (C)**

For the drive shaft to rotate in the opposite direction to engine rotation, move the lever to the position (C1).

To put the reverse gearbox into neutral move the lever to the centre position (C2).

For the drive shaft to have the same direction of rotation as the engine, move the lever to the position (C3).

## Emergency procedures

### If the engine stops

1. Check that the fuel supply valve (if fitted) is in the open position.
2. Check the fuel pre-filter (if fitted) and the fuel filters for water. If a warning light (see page 11/A5) for water in the fuel is fitted, and it is illuminated, water has entered the pre-filter. Water must be removed before the engine is operated. Drain any water found and fit new filters.
3. Check the amount of fuel in the tank. If the engine has run until the tank is empty, there can be dirt or air in the fuel pipes. Change the fuel filter (see chapter 4), fill the tank, eliminate air from the system (see chapter 4) and start the engine again. If the engine still will not start, disconnect the electrical stop solenoid of the fuel injection pump and start the engine. The mechanical stop lever of the pump can be used to stop the engine.

### If there is a reduction in engine speed or a loss of power

1. Check that the propeller is free of debris, etc.
2. Check that the induction system is not restricted and that the engine compartment has a good supply of air.
3. Check that the fuel pre-filter or the fuel filter elements are not restricted or contaminated by water. If a warning light (see page 11/A5) for water in the fuel is fitted, and it is illuminated, water has entered the pre-filter. Water must be removed before the engine is operated. Drain any water found and fit new filters.

### If the engine coolant is at boiling point

1. Reduce the engine speed to idle. Stop the engine if there is a leakage of steam or coolant from the engine.
2. Check that the coolant level is correct after the engine has cooled.

**Warning!** Do not remove the filler cap while the engine is still hot and the system is under pressure, because dangerous hot coolant can be discharged.

3. Check the seacock and strainer to ensure that there is a good supply of water to the cooling system.
4. Check the strainer at the outlet of the raw water pump.

5. Check the raw water pump operation for impeller failure, etc.

Coolant leakage can be stopped temporarily with adhesive tape, hose and hose clips.

### If a bad leakage occurs from a high pressure fuel pipe

**Warning!** Ensure that fuel does not spray onto the skin. Stop the engine if there is a leakage of high-pressure fuel.

1. Stop the engine.
2. Remove the broken pipe from the engine.
3. Connect the good end of the pipe to the fuel injection pump. Put the broken end of the pipe into a suitable container.
4. Operate the engine at a reduced speed on the remainder of the cylinders. Empty the container at regular intervals.

If leakage occurs from a low pressure fuel pipe

Temporarily stop the leak with a hose and hose clips.

### If a bad lubricating oil leakage occurs

1. Stop the engine immediately and try to find the cause.
2. If the main flow can be reduced, put a suitable container under the leakage point.
3. Fill the engine with new lubricating oil at the same rate as the loss of oil and frequently check the lubricating oil pressure.

## Preventive maintenance

### Preventive maintenance periods

These preventive maintenance periods apply to average conditions of operation. Check the periods given by the manufacturer of the boat in which the engine is installed. If necessary, use the shorter periods. When the operation of the engine must conform to the local regulations these periods and procedures may need to be adapted to ensure correct operation of the engine.

It is good preventive maintenance to check for leakage and loose fasteners at each service.

These maintenance periods apply only to engines that are operated with fuel and lubricating oil which conform to the specifications given in this handbook.

Use the procedures in this chapter to maintain your engine in accordance with the preventive maintenance schedule on page 26 and page 27.

**Schedules**

The schedules which follow must be applied at the interval (hours or months) which occur first.

**A** First service at 20/40 hours

**D** Every 400 hours or 12 months

**B** Every day or every 8 hours

**E** Every 2000 hours or 2 years

**C** Every week

A	B	C	D	E	Operation
	•				Check the amount of coolant in the header tank
	•				Check the engine for leakage of oil and coolant
•				•	Check the specific gravity of the coolant <sup>(1) (2)</sup>
	•				Check the condition of the drive belt for the alternator
•			•		Check the tension of the drive belt for the alternator
			•		Check the impeller of the raw water pump
			•		Check the strainer for the raw water system
			•		Check the seal faces of the heat exchanger for signs of leakage <sup>(2)</sup>
			•		Check the condition of the tube stack for the heat exchanger <sup>(2)</sup>
		•			Drain water from the fuel pre-filter (or earlier if your fuel supply is contaminated)
			•		Clean the sediment chamber and the strainer of the fuel lift pump
			•		Renew the element of the fuel filter
			•		Ensure that the atomisers are checked <sup>(2)</sup>
	•				Check the amount of lubricating oil in the sump
	•				Check the lubricating oil pressure at the gauge
•			•		Renew the engine lubricating oil <sup>(3)</sup>
•			•		Renew the canisters of the lubricating oil filter.
			•		Check for oil in the inlet manifold reservoir.

(1) Check the specific gravity every 12 months and renew the antifreeze every 6 years. If a coolant inhibitor is used instead of antifreeze, it should be renewed every 6 months. If combustion gases are released into the coolant circuit, the coolant must be renewed.

(2) By a person who has had the correct training.

(3) The oil change period will change with the amount of sulphur in the fuel (see the fuel specification in chapter 5). The interval to change the canister of the lubricating oil filter is not affected.

Continued

**Schedules**

The schedules which follow must be applied at the interval (hours or months) which occur first.

**A** First service at 20/40 hours

**D** Every 800 hours

**B** Every day or every 8 hours

**E** Every 2000 hours

**C** Every 400 hours or 12 months

**F** Every 2000 hours or 2 years

A	B	C	D	E	F	Operation
	•					Check the amount of lubricating oil in the reverse gearbox
•		•				Refer to gearbox manufacturers handbook for lubricating oil change intervals
			•			Clean the strainer for the lubricating oil in the Newage PRM 1000 reverse gearbox or the ZF IRM 220A reverse gearbox
			•			Clean the engine breather system, all engines except M265Ti and M300Ti
					•	Renew the engine breather system, M265Ti and M300Ti engines <sup>(1)</sup>
		•				Clean or renew the air filter element(s)
		•				Check the audible warning system which protects the engine
		•				Check the engine mounts
		•				Check all hoses and connections
		•				Check the condition of the crankshaft damper
•					•	Ensure that the valve tip clearances of the engine are checked and, if necessary, adjusted, all engines except M265Ti and M300Ti <sup>(2)</sup>
•		•				Ensure that the valve tip clearances of the engine are checked and, if necessary, adjusted, M265Ti and M300Ti engines <sup>(2)</sup>
		•				Ensure that the turbocharger impeller and the turbocharger compressor casing are cleaned <sup>(2)</sup>
				•		Ensure that the alternator, the starter motor, and the turbocharger, etc. are checked. <sup>(2)</sup>

(1) The valve for the breather system must be renewed every 4000 hours.

(2) By a person who has had the correct training.

To ensure that the engine runs at maximum efficiency the operations which follow must be done every 12 months or less. If the raw water is excessively contaminated, these operations should be done more frequently. Refer to the workshop manual for instructions.

- Clean the tube stack of the heat exchanger for the closed circuit coolant.
- Clean the tube stack of the oil cooler for the reverse gearbox.
- Clean the fins on the tube stack of the heat exchanger for the air charge cooler, where fitted.

## How to fill the coolant circuit

**Warning!** If coolant is to be added to the circuit during service, allow the engine to cool before the coolant is added. Remove the filler cap slowly as dangerous coolant could be discharged if the coolant is still hot and the system under pressure.

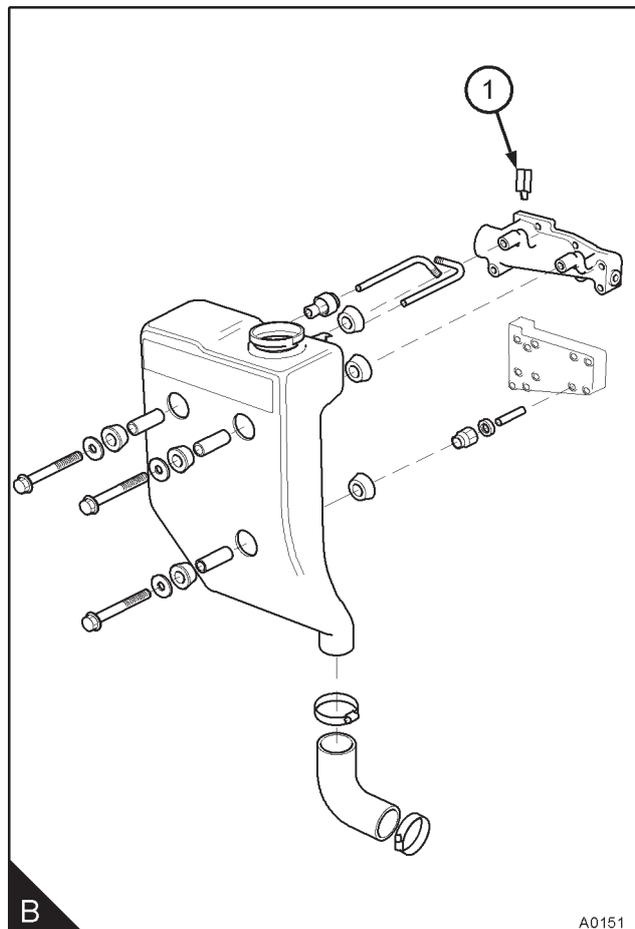
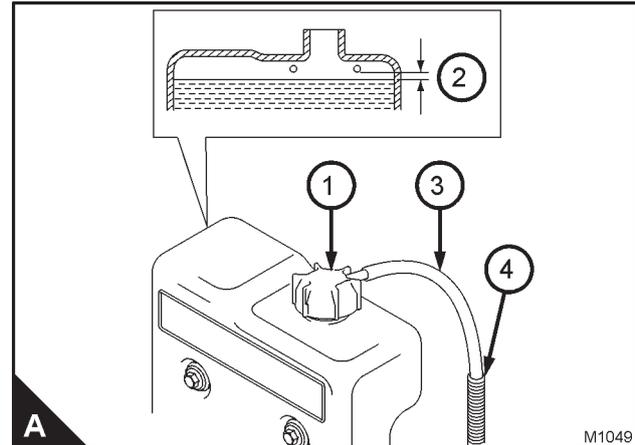
Do not put too much coolant in the coolant circuit. There is a relief valve in the filler cap which will open and release hot coolant if too much coolant is added.

**Caution:** If coolant is added to the circuit during service, it must consist of the same original mixture as used to fill the system, see 'Coolant specification' on page 51 for details of the correct coolant to be used in the circuit.

1. Remove the filler cap (A1) of the header tank and slowly fill the coolant system until the coolant level is just below the pipes (A2) inside the header tank.

**Note:** It is not necessary to vent air from the system except where the engine is installed with the front of the engine more than 10° higher than the rear. For this type of installation a vent plug (B1) is fitted to the top of the water outlet adaptor at the front of the cylinder head. This plug must be removed to eliminate air from the cylinder block when the coolant system is filled.

2. Wait for five to ten minutes and check the coolant level, add coolant if necessary. Fit the filler cap.
3. Start the engine. When it has reached its normal temperature of operation, stop it and let it cool.
4. Remove the filler cap of the header tank and add coolant until the level of the coolant (A2) is between 25 mm (1.00 in) and 40 mm (1.50 in) below the bottom of the pipes (A1). Fit the filler cap.



### How to drain the coolant circuit

**Warnings!**

- Discard the used coolant in a safe place and in accordance with local regulations.
- Do not drain the coolant while the engine is still hot and the system is under pressure because dangerous hot coolant can be discharged.

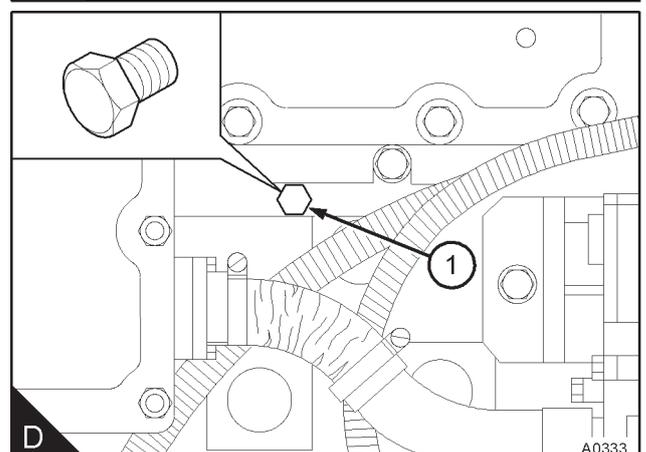
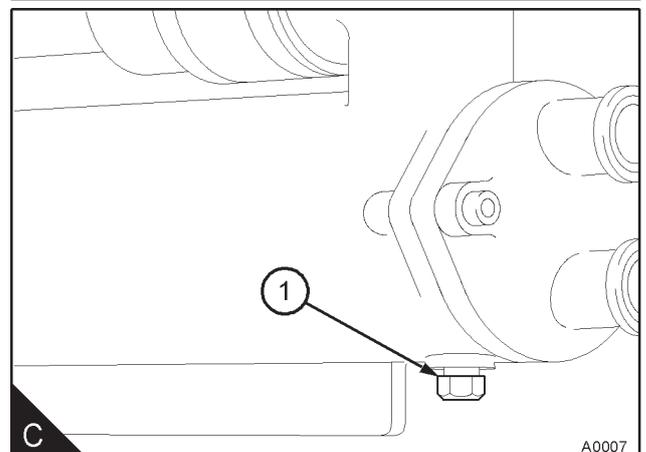
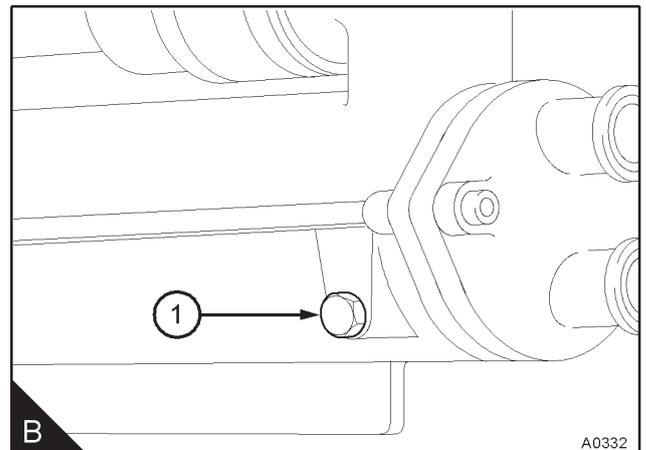
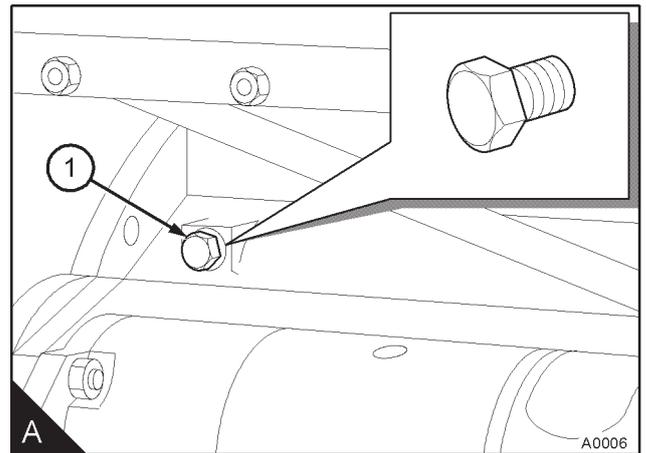
1. Remove the coolant filler cap (see page 22A1). Remove the drain plug (A1) from the cylinder block.
2. For M265Ti and M300Ti engines remove the drain plug (B1) from the heat exchanger for the coolant system. For all other engines remove the drain plug (C1) from the heat exchanger for the coolant system. Remove the drain plug (D1) from the cooled manifold assembly. Ensure that the drain holes are not restricted.
3. After the system has been drained, fit the filler cap and the drain plugs.
4. Fasten a label in a suitable place to indicate that the coolant system has been drained.

**Caution:** The closed circuit system cannot be drained completely. If the coolant is drained for engine preservation purposes or for protection from frost, the coolant system must be filled again with an approved antifreeze mixture, see ‘Coolant specification’ on page 51 for details of the correct coolant to be used in the circuit.

**Engines fitted with keel coolers**

The coolant capacity and the method used to drain the coolant circuit of an engine connected to a keel cooler will vary in different applications.

Use the instructions given by the keel cooler manufacturer to drain and renew the engine coolant if a keel cooler is fitted.



## How to check the specific gravity of the coolant

For mixtures which contain inhibited ethylene glycol:

1. Operate the engine until it is warm enough to open the thermostat. Continue to run the engine until the coolant has circulated the cooling system.
2. Stop the engine.
3. Allow the engine to cool until the temperature of the coolant is below 60°C (140°F).

**Warning!** Do not drain the coolant while the engine is still hot and the system is under pressure because dangerous hot coolant can be discharged.

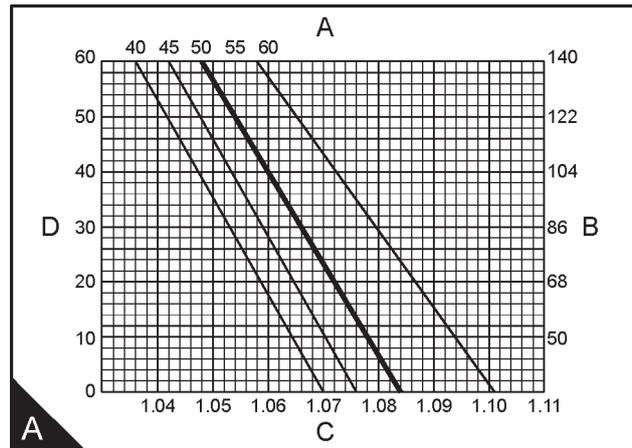
4. Remove the filler cap of the cooling system.
5. Drain some coolant from the cooling system into a suitable container.
6. Use a special coolant hydrometer that will check the temperature and the specific gravity of the coolant, follow the manufacturer's instructions.

**Note:** If a special coolant hydrometer is not available, put a hydrometer and a separate thermometer into the antifreeze mixture and check the readings on both instruments. Compare the readings with the chart (A).

7. Adjust the strength of the mixture as necessary.

**Note:** If it is necessary to fill or replenish the coolant system in service, mix the coolant to the correct strength before it is added to the coolant system.

Perkins POWERPART antifreeze with a concentration of 50% will give protection against frost to a temperature of -35°C (-31°F). It will also give protection against corrosion. This is especially important when there are aluminium components in the coolant circuit.



**Specific gravity chart**

**A** = Percentage antifreeze by volume

**B** = Mixture temperature in °F

**C** = Specific gravity

**D** = Mixture temperature in °C

### How to drain the raw water system

**Caution:** The raw water system cannot be drained completely. If the system is drained for engine preservation purposes or for protection from frost, the system must be filled again with an approved antifreeze mixture, see ‘Coolant specification’ on page 51 for details of the correct coolant to be used. See chapter 7 for details of how to add antifreeze to the raw water system for engine preservation purposes.

#### Turbocharged engines

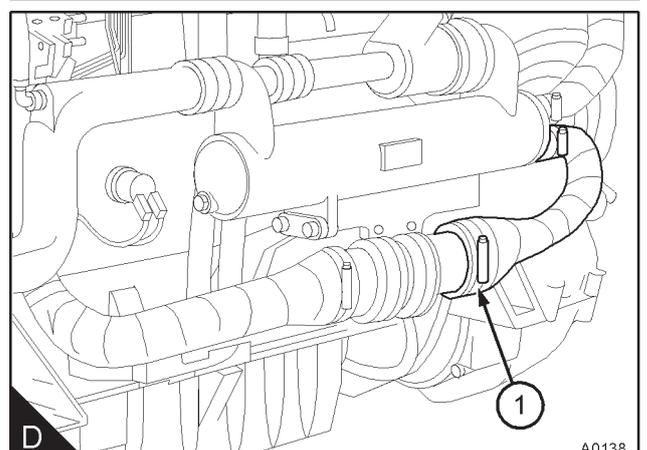
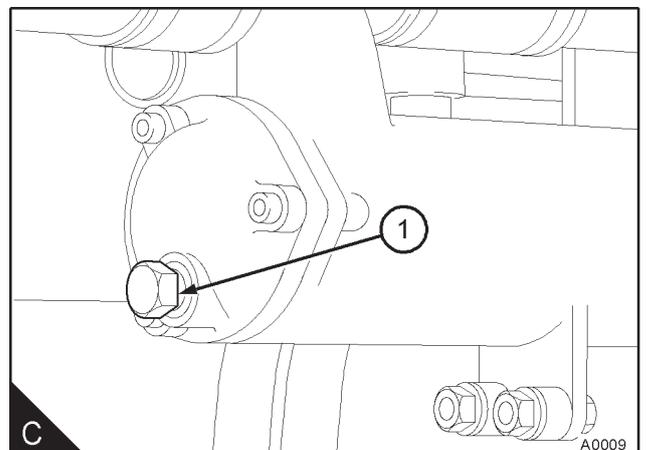
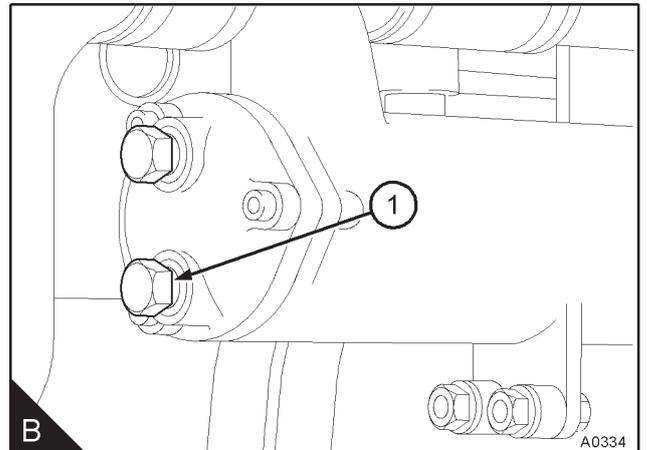
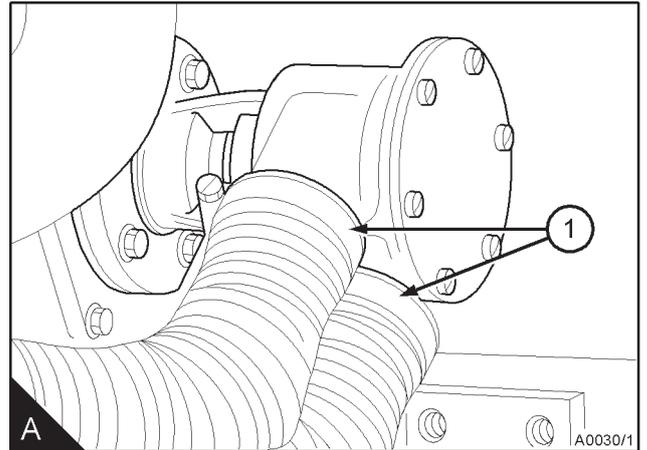
1. Ensure that the seacock is closed.
2. Disconnect both hoses (A1) at the raw water pump.
3. Remove the drain plug (B1), for M265Ti and M300Ti engines and (C1) for all other engines, from the front cover of the heat exchanger for the coolant system. Ensure that the drain hole is not restricted.
4. Turn the crankshaft to ensure that the raw water pump is empty.
5. Connect the hoses at the raw water pump and tighten the clips.
6. Fit the drain plug to the heat exchanger.

**Caution:** When the raw water system is to used again, ensure that the seacock is open.

#### Naturally aspirated engines

1. Ensure that the seacock is closed.
2. Disconnect both hoses (A1) at the raw water pump.
3. Release the clip (D1) and remove the hose from the cooler for the reverse gearbox to drain the raw water system.
4. Turn the crankshaft to ensure that the raw water pump is empty.
5. Connect the hoses at the raw water pump and at the cooler for the reverse gearbox and tighten the clips.

**Caution:** When the raw water system is to used again, ensure that the seacock is open.



## How to check the drive belt of the alternator

**Warning!** The engines have a guard fitted to give protection from the alternator fan and the drive belt. Ensure that this guard is fitted before the engine is started.

Renew the belt if it is worn or damaged.

To ensure maximum belt life, it is recommended that a belt tensioner gauge, part number 21825686, is used to check the belt tension. The tool can be obtained from the nearest Perkins distributor. Fit the gauge (A) at the centre of the longest free length and check the tension. If a belt tensioner gauge is used, the correct tension is 355 N (80 lbf) 36 kgf. If the tension is 220 N (50 lbf) 22 kgf or below, adjust the tension to 355 N (80 lbf) 36 kgf as indicated below.

If a gauge is not available, press down the belt with the thumb at the centre of the longest free length and check the deflection. With moderate thumb pressure - 45 N (10 lbf) 4,5 kgf - the correct deflection of the belt is 10 mm (3/8 in).

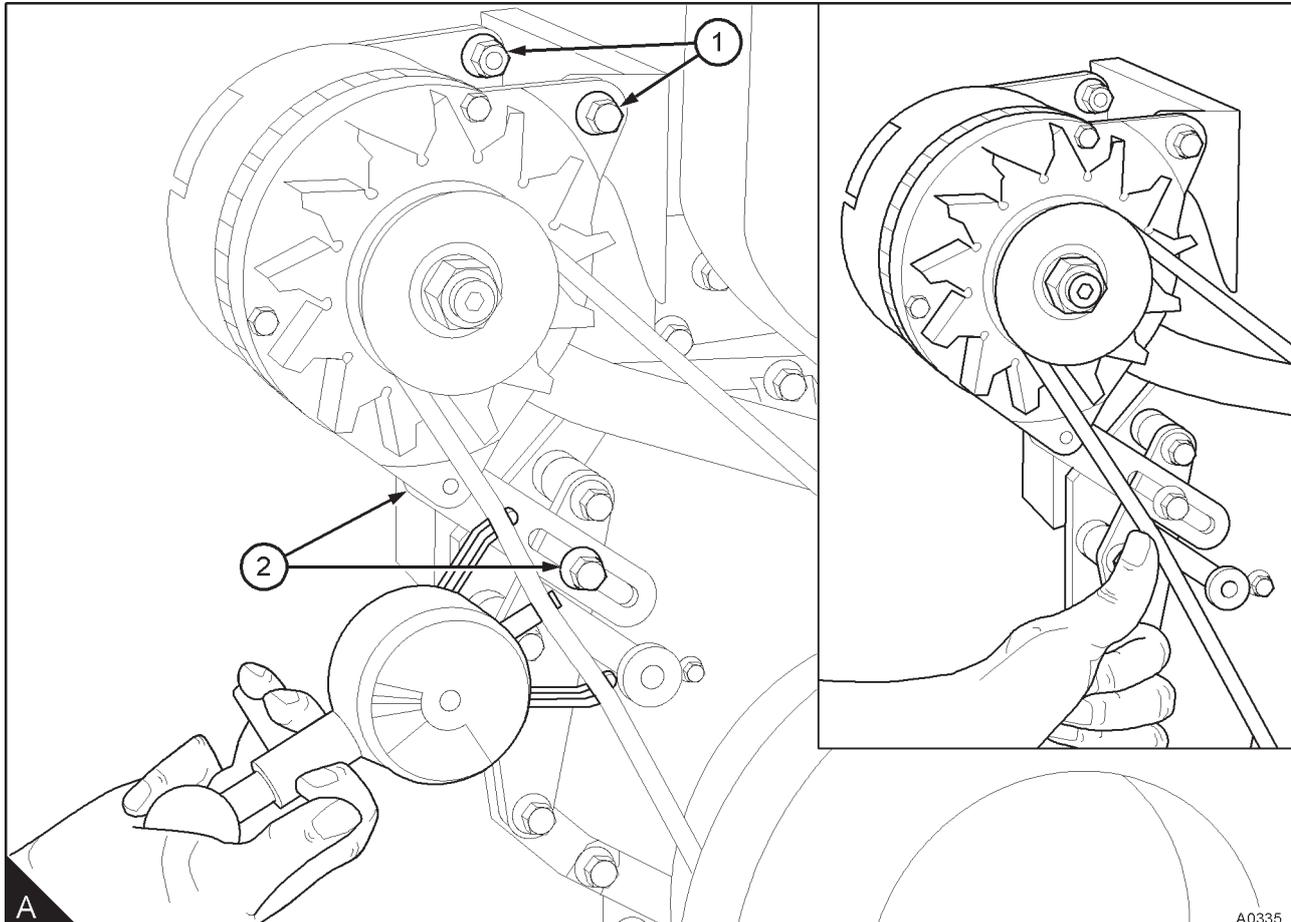
## How to adjust the belt tension

Loosen the pivot fasteners (A1) of the alternator and the adjustment link fasteners (A2).

Change the position of the alternator to give the correct tension. Tighten the pivot fasteners of the alternator and the adjustment link fasteners.

Check the belt tension again to ensure that it is still correct.

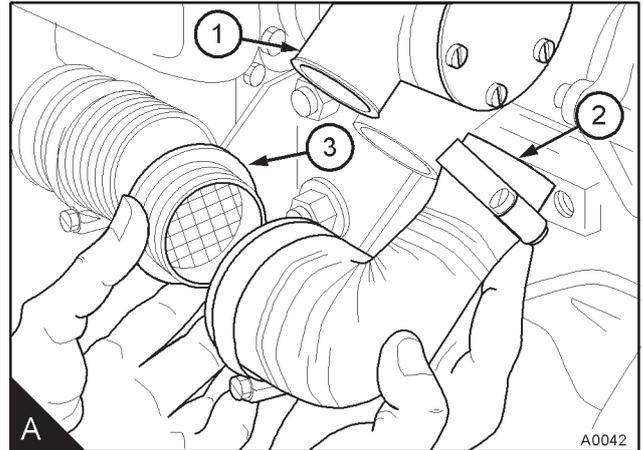
**Note:** If a new belt is fitted, the correct belt tension must be checked again after the first 20 hours of operation.



### How to clean the strainer for the raw water pump

The strainer for the raw water pump is fitted in the outlet hose for the raw water pump. The purpose of the strainer is to protect the air charge cooler from debris. The strainer is fitted only to turbocharged engines.

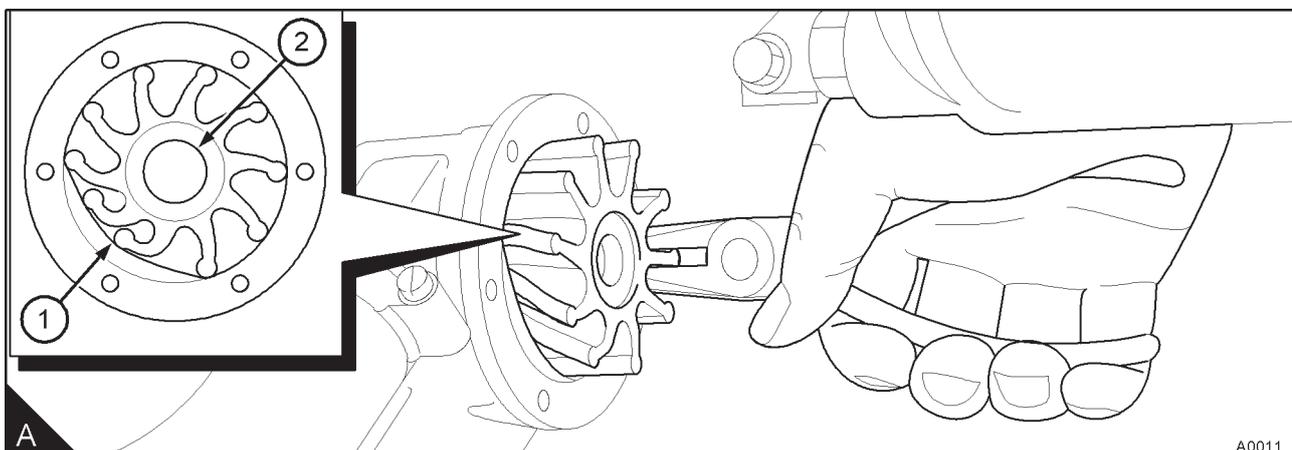
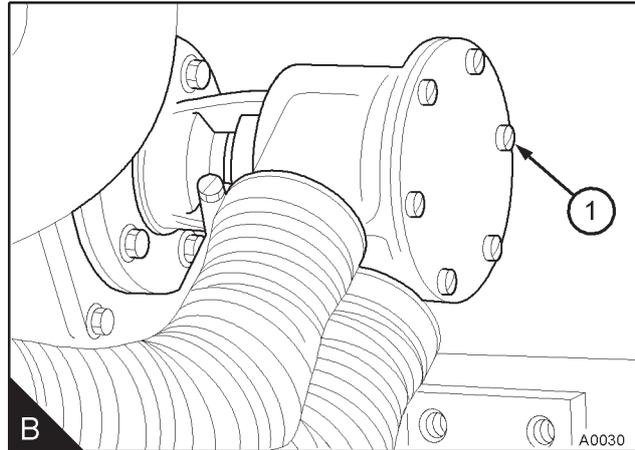
1. Ensure that the seacock is closed.
2. Release the hose clip at the outlet connection (A 1) of the raw water pump and on each side of the strainer (A3). Remove the hose (A2).
3. Remove the strainer and wash in clean water. If there is debris in the strainer from the impeller of the raw water pump, check the impeller.
4. Put the strainer into position and fit the hose. Tighten the hose clips.
5. Open the seacock.



## How to check the impeller of the raw water pump

**Caution:** When the impeller is checked, the strainer in the outlet hose of the raw water pump must also be checked, see page 27.

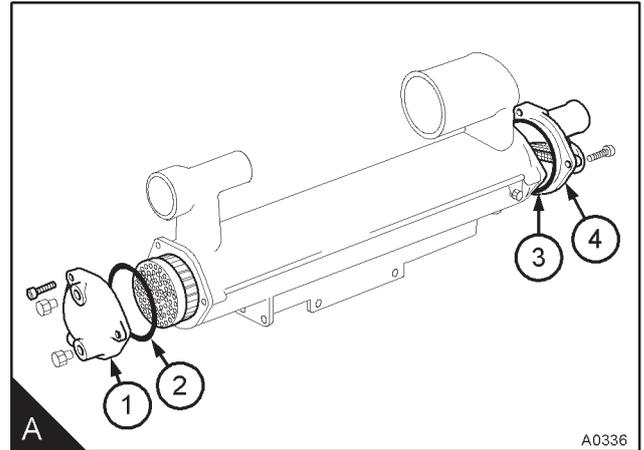
1. Ensure that the seacock is closed.
2. Release the six screws (B1) which fasten the end plate of the raw water pump and remove the plate. When the end plate of the raw water pump is removed, some raw water will flow from the pump.
3. Remove the rubber end cap (A2) and then pull the impeller from the shaft.
4. Clean the contact surfaces of the pump body and the end plate.
5. Inspect the rubber impeller for excessive wear or for damage and renew it, if necessary.
6. Apply Spheerol SX2 grease to the blades of the new impeller and fit the impeller into the housing with the blades bent clockwise (A). Fit the rubber end cap.
7. Apply jointing compound to a new joint and fit it to the body with the wide area of the joint over the eccentric plate (A1) in the body. Fit the end plate and tighten the end plate screws.
8. Open the seacock.



### How to check the condition of the seal faces of the heat exchanger

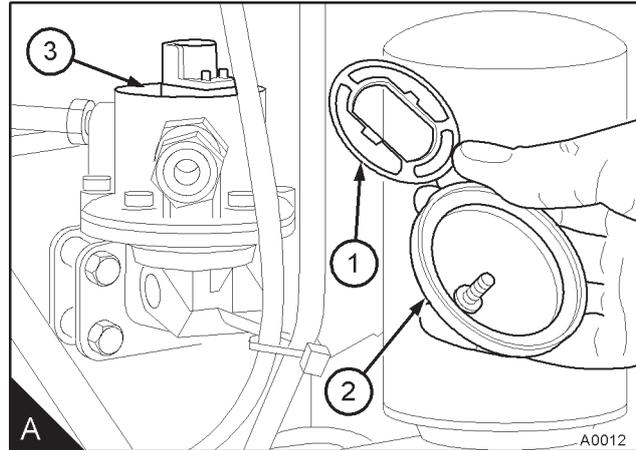
1. Inspect thoroughly the condition of the outer area between the end caps (A1 and A4) and the body of the heat exchanger. Ensure that there is enough light and that the area can be seen clearly.
2. If there is leakage or corrosion, close the seacock and drain the raw water system, see page 25.
3. Drain the coolant circuit at the heat exchanger, see page 23. The coolant could be kept and returned to the header tank later.
4. Disconnect the hoses and remove the end caps.
5. Remove the "O" rings (A2 and A3).
6. Clean thoroughly the seal faces of the end caps and the heat exchanger body. If there is corrosion on the body in the area of the "O" ring seats, the body must be renewed.
7. Fit new "O" rings and apply a thick layer of waterproof grease.
8. Fit the end caps and connect the hoses. Open the seacock.
9. Return or add coolant to the header tank as necessary, see page 22. Ensure that the coolant is of the same original mixture.
10. Open the sea cock.
11. Start the engine and check for leaks.

**Note:** If it is necessary to clean the tube stack, refer to the workshop manual.



### How to clean the gauze strainer of the fuel lift pump

1. Close fuel supply valve, if fitted.
2. Remove the cover (A2) together with the joint from the top of the fuel lift pump (A3) and remove the gauze strainer (A1).
3. Wash carefully all of the sediment from the lift pump body.
4. Clean the gauze strainer, the joint and the cover.
5. Assemble the lift pump. Use a good joint and ensure that the lift pump body and the cover are fitted together correctly because leakage at this point will let air into the fuel system.
6. Open fuel supply valve, if fitted.
7. Eliminate the air from the fuel system through the filter vent point, see page 34.



### Fuel pre-filter

This will normally be fitted between the fuel tank and the engine. Check the filter bowl for water at regular intervals and drain as necessary.

## How to renew the elements of the twin fuel filter

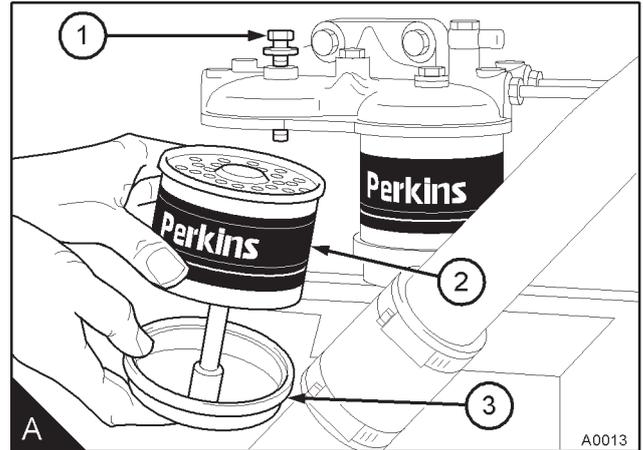
**Warning!** Discard the used element or canister and fuel oil in a safe place and in accordance with local regulations.

### Cautions:

- It is important that only the genuine Perkins parts are used. The use of a wrong canister or element can damage the fuel injection pump.
- Do not allow dirt to enter the fuel system. Before a connection is disconnected, clean thoroughly the area around the connection. After a component has been disconnected, fit a suitable cover to all open connections.
- The pre-filter and main filter canisters must be renewed at the same time.

**Note:** The fuel filter (A) has twin elements, both of the elements must be renewed at the same time.

1. Close fuel supply valve, if fitted.
2. Clean the outside surfaces of the fuel filter assembly.
3. Hold the bottom cover (A3) of the filter element and release the setscrew (A1) which is fitted through the filter head above the centre of each element.
4. Lower the bottom cover of the filter.
5. Remove the element (A2) and discard it.
6. Clean the inside surfaces of the filter head and of the cover.
7. Renew the joints and lightly lubricate them with clean fuel. The larger joint is fitted to the filter head and the smaller joint is fitted to the bottom cover.
8. Put the bottom cover under the new element and hold it squarely to the filter head. Ensure that the element is fitted in the centre against the joint in the filter head. With the assembly in this position, engage and tighten the setscrew.
9. Open fuel supply valve, if fitted.
10. Eliminate the air from the fuel filter, see page 34.

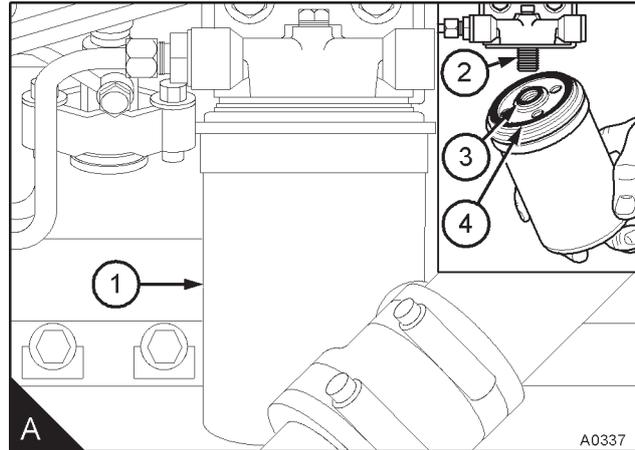


## How to renew the canister of the single fuel filter

**Warning!** Discard the used canister and fuel oil in a safe place and in accordance with local regulations.

### Cautions:

- It is important that only the correct genuine Perkins fuel filter canister is used. The use of a wrong canister can damage the fuel injection pump.
- The fuel filter canister fitted in the factory has a special sealant applied to the threads of the adaptor. Filter canisters supplied in service have an inner seal assembly (A3) instead. The seal is held in position by a plastic clip. Damage to the fuel injection pump may occur if the canister seals are not fitted correctly.
- Do not allow dirt to enter the fuel system. Before a connection is disconnected, clean thoroughly the area around the connection. After a component has been disconnected, fit a suitable cover to all open connections.
- The pre-filter and main filter canisters must be renewed at the same time.



1. Close fuel supply valve, if fitted.
2. Thoroughly clean the outside surfaces of the fuel filter assembly.
3. Use a strap wrench or similar tool to loosen the filter canister (A1) and remove the canister and discard it.
4. Ensure that the threaded adaptor (A2) is secure in the filter head and that the inside of the head is clean.
5. Ensure that the outer seal (A4), which is supplied with the new canister, is in position on top of the canister.
6. Lightly lubricate the seals of the new canister with clean fuel. Fit the new canister to the filter head and tighten by hand only.
7. Open fuel supply valve, if fitted.
8. Eliminate the air from the fuel filter, see page 34.

### Atomiser fault

#### Warnings!

- If your skin comes into contact with high-pressure fuel, obtain medical assistance immediately.
- Keep away from moving parts during engine operation. Some moving parts cannot be seen clearly while the engine runs.

An atomiser fault can cause an engine misfire.

In order to find which atomiser is defective, operate the engine at a fast idle speed. Loosen and tighten the union nut of the high-pressure fuel pipe at each atomiser. When the union nut of the defective atomiser is loosened, it has little or no effect on the engine speed.

### How to renew an atomiser

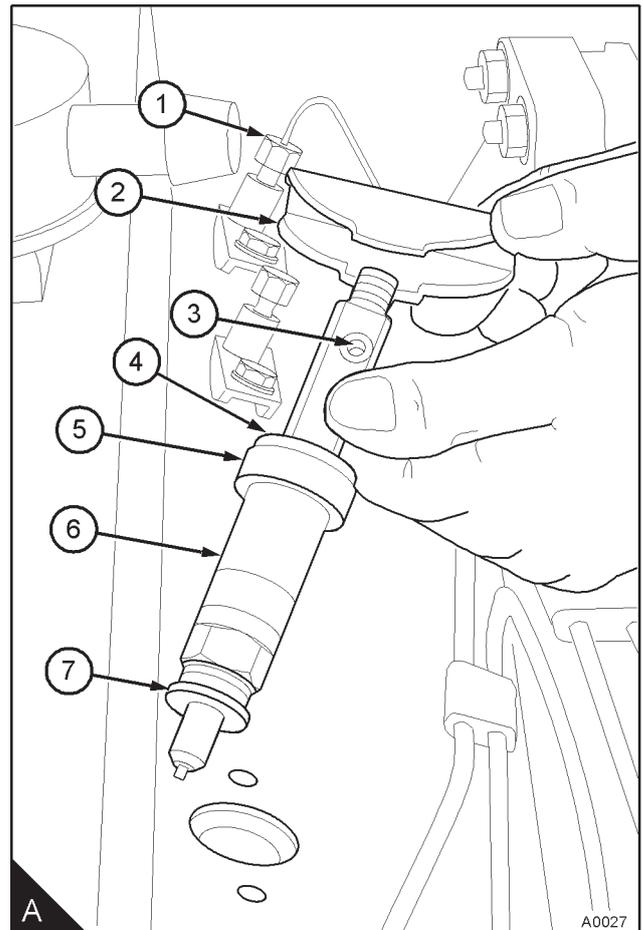
#### Cautions:

- Atomisers must be removed and fitted by a person with the correct training.
- Do not allow dirt to enter the fuel system. Before a connection is disconnected, clean thoroughly the area around the connection. After a component has been disconnected, fit a suitable cover to all open connections.

1. Remove the fuel leak-off pipe.
2. Remove the union nuts (A1) of the high-pressure pipe from the atomiser and from the fuel injection pump. Do not bend the pipe. If necessary, remove the pipe clamps.

**Caution:** Remove and discard the seat washer (A7). If the original seat washer remains in the recess for the atomiser, the nozzle protrusion will be incorrect when a new seat washer is added.

3. Remove the atomiser setscrews and remove the clamp (A2), the atomiser (A6) and its seat washer (A7). Remove the dust seal (A5) and the spacer (A4) and fit the spacer and a new dust seal onto the new atomiser.
4. Put the new atomiser in position with its spacer, new dust seal and a new seat washer, ensure that the fuel leak-off connection (A3) is not toward the engine. Position the clamp and engage the atomiser setscrews. Ensure that the atomiser is not tilted and tighten the setscrews for the clamp evenly and gradually to 12 Nm (9 lbf ft) 1,2 kgf m.



**Caution:** Do not tighten the union nuts of the high-pressure pipes more than the recommended torque tension. If there is a leakage from the union nut, ensure that the pipe is correctly aligned with the atomiser inlet. Do not tighten the atomiser union nut more, as this can cause a restriction at the end of the pipe. This can affect the fuel delivery.

5. Fit the high-pressure fuel pipe and tighten the union nuts to 27 Nm (20 lbf ft) 2,8 kgf m. If necessary, fit the pipe clamps.
6. Renew the sealing washers and fit the leak-off pipe. Tighten the banjo bolts to 9,5 Nm (7,0 lbf ft) 1,0 kgf m.
7. Operate the engine and check for leakage of fuel and air.

## How to eliminate air from the fuel system

### Engines with an in-line fuel injection pump

If air enters the fuel system, it must be removed before the engine can be started.

Air can enter the system if:

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

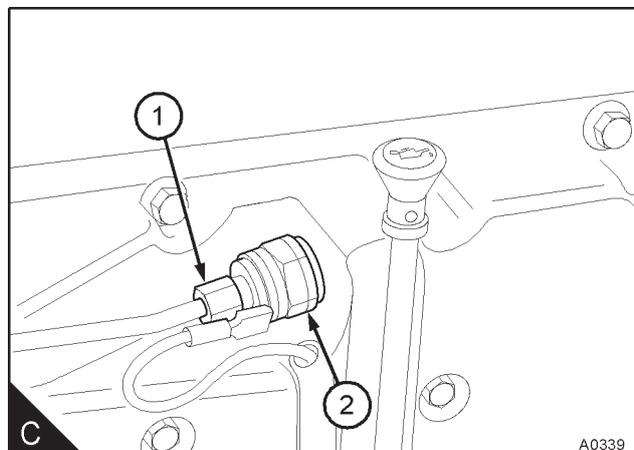
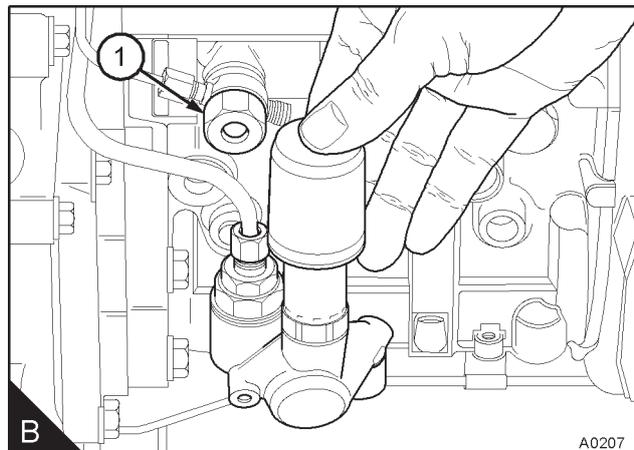
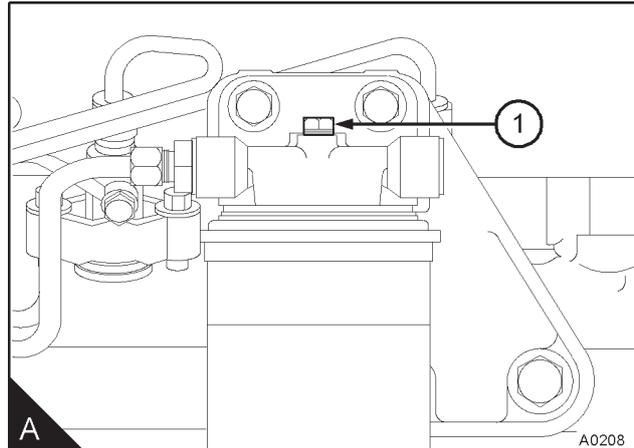
In order to eliminate air from the fuel system, proceed as follows:

**Caution:** Do not allow fuel from the engine to contaminate the engine compartment. Put a drip tray under the engine and discard old fuel in accordance with local instructions.

1. Loosen the vent plug (A1) on top of the fuel filter by two or three turns. Operate the priming pump (B) of the fuel lift pump until fuel, free of air, comes from the filter vent point. Tighten the vent plug.
2. Loosen the banjo connection bolt (B1) at the drive end of the pump. Operate the priming pump of the fuel lift pump until fuel, free of air, comes from the loosened connection. Tighten the banjo connection bolt.

**Caution:** Use a spanner on the flats (C2) of the fuelled starting aid to prevent its movement when the union nut (C1) is loosened and tightened.

3. If the pipe to the fuelled starting aid has been drained, loosen the union nut (C1) at the fuelled starting aid and operate the lift pump until fuel, free from air, comes from the connection. Tighten the union nut at the starting aid. Use a spanner on the flats (C2) of the fuelled starting aid to prevent its movement when the union nut is loosened and tightened.
4. Ensure that the stop control is in the run position and the speed control is in the maximum speed position. Operate the starter motor. When the engine starts, reduce the engine speed. If the engine runs correctly for a short time and then stops or runs roughly, check for air in the fuel system. If there is air in the fuel system, there is probably a leakage in the low pressure system.



**Engines fitted with a rotary fuel injection pump**

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

Air can enter the system if:

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

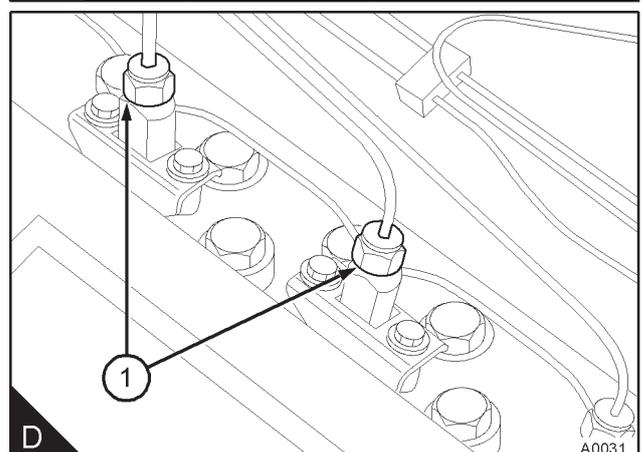
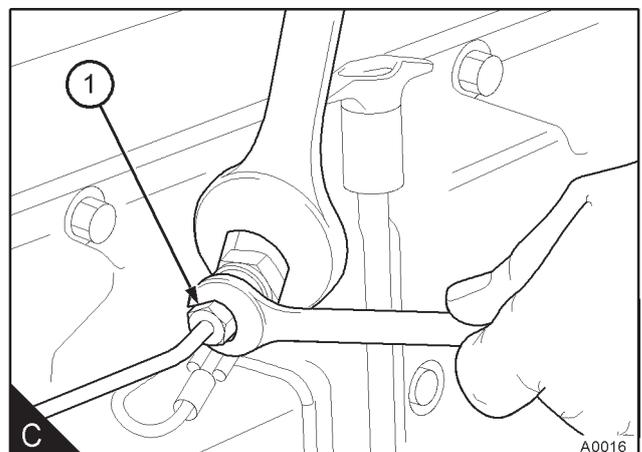
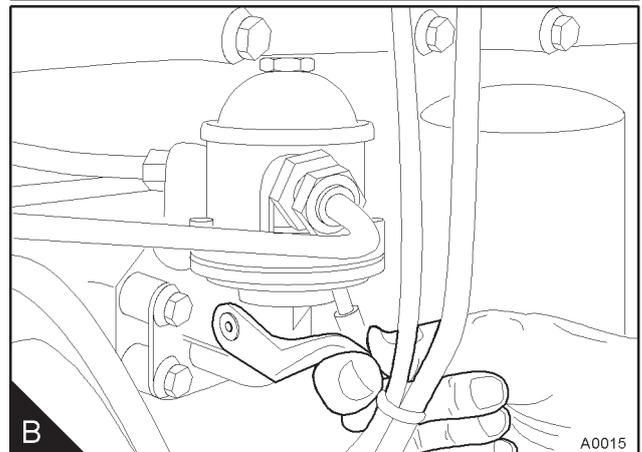
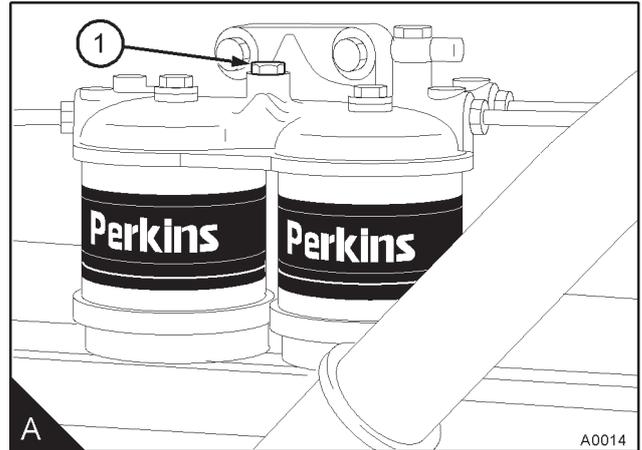
In order to eliminate air from the fuel system, proceed as follows:

1. Loosen the vent plug (A1) on the top of the filter head.
2. Operate the priming lever on the fuel lift pump (B) until fuel, free from air, comes from the filter vent point. Tighten the vent plug.

**Note:** If the drive cam of the fuel lift pump is at the point of maximum cam lift, it will not be possible to operate the priming lever. In this situation, the crankshaft must be turned one revolution.

3. If the pipe to the fuelled starting aid has been drained, loosen the union nut (C1) at the fuelled starting aid and operate the lift pump until fuel, free from air, comes from the connection. Tighten the union nut at the starting aid. Use a spanner on the hexagon of the fuelled starting aid to prevent its movement when the union nut is loosened and tightened.
4. Loosen the union nuts (D1) of the high-pressure pipes at two of the atomisers.
5. Put the electrical system switch (see page 11) to the "ON" position. Operate the starter motor until fuel, free from air, comes from the pipe connections. Tighten the high-pressure pipe connections to 27 Nm (20 lbf ft) 2,8 kgf m. Return the switch to the "OFF" position.
6. The engine is now ready to start.

If the engine runs correctly for a short time and then stops or runs roughly, check for air in the fuel system. If there is air in the fuel system, there is probably a leakage in the low pressure system.



## M300Ti/M265Ti - How to eliminate air from the fuel system

If air enters the fuel system, it must be removed before the engine can be started.

Air can enter the system if:

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

In order to eliminate air from the fuel system, proceed as follows:

**Caution:** Do not allow fuel from the engine to contaminate the engine compartment. Put a drip tray under the engine and discard old fuel in accordance with local instructions.

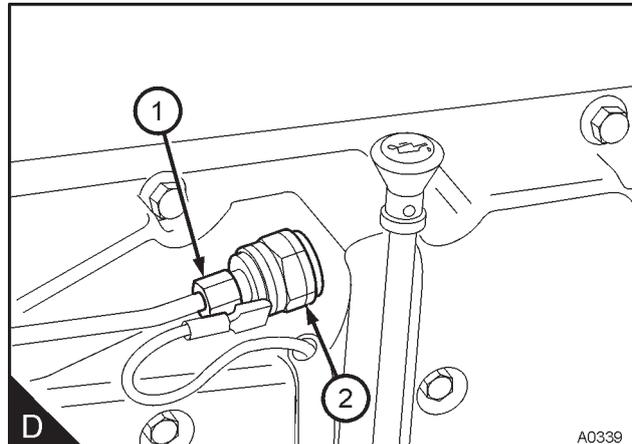
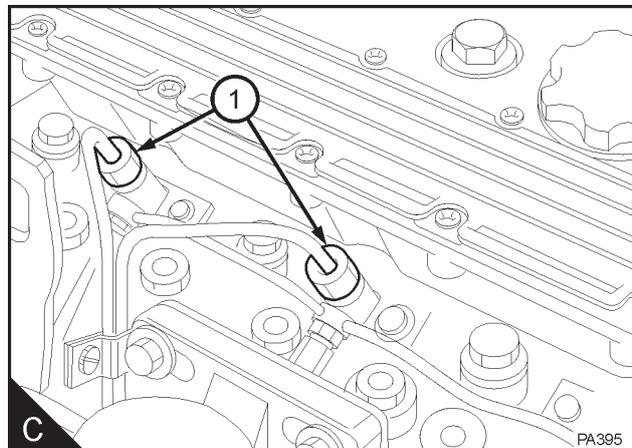
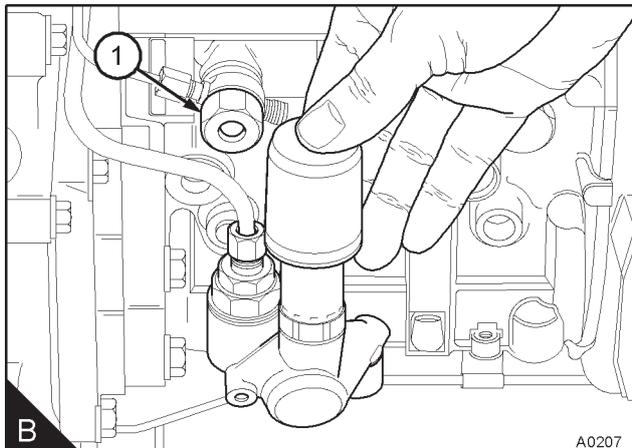
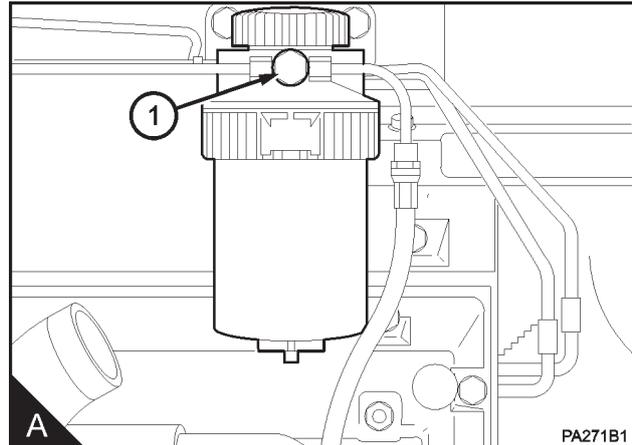
1. Loosen the vent plug (A1) on the filter head for the filter.
2. Operate the priming pump on the fuel lift pump (B1) until fuel, free from air, comes from the filter vent point. Tighten the vent plug.
3. If the pipe to the fuelled starting aid has been drained, loosen the union nut (D1) at the fuelled starting aid and operate the lift pump until fuel, free from air, comes from the connection. Tighten the union nut at the starting aid.

**Caution:** Use a spanner to hold the body (D2) of the fuelled starting aid to prevent its movement when the union nut is loosened and tightened.

4. Loosen the union nuts (C1) of the high pressure pipes at two of the atomisers.

**Caution:** Do not tighten the union nuts of the high-pressure pipes more than the recommended torque tension. If there is a leakage from the union nut, ensure that the pipe is correctly aligned with the atomiser inlet. Do not tighten the atomiser union nut more, as this can cause a restriction at the end of the pipe. This can affect the fuel delivery.

5. Put the electrical system switch to the "ON" position. Operate the starter motor until fuel, free from air, comes from the pipe connections. Tighten the high pressure pipe connections to 27 Nm (20 lb ft) 2,8 kgf m. Return the switch to the "OFF" position.
6. The engine is now ready to start.
7. If the engine runs correctly for a short time and then stops or runs roughly, check for air in the fuel system. If there is air in the fuel system, there may be a leakage in the low-pressure system.

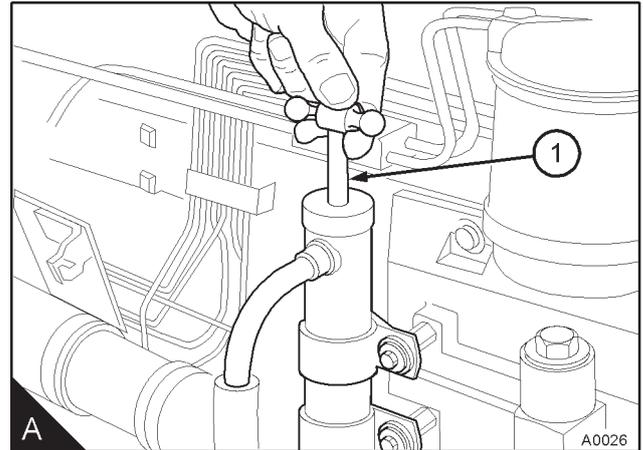


## How to renew the lubricating oil of the engine

**Warning!** Discard the used lubricating oil in a safe place and in accordance with local regulations.

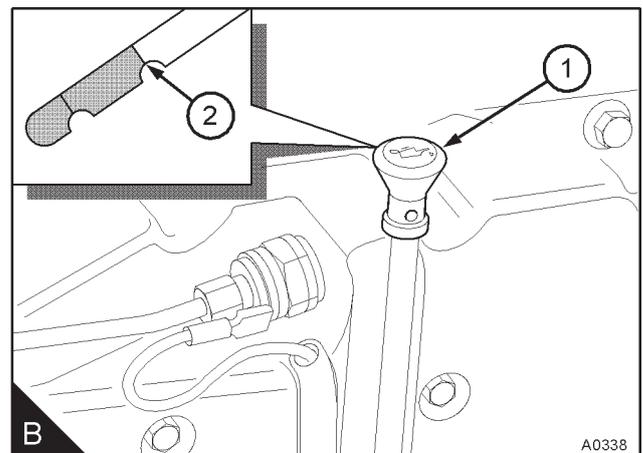
**Caution:** Do not move the position of the sump drain pump as leakage of oil to the coolant could occur.

1. Connect a suitable hose to the outlet of the sump drain pump (A1). Put the free end of the hose into a suitable container with a capacity of at least 18 litres (32 UK pints) 19 US quarts. Use the drain pump to empty the sump. If possible, the lubricating oil should be drained while it is still hot.



**Caution:** Do not fill the sump past the notch (mark B2) on the dipstick as this can have an adverse affect on the performance of the engine or damage the engine. Excess lubricating oil must be drained from the sump.

2. Clean the area around the filler cap on top of the rocker cover. Remove the cap and add slowly approximately 15 litres (26 UK pints) 16 US quarts of new and clean lubricating oil of an approved specification (see page 50) to the engine. Allow the oil enough time to pass to the sump. Remove the dipstick (B1) and ensure that the lubricating oil is to the full mark (B2). Do not exceed the full mark on the dipstick. Fit the filler cap and ensure that the dipstick is fitted correctly in the dipstick tube.



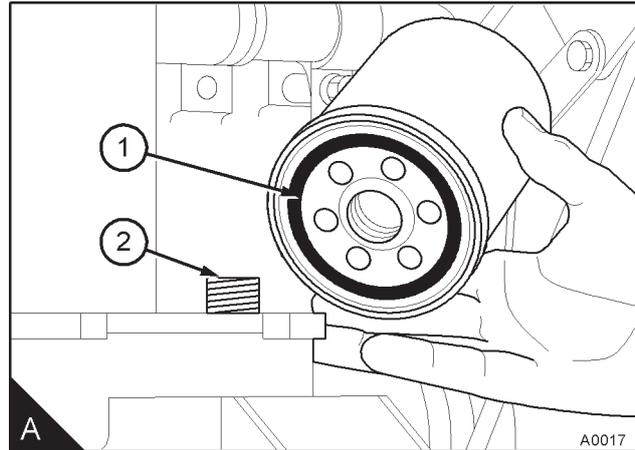
**Note:** Renew the filter canisters when the lubricating oil is renewed.

## How to renew the canisters of the lubricating oil filter

**Warning!** Discard the used canister and lubricating oil in a safe place and in accordance with local regulations.

1. Put a tray under the filter to retain spilt lubricating oil.
2. Remove the filter canister with a strap wrench or similar tool. Ensure that the adaptor (A2) is secure in the filter head. Then discard the canister.
3. Clean the filter head.
4. Lubricate the top of the canister seal (A1) with clean engine lubricating oil.
5. Fit the new canister and tighten it by hand only. Do not use a strap wrench.
6. Ensure that there is lubricating oil in the sump. With the stop switch (see page 11) held in the "STOP" position, operate the starter motor until the oil pressure warning light is extinguished or there is a reading on the gauge.
7. Operate the engine and check for leakage from the filter. When the engine has cooled, check the oil level on the dipstick and put more oil into the sump, if necessary.

**Caution:** The canister contains a valve and special tube to ensure that lubricating oil does not drain from the filter. Therefore, ensure that the correct Perkins POWERPART canister is used.



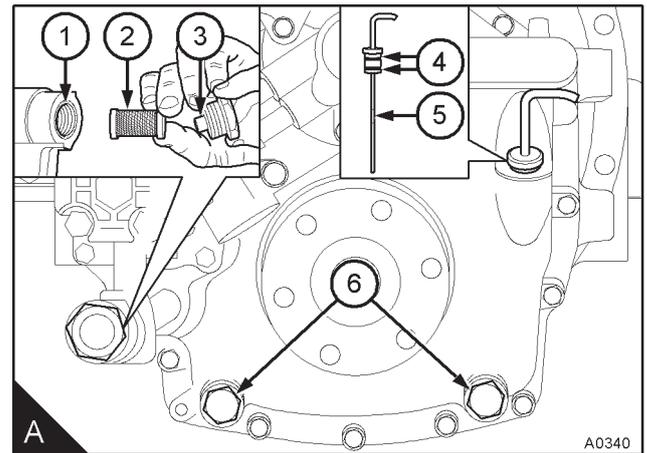
## How to renew the lubricating oil of the ZF IRM 220A reverse gearbox

**Note:** When the lubricating oil of the reverse gearbox is renewed, the filter element should also be cleaned.

1. Pull the dipstick (A5) from the gearbox.
2. Put a suitable container of at least 5 litres (9 UK pints) capacity under the gearbox and remove one of the drain plugs (A6) to drain the lubricating oil.
3. Remove any debris from the plug's magnet and fit the drain plug.
4. Release the plug for the filter element and remove the element (A2).
5. Clean the filter element in an approved safe cleaning fluid in accordance with the manufacturers instructions. Ensure all of the cleaning fluid is removed after cleaning.
6. Remove any debris from the plug's magnet (A3).
7. Fit the filter element. Renew the copper washer (A1), put the copper washer into position and fasten the plug.
8. Add 4 litres (7 UK pints) 4.2 US quart of transmission fluid (see page 62) through the hole for the dipstick, until the oil is level with the top mark (A5) on the dipstick.
9. If necessary renew the two "O" ring seals (A4).
10. With the lever for gear selection in the neutral position, run the engine at idle speed for two minutes. This will ensure that the lubricating oil has circulated around the lubricating oil cooler and its pipes. Stop the engine and check the lubricating oil level again. If necessary, add more **lubricating oil. Insert the dipstick fully.**

**Caution:** Some lubricating oil could flow back from the lubricating oil filter after the engine is stopped. This could cause the lubricating oil level to be over the maximum mark on the dipstick. If this occurs, do not remove the excess lubricating oil.

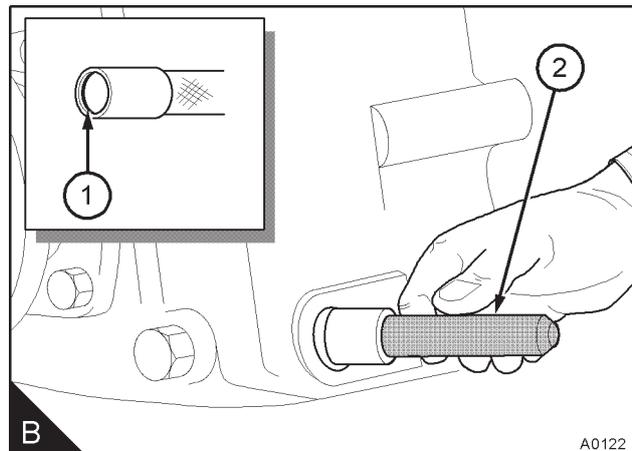
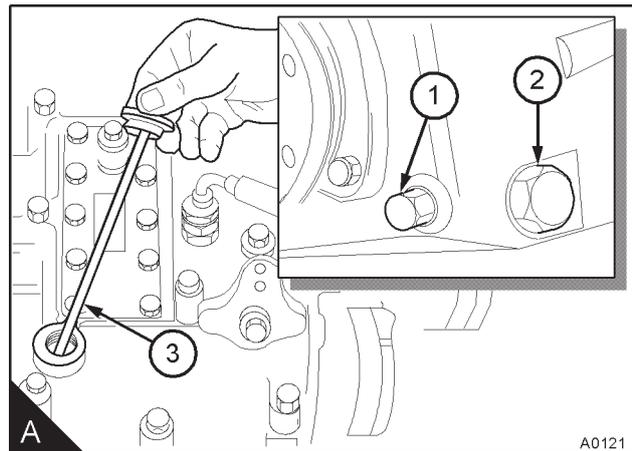
**Note:** In service the level of the lubricating oil can be checked with the lubricating oil hot or cold. Always check the level of the lubricating oil before the transmission is used.



## How to renew the lubricating oil of the Newage PRM 1000 reverse gearbox

**Note:** When the lubricating oil of the reverse gearbox is renewed, the lubricating oil strainer should be cleaned.

1. Put a suitable container with a capacity of at least 5 litres (9 UK pints) 5.3 US quarts under the reverse gearbox. Remove the drain plug (A1) and its sealing washer and drain the oil from the reverse gearbox.
2. Inspect the sealing washer for the plug and, if necessary, renew it. Fit the drain plug and its sealing washer. Tighten the plug.
3. Remove the plug (A2) for the strainer together with its sealing washer, and remove the strainer (B2). Clean the strainer with an approved cleaning fluid. Inspect the "O" ring (B1) and renew it, if necessary. Fit the strainer.
4. Inspect the sealing washer for the plug and, if necessary, renew it. Fit the plug together with its sealing washer. Tighten the plug.
5. Turn the hexagonal head of the dipstick (A3) counter-clockwise to release the dipstick and remove it from the dipstick / filler tube. Ensure that the sealing washer is not lost. Add lubricating oil of the correct specification (see page 62) for the correct quantity and specification) through the dipstick / filler tube. Ensure that the sealing washer is on the dipstick. Fit the dipstick fully into the dipstick / filler tube. Turn the hexagonal end of the dipstick clockwise until the dipstick is tight in the tube.
6. Ensure that the reverse gearbox is in neutral (lever in the centre position). Start the engine to allow the lubricating oil in the reverse gearbox to circulate around the system. Stop the engine and wait a two minutes. Remove and clean the dipstick. Insert and tighten the dipstick fully into the dipstick / filler tube then immediately remove the dipstick to check the oil level. Check that the oil is at the full mark and, if necessary, add more lubricating oil. Ensure that the sealing washer is on the dipstick. Fit the dipstick fully into the dipstick / filler tube. Turn the hexagonal end of the dipstick clockwise until the dipstick is tight in the tube.

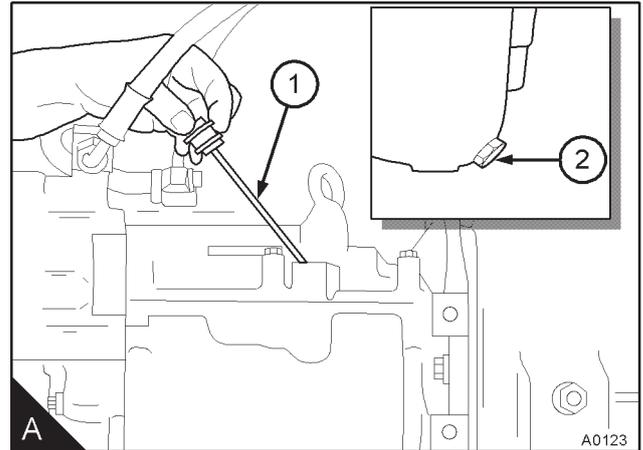


**Caution:** In service the lubricating oil of these reverse gearboxes should be checked with the lubricating oil cold. Always check the lubricating oil level before the transmission is used.

### How to renew the lubricating oil of the Newage PRM 500 reverse gearbox

1. Put a suitable container with a capacity of at least 4 litres (7 UK pints) 4.2 US quarts beneath the reverse gearbox. Remove the drain plug (A2) together with its sealing washer and drain the oil from the reverse gearbox.
2. Inspect the sealing washer for the plug and, if necessary, renew it. Fit the plug together with its sealing washer. Tighten the plug.
3. Turn the hexagonal end of the dipstick (A 1) counter-clockwise to release the dipstick and remove it from the dipstick / filler tube. Ensure that the sealing washer is not lost. Add lubricating oil of the correct specification (see page 62) for the correct quantity and specification) through the dipstick / filler tube. Ensure that the sealing washer is on the dipstick. Fit the dipstick fully into the dipstick / filler tube. Turn the hexagonal end of the dipstick clockwise until the dipstick is tight in the tube.
4. 4 Ensure that the reverse gearbox is in neutral (lever in the centre position). Start the engine to allow the lubricating oil in the reverse gearbox to circulate around the system. Stop the engine and wait a few minutes. Remove and clean the dipstick. Insert and tighten the dipstick fully into the dipstick / filler tube then immediately remove the dipstick to check the oil level (A1). Check that the oil is at the full mark and, if necessary, add more lubricating oil. Ensure that the sealing washer is on the dipstick. Fit the dipstick fully into the dipstick / filler tube. Turn the hexagonal end of the dipstick clockwise until the dipstick is tight in the tube.

**Caution:** In service the lubricating oil of these reverse gearboxes should be checked with the lubricating oil cold. Always check the lubricating oil level before the transmission is used.



## How to renew the lubricating oil of the Hurth HSW 630 reverse gearbox

**Note:** When the lubricating oil of the reverse gearbox is renewed, the filter element should also be renewed.

1. Turn the handle (A1) of the filler cap counterclockwise and remove the filler cap together with a filter which is fitted to the cap.
2. As there is no drain plug, the lubricating oil must be removed with a pump (B1).

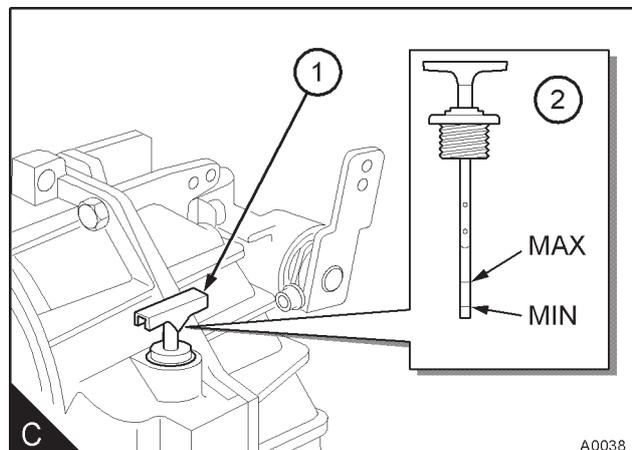
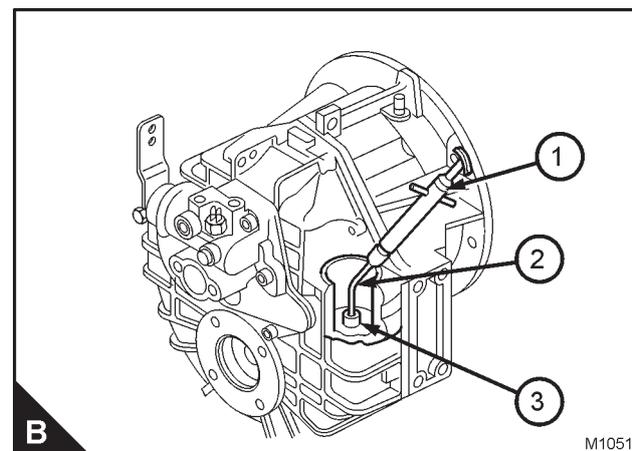
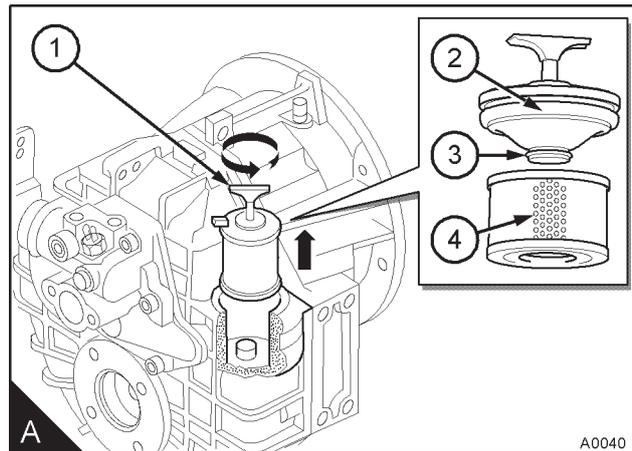
Connect a hose (B2) to the pump. Push the hose into the suction tube (B3) and down to the bottom of the housing. Operate the pump to remove the lubricating oil; approximately 4.0 litres (8.4 UK pints) 4.2 US quarts.

**Note:** The outside diameter of the hose must not be more than 16,0 mm (0.625 in).

3. Add 4.0 litres (7.0 UK pints) 4.2 US quarts of ATF transmission fluid. (see page 62).
4. Pull the filter element (A4) off the filler cap. Fit new "O" rings (A2 and A3) and push a new filter element onto the filler cap.
5. Fit the filter and filler cap assembly and turn the handle clockwise to fasten the filler cap.
6. Turn the handle of the dipstick (C1) counterclockwise to release the dipstick. Remove the dipstick. Clean the dipstick and check the level of the lubricating oil. The level should be between the minimum and the maximum marks (C2). Add more lubricating oil if necessary. Insert the dipstick and turn the handle clockwise to fasten it.
7. With the lever for gear selection in the neutral position, run the engine at idle speed for a few minutes. This will ensure that the lubricating oil has circulated around the lubricating oil cooler and its pipes. Stop the engine and check the lubricating oil level again. Add more lubricating oil, if necessary. Insert and fasten the dipstick.

**Caution:** Some lubricating oil could flow back from the lubricating oil filter after the engine is stopped. This could cause the lubricating oil level to be over the maximum mark on the dipstick. If this occurs, do not remove the excess lubricating oil.

**Note:** In service the level of the lubricating oil can be checked with the lubricating oil hot or cold. Always check the level of the lubricating oil before the transmission is used.



### How to renew the engine breather

#### Turbocharged engines (closed breather)

**Caution:** Do not use excessive force to remove the hose (A4) from the breather outlet pipe.

1. Release the hose clip and carefully remove the hose from the breather outlet.
2. Remove the rocker cover.
3. Caution: Ensure that the lever does not damage the cover.
4. Release the fasteners and carefully remove the breather cover from the breather body. A suitable lever may be necessary to release the cover from the body of the breather. Ensure that the lever does not damage the cover. Discard the joint (A5).

**Caution:** Do not clean the breather valve or the gauze filter. The breather valve (A1) and the gauze (A3) must be renewed in accordance with the schedules on page 28.

4. Release the clips (A2) from the clip retainers (A7) and push the breather valve out of the breather cover. Discard the breather valve.
5. Remove and discard the gauze.

**Warning!** Do not allow compressed air to contact your skin. If compressed air enters your skin, obtain medical help immediately.

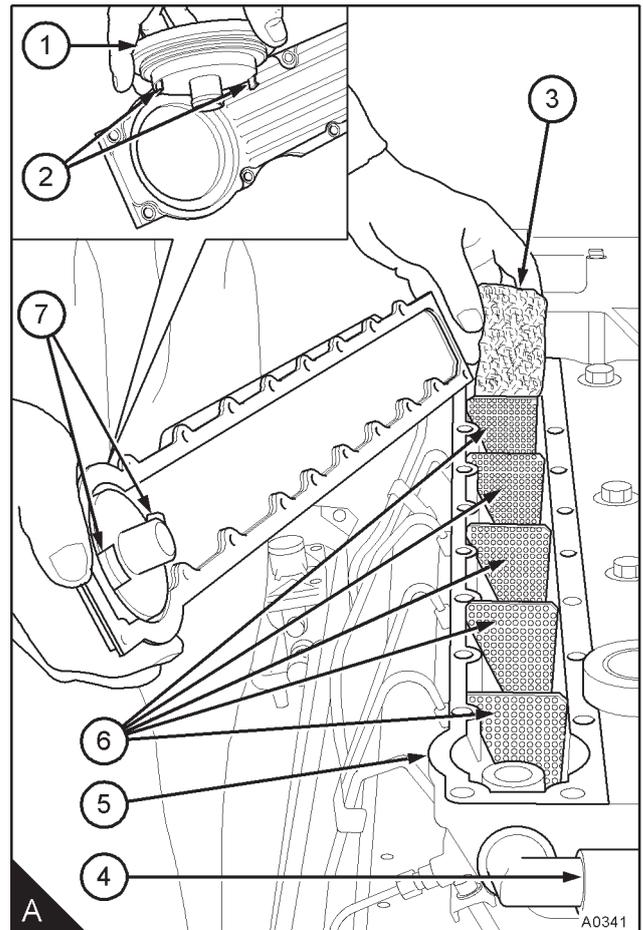
6. Wash the body of the breather, the cover, the baffle plates (A6) and the breather pipe, every 2000 hours of operation. Use an approved kerosene cleaning fluid and dry them with compressed air at low pressure.
7. Ensure that the holes at the bottom of the baffle plates in the breather body are not restricted. If necessary, clean the holes.

#### To assemble

1. Fit the baffle plates into the grooves in the breather body.
2. Renew and fit the gauze filter into the breather body.
3. Renew and fit the new valve into the breather cover. Ensure that the clips are engaged correctly.

**Note:** The breather valve is renewed every 4000 hours, refer to the schedule on page 28.

4. Renew the joint, which is fitted dry. Put the cover



and valve assembly into position on the breather body. Loosely fit the fasteners. Tighten the fasteners gradually and evenly to 3 Nm (2.2 lbf ft) 0.3 kgf m.

**Caution:** Do not use excessive force to fit the hose to the breather outlet pipe.

5. Check that there is no restriction in the breather pipe or the breather hose. Fit the breather hose to the cover and tighten the clip.

**Naturally aspirated engines (open breather)**

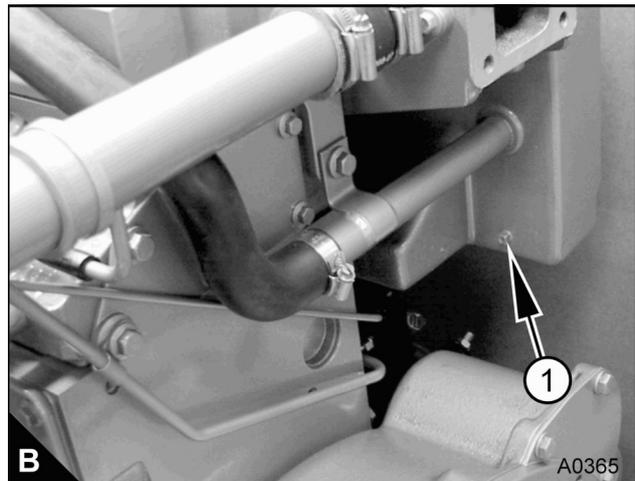
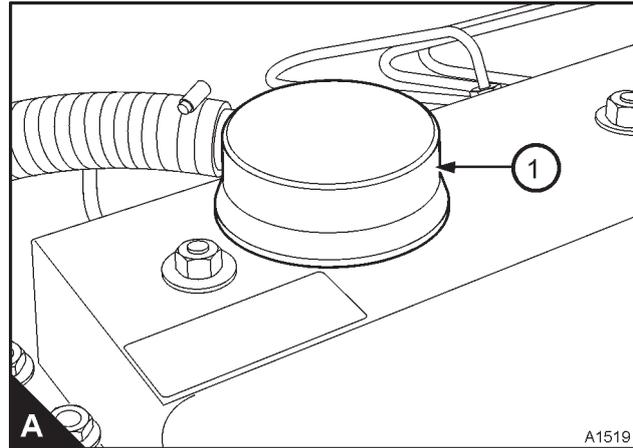
Some engines have an open breather system that has an oil separator (A1) fitted to the rocker cover.

The oil separator should not be dismantled or cleaned, but must be renewed at every engine overhaul or 8000 hours. Refer to your local distributor.

**Draining excess oil from the inlet manifold breather reservoir.**

On the M130C and M135 a hose connects the breather valve on the top of the rocker cover to the inlet manifold. A small proportion of the crankcase oil mist drawn through the breather system will collect in a reservoir in the bottom of the inlet manifold. The level of oil in the reservoir must be checked and drained if necessary every 400 hours or 12 months, whichever occurs first.

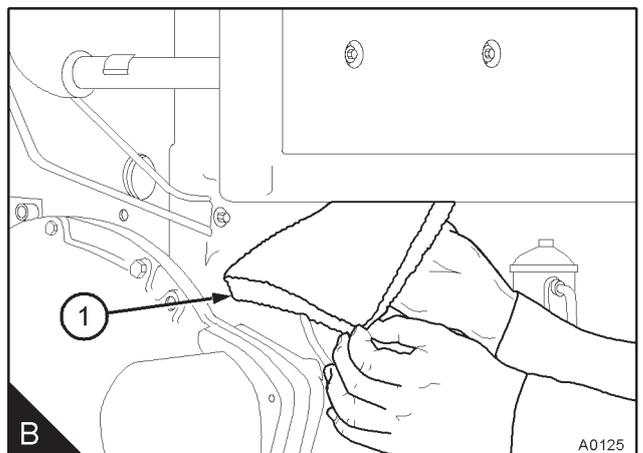
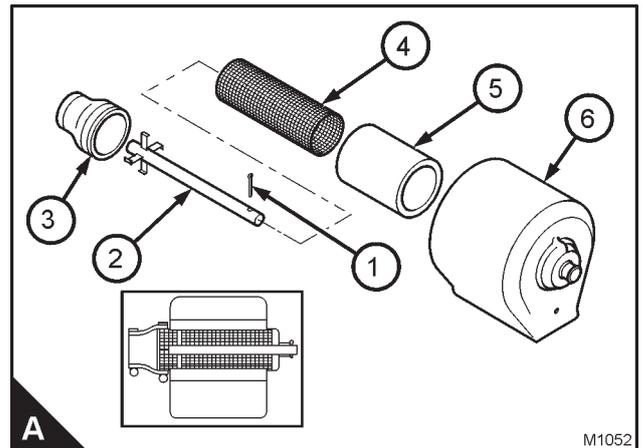
The drain plug for the inlet manifold oil reservoir is located towards the rear of the manifold on the inboard side as shown in (B1).



**How to clean the air filter**

**Turbocharged engines**

1. Disconnect the engine breather pipe from the filter case. Release the hose clip for the adaptor (A3) from the turbocharger inlet. Release the setscrew that retains the bracket to the filter case and remove the air filter assembly.
2. Release the hose clip and remove the adaptor (A3) from the filter case.
3. Remove the split pin (A1) from the tube (A2) and remove the tube. Remove the support tube with (A4). Remove the filter element (A5).
4. Clean the filter case and the support tube with a clean rag. Either wash the element in a soap solution or renew the element.
5. Fit the element into the case. Fit the support tube into the centre of the filter element, ensure that the support tube is engaged in the recess in the case.
6. Fit the filter (A2) into the support bracket and fit the split pin through the tube where it protrudes through the end of the case to retain the tube in the case.
7. Fit the adaptor hose to the filter case and tighten the hose clip.
8. Fit the air cleaner to the engine. Connect the filter to the turbocharger inlet and fit the engine breather hose to the filter case. Fit the setscrews to the support bracket. Tighten the hose clips and the setscrews.



**Naturally aspirated engines**

1. Pull the air filters (B1) from the recesses in the induction manifold.
2. Either wash the air filters in a solution of soap and water or renew them.
3. Push the air filters into the recesses in the induction manifold.

## How to check the condition of the viscous damper

**Caution:** A viscous damper (A1) should be renewed if there is impact damage to the outer casing or if there is leakage of the viscous fluid from the cover plate.

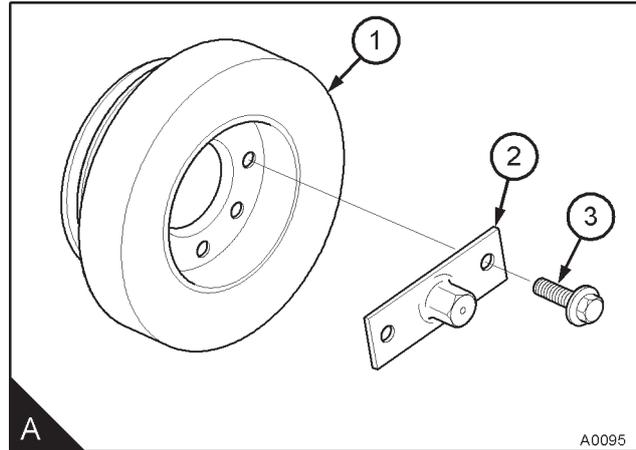
Check the area around the holes for the damper fasteners (A3) for cracks and general wear if the damper has become loose in service.

Check that the fasteners for the viscous damper are tightened correctly:

Tighten the M12 setscrews to 85 Nm (63 lb ft) 8,7 kgf m.

Tighten the two M12 setscrews which secure the device to rotate the crankshaft (A2) to 85 Nm (63 lb ft) 8,7 kgf m.

If it is necessary to renew the viscous damper refer to the workshop manual, TPD 1318.



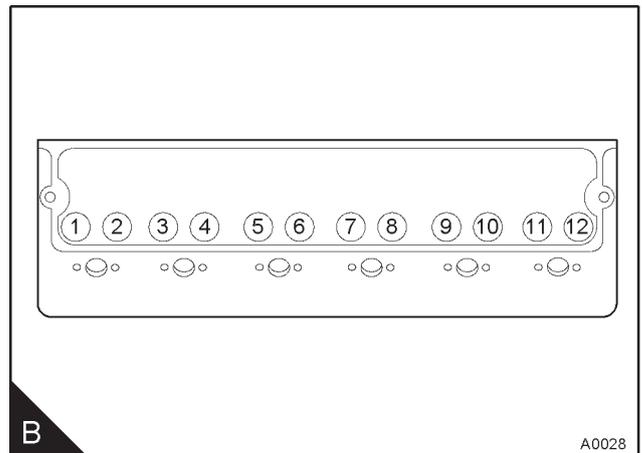
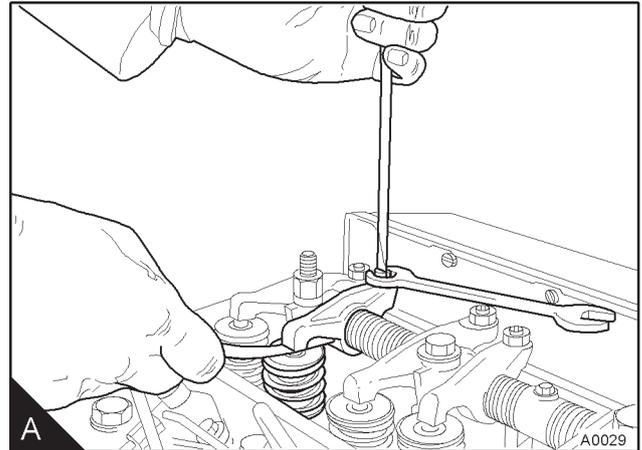
### How to check the valve tip clearances

These are checked between the top of the valve stem and the rocker lever (A), with the engine hot or cold. The correct clearance for inlet valves is 0,20 mm (0.008 in) and 0,45 mm (0.018 in) for exhaust valves. The valve positions are shown at (B).

The sequence of valves from number 1 cylinder is shown in the table below.

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

1. Rotate the crankshaft in the normal direction of rotation until the inlet valve (B12) of number 6 cylinder has just opened and the exhaust valve (B11) of the same cylinder has not closed completely. Check the clearances of the valves (B1 and B2) of number 1 cylinder and adjust them, if necessary.
2. Set the valves (B4 and B3) of number 2 cylinder as indicated above for number 6 cylinder. Then check / adjust the clearances of the valves (B9 and B10) of number 5 cylinder.
3. Set the valves (B8 and B7) of number 4 cylinder. Then check / adjust the clearances of the valves (B5 and B6) of number 3 cylinder.
4. Set the valves (B1 and B2) of number 1 cylinder. Then check / adjust the clearances of the valves (B11 and B12) of number 6 cylinder.
5. Set the valves (B9 and B10) of number 5 cylinder. Then check / adjust the clearances of the valves (B3 and B4) of number 2 cylinder.
6. Set the valves (B5 and B6) of number 3 cylinder. Then check / adjust the clearances of the valves (B7 and B8) of number 4 cylinder.



Cylinder and valve number	1		2		3		4		5		6	
	1	2	3	4	5	6	7	8	9	10	11	12
Valve	In	Ex	Ex	In	In	Ex	Ex	In	In	Ex	Ex	In

## Seacock strainer

The seacock strainer must be cleaned regularly, especially if there is a large amount of small debris in the water.

## Corrosion

This can occur when two different metals are in contact near to, or in, sea water. For example, a brass or bronze pipe fitted into aluminium can cause rapid corrosion. For this reason, special precautions are necessary when an engine is installed. In this situation, some components will be connected to a sacrificial anode fitted to the hull. Specialist manufacturers will advise on the maintenance of these anodes.

## Supplementary tools

A general tool kit and an on-board repair kit are available from your Wimborne Marine Power Centre Distributor. It is recommended that the tools and other parts, listed below, are also retained on-board:

Wire, 20 SWG (1mm in diameter)

Insulation tape

Jointing compound

Magnet (keep this away from the compass)

Mechanical fingers

Self-gripping wrench

Suitable lagging material

Rubber olives for the low-pressure fuel system

Extra blades for a small hacksaw

Start circuit fuse, rated at 40 amperes

Heat circuit fuse, rated at 25 amperes

Stop circuit fuse, rated at 25 amperes

Panel circuit fuse, rated at 10 amperes

## Engine fluids

### Fuel specification

To get the correct power and performance from your engine, use good quality fuel. The recommended fuel specification for Wimborne Marine Power Centre engines is indicated below:

Cetane number.....45 minimum  
 Viscosity ..... 2.0/4.5 centistokes at 40°C  
 Density.....0,835/0,855 kg/litre  
 Sulphur .....0.2% of mass, maximum  
 Distillation ..... 85% at 350°C

**Cetane number** indicates ignition performance. A fuel with a low cetane number can cause cold start problems and affect combustion.

**Viscosity** is the resistance to flow and engine performance can be affected if it is outside the limits.

**Density:** A lower density reduces engine power, a higher density increases engine power and exhaust smoke.

**Sulphur:** A high amount of sulphur (not normally found in Europe, North America or Australasia) can cause engine wear. Where only high sulphur fuels are available, it is necessary to use a highly alkaline lubricating oil in the engine or to renew the lubricating oil more frequently, see the table below.

Percentage of sulphur in the fuel(%)	Oil change interval
<0.5	Normal
0.5 to 1.0	0,75 of normal
> 1.0	0,50 of normal

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

### Low temperature fuels

Special winter fuels may be available for engine operation at temperatures below 0°C. These fuels have a lower viscosity and also limit the wax formation in the fuel at low temperatures. If wax formation occurs, this could stop the fuel flow through the filter.

If you need advice on adjustments to an engine setting or to the lubricating oil change periods which may be necessary because of the standard of the available fuel, consult your nearest Perkins distributor or one of the companies listed on page 12.

## Lubricating oil specification

### Naturally aspirated engines M130C and M135

Use only a good quality lubricating oil which is not less than the specification API CC

API CD (other monograde)

API CE (SAE 30)

API CF-4 (SAE 15W-40 and 10W-30)

ACEA E2-96 (SAE 15W-40)

### Turbocharged engines M185C, M215C and M225Ti

Use only a good quality lubricating oil which is not less than the specifications listed:-

API CF-4 (SAE 15W-40 and 10W-30)

API CE (Minimum specification)

**Note:** CF-4 is the recommended specification and must always be used in countries where it is available for purchase.

In countries where the recommended oil is not available for purchase, lubricating oil having a minimum specification of not less than that for CE oil must be used.

ACEA E2-96 (SAE 15W-40)

### M265Ti and M300Ti

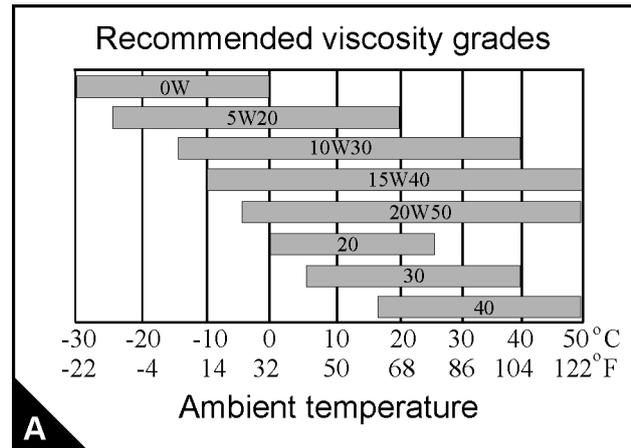
Use a top quality Super High Performance Diesel Engine Oil (SHPD). The specification which is not less than:-

API CG-4

ACEA E3-96

**Caution:** The type of lubricating oil to be used may be affected by the quality of the fuel which is available. For further details, see 'Fuel specification' on page 49.

Always ensure that the correct viscosity grade of lubricating oil is used for the ambient temperature range in which the engine will run as shown in the chart (A).



## Coolant specification

The quality of the coolant which is used can have a great effect on the efficiency and life of the cooling system. The recommendations indicated below can help to maintain a good cooling system and to protect it against frost and/or corrosion.

If the correct procedures are not used, Wimborne Marine Power Centre cannot be held responsible for damage caused by frost or corrosion, or for loss of cooling efficiency.

The correct coolant/anti-freeze to use is 'Extended Life Coolant'.

Extended Life Coolant
Qty: 5 litres Part No 60061
Qty: 25 litres Part No 60062

The coolant mixture must be a 50/50 mix with clean water.

'Extended Life Coolant' has a service life of 6000 service hours or 6 years whichever ever is sooner.

'Extended Life Coolant' should not be mixed with other products.

Unlike many protective coolants, 'Extended Life Coolant' does not coat components with a protective layer to prevent corrosion. Instead it uses virtually non-depleting corrosion inhibitors.

An alternative to 'Extend Life Coolant' is Havoline (XLC) Extended Life Coolant/Anti-freeze.

**Caution:** *Using a coolant/anti-freeze which coats components with a protective layer to prevent corrosion may impair the efficiency of the cooling system and lead to the engine overheating.*

An anti-freeze which contains the correct inhibitor must be used at all times to prevent damage to the engine by corrosion, because of the use of aluminium in the coolant circuit.

If frost protection is not necessary, it is still extremely important to use an approved anti-freeze mixture because this gives a protection against corrosion and also raises the boiling point of the coolant.

**Note:** If combustion gases are released into the coolant circuit, the coolant must be renewed after repair of



## Fault diagnosis

## Problems and possible causes

## Engine

Problem	Possible causes	
	Checks by the user	Checks by the workshop personnel
The starter motor turns the engine too slowly	1, 2, 3, 4	
The engine does not start	5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 17	32, 33, 34, 36, 37, 41, 42, 43
The engine is difficult to start	5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 19	32, 34, 36, 37, 39, 41, 42, 43
Not enough power	8, 9, 10, 11, 12, 13, 16, 17, 18, 19, 20, 21	32, 34, 36, 37, 38, 41, 42, 43, 60, 62, 64
Misfire	8, 9, 10, 12, 13, 15, 20	32, 34, 35, 36, 37, 38, 39, 40, 42
High fuel consumption	11, 13, 17, 18, 19, 21	32, 34, 35, 36, 37, 38, 39, 41, 42, 43, 62
Black exhaust smoke	11, 13, 17, 19, 21	32, 34, 35, 36, 37, 38, 39, 41, 42, 43, 60, 62
Blue or white exhaust smoke	4, 15, 21	34, 36, 37, 38, 41, 43, 44, 51, 57, 61
The pressure of the lubricating oil is too low	4, 22, 23, 24	45, 46, 47, 49, 50, 58
The engine knocks	9, 13, 15, 17, 20	34, 35, 36, 39, 41, 43, 45, 51, 53, 59
The engine runs erratically	7, 8, 9, 10, 11, 12, 13, 15, 16, 18, 20	32, 35, 37, 39, 40, 43, 51, 59
Vibration	13, 18, 20, 25	32, 37, 38, 39, 40, 43, 51, 53
The pressure of the lubricating oil is too high	4, 23	48
The engine oil temperature is too high	11, 13, 15, 19, 26, 28, 29, 30, 31	32, 34, 36, 38, 51, 54, 55, 56, 63, 64
Crankcase pressure	27	38, 41, 43, 44, 51
Bad compression	11	35, 36, 38, 39, 41, 42, 43, 52, 59
The engine starts and stops	10, 11, 12	

Continued

## Reverse gearbox

Problem	Possible causes	
	Checks by the user	Checks by the workshop personnel
Delay of gear engagement <sup>(1)</sup>	65, 66	
No transmission	67	70
Boat does not reach maximum speed <sup>(2)</sup>	68, 69	70

(1) Propeller rotates only after a delay of several seconds or only after engine speed is increased.

(2) Temperature of reverse gearbox is high.

**List of possible causes**

1. Battery capacity low.
2. Bad electrical connections.
3. Fault in starter motor.
4. Wrong grade of lubricating oil.
5. Starter motor turns engine too slowly.
6. Fuel tank empty.
7. Fault in stop control.
8. Restriction in a fuel pipe.
9. Fault in fuel lift pump.
10. Dirty fuel filter element.
11. Restriction in air induction system.
12. Air in fuel system.
13. Fault in atomisers or atomisers of an incorrect type.
14. Cold start system used incorrectly.
15. Fault in cold start system.
16. Restriction in fuel tank vent.
17. Wrong type or grade of fuel used.
18. Restricted movement of engine speed control.
19. Restriction in exhaust pipe.
20. Engine temperature is too high.
21. Engine temperature is too low.
22. Not enough lubricating oil in sump.
23. Defective gauge.
24. Dirty lubricating oil filter element.
25. Fault in engine mounting or flywheel housing.
26. Too much lubricating oil in sump.
27. Restriction in breather system.
28. Restriction in seacock or raw water strainer.
29. Insufficient coolant in circuit.
30. Restriction in heat exchanger or oil coolers.
31. Fault in coolant pump.
32. Fault in fuel injection pump.
33. Broken drive on fuel injection pump.
34. Timing of fuel injection pump is incorrect.
35. Valve tip clearances are incorrect.
36. Valve timing is incorrect.
37. Bad compression.
38. Cylinder head gasket leaks.
39. Valves are not free.
40. Wrong high-pressure pipes.
41. Worn cylinder bores.
42. Leakage between valves and seats.
43. Piston rings are not free or they are worn or broken.
44. Valve stems and/or guides are worn.
45. Crankshaft bearings are worn or damaged.
46. Lubricating oil pump is worn.
47. Relief valve does not close.
48. Relief valve does not open.
49. Relief valve spring is broken.
50. Fault in suction pipe of lubricating oil pump.
51. Piston is damaged.
52. Piston height is incorrect.
53. Flywheel housing or flywheel is not aligned correctly.
54. Fault in thermostat or thermostat is of an incorrect type.
55. Restriction in coolant passages.
56. Fault in water pump.
57. Valve stem seal is damaged.
58. Restriction in oil strainer.
59. Valve spring is broken.
60. Turbocharger impeller is damaged or dirty.
61. Lubricating oil seal of turbocharger leaks.
62. Induction system leaks (turbocharged engines).
63. Fault in raw water pump.
64. Turbocharger waste-gate does not work correctly.
65. Movement of control lever of reverse gearbox is not equal in both directions.
66. Insufficient movement of control cable for reverse gearbox.
67. Control cable for reverse gearbox is not free or radii are too small.
68. Wrong type of lubricating oil in reverse gearbox.
69. A lubricating oil cooler is needed for the reverse gearbox for conditions of operation.
70. Worn or broken drive components.



## Engine preservation

### Introduction

The recommendations indicated below are designed to prevent damage to the engine when it is withdrawn from service for a prolonged period. Use these procedures if the engine is to be withdrawn from service. The instructions for the use of POWERPART products are given on the outside of each container.

### Procedure

- 1 Completely clean the outside of the engine.
- 2 When a preservative fuel is to be used, drain the fuel system and fill it with the preservative fuel. POWERPART Lay-Up 1 can be added to the normal fuel to change it to a preservative fuel. If preservative fuel is not used, the system can be completely filled with normal fuel but the fuel must be drained and discarded at the end of the storage period together with the fuel filter canister.
- 3 Operate the engine until it is warm. Then correct leakages of fuel, lubricating oil or air. Stop the engine and drain the lubricating oil from the sump.
- 4 Renew the canister of the lubricating oil filter.
- 5 Fill the sump to the full mark with new and clean lubricating oil and add POWERPART Lay-up 2 to the oil to protect the engine against corrosion. If POWERPART Lay-Up 2 is not available, use a correct preservative fluid instead of the lubricating oil. If a preservative fluid is used, this must be drained and the lubricating oil sump must be filled to the correct level with normal lubricating oil at the end of the storage period.
- 6 Drain the coolant circuit, see page 23. In order to protect the cooling system against corrosion, fill it with an approved antifreeze mixture because this gives protection against corrosion, see page 51.  
  
*Caution: If protection against frost is not necessary and a corrosion inhibitor is to be used, it is recommended that you consult the Service Department, Wimborne Marine Power Centre, see page 6.*
- 7 Operate the engine for a short period in order to circulate the lubricating oil and the coolant in the engine.
- 8 Close the seacock and drain the raw water

cooling system.

**Caution:** *The raw water system cannot be drained completely. If the system is drained for engine preservation purposes or for protection from frost, the system must be filled again with an approved antifreeze mixture, see page 51.*

- 9 Remove the impeller from the raw water pump and put the impeller in a dark place for storage. Before the impeller is fitted at the end of the storage period, lubricate lightly the blades and each end of the impeller and the inside of the pump with Spherol SX2 grease or glycerine.

**Caution:** *The raw water pump must never run in a dry condition because this can damage the impeller blades.*

- 10 Remove the atomisers and spray POWERPART Lay-Up 2 for one to two seconds into each cylinder bore with the piston at Bottom Dead Centre.

Slowly turn the crankshaft one revolution and then fit the atomisers, complete with new seat washers.

- 11 Spray POWERPART Lay-Up 2 into the induction manifold. Seal the manifold and breather outlet with waterproof tape.

- 12 Remove the exhaust pipe. Spray POWERPART Lay-Up 2 into the exhaust manifold. Seal the manifold with waterproof tape.

- 13 Disconnect the battery. Then put the battery into safe storage in a fully charged condition. Before the battery is put into storage, protect its terminals against corrosion. POWERPART Lay-Up 3 can be used on the terminals.

- 14 Seal the vent pipe of the fuel tank or the fuel filler cap with waterproof tape.

- 15 Remove the alternator drive belt and put it into storage.

- 16 In order to prevent corrosion, spray the engine with POWERPART Lay-Up 3. Do not spray the area inside the alternator cooling fan.

- 17 If the transmission is not to be used for at least a year, fill the reverse gearbox completely with its normal lubricating oil. This will have to be drained and the normal amount of new lubricating oil added when the engine is returned to service, see page 39 to page 42.

*Continued*

**Caution:** *After a period in storage, but before the engine is started, operate the starter motor with the stop switch held in the "STOP" position until oil pressure is indicated. Oil pressure is indicated when the low pressure warning light is extinguished. If a solenoid stop control is used on the fuel injection pump, it must be disconnected for this operation.*

If the engine protection is done correctly according to the above recommendations, no corrosion damage will normally occur. Wimborne Marine Power Centre are not responsible for damage which may occur when an engine is in storage after a period in service.

#### **How to add antifreeze to the raw water system for engine preservation purposes**

Before antifreeze is added to the raw water system the system should be flushed out with fresh water. To do this operate the engine for one to two minutes with the seacock closed and with a supply of fresh water through the open top of the raw water strainer.

- 1 Obtain two empty, clean containers each with a capacity of approximately 9,0 litres (2 UK gallons) 9.6 US quarts. Also obtain 4,5 litre (1 UK gallon) 5 US quarts of POWERPART antifreeze.
- 2 Remove the hose from the connection on the exhaust elbow and put the end of the hose into one of the containers.
- 3 Remove the cover from the top of the raw water strainer, and with the seacock closed, add some antifreeze through the open top of the raw water strainer. Start the engine and run the engine at idle speed, then continue to add the remainder of the antifreeze through the open top of the strainer.
- 4 Operate the engine for several minutes. During this period, change the containers around, pour the antifreeze/water solution from the container at the outlet (hose end) into the strainer.
- 5 When the antifreeze is mixed thoroughly and has been circulated through the raw water system, stop the engine. Fit the top of the raw water strainer.

## Introduction

If problems occur with your engine or with the components fitted onto it, your Wimborne Marine Power Centre distributor can make the necessary repairs and will ensure that only the correct parts are fitted and that the work is done correctly.

## Service literature

Workshop manuals, Installation drawings and other service publications are available from your Wimborne Marine Power Centre distributor at a nominal cost.

## Training

Local training for the correct operation, service and overhaul of engines is available at Wimborne Marine Power Centre distributor. If special training is necessary, your Wimborne Marine Power Centre distributor can advise you how to obtain it at Wimborne Marine Power Centre or the Perkins Customer Training Department, Peterborough, or other main centres.

## On-board repair kit

The contents of this kit has been carefully prepared to ensure that it is correct for the original engine specification and the owner's/operator's needs.

**POWERPART recommended consumable products**

Perkins have made available the products recommended below in order to assist in the correct operation, service and maintenance of your engine and your machine. The instructions for the use of each product are given on the outside of each container. These products are available from your Perkins distributor or Wimborne Marine Power Centre.

**POWERPART Antifreeze**

Protects the cooling system against frost and corrosion, see page 51.

**POWERPART Easy Flush**

Cleans the cooling system. Part number 21820122.

**POWERPART Gasket and flange sealant**

To seal flat faces of components where no joint is used. Especially suitable for aluminium components. Part number 21820518.

**POWERPART Gasket remover**

An aerosol for the removal of sealants and adhesives. Part number 21820116.

**POWERPART Griptite**

To improve the grip of worn tools and fasteners. Part number 21820129.

**POWERPART Hydraulic threadseal**

To retain and seal pipe connections with fine threads. Especially suitable for hydraulic and pneumatic systems. Part number 21820121.

**POWERPART Industrial grade super glue**

Instant adhesive designed for metals, plastics and rubbers. Part number 21820125.

**POWERPART Lay-Up 1**

A diesel fuel additive for protection against corrosion. Part number 1772204, see page 57.

**POWERPART Lay-Up 2**

Protects the inside of the engine and of other closed systems. Part number 1762811, see page 57.

**POWERPART Lay-Up 3**

Protects outside metal parts. Part number 1734115, see page 57.

**POWERPART Metal repair putty**

Designed for external repair of metal and plastic.

Part number 21820126.

**POWERPART Pipe sealant and sealant primer**

To retain and seal pipe connections with coarse threads. Pressure systems can be used immediately. Part number 21820122.

**POWERPART Retainer (high strength)**

To retain components which have an interference fit. Currently Loctite 638. Part number 21820638.

**POWERPART Safety cleaner**

General cleaner in an aerosol container. Part number 21820128.

**POWERPART Silicone adhesive**

An RTV silicone adhesive for application where low pressure tests occur before the adhesive sets. Used for sealing flange where oil resistance is needed and movement of the joint occurs. Part number 21826038.

**POWERPART Silicone RTV sealing and jointing compound**

Silicone rubber sealant which prevents leakage through gaps. Currently Hylosil. Part number 1861108.

**POWERPART Stud and bearing lock**

To provide a heavy duty seal to components that have a light interference fit. Part number 21820119 or 21820120.

**POWERPART Threadlock and nutlock**

To retain small fasteners where easy removal is necessary. Part number 21820117 or 21820118.

**POWERPART Universal jointing compound**

Universal jointing compound which seals joints. Currently Hylomar. Part number 1861117.

General data

Engine

Number of cylinders.....	6
Cylinder arrangement.....	In line
Cycle.....	Four stroke
Induction system:	
- M300Ti, M265Ti, M225Ti, M215C, M185C.....	Turbocharged/intercooled
- M135, M130C.....	Naturally aspirated
Combustion system.....	Direct injection
Nominal bore.....	100 mm (3.937 in)
Stroke.....	127 mm (5.000 in)
Compression ratio:	
- M300Ti, M265Ti.....	17.5:1
- M225Ti, M215C, M185C.....	16.0:1
- M135, M130C.....	16.5:1
Cubic capacity.....	6 litres (365 in <sup>3</sup> )
Firing order.....	1, 5, 3, 6, 2, 4
Valve tip clearances (hot or cold):	
- Inlet.....	0.20 mm (0.008 in)
- Exhaust.....	0.45 mm (0.018 in)
Lubricating oil pressure (minimum at maximum engine speed and normal engine temperature).....	
	207 kPa (30 lbf/in <sup>2</sup> ) 2,1 kgf/cm <sup>2</sup>
Capacity of lubricating oil sump <sup>(1)</sup> :	
- Maximum.....	15.0 litres (26.4 UK pints) 15.8 US quarts
- Minimum.....	13.0 litres (23 UK pints) 13.7 US quarts
Coolant capacity (closed circuit)	
- M300Ti, M265Ti.....	26.3 litres (46.26 UK pints) 27.7 US quarts
- M225Ti, M215C, M185C, M135, M130C.....	25.3 litres (44.5 UK pints) 26.7 US quarts
Direction of rotation.....	Clockwise from the front
Batteries.....	Two 12 volt 510 amperes (BS3911) or two 12 volt 790 amperes (SAE J537)
Weight of the engine with coolant and engine lubricating oil	
- M300Ti, M265Ti.....	638 kg ( 1407lbs)
- M225Ti, M215Ti, M185C.....	609 kg ( 1343lbs)
- M135Ti, M130C.....	595 kg ( 1312lbs)

(1) The capacity of the sump will vary according to the installation angle. Fill to the mark on the dipstick, see page 37.

**Reverse gearbox****Newage PRM 500D**

- Lubricating oil capacity <sup>(1)</sup> ..... 2.5 litre (4.4 UK pints) 2.6 US quart
- Lubricating oil specification ..... Engine lubricating oil API CF-4 or ACEA E2
- Control lever movement from neutral to engaged position..... 35°

**Newage PRM 1000A**

- Lubricating oil capacity <sup>(1)</sup> ..... 3.5 litre (6.2 UK pints) 3.7 US quart
- Lubricating oil specification ..... Engine lubricating oil API CF-4 or ACEA E2
- Control lever movement from neutral to engaged position..... 35°

**Newage PRM 1000D**

- Lubricating oil capacity <sup>(1)</sup> ..... 4.2 litre (8.8 UK pints) 4.2 US quart
- Lubricating oil specification ..... Engine lubricating oil API CF-4 or ACEA E2
- Control lever movement from neutral to engaged position..... 35°

**Hurth HSW 630A**

- Lubricating oil capacity <sup>(1)</sup> ..... 4.0 litre (8.4 UK pints) 4.2 US quart
- Lubricating oil specification ..... Shell ATF Dexron 11-D
- Control lever movement from neutral to engaged position.....23°/26.6°

**Hurth HSW 630H**

- Lubricating oil capacity <sup>(1)</sup> ..... 3.5 litre (6.2 UK pints) 3.7 US quart
- Lubricating oil specification ..... Shell ATF Dexron 11-D
- Control lever movement from neutral to engaged position.....23°/26.6°

**ZF IRM 220A**

- Lubricating oil capacity <sup>(1)</sup> ..... 4 litre (7. UK pints) 4.2 US quart
- Lubricating oil specification ..... SAE 30 MIL L210A C/D/E
- Control lever movement from neutral to engaged position..... 45°

(1) The capacity of the reverse gearbox will vary according to the installation angle of the transmission. The capacity given does not include the oil cooler for the reverse gearbox or for the pipes for the oil cooler.

**California**

Proposition 65 Warning

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



**Perkins®**  
**Marine Power**

All information in this document is substantially correct at the time of printing and may be altered subsequently.  
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**Wimborne Marine Power Centre**  
22 Cobham Road,  
Ferndown Industrial Estate,  
Wimborne, Dorset, BH21 7PW, England.  
Tél: +44 (0)1202 796000,  
Fax: +44 (0)1202 796001  
E-mail: [Marine@Perkins.com](mailto:Marine@Perkins.com)

**Web:** [www.perkins.com/Marine](http://www.perkins.com/Marine)