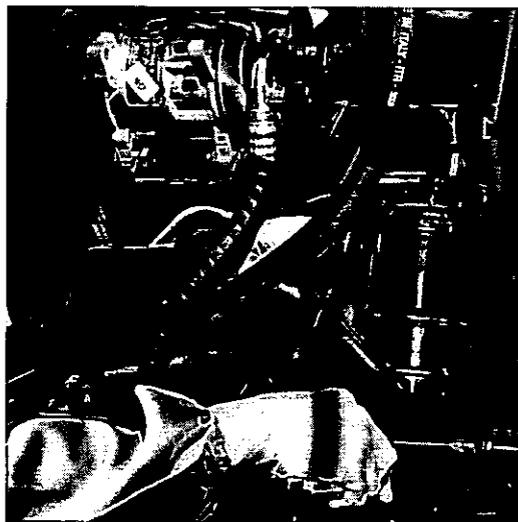
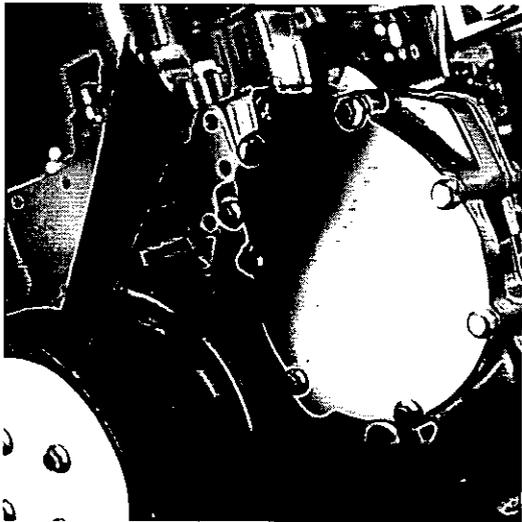


 Perkins®

User's Handbook

4.203 Series Diesel Engines



Ⓞ GB

D4.203, 4.2032

TPD 1216

USERS HANDBOOK

4.203 Series Diesel Engines

D4.203, 4.2032

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PACE

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General information

Introduction

This handbook has been written to give you assistance in the correct maintenance and operation of your engine.

To get the best performance and longest life from your engine, you must have the maintenance operations done at the periods shown in 'Preventive maintenance'. If the engine operates in very dusty or other adverse conditions, some maintenance periods will have to be reduced. Keep your engine clean inside by regular filter element and lubricating oil changes.

Ensure that all adjustments and repairs are done by personnel who have had the correct training. Perkins distributors have these personnel available. You can also get parts and other service from your Perkins distributor. If you do not know the location of your nearest distributor, check with one of the Perkins companies given on page 8.

The left and right sides of the engine are as seen from the rear.

Read and remember the 'Safety precautions'. These are given for your protection and must be used at all times.

Safety precautions

These safety precautions are important. Reference must also be made to the local regulations in the country of operation.

- Do not use these engines in marine applications.
- Do not change the specification of the engine.
- Do not smoke when you put fuel in the tank.
- Clean away any fuel which has fallen and move material which has fuel contamination to a safe place.
- Do not put fuel in the tank during engine operation (unless really necessary).
- Never clean, lubricate or adjust the engine during operation (unless you have had the correct training when extreme caution must be used to prevent injury).
- Do not make any adjustments you do not understand.
- Ensure the engine is not in a position to cause a concentration of toxic emissions.
- Persons in the area must be kept clear during engine and equipment or machine operation.
- Do not permit loose clothing or long hair near parts which move.
- Keep away from parts which turn during operation. Note that fans cannot be seen clearly while the engine runs.
- Do not run the engine with any safety guards removed.
- Do not remove the radiator cap while the engine is hot and the coolant is under pressure as dangerous hot coolant can be discharged.
- Do not use salt water in the cooling system or any other coolant which can cause corrosion.
- Keep sparks or fire away from batteries (especially during charge) or combustion can occur. The battery fluid can burn and is also dangerous to the skin and especially the eyes.
- Disconnect the battery terminals before you make a repair to the electrical system.
- Only one person must be in control of the engine.
- Ensure the engine is only operated from the control panel or operators position.
- If your skin comes into contact with high pressure fuel, get medical assistance immediately.
- Diesel fuel can cause skin damage to some persons. Use protection on the hands (gloves or special skin protection solutions).
- Do not move equipment unless the brakes are in good condition.
- Ensure that the transmission drive control is in 'out of drive' position before the engine is started.
- Fit only correct Perkins parts.

CARECARD

The Perkins CARECARD system is only applicable where the Perkins distributor is responsible for the engine service.

When you receive your new equipment, give all the relevant details to your Perkins distributor who will provide a CARECARD (see fig. 1) and instructions for its use.

Each time you need service or information, give the CARECARD to your distributor. This will enable the distributor to provide the correct service and ensure that genuine Perkins parts are used. The distributor will also ensure that you obtain the best performance from your Perkins engine at all times.

	CARECARD
ENGINE NO.	
ISSUED TO	
SIGNED	
ISSUED BY	
EXPIRES <input type="text"/>	

Fig 1 CARECARD

Engine identification

There are two engine types in the 4.203 Series. These are the D4.203 and 4.2032 engines.

The first two letters of the engine number give an indication of the engine type as shown below:

Code	Engine type
JE	D4.203
JG	4.2032

The engine number is stamped on a machined pad on the top right hand side of the cylinder block (see 1, fig. 2), or on the rear face of the cylinder block (see 2, fig 2). A typical engine number is JG50135U583103K.

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

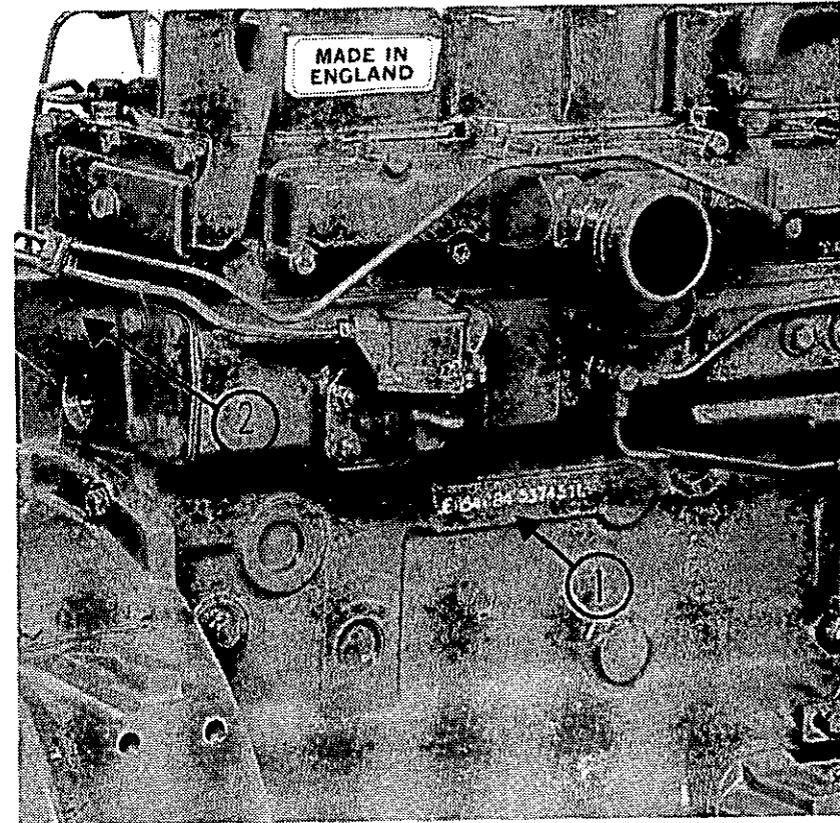


Fig. 2 Engine number position

Perkins companies

Australia

Perkins Engines Australia Pty. Ltd.,
Suite 2, 364 Main Street,
Mornington 3931, Victoria, Australia.
Telephone: 597 51877
Telex: Perkoil AA30816
Fax: 597 58793

France

Moteurs Perkins S.A.,
9-11 Avenue Michelet,
93583 Saint Ouen, Cedex, France.
Telephone: (1) 40 10 42 00
Telex: 642924F
Fax: (1) 40-10-42-45

Germany

Perkins Motoren G.m.b.H.,
8752 Kleinostheim, Postfach 1180,
West Germany.
Telephone: 6027 5010
Telex: 4188869A PER D
Fax: 6027 501124

Italy

Motori Perkins S.p.A.,
Via Socrate 8,
22070 Casnate con Bernate (Como)
Italy.
Telephone: 031 452332
Telex: 380658 Perkit I
Fax: 031 452335

Japan

Varity (Japan) K.K.,
Reinanzaka Building, 5th Floor,
14-2 Akasaka, 1-chome, Minato-ku,
Tokyo 107, Japan.
Telephone: 03 586 7377
Telex: Perkoil J2424823
Fax: 03 582 1596.

Singapore

Perkins Engines Asia Pacific,
4 Kian Teck Drive,
Singapore 2262.
Telephone: 2656333/2653223
Telex: Perkoil RS37729
Fax: 2641188

United Kingdom

Perkins Engines Limited,
Frank Perkins Way, Eastfield,
Peterborough PE1 5NA, England.
Telephone: 0733 67474
Telex: 32501 Perken G
Fax: 0733 582240

United States of America

Perkins Engines Inc.,
1700, Bellemeade Court,
Lawrenceville,
Georgia 30245, U.S.A.
Telephone: 404 822 3000
Telex: 544141 Perken Law
Fax: 404 822 3006

Perkins Engines Latin America Inc.,
Suite 620,
999, Ponce de Leon Boulevard,
Coral Gables,
Florida 33134, U.S.A.
Telephone: 305 442 7413
Telex: 32501 Perken G
Fax: 305 442 7419

In addition to the above companies, there are Perkins distributors in most countries. Perkins Power Sales and Services Ltd., Peterborough or one of the above companies can provide details.

Engine views

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

- 1 Thermostat housing
- 2 Front lift bracket
- 3 Lubricating oil filler
- 4 High pressure pipe from fuel pump to atomiser
- 5 Exhaust manifold
- 6 Atomiser
- 7 Atomiser leak off pipe
- 8 Fuel oil filter
- 9 Fuel injection pump
- 10 Sump dipstick
- 11 Flywheel housing
- 12 Lubricating oil pump
- 13 Crankshaft pulley
- 14 Hydraulic pump drive housing
- 15 Water pump

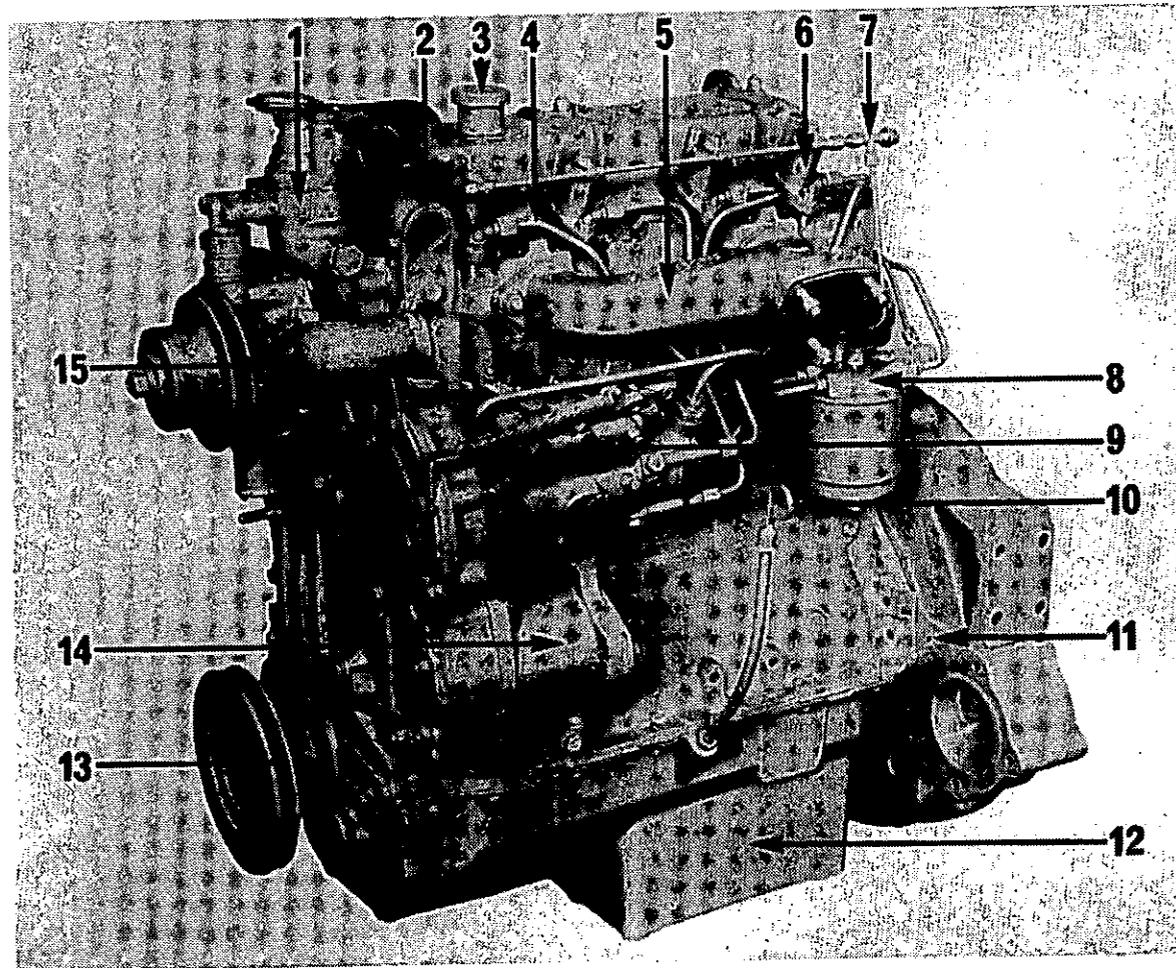


Fig. 3 Front/left side of 4.2032 engine

- 16 Rear lift bracket
- 17 Rocker cover
- 18 Cold start aid
- 19 Breather vent valve
(4.2032 only)
- 20 Induction manifold
- 21 Engine number location
- 22 Lubricating oil filter
- 23 Sump drain plug
- 24 Flywheel
- 25 Cylinder block drain plug
- 26 Fuel lift pump

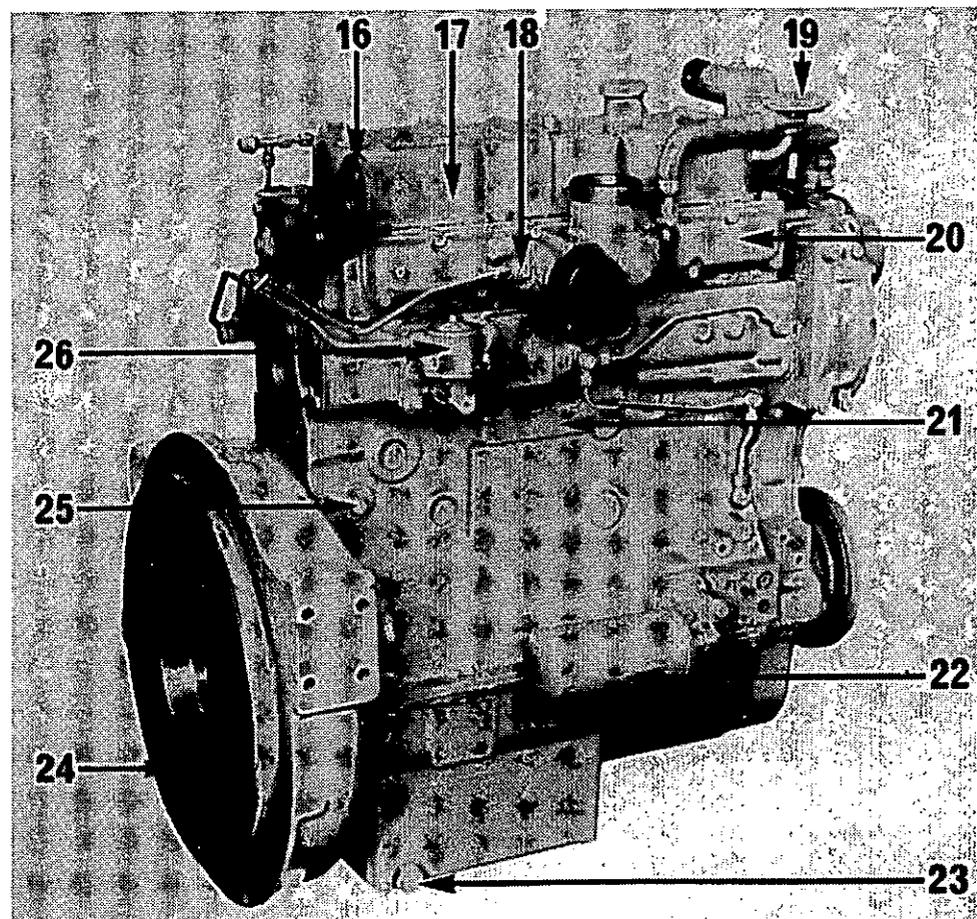


Fig. 4 Rear/right side of the 4.2032 engine

Engine data

	D4.203	4.2032
Number of cylinders	Four	Four
Cylinder arrangement	In line	In line
Cycle	Four stroke	Four stroke
Induction system	Naturally aspirated	Naturally aspirated
Combustion system	Direct injection	Direct injection
Nominal bore	91,44 mm (3.60 in)	91,44 mm (3.60 in)
Stroke	127 mm (5 in)	127 mm (5 in)
Compression ratio	18.5:1	19:1
Cubic capacity	3,33 litres (203 in ³)	3,33 litres (203 in ³)
Firing order	1, 3, 4, 2	1, 3, 4, 2
Tappet clearance		
Inlet (cold)	0,20 mm (0.008 in)	0,20 mm (0.008 in)
Exhaust (cold)	0,30mm (0.012 in)	0,30 mm (0.012 in)
Lubricating oil pressure	207 kN/m ² (30 lbf/in ²) 2,1 kgf/cm ² minimum at maximum engine speed and normal engine temperature.	
Direction of rotation	Clockwise from the front.	

Instructions for operation

To start the engine

There are several factors which affect engine start, for example:

- The power of the batteries.
- Performance of the starter motor.
- Viscosity of the lubricating oil.
- Installation of a cold start system.

Diesel engines need a cold starting aid when they are to operate in very cold conditions. Your machine will normally be fitted with the correct equipment for your area of operation.

Different systems of cold starting aids can be fitted to Perkins diesel engines for the 4.203 series of engines; they are:

Thermostart: An electrically operated device which heats the induction air. This device burns a controlled amount of diesel fuel.

Start Pilot: A hand pump discharges the cold start fluid into the induction manifold through an atomiser. The cold start fluid is held in a separate reservoir.

KBi: The cold start fluid is held in an aerosol container. It is released by a push button operated solenoid and sprayed into the induction manifold by a nozzle.

To start a warm engine

1 Ensure that the stop control (where fitted) is in the 'run' position.

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

3 Turn the start key to the 'HS' position (see fig. 5), to engage the starter motor.

4 As soon as the engine starts, release the start key to the 'R' position.

5 If the engine does not start in 15 seconds, return the start key to the 'R' position. Do not engage the starter motor again until 10 to 15 seconds have passed.

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

Engine start procedure with Thermostart

1 Ensure that the engine stop control (where fitted) is in the 'run' position.

2 Turn the start key to the 'H' position (see fig. 5), and hold it there for 20 seconds.

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

4 Turn the start key to the 'HS' position to engage the starter motor. As the engine starts, release the start key to the 'R' position and adjust the engine speed control to give a smooth idle speed.

5 If the engine does not start in 15 seconds, return the start key to the 'H' position for 10 seconds and then engage the starter motor again.

Engine start procedure with Start Pilot

The Start Pilot hand pump must not be used until the starter motor is engaged.

Experience will show how much fluid is needed for each engine start.

1 Where necessary, charge the reservoir with fluid. Raise the cover of the reservoir and press the can, head down, on to the filler plug and hold squarely until fluid fills the bowl up to the maximum mark.

2 Ensure that the engine stop control (where fitted) is in the 'run' position.

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

4 Engage the starter motor for a maximum of 30 seconds and operate the Start Pilot pump during this period. Adjust the engine speed control.

5 If the engine does not start during the first 30 seconds, disengage the starter motor for another 30 seconds and then engage the starter motor again and operate the Start Pilot pump.

The air filter at the outer end of the pump must be inspected from time to time and if necessary it must be washed in kerosene.

The inside surface of the cylinder can be lightly lubricated with a thin lubricating oil.

The nozzle in the induction manifold can be removed and washed in kerosene, when necessary.



Start Pilot equipment must not be used with heat type cold starting aids such as Thermo-start.

Engine start procedure with KBi

1 Where necessary, renew the screw type canister. A safety valve is integral with the container.

2 Ensure that the engine stop control (where fitted) is in the 'run' position.

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

4 Engage the starter motor.

5 As the engine turns, press the KBi button for a maximum period of 2 seconds. If the engine does not start after the first 2 second application, keep the starter motor engaged and after 5 seconds press the KBi button again for 2 seconds.

- | | |
|----|----------------|
| O | Off |
| R | Run |
| H | Heat |
| HS | Heat and start |

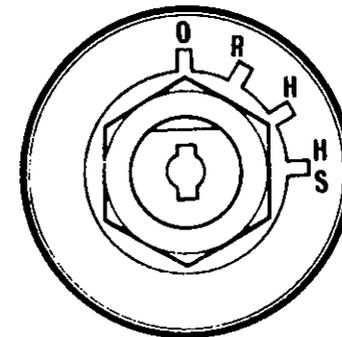


Fig. 5 Heat/start switch

In some conditions, it is necessary to give another application of KBi fluid after the engine has started to ensure that the engine continues to run.

KBi equipment must not be used with heat type cold starting aids such as Thermostart.

To stop the engine

Either turn the engine start key to the 'O' (off) position (see fig. 5) or operate the separate stop control. Where a separate stop control is used, ensure that the control is returned to the 'run' position after the engine has stopped and the engine start key is turned to the 'O' position.

Engine speed adjustment

The idle or maximum speed settings must not be changed by the engine operator as this can damage the engine or transmission. If the seals on the fuel injection pump are broken during the warranty period by a person who is not approved by Perkins Engines Ltd., it can have an effect on the warranty.

Running-in procedure

A gradual running-in of a new or Power Exchange engine is not necessary. Extended light load operation during the early life of the engine is not recommended.

Full load can be applied to a new or Power Exchange engine as soon as the engine is put into service and the coolant temperature is at a minimum of 60°C (140°F).

Do not run the engine at high no load speeds.

Do not apply an overload to the engine.

Altitude

If the naturally aspirated engine is to operate at an altitude higher than 600 m (2,000 ft), the fuel delivery can be changed to reduce smoke and fuel consumption. Perkins Engines Ltd. can give the percentage of fuel reduction needed if details of engine application and ambient conditions are given. Any change to the fuel injection pump settings must be made by a Perkins distributor or an approved fuel pump distributor.

Engine fluids

Fuel specification

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

Cetane number	45 minimum
Viscosity	2.5/4.5 centistokes at 40°C
Density	0,835/0,855 kg/litre
Sulphur	0.5% of mass, maximum
Distillation	85% at 350°C

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

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

Density: Lower density will reduce engine power, higher density will increase engine power and exhaust smoke.

Sulphur: High sulphur content (not normally found in Europe, North America or Australasia) can cause engine wear. Where only high sulphur fuels are available, it will be necessary to use a highly alkaline lubricating oil in the engine or to reduce the lubricating oil change interval.

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.

Lower 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.

Aviation kerosene fuels

These fuels can be used but they can affect engine performance. It is recommended that you consult the Perkins Technical Service Department at Peterborough, especially if JP4 fuel is to be used. Aviation fuels are more flammable than diesel fuel and need careful storage and management.

If you need advice on any adjustment to the engine or to the lubricating oil change periods which may be necessary because of the standard of available fuel, consult your nearest Perkins distributor or the Technical Service Department at one of the addresses on page 8.

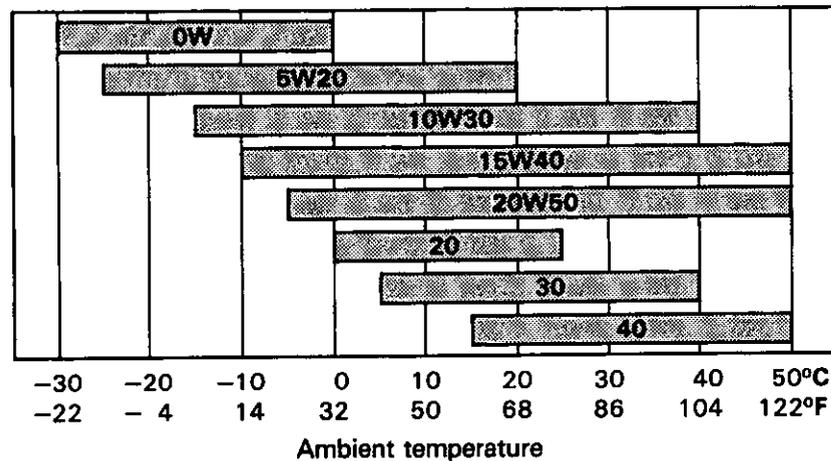
Lubricating oil specification

Use only a good quality lubricating oil to the relevant specification as shown in the table over page.

Attention: The type of lubricating oil used may be affected by the quality of the fuel oil which is used. For further details see "Fuel specification" on this page.

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 below.

Recommended SAE viscosity grades



Coolant specifications

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, Perkins cannot be held responsible for frost or corrosion damage.

- 1 If it is possible, use clean soft water.
- 2 If an antifreeze mixture, other than Perkins

POWER-PART, is used to prevent frost damage, it must have an ethanediol base (ethylene glycol) with a corrosion inhibitor. It is recommended that the corrosion inhibitor is of the sodium nitrite or sodium benzoate type. The antifreeze mixture must be an efficient coolant at all ambient temperatures and it must provide protection against corrosion. It must also have a specification at least as good as the requirements of the standards below:

United Kingdom: BS 6580: 1985: "Specification for corrosion inhibiting, engine coolant concentrate (antifreeze)."

United States of America: ASTM D3306-74: "Ethylene Glycol Base Engine Coolant."

Australia: AS 2108-1977: "Antifreeze Compounds and Corrosion Inhibitors for Engine Cooling Systems."

Perkins POWERPART antifreeze exceeds the requirements of the above standards.

The quality of the antifreeze coolant must be checked at least once a year, for example, at the beginning of the cold period.

The antifreeze must consist of equal quantities of antifreeze and water. Concentrations of more than 50% of antifreeze must not be used because these can effect adversely the performance of the coolant.

- 3 When frost protection is not necessary, it is still an advantage to use an approved antifreeze mixture because

this gives the necessary protection against corrosion and also raises the boiling point of the coolant.

If an antifreeze is not used, a correct mixture of corrosion inhibitor must be added to the water.

Renew the mixture of water and corrosion inhibitor every six months or check it according to the inhibitor manufacturer's recommendations.

Attention: Certain corrosion inhibitor mixtures contain soluble oil which can have an adverse affect on certain types of water hose.

To drain the cooling system

- 1 Ensure that the machine is on level ground.
- 2 Remove the radiator filler cap.
- 3 Remove the drain plug from the side of the cylinder block (see 1, fig. 6) to drain the engine. Ensure that the drain hole does not have any restriction.
- 4 Open the tap or remove the drain plug at the bottom of the radiator to drain the radiator. If a tap or plug is not fitted to the radiator, disconnect the bottom radiator hose.
- 5 Where necessary, flush the system with clean water.
- 6 Fit the drain plugs and radiator cap. Where necessary, close the radiator tap or connect the radiator hose.

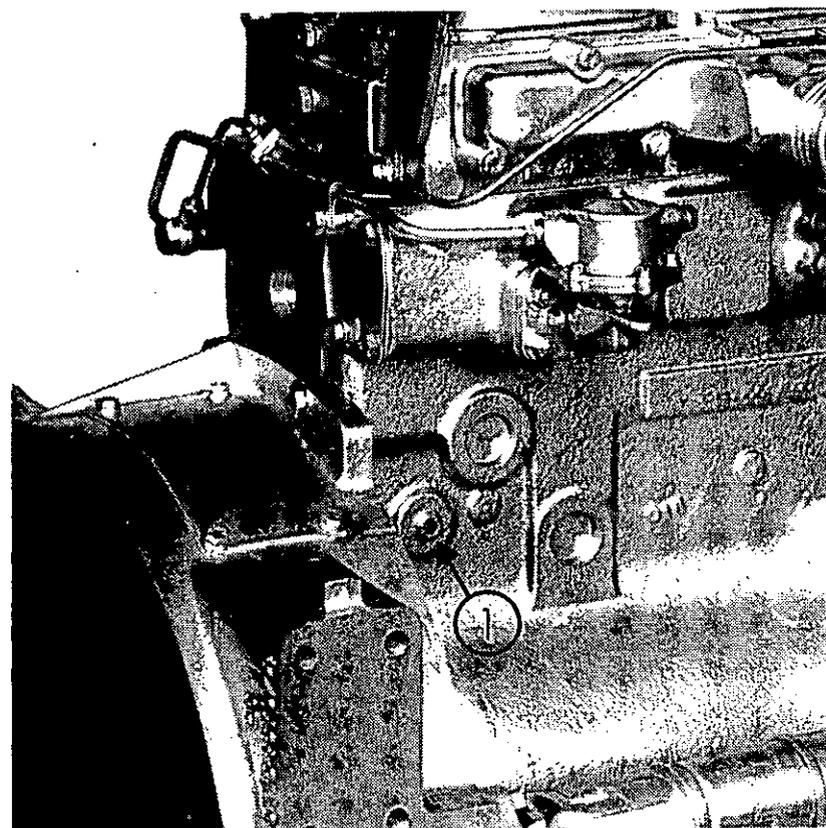


Fig. 6 Cylinder block drain plug

Preventive maintenance

These preventive maintenance periods are general in application. Check the periods given by the manufacturer of the equipment in which the engine is installed and, where necessary, use the shorter periods. These periods and procedures must also be adapted to ensure correct operation for any local machine regulations.

Note: On stop/start short distance operation the hours run are more important than the distance.

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

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

Schedules

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

D4.203 ENGINES

Daily or every 8 hours

Check amount of coolant.

Check amount of lubricating oil in the sump.

Check lubricating oil pressure (where a gauge is installed).

In extreme dust conditions, clean the air cleaner or empty the dust bowl of the air filter.

Every 250 hours or 4 months

Renew the lubricating oil.

Renew the lubricating oil filter canister.

Clean the air cleaner, or empty the dust bowl of the air filter.

Check the drive belt(s).

Check for water in the fuel pre-filter (where fitted).

Every 500 hours or 12 months

Change the fuel filter element.

Clean or renew the air filter element (if not indicated earlier).

Clean the lift pump sediment chamber and gauze strainer (where fitted).

Every 2,500 hours

Check the accessory equipment (starter motor, alternator, exhaust, etc.).

Check and, if necessary, adjust the tappet clearances.

Check the atomisers.

4.2032 ENGINES

Daily or every 8 hours

Check amount of coolant.

Check amount of lubricating oil in the sump.

Check lubricating oil pressure (where a gauge is installed).

In extreme dust conditions, clean the air cleaner or dust bowl of the air filter.

Every 200 hours or 4 months

Clean the air cleaner, or empty the dust bowl of the air filter.

Check the drive belt(s).

Check for water in the fuel pre-filter (where fitted).

Every 400 hours or 12 months

Renew the lubricating oil.

Renew the lubricating oil filter canister.

Renew the fuel filter element.

Renew the air filter element (if not indicated earlier).

Clean the lift pump sedimenter chamber and gauze strainer (where fitted).

Check and if necessary adjust tappet clearances.

Every 800 hours

Check the atomisers.

Every 2,400 hours

Check the accessory equipment (starter motor, alternator, etc.).

Post delivery service

The service procedures given below must be applied at the first 25/50 hours of operation.

- 1 Run the engine until it is warm. Stop the engine and drain the lubricating oil from the sump. Fill the sump to the 'full' mark on the dipstick with clean new lubricating oil to an approved grade.
- 2 Renew the lubricating oil filter canister.
- 3 Adjust the tappet clearances (see page 24).
- 4 Check that the induction and exhaust manifold nuts are tight.
- 5 Check the tension of the alternator/water pump drive belt.
- 6 Check that all fasteners on and around the engine are tight.
- 7 Run the engine and check for fuel, coolant and lubricating oil leakage.
- 8 If necessary, get a person who has had the correct training to adjust the idle speed.

Instructions for maintenance

Air filter

Environment conditions have an important effect on the frequency at which the dry type air filter will need service.

Some air filters have a separate dust bowl that has to be cleaned at intervals. The amount of dust in the bowl will show if it has been removed at the correct time for the conditions of operation. Do not let the bowl get full of dust as this will reduce the life of the filter element.

Some air filters have automatic dust valves through which dust is discharged from the filter. The rubber dust valve must be kept clean and checked to ensure that the sides of the valves close together, but will come apart freely.

Where a restriction indicator is installed, it will give a positive indication that the air filter element needs service. This will prevent the early removal of the filter element which causes extra cost or late element removal which can cause loss of engine power.

The filter element must be cleaned or renewed according to the manufacturer's recommendations.

Air cleaner

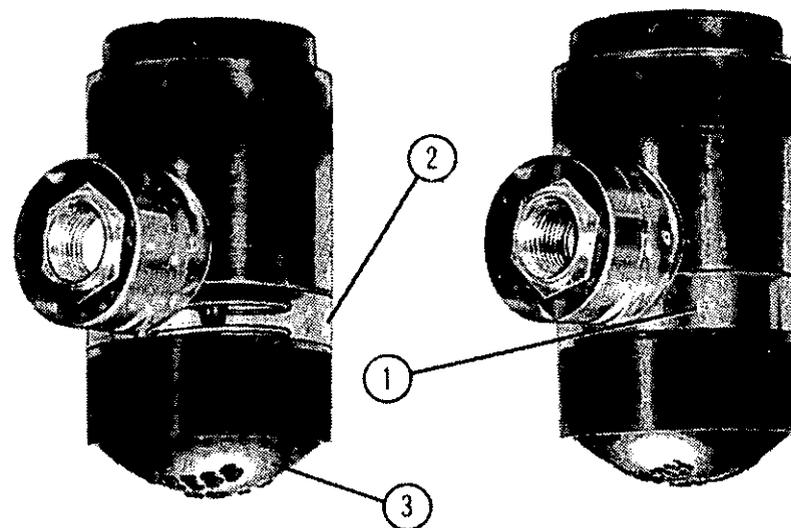
The wet type air cleaner must be drained at a suitable interval and the container and element cleaned with a suitable fluid or kerosene. Do not use gasoline. Fill with clean engine lubricating oil to the indicated level.

Restriction indicator

The restriction indicator for these engines must be the type that operates at a pressure difference of 457 mm (18 in) of water gauge. It is installed on the air filter outlet or between the air filter and the induction manifold.

When the red warning indicator (1, fig. 7) is seen through the clear panel (2) after the engine has stopped, the air filter element must be removed for service.

After a clean element has been fitted, press the rubber bottom (3) of the restriction indicator to reset the red warning indicator.



1 Red panel 2 Clear panel 3 Rubber bottom

Fig. 7 Restriction indicator

To renew the lubricating oil filter canister

- 1 Put a tray under the filter to hold any lubricating oil drops.
- 2 Remove the filter canister (see fig. 8) with a strap wrench or similar tool and discard the canister.
- 3 Clean the filter head.
- 4 Add clean engine lubricating oil to the new canister. Give the oil time to fill the canister through the filter element.
- 5 Lubricate the top of the canister seal with clean engine lubricating oil.
- 6 Install the new canister and tighten it by hand only. Do not use a strap wrench.
- 7 After lubricating oil has been added to the sump, run the engine and check for leakage from the filter.

Note: The canister has a valve inside to ensure that lubricating oil does not drain from the filter and a special tube is fitted, so ensure that the correct Perkins POWERPART canister is used.

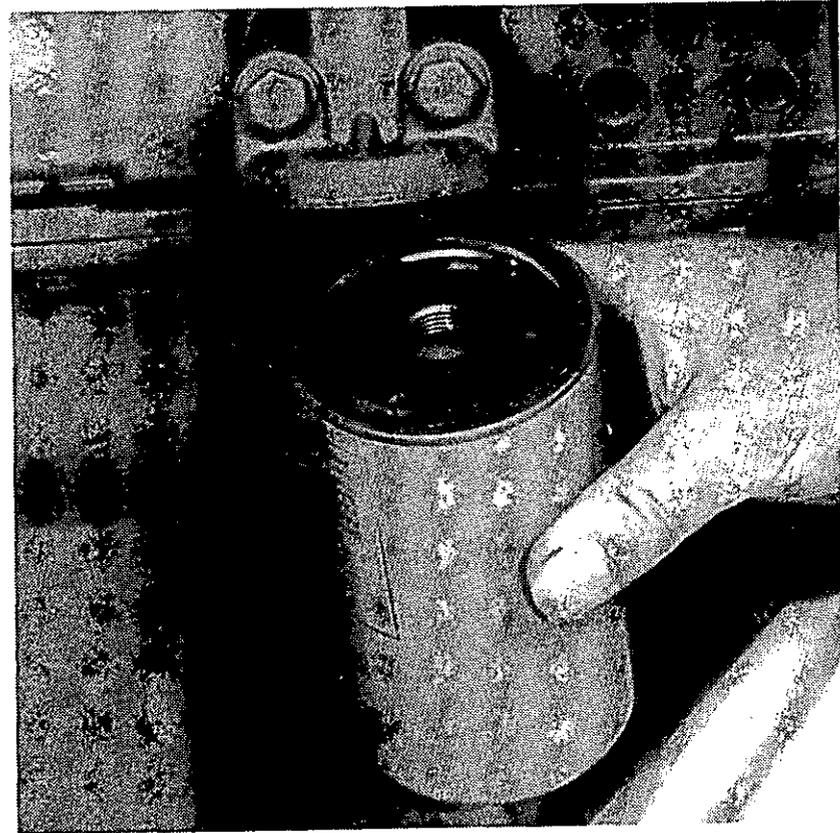


Fig. 8 To renew the lubricating oil canister

To check the drive belt

Renew the belt if it is worn or damage has occurred.

With thumb pressure, press the fan belt down at the centre of the longest free length and check the movement (see fig. 9). The belt movement must be 10 mm ($\frac{3}{8}$ in).

To adjust the belt tension:

- 1 Loosen the alternator mounting and adjustment link fasteners.
- 2 Change the alternator position to give the correct tension and tighten the alternator adjustment link fasteners.
- 3 Check the belt tension again to ensure that it is still correct.

If a new belt is fitted, the belt tension must be checked again after the first 25 hours of operation.

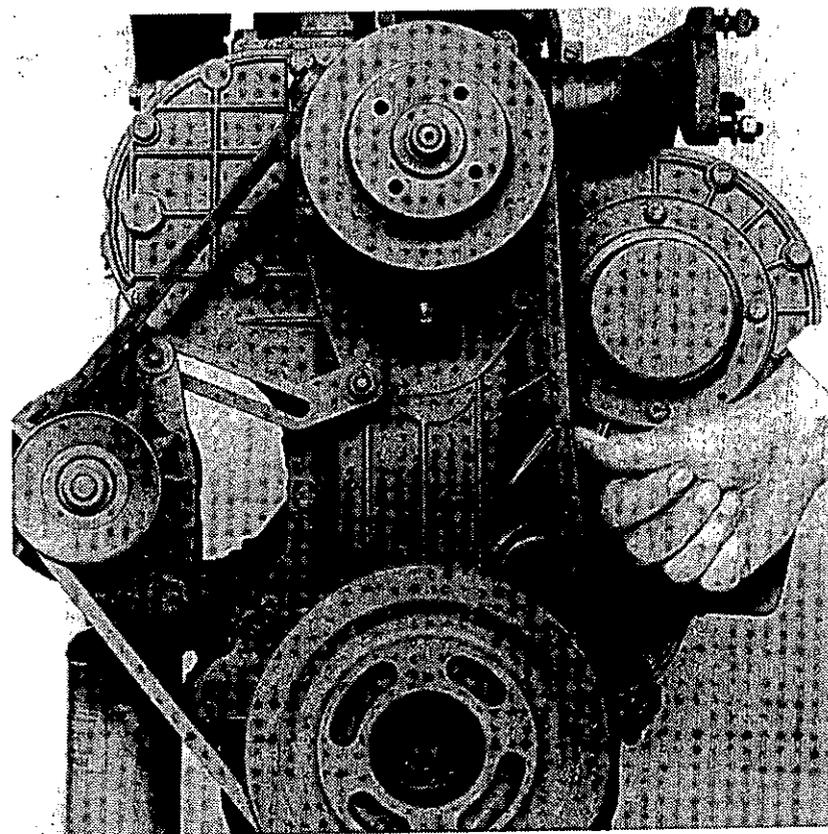


Fig. 9 To check the drive belt tension

To check the tappet clearances

These are checked between the top of the tappet and rocker lever (see fig. 10).

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

The correct clearance for the inlet valves is 0,20 mm (0.008 in) and for the exhaust valves 0,30 mm (0,012 in) with the engine cold.

- 1 Turn the crankshaft in the normal direction of rotation, until the inlet valve of number 4 cylinder has just opened and the exhaust valve of the same cylinder has not fully closed. Check the clearances of number 1 cylinder valves and adjust if necessary.
- 2 With number 2 cylinder valves set as given above for number 4 cylinder, check/adjust clearances of number 3 cylinder valves.
- 3 With number 1 cylinder valves set, check/adjust clearances of number 4 cylinder valves.
- 4 With number 3 cylinder valves set, check/adjust clearances of number 2 cylinder valves.

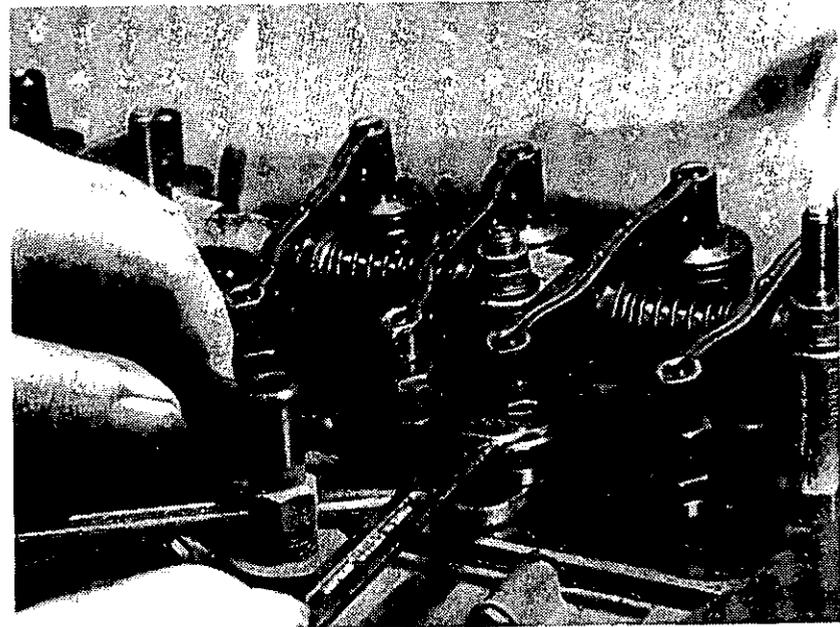


Fig. 10 To check tappet clearance

To renew a fuel filter element

- 1 Clean the outside of the fuel filter element.
- 2 Release the setscrew in the centre of the cover of the filter (see fig. 11).
- 3 Lower the filter bottom cover.
- 4 Remove the element and discard.
- 5 Before you put the new element in position, clean the top and bottom filter covers.
- 6 If the joints are not in good condition, renew them.
- 7 Put the new element on the bottom cover and assemble it squarely to the filter head so that the element fits in the centre against the joint in the filter head.
- 8 Hold in this position and fit the setscrew in the centre of the filter head.
- 9 Remove air from the fuel system (see page 26).

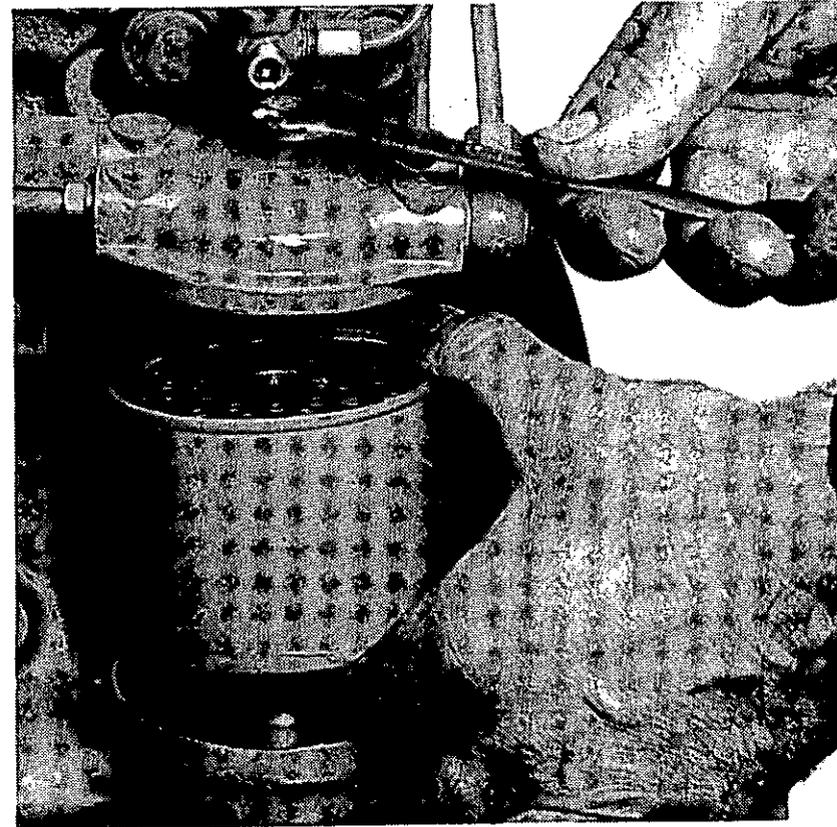


Fig. 11 To renew a fuel filter element

To remove air from the fuel system

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

Air can get into the system if:

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

1 To remove air from the fuel filter loosen the vent plug or, if this is not fitted, the return to tank banjo connection in the top of the filter. This will reduce the time needed to fill the filter with fuel when the priming lever of the fuel lift pump is operated (see fig. 14). If the fuel lift pump drive cam is on maximum lift, it will not be possible to operate the priming lever and the crankshaft must be turned through one revolution. When fuel, free of air, comes from the vent plug or connection tighten the plug or connection.

2 Where the fuel filter is fitted lower than the fuel injection pump, loosen the inlet connection at the fuel pump (see fig. 15) and operate the lift pump to remove any air (see fig. 14).

Tighten the inlet connection.

3 Loosen the vent screw near the top of the fuel injection pump governor control cover for mechanical governor (see fig. 12).

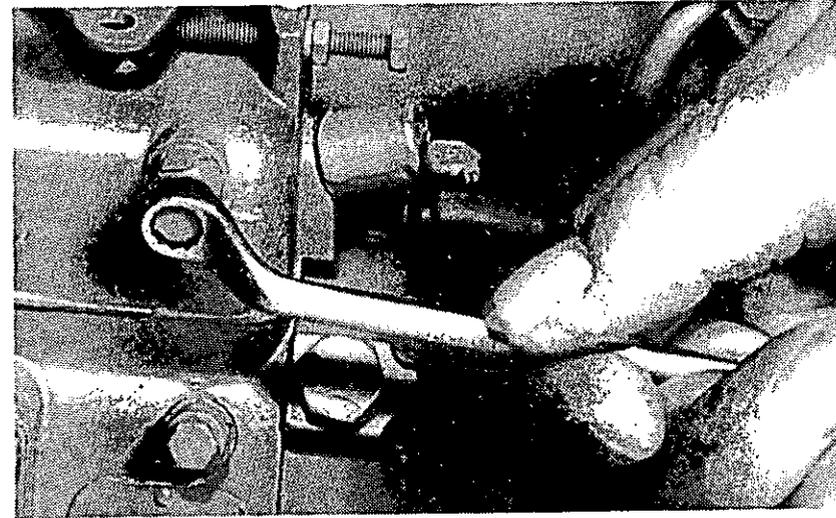


Fig. 12 Vent screw on mechanical governor

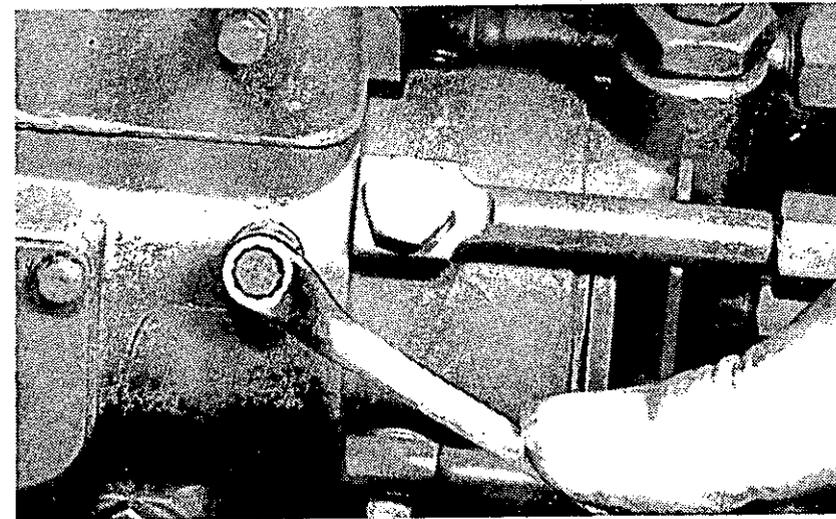


Fig. 13 Vent screw on hydraulic head

4 Loosen the vent screw on the fuel injection pump hydraulic head locking screw on the side of the fuel injection pump (see fig. 13).

5 Operate the priming lever on the fuel lift pump (see fig. 14) until fuel, free of air, comes from all vents.

6 Continue to operate the priming lever and close the vents in the order given below:

- Head locking screw on the fuel injection pump (see fig. 13).
- Governor housing vent screw (see fig. 12).

7 If the fuel pipe to the Thermostart cold starting aid has been drained, loosen the union nut at the starting aid and operate the priming lever until fuel, free from air, comes from the connection. Tighten the union nut at the Thermostart.

8 Loosen the high pressure pipe connections at two of the atomisers.

9 Ensure that the stop control, if fitted, is in the 'run' position. If an electrical stop solenoid is fitted, turn the start key to the 'R' position. Operate the starter motor until fuel, free from air, comes from the pipe connections.

10 Tighten the high pressure pipe connections.

11 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 suction or low pressure system.



Fig. 14 Priming lever on fuel lift pump

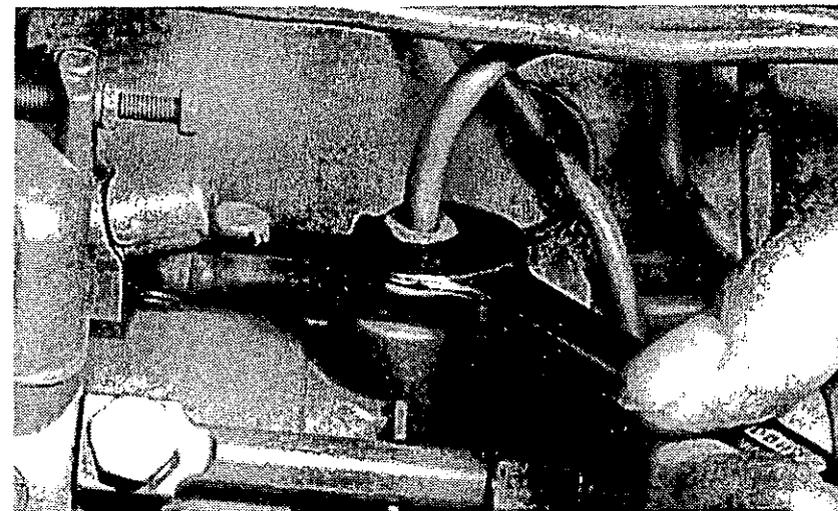


Fig. 15 Inlet pipe connection at fuel injection pump

Atomiser fault

An atomiser fault can be shown by an engine misfire.

To find which atomiser is at fault, run the engine at a fast idle speed and loosen and tighten the high pressure fuel pipe union at each atomiser. When the union nut of the atomiser at fault is loosened, it will have little or no effect on the engine speed. Do not let the fuel spray on to your skin.

To renew an atomiser

- 1 Remove the fuel leak off pipe.
- 2 Remove the high pressure pipe union nuts from the atomiser and fuel injection pump and release the pipe. Do not bend the pipe. Where necessary, remove the pipe clamp(s).
- 3 Remove the atomiser flange nuts and remove the atomiser and seat washer. Remove the dust seal and, if suitable for use, fit it to the new atomiser.
- 4 Put the new atomiser in position complete with a dust seal and a new seat washer. Ensure the atomiser is not tilted and tighten the flange nuts evenly by small amounts to 16 Nm (12 lbf ft) 1,7 kgf m.
- 5 Fit the high pressure fuel pipe and tighten the nut to 20 Nm (15 lbf ft) 2,1 kgf m. Where necessary, tighten the pipe clamps.
- 6 Fit the leak off pipe.
- 7 Run the engine and check for fuel and air leakage.

To clean the gauze strainer in the lift pump

- 1 Remove the cover and joint (see fig. 16) from the top of the fuel lift pump and remove the gauze strainer.
- 2 Carefully wash any sediment from the lift pump.
- 3 Clean the gauze strainer, joint and cover.
- 4 Assemble the lift pump. Ensure that a good joint is made between the lift pump body and the cover because any leakage here will let air into the fuel system.

Closed circuit breather vent valve

This is fitted between the cylinder head cover and induction manifold on 4.2032 engine only.

To clean, seal the small breather hole in the top face and wash the unit in gasoline or kerosene. If air pressure is used to dry the unit, use low pressure, because high pressure will cause damage to the unit.

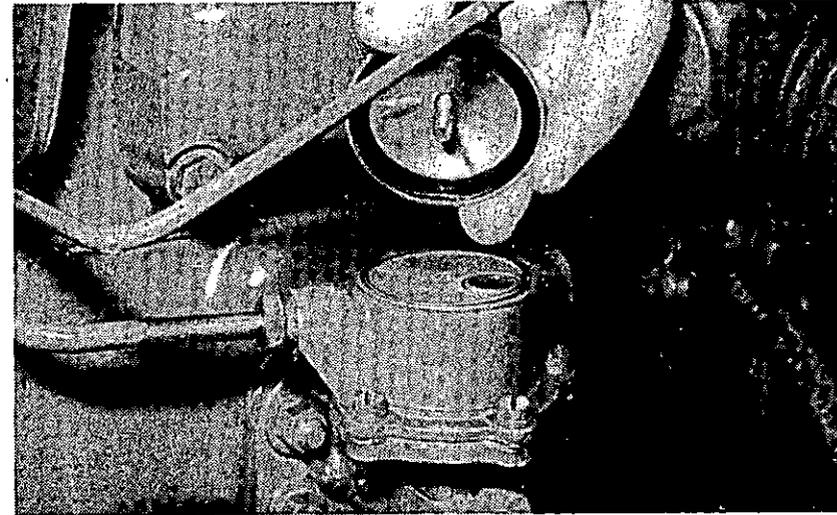


Fig. 16 Fuel lift pump cover removal

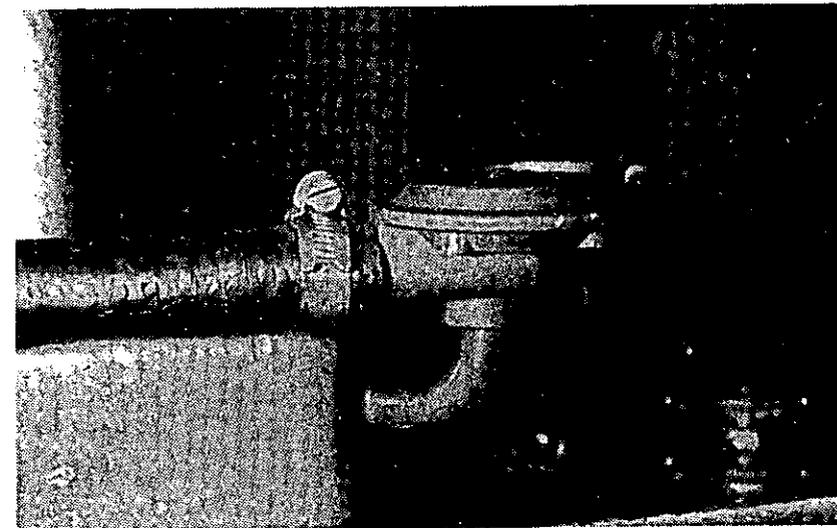


Fig. 17 Breather vent valve (4.2032)

Protection of an engine not in service

The recommendations given below are to ensure that damage is prevented when an engine is removed from service for an extended period. Use these procedures immediately the engine is removed from service. The instructions for the use of POWERPART products are given on the outside of each container.

- 1 Thoroughly clean the outside of the engine.
- 2 Where a preservative fuel is to be used, drain the fuel system and fill 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 kept charged with normal fuel but this will have to be drained and discarded at the end of the storage period together with the fuel filter.
- 3 Run the engine until it is warm. Correct any fuel, lubricating oil or air leakage. Stop the engine and drain the lubricating oil sump.
- 4 Renew the lubricating oil filter canister.
- 5 Fill the sump to the full mark on the dipstick with clean new lubricating oil or with a correct preservative fluid. POWERPART Lay-Up 2 can be added to the lubricating oil to give protection against corrosion during the period in storage. If a preservative fluid is used, this must be drained and normal lubricating oil used when the engine is returned to service.
- 6 Drain the cooling system, see page 17. To give protection against corrosion, it is better to fill the cooling system with a coolant that has a corrosion inhibitor, see 'Engine coolant' on page 16. If frost protection is needed, use an antifreeze mixture. If no frost protection is needed, use water with an approved corrosion inhibitor mixture.
- 7 Run the engine for a short period to send the lubricating oil and coolant around the engine.
- 8 Clean out the engine breather pipe and seal the end of the pipe.
- 9 Remove the atomisers and spray POWERPART Lay-Up 2 into each cylinder bore. If this is not available, clean engine lubricating oil will give a degree of protection. Spray into the cylinder bores 140 ml (¼ pint) of lubricating oil divided evenly between the four cylinders.
- 10 Slowly turn the crankshaft one revolution and then install the atomisers complete with new seat washers.
- 11 Remove the air filter and any pipe installed between the air filter and induction manifold. Spray POWERPART Lay-Up 2 into the induction manifold. Seal the manifold with waterproof tape.
- 12 Remove the exhaust pipe. Spray POWER Lay-Up 2 into the exhaust manifold. Seal the manifold with waterproof tape.

13 Remove the cylinder head cover. Spray POWERPART Lay-Up 2 around the rocker shaft assembly. Fit the cylinder head cover.

14 Disconnect the battery and put it into safe storage in a fully charged condition. Before the battery is put into storage, give the battery terminals a protection against corrosion. POWERPART Lay-Up 3 can be used on the terminals.

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

16 Remove the drive belt and put it into storage.

17 To prevent corrosion, spray the engine with POWERPART Lay-Up 3. Do not spray inside the alternator cooling fan area.

Note: Before the engine is started after a period in storage, operate the starter motor with the engine stop control in the 'off' position until oil pressure shows on the oil pressure gauge or the oil warning light goes out. If a solenoid stop control is used, this will have to be disconnected for this operation.

If the engine protection is done correctly according to the above recommendations, no corrosion damage will normally occur. Perkins Engines Ltd. are not responsible for any damage that occurs in relation to a service storage period.

Fault diagnosis

Problem	Possible causes
Starter motor turns engine too slowly	1, 2, 3, 4
Will not start	5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 22, 31, 32, 33
Difficult to start	5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 22, 24, 29, 31, 32, 33
Not enough power	8, 9, 10, 11, 12, 13, 14, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 31, 32, 33
Misfire	8, 9, 10, 12, 13, 14, 16, 18, 19, 20, 25, 26, 28, 29, 30, 32
High fuel consumption	11, 13, 14, 16, 18, 19, 20, 22, 23, 24, 25, 27, 28, 29, 31, 32, 33
Black exhaust	11, 13, 14, 16, 18, 19, 20, 22, 24, 25, 27, 28, 29, 31, 32, 33
Blue/white exhaust	4, 16, 18, 19, 20, 25, 27, 31, 33, 34, 35, 45, 56
Low lubricating oil pressure	4, 36, 37, 38, 39, 40, 42, 43, 44, 58
Engine knocks	9, 14, 16, 18, 19, 22, 26, 28, 29, 31, 33, 35, 36, 45, 46, 59
Runs erratically	7, 8, 9, 10, 11, 12, 13, 14, 16, 20, 21, 23, 26, 28, 29, 30, 33, 35, 45, 59
Vibration	13, 14, 20, 23, 25, 26, 29, 30, 33, 45, 47, 48, 49
High lubricating oil pressure	4, 38, 41
Engine temperature too high	11, 13, 14, 16, 18, 19, 24, 25, 45, 47, 50, 51, 52, 53, 54, 57
Crankcase pressure	25, 31, 33, 34, 45, 55
Bad compression	11, 19, 25, 28, 29, 31, 32, 33, 34, 46, 59
Starts and stops	10, 11, 12

Code list of possible causes

- 1 Battery capacity low.
- 2 Bad electrical connections.
- 3 Fault in starter motor.
- 4 Wrong grade of lubricating oil.
- 5 Low engine speed from starter motor.
- 6 Fuel tank empty.
- 7 Stop control fault.
- 8 Restriction in fuel pipe.
- 9 Fault in fuel lift pump.
- 10 Dirty fuel filter element.
- 11 Restriction in air filter or induction system.
- 12 Air in fuel system.
- 13 Fault in fuel injection pump.
- 14 Fault in atomisers or not correct type.
- 15 Cold start equipment not used correctly.
- 16 Fault in cold start equipment.
- 17 Broken fuel injection pump drive.
- 18 Fuel injection pump timing not correct.
- 19 Valve timing not correct.
- 20 Bad compression.
- 21 Restriction in fuel tank vent.
- 22 Type or grade of fuel not correct.
- 23 Restriction of engine speed control movement.
- 24 Restriction in exhaust pipe.
- 25 Cylinder head gasket leaks.
- 26 Engine temperature too high.
- 27 Engine temperature too low.
- 28 Tappet clearances not correct.
- 29 Valves not free.
- 30 Wrong high pressure pipes.
- 31 Worn cylinder bores.
- 32 Valves and seats do not seal correctly.
- 33 Piston rings not free or are worn or broken.
- 34 Valve stems and/or guides worn.
- 35 Wet type air cleaner too full or wrong oil used.
- 36 Crankshaft bearings wear or damage.
- 37 Not enough lubricating oil in the sump.
- 38 Gauge not correct.
- 39 Lubricating oil pump worn.
- 40 Relief valve not free to close.
- 41 Relief valve not free to open.
- 42 Relief valve spring broken.
- 43 Fault in suction pipe of lubricating oil pump.
- 44 Dirty lubricating oil filter element.
- 45 Piston damage.
- 46 Piston height not correct.
- 47 Fan damage.
- 48 Fault in engine mounting (housing).
- 49 Flywheel housing or flywheel not aligned correctly.
- 50 Fault in thermostat or wrong type.
- 51 Restriction in coolant passages.
- 52 Water pump drive belt loose.
- 53 Restriction in radiator.
- 54 Fault in water pump.
- 55 Restriction in breather pipe.
- 56 Damage to valve stem oil seals (where used).
- 57 Not enough coolant in system.
- 58 Restriction in sump strainer.
- 59 Valve spring broken.

POWERPART consumable products

Perkins have made available the products indicated 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.

POWERPART Antifreeze

Protects the cooling system against frost and corrosion. See page 16.

POWERPART De-Icer

Removes frost.

POWERPART Easy Flush

Cleans the cooling system.

POWERPART Easy Seal

Stops leakages from the cooling system.

POWERPART Foam Action Gasket Remover

Allows easy and rapid removal of old gaskets and joints.

POWERPART Hylomar

Universal jointing compound which seals joints.

POWERPART Hylosil

Silicone rubber sealant which prevents leakage through gaps.

POWERPART Inhibitor

Protects cooling system against corrosion when anti-freeze is not used.

POWERPART Lay-Up 1

A diesel fuel additive for protection against corrosion. See page 30.

POWERPART Lay-Up 2

Protects the inside of the engine and of other closed systems. See page 30.

POWERPART Lay-Up 3

Protects outside metal parts. See page 31.

POWERPART Moisture Dispersant and Rust Penetrant

Dries damp equipment and gives protection against corrosion. Passes through dirt and corrosion to lubricate and to assist removal of components.

POWERPART Retaining Compound

Retains components which have a transition fit or an interference fit, for example, pulleys, bushes etc.

POWERPART Studlock

Secures threaded fasteners. Recommended for fasteners which, normally, are not removed.

POWERPART Threadseal

Seals threads and pipe connections. Low pressure systems can be used immediately.

Examples of service assistance

Service

If any problems occur with your engine or the components fitted to it, your Perkins distributor can make the necessary repairs and will ensure that only the correct parts are fitted and that the work is done correctly.

Certain components can be supplied by your Perkins distributor through the Perkins Power Exchange system. These will enable you to reduce the cost of some repairs.

Extended warranty

The engine warranty period can be extended to two years. For details get in contact with your nearest Perkins distributor.

Service literature

Workshop manuals and other service publications are available from your Perkins distributor at a nominal cost.

Training

Local training on correct engine operation, overhaul and service is available at some Perkins distributors. If special training is needed, your Perkins distributor can give details on how to get this at the Product Education Department, Peterborough, or other main centres.

Parts illustrations

The illustrations which follow are a guide for your assistance in the purchase of Perkins service parts. A list of the reference numbers and part descriptions is given on pages 47 and 48.

There can be differences in the shape of similar components in different engine applications.

Many years of experience and development have ensured that Perkins parts are of the highest quality and standard. Use correct Perkins parts which are available from all Perkins distributors.

To ensure you get the correct parts when you order, give the complete engine number, the machine or vehicle description, name and serial number.

Note: Perkins can not supply an operator directly. To purchase the correct Perkins parts, give a correct order to your Perkins distributor.

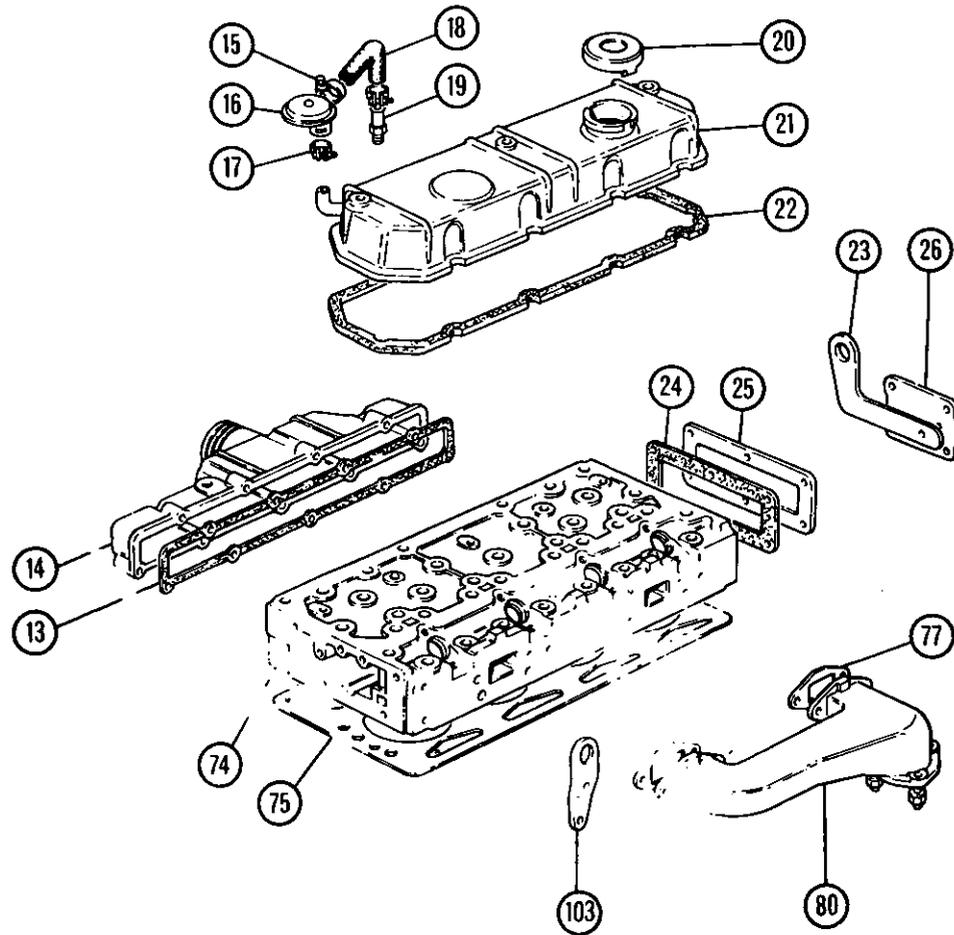


Fig. 18 Cylinder head arrangement

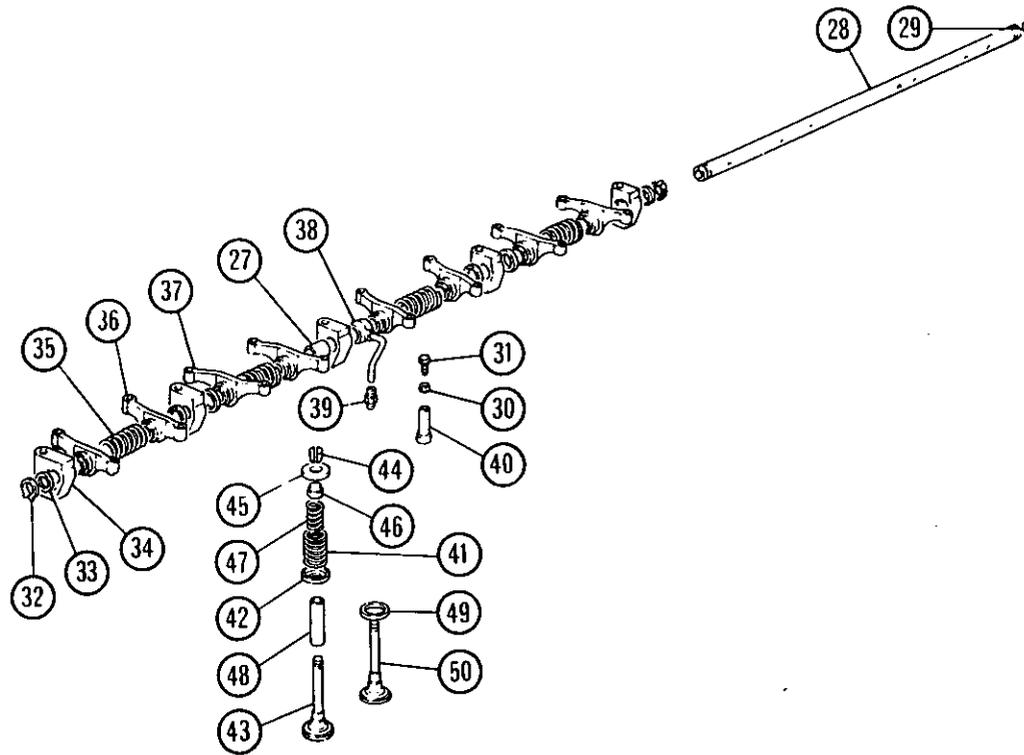


Fig. 19 Valves and rocker assembly

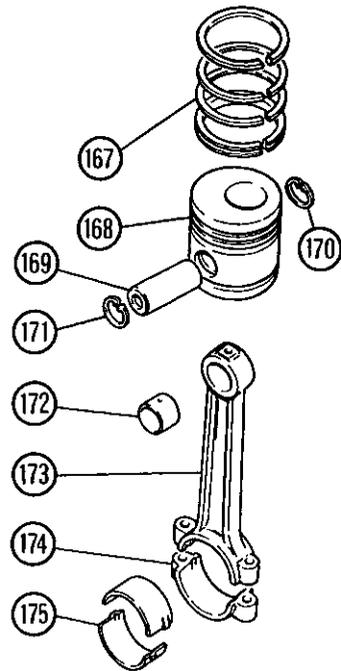


Fig. 20 Piston and connecting rod

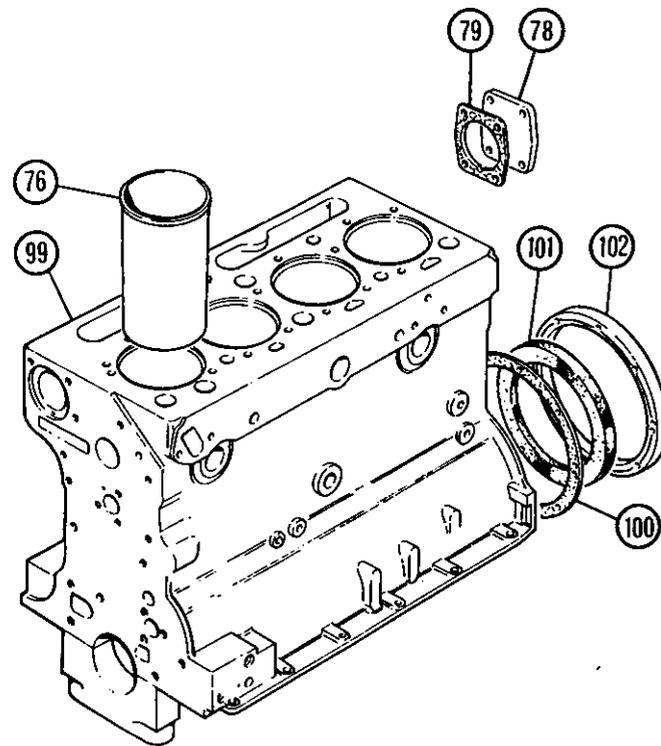


Fig. 21 Cylinder block assembly

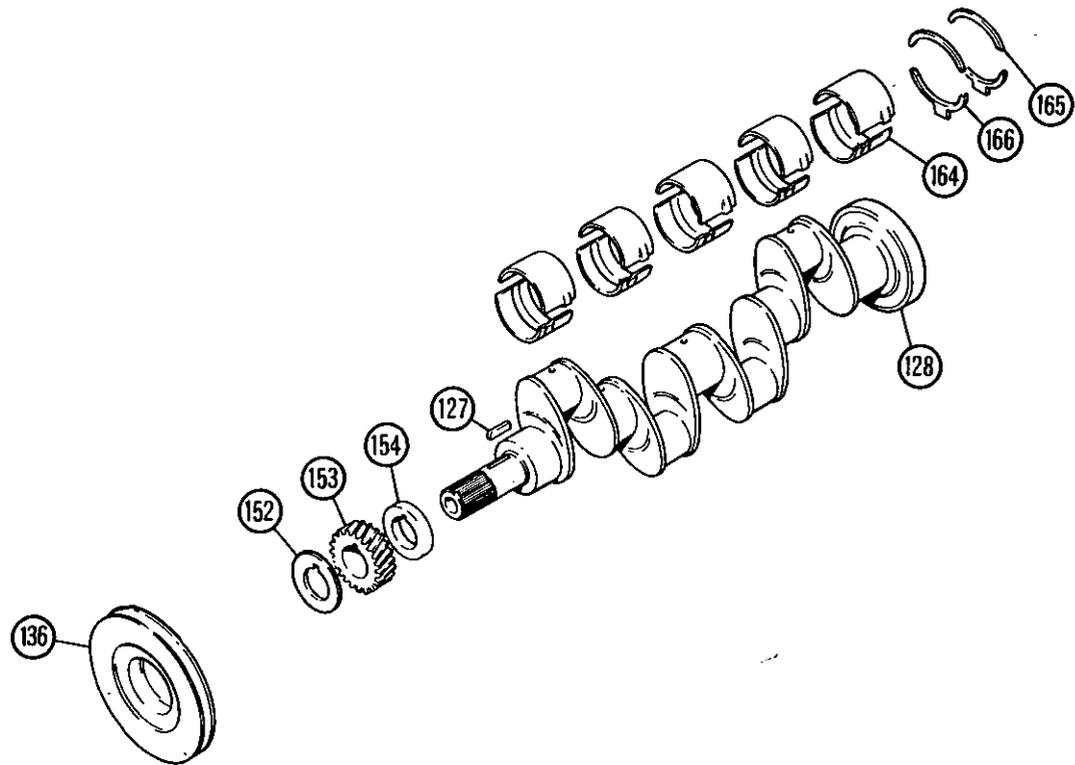


Fig. 22 Crankshaft assembly and pulley

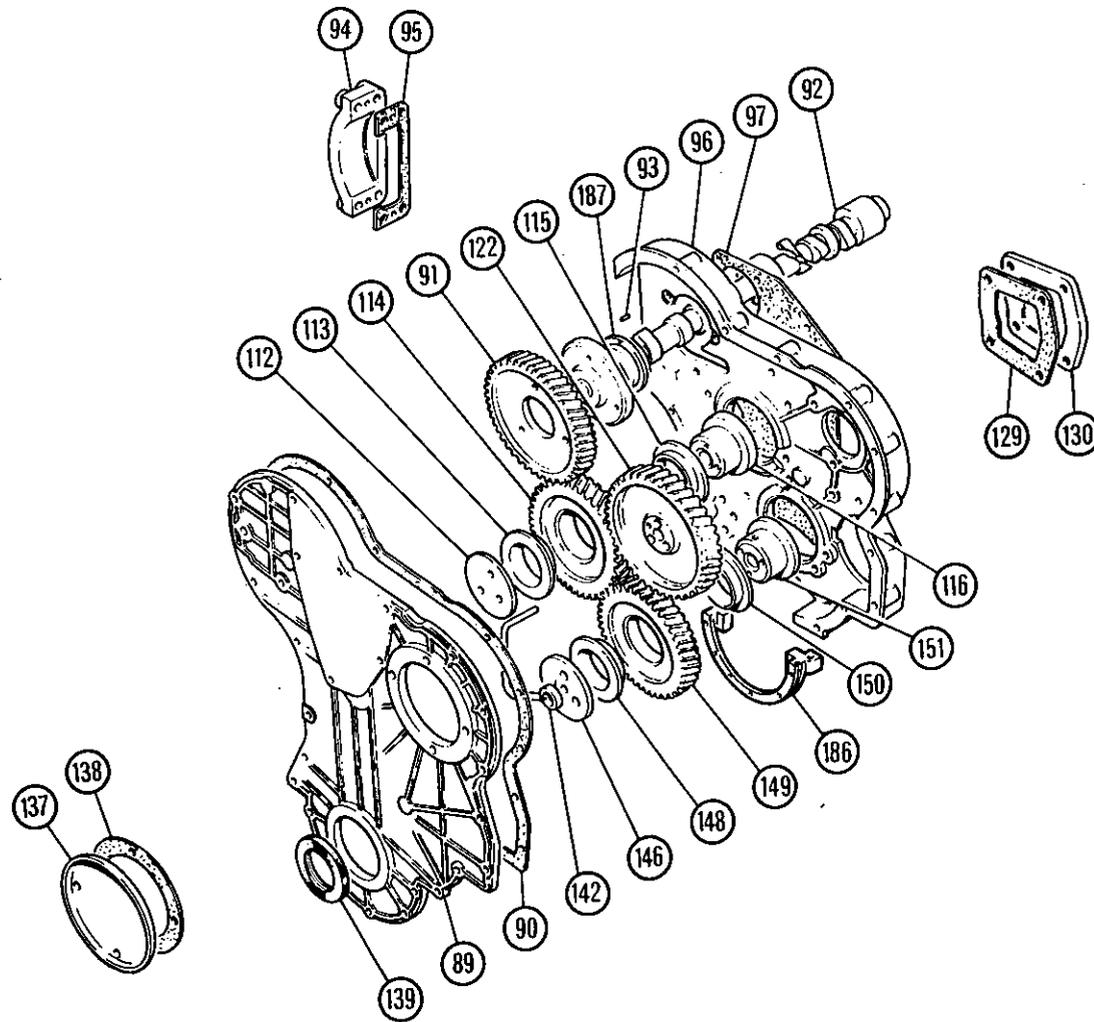


Fig. 23 Timing case and drive arrangement

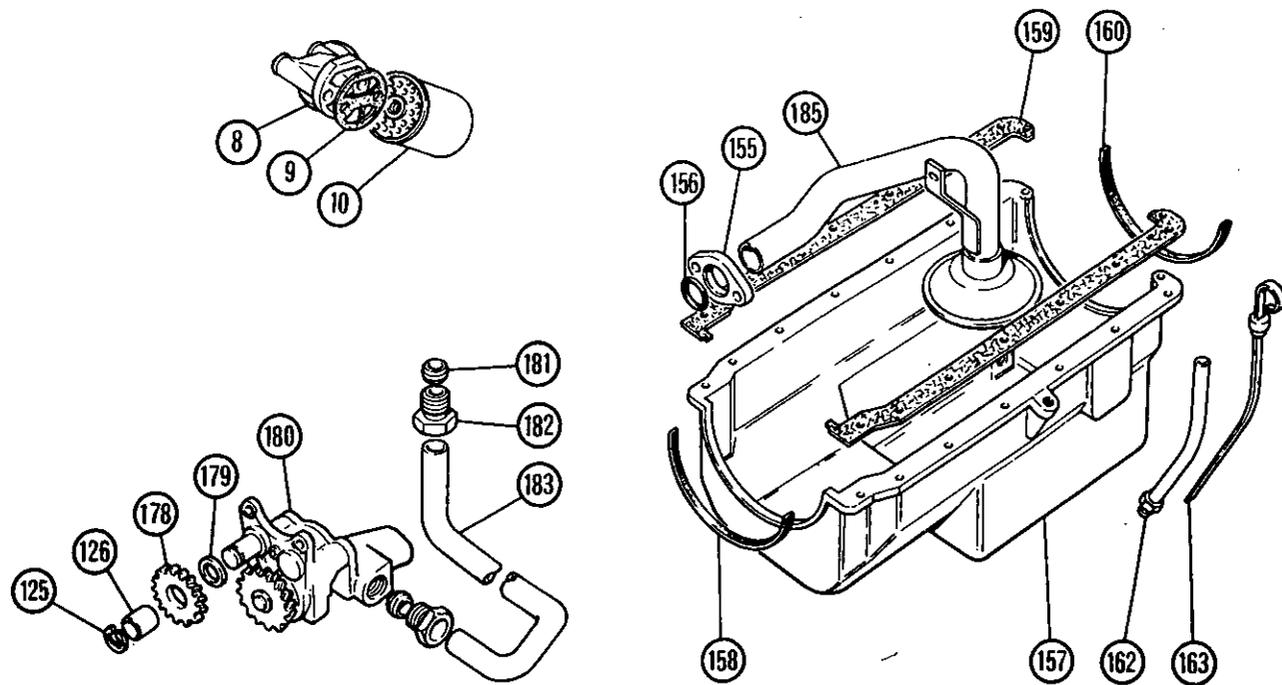


Fig. 24 Lubrication system components

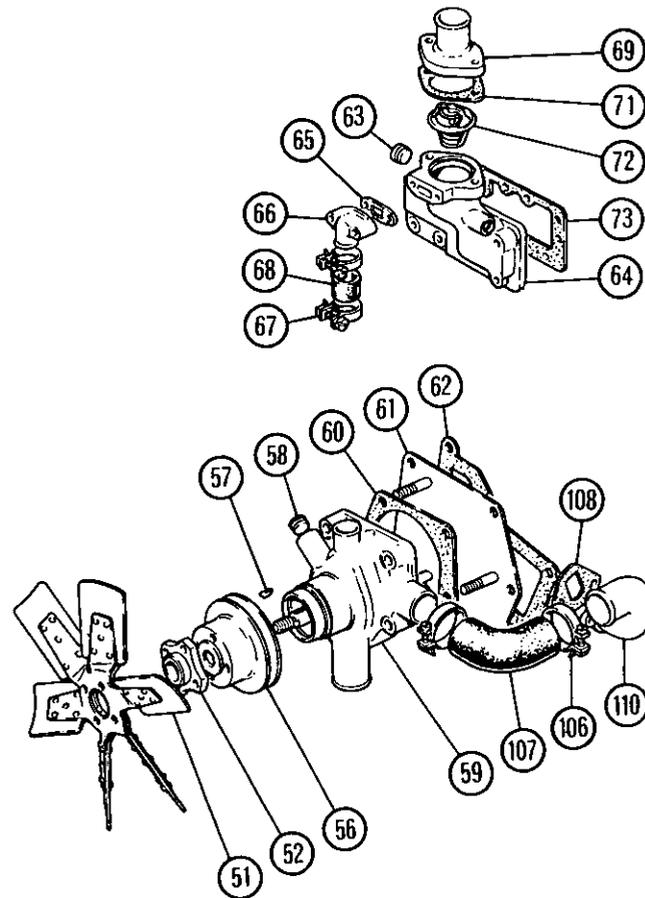


Fig. 25 Cooling system components

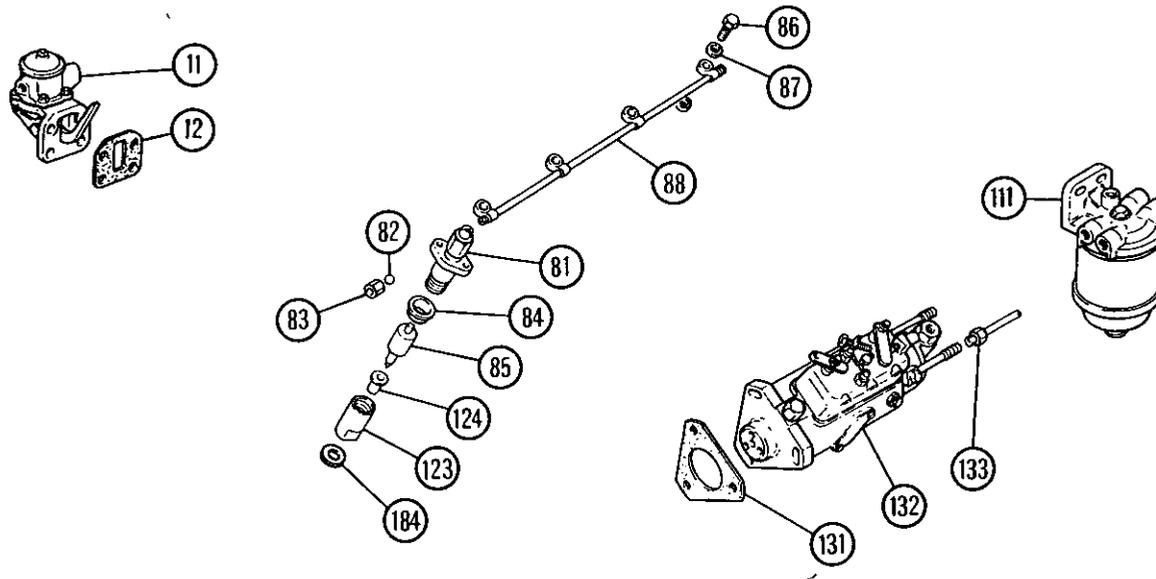


Fig. 26 Fuel system components

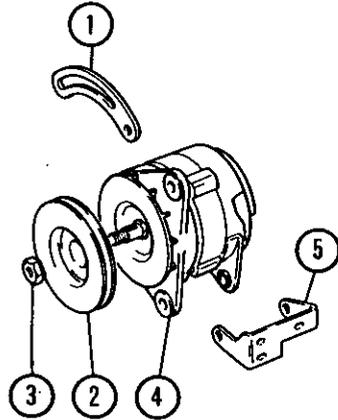


Fig. 27 Alternator and brackets

Part descriptions

To be used with the illustrations given on pages 37 to 46.

1 Adjustment link	28 Rocker shaft	57 Key	89 Cover
2 Pulley	29 Plug	58 Plug	90 Joint
3 Nut	30 Lock nut	59 Water pump	91 Camshaft gear
4 Alternator	31 Adjusting screw	60 Joint	92 Camshaft
5 Bracket	32 Circlip	61 Back plate	93 Dowel
8 Adaptor	33 Washer	62 Joint	94 Cover
9 Joint	34 Bracket	63 Plug	95 Joint
10 Lubricating oil filter canister	35 Spring	64 Housing	96 Timing case
11 Fuel lift pump	36 Rocker lever	65 Joint	97 Joint
12 Joint	37 Rocker lever	66 Elbow	99 Cylinder block
13 Joint	38 Oil feed banjo	67 Clip	100 Joint
14 Induction manifold	39 Connector	68 Hose	101 Seal
15 Clip	40 Tappet	69 Water outlet	102 Housing
16 Breather	41 Outer valve spring	71 Joint	103 Lifting eye
17 Clip	42 Spring seat	72 Thermostat	106 Clip
18 Pipe	43 Inlet valve	73 Joint	107 Elbow
19 Connector	44 Collets	74 Cylinder Head	108 Joint
20 Lubricating oil filler cap	45 Valve cap	75 Gasket	110 Outlet
21 Rocker cover	46 Seal	76 Liner	111 Fuel filter
22 Joint	47 Inner valve spring	77 Joint	112 Plate
23 Lifting eye	48 Valve guide	78 Plate	113 Bush
24 Joint	49 Valve seat insert	79 Joint	114 Idler gear
25 Plate	50 Valve exhaust	80 Exhaust manifold	115 Bush
26 Plate	51 Fan	81 Injector body	116 Hub
27 Bush	52 Spacer	82 Ball	122 Fuel injection pump gear
	56 Pulley	83 Union nut	123 Nozzle cap nut
		84 Seal	124 Heat shield
		85 Nozzle	125 Circlip
		86 Union bolt	126 Bush
		87 Washer	127 Key
		88 Leak-off pipe	128 Crankshaft

129 Joint	149 Idler gear	162 Dipstick tube	174 Connecting rod cap
130 Plate	150 Bush	163 Dipstick	175 Big end bearing
131 Joint	151 Hub	164 Main bearings	178 Idler gear
132 Fuel injection pump	152 Spacer or oil thrower	165 Top thrust washer	179 Spacer
133 Pipe	153 Crankshaft gear	166 Bottom thrust washer	180 Lubricating oil pump
136 Pulley	154 Spacer	167 Piston rings	181 Olive
137 Plate	155 Flange	168 Piston	182 Union
138 Joint	156 Seal	169 Gudgeon pin	183 Pipe
139 Seal	157 Sump	170 Circlip	184 Washer
142 Oil sprayer	158 Joint	171 Circlip	185 Suction pipe and strainer
146 Plate	159 Joint	172 Small end bush	186 Bridge piece
148 Bush	160 Joint	173 Connecting rod	187 Camshaft thrust washer

Latest information

Introduction

The purpose of this page is to enable important information to be added to this handbook after publication.

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.

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