



# User's Handbook

*200 Series*



Models 4.135, 4.154, 4.182, 204-25 & 204-30

TPD1171

# HANDBOOK FOR 200 SERIES DIESEL ENGINES

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## CONTENTS

Introduction .....	3
Safety Precautions .....	4
Engine Identification .....	5
Engine Views .....	6
Engine Data .....	9
Operating Instructions .....	10
Lubricating Oil Recommendations .....	12
Fuel Recommendations .....	12
Engine Coolant .....	13
Preventive Maintenance .....	15
Post-Delivery Service .....	16
Instructions for Maintenance .....	17
Protection of an Engine not in Service .....	26
Fault Diagnosis .....	28
POWERPART Consumable Products .....	30
Latest Information .....	31

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

## 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, 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 2.

The left and right hand side 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.

*This publication is written in  
Perkins Approved Clear English*

**PACE**

# 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 vehicle operation.

Do not permit loose clothing or long hair near parts that move.

Keep away from parts which turn during operation. Note that fans can not 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 while 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, seek 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 genuine Perkins Parts.

## ENGINE IDENTIFICATION

There are five engine types in the 200 Series. These are the 4.135, 4.154 and 4.182 engines and the latest 204-25 and 204-30 engines.

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

GA — 4.154 engine	GD — 204-25
GB — 4.135 engine	GE — 204-30
GC — 4.182 engine	

The engine number is stamped on a machined pad on the left side of the cylinder block above the fuel injection pump (see Fig. 1). A typical engine number is GBA12345J.

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

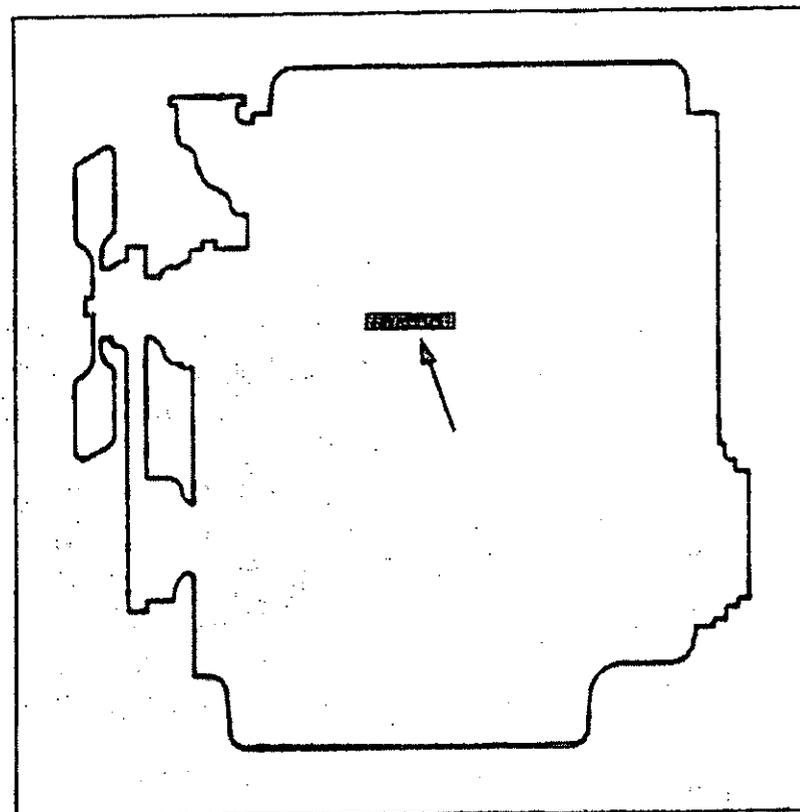
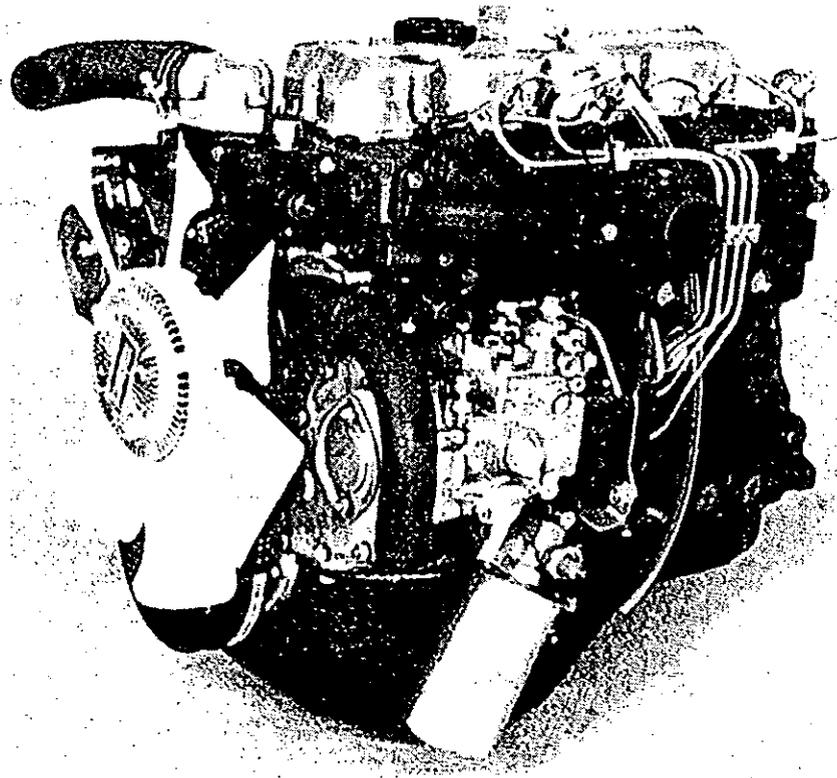
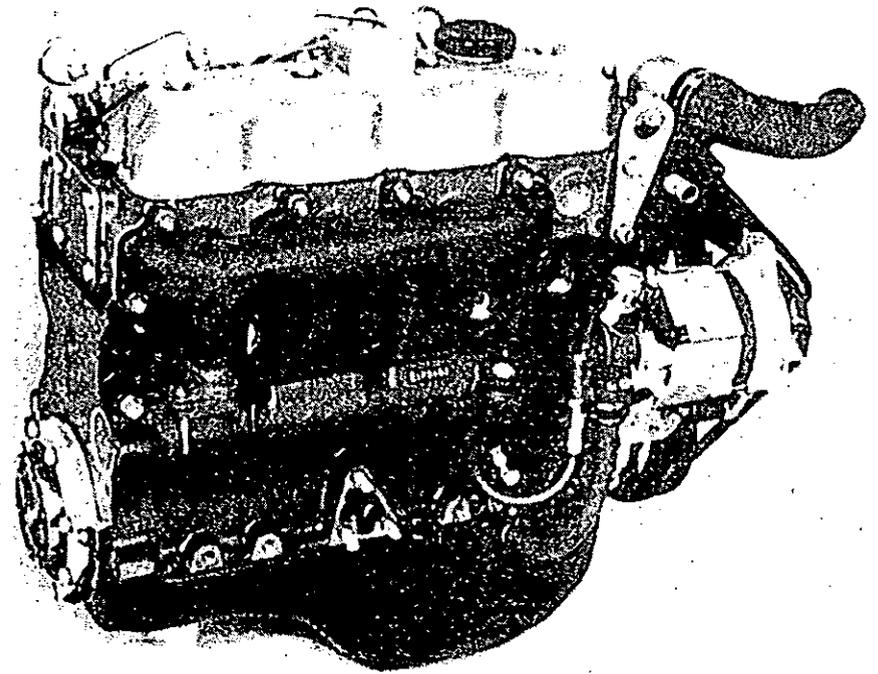


Fig. 1  
Engine Number Position.

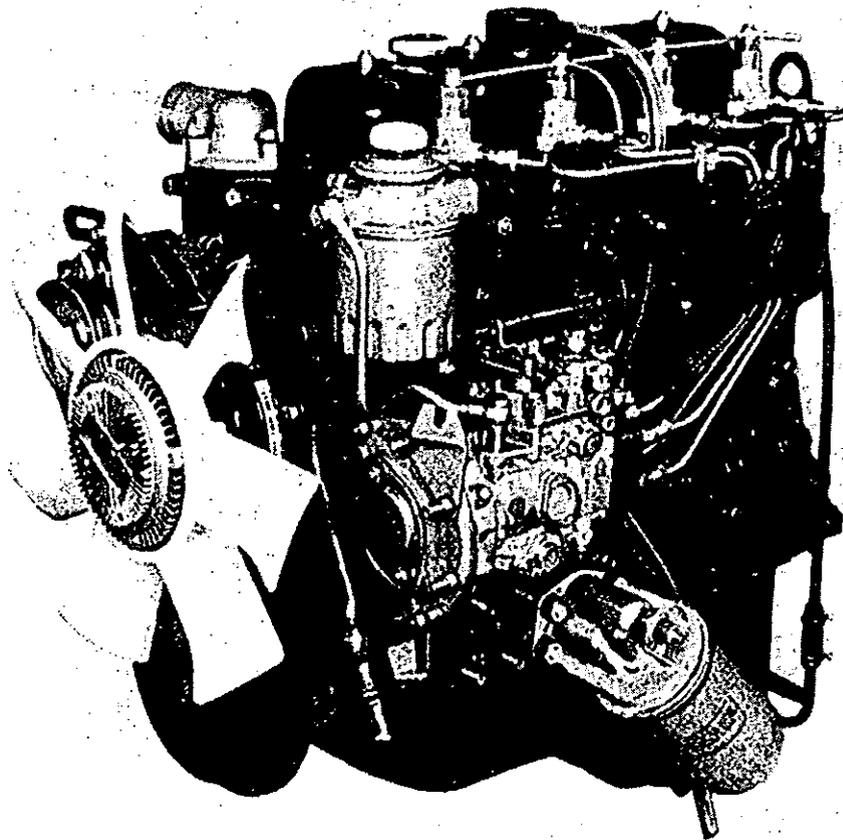
# ENGINE VIEWS



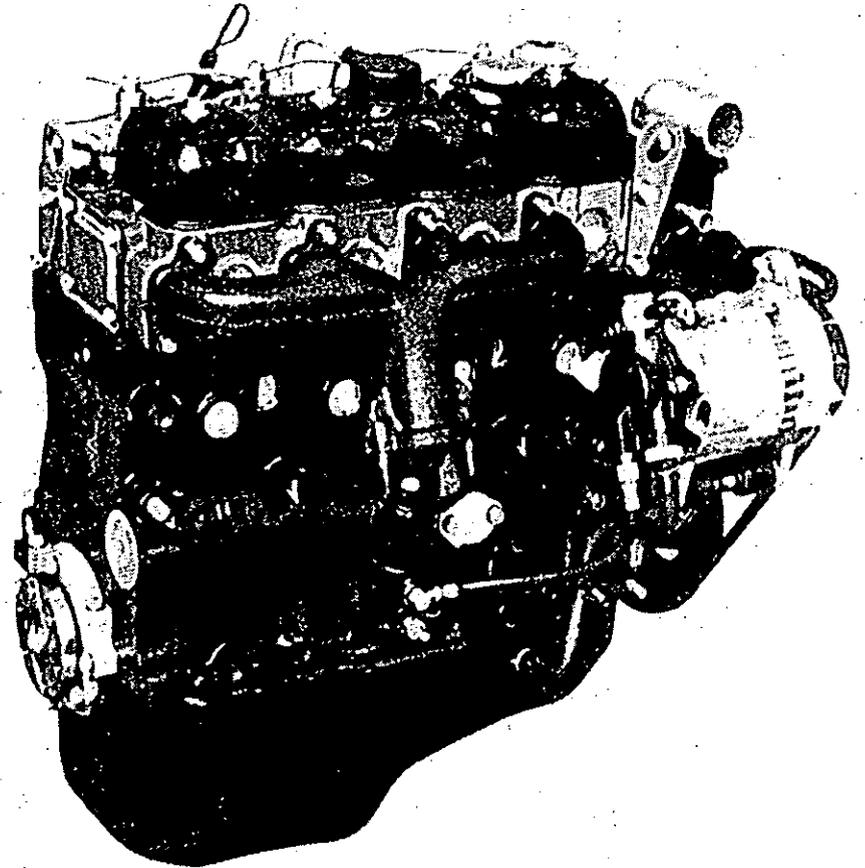
Front/Left Side of 4.135 Engine



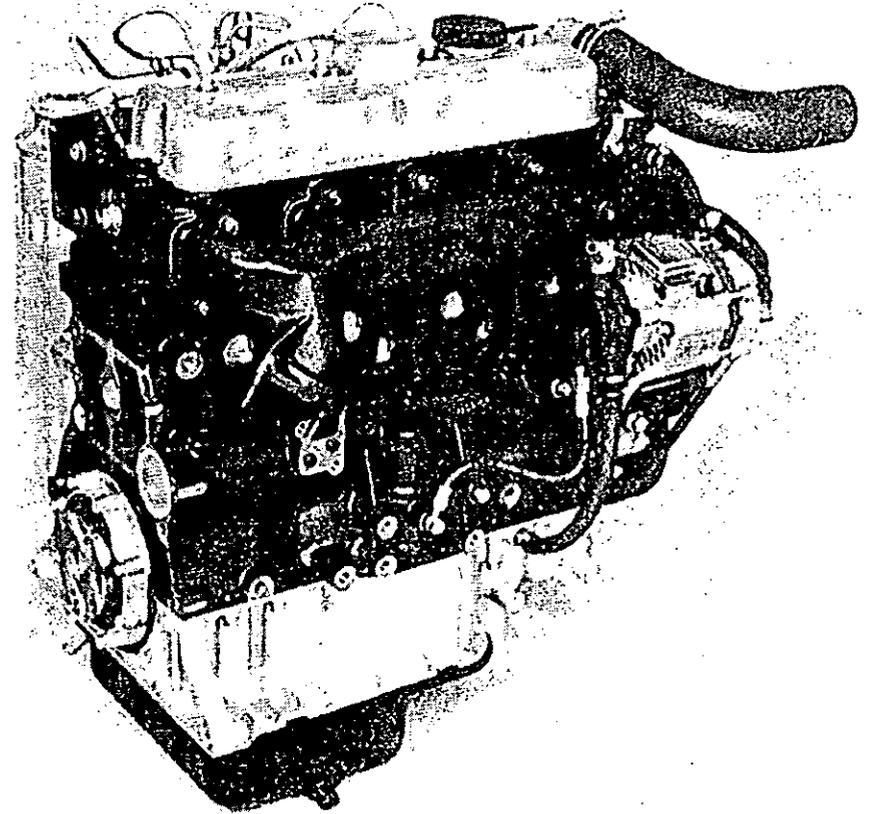
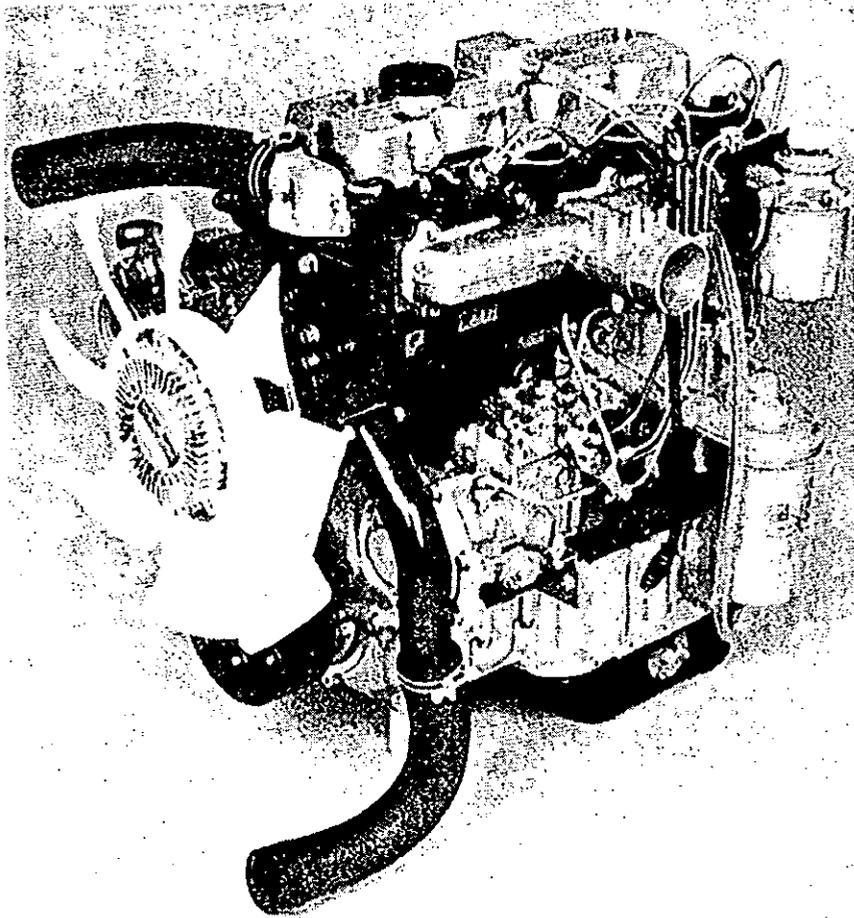
Rear/Right Side of 4.135 Engine



Front/Left Side of 4.154 Engine



Rear/Right Side of 4.154 Engine



Front/Left Side and Rear/Right Side of 4.182 Engine and 204-25/30 Engines

# ENGINE DATA

	4.135	4.154 204-25	4.182 204-30
No. of Cylinders	4	4	4
Cycle	Four Stroke	Four Stroke	Four Stroke
Combustion System	Indirect Injection	Indirect Injection	Indirect Injection
Nominal Bore	88,9 mm (3.5 in)	88,9 mm (3.5 in)	95,0 mm (3.74 in)
Stroke	88,9 mm (3.5 in)	101,6 mm (4.0 in)	105,0 mm (4.13 in)
Compression Ratio	21:1	21:1	21:1
Cubic Capacity	2,209 litres (134.8 in <sup>3</sup> )	2,523 litres (153.9 in <sup>3</sup> )	2,977 litres (181.7 in <sup>3</sup> )
Firing Order	1,3,4,2	1,3,4,2	1,3,4,2
Valve Tip Clearance (Cold)	0,30 mm (0.012 in)	0,30 mm (0.012 in)	0,30 mm (0.012 in)
Lubricating Oil Sump Capacity	5,0 litres (8.8 Imp. pints) 5,3 U.S. quarts	6,0 litres (10.6 Imp. pints) 6,3 U.S. quarts	6,0 litres (10.6 Imp. pints) 6,3 U.S. quarts
Lubricating Oil Pressure:	207 kN/m <sup>2</sup> (30 lbf/in <sup>2</sup> ) 2,1 kgf/cm <sup>2</sup> minimum at maximum engine speed and normal engine temperature.		
Direction of Rotation:	Clockwise from the front.		

# OPERATING INSTRUCTIONS

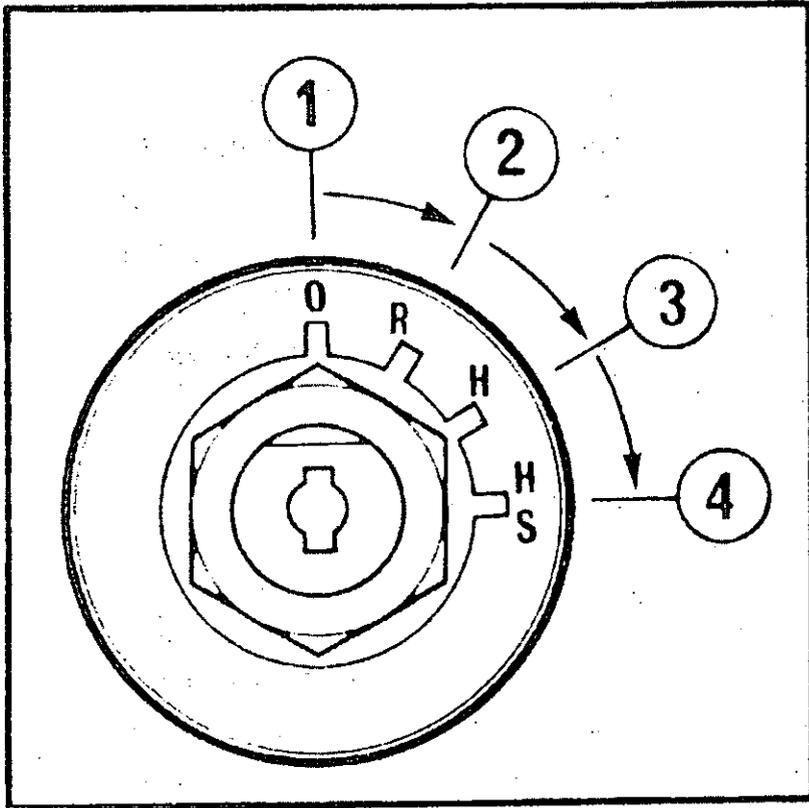


Fig. 2

- Heat/Start Switch.
1. Off Position.
  2. Run Position.
  3. Heat Position.
  4. Heat and Start Position.

## To Start the Engine

When the engine is cold:

1. Where a separate stop control is used, ensure that this is in the 'run' position.
2. Turn the start key to the 'heat' position (see Fig. 2) and hold it there for 15 seconds.
3. Adjust the engine speed control to the maximum speed position.
4. Turn the start key to the 'heat/start' position to engage the starter motor. As the engine starts, release the start key to the 'run' position and adjust the speed control to give a smooth idle speed. If the engine does not start in 15 seconds, return the start key to the 'heat' position for 10 seconds and then engage the starter motor again.

When the engine is warm:

1. Where a separate stop control is used, ensure that this is in the 'run' position.
2. Adjust the speed control to the idle speed position.
3. Turn the start key directly to the 'heat/start' position (see Fig. 2) to engage the starter motor.

4. As soon as the engine starts, release the start key to the 'run' position. If the engine does not start in 15 seconds, release the start key to the 'run' position. Do not engage the starter motor again until 5 to 10 seconds have passed.

**Note:** For 204-25 and 204-30 engines, an automatic 'quick start' glow plug control system is used.

### **To Stop the Engine**

Either turn the engine start key to the 'off' position (see Fig. 2) 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 'off' 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**

To get maximum performance and life from your new engine, operate the engine as shown below for the first 800km (500 miles) or 25 hours of operation.

Where possible, operate the engine at different speeds.

If your machine has a geared drive, use a lower gear when more power is needed.

Do not run the engine at high no load speeds.

Do not apply an overload to the engine.

### **Altitude**

If the engine is to operate at an altitude higher than 1500m (5,000ft), the fuel delivery can be changed to reduce exhaust smoke and fuel consumption. Perkins Engine 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.

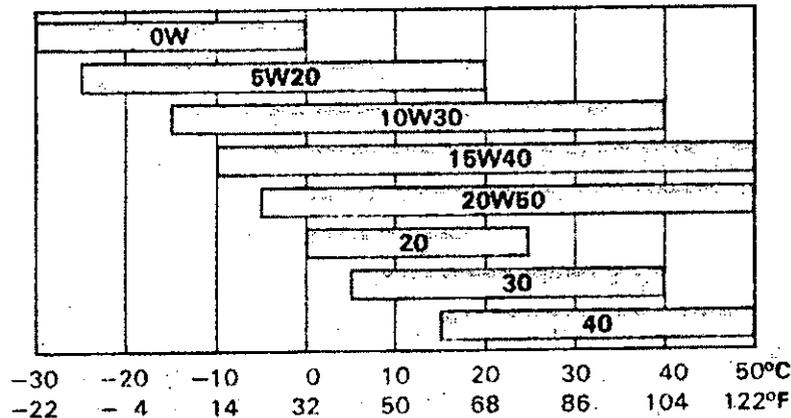
# LUBRICATING OIL RECOMMENDATIONS

The specification of the engine lubricating oil must be equal to API CC/SE.

Lubricating oils for use in Perkins diesel engines must have a minimum Viscosity Index of 80.

Always ensure that the correct viscosity grade of oil is used for the temperature range in which the engine will run as shown in the chart below.

## Recommended SAE viscosity grades



Ambient temperature

# FUEL RECOMMENDATIONS

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	50 minimum
Viscosity	2.5/4.5 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. 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, see the table below.

Fuel sulphur content, %	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.

## **ENGINE COOLANT**

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 be of assistance in the maintenance of a good cooling system with protection against frost and/or corrosion.

If the correct procedures are not used, Perkins Engines Ltd. can not be held responsible for frost or corrosion damage.

1. If it is possible, use clean soft water in the coolant mixture.
2. If an antifreeze mixture, other than Perkins POWERPART, is used to prevent frost damage, it must have an ethanediol (ethylene glycol) base with a corrosion inhibitor. It is recommended that the corrosion inhibitor is of the sodium nitrite/benzoate type. The antifreeze mixture

must provide cooling/corrosion protection at least as good as the requirements of the standard BS6580.

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 mixture must consist of equal quantities of antifreeze and water. Concentrations of more than 50% of antifreeze must not be used as this can affect 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 a protection against corrosion and also raises the boiling point of the coolant.

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

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

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

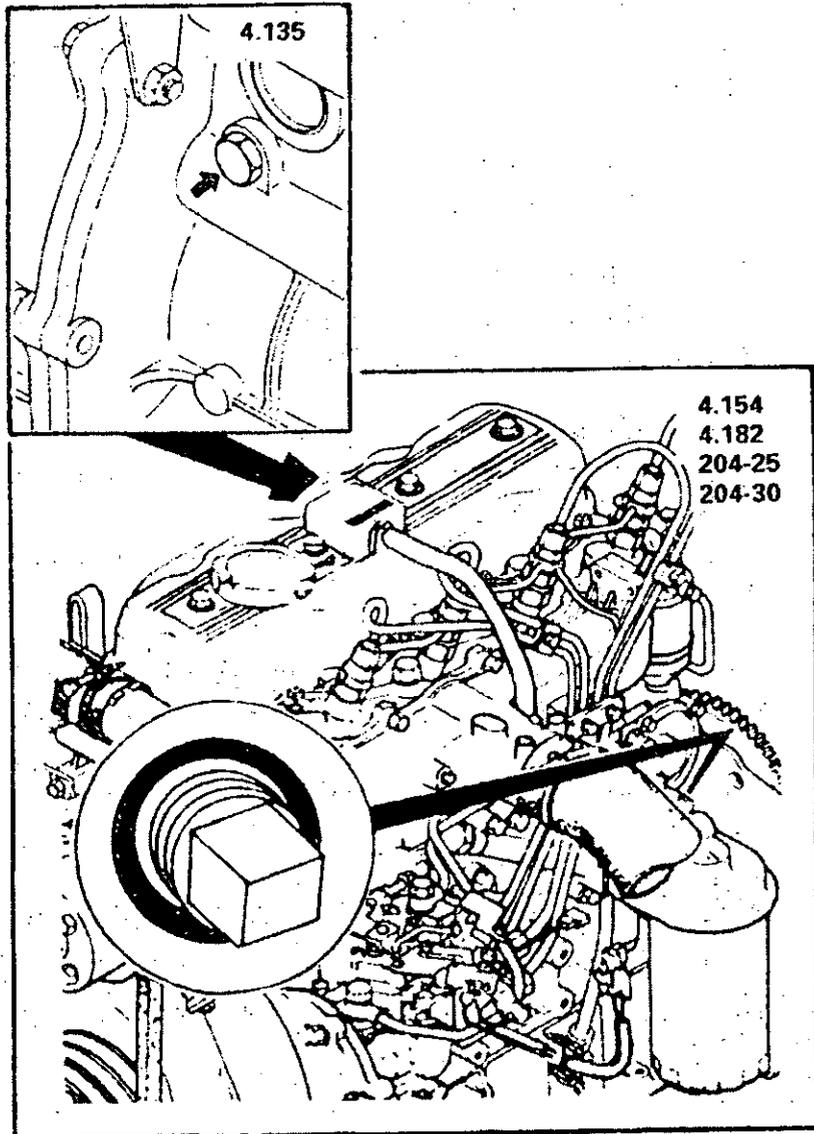


Fig. 3  
Coolant Drain Positions.

### To Drain the Cooling System

1. Ensure that the vehicle or machine is on level ground.
2. Remove the radiator filler cap.
3. Remove the drain plug from the side of the cylinder block (see Fig. 3) 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.

## 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 vehicle or machine regulations.

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.

### **Daily or Every 8 Hours (Use Interval that comes First)**

Check amount of coolant.

Check amount of lubricating oil in sump.

Check lubricating oil pressure (where gauge installed).

In extreme dust conditions, clean dust bowl of air filter (where fitted).

### **Every 5000km (3000 Miles), 150 Hours or 1 Month (Use Interval That Comes First)**

Change lubricating oil.

Change lubricating oil filter canister.

Inspect drive belt.

Clean dust bowl of air filter (where fitted).

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

### **Every 15000km (9000 Miles) or 450 Hours (Use Interval That Comes First)**

Adjust valve tip clearances.

Check atomisers

### **Every 20000km (12000 Miles) or 600 Hours (Use Interval That Comes First)**

Tighten induction and exhaust manifold nuts.

Change fuel filter canister.

Check ignition timing.

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

### **Every 100000km (60000 Miles) or 3000 Hours (Use Interval That Comes First)**

Have the accessory equipment (starter motor, alternator, exhaustor etc.) checked.

## POST-DELIVERY SERVICE

The service procedures given must be carried out at the first 1000km (600 miles) or 30 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 oil to an approved grade.
2. Renew the canister of the lubricating oil filter.
3. Tighten the cylinder head setscrews (see Page 17).
4. Adjust the valve tip clearances to 0,30mm (0.012in) with the engine cold.
5. Check that the induction and exhaust manifold nuts are tight.
6. Check the tension of the fan belt.
7. Check the atomisers.
8. Check that all fasteners are tight.
9. Run the engine and check for fuel, coolant and lubricating oil leakage.
10. Adjust the idle speed, if necessary.

# INSTRUCTIONS FOR MAINTENANCE

## To Check the Cylinder Head Setscrew Tension

Run the engine until the coolant outlet temperature is higher than 77°C (170°F).

Stop the engine and remove the rocker cover.

Check the tension of the cylinder head setscrews in the sequence given in Fig. 4. The correct torque tension is given below:

4.135 .....	115 Nm (85 lbf ft)	11,7 kgf m
4.154 .....	115 Nm (85 lbf ft)	11,7 kgf m
4.182, 204-25/30 .....	122 Nm (90 lbf ft)	12,4 kgf m

If a setscrew turns when checked, tighten it to the correct tension.

If a setscrew does not turn when checked, loosen it by 30° to 60° and then tighten it to the correct torque tension.

After all the setscrews have been checked, check the first 10 positions again to ensure that they are still to the correct tension. During this last check, do not loosen the setscrews.

Check the valve tip clearances, see Page 21 and adjust as necessary.

Install the rocker cover.

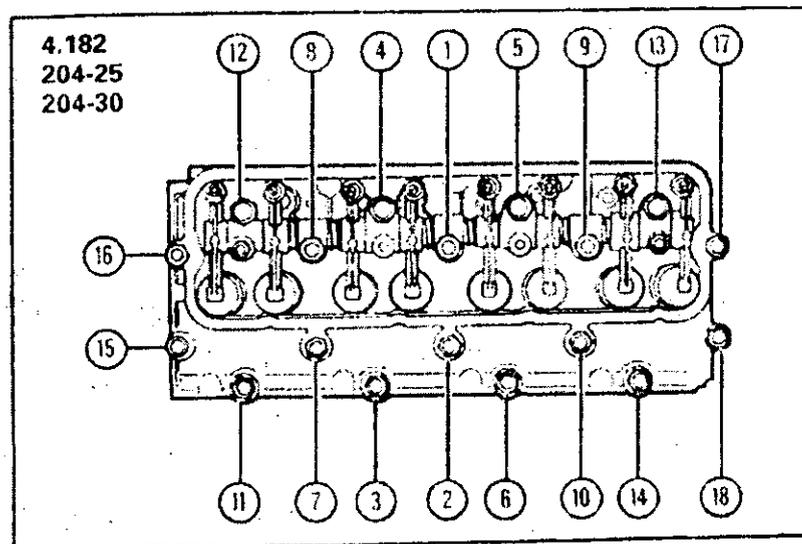
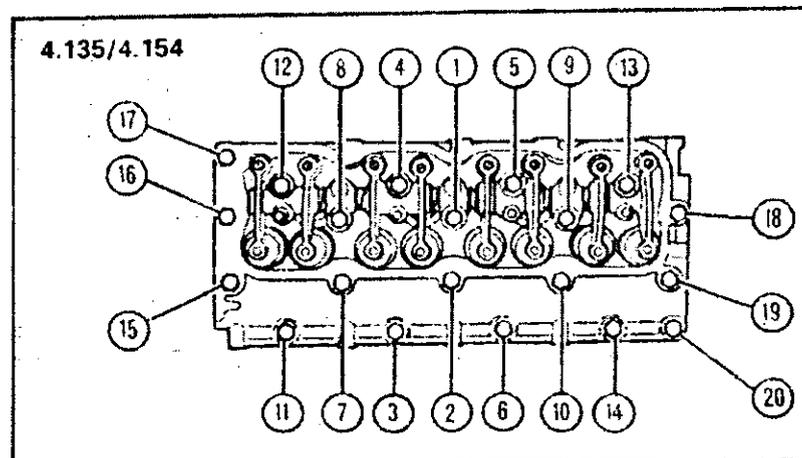


Fig. 4  
Sequence To Tighten Cylinder Head Setscrews.

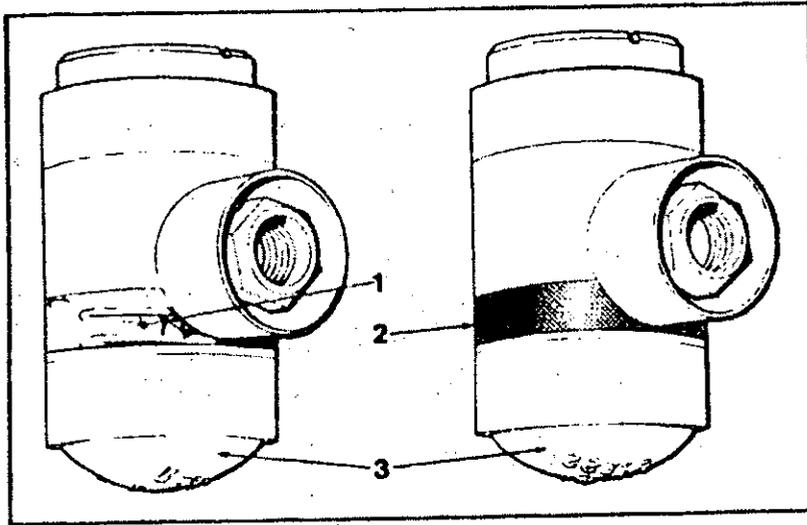


Fig. 5

**Restriction Indicator.**

1. Clear Panel (No Restriction).
2. Red Panel (Element Needs Service).
3. Press To Reset Red Panel.

**Air Filter**

Environment conditions have an important effect on the frequency at which the 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 be 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.

**Restriction Indicator**

The restriction indicator for these engines must be the type that operates at a pressure difference of 460mm (18in) water gauge. It is installed on the air filter outlet or between the air filter and the induction manifold.

When the red warning indicator is seen through the clear panel after the engine has stopped (see Fig. 5), the air filter element must be removed for service.

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

## To Renew the Lubricating Oil Filter Canister

1. Put a tray under the filter to hold any oil drops.
2. Remove the filter canister (see Fig. 6) 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.

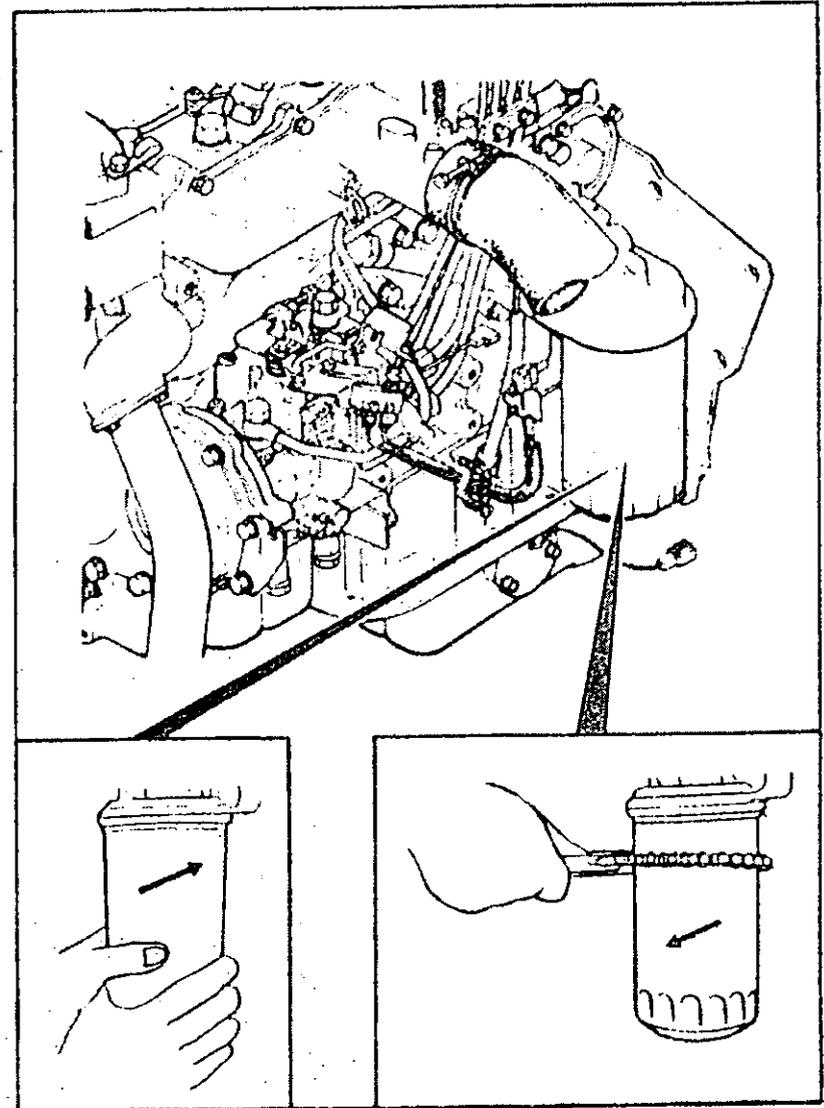


Fig. 6  
Lubricating Oil Filter Removal and Installation.

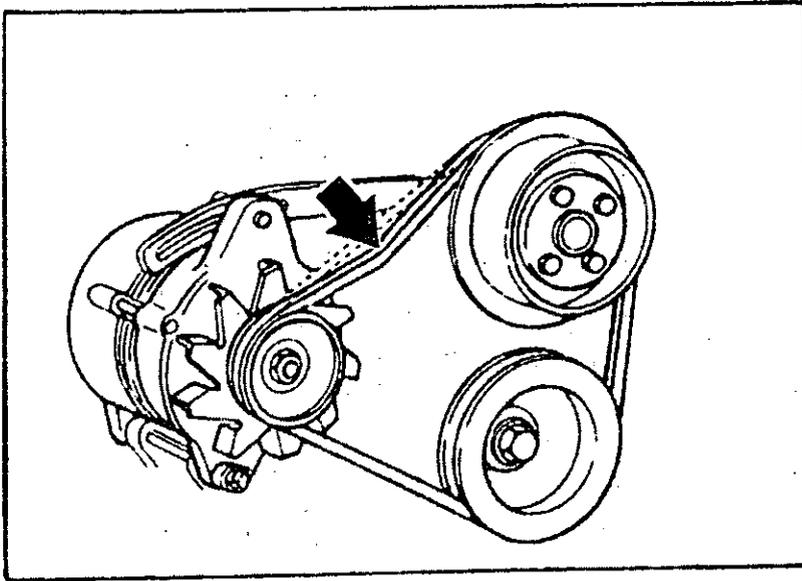


Fig. 7  
Fan Belt Tension Check.

### To Check the Fan Belt

Renew the belt if it is worn or damaged.

With thumb pressure of approximately 10kgf (22lbf), press the fan belt down at a position halfway between the alternator and water pump pulleys and check the deflection (see Fig. 7). The belt deflection must be 10mm ( $\frac{3}{8}$ in) for 4.135 engines and 13mm ( $\frac{1}{2}$ in) for 4.154 and 4.182 engines.

To adjust the belt tension:

1. Loosen the alternator mounting bolt(s) and the adjustment lever bolts.
2. Change the alternator position to give the correct tension and tighten the alternator and adjustment lever bolts.
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 1,000 km (600 miles) or 30 hours of operation.

### To Check Valve Tip Clearances

These are checked between the top of the valve stem (or the valve stem cap, if used) and the rocker lever (see Fig. 8). The correct clearance for both the inlet and exhaust valves is 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 No. 4 cylinder has just opened and the exhaust valve of the same cylinder has not fully closed. Check the clearances of No. 1 cylinder valves and adjust, if necessary.
2. With No. 2 cylinder valves set as shown above for No. 4 cylinder, check/adjust clearances of No. 3 cylinder valves.
3. With No. 1 cylinder valves set, check/adjust clearances of No. 4 cylinder valves.
4. With No. 3 cylinder valves set, check/adjust clearances of No. 2 cylinder valves.

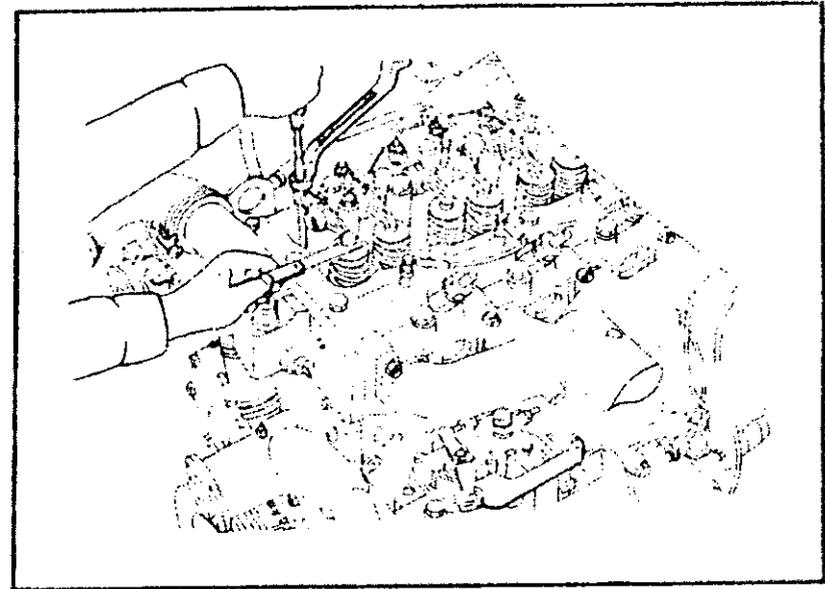


Fig. 8  
Valve Tip Clearance Adjustment.

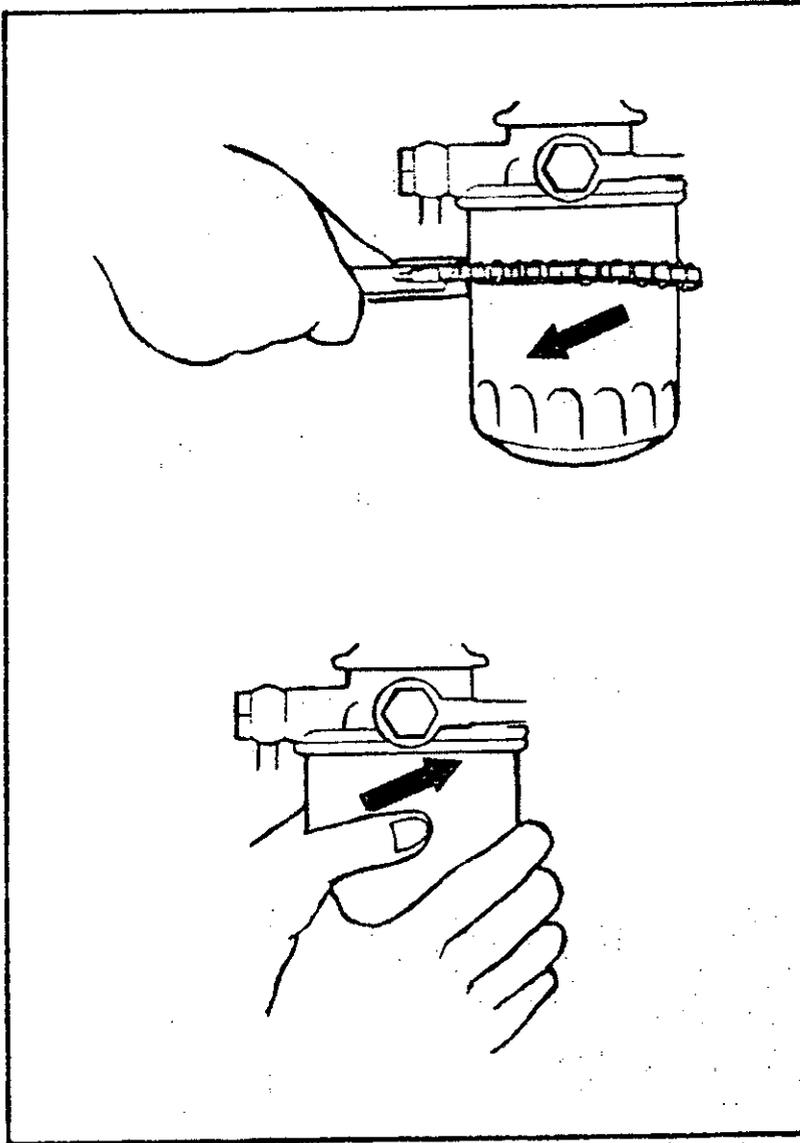


Fig. 9  
Fuel Filter Removal and Installation.

### To Renew Fuel Filter Canister

1. Clean the surface of the filter.
2. Remove the filter canister (see Fig. 9) with a strap wrench or similar tool. Discard the canister.
3. Lubricate the seal of the new canister with clean fuel.
4. Fit the new canister to the filter head and tighten it by hand only. Do not use a strap wrench.
5. Loosen the vent screw at the top of the filter (see Fig. 10). Operate the priming pump on the top of the filter until fuel, free from air, comes from the vent point. Tighten the vent screw.

## 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 engine operation.
- ⊕ The low pressure fuel pipes are disconnected.
- ⊕ Any part of the low pressure fuel system leaks during engine operation.

Remove air from the fuel system as follows:

1. Loosen the vent screw on the top of the fuel filter (see Fig. 10).
2. Operate the priming pump on the top of the fuel filter until fuel, free from air, comes from the filter vent point.
3. With the priming pump held down, tighten the filter vent screw.
4. Loosen the return connection of the fuel injection pump (see Fig. 11).
5. Operate the priming pump until fuel, free from air, comes from the injection pump vent point.
6. With the priming pump held down, tighten the return connection of the injection pump.

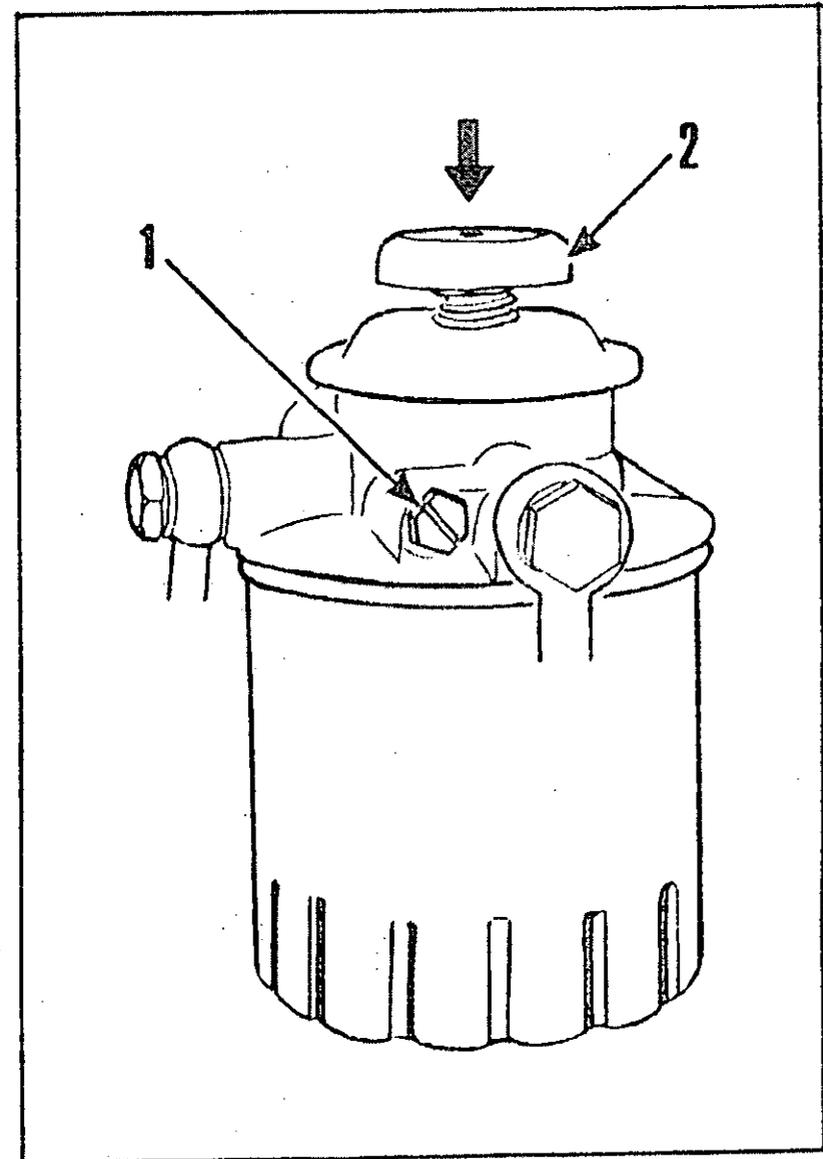


Fig. 10  
Removal Of Air From Fuel Filter.  
1. Filter Vent Screw.      2. Priming Pump Handle.

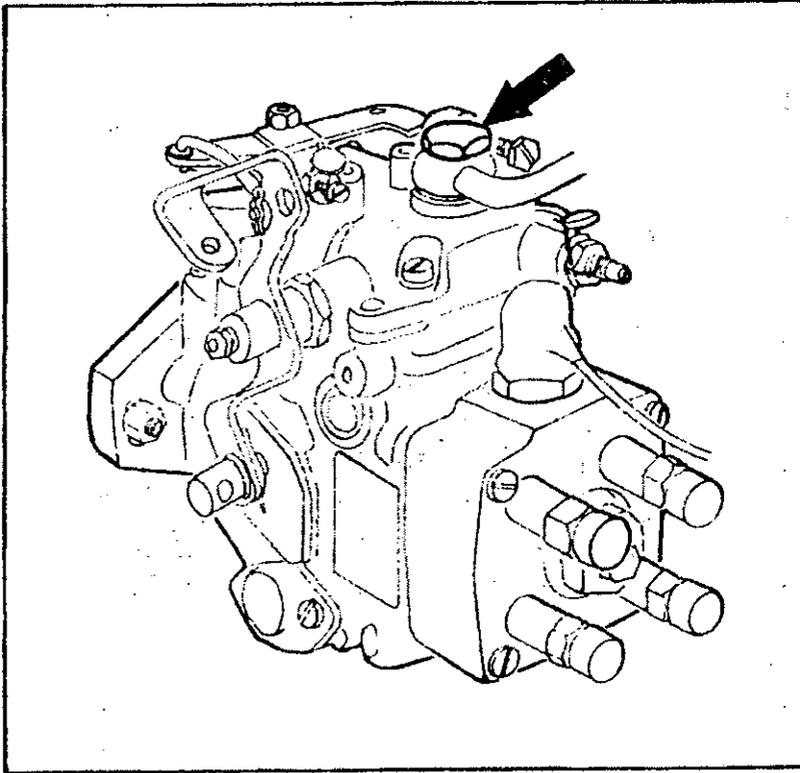


Fig. 11  
Fuel Injection Pump Vent Point.

7. Loosen the high pressure fuel pipe connections at the atomisers.
8. Ensure that the stop control (if fitted) is in the 'run' position. Operate the starter motor until fuel, free from air, comes from the pipe connections.
9. Tighten the high pressure fuel pipe connections. 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 system, there is probably leakage in the low pressure system.

### 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

### 4.135, 4.182 and 204-25/30 Engines

1. Remove the high pressure pipe union nuts from the atomisers and the fuel injection pump and release the pipes.
  2. Remove the leak off pipe lock nuts and washers and remove the leak off pipe.
  3. Turn the atomiser counterclockwise to release it from the cylinder head and remove the atomiser and seat washer. Ensure that the spanner engages on the bottom body of the atomiser.
  4. Fit a new atomiser in the cylinder head, complete with a new seat washer. Tighten the atomiser to 68 Nm (50 lbfft) 7 kgfm.
  5. Fit the fuel leak off pipe and high pressure pipes.
  6. Run the engine and check for fuel and air leakage.
4. Put the new atomiser in position with a new seat washer. Ensure that the atomiser is not tilted and tighten the flange nuts evenly by small amounts to 23 Nm (17 lbfft) 2,4 kgfm.
  5. Fit the high pressure fuel pipe and leak off pipe.
  6. Run the engine and check for fuel and air leakage.

### 4.154 Engines

1. Remove the fuel leak off pipe.
2. Remove the high pressure pipe union nuts from the atomiser and fuel injection pipe and release the pipe.
3. Remove the atomiser flange nuts and remove the atomiser and seat washer.

## 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 14. 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 12. 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 (1/4 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 **POWERPART Lay-Up 2** into the exhaust manifold. Seal the manifold with waterproof tape.
13. Remove the lubricating oil filler cap. Spray **POWERPART Lay-Up 2** around the rocker shaft assembly. Fit the filler cap.
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 fan 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 are not responsible for any damage that occurs in relation to a service storage period.

# FAULT DIAGNOSIS CHART

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

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

## **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 13.

### **POWERPART Easy Flush**

Cleans the cooling system.

### **POWERPART Hylomar**

Universal jointing compound which seals joints.

### **POWERPART Hylosil**

Silicone rubber sealant which prevents leakage through gaps.

### **POWERPART Lay-Up 1**

A diesel fuel additive for protection against corrosion. See page 26.

### **POWERPART Lay-Up 2**

Protects the inside of the engine and of other closed systems. See page 26.

### **POWERPART Lay-Up 3**

Protects outside metal parts. See page 27.

### **LOCTITE Chisel**

Allows easy removal of old gaskets and joints.

### **LOCTITE Repel**

Dries damp equipment and gives protection against corrosion. Passes through dirt and corrosion to

lubricate and to assist removal of components.

### **LOCTITE 222e**

To retain small fasteners where easy removal is necessary.

### **LOCTITE 242e**

To retain and seal threaded fasteners and cup plugs where easy removal is necessary.

### **LOCTITE 270**

To permanently retain large fasteners and studs.

### **LOCTITE 518**

To seal flat surfaces of components where no joint is used. Especially suitable for aluminium components.

### **LOCTITE 542**

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

### **LOCTITE 575**

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

### **LOCTITE 603**

To retain components which have a transition fit.

### **LOCTITE 638**

To retain components which have an interference fit.

**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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