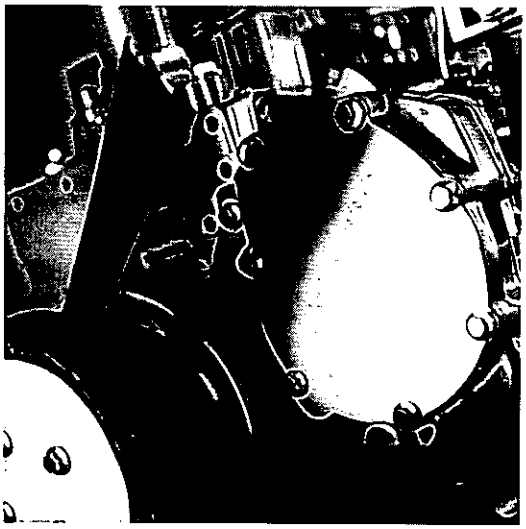
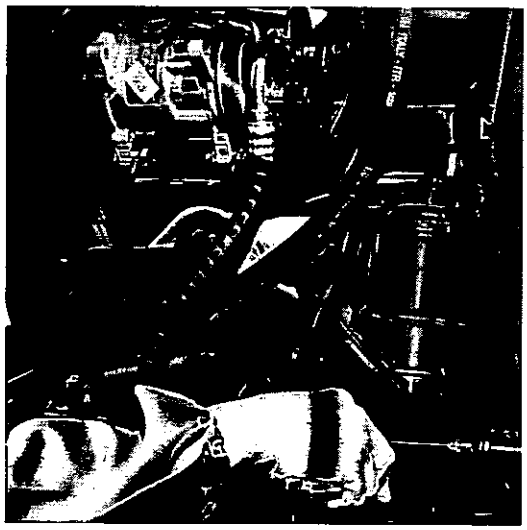
Perkins®

User's Handbook

G4.236 Series Spark Ignition Engines





(GB)

G4.236 Gasolene, G4.236 LPG,

G4.236 Natural Gas

TPD 1234

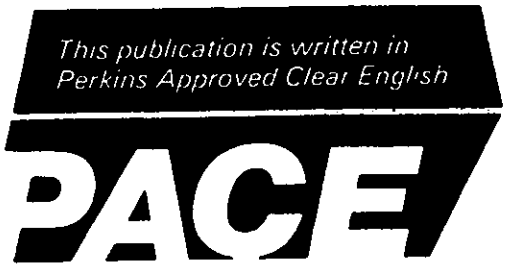
USERS HANDBOOK

G4.236 Series Spark Ignition Engines

G4.236 Gasolene, G4.236 LPG, G4.236 Natural gas

Publication 201 TPD 0584 1234

May 1984
Perkins Engines Ltd.,
Peterborough, England.


This publication is written in
Perkins Approved Clear English
PACE

Contents

General information

Introduction

This handbook has been written to give you assistance in the correct maintenance and operation of your engine. Any information on LPG (liquid petroleum gas) engines which is not to be found in this publication, such as ignition timing, engine start procedures, equipment to reduce gas pressure, pre-heating and carburation, can be supplied from the manufacturer of the machine or his distributor.

Perkins Engines Limited is not responsible for any damage caused to this engine or to its component parts by the use of LPG or natural gas conversion equipment not approved by the Company or which is not correctly fitted or adjusted.

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 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.

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 which 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.
- 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

This is a system for operators of equipment fitted with Perkins engines to introduce them to their nearest Perkins distributor where the distributor is responsible for the engine service.

When you get your new equipment, remove the label (1, fig. 1) from the engine and send it to your Perkins distributor and he will supply you with a **CARE**CARD (2, fig. 1) and full instructions for its use.

Every time you need service or information, give the **CARE**-CARD to your distributor and it will enable him to give you the best service with the use of Perkins parts and will also ensure that you get the best performance from your Perkins engine at all times.

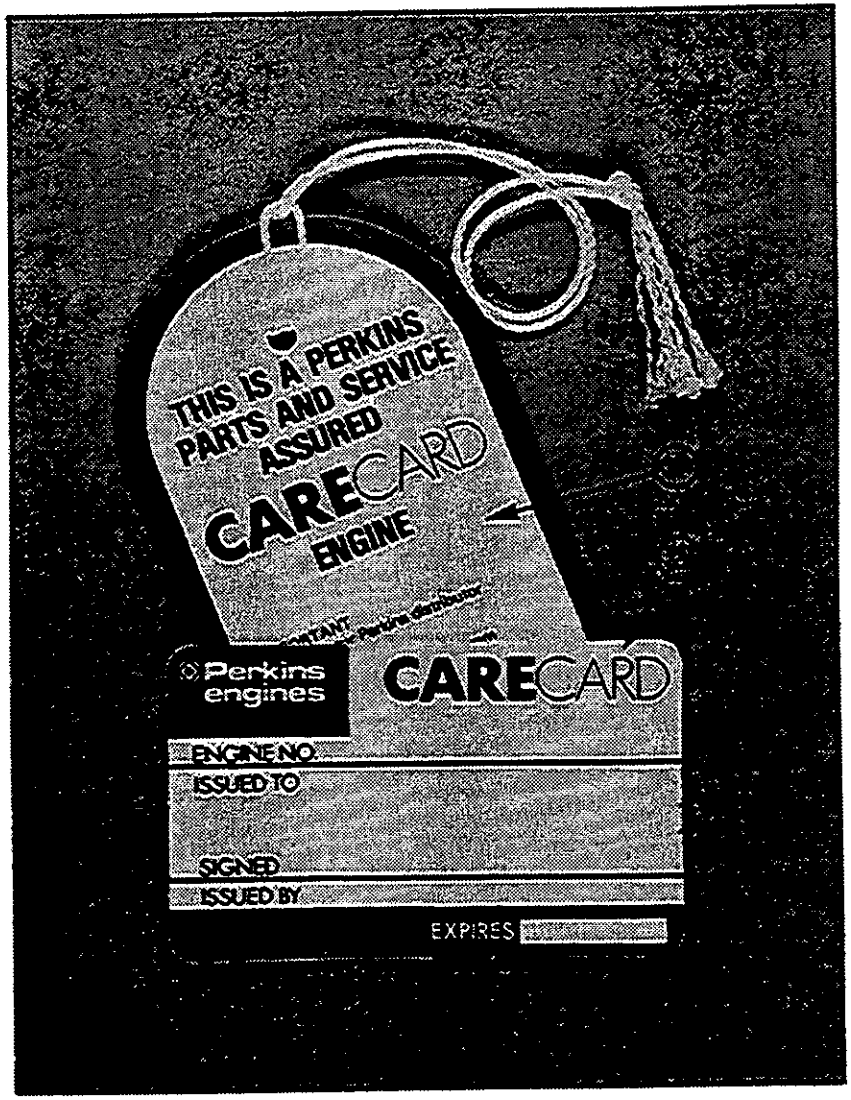


Fig. 1 **CARE**CARD label and **CARE**CARD

Engine identification

There are three engine types in the G4.236 Series. These are the G4.236 Gasolene, G4.236 LPG and G4.236 Natural gas engines.

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

Code	Engine type
LE	G4.236

The engine number is stamped on a machined pad on the top left side of the cylinder block to the right of the distributor (1, fig. 2). A typical engine number is LE80177U934482K.

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

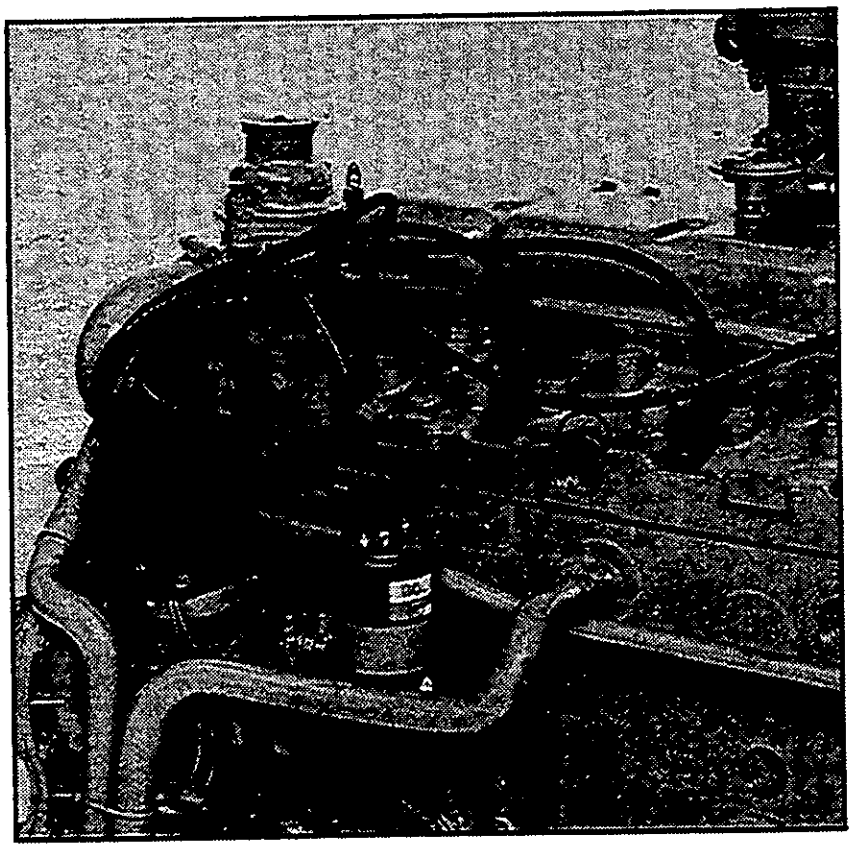


Fig. 2 Engine number location

Perkins companies

Australia

Perkins Engines Australia Pty. Ltd.
P.O. Box 156, Dandenong 3175, Victoria, Australia..
Telephone: 792 0431. Telex: 30816.
Cables: 'Perkoil' Melbourne.

France

Moteurs Perkins S.A.
9-11 Ave. Michelet, Boite Postale 69,
93402 Saint Ouen, Cedex, France.
Telephone: 257 14 90. Telex: 'Perkoil' 642924'.

Germany

Perkins Motoren G.m.b.H.
8752 Kleinostheim, Postfach 1180, Germany.
Telephone: 06027 5010. Telex: 4188869.

Great Britain

Perkins Engines Limited
Peterborough, PE1 5NA, England.
Telephone: Peterborough 67474. Telex: 32501.
Cables: 'Perkoil' Peterborough.

Italy

Motori Perkins S.p.A.
Via Gorizia 11, P.O. Box 12,
22070 Portichetto/Luisago (Como), Italy.
Telephone: (031) 927364. Telex: 380658 Perkit I.
Cables: 'Perkoil' Portichetto.

Japan

Massey Ferguson Perkins K.K.
6th Floor, Reinanzaka Building, 14-2 Akasaka, 1-chome,
Minato-Ku, Tokyo 107, Japan.
Telephone: (03) 586 7377. Telex: J2424823 Perkoil J.

U.S.A.

Perkins Engines Inc.
P.O. Box 697, Wayne, Michigan 48184, U.S.A.
Telephone: 313 595 9600. Telex: 23-4002.
Cables: Perkeng Wane.

In addition to the above, there are Perkins Distributors in most countries. Perkins Engines Ltd., Peterborough or one of the above companies can give details.

Engine views

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

1 Lubricating oil filler cap
2 Spark plug
3 Distributor
4 Breather pipe
5 Lubricating oil dipstick
6 Lubricating oil filter
7 Crankshaft pulley
8 Drive belt
9 Water pump
10 Alternator pulley
11 Front lift bracket
12 Thermostat housing

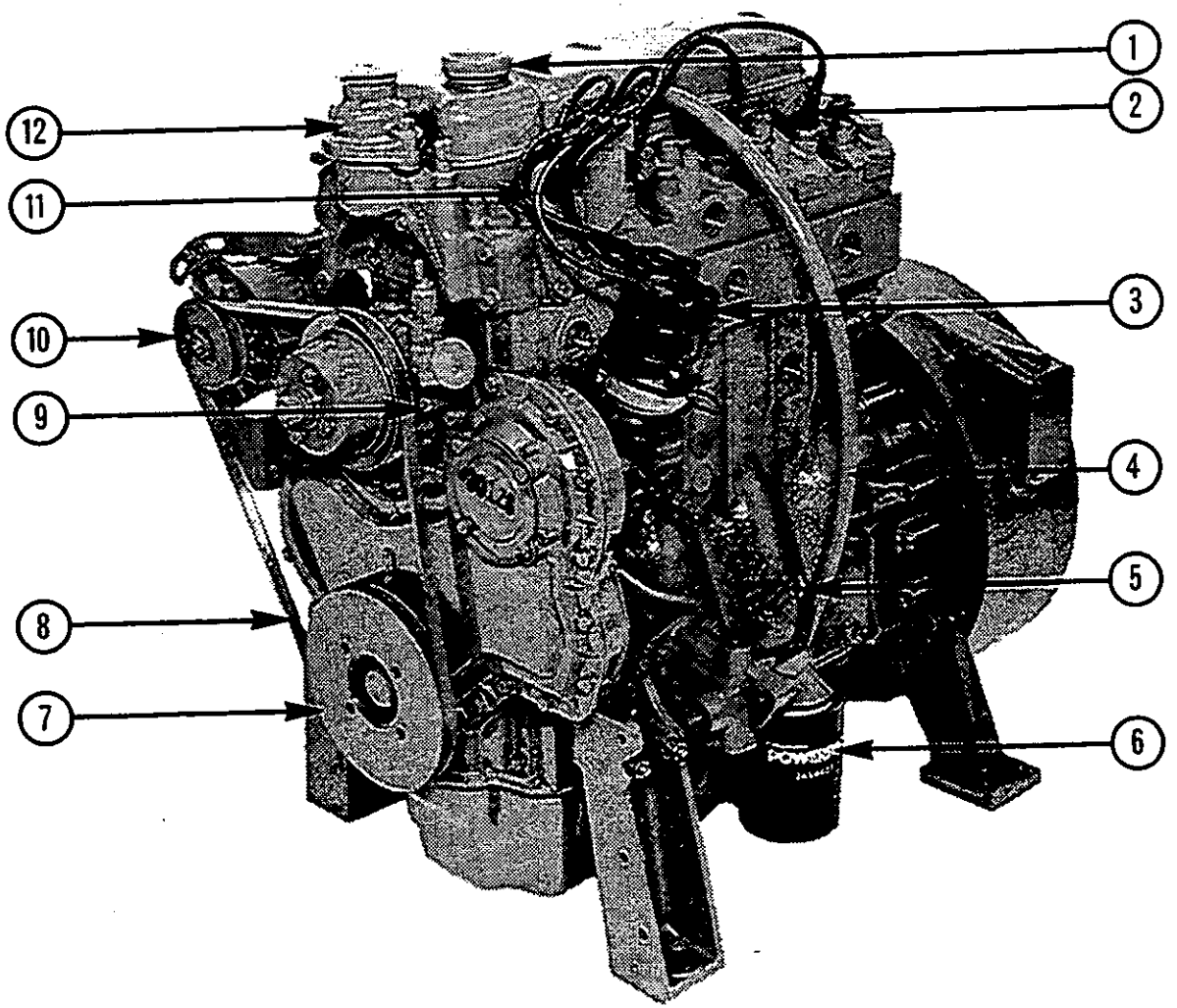


Fig. 3 Front/left side of G4.236 gasolene/LPG engine

13 Induction manifold
14 Alternator
15 Starter motor
16 Lubricating oil sump
17 Lubricating oil sump drain plug
18 Flywheel housing
19 Flywheel
20 Cylinder block drain plug
21 Rear lift bracket

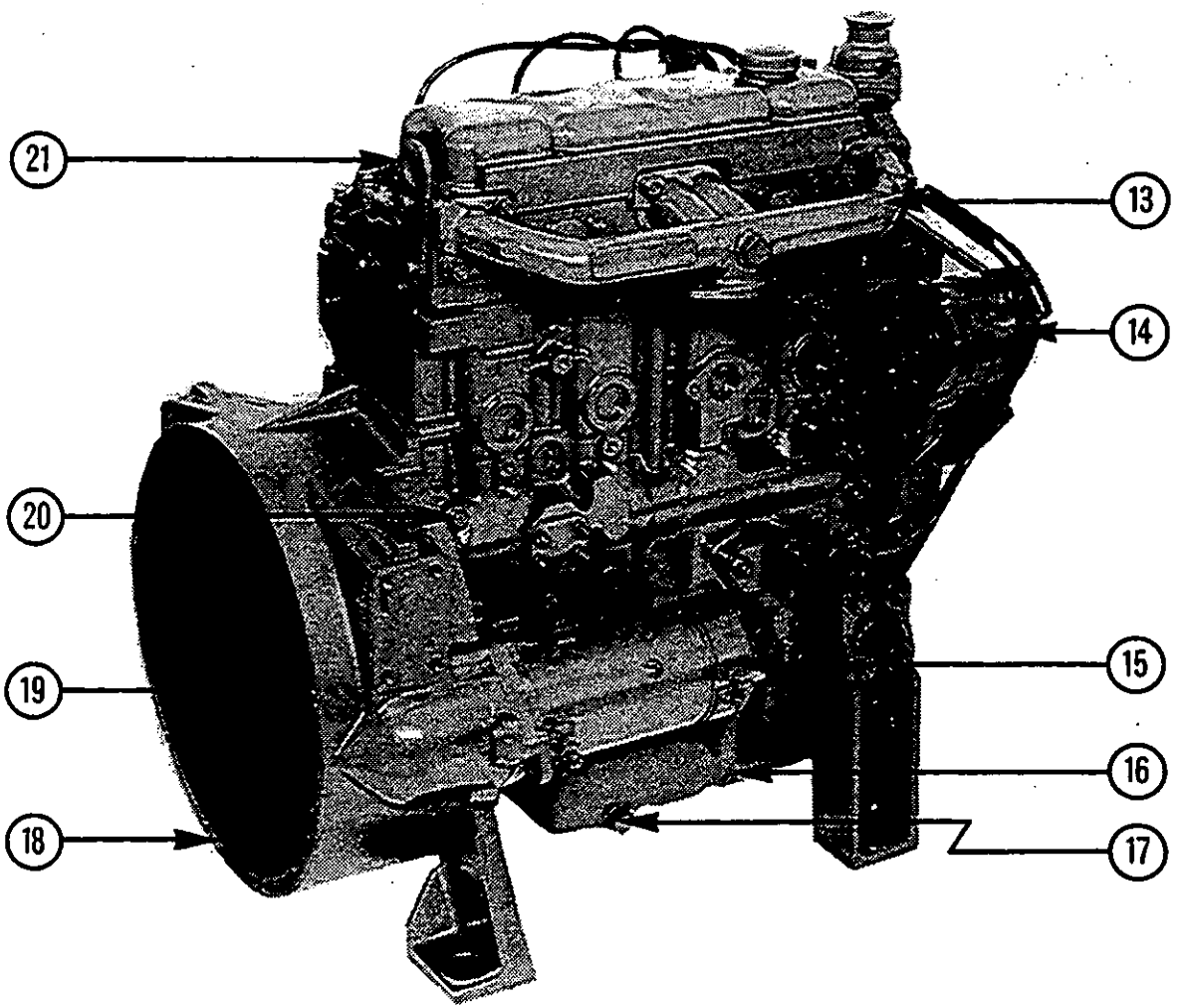


Fig. 4 Rear/right side of G4.236 gasolene/LPG engine

1 Lubricating oil filler cap
2 Spark plug
3 Distributor
4 Coil
5 Cylinder block drain plug
6 Lubricating oil dipstick
7 Lubricating oil cooler
8 Lubricating oil filter
9 Crankshaft pulley
10 Drive belt
11 Water pump
12 Thermostat housing

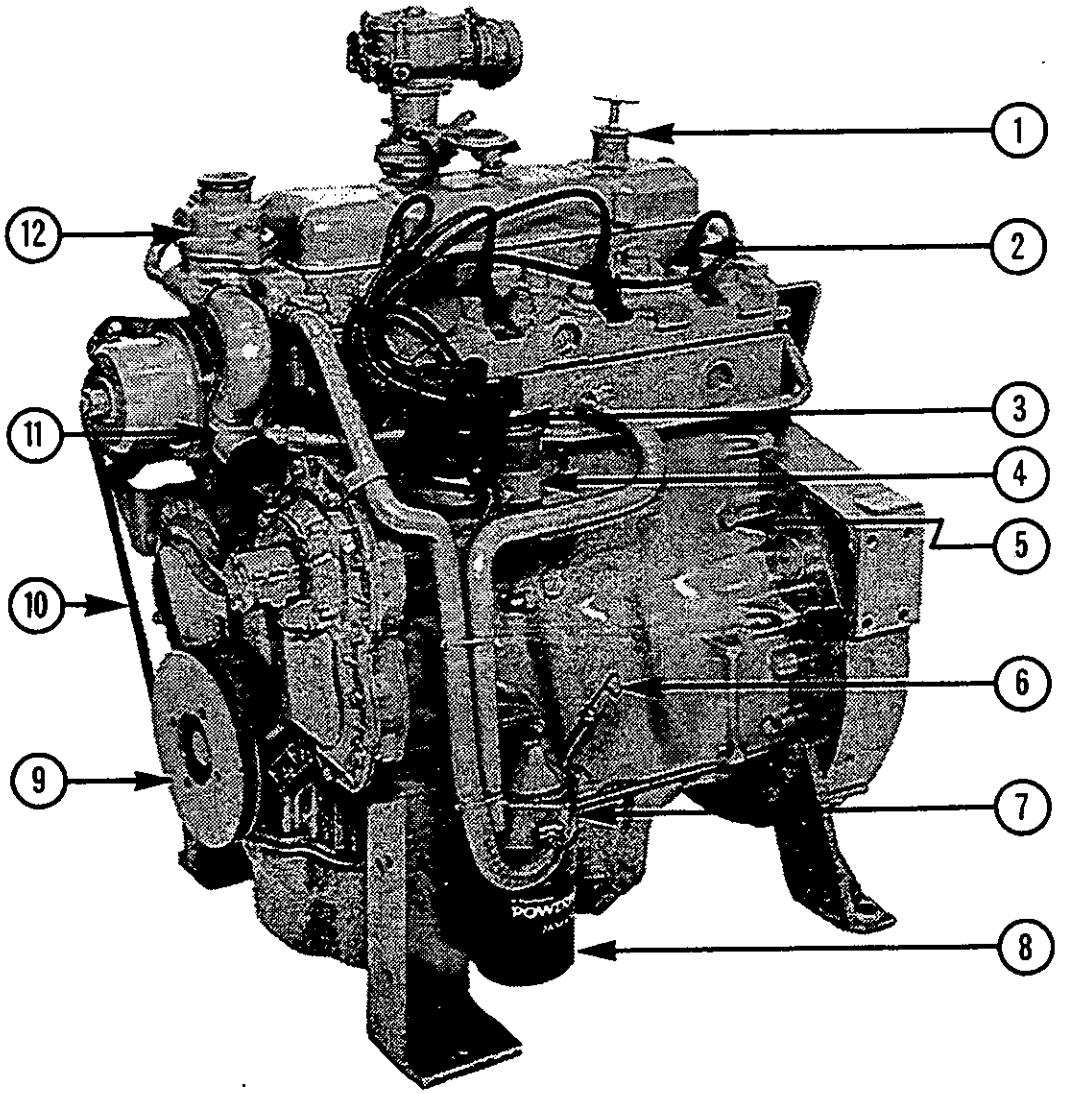


Fig. 5 Front/left side of G4.236 natural gas engine

13 Induction manifold
14 Exhaust manifold
15 Alternator
16 Starter motor
17 Lubricating oil sump
18 Sump drain plug
19 Flywheel housing
20 Flywheel
21 Breather
22 Carburettor

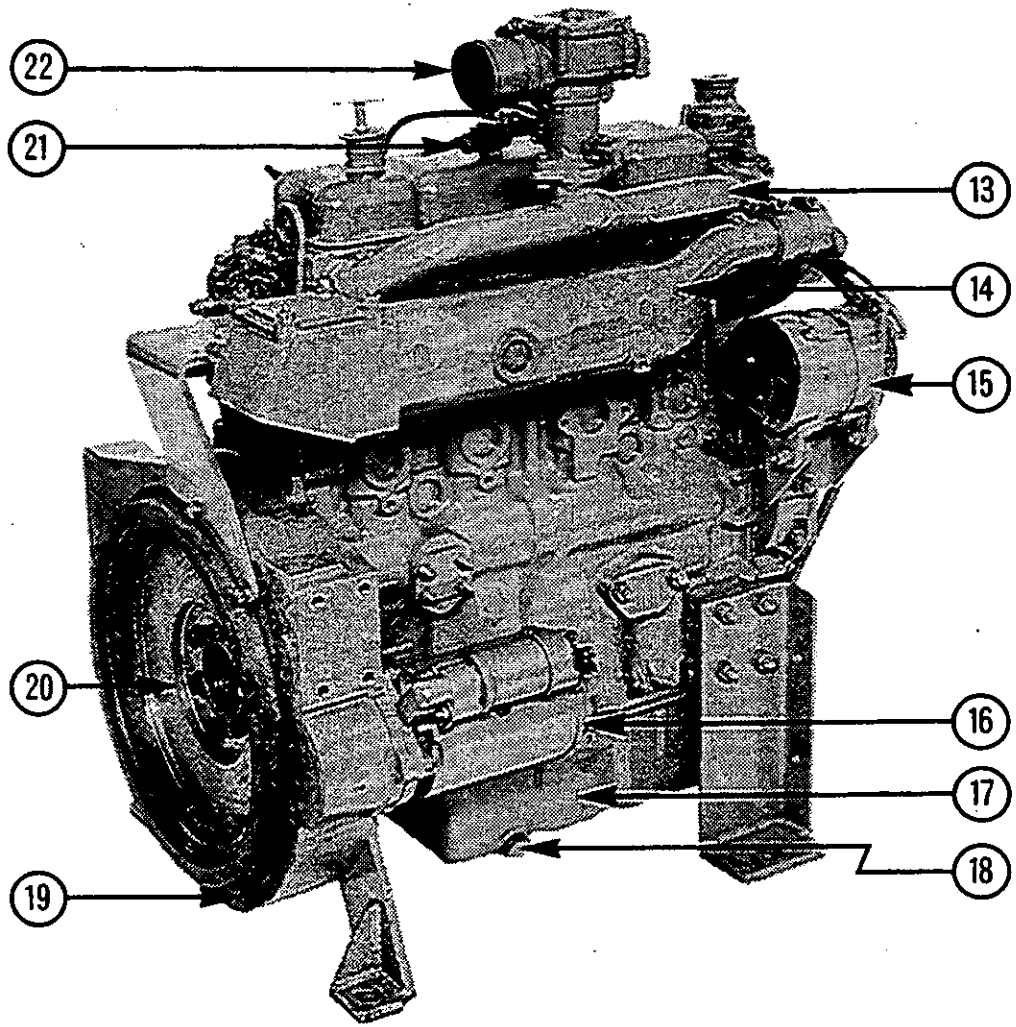


Fig. 6 Rear right side of G4.236 natural gas engine

Engine data

	G4.236 Gasolene	G4.236 LPG	G4.236 Natural gas
Number of cylinders	4	4	4
Cylinder arrangement	In line	In line	In line
Cycle	Four stroke	Four stroke	Four stroke
Induction system	Naturally aspirated	Naturally aspirated	Naturally aspirated
Combustion system	Spark ignition	Spark ignition	Spark ignition
Ignition timing			
Static (BTDC)	3°	–	24°
Dynamic (BTDC)	15° at 1400 rev/min	See manufacturers data	24° at 1400 rev/min
Spark plug	Champion N11Y 14 mm	Champion N11Y 14 mm	Champion N180B 14 mm
Spark plug gap	0,50 mm (0.020 in)	0,50 (0.020 in)	Not adjustable
Contact breaker points gap	0,38 mm (0,015 in)	0,38 mm (0.015 in)	Breakerless ignition
Nominal bore	98,43 mm (3.875 in)	98,43 mm (3.875 in)	98,43 mm (3.875 in)
Stroke	127,0 mm (5.000 in)	127,0 mm (5.000 in)	127,0 mm (5.000 in)
Compression ratio	7.5 : 1	7.5 : 1	11.5 : 1
Cubic capacity	3,87 litres (236.9 in^3)	3,87 litres (236.9 in^3)	3,87 litres (236.9 in^3)
Firing order	1, 3, 4, 2	1, 3, 4, 2	1, 3, 4, 2
Valve tip clearance			
Inlet (cold)	0,30 mm (0.012 in)	0,30 mm (0.012 in)	0,30 mm (0.012 in)
Exhaust (cold)	0,38 mm (0.015 in)	0,38 mm (0.015 in)	0,38 mm (0.015 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.

GASOLENE ENGINES

To start a warm engine

1 Disengage the clutch and adjust the engine speed control to its one third open position.

2 Turn the ignition switch start key to the 'S' position (see fig. 7) to engage the starter motor.

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

4 If the engine does not start after four 30 second operations of the starter motor, pull the choke control out a small amount and try again.

5 As the engine starts, gradually return the choke control to its normal position until the engine runs at a smooth idle speed.

To start a cold engine

1 Pull out the choke control to its maximum position.

2 Disengage the clutch and adjust the engine speed control to its one third open position.

3 Turn the ignition switch key to the 'S' position (see fig. 7) to engage the starter motor.

4 As soon as the engine starts, release the key to the 'R' position. As the engine warms, gradually return the choke control to its normal position until the engine runs at a smooth idle speed.

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

LPG ENGINES

For engine start and stop procedures see the machine manufacturers recommendations.

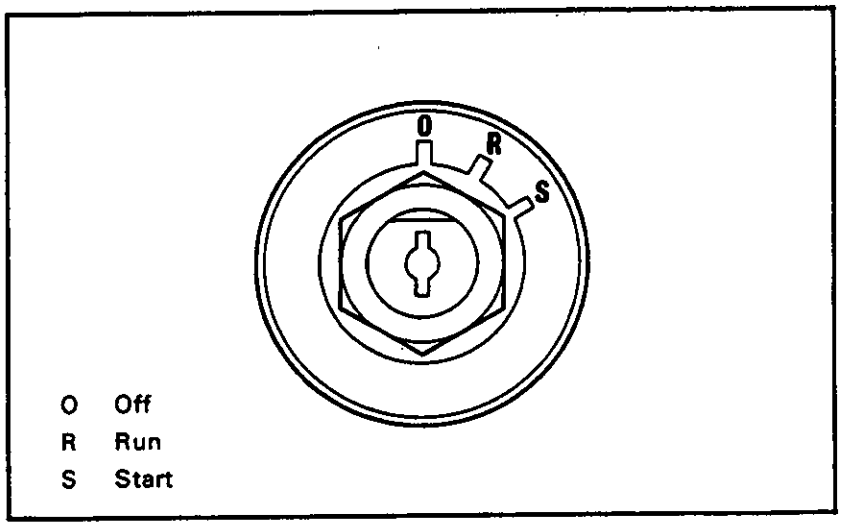


Fig. 7 Start switch

NATURAL GAS ENGINES

To start the engine

1 Disengage the clutch and adjust the engine speed control to its one third open position.

2 Turn the ignition switch key to the 'S' position, (see fig. 7) to engage the starter motor.

3 As soon as the engine starts, release the key to the 'R' position, and adjust the engine speed control as needed.

Note: Ensure the gas supply pressure at the input to the gas mixing valve is H_2O 125mm minimum, 200mm maximum.

To stop the engine

Return the engine speed control to its fully closed position and turn the ignition switch key to the 'O' position (see fig. 7).

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 engine as soon as the engine is put into service and the coolant temperature is at a maximum of 60°C (140°F).

Do not run the engine at high no load speeds.

Do not apply an overload to the engine.

Fuel and lubricating oil recommendations

Fuel specification

When adjusted to factory standards, these engines will operate correctly on fuel to one of the specifications which follow.

Gasolene engines
BS.4060 U.K. 2 star (minimum RON90)

LPG engines
Liquid petroleum gas, Calor 9158

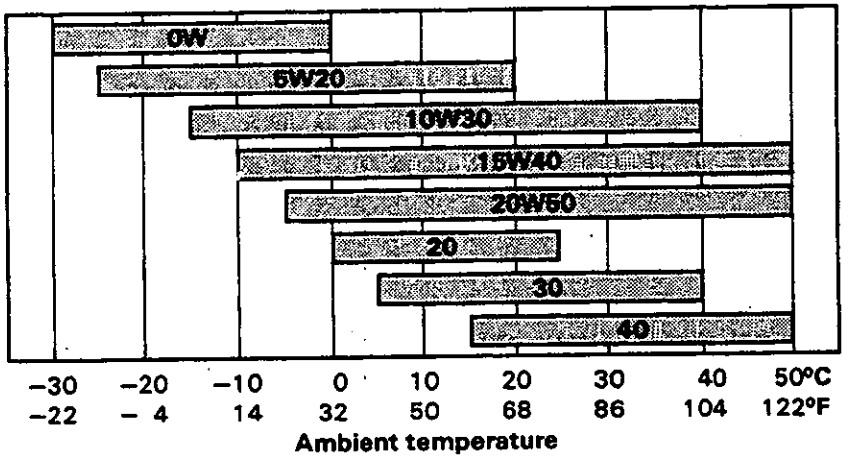
Natural gas engines
Methane gas at 15°C and 101.3kPa dry, with a calorific value of 34.82 MJ/m³ net.

Lubricating oil specification

Lubricating oils must be equal to the specification API SE CC (MIL-L-46152). Where lubricating oils are not available to the MIL-L-46152 specification, then MIL-L-46152B can be used.

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

Recommended SAE viscosity grades



Engine coolant

The quality of the coolant used can have a large effect on the efficiency and life of the cooling system. The recommendations given below can be of assistance in the maintenance of a good cooling system with frost and/or corrosion protection.

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

1 Where possible, use clean soft water.

2 If an antifreeze mixture is used to prevent frost damage, it must have an ethylene glycol (ethanediol) base. An antifreeze that is to one of the standards given below or to an equal standard is acceptable if the pH value is kept within the range of 7.0 – 8.5 when diluted.

U.K.: BS 3151: 1959; Ethanediol Antifreeze Type B with Sodium Benzoate and Sodium Nitrite Inhibitors.
U.S.A.: ASTM D3306-74; Ethylene Glycol Base Engine Coolant.
Australia: AS 2108-1977; Antifreeze Compounds and Corrosion Inhibitors for Engine Cooling Systems.

When Perkins POWERPART antifreeze is used, the correct mixtures of antifreeze and water are as given in the table on this page. Perkins POWERPART Antifreeze fully passes the above standards.

Lowest temperature of protection needed	Volume of POWERPART antifreeze %	Mixture ratio by volume POWERPART antifreeze: water
−12°C (10°F)	25	1:3
−18°C (0°F)	33	1:2
−25°C (−13°F)	40	1:1.5
−37°C (−34°F)	50	1:1
−60°C (−76°F)	66	2:1

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

3 When frost protection is not necessary, it is still an advantage to use an approved antifreeze mixture (see 2 on this page) as this gives a protection against corrosion and also raises the boiling point of the coolant. A minimum concentration of 25% by volume of antifreeze is necessary, but it is our recommendation that 33% concentration by volume is used.

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

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

Note: Some corrosion inhibitor mixtures contain soluble oil which can have an adverse effect on some types of water hose.

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 (1, fig. 8) 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.

With natural gas engines, the oil cooler in the lubricating oil filter assembly must also be drained. To do this, remove bottom coolant connection at the cooler (7, fig. 5).

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. 8 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 vehicle or 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 (kilometres, miles, hours or months) which occurs first.

GASOLENE 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 7500 km (5,000 miles), 250 hours or 4 months

Renew the lubricating oil.
Clean the air cleaner or empty the dust bowl of the air filter.
Check the drive belt(s).
Lubricate distributor cam.

Every 15000 km (10,000 miles), 500 hours or 12 months

Clean and service spark plugs.
Renew the lubricating oil filter canister.
Clean the lift pump sediment chamber and gauze strainer (where fitted).
Remove protrusions from contact breaker points and set to specification.
Clean fuel water trap and pre-filters (where fitted).

Every 30000 km (20,000 miles) or 1,000 hours.

Renew spark plugs.
Renew and set contact breaker points.
Strip and clean carburettor.
Check ignition timing.
Renew air filter element.
Check and if necessary, adjust the valve tip clearances.

Every 90000 km (60,000 miles) or 2,500 hours.

Check the accessory equipment (starter motor, alternator, exhauster, etc.) and service distributor.

LPG/NATURAL GAS 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 7500 km (5,000 miles), 250 hours or 4 months

Clean the air cleaner or empty the dust bowl of the air filter, (if not indicated earlier).
Check the drive belt(s).
Lubricate distributor cam (LPG engines).

Every 15000 km (10,000 miles) 500 hours or 12 months

Renew the lubricating oil.
Remove protrusions from contact breaker points and set to specification. (LPG engines).

Every 30000 km (20,000 miles) or 1,000 hours

Renew the lubricating oil filter canister.
Check ignition timing (while the engine runs).
Renew spark plugs.
Check and, if necessary, adjust the valve tip clearances.
Renew and set contact breaker points. (LPG engines).

Every 90000 km (60,000 miles) or 2,500 hours

Check the accessory equipment (starter motor, alternator, exhauster, etc.), service the distributor and if necessary the carburettor.

Post delivery service

The service procedures given below must be applied at the first 800/1600 km (500/1,000 miles), 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 canister of the lubricating oil filter.

3 Tighten the cylinder head nuts/setscrews (see page 23).

4 Adjust the valve tip clearances (see page 27).

5 Check that the induction and exhaust manifold nuts are tight.

6 Check the tension of the alternator/water pump drive belt.

7 Check ignition timing (while engine runs).

8 Check that all fasteners are tight.

9 Run the engine and check for fuel, coolant and lubricating oil leakage.

10 If necessary, get a person who has had the correct training to adjust the idle speed.

To check the cylinder head nut/set-screw tension

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

2 Stop the engine and remove the cylinder head cover.

3 Check the tension of the cylinder head nuts/setscrews in the correct sequence (see fig. 9). The correct torque tension for G4.236 engines is 131 Nm (96 lbf ft) 13,2 kgf m for studs or setscrews.

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

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

After all the nuts/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 nuts/setscrews.

4 Check the valve tip clearances (see page 27) and adjust as necessary.

5 Install the cylinder head cover.

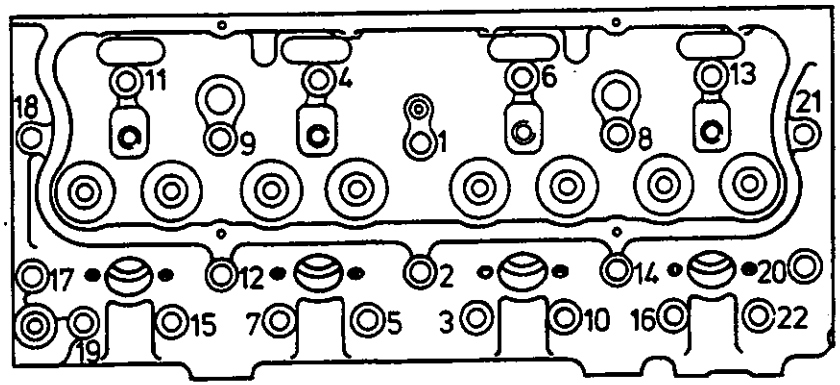


Fig. 9 Sequence to tighten cylinder head

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 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 gasolene. 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 558 mm (22 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. 10) 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.

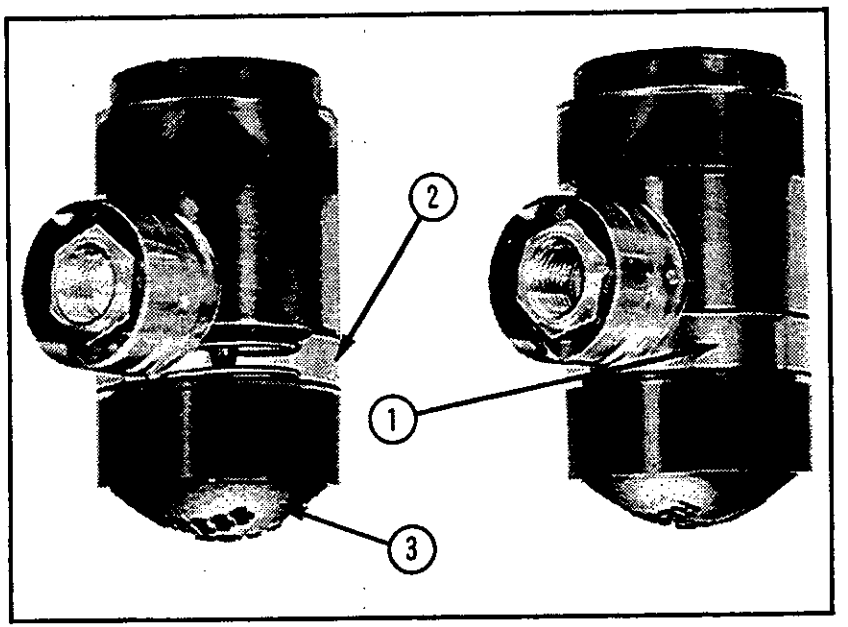


Fig. 10 Restriction indicator

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. 11) 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 lubricating 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 POWER-PART canister is used.

When the canister is renewed on natural gas engines, check that the centre adaptor which passes through the lubricating oil cooler is tight. If this is loose, it can cause a leakage of lubricating oil between the filter head, cooler and canister.

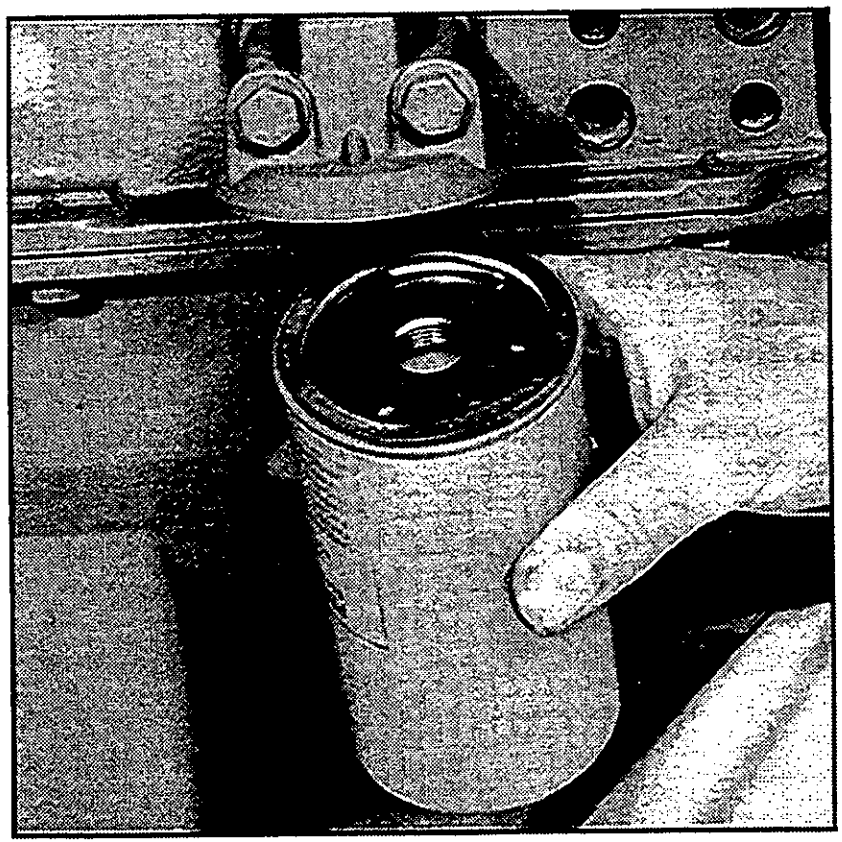


Fig. 11 To renew lubricating oil filter canister

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. 12). The belt movement must be 10 mm ($^3/_8$ 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 and 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 800 km (500 miles) or 25 hours of operation.

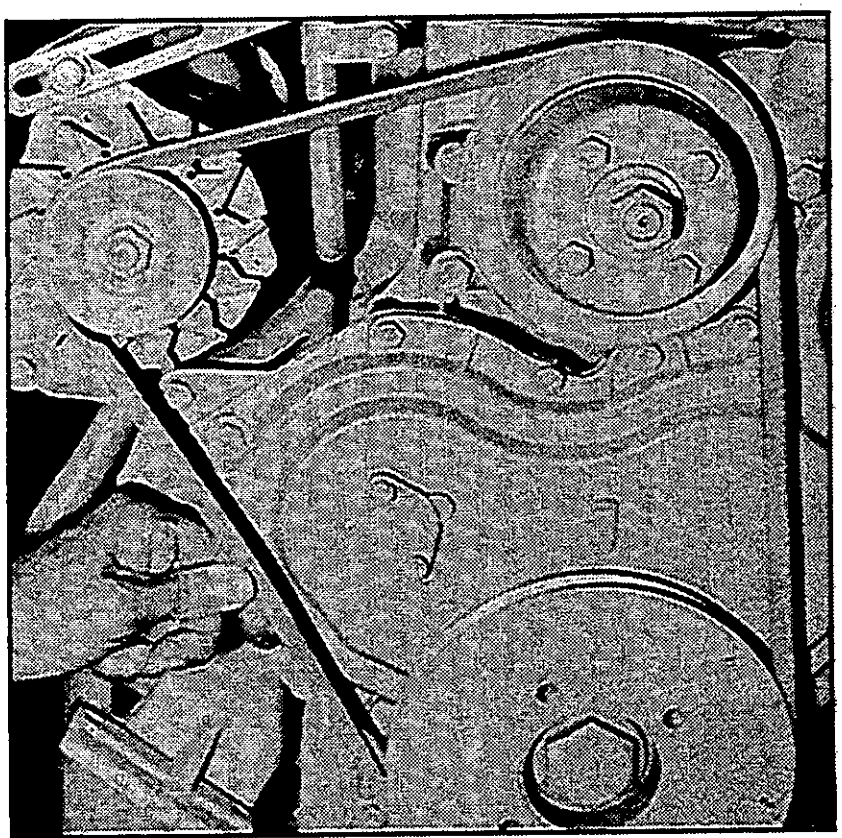


Fig. 12 To check drive belt tension.

To check the valve tip clearances

These are checked between the top of the valve stem and the rocker lever (see fig. 13). The correct clearance is, inlet 0,30 mm (0.012 in), exhaust 0,38 mm (0.015 in) with the engine cold.

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

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. 13 To check valve tip clearance

To check distributor contact breaker points gap

Worn contacts need not be replaced unless the wear is more than 0,38 mm (0.015 in). Points can be cleaned with a file. Care must be taken to ensure that the contact faces remain parallel.

When the contact breaker points gap (1, fig. 14) is adjusted, turn the crankshaft in the normal direction of rotation until the heel of the breaker lever is on the peak of one of the cam lobes (2). Release the fastener screw (3) from the contact breaker plate and use a screwdriver blade in the slot (4) provided to set the points gap to 0,38 mm (0.015 in).

Put a small drop of light lubricating oil on the cam, and one or two drops of engine lubricating oil on the contact breaker points lever pivot every 250 hours. Care must be taken with this operation as any lubricating oil on the contact breaker points will case rapid erosion to occur.

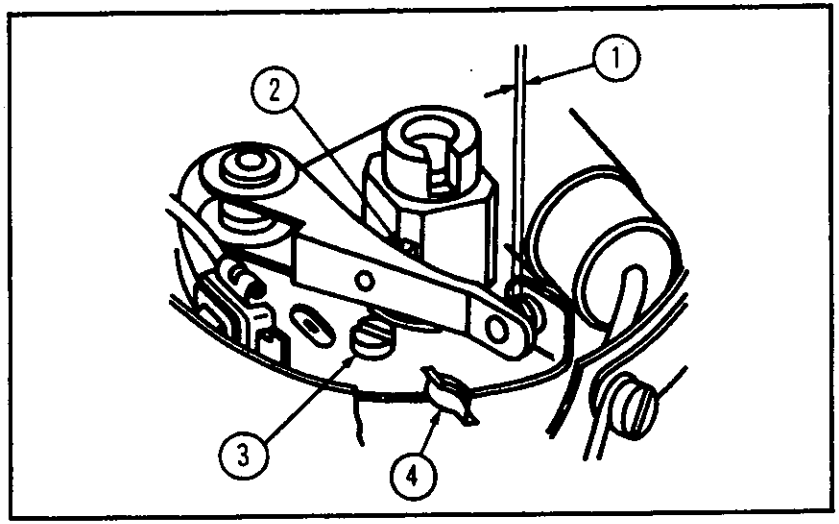


Fig. 14 To check distributor contact breaker points gap

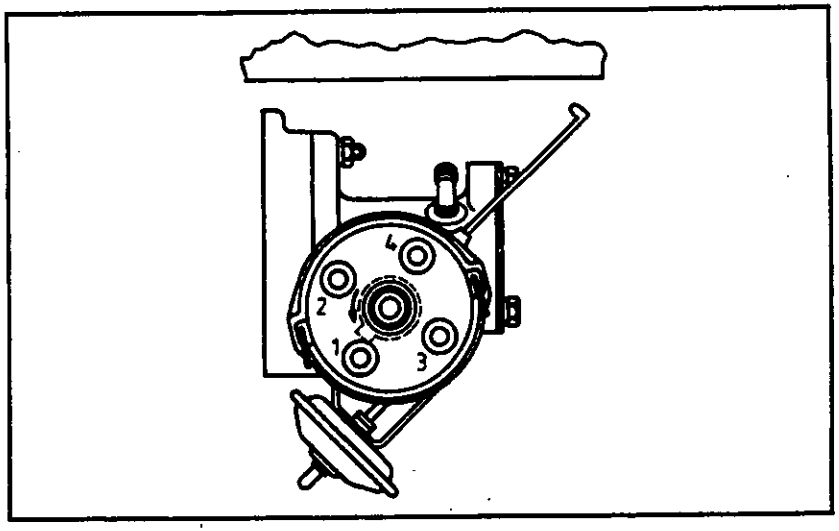


Fig. 15 Distributor rotor arm position

To check the static ignition timing

1 Set number 1 piston to 3° BTDC on its firing stroke for gasolene engines or 24° for natural gas engines. Where the crankshaft pulley has only one timing mark and pointer (1, fig. 16) to show TDC check with the workshop manual or your local Perkins distributor for timing details.

2 Ensure the distributor rotor arm is aligned with number 1 spark plug lead (see fig. 15).

3 Connect a low voltage battery and timing light in series with the distributor low tension lead and ground (engine cylinder block).

4 Turn the distributor clockwise until the timing light just goes out and tighten the distributor clamp.

To check the dynamic ignition timing

1 Remove the vacuum advance pipe (where fitted).

2 Remove the high tension lead from number 1 spark plug and connect it to a neon timing light.

3 Connect the lead of the timing light to the spark plug.

4 While the engine runs, direct the timing light onto the crankshaft pulley and timing pointer (see fig. 16).

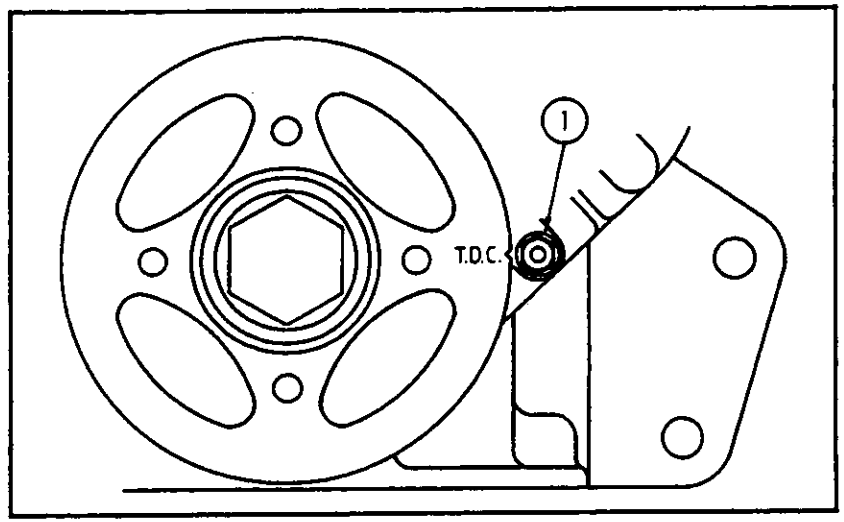


Fig. 16 Crankshaft pulley TDC mark

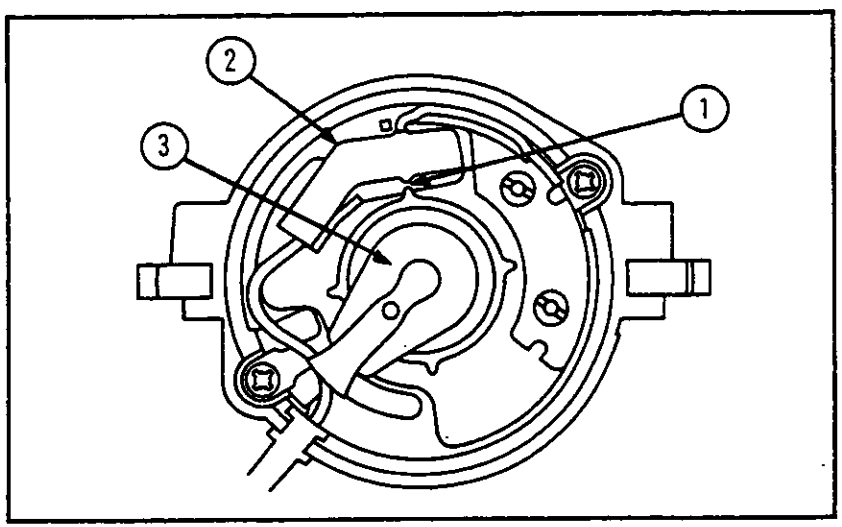


Fig. 17 Reluctor tooth position

5 The timing must be checked with the engine speed at 1400 rev/min. It is correct when the timing pointer is seen to be aligned at 15° BTDC for gasolene engines, or 24° BTDC for natural gas engines.

Note: On some engines, the positions of the timing marks and pointer are changed.

6 To advance or retard the ignition, loosen the distributor clamp and turn the distributor body in the direction of rotation of the rotor arm to retard, or against the direction of rotation to advance the ignition. Tighten distributor clamp when timing is correct.

Note: Where electronic (breakerless) ignition is used, turn the distributor body to align the nearest reluctor tooth (1, fig. 17) with the pick up arm (2) and ensure that the rotor arm (3) is aligned with number 1 spark plug lead for correct timing.

To clean the gauze strainer in the lift pump

1 Remove the cover and joint (see fig. 18) 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.

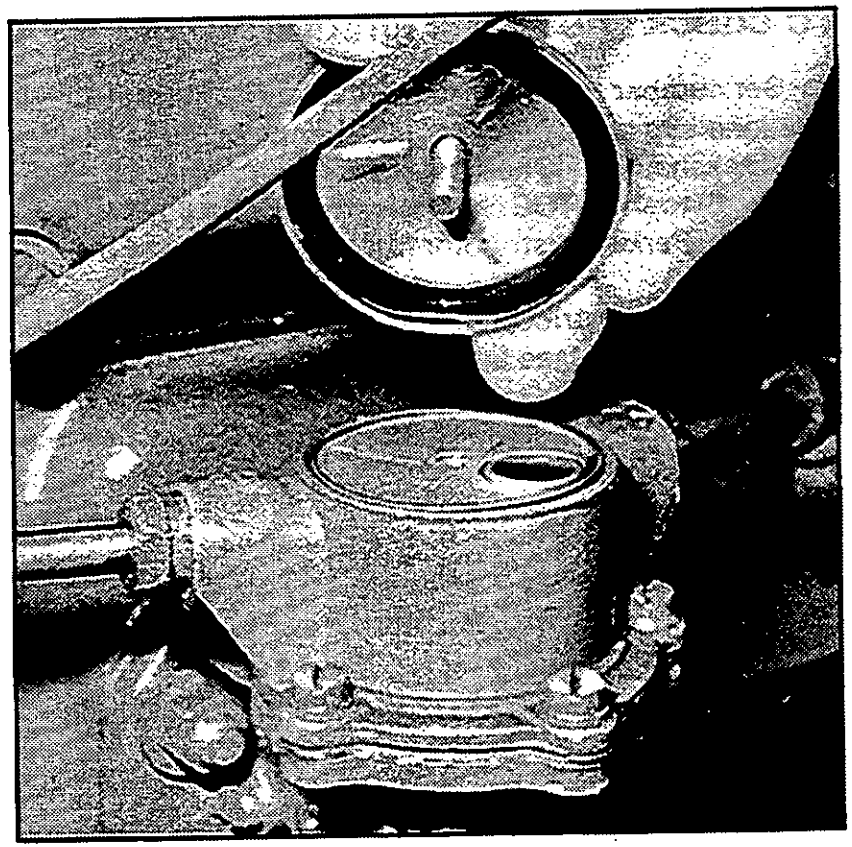


Fig. 18 Fuel lift pump cover removal.

Closed circuit breather vent valve

This is fitted between the cylinder head cover and induction system on some natural gas engines (see 1, fig. 19).

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

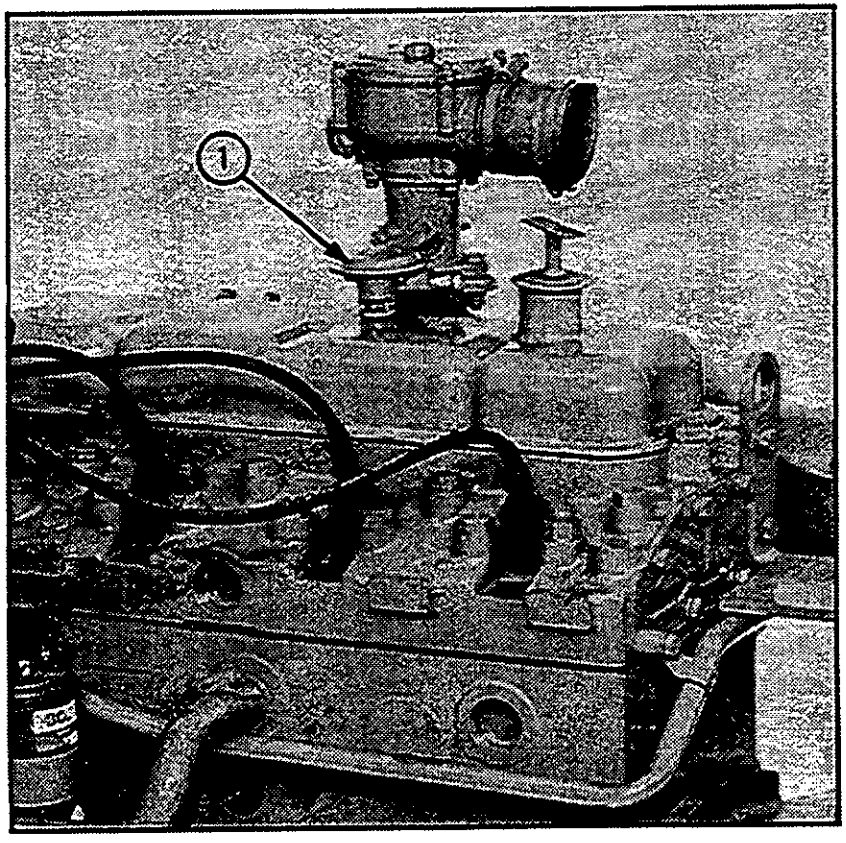


Fig. 19 Breather vent valve

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. 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 19. 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 18. 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 (where fitted) and seal the end of the pipe.

9 Remove the spark plugs 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 spark plugs.

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 drive belt(s) and put it (them) 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, remove the high tension coil lead from the centre of the distributor and operate the starter motor until oil pressure shows on the oil pressure gauge or the oil warning light goes out.

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	22, 31, 35, 38.
Will not start	1, 5, 30, 31, 32, 35, 38, 39, 40, 41, 42, 43, 54, 55.
Stops	1, 5, 28, 29, 37, 40, 41, 42, 44, 47, 48, 51, 52.
Misfire at idle speed	1, 5, 28, 29, 34, 35, 36, 37, 39, 40, 41, 42, 43, 48, 52.
Misfire at high speed	1, 27, 28, 32, 34, 36, 37, 40, 41, 42, 46, 47, 50.
Misfire during increase of engine speed	1, 29, 32, 40, 42, 46, 50.
Not enough power	1, 5, 6, 9, 10, 24, 28, 29, 30, 32, 33, 36, 37, 40, 41, 42, 46, 47, 50, 52, 54.
Engine temperature too high	9, 11, 12, 13, 14, 22, 30, 32, 46, 47, 49.
Low lubricating oil pressure	15, 16, 17, 19, 20, 21, 22, 23, 25.
High lubricating oil pressure	18, 21, 22.
Crankcase pressure	7, 8, 9, 24.
Starts and stops	45, 53.
Engine speed too high on max. load condition	10.
Erratic performance	36.
Noisy	2, 25, 28.
High oil consumption	3, 4, 7, 15, 18, 22, 24.
Engine knocks	25, 26, 27, 46.

Code list of possible causes

1 Spark plug dirty or gap not correct.
2 Piston knock.
3 Worn valve guides.
4 Lubricating oil level in sump too high.
5 Carburettor float setting, not correct.
6 Restriction in exhaust system.
7 Restriction in breather pipe.
8 Piston rings not free or are worn or broken.
9 Cylinder head gasket, damaged.
10 Governor fault or setting not correct.
11 Thermostat fault or wrong type.
12 Water pump drive belt loose.
13 Restriction in radiator or coolant system.
14 Coolant level in system too low.
15 Lubricating oil leak.
16 Loose or restricted lubricating oil pipes.
17 Pressure relief valve not free to close.
18 Pressure relief valve not free to open.
19 Fault in suction pipe of lubricating oil pump.
20 Lubricating oil pump worn.
21 Pressure gauge not correct.
22 Lubricating oil grade not correct.
23 Not enough lubricating oil in sump.
24 Worn cylinder bores.
25 Crankshaft bearings wear or damage.
26 Piston height not correct.
27 Valve spring broken.
28 Valve tip clearances not correct.
29 Wear or erosion of the valves.
30 Valve timing not correct.
31 Starter motor fault.
32 Ignition timing not correct.
33 Automatic advance not correct.
34 Rotor arm fault.
35 Battery capacity low.
36 Distributor drive shaft worn.
37 Distributor cam worn.
38 Fault in electrical connections.
39 Damaged distributor head.
40 High tension coil or condenser fault.
41 High tension leads fault.
42 Erosion of contact breaker points or gap not correct.
43 Damp high tension leads.
44 Air leak in induction manifold.
45 Fuel tank vent restricted.
46 Fuel grade not correct.
47 Dirt or water in carburettor.
48 Idle speed not correct.
49 Weak air/fuel mixture.
50 Carburettor jets dirty or restricted.
51 Choke adjustment not correct.
52 Idling mixture not correct.
53 Vapour lock.
54 Dirty or restricted fuel feed pipe.
55 Carburettor overfilled.

POWERPART consumable products

To give assistance in the correct operation, service and maintenance of your engine and machine, Perkins Engines Ltd. have made available the products shown below. 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

Gives corrosion protection and also a more efficient coolant in hot conditions See page 18.

POWERPART Lay-Up 2

Gives inside protection to the engine and other closed systems. See page 32.

POWERPART Lay-Up 3

Gives outside protection to any metal parts. See page 33.

POWERPART De-Icer

To remove frost.

POWERPART Silent Spray

Silicone lubrication to lubricate and prevent noise from hinges, slide doors, etc.

POWERPART Damp Displacer

To make damp electrical equipment dry and to give future protection.

POWERPART Hylomar

Universal sealing compound to seal joints.

POWERPART Hylosil

Silicone rubber sealant to prevent leakage.

POWERPART Impact Adhesive

To keep joints in position during installation and other general attachment purposes.

POWERPART Solvent

To thoroughly clean metal faces before assembly.

POWERPART Locking Agent

Used to securely install fasteners, sleeves, etc.

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 of how to get this at the Product Education Department, Peterborough, or other main centres.

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.

Asia
Perkins Engines (Asia Pacific) Pte Ltd
7 Tractor Road
Singapore 627968
Telephone +65 6828 7469
Fax +65 6828 7414

Europe, Middle East and Africa
Perkins Engines Company Limited
Peterborough PE1 5NA
United Kingdom
Telephone +44 (0)1733 583000
Fax +44 (0)1733 582240

North America
Perkins Engines Inc
N4 AC 6160
PO Box 610
Mossville, IL 61552-0610, USA
1-888-PERK-ENG
Telephone +1 309 578 7364
Fax +1 309 578 7329

Latin America
Perkins Motores do Brasil Ltda
Rua Alexandre Dumas, 1711 Ed. Birman 11, 9° andar
Chácara Santo Antonio
São Paulo / SP - Brasil
Cep: 04717-004
Telephone +55 11 2109 2038
Fax +55 11 2109 2089

Perkins®

www.perkins.com