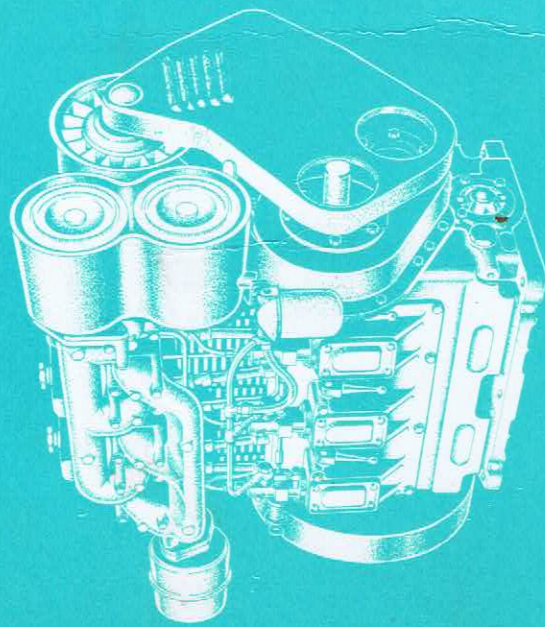


PETTER

DIESEL ENGINES



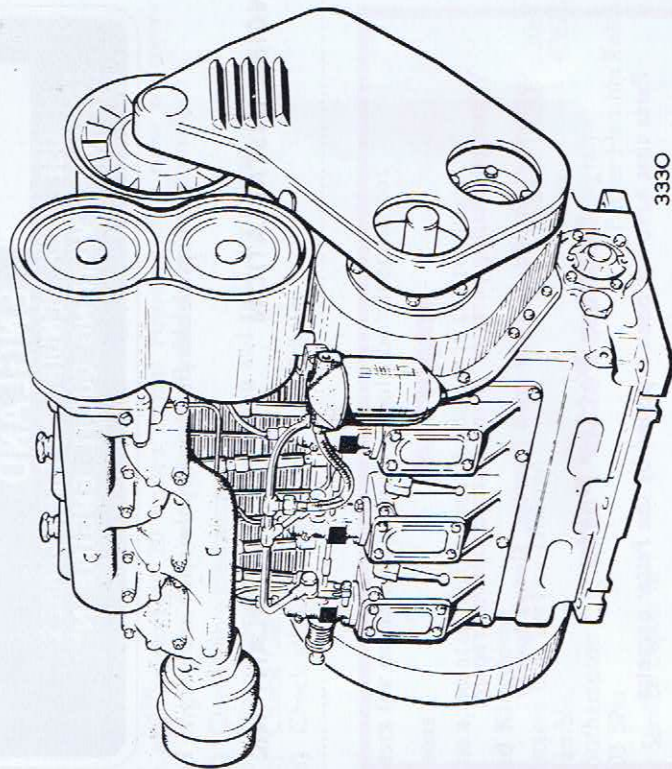
PJ3-4

OPERATORS HANDBOOK

ISSUE 6

Petter Diesel Engines

TYPES PJ3 and PJ4



HEALTH AND SAFETY

TO PROMOTE SAFETY AND TO AVOID RISK TO HEALTH, USERS OF PETTER DIESEL ENGINES SHOULD OBSERVE THE FOLLOWING PRECAUTIONS: ENSURE THAT THE ENGINE IS CORRECTLY INSTALLED, OPERATED AND MAINTAINED. ALWAYS FOLLOW 'MAKERS' INSTRUCTIONS. BEFORE STARTING THE ENGINE, REMOVE AS MUCH OF THE LOAD AS POSSIBLE.

WHEN USING A STARTING ROPE, DO NOT WIND THE ROPE ROUND HAND OR WRIST. MAKE SURE THE ROPE IS NOT TANGLED OR FRAYED.

WHEN USING A STARTING HANDLE, HOLD THE HANDLE FIRMLY WITH THE THUMB ON TOP OF THE GRIP AND NOT ROUND IT. KEEP THE HANDLE AND SHAFT CLEAN AND LUBRICATED TO ENSURE EASY WITHDRAWAL OF HANDLE.

DO NOT REMOVE GUARDS.

KEEP CLEAR OF HOT, MOVING OR ELECTRICAL PARTS.

IF THE ENGINE IS INSTALLED IN AN ENCLOSED SPACE, VENT THE EXHAUST FUMES TO ATMOSPHERE.

WHEN TESTING FUEL INJECTORS, DO NOT DIRECT THE SPRAY AT ANY EXPOSED PART OF THE BODY - IT CAN PENETRATE THE SKIN.

Publication No. 3165701

This book will help the user to get the best results from the engine. No engine will run without care, but it will give good service if given the attention described in this book.

Please record details of engine and installation in the spaces below

PETTER

TYPE	N ^o	b h p	rev / min
BS rating			

ENGLAND

USE ONLY GENUINE PETTER SPARES
WHEN WRITING QUOTE ENGINE N^o

3658

Copy details from engine label

ENGINE INSTALLATION

PLANT N^o.

Please remember . . .

- . . . an engine needs fuel—
Keep fuel, tank, filter and piping clean.
- . . . an engine needs lubricating oil—
Use the correct grade of oil. Keep oil level topped up.
- . . . an engine needs air—
Keep air cleaner clean. Keep air inlet manifold and entire exhaust system free of carbon and any other restriction.
- . . . an engine needs cooling—
Keep cooling system free from obstruction.

After approximately 20 hours initial running of a new or overhauled engine the following points should receive attention:

- (a) Check valve clearance
- (b) Drain lubricating oil from sump and refill with clean oil
- (c) Check fuel filter
- (d) Check all nuts, bolts, etc., for tightness

Requests for parts and service should be directed to:

Overseas

The appointed Petter agent or dealer in the territory

United Kingdom

Petters Ltd. Service Division
Hamble,
Southampton
SO3 5NJ
or Service Depots at

Phone: Hamble 2061
Telex: 47626
Telegrams:
Petter Hamble Telex

Petters Ltd. Service Depot,
Broomhill Industrial Estate,
Kirkintilloch,
Dunbartonshire

Kirkintilloch 041-776 2316/7/8
Telex: 778204

Petters Ltd. Service Depot,
Limewood Road, Seacroft, Leeds LS14 1LS

Leeds 649101

Petters Ltd. Service Depot,
Cliff Works, Burton-on-the-Wolds,
Loughborough, Leics

Wymeswold 880333

Petters Ltd. Service Depot,
Bridge Works, Staines, Mddx TW18 3AR

Staines 51333

[2]

[3]

Important

When purchasing parts or giving instructions for repairs customers should, in their own interest, always specify:

Genuine Petter Parts

Parts that have not been supplied by the Petter organisation cannot be relied upon for correct material, dimensions or finish. Petters cannot, therefore, be responsible for any damage arising from the use of such parts and the guarantee will be invalidated.

In your own interest, therefore, specify:

Genuine Petter Parts

Bore (nominal) 3-1/8 in (96.8mm)
 Stroke 110mm (4.33in)

Power and Speed per cylinder (B.S. continuous rating):

8.5 bhp at 1500 rev/min
 10 bhp at 1800 rev/min
 11.25 bhp at 2000 rev/min

Cubic capacity per cylinder 49.4 in³ (810.1 cm³)

Compression ratio 17.5:1

Lubricating oil pressure (min.) 40 lbf/in² (2.81 kgf/cm²)

Fuel injection release pressure 2850/3150 lbf/in² (200/221 kgf/cm²)

Fuel injection timing (by spill):

Fixed speed

Up to 1650 rev/min 23° before TDC
 1651 to 2000 rev/min 26° before TDC
 Variable speed 23° before TDC

Inlet valve opens 4 1/2° before TDC

Inlet valve closes 35 1/2° after BDC

Exhaust valve opens 35 1/2° before BDC

Exhaust valve closes 4 1/2° after TDC

With valve rockers set at 0.007in (0.18mm) hot clearance

Firing order (from gear end):

Three-cylinder engine 1. 3. 2.
 Four-cylinder engine 1. 3. 4. 2.

Oil capacity:

Three-cylinder engine 13.5 pints (7.67 litres)
 Four-cylinder engine 17.5 pints (9.94 litres)

Lubricating oil See approved list

Fuel A high grade light distillate diesel fuel in accordance with B.S. Specification No. 2869:1967 Class A1 or A2

Starter motor battery Volts 12
 Amperes 120

NOTE: Oil capacities, etc., are based on the Imperial (U.K.) gallon

Camshaft end float 0.005/0.028in (0.13/0.71mm)
 Crankshaft end float (new) 0.005/0.017in (0.13/0.43mm)
 Crankshaft end float (not to exceed) 0.025in (0.63mm)
 Crankpin ovality (not to exceed) 0.003in (0.08mm)
 Cylinder bore wear (not to exceed) 0.010in (0.25mm)
 Piston ring gap (new) 0.029/0.037in (0.74/0.94mm)
 Piston ring gap (not to exceed) 0.060in (1.52mm)
 Exhaust valve lift by decompressor (max) 0.025in (0.63mm)
 Bumping clearance 0.036/0.042in (0.91/1.07mm)
 Valve rocker clearance (cold) 0.004in (0.10mm)
 Valve depth from cylinder head face (new) 0.027/0.038in (0.68/0.96mm)
 Main bearing clearance (new) 0.0020/0.0050in (0.051/0.127mm)
 Large end bearing clearance (new) 0.0010/0.0030in (0.025/0.076mm)
 Small end bush diameter (fitted) 1.1825/1.1830in. (30.035/30.048mm)
 Drive shaft diameter 2.1246/2.1238in (53.964/53.944mm)
 Drive shaft keyway width 0.624/0.625in (5.85/5.87mm)

Cylinder reboring diameters:

Standard 3.8175/3.8185in (96.965/96.990mm)
 Oversize:
 0.020in 3.8375/3.8385in (97.478/97.498mm)
 0.040in 3.8575/3.8585in (97.981/98.006mm)

Crankshaft regrinding diameters:

	Main journal (gear end)	Main journal (flywheel end)	Intermediate journal and crankpin
Standard	2.3735/2.3733in (60.287/60.274mm)	4.1210/4.1205in (104.673/104.661mm)	2.3750/2.3745in (60.325/60.312mm)
Undersize:			
0.010in	2.3635/2.3630in (60.033/60.020mm)	4.1110/4.1105in (104.419/104.407mm)	2.3650/2.3645in (60.071/60.058mm)
0.020in	2.3535/2.3530in (59.779/59.766mm)	4.1010/4.1005in (104.165/104.153mm)	2.3550/2.3545in (59.817/59.804mm)
0.030in	2.3435/2.3430in (59.525/59.512mm)	4.0910/4.0905in (103.911/103.899mm)	2.3450/2.3445in (59.563/59.550mm)
0.040in	2.3335/2.3330in (59.271/59.258mm)	4.0810/4.0805in (103.657/103.643mm)	2.3350/2.3345in (59.309/59.296mm)

Torque spanner settings:

Large end bolt 57 lbf ft (7.88kgf m)
 Cylinder head nut 60 lbf ft (8.30kgf m)
 Cylinder stud 27 lbf ft (3.73 kgf m)
 Fuel pump union body 40 lbf ft (5.53 kgf m)
 Balance weight bolt 117 lbf ft (16.18 kgf m)
 Extension and starting shaft setscrew 27 lbf ft (3.73 kgf m)
 Flywheel and extension shaft bolt 47 lbf ft (6.49 kgf m)

TROUBLE LOCATING CHART

[8]

Trouble	Reason	Causes	Suggested Remedy
Engine will not start	Fuel supply failure Check by operating the fuel pump priming lever and listen for the characteristic squeak in the injector	No fuel in tank Air in the pipe line Broken fuel pipe or leaking connection Fuel filter choked Faulty injector nozzle Fuel pump plunger sticking Fuel pump tappet sticking	Fill tank and bleed the fuel system Repair or renew the pipe and tighten the connection Fit new filter element Fit new nozzle Fit new pump Free and clean the tappet
	Poor compression	Valves sticking Cylinder head loose Cylinder head gasket blown Piston rings stuck in grooves Worn cylinder and piston Valves not seating properly	Free the valves Tighten all nuts Fit new gasket Check rings and clean the piston Overhaul the engine Grind in if necessary Check valve clearance
	Incorrect lubricating oil	Too high a viscosity oil causing excessive engine drag	Drain the sump and fill with correct oil

TROUBLE LOCATING CHART—contd.

[6]

Trouble	Reason	Causes	Suggested Remedy
Engine starts but fires intermittently or soon stops	Faulty fuel supply Air in fuel lines Water in the fuel Faulty injector nozzle Fuel filter choked	Fuel filter choked Broken valve spring Sticking valve Pitted valve	Bleed the system Drain fuel system and fill with clean fuel Fit new nozzle Fit new filter element
	Faulty compression	Broken valve spring Sticking valve Pitted valve	Fit new spring Free the valve Grind or renew
Engine lacks power and/or shows dirty exhaust	Dirty exhaust	Blocked exhaust pipe or similar	Clean out
	Faulty fuel supply	Faulty fuel pump Faulty injector nozzle Unsuitable fuel	Fit new pump Fit new nozzle Drain the fuel system and fill with correct fuel
	Out of adjustment	Valve clearance incorrect Fuel timing incorrect	Adjust
	Dirty engine	Blocked exhaust pipe or similar Dirty air cleaner Faulty piston ring Excessive carbon on piston and cylinder head Worn cylinder and piston	Clean out Clean out Fit new ring Decarbonise Overhaul the engine

b installation

1. Engine bearers

Engine mounting bearers or framework must be of rigid construction and neither deflect nor twist when subjected to the weight of the engine and any ancillary equipment.

2. Erection

- (a) Installation drawings are obtainable from *Petters Ltd* or their agents.
- (b) Provision must be made for:
 - (i) Dipstick withdrawal, oil filler cap removal and oil draining.
 - (ii) Fuel and oil filter and air cleaner maintenance.
 - (iii) Fan belt adjustment.
 - (iv) Starting handle withdrawal and operation of controls.
- (c) Only good quality holding down bolts or studs may be used. Setscrews must NOT be used.
- (d) *Petters Ltd* or their agents should be consulted in the following cases:
 - (i) Before proceeding with any new form of installation.
 - (ii) Where the use of anti-vibration mountings is contemplated. (An unsuitable choice can be dangerous.)
 - (iii) When a portable installation is contemplated. In this instance a *Petter* engineer should be present when the initial installation is made.
 - (e) On direct driven sets, the driving and driven units must be lined up and a flexible coupling fitted.

3. Exhaust

- (a) The exhaust manifold has a 2in BSP thread. When a 'pepper-pot' type silencer is not fitted, the manifold is adapted to 2½in BSP.
- (b) Exhaust piping up to 20ft (6m) must be 2½in BSP. For exhaust pipe lengths in excess of 20ft (6m) consult *Petters Ltd* or their agents.
- (c) The 'pepper-pot' type of silencer supplied with the engine may only be screwed directly into the exhaust manifold. When an extended exhaust pipe is used, a larger silencer with a thread size the same as the exhaust pipe must be used.
- (d) An acoustic type silencer is obtainable from *Petters Ltd* or their agents and the thread size of the silencer must be the same as that of the exhaust pipe. A tail-pipe must be fitted to this type of silencer and the length of the tail-pipe must be ten times the inside diameter of the exhaust pipe, i.e., a tail-pipe 25in (635mm) long must be fitted to a 2½in BSP acoustic silencer.

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Trouble	Reason	Causes	Suggested Remedy
Knocking	Carbon on piston crown Injector needle sticking Fuel timing too far advanced Broken piston ring Slack piston Worn large end bearing Loose flywheel Worn main bearing	Adjust idler pulley Reduce the load Fill the sump and check system Check and adjust fuel pump setting Adjust Check that the cooling system is in order and free from obstruction	Decarbonise Fit new nozzle Adjust timing Fit new rings Renew and check lubrication Refit Renew and check lubrication
Overheating	Slack fan belt Overload Lubricating oil failure Cylinders giving unequal power Excessive valve clearance Cooling system failure	Air in fuel pipes Governor sticking	Adjust idler pulley Reduce the load Fill the sump and check system Check and adjust fuel pump setting Adjust Check that the cooling system is in order and free from obstruction
Speed surges	Empty fuel tank Choked injector Fuel pipe broken Seized piston	Air in fuel pipes Governor sticking	Adjust idler pulley Reduce the load Fill the sump and check system Check and adjust fuel pump setting Adjust Check that the cooling system is in order and free from obstruction
Sudden stop	Empty fuel tank Choked injector Fuel pipe broken Seized piston	Air in fuel pipes Governor sticking	Adjust idler pulley Reduce the load Fill the sump and check system Check and adjust fuel pump setting Adjust Check that the cooling system is in order and free from obstruction
Heavy vibration	Loose holding down bolts	Air in fuel pipes Governor sticking	Adjust idler pulley Reduce the load Fill the sump and check system Check and adjust fuel pump setting Adjust Check that the cooling system is in order and free from obstruction

[10]

- (e) The exhaust system should be as short as possible and with a minimum of bends, otherwise a serious reduction of power will result.
- (f) A short length of flexible exhaust piping should be included between the engine and main run of piping.

4. Air intake

Air is taken in through an air cleaner.

Engines installed in confined spaces require good ventilation to ensure a plentiful supply of cool, clean air.

5. Cooling (Fig. 1)

- (a) Cooling air is supplied by axial flow fans and care must be taken to ensure that fan housing air intakes are unobstructed.
- (b) Engines mounted inside housings or confined spaces must be provided with ample openings for the free circulation of air.
- (c) **UNDER NO CIRCUMSTANCES MAY ENGINES BE RUN WITHOUT FAN COWLINGS AND COWLING COVERS IN POSITION.**

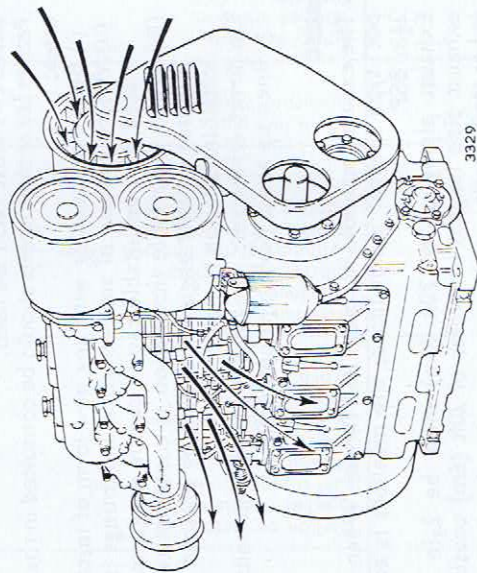


Fig. 1

6. Lubrication

- (a) The engine oils listed under Approved Lubricants are heavy duty oils with a minimum performance level as specified by: British Defence Specification No. 2101D or US Specification MIL/L/2104B
- (b) Suitable additional heavy duty engine oils will be recommended by a local oil distributor but a minimum performance level as above must be specified.

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- (c) Petters Ltd or their agents should be consulted if doubt arises regarding the selection of an engine oil.
- (d) **MARINE AUXILIARY INSTALLATIONS.** Although three viscosities of oil are recommended for differing climatic conditions, it is not always practical to change oils as the engine passes from one climate to another. Under these circumstances, for engines operating fire pumps or other equipment required to operate **IN AN EMERGENCY**, it is recommended that the oil selected should be of a viscosity suitable for the coldest climate likely to be encountered. It should be noted that this recommendation is made with ease of hand starting as a first consideration where an approved multi-grade oil is not available.

7. Fuel

- (a) The bulk storage of diesel fuel is subject to official regulations, but generally, storage is permitted above ground provided containers of authorised construction and capacity are used. **DO NOT** use galvanised containers or the zinc coating will react with the fuel and damage the fuel injection.
- (b) To prevent the harmful effects of moisture absorbed by fuel, provision must be made for draining off water which may accumulate at the base of the storage tank. The amount of water absorbed by fuel can be minimised by keeping storage tanks as full as possible and ensuring that filler caps, inspection covers, etc., have effective sealings.
- (c) Tank cocks for withdrawing fuel should be fitted a short distance above the base, enabling clean fuel to be withdrawn without disturbing water or sediment.
- (d) To ensure proper working of the fuel system the fuel must always be **CLEAN**.
- (e) Fuel should be allowed to settle before use. Sludge or water at the bottom of the container must not be used. Due to increased engine repair costs, a cheap fuel may prove very expensive in the long run.
- (f) Funnels or cans used for fuel should not be used for anything else and must be kept absolutely clean. They should be thoroughly dried before use.
- (g) The fuel tank should always be filled through a strainer. Occasionally the tank should be flushed out with petrol or paraffin.
- (h) The fuel used should be high grade light diesel fuel, gas oil or DERV fuel. It should comply with B.S.2869: 1967 Class A1 or A2, an extract of which is as follows:

	Class A1	Class A2
Cetane number (min.)	50	45
Viscosity (kinematic) at 37.8°C (100°F)	1.6 to 6.0 cSt	1.6 to 6.0 cSt

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Carbon residue. Conradson on 10% residue (by weight) (max) 0.2% 0.2%

Distillation recovered at 357°C (675°F) (by volume) 90% 90%

Flash point (closed) 55°C (130°F) 55°C (130°F)

Water (by volume) (max) 0.05% 0.05%

Sediment (by weight) (max) 0.01% 0.01%

Ash (by weight) (max) 0.01% 0.01%

Sulphur (by weight) (max) 0.5% 1.0%

Class A1 fuel is intended primarily for automotive use.

Class A2 is a general purpose fuel.

- (j) Winter and summer grades of diesel fuels are marketed during the appropriate seasons and are also graded for that part of the world in which they are intended to be used. Diesel fuels available for use in low temperature climates are classified as 'Cold Start Reference Fuels'. Make sure that the fuel being used is suitable for the prevailing temperature conditions.
- (k) Fuels for marine auxiliary engines required to operate under constantly differing climatic conditions should be suitable for the coldest condition likely to be encountered. This is particularly important when considering fire pumps, etc. required to operate in an emergency.
- (l) Some diesel fuels not suitable for low temperatures may form wax under these conditions. If it is suspected that wax has formed, the whole engine should be gently warmed throughout and the fuel tank, pipes, injector and fuel injection pump then completely drained and flushed with the correct fuel. Refill the fuel system with the correct fuel and bleed and prime before attempting to start.

8. Governing

The governor controls the engine at a predetermined speed irrespective of load variations between idling and full rated speed.

The governor weights are fitted to the camshaft and their action is transmitted by push rods in the camshaft to the fuel pump rack which governs the fuel available to the engine. The centrifugal forces on the governor weights are balanced out by an adjustable speeder spring. By varying the speeder spring pressure the speed of the engine can be altered.

The overload stop is set by *Petters Ltd* and should not be disturbed. Interference with the setting may result in the engine being overloaded or not delivering its rated power. Excessive load must be avoided and this will be indicated by the engine running below its rated speed and/or dirty exhaust.

[14]

C drive arrangements

9. Engine drive

Drive at engine speed on crankshaft at flywheel end. Starting on half speed extension at end remote from flywheel.

10. Pulley drive (Fig. 2)

When belt drives are used the belt should be as close to the engine as possible. When fixed and loose pulleys are fitted, the fixed drive must be nearest the engine.

To prevent damage to new vee belts when fitting, the distance between the centre of the engine pulley (A) and the driven pulley (B) must be capable of a reduction from the designed running position.

Provision must also be made for an increase of at least 2½% over the designed running position to provide adjustment for belt stretch and wear during the life of the belts. Multiple belts should always be renewed in matched sets.

Recommendations for flat and vee belt pulley drives are given on Data Sheet Nos. 81A and 81B obtainable from *Petters Ltd* or their agents.

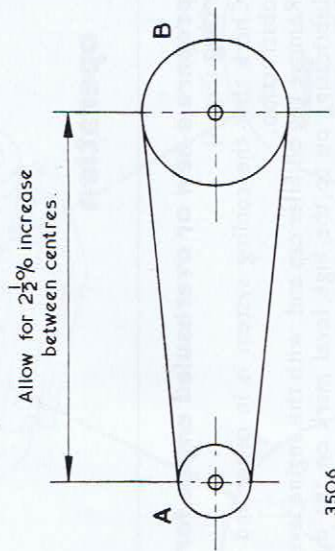


Fig. 2

11. Rotation

Standard engine rotation is clockwise when viewed from the flywheel end.

Engines with rotation reverse to standard are identified by a letter 'R' following the engine serial number.

[15]

12. Starting handle (Fig. 3)

The starting handle assembly can be arranged for either clockwise or anti-clockwise rotation of the starting shaft. (Check that the pawl is correctly assembled.)

The pawl may be fitted at the top or bottom to give alternative starting positions.

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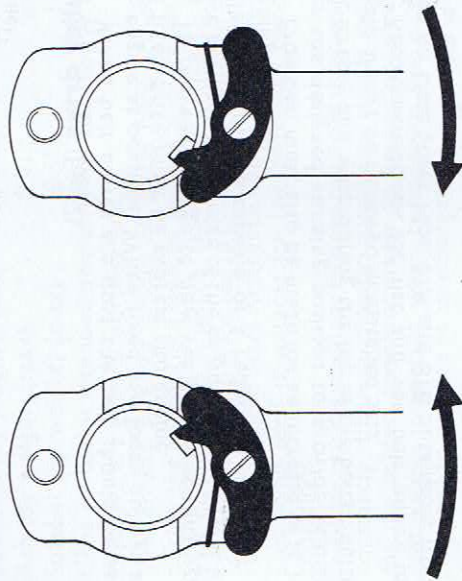


Fig. 3

d operation

13. To prepare a new or overhauled engine for starting (Fig. 4)

- Check that the cooling system is in order and free from obstruction.
- Remove the oil filler cap and, with the engine level, fill with lubricating oil to the high level mark on the dipstick. To ensure a correct reading, the dipstick should remain withdrawn while oil is being added and wiped before replacement. It should be submerged for at least five seconds between readings. Replace cap. (After a few minutes running, stop the engine and top up the oil, as the level always falls slightly after the initial circulation.)
- Grease the fan and fan idler pulley bearings.
- Lift the decompressor level and turn the engine fifteen times to help circulate the oil.
- Fill the fuel tank. Bleed and prime the fuel system.

[16]

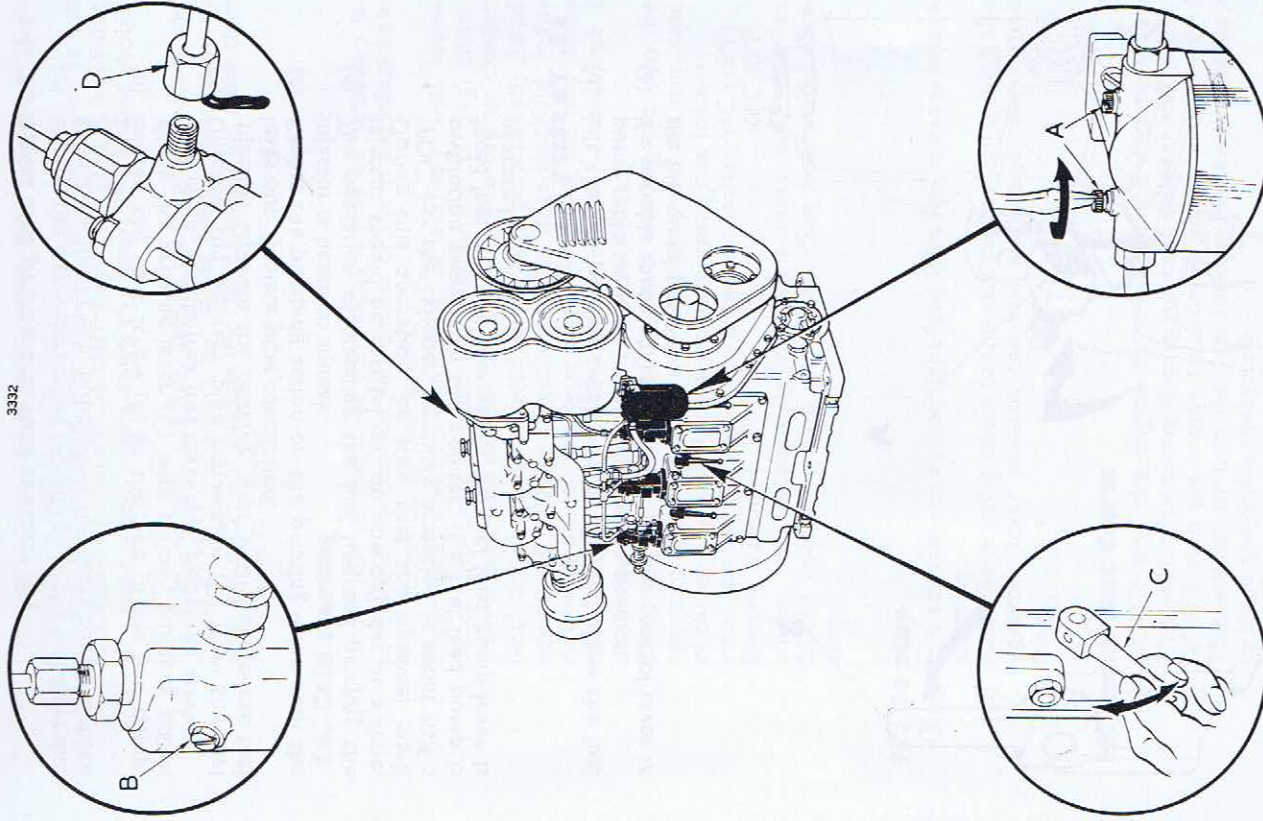


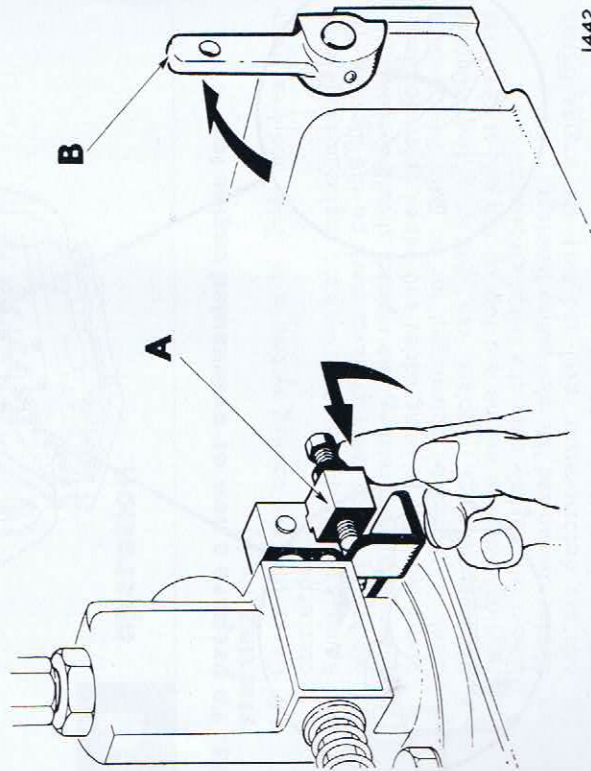
Fig. 4
[17]

14. To bleed and prime the fuel system (Fig. 4)

- (a) Loosen the two vent screws (A) on top of the fuel filter and keep loose until clean, bubble-free fuel leaks out. Retighten screws.
- (b) Loosen the vent screw (B) at the side of the fuel pump. Work the priming lever (C) with a slow, pumping action until clean, bubble-free fuel leaks out. Retighten screw.
- (c) Unscrew the delivery pipe connection (D) from the fuel injector. Operate the priming lever until bubble-free fuel leaks out. Replace pipe connection.
- (d) Repeat the pumping action on the priming lever until the injector is heard to squeak.
- (e) The operation of bleeding the fuel line and priming the injector should be carried out on one cylinder at a time. During this operation, be sure that the flywheel mark 'TDC' for the cylinder receiving attention is about half a revolution away from the pointer. If a fuel feed pump is fitted fuel will not flow unless the fuel feed pump lever is operated.

15. To start (Fig. 5)

- (a) Lift the red painted overload stop (A) and allow the fuel pump racks to move into the fully open position.
- (b) If a variable speed control is fitted, set the control lever in the full speed position.



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Fig. 5

[18]

- (c) Give each cylinder half a dozen priming strokes. (This is unnecessary with a warm engine.)
- (d) Lift the decompressor level (B) and turn the engine as fast as possible or operate the starter motor. When it is turning at a good speed, knock down the lever. The engine should now fire.
- (e) If the engine does not fire, lift the decompressor lever and slowly turn the engine a few times before attempting to start again. Do not operate the starter motor for more than 20 seconds at a time.

16. Cold starting

- (a) Under low temperature conditions it may be necessary to use a cold starting aid and details of these are obtainable from *Petters Ltd* or their agents. These aids may be in the form of auxiliary fuels introduced into the combustion system during starting, either from a hand-held aerosol can, spraying into the air cleaner (with the element removed) or through permanently fitted equipment spraying directly into the inlet manifold. Indiscriminate use of this type of cold starting aid may cause damage. *Petters Ltd* or their agents should be consulted if doubt arises regarding the use of such aids. Temperatures below which a cold starting aid may be required will depend on the installation and the condition of the engine and these are approximately as follows:
Hand starting (on half speed extension shaft) — 9°C (15°F)
Electric starting — 18°C (0°F)
Under low temperature conditions make sure that an SAE10 viscosity engine oil is used. (See Approved Lubricants.)

17. To stop

- (a) It is advisable to run on light load for a few minutes before stopping.
- (b) Raise the priming levers to the vertical position or push the governor lever towards the fuel pump until the engine stops.

18. Important don'ts

- (a) DON'T stop the engine by means of the decompressor. This will lead to damaged valve seats and cylinder head joints.
- (b) DON'T stop the engine by allowing the tank to run dry. This will let air into the fuel lines and make it necessary to bleed and prime the system.
- (c) DON'T remove or alter the setting of the overload stop.
- (d) DON'T forget to grease the starting handle shaft. Make sure the starting handle can be freely withdrawn.

[19]

running maintenance

19. Daily

- (a) Check lubricating oil and top up if necessary.
- (b) Check that the cooling system is in order and free from obstruction.
- (c) Check fan belt tension.
- (d) Screw down the grease cup half a turn on the fan belt idler pulley housing.

NOTE:

The following maintenance recommendations are for average operating conditions. Under very dusty conditions, air cleaners, lubricating oil and fuel filters will require more frequent attention. Decarbonising may be required more frequently when engines are running on light load for long periods.

20. Every 50 hours

- (a) Clean the air cleaner (oil bath type.)

21. Every 250 hours

- (a) Clean the fuel filter.
- (b) Check all nuts, bolts, etc., for tightness. (The cylinder head nuts must NOT be tightened when the engine is hot.)
- (c) Make sure the fuel tank filler cap vent hole is clear.
- (d) Clean the air cleaner (paper element type).
- (e) Clean out deposit from exhaust system.
- (f) Clean the fuel feed pump strainer.
- (g) Grease the fan.
- (h) Drain the sump, flush out with flushing oil and refill with new oil. Clean the strainer. (Paraffin may be used if flushing oil is unobtainable but the engine must not be run with paraffin in the sump.)
- (j) Test the fuel system for leaks.
- (k) Remove the fuel injectors and test spray. If in order replace without further interference.
- (l) Check the valve clearance and adjust if necessary.
- (m) Fit new lubricating oil filter element and joint ring.
- (n) Lubricate the speed control linkage.

22. Every 500 hours

- (a) Fit new fuel filter element.
- (b) Fit new air cleaner elements.

23. Every 2000 hours

- (a) Decarbonise.
- (b) Clean out piston oil return holes. Check cylinder bore wear.

[20]

f

general maintenance

- (c) Examine the crankshaft bearings and renew if clearance is excessive.
- (d) Clean out the fuel tank thoroughly.
- (e) Wash out lubricating oil system.
- (f) Fit new fan belt.

24. Decarbonising

A carbon deposit forms on piston and cylinder heads and the presence of an excessive carbon deposit is usually indicated by a dirty exhaust and a falling off of power.

Decarbonising necessitates the removal of the cylinder head, followed by the removal of all carbon and the grinding in of the valves. These operations are described in subsequent paragraphs. Sets of joints are obtainable from *Petters Ltd or their agents*.

25. To remove cylinder head

- (a) Remove the cylinder cowl.
- (b) Remove the air inlet and exhaust manifolds.
- (c) Remove the fuel injector.
- (d) Disconnect the rocker oil pipe.
- (e) Remove the rocker box.
- (f) Remove the rocker assembly complete with its support and withdraw the push rods.
- (g) Remove the cylinder head nuts and lift off the cylinder head.

26. To dismantle cylinder head

- (a) Remove the decompressor shaft pin and slide off washers and oil seal. Remove the rocker box plate, remove the decompressor screw and withdraw the shaft.
- (b) Remove the circlips from valve rocker shaft and remove the rockers.
- (c) To remove valves. Remove the split pin locating the inlet valve. Press down the valve spring cups and remove the split collets from the valves stems. A special tool for this purpose can be obtained from *Petters Ltd or their agents*. Valves and springs can now be removed.

27. To remove carbon

- (a) Turn crankshaft until piston is at top of its stroke.
- (b) Scrape carbon from the cylinder head and top of piston. An old screwdriver or other blunt tool may be used. Emery cloth must NOT be used. Do not allow carbon dust to fall between the piston and the cylinder bore.

[21]

- (c) Thoroughly clean out the exhaust and inlet ports and manifolds.
- (d) IT IS IMPORTANT that the recesses at the ends of valve guide bores are free from carbon.
- (e) Thoroughly clean the valves and examine the valve seats. If these show signs of pitting, they should be ground in.
- (f) Make sure the valves are seating properly. Leaking valves cause loss of compression and difficult starting.

28. To grind in valves

- (a) Care must be taken that the valves are returned to their correct seatings for this operation.
- (b) Place a very small quantity of grinding paste evenly around the valve seat and insert the valve. Partially rotate the valve backwards and forwards on its seating exerting a gentle but firm pressure.
- (c) Periodically lift the valve from its seating and give it half a turn, thus ensuring that the grinding paste is evenly spread. It is unnecessary to continue grinding once the faces of the valve and its seating have a clean, even, matt-surfaced appearance. A polished surface must not be expected and is unnecessary.
- (e) Wash out the ports thoroughly with petrol or paraffin making sure that all traces of grinding paste are removed from the valves and guides.
- (f) Replace the valves and rotate them backwards and forwards a few times. If the valves have been correctly ground a thin polished line will appear all round the seat.

29. To replace cylinder head (Fig. 6)

- (a) Generally reverse the instructions for removal and dismantling.
- (b) It is IMPORTANT that the exhaust and inlet valves be returned to their correct positions.
- (c) If the valves are distorted or very badly pitted, fit new ones.
- (d) If new valves or guides are fitted, the valves must be ground in.
- (e) The split pin hole in the inlet valve stem is offset from the centre. Ensure that the valve spring cup is located by its pin and the hole in the valve stem lines up with the groove in the cup before fitting the split pin.
- (f) A new cylinder head gasket must be fitted if the old one shows any sign of damage. It is a wise policy to fit a new cylinder head gasket every time a cylinder head is removed. Make sure the manifold bolting faces are square and parallel with each other. Check with a straight edge before tightening the cylinder head nuts.
- (h) When replacing the push rod tubes, make sure that the stepped portion (A) of the assembly is fitted at the bottom and that the oil seals (B) and joint washers (C) are in good

condition and seating properly. Make sure that the push rod tube covers (D) are correctly fitted with the ends folded inward to form a dust-proof and oil-tight seal. Failure to observe these precautions may lead to oil leaks.

- (j) As the engine is fitted with long, through studs from the crankcase to the cylinder head it is MOST IMPORTANT that the cylinder head nuts are correctly tightened and in the right sequence. Proceed as follows:

- (i) Screw down each cylinder head nut until finger tight.
- (ii) Tighten each nut a quarter of a turn at a time working diagonally across the cylinder head until all nuts are tight.

- (k) Tighten the cylinder head nuts using a torque spanner set to the figure shown under Technical Data.

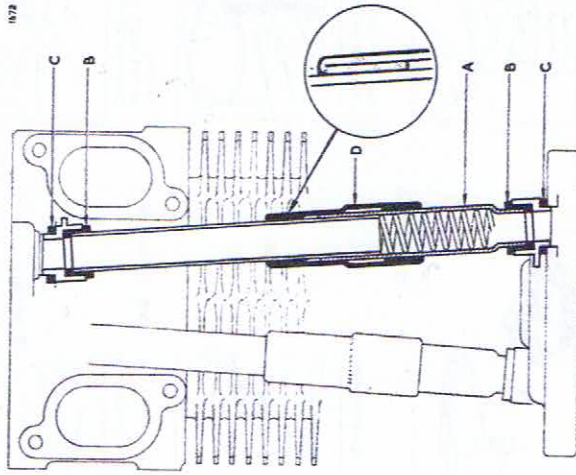


Fig. 6

30. To adjust valve rockers (Fig. 7)

- (d) To adjust the clearance, set the engine with valves closed (TDC of firing stroke), loosen the locknut (A) and turn the rocker adjusting screw (B) with a screwdriver. Measure the gap with a feeler gauge, and when the correct setting is obtained (see Technical Data) retighten the locknut. Recheck the gap.

(b) The exhaust valve should be lifted the correct amount by the movement of the decompressor lever, when fitted, from the horizontal to the vertical position. The setting may be obtained as follows:

- (i) Turn the engine until piston is on the compression stroke, i.e. both valves closed.
- (ii) Remove the rocker box plate and turn the decompressor lever to the vertical position.
- (iii) Slacken locknut and turn the decompressor adjusting screw until it just touches the valve rocker. A further two thirds of a turn will lower the valve the required amount. The easiest way to carry out this adjustment is to insert a box spanner through the hole in the rocker box to loosen the locknut and to pass a screwdriver through the box spanner to adjust the decompressor adjusting screw. Make sure the screw does not move while tightening the locknut.

NOTE: The valve should not be lifted more than the specified amount (see Technical Data) or it will cause serious damage by hitting the piston. When the decompressor is in operation, air is allowed to escape from the cylinder through the slightly opened exhaust valve. Compression cannot therefore build up and the engine will turn and will not fire.

(c) **IMPORTANT.** The cylinder head must be firmly bolted in position, with all nuts finally tightened, before the rocker clearances are adjusted. This also applies to the rocker box when adjusting the decompressor lift. ALWAYS check the decompressor after removing the rocker box and adjust if necessary.

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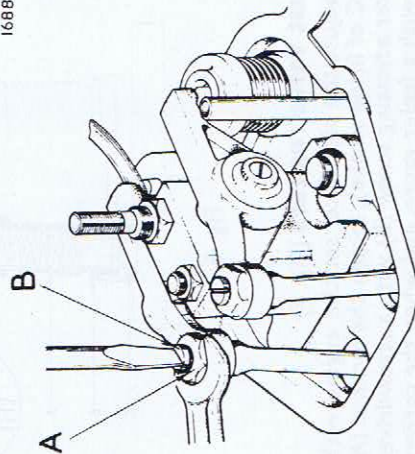


Fig. 7

[24]

31. To remove cylinder and piston

- (a) Remove the cylinder head.
- (b) Lift the cylinder off the crankcase and draw it off the piston.
- (c) To remove piston, take out one gudgeon pin circlip and push out gudgeon pin. If the gudgeon pin is a tight fit in the piston, wrap the piston in a cloth soaked in hot water. After a few minutes the gudgeon pin will be released and can be pushed out.

32. Cylinder maintenance

- (a) When the cylinder bore wear has reached the maximum (see Technical Data) the cylinder should be bored out and an oversize piston and rings fitted.
- (b) The cylinder should be rebored and honed to the sizes shown under Technical Data.

33. Piston maintenance (Fig. 8)

Excessive lubricating oil consumption, loss of compression and knocking are signs that a piston may need attention.

- (a) If the ring gaps are excessive (see Technical Data) the rings should be renewed. To measure the gaps remove the rings from the piston noting the order of assembly and which ring face is uppermost.
- (b) Remove all the carbon deposit from the rings and ring grooves. The small holes (A) in scraper ring grooves should receive attention as their purpose is to return excess oil to the sump.
- (c) Insert the piston into the cylinder bore with the crown towards the bottom end of the bore to about $\frac{1}{2}$ in (13mm) from the bottom edge. Insert the rings one at a time, pushing each ring hard up against the piston crown to ensure that it is level in the cylinder bore. Withdraw the piston sufficiently to allow the gap to be measured with a feeler gauge.
- (d) Assemble the rings on the piston in the correct order with the correct face uppermost. Rings should not be slack or stuck fast in the groove. With the piston held in a horizontal position the rings should not fall downwards unless the piston is shaken. This applies only to a piston and rings free from grease or oil.
- (e) When the engine has been fully run in, the bore will have a highly polished and very hard surface. If new piston rings are fitted without the cylinder being rebored or resleeved, the new rings will not bed in satisfactorily. Under these conditions the cylinder should be removed and the hard polished bore lightly roughened using a medium grade emery cloth. The roughening should be carried out radially by hand and should be sufficient only to produce a matt surface on the bore. Alternatively, a suitably sized de-glazing tool of the rotary brush type with silicone-carbide tips may be

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used provided method used is in accordance with manufacturers' instructions. After this treatment the cylinder must be thoroughly washed in petrol or paraffin to remove all traces of corborundum.

- (f) To allow the piston rings to bed in satisfactorily it is recommended that the engine be run on half load whenever possible after overhaul.

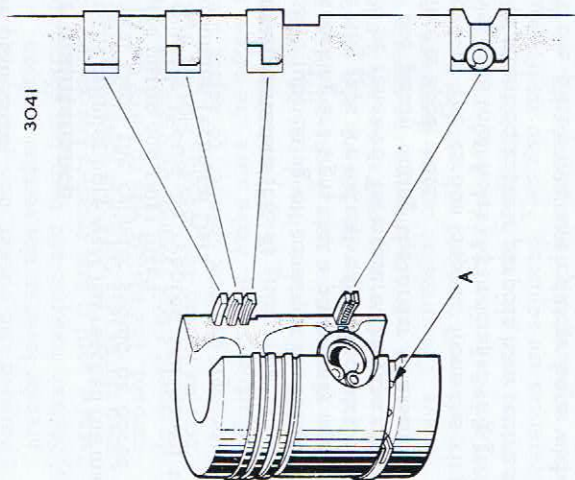


Fig. 8

34. To replace cylinder and piston

- When replacing the cylinder make sure the cylinder ring is smeared with grease and correctly fitted in the groove.
- Take care that the piston ring gaps are not in line but well distributed around the piston circumference.
- Replace the shims between the cylinder and the crankcase. The thickness of the shims controls the bumping clearance between the piston and the cylinder head at TDC.
- Push the cylinder into the crankcase by hand. Push it in squarely to avoid damaging the cylinder ring.
- Before completing reassembly, check the bumping clearance (see Technical Data) as follows:
Place two pieces of lead wire on top of the piston roughly at right angles to the gudgeon pin. Replace the cylinder head gasket and cylinder head and bolt down firmly. Turn the engine over TDC, remove the cylinder head and measure the thickness of the now flattened lead wire with a micrometer.

- (f) After completing reassembly, check the valve rocker clearance and reset the decompressor.

35. To examine connecting rod

- Remove the crankcase inspection cover.
- Insert hand and grasp the large end of the connecting rod. Check for undue play or shake in the bearing. The engine should be decompressed during this operation and the flywheel rocked backwards and forwards.
- Check that the connecting rod bolts are tight.

36. To remove connecting rod

- Remove the cylinder head and cylinder.
- Remove the crankcase inspection cover.
- Remove the fuel pump bracket assembly.
- Remove the large end bolts and withdraw the connecting rod and piston assembly, being careful to note in which position the bearing halves are fitted. Note the crankshaft assembly positions.

37. Connecting rod maintenance

- When fitting a small end bush take care that the oil hole coincides with that in the connecting rod and that the bush enters the connecting rods squarely. In the absence of a press, a block of wood and mallet may be used for driving it home. New small end bushes are supplied with a reaming allowance, and after fitting must be reamed to the size shown under Technical Data.
- Large end bearings are of the precision thin wall steel backed type and consist of two half shells lined with bearing metal. They should be replaced in their original positions.
- New bearings are machined to give the required fit when in position and should not be scraped or bedded in, neither should shims of any description be fitted. If the faces of the connecting rod or its cap are filed the rod becomes useless regarding replacement bearing shells. When fitting make sure that the connecting rod bore and the outside of shells and their split faces are clean.
- Connecting rods and caps are stamped with an assembly serial number and care must be taken that numbers are correctly assembled and on the same side.
- Undersize bearings are obtainable from *Petters Ltd* or their agents.

38. To replace connecting rod

- (a) Generally reverse the instructions for removal. When replacing the connecting rods make sure that the bolt heads are facing **AWAY** from the camshaft and fuel injection pumps.

- (b) Replace the connecting rods in their original positions. New connecting rods must balance within $\frac{1}{4}$ oz (7g).
- (c) Tighten the large end bolts using a torque spanner set to the figure shown under Technical Data. Do not overtighten the bolts or the bearings may distort.
- (d) When replacing the cylinder and cylinder head, check the bumping clearance and adjust valve rocker clearance.

39. To remove flywheel

- (a) Bend back the tabwashers on the flywheel or flywheel extension shaft bolts.
- (b) Remove two of the flywheel retaining bolts (diagonally opposite) and replace the two bolts by similar threaded studs. Remove the four remaining flywheel retaining bolts and pull off the flywheel onto the two long studs, taking care not to damage the flywheel fan if fitted.

40. To replace flywheel

- (a) Generally reverse the instructions for removal.
- (b) Tighten the flywheel or flywheel extension shaft bolts using a torque spanner set to the figure shown under Technical Data.
- (c) Bend up the tabwashers.

41. To remove crankshaft

- (a) Remove the cylinder heads, cylinders and connecting rods.
- (b) Remove the fan belt guard, slacken the idler pulley or dynamo-adjustment and remove the fan belt.
- (c) Remove the setscrews securing the fan driving pulley and withdraw the pulley.
- (d) Release the strap holding the cowl to the fan housing.
- (e) Remove the flywheel.
- (f) Remove the gear cover and fan assembly. The two hexagonal headed dowels can be levered out with a spanner on edge.
- (g) Remove the bolt and gearwheel retaining plate from the gear end of the crankshaft and withdraw the gearwheel with a simple extractor. A special tool for this purpose can be obtained from *Petters Ltd* or *their agents*.
- (h) Remove the setscrews at the side of the crankcase that hold the intermediate main bearings housings in position.
- (i) Mark the balance weights to identify the assembly positions. Unscrew the bolts and remove the balance weights and washers.
- (k) Remove the flywheel end main bearing housing.
- (l) Withdraw the crankshaft by pulling towards the flywheel end. The oil pump gearwheel is a forced fit on the crankshaft and should not be removed.

- (m) Mark the halves of the intermediate main bearing housings to identify the assembly positions and remove the housings. The halves of each housing are machined as an assembly and must not be mixed with those of another housing assembly.

42. Crankshaft maintenance

- (a) Carefully examine the bearing journals and crankpins. They should be free from score marks and ovality should not exceed the maximum (see Technical Data).
- (b) If these defects are present the crankshaft should be re-ground to the diameter shown under Technical Data and undersize bearings fitted.
- (c) Carefully clean out the oil holes and make sure they have radiused edges.

43. Main bearing maintenance

- (a) Intermediate main bearings are of the precision thin wall steel backed type and consist of two half shells lined with bearing metal. They should be replaced in their original positions. The two halves of the intermediate bearing housing are stamped with an assembly serial number and care must be taken that numbers are correctly assembled and on the same side.
- (b) Main bearings are of the precision thin wall steel backed sleeve type lined with bearing metal. When replacing a bearing take care that it enters the bearing housing squarely, that the oil holes in the bearing and the housing are in line, and the bearing split is slightly above the horizontal.
- (c) New bearings are machined to give the required fit when in position and should not be scraped or bedded in, neither should shims of any description be fitted.
- (d) Undersize bearings are obtainable from *Petters Ltd* or *their agents*.

44. To replace crankshaft and time engine (Fig. 9, 10 & 14)

- (a) Generally reverse the instructions for removal. The crankshaft gearwheel is a tight fit on the crankshaft and it may be necessary to heat the gearwheel before fitting it to the crankshaft. Do not overheat the gearwheel or its hardness may be affected.
- (b) Fit new bearings if the old ones have excessive clearance or show signs of the metal having run. Make sure that the bearing shell at the gear end does not protrude beyond the limits shown in the illustration.
- (c) Make sure that the intermediate main bearing housings are correctly fitted with the oil hole (A) and locking screw hole (B) in their relative positions. Make sure that the dowels (D) are correctly fitted.

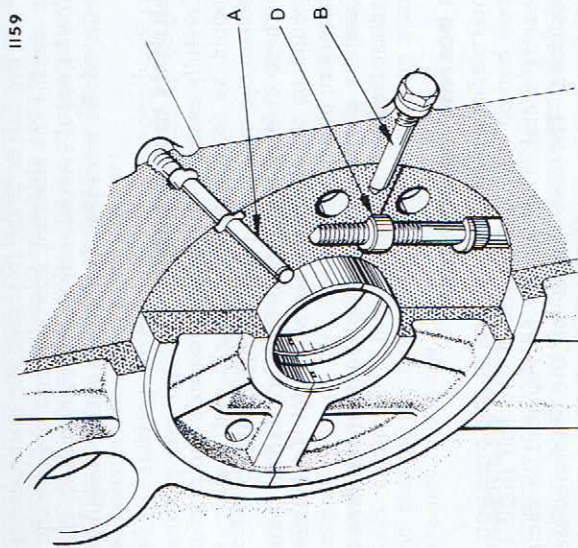


Fig. 9

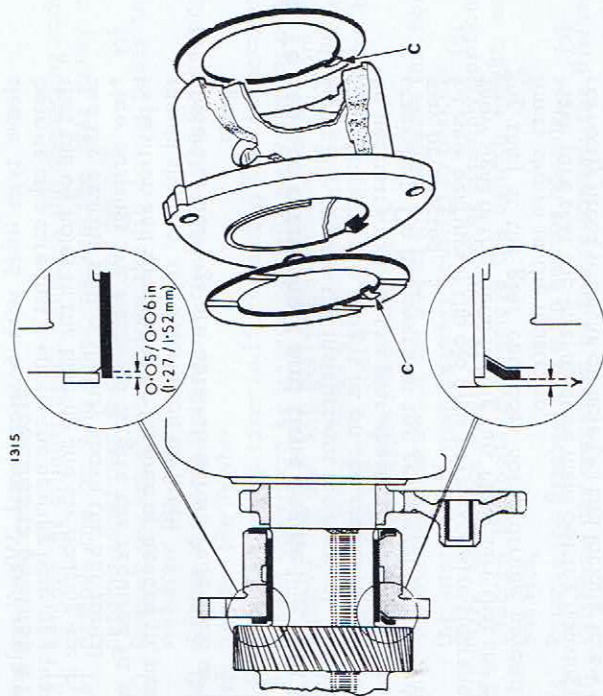


Fig. 10

[30]

- (d) If the main bearing housing at the gear end has been removed, make sure it is correctly fitted with the oil hole in line with the oil hole in the crankcase.
- (e) When replacing the thrust washers, be sure that the grooved sides are away from the bearing housing and the tongues (C) located in their respective recesses.
- (f) Before completing the assembly, check the end float (Y) and if excessive fit new thrust washers (see Technical Data). The outer thrust washer is located by the bearing shell which protrudes slightly from the housing and the inner one by a recess in the housing. They should be replaced in their original positions.
- (g) Replace the balance weights in their original positions. New balance weights must be balanced within $\frac{1}{4}$ oz (7g). If balance weights have been removed tighten the balance weight bolts using a torque spanner set to the figure shown under Technical Data.
- (h) When assembling the gearwheels make sure that the teeth marked with dots are in their relative positions.

45. Lubricating oil system (Fig. 11)

- (a) The lubricating oil system is as follows:
 - (i) A rotary oil pump is mounted on the crankcase at the gear end. The pump is driven by a gear and idler gear from the crankshaft.
 - (ii) Oil is drawn through a strainer and fed to the filter.
 - (iii) Oil flows from the filter via oilways in the crankcase to the main bearings.
 - (iv) The large end bearings are supplied with oil from the main bearings via holes in the crankshaft.
 - (v) The valve rockers are supplied with oil by an external pipe.
 - (vi) An adjustable pressure relief valve is incorporated to control the oil pressure.
- (b) The cylinders, small end bearings and camshaft are splash lubricated.
- (c) The sump can be drained by removing the plug at the bottom of the crankcase.
- (d) Oil must always be CLEAN and containers, funnels, etc., must be kept in a spotless condition. Use only approved oil. Cheap, unsuitable or dirty oil will cause trouble.

46. Oil filter maintenance

- (a) The filter incorporates an adjustable pressure relief valve to control the oil pressure. This valve is set by Petters Ltd and should not require further adjustment.
- (b) Should the filter become blocked with dirt, the element bypass valve will open and unfiltered oil will flow directly from the pump to the bearings, etc. Make sure that the

[31]

- (c) To replace
 - (i) Generally reverse the instructions for removal, making sure that the joint washer and oil seal are in position.
 - (ii) When tightening the banjo bolt securing the strainer to the crankcase make sure that the strainer is firmly held in its correct position. Failure to observe this precaution may result in the strainer twisting and being damaged.

48. To remove oil pump

- (a) Drain the oil.
- (b) Remove the oil strainer.
- (c) Remove the setscrews and nut retaining the pump and remove the pump, noting the position of the stepped stud locating the pump. The easiest way of removing the pump is to screw two $\frac{5}{16}$ in BSF bolts into the threads provided in the pump and to exert an even pull on both bolts.
- (d) The idler gear is retained on the spigot by a circlip and is accessible through the crankcase inspection cover. The spigot is located in the crankcase by the gear cover plate.

49. To dismantle oil pump

- (a) Tap the pin out of the driving gear hub and pull off the gear.
 - (b) Remove the screws retaining the cover and remove the cover.
 - (c) Withdraw the rotor and stator components.
- NOTE: The cover is dowelled to the body.

50. Oil pump maintenance

- (a) Thoroughly clean all parts.
- (b) Carefully examine the rotor and stator. If they are scored or show signs of wear fit new parts.

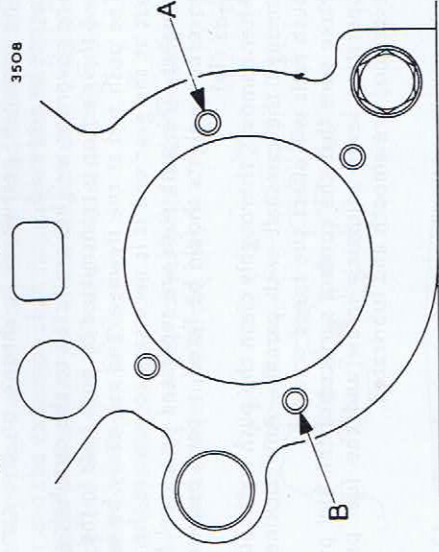


Fig. 12

[33]

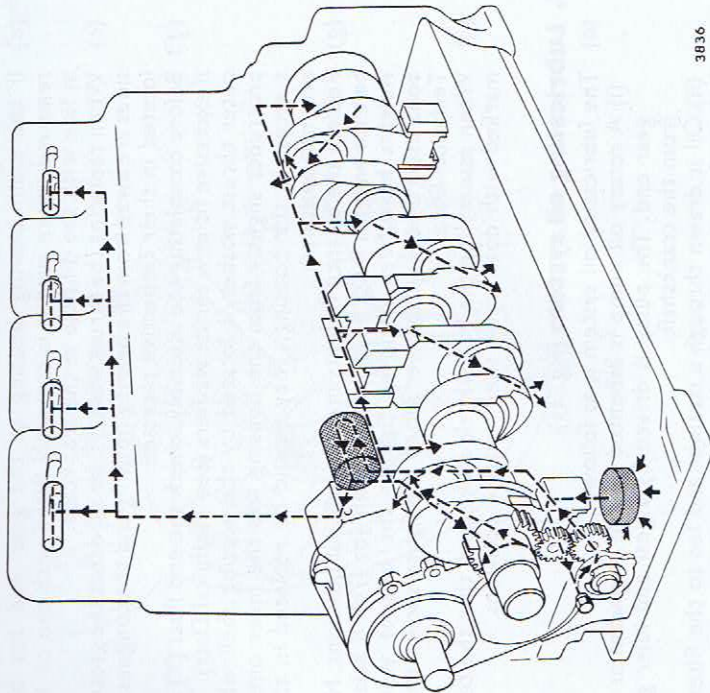


Fig. 11

bypass valve is seating correctly but do not dismantle the valve.

- (c) To change element
 - (i) Unscrew the clamp bolt at the centre of the filter bowl and withdraw the bowl complete with element.
 - (ii) Thoroughly clean out the bowl and examine the joint ring.
 - (iii) If the element shows a large deposit of dirt, fit a new element, obtainable from *Petters Ltd* or their agents. Do not attempt to clean the element.
 - (iv) Fit the new joint ring supplied with each element.

47. Oil pump strainer

- (a) To remove
 - (i) Drain the oil.
 - (ii) Remove the crankcase inspection cover.
 - (iii) Remove the banjo bolt securing the strainer to the crankcase and remove the strainer.
- (b) To clean
 - (i) Wash the strainer in clean paraffin or fuel.

[32]

51. To replace oil pump (Fig. 12)

- (a) Generally reverse the instructions for removal and dismantling.
- (b) Make sure the stepped stud locating the pump is in the correct position. The stud should be fitted at (A) for standard rotation engines or at (B) for reverse rotation engines.

52. To remove camshaft

- (a) Remove the starting shaft oil seal housing or blanking plate.
- (b) Remove the fan belt guard, slacken the idler pulley or dynamo adjustment and remove the fan belt.
- (c) Remove the setscrews securing the fan driving pulley and withdraw the pulley.
- (d) Release the strap holding the cowl to the fan housing.
- (e) Remove the gear cover. The two hexagon-headed dowels can be levered out with a spanner on edge.
- (f) Disconnect fuel pipes and remove the fuel pump bracket assemblies.
- (g) Remove rocker box and rocker assemblies complete with the supports and withdraw the push rods. Remove the push rod tubes.
- (h) Wind a rubber band or piece of string round the shanks of the tappets to prevent their falling into the sump when the camshaft is withdrawn.
- (j) Withdraw the camshaft assembly, which includes the governor, from the gear end of the engine.

53. Camshaft and governor maintenance

- (a) Carefully examine the faces of the cams. If these are worn or chipped it will be necessary to fit a new camshaft.
- (b) The camshaft gearwheel is shrunk on the camshaft and cannot be removed.
- (c) The governor weights are fitted to the camshaft gearwheel and their action is transmitted by push rods in the camshaft. The push rod at the flywheel end can easily be withdrawn but at the gear end it is necessary to remove the governor weights. The push rods are separated by a steel ball. New governor weights should be fitted in pairs balanced within $\frac{3}{32}$ oz (1g).
- (d) After removal, thoroughly clean the push rods and the hole through the camshaft with paraffin. Any stickiness of the push rods will affect the speed control.
- (e) Make sure that the contact surfaces of the fuel pump rack operating lever adjusting screw and the fuel pump rack extension are smooth and lubricated.

54. To replace camshaft and time engine (Fig. 13 & 14)

- (a) Generally reverse the instructions for removal.

- (b) When fitting new thrust washers, be sure that the grooved side of the inner thrust washer is against the thrust face of the camshaft and that the tongue (A) is located in the recess. Fit new pins (D). The inner thrust washer is located by the gear cover plate and the outer one by the extension shaft housing or blanking plate.
- (c) When assembling the gearwheels make sure that the teeth marked with dots are in their relative positions.

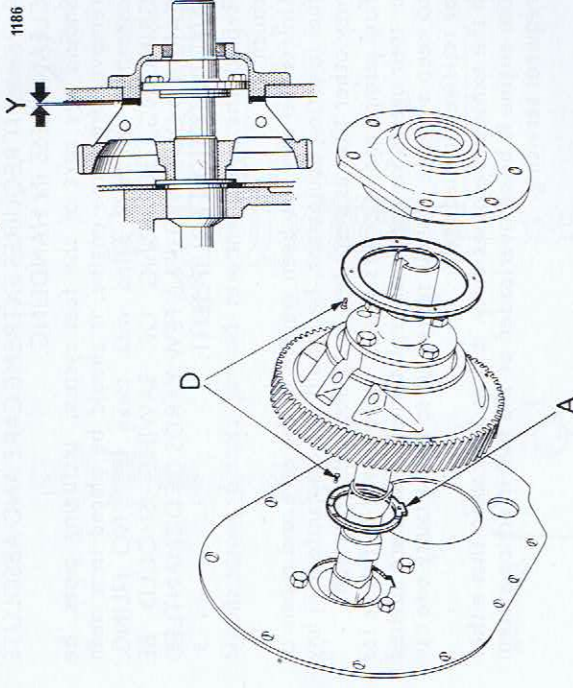


Fig. 13

- (d) Make sure that the correct joint is fitted between the gear cover and the extension shaft housing or blanking plate. The thickness of the joint will affect the camshaft end float.
- (e) Check the end float (Y) and if excessive fit new thrust washers (see Technical Data).
- (f) Adjust valve clearances.
- (g) When replacing the gear cover plate bolts ensure that the small headed bolts are at the top.

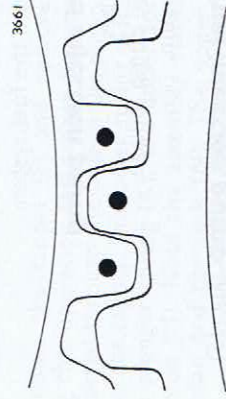


Fig. 14

55. Fuel system

- (a) Fuel from the tank flows through a filter to the injection pump which supplies it under high pressure to the injector.
- (b) A small amount of fuel is always leaking back along the injector nozzle needle and this is returned to the fuel system by a pipe.
- (c) The quantity of fuel injected during each cycle is very small and the fuel injection equipment is manufactured to very fine limits. IT REQUIRES EXTREME CARE AND ABSOLUTE CLEANLINESS IN HANDLING.
- (d) Should any part of the fuel system, including pipes, be removed from the engine, it should be placed in a clean container which is filled with clean fuel. NO FILING, GRINDING, SCRAPING OR SAWING SHOULD BE CARRIED OUT WITHIN A FEW YARDS OF DISMANTLED FUEL INJECTION EQUIPMENT.
- (e) Replace the equipment wet. No rag, cloth or waste should touch it.
- (f) Unless the user has been trained in the care and repair of fuel injection equipment, he should not dismantle it in any way other than as described in subsequent paragraphs.
- (g) Fuel pumps and injectors should be returned to *Petters Ltd* or their agents for repair or replacement. Users are advised to keep a nozzle in their spares kit so that a faulty one can be renewed immediately.
- (h) If the exhaust becomes dirty, it is an indication that either the engine is being overloaded or the fuel injection system requires servicing.

56. To clean fuel filter

- (a) Unscrew the clamp bolts at the centre of the filter bowl and withdraw the bowl complete with element.
- (b) Thoroughly clean out the bowl and examine the joint ring.
- (c) If the element shows a large deposit of dirt, fit a new element obtainable from *Petters Ltd* or their agents. Do not attempt to clean the element.
- (d) It is advisable to fit a new joint ring when the element is changed.
- (e) Reassemble the filter.
- (f) Bleed and prime the fuel system.

57. To remove fuel injection pump

- (a) Disconnect pipes.
- (b) Disconnect the pump linkage.
- (c) Remove the pump.

58. To dismantle fuel injection pump (Fig. 15)

- (a) Thoroughly clean the exterior of the pump.

[36]

- (b) Unscrew the union body (A) and lift out the delivery valve spring (B) and the delivery valve (C).
- (c) Withdraw the delivery valve seat (D) and the joint (E). A special tool for this purpose can be obtained from *Petters Ltd* or their agents, or the delivery valve seat can be pushed out with the element as described in (f) below if the special tool is not available.

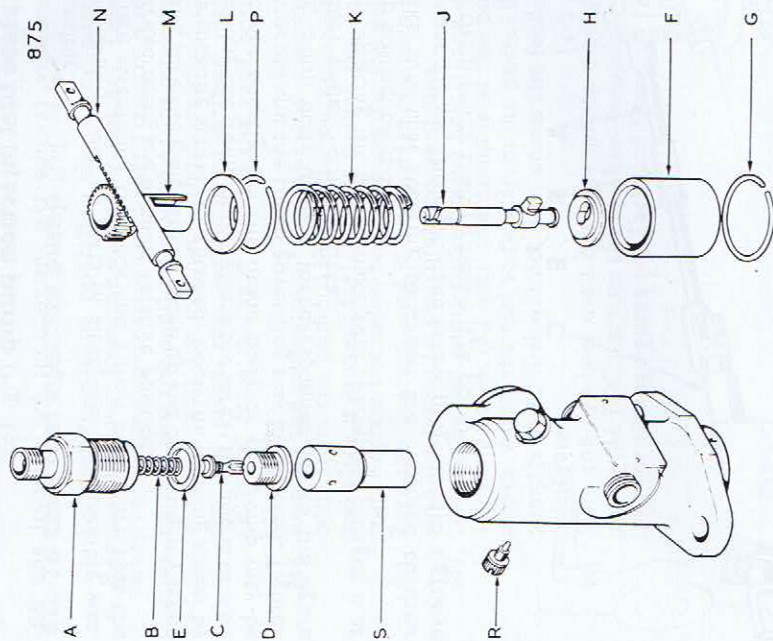


Fig. 15

- (d) Press down the tappet (F) and remove the circlip (G). During this operation the tappet may be held down by a pin inserted through the hole in the pump body.
- (e) Remove the tappet, the lower spring plate (H), the plunger (J) and plunger spring (K), the upper spring plate (L) and the pinion (M). Note the assembly marks on the teeth of the pinion and the rack (N). The upper spring plate and pinion are retained by a circlip (P).
- (f) Remove the element locating screw (R) and push out the element (S) through the top of the pump.

[37]

59. Fuel injection pump maintenance

- (a) Each plunger of a pump assembly is mated to one element and must never be used in another.
- (b) Make sure the delivery valve joint is in good condition and that the valve is seating properly. Leaking valves cause loss of fuel injection pressure and difficult starting.
- (c) Make sure the rack is free throughout its travel.

60. To replace fuel injection pump (Fig. 15)

- (a) Generally reverse the instructions for removal and dismantling.
- (b) Thoroughly clean all parts in clean fuel and assemble wet.
- (c) When assembling the rack and pinion make sure that the marked teeth are in their relative positions.
- (d) Make sure the element can move up and down slightly when the locating screw is tightened. Lock the locating screw by caulking the pump body against the screw serrations or slot.
- (e) Do not overtighten the union body or the pump may be distorted and the speed governing may be affected. Tighten the union body using a torque spanner set to the figure shown under Technical Data.
- (f) On replacing the pump make sure the tappet plunger is at the bottom of its stroke.
- (g) Make sure that securing setscrews are returned to their proper places. The right-hand screw projects into a groove on the priming shaft to retain it in position.

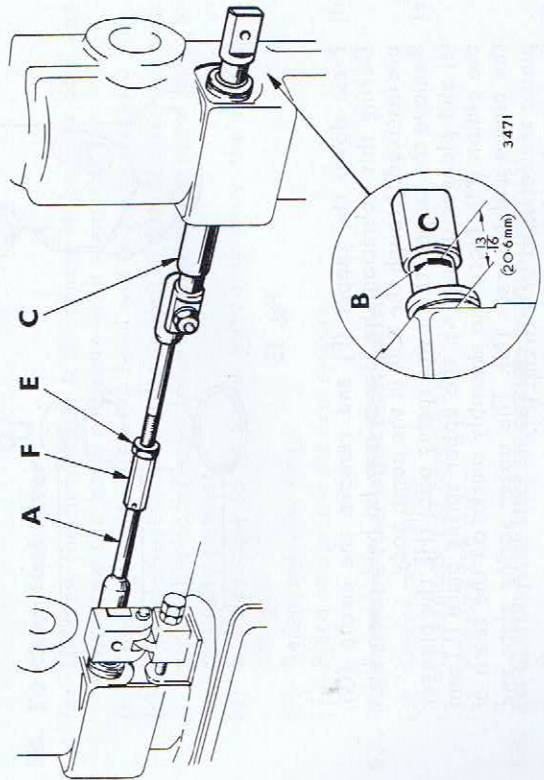


Fig. 16

[38]

- (h) The link (A) connecting the pumps should be adjusted by slackening the locknut (E) and rotating the adjuster (F) until the pump racks are in the fully open position together. Check that the calibration marks (B) on the racks (C) are an equal distance from the spot face on the pumps. This is important, as faulty setting will result in cylinders receiving unequal fuel.
- (i) Pumps not required for immediate use should have connections sealed against the admission of dirt, etc.

61. To time fuel injection pump (Fig. 16 & 17)

- Perform the timing operation on one cylinder at a time. Remove the cover from the fuel pump bracket. Take extra care when removing a cover on which a speed control is mounted.
- (a) Be sure that the overload stop adjusting screw is against the overload stop. On engines without overload stops, secure the fuel pump rack with the calibration mark (B) $\frac{1}{8}$ in (20.6mm) from the spot face on the rack boss, NOT the rack bush.
 - (b) Remove the pump-to-injector pipe and unscrew the union body from the pump. Lift out the delivery valve assembly and place it in clean fuel. Do not disturb the delivery valve seat. Replace the union body, leaving out the delivery valve.
 - (c) Turn the flywheel until it is a quarter of a turn before TDC with the piston on the compression stroke.
 - (d) Loosen the fuel pump rocker pinch bolt (J) and unscrew the adjusting screw (K) until the pump is at the bottom of its stroke. Allow the fuel to flow from the pump. If a fuel feed pump is fitted fuel will not flow unless the feed pump lever is operated.
 - (e) Turn the flywheel until the appropriate timing mark preceding the TDC mark on the flywheel is opposite the pointer (H). For timing figures see Technical Data.

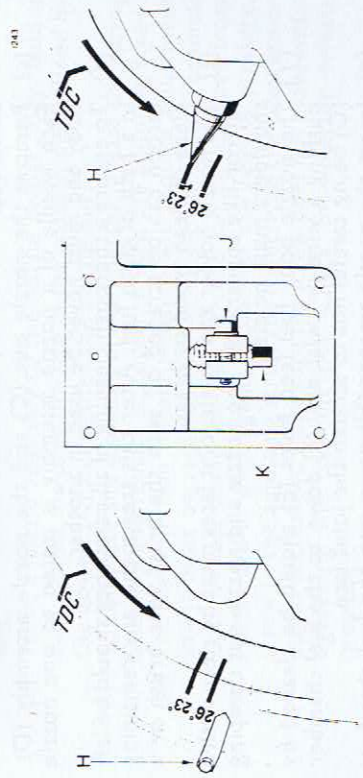


Fig. 17

[39]

- (f) Screw up the rocker adjusting screw until the fuel stream just stops. Adjust the screw until the EXACT position where the fuel flow stops. This position is known as the spill point.
- (g) When the spill point is correctly adjusted, tighten the rocker pinch bolt taking care not to alter the setting.
- (h) Reassemble the fuel injection equipment including the fuel delivery valve. Do not overtighten the union body or the pump may be distorted and the speed governing may be affected. Tighten the union body using a torque spanner set to the figure shown under Technical Data.
- (j) Refit the fuel pump bracket cover and bleed the fuel system.

62. To remove and test fuel injector

- (a) Undo the pipe connections.
- (b) Remove the injector flange nuts and carefully lever out the injector and the finned cooling sleeve. Examine the joint washer and renew if necessary.
- (c) Reconnect the injector to the pump-to-injector pipe in such a way that the nozzle points away from the engine.
- (d) Operate the fuel pump priming lever. The fuel should squirt out suddenly in four fine mist sprays which should stop just as suddenly. If the nozzle fails to spray, or gives solid squirts of fuel, or dribbles after the sprays have stopped, fit a new nozzle.
- (e) When testing, BE CAREFUL to see that the spray is not directed at any exposed part of the body. The force behind the spray will cause it to penetrate the skin.

63. Fuel injector maintenance (Fig. 18)

- An injector servicing kit consisting of brass wire brush, nozzle scraper and spray hole cleaner is obtainable from *Petters Ltd or their agents*.
- (a) Thoroughly clean the exterior of the injector.
 - (b) Remove the nozzle holder cap nut (A) and the adjusting screw (B).
 - (c) Remove the nozzle nut (C) and the nozzle assembly (D). Each needle of a nozzle assembly is mated to one nozzle body and must never be used in another.
 - (d) To ensure a thorough cleaning of all parts they should be left in a bath of clean fuel. After this treatment, any remaining carbon can be scraped off with the brass wire brush or a piece of clean wood or brass.
 - (e) The nozzle holder and nozzle joint faces must be clean with a mirror-like appearance. The nozzle and nozzle nut clamping shoulders must be clean.
 - (f) The nozzle body fuel feed holes (E) should be cleaned by pushing a wire or twist drill (F) down to the fuel chamber (G) being careful not to scratch the joint face.
 - (g) Insert the nozzle scraper (H) down into the fuel chamber, press sideways and rotate to remove carbon, etc.

- (h) Soft carbon can be removed from the spray holes with the spray hole cleaner (J). Care must be taken that the wire is not broken off in the spray hole.

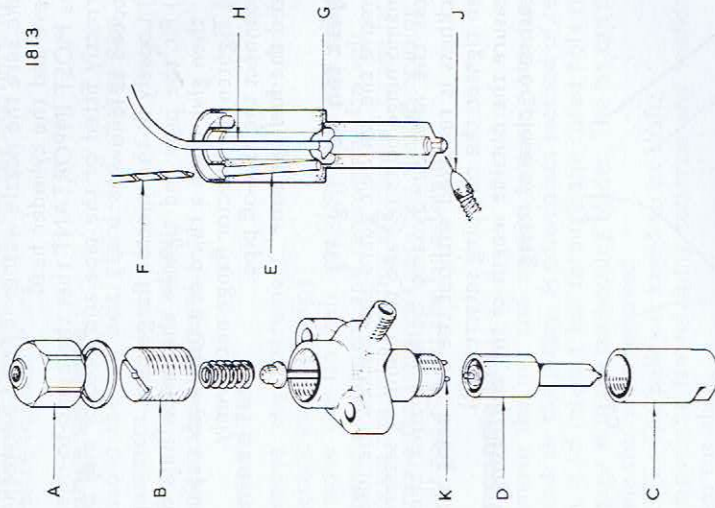


Fig. 18

- (j) Wash the nozzle body and needle in clean fuel and assemble wet.
- (k) To fit a nozzle assembly to the nozzle holder body, hold it hard against the pressure face in the position determined by the dowels (K) and tighten the nozzle nut.
- (l) To complete the assembly of the injector, grease the spring assembly and replace it, together with the adjusting screw.
- (m) The fuel injection release pressure will require adjustment and it must be reset to the figure shown under Technical Data. A test pump for this purpose can be obtained from *Petters Ltd or their agents*. To adjust the release pressure, screw in the adjusting screw (B) to increase the pressure or out to decrease it. Make sure the screw does not move while tightening the cap nut (A). Check the injector release pressure.
- (n) Injectors not required for immediate use should have pipe connections sealed against the admission of dirt, etc.

64. To replace fuel injector

(a) Slide the injector into the finned cooling sleeve. THE ENGINE MUST NOT BE RUN WITHOUT THIS SLEEVE. Make sure the nozzle washer is fitted between the cooling sleeve and the cylinder head.

(b) It is MOST IMPORTANT that the pump-to-injector pipe is correctly fitted or the pipe and injector may be damaged. Proceed as follows:

(i) Loosely fit the injector flange nuts.

(ii) Fit the pipe and tighten the union nuts finger tight, then give them a third of a turn with a spanner.

(iii) Tighten the injector flange nuts evenly.

(c) Reconnect the leak-off pipe.

(d) Bleed the fuel system.

65. To adjust fan belt (Fig. 19)

(a) Remove the fan belt guard and slacken the idler pulley or dynamo hinge bolts (A) and the clamping setscrew (B).

(b) Press the idler or dynamo pulley against the belt until slackness is removed without the belt being stretched and then tighten the clamping setscrew (B).

(c) Measure the outside length of the belt, using a steel tape measure or piece of string.

990

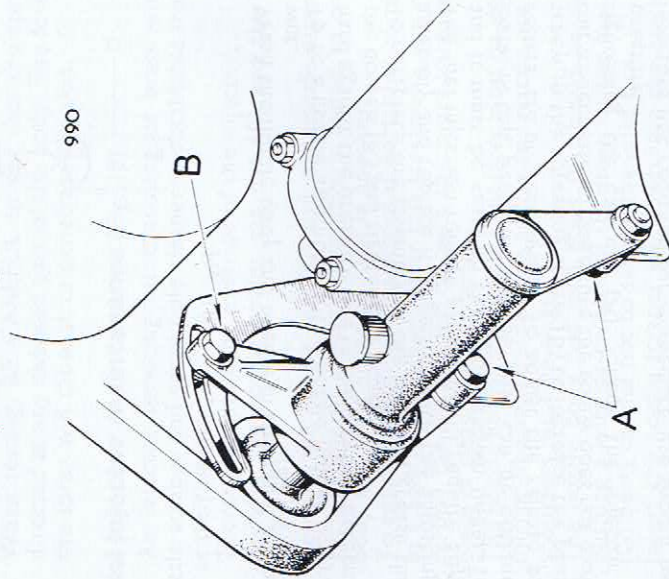


Fig. 19

[42]

(d) Slacken the clamping setscrew (B) and increase the pressure on the idler or dynamo pulley until the belt is stretched sufficiently to increase the measured length by $\frac{1}{4}$ in (6mm). Tighten the clamping setscrew (B) and the hinge bolts (A). Replace the belt guard.

66. To change fan belt

(a) Remove the fan belt guard and slacken the idler pulley adjustment.

(b) Change the belt and adjust.

(c) Replace the belt guard.

67. To remove fan

(a) Remove the instrument housing from the fan housing. (Electric starting only.)

(b) Remove the fan belt guard, slacken the idler pulley or dynamo adjustment and remove the fan belt.

(c) Release the strap holding the cowl to the fan housing.

(d) Remove the setscrews securing the fan housing to the gear cover and pull out the fan assembly.

68. To dismantle fan

(a) Remove the nut and washer retaining the fan pulley and withdraw the pulley. A convenient method of removing the nut is to insert a bar through the cored hole in the fan to engage with the fan housing blades. The fan can then be held while the nut is removed.

NOTE: The pulley is keyed to its shaft.

(b) Remove the fan retaining setscrew and withdraw the fan from the shaft.

(c) Remove the key and the pulley washer and pull out the distance sleeve.

(d) Tap out the shaft from the pulley end taking care not to damage the thread.

(e) Release the oil seals, release the circlips and tap out the bearings and distance sleeves.

69. To replace fan

(a) Generally reverse the instructions for removing and dismantling.

(b) When replacing the bearings note that the roller bearing should be at the pulley end of the shaft.

(c) If the oil seals are damaged they should be renewed.

(d) Fit new locking plates to the fan setscrews.

(e) Grease the fan bearings.

70. To adjust speed control (Fig. 20, 21 & 22)

The centrifugal forces on the governor weights are transmitted to the fuel pump rack. These forces, which vary

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with the speed of the engine, are balanced by an adjustable speeder spring (A). This adjustment allows a set range of speed. To adjust the speed outside this range different speeder and governor springs may be required and these are obtainable from *Petters Ltd* or their agents. The screw (B) is set by *Petters Ltd* and any further adjustment may result in the engine overspeeding when the load is suddenly removed. The speed is set by *Petters Ltd* and should not require further adjustment. However, if the setting is disturbed on fixed and variable speed engines, or a different speed is required on variable fixed speed engines, adjustments are carried out as follows:

- (a) Fixed speed
- (i) Loosen the locknut (C). Screw in the adjustment (D) to increase the speed or out to decrease it. Tighten the locknut (C). The speed should be set at 4% above the rated speed as shown on the engine nameplate, when running without load.

600

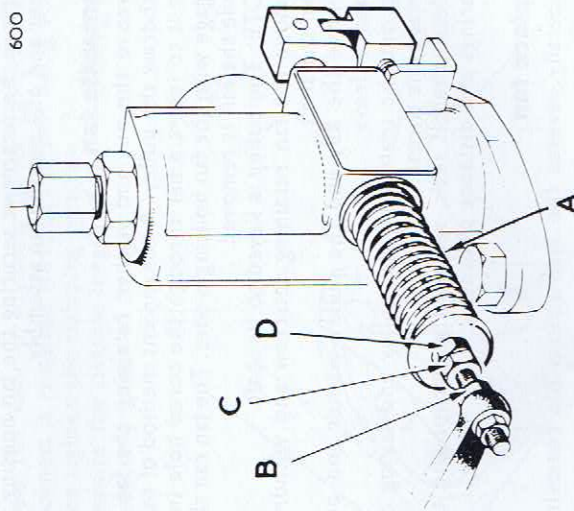


Fig. 20

- (b) Variable fixed speed
- (i) To decrease speed. Loosen the locknuts (M) and (N) then turn locknut (P) towards the flywheel until required speed is obtained. Tighten locknut (N) against bracket (Q). Tighten locknut (M).

- (ii) To increase speed. Loosen the locknuts (M) and (P) then turn locknut (N) away from the flywheel until required speed is obtained. Tighten locknut (P) against bracket (Q). Tighten locknut (M).
- (iii) Check the spill timing (see 'To time fuel injection pump') and reset if necessary.

3824

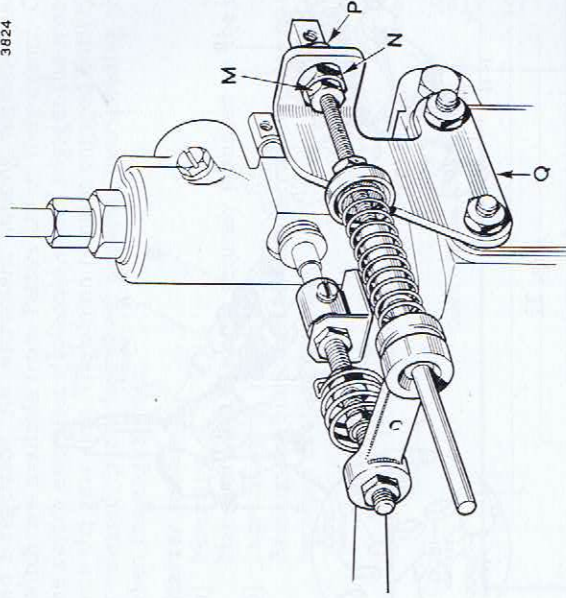


Fig. 21

- (c) Variable speed
- (i) Set the control in the idling position.
 - (ii) Loosen the locknut (E) and adjust the idling speed to approximately 500-600 rev/min by screwing in the adjustment (F) to increase the speed or out to decrease it. Tighten the locknut (E).
 - (iii) Set the control in the full speed position.
 - (iv) Loosen the locknut (G) and adjust the full speed by screwing in the adjustment (H) to decrease the speed or out to increase it. The speed should be set at 8% above the rated speed as shown on the engine nameplate, when running without load, i.e. 2160 for 2000 rev/min engines. Tighten the locknut (G) and fit new seal and locking wire.
- NOTE: On ratchet type control, make sure that the full speed stop (J) is fitted in the appropriate speed position.
- (v) Re-check the idling speed and adjust if not correct.

- (vi) To adjust the control cable, when fitted, set the cable control lever in the idling position. Slacken the locknut (K) and screw in the adjuster (L) until the control is hard against the adjustment (F) and there is a small amount of slack in the inner cable, i.e., the cable control lever can just be moved before the inner cable begins to move the control. Tighten the locknut (K).

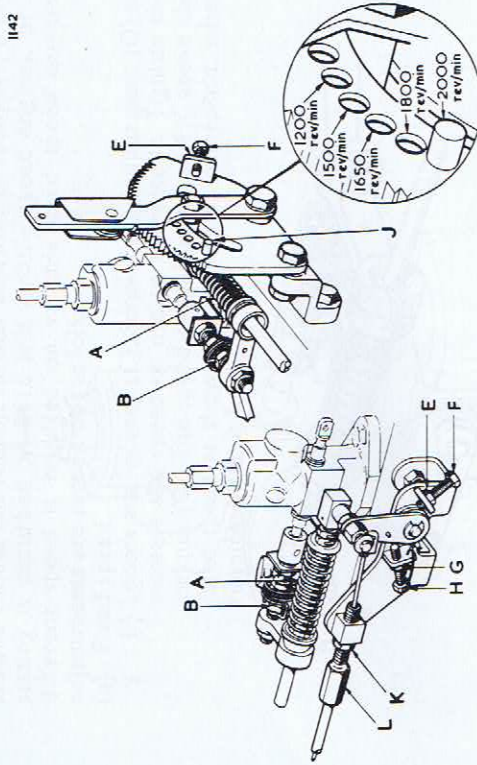


Fig. 22

71. Air cleaner maintenance

- (a) Paper element type
- (i) Unscrew the nut on the covers and remove the covers.
 - (ii) Remove the elements. The elements may be cleaned by blowing compressed air from the inside to the outside. Do not attempt to clean the elements by any other means.
 - (iii) A strong light directed into the inside of an element and viewed from the outside will reveal any damage to the paper corrugations. If the elements are damaged or show a large deposit of dirt, fit new elements, obtainable from *Petters Ltd or their agents*. Elements should be renewed in pairs.
 - (iv) Replace the elements and covers making sure that the element sealing rings and inlet manifold joint are in good condition.
- (b) Oil bath type
- (i) Remove the bottom cup and thoroughly clean out the sediment.
 - (ii) Remove the cleaner and wash out in petrol or paraffin and allow to drain.

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- (iii) Refit the cleaner and fill the cup with clean engine oil to the level indicated.
- (iv) Refit the cup.

72. Electric starting equipment (Fig. 23)

This consists of a battery-operated starter motor engaging with a gear ring on the flywheel, a dynamo for battery charging and a regulator. An instrument housing, ammeter and starter switch are available from *Petters Ltd or their agents*. Operating the switch energises a solenoid which engages the motor pinion with the gear ring. The pinion remains engaged until the switch is released, but a freewheel prevents overspeeding the motor when the engine fires.

Starter motor

- (a) Mounting
Make sure the motor is securely mounted on the engine.
- (b) Lubrication
Bearings are lubricated on assembly and require no attention between overhaul periods.

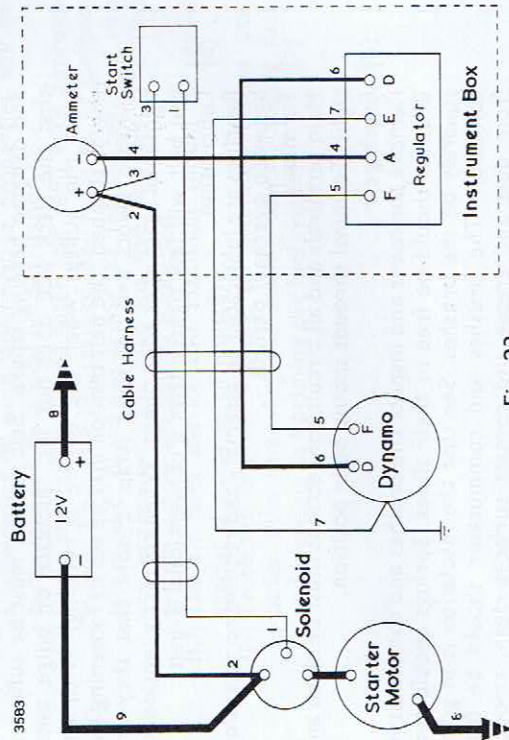


Fig. 23

- | | | | | |
|---|---|---|--|---|
| 1 | White/Red
(32/0-020mm 1-0 mm ²) | 5 | Yellow/Green
(32/0-20mm 1-0 mm ²) | 14/0-012in
(28/0-012in) |
| 2 | Brown
(30/0-25mm 1-5 mm ²) | 6 | Yellow
(30/0-25mm 1-5 mm ²) | 28/0-012in
(14/0-012in) |
| 3 | Brown/White
(32/0-20mm 1-0 mm ²) | 7 | Black
(19/1-78mm 50 mm ²) | 61/0-044in
(19/1-78mm 50 mm ²) |
| 4 | Brown/White
(30/0-25mm 1-5 mm ²) | 8 | Black
(19/1-78mm 50 mm ²) | 61/0-044in
(19/1-78mm 50 mm ²) |
| | | 9 | Brown/Red
(19/1-78mm 50 mm ²) | 61/0-044in
(19/1-78mm 50 mm ²) |

[47]

- (c) **Terminals**
Main terminals and all circuit connections must be clean and tight. Terminal shrouds should be in position.
- (d) **Brush gear**
Remove the cover and inspect the brushes and commutator. Brushes should be free in their slides. Springs should seat squarely on the brushes. See that the insulation is in good condition. The brushes and commutator should be free from dust and grease and contact surfaces clean, smooth and uniform in colour.
- (e) **Solenoid**
The solenoid should move freely and contact faces be clean and unburnt. Do not attempt to clean the solenoid without disconnecting the battery.

Dynamo

- (a) **Mounting**
The dynamo driving belt tension should be checked carefully. A slack belt overheats, causes low dynamo output and may work off the pulleys. A tight belt leads to early belt and dynamo bearing failure. Belt tension must be sufficient that the slack side does not sag, fluctuate or bulge away from the pulleys when the engine is running. With the engine stopped, the belt tension may be set by loosening the dynamo pivots and adjusting strap. Ensure that they are tightened again after adjustment. When correctly tensioned, the belt will feel tighter than a conventional V-belt.
- (b) **Lubrication**
Bearings are lubricated on assembly and require no attention between overhaul periods.
- (c) **Terminals**
Main terminals and all circuit connections must be clean and tight. Terminal shrouds should be in position.
- (d) **Brush gear**
Remove the cover and inspect the brushes and commutator. Brushes should be free in their slides. Springs should seat squarely on the brushes. See that the insulation is in good condition. The brushes and commutator should be free from dust and grease and contact surfaces clean, smooth and uniform in colour.

Regulator

Adjustments should not be made other than by an electrical engineer.

73. Protection and preservation

- (a) **Dust protection**
In a dust laden atmosphere lubricating oil filters and fuel pump rack covers should be fitted.

- (b) **Covers**

When not in use engines should be protected by a waterproof cover. Under tropical conditions a permanent awning should be provided.

- (c) **Storage**

Before despatch from the factory engines are preserved for storage and should not be disturbed until required for use.

- (d) **Intermittent use**

When not in regular use, engines should be run for a thirty-minute period each week to lubricate internal parts and boil off any condensation that has formed. External unpainted parts should be wiped with an oil rag, and external controls, etc., lubricated.

- (e) **Preservation**

Engines remaining idle for more than a month may corrode, and as serious damage may result it is recommended that they be preserved as follows:

- (i) Drain the sump, flush out with flushing oil and refill with the appropriate grade of Shell lubricating oil which will provide internal protection. (Alternatively, a lubricating oil with preservative properties will be recommended by a local oil distributor.)
- (ii) Drain the fuel tank and filter and refill with approximately 2 pints (1.14 litres) of Shell Fusus oil or Calibration Fluid C. Bleed and prime the fuel system and run the engine on light load for five minutes. The fuel system is now adequately protected.
- (iii) The air inlet and exhaust manifolds should be sealed against the ingress of moisture.
- (iv) Protected engines require no attention before use, other than removing the sealing covers, adding fuel, and bleeding and priming the fuel system.

PJ3-4 RUNNING MAINTENANCE CHART

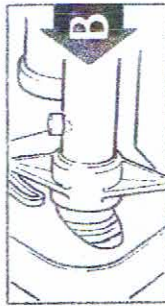
DAILY

250 HOURS

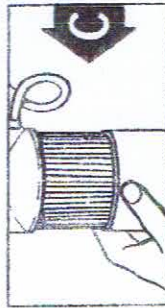
3637



Check the lubricating oil level on the dipstick and top up if necessary.



Check fan belt tension.



Clean the fuel filter bowl.



Check all nuts, belts, etc. for tightness. (The cylinder head nuts must NOT be tightened when the engine is hot.)



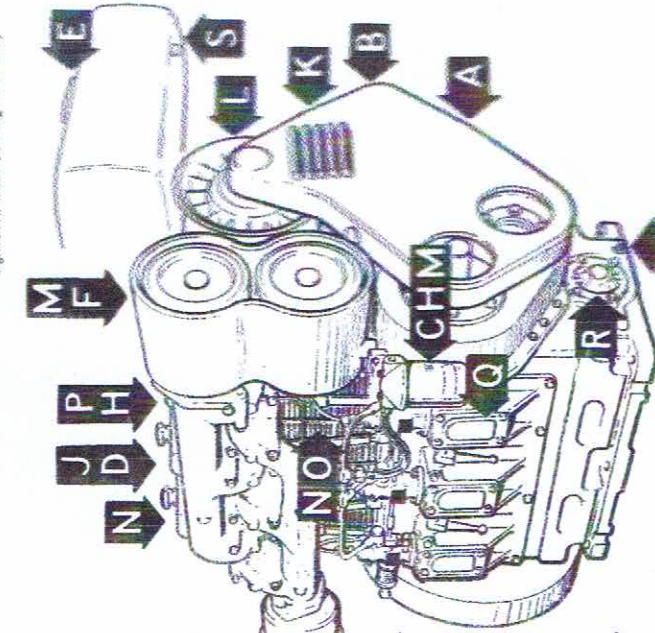
Make sure the fuel tank filler cap vent hole is clear.



Clean the air cleaner. (In very dusty conditions this must be done more frequently.)



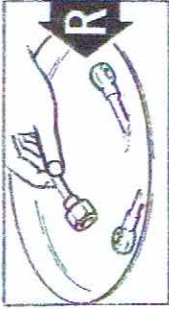
Clean out the fuel tank thoroughly.



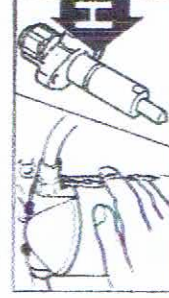
Keep cooling system free from obstruction.
Use only the lubricants approved by



This chart has been designed to help you. Its correct application will ensure maximum service from your engine.



Wash out lubricating oil system.



Test the fuel system for leaks. Remove the fuel injectors and test spray.



Examine the crankshaft bearings and renew if clearance is excessive.



Check the valve clearance and adjust if necessary.



Clean out piston oil return holes. Check cylinder bore wear.



Remove cylinder head and decarbonise.



Grease air pressure elements and fuel filter element.



Grease fan and idler pulley.



Fit new lubricating oil filter element and joint ring.

2000 HOURS

500 HOURS

1. Vergeet niet dat

- (a) Een motor brandstof nodig heeft:
Houd brandstof, tank, filter en leidingen schoon.
- (b) Een motor smeerolie nodig heeft:
Gebruik de juiste oliesoort. Controleer geregeld de oliestand en vul zo nodig bij.
- (c) Een motor lucht nodig heeft:
Houd het luchtfilter schoon. Houd het inlaatspruitstuk en het gehele uitlaatsysteem vrij van koolaanslag en andere verontreinigingen.
- (d) Een motor koeling nodig heeft:
Zorg dat het koelsysteem niet verstopt raakt.

2. Montage

- (a) Installatietekeningen zijn verkrijgbarr bij *Petters Ltd of hun agenten*.
- (b) Voldoende ruimte overlaten voor:
 - (i) Het uittrekken van de oliepeilstok, het verwijderen van de olievuldop en het aftappen van de olie.
 - (ii) Het onderhoud van brandstof-, olie- en luchtfilter.
 - (iii) Het bijstellen van de ventilateurriem.
 - (iv) Het uittrekken van de aanzetslinger en de bediening van de regelorganen.
- (c) Alleen fundatiebouten of tapbouten van goede kwaliteit mogen worden gebruikt. Bevestigingsschroeven mogen NIET worden toegepast.
- (d) In de volgende gevallen moet men inlichtingen inwinnen bij *Petters Ltd of hun agenten*:
 - (i) Voordat men een nieuwe montage methode toepast.
 - (ii) Wanneer men de toepassing van trillingsdempers overweegt. (Een verkeerde keuze kan gevaarlijk zijn.)
 - (iii) Wanneer men van plan is de installatie verplaatsbaar te maken. In dit geval is de aanwezigheid van een *Petter* technicus noodzakelijk bij de eerste installatie.
- (e) Bij direct aangedreven aggregaten moet het aandrijvende en het aangedreven gedeelte worden uitgericht en onderling met een flexibele koppeling worden verbonden.

3. Koeling (Fig. 1)

- (a) Koellucht wordt toegevoerd door een axiaalventilator en er moet op gelet worden dat de luchtinlaat van het ventilatorhuis vrij en open is.
- (b) Kasten of gesloten ruimten waarin motoren zijn gemonteerd, moeten voorzien zijn van ruime openingen waardoor de lucht vrij kan circuleren.

WICHTIG

Beim Kauf von Ersatzteilen bzw. bei Aufträgen zu Reparaturen wird Kunden nahegelegt, in ihrem eigenen Interesse stets:

ORIGINAL PETTER TEILE

vorzuschreiben. Ersatzteile, die nicht von Mitgliedern der *Petter* Organisation geliefert worden sind, sind in bezug auf richtigen Werkstoff, Masse und Ausführung nicht verlässlich. Die Fa. *Petter* lehnt daher jede Verantwortung für irgendwelche Schäden ab, die sich aus der Verwendung solcher Teile ergeben, und die Garantie erlischt ebenfalls.

In Ihrem eigenen Interesse verlangen Sie daher stets:

ORIGINAL PETTER TEILE

- (c) ONDER GEEN OMSTANDIGHEID MAG MEN MOTOREN LATEN LOPEN ZONDER DAT DE BESCHERMKAP VAN DE VENTILATOR OP ZIJN PLAATS IS.

4. Voor het starten gereede motor (Fig. 4)

- (a) Controleren of het koelsysteem in orde is en niet is verstopt.
(b) De olievuldop verwijderen en de motor met smeerolie vullen tot aan de bovenste streep op de oliepeilstok. Om zeker te zijn dat de aflezing juist is, moet tijdens het vullen met olie de peilstok uitgetrokken blijven en voordat hij wordt teruggeplaatst moet hij worden afgeveegd. Tussen twee aflezingen moet de peilstok minstens vijf seconden ingestoken blijven. Vuldop weer aanbrengen. (Nadat de motor een paar minuten heeft gelopen, deze stilzetten en de olie bijvullen, omdat het niveau altijd iets zakt na de eerste inbedrijfstelling.)
(c) Ventilateur- en spanrollagers met vat smeren.
(d) De decompressor hefboom omhoog trekken en de motor 15 malen draaien om de oliecirculatie aan de gang te krijgen.
(e) Brandstoftank vullen. Het brandstofsysteem ontluichten en bijvullen.

5. Het brandstofsysteem ontluichten en bijvullen (Fig. 4)

- (a) De beide ontluchtingsschroeven (A) boven op het brandstof filter losdraaien en los laten tot schone brandstof zonder luchtballen uitstroomt. Dan schroeven weer vastdraaien.
(b) Ontluchtingsschroef (B) aan de zijkant van de brandstofpomp losdraaien. Vulhefboom (C) langzaam heen en weer bewegen tot schone brandstof zonder luchtballen uitstroomt. Dan de schroef weer vastdraaien.
(c) De aansluiting van de brandstofleiding (D) van de verstuiver losschroeven. De vulhefboom heen en weer bewegen tot er brandstof zonder luchtballen uitstroomt. Dan de wartel van de leiding weer vastdraaien.
(d) Weer pompen door de vulhefboom heen en weer te bewegen tot de verstuiver een pipend geluid maakt.
(e) Het ontluichten van de brandstofleiding en het vullen van de verstuiver moet bij één cilinder tegelijk worden uitgevoerd. Men moet er op letten dat daarbij het 'TDC' (bovenste dode punt) merk op het vlieg wiel voor de desbetreffende cilinder ongeveer een halve omwenteling van de wijzer is verwijderd. Wanneer de motor voorzien is van een brandstofvoerpomp zal er geen brandstof vloeien voordat er met de pomphefboom is gepompt.

[92]

6. Het starten van de motor (Fig. 5)

- (a) De rood geschilderde overbelastingaanslag (A) oplichten en de regelstangen van de brandstofpomp in de geheel open stand laten komen.
(b) Wanneer de motor is voorzien van een variabele snelheidsregelaar, moet de regelhandel op maximum worden ingesteld.
(c) Een half dozijn slagen met de brandstofpomp maken voor iedere cilinder. (Dit is niet nodig bij een warme motor.)
(d) De hefboom van de decompressie-inrichting (B) oplichten en de motor zo snel mogelijk draaien of de starter gebruiken. Wanneer de motor voldoende snel draait de hefboom naar beneden slaan. De motor moet nu aanslaan.
(e) Als de motor niet aanslaat, de decompressiehefboom oplichten en de motor langzaam enige malen door draaien, voordat men nog eens probeert de motor aan te slaan. Startmotor niet langer dan telkens 20 seconden laten draaien.

7. Het starten bij koud weer

- (a) Bij lage temperatuur kan het gebruik van een aanzethulp-middel nodig zijn, waarover nadere bijzonderheden verkrijgbaar zijn bij *Petters Ltd of hun agenten*. Deze hulpmiddelen kunnen hulpbrandstoffen zijn, die bij het aanzetten van de motor in het verbrandingssysteem worden gebracht, hetzij door insputting in de luchtfilter (na verwijdering van het filterelement) uit een in de hand gehouden aerosol-sproeibus, hetzij door middel van ingebouwde apparatuur, die rechtstreeks in het inlaatspruitstuk spuit.

Overmatig en willekeurig gebruik van dergelijke aanzethulpmiddelen kan beschadiging veroorzaken. Bij eventuele twijfel omtrent het gebruik daarvan raadplege men *Petters Ltd of hun agenten*.

Bij welke graad van kou het gebruik van een aanzethulpmiddel eventueel nodig wordt, zal afhangen van de toestand van de motor en hoe hij geïnstalleerd is. Globaal gelden de volgende waarden voor de betreffende temperatuur:

Met de hand aanzetten
(met verleng-as voor halve snelheid)

—9°C
—18°C

Electrisch aanzetten
Bij lage temperatuur dient men steeds een motorolie met viscositeit SAE 10 te gebruiken (zie APPROVED LUBRICANTS).

8. Het afzetten van de motor

- (a) Het is raadzaam de motor vóór het afzetten een paar minuten met kleine belasting te laten lopen.

[93]

- (b) Pomphefboom omhoogbrengen tot in de vertikale stand, of de hefboom van de reguleator naar de brandstofpomp toe duwen, tot de motor stilhoudt.

WAT MEN NOOIT DOEN MAG

- (a) Men mag de motor NIET stilzetten door middel van de decompressie-inrichting. Dit kan beschadiging van de klepzittingen en van de cilinder-koppakkingen tot gevolg hebben.
- (b) Men mag de motor NIET stilzetten door de tank te laten leegragen. Daardoor komt er lucht in de brandstofleiding, zodat het systeem weer ontlicht en bijgevolg moet worden.
- (c) De overbelastingaanslag NIET verwijderen of de stand daarvan veranderen.
- (d) NIET vergeten de aanzetslinger te smeren. De aanzetslinger moet gemakkelijk kunnen worden verwijderd.

9. Inlooptijd

Na een inlooptijd van ongeveer 20 uur van een nieuwe of een gereviseerde motor moet men de volgende punten nalopen:

- (a) Klepdeling controleren.
- (b) Oliecarter aftappen en opnieuw vullen met zuivere olie.
- (c) Brandstoffilter controleren.
- (d) Controleren of alle moeren, bouten, enz. goed zijn vastgedraaid.

10. Regelmatig onderhoud

Dagelijks

- (a) Smeerolieniveau met de peilstok controleren en zo nodig bijvullen.
- (b) Koelsysteem op goede werking en op verstoppingen controleren.
- (c) Ventilateurriem-spanning controleren.
- (d) Smeerdop op huis van ventilateurriem-spanrol een halve slag aandraaien.

ATTENTIE:

De volgende aanbevelingen voor motoronderhoud gelden voor gemiddelde bedrijfsomstandigheden. Bij gebruik in zeer stoffige omgeving moeten de lucht-, smeerolie- en brandstoffilters vaker worden gereinigd. Indien de motor lange tijd licht belast loopt, zal ontkoling bij kortere tussenpozen noodzakelijk zijn.

Om de 50 uur

- (a) Luchtfilter reinigen (oliebad-type).

Om de 250 uur

- (a) Brandstoffilter reinigen.

- (b) Controleren of alle moeren, bouten, enz. goed zijn vastgedraaid. (De kopbouten van de cilinders mogen NIET worden aangedraaid terwijl de motor warm is.)
- (c) Nazien of het ontluuchtingsgat in de dop van de brandstof-tank vrij is.

- (d) Luchtfilter reinigen (papier-element).
- (e) Aanslag uit de knaldemper verwijderen.
- (f) Filter van de brandstofaanvoerpomp reinigen.
- (g) Ventilateur met vet smeren.
- (h) Oliecarter laten leeglopen, uitspoelen met spoelolie en met nieuwe olie vullen. Oliefilter reinigen. (Wanneer geen spoelolie beschikbaar is kan petroleum worden gebruikt, maar de motor mag niet lopen met petroleum in het carter.)
- (j) Onderzoeken of er lekken in het brandstofsysteem zijn.
- (k) Brandstofverstuivers verwijderen en de straal controleren. Wanneer deze in orde is de verstuiver opnieuw aanbrengen zonder er iets aan te veranderen.
- (l) Klepdeling controleren en zo nodig bijstellen.
- (m) Nieuw filterelement en nieuwe pakkingring aanbrengen in het smeeroliefilter.
- (n) Smeer de trekstang van de snelheidsregelaar.

Om de 500 uur

- (a) Nieuw brandstoffilterelement aanbrengen.
- (b) Nieuw luchtfilterelement aanbrengen.

Om de 2000 uur

- (a) Ontkolen.
- (b) Olieterugloopgaten in de zuigers reinigen. Cilinderslijtage controleren.
- (c) Krukaslagers onderzoeken en vernieuwen als er te veel speling is.
- (d) Brandstof-tank inwendig grondig reinigen.
- (e) Smeeroliesysteem doorspoelen.
- (f) Monteer een nieuwe ventilatorriem.

11. Instellen van de snelheidsregelaar

De centrifugale krachten, welke werken op de gewichten van de reguleator, worden overgebracht op de regelstang van de brandstofpomp. Deze krachten, welke met de snelheid van de motor veranderen, worden gecompenseerd door een verstelbare regelveer (A). Door het instellen van deze veer kan het toerental van de motor binnen een bepaald bereik worden geregeld. Wanneer een grotere regelmogelijkheid wordt gewenst, kan het nodig zijn andere veren en reguleatorgewichten toe te passen en deze zijn verkrijgbaar bij de firma *Peters Ltd of hun agenten*. Schroef (B) wordt door *Peters Ltd* ingesteld en wanneer men deze ver stelt zou de motor op hol kunnen slaan bij het plotseling wegnemen van de belasting. De snelheid wordt

door *Petters Ltd* ingesteld en behoeft niet te worden veranderd. Als echter de instelling van motoren met vast en variabel toerental niet juist meer is, of als een ander toerental gewenst is van motoren met een variabel vast toerental, dan is het toerental als volgt opnieuw in te stellen:

- (d) Vast toerental
- (i) Contramoer (C) losdraaien. Regelaar (D) inschroeven om het toerental te vergroten en deze uitschroeven om het toerental te verkleinen. Contramoer (C) weer vastdraaien. Het toerental moet 4% hoger worden ingesteld dan het nominale toerental, dat op het motornaamplaatje staat vermeld, terwijl de motor onbelast loopt.
- (b) Variabel vast toerental
- (i) Om het toerental te verlagen. Borgmoeren (M) en (N) losdraaien, dan moer (P) naar het vliegwiel toe draaien, totdat het juiste toerental is bereikt. Moer (N) vastdraaien tegen steun (Q) en daarna moer (M) weer vastdraaien.
- (ii) Om het toerental te verhogen. Borgmoer (M) en moer (P) losdraaien, daarna moer (N) van het vliegwiel afdraaien, totdat het juiste toerental is bereikt. Moer (P) vastdraaien tegen steun (Q) en daarna moer (M) weer vastdraaien.
- (iii) Controleer de inspuittijd (zie 'To time fuel injection pump') en stel deze indien nodig opnieuw af.
- (c) Variabel toerental
- (i) Bedieningshandel in de stationairstand zetten.
- (ii) Contramoer (E) losdraaien en het stationaire toerental op ongeveer 500-600 omw/min instellen. Dit geschiedt door regelschroef (F) in te schroeven om het toerental te vergroten en deze uit te schroeven om het toerental te verminderen. Contramoer (E) weer vastdraaien.
- (iii) Bedieningshandel in de stand voor het hoogste toerental zetten.
- (iv) Contramoer (G) losdraaien en hoogste toerental instellen. Regelschroef (H) inschroeven om het toerental te verkleinen en deze uitschroeven om het toerental te vergroten. Het toerental moet 8% boven het nominale toerental worden ingesteld, dat op het motornaamplaatje staat vermeld, terwijl de motor onbelast loopt, d.w.z. 2160 voor motoren met een toerental van 2000 omw/min. Contramoer weer vastdraaien en de plombe met nieuw plombeerdraad weer aanbrengen.
- ATTENTIE: Wanneer een pallenregelaar is toegepast, moet men controleren of de stuit voor de topsnelheid in de stand voor het juiste toerental is aangebracht.
- (v) Controleer het stationaire toerental nog eens en stel dit zo nodig bij.

- (vi) Wanneer de motor is uitgerust met een bedieningskabel, kan deze als volgt worden ingesteld. Kabelhandel in de stationairstand zetten. Contramoer (K) losdraaien en regelmoer (L) aandraaien tot de regelaar tegen regelschroef (F) wordt gedrukt en er nog een beetje speling in de binnenkabel is, d.w.z. dat de kabelhandel nog even kan worden bewogen voordat de binnenkabel de regelaar begint te bewegen. Contramoer (K) weer vastdraaien.

12. Technische gegevens

Instelling van het moment van inspuiting (door overloop):

Vast snelheid	Tot 1650 omw/min	23° vóór b.d.p.
	1651-2000 omw/min	26° vóór b.d.p.
Variabele snelheid		23° vóór b.d.p.
Min. afstand tussen zuigerbodem en cilinderkop		0,91/1,07mm
Speling kleptuimelaar (koud)		0,10mm
Hefhoogte van uitlaatklep door decompressor (max.)		0,63mm

13. Smering

- (a) De onder 'APPROVED LUBRICANTS' aangegeven motor-oliesoorten zijn H.D. oliën en bezitten een prestatie niveau welke voldoet aan de volgende voorschriften: British Defence Specification No. 2101D of U.S. Specification MIL/L/2104B
- (b) Andere H.D. oliesoorten kunnen door een olieleverancier ter plaatse worden aanbevolen, doch een prestatie niveau als hierboven aangegeven is vereist.
- (c) In geval van twijfel betreffende de keuze van de juiste oliesoort wende men zich tot *Petters Ltd* of hun agenten.
- (d) HULPINSTALLATIES OP SCHEPEN. Ofschoon er drie olieviscositeitswaarden aanbevolen worden voor verschillende klimaatgesteldheden, is het niet altijd praktisch om bij overgang van het ene klimaat in het andere de olie te vervangen. Onder dergelijke omstandigheden is het gewenst om voor de motoren van brandspuiten of andere inrichtingen die IN GEVAL VAN NOOD in werking gesteld moeten worden, die oliesoort te kiezen, welke geschikt is voor het koudste te verwachten klimaat. Deze aanbeveling geldt vooral met het oog op het gemakkelijk met de hand aanzetten van de betreffende motoren in gevallen, waarin een voor alle klimaatgesteldheden geschikte oliesoort niet beschikbaar is.

14. Draairichting

De normale draairichting is rechtsom, als u naar het vliegwiel kijkt. Motoren met een draairichting tegengesteld aan de normale

zijn gekenmerkt door de letter 'R' achter het serienummer van de motor.

15. Reserverdelen

Wanneer men onderdelen bestelt, het motortype en het serienummer, het bestelnummer van het onderdeel en het gewenste aantal vermelden.

Bestellingen op onderdelen en opdrachten voor reparaties moeten worden gezonden aan de officiële *Petterter agent of handelaar* in uw gebied.

* Geeft aan dat een onderdeel niet is afgebeeld.

8 Parts list

When ordering parts, state the engine type and serial number, the reference number of the part and the quantity required.

Common detail parts are separately listed in numerical order at the end of the Parts List and these may generally be obtained locally.

Requests for parts and service should be directed to:

Overseas

The appointed *Petterter agent or dealer* in the territory.

United Kingdom

Petterter Ltd Service Division or Service Depot at the addresses shown at the front of this handbook.

*Denotes that the part is not illustrated.

BELANGRIJK

Bij het kopen van onderdelen en het geven van opdrachten voor reparaties, worden klanten in hun eigen belang aangeraden steeds:

ORIGINELE PETERTER ONDERDELEN

te eisen. Bij onderdelen, die niet door de *Petterter* organisatie zijn geleverd, is men niet zeker dat het materiaal, de afmetingen en de afwerking juist zijn. Daarom wijst *Petterter* iedere verantwoordelijkheid af voor schade ontstaan door het gebruik van zulke onderdelen en bovendien vervalt dan de garantie.

Eist daarom steeds in uw eigen belang:

ORIGINELE PETERTER ONDERDELEN

Important

When purchasing parts or giving instructions for repairs customers should, in their own interest, always specify:

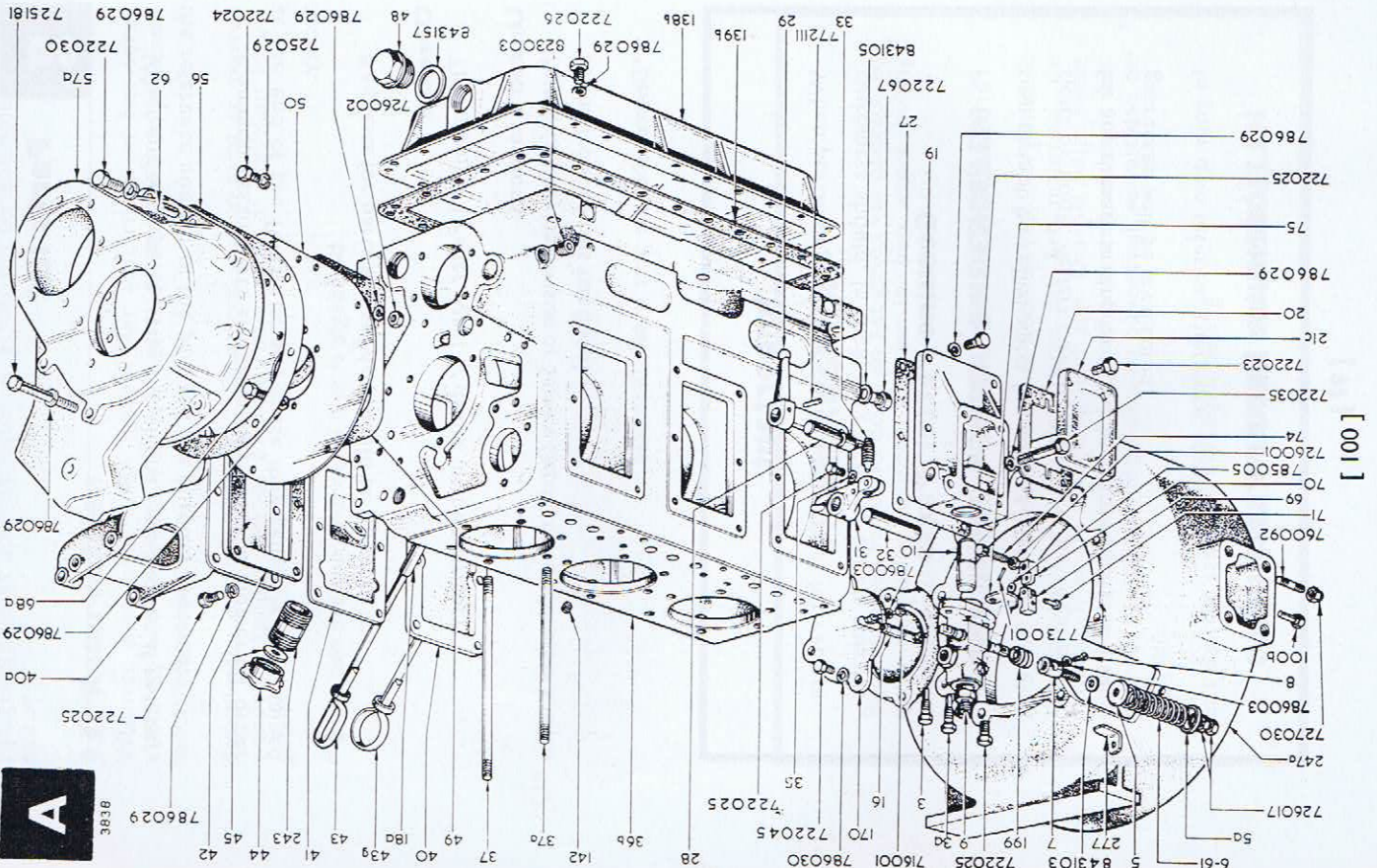
Genuine Petterter Parts

Parts that have not been supplied by the *Petterter* organisation cannot be relied upon for correct material, dimensions or finish. *Petterters* cannot, therefore, be responsible for any damage arising from the use of such parts and the guarantee will be invalidated.

In your own interest, therefore, specify:

Genuine Petterter Parts

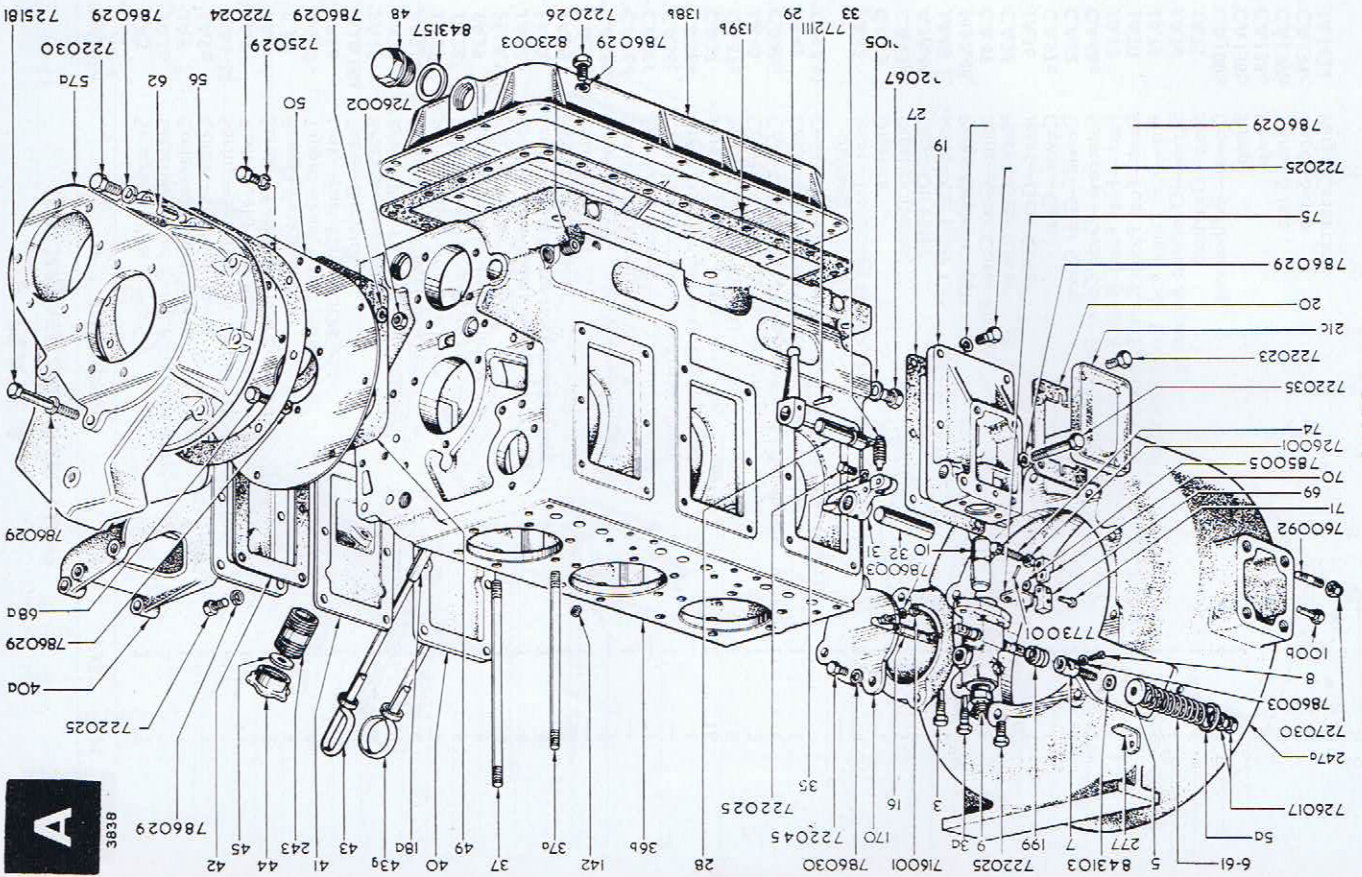
PLATE A CRANKCASE AND FUEL PUMP



Ref. No.	Description	PJ3	PJ4
JA3	Setscrew—Fuel Pump	2	3
JA3a	Setscrew—Fuel Pump (Overload Stop)	1	1
JA5	Collar—Speeder Spring	1	1
JA5a	Collar—Speeder Spring	1	1
CA6-61	Spring—Speeder (for details see separate list)	1	1
JA7	Rod—Fuel Pump Rack Extension	1	1
JA8	Screw—Extension Rod Locating	1	1
CA9	Pump—Fuel Injection	3	4
JA10	Tappet—Fuel Pump Plunger	3	4
JA16	Link—Fuel Pump Racks	2	3
AJA18a	Tube—Dipstick	1	1
JA19	Bracket—Fuel Pump	3	4
JA20	Joint—Fuel Pump Bracket Cover	3	4
JA21c	Cover—Fuel Pump Bracket	3	4
JA27	Joint—Fuel Pump Bracket	3	4
JA28	Shaft—Fuel Pump Priming	3	4
JA29	Handle—Fuel Pump Priming	3	4
HJA31	Rocker—Fuel Pump	3	4
JA32	Spindle—Fuel Pump Rocker	3	4
JA33	Screw—Fuel Pump Rocker Adjusting	3	4
JA35	Shakeproof Washer	3	4
CA36b	Crankcase	1	1
CA36c	Crankcase	1	1
CA36e	Crankcase (Sump)	1	1
CA36f	Crankcase (Sump)	1	1
CA36j	Crankcase (for use with Engine Feet)	1	1
CA36k	Crankcase (for use with Engine Feet)	1	1
CA37	Stud—Cylinder (Long)	12	16
CA37a	Stud—Cylinder (Short)	6	8
JA40	Cover—Crankcase Inspection	2	2
CA40a	Cover—Crankcase Inspection and Idler Pulley	1	1
JA41	Cover—Crankcase Inspection and Oil Filler	1	1
CMA41	Cover—Crankcase Inspection and Oil Filler (Electric Starting)	1	1
JA42	Joint—Inspection and Oil Filler Covers	3	4
CA43	Dipstick	1	1
CA43g	Dipstick (Sump)	1	1
AJA44	Cap—Oil Filler	1	1
JA45	Joint—Oil Filler Cap	1	1
HJA48	Plug—Drain, 1" BSP	1	1
CA49	Joint—Gear Cover Plate	1	1
CA50	Plate—Gear Cover	1	1
JA56	Joint—Gear Cover	1	1
CA57a	Cover—Gear	1	1
CA62	Dowel—Gear Cover	2	2
CA68a	Setscrew—Gear Cover Plate	2	2
JA69	Fork—Fuel Pump Rack Extension	1	1
JA70	Pawl—Fuel Pump Rack Extension	1	1
JA71	Pin—Fuel Pump Rack Extension Pawl	1	1
JA74	Screw—Overload Adjusting	1	1
JA75	Stop—Overload	1	1
CA100b	Dowel—Bellhousing	2	2
CA138b	Sump	1	1
CA138c	Sump	1	1
CA139b	Joint—Sump	1	1
CA139c	Joint—Sump	1	1
JA142a	Plug—Crankcase	4	5

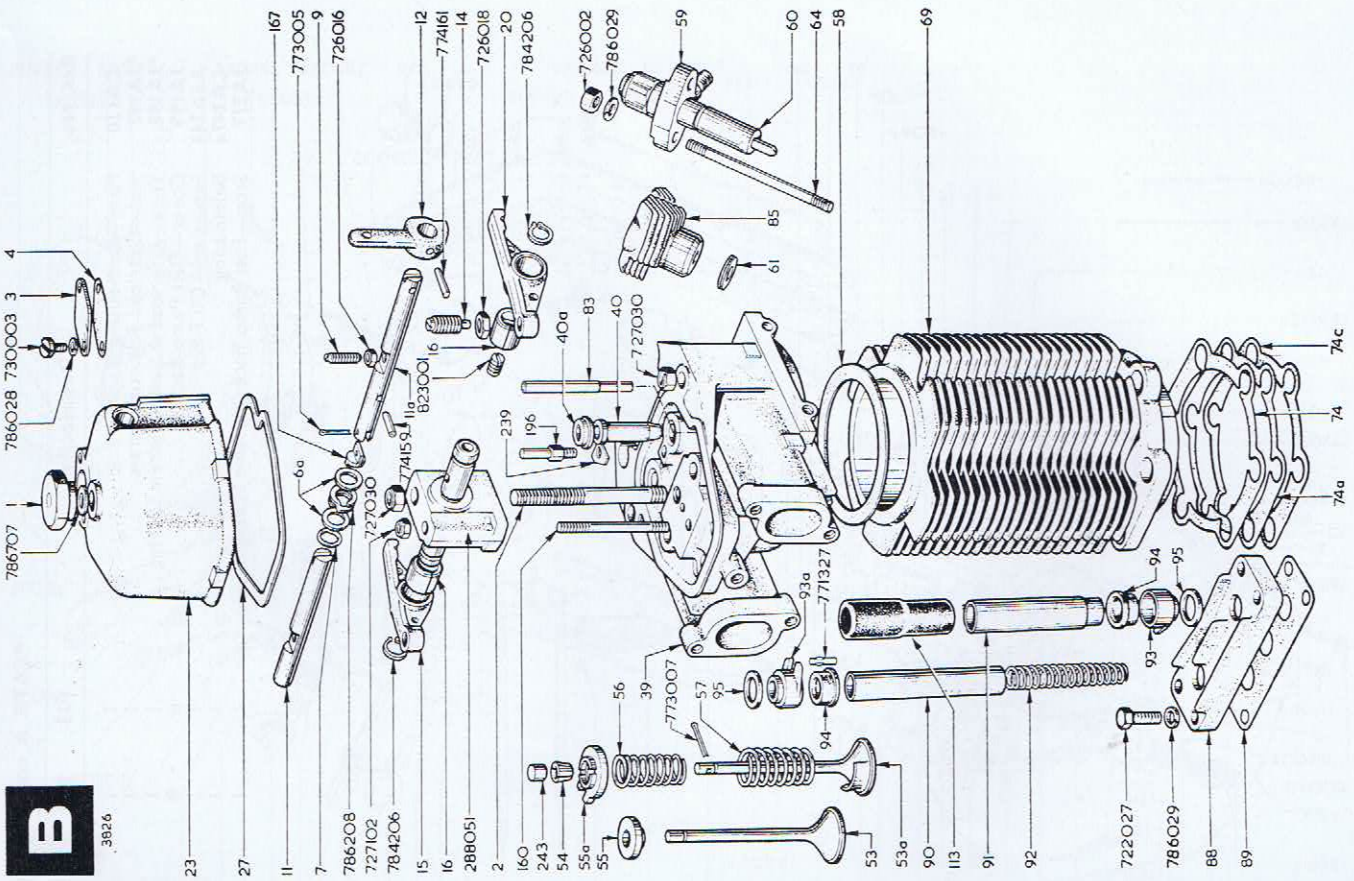
PLATE A contd.

Ref. No.	Description	PJ3	PJ4
CA170	Plate—Bellhousing Blanking ...	—	—
*JAI197	Seal—Overload Adjusting Screw ...	—	—
*JAI198	Wire—Overload Adjusting Screw Locking ...	—	—
JAI199	Cover—Fuel Pump Rack ...	6	8
AJA243	Extension—Oil Filler ...	—	—
CA247a	Bellhousing ...	—	—
JAZ77	Stop—Fuel Pump Rack (Variable Speed)	—	—



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PLATE B
CYLINDER AND CYLINDER HEAD



Ref. No.	Description	PJ3	PJ4
CB1	Nut—Rocker Box Cover	3	4
CB2	Stud—Rocker Box Cover	3	4
CB3	Plate—Rocker Box	3	4
CB4	Joint—Rocker Box Plate	3	4
*CB6	Washer—Decompressor Shaft	2	3
ZPB7	Washer—Decompressor Shaft	6	8
CB9	Pin—Decompressor	6	8
CB11	Shaft—Decompressor (Short)	3	4
CB11a	Shaft—Decompressor (Long)	1	1
CB12	Lever—Decompressor	2	3
CB14	Screw—Valve Rocker Adjusting	1	1
CB15	Rocker—Exhaust Valve	6	8
CB16	Bush—Valve Rocker	3	4
CB20	Rocker—Inlet Valve	6	8
CB23	Rocker Box	3	4
CB27	Joint—Rocker Box	3	4
CB32	Support—Rocker Shaft	3	4
CB39	Cylinder Head	2	3
*CB39a	Cylinder Head (Flywheel end)	1	1
HJB40	Guide—Valve	6	8
HJB40a	Spring Plate—Valve Guide	6	8
CB53	Valve—Exhaust	3	4
CB53a	Valve—Inlet	3	4
TB54	Collet—Valve	6 prs.	8 prs.
JB55	Cup—Exhaust Valve	3	4
CB55b	Cup—Inlet Valve	3	4
JB56	Spring—Valve (Inlet)	6	8
JB57	Spring—Valve (Outer)	6	8
CB58	Gasket—Cylinder Head	3	4
BAB59	Injector—Fuel (less Nozzle)	3	4
CB60	Nozzle—Fuel Injector	3	4
CB61	Washer—Fuel Injector Nozzle	3	4
CB64	Stud—Fuel Injector	3	4
CB69	Cylinder	3	4
CB74	Joint—Cylinder (0.015")	As required	As required
CB74a	Joint—Cylinder (0.005")	As required	As required
CB74c	Joint—Cylinder (0.003")	As required	As required
CB83	Tube—Breather	3	4
CB85	Sleeve—Nozzle	3	4
CB88	Base—Push Rod Tube	3	4
CB89	Joint—Push Rod Tube Base	3	4
CB90	Tube—Push Rod (Upper)	3	4
CB91	Tube—Push Rod (Lower)	6	8
CB92	Spring—Push Rod Type	6	8
AJB93	Adaptor—Push Rod Tube (Lower)	6	8
CB93a	Adaptor—Push Rod Tube (Upper)	6	8
AJB94	Oil Seal—Push Rod Tube	6	8
CB95	Joint Washer—Push Rod Tube Adaptor	12	16
CB113	Cover—Push Rod Tube	12	16
CB160	Stud—Rocker Shaft Support	6	8
HBI67	Coupler—Decompressor Shaft	3	4
CB196	Pin—Inlet Valve Locating	2	3
CB239	Tabwasher—Inlet Valve Locating Pin	3	4
BAB243	Cap—Valve	6	8

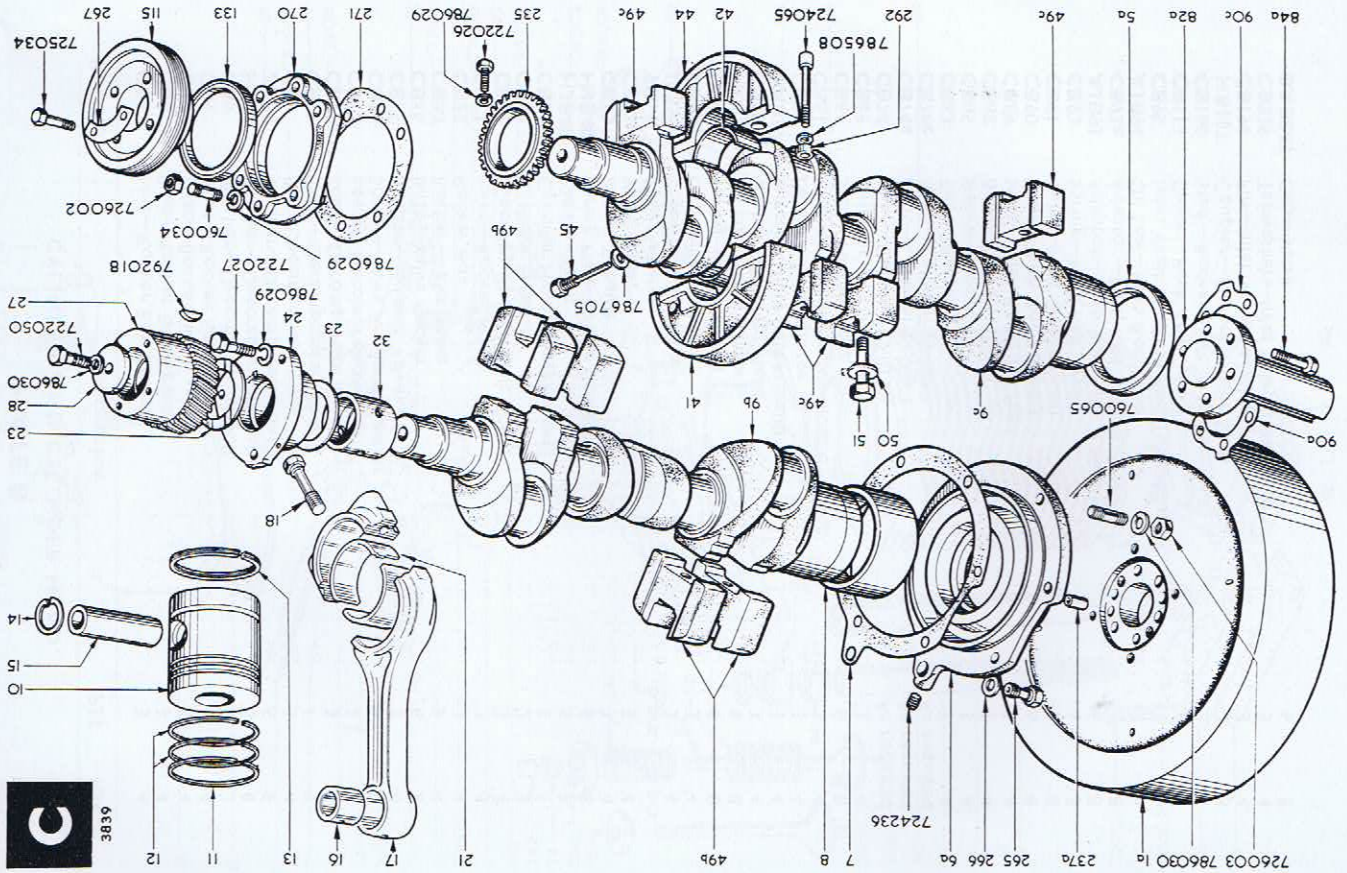
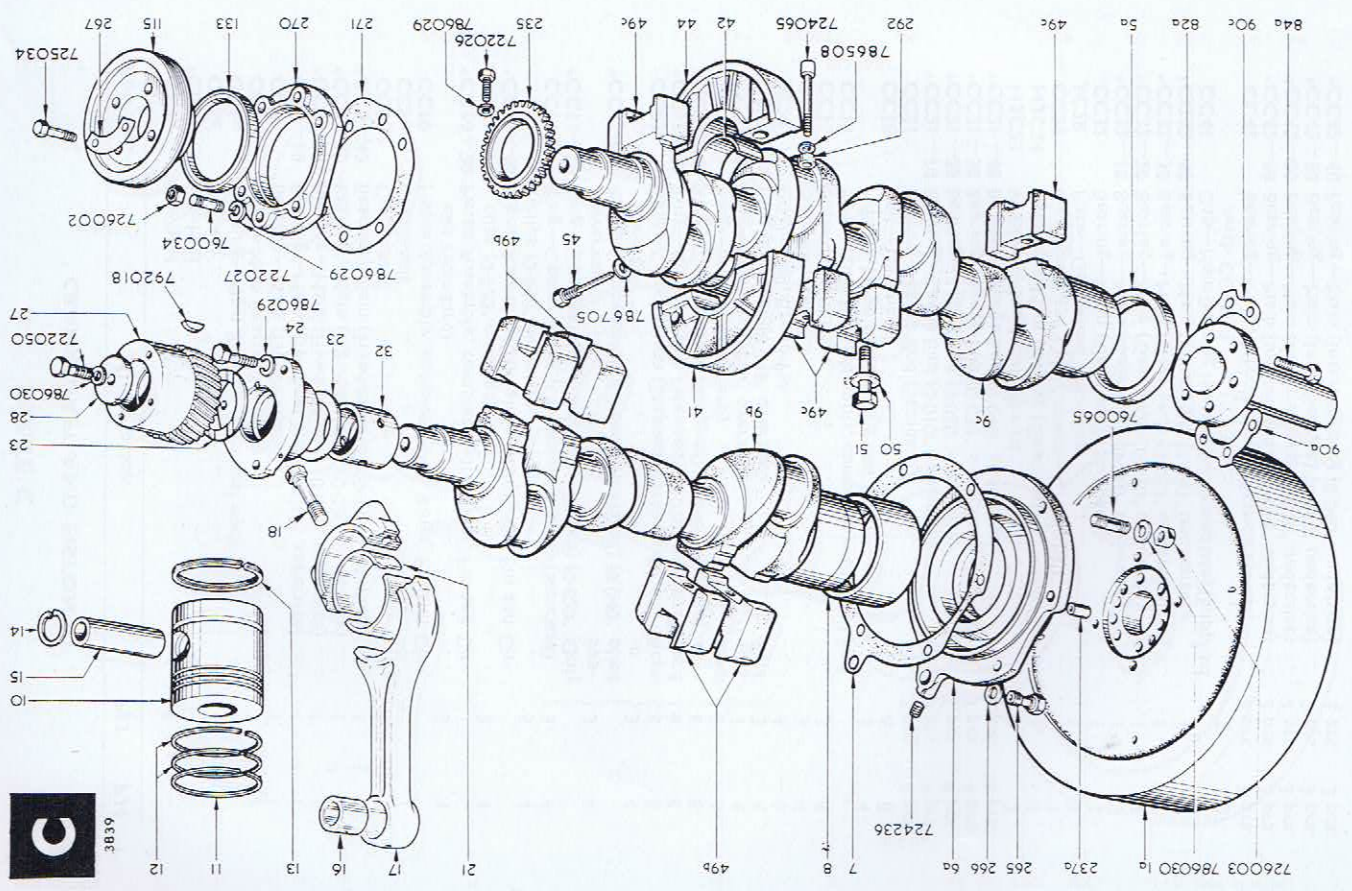


PLATE C

CRANKSHAFT AND PISTON

Ref. No.	Description	PJ3	PJ4
CC1a	Flywheel	—	—
*CC1c	Flywheel	—	—
CC5a	Oil Seal	—	—
CC6a	Housing—Main Bearing (Flywheel end)	—	—
CC7	Joint—Main Bearing Housing	—	—
CC8	Bearing—Main (Flywheel end)	—	—
*CC8-10	Bearing—Main (Flywheel end) (0-010" undersize)	—	—
*CC8-20	Bearing—Main (Flywheel end) (0-020" undersize)	—	—
*CC8-30	Bearing—Main (Flywheel end) (0-030" undersize)	—	—
*CC8-40	Bearing—Main (Flywheel end) (0-040" undersize)	—	—
CC9b	Crankshaft	—	—
CC9c	Crankshaft	—	—
CC10	Piston Assembly, complete with Rings, Pin and Circlip (Standard)	3	4
*CC10+20	Piston Assembly, complete with Rings, Pin and Circlips (0-020" oversize)	3	4
*CC10+40	Piston Assembly, complete with Rings, Pin and Circlips (0-040" oversize)	3	4
CC11	Ring—Compression (Chromium Plated) (Standard)	3	4
*CC11+20	Ring—Compression (Chromium Plated) (0-020" Only oversize)	3	4
*CC11+40	Ring—Compression (Chromium Plated) (0-040" Only oversize)	3	4
CC12	Ring—Compression (Stepped) (Standard)	6	8
*CC12+20	Ring—Compression (Stepped) (0-020" oversize) Standard	6	8
*CC12+40	Ring—Compression (Stepped) (0-040" oversize) Standard	6	8
CC13	Ring—Scraper (Standard)	3	4
*CC13+20	Ring—Scraper (0-020" oversize)	3	4
*CC13+40	Ring—Scraper (0-040" oversize)	3	4
JC14	Circlip—Gudgeon Pin	6	8
CC15	Gudgeon Pin	3	4
CC16	Bush—Small End	3	4
CC17	Connecting Rod Assembly, complete with Small End Bush, Large End Bearing and Bolts	3	4
CC18	Bolt—Large End	6	8
CC21	Bearing—Large End (Standard)	3 prs.	4 prs.
*CC21-10	Bearing—Large End (0-010" undersize)	3 prs.	4 prs.
*CC21-20	Bearing—Large End (0-020" undersize)	3 prs.	4 prs.
*CC21-30	Bearing—Large End (0-030" undersize)	3 prs.	4 prs.
*CC21-40	Bearing—Large End (0-040" undersize)	3 prs.	4 prs.
HJC23	Washer—Crankshaft Thrust	2	2
HJC24	Housing—Main Bearing (Gear end)	1	1
CC27	Gearwheel and Oil Thrower—Crankshaft	1	1
JC28	Plate—Gearwheel Retaining	1	1
CC32	Bearing—Main (Gear end) (Standard)	1	1
*CC32-10	Bearing—Main (Gear end) (0-010" undersize)	1	1
*CC32-20	Bearing—Main (Gear end) (0-020" undersize)	1	1
*CC32-30	Bearing—Main (Gear end) (0-030" undersize)	1	1
*CC32-40	Bearing—Main (Gear end) (0-040" undersize)	1	1
CC41	Cap—Main Bearing Housing (Intermediate) (Supplied with CC44)	2	3
CC42	Bearing—Main (Intermediate) (Standard)	2 prs.	3 prs.
*CC42-10	Bearing—Main (Intermediate) (0-010" undersize)	2 prs.	3 prs.
*CC42-20	Bearing—Main (Intermediate) (0-020" undersize)	2 prs.	3 prs.
*CC42-30	Bearing—Main (Intermediate) (0-030" undersize)	2 prs.	3 prs.
*CC42-40	Bearing—Main (Intermediate) (0-040" undersize)	2 prs.	3 prs.

Ref. No.	Description	PJ3	PJ4
CC44	Housing—Main Bearing (Intermediate) (Supplied with CC41) ...	2	3
CC45	Screw—Main Bearing Housing Locking (Intermediate) ...	2	3
CC49b	Balance Weight ...	4	—
CC49c	Balance Weight ...	4	—
CC50	Tabwasher—Balance Weight ...	4	4
HJC51	Bolt—Balance Weight ...	4	4
CC82a	Shaft—Crankshaft Extension (Flywheel end) ...	1	1
CC84a	Bolt—Extension Shaft ...	6	6
CC90a	Tabwasher ...	1	—
CC90c	Tabwasher ...	1	—
*CC99a	Bolt—Flywheel ...	6	6
CCI15	Pulley—Fan Driving ...	—	—
*CCI15a	Pulley—Fan Driving ...	—	—
CCI13	Oil Seal—Fan Driving Pulley ...	1	1
CC235	Gearwheel—Oil Pump Driving ...	1	1
CC237a	Dowel—Flywheel ...	2	2
CC265	Banjo Bolt—Main Bearing Housing (Flywheel end) ...	1	1
CC266	Joint Washer ...	1	1
CC267	Tabwasher ...	2	2
CC270	Housing—Fan Driving Pulley ...	1	1
CC271	Joint—Fan Driving Pulley Housing ...	1	1
CC292	Dowel—Intermediate Main Bearing Housing ...	4	6



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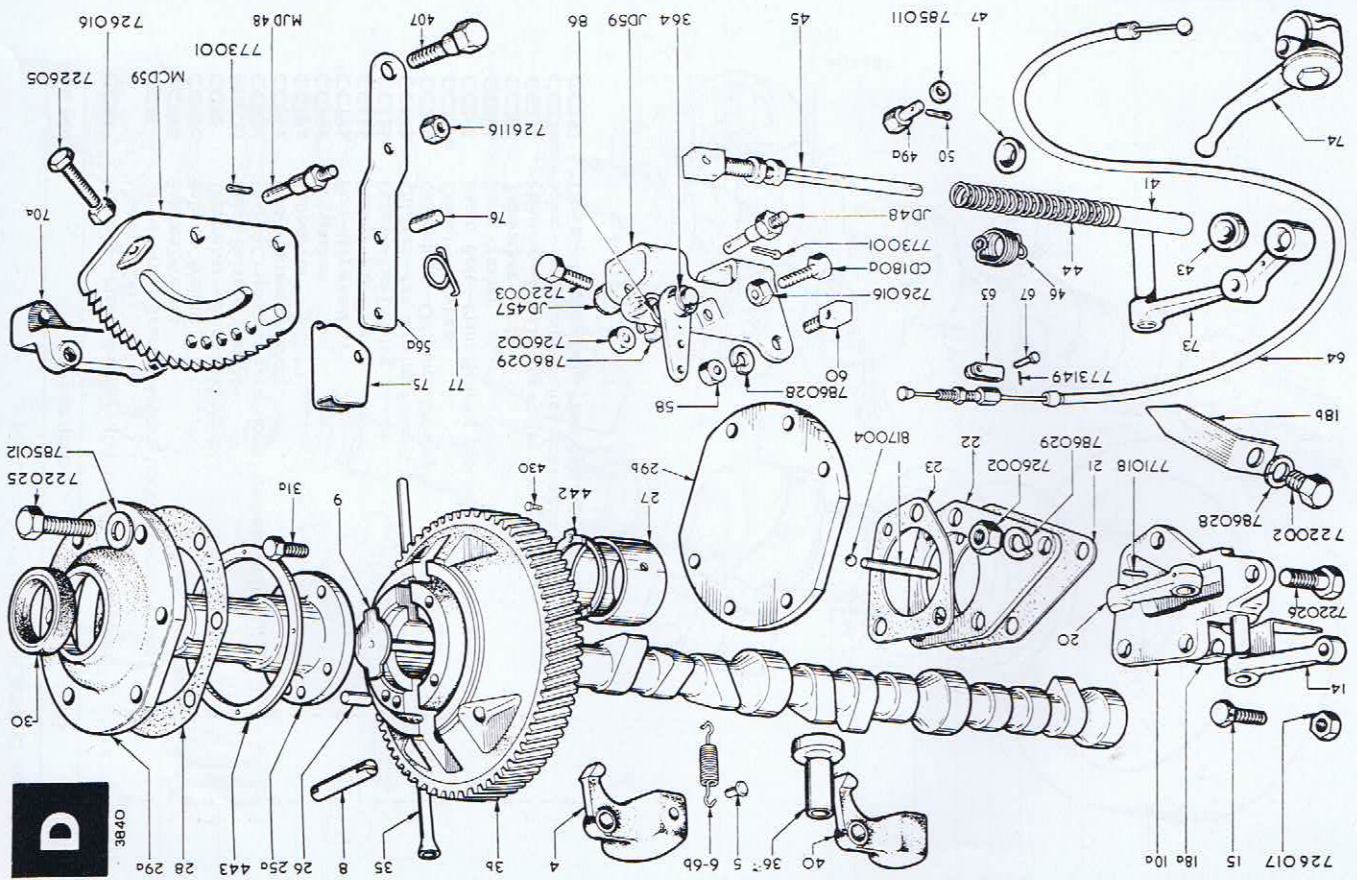


PLATE D
CAMSHAFT AND GOVERNOR

Ref. No.	Description	PJ3	PJ4
UDI	Push Rod—Governor (Flywheel end)	—	—
CD3b	Camshaft and Gearwheel Assembly (Standard Rotation—see Para. 11)	—	—
*CD3c	Camshaft and Gearwheel Assembly (Standard Rotation—see Para. 11)	—	—
*CD3f	Camshaft and Gearwheel Assembly (Reverse Rotation—see Para. 11)	—	—
*CD3g	Camshaft and Gearwheel Assembly (Reverse Rotation—see Para. 11)	—	—
JD4	Governor Weight	1 pr.	1 pr.
JD5	Pin—Governor Spring	4	4
JD6-6b	Spring—Governor (see separate list)	2	2
CD8	Pin—Governor Weight	2	2
CD9	Push Rod—Governor (Governor end)	—	—
*CD9a	Bracket—Governor Fulcrum	—	—
CD10a	Lever—Fuel Pump Rack Operating (External)	—	—
JD14	Screw—Lever Adjusting	—	—
JD15	Pointer—Flywheel (Bellhousing)	—	—
CD18a	Lever—Fuel Pump Rack Operating (Internal)	—	—
CD18b	Joint—Governor Fulcrum Bracket	—	—
CD20	Plate—Governor Fulcrum Bracket	—	—
CD21	Joint—Governor Fulcrum Bracket Plate	—	—
CD22	Shaft—Starting Shaft	—	—
CD23	Dowel—Starting Shaft	—	—
CD25a	Bush—Camshaft and Starting Shaft Bearing	4	5
TD26	Joint—Oil Seal Housing	—	—
JD27	Housing—Oil Seal	—	—
CD28	Plate—Camshaft Blanking	—	—
CD29a	Oil Seal	—	—
CD29b	Set screw—Starting Shaft	4	4
HD30	Push Rod—Valve	6	8
CD31a	Tappet—Valve	6	8
CD35	Governor Weight (Variable Speed)	—	—
JD36	Tube—Speeder Spring Guide (Variable Speed)	—	—
MJD40	Washer	—	—
MJD41	Spring—Speeder (Variable Speed)	—	—
MJD44	Spindle Assembly—Speeder Spring, complete with Bracket and Locknuts (Variable Fixed Speed)	—	—
*CD45	Spindle Assembly—Speeder Spring (Variable Speed)—Ratchet Type Control	—	—
JD45	Spring—Fuel Pump Rack (Variable Speed)	—	—
*MCD45	Cup—Speeder Spring (Variable Speed)	—	—
MJD46	Pin—Speeder Spring Spindle (Variable Speed)	—	—
MJD47	Pin—Speeder Spring Spindle (Variable Speed)	—	—
JD48	Pin—Speeder Spring Spindle (Variable Speed)	—	—
MJD48	Ratchet Type Control	—	—
JD49a	Connection	—	—
MJD50	Split Pin (Ratchet Type Control)	2	2
JD56a	Lever—Variable Speed (Ratchet Type Control)	—	—
JD58	Locknut—Cable Adjusting Stop	—	—
JD59	Plate—Variable Speed Control	—	—
MCD59	Plate—Variable Speed Control (Ratchet Type Control) (quote engine speed)	—	—
JD60	Stop—Cable Adjusting	—	—
JD63	Shackle—Cable	—	—

Ref. No.	Description	PJ3	PJ4
JD64	Cable—Operating (Variable Speed) (To length required)	—	—
JD67	Pin—Cable Shackles	—	—
JD70a	Bracket—Variable Speed (Ratchet Type Control)	—	—
JD73	Lever—Fuel Pump Rack Operating (External) (Variable Speed)	—	—
TD74	Lever—Cable Control	—	—
JD75	Pawl (Variable Speed—Ratchet Type Control)	—	—
JD76	Pin—Pawl	—	—
JD77	Spring—Pawl	—	—
JD86	Spring—Lever Return (Variable Speed)	—	—
CD180a	Screw—Adjusting (Variable Speed)	—	—
*JD297	Seal—Adjusting Screws JD15 and CD180a	2	2
*JD298	Wire—Adjusting Screw Locking	2	2
JD364	Circlip—Lever Pin (Variable Speed)	1	1
MJD407	Bolt—Variable Speed (Ratchet Type Control)	1	1
CD430	Pin—Camshaft Thrust Washer	6	6
CD442	Washer—Camshaft Thrust (Inner)	1	1
CD443	Washer—Camshaft Thrust (Outer)	1	1
JD457	Collar—Variable Speed Spindle Pin	2	2

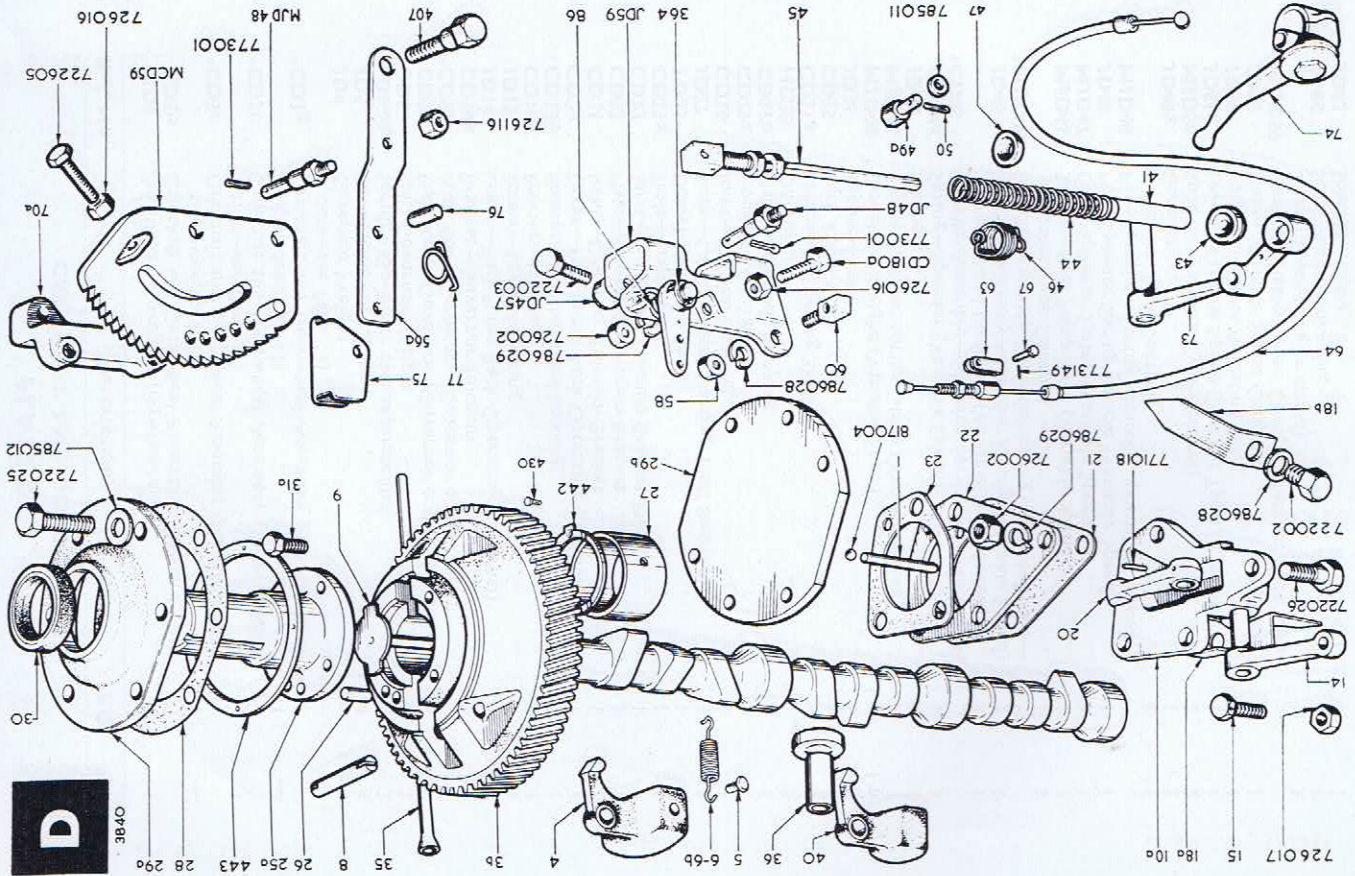


PLATE E
FUEL FILTER AND PIPES

Ref. No.	Description	PJ3	PJ4
CE6a	Pipe—Injector Leak-off	—	—
JE32	Pipe—Fuel (9½" Flexible)	—	—
CE33	Pipe—Fuel (Filter to Pump)	—	—
CE33a	Pipe—Fuel (Filter to Pump)	3	4
CE34	Pipe—Fuel (Pump to Injector)	—	—
CE42	Pipe—Oil (Banjo to Rocker Union)	—	—
CE43a	Pipe—Oil (Rocker Union to Rocker Shaft)	—	—
CE43b	Pipe—Oil (Rocker Union)	4	4
JE45	Clip—Oil Pipe	—	—
JE46	Clip—Oil Pipe	3	4
ASE64a	Filter—Fuel (for details see separate list)	—	—
JE71	Banjo Bolt—Fuel Pump	3	4
JE72	Joint Washer—Fuel Pump	6	8
CE115	Adaptor—Injector Leak-off Pipe	—	—
MJE118	Seal—Union Nut	—	—
MJE119	Union Nut	—	—
ASE146	Banjo Bolt—Flexible Pipe	—	—
CE218	Pipe—Injector Leak-off	—	—
CE218a	Pipe—Injector Leak-off	—	—
CE218b	Pipe—Injector Leak-off	—	—
AAE220	Joint Washer—Injector Leak-off Pipe	6	8
AAE221	Banjo Bolt—Injector Leak-off Pipe	3	4
ASE275	Nipple—Leak-off Pipe	2	2
ASE276	Union Nut—Leak-off Pipe	2	2
CE343	Packing—Fuel Filter	—	—

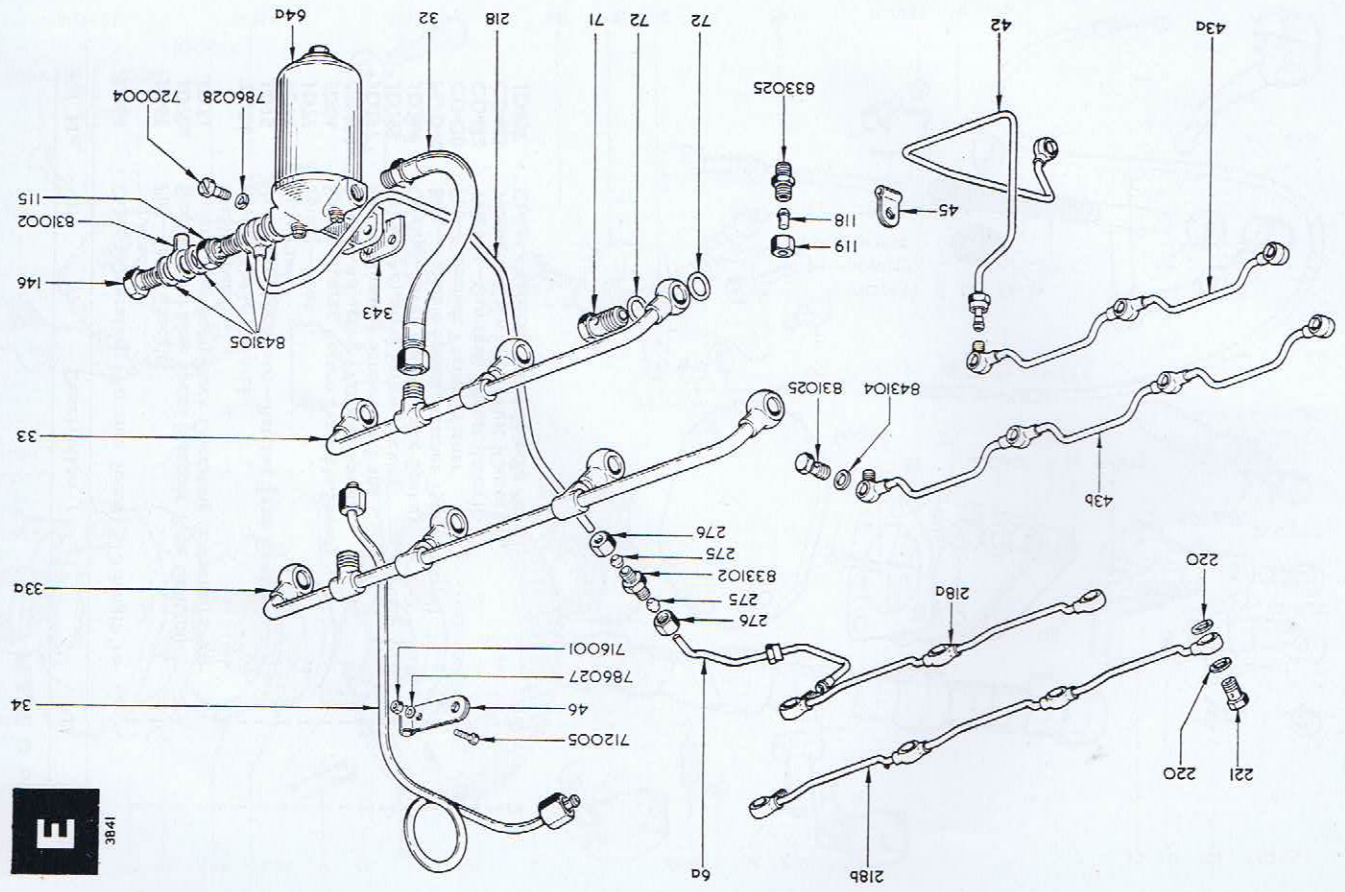
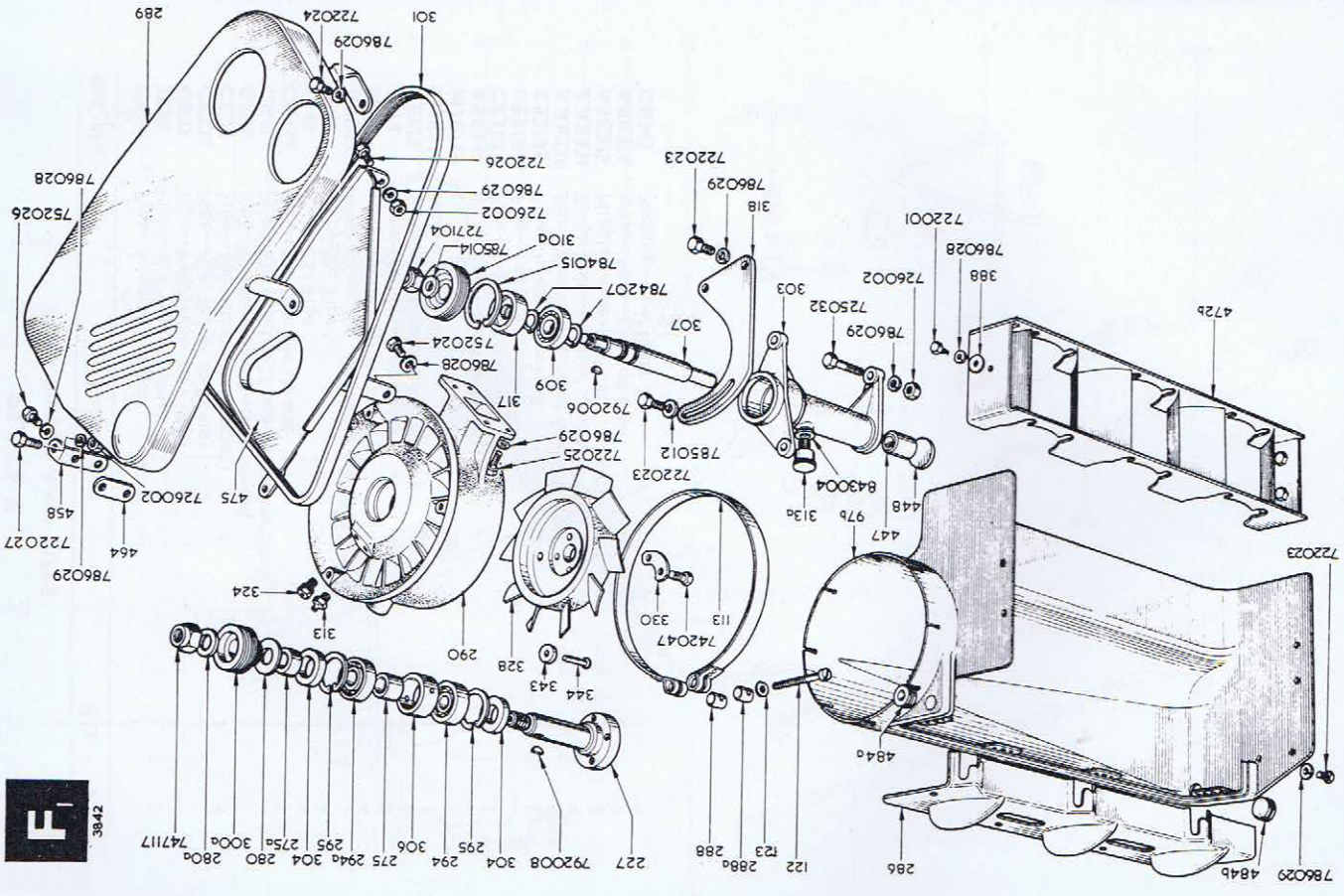
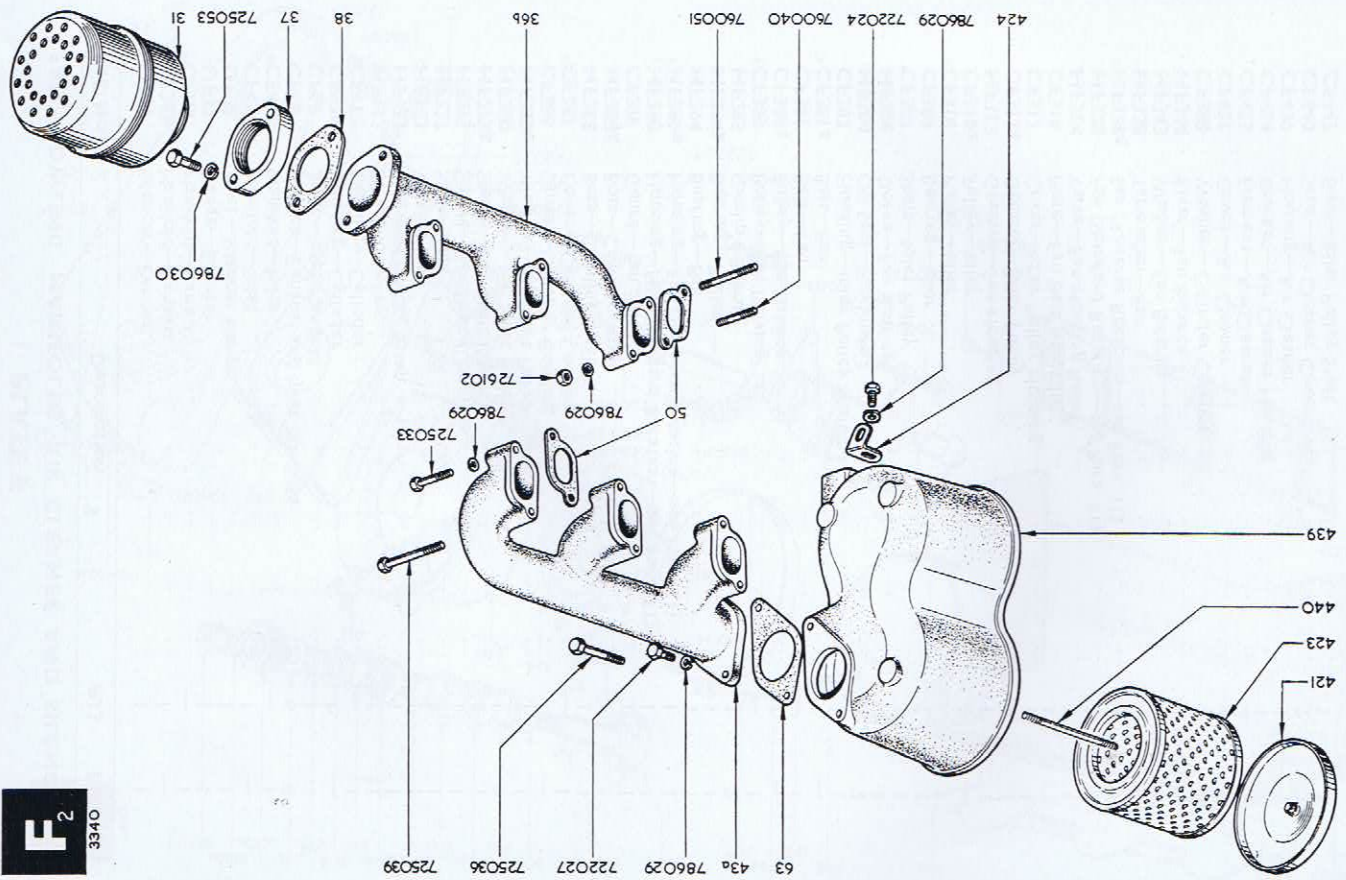


PLATE F
FAN, COWLING, MANIFOLDS, AIR CLEANER AND SILENCER

Ref. No.	Description	PJ3	PJ4
UF31	Silencer—Exhaust		
CF36b	Manifold—Exhaust		
*CF36c	Manifold—Exhaust		
UF37	Flange—Silencer		
UF38	Joint—Silencer Flange		
CF43a	Manifold—Inlet		
*CF43b	Manifold—Inlet		
CF50	Gasket—Exhaust and Inlet Manifold	6	8
CF63	Joint—Inlet Manifold		
CF97b	Cowling—Cylinder		
*CF97c	Cowling—Cylinder		
HF113	Strap—Cowling		
HF123	Screw—Cowling Strap		
HF227	Washer		
HF275	Shaft—Fan		
HF275a	Sleeve—Fan Shaft (Long)		
HF280	Sleeve—Fan Shaft (Short)		
HF280a	Washer—Fan Shaft Pulley		
CF286	Washer—Fan Shaft Pulley		
*CF287	Cover—Cylinder Cowling		
HF288	Boss—Cowling Strap		
HF288a	Boss—Cowling Strap		
CF289	Guard—Fan Belt		
*HF290	Housing—Fan (Standard Rotation—see Para. 11)		
HF294	Housing—Fan (Reverse Rotation—see Para. 11)		
HF294a	Bearing—Ball	2	2
HF295	Bearing—Roller		
*CF300	Circlip—Bearing		
CF300a	Pulley—Fan Driving		
CF301	Pulley—Fan Driving		
*CF301a	Belt—Fan		
CF303	Housing—Idle Pulley Shaft		
HF304	Oil Seal—Fan Shaft	2	2
HF306	Sleeve—Fan Bearing		
CF307	Shaft—Idle Pulley		
CF309	Bearing—Idle		
*CF310	Pulley—Idle		
CF310a	Pulley—Idle		
HF313	Greaser—Fan Housing		
CF313a	Greaser—Idle Pulley		
CF317	Cover—Idle Pulley Housing		
CF318	Plate—Fan Belt Adjusting		
HF324	Valve—Fan Housing Relief		
HF328	Fan (Standard Rotation—see Para. 11)		
*HF328a	Fan (Reverse Rotation—see Para. 11)		
HF330	Tabwasher—Fan	2	2
HF343	Washer—Fan Balance	As required	
HF344	Rivet—Fan Balance	As required	
CF388	Washer—Cylinder Cowling	3	3
CF421	Cover—Air Cleaner	2	2
CF423	Element—Air Cleaner	2	2
CF424	Bracket—Air Cleaner Housing	1	1
CF439	Housing—Air Cleaner	1	1
CF440	Stud—Air Cleaner Cover	2	2
CF447	Bush—Idle Pulley Shaft		



Ref. No.	Description	PJ3	PJ4
CF448	Core Plug—Idle Pulley Housing	---	---
CF458	Bracket—Fan Belt Guard	---	---
CF464	Packing—Fan Belt Guard Bracket	---	---
CF472b	Cowling—Cylinder	---	---
*CF472c	Cowling—Cylinder	---	---
CF475	Guard—Fan Belt (Rear)	---	---
CF484a	Grommet	---	---
CF484b	Plug—Cylinder Cowling	---	---



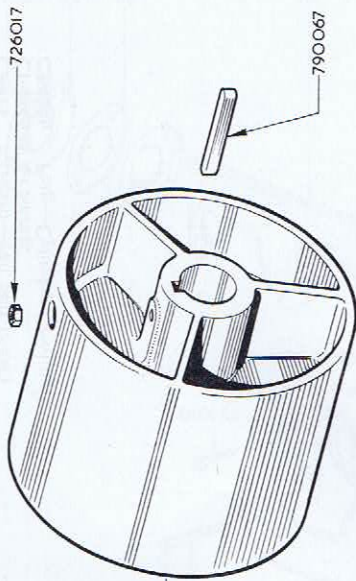
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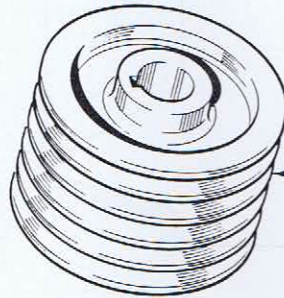


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PLATE H PULLEYS

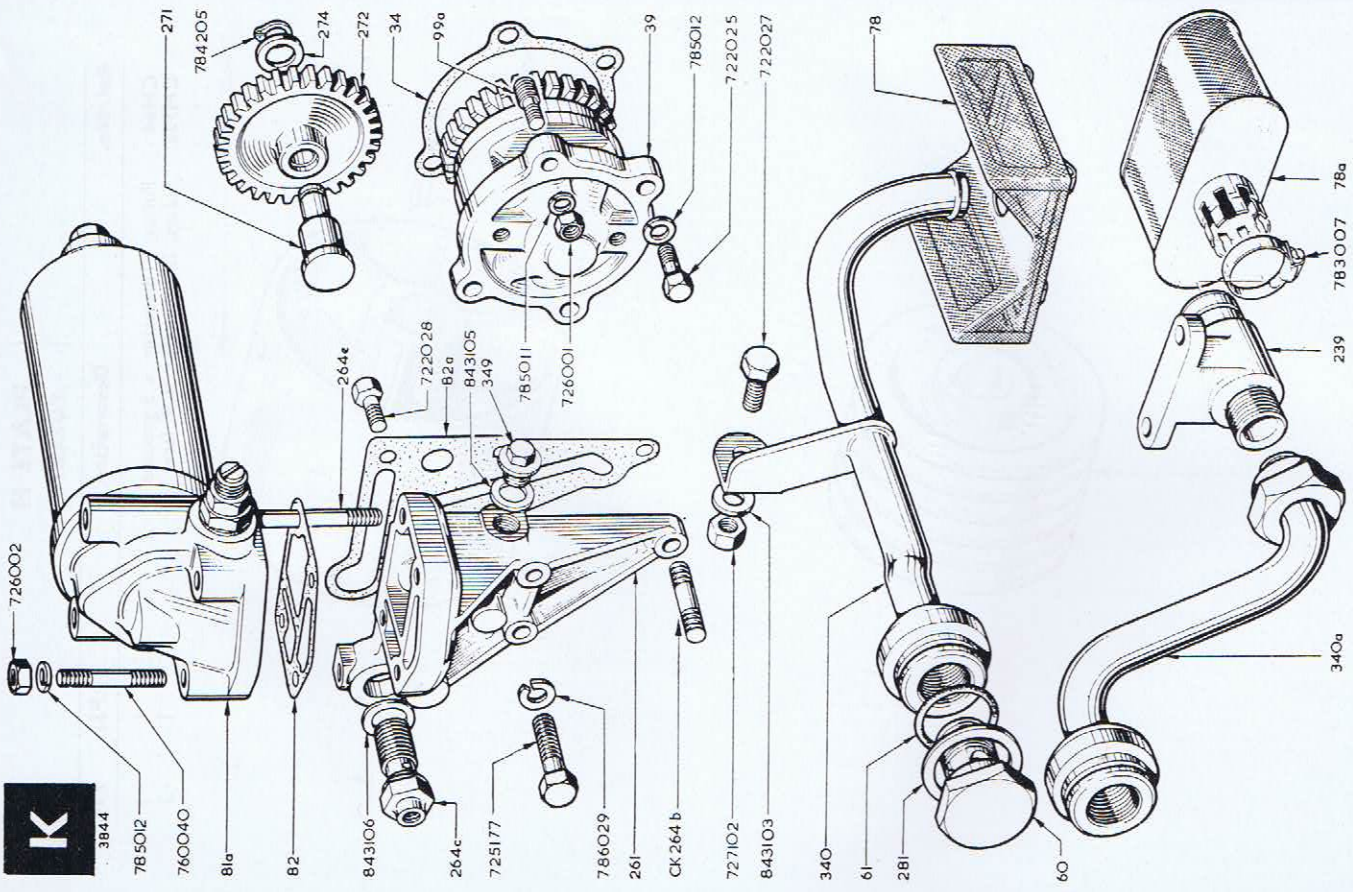
Ref. No.	Description	PJ3	PJ4
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CH64	Pulley, 9" diameter X 5 grooves
CH77a	Pulley, 12" diameter X 9" face

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K

726002



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PLATE K
LUBRICATING OIL PUMP AND FILTER

Ref. No.	Description	PJ3	PJ4
CK34	Joint—Oil Pump
CK39	Pump—Lubricating Oil	.....	.....
CK60	Banjo Bolt—Oil Pump Strainer	.....	.....
CK61	Oil Seal—Oil Pump Strainer	.....	.....
CK78	Strainer—Oil Pump	.....	.....
UK78a	Strainer—Oil Pump (Sump)	.....	.....
HK81a	Filter—Lubricating Oil (for details see separate list)	.....	.....
CK82	Joint—Oil Filter	.....	.....
CK82a	Joint—Oil Distribution Bracket	.....	.....
JK99a	Stud—Oil Pump	.....	.....
CK239	Adaptor—Oil Pump to Strainer (Sump)	.....	.....
CK261	Bracket—Oil Distribution (complete with Plug and Joint Washer)	.....	.....
CK264b	Stud—Oil Distribution Bracket	.....	.....
JK264c	Banjo Bolt—Rocker Oil Restrictor	.....	.....
JK264e	Stud—Lubricating Oil Filter	.....	2
JK271	Spigot—Idler Gear	.....	.....
JK272	Idler Gear—Oil Pump	.....	.....
JK274	Washer—Oil Pump Idler Gear	.....	.....
CK281	Joint Washer—Oil Pump Strainer	.....	.....
CK340	Pipe—Oil Pump Strainer	.....	.....
CK340a	Pipe—Oil Pump Strainer (Sump)
CK349	Plug—Oil Distribution Bracket

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SPEEDER SPRING DETAILS

Ref. No.	Colour	Position	Engine Speed (rev/min)
CA6k	Dark Violet	...	1500/1550
CA6l	Dark Violet/ Brilliant Green	Bands	...
CA6	Yellow/Brown	Bands	1800/1849
		Ends	1850/2000

GOVERNOR SPRING DETAILS

Ref. No.	Colour	Position	Engine Speed (rev/min)
JD6	Aluminium	...	1500/1550
JD6b	Green/Blue	Bands	...
		Bands	1800/2000

SETS OF JOINTS

Ref. No.	Description	PJ3	PJ4	
CZ2	Decarbonising Set of Joints	...	4	
	Consisting of: (See Plates B and F)	...	3	
	CB4	Joint—Rocker Box Plate	...	4
	CB27	Joint—Rocker Box	...	4
	CB58	Gasket—Cylinder Head	...	4
	CB61	Washer—Fuel Injection Nozzle	...	4
	CB89	Joint—Push Rod Tube Base	...	4
	CB94	Oil Seal—Push Rod Tube	...	12
	CB95	Joint Washer—Push Rod Tube Adaptor	...	16
	UF38	Joint—Silencer Flange	...	3
	CF50	Gasket—Exhaust and Inlet Manifold	...	8
	CF63	Joint—Inlet Manifold	...	4
	CZ1c	Complete Set of Joints	...	1
	CZ1d	Complete Set of Joints	...	1
CZ2	Consisting of:	...	...
	CZ2	Decarbonising Set of Joints	...	
CZ3c	Conversion Set of Joints	...	3	
CZ3c	Consisting of:	...	...
	CZ3c	Conversion Set of Joints	...	
CZ3c	Conversion Set of Joints	...	1	
	Consisting of: (See Plates A, B, C, D, E, F and K)	...	...
	JA20	Joint—Fuel Pump Bracket Cover	...	
	JA27	Joint—Fuel Pump Bracket	...	
	JA42	Joint—Inspection and Oil Filler Covers	...	
	JA45	Joint—Oil Filler Cap	...	
	CA49	Joint—Gear Cover Plate	...	
	JA56	Joint—Gear Cover	...	
	ZPB7	Washer—Decompressor Shaft	...	
	CC7	Joint—Main Bearing Housing	...	
	CC266	Joint Washer	...	
	CC271	Joint—Fan Driving Pulley Housing	...	
	CD21	Joint—Governor Fulcrum Bracket	...	
	CD23	Joint—Governor Fulcrum Bracket Plate	...	
	CD28	Joint—Oil Seal Housing	...	
	JE72	Joint Washer—Fuel Pump	...	
	AAE220	Joint Washer—Injector Leak-off Pipe	...	
	CK34	Joint—Oil Pump	...	
	CK61	Oil Seal—Oil Pump Strainer	...	
	CK82	Oil Filter	...	
	CK82a	Joint—Oil Distribution Bracket	...	
	CK281	Joint Washer—Oil Pump Strainer	...	
	786705	Lockwasher, $\frac{5}{16}$ "	...	
	843004	Joint Washer, $\frac{3}{8}$ " (Fibre)	...	
	843103	Joint Washer, $\frac{3}{8}$ " (Copper)	...	
	843104	Joint Washer, $\frac{3}{8}$ " (Copper)	...	
	843105	Joint Washer, $\frac{1}{2}$ " (Copper)	...	
	843106	Joint Washer, $\frac{3}{8}$ " (Copper)	...	

AIR CLEANER, FUEL AND OIL FILTER ELEMENT PACKS

Ref. No.	Description	PJ3	PJ4
HZ10b	Element Pack—Fuel Filter Consisting of: JE64a/6 Element—Fuel Filter	...	...
JZ11B	Element Pack—Lubricating Oil Filter Consisting of: JK81/6 Element—Lubricating Oil Filter	...	...
CZ12	Element Pack—Air Cleaner Consisting of: CF423 Element—Air Cleaner	...	...

COMMON DETAIL PARTS—PJ3-4

‡ Denotes that part must be obtained from Petters Ltd or their agents
Stud lengths quoted are overall lengths

Ref. No.	Description
712005	Screw—Hex Head, 2BA × $\frac{3}{8}$ "
713005	Screw—Round Head, 2BA × $\frac{3}{8}$ "
716001	Nut, 2BA
720004	Screw—Cheese Head, $\frac{1}{4}$ " BSF × $\frac{3}{4}$ "
722001	Screw—Hex Head, $\frac{1}{4}$ " BSF × $\frac{1}{2}$ "
722002	Screw—Hex Head, $\frac{1}{4}$ " BSF × $\frac{3}{4}$ "
722003	Screw—Hex Head, $\frac{1}{4}$ " BSF × $\frac{1}{2}$ "
722023	Screw—Hex Head, $\frac{5}{16}$ " BSF × $\frac{1}{2}$ "
722024	Screw—Hex Head, $\frac{5}{16}$ " BSF × $\frac{3}{4}$ "
722025	Screw—Hex Head, $\frac{5}{16}$ " BSF × $\frac{1}{2}$ "
722026	Screw—Hex Head, $\frac{5}{16}$ " BSF × $\frac{3}{4}$ "
722027	Screw—Hex Head, $\frac{5}{16}$ " BSF × $\frac{1}{2}$ "
722028	Screw—Hex Head, $\frac{5}{16}$ " BSF × $\frac{3}{4}$ "
722029	Screw—Hex Head, $\frac{5}{16}$ " BSF × $\frac{1}{2}$ "
722030	Screw—Hex Head, $\frac{5}{16}$ " BSF × $\frac{3}{4}$ "
722031	Screw—Hex Head, $\frac{5}{16}$ " BSF × $\frac{1}{2}$ "
722035	Screw—Hex Head, $\frac{5}{16}$ " BSF × $\frac{3}{4}$ "
722045	Screw—Hex Head, $\frac{3}{8}$ " BSF × $\frac{1}{2}$ "
722050	Screw—Hex Head, $\frac{3}{8}$ " BSF × $\frac{3}{4}$ "
722067	Screw—Hex Head, $\frac{1}{2}$ " BSF × $\frac{1}{2}$ "
722605	Screw—Hex Head, $\frac{1}{2}$ " BSF × $\frac{1}{2}$ "
724065	Capscrew—Socket Head, $\frac{3}{8}$ " BSF × $2\frac{3}{4}$ "
724236	Grubscrew—Socket Head, $\frac{1}{16}$ " BSF × $\frac{3}{8}$ " (Cup Point)
725929	Bolt—Hex Head, $\frac{5}{16}$ " BSF × $1\frac{1}{4}$ "
725032	Bolt—Hex Head, $\frac{5}{16}$ " BSF × $1\frac{3}{4}$ "
725033	Bolt—Hex Head, $\frac{5}{16}$ " BSF × 2"
725034	Bolt—Hex Head, $\frac{5}{16}$ " BSF × $2\frac{1}{4}$ "
725036	Bolt—Hex Head, $\frac{5}{16}$ " BSF × $2\frac{3}{4}$ "
725039	Bolt—Hex Head, $\frac{5}{16}$ " BSF × 3"
725053	Bolt—Hex Head, $\frac{3}{8}$ " BSF × $1\frac{1}{2}$ "
725177	Bolt—Hex Head, $\frac{3}{8}$ " BSF × $1\frac{5}{8}$ "
725181	Bolt—Hex Head, $\frac{3}{8}$ " BSF × $1\frac{3}{4}$ "
726001	Nut, $\frac{1}{4}$ " BSF
726002	Nut, $\frac{1}{4}$ " BSF
726003	Nut, $\frac{3}{8}$ " BSF
726016	Locknut, $\frac{1}{8}$ " BSF
726017	Locknut, $\frac{1}{8}$ " BSF
726018	Locknut, $\frac{1}{8}$ " BSF
726101	Nut, $\frac{1}{4}$ " BSF (Brass) (Plated)
726102	Nut, $\frac{1}{4}$ " BSF (Brass) (Plated)
726116	Locknut, $\frac{5}{16}$ " BSF (Brass) (Plated)
727014	Nut, $\frac{1}{4}$ " BSF (Self-locking) (Nylon Insert) (Thin)
727030	Nut (Self-locking) (Nylon Insert)
727102	Nut, $\frac{1}{8}$ " BSF (Self-locking) (Phosphated)
727104	Nut, $\frac{1}{8}$ " BSF (Self-locking) (Phosphated)
727130	Nut (Self-locking) (Phosphated)
730003	Screw—Cheese Head, $\frac{1}{4}$ " BSW × $\frac{5}{8}$ "
742047	Screw—Hex Head, $\frac{1}{2}$ " UNF × $1\frac{1}{8}$ "
747117	Nut, $\frac{5}{8}$ " UNF (Self-locking) (Phosphated) (Thin)
752024	Screw—Hex Head, $\frac{1}{4}$ " UNC × $\frac{5}{8}$ "
752026	Screw—Hex Head, $\frac{1}{4}$ " UNC × $\frac{3}{8}$ "
752648	Screw—Hex Head, $\frac{3}{8}$ " UNC × $\frac{1}{2}$ " (Plated)
760034	Stud, $\frac{5}{16}$ " BSF × $1\frac{1}{2}$ "
760040	Stud, $\frac{5}{16}$ " BSF × $2\frac{1}{4}$ "
760051	Stud, $\frac{1}{2}$ " BSF × $3\frac{1}{4}$ "

Ref. No.	Description	Section	Paragraph
760061	Stud, $\frac{3}{8}$ " BSF X $1\frac{3}{8}$ "	a	71
760065	Stud, $\frac{3}{8}$ " BSF X $1\frac{7}{8}$ "	b	4
760092	Stud, $\frac{1}{2}$ " BSF X $1\frac{3}{4}$ "	c	1
771018	Pin, $\frac{1}{16}$ " X $1\frac{1}{2}$ " (Full length taper groove)	d	53
771327	Pin, $\frac{1}{16}$ " X $\frac{3}{4}$ " (Half length reverse taper groove)	e	52
772111	Pin—Cotter, $\frac{1}{16}$ " X $1\frac{1}{2}$ "	f	54
773001	Split Pin, $\frac{1}{16}$ " X $\frac{3}{4}$ "	e	27
773005	Split Pin, $\frac{1}{16}$ " X $\frac{7}{8}$ "	f	35
773007	Split Pin, $\frac{1}{16}$ " X $\frac{1}{8}$ "	f	37
773022	Split Pin, $\frac{3}{16}$ " X $1\frac{3}{8}$ "	f	36
773149	Split Pin, $\frac{1}{16}$ " X $\frac{7}{8}$ "	f	38
774159	Pin—Spring Tension, $\frac{3}{16}$ " X $\frac{3}{4}$"	...	...
774161	Pin—Spring Tension, $\frac{3}{16}$ " X $1\frac{1}{8}$"	...	...
783007	Clip—Worm Drive, $1\frac{1}{2}$"	...	...
784015	Circlip, $2\frac{1}{2}$ " X 0-079" (Internal)	...	...
784205	Circlip, $\frac{1}{8}$ " X 0-039" (External)	...	...
784206	Circlip, $\frac{3}{16}$ " X 0-039" (External)	...	...
784207	Circlip, $\frac{1}{4}$ " X 0-047" (External)	...	...
785005	Washer—Bright, 2BA (Small)	...	...
785011	Washer—Bright, $\frac{1}{4}$ " (Small) (Heavy Gauge)	...	...
785012	Washer—Bright, $\frac{1}{8}$ " (Small) (Heavy Gauge)	...	...
785014	Washer—Bright, $\frac{1}{16}$ " (Small) (Heavy Gauge)	...	...
786003	Spring Washer—Single Coil, 2BA (Square Section)	...	...
786027	Spring Washer—Single Coil, 2BA (Rectangular Section)	...	...
786028	Spring Washer—Single Coil, $\frac{1}{2}$ " (Rectangular Section)	...	...
786029	Spring Washer—Single Coil, $\frac{1}{2}$ " (Rectangular Section)	...	...
786030	Spring Washer—Single Coil, $\frac{3}{8}$ " (Rectangular Section)	...	...
786208	Spring Washer—Double Coil, $\frac{3}{8}$"	...	...
786508	Washer—Shakeproof, $\frac{3}{16}$ " (Internal Teeth)	...	...
786705	Washer—Shakeproof, $\frac{1}{16}$ " (Internal Teeth) (Sealing)	...	...
786707	Washer—Shakeproof, $\frac{1}{16}$ " (Internal Teeth) (Sealing)	...	...
790067	Key—Parallel, $\frac{3}{8}$ " X $\frac{1}{16}$ " X $\frac{1}{2}$"	...	...
792006	Key—Woodruff, $\frac{1}{8}$ " X $\frac{1}{2}$"	...	...
792008	Key—Woodruff, $\frac{3}{16}$ " X $\frac{1}{2}$"	...	...
792018	Key—Woodruff, $\frac{3}{16}$ " X $1\frac{1}{2}$"	...	...
817004	Ball— $\frac{5}{16}$ " (Stainless)	...	...
823001	Plug—Socket Head, $\frac{1}{8}$ " BSP (Taper)	...	...
823003	Plug—Socket Head, $\frac{3}{8}$ " BSP (Taper)	...	...
831002	Banjo—Pipe Connection, $\frac{1}{4}$ " O.D. Pipe (Brass)	...	...
831025	Bolt—Banjo— $\frac{3}{8}$ " BSP	...	...
†833025	Union (Pipe fitting one end only)	...	...
833102	Union—Equal, $\frac{1}{2}$ " BSP (Brass)	...	...
843004	Joint Washer, $\frac{3}{8}$ " (Fibre)	...	...
843103	Joint Washer, $\frac{1}{2}$ " (Copper)	...	...
843104	Joint Washer, $\frac{3}{4}$ " (Copper)	...	...
843105	Joint Washer, $\frac{1}{2}$ " (Copper)	...	...
843106	Joint Washer, $\frac{3}{4}$ " (Copper)	...	...
843157	Joint Washer, $1\frac{1}{2}$ " (Copper-Asbestos)	...	...
	TECHNICAL DATA	...	...
	INSTALLATION	...	...
	DRIVE ARRANGEMENTS	...	...
	OPERATION	...	...
	RUNNING MAINTENANCE	...	...
	GENERAL MAINTENANCE	...	...
	PARTS LIST	...	...
	Air cleaner maintenance	...	...
	Air intake	...	...
	Bearers	...	...
	Camshaft maintenance	...	...
	Camshaft removal	...	...
	Camshaft replacement	...	...
	Carbon removal	...	...
	Connecting rod examination	...	...
	Connecting rod maintenance	...	...
	Connecting rod removal	...	...
	Connecting rod replacement	...	...
	Cooling	...	...
	Crankshaft maintenance	...	...
	Crankshaft removal	...	...
	Crankshaft replacement	...	...
	Cylinder head dismantling	...	...
	Cylinder head removal	...	...
	Cylinder head replacement	...	...
	Cylinder maintenance	...	...
	Cylinder removal	...	...
	Cylinder replacement	...	...
	Decarbonising	...	...
	Don'ts	...	...
	Electric starting equipment	...	...
	Erection	...	...
	Exhaust	...	...
	Fan belt adjustment	...	...
	Fan belt changing	...	...
	Fan dismantling	...	...
	Fan removal	...	...
	Fan replacement	...	...
	Fuel	...	...
	Fuel filter cleaning	...	...
	Fuel injector maintenance	...	...
	Fuel injector removal	...	...
	Fuel injector replacement	...	...
	Fuel injector testing	...	...
	Fuel pump dismantling	...	...
	Fuel pump maintenance	...	...
	Fuel pump removal	...	...
	Fuel pump replacement	...	...
	Fuel pump timing	...	...
	Fuel system	...	...
	Governor maintenance	...	...
	Lubricating oil filter maintenance	...	...
	Lubricating oil pump dismantling	...	...
	Lubricating oil pump maintenance	...	...
	Lubricating oil pump removal	...	...
	Lubricating oil pump replacement	...	...
	Lubricating oil pump strainer	...	...

Lubricating oil system	Paragraph
Lubrication	45
Main bearing maintenance	6
Piston maintenance	43
Piston removal	33
Piston replacement	31
Preparation for starting	34
Protection and preservation	13
Pulley drive	73
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NEDERLANDSE GEBRUIKSAANWIJZING

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