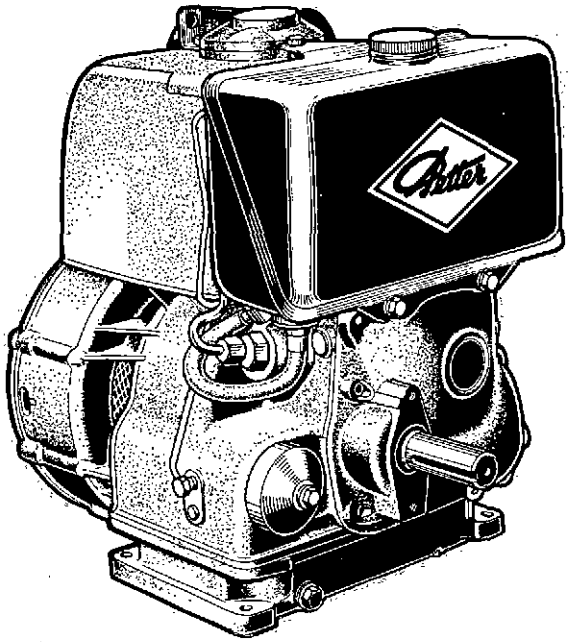
PETTER

DIESEL ENGINES



ABI

OPERATORS HANDBOOK

ISSUE 4

Price 5/-

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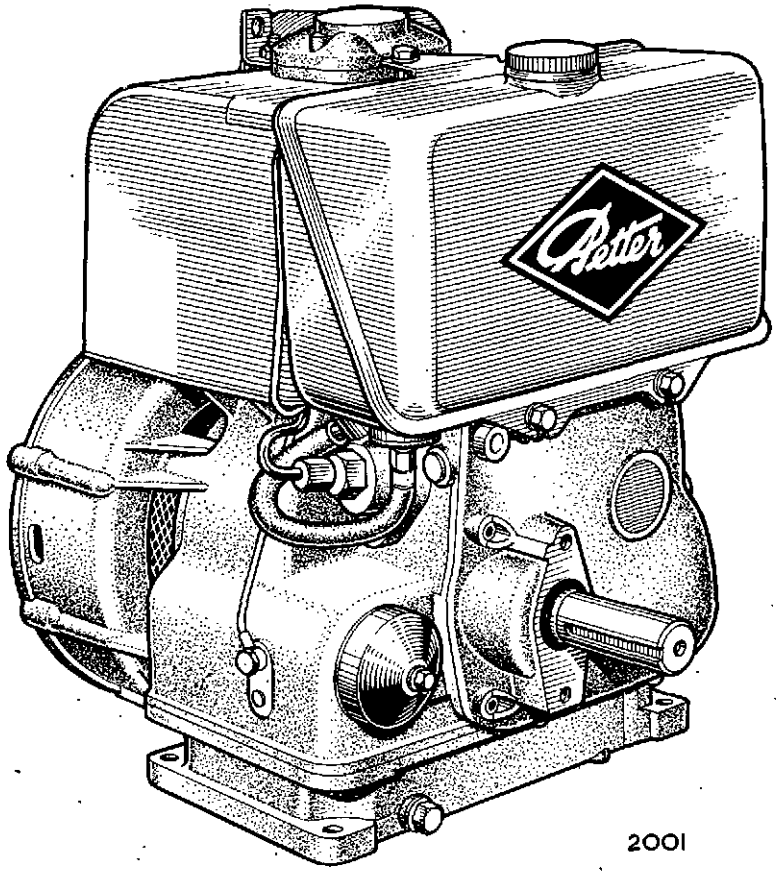
Petter Diesel Engines

TYPE ABI



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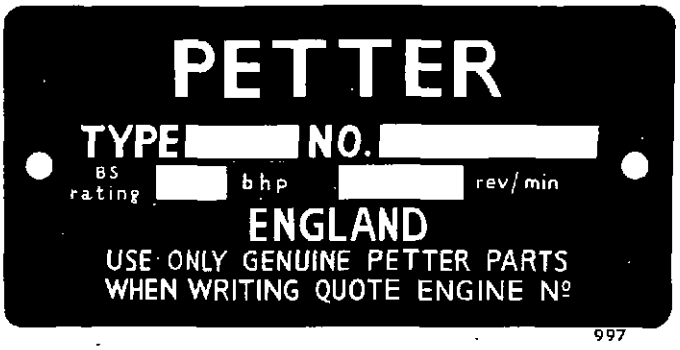
This book will help the user to get the best results from the engine. No engine will run without care; but it will give good service if given the attention described in this book.

Please record details of engine and installation in the spaces below



Copy details from engine label

ENGINE INSTALLATION **PLANT No.**

....

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

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-in 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	Phone: Hamble 2061 Telex: 47626 Telegrams: Petter Hamble Telex
or Service Depots at	
Petters Ltd. Service Depot, 90 Loch Street, Aberdeen	Aberdeen 53217
Petters Ltd. Service Depot, Broomhill Industrial Estate, Kirkintilloch, Dumbartonshire	Kirkintilloch 04-1776 2316/7 04-1776 3451 Telex: 778204
Petters Ltd. Service Depot, Limewood Road, Seacroft, Leeds, 14	Leeds 649101
Petters Ltd. Service Depot, Cliff Works, Burton-on-the-Wolds, *Loughborough, Leics*	Wymeswold 333
Petters Ltd. Service Depot, Bridge Works, Staines, Mddx	Staines 51333

a technical data

Bore (nominal)	3in (76·2mm)
Stroke	2¼in (57·15mm)
Power and Speed (B.S. continuous rating):	
	2·3 bhp at 1500 rev/min
	2·7 bhp at 1800 rev/min
	3·2 bhp at 2100 rev/min
	3·85 bhp at 2500 rev/min
	4·5 bhp at 3000 rev/min
	5·0 bhp at 3600 rev/min
Cubic capacity	15·9 in³ (261 cm³)
Compression ratio	16·25 to 1
Lubricating oil pressure (min.)	35 lb/in² (2·46 kg/cm²)
Compression pressure	590 lb/in² (41·5 kg/cm²)
Fuel injection release pressure	2350/2650 lb/in² (165·2/186·3 kg/cm²)
Fuel injection timing (by spill):	
Fixed speed	
1500 rev/min	23° before TDC
1800 rev/min	23° before TDC
2100 rev/min	23° before TDC
2500 rev/min	26° before TDC
3000 rev/min	30° before TDC
3600 rev/min	35° before TDC
Variable speed	30° before TDC
Inlet valve opens	13° before TDC
Inlet valve closes	38° after TDC
Exhaust valve opens	38° before TDC
Exhaust valve closes	13° after TDC
Reduction gear ratio	1⅘:1
	2:1
	4:1
	6:1
Fuel tank capacity (engine mounted) ...	9 pints (5·13 litres)
Oil capacity	3¼ pints (1·9 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	12 Volts 57 Ampere hour (min.)

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

Camshaft end float	0·003/0·010in (0·08/0·25mm)
Crankshaft end float (new)	0·005/0·017in (0·13/0·43mm)
Crankshaft end float (not to exceed) ...	0·020in (0·51mm)
Crankpin ovality (not to exceed) ...	0·0025in (0·063mm)
Cylinder bore wear (not to exceed) ...	0·010in (0·25mm)
Piston ring gap (new)	0·012/0·017in (0·30/0·43mm)
Piston ring gap (not to exceed) ...	0·045in (1·14mm)
Exhaust valve lift by decompressor (max.)	0·015in (0·38mm)
Bumping clearance	0·022/0·026in (0·56/0·66mm)
Valve rocker clearance (cold)	0·004in (0·10mm)
Valve depth from cylinder head face (new)	0·039/0·042in (0·99/1·07mm)
Main bearing clearance (new)	0·0008/0·0029in (0·020/0·077mm)
Large end bearing clearance (new) ...	0·0010/0·0035in (0·025/0·090mm)
Small end bush diameter (fitted) ...	0·8753/0·8757in (22·233/22·243mm)
Reduction gear power take-off shaft end float	0·002/0·005in (0·05/0·13mm)
Cylinder reboring diameters:	
Standard	3·000/3·001in (76·20/76·23mm)
Oversize:	
0·020in	3·020/3·021in (76·71/76·73mm)
0·030in	3·030/3·031in (76·96/76·99mm)
0·040in	3·040/3·041in (77·22/77·24mm)
Crankshaft regrinding diameters:	Main journal and crankpin
Standard	1·6250/1·6245in (41·275/41·262mm)
Undersize:	
0·010in	1·6150/1·6145in (41·021/41·008mm)
0·020in	1·6050/1·6045in (40·767/40·754mm)
Torque spanner settings:	
Large end bolt	25 lb ft (3·46 kg m)
Cylinder head nut	20 lb ft (2·77 kg m)
Injector stud nut	10 lb ft (1·39 kg m)
Flywheel nut	155 lb ft (21·43 kg m)
Air cell cap	70 lb ft (9·70 kg m)
Lubricating oil filter centre bolt ...	10 lb ft (1·39 kg m)
Reverse gear clutch cone screw ...	10 lb ft (1·39 kg m)
Fuel pump discharge union body ...	30 lb ft (4·15 kg m)
Crankshaft extension shaft capscrew	14 lb ft (1·94 kg m)

APPROVED LUBRICANTS

(Only fully detergent oils may be used. See note under Lubrication.)

Supplier	U.K. Winter & Summer *Up to 32°C (90°F)*	Tropical *Above 32°C (90°F)*
Shell Group of Companies	Rotella S 10W Rotella T 10W Rotella 10W/30 X100 10W X100 10W30 Talona 10W	Rotella S 20/20W Rotella T 20/20W Rotella 10W/30 X100 20/20W X100 10W/30 Talona 20 Tractor Universal
Mobil Oil Co. Ltd.	Delvac Special Delvac 1110 Mobiloil Special Mobiloil 10W Mobiland Universal Mobiland Diesel 10 Tractor	Delvac Special Delvac 1120 Mobiloil Special Mobiloil Arctic Mobiland Universal Mobiland Diesel 20 Tractor Mobilgard 212
Power Pet Co. Ltd. (U.K.) B.P. Companies (Overseas)	Energol DD Multigrade Energol DD 10W Energol IC-D10 Energol Motor 10W Energol Visco Static Energol IC-M10W	Energol DD Multigrade Energol DD 20W Energol IC-D20 Energol Motor 20W Energol Visco Static Energol IC-M20W Tractor Universal
Castrol Group of Companies	Castrol CR 10 Castrol CRI 10 Deusol CR 10 Deusol CRI 10 Deusol CRML Agricastrol HD 10 Agricastrol HD 10/1	Castrol CR 20 Castrol CRI 20 Deusol CR 20 Deusol CRI 20 Deusol CRML Agricastrol HD 20 Agricastrol HD 20/1
Esso Marketers	Essolube HD 10W Essolube HD 10W/30	Essolube HD 20 Essolube HD 10W/30 Estor HD 20 Tromar HD 20
Caltex/Regent Co. Ltd. Texaco Ind.	Caltex RPM Delo Special 10 Caltex RPM Delo Multi-Special 10W/30 Havoline Motor 10W/30 Texaco Ursa Heavy Duty 10W	Caltex RPM Delo Special 20 Caltex RPM Delo Multi-Special 10W/30 Havoline Motor 10W/30 Texaco Ursa Heavy Duty 20W
Gulf Oil Group of Companies	Gulflube HD 10W Gulflube Motor HD 10W/30 Gulfpride Single G Veritas HD V3	Gulflube HD 20/20W Gulflube Motor HD 10W/30 Gulfpride Single G Veritas HD V6 Gulfarm Universal

NOTE: Since some SAE 10W oils are thinner than SAE 10W/30 multigrades at low temperatures, the starting of the engine at these temperatures will be marginally better using SAE 10W oils.

TROUBLE LOCATING CHART

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

TROUBLE LOCATING CHART—contd.

Trouble	Reason	Causes	Suggested Remedy
Engine starts but fires intermittently or soon stops	Faulty fuel supply	Air in the fuel lines Water in the fuel Faulty injector nozzle Fuel filter choked	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
	Dirty engine	Blocked exhaust pipe or similar	Clean out
Engine lacks power and/or shows dirty exhaust	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 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

TROUBLE LOCATING CHART—contd.

Trouble	Reason	Causes	Suggested Remedy
Faulty running	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	Decarbonise Fit new nozzle Adjust timing Fit new ring Fit new piston Renew and check lubrication Refit Renew and check lubrication
	Overheating	Overload Lubricating oil failure Excessive valve clearance Cooling system failure	Reduce the load Fill the sump and check system Adjust Check that the cooling system is in order and free from obstruction
	Speed surges	Air in fuel pipes Governor sticking	Bleed the system Free the governor
	Sudden stop	Empty fuel tank Choked injector Fuel pipe broken Seized piston	Fill tank and bleed the system Fit new nozzle Repair or renew Fit new piston or, in an emergency, stone down
	Heavy vibration	Loose holding down bolts	Tighten up
	Dirty engine	Worn breather valve	Fit new valve

b installation

1. Engine bearers

Engine mounting superstructure must be of rigid construction and neither deflect nor twist when subjected to the engine weight.

2. Erection

(a) Installation drawings are obtainable from *Petters Ltd or their agents.*

(b) Provision must be made for:
- (i) Oil filler cap removal and oil draining.
- (ii) Fuel and oil filter and air cleaner maintenance.
- (iii) Starting 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) An exhaust manifold flange is available from *Petters Ltd or their agents* and is tapped to take a pipe with a. 1in BSP thread. A 1in BSP exhaust pipe is suitable for lengths up to 18in (46cm). For lengths between 18in (46cm) and 10ft (3m) use a 1½in BSP exhaust pipe and between 10ft (3m) and 20ft (6m) use a 2in BSP exhaust pipe. For exhaust pipe sizes for lengths in excess of 20ft (6m) consult *Petters Ltd or their agents.*

(b) 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 15in (381mm) long must be fitted to a 1½in BSP acoustic silencer.

(c) The exhaust system should be as short as possible and with a minimum of bends, otherwise a serious reduction of power will result.

(*d*) A short length of flexible exhaust pipe 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 the flywheel fan and care must be taken to ensure that the fan cowling air intake is unobstructed.

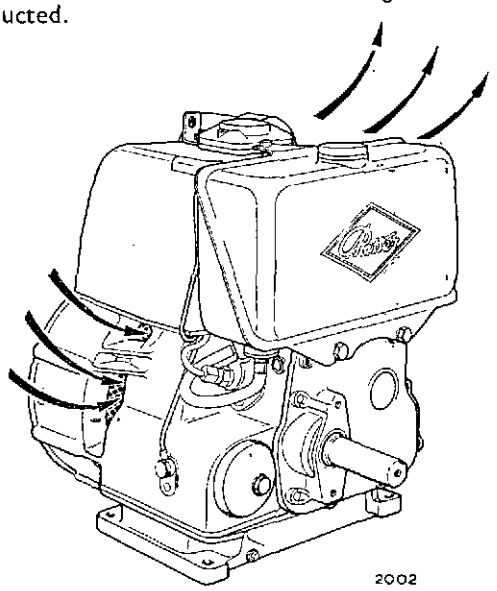


Fig. 1

(*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 IN POSITION.

6. Lubrication

(*a*) The engine oils listed under Approved Lubricants are heavy duty oils with a minimum detergency as specified by:

British Defence Specification No. 2101B

or

U.S. Specification MIL/L/2104A.

(*b*) Suitable additional heavy duty engine oils will be recommended by a local oil distributor but a minimum detergency as above must be specified.

(*c*) *Petters Ltd or their agents* should be consulted if doubt arises regarding the selection of an engine oil.

(*d*) MARINE AUXILIARY INSTALLATIONS. Although two viscosities of oil are recommended for different 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 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.

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 equipment.

(*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 sec	1·6 to 6·0 sec
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 purposes 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 conditions 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 temperature 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 constant speed irrespective of load variations and will be either a fixed speed type governing the engine at its rated speed only or a variable speed type allowing the governed speed to be varied between idling and full rated speed.

The centrifugal forces on the governor balls are transmitted to the fuel pump rack. These forces, which vary with the speed of the engine, are balanced by an adjustable speeder spring. On a variable speed governor the tension of the speeder spring may be externally altered to give the required governed speed. On fixed speed governors the speeder spring may be adjusted to give an included variation of 10%.

For starting purposes only, operation of the overload stop lever fitted to variable speed governors allows the fuel pump rack to move into the excess fuel pump position. When the engine runs up to its rated speed the governor closes the rack which is then prevented from returning to the excess fuel position by the ratchet action of the overload stop cam.

The overload stop limiting the travel of the rack into the excess fuel position on variable speed engines is set by *Petters Ltd* and the internal adjustment 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 a dirty exhaust.

C drive arrangements

Engine marks

Power can be taken from more than one shaft at the same time provided the total power absorbed is not greater than the rated power of the engine.

Drive and starting arrangements are as follows:

MARK I Drive at half engine speed on camshaft extension at end remote from flywheel. Rope-starting at flywheel end.

MARK II Drive at engine speed on crankshaft extension at end remote from flywheel. Rope-starting at flywheel end.

MARK VI Drive at engine speed from flywheel end. Rope-starting at end remote from flywheel.

Pulley drive (Fig. 2)

When belt drives are used the belts should be as close to the engine as possible.

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.

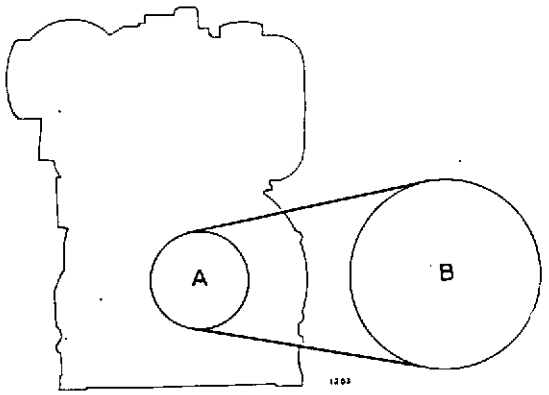


Fig. 2

9. Rotation

Standard rotation is clockwise when looking at the flywheel.

10. To prepare a new or overhauled engine for starting (Fig. 3)

(*a*) Check that the cooling system is in order and free from obstruction.

(*b*) Remove the oil filler cap and fill with lubricating oil to the high level mark on the dipstick. (To remove the cap, push down and twist.) 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.)

(*c*) Unscrew the nut on the air cleaner cover, remove the cover and element and dip the cover, but not the element, in a bath of clean engine oil. Allow the cover to drain. Replace the element and cover making sure that the element is correctly seated on the sealing rings.

(*d*) Lift the decompressor lever and turn the engine one or two dozen revolutions to help circulate the oil.

(*e*) Fill the fuel tank.

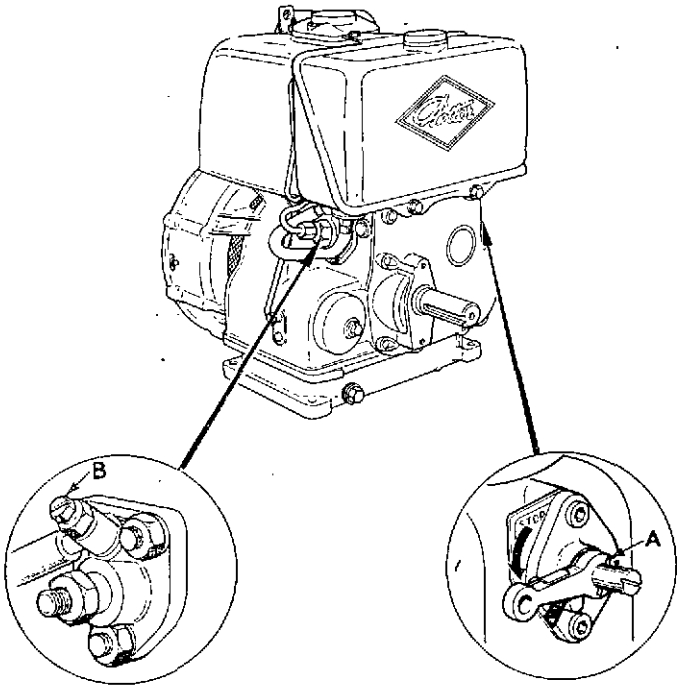


Fig. 3

(*f*) Bleed and prime the fuel system as follows:
(i) If a variable speed control is fitted, set the control in the full speed position.
(ii) If an idler speed control is fitted set the control in the 'RUN' position.
(iii) Move the stop/run lever (A) to the 'RUN' position, i.e. horizontal.
(iv) Loosen the vent screw (B). Turn the engine a few times *until clean, bubble-free fuel leaks out. Retighten screw.*
(v) Turn the engine until the injector is heard to squeak.

11. To start (Fig. 4)

(*a*) Remove the load from the engine.
(*b*) Move the stop/run lever (A) to the 'RUN' position, i.e. horizontal.
(*c*) If a variable speed control is fitted, set the control lever to the half speed position then push down and release the overload stop lever (B).
(*d*) If an idler speed control is fitted, set the control in the 'RUN' position.
(*e*) Rope starting
(i) Turn the starting pulley in the opposite direction to the arrow until a resistance is felt. Bounce the pulley vigorously against the resistance until the injector has squeaked ten times. (This is unnecessary with a warm engine.)
(ii) Wind the rope round the starting pulley in a clockwise direction when looking on the flywheel. The end of

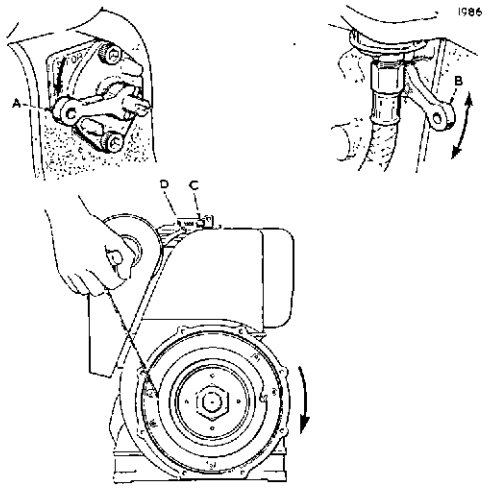


Fig. 4

the rope should be in the pulley notch and the rope should be wound round the pulley from two to two-and-a-half turns.

WARNING: The rope should not be wound round the operator's wrist.

(iii) Make sure that the decompressor lever is disengaged and then pull the rope smartly until it unwinds completely from the pulley. The engine should now fire.

(*f*) Handle starting

(i) Lift the decompressor lever (D) and turn the handle in the direction of rotation and listen for the squeak of the injector.

(ii) Stop turning the engine when the piston is just past TDC on the compression stroke and then disengage the decompressor lever (D).

(iii) Turn the engine as fast as possible in the direction of rotation. The engine should now fire.

(*g*) 4:1 hand starting

(i) Lift the starter dog to engage the gears.

(ii) Engage the starting handle in the starter dog. The handle will not fully engage unless the dog has been lifted.

(iii) Lift and hold the decompressor lever (D). Turn the handle slowly and listen for the squeak of the injector.

(iv) When the injector has squeaked turn the handle as fast as possible and release the decompressor lever (D). Keep turning. The engine should now start. The gears and starting handle will disengage automatically as the engine increases speed.

(*h*) Electric starting

(i) Make sure that the decompressor lever is disengaged and operate the dynastart. Do not operate the dynastart for more than 20 seconds at a time.

(*j*) Should the engine fire and then stop, push down and release the overload stop lever (B), if fitted, before attempting to start again.

(*k*) Below 13°C (55°F) it may be necessary to operate the priming plunger (C) BEFORE attempting to start. Proceed as follows:

(i) Remove the priming plunger (C).

(ii) Fill the priming chamber with engine oil—NOT fuel.

(iii) Replace the priming plunger and press down.

(*l*) Below 0°C (32°F) it may be an advantage not to use the cold oil from the sump for priming but to use oil at a higher temperature. Also it may be necessary to prime the engine a second time before attempting to start.

(*m*) If under cold conditions the engine does not run up to its rated speed after starting, operate the priming plunger again while the engine is running.

(*n*) To minimise cold starting difficulties, it is a wise policy to keep the engine under cover when not in use and to ensure that an SAE10 viscosity engine oil is used (see Approved Lubricants).

(*p*) Below –4°C (25°F) it may be necessary to use low temperature starting equipment and details of this are obtainable from *Petters Ltd or their agents*. This 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, or through permanently fitted equipment spraying directly into the inlet manifold. Indiscriminate use of auxiliary starting fuels may cause damage. *Petters Ltd or their agents* should be consulted if doubt arises regarding the use of such fuels.

(*q*) Below –9·4°C (15°F) the light alloy engine construction imposes internal friction and special instructions are obtainable from *Petters Ltd or their agents* regarding warming the whole engine, maintaining it at a raised temperature and diluting the lubricating oil.

12. To stop (Fig. 4)

(*a*) It is advisable to run on light load for a few minutes before stopping.

(*b*) Move the stop/run lever (A) to the 'STOP' position, i.e., upward, and hold in this position until the engine stops.

13. 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 fuel 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 operate the overload stop lever when the engine is running.

e running maintenance

14. Clutch

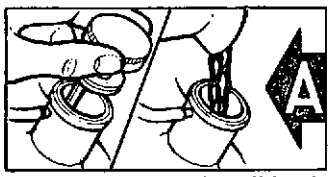
If a *Petter* clutch is fitted it should be adjusted in accordance with the instructions given under General Maintenance.

15. Daily

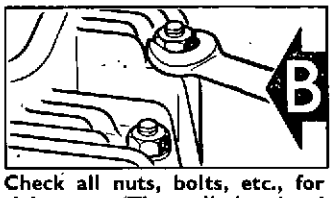
(*a*) Check lubricating oil and top up if necessary.

(*b*) Check that the cooling system is in order and free from obstruction.

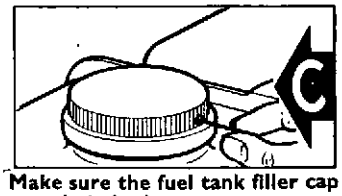
DAILY



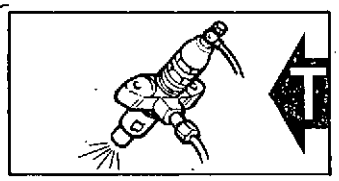
Check the lubricating oil level on the dipstick and top up if necessary.



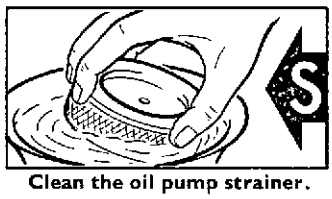
Check all nuts, bolts, etc., for tightness. (The cylinder head nuts must NOT be tightened when the engine is hot.)



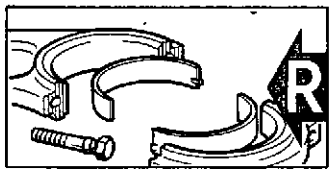
Make sure the fuel tank filler cap vent hole is clear.



Remove the injector and test spray.

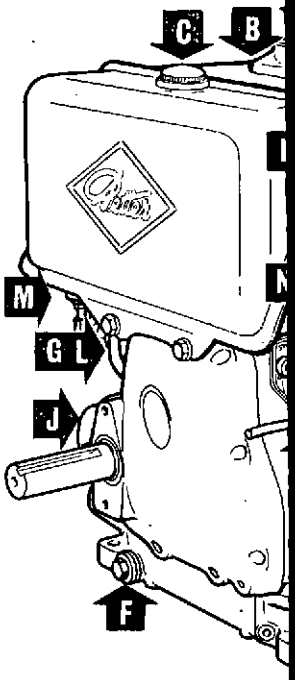


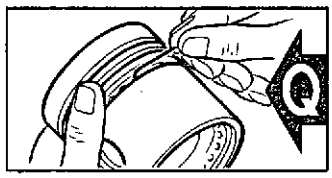
Clean the oil pump strainer.



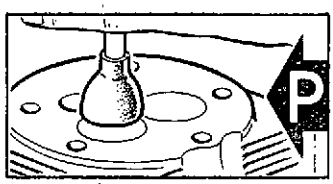
Examine the crankshaft bearings and renew if clearance is excessive.

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

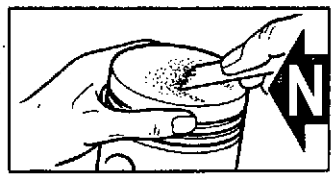




Clean the piston oil return holes. Check cylinder bore wear.



Examine the valves and grind if necessary.



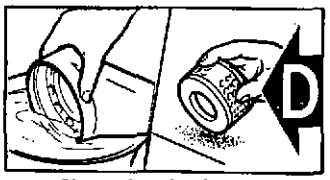
Remove cylinder head and decarbonise.

2,000 HOURS

INTENANCE CHART

250 HOURS

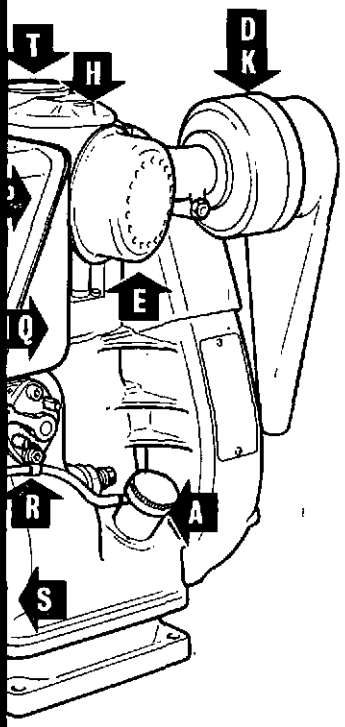
1987



Clean the air cleaner.

Clean out deposit from exhaust system.

Drain the sump, flush out with flushing oil and refill with new oil.



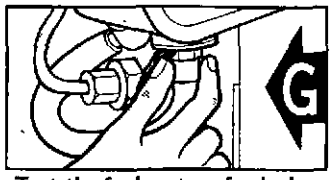
Keep cooling system

free from obstruction.

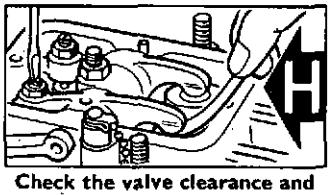
Use only the lubricants

approved by

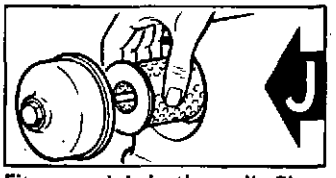
Petter



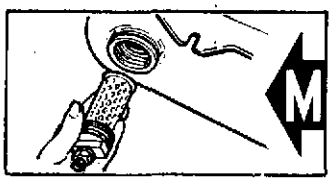
Test the fuel system for leaks.



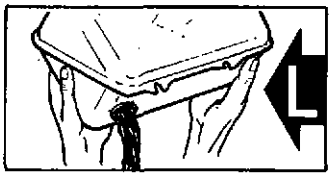
Check the valve clearance and adjust if necessary.



Fit new lubricating oil filter element and joint ring.

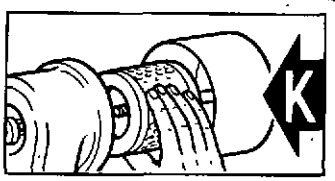


Fit new fuel filter element.



Clean out the fuel tank thoroughly.

1,000 HOURS



Fit new air cleaner element.

500 HOURS

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.

16. Every 50 hours

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

17. Every 250 hours

(*a*) Check all nuts, bolts, etc., for tightness. (The cylinder head nuts must NOT be tightened when the engine is hot.)
(*b*) Make sure the fuel tank filler cap vent hole is clear
(*c*) Clean the air cleaner (paper element type).
(*d*) Clean out deposit from exhaust system.
(*e*) Drain the sump, flush out with flushing oil and refill with new oil. (Paraffin may be used if flushing oil is unobtainable but the engine must not be run with paraffin in the sump.)
(*f*) Test the fuel system for leaks.
(*g*) Check the valve clearance and adjust if necessary.
(*h*) Fit new lubricating oil filter element and joint ring.
(*j*) Lubricate the speed control linkage.

18. Every 500 hours

(*a*) Fit new air cleaner element (paper element type).

19. Every 1000 hours

(*a*) Clean out the fuel tank thoroughly.
(*b*) Fit new fuel filter element.

20. Every 2000 hours

(*a*) Decarbonise.
(*b*) Clean out piston oil return holes. Check cylinder bore wear.
(*c*) Examine the crankshaft bearings and renew if clearance is excessive.
(*d*) Clean the oil pump strainer.
(*e*) Remove the fuel injector and test spray. If in order replace without further interference.

f general maintenance

21. 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.*

22. To remove cylinder head

(*a*) Remove cylinder cowling and fuel tank.
(*b*) Remove the crankcase-to-rocker-box oil pipe.
(*c*) Disconnect fuel pipe and remove air cleaner and manifold.
(*d*) Remove rocker cover.
(*e*) Remove the exhaust silencer or manifold.
(*f*) Remove the fuel injector.
(*g*) Remove the rocker assembly and withdraw the push rods.
(*h*) Remove the cylinder head nuts and lift off the cylinder head and push rod tubes.

23. To remove valves

(*a*) Hold the valve on the seat and depress the valve spring cap and remove the split collets. Valve and spring can now be removed.

24. 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.
(*c*) Thoroughly clean out the exhaust and inlet ports and manifolds.
(*d*) Do not disturb the air cell. This should not normally require attention.
(e) Make sure the recesses at the ends of valve guide bores are free from carbon.
(*f*) Thoroughly clean the valves and examine the valve seats. If these show signs of pitting, they should be ground in.
(*g*) Make sure the valves are seating properly. Leaking valves cause *loss of compression and difficult starting.*

25. To grind in valves

(*a*) Care must be taken that the valves are returned to their correct seating for this operation.
(*b*) Place a very small quantity of valve 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.
(*d*) It is unneccesary 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 unneccesary.

(e) Wash out the ports thoroughly with petrol or paraffin making sure that all traces of grinding paste are removed from the ports 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.

26. To replace cylinder head

(a) Generally reverse the instructions for removal and dismantling. The rocker bushes and push rod ends should be smeared with moly-disulphide before assembly.

(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 the new valves are fitted, the valves must be ground in.

(e) The cylinder head should be returned to *Petters Ltd or their agents* if new valve guides are required.

(f) A new cylinder head gasket must be fitted.

(g) When replacing the cylinder head make sure the push rod tube seals are in good order. Failure to observe this precaution may lead to oil leaks.

(h) As the engine is fitted with long through studs from crankcase to 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.

(j) A torque spanner is advisable for tightening the cylinder head nuts. It should be set to the figure shown under Technical Data.

27. To adjust valve rockers (Fig. 5)

(a) To adjust the clearance, set the engine with valve closed

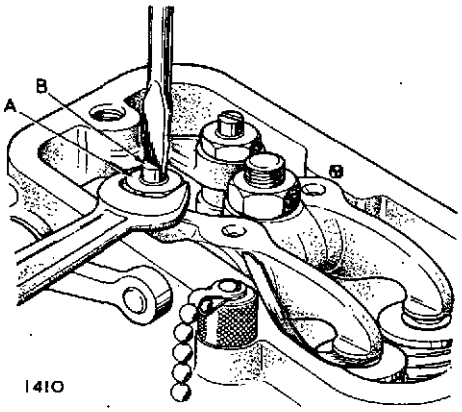


Fig. 5

(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) re-tighten the locknut. Recheck the gap.

(*b*) IMPORTANT. The cylinder head must be firmly bolted in position, with all nuts finally tightened, before the rocker clearances are adjusted.

28. To remove cylinder and piston

(*a*) Remove 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.

29. 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.

30. Piston maintenance (Fig. 6)

Excessive lubricating oil consumption; loss of compression and knockings 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 and about $\frac{1}{2}$in (12mm) 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. The gap can now be checked 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.
(*e*) When the engine has been fully run-in, the bore will have a highly polished and very hard surface. If new piston rings

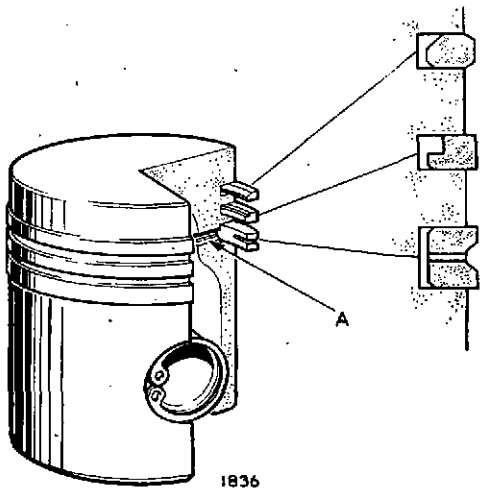


Fig. 6

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. After this treatment the cylinder must be thoroughly washed in petrol or paraffin to remove all traces of carborundum.

31. To replace cylinder and piston

(*a*) Take care that the piston ring gaps are not in line but well distributed around the piston circumference.

(*b*) Replace the shims between the cylinder and the crankcase. The thickness of the shims controls the bumping clearance between the piston and cylinder head at TDC.

(*c*) Before completing reassembly check the bumping clearance (see Technical Data) as follows:
Place a piece of lead wire approximately 1in (25mm) long on top of the piston in the centre and 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.

(*d*) After completing reassembly, check the valve rocker clearance.

32. To examine connecting rod

(a) Remove cylinder head and cylinder.
(b) Check for undue play or shake in the large and small end bearings.

33. To remove connecting rod

(a) Remove the cylinder head and cylinder.
(b) Drain the oil from the sump.
(c) Remove the sump.
(d) Unscrew the large end bolts and withdraw the connecting rod and piston assembly, being careful to note in which position the bearing halves are fitted.

34. Connecting rod maintenance

(a) 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 rod squarely. In the absence of a press, a block of wood and mallet may be used for driving it home.
(b) New small end bushes are supplied with a reaming allowance, and after fitting must be reamed to the size shown under Technical Data.
(c) 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.
(d) 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.
(e) 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.
(f) Undersize bearings are obtainable from Petters Ltd or their agents.

35. To replace connecting rod

(a) Generally reverse the instructions for removal, making sure that the connecting rod cap is away from the dipstick side of the engine.
(b) When replacing the cylinder and cylinder head, check the bumping clearance and adjust valve rocker clearance.
(c) A torque spanner is advised for tightening the large end bolts. It should be set to the figure shown under Technical Data. Do not over-tighten the large end bolts or the bearing may distort. If a torque spanner is not available, the bolts may be tightened using a moderate force on a spanner gripped approximately 8in (200mm) from the bolt.

36. To remove crankshaft

(*a*) Remove the cylinder head, cylinder and connecting rod.
(*b*) Bend back the tabwasher on the flywheel retaining nut and remove the nut and tabwasher.
(*c*) Remove the flywheel. The flywheel is fitted on a taper and located by a key. Remove the key. Make sure that the flywheel fan is not damaged when removing the flywheel.
(*d*) Remove the gear cover. The cover is dowelled to the crankcase.
(*e*) Remove the crankshaft extension shaft at the gear end.
(*f*) Remove the crankshaft gearwheel retaining bolt. Withdraw the gearwheel with a simple extractor.
(*g*) Remove the nuts retaining the flywheel end main bearing housing. Remove the housing taking care not to damage the oil seal.
(*h*) Withdraw the crankshaft by pulling towards the flywheel end.

37. Crankshaft maintenance

(*a*) Carefully examine the bearing journals and crankpin. 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.

38. Main bearing maintenance

(*a*) Main bearings are of the precision thin wall steel backed sleeve type lined with bearing metal.
(*b*) When removing a gear end bearing from the crankcase or a flywheel end bearing from the bearing housing, heat the crankcase or bearing housing to a temperature of 93/120°C (200/250°F) before pressing out the bearing.
(*c*) When fitting a bearing, the crankcase or bearing housing should again be heated as above and the outer surface of the bearing should be smeared with moly-disulphide or tallow before pressing in. It is an advantage if the bearing can be placed in a domestic type refrigerator for a time before fitting.
(*d*) Do not remove the bearings unnecessarily or their tightness in the crankcase or bearing housing may be affected. It is not advisable to remove the bearings more than five times.
(*e*) When fitting a bearing take care that it enters squarely.
(*f*) 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.
(*g*) Undersize bearings are obtainable from *Petters Ltd or their agents.*

39. To replace crankshaft and time engine (Fig. 7 & 9)

(*a*) Generally reverse the instructions for removal.
(*b*) Fit new bearings if the old ones have excessive clearance or show signs of the metal having run.
(*c*) If the main bearing housing has been removed make sure *it is correctly fitted with the oil drain hole at the bottom.*
(*d*) When fitting new thrust washers, be sure that the grooved sides are away from the bearing housing and that the tongues (A) are located in the respective recesses. Fit new pins (B).

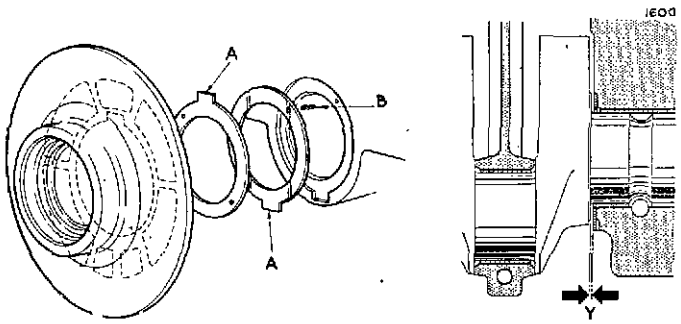


Fig. 7

(*e*) Before completing the assembly, check the end float (Y) and if excessive fit new thrust washers (see Technical Data).
(*f*) When assembling the gearwheels make sure the teeth marked with dots are in their relative positions.

40. To remove camshaft (Fig. 8)

(*a*) Remove the gear cover. The cover is dowelled to the crankcase.
(*b*) Remove the rocker cover, rocker support and rocker assembly and withdraw the push rods. Remove the push rod base.
(*c*) Remove the fuel injection pump.
(*d*) Remove the screws (A) retaining the camshaft thrust plate. The screws are accessible through holes in the gearwheel.
(*e*) Turn the engine onto its side to prevent the tappets from falling into the sump.
(*f*) Withdraw the camshaft and gearwheel assembly from the gear end of the engine.
(*g*) The gearwheel is a tight fit on the camshaft. To fit a new thrust plate remove the gearwheel retaining bolt and press the shaft from the gearwheel. The gearwheel is keyed to the shaft.

41. Camshaft maintenance

(*a*) Carefully examine the faces of the cams. If these are worn or chipped it will be necessary to fit a new camshaft.

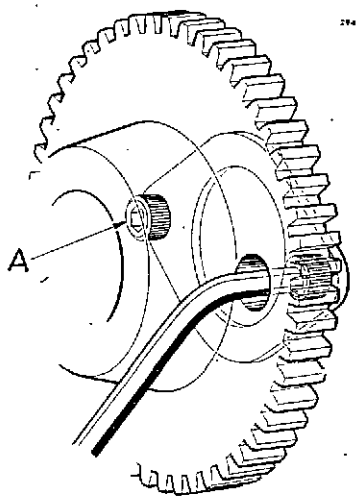


Fig. 8

42. To replace camshaft and time engine (Fig. 9)

(*a*) Generally reverse the instructions for removal.
(*b*) When assembling the gearwheels make sure that the teeth marked with dots are in their relative positions.
(*c*) Retime the fuel injection and adjust valve clearances.

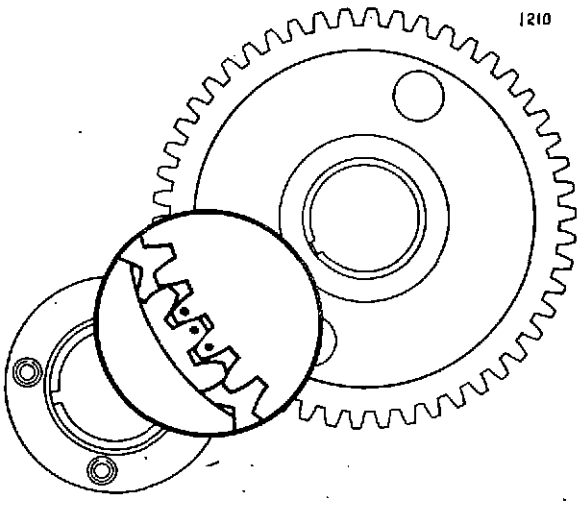


Fig. 9

43. To remove governor (Fig. 10)

(*a*) Remove the gear cover.

(*b*) Remove the screws (J) securing the governor housing cover and withdraw the governor assembly.

44. To remove governor linkage (Fig. 10)

(*a*) Remove the governor.

(*b*) Remove the camshaft and gearwheel assembly.

(*c*) Loosen the governor bracket screw (A)

(*d*) Remove the dowel (B) securing the governor stop lever and remove the lever (C).

(*e*) Remove the screws (D) securing the governor stop cover and withdraw the cover (E).

(*f*) Remove the governor plug (F) and withdraw the operating lever shaft (G).

(*g*) Withdraw the operating lever assembly (H).

(*h*) On variable speed engines remove the dowel (K) securing the overload stop lever and remove the lever (L). Do not loosen the screw clamping the overload cam to the spindle. The cam is set by *Petters Ltd* and should not be disturbed unless a new fuel pump is fitted (see instructions given under 'To fit new fuel injection pump'). Remove the overload stop spindle and cam.

45. Governor maintenance

(*a*) Examine the faces of the governor sliding housing and the governor rotating housing for signs of wear.

(*b*) If, on a variable speed engine, oil leaks at the governor overload stop lever spindle, renew the oil seal. To remove the oil seal, carefully extract the spindle. When refitting the spindle ensure that it is free from burrs.

46. To replace governor and linkage (Fig. 10)

(*a*) Generally reverse the instructions for removal.

(*b*) Thoroughly clean all parts in paraffin or clean fuel, paying particular attention to all bearings and the governor balls.

(*c*) Make sure the governor bracket fork ends are hard against the governor thrust bearing when the faces of the governor sliding housing and the governor rotating housing are together.

(*d*) Check the setting (M) between the operating shaft bush and the operating lever with a feeler gauge. This should be 0·010in (0·25mm). Loosen the governor bracket screws and adjust the governor operating lever until the correct setting is obtained.

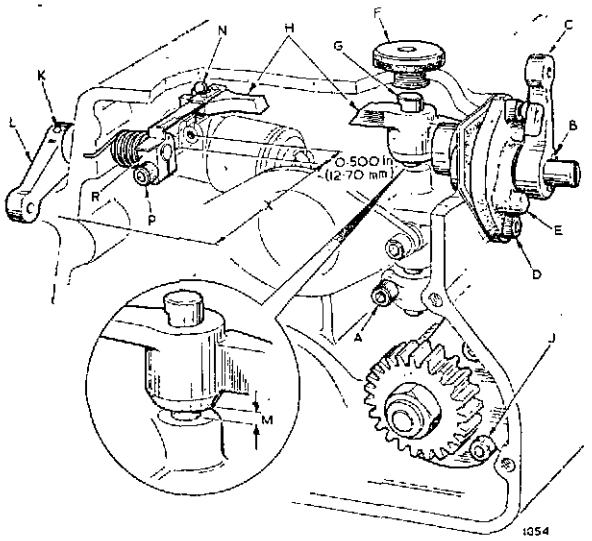


Fig. 10

47. Lubricating oil system (Fig. 11)

(*a*) The lubricating oil system is as follows:
- (i) A rotary oil pump (A) is mounted in the crankcase at the gear end. The pump is driven by a gear from the camshaft.
- (ii) Oil is drawn through a strainer (B) and fed to the filter (C).
- (iii) Oil flows from the filter via a hole in the crankcase to the gear end main bearing. It is then transferred via holes in the crankshaft to the large end bearing and the flywheel end main bearing.
- (iv) The valve rockers are supplied by an external pipe.
- (v) A pressure relief valve is incorporated to control the oil pressure.

(*b*) The cylinder, small end bearing and camshaft are splash lubricated.

(*c*) The crankcase can be drained by removing the plug at the bottom of the sump.

(*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.

48. To clean oil filter

(*a*) Unscrew the bolt at the centre of the filter cover and withdraw the cover and element.

(*b*) Thoroughly clean out the cover and renew the joint ring.

(*c*) If the element shows a large deposit of dirt, it should be

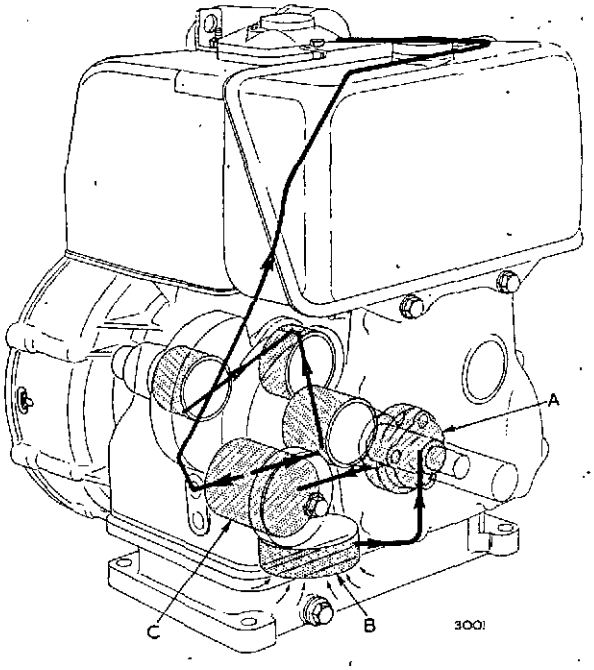


Fig. 11

replaced by a new element, obtainable from *Petters Ltd or their agents*. Do not attempt to clean the element.

(*d*) When replacing the element a torque spanner is advisable for tightening the centre bolt. It should be set to the figure shown under Technical Data.

49. Oil pump strainer.

(*a*) To remove
  (i) Drain the oil.
  (ii) Remove the setscrews from the sump and remove the sump.
  (iii) Remove the centre bolt and spring plate and remove the strainer.

(*b*) To clean
  (i) Wash the strainer in clean paraffin or fuel.

(*c*) To replace
  (i) Generally reverse the instructions for removal, making sure that the strainer is correctly seated in the sump.

50. To remove oil pump

(*a*) Loosen the oil pump gearwheel retaining nut.

(*b*) Remove the camshaft and gearwheel assembly.

(c) Remove the nut retaining the oil pump gearwheel and remove the gearwheel. The gearwheel is keyed to the shaft.
(d) Remove the screws securing the pump and withdraw the pump.
(e) The backplate is dowelled to the body.

51. 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.
(c) Examine joint and renew if necessary.

52. To replace oil pump

(a) Generally reverse the instructions for removal.
(b) Pour a small quantity of engine oil into the pump through the port before assembling the pump to the engine.

53. 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.

54. To clean fuel filter (engine mounted fuel tank)

(a) To remove element
(i) Drain the fuel tank.

(ii) Remove the tank-to-pump fuel pipe.
(iii) Remove the element plug from below the tank.
(iv) Carefully pull down the element and remove it from the tank.

(*b*) If the element shows a large deposit of dirt, remove the tank and wash out with paraffin or clean fuel. Fit a new element, obtainable from *Petters Ltd or their agents*. Do not attempt to clean the element.

(*c*) To replace the element
(i) Generally reverse the instructions for removal making sure that the element seal is in good condition.
(ii) Bleed the fuel system.

55. To clean fuel filter (separately mounted fuel tank)

(*a*) Unscrew the clamp bolt 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 the fuel system.

56. To remove fuel injection pump

(*a*) Drain the fuel tank.
(*b*) Remove the fuel tank.
(*c*) Remove the cowling.
(*d*) Disconnect fuel pipe.
(*e*) Remove the pump, noting the number and total thickness of shims between the fuel pump and crankcase.

57. To dismantle fuel injection pump (Fig. 12)

NOTE: Fuel injection pumps fitted to all variable speed engines are subjected to special calibration by the manufacturers and should not be dismantled. These pumps should be returned to the manufacturers or to *Petters Ltd or their agents* for servicing.

(*a*) Thoroughly clean the exterior of the pump.
(*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), the joint (E) and the ring (F).
(*d*) Rotate the circlip (G) in its groove until the dowel (H) is between the ends of the circlip.
(*e*) Press down the tappet and roller assembly against the spring pressure and shake out the dowel (H).

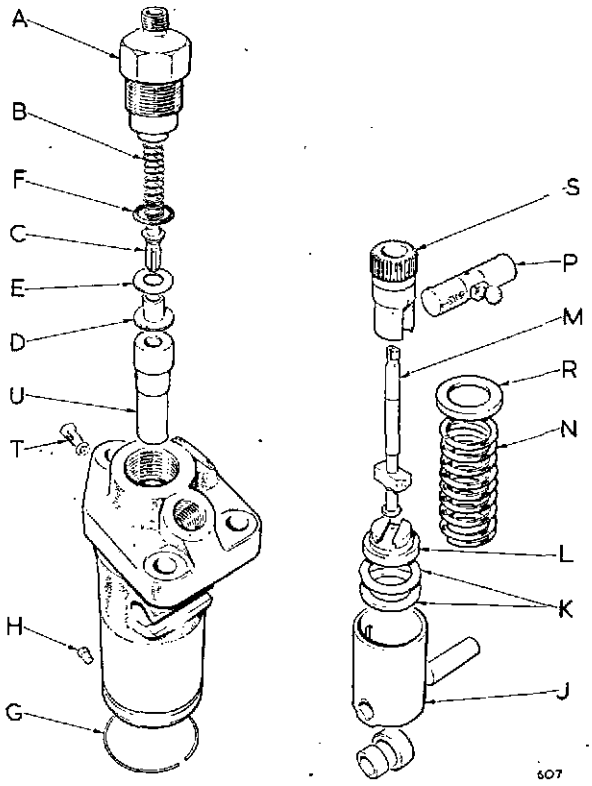


Fig. 12

(*f*) Remove the tappet (J) together with the roller and roller pin. Note the number and thickness of the calibrating shims (K) between the tappet and the lower spring plate (L).

(*g*) Remove the lower spring plate (L), the plunger (M) and the plunger spring (N). Note the assembly mark on the plunger arm farthest from the rack (P).

(*h*) Remove the upper spring plate (R) and the pinion (S). Note the assembly marks on one tooth of the pinion (S) and on the rack (P). Note also the relative position of the 'STOP' mark and arrow on the rack before sliding out the rack from the pump body.

(*j*) Remove the element locating screw (T) and push out the element (U) through the top of the pump.

58. 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 and ring are in good condition and that the valve is seating correctly. Leaking valves cause loss of fuel injection pressure and difficult starting.
(*c*) Make sure the rack is free throughout its travel.

59. To replace fuel injection pump (Fig. 12)

(*a*) Generally reverse the instructions for removal and dismantling.
(*b*) Thoroughly clean all parts in clean fuel and assemble wet.
(*c*) The ring (F) should be fitted over the lower shoulder of the union body (A) before the union body is screwed into the pump body. Failure to observe this precaution may result in the ring being crushed between the union body and the joint (E). A torque spanner is advisable for tightening the union body. It should be set to the figure shown under Technical Data.
(*d*) When assembling the rack (P) and pinion (S) make sure that the marked tooth of the pinion is opposite the mark on the rack and that the rack is assembled in the pump body so that the 'STOP' mark and arrow will be towards the gear end of the engine when the pump is fitted.
(e) Make sure that the element (U) can be moved up and down slightly when the locating screw (T) is tightened.
(*f*) Replace the plunger (M) with the marked locating arm engaged with the marked slot in the pinion (S), i.e., the marked locating arm is towards the locating screw (T).
(*g*) With the element, plunger and pinion correctly assembled, the scroll at the top of the plunger will be adjacent to the fuel port in the side of the element when the rack is in the centre of its travel.
(*h*) Replace the tappet (J) making sure that the correct number and thickness of shims is used.
(*j*) Press down the tappet and roller assembly and fit the dowel (H) to engage with the slot in the tappet. Rotate the dowel to line up its slot with the ends of the circlip (G) and then turn the circlip in its groove until the ends of the circlip are away from the dowel.
(*k*) Make sure that the fuel pump cam is away from the fuel pump housing—turn the engine until the exhaust or inlet valve is open.
(*l*) Make sure that the fuel pump rack ball engages with the governor fork and that the correct number and thickness of shims is fitted between the pump and crankcase.
(*m*) IMPORTANT. New fuel injection pumps require special fitting instructions and these are given in the following paragraph.

60. To fit new fuel injection pump (Fig. 10)

(*a*) Fixed speed engines
(i) Make sure that the fuel pump cam is at the bottom of

its stroke. Turn the engine until the exhaust or inlet valve is open.

(ii) Turn the STOP/RUN lever (C) until the governor lever fork end is at the centre of the fuel pump housing.

(iii) Fit the fuel pump. Make sure that the fuel pump rack ball (N) has engaged with the governor lever fork.

(*b*) Variable speed engines

(i) to (iii) as for fixed speed engines.

(iv) Loosen the overload stop cam screw (P).

(v) Turn the STOP/RUN lever (C) fully towards the 'STOP' position and with the lever held in this position, measure the distance (X) between the end of the fuel pump rack and the gear cover face using a depth gauge.

(vi) Add 0·500in (12·70mm) to the depth gauge reading and reset the fuel pump rack in this position by turning the STOP/RUN lever towards the 'RUN' position.

(vii) Hold the rack in this position and set the overload stop cam (R) to just touch the overload stop (S). With the overload cam in this position, tighten the cam screw.

(viii) Check that the total movement from the fully forward (dead rack) position to the overload stop position is 0·500in (12·70mm).

(*c*) Time the fuel injection pump on all engines.

NOTE: Variable speed engines are fitted with special fuel injection pumps. Quote the type required when ordering new pumps (See Parts List plate N.)

61. To time fuel injection pump (Fig. 13)

Before timing the pump be sure the fuel line is bled up to the fuel pump. On engines fitted with variable speed control set the control to the full speed position.

(*a*) On fixed speed engines running at speeds above 3000 rev/min and on all variable speed engines, move the stop/run lever towards the 'STOP' position until it is 10° before the vertical position. At this position the pump rack will be held away from the retarded spill point. Fix the stop/run lever in this position and carry out the instructions given in sub-paragraphs (*b*) to (*k*).

On all fixed speed engines running at 3000 rev/min and below, the stop/run lever may be left in the 'RUN' position, i.e., horizontal.

(*b*) Drain the fuel tank. Remove the pump-to-injector pipe and unscrew the union body from the pump. Make sure that the union body sealing ring is withdrawn with the union body.

(*c*) Lift out the delivery valve and spring and place them in clean fuel. Do not disturb the delivery valve seat or the joint washer. Replace the union body and sealing ring leaving out the delivery valve and spring.

(*d*) Turn the flywheel until it is a quarter of a turn before TDC on the compression stroke.

(*e*) Pour a quantity of fuel into the tank. A small stream of fuel should then flow from the pump.

(*f*) Turn the flywheel slowly by hand in the normal running direction until the flow from the pump stops. Find by repeated trial the EXACT flywheel position at which this happens. This position is known as the spill point.

(*g*) When the flywheel is in the exact position where the flow stops, the appropriate timing mark preceding the TDC hole in the flywheel should be in line with the hole in the bellhousing.

(*h*) If the timing mark indicates a position before the bellhousing hole, add shims between the pump and crankcase until the correct timing is obtained. If the timing mark

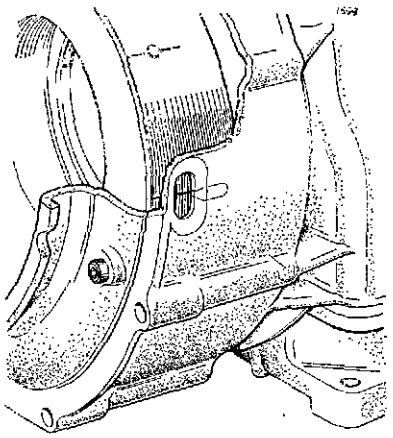


Fig. 13

indicates a position after the bellhousing hole, remove shims to obtain the correct timing.

(*j*) Reassemble the fuel injection equipment including the fuel delivery valve and spring. Make sure that the union body sealing ring is fitted and is not damaged.

(*k*) Bleed the fuel system.

62. To remove and test fuel injector

(*a*) Remove the cowling.

(*b*) Undo the pipe connections.

(*c*) Remove the injector flange nuts and carefully lever out the injector. Examine the joint washer and renew if necessary.

(*d*) Reconnect the injector to the pump-to-injector pipe in such a way that the nozzle points away from the engine.

(*e*) Turn the engine over slowly. The fuel should squirt out suddenly in a fine mist spray which should stop as suddenly.

If the nozzle fails to spray, or gives a solid squirt of fuel, or dribbles after the spray has stopped, fit a new nozzle.

(*f*) 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. 14)

(*a*) Thoroughly clean the exterior of the injector.

(*b*) Remove the nozzle holder cap nut (A) and the locknut (B).

(*c*) Remove the spring adjusting screw (C) and remove the spring pad (D), the spring (E) and the spring pressure rod (F).

(*d*) Remove the nozzle nut (G) and the nozzle assembly (H). Each needle of a nozzle assembly is mated to one nozzle body and must never be used in another.

(*e*) 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 a soft brass wire brush or a piece of clean wood or brass.

(*f*) The nozzle holder and nozzle joint faces must be clean with mirror-like appearance. The nozzle and nozzle nut clamping shoulders must be clean.

(*g*) The nozzle body fuel holes (J) should be cleaned by pushing a wire or twist drill (K) down to the fuel chamber (L) being careful not to scratch the joint face.

(*h*) Insert a nozzle scraper (M) down into the fuel chamber, press sideways and rotate to remove carbon, etc.

(*j*) Soft carbon can be removed from the spray hole with a spray hole cleaner (N).

(*k*) Wash the nozzle body and needle in clean fuel and assemble wet.

(*l*) To fit a nozzle assembly to the nozzle holder body, hold it hard against the pressure face and tighten the nozzle nut.

(*m*) To complete the assembly of the injector, grease the spring assembly and replace it, together with the adjuster, locknut and cap nut.

(*n*) Reset the fuel injector release pressure 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, loosen the locknut (B) and screw in the adjusting screw (C) to increase the pressure or out to decrease it. Tighten the locknut.

(*p*) Injectors not required for immediate use should have pipe connections sealed against the admission of dirt, etc.

64. To replace fuel injector

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

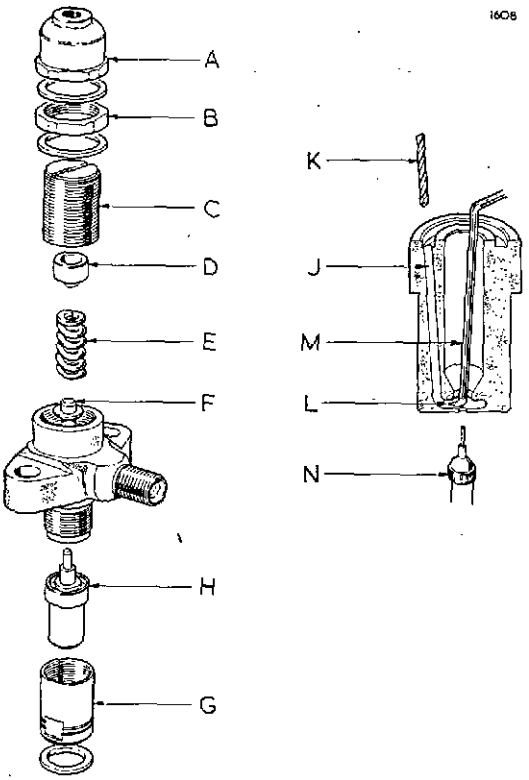


Fig. 14

(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.* A torque spanner is advisable for tightening the nuts. It should be set to the figure shown under Technical Data.

(*b*) Reconnect the leak-off pipe.
(*c*) Bleed the fuel system.

65. To adjust speed control (Fig. 15 & 16)

The centrifugal forces on the governor balls are transmitted to the fuel pump rack. These forces, which vary 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 a different fuel pump and springs may be required and these are obtainable from *Petters Ltd or their agents.* The speed is set by *Petters Ltd* and should not require further adjustment. However, if the setting is disturbed, adjustments are carried out as follows:

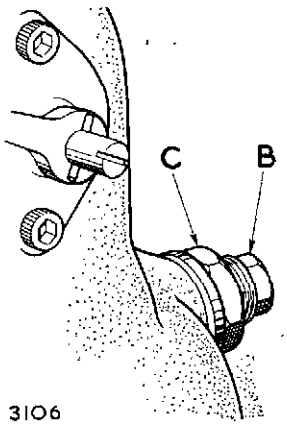


Fig. 15

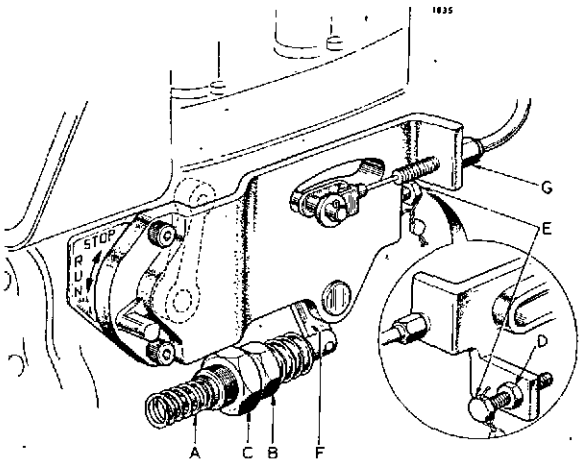


Fig. 16

(*a*) Fixed speed

(i) Loosen the locknut (C) on the dipstick side of the engine and screw in the adjuster (B) to increase the speed or out to decrease it. Tighten the locknut (C).

(*b*) Variable speed

(i) Set the control in the idling position.

(ii) Loosen the locknut (C) and adjust the idling screw to approximately 1000 rev/min by screwing in the adjuster (B) to increase the speed or out to decrease it. Tighten the locknut (C).

(iii) Set the control in the full speed position.

(iv) Loosen the locknut (D) and adjust the full speed by screwing the adjusting screw (E) out to increase the speed or in to decrease it. Tighten the locknut (D). Replace the seal with new locking wire.
(v) Check the idling speed and adjust if not correct.
(vi) To adjust the control cable, set the cable control lever (F) in the idling position. Screw in the cable adjuster (G) until 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 speed control.

66. Air cleaner maintenance

(a) Paper element type
(i) Unscrew the nut on the cover and remove the cover.
(ii) Remove the element. The element may be cleaned by blowing compressed air from the inside to the outside. Do not attempt to clean the element 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 element is damaged or shows a large deposit of dirt, fit a new element obtainable from Petters Ltd or their agents.
(iv) Thoroughly wash out the cover in petrol or paraffin and allow to drain. Make sure the gauze is clean.
(v) Dip the cover in a bath of clean engine oil and allow to drain before refitting.
(vi) Replace the element and cover making sure that the element sealing rings and inlet manifold seal 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.
(iii) Refit the cleaner and fill the cup with clean engine oil to the level indicated.
(iv) Refit the cup.

67. Clutch (single-plate) (Fig. 17)

(a) To remove
(i) Remove the screws (A) securing the clutch housing (B) to the crankcase and withdraw the housing complete with the operating lever and shaft.
(ii) Slacken each setscrew (C) securing the clutch to the flywheel half a turn at a time working diagonally across the clutch until all the clutch spring pressure is released. Remove the setscrews.
(iii) Remove the clutch (D) and clutch plate (E) from the flywheel. The clutch is dowelled to the flywheel.

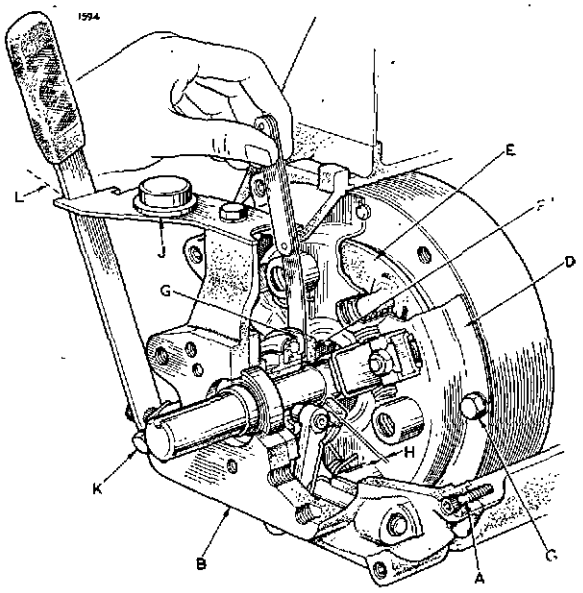


Fig. 17

(iv) The clutch should not be dismantled unless special tools are available for assembly and balancing the clutch.

(*b*) Clutch maintenance

(i) Parts most likely to wear are the clutch pressure plate (F), thrust bearing (G) and the clutch linings.

(ii) The surfaces of the flywheel and the clutch pressure plate should have a clean, even, polished appearance. If the surfaces have a glazed or varnished appearance make sure that oil is not penetrating to the clutch housing from the engine.

(iii) If the clutch plate linings or splines are worn fit a new clutch plate. Do not attempt to fit new linings.

(iv) Check the clearance (H) between the clutch pressure plate (F) and the thrust bearing (G). The clearance should be 0·10/0·15in (2·5/2·8mm) and may be checked by removing the plug (J) and inserting a feeler gauge between the pressure plate and the thrust bearing. To adjust the clearance, loosen the operating lever pinch bolt (K). With the lever in the engaged position (L) turn the yoke shaft against the spring pressure until the feeler gauge is gripped between the thrust bearing and then tighten the pinch hole. Check the clearance and replace the plug.

(c) To replace

(i) Generally reverse the instructions for removal.

(ii) Make sure that the clutch plate is fitted with the longer end of the splined hub away from the flywheel.
(iii) Make sure that the clutch plate is centralised.

68. Clutch (centrifugal)

(*a*) *To remove*
(i) Remove the clutch retaining screw and withdraw the clutch. The clutch is keyed to the shaft.
(*b*) Clutch maintenance
(i) Examine the clutch linings for signs of wear. If worn, renew, making sure that the new linings are clean and free from oil and grease.
(ii) If the inside of the drum has a glazed or varnished appearance make sure that oil is not penetrating to the drum from the engine.
(*c*) To replace
(i) Generally reverse the instructions for removal.

69. Reduction gear

(a) To remove
(i) Remove the fuel tank.
(ii) Remove the screws securing the bearing housing and remove the housing complete with the power take-off shaft and reduction gearwheel. Remove the shims.
(iii) Remove the reduction gear housing.
(iv) 4:1 or 6:1 ratios
Remove the nuts retaining the driving gearwheel.
2:1 or $1\frac{2}{3}$:1 ratios
Remove the bolts retaining the driving gearwheel.
(*b*) Reduction gear maintenance
(i) Examine the bearings and fit new parts if rollers or roller tracks show signs of wear.
(*ii*) Examine the driving and driven gearwheels. Renew if the teeth are scored or show signs of wear.
(*c*) To replace
(i) Generally reverse the instructions for removal making sure the oil seal is in good condition.
(Ii) Check the power take-off shaft end float (see Technical Data) and if not correct, alter the total thickness of the shims.

70. Electric starting equipment (Fig. 18)

This consists of a battery-operated combined starter motor and dynamo (dynastart) belt-connected to the crankshaft, a regulator, an ammeter, and a switch. Operating the switch energises a solenoid which energises the starting windings of the dynastart. The windings remain energised until the switch is released.

Dynastart

(*a*) Mounting

Make sure the dynastart is securely mounted on the engine. The belt tension should be checked carefully. A slack belt overheats and causes low output or insufficient speed for starting. A tight belt overloads the bearings and leads to early belt and bearing failure. As it depends solely on the operating conditions, it is not possible to lay down any hard and fast rule as to how frequently adjustment should be made. Belt slackness should not be more than $\frac{1}{2}$in (12mm). To adjust the tension, loosen the dynamo pivots and adjusting clamp screw. Make sure the pivots and adjusting clamp screw are tightened after adjustment.

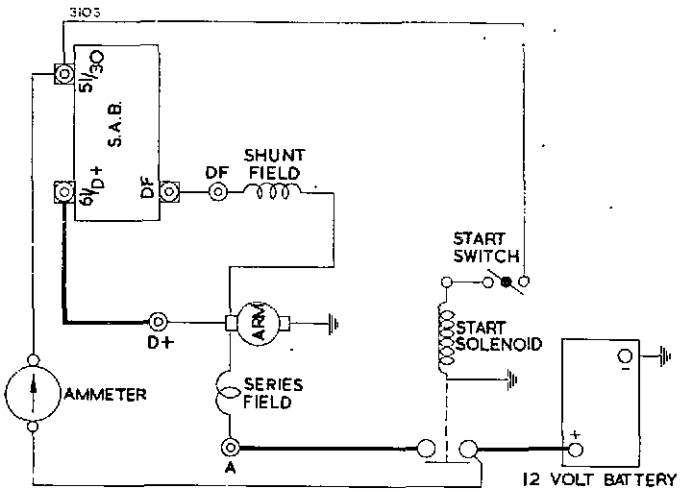


Fig. 18

(*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.

(*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.

71. Protection and preservation

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

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

(c) Intermittent use
When not in regular use engines should be run for a thirty-minute period each week to lubricate internal parts. External unpainted parts should be wiped with an oil rag and external controls, etc. lubricated.

(d) Preservation
Engines remaining idle for more than a month may corrode and as serious damage may result it is recommended that engines be preserved as follows:

(i) Drain the sump, flush out with flushing oil and refill with *Shell Rotella 10W or 20/20W. (Paraffin may be used if flushing oil is unobtainable, but the engine must not be run with paraffin in the sump.) The Rotella provides internal protection.

(ii) Drain the fuel system and refill with Shell Fusus A sufficient to run the engine on light load for five minutes. The Fusus A provides protection of the fuel injection equipment.

(iii) The crankshaft should not be turned after this operation.

(iv) Air inlet, exhaust manifold, etc. should be sealed against the ingress of moisture.

(v) Preserved engines require no attention before use other than removing the seals, but check that the viscosity of the *Rotella oil used for internal protection is suitable for the temperature conditions.

* See Approved Lubricants.

INSTRUCTIONS EN FRANÇAIS

1. Ne pas oublier que

(*a*) Un moteur a besoin de combustible:
Maintenir le combustible, le réservoir, le filtre et la tuyauterie propres.

(*b*) Un moteur a besoin d'huile de graissage:
Utiliser la qualité correcte d'huile. Maintenir le plein d'huile.

(*c*) Un moteur a besoin d'air:
Maintenir le filtre à air propre. Maintenir le collecteur d'admission d'air et la totalité du système d'échappement exempts de carbone et de toute autre obstruction.

(*d*) Un moteur a besoin d'être refroidi:
Veiller à ce que le circuit de refroidissement soit exempt de toute obstruction.

2. Montage

(*a*) Les plans d'installation peuvent être obtenus auprès de la *Petters Ltd ou des se agents:*

(*b*) Il faut pouvoir:
(i) Retirer le bouchon de remplissage d'huile et vidanger l'huile.
(ii) Entretenir les filtres à combustible et à huile et l'épurateur d'air.
(iii) Mettre en marche et manoeuvrer les commandes.

(*c*) Employer uniquement des goujons ou des boulons de fondation de bonne qualité. Ne PAS employer des vis de pression.

(*d*) Il faudra consulter la *Petters Ltd ou ses agents* dans les cas suivants:
(i) Avant de procéder à une nouvelle forme d'installation.
(ii) Lorsqu'on envisage l'emploi de montages anti-vibration. (Un choix inapproprié pourrait s'avérer dangereux.)
(iii) Lorsqu'on envisage une installation portative. Dans ce cas un ingénieur Petter doit être présent lors de la première installation.

(*e*) Sur les groupes à commande directe, les appareils de commande et commandés doivent être alignés et dotés d'un accouplement flexible.

3. Préparation d'un moteur neuf ou révisé pour la mise en marche (Fig. 3)

(*a*) S'assurer que le système de refroidissement soit en état de marche et exempt de toute obstruction.

(*b*) Retirer le bouchon de remplissage d'huile et remplir le moteur d'huile de graissage jusqu'à la marque la plus élevée sur la pige de niveau. (Pour retirer le bouchon de remplissage d'huile, pousser vers la bas et tourner.)

Remettre le bouchon en place. (Après quelques minutes de fonctionnement, arrêter le moteur et faire le plein d'huile car le niveau tombe toujours légèrement après la circulation initiale.)

(c) Dévisser l'écrou sur le couvercle du filtre à air, retirer le couvercle et l'élément et tremper le couvercle, mais non pas l'élément, dans un bain d'huile moteur propre. Laisser le couvercle s'égoutter. Remonter l'élément et le couvercle en s'assurant que l'élément soit correctement assis sur les joints d'étanchéité.

(d) Soulever le levier de décompression et faire tourner le moteur une ou deux douzaines de fois pour aider la circulation de l'huile.

(e) Remplir le réservoir de combustible.

(f) Amorcer et purger le système d'alimentation en combustible comme suit:

(i) Si une commande de vitesse variable est montée, mettre le levier de commande en position de pleine vitesse.

(ii) Si une commande de vitesse ralenti est prévue, la mettre en position 'RUN'.

(iii) Mettre le levier marche/arrêt (A) en position 'RUN', c.à.d. horizontalement.

(iv) Desserrer la vise de prise d'air (B) de la pompe à combustible. Faire tourner le moteur plusieurs fois jusqu'à ce que sorte du combustible propre et sans bulles d'air. Resserrer l'écrou.

(v) Faire tourner le moteur jusqu'à ce qu'on entende le grincement de l'injecteur.

4. Mise en marche du moteur (Fig. 4)

(a) Séparer le moteur de tout mécanisme entraîné éventuel.

(b) Mettre le levier marche/arrêt (A) sur la position 'RUN', c.à.d. horizontalement.

(c) Si un contrôle de vitesse variable est monté, mettre le levier de contrôle dans la position de demi-vitesse, ensuite pousser vers le bas le levier d'arrêt de surcharge (B) et le relâcher.

(d) Si une commande de vitesse ralenti est prévue, la mettre en position 'RUN'.

(e) Démarrage à la corde

(i) Faire tourner la poulie de démarrage, dans le sens opposé à celui indiqué par la flèche, jusqu'à ce qu'il y ait une résistance à cette rotation. Forcer la poulie contre la résistance jusqu'à ce que l'injecteur ait grincé dix fois. (Ceci n'est pas nécessaire avec un moteur chaud.)

(ii) Enrouler la corde autour de la poulie de démarrage dans le sens des auguilles d'une montre pour un observateur regardant le volant. L'extrémité de la

corde doit se trouver dans l'encoche de la poulie et la corde doit s'enrouler autour de la poulie sur deux tours ou deux tours et demi.

AVIS: La corde ne doit pas s'enrouler autour du poignet de l'opérateur.

(iii) S'assurer que le levier de décompression soit dégagé puis tirer brusquement sur la corde jusqu'à ce qu'elle se déroule complètement de la poulie. Le moteur doit maintenant se mettre en marche.

(*f*) Démarrage à la manivelle

(i) Lever le levier de décompression (D), tourner la manivelle dans le sens de la rotation et écouter le grincement de l'injecteur.

(ii) Arrêter de tourner le moteur lorsque le piston dépasse tout juste le point mort haut en temps de compression, puis libérer le levier de décompression (D).

(iii) Faire tourner le moteur aussi vite que possible dans le sens de la rotation. Il doit maintenant se mettre en marche.

(*g*) Démarrage manuel, 4:1

(i) Soulever l'encliquetage de démarrage pour mettre en prise les engrenages.

(ii) Accrocher la manivelle dans l'encliquetage de démarrage. La manivelle ne s'introduira complètement que si l'encliquetage aura été soulevé.

(iii) Lever et tenir le levier de décompression (D). Tourner la manivelle lentement et écouter le grincement de l'injecteur.

(iv) Après que l'injecteur ait grincé, tourner la manivelle aussi vite que possible et libérer le levier de décompression (D). Continuer à tourner. Le moteur doit maintenant se mettre en marche. Les engrenages et la manivelle se sépareront automatiquement à mesure que s'accroît la vitesse du moteur.

(*h*) Démarrage électrique

(i) S'assurer que le levier de décompression est dégagé et actionner le démarreur. Ne pas actionner le démarreur plus de 20 secondes à chaque fois.

(*j*) Si la moteur démarre puis s'arrête, pousser vers le bas et relâcher le levier d'arrêt de surcharge (B), le cas échéant, avant d'essayer de mettre en marche à nouveau.

(*k*) Au-dessous de 13°C il pourra s'avérer nécessaire de manoeuvrer le plongeur d'amorçage (C) AVANT d'essayer de mettre en marche. Procéder de la manière suivante:

(i) Retirer le plongeur d'amorçage (C).

(ii) Remplir la chambre d'amorçage avec de l'huile du moteur—et NON PAS du combustible.

(iii) Replacer le plongeur d'amorçage et appuyer vers le bas.

(*l*) Au-dessous de 0°C il pourra s'avérer avantageux d'employer de l'huile tiède pour l'amorçage plutôt que de l'huile froide

provenant du puisard. Il pourra également s'avérar nécessaire d'amorcer le moteur une deuxième fois avant d'essayer de mettre en marche.

(*m*) Si par températures basses, le moteur n'atteint pas son régime nominal après le démarrage, manoeuvrer à nouveau le plongeur d'amorçage pendant que le moteur est en marche.

(*n*) Pour réduire au minimum les difficultés de démarrage par températures basses, il est conseillable de tenir le moteur couvert lorsqu'on ne s'en sert pas et d'employer une huile de moteur ayant une viscosité SAE 10 (voir APPROVED LUBRICANTS).

(*p*) Au-dessous de –4°C il pourra s'avérar nécessaire d'employer un équipement de démarrage basse température; vous pourrez obtenir les détails de cet équipement auprès de la *Petters Ltd ou de ses agents*. Il peut s'agir de combustibles auxiliares introduits dans le système du combustion pendant la mise en marche, vaporisé directement dans la filtre à air, soit à la main à partir d'un aérosol, soit au moyen d'un équipement installé en permanence et vaporisant directement dans le collecteur d'entrée. L'usage sans distinction de combustibles auxiliaires de mise en marche peut causer des dégâts. La *Petters Ltd ou ses agents* devront être consultés en cas de doute concernant l'emploi de ces combustibles.

(*q*) Au-dessous de –9,4°C, la construction du moteur en alliage léger impose un frottement interne, et on pourra obtenir des instructions spéciales auprès de la *Petters Ltd ou ses agents* en ce qui concerne le chauffage du moteur entier, son maitien à une température élevée et la dilution de l'huile de graissage.

5. Arrêt du moteur (Fig. 4)

(*a*) Il est recommandé de faire tourner le moteur avec une faible charge pendant quelques minutes avant de l'arrêter.

(*b*) Mettre le levier marche/arrêt (A) en position 'STOP', c.à.d. pointé vers le haut, et le maintenir dans cette position jusqu'à ce que le moteur s'arrête.

IMPORTANT

(*a*) NE PAS arrêter le moteur au moyen du décompresseur. Ceci provoquerait des dégâts aux sièges de soupapes et aux joints de culasse.

(*b*) NE PAS arrêter le moteur en laissant le réservoir se vider complètement. Ceci permettrait l'entrée d'air dans les canalisations de combustible, et il faudrait alors purger et amorcer le système.

(*c*) NE PAS retirer ou modifier le réglage de la butée de surcharge.

(*d*) NE PAS manoeuvrer le levier d'arrêt du surcharge lorsque le moteur est en marche.

6. Réglages initiaux

Apres 20 heures environ de rodage initial d'un moteur neuf ou révisé, il faudra:

(*a*) Vérifier le jeu des soupapes.
(*b*) Vidanger le puisard et remplir avec de l'huile neuve.
(*c*) Vérifier le filtre à combustible.
(*d*) Vérifier le serrage de tous les écrous, boulons, etc.

7. Entretien courant

Tous les jours

(*a*) Vérifier le niveau d'huile de graissage et faire l'appoint si nécessaire.
(*b*) S'assurer que le système de refroidissement soit en bon état et exempt de toute obstruction.

NOTA:

Les recommendations suivantes concernant l'entretien s'appliquent aux conditions normales de service. Dans des conditions très poussiéreuses, les filtres a air, les filtres d'huile de graissage et les filtres de combustible exigeront des soins plus fréquents. Le décalaminage devra s'effectuer plus fréquemment lorsque les moteurs fonctionnent avec une faible charge pendant de longues périodes.

Toutes les 50 heures

(*a*) Nettoyer le filtre à air (type à bain d'huile).

Toutes les 250 heures

(*a*) Vérifier le serrage de tous les écrous, boulons, etc. (Les écrous de la culasse ne doivent PAS être serrés lorsque le moteur est chaud.)
(*b*) S'assurer que le trou de prise d'air dans le bouchon du réservoir de combustible ne soit pas obstrué.
(*c*) Nettoyer la filtre à air (élément en papier).
(*d*) Nettoyer tout dépôt dans le systéme d'échappement.
(*e*) Vidanger le puisard, rincer avec de l'huile de rinçage et remplir avec de l'huile neuve. (On peut utiliser du pétrole si on ne dispose pas d'huile de rinçage, mais il importe de ne pas faire tourner le moteur avec du pétrole dans le puisard.)
(*f*) S'assurer qu'il n'y ait pas de fuites dans le système d'alimentation de combustible.
(*g*) Vérifier le jeu des soupapes et régler si nécessaire.
(*h*) Monter un nouvel élément de filtre à huile de graissage et un joint annulaire.
(*j*) Graisser la timonerie de commande vitesse.

Toutes les 500 heures

(*a*) Installer un nouvel élément de filtre à air (élément en papier).

Toutes les 1000 heures

(*a*) Nettoyer à fond le réservoir de combustible.
(*b*) Installer un nouvel élément de filtre à combustible.

Toutes les 2000 heures

(*a*) Décalaminer.
(*b*) Nettoyer les trous de retour d'huile du piston. Vérifier l'usure de l'alésage du cylindre.
(*c*) Examiner les paliers du vilebrequin et renouveler si le jeu est excessif.
(*d*) Nettoyer le crépine de la pompe d'huile.
(*e*) Retirer l'injecteur de combustible et éprouver la pulvérisation. Si elle est correcte, remettre l'injectuer en place.

8. Réglage de la commande de vitesse (Fig. 15 & 16)

Les forces centrifuges exercées sur les boules du régulateur sont transmises à la crémaillère de la pompe à combustible. Ces forces, qui varient avec la vitesse du moteur, sont équilibrées par un ressort réglable de contrôle de vitesse (A). Ce réglage permet une gamme de vitesse définie. Pour ajuster la vitesse en dehors de cette gamme, une pompe à combustible et des ressorts différents pourraient être nécessaires; ceux-ci peuvent être obtenus auprès de la *Société Petters Ltd ou de ses agents*. La vitesse est réglée par la *Petters Ltd* et ne devrait pas nécessiter un ajustage ultérieur. Cependant, si le réglage est perturbé, il convient d'effectuer les ajustages suivants:

(*a*) Vitesse fixe
  (i) Desserrer le contre-écrou (C) sur le côté pige de niveau du moteur et visser le dispositif de réglage (B) pour augmenter la vitesse, ou dans le sens opposé pour la diminuer. Serrer le contre-écrou (C).

(*b*) Vitesse variable
  (i) Placer la commande dans la position de ralenti.
  (ii) Desserrer le contre-écrou (C) et régler la vitesse de ralenti à 1000 t/min environ en vissant le dispositif de réglage (B) pour augmenter la vitesse ou en le dévissant pour la diminuer. Serrer le contre-écrou (C).
  (iii) Placer la commande en position de plaine vitesse.
  (iv) Desserrer le contre-écrou (D) et régler la pleine vitesse en dévissant la vis de réglage (E) pour augmenter la vitesse, ou en la vissant pour la dimineur. Serrer le contre-écrou (D).
  (v) Vérifier la vitesse de ralenti et régler si elle n'est pas correcte. Replomber avec du fil neuf.
  (vi) Pour adjuster le câble de commande, mettre le levier (F) de commande du câble dans la position de ralenti. Visser le dispositif régleur du câble (G) jusqu'à ce que le levier de commande soit bien appuyé contre la fente et qu'il y ait un peu de jeu dans le câble interne, c'est-à-dire jusqu'à ce que le levier de commande du câble puisse à peine être déplacée avant que le câble interne commence à déplacer la commande de vitesse.

9. Caractéristiques techniques

Calage de l'injection (par contrôle d'écoulement):	
Vitesse fixe	
1500 t/min	23° avant PMS
1800 t/min	23° avant PMS
2100 t/min	23° avant PMS
2500 t/min	26° avant PMS
3000 t/min	30° avant PMS
3600 t/min	35° avant PMS
Vitesse variable	30° avant PMS
Hauteur de l'espace mort	0,56/0,66mm
Jeu de culbuteur de soupape (à froid)	0,10mm
Levée de la soupape d'échappement par le décompresseur (maxi.)	0,38mm

10. Lubrification

(*a*) Les huiles de moteur indiquées sous la rubrique 'APPROVED LUBRICANTS' sont des huiles à grand rendement, d'une détergence minimale, se conformant aux normes:
British Defence Specification No. 2101B
ou
U.S. Specification MIL/L/2104A.

(*b*) D'autres huiles de moteur à grand rendement seront recommandées par un distributeur local d'huile, mais il faudra spécifier une détergence minimale se conformant aux normes ci-dessus.

(*c*) Il faudra consulter la *Petters Ltd ou ses agents* en cas de doute quant au choix d'une huile de moteur.

(*d*) INSTALLATIONS AUXILIARES MARINES. Quoique deux viscosités d'huile soient recommendées pour différents climats, il n'est pas toujours pratique de changer les huiles lorsque le moteur passe d'un climat à an autre. Dans ces circonstances, pour les moteurs actionnant des pompes à incendie ou tout autre matériel destiné à l'usage EN CAS D'URGENCE on recommande que l'huile choisie ait une viscosité s'adaptant au climat le plus froid qui pourrait sévir. A noter que cette recommendation est faite compte tenu principalement de la facilité du démarrage manuel en l'absence d'une huile polyvalente.

11. Rotation

La rotation normale se fait dans le sens des aiguilles d'une montre pour un observateur regardant le volant.

12. Pièces dé rechange

Toute commande de pièces de rechange devra mentionner le type et le numéro de série du moteur, le numéro de référence de la pièce et le nombre requis.

Toute demande de pièces de rechange ou d'entretien devra être adressée à *l'agent ou le concessionaire nomme par la Petters* dans le *territoire.*

* Indique que la pièce n'est pas illustrée.

IMPORTANT

Lorsqu'ils achètent des pièces détachées ou lorsqu'ils donnent des instructions pour les réparations, les clients devront, dans leur propre intérêt, toujours spécifier:

PIÈCES DE RECHANGE
PETTER D'ORIGINE

On ne peut être sûr d'obtenir les matériaux, les dimensions ou le fini corrects avec les pièces de rechange qui n'ont pas été fournies par l'organisation *Petter.* Par conséquent, la *Petters* ne peut être tenue responsable de tout dégât provenant de l'usage de ces pièces, et la garantie sera invalidée.

Dans votre propre intérêt, spécifiez donc:

PIÈCES DE RECHANGE
PETTER D'ORIGINE

INSTRUCCIONES EN ESPAÑOL

1. Tenga siempre presente

(*a*) El motor necesita combustible:
Mantenga limpios el combustible, el tanque, el filtro y la tubería.

(*b*) El motor necesita aceite lubricante:
Emplee aceite del tipo correcto. Mantanga el nivel de aceite.

(*c*) El motor necesita aire:
Mantanga limpio el depurador de aire. Mantenga la lumbrera de entrada de aire y la totalidad del sistema de escape libres de hollín y de otras obstrucciones.

(*d*) El motor necesita enfriamiento:
Mantenga el sistema de enfriamiento libre de obstrucciones.

2. Montaje

(*a*) Los planos de instalación pueden obtenerse de *Petters Ltd* o de sus agentes.

(*b*) Dispóngase espacio para:
(i) Desmontar la tapa de llenado de aceite y vaciar el aceite.
(ii) Conservación de los filtros de combustible y aceite y el depurador de aire.
(iii) Arranque y manejo de los mandos.

(*c*) Solamente deben emplearse pernos o espárragos de anclaje de buena calidad. NO deben emplearse prisioneros.

(*d*) Debe consultarse a *Petters Ltd o a sus agentes* en los casos siguientes:
(i) Antes de procedar a otra nueva forma de instalación.
(ii) En el caso de que se tenga el propósito de instalar monturas antivibración. (Una elección incorrecta puede ser peligrosa.)
(iii) En los casos en que se tenga el propósito de realizar una instalación portátil. En tal caso debe hallarse presente un ingeniero de la *Petters* al afectuar le instalación inicial.

(*e*) En grupos accionados directamente, el grupo motriz y el mandado deben estar alineados y hay que instalar un acoplamiento flexible.

3. Preparación de un motor nuevo o reacondicionado para la puesta en marcha (Fig. 3)

(*a*) Comprobar que el sistema de refrigeración se halla en buen estado y está libre de restricciones.

(*b*) Quitar el tapón de la boca de llenado y llenar el cárter con aceite lubricante hasta el nivel alto marcado en la varilla indicadora. (Para quitar el tapón de la boca de llendao de aceite, apretar y girar.) Volver a colocar el tapón. (Al cabo de unos cuantos minutos de marcha, parar el motor y

llenar de aceite hasta arriba, pues el nivel siempre baja ligeramente después de la circulación inicial.)

(c) Aflojar la tuerca de la cubierta del depurador de aire, quitar la cubierta y el elemento, y sumergir la cubierta, pero no el elemento, en un baño de aceite de motor limpio. Después de dejar escurrir la cubierta, volver a colocar el elemento y la cubierta, asegurándose de que el elemento esté correctamente ajustado en los anillos de cierre.

(d) Levantar la palanca del descompresor y hacer girar el motor quince o veinte veces para hacer circular el aceite.

(e) Llenar el tanque con combustible.

(f) Purgar y cebar el sistema de combustible como sigue:

(i) Si hay instalado un regulador de velocidad variable, poner la palanca de control en la posición de toda velocidad.

(ii) Si hay instalado un regulador de velocidad minima, poner la palanca de control en la posición de marcha (RUN).

(iii) Mover la palanca de parada marcha (A) a la posición de marcha (RUN), es decir, horizontal.

(iv) Aflojar el tornillo purgador de la bomba de combustible (B). Girar el motor unas cuantas veces hasta que salga combustible limpio y libre de burbujas. Apretar nuevamente el tornillo.

(v) Girar el motor hasta que se oiga un 'chirrido' en el inyector.

4. Arranque (Fig. 4)

(a) Desconecte la carga del motor.

(b) Mover la palanca de parada/marcha (A) a la posición de marcha (RUN), es decir, horizontal.

(c) Si hay instalado un regulador de velocidad variable, poner la palanca de control en la posición de media velodicad, luego bajar y soltar la palanca de tope de sobrecarga (B).

(d) Si hay instalado un regulador de velocidad minima, poner la palanca de control en la posición de marcha (RUN).

(e) Arranque por cuerda

(i) Hacer girar la polea de arranque en sentido opuesto a la flecha hasta notar resistencia. Balancear vigorosamente la polea contra la resistencia hasta que el inyector haya chirriado diez veces. (Esto no es necesario cuando el motor se halle caliente.)

(ii) Enrollar la cuerda alrededor de la polea de arranque en el sentido de las agujas del reloj mirando al volante. El extremo de la cuerda debe estar en la entalladura de la polea y la cuerda debe estar enrollada de dos a dos vueltas y media en la polea.
AVISO: El operador no debe enrollarse la cuerda a la muñeca.

(iii) Asegurarse de que le palanca del descompresor está libre y entonces tirar de la cuerda con presteza hasta

que se desenrolle completamente de la polea. De esta manera el motor debería arrancar.

(f) Arranque por manivela

(i) Lebantar la palanca del descompresor (D) y hacer girar la manivela en el sentido de rotación hasta oir el chirrido del inyector.

(ii) Dejar de girar el motor cuando el pistón haya rebasado el PMS (punto muerto superior) en la carrera de compresión, y luego reponer la palanca del descompresor (D) en la posición libre.

(iii) Girar el motor con la mayor rapidez posible en el sentido de rotación. El motor deberá arrancar.

(g) Arranque a mano, 4:1

(i) Elevar el agarrador del mecanismo de arranque para que éste engrane.

(ii) Engranar la manivela de arranque en el agarrador del mecanismo de arranque. La manivela no encajará completamente a menos que el agarrador esté elevado.

(iii) Elevar y aguantar la palanca del descompresor (D). Girar lentamente la manivela hasta oir el chirrido del inyector.

(iv) Cuando el inyector haya chirriado, girar la manivela con la mayor rapidez posible y dejar libre la palanca del descompresor (D). Continuar girando; el motor deberá arrancar. Al incrementarse la velocidad del motor, los engranajes y la manivela de arranque se desembragarán automáticamete.

(h) Arranque eléctrico

(i) Asegurarse de que la palanca del descompresor está libre y entonces hacer funcionar el arrancador-dinamo. No hacer funcionar el arrancador-dinamo por más de 20 segundos seguidos.

(j) Caso de que el motor arranque y luego se pare, bajar y soltar la palanca de tope de sobrecarga (B), si existe, antes de intentar arrancar de nuevo.

(k) A temperaturas inferiores a 13°C quizá sea necesario emplear émbolo de cebado (C) ANTES de intentar el arranque. Proceder de la manera siguiente:

(i) Sacar el émbolo de cebado (C).

(ii) Llenar la cámara de cebado con aceite de motor—NO con aceite combustible.

(iii) Reponer el émbolo de cebado y apretarlo hacia abajo.

(l) A temperaturas bajo 0°C puede resultar más ventajoso emplear aceite caliente para el cebado en vez del aveite frío del sumidero. Puede ser necesario también cebar el motor por segunda vez antes de intentar el arranque.

(m) Si a bajas temperaturas el motor no alcanza su velocidad nominal después de arrancar, emplear otra vez el émbolo de cebado mientras el motor está en marcha.

(*n*) Para reducir las dificultades del arranque en tiempo frío, es recomendable mantener el motor cubierto cuando no está en uso y asegurarse de emplear un aceite de viscosidad SAE10 (véase APPROVED LUBRICANTS).

(*p*) A temperaturas más bajas de –4°C puede ser necesario emplear auxilios para el arranque a baja temperatura; detalles de los varios auxilios disponibles pueden obtenerse de *Petters Ltd o de sus agentes*. Estos auxilios pueden ser en forma de combustibles auxiliares introducidos en el sistema de combustión durante el arranque, ya sea con un bote de aerosol de mano rociando el interior del depurador de aire, a bien con un dispositivo permanente rociando directamente en el colector de entrada. El ampleo arbitrario de estos combustibles de arranque auxiliares puede causar perjuicios. Debe consultarse a *Petters Ltd o a sus agentes* si surje alguna duda referente al empleo de tales auxilios.

(*q*) A temperaturas más bajas de –9,4°C la construcción del motor en aleación ligera impone fricción interna y pueden *obtenerse instrucciones especiales de Petters Ltd o de sus agentes* relacionadas con el calentamiento del motor entero, manteniéndolo a una temperatura más elevada y diluyendo el aceite lubricante.

5. Para parar el motor (Fig. 4)

(*a*) Se recomienda hacer funcionar con poca carga durante unos minutos antes de parar.

(*b*) Mover la palanca de parada/marcha (A) a la posición de parada (STOP), es decir, hacia arriba, y mantenerla en esta *posición hasta que se pare el motor.*

'NOS' IMPORTANTES

(*a*) NO parar nunca el motor empleando la palanca del descompresor, pues esto dañará los asientos de las válvulas y las juntas de la culatas.

(*b*) NO parar nunca el motor dejando que se vacíe el tanque de combustible. Esto permitiría la entrada de aire al sistema de combustible, y luego sería necesario purgar y cebar de nuevo el sistema.

(*c*) NO retirar el tope de sobrecarga ni variar la puesta a punto del mismo.

(*d*) NO operar la palanca de tope de sobrecarga cuando le motor está en marcha.

6. Ajustes iniciales

Después de aproximadamente 20 horas del rodaje inicial del motor nuevo o reacondicionado, debe prestarse atención a los puntos siguientes:

(a) Comprobar la luz de las válvulas.
(b) Vaciar el aceite lubricante del cárter y rellenar con aceite limpio.
(c) Inspeccionar el filtro de combustible.
(d) Comprobar todas las tuercas y tornillos para ver si están bien apretados.

7. Conservación rutinaria

Diariamente

(a) Comprobar el aceite lubricante y llenar de aceite si es necesario.
(b) Comprobar que el sistema de refrigeración se halla en buen estado y está libre de obstrucciones.

NOTA:
Las recomendaciones de mantenimiento que damos a continuación son adecuadas para condiciones medias de functionamiento. En ambientes muy polvorientos, los depuradores de aire y los filtros de aceite lubricante y de combustible necesitan cuidados más frecuentes. Posiblemente se precisará descarbonizar más frecuentemente, cuando los motores funcionen a baja carga durante largos períodos.

Cada 50 horas

(a) Limpiar el depurador de aire (tipo a baño de aceite).

Cada 250 horas

(a) Comprobar todas las tuercas y tornillos para ver si están bien apretados. (Las tuercas de la culata NO deben ser apretadas cuando el cilindro está caliente.)
(b) Asegurarse de que el respiradero del tapón del tanque de combustible no esté obstruido.
(c) Limpiar el depurador de aire (elemento del tipo de papel).
(d) Limpiar los depósitos del sistema de escape.
(e) Vaciar el cárter, lavarlo con aceite liviano y rellenarlo con aceite nuevo. (Se puede utilizar aceite de parafina se no se puede obtener aceite liviano, pero el motor no debe funcionar teniendo parafina en el cárter.)
(f) Verificar que no existen fugas en el sistema de combustible.
(g) Comprobar las luces de válvula y ajustarlas si es necesario.
(h) Instalar un nuevo elemento y un neuvo anillo de junta en el filtro de aceite lubricante.
(j) Lubricar el varillaje de mando de velocidad.

Cada 500 horas

(a) Renovar el elemento del depurador de aire (elemento del tipo de papel).

Cada 1000 horas

(a) Limpiar perfectamente el tanque de combustible.
(b) Renovar el elemento del filtro de combustible.

Cada 2000 horas

(*a*) Decarbonizar.
(*b*) Limpiar cuidadosamente los orificios de retorno de aceite. Inspeccionar el cilindro por desgaste y juego excesivo.
(*c*) Examinar los cojinetes del cigüeñal y reemplazarlos si el juego es excesivo.
(*d*) Limpiar el colador de la bomba de aceite lubricante.
(*e*) Sacar el inyector y comprobar el pulverizado. De hallarlo en buenas condiciones, volverlo a colocar sin más ingerencias.

8. Ajuste del regulador de velocidad (Fig. 15 y 16)

Las fuerza centrífugas que actúan sobre las bolas del regulador se transmiten a la cremallera de la bomba de combustible. Estas fuerzas, que varían según la velocidad del motor, se compensan por medio de un resorte graduable (A). Este ajuste dispone un límite fijo de velocidad. Para ajustar la velocidad fuera de esta gama pueden hacer falta diferentes resortes y bomba de combustible y éstos pueden obtenerse de *Petters Ltd o sus Agentes. Petters Ltd* ajusta la velocidad y ésta no debe exigir ulteriores ajustes. Sin embargo, si esta puesta a punto sufriese alguna variación, los ajustes deben llevarse a cabo como sigue:

(*a*) Velocidad fija
  (i) Aflojar la contratuerca (C) del lado del motor que va provisto de la varilla y apretar el tornillo de ajuste (B) para aumentar la velocidad o aflojarlo para disminuirla. Apretar la contratuerca (C).

(*b*) Velocidad variable
  (i) Colocar el mando en la posición de marcha en vacío.
  (*ii*) Aflojar la contratuerca (C) y ajustar la marche en vacío a aproximadamente 1000 rev/min enroscando al ajuste (B) para aumentar la velocidad y desenroscándolo para disminuirla. Apretar la contratuerca (C).
  (iii) Colocar el mando en la posición de plena velocidad.
  (iv) Aflojar la contratuerca (D) y ajustar la plena velocidad desenroscando el tornillo de ajuste (E) para aumentar la velocidad o enroscándolo para disminuirla. Apretar la contratuerca (D). Reponer los precintos con neuvo alambre de precintar.
  (v) Comprobar la marcha en vacío y ajustarla si no es la debida.
  (vi) Para ajustár el cable de mando, poner la palanca de mando (F) en la posicióu de marcha en uacío. Enroscar el ajustador (G) del cable hasta que la palanca de mando se halle bein oprimida contra la ranura y el cable interior tenga un pequeño juego, estos es, la palanca de mando del cable apenas es movida cuando el cable interior empieza a mover el mando de velocidad.

9. Datos técnicos

Ángulo de inyección de combustible (por derrame)	
Velocidad fija	
1500 rev/min	23° antes del PMS
1800 rev/min	23° antes del PMS
2100 rev/min	23° antes del PMS
2500 rev/min	26° antes del PMS
3000 rev/min	30° antes del PMS
3600 rev/min	35° antes del PMS
Velocidad variable	30° antes del PMS
Espacio muerto entre el pistón y la culata	0,56/0,66mm
Luz de válvulas (en frío)	0,10mm
Apertura máxima de la válvula de escape por la palanca de descompresión	0,38mm

10. Lubricación

(a) Los aceites de motor cuya lista aparece bajo el título 'APPROVED LUBRICANTS' son aceites para servicio pesado con una detergencia mínima según especificados por:
Especificación Británica de Defensa No. 2010B
o
Especificación de los EE. UU. MIL/L/2104A.

(b) Aceites de motor para servicio pesado adecuados adicionales serán recomendados por un distribuidor local de aceites, pero es imprescindible especificar la detergencia mínima como indicada más arriba.

(c) *Petters Ltd o sus agentes* deben ser consultados si surgen dudas sobre la elección de un aceite de motor.

(d) INSTALACIONES AUXILIARES DE MARINA. Aun cuando se recomiendan dos viscosidades de aceite para diferentes condiciones climatológicas, no resulta siempre práctico cambiar el aceite al pasar de un clima a otro. En estas circunstancias, para motores que accionan bombas de incendios o otro equipo que se necesita hacer funcionar EN CASO DE URGENCIA, se recomienda que el aceite elegido sea de una viscosidad adecuada para el clima más frío que se espere encontrar. Debe observarse que esta recomendación se hace teniendo como primera consideración la mayor facilidad de puesta en marcha a mano cuando no se disponga de un aceite multigrado aprobado.

11. Rotación

La rotación normal es dextrógira mirando al volante.

12. Lista de piszas

Al hacer pedido de piezas de repuesto, hay que indicar el tipo y número de serie del motor, el número de referencia de la pieza y la cantidad requerida.

Las solicitudes de piezas y servicio deben ser dirigidas al *agente o distribuidor oficial de Petter* en el territorio.

* Indica que la pieza no se halla ilustrada.

IMPORTANTE

Al adquirir repuestos o dar instrucciones para reparaciones, el cliente debe especificar siempre en aras de su propio interés:

PIEZAS PETTER GENUINAS

Con piezas de recambio que no hayan sido suministradas por la organizacion *Petter*, no puede tenerse la seguridad de que el material, dimensiones o acabado, sean correctos. Por consiguiente, *Petters* no puede aceptar responsabilidad alguna por cualquier avería que derivare del uso de tales piezas y la garantía quedará sin efecto.

Por lo tanto, en su propio interés, especifique:

PIEZAS PETTER GENUINAS

ISTRUZIONI IN ITALIANO

1. Non dimentichiamo che:

(*a*) Un motore ha bisogno di combustibile:
E' quindi necessaria la massima pulizia del combustibile, del serbatoio, del filtro e delle tubazioni.

(*b*) Un motore ha bisogno di olio lubrificante:
Si usi sempre il tipo adatto di lubrificante e si mantangono al massimo i livelli.

(*c*) Un motore ha bisogno di aria:
Si raccomanda la massima pulizia del filtro d'aria, del collettore di aspirazione e di tutto il sistema di scarico.

(*d*) Un motore ha bisogno di raffreddamento:
Impedire pertanto l'ostruzione dell'impianto di raffreddamento.

2. Installazione

(*a*) Si potranno ottenere i disegni d'impianto dalla *Società Petters Ltd o dai suoi agenti.*

(*b*) Si dovranno prendere le misure necessarie per:
(i) Togliere il tappo del bocchettone e scaricare l'olio.
(ii) La manutenzione del filtro combustibile ed olio e del filtro d'aria.
(iii) L'avviamento e l'azionamento dei comandi.

(*c*) Si dovranno usare solamente bulloni o prigionieri di buona qualità. Non adoperare MAI viti di fermo.

(*d*) Interpellare la *Petters Ltd o i suoi rappresentanti*:
(i) Prima di passare a qualsiasi nuovo tipo d'installazione.
(ii) Qualora si abbia intenzione di montare dei supporti antivibrazioni, in quanto una scelta errata può avere serie conseguenze.
(iii) Qualora si intenda impiantare un'installazione mobile. In tale caso è bene che sia presente un tecnico della *Petters* alla messa in opera dell'installazione iniziale.

(*e*) Sui complessi a presa diretta, allineare il complesso motore e quello comandato, montando un accoppiamento flessibile.

3. Preparazione all'avviamento di un motore nuovo o revisionato (Fig. 3)

(*a*) Controllare che il sistema di raffreddamento funzioni a dovere e sia libero da ostruzioni.

(*b*) Togliere il tappo dell'olio e riempire con lubrificante sino a raggiungere l'incisione piú alta sull'asta indicatrice di livello. (Per togliere il tappo dell'olio, premere e girare.) Riavvitare il tappo. (Dopo alcuni minuti di funzionamento, arrestare il motore e rabboccare l'olio, in quanto il livello scende sempre leggermente dopo la circolazione iniziale.)

(*c*) Svitare il dado sul coperchio del filtro d'aria, togliere il coperchio e l'elemento e immergere il primo, senza il

secondo, in un bagno d'olio di motore pulito. Lasciare scolare il coperchio. Riporre l'elemento e il coperchio accertandosi che l'elemento sia perfettamente assestato sugli anelli di tenuta.

(*d*) Sollevare le lava di decompressione e far compiere da 10 a 20 giri al motore per facilitare la circolazione dell'olio.

(e) Riempire il serbatoio combustibile.

(*f*) Spurgare e innescare il sistema combustibile, attenendosi alle seguenti norme:

(i) Qualorsa sia provvisto un comando di regime variabile, sistemare la leva di comando in posizione de pieno regime.

(ii) Se è provvisto un comando di regolazione del minimo, lo si disponga nella posizione 'RUN' (Avviamento).

(iii) Portare la leva d'arresto/avviamento (A) in posizione di 'RUN' (Avviamento), ovvero in posizione orizzontale.

(iv) Allentare la vite de sfiato (B) sulla pompa combustibile, far compiere alcuni giri al motore finché il combustibile, scorre pulito e senza bolle d'aria, indi ristringere il bullone.

(v) Far girare il motore finché non si ode il caratteristico 'stridío' dell'iniettore.

4. Avviamento (Fig. 4)

(*a*) Far girare il motore scarico.

(*b*) Portare la leva (A) d'avviamento/arresto in posizione orizzontale di 'RUN' (Funzionomento).

(*c*) Si è previsto un comando di velocità variabile, portare la leva di comando nella posizione di mezzo regime, indi spingere in basso e rilasciare la lave (B) d'arresto di sovraccarico.

(*d*) Se è previsto un comando di regolazione del minimo, portarlo alla posizione di 'RUN' (Funzionamento).

(e) Avviamento a cordicella

(*i*) Girare la puleggia d'avviamento in senso opposto alla freccia sino ad incontrare resistenza. Afferrare la puleggia ed impartirle un forte movimento di rimbalzo fino a che l'iniettore non abbia 'cirgolato' dieci volte (operazione inutile per un motore caldo).

(ii) Avvolgere la cordicella attorno alla puleggia d'avviamento in senso orario guardando il volano. L'estremità del cavo deve alloggiare nella gola della puleggia e al cavo debbono essere impartiti da due a due giri e mezzo. AVVERTENZA: L'operatore deve evitare di avvolgersi la cordicella intorno al polso.

(*f*) Avviamento a manovella

(i) Sollevare la leva di decompressione (D) e girare la manovella nel senso di rotazione, in attesa del cigolio dell'iniettore.

(ii) Smettere di far girare il motore appena il pistone supera

il PMS nella corsa di compressione e quindi disimpegnare la leva di decompressione (D).

(iii) Far girare il motore il piú velocemente possibile nel senso di rotazione. Il motore dovrebbe avviarsi.

(*g*) Avviamento a mano 4:1

(i) Sollevare il dente d'avviamento per impegnare gl'ingranaggi.

(ii) Impegnare la manovella d'avviamento nel dente d'avviamento. La manovella non impegna a fondo se non si è sollevato il dente.

(iii) Sollevare e tenere la leva di decompressione (D) in posizione alta. Girare lentamente la manovella in attesa del cigolio dell'iniettore.

(iv) Quando l'iniettore ha cigolato, girare la manovella il piú rapidamente possibile e rilasciare la leva di decompressione (D). Continuare a far girare. Il motore dovrebbe avviarsi. Gl'ingranaggi e la manovella d'avviamento si disimpegneranno automaticamente quando il motore aumenta di regime.

(*h*) Avviamento elettrico

(i) Assicurarsi che la leva di decompressione sia disimpegnata, quindi azionare l'avviamento dinamo. Non far funzionare l'avviamento/dinamo per piú di 20 secondi alla volta.

(*j*) Se il motore si avvia e quindi si arresta, premere e rilasciare la leva d'arresto del sovraccarico (B), si è provvisto, prima di ritentare l'avviamento.

(*k*) Con temperatura al disotto di 13°C a volte è consigliabile di azionare il pistone di adescamento (C) PRIMA di cercare di avviare il motore. Eseguire l'operazione attenendosi alla seguente procedura:

(i) Sfilare il pistone di adescamento (C).

(ii) Riempire la camera di adescamento con olio motore e NON con combustibile.

(iii) Riporre il pistone di adescamento e premerlo in posizione.

(*l*) A temperature inferiori alla 0°C, a volte è consigliabile impiegare dell'olio caldo per l'adescamento, anziché dell'olio freddo prelevato dalla coppa. Può anche essere necessario adescare il motore una seconda volta prima di ritentarne l'avviamento.

(*m*) Se, durante la stagione, fredda, il motore non raggiunge il regime normale dopo l'avviamento, azionare nuovamente il pistone d'adescamento mentre il motore gira.

(*n*) Per ridurre al minimo le difficoltà incontrate alle basse temperature, è bene tener il motore coperto quando inoperoso ed adoperare un olio per motore SAE10 (vedasi APPROVED LUBRICANTS).

(*p*) A temperature inferiori ai –4°C può essere necessario impiegare l'attrezzatura per l'avviamento a bassa tempera-

tura, di cui si possono avere i particolari rivolgendosi alla *Petters Ltd o ai suoi agenti*. L'operazione consiste nell'introduzione di combustibili ausiliari nel sistema di combustione durante l'avviamento, mediante, nebulizzatore aerosol, a mano, che spruzza nel filtro d'aria o mediante impianto fisso montato sul motore che spruzza direttamente nel collettore d'aspirazione. l'impiego indiscriminato dei combustibili ausiliari d'avviamento può danneggiare il motore. In caso di dubbi sull'uso di questi combustibili si è pregati di rivolgersi alla *Petters Ltd o ai suoi agenti*.

(*q*) A temperature inferiori ai –9,4°C, il motore in lega leggera subisce degli attriti interni. Per riscaldare l'intero motore, mantenerlo ad una temperatura superiore e diluire l'olio lubrificante si possono richiedere le istruzioni alla *Petters Ltd o ai suoi agenti*.

5. Arresto (Fig. 4)

(*a*) Prima dell'arresto, si consiglia di lasciar girare il motore alcuni minuti a basso carico.

(*b*) Portare la leva d'arresto/avviamento (A) in posizioni di 'STOP' (Arresto), ovvero rivolta verso l'alto, e tenerla in posizione fino all'arresto del motore.

QUELLO CHE NON SI DEVE FARE

(*a*) NON si deve arrestare il motore colla leva di decompressione, *in quanto si danneggerebbero le sedi valvole* e le guarnizioni delle testate.

(*b*) *NON si deve arrestare il motore lasciando che il serbatoio* combustibile si vuoti, in quanto così facendo l'aria *filtrerebbe nelle tubazioni del combustibile* e *renderebbe* indispensabile ripertere lo spurgo e l'adescamento del *sistema*.

(*c*) NON asportare l'arresto di sovraccarico o alterarne la messa in fase.

(*d*) NON si deve azionare la lava d'arresto del sovraccarico con il motore in marcia.

6. Registrazioni iniziali

Dopo circa 20 ore di rodaggio iniziale di un motore nuovo o revisionato, so proceda a:

(*a*) Controllare il gioco dei bilancieri delle valvole.

(*b*) Vuotare la coppa dell'olio e riempire di olio fresco.

(*c*) Controllare il filtro combustibile.

(*d*) Controllare la tenuta di tutti i dadi, bulloni, ecc.

7. Manutenzione

Ogni giorno

(*a*) Controllare il livello del lubrificante ed al caso rabboccare.

(*b*) Controllare che il sistema di raffreddamento funzioni a dovere e sia libero da ostruzioni.

NOTA:

Le seguenti raccomandazioni per la manutenzione si referiscono a condizioni medie di lavoro. In condizioni molto polverose, i filtri d'aria dell'olio di lubrificazione e del carburante dovranno ricevere attenzioni piú frequentemente. La decarburazione potrà essere necessaria piú frequentemente quando i motori operano con carico leggero per lunghi perodi.

Ogni 50 ore

(*a*) Pulire il filtro dell'aria (tipo a bagno d'olio).

Ogni 250 ore

(*a*) Controllare la tenuta di tutti i dadi, bulloni, ecc. (NON stringere i dadi della testa cilindri a motore caldo.)
(*b*) Assicurarsi che il foro di sfiato del tappo del serbatoio combustibile non sia otturato.
(*c*) Ripulire il filtro d'aria (tipo ad elemento di carta).
(*d*) Ripulire il sistema di scarico delle incrostazioni.
(*e*) Vuotare la coppa, pulire con olio di lavaggio e riempire di lubrificante fresco. (Qualora non si disponga di olio per lavaggio, si potrà impiegare olio di paraffina, ma non si dovrà mai far funziona il motore con olio di paraffina nella coppa.)
(*f*) Controllare che non esistano perdite nel sistema combustibile.
(*g*) Controllare il gioco dei bilancieri valvole e, se necessario, registrare.
(*h*) Sostituire l'elemento del filtro lubrificante e l'anello di tenuta.
(*j*) Lubrificare il leveraggio del comando velocità.

Ogni 500 ore

(*a*) Sostituire l'elemento del filtro aria (tipo ad elemento di carta).

Ogni 1.000 ore

(*a*) Pulire completamente il serbatoio combustibile.
(*b*) Sostituire l'elemento del filtro combustibile.

Ogni 2.000 ore

(*a*) Decarburare.
(*b*) Ripulire i fori di recupero olio dei pistoni e controllare l'usura dell'alesaggio cilindri.
(c) Verificare i cuscinetti dell'albero a gomito ed in caso di gioco eccessivo sostituire.
(*d*) Repulire il filtro della pompa di olio lubrificante.
(*e*) Smontare gli iniettori e provarne lo spruzzo. Se tutto funziona a dovere, rimontare gli iniettori senza manipolarli.

8. Regolazione del comando regime (Figg. 15 e 16)

Le forze centrifughe sulle sfere del regolatore vengono trasmesse alla cremagliera della pompa combustibile. Tali forze, che variano con il regime del motore, sono compensate dalla molla (A) registrabile del regolatore di velocità. Con detta registrazione si ottiene una gamma fissa di regimi. Per regolare il regime e portarlo fuori della gamma si può aver bisogno di molle e pompa combustibile differenti, ottenibili rivolgendosi alla *Petters Ltd o ai suoi agenti*. Il regime é regolato dalla *Petters Ltd* e non richiede ulteriori regolazioni. Se per una ragione o per l'altra il regime è variato, ci si attenga alle istruzioni seguenti per le regolazioni:

(*a*) Regime fisso

(i) Allentare il controdado (C) sul lato stecca del motore e stringere il dado di regolazione (B) per aumentare il regime oppure allentarlo per diminuirlo. Stringere nuovamente il controdado (C).

(*b*) Regime variable

(i) Portare il regolatore in posizione di minimo.

(ii) Allentare il contradodo (C) e regolare il minimo fino a circa 1000 giri/min serrando il regolatore (B) per aumentare il regime oppore allentandolo per diminuirlo. Stringere pol il controdado (C).

(iii) Portare il regolatore in posizione di regime massimo.

(iv) Allentare il controdado (D) e regolare il regime massimo allentando la vite regolatrice (E) per aumentarlo o stringendo per diminuirlo. Ristringere il controdado (D). Risigillare con nuovo fil de ferro.

(v) Controllare il regime di minimo e regolarlo se non è guisto.

(vi) Per regolare il cavo di comando, portare le leva (F) regolatrice del cavo in posizone di minimo. Stringere il regolatore del cavo (G) fino quando la leva regolatrice del cavo preme fortemente contro la scanalatura e non si nota una leggera scorta nel cavo interno, cioè fino a quando la leva può appena essere spostata prime che il cavo interno cominci a spostare il regolatore di regime.

9. Dati tecnici

Messa in fase iniezione (mediante valvola disaerazione):

Regime fisso

1500 giri/min.	23° prima del PMS
1800 giri/min.	23° prima del PMS
2100 giri/min.	23° prima del PMS
2500 giri/min.	26° prima del PMS
3000 giri/min.	30° prima del PMS
3600 giri/min.	35° prima del PMS

Regime variable	30° prima del PMS
Spazio nocivo (fra pistoni e testate)	0,56÷0,66mm
Gioco bilancieri valvole (a freddo)	0,10mm
Alzata massima della valvola scarico mediante decompressore	0.38mm

10. Lubrificazione

(*a*) Gli oli motore elencati sulla distinta degli 'APPROVED LUBRICANTS' sono oli lubrificanti per servizio pesante con un potere detergente minimo, come da
Norma della Difesa Britannica No. 2101B
oppure
Norma U.S.A. MIL/L/2104A.

(*b*) Il concessionario lubrificanti della località può consigliare altri lubrificanti per servizio pesante indicati, sempre precisando però un potere detergente minimo come sopra.

(*c*) In caso di dubba sulla scelta dell'olio lubrificante, rivelgersi alla *Petters Ltd o ai suoi agenti.*

(*d*) INSTALLAZIONE MARINE AUSILIARIE. Benché si raccomandino oli di due viscosità differenti, secondo le condizioni climatiche d'impiego, non è sempre possibile cambiare l'olio quando si passa da un clima ad un altro. Ciò stante, per i motori di autopompe o per attrezzatura da impiegarsi in casi di EMERGENZA, si raccomanda di scegliere un lubrificante di viscosità indicata per la temperatura piú bassa che si prevede d'incontrare. Ma ciò, solamente se non si dispone di un olio multigrado approvato.

11. Senso di rotazione

Il senso di rotazione normale è orario, guardando verso il volano.

12. Parti di ricambio

All'ordinazione delle parti di ricambio, indicare il modello del motore e il numero di serie, il numero di referimento della parte e la quantità desiderata.

Le richieste di parti di ricambio e di assistenza tecnica vanno indirizzate *all'Agente ufficial e o al Fornitore Petters* della zona.

* Parte non illustrata.

IMPORTANTE

Quando ordinano parti di ricambio o si danno istruzioni per riparazioni, nel loro stesso interesse, i Sigg. Clienti richiedano sempre:

RICAMBI ORIGINALI PETTER

I ricambi che non siano stati forniti dall' Organizzazione *Petter* non danno pieno affidamento quanto a idoneità di materiale, a precisione di dimensioni o di finiture. La Società *Petter*, quindi, non può assumersi nessuna responsabilità per danni che possano insorgere dall'uso di tali ricambi e in casi del genere la garanzia non ha valore.

Nel proprio interesse, perciò richiedere sempre:

RICAMBI ORIGINALI PETTER

INSTRUÇÕES EM PORTUGUÊS

1. É favour lembrar-se de que:

(*a*) O motor precisa de combustível:
Mantenha limpos o combustível, o depósito, o filtro e a tubagem.

(*b*) O motor precisa de óleo lubrificante:
Use óleo do tipo indicado. Mantenha o nível de óleo.

(*c*) O motor precisa de ar:
Mantenha limpo o filtro de ar. Mantenha o colector de entrada de ar e todo o sistema de escape livres de carvão e outras restricções.

(*d*) O motor precisa de arrefecimento:
Mantenha o sistema de arrefecimento livre de obstruçoes.

2. Montagem

(*a*) Os planos de instalação podem obter-se da *Petters Ltd ou os seus agentes.*

(*b*) Deverá haver espaço suficiente para:
(i) Remoção do tampão de enchimento de óleo e drenagem do óleo.
(ii) Manutenção dos filtros de combustível, óleo lubrificante e ar;
(iii) Comandos de arranque e opação.

(*c*) Deverão usar-se sòmente parafusos com porcas ou prisioneiros de boa qualidade. NAO se devem usar, seja em que circunstância fôr, parafusos sem porcas.

(*d*) Nos casos seguintes deve consultar-se *Petters Ltd ou os seus agentes:*
(i) Antes de iniciar qualquer novo sistema de instalação.
(ii) Quando se previr o uso de blocos anti-vibração (uma escolha arbitrária pode ser perigosa).
(iii) Quando se tiver a intenção de fazer uma instalação móvel. Neste caso deve estar presente um engenheiro da Petters ao fazer a instalação inicial.

(*e*) Nos grupos accionados directamente, o cunjunto propulsor e o accionado devem estar alinhados; é necessário usar um acoplamento flexível.

3. Preparação de um motor novo ou revisto para ser pôsto em marcha (Fig. 3)

(*a*) Verifique se o sistema de arrefecimento está em ordem e livre de obstruções.

(*b*) Remova a tampa de enchimento de óleo e encha o carter inferior com óleo lubrificante até ao nível alto marcado na vareta indicadora. (Para remover o tampão de enchimento de óleo premir e rodar.) Torne a colocar a tampa. (Depois de alguns minutos de marcha, pare o motor e meta mais

óleo, visto que o nível baixa sempre alguma coisa depois da circulação inicial.)

(c) Desaparafuse a porca da tampa do filtro de ar, retire a tampa e o elemento e meta a tampa, mas não e elemento, num banho de óleo de mãquinas limpo. Deixe escorrer bem a tampa. Coloque de novo o elemento e a tampa certificando-se de que elemento se encontre assente correctamente nos segmentos de vedagem.

(d) Levante a alavanca do descompressor e vire o motor uma dezena de vezes (ou mais) para ajudar a circular o óleo.

(e) Encha o depósito de combustível.

(f) Sangre e escorve o sistema de combustível da maneira seguinte:

(i) Se existir um comando de velocidade variável colocar a alavanca de comando no posição de abertura máxima.

(ii) Se existir um comando de velocidade de ralenti, regule o comando na posição de 'RUN'.

(iii) Desloque a alavanca (A) de parar/operar para a posição 'RUN', isto é, horizontal.

(iv) Desaperte o parafuso de ventilação (B) do invólucro da bomba de combustível. Dar umas quantas voltas ao motor até que o combustível saia limpo e sem bolhas de ar. Torne a apertar o parafuso.

(v) Vire o motor até que se ouça chiadeira do injector.

4. Para arrancar (Fig. 4)

(a) Remova a carga do motor.

(b) Desloque a alavanca (A) de parar/marchar para a posição 'MARCHA' (RUN), isto é, horizontal.

(c) Se existir um comando de velocidade variável, regule a alavanca de comando na posição de meia velocidade e depois empurre para baixo e desengate a alavanca de parada de sobrecarga (B).

(d) Se existir um comando de velocidade de ralenti, regule o comando na posição de 'MARCHA' (RUN).

(e) Arranque por corda

(i) Vire a polia de arranque no sentido contrário à seta até que se sinta uma certa resistência. Faça bater a polia vigorosamente contra a resistência até que o injector tenha chiado dez vezes. (Isto é desnecessário com um motor quente.)

(ii) Enrolar a corda em torno da polia de arranque, no sentido dos ponteiros dum relógio, olhando para a roda do volante. A extremidade da corda deve estar fixa ao encaixe na polia e devem dar-se duas voltas a duas voltas e meia em torno da polia. AVISO: A corda não deve ser enrolada ao pulso do operador.

(iii) Certifique-se de que a alavanca do descompressor está desengatada e puxe bruscamente a corda até que se solte completamente da polia. O motor deve pegar.

(*f*) Arranque por manivela

(i) Levante a alavanca de descompressão (D), vire a manivela no sentido de rotação e escute procurando ouvir o chiado do injector.

(ii) Pare de virar o motor quando o pistão mal tiver passado além do PMS, no curso de compressão, e então desengate a alavanca do descompressor (D).

(iii) Vire o motor o mais rápido possível no sentido da rotação. O motor deve agora pegar.

(*g*) Arranque manual 4:1

(i) Levante o trinco do arranque para engatar as engrenagens.

(ii) Engate a manivela de arranque no trinco do arranque. A manivela não engatará completamente a não ser que a trinco tenha sido levantado.

(iii) Levante e segure a alavanca de descompressão (D). Vire a manivela lentamente e escute procurando ouvir o chiado do injector.

(iv) Quando o injector tiver chiado, vire a manivela o mais rápido possível, e desengate a alavanca do descompressor (D). Continue a virar. O motor deve, agora, arrancar. As engrenagens e manivela de arranque desengatar-se-ão automàticamente à medida que o motor ganha velocidade.

(*h*) Arranque eléctrico

(i) Verifique que a alavanca do descompressor esteja desengatada e depois opere o dinarranque. Não opere o dinarranque por periodos superiores a 20 segundos de cada vez.

(*j*) Se o motor disparar mas parar em seguida, puxe e solte a alavanca limitadora de sobrecarga (B), quando fôr instalada, antes de tentar novo arranque.

(*k*) A temperaturas abaixo de 13°C talvez seja necessário accionar o émbolo de escorva (C) ANTES de tentar arrancar. Proceda da forma seguinte:

(i) Remova o émbolo de escorva (C).

(ii) Encha a câmara de escorva com óleo de motor – NÃO COMBUSTIVEL.

(iii) Reponha o émbolo de escorva e empurre-o para baixo.

(*l*) Em temperaturas inferiores a 0°C pode tornar-se vantajoso o uso de óleo quente para escorvamento em vez de óleo frio da panela. Pode também ser necessário escorvar o motor uma segunda vez antes de tentar o aranque.

(*m*) Se, em condições frias, o motor, após o arranque, não trabalhar à velocidade prevista operar o êmbolo de escorva com o motor a functionar.

(*n*) Para reduzir dificuldades em arranque a frio é aconselhável manter o motor coberto quando não esteja em funcionamento e fazer uso de um óleo de motor com viscosidade SAE 10 (ver APPROVED LUBRICANTS).

(*p*) A temperaturas inferiores a –4°C pode tornar-se necessário o uso de equipamento de arranque a baixas temperaturas de que se podem obter pormenores de *Petters Ltd ou seus Agentes*. Este processo pode tomar a forma de carburantes auxiliares introduzidos no sistema de combustão durante o arranque quer por lata vaporizadora de aerosol aplicado manual e directamente ao filtro de ar ou por equipamento de vaporização de caracter permanente operando directamente no colector de admissão. O uso indiscriminado de carburantes auxiliares do arranque podem causar avarias. Se tiverem dúvidas sobre o uso destes carburantes devem consultar a *Petters Ltd ou seus Agentes*.

(*q*) A temperaturas inferiores a –9,4°C a construção em liga metálica leve do motor causa fricção interna a devem obter-se instruções especiais da *Petters Ltd ou seus Agentes* sobre o aquecimento global do motor, mantendo-o a uma temperatura elevada, e sobre e diluição do óleo lubrificante.

5. Para parar o motor (Fig. 4)

(*a*) Recomenda-se que o motor funcione durante uns minutos com pouca carga antes de parar.

(*b*) Mova a alavanca parar/andar (A) para a posição 'STOP' (parar), isto é, apontando no sentido do volante, e retenha-a nesta posição até que o motor pare.

'NÃOS' IMPORTANTES

(*a*) NÃO pare o motor fazendo uso do descompressor. Isto resultará na danificação das sedes das válvulas.

(*b*) NÃO pare o motor fechando a torneira de combustível ou deixando esvaziar o depósito. Isto permitirá a entrada de ar no sistema de combustível e tornará necessário sangrar e escorvar o sistema.

(*c*) NÃO remova o limitador de sobrecarga ou altere a sua regulação.

(*d*) NÃO operar a alavanca limitadora de sobrecarga com o motor a trabalhar.

6. Ajustamentos iniciais

Depois de aproximadamente 20 horas de rodagem inicial de um motor novo ou revisto, deve prestar-se atenção aos seguintes pontos:

(*a*) Verifique a folga das válvulas.

(*b*) Drene o lubrificante do carter inferior e encha com óleo novo.

(*c*) Verifique o filtro de combustível.

(*d*) Verifique se todas as porcas, parafusos etc., estão apertados.

7. Manutenção operacional

Diàriamente

(*a*) Verifique o nível do lubrificante e deite óleo se fôr necessário.

(*b*) Verifique se o sistema de arrefecimento está em ordem e livre de obstruçoes.

NOTA:

As recomendações de manutenção que se seguem são para aplicação em condições de operação medianas. Em condições de poeira excessiva, os filtros de ar, de combustível e de óleo lubrificante requerem atenção mais frequentemente. É possível que seja necessário descarbonizar com mais frequência quando os motores funcionam a baixa carga por períodos prolongados.

Todas as 50 horas .

(*a*) Limpe o filtro de ar (tipo banho de óleo).

Todas as 250 horas

(*a*) Verifique se todas os parafusos, porcas, etc., esto bem apertados. (As porcas de cabeça do cilindro NÃO deverão ser apertadas quando o motor está quente).

(*b*) Verifique se o orificio de respiradouro na tampa do tubo de enchimento do depósito de combustível está desobstruído.

(*c*) Limpe o filtro de ar (tipo de elemento de papel).

(*d*) Remova os sedimentos do sistema de escape.

(*e*) Drene o carter inferior, lavando-o com óleo de lavagem e reencha-o com óleo novo. (Se não fôr possível obter óleo de lavagem, pode-se usar petróleo, mas o motor não deverá funcionar com petróleo no carter inferior.)

(*f*) Experimente se o sistema de combustível veda bem.

(*g*) Verifique a folga dos balancins das válvulas e ajuste-os se fôr necessário.

(*h*) Coloque um novo elemento no filtro de óleo de lubrificação e uma nova anilha de junta.

(*j*) Lubrifique as ligações de comando do velocidade.

Todas as 500 horas

(*a*) Coloque um novo elemento no filtro de ar (tipo de elemento de papel).

Todas as 1000 horas

(*a*) Limpe meticulosamente o depósito de combustível.

(*b*) Coloque um novo elemento no filtro de combustível.

Todas as 2000 horas

(*a*) Descarbonize.

(*b*) Limpe os orificios de retôrno do óleo dos pistões. Verifique o desgaste das cavidades dos cilindros.

(*c*) Examine os mancais do eixo manivela e substitua se a folga fôr excessiva.

(*d*) Limpe o coador da bomba de óleo lubrificante.

(*e*) Remova o injector de combustível e comprove a pulverização. Se estiver em ordem reponha-o sem atenção adicional.

8. Como ajustar o comando de velocidade Figs. 15 e 16)

As fôrcas centrífugas nas esferas do regulador são transmitidas à cremalheira da bomba de combustível. Estas fôrcas, que varian de acôrdo com a velocidade do motor, são equilibradas por uma mola (A) de regulador de mudança, ajustável. Esse ajustamento permite uma escala fixa de velocidade. Para ajustar a velocidade fora dêsse limite seriam necessárias molas e bomba de combustível diferentes, que podem ser obtidas de *Petters Ltd ou seus agentes.* A velocidade é ajustada pela *Petters Ltd* e não deve precisar novo ajustamento. Contudo, se o regulador fôr perturbado, os ajustamentos são feitos da seguinte maneira:

(*a*) Velocidade fixa

(*i*) Afrouxar a contraporca (C) no motor do lado da vareta e aparafuse ou desaparafuse o ajustamento (B) para aumentar ou diminuir a velocidade. Aperte a contraporca (C).

(*b*) Velocidade variável

(*i*) Coloque o contrôle na posição de marcha ao ralenti.

(ii) Afrouxe a contraporca (C) e ajuste a marcha ao relenti a aproximadamente 1000 rot/min, aparafusando ou desaparafusando o ajustamento (B) afim de aumentar a velocidade ou diminuí-la. Aperte a contraporca (C).

(iii) Coloque a contrôle na posição de máxima velocidade.

(iv) Afrouxe a contraporca (D) e ajuste a velocidade máxima atarraxando ou desatarraxando o ajustamento (E) para aumentar ou diminuir a velocidade. Aperte a contraporca (D). Coloque arame novo no sêlo.

(v) Verifique a marcha ao relenti e ajuste-a se não estiver correcta.

(vi) Para adjustar o cabo de contrôle coloque a alavanca de contrôle do cabo (F) na posição de marcha vazia. Atarraxe o ajustador do cabo (G) até que alavanca do cabo de comando fique bem encostada contra a ranhura e haja uma pequena folga no cabo interno, isto é, a alavanca de contrôle do cabo apenas pode ser movida antes que o cabo interior comece a mover o comando de velocidade.

9. Dados técnicos

Distribuição da injecção de combustível (por derrame):

Velocidade fixa	
1500 rot/min	23° antes do PMS
1800 rot/min	23° antes do PMS
2100 rot/min	23° antes do PMS
2500 rot/min	26° antes do PMS
3000 rot/min	30° antes do PMS
3600 rot/min	35° antes do PMS
Velocidade variável	30° antes do PMS

Folga entre o êmbolo e a cabeça dos cilindros espaço morto	0,56/0,66mm
Folga dos balancins (frío)	0,10mm
Ascensão da válvula de descarga descompressor (max.)	0,38mm

10. Lubrificação

(a) Os óleos de lubrificação de motores, relacionados sob o título 'APPROVED LUBRICANTS', são óleos para serviço pesado com uma detergência mínima em conformidade com a
Norma Britânica de Defesa No 2101B
ou a
Norma Americana MIL/L/2104A.

(b) Os distribuidores locais de óleos lubrificantes poderão recomendar adicionalmente óleos de motor apropriados para serviço pesado, mas deve especificar-se um mínimo de detergência, como se indicou atrás.

(c) Caso surjam dúvidas sobre a selecção de um óleo de lubrificação deve consultar-se *Petters Ltd ou seus agentes.*

(d) INSTALAÇÕES AUXILIARES MARÍTIMAS. Embora se recomendem duas viscosidades de óleo segundo as diferentes condiçoes climatéricas, nem sempre se torna prático mudar o óleo quando o motor passa de um clima para outro. Nestas circunstâncias, para motores que accionam bombas de incéndio, ou outro equipamento necessário para CASOS DE EMERGÉNCIA, recomenda-se que o óleo a escolher seja de uma viscosidade própria para o clima mais frio que se espera encontrar. Esta recomendacão é feita tomando em consideração primordial a facilidade de arranque manual nos casos em que não haja à venda óleo 'multi-grade' aprovado.

11. Rotação

A rotação normal é para a direita quando estamos de frente para o volante.

12. Lista de peças

Ao encomenda peças, indique o tipo do motor e o número de série da peça e as quantidades desejadas.

Pedidos de peças e assistência devem ser dirigidos ao *agente ou negociante Petters autorizado* no respectivo território.

* Denota que a peça não está incluída na ilustração.

IMPORTANTE

Ao adquirir peças ou ao dar instruçoes para reparaçoes, o cliente, em seu proprio interesse, deve especificar sempre que deseja:

PEÇAS PETTER GENUINAS

Peças sobressalentes que não tenham sido fornecidas pela organização *Petter* não podem ser garantidas no quanto respeita a materiais, dimensões ou acabamento correctos. Por conseguinte, a *Petters* não se responsabiliza por quaisquer avarias que surjam devido ao efeito de tais peças e a garantia ficará anulada.

Portanto, no seu próprio interesse insista em:

PEÇAS PETTER GENUINAS

DEUTSCHE GEBRAUCHSANWEISUNG

1. Bitte nicht vergessen

(*a*) Der Motor braucht Brennstoff:
Brennstoff, Behälter, Filter und Leitungen sauber halten.

(*b*) Der Motor braucht Schmieröl:
Richtige Ölsorte verwenden. Ölstand stets beachten und gegenbenenfalls auffüllen.

(c) Der Motor braucht Luft:
Luftfilter sauber halten. Ansaugrohr und ganzes Auspuffsystem von Russ und anderen Fremdstoffen freihalten.

(*d*) Der Motor braucht Kühlung:
Kühlsystem von Verstopfungen freihalten.

2. Montage

(*a*) Montagepläne sind von *Petters Ltd bzw. deren Vertretern* erhältlich.

(*b*) Vorsorge ist zu treffen für:
(*i*) Das Abnehmen des Öleinfüllverschlusses und das Ablassen des Öls.
(ii) Die Wartung des Brennstoff-, Öl- und Luftfilters.
(iii) Das und die Betätigung Anlassen der Bedienungsgriffe.

(c) Es sind nur erstklassige Ankerbolzen bzw. Stehbolzen zu verwenden. Kopfschrauben dürfen NICHT benutzt werden.

(*d*) In folgenden Fällen wende man sich an *Petters Ltd bzw. deren Vertreter:*
(*i*) Bevor man an irgendeine neue Montageform herangeht.
(ii) Falls beabsichtigt ist Schwingungsdämpfer vorzusehen. (ungeeignete Wahl hann gefährlich sein!)
(iii) Falls eine ortsbewegliche Anlage in Aussicht genommen ist. In einem solchen Falle empfiehlt sich die Anwesenheit eines Petter-Ingenieurs bei der Erstmontage.

(*e*) Bei direkt angetriebenen Anlagen ist das antreibende und angetriebene Teil zu fluchten und mittels einer flexiblen Kupplung zu verbinden.

3. Vorbereitung eines neuen bzw. überholten Motors zum Starten (Abb. 3)

(*a*) Kühlsystem auf gute Funktion und Freiheit von Verstopfungen prüfen.

(*b*) Öleinfüllverschluss abnehmen und Schmieröl bis zur Hochstansmarke am Ölprüfstab einfüllen. (Um den Öleinfüllverschluss abzunehmen, eindrücken und drehen.) Verschluss wieder aufsetzen. (Nach einer Laufzeit von einigen Minuten Motor abstellen und Öl nachfüllen, da der Ölstand nach dem anfänglichen Umlauf stets etwas absinkt.)

(c) Mutter auf dem Deckel des Luftfilters abschrauben, Deckel und Einsatz abnehmen und den Deckel, nicht den Einsatz, in ein Bad mit sauberem Schmieröl tauchen. Deckel abtropfen lassen. Einsatz und Deckel wieder anbringen, dabei darauf achten, dass der Einsatz richtig auf den Dichtringen sitzt.

(d) Dekompressorhebel anheben und Motor ein oder zwei Dutzend Mal durchdrehen um die Ölzirkulation zu erleichtern.

(e) Brennstoffbehälter füllen.

(f) Wie folgt die Luft ablassen und das Brennstoffsystem vorfüllen:

(i) Ist variable Drehzahlregelung vorgesehen, so ist der Steuerhebel auf Maximum zu stellen.

(ii) Ist Leerlauf-Drehzahlregelung vorgesehen, so ist der Steuerhebel in die 'RUN'-Stellung zu bewegen.

(iii) Der Abstellhebel (A) mit der Bezeichnung 'Stop/Run' ist in die 'RUN'-Stellung, d.h. Horizontalstellung zu bewegen.

(iv) Die Entlüfterschraube (B) der Brennstoffpumpe lösen. Den Motor einige Male durchdrehen, bis suaberer, blasenfreier Brennstoff ausfliesst. Die Schraube wieder festziehen.

(v) Den Motor durchdrehen, bis die Einspritzdüse quietscht.

4. Anlassen des Motors (Abb. 4)

(a) Last vom Motor abnehmen.

(b) Den Abstellhebel (A) in die Stellung 'RUN', d.h. Horizontalstellung bringen.

(c) Ist variable Drehzahlregelung vorgesehen, Steuerhebel auf halbe Geschwindigkeit stellen, dann Überlastanschlaghebel (B) niederdrücken und wieder auslassen.

(d) Ist Leerlauf-Drehzahlregelung vorgesehen, so ist der Steuerhebel in die 'RUN'-Stellung zu bewegen.

(e) Anlassen mit Seil

(i) Anlassscheibe entgegen der Richtung des Pfeiles drehen, bis ein Widerstand fühlbar wird. Scheibe kräftig gegen den Widerstand prellen, bis die Einspritzdüse zehnmal gequietscht hat. (Bei warmen Motor ist dies nicht notwendig.)

(ii) Seil in Richtung Schwungrad gesegen im Uhrzeigersinn um die Anlassscheibe wickeln. Das Ende des Seils muss in der Scheibenkerbe liegen und das Seil in zwei oder zweieinhalb Windungen um die Scheibe gewunden werden.

WARNUNG: Das Seil darf nicht un das Handgelenk der Bedienungsperson gewickelt werden.

(iii) Sicherstellen, dass der Dekompressorhebel ausgerückt ist und dann Seil kräftig anziehen, bis es völlig von der Scheibe abgewickelt ist. Der Motor sollte nun laufen.

(*f*) Anlassen mit Andrehkurbel

(*i*) Dekompressorhebel (D) anheben, Kurbel in Drehrichtung drehen und auf das Quietschen der Einspritzdüse hören.

(ii) Mit dem Durchdrehen aufhören, wenn der Kolben den oberen Totpunkt im Verdichtungshub gerade überschritten hat. Dekompressorhebel (D) wieder ausrücken.

(iii) Motor so schnell wie möglich in Drehrichtung durchdrehen. Der Motor sollte nun anspringen.

(*g*) Anlassen von Hand mit Übersetzung 4:1

(i) Andrehklaue zwecks Einrückens der Zahnräder anheben.

(ii) Andrehkurbel in die Andrehklaue einrasten. Völliges Einrasten ist nur bei angehobener Klaue möglich.

(iii) Dekompressorhebel (D) anheben und in gehobener Stellung halten. Andrehkurbel langsam drehen und auf das Quietschen der Einspritzdüse hören.

(iv) Wenn die Einspritzdüse gequietscht hat, Andrehkurbel so schnell wie möglich drehen und Dekompressorhebel (D) auslassen. Weiter drehen. Der Motor sollte nun anspringen. Zahnräder und Andrehkurbel rücken bei zunehmender Drehzahl des Motors von selbst aus.

(*h*) Elektrisches Anlassen

(i) Darauf achten, dass der Dekompressorhebel ausgerückt ist, . dann die Anlasserlichtmaschine (Dynastart) betätigen. Dynastart nicht länger als jeweils 20 Sekunden betätigen.

(*j*) Sollte der Motor anlaufen und dann wieder aussetzen, so ist der Überlastungsanschlag (B), wenn vorgesehen, auszuklinken bevor erneutes Anlassen versucht wird.

(*k*) Bei Temperaturen under 13°C kann es nötig sein, den Anlassplunger (C) zu betätigen, BEVOR ein Anlassversuch gemacht wird. Es ist wie folgt vorzugehen:

(*i*) Anlassplunger (C) entfernen.

(*ii*) Anlasskammer mit Motoröl – NICHT BRENNSTOFF – füllen.

(iii) Anlassplunger wieder einsetzen und einpressen.

(*l*) Bei Temperaturen under 0°C dürfte es vorteilhaft sein, warmes Öl zum Anlassen anstatt des kalten Sumpföls zu verwenden. Es dürfte auch notwendig sein, den Motor noch einmal vorzufüllen bevor ein Anlassversuch gemacht wird.

(*m*) Falls unter kalten Bedingungen der Motor nach dem Start seine Nenngeschwindigkeit nicht erreicht, ist der Anlassplunger nochmals uz betätigen während der Motor läuft.

(*n*) Um Kaltstartschwierigkeiten auf ain Mininun herabzusetzen ist es ratsam, den Motor bei Nichtgebrauch abgedeckt zu halten und sicherzustellen, dass Motoröl mit der Zähigkeit SAE10 verwendet wird. (Siehe APPROVED LUBRICANTS).

(*p*) Unter –4°C dürfte es notwendig sein Kaltstarthilfen zu verwenden, und Einzelheiten hierüber sind von *Petters Ltd oder deren Vertretern* erhältlich. Diese können Hilfskraftstoffe sein, die während des Anlassens ins Verbrennungs-system eingeführt werden, und zwar entweder von Hand durch Einspritzen in den Luftfilter mit einer. Aerosolspritzdose oder durch fest eingebaute Ausrüstung, die direkt in den Ansaugkrümmer spritzt. Unbegrenzte Verwendung von Hilfsstart-Kraftstoffen kann zur Beschädigung des Motors führen. *Petters Ltd oder deren Vertreter* sollten in Zweifelsfällen beim Gebrauch solcher Kraftstoffe befragt werden.

(*q*) Bei Temperaturen unter –9,4°C führt die Konstruktion des Motors aus leichter Legierung zu inneren Reibungen und Spezialanleitungen bezüglich der Erwärmung des ganzen Motors, Aufrechterhaltung einer gewissen Temperatur und der Verdünnung des Schmieröls sind von *Petters Ltd oder deren Vertretern* erhältlich.

5. Abstellen des Motors (Abb. 4)

(*a*) Es ist ratsam, den Motor vor dem Abstellen ein paar Minuten mit kleiner Last laufen zu lassen.

(*b*) Den Abstellhebel (A) in die 'STOP'-Stellung bringen, d.h. in die Aufwärtsrichtung und diese Position halten, bis der Motor hält.

WAS MAN NIE TUN DARF

(*a*) Motor mittels Dekompressors zum Stehen bringen. Dies beschädigt die Ventilsitze und Zylinderkopfdichtungen.

(*b*) Motor darf nicht durch Absperren des Brennstoffs oder Leerlaufenlassen des Behälters abgestellt werden. Dadurch gelangt Luft in die Brennstoffleitungen, so dass das Entlüften und Vorfüllen des Systems wiederholt werden muss.

(*c*) Der Überlastanschlag darf nicht entfernt oder anders eingestellt werden.

(*d*) Den Überlastanschlaghebel NICHT bedienen, wenn der Motor läuft.

6. Einlaufzeit

Nach einer ersten Einlaufzeit von etwa 20 Stunden eines neuen oder überholten Motors:

(*a*) Ventilschwinghebelspiel überprüfen.

(*b*) Ölsumpf entleeren und mit sauberem Öl füllen.

(*c*) Brennstoffilter nachsehen.

(*d*) Alle Muttern, Schrauben usw, aus festen Sitz prüfen.

7. Regelmässige Wartung

Täglich

(*a*) Schmierölstand prüfen und gegebenenfalls auffüllen.

(*b*) Kühlsystem auf gute Funktion und Freiheit von Verstopfungen prüfen.

ZUR BEACHTUNG:

Die folgenden Wartungsanleitungen gelten für normale Betreibsbedingungen. Bei sehr staubigen Verhaltnissen bedürfen Luftfilter, Schmieröl und Kraftstoffilter haüfigerer Wartung. Entkohlung wird gewöhnlich in kürzeren Zeitabständen notwendig, wenn die Motoren lange unter leichter Belastung laufen.

Alle 50 Stunden

(*a*) Luftfilter reinigen (Ölbadtyp).

Alle 250 Stunden

(*a*) Alle Muttern, Schrauben usw. auf festen Sitz prüfen. (Die Zylinderkopfmuttern dürfen NICHT bei heissem Motor angezogen werden.

(*b*) Nachsehen, ob Entlüftungsloch im Brennstoffbehälterverschluss frei ist.

(*c*) Nachsehen, ob Luftfiltereinsatz (Papiertyp) in gutem Zustand ist.

(*d*) Auspuffsystem entrussen.

(*e*) Sumpf entleeren, mit Spülöl durchspülen und mit Frischöl nachfüllen. (Wenn Spülöl nicht verfügbar, kann Petroleum benutzt werden; der Motor darf jedoch nicht mit Petroleum in der Ölwanne betreiben werden.)

(*f*) Brennstoffsystem auf etwaige Undichtigkeiten untersuchen.

(*g*) Ventilschwinghebelspiel messen und wenn nötig nachstellen.

(*h*) Einsatz und Dichtring im Schmierölfilter erneuern.

(*j*) Drehzahlregelgestänge schmieren.

Alle 500 stunden

(*a*) Luftfiltereinsatz (Papiertyp) erneuern.

Alle 1000 Stunden

(*a*) Brennstoffbehälter innen gründlich reinigen.

(*b*) Brennstoffiltereinsatz erneuern.

Alle 2000 Stunden

(*a*) Ölkohle entfernen.

(*b*) Kolben-Ölrücklauflöcher reinigen. Zylinderabnutzung prüfen.

(*c*) Kurbellager untersuchen und bei zuviel Spiel erneuern.

(*d*) Filter der Ölpumpe reinigen.

(*e*) Treibstoffeinspritzdüsen herausnehem und Strahl prüfen. Wenn in Ordnung, wieder einbauen ohne daran herumzumanipulieren.

8. Einstellung des Geschwindigkeitsreglers (Abb. 15 & 16)

Die Fliehkräfte auf die Reglerkugeln werden auf die Brennstoffpumpen-Regelstange übertragen. Diese mit der Drehzahl des Motors veränderlichen Kräfte werden mittels einer verstellbaren Reglerfeder (A) ausgeglichen. Durch Verstellen der Feder lässt sich die Drehzahl in einem gewissen Bereich verändern. Wird grössere Einstellmöglichkeit gewünscht, so sind u.U. andere Federn und eine andere Brennstoffpumpe notwendig, die von *Petters Ltd oder deren Vertretern* zu haben sind. Die Drehzahl wird von *Petters Ltd* eingestellt und sollte keiner Nachstellung bedürfen. Ist jedoch an der Einstellung etwas verändert worden, so kann eine Nachstellung wie folgt ausgeführt werden:

(*a*) Feste Drehzahl

(i) Die Gegenmutter (C) auf der Ölprüfstabseite des Motors lösen und die Justierung (B) hineinschrauben, um die Geschwindigkeit zu erhöhen oder herausschrauben, um die Geschwindigkeit zu senken. Die Gegenmutter (C) festziehen.

(*b*) Variable Drehzahl

(i) Regulierhebel auf Leerlauf stellen.

(ii) Gegenmutter (C) lösen und Leerlaufdrehzahl auf etwa 1000 U/min einstellen. Dies geschieht durch Einschrauben der Justierung (B) zur Drehzahlerhöhung bzw. durch Herausschrauben derselben zur Drehzahlverminderung. Gegenmutter (C) anziehen.

(iii) Regulierhebel auf Höchstgeschwindigkeit stellen.

(iv) Gegenmutter (D) lösen und maximale Drehzahl durch Herausschrauben der Justierung (E) zur Drehzahlerhöhung bzw. Hineinschrauben derselben zur Drehzahlverminderung einstellen. Gegenmutter (D) anziehen. Plombe mit neuem Sicherungsdraht versehen.

(v) Leerkaufdrehzahl prüfen und gegebenenfalls nachstellen.

(vi) Zur Einstellung des Steuerkabels Kabelhebel (F) auf Leerlauf stellen. Kabeljustierung (G) einwärts schrauben, bis der Kabelhebel fest gegen den Schlitz leight und im Innenkabel etwas Spiel ist, d.h. dass der Kabelhebel ein wenig bewegt werden kann, bevor das Innenkabel die Regulierung zu bewegen beginnt.

9. Technische Daten

Einstellung des Einspritzmoments (durch Überlauf):

Feste Drehzahl	
1500 U/min	23° vor OT. (TDC)
1800 U/min	23° vor OT. (TDC)
2100 U/min	23° vor OT. (TDC)
2500 U/min	26° vor OT. (TDC)
3000 U/min	30° vor OT. (TDC)
3600 U/min	35° vor OT. (TDC)

Variable Drehzahl	30° vor OT. (TDC)
Abstand zwischen Kolbenboden und Zylinderkopf	0,56/0,66mm
Ventilschwinghebelspiel (kalt)	0,10mm
Auspuffventilhub durch Dekompressor (maximal)	0,38mm

10. Schmierung

(a) Die im Verzeichnis 'APPROVED LUBRICANTS' aufgeführten Motorenöle sind Hochleistungsöle mit einem Mindestgehalt an Zusatzmitteln zur Verhütung der Ölschlammabsonderung nach den Normvorschriften:
British Defence Specification No. 2101B
bzw.
U.S. Specification MIL/L/2104A.

(b) Weitere geeignete Hochleistungs-Motorenöle können bei örtlichen Ölverkaufsstellen erfragt werden; es ist jedoch in jedem Fall auf den oben erwähnten Mindestgehalt an Zusatzmitteln zu achten.

(c) In Zweifelsfällen bei der Wahl von Motorenölen wende man sich an *Petters Ltd oder deren Vertreter.*

(d) SCHIFFS-HILFSANLAGEN. Obgleich zwei verschiedene Zähigkeitsgrade für die verschiedenen klimatischen Bedingungen emfohlen werden, ist es praktisch nicht immer möglich, einen Ölwechsel vorzunehmen, wenn der Motor von einem zum anderen Klima übergeht. Es empfiehlt sich in solchen Fällen, für Motoren, die zum Antrieb von Feuerlöschpumpen oder anderen Geräten IM NOTFALL dienen, ein Öl zu wählen, dessen Zähigkeit für das kälteste zu erwartende Klima passend ist. Bei dieser Empfehlung ist in erster Linie der Gesichtspunkt leichten Andrehens von Hand massgebend, wenn kein zugelassenes Mehrbereich-Öl zur Verfügung steht.

11. Drehrichtung

Auf das Schwungrad gesehen erfolgt die Drehung normalerweise im Uhrzeigersinn.

12. Ersatzteile

Bei Bestellung von Ersatzteilen ist die Motortype und Laufnummer, die Teilnummer und die gewünschte Anzahl anzugeben.

Aufträge für Ersatzteile und Reparaturen sind an den in Ihrer Gegend von der Firma *Petter ernannten Vertreter oder Händler* zu richten.

* Der Stern bedeutet, dass der betreffende Teil nicht abgebildet ist.

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 aud ser Verwendung solcher Teile ergeben, und die Garantie erlischt ebenfalls.

In Ihrem eigenen Interesse verlangen Sie daher stets:

ORIGINAL PETTER TEILE

NEDERLANDSE GEBRUIKSAANWIJZING

1. Vergeet niet dat

(*a*) Een motor brandstof nodig heeft:
Houd brandstof, tank, filter en leidengen 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 verkrijgbaar bij *Petters Ltd of hun agenten.*

(*b*) Voldoende ruimte overlaten voor:
(i) Het verwijderen van de olievuldop en het aftappen van de olie.
(ii) Het onderhoud van olie- en luchtfilter.
(*iii*) Het aanzetten van de motor 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 *Petter Ltd of hun agenten:*
(i) Voordat men een nieuwe montagemethode 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* ingenieur noodzakelijk bij de eerste installatie.

(*e*) Bij direct aangedreven aggregaten moet het aandrijvende en het aangedreven gedeelte worden uitgericht en met een flexibele koppeling worden verbonden.

3. Voor het starten gereedmaken van een nieuwe of gereviseerde motor (Fig. 3)

(*a*) Controleren of het koelsysteem im odre is en niet is verstopt.

(*b*) De olievuldop verwijderen en de motor met smeerolie vullen tot aan de bovenste streep op de oliepeilstok. (Voor het verwijderen van de olievuldop deze indrukken en draaien.) 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) De moer op het deksel van het luchfiltert losdraaien, het deksel en het element verwijderen en het deksel, maar niet het element, in een schoon oliebad dompelen. De olie van het deksel laten afdruipen. Het element en het deksel weer op hun plaats brengen en daarbij opletten dat het element goed op de pakkingringen komt te rusten.

(d) De decompressor hefboom omhoog trekken en de motor één of tween dozijn malen draaien om de oliecirculatie aan de gang te krijgen.

(e) Brandstoftank vullen.

(f) Het brandstofsysteem als volgt ontluchten en bijvullen:

(i) Wanneer de motor is voorzien van een variabele snelheidsregelaar, moet de regelhandel op maximum worden ingesteld.

(ii) Wanneer de motor is voorzien van een regelaar voor het stationair toerental, meot de regelhandel in de 'RUN'-stand worden gezet.

(iii) Draai de stop/loop-handel (A) in de 'RUN'-stand, d.w.z. horizontaal.

(iv) Draai de ontluchtingsschroef (B) van de brandstofpomp los. De motor een paar slagen draaien, tot schone brandstof zonder luchtbellen eruit loopt. Bout weer vastdraaien.

(v) De motor draaien tot de verstuiver een peipend geluid maakt.

4. Het starten (Fig. 4)

(a) Motor van de belasting loskoppelen.

(b) Breng de stop/loop-handel (A) in de 'RUN'-stand, d.w.z. horizontaal.

(c) Wanneer de motor is voorzien van een variabele snelheidsregelaar, de regelhandel in de stand voor halve snelheid zetten, dan de handel van de overblastingsaanslag (B) naar beneden drukken en weer loslaten.

(d) Wanneer de motor is voorzien van een regelaar voor het stationaire toerental, moet de regelhandel in de 'RUN'-stand worden gezet.

(e) Starten met koord.

(i) Draai de aanzetschijf tegen de pijlrichting in tot u weerstand voelt. De aanzetschijf krachtig heen en weer draaien, tegen de weerstand in tot de verstuiver tienmaal heeft gepieot. (Dit is niet nodig bij een warme motor.)

(ii) Wikkel het koord om de aanzetschijf, rechtsom wanneer u tegen het vliegwiel aankijkt. Het einde van het koord moet in de inkeping van de schijf liggen en het koord moet twee tot twee-en-een-halve slag om de schijf worden gewikkeld. WAARSCHUWING: Men mag het koord niet om de pols wikkelen.

(iii) Overtuig u dat de decompressiehefboom in de vrije stand staat en trek dan flink aan het koord tot het geheel van de schijf is afwegikkeld. De motor moet nu aanslaan.

(*f*) Starten met aanzetslinger

(i) De decompressiehefboom (D) oplichten, de handel in de draairichting draaien en luisteren of de verstuiver piept.

(ii) De motor niet verder draaien als de zuiger tijdens de compressieslag net voorbij het bovenste dode punt is en dan de decompressiehefboom (D) weer terugzetten in de vrije stand.

(iii) Draai de motor zo snel mogelijk in de draairichting. De motor moet nu aanslaan.

(*g*) 4:1 starten met de hand

(i) Licht de aanzetklauw op voor het ingrijpen van de tandwielen.

(ii) Steek de aanzetslinger in de aanzetklauw. De slinger kan niet geheel worden ingestoken als de klauw niet eerst is opgelicht.

(iii) De decompressiehefboom (D) oplichten en vasthouden. De slinger langzaam draaien en luisteren of de verstuiver piept.

(iv) Wanneer de verstuiver heeft gepiept de slinger zo snel mogelijk draaien en de decompressiehefboom (D) loslaten. Blijf doordraaien. De motor moet nu aanslaan. De tandwielen en de aanzetslinger komen automatisch vrij wanneer de snelheid van de motor toeneemt.

(*h*) Elektrisch starten

(i) Overtuig u dat de decompressiehefboom in de vrije stand staat en den de dynastart inschakelen. Met de dynastart niet langer dan 20 seconden achter elkaar starten.

(*j*) Als de motor aanslaat en dan weer stopt, de handel (B), waan voorzien, van de overbelastingsaanslag naar beneden drukken en dan weer loslaten, voordat men probeert de motor weer aan te slaan.

(*k*) Bij temperaturen onder –13°C kan het nodig zijn de inspuitplunjer (C) te gebruiken VOORDAT men probeert de motor aan te zetten. Dit moet op de volgende wijze geschieden:

(i) Verwijder de inspuitplunjer (C).

(ii) Vul de inspuitkamer met smeerolie – NIET brandstofolie.

(iii) De inspuitplunjer weer op zijn plaats brengen en indrukken.

(*l*) Bij temperaturen onder 0°C kan het beter zijn voor het inspuiten warme olie te gebruiken, in plaats van koude olie uit het carter. Het kan tevens nodig zijn de motor nog een

tweede keer in te spuiten, voordat men tracht dexe aan te zetten.

(*m*) Indien bij koud weer de motor na het aanzetten niet op de juiste snelheid komt, moet men de inspuitplunjer nogmaals indrukken terwijl de motor loopt, maar man meg de peilstok niet verwijderen.

(*n*) Om moeilijkheden met koud aanzetten zoveel mogelijk te verminderen, wordt aanbevolen de motor onder dak te brengen, wanneer deze niet in gebruik is, en ervoor te zorgen dat smeerolie met een viscositeit van SAE10 wordt toegepast (zie APPROVED LUBRICANTS).

(*p*) Bij temperaturen onder –4°C kan het gebruik van een aanzethulpmiddel 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 inspuiting in het luchtfilter 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.*

(*q*) Bij temperaturen onder 9,4°C zal er inwendige wrijving ontstaan doordat de motor van een lichte metaallegering is vervaardigd. Speciale aanwijzingen kunnen door *Petters Ltd of hun agenten* worden verstrekt omtrent het verwarmen van de gehele motor, het op temperatuur houden daarvan en het verdunnen van de smeerolie.

5. Het afzetten van de motor (Fig. 4)

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

(*b*) Draai de stop/handel (A) in de 'STOP'-stand, d.w.z. naar boven toe en houd hem in deze stand totdat 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 klepzitingen en van de cilinder-koppakkingen tot gevolg hebben.

(*b*) Men mag de motor NIET stilzetten door de gebruik van alle brandstof, zodat te tank leegraakt. Daardoor komt er lucht in de branstofleiding, zodat het systeem weer ontlucht en bijgevuld moet worden.

(*c*) De overbelastingsaanslag NIET verwijderen of de stand daarvan veranderen.

(*d*) Draai NIET aan de handel van de overbelastingsaanslag, als de motor loopt.

6. Inlooptijd

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

(*a*) Klepspeling controleren.
(*b*) Oliecarter aftappen en opnieuw vullun met zuivere olie.
(*c*) Branstoffilter controleren.
(*d*) Controleren of alle moeren, bouten, enz. goed zijn vastegdraaid.

7. Regelmatig onderhoud

Dagelijks

(*a*) Smeerolieniveau met de peilstok controleren en zo nodig bijvullen.
(*b*) Koelsysteem op goede werking en op verstoppingen controleren.

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*) Controleren of alle moeren, bouten, enz. goed zijn vastgedraaid. (De kopbouten van de cilinders mogen NIET worden aangedraaid terwijl de motor warm is.)
(*b*) Nazien of het ontluchtingsgat in de dop van de brandsoftank vrij is.
(*c*) Luchtfilter reinigen (papier-element type).
(*d*) Aanslag uit de knaldemper verwijderen.
(*e*) Oliecarter laten leeglopen, uitspoelen met spoelolie en met nieuwe olie vullen. (Wanneer geen spoelolie beschikbaar is kan petroleum worden gebruikt, maar de motor mag niet lopen met petroleum in het carter.)
(*f*) Onderzoeken of er lekken in het brandstofsysteem zijn.
(*g*) Klepspeling controleren en zo nodig bijstellen.
(*h*) Nieuw filterelement en nieuwe pakkingring aanbrengen in het smeeroliefilter.
(*j*) Smeer de trekstang van de snelheidsregelaar.

Om de 500 uur

(*a*) Nieuw element in het luchtfilter plaatsen (papier-element type).

Om de 1000 uur

(*a*) Brandstoftank inwendig grondig reinigen.
(*b*) Nieuw brandstoffilterelement 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*) Filter van de oliepomp reinigen.
(e) De brandstofverstuiver verwijderen en de straal controleren. Wanneer deze in orde is de verstuiver opnieuw aanbrengen zonder er iets aan te veranderen.

8. Instellen van de snelheidsregelaar Figs. 15 & 16)

De centrifugale krachten op de kogels van de regulateur, 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 beparld bereik worden geregeld. Wanneer een grotere regelmogelijkheid wordt gewenst, kan het nodig zijn andere veren en brandstofpump toe te passen en deze zijn verkrijgbaar bij de firma *Petters Ltd of hun agenten.* De snelheid wordt door *Petters Ltd* ingesteld en behoeft niet te worden veranderd. Mocht echter de instelling zijn verstoord, dan kan men de snelheid als volgt opnieuw instellen:

(*a*) Vast toerental
  (i) Contramoer (C), aan de zijde van de motor waar de peilstok zich bevindt, losdraaien en de regelaar (B) indraaien om het toerental te vergroten, of uitdraaine om het te verkleinen. De contramoer (C) weer vastdraaien.

(*b*) Variabel toerental
  (i) Bedieningshandel in de stationairstand zetten.
  (ii) Contramoer (C) losdraaien en het stationaire toerental op ongeveer 1000 omw/min instellen. Dit geschiedt door regelschroef (B) in te schroeven om het toerental te vergroten en deze uit te schoeven om het toerental te verkleinen. Contramoer (C) weer vastdraaien.
  (iii) Bedieningshandel in de stand voor het hoogste toerental zetten.
  (iv) Contramoer (D) losdraaien en hoogste toerental instellen. Regelschroef (E) uitschroeven om het toerental te vergroten, of inschroeven om het te verkleinen. Contramoer (D) weer vastdraaien. De plombe met nieuw plombeerdraad weer aanbrengen.
  (v) Controleer het stationaire toerental nog eens en stel dit zo nodig bij.
  (vi) Voor het instellen van de bedieningskabel, de kabelhandel (F) in de stationairstand zetten. De kabel-

spanmoer (G) aandraaien tot de kabelhandel tegen het einde van de geulf wordt gedrukt er nog een beetje speling in de binnenkanel is, d.w.z. dat de kabelhandel nog even kan worden bewogen, voordat de binnenkabel de regelaar begint te bewegen.

9. Technische gegevens

Instelling van het moment van inspuiting (door overloop):

Vaste toerental	
1500 omw/min	23° vóór b.d.p.
1800 omw/min	23° vóór b.d.p.
2100 omw/min	23° vóór b.d.p.
2500 omw/min	26° vóór b.d.p.
3000 omw/min	30° vóór b.d.p.
3600 omw/min	35° vóór b.d.p.
Variabel toerental	30° vóór b.d.p.
Min. afstand tussen zuigerbodem en cilinderkop	0,56/0,66mm
Speling kleptuimelaar (koud)	0,10mm
Hefhoogte van uitlaatklep door decompressor (max.)	0,38mm

10. Smering

(a) De onder 'APPROVED LUBRICANTS' aangegeven motoroliesoorten zijn zware olien en bezitten een minimumreinigingseffect. Zij voldoen aan de volgende voorschriften:
British Defence Specification No. 2101B
of
U.S. Specification MIL/L/2104A.

(b) Andere zware oliesoorten kunnen door een olieleverancier ter plaatse worden aanbevolen, doch een minimumreinigingseffect 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.

11. Draairichting

De normale draairichting is rechtsom, als u naar het vliegwiel kijkt.

12. Reservedelen

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 *Petter agent of handelaar* in uw gebied.

* Geeft aan dat een onderdeel niet is afgebeeld.

BELANGRIJK

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

ORIGINELE PETTER ONDERDELEN

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

Eist daarom steeds in uw eigen belang:

ORIGINELE PETTER ONDERDELEN

g 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 *Petter agent or dealer* in the territory.

United Kingdom

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

** Denotes that the part is not illustrated.*

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

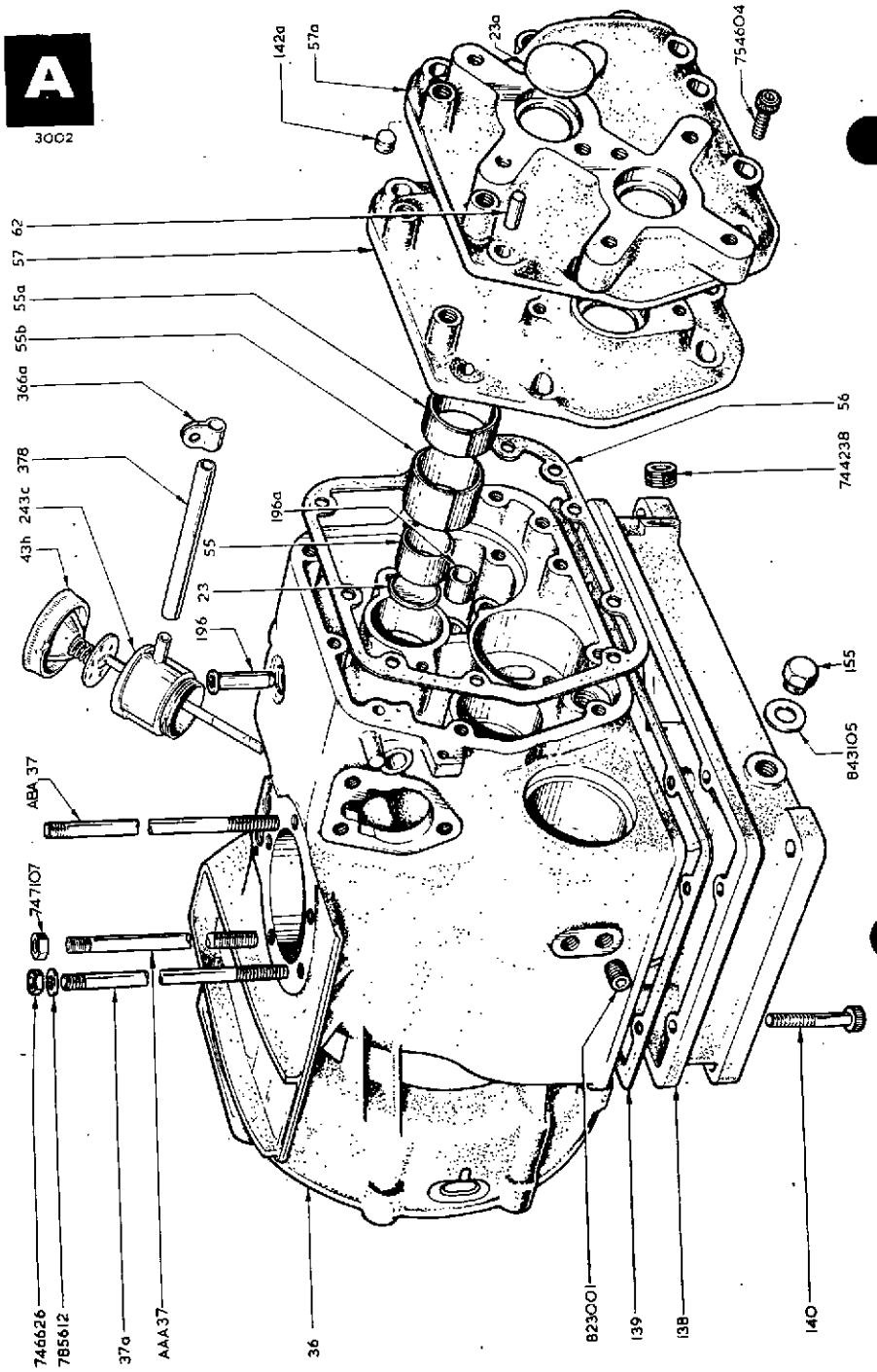

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PLATE A

CRANKCASE

Ref. No.	Description	ABI
AAA23	Plug—Camshaft Bore (Flywheel end)	1
AAA23a	Plug—Gear Cover	1
ABA36	Crankcase, complete with Camshaft Bushes, Governor Operating Shaft Bush, Governor Shaft Bush and Crankshaft Bearing (Gear end)	1
ABA37	Stud—Cylinder Head (Fuel Tank)	1
AAA37	Stud—Cylinder Head (Short)	2
AAA37a	Stud—Cylinder Head (Long)	3
AAA43h	Dipstick, Oil Filler Cap and Breather Assembly	1
AAA55	Bearing—Camshaft (Flywheel end)	1
AAA55a	Bearing—Camshaft (Gear end)	1
AAA55b	Bearing—Camshaft (Intermediate)	1
AAA56	Joint—Gear Cover (Supplied only in Sets of Joints) ...	1
AAA57	Cover—Gear	1
AAA57a	Cover—Gear (Electric Starting)	1
AAA62	Dowel—Gear Cover	2
AAA138	Sump	1
AAA139	Joint—Sump (Supplied only in Sets of Joints)	1
AAA140	Screw—Sump	8
AAA142a	Plug—Gear Cover (Raised Hand Starting)	4
AAA155	Plug—Sump Drain	2
AAA196	Bush—Governor Operating Shaft	1
AAA196a	Bush—Governor Shaft	1
AAA243c	Collar—Oil Filler	1
AAA366a	Clip—Breather Pipe	1
AAA378	Pipe—Breather	1

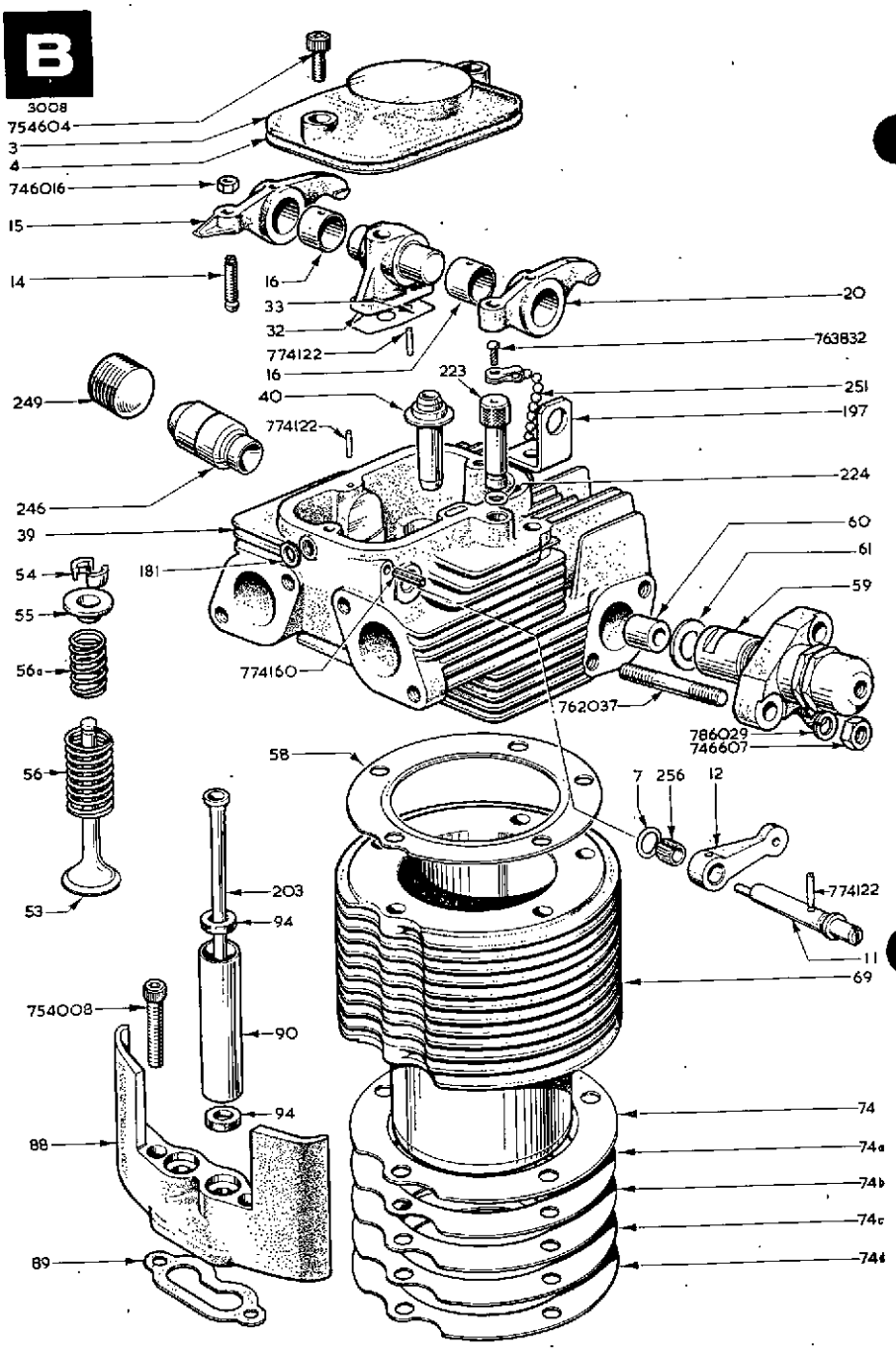
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PLATE B

CYLINDER AND CYLINDER HEAD

Ref. No.	Description	AB1
AAB3	Cover—Rocker Box	1
AAB4	Joint—Rocker Box Cover (Supplied only in Sets of Joints)	1
AAB7	Oil Seal—Decompressor Shaft	1
AAB11	Shaft—Decompressor	1
AAB12	Lever—Decompressor	1
AAB14	Screw—Valve Rocker Adjusting	2
ABB15	Rocker—Exhaust Valve	1
AAB16	Bush—Valve Rocker	2
ABB20	Rocker—Inlet Valve	1
ABB32	Support—Rocker	1
AAB33	Joint—Rocker Support	1
ACB39	Cylinder Head, complete with Valve Springs, Valves and Valve Guides	1
ABB40	Guide—Valve	2
ABB53	Valve	2
ABB54	Collet—Valve	2 prs.
ABB55	Cup—Valve	2
ABB56	Spring—Valve (Outer)	2
ABB56a	Spring—Valve (Inner)	2
ABB58	Gasket—Cylinder Head (Supplied separately or in Sets of Joints)	1
AAB59	Holder—Fuel Injector Nozzle	1
AAB60	Nozzle—Fuel Injector	1
AAB61	Joint Washer—Fuel Injector (Supplied only with Fuel Injector Nozzle or in Sets of Joints)	1
ACB69	Cylinder	1
ABB74	Joint—Cylinder (0·003″)	As reqd.
ABB74a	Joint—Cylinder (0·005″)	As reqd.
ABB74b	Joint—Cylinder (0·010″)	As reqd.
ABB74c	Joint—Cylinder (0·015″)	As reqd.
ABB74d	Joint—Cylinder (0·020″)	As reqd.
ABB88	Base—Push Rod Tube	1
AAB89	Joint—Push Rod Tube Base (Supplied only in Sets of Joints)	1
ACB90	Tube—Push Rod	2
ABB94	Seal—Push Rod Tube	4
ABB181	Washer—Cylinder Head Oil Pipe	2
AAB197	Bracket—Lifting	2
ACB203	Push Rod—Valve	2
AAB223	Plunger—Priming	1
AAB224	Seal—Priming Plunger	1
*ABB245	Insert—Valve	2
AAB246	Air Cell	1
AAB249	Plug—Air Cell Retaining	1
AAB251	Chain—Priming Plunger	1
AAB256	Bush—Decompressor Shaft	1

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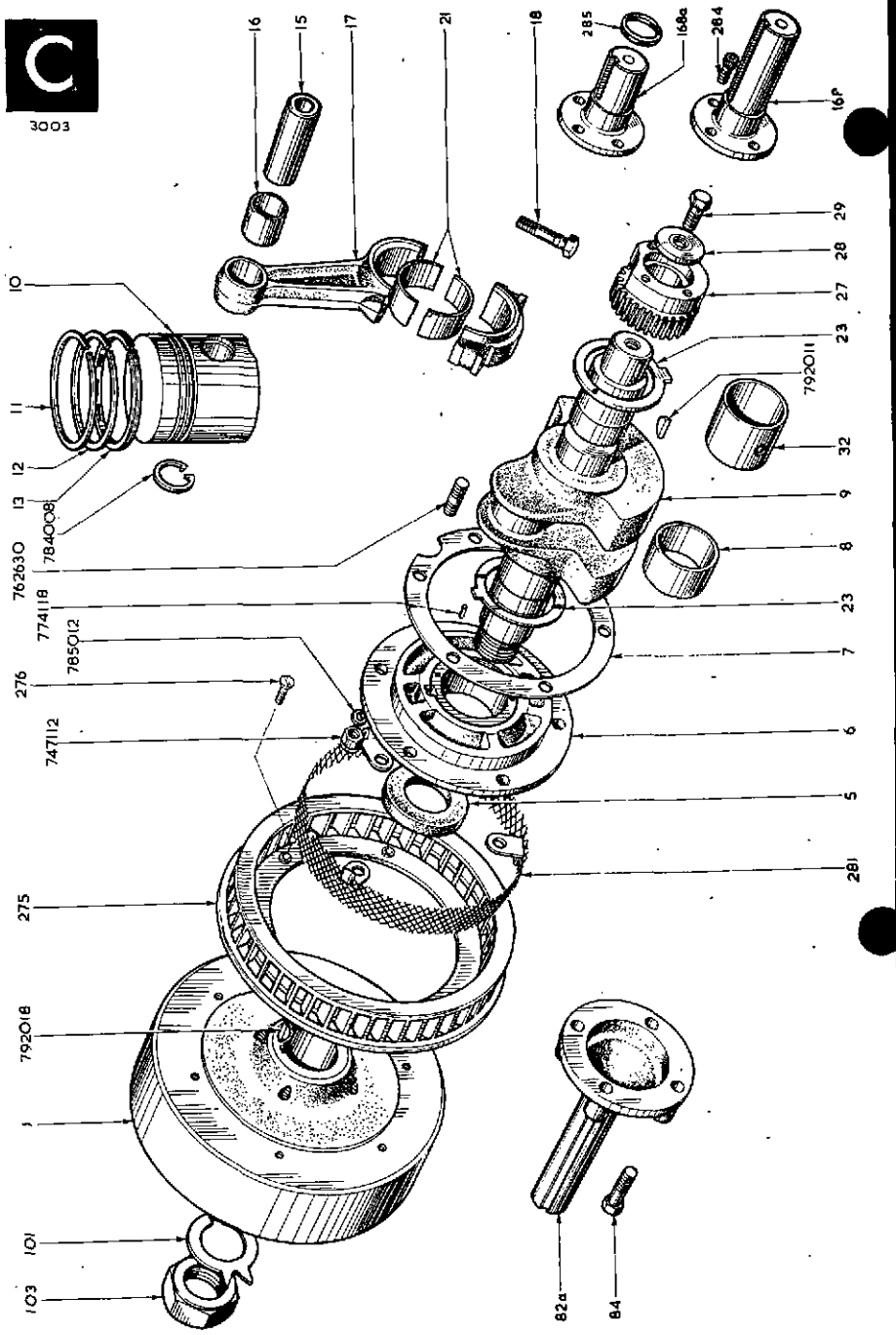
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PLATE C
CRANKSHAFT AND PISTON

Ref. No.	Description		ABI
ABC1	Flywheel		1
*ABC1a	Flywheel (Single Plate Clutch)		1
AAC5	Oil Seal		1
AAC6	Housing—Main Bearing (Flywheel end)		1
AAC7	Joint—Main Bearing Housing (Supplied only in Sets of Joints)		1
AAC8	Bearing—Main (Flywheel end) (Standard)		1
*AAC8—10	Bearing—Main (Flywheel end) (0·010" Undersize)		1
*AAC8—20	Bearing—Main (Flywheel end) (0·020" Undersize)		1
AAC9	Crankshaft		1
ABC10	Piston Assembly, complete with Rings, Pin and Circlips (Standard)		1
*ABC10+20	Piston Assembly, complete with Rings, Pin and Circlips (0·020" Oversize)		1
*ABC10+30	Piston Assembly, complete with Rings, Pin and Circlips (0·030" Oversize)		1
*ABC10+40	Piston Assembly, complete with Rings, Pin and Circlips (0·040" Oversize)		1
ABC11	Ring—Compression (Chromium Plated) (Standard)	Only supplied in Standard or Oversize Sets	1
*ABC11+20	Ring—Compression (Chromium Plated) (0·020 Oversize)		1
*ABC11+30	Ring—Compression (Chromium Plated) (0·030" Oversize)		1
*ABC11+40	Ring—Compression (Chromium Plated) (0·040" Oversize)		1
ABC12	Ring—Compression (Plain) (Standard)		1
*ABC12+20	Ring—Compression (Plain) (0·020" Oversize)		1
*ABC12+30	Ring—Compression (Plain) (0·030" Oversize)		1
*ABC12+40	Ring—Compression (Plain) (0·040" Oversize)		1
ABC13	Ring—Scraper (Standard)		1
*ABC13+20	Ring—Scraper (0·020" Oversize)		1
*ABC13+30	Ring—Scraper (0·030" Oversize)		1
*ABC13+40	Ring—Scraper (0·040" Oversize)		1
ABC15	Gudgeon Pin		1
AAC16	Bush—Small End		1
AAC17	Connecting Rod Assembly, complete with Small End Bush, Standard Large End Bearing and Bolts		1
AAC18	Bolt—Large End		2
AAC21	Bearing—Large End (Standard)		1 pr.
*AAC21—10	Bearing—Large End (0·010" Undersize)		1 pr.
*AAC21—20	Bearing—Large End (0·020" Undersize)		1 pr.
AAC23	Washer—Crankshaft Thrust		2
AAC27	Gearwheel—Crankshaft		1
AAC28	Plate—Gearwheel Retaining		1
AAC29	Setscrew—Gearwheel Retaining		1
AAC32	Bearing—Main (Gear End) (Standard)		1
*AAC32—10	Bearing—Main (Gear End) (0·010" Undersize)		1
*AAC32—20	Bearing—Main (Gear End) (0·020" Undersize)		1
AAC82a	Shaft—Flywheel End		1
AAC84	Bolt—Flywheel End Shaft		4
AAC101	Tabwasher—Flywheel		1
AAC103	Nut—Flywheel		1
AAC168	Shaft—Crankshaft Extension		1
ABC168a	Shaft—Crankshaft Extension (Rope Start—Gear end)		1
AAC275	Fan—Flywheel		1
AAC276	Screw—Flywheel Fan		6
AAC281	Guard—Flywheel		1
AAC284	Screw—Crankshaft Extension Shaft		4
AAC285	Oil Seal—Crankshaft Extension Shaft		1

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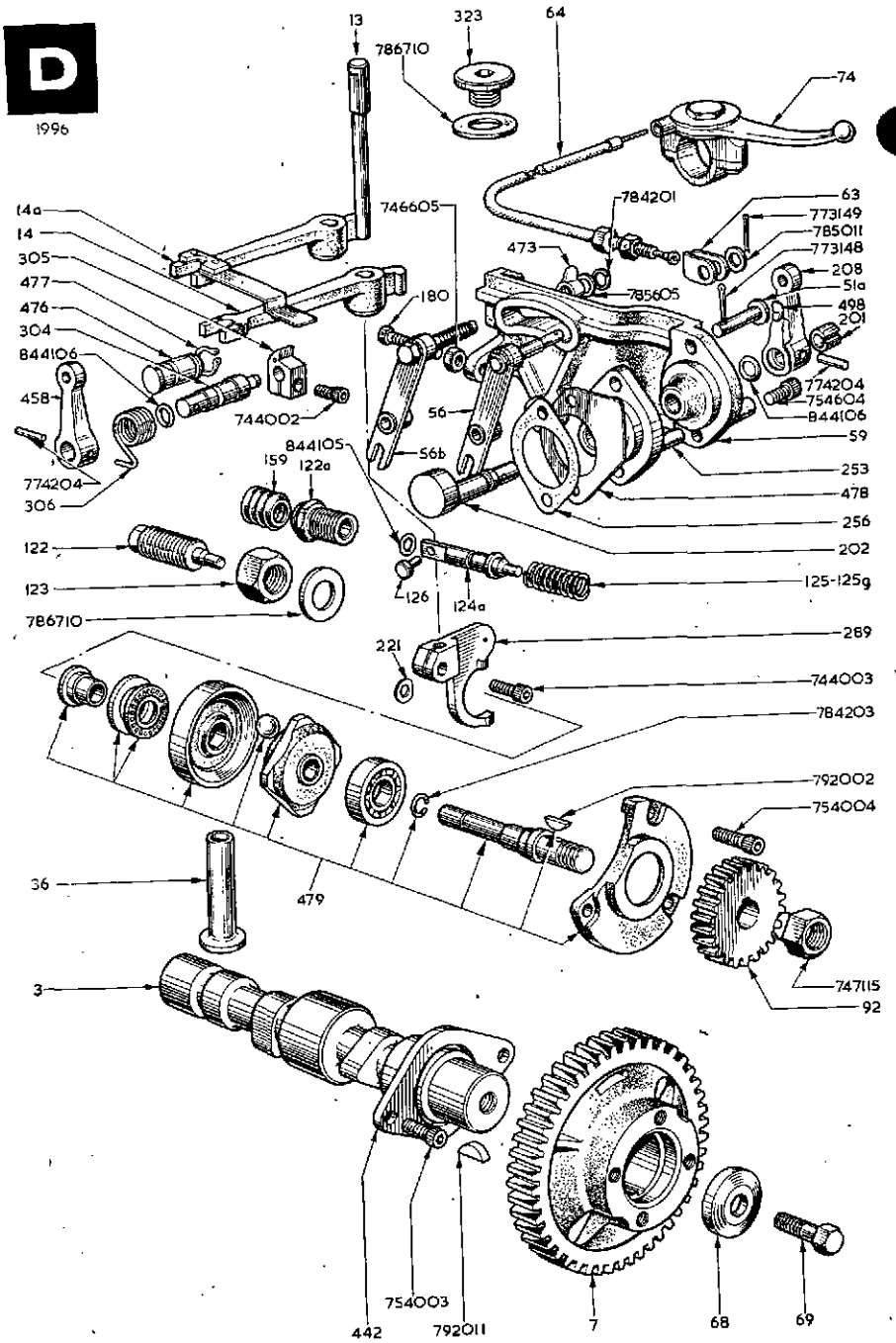
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PLATE D

CAMSHAFT AND GOVERNOR

Ref. No.	Description	ABI
ABD3	Camshaft	1
AAD7	Gearwheel—Camshaft	1
AAD13	Shaft—Governor Operating	1
AAD14	Lever—Governor	1
AAD14a	Lever—Governor (Variable Speed)	1
AAD36	Tappet—Valve	2
AAD51a	Pin—Variable Speed Lever	1
AAD56	Lever Assembly—Variable Speed	1
AAD56b	Lever Assembly—Idler Control	1
AAD59	Bracket—Variable Speed	1
JD63	Shackle—Cable	1
AAD64	Cable—Operating (Variable Speed) (To length required)	1
AAD68	Plate—Gearwheel Retaining	1
AAD69	Screw—Gearwheel Retaining	1
TD74	Lever—Cable Control	1
AAD92	Gearwheel—Governor	1
AAD122	Adjuster—Speeder Spring	1
AAD122a	Adjuster—Speeder Spring (Variable Speed)	1
AAD123	Locknut—Speeder Spring Adjuster, $\frac{5}{8}$" UNF	1
AAD124a	Plunger—Speeder Spring	1
AAD125-g	Spring—Speeder (for details see separate list)	1
AAD126	Pin—Plunger	1
AAD159	Bellows—Speeder Spring Plunger	1
HD180	Screw—Speed Stop (Variable Speed)	1
AAD201	Bush—Governor Stop Lever	1
AAD202	Spindle—Governor Stop Lever	1
AAD208	Lever—Governor Stop	1
AAD221	Spacer—Governor Bracket	1
AAD253	Cover—Governor Stop Lever Spindle	1
AAD256	Joint—Variable Speed Plate	1
AAD289	Bracket—Governor	1
*JD298	Wire—Adjusting Screw Locking	1
AAD304	Spindle—Overload Stop (Variable Speed)	1
AAD305	Cam—Overload Stop	1
AAD306	Spring—Overload Stop Return	1
AAD323	Plug—Governor	1
AAD442	Plate—Camshaft Thrust	1
AAD458	Lever—Overload Stop (Variable Speed)	1
*AAD471	Seal—Locking Wire	1
AAD473	Wing Nut—Idler Control Lever Bolt	1
AAD476	Spindle—Overload Stop Blanking	1
AAD477	Circlip—Overload Stop Blanking Spindle	1
AAD478	Plate—Stop/Run	1
AAD479	Governor Thrust Assembly	1
AAD498	Spring—Governor Stop Lever	1

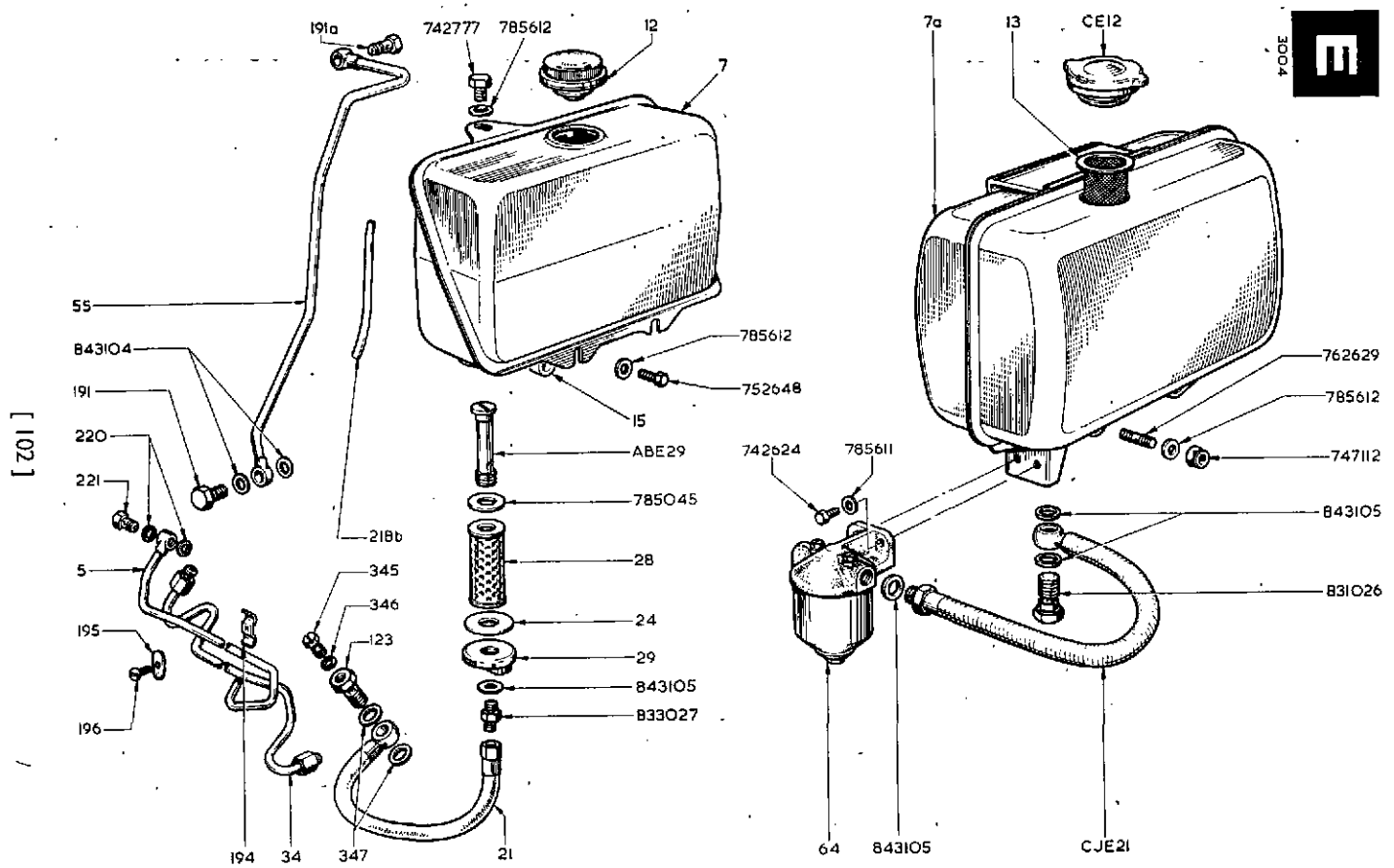
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PLATE E

FUEL TANK, FUEL FILTER AND PIPES

Ref. No.	Description	ABI
AAE5	Pipe—Injector Leak-off	1
ABE7	Tank—Fuel, complete with Cap, Fuel Filter Element and Element Retainer	1
AAE7a	Tank—Fuel (2 gal)	1
AAE12	Cap—Fuel Tank	1
CE12	Cap—Fuel Tank (2 gal)	1
JE13	Strainer—Fuel Tank (2 gal)	1
ABE15	Spacer—Fuel Tank	2
CJE21	Pipe—Fuel (Tank to Filter) (2 gal Fuel Tank)	1
AAE21	Pipe—Fuel (Tank to Pump)	1
*AAE21a	Pipe—Fuel (Tank to Pump—24" flexible) (For use with engine having separately mounted Fuel Tank)	1
AAE24	Washer—Fuel Filter Element Plug	1
AAE28	Element—Fuel Filter	1
AAE29	Plug—Fuel Filter Element	1
ABE29	Bolt—Fuel Filter Element	1
ABE34	Pipe—Fuel (Pump to Injector) (Fixed Speed)	1
*ABE34a	Pipe—Fuel (Pump to Injector) (Variable Speed)	1
ABE55	Pipe—Oil (Crankcase to Cylinder Head)	1
ASE64	Filter—Fuel (For use with engine having separately mounted Fuel Tank and 2 gal Fuel Tank)	1
*ABE100	Nut—Fuel Tank (2 gal)	1
AAE123	Banjo Bolt (Fuel Pump)	1
ABE191	Banjo Bolt—Crankcase	1
ABE191a	Banjo Bolt—Cylinder Head	1
AAE194	Clip	2
AAE195	Plate	1
AAE196	Screw	1
*AAE218	Pipe—Injector Leak-off (For use with engine having separately mounted Fuel Tank)	1
HE218b	Pipe—Injector Leak-off	1
*HE218k	Pipe—Injector Leak-off (2 gal Fuel Tank)	1
AAE220	Joint Washer—Injector Leak-off Pipe	2
AAE221	Banjo Bolt—Injector Leak-off Pipe	1
AAE345	Vent Screw—Fuel Pump	1
AAE346	Washer—Vent Screw	1
AAE347	Joint Washer—Fuel Pipe	2

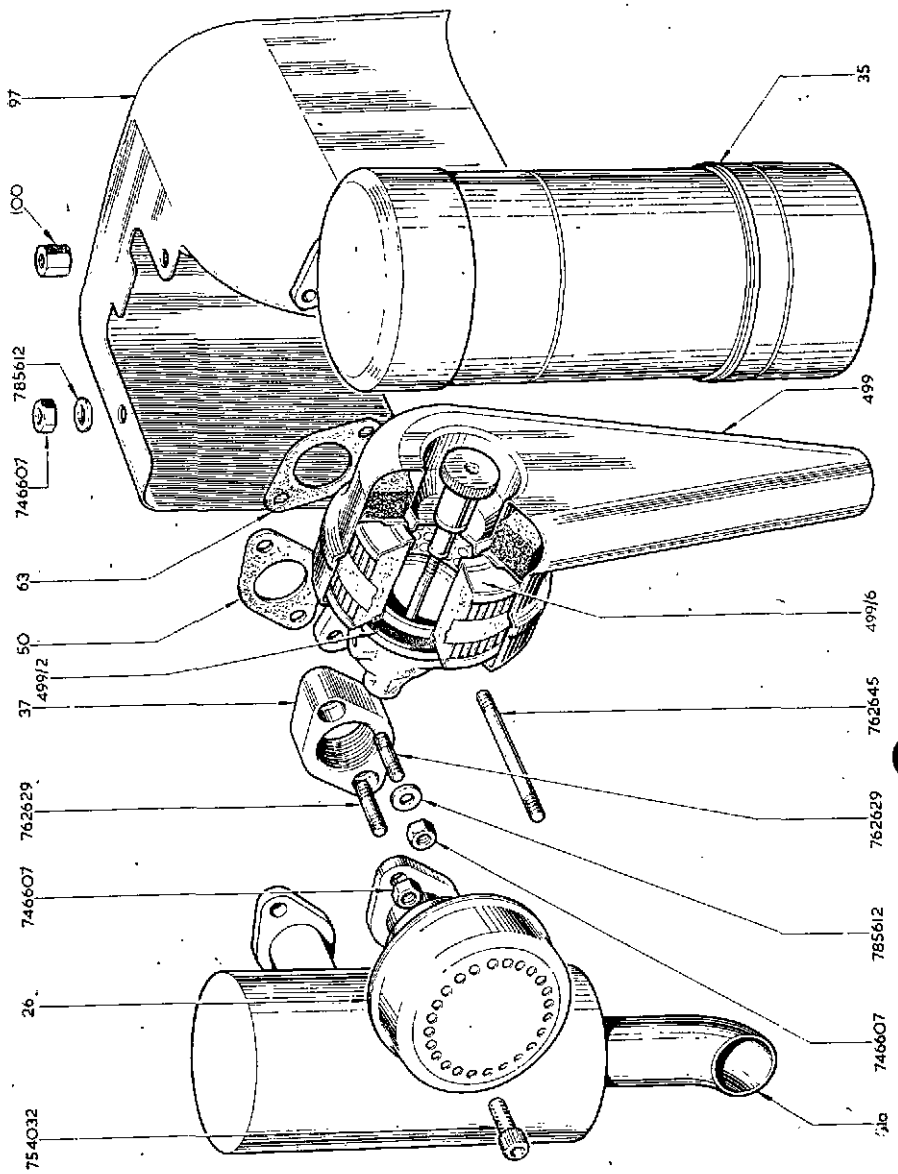
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PLATE F

AIR CLEANER, SILENCER AND COWLING

Ref. No.	Description	ABJ
ABF26	Silencer—Exhaust	1
AAF31a	Silencer—Exhaust (Acoustic)	1
AAF35	Air Cleaner (Oil Bath)	1
AAF37	Flange—Exhaust	1
AAF50	Gasket—Exhaust Silencer	1
AAF63	Joint—Air Inlet Manifold	1
AAF97	Cowling—Cylinder	1
ABF100	Nut—Cylinder Head	1
ABF499	Air Cleaner, complete with Manifold, Seal and Element ...	1
AAF499/2	Seal—Air Cleaner (Casing to Manifold)	1
AAF499/6	Element—Air Cleaner	1

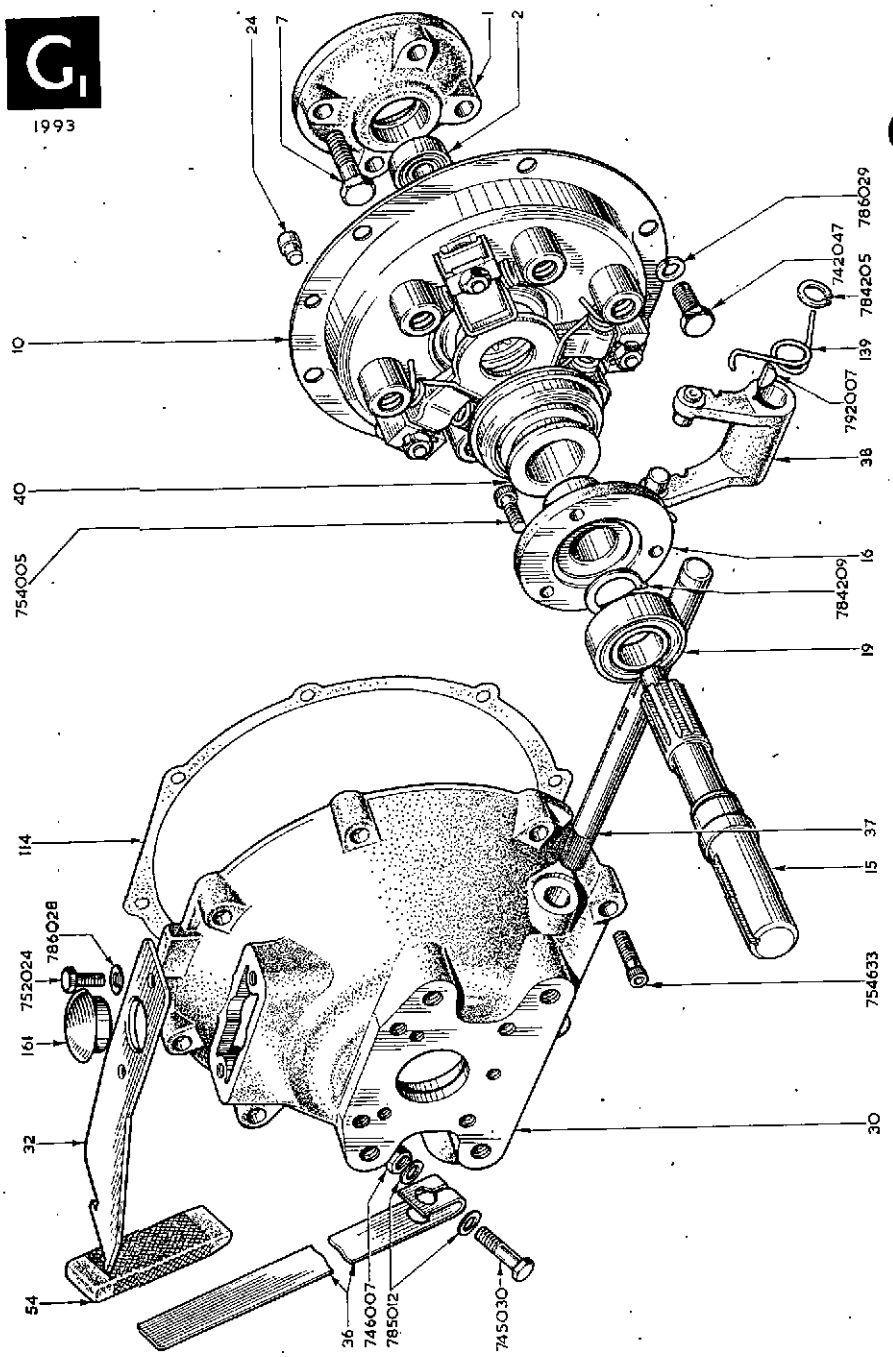
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PLATE G

CLUTCH

Ref. No.	Description	ABI
AAG1	Housing—Bearing	1
AAG2	Bearing	1
AAG7	Bolt	4
AAG10	Plate Assembly—Clutch	1
AAG15	Shaft—Clutch	1
AAG16	Sleeve—Retaining	1
AAG19	Bearing—Ball	1
AAG24	Dowel	2
AAG30	Housing—Clutch	1
AAG32	Guide—Operating Lever	1
AAG36	Lever—Clutch Operating	1
AAG37	Shaft—Yoke	1
AAG38	Yoke	1
AAG40	Bearing—Thrust	1
AAG54	Grip	1
ABG73	Clutch—Centrifugal (Crankshaft Drive)	1
ABG73a	Clutch—Centrifugal (Camshaft Drive)	1
ABG73b	Clutch—Centrifugal (Reduction Gear Drive)	1
ABG73c	Coupling—Centrifugal (Crankshaft Drive)	1
AAG76a	Plate—Centrifugal Clutch Retaining	1
AAG114	Shim	As reqd.
ABG129	Shaft—Centrifugal Clutch	1
ABG130	Shaft—Centrifugal Clutch	1
AAG139	Spring—Yoke	1
AAG161	Plug	1

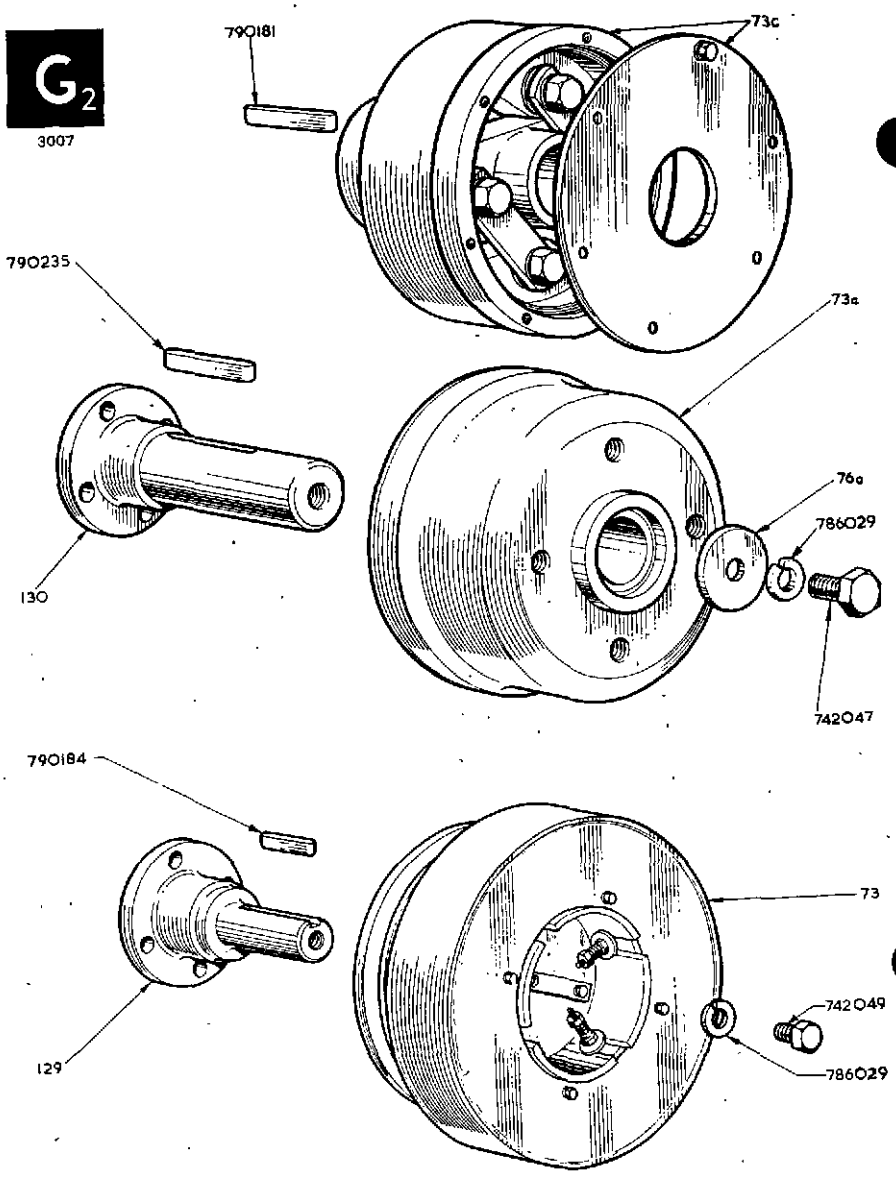
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PLATE G

CLUTCH

Ref. No.	Description	ABI
AAG1	Housing—Bearing	1
AAG2	Bearing	1
AAG7	Bolt	4
AAG10	Plate Assembly—Clutch	1
AAG15	Shaft—Clutch	1
AAG16	Sleeve—Retaining	1
AAG19	Bearing—Ball	1
AAG24	Dowel	2
ACG30	Housing—Clutch	1
AAG32	Guide—Operating Lever	1
AAG36	Lever—Clutch Operating	1
AAG37	Shaft—Yoke	1
AAG38	Yoke	1
AAG40	Bearing—Thrust	1
AAG54	Grip	1
ABG73	Clutch—Centrifugal (Crankshaft Drive)	1
ABG73a	Clutch—Centrifugal (Camshaft Drive)	1
*ABG73b	Clutch—Centrifugal (Reduction Gear Drive)	1
ABG73c	Coupling—Centrifugal (Crankshaft Drive)	1
AAG76a	Plate—Centrifugal Clutch Retaining	1
AAG114	Shim	As reqd.
ABG129	Shaft—Centrifugal Clutch	1
ABG130	Shaft—Centrifugal Clutch	1
AAG139	Spring—Yoke	1
AAG161	Plug	1

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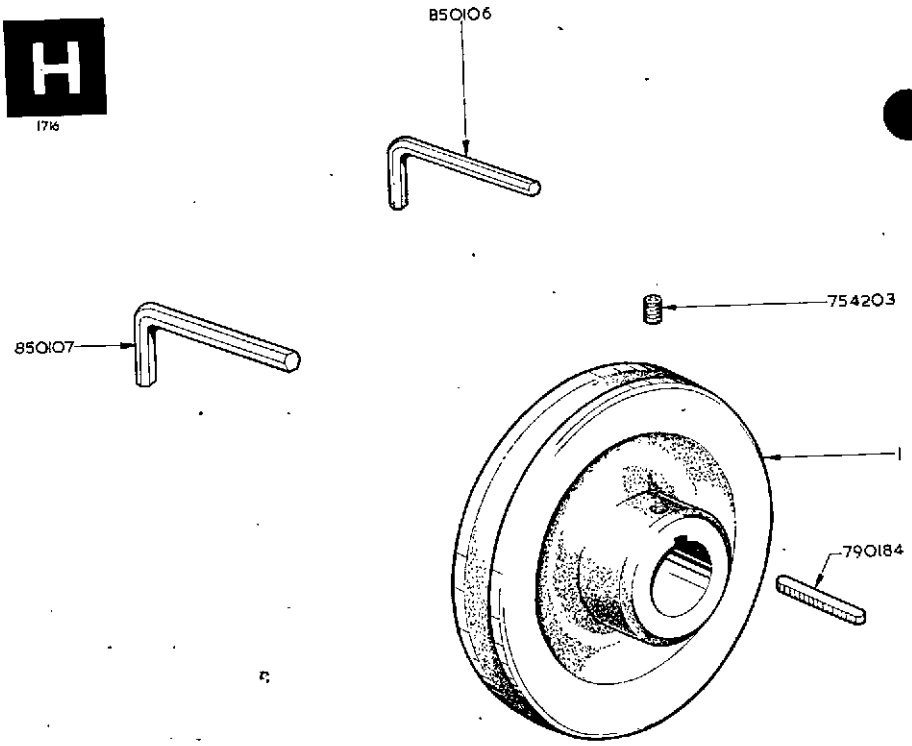

PLATE H

TOOLS AND PULLEY

Ref. No.	Description	ABI
AAHI	Pulley, 4½" diameter × 1 groove	1

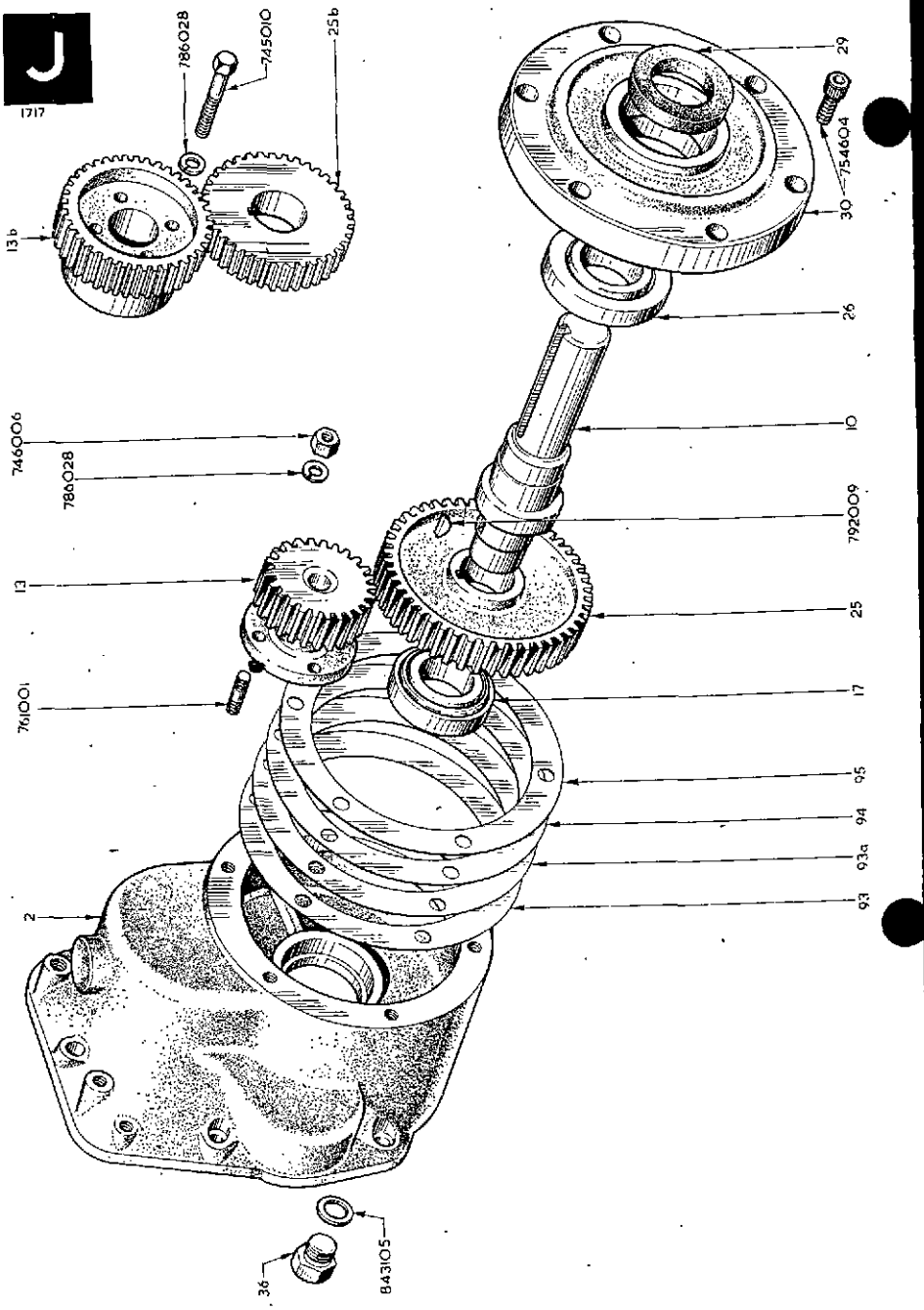
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PLATE J

REDUCTION GEAR

Ref. No.	Description	ABI
AAJ2	Housing—Reduction Gear	1
AAJ10	Shaft—Power Take-off	1
AAJ13	Gearwheel—Driving (4:1 Ratio)	1
*AAJ13a	Gearwheel—Driving (6:1 Ratio)	1
AAJ13b	Gearwheel—Driving (2:1 Ratio)	1
*AAJ13c	Gearwheel—Driving (1⅔:1 Ratio)	1
AAJ17	Bearing—Roller (Inner)	1
AAJ25	Gearwheel—Driven (4:1 Ratio)	1
*AAJ25a	Gearwheel—Driven (6:1 Ratio)	1
AAJ25b	Gearwheel—Driven (2:1 Ratio)	1
*AAJ25c	Gearwheel—Driven (1⅔:1 Ratio)	1
AAJ26	Bearing—Roller (Outer)	1
AAJ29	Oil Seal	1
AAJ30	Housing—Bearing	1
AAJ36	Plug—Drain	1
AAJ93	Shim (0·002")	As reqd.
AAJ93a	Shim (0·005")	As reqd.
AAJ94	Shim (0·007")	As reqd.
AAJ95	Shim (0·020")	As reqd.

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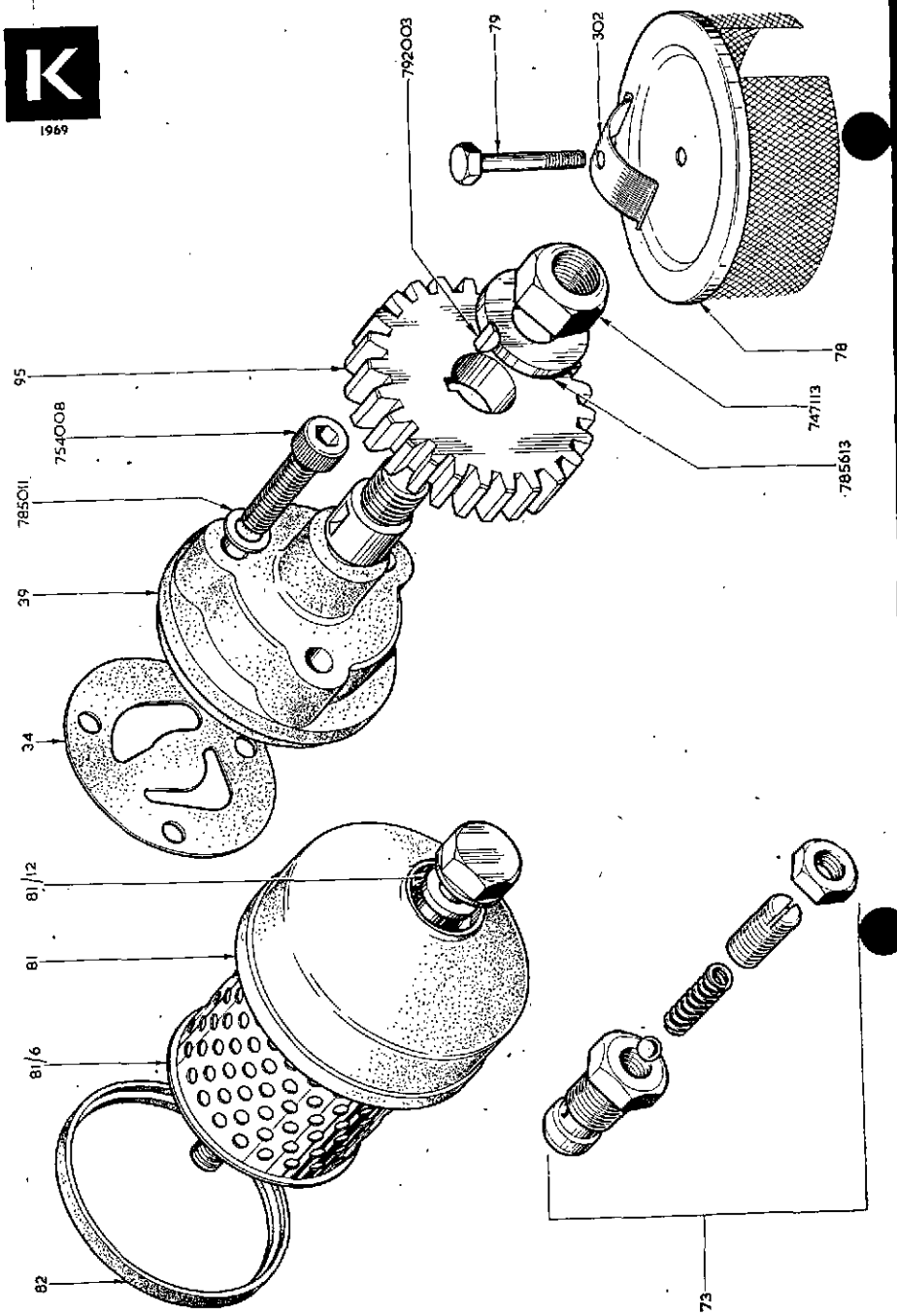
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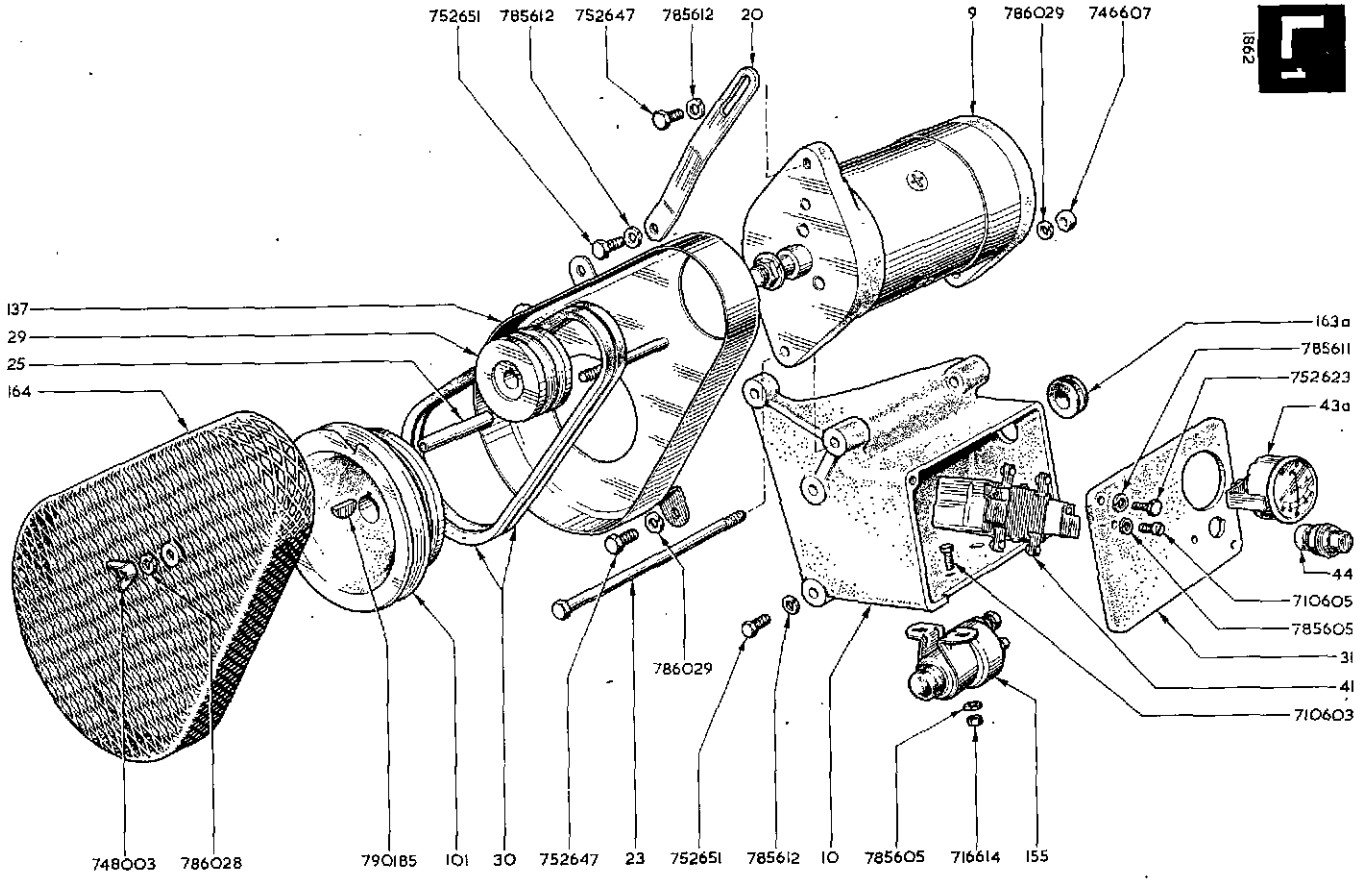
PLATE K

OIL PUMP, STRAINER AND OIL FILTER

Ref. No.	Description	ABI
AAK34	Joint—Oil Pump	1
AAK39	Pump—Lubricating Oil, complete with Joint	1
ABK73	Relief Valve Assembly	1
AAK78	Strainer—Oil Pump	1
AAK79	Bolt—Oil Pump Strainer	1
AAK81	Filter—Lubricating Oil, complete with Joint and Element	1
AAK81/6	Element—Filter	1
AAK81/12	Joint Washer—Filter (Supplied only in Sets of Joints) ...	1
AAK82	Joint—Filter	1
AAK95	Gearwheel—Oil Pump	1
AAK302	Clip—Oil Pump Strainer	1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29
25
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43a
44
710605
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710603
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748003
786028
790185
101
30
752647
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752651
785612
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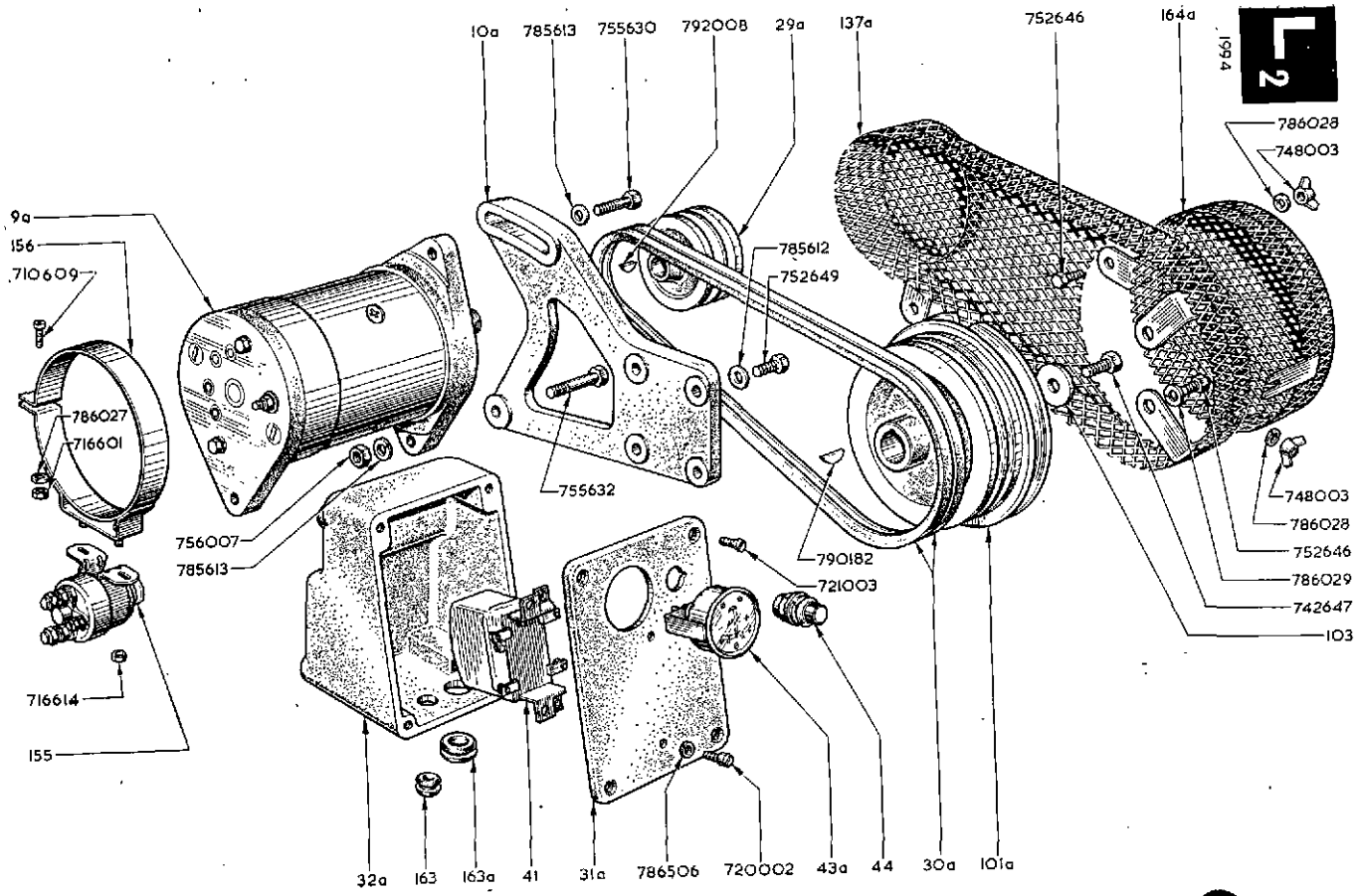
785605
716614
155

PLATE L
STARTING

Ref. No.	Description	ABI
AAL1a	Starting Handle Assembly	1
	Consisting of:	
	AAL2 Plunger—Starting Handle	1
	AAL3 Spring—Starting Handle Plunger	1
	AAL5 Starting Handle	1
	774125 Pin—Starting Handle Plunger	1
AAL1d	Starting Handle (4:1 Hand Starting)	1
AAL9	Dynastart (Flywheel end)	1
AAL9a	Dynastart (Gear end)	1
ACL10	Bracket—Dynastart (Flywheel end)	1
AAL10a	Bracket—Dynastart (Gear end)	1
AAL20	Strap—Dynastart Adjusting	1
AAL23	Bolt—Dynastart Pivot	1
AAL25	Spacer—Belt Guard	1
AAL29	Pulley—Dynastart (Flywheel end)	1
AAL29a	Pulley—Dynastart (Gear end)	1
AAL30	Belt—Dynastart (Flywheel end)	1
AAL30a	Belt—Dynastart (Gear end)	1
AAL31	Panel—Instrument (Dynastart—Flywheel end)	1
JL31a	Panel—Instrument (Dynastart—Gear end)	1
JL32a	Box—Instrument Panel (Dynastart—Gear end)	1
AAL41	Regulator	1
JL43a	Ammeter	1
VPL44	Switch—Starter	1
AAL50	Screw—Extension Shaft	4
AAL54	Shaft—Camshaft Extension (Raised Hand Starting) ...	1
AAL54d	Shaft—Crankshaft Extension (4:1 Hand Starting—Gear end)	1
AAL56	Chainwheel—Upper (Raised Hand Starting—Gear end) ...	1
AAL57	Washer—Starting Shaft	2
AAL59	Pin—Starting Shaft	1
AAL61	Chain—Raised Hand Starting (Gear end)	1
AAL68	Shaft—Retaining (Raised Hand Starting)	1
AAL76	Shaft—Driving (Raised Hand Starting)	1
AAL77	Spring—Driving Shaft	1
AAL83	Screw—Retaining Shaft	1
AAL88	Shaft—Starting (Raised Hand Starting)	1
AAL101	Pully—Crankshaft (Dynastart—Flywheel End)	1
AAL101a	Pulley—Crankshaft (Dynastart—Gear end)	1
AAL103	Plate—Pulley Retaining	1
AAL108	Oil Seal—Extension Shaft	1
AAL119	Housing—Chain (Raised Hand Starting—Gear end) (Rear)	1
AAL119a	Housing—Chain (Raised Hand Starting—Gear end) (Front)	1
AAL137	Guard—Belt (Inner) (Dynastart—Flywheel end)	1
AAL137a	Guard—Belt (Dynastart—Gear end)	1
AAL155	Solenoid—Dynastart	1
AAL156	Clip—Dynastart Solenoid	1
JL163	Grommet (small)	1
JL163a	Grommet (large)	1
AAL164	Guard—Belt (Outer) (Dynastart—Flywheel end)	1
AAL164a	Guard—Pulley (Dynastart—Gear end)	1
AAL181a	Chainwheel—Lower (Raised Hand Starting)	1
AAL192	Pin—Chainwheel	1
AAL223	Sleeve—Chain Housing	1
AAL233	Bolt—Pinion (4:1 Hand Starting—Flywheel end)	4
AAL245	Spacer—Torsion Spring (4:1 Hand Starting—Gear end)	1
AAL313	Bush—Shaft (Raised Hand Starting)	1
ACL411	Pulley—Rope Start (Flywheel end)	1
AAL411a	Pulley—Rope Start (Gear end)	1
AAL414	Rope Assembly—Starting	1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742647
103
716614
155
32a
163
163a
41
31a
786506
720002
43a
44
30a
101a

Ref. No.	Description	ABI
AAL434	Guard—Rope Start Pulley (Gear end)	1
ACL434a	Guard—Rope Start Pulley (Flywheel end)	1
AAL458	Dowel	2
AAL460	Pinion—4:1 Hand Starting (Flywheel end)	1
AAL460a	Pinion—4:1 Hand Starting (Gear end)	1
AAL461	Plate Assembly—4:1 Hand Starting (Flywheel end) ...	1
AAL461a	Plate Assembly—4:1 Hand Starting (Gear end)	1
AAL462	Screw—Locating (4:1 Hand Starting—Gear end)	2
AAL462	Screw—Locating (4:1 Hand Starting—Flywheel end) ...	3
AAL462a	Screw—Locating (4:1 Hand Starting—Gear end)	1
AAL463	Gearwheel (4:1 Hand Starting)	1
AAL464	Bearing (4:1 Hand Starting)	1
ACL465	Guard—4:1 Hand Starting (Flywheel end)	1
AAL465a	Guard—4:1 Hand Starting (Gear end)	1
ACL466	Mounting Plate Assembly—4:1 Hand Starting (Flywheel end)	1
AAL466a	Mounting Plate Assembly—4:1 Hand Starting (Gear end)	1
AAL467	Guard (Inner)—4:1 Hand Starting (Gear end)	1
AAL468	Fastener—Guard	3
AAL469	Screw—Guard Fastener	3
ABL473	Spacer—Rope Start Guard (Gear end)	2
AAL474	Plate—Pinion Retaining (4:1 Hand Starting)	1
AAL475	Spring—Return (4:1 Hand Starting—Gear end)	1
ACL476	Stop—Mounting Plate (4:1 Hand Starting—Flywheel end)	2

L3

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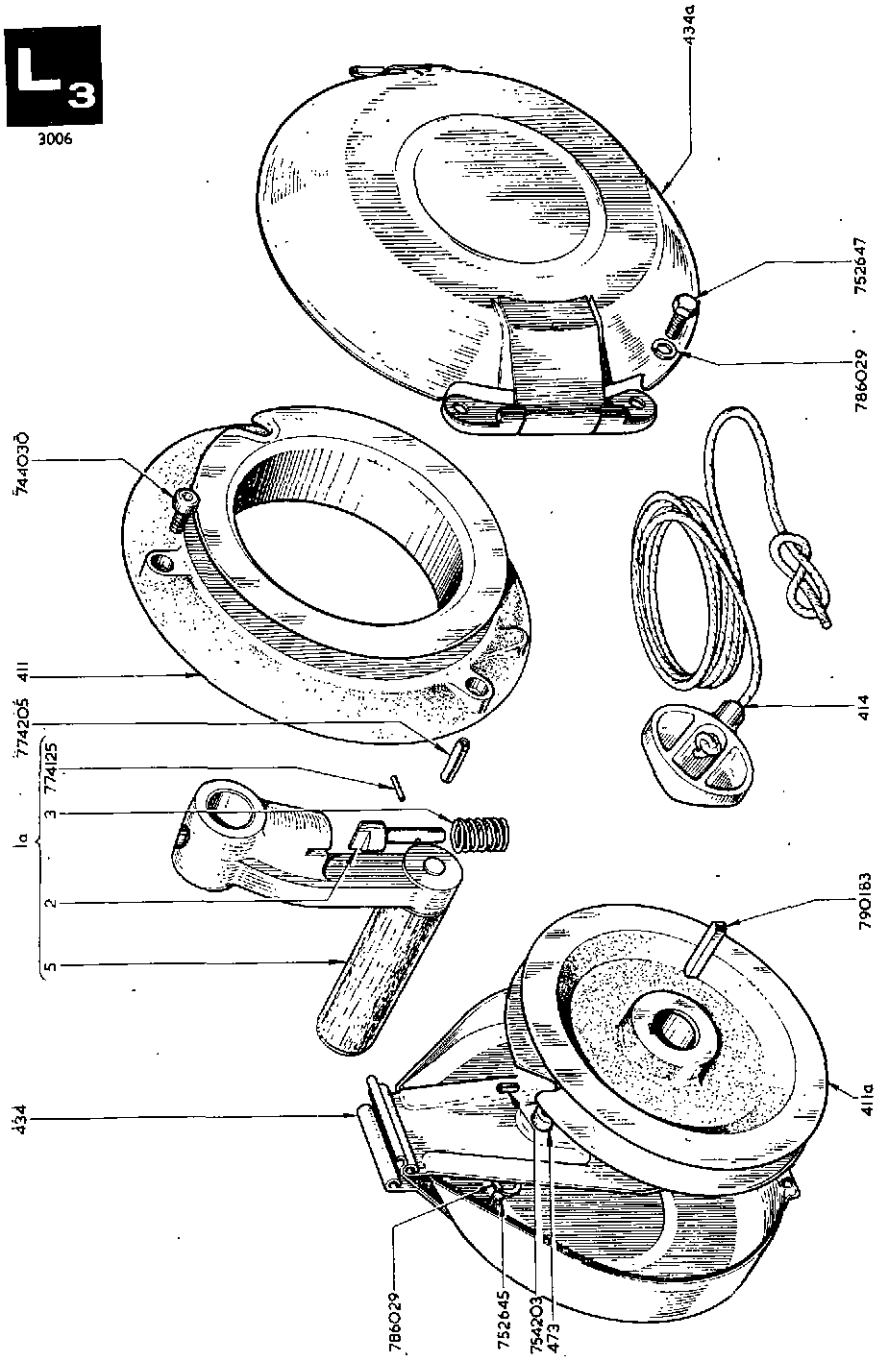
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411
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774125
1a
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2
5
414
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411a
434
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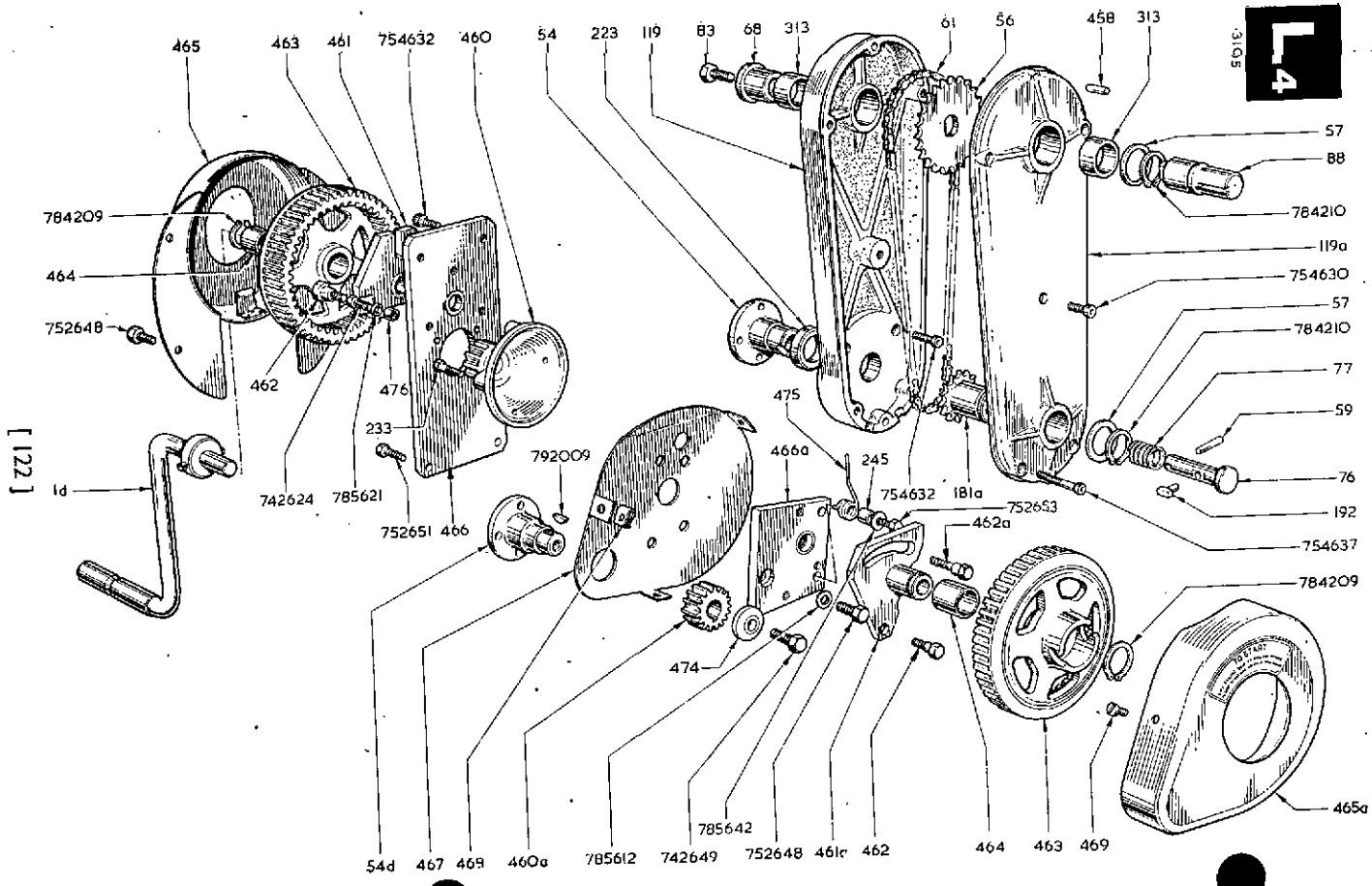
752645
754203
473

PLATE L
STARTING

Ref. No.	Description	ABI
AAL1a	Starting Handle Assembly	1
	Consisting of:	
	AAL2 Plunger—Starting Handle	1
	AAL3 Spring—Starting Handle Plunger	1
	AAL5 Starting Handle	1
	774125 Pin—Starting Handle Plunger	1
AAL1d	Starting Handle (4:1 Hand Starting)	1
AAL9	Dynastart (Flywheel end)	1
AAL9a	Dynastart (Gear end)	1
AAL10	Bracket—Dynastart (Flywheel end)	1
AAL10a	Bracket—Dynastart (Gear end)	1
AAL20	Strap—Dynastart Adjusting	1
AAL23	Bolt—Dynastart Pivot	1
AAL25	Spacer—Belt Guard	1
AAL29	Pulley—Dynastart (Flywheel end)	1
AAL29a	Pulley—Dynastart (Gear end)	1
AAL30	Belt—Dynastart (Flywheel end)	1
AAL30a	Belt—Dynastart (Gear end)	1
*AAL31	Panel—Instrument (Electric Starting—Flywheel end) ...	1
JL31a	Panel—Instrument (Dynastart—Gear end)	1
JL32a	Box—Instrument Panel (Dynastart—Gear end)	1
AAL41	Regulator	1
JL43a	Ammeter	1
VPL44	Switch—Starter	1
AAL50	Screw—Extension Shaft	4
AAL54	Shaft—Camshaft Extension (Raised Hand Starting) ...	1
AAL54d	Shaft—Crankshaft Extension (4:1 Hand Starting—Gear end)	1
AAL56	Chainwheel—Upper (Raised Hand Starting—Gear end) ...	1
AAL57	Washer—Starting Shaft	2
AAL59	Pin—Starting Shaft	1
AAL61	Chain—Raised Hand Starting (Gear end)	1
AAL68	Shaft—Retaining (Raised Hand Starting)	1
AAL76	Shaft—Driving (Raised Hand Starting)	1
AAL77	Spring—Driving Shaft	1
AAL83	Screw—Retaining Shaft	1
AAL88	Shaft—Starting (Raised Hand Starting)	1
AAL101	Pulley—Crankshaft (Dynastart—Flywheel end)	1
AAL101a	Pulley—Crankshaft (Dynastart—Gear end)	1
AAL103	Plate—Pulley Retaining	1
AAL108	Oil Seal—Extension Shaft	1
AAL119	Housing—Chain (Raised Hand Starting—Gear end) (Rear)	1
AAL119a	Housing—Chain (Raised Hand Starting—Gear end) (Front)	1
AAL137	Guard—Belt (Inner) (Dynastart—Flywheel end)	1
AAL137a	Guard—Belt (Dynastart—Gear end)	1
AAL155	Solenoid—Dynastart	1
AAL156	Clip—Dynastart Solenoid	1
JL163	Grommet (small)	1
JL163a	Grommet (large)	1
AAL164	Guard—Belt (Outer) (Dynastart—Flywheel end)	1
AAL164a	Guard—Pulley (Dynastart—Gear end)	1
AAL181a	Chainwheel—Lower (Raised Hand Starting)	1
AAL192	Pin—Chainwheel	1
AAL223	Sleeve—Chain Housing	1
AAL233	Bolt—Pinion (4:1 Hand Starting—Flywheel end)	4
AAL245	Spacer—Torsion Spring (4:1 Hand Starting—Gear end)	1
AAL313	Bush—Shaft (Raised Hand Starting)	1
AAL411	Pulley—Rope Start (Flywheel end)	1
AAL411a	Pulley—Rope Start (Gear end)	1
AAL414	Rope Assembly—Starting	1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792009
466a
475
245
754632
181a
752653
462a
474
54d
467
469
460a
785612
742649
752648
461a
462
785642
464
463
469
1d

Ref. No.	Description	ABI
AAL434	Guard—Rope Start Pulley (Gear end)	1
ACL434a	Guard—Rope Start Pulley (Flywheel end)	1
AAL458	Dowel	2
AAL460	Pinion—4:1 Hand Starting (Flywheel end)	1
AAL460a	Pinion—4:1 Hand Starting (Gear end)	1
AAL461	Plate Assembly—4:1 Hand Starting (Flywheel end) ...	1
AAL461a	Plate Assembly—4:1 Hand Starting (Gear end)	1
AAL462	Screw—Locating (4:1 Hand Starting—Gear end)	2
AAL462	Screw—Locating (4:1 Hand Starting—Flywheel end)	3
AAL462a	Screw—Locating (4:1 Hand Starting—Gear end)	1
AAL463	Gearwheel (4:1 Hand Starting)	1
AAL464	Bearing (4:1 Hand Starting)	1
ACL465	Guard—4:1 Hand Starting (Flywheel end)	1
AAL465a	Guard—4:1 Hand Starting (Gear end)	1
ACL466	Mounting Plate Assembly—4:1 Hand Starting (Flywheel end)	1
AAL466a	Mounting Plate Assembly—4:1 Hand Starting (Gear end)	1
AAL467	Guard (Inner)—4:1 Hand Starting (Gear end)	1
AAL468	Fastener—Guard	3
AAL469	Screw—Guard Fastener	3
ABL473	Spacer—Rope Start Guard (Gear end)	2
AAL474	Plate—Pinion Retaining (4:1 Hand Starting)	1
AAL475	Spring—Return (4:1 Hand Starting)—Gear end	1
ACL476	Stop—Mounting Plate (4:1 Hand Starting—Flywheel end)	2

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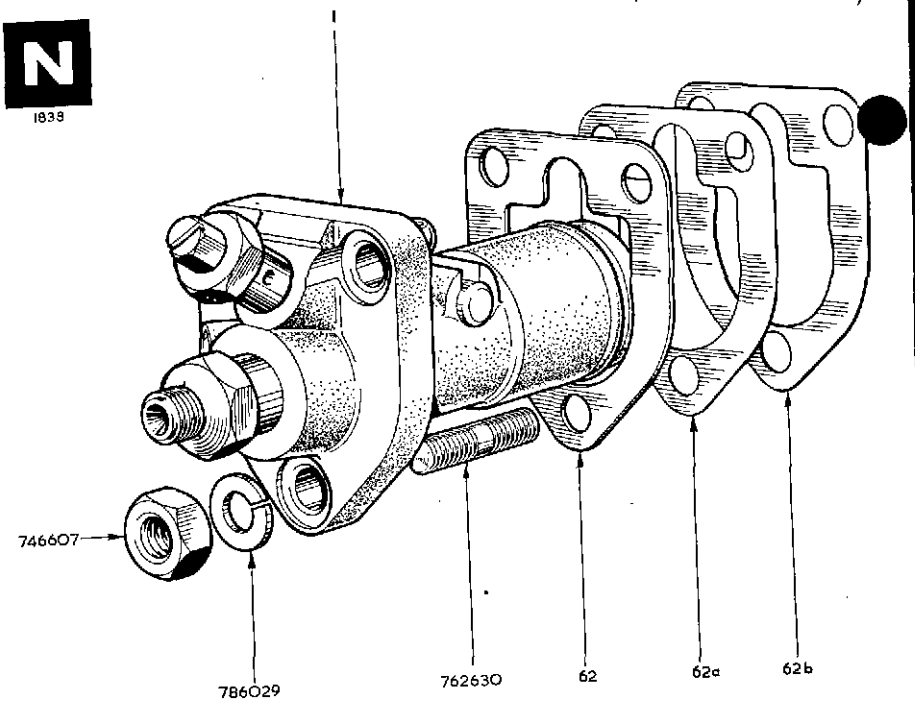
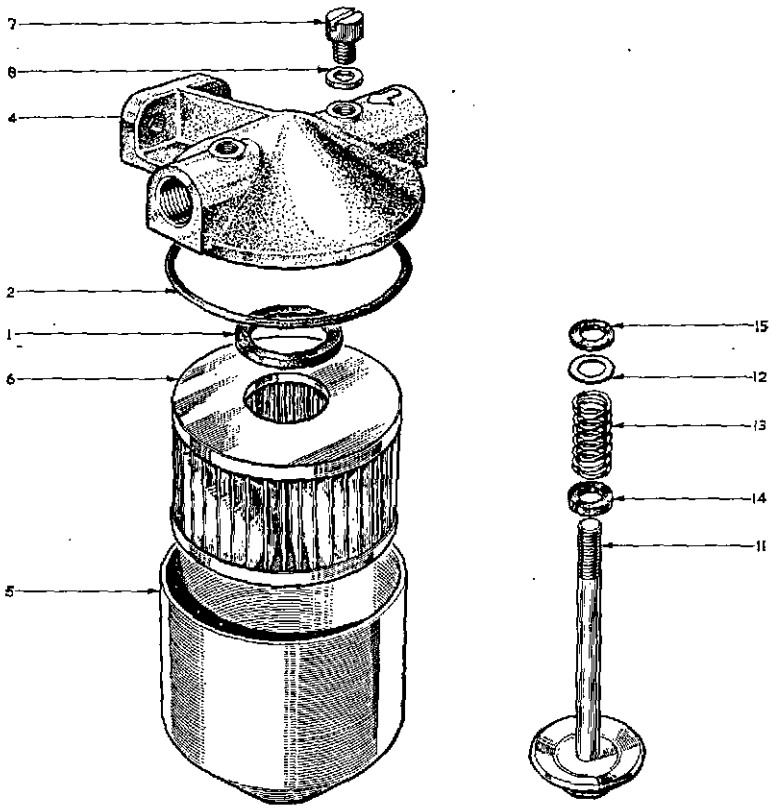


PLATE N

FUEL PUMP

Ref. No.	Description	ABI
AAN1	Pump—Fuel Injection (Fixed Speed up to 3000 rev/min) ...	1
***AAN1a**	Pump—Fuel Injection (Fixed Speed 3600 rev/min) ...	1
***AAN1b**	Pump—Fuel injection (Variable Speed)	1
AAN62	Shim—Fuel Pump (0·005″)	As reqd.
AAN62a	Shim—Fuel Pump (0·0025″)	As reqd.
AAN62b	Shim—Fuel Pump (0·025″)	As reqd.



FUEL FILTER ASE64

Ref. No.	Description
ASE64/1	Joint Washer—Element
ASE64/2	Seal—Bowl
ASE64/4	Head
ASE64/5	Bowl
ASE64/6	*Element*
ASE64/7	Screw—Bleed
ASE64/8	Washer—Bleed Screw
ASE64/11	Bolt—Centre
ASE64/12	*Washer—Centre Bolt*
ASE64/13	Spring—Centre Bolt
ASE64/14	Seal—Centre Bolt (Lower)
ASE64/15	Seal—Centre Bolt (Upper)

SETS OF JOINTS

Ref. No.	Description	ABI
ABZ2	Decarbonising Set of Joints	1
	Consisting of: (See Plates B and F)	
	AAB4 Joint—Rocker Box Cover	1
	ABB58 Gasket—Cylinder Head	1
	AAB61 Joint Washer—Fuel Injector	1
	AAB89 Joint—Push Rod Tube Base	1
	AAF50 Gasket—Exhaust Silencer	1
	AAF63 Joint—Air Inlet Manifold	1
ABZ1	Complete Set of Joints	1
	Consisting of:	
	ABZ2 Decarbonising Set of Joints	1
	AAZ3 Conversion Set of Joints	1
AAZ3	Conversion Set of Joints	1
	Consisting of (see Plates A, B, C, D, E, F and K):	
	AAA56 Joint—Gear Cover	1
	AAA139 Joint—Sump	1
	AAB264 Gasket—Breather Cover	1
	AAC7 Joint—Main Bearing Housing	1
	AAD256 Joint—Variable Speed Plate	1
	AAE346 Washer—Vent Screw	1
	AAE347 Joint Washer—Fuel Pipe	1
	843105 Joint Washer, $\frac{1}{2}$" (Copper)	1

AIR CLEANER, FUEL AND OIL FILTER ELEMENT PACKS

Ref. No.	Description	ABI
AAZ12	Element Pack—Air Cleaner	1
	Consisting of:	
	AAF499/6 Element—Air Cleaner	4
AAZ10	Element Pack—Fuel Filter	1
	Consisting of:	
	AAE24 Joint Washer—Element Plug	4
	AAE28 Element—Fuel Filter	4
AAZ11	Element Pack—Oil Filter	1
	Consisting of:	
	AAK81/6 Element—Oil Filter	8
	AAK81/12 Joint Washer	8

SPEEDER SPRING DETAILS

Ref. No.	Colour	Engine Speed (rev/min)
AAD125g	Aluminium/Yellow	1500
AAD125f	Aluminium/Orange	1800
AAD125e	Brown/Black	2100
AAD125d	Orange/Brown	2500
AAD125	Orange/Blue	3000
†**AAD125c**	Yellow/Brown	3600
†**AAD125a**	Aluminium/Blue	Variable Speed

†For 3600 rev/min fixed speed engines and variable speed engines Fuel Pump AAN1a or AAN1b (see Parts List Plate N) must be fitted.

Ref. No.	Description
710603	Screw—Cheese Head, 2BA × $\frac{1}{4}$″ (Plated)
710605	Screw—Cheese Head, 2BA × $\frac{3}{8}$″ (Plated)
710609	Screw—Cheese Head, 2BA × $\frac{3}{4}$″ (Plated)
716601	Nut, 2BA
716614	Locknut, 2BA
720002	Screw—Cheese Head, $\frac{1}{4}$″ BSF × $\frac{1}{2}$″
721003	Screw—Countersunk, $\frac{1}{4}$″ BSF × $\frac{5}{8}$″
726001	Nut, $\frac{1}{4}$″ BSF
742023	Screw—Hex Head, $\frac{1}{4}$″ UNF × $\frac{1}{2}$″
742047	Screw—Hex Head, $\frac{5}{16}$″ UNF × $\frac{3}{4}$″
742624	Screw—Hex Head, $\frac{1}{4}$″ UNF × $\frac{3}{8}$″ (Plated)
742647	Screw—Hex Head, $\frac{5}{16}$″ UNF × $\frac{3}{4}$″ (Plated)
742648	Screw—Hex Head, $\frac{5}{16}$″ UNF × $\frac{7}{8}$″ (Plated)
742777	Screw—Hex Head, $\frac{5}{16}$″ UNF × $\frac{3}{8}$″ (Plated)
744002	Capscrew—Socket Head, $\frac{1}{4}$″ UNF × $\frac{1}{2}$″
744003	Capscrew—Socket Head, $\frac{1}{4}$″ UNF × $\frac{5}{8}$″
744030	Capscrew—Socket Head, $\frac{5}{16}$″ UNF″ × $\frac{3}{4}$″
744201	Grubscrew—Socket Head, $\frac{1}{4}$″ UNF × $\frac{1}{4}$″
744238	Grubscrew—Socket Head, $\frac{7}{16}$″ UNF × $\frac{1}{2}$″
745010	Bolt—Hex Head, $\frac{1}{4}$″ UNF × $1\frac{3}{4}$″
745030	Bolt—Hex Head, $\frac{5}{16}$″ UNF × $1\frac{3}{8}$″
746006	Nut, $\frac{1}{4}$″ UNF
746007	Nut, $\frac{5}{16}$″ UNF
746016	Locknut, $\frac{1}{4}$″ UNF
746605	Nut, 10–32 UNF (Plated)
746607	Nut, $\frac{5}{16}$″ UNF (Plated)
746626	Nut, $\frac{5}{16}$″ UNF (Plated)
747017	Nut, $\frac{5}{16}$″ UNF (Self-locking)
747112	Nut, $\frac{5}{16}$″ UNF (Self-locking)
747113	Nut, $\frac{3}{8}$″ UNF (Self-locking)
747115	Nut, $\frac{1}{2}$″ UNF (Self-locking)
748003	Wing Nut, $\frac{1}{4}$″ UNF
752024	Screw—Hex Head, $\frac{1}{4}$″ UNC × $\frac{5}{8}$″
752623	Screw—Hex Head, $\frac{1}{4}$″ UNC × $\frac{1}{2}$″ (Plated)
752645	Screw—Hex Head, $\frac{5}{16}$″ UNC × $\frac{1}{2}$″ (Plated)
752646	Screw—Hex Head, $\frac{5}{16}$″ UNC × $\frac{5}{8}$″ (Plated)
752647	Screw—Hex Head, $\frac{5}{16}$″ UNC × $\frac{3}{4}$″ (Plated)
752648	Screw—Hex Head, $\frac{5}{16}$″ UNC × $\frac{7}{8}$″ (Plated)
752649	Screw—Hex Head, $\frac{5}{16}$″ UNC × 1″ (Plated)
752651	Screw—Hex Head, $\frac{5}{16}$″ UNC × $1\frac{1}{4}$″ (Plated)
754003	Capscrew—Socket Head, $\frac{1}{4}$″ UNC × $\frac{5}{8}$″
754004	Capscrew—Socket Head, $\frac{1}{4}$″ UNC × $\frac{3}{4}$″
754005	Capscrew—Socket Head, $\frac{1}{4}$″ UNC × $\frac{7}{8}$″
754008	Capscrew—Socket Head, $\frac{1}{4}$″ UNC × $1\frac{1}{2}$″
754032	Capscrew—Socket Head, $\frac{5}{16}$″ UNC × 1″
754203	Grubscrew—Socket Head, $\frac{1}{4}$″ UNC × $\frac{3}{8}$″
754604	Capscrew—Socket Head, $\frac{1}{4}$″ UNC × $\frac{3}{4}$″ (Plated)
754630	Capscrew—Socket Head, $\frac{5}{16}$″ UNC × $\frac{3}{4}$″ (Plated)
754632	Capscrew—Socket Head, $\frac{5}{16}$″ UNC × 1″ (Plated)
754637	Capscrew—Socket Head, $\frac{5}{16}$″ UNC × $2\frac{1}{4}$″ (Plated)
755630	Bolt—Hex Head, $\frac{5}{16}$″ UNC × $1\frac{3}{8}$″ (Plated)
755632	Bolt—Hex Head, $\frac{5}{16}$″ UNC × $1\frac{3}{4}$″ (Plated)
756007	Nut, $\frac{5}{16}$″ UNC
761001	Stud, $\frac{1}{4}$″ UNF × 1″
762037	Stud, $\frac{5}{16}$″ UNF/UNC × $2\frac{1}{8}$″
762629	Stud, $\frac{5}{16}$″ UNF/UNC × $1\frac{1}{8}$″ (Plated)
762630	Stud, $\frac{5}{16}$″ UNF/UNC × $1\frac{1}{4}$″ (Plated)
762645	Stud, $\frac{5}{16}$″ UNF/UNC × $3\frac{1}{8}$″ (Plated)

Ref. No.	Description
763832	Screw—Hammer Drive, $\frac{3}{8}$"
773148	Split Pin, $\frac{3}{64}$" × $\frac{3}{8}$"
773149	Split Pin, $\frac{1}{16}$" × $\frac{7}{16}$"
774118	Dowel—Spring Tension, $\frac{1}{8}$" × $\frac{1}{4}$"
774122	Dowel—Spring Tension, $\frac{1}{8}$" × $\frac{1}{2}$"
774125	Dowel—Spring Tension, $\frac{1}{8}$" × $\frac{3}{4}$"
774143	Dowel—Spring Tension, $\frac{5}{32}$" × $\frac{7}{8}$"
774160	Dowel—Spring Tension, $\frac{3}{16}$" × $\frac{7}{8}$"
774204	Dowel—Spring Tension, $\frac{1}{8}$" × $1\frac{1}{16}$"
774205	Dowel—Spring Tension, $\frac{3}{16}$" × $1\frac{1}{16}$"
784008	Circlip, $\frac{7}{8}$" (Internal)
784009	Circlip, 1" (Internal)
784201	Circlip, $\frac{3}{16}$" (External)
784203	Circlip, $\frac{3}{8}$" (External)
784205	Circlip, $\frac{9}{16}$" (External)
784209	Circlip, 1" (External)
784210	Circlip, $1\frac{1}{8}$" (External)
785011	Washer, $\frac{1}{4}$"
785012	Washer, $\frac{5}{16}$"
785045	Washer, $\frac{1}{2}$"
785605	Washer, 2BA (Plated)
785611	Washer, $\frac{1}{4}$" (Plated)
785612	Washer, $\frac{5}{16}$" (Plated)
785613	Washer, $\frac{3}{8}$" (Plated)
786027	Spring Washer, 2BA
786028	Spring Washer, $\frac{1}{4}$"
786029	Spring Washer, $\frac{5}{16}$"
786506	Shakeproof Washer, $\frac{1}{4}$"
786703	Lockwasher, 2BA
786710	Lockwasher, $\frac{5}{8}$"
744004	Capscrew—Socket Head, $\frac{1}{4}$" UNF × $\frac{3}{4}$"
744030	Capscrew—Socket Head, $\frac{5}{16}$" UNF × $\frac{3}{4}$"
790182	Key, $\frac{1}{4}$" × $\frac{1}{4}$" × $1\frac{1}{4}$"
790183	Key, $\frac{1}{4}$" × $\frac{1}{4}$" × $1\frac{3}{8}$"
790184	Key, $\frac{1}{4}$" × $\frac{1}{4}$" × $1\frac{1}{2}$"
790185	Key, $\frac{1}{4}$" × $\frac{1}{4}$" × $1\frac{3}{4}$""
790235	Key, $\frac{1}{2}$" × $\frac{1}{4}$" × $1\frac{3}{16}$"
792001	Key (Woodruff), $\frac{1}{16}$" × $\frac{3}{8}$"
792003	Key (Woodruff), $\frac{1}{8}$" × $\frac{3}{8}$"
792007	Key (Woodruff), $\frac{3}{32}$" × $\frac{5}{8}$"
792008	Key (Woodruff), $\frac{1}{8}$" × $\frac{3}{8}$"
792009	Key (Woodruff), $\frac{5}{32}$" × $\frac{5}{8}$"
792011	Key (Woodruff), $\frac{5}{32}$" × $\frac{3}{4}$"
792018	Key (Woodruff), $\frac{5}{16}$" × 1"
823001	Plug, $\frac{1}{8}$" BSP (Recess Head) (Taper)
823031	Plug, $\frac{5}{16}$" UNF (Recess Head) (Taper)
831025	Banjo Bolt, $\frac{3}{16}$" BSP
831026	Banjo Bolt, $\frac{1}{4}$" BSP
833027	Union, $\frac{1}{4}$" BSP
843005	Joint Washer, $\frac{1}{2}$" (Fibre)
843104	Joint Washer, $\frac{3}{8}$" (Copper)
843105	Joint Washer, $\frac{1}{2}$" (Copper)
844105	Oil Seal, $\frac{1}{4}$"
844106	Oil Seal, $\frac{5}{16}$"
850106	Wrench—Socket, $\frac{3}{32}$" A/F
850107	Wrench—Socket, $\frac{7}{32}$" A/F

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