COVENTRY VICTOR

AD3 (MkIII) and WD3 (MkIII)
Servicing instructions and spare parts list

COVENTRY VICTOR

P.O.Box 328,
WATFORD,
Herts. WD2 5PZ.
tel.& fax 0923 227456.

SERVICING INSTRUCTIONS

AND

SPARE PARTS LIST.

TYPES: AD3 (Mk.III) (Air cooled)
WD3 (Mk.III) (Water cooled)

And

NOTES FOR OWNERS OF MODELS
AD1 and WD1
AD2 and WD2
AD3 Mk.1 and Mk.II
WD3 Mk.1 and Mk.II

Much useful information will be found on pages 39-40 and 45 onwards for owners of these engines.

Please read this Instruction Book carefully before starting new engine. In case of any difficulty arising, contact these works direct.

WHEN MAKING ANY ENQUIRIES OR ORDERING SPARE PARTS

ALWAYS QUOTE YOUR ENGINE NUMBER AND TYPE.

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ECHNICAL DATA.

:OMPONENT.	AD3/III. WD3/III.
:ylinder Bore.	3.543 in (90mm)
Cylinder Stroke.	3.937 in (100mm)
Capacity.	636.17 cc. (38.8 cu.in.)
Compression Ratio.	19.5:1
Piston Speed per 1000 r.p.m.	656 ft./min.
Cycle.	Four Stroke.
Combustion System.	Pre-combustion chamber with patented cold starting device. Mk.1.,Mk.II and Mk.III priming cup.
Fuel Injection Pump.	BRYCE. FAOAB 065 C290.
Fuel Injection Nozzle.	BDN - OSD 21.
Fuel Injection Nozzle-Holder.	NL NSD OA 050 D 0411.
Injection Pressure.	125 A.T.S.
Lubrication.	Pressure feed to Main and Big End bearings from gear type oil pump. Oil filter in sump.
Oil Pressure.	50/60 lbs. sq.in.
Oil Capacity.	6 pints (3.4 litres; 7.2. U.S. pints).
Tappet Clearances.	Inlet .003" Exhaust .004" ENGINE COLD
Valve Timing.	Inlet opens 3° to 4° before Top Dead Centre.
Pump "Spill" Timing.	24° Before Top Dead Centre.
Crankshaft.	Main and Big End Journals 2.000" std.- .0005". 3/32" radius.
Crankshaft End Float.	.008" - .010".
MAIN BEARINGS.	BEARINGS ARE PRESSED INTO HEATED CRANKCASE AND REAR BEARING HOUSING. WHEN COLD THE TWO COMPONENTS ARE ASSEMBLED AND BEARINGS ARE BROACHED IN LINE. Size Std.2.0" + .0015"/.002"
CAMSHAFT BEARINGS.	PRESSED INTO HEATED CRANKCASE AND LINE-REAMED WHEN COLD. Size 1.5625"
TAPPET GUIDES.	PRESSED INTO HEATED CRANKCASE. BROACHED OR REAMED WHEN COLD. AD.165. (PUMP) Size .625"+.0005" AD.238. (VALVE)Size .625"-.0005"

CYLINDER LINERS. SEE NOTES FOR OWNERS OF EARLY ENGINES.

TORQUE LOADINGS.

CYLINDER HEAD NUTS. WD = 65 lbs/ft.
AD = 55 lbs/ft.

CYLINDER BASE NUTS. 55/60 lbs/ft.

BIG END NUTS. (Clevelok) 35 lbs/ft.
or castelated with split pin.

ELECTRICAL EQUIPMENT (Where fitted).

12 volt Starter Motor.	- CA.45D. or F.12 - 35M.
Charging Dynamo.	- D.45/DN/58/M or GL.4512/4M.
Control Box.	- 75B/19/M.
Ammeter.	- A.4138A.
Push Button.	- SS.5. Despatch No. 31071.

2 ST Relay Keyswitch and Solenoid circuit.

COVENTRY VICTOR.
COLD STARTING, HIGH SPEED, SINGLE CYLINDER DIESEL ENGINES.

MODELS: AD3 Mk.III (Air cooled)
WD3 Mk.III (Water cooled)

CARE AND MAINTENANCE INSTRUCTIONS.

SECTION 1.

1. The Victor Diesel Engines are of the vertical, single-cylinder type, manufactured in air-cooled and water-cooled forms.

ENGINE DATA.

MODEL.	BHP @1500 RPM. CONTINUOUS DUTY.	BORE.	STROKE.	COOLING.
AD3 Mk.III	6.0.	90mm (3.543 in.)	100 mm (3.937 in.)	Air.
WD3 Mk.III	7.5.	90mm (3.543 in.)	100 mm (3.937 in.)	Water.

The engines operate on the four-stroke principle and, in the case of the water-cooled models, are efficiently water-jacketed. Cooling is by tank or radiator for industrial units. For marine engines a built-in impeller type water circulating pump is incorporated in the cooling system.

Air-cooled engine cooling is by means of a fan type flywheel, housed within a cast alloy air duct cowling.

All working parts are totally enclosed and easily accessible.

The most important considerations to ensure the maximum efficiency and long life of the engine are :-

1) Careful installation (See SECTION 2)
2) Efficient cooling arrangement (See SECTION 3)
3) The use of the Makers' recommended oil (See SECTION4/1)
4) Correct operation (See SECTION 5)
5) Regular maintenance routine (See SECTIONS 6 and 7)

INSTALLATIONS.

SECTION 2.

2. LAYOUT: (INDUSTRIAL ENGINES).

It is essential the bed to which the engine is to be fitted is solid and a perfectly flat surface. For stationary plant the foundation should be of solid concrete and of sufficient height from the ground, to give the easiest position for cranking by hand. The installation is simplified if the engine is mounted on accurately faced lengths of steel channel, bolted firmly to the bed. If the centre of the starting handle shaft is raised to about 28 in (71 cm) from the ground the engine can easily be turned at a fast speed by the average person.

LAYOUT: (MARINE ENGINES).

The engine with gearbox must be secured firmly to accurate bearers extended fore and aft of the unit to enable weight and stress to be equally distributed. The engine should be secured to the bed, or bearers,

by 5/8 in (16mm) diameter holding-down bolts with nuts. Allowance should be made when laying out for easy access to the starting handle, oil level dipstick, top inspection cover, oil filter and oil drain plug. Air-cooled marine installations where the engine is enclosed must have the hot air ducted to atmosphere to prevent recirculation and overheating. It is very important that all couplings and shaft lines be perfectly true, and after the boat has been launched alignment finally checked.

In cases where engines are provided with electric starting equipment, the batteries should be placed in a separate ventilated space and suitably protected.

ANGLE OF INSTALLATION.

The engine can be installed at angles up to 12^{o} for marine and if greater angles are necessary special arrangement can be made during original manufacture.

2/1. EXHAUST PIPE.

The exhaust piping must be connected to the exhaust port by means of a flange, flange washer and two nuts. The pipes should be free of sharp bends and the extreme outlet should project through to the outside of the building in the case of stationary installations. In the case of marine installations, great care must be taken to prevent ingress of sea water via exhaust pipe. In this connection a 'Swan' neck exhaust pipe is essential.

2/2. SILENCER.

This should be of a type which eliminates back pressure. Our straight through type is recommended. Heavy baffling should be avoided as it is not necessary and only prejudices the performance of the engine. A water-cooled silencer is recommended for marine engines, or a C.V. waste water ejector may be supplied.

2/3. GENERAL.

Diesel fuel oil and lubricating oil, whether stored in bulk or in small quantities, should always be kept in a steel container with a sealed lid to prevent the ingress of dirt or other foreign matter. It is also essential that engines and engine rooms be kept clean. This is particularly important in the case of air-cooled engines, as if engines of this type are to operate at normal working temperatures air must be allowed to flow freely round the cooling fins on the cylinder barrel and head. For this reason the cooling fins on air-cooled engines should be properly cleaned at regular intervals.

SECTION 3.

ENGINE COOLING ARRANGEMENTS.

3. COOLING TANKS.

For Stationary engines we recommend static water tanks of approximately 50 gallons (227 litres: 60 U.S. gallons) capacity, the tank dimensions being 24 in (61 cm) diam x 38 in (96 cm) deep, approximately. For tropical climates we recommend 70 gallons (318 litres:84 U.S.gallons) capacity, the diameter being 24 in (61 cm) and the depth

50 in (127 cm) approximately. In cases where cooling tanks are used, the tanks should be located not more than 4 ft (1.2m) from the engine, or, in the case of outside installation, at a maximum distance of 8 ft (2.4m). Both supply and return pipes should slope downwards towards the engine. Minimum inclination being 8 to 10 degrees.A stop cock fitted to the supply pipe will obviate draining the tank when servicing the engine.

In cases where tanks are required at a greater distance for some special reason, pump assisted cooling should be used and you are invited to consult the works on any problem arising in this connection. For all forms of water cooling, soft water is recommended to prevent choking in the water jacketing.

3/1. SEA WATER COOLING.

Where sea water is used for cooling purposes the "Sea-Vee" water circulating gear pump was originally fitted. This has now been replaced by the "Jabsco" vane type pump (Section 3/7). It is necessary to fit an effecient filter against sand, mud and weeds entering the water circulating system. A heat exchanger system may be used for closed circuit cooling.

3/2. THE "SEA-VEE" WATER CIRCULATING PUMP

This is of the gear type and beyond an occasional quarter turn of the knurled screw 'H' adjusting the packing gland, the pump requires very little attention. On no account use tallo packing as this is unsuitable for marine engines. Before starting the engine see the greaser cap 'B' is filled with best quality water pump grease. Screw down slowly to fill the pump with grease, then screw the greaser cap back and refill with grease, up to approximately half way. See that all cover screws and joints are tight to avoid leakages.

A - GLAND PACKING.

B - GREASER CAP.

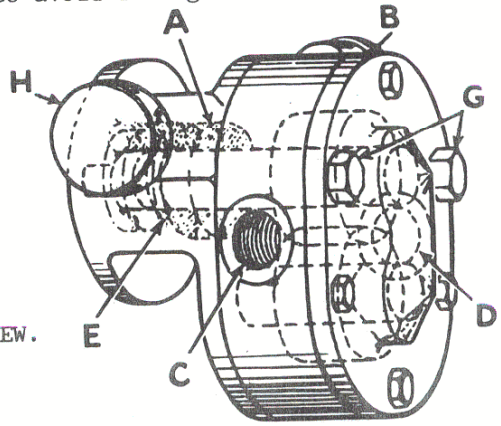
C - INLET.

D - OUTLET.

E - DEFLECTOR DISC.

G - SECURING SCREWS.

H - GLAND PACKING SCREW.



THE "SEA-VEE" GEAR TYPE WATER CIRCULATING PUMP
Fig.1.

3/3. RADIATOR COOLING.

For portable units a radiator and cooling fan can be fitted. The radiator should be of the standard size recommended by us, with special sizes for tropical conditions.

NOTE: The MAXIMUM WATER TEMPERATURES (discharge from outlet) should not exceed 180°F. (82.2° C).

3/4. WATER CIRCULATION.

The water intake pipe must be connected to the bottom water port. Water entering the intake flows through the water jacketing around the cylinder rising to the cylinder head. The outlet pipe must rise from the cylinder head to a point above the engine.

3/5. DRAINING THE WATER SYSTEM.

Disconnect the bottom water pipe on cylinder, water will then drain away, or a drain tap can be fitted in the pipe line at the lowest point.

3/6. AIR COOLING.

It is important that an air-cooled engine is well ventilated even when mounted in portable machinery and, in particular, there should be no obstruction to the flow of cooling air to or from the flywheel blower.

3/7. 'JABSCO' WATER CIRCULATING PUMP.

Water-cooled engines from Crankcase No. 8175 are fitted with the 'Jabsco' water pump.

This is of the vane type consisting of a Neoprene impeller rotating on a stainless steel shaft on a bronze bearing. The pump itself is water lubricated and requires no regular attention.

Before starting the engine check that cover retaining screws and all pipe unions are tight to prevent any leakage of water.

It is emphasised that no sand, mud or weeds should be allowed to pass into the pump. It is advisable to fit a fine gauze filter guard to the intake piping, especially in the case of craft working in sandy, muddy or weed infested waters.

To drain the pump in frosty weather, slacken off the front cover. When storing the engine, or otherwise taking it out of service for a lengthy period, the front cover should be removed and the impeller taken out and placed in safety until required again.

NOTE: Engines fitted with 'Jabsco' pumps must not be started and run without water, even for short periods, as damage is liable to occur to the pump impeller.

3/8. COLD WEATHER PRECAUTIONS (WATER COOLING).

To avoid the possibility of the cooling system freezing in cold weather, or when the engine is operating in cold climatic conditions, it is recommended an anti-freeze solution of reputable manufacture is used. We recommend an anti-freeze based on inhibited glycol which conforms to both BS.3151 and BS.3152 British Standards.

Anti-freeze using alcohol as a base is not suitable, as it is subject to loss by evaporation.

BS.3151 or BS.3152 Anti-freeze recommendations.

Solution Strength.	Against Frost Damage.
25%	- 15° F (- 26°C.)
30%	- 28° F (- 33°C.)
40%	- 42° F (- 41°C.)
50%	- 53° F (- 47°C.)

SECTION 4.

4/1. LUBRICATING OIL RECOMMENDATIONS.

We recommend oils of the type listed :-

TEMPERATURE	B.P.	CASTROL.	ESSO.	SHELL.
0° - 32° F.	Vanellus M.20.	Deusol RX.20.	Tromar HD.20.	Rotella SX20.
33° - 90° F.	Vanellus M.30.	Deusol RX.30.	Tromar HD.30.	Rotella SX30.
Above 90° F.	Vanellus M.40.	Deusol RX.40.	Tromar HD.40.	Rotella SX40.

These are detergent oils suitable for use with fuel oils having a sulphur content of not more than 1.3%. Inferior or reclaimed oils must not be used.

FLUSHING INSTRUCTIONS - CRANKCASE AND SUMP.

The sump must be drained and re-filled with a proper flushing oil, run under light load conditions for approximately 15 minutes, then drained off. It may be necessary to repeat this operation in the case of an engine that has run for a considerable time on straight mineral oil. It is important the inspection door of the crankcase be removed to ascertain that no sludge remains within the crankcase or any moving parts.

When the sump has been refilled, in accordance with the fore-going instructions, turn the engine over a number of times to make sure that the fresh oil has reached the bearing surfaces.

NOTE: Under no circumstances must paraffin oil be used as flushing oil.

GEARBOX LUBRICATION.

Use the same oil in Marine forward and reverse, chain reduction gears and clutch boxes as that recommended for our engines. For gear driven reduction gears with the 'Perfecta' No. 2. epicyclic gearboxes, use gear oil S.A.E. 80/90.

OIL CIRCULATION. (See Section 6/2).

4/2. FUEL OIL.

Do not, on any account, use low grade fuel oil as this, due to high viscosity and extraneous content matter may prove a very expensive item causing excessive wear on the moving parts and resulting in poor running of the engine.

Use only diesel fuel oil at all times, possessing approximately the following characteristics :-

SPECIFIC GRAVITY AT 60°F.	0.88 MAXIMUM
FLASH POINT (CLOSED)	Over 150°F.
VISCOSITY REDWOOD NO.1 @ 100°F.	45 SECS. MAXIMUM,
POUR TEST.	NOT EXCEEDING 20°F.

SECTION 5.

5/1. STARTING A NEW ENGINE.

Put six pints of the recommended lubricating oil into the crankcase sump via the combined oil filler and dipstick orifice. This will bring the oil level up to the 'HIGH' mark on the dipstick. See there is a good supply of fuel in the fuel tank and turn on the fuel. Should the engine have been stored, remove rocker cover, lubricate rocker assembly - replace cover and crank engine until oil pressure is registered.

1. Set the control cam, situated on the front of the engine in 'START' position. In the case of engines fitted with variable speed governors, move control lever to fully open position.

2. Prime the cylinder as follows :-

   a) Fill the priming cup of patent cold starting injector on cylinder head with lubricating oil up to the level hole on the priming cup.

   b) Open the needle valve two turns and press down the plunger, thus forcing the oil past the valve into the cylinder.

   c) Close the needle valve TIGHTLY.

   d) Mk.III engines fill priming cup on air filter pipe with lubricating oil.

3. Press the decompressor knob down and engage the starting handle. Turn the engine over rapidly and, when adequate speed has been attained and the 'click' of the injector can be clearly heard, release the decompressor knob and turn quickly over full compression to start.

   NOTE: The faster the engine is turned before releasing the decompressor, the easier the engine will start.

4. In the case of engines fitted with constant speed governors, turn the control cam to 'RUN' position.

5. Allow the engine to warm up slowly before applying full load.

6. The oil pressure gauge fitted should show a steady reading of 50/60 lbs PRESSURE when the engine is running on normal load. THE ENGINE MUST BE STOPPED AT ONCE IF OIL PRESSURE FALLS BELOW 30 LBS and the cause investigated (SECTION 5/2).

5/2. STARTING THE ENGINE FROM COLD (ENGINE FITTED WITH CONSTANT SPEED GOVERNOR).

Follow the same procedure as shown in SECTION 5/1 above, paragraph 1 to 5 and when the engine has warmed up, check the oil pressure gauge which should show a steady 50/60 lbs pressure with the engine running on normal load. Should the pressure fall below 30 lbs stop the engine and check the oil level by the dipstick, wipe it clean and take a further check.

It may only be necessary to top up with new oil but, should the low pressure persist, drain off the oil and remove the small flange on the crankcase sump, marked 'OIL FILTER', wash out the filter gauze therein with petrol or fuel oil and replace carefully and refill the sump with new oil when the pressure should then be normal. Should this not be so, it will be necessary to remove the timing cover and check the oil relief valve. This is screwed in to the oil pump body. If dirt has entered the valve it is advisable to take the oil pressure control screw out and wash the valve. Afterwards adjust to exactly the same position as before - this is very important. Check the oil pressure gauge frequently whilst the engine is running to make sure the correct pressure is being registered. Also check the exhaust system is free throughout its length. (Clean out all pipes regularly).

STARTING FROM COLD (ENGINE FITTED WITH VARIABLE SPEED GOVERNOR.)

1. Set the speed control at fully open and trip the load stop which is situated on the governor arm. Then follow the instructions as given in Section 5/1, paragraph 2 to 5.

STARTING THE ENGINE WHEN WARM.

1. Carry out operations described in Section 5/2 with the exception priming is not necessary. If the engine is hot the control cam, or lever, may be put into "RUNNING" position for starting.

RUNNING.

1. Check the control cam, or lever, and governor action. This should be done at fast idling speed in the case of the variable speed governor.
2. Oil pressure should register approximately 50/60 lbs per sq.in. when the engine reaches working temperature.
3. See that cooling is maintained. When running on full load the temperature of the water on leaving the cylinder water jacketing should NOT EXCEED 180°F, or 82.0°C. Correct running temperature ensures minimum wear with highest efficiency. If running too hot, or too cold, adjustment must be made to the capacity of the cooling system where a tank or radiator is used and the radiator cooling fan should also be adjusted to ensure correct temperature control.
   a) Check the exhaust system is free and clear.
   b) Be sure the governor is functioning correctly.
   c) Do not let the engine idle longer than is necessary on a very light load.
   d) See that water connections are in order on water-cooled models and the circulation system is functioning freely.

5/3. STOPPING THE ENGINE FITTED WITH CONSTANT SPEED GOVERNOR.

Decrease load on engine and allow to run 'LIGHT' for a few minutes at its normal governed speed. This is particularly important in the case of air-cooled engines as, when stopping, induced cooling ceases and for a short time engine temperature increases. If stopped suddenly under maximum output conditions, this increase can be quite high. It is, therefore, wise

in the interest of normal life, to allow engine to run as previously stated at normal operated speed for a few minutes before shutting down, which will prevent undue temperature rise. Slow down to idling speed, remove cold start primer plunger and open the injector needle valve and 'blow' through to clear of carbon as the engine slows down. Move the control cam to 'STOP' position. Leave the fuel supply 'ON' unless the engine is to be stopped for a long period. Should air-lock occur the fuel system should be bled (Section 7/2.)

WATER-COOLED ENGINES.

When stopping a water-cooled engine in cold weather, take precautions against frost. If cooling system does not contain an anti-freeze solution drain off all cooling water at the lowest point, making sure none is trapped in the piping or engine due to installation peculiarities.

ENGINES FITTED WITH VARIABLE SPEED GOVERNORS.

Decrease the load as advised for engine fitted with constant speed governor and move the speed control lever to 'STOP' position.

SECTION 6.

GENERAL MAINTENANCE.

6/1. All maintenance points should be studied and adhered to regularly in your own interests. Give special attention if the engine is working under bad conditions of grit and dirt of any description. We will advise about special conditions if you will contact us.

CLEANLINESS.

Use only clean fuel oil and lubricating oil, in accordance with recommendations we give in Section 4/1 and 4/2. Oil containers must be kept clean.

When removing any parts from the engine for cleaning or adjustment, make sure that tools and benches which may be used in connection with the operations are clean and that cotton waste, or 'fluffy' rags are not used. These remarks apply particularly to the cleaning of fuel injection equipment where clearances between the moving parts are very close. Parts should be cleaned in paraffin or clean fuel oil and re-assembled without being wiped with any kind of material.

6/2. OIL CIRCULATION.

The oil in the crankcase, which is pumped by an enclosed, gear type, chain driven oil pump, is delivered under pressure to the main and big end bearings. A quickly detachable oil filter is fitted in the sump, through which all oil passes, and a pressure relief valve returns surplus oil to the sump, at all speeds. Normal oil pressure is approximately 50/60 lbs., with a minimum pressure of 30 lbs.

UNDER NO CIRCUMSTANCES MUST THE OIL PRESSURE BE ALLOWED TO FALL BELOW THE PRESSURE SPECIFIED. STOP THE ENGINE AT ONCE AND INVESTIGATE THE CAUSE.

6/3. THE LUBRICATING OIL FILTER.

This is situated in the crankcase sump on the front left hand side. It is of thimble shaped gauze and is quickly accessible.

The filter gauze must be kept clean by withdrawing at intervals and washing in petrol. Do not wipe with cloth.

NOTE: Before removing the oil filter drain the sump via the drain plug.

6/4. FUEL INJECTION.

The fuel injection pump and atomiser operate against high pressure and these exacting conditions call for a high standard of workmanship and precision in manufacture. The internal parts of this equipment must, of necessity, be protected from damage by dirt which may be present in the fuel oil.

Fuel oil tanks must be kept free from all dirt. They should be drained regularly to remove any water caused by condensation. The containers used for filling the fuel tank should also be scrupulously clean and a fine filter used for the filling operation. Do NOT turn off the fuel every time the engine is stopped, and never allow the fuel tank to become empty. If erratic firing occurs and persists, the fuel system should be bled in accordance with the procedure given in Section 7/2. Test all unions for tightness every 200 hours running.

6/5. FUEL TANKS.

These should be thoroughly cleaned out occasionally and, as an additional safeguard to ensure clean fuel oil, a tank filter (special for diesel oils) may be fitted between the tank and the engine fuel oil filter as a further precaution. The fuel pipe (filter/engine) should be of 3/8 in. (9.5mm.) outside diameter, 18 gauge, and should be fitted with a downward run from the fuel tank to filter,(minimum head: 6in.(15.2 cm.) above filter.)

6/6. AFTER EVERY 10 HOURS RUNNING.

1. Inspect oil level in sump and top us as necessary.
2. Screw down cap of gear type water circulating pump grease cup one turn (if water pump fitted.)

NOTE. If the oil level is above 'Maximum' and the sump has not been over-filled, wipe the dipstick and take a second reading. If still the same, suspect a leakage of fuel oil into the sump. Such leak must be traced at once.

AFTER EVERY 100 HOURS RUNNING.

1. Remove atomiser, test the pressure and adjust as necessary.
2. Check the fuel oil filter flow.
3. Drain the crankcase completely by means of the oil drain plug and wash out thoroughly.
4. Remove oil filter, clean filter chamber and filter, replace carefully and fill with fresh oil.

AFTER EVERY 200 HOURS RUNNING.

1. Carefully remove the rocker cover on top of the engine taking care to preserve the joint and clean out waste oil. Clean and oil both valves and rockers.
2. Examine valve and tappet clearances, adjust if necessary, and replace cover.(Section 6/9).
3. Inspect all fuel pipe connections, paying particular attention to the fuel pump and fuel filter joints, and tighten as necessary.
4. Bleed air from fuel pipes at fuel filter.
5. Check against excessive leakage of water from water pump body, if gear type water pump fitted tighten up gland as necessary.

AFTER EVERY 300 HOURS RUNNING.

1. Remove and clean fuel oil element thoroughly (Section 6/7).
2. Check patent cold starting injector (if fitted). When shutting down the engine the plunger should always be removed and the injector blown through to clear passages.

AFTER EVERY 500 HOURS RUNNING.

1. Decarbonise and grind in valves (Section 6/7.).
2. Inspect piston, free piston rings if required and see that piston ring gaps are staggered.
3. Inspect air filter, clean, and if an oil bath air filter is fitted clean out the oil reservoir and replenish with fresh oil.
4. Drain oil sump and flush crankcase. Refill with fresh oil.
5. Make any other adjustments as necessary.

AFTER EVERY 1000 HOURS RUNNING.

1. Remove fuel oil filter and thoroughly clean, fitting a new filter element if necessary.

6/7. DECARBONISING AND GRINDING IN VALVES (WATER-COOLED ENGINES).

a) Remove the top cover, rockers and rocker box.
b) Remove the fuel filter and bracket (Section 7/1).
c) Remove the nozzle holder (Section 7/12).
d) Remove cold starting injector (if fitted).
e) Remove inlet and exhaust pipes, also water pipe (after draining).
f) Remove cylinder nuts and the cylinder head.
g) Remove valve spring cotters and valve springs.
h) Clean off all carbon deposits and thoroughly clean up.

i) Grind-in valves, afterwards carefully removing all traces of grinding-in paste from valves and valve seatings before re-assembly.

j) Fit new cylinder head gasket.

k) Re-assembly procedure being the reverse.

DECARBONISING AND GRINDING-IN VALVES - AIR-COOLED ENGINES.

a) Remove the cylinder head cowlings.

b) Remove the rocker box cover.

c) Remove rocker assembly complete.

d) Remove air cleaner (Section 7/8).

e) Remove fuel filter and bracket (Section 7/1).

f) Disconnect fuel leak-off pipe between the injector and tank.

g) Remove atomiser complete, also cold starting injector.

h) Remove fuel pipe between the fuel pump and injector.

i) Slacken off push rod tube bottom gland nuts.

j) Remove remaining 5/16 in. UNF nut holding down the rocker box, which can be lifted complete with push rod tubes.

k) Remove cylinder head nuts and cylinder head.

l) Remove valve spring cotters and valve springs.

m) Clean off all carbon deposits and thoroughly clean up.

n) Grind-in valves, afterwards carefully removing all traces of grinding-in paste from valves and valve seatings before re-assembly.

o) Fit new cylinder head gasket.

p) Re-assembly procedure being the reverse.

AIR CELL COMBUSTION CHAMBER.

The air cell requires no attention.

DURING RE-ASSEMBLY, AFTER OVERHAUL, IT IS STRONGLY RECOMMENDED ONLY GASKETS AND JOINTS SUPPLIED BY US SHOULD BE USED.

6/8. CLEARANCE BETWEEN PISTON CROWN AND CYLINDER HEAD.

It is essential to check the top clearance whenever new big end bearings, pistons or gaskets have been fitted. Insert a length of 1/8 in.(3.1mm.) lead wire on top of the piston in such a position that it will be clear of valve heads and venturi orifice when the head is replaced. Fit the cylinder head gasket and tighten down evenly. Turn the engine over TOP DEAD CENTRE two or three times, then remove the cylinder head, extract the strip of lead wire and check the flat measurement by a micrometer.

NOTE: Care should be taken in the case of all models to ensure the lead wire used in this clearance check is not lying across the head of a valve otherwise a false reading will be obtained. IT IS POSSIBLE TO ALTER THE TOP CLEARANCE, IF IT IS OUTSIDE THE LIMITS, BY FITTING A PACKING, OR SHIM, OF DIFFERENT SIZE BETWEEN THE CRANKCASE AND THE CYLINDER BARREL. A FULL RANGE OF PACKINGS, OR SHIMS, CAN ALWAYS BE OBTAINED FROM OUR SPARE PARTS DEPARTMENT.

PISTON TOP CLEARANCE.

A.D.3. and W.D.3. Mark II Engines.
.050 in.(1.27 mm) to .053 in.(1.34 mm).

A.D.3.Mk.III from engine no.2248/W.D.3. Mk.III from engine no.9917.
.029 in.(.74 mm) to .032 in.(.82 mm).

When fitting a new cylinder head, procedure for arriving at the correct piston top clearance should be as stated. In addition, it is necessary to ensure the exhaust and inlet valves when seated are sunk .008 in. below spigot face. The angle of the valve seat is 45°. whenever cylinder heads are removed for decarbonising, the nozzle orifice to the cylinder should be well cleaned and polished, likewise the cold starting injector assembly and its orifice.

Any formation of scale in the water passages (water-cooled engines) can be removed by means of a diluted (15%)solution of hydrochloric acid. The water space should be filled with the diluted acid and left for a few hours, or until 'bubbling' action has ceased. Then drain off and remove all traces of the acid by washing thoroughly with clean soft water. In the case of air-cooled engines, any formation of dirt between the fins on the cylinder barrel and head should be removed. The cowling should also be thoroughly cleaned inside and out.

After replacement of the cylinder head, the holding down stud nuts must be tightened down evenly using a diagonal selection. Finally check to ascertain that each nut is correctly torqued.

When replacing the rocker gear, make sure the rockers are left quite free. If there is any stiffness due to lack of side play, a slight outward tap on each bracket will give relief.

Do not omit to adjust clearance correctly.

6/9. TAPPET CLEARANCE ADJUSTMENT.

THE TAPPET CLEARANCE ON VALVE SHOULD BE .003 in (.07mm) INLET AND .005 in (.12mm) EXHAUST ENGINE COLD. THE INLET VALVE OPENS 3° to 4° BEFORE TOP DEAD CENTRE.

6/10. VALVE TIMING.

A timing screw is fitted in the camshaft sprocket, which has two threaded holes, and engages with one of seven holes in the camshaft flange. The crankshaft sprocket has one keyway to locate with the crankshaft key.
BEFORE DISMANTLING THE TIMING ENSURE THAT BOTH SPROCKETS ARE MARKED TO ASSIST REASSEMBLY.

TO RE-SET TIMING WHICH HAS BEEN DISTURBED PROCEED AS FOLLOWS :-

1. Fit inlet valve push rod only and adjust tappet clearance.
2. Rotate camshaft by hand in engine direction rotation until the valve rocker is felt to be pressing on the inlet valve. (Valve to start opening).
3. Position flywheel with timing mark (4^{o}B.T.D.C.) at 12 O'clock or centre of timing plug where applicable.
4. Position sprockets in duplex chain and offer up to crankshaft and camshaft until one of the holes in the camshaft sprocket can be seen to line up with one of the holes in the camshaft flange. Fit timing screw and check inlet valve opening position.

- WARNING. EARLY TIMING WILL CAUSE PISTON TO FOUL VALVE.

5. When timing is correct fit locknut/starter jaw and again check timing.
6. Fit exhaust valve push rod and adjust tappet clearance.

6/11. CLEANING FUEL INJECTION PARTS.

When the necessity for dismantling the fuel injection equipment arises, the utmost cleanliness must be observed. The work bench on which this work is to be carried out should be linoleum, or oil cloth covered, free from dirt, dust filings, grease or acid. Cotton wastes and 'fluffy' rags must not be used.

The bench vice should have soft jaws to prevent damage to the parts to be held. Tools should be maintained in perfectly clean condition. Always have clean fuel oil available for washing parts. After washing, allow the parts to dry naturally. DO NOT WIPE.

CLEANING THE INJECTION NOZZLE.

For the occasional cleaning of the nozzle, it will be sufficient to work off the carbon from the face of the nozzle and pintle valve projection with a piece of wood, or a brass wire brush.

If the pintle is suspected of being dirty in any way, unscrew the collar securing the nozzle to the holder. With the nozzle removed, extract the pintle plunger and clean carefully, using no abrasives.

If any particles of foreign matter are found on the plunger, they must be removed by soaking in clean fuel oil and the application of a brass wire brush. Nothing of a hard nature should be used in the cleaning of fuel injection equipment.

IT IS ADVISABLE TO CARRY A SPARE NOZZLE AND HOLDER COMPLETE IN ORDER TO SAVE TIME WHILST CLEANING AND TESTING THE OLD ONE.

NOTE: The nozzle holder must be an easy fit into the cylinder head and on the holding down studs so that they can be placed in position without force of any kind. The securing nuts should be tightened evenly with a box spanner.

SECTION 7.

7/1. THE FUEL OIL FILTER.

The filter element should be removed from the fuel filter after every 300 hours running. Clean and replace.

To clean the filter proceed as follows :=

a) Turn off at cock under the fuel tank.

b) Unscrew body cap which will release the bowl and withdraw centre bolt to release element. (Bolt through base of bowl). Later models.

c) Lift out the element and clean by washing out in petrol and allow to dry without wiping.

d) Replace the filter element and bowl.

e) Current engine fitted with spin off fuel filter element.

7/2. BLEEDING THE FUEL SYSTEM.

The procedure for bleeding a gravity fed fuel system is detailed below. Bleeding a system which includes a fuel lift pump differs only in that the pump priming lever must be continuously operated to prime the system.

a) Ensure (1) fuel in the tank, (2) fuel cock is open and (3) fuel control cam at 'Stop'.

b) Slacken 'in' bleed screw on top of the filter, wait until bubble-free fuel appears then tighten the screw. Repeat the operation on the 'Out' bleed screw.

c) With fuel pump control rod in 'Stop' position slacken the banjo union bolts on top of the fuel injection pump and wait until bubble-free fuel appears, then tighten the bolt. (On Bryce pumps slacken small bleed screw to remove air.)

d) Slacken the injection pump delivery pipe nut at the injector, set the fuel control cam to excess fuel (start) and crank the engine until fuel appears at the injector, then tighten the pipe nut.

e) With the control cam at excess fuel, crank the engine until the injector 'creaks', indicating priming is complete.

7/3. FUEL PUMP TIMING.

a1) AD3 and all water-cooled models with flywheel housings.
Remove timing plug only. This exposes the flywheel 'SPILL' timing mark.

a2) Carry out procedure as paragraph 7/2 (c) when necessary.

a3) Close fuel tank cock.

b) Disconnect fuel pipe from pump to injector.

c) Remove union from top of pump.

d) Remove delivery valve and spring and place the parts in a tray of clean fuel oil.

e) Replace the unions.

f) Set the pump in fully open position.

g) Rotate the engine until the piston is just rising on the compression stroke. (This can be ascertained when both valves are closed and the fuel pump tappet is commencing to rise.)

h) Turn on the fuel tap.

i) Fuel should stop flowing from the pump top union as indicated when the mark 'SPILL' on the flywheel is in the vertical position, except in the case of the AD3 model when the 'SPILL' mark should be exactly in the centre of the timing plug aperture, in the flywheel housing.

TO ADJUST FUEL PUMP TIMING.

a) Raise fuel pump tappet adjuster to advance timing.

b) Lower fuel pump tappet to retard timing.

c) Lock firmly.

WARNING. EXCESSIVE ADJUSTMENT DUE TO WORN CAMSHAFT CHAIN WILL RESULT IN PUMP DAMAGE. RENEW CHAIN.

7/4. CAMSHAFT WITHDRAWAL AND REPLACEMENT.

a) Remove the timing cover.

b) Unscrew the starting dog, or jaw, on the camshaft.

c) Remove the governor bobbin and weight carrier.

d) Unscrew the crankshaft nut.

e) Withdraw the crankshaft and camshaft chains and sprockets complete.

f) Remove the flywheel (Section 7/7.)

g) Remove rear bearing housing.

h) Remove thrust plate on camshaft and discard the screws (see 'j' below)

i) Lift valve and pump tappets - withdraw camshaft.

j) To replace, reverse the above procedure, fitting Wedgelok countersunk head screws to camshaft thrust plate. Centre-punch on the periphery in two opposing places on each screw to secure, if standard c/s head Wedgelok are not available, or not applicable.

7/5. PISTON AND CONNECTING ROD - REMOVAL AND REPLACEMENT.

Remove the cylinder head and cylinder barrel, the piston and the connecting rod can then be dismantled.

7/6. CRANKSHAFT ASSEMBLY - REMOVAL AND REPLACEMENT.

Need not be removed except for major overhaul. Proceed as 7/5.

7/7. FLYWHEEL - REMOVAL AND REPLACEMENT.

Remove flywheel nut and washer, withdraw flywheel. When replacing the flywheel it is important to see the taper fits perfectly and the key must not bind. After tightening, give the spanner a few blows with a hammer to ensure a solid fit, and turn over one side of flywheel washer, to lock nut.

7/8. AIR CLEANER - REMOVAL AND REPLACEMENT.

Remove the filter cover, take out the element and clean or renew as necessary.

OIL BATH AIR CLEANER - REMOVAL AND REPLACEMENT.

Unclip the oil reservoir at the base of the cleaner, wash thoroughly and re-fill with fresh oil to the level bead, inner and outer cups, every 10 - 60 hours running (depending on dust conditions). Oil must flow freely through the cleaner. Never allow the level of dirt or sludge in cups to exceed ½ in.(12.7 mm). Carefully replace the oil reservoir and clip securely in position.

7/9. BREATHER.

Requires no attention apart from keeping clean.

7/10. LUBRICATING OIL PUMP - REMOVAL AND REPLACEMENT.

a) Remove the timing cover.

b) Remove the oil pump chain.

c) Remove the oil pump carefully and clean all surfaces.

d) Replace by reversing the above procedure. Applying jointing compound to oil pump joint faces.

7/11. WATER CIRCULATING PUMP - REMOVAL AND REPLACEMENT.

Water-cooled engines: the water circulating pump can be easily detached complete by the removal of two hexagon headed screws Sections 3/2 3/7) which secure the pump to the engine casing and withdrawing from the driving jaw in the timing cover. When replacing see that the driving spindle fully engages with the Oldham coupling; approximately 1/32 in. (.79mm) end clearance.

7/12. FUEL INJECTOR AND NOZZLE ASSEMBLY - REMOVAL AND REPLACEMENT.

a) Disconnect fuel pipe from pump to injector. Disconnect also the leak-off pipe from injector.

b) Remove two 5/16 in. nuts holding injector body to cylinder head.

c) The injector assembly can now be withdrawn from position in cylinder head. It may be necessary, however, to exert a gentle leverage between the injector body flange and the cylinder head by means of a suitable lever or strong screwdriver. Ease off, do not use force.

7/13. FUEL PUMP - REMOVAL AND REPLACEMENT.

a) Turn off fuel supply.

b) Disconnect fuel pipe unions at pump.

c) Disconnect Link rod to control panel.

d) Remove two 5/16 in. nuts from studs holding base of pump to the location on the fuel pump block.

e) The pump may now be lifted over the studs and removed.

f) To replace, reverse the above procedure.

FAULT FINDING.

SECTION 8.

	TROUBLE.	REMEDY.
A1.	ENGINE WILL NOT START.	
	a) No fuel in tank and air in fuel lines.	Fill up and bleed fuel system (Section 7/2).
	b) Fuel delivery valve dirty.	Remove and wash in clean fuel oil, flush pump.
	c) Fuel pump leaking.	Inspect fuel supply, renew pipe and washers if faulty, tighten all unions.
	d) Water in fuel tank.	Thoroughly clean fuel system.
	e) Starting cam incorrectly set.	Set cam to 'Start' position.
	f) Sticking valve.	Lubricate valve stems, check that water ports or fins are not blocked thus causing overheating and valve stem seizures.
	g) Decompressor sticking.	Remove top cover and check for fouling, check spring.
	h) Excessive oil drag.	Use correct grade and check engine room temperature.
	i) Piston rings gummed up.	Remove and clean, see that the gaps are staggered on replacement.
	j) Exhaust system choked.	Clean out.
A2.	ENGINE MISFIRES.	
	a) Valve or valves sticking.	As A1 (f).
	b) Induction system obstructed.	Clean air filter, renew paper element.
	c) Dirt in injector.	Strip and clean with correct equipment.
	d) Injector not seating squarely.	Slack off injector holding down nuts and tighten evenly.
	e) Air-lock in fuel system.	Bleed fuel system. (Section 7/2).
	f) Fuel pump spring broken.	Return to nearest Lucas/ C.A.V. Service Agent.
	g) Fuel delivery valve dirty.	Remove and wash in clean fuel, flush pump.
	h) Fuel filter element clogged.	Replace with new element.

i) Fuel in tank too low.	Top up and check for air locks.
j) Dirt in pump rack teeth.	Thoroughly clean.

A3. POOR COMPRESSION : May be due to

a) Poor valve seatings.	Grind in both valves. (Section 6/7.)
b) Lack of valve clearance.	Re-set to instructions (Section 6/9.)
c) Induction system obstructed.	Clean filter, renew paper element.
d) Broken valve spring or springs.	Replace with new.
e) Injector not seating squarely.	Slack off injector holding down nuts and tighten evenly.
f) Need for de-carbonising and grinding in valves.	Remove cylinder head, decarbonise and grind in valves (Section 6/7).
g) Worn cylinder and piston.	Rebore and renew piston.

A4. ENGINE KNOCKING BADLY.

a) Nozzle pintle sticking.	Strip and clean with correct cleaning apparatus.
b) Inlet valve fouling piston.	Correct valve timing (Section 6/10).
c) Broken valve spring or springs.	Replace with new.
d) Worn gudgeon pin.	Fit new piston with pin complete.
e) Big end failure.	Renew shell bearings.
f) Excessive cylinder head carbon.	Decarbonise and check if overloading engine (Section 6/7).
g) Overheated engine.	Ease the load, check water circulation on water-cooled models.
h) Dirt in injector.	As A2 (c).
i) Main Bearing failure.	Fit new bearings.

A5. UNEVEN RUNNING.

a) Injector not seating squarely.	Slack off injector holding down nuts and tighten evenly.
b) Fuel delivery valve dirty.	Remove and wash in clean fuel, flush pump.
c) Fuel pipe leakage.	Inspect fuel supply, tighten all unions, renew pipe and washers if faulty.

d) Fuel filter element clogged.	Replace with new element.
e) Fuel level in tank too low.	Top up, and bleed fuel system (Section 7/2).
f) Air-lock in fuel system.	Bleed fuel system (Section 7/2).
g) Stiffness in pumps to governor linkage.	Ease off.
h) Faulty injector.	Replace.
i) Dirt in pump rack teeth.	Thoroughly clean.

A6. LOW OIL PRESSURE.

a) Oil filter dirty.	Clean out thoroughly.
b) Oil relief valve not seating or dirty.	Remove and clean.
c) Insufficient oil in sump..	Top up.
d) Incorrect grade of oil.	Use correct grade (Section 4/1).
e) Oil pump clearances excessive.	Remove and re-fit correctly.
f) Worn bearings.	Replace.

A7. ENGINE OVERHEATS (Water-cooled models).

a) Insufficient water.	Top up.
b) Water passages obstructed.	Thoroughly flush system.
c) Water pump worn.	Replace.
d) Excessive leak past pump gland.	Renew gland seal.
e) Obstruction in cylinder jackets.	Clean passages thoroughly.
f) Faulty joint at inlet port.	Replace.
g) Cylinder head gasket faulty.	Replace.

A8. ENGINE OVERHEATS (Air-cooled models).

a) Cooling intakes or outlets obstructed.	Thoroughly clean out.
b) Insufficient air supply to engine.	Arrange for improved ventilation and air supply.
c) Dirt in engine cowling.	Clean.
d) Cylinder fins choked.	Clean.
e) Breather choked.	Clean.

f) Late injection.	Re-adjust timing accordingly.
g) Injection obstructed.	Clean filter, renew air filter element.
h) Overload.	Ease the load.

THE STARTER MOTOR.

SECTION 9.

THE COMMUTATOR.

Ensure the commutator surface is kept clean and free from uneven discoloration. There should be no deposit bridging the segments across the inter-segment insulation. To clean the surface use a fine linen duster dipped in petrol, see that no dust or abrasive particles remain and the surface is free of oil and petrol.

BRUSHES AND BRUSH GEAR.

Brushes should be inspected at regular intervals to ascertain they are free in their guide and flex leads are perfectly clear for movement. Where special fibre insulation is provided for the brush flexes see it has not become charred or burnt so that short circuiting will not occur. Positive and negative brush holders and brushes must be well insulated from each other. If for any reason brushes are removed, take care to replace them in exactly the same position in the brush holders so the 'bedding' curvature of the brush surface accurately conforms with the commutator periphery.

REPLACEMENT BRUSHES.

Replacement brushes must be of the same grade as those originally fitted. They should be well 'bedded', i.e. they should be worn to the commutator periphery. To ensure perfect 'bedding', wrap a strip of very fine emery paper firmly around the commutator, rough side upwards, and with the brush or brushes in position, rotate the armature by hand in the working direction of rotation until the correct shape is obtained, afterwards removing all traces of dust and abrasive particles. It is important none but the genuine C.A.V. brushes be fitted, and when ordering brush replacements, state the type and service number of the starter motor.

TERMINALS.

Keep all nuts spanner tight and clean and where rubber caps are fitted to cover terminals they should not be dispensed with when connecting cables.

(CA 45 STARTER MOTOR).

To lubricate shaft, remove the spring loaded cap on rear, taking care not to lose the steel ball contained in it, and pack with grease. Replace cap.

USING THE STARTER MOTOR.

1. Make sure all engine controls are correctly adjusted.
2. Release the starter switch immediately the engine fires.
3. If the engine does not fire at once, allow it to come to rest before again using the starter switch.
4. Do not use the starter switch continuously if the engine does not fire but ascertain the cause of failure.
5. On no account operate the starter while the engine is running, otherwise serious damage can occur to both starter and starter ring gear.

THE CHARGING DYNAMO.

The dynamo fitted is either a D45/DN/58M or a GL45/2/4M, both models being of the 12 volt flange-mounted type manufactured by C.A.V. Ltd. It is used in conjunction with a regulator and cut-out to operate according to design on the compensated current voltage control system. With this system there is automatic adjustment of the charging rate in relation to battery condition. Once the generator has exceeded cutting-in speed, the output voltage is kept slightly in excess of the back pressure of the battery irrespective of any speed variation. In addition the excess voltage of the generator is made greater as the battery becomes discharged and less as the battery becomes more fully charged.

The current voltage control system charges a partially charged battery at a constant current until a certain battery voltage is reached when the charging changes to constant voltage control. Constant voltage control then allows the charging current to drop as the fully charged state in the battery is approached until it reaches the normal trickle charge value.

LUBRICATION : D45 - DN58 DYNAMOS.

To lubricate the shaft, remove the slotted head screws situated on top and rear of dynamo casing and fill with grease.

NOTE: Shell Alvania 3 is the recommended grease for both starter motor and dynamo where grease is recommended.

ARMATURE, BRUSHES AND BRUSH GEAR AND TERMINALS.

Instructions for maintenance of these items are the same as for the Starter Motor.

IN THE CASE OF FAILURE OF STARTER MOTOR OR DYNAMO

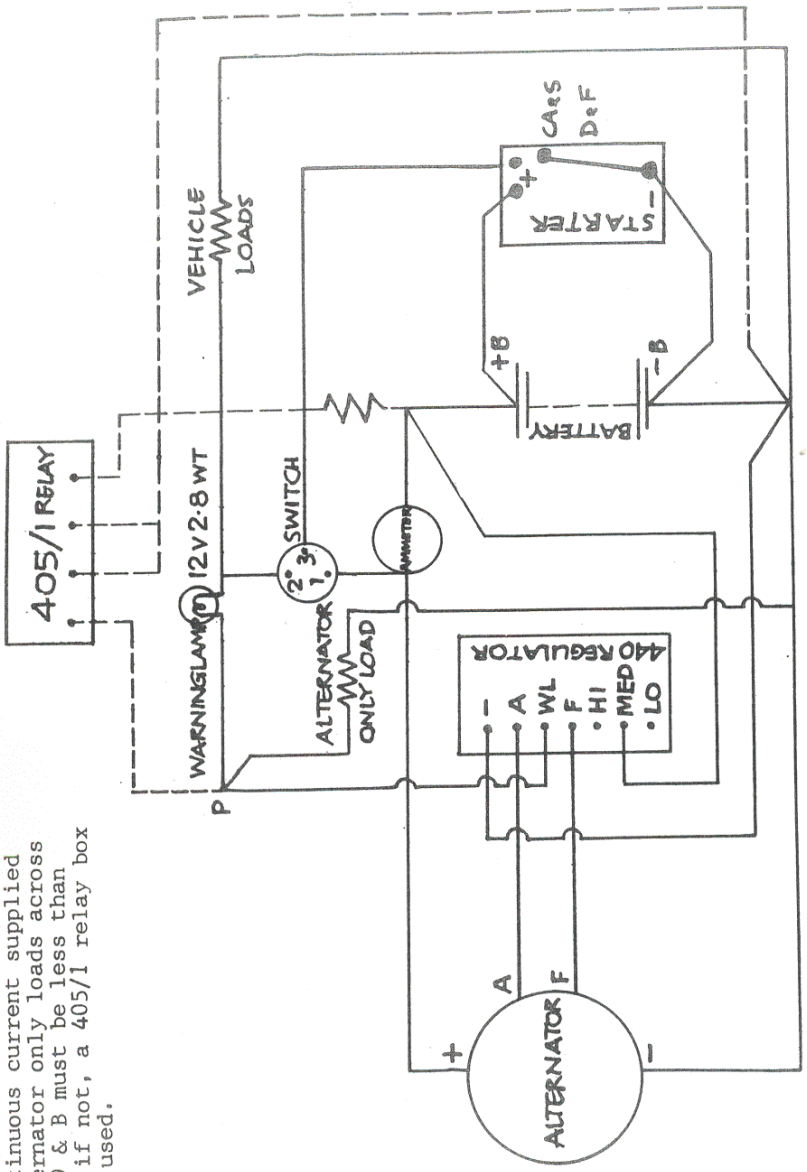
REMOVE AND SEND DIRECT TO THE MAKERS :-

C.A.V. LIMITED, ACTON, LONDON W.3.

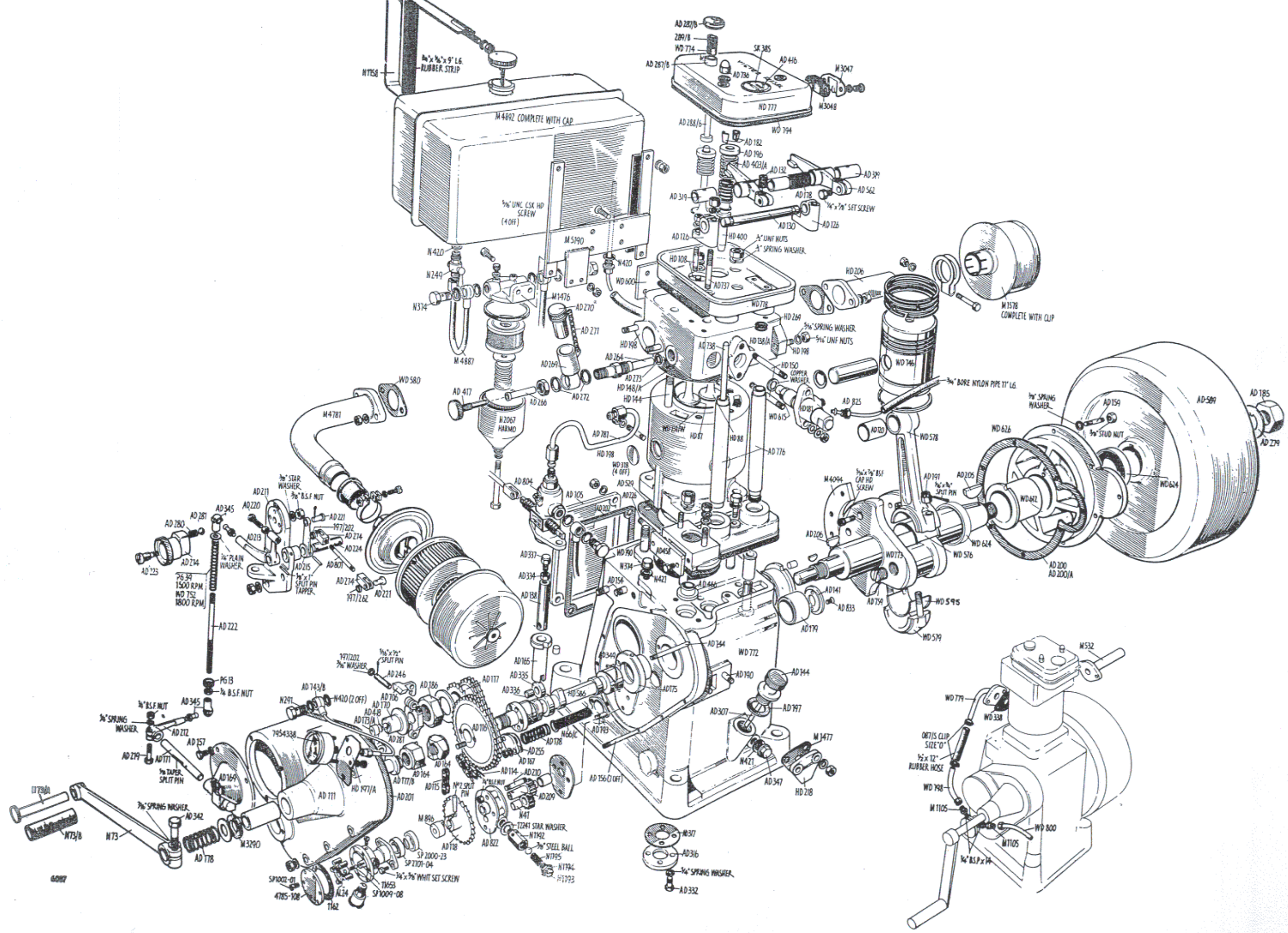
OR TO THE NEAREST AGENT.

We cannot accept responsibility for incorrect wiring and if in any doubt contact the manufacturers.

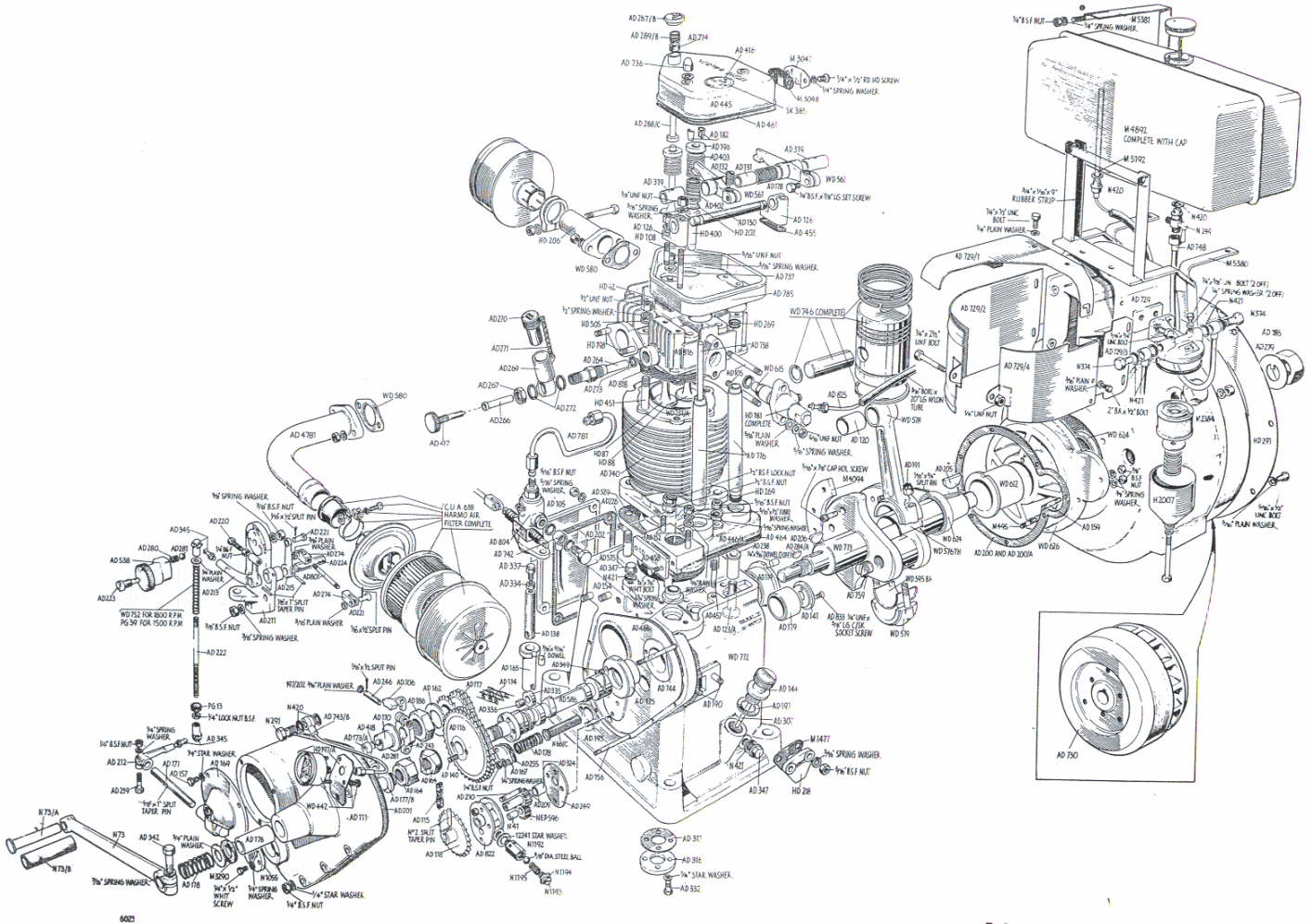
WIRING DIAGRAM FOR
AC5 - 12V ALTERNATOR



The continuous current supplied for alternator only loads across points 9 & B must be less than 5 amps; if not, a 405/1 relay box must be used.



Water cooled engine



Air cooled engine