

# Operators Manual

## **BEDFORD** INDUSTRIAL & MARINE DIESEL ENGINES

A copy of this book is issued free with every engine  
Extra copies may be obtained (price one shilling and sixpence)



POWER AND INDUSTRIAL DIVISION OF  
**GENERAL MOTORS LIMITED**  
WELLINGBOROUGH • NORTHAMPTONSHIRE  
ENGLAND

BD/SE/2 Rev. MARCH/67

Telephone: Wellingborough 4271

# INDEX

	Page		Page
<b>A</b>		<b>I</b>	
After the first 20 hours ..	10	Injection Pump Cambox ..	12
Air Cleaners .. ..	14, 25	Injector Pipe Clips ..	14
Air Venting Fuel System ..	23, 24, 25	Injectors, Operation of ..	20, 21
Anti-freeze .. ..	28		
<b>B</b>		<b>L</b>	
Batteries .. ..	12	<b>Lubrication, Notes on</b> ..	11
Before using the Engine ..	7	Capacities .. ..	5, 6
<b>C</b>		Clutch .. ..	12
Care of the Cooling System		Control Joints .. ..	13
in Winter .. ..	28	Gearbox .. ..	13
Clutch .. ..	12, 15	Lubricants, Recommended ..	16, 17
Coolant Pump .. ..	27		
Cooling System .. ..	11, 27		
<b>D</b>		<b>M</b>	
Data .. ..	5, 6	Maintenance Routine ..	11
<b>Draining</b>		Manifolds .. ..	20
Cooling System .. ..	25	Model Identification ..	4
Engine Oil .. ..	12		
Injection Pump .. ..	12		
<b>E</b>		<b>P</b>	
<b>Engine</b>		<b>Pump</b>	
Number .. ..	4	Coolant .. ..	27
Oil Filter .. ..	13	Fuel .. ..	23, 24, 25
Oil Level .. ..	11	Raw Water .. ..	31, 32
Oil Pump Strainer ..	21		
Running-in .. ..	10		
Starting .. ..	8		
Stop Control .. ..	10		
Valve Clearance .. ..	19, 20		
Excess Fuel Device ..	23, 24		
Exhauster .. ..	21		
<b>F</b>		<b>R</b>	
Fan Belt .. ..	14, 27	Return Engine to Service ..	31, 32
Filter, Fuel Oil .. ..	11, 18, 23		
Filter, Lubricating Oil ..	13		
<b>G</b>		<b>S</b>	
<b>Gearbox</b>		Specification of Engine ..	5, 6
Allison Automotive ..	7	Starting the Engine ..	9, 10
Bedford Automotive ..	13, 18	Stop Control .. ..	10
Borg-Warner Marine ..	30	Storage of Engine .. ..	31
Paragon Marine .. ..	29		
Parsons Marine .. ..	29		
Generator .. ..	19		
Governor, Mechanical ..	26		
		<b>T</b>	
		Tap, Cylinder Block Drain ..	27
		Turbocharged Engines, Special Precautions ..	22
		<b>V</b>	
		Valve Clearance .. ..	19, 20

## FOREWORD

**D**ETAILED instructions are given in this handbook for the operating adjustment and general maintenance of the Bedford Industrial and Marine diesel engines listed on page 9. Your special attention is drawn to the information on page 7, under the heading "Before Using a New Engine".

In accordance with the General Motors policy of progressive improvement, the right is reserved to alter any details of specification and equipment without notice.

Conscientious attention to the routine and general maintenance described in the following pages is essential. Providing the instructions are carried out regularly and thoroughly, the parts will be protected from unnecessary wear, the engine will continue to function efficiently for longer periods, and fewer repairs and replacements will be necessary.

As a general guide, the information given in this book is confined to operation, care and general maintenance.

Finally, a word to the operator. The engine which you are using was built to stand up to hard work. It will stand up to hard work if you play your part in looking after it. Make it your business to learn all you can about it. Operate it as you would want someone else to operate it if it belonged to you. Don't neglect to do any of the things you know are necessary to keep it in good condition.

**For operators in the United Kingdom a comprehensive Service Manual giving full information on the procedure for the overhaul and major servicing of the engines covered by this book is available from:**

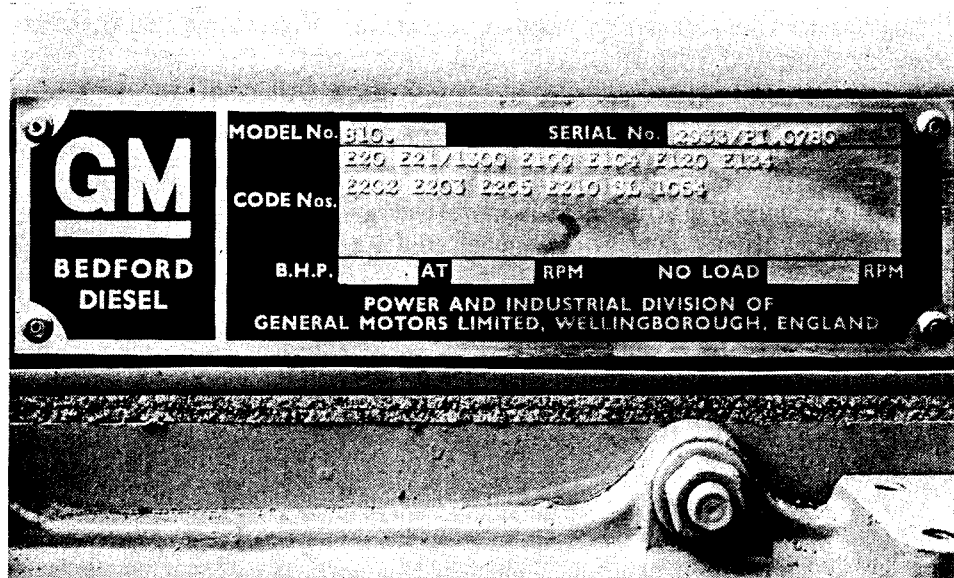
**The Service Department  
Power and Industrial Division of  
General Motors Limited,  
London Road,  
Wellingborough,  
Northamptonshire.  
Telephone: Wellingborough 4271**

**Service Manuals are available to overseas operators from the General Motors Plant in their territory.**

## MODEL IDENTIFICATION

This handbook contains instructions on the operation and preventive maintenance of the current Bedford Industrial and Marine Diesel Engines. The models covered in this book are the 330 cu. in. six-cylinder model B5, OB5; and the 220 cu. in. four-cylinder model B10. Except where specifically stated otherwise, the instructions apply to both types of engines.

The engine model and serial numbers together with the applicable code numbers are stamped on a plate attached to the rocker cover. In any communications with the factory, or when ordering replacements parts from your dealer, the model, serial and code numbers must always be quoted.



# GENERAL DATA

## CAPACITIES

### Engine Oil Sump:

Six-cylinder, 330 cubic inch Standard sump:						
Total	..	..	..	..	..	17 pints (9.65 litres)
Refill	..	..	..	..	..	14 pints (7.96 litres)
Refill with filter element change	..	..	..	..	..	15 $\frac{3}{4}$ pints (8.95 litres)
Six-cylinder 330 cu. in. optional sump:						
Total	..	..	..	..	..	19 pints (10.79 litres)
Refill	..	..	..	..	..	16 pints (9.09 litres)
Refill with filter element change	..	..	..	..	..	17 $\frac{3}{4}$ pints (10.08 litres)
Six-cylinder 330 cu. in. with 30° inclination oil system.						
Total	..	..	..	..	..	19 pints (10.79 litres)
Refill	..	..	..	..	..	16 pints (9.09 litres)
Refill with filter element change	..	..	..	..	..	17 $\frac{3}{4}$ pints (10.08 litres)
Four-cylinder—220 cubic inch—standard sump.						
Total	..	..	..	..	..	14 pints (7.96 litres)
Refill	..	..	..	..	..	11 pints (6.25 litres)
Refill with filter element change	..	..	..	..	..	12 $\frac{3}{4}$ pints (7.24 litres)
Four-cylinder—220 cubic inch, optional deep sump.						
Total	..	..	..	..	..	17 pints (9.65 litres)
Refill	..	..	..	..	..	14 pints (7.96 litres)
Refill with filter element change	..	..	..	..	..	15 $\frac{3}{4}$ pints (8.95 litres)
Bedford Gearbox	..	..	..	..	..	6 $\frac{1}{2}$ pints (3.7 litres)
Allison Gearbox	..	..	..	..	..	capacity dependent on actual installation of unit.

### MARINE GEARBOXES

#### Parsons

HG4 type hydraulic reverse gear	..	..	..	4 pints
D/A Marinomatic reverse gear	..	..	..	1.25 pints
D/A Marinomatic 2:1 reduction section (2 wheel R.H. rotation)	..	..	..	.25 pints
D/A Marinomatic 3:1 reduction section (2 wheel R.H. rotation)	..	..	..	.4 pints.

#### Borg Warner

#### Paragon

Fuel Injection Pump	..	..	Driven at half engine speed from the timing gears at forward end of engine. Flexible adjustable coupling, clockwise rotation viewed from the front. The fuel injection spill points are as follows. B10 engine is 22° B.T.D.C. B5 engine is 26° B.T.D.C. OB5 engine is 24° B.T.D.C. Turbocharged B5 engine is 22° B.T.D.C. Turbocharged OB5 engine is 20° B.T.D.C.
---------------------	----	----	---

#### Governor "in line pumps"

Pneumatic or Mechanical	6 cyl. C.A.V.	4 cyl. Simms.
-------------------------	---------------	---------------

#### Governor Distributor type pump

Hydraulic	..	..	6 cyl. C.A.V.
-----------	----	----	---------------

Fuel Feed Pump	..	..	Operated by an arm in contact with an eccentric on injection pump camshaft in the case of engines fitted with "in-line" fuel pumps and engines equipped with "distributor type" fuel injection pumps directly from eccentric on engine camshaft.
----------------	----	----	--

Fuel Oil Filter	..	..	C.A.V. on 6 cylinder engines. AC Delco on 4 cylinder engines.
-----------------	----	----	---

Engine Oil Filter	..	..	AC Delco full flow
-------------------	----	----	--------------------

## GENERAL DATA

**Transmission** .. .. Some engines are fitted with the standard Bedford Automotive 4 speed gearbox which has synchromesh on top, third and second gears. The box is available with either close ratio or wide ratio gears. Some engines are fitted with the Allison Automatic transmissions, other transmission applications are to customers choice.

### RATIOS

#### Standard Bedford Automotive

	<i>Close ratio</i>	<i>Wide ratio</i>
First	6·500:1	7·059:1
Second	2·860:1	3·332:1
Third	1·576:1	1·711:1
Fourth (Top)	Direct	Direct
Reverse	6·500:1	7·059:1

#### ALLISON MT. 31

Stall Torque Ratio 2·8:1

		<i>Overall Ratio</i>
First	5·29:1	14·81
Second	3·81:1	
Third	2·69:1	7·53
Fourth	1·95:1	
Fifth	1·39:1	
Sixth (Top)	Direct	
Reverse	6·04:1	16·91

## BRIEF SPECIFICATION OF THE BASIC ENGINE

**Type** .. .. GM Bedford vertical in line, compression ignition, direct injection, overhead valve, water cooled.

	220 cu. in.	330 cu. in.
No. of Cylinders .. ..	4	6
Bore .. ..	4·0625 in. (103·18 mm.)	4·0625 in. (103·18 mm.)
Stroke .. ..	4·25 in. (107·95 mm.)	4·25 in. (107·95 mm.)
Piston Displacement .. ..	220 cu. in. (3605 c.c.)	330 cu. in. (5408 c.c.)
Comp. Ratio .. ..	17:1	17:1
B.H.P. (Gross) .. ..	70 at 2,800	105·5 at 3,000
Brake Torque (Gross) ..	157 lb. ft. at 1,400	238 lb. ft. at 1,800
Valve Clearance (Hot) ..	·013 in.	·013 in.
Firing Order .. ..	1, 3, 4, 2	1, 5, 3, 6, 2, 4
Fuel Injectors .. ..	Simms	C.A.V.

## BEFORE USING A NEW ENGINE

Before the engine left the factory the cooling and lubricating systems were drained, and several other operations were carried out to prevent possible corrosion and other troubles occurring during storage or delivery to the customer.

Before using the engine for the first time the sequence of operations given below must be carefully followed. Any attempt to run the engine before carrying out this procedure, may result in serious damage.

1. Take off the rocker cover and adjust all valve clearances to .013 in. It will be necessary to readjust the valve clearances after the engine has been warmed up.

2. Fill air intake oil bath air cleaner to indicated level with Viscosity SAE 50 engine oil. (See page 14 for details).

3. Fill engine oil pan to "FULL" mark on dipstick. See page 5 for capacity, and page 16 for table of recommended lubricants.

4. On six-cylinder engines with C.A.V. In Line Injection Pump, a third of a pint (200 c.c.) of engine oil must be added to the injection pump cambox.

5. On both engines, where a mechanical governor is fitted, the governor casing must be filled to the level plug opening with engine oil, this does not apply in the case of distributor type pumps, which are self lubricating.

6. See that there is fuel in the tank, and then air vent the fuel system. (See page 23 for details).

7. Ensure that the coolant drain tap at the rear left-hand of the cylinder block is closed. Fill the cooling system with coolant, taking care to vent external connections.

8. Ensure that the fan belt tension is correct (See page 14).

9. Check that the turning dog stud at the front end of the crankshaft is tight. (This is sometimes removed for packing purposes).

10. Ensure that the breather pipe from the push rod cover is connected to the air cleaner by a rubber hose and clips, and that the connections at both ends of the breather pipe are secure.

11. Fill the standard Bedford automotive gearbox, if fitted to the level of the filler plug opening, which is at the rear left-hand side of the gearbox.

See page 16 for list of recommended lubricants.

12. If an Allison Transmission is fitted reference should be made to the booklet, Instructions on Driving—Operation—Care of the Allison Fully Automatic M.T. Series Transmission.

## **BEFORE USING A NEW ENGINE**

13. If a Marine gearbox is fitted full details of the filling procedures are given for all types of marine gearboxes which are fitted to GM Bedford engines on pages 29/30.

### **Starting the Engine**

Start the engine in the manner described on page 9. Pay special attention to the different starting procedures according to the ambient temperature.

### **IMPORTANT NOTE:**

*Allow the engine to warm up thoroughly and then reset accurately the valve clearances to .013 in., with the engine running (see page 20).*

*After replacing the rocker cover re-start the engine and check for fuel, oil and coolant leaks, rectifying as necessary.*



## OPERATION

**BEFORE STARTING THE ENGINE.** Before attempting to start the engine see that:—

1. The cooling system is full.
2. The engine oil level is correct.
3. There is an adequate fuel supply in the tank.
4. The gear lever (where fitted) is in neutral.
5. The engine stop control is fully home in the “run” position.
6. The fuel pump oil level is correct (See page 12, item 2 and 3).

**STARTING THE ENGINE.** The method of starting the engine when fitted with “in line” fuel pump is dependent on the prevailing temperature, and the operator should make sure that he is thoroughly familiar with the following instructions.

**Starting the engine from cold (temperature above freezing point).**

1. Switch on.
2. Firmly operate the starter control and the engine should start.

It may sometimes be found necessary, especially during cold weather, to keep the engine speed control more or less fully open for a few moments after the engine starts, do not operate starter for more than 30 secs. and allow 60 secs. rest between each attempt to start. If after 4 attempts the engine will not run find out why.

**Starting the engine from cold (temperature below freezing point).**

Engines fitted with “in line” fuel pumps.

1. Set the excess fuel device on the injection pump (see page 23).
2. Switch on.
3. Operate the starter control and the engine should start.

Keep the engine speed control more or less fully open for a few moments after the engine starts.

**Starting the engine at temperature below 15°F. (−8.4°C)**

Engines fitted with “in line” fuel pumps.

When the engine is used in territory where the night temperature frequently falls below 15°F., (−8.4°C) a “Thermostart” heater should be fitted to the intake manifold.

**To start the engine**

1. Set the injection pump in the excess fuel position (See page 23).
2. Switch on.
3. Firmly press in and hold depressed the “Thermostart” heater button.
4. After 10 seconds, more or less, fully open the throttle and operate the starter control, still keeping the “Thermostart” heater button depressed. After a few seconds motoring the engine should start. Release both starter control and “Thermostart” button and maintain a reasonably high engine speed for a few moments.

**Operation of engines fitted with distributor type fuel pump**

On engines fitted with the Distributor type fuel pump no excess fuel device is fitted as the fuel pump has a form of advance and retard mechanism built into it. The starting procedure for cold

## OPERATION

---

starts when temperature is above freezing point is the same as that laid down for "In-Line" pumps.

### **Starting a cold engine. (Temperature below freezing)**

To start the engine the Thermostart control switch, which is spring loaded to the off position, is switched on for 15 to 20 seconds, and then the starter operated. Both Starter and Thermostart switches should be released when the engine starts. If after about 10 seconds cranking time the engine has not started it is advantageous to stop cranking for 10 seconds leaving the Thermostart energised, and then resume cranking.

### **Restarting a warm engine**

When the engine is warm it can be re-started by switching on and then operating the starter control. This applies to all types of injection pumps, fitted on GM Bedford engines.

*Note: As soon as the engine is running, check that oil pressure is present either by observing the indicator light or the oil pressure gauge.*

**TO STOP THE ENGINE.** Move the engine stop control to the "Stop" position, and hold it in this position until the engine stops. See that the control is returned to the running position after the engine has stopped.

**AFTER THE FIRST 20 HOURS.** After the first 20 hours of operation, the engine oil should be drained and refilled with an approved lubricant. See page 16.

**RUNNING-IN.** The engine will run in under 75% load conditions more effectively than by light operation, however it is important to ensure that operating temperatures 160°-170°F (71°-77°C) are reached before applying full load, and during the first 30 hours of engine life full load should only be applied for short periods up to 15 minutes if operating circumstances permit.

Note when a period of full load has been run the engine should run at light or no load at 1000-1500 r.p.m. for 5 mins. before shutting down, this will allow high temperature parts of the engine to return to normal without distortion.

Do not idle for long periods, if engine is not required shut it down and heat will be retained longer than at idle.

**FUEL CONSUMPTION.** Good consumption depends on observing these instructions:

Keep the engine in efficient "tune", with correct valve clearances and properly adjusted fuel feed system.

Use the correct grade of oil.

Idling when you start up wastes fuel and is bad for the engine.

In winter, if necessary, blank off part of the radiator to maintain optimum operating temperature.

## ROUTINE MAINTENANCE

It is vitally important that each and every item be attended to conscientiously, as no engine can give of its best, either in performance or long life, unless it is properly maintained.

The operating periods under which the various items are listed are intended to apply to engines engaged on normal types of work. More frequent attention will be necessary to engines which are working under adverse conditions.

### NOTE ON LUBRICATION

Always use oils of the correct grade as listed in the tables. Good quality lubricant reduces carbon deposit, saves battery overload by making starting easier, and retains its lubricating qualities for longer periods.

Even with the finest lubricant, however, neglect to change the oil at regular intervals is false economy. The oil itself may not deteriorate, but it will inevitably become contaminated with unburned fuel, carbon, particles of metal, moisture and other impurities. These impurities reduce its efficiency as a lubricant and lead to wear if they are allowed to remain in the system.

### GENERAL PRECAUTIONS

Where it is suggested various parts should be checked for tightness care should be exercised not to overtighten as repeated overtightening will lead to eventual failure of the threads or the parts being retained.

The time interval for various operations is based on operation in a clean temperate climate and extremes of temperature or dust would indicate more frequent attention to oil changes, filter changes and air cleaner servicing.

### DAILY

#### COOLING SYSTEM

**1. Check Coolant Level.** If necessary, add coolant until the level is correct, approx. 1 inch below filler neck.

#### ENGINE

**2. Check Oil level in Sump.** To ensure a correct reading always wipe the dipstick before checking, and make sure that the engine is at the basic installation angle. Keep level as close as possible to "FULL" mark without overfilling. Do not operate with level below lower mark. See page 16 for recommended lubricants table.

**3. Drain Main Fuel Filter** (6-Cyl. engines). Slacken the drain plug at the bottom of the filter bowl, operate the priming lever on the (fuel feed pump) and allow fuel to flow until clean fuel oil appears. Tighten the drain plug. Air vent the system (see page 23).

## ROUTINE MAINTENANCE

---

### **CLUTCH—ROCKFORD INDUSTRIAL TYPE (where fitted)**

Lubricate Release Bearing. Apply the lubricant gun, filled with high melting-point grease, to the nipple secured by a circlip to the outside of the clutch housing and connected to the release bearing trunnion by a flexible tube. Do not over-lubricate as this will lead to a greasy clutch, with resultant slip.

**Note:** Certain clutches do not have the flexible tube type of lubrication for the release bearing: in these cases the nipple is screwed directly into the release bearing trunnion, and access to the nipple is obtained by releasing a plate on the top of the clutch housing.

### **EVERY 50 HOURS NORMAL CONDITIONS**

**Check Level of Battery Electrolyte.** Remove the battery vent plugs and, if necessary, top up with distilled water until the tops of the plates are just covered *Do not use a naked light to inspect electrolyte level.* Replace the vent plugs. If high charge rates are used or the battery is in a hot location more frequent attention may be required.

### **CLUTCH—ROCKFORD INDUSTRIAL TYPE (where fitted)**

**Lubricate Main and Pilot Bearings.** Lubricate the main bearings by applying the lubricant gun, filled with high melting-point grease to the nipple screwed into the outside of the clutch housing. Also, where appreciable lubricate the pilot bearing by applying the gun to the nipple which may be fitted either in the end of the drive shaft or half-way along the shaft.

### **EVERY 100 HOURS NORMAL CONDITIONS**

Repeat the items listed under 50 hour heading, plus the following:

#### **ENGINE**

**1. Change Engine Oil.** The drain plug is at the bottom of the engine sump. Drain when the engine is thoroughly hot, when the oil is warm and fluid, and thoroughly agitated. The impurities will then be in suspension and will be drained out with the oil (see page 16 for table of recommended lubricants).

**2. Drain and refill Injection Pump Cambox (6-Cyl. engines).** Remove the drain plug and allow the contaminated oil to drain off. Replace the drain plug. Remove the three screws securing the side cover to the pump, and refill the new engine oil until it runs out of the drain tube at the side of the pump. Replace the side cover.

On engines fitted with the Distributor type of fuel pump no routine maintenance is required.

**3. Drain and refill Injection Pump Cambox (4-cyl. engines).** Remove the drain plug from the bottom of the injection pump, and drain the oil. Replace the plug. Remove the side cover from the pump and refill with new engine oil until it runs out of the drain tube at the side of the pump. Replace the side cover.

**4. Check Oil Level in Mechanical Governor.** Remove the level plug from the end of the governor casing when the oil level, if

correct, will be at the bottom of the level plug hole. If the level is low, on C.A.V. governors fitted to in-line C.A.V. pump remove the breather cover, and on Simms governors the large plug at the top of the casing, and add engine oil until it drains out of the level plug hole. Replace all plugs and the breather cover.

**5. Lubricate Control Joints.** Using an oil can (filled with engine oil) lubricate the joints of the control from the engine speed control pedal/lever to the governor.

**6. Examine for Fuel Leaks.** Check the pipes and unions from the tank to the injectors. Take care not to twist the pipes when tightening any unions.

**7. Examine for Oil Leaks.** Tighten any joints that are leaking. If tightening does not stop the leakage, new gaskets may be required. It is advisable to keep the engine clean so that oil leaks can be detected as soon as they develop.

#### STANDARD BEDFORD GEARBOX (where fitted)

**Check Oil Level in Automotive Gearbox.** The level should be up to the bottom of the filler plug opening. Replenish, if necessary, with the correct oil (see page 16). Clean around the filler plug before removing it.

#### EVERY 200 HOURS NORMAL CONDITIONS

Repeat items listed under 50 hour and 100 hour headings, plus the following:

#### ENGINE

**1. Renew Lubricating Oil Filter Element.** The average life of the detachable element fitted to the AC oil filter is 200 hours, after which it should be renewed.

When this operation becomes due place a tray on the floor beneath the filter. Unscrew the bolt at the bottom of the filter and remove the shell complete with element, keeping it upright to avoid spilling the oil. Drain the oil from the casing and lift out and discard the element.

Thoroughly wash the inside of the filter head and shell to remove any sludge deposits. Remove the seal from the groove in the underside of the filter head and replace it with the new seal supplied with the element. Make sure the seal is located correctly and free from kinks.

Position the new element in the filter shell and bolt the assembly to the filter head. Ensure that the shell is located correctly and then securely tighten the bolt.

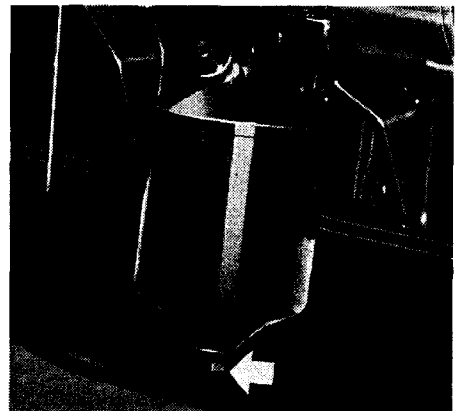


Fig. 1. AC lubricating oil filter

**2. Clean Engine Air Cleaner (Standard Type).** Slacken the clip securing the cleaner to the air intake and, where fitted, detach the rubber breather pipe. Lift the cleaner away, keeping it vertical to avoid spilling the oil.

Unscrew the finger-nut at the top of the cleaner and remove the cover and filter element. Rinse the element in clean paraffin and shake it to remove all traces of the paraffin. Drain the oil from the oil bath and clean out any sediment.

Refill the oil bath up to the indicated level with fresh oil (Viscosity SAE 50). Replace the element and before refitting the top cover, check that the gasket is in good condition. Finally, refit the cleaner by reversing the instructions given for removal.

**3. Clean Engine Oil Bath Air Cleaner and Pre-Cleaner (Heavy Duty Type).** Slacken the clip securing the centrifugal pre-cleaner to the main cleaner, and remove any dust or foreign matter from the side of the cowl and the vanes in the inlet tube.

Remove the detachable bottom element and oil container by releasing the four toggle clips fitted around the rim of the oil container. Lift out the element and rinse it in clean paraffin. When clean, allow the element to drain thoroughly. Drain the oil from the oil bath and, if necessary, remove any sludge which may have accumulated in the base.

Refill the oil container with fresh oil (Viscosity SAE 50) to the indicated level. Replace the filter element, and before refitting to the main body, see that the gasket is clean and sound.

Depending on operating conditions it will be necessary to periodically clean out the upper element which is attached inside the main body. To do this remove the main body from the engine and after dismantling the oil container and element, wash the main body in a container of clean paraffin, draining thoroughly before re-assembly.

**4. Check Tightness of Injector Pipe Clips.** With a screw driver check the tightness of the screws securing the clips to the pipes.

**5. Check Fan Belt Tension.** The tension can be checked by pressing a thumb on the belt midway between the fan and generator pulleys. A deflection of  $\frac{1}{2}$  inch (12 mm.) should be obtained with a load of 11 – 13 lb. (5 – 6 kg.) on the 4-cylinder engine, and 7 – 9 lb. (3.2 – 4.1 kg.) on the 6-cylinder engine, if however the engine is fitted with an alternator a deflection of  $\frac{1}{2}$  inch with a load of 5 – 7 lb. should be obtained. To adjust, slacken the three bolts securing the generator (there are two bolts at the front of the generator, one at the top, the other at the bottom; the one at the rear is at the top of the generator) and pivot the generator bodily away from or towards, the engine to tighten or slacken the belt respectively. When the tension is correct, tighten the securing bolts and then check the tightness of the bolt securing the slotted brace rod to the engine. Do not over tension the belt as this will impose a heavy load on the water pump and generator bearings.

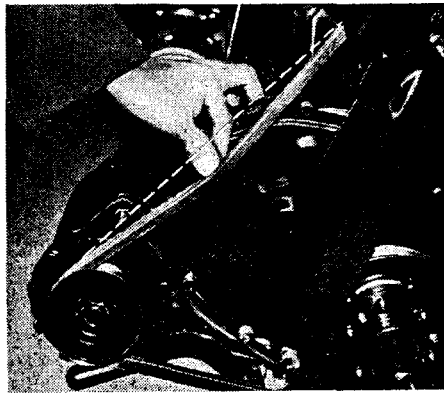


Fig. 2. Checking fan belt tension

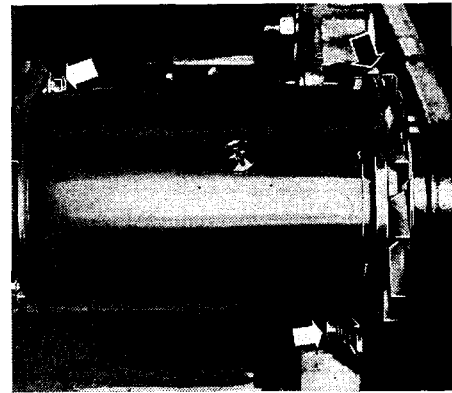


Fig. 3. Generator mounting points

**6. Check for Water Leaks.** Examine the cooling system for leaks from the radiator, heat exchanger, water pump and hoses. Tighten the hose clips if any connections are leaking, but do not overtighten.

**7. Check Engine Mounts for Tightness.** See that all nuts and bolts on the front and rear mounts are kept tight.

**8. Check Tightness of Exhaust System.** Check and tighten, if necessary, the nuts securing the exhaust pipe to the manifold, the silencer to its support bracket, and the tail pipe mountings.

## CLUTCH

**9. Check Clutch Fork Lever Free Travel (Bedford Automotive).** The fork lever should have  $\frac{3}{16}$  inch (4.7 mm.) of free movement at the outer end of the fork. If the free travel is reduced, clutch slip will follow inevitably.

**10. Check Clutch Adjustment (Rockford Industrial).** Regular attention to clutch adjustment is necessary to prevent slip, but the frequency of adjustment depends upon the application and usage of the clutch. When properly adjusted a 55 lb. (25 kg.) pressure is required at the end of the hand lever to engage the clutch, or torque on shaft of 110 lb ft.

If the clutch is slipping, or should the load upon the hand lever be insufficient to provide correct clutch operation, proceed as follows:

Remove the inspection cover and using a tommy bar, turn the adjusting ring in the required direction until a 55 lb (25 kg.) pressure is required at the end of the hand lever to engage the clutch. The adjusting ring should be stiff to operate; on no account apply lubricant to the pinion which acts as an automatic locking device. After adjusting the clutch replace the inspection cover.

*Note: In some applications an Allen screw is fitted to the adjusting ring to provide an additional lock. It must be unscrewed before adjustment is made, and re-tightened after adjustment, ensuring that it engages in a tooth space and not on the crest of the threads.*

## ROUTINE MAINTENANCE

RECOMMENDED LUBRICANTS			
<i>Unit</i>	<i>Ambient temperature Range</i>	<i>G.M. Spec.</i>	<i>Oil Grade</i>
Engine *	Above 90°F (31°C)	4712-M	SAE 30
Engine *	+90°F to +10°F (31°C to -8°C)	4706-M	SAE 20 or 20W
Engine *	+10°F to -10°F (-8°C to -24°C)	4705-M	SAE 10
Turbocharged Engines		Supplement 1	As above depending on ambient temperature
Standard Bedford Automotive Gearbox	Above 32°F (0°C)	4519-M	SAE 90
Standard Bedford Automotive Gearbox	32°F to -25°F (0°C to -31°C)	4592-M	SAE 80
Standard Bedford Automotive Gearbox	Below -25°F (-31°C)	—	SAE 80 plus 10% kerosene
Allison MT	See booklet PI/SE/6		Automatic Transmission Fluid Type 'A' Suffix 'A' SAE 10W
Borg-Warner Velvet Drive			Automatic Transmission Fluid Type 'A' Suffix 'A' SAE 10W
Parsons	Above 90°F (31°C)	—	SAE 30
	90°F to 10°F (31°C to -8°C)	—	SAE 20 or 20W
Paragon	Above 32°F (0°C)	—	SAE 30
	32°F to 0°F (0°C to -18°C)	—	SAE 20

\* Note the Engine Lubricating Oils must be to a minimum of British Defence Specification



# ROUTINE MAINTENANCE

CANTS AND CHANGE PERIODS			
<i>Oil temperature</i>	<i>Level Check</i>	<i>Oil Change Normal Operating Conditions</i>	<i>Filter Change Normal Operating Conditions</i>
—	DAILY	100 HOURS	200 HOURS
—	DAILY	100 HOURS	200 HOURS
—	DAILY	100 HOURS	200 HOURS
—	DAILY	100 HOURS	200 HOURS
—	50 HOURS	—	—
—	50 HOURS	—	—
—	50 HOURS	—	—
160°F to 180°F } Nor- (71°C to 82°C) } mal 300°F (149°C) Max.	DAILY	300 HOURS	300 HOURS
190°F } (88°C) } Max.	50 HOURS	End of Season	
—	50 HOURS	300 HOURS	300 HOURS
—	50 HOURS	300 HOURS	300 HOURS
250°F/(121°C) Max.	50 HOURS	200 HOURS	—
250°F } (121°C) } Max	50 HOURS	200 HOURS	—

m standard in accordance with U.S. Defence Specification MIL-L-2104A,  
fication DEF 2101 B.

## ROUTINE MAINTENANCE

---

### BEDFORD GEARBOX (WHERE FITTED)

**Check Gearbox Mounting for Tightness.** Check for tightness the four nuts which retain the gearbox to the engine.

### BATTERY

**1. Battery Terminals.** Keep the battery terminals clean; if they are corroded, scrape them clean and smear them with petroleum jelly. Make sure the terminals are tight, and that the batteries are dry on top and secure in their containers.

**2. Check Specific Gravity of Battery. Temperate Zone.** Check the specific gravity of the electrolyte in each cell with a hydrometer.

#### Specific Gravity readings at 80°F. (27.7°C)

Fully charged	..	..	..	..	1.281 – 1.266
Half charged	..	..	..	..	1.202 – 1.187
Discharged	..	..	..	..	1.111 – 1.098

The readings for each cell should be approximately the same. Any appreciable variation should be investigated promptly.

If electrolyte is spilled from the battery, it should be replaced by sulphuric acid solution, diluted to the same specific gravity as the acid in the cells, do not use naked light to check electrolyte level. For Tropical or Arctic operation specific gravity should be adjusted to Battery Manufacturers' recommendations.

### EVERY 500 HOURS

**Repeat items listed under the 50 hour, 100 hour and 200 hour headings, plus the following:**

#### ENGINE

**1. Renew Main Fuel Filter Element.** The main filter is of the paper element type, and under no circumstances must any attempt be made to clean the element. Instructions for renewing the elements, for both types of filters, are given below.

**AC FILTER.** Clean off all dirt and dust from the exterior surface of the filter and then unscrew the centre bolt at the top of the filter and remove the shell. Drain the casing and discard the element. Clean the casing with paraffin to remove any foreign matter. Remove the seal from the groove in the underside of the filter head and replace it with the new seal supplied with the element. Make sure the seal is located correctly and free from kinks.

Ensure that the small sealing washer in the underside of the filter head and the washer at the base of the centre tube are in position. Place the new element into the shell and securely bolt to the filter head. Then air vent the system (see page 23).

**C.A.V. FILTER.** As used with the In-Line Fuel Pump. Before dismantling the filter remove all dirt and dust from the exterior surfaces of the filter and then slacken the drain plug at the bottom of the filter housing to allow sediment or water trapped in the filter

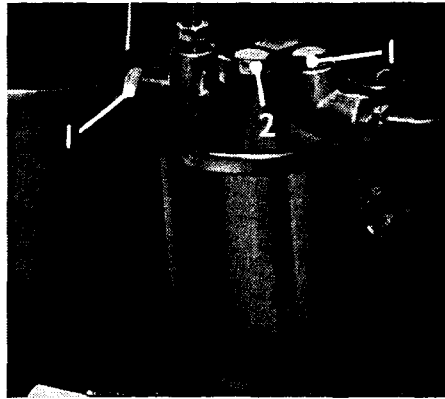


Fig. 4. AC fuel filter  
1. Air vent plugs. 2. Cover cap bolt

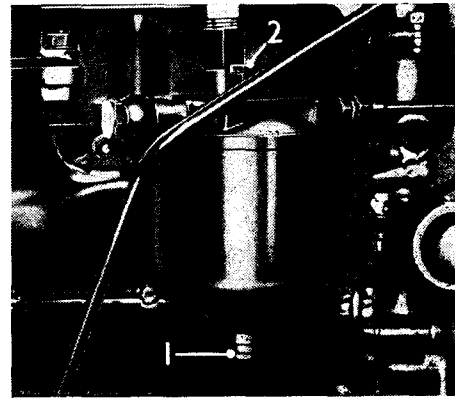


Fig. 5. C.A.V. fuel filter  
1. Drain Plug. 2. Air vent plug

to drain out. Unscrew the cover clamp bolt, remove the filter housing and discard the element.

Fit a new paper element complete with new sealing ring and re-assemble the housing using a new rubber gasket in the filter cover. Tighten the clamp bolt and then air vent the system (see page 24). The C.A.V. Filter as fitted on engines equipped with the C.A.V. distributor type pump. Before dismantling the filter remove all dirt and dust from the exterior surfaces of the filter.

Remove the centre bolt from the assembly, the unit will then be in three pieces, the filter head which is left attached to the engine, the filter element and filter base.

The design of the filter is such that the filter element forms part of the outer casing thus making it impossible to run the engine without the element being installed. Remove all sealing rings and renew with those supplied with the element. Re-assemble the filter assembly using the new element ensuring that all seals are correctly located, and free from kinks. Tighten centre clamp and then air vent the system (See page 24).

**2. Lubricate Generator Bearing.** With an oil can inject a few drops of engine lube oil into the generator rear bearing cavity.

**3. Check Tightness of Rocker Gear and Check Valve Clearances.**

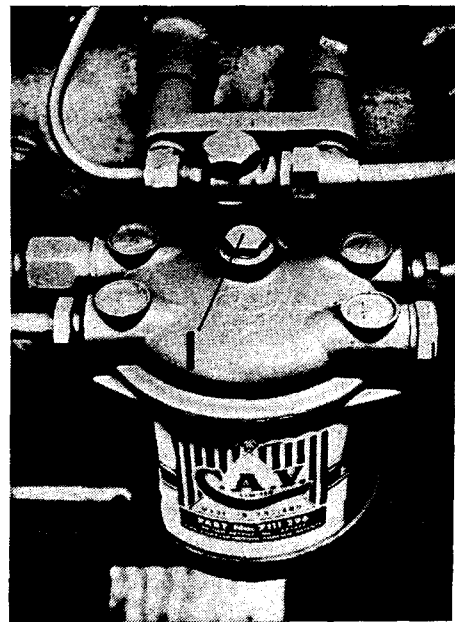


Fig. 6. Fuel filter as used with C.A.V. distributor type fuel pump.

1. Centre bolt element retaining.
2. Spare outlet plug.

## ROUTINE MAINTENANCE

To carry out these operations the engine must be thoroughly hot, and if it is not, it should be run at a fast idling speed for twenty minutes.

Start by removing the valve cover and checking the tightness of the rocker gear attachments to the cylinder head. Now check the clearances between the valve stems and rocker arms with the engine running slowly. Adjustment for valve clearance is provided by a screw and nut at the push rod end of each valve rocker. The correct clearance when the engine is hot is .013 inch for all valves.

Insert a .013 inch feeler gauge between the end of the valve stem and the rocker arm. Slacken off the adjustment locknut and turn the adjuster by means of a screwdriver until it is nipping the gauge; then slacken it off slightly until the gauge can just be withdrawn. Finally, tighten the locknut.

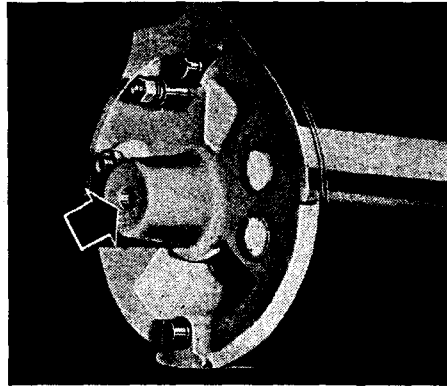


Fig. 7. Generator lubrication

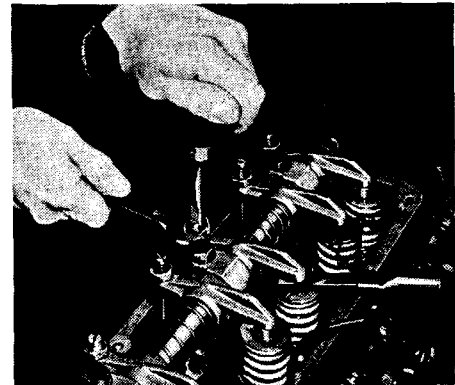


Fig. 8. Adjusting valve clearance

**4. Check Tightness of Inlet and Exhaust Manifolds.** With the engine thoroughly warm check the nuts securing the inlet manifold to the cylinder head, and the nuts securing the venturi to the manifold. Check all the nuts securing the exhaust manifold to the cylinder head.

**5. Check Operation of Injectors.** The injectors must be removed periodically from the engine to check their operation and, if necessary to clean and recondition them.

The period at which the injectors require attention depends on so many factors that it is impossible to quote one figure that will be satisfactory for all conditions, but in no case should the interval between checks exceed 500 hours.

Depending on the operating conditions, cleanliness and quality of fuel, etc. the injectors may require servicing at more frequent intervals; in general, frequent periods of idling is more detrimental to injector condition than continuous operation, but experience is the only guide.

The need for servicing makes itself apparent in various ways

and the following symptoms can be taken as evidence of the need for attention to the injectors.

- a) Black smoke from the exhaust.
- b) Loss of performance.
- c) Increased fuel consumption.
- d) Heavy "Diesel Knock" on one or more cylinders.
- e) Complete or intermittent misfiring.

When any of these symptoms are observed, the injectors should be removed and checked however short the time since the last check, as running with faulty injectors may be harmful to the engine. A quick method for locating a completely inoperative injector is by slackening off the high pressure pipe union nut of an injector while the engine is idling, thus cutting-out the injector. If, after slackening the union nut, the engine revolutions do not vary, it may be assumed that the injector is faulty. Do this with each injector in turn. This method will enable a quick diagnosis to be made but it should not be regarded as final proof. The only completely satisfactory means of testing is by removal of the injectors and testing on the special equipment developed for this purpose.

Full instructions for the testing and servicing of injectors used in the Bedford diesel engine are given in the Service Training Manual. Special tools, equipment, and trained personnel are required and if these are not available, you should let your Bedford dealer carry out the servicing of the injectors.

*Do not attempt to service any injectors without the proper tools, equipment and training.*

**6. Clean Exhauster Strainer.** (where fitted). This is mounted in the control block on top of the exhauster and can be withdrawn after removing the large hexagon-headed plug. Wash the filter gauze in clean paraffin and then shake it to remove all traces of paraffin. After replacing the filter and the retaining plug, start the engine and examine for leaks.

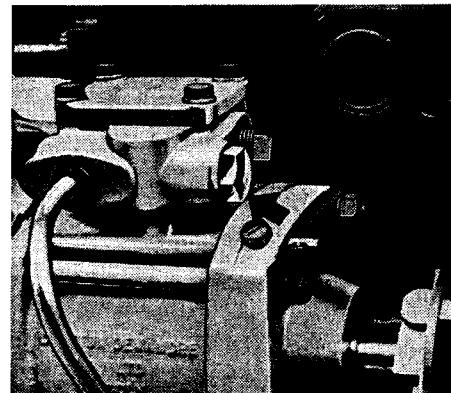


Fig. 9. Exhauster strainer

### EVERY 1,000 HOURS

Repeat items listed under 50 hours, 100 hours, 200 hours and 500 hours, heading, plus the following:

#### ENGINE

**1. Clean Oil Pump Strainer.** As this operation necessitates the removal of the engine sump we suggest that it is best to let your Bedford dealer carry out this work.

## **ROUTINE MAINTENANCE**

---

### **TURBOCHARGED ENGINES**

The turbocharger is a simple machine and should require no attention between major overhauls. Usually any deterioration in the performance of a turbocharged engine can be attributed to causes other than the turbocharger itself. A turbocharger runs at very high speed and in consequence the bearings require a constant supply of clean oil for lubrication and cooling. When starting the engine after an engine oil change, or whenever the oil supply has been disconnected for any reason, start engine at idle and allow it to run at this speed until such time as oil pressure is showing on the gauge, otherwise extensive damage may result to the turbocharger unit.

When operating an engine fitted with a turbocharger it is most important that the recommendations regarding oil changes and filter cleaning procedure be followed at the intervals specified on page 16, also check that no leaks have developed in the pipe connections between manifolds and turbocharger unit, a leak in these pipes can cause considerable loss of turbocharger efficiency. When changing the engine oil filter the strainer fitted to the turbocharger should also be removed and cleaned. The strainer is located in the oil inlet union on the turbocharger, this union must be removed in order to service the filter. When refitting the union ensure that the joint does not leak.

After every 1500 hours the unit should be serviced by a workshop which has the specialised equipment necessary for servicing turbochargers.

## FUEL SYSTEM

**EXCESS FUEL DEVICE.** This device allows more fuel to be made available to the engine when starting from cold. To operate it on the 6-cylinder engine, fitted with the "in-line" fuel pump pull the stop control bodily outwards. With the 4-cylinder engine push the shaft which protrudes through the stop control lever right up to the face of the lever. In each case this will set and hold the pump in the excess fuel position until the engine starts. Refer to cold start procedure (page 9).

**AIR VENTING THE FUEL SYSTEM.** Whenever the fuel pipe lines are disconnected such as when cleaning or renewing the filter elements, or if the fuel tank has been allowed to run dry, it will be necessary to air vent or bleed the system before attempting to start the engine. The air venting procedure is as follows:

ENGINES FITTED WITH A.C. FUEL FILTER & SIMMS "IN-LINE" FUEL INJECTION PUMP.

1. Slacken the off centre plug in the filter head and operate the priming lever on the fuel lift pump. Continue operating the lever until fuel, free from air bubbles, is discharged. Tighten the plugs as fuel is being discharged.

2. Slacken the plugs directly above the pump side cover, operate lift pump until fuel free from air is being discharged. Tighten screw as air free fuel is being discharged.

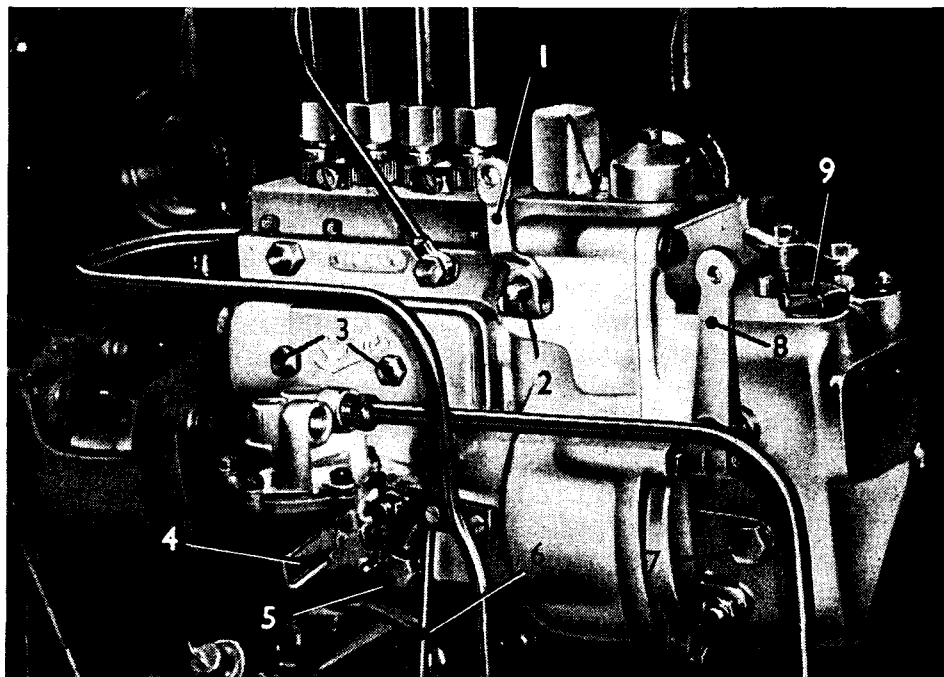


Fig. 10. Fuel injection pump—4 cylinder engine  
1. Stop control lever. 2. Excess fuel device. 3. Side cover bolts. 4. Fuel feed pump priming lever. 5. Drain plug. 6. Oil level tube. 7. Mechanical governor level plug. 8. Speed control lever. 9. Filler plug—mechanical governor

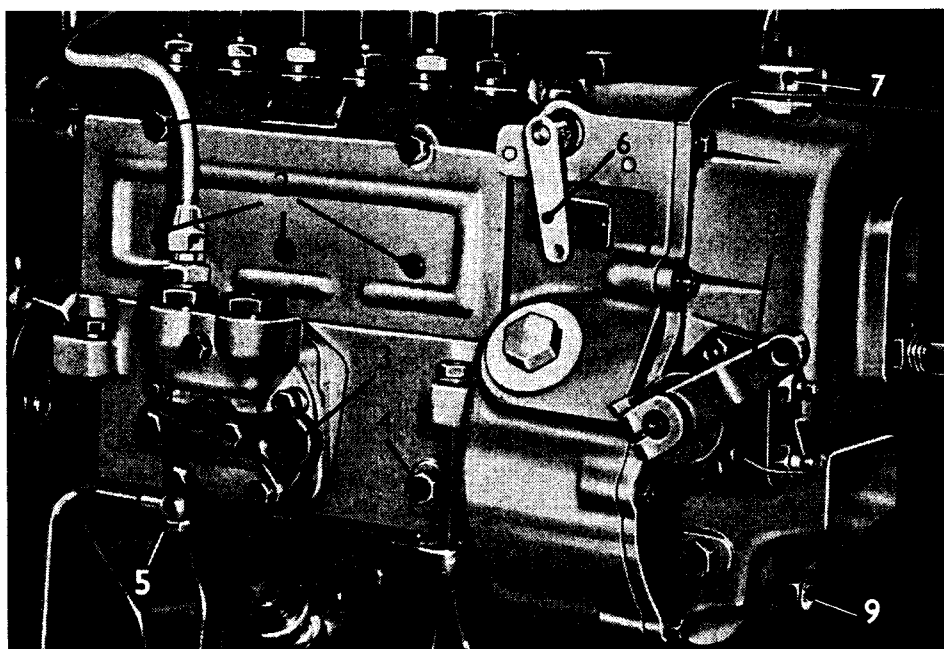


Fig. 11. Fuel injection pump—6 cylinder engine  
1. Air vent plugs. 2. Side cover screws. 3. Feed pump priming lever. 4. Pump drain plug. 5. Oil level tube. 6. Stop control and excess fuel device. 7. Breather and oil filler—mechanical governor. 8. Speed control lever. 9. Level plug—mechanical governor

### ENGINES FITTED WITH C.A.V. IN-LINE TYPE FUEL PUMP

1. Slacken the air vent plug at the top of the fuel filter.
2. Operate the priming lever of the fuel feed pump until fuel, free from air bubbles, is discharged from the air vent. Tighten the air vent plug as fuel is being discharged.
3. Similarly, slacken the two air vent plugs immediately above the fuel, injection pump inspection cover and operate the priming lever until fuel, free from air bubbles, is being discharged from the air vents. Tighten the air vent plugs as fuel is being discharged.

### ENGINES FITTED WITH C.A.V. DISTRIBUTOR TYPE FUEL INJECTION PUMPS

1. Slacken the spare outlet plug on the filter head and operate the fuel lift pump until air free fuel is discharged, tighten plug whilst fuel is still being discharged.
2. Slacken the banjo on the fuel pump which is attached to fuel pipe from filter, operate fuel lift pump until air free fuel is discharged, tighten banjo whilst fuel is still being discharged.
3. Slacken the vent valve fitted on one of the two hydraulic head locking screws, and the vent screw on the top of the governor housing. Operate the fuel lift pump until air free fuel is discharged. Tighten the housing vent screw and then the governor vent screw whilst air vent free fuel is still being discharged.



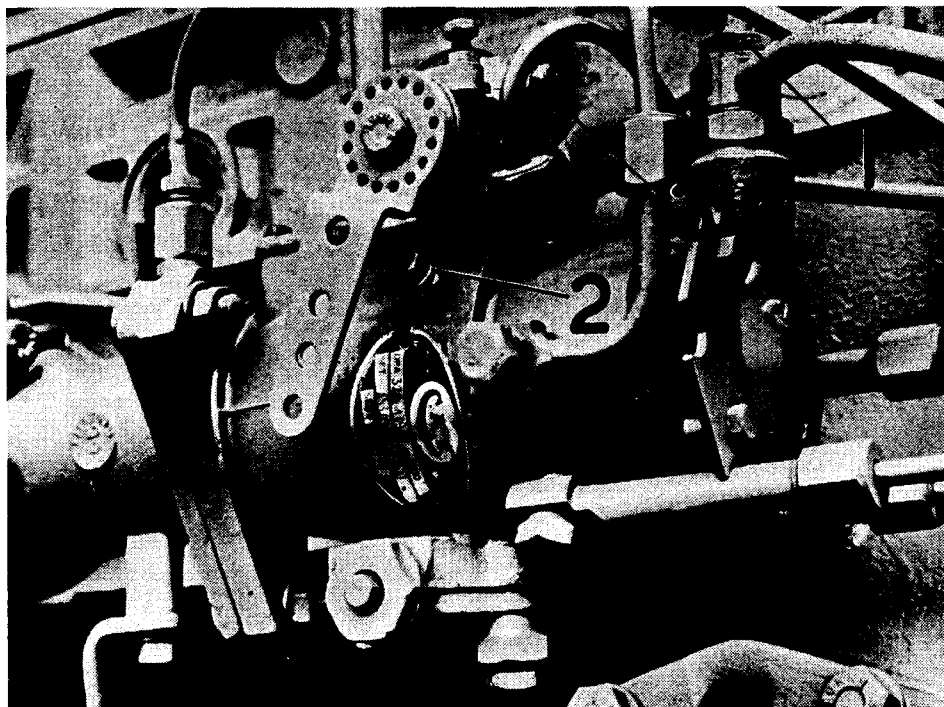


Fig. 12. C.A.V. distributor type fuel pump.

1. Banjo, fuel feed pipe.
2. Vent valve, hydraulic head locking screw.
3. Vent screw, governor housing

4. Slacken any two injector high pressure pipe unions at the injector end. Set the throttle to the fully open position and ensure the stop control is in the "run" position. Turn the engine with the starter motor until fuel free from air flows. Tighten unions whilst fuel is flowing. There is a possibility that the engine may start and run on 4 cylinders, if it should the throttle should be returned to idle position and injectors tightened as above.

**AIR INTAKE CLEANER.** Two types of air cleaner are available, namely the standard oil bath type and the heavy duty type. With the heavy duty cleaner a centrifugal air cleaner is combined with the oil bath to give an additional cleaning operation.

In each type of cleaner the incoming air impinges on the surface of the oil in the oil bath. Afterwards, there is another metallic mesh which is automatically kept moistened with oil. At intervals of 200 hours the filter should be cleaned and the oil bath refilled with fresh oil. (See page 14 in "Routine Maintenance").

**ENGINE SPEED GOVERNOR.** The engine speed is controlled by a C.A.V. governor on 6-cylinder engines and by a Simms governor

## **FUEL SYSTEM**

---

on 4-cylinder engines. There are two types of each make of governor available, one type being pneumatically operated, the other of the mechanical type.

**On the mechanical type of governor fitted to the in-line type fuel pumps, the oil level must be checked every 100 hours (see page 12).**

There is no routine maintenance required on the pneumatic governors.

## COOLING SYSTEM

Coolant circulation is by a centrifugal type pump driven by "V" belt from the crankshaft. A fan is mounted on the end of the water pump spindle.

A thermostat is embodied on the cooling system to enable the engine to warm up rapidly. While the engine is cold, the thermostat valve remains closed, thus by-passing circulation of the coolant through the radiator. When the coolant surrounding the block and head reached correct operating temperature the thermostat valve begins to open, thereby permitting normal circulation to take place.

*Note: When the thermostat is closed sufficient coolant is allowed to by-pass the valve to prevent the coolant from becoming locally overheated.*

**To drain.** To drain the cylinder block a tap is fitted in the rear left hand side of the cylinder block when viewed from the rear of the engine. To drain the complete cooling system the drain tap at the bottom of the radiator must also be opened, and radiator cap removed. (*Note if a cab heater is fitted this may need separate draining*).

**Overheating.** Overheating is usually indicated by boiling and loss of coolant. In such circumstances, never fill up right away with cold water as the sudden change of temperature may crack the cylinder head. Always allow the engine to cool down first.

Probable reasons for boiling are (1) topping up the radiator has been neglected, (2) coolant water has been lost from the drain taps or a faulty hose, (3) the fan belt may be too slack to operate the pump, (4) flow through the radiator may be restricted due to the use of dirty coolant, (5) Radiator core may be clogged with chaff or oily dust.

*Note: When the engine is hot remove the radiator filler cap slowly, to prevent scalding of hands.*

**FAN BELT REMOVAL AND REPLACEMENT.** To renew a fan belt, proceed as follows:

Slacken the generator bracket bolts and swing the generator inwards as far as it will go. Turn the engine over slowly and slip the belt over the generator, pump and crankshaft pulleys.

To replace the belt, reverse the foregoing operations. See page 14 for adjustment instructions.

**COOLANT PUMP.** Coolant circulation is maintained through the cooling system by an impeller which is driven by the belt encircling the crankshaft, coolant pump and generator pulleys. The impeller spindle runs in sealed ball bearings which require no lubrication. It is fitted with a self-adjusting gland to prevent coolant leakage.



Fig. 13. Cylinder block drain tap

## COOLING SYSTEM

---

**CARE OF THE COOLING SYSTEM IN WINTER.** To prevent damage to the engine due to the freezing of the water, a reliable anti-freeze solution should be added to the cooling system. We recommend that only ethylene/glycol type of anti-freeze be used. The use of an alcohol anti-freeze is not recommended as it lowers the boiling point of the coolant and causes high losses due to evaporation.

A 20 per cent solution of anti-freeze will safeguard a parked engine against cracking of the engine castings down to about 35° of frost (-3°F) or (-22°C).

Complete protection against the formation of ice crystals in the solution is afforded down to approximately 17°F., (-8°C) and the engine may be put to work immediately after starting up from cold without the fear of boiling.

From 17°F (-8°C) down to 7°F (-14°C) ice crystals form and the solution becomes mushy. Within this temperature range the engine can be started, but not put to work immediately after starting up from cold. To prevent any danger of boiling, the radiator should be covered and the engine run at a fast speed for at least five minutes before commencing work.

At temperatures below 7°F (-14°C) the solution will be sufficiently hard to prevent the water pump from rotating and no attempt should be made to start the engine. To avoid damage it will be necessary to thaw out the engine before starting it.

Where temperature conditions warrant it, a 30 per cent anti-freeze solution should be used. This will give complete protection against the formation of ice down to 5°F, (-15°C) and the engine may be put to work immediately after starting up.

A 50 per cent solution of anti-freeze will give complete protection down to a temperature of -30°F (-36°C).

**Note.—1** When topping up the cooling system, it is essential that only anti-freeze solution (of the correct strength) should be used. The use of plain water will dilute the solution in the system and reduce the degree of protection. Do not overfill the system.

**Note.—2** Do not forget to account for cabin heater circuits when determining the quantity of anti-freeze required.

Anti-freeze tends to loosen any rust from the water passages and the cooling system should be cleaned out to prevent this occurring.

After completing the cleaning process, but before filling with anti-freeze mixture, it is advisable to check the following: (a) water hoses for deterioration—renew if necessary; (b) water hose connections for tightness; (c) cylinder head nuts for tightness. Any leakage of anti-freeze solution past the cylinder head gaskets will result in a “gummed-up” engine and necessitate repairs.

When warm weather returns, the system should be drained and the process of cleaning and flushing repeated.

If a water filter is in circuit ensure the correct element is used for anti-freeze solutions.

## MARINE GEARBOXES

Gearboxes fitted to Bedford engines intended for marine use, consist of either 1 unit or 2 unit assemblies. The single unit assemblies are always the hydraulically actuated forward and reverse gearbox, where the output shaft rotates at the same speed as the engine crankshaft, although the direction of rotation can be selected. The second unit, when fitted is used to reduce the r.p.m. of the output shaft relative to the input shaft.

**PARSONS, DA AND "DA" MARINOMATIC:** the same grade of oil can be used as in the engines (see page 16). The forward and reverse unit can be filled through the filler which is situated on the top of gearbox close to the engine, the level being checked with the dipstick which is located on the left hand side when viewed from the rear of the gearbox. The gearbox oil is drained from the plug which is situated in the bottom of the gearbox directly underneath the filler. The oil should be drained and changed at the end of each season, or every 300 hours.

The reduction gearbox is filled with the same grade of oil as the forward and reverse gearbox, the filler is a hexagon plug on the top of the gearbox, the level is checked by removing a hexagon plug on the left side of the rear face, the level being correct when the oil flows from this hole, replace plugs before running the engine. The oil should be changed at the same time as forward reverse gearbox, the drain plug being situated at the lowest point on the casing.

**PARSONS HG4.** The basic instructions are very similar to the DA and DA Marinomatic for filling the units. An oil filter is fitted on the forward/reverse unit. This filter contains an easily replaced element which should be replaced every 300 hours or end of the season, whichever is sooner. When remote controls are fitted to Parsons Gearboxes they should be lubricated each month, keeping them in a free working condition.

**PARAGON:** Engine oil is used in the forward/reverse gearbox also in the reduction gearbox. The procedure to be followed when changing the oil, which should be done every 200 hours, is as follows. The drain plug for the forward/reverse unit is situated low on the right hand side when viewed from the rear, care must be taken to select the correct plug, there being two, the one closest to the engine being for lubricating oil, whilst the other is for the gearbox coolant. The reduction gearbox drain is situated underneath the reduction gearbox. To refill the gearbox remove the dipstick, filler which is found on the right hand side viewed from the rear. When the full mark is reached start the engine and allow to run on light load for three or four minutes, stop engine and recheck oil level and bring to full mark on the dipstick. Every 50 hours check oil level in gearbox, run the engine at idle speed for approx 2 minutes and check with dipstick. Before checking any oil level with a dipstick it should be wiped clean with clean lint-free rag.

**BORG-WARNER VELVET DRIVE:** The same oil is used to lubricate the reduction gearbox as the forward/reverse unit therefore only one filler and one drain plug are fitted.

When filling the Velvet Drive gearbox the correct grade of Transmission Fluid must be used, Automatic Transmission Fluid Type "A".

It is recommended that the Transmission Fluid be changed at the end of each season. When draining the transmission a container capable of holding the oil should be placed under the drain plug which is situated on the lower right hand side of the gearbox. The correct plug can be determined by observing the layout of pipes carrying the oil from the gearbox to the oil cooler attached to the gearbox, it will be noted that one pipe leads from the oil cooler to a point at the bottom edge of the gearbox. It will also be noted that immediately before this pipe enters the gearbox an elbow is fitted, it is at this point that the pipe must be disconnected, above the elbow will be noted a hexagonal union can be gripped with a spanner, to prevent damage to the pipe is another hexagon which must also be gripped with a spanner to prevent the pipe turning. After disconnecting the pipe the hexagon plug can be removed in the normal way, do not attempt to remove the elbow from the plug as this is a sealed joint. When the hexagon plug has been removed an oil strainer will be observed inside the gearbox, this must be removed and cleaned, before refilling the gearbox. To ensure complete draining of the gearbox the filler should be removed, this is located below the gear change lever on the rear left side of gear case. Replace the strainer, plug and reconnect the oil pipe from oil cooler to gearbox. When refilling or checking oil level in gearbox the oil filler plug dipstick assembly should be started in the thread of filler hole and given one turn, this will locate dipstick in correct position relative to the oil level. When gearbox is filled to full level start the engine and idle for 3 to 4 minutes, this will fill all oil passages in gearbox case, add oil to bring to full mark on dipstick. It is recommended that oil be checked after every 50 hours running.

When operating a vessel fitted with one of the above gearboxes care must be taken not to reverse the direction of gearbox without first reducing engine speed to below 1000 r.p.m.

## **STORAGE OF ENGINES, OR OUT OF SEASON LAY-UP**

The instructions for the lay-up marine units and other engines are very similar and can therefore be considered as one problem.

The procedures as laid out are for 6 months only and if storage period is for over 6 months these processes must be repeated.

1. All engines immediately prior to storage must have been run on inhibiting fluid, Shell RE 11, which ensures protection for the whole of the fuel system.

2. Drain engine oil from oil pan, and fill with oil, Shell Ensis 20 start engine and run at 1000 r.p.m. no load for 10 minutes.

### **3. IMPORTANT INJECTORS MUST BE SLACKENED BEFORE THE FOLLOWING OPERATION IS CARRIED OUT AND RETIGHTENED AFTER THE OPERATION.**

Insert a spray gun with a high pressure atomiser into the air intake elbow with the butterfly valve in the full open position, and spray oil into the cylinder bores whilst motoring the engine for a period of 20 seconds. Total amount of oil used should not exceed 0.05 pint per cylinder. (1 fluid ounce or approx. two tablespoonfuls).

4. Remove oil sump drain plug, and drain sump.

5. Seal the air intake and exhaust, also any other point at which air can get into engine or fuel system.

6. Drain the engine cooling system and refill with a 1 per cent solution of oil, Shell Dromus Oil B, drain this solution from the engine. The tap for draining the coolant is situated on the rear right hand side of the block, when viewed from the front of the engine, also the filler cap should be removed from the heat exchanger or radiator. If the unit is fitted with a radiator this must also be drained the tap being fitted at the bottom of the radiator.

7. Drain the oil from the in-line type fuel pumps.

8. The battery should be removed and stored in a dry place, care being taken not to allow the electrolyte to freeze, if the battery is kept charged however it is unlikely that it will suffer damage from frost. In the event of any doubt the advice of a reputable battery service agent should be sought.

9. The battery connection should be cleaned and smeared with grease to prevent corrosion.

10. Drain the raw water from the cooling system, to do this remove the heat exchanger drain plug. Viewed from the front of the engine the drain plug is the hexagon plug located on the end cap of cylindrical portion of the heat exchanger, a receptical should be placed such that the water can be collected. The raw water pump has no drain tap, and can only be drained by removing the end cover. The pump is situated on the left hand side of the engine mounting brackets, the end cover being retained with six screws.

### **PUTTING YOUR ENGINE BACK INTO SERVICE**

1. Fill the radiator or heat exchanger with fresh water.

2. Replace battery and connect leads to terminals, take care to

## **STORAGE OF ENGINES**

---

connect battery the correct way round also that the battery is fully charged when re-fitted.

3. Fill the engine sump with the recommended lubricant (see page 16).

4. Refill the fuel injection pump, if this is of the in-line type, with the recommended lubricant (see page 12, items 2 and 3).

5. On heat exchanger units, re-tighten the six screws which secure the raw water pump cover to the pump body.

6. Check for sufficient fuel in the tank.

7. Air vent the fuel system, for details of this operation, see page 23 and 24.

8. Start the engine as specified on page 9. The engine may not start at the first attempt as the fuel has to fill the pipes from the injection pump to the injectors.

9. On heat exchanger units, check that raw water flow has commenced or the raw water pump impellor will be damaged.

**AFTER 20 HOURS FROM STARTING.** The engine oil should be drained and refilled with an approved lubricant (See Page 16). The lubricating oil filter should also be changed.

In order to obtain the maximum serviceability from your GM Bedford Diesel engine the following books have been prepared.

Master Parts Catalogue BD. SP. 1 Price £1. 10 0d.

Service Manual BD. SE. 2 Price £2. 5 0d.

Both books are subject to an updating service which means that your book is never out of date. The books are available from your dealer or direct from the Power and Industrial Division whose address is on the inside cover of this booklet.

For normal routine servicing the only tools required are a set of A/F ring spanners, pliers, screwdrivers, and feeler gauges.