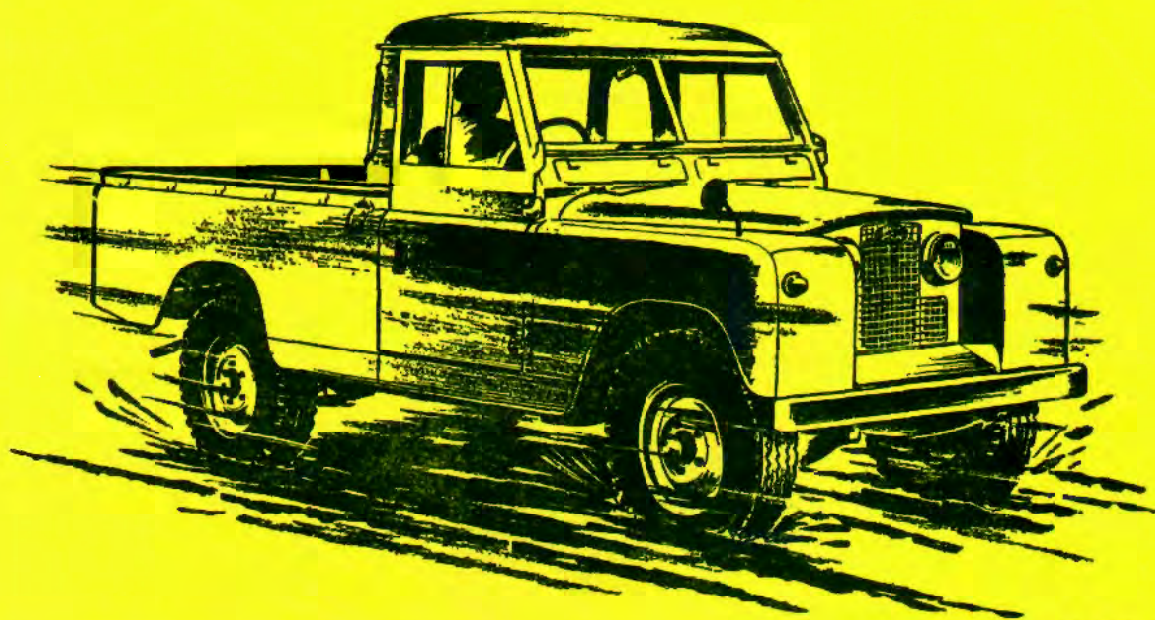


# INSTRUCTION MANUAL

## IMPORTANT

Attention is particularly drawn to the section in this book dealing with Recommended Lubricants on page E-40

## ROVER 2-LITRE DIESEL



Part No. 4205

**LAND-  
-ROVER**

SERIES II  
*88 AND 109*



# Instruction Manual

FOR THE

## Series II

# **LAND-ROVER 88 AND 109**

FITTED WITH THE

## **ROVER 2-LITRE DIESEL ENGINE**



# The Rover Co. Ltd.

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*By Appointment  
to Her Majesty  
Queen Elizabeth II*



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C 750



C 838

# Introduction

Every effort has been made in the design of the Land-Rover Diesel to reduce the amount of attention which the owner must devote to upkeep; this manual provides all the information necessary for periodic maintenance attention. All models are very similar in design, differences being noted at appropriate points in the text.

For ease of reference, the manual is divided into four distinct sections:—

Section A describes the driving controls and includes general information to assist in operating the vehicle to the best advantage.

Section B deals with all the maintenance items.

Section C provides information on all items of extra equipment available.

Section D gives details of the facilities offered by our Service Department.

Although the instructions have been made as simple and clear as possible, there may be occasions when the owner finds himself in some difficulty, in which case reference should be made either to a Rover distributor or dealer or direct to our Service Department (see Section D).

It is well to read this book carefully on receipt of the vehicle, particular attention being paid to the running-in instructions on Page E-14.

To those Land-Rover owners who are not familiar with diesel engines, a brief definition and description is given below.

The main difference between the normal petrol engine and the diesel engine is the method used to introduce and ignite the fuel.

Petrol engines use a carburetter to supply a mixture of petrol and air into the cylinder, where it is ignited by an electric spark.

Diesel engines draw only air into their cylinders, which is then compressed and the heat generated by high compression used to ignite a spray of atomised fuel supplied to the cylinder by injection pump and injector.

The diesel engine has certain advantages which may be summarised as follows:—

- (a) Higher thermal efficiency. This means in ordinary usage a more economical consumption figure for a given load.
- (b) The diesel engine pulls well over all its speed range and does not easily stall at low speeds.
- (c) The fuel is not dangerously inflammable, and as it does not evaporate gives increased fuel economy; particularly in hot countries where fuel loss due to evaporation can be high.

## THE ROVER 2-LITRE DIESEL ENGINE.

The Rover 2-Litre Diesel Engine is specially designed for use with the Land-Rover 88 and 109. It has the following features: Four-cylinder water-cooled engine flexibly mounted on rubber at four points, with wet detachable liners and with detachable cylinder head. Three crankshaft bearings; four camshaft bearings. Vibration damper on crankshaft integral with fan driving pulley. Overhead inlet and exhaust valves operated by roller tappets, push rods and rockers; camshaft is driven by duplex chain automatically adjusted by hydraulic tensioner. Lubrication is full pressure from gear-type oil pump to all bearings and valve gear. External full-flow pressure filter is fitted, with an intake filter on the oil pump.

Mechanical fuel pump with sediment bowl filter is operated by the camshaft, and feeds fuel through the CAV paper element type filter to the fuel distributor pump, mounted vertically on the engine.

The distributor-type pump forces fuel through high pressure pipes to the injectors. A spill pipe returns fuel back leakage, from injectors back to the tank, and from distributor pump back to the filter.

## GUARANTEE.

In order to obtain the Certificate of Guarantee for the vehicle, the guarantee form supplied should be filled in and returned by the owner or dealer; failure to return this form may seriously jeopardise any claim on the Company under the terms of the standard guarantee.

## VEHICLE SERIAL NUMBERS.

The vehicle serial number, comprising nine digits, will be found on the transfer box instruction plate on the dash panel over the gearbox cover. It is the same as the chassis number, which is stamped on the left-hand rear spring shackle bracket.

**The full vehicle serial number must be quoted in all correspondence; the registration number of the vehicle is of no use whatever to us.**

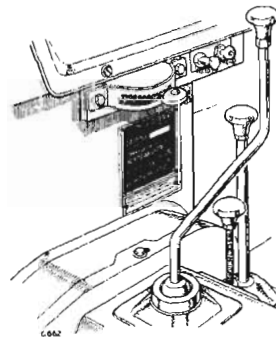


Fig. 1.  
Vehicle serial number.

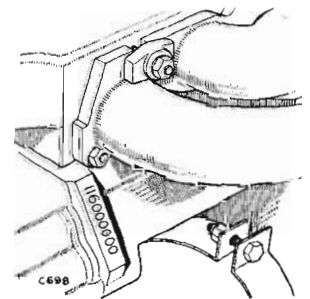


Fig. 2.  
Engine serial number.

The engine serial number, which need not be quoted in correspondence unless specifically asked for, is stamped on the left-hand side of the cylinder block at the front.

Other units bear serial numbers as detailed below, but they should not be quoted unless specifically requested:—

Gearbox number: Right-hand side of gearbox casing at rear.

Rear axle: On top of axle casing on left-hand side.

Front axle: On top of axle casing on left-hand side.

## NOMENCLATURE.

To cater for both right- and left-hand drive models, reference is made throughout the text to the "left-hand" and "right-hand" sides of the vehicle, rather than to "near-side" and "off-side". The "left-hand" side is that to the left hand when the vehicle is viewed from the rear; similarly "left-hand drive" models are those having the driving controls on the left-hand side, again when the vehicle is viewed from the rear.

In some instances the abbreviation "L.H.D." is used to denote left-hand drive and "R.H.D." for right-hand drive.

## FUEL LOG BOOK.

The attention of Land-Rover Diesel owners in Great Britain is drawn to the fact that they are under a legal obligation to keep records of all fuel used. The records, which must be kept in a permanent form and produced to any Officer of Customs and Excise on demand at any reasonable time, must show the following:—

- (i) the name and address of the supplier of the fuel
- (ii) the quantity and description of the fuel
- (iii) the date of receipt of the fuel.

A record must also be kept of the use of fuel in the vehicles, showing each day for each vehicle owned or used:—

- (i) the registration mark and number of the vehicle
- (ii) the date of the journey
- (iii) the quantity of fuel supplied to the vehicle
- (iv) the number of miles travelled by the vehicle on the journey or journeys on which the fuel was used.

Full particulars of owners' obligations in this respect are automatically supplied by the Customs and Excise on the registration of a diesel engine vehicle.

## SPECIFICATION.

It will be realised that from time to time alterations in design and in the make of various accessories occur and this instruction manual, while being kept up-to-date as far as possible, is not to be taken as a standard specification. The specification may be altered at any time, without incurring any obligation to incorporate such alteration in vehicles already delivered.

## GENUINE ROVER PARTS.

All Rover owners should recognize the importance which attaches to the use of only GENUINE ROVER PARTS or ROVER APPROVED PARTS when repair or maintenance work is being carried out on their vehicles.

Rover parts are produced to the same high standard as those parts built into the vehicle in its original production, and for this and other reasons it is in their interests that Rover owners should insist that only GENUINE ROVER PARTS or ROVER APPROVED PARTS are fitted to their vehicles.

THE ROVER CO. LTD.,  
SOLIHULL, WARWICKSHIRE,  
ENGLAND.

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## GENERAL DATA

### ENGINE

Bore	....	....	....	85,725 mm. (3.375 in.)
Stroke	....	....	....	88,9 mm. (3.500 in.)
Number of cylinders	....	....	....	4
Cylinder capacity	....	....	....	2,052 c.c. (125.17 cu. in.)
B.H.P.	....	....	....	52 at 3,500 R.P.M.
Maximum torque	....	....	....	87 lb/ft. (12 mKg.) at 2,000 R.P.M.
Firing order	....	....	....	1, 3, 4, 2
Tappet clearance—inlet	....	....	....	.010 in. (0,25 mm.)
"    "    —exhaust	....	....	....	.010 in. (0,25 mm.)
Valve timing (No. 1 exhaust valve peak)	....	....	....	106° B.T.D.C.
Number of crankshaft bearings	....	....	....	3
"    "    camshaft bearings	....	....	....	4
Vibration damper	....	....	....	Integral with fan driving pulley
Valve gear—inlet and exhaust	....	....	....	Overhead operated by roller followers, push rods and rockers
Oil pressure	....	....	....	50 to 60 lb/.sq.in. (3,5 to 4,2 kg./cm. <sup>2</sup> ) at 30 m.p.h. (50 k.p.h.) in top gear with engine warm
Lubrication	....	....	....	Full pressure
Oil filter—internal	....	....	....	Gauze pump intake filter in sump
"    "    —external	....	....	....	Full-flow filter
Mountings	....	....	....	Four-point rubber

### CLUTCH

Type	....	....	....	Single dry plate 9 in. (230 mm.) diameter
Operation	....	....	....	Hydraulic
Adjustment	....	....	....	$\frac{3}{4}$ in. (20 mm.) free movement at pedal pad

### MAIN GEARBOX

Type	....	....	....	Single helical constant mesh with synchro-mesh on top and third speeds
------	------	------	------	--

### TRANSFER BOX

Type	....	....	....	Two speed reduction on main gearbox output
Front wheel drive	....	....	....	Two/four wheel drive control on transfer box output

### PROPELLER SHAFTS

Type	....	....	....	Open type to both axles
------	------	------	------	-------------------------

### REAR AXLE

Type	....	....	....	Spiral bevel; fully-floating shafts
Ratio	....	....	....	4.7-1

### FRONT AXLE

Differential	....	....	....	Spiral bevel
Front wheel drive	....	....	....	Enclosed universal joints
Ratio	....	....	....	4.7-1

### GEAR RATIOS

Main gearbox	Top	Direct
	Third	1.377-1
	Second	2.043-1
	First	2.996-1
	Reverse	2.547-1

Transfer gearbox: .....	High transfer .....	1.148-1
	Low transfer .....	2.888-1

Overall ratio (final drive)		
	<i>In High Transfer</i>	<i>In Low Transfer</i>
Top .....	5.396-1	13.578-1
Third .....	7.435-1	18.707-1
Second .....	11.026-1	27.742-1
First .....	16.171-1	40.688-1
Reverse .....	13.745-1	34.585-1

### *INJECTION SYSTEM*

Injector pump .....

Distributor type, self-governing

Injectors:

Type .....

CAV Pintaux

### *FUEL SYSTEM*

Fuel pump .....

Mechanical with hand primer (high pressure type)

Air cleaner .....

Oil bath type

Fuel filters .....

Sediment bowl and gauze filter on mechanical fuel pump, CAV paper type filter

### *COOLING SYSTEM*

Type .....

Pump, fan and by-pass thermostat; pressurised.

### *ELECTRICAL SYSTEM*

Type .....

Positive earth

Voltage .....

12. Two 6 volt batteries in series

Battery capacity .....

120 A.H.

Charging circuit .....

Compensated current control

### *SUSPENSION*

Road springs .....

Semi-elliptic leaf

Hydraulic dampers .....

Telescopic; non-adjustable

### *BRAKES*

Foot brake—Land-Rover 88 .....

Hydraulic, 10" brake drums

    "    " —Land-Rover 109 .....

Hydraulic, 11" brake drums

Hand brake .....

Mechanical on transfer box output shaft

### *STEERING*

Type .....

Re-circulating ball. Variable ratio

    Straight ahead 15.6-1    Full lock 23.8-1

Front wheel toe-in .....

3/64 to 3/32 in. (1,2 to 2,4 mm.)

Camber angle .....

1½°

Castor angle .....

3°

Swivel pin inclination .....

7°

### *WHEELS*

Type 88 .....

16 in. well-base or divided

Type 109 .....

16 in. well-base

### *TYRES*

Pressures .....

See Page E-32

<i>CAPACITIES</i>	Imperial Unit	U.S. Unit	Litres
Engine sump oil	11 pints	13 pints	6
Extra when refilling after fitting new filter	2 pint	2½ pints	1,0
Air cleaner oil	1½ pints	2 pints	0,85
Main gearbox oil	2½ pints	3 pints	1,5
Transfer box oil	4½ pints	5½ pints	2,5
Rear differential	3 pints	3½ pints	1,75
Front differential	3 pints	3½ pints	1,75
Swivel pin housing oil (each)	1 pint	1.2 pints	0,5
Fuel tank	10 gallons	12 gallons	45
Cooling system	17 pints	20½ pints	9,75

<i>DIMENSIONS</i>	88 Basic		109 Basic		88 Station Wagon	
	British	Metric	British	Metric	British	Metric
Overall length	142¾ in.	3,62 m.	175 in.	5,33 m.	142¾ in.	3,62 m.
Overall width	64 in.	1,63 m.	64 in.	1,63 m.	64 in.	1,63 m.
Overall unladen height, hood up	77½ in.	1,97 m.	81 in.	2,06 m.	—	—
Overall unladen height, hood down, screen up	68 in.	1,73 m.	—	—	—	—
Overall unladen height, hood down, screen down	57½ in.	1,46 m.	—	—	—	—
Overall unladen height, with truck cab or hard top	76⅞ in.	1,95 m.	80½ in.	2,04 m.	77⅞ in.	1,98 m.
Wheelbase, 88 and 109 models	88 in.	2,23 m.	109 in.	2,77 m.	88 in.	2,23 m.
Track	51½ in.	1,31 m.	51½ in.	1,31 m.	51½ in.	1,31 m.
Turning circle (6.00-16 tyres)	38 ft.	11,6 m.	—	—	38 ft.	11,6 m.
Turning circle (7.00-16 tyres)	38 ft.	11,6 m.	—	—	38 ft.	11,6 m.
Unladen ground clearance, under differentials (6.00-16 tyres)	8 in.	203 mm.	—	—	8 in.	203 mm.
Unladen ground clearance, under differentials (7.00-16 tyres)	8¾ in.	222 mm.	—	—	8¾ in.	222 mm.
Maximum drawbar pull (dependent upon surface conditions)	1,200 to 2,000 lbs.	550 to 900 kg.	1,200 to 2,000 lbs.	550 to 900 kg.	1,200 to 2,000 lbs.	550 to 900 kg.
Internal body dimensions—length	43 in.	1,09 m.	72¾ in.	1,85 m.	43 in.	1,09 m.
—width	56⅞ in.	1,44 m.	56⅞ in.	1,44 m.	56⅞ in.	1,44 m.
—depth	19½ in.	495 mm.	19 in.	483 mm.	—	—
—height of wheel-arch	8½ in.	216 mm.	9 in.	229 mm.	8½ in.	216 mm.
—width of wheel-arch	13¾ in.	349 mm.	13¾ in.	349 mm.	13¾ in.	349 mm.
—width of floor	36¼ in.	921 mm.	36¼ in.	921 mm.	36¼ in.	921 mm.

# SECTION A

## DESCRIPTION *and* DRIVING INSTRUCTIONS

### CONTROLS AND INSTRUMENTS

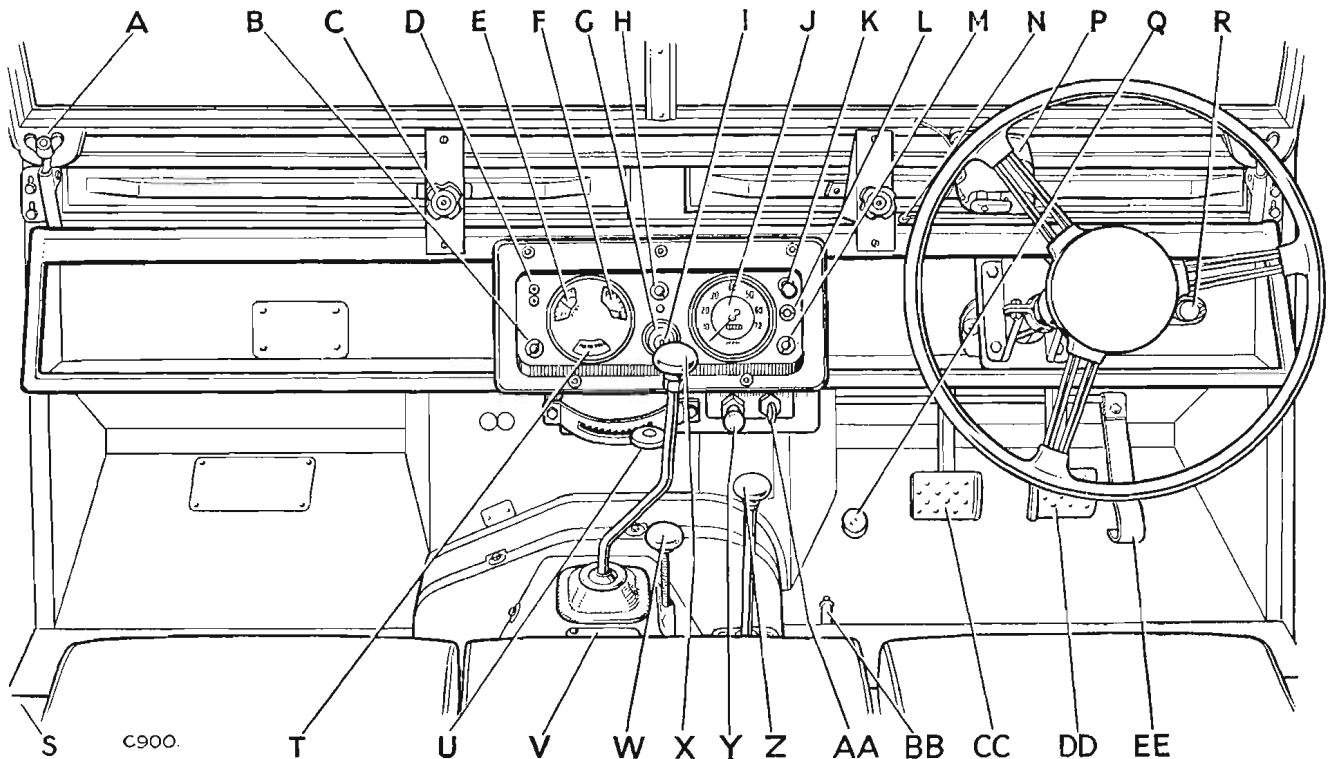


Fig. 3. Layout of controls and instruments.

- |  |  |  |
|--|--|--|
| <p>A—Wingnuts securing windscreen.<br/>           B—Oil pressure warning light.<br/>           C—Windscreen ventilators.<br/>           D—Lead lamp socket.<br/>           E—Ammeter.<br/>           F—Fuel level gauge.<br/>           G—Lamp switch.<br/>           H—Charging warning light.<br/>           I—Electrical services switch.<br/>           J—Speedometer.</p> | <p>K—Instrument panel light switch.<br/>           L—Fuel tank warning light.<br/>           M—Heater plug warning light.<br/>           N—Wiper lead plug.<br/>           P—Windscreen wiper.<br/>           Q—Headlamp dipper switch.<br/>           R—Horn button.<br/>           S—Access to tool locker.<br/>           T—Headlamp warning light.<br/>           U—Engine hand speed control.</p> | <p>V—Access to gearbox oil filler.<br/>           W—Front wheel drive control.<br/>           X—Main gear change lever.<br/>           Y—Engine stop control.<br/>           Z—Transfer box lever.<br/>           AA—Switch for starter and heater plug.<br/>           BB—Hand brake.<br/>           CC—Clutch pedal.<br/>           DD—Brake pedal.<br/>           EE—Accelerator pedal.</p> |
|--|--|--|

The controls and instruments are illustrated at Fig. 3; the layout is similar to that on a normal car, with the addition of transfer box and front wheel drive controls.

#### FOOT PEDALS

Pendent type, normal in operation.

#### ELECTRICAL SERVICES SWITCH AND KEY

The key is integral with the lamp switch in the centre of the instrument panel; turn the key clockwise for 'on.' The key is detachable.

Switching the key 'off' will not stop the engine as does the ignition key on a petrol-engined vehicle.

The engine will run with the key 'off', however it is essential to keep the key 'on' when operating the vehicle, to ensure normal functioning of the electrical equipment.

Remember to switch the key 'off' when the engine has been stopped.

The "Engine stop" control marked on the dash panel below the speedometer, must be pulled to stop the engine. See page E-12 for further details.

#### CHARGING WARNING LIGHT (Large Red).

The red warning light at the top centre of the panel appears when the dynamo fails to charge or the dynamo charging rate is low. It will glow when the electrical services key is switched on and the engine is stationary or running slowly and will go out when the engine speed rises.

#### STARTER AND HEATER PLUG SWITCH

Located on the dash below the instrument panel. To operate see Starting Procedure on Page E-12.

#### HEATER PLUG WARNING LIGHT (Amber).

The amber warning light at the bottom right-hand corner of the panel will glow when the heater plug switch is operated; this indicates that current is being passed through the heater plugs. If the warning light glows more brightly at any time, a short circuit in the system is indicated. No light will indicate an open circuit. This should receive attention at your nearest Rover Distributor or Dealer.



### *ENGINE STOP CONTROL.*

Marked "Engine stop" and mounted on the dash panel below the speedometer. See Page E-12 for operation.

### *FUEL TANK LEVEL WARNING LIGHT (Blue).*

The blue warning light fitted in the centre of dash is operated by the fuel level gauge and lights up when the fuel level drops below 1½ gallons (7 litres), and remains 'on' until the fuel supply is replenished.

Intermittent flashing may occur when cornering, before the fuel level drops below 1½ gallons.

This warning light is fitted to reduce the possibility of the driver inadvertently allowing the vehicle to run out of fuel. Should the fuel supply become completely exhausted at any time, the system must be primed as described on Page E-27.

### *OIL PRESSURE WARNING LIGHT (Green).*

The green warning light at the bottom left-hand corner of the panel glows when the engine oil pressure drops below a safe figure. It will light up when the engine is stationary and fade out when the engine starts and the oil pressure builds up to normal. See Page E-18 for further details.

### *HAND BRAKE.*

Protrudes through the front of the seat box. To release the brake, pull upwards slightly, depress the button in the top of the hand grip and push down as far as possible; to apply the brake, pull the lever upwards.

### *HORN.*

Operated by a push button mounted on an extension arm attached to the steering column.

### *AMMETER.*

The ammeter, in the multiple gauge, indicates the charging or discharging rate of the battery; usually a charge reading of three or four amperes will be shown.

When starting from cold, the charge reading will rise to a steady maximum, remain constant for a short while and then fall to a steady charge most suitable for the particular state of charge of the battery.

### *FUEL LEVEL GAUGE.*

The fuel level gauge, in the multiple panel, only operates with the electrical services switch 'on'. This gauge is not a precision instrument and cannot be used to derive fuel consumption figures; such tests must be made with an auxiliary tank of known size.

### *ENGINE SPEED HAND CONTROL.*

The engine speed hand control is situated below the instrument panel. See Page E-36 for further details.

### *INSTRUMENT PANEL LIGHT SWITCH.*

The push-pull switch controlling the panel lights, in the top right-hand corner of the panel, is only operative with the lamp switch at S or H.

### *WINDSCREEN WIPER SWITCH.*

To set the wiper in operation, pull out the blade lever, turn it to clear the switch lever and turn the latter through 90°. To park the blade, reverse these operations.

### *LAMP SWITCH.*

Turn the rotary lamp switch to the required position: OFF, S (side, tail and rear number plate lamps) or H (as S plus headlamps).

*NOTE.*—On North American vehicles, the side lamps are extinguished when the switch is moved to H and vice-versa.

### *HEADLAMP DIPPER SWITCH.*

Operation of the dipper switch, on the toeboard, replaces the primary filaments in both headlamps by secondary 'out-of-focus' filaments directed towards the near-side of the road.

### *HEADLAMP WARNING LIGHT (Small Red).*

The small red warning light at the bottom centre of the multiple gauge glows when the primary headlamp beams are in use; its purpose is to remind the driver to switch off or dip the headlamps on entering a brightly-lit area.

### *LEAD LAMP SOCKET.*

In the top left-hand corner of the instrument panel are a pair of sockets which can be used either for a lead lamp or trickle battery charger; the red socket is earthed.

### *MAIN GEAR CHANGE LEVER.*

See Page E-13 for gear changing instructions.

### *TRANSFER BOX LEVER.*

The lever controlling the two-speed transfer box is situated to the right of the gearbox cover; it must be pushed right forward for normal high ratio work. See Page E-13 for instructions on use of the transfer box.

### *FRONT WHEEL DRIVE CONTROL.*

Operation of the yellow knob, protruding from the gearbox cover, controlling the front wheel drive is described on Page E-13.

## STANDARD BODY FITTINGS

The following points on the Land-Rover may require explanation to ensure maximum utility from the vehicle.

### LOCKING THE VEHICLE.

To protect the vehicle against theft, the electrical services key should always be removed when parking.

When private locks and window catches are fitted, these should be secured when the vehicle is left unattended.

### BONNET.

The bonnet top panel is secured by a catch at the front.



Fig. 4.  
Bonnet fastener.

To open, press lever as far to the left as possible; then raise panel until the jointed prop can be pulled slightly forward at the joint.

The panel can be removed from the vehicle as follows:—

- (a) Withdraw one of the split pins securing the prop rod.
- (b) Slide the panel off the hinges on the dash.

### FRONT BUMPER AND REAR DRAWBAR.

Attached by bolts and readily detachable for attention to accidental damage.

### TOWING ATTACHMENTS.

An attachment bracket and towing jaw are supplied as standard equipment.

The towing jaw can be bolted directly to the centre of the rear chassis cross-member and can be used for towing a trailer or other equipment.

An alternative lower position is provided by fixing the attachment bracket to the centre of the rear chassis cross-member. The towing jaw can then be bolted to the two lower holes in the attachment bracket.

Alternative towing attachments are also available (see Section C).

### SEATS.

The fore-and-aft position of the driver's seat on the 109 model is readily adjusted by pushing to the left the lever at the left-hand side of the seat base and moving the seat into the most convenient position.

The seat cushion can be removed by lifting at the front and pulling forward. If the vehicle is parked during inclement weather without a covering, the back rests may be folded down on the seat cushions.

### TOOL STOWAGE.

Small tools are carried in the left-hand locker, under the seat cushion. Except on some special vehicles, the starting handle and lifting jack handle extension are secured in clips on the seat back-rest panel and are accessible with the seat backs lowered.

Also in the tool kit will be found a spare injector and washers and heater plug.

### WINDSCREEN.

On canvas covered vehicles only, provision is made for folding the windscreen down on to the bonnet.

### WINDSCREEN VENTILATORS.

The two ventilators in the windscreen frame may be opened independently by turning the knob anti-clockwise until each ventilator is open to the desired position. Use of the ventilators will be found advantageous when traversing dusty roads, as they greatly reduce the amount of dust blown into the vehicle from the rear. To close turn the knob clockwise.

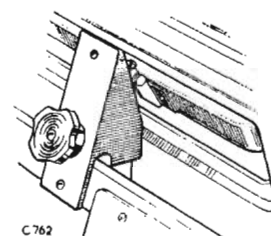


Fig. 5.  
Windscreen ventilator.

### TAILBOARD.

In the horizontal position, the tailboard is retained by two chains. To remove the tailboard completely, remove the split pin and plain washer from one of the hinges, unhook the chains and slide it off its hinges.

### SIDESCREENS 88.

The sidescreens are readily detachable after removing the securing nuts and washers.

### FUEL FILLER.

**ABSOLUTE CLEANLINESS IS ESSENTIAL WHEN FILLING WITH DIESEL FUEL.**

The fuel filler cap is located at the front right-hand side of the body.

To facilitate filling, when the cap is removed, a telescopic tube may be drawn out of the tank neck and locked by a slight anti-clockwise movement. The tank capacity is 10 Imperial gallons (45 litres).

If fuel oil has to be kept in drums or barrels they should be stored in a clean shed, with the outlet tap slightly higher than the other end, so that any water or sediment in the fuel will settle in the well thus formed.

Never tip the barrel to draw off fuel below the level of the tap.

Any good brand of diesel fuel oil is suitable for this vehicle.

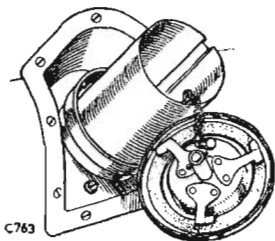


Fig. 6.  
Fuel filler.

### *RADIATOR FILLER.*

**NEVER RUN THE DIESEL ENGINE WITHOUT WATER—SEE PAGE E-30.**

Access to the radiator filler is gained by lifting the bonnet panel.

The cooling system is pressurised and great care must be taken when removing the radiator filler cap, especially when the engine is hot, to avoid steam which may be blown out with considerable force.

When removing the filler cap, first turn it anti-clockwise to the stop and allow all pressure to escape before pressing it down, and turning further in the same direction to lift it off.

The correct water level is to the bottom of the filler neck; the total capacity of the system is  $15\frac{1}{2}$  Imperial pints (8,8 litres).

**NOTE.** Use soft water wherever possible; if the local water supply is hard, rain or distilled water should be used.

## STARTING PROCEDURE

Before attempting to start the engine, read the following notes.

### WARNING

Do not run the diesel engine without water, not even for very brief periods, as the extremely high rate of heat transfer in the cylinder head can cause damage to the injection nozzles.

### ENGINE STOP CONTROL.

This control overrides the fuel supply metering valve located in the injection pump. When the control is pushed in fully, fuel is supplied via the distributor pump to the injectors. The fuel supply to the injectors is cut off by pulling out the control, thereby stopping the engine.

### STARTER AND HEATER PLUG SWITCH.

The switch, located on the dash below the instrument panel, gives a 'start' position, a 'heater plug' position and a combined 'start' and 'heater plug' position and operates as follows:—

1. When starting during cold weather turn the key 30° anti-clockwise to the first position, current can then pass through the heater plugs causing them to glow; this raises the temperature in the combustion chamber and assists starting from cold.  
The time taken to heat the combustion chamber depends on the air and engine temperature. For example, with a cold engine and an air temperature of 32°F. the key should be held in the first position for 30 seconds. The time required for any set of circumstances will be found with experience.  
Further movement of the key anti-clockwise to the second position will operate the starter motor and at the same time still allow current to flow to the heater plugs.  
As soon as the engine is running, release the key, which will automatically return to the upright position.
2. When starting with a warm engine, turn the key clockwise—this will immediately operate the starter but does not allow any current to flow to the heater plugs.  
As soon as the engine is running, release the key, which will automatically return to the upright position.
3. The starter switch key can be removed as a safety precaution.

### STARTING THE ENGINE.

1. Ensure that the main gear lever is in the neutral position.
2. Ensure that the transfer box lever is in the high ratio position, i.e., right forward.
3. Start the engine as follows:—
  - (i) Ensure that the engine stop control is pushed right in.

- (ii) Ensure that the engine speed hand control is in the inoperative position.
- (iii) Switch on the electrical services key.
- (iv) Depress the accelerator fully.
- (v) Operate the starter switch key either clockwise or anti-clockwise, depending on engine temperature. See above. As soon as the engine is running release the starter switch key.

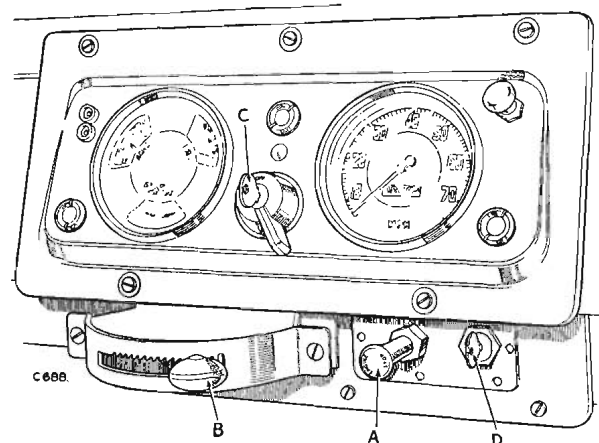


Fig. 7. Starter and heater plug switch.

- A—Engine stop control.  
B—Engine speed hand control at inoperative position.  
C—Electrical services switch.  
D—Starter and heater plug switch key.

Do not race the engine whilst it is still cold, for the oil has to become warm before it will lubricate the engine thoroughly.

If necessary adjust slow running with engine speed hand control to avoid stalling.

Should the engine fail to start after prolonged cranking, investigate and correct the cause before the batteries are run down needlessly.

### WARNING LIGHTS.

Like all mechanical devices the warning light systems are not foolproof and care should be taken that the systems do not become inoperative due to simple faults such as bulb failure. Check that the oil pressure warning light and the dynamo charging light come on when the electrical services key is switched on. The heater plug warning light can be checked by seeing if it glows when the heater switch is pressed.

To check the fuel tank warning light; remove fuel tank cap and filter and depress the level gauge float.

### STOPPING THE ENGINE.

To stop the engine pull the "Engine stop" control out. This cuts off the fuel supply to the engine. The electrical services key has no effect on the engine whilst running.



## GEAR CHANGING INSTRUCTIONS

### MAIN GEAR LEVER.

The positions of the main gear change lever are marked on the lever knob. It should be noted that the only reverse stop is a spring in the selector mechanism which tends to hold the lever away from the reverse selector shaft.

### GEAR CHANGING.

Gear changing on the main gearbox is carried out in the normal manner. Synchro-mesh gears are provided for changing from second to third, third to top and top to third and in these cases single de-clutching may be used; for all other changes, it is advisable to use the double de-clutch method.

Until experience is gained under differing operating conditions, the following speeds may be used as a guide when changing gear:—

	High ratio	Low ratio
First to second	5-8 m.p.h. (8-15 k.p.h.)	Within two or three vehicle lengths of starting.
Second to third	15 m.p.h. (25 k.p.h.)	6 m.p.h. (10 k.p.h.)
Third to top	20-25 m.p.h. (35-40 k.p.h.)	10 m.p.h. (15 k.p.h.)

### TRANSFER BOX LEVER.

The transfer box gives two ratios in the output from the main gearbox, termed 'high' and 'low', thus giving a total of eight forward and two reverse speeds in all. It is controlled by the lever to the right of the gearbox cover; this has three positions—right forward for high ratio, mid-way for neutral and right back for low ratio.

For normal usage and road work the lever should be in the high position. Low ratio is used when the vehicle is to be operated on heavy ground and for heavy pulling.

The neutral position mid-way between 'high' and 'low' is quite definite and is used with the power take-off for stationary work; the vehicle cannot be driven with the lever in neutral.

### TRANSFER GEAR CHANGING

Changing from HIGH to LOW transfer ratio should only be attempted when the vehicle is stationary. The engine may be left running, but the main gear lever must be in the neutral position. Depress the clutch pedal and pull the transfer box lever right back; release the clutch. Should there be any hesitation in the gear engaging, do not force the lever. With the engine running, engage a gear in the main gearbox and let in the clutch momentarily; then return the main gear lever to neutral and try the transfer control again.

Changing from LOW to HIGH transfer ratio may be accomplished at any time, regardless of vehicle speed. Release the accelerator pedal, depress the clutch pedal and push the transfer box lever right forward, pausing slightly in the neutral position; let in the clutch.

### FRONT WHEEL DRIVE CONTROL.

The vehicle may be operated in two-wheel or four-wheel drive as required; the drive to the front wheels is through a dog-clutch in the casing on the front of the transfer box, controlled by the yellow knob on the gearbox cover.

When operating the vehicle in HIGH transfer ratio, the drive is normally to the rear wheels only; should conditions call for drive on all four wheels, i.e., when traversing soft country or descending a steep, muddy gradient, the front wheel drive should be engaged by pressing down the knob on the gearbox cover. In order to regain two-wheel drive, on resuming hard surface travelling, stop the vehicle, engage LOW transfer ratio and return to HIGH transfer ratio, when the dog-clutch is automatically disengaged and the control knob returns to the 'up' position.

When operating the vehicle in LOW transfer ratio, four-wheel drive is automatically engaged at the same time as LOW ratio is selected; the front wheel drive is automatically disengaged on regaining HIGH transfer ratio.

## RUNNING-IN THE NEW VEHICLE

### *RUNNING-IN PERIOD.*

Progressive running-in of a new vehicle is of the utmost importance and has a direct bearing on durability and smooth running throughout its life.

The running-in period is 500 miles (750 km.), during which time 35-40 m.p.h. (55-65 k.p.h.) in high transfer ratio top gear should not be exceeded. The engine must not be allowed to labour at any time and full use should be made of the indirect gears to ensure that maximum accelerator travel is not used even to achieve 40 m.p.h. (65 k.p.h.) If the vehicle is used in low transfer ratio when new, 15 m.p.h. (25 k.p.h.) should not be exceeded in top gear. Corresponding maximum speeds should be used in the lower gears.

Thereafter, maximum speeds may be increased gradually, but the vehicle should not be driven at prolonged high speeds until it has done 1,000 miles (1,500 km.).

Never race the engine when cold at any time during the life of the vehicle.

### LUBRICATION AND FREE SERVICE.

Except under tropical or extreme winter conditions, it is recommended that the oil placed in the engine, gearbox and axles on initial assembly be used for the first 750 miles (1,000 km.), when it should be changed in accordance with the first service inspection detailed on the Free Service Card supplied with the vehicle.

Under the exceptional conditions stated, the oils should be changed on receipt of the vehicle to the correct grade and again at the free service stage.

A second service inspection is carried out by the dealer at 1,500 miles (2,500 km.).

### *SPARE WHEEL.*

On the Land-Rover 88, the spare wheel is carried behind the seat backrest and secured by a clamp and wing nut, it can also be fitted to the bonnet panel as an optional extra. (See page E-42.)

On the 109, fittings are available to secure the spare wheel, either in the rear body or on the bonnet.

### WHEEL CHANGING.

1. Slacken the double-ended wheel securing nuts.
2. Jack up the corner of the vehicle, fitting the jack under the road spring below the axle casing.

3. Remove the nuts and withdraw the wheel over the studs.
4. If available, place a drop of oil on the stud threads, to assist in subsequent removal.
5. Fit the new wheel, with the 'V' tread (if fitted) directed to the front at the top; tighten the nuts securely and lower the vehicle to the ground.

**WARNING.** Do not touch the outer ring of nuts on divided type wheels, unless the wheel is removed and the tyre fully deflated, or severe personal injury may result.

### FREE SERVICE INSPECTIONS.

Rover Distributors/Dealers will give your Land-Rover two Free Service inspections, any oil used being charged for. This Service is provided on new Land-Rovers sold direct by Distributor/Dealer to the user, on completion of the first 750 miles (1,000 km.) and again after the first 1,500 miles (2,500 km.).

With the literature supplied with each new vehicle there is included a 'Free Service Card' which details the items to be covered by each Service and two detachable Vouchers should be taken to the Distributor/Dealer as each Service becomes due.

The importance of regular and systematic maintenance cannot be too highly stressed and we strongly advise the Land-Rover owner to take advantage of these free service facilities which are offered by the Rover Organisation.

In the event of an owner residing some distance from the Rover Distributor/Dealer from whom the vehicle was purchased, it may be more convenient for him to have the two Free Service Inspections carried out elsewhere. Agreement can usually be reached with the 'vendors' of the vehicle to accept an Inter-Dealer charge at our agreed rates from another repairer for carrying out these services on their behalf, but the owner should confirm this arrangement with the 'vendors' of the car beforehand.

In the case of vehicles sold in the British Isles against a Home Delivery Order (for eventual export), it becomes necessary for the owner concerned to obtain the two Free Services from one of our Home Distributors or Dealers. The owner can obtain these facilities from any Rover Distributor or Dealer in the British Isles on presentation of the Service Vouchers. In these circumstances the Rover Company will accept responsibility for the labour charges involved at our agreed Inter-Dealer Rates on receipt of any invoice from the Distributor/Dealer. The oil used will be charged to the owner.

# SECTION B

## ROUTINE MAINTENANCE *and* REPAIR WORK

### SUMMARY OF POINTS REQUIRING MAINTENANCE ATTENTION

All items of regular or occasional maintenance are listed below in terms of mileage and operation hours which would apply in a temperate climate under clean working conditions. Climatic and operating conditions affect maintenance intervals to a large extent; in many cases, therefore, the determination of such intervals must be left to the good judgment of the operator, but the recommendations will serve as a firm basis for maintenance work.

If the vehicle is used almost exclusively in low transfer ratio or for stationary work, mileage is of no use whatever in deciding maintenance intervals; lubrication attention must then be based on operation hours.

To ensure that the correct procedure is followed as each item is dealt with, it is most important that attention be transferred in turn to the appropriate page as indicated. In addition, these notes concerning more frequent attention to certain important lubrication points should be read carefully to ensure long and efficient service from the vehicle.

**Engine.** Under severe conditions of mud or dust, the first and subsequent oil changes must be more frequent, even to the extent of a daily change. Under deep wading conditions through water carrying mud and grit, a daily oil change is essential.

**Air cleaner.** When the vehicle is used for dusty road or field work, attention must be more frequent and may involve a daily oil change; under extremely bad conditions, cleaning twice daily may be called for.

**Gearbox, transfer box, differentials and swivel pin housings.** It is essential to change oil much more frequently than indicated if the vehicle is operated under bad conditions, especially if deep wading is carried out.

**Propeller shafts.** Under tropical or severe conditions, particularly where sand is encountered, the sliding joints must be lubricated very frequently to prevent ingress of abrasive material.

**Fuel system.** ABSOLUTE CLEANLINESS IS ESSENTIAL WHEN DEALING WITH THE FUEL SYSTEM. Two filters are incorporated in the fuel system; they must both receive regular attention to ensure efficient running and to prevent damage to the distributor pump and injectors. The quantity of fuel and general operating conditions will determine to a large extent how often the filters need attention.

USE ONLY THE RECOMMENDED LUBRICANTS  
LISTED ON PAGE E-40.

### POINTS REQUIRING REGULAR ATTENTION

#### MONTHLY.

1. **TYRES.** Check tyre pressures. Inspect tyre treads (Page E-31).

#### EVERY SIX MONTHS.

1. Check headlamp beam setting (Page E-35).

#### EVERY 250 MILES (500 Km.) OR 10 OPERATION HOURS.

1. **ENGINE.** Replenish oil level in sump as necessary.

#### AT FIRST 750 MILES (1.000 Km.) OR 30 OPERATION HOURS.

1. Distributor or dealer will carry out the first service inspection as detailed on the Free Service Card.
2. Check fan belt tension. See Page E-30.

#### EVERY 1,000 MILES (1.500 Km.) OR 40 OPERATION HOURS.

1. **BATTERY.** Check acid level (Page E-34).

#### AT FIRST 1,500 MILES (2.500 Km.) OR 60 OPERATION HOURS.

1. Distributor or dealer will carry out the second service inspection as detailed on the Free Service Card.

#### EVERY 3,000 MILES (5.000 Km.) OR 120 OPERATION HOURS.

1. **FUEL FILTER.** See Note on next page under 12,000 miles (20.000 Km.)
2. **ENGINE.** Drain the sump and refill with fresh oil (Page E-18). Clean the breather filters (Page E-18).
3. **GEARBOX.** Replenish oil level as necessary (Page E-22). Remove the drain plug from the bell housing and allow any oil to drain away (Page E-23).
4. **TRANSFER BOX.** Replenish oil level as necessary (Page E-23).
5. **FRONT AND REAR DIFFERENTIALS.** Replenish oil levels as necessary (Page E-24).
6. **SWIVEL PIN HOUSINGS.** Replenish oil levels as necessary (Page E-24).
7. **STEERING BOX.** Replenish oil level as necessary (Page E-25).
8. **STEERING BALL JOINTS.** Check that the rubber boots on the steering ball joints have not become dislodged or the joint damaged. (See Page E-25.)
9. **PROPELLER SHAFTS.** Lubricate the sliding joints and journals (Page E-23).

11. AIR CLEANER. Empty, clean and refill the air cleaner (Page E-29).
12. WHEELS. Change round all wheels (Page E-32).

**EVERY 6,000 MILES (10.000 Km.) OR  
240 OPERATION HOURS.**

1. ENGINE. Renew the external oil filter element (Page E-18).
2. ENGINE. Clean the oil pump intake filter (Page E-18).

**EVERY 9,000 MILES (15.000 Km.) OR  
360 OPERATION HOURS.**

1. GEARBOX. Drain and refill with fresh oil (Page E-23).
2. TRANSFER BOX. Drain and refill with fresh oil (Page E-23).
3. FRONT AND REAR DIFFERENTIALS. Drain and refill with fresh oil (Page E-24).
4. SWIVEL PIN HOUSINGS. Drain and refill with fresh oil (Page E-24).

**EVERY 12,000 MILES (20,000 Km.) OR  
480 OPERATION HOURS.**

1. FUEL FILTER. Change paper element. (See Page E-28.) Remove and clean sediment bowl. (See Page E-28 and note below).

After the above operations it will be necessary to prime the fuel system. (See Page E-27.)

All Export Land-Rover Diesel models are fitted with an additional C.A.V. paper element type fuel filter (G in sketch) mounted on the engine side of the dash, in the pipe line between the fuel tank and the mechanical fuel pump. See Fig. 15.

This means that the bowl on the additional filter becomes the water trap, therefore when two C.A.V. filters are fitted, the sediment bowl on the mechanical fuel pump and second fuel filter (F in sketch) mounted at the front right-hand side of the engine will only need cleaning and the element changed every 24,000 miles (40.000 km).

The bowl of the filter mounted on the dash should be emptied and cleaned every 3,000 miles (5.000 km) and the paper element replaced every 6,000 miles (10.000 km).

If the amount of dirt and water collected when cleaning the bowl at 3,000 miles (5.000 km) appears excessive the element should also be changed; it will also indicate that more frequent checking of the filter bowl is required.

2. INJECTORS. Check operation of injectors and replace as necessary. (See Page E-21.)
3. FRONT AND REAR AXLES. Check tightness of U bolts and spring clips (Page E-25).
4. PROPELLER SHAFTS. Check tightness of securing bolts (Page E-24).
5. BODY. Check tightness of body securing bolts, wing bolts, etc.
6. DYNAMO. Lubricate (Page E-34).

**POINTS REQUIRING OCCASIONAL  
ATTENTION AS FOUND NECESSARY**

1. COOLING SYSTEM. Replenish water level (Pages E-11 and E-30). Adjust fan belt tension (Page E-30).
2. BRAKES AND CLUTCH. Replenish fluid level in supply tank. Make sure that the fluid level is just above the top of the inner reservoir (Page E-26).
3. GENERAL. Apply a few spots of oil to all exposed joints such as accelerator joints, clutch linkage, door locks and hinges, bonnet prop, etc. Inspect wiring and pipes for signs of chafing which might cause 'shorts' or leaks.
4. CLUTCH. Adjust free pedal movement (Page E-22).
5. ENGINE. Adjust tappet clearances (Page E-19).

**TOP OVERHAUL**

It is not possible to lay down a hard and fast rule concerning the mileage intervals at which the engine should be top overhauled and the valves ground in, for it is not actually necessary to carry out the operation until there is a 'fall-off' in performance.

The point at which this condition is reached will vary under different conditions of service and some difficulty may be experienced in detecting it. Should this be the case, seek advice from the nearest Rover distributor or dealer.

**EXTRA EQUIPMENT REQUIRING REGULAR ATTENTION**

Certain items of extra equipment (see Pages E-41 to E-45) require regular maintenance attention as follows:—

**EVERY 40 OPERATION HOURS.**

1. CAPSTAN WINCH. Replenish oil level as necessary Lubricate at nipples (Page E-44).

**EVERY SIX MONTHS.**

1. CAPSTAN WINCH. Drain and refill with fresh oil (Page E-44).



# LUBRICATION AND MAINTENANCE

## GENERAL INSTRUCTIONS.

One of the most important factors in the performance and durability of any vehicle is its lubrication. The responsibility for correct lubrication attention rests mainly on the driver; for this reason, the relative instructions set out in this section of the manual should be followed carefully.

The instructions are complete and any part of the vehicle not specifically mentioned does not require routine attention in this respect.

The recommended lubricants are detailed on Page E-40; as a result of exhaustive tests, they have been found pre-eminently suitable for Land-Rovers and should be used whenever possible. In the interests of smooth and economic running, heavier grade oil should not be used; when ordering oil, the correct grade, as well as the make, should be clearly stated.

## OIL ADDITIVES.

No responsibility can be taken for damage arising from the use of any additive to the recommended lubricants.

The oils selected are complete in themselves and afford every protection. A warning is necessary against the addition of any oils or other products, as these may materially impair the character of the lubricant in use.

## ENGINE

### ENGINE OIL CONSUMPTION.

The Rover Company feels that there are many owners who may not be fully aware of certain changes which have come about in engine design and manufacturing technique, and the characteristics of modern engine lubricants.

The Rover Company, in common with other manufacturers, expects from a new engine a definite consumption of engine oil.

It is usually a characteristic that in the early life of an engine the consumption of oil will be higher than subsequently, and it is quite normal for consumption figures to improve up to and even beyond 6,000 miles (9.600 Km.).

The reason for the heavier consumption when new is that as the piston rings bed in so is the consumption reduced. This consumption of oil in the early stages of the engine's life is a desirable characteristic, aiding as it does the effective running in of pistons, rings and cylinder bores, resulting in subsequent longevity.

It should also be realised that with the trend towards modern thinner lubricants, which is in itself a highly desirable feature, there may be some tendency for the consumption also to be slightly increased.

Owners when checking oil consumption should make quite sure that the check is made with the engine cold and the vehicle standing on level ground, otherwise a false reading may result.

Over-filling an engine with lubricating oil has no advantages and can quite easily result in a loss of lubricant, giving a completely misleading impression.

It is also unnecessary to top-up oil in the sump for every half-pint (0,25 litre) that may be consumed, but topping-up should not be delayed after the oil level has, or is likely to reach in the course of current running, the low mark on the dipstick.

## ENGINE LUBRICATION.

### OIL LEVEL.

Since a certain amount of oil may be used up in proper operation of the engine, the oil supply must be replenished at intervals, in addition to periodic oil changes.

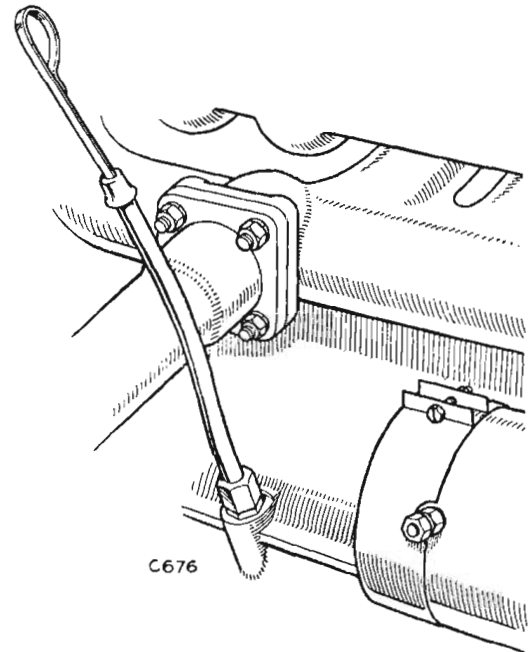


Fig. 8. Engine dipstick.

The oil level dipstick on the left-hand side of the engine, accessible when the bonnet panel is raised, carries two marks, H (High) and L (Low). The oil level must be maintained as near the H mark as possible and must never fall below the L mark. The oil filler is on the right-hand side of the engine. (See Fig. 8.)

To check the oil level, proceed as follows:—

Stand the vehicle on level ground and allow a few minutes for the oil to drain back into the sump from the valve gear, etc. Withdraw the dipstick wipe it clean, re-insert to its full depth and remove a second time to take the reading. Add oil as necessary; never fill above the H mark, as the engine may then require more frequent decarbonisation.

## OIL PRESSURE.

The oil pressure warning light on the instrument panel will glow, when, for any reason, the pressure drops below 10 to 12 lb./sq.in. (0,7 to 0,8 kg./cm.<sup>2</sup>). It will light up when the engine is stationary and will go out when the engine has started and the oil pressure has built up to exceed this figure.

**NOTE:** The light may flicker when the engine is running at idling speed, but providing it fades out immediately the engine is speeded up, the oil pressure can be considered satisfactory.

Should the warning light appear at any time when the engine is running above idling speed, stop the engine immediately and investigate the cause; usually it will be due to low oil level in the sump, or occasionally, to a choked oil pump intake filter.

## ENGINE OIL CHANGES.

When the vehicle leaves the factory, engine oil of a grade suitable for a temperate climate is in use.

Except under tropical or extreme winter conditions, the first engine oil change should be made at 750 miles (1.000 km.) or 30 hours; under such conditions the oil should be changed to the appropriate grade immediately upon receipt of the vehicle and then changed again at 750 miles (1.000 km.) or 30 hours.

Thereafter the oil must be changed at regular intervals (see Page E-15).

To change the engine oil, proceed as follows:—

Run the engine to warm up the oil, stop the engine by operating engine stop control and remove the drain plug in the right-hand side of the sump. Allow time for the oil to drain away completely and replace the plug.

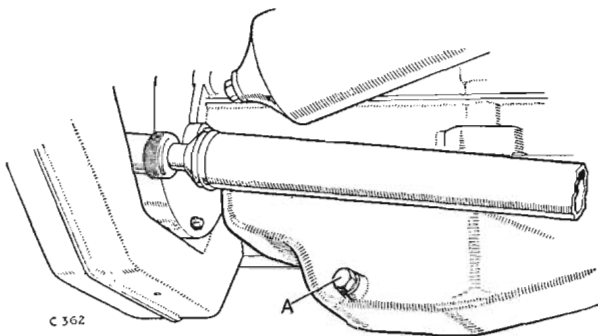


Fig. 9. Engine sump drain plug.  
A—Drain plug.

Refill with oil of the correct grade through the filler at the right-hand side of the engine; the capacity is 11 Imperial pints (6 litres).

## OIL FILTERS.

In addition to the gauze pump intake filter in the sump, the oil is cleaned by means of a full-flow pressure filter mounted externally on the engine.

The gauze filter on the pump must be cleaned and the element of the full-flow filter renewed at regular intervals (see Page E-16). Both filters can conveniently receive this attention at a routine oil change.

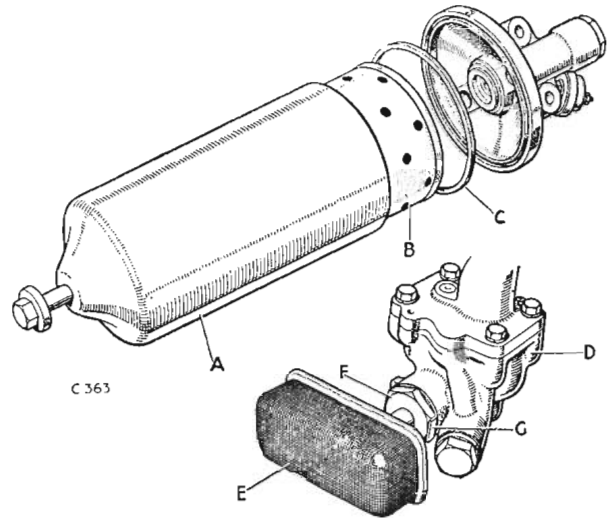


Fig. 10. Engine oil filters.

A—Container    D—Oil pump.    F—Nut for filter gauge  
B—Element    E—Filter gauze.    G—Locker for nut.  
C—Gasket.

To clean gauze filter remove the sump and dismantle filter from pump. Wash filter in petrol and clean with a stiff brush then refit to pump.

Clean sump with petrol and replace.

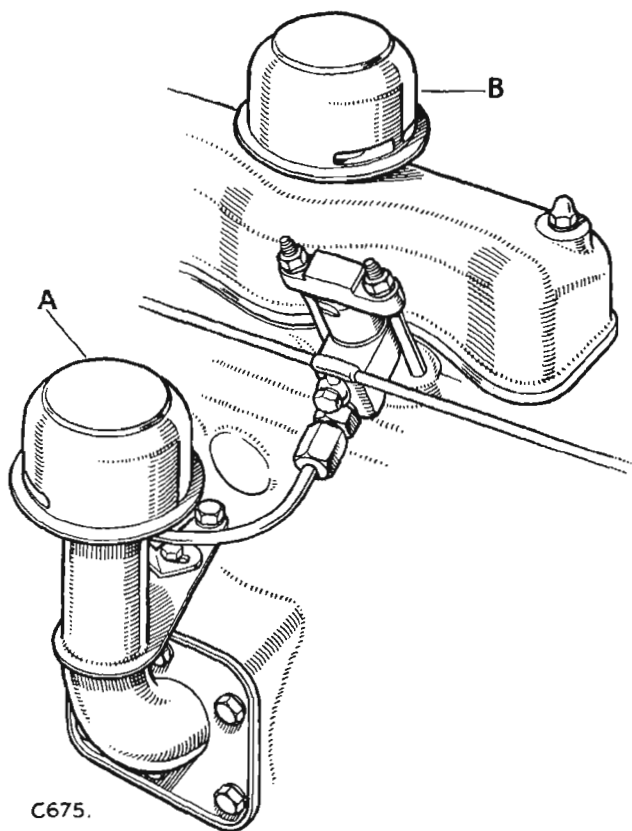
To remove the full-flow filter element located on the right-hand side of the engine: Place oil tray under filter. Unscrew the bolt in the bottom of the filter container and remove the container complete with the filter element. Remove and discard the used filter element and large rubber washer. Wash the container in petrol. Place the new filter element in the container and reassemble the unit using the new large rubber washer supplied with the element. Ensure that all the sealing washers are in position and intact and that the container is correctly located in the top cover.

Refill with correct grade of engine oil and run engine for five minutes, then check for leaks. Check oil level and replenish if necessary.

## ENGINE BREATHER FILTERS.

The oil-wetted gauze filters fitted to the top rocker cover breather and oil filler pipe should be cleaned at regular intervals (see Page E-15) in the following manner:—

Remove the filters and wash the gauze thoroughly by swilling the units in a dish of petrol. Re-wet the gauzes by dipping in clean engine oil and shake off the surplus; replace the top filter with the slot facing forward and the bottom filter with the slot facing the rear of the vehicle.



C675.

Fig. 11

Engine breather filters.

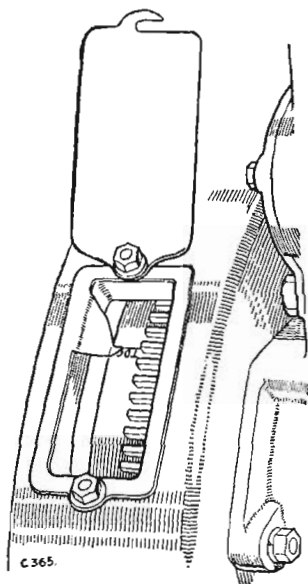
A—Oil filler filter.

B—Top rocker cover filter.

### ENGINE TIMING.

#### FLYWHEEL MARKINGS.

Injection and valve timing is based on markings on the engine flywheel which are visible, adjacent to a pointer, under the inspection cover on the right-hand side of the flywheel housing.



C365.

Fig. 12.

Flywheel markings.

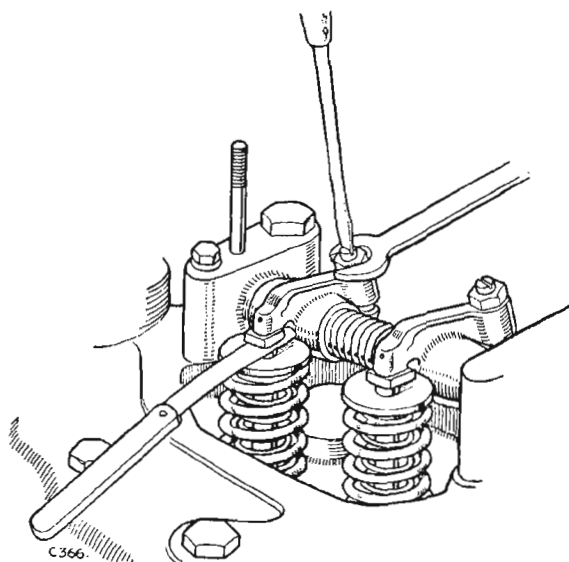
The markings and their meanings are as follows:—

1. The line against which the letters T.D.C. are stamped, when brought opposite the pointer, indicates that No. 1 (front) piston is at top dead centre, i.e., at the top of its stroke.

2. The line against which the letters SI are stamped, when set opposite the pointer, indicates the injection-point of No. 1 cylinder, i.e., the position at which injection starts.
3. The line against which the letters E.P. are stamped, when set opposite the pointer, indicates the point at which No. 1 exhaust valve should be at the peak of its lift (fully open). It is 106° before T.D.C. (29½ flywheel teeth).

### TAPPET ADJUSTMENT.

It is most important that tappet clearances be maintained at the correct figure and adjustment is therefore provided on each valve rocker. If anything less than the correct clearance is used, a fall in power output will follow, while greater clearance will mean noisy tappets.



C366.

Fig. 13. Tappet adjustment.

The correct clearance is .010 in. (0.25 mm) on all valves, with the engine either cold or at running temperature. The cylinder firing order is 1, 3, 4, 2.

To carry out tappet adjustment, proceed as follows:—

1. Rotate the engine in the running direction until the valve receiving attention is fully open, and then move the engine one complete turn, to bring the tappet on to the back of the cam.
2. Check the tappet clearance with a feeler gauge. If adjustment is required, slacken the locknut and rotate the tappet adjusting screw until the clearance is correct; re-tighten the locknut, taking care to ensure that this operation does not upset the clearance.
3. Repeat for the other valves in turn.

### DISTRIBUTOR PUMP.

This unit is correctly set on leaving the factory and requires no further adjustment. It is lubricated by the diesel fuel and does not require any maintenance in this respect.

Should any trouble be experienced with the distributor pump, consult your nearest CAV Agent.

If for any reason the distributor pump has been removed, it must be refitted and timed as follows:

1. Turn the crankshaft in direction of rotation until the mark 'SI' on flywheel is in line with pointer on flywheel housing and both valves of No. 1 cylinder are closed.
2. Remove the rear inspection cover from distributor pump and rotate the spindle in direction of rotation until the line marked 'A' on the driving plate aligns with mark on timing ring.
3. Offer the pump to engine with fuel inlet connection rearward and engage in the splined drive.

Observe the markings through inspection aperture in distributor pump—using a mirror—and make any final necessary adjustment by turning the distributor pump body to align timing marks.

4. It is very important that the injection pump is timed as accurately as possible. Two or three degrees retardation can cause excessive white smoke when starting from cold and running at light load. Two or three degrees advance can cause excessive black smoke at low speed full load.

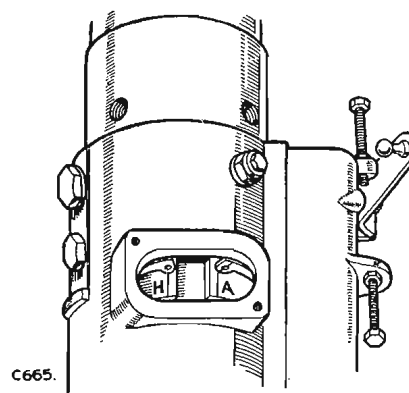


Fig. 14. Distributor pump timing marks correctly aligned.

The timing must be checked by turning the engine until the timing marks on the pump are dead in line and then checking the timing marks on the flywheel. In this way any slight error is magnified by the 2:1 ratio of camshaft to crankshaft and the large diameter of the flywheel. An error of a given width on the pump markings will be 12 times that width if transferred to the flywheel.

5. Tighten pump down and re-check setting. Replace inspection cover on pump and flywheel housing.
6. Prime the fuel system as detailed on page E-27.

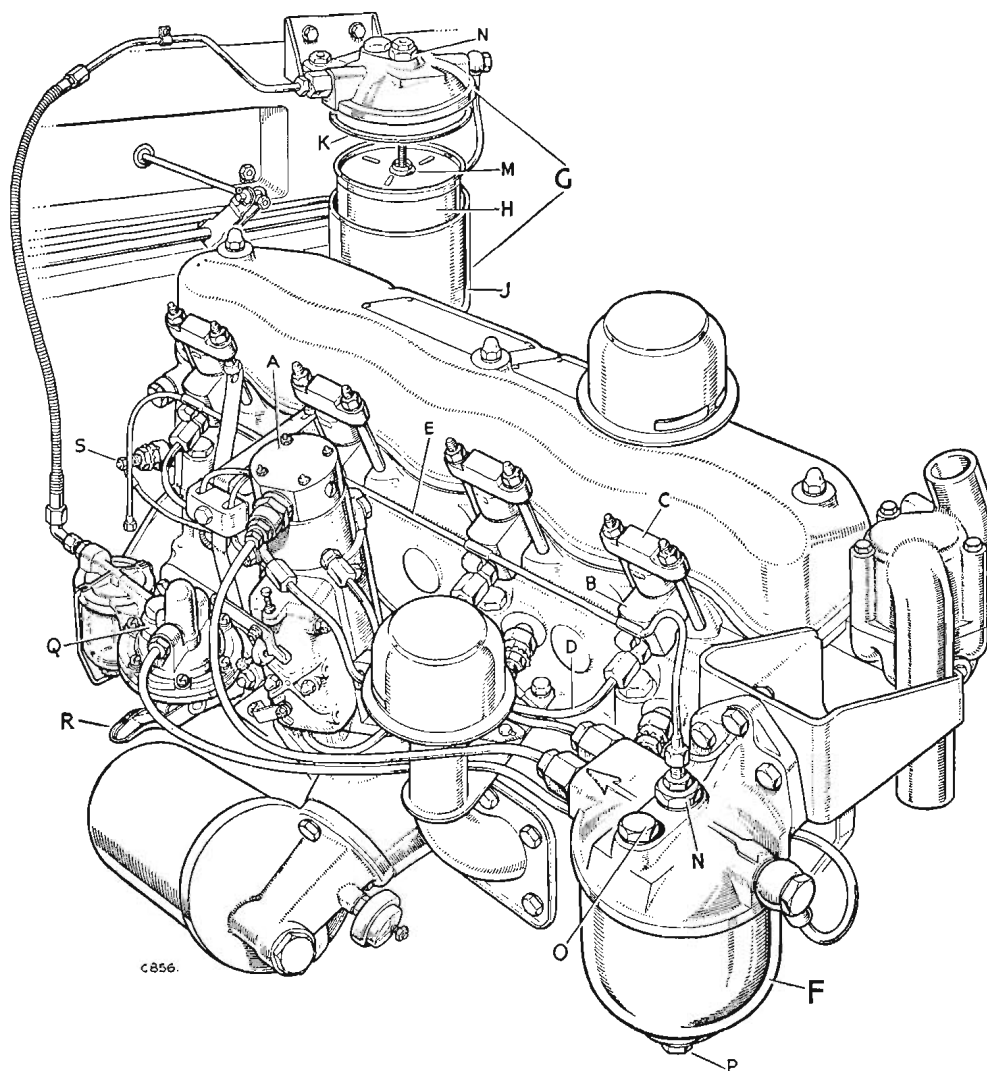


Fig. 15.

Layout of distributor pump and injectors

- A—Distributor pump
- B—Injector
- C—Clamp bar
- D—Feed pipes
- E—Spill pipes
- F—Fuel filter at engine
- G—Fuel filter at dash
- H—Element
- J—Container
- K—Large washer
- M—Small washer
- N—Retainer nut
- O—Air vent plug
- P—Drain plug
- Q—Mechanical fuel pump
- R—Hand priming lever
- S—Heater plug

## FUEL INJECTORS.

ABSOLUTE CLEANLINESS IS ESSENTIAL WHEN HANDLING FUEL INJECTORS.

The Pintaux injector nozzle used on the Land-Rover Diesel engine has an auxiliary spray hole to assist easy starting under cold conditions.

At engine starting speeds the needle valve is not lifted sufficiently to clear the pintle hole and the fuel is discharged through the auxiliary hole. At normal running speeds increased pressure in the fuel system raises the needle valve sufficiently to allow the bulk of the fuel to be discharged through the main spray hole for general running conditions.

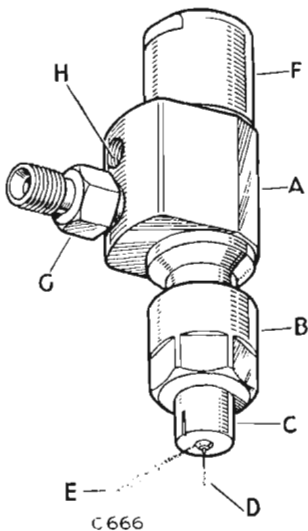


Fig. 16. Injection nozzle.

- A—Body.
- B—Nozzle retainer.
- C—Nozzle.
- D—Main spray.
- E—Auxiliary spray.
- F—Cover nut.
- G—Fuel inlet.
- H—Spill.

Nozzle holders and nozzles should not be dismantled unless proper testing and re-setting facilities are available. If a nozzle is found to be faulty, replace the complete unit.

The injectors are located in the top of the cylinder head on the right-hand side. They should be checked at regular intervals (see Page E-16). Injectors may be removed for checking and adjustment as follows:—

- (a) Disconnect the spill pipe complete and the feed pipe from the injector pump. These pipes should be free at both ends; on no account must the pipes be bent to clear the union on the injector.
- (b) Remove the nuts retaining the clamp bar on the top of the injector and remove the bar.
- (c) Lift out the injector, the copper washer, and the steel washer from inside the injector hole.
- (d) Fit the new injector-block, taking great care not to damage nozzle and also ensure that both new copper and steel washers are fitted. The steel washer must be fitted with the 'U' of the corrugation downwards. See Fig. 17.
- (e) Replace the clamp bar and nuts. Refit the spill pipe and feed pipe ensuring that no foreign matter is present. Tighten each nut alternately an equal amount to ensure that the injector goes into position evenly.

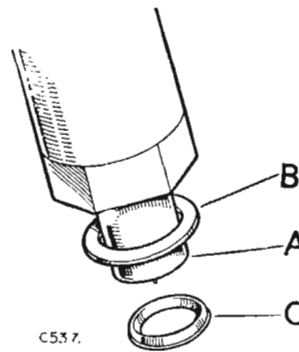


Fig. 17.

Position of injector nozzle washers.

- A—Nozzle.
- B—Copper washer.
- C—Steel washer.

## CHECKING NOZZLES IN ENGINE.

The first symptoms of nozzle trouble usually come under one or more of the following headings:

1. Cylinder knock.
2. Engine overheating.
3. Loss of power.
4. Smoky exhaust (black).
5. Increased fuel consumption.

To check the nozzles, proceed as follows:—

- (a) With the engine running, release the fuel feed pipe union on each nozzle in turn.
- (b) If the injector being checked has been operating properly, there will be a distinct reduction in engine speed accompanied by obvious roughness, but a faulty injector will make less reduction to engine speed when its fuel pipe is loosened.

Do not assume, however, that the nozzles are the only cause of the trouble, as faulty valve timing, leaking valves, incorrect pump timing, dirty filters, etc., may all cause similar trouble.

## ADJUSTING INJECTORS.

The use of a test pump is essential when adjusting injectors; we strongly recommend therefore, that adjustment required on injectors be carried out by your nearest Rover Distributor or Dealer or CAV Agent.

## WARNING.

Great care should be taken to prevent the hands getting into contact with the spray, as the working pressure will cause the fuel to penetrate the skin with ease.

## HEATER PLUGS.

The heater plugs do not require any maintenance. However, if at any time when the heater plug is used, the warning light glows very brightly a short circuit in the system is indicated. No light will indicate an open circuit. This should receive attention at your nearest Rover Distributor or Dealer.

**NOTE.** Great care must be taken not to twist the centre terminal when removing heater plug leads.

## CLUTCH

The clutch, which is hydraulically operated, must only be used when starting the vehicle from rest or when changing gear; at all other times the foot should be kept clear of the clutch pedal to avoid unnecessary lining wear.

The hydraulic clutch system comprises a pendent foot pedal, mounted on the dash and operating a master cylinder, which in turn is connected by pipes to the slave cylinder fitted adjacent to the bell housing. The slave cylinder is connected to the clutch lever by means of an adjustable push rod.

### CLUTCH ADJUSTMENT

To ensure efficient operation of the clutch unit, there must be free movement at the pedal to the extent of  $\frac{3}{4}$  in. (20 mm).

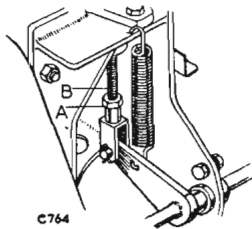


Fig. 18.  
Clutch adjustment.

This point must be checked from time to time. If the free movement is incorrect adjustment must be made at the slave cylinder adjacent to the bell housing as follows:—

- (a) Slacken locknut 'A'.
- (b) Adjust the push rod 'B' with the fingers until the movement is correct.
- (c) Secure with the locknut.

The adjustment at the master cylinder push rod and the clutch foot pedal position adjustment are correctly set on initial assembly and should not be disturbed.

### BLEEDING THE CLUTCH SYSTEM

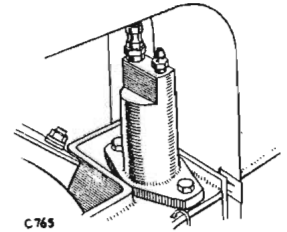
If the level of the fluid in the combined brake and clutch reservoir is allowed to fall too low or if the pipe has been disconnected, the clutch will not operate correctly due to air having been absorbed in the system.

This air lock must be removed by bleeding the hydraulic system at the slave cylinder.

- (a) Attach a length of rubber tubing to the bleed nipple and place the lower end of the tube in a glass jar.

- (b) Slacken the nipple and pump the clutch pedal, pausing at each end of each stroke, until the fluid issuing from the tube shows no signs of air bubbles when the tube is held below the surface of the fluid in the jar.
- (c) Hold the tube under the fluid surface and tighten the bleed screw.
- (d) Adjust pedal movement as necessary.
- (e) The fluid in the reservoir should be replenished throughout the operation to prevent another air lock being formed. Note particularly that the fluid reservoir for the clutch is the small central tube in the combined reservoir.

Fig. 19.  
Bleed nipple for clutch  
slave cylinder.



## MAIN GEARBOX

### MAIN GEARBOX LUBRICATION.

The main gearbox and clutch withdrawal mechanism are lubricated as one unit.

### OIL LEVEL.

The main gearbox oil level must be checked periodically (see Page E-15) and replenished as necessary to the H mark on the dipstick. Both the dipstick and filler plug are accessible through the swinging cover plate on the gearbox cover.

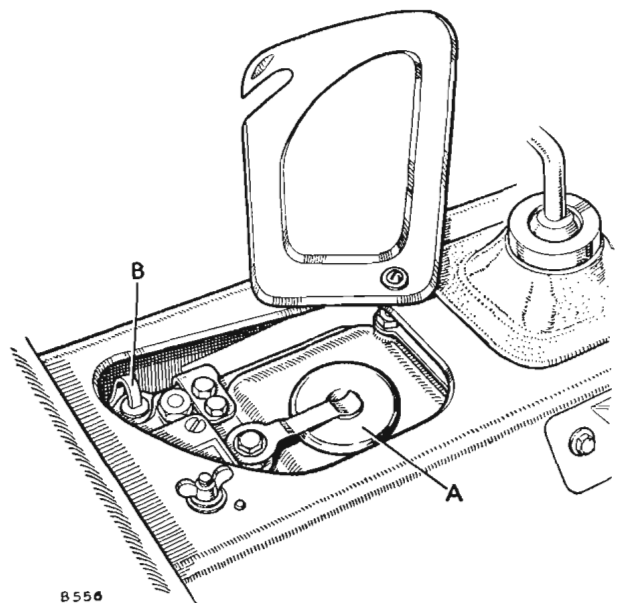


Fig. 20. Gearbox oil filler.  
A—Filler cap. B—Dipstick

## BELL HOUSING DRAIN PLUG.

The gearbox bell housing is completely sealed to exclude dust and mud under severe wading conditions. Because of this, a drain plug is provided in the bottom of the housing, so that any oil accumulating from the rear main bearing or gearbox can be drained away before it affects the clutch.

This plug must be removed periodically (see Page E-15) and all oil allowed to drain off before the plug is replaced.

**NOTE.** If the vehicle is not expected to do wading or very muddy work, the plug can be left out at the operator's discretion, provided the plug is replaced if it later becomes necessary to undertake wading work.

## GEARBOX OIL CHANGES.

Except under extreme winter conditions, the first gearbox oil change should be made at 750 miles (1.000 km.) or 30 hours; under such conditions the oil should be changed to the appropriate grade immediately upon receipt of the vehicle and then changed again at 750 miles (1.000 km.) or 30 hours.

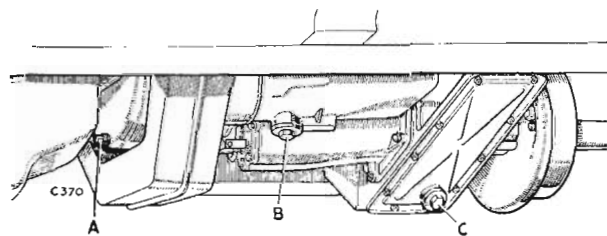


Fig. 21. Gearbox drain plugs.

A—Bell housing plug. B—Gearbox plug.  
C—Transfer box plug.

Thereafter the oil must be changed periodically (see Page E-16).

To change the oil, remove the drain plug from the bottom of the main gearbox casing, immediately after a run when the oil is warm; allow the oil to drain away completely and replace the plug. Refill with oil of the correct grade; the capacity is approximately  $2\frac{1}{2}$  Imperial pints (1,5 litres).

## TRANSFER BOX

### TRANSFER BOX LUBRICATION.

The transfer box and front wheel drive housing are lubricated as one unit.

### OIL LEVEL.

The transfer box oil level must be checked periodically (see Page E-15) and replenished as necessary to the bottom of the level plug hole. The level plug is in the rear face of the transfer box and the filler plug on the cover plate on top of the box on the right-hand side; both are accessible when the seat box centre panel is removed.

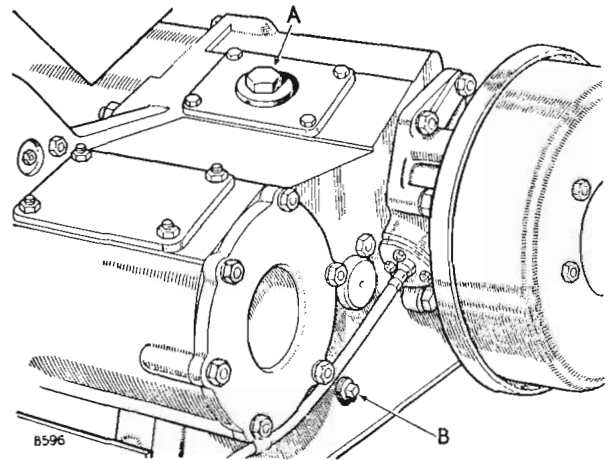


Fig. 22. Transfer box lubrication.

A—Filler plug. B—Level plug.

## TRANSFER BOX OIL CHANGES.

Except under extreme winter conditions, the first transfer box oil change should be made at 750 miles (1.000 km.) or 30 hours; under such conditions the oil should be changed to the appropriate grade immediately upon receipt of the vehicle and then changed again at 750 miles (1.000 km.) or 30 hours.

Thereafter the oil must be changed periodically (see Page E-16).

To change the oil, remove the drain plug (see Fig. 21) from the bottom of the transfer box immediately after a run when the oil is warm; allow the oil to drain away completely and replace the plug. Refill with oil of the correct grade; the capacity is  $4\frac{1}{2}$  Imperial pints (2,5 litres).

## PROPELLER SHAFTS

### PROPELLER SHAFT LUBRICATION.

At regular intervals (see Page E-15), apply one of the recommended oils, using the oil gun provided in the tool kit, at the lubrication nipple on the sliding portion of the front and rear propeller shafts.

At the same time, apply the correct grade of oil at the lubrication nipples fitted to the four universal joints. It is preferable to use the oil gun provided, but if high pressure equipment is used, care must be taken not to damage the seals in the joints.

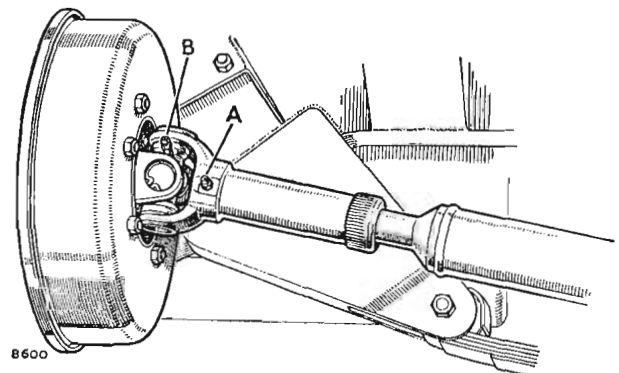


Fig. 23. Propeller shaft lubrication.

A—Sliding sleeve nipple. B—Universal joint nipple.



## PROPELLER SHAFT BOLTS.

Periodically check the security of the propeller shaft securing bolts and rectify as necessary (see Page E-16).

## FRONT AND REAR DIFFERENTIALS

### FRONT AND REAR DIFFERENTIAL LUBRICATION.

#### OIL LEVEL.

The differential oil levels must be checked periodically (see Page E-15), immediately after a run when the oil is warm, and replenished as necessary to the bottom of the filler plug hole. The rear axle level/filler plug is on the right-hand side of the differential casing and the front axle plug is at the front of the axle casing.

**NOTE.** A second plug fitted at the rear of the front axle casing can be disregarded.

#### DIFFERENTIAL OIL CHANGES.

Except under extreme winter conditions, the first differential oil change should be made at 750 miles (1,000 km.) or 30 hours; under such conditions, the oil should be changed to the appropriate grade immediately upon receipt of the vehicle and then changed again at 750 miles (1,000 km.) or 30 hours.

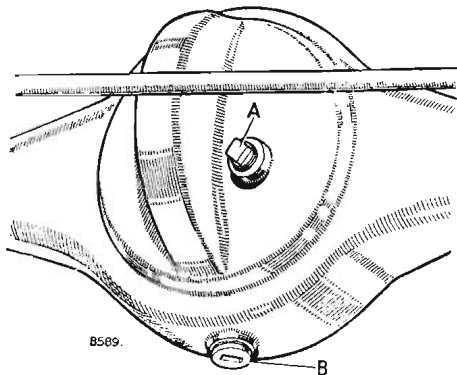


Fig. 24. Front differential lubrication.  
A—Filler/level plug. B—Drain plug.

Thereafter the oil must be changed periodically (see Page E-16) in the following manner:—

Immediately after a run, when the oil is warm, drain off the oil by removing the drain plugs in the bottom of the axle casings. Replace the drain plugs and refill with oil of the correct grade; the capacity of each differential is approximately 3 Imperial pints (1,75 litres).

The drain plugs have slotted heads and can be removed with the aid of the handle of the single-ended spanner in the tool kit.

**NOTE:** Fully floating rear axle. The oil filler plug located in the driving member is for initial filling only. During normal running the oil level is maintained from the differential and the hub requires no further attention in this respect.

**Special Note:** If the hub is replaced or has been stripped down for any purpose, it must be filled on assembly with one-third pint of the same grade of oil as used in the differential.

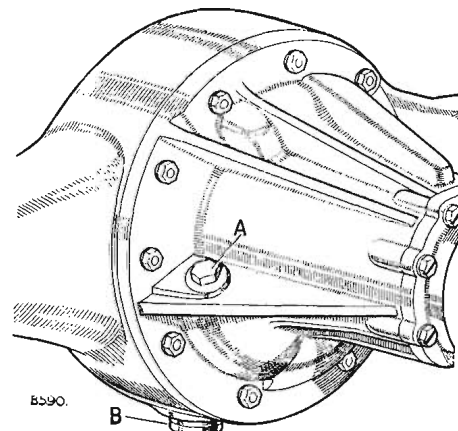


Fig. 25. Rear differential lubrication.  
A—Filler/level plug. B—Drain plug.

## SWIVEL PIN HOUSINGS

### SWIVEL PIN HOUSING LUBRICATION

The front wheel drive universal joints, swivel pins and front hubs receive their lubrication from the swivel pin housings.

#### OIL LEVEL.

The swivel pin housing oil levels must be checked periodically (see Page E-15) and replenished as necessary to the bottom of the filler/level plug holes at the rear of the housings.

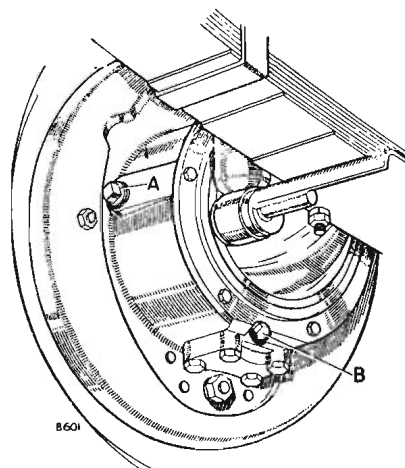


Fig. 26.  
Swivel pin housing lubrication.  
A—Filler/level plug.  
B—Drain plug.

#### SWIVEL PIN HOUSING OIL CHANGES.

Except under extreme winter conditions, the first oil change should be made at 750 miles (1,000 km.) or 30 hours; under such conditions, the oil should be changed to the appropriate grade immediately upon receipt of the vehicle and then changed again at 750 miles (1,000 km.) or 30 hours.

Thereafter the oil must be changed periodically (see Page E-16).

To change the oil, remove the drain plug from the bottom of each housing, immediately after a run when the oil is warm; allow the oil to drain away completely and replace the plugs. Refill with oil of the correct grade through the filler/level plug holes; the capacity of each housing is approximately 1 Imperial pint (0,5 litre).

## STEERING

### *STEERING BOX LUBRICATION.*

The steering box oil level must be checked periodically and replenished as necessary to the bottom of the filler plug hole on the top of the cover plate. Access to the plug is gained by lifting the bonnet panel.

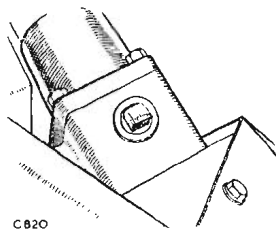


Fig. 27.  
Recirculating steering box  
lubrication.

### *ROCKER SHAFT ADJUSTMENT.*

End play in the rocker shaft may be taken up by means of the adjuster in the side cover plate. Need for attention at this point will be indicated by a slight rattle from the steering column.

The adjustment should be carried out after the first 750 miles (1.000 km.) but thereafter will only be required at long intervals.

Proceed as follows:—

With the road wheels set straight ahead, slacken the locknut and screw the adjuster down by hand until it contacts the top of the rocker shaft; tighten a further one-tenth of a turn and secure with the locknut.

### *STEERING COLUMN ADJUSTMENT.*

End thrust in the steering column is taken up by removing shims and joint washers under the bottom cover of the steering box.

1. This adjustment will be made more accessible by the removal of the off-side front wheel.
2. Remove bottom cover of steering box, which is retained by four nuts.
3. Withdraw bottom cover and remove all shims and joint washers.
4. Replace bottom cover only and tighten up until no end-float is experienced on rotating the steering wheel.

Measure, with a feeler gauge, the gap between the bottom cover and the body of the box that has been caused by the removal of shims and joint washers.

5. Remove bottom plate and insert required number of shims and alternate joint washers as ascertained above, checking on assembly that no end-thrust is apparent.
6. Lower vehicle and top-up steering box with correct grade of oil.

### *STEERING BALL JOINTS.*

Steering joints on the Land-Rover have been designed in such a way as to retain the initial filling of grease for the normal life of the ball joints, however this applies only if the rubber boot remains in position on the ball joint. The rubber boots should be checked periodically (see Page E-16) to ensure that they have not become dislodged or the joint be damaged. Should any of the rubber boots be pushed out of position proceed as follows:—

- (a) Remove ball end from lever.
- (b) Remove rubber boot.
- (c) Thoroughly clean all parts.
- (d) Apply grease (Castrolase Heavy, Energrease C.3 or Mobilgrease No. 4) round taper of ball joint and also fill the boot.
- (e) Re-assemble all parts using new rubber boot and springs as required.

## SUSPENSION

### *HYDRAULIC DAMPERS.*

The telescopic hydraulic dampers on both front and rear springs require no maintenance attention; should they be damaged, replacement units must be fitted.

### *FRONT WHEEL ALIGNMENT.*

As an aid to maximum tyre life and comfortable steering, the front wheel alignment should be checked by a Rover dealer at regular intervals.

### *ROAD SPRINGS.*

At regular intervals (see Page E-16), check the security of the road spring leaf clips and the nuts on the U bolts securing the axles to the springs; rectify as necessary.

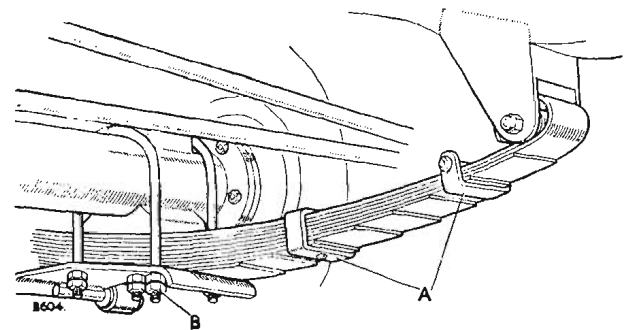


Fig. 28. Leaf clips and U bolts.  
A—Leaf clips.                      B—U bolt nuts.

## BRAKE SYSTEM

The wheel brakes, operated by the foot pedal, are of the hydraulic type, while the hand-brake operates a mechanical brake unit mounted on the output shaft from the transfer box.

### *BRAKE AND CLUTCH FLUID RESERVOIR*

The combined fluid reservoir for the brakes and clutch is mounted above the foot pedals on the engine side of the dash.

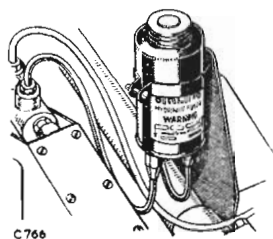


Fig. 29.  
Brake and clutch fluid reservoir.

The level is correct when the fluid is just above the top of the inner reservoir; periodically, remove the filler cap and replenish as necessary, making sure that both clutch and brake reservoirs are topped up. Use only Girling Crimson Brake Fluid (obtainable from any Rover Distributor or Dealer).

### *WHEEL BRAKE ADJUSTMENT.*

When lining wear has reached the point where the pedal travel becomes excessive, it is necessary to adjust the brake shoes in closer relation to the drum.

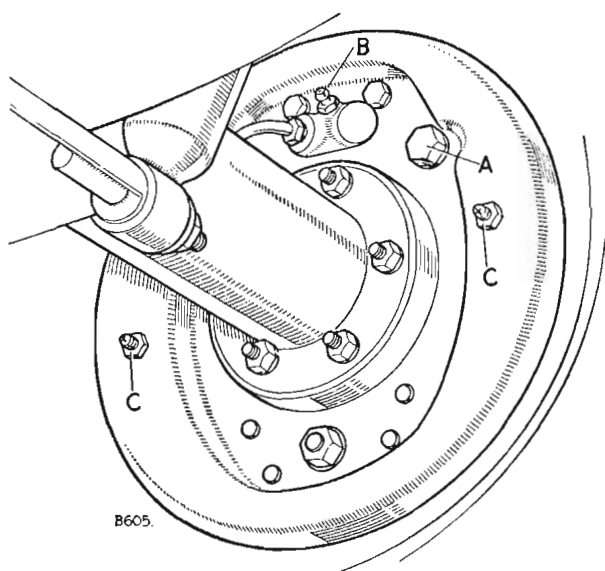


Fig. 30. 88 models—Wheel brake adjustment.

A—Adjustment bolt.      B—Bleed nipple.  
C—Shoe steady posts.

Proceed as follows:—

All 88 models.

Jack up each wheel in turn. On the back face of the brake anchor plate, will be found a hexagon adjustment bolt (A), which operates a snail cam bearing on the leading shoe. Only one of these is fitted to each wheel brake unit, thereby providing single-point adjustment. Spin the wheel and rotate the adjuster bolt until the brake shoe contacts the drum, then ease the adjuster until the wheel again rotates freely. Repeat for the other three wheels.

All 109 models.

#### **Front**

Each shoe is independently set by means of an adjuster operating through a serrated snail cam.

1. With the vehicle jacked up, ensure that the wheels rotate freely; slacken off the adjusters if necessary by turning anti-clockwise.
2. Turn the adjuster for each shoe clockwise until the shoe just brushes the brake drum, then slacken off two serrations.

#### **Rear**

The rear brake shoes are adjusted by means of the adjuster wedge spindle (A in Fig. 31) which protrudes from the adjuster wedge assembly, fitted at the lower side of the anchor plate. This expands or contracts the brake shoes equally and simultaneously.

As the adjuster spindle is rotated, the shoes will expand and probably contact the drum and then contract rapidly with a loud click at the quarter revolution of the adjuster spindle, the adjusted position. This latter position will result in the linings being further from or nearer to the drum, according to the direction of rotation of the spindle—clockwise to adjust the brakes 'on'—anti-clockwise to adjust

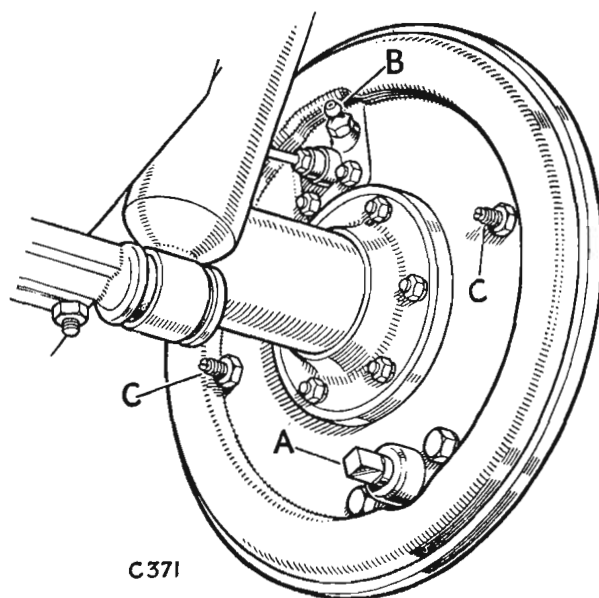


Fig. 31. Wheel brake adjustment—109 models

A—Adjuster spindle.      B—Bleed Nipple.  
C—Shoe steady post.

the brakes 'off'. Care should be taken to ensure that the shoes have settled back to their adjusted position and not left in the position where the shoes are expanded against the drum.

To adjust proceed as follows:—

1. Jack up the rear wheels and ensure that they rotate freely; if necessary slacken the adjuster spindle through several quarter revolutions by turning it anti-clockwise.
2. Turn the adjuster spindle in a clockwise direction through several quarter revolutions, until the brake shoes are in full contact with the drum. Then slacken the adjuster spindle two quarter revolutions (i.e. two 'clicks') and apply and release the foot brake several times in order to centralise the shoes. Check that the drum is not touching the linings when the brakes are 'off'.

### TRANSMISSION BRAKE ADJUSTMENT.

Periodic adjustment of the transmission brake unit will be required; proceed as follows:—

Release the hand-brake. Adjustment is made by means of the adjuster wedge spindle (A) protruding from the front of the brake back-plate, accessible from beneath the vehicle or after removing the centre seat box panel; during rotation of the adjuster a click will be felt and heard at each quarter revolution. Rotate the spindle as far as possible in a

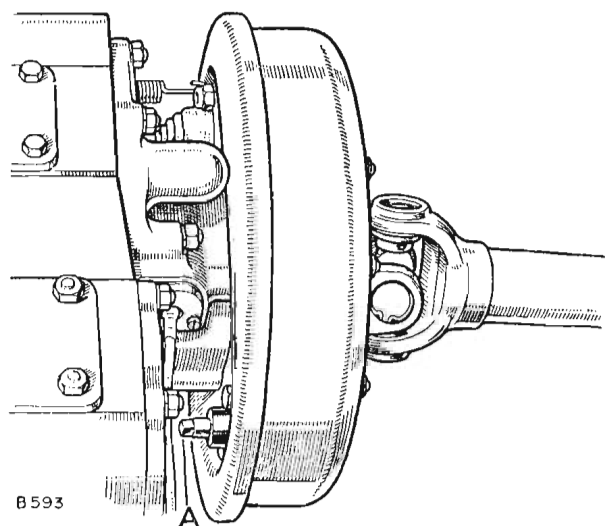


Fig. 32. Transmission brake adjustment.

A—Adjuster.

clockwise direction, i.e., until the brake shoes contact the drum. Then unscrew the adjuster two clicks and give the brake a firm application to centralise the shoes; the brake drum should now be quite free to rotate. No other adjustment to the hand-brake system is necessary to compensate for lining wear.

### BLEEDING THE BRAKE SYSTEM.

If the level of fluid in the reservoir is allowed to fall too low, or if any section of the brake pipe system is disconnected, the brakes will feel 'spongy', due to air having been absorbed into the system. This air lock must be removed by bleeding the hydraulic system at the wheel cylinders; bleeding must always be carried out at all wheels, irrespective of which portion of the pipe-line is affected:—

1. Slacken the shoe adjustment bolts right off.
2. Attach a length of rubber tubing to the bleed nipple on the wheel unit farthest from the brake pedal and place the lower end of the tube in a glass jar.
3. Slacken the bleed screw and pump the brake pedal sharply two or three times and then more slowly, pausing at each end of each stroke, until the fluid issuing from the tube shows no signs of air bubbles when the tube is held below the surface of the fluid in the jar.
4. Hold the tube under the fluid surface and tighten the bleed screw.
5. Repeat for the other three wheels in turn, finishing at the one nearest the brake pedal.
6. Readjust the brakes.

The fluid in the reservoir should be replenished throughout the operation, to prevent another air-lock being formed.

### FUEL SYSTEM

CLEANLINESS IS ESSENTIAL WHEN FILLING FUEL TANK AND WHEN CLEANING FILTERS.

The fuel system comprises the fuel tank, pipe lines, sediment bowl filter, mechanically operated pump, paper element type filter, injectors and injection pump. It is most important that the system be kept clean and free from leaks.

### PRIMING THE FUEL SYSTEM.

(Single or twin filter system).

- A. When the filter bowl has been cleaned or the paper element changed on **either or both** fuel filters the system must be primed as follows:—
  1. Do not attempt to start the engine hoping to draw the fuel through in this way, otherwise the full priming procedure will be necessary.
  2. Slacken the air vent screw 'O', Fig. 15, on the top of the engine filter.
  3. Operate the hand priming lever 'A', Fig. 34, on the mechanical pump until fuel free from bubbles emerges.
  4. Tighten the air vent screw.
  5. Operate the hand priming lever once or twice to clear the last bubbles of air into the filter bleed pipe.
  6. Start engine in normal way and check for leaks.

- B. When fuel system has been completely emptied proceed as follows:—
7. Carry out operations above, 1 to 5 inclusive.
  8. Release air vent screw 'A' on distributor body. See Fig. 33.

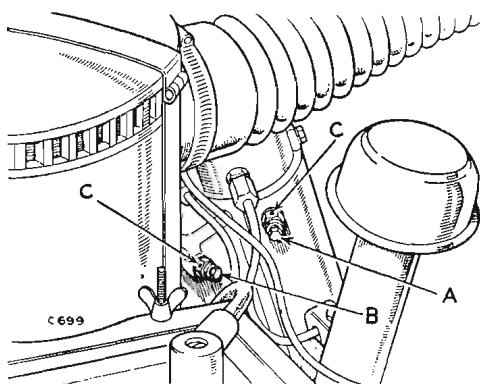


Fig. 33. Priming the distributor pump.

- A—Air vent screw on distributor body.  
 B—Air vent screw on distributor control cover.  
 C—Fuel orifice.

9. Operate the fuel pump hand priming lever until fuel free of air emerges. See hand lever 'A', Fig. 34.
  10. Retighten the air vent screw.
  11. To ensure that all air is exhausted from the pump it may also be necessary to slacken air vent screw 'B' in the distributor control cover and repeat items 9 and 10.
  12. Start the engine in the normal way and check for leaks.
- C. When distributor pump only has been drained it is only necessary to carry out operations 8 to 12 inclusive.

NOTE: Ensure that fuel pump lever is on the bottom of the operating cam when priming the fuel system, otherwise maximum movement of the priming lever will not be obtained.

#### FUEL PUMP.

The mechanically operated fuel pump, with hand primer, is located on the right-hand side of the engine block. The sediment bowl filter is attached to it. The pump itself does not need routine maintenance. If, however, it is necessary to change the fuel pump diaphragm proceed as follows:—

1. Disconnect the feed pipe to the filter and for ease of operation remove the glass bowl.
2. Remove the six screws holding the top of the pump.
3. Remove the old diaphragm by turning through 90° and replace with the new one.
4. Operate the hand primer until the diaphragm is level with the joint face and hold in this position.
5. Replace the lid of the pump and replace the screws and tighten until the spring washers are just pinched.
6. Release lever and fully tighten screws.

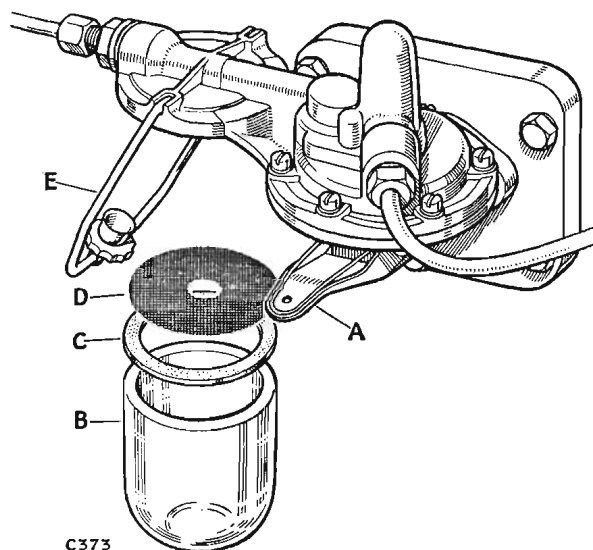


Fig. 34. Fuel pump and sediment bowl.

- A—Hand lever.                      D—Filter for sediment bowl.  
 B—Sediment bowl.                E—Retainer.  
 C—Joint washer.

#### SEDIMENT BOWL FILTER.

The sediment bowl filter is attached to the mechanical pump located on the right-hand side of the engine. The bowl and filter gauze should be cleaned at regular intervals (see Page E-16) or if an appreciable amount of foreign matter has collected in the bowl. To clean the filter proceed as follows:

- (a) Remove the glass bowl by slackening the thumb-screw and swinging the wire holder aside.
- (b) Remove the gauze filter from the body of the unit and wash it and the bowl in petrol or fuel oil.
- (c) Ensure that the sealing washer is in good condition.
- (d) Replace the gauze correctly over the square inlet nozzle.
- (e) Fill glass bowl with fuel oil, refit bowl, reposition the wire holder and tighten thumb-screw.
- (f) Prime by operating the pump hand lever. Air in the system will be expelled through the air bleed pipe on top of the container for the paper element fuel filter.

#### FUEL FILTER, PAPER ELEMENT TYPE.

The fuel filter paper element must be renewed at regular intervals (see Page E-16) or as found necessary according to the cleanliness of fuel used. Proceed as follows:

#### FUEL FILTER ON DASH

1. Unscrew the special bolt on the top of the filter, until the element holder can be removed.
2. Remove and discard the used element and the rubber washer.
3. Wash the container in petrol or fuel oil.

4. Renew the large rubber washer in the filter top, place a new element in the container with the perforated holes to the bottom. Renew the small rubber washer on the top of the element.
5. Fit the container complete with element to the filter top and tighten the special bolt.
6. Prime the system as detailed on Page E-27.

#### FUEL FILTER AT ENGINE

1. Disconnect the bleed pipe from the top of the filter, by unscrewing the union nut holding the pipe to the special bolt on the filter. (Do not bend bleed pipe.)
2. Unscrew the special bolt on the top of the filter, until the element holder can be removed.
3. Remove and discard the used element and the rubber washer.
4. Wash the container in petrol or fuel oil.
5. Renew the large rubber washer in the filter top, place a new element in the container with the perforated holes to the bottom. Renew the small rubber washer on the top of the element.

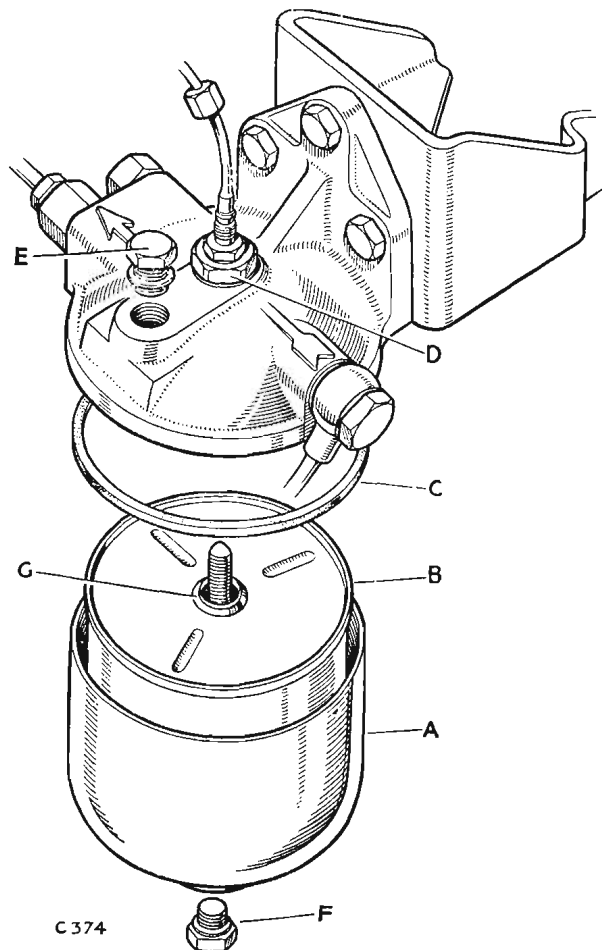


Fig. 35. Paper element filter.

- |                     |                        |
|---------------------|------------------------|
| A—Filter container. | E—Air vent plug.       |
| B—Element.          | F—Drain plug.          |
| C—Washers.          | G—Small rubber washer. |
| D—Retaining washer. |                        |

6. Fit the container complete with element to the filter top and tighten the special bolt. Connect the bleed pipe.
7. Prime the system as detailed on Page E-27.

#### AIR CLEANER.

Attention to the air cleaner is extremely important, especially under dusty conditions, as engine wear generally will be seriously affected if the vehicle is run with an excessive amount of sludge in the cleaner oil bath.

Under clean road or stationary conditions, the cleaner oil bath should be cleaned and refilled at each engine oil change. In cases where the vehicle is operated under dusty road or field conditions, attention must be more frequent, even to the extent of a daily oil change; under extremely bad conditions, cleaning twice daily may be called for.

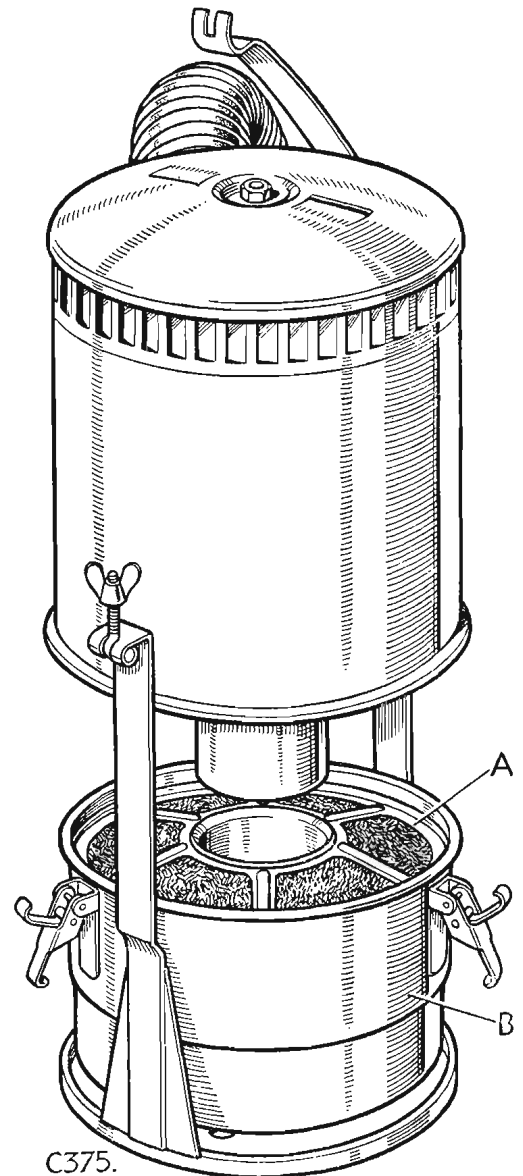


Fig. 36. Air cleaner.

- |             |                   |
|-------------|-------------------|
| A—Oil bowl. | B—Oil level mark. |
|-------------|-------------------|

Proceed as follows:—

1. Release the clamping strap securing the complete air cleaner to the battery box support, disconnect the outlet pipe from the manifold by slackening the clip and remove the cleaner from the vehicle.
2. Remove the oil bowl from the bottom of the cleaner by releasing the three securing clips.
3. Clean all dirty oil and sludge from the bowl and refill with fresh engine oil to the level indicated by a ring formed in the pressing; the capacity is approximately  $1\frac{1}{2}$  Imperial pints (0,85 litre).
4. Clean the filter in the cleaner body by swilling the complete body in petrol or paraffin and shake off the surplus.
5. Replace the bowl.
6. Refit the complete unit in the vehicle.

### COOLING SYSTEM

NEVER RUN THE ENGINE WITHOUT WATER, not even for a very brief period, otherwise the injectors may be seriously damaged. This is due to the very high rate of heat transfer in the region of the injector nozzles.

#### COOLING SYSTEM MAINTENANCE.

It is a good plan to inspect the cooling system at the same time as the engine oil level is checked; such care would largely prevent the possibility of a sudden and costly delay due to coolant loss and consequent engine damage. Attention should be paid to the following points:—

1. Water level in radiator—to the bottom of the filler neck.
2. Condition of all hoses—freedom from cracks and hose clips tight.
3. Any other water leaks.
4. Check that the drain taps are fully closed.

#### FAN BELT ADJUSTMENT.

As the fan belt is of the 'V' type, the drive is on the sides of the belt and it is not therefore necessary to adjust it tightly and so put an excessive load on the water pump and dynamo bearings; the tension is correct when the belt can be depressed  $\frac{3}{16}$  to  $\frac{1}{4}$  in. (4 to 6 mm) by thumb pressure between the fan and crankshaft pulleys. The procedure for adjustment is as follows:—

Slacken the dynamo pivot bolts and the bolts securing the dynamo to the adjusting links. Move the dynamo outwards until the tension is correct and re-tighten the bolts.

#### DRAINING THE COOLING SYSTEM.

As a precaution against corrosion, the cooling system should be drained and flushed out at least twice each year in the following manner:—

1. Remove the radiator filler cap (see Page E-11).
2. Open the water drain taps at the bottom of the radiator and on the left-hand side of the cylinder block just below the exhaust manifold.

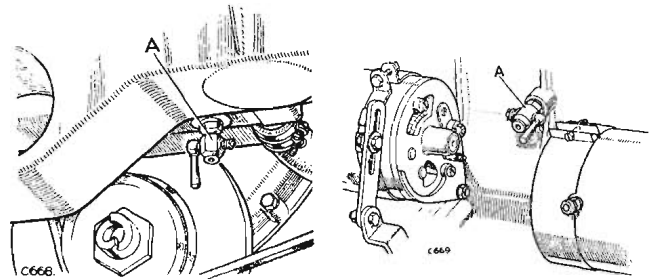


Fig. 37. Drain taps.  
A—Drain tap.

3. When the water flow has ceased, insert a piece of wire in each tap, to make sure that a blockage has not been caused by rust or scale.
  4. Place a hose in the radiator filler neck, refill and then adjust the flow of water to equal that draining from the taps.
  5. Run the engine for a short time to ensure thorough cleaning of the whole system.
  6. Stop the engine, remove the hose and close the taps. Refill the system with clean water to the bottom of the filler neck and replace the filler cap. The total capacity is 17 Imperial pints (9,75 litres).
- NOTE.* Use soft water wherever possible; if the local water supply is hard, rain or distilled water should be used.
7. Run the engine until working temperature is reached and top up the water level as necessary.

#### CLEANING RADIATOR.

In the event of the cooling gills of the radiator becoming blocked with dirt, straw, etc., they should be cleaned by means of compressed air or water pressure applied from the rear, so forcing the foreign matter out through the front of the radiator. Never use a metal implement for this purpose or serious damage may result to the radiator core.

#### FROST PRECAUTIONS.

In cold weather, when the temperature may drop to or below freezing point, precautions must be taken to prevent freezing of the water in the cooling system.

As a thermostat is fitted in the system, it is possible for the radiator block to freeze in cold weather even though the engine running temperature is quite high; for this reason, the use of an anti-freezing mixture is essential.



Only high quality inhibited glycol-base solutions should be used.

When the temperature is between 32° F and 14° F (0° C and minus 10° C) use 1 part of anti-freeze to 4 parts of water. If the temperature is between 5° F and 14° F. (minus 10° C and minus 15° C) use 1 part of anti-freeze to 3 parts of water.

Proceed as follows:—

1. Ensure that the cooling system is leak-proof; anti-freezing solutions are far more 'searching' at joints than water.
2. Drain and flush the system as described on Page E-30.
3. Mix the solution to the required strength in a separate container and refill the system.
4. Run the engine to ensure good circulation of the mixture.

When the winter is over, as a precaution against corrosion, the anti-freezing solution should be drained off and the system flushed thoroughly again.

If the vehicle is to be stored in cold weather, unless it is kept in a well-heated garage or anti-freeze solution has been used, the cooling system must be completely drained.

**NOTE.** During the winter months in Britain vehicles leaving the Rover Factory have the cooling system filled with 25% of anti-freeze mixture. This gives protection against frost down to 0° F (minus 17° C). Vehicles so filled can be identified by the Yellow label affixed to the right-hand side of the windscreen and a Yellow label tied to the engine.

If the prevailing weather makes the use of anti-freeze mixture unnecessary when the vehicle is received, the cooling system must be drained, flushed and refilled as a precaution against corrosion. The Yellow labels should be removed from the windscreen and engine when this has been carried out.

## WHEELS AND TYRES

The standard tyre equipment for the Land-Rover 88 is the 6.00-16 size; this is a dual-purpose tyre. It is suitable for general cross-country work including towing and is serviceable both on and off the road.

Alternatively, 6.50-16 tyres may be fitted as original equipment on the Land-Rover 88; they are also dual-purpose tyres, but provide rather better traction off the road than the 6.00-16 tyre.



Fig. 38.  
Typical tyre for road  
and cross-country.

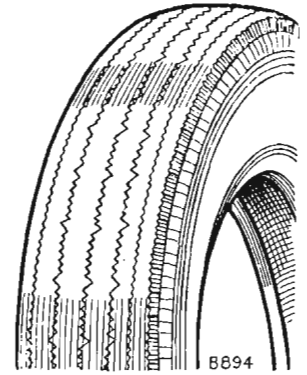


Fig. 39.  
Typical tyre for road  
work only.

For certain special conditions, alternative tyres are available as original equipment.

1. **SOFT MUDLAND AND PLOUGHLAND**, etc., especially when towing on such surfaces. Under such conditions, greater wheel grip and maximum power are required and can be obtained from the 7.00-16 Tractor pattern tyres. Their special tread design with deep, widely-spaced bars is ideal, but they are noisy and will wear rapidly if used extensively on hard dry surfaces and on the road. They must be regarded, therefore, as special purpose tyres.

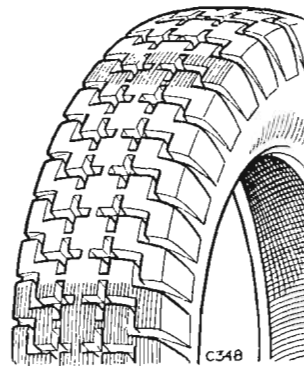


Fig. 40.  
Typical sand tyre

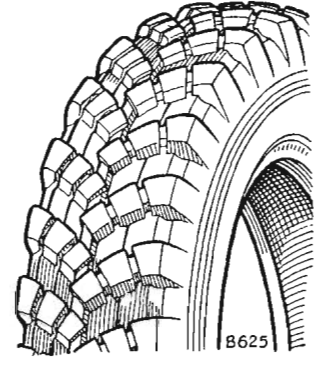


Fig. 41.  
Typical cross-country tyre.

2. **ROAD USE.** Where exceptional conditions cause the majority of service to be on road and the vehicle will not be expected to operate on soft ground, best service will be obtained by fitting car type tyres.

3. **SURFACES WHERE MINIMUM CONTACT PRESSURES ARE REQUIRED**, e.g., SANDY DESERT. Under such conditions sand type tyres are recommended.

### **TYRE PRESSURES.**

Careful attention must be given to the question of correct tyre pressures if maximum tyre life and performance are to be obtained.

1. For normal road and cross-country work, tyre pressures must be maintained at:—

**Land-Rover. All models**

Front and Rear:  
25 lb. per sq. in. (1,75 kg./cm.<sup>2</sup>).

When loads in excess of 550 lb. (250 kg.) are carried in the rear of the vehicle, pressures in the rear tyres only must be raised to:—

Land-Rover 88; 30 lb. per sq. in. (2,1 kg./cm.<sup>2</sup>).  
Land-Rover 109: 30 lb. per sq. in. (2,1 kg./cm.<sup>2</sup>).

2. Should it be desired to traverse exceptionally soft ground, the tyre pressures may be reduced to:—

**Land-Rover 88**

Front and Rear:  
6.00-16 tyres: 15 lb. per sq. in. (1,05 kg./cm.<sup>2</sup>).  
6.50-16 tyres: 15 lb. per sq. in. (1,05 kg./cm.<sup>2</sup>).  
7.00-16 tyres: 13 lb. per sq. in. (0,9 kg./cm.<sup>2</sup>).

When loads in excess of 550 lb. (250 kg.) are carried in the rear of the vehicle, pressures in the rear tyres only must be raised to:—

6.00-16 tyres: 20 lb. per sq. in. (1,4 kg./cm.<sup>2</sup>).  
6.50-16 tyres: 20 lb. per sq. in. (1,4 kg./cm.<sup>2</sup>).  
7.00-16 tyres: 18 lb. per sq. in. (1,25 kg./cm.<sup>2</sup>).

*Reduced pressures must only be employed when absolutely essential and the pressures must be returned to normal immediately after the soft ground has been negotiated.*

Pressures should be checked and adjusted monthly, paying attention to the following points:—

1. Whenever possible, check with the tyres cold, as the pressure is about 2 lb. (0,1 kg.) higher at running temperature.
2. Always replace the valve caps, as they form a positive seal on the valves.
3. Any unusual pressure loss (in excess of 1 to 3 lb. (0,05 to 0,20 kg.) per month) should be investigated and corrected.
4. Always check the spare wheel, so that it is ready for use at any time.
5. At the same time, remove embedded flints, etc., from the tyre treads with the aid of a penknife or similar tool. Clean off any oil or grease on the tyres, using petrol sparingly.

**TYRE TREADS.**

The tread form of the special purpose tyres makes them uni-directional. They must be fitted with the 'V' or arrow in the tread pattern pointing forwards at the top of the wheel, to ensure maximum grip and efficient tread cleaning when operating on soft ground. For this reason, it may be necessary to reverse the spare tyre on its wheel (depending on which side of the vehicle it is to be fitted) when putting it into service.

**CHANGING TYRE POSITIONS.**

In the interests of tyre mileage and even wear, it is desirable to change the position of the tyres on the vehicle (including the spare) at intervals of 3,000 miles (5.000 km.). The front and rear wheels should be interchanged on each side of the vehicle; at the same time, the spare wheel should be fitted to give it a spell of duty and one of the other wheels removed to become the spare.

**FACTORS AFFECTING TYRE LIFE.**

The most important factors, among many which have an adverse effect on tyre life, are:—

1. Incorrect tyre pressures.
2. High average speeds.
3. Harsh acceleration.
4. Frequent hard braking.
5. Warm, dry climatic conditions.
6. Poor road surfaces.
7. Impact fractures caused by striking a kerb or loose brick, etc.
8. Incorrect front wheel alignment. Alignment should be checked periodically by a Rover dealer and adjusted as necessary.

**WHEELS.**

As standard equipment, well-base wheels are fitted, but divided type wheels, identified by the ring of bolts securing the two halves together, are available as original equipment as an optional extra on 88 only. Either pattern wheel may be used with 6.00-16 or 7.00-16 tyres, although 7.00-16 Tractor type tyres are more readily fitted to the divided type. Rubber protection flaps must be fitted when divided wheels are used.

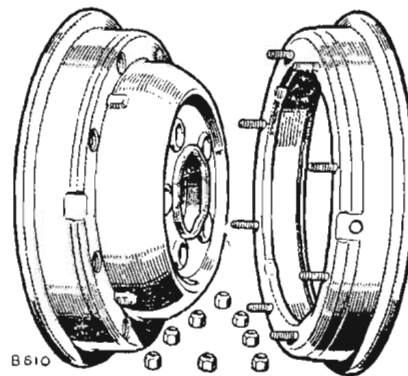


Fig. 42.  
Divided wheel.

**NOTE: DIVIDED WHEELS.** Under no circumstances must the clamping nuts, which hold the two halves of the wheel together, be slackened unless the tyre is fully deflated. Failure to observe this rule may result in damage to the equipment and will certainly involve the risk of personal injury.

## TYRE REMOVAL—WELL-BASE WHEELS.

As inextensible wires are incorporated in the beads of the outer cover, the beads must not be stretched over the wheel rim. The operation will be more easily carried out if the cover beads are lubricated liberally with water, preferably with a little soap added. Tyre levers should be dipped before each insertion. The correct method of tyre removal is as follows:—

1. Remove the valve cap and core (using the extractor provided in the tool kit) and deflate the tyre.
2. Press each bead in turn off its seating. Insert a lever at the valve position and, while pulling on this lever, press the bead into the well diametrically opposite the valve.
3. Insert a second lever close to the first and prise the bead over the wheel rim. Continue round the bead in small steps until it is completely off the rim.
4. Remove the inner tube and pull the second bead over the rim.

Minor tyre injuries, such as from nails, require no attention other than removal of the object, but more severe tread or wall cuts require vulcanised repairs.

Avoid the use of gaiters or liners except as a temporary expedient.

“Butyl” synthetic inner tubes are fitted and all repairs must be vulcanised.

## TYRE REPLACEMENT—WELL-BASE WHEELS.

Outer covers and tubes marked with balance spots should be fitted so that the white spots near the cover bead coincide with the black spots across the base of the tube. This achieves a high degree of tyre balance.

1. Place the cover over the wheel and press the lower bead over the rim edge into the well.
2. Inflate the inner tube until it is just rounded out and insert it in the cover.
3. Press the upper bead into the well diametrically opposite the valve and lever the bead over the rim edge.
4. Push the valve inwards to ensure that the tube is not trapped under the bead, pull it back and inflate the tyre.
5. Check the concentricity of the fitting line on the cover and the top of the wheel flange. Deflate the tube completely and re-inflate to the correct pressure, to relieve any strains in the tube.

## TYRE REMOVAL—DIVIDED WHEELS.

Do not touch the nuts securing the two halves of the wheel together before the tyre is deflated or serious personal injury may result.

Remove the tyre as follows:—

1. Remove the valve cap and core to deflate the tyre.
2. Press each bead in turn away from the flange, using levers and working round the tyre in small steps. Two or three circuits of the tyre may be necessary to free the beads completely.
3. Slacken and remove the clamping nuts. Remove the upper half of the wheel. Push the valve through the lower half of the wheel and remove the cover and tube.

Minor tyre injuries, such as from nails, require no attention other than removal of the object, but more severe tread or wall cuts require vulcanised repairs. Avoid the use of gaiters or liners except as a temporary expedient.

“Butyl” synthetic inner tubes are fitted and all repairs must be vulcanised.

## TYRE REPLACEMENT—DIVIDED WHEELS.

1. Thoroughly examine the cover for nails, flints, etc., and ensure that no loose objects have been left inside. Clean the wheel rim flanges and seatings.
2. Inflate the inner tube until it is just rounded out, dust with French chalk and insert it in the cover with the white spots near the cover bead coinciding with the black spots on the tube.
3. Fit the protection flap, starting at the valve position. Make sure that the edges of the flap are not turned over inside the cover and that it lies centrally between the beads. See that the flap fits closely against the tube round the valve.
4. Lay the studded half of the wheel on the floor or bench with the studs pointing upwards. Fit the cover over the wheel and thread the valve through the hole, making sure that it points downwards.
5. Fit the other half of the wheel and tighten the clamping nuts lightly. Finally tighten the nuts in the sequence illustrated. See Fig. 43. Check that the valve is free and inflate the tyre to the recommended pressure.

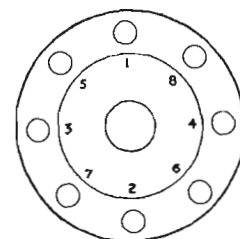


Fig. 43. Sequence of tightening wheel nuts.

## WHEEL AND TYRE BALANCE.

Wheel and tyre units are accurately balanced on initial assembly with the aid of small weights secured to the inner side of the wheel slot flanges by means of set bolts. In the interests of smooth riding and even tyre wear, it is advantageous for a Rover dealer to check the balance whenever a tyre is refitted.

## ELECTRICAL EQUIPMENT

### BATTERIES.

Two six volt batteries are carried under the bonnet on either side.

At regular intervals (see Page E-16), check the battery level as follows:—

1. Wipe all dirt and moisture from the battery top.
2. Remove the filler plug from each cell in turn. If necessary, add sufficient distilled water to raise the level to the top of the separators. Replace the filler plug. Avoid the use of a naked light when examining the cells.

In hot climates it will be necessary to top-up the batteries at more frequent intervals.

In very cold weather it is essential that the vehicle be used immediately after topping-up, to ensure that the distilled water is thoroughly mixed with the electrolyte. Neglect of this precaution may result in the distilled water freezing and causing damage to the battery.

Occasionally check the condition of the batteries by measuring the specific gravity of the electrolyte in each cell, using a hydrometer. Specific gravity readings and their indications are as follows:—

1.280 to 1.300 (32° to 34° Baumé)

Battery fully charged.

About 1.210 (25° Baumé)

Battery about half discharged.

Below 1.150 (19° Baumé) Battery fully discharged.

These figures assume an electrolyte temperature of 60° F (15.5° C). If one cell gives a reading very different from the rest, it may be that acid has leaked from that particular cell, or there may be a short circuit between the plates, in which case the battery should be inspected at a service depot.

Never leave the batteries in a discharged condition for any length of time; they should be given a short refreshing charge every fortnight, to prevent permanent sulphation of the plates.

**NOTE:** If the vehicle is to be left in the open in very cold weather, care must be taken to ensure that the batteries are in a good state of charge, otherwise there is danger of the electrolyte freezing and consequent damage to them.

If the battery lugs have been removed for any reason they must always be refitted as follows:—

1. Clean terminal post and inside of the battery lug.
2. Fit lug to terminal post and lightly tap on to the taper of the post.
3. Smear vaseline or anti-corrosion grease in the hole for the retaining screw.
4. Replace screw, taking care not to overtighten. On no account must the screw be used for pulling down the lug.

### DYNAMO

Periodically (see Page E-16), the dynamo must be lubricated at the commutator end bearing by inserting the nozzle of a pump type oil can in the small central hole and injecting just sufficient engine oil to moisten the lubricating pad.

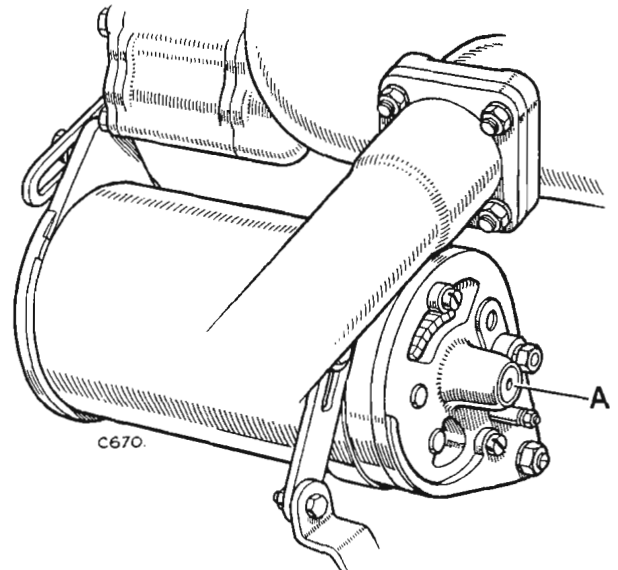


Fig. 44. Dynamo lubrication.  
A—Oil hole.

### CURRENT CONTROL BOX.

This unit is mounted on the engine side of the dash and houses the cut-out and dynamo current regulator, which are accurately set before leaving the works and should not normally require any further attention.

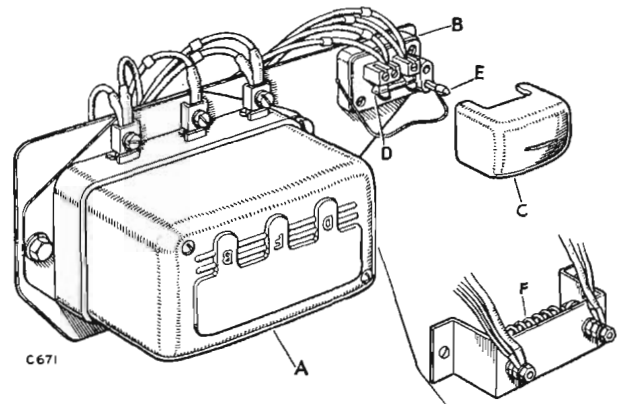


Fig. 45. Current control and fuse boxes.

A—Current control box. D—Fuse (35 amp.).  
B—Fuse box. E—Spare fuse.  
C—Fuse box cover. F—Resistor for heater plug.

### FUSE.

The single fuse is housed under a separate cover alongside the current control box; it protects the horn, windscreen wiper, fuel tank level unit and the stop lights.

All other electrical components are not fused.

A blown fuse is indicated by the failure of all the units protected by it and is confirmed by examination of the fuse. Before replacing a blown fuse, locate and remedy the fault in the wiring of the units which have failed. If the cause of the trouble cannot be found and a new fuse blows immediately, the vehicle should be examined at a service depot.

A spare fuse is carried in the fuse box; only 35 amp. cartridge type fuses must be used.

## STARTER.

For operation of the starter see Starting Procedure on Page E-12.

## HORN.

The horn is adjusted on initial assembly and should not require attention for a considerable time. Adjustment merely takes up wear of moving parts and does not alter the pitch of the note; proceed as follows:—

1. Ascertain that the horn failure or faulty note is not due to some outside source, such as a discharged battery, loose connection, loose part adjacent to the horn, etc.

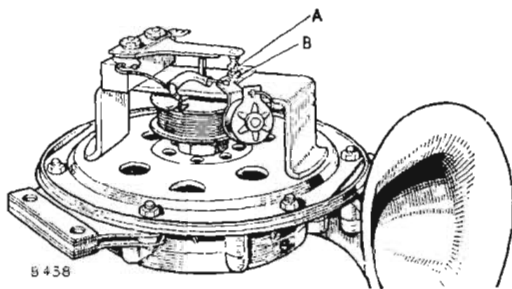


Fig. 46. Horn adjustment.

A—Adjustable contact. B—Locknut.

2. Disconnect the supply lead from the horn, taking care that the end does not contact any part of the vehicle.
3. Remove the horn cover, slacken the locknut on the fixed contact and rotate the adjusting nut until the contacts are just separated (indicated by the horn failing to sound, when the horn button is momentarily depressed).
4. Turn the nut half a revolution in the opposite direction and tighten the locknut.
5. Replace the cover.
6. If the note is still unsatisfactory, the horn should be examined at a Service Department.

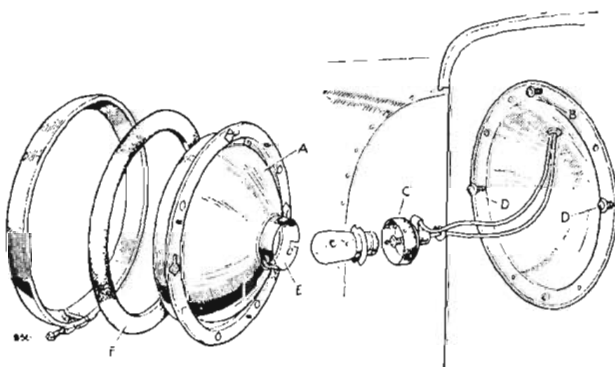


Fig. 47. Headlamp.

A—Light unit. B—Vertical setting screw. C—Back shell. D—Horizontal setting screws. E—Bulb holder. F—Dust excluder.

## HEADLAMP BULB REPLACEMENT.

Slacken the clamping bolt at the bottom of the headlamp rim and lift off the rim and dust-excluding rubber. Press in the light unit against the tension

of the springs on the three adjustment screws, turn it anti-clockwise and withdraw. Twist the back shell in an anti-clockwise direction and pull it off the light unit; the bulb can then be replaced and the unit reassembled.

## REPLACEMENT BULBS.

Position	Make and Type	Voltage	Wattage
Headlamps (R.H.D. models)	Lucas No. 354	12	42/36 Double filament (dip to left)
Headlamps (L.H.D. models except North America and Europe)	Lucas No. 355	12	42/36 Double filament (dip to right)
Headlamps (Europe except France)	Lucas No. 370	12	45/40 Double filament (Duplo) (vertical dip)
Headlamps (France and North America)	Special	12	—
Sidelamps	Lucas No. 222	12	4
Stop, tail lamps	Lucas No. 380	12	21/6 Double filament
Rear number plate lamp	Lucas No. 222	12	4
Instrument panel lights	Lucas No. 987	12	2.2 M.E.S.
Warning lights	Lucas No. 987	12	2.2 M.E.S.

## HEADLAMP SETTING.

The headlamps should be set so that the main driving beams are parallel with the road surface. If adjustment is required, remove the rim as described above. The vertical setting can then be made by turning the screw at the top of the lamp and horizontal adjustment by means of the screws at the side of the unit.

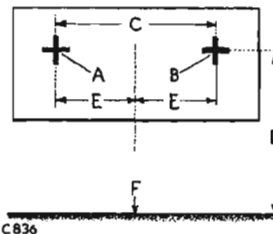


Fig. 47A. Headlamp setting board dimensions.

A—Concentrated area of light—L.H. headlamp.  
 B—Concentrated area of light—R.H. headlamp.  
 C—21 $\frac{3}{8}$  in. (543 mm).  
 D—37 $\frac{1}{2}$  in. (952 mm) 88 models  
 39 $\frac{1}{2}$  in. (1002 mm) 109 models.  
 E—10 $\frac{11}{16}$  in. (271 mm).  
 F—Ground level.

In order to adjust headlamps, using a beam setting board, proceed as follows:—

1. Mark on the board the dimensions given in Fig. 47A and position the vehicle, unladen, on level ground.
2. Place the board 12 ft. (365 cm.) in front of the headlamps, ensuring that it is at right angles to the vehicle centre line and that the centre line on the board is in the same plane as the vehicle centre line.
3. Adjust the beam by turning the adjusting screws until the area of concentrated light corresponds with the marks on the beam setting board.

## SIDE, STOP AND TAIL LAMP BULB REPLACEMENT

(AND FLASHER LAMPS WHEN FITTED)

Remove rim retaining screws. Lever the rubber bead away from the lamp and remove the rim and glass from the bottom first. Renew the bulb, press the rubber bead aside, locate the rim at the top of the lamp and press it into position; finally position the bead so that it fits snugly round the rim. Replace rim retaining screws.

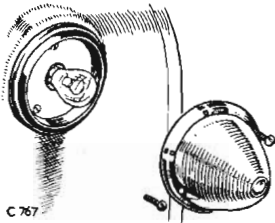


Fig. 48.  
Side, stop and tail lamp  
bulb replacement.

## REAR NUMBER PLATE LAMP BULB REPLACEMENT.

Slacken the securing screw and swing open the cover; the bulb is then accessible in the lamp body.

## INSTRUMENT PANEL AND WARNING LIGHT BULB REPLACEMENT.

Should a warning light bulb burn out, operation of the corresponding component will not be affected, but it should be replaced at the earliest opportunity to safeguard that particular item of equipment.

The charging, heater plug and oil pressure warning light bulbs can be renewed after unscrewing the respective bezels from the front of the instrument panel. Access to the instrument panel illumination, fuel tank and headlamp warning light bulbs is gained by withdrawing the instrument panel facia; this is effected by removing the five screws, washers and nuts securing the panel. See Fig. 3, Page E-8.

## WINDSCREEN WIPER.

### WINDSCREEN WIPER ARM AND BLADE REPLACEMENT.

Slacken the fixing nut and tap sharply to release the collet which clamps the arm on to the spindle; then remove the complete assembly.

When fitting the replacement arm and blade, slacken the securing nut and push the arm boss over the end of the spindle as far as it will go. Secure by tightening the nut.

## WINDSCREEN WIPER BLADE REPLACEMENT.

Remove the rubber bush securing the old blade to the arm; insert the tongue on the replacement blade through the slot in the arm and secure it by fitting the rubber bush through the hole in the tongue.

## ENGINE SPEED HAND CONTROL.

An engine speed hand control is fitted as standard equipment.

It is connected to the distributor pump and limits the amount of fuel which can be injected, dependent upon the quadrant lever setting on the dash panel.

Speed control is maintained by the governor incorporated in the distributor pump.

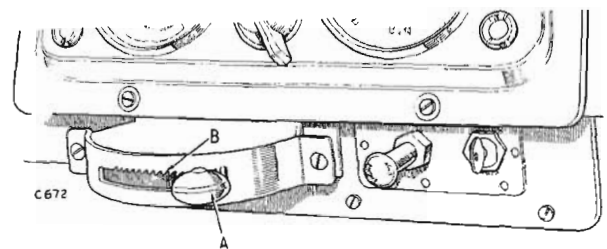


Fig. 49. Hand speed control.

A—Quadrant lever at inoperative position.  
B—Operating notches.

The quadrant has a number of notches for the operating lever. The notch to the extreme right is for use when the hand speed control is not required. In order to bring the hand speed control into operation, the control lever must be moved to the left into one of the remaining notches.

## BODYWORK

### CLEANING BODY.

It is always preferable to clean the bodywork with water and sponge, using plenty of water; wherever possible the surface should be freely hosed. Dry with a chamois leather.

It is well periodically to wash the underside of the vehicle, to prevent the formation of mud pockets.



# IN CASE OF TROUBLE

## LOCATION AND REMEDY OF FAULTS

Although every precaution is taken to eliminate all possible causes of trouble, failure may occasionally develop through lack of attention to the equipment, or damage to the wiring. The following pages set out the recommended procedure for a systematic examination to locate and remedy the causes of some of the more probable faults which may occur during the life of the vehicle.

All the checks listed can be readily carried out without special equipment; if the fault is not located in this way, consult the local Rover distributor or dealer, who will be able to investigate the defect more closely.

### ENGINE FAILS TO START

1. Check that the electrical services switch is ON.
2. Check that there is sufficient fuel in the tank.
3. Check that the engine stop control is set correctly for starting (see Page E-12).
4. Check that the engine is being turned at an adequate speed by the starter motor; this speed will be recognised after some experience with the vehicle.  
If the cranking speed is too low:—
  - (i) Check the battery connections for tightness and cleanliness.
  - (ii) Check the state of charge of the battery by switching on the headlamps and pressing the starter button; if the headlamps go out or very dim when the starter is operated, the battery requires recharging from an independent electrical supply.
  - (iii) In cold weather check that the heater plugs are working correctly.
  - (iv) Check that fuel vapour is coming from exhaust pipe.
5. Disconnect the fuel pipe from the injector, and check that fuel is delivered when the engine is turned over by the starter. (Accelerator fully depressed.) If fuel is not delivered:
  - (i) Check that the fuel pipes and filters are clear (see Page E-27).
  - (ii) Check that there are no air leaks in the suction line to the fuel pump (see Page E-27).

### ENGINE STARTS BUT SOON STOPS

1. Check that the controls are set correctly (see Page E-13).
2. Check the fuel feed to the injectors by disconnecting the pipe from the injectors and noting the fuel flow when the engine is turned over by the starter. (Accelerator fully depressed.)  
If there is little or no flow:—
  - (i) Check the fuel level in the tank.
  - (ii) Check that the air vent in the filler neck is clear.
  - (iii) Check the fuel pump for correct operation (see Page E-28).
  - (iv) Check that the fuel filters are clear (see Page E-27).
  - (v) Check that the fuel pipes are clear (see Page E-27).

### ENGINE MISFIRES

Engine running on less than four cylinders, either intermittently or continually.

1. Check injectors, and replace if necessary.
2. Check for leaks on high pressure pipes.

### LACK OF ENGINE POWER

1. Check that the accelerator lever is opening fully.
2. Check injectors.
3. Check that the brakes are not binding and that the tyre pressures are correct.
4. Check the tappet adjustment.
5. If items 1—4 are satisfactory, it is probable that the engine needs a top overhaul, and your Rover distributor or dealer should be consulted.

### CHARGING CIRCUIT

1. **Batteries in low state of charge.**
  - (a) This state will be shown by lack of power when starting, poor light from the lamps and hydrometer readings below 1.200, and may be due to the dynamo either not charging or giving low or intermittent output. Check the ammeter reading when the vehicle is running steadily in top gear with no lights in use; a definite steady charge should be indicated. The charging warning light will not go out if the dynamo fails to charge, or will flicker on and off in the event of intermittent output.
  - (b) Examine the charging and field circuit wiring, tightening any loose connections, or replacing broken cables.  
Pay particular attention to the battery connections.
  - (c) Examine the fan and dynamo driving belt; take up any undue slackness by turning the dynamo on its mounting (see Page E-30).
  - (d) If the cause of the trouble is not apparent, have the equipment examined at a service depot.

2. **Batteries overcharged.**

This will be indicated by burnt-out bulbs, very frequent need for topping-up of batteries and high hydrometer readings. Check the ammeter reading when the car is running steadily—with fully charged batteries and no lights or accessories in use, the charge reading should be of the order of only 3-4 amperes. If the ammeter reading is in excess of this value, it is advisable to have the regulator setting tested and adjusted if necessary at a service depot.

### STARTER MOTOR

1. **Starter motor lacks power or fails to turn engine.**
  - (a) Check that the trouble is not due to discharged batteries.
  - (b) Examine the connections to batteries, starter and starter switch, making sure that they are tight and that the cables connecting these units are not damaged.

### LIGHTING CIRCUITS

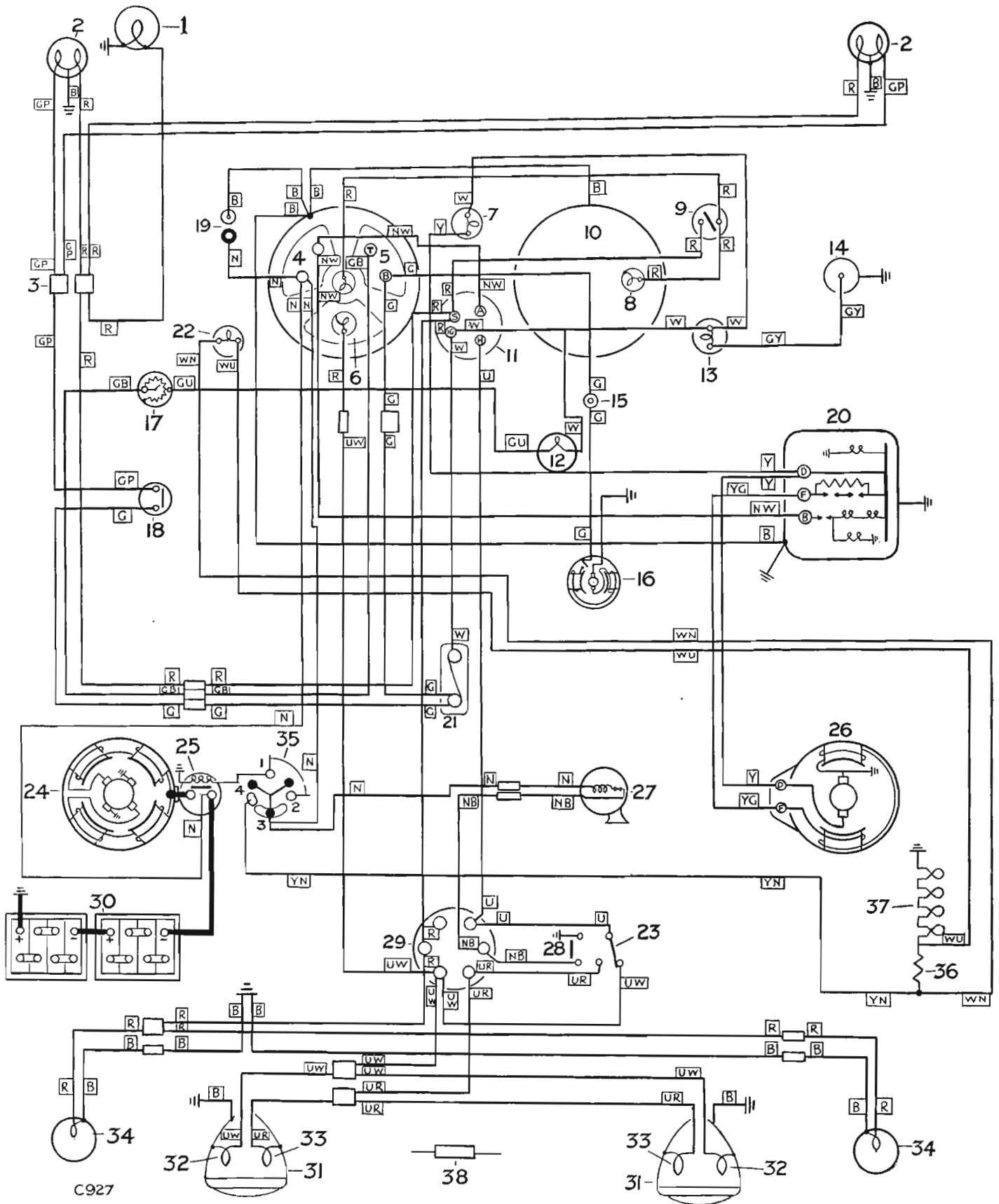
1. **Lamps give insufficient illumination.**
  - (a) Test the state of charge of the batteries, recharging them if necessary either by a long period of day-time running or from an independent electrical supply.
  - (b) Check the setting of the headlamps (see Page E-35).
  - (c) If the bulbs are discoloured as a result of long service, they should be renewed.
2. **Lamps light when switched on, but gradually fade out.**

As para. 1 (a).
3. **Brilliance varies with speed of vehicle.**
  - (a) As para. 1 (a).
  - (b) Examine the battery connections, making sure that they are tight; replace faulty cables.
4. **Lights flicker.**


Examine the circuits of the lamps for loose connections.
5. **Failure of lights.**
  - (a) As para. 1 (a).
  - (b) Examine the wiring for a loose or broken connection and remedy.



# WIRING DIAGRAM



## KEY TO WIRING DIAGRAM

- |   |  |
|---|--|
| 1. Trailer light socket (extra equipment)   | 20. Current control box  |
| 2. Stop, tail lamps                         | 21. S.F.5 fuse box (35 amp. fuse)  |
| 3. Snap connectors for trailer light        | 22. Heater plug warning light  |
| 4. Ammeter                                  | 23. Headlamp dipper switch   |
| 5. Fuel level gauge                         | 24. Starter.   |
| 6. Headlamp main beam warning light         | 25. Starter solenoid switch  |
| 7. Charging warning light                   | 26. Dynamo   |
| 8. Panel lights                             | 27. Horn   |
| 9. Panel light switch                       | 28. Horn push  |
| 10. Speedometer                             | 29. Junction box   |
| 11. Electrical services and lighting switch | 30. 6-volt batteries (positive earth)  |
| 12. Fuel level warning light                | 31. Headlamps  |
| 13. Oil pressure warning light              | 32. Main beam  |
| 14. Oil pressure switch                     | 33. Dip beam   |
| 15. Windscreen wiper plug and socket        | 34. Side lamps   |
| 16. Windscreen wiper                        | 35. Starter and heater plug switch   |
| 17. Fuel tank level unit                    | 36. Resistance for heater plug.  |
| 18. Stop lamp switch                        | 37. Heater plugs.  |
| 19. Inspection lamp sockets                 | 38. Snap connectors shown thus —  — |

NOTE. On vehicles to the North American specification, the connections at the lighting switch are such that the sidelamps are extinguished when the headlamps are in use.

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### KEY TO CABLE COLOURS

B—BLACK	N—BROWN	R—RED	W—WHITE
G—GREEN	P—PURPLE	U—BLUE	Y—YELLOW
RN—RED WITH BROWN AND SO ON			

## RECOMMENDED LUBRICANTS

The Rover Company attaches very great importance to the nature of the lubricants used in its products and therefore maintains tests of those which it recommends.

Because of the extensive nature of these tests they cannot be carried out upon more than a strictly limited number of different makes. Consequently the Rover Company currently confines its recommendations to those set out below.

Should for any reason such lubricants not be available in certain overseas territories, the Rover Distributor or Dealer for that territory will obtain specific guidance from the Rover Company, or owners may communicate with the Company where they so wish.

The attention of owners is drawn to the fact that the use of lubricants, other than those recommended, could in certain circumstances affect the settlement of claims put forward under the terms of the Company's guarantee.

COMPONENTS		S.A.E.	B.P.	DUCKHAM'S	ESSO	MOBIL	SHELL	WAKEFIELD
ENGINE AND AIR CLEANER	Extreme Winter (below 10°F)	10W	Energol Diesel D10W	NOL Diesel Engine Oil 10	Essolube HD10 W	Mobilcil 10W	Rotella 10W	Castrol CR10
	Winter (10°F to 32°F)	20W	Energol Diesel D20W	NOL Diesel Engine Oil 20	Essolube HD20 W	Mobiloil Arctic Mobiloil A	Rotella 20/20W Rotella 30	Castrol CR20
	Summer (32°F to 90°F)	30	Energol Diesel D30	NOL Diesel Engine Oil 30	Essolube HD30			Castrol CR30
	Tropical (above 90°F)	40	Energol Diesel D40	NOL Diesel Engine Oil 40	Essolube HD40	Mobiloil BB	Rotella 40	Castrol CR40
GEARBOX AND TRANSFER BOX	Normal (above 32°F)	50	Energol SAE 90	Duckham's NOL Fifty	Essolube 50	Mobiloil C X 90	Dentax 90	Castrol XXL
	Winter (32°F to 10°F)	80	Energol SAE 80	Duckham's SG 80	Essolube 30	Mobilube GX 80	Dentax 80	Castrol XL
	Extreme Winter (below 10°F)	20	Energol SAE 20W	Duckham's NOL Twenty	Essolube 20	Mobiloil Arctic	X100 Motor Oil 20/20W	Castrolite
DIFFERENTIALS AND SWIVEL PIN HOUSINGS	Normal (above 0°F)	90EP	Energol EP SAE 90	Duckham's NOL EP 90	Esso Expee Compound 90	Mobilube GX 90	Spirax 90 EP	Castrol Hipress 140 EP
	Extreme Winter (below 0°F)	80EP	Energol EP SAE 80	Duckham's NOL EP 80	Esso Expee Compound 80	Mobilube GX 80	Spirax 80 EP	Castrol Hypoy Light
STEERING BOX AND LUBRICATION NIPPLES	Normal (above 32°F)	140	Energol SAE 140	Duckham's SG 140	Esso Gear Oil 140	Mobilube C140	Spirax 140 EP	Castrol D
	Winter (32°F to 0°F)	90	Energol SAE 90	Duckham's SG 90	Esso Gear Oil 90	Mobilube C90	Spirax 90 EP	Castrol ST 90
	Extreme Winter (below 0°F)	80	Energol SAE 80	Duckham's SG 80	Essolube 30	Mobilube C80	Spirax 80 EP	Castrol ST 80
STEERING RELAY UNIT (SEALED)		140	Energol SAE 140	Duckham's SG 140	Esso Multi-purpose Grease H	Mobilube C140	Spirax 140 EP	Castrol D
REAR POWER TAKE-OFF, PULLEY UNIT AND CAPSTAN WINCH		20W	Energol SAE 20W	Duckham's NOL Twenty	Essolube 20	Mobiloil Arctic	X100 Motor Oil 20/20W	Castrolite

NOTE 1: -20°F = -28°C; 0°F = -17°C; 10°F = -12°C; 32°F = 0°C; 90°F = 32°C.

NOTE 2: NO lubricants of other MAKES, GRADES or TYPES are currently recommended.  
(See also paragraph 3 under Recommended Lubricants above.)

# SECTION C

## EXTRA EQUIPMENT

This section of the Instruction Manual gives information on all the extra equipment which may be fitted to the Land-Rover; where applicable, maintenance instructions are also included.

### FULL LENGTH HOOD

The canvas full length hood completely encloses the vehicle and can be opened at the rear to facilitate loading. It is available with plain sides or, for Export territories only, with side windows on the Land-Rover 88 and 109.

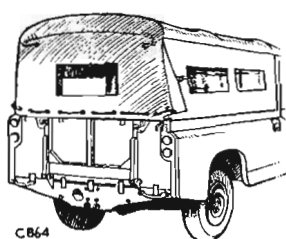


Fig. 50.  
Full length hood.

### CAB

The light alloy cab, which has sliding windows in the rear panel, encloses the driving compartment only. It is standard equipment on the basic 109 model and must be fitted when a three-quarter length hood is required.

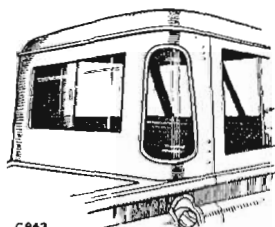


Fig. 51.  
Cab.

### REAR SEATS

Rear seats are available, each accommodating two persons. The frames are bolted to the body and wheel arch and the detachable cushions can be hinged up when not in use, to provide maximum carrying space.

Up to four units may be used in the 109 models.

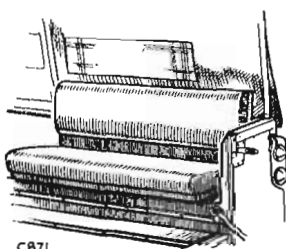


Fig. 52.  
Rear seats.

### LOCKING HANDLES AND PRIVATE LOCKS

Locking handles are available for fitting to front R.H. and rear doors. A locking catch can be fitted to the lock on the inside of the L.H. front door and all sliding windows can be secured by locking attachments.

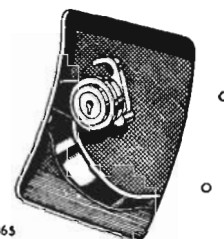


Fig. 53.  
Locking handles.

### FLYSCREENS FOR DASH VENTS

These consist of fine gauze screens on the inside of the dash over the ventilator openings. They can be fitted to all Land-Rover models.

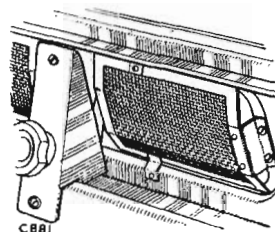


Fig. 54.  
Flyscreens for dash vents.

### SPEEDOMETER WITH TRIP

Speedometers with trip are available for the 88 and 109 models. They are obtainable with either M.P.H. or K.P.H. readings.

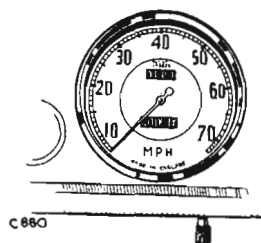


Fig. 55.  
Speedometer with trip.

### RECIRCULATING HEATER/DEMISTER UNIT

A re-circulatory heater unit is available with or without windscreen demisting attachments; it is heated from the engine cooling system and controlled by a rheostat switch.

To obtain warm air to the body of the vehicle and to the demisters, open the flaps on the heater casing. The volume of air can be regulated by means of the rheostat switch, while the flaps afford control over the air flow.

If maximum air flow is required to the demisters, set the switch to maximum speed and close the flaps.

In warm weather, the heater can be used for air circulation with the water supply cut off by means of the tap on the inlet pipe under the bonnet.

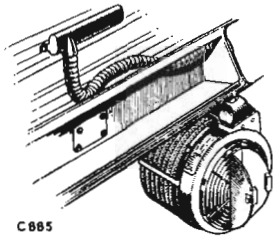


Fig. 56.  
Heater unit.

### RUBBER PEDAL PADS

Rubber pads can be supplied for the brake and clutch pedals; they are not advised if the vehicle is operating under almost continuous wet or muddy conditions, owing to danger of the feet slipping off the pedals.

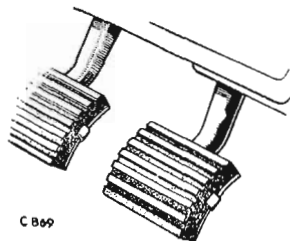


Fig. 57.  
Rubber pedal pads.

### FLASHING INDICATOR LAMPS

Additional lamps, similar to the side and rear lamps, can be fitted to the Land-Rover for use as flashing indicators.

A small control unit comprising panel, self-cancelling switch, green warning light and flasher unit is attached to the instrument panel.

When the indicators are functioning correctly the warning light will flash and the flasher unit will be audible.

Should either a front or rear indicator bulb fail, the other bulb will continue to flash, but the warning light will not be seen and the flasher will not be heard.

To replace a bulb, remove retaining screw, lever the rubber bead away from rim and lamp, and remove the rim and glass from the bottom first.

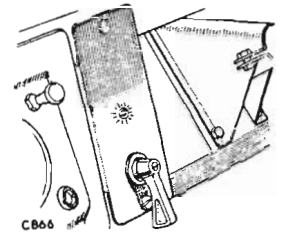


Fig. 58.  
Flasher self-cancelling  
switch and warning  
light.

Renew the bulb, move the rubber bead aside, locate the rim at the top of the lamp and press it into position; finally position the bead so that it fits snugly round the rim.

Replacement bulbs .... Lucas No. 382, 12v., 21w.

### SPARE WHEEL CARRIER

When it is desired to utilise the entire body space, an alternative carrier for the spare wheel can be mounted on the bonnet panel. It comprises a central mounting plate, with four rubber support blocks positioned under the tyre wall to ensure even weight distribution.

A special dished bonnet top panel is required with the 109 model.

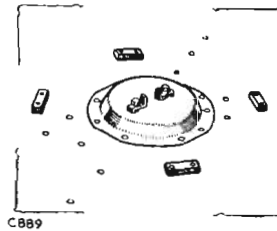


Fig. 59.  
Spare wheel carrier

### HEAVY DUTY TOWING PINTLE

This towing pintle is designed to suit trailers having a towing eye larger than can be used with the standard towing jaw; it is secured to the rear chassis cross member with four bolts.

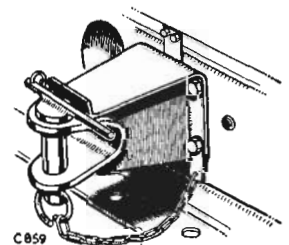


Fig. 60.  
Heavy duty towing  
pintle.

### REAR DRAW BAR AND EXTENSION BRACKET FOR TOWING JAW

Draw bar and bracket are supplied with the rear power take-off unit and are also available separately. They enable the towing jaw to be used with the power take-off unit in position.

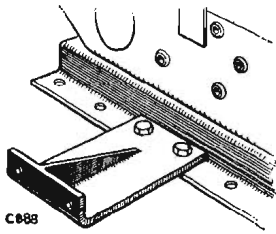


Fig. 61.  
Draw bar and extension  
for towing jaw.

### LIFTING AND TOWING RINGS

Lifting and towing rings are available and are fitted one on each side of the front bumper where the bumper is attached to the chassis frame.

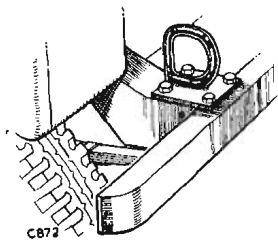


Fig. 62.  
Lifting and towing rings.

### PROPELLER SHAFT COVERS

Special covers are available to prevent the propeller shaft universal joints from becoming entangled with grass, etc., when the vehicle is used for haymaking or similar cross-country work.

The set of covers comprises shields under the front and rear differential joints and a plate secured under the transfer box to protect the front output shaft joint.

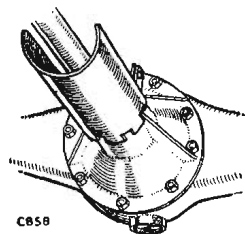


Fig. 63.  
Propeller shaft covers.

### POWER TAKE-OFF UNITS

The layout of the Land-Rover transmission has been arranged so that power take-off drive for auxiliary equipment can be taken from two points. A pulley drive fitted immediately behind the gearbox (called the centre power take-off) can be used for driving appliances mounted on the vehicle, while the take-off unit at the rear, with spline and pulley drive, is for the purpose of driving all kinds of machinery, both stationary and towed. Either or both of these drives may be readily installed at any time and their presence in no way affects normal operation of the vehicle.

For stationary work, engine R.P.M. must not be allowed to exceed 2,550, i.e. governor position 12. Should the machinery require a higher speed, a step-up belt drive or gearbox must be used.

The drive is taken through a dog clutch on the rear of the gearbox mainshaft and incorporates a flanged output shaft. Selector mechanism is bolted to the top of the transfer box, the selector lever being accessible through a hinged cover plate in the seat-box centre panel. To engage the power take-off drive, the selector knob must be pushed forward.

Horse-power figures quoted throughout this section are in British units.

Operating instructions for the power take-off units together with pulley, engine and road speeds are contained in a separate booklet; copies obtainable on request to:

The Rover Company Ltd.,  
Technical Service Dept.,  
Solihull, Warwickshire,  
ENGLAND.

### CENTRE POWER TAKE-OFF

The driving pulley, usually of the multi-belt pattern, bolts directly on to the flanged output shaft. Operation and maintenance instructions for the driven equipment will be provided with the equipment and is available from the manufacturer. Not more than 20-25 B.H.P. can be transmitted through the centre power take-off, or damage to the rear engine mountings will result.

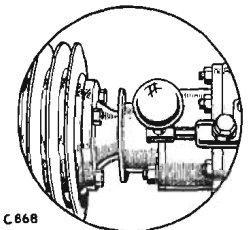


Fig. 64.  
Centre power take-off.

### Centre power take-off maintenance:

The belt drive to the driven equipment must be adjusted periodically to ensure that the tension is correct. It should be possible to depress the belts by thumb pressure  $\frac{1}{2}$  to 1 in. (12 to 25 mm) at a point midway between the pulleys.

In the case of multi-belt drives, all must be renewed if one belt breaks or is damaged. Whenever the belts are removed they should be marked to ensure replacement in the original grooves.

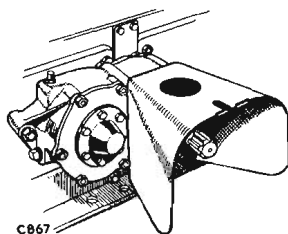
### REAR POWER TAKE-OFF

The rear power take-off unit, mounted on the rear chassis cross-member, is driven by a propeller shaft from the flanged output shaft at the rear of the gearbox and is designed to transmit up to 20-25 B.H.P.; the standard S.A.E. six-splined output shaft is on the centre-line of the vehicle and provides power for towed equipment.

Rear power take-off maintenance:

1. Oil level. The oil level must be checked at every 40 operation hours and replenished as necessary to the bottom of the filler/level plug hole on the side of the casing.

Fig. 65.  
Rear power take-off.



2. Oil changes. The oil should be completely drained from the unit after the first 30 hours and thereafter at intervals of six months by removing the drain plug from the bottom of the casing; refill to the bottom of the level plug hole with oil of the recommended grade. The oil capacity is approximately 1 Imperial pint (0,5 litre).
3. Propeller shaft. Lubricate the three nipples on the propeller shaft with oil of the correct grade at intervals of six months.

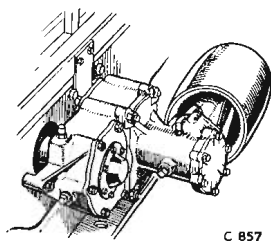
### REAR DRIVE PULLEY

The 8 in. (200 mm.) rear drive pulley unit may be attached to the rear power take-off unit in place of the guard by means of four spring washers and nuts. Difficulty would be experienced in holding the vehicle steady if more than 20 B.H.P. is transmitted through the pulley.

Rear drive pulley maintenance:

1. Oil level. The oil level must be checked at every 40 operation hours and replenished as necessary to the bottom of the small level plug hole in the side of the casing, through the larger filler plug hole.

Fig. 66.  
Rear drive pulley.



2. Oil changes. The oil should be completely drained from the unit after the first 30 hours and thereafter at intervals of six months by removing the unit from the vehicle and pouring out the oil through the filler plug hole. Refill to the bottom of the level plug hole with oil of the recommended grade; the capacity is approximately  $\frac{3}{4}$  Imperial pint (0,5 litre).

### OIL COOLER

An engine oil cooler must be fitted when the vehicle is used to drive stationary equipment under conditions in excess of:—

Power required: 20 B.H.P. at 1500 R.P.M.  
24 B.H.P. at 2000 R.P.M.  
20 B.H.P. at 2500 R.P.M.  
10 B.H.P. at 3000 R.P.M.

Ambient air temperatures: 20°C. (68°F.).

Running time: 30 minutes.

It incorporates a cooling radiator inserted in the engine oil system and mounted just in front of the radiator; a gauge on the dash panel gives continuous indication of the oil temperature.

The oil temperature should never exceed 90°C. and the engine must be switched off and the oil allowed to cool down if this temperature is reached under working conditions.

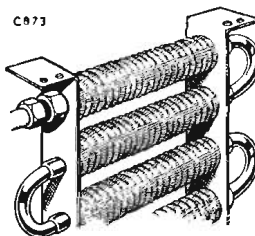


Fig. 67.  
Oil cooler.

### CAPSTAN WINCH

The front capstan winch, designed for a maximum pull of 2,500 lb. (1.135 kg.), is mounted on the front bumper and driven directly from the engine crankshaft.

The winch must be used with the engine running 600 R.P.M., i.e. a fast idling speed.

It is used with one end of the rope attached to the vehicle being pulled, then wound twice round the bollard, and with the winch drive engaged, the operator maintains a steady pull on the free end of the rope, thus causing it to grip the bollard.

The most suitable rope size and type is  $1\frac{1}{4}$  in. dia. (31,5 mm. dia.) manilla.

Rope speed is  $12\frac{3}{4}$  ft./min. (4 metre/min.) at 600 engine R.P.M.

The drive should be engaged or disengaged by means of the operating knob on the winch casing, with the engine stationary and without any load on the rope.

With the winch installed, provision is made for the engine starting handle to be applied at the front of the winch instead of at the dog on the crankshaft.

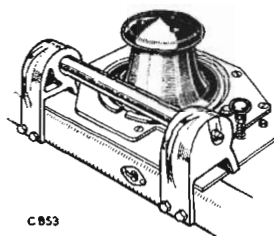
Front winch maintenance.

1. Oil level. Every 40 operation hours, check the oil level by means of the dipstick incorporated in the filler plug and replenish as necessary.



2. Oil changes. Every six months, drain off the oil through the drain plug in the bottom of the winch casing and refill with oil of the correct grade; the capacity is  $3\frac{1}{2}$  Imperial pints (2 litres).
3. Lubrication nipple. Access to the lubrication nipple on the bollard shaft is gained by turning

Fig. 68.  
Front capstan winch.



the bollard until the hole is in line with the nipple. Lubricate this point at intervals of 40 operation hours.

In addition, lubrication nipples are provided on the drive shaft and rope guide. Access to the drive shaft nipple may be gained from beneath the vehicle. Lubricate these points occasionally.

### *SPECIAL VEHICLES*

Special vehicles can be supplied with auxiliary equipment, such as fire-fighting apparatus, etc., permanently installed. Such vehicles are despatched complete with instructional literature applicable to the special fittings.

# SECTION D

## ROVER SERVICE ORGANISATION

Instructions are given in this book for items of routine maintenance to which due attention should be paid if smooth and efficient running is to be ensured.

In addition, however, there may be times when additional information is desired, either on repair work beyond the scope of this manual or when some difficulty is experienced.

We are always pleased to give such cases our special attention and to reply as fully as possible to any queries you may raise by letter or when you visit either of our Service Depots at Solihull and London.

Complete instructions can be supplied for any operation which you may desire to carry out on your Land-Rover; alternatively, a complete Workshop Manual is available, from any Rover distributor or dealer.

In the event of replacements being required, they should be obtained through the nearest Rover distributor or dealer.

Additional copies of this instruction manual may be obtained from any Rover distributor or dealer. Editions in French, German, Portuguese and Spanish are also available.

Please address enquiries under all these headings to:—

The Rover Co., Ltd.,  
Service Department,  
Solihull,  
Warwickshire.

*Telephone:* SHEldon 4242

*Telegrams:* Rovrepair, Solihull

*Telex:* 33-156