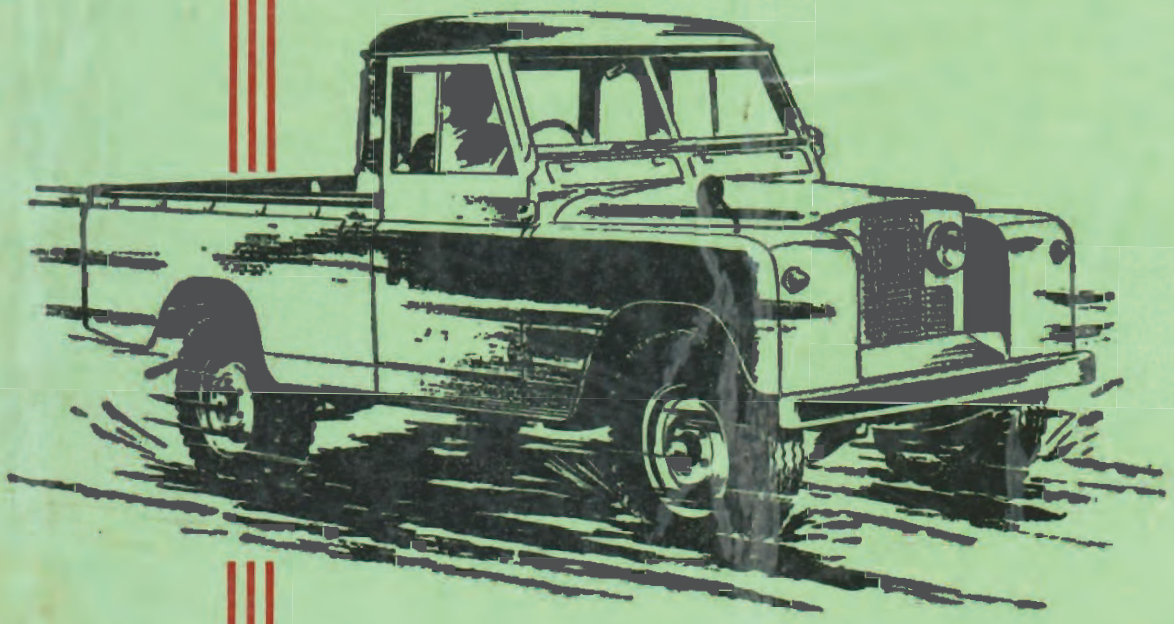
LAND-ROVER

SERIES IIA



PETROL & DIESEL MODELS

OWNER'S MANUAL

PART No. 4388

LAND-ROVER

SERIES IIA

PETROL AND DIESEL MODELS

OWNER'S MANUAL

THE ROVER COMPANY LTD.

By Appointment to Her Majesty Queen Elizabeth II

Manufacturers of Land-Rovers

SOLIHULL

WARWICKSHIRE

ENGLAND

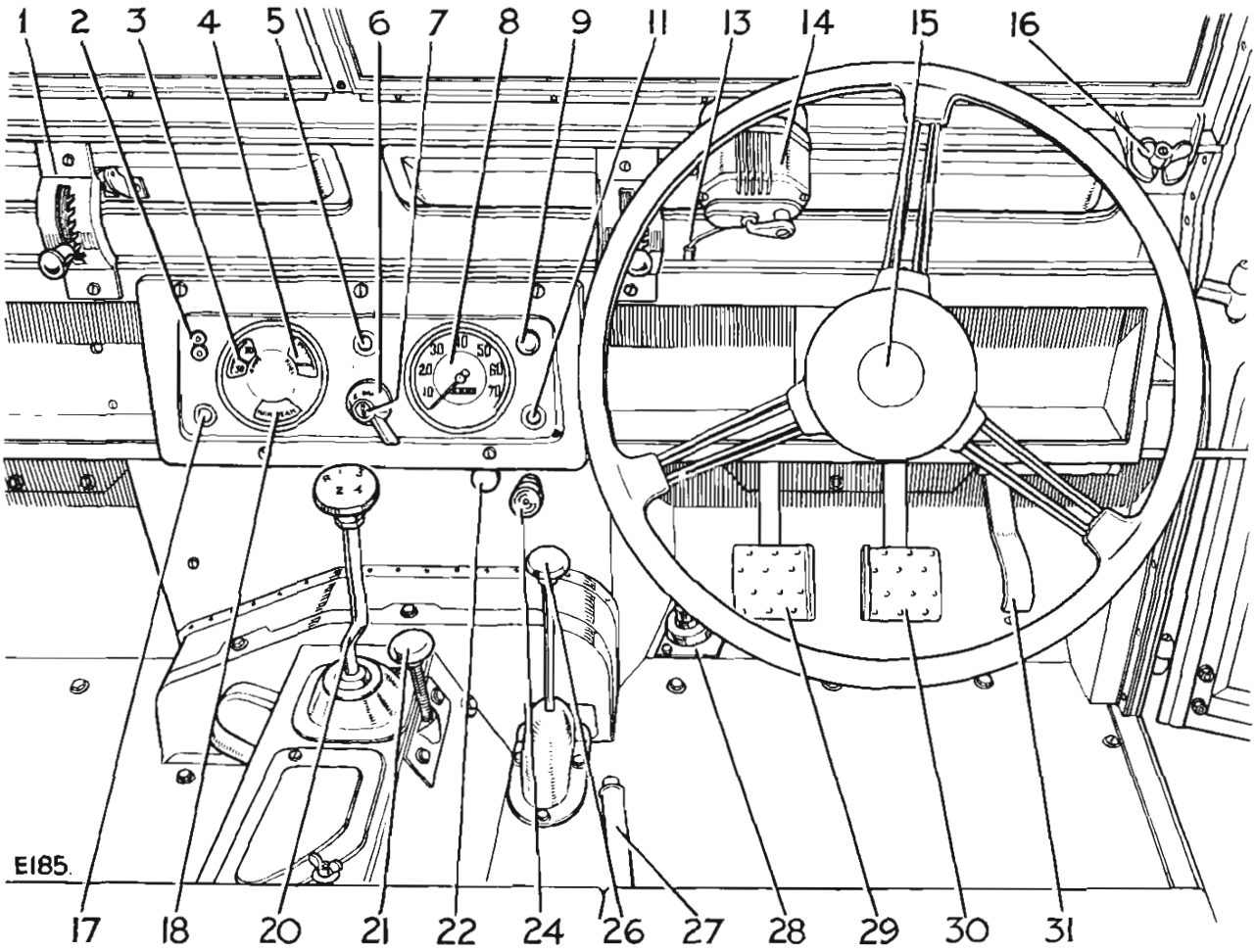
Publication No. TP.275/A

AUGUST 1961

Part No. 4388

LAND-ROVER SERIES IIA 88 MODEL

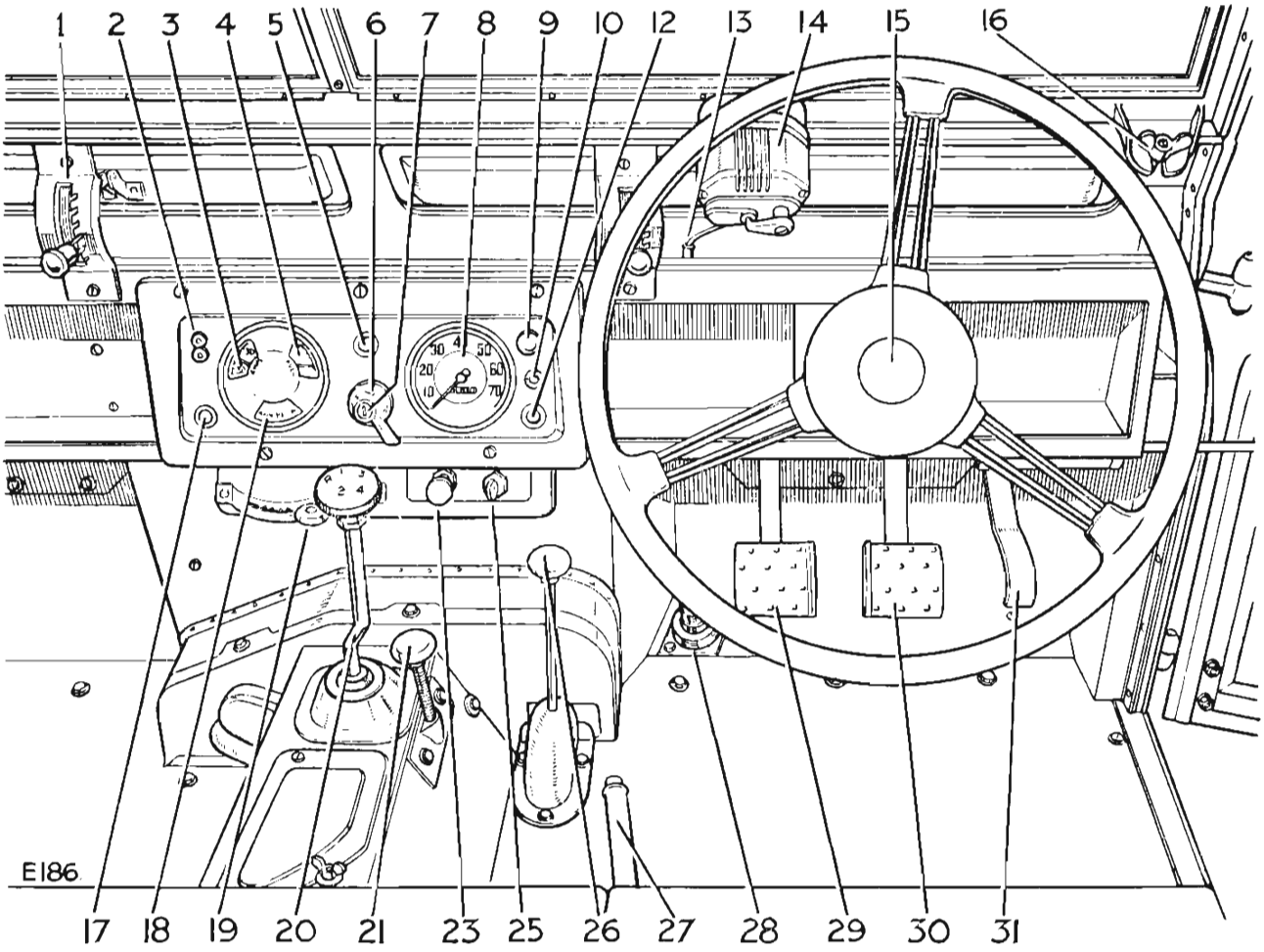
LAND-ROVER SERIES IIA 109 MODEL



Layout of controls and instruments, Petrol models

1 Windscreen ventilators
2 Lead lamp socket
3 Ammeter
4 Fuel level gauge
5 Oil pressure warning light
6 Main lamp switch
7 Ignition switch
8 Speedometer
9 Panel light switch
11 Cold start control warning light
13 Wiper plug lead
14 Windscreen wiper
15 Horn button
16 Wing nut securing windscreen
17 Charging warning light
18 Headlamp warning light
20 Main gear change lever
21 Front wheel drive control
22 Cold start control
24 Starter switch
26 Transfer box lever
27 Hand brake
28 Headlamp dipper switch
29 Clutch pedal
30 Brake pedal
31 Accelerator

For details of the operation of the instruments and controls
see following pages



Layout of controls and instruments, Diesel models

1 Windscreen ventilator
2 Lead lamp socket
3 Ammeter
4 Fuel level gauge
5 Oil pressure warning light
6 Lamp switch
7 Electrical services switch
8 Speedometer
9 Instrument panel light switch
10 Fuel tank warning light
12 Heater plug warning light
13 Wiper lead plug
14 Windscreen wiper
15 Horn button
16 Wingnut securing windscreen
17 Charging warning light
18 Headlamp warning light
19 Engine hand speed control
20 Main gear change lever
21 Front wheel drive control
23 Engine stop control
25 Switch for starter and heater plug
26 Transfer box lever
27 Hand brake
28 Headlamp dipper switch
29 Clutch pedal
30 Brake pedal
31 Accelerator pedal

For details of the operation of the instruments and controls see following pages.

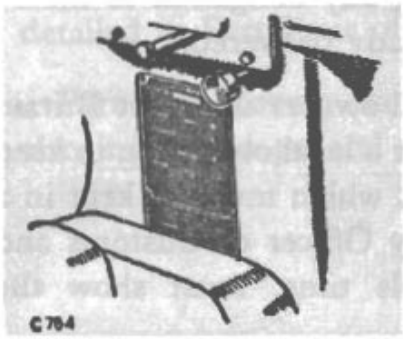
CONTENTS

INTRODUCTION

This book has been prepared, to present as clearly as possible to you, all the information necessary for the efficient care and maintenance of your Land-Rover. It covers both the Petrol and Diesel models. The paragraphs in this book are therefore applicable to both models, unless otherwise stated in the sub-headings.

Careful running-in of your vehicle is of great importance; high speeds and harsh driving for the first 500 miles can cause unnecessary wear in the engine and transmission and so shorten the life of the Land-Rover.

Although the instructions have been made as simple and clear as possible, there may be occasions when further information is required; in cases such as this you are advised to see your local Rover distributor or dealer, or, if necessary, you can write direct to our Service Department.

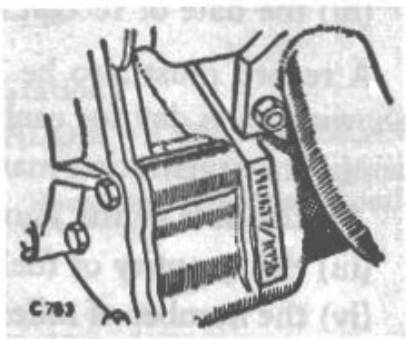


Vehicle serial number

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

The vehicle serial number will be found on the transfer box instruction plate on the dash panel over the gearbox cover.

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



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.

We feel it important that you should recognise the importance of using only genuine Rover Parts or Rover Approved Parts when repair or maintenance work is being carried out on your Land-Rover.

Rover parts are produced to the same high standard as those parts built into the Land-Rover in its original production and it is in your best interests that you should insist that only genuine Rover Parts or Rover Approved Parts are fitted to your Land-Rover.

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.

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 engined vehicle.

For ease of reference the book has been divided into five parts.

Part One gives all the information needed about handling your Land-Rover.

In Part Two will be found full details of the lubrication and maintenance needed, for those owners who intend to carry out this work themselves. If you do not wish to service the Land-Rover yourself we strongly advise that you consult your nearest Rover distributor or dealer and arrange a regular maintenance schedule with him.

Part Three gives the procedure for a systematic examination to locate and remedy the causes of some of the faults which may occur.

Optional equipment which is available for the Land-Rover is detailed in Part Four of this book.

Part Five covers the specification of your Land-Rover and also includes a general index to the whole of the book.

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Rovrepair, Wesphone, London

PART ONE

OPERATING INSTRUCTIONS

The instruments and driving controls of your Land-Rover are situated so they can be conveniently seen and used, thus allowing maximum attention to be given to the road ahead. They are all illustrated and described on the following pages.

The paragraphs in this book are applicable to both Petrol and Diesel models unless otherwise stated in the sub-headings.

The numbers in brackets after each sub-heading refer to the illustrations on Page 4 for Petrol models and Page 5 for Diesel models.

Points to remember, Diesel models

DO

Fill the tank with *clean* fuel.

Make sure the engine stop control is right in, run position, when starting.

Depress the throttle pedal fully when starting.

Use correct grade of oil for prevailing climatic conditions.

Change C.A.V. filter element regularly; also clean sediment bowl.

Always prime fuel system if any part of the fuel lines or filters are disconnected.

Eliminate air from the fuel system and make sure all connections are tight.

If the engine stops without apparent reason, make sure that fuel is reaching the distributor pump.

Use a recommended grade of fuel, e.g. Class A, Derv, etc.

With engine cold use heater plugs to conserve batteries; see starting procedure.

DON'T

Allow fuel to get low in tank. Replenish when blue warning light flashes.

Allow the batteries to get in a discharged condition.

Misuse the starter switch. Wait until the engine comes to rest before each application.

Use dirty fuel. Ensure that fuel storage tanks are kept in a very clean condition and exclude dust and water.

Attempt to start the engine unless the pump is primed with fuel.

Attempt to rectify the distributor pump. Send it to the nearest C.A.V. Agent and fit a service unit.

Allow hands and eyes to come in contact with spray from an injector nozzle, when testing.

Run engine without ensuring that the water is to the correct level in the radiator, otherwise overheating may occur with risk of nozzle sticking and other troubles.

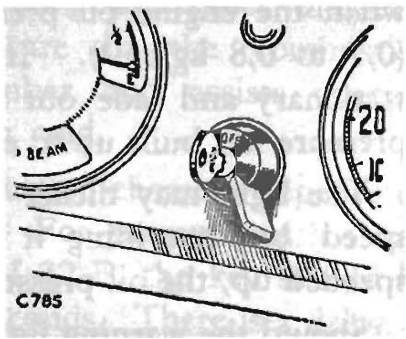
Overtighten bolts, nuts and fuel connections.

Ignition switch and key (7), Petrol models

Integral with the lamp switch in the centre of the instrument panel; turn the key clockwise for "on".

With the ignition "off", only the following electrical equipment can be used:—

Driving lights (head, side and tail lamps), instrument panel lights, lead lamp socket and horn.



Ignition or electrical services switch and key

Electrical services switch and key (7), Diesel models

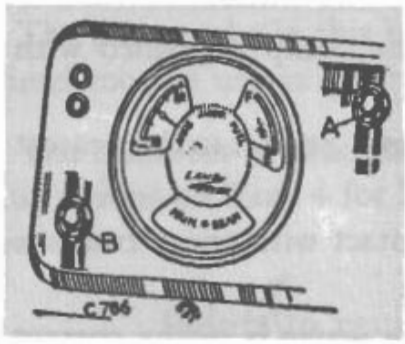
The key is integral with the lamp switch in the centre of the instrument panel; turn the key clockwise for "on".

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 control marked "Engine stop" on the dash panel below the speedometer, must be pulled to stop the engine.



Charging and oil pressure warning lights
A—Oil pressure warning light
B—Charging warning light

Charging warning light (17)

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

Oil pressure warning light (5)

The green warning light at the top centre of the panel glows when the engine oil pressure drops below 10 to 12 lb./sq.in. (0,7 to 0,8 kg/cm²). It will light up when the engine is stationary and fade out when the engine starts and the oil pressure has built up to exceed this figure.

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.

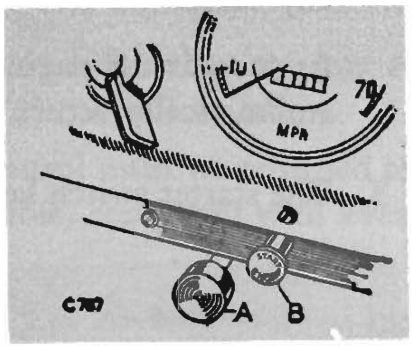
To guard against bulb failure in the oil pressure and charging warning lights, a check should be made that the bulbs glow each time the ignition is switched on.

Withdraw the instrument panel to renew bulbs.

Replacement bulbs.
Oil and charging warning lights: Lucas No. 987 12 v., 2.2 MES.

Starter switch (24), Petrol models

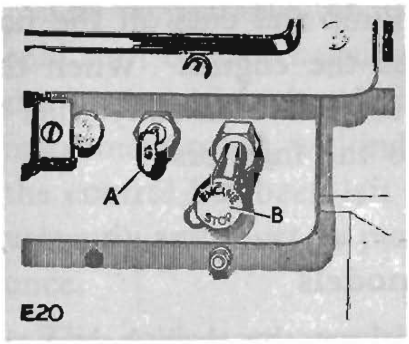
On the dash panel below the instrument panel; to operate, press and release as soon as the engine fires.



Starter switch and cold start control, Petrol models
A—Starter switch
B—Cold start control

Starter and heater plug switch (25), Diesel models

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:—



Starter and heater plug switch, Diesel models

1. When starting with a cold engine 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 10 seconds. There is a delay of 2 or 3 seconds before the warning light glows. The time required for any set of circumstances will be found with experience.

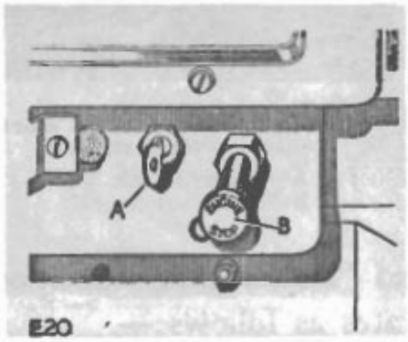
Further movement of the key anti-clockwise to the second position will operate the starter motor and at the same time still allow current to flow to the heater plugs.

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.



Engine stop control. Diesel models

Engine stop control (23) Diesel models

To stop the engine pull the "Engine stop" control out. This control overrides the fuel supply metering valve located in the injection pump and cuts off the fuel supply to the engine. When the control is pushed in fully, fuel is supplied via the distributor pump to the injectors.

Cold start control (22), Petrol models

Marked "Cold Start" and mounted on the dash below the speedometer.

It is fully progressive and it is only necessary to pull it out sufficiently to start the engine.

On models with carburetter starter heater element fitted, the first $\frac{3}{8}$ in. (9,5 mm) movement gives a fast idle position without enrichment of the mixture. Further movement of the control switches on the heater element and also enriches the mixture. If the heater element is functioning an additional 3-4 amp. discharge will show on the vehicle ammeter.

The heater in operation warms the ducted air as it enters the starter box, therefore preventing an icing-up condition in that region.

The half-way position, which is indicated when a light click is felt, should be sufficient to start the engine at temperatures around freezing point.

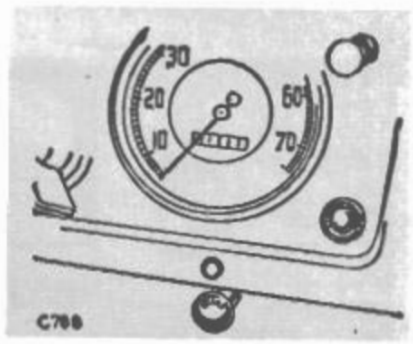
The control should only be pulled out fully when starting at extremely low temperatures such as 0°F (–17°C) or below.

When the engine has started, the control must be returned to the normal position as soon as possible, consistent with even running and freedom from stalling.

On models with a carburetter starter heater element fitted the last $\frac{3}{8}$ in. (9,5 mm) of movement gives a fast idle position without enrichment of the mixture.

Cold start control warning light (11), Petrol models

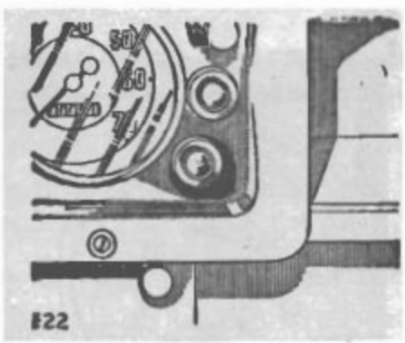
The appearance of the amber cold start control warning light, at the bottom right hand side of the instrument panel, will indicate that the control has been left out inadvertently and must be pushed in at once.



Cold start control warning light, Petrol models

The cold start control warning system is not completely fool-proof and the responsibility for pushing in the cold start control rests with the driver.

Withdraw the instrument panel to renew bulb.



Heater plug warning light, Diesel models

Replacement bulb.
Cold start control warning lamp:
Lucas No. 987, 12 v., 2.2 MES.

Heater plug warning light (12), Diesel models

The amber warning light at the bottom right-hand corner of the panel will glow when the heater plug switch is operated; this indi-

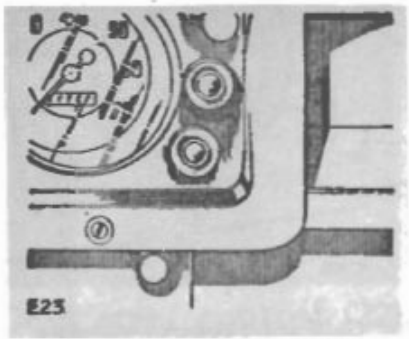
cates that current is being passed through the heater plugs; there is a delay of 2 or 3 seconds before it glows. If the warning light glows more brightly at any time, a short circuit in the system is indicated. No light will indicate an open circuit. This should receive attention at your nearest Rover Distributor or Dealer.

Withdraw the instrument panel to renew bulb.

Replacement bulb.
Heater plug warning light: Lucas No. 987, 12 v., 2.2 MES.

Fuel tank level warning light (10), **Diesel models**

The blue warning light, fitted in the centre of dash at the right-hand side, is operated by the fuel level gauge, and lights up when the fuel level drops below $1\frac{1}{2}$ gallons (7 litres), and remains "on" until the fuel supply is replenished.



Fuel tank warning light, Diesel models

Intermittent flashing may occur when cornering, before the fuel level drops below $1\frac{1}{2}$ gallons.

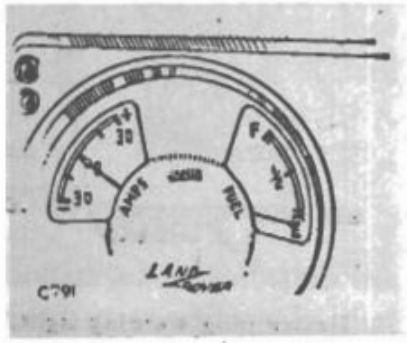
This warning light is fitted to reduce the possibility of the driver inadvertently allowing the vehicle to run out of fuel. Should the fuel supply become completely exhausted at any time, the system must be primed.

Replacement bulb.
Fuel tank warning light: Lucas No. 987, 12 v., 2.2 MES.

Ammeter (3)

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



Ammeter and fuel level gauge

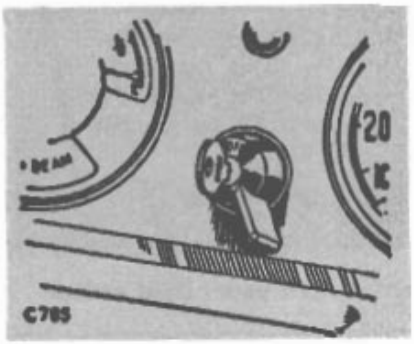
short while and then fall to a steady charge most suitable for the particular state of charge of the battery.

Fuel level gauge (4)

The fuel level gauge, in the multiple panel, only operates with the ignition or electrical services switch "on". This gauge is not a precision instrument and cannot be used to derive fuel consumption figures.

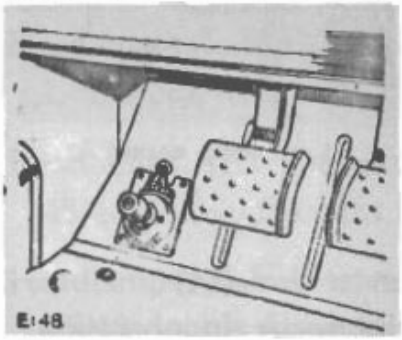
Main lamp switch (6)

Turn the rotary lamp switch to the required position: "OFF", to "S" for side, tail and rear number plate lamp, or "H" for headlamps, side, tail and rear number plate lamp



Main lamp switch

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



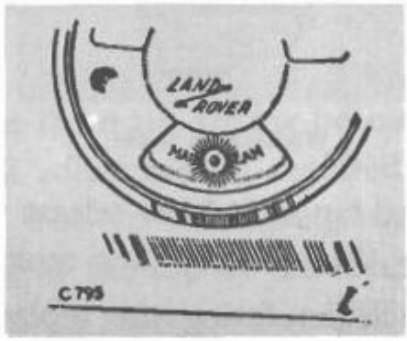
Headlamp dipper switch

Headlamp dipper switch (28)

When the foot-operated dipper switch, situated to the left of the clutch pedal, is used it replaces the primary filaments in both headlamps by secondary filaments directed towards the nearside of the road.

Headlamp warning light (18)

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 or when approaching other traffic.

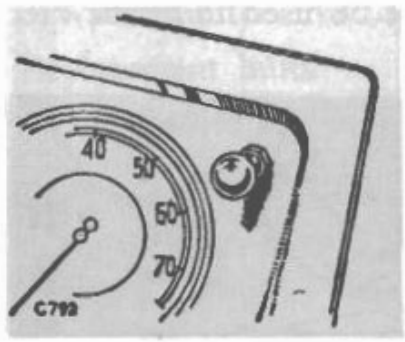


Headlamp warning light

Withdraw the instrument panel to renew bulb.

Replacement bulbs.

Headlamp warning light and instrument panel lights:
Lucas No. 987, 12 v., 2.2 M.E.S.



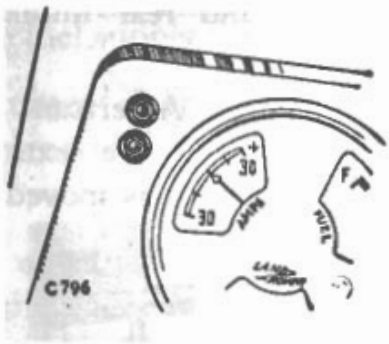
Instrument panel light switch

Instrument panel light switch (9)

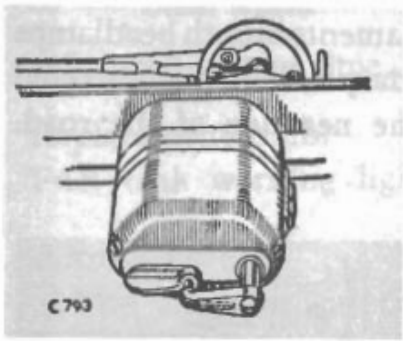
The push-pull switch controlling the panel lights, in the top right-hand corner of the panel, is only operative with the lamp switch at "S" or "H".

Lead lamp socket (2)

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.



Lead lamp socket



Windscreen wiper

Windscreen wiper (14)

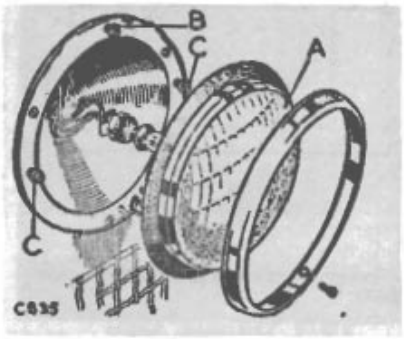
To set the wiper in operation, pull out the blade lever, turn it to clear the switch lever and turn the latter through 90°. To park the blade, reverse these operations.

To replace windscreen wiper arm and blade, 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.

Headlamps

The headlamps are mounted on the radiator grille; to replace a bulb slacken the clamping screw 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 bulb adaptor in an anti-clockwise direction and pull it off the light unit; the bulb can then be replaced and the unit reassembled.



Headlamp
A—Light unit
B—Vertical setting screw
C—Horizontal setting screws

Replacement bulbs.

Headlamps (R.H.D. models): Lucas No. 414, 12 v., 50/40 double filament (dip to left)

Headlamps (L.H.D. models except North America and Europe): Lucas No. 415, 12 v., 50/40 double filament (dip to right)

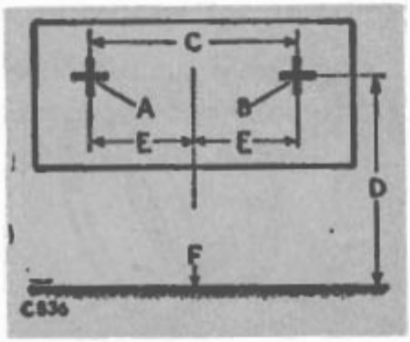
Headlamps (Europe except France): Lucas No. 410, 12 v., 45/40 double filament (duplo) (vertical dip)

Headlamps (L.H.D. models France): Lucas No. 411, 12 v., 45/40 double filament, duplo yellow (vertical dip).

Headlamps (L.H.D. North America): Sealed beam unit 12 v.

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.



Headlamp setting board dimensions

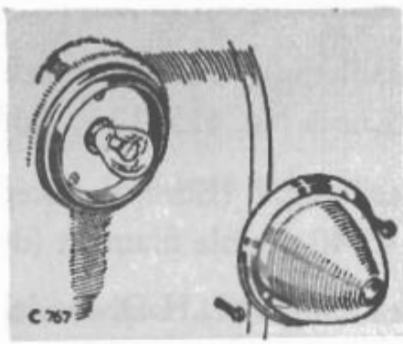
A—Concentrated area of light—L.H. headlamp
B—Concentrated area of light—R.H. headlamp
C—20 in. (508 mm)
D—37½ in. (945 mm)—109 models
35½ in. (810 mm)—88 models
E—10 in. (254 mm)
F—Ground level

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

1. Mark on the board the dimensions shown on the illustration 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, tail and stop lamps (flasher lamps when fitted).

The side, tail, stop and flasher lamps are all of the same basic design and are mounted in the front wings and rear body respectively. To replace a bulb:



Side, tail and stop lamp bulb replacement

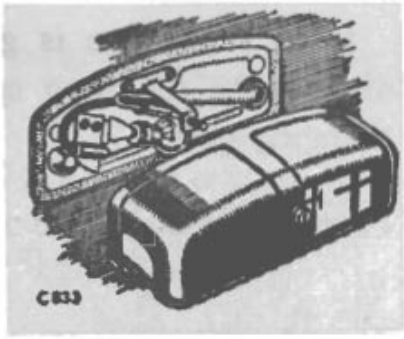
Remove rim retaining screws, lever the rubber bead away from the lamp and remove the rim and glass from the bottom first. Renew the bulb, move the rubber bead aside, locate the rim at the top of the lamp and press it into position; finally position the bead so that it fits snugly round the rim. Replace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

Replacement bulbs.
Side lamps: Lucas No. 207, 12 v., 6 w.
Stop, tail lamps: Lucas No. 380, 12 v., 21/6 double filament
Flasher lamps: Lucas No. 382, 12 v., 21 w.

Rear number plate illumination lamp

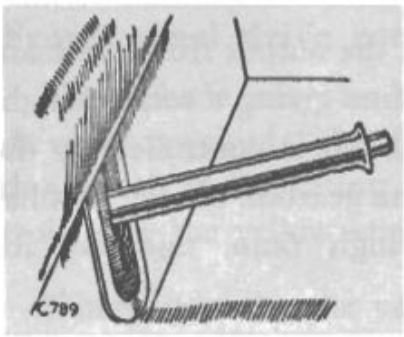
The rear number plate illumination lamp is mounted on the rear body.

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



Rear number plate illumination lamp

Replacement bulb.
Rear number plate illumination lamp: Lucas No. 222, 12 v., 4 w.



Hand brake

Hand brake (27)

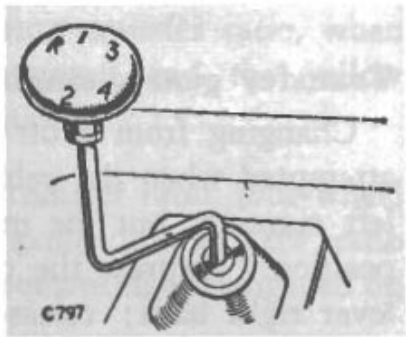
Protrudes through the front of the seat box. To release the brake, pull upwards slightly, depress the button in the top of the hand grip and push down as far as possible; to apply the brakes, pull the lever upwards.

Main gear change lever (20)

The positions on 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 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.



Main gear change lever

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 gear lever (26)

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, with red knob, 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.

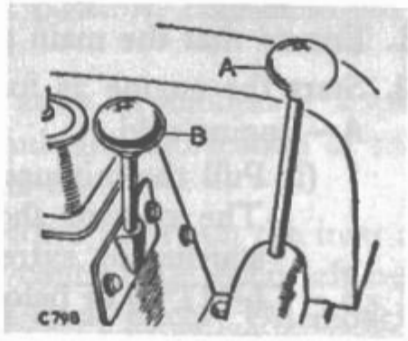
The neutral position mid-way between "high" and "low" is quite definite and is used with the power take-off for stationary work; the vehicle cannot be driven with the lever in neutral.

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 hestitation 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.



Transfer gear change lever, and front wheel drive control
A—Transfer gear change lever
B—Front wheel drive control

Front wheel drive control (21)

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 yellow knob on the gearbox cover. This engages four-wheel drive in HIGH transfer. In order to regain two-wheel drive, on resuming hard surface travelling, stop the vehicle, engage LOW transfer ratio—gear lever with red knob—and return to HIGH transfer ratio, when the dog-clutch is automatically disengaged and the yellow 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.

Low transfer should only be engaged with the vehicle stationary.

Starting procedure, Petrol models

1. Ensure that the main gear lever is in the neutral position.
2. Start the engine as follows:—

A—Engine cold.

(i) Pull the mixture control to the half-way out position. The control should only be pulled out fully when starting at extremely low temperatures such as 0°F (—17°C) or below.

On models with carburetter starter heater element fitted, the first $\frac{3}{8}$ in. (9,5 mm) movement gives a fast idle position without enrichment of the mixture. Further movement of the control switches on the heater element and also enriches the mixture. If the heater element is functioning, an additional 3-4 amp. discharge will show on the vehicle ammeter.

The heater in operation warms the ducted air as it enters the starter box, therefore preventing an icing-up condition in that region.

(ii) Keep the foot clear of the accelerator.

(iii) Switch on the ignition, check that the green oil pressure and red charging warning lights appear.

(iv) Press the starter button, when the engine should start after a turn or two.

Never pump the accelerator pedal when starting the engine, as the action of the carburetter accelerator pump will tend to prime the cylinders with an over-rich mixture.

B—Engine warm or hot.

(i) Make sure the mixture control is right in.

(ii) Depress the accelerator half-way.

(iii) Switch on the ignition, check that the green oil pressure and red charging warning lights appear.

(iv) Press the starter button.

(v) Remove the foot from the accelerator as soon as the engine fires.

If the engine makes a false start, allow the starter to come to rest before pressing the starter button again. Should the engine fail to start after two or three attempts, investigate and correct the cause before the battery is run down needlessly.

3. The mixture control is fully progressive and must be returned to the normal position as soon as possible, consistent with even running.

   Do not race the engine; drive away at moderate speed immediately after starting, so stimulating lubrication of the cylinder walls as the engine warms up.

   The appearance of the AMBER WARNING LIGHT on the instrument panel will indicate that the control has been left out inadvertently and must be pushed in at once. On models with starter heater element the last $\frac{3}{8}$ in. (9 mm.) of movement gives a fast idle position.

Starting procedure, Diesel models

The use of ether in capsules or in any other form must not be used to start the engine, as very high cylinder pressures are developed under these conditions, which can lead to serious and expensive mechanical failure.

The Land-Rover Diesel engine will start satisfactorily, with the proper use of the heater plugs down to temperatures of −20°C, even with batteries only 70% charged, provided the correct grade of oil is used.

1. Ensure that the main gear lever is in the neutral position.
2. 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. As soon as the engine is running release the starter 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.

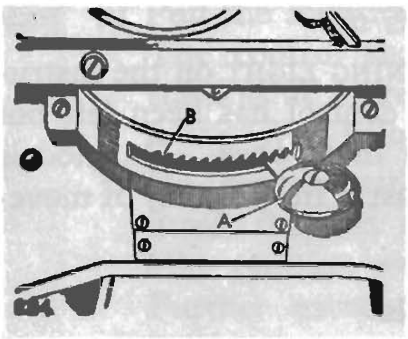
If necessary adjust slow running with engine speed hand control to avoid stalling and maintain smooth idling speed.

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

Engine speed hand control, Diesel models

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.



Engine hand speed control, Diesel models

A—Quadrant lever at inoperative position
B—Operating notches

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

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.

Running-in period

Progressive running-in of your 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 full throttle 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.

Fuel consumption, Petrol models

The Land-Rover has a high-powered and efficient 2¼ litre engine designed for hard work under almost any conditions.

With all this power available, the vehicle is capable of sustained high speeds under normal road conditions. In common with all vehicles the petrol consumption mounts rapidly if high speeds are maintained. For example, at 50 m.p.h. (80 k.p.h.), the consumption in miles per gallon will be one and a half times as much as at 30 m.p.h. (48 k.p.h.) and at 70 m.p.h. (112 k.p.h.) the rate will be twice as much.

On 88 models there is an additional spring inserted in the accelerator linkage. This allows the accelerator to be pressed down with normal pressure for about three-quarters of its travel, thereafter higher pressure is required for the rest of the travel.

This device results in considerably improved fuel consumption, especially where the driver tends to use the full throttle opening unnecessarily.

Free Service Inspections

Your Rover distributor or dealer 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 the distributor or 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.).

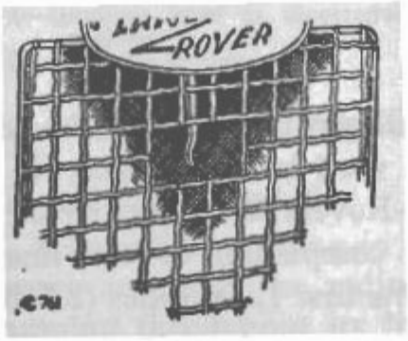
With the literature supplied with each new vehicle there is included a "Free Service Card" which details the items to be covered by each Service and two detachable Vouchers should be taken to the distributor or dealer as each Service becomes due.

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 or 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 vehicle 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 or dealer. The oil used will be charged to the owner.



Bonnet catch

Bonnet

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

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.

A de-luxe bonnet top panel with rounded front edge is fitted to all 109 models and is also available as optional equipment on the 88 model. A special version is required when the spare wheel is mounted on the bonnet.

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.

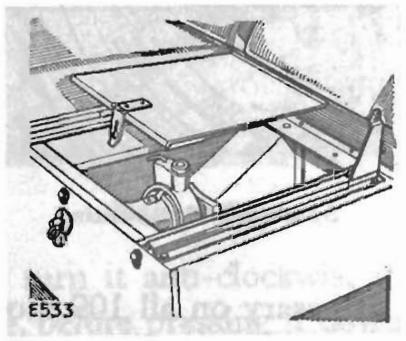
Seat adjustment—109 models

The seat cushions can be removed by lifting at the front and pulling forwards.

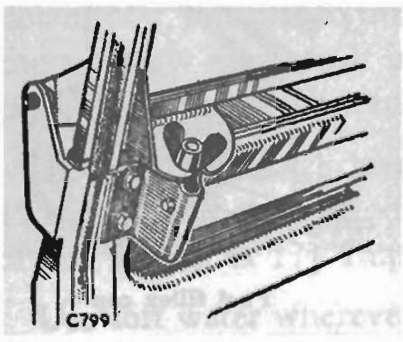
If the vehicle is parked during inclement weather without a covering the back rests may be folded down on the seat cushions.

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.



Tool stowage



Windscreen fixing screws

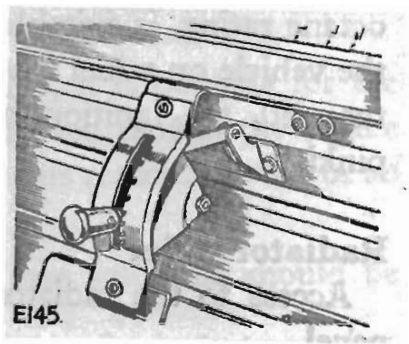
Windscreen

On canvas covered vehicles only, provision is made for folding the windscreen down on to the bonnet as follows:—

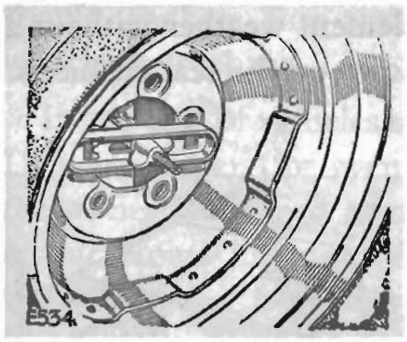
Remove the hood and water channels. Then disconnect the windscreen wiper lead at the plug adjacent to the wiper motor. Slacken the wing nuts at the bottom corners of the windscreen. Lower the windscreen to the bonnet.

Windscreen ventilators (1)

The two ventilators in the windscreen frame may be opened independently by pushing the lever upwards 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.



Windscreen ventilators



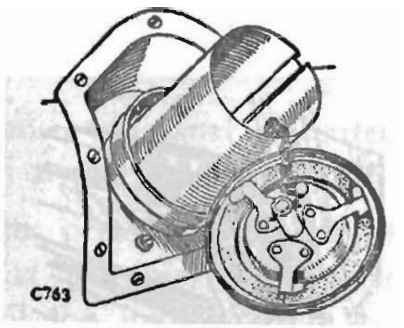
Spare wheel mounting

Spare wheel

The spare wheel on the 88 models is mounted at the front of the rear body; on 109 models can be mounted in a well at the front of either the right or left wheelarch panel. It can also be fitted to the bonnet panel as optional equipment on both the 88 and 109, but a special bonnet top panel is necessary on all 109 models, and the 88 de-luxe models.

Fuel filler

The fuel filler cap is located at the front right-hand side of the body, except on the 109 Station Wagon, which has the fuel filler cap at the rear right-hand side of the body.



Fuel filler cap

To facilitate filling when the cap is removed, a telescopic tube may be drawn out of the neck and locked by a slight anti-clockwise movement. The tank capacity is 10 Imperial gallons (45 litres), except the 109 Station Wagon, which has a capacity of 16 gallons (73 litres).

Petrol models. Any good brand of petrol of approximately 80 octane rating, is suitable for this vehicle. If it is desired to run the vehicle on a fuel having an octane rating of substantially less than 80, the ignition may require slightly retarding to avoid pinking.

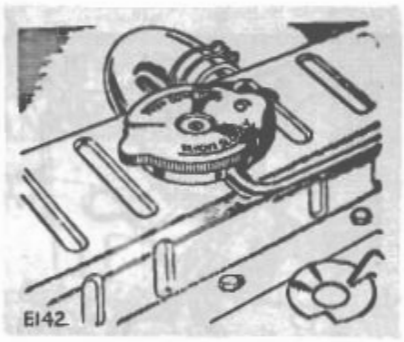
Radiator filler

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

Diesel models. 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.

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.



Radiator filler

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.

When replacing the filler cap it is important that it is tightened down fully, not just to the first stop. Failure to tighten the filler cap properly may result in the water boiling away rapidly, with possible damage to the engine through overheating.

The correct water level is approximately $\frac{1}{2}$ to $\frac{3}{4}$ in. (12 to 19 mm) below the bottom of the filler neck; the total capacity of the system is $17\frac{1}{2}$ Imperial pints (10 litres).

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

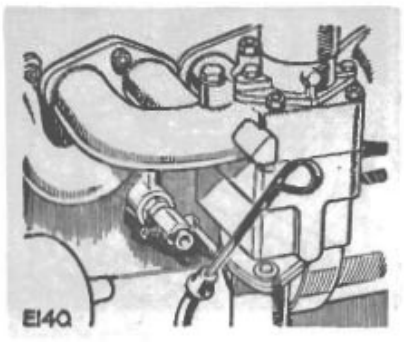
Frost precautions

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 0° F (0° C and minus 17° C) use 1 part of anti-freeze to 3 parts of water.



Drain tap, engine

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.
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.

Drain tap, radiator

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 blue label affixed to the right-hand side of the windscreen and a blue 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 blue labels should be removed from the windscreen and engine when this has been carried out.

PART TWO

ROUTINE MAINTENANCE AND ADJUSTMENTS

Lubrication and maintenance are necessary to keep your Land-Rover in good mechanical condition. All the items which require regular or occasional maintenance are shown on the following chart 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. 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, Diesel models. Absolute cleanliness is essential when dealing with the fuel system. Two filters on Home models and three on Export models are incorporated in the fuel system ; they must 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 ROVER RECOMMENDED LUBRICANTS

After exhaustive tests the recommended lubricants 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.

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 on the next page.

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.

No lubricants of other makes, grades or types are currently recommended.

Multigrade oils, produced by the makers of the lubricants listed on the next page, are also approved for the range of S.A.E. grades that they cover.

Recommended Lubricants

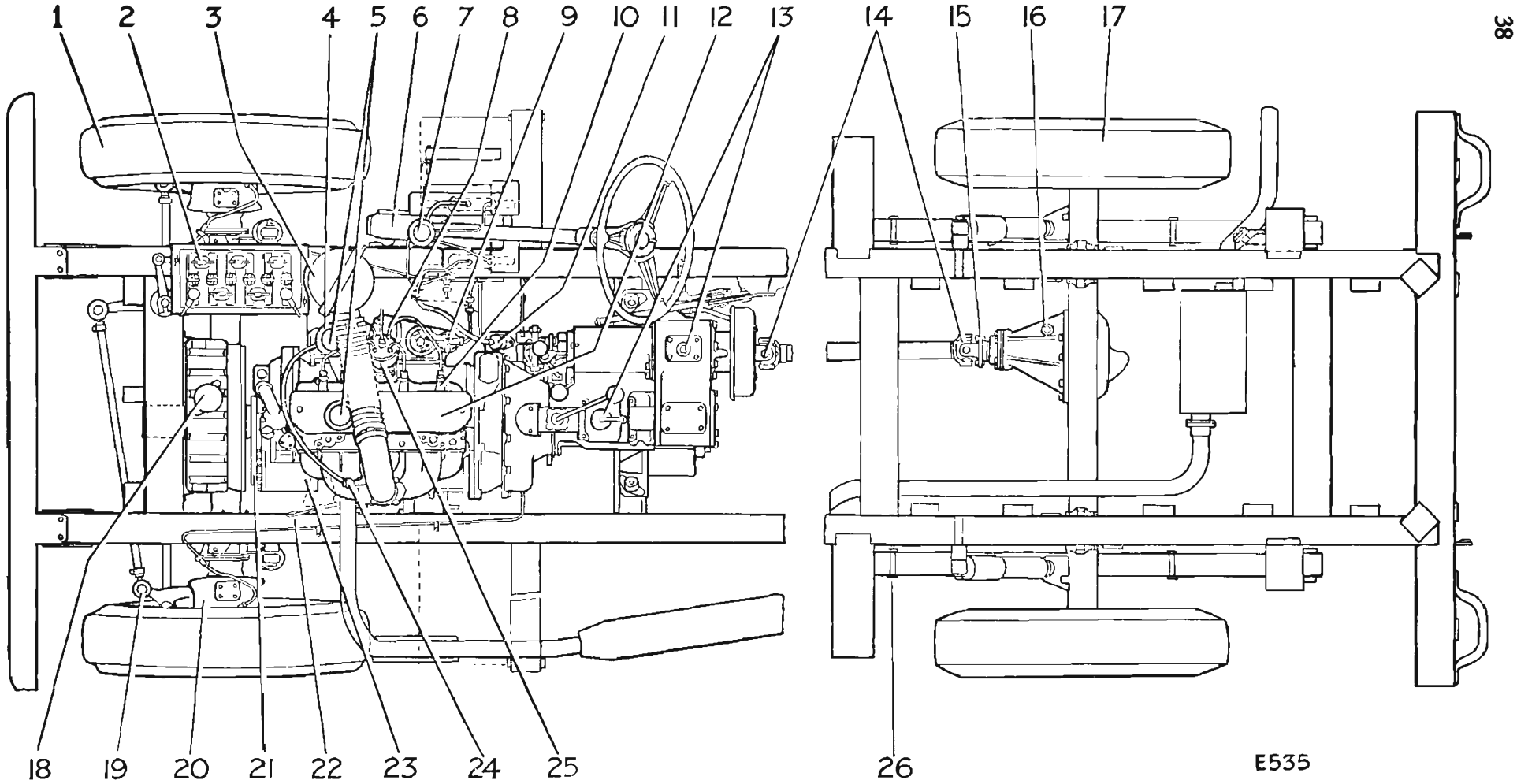
These recommendations apply to temperate climates where operational temperatures may vary between approximately 10°F (–12°C) and 90°F (32°C).

Information on oil recommendations for use under extreme winter or tropical conditions can be obtained from your local Rover Distributor or Dealer or The Rover Co. Ltd., Technical Service Department.

COMPONENTS	S.A.E.	B.P.	DUCKHAM'S	ESSO	MOBIL	REGENT	SHELL	WAKEFIELD
PETROL MODELS ENGINE, AIR CLEANER AND GOVERNOR	20W	Energol SAE 20W	Duckham's NOL Twenty	Esso Extra Motor Oil 20W/30	Mobiloil Arctic	Advanced Havoline 20/20W	Shell X100 SAE 20/20W	Castrolite
DIESEL MODELS ENGINE AND AIR CLEANER	20W	Energol Diesel D20W	NOL Diesel Engine Oil 20	Essolube HD20	Mobiloil Arctic	RPM Delo Special 20	Rotella 20/20W	Castrol CR20
GEARBOX AND TRANSFER BOX DIFFERENTIALS AND SWIVEL PIN HOUSINGS STEERING BOX STEERING RELAY UNIT (SEALED) REAR POWER TAKE-OFF, PULLEY UNIT AND CAPSTAN WINCH HYDRAULIC WINCH GEARBOX	90EP	Energol EP SAE 90	Duckham's Hypoid 90	Esso Gear Oil GP 90	Mobilube GX 90	Universal Thuban 90	Spirax 90 EP	Castrol Hypoy
HYDRAULIC WINCH SUPPLY TANK	—	Energol HL65	—	Teresso 43 or Essolube HD10W	DTE Light	—	Tellus 27	Hyspin 70 or Castrolite
LUBRICATION NIPPLES	—	Energrease L2	Duckham's LB10 Grease	Esso Multi-purpose Grease H	Mobilgrease MP	Marfak Multi-purpose 2	Retinax A	Castrolease LM

On the following pages, in the same order as listed on the chart, will be found full instructions on how to carry out the maintenance and adjustments required on your Land-Rover.

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



Maintenance diagram, Petrol model illustrated

LAND-ROVER SERIES II

PETROL AND DIESEL MODELS

MAINTENANCE CHART

Your Rover Distributor or Dealer will carry out the first and second free service inspection at 750 miles (1.000 km.) and 1,500 miles (2.500 km.) respectively.

Key No. 1 Page No. 39 Check tyre pressures and inspect tyre treads every month.
Key No. 22 Page No. 40 Check engine oil level every 250 miles (500 km.).

4326

ITEM	KEY No.	PAGE No.	DETAILS	EVERY 3,000 MILES, (5,000 KM) OR 120 HOURS 3,000	EVERY 6,000 MILES, (10,000 KM) OR 240 HOURS 6,000	EVERY 9,000 MILES, (15,000 KM) OR 360 HOURS 9,000	EVERY 12,000 MILES, (20,000 KM) OR 480 HOURS 12,000	EVERY 15,000 MILES, (25,000 KM) OR 600 HOURS 15,000	EVERY 18,000 MILES, (30,000 KM) OR 720 HOURS 18,000	EVERY 21,000 MILES, (35,000 KM) OR 840 HOURS 21,000	EVERY 24,000 MILES, (40,000 KM) OR 960 HOURS 24,000	OCCASIONAL ATTENTION	EVERY SIX MONTHS
TYRES AND WHEELS	17	40	Change round all wheels	▲	▲	▲	▲	▲	▲	▲	▲		
ENGINE	4	41	Drain and refill	▲	▲	▲	▲	▲	▲	▲	▲		
	5	42	Clean breather filters		▲		▲		▲		▲		
	8	42	Renew external oil filter element		▲		▲		▲		▲		
	10	43	Check or replace sparking plugs		▲		▲		▲		▲		
	12	43	Adjust tappets									▲	
GEARBOX AND TRANSFER BOX	—	44	Remove flywheel housing drain plug (when fitted for wading)	▲	▲	▲	▲	▲	▲	▲	▲		
	13	45	Check oil level	▲	▲	▲	▲	▲	▲	▲	▲		
	13	45	Drain and refill			▲			▲				
FRONT AND REAR AXLES	16	46	Check differential oil level	▲	▲	▲	▲	▲	▲	▲	▲		
	16	47	Drain and refill differential			▲			▲				
	20	47	Check oil level in front swivel pin housing	▲	▲	▲	▲	▲	▲	▲	▲		
	20	48	Drain and refill front swivel pin housing			▲			▲				
STEERING BOX AND BALL JOINTS	6	48	Check oil level	▲	▲	▲	▲	▲	▲	▲	▲		
	19	48	Check rubber boots on steering joints	▲	▲	▲	▲	▲	▲	▲	▲		
PROPELLER SHAFTS, FRONT AND REAR	14	49	Lubricate joints and journals	▲	▲	▲	▲	▲	▲	▲	▲		
	15	49	Check securing bolts				▲				▲		
DISTRIBUTOR PETROL MODELS	25	50	Lubricate	▲	▲	▲	▲	▲	▲	▲	▲		
	25	50	Check contact points		▲		▲		▲		▲		
AIR CLEANER	3	52	Empty, clean and refill	▲	▲	▲	▲	▲	▲	▲	▲		

				3,000	6,000	9,000	12,000	15,000	18,000	21,000	24,000
FUEL SYSTEM PETROL MODELS	9	53	Clean sediment bowl				▲				▲
	24	53	Clean carburetter filter				▲				▲
FUEL SYSTEM DIESEL MODELS											
Home models with one filter on dash	—	56	Change fuel filter element				▲				▲
	—	57	Clean sediment bowl				▲				▲
											Prime fuel system after these operations
Export models with two filters on dash	—	56	Change 1st fuel filter element, that is filter fed from fuel pump				▲				▲
	—	56	Change 2nd fuel filter element, that is filter which feeds to Distributor pump	EVERY 36,000 MILES (60,000 KM)							
	—	57	Clean sediment bowl				▲				▲
											Prime fuel system after these operations
DIESEL MODELS INJECTORS	—	59	Check and adjust				▲				▲
BATTERY	2	61	Check acid level	▲	▲	▲	▲	▲	▲	▲	▲
DYNAMO	23	61	Lubricate				▲				▲
BODY	—	62	Check tightness of body securing bolts								▲
COOLING SYSTEM	18	30	Check water level								▲
	21	62	Check and adjust fan belt if necessary		▲		▲		▲		▲
BRAKES AND CLUTCH	7	63	Check fluid level in reservoir	▲	▲	▲	▲	▲	▲	▲	▲
	—	63	Adjust brake shoes								▲
	—	—	Renew all rubber seals	EVERY 39,000 MILES (65,000 KM) OR THREE YEARS							
	11	66	Adjust clutch free pedal movement								▲
GENERAL	—	—	Apply a few spots of oil to all exposed joints on throttle linkage, door locks and hinges, bonnet prop rod, etc. Inspect wiring and pipes for signs of chafing which might cause a short circuit or leaks								▲
ROAD SPRINGS	26	67	Check tightness of "U" bolts and spring clips								▲
HEADLAMPS	—	19	Check beam setting								▲
LAMPS	—	—	Check for correct operation		▲		▲		▲		▲

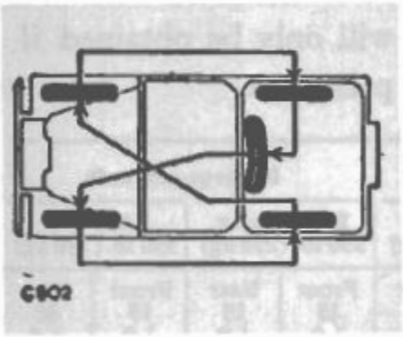
Tyre pressures

Maximum tyre life and performance will only be obtained if the tyres are maintained at the correct pressures.

		Normal				Emergency soft			
		Load under 550 lb. (250 kg)		Load over 550 lb. (250 kg)		Load under 550 lb. (250 kg)		Load over 550 lb. (250 kg)	
88 models		Front	Rear	Front	Rear	Front	Rear	Front	Rear
Avon or Dunlop	lb/sq.in.	25	25	25	30	15	15	15	20
6.00 x 16.00	kg/cm²	1,7	1,7	1,7	2,1	1,0	1,0	1,0	1,4
Avon or Dunlop	lb/sq.in.	25	25	25	30	15	15	15	20
7.00 x 16.00	kg/cm²	1,7	1,7	1,7	2,1	1,0	1,0	1,0	1,4
Avon or Dunlop	lb/sq.in.	25	25	25	30	15	15	15	20
7.50 x 16.00	kg/cm²	1,7	1,7	1,7	2,1	1,0	1,0	1,0	1,4
Michelin XY	lb.sq.in.	15	15	15	22	10	10	10	16
7.50 x 16.00	kg/cm²	1,0	1,0	1,0	1,5	0,7	0,7	0,7	1,1
109 models									
Avon or Dunlop	lb/sq.in.	25	25	25	36	12	12	15	24
7.50 x 16.00	kg/cm²	1,7	1,7	1,7	2,5	0,8	0,8	1,0	1,6
Michelin XY	lb/sq.in.	20	20	20	35	15	15	15	26
7.50 x 16.00	kg/cm²	1,4	1,4	1,4	2,4	1,0	1,0	1,0	1,75

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.
6. "Butyl" synthetic inner tubes are fitted and all repairs must be vulcanised.



Changing wheel positions

Changing wheel positions

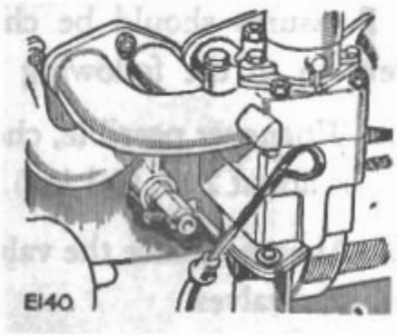
It is recommended that the wheels are changed round every 3,000 miles (5.000 km) to equalise tyre wear. Spare to left-hand front; left-hand front to left-hand rear; left-hand rear to right-hand front; right-hand front to right-hand rear and right-hand rear to spare.

When cross-country tyres are used the "V" tread should be directed to the front at the top.

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.

Engine oil level

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



Engine oil level dipstick

The oil level dipstick on the left-hand side of the engine carries three marks: H (High) L (Low) and MIN (Minimum).

When using the Land-Rover under normal circumstances the oil level should not be allowed to fall below the minimum level mark, that is the lower line on the dipstick.

However, when using the Land-Rover in circumstances which involve it being used at steep angles, the oil should not be allowed to fall below the intermediate mark, that is, the low level. This will obviate any danger of oil pump starvation when the vehicle is facing downhill at a steep angle.

The oil filler is at the front of the engine.

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. Withdraw the dipstick upwards, 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 additives

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

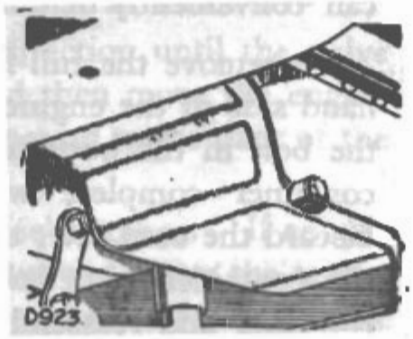
The oils selected are complete in themselves and afford every protection. A warning is necessary against the addition of any oils or other products, as these may materially impair the character of the lubricant in use.

Engine oil changes

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

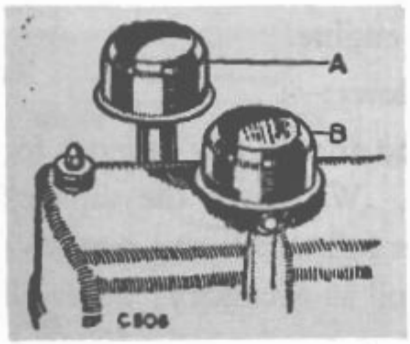
The first engine oil change should be made at 750 miles (1.000 km.) or 30 hours; thereafter the oil must be changed every 3,000 miles (5.000 km.) as follows:—

Run the engine to warm up the oil, switch off the ignition or electrical services and remove the drain plug in the right-hand side of the sump. Allow the oil to drain away completely, then replace the plug.



Engine sump drain plug

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



Engine breather filters
A—Oil filler filter
B—Rocker cover filter

Engine breather filters

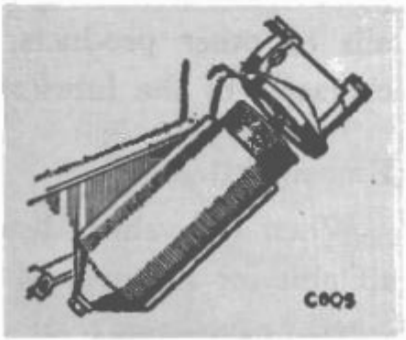
The oil-wetted gauze filters fitted to the top rocker cover breather and oil filler pipe should be cleaned every 6,000 miles (10,000 km) in the following manner:

Remove the filters and wash the gauze thoroughly by swilling the units in 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.

Under severe conditions of dust the filters must be cleaned more frequently.

Engine 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.



Engine oil filter

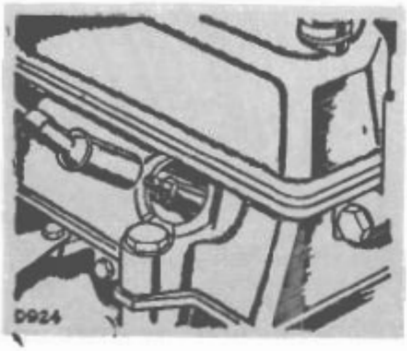
The element of the full-flow filter should be renewed every 6,000 miles (10.000 km). This can conveniently be done at a routine oil change.

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.

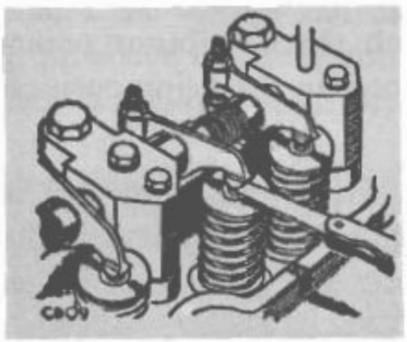
Sparking plugs, Petrol models

The sparking plugs are fitted with plastic covers. To gain access to the plugs for cleaning and gap-setting, pull up the plug covers, without detaching them from the high tension leads.



Sparking plug, Petrol models

Every 6,000 miles (10.000 km) check or replace the sparking plugs; if the plugs are still in good condition clean and reset the electrode gaps to .029 to .032 in. (0,75 to 0,80 mm).



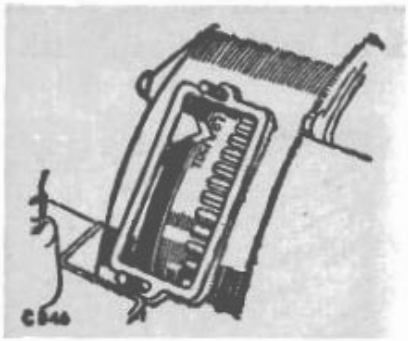
Tappet adjustment

Tappet adjustment

It is most important that tappet clearances be maintained at the correct figure, that is .010 in. (0,25 mm) on all valves with the engine either cold or at running temperature. Less than the correct clearance will result in a fall in power output, while greater clearance will mean noisy tappets.

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.



Flywheel markings

Flywheel markings

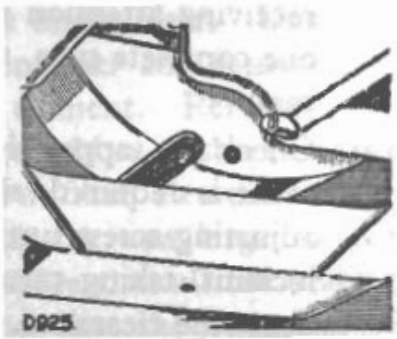
Ignition or injector and valve timing is based on markings on the engine flywheel which are visible, adjacent to a pointer, under the inspection cover on the right-hand side of the flywheel housing.

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. Petrol models. The line against which the figure 3° with regular fuels, or 6° with premium fuels, is stamped, when set opposite the pointer, indicates the firing-point of No. 1 cylinder, i.e., the position at which the distributor points should be just opening, with the rotor in the firing position for No. 1 cylinder.
3. Diesel models. The line against which the figure 16° is stamped, when set opposite the pointer, indicates the injection-point of No. 1 cylinder, i.e., the position at which injection starts.
4. 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). On Petrol models it is 95° before T.D.C. and 109° before T.D.C. on Diesel models.

Flywheel housing drain plug

The flywheel housing can be completely sealed to exclude mud and water under severe wading conditions, by means of a plug fitted in the bottom of the housing.



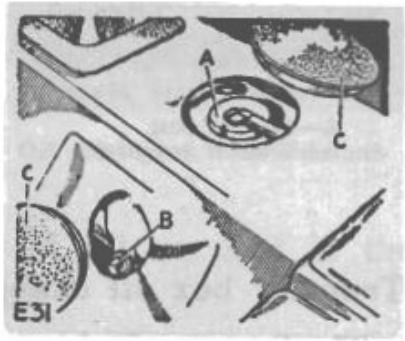
Flywheel housing drain plug

The plug is screwed into a bracket adjacent to the drain hole, and should only be fitted when the vehicle is expected to do wading or very muddy work.

When the plug is in use it must be removed every 3,000 miles (5.000 km) and all oil allowed to drain off before the plug is replaced.

Main gearbox oil level

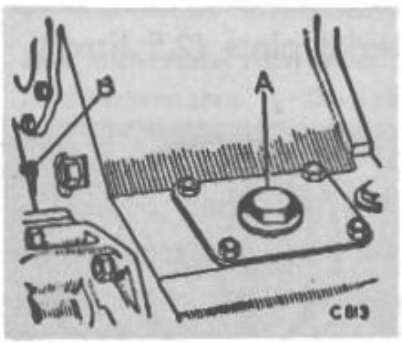
The main gearbox and clutch withdrawal mechanism are lubricated as one unit, the oil level must be checked every 3,000 miles (5.000 km) and replenished as necessary, to the bottom of the level plug hole.



Gearbox oil filler

A—Filler cap
B—Oil level plug
C—Rubber grommet

This plug is accessible from under the vehicle and can be seen from above when the rubber grommet is removed from the left-hand side of the gearbox cover.



Transfer box lubrication

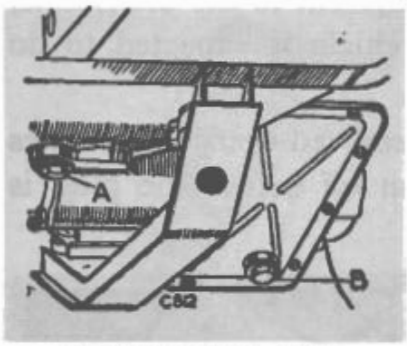
A—Filler plug B—Level plug

Transfer box oil level

The transfer box and front wheel drive housing are lubricated as one unit, the oil level must be checked every 3,000 miles (5.000 km) 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.

Main gearbox oil changes

The first gearbox oil change should be made at 750 miles (1.000 km) or 30 hours; thereafter the oil must be changed every 9,000 miles (15.000 km) as follows:



Gearbox drain plugs
A—Gearbox plug
B—Transfer box plug

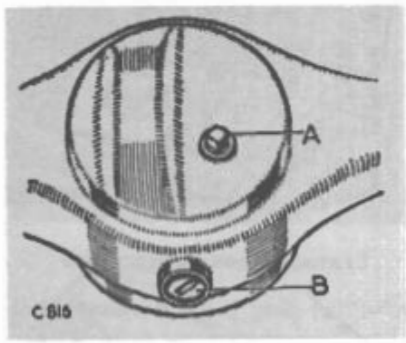
Remove the drain plug from the bottom of the main gearbox casing, immediately after a run when the oil is warm; allow the oil to drain away completely and replace the plug. Refill with oil of the correct grade; the capacity is approximately 2½ Imperial pints (1,5 litres).

Transfer box oil changes

The first transfer box oil change should be made at 750 miles (1.000 km) or 30 hours; thereafter the oil must be changed every 9,000 miles (15.000 km.) as follows:

Remove the drain plug 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 4½ Imperial pints (2,5 litres).

Front and rear differential oil level



Front differential lubrication
A—Filler/level plug
B—Drain plug

The differential oil levels must be checked every 3,000 miles (5.000 km), 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.

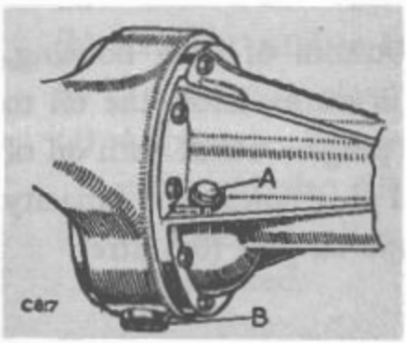
A second plug fitted at the rear of the front axle casing can be disregarded.

Driving member, front and 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.

Oil filler plug, rear axle hub

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.



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

Front and rear differential oil changes

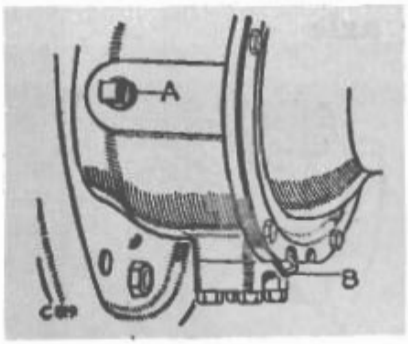
The first differential oil change should be made at 750 miles (1.000 km.) or 30 hours; thereafter the oil must be changed every 9,000 miles (15.000 km.) as follows:

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 single-ended spanner in the tool kit.

Swivel pin housing oil level

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



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

oil levels must be checked every 3,000 miles (5.000 km) and replenished as necessary to the bottom of the filler/level plug holes at the rear of the housings.

Swivel pin housing oil changes

The first oil change should be made at 750 miles (1.000 km) or 30 hours; thereafter the oil must be changed every 9,000 miles (15.000 km.) as follows:

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 box lubrication

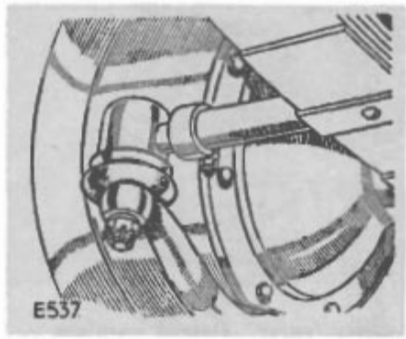
The steering box oil level should be checked every 3,000 miles (5.000 km) and replenished as necessary to the bottom of the filler plug hole on the top of the cover plate. Access to the plug is gained by lifting the bonnet panel.

Steering box lubrication

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

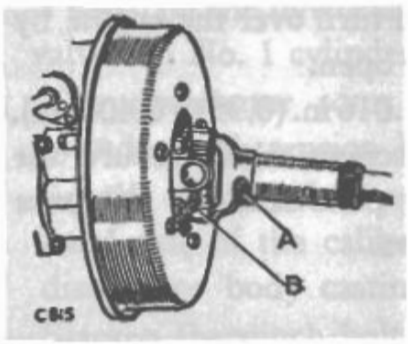
in position on the ball joint. The rubber boots should be checked every 3,000 miles (5.000 km) to ensure that they have not become dislodged or the joint be damaged.



Steering ball joint

To check for wear move the ball joint vigorously up and down. Should there by any appreciable free movement the complete joint must be replaced. 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 one of the recommended greases round taper of ball joint and also fill the boot;
(*e*) Re-assemble all parts using new rubber boots and springs as required.



Propeller shaft lubrication
A—Sliding sleeve nipple
B—Universal joint nipple

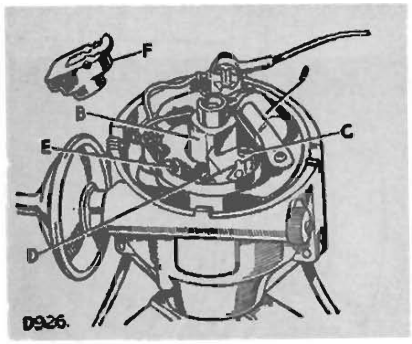
Propeller shaft lubrication

Every 3,000 miles (5.000 km) apply one of the recommended greases at the lubrication nipple on the sliding portion of the front and rear propeller shafts.

At the same time, apply the correct grade of grease at the lubrication nipples fitted to the universal joints. If high pressure equipment is used, care must be taken not to damage the seals in the joints.

Propeller shaft bolts

Check the security of the propeller shaft securing bolts every 12,000 miles (20.000 km). Tighten if necessary.



Distributor, Petrol models

A—Condenser
B—Cam
C—Contact breaker pivot
D—Contact points
E—Screws securing movable contact
F—Rotor arm

Distributor maintenance, Petrol models

Every 3,000 miles (5.000 km), remove the distributor cap and lubricate as follows:—

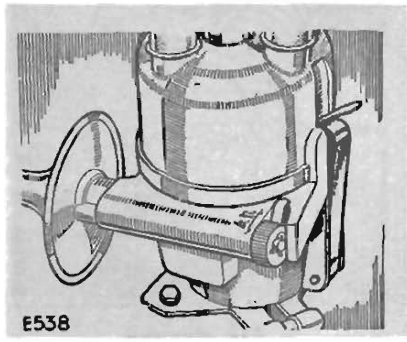
1. Lightly smear the cam with clean engine oil.
2. Lift off the rotor and add a few drops of thin machine oil to lubricate the cam bearing and distributor shaft; push the rotor on the shaft as far as possible.
3. Place a drop of clean engine oil on the contact breaker lever pivot, taking care not to oil the contacts.
4. Add a few drops of thin machine oil through the hole in the contact breaker base plate, to lubricate the automatic timing control.
5. Every 6,000 miles (10.000 km) check and adjust the contact breaker clearance as follows:—
   (i) Remove the distributor cap and turn over the engine by hand until the contacts are fully open.
   (ii) The clearance should be .014 to .016 in. (0,35 to 0,40 mm).
   (iii) If necessary, slacken the two screws which secure the adjustable contact and move the plate until the clearance is correct; re-tighten the screws.
   (iv) Replace the distributor cap.

Ignition timing, Petrol models

In addition to automatic timing advance mechanism, the distributor incorporates a hand setting control, known as the octane selector. This is a vernier adjustment attached to the distributor, fitted with a sliding portion controlled by an adjusting screw and a calibrated scale marked R (retard) and A (advance) with a number of divisions between. The standard setting for the ignition is with the long line of the scale on the sliding portion

against the mark on the selector body, thus leaving one division further possible advance and four divisions retard.

This setting is correct for 80 octane fuel and with a clean engine, but should pinking develop as a result of the need for decarbonising, the control can be retarded a little by turning the screw in a clockwise direction. Do not forget to return it to the original position after decarbonising.



Ignition timing, Petrol models

In certain countries very low grade fuel is supplied, in which case it may be necessary to adjust the octane selector to avoid pinking, even with a clean engine.

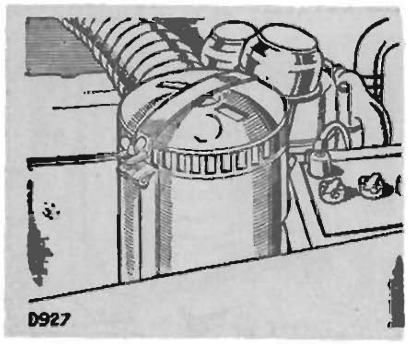
Should the distributor have been disturbed, the ignition timing must be reset as follows:—

1. Set the contact breaker point gap to .014 to .016 in. (0,35 to 0,40 mm) with the points fully open.
2. Rotate the engine in the running direction until the 3° mark, when using regular fuels, or 6° mark, if premium fuel is used, on the flywheel is in line with the pointer, with both valves on No. 1 cylinder closed.
3. The distributor rotor will now correspond with No. 1 cylinder high tension lead terminal.
4. Set the octane selector so that the fourth line from the left-hand side of the calibrated slide is against the face of the distributor body casting.
5. Slacken the pinch bolt at the base of the distributor head; rotate the distributor bodily in the opposite direction to the arrow on the rotor arm until the contact breaker points are just opening with the fibre cam follower on the leading side of the cam; re-tighten the pinch bolt.

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.



Air cleaner

Under clean road or stationary conditions, the cleaner oil bath should be cleaned and refilled every 3,000 miles (5.000 km). 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.

Proceed as follows:

1. Release the clamping strap securing the complete air cleaner to the battery box support, disconnect the outlet elbow from the carburetter intake pipe 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 1½ 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 and refit the complete unit in the vehicle.

Fuel system, Petrol models

The fuel system comprises the tank, pipe lines, sediment bowl, pump, carburetter and air cleaner.

It is most important that the entire system be kept clean and free from leaks.

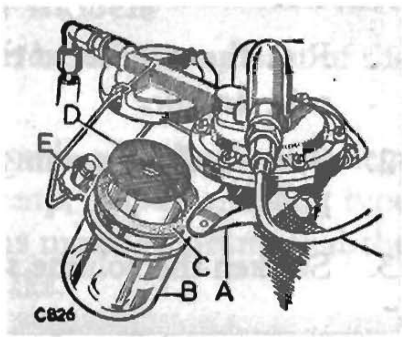
Fuel pump and filter, Petrol models

The mechanically operated fuel pump with hand-primer, is located on the right-hand side of the engine. The sediment

bowl filter is attached to it. The bowl and filter should be cleaned every 12,000 miles (20.000 km) or more frequently if an appreciable amount of foreign matter can be seen in the bowl.

To clean proceed as follows:

1. Remove the bowl by slackening the thumb screw and swinging the retainer aside.
2. Remove and clean filter gauze in petrol.
3. Ensure that the sealing washer is in good condition.
4. Replace gauze and refit bowl.
5. Prime by operating hand lever.



Fuel pump and sediment bowl Petrol models

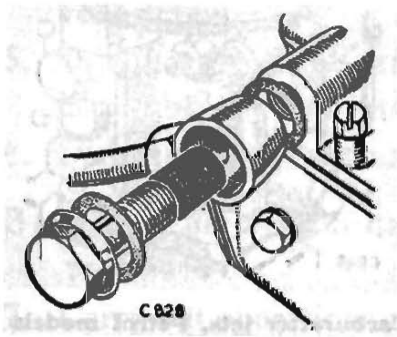
A—Hand priming lever
B—Sediment bowl
C—Sealing washer
D—Gauze filter
E—Retainer

Carburetter, Petrol models

The carburetter is adjusted on assembly and, apart from occasional cleaning of the filter, should require no further attention. The only normal adjustment provided is that to obtain smooth engine idling.

Some models have a carburetter starter heater element fitted. It is wired in conjunction with the manual and thermostatic switches operating the cold start warning light, therefore the heater element functions immediately the cold start control is pulled out beyond the fast idle position, that is, after the first $\frac{3}{8}$ in. (9,5 mm) movement.

The heater in operation warms the ducted air as it enters the starter box and prevents icing up in that region.



Carburetter filter, Petrol models

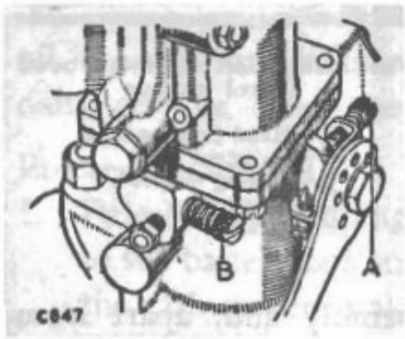
Cleaning carburetter filter, Petrol models

When necessary, disconnect the petrol pipe from the carburetter and withdraw the gauze filter from the float chamber cover. Clean the filter in petrol, using a stiff brush.

Carburetter slow-running adjustment, Petrol models

To adjust the slow-running of the carburetter, proceed as follows:—

1. Run the engine until it is hot, never set the idling with a cold engine.
2. Set the slow-running screw until the idling speed is rather high.
3. Slacken the volume screw until the engine begins to hunt.



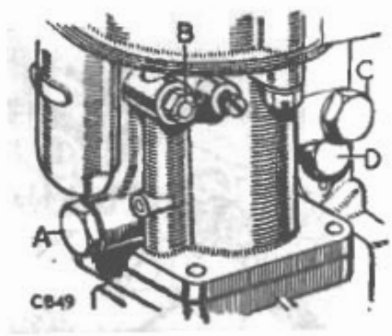
Carburetter adjustment, Petrol models
A—Slow-running screw
B—Volume screw

4. Screw it in very gradually until the hunting just disappears.
5. If the engine speed is too high, reset the slow-running screw to slow it down to an idling speed of about 500 r.p.m.
6. This may cause a resumption of slight hunting. If so, turn the volume control screw gently in a clockwise direction until the idling is once more satisfactory.

Cleaning carburetter jets, Petrol models

It is most unlikely that trouble will be experienced with blocked jets, but the following notes will assist in location of jets which may need cleaning:—

1. Main petrol jet; the jet proper is screwed in to the inner end of the carrier, which must be removed to gain access to the jet.
2. Pilot jet has a screwdriver slot in the hexagon head.
3. Accelerator pump jet is located above the starter jet.



Carburetter jets, Petrol models
A—Main jet
B—Pilot jet
C—Accelerator jet
D—Starter jet

4. Starter petrol jet is a plain hexagon-headed unit at the rear of the carburetter.

Fuel and injection system, Diesel models

Absolute cleanliness is essential when handling any part of the fuel injection system.

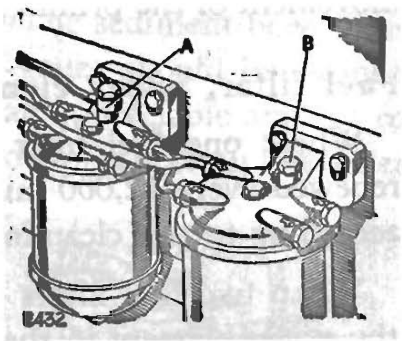
The fuel system comprises the fuel tank, pipe lines, sediment bowl filter, mechanically operated pump, paper element type filter, injectors and injection pump. It is most important that the system be kept clean and free from leaks.

Priming the fuel system, Diesel models

(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 bleed pipe or air vent screw as the case may be, on the top of the filter which has had the replacement element fitted.
3. Operate the hand priming lever on the mechanical pump, until fuel free from bubbles emerges.
4. Tighten the bleed pipe or air vent screw.



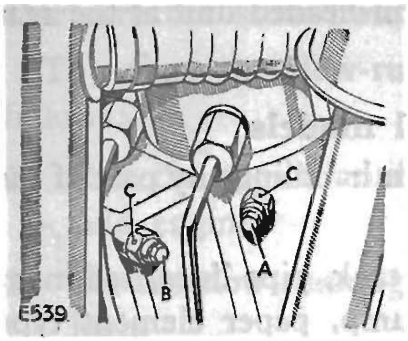
Air vent on filter, Diesel models
Twin filter system illustrated

A—Bleed pipe
B—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.



Priming the distributor pump, Diesel models

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.
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.

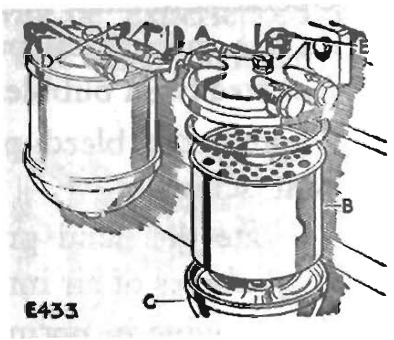
C—When distributor pump only has been drained it is only necessary to carry out operations 8 to 12 inclusive.

Always 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 filter, paper element type

Where one fuel filter is fitted the paper element must be renewed every 12,000 miles (20.000 km.) or as found necessary according to the cleanliness of the fuel used.

When two fuel filters are fitted, the paper element in the first one which is fed direct from the fuel pump, must be renewed every 12,000 miles (20.000 km.); the paper element in the second fuel filter which feeds straight to the distributor pump must have the paper element renewed every 36,000 miles (60.000 km.); in both cases more frequent changes may be necessary according to the cleanliness of the fuel used.



Paper element filter, Diesel models
Twin filter system illustrated

A—Element retaining bolt
B—Element
C—Element holder
D—Bleed pipe
E—Air vent screw

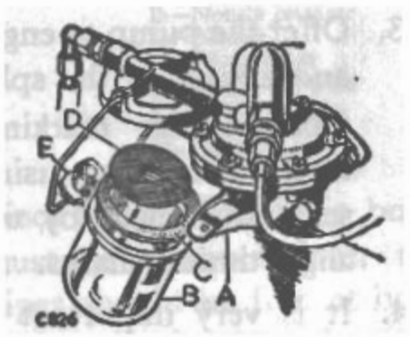
Proceed as follows:

1. Support element holder and unscrew the special bolt on the top of the filter, the element holder can now be removed.
2. Remove and discard the used element.
3. Wash the element holder in petrol or fuel oil.
4. If necessary renew both the large rubber washer and the small rubber washer in the filter top, also renew the large rubber washer in the element holder.
5. Push the new element on to the filter top spigot with the perforated holes in the element to the top.
6. Fit the element holder to the bottom of the element, and secure with the special bolt.
7. Prime the system and check for fuel leaks.

Fuel pump and filter, Diesel models

The mechanically operated pump, with hand primer, is located on the right-hand side of the engine. The sediment bowl filter is attached to it. The bowl and filter gauze should be cleaned every 12,000 miles (20.000 km.) or if an appreciable amount of foreign matter has collected in the bowl. To clean the filter proceed as follows:

1. Remove the glass bowl by slackening the thumb-screw and swinging the wire holder aside.
2. Remove the gauze filter from the body of the unit and wash it and the bowl in petrol or fuel oil.
3. Ensure that the sealing washer is in good condition.
4. Replace the gauze correctly over the square inlet nozzle.



Fuel pump and sediment bowl, Diesel models

A—Hand priming lever
B—Sediment bowl
C—Sealing washer
D—Gauze filter
E—Retainer

5. Fill glass bowl with fuel oil, refit bowl, re-position the wire holder and tighten thumb-screw.

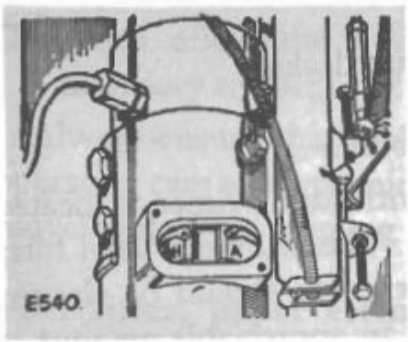
6. Prime by operating the pump hand lever. Air in the system will be expelled through the air bleed pipe on top of the container for the paper element fuel filter.

Distributor pump, Diesel models

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:



Distributor pump timing marks correctly aligned, Diesel models

1. Turn the crankshaft in direction of rotation until the pointer is in line with 16° mark on flywheel.
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.

   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.

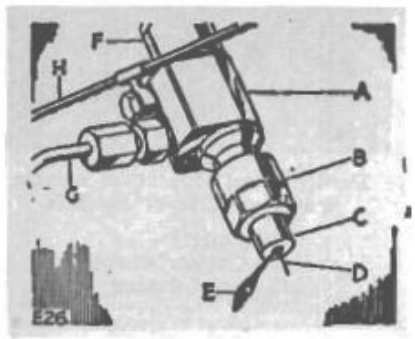
5. Tighten pump down and re-check setting. Replace inspection cover on pump and flywheel housing.
6. Prime the fuel system and check for fuel leaks.

Fuel injectors, Diesel models

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.

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.



Injection nozzle, Diesel models

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

The injectors are located in the top of the cylinder head on the right-hand side. They should be checked at every 12,000 miles (20.000 km.). Injectors may be removed for checking and adjustment as follows:—

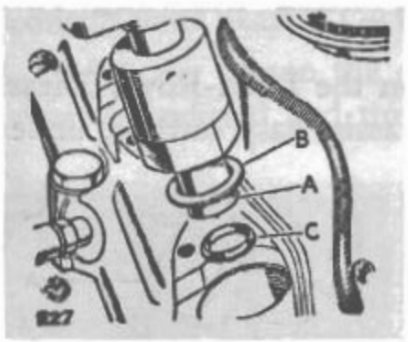
(*a*) Disconnect the spill pipe at tee piece and slacken banjo bolts at nozzles. The feed pipes must be removed from the injectors and the pump, these pipes should be free at both ends; on no account must the pipes be bent to clear the union on the injector.

(*b*) Remove the nuts retaining the clamp bar on the top of the injector and remove the bar.

(*c*) Lift out the injectors, complete with spill pipe and copper washers. Remove the steel washers from inside the injector holes.

(*d*) Fit spill pipe to new injectors, ensuring that no foreign matter is present. Do not fully tighten banjo bolts at this stage. Fit assembly of injectors and spill pipe to cylinder head, 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.

(*e*) Replace the clamp bar and nuts. Tighten each nut alternately an equal amount to ensure that the injector goes into position evenly. Finally, tighten spill pipe banjo bolts.



Position of injector nozzle washers, Diesel models

A—Nozzle
B—Copper washer
C—Steel washer

Checking nozzles in engine, Diesel models

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, Diesel models

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.

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.

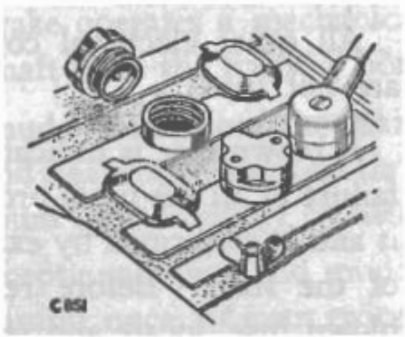
Heater plugs, Diesel models

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.

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

Battery

On Petrol models the positive earth 12 volt battery is carried under the bonnet on the right-hand side. On Diesel models two 6 volt batteries are fitted, one under the bonnet at the right-hand side, the other under the left-hand passenger's seat.



Battery

Every 3,000 miles (5.000 km) 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 battery 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.

Dynamo lubrication

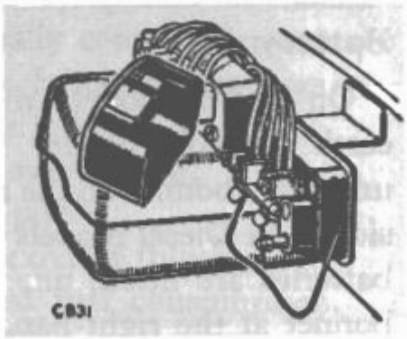
Dynamo

Every 12,000 miles (20.000 km) 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.

Fuse box

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

All other electrical components are not fused.



Fuse box
Petrol model illustrated

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 should be used.

Body

Occasionally check tightness of body-securing bolts.

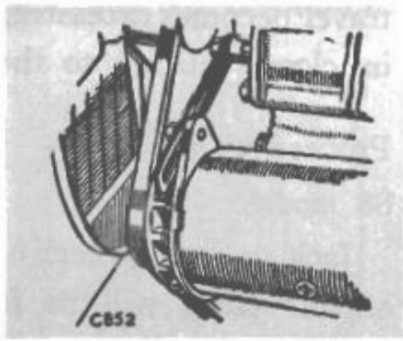
Fan belt adjustment

Every 6,000 miles (10.000 km) the fan belt should be checked and adjusted if necessary.

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 $\frac{5}{16}$ to $\frac{7}{16}$ in. (8 to 11 mm) by thumb pressure between the fan and crankshaft pulleys. The procedure for adjustment is as follows:—

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



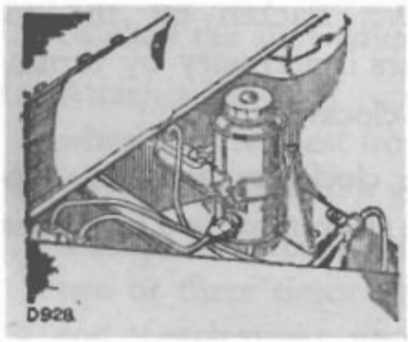
Fan belt adjustment

Brake system

The wheel brakes, operated by a pendant 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.

When the vehicle is used in deep muddy conditions the brake drums must be periodically removed and cleaned, at the same time the brake shoes and anchor plate should be thoroughly cleaned.

When used continuously under exceptionally wet and muddy conditions this operation may be advisable once, or even twice a week, to prevent the abrasive action of packed mud rapidly wearing out brake linings and drums.



Brake and clutch fluid reservoir

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.

The level, which should be checked every 3,000 miles (5.000 km). is correct when the fluid is just showing in the bottom of the filter; 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.

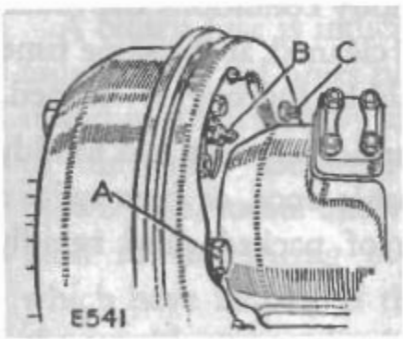
Wheel brake adjustment

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.

Proceed as follows:—

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.



Wheel brake adjustment
A—Adjustment bolt
B—Bleed nipple
C—Shoe steady posts

109 *models*

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

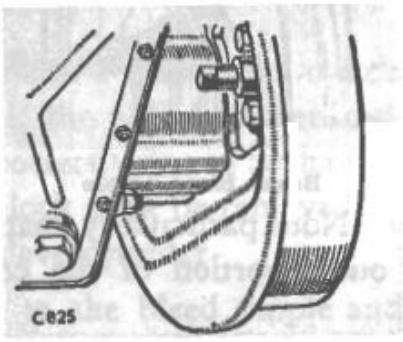
1. With the vehicle jacked up, ensure that the wheels rotate freely; slacken off the adjusters if necessary by turning anti-clockwise.
2. Turn the adjuster for each shoe clockwise until the shoe just brushes the brake drum, then slacken off two serrations.

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 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 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.



Transmission brake adjustment

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 sign 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.

Brake bleed nipple

5. Repeat for the other three wheels in turn, finishing at the one nearest the brake pedal.
6. Re-adjust the brakes.

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 brake is the outer portion of the combined reservoir.

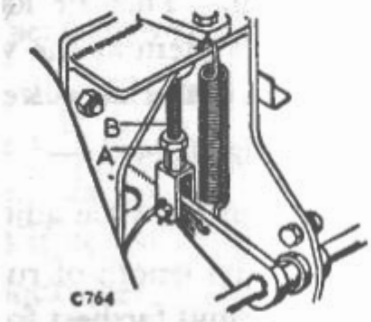
Clutch

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 pendant foot pedal, mounted in 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 $1\frac{1}{2}$ in. (38 mm).



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.

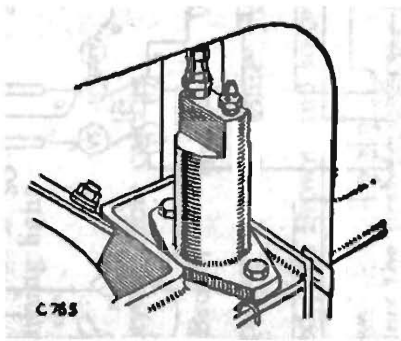
The adjustment at the master cylinder push rod, and the clutch foot pedal position adjustment are correctly set on initial assembly and should not be disturbed.

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 sign of air bubbles when the tube is held below the surface of the fluid in the jar.

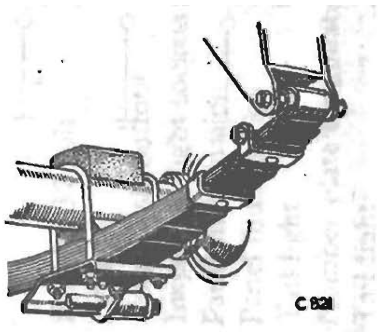


Bleed nipple for clutch slave cylinder

(*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.

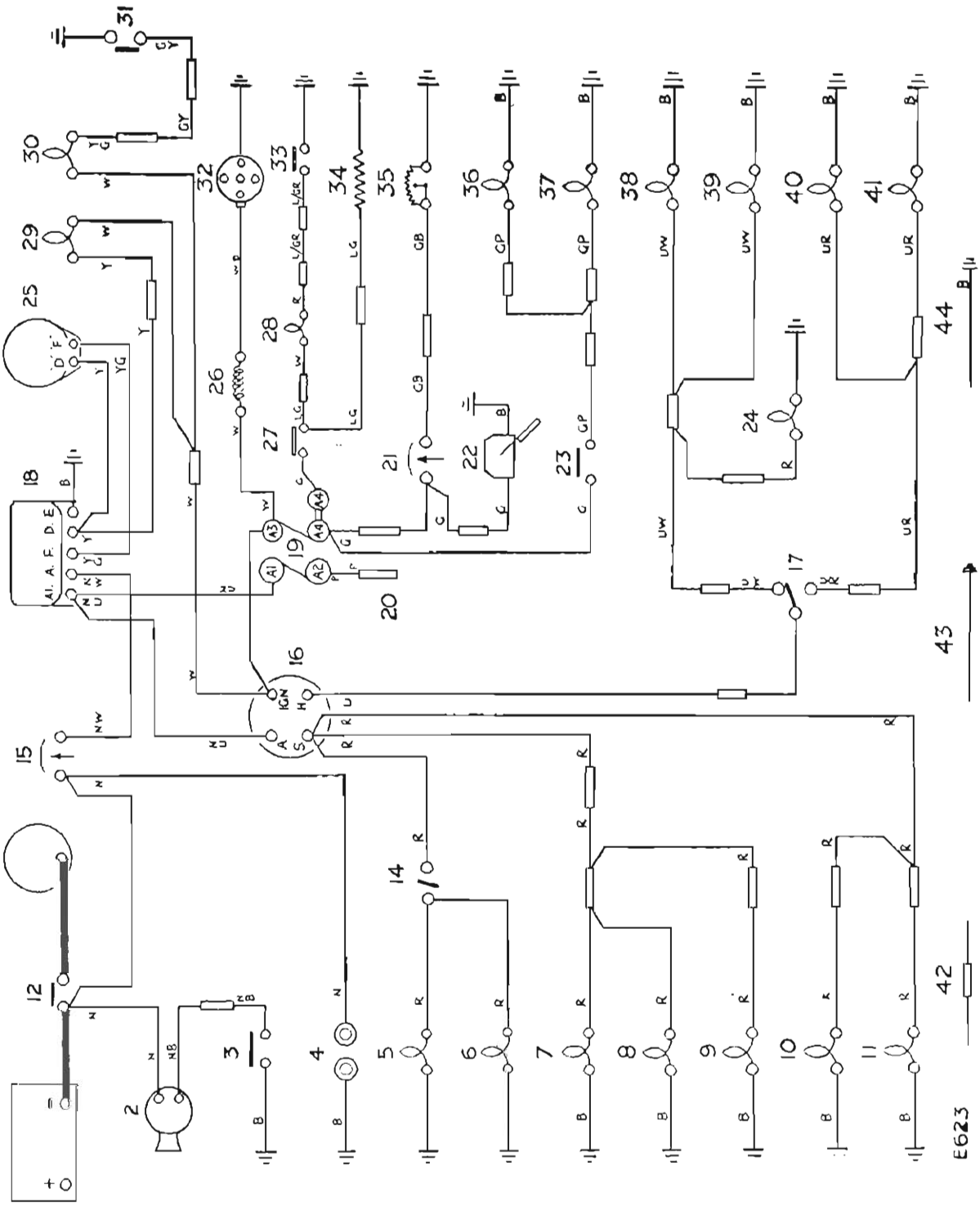


Leaf clips and U bolts

Road springs

Occasionally check the security of the road spring leaf clips and the nuts of the U bolts securing the axles to the springs; rectify as necessary.

Wiring diagram, Petrol models



Key to wiring diagram, Petrol models

1 Battery, 12 volt
2 Horn
3 Horn push button
4 Inspection light sockets
5 Panel illumination
6 Panel illumination
7 Tail light
8 Number plate illumination
9 Tail light
10 Side light
11 Side light
12 Starter switch
13 Starter
14 Panel light switch
15 Ammeter
16 Ignition and lighting switch
17 Headlight dip switch
18 Voltage control box
19 Fusebox
20 To interior lights
21 Fuel gauge
22 Screenwiper and plug and socket
23 Stop light switch
24 Main beam warning light
25 Dynamo
26 Ignition coil
27 Mixture switch
28 Mixture warning light
29 Warning light, charging
30 Oil pressure warning light
31 Oil pressure switch
32 Distributor
33 Mixture thermostat switch
34 Carburetter heater element, optional equipment
35 Gauge, fuel tank
36 Stop light
37 Stop light
38 Headlight, main
39 Headlight, main
40 Headlight, dip
41 Headlight, dip
42 Snap connectors
43 Earth connections via terminals and fixing bolts
44 Earth connections via cables

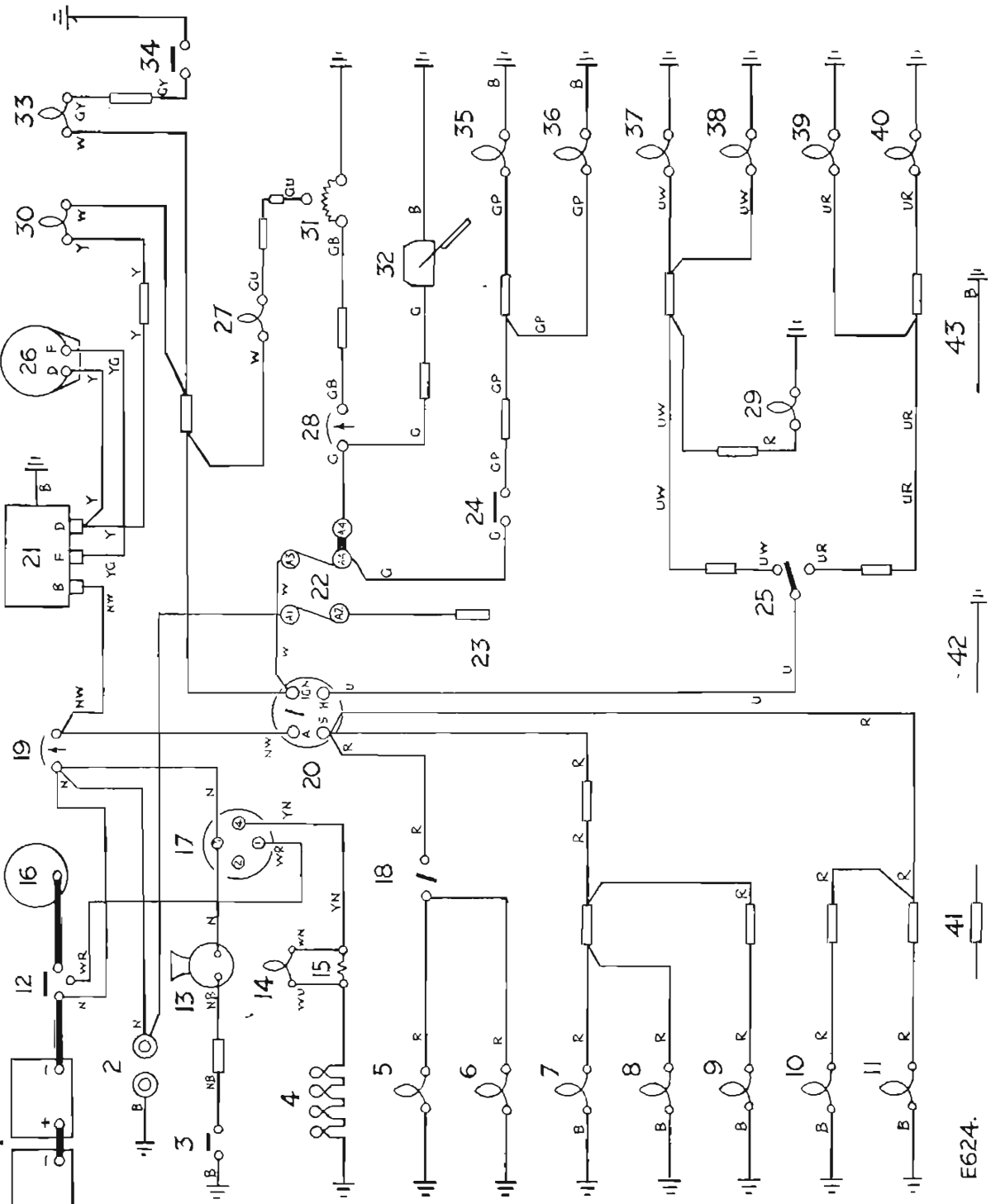
Key to cable colours

B—Black N—Brown R—Red W—White
G—Green P—Purple U—Blue Y—Yellow

RN—Red with Brown, and so on.

When cables have two-colour code letters the first denotes the main and the latter the tracer.

Wiring diagram, Diesel models



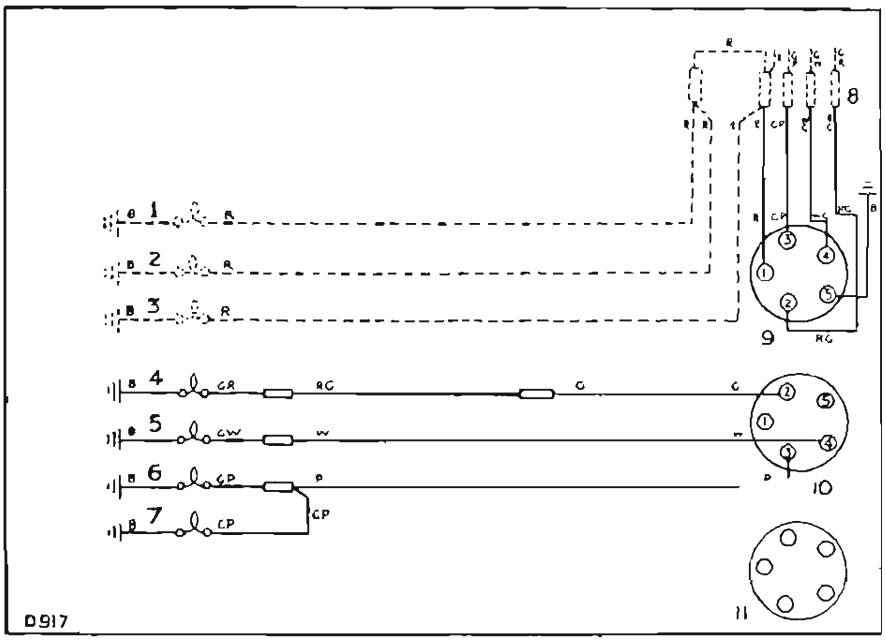
Key to wiring diagram, Diesel models

1 Batteries, two, 6 volt positive earth
2 Inspection socket
3 Horn push button
4 Heater plugs
5 Panel illumination
6 Panel illumination
7 Tail lamp
8 Number plate illumination
9 Tail lamp
10 Side lamp
11 Side lamp
12 Switch, starter
13 Horn
14 Warning light, heater plug
15 Resistor for heater plug
16 Starter motor
17 Switch, heater plug
18 Switch, panel light
19 Ammeter
20 Switch, electrical services and lighting
21 Current-voltage regulator
22 Fuse box
23 To interior lights
24 Switch, stop light
25 Switch, headlamp dip
26 Dynamo
27 Warning light, fuel level
28 Fuel gauge
29 Warning light, headlamp main beam
30 Warning light, charging
31 Gauge unit, fuel tank
32 Wiper motor
33 Warning light, oil pressure
34 Switch, oil pressure warning light
35 Stop lamp
36 Stop lamp
37 Headlamp, main beam
38 Headlamp, main beam
39 Headlamp, dip beam
40 Headlamp, dip beam
41 Snap connectors
42 Earth connections via terminals or fixing bolts
43 Earth connections via cables

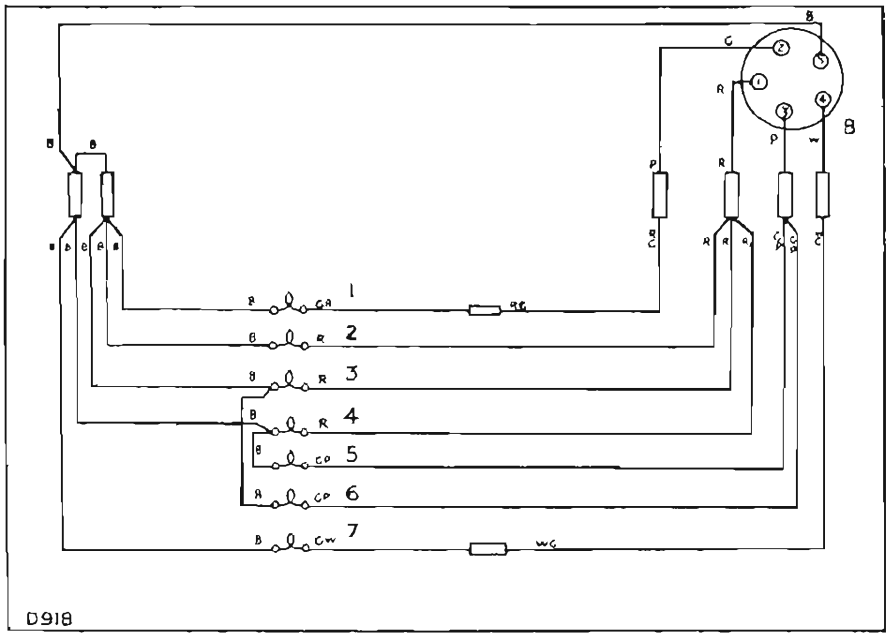
Key to cable colours

B—Black	N—Brown	R—Red	W—White
G—Green	O—Orange	S—Slate	Y—Yellow
L—Light	P—Purple	U—Blue	RN—Red with Brown and so on

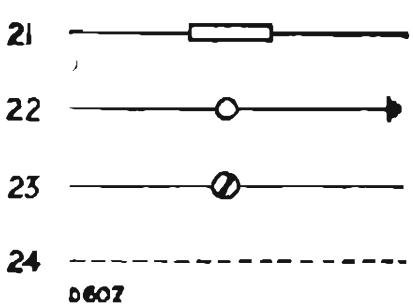
When cables have two-colour code letters the first denotes the main and the latter the tracer.



Flasher plug on vehicle



Flasher plug on trailer



Key to flasher plug on vehicle

1 Existing L.H. tail lamp
2 Existing number plate lamp
3 Existing R.H. tail lamp
4 Flasher L.H.
5 Flasher R.H.
6 Stop lamp L.H.
7 Stop lamp R.H.
8 Existing snap connectors
9 Socket on vehicle
10 Flasher plug
11 Dummy socket

Key to flasher plug on trailer

1 Flasher lamp L.H.
2 Number plate lamp
3 Tail lamp L.H.
4 Tail lamp R.H.
5 Stop lamp R.H.
6 Stop lamp L.H.
7 Flasher lamp R.H.
8 Plug on trailer

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21 Snap connectors
22 Earth connections via terminals and fixing bolts
23 Junction box terminals
24 Circuits shown dotted are existing on vehicle

PART THREE
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, Petrol models

1. Check that the ignition is switched on.
2. Check that there is sufficient petrol in the tank.
3. Check that the cold start control is set correctly and, where fitted, carburetter starter heater element is functioning correctly, indicated by an additional 3-4 amps discharge on vehicle ammeter.
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.

   It should be possible to start the engine by cranking with the starting handle.

5. Remove the cable from each sparking plug terminal in turn and hold it so that the end is about ¼ in. (7 mm) away from some metal part of the chassis, while the engine is turned over; if sparks jump the gap regularly, the coil and distributor are functioning correctly.

   (i) If the sparks are strong and regular, remove and clean the sparking plugs and reset the electrode gaps to .029 to .032 in. (0,75 to 0,80 mm).

   (ii) If the sparks are not regular:—

      (*a*) Check that the distributor rotor is in position.

      (*b*) Check that the L.T. connections on the coil and distributor are clean and tight.

      (*c*) Check that the distributor points are:—

         1. Clean and opening and closing correctly.

         2. Correctly set when open, gap .014 to .016 in. (0,35 to 0,40 mm).

      (*d*) Check that current is present at the SW terminal on the coil, by disconnecting the wire at the coil end and touching it against the SW terminal, with the ignition switch on and the distributor contact-breaker points closed. If sparks occur, low tension current is flowing through the coil correctly; if there is no spark, either the coil or the low tension wiring is defective and your dealer should be consulted.

   (iii) If the sparks are weak and in addition there is a flashing at the distributor contact breaker points, a faulty distributor condenser is indicated.

   (iv) If the sparks are present on some leads, but not on others, check the distributor cap for cracks and the plug leads for faulty insulation.

6. Disconnect the petrol pipe from the carburetter and check that petrol is delivered to the carburetter when the hand lever on the petrol pump is operated. If petrol is not delivered from the pipe:—
   (i) Check that the petrol pipes and filters are clear.
   (ii) Check that there are no air leaks in the suction line to the petrol pump.

Engine starts but soon stops, Petrol models

1. Check that the controls are set correctly.
2. Check the petrol feed to the carburetter.

   If there is little or no flow:—
   (i) Check the petrol level in the tank.
   (ii) Check that the air vent in the filler neck is clear.
   (iii) Check the petrol pump for correct operation.
   (iv) Check that the petrol filters are clear.
   (v) Check that the petrol pipes are clear.
3. Check that the carburetter jets are clear, in the following order:—
   (i) Starter petrol jet; (ii) Main jet; (iii) Pilot jet.
4. Remove the carburetter top cover and check that there is no water in the float chamber.

Engine misfires, Petrol models

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

1. Stop the engine and endeavour to re-start with the starter motor to check the state of the battery and connections. If the battery is in a low state of charge, it will need recharging from an independent electrical supply, and the charging circuit should be checked as directed under charging circuit below.

2. Remove the lead from each sparking plug in turn and check:

(i) By holding the end of the lead about ¼ in. (7 mm) away from a metal part of the engine with the engine running. Sparks should jump the gap regularly.

If no spark is present on one or more cylinders:—

(*a*) Check for moisture on the H.T. leads or distributor.

(*b*) Check, clean and reset the distributor contact-breaker points to .014 to .016 in. (0,35 to 0,40 mm) as necessary.

(*c*) Check the distributor cap for checks and the plug leads for faulty insulation.

If the spark is irregular on all cylinders:—

(*a*) Check for moisture on H.T. leads or distributor.

(*b*) Check the distributor points, clean and re-set as necessary.

(*c*) Check the distributor cap for cracks and plug leads for faulty insulation.

(*d*) Check the L.T. connections for tightness and cleanliness.

(*e*) Check for flashing or "blueing" of the contact-breaker points. If present, the distributor condenser should be renewed.

(*f*) Check for a fault in the ignition circuit by connecting a wire between the "A" connection on the voltage regulator box and the "SW" connection on the coil, thus by-passing the ignition switch. At the same time, the wire from the ignition switch must be disconnected from the coil.

(ii) For any audible alteration in the running of the engine, as each lead is removed. No alteration will indicate that the sparking plug in question is at fault:—

(*a*) Remove and replace or clean the plug; reset the gap to .029 to .032 in. (0,75 to 0,80 mm) as necessary.

3. If the "missing" is accompanied by "spitting back" through the carburetter, a valve may be sticking. This can often be cured by slowly dropping oil or upper cylinder lubricant into the carburetter intake, while the engine is running.

Lack of engine power, Petrol models

1. Check that the carburetter throttle is opening fully.
2. Check that the brakes are not binding and that the tyre pressures are correct.
3. Check that the carburetter jets are not blocked, in the following order.
   (i) Main jet; (ii) Pump jet; (iii) Economy jet.
4. Check the ignition timing.
5. Check the tappet adjustment.
6. If items 1-5 are satisfactory, it is probable that the engine needs decarbonising, and your Rover distributor or dealer should be consulted.

Starter motor, Petrol models

1. Starter motor lacks power or fails to turn engine.
   (*a*) See if the engine can be turned over by hand. If not, the cause of the stiffness of the engine must be located and remedied.
   (*b*) If the engine can be turned by hand, check that the trouble is not due to a discharged battery.
   (*c*) Examine the connections to battery, starter and starter switch, making sure that they are tight and that the cables connecting these units are not damaged.
   (*d*) It is also possible that the starter pinion may have jammed in mesh with the flywheel, although this is by no means a common occurrence. To disengage the pinion, pull off the dust cap and rotate the squared end of the starter shaft by means of a spanner.

2. Starter operates, but does not crank engine.

   This fault will occur if the pinion of the starter drive is not allowed to move along the screwed sleeve into engagement with the flywheel, due to dirt having collected on the screwed sleeve. Clean the sleeve carefully with paraffin.

3. Starter pinion will not disengage from flywheel when engine is running.

   Stop the engine and ascertain if the starter pinion is jammed in mesh with the flywheel. Release it, if necessary, by withdrawing the dust cap and rotating the squared end of the starter shaft in the opposite direction to normal rotation. If the pinion persists in sticking in mesh, have the equipment examined at a service depot. Serious damage may result to the starter if it is driven by the flywheel.

Engine will not crank by starter, Diesel models

1. Gearbox or power take-off auxiliary engaged.
2. Battery terminals loose or broken or batteries discharged.
3. Switch wires and connections loose or broken or switch fault.
4. Starter or solenoid faulty.
5. Short circuit on heater plugs.

Engine will not crank, starter motor rotates, Diesel models

1. Faulty starter clutch assembly.

Engine will not crank on handle, Diesel models

1. Gearbox or power take-off auxiliary engaged.
2. Starter bendix jammed.
3. Hydraulic lock. Water in combustion chamber. Check for internal water leaks.
4. Hydraulic lock. Oil in combustion chamber.
5. Pump faulty. Must be repaired by a CAV Agent.

Engine cranking speed low, Diesel models

1. Battery terminals loose or broken or batteries discharged.
2. Earth connection, chassis to engine, broken or loose.
3. Wrong grade engine oil.
4. Starter faulty or short circuit on heater plugs.

Sufficient engine cranking speed, Engine will not start, Diesel models

1. Little or no fuel in tank. Replenish and prime system.
2. Stop control out or shut-off lever jammed. Linkage incorrectly adjusted.
3. Incorrect starting procedure.
4. Heater plugs faulty.
5. Throttle sticking or incorrectly adjusted.
6. Air in system due to fuel leaks on fuel pump, filter, injection pump or connection pipes. Rectify as necessary and prime system.
7. Insufficient flow of fuel at injection pump inlet.
8. Ample fuel at pump inlet but little or no fuel at injector pipes. Check that nylon or gauze filter at distributor pump inlet connection is not blocked or choked. If in doubt about pressure of fuel to injectors, remove injector and allow to spray in air. Keep well away from spray as fuel will penetrate the skin easily under these conditions. Ensure stop lever is in "run" position. If no injection, remove pump for checking, rectification or replacement.
9. Water in fuel system. Drain fuel system completely. Fit new paper filter element. It is advisable to remove injector pump for checking by a CAV Agent. After refitting pump, refill tank with clean fuel, prime fuel system.
10. Air vent at fuel tank restricted, causing vacuum.
11. Tank pick-up pipe blocked or fractured.
12. Incorrect pump timing or valve timing.

13. Very low compression pressure.
14. Injectors or pump faulty. Pump must be repaired by a CAV Agent.
15. Aid to diagnosis of trouble, observe whether white smoke is emitted from exhaust. If no white smoke, fault is with injection equipment. If white smoke, fault is unlikely to be in injection equipment.

Engine difficult to start, cranking speed sufficient, Diesel models

1. Stop control out or shut-off lever jammed. Linkage incorrectly adjusted.
2. Incorrect starting procedure.
3. Heater plugs faulty.
4. Throttle sticking or incorrectly adjusted.
5. Faulty injectors.
6. Incorrect pump timing.
7. Leaking injector pipes.
8. Low compression pressures.
9. Pump faulty. Must be repaired by a CAV Agent.

Engine starts but stops after a little running, requires priming to restart, Diesel models

1. Little or no fuel in tank. Replenish and prime system.
2. Air in system due to fuel leaks on fuel pump, filter, injection pump or connection pipes. Rectify as necessary and prime system.
3. Insufficient flow of fuel at injection pump inlet.
4. Ample fuel at pump inlet but little or no fuel at injector pipes. Check that nylon or gauze filter at distributor pump inlet connection is not blocked or choked. If in doubt about pressure of fuel to injectors, remove injector and allow to spray in air. Keep well away from spray as fuel will penetrate the skin easily under these conditions. Ensure stop lever is in "run" position. If no injection, remove pump for checking, rectification or replacement.

5. Water in fuel system. Drain fuel system completely. Fit new paper filter element. It is advisable to remove distributor pump for checking by a CAV Agent. After refitting pump, refill tank with clean fuel, prime fuel system.
6. Air vent at fuel tank restricted, causing vacuum.
7. Tank pick-up pipe blocked or fractured.
8. Water in fuel. Drain and clean complete fuel system. Renew paper filter element. Drain and clean fuel storage tank. Ensure that dust and water is excluded to avoid recurrence of trouble.

Engine stalls, Diesel models

1. Engine operating temperature too low.
2. Idling stop incorrectly set. Reset to 590 ± 20 r.p.m. with hand-brake on, while engine is hot. Must be carried out by Rover Distributor or Dealer.
3. Faulty injectors, incorrect pump timing, leaking injector pipes, faulty pump.
4. Excessive load, e.g., power take-off.
5. Internal collapse of air cleaner connection.

Engine will not idle, Diesel models

1. Hand or foot throttle linkage incorrectly set or jamming. Check with hand-brake on and off and adjust as necessary.
2. Idling stop incorrectly set.
3. Injectors or pump faulty. Pump must be repaired by a CAV Agent.

Engine misfires, Diesel models

1. Engine running on less than four cylinders, either intermittently or continually. Check injectors, rectify or replace. Check for leaks on high pressure pipes.
2. Check for blockage in spill pipe and connections.

Lack of power, Diesel models

1. Linkage incorrectly set or jamming.
2. Excessive load on vehicle or power take-off; e.g., brakes binding.

3. Faulty injectors or low compression pressures.
4. Maximum speed stop incorrectly set. Reset to 3,650 ± 20 r.p.m. with engine hot. Must be carried out by a Rover Distributor or Dealer.
5. Pump faulty. Must be repaired by a CAV Agent.
6. Tappets incorrectly set. Reset inlet and exhaust tappets to .010 in. (0,25 mm) with engine hot or cold.
7. Petrol in fuel.

Smoke, Diesel models

1. Faulty injectors or incorrect pump timing.
2. Overfilled oil bath in air cleaner. Fill to correct level.
3. Choked air cleaner. Clean as maker's instructions.
4. Worn or faulty engine condition.
5. Pump faulty. Must be repaired by a CAV Agent.

Charging circuit

1. Battery 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; adjust tension as necessary.

   (*d*) If the cause of the trouble is not apparent, have the equipment examined at a service depot.

2. Battery overcharged.

   This will be indicated by burnt-out bulbs, very frequent need for topping-up of battery and high hydrometer readings. Check the ammeter reading when the car is running steadily —with a fully charged battery 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.

Lighting circuits

1. Lamps give insufficient illumination.
   (*a*) Test the state of charge of the battery, recharging it if necessary either by a long period of day-time running or from an independent electrical supply.
   (*b*) Check the setting of the headlamps.
   (*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.

   Test the state of charge of the battery, recharging it if necessary either by a long period of day-time running or from an independent electrical supply.
3. Brilliance varies with speed of vehicle.
   (*a*) Test the state of charge of the battery, recharging it if necessary either by a long period of day-time running or from an independent electrical supply.
   (*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*) Test the state of charge of the battery, recharging it if necessary either by a long period of day-time running or from an independent electrical supply.
   (*b*) Examine the wiring for a loose or broken connection and remedy.

PART FOUR

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

Full length hood

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.

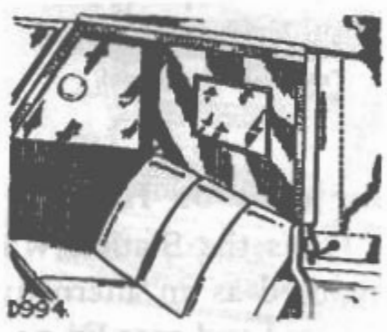
Three-quarter length hood

Three-quarter length hood

The canvas three-quarter length hood covers the rear body only and must be used in conjunction with the metal cab. Versions of this hood are available for both the Land-Rover 88 and 109 with either plain sides or, for Export territories only, with side windows.

Curtain for driver's compartment

The canvas curtain includes a transparent window which can be fitted behind the driver to assist in isolating the driving compartment. This will prove useful under dusty conditions.



Curtain for driver's compartment

It is supported by the hood sticks and straps and can therefore only be used in conjunction with a full length hood.

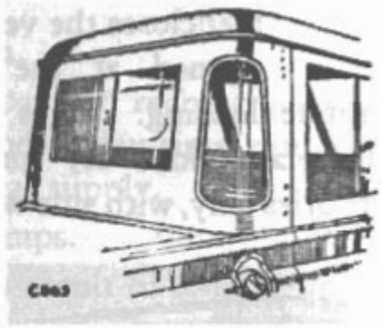
Hard top

Hard top

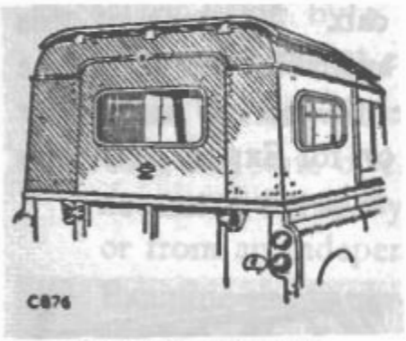
The light alloy hard top is interchangeable with the full length canvas hood. It incorporates a rear door to facilitate loading, and models for both the 88 and 109 are available with plain sides or, for Export territories only, with side windows.

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 can also be used on the 88 model. It must be fitted when a three-quarter length hood is required.



Cab



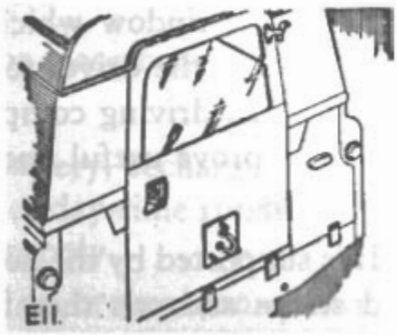
Tropical roof panel

Tropical roof panels for hard top and cab

For use in hot climates a tropical roof panel can be supplied for the hard top or cab. This is an additional panel fitted to the roof. The air pocket so formed between the two panels acts as an insulator against the sun's rays.

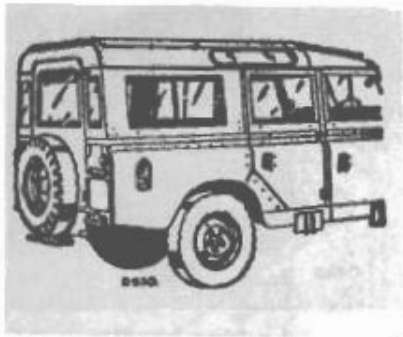
Rear door on Hard Top

This is the Station Wagon rear door used as an alternative to the tail-board and rear lid on both the 88 and 109 Hard Top models.



Rear door on Hard Top

Station Wagon

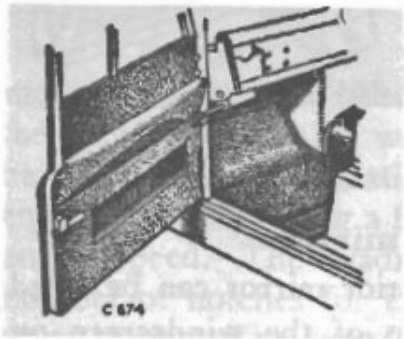


Station Wagon, 109 Illustrated

The 88 Station Wagon will accommodate seven people, three in the front and four facing inwards on the folding seats fitted to the rear wheel arch boxes.

The ten-seater 109 Station Wagon provides accommodation for three people in the front seat, three on the back seat and four facing inwards on the seats fitted to the rear wheel arch boxes.

Both models have the side doors, toe boards and scuttle trimmed; with ribbed rubber matting on the floor. All doors can be locked and the sliding windows are also fitted with locking attachments.



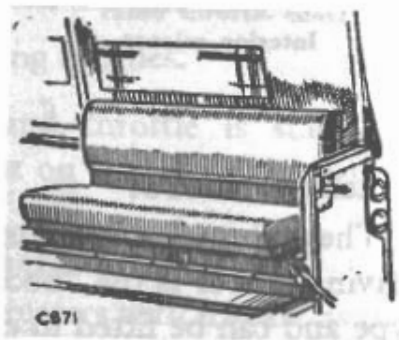
De-luxe trim

De-luxe trim

Complete de-luxe trim is available on all models with cab, and comprises roof lining, floor covering, trim panels with arm rests on doors, private locks and window catches, etc. De-luxe trim for floors and doors only can be fitted to vehicles with full length hood or Hard Top models.

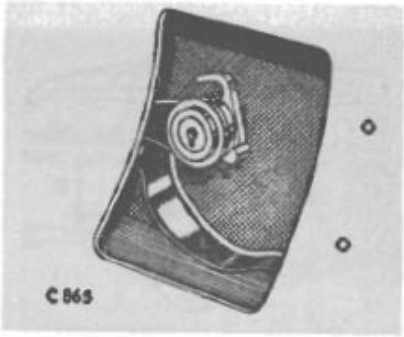
Rear seats

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.



Rear seats

Two units can be fitted in the 88 models whilst up to four may be used in the 109 models.



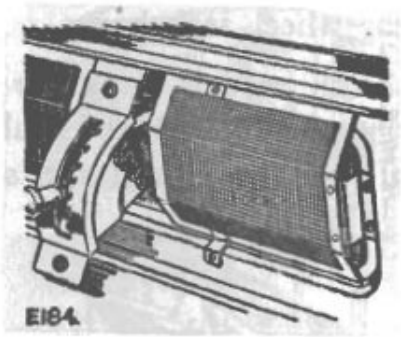
Locking handles

Locking handles and private locks

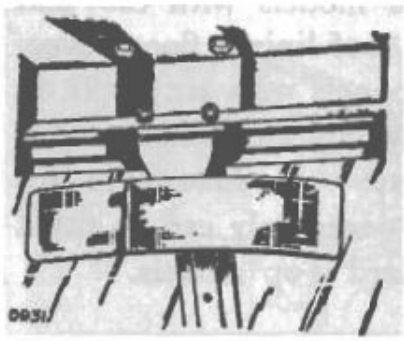
Locking handles are available for fitting to front R.H. and rear doors. A locking catch can be fitted to the lock on the inside of the L.H. front door and all sliding windows can be secured by locking attachments. They can be fitted to all 88 models and are standard equipment on 109 models and all Station Wagons.

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.



Flyscreens for dash vents



Interior mirror

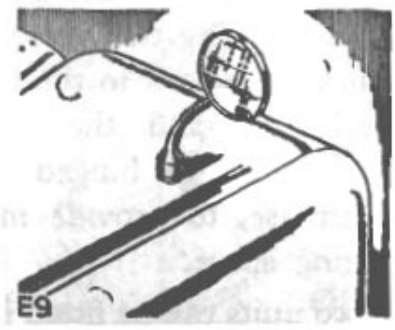
Interior mirror

An interior mirror can be fitted to the top of the windscreen on vehicles with the full length hood.

It is standard equipment on Station Wagons, Hard Tops and Cabs.

External mirror

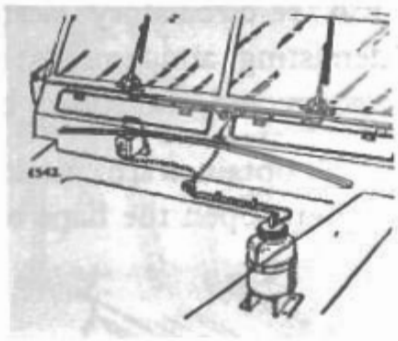
The external chromium plated driving mirror is the "boomerang" type and can be fitted to either the right- or left-hand front wing.



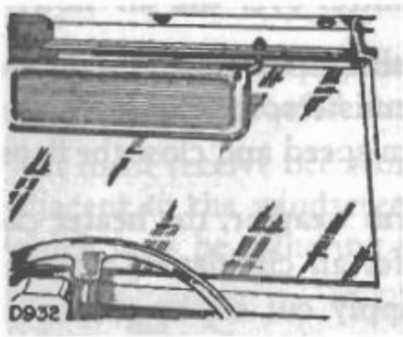
External mirror

Windscreen washer

Either one or two windscreen washer jets can be fitted to the Land-Rover. The jets are attached to the windscreen wiper arms, thus ensuring that water is directed on to the windscreen under all conditions.



Windscreen washer



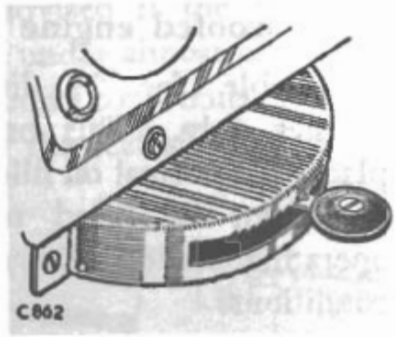
Sun visor

Sun visor

Sun visors for both driver and passenger can be fitted to the top rail of the windscreen.

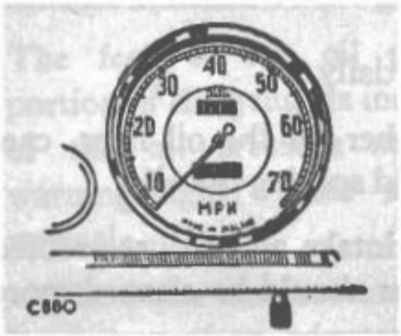
Hand throttle control

A hand throttle control can be mounted on the dash panel and must be used in conjunction with the capstan winch; it would also be useful when operating other equipment demanding a fast idling engine speed. The quadrant has a number of notches for the operating lever. The notch to the extreme right is for use when the hand throttle is not required. In order to bring the hand throttle control into operation move the lever to the left into one of the remaining notches.



Hand throttle control

The hand throttle is standard equipment on the Diesel model.



Speedometer with trip

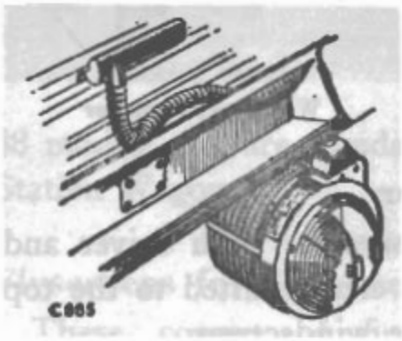
Speedometer with trip

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

Recirculating heater/demister unit

A re-circulatory heater unit is available with 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.



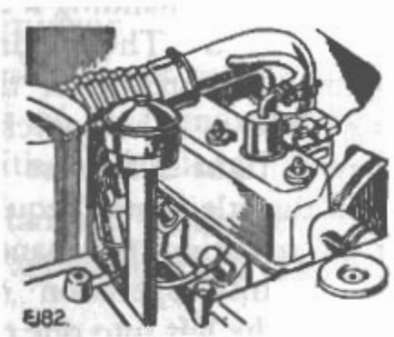
Heater unit

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.

Dust-proofed engine breather

Suitable for 2¼ litre petrol engines only. This breather replaces the normal oil filler cap. It must not be fitted to vehicles operating under cold and misty conditions.



Dust-proofed engine breather

The oil in the engine breather must be renewed weekly. If, however, the vehicle is operating under extremely dusty conditions, this change of oil should be carried out daily.

When removing the oil bath breather on the oil filler, care must be taken to hold it upright to avoid spilling the oil.

On vehicles fitted with a raised air intake and a dust proofed engine breather, the normal air cleaner should be cleaned more frequently.

Raised air intake

Suitable for 2¼ litre petrol models only, it comprises an air intake for the air cleaner attached to the windscreen, with the engine breather on the top rocker cover connected to an elbow between carburetter and air cleaner.

Raised air intake

This optional equipment must only be used in conjunction with the dustproofed engine breather described previously.

It must receive occasional attention by removing the air intake adjacent to the windscreen and blowing out any foreign matter which may be adhering to it.

Rubber pedal pads

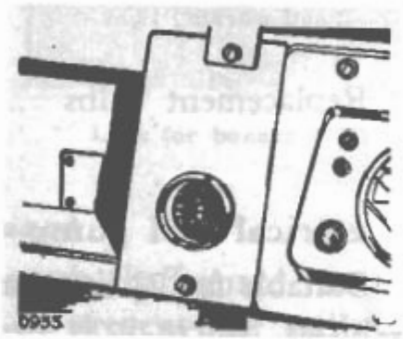
Rubber pedal pads

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.

Water thermometer and oil pressure gauge

The gauge, together with an illumination lamp, is mounted on a bracket attached to the glove box.

The feed to the oil pressure portion of the gauge is independent of the oil pressure switch and warning light; these are left as normal.



Water thermometer and oil pressure gauge

The water temperature bulb is connected to the cylinder head by means of an adaptor.

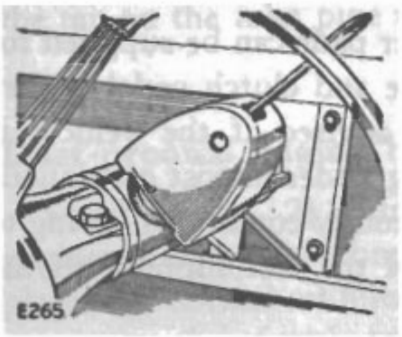
Flashing indicator lamps

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

The self-cancelling switch, complete with warning light, is on the steering column, and is cancelled by movement of the steering wheel.

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.



Flasher self-cancelling switch and warning light

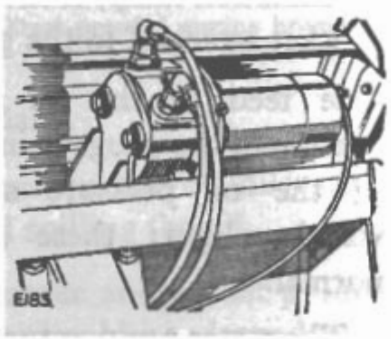
To replace a bulb, remove retaining screw, lever the rubber bead away from rim and lamp, and remove the rim and glass from the bottom first.

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.

Electrical fuel pump

Suitable for 2¼ litre basic petrol vehicles, where it is desirable to replace the mechanical AC pump by an electrical SU pump. The electrical fuel pump is fitted adjacent to the dash vent aperture.

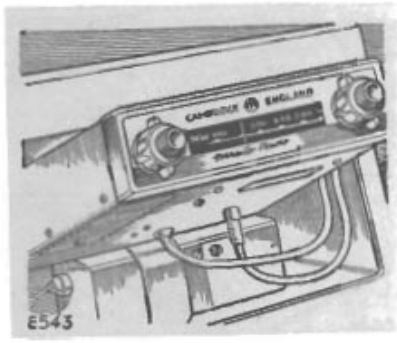


Electrical fuel pump fitted on dash

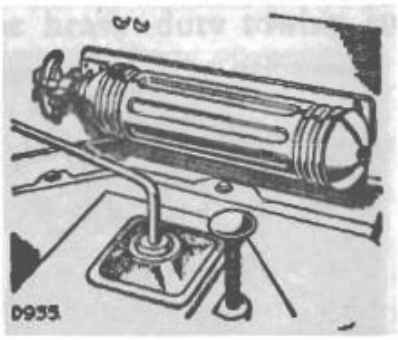
Radio installation

The radio installation is suitable for all models. The set is located in the glove box with the aerial attached to a bracket on the windscreen.

Radio interference suppressors are also available.



Radio



Fire extinguisher

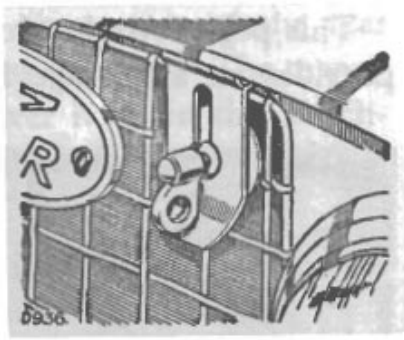
Fire extinguisher

This is a standard quart size extinguisher, finished bright chrome with a painted bracket. It can be mounted on the toe board adjacent to the gear-change lever. It is suitable for all models.

Lock for bonnet

This consists of a hasp fixed to the bonnet which slips over a turn-buckle attached to the grille panel. They are available for both plain and de-luxe bonnets.

The padlock is not supplied by The Rover Company.



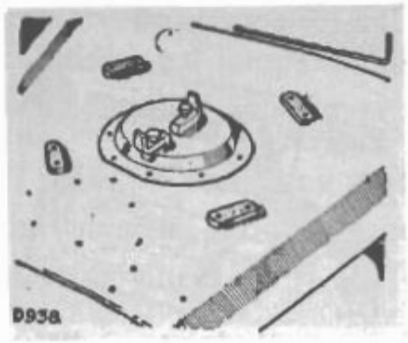
Lock for bonnet

Chaff guard

Chaff guard

A fine-mesh chaff guard can be supplied to prevent the radiator becoming clogged when the vehicle is used for farm work.

The guard is fitted in front of the radiator grille, using the existing fixings.



Spare wheel carrier

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.

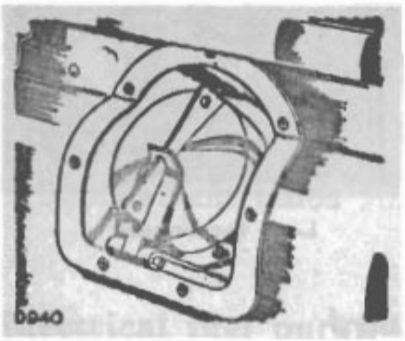
A special dished bonnet top panel is required with the 109 and 88 de-luxe models.

Lock for spare wheel

Lock for spare wheel

This consists of a spare wheel support on the bonnet to which a peg is fitted.

This peg protrudes through one of the wheel stud holes and provides an anchorage for a suitable padlock. It can be fitted to all models. The padlock is not supplied by The Rover Company.



Lock for fuel filler

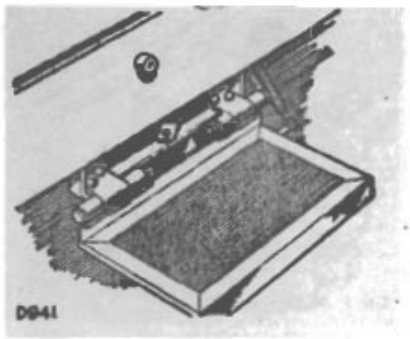
Lock for fuel filler

This consists of a hinged bracket which slips over the filler cap and prevents it from being rotated. The bracket is attached to the body by means of the fuel filler screws. It is suitable for all models. The padlock is not supplied by The Rover Company.

Folding steps for side door

The folding steps are bolted to the chassis frame adjacent to the side doors. Two steps may be fitted to the 88 and 109

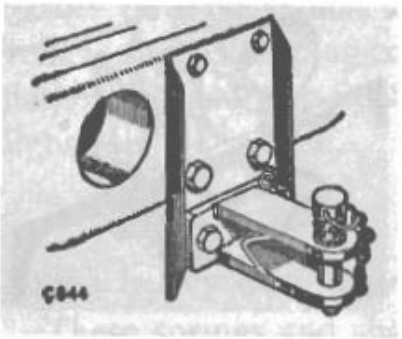
basic models and up to four on the 109 Station Wagon.



Folding steps for side door

Standard towing jaw and attachment bracket

The standard jaw is suitable for towing trailers with a maximum gross laden weight of up to 4,480 lb. (2.032 kg); for heavier loads the heavy duty towing jaw, illustrated below, is required.



Standard towing 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. It must be used in this position on the 88 Station Wagon.

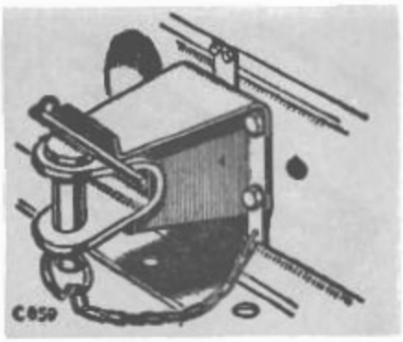
An alternative lower position is provided by fixing the attachment bracket to the centre of the rear chassis cross-member. The towing jaw can then be bolted to the two lower holes in the attachment bracket. This is the normal position for the towing jaw on the 109 Station Wagon.

When using the towing bracket it is important that only the pin provided on the retaining chain be used.

Make sure, when the pin is in position, that the coil spring is under the head of the pin, and that the spring clip attached to the other end of the retaining chain is on the underside of the bracket and properly secured in the groove at the bottom of the pin.

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. It can

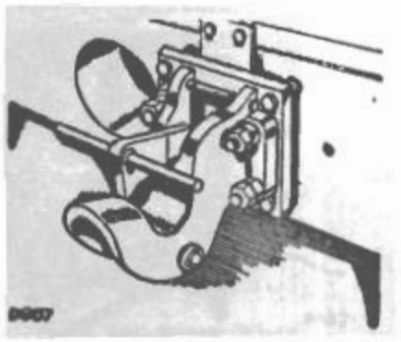


Heavy duty towing pintle

also be fitted to the 109 Station Wagon if the fuel tank is removed and replaced to allow access to the hook fixing bolts.

Towing hook

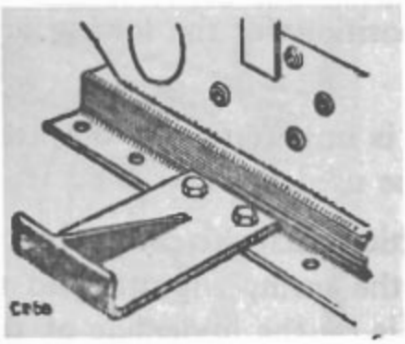
This is a heavy duty type towing hook and can only be fitted to the chassis frame in conjunction with the adaptor plate supplied. It can also be fitted to the 109 Station Wagon if the fuel tank is removed and replaced to allow access to the adaptor fixing bolts.



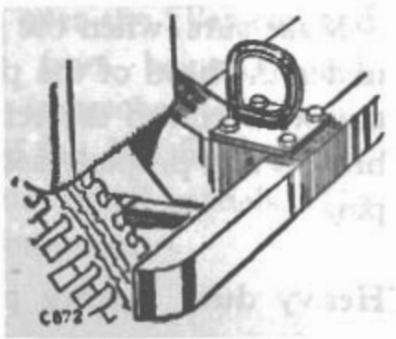
Towing hook

Rear draw plate and extension plate for towing jaw

Draw plate and extension 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. These items are not suitable for the 109 Station Wagon.



Draw bar and extension for towing jaw

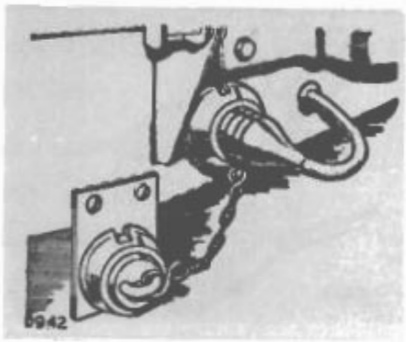


Lifting and towing rings

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.

Trailer plug lead

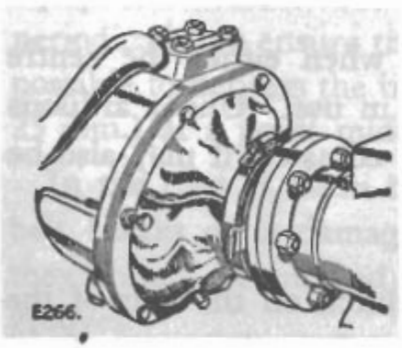


Trailer socket and plug

A five-pin plug for fitting to the chassis frame and a five-pin lead and socket for the trailer is available to provide connection to stop, tail and flasher lights on a trailer. When trailer is not in use the flasher plug on vehicle must be connected to socket on vehicle; this gives flasher and stop lights on vehicle. With trailer on tow flasher plug on vehicle must be inserted in dummy socket on vehicle and trailer plug connected to vehicle socket, this connects flasher, tail and stop lights to trailer, while still retaining the tail lights on the vehicle.

Extra heavy duty road springs and shock absorbers

These springs and shock absorbers are designed for vehicles operating permanently loaded or driven frequently over rough roads.



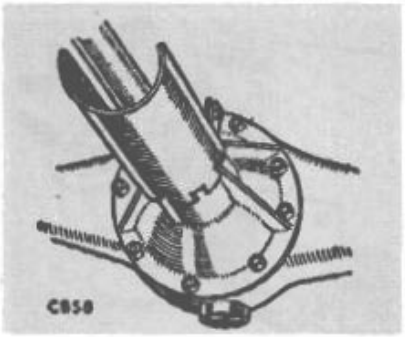
Gaiters for swivel housing

Gaiters for swivel housing

Chamois leather gaiters can be fitted to the swivel pin housing to give additional protection to the spherical swivel ball. They can be fitted to all models.

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.



Propeller shaft covers

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.

Power take-off units

The lay-out 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.

An engine governor may be fitted when either the centre power take-off or rear pulley drive is in use. Under arduous operating conditions and/or in tropical climates, it may also be necessary to fit an engine oil cooler.

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, and controlled by a knob on the heel board. To engage the power take-off drive, the selector knob must be pushed forward.

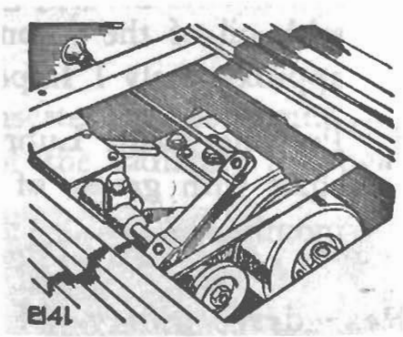
Horse-power figures quoted throughout this section are in British units.

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. When the drive is by vee belt, 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.



Centre power take-off

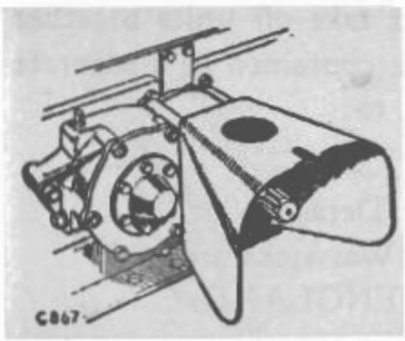
Centre power take-off maintenance

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 ½ 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; 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

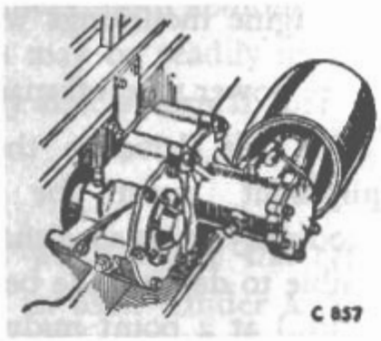
Rear power take-off maintenance.

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.

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 grease of the correct grade at intervals of six months.

Rear drive pulley



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.

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 ¾ 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: 24 B.H.P. at 2,000 R.P.M. —Petrol models

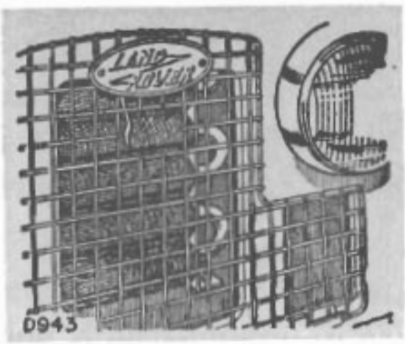
20 B.H.P. at 1,500 R.P.M.
24 B.H.P. at 2,000 R.P.M.
20 B.H.P. at 2,500 R.P.M.
10 B.H.P. at 3,000 R.P.M.
} Diesel models

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

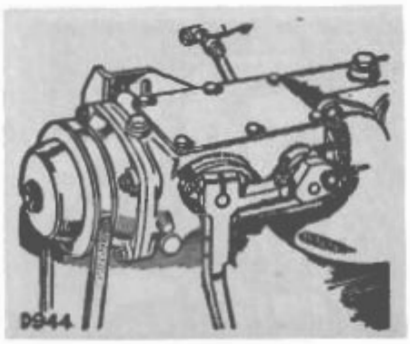
Running time: 30 minutes.

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.



Oil cooler



Engine governor, Petrol models

Engine governor, Petrol models

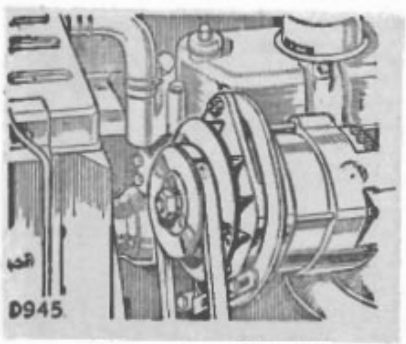
An engine governor may be fitted when a centre power take-off or rear drive pulley is used; it would also simplify many jobs necessitating use of the rear splined output shaft.

The governor is connected to a quadrant lever on the dash panel.

The quadrant has notches giving twelve positions for the operating lever. The notch to the extreme right is for use when the governor is not required. In order to bring the governor into operation, the control lever must be moved to the left; with the lever in the first operating notch, the throttle is opened until the engine is running at 1,500 r.p.m. and the governor will then allow for variations in load, so controlling the engine speed at that figure. Each succeeding notch represents an increase in engine speed of approximately 150 r.p.m.

Engine governor maintenance

Every 40 operation hours, check the oil level in the governor body by removing the filler plug at the top front and the level plug at the right-hand side; replenish as necessary with engine oil through the filler hole, until the level is to the bottom of the level plug hole. Replace both plugs.



Alternator, 12 volt

Alternator, 12 volt

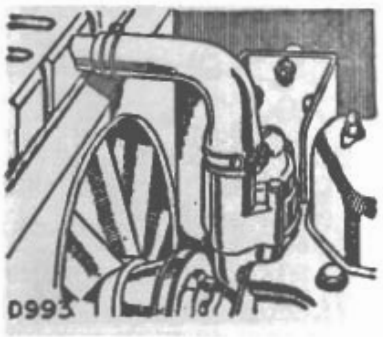
The 12 volt A.C. alternator, which contains a rectifier, is mounted on brackets attached to the cylinder head and is driven by a separate belt from the twin pulley.

A separate 60-0-60 ammeter is fitted to a bracket attached to the dash.

Eight-blade fan

This fan is suitable for all models where increased cooling is required. It will be found particularly useful on Diesel models.

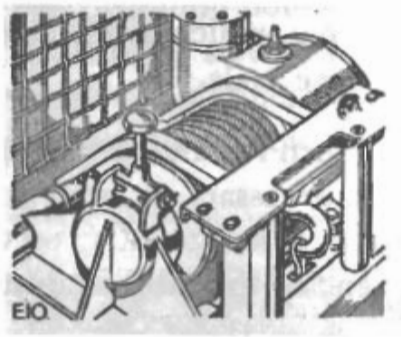
Twin fan belts are used in conjunction with the eight-blade fan with suitable pulleys on water pump, dynamo and crankshaft.



Eight-blade fan

There is also an engine tie rod from bell housing to chassis to prevent excessive fore and aft movement.

Front winch, hydraulic



Front winch, hydraulic

This comprises a hydraulic drum winch complete with cable mounted at the front of the vehicle. It is driven by a hydraulic pump fitted to the rear of the transfer box. The control valve operating the winch is mounted on the heel board, with an oil supply tank fitted in the rear wheelarch. The hydraulic front winch can be fitted to both the 88 and 109 models.

Instructions for using hydraulic winch

1. Vehicle should be positioned in line with the object to be recovered, or in the case of self-recovery the end of the cable should be anchored in line with the vehicle.
2. The transfer box lever should be placed in the neutral position.
3. Engage 3rd gear in the main gearbox and pull out the power take-off lever protruding through the heel board. The hydraulic pump will then be driving when the clutch is released.

   The engine should be run at approximately 2,000 r.p.m., which will result in the pump being driven around 1,500 r.p.m. In practice the engine can be controlled during self-recovery by the accelerator pedal, but for some applications the hand throttle can be used.
4. The hydraulic control lever protruding from the heel board, which should be in the central position, can now be moved downwards to "Pay-out" or upwards for "Paying-in" the cable and held in position.

The following points should be noted:

1. The control knob on the left-hand side of the winch unit (viewed from the front) is for the engagement of the cable drum to the driving shaft. When disengaged for a rapid run-out of

the cable, two inbuilt brake pads prevent over-run of the drum, which would otherwise cause the cable to spring into loose coils.

2. When rewinding the slack cable after a winching operation, it is necessary to apply some resistance to the cable to obtain a neat and even lay on the drum (i.e. an assistant holding the end of the cable against the pull of the drum).

3. If the overload safety valve operates during a winching operation (indicating that the maximum pull has been exceeded) the control valve can be moved to the "Pay-out Position" and then re-engaged to "Pull-in Position".

4. When recovery or self-recovery operations take place on a very steep slope, the maximum pull sometimes is exceeded due to the angle of the cable when the vehicle has reached the apex of the hill. If the safety valve operates it will sometimes be found that a restart is not possible. In these circumstances the vehicle should be lowered a certain amount in the "Pay-out Position", and a further attempt made after the tension in the cable has been reduced.

5. Ground anchors, sprags under the wheels, other vehicles, trees, etc., can be used for securing the vehicle when it is used for general winching or for securing the end of the cable when self-recovery is necessary. The safety valve in the pressure line of the hydraulic system will prevent damage to both the winch and the vehicle.

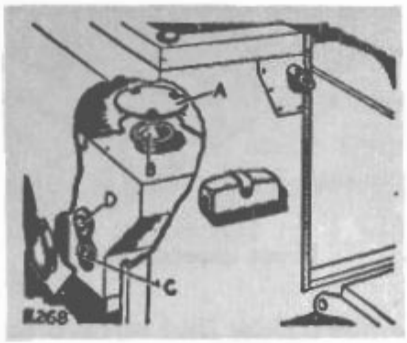
6. The power take-off lever should be pushed in after winching operations are completed, to prevent the pump being driven unnecessarily when travelling along the road.

Hydraulic winch maintenance

1. Oil level in supply tank. Every 40 operation hours check the oil level by removing the cover plate on left-hand wheel arch box and filler cap. Oil level should be just visible in the bottom of the oil filter.

2. Oil level in winch gearbox. Every 40 operation hours check the oil level by removing the level plug in the side of the end casing. Replenish as necessary, through the oil filler plug on top of the casing, to the bottom of the level plug hole.

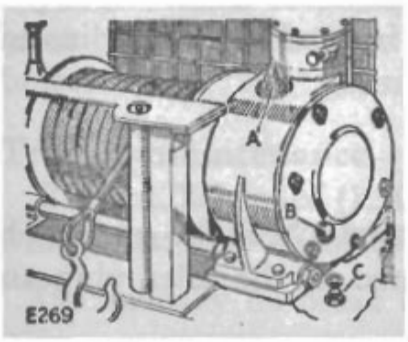
3. Oil changes. Every six months, drain off the oil from the supply tank by removing the rubber plug from the left-hand rear body side and the slotted head drain plug. At the same time remove and clean the tank oil filter.



Supply tank for hydraulic front winch
A—Cover plate C—Drain plug
B—Filler cap D—Oil filter

Also drain off the oil from the winch gearbox by removing the drain plug in the bottom of the casing.

Refill both supply tank and winch gearbox with oil of the correct grade.



Hydraulic front winch gearbox
A—Filler plug B—Level plug
C—Drain plug

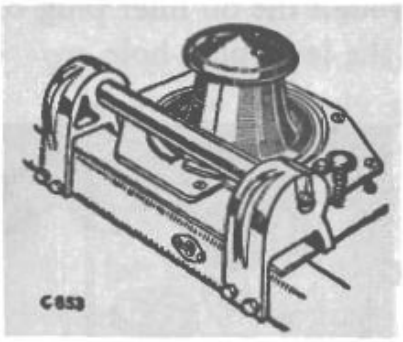
Capacity:
Supply tank: 4½ gallons (20,0 litres)
Winch gearbox: 2 pints (1,0 litre)

4. Lubrication nipples. Every 40 operation hours apply one of the recommended grades of grease to the lubrication nipples on the roller guide for cable. Also to the two lubrication nipples in the drum. Access to these nipples can be obtained by paying out the winch cable.

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 at 600 R.P.M., i.e., a fast idling speed and for this purpose a hand throttle control must also be fitted.



Front capstan winch

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.), $3\frac{3}{4}$ in. (100 mm) circumference Manila

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.

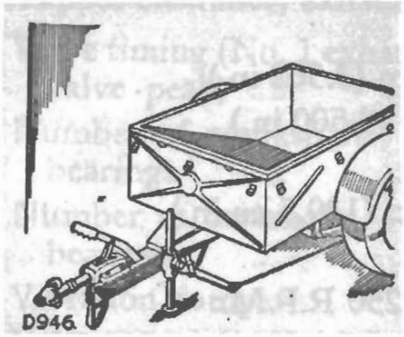
Capstan winch maintenance.

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 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.



Trailer

Trailer

A two-wheeled trailer has been specially designed for use with the Land-Rover; its normal capacity is 1,680 lb. (760 kg.), but, over exceptionally rough ground, the load should be restricted to 1,340 lb. (650 kg).

A special towing ball which bolts directly on to the rear chassis cross-member is supplied with the trailer. The towing ball-cup on the pull-pin is adjustable to allow wear on the towing ball to be taken up, so enabling a snug fit of the ball to be maintained at all times.

The pull-pin is interconnected with the brake linkage, so that when the vehicle brakes are applied and the trailer tends to over-run the towing vehicle, the trailer brakes are automatically applied. When reversing, a pivoted catch on the hand brake must be swung down to limit the pull-pin travel, to keep the brakes in the "off" position.

Trailer maintenance

Every 1,000 miles (1,500 km) smear the towing ball and cup with grease, also check the grease in the hub bearing caps.

Occasionally oil brake rod linkage joints, etc.

Brakes

Periodically adjust the brakes so that they commence to function when the pull-pin is pushed in 1 in. (25 mm).

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.

PART FIVE

GENERAL DATA

Engine, Petrol models

Bore	90.49 mm (3.562 in.)
Stroke	88.9 mm (3.500 in.)
Number of cylinders	4
Cylinder capacity	2,286 c.c. (139.5 cu.in.)
Compression ratio	7.0–1
B.H.P.	77 at 4,250 R.P.M.
Maximum torque	124 lb.ft. (17 mKg.) at 2,500 R.P.M.
Firing order	1, 3, 4, 2
Sparking plug point gap	.029 to .032 in. (0,75 to 0,80 mm)
Distributor contact breaker gap	.014 to .016 in. (0,35 to 0,40 mm)
Ignition timing (static—full retard)	3° B.T.D.C. Regular fuels
Ignition timing to be set to	6° B.T.D.C. when Premium fuels are used
Tappet clearance, inlet	.010 in. (0,25 mm) } Engine cold
Tappet clearance, exhaust	.010 in. (0,25 mm) } or at running temperature
Valve timing (No. 1 exhaust valve peak)	95° B.T.D.C.
Oil pressure	55 to 65 lb./sq.in. (3,8 to 4,6 kg./cm.²) 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
Oil filter, external	Full-flow filter

Engine, Diesel models

Bore	90,49 mm (3.562 in.)
Stroke	88,9 mm (3.500 in.)
Number of cylinders	4
Compression ratio	23–1
Cylinder capacity	2,286 c.c. (139.5 cu.in.)
B.H.P.	62 at 4,000 R.P.M.

Maximum torque	103 lb./ft. (14 mKg.) at 1,750 R.P.M.
Firing order	1, 3, 4, 2
Tappet clearance, inlet	.010 in. (0,25 mm) } Engine cold or at running temperature
Tappet clearance, exhaust	.010 in. (0,25 mm) } Engine cold or at running temperature
Valve timing (No. 1 exhaust valve peak)	109° B.T.D.C.
Number of crankshaft bearings	3
Number of 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.^{2}) 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
Oil filter, external	Full-flow filter
Mountings	Four-point rubber

Clutch

Type	Single dry plate 9 in. (230 mm) diameter. Hydraulic operation
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)

	In High Transfer	*In Low Transfer*
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

Fuel system, Petrol models

Petrol pump	Mechanical, with sediment bowl
Carburetter, basic	Solex PA10-5A downdraught type
Carburetter, with heater element	Solex PA10-6, downdraught type
Air cleaner	Oil bath type with integral centrifugal pre-cleaner

Fuel system, Diesel models

Fuel pump	....	Mechanical with hand primer (high pressure type)
Air cleaner	....	Oil bath type with integral centrifugal pre-cleaner
Fuel filters	....	Sediment bowl and gauze filter on mechanical fuel pump, CAV paper type filter

Injection system, Diesel models

Injector pump	....	Distributor type, self-governing
Injectors: Type	....	CAV Pintaux
Start of injection	....	16° B.T.D.C.

Cooling system

Type	....	Pump, fan and thermostat; pressurised to 9 lb./sq.in (0,6 kg/cm²)

Electrical system, Petrol models

Type	....	Positive earth
Voltage	....	12
Battery capacity	....	57 A.H.
Ignition system	....	Coil
Charging circuit	....	Compensated voltage control

Electrical system, Diesel models

Type	....	Positive earth
Voltage	....	12. Two 6 volt batteries in series
Battery capacity	....	120 A.H.
Charging circuit	....	Current-voltage control

Replacement bulbs

Headlamps:

R.H.D.	Lucas 414, 12v., 50/40w.
L.H.D. Except North America and Europe	Lucas 415, 12v., 50/40w.
L.H.D. Europe except France	Lucas 410, 12v., 45/40w. Duplo
L.H.D. France	Lucas 411, 12v., 45/40w. Duplo yellow
L.H.D. North America	Sealed beam unit, 12v.
Sidelamps	Lucas 207, 12v., 6w.
Stop, tail lamps	Lucas 380, 12v., 21/6w.
Flasher lamps	Lucas 382, 12v., 21w.
Rear number plate lamp	Lucas 222, 12v., 4w.
Instrument panel lights	Lucas 987, 12v., 2.2 MES
Warning lights	Lucas 987, 12v., 2.2 MES

Suspension

Road springs	Semi-elliptic leaf
Hydraulic dampers	Telescopic; non-adjustable

Brakes

Foot brake 88	Hydraulic, 10″ brake drums
Foot brake 109	Hydraulic, 11″ brake drums
Hand brake	Mechanical on transfer box output shaft

Steering

Recirculating ball.	Ratio:	straight ahead 15.6–1
		full lock 23.8–1
Front wheel toe-in		3/64 to 3/32 in. (1,32 to 2,4 mm)
Camber angle		1½°
Castor angle		3°
Swivel pin inclination		7°

Capacities	Imperial unit	U.S. unit	Litres
Engine sump oil	11 pints	13 pints	6,0
Extra when refilling after fitting new filter	3 pints	3½ pints	1,75
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, except 109 Station Wagon	10 gallons	12 gallons	45
Fuel tank, 109 Station Wagon	16 gallons	19 gallons	73
Cooling system, Petrol models	17½ pints	21 pints	10,0
Cooling system, Diesel models	17 pints	20½ pints	9,75
Hydraulic front winch, supply tank	4½ gallons	7½ gallons	20,0
Hydraulic front winch, gearbox	2 pints	1.4 pints	1,0

Dimensions and Weights	88 Basic		88 Station Wagon		109 Basic		109 Station Wagon	
	British	Metric	British	Metric	British	Metric	British	Metric
Overall length	142⅜ in.	3,62 m	142⅜ in.	3,62 m	175 in.	4,44 m	175 in.	4,44 m
Overall width	64 in.	1,63 m	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	—	—	—	—	—	—
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 cab or hard top	76⅞ in.	1,95 m	77⅞ in.	1,98 m	81 in.	2,06 m	81⅜ in.	2,07 m
Wheelbase	88 in.	2,23 m	88 in.	2,23 m	109 in.	2,77 m	109 in.	2,77 m
Track	51½ in.	1,31 m	51½ in.	1,31 m	51½ in.	1,31 m	51½ in.	1,31 m
Turning circle	38 ft.	11,6 m	38 ft.	11,6 m	45 ft.	13,72 m	45 ft.	13,72 m
Unladen ground clearance under differentials, 6.00 x 16 tyres	8 in.	203 mm	8 in.	203 mm	—	—	—	—
Unladen ground clearance under differentials, 7.00 x 16 tyres	8¾ in.	222 mm	8¾ in.	222 mm	—	—	—	—
Unladen ground clearance under differentials, 7.50 x 16 tyres	—	—	—	—	9¾ in.	248 mm	9¾ in.	248 mm
Weight, running, with water, oil, 5 gallons fuel:								
Petrol models	2,900 lb.	1.315 kg.	3,228 lb.	1.465 kg.	3,294 lb.	1.494 kg.	3,745 lb.	1.700 kg.
Diesel models	3,118 lb.	1.324 kg.	3,446 lb.	1.563 kg.	3,496 lb.	1.585 kg.	3,947 lb.	1.853kg.

Dimensions and Weights	88 Basic		88 Station Wagon		109 Basic		109 Station Wagon	
	British	Metric	British	Metric	British	Metric	British	Metric
Maximum approved pay load, normal roads	*Driver, two passengers and: 1,000 lb.	454 kg.	*7 persons and: 100 lb.	45 kg.	Driver, two passengers and: 2,000 lb.	908 kg.	10 persons and: 400 lb.	181 kg.
Maximum approved pay load, cross-country	Driver, two passengers and: 800 lb.	363 kg.	6 persons and: 50 lb.	23 kg.	Driver, two passengers and: 1,800 lb.	816 kg.	10 persons and: 200 lb.	91 kg.
Maximum drawbar pull, dependent upon surface conditions—								
Petrol models	4,000 lb.	1.800 kg.	4,000 lb.	1.800 kg.	3,500 lb.	1.600 kg.	3,500 lb.	1.600 kg.
Diesel models	3,300 lb.	1.497 kg.	3,330 lb.	1.497 kg.	2,900 lb.	1.315 kg.	2,900 lb.	1.315 kg.
Internal body dimensions:								
length (between cappings)	43 in.	1,09 m	—	—	72¾ in.	1,85 m	—	—
width (between cappings)	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	—	—
width of wheel arch (to body side)	13¾ in.	349 mm	—	—	13¾ in.	349 mm	—	—
width of floor (between wheel arches)	36¼ in.	921 mm	—	—	36¼ in.	921 mm	—	—
height, floor to roof (maximum)	48½ in.	1,23 m	—	—	48 in.	1,22 m	—	—

* Maximum loads for cross-country when heavy duty springs are fitted.

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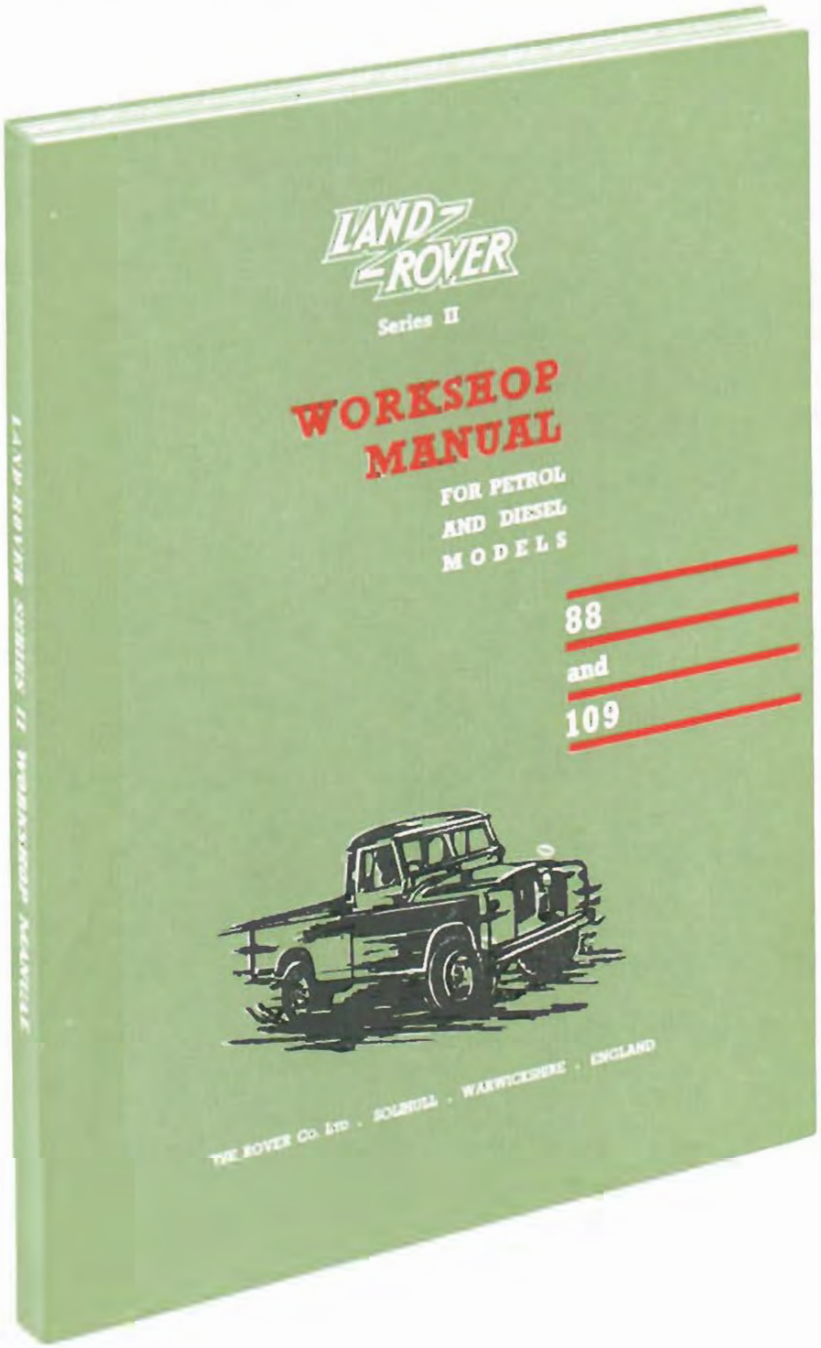
LAND-ROVER Workshop Manual



Containing practical information of the greatest value to everybody concerned with the maintenance and overhaul of the LAND-ROVER.

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THE ROVER COMPANY LIMITED
Technical Service Department . . . . . Solihull, Warwickshire

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JOSEPH WONES LIMITED
WEST BROMWICH, STAFFS
10029/30