

OWNER'S
INSTRUCTION MANUAL

**LAND-
ROVER**

PETROL MODELS



SERIES II
88 AND 109

Part No. 4215

61

Owner's Instruction Manual



Series II

88 and 109 petrol models

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By Appointment to
Her Majesty
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Manufacturers
of
Land-Rovers

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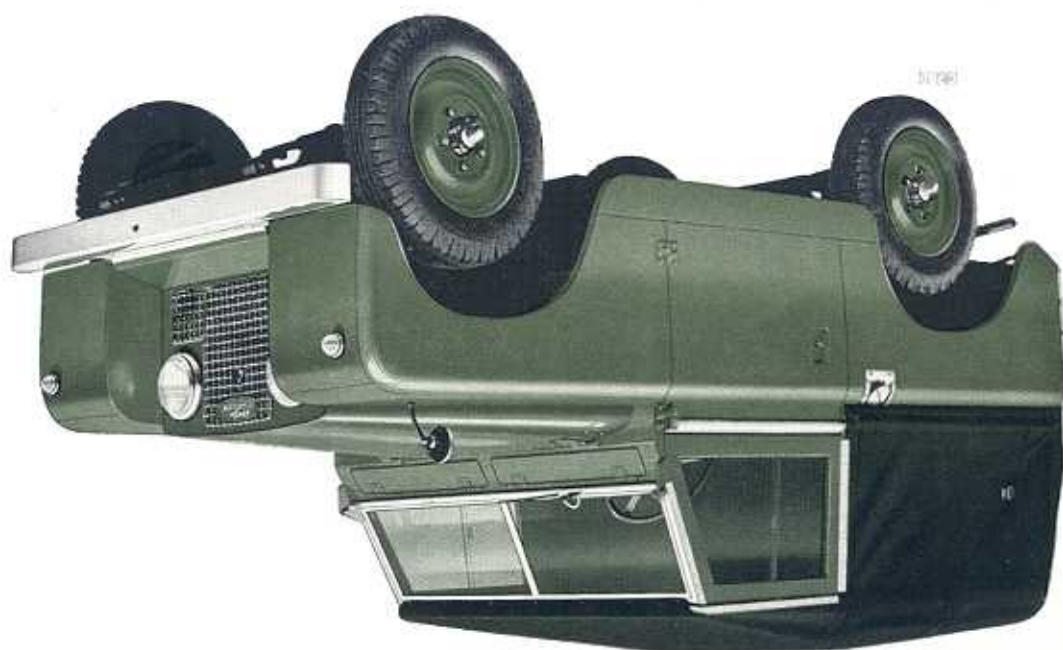
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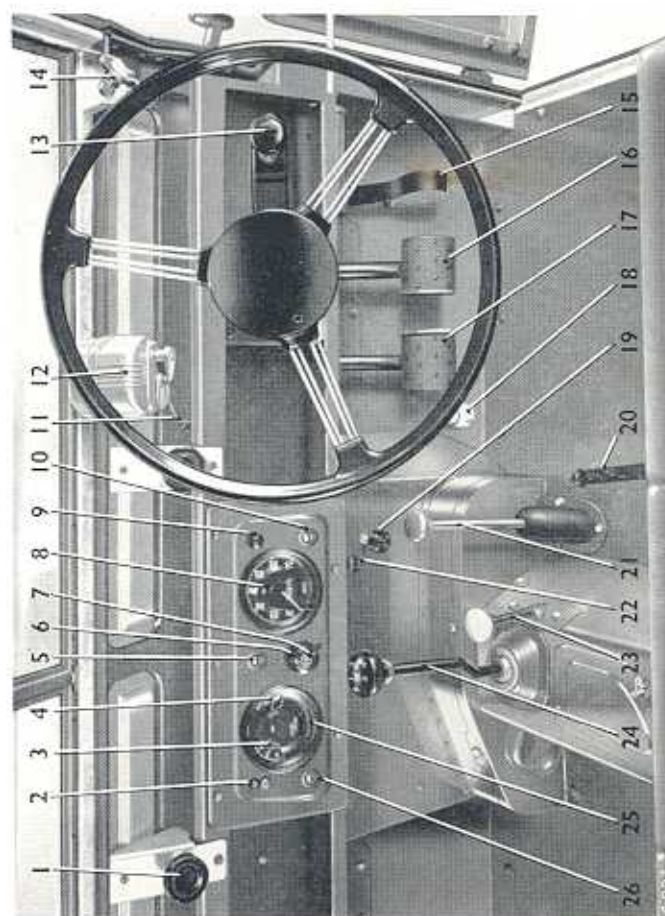
4th Revision, March, 1960

LAND-ROVER SERIES II 109 MODEL



LAND-ROVER SERIES II 88 MODEL





Layout of controls and instruments

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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.

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

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.

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.



Engine serial number

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.

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.

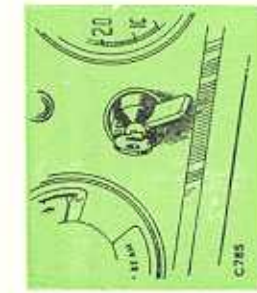
Part Five covers the specification of your Land-Rover and also includes a general index to the whole of the book.

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

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 numbers in brackets after each sub-heading refer to the illustration on Page 4.



Ignition switch and key

Ignition switch and key (7)

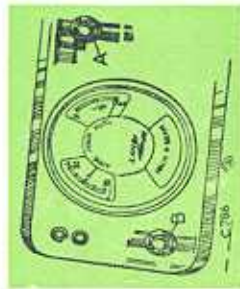
Integral with the lamp switch in the centre of the instrument panel; turn the key clockwise for "on".

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 warning light (5)

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



Ignition and oil pressure warning lights

A—Ignition warning light
B—Oil pressure warning light

Oil pressure warning light (26)

The green warning light at the bottom left-hand corner 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, or occasionally, to a choked oil pump intake filter.

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

Should a warning light bulb burn out, operation of the corresponding component will not be affected, but it should be replaced at the earliest opportunity to safeguard that particular item of equipment. The bulbs can be removed after withdrawing the instrument panel by removing the five securing screws.

Replacement bulbs.

Oil and ignition warning lights: Lucas No. 987 12 v., 2.2 MES.

Starter switch (19)

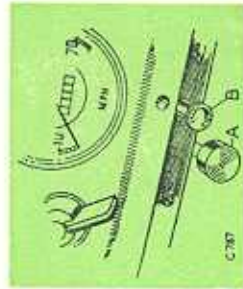
On the dash panel below the instrument panel; to operate, press and release as soon as the engine fires.

Cold start control (22)

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.

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.

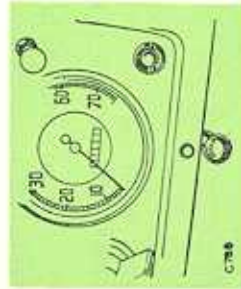


Starter switch and cold start control

A—Starter switch
B—Cold start control

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.



Cold start control warning light

Cold start control warning light (10)

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.

Like all mechanical devices, 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, especially as the warning light may never appear owing to bulb failure. Suspected bulb failure may be confirmed by pulling out the cold start control momentarily when the engine is hot, when the bulb should be illuminated.

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

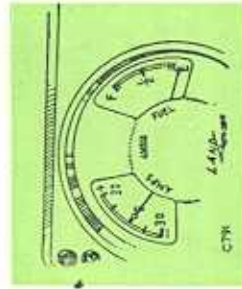
The bulb can be renewed after withdrawing the instrument panel by removing five securing screws.

Replacement bulb.

Cold start control warning lamp: 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.



Ammeter and petrol level gauge

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

Petrol level gauge (4)

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

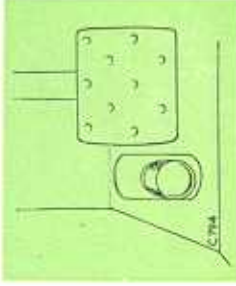
Main lamp switch (6)

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 (18)

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 (25)

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

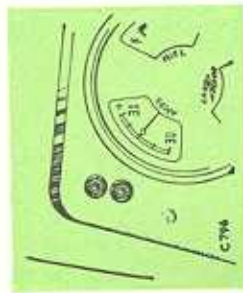
Access to the instrument panel illumination and headlamp warning light bulbs is gained by withdrawing the instrument panel fascia; this is effected by removing the five screws, washers and nuts securing the panel.

Replacement bulbs.

Headlamp warning light and instrument panel lights; Lucas No. 987 12 v. 2.2. MES.

Instrument panel light switch (9)

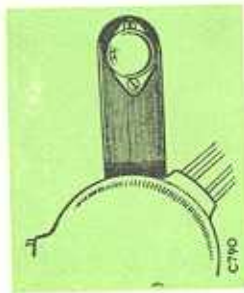
The push-pull switch controlling the panel lights, in the top right-hand corner of the panel, is only operative with the lamp switch at "S" or "H".



Lead lamp socket

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.



Horn button

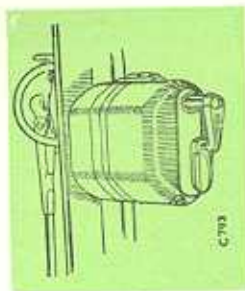
Horn button (13)

The horn push button is housed on an extension arm attached to the steering column.

Windscreen wiper (12)

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



Windscreen wiper

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.

Speedometer (8)

The speedometer indicates the speed of the vehicle and also shows the total mileage.



Speedometer

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



Headlamp

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

and withdraw. Twist the back shell in an anti-clockwise direction and pull it off the light unit; the bulb can then be replaced and the unit reassembled.

Replacement bulbs.

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)

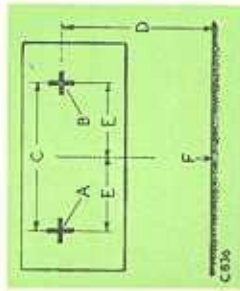
Headlamps (Europe except France): Lucas No. 410, 12 v., 45/40 double filament (duplo) (vertical dip)

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.

B—Concentrated area of light—R.H.

C—20 in. (508 mm)

D—37½ in. (945 mm)—109 models

E—34 in. (860 mm)—88 models

F—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:

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.



Side, tail and stop lamp bulb replacement

Rear number plate illumination lamp

The rear number plate illumination lamp is mounted at either to the right or left on the rear body depending if the vehicle is right-hand or left-hand drive.



Rear number plate illumination lamp

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

Replacement bulb.

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



Hand brake

Hand brake (20)

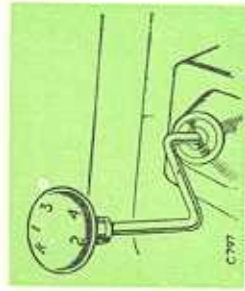
Protrudes through the front of the seat box. To release the brake, pull upwards slightly, depress the button in the top of the hand grip and push down as far as possible; to apply the brakes, pull the lever upwards.

Main gear change lever (24)

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 (21)

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 hesitation in the gear engaging, do not force the lever. With the engine running, engage a gear in the main gearbox and let in the clutch momentarily; then return the main gear lever to neutral and try the transfer control again.

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



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

Front wheel drive control (23)

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

1. Ensure that the main gear lever is in the neutral position.
2. Ensure that the transfer box lever is in high ratio position, that is right forward.

3. 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.

- (ii) Keep the foot clear of the accelerator.

- (iii) Switch on the ignition, check that the green oil pressure and red ignition 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 carburettor 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 ignition 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.

When the engine starts

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.

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.

Petrol consumption

The Land-Rover has a high-powered and efficient 2½ 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.

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

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.



Bonnet catch

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

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

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.

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.



Seat adjustment—109 models

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

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

Remove the hood 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 fixing screws

Windscreen ventilators (1)

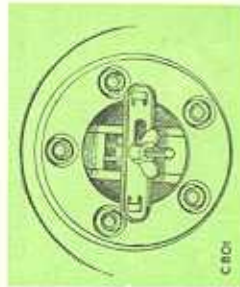
The two ventilators in the windscreen frame may be opened independently by turning the knob anti-clockwise until each ventilator is open to the desired position. Use of the ventilators will be found advantageous when traversing dusty roads, as they greatly reduce the amount of dust blown into the vehicle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



Windscreen ventilators

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.



Spare wheel mounting

Petrol filler



Petrol filler cap

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

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 on all except the 109 Station Wagon is 10 Imperial gallons (45 litres), the 109 Station Wagon tank capacity is 16 gallons (73 litres).

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 knocking.

Radiator filler

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

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

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

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.



Radiator filler

The correct water level is approximately $\frac{3}{4}$ to 1 in. (19 to 25 mm) below the bottom of the filler neck; the total capacity of the system is 17½ 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.

Proceed as follows:—

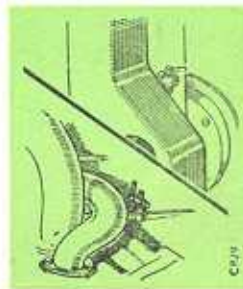
1. Ensure that the cooling system is leak-proof; anti-freezing solutions are far more "searching" at joints than water.

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.



Drain taps

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. After the water has drained out, it is well to run the engine at a fast idling speed for not more than half a minute, so as to dry out any water that may have been retained in the bottom of the jacketing.

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.

USE ONLY ROVER RECOMMENDED LUBRICANTS

After exhaustive tests the recommended lubricants have been found pre-eminent 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.

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.

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

COMPONENTS	S.A.E.	B.P.	DUCKHAM'S	ESSO	MOBIL	SHELL	WAKEFIELD
ENGINE, AIR CLEANER AND GOVERNOR	20W	EnerGel SAE 20W	Duckham's NOL Twenty	Esso Extra 20W/30	Mobiloil Arcus	Shell X100 SAE 20/20W	Castrolite
GEARBOX AND TRANSFER BOX							
DIFFERENTIALS AND SWAY BAR HOUSINGS							
STEERING BOX							
STEERING RELAY UNIT (SEALED)	90EP	EnerGel EP SAE 90	Duckham's Hypoid 90	Esso Expec Compound 90	Mobilube GX 90	Sprix 90 EP	Castrol Hypov
REAR POWER TAKE-OFF, PULLEY UNIT AND CAPSTAN WINCH							
LUBRICATION NIPPLES	—						
		EnerGelase L2	Duckham's LB10 Grease	Esso Multi- purpose Grease	MobilGrease NIP	Petimax A	Castrolase LM

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

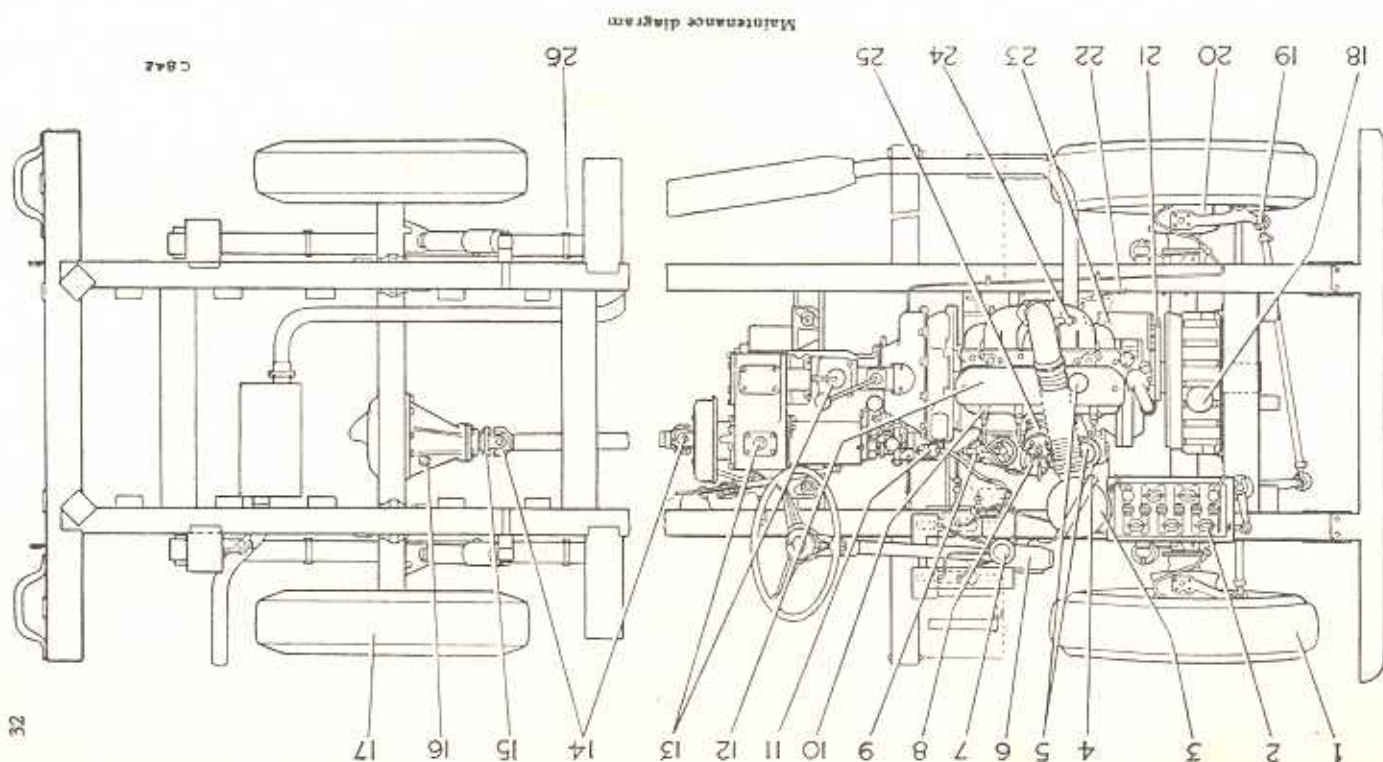
On the following pages, in the same order as listed on the chart, will be found full instructions on how to carry out the maintenance and adjustments required on your Land-Rover.

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

LAND-ROVER SERIES II

MAINTENANCE CHART

FUEL SYSTEM			
3	47	Empty, clean and refill air cleaner	▼
9	48	Clean sediment bowl	▼
24	49	Clean carburettor filter	▼
BATTERY			
2	50	Check acid level	▼



Tyre pressures

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

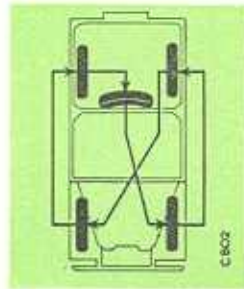
	Normal				Emergency soft			
	Load under 550 lb. (250 kg)		Load over 550 lb. (250 kg)		Load under 550 lb. (250 kg)		Load over 550 lb. (250 kg)	
	Front	Rear	Front	Rear	Front	Rear	Front	Rear
88 models Avon or Dunlop lb/sq.in. 6.00 x 16.00 kg/cm ²	25 1.7	25 1.7	25 1.7	30 2.1	15 1.0	15 1.0	15 1.0	20 1.4
Avon or Dunlop lb/sq.in. 7.00 x 16.00 kg/cm ²	25 1.7	25 1.7	25 1.7	30 2.1	15 1.0	15 1.0	15 1.0	20 1.4
Avon or Dunlop lb/sq.in. 7.50 x 16.00 kg/cm ²	25 1.7	25 1.7	25 1.7	30 2.1	15 1.0	15 1.0	15 1.0	20 1.4
Michelin XY 7.50 x 16.00 lb/sq.in. kg/cm ²	15 1.0	15 1.0	15 1.0	22 1.5	10 0.7	10 0.7	10 0.7	16 1.1
109 models Avon or Dunlop lb/sq.in. 7.50 x 16.00 kg/cm ²	25 1.7	25 1.7	25 1.7	36 2.5	12 0.8	12 0.8	15 1.0	24 1.6
Michelin XV 7.50 x 16.00 lb/sq.in. kg/cm ²	20 1.4	20 1.4	20 1.4	35 2.4	15 1.0	15 1.0	15 1.0	28 1.9

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.

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.



Changing wheel positions

Wheel changing

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

4. If available, place a drop of oil on the stud threads, to assist in subsequent removal.

5. Fit the new wheel, when cross-country tyres are used, with the "V" tread, directed to the front at the top; tighten the nuts securely and lower the vehicle to the ground.

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

Wheel and tyre balance

Wheel and tyre units are accurately balanced on initial assembly with the aid of small weights secured to the inner side of the wheel slot flanges by means of set bolts. Outer covers and tubes marked with balance spots should be fitted so that the white spots near the cover head coincide with the black spots across the base of the tube. This achieves a high degree of tyre balance.

However in the interests of smooth riding and even tyre wear, it is advantageous for a Rover dealer to check the balance whenever a tyre is refitted.

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.

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



Engine dipstick

To check the oil level proceed as follows:—

Stand the vehicle on level ground and allow a few minutes for the oil to drain back into the sump from the valve gear, etc. Withdraw the dipstick 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.



Divided rim wheel 88 models.

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.).



Engine sump drain plug

To change the engine oil, proceed as follows:—

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

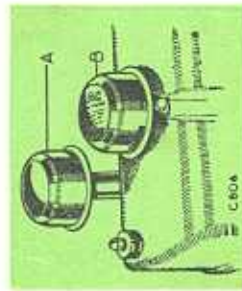
Refill with oil of the correct grade through the filler at the left-hand front of the engine; the capacity is 11 Imperial pints (6 litres).

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 a dash of petrol. Re-wet the gauzes by dipping in clean engine oil and shake off the surplus; replace the top filter with the slot facing forward and the bottom filter with the slot facing the rear of the vehicle.

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



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

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.

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.



Engine oil filter

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.

Sparkling plugs

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.



Sparkling plug



Tappet adjustment

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

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

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

To carry out tappet adjustment, proceed as follows:—

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

Flywheel markings

Ignition 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. 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 or No. 4 cylinder.
3. The line against which the letters E.P. are stamped, when set opposite the pointer, indicates the point at which No. 1 exhaust valve should be at the peak of its lift (fully open). It is 95° before T.D.C.



Flywheel housing drain plug

Flywheel housing 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.

On early models the plug is fitted in the flywheel housing on initial assembly. It should be removed and stored in the tool locker if the vehicle is not expected to do wading or very muddy work.

Late models have the plug screwed into a bracket adjacent to the drain hole; on these vehicles the plug 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, on early models, to the H mark on the dipstick, and on late models to the bottom of the level plug hole. On early models both the dipstick and filler plug are accessible through the swinging cover plate on the gearbox cover.



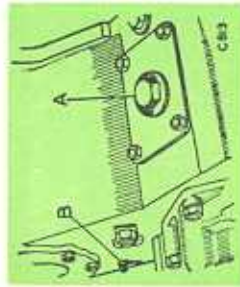
Gearbox oil filler

- A—Filler cap
- B—Dipstick, early models
- C—Oil level plug, late models
- D—Rubber grommet, late models

On late models an oil level plug replaces the dipstick. 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 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.



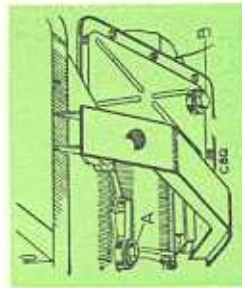
Transfer box lubrication

- A—Filler plug
- B—Level plug

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).

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



Gearbox drain plugs

- A—Gearbox plug
- B—Transfer box plug

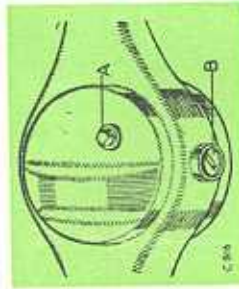
Transfer box oil changes

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.)

To change the oil, 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

The differential oil levels must be checked every 3,000 miles (5,000 km), immediately after a run when the oil is warm, and replenished as necessary to the bottom of the filler plug hole. The rear axle level/filler plug is on the right-hand side of the differential casing and the front axle plug is at the front of the axle casing.



Front differential lubrication

- A—Filler level plug
- B—Drain plug

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

Driving member, front and rear axle



Oil filler plug, rear axle hub

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.

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.

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) in the following manner:—

Immediately after a run, when the oil is warm, drain off the oil by removing the drain plugs in the bottom of the axle casings. Replace the drain plugs and refill with oil of the correct grade; the capacity of each differential is approximately 3 Imperial pints (1.75 litres).

The drain plugs have slotted heads and can be removed with the aid of the 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 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.

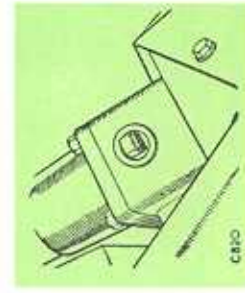
Swivel pin housing oil changes

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).



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

To change the oil, remove the drain plug from the bottom of each housing, immediately after a run when the oil is warm; allow the oil to drain away completely and replace the plugs. Refill with oil of the correct grade through the filler/level plug holes; the capacity of each housing is approximately 1 Imperial pint (0.5 litre).



Steering box lubrication

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 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.

To check for wear move the ball joint vigorously up and down. Should there be 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 grease (Shell Retinax A, Esso Multi-purpose grease H, Duckham's LB10, Castrolase LM, Energol L2 or Mobilgrease MP) round taper of ball joint and also fill the boot; (e) Re-assemble all parts using new rubber boot and springs as required.



Steering ball joint

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.



Propeller shaft lubrication

A—Sliding sleeve nipple
B—Universal joint nipple

Distributor maintenance

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 marked "OIL HERE" in the contact breaker base plate, to lubricate the automatic timing control.



Distributor

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

Occasionally clean the distributor as follows:—

1. Wipe the inside and outside of the cap with a soft, dry cloth; ensure that the small carbon brush works freely in its holder.
2. Slacken the nuts on the terminal block and lift off the spring and moving contact. Ensure that the contacts are free from grease or oil; if they are burned or blackened, clean with a fine carborundum stone or very fine emery cloth and wipe with a petrol-moistened cloth. Replace the moving contact.
3. 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) i.e., the feeler gauge supplied in the tool kit should be a sliding fit between the contacts.

- (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

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.



Ignition timing

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:—

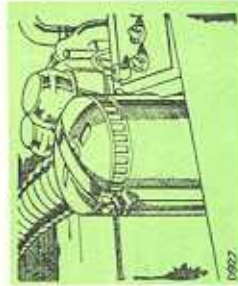
1. Set the contact breaker point gap to .014 to .016 in. (0.35 to 0.40 mm) with the points fully open.
2. Rotate the engine in the running direction until the 3° mark, when using regular fuels, or 6° mark, if premium fuel is used, on the flywheel is in line with the pointer, with both valves on No. 1 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.

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.



Air cleaner

Proceed as follows:

1. Release the clamping strap securing the complete air cleaner to the battery box support, disconnect the outlet elbow from the carburettor intake pipe by slackening the clip and remove the cleaner from the vehicle.
2. Remove the oil bowl from the bottom of the cleaner by releasing the three securing clips.
3. Clean all dirty oil and sludge from the bowl and refill with fresh engine oil to the level indicated by a ring formed in the

pressing; the capacity is approximately $1\frac{1}{2}$ Imperial pints (0.85 litre).

4. Clean the filter in the cleaner body by swilling the complete body in petrol or paraffin and shake off the surplus.
5. Replace the bowl.
6. Refit the complete unit in the vehicle.

Fuel system

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

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:

- (a) Remove the bowl by slackening the thumb screw and swinging the retainer aside.
- (b) Remove and clean filter gauze in petrol.
- (c) Ensure that the sealing washer is in good condition.
- (d) Replace gauze and refit bowl.
- (e) Prime by operating hand lever.



Fuel pump and sediment bowl

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

Carburetter

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.

Cleaning carburetter filter

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

It may occasionally become necessary to adjust the slow-running qualities of the carburetter, in which case 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

- 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

It is most unlikely that trouble will be experienced with blocked jets, but the following notes will assist in location of



Carburettor jets

A—Main jet
B—Pilot jet
C—Accelerator jet
D—Starter jet

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.

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

Battery

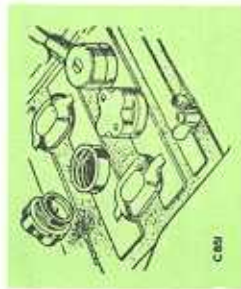
The positive earth 12-volt battery is carried under the bonnet on the right-hand side.

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.



Battery

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.



Dynamo lubrication

Fuse box

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

All other electrical components are not fused.

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

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



Fuse box

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 $\frac{1}{16}$ to $\frac{1}{8}$ in. (8 to 11 mm) by thumb pressure between the fan and crankshaft pulleys. The procedure for adjustment is as follows:—



Fan belt adjustment

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.

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.

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.



Brake and clutch fluid reservoir

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:—

All 88 models

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



Wheel brake adjustment

Front and rear, 88 models
Front only, 109 models
A—Adjustment bolt
B—Snail cam
C—Shoe steady posts

109 models

Front

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

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

Rear

The rear brake shoes are adjusted by means of a single adjuster assembly fitted at the lower side of the brake anchor plate which allows the shoes to expand or contract equally.

Wheel brake adjustment
Rear only, 109 models

1. With the rear wheels jacked up ensure that they rotate freely; slacken the adjuster if necessary, by turning anti-clockwise.
2. Apply the foot brake to ensure that the shoes are bedded in

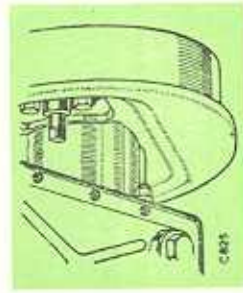
and turn the adjuster clockwise until the linings brush the brake drum then slacken adjuster off (anti-clockwise) two clicks.

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
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.



Brake bleed nipple

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 $\frac{3}{4}$ in. (20 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:

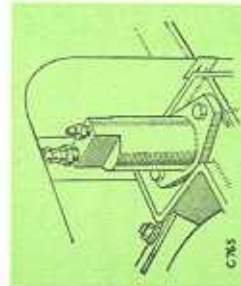
- (a) Slacken locknut "A".
- (b) Adjust the push rod "B" with the fingers until the movement is correct.
- (c) Secure with the locknut.

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.

- (c) Hold the tube under the fluid surface and tighten the bleed screw.

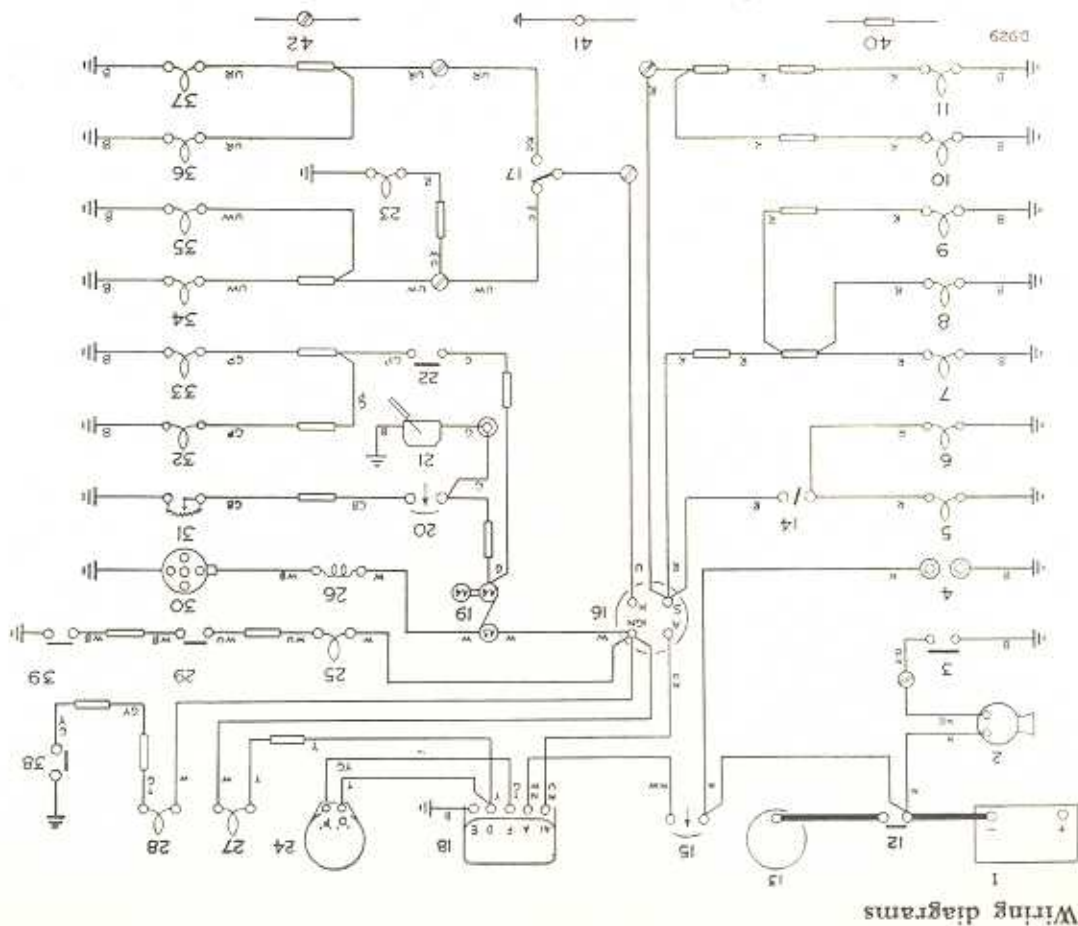
- (d) Adjust pedal movement as necessary.

- (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.

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.



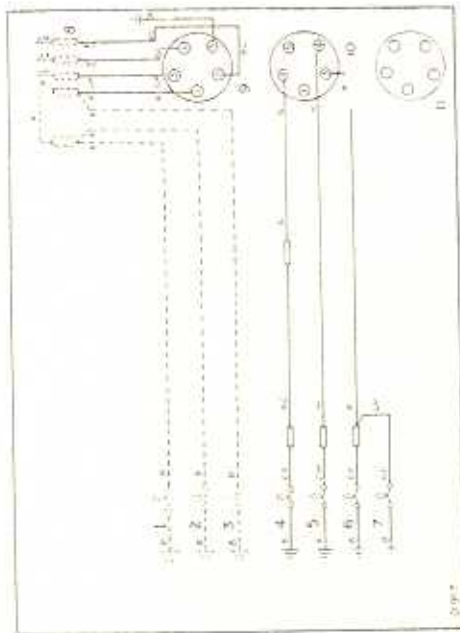


When cables have two-colour code letters the first denotes the main and the latter the tracer.

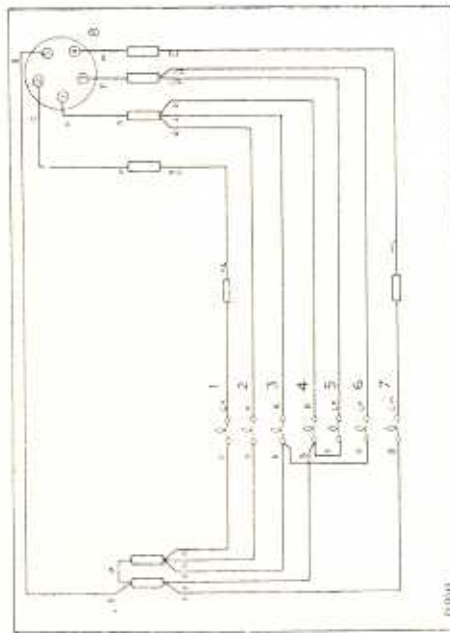
KEY TO CABLE COLOURS

B—Black N—Brown R—Red W—White
G—Green P—Purple U—Blue Y—Yellow
RN—Red with Brown, and so on.

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



FLASHER PLUG ON VEHICLE



FLASHER PLUG ON TRAILER



Key to flasher plug on vehicle

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

Key to flasher plug on trailer

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

- | |
|---|
| 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

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.
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 $\frac{1}{4}$ 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.
2. Opening and closing correctly.
3. 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 carburettor and check that petrol is delivered to the carburettor 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

1. Check that the controls are set correctly.

2. Check the petrol feed to the carburettor.

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 carburettor jets are clear, in the following order:—

- (i) Starter petrol jet.
- (ii) Main jet.
- (iii) Pilot jet.

4. Remove the carburettor top cover and check that there is no water in the float chamber.

Engine misfires

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 $\frac{1}{4}$ 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 cracks 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 clean the plug; reset the gap to .029 to .032 in. (0.75 to 0.80 mm) as necessary.
- (b) If still faulty, fit a new sparking plug.

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

Lack of engine power

1. Check that the carburettor throttle is opening fully.
2. Check that the brakes are not binding and that the tyre pressures are correct.
3. Check that the carburettor 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.

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 ignition 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.

Starter motor

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.

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

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.



Three-quarter length hood

Hard top

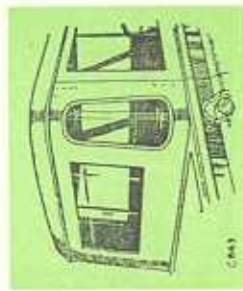
The light alloy hard top is interchangeable with the full length canvas hood. It incorporates a rear door to facilitate loading, and models for both the 88 and 109 are available with plain sides or, for Export territories only, with side windows.



Hard top

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 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.



Tropical roof panel

Station Wagon

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.



Station Wagon, 109 illustrated



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

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.



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 top and cabs.



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



Hand throttle control

Optional equipment

control into operation move the lever to the left into one of the remaining notches.



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 or without wind-screen demisting attachments; it is heated from the engine cooling system and controlled by a rheostat switch.

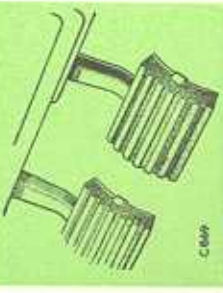
To obtain warm air to the body of the vehicle and to the demisters, open the flaps on the heater casing. The volume of air can be regulated by means of the rheostat switch, while the flaps afford control over the air flow.

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

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



Heater unit



Rubber pedal pads

Rubber pedal pads

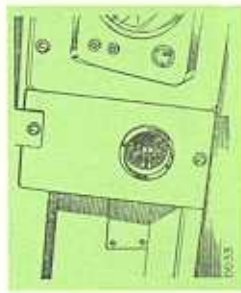
Rubber pads can be supplied for the brake and clutch pedals; they are not advised if the vehicle is operating under almost continuous wet or muddy conditions, owing to danger of the feet slipping off the pedals.

Optional equipment

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.



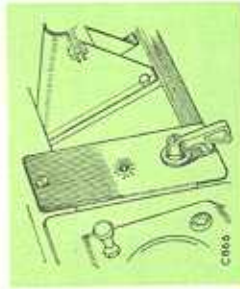
Water thermometer and oil pressure gauge

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.

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



Flasher self-cancelling switch and warning light

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

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

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

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.

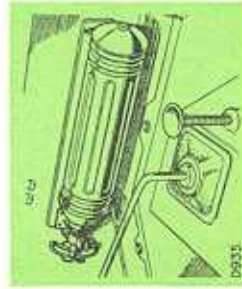


Radio

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.



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

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.

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.

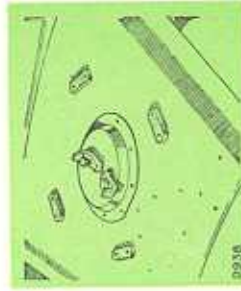


Chaff guard

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.



Spare wheel carrier

Lock for spare wheel

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

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 spare wheel

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.



Lock for fuel filler

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

Optional equipment



Folding steps for side door

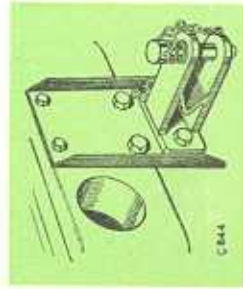
basic models and up to four on the 109 Station Wagon.

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.

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.



Standard towing equipment

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

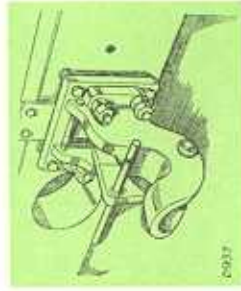
This towing pintle is designed to suit trailers having a towing eye larger than can be used with the standard towing jaw; it is

Optional equipment

secured to the rear chassis cross-member with four bolts. It can 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

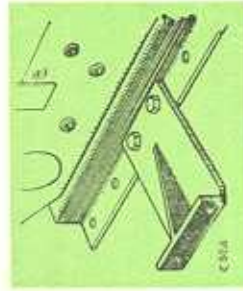
This is a heavy duty type towing hook and can only be fitted to the chassis frame in conjunction with the adaptor plate supplied. It can also be fitted to the 109 Station Wagon if the fuel tank is removed and replaced to allow access to the hook fixing bolts.



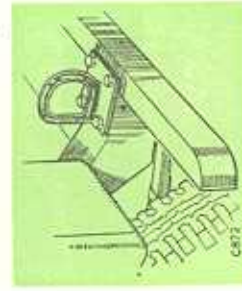
Towing hook

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 socket and plug

Trailer plug lead

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.

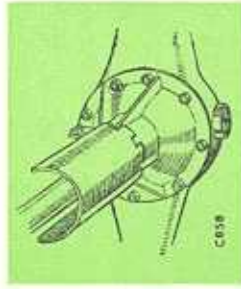
Extra heavy duty road springs and shock absorbers (88)

These springs and shock absorbers are for Land Rover 88 models only, and are designed for vehicles operating permanently loaded or driven frequently over rough roads.

Propeller shaft covers

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

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



Propeller shaft covers

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 must 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.

For stationary work, engine R.P.M. must not be allowed to exceed 2,550, i.e., governor position 8. Should the machinery require a higher speed, a step-up belt drive or gearbox must be used.

The drive is taken through a dog clutch on the rear of the gearbox mainshaft and incorporates a flanged output shaft. Selector mechanism is bolted to the top of the transfer box, the selector lever being accessible, on early models, through a cover plate in the seat-box centre panel. On late models selection is made 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



D946

Centre power take-off

provided with the equipment and is available from the manufacturer. Not more than 20-25 B.H.P. can be transmitted through the centre power take-off, or damage to the rear engine mountings will result.

Centre power take-off maintenance

The belt drive to the driven equipment must be adjusted periodically, to ensure that the tension is correct. It should be possible to depress the belts by thumb pressure $\frac{1}{4}$ to 1 in. (12 to 25 mm.) at a point midway between the pulleys.

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

Rear power take-off

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



C 857

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.



C 857

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 $\frac{3}{4}$ Imperial pint (0.5 litre).

Oil cooler

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

Power required: 24 B.H.P.

R.P.M.: 2,000.

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.



Oil cooler

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.

Engine governor

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, and with the lever in this position the throttle opening is not influenced by the governor mechanism. In order to bring the governor into operation, the control lever must be moved to the left into one of the remaining eleven notches; 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 applied at the power take-off, so controlling the engine speed at that figure. Each succeeding notch represents an increase in engine speed of approximately 150 r.p.m., so that the eleventh and last notch on the extreme left of the quadrant will provide an engine speed of 3,000 r.p.m.



Engine governor

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

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.



Alternator, 12 volt

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 1½ in. dia. (31.5 mm dia.), 3¼ in. (100 mm) circumference Manila

Rope speed is 12½ ft./min. (4 metre/min.) at 600 engine R.P.M.

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

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

Front winch maintenance.

1. Oil level. Every 40 operation hours, check the oil level by means of the dipstick incorporated in the filler plug and replenish as necessary.
2. Oil changes. Every six months, drain off the oil through the drain plug in the bottom of the winch casing and refill with oil of the correct grade; the capacity is $3\frac{1}{2}$ Imperial pints (2 litres).
3. Lubrication nipple. Access to the lubrication nipple on the bollard shaft is gained by turning 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

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 overrun 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	
Bore	90.49 mm (3.562 in.)
Stroke	88.9 mm (3.500 in.)
Number of cylinders	4
Cylinder capacity	2,286 c.c. ¹ (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
Spark 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
Clutch	
Type	Single dry plate 9 in. (230 mm) diameter. Hydraulic operation
Adjustment	1 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	Third	Second	First	Reverse	Direct
	...	...	...	...	...	...
	...	...	...	...	...	...
	...	...	...	...	...	...
	...	...	...	...	...	...
Transfer gearbox:	High transfer	Low transfer				
	...	...				
	...	...				
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 pump	.....	Mechanical, with sediment bowl
Carburettor	.....	Solex down-draught type
Air cleaner	.....	Oil bath type with integral centrifugal pre-cleaner

Cooling system

Type		Pump, fan and thermostat; pressurised to 10 lb./sq. in (0.7 kg/cm ²)
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Electrical system

Type		Positive earth
Voltage		12
Battery capacity		57 A.H.
Ignition system	.....	Coil
Charging circuit	.....	Compensated 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 Station Wagon	10 gallons	12 gallons	45
Fuel tank, 109 Station Wagon	16 gallons	19 gallons	73
Cooling system	17½ pints	21 pints	10.0

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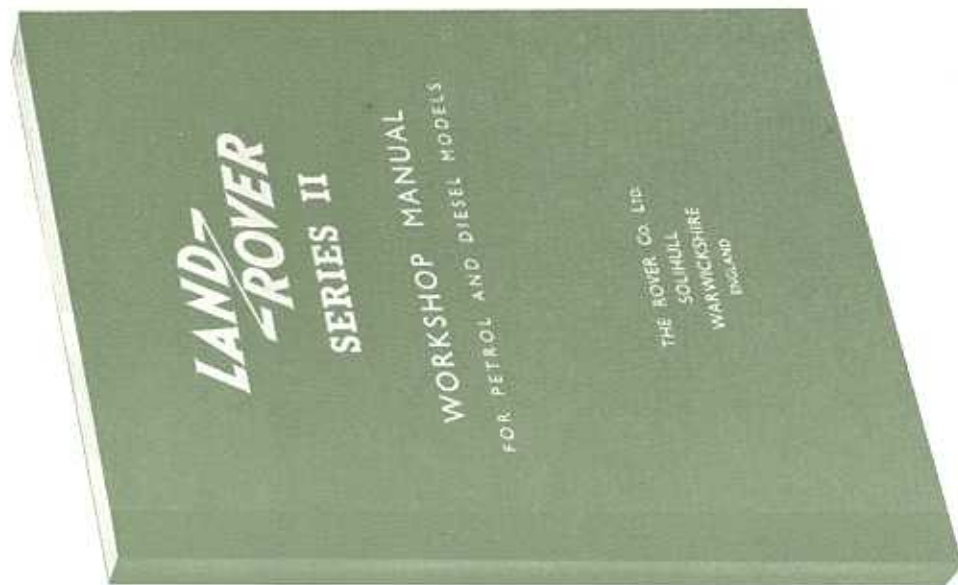
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Workshop Manual



Containing practical information of the greatest value to everybody concerned with the maintenance and overhaul of the LAND-ROVER. Copies can be obtained from all Rover Distributors and Dealers.

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