ARMY CODE NO.
22230

AIR PUBLICATION
5049B
(UH)

Issued April 1972

TRUCK, UTILITY, ¾ ton, 4 x 4,

ROVER SERIES III

USER HANDBOOK

Produced to the requirement of
THE MINISTRY OF DEFENCE
by DIRECTOR OF QUALITY ASSURANCE
(FIGHTING VEHICLES AND ENGINEER EQUIPMENT)

Part No. 608179

NOTES TO READERS

The subject matter of this publication may be affected by Defence Council Instructions, EMER Modification or Miscellaneous Instructions or General Orders and Modification Leaflets. If possible, amendments are issued to correct this publication accordingly. When an Instruction or Leaflet contradicts any portion of this publication, the Instruction or Leaflet must be taken as the overriding authority.

The lubricants and lubrication periods to be used will be those quoted in the Servicing Schedule or Lubrication Air Diagram.

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SECTION I

General Description

CHAPTER 1

INTRODUCTION

VEHICLE SERIAL NUMBERS

1. The vehicle serial number, comprising eight digits and a suffix letter, will be found on the transfer box instruction plate on the dash panel over the gearbox cover on 12 volt models, and on a plate attached to the driver's seat box on 24 volt models. It is the same as the chassis number, which is stamped on the right-hand front spring shackle bracket.

The engine serial number is stamped on the left-hand side of the cylinder block at the front.

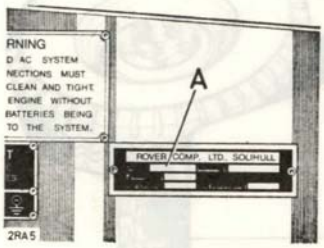

Fig. 1
Vehicle Serial Number, 24 volt models
A—Vehicle Serial Number

Fig. 2
Engine Serial Number
A—Engine Serial Number

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

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

Rear axle: At rear of axle casing on left-hand side.

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

NOMENCLATURE

2. Reference is made throughout the text to the 'left-hand' and 'right-hand' sides of the vehicle, rather than to 'near-side' and 'off-side'. The 'left-hand' side is that to the left hand when sitting in the driver's seat.

In some instances the abbreviation 'R.H.D.' is used to denote right-hand drive.

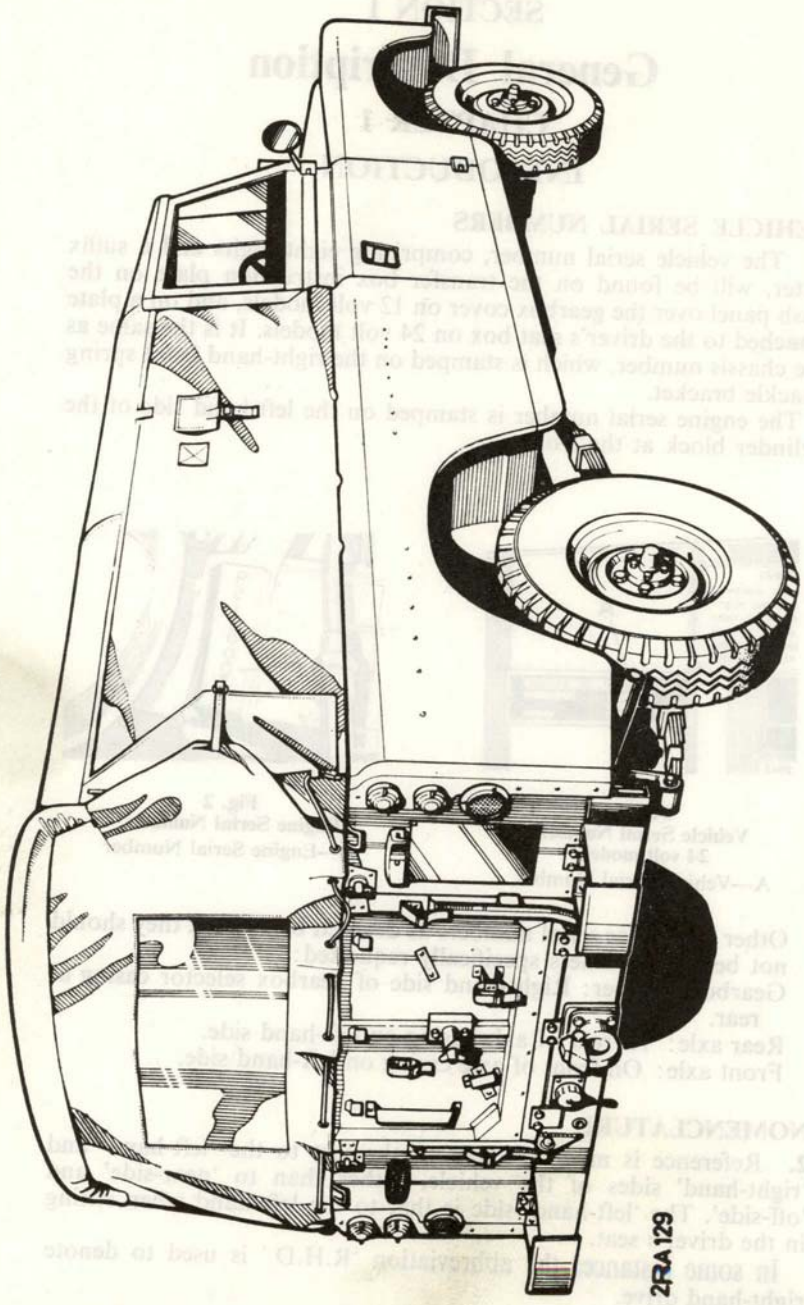

Fig. 3 Three-quarter rear view, 24 volt model illustrated

Fig. 3A Three-quarter front view. 24 volt model illustrated

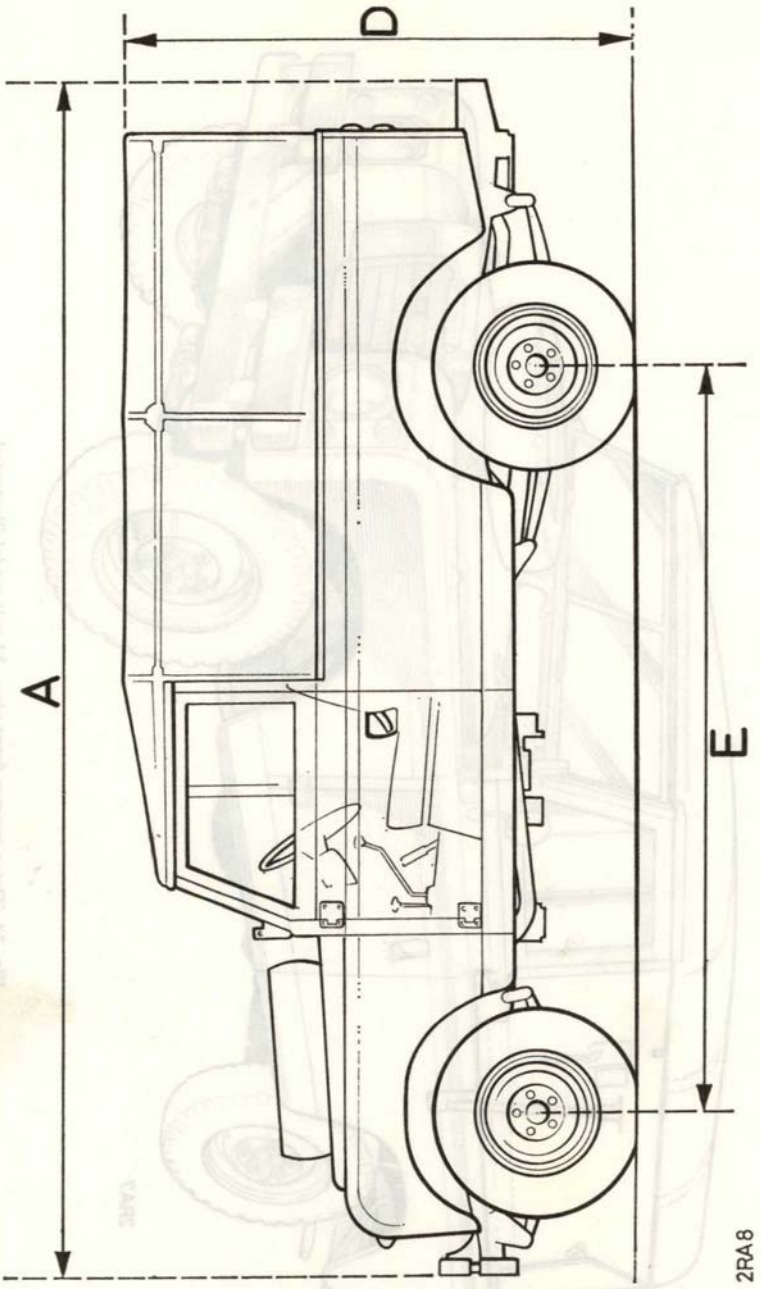

Fig. 4. General side view, 24 volt model illustrated

General side view, 24 volt model illustrated

General Arrangement

	12 volt models	British	Metric
A.	Overall length (tailboard up)	179⅜ in.	4,56 m
D.	Overall height (unladen)	80 in.	2,03 m
E.	Wheelbase	109 in.	2,77 m

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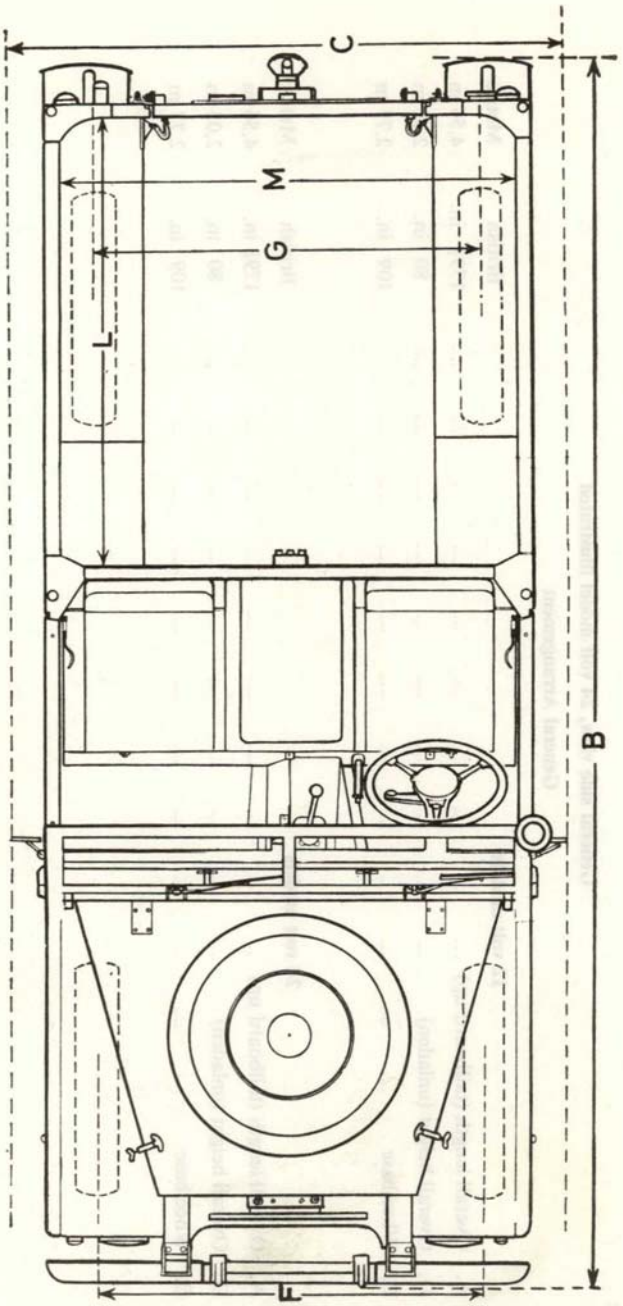

Fig. 5. General plan view, 24 volt model illustrated

Fig. 6 General plan view, 24 volt model illustrated

General Arrangement

12 volt models	British	Metric
B. Overall length (tailboard up)	179⅜ in.	4,56 m
C. Overall width	66 in.	1,68 m
F. Track, front	52½ in.	1,33 m
G. Track, rear	52½ in.	1,33 m
L. Length of body (internal)	72 in.	1,83 m
M. Width of body (internal)	56¾ in.	1,44 m

24 volt models	British	Metric
B. Overall length (tailboard up)	179⅜ in.	4,56 m
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CHAPTER 2
DESCRIPTION OF VEHICLE

3. The vehicles drive on the rear wheels with the option of front wheel drive when conditions make it necessary to drive on all four wheels. The description that follows applies to all vehicles unless the paragraph states otherwise.

4. Engine, four-cylinder, detachable cylinder head; flexibly mounted on rubber at four points, three crankshaft bearings, four camshaft bearings, overhead inlet and exhaust valves operated by followers and push rods, camshaft driven by duplex chain automatically adjusted by hydraulic tensioner.

5. Lubrication is full pressure from gear type oil pump to all bearings and valve gear, external AC full-flow oil filter and an intake filter on the oil pump.

6. Impeller type coolant pump and fan driven from crankshaft, temperature controlled by thermostat, pressurised system to decrease loss of coolant under hard working conditions.

7. Front-wheel drive is transmitted through spiral bevel gearing and normal type differential to the half-shafts and thence via enclosed universal joints to the front hubs.

8. The rear axle is of the 'fully-floating' type, the drive being transmitted by spiral bevel gearing and normal type differential to the axle shafts.

9. The gearbox unit comprises a main gearbox, four forward speeds and a reverse and a two-speed transfer box mounted on the rear of the main gearbox with output shafts to front and rear axles.

10. The suspension is by semi-elliptic leaf springs at both front and rear. As a safeguard in the event of main spring fracture, the ends of each second leaf are curled over the bushes to afford some measure of support until the defect can be rectified.

11. The steering is of the re-circulating ball type.

12. Hydraulic brakes on all wheels, with mechanical hand brake operating on the transmission output shaft from the transfer box.

13. 12 volt models. A 12 volt negative earth electrical system with coil ignition is fitted. The distributor has both centrifugal and vacuum advance and retard. Waterproof covers are fitted on 14 mm long-reach plugs.

The vehicles are partially prepared to receive a radio station. See Chapter 15.

14. 24 volt models. A 24 volt negative earth electrical system is used. It comprises an alternating current (AC/DC) 90 amp. generator with built-in rectifier. A screened and waterproof coil ignition system is also fitted.

The vehicles are prepared to receive a radio station and are completely suppressed to prevent interference to radio. See Chapter 15.

Dimensions	British	Metric
Overall length, 12 volt models	179⅜ in.	4,56 m
Overall length, 24 volt models	179⅜ in.	4,56 m
Overall width, 12 volt models	66 in.	1,68 m
Overall width, 24 volt models	66 in.	1,68 m
Overall unladen height:		
Hood up or with cab or hard top	80 in.	2,03 m
Wheel base	109 in.	2,77 m
Track	52½ in.	1,33 m
Internal body dimensions:		
Length, between cappings	72 in.	1,83 m
Width, between cappings	56¾ in.	1,44 m
Depth of tail board	19¼ in.	489 mm
Width of floor, between wheel-arches	36¼ in.	921 mm
Turning circle	50 ft. max.	15 m max.
Unladen ground clearance under axle:		
7.50 x 16 tyres	9 in.	228 mm

Weights, 12 volt models	British	Metric
Unladen:		
Running with coolant, oil, 20 gallon fuel	3,710 lb	1,680 kg
Front axle	2,030 lb	920 kg
Rear axle	1,680 lb	760 kg
Laden:		
*Total, maximum approved gross loaded	5,905 lb	2.680 kg
Front axle	2,320 lb	1.050 kg
*Rear axle	3,585 lb	1.630 kg

Weights, 24 volt models	British	Metric
Unladen:		
Running with coolant, oil, 20 gallon fuel	4,150 lb	1.890 kg
Front axle	2,220 lb	1.010 kg
Rear axle	1,930 lb	880 kg
Laden:		
*Total, maximum approved gross loaded	5,905 lb	2.680 kg
Front axle	2,320 lb	1.050 kg
*Rear axle	2,585 lb	1.630 kg

*Cross-country work, rear axle load must be reduced by 200 lbs (91 kg)

Bridge classification	3
Shallow fording depth (unprepared)	20 in. (508 mm)

Performance

Average safe speed (cross-country laden)	12 m.p.h. (20 km/h.) depending upon terrain
Maximum gradient climbable (fully laden on dry concrete)	30°
Range of action on road (average speed 30 mph (50 km/h.)	280 miles (450 km)
Fuel consumption target (normal road conditions)	14 m.p.g.(4.9 km/litre) approx.
Nett power/gross wt. ratio	26.8 b.h.p./ton (19,4 kw/tonne
Maximum tractive effort—top gear and high transfer engaged (100 per cent efficiency)	203 lb./ton (91 kg/tonne)
Tyre size	7.50 x 16 cross-country
Tyre pressures (recommended)— Road (normal)	Front 25 lb./sq. in. Rear 25 lb/sq. in.
(Fully laden)	Front 25 lb/sq. in. Rear 30 lb/sq. in.
Cross-country (soft ground—load under 5 cwt)	Front 15 lb./sq. in. Rear 15 lb./sq. in.
Soft ground—load over 5 cwt.	Front 15 lb./sq. in. Rear 20 lb./sq. in.
Wheel type	Steel, well base

Capacities

	Imp. Unit	*U.S. Unit*	*Litres*
Fuel	20 galls	24 galls	90
Coolant	14¼ pints	17 pints	8,1
Engine sump, 1½ pints (0,85 litre) extra when refilling after fitting new filter	11 pints	13 pints	6,0
Gearbox	2½ pints	3 pints	1,28
Transfer box	4½ pints	5½ pints	2,5
Rear axle	3 pints	3½ pints	1,75
Front axle	3 pints	3½ pints	1,75
Swivel pin housing (each)	1 pint	1.2 pints	0,5
Air cleaner	1½ pints	2 pints	0,85

Engine

Type	Gasoline
Number of cylinders	4
Cylinder arrangement	Vertical in line
Maximum b.h.p. at clutch	70 (52 kw) at 4,000 r.p.m.
Loss of efficiency at altitudes of:	
5,000 feet	18 per cent
10,000 feet	34 per cent
Maximum torque	120 lb. ft. (163 Nm) at 1,500 r.p.m.
Bore	90.47 mm (3.562 in.)
Stroke	88.9 mm (3.500 in.)
Cylinder capacity	2,286 c.c. (139.5 cu. in.)
Compression ratio	8.0:1
Tappet clearance—inlet	.010 in. (0,25 mm) engine cold or at running temp.
Tappet clearance—exhaust	.010 in. (0,25 mm) engine cold or at running temp.
Valve timing (No. 1 exhaust valve peak)	95° B.T.D.C.

Ignition, 12 volt models

Distributor—Model	Lucas type DM2
Distributor contact breaker gap	.014–.016 in. (0,35–0,40 mm)
Ignition timing (static—full retard)	T.D.C. when using 91-93 octane fuel 3° ATDC when using 85 octane fuel

Firing order	1, 3, 4, 2
Coil	Lucas type HA12 (Universal)
Sparking plugs (fitted on production)	Champion UN12Y 14 mm with suppressors
Replacement sparking plugs	LV6/MT4/2920-99-802-4046
Sparking plug point gap	.029–.032 in. (0,75–0,80 mm)
Suppressor (sparking plug cables) 10,000 to 15,000 ohms	LV6/MT4/2920–99–803–5505

Ignition, 24 volt models

Distributor—Model	Lucas type D.Z.S.4A (Screened) Part No. 40753
Distributor contact breaker gap	0.14–.016 in. (0,35–0,40 mm)
Ignition timing (static—full retard)	TDC when using 91-93 octane fuel 3° ATDC when using 85 octane fuel
Firing order	1, 3, 4, 2
Coil	Lucas type 5C.10
Sparking plugs (fitted on production)	Screened type Champion RSN 101
Replacement sparking plugs	LV6/MT4/2920-99-803-6518
Sparking plug point gap	0.015–0.018 in. (0,381–0,457 mm)

Engine lubrication system

Type	Full pressure
Oil filter—internal	Gauze pump intake filter in sump
Oil filter—external	Full-flow filter, AC type: Element: AC type 72
Oil pump	Gear type, camshaft operated
Oil pressure	50–60 lb./sq. in. (3,5–4,2 kg/cm²) at 30 m.p.h. (50 k.p.h.) in top gear with engine warm
Pressure relief valve	20 lb./sq. in. (1,4 kg/cm²)

Cooling system

Type	Pressurised. 9 lb./sq. in., semi-sealed with expansion bottle
Radiator	Fin and tube type
Fan	8-bladed, belt driven from crankshaft
Circulation	By centrifugal impeller type coolant pump
Cooling control	By thermostat. Start to open at 158°–167°F. (70–75°C.). Fully open at 187°F. (86°C.)
Capacity	14¼ Imperial pints (8,1 litres)

Fuel system

Fuel pump	AC mechanical with sediment bowl
Carburetter	Down-draught type, Zenith 36 IV
Carburetter jets	Main jet .... 125 Pump jet .... 65 Slow running jet .... 60 Enrichment jet .... 195 Needle valve .... 1.75 Ventilation screw for choke 3.0
Air cleaner	AC oil bath type with integral centrifugal pre-cleaner
Filter	Sediment bowl type

Clutch

Type	Single dry plate 9½ in. (240 mm) diameter and diaphragm pressure spring, Borg and Beck
Operation	Hydraulic

Main gearbox

Type	Helical constant mesh, with syncromesh on all forward speeds
Main gearbox ratios	Reverse gear straight spur type

Top	Direct
Third	.51:1
Second	2.22:1
First	3.68:1
Reverse	4.01:1

Transfer gearbox

Type .... Two-speed reduction on main gearbox output

Front-wheel drive .... Two/four wheel drive control on transfer gearbox output

Transfer gearbox ratios

High transfer	1.14:1
Low transfer	2.40:1

Front axle

Differential .... Spiral bevel; fully floating shafts

Front wheel drive .... Enclosed universal joints

Ratio 4.7:1

Rear axle

Type .... Hypoid; fully-floating shafts

Ratio 4.7:1

Overall ratio including final drive

	High transfer	*Low transfer*
Top	5.40:1	11.1:1
Third	8.05:1	16.5:1
Second	12.00:1	24.6:1
First	19.88:1	40.7:1
Reverse	21.60:1	44.3:1

Change speeds for all the above ratios. See para. 52.

Front brake—

Type	Girling hydraulic by two leading shoes
Total braking area of linings	95 sq. in. (613 cm²)
Brake drum diameter	11 in. (279,4 mm)

Rear brake—

Type	Girling hydraulic by leading and trailing shoes
Total braking area of linings	95 sq. in. (613 cm²)
Brake drum diameter	11 in. (279,4 mm)

Hand brake—

Type	Mechanical on transfer box output shaft. Leading and trailing shoes
Total braking area of linings	30.2 sq. in. (193,5 cm²)
Drum diameter	9 in. (228 mm)

Steering (re-circulating ball type)

Type	Burman re-circulating ball
Gear ratio—variable	Straight ahead .... 15.6:1 Full lock 23.8:1
Diameter of steering sheel	17 in. (431 mm)
Front wheel toe-in	$\frac{3}{64}$–$\frac{3}{32}$ in. (1,2–2,4 mm)
Camber angle	$1\frac{1}{2}°$
Castor angle	3°
Swivel pin inclination	7°
Steering wheel free movement	$\frac{5}{8}$ in. (16 mm)

Suspension

Road springs	Semi-elliptic leaf
Hydraulic dampers	Telescopic, non-adjustable Make: Woodhead-Monroe; front and rear

Electrical equipment, 12 volt models

System	12 volt negative earth
Battery—	
Type	Lucas CB9
Voltage	12 volt
Capacity	51 a.h.
Alternator	Lucas 16ACR
Control box	Integral with alternator
Starter	Lucas M418G
Fuse box—on steering column shroud	35 amp. cartridge type. Lucas 6FJ

Electrical equipment, 24 volt models

System	24 volt negative earth with rectified AC generating system
Batteries—	
Type	Lucas CT9/7
Voltage	24 volt 2×12 volt in series
Capacity	44 a.h.
Generator	No. 10 Mk 2. FV546125
Generator panel	No. 9 Mk 3. FV546128
Starter	CAV type SCA/150
Fuses—on steering column shroud	35 amp. cartridge type. Lucas 6FJ

Lamps, 12 volt models

Position	*Make and Type*	*Voltage*	*Wattage*
Headlights (vertical dip) ...	Lucas No. 367	12	44/38
Sidelights	Lucas No. 223	12	7
Stop/tail lights	Lucas No. 380	12	6/21
Instrument panel lights ...	Lucas No. 937	12	2.2 M.E.S.
Warning lights in speedo	Lucas No. 937	12	2.2 M.E.S.
Warning lights, turnlight and trailer	Lucas No. 281	12	2
Warning light, ignition ...	Lucas No. 281	12	2
Convoy light	Lucas No. 223	12	7
Turnlights	Lucas No. 382	12	21
Number light	Lucas No. 989	12	6
Warning light, brake failure	Lucas No. 280	12	1.5
Warning light, hazard ...	Hella 96	12	21

Lamps, 24 volt models

Position	*Make and Type*	*Voltage*	*Wattage*
Headlights (vertical dip)	Lucas No. 368	24	50/50 double filament
Sidelights	Lucas No. 149	24	6
Stop/tail lights	Lucas No. 337	24	Double filament 7/30
Instrument panel lights	Lucas No. 650	24	2.8 M.E.S.
Warning lights in speedo	Lucas No. 650	24	2.8 M.E.S.
Convoy light	Lucas No. 149	24	6
Turnlights	Lucas No. 333	24	24
Number light	Lucas No. 227	24	6
Warning lights, turnlight and trailer	Lucas No. 283	24	3
Warning light, ignition	Lucas No. 283	24	3
Warning light, hazard	Hella 96	24	21
Warning light, brake failure	Lucas No. 688	24	1.1

SECTION II
Operation
CHAPTER 1
CONTROLS

Controls

15. The controls and instruments are illustrated at Fig. 9.

Pedals

16. Pendant type accelerator, footbrake and clutch with hydraulic brake and clutch operation.

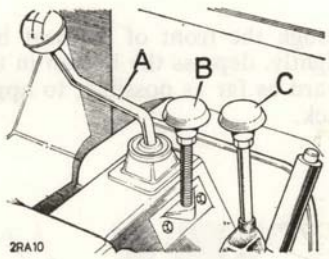


Fig. 6 Gear change levers

A—Main gear change lever, black knob
B—Four-wheel drive control, yellow knob
C—Transfer gear lever, red knob

Main gear change lever—black knob A

17. The gears are selected by means of the centrally-placed gear lever. Gear positions are marked on the knob. To engage reverse, press lever to the left against spring pressure.

Synchro-mesh is provided on all forward gears.

See paras. 51 and 52 for gear changing instructions.

Transfer gear lever—red knob C

18. The transfer gear lever has three positions:

(1) 'High' range position, fully forward. In this position the main gear lever will select the gear ratios giving normal road speeds.

(2) 'Neutral' mid-way position. Used when driving power take-off equipment.

(3) 'Low' range position, fully rearwards. When in this position the low range of gears will be selected by the main gear lever.

See para. 53 for instructions on the use of the transfer box.

Four-wheel drive control—yellow knob B

19. When in 'High' transfer ratio, the vehicle may be operated in two-wheel or four-wheel drive as required.

The four-wheel drive control has two positions:

(1) Disengaged. In this position the control is fully up.

(2) Engaged. Control pushed fully down.

The operation is described in para. 55.

Gear changing procedures, together with illustrations of gear lever positions under various driving conditions will be found on the following pages.

Hand brake

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

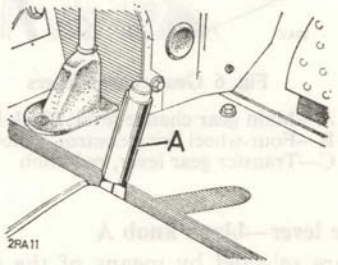


Fig. 7 Hand brake

A—Hand brake lever

Hand throttle control, 24 volt models

21. The hand throttle control, which is the quadrant type is mounted below the instrument panel attached to the lower dash panel.

The quadrant has a number of notches for the operating lever. The notch to the extreme left is for use when the hand throttle is not required. In order to bring the hand throttle into operation move the lever to the right into one of the remaining notches.

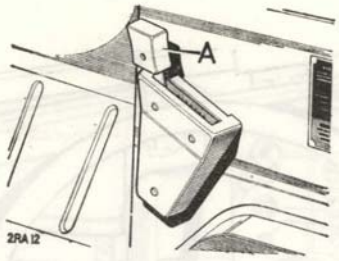


Fig. 8 Hand throttle control

A—Hand throttle control

Ignition and steering column lock switch

22. The switch has four positions. Use largest key.

(1) Key horizontal at '0' position. Electrical switch off. Steering column lock will be engaged when key is removed. Turn steering wheel until locking plunger clicks into position. If there is difficulty in turning the key after replacement release load on steering column lock by slightly moving the steering wheel to and fro.

(2) Turn right to position 'I'. Accessories can be used, that is, heater.

(3) Turn to position 'II'. Ignition and all accessories on.

(4) Continue to turn to right against spring pressure to position 'III'. Starter will operate.

The operating sequence has been designed to prevent accidental locking. The key must be depressed in the 'I' position before it can be turned to the lock position '0'. The key can only be withdrawn or inserted in the lock '0' position.

Warning. If for any reason the (ignition) engine is switched off while the vehicle is in motion, **do not** attempt under any circumstances to depress, or turn the key into the lock '0' position, as this is part of the locking sequence for the steering.

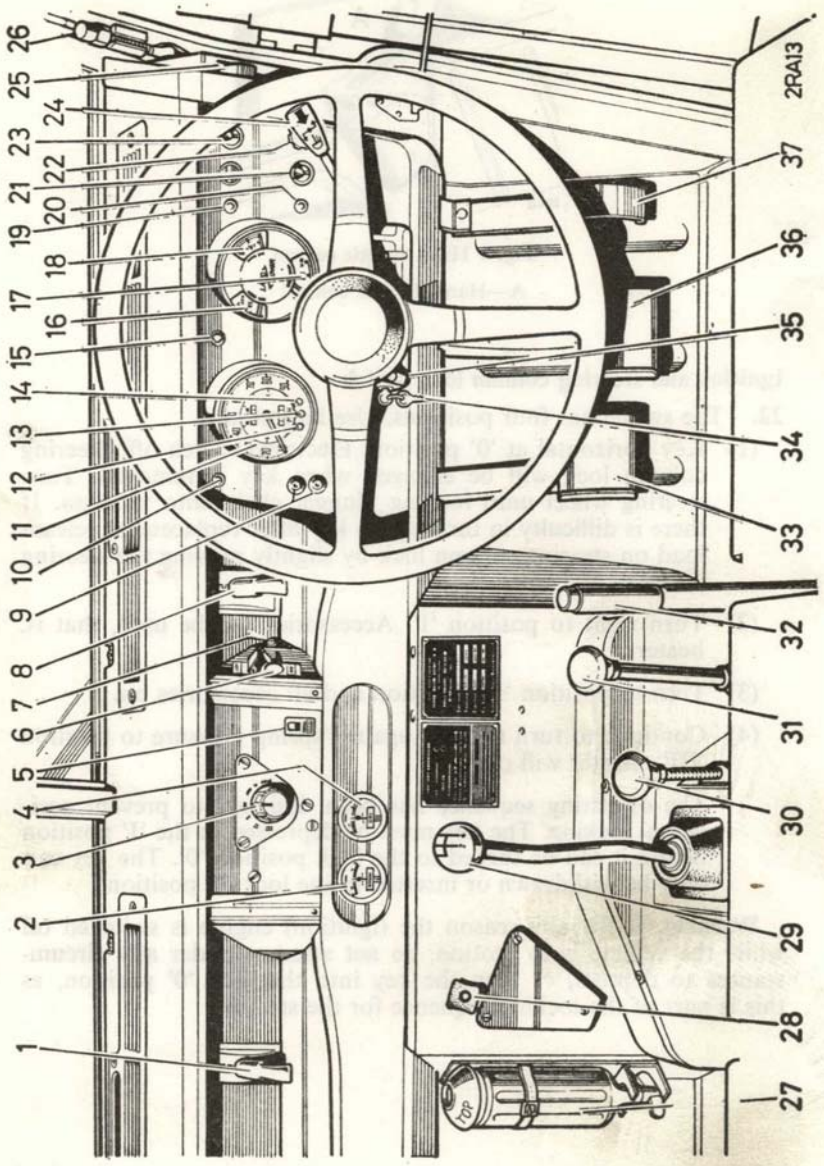


Fig. 9 Layout of controls and instruments

Key to Fig. 9

		See Para No.
1	Ventilator control	357
2	Vehicle ammeter, 24 volt models	34
3	Lighting switch, 6-way	24
4	Radio ammeter, 24 volt models	34
5	Brake system warning light and check button	44
6	Headlight infra-red switch	29
7	Hazard warning switch	30
8	Ventilator control	357
9	Inspection lamp sockets	31
10	Trailer warning light	43
11	Speedometer	38
12	Oil pressure warning light	40
13	Main beam warning light	41
14	Cold start warning light	42
15	Trip button for speedometer	38
16	Water temperature gauge	35
17	Oil temperature gauge	37
18	Fuel level gauge	36
19	Turnlight warning light	43
20	Charging warning light	39
21	Heater switch, two position	27
22	Windscreen wiper/washer switch	36
23	Panel light switch	25
24	Headlight dipper switch combining turn lights, horn and headlamp flash	28
25	Heater controls	27
26	Nut securing windscreen	353
27	Fire extinguisher	365
28	Hand throttle control	21
29	Main gear lever	17
30	Front wheel drive control	19
31	Transfer gear change lever	18
32	Handbrake	20
33	Clutch pedal	16
34	Ignition and steering column lock switch	22
35	Cold start control	23
36	Brake pedal	16
37	Accelerator pedal	16

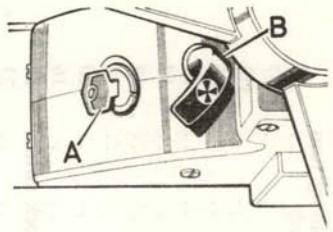


Fig. 10 Ignition switch and cold start control

A—Ignition and steering column lock switch
B—Cold start control

Cold start control

23. The cold start control is incorporated in the steering column shroud adjacent to the ignition and steering column lock switch. See para. 46 for operation.

Light switch, 6-way

24. Situated on a panel at the side of the instrument panel. Also fitted to the panel is an indicator plate showing the switch positions. At left-hand side on R.H.D. models, right-hand side on L.H.D. models.

Stop and turnlights are on at all switch positions except when turned to right, i.e. when convoy lights are on.

Turn switch to right:
- First position—convoy light.
- Second position—side and convoy lights.

Turn switch to left:
- First position—tail and number lights.
- Second position—side, tail and number lights.
- Third position—head, side, tail and number lights.

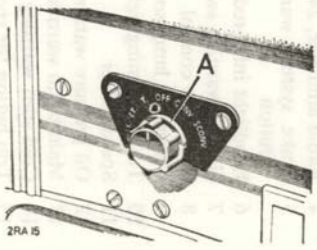


Fig. 11 Light switch, 6-way

A—Light switch, 6-way

Instrument panel light switch

25. The switch has two positions and is only operative with the side lamps on.

(1) Switch in upper position: light off.

(2) Switch in down position: light on.

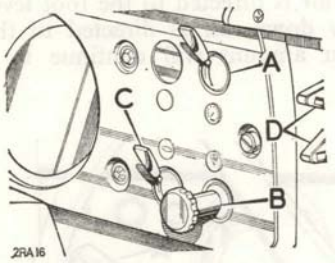


Fig. 12 Panel switches and heater controls

A—Instrument panel light switch
B—Windcreen wiper/washer switch
C—Heater switch
D—Heater controls

Windscreen wiper switch and screenwash

26. The switch has three positions and is only operative with the ignition switched on.

(1) Rotate the switch clockwise to operate wipers.

(2) To wash the windscreen, press in wiper switch knob and hold until sufficient water is on the windscreen. This can be done with the wiper switch on or off.

Heater switch and controls

27. The switch has three positions:

(1) Switch in upper position: heater fan off.

(2) Switch in central position: heater fan operating at low speed.

(3) Switch in down position: heater fan operating at full speed.

The fresh air heating system relies on the two speed heater fan being operative, as described above, before air can be drawn into the vehicle through the heater unit.

The controls are positioned at the end of the instrument panel adjacent to the driver and consists of two levers which operate vertically to control air distribution and temperature. The temperature control lever, knob coloured red and blue, controls the temperature of the air emitted from the heater unit. Move in blue direction to decrease temperature and red direction to increase heat. The distribution control lever, knob with black arrows on a white background, controls the direction of air flow. Lever fully up, all air is directed on to the screen through the demister vents. Lever mid-way position, air is directed to the foot level vents and to the screen. Lever fully down, air is directed to the foot level vents although a certain amount will continue to pass through the demister vents.

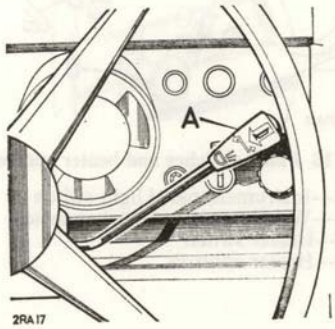


Fig. 13 Headlight dipper switch
A—Headlight dipper switch

Headlight dipper switch combining turnlights, horn and headlight flasher

28. The switch is attached to the steering column. Movement of the steering wheel automatically cancels the turnlights after operation. The switch has six positions:

(1) Switch in central position: dipped headlights.

(2) Push switch fully forward: headlights on main beam.

(3) Lift fully upwards: headlamps flash. The headlamps can be flashed at any time irrespective of other switch positions.

(4) Press dipper switch knob inwards to operate horn.

(5) Move switch anti-clockwise to indicate a left-hand turn.

(6) Move switch clockwise to indicate a right-hand turn.

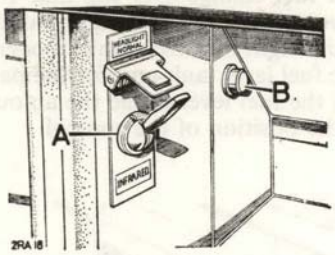


Fig. 14 Headlight infra-red switch and hazard warning light switch
A—Infra-red switch B—Hazard warning light switch

Headlight infra-red switch

29. The headlight infra-red switch when operated extinguishes all vehicle lights, except the headlights irrespective of the position of the 6-way lighting switch. The system is designed to be used in conjunction with shields fitted over the headlights and requires the use of special goggles which are worn by the vehicle operator.

Hazard warning light

30. When the hazard warning light switch button is pushed in the button will automatically extend out to the on position and all four turn lamps will operate simultaneously. The red warning light in the switch will flash in conjunction with the exterior turn lights.

To cancel the hazard warning lights, push in the switch button when it will remain in the off position.

Use the hazard warning system to warn following or oncoming traffic of any hazard, that is, breakdown on fast road, or an accident to your own or other vehicles.

Inspection light socket

31. In the bottom left-hand corner of the instrument panel are a pair of inspection light sockets; the black socket is earthed.

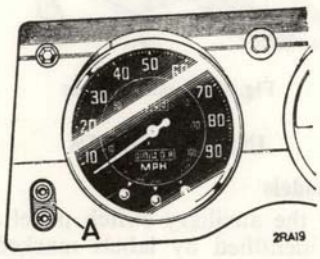


Fig. 15 Inspection light sockets
A—Inspection light sockets

Fuel change-over tap and switch

32. The combined fuel change-over tap and switch is located on the heel-board between the centre and right-hand seat. Turn lever to left for L.H. tank and right for R.H. tank; movement of the control also switches on the fuel level tank unit for the particular tank in use and so indicates on the fuel level gauge the amount of fuel in either tank according to the position of the control.

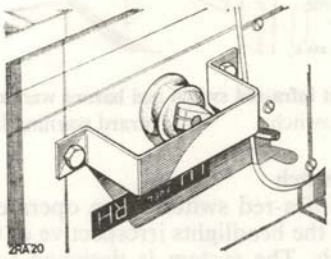


Fig. 16 Fuel change-over tap and switch

Bonnet

33. The bonnet top panel is secured by two pull-on type catches, one at each side.

To open bonnet, release catches and raise until it is held open by the support stay. To close, release support stay, lower and secure the bonnet with the catches at either side.

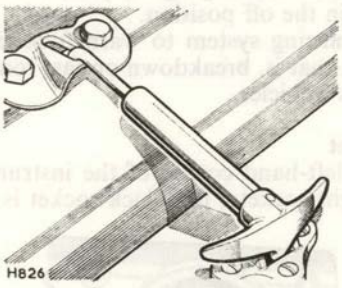


Fig. 17 Bonnet catches

INSTRUMENTS

Ammeters, 24 volt models

34. Situated below the auxiliary switch panel are two ammeters. The ammeters are identified by labels marked 'VEHICLE' and 'AUX' respectively. They are graduated 100–50–0–50–100 and indicate the charge or discharge rates.

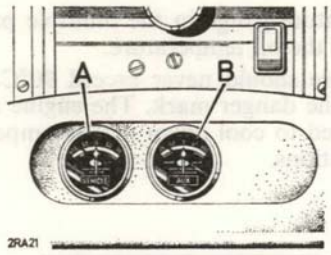


Fig. 18 Ammeters, 24 volt models

A—Vehicle ammeter B—Auxiliary ammeter

Water temperature gauge

35. The water temperature gauge in the multiple panel indicates the engine working temperature. Under normal running conditions the needle should register round about 75° to 80°. If the needle reaches the red band 100° mark immediately stop the engine and investigate the cause of the temperature rise.

Fuel level gauge

36. The fuel 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 fuel consumption figures. The design of the fuel level gauge on 12 volt models, ensures that the needle does not fluctuate, but there is a time lag of a few seconds before it registers after the ignition has been switched on.

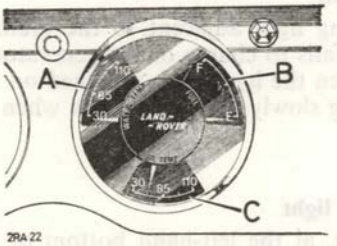


Fig. 19 Gauges

A—Water temperature gauge B—Fuel level gauge

C—Oil temperature gauge

Oil temperature gauge

37. The oil temperature gauge in the multiple panel gives a continuous indication of the oil temperature.

The oil temperature should never exceed 90°C., a red band on the gauge indicates the danger mark. The engine must be switched off and the oil allowed to cool down if this temperature is reached under working conditions.

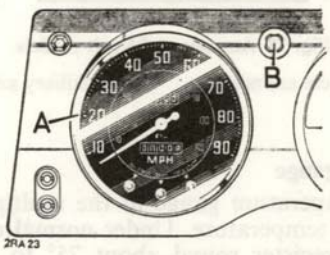


Fig. 20 Speedometer

A—Speedometer B—Trip reset button

Speedometer

38. A speedometer is situated to the left of the multiple gauge, it indicates the speed of the vehicle and also shows total mileage.

A trip mileage indicator is incorporated and the trip reset button is fitted to the instrument panel between the speedometer and multiple gauge panel.

Charging warning light

39. The red warning light adjacent to the multiple gauge glows when the generator fails to charge or the generator 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.

Oil pressure warning light

40. The green light, at the left-hand bottom of the speedometer, glows when the engine oil pressure drops below a safe figure. It will light up when the engine is stationary and fade out when the engine starts and the oil pressure builds up to normal. See para. 87 for further details.

Headlight main beam warning light

41. The small blue light at the bottom centre of the speedometer glows when the main headlight beams are in use; its purpose is to remind the driver to switch off or dip the headlights on entering a brightly-lit area.

Cold start warning light

42. The amber light at the right-hand bottom of the speedometer glows when the engine is hot and the cold start control is 'out', thus reminding the driver to push in the control. See para. 50.

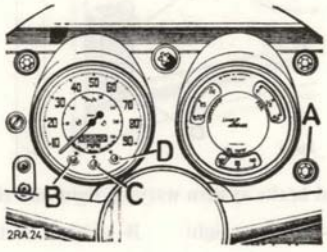


Fig. 21 Warning lights

A—Charging warning light
B—Oil pressure warning light
C—Main beam warning light
D—Cold start warning light

Turnlight warning light

43. When the turnlights are functioning correctly the green warning light will flash in conjunction with the selected set of turn lights. In addition the flasher unit is audible while the lights are flashing.

Should either a front or rear turn lamp fail, the other lamp will continue to operate but lamp failure will be indicated by the rapid flashing of the warning light and the flasher unit will not be heard.

The trailer flasher warning light, adjacent to the multiple gauge, operates as detailed above when a trailer is connected via the NATO socket to the vehicle.

Dual brake system warning light

44. The red warning light in the brake system check button should glow when the button is depressed with the ignition switched on. This ensures that the warning light bulb is operating satisfactorily. The system can be checked at any time in this manner providing the ignition is on. The warning light will go out when the button is released.

NOTE. The warning light will glow prior to starting the engine due to loss of vacuum from the servo unit but will go out as soon as vacuum is restored after engine starting.

The sudden appearance of the warning light during normal running conditions indicates a fault in the hydraulic components, i.e. a loss of fluid from either the front or rear system, or a loss of vacuum from the brake servo unit. The vehicle should be stopped and the cause investigated.

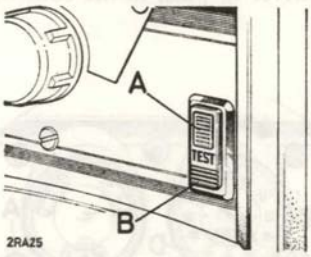


Fig. 22 Dual brake system warning light and check button

A—Warning light B—Check button

CHAPTER 2

OPERATING INSTRUCTIONS

BEFORE STARTING THE ENGINE

45. Before attempting to start the engine, read the following notes concerning the cold start control and accelerator.

Cold start control

46. The control is mounted on the steering column shroud adjacent to the ignition and starter switch.

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

By turning the control in a clockwise motion it can be locked in any position.

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

Accelerator

47. The carburetter is fitted with an accelerator pump, so that when the accelerator is fully depressed, an extra rich mixture is provided to assist acceleration. As this is not required when starting the engine, except under abnormal starting conditions, the accelerator must not be touched when starting with a cold engine.

It may assist starting a hot engine if the accelerator is depressed half-way and then released as soon as the engine fires.

Never pump the accelerator pedal under any circumstances.

STARTING THE ENGINE

48. To start the engine adopt one of the methods detailed below.

(1) Ensure that the main gear lever is in the neutral position and that the transfer box lever is in high ratio position, i.e. right forward.

(2) Start the engine as follows:

(a) Engine cold.

(i) Pull the mixture control out as necessary.

(ii) Keep the foot clear of the accelerator.

(iii) Switch on the ignition, check that the green oil pressure warning light and the red charging warning light both glow.

(iv) Continue to turn against spring pressure, starter motor will operate, the engine should start after a turn or two. Release the key immediately the engine fires.

(b) Engine warm or hot.

(i) Ensure that the mixture control is right in.

(ii) Depress the accelerator half-way.

(iii) Switch on the ignition, check that the green oil pressure warning light and the red charging warning light both glow.

(iv) Operate the starter motor.

(v) Release the ignition key, remove the foot from the accelerator as soon as the engine fires.

NOTE. 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

49. The following points should be noted when the engine starts.

(1) The cold start control must be returned to the normal position as soon as possible, consistent with even running.

(2) A glow from 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.

(3) 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.

(4) Check that the green (oil) and the red (charging) warning lights go out. See paras. 87 and 39.

Warning lights

50. Like all mechanical devices, the cold start control warning system is not completely foolproof and the responsibility for pushing in the control rests with the driver, especially as the warning light may not glow due to lamp failure. Suspected lamp failure may be confirmed by pulling out the cold start control momentarily when the engine is hot, when the lamp should be illuminated.

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

MOVING OFF

51. Start the engine as detailed in para. 48 and select the appropriate gear. The latter will be dependent upon the type of terrain to be negotiated. See paras. 52, 53, 54 and 55.

After observing the previous paragraphs, proceed as follows:

(1) Depress the clutch pedal fully and engage first gear. Increase the engine speed slightly, release the hand brake lever and gradually release the clutch pedal. As the engine begins to take the load, increase the engine speed.

(2) Accelerate the engine sufficiently to enable the next higher gear to be engaged without overloading the engine. See para. 52.

GEAR-CHANGING PROCEDURE

52. The Land-Rover gearbox may be regarded as having ten gear ratios, that is eight forward speeds and two reverse.

For convenience in use these gears are evenly divided into two groups, termed 'low' range and 'high' range.

'Low' range consists of four low forward gears, plus a low reverse gear.

'High' range consists of four normal gear ratios, plus a normal reverse gear.

The two ranges may be used progressively when changing up, if conditions demand.

Gear levers

Three gear levers are provided to control the gearbox, these being:

(1) The main gear lever, fitted with a black knob. This is used in the normal way, and will engage the five gears within the range selected by the transfer lever.

(2) The transfer gear lever is fitted with a red knob and is used to select the high or low range of gears; it also has a neutral (mid-way) position.

(3) The four-wheel drive control lever, fitted with a yellow knob and used to select two- or four-wheel drive. The use of this control is explained later.

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. (8–13 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. (32–40 k.p.h.)	10 m.p.h. (16 k.p.h.)

Use of gear ranges

53. When selecting the low range of gears with the transfer gear lever, the gearbox will automatically engage four-wheel drive at the same time.

Therefore, when using the low gear range, the vehicle automatically provides maximum traction with maximum torque.

When using the high range of gears under normal conditions, the drive is to the rear wheels only.

Should the operator encounter conditions calling for four-wheel drive in the high gear range (for example, ice or mud on the road) then this may be obtained immediately, by operating the four-wheel drive control.

As an example of how the full progressive range of the gearbox may be used, consider a vehicle which is heavily laden or towing a heavy trailer, and which is required to pull away from a standing start, up a steep gradient.

With the transfer gear lever in the low range position, the vehicle will pull away in first gear, and the gear changes for the first four gears can be made in the normal way, with the main gear lever.

When road conditions are suitable for the high gear range, they may be brought into operation without stopping the vehicle as follows:

Depress the clutch pedal, select the high range with the transfer gear lever and move the main gear lever into the second or third gear position, depending on road conditions. Release the clutch pedal and continue to change up in the normal way.

This operation can be carried out smoothly and quickly after a little practice.

By making use of the full range of the gearbox in this manner, the clutch life will not be shortened by having to compensate for the selection of an unsuitable gear ratio.

Transfer gear changing

54. Changing from high (lever fully forward) to low (lever fully back) 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 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 with the main gear lever 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.

Four-wheel drive control

55. Push lever down to engage four-wheel drive when in high transfer.

Front wheel drive in high transfer can be engaged at any time, irrespective of road speed.

However, in order to prevent excessive tyre wear, it is strongly recommended that 30 m.p.h. (50 k.p.h.) should not be exceeded when using four-wheel drive in high transfer, and also that a return to two-wheel drive be made as soon as road conditions permit.

In order to regain two-wheel drive, stop the vehicle, move the transfer lever to the 'low' position then back to the 'high' position. Front wheel drive will be automatically disengaged, and the yellow control lever will return to the disengaged position.

General

56. Before moving off in the vehicle after it has been parked for some time, it is a wise precaution to check that front wheel drive has not been engaged.

The following chart showing various work conditions alongside the recommended gearbox setting will be found useful until the operator has become conversant with the gearbox.

57. Chart showing various work conditions alongside the recommended gearbox setting.

Work Conditions	CONTROL LEVER POSITION			Drive condition on vehicle	To obtain recommended drive setting	To regain normal drive setting	Remarks
	Main gear lever—black	Transfer box lever—red	Four wheel drive control—yellow				
A—Normal road work *See Fig.* 23	Select gear required	'High' position—fully forward	Disengaged	Driving rear wheels only, through the high range of gears	Check by moving transfer lever—(red) into 'Low' position—fully back, and return to the 'High' position—fully forward		Check that four-wheel drive is not engaged while vehicle is stationary, engine idling, and the clutch pedal depressed
B—Hard pulling on road. Ice or mud on road and grassland *See Fig.* 24	Select gear required	'High' position—fully forward	Engaged	Drive on four wheels, in the high range of gears	Operate four-wheel drive control (yellow) when vehicle is in motion or stationary	Stop the vehicle. Select 'Low' transfer (red), then return to 'High' position	Do not exceed 30 m.p.h. (50 k.p.h.) in four-wheel drive, or excessive tyre wear will take place. Return to normal drive as soon as conditions permit
C—Very heavy load pulling. Heavy ground work. Ascending or descending steep gradients *See Fig.* 25	Select gear required	'Low' position—fully back	Four-wheel drive is automatically engaged by selection of low transfer. Yellow control knob remains in the disengaged position	Drive on four wheels through the low range of gears	Stop vehicle, depress clutch, move transfer lever (red) to the 'Low' position—fully back	Release throttle pedal, depress clutch pedal, push transfer lever (red) forward firmly and slowly, to the 'High' position	Changing to the high gear range may be accomplished with the vehicle on the move, as soon as conditions permit
D—Parking with heavy load on steep gradient, hand brake applied *See Fig.* 26	First or reverse gear engaged	'Low' position—fully back	Four-wheel drive is automatically engaged by selection of low transfer. Yellow control knob remains in the disengaged position	Stationary engine coupled to all wheels	Depress clutch and select 'Low' transfer ratio; select first or reverse, stop engine and release clutch	Depress the clutch pedal and move transfer lever into the 'High' position	Hand brake is effective on both axles in this condition

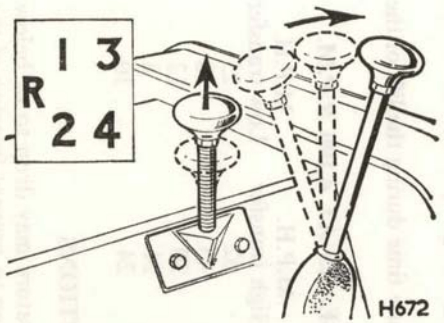


Fig. 23 Gear lever positions
A—Normal road work

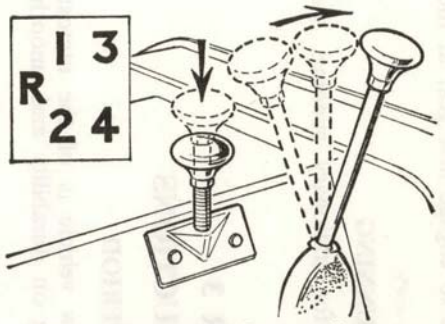


Fig. 24 Gear lever positions
B—Hard pulling, ice, mud, grassland

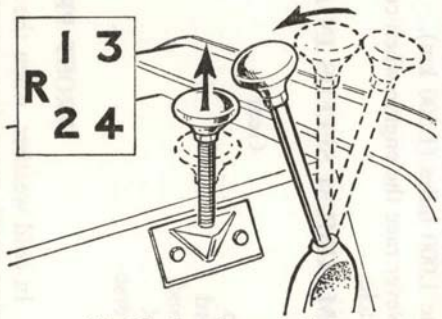


Fig. 25 Gear lever positions
C—Heavy load pulling

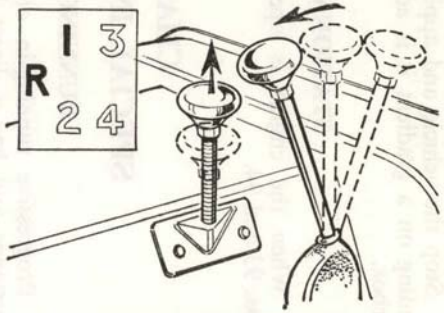


Fig. 26 Gear lever positions
D—Parking with heavy load

PARKING THE VEHICLE

58. Stop the vehicle and apply the hand brake. If the vehicle is standing on a gradient it is advisable to engage first gear at the gearbox.

STATIONARY RUNNING

59. When the engine is operated for stationary running, see paras. 93 and 94.

CHAPTER 3
SPECIAL INSTRUCTIONS

RUNNING-IN PERIOD

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

The running-in period is 500 miles (750 km), during which time 35–40 m.p.h. (55–65 k.p.h.) in high transfer ratio top gear should not be exceeded. The engine must not be allowed to labour at any time and full use should be made of the indirect gears to ensure that 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. (24 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.

MAXIMUM SPEEDS IN ALL GEARS AT 4,100 R.P.M.

61.

Gear	M.P.H. High transfer	M.P.H. Low transfer
Top	62	25
Third	45	18
Second	30	12
First	21	8
Reverse	24	10

FROST PRECAUTIONS

62. In cold weather, when the temperature may drop to or below freezing point, precautions must be taken to prevent freezing of the coolant 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.

63. In cold weather, unless the vehicle is kept in a well-heated garage or anti-freeze solution has been used, the cooling system must be completely drained. After the coolant 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 coolant that may have been retained in the bottom of the jacketing.

For draining instructions see para. 104.

Precautions concerning the battery will be found in Chapter 13 for 12 volt models and Chapter 14 for 24 volt models.

TOWED EQUIPMENT

64. Before commencing to tow, the driver of the towing vehicle and the officer in charge must refer to the User Handbook/Servicing Schedule of the towed equipment or plant in order to familiarise themselves with:

(1) Special checks that may be required before starting and during the journey.

(2) Types of lubricant required for road wheel bearings, etc., and method of application.

(3) Speed restriction and bridge classification imposed by the nature of the towed equipment or plant.

NOTE—When a vehicle tows an equipment or plant, except in the case of a standard train where the dual classification is usually given, the classification of the train should normally be taken as the sum of the separate classification of the prime mover and the towed equipment or plant.

FIRE AND SAFETY PRECAUTIONS

65. One fire extinguisher is provided with each vehicle. This is mounted vertically on the left-hand toe box below the facia panel.

To operate proceed as follows:

(1) Free the extinguisher from the spring clip with a sharp pull and lift it out of the support cup.

(2) Hold in one hand and point the nozzle in the base of the container towards the base of the fire.

(3) With the other hand give the handle a half-turn to unlock it from the body and pull the handle outwards in an ordinary pumping cycle until the fire is out.

NOTE—The pump has a double action and will operate on the first upwards stroke.

(4) If the fire is extinguished before the liquid content of the unit is exhausted, the handle can be relocked in position and the extinguisher used again. It must, however, be replenished as soon as possible.

TRANSMISSION 'WIND UP'

66. Transmission 'wind up' can occur under one or a combination of the following conditions:

(1) Prolonged use in four-wheel drive under normal road conditions.

(2) A badly worn tyre in a set.

(3) A combination of different tyre sizes.

A characteristic of transmission 'wind up' is the increasing difficulty in turning the steering wheel coupled with a rhythmical kick-back of the steering wheel during turning.

This condition can be overcome by:

(1) Selecting two-wheel drive and allowing the transmission to unwind, preferably on wet grass or mud to enable the wheels to spin.

(2) Jacking up the axle on which the tyres with the smaller circumference are fitted to allow the raised wheels to spin and free the transmission.

USE OF JACKS

67. When lifting the vehicle, place the jack under the road spring (below the axle casing) or below the chassis rear cross-member, ensuring that the wheels remaining on the ground are scotched, or alternatively apply the hand brake and at the same time engage four-wheel drive. This action ensures that the transmission hand brake is operative on the three remaining road wheels.

FORDING

68. Fording depth is given below.

Maximum depth unprepared .... 20 in.

Lifting and towing rings

69. Lifting and towing rings are incorporated front and rear, one on each side of the front bumper adjacent to the bumperettes. The rear lifting and towing rings are incorporated inside the rear bumperettes.

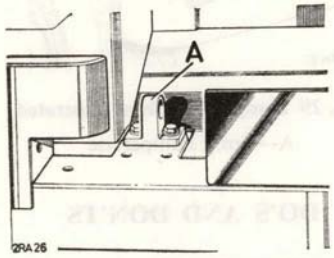


Fig. 27. Lifting and towing ring, front illustrated

A—Lifting and towing ring

Rotating towing hook

70. This is a heavy duty towing hook and is attached to the rear of the chassis frame.

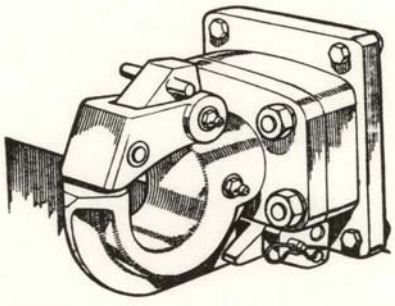


Fig. 28 Rotating towing hook

Bumperettes

71. Bumperettes are fitted to the front and rear.

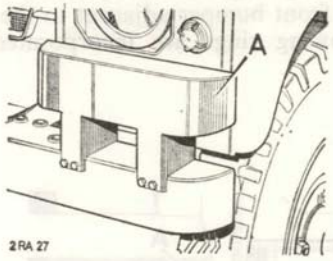


Fig. 29 Bumperettes, front illustrated

A—Front bumperette

DO'S AND DON'TS

72. **Do** keep radiator filled with soft water.

Do maintain recommended pressures in tyres, including the spare wheel.

Do ensure bonnet panel is fastened before driving away.

Don't keep your foot on the clutch pedal longer than is necessary. It will avoid unnecessary wear.

Don't agitate the accelerator pedal when starting the engine.

SECTION III

User Servicing and Adjustments

GOOD SERVICING IS ESSENTIAL FOR SUCCESSFUL FORDING

CHAPTER 1
THE ENGINE

Description

73. The four cylinder engine has overhead inlet and exhaust valves operated by push rods and roller tappets.

74. The engine is built in unit construction with a dry single-plate clutch and the main and transfer gearboxes, the whole being carried on four flexible rubber mountings.

75. The crankshaft is carried in three main bearings. At the front of the crankshaft is a pulley which drives the coolant pump and generator, while a spigot diameter at the rear, carries the flywheel.

76. Aluminium alloy pistons with two compression rings, and one slotted oil control ring are fitted.

77. The camshaft, driven from the crankshaft by a duplex roller chain, runs in five white metal steel-backed bearings. The chain is kept in adjustment by a hydraulic tensioner.

78. The detachable 'flat' cylinder head carries both the inlet and exhaust valves.

79. A removable pressed steel sump carries the oil, which is pressure fed by a gear type oil pump in the sump driven from the camshaft through skew-gearing, to the main and connecting rod bearings and valve rocker shafts through a gallery pipe in the cylinder block. The oil is cleaned by means of a gauze strainer on the pump intake and an external full-flow filter.

80. An oil cooler is fitted to maintain the correct running temperature when the engine is run for long periods with the vehicle stationary. See para. 94.

81. A thermostat is fitted in the coolant system and the coolant is circulated by means of an impeller type pump, driven by a 'V' belt from the crankshaft pulley. The belt tension is adjustable.

82. The fuel supply is by a Zenith type 36 IV carburetter.

83. Ignition is by coil (screened on 24 volt models), the distributor being mounted on an extension of the oil pump driving shaft. Automatic advance and retard mechanism is fitted, and, in addition, hand-setting facilities are provided to give control over the ignition setting when low quality fuel is used.

84. On 12 volt models the sparking plugs are fitted with water-proof covers, on 24 volt models they are fully screened to prevent radio interference.

ENGINE LUBRICATION

Oil level

85. A certain amount of oil is consumed during the normal operation of the vehicle, the oil in the sump must be checked and replenished daily, in addition to periodic oil changes.

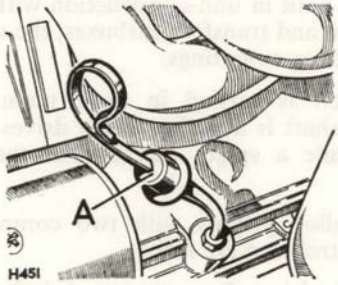


Fig. 30 Engine oil level dipstick

A—Dipstick at left-hand side of engine

The oil level dipstick is on the left-hand side of the engine and is accessible when the bonnet panel is raised. The oil level dipstick carries three marks: III, II and I MIN. Under normal circumstances the oil level should not be allowed to fall below the minimum level mark 'I MIN', that is the lower line on the dipstick. However, when using the Land-Rover on cross-country work in circumstances which involve it being used at steep angles the oil should not be allowed to fall below the intermediate mark 'II', that is the low level. This will obviate any danger of oil pump starvation when the vehicle is facing downhill at a steep angle. The oil filler is on the right-hand front corner of the engine.

86. 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 'III' mark.

Oil pressure

87. The oil pressure warning light on the instrument panel will glow when, for any reason, the pressure drops below 10–12 lb./sq. in. (0,7-0,8 kg/cm²). It will light up when the engine is stationary and will go out when the engine has started and the oil pressure has built up to exceed this figure.

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

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

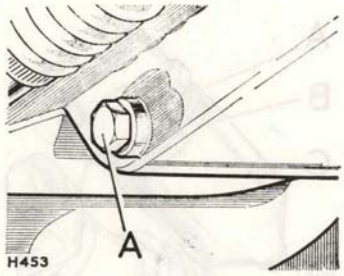


Fig. 31 Engine sump drain plug

A—Drain plug at right-hand side of engine

Engine oil changes

88. 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 front of the engine, the capacity is 11 Imperial pints (6 litres). See para. 85.

It is essential to add a further 1½ pints (0,85 litres) of engine oil when the full-flow filter element has been changed, to bring the oil level up to the 'III' level mark on the dipstick.

Oil filters. (*To be carried out by a vehicle mechanic*)

89. 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 at regular intervals, preferably at a routine oil change.

To renew the external filter element proceed as follows: Place oil tray under the 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 kerosene. 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.

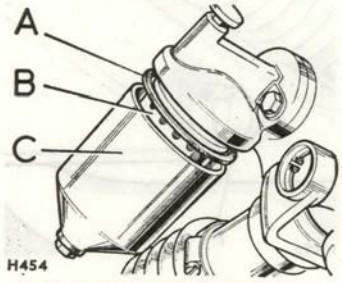


Fig. 32 Engine oil filter

A—Large rubber washer B—Oil filter element
C—Container for oil filter

Engine top cover breather filter

90. The oil-wetted gauze filter fitted to the top rocker cover breather should be cleaned at regular intervals in the following manner:

(1) Remove the rubber hose from the filter.

(2) Remove the set bolt and sealing washer securing the breather filter to the rocker cover and lift off the filter.

(3) Remove the 'O' ring.

(4) Clean the unit thoroughly by swilling in kerosene. Re-wet the gauze by dipping in clean engine oil and allowing to drain.

(5) Refit the unit to the top cover ensuring that the 'O' ring and sealing washer are in good order and correctly fitted.

(6) Fully tighten the set bolt.

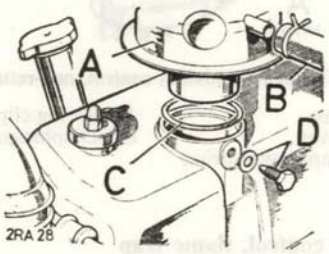


Fig. 33 Engine top cover breather filter

A—Top cover breather filter B—Rubber hose
C—'O' ring D—Set bolt and sealing washer

Crankcase emission control, non-return valve

91. A hose is connected between the top cover breather filter and carburetter adaptor via a non-return valve.

During engine running engine fumes which collect in the top cover are vented through the non-return valve and into the carburetter adaptor to be burnt with the fuel/air mixture.

The non-return valve should be cleaned at regular intervals in the following manner:

(1) Remove the spring clip retaining the cover and remove the cover.

(2) Remove the diaphragm unit complete with orifice plunger.

(3) Remove the diaphragm spring.

(4) Clean orifices, control body and cover in Ethanol (methylated spirits).

NOTE—The diaphragm must not be cleaned with methylated spirits.

(5) Check all components for damage or deterioration, replace as necessary.

(6) Reassemble by replacing the spring, locating it in the body. Locate the diaphragm in the body and on to the spring. Replace the cover and refit the spring clip. Ensure diaphragm is seating correctly and that the cover fits evenly to the body.

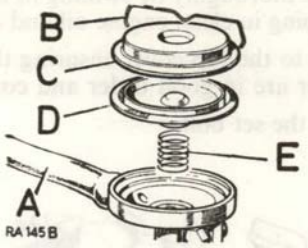


Fig. 34 Crankcase emission control, non-return valve

A—Hose B—Spring clip
C—Cover D—Diaphragm unit
E—Diaphragm spring

Crankcase emission control, flame trap

92. A hose is connected between the sealed crankcase oil filler tube and the air cleaner to carburetter elbow via a flame trap. Fumes which collect in the lower crankcase pass through the flame trap and into the carburetter intake to be burnt with the fuel/air mixture.

The flame trap should be replaced at regular intervals.

Detach the rubber hoses from each side of the flame trap by compressing the clips and withdraw the flame trap. Fit new flame trap and replace hoses.

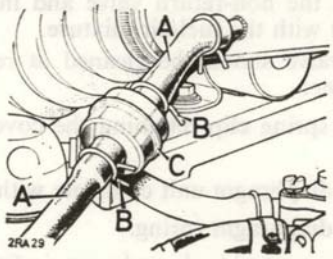


Fig. 35 Crankcase emission control, flame trap

A—Hoses B—Clips C—Flame trap

Checks

93. The following checks should be made:

(1) Check the engine sump for oil leaks and the securing bolts for tightness.

(2) Check the front cover for oil leaks and the securing bolts for tightness.

(3) Check the rocker cover for oil leaks and the fixings for tightness.

(4) Check for leaks at the banjo bolts and the oil pipe cylinder head to cylinder block at the rear of the engine. Check the bolts for tightness.

NOTE—After the bolts have been checked for tightness any leaks from the joints mentioned in this para. (1)—(4) must be reported.

(5) (*To be carried out by a vehicle mechanic*)

Ensure that the clamps and bolts securing the exhaust manifold are correctly positioned and tight. Also check the nuts securing the front exhaust pipe to the manifold, the front exhaust pipe to the intermediate exhaust pipe (in front of the rear left-hand wheel) and the intermediate exhaust pipe to the silencer. Check the exhaust pipe mountings to the chassis side members (in front of the rear axle and behind the rear right-hand wheel).

(6) (*To be carried out by a vehicle mechanic*)

Check the nuts and bolts securing the inlet manifold for tightness. Also check the two nuts securing the carburetter to the manifold for tightness.

(7) Inspect the front engine mountings. The rubber bushes should be free from oil or grease and the mounting bolts tight.

(8) Check the oil filter adaptor for leaks, and the securing bolts for tightness. The joint washer should be renewed if necessary. Ensure that the bolt at the bottom of the filter container is tight and that there is no oil leak from the large rubber washer (Fig. 32).

(9) Check the tension of the fan and generator belts and adjust if necessary. See para. 103.

(10) Ensure that the engine sump drain plug is tight.

(11) (*To be carried out by a vehicle mechanic*)

Check cylinder head bolts for tightness. See para. 97.

Engine oil cooler

94. The oil cooler radiator is inserted in the engine oil system and mounted just in front of the engine coolant radiator, see para. 99; a gauge on the dash panel gives continuous indication of the oil temperature.

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

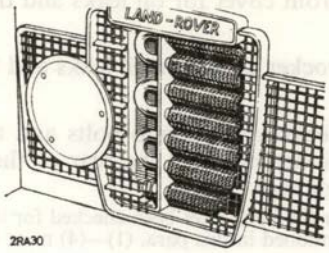


Fig. 36 Engine oil cooler

Checks

95. The following checks should be made:

(1) Check all pipe connections for oil leaks at oil cooler, engine oil sump, oil filter adaptor and thermometer pocket.

(2) Check all connections for tightness.

(3) Check fan belt for tension. See para. 103.

Routine adjustments and servicing

Tappet adjustment (*To be carried out by a vehicle mechanic*)

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

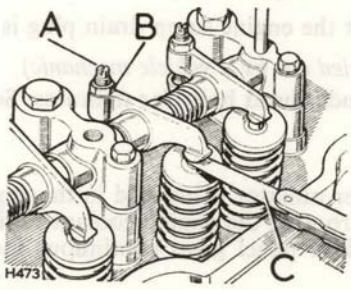


Fig. 37 Tappet adjustment

A—Adjusting screw B—Locknut C—Feeler gauge

The correct clearance is .010 in. (0,25 mm) for both inlet and exhaust 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) Remove the top rocker cover.

(2) Turn the engine with the starting handle in the running direction until the valve receiving attention is fully open and then rotate the engine one complete turn, to bring the tappet on to the back of the cam.

(3) 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, holding the adjusting screw to prevent it turning. Recheck the clearance to ensure that it is still correct.

(4) Repeat for the other valves in turn.

Cylinder head, to check tightness

97. Tightening torque for securing bolts. $\frac{1}{2}$ in. U.N.F. 65 lb./ft. (8,9 kg/m). $\frac{5}{16}$ in. U.N.F. 18 lb./ft. (2,4 kg/m). Engine hot.

Proceed as follows:

(1) Remove the filler cap and remove the plug at base of radiator and drain the coolant from this point only.

(2) Lift bonnet panel clear.

(3) Remove the carburetter air intake pipe complete.

(4) Disconnect: throttle return spring linkage, at a ball joint; mixture control cable, at clamp-bolt; hand throttle control, at ball joint; plug leads.

(5) Unscrew the dome nuts securing rocker cover and lift the cover clear.

(6) Tighten down the cylinder head bolts in the order indicated in Fig. 38. The $\frac{1}{2}$ in. U.N.F. bolts including those that secure the rocker shaft brackets must be pulled down to 65 lb./ft. (8,9 kg/m), $\frac{5}{16}$ in. U.N.F. bolts should be tightened to 18 lb./ft. (2,4 kg/m). Engine hot.

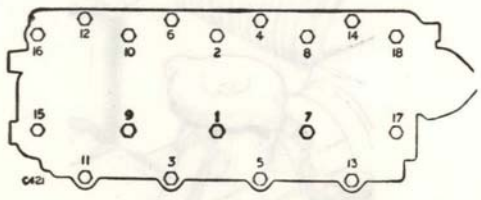


Fig. 38 Order of tightening cylinder head bolts
$\frac{1}{2}$ in. bolts to 65 lb./ft. (8,9 kg/m)
$\frac{5}{16}$ in. bolts to 18 lb./ft. (2,4 kg/m)

(7) Reverse removal procedure renewing the top rocker cover joint washer if there is any sign of deterioration.

CHAPTER 2

THE COOLING SYSTEM

Description

98. Coolant enters the pump through a pipe from the bottom of the radiator, and is then forced down into the cylinder block. The coolant circulates round the cylinder jackets in the block, from where it rises to the cylinder head. After circulation round the valve ports in the cylinder head casting, the greater part of the coolant passes to the front of the head and so into the thermostat housing. If the termostat is open, it returns through the top hose to the radiator.

On 12 volt models two 'V' type belts driven from the crankshaft pulley drive the alternator, water pump and fan. On 24 volt models there are three 'V' type belts driven from the crankshaft pulley, two driving the generator, the other driving a water pump and fan.

Radiator filler

99. 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.

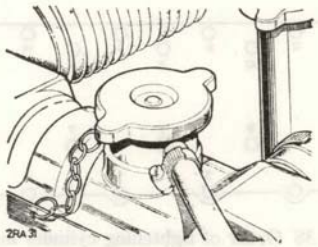


Fig. 39 Radiator filler

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 water boiling away rapidly, with possible damage to the engine through overheating.

The correct coolant level is one inch below the bottom of the filler neck; the total capacity of the system is $14\frac{1}{4}$ Imperial pints (8,1 litres).

The radiator incorporates an overflow pipe, fitted with a valve, from the filler neck which serves as a steam escape and air inlet for the sealed filler cap; it also prevents over-filling of the system.

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

Coolant pump

100. The impeller type coolant pump is mounted on the front of the cylinder block and is belt driven. See para. 98.

Thermostat

101. The wax type thermostat is fitted above the coolant pump casing. Its purpose is to provide rapid warming up by causing the coolant to circulate only round the engine until a pre-determined temperature is reached, when it opens to allow full circulation through the radiator. The unit operates at 158°–187°F. (70°–86°C.).

Checks

102. Check the following points:

(1) Examine the hose connections, which should be free from cracks or signs of perishing. Tighten the hose clips as necessary.

(2) Examine the cylinder block core plugs for signs of leaks. Renew if necessary.

(3) Check the following connections for signs of leakage. Inlet manifold to outlet pipe; inlet elbow to thermostat; inlet pipe to coolant pump.

(4) Check connection between coolant pump and thermostat housing. Check coolant pump and thermostat housing for signs of leakage.

(5) Check that the radiator drain plug and cylinder block drain tap are fully closed. See para. 104, Fig. 44 and 45.

(6) Ensure that the bolts securing the radiator block to the grille panel are tight.

(7) Check that the bolts and nuts securing the fan to the fan pulley are tight.

(8) Check that the bolts securing the coolant pump and the thermostat housing to the cylinder block are tight.

(9) Check the fan belt tension and adjust if necessary. See para. 103.

(10) Check that the radiator block is not damaged.

Routine adjustments and servicing

Fan and generator belt adjustment (*to be carried out by a vehicle mechanic*)

103. As the fan belts are of the 'V' type, the drive is on the sides of the belts and it is not therefore necessary to adjust them tightly and so put an excessive load on the coolant pump and generator bearings; the tension is correct when the belts can be depressed as follows:

12 and 24 volt models

Fan belt $\frac{5}{16}$–$\frac{7}{16}$ in. (8–11 mm).

24 volt models

Generator belt $\frac{1}{2}$–$\frac{3}{4}$ in. (12–19 mm) by thumb pressure between the two pulleys.

(1) *Fan belt adjustment* (*coolant pump*), 12 *volt models*

Fan belt adjustment is by the alternator situated on the left-hand side of the engine. See Fig. 40.

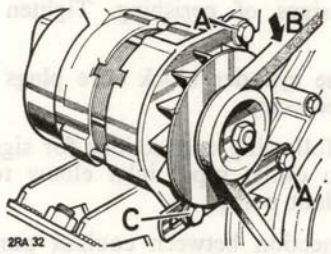


Fig. 40 Fan belt adjustment (coolant pump), 12 volt models

A—Pivot bolts B—Check at this point $\frac{5}{16}$ to $\frac{7}{16}$ in. (8 to 11 mm) movement
C—Adjusting bolt

To adjust:

(a) Slacken the pivot bolts securing the alternator to the mounting bracket, slacken the adjusting bolt.

(b) Pivot the alternator inwards or outwards as necessary and adjust until the correct belt tension is obtained.

(c) Tighten adjusting and pivot bolts.

(2) *Fan belt adjustment (coolant pump), 24 volt models*

Fan belt adjustment is by means of a jockey pulley situated on the left-hand side of the engine. See Fig. 41.

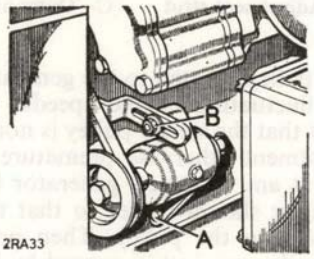


Fig. 41 Fan belt adjustment (coolant pump), 24 volt models

A—Jockey pulley fixing bolt B—Jockey pulley adjustment nut

To adjust:

(a) Slacken the jockey pulley fixing bolt.

(b) Slacken the adjustment nut.

(c) Pivot the jockey pulley inwards or outwards until the correct tension is obtained.

(d) Tighten the jockey pulley fixing bolt and adjustment nut.

(3) *Generator belt adjustment, 24 volt models*

Generator belt adjustment is by means of an adjustment strut at the top of the generator. See Fig. 42.

To adjust:

(a) Slacken the two generator pivot bolts.

(b) Unscrew the outer nut on the generator adjustment strut.

(c) Adjust by screwing or unscrewing the inner nut until the correct tension has been obtained.

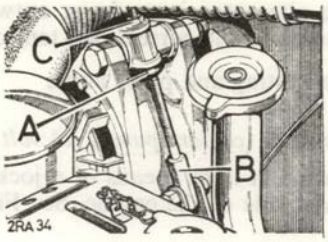


Fig. 42 Generator belt adjustment, 24 volt models
A—Generator B—Adjustment strut C—Outer nut on adjustment strut

(d) A steady pulley is fitted to the generator belts to prevent twist at fluctuating engine speeds. See Fig. 43. It is important that the steady pulley is not used for generator belt adjustment otherwise premature bearing wear will occur. If at any time new generator belts are fitted, the steady pulley should be set so that the belts are inside the grooves on the pulley. Then position the unit so that the pulley can just be turned by hand, but does not distort the belts in any way.

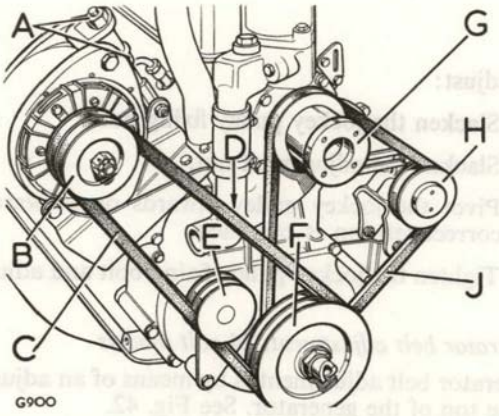


Fig. 43 Generator and fan belt layout, 24 volt models
A—Nuts for generator belt adjustment
B—Pulley for generator, twin groove
C—Belts for generator
D—Check belt free movement at this point
E—Steady pulley for generator belts, twin groove
F—Crankshaft pulley, three groove
G—Pulley for water pump, single groove
H—Pulley for jockey pulley, single groove
J—Belt for fan

Draining and flushing the cooling system

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

NOTE—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.

(1) Remove the radiator filler cap.

(2) Open the coolant drain plug at the bottom of the radiator and the drain tap on the left-hand side of the cylinder block at the front.

(3) When the coolant flow has ceased, insert a piece of wire in the plug orifice and tap, to make sure that a blockage has not been caused by rust or scale.

(4) Place a hose in the radiator filler neck and adjust the flow of water to equal that draining from the plug and tap.

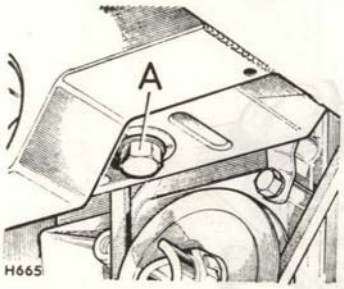


Fig. 44 Radiator drain plug
A—Drain plug at right-hand side

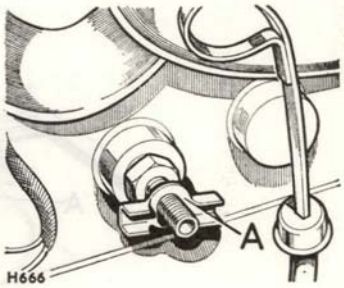


Fig. 45 Cylinder block drain tap
A—Drain tap at left hand side of engine

(5) Run the engine for a short time to ensure thorough cleaning of the whole system.

(6) Switch off the engine, remove the hose, replace the plug and close the tap. Refill the system with clean coolant to the bottom of the filler neck and replace the filler cap. The total capacity is $14\frac{1}{4}$ Imperial pints (8,1 litres).

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

(7) Run the engine until working temperature is reached and top up the coolant level as necessary.

CHAPTER 3

FUEL SYSTEM

105. The fuel system comprises two tanks, 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 TANKS

Description

106. Twin fuel tanks are fitted, they are both located under the seat box.

The fuel filler caps are located beneath the locker lids on each side of the seat box, accessible after the seat cushions are removed. When the cap is removed, a telescopic tube may be drawn out of the tank neck and locked by a slight anti-clockwise movement, to facilitate filling. Each tank capacity is 10 Imperial gallons (45 litres).

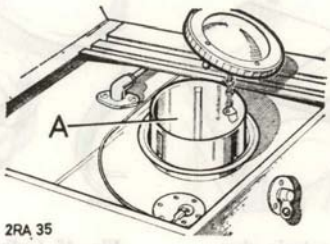


Fig. 46 Fuel filler, twin fuel tanks

A—Telescopic tube

Checks

107. The following points on the fuel tank should be checked:

(1) Check that the bolts securing the tanks to the chassis brackets are tight.

(2) Check that the drain plugs are tight.

(3) Check that the gauge electrical lead fitted to each fuel tank is secure.

FUEL PUMP AND FILTER

Description

108. The mechanically operated fuel pump with hand primer, located on the right-hand side of the engine, is actuated by a lobe on the camshaft. The sediment bowl is attached to the pump.

Checks

109. The following points should be checked on the pump:

(1) Check the inlet and outlet union for signs of leakage and tighten if necessary.

(2) Check for tightness the screws securing the two halves of the pump together, and the bolts securing the pump to the engine.

(3) Check for signs of a leak from the diaphragm, replace if necessary.

Routine adjustments and servicing

Clean filter sediment bowl (*to be carried out by a vehicle mechanic*)

110. Should the filter become choked or if an appreciable amount of foreign matter has collected in the bowl the unit should be cleaned as follows:

(1) Remove the bowl by slackening the thumb screw and swinging the retainer aside.

(2) Remove and clean filter gauze in gasoline.

(3) Ensure that the sealing washer is in good condition.

(4) Replace gauze and refit bowl.

(5) Prime by operating hand lever.

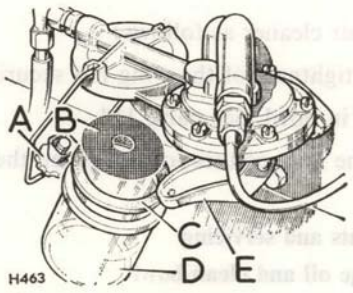


Fig. 47 Fuel pump and sediment bowl

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

Fuel pump fault location

111. If fuel pump trouble is suspected:

(1) Disconnect the fuel pipe from the carburetter and check that fuel is delivered to the carburetter when the hand lever on the fuel pump is operated. If fuel is not delivered from the pipe:

(a) Check that the fuel pipes and filters are clear.

(b) Check that there are no air leaks in the suction line to the fuel pump.

(c) Check that the diaphragm is not leaking and that the retaining screws are tight.

Failure to locate and rectify the fault in this manner will indicate that the pump itself is at fault and it should receive workshop attention.

AIR CLEANER

Description

112. The AC oil-bath type air cleaner is mounted on a carrier bracket over the right-hand chassis sidemember, to which it is secured by means of a clamping strap.

An integral centrifugal pre-cleaner separates out the coarser particles of foreign matter. The air passes down a large diameter tube in the centre of the cleaner, at the bottom of which a sharp reversal of direction takes place, thus depositing the majority of dust into the oil reservoir in the detachable tray forming the bottom of the cleaner. It then passes up through the woven steel packing, where the remaining particles are extracted.

Checks

113. Check the air cleaner as follows:

(1) Check the tightness of the wing nut securing the air cleaner.

(2) Inspect oil in bowl. See para. 114.

(3) Examine the hose connections. Tighten the clips if necessary.

Routine adjustments and servicing

Air cleaner, change oil and clean bowl

114. 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.

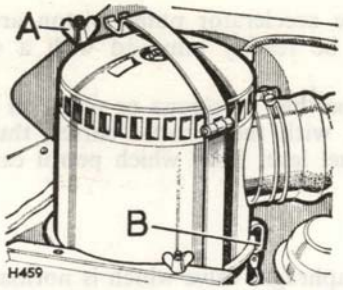


Fig. 48 Air cleaner
A—Wing nut for securing clamp B—Securing clip

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

Proceed as follows:

(1) Release the clamping strap securing the air cleaner, disconnect the outlet elbow from the carburetter 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 1½ Imperial pints (0,85 litre).

(4) Clean the filter in the cleaner body by swilling the complete body in kerosene and shake off the surplus.

(5) Replace the bowl.

(6) Refit the complete unit in the vehicle.

CARBURETTER

Description

115. Zenith carburetter type 36 IV. No adjustment of the carburetter is normally required and the only manual setting provided is that to obtain smooth engine idling.

Twin floats in the float chamber are set close to the throttle bore to give a high flooding angle, this effectively controls fuel level so that performance is not affected by angles of incline, fast acceleration, harsh braking or surging on bends.

All jets and the accelerator pump piston are in the emulsion block which can be readily removed with a screwdriver and a $\frac{7}{16}$ in. spanner.

The float chamber has no screws or plugs on the exterior and is cast in one piece with the throttle barrel, thus eliminating any joint below the fuel level from which petrol can leak outside the carburetter.

Economy device

116. This is a diaphragm valve which is normally held in a flexed condition by a compression spring. Depending on throttle conditions the mixture is adjusted to give the best possible consumption figures.

The action of the economy device is entirely automatic and is controlled by the demands of the engine.

The accelerator pump

117. An accelerator pump is incorporated in the carburetter to eliminate a weak mixture flat spot occurring during rapid throttle opening by injecting fuel into the engine during the change-over from slow running to cruising conditions.

Lubrication

118. The throttle linkage should be lubricated by means of an oilcan at the following points:

(1) Accelerator pedal shaft at points of contact with brackets.

(2) The ball joints on the rods from pedal shaft to relay shaft, and from relay shaft to carburetter.

(3) Relay shaft at points of contact with bracket.

(4) Carburetter bell-crank and spindle.

Checks

119. The following points should be checked on the carburetter:

(1) A general examination of the carburetter and pipe lines should be made for fuel leaks, for tightness of the unions and securing bolts. Renew joint washers if necessary.

(2) Examine the cold start control cable for any damage that would prevent the control from fully closing the cold start control lever.

(3) Check the accelerator and hand throttle linkage for damaged or weak return springs.

(4) Examine ball joints for excessive wear and ensure that the levers are secure on the shafts.

(5) Check hose connection on carburetter intake. Tighten if necessary.

Routine adjustments and servicing

120. The carburetter is adjusted on assembly and should require no further attention. The only normal adjustment provided is that to obtain smooth engine idling.

Carburetter slow-running adjustment (*to be carried out by a vehicle mechanic*)

121. The only adjustments provided at the carburetter are a throttle stop screw and a volume control screw.

Should the carburetter require adjustment for any reason, proceed as follows:

(1) Run the engine until normal operating temperature is obtained. Release the locknut and adjust the throttle stop screw to give a satisfactory idling speed.

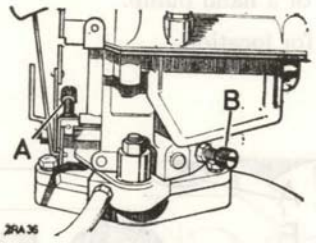


Fig. 49 Carburetter slow running adjustment

A—Throttle stop screw B—Volume control screw

(2) Release the volume control screw locknut and adjust the volume control screw so that the engine will idle evenly with no tendency to stall on snap closure of the throttle. Tighten the locknut.

(3) Check that, as the throttle is opened slowly, there is a clear positive acceleration of the engine speed.

(4) Finally, it may be necessary to readjust the throttle stop screw to give a satisfactory idle speed. Tighten the locknut upon completion.

Cleaning carburetter jets (*to be carried out by a vehicle mechanic*)

122. For jet sizes see page 14, Data—Fuel System.

When trouble is experienced with blocked jets, the following illustrations will assist in location of the jets which need cleaning.

All jets and the accelerator pump piston are in the emulsion block which can be readily removed with a screwdriver and a $\frac{7}{16}$ in. spanner.

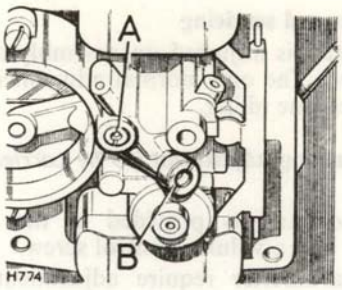


Fig. 50 Main and compensating jets

A—Main jet B—Compensating jet

Under no circumstances should wire be used for cleaning jets. Use compressed air or a hand pump.

See Figs. 50 and 51 for location.

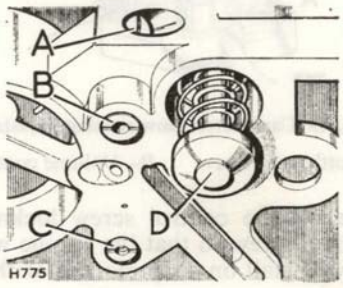


Fig. 51 Pump assembly, pump jet and slow-running jet

A—Pump assembly B—Pump jet C—Slow-running jet
D—Piston for accelerator pump

Draining the fuel system

123. If the vehicle is to be stored for an extended period, the fuel system should be completely drained to prevent the formation of gum in the pump and carburetter. Remove the drain plug from the bottom of each fuel tank and replace when the tanks are empty; then run the engine until the fuel in the pipe-lines from each tank is exhausted.

CHAPTER 4

CLUTCH

Description

124. The Borg and Beck clutch unit is of the single dry plate type, consisting of a driven plate and a cover assembly.

125. The 9.5 in. (241 mm) driven plate is the spring type pattern, in which the splined hub is indirectly attached to a disc bearing the two lining faces through three drive and three over-drive coil springs.

126. The cover assembly is of the diaphragm spring type and requires no maintenance.

127. The clutch withdrawal mechanism is located inside the bell housing and consists of a withdrawal bearing and sleeve sliding over the splined primary pinion, operated by a release fork lever. The whole assembly is dry and requires no maintenance.

128. Pressure on the clutch release fork, attached directly to the clutch slave cylinder operates the withdrawal bearing and sleeve to pull the pressure plate clear of the driven plate via the diaphragm spring cover.

Clutch operation

129. 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 release fork lever by means of a push rod.

Clutch fluid reservoir

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

Periodically check the fluid level in reservoir.

The level is correct when the fluid is up to the fluid level line on the reservoir casing; remove the filler cap and replenish as necessary.

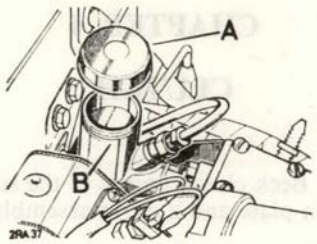


Fig. 52 Clutch fluid reservoir

A—Filler cap B—Clutch reservoir

Lubrication

131. The only regular lubrication by means of an oil can required for the linkage is to the clutch pedal shaft and trunnion.

Routine adjustments and servicing

Clutch adjustment

132. Land-Rover models are fitted with a hydrostatic clutch, that is a clutch mechanism which is correctly set on initial assembly to give approximately $\frac{5}{16}$ in. (8 mm) free movement at the pedal pad, and which requires no adjustment throughout the life of the clutch plate.

Many drivers do not recognise the symptoms of hydraulic clutch maladjustment in time to prevent slipping and excess wear.

It should be noted that the feel of the pedal is in three stages:

(1) Master cylinder free play against the pedal return spring.

(2) Slave cylinder free play through the hydraulic system and against the slave cylinder return spring.

(3) Operating the clutch against the full force of the diaphragm spring pressure.

These points must be checked from time to time. If the free movement is incorrect, adjustment must be made as follows:

Clutch pedal and master cylinder free play, to adjust (*to be carried out by a vehicle mechanic*)

133. Adjust clutch pedal setting as follows:

(1) Slacken both locknuts on the master cylinder push rod.

(2) Check the distance from the lower edge of the clutch pedal to floor. Distance should be 5½ in. (140 mm). Adjust pedal stop as required.

Adjust master cylinder free play as follows:

(3) Check the free play between the master cylinder piston and the push rod. This free play should be $\frac{1}{16}$ in. (1,5 mm) at the push rod and is felt as approximately $\frac{5}{16}$ in. (8 mm) at the pedal pad. If the movement is less than the given figure rotate the push rod with the fingers until the correct movement has been obtained. Tighten the locknuts.

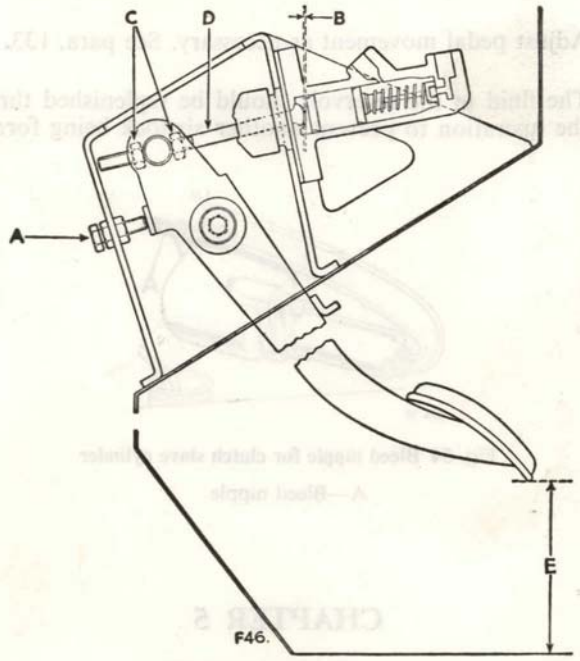


Fig. 53 Clutch linkage setting

A—Pedal position setting bolt
B—Free play against master cylinder push rod $\frac{1}{16}$ in. (1,5 mm)
C—Master cylinder push rod locknuts
D—Master cylinder push rod
E—5½ in. (140 mm) from underside of pedal pad to floor board

Bleeding the clutch system (*to be carried out by a vehicle mechanic*)

134. If the level of the fluid in the 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 from the slave cylinder.

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

(2) Slacken the nipple and pump the clutch pedal, pausing at the end of each return 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.

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

(4) Adjust pedal movement as necessary. See para. 133.

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

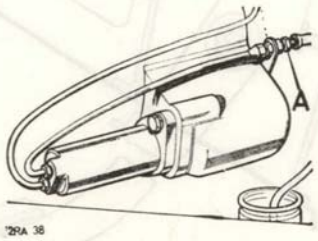


Fig. 54 Bleed nipple for clutch slave cylinder

A—Bleed nipple

CHAPTER 5

GEARBOX

135. The gearbox unit comprises the main gearbox (four speeds forward, and reverse), the two-speed transfer box and the output shafts to the front and rear axles.

MAIN GEARBOX

Description

136. The complete gearbox is flexibly mounted as a unit with the engine, the transfer gearbox being offset to the right, to allow clearance for the front axle drive. Synchromesh operates on all forward gears. The main gear change lever, centrally mounted, is secured directly to the gearbox casing.

Lubrication

137. The main gearbox is lubricated as a separate unit to the transfer box and should periodically have the lubricant changed. See para. 140.

Oil level

138. The main gearbox oil level must be checked periodically and replenished as necessary to the bottom of the oil level plug hole. This plug is accessible from under the vehicle, it can also be seen when the rubber grommet on the side of the gearbox cover is removed. The filler cap is accessible through the grommet on the gearbox cover.

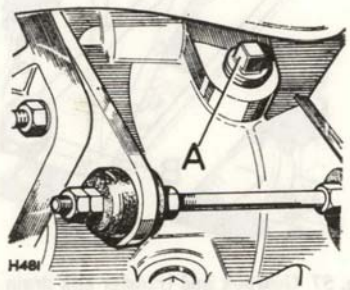


Fig. 55 Gearbox oil filler/level plug

A—Oil filler/level plug

Bel housing drain plug

139. A plug is provided for fitting into a drain hole in the bottom of the flywheel housing to seal it against the entry of mud or water when fording. When not in use, the plug is screwed into a bracket adjacent to the housing drain hole.

The plug should only be fitted into the drain hole when the vehicle is fording or travelling over very muddy terrain and it must be removed periodically to allow all oil to drain before being replaced.

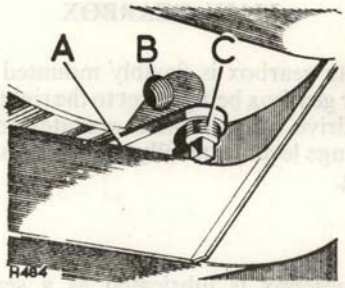


Fig. 56 Flywheel housing drain plug

A—Bracket for plug B—Aperture for plug in flywheel housing C—Plug

Gearbox oil changes

140. 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 then replace the plug. Refill with oil of the correct grade; the capacity is approximately 2½ Imperial pints (1,5 litres).

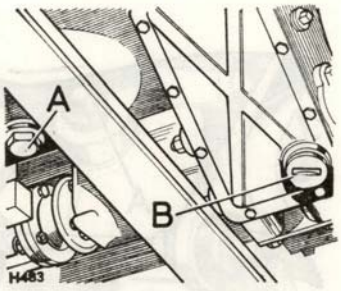


Fig. 57 Gearbox and transfer box drain plugs

A—Gearbox drain plug B—Transfer box drain plug

Checks

141. Check the following points for oil leakage and mounting bolts for tightness. Tighten the bolts and nuts if necessary.

(1) Bell housing to flywheel housing.

(2) Gearbox casing to bell housing.

(3) Top cover to gearbox casing.

(4) Gearbox drain plug.

TRANSFER GEARBOX

Description

142. The rear end of the main gearbox mainshaft extends into the transfer casing, bolted at right angles to the gearbox. From a gear on the mainshaft, the drive is through an intermediate gear cluster to high and low speed gears on the output shaft. Transfer gear changing is obtained via a long selector shaft passing forwards through the front output housings to the transfer gear change lever on the right of the main lever; the transfer control is interlocked with that for the front-wheel drive.

143. The rear axle output flange is bolted to the rear of the output shaft, which passes through the speedometer drive housing; this housing also carries the mechanical transmission brake operated by the hand brake lever.

144. The forward end of the output shaft is splined into the sliding member of the front-wheel drive dog-clutch which, along with the front output shaft, is enclosed in a long housing on the front of the transfer casing. This housing carries the front bearing for the front output shaft, which is located at its rear end on a phosphor bronze bush running on an extension of the transfer box output shaft.

Lubrication

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

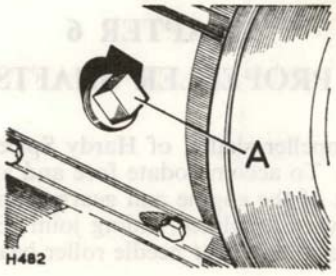


Fig. 58 Transfer box oil level

A—Filler/level plug

Oil level

146. The transfer box oil level must be checked periodically and replenished as necessary until oil commences to flow from the filler/level plug hole. Fig. 58. The filler/level plug is in the rear face of the transfer box, accessible when the seat box centre panel is removed or from underneath the vehicle.

Transfer box oil changes

147. To change the oil, remove the drain plug (see Fig. 57) from the bottom of the transfer box immediately after a run when the oil is warm; allow the oil to drain away completely, replace the drain plug, then remove the filler/level plug. Refill with oil of the correct grade; the capacity is approximately 4½ Imperial pints (2,5 litres).

Checks

148. Check the following points for oil leakage and mountings for tightness. Tighten bolts and nuts as necessary and report if leakage persists.

(1) Bottom cover plate to transfer casing.

(2) Transfer casing to main gearbox casing.

(3) Rear mainshaft bearing housing to transfer casing.

(4) Front output shaft housing to transfer casing.

(5) Speedometer pinion housing to transfer casing.

(6) Transfer box drain plug.

(7) Transfer box oil filler/level plug.

Check front and rear output shafts for sign of leakage. Check the rear engine mountings, situated on either side of transfer box. They should be free from oil or grease and the mounting bolts tight.

CHAPTER 6

PROPELLER SHAFTS

Description

149. The two propeller shafts, of Hardy Spicer manufacture, are identical in design. To accommodate fore and aft movement of the axles and the float of the engine and gearbox unit, one end of each shaft is provided with a splined sliding joint. Each universal joint consists of a centre spider, four needle roller bearing assemblies and two yokes.

Lubrication

150. At regular intervals apply grease, using the grease gun, at the lubrication nipple on the sliding portion of the propeller shafts.

Apply grease at the lubrication nipples fitted to the universal joints. It is preferable to use the grease gun, but if high pressure equipment is used, care must be taken not to damage the seals in the joints.

A rubber grommet is fitted over the sliding spline, to prevent ingress of dirt and water. This does not affect lubrication in any way.

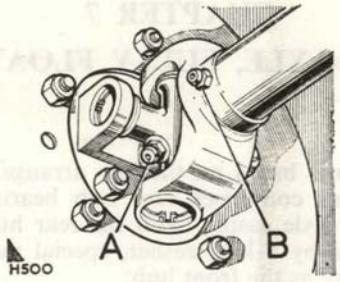


Fig. 59 Propeller shaft lubrication

A—Universal joint nipple B—Sliding sleeve nipple (Plug on front shaft)

151. Lubricate the sliding spline on the front propeller shaft as follows:

(1) Disconnect one end of the propeller shaft.

(2) Remove clip securing rubber grommet at journal end and compress grommet to clear plug in sliding spline.

(3) Remove plug in sliding spline and fit a suitable grease nipple.

(4) *Important*. Compress propeller shaft at sliding joint to avoid overfilling, then apply grease.

(5) Replace grease nipple with plug, refit grommet and re-connect propeller shaft.

Checks (*to be carried out by a vehicle mechanic*)

152. The following points should be checked:

(1) Periodically check the security of the propeller shaft securing bolts and rectify as necessary.

(2) Check the bearing races and spider journals for excessive wear.

Wear on the thrust faces of the bearings can be located by testing the lift in the joint, either by hand or with the aid of a bar suitably pivoted.

Any circumferential movement of the shaft relative to the flange yokes indicate wear in the roller bearings or the splined joint.

(3) Check the universal joint bearings for oil leaks.

(4) Check that rubber grommet on prop-shaft spline is not damaged and is securely fastened.

CHAPTER 7
REAR AXLE, FULLY FLOATING

Description

153. The rear hub is based on the hub arrangement used on the front axle. The unit comprises rear hub bearing sleeves bolted to the existing rear axle casing, with the rear hubs fitted to these sleeves and retained by a key washer, special nuts and lockers in exactly the same way as the front hub.

The one-piece axle shafts are splined into the differential wheels at the inner end with hub driving members fitted to splines at the outer end. The hub driving members are bolted to the rear hubs and secured to the axle shafts by circlips.

Lubrication

Differential oil level

154. The differential oil level must be checked periodically, immediately after a run when the oil is warm, and replenished as necessary to the bottom of the filler plug hole. The filler/level plug is on the right-hand side of the differential casing. (See Fig. 60.)

Differential oil changes

155. Immediately after a run, when the oil is warm, drain off the oil by removing the drain plug(s) in the bottom of the axle casing(s). Replace the drain plug(s) and refill with oil of the correct grade; the capacity of the rear differential is approximately 4½ Imperial pints (2,5 litres).

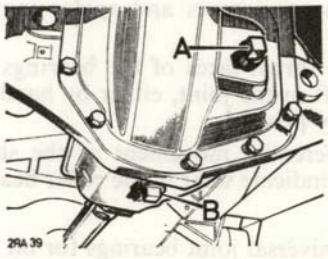


Fig. 60 Rear differential lubrication

A—Filler/level plug B—Drain plug

Checks

156. Check the following:

(1) Check that the nuts securing the bevel pinion housing to the axle casing are tight and that there is no oil leak at this point.

(2) Check that the bevel pinion and hub oil seals do not leak.

(3) Check that the oil level and drain plugs are tight.

Routine adjustments and servicing

Fully-floating rear axle

Hub adjustment (*to be carried out by a vehicle mechanic*)

157. The adjusting procedure for the rear hub is exactly as that on the front hub. Para. 171 covers the procedure to be carried out except that items 2 and 10 are not applicable. See Fig. 64.

CHAPTER 8

FRONT AXLE

Description

158. The front axle is a live driving unit of the 'fully-floating' type, the drive being transmitted through spiral bevel gearing and normal type differential to the half shafts and thence via universal joints to the wheel hubs.

159. The inner end of each half shaft is splined into the differential assembly, while the outer end is carried in a taper roller bearing enclosed in a spherical housing secured to the axle casing.

160. The lower swivel pin is mounted in a taper roller bearing carried in a spherical housing, while the upper pin is carried in a railko bush type steering damper.

161. The spherical and swivel pin housing (known together as the universal joint housing) enclose the universal joint.

162. The driving shaft is carried in a bush pressed into the hollow stub axle bolted to the swivel pin housing. Two taper roller bearings support the hub on the stub axle.

163. A nut and a locknut provide adjustment of the hub end-float. The drive is transmitted from the driving shaft to the hub by means of a driving member, which also serves to enclose the hub assembly.

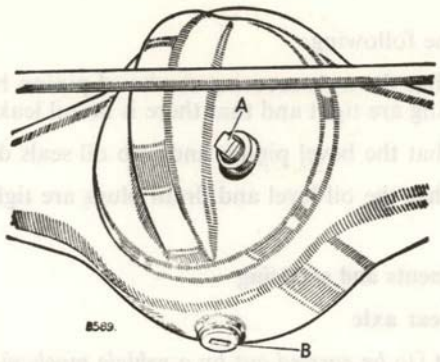


Fig. 61 Front differential lubrication

A—Filler/level plug B—Drain plug

Lubrication

Differential oil level

164. The differential oil level must be checked periodically, immediately after a run when the oil is warm, and replenished as necessary to the bottom of the filler plug hole. The front axle filler/level plug is at the front of the axle casing.

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

Differential oil changes

165. See Para. 155. The capacity of the front differential is approximately 3 Imperial pints (1,75 litres).

Swivel pin housing lubrication

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

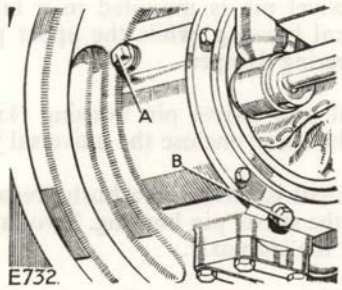


Fig. 62 Swivel pin housing lubrication

A—Filler/level plug B—Drain plug

Swivel pin housing oil level

167. The swivel pin housing oil levels must be checked periodically and replenished as necessary to the bottom of the filler/level plug holes at the rear of the housings. See Fig. 62.

Swivel pin housing oil changes

168. To change the oil, remove the drain plug from the bottom of each housing, see Fig. 62, 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).

Swivel pin housing gaiter

169. Chamois leather gaiters fitted to the spherical and swivel pin housings give protection to the ball of the spherical housing. They do not interfere with draining or refilling the swivel pin housing and should not be disturbed when carrying out this operation.

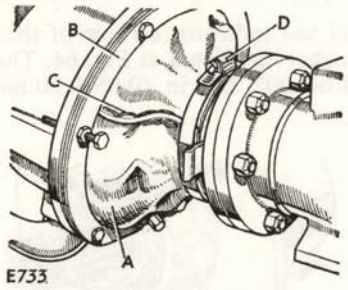


Fig. 63 Swivel pin housing gaiter

A—Gaiter B—Retainer C—Lace D—Clip

Checks

170. The following points should be checked:

(1) Check that the nuts securing the bevel pinion housing to the axle casing are tight and that there is no oil leak at this point.

(2) Check that the bevel pinion oil seal, swivel pin housing oil seal and hub oil seal do not leak.

(3) Check that the bolts and nuts securing the swivel pins to the housing are tight.

(4) Check that the bolts securing the driving member to the front hubs are tight.

(5) Check that the differential and swivel pin housing filler and drain plugs are tight.

(6) Report any oil leakage from the flange joints.

(7) Check chamois leather gaiter on swivel pin housing for signs of damage, displacement or tears.

Routine adjustments and servicing

Hub end-float adjustment (*to be carried out by a vehicle mechanic*)

171. Check and adjust hub end-float as follows:

(1) Jack up the front of the vehicle and remove the road wheel and brake drum.

(2) Drain off the oil from the universal joint housing (remove both drain and filler plugs).

(3) Remove hub cap (press fit on the driving member).

(4) Place a drip tray below the hub and remove the driving member and joint washer from the stub shaft and the hub.

(5) Mount a dial test indicator on one of the road wheel studs, using the bracket illustrated at Fig. 64. The total hub movement should be .002–.004 in. (0,05–0,10 mm).

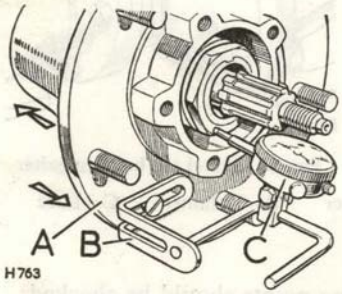


Fig. 64 Checking hub end-float

A—Hub flange B—Bracket for mounting dial test indicator
C—Dial test indicator

(6) Should the end-float prove to be correct, reassemble by reversing the stripping procedure. Replace the drain plug and refill the universal joint housing with oil.

(7) If the end-float is not correct, prise up the locking tabs and unscrew the outer locknut.

(8) Adjust the inner hub nut, tighten the locknut and again check the end-float. After each adjustment of the inner nut, spin the hub to resettle the bearings before rechecking the end-float. When the hub movement is correct, tighten the locknut and bend over two new tabs of the locking washer. As a safeguard, the end-float should be checked once more after locking the nuts.

(9) Replace the driving member and joint washer and complete the assembly by reversing the stripping procedure, taking care not to over-tighten the nut securing the driving shaft to the driving member.

(10) Replace the drain plug and refill the universal joint housing with oil.

NOTE—If no dial test indicator is available, the hub end-float can be satisfactorily adjusted as follows: Tighten up the adjusting nut until the bearings are felt to bind, then slacken off the nut just sufficiently to permit the hub to revolve freely, but without noticeable end-float. Then proceed as described above.

CHAPTER 9

STEERING

RECIRCULATING BALL TYPE

Description

172. The steering unit is secured to a chassis bracket at the steering box and to a bracket on the dash panel at its upper end. It is of the recirculating ball type, the inner column having a spiral thread on which operates the main nut assembly.

The nut is free to move longitudinally in the steering box. The steering box is fitted with two replaceable bushes, in which operates the rocker shaft. The rocker shaft is attached to the main nut assembly by a fork and roller joint.

173. The 17 in. steering wheel is splined on to the inner column and secured by a bolt.

174. A longitudinal steering tube, having left-hand and right-hand threaded ball joints, connects the drop arm to the upper lever of the steering relay unit mounted in the chassis cross-member below the radiator. This relay unit incorporates spring loaded split 'Tufnol' cone bushes which damp the steering action and prevent minor road shocks being transmitted to the steering wheel.

175. The lower lever of the relay unit is connected to one steering arm by the drag link, which has left-hand and right-hand ball joints; the system is completed by the track rod connecting both steering arms, which is of a similar construction to the drag link.

Steering box

Lubrication

176. The steering box oil level must be checked periodically and replenished as necessary to the bottom of the filler plug hole on the top cover plate. Access to the plug is gained by lifting the bonnet panel. See Fig. 65.

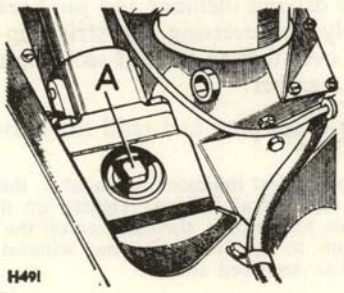


Fig. 65 Steering box oil filler plug

A—Filler plug

Checks

177. The following points should be checked:

(1) Check for tightness the bolts securing steering box to the chassis bracket.

(2) Check the side and bottom plates of the steering box for oil leakage and tightness.

(3) Check that the drop arm, mounted on the steering box rocker shaft is secure.

(4) Check steering column for wear or end-play. Adjust as necessary (see para. 179).

(5) Check for tightness the bolts securing the steering column support bracket to dash panel.

(6) Check end play in rocker shaft and adjust as necessary (see para. 178).

(7) Check ball joint for wear (see para. 180).

Routine adjustments and servicing

Rocker shaft adjustment

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

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

Proceed as follows:

With the road wheels set straight ahead, slacken the locknut and screw the adjuster in by hand until it contacts the top of the rocker shaft; then secure with the locknut. See Fig. 66.

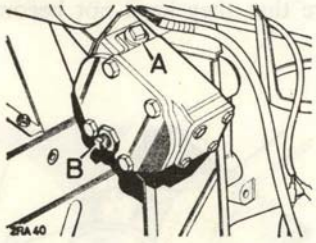


Fig. 66 Rocker shaft adjustment
A—Filler plug B—Adjuster

Steering column adjustment (*to be carried out by a vehicle mechanic*)

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

Wear or end play in the steering unit can therefore be taken up when necessary in the following manner:

(1) This adjustment will be made more accessible by the removal of the offside front wheel.

(2) Remove bottom cover of steering box which is retained by four bolts.

(3) Withdraw bottom cover and remove all shims and joint washers. Take care that the inner column ball races are not dislodged, otherwise it will be necessary to remove the steering unit to enable replacement to be made.

(4) Replace bottom cover only and tighten up until no end-float is experienced on rotating the steering wheel. Measure with a feeler gauge the gap that has been caused by the removal of the shims and joint washers.

(5) Remove bottom plate and insert required number of shims and alternate joint washers, checking on assembly that no end thrust is apparent.

(6) Replace wheel, lower vehicle and top up steering box with correct grade of oil.

Steering ball joints

180. The steering joints 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 oint damaged.

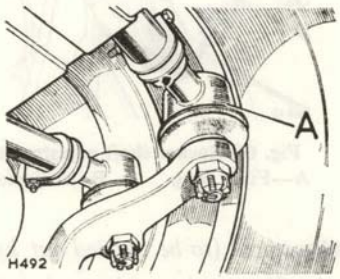


Fig. 67 Steering ball joint

A—Steering ball joint

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:

(1) Remove ball end from lever.

(2) Remove rubber boot.

(3) Thoroughly clean all parts.

(4) Apply suitable grease round taper of ball joint and also fill the boot.

(5) Reassemble all parts using new rubber boot and springs as required.

Steering link adjustment

181. All ball joints are of the non-adjustable type and are screwed into the ends of the steering tubes and retained by clips and pinch bolts. Adjustment to each steering link can be made by releasing the ball joint clips and rotating the tube to lengthen or shorten the link as required.

Front wheel alignment (*to be carried out by a vehicle mechanic*)

182. No adjustment is provided for castor, camber or swivel pin inclination.

The toe-in is adjustable. Proceed as follows:

(1) Set vehicle on level ground with the road wheels in the straight ahead position and push it forward a short distance.

(2) Measure the distance between the edges of the rims, at the height of the hub centres, in front of the axle, marking the points between which the measurement is taken.

(3) Move the vehicle forward until the marks on the rim are at hub height, at the rear of the axle.

(4) Measure the distance between the marks. The measurement at the front of the axle should be $\frac{3}{64}$–$\frac{3}{32}$ in. (1,2–2,4 mm) less than that at the rear.

(5) If correction is required to the toe-in, slacken the clips securing the ball joints to the track rod, and turn the rod to decrease or increase its effective length as necessary, until the toe-in is correct.

(6) Tighten the ball joint clips.

CHAPTER 10

DUAL BRAKE SYSTEM

Description

Foot brake

183. The dual brake system, operated by a pendant foot pedal, is the Girling servo assisted hydraulic type. The hand brake operates a Girling mechanical brake unit mounted on the output shaft from the transfer box.

Brake fluid reservoir

184. The nylon fluid reservoir for the brakes is integral with the master cylinder and servo unit.

The reservoir is mounted above the foot pedals on the engine side of the dash.

The level is correct when the fluid is up to the 'level' mark on the reservoir body.

Periodically remove the filler cap and replenish as necessary making sure that the reservoir is topped up both sides of the divider.

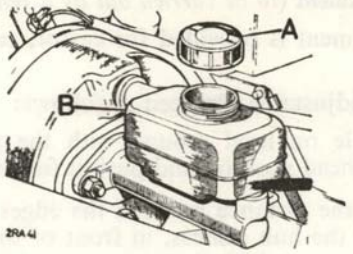


Fig. 68 Brake fluid reservoir

A—Filler cap B—Brake reservoir

Pipe system

185. From the master cylinder two separate pipes lead to a five-way brake failure switch on the chassis side member. From the brake failure switch two separate pipes lead to each front wheel cylinder via flexible hoses; the third pipe runs to a 'T' junction on the rear axle casing, via a flexible hose situated between the right-hand chassis side member and the rear axle casing. The connection is completed by pipes to the rear wheel cylinders, secured to the axle casing with clips. There is a permanent fluid line connection between the master cylinder and wheel cylinders. In the event of a brake servo failure the brakes remain fully operative although the pedal pressure required to operate the brakes will be higher. In addition to the foregoing the dual system will continue to provide braking to either the front or rear wheels, as applicable, in the event of a hydraulic failure or malfunction to one or more component parts of the system.

A failure to the fluid pipes or a hydraulic component on the rear brakes causes a pressure difference in the fluid which moves a shuttle valve in the brake failure switch with subsequent warning lamp illumination. In addition brake pedal movement will be reduced to approximately half travel indicating that there is emergency braking to the front brakes only.

Conversely, should a failure occur in any of the hydraulic components serving the front brakes, braking will still be operational on the rears.

If any of the above faults occur when the vehicle is operational the red warning light in the brake system check switch will be illuminated, see para. 44.

The vehicle should be stopped immediately and the cause investigated.

Wheel brake units

186. Front. Two leading shoe arrangements operated hydraulically by individual wheel cylinders connected to each other by an external pipe.

Each piston has one pressure seal (cup) which keeps the piston in light contact with the brake shoe. A bleed screw nipple and non-return valve is fitted in one cylinder only, access to the nipple is gained from the rear of the anchor plate. (Fig. 70.) Rubber covers are fitted over the bleed nipple and pistons to exclude dust and mud. Two adjusting cams, one for each shoe, are fitted to both the front anchor plates. See Fig. 69.

Rear. Hydraulically operated with leading and trailing shoes.

The brake shoes pivot at a common point and are free to float at the hydraulic expander unit (wheel cylinder). Two pistons having pressure seals (cups) in the wheel cylinder are held apart by a spring which prevents malalignment of the cups and keeps the pistons in light contact with the brake shoes. A bleed screw nipple and non-return valve are provided on the wheel cylinder, access to the nipple being gained from the rear of the anchor plate. Rubber covers are fitted over the bleed nipple and pistons to exclude dust and mud. Two adjusting cams, one for each shoe, are fitted to the rear anchor plates.

Brake pedal

187. The pendant type brake pedal is mounted on the dash and operates the master cylinder by means of a short push rod. The adjustment on the stop bolt which controls the position of the brake pedal is set on initial assembly and should not be disturbed.

A stop lamp switch is located on the brake pedal box cover in the engine compartment and is operated by movement of the brake pedal.

Hand brake

188. The hand brake shoes are mounted at the rear of the transfer box on the speedometer drive housing and operate on the transfer box output shaft.

The brake shoes pivot on two adjuster plungers and are operated by an expander cone and two expander plungers. The hand brake lever of the normal ratchet type, is mounted on the right-hand chassis side member, and is connected to the relay lever by means of a vertical adjuster rod. The relay lever, mounted on a spindle in the chassis side member, pulls forward the operating rod fixed to the expander cone when the hand brake is operated.

Under adverse conditions it is advisable to engage four-wheel drive as well as applying the hand brake. By this method the hand brake will be effective on all road wheels.

Lubrication

189. The hand brake linkage should be lubricated by means of an oil can at the following points:

(1) At the connection between hand brake lever and operating rod.

(2) At the joints on the hand brake bell crank lever.

Checks

190. The following points should be checked:

(1) Check the three flexible hoses and the pipe lines for signs of damage and the unions for tightness.

(2) Check the level of the fluid in the supply tank. See para. 184.

(3) Check the nuts securing the master cylinder and servo unit to pedal box bracket for tightness.

(4) Check the set screws fixing the brake drums for tightness after the road wheels have been removed.

Routine adjustments and servicing

Wheel brake adjustment (*to be carried out by a vehicle mechanic*)

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

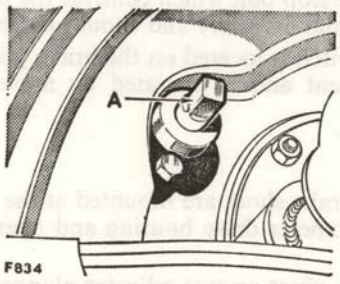


Fig. 69 Wheel brake adjustment

A—Adjuster bolt

Front and rear: 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 adjuster if necessary by turning anti-clockwise.

(2) Turn the adjuster for each shoe clockwise until the shoe contacts the brake drum, then slacken off until the wheel rotates freely.

Hand brake (transmission brake) adjustment (*to be carried out by a vehicle mechanic*)

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

(1) Release the hand brake.

(2) Adjustment is made by means of the adjuster wedge spindle (A) (Fig. 70) protruding from the front of the brake backplate, accessible from beneath the vehicle; during rotation of the adjuster a click will be felt and heard at each quarter revolution.

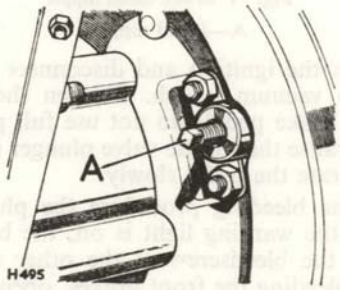


Fig. 70 Transmission brake adjustment

A—Adjuster

(3) Rotate the spindle as far as possible in a clockwise direction, i.e. until the brake shoes contact the drum.

(4) 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.

(5) No other adjustment to the hand brake system is necessary to compensate for lining wear.

Bleeding the brake system (*to be carried out by a vehicle mechanic*)

193. 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 off the brake shoe adjusters on each wheel to minimise wheel cylinder volume.

(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.

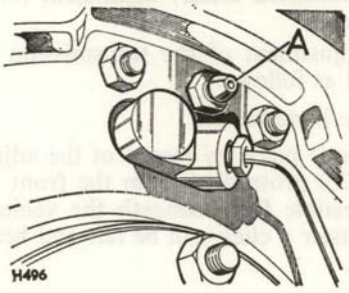


Fig. 71 Brake bleed nipple

A—Bleed nipple

Switch on the ignition and disconnect the lead from the brake servo vacuum switch. Slacken the bleed screw and depress the brake pedal; do not use full pedal travel as this may decentralise the shuttle valve plunger in the brake failure switch. Operate the pedal slowly.

(3) If during the bleeding procedure the plunger operates the switch and the warning light is on, the bleedscrew must be closed and the bleedscrew at the other end of the vehicle opened (if bleeding the front brakes, open a bleedscrew on a rear brake and vice versa).

A steady pressure must then be applied to the pedal until the light goes out, when the bleedscrew should immediately be closed and the pressure released. Otherwise the piston will move too far in the opposite direction and require resetting.

(4) Repeat the procedure until fluid discharged from the bleed tube is free of air, then tighten the bleed nipple during a pedal downstroke.

(5) Repeat the procedure on the remaining wheels, commencing and continuing at the next wheel farthest from the master cylinder. Switch off the ignition and reconnect the lead to the brake servo vacuum switch.

(6) Adjust the brakes. See para 191.

(7) Hold foot pressure on the brake pedal and start the engine. If the vacuum system is functioning correctly, the pedal will move towards the board. If no movement is felt, the vacuum system is not operating and the warning light in the check switch will remain on.

(8) The fluid in the reservoir should be replenished throughout the operation to prevent more air getting into the system.

CHAPTER 11

CHASSIS AND SUSPENSION

CHASSIS

Chassis frame

194. The chassis frame is of box section throughout, providing extreme rigidity, and requires no attention.

Front bumper and bumperettes

195. Attached by bolts and readily detachable for attention to accidental damage. Bumperettes are situated on each side of the front bumper.

Rear bumperettes are attached to the rear cross member.

SUSPENSION

Description

196. The suspension is by semi-elliptic leaf springs at both front and rear. As a safeguard, in the event of main spring leaf fracture, the ends of each second leaf are curled over the bushes, to afford some measure of support until the defect can be rectified.

197. The road springs are attached directly to the chassis at the front, while swinging shackles are fitted at the rear ends of the springs. Each shackle pin is mounted through a bonded rubber bush; the bushes do not rotate, angular movement being taken by torsional deflection of the rubber elements. Flexible fabric check straps, secured to the chassis side members, are provided to limit the downward movement of the rear axle. To avoid the possibility of the check straps chafing through the rear brake pipes, suitable shields are fitted between the axle casing and the road springs.

198. A rubber bump block is secured to the underside of the chassis side member above each road spring.

199. Non-adjustable telescopic hydraulic dampers are fitted to each spring; they are secured in rubber mounting bushes, to bolts in the chassis side members and pins in the road spring bottom plates. This type of damper incorporates a special seal which prevents leakage of hydraulic fluid; consequently no 'topping-up' or other servicing attention is required at any time.

Checks (*to be carried out by a vehicle mechanic*)

200. The following points should be checked:

(1) The U-bolt nuts (Fig. 72) should be tight.

(2) Examine the spring leaves for cracks or displacement and correct as necessary.

(3) Check that leaf clips (Fig. 72) are tight.

(4) Check that all damper retaining nuts are tight.

(5) Check the spring bushes for excessive wear or damage and replace as necessary.

(6) Check that the bump rubbers are secure and undamaged; replace as necessary.

(7) Ensure that the check straps are not excessively worn or damaged, and that the securing bolts are tight.

(8) Check the hydraulic dampers by bouncing each corner of the vehicle in turn. Uniform movement would indicate that no attention is required, but if the damping effect is slight or erratic, the damper should be renewed.

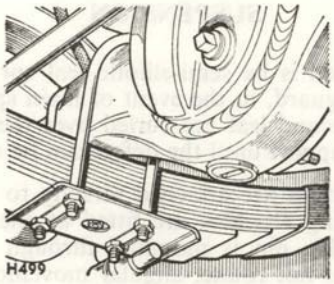


Fig. 72 Road springs

CHAPTER 12

WHEELS AND TYRES

WHEELS

Description

201. Steel wellbase type wheels are attached to the axle flange at the rear and to the hubs at the front by means of five studs and nuts.

Checks

202. Ensure that the wheel securing nuts are tight and that there is no damage to the road wheels.

Routine adjustments and servicing

Wheel changing

203. Important. As the Land-Rover is fitted with a transmission brake, it is necessary before removing a road wheel to apply the

hand brake and engage four-wheel drive. This will ensure that the hand brake is operative on all four wheels and there will be no tendency for the vehicle to run off the jack if the jacking operation is carried out on a slight slope. Remember to engage two-wheel drive when the road wheel has been replaced.

Proceed as follows:

(1) Slacken the 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 replacement.

(5) Fit the new wheel, with the 'V' tread, if applicable, directed to the front at the top; tighten the nuts securely and lower the vehicle to the ground.

TYRES

Description

204. Dual purpose 7.50 × 16 tyres are fitted.

Tyre treads

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

Factors affecting tyre life

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

(1) Incorrect tyre pressures.

(2) High average speeds.

(3) Harsh acceleration.

(4) Frequent hard braking.

(5) Warm, dry climatic conditions.

(6) Poor road surfaces.

(7) Impact fractures caused by striking a kerb or loose brick, etc.

(8) Incorrect front wheel alignment. Alignment should be checked periodically and adjusted as necessary. See para. 182.

Checks

207. Check tyre pressures, including the spare wheel.

Routine adjustments and servicing

Tyre pressures

208. 'Butyl' synthetic rubber inner tubes are fitted and all repairs must be vulcanised.

(1) Check the pressure with the tyres cold, as the pressure is about 2 lb./sq. in. (0,14 kg/cm²) 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 1-3 lb./sq. in. (0,07 kg/cm²–0,21 kg/cm²) per week) should be investigated and corrected.

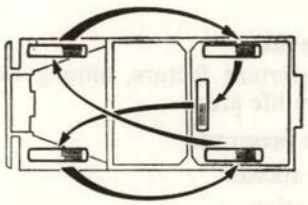
(4) Always check the spare wheel, so that it is ready for use at any time.

(5) 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 gasoline sparingly.

(6) Check that there are no lumps or bulges in the tyres or exposure of the ply or cord structure.

Changing wheel positions

209. In the interests of tyre mileage and even wear, it is desirable to change the position of the tyres on the vehicle (including the spare) at regular intervals. The front and rear wheels should be interchanged on each side of the vehicle; at the same time, the spare wheel, see Fig. 73, should be fitted to give it a spell of duty and one of the other wheels removed to become the spare.



H498

Fig. 73 Changing wheel positions

Wheel and tyre balance

210. In the interests of smooth riding and even tyre wear, it is advantageous to balance the wheel whenever a tyre is refitted.

CHAPTER 13

ELECTRICAL EQUIPMENT, 12 VOLT MODELS

SUPPRESSION OF ELECTRICAL INTERFERENCE TO RADIO SERVICES

211. The introduction of VHF wireless sets to the services calls for a high standard of vehicle suppression if interference is to be adequately suppressed and full advantage of the sets obtained; good maintenance of the electrical system is therefore essential. It should be remembered that even if a wireless set is not fitted the vehicle electrical system can cause interference to nearby wireless sets. Attention to the following details will do much to maintain the required standard of suppression.

(a) Sparking plugs

Ensure that the mating surface of the plug, gasket and cylinder head are clean and that the plug is fitted tightly into the cylinder head.

(b) Ignition leads

(i) Ensure that connections to the plugs are clean and tight.

(ii) Ensure that a suppressor is fitted in each plug lead; also that all leads make good connections in their suppressors.

(iii) Where the ignition leads are screened (heavy utility vehicles) ensure that the screening is not corroded or frayed, but is continuous and properly earthed at both ends.

(c) Distributor

(i) Ensure that the ignition leads make a good connection in the distributor cap.

(ii) Keep all connections and mating surfaces tight, clean, free from paint, corrosion, and lubricant.

(iii) Where the ignition system is screened, maintain a good contact between screen of L.T. and H.T. ignition leads and that of the distributor, which must be properly earthed.

(d) Coil

(i) Ensure good, clean and tight connection of all coil leads.

(ii) Maintain a good metal-to-metal contact, free from paint, corrosion and lubricant, between the body of the coil and its mounting.

(iii) Where a coil is screened, maintain a good contact between the junctions of the screen.

(e) Battery

Keep the battery terminals and leads clean and properly fitted to provide a good electrical connection.

(f) Earthing and bonding strips

Keep all junctions clean, free from corrosion or paint and ensure that they are tight.

(g) Do NOT disconnect the battery cables while the engine is running or damage to alternator semiconductor devices may occur.

It is also inadvisable to break or make any connection in the alternator charging and control circuits while the engine is running.

It is essential to observe the polarity of connections to the battery, alternator and regulator, as any incorrect connections made may cause irreparable damage to the semiconductor devices.

(h) Remainder of electrical systems

(i) Ensure that there is no intermittent contact on any of the fuses, leads, switches or connections.

(ii) Ensure that any screening is continuous and is properly earthed at both ends.

(i) Do not interfere with the vehicle wiring system, alternator and switches.

(j) Avoid making improvised connections to the electrical system.

(k) Avoid tampering with any parts of the electrical system which are not understood.

(l) Do not paint under bonding strips, or earth braids or other parts intended to be in electrical contact.

(m) Do not remove any suppression equipment that may be fitted to the vehicle.

(n) Refrain from using switches unnecessarily.

(o) Report immediately any defects which may affect the standard of suppression of the vehicle.

IGNITION SYSTEM, 12 VOLT MODELS

DISTRIBUTOR

Description

212. The distributor is mounted on an extension of the oil pump driving shaft.

213. 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. See Fig. 74.

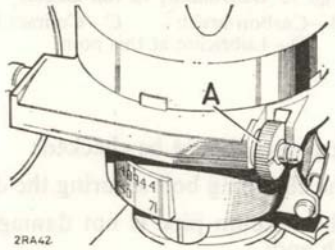


Fig. 74 Ignition timing, 12 volt models

A—Adjuster screw, ignition timing

This setting is correct for 90 octane fuel and with a clean engine, but should pinking develop as a result of the need for decarbonising, the control can be retarded a little by turning the screw in an anti-clockwise direction. Do not forget to return it to the original position after decarbonising.

Lubrication

214. At regular intervals remove the distributor cap by springing off the clips.

Lubricate as follows:

(1) Lightly smear the cam with clean engine oil.

(2) Lift off the rotor and add a few drops of thin machine oil to lubricate the cam bearing and distributor shaft; push the rotor on the shaft as far as possible.

(3) Place a drop of clean engine oil on the contact breaker lever pivot, taking care not to oil the contacts.

(4) Add a few drops of thin machine oil through the hole in the contact breaker base plate, to lubricate the automatic timing control.

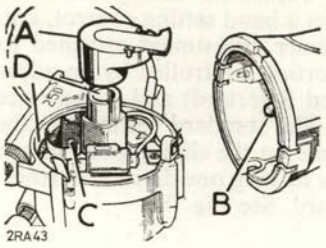


Fig. 75 Distributor, 12 volt models

A—Rotor arm B—Carbon brush C—Contact breaker lever pivot
D—Lubricate at this point

Checks

215. The following points should be checked:

(1) Check that the clamping bolt securing the distributor is tight.

(2) Check that the vacuum pipe is not damaged and is secured tightly at both ends.

(3) Check that the high tension cable, coil-distributor, is correctly located.

Routine adjustments and servicing

Clean and adjust distributor points (*to be carried out by a vehicle mechanic*)

216. Periodically 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.

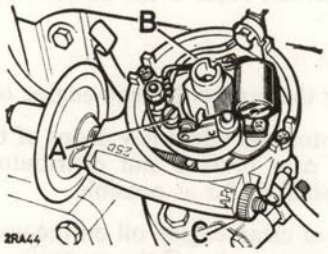


Fig. 76 Distributor contact points, 12 volt models

A—Securing screw for adjustable contact
B—Adjuster slot for contact points
C—Adjuster screw, ignition timing

(2) Remove nut and lift off the spring and moving contact. If necessary remove the adjustable contact plate. 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 gasoline-moistened cloth. Replace the contact set.

(3) Check and adjust the contact breaker clearance as follows:

(i) Remove the distributor cap and rotor arm then turn the engine by hand until the contacts are fully open.

(ii) The clearance should be .014 in.–.016 in. (0,35–0,40 mm), i.e., the feeler gauge should be a sliding fit between the contacts.

(iii) If necessary, slacken the screw which secures the adjustable contact and adjust by the adjuster slot until the clearance is correct, re-tighten the retaining screw.

(iv) Replace the rotor arm and distributor cap.

To adjust ignition timing (*to be carried out by a vehicle mechanic*)

217. 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.

Reset ignition timing as follows:

(1) Set the contact breaker point gap to .014–.016 in. (0,35–0,40 mm) with the points fully open.

(2) Rotate the engine in the running direction until the mark on the crankshaft pulley is in line with the pointer, with both valves on No. 1 cylinder closed.

See page 12 for correct ignition timing details.

(3) The distributor rotor should 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 casing.

(5) Slacken the pinch bolt at the base of the distributor; rotate the distributor body until the contact breaker points are just opening with the follower on the leading side of the cam; re-tighten the pinch bolt.

SPARKING PLUGS, 12 VOLT MODELS

Description

218. 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.

Routine adjustments and servicing

Clean and adjust sparking plugs (*to be carried out by a vehicle mechanic*)

219. At regular intervals remove the plugs, clean and if necessary, reset the electrode gaps to 0.029–0.032 in. (0,75–0,80 mm). Do not adjust the central electrode.

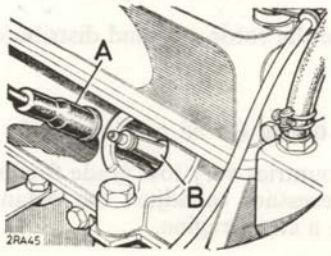


Fig. 77 Sparking plug

A—Cover B—Sparking plug

HIGH TENSION CABLES, 12 VOLT MODELS

220. 7 mm rubber-covered ignition cable must be used for replacement purposes when the original cable is cracked or perished. Connections are made as follows:

(a) To coil and sparking plug suppressors. Suppressors screw into the ends of the cables.

(b) To distributor. Unscrew the pointed fixing screws on the inside of the distributor cap and push the cables, which should not be bared but cut off flush to the required length, well home into their respective terminals and tighten the fixing screws. The screw securing the centre cable is accessible when the carbon brush is removed.

BATTERY, 12 VOLT MODELS

Description

221. The negative earth 12 volt battery is carried under the bonnet on the right-hand side. Together with the air-cleaner, it is mounted in a support bolted to four chassis brackets, and is secured by means of a cover and two wing nuts.

NOTE—For full user information on lead acid batteries reference should be made to EMER'S Power J318 and J468.

Checks

222.

(1) Check the state of charge of the battery. See para. 224.

(2) Check that the battery terminals are clean. Clean if necessary by removing the lugs, and refit as described in para. 225.

(3) Check that the lead from the battery to starter switch is not damaged and is secured tightly at the starter switch.

(4) Check that the earth lead is not damaged and has a good connection with the chassis side member.

(5) Ensure that the vent holes in the centre of the filler plugs are clear.

(6) Ensure that the bolts and nuts securing battery support to chassis brackets are tight.

Routine adjustments and servicing

Topping-up the battery

223. Proceed as follows:

(1) Wipe all dirt and moisture from the battery top.

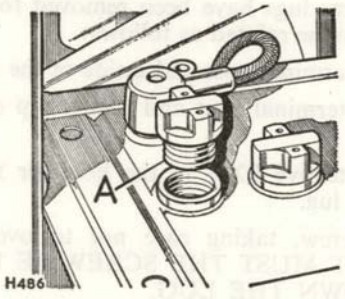


Fig. 78 Battery, 12 volt models
A—Filler plug

(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.

To check electrolyte (*to be carried out by a vehicle mechanic*)

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

1.280–1.300 (32°–34° Baumé)	....	Battery fully charged
About 1.210 (25° Baumé)	....	Battery about half discharged
Below 1.150 (19° Baumé)	....	Battery fully discharged

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

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

When using rapid charge equipment to recharge the battery, the battery must be disconnected from the vehicle.

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

Refitting battery lugs

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

(1) Clean the terminal post and inside of the battery lug.

(2) Fit lug to terminal post and lightly tap on the taper of the post.

(3) Smear Protective PX-7 in the hole for the retaining screw and on the lug.

(4) Replace screw, taking care not to overtighten. ON NO ACCOUNT MUST THE SCREW BE USED FOR PULLING DOWN THE LUG.

ALTERNATOR, 12 VOLT MODELS

Description

226. The alternator is a complete and sealed unit incorporating a voltage regulator and is mounted on the left-hand side of the engine driven by a 'V' type belt.

It requires no servicing or lubrication.

The electronic voltage regulator employs micro-circuit techniques resulting in improved performance under difficult service conditions.

The whole assembly is encapsulated in silicone rubber and housed in an aluminium heat sink, ensuring complete protection against the adverse affects of temperature, dust and moisture etc.

The alternator system provides for direct connection of the ignition indicator warning light and eliminates the need for a field switching relay or warning light control unit. As the warning light is connected in the charging circuit, bulb failure will cause loss of charge. The light should be checked regularly and a spare carried.

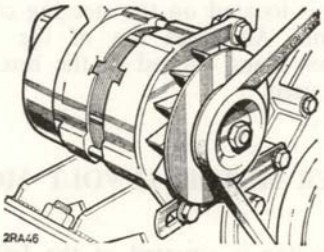


Fig. 79 Alternator, 12 volt models

Checks

227. The following points should be checked:

(1) Check the driving belt tension (see para. 103).

(2) Check that the electrical connections are tight.

(3) Ensure that the pivot bolts fixing alternator to anchor brackets, and the bolts fixing the alternator to the adjusting bracket, are tight.

FUSE BOX, 12 VOLT MODELS

Description

228. 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 fault must be reported and rectified.

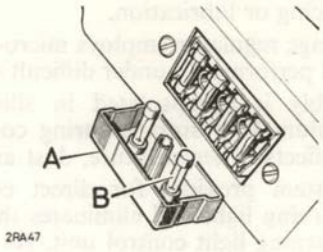


Fig. 80 Fuse box, 12 volt models

A—Cover for fuse box B—Spare fuses

229. The fuse box is located on the steering column shroud. See Fig. 80 for location. All fuses are of the 35 amp cartridge type, two spare fuses being carried in the box. Only the correct type of fuse may be used.

STARTER MOTOR, 12 VOLT MODELS

Description

230. The starter motor is situated at the left-hand side of the engine and mounted to the flywheel housing. It is operated by the ignition switch on the steering column shroud.

In the event of the starter pinion becoming jammed in mesh with the flywheel, it can usually be freed by withdrawing the dust cap and turning the starter armature by means of a spanner applied to the shaft extension at the commutator end.

Checks

231. The following points should be checked on the starter motor:

(1) Check that the nuts securing the starter to the flywheel housing are tight.

(2) Check that the electrical connections are tight.

(3) Check that the feed lead is not damaged and is secure at the starter switch.

Routine adjustments and servicing

Check starter motor brush gear (*to be carried out by a vehicle mechanic*)

232. (1) Remove the starter motor end cover.

(2) Check that the brushes move freely in their holders by holding back the brush springs and pulling gently on the flexible connectors. If a brush is inclined to stick, remove it from its holder and clean it with a gasoline-moistened rag.

(3) If the brushes are worn, or if the brush flexible connector is exposed to the running face, new brushes should be fitted by an electrician.

Commutator

233. At the same time examine the commutator, which should have a bright burnished appearance. Remove any oil or dirt with a gasoline-moistened cloth.

STARTER SOLENOID SWITCH, 12 VOLT MODELS

Description

234. A solenoid type switch is fitted to the bulkhead and operates the starter motor.

No user servicing is necessary.

HORN, 12 VOLT MODELS

Description

235. The horn is mounted under the bonnet lid, and is secured by two bolts.

Checks

236. Check horn as follows:

(1) Check that the bolts securing the horn are tight.

(2) Check that the connection of the feed lead is not loose.

WINDSCREEN WIPER MOTOR, 12 VOLT MODELS

237. One windscreen wiper motor is fitted behind a cover panel at the left-hand side of the facia panel. The two wiper blades are operated via wheelboxes by a flexible drive cable.

A lead from the wiper switch plugs on to a Lucar blade located on the ledge above the instrument panel.

When the windscreen is folded flat, this plug must be removed, as this prevents the wiper motor being inadvertently switched on.

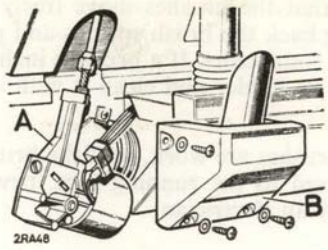


Fig. 81 Wiper motor, 12 volt models

A—Wiper motor B—Cover for wiper motor

LIGHTS, 12 VOLT MODELS

Description

Headlights

238. The headlights, mounted in the wing front panels, incorporate a combined reflector and front lens assembly known as the Lucas light unit. Double filament lamps give a vertical dip.

Side lights

239. The side lights are also mounted in the wing front panels, and the covers are secured by a threaded type holder.

Stop/tail lights

240. Two combined stop/tail lights similar to the side lights are fitted at the rear body.

Turnlights

241. The front turnlights are mounted in the front wing panels below the side lights. The rear turnlights are situated on the rear body above the stop/tail lights.

Number plate light

242. The number plate light is mounted on the right-hand side at the rear of the body adjacent to the turnlight.

Convoy light

243. The convoy light is situated centrally under the rear chassis member.

Instrument panel lamps

244. The instrument panel incorporates an illumination lamp, the charging, mixture control, oil pressure and main beam warning lamps.

Checks

245. The following points should be checked:

(1) Check lights for broken or cracked glass. If the headlight glass is broken the complete light unit must be renewed. If the lamps are discoloured as a result of long service they should be renewed.

(2) Ensure that the stop/tail light, turnlight and side light covers are secure.

Routine adjustments and servicing

Headlight lamp replacement

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

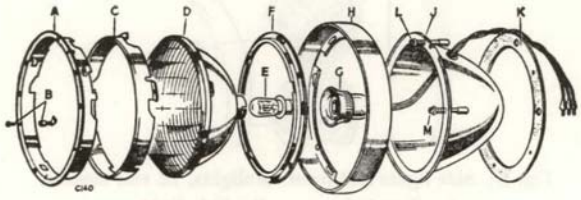


Fig. 82 Headlight, vertical dip, 12 volt models

A—Mask adaptor rim
B—Fitting securing mask adaptor rim
C—Light unit securing rim, front
D—Light unit
E—Lamp
F—Light unit securing rim, rear
G—Lamp contact housings
H—Fairing rim
J—Light shell
K—Rubber gasket
L—Adjusting screw—vertical
M—Adjusting screw—horizontal

Headlight setting (*to be carried out by a vehicle mechanic*)

247. The headlights should be set so that the main driving beams are parallel with the road surface. If adjustment is required, the vertical light 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.

When checking headlights to the dimensions shown at Fig. 83, the vehicle must be unladen, on level ground and 12 ft. (365 cm.) from the level marks. Adjust so that area of concentrated light corresponds with marks.

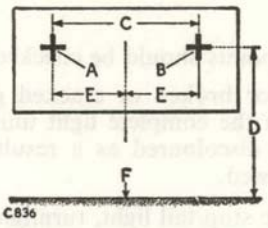


Fig. 83 Headlight setting dimensions, 12 volt models

A—Concentrated area of light, L.H. headlight
B—Concentrated area of light, R.H. headlight
C—20 in. (508 mm)
D—37½ in. (945 mm)
E—10 11/16 in. (271 mm)
F—Ground level

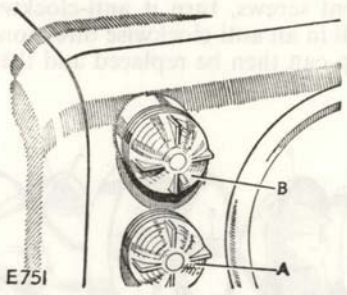


Fig. 84 Side lights and front turnlights, 12 volt models

A—Turnlight B—Side light

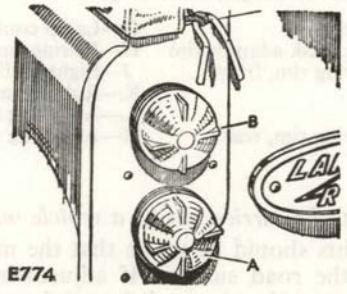


Fig. 85 Stop/tail lights and rear turnlights, 12 volt models

A—Stop/tail light B—Rear turnlight

Side, tail/stop and turnlight lamp replacement

248. All lights are of the same design, the difference being in the colour of the lens, side lights have white, rear lights red and turn-lights amber lenses.

To replace lamps in any of the above the glass is unscrewed from its threaded holder when the lamp is readily accessible and can be replaced. Finally screw back the lens.

Number plate light lamp replacement

249. To replace lamp; remove the securing screw and cover. The lamp is then accessible in the lamp body.

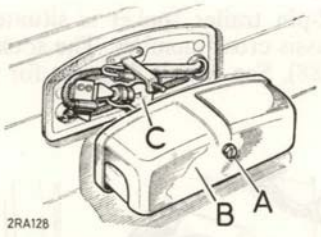


Fig. 86 Number plate light, 12 volt models
A—Screw B—Cover C—Bulb

Instrument panel and warning light lamp replacement

250. Should a warning lamp 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.

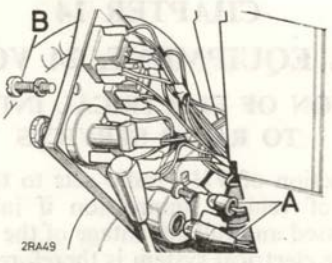


Fig. 87 Warning lights, 12 volt models
A—Bulbs B—Screw retaining instrument panel

To replace warning light bulbs:

(1) Release the speedometer cable from the clip attached to the rear side cover.

(2) Remove screws retaining the instrument panel.

(3) The instrument panel can now be eased forward for access to bulbs. Replace as necessary.

Convoy light lamp replacement

251. To replace the lamp, remove the screws holding the rim cover and withdraw rim and glass cover. The lamp can now be removed. Push new lamp into the holder turning the lamp to the left.

NATO trailer socket

252. A NATO 12-pin trailer socket is situated on the left-hand side on the rear chassis cross member. The socket is protected by a rubber cover (Fig. 88). See circuit diagram for wiring connections.

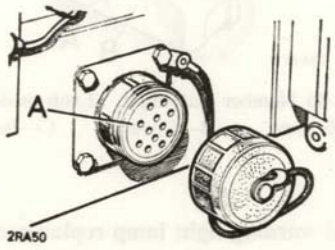


Fig. 88 NATO trailer plug socket

A—NATO trailer socket

CHAPTER 14

ELECTRICAL EQUIPMENT, 24 VOLT MODELS

SUPPRESSION OF ELECTRICAL INTERFERENCE TO RADIO SERVICES

253. The introduction of VHF radio sets to the services calls for a high standard of vehicle suppression if interference is to be adequately suppressed and full advantage of the sets obtained; good maintenance of the electrical system is therefore essential. It should be remembered that even if a radio set is not fitted the vehicle electrical system can cause interference to nearby radio sets.

Attention to the following details will do much to maintain the required standard of suppression.

(a) Sparking plugs

Ensure that the mating surface of the plug, gasket and cylinder head are clean and that the plug is fitted tightly into the cylinder head.

(b) Ignition leads

(i) Ensure that connections to the plugs are clean and tight.

(ii) Ensure that the screening is not corroded or frayed, but is continuous and properly earthed at both ends.

(c) Distributor

(i) Keep all connections and mating surfaces tight, clean, free from paint, corrosion and lubricant.

(ii) Maintain a good contact between screen of LT and HT ignition leads and that of the distributor, which must be properly earthed.

(d) Coil

(i) Ensure good, clean and tight connection of all coil leads.

(ii) Maintain a good metal-to-metal contact, free from paint, corrosion and lubricant, between the body of the coil and its mounting and between the junctions of the screen.

(e) Battery

Keep the battery terminals and leads clean and properly fitted to provide a good electrical connection.

(f) Earthing and bonding strips

Keep all junctions clean, free from corrosion or paint and ensure that they are tight.

(g) Remainder of electrical systems

(i) Ensure that there is no intermittent contact on any of the fuses, leads, switches or connections.

(ii) Ensure that any screening is continuous and is properly earthed at both ends.

(h) Do not interfere with the vehicle wiring system.

(i) Avoid making improvised connections to the electrical system.

(j) Avoid tampering with any parts of the electrical system which are not understood.

(k) Do not paint under bonding strips, or earth braids or other parts intended to be in electrical contact.

(l) Do not remove any suppression equipment that may be fitted to the vehicle.

(m) Refrain from using switches unnecessarily.

(n) Report immediately any defects which may affect the standard of suppression of the vehicle.

IGNITION SYSTEM, 24 VOLT MODELS
DISTRIBUTOR

Description

254. The distributor is mounted on an extension of the oil pump driving shaft. It is of the screened type having a centrifugal automatic advance mechanism which has an operating range of 0–22 degrees over a distributor speed range of 750–2,400 rev/min (1,500–4,800 rev/min engine speed).

255. Further adjustment to the distributor may be made by slackening off the retaining bolt and moving distributor body round to either R (retard) or A (advance) as shown on the calibrated scale. The standard setting is with the bolt in the centre of the scale, leaving two divisions possible advance and two divisions retard. See Fig. 89.

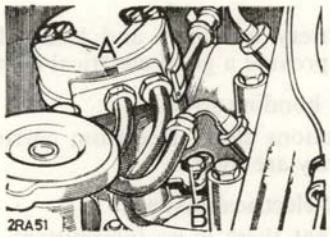


Fig. 89 Ignition timing, 24 volt models

A—Screws retaining distributor cap B—Ignition timing adjuster

Lubrication

256. At regular intervals remove the distributor cap by slackening off the two outer screws retaining the distributor cap. See Fig. 89.

Lubricate as follows:

(1) Lightly smear the cam with clean engine oil.

(2) Lift off the rotor and add a few drops of thin machine oil to lubricate the cam bearing and distributor shaft; push the rotor on the shaft as far as possible.

(3) Place a drop of clean engine oil on the contact breaker lever pivot, taking care not to oil the contacts.

(4) Add a few drops of thin machine oil through the hole in the contact breaker base plate, to lubricate the automatic timing control.

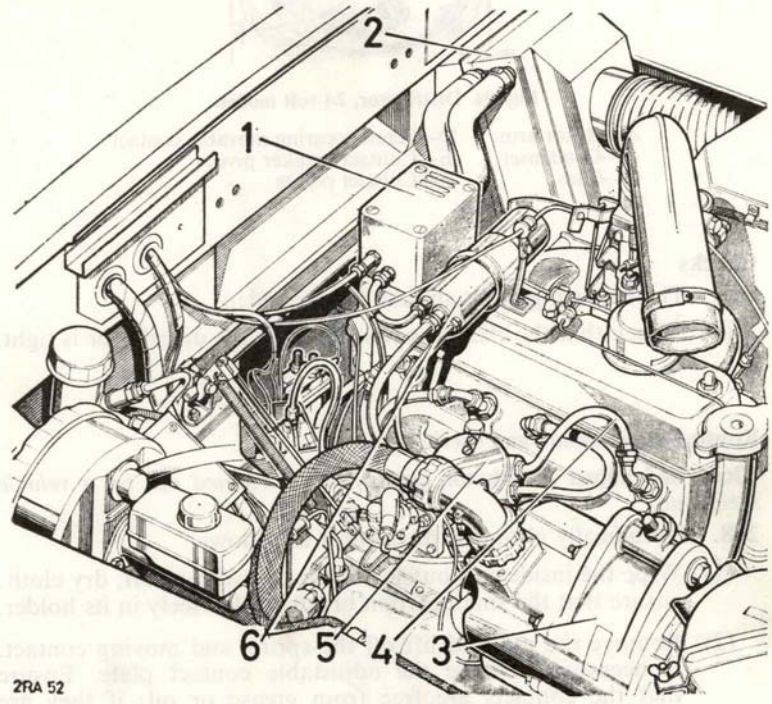


Fig. 90 Electrical equipment in engine compartment, 24 volt models

1 Filter for ignition coil
2 Heater blower unit
3 Generator
4 Screened high tension leads
5 Distributor
6 Ignition coil

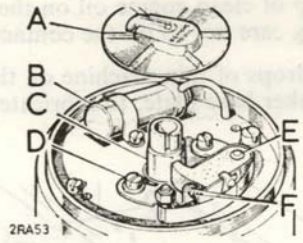


Fig. 91 Distributor, 24 volt models

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

Checks

257. The following point should be checked:

(1) Check that the clamping bolt securing the distributor is tight.

Routine adjustments and servicing

Clean and adjust distributor points (*to be carried out by a vehicle mechanic*)

258. Periodically 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) Remove the nut and lift off the spring and moving contact. If necessary remove the adjustable contact plate. 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 gasoline-moistened cloth. Replace the contact set.

(3) 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–.016 in. (0,35–0,40 mm), i.e. the feeler gauge should be a sliding fit between the contacts.

(iii) If necessary, slacken the two screws which secure the adjustable contact plate and move until the clearance is correct; re-tighten the screws.

(iv) Replace the distributor cap.

To adjust ignition timing (*to be carried out by a vehicle mechanic*)

259. Reset ignition timing as follows:

(1) Set the contact breaker point gap to .014–.016 in. (0,35–0,40 mm) with the points fully open using a feeler gauge.

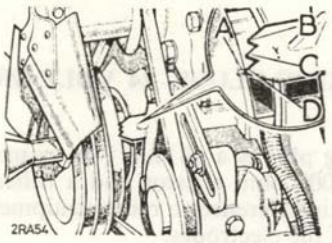


Fig. 92 Ignition timing, 24 volt models

A—Timing pointer
B—6° point on timing pointer
C—3° point on timing pointer
D—TDC on timing pointer

(2) Rotate the engine in running direction until the mark on the crankshaft pulley is in line with the pointer as applicable.

(3) The distributor rotor should now correspond with No. 1 cylinder high tension lead terminal.

(4) Set distributor adjustment so that the retaining bolt is central between the 'A' and 'R' marks on the calibrated scale.

(5) Slacken the pinch bolt at the base of the distributor; rotate the distributor body until the contact breaker points are just opening with the cam follower on the leading side of the cam; re-tighten the pinch bolt.

IGNITION COIL, 24 VOLT MODELS

Description

260. The ignition coil is a 10 volt oil filled unit and to make it suitable for the 24 volt system a ballast resistor is connected in series with the primary winding of the coil. The ballast resistor is housed with the filter unit.

FILTER UNIT, 24 VOLT MODELS

Description

261. The filter unit is fitted to suppress interference to radio equipment. It consists of a choke, connected in series with the supply to the ignition coil, and two capacitors connected one across each end of the choke and earth.

SPARKING PLUGS, 24 VOLT MODELS

Description

262. The sparking plug is a 14 mm $\frac{3}{4}$ in. reach, 3-piece type with a built-in 1,000–3,000 ohm resistor and a rolled-steel washer. The resistor suppresses interference to radio equipment and also reduces the burning rate of the electrodes.

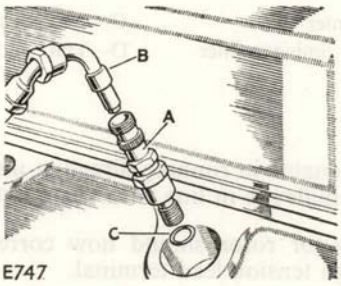


Fig. 93 Sparking plug, 24 volt models

A—Sparking plug B—Screened lead C—Washer for sparking plug

Routine adjustments and servicing

Clean and adjust sparking plugs (*to be carried out by a vehicle mechanic*)

263. At regular intervals remove the plugs, clean and if necessary, reset the electrode gaps to 0.015–0.018 in. (0,38–0,45 mm). Do not adjust the central electrode.

HIGH TENSION CABLES, 24 VOLT MODELS

264. Examine the screen and glands on each cable to ensure that the metallic screen is undamaged and metal-to-metal contact is maintained throughout the ignition screened system.

BATTERIES, 24 VOLT MODELS

Description

265. Vehicle and radio batteries are located as follows:

(1) **Vehicle batteries.** A negative earth return system is used, employing two 12 volt batteries connected in series, giving 24 volts output. They are located in the centre of the seat box between the driver and passenger seats, and are protected by a metal cover secured by two wing nuts. See Fig. 94.

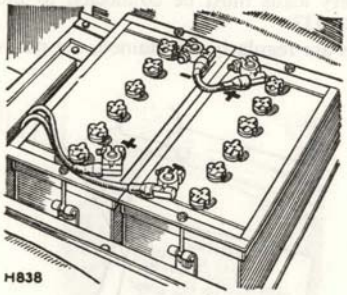


Fig. 94 Vehicle batteries, 24 volt models

(2) **Radio batteries.** Two 12 volt batteries connected in series giving 24 volts output are used for the radio system. They are housed in the body beneath the radio table and are protected by a metal cover. See Fig. 95.

IMPORTANT: Ensure that the batteries are connected in series and that the leads are connected as shown at Figs. 94 and 95.

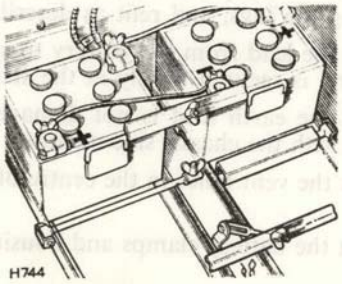


Fig. 95 Radio batteries, 24 volt models

266. The gases liberated from a battery are highly inflammable, therefore, it is important that electrical connections are maintained clean and tight as an insurance against fire.

It is equally important to ensure that the vents in the battery cell filler plugs are kept clear, as pressure within the battery cell is produced if the gases resulting from charging cannot escape. A blocked cell vent may result in a burst battery.

NOTE—For full user information on lead acid batteries reference should be made to EMER'S Power J 318 and J 330.

WARNING—This vehicle is fitted with a rectified AC system. See Fig. 96.

(1) The battery connections must always be clean and tight.

(2) Never run the engine without vehicle batteries being connected to the system, this applies even when using slave batteries.

(3) The radio battery leads must be connected to the battery or correctly stowed, see para. 337.

(4) Ensure batteries are regularly maintained, see paras. 267–269.

Fig. 96 Warning plate, rectified AC system, 24 volt models

Checks

267.

(1) Check the state of charge of the batteries. See para. 269.

(2) Check that the battery terminals are clean. Clean if necessary by removing the lugs, and refit as described in para. 270.

(3) Check that the lead from the battery to starter switch is not damaged and is secured tightly at the starter switch.

(4) Check that the earth lead is not damaged and has a good connection with the chassis side member.

(5) Ensure that the vent holes in the centre of the filler plugs are clear.

(6) Ensure that the battery clamps and housings are tight.

Routine adjustments and servicing

Topping-up vehicle and radio batteries (two 12 volt in series)

268. Proceed 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.

To check electrolyte (*to be carried out by a vehicle mechanic*)

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

1.280–1.300 (32°–34° Baumé)	....	Battery fully charged
About 1.210 (25° Baumé)	....	Battery about half discharged
Below 1.150 (19° Baumé)	....	Battery fully discharged

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

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

Refitting battery connectors

270. If the battery connectors have been removed for any reason, see para. 266. WARNING—they must always be refitted as follows:

(1) Clean the terminal post and connector.

(2) Fit connector to terminal post and lightly tap on the taper of the post.

(3) Smear Protective PX-7 on the terminal post and on the connector.

(4) Tighten retaining bolt and nut.

GENERATING SYSTEM, 24 VOLT MODELS

Description

271. To meet the heavy demands of the electrical system the vehicle is fitted with a 24 volt alternating current (AC) 90 amp. generator together with an associated rectifier system and generator panel.

The use of this system permits a high generator output to be obtained at low engine speeds.

Provision is made to charge the batteries with the vehicle stationary, a hand throttle control (para. 21) is provided which can be adjusted to vary the engine speed to give an optimum charging rate.

The generator is installed alongside the engine and is swing-mounted on fixing lugs located at each end of the generator.

Running the generator with the battery disconnected results in the generation of a very high voltage and if this occurs the rectifier units will be destroyed; faulty connections in the charging circuit will cause voltage surges and a similar effect will result. Consequently the engine must never be run with the vehicle battery disconnected or with faulty connections in the charging circuit. A warning plate to this effect is fitted to the seat base, driver's side (see Fig. 96).

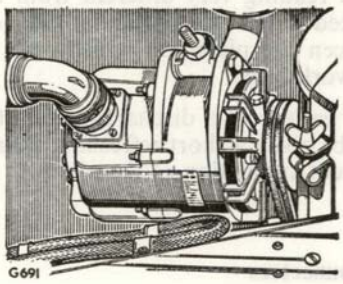


Fig. 97 Generator No. 10 Mk 2, 90 amp., 24 volt models

Generator No. 10, Mk 2, 90 amp.

Description

272. The generator is a fully suppressed 7 in., partially waterproofed, fan ventilated, self excited 3-phase alternator with a built-in rectifier system. It generates 24 volts at a generator speed (cutting-in speed) of 900 rev./min. and attains its maximum output of 90 amperes at 1,900 rev./min. (1,070 rev./min. engine speed).

(a) The 3-phase main windings are carried in the fixed stator portion of the machine; they are bar wound and star connected. The three ends of the windings are connected to six silicon diodes to give the required 24 volt rectified output and to another three diodes to give a 24 volt rectified supply to a relay in the generator panel (para. 275).

(b) The diodes are located in heat sinks in the end shield at the slip-ring end of the machine; they are cooled by means of a fan attached to the rotor shaft inside the generator which draws air through the machine via apertures in the end shields.

(c) The rotor consists of two 6-fingered cup-shaped portions mounted on the shaft to form a 12-pole unit. The field coil is wound around the shaft and is enveloped by the 12 poles of the rotor, the field current being supplied through carbon brushes and the slip rings which, since the field current is approximately only half amp, will give long and trouble-free service.

(d) As stated above the generator is self excited, the field circuit being taken from the positive line of the generator via the regulator (para. 275).

(e) The rotor is carried by a ball bearing at the slip-ring end and a roller bearing at the driving end, the bearings being located in waterproofed housings which are packed with grease XG271 on assembly and require no additional lubrication between major overhauls of the unit.

(f) Water can enter into the body of the unit, but is prevented from reaching the bearing housings and the brush gear assembly from the inside and from the outside by means of oil seals, sealing gaskets and by the application of sealing compound to screws and joints.

(g) The brush gear assembly is enclosed in the bearing housing, the bearing at this end being of the semi-sealed type, the seal being located facing the brush gear to prevent grease reaching this assembly. The brush gear is carried by an insulating moulding which is bolted to a web in the housing and helps to separate the bearing from the brush gear.

(h) Connection to the generator is made via a multi-pin plug.

Lubrication

273. The generator requires no lubrication to its bearings as they are pre-packed on manufacture.

Checks

274. The following points should be checked on the generator:

(1) Check the driving belt tension (see para. 103).

(2) Check that the cable harness is secure.

(3) Ensure that the pivot bolts fixing generator to anchor brackets are tight.

(4) Check adjustment strut nuts for tightness.

Generator panel No. 9 Mk 3, for use with the 90 amp. generator

Description

275. Generator panel No. 9 Mk 3 is used in conjunction with generator No. 10 Mk 2, it is located in the rear body at the right-hand front corner and is bolted to a bracket attached to the body side above the wheel arch, it is a cast aluminium box with cover housing the control units for the generator.

(a) The interior of the box is divided into two compartments one of which houses a BCK 102 relay and the other the regulator and its associated resistances, high/low voltage setting link and radio interference suppression filters. The partition between the compartments, together with capacitors, provide a radio interference screen around the regulator.

(b) A vibrating contact C.A.V. 'N' type regulator is used to control the voltage of the generator, current regulation is inherent in the design of the generator, maximum impedance being reached at its rated output of 90A.

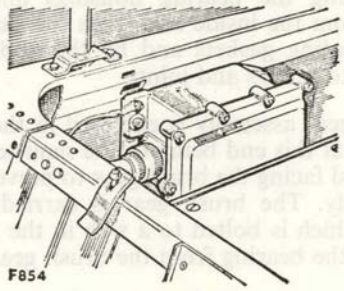


Fig. 98 Generator panel No. 9, Mk 3, 24 volt models

(c) The regulator contacts are connected in the field circuit, the main operating coil being connected across the output terminals of the generator and hence responding to output voltage.

(d) The regulator operating voltage can be set to a high or low range by means of the high/low setting link. The low position is for high ambient temperature conditions (tropical); the high position is for normal ambient temperatures.

(e) The C.A.V. BCK 102 relay is fitted to connect the radio batteries (when fitted) in parallel with the vehicle batteries for charging purposes when the generator is functioning. The operating coil of the relay is connected to the auxiliary rectified output terminal of the generator. Two pairs of contacts are fitted to the relay, these are used to connect the positive line of the generator to the vehicle battery positive connection and to the radio battery positive connection respectively when the relay closes.

(f) A normal type of cut-out is not fitted but the relay has a second winding incorporated to work in conjunction with two blocking diodes to hold the relay open in the event of reversed battery connections.

Servicing

276. User servicing of the generator panel is not permitted; the panel must not be tampered with.

Operation of 90 amp. generating system

277. Closing the ignition switch preparatory to starting the engine completes the field circuit through the closed contacts of the relay and of the regulator.

(a) As the engine is started and its speed increases the generated voltage rises and when it reaches 18–20 volts the BCK relay closes and the generator positive line is connected to the vehicle and radio batteries. The rate of charge of the two circuits is indicated by ammeters in front of the driver. If the radio battery connections are reversed the 'Aux.' ammeter will read excessively high.

(b) When the generated voltage reaches 28.5–29.0 volts the regulator contacts open to insert a resistance in the field circuit, the voltage falls and the regulator contacts close again. This cycle repeats continuously and rapidly until the speed of the generator is reduced and the voltage is below the regulator operating voltage.

The generated voltage is reduced to 26.5–27.0 volts for the low setting (para. 275).

(c) If the batteries are discharged and normal running of the vehicle is not contemplated they may be charged by running the engine with the vehicle stationary. The hand throttle

control should be adjusted so that the engine runs at the lowest speed at which maximum generator output is obtained; as the battery voltage rises and the charging rate falls the speed should be decreased.

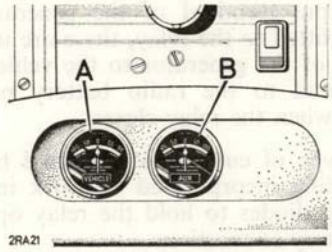


Fig. 99 Ammeters, 24 volt models

A—Vehicle ammeter B—Radio ammeter ('Aux.')

FUSE BOX, 24 VOLT MODELS

Description

278. The fuse box is fitted to the underside of the steering column shroud; Fig. 90 shows its location. The fuses are of the 35 amp. cartridge type and two are carried in the box as spares.

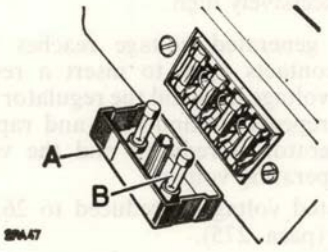


Fig. 100 Fuse box, 24 volt models

A—Cover for fuse box B—Spare fuses

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 workshop.

Use only the correct size fuse as a replacement.

STARTER MOTOR, 24 VOLT MODELS

Description

279. The starter motor is situated at the left-hand side of the engine and mounted to the flywheel housing. It is operated by the ignition switch on the steering column shroud.

In the event of the starter pinion becoming jammed in mesh with the flywheel, it can usually be freed by withdrawing the dust cap and turning the starter armature by means of a spanner applied to the shaft extension at the commutator end.

Checks

280. The following points should be checked on the starter motor:

(1) Check that the nuts securing the starter to the flywheel housing are tight.

(2) Check that the electrical connections are tight.

(3) Check that the feed lead is not damaged and is secure at the starter switch.

Routine adjustments and servicing

Check starter motor brush gear (*to be carried out by a vehicle mechanic*)

281.

(1) Remove the starter motor end cover.

(2) Check that the brushes move freely in their holders by holding back the brush springs and pulling gently on the flexible connectors. If a brush is inclined to stick, remove it from its holder and clean it with a gasoline-moistened rag.

(3) If the brushes are worn, or if the brush flexible connector is exposed to the running face, new brushes should be fitted by an electrician.

Commutator

282. At the same time examine the commutator, which should have a bright burnished appearance. Remove any oil or dirt with a gasoline-moistened cloth.

STARTER SOLENOID SWITCH, 24 VOLT MODELS

Description

283. A solenoid type switch is fitted to the bulkhead and operates the starter motor. No user servicing is necessary.

HORN, 24 VOLT MODELS

Description

284. The horn is mounted on the left-hand radiator baffle and is secured by two bolts.

Checks

285. Check horn as follows:

(1) Check that the bolts securing the horn are tight.

(2) Check that the connection of the feed lead is not loose.

HORN RELAY, 24 VOLT MODELS

Description

286. The horn relay is mounted at the top centre of the engine side of the dash. It is of the simple single-pole totally enclosed type fitted to prevent burning of the horn push-button contacts.

287. The operating coil of the relay is connected to the vehicle supply and to the horn push-button; its normally open contacts are connected to the supply and to the horn. Operation of the horn push-button energises the relay which operates to close its contacts and so complete the horn circuit.

WINDSCREEN WIPER, 24 VOLT MODELS

Description

288. The windscreen wiper motor is fitted behind a cover panel at the left-hand side of the facia panel. The two wiper blades are operated, via wheelboxes, by a flexible drive cable.

A radio interference suppression unit is fitted adjacent to the wiper motor. A lead from the wiper switch plugs on to a Lucar blade located on the ledge above the instrument panel.

When the windscreen is folded flat, this plug must be removed, as this prevents the wiper motor being inadvertently switched on.

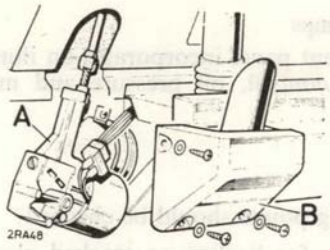


Fig. 101 Wiper motor, 24 volt models

A—Wiper motor B—Cover panel for wiper motor

LIGHTS, 24 VOLT MODELS

Description

Headlights

289. The headlights, mounted in the wing front panels incorporate a combined reflector and front lens assembly known as the Lucas light unit. Double filament lamps give a vertical dip.

Side lights

290. The side lights are also mounted in the wing front panels, and the covers are secured by a threaded type holder.

Stop/tail lights

291. Two combined stop/tail lights similar to the side lights are fitted at the rear body.

Turnlights

292. The front turnlights are mounted in the front wing panels below the side lights. The rear turnlights are situated on the rear body above the stop/tail lights.

Number plate light

293. The number plate light is mounted on the right-hand side at the rear of the body adjacent to the turnlight.

Convoy light

294. The convoy light is situated centrally under the rear chassis member.

Instrument panel lamps

295. The instrument panel incorporates an illumination lamp, the charging, mixture control, oil pressure and main beam warning lamps.

Checks

296. The following points should be checked:

(1) Check lights for broken or cracked glass. If the headlight glass is broken the complete light unit must be renewed. If the lamps are discoloured as a result of long service they should be renewed.

(2) Ensure that the stop/tail light, turnlight and side light covers are secure.

Routine adjustments and servicing

Headlight lamp replacement

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

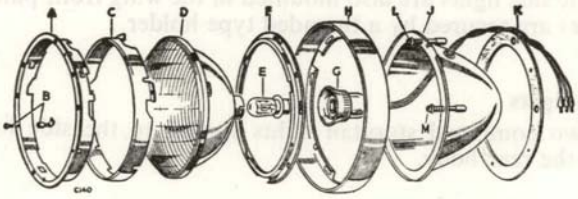


Fig. 102 Headlight, vertical dip, 24 volt models

A—Mask adaptor rim
B—Fitting securing mask adaptor rim
C—Light unit securing rim, front
D—Light unit
E—Lamp
F—Light unit securing rim, rear
G—Lamp contact housings
H—Fairing rim
J—Light shell
K—Rubber gasket
L—Adjusting screw—vertical
M—Adjusting screw—horizontal

Headlight setting (*to be carried out by a vehicle mechanic*)

298. The headlights should be set so that the main driving beams are parallel with the road surface. If adjustment is required, the vertical light 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.

When checking headlights to the dimensions shown at Fig. 103, the vehicle must be unladen, on level ground and 12 ft. (365 cm) from the level marks. Adjust so that area of concentrated light corresponds with marks.

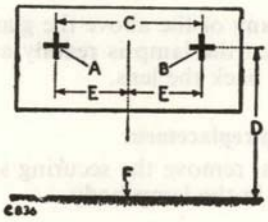


Fig. 103 Headlight setting dimensions

A—Concentrated area of light, L.H. headlight
B—Concentrated area of light, R.H. headlight
C—20 in. (508 mm)
D—37½ in. (945 mm)
E—10 11/16 in. (271 mm)
F—Ground level

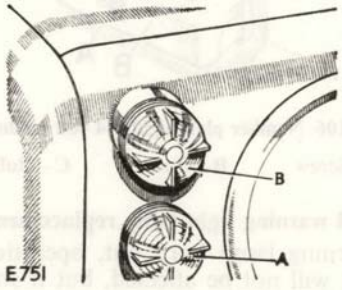


Fig. 104 Side lights and front turnlights, 24 volt models

A—Turnlight B—Front side light

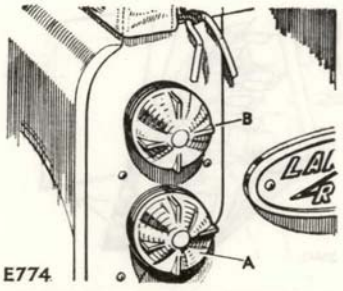


Fig. 105 Stop/tail lights and rear turnlights, 24 volt models

A—Stop/tail light B—Rear turnlight

Side, tail/stop and turnlight lamp replacement

299. All lights are of the same design, the difference being in the colour of the lens, side lights have white, rear lights red and turn-lights amber lenses.

To replace lamps in any of the above the glass is unscrewed from its threaded holder when the lamp is readily accessible and can be replaced. Finally screw back the lens.

Number plate light lamp replacement

300. To replace lamps, remove the securing screw and cover. The lamp is then accessible in the lamp body.

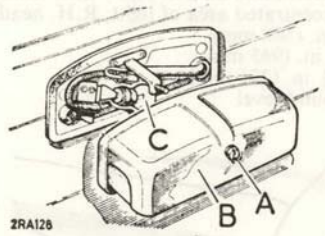


Fig. 106 Number plate light, 24 volt models

A—Screw B—Cover C—Bulb

Instrument panel and warning light lamp replacement

301. Should a warning lamp 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.

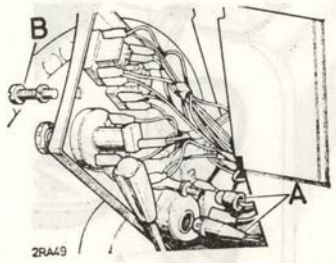


Fig. 107 Warning lights, 24 volt models

A—Bulbs B—Screw retaining instrument panel

To replace warning light bulbs:

(1) Release the speedometer cable from the clip attached to the rear side cover.

(2) Remove screws retaining the instrument panel.

(3) The instrument panel can now be eased forward for access to bulbs.

Replace as necessary.

Convoy light lamp replacement

302. To replace the lamp, remove the screws holding the rim cover and withdraw rim and glass cover. The lamp can now be removed. Push new lamp into the holder turning the lamp to the left.

NATO trailer socket

303. A NATO 12-pin trailer socket is situated on the left-hand side on the rear chassis cross member. The socket is protected by a ubber cover. (Fig. 108). See circuit diagram for wiring connections.

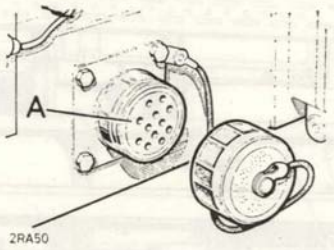


Fig. 108 NATO trailer plug socket, 24 volt models

A—NATO trailer socket

Relay for stop lamp

304. A relay for stop lamp is fitted to the bulkhead. This is completely sealed and no maintenance can be carried out.

CHAPTER 15

FITTINGS FOR RADIO STATIONS

24 VOLT MODELS

General

305. Various radio stations are authorised for this vehicle in its different roles, and to facilitate the installation the items comprising the complete installation are divided into kits—multi-purpose kit,

set kit and set ancillary kit—plus fitted for radio (FFR) equipment which is fitted in the vehicle during manufacture. The use and location of FFR equipment is described below.

306. The multi-purpose kit is fitted by the user. It consists of items which are common to all radio stations.

307. The set kit consists of the radio set, power supply unit, set carrier and standard set connectors. The set ancillary kit is 'tied' to the set kit and consists of those items required to fit the set kit into the vehicle; it includes the aerial base and special connectors for the set.

308. Twelve volt cargo vehicles are, in a measure, prepared to receive a radio station in the event of an emergency, i.e. certain items of FFR equipment may readily be transferred from an FFR vehicle to a cargo vehicle. References to cargo vehicles in the following paragraphs refer to 12 volt vehicles only.

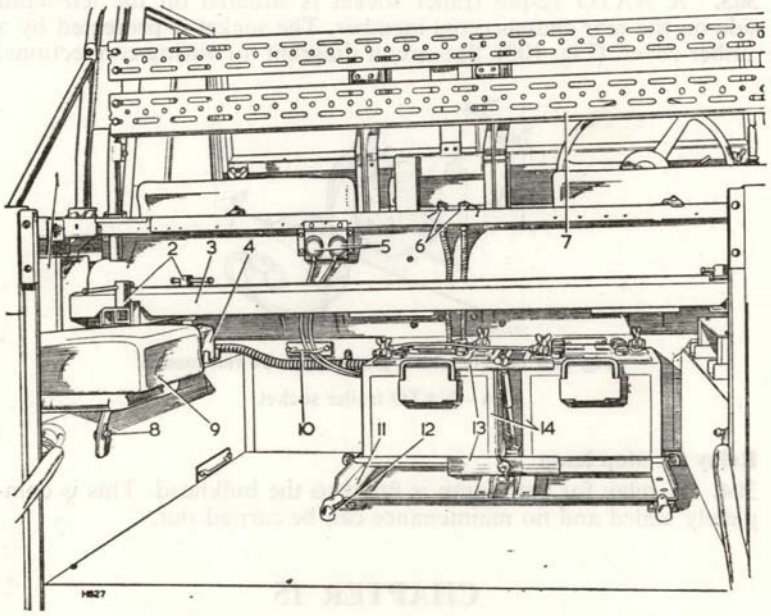


Fig. 109 Rear body compartment

1 Shunt box
2 Screw clamp for table top
3 Table top
4 Runner mounting block
5 Insulated terminals
6 Aerial co-axials
7 Slotted angle framework
8 Seat locating stud
9 Operator's seat
10 Special cleat
11 Radio battery carrier
12 Fastener for battery cover
13 Clamp plates for batteries
14 Radio batteries

309. The cargo vehicle has certain stiffening plates fitted and holes provided to accept the appropriate components. These holes are normally sealed with slave nuts and bolts or grommets, some have captive nuts to facilitate the fitting of the components.

310. Cargo vehicles have a 12 volt vehicle supply and when a station is transferred to these vehicles the radio equipment is connected direct to the radio batteries.

311. Certain items of the kit may be removed from the vehicle when it is required to use the station in the ground role.

312. The introduction of VHF radio sets to the services calls for a high degree of suppression and filtering if interference is to be avoided (see Chapter 13). Earth braids are located at the following:

(a) Seat back, R.H. and L.H.
(b) Exhaust tail pipe.
(c) Starter motor to chassis.
(d) Chassis to scuttle.
(e) Gearbox to chassis.
(f) Bonnet to scuttle.
(g) Radio table.
(h) Wiper motor.

It is essential that the connection points of these braids be maintained clean and tight.

313. Details of the set and ancillary kits, and installation instructions are included in the appropriate User Handbook listed under ASSOCIATED PUBLICATIONS on page xv.

FFR EQUIPMENT

Aerial mounting bracket

314. An aerial mounting bracket (Fig. 110) is bolted to each side of the vehicle. The brackets accommodate aerial base mountings associated with a station having two H.F. sets, e.g. radio set C11, C12 or C13; when only one H.F. set is fitted the left-hand bracket is used.

Mounting aerial base, 18 in. No. 1

315. An aerial base mounting (Fig. 110) is secured to each aerial mounting bracket and is provided to accommodate the appropriate aerial base. The stem of the mounting locates in a boss on the bracket and is secured by a captive screw which screws into a tapped hole in the bottom of the bracket. A hole is provided in the head of the screw to accept a tommy bar.

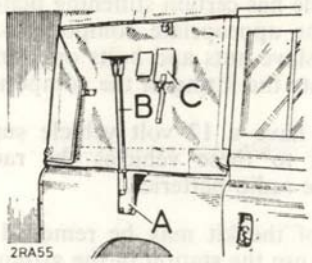


Fig. 110 Aerial mounting bracket

A—Aerial mounting bracket B—Aerial base mounting
C—Protection flap in hood

316. The bracket and mounting are quickly detachable when a minimum width is required for air transportation.

Disc rubber and rivet assembly

317. The connector from each of the aerial bases when fitted to the mountings mentioned above are led into the vehicle through a hole in a rubber disc riveted to the canvas hood adjacent to each aerial base. A protection flap (Fig. 110) is provided for the disc.

318. Discs and flaps are fitted to cargo vehicles, but the holes are temporarily sealed.

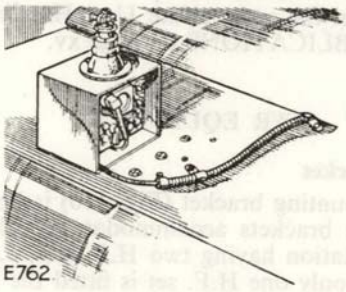


Fig. 111 Aerial tuning unit

Aerial tuning unit

Plate and screw assembly

319. In installations where two VHF sets are used the associated aerial tuning units (ATU) are fitted to the top of the front wings. In installations where only one VHF set is used, the left-hand position is used. The ATU are part of the ancillary kit and transferable with it.

320. Three holes (Fig. 112) are provided in each wing to accept the ATU's, these holes are temporarily sealed by nuts and bolts or grommets by the vehicle erector. The centre hole accepts the special winged screw securing the ATU; the two outer holes are for locating dowels.

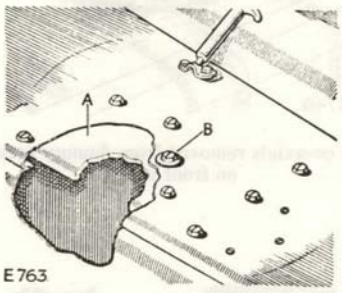


Fig. 112 Front wing strengthening plate

A—Strengthening plate B—Blanking screws

321. The front wings are strengthened to carry the ATU by plates bolted to their undersides. Similar strengthening plates are fitted to cargo vehicles. See Fig. 112.

Connector co-axial

322. Two connector co-axials (Fig. 113) are fitted to the vehicle to connect the ATU to the appropriate radio set. The rear end of the connectors (Fig. 114) are stowed vertically at the centre of the driver's compartment seat rest adjacent to the location of the VHF sets. Captive screw caps (Fig. 114) are provided to protect the ends of the connectors when disconnected. The plugs on the front end of the connectors fit on dummy sockets (Fig. 115) fitted to the inside of the wing valance beneath the engine bonnet.

323. These connectors are not transferable to a cargo vehicle.

To re-route the front end of the connector in preparation for connection to the ATU:

(1) Unscrew the locking ring securing the connector plug to the dummy socket and withdraw the plug. See Fig. 115.

(2) Release the last two cable clips (Fig. 116), each secured by a screw and captive nut. Replace the screws to seal the holes.

(3) Unscrew the two screws (Fig. 116) located in the holes leading to the ATU. Captive nuts are fitted to the underside of these holes.

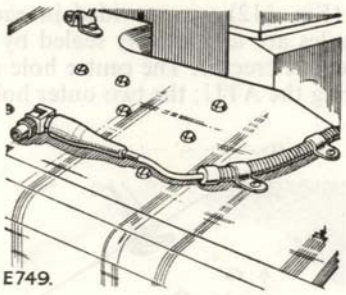


Fig. 113 Aerial co-axials removed from dummy socket and located on front wing

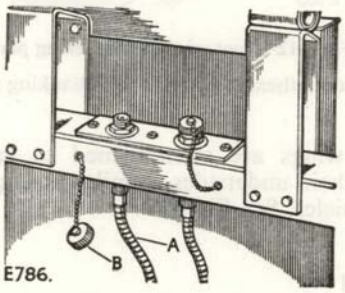


Fig. 114 Aerial co-axials in rear body

A—Aerial co-axials B—Captive screw cap

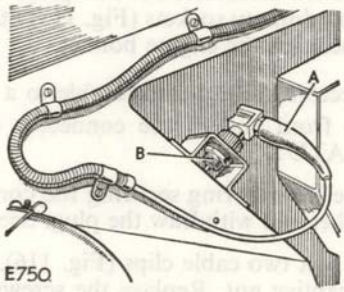


Fig. 115 Aerial co-axial and dummy socket on wing valance

A—Aerial co-axial B—Dummy socket

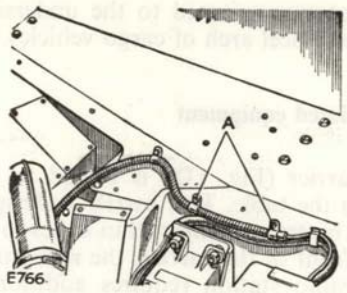


Fig. 116 Cable clips for aerial co-axial leads

A—Clips to be removed and transferred to wing top

(4) Re-route the connector securing the clips at the points uncovered at (3) above. A suitable notch is formed in each side of the engine bonnet to accommodate the connector; the connector and clips must be arranged so that the connector locates in the notch and runs neatly to the ATU. Similar notches are formed in cargo vehicle bonnets.

Table top

Runner assembly

Stiffening plate

324. A table top (Fig. 117) to carry one or two radio sets is located immediately behind the driver's compartment seat rest. It is secured by four screw clamps (Fig. 117) to a pair of runner assemblies (Fig. 117) bolted to the vehicle body wheel arches. The table top is earthed to the vehicle by copper braids, located at the right-hand side, via the runner assemblies.

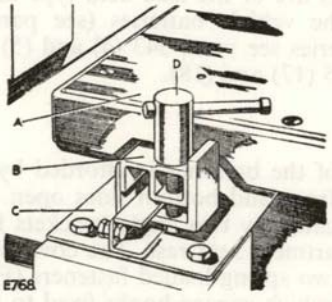


Fig. 117 Radio table

A—Table top B—Clamping bracket C—Runner assembly
D—Screw clamp

325. Stiffening plates are riveted to the underside of each wheel arch and also to the wheel arch of cargo vehicles.

Batteries and associated equipment

Battery carrier

326. A battery carrier (Fig. 118) is bolted to the floor plate of the vehicle beneath the table. This carrier is designed to house two sets of two 12 volt batteries connected in series to give 24 volts. One set is fitted at the front of the carrier, the remaining set being fitted in service if the radio station requires additional power, and is connected in parallel with the first set.

327. Each set of batteries is secured in the carrier by a centrally disposed swivel bolt with clamp plate and wing nut. The clamp plate locates on the rear top edges of the batteries (Fig. 109 (13)).

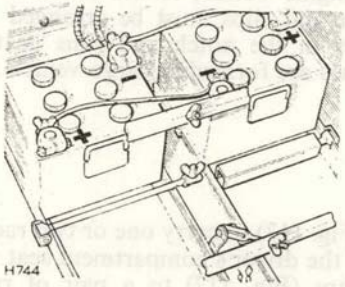


Fig. 118 Radio batteries

Batteries, see para. 266 WARNING

328. The batteries are of the lead acid type and require the same maintenance as the vehicle batteries (see para. 267). To obtain access to the batteries see para. 343 (4) and (5), and to replace the cover see para. 345 (17) and (18).

Battery cover

329. Protection of the batteries is afforded by a box-shaped steel cover, having its front and bottom sides open. The top front edge of the cover is located by two angle brackets fixed to the back of the driver's compartment seat rest. The cover is secured at its rear end by means of two spring-loaded fasteners (Fig. 109 (12)), bolted to the floor plate, which engage hooks fixed to the cover.

330. The cover is robustly designed to permit its use as a platform for the radio sets when the station is being used in the ground role.

Battery post connectors

331. Radio set battery leads are fitted with spade terminals, and when the set is used in a cargo vehicle or in the ground role, the LT interconnecting box on the set is connected directly to the battery. To accommodate these terminals, special battery post connectors are provided. These connectors are of the split clamp type to fit the battery terminal post and incorporate a lead-coated terminal stud fitted with a DT spring washer and wing nut to which the spade terminal is fitted.

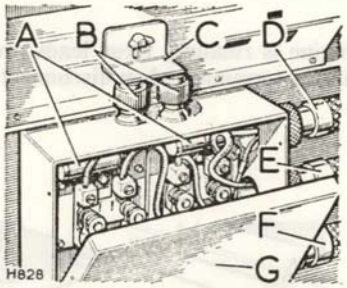


Fig. 119 Shunt box

A—Capacitors
B—Radio terminals
C—Retaining plate for radio terminals
D—Cable, shunt box to generator panel
E—Cable, ammeter feeds and vehicle battery charging circuit
F—Cable, radio battery charging circuit
G—Box cover

Shunt box

332. A shunt box (Fig. 119) is located on the left side of the vehicle adjacent to the table.

333. The radio batteries and the charging circuit are connected together at the shunt box (Fig. 119) hence the batteries are charged simultaneously with the vehicle batteries. See wiring circuit and para. 275.

334. The radio station is also connected to the shunt box at the upper red and black terminals (Fig. 119) which has a 2 microfarad F capacitor connected across its terminals.

335. The positive terminal is also connected to the generator side of the radio ammeter, and the negative terminals of the box are connected together and to earth. The radio station is therefore connected to the radio batteries via the ammeter.

336. The radio ammeter indicates radio battery charging current when the generator is 'on line', and discharge current when the generator is not 'on line' and the radio station is being fed from the radio batteries.

Insulated terminals

337. A pair of insulated terminals (Fig. 120) are mounted on a bracket attached to the front of the rear body adjacent to the radio table. These terminals provide a safe stowage for the ends of the battery/terminal box leads when disconnected from the battery.

338. When the engine is running, these leads are 'live' and must be stowed on the insulated terminals when disconnected.

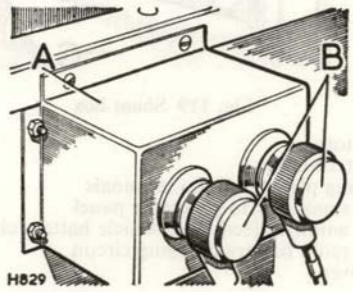


Fig. 120 Insulated terminals

A—Bracket fitted to front of rear body B—Insulated terminals

Stowage cleat

339. A stowage cleat is bolted to the rear of the bulkhead between cab and cargo compartment to accommodate the cables connecting the radio batteries to the shunt box when re-routed to stow on the insulated terminals (para. 337). See Fig. 109 (10).

Slotted angle framework

340. A slotted angle framework (Fig. 109 (1)) is mounted transversely across the vehicle just forward of the radio set table. This provides a mounting for miscellaneous radio control units.

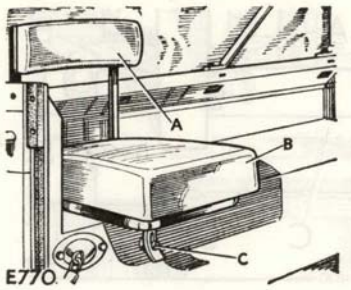


Fig. 121 Operator's seat

A—Backrest B—Seat cushion C—Strap retaining stud

Seats

341. Two operators' seats are provided (Fig. 121). These are lightweight, quickly detachable seats which rest upon the wheel arches of the vehicle and have hooks on their backs to locate on the sides of the body.

The seats are secured, particularly for cross-country work, by means of a strap fitted to the underside of the seat which locates on a stud (Fig. 121 (C)) fitted to the side of each wheel arch.

Top hat sections

342. When it is required to fit additional radio equipment this may be done by fitting three top hat sections to the rear of each wheel arch.

Slave nuts and bolts are used to plug the fixing holes for these sections.

To dismantle FFR equipment

343. To dismantle the FFR equipment for transfer to a cargo vehicle:

(1) Remove the fuse located on the left side of the instrument panel assembly and stow in some convenient bin.

(2) Unscrew the four table top clamping screws (Fig. 117 (D)).

(3) Slide the retaining brackets from the runners.

(4) Release the table earth braid (Fig. 122 (B)) from its fixing at the right-hand forward stay of the slotted angle framework (Fig. 109 (1)) and lift off the table.

(5) Release the two runner assemblies; each is secured by four bolts with nuts and locknuts. Also release the earth braid connecting each assembly to the body (Fig. 122 (D)).

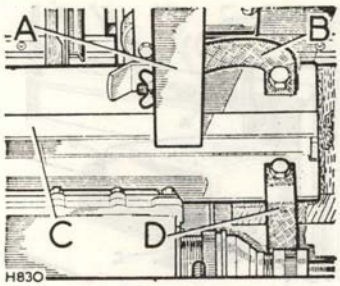


Fig. 122 Radio table earth braid

A—Table top on edge
B—Earth braid, table top to runner
C—Runner for table top
D—Earth braid, runner to generator panel

(6) Release the two spring-loaded fasteners from the hooks on the front of the battery cover.

(7) Carefully withdraw the cover rearwards from the batteries.

(8) Slacken the wing nuts securing the slotted battery interconnector and remove the connector. Do not remove the battery post connectors. If two sets of batteries are fitted, disconnect the second set similarly.

(9) Similarly release the remaining two battery connections, double back the leads and secure the spade terminals to the insulated terminals (Fig. 120 (B)) on the rear of the bulkhead. Locate the double-back section of the leads in the stowage cleat (Fig. 109 (10)) situated below the insulated terminals.

(10) Release the batteries secured by the swivel type clamps, and lift them from the carrier.

(11) Release the battery carrier secured by ten countersunk bolts with nuts and spring washers.

(12) Release the two spring-loaded fasteners used to secure the battery cover. Two bolts with spring washers secure each fastener; captive nuts are provided beneath the floor.

(13) Unscrew the four nuts and bolts securing each aerial mounting bracket (left-hand bracket for one HF set installation) and remove the bracket complete with mounting. Alternatively first remove the mounting from the bracket by unscrewing the captive screw at the bottom of the mounting and then withdrawing the mounting; use a tommy bar to turn the screw.

(14) Only if required, release the slotted angle framework. Six bolts with plain washers screwed into captive nuts secure the assembly.

(15) Release the seat strap/s from the stud/s on the wheel arches and lift the seat/s from the vehicle.

(16) Release the small table, if fitted, secured by four nuts and spring washers.

(17) Release the three top hat sections, if fitted, from each wheel arch; each section is secured by two bolts with nuts and spring washers and distance pieces.

(18) Re-route and stow the ATU co-axial connectors in the reverse sequence to that indicated at para. 323.

FFR equipment to be transferred

344. Transfer the following items of FFR equipment to the cargo vehicle:

(1) Radio batteries complete with battery post connectors.

(2) Battery inter-connectors.

(3) Battery carrier with fixing bolts, nuts and spring washers.

(4) Battery cover.

(5) Two spring-loaded fasteners with securing bolts, and spring washers for securing the battery cover.

(6) Aerial mounting brackets each with four bolts, nuts and washers.

(7) Aerial base mountings.

(8) Table top complete with four clamping screws and brackets, together with the earth braid and securing wing nut, plain washer and shake-proof washer.

(9) Two runner assemblies each complete with two mounting blocks and four bolts with nuts and locknuts together with their earth braids.

(10) If required, the slotted angle framework complete with six bolts and washers. If the framework is not required the table top earth braid securing bolt and washer must be transferred.

(11) Operator's seat or seats.

(12) If required:

(a) Small table.

(b) Six top hat sections, if fitted, each complete with two bolts, nuts and spring washers, and distance pieces.

To fit FFR equipment

345. To fit the FFR equipment in a cargo vehicle:

(1) Remove the nuts and bolts or grommets from the holes in the vehicle floor plate immediately behind the driver's compartment seat rest; ten for the battery carrier and four for the battery cover securing fasteners.

NOTE—Four additional sealed holes are provided to secure the battery carrier baseboard used in earlier radio installation kits. If the baseboard is fitted it must be removed and the holes sealed.

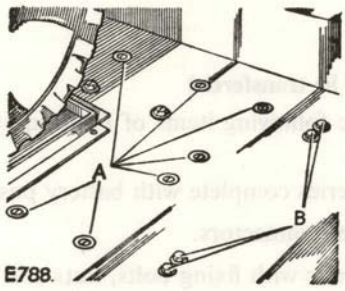


Fig. 123 Position of battery carrier holes

A—Position for battery carrier B—Position for cover fasteners

(2) Fit the battery carrier and the two spring-loaded battery cover fasteners.

(3) Locate the batteries in the carrier, forward section if only one set of batteries are being used, and secure by the swivel clamps. The clamp locates on the top rear edges of the batteries.

(4) Ensure that the battery post connectors are clean and tight.

(5) Fit the battery inter-connector and fully tighten the securing wing nuts.

(6) Remove the four nuts and bolts or grommets from the two sills immediately behind the seat rest.

(7) Fit the two runner assemblies (See Fig. 117 (C)) and their respective earth braids.

(8) If disconnected, fit the earth braid to the stud on the underside of the table and secure by the plain washer, shake-proof washer and wing nut. Ensure that the connection is clean and tight.

(9) Slide the four table top clamping brackets in the runners and secure the table top by the clamping screws. The earth braid locates in the forward, right-hand position.

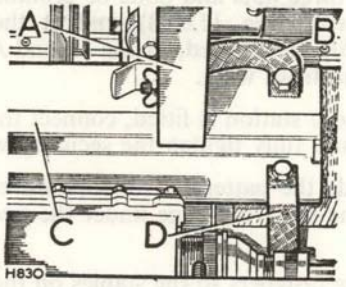


Fig. 124 Position of radio table earth braids

A—Table top on edge
B—Earth braid, table top to runner
C—Runner for radio table
D—Earth braid, runner to generator panel

(10) Remove the six nuts and bolts or grommets from the holes in the side cappings of the vehicle, adjacent to the table top, for the slotted angle framework. Fig. 125.

(11) Fit the slotted angle framework. Secure the table top earth braid by the rear bolt of the forward stay. The braid locates on the top of a shake-proof washer. Ensure that the earth connections are clean and tight.

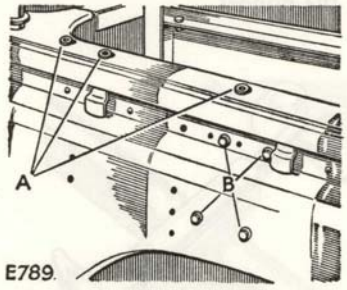


Fig. 125 Holes for angle framework and aerial bracket

A—Position for angle framework B—Position for aerial bracket

(12) Remove the four nuts and bolts or grommets from the holes (Fig. 125 (B)) in the two side plates for the aerial mounting bracket. Left-hand side for one HF set.

(13) Fit the aerial mounting bracket/s.

(14) Locate the aerial base mounting in the boss on the bracket and secure by the captive screw. Use a tommy bar to tighten the screw.

(15) Remove the three nuts and bolts or grommets from the left-hand front wing (Fig. 112 (B)) and fit the ATU assembly (see para. 320). If required, fit the second ATU assembly on the right-hand front wing.

(16) When the radio station is fitted, connect the station leads to the battery and fully tighten the securing wing nuts.

(17) Carefully slide the battery cover forward over the batteries, and locate the top front edge under the two brackets on the seat rest.

(18) Fit the spring fasteners to the staples on the battery cover.

(19) Locate the operator's seat/s in the vehicle.

CHAPTER 16

BODY

Description

346. With the exception of the dash panel, which is steel, the body panels are constructed throughout from Birmabright 2 with steel cappings and corner plates, which are galvanised.

Bonnet

347. The bonnet top panel is secured by two pull-on type catches, one at either side of the bonnet.

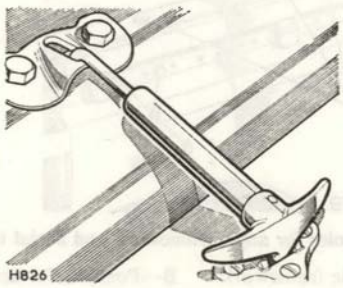


Fig. 126 Bonnet catches

To open, release the catches and raise the bonnet until it is held open by the support stay. To close, release support stay, lower and secure by catches.

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.

Spare wheel

348. The spare wheel is mounted on the bonnet panel.

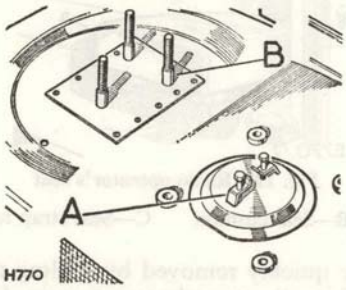


Fig. 127 Spare wheel mounting on bonnet

Rifle clips

349. Rifle clips are fitted behind the front seats.

Front seats

350. The fore-and-aft position of the driver's seat 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.

The seat backs are secured to the backrest panel in the upright position by straps; if the vehicle is parked in inclement weather without a covering, they may be folded down on to the seat cushions.

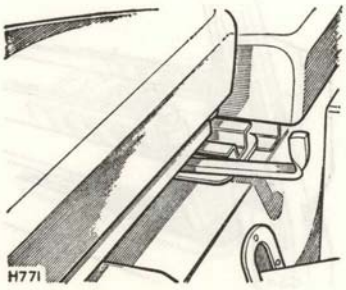


Fig. 128 Seat adjustment

Radio operator's seat, 24 volt models

351. Two seats are used, one at each side of the rear wheel arch.

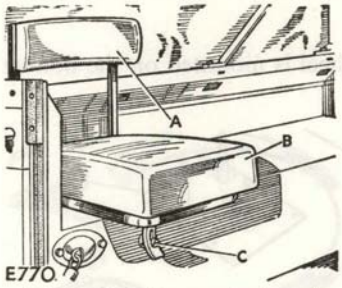


Fig. 129 Radio operator's seat

A—Backrest B—Seat cushion C—Seat strap retaining stud

The seats can be quickly removed by pulling the retaining strap off the stud and lifting the complete seat upwards.

Tool stowage

352. 12 volt models: The small tools are stowed in lockers situated in the rear wheel arches.

The starting handle and lifting jack handle extension are secured in clips on the seat back-rest panel and are accessible with the back-rests lowered.

Windscreen

353. 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. Slacken the nuts at the bottom corners of the windscreen. Lower the windscreen to the bonnet.

The windscreen wiper arms are spring-loaded and fold with the windscreen.

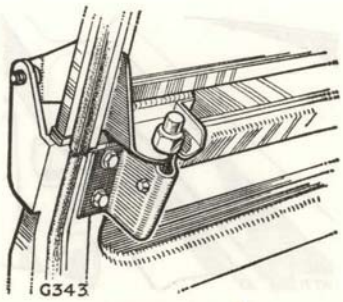


Fig. 130 Windscreen fixing screw

Windscreen wiper arm and blade replacement

354. To replace a windscreen wiper blade, pull arm away from windscreen and rotate blade off end of arm. See Fig. 131.

Refit by reversing removal procedure.

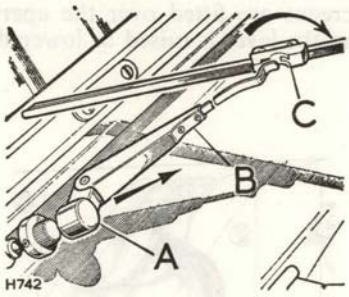


Fig. 131 Wiper blade and arm

A—Remove complete assembly by pulling in direction of arrow
B—Wiper arm pulled forward
C—Remove blade by rotating in direction of arrow

355. To replace windscreen wiper blade and arm, pull arm away from windscreen and until it is almost at right angles with the screen. Then pull complete unit off the splines of wiper spindle.

To refit, position arm on spindle and push on to splines.

Windscreen washer

356. Ensure that the windscreen washer reservoir is topped up to the level mark.

To prevent freezing in winter use one-third capacity methylated spirits.

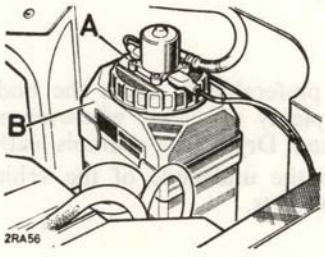


Fig. 132 Windscreen washer reservoir

A—Filler cap B—Water level

Windscreen ventilators

357. The two ventilators in the scuttle may be opened independently. Use of the ventilators may be found advantageous when traversing dusty roads as they greatly reduce the amount of dust blown into the vehicle from the rear.

Fine gauze flyscreens are fitted over the apertures. To open or close the ventilators the lever is raised or lowered as necessary.

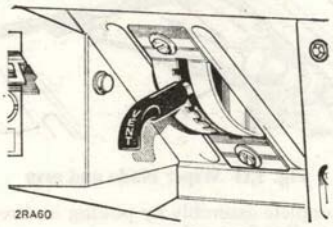


Fig. 133 Windscreen ventilators

To open ventilator push lever upwards to register in required notch, to release reverse the operation.

Doors

358. Occasionally apply a few drops of oil on the door hinges and door locks.

Tailboard

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

Cleaning body

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

Periodically wash the underside of the vehicle, to prevent the formation of mud pockets.

Jerrican holder, 12 volt models

361. A jerrican holder is provided in the body. It can be converted into an alternative spare wheel carrier if desired.

Jerrican holder, 24 volt models

362. A jerrican holder is provided between the front seats above the vehicle batteries.

Soft hood

363. The soft hood completely encloses the vehicle and can be opened at the rear to facilitate loading.

Should the hood and hood sticks have been removed at any time, they may be refitted in the following sequence:

(1) Fit the two hood sticks in the sockets at the corners of the rear body and secure with clamp arms, bolts, washers and nuts.

(2) Secure the tie tubes between the sticks by means of four self-locking nuts.

(3) Fit the intermediate hood stick between the tie tubes, securing it with locknuts.

(4) Secure the door top drain channels between the windscreen and front hood stick with bolts, plain washers and self-locking nuts.

(5) If not already fitted, secure the door rear drain channels to the front hood stick with bolts, plain washers and self-locking nuts.

(6) Place the hood over the sticks and secure it to the windscreen top rail.

(7) Secure the front support straps to the support stays at the top of the windscreen.

(8) Secure the rear hood straps to the staples on the body and the side curtain straps to the front hood stick.

(9) Pass the side ropes round the hooks at the front corners of the body, secure under the side hooks and, together with the rear ropes, which have been previously laced round the rear hood stick, to the hooks at the rear of the body.

(10) Push the rear curtain side flaps through the side pockets and secure.

If it is desired to raise the rear curtain, release the side flaps and the curtain bottom rope. Fold in the flaps and roll the curtain into three folds; secure by means of the short straps sewn inside the curtain.

Checks

364. The following points on the body should be checked:

(1) Check that nuts and screws securing the lock to the door are tight.

(2) Check that the bolts fixing the support bracket for striking plate are tight.

(3) Check that the door slightly compresses the rubber draught excluders when fully closed. If necessary, adjust the position of the striking plate by slackening the two securing bolts and nuts.

(4) Check bolts securing door hinges.

(5) Check the rear body securing bolts for tightness at the rear of chassis frame and at chassis brackets in front of the rear wheels.

(6) Check for tightness the bolts securing the front wings to the dash pillar, radiator grille, dash and wing stay.

(7) Check for tightness the bolts securing the radiator grille panel to the chassis frame.

Fire extinguisher

365. The fire extinguisher is secured to the left-hand side toe-box below the facia panel. Ensure securing screws are tight.

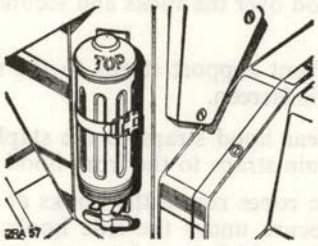


Fig. 134 Fire extinguisher

SECTION IV

FAULT-FINDING CHART

366. 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, the vehicle should receive workshop attention.

ENGINE FAILS TO START

367. Proceed as follows:

(1) Check that the ignition is switched on.

(2) Check that there is sufficient fuel in the tank.

(3) Check that the cold start control is set correctly for starting (see para. 46).

(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 batteries by switching on the headlights and pressing the starter button; if the headlights go out or are very dim when the starter is operated, the battery requires recharging. See paras. 224 and 271.

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

(5) (a) **12 volt models.** Lift the plug cover from each plug terminal in turn about $\frac{1}{4}$ in. (7 mm) and listen for the sharp snap of the spark as the engine is turned over. Sparking should be strong and regular.

(b) **24 volt models.** Remove the screened lead 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.

(6) (i) If the sparks are strong and regular, remove and clean the sparking plugs and reset the side electrode to give a gap of .029–.032 in. (0,75–0,80 mm) on 12 volt models and .015–.018 in. (0,38–0,45 mm) on 24 volt models.

(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–.016 in. (0,35–0,40 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 the vehicle should receive workshop attention.

(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 damage.

(7) Disconnect the petrol pipe from the carburetter and check that petrol is delivered to the carburetter when the hand lever on the petrol pump is operated. If petrol is not delivered from the pipe:

(i) Check that the petrol pipes and filters are clear.

(ii) Check that there are no air leaks in the suction line to the petrol pump.

(iii) Check that the diaphragm is not leaking and that the retaining screws are tight.

ENGINE STARTS BUT SOON STOPS

368. Check as detailed below:

(1) Check that the controls are set correctly (see para. 48).

(2) Check the fuel feed to the carburetter. See para. 368, item 7.

If there is little or no flow:

(i) Check the fuel level in the tank.

(ii) Check that the air vent in the filler neck is clear.

(iii) Check the fuel pump for correct operation (see para. 111).

(iv) Check that the fuel filters are clear.

(v) Check that the fuel pipes are clear (see para. 119).

(3) Check that the carburetter jets are clear, in the following order (para. 122):

(i) Slow running jet.

(ii) Slow running air bleed.

(4) Check for a fault in the ignition circuit by connecting a wire between the ammeter and the SW ((+) on 'Universal' coils) 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.

(5) Remove the carburetter top cover and check that there is no water in the float chamber.

ENGINE MISFIRES

369. 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, the charging circuit should be checked as directed under charging circuit below.

(2) (i) Check spark as detailed under para. 368, item 5 (a) for 12 volt models and item 5 (b) for 24 volt models.

If no spark is present on one or more cylinders:

(a) Check for moisture on the ignition system.

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

(c) Check the distributor cap for cracks and the plug leads for damage.

(ii) If the spark is irregular on all cylinders:

(a) Check for moisture as in (i) (a) above.

(b) Check the distributor points as in (i) (b) above.

(c) Check the cap and leads as in (i) (c) above.

(d) Check the LT 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 ammeter and the SW ((+) on 'Universal' coils) 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.

(iii) Check 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–.032 in. (0,75–0,80 mm) on 12 volt models and .015–.018 in. (0,38–0,45 mm) on 24 volt models as necessary.

(b) If still faulty, fit a new sparking plug.

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

LACK OF ENGINE POWER

370. Check the following points:

(1) Check that the carburetter throttle is opening fully.

(2) Check that the brakes are not binding and that the tyre pressures are correct.

(3) Check that the carburetter jets are not blocked.

(4) Check the ignition timing.

(5) Check the tappet adjustment.

(6) If items 1–4 are satisfactory, it is probable that the engine needs decarbonising.

CHARGING CIRCUIT

371. Proceed as follows:

(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 generator 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.

(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 generator driving belt; take up any undue slackness by turning the generator on its mounting (see para. 103).

(d) If the cause of the trouble is not apparent, the vehicle should receive workshop attention.

(2) **Battery overcharged.**

This will be indicated by burnt-out lamps, very frequent need for topping-up of battery and high hydrometer readings. This indicates that the regulator setting should be tested and adjusted.

STARTER MOTOR

372. Check points detailed below:

(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 kerosene.

(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, the vehicle should receive workshop attention. Serious damage may result to the starter if it is driven by the flywheel.

LIGHTING CIRCUITS

373. Check the following points:

(1) **Lamps give insufficient illumination.**

(a) Test the state of charge of the battery, recharging it if necessary. See paras. 224 and 271.

(b) Check the setting of the headlights (see paras. 247 and 298).

(c) If the lamps are discoloured as a result of long service they should be renewed.

(2) **Lamps light when switched on, but gradually fade out.**
As (1) (a).

(3) **Brilliance varies with speed of vehicle.**

(a) As (1) (a).

(b) Examine the battery connections, making sure that they are tight; replace faulty cables.

(4) **Lights flicker.**

Examine the circuits of the lamps for loose connections.

(5) **Failure of lights.**

(a) As (1) (a).

(b) Examine the wiring for a loose or broken connection and remedy.

GOOD SERVICING IS ESSENTIAL FOR SUCCESSFUL FORDING

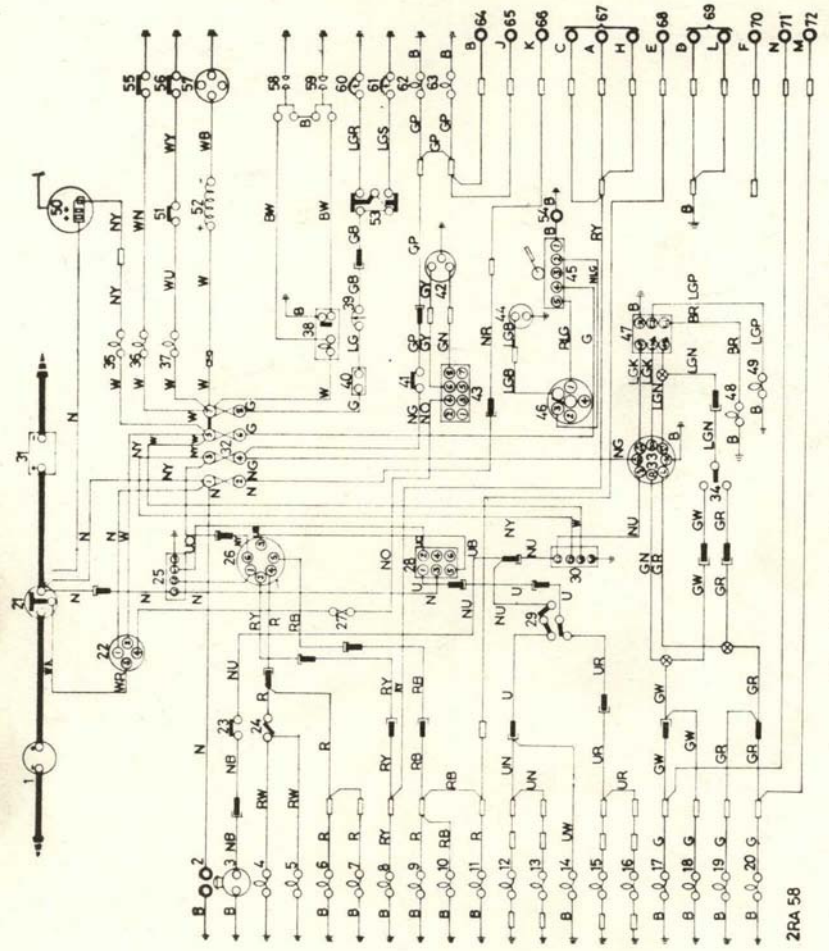


Fig. 135 Circuit diagram, 12 volt models

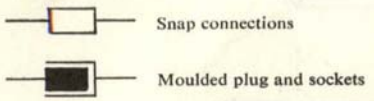
KEY TO CABLE COLOURS

B—BLACK	K—PINK	O—ORANGE	S—SLATE
D—DARK	L—LIGHT	P—PURPLE	U—BLUE
G—GREEN	N—BROWN	R—RED	W—WHITE
			Y—YELLOW

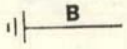
When cables have two code letters the first is the main colour, the second the tracer, i.e. RG—Red with Green

KEY TO CIRCUIT DIAGRAM

1 Starter motor
2 Inspection sockets
3 Horn
4 Instrument illumination
5 Speedometer illumination
6 Side lamp, R.H.
7 Side lamp, L.H.
8 Convoy lamp
9 Tail lamp, R.H.
10 Number plate illumination
11 Tail lamp, L.H.
12 Headlamp, main, R.H.
13 Headlamp, main, L.H.
14 Warning light, main beam
15 Headlamp, dip, R.H.
16 Headlamp, dip, L.H.
17 Turnlight, rear, R.H.
18 Turnlight, front, R.H.
19 Turnlight, front, L.H.
20 Turnlight, rear, L.H.
21 Starter solenoid
22 Ignition and starter switch
23 Horn push
24 Panel light switch
25 Relay unit for infra-red switch
26 Lighting switch, 6 way
27 In-line fuse for heater
28 Infra-red switch
29 Headlamp flasher and dip switch
30 Relay unit for lights
31 Battery, 12 volt
32 Fuses
33 Hazard warning switch
34 Turnlight switch
35 Warning light, ignition
36 Warning light, oil pressure
37 Warning light, choke
38 Brake warning light and test button switch
39 Fuel gauge
40 Voltage stabiliser
41 Stop lamp switch
42 Heater motor, 2-speed
43 Switch for heater motor
44 Windscreen washer motor
45 Windscreen wiper motor
46 Windscreen wiper/washer switch
47 Hazard and turnlight unit
48 Warning light, turnlights
49 Warning light, trailer
50 Alternator, 16ACR
51 Cold start control warning light switch
52 Ignition coil
53 Mechanical fuel change-over switch
54 Inhibitor socket for windscreen wiper motor
55 Oil pressure switch
56 Cold start control thermo switch
57 Distributor
58 Brake servo vacuum loss switch
59 Brake, dual system shuttle valve switch
60 Fuel tank, R.H.
61 Fuel tank, L.H.
62 Stop lamp, R.H.
63 Stop lamp, L.H.
64 Stop lamp } NATO socket 12 pin
65 Stop lamp } NATO socket 12 pin
66 Auxiliary } NATO socket 12 pin
67 Convoy, trailer } NATO socket 12 pin
68 Tail light, trailer } NATO socket 12 pin
69 Earth } NATO socket 12 pin
70 Spare } NATO socket 12 pin
71 Turnlight, trailer, R.H. } NATO socket 12 pin
72 Turnlight, trailer, L.H. } NATO socket 12 pin


Snap connections

Moulded plug and sockets



Earth connections via cables

Earth connections via fixing bolts


In-line connections


Fixed' clinch' connections

Unipren

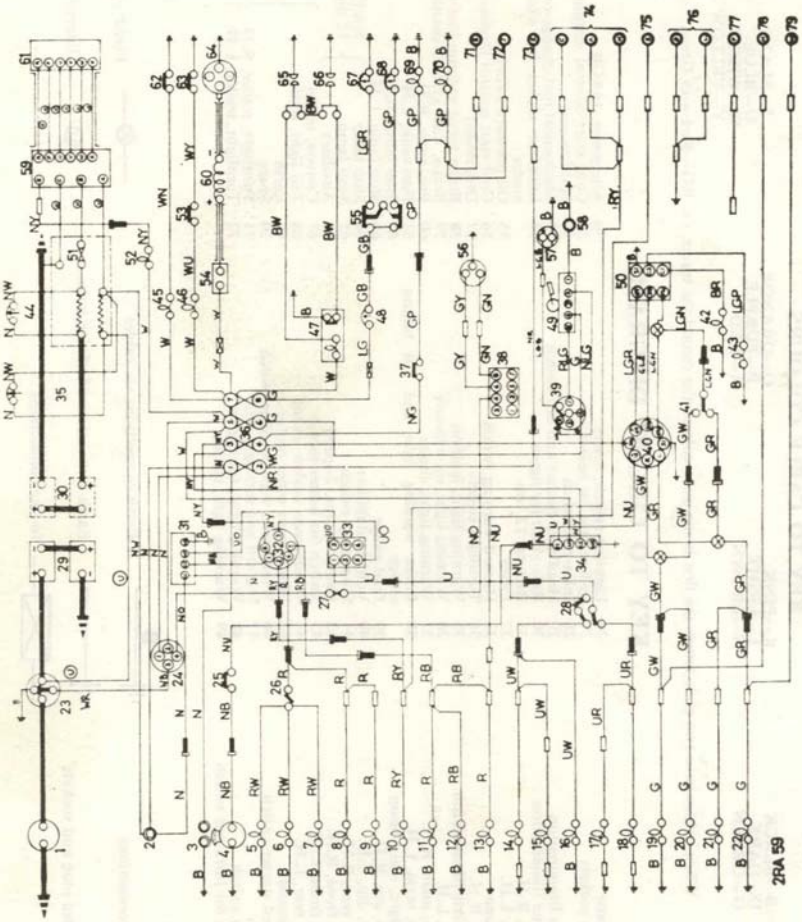


Fig. 136 Circuit diagram, 24 volt models

KEY TO CABLE COLOURS

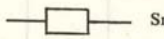
B—BLACK	L—LIGHT	P—PURPLE	U—BLUE
G—GREEN	N—BROWN	R—RED	W—WHITE
K—PINK	O—ORANGE	S—SLATE	Y—YELLOW

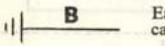
When cables have two code letters, the first is the main colour and the second the tracer, i.e. RG—Red with Green

KEY TO CIRCUIT DIAGRAM

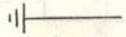
1 Starter motor
2 Terminal post
3 Inspection sockets
4 Horn
5 Instrument illumination
6 Speedometer illumination
7 Ammeter illumination
8 Side lamp, R.H.
9 Side lamp, L.H.
10 Convoy lamp
11 Tail lamp, R.H.
12 Number plate illumination
13 Tail lamp, L.H.
14 Headlamp, main, R.H.
15 Headlamp, main, L.H.
16 Warning light, headlamp main beam
17 Headlamp, dip, L.H.
18 Headlamp, dip, R.H.
19 Turnlight, rear, R.H.
20 Turnlight, front, R.H.
21 Turnlight, front, L.H.
22 Turnlight, rear, L.H.
23 Starter solenoid
24 Ignition and starter switch
25 Horn push
26 Switch for instruments' illumination
27 In-line fuse for heater
28 Headlamp flash and dip switch
29 Vehicle batteries—two 12 volt
30 Radio batteries—two 12 volt
31 Relay for infra-red switch
32 Lighting switch—6 way
33 Infra-red switch
34 Relay for lamps
35 Vehicle ammeter
36 Fuses
37 Stop light switch
38 Heater motor switch
39 Windscreen wiper/washer switch
40 Hazard warning switch
41 Turnlights switch
42 Turnlights warning light
43 Trailer warning light
44 Radio ammeter
45 Oil pressure warning light
46 Cold start warning light
47 Brake system warning light and test button
48 Fuel gauge
49 Windscreen wiper motor
50 Hazard warning and indicator unit
51 In-line fuse for radio
52 Ignition warning light
53 Cold start control switch
54 Filter unit for ignition coil
55 Mechanical fuel change-over switch
56 Heater motor, 2-speed
57 Windscreen washer motor
58 Inhibitor for wiper motor
59 Generator panel
60 Ignition coil
61 Generator
62 Oil pressure switch
63 Cold start control thermo switch
64 Distributor
65 Brake servo vacuum loss switch
66 Dual braking system shuttle valve
67 Fuel tank, R.H.
68 Fuel tank, L.H.
69 Stop light, R.H.
70 Stop light, L.H.
71 Stop lamp
72 Stop lamp
73 Auxiliary
74 Convoy
75 Tail lamp
76 Earth
77 Spare
78 Turnlight, trailer, R.H.
79 Turnlight, trailer, L.H.

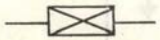
(71–79: NATO trailer socket, 12 pin)


Snap connections



Earth connections via cables


Earth connections via fixing bolts


In-line connections


Fixed 'clinch' connections


Moulded plugs and sockets

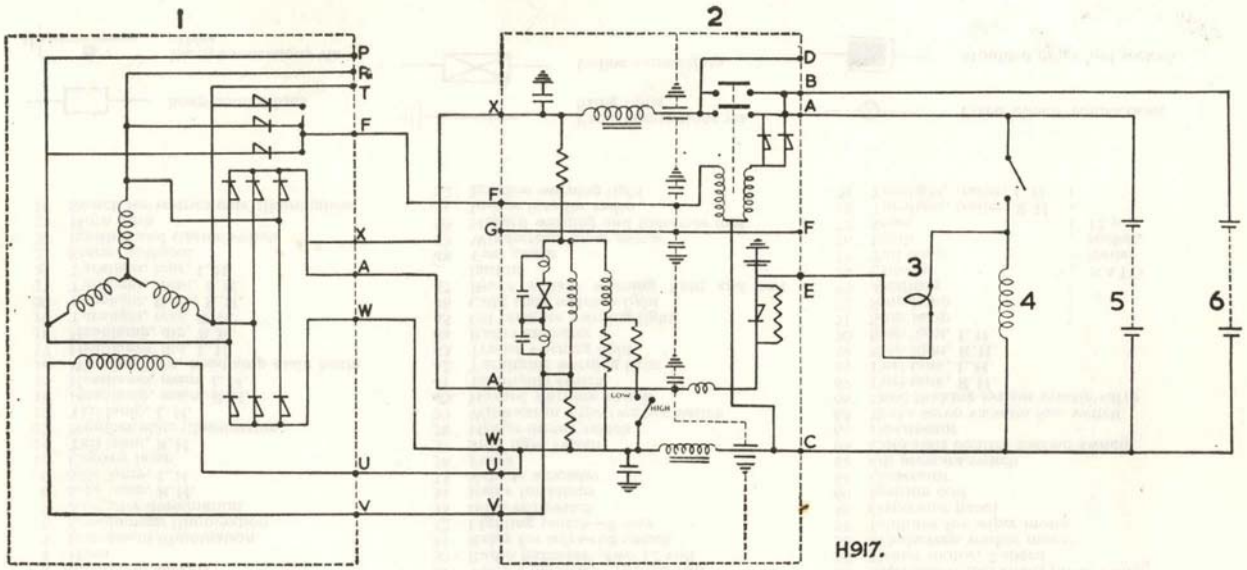


Fig. 137 Circuit diagram, charging details, 24 volt 90 amp generator

KEY TO CABLE COLOURS

B—BLACK	N—BROWN	R—RED	W—WHITE
G—GREEN	O—ORANGE	S—SLATE	Y—YELLOW
	P—PURPLE	U—BLUE	

KEY TO CIRCUIT DIAGRAM

1 Generator
2 Generator panel
3 Charging warning light
4 Ignition coil
5 Vehicle batteries
6 Radio batteries

SAFETY HARNESS

Description

374. The safety harness has two main components: a short tongue strap carrying the buckle, and a long combined diagonal shoulder and lap strap on which the mating lug is fitted.

In your own interests always use the safety harness provided, even for the shortest of journeys.

Alterations and additions must NOT be made to this harness.

Harness which has been used in an accident or has become frayed or cut must be replaced.

375. Safety harness for both driver and outer passenger is fitted to the vehicle by means of shackle bolts and shackles. See Fig. 138.

(1) If the shackle bolts are removed for any reason it is important that they are aligned as shown at Fig. 139 when they are refitted. Shackle must be allowed to rotate about shackle bolt; do not overtighten fixing nut.

Fig. 138
Shackle end fixings for safety harness

A—Bolt
B—Shackle
C—Strap
D—Nut
E—Rubber washer
F—Plain washer
G—Shackle bolt

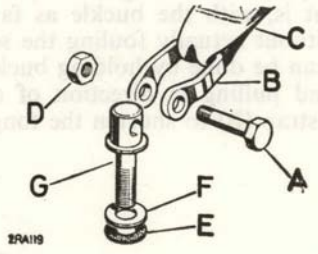
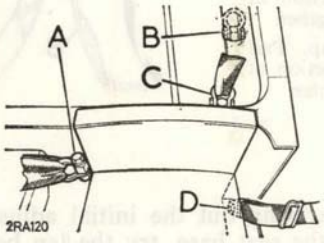


Fig. 139
Location and fitted position of safety harness shackles. Left-hand side illustrated

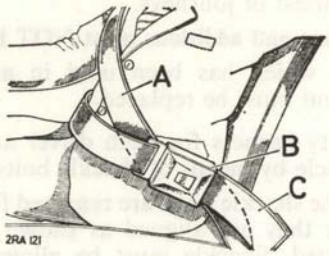
A—Inner shackle at seat base
B—Lower shackle at body side. Use this position when body is stripped for air lift
C—Upper shackle at body side
D—Outer shackle at seat base



(2) With the occupant seated in the front seat the diagonal shoulder strap should pass over the outboard shoulder as shown in Fig. 140.

Fig. 140
Showing safety harness in correct position. Right-hand position illustrated

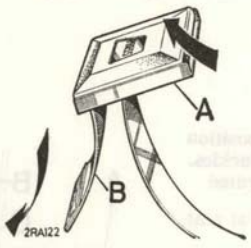
A—Diagonal shoulder strap
B—Buckle on tongue strap
C—Short tongue strap



(3) Adjust the position of tongue strap buckle to the position shown, that is, with the buckle as far round the body as possible without actually fouling the seat, as shown at Fig. 140. This can be done by holding buckle (A) at right-angles to strap and pulling in direction of arrow to lengthen or by pulling strap (B) to shorten the tongue strap. Fig. 141.

Fig. 141
Showing adjustment of tongue strap

A—Quck-release buckle. Hold buckle at right-angles to strap and pull in direction of arrow to lengthen
B—Tongue strap. Pull strap in direction of arrow to tighten



(4) Before carrying out the initial adjustment of the diagonal strap at the seat base, try the lap belt round the body for buckle position and make visual assessment of adjustment required, in accordance with instructions at item (2). See also Figs. 140 and 141.

(5) Then adjust the diagonal strap at the adjustment buckle by slackening off strap in buckle, then tightening by pulling buckle in direction of arrow 'A' or slackening by pulling buckle in direction of arrow 'B'. See Fig. 142.

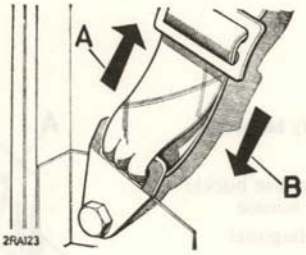


Fig. 142
Showing adjustment of diagonal strap buckle at seat base, right-hand illustrated

A—Direction to tighten
B—Direction to slacken

Day-to-day use of safety harness

376. To attain the maximum designed protection from the safety harness, it is essential that it be properly fitted and adjusted.

(1) With the occupant in the front seat, fasten the safety harness as follows:

Insert diagonal strap lug 'A' into tongue strap buckle 'B' to secure the safety harness. See Fig. 143.

Straps should be comfortably tight, just enough to allow the hand to be passed between upper shoulder strap and body. It is important to ensure that the lap strap is worn low so that it rests on the bony part of the hip.

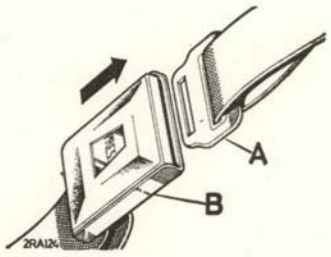


Fig. 143
Showing safety harness connection

A—Diagonal strap lug
B—Quick-release buckle

(2) To undo the buckle and leave the seat, simply press the release button on the buckle. The two sections of harness will instantly fall apart, as shown in Fig. 144.

(3) When the safety harness is not in use, the lug of diagonal strap should be stowed on 'BC' post stowage hook.

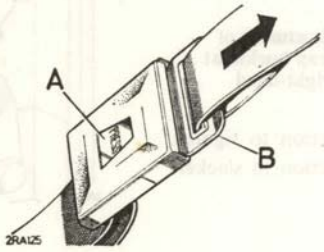


Fig. 144
Releasing safety harness buckle

A—Quick-release buckle Press to release

B—Lug of diagonal strap

Harness cleaning

377. The safety harness may be washed in hand-hot water with soap or household detergent. Do not use any other cleaning fluid.

SECTION V

DESTRUCTION OF EQUIPMENT TO PREVENT ENEMY USE

GENERAL

Destruction

378. Destruction of the equipment, when subject to capture or abandonment in the combat zone, will be undertaken by the using arm.

Degree of damage

379. (1) Methods of destruction should achieve such damage to equipment and essential spare parts that it will not be possible to restore the equipment to a usable condition in the combat zone either by repair or by cannibalization.

(2) Classified equipment must be destroyed in such degree as to prevent, whenever possible, duplication by, or revealing means of operation or function to the enemy.

(3) Any classified documents, notes, instructions or other written material pertaining to function, operation, maintenance or employment, including drawings or parts lists, must be destroyed in a manner to render them useless to the enemy.

Priorities for desctruction

380. (1) Priority must be given to the destruction of classified equipment and associated documents.

(2) When lack of time and/or stores prevents complete destruction of equipment, priority is to be given to the destruction of essential parts, and the same parts are to be destroyed on all like equipment.

(3) A guide to priorities for destruction of the vehicle and radio equipment is shown overleaf.

Equipment	*Priority*	*Parts*
Vehicle	1	Carburetter and distributor
	2	Engine block and cooling system
	3	Tyres and suspensions
	4	Hydraulic system
	5	Axle and suspensions
	6	Body
Radio (when fitted)	1	Transmitter
	2	Receiver
	3	Remote control units
	4	Power supply
	5	Antennae
	6	Tuning heads

Equipment installed in vehicles

381. Equipment installed in vehicles should be destroyed in accordance with the priorities for the equipment itself, taking into account the relative importance of the installed equipment and the vehicle itself.

Spare parts

382. The same priority, for destruction of component parts of a major item necessary to render the item inoperable, must be given to the destruction of similar components in spare parts storage areas.

Authority

383. The authority for ordering the destruction of equipment is vested in the divisional and higher commanders, who may delegate authority to subordinate commanders when the situation requires.

Reporting

384. The reporting of the destruction of equipment is to be done through command channels.

METHODS OF DESTRUCTION

385. The following information is for guidance only. Of the several means of destruction, those most generally applicable are as under.

Mechanical

386. This requires an axe, pick, crowbar or similar implement. The vehicle and radio installation should be destroyed in accordance with the priorities given in para. 376.

Burning

387. This requires gasoline, oil or other flammables.

(1) Remove and empty the portable fire extinguishers.

(2) Smash all vital components such as carburetter, distributor, spark plugs, lights, switches, instruments and control levers. Destroy the radio equipment by smashing with a heavy implement.

(3) Smash the engine block, engine cylinders, gearbox, transfer box, axle and suspensions.

(4) Drain or puncture the fuel tank. If gasoline is not readily available, collect the fuel for use as outlined in sub-para.(5).

(5) With all hatches and windows open to admit air for combustion, pour gasoline and oil in and over the entire vehicle. Ignite by means of an incendiary grenade fired from a safe distance, by a burst from a flame thrower, by a combustible train of suitable length, or other appropriate means. Take cover immediately.

Warning: *Cover must be taken without delay since an early explosion of the fuel tank may be caused by the fire. Due consideration should be given to the highly flammable nature of gasoline and its vapour. Carelessness in its use may result in painful burns.*

Gunfire

388. (1) Remove and empty the portable fire extinguishers.

(2) Smash all vital components such as carburetter, distributor, spark plugs, light switches, instruments and control levers. Destroy the radio equipment by smashing with a heavy implement.

(3) Smash the engine block, engine cylinders, gearbox, transfer box, axle and suspensions.

(4) Drain or puncture the fuel tank.

(5) Destroy the vehicle by gunfire, using adjacent gun tanks, self propelled guns, artillery, rifles, using rifle grenades or launchers, using anti-tank rockets. Fire on the vehicle, aiming at the road wheels, engine compartment and transmission. Although one well-placed direct hit may render the vehicle temporarily useless, several hits are usually required for complete destruction unless an intense fire is started, in which case the vehicle may be considered destroyed.

Warning: *Firing artillery at ranges of* 500 *yards or less should be from cover. Firing rifle grenades or anti-tank rockets should also be from cover.*

389. In general, destruction of essential parts, followed by burning, will usually be sufficient to render the vehicle, armament, and equipment useless. However, selection of the particular method of destruction requires imagination and resourcefulness in the utilization of the facilities at hand under the existing conditions. Time is usually critical.

390. If destruction is ordered, due consideration should be given to:

(1) Selection of a point of destruction that will cause greatest obstruction to enemy movement and also prevent hazard to friendly troops from fragments or ricocheting projectiles which may occur incidental to the destruction by gunfire.

(2) Observance of appropriate safety precautions.

APPENDIX 1

Cross-references to Servicing Operations

The 'Op. No.' in the table below refers to operation numbers in the Servicing Schedule contained in the Vehicle Log Book. Against the operation numbers are the numbers of the paragraphs in this Handbook, describing how the operations will be carried out and the Fig. Nos. of the appropriate illustrations.

Op. No.	*Para. No.*	*Fig. No.*	*Op. No.*	*Para. No.*	*Fig. No.*
1	97 (6)	38	24	140	57
2	97 (6)	38	25	147	—
3	93 (5), (6)	—	26	155, 165	60, 61
4	177	—	27	168	62
5	200 (1)	72	30	176	65
12	96	37	31	184	68
13	263	93	33	—	41
14	256, 258	91	38	110	47
15	103	41	45	150	59
17	187	—	46	150	59
18	132	53	49	—	28
19	182	—	52	189	—
22	88, 89	32	53	126	—
23	114	48	55	70	—

Op. No.	*Para. No.*	*Fig. No.*	*Op. No.*	*Para. No.*	*Fig. No.*
64	270	—			
65	180	—			
67	89, 90	32			
68	114	48			
69	164	61			
70	167	62			
71	176	65			
72	138)) 146)	55)) 58)			
73	154	60			
74	184	68			
77	—	41			
80	91	33			
81	108	47			
85	256	91			
90	155, 165	61			
91	168	62			
92	148	57			
93	147	—			
94	155	60			

AMENDMENTS

It is essential that this book be kept up to date with all amendments. Immediately an amendment is inserted, particulars will be entered hereunder.

Amdt. No.	*Date*	*Sig.*	*Amdt. No.*	*Date*	*Sig.*

VEHICLE TYPES AND IDENTIFICATION

This book covers the following Rover vehicles:

¾ ton 109 in. wheelbase, 24 volt models

External identification: Aerial bracket fitted to rear of body above wheelarch.

Internal identification: Two front seats. Centre seat position taken up by battery box cover.

¾ ton 109 in. wheelbase, 12 volt models

External identification: No aerial bracket fitted to rear of body.

Internal identification: Three front seats fitted.