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NEW PAGES

Remove and replace pages:-

xii-xiv, 1-2, 3-4, 9-10, 11-12, 13-14, 21-22, 45-46, 51-52, 53-54,
63-64, 65-66, 73-74, 75-76, 81-82, 83-84, 85-86, 87-88, 95-96,
109-110, 111-112, 113-114, 119-120, 121-122, 131-132, 133-134,
135-136, 141-142, 145-146, 147-148, ~~153-154~~, 157-158, 161-162,
163-164, 173-174.

AMENDMENT RECORD

Record the incorporation
of this amendment on the
Amendment Record Sheet.

LIST OF ILLUSTRATIONS—continued

Figure No.	Description	Page
88	Sequence of distributor leads	112
89	High tension cable arrangement	113
90	Battery, 12 volt models	114
91	Alternator, 12 volt models	116
92	Fuse box, 12 volt models	117
93	Wiper motor, 12 volt models	119
94	Headlamp, vertical dip, 12 volt models	120
95	Headlamp setting dimensions, 12 volt models	121
96	Sidelights and front turnlights, 12 volt models	121
97	Stop/tail lights and rear turnlights, 12 volt models	122
98	Number plate light lamp replacement	122
99	Warning lights, 12 volt models	123
100	Differential lock warning lamp replacement	123
101	Convoy light, 12 volt models	124
102	NATO trailer socket, 12 volt models	124
103	Ignition timing, 24 volt models	129
104	Electrical equipment in engine compartment, 24 volt models	130
105	Distributor in line filter, 24 volt models	131
106	Distributor maintenance, 24 volt models	131
107	Ignition timing pointer, 24 volt models	132
108	Ignition timing	133
109	Sparking plug, 24 volt models	134
110	Vehicle batteries, 24 volt models	135
111	Warning plate, rectified AC system, 24 volt models	135
112	Generator AC 90/5, 24 volt models	137
113	Generator panel No. 9, Mk 3, 24 volt models	140
114	Ammeters, 24 volt models	141
115	Shunt box	142
116	Fuse box, 24 volt models	143
117	Wiper motor, 24 volt models	145
118	Headlight, vertical dip, 24 volt models	146
119	Headlight setting dimensions, 24 volt models	147
120	Sidelight and front turnlights, 24 volt models	147
121	Stop/tail lights and rear turnlights, 24 volt models	147
122	Number plate light lamp replacement	148
123	Warning lights, 24 volt models	148
124	Differential lock warning lamp replacement	149
125	Convoy light, 24 volt models	149
126	NATO trailer plug socket, 24 volt models	150
127	Spare wheel mounting	152
128	Rear seats	152
129	Tool locker	153
129a	Jerrycan stowage	153
130	Windscreen fixing bolts	153

LIST OF ILLUSTRATIONS—*continued*

<i>Figure No.</i>	<i>Description</i>	<i>Page</i>
131	Wiper blade and arm	154
132	Windscreen washer reservoir	154
133	Fire extinguisher	156
134	Shackle end fixings for safety harness	157
135	Location and fitted position of safety harness shackles	157
136	Safety harness in correct position	158
137	Adjustment of lap harness	158
138	Adjustment of shoulder strap buckle	159
139	Safety harness connection	159
140	Tightening of harness	160
141	Releasing safety harness buckle	160
142	Circuit diagram, 12 volt models	168
143	Circuit diagram, 24 volt models	170
144	Circuit diagram, charging details, 24 volt, 90 amp generator	172
145	Winch control lever and warning light	173
146	Winch cable layout, forward pulling	175
147	Winch cable layout, rearward pulling	176
148	Winch lubrication	177
149	Rear trailer drive coupling	178
150	Rear trailer drive coupling ready for trailer	178

SECTION I

General Description

CHAPTER 1

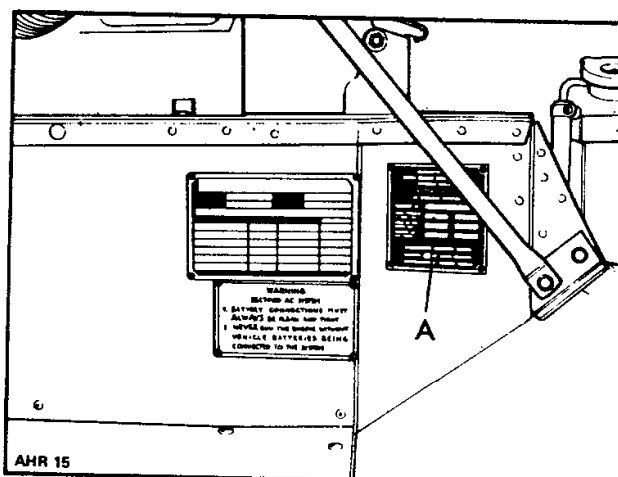
INTRODUCTION

VEHICLE SERIAL NUMBERS

1. The vehicle serial number, comprising eight digits and a suffix letter, will be found on a plate on the radiator ducting, passenger side.

Fig. 1
Vehicle Serial Number

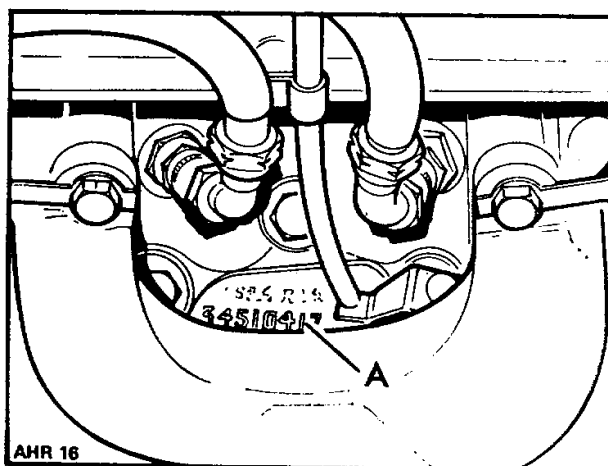
A—Vehicle Serial
Number



The engine serial number is stamped on the cylinder block on a cast pad between numbers 3 and 5 cylinders adjacent to the engine oil level dipstick.

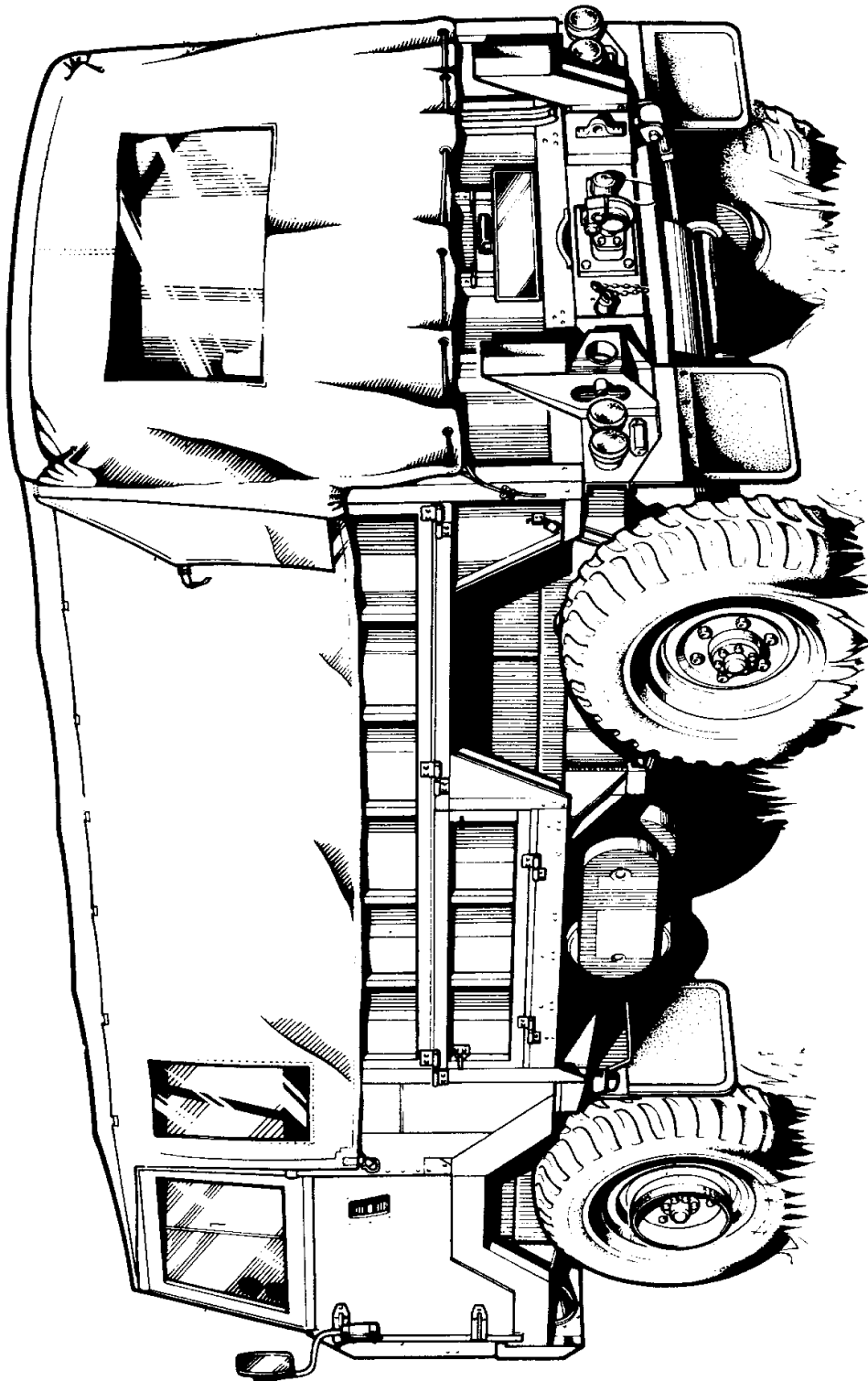
Fig. 2
Engine Serial Number

A—Engine Serial
Number



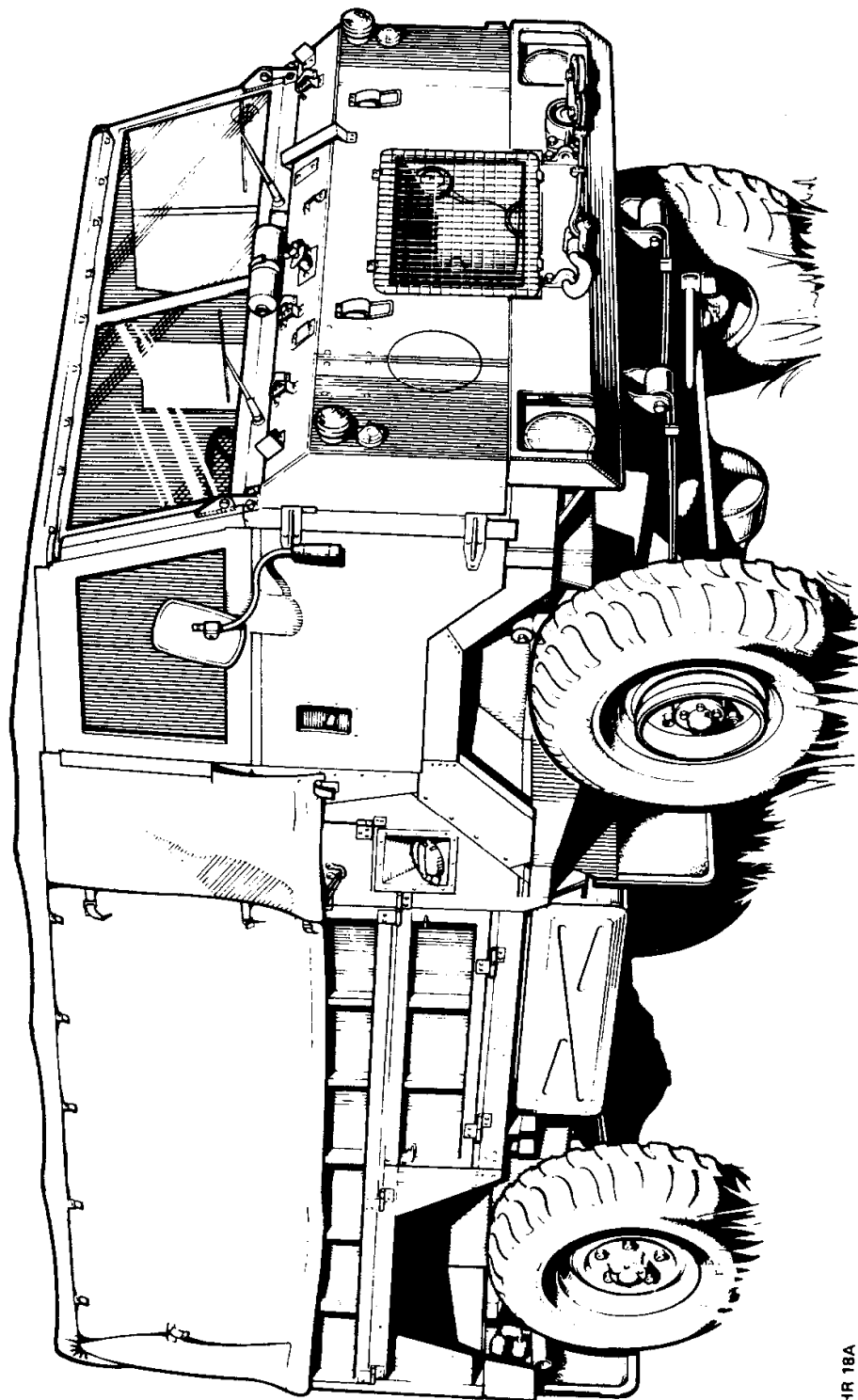
Other units bear serial numbers as detailed below, but they should not be quoted unless specifically requested:

Gearbox number: On top of the gearbox spacer between the main gearbox casing and bell housing.
Rear axle: On top of axle casing on left-hand side.
Front axle: On top of axle casing on left-hand side.



AHR 17A

Fig. 3. Three-quarter rear view, 101 in. wheelbase



AHR 18A

Fig. 4. Three-quarter front view, 101 in. wheelbase

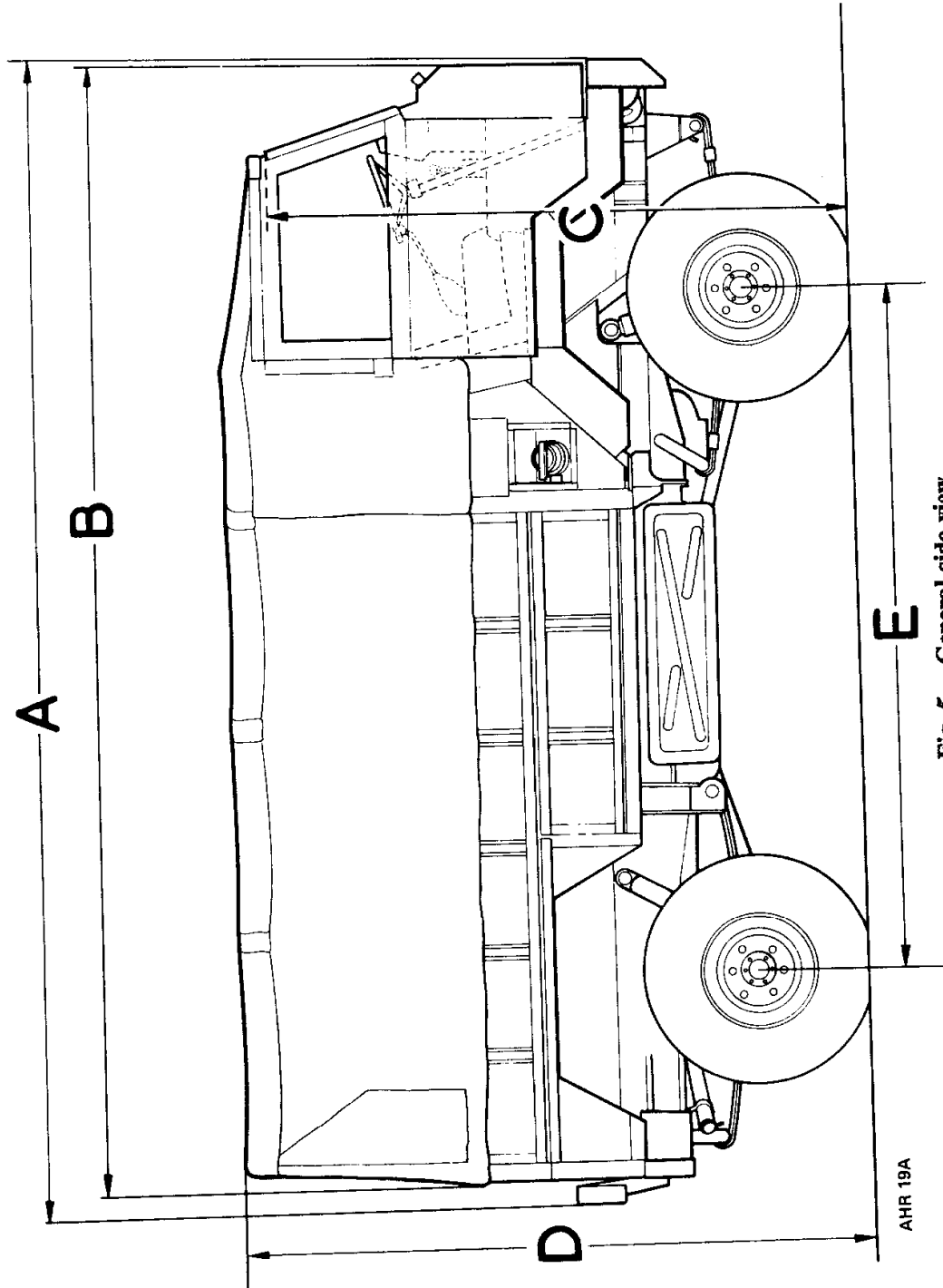


Fig. 5. General side view

CHAPTER 3

DATA

Dimensions	Rover 1 tonne 12 and 24 volt models	
	Metric	British
Overall length, fully equipped	4330 mm	170½ in.
Overall length, basic, stripped	4217 mm	166 in.
Overall width ..	1842 mm	72½ in.
Overall height:		
Over hood	2283 mm	90 in.
To top of windscreen	2138 mm	84 in.
Wheel base ..	2565 mm	101 in.
Track, front	1524 mm	60 in.
Track, rear	1549 mm	61 in.
Internal body dimensions:		
Length ..	2491 mm	98 in.
Width ..	1720 mm	67½ in.
Width between wheel boxes ..	991 mm	39 in.
Height, floor to underside of hoop sticks	1334 mm	52½ in.
Height of wheel-boxes ..	282 mm	11 in.
Turning circle ..	11,3 m	37 ft
Minimum ground clearance under axles	254 mm	10 in.

General Description

I

Performance

Average safe speed cross-country (laden)	20–30 km/h (12–18 mph) depending upon terrain
Maximum gradient climbable (dry concrete)	Greater than 60 %
Range of action on road (nominal)	545 km (340 miles)
Range of action, cross-country (nominal)	320 km (200 miles)
Fuel consumption target (normal road conditions)	20 litres/100 km (14.2 mpg)
Fuel consumption target (cross-country)	35 litres/100 km (8 mpg)
Nett power/gross wt ratio .. .	29.4 kw/tonne (38.8 bhp/ton) (12 volt)
Maximum tractive effort—top gear and high transfer engaged (100 per cent efficiency)	1002 n/tonne (229 lb/ton)
Maximum tractive effort—bottom gear and low transfer engaged (100 per cent efficiency)	14730 n/tonne (3365 lb/ton)
Tyre size	900—16 cross country (tubed)

Tyre pressures

Road conditions	Front : 2,0 kg/cm ² (28 lb/sq in) Rear : 2,5 kg/cm ² (35 lb/sq in)
-------------------------	---------------------------------------------------------------------------------------------------

Cross country conditions	Front : 1,5 kg/cm ² (21 lb/sq in) Rear : 1,5 kg/cm ² (21 lb/sq in)
----------------------------------	---------------------------------------------------------------------------------------------------

NOTE—Reference to be made to current instructions

Wheel type	Steel, well base
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I

General Description

Capacities

	<i>Litres</i>	<i>Imp. Unit</i>
Fuel ..	109,2	24 galls
Coolant (including heater) ..	14,2	25 pints
Engine sump and oil cooler	6,8	11½ pints
0.80 litre (1 pint) extra when refilling after fitting new filter ..	7,1	12½ pints
Gearbox (main) ..	2,7	4½ pints
Gearbox (transfer) ..	3,1	5½ pints
Rear axle ..	2,5	4½ pints
Front axle ..	2,5	4½ pints
Swivel pin housings (each) ..	0,8	1½ pints
Steering box ..	0,5	0.9 pints
Winch drive chain case ..	0,2	0.4 pints
Winch drive gearbox ..	0,2	0.4 pints

Engine

Type ..	Gasoline
Number of cylinders ..	8
Cylinder arrangement ..	90° Vee
Minimum bhp at clutch, nett ..	120 at 5000 rpm, 12 volt.
Minimum torque, nett ..	116 at 5000 rpm, 24 volt
	261,9 kg/m (176 lb ft) at 2500 rpm, 12 volt. 252,9 kg/m (170lb ft) 24 volt
Bore ..	88,90 mm (3.500 in.)
Stroke ..	71,12 mm (2.800 in.)
Cylinder capacity ..	3528 cc (215 cu in.)
Compression ratio ..	8.25:1
Valve timing:	
Exhaust valve peak ..	105.5° BTDC
Inlet valve peak ..	112.5° ATDC

Ignition, 12 volt models

Distributor ..	Lucas type 35 D8-G
Distributor dwell angle ..	26°—28° at 600 rpm
Distributor contact breaker gap ..	0,35—0,40 mm (0.014—0.016 in)
Ignition timing (static and dynamic)	3° BTDC at 600 rpm when using 91—93 octane fuel
	TDC at 600 rpm when using 85 octane fuel
Firing order ..	1, 8, 4, 3, 6, 5, 7, 2
Coil ..	Lucas type 16c6
Sparkign plugs (fitted on production) ..	Champion L92 Y 14 mm with suppressors

General Description**I**

Sparking plug point gap	0,60 mm (0.025 in)
Suppressor (sparking plug cables) 10,000 to 15,000 ohms	LV6/MT4/2920-99-803-5505

Ignition, 24 volt models

Distributor	Lucas twin lever concentric contact breaker (Screened)
Distributor contact breaker gap ..	0,27-0,33 mm (0.011-0.013in)
Ignition timing (static and dynamic)	3° BTDC when using 91-93 octane fuel TDC at 600 rpm when using 85 octane fuel
Firing order	1, 8, 4, 3, 6, 5, 7, 2
Coil	Lucas type 5C10
Sparking plugs (fitted on produc- tion)	Screened and waterproofed, type Champion RSL 87Y 14 mm
Sparking plug point gap	0,72 mm (0.030 in.)

Engine lubrication system

Type	Full pressure
Oil filter—internal	Gauze pump intake filter in sump
Oil filter—external	Full-flow filter, AC Delco; P.F.2.
Oil pump	Gear type, camshaft operated
Oil pressure	2,1—2,8 kg/cm ² (30—40 lb/sq in.) at 2400 rpm with engine warm
Pressure relief valve	0,56—0,84 kg/cm ² (8—12 lb/sq in.)
Oil cooler	Marston still tube, full-flow

Cooling system

Type	Pressurised 1,05 kg/cm ² (15 lb/sq in.)
Radiator	4 row fin and tube type with overflow bottle
Fan	7-bladed, cowled, 406 mm (16 in.) dia, belt driven from crankshaft

I

General Description

Circulation By centrifugal impeller type coolant pump with viscous drive to fan

Cooling control By wax type thermostat. Start to open at 79.4°—82.2°C (175°—180°F) Fully open at 93°C (195°F)

Fuel system

Fuel pump Electric, AC 6440793

Carburettors Two Zenith 175 CD 2S (internally vented)

Carburettor needle 2AY

Idling speed 600 rpm

Air cleaner AC Cyclone paper filter element 228,6 mm (9 in)

Filter Sediment bowl type and element type

Clutch

Type Single dry plate with diaphragm spring centre 266 mm (10½ in.) diameter Borg and Beck

Operation Hydraulic

Main gearbox

Type Single helical constant mesh with synchro-mesh on all forward speeds

Main gearbox ratios

Top	..	..	..	..	..	..	..	..	Direct
Third	..	..	..	..	..	..	..	..	1.50:1
Second	..	..	..	..	..	..	..	..	2.44:1
First	..	..	..	..	..	..	..	..	4.06:1
Reverse	..	..	..	..	..	..	..	..	3.66:1

Transfer gearbox

Type Two-speed reduction on main gearbox output

Controls High/Low lever, cable operated, and differential lock switch vacuum control, mounted on the radiator ducting

Operation

II

Under certain conditions a slight delay may be experienced before the differential becomes engaged, with subsequent warning light illumination. This delay is a built-in safety precaution and ensures that gears are correctly aligned before engagement commences.

NOTE: To avoid unnecessary wear and possible damage to the transmission and final drive it is important that wide throttle openings are not used when the vehicle is operating in 1st and/or 2nd gear low range with the differential lock engaged.

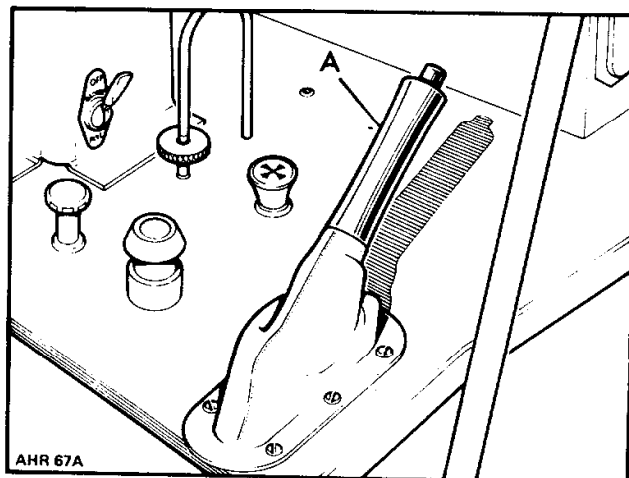
A return to the unlocked position should be made as soon as traction is regained.

Hand brake

20. The hand brake protrudes through the driver's side of the radiator ducting. 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 back.

Fig. 8
Hand brake

A—Hand brake lever



TOWED EQUIPMENT

59. Before commencing to tow, the driver of the towing vehicle and the NCO/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.

TOWING LIMITATIONS

- 59a. Any towed equipment or trailer (except the Light Gun) must not exceed 1800 kg (3970 lb) AUV. A laden trailer or equipment is **not** to be towed behind an **unladen** truck. If an unladen truck is to tow an equipment eg Light Gun, or a laden trailer, the truck must have ballast of 544 kg (1200 lb) evenly distributed over the available load space or biased towards the tail. Suitable ballast, eg sand filled ammunition boxes, should be provided under unit arrangements.
- 59b. If a laden truck is to tow an equipment eg, Light Gun or a laden trailer, the draw bar preponderance of the trailed load or equipment must not exceed 68 kg (150 lb). The 68 kg preponderance imposes a weight of 91 kg (200 lb) on the rear axle. This weight must be inclusive of the maximum rear axle permitted load (see Section 1 General Description, DATA, Table of Weights and Loads). Operated under these conditions it is not expected that the vehicle will achieve its performance Specification.

FIRE AND SAFETY PRECAUTIONS

60. Two fire extinguishers are provided with each vehicle. One is mounted externally on the scuttle above the radiator tunnel and the other internally, attached to the toe box, passenger side.

To operate proceed as follows:

- (1) Free the extinguisher by pulling free the retaining strap and lifting it out of the support cup.
- (2) Hold in hand and strike knob in base of container squarely on a hard surface. Point the nozzle towards the base of the fire.

USE OF JACKS

61. When lifting the vehicle, place the jack under the axle casing either side of the road spring.

Wheels should be chocked in all circumstances.

- (1) On level or sloping ground, the gearbox differential lock should be engaged prior to stopping the engine and parking the vehicle.

II

Operation

- (2) The differential lock is only engaged if the warning light on the instrument panel is illuminated with the ignition switched on.
- (3) If the vehicle has been stationary prior to the jacking operation, the differential lock may not operate when the switch is raised. In this case it will be necessary to start the engine, to create a vacuum and, perhaps drive the vehicle, until the warning light is illuminated. Then switch off engine.
- (4) Apply the hand brake.

Explanatory note: Owing to the fact that the vehicle is fitted with a transmission hand brake, this will not be operative if the differential lock has not been engaged and one or both rear wheels are jacked up, whilst either gearbox is in neutral. Therefore, to obtain engine braking, both gearboxes should be engaged in 1st gear and 'low' transfer respectively.

The design of the transmission is such that jacking up the rear wheels, whilst on a slope, even with the differential lock engaged, could result in limited vehicle movement as a result of the 'back-lash' in the transmission.

The hand brake is operative within transmission back-lash limits, if the rear wheels are to stay on the ground and one or both front wheels are jacked up, irrespective of the gearbox differential lock engagement. **Therefore always chock wheels.**

Warning. The vehicle has permanent four-wheel drive and under no circumstances should any test be carried out that involves jacking up one or a pair of wheels and running the vehicle in gear without first locking the gearbox differential and removing the rear propeller shaft if the front wheels are to be driven, or the front propeller shaft if the rear wheels are to be driven. Failure to observe these instructions could result in injury to personnel.

Transmission wind-up

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

- (1) Prolonged use of the differential lock in the transfer gearbox under any 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) Immediate unlocking of the differential via the switch.

75. The two detachable cylinder heads carry both the inlet and exhaust valves.
76. A removable pressed steel sump carries the oil, which is pressure fed by a gear type oil pump driven from the camshaft through skew-gearing, to the main and connecting rod bearings, camshaft 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 in the sump and an external full flow filter.
77. 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. 90.
78. A thermostat is fitted in the coolant system and the coolant is circulated by means of an impeller type pump, driven by a wedge shaped belt from the crankshaft pulley. The belt tension is adjustable.
79. The fuel supply is by an immersed type electrical fuel pump to twin Zenith-Stromberg type CD 175-2S carburetters.
80. 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.
81. On 12 volt models the sparking plugs are fitted with suppression covers, on 24 volt models they are fully screened to prevent radio interference.

ENGINE LUBRICATION

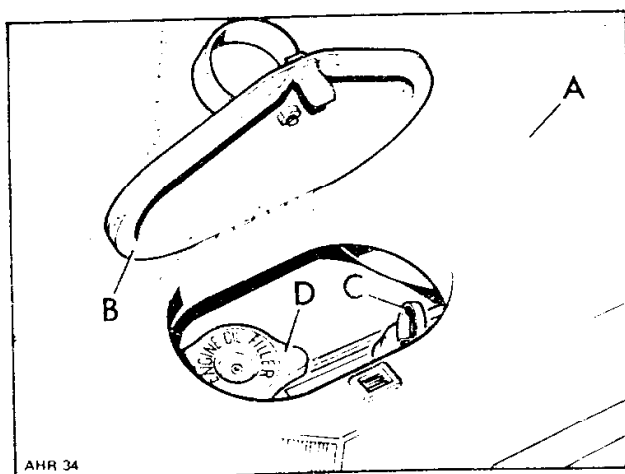
Oil level

82. 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.

The oil level dipstick is on the left-hand side of the engine and is accessible through a hatch in the engine compartment lid. The dipstick carries the marks 'High' and 'Low'. Under normal circumstances the oil level should not be allowed to fall below the minimum level mark, that is the lower line on the dipstick. The oil filler cap is on the left-hand front corner of the engine accessible through the same hatch in the engine compartment lid.

Fig. 36
Engine oil level dipstick

- A—Engine compartment lid
- B—Hinged inspection hatch
- C—Engine oil level dipstick
- D—Oil filler cap



83. 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. Release the catch securing the rear hinged inspection hatch to the engine compartment lid and lift hatch to gain access to oil level dipstick and filler cap (see Fig. 36). Withdraw the dipstick upwards through the hatch, 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 'High' mark.

Oil pressure

84. The oil pressure warning light on the instrument panel will glow when, for any reason, the pressure drops below 0,3—0,4 kg/cm² (4—6 lb/sq in). It will light up when the engine is stationary with the ignition 'on' and will go out when the engine has started and the oil pressure has built up to exceed this figure.

NOTE: The oil pressure switch is designed to cut off the fuel pump delivery if the oil pressure falls below 0,14—0,21 kg/cm² (2—3 lb/sq in.) whilst the engine is running. This is overridden for starting purposes.

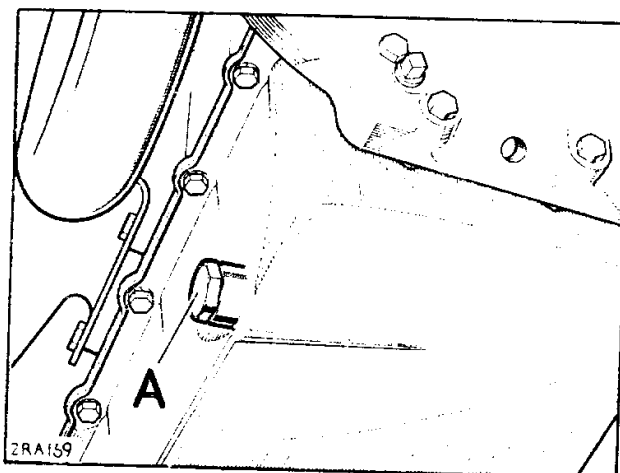
Should the warning light appear at any time when the engine is running above idling speed, stop the engine immediately and investigate the cause, usually it will be due to low oil level in the sump, or occasionally, to a choked oil pump intake filter.

Engine oil changes

85. 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 left-hand side of the sump. Allow time for the oil to drain away completely and replace the plug.

Fig. 37
Engine sump drain plug
A—Drain plug at left-hand side of engine



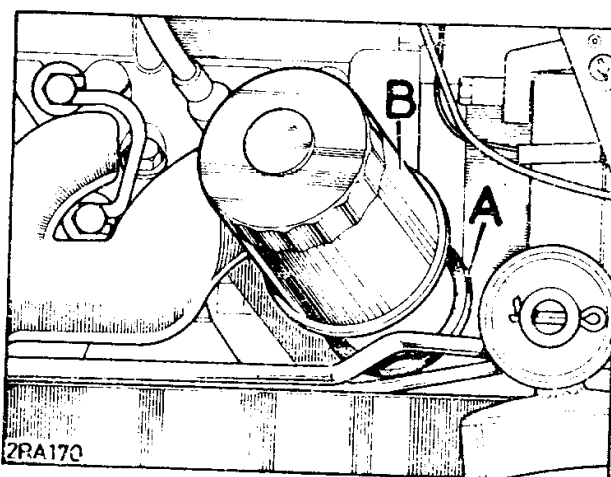
Refill with oil of the correct grade through the filler at the front of the engine, the capacity is 6,8 litres (11½ Imperial pints). See para. 82. It is essential to add a further 0,80 litres (1 pint) of engine oil when the full-flow filter has been changed, to bring the oil level up to the 'High' level mark on the dipstick.

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

86. 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 filter should be renewed at the specified intervals.

Fig. 38
Engine oil filter
A—Large rubber sealing ring
B—Oil filter



To renew the external filter proceed as follows: slacken the three quarter-turn fasteners and remove the side cover plate from the right-hand front wheel arch. Place an oil tray under the filter. Unscrew the filter anti-clockwise using a strap spanner if necessary.

III

User Servicing and Adjustments

Remove the filter complete with the sealing ring and discard. Smear a little clean engine oil on the rubber sealing ring of the new filter; screw the new filter on clockwise until the rubber washer touches the oil pump cover face, then tighten a further half-turn by hand only. Do not overtighten.

Refill with correct grade of engine oil and run engine for five minutes, then check for leaks. Check oil level and replenish if necessary. Replace the wheel arch side cover plate.

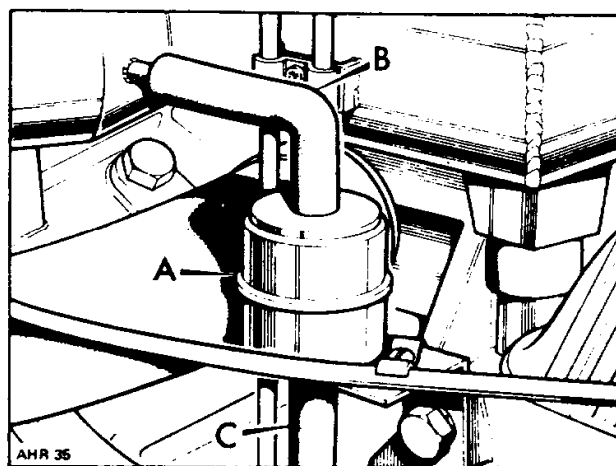
Engine breather filter

87. The engine breather filter should be replaced at the specified intervals to ensure satisfactory crankcase breathing at all times.

Withdraw the top hose from the filter. Withdraw the filter from the bottom hose. Fit new filter with the end marked 'IN' facing upwards. Alternatively if the filter is marked with arrows they must point downwards. Refit hoses.

Fig. 39
Engine breather filter

- A—Engine breather filter
- B—Top hose
- C—Bottom hose



Engine flame traps

88. Two engine flame traps are fitted, one from each top rocker cover attached to the air cleaner elbows by clips.

The flame traps should be replaced at regular intervals to ensure satisfactory operation.

Proceed as follows:

Pull the hoses clear of the retaining clips on both air cleaner elbows. Withdraw the flame traps from the hoses. Fit new flame traps into the hoses and replace hoses into the clips.

- (5) Remove the hose, close the taps and replace radiator drain plug. Refill the system with the correct mixture of anti-freeze and water to within 12,7—19 mm ($\frac{1}{2}$ — $\frac{3}{4}$ in.) of the bottom of the filler neck. Replace the filler cap. The total capacity is 14,2 litres (24 Imperial pints).
- (6) Run the engine until working temperature is reached. Switch off the engine, allow to cool and top up the coolant level as necessary.

CHAPTER 3 FUEL SYSTEM

INDEX

Fuel tank	
Description	.. .. . Fig. 49 Fuel filler, fuel tank
Checks	
Fuel pump sediment bowl and filter.	
Description	
Checks	
Clean filter sediment bowl	.. Fig. 50 Fuel sediment bowl
Main fuel filter element	.. Fig. 51 Fuel filter element
Fuel pump fault location	
Air cleaner	
Description	
Checks	
Air cleaner element cleaning and replacement	.. Fig. 52 Air cleaner location Fig. 53 Air cleaner element
Carburettor	
Description	
Carburettor hydraulic dampers	
Checks	
Routine adjustments and servicing	
Carburettor adjustment ..	.. Fig. 54 Throttle adjusting lever and throttle stop screws. Fig. 55 Carburettor balancing device Fig. 56 Throttle lever setting LH Fig. 57 Throttle lever setting RH

III

User Servicing and Adjustments

Cold start unit Fig. 58 Spring loaded pin for cold start.

99. The fuel system comprises one tank, electric fuel pump, pipe lines, sediment bowl, filter, carburetters and air cleaner.

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

FUEL TANK

Description

100. The fuel tank is fitted under the front of the rear body at the right-hand side.

The fuel filler cap is located externally above the fuel tank on the right-hand side. 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. The tank capacity is 109 litres (24 Imperial gallons).

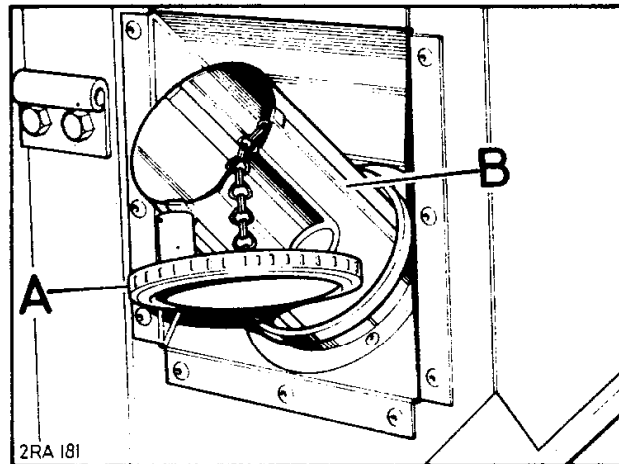


Fig. 49
Fuel filler, fuel tank

A—Fuel filler cap
B—Telescopic tube

Checks

101. The following points on the fuel tank should be checked. Any leakage which persists after tightness checks and all defects noted must be reported.

- (1) Check that the bolts securing the tank to the chassis brackets are tight.
- (2) Examine area around fuel tank drain plug for signs of leakage. Tighten drain plug if necessary.

FUEL PUMP, SEDIMENT BOWL AND FILTER

Description

102. The electrically operated fuel pump is immersed in the fuel tank and supplies fuel to the carburetters via a sediment bowl and a main filter element attached to the right-hand rear body frame in the engine compartment.

As a safety precaution the pump is only operative when the starter motor is operated, via the ignition and start switch, or with the engine running.

On 24 volt models, a voltage 'dropper' is fitted behind the right-hand front wheel 'splash panel'.

Checks

103. The following points should be checked. Any leakage which persists after tightness checks and all defects noted must be reported.

- (1) Inspect all fuel pipe unions for signs of leakage and tighten if necessary.
- (2) Check for tightness the screws securing the two halves of the sediment bowl together, and the bolts securing the unit to the engine compartment.
- (3) Check for signs of leakage from the filters, rectify if necessary.

Routine adjustments and servicing

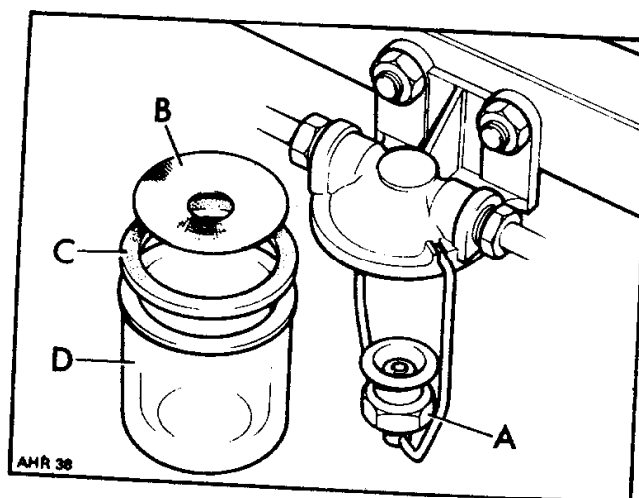
Clean filter sediment bowl (*To be carried out by a vehicle mechanic*)

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

- (a) Remove the bowl by slackening the thumb screw and swinging the retainer aside.
- (b) Remove and clean filter gauze in gasoline.
- (c) Ensure that the sealing washer is in good condition.
- (d) Refit gauze and bowl.

Fig. 50
Fuel sediment bowl

A—Retainer
B—Filter gauze
C—Sealing washer
D—Sediment bowl



III

User Servicing and Adjustments

Main fuel filter element

105. Replace the fuel filter element at the specified intervals as follows:

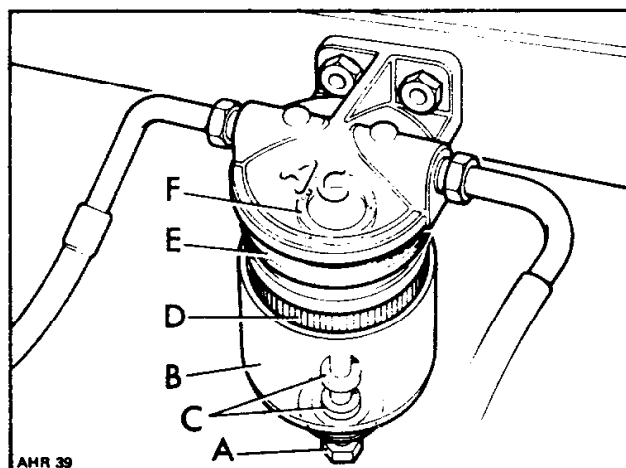
- (1) Unscrew the centre bolt and withdraw the filter bowl.
- (2) Remove the small sealing rings and remove the element.
- (3) Withdraw the large sealing ring from the underside of the filter body.

Refitting

- (4) Fit new centre sealing ring as necessary.
- (5) Fit new large sealing ring.
- (6) Fit new element with small hole downwards.
- (7) Fit new small sealing rings; replace filter bowl and tighten bolt.

Fig. 51
Fuel filter element

- A—Centre bolt
B—Filter bowl
C—Small sealing rings
D—Filter element
E—Large sealing ring
F—Centre sealing ring



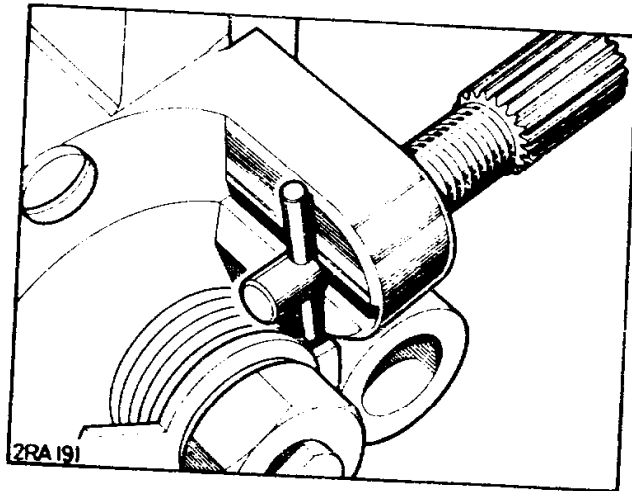
Fuel pump fault location.

106. If fuel pump trouble is suspected.

- (1) Disconnect the lead fitted with the small lucar connector from the starter motor solenoid and using extension leads touch the live positive terminal on the battery. If the fuel pump operates the fault lies within the solenoid switch and should be investigated.
- (2) Disconnect the fuel pump lead from the oil pressure inhibitor switch and touch the lead to the live positive terminal on the battery, using the extension leads. If the pump operates the fault lies within the inhibitor switch which should be replaced.

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

Fig. 58
Spring loaded pin for cold start



Draining the fuel system

115. 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 sediment bowl and carburetters. Remove the drain plug from the bottom of the tank and replace when the tank is empty; then run the engine until the fuel in the pipe-lines from the tank is exhausted.

CHAPTER 4

CLUTCH

INDEX

Description

Clutch operation

Clutch and brake fluid reservoir .. Fig. 59 Clutch and brake fluid reservoir.

Lubrication

Clutch adjustment

Bleeding the clutch system .. Fig. 60 Bleed nipple for clutch slave cylinder

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

117. The 266 mm (10½ in.) driven plate is of 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.

118. The cover assembly is of the diaphragm spring type and no maintenance procedures are necessary.

119. The clutch withdrawal mechanism is located inside the bell housing and is operated by a release fork lever.

Clutch operation

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

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

Clutch and brake fluid reservoir

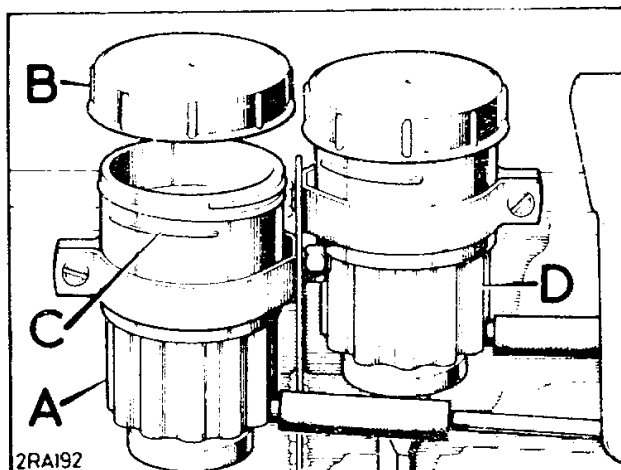
121. The combined fluid reservoir for one brake circuit and clutch is mounted adjacent to the second brake fluid reservoir at the side of the instrument panel.

Check the fluid level in reservoir as follows:

The level is correct when the fluid is just above the top of the inner reservoir; periodically remove the filler cap and replenish as necessary making sure that both inner and outer reservoirs are topped up.

Fig. 59
Clutch and brake fluid reservoir

- A—Brake fluid reservoir
- B—Filler cap
- C—Fluid level mark
- D—Brake and clutch fluid reservoir

**Lubrication**

122. The withdrawal mechanism is 'dry' and lubrication attention is not required.

The only regular lubrication required for the linkage is to the spindle shaft and pivot. Lubricate by means of an oil-can the following points:

- (1) At spindle shaft pins.
- (2) At pedal pivot bolt.

Routine adjustments and servicing**Clutch adjustment**

123. Land-Rover models are fitted with a hydrostatic clutch, that

is a clutch mechanism which is correctly set on initial assembly to give approximately 8 mm ($\frac{5}{16}$ in.) 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 pressure springs.

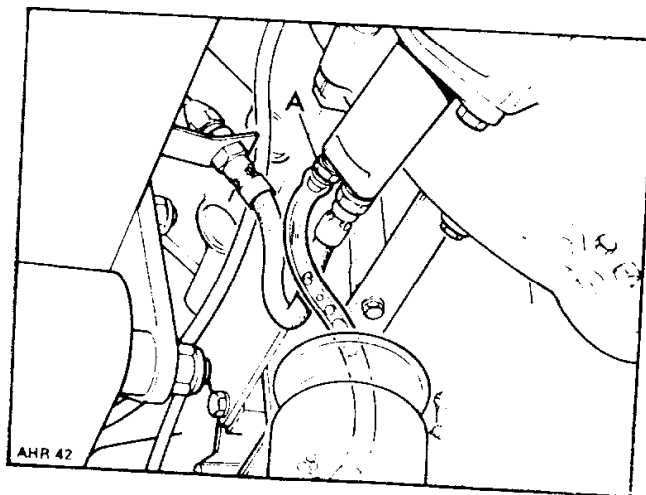
These points must be checked from time to time. Report if the free movement is incorrect.

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

124. If the level of the fluid in the inner reservoir is allowed to fall too low or if the pipe has been disconnected, the clutch will not operate correctly due to air having been absorbed in the system. This air lock must be removed by bleeding the hydraulic system at the slave cylinder.

Fig. 60
Bleed nipple for clutch
slave cylinder

A—Bleed nipple



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

III

User Servicing and Adjustments

- (iii) Hold the tube under the fluid surface and tighten the bleed screw.
- (iv) The fluid in the reservoir should be replenished throughout the operation to prevent another air-lock being formed. Note particularly that the fluid reservoir for the clutch is the small central tube in the combined reservoir.

CHAPTER 5 GEARBOX

INDEX

Main gearbox

Description

Lubrication

Oil level Fig. 61 Gearbox oil filler/level plug

Flywheel housing drain plug .. Fig. 62 Flywheel housing drain plug

Gearbox oil changes Fig. 63 Gearbox and transfer box drain plugs

Checks

Transfer gearbox

Description

Lubrication Fig. 64 Transfer box oil level

Oil level

Transfer box oil changes

Checks

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

MAIN GEARBOX

126. The complete gearbox is flexibly mounted as a unit with the engine. Synchromesh operates on all forward speeds. The remote control main gear change lever is connected to the main gearbox via rods and clevis joints.

Lubrication

127. The main gearbox is lubricated as a separate unit from the transfer gearbox and should periodically have the lubricant changed.

User Servicing and Adjustments

III

The sliding splines are lubricated on assembly and do not normally require maintenance attention. However under severe conditions or when fording, the sliding splines should be lubricated daily.

A rubber grommet is fitted over the sliding spline, to prevent ingress of dirt and water.

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

139. The following points should be checked. All defects noted must be reported:

- (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 INDEX

Description

Differential oil level Fig. 66 Rear differential lubrication

Differential oil changes front and rear

Checks

140. 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 means of a circlip.

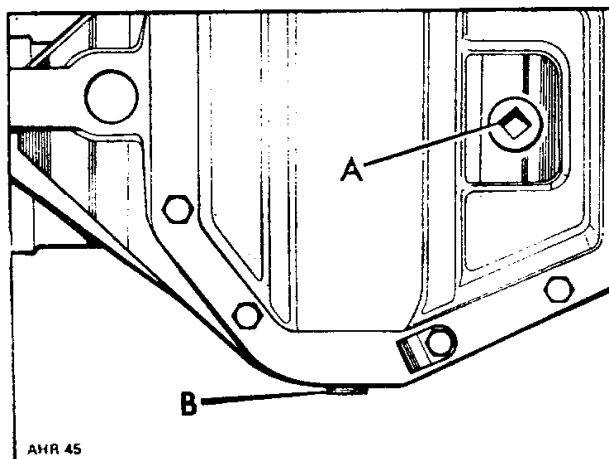
The hub bearings are greased on assembly, subsequently lubricated by the differential oil and do not require any further maintenance.

Lubrication**Differential oil level**

141. The differential oil level must be checked at the specified intervals, 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. 66.

Fig. 66
Rear differential
lubrication

A—Filler/level plug
B—Drain plug

**Differential oil changes, front and rear**

142. 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 each differential is approximately 2,5 litres (4½ Imperial pints). See Figs. 66 and 67.

Checks

143. Check the following. Any leakage which persists after tightness checks and all defects noted must be reported:

- (1) Check that the bevel pinion and hub oil seals do not leak.
- (2) Check for signs of oil leakage from the oil level and drain plugs, tighten if necessary.

CHAPTER 8

FRONT AXLE

INDEX

Description	.. .. .	Fig. 67 Front differential lubrication.
Differential oil level		
Differential oil changes		

Swivel pin housing lubrication
Swivel pin housing oil level

Fig. 68. Swivel pin housing lubrication.

Swivel pin housing oil changes
Checks

Description

144. 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.

145. 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.

146. The lower swivel pin is mounted in a taper roller bearing carried in a spherical housing, while the upper pin is carried in an asbestos resin bearing.

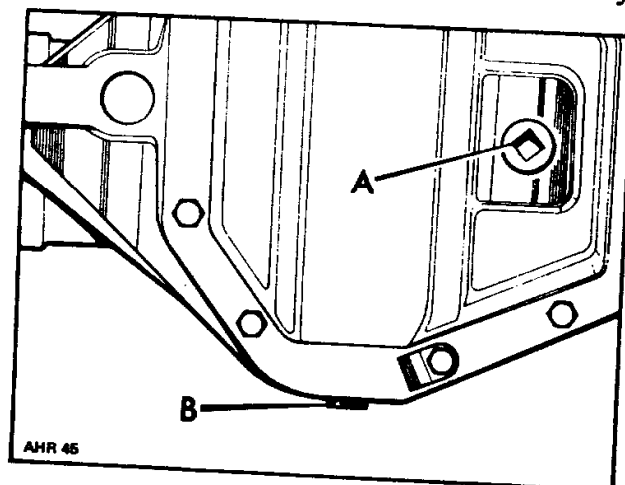
147. The spherical and swivel pin housing (known together as the universal joint housing) enclose the universal joint.

148. 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.

149. 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. 67
Front differential
lubrication

A—Filler/level plug
B—Drain plug



Lubrication

Differential oil level

150. The differential oil level must be checked at the specified intervals, immediately after a run when the oil is warm, and

III

User Servicing and Adjustments

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. See Fig. 67.

Differential oil changes

151. See para. 142.

Swivel pin housing lubrication

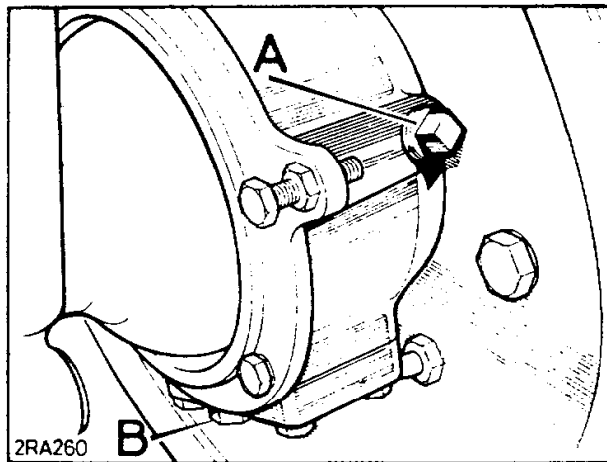
152. The front-wheel drive constant velocity joints and swivel pins receive their lubrication from the swivel pin housings. The front hub bearings are greased on assembly and subsequently lubricated by the swivel pin housing oil. They do not require any further maintenance.

Swivel pin housing oil level

153. 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 housing. See Fig. 68.

Fig. 68
Swivel pin housing
lubrication

A—Filler/level plug
B—Drain plug



Swivel pin housing oil changes

154. To change the oil, remove the drain plug from the bottom of each housing, see Fig. 68, 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 0,8 litres (1½ Imperial pints).

Checks

155. The following points should be checked. Any leakage which persists after tightness checks and all defects noted must be reported:

- (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 for signs of oil leakage from the differential and swivel pin housing filler and drain plugs, rectify if necessary.

CHAPTER 9

STEERING

RECIRCULATING BALL TYPE

Description

INDEX

Steering box lubrication	...	...	Fig. 69. Steering box oil filler plug.
Checks			
Steering ball joints			
Steering link adjustment	...	...	Fig. 70. Steering ball joint.
Front wheel alignment			
Steering relay unit	...	...	Fig. 71. Radiator grille removal.
			Fig. 72. Steering relay.

156. 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.

157. The 406 mm (16 in.) steering wheel is splined on to the inner column and secured by a nut.

158. 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 just in front of 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.

159. 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.

III

User Servicing and Adjustments

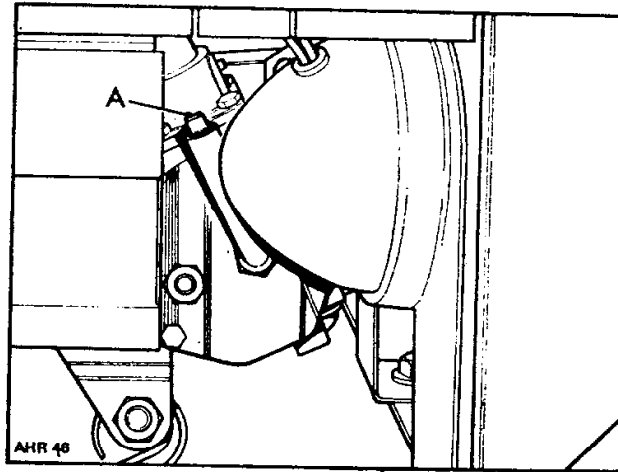
Steering box

Lubrication

160. The steering box oil level must be checked periodically and replenished as necessary to the bottom of the filler tube plug hole on the side cover plate. See Fig. 69. Access to the plug is gained from the front wheel arch adjacent to the headlight.

Fig. 69
Steering box oil filler plug

A—Filler plug



Checks

161. The following points should be checked. Any leakage which persists after tightness checks and all defects noted must be reported:

- (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.
- (5) Check for tightness the bolts securing the steering column support bracket to dash panel.
- (6) Check steering wheel backlash; adjust as necessary.
- (7) Check ball joint for wear (see para. 162).
- (8) Check ball joint rubber boots ensuring that they have not become dislodged or damaged.

Steering ball joints

162. 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. See Fig. 70. The rubber boots should be inspected to

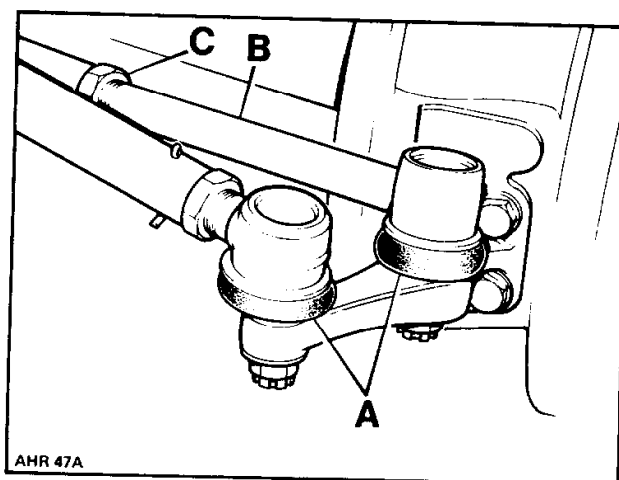
ensure that they have not become dislodged or the joint damaged.

To check for wear move the ball joint vigorously up and down. Report should there be any appreciable free movement.

Steering link adjustment

163. All ball joints are of the non-adjustable type and are screwed into the ends of the steering tubes and retained by a locknut. Adjustment to each steering link can be made by rotating the tube to lengthen or shorten the link as required.

Fig. 70
Steering ball joints
A—Steering ball joints
B—Track rod
C—Track rod locknuts



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

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

The toe-out 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 1,2–2,4 mm ($\frac{3}{64}$ – $\frac{3}{32}$ in.) more than that at the rear.
- (5) If correction is required to the toe-out, slacken the locknuts securing the ball joints to the track rod, (Fig. 70), and turn the rod to decrease or increase its effective length as necessary, until the toe-out is correct.
- (6) Tighten the ball joint locknuts to the correct torque.

III

User Servicing and Adjustments

Steering relay unit

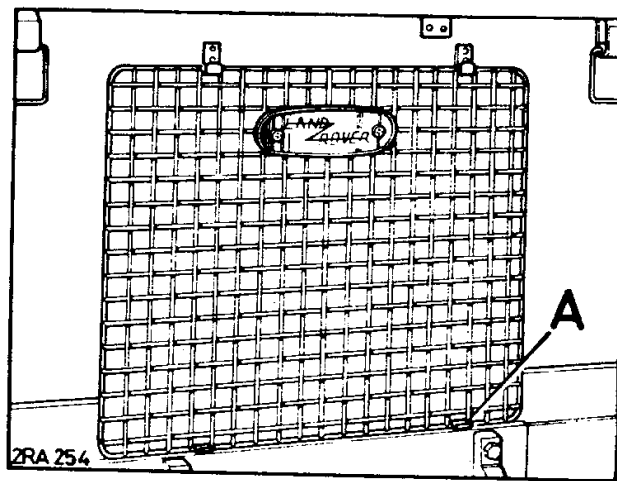
165. The steering relay unit is situated on the driver's side and is located through the No. 2 front chassis cross-member. It is accessible after removal of the radiator grille.

Periodically check oil level and top-up if necessary until the oil is visible at the base of the filler and breather holes. If significant topping-up is required, check joints for leakage and fit new joint washers as necessary. To check oil level and top up, proceed as follows:

- (1) Remove radiator grille by pulling bottom of grille clear of spring fasteners and sliding grille upwards to clear the top retaining clips.

Fig. 71
Radiator grille removal

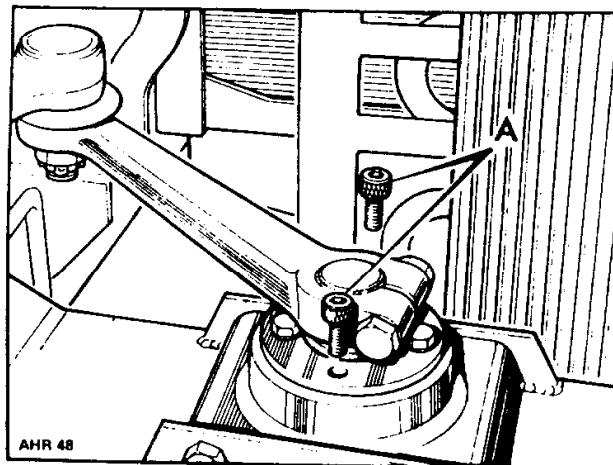
A—Spring fasteners



- (2) Remove the two hexagon headed socket screws securing the relay top cover.
- (3) Using one of the holes as an oil filler (the other acting as a breather hole) fill the relay unit with the correct grade of lubricating oil to the bottom of the filler hole.

Fig. 72
Steering relay

A—Socket screws securing relay top cover



The link is set correctly on assembly and should not normally require attention, however adjustment may be necessary after a new axle has been fitted or apportioning valve or the rear axle braking characteristics alter during service. Proceed as follows:

NOTE: No line pressure will be available at the rear wheels if the connections at the apportioning valve are incorrectly assembled. The lower connection is the input from the master cylinder.

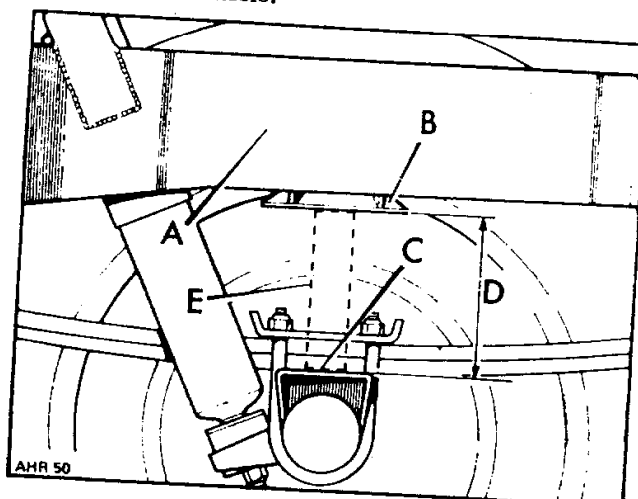
- (1) Remove the bump stop rubbers from the chassis mounting bracket.
- (2) Measure the distance vertically between the undersides of the bump stop mounting brackets on the chassis frame side member and the top of the bump stop brackets welded onto the rear axle casing on both sides of the chassis.

The distance must be 177 mm (7 in.). If necessary jack the rear springs until this measurement is achieved.

NOTE: It is recommended that gauge pieces of the correct length are obtained and inserted between the datum surfaces to ensure that the axle is parallel and at the correct position in relation to the chassis.

Fig. 78
Measuring distance
between chassis frame
and rear axle casing

- A—Chassis frame
- B—Rear bump stop mounting bracket
- C—Bump stop bracket on axle casing
- D—Distance must be 178 mm (7 in)
- E—Gauge piece



- (3) With a feeler gauge check the clearance between the apportioning valve plunger and the set bolt in the spring link housing. The clearance should be 0,050 mm (0.002in).
- (4) If adjustment is required slacken the two locking nuts on the adjustment strut end with a suitable 'tommy' bar located through the holes in the adjustment strut, screw the strut either clockwise or anti-clockwise as necessary until the clearance between the plunger and set bolt is correct.

If the reactor arm is obviously not parallel with the lower edge of the chassis side member, reset the adjustment strut until the reactor arm is approximately horizontal and parallel. Adjust the clearance to approximately 0,050 mm (0.002 in) via the set bolt on the apportioning valve and obtain final adjustment by the adjustment strut.

- (5) Tighten both adjustment strut locknuts.

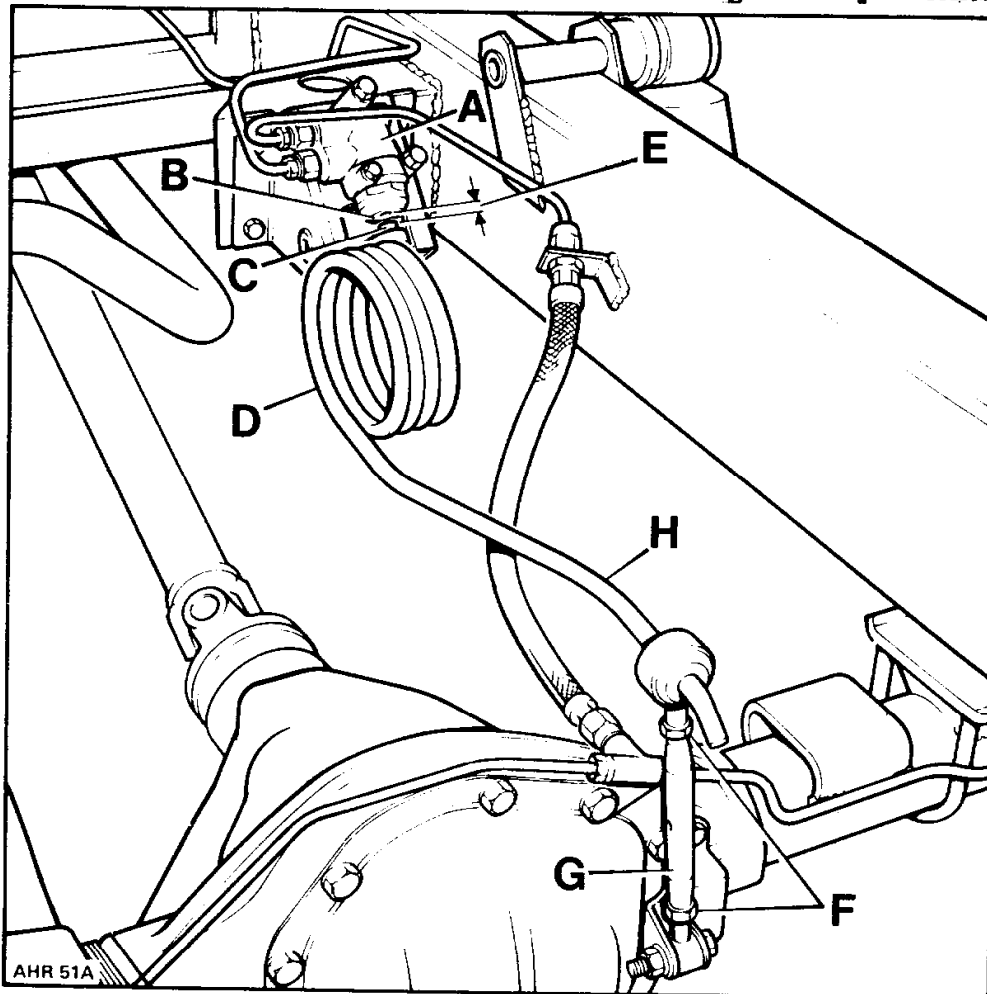


Fig. 79

Brake apportioning valve adjustment

- | | | |
|------------------------------|-------------------------------------------|-----------------------------|
| A—Apportioning valve | D—Spring link | F—Adjustment strut locknuts |
| B—Apportioning valve plunger | E—Clearance should be 0,050 mm (0.002 in) | G—Adjustment strut |
| C—Set bolt | | H—Reactor arm |

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

177. If the level of fluid in the reservoirs 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.

Continue a further two turns of the adjuster in an anti-clockwise direction.

During this operation the adjusting nut should be pressed inwards with the thumb to assist the helical return spring.

Slowly turn the adjusting nut **clockwise** until the timing lamp just comes on, or there is a voltage shown on the voltmeter.

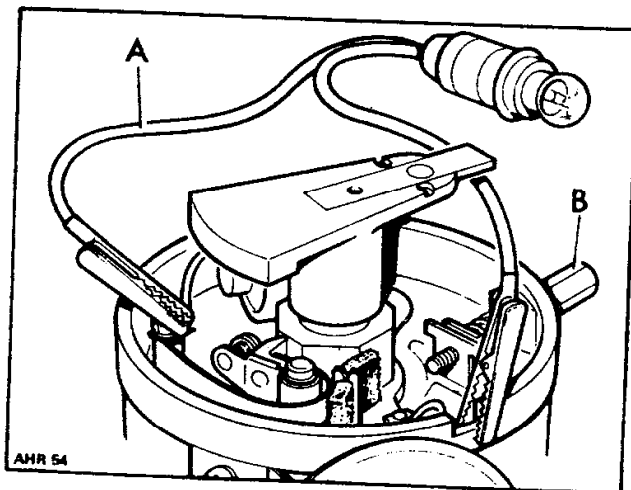
Noting the position of the flats on the adjusting nut, continue in a clockwise rotation for a further **five flats**.

Remove timing lamp or voltmeter and switch off ignition.

Replace the distributor cap.

Fig. 84
Distributor contact points
adjustment, timing lamp
method

A—Timing lamp
B—Adjusting nut



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

198. The accurate setting of the ignition timing is of extreme importance. It is therefore necessary to set the ignition timing dynamically, using a stroboscopic timing light with the engine at idling speed.

It is also important that carburetter linkage and carburetter adjustment are correct before setting ignition timing.

Ignition timing when using fuel of 91–93 octane rating.

Static ignition timing: 3° BTDC.

Dynamic ignition timing: 3° BTDC at 600 revs/min.

Set ignition timing statically to 3° BTDC prior to engine being run, by the basic timing lamp method. (This sequence is to give only an approximation in order that the engine may be run. The engine must not be started after distributor replacement until this check has been carried out).

III

User Servicing and Adjustments

Set ignition timing as follows:

Disconnect vacuum advance pipe from distributor and block the vacuum pipe by suitable means.

Couple stroboscopic timing lamp to engine following the manufacturer's instructions with the high-tension lead attached into No. 1 cylinder plug lead. (Front cylinder on left-hand bank).

Ensure engine is still idling at 600 revs/min.

Slacken distributor clamping bolt.

Turn distributor until stroboscopic lamp synchronises the timing pointer and the timing mark at 3° BTDC on the vibration damper rim.

Arrow (R) indicates direction to retard ignition. Arrow (A) indicates direction to advance ignition. (Fig. 85).

Re-tighten the distributor clamping bolt securely.

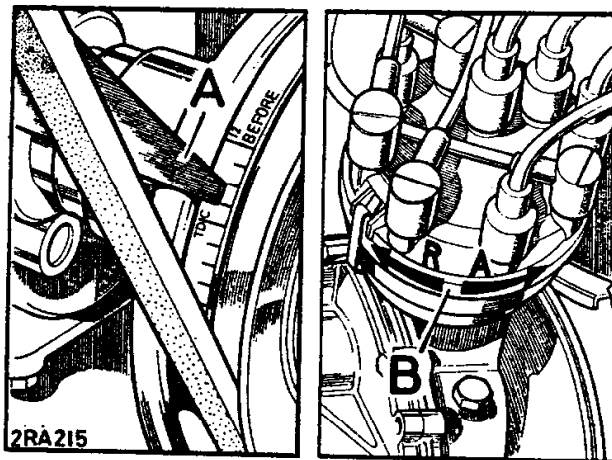
Switch off engine, disconnect stroboscopic timing lamp.

Refit vacuum advance pipe.

NOTE: Engine speed accuracy during ignition timing is of paramount importance. Any variation from the required 600 revs/min, particularly in an upward direction, will lead to wrongly set ignition timing.

Fig. 85
Ignition timing

- A—Timing pointer
- B—Distributor direction to advance or retard ignition



SPARKING PLUGS, 12 VOLT MODELS

Description

199. The sparking plugs are fitted with suppression covers. To gain access to the plugs for cleaning and gap-setting, remove the leads complete from the plugs.

Routine adjustments and servicing

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

200. At regular intervals remove the plugs, clean or replace if necessary.

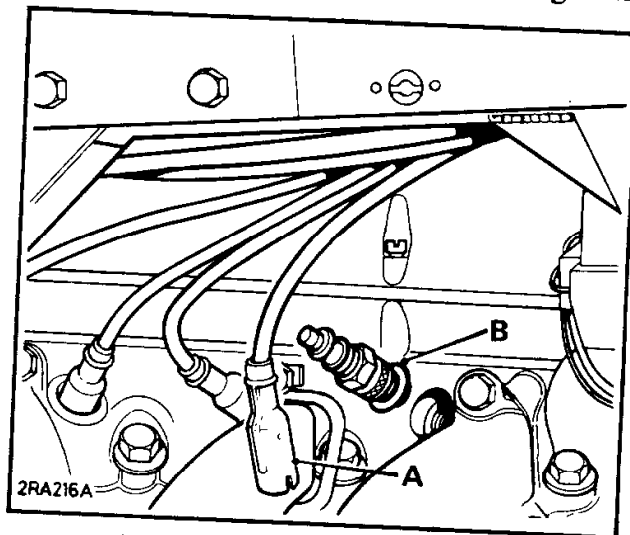
Take great care when fitting spark plugs not to cross-thread the plug, otherwise costly damage to the cylinder head will result.

If the plugs are in good condition, clean and reset the electrode gaps to 0,60 mm (0.025 in.), at the same time file the end of the central electrode until bright metal can be seen.

It is important that only the correct spark plugs are used for replacements.

Incorrect grades of plug may lead to piston over-heating and engine failure.

Fig. 86
Spark plug
A—Suppression cover for
spark plug
B—Spark plug



To remove spark plugs proceed as follows:

Remove the side panels, secured by three quarter turn fasteners from each front wing valance to allow access to the spark plugs.

Remove the leads from the spark plugs.

Remove the plugs and washers.

To clean the spark plugs:

Fit the plug into a 14 mm adaptor of an approved spark plug cleaning machine.

Wobble the plug in the adaptor with a circular motion for **three or four seconds only** with the abrasive blast in operation.

Important: Excessive abrasive blasting will lead to severe erosion of the insulator nose. Continue to wobble the plug in its adaptor with **air only**, blasting the plug for a minimum of **30 seconds**; this will remove abrasive grit from the plug cavity.

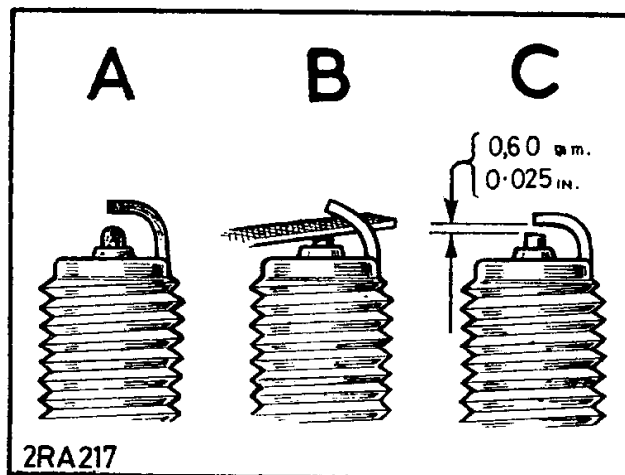
Wire-brush the plug threads; open the gap slightly, and vigorously file the electrode sparking surfaces using a point file. This operation is important to ensure correct plug operation by squaring the electrode sparking surfaces.

III

User Servicing and Adjustments

Set the electrode gap to the recommended clearance of 0,60 mm (0.025 in.).

Fig. 87
Spark plug cleaning
A—Dirty plug
B—Filing plug electrodes
C—Clean plug set to correct gap



Test the plugs in accordance with the plug cleaning machine manufacturer's recommendations.

If satisfactory the plugs may be replaced in the engine.

When pushing the leads on to the plugs, ensure that the shrouds are firmly seated on the plugs.

HIGH TENSION CABLES, 12 VOLT MODELS

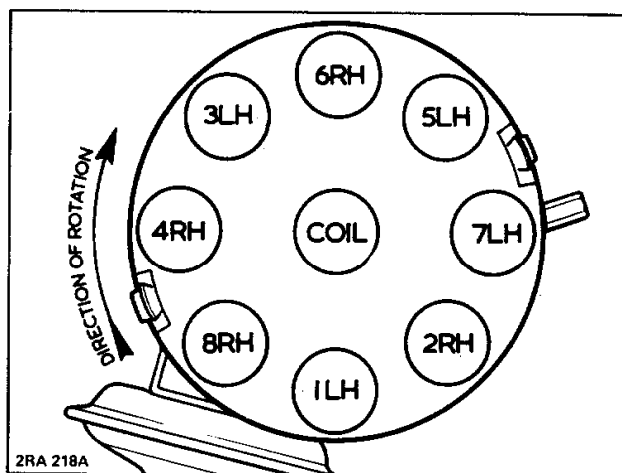
201. A careful examination should be carried out on all high-tension leads, including the coil to distributor lead.

Look for any signs of insulation cracking or deterioration and corrosion at the end contacts.

Replace any faulty leads.

The correct sequence of plug leads is shown in Fig. 88.

Fig. 88
Sequence of distributor leads

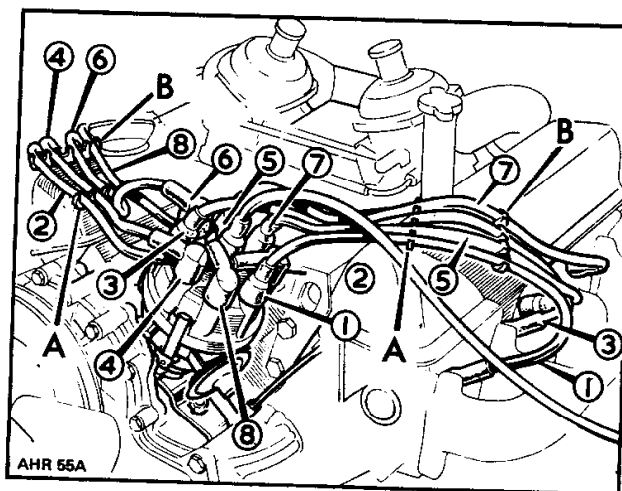


The numbers and letters in the circles indicate spark plug numbers and also the right-hand (RH) or left-hand (LH) bank of the engine to which the leads go.

High tension leads must be replaced in the correct relationship to each other, as well as ensuring correct firing order. Failure to do this may result in cross firing.

Fig. 89
High tension cable
arrangement

- A—Cable locating clips
fixed to rocker
cover
B—Loose clips locating
cables



The numbers in the arrowed circles in Fig. 89 show the plug lead numbers.

NOTE: The electrical leads to the ignition coil are fitted with male and female connectors; ensure that they are fitted to the correct blade on the coil.

BATTERY, 12 VOLT MODELS

Description

202. The negative earth 12 volt battery is carried behind the passenger seat and is secured by 'J' bolts in an angle mounting frame. An aluminium cover is provided and is attached by four quarter-turn fasteners.

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

Checks

203. Check the following points. All defects noted must be reported:

- (1) Check the state of charge of the battery. See para. 205.
- (2) Check that the battery terminals are clean. Clean if necessary by removing the lugs, and refit as described in para. 206.
- (3) Check that the battery clamps are secure.
- (4) Check that the lead from the battery to starter solenoid is not damaged and is secured tightly at the starter motor.

III

User Servicing and Adjustments

- (5) Check that the earth lead is not damaged and has a good connection with the chassis member.
- (6) Ensure that the vent holes in the centre of the filler plugs are clear.
- (7) Ensure that the bolts and nuts securing battery support to the mounting frame are tight.

Routine adjustments and servicing

Topping-up the battery

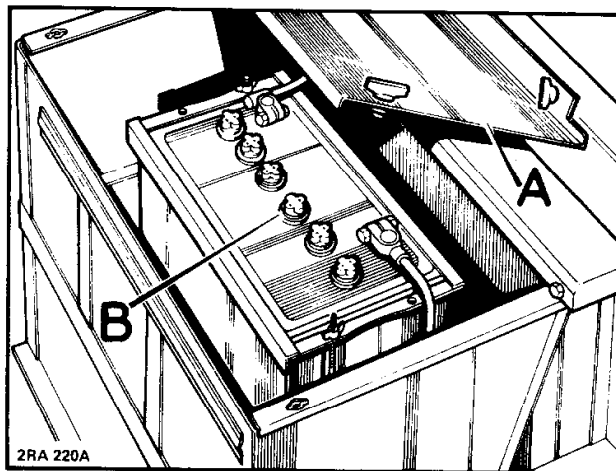
204. Proceed as follows:

- (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.

If the vehicle is used in high ambient temperature or is run at a high charge rate, it may be necessary to top-up daily.

Fig. 90
Battery, 12 volt models

A—Battery cover
B—Filler plug



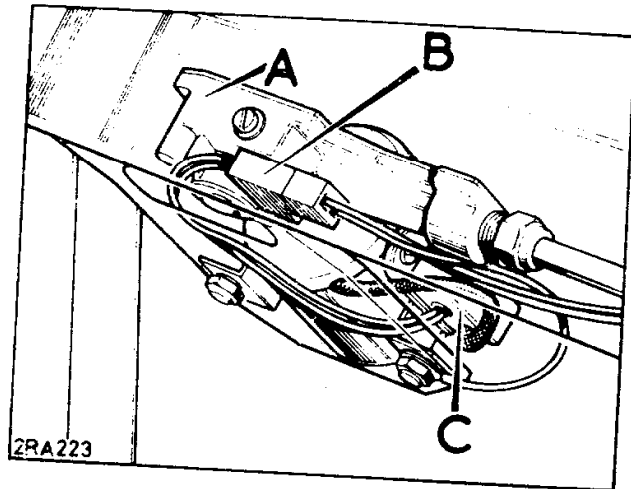
In very cold weather it is essential that the vehicle be used immediately after topping-up, to ensure that the distilled water is thoroughly mixed with the electrolyte. Neglect of this precaution may result in the distilled water freezing and causing damage to the battery.

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

205. Occasionally check the condition of the battery by measuring the specific gravity of the electrolyte in each cell, using a hydrometer.

Fig. 93
Wiper motor, 12 volt
models

- A—Wiper motor cover removed
- B—Wiring plug
- C—Suppressor for wiper motor



LIGHTS, 12 VOLT MODELS

Description

Headlights

217. The headlights, mounted in the front chassis cross-member, incorporate a combined reflector and front lens assembly known as the Lucas light unit. Double filament lamps give a vertical dip.

Side lights

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

Stop/tail lights

219. Two combined stop/tail lights similar to the turnlights are fitted on the rear chassis cross-member.

Turnlights

220. The front turnlights are mounted in the front wing panels above the side lights. The rear turnlights are situated on the rear chassis cross-member adjacent to the stop/tail lights.

Number plate light

221. The number plate light is mounted on a hinged plate on the tailboard and is secured in the vertical position with a nylon push-in clip. Pull number plate free of clip when vehicle is operated with tailboard down.

Convoy light

222. The convoy light is situated on the inner side of the right-hand rear chassis cross-member.

III

User Servicing and Adjustments

Instrument panel lamps

223. The instrument panel incorporates illumination lamps, the charging, cold start control, oil pressure and main beam warning lamps, turnlight and trailer warning lamps, dual brake system warning lamp and check button, hazard warning lamp and gearbox differential lock warning lamp.

Checks

224. The following points should be checked. All defects noted must be reported:

- (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.

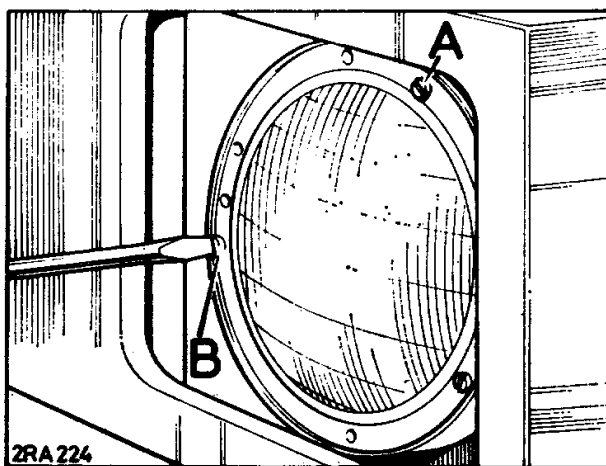
Routine adjustments and servicing

Headlight lamp replacement

225. 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. 94
Headlight, vertical dip,
12 volt models

- A—Adjusting screw,
vertical
B—Adjusting screw
horizontal



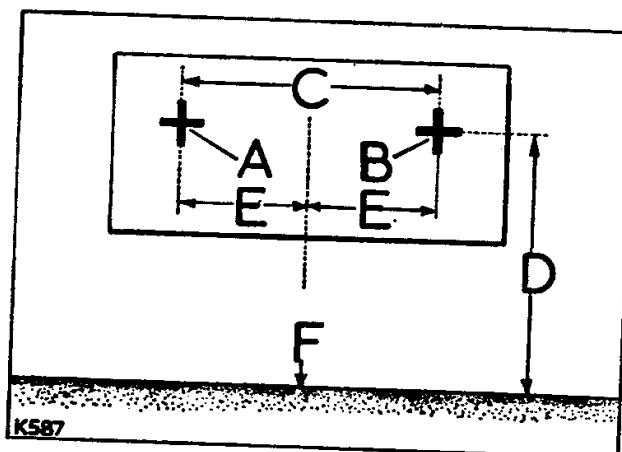
Headlight setting (*To be carried out by a vehicle mechanic*)

226. 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. 95, the vehicle must be unladen, on level ground and 365 cm (12 ft) from the level marks. Adjust so that area of concentrated light corresponds with marks.

Fig. 95
Headlight setting
dimensions, 12 volt models

- A—Concentrated area of light, LH Headlight
- B—Concentrated area of light, RH Headlight
- C—1500 mm (59 in.)
- D—813 mm (32 in.)
- E—749 mm (29½ in.)
- F—Ground level

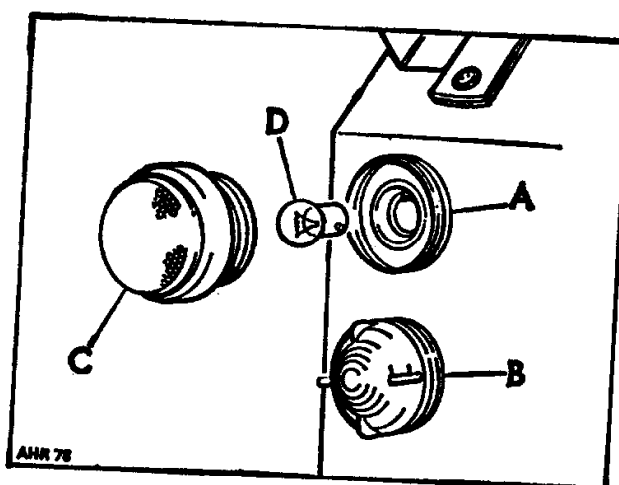


Side, tail/stop and turnlight lamp replacement

227. 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.

Fig. 96
Side lights and front
turnlights, 12 volt models

- A—Turnlight
- B—Sidelight
- C—Lens for front turnlight
- D—Bulb for front turnlight

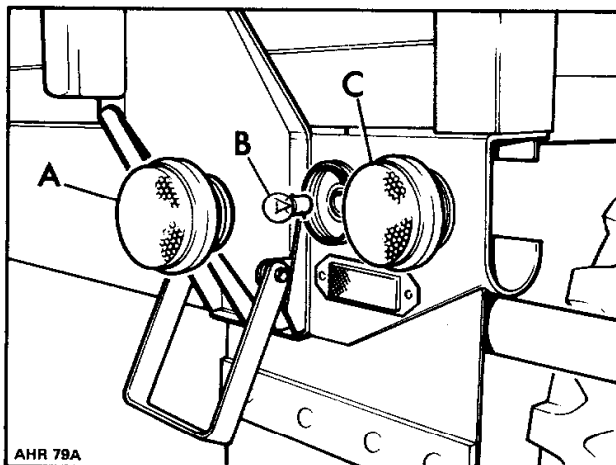


III

User Servicing and Adjustments

Fig. 97
Stop/tail lights and rear
turnlights, 12 volt models

- A—Rear turnlight
- B—Bulb for rear
turnlight
- C—Stop/tail light

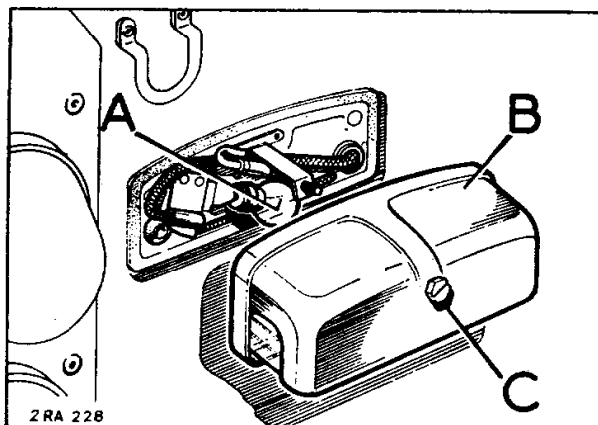


Number plate light lamp replacement

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

Fig. 98
Number plate light lamp
replacement

- A—Bulb
- B—Cover
- C—Retaining screw for
cover



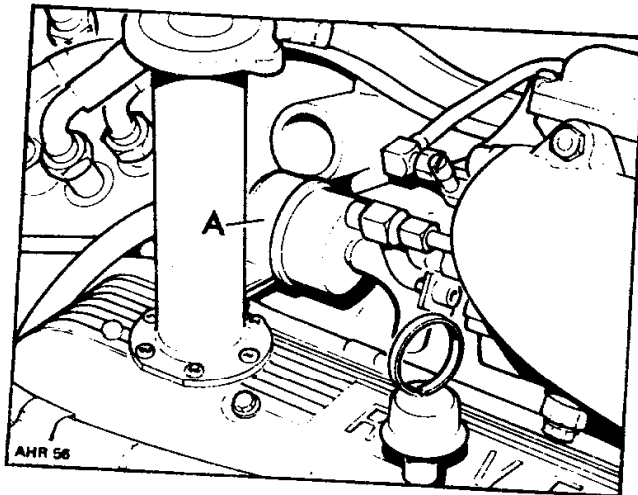
Instrument panel and warning light lamp replacement

229. 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.

To remove warning lights:

- (1) Disconnect the battery.
- (2) Remove the four bolts retaining instrument panel and mounting bracket and tilt panel upwards.
- (3) Bulbs can then be replaced as necessary.
- (4) Replace instrument panel and reconnect the battery.

Fig. 105
Distributor in-line filter
A—Filter



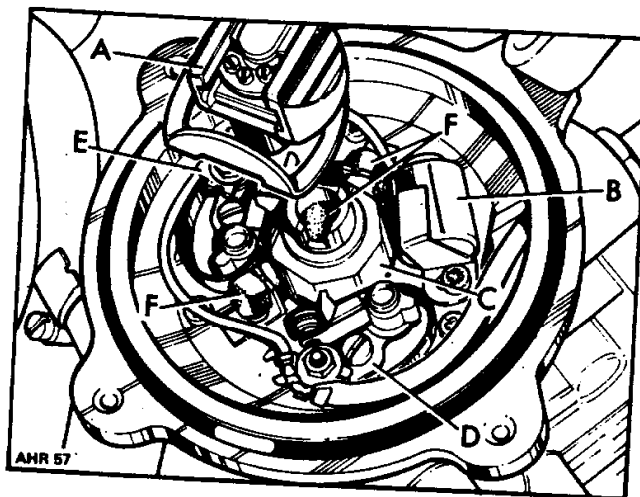
Checks

237. The following points should be checked. All defects noted must be reported:

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

Fig. 106
Distributor maintenance,
24 volt models

- A—Rotor arm
- B—Condenser
- C—Cam
- D—Contact points
- E—Contact points
- F—Felt lubricating pads



Routine adjustments and servicing

Clean and adjust distributor contact points (*To be carried out by a vehicle mechanic*). When removing the distributor cap it may be necessary to disconnect the screened leads from the cap.

238. Periodically clean and lubricate 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.

III

User Servicing and Adjustments

- (2) Lift off the rotor arm and add a few drops of thin machine oil to lubricate the felt pads.
- (3) Remove the nut and lift off the spring and moving contact. If necessary remove the adjustable contact plates. Ensure that the contacts are free from grease or oil; if they are burned or blackened, renew. Repeat procedure for other contact set.
- (4) Check and adjust the contact breaker clearance on each contact set as follows:
 - (i) Remove the distributor cap and turn over the engine by hand until one of the contacts are fully open.
 - (ii) The clearance should be 0,27—0,33 mm (0.011—0.013 in.), i.e. the feeler gauge should be a sliding fit between the contacts.
 - (iii) If necessary, slacken the screw securing the adjustable contact plate and move until the clearance is correct; re-tighten the screw. Repeat for the other contact set.
 - (iv) Replace the distributor cap and reconnect distributor leads if disconnected.

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

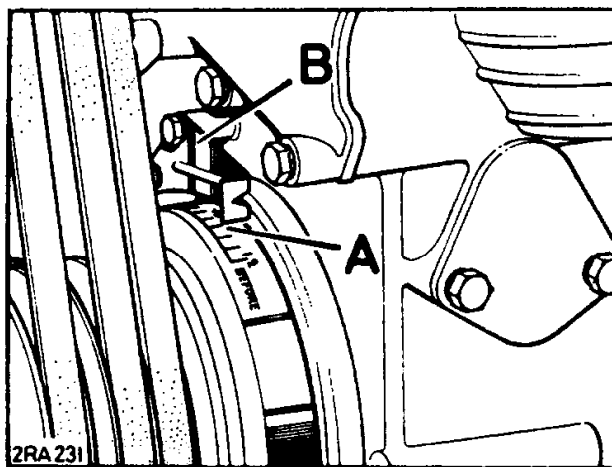
239. Reset ignition timing as follows:

NOTE: When setting the ignition timing on 24 volt models it will not be necessary to use a Tachometer.

- (1) Set the contact breaker point gap to 0,27—0,33 mm (0.011—0.013 in.) with the points fully open, using a feeler gauge as previously described.
- (2) Rotate the crankshaft in running direction until the 3° BTDC mark on the crankshaft pulley is in line with the pointer.

Fig. 107
Ignition timing pointer

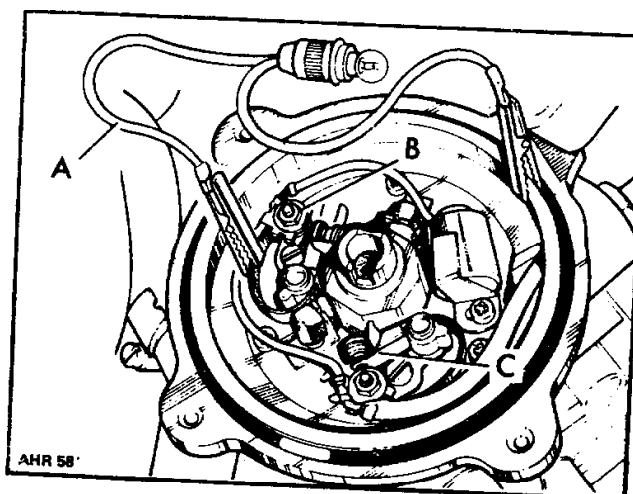
A—3° mark on crankshaft pulley
B—Timing pointer



- (3) The distributor rotor should correspond with No. 1 cylinder high tension lead terminal.
- (4) Connect a 24 volt timing lamp or voltmeter across the contact breaker lead terminal and a suitable earth point on the set of contact points marked 'B' in Fig. 108. This set of contact points are those nearest the inlet manifold. Switch on the ignition.
- (5) Slacken the clamp pinch bolt at the base of the distributor and rotate the distributor anti-clockwise until the set of contact points marked 'B' in Fig. 108 just begins to open and the timing lamp just comes on. This is the firing point when contacts marked 'C' in Fig. 108 start to open.
- (6) Tighten the distributor clamp pinch bolt and switch off the ignition. Disconnect the timing lamp. Refit distributor cap and reconnect leads if disconnected. Ensure that all lead ends are secure at distributor and sparking plugs thus ensuring screening continuity.

Fig. 108
Ignition timing

A—Timing lamp
B—Contact points
C—Contact points



IGNITION COIL, 24 VOLT MODELS

Description

240. 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

241. 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.

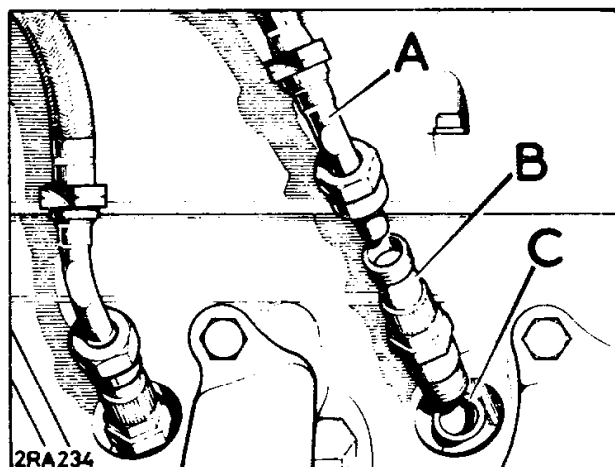
SPARKING PLUGS, 24 VOLT MODELS

Description

242. 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. 109
Sparking plug, 24 volt models

- A—Screened lead in vertical position
- B—Sparking plug
- C—Washer for sparking plug



Routine adjustments and servicing

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

243. At regular intervals remove the plugs, clean or if necessary replace, reset the electrode gaps to 0,72 mm (0.030 in.). Do not, adjust the central electrode.

HIGH TENSION CABLES, 24 VOLT MODELS

244. Examine the connectors on each cable end to ensure that they are undamaged. Examine the cable neoprene covering for damage.

Ensure that when refitting the leads to each spark plug they are located correctly and finally tightened in the vertical position. See Fig. 109.

BATTERIES, 24 VOLT MODELS

Description

245. Vehicle batteries are located as follows:

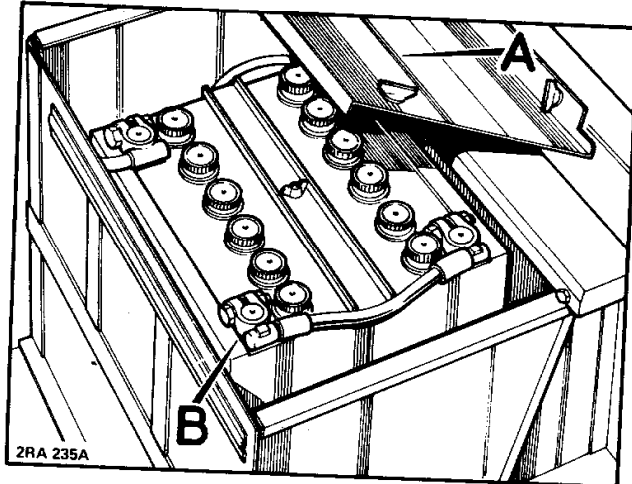
A negative earth return system is used, employing two 12 volt batteries connected in series, giving 24 volts output. They are

located behind the passenger seat, and are protected by a metal cover secured by four quarter turn fasteners. See Fig. 110.

IMPORTANT: Ensure that the batteries are connected in series and that the leads are connected as shown at Fig. 110.

Fig. 110
Vehicle batteries, 24 volt models

A—Battery cover
B—Batteries



246. 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.

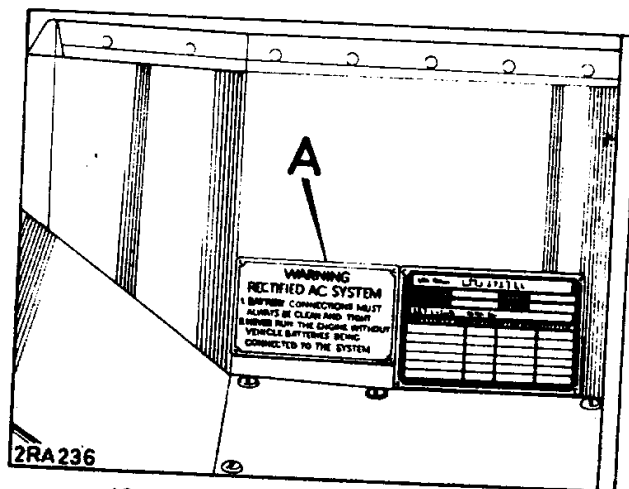
NOTE: For full user information on lead acid batteries reference should be made to EMER'S Power J318 and J330.

WARNING—This vehicle is fitted with a rectified AC system. See Fig. 111.

- (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.
- (4) Ensure batteries are regularly maintained, see paras. 248–249.

Fig. 111
Warning plate, rectified AC system, 24 volt models

A—Warning plate



III

User Servicing and Adjustments

Checks

247. Check the following points. All defects noted must be reported:

- (1) Check the state of charge of the batteries. See para. 249.
- (2) Check that the battery terminals are clean. Clean if necessary by removing the lugs, and refit as described in para. 250.
- (3) Check that the lead from the battery to starter solenoid is not damaged and is secured tightly at the starter motor.
- (4) Check that the earth lead is not damaged and has a good connection at fixing point.
- (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 batteries (two 12 volt in series)

248. Proceed as follows:

- (1) Remove the battery housing cover secured by four quarter turn fasteners.
- (2) Wipe all dirt and moisture from the battery top.
- (3) 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.

If the vehicle is used in high ambient temperature or is run at a high charge rate, it may be necessary to top up daily.

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*)

249. 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).

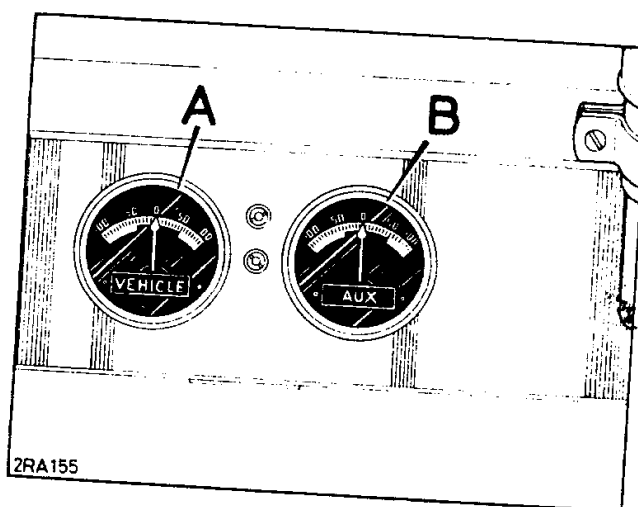
Operation of 90 amp generating system

257. 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 the centre of the facia panel. 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. 255 (d)).
- (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. 114
Ammeters, 24 volt models

A—Vehicle ammeter
B—Radio ammeter
(‘Aux’)



SHUNT BOX, 24 VOLT MODELS

Description

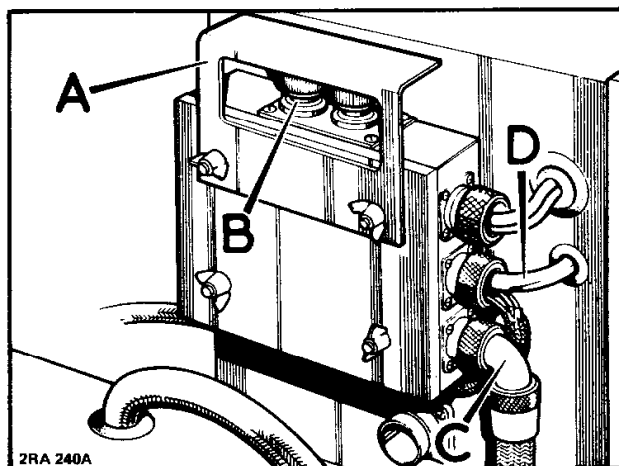
258. A shunt box is located on the passenger side of the vehicle attached to the battery carrier box. See Fig. 115. The radio batteries and charging circuit are connected together at the shunt box hence the radio batteries, when fitted, and the vehicle batteries are charged simultaneously.

The radio station, when fitted, is also connected to the shunt at the upper red and black terminals.

For information on the use of the shunt box, see handbook for radio installation in FFR 'B' vehicles, WO Code No. 12798.

Fig. 115
Shunt box

- A—Retaining plate for radio terminals
- B—Radio terminals
- C—Cable, shunt box to generator panel
- D—Cable, radio battery charging circuit



FUSE BOX, 24 VOLT MODELS

Description

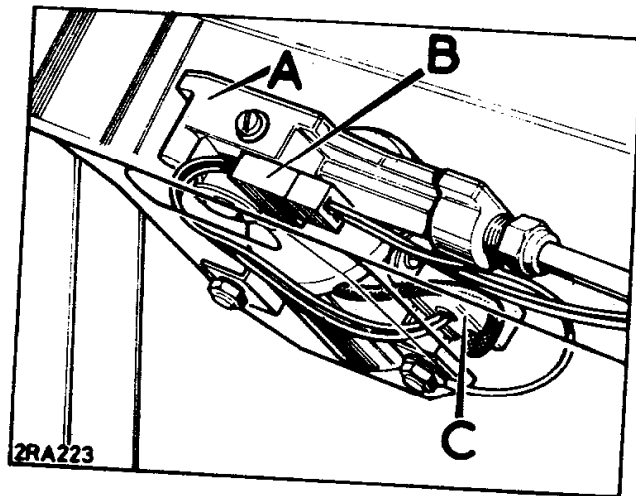
259. The fuse box is fitted on the inside of the front panel adjacent to the clutch pedal; Fig. 116 shows its location. The fuses are of the 35 amp cartridge type and two are carried in the box as spares.

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.

Fig. 117
Wiper motor, 24 volt models

- A—Wiper motor
- B—Wiring plug
- C—Suppressor for wiper motor



LIGHTS, 24 VOLT MODELS

Description

Headlights

268. The headlights, mounted in the front chassis cross member, incorporate a combined reflector and front lens assembly known as the Lucas light unit. Double filament lamps give a vertical dip.

Side lights

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

Stop/tail lights

270. Two combined stop/tail lights are fitted on the rear chassis cross member.

Turnlights

271. The front turnlights are mounted in the front panels above the side lights at outside edge of front wing. The rear turnlights are situated on the rear chassis cross member on the inside of the stop/tail lights.

Number plate light

272. The number plate light is mounted on a hinged plate on the lower tailboard and is secured in the vertical position with a nylon push-in clip. Pull number plate free of clip when vehicle is operated with the tailboard down.

Convoy light

273. The convoy light is situated at the right-hand side under the rear chassis member.

Instrument panel lamps

274. The instrument panel incorporates illumination lamps, the charging, cold start control, oil pressure and main beam warning lamps, turn-lamps and trailer warning lamps, brake system warning lamp, hazard indicator warning lamp and gearbox differential lock warning lamp.

Checks

275. The following points should be checked. All defects noted must be reported:

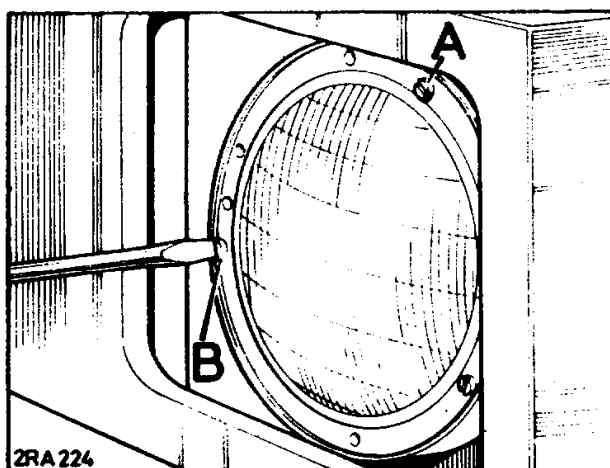
- (1) Check lights for broken or cracked glass. If the headlight glass is broken the complete light unit must be renewed. If the lamps are discoloured as a result of long service they should be renewed.
- (2) Ensure that the stop/tail light, turnlight and side light covers are secure.

Routine adjustments and servicing**Headlight lamp replacement**

276. 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. 118
Headlight, vertical dip,
24 volt models

- A—Adjusting screw—
vertical
B—Adjusting screw—
horizontal

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

277. 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. 119, the vehicle must be unladen, on level ground and 365 cm (12 ft) from the level marks. Adjust so that area of concentrated light corresponds with marks.

Fig. 119
Headlight setting dimensions

- A—Concentrated area of light, LH Headlight
- B—Concentrated area of light, RH Headlight
- C—1500 mm (59 in.)
- D—813 mm (32 in.)
- E—749 mm 29½ in.)
- F—Ground level

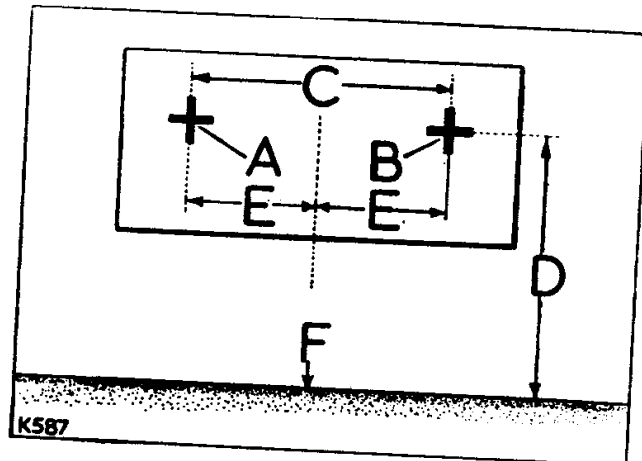


Fig. 120
Side lights and front turnlights, 24 volt models

- A—Front turnlight
- B—Side light
- C—Lens for turnlight
- D—Bulb for turnlight

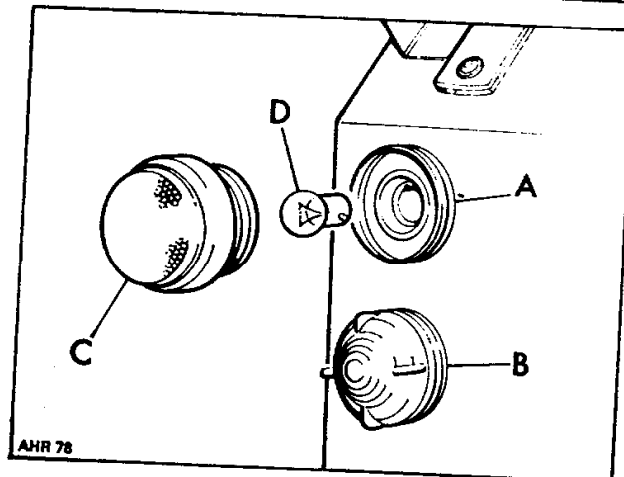
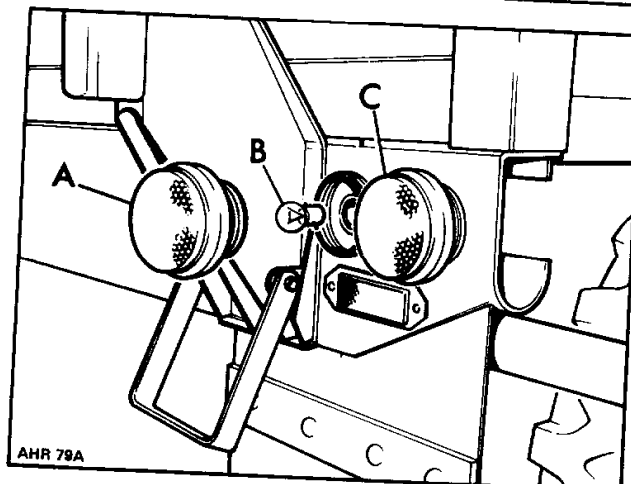


Fig. 121
Stop/tail lights and rear turnlights, 24 volt models

- A—Rear turnlight
- B—Bulb for rear turnlight
- C—Stop/tail light



III

User Servicing and Adjustments

Side, tail/stop and turnlight lamp replacement

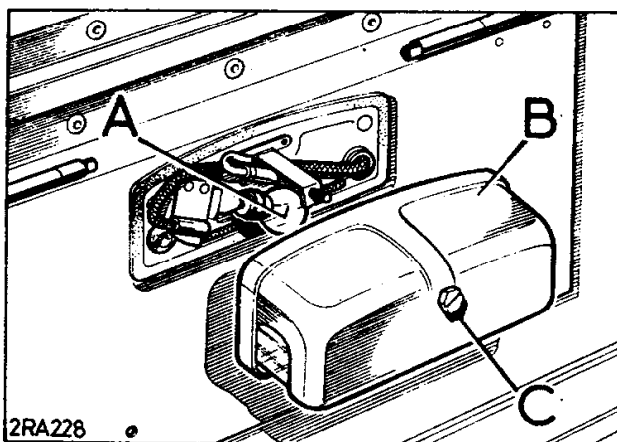
278. To replace lamps in any of the above the glass is unscrewed from its threaded holder when the lamp is readily accessible and can be replaced. Finally screw back the lens.

Number plate light lamp replacement

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

Fig. 122
Number plate light lamp replacement

- A—Bulb
- B—Cover
- C—Retaining screw for cover

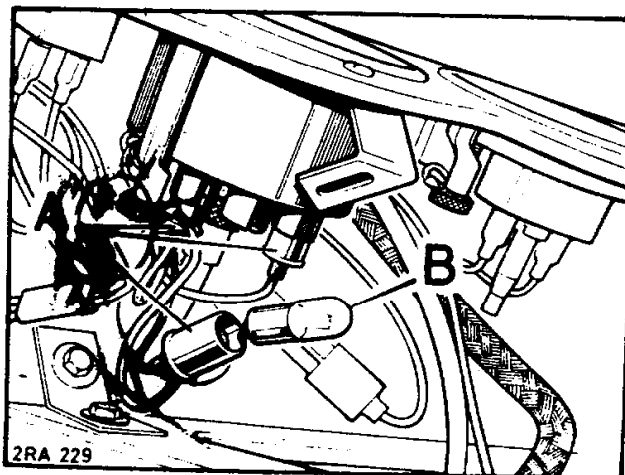


Instrument panel and warning light lamp replacement

280. 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. 123
Warning lights, 24 volt models

- A—Bulb holders for oil pressure, main beam and mixture control warning lights
- B—Bulb



SAFETY HARNESS

Description

302. 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.

303. Safety harness for both driver and outer passenger is fitted to the vehicle by means of shackle bolts and shackles. See Fig. 134.

(1) If the shackle bolts are removed for any reason it is important that they are aligned as shown at Fig. 134 when they are refitted. Shackle must be allowed to rotate about shackle bolt; do not overtighten fixing nut.

Fig. 134
Shackle end fixings for safety harness

- A—Bolt
- B—Shackle
- C—Strap
- D—Nut
- E—Rubber washer
- F—Plain washer
- G—Shackle bolt

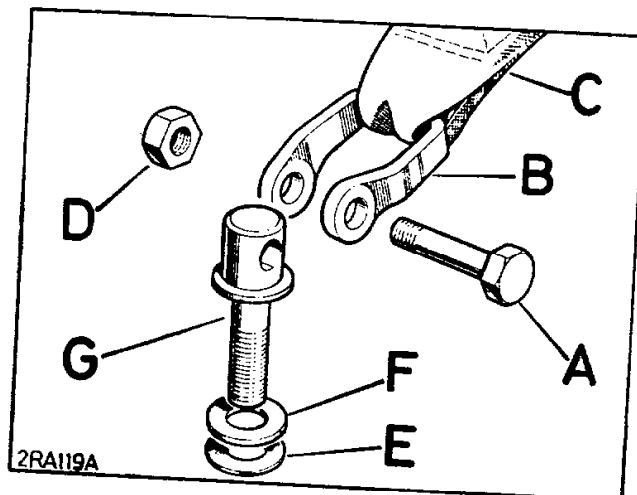
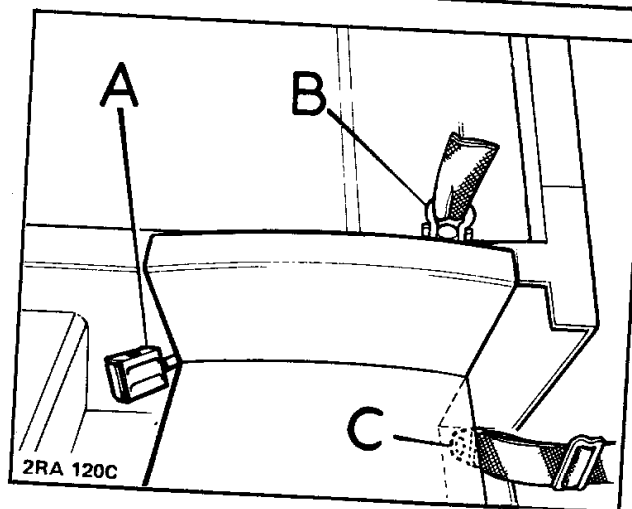


Fig. 135
Location and fitted position of safety harness shackles.

- A—Inner shackle at seat base
- B—Upper shackle at body side
- C—Outer shackle at seat base



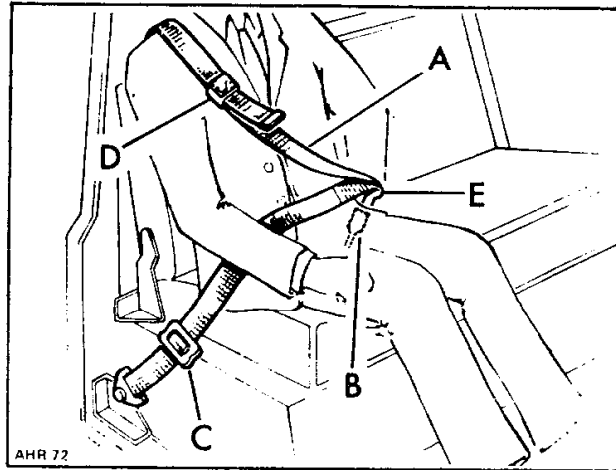
III

User Servicing and Adjustments

- (2) With the occupant seated in the front seat, the diagonal shoulder strap should pass over the outboard shoulder, as shown at Fig. 136.

Fig. 136
Showing safety harness in correct position.

- A—Diagonal shoulder and lap strap
- B—Short strap with engagement/release buckle
- C—Main adjustment buckle
- D—Shoulder strap adjustment buckle
- E—Tongue on diagonal shoulder and lap strap

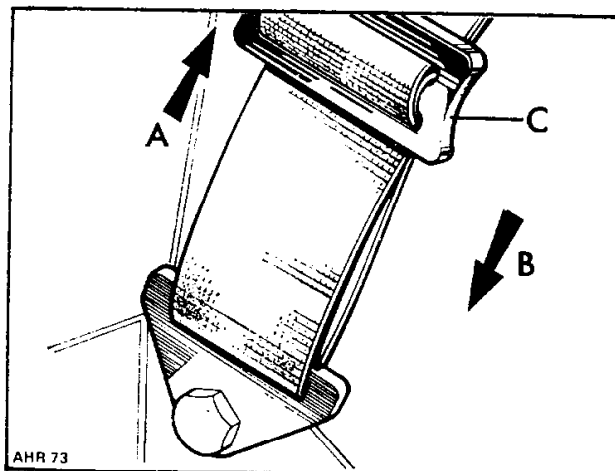


Main adjustment

- (3) With shoulder strap over the outboard shoulder make visual assessment of adjustment required. Adjustment to the length of the lap harness is made through the adjustment buckle (C) on the outer strap, shortening by pulling buckle in the direction of arrow 'A' or lengthening by pulling buckle in direction of arrow 'B'. Fig. 137.

Fig. 137
Showing adjustment of lap harness

- A—Pull strap in direction of arrow to shorten
- B—Pull strap in direction of arrow to lengthen
- C—Main adjustment buckle



Day-to-day use of safety harness

304. To obtain the maximum designed protection from the safety harness, it is essential that it be properly fitted and adjusted.

SECTION IV

FAULT-FINDING CHART and CIRCUIT DIAGRAMS

306. 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

307. 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. 45).
- (4) Check that carburetters are not flooding due to sticking needle valve in float chambers.
- (5) 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 operating the starter motor; if the headlights go out or are very dim when the starter is operated, the battery requires recharging. See paras. 205 and 249.

The engine cannot normally be started with the starting handle unless the lead to the starter solenoid is disconnected and then connected direct to a battery feed, thus by-passing the ignition/start switch and oil pressure switch. As soon as the engine starts, the lead can be reconnected to the solenoid. See para. 106.

- (6) (a) **12 volt models.** Lift the plug suppression cover from each plug terminal in turn about 7 mm ($\frac{1}{4}$ in.) 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 7 mm ($\frac{1}{4}$ in.) away from some metal part of the chassis.

IV

Fault Finding

while the engine is turned over; if sparks jump the gap regularly, the coil and distributor are functioning correctly.

- (7) (i) If the sparks are strong and regular, remove and clean the sparking plugs and reset the side electrode to give a gap of 0,60 mm (0.025 in.) on 12 volt models and 0,72mm (0.030 in.) on 24 volt models.
 - (ii) If the sparks are not regular:
 - (a) Check that the distributor rotor is in position.
 - (b) Check that the LT 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 0,35—0,40 mm (0.014—0.016 in.) on 12 volt models, 0,28—0,33 mm (0.011—0.013 in.) on 24 volt models.
 - (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.
- (8) Disconnect the petrol delivery pipe to the carburetter and check that petrol is delivered to the carburetter when the engine is turned over. See para. 106. If petrol is not delivered from the pipe:
 - (i) Check that the petrol pipes and filters are clear.
 - (ii) Check that the oil pressure switch has not failed, see para 106.

ENGINE STARTS BUT SOON STOPS

308. Check as detailed below:

- (1) Check that the controls are set correctly (see para. 44).

Fault Finding

IV

- (2) Check the fuel feed to the carburetter. See para. 106.
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 that the fuel filters are clear.
 - (iv) Check that the fuel pipes are clear.
- (3) Check that the carburetter float chamber needle valves are not sticking.
- (4) Check for a fault in the ignition system:
 - (i) **12 volt models.** Disconnect the cable from the SW (+) terminal on the coil and connect another cable between the battery + and the vacant terminal.
 - (ii) **24 volt models.** Disconnect the cable from the input to the ballast resistor and connect another cable between the battery + and the input lead.

ENGINE MISFIRES

309. Engine running on less than eight 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. 307, item 6 (a) for 12 volt models and item 6 (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 0.35—0.40 mm (0.014—0.016 in.) as necessary on 12 volt models and 0.28—0.33 mm (0.011—0.013 in.) on 24 volt models.
 - (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.

IV

Fault Finding

- (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 system:
 - 1. **12 volt models.** Disconnect the cable from the SW (+) terminal on the coil and connect another cable between the battery + and the vacant terminal.
 - 2. **24 volt models.** Disconnect the cable from the input to the ballast resistor and connect another cable between the battery + and the input lead.
- (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 0,60 mm (0.025 in.) on 12 volt and 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 induction, 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

310. Check the following points:

- (1) Check that the carburetter linkage is operating correctly.
- (2) Check that the brakes are not binding and that the tyre pressures are correct.
- (3) Check that the carburetter hydraulic dampers contain oil.
- (4) Check carburetter piston assemblies move freely and return under spring load.
- (5) Check float chamber for presence of water in fuel.
- (6) Check ignition timing and ignition system generally.

CHARGING CIRCUIT

311. 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

SECTION V

Optional Equipment

12 VOLT AND 24 VOLT MODELS

Some of the optional equipment which may be fitted to the Land-Rover 1 Tonne may need some explanation concerning its use. These details are given on the pages that follow under the appropriate headings.

POWERED WINCH

Description

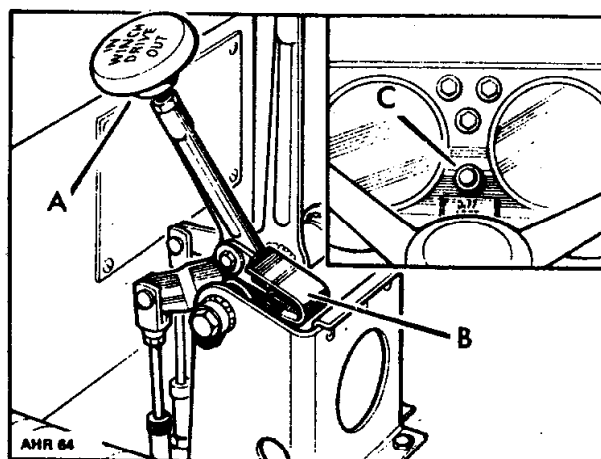
314. The winch is mounted on the left-hand chassis side member and is driven from a bottom power take-off unit fitted to the underside of the transfer gearbox. A multi pulley arrangement provides two alternative routes for the winch cable, giving a front or rear pull capability.

Operation

315. The winch is controlled from the driving compartment by the lever with the green knob, mounted on the top of the radiator ducting. The lever incorporates a safety catch to prevent accidental engagement of the winch drive; there is also a white warning light fitted in the instrument panel that illuminates when the winch drive is engaged and is extinguished when the drive is disengaged.

Fig. 145
Winch control lever and
warning light

- A—Winch control lever
- B—Lever safety catch
- C—Warning light



V**Optional Equipment**

All normal winching should be carried out with the transfer gear lever in the 'Neutral' position but, if the circumstances demand, it is permissible to winch and drive simultaneously in either 'Low' or 'High' transfer.

Any gear in the main gearbox may be selected for winching, giving four winching-in and one pay-out cable speeds relative to engine rev/min. The following chart provides a guide to the cable speeds obtainable in the specified gear at 1000 engine rev/min.

<i>Gear</i>		<i>Metres/min</i>	<i>ft/min</i>
Reverse	{ cable pay out	7.30	24
1	{ cable winching in	6.60	21
2		10.87	36
3		17.81	58
4		26.76	88

Operate the winch as follows:

- (i) Position the vehicle in line with the object to be recovered, or in the case of self-recovery the end of the cable should be anchored in line with the vehicle.
- (ii) Place the transfer gear lever in the 'NEUTRAL' position.
- (iii) Place the main gear lever in the 'neutral' position.
- (iv) Start the engine.
- (v) Lift the safety catch and move the winch control lever to the 'IN' position.
- (vi) Engage the required gear in the main gearbox, the winch will then commence operation when the clutch is released.
- ◀ (vii) The winch must only be stopped when under 'load' conditions by switching the ignition switch 'OFF' and stopping the engine. The vehicle clutch, gear lever and winch control lever must not be disengaged until the load, self-recovery or other object – is safely checked, secured or removed. ▶
- (viii) After completion of the winching operation, rewind the remaining cable under light load to ensure even distribution on the drum, then move the main gear lever to the 'neutral' position and the winch control lever to the 'OUT' position.
- (ix) Stop the engine, as required.

Lubrication

316. Lubricate the winch driving chain and cable assembly as necessary after use, also at the recommended intervals using approved lubricants.

Winch drive gearbox and chain

317. Remove the oil level plug from the winch drive gearbox casing; oil should be level with the bottom of the plug hole, top up if necessary and replace plug.