



BY APPOINTMENT TO HER MAJESTY THE QUEEN  
BL CARS LIMITED, BIRMINGHAM  
MANUFACTURERS OF ROVE-CARS, LAND ROVERS,  
RANGE ROVERS AND ALSTIN CARS



BY APPOINTMENT TO HER MAJESTY QUEEN ELIZABETH  
THE QUEEN MOTHER  
BL CARS LIMITED, COVENTRY AND BIRMINGHAM  
MANUFACTURERS OF DAIMLER, JAGUAR AND ROVER CARS  
AND LAND ROVERS



BY APPOINTMENT  
TO HRH THE PRINCE OF WALES  
LAND ROVER LIMITED, SOLIHULL  
MANUFACTURERS OF MOTOR VEHICLES



# LAND ROVER V8

## REPAIR OPERATION MANUAL SUPPLEMENT

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INTRODUCTION

This supplement details the specification and operations relating to Land-Rover V8 vehicles. It is intended to be used with the current edition of the Land-Rover Series III Repair Operation Manual. When seeking information, reference should first be made to this supplement—failure to find the details required indicates that the Repair Operation Manual content is relevant.

SPECIFICATION

Purchasers are advised that the specification details set out in this Manual apply to a range of vehicles and not to any one. For the specification of a particular vehicle, purchasers should consult their Distributor or Dealer. The manufacturers reserve the right to vary their specifications with or without notice, and at such times and in such manner as they think fit. Major as well as minor changes may be involved in accordance with the manufacturer's policy of constant product improvement.

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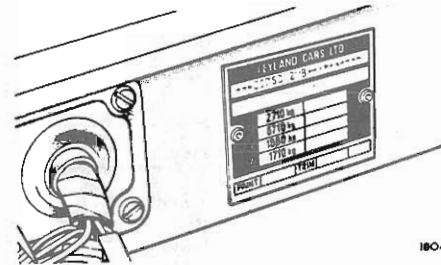
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LOCATION OF VEHICLE IDENTIFICATION AND UNIT NUMBER

Chassis serial number

The chassis serial number, together with the maximum vehicle weights, will be found on the inside of the engine bulkhead.

The chassis number is also stamped on the right-hand side of the chassis, adjacent to the front shock absorber.

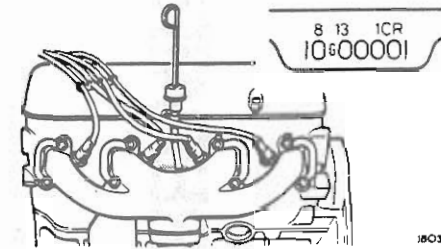


Engine serial number

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

The gearbox serial number is stamped on the rear face of the transfer gearbox adjacent to the oil level filler plug.

The front axle serial number is stamped on the front face of the left-hand tube.



The rear axle serial number is stamped on the rear face of the left-hand tube.

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## GENERAL SPECIFICATION DATA

<b>ENGINE</b>	
Type	V8
Number of cylinders	Eight, two banks of four
Bore	88,50 mm (3.500 in)
Stroke	71,12 mm (2.800 in)
Capacity	3528 cm <sup>3</sup> (215 in <sup>3</sup> )
Valve operation	Overhead by push-rod
<b>Crankshaft</b>	
Main journal diameter	58,400 to 58,413 mm (2.2992 to 2.2997 in)
Minimum regrind diameter	57,384 to 57,396 mm (2.2592 to 2.2597 in)
Crankpin journal diameter	50,800 to 50,812 mm (2.0000 to 2.0005 in)
Minimum regrind diameter	49,784 to 49,797 mm (1.9600 to 1.9605 in)
Crankshaft end thrust	Taken on thrust faces of centre main bearing
Crankshaft end-float	0,10 to 0,20 mm (0.004 to 0.008 in)
<b>Main bearings</b>	
Number and type	5, Vandervell shells
Material	Lead-indium
Diametrical clearance	0,023 to 0,065 mm (0.0009 to 0.0025 in)
Undersizes	0,254 mm, 0,508 mm (0.010 in, 0.020 in)
<b>Connecting rods</b>	
Type	Horizontally split big-end, plain small-end
Length between centres	143,71 to 143,81 mm (5.658 to 5.662 in)
<b>Big-end bearings</b>	
Type and material	Vandervell VP lead-indium
Clearance on crankshaft	0,015 to 0,055 mm (0.0006 to 0.0022 in)
End-float on crankshaft	0,15 to 0,37 mm (0.006 to 0.014 in)
Undersizes	0,254 mm, 0,508 mm (0.010 in, 0.020 in)
<b>Gudgeon pins</b>	
Length	72,67 to 72,79 mm (2.861 to 2.866 in)
Diameter	22,215 to 22,22 mm (0.8746 to 0.8749 in)
Fit-in con rod	Press fit
Clearance in piston	0,002 to 0,007 mm (0.0001 to 0.0003 in)
<b>Pistons</b>	
Clearance in bore measured at bottom of skirt at right angles to gudgeon pin	0,018 to 0,033 mm (0.0007 to 0.0013 in)
<b>Piston rings</b>	
Number of compression	2
Number of oil	1
No. 1 compression ring	Chrome parallel faced
No. 2 compression ring	Stepped to 'L' shape and marked 'T' or 'TOP'
Width of compression rings	1,56 to 1,59 mm (0.0615 to 0.0625 in)
Compression ring gap	0,44 to 0,57 mm (0.017 to 0.022 in)
Oil ring type	Perfect circle, type 98-6
Oil ring width	4,811 mm (0.1894 in) max.
Oil ring gap	0,38 to 1,40 mm (0.015 to 0.055 in)

continued

<b>Camshaft</b>	
Location	Central
Bearings	Non-serviceable
Timing chain	9,52 mm (0.375 in) pitch × 54 pitches
<b>Valves</b>	
<b>Inlet:</b>	
Overall length	116,58 to 117,34 mm (4.590 to 4.620 in)
Head diameter	39,75 to 40,00 mm (1.565 to 1.575 in)
Angle of face	45°
Stem diameter	8,640 to 8,666 mm (0.3402 to 0.3412 in) at the head and increasing to 8,653 to 8,679 mm (0.3407 to 0.3417 in)
Stem to guide clearance: Top	0,02 to 0,07 mm (0.001 to 0.003 in)
Bottom	0,013 to 0,063 mm (0.0005 to 0.0025 in)
<b>Exhaust:</b>	
Overall length	116,58 to 117,34 mm (4.590 to 4.620 in)
Head diameter	34,226 to 34,480 mm (1.3475 to 1.3575 in)
Angle of face	45°
Stem diameter	8,628 to 8,654 mm (0.3397 to 0.3407 in) at the head and increasing to 8,640 to 8,666 mm (0.3402 to 0.3412 in)
Stem to guide clearance: Top	0,038 to 0,088 mm (0.0015 to 0.0035 in)
Bottom	0,05 to 0,10 mm (0.002 to 0.004 in)
Valve lift (both valves)	9,9 mm (0.39 in)
Valve spring length	40,0 mm (1.577 in) at pressure of 30.16 to 33.34 kg (66.5 to 73.5 lb)
<b>Valve timing</b>	
Inlet opens	30° B.T.D.C.
Inlet closes	75° A.B.D.C.
Inlet duration	285°
Inlet peak	112.5° A.T.D.C.
Exhaust opens	68° B.B.D.C.
Exhaust closes	37° A.T.D.C.
Exhaust duration	285°
Exhaust peak	105.5° B.T.D.C.
<b>Lubrication</b>	
System	Wet sump, pressure fed
System pressure, engine warm at 2400 rev/min	2,1 to 2,8 kgf/cm <sup>2</sup> (30 to 40 lbf/in <sup>2</sup> )
Oil filter	Full-flow, self-contained cartridge
Oil pump type	Gear
<b>Oil pressure relief valve:</b>	
Type	Non-adjustable
<b>Relief valve spring:</b>	
Free length	81,2 mm (3.200 in)
Compressed length at 4.2 kg (9.3 lb) load	45,7 mm (1.800 in)
<b>Oil filter by-pass valve:</b>	
Type	Non-adjustable
<b>By-pass valve spring:</b>	
Free length	37,5 mm (1.48 in)
Compressed length at 0.34 kg (0.75 lb)	22,6 mm (0.89 in)

**GENERAL SPECIFICATION DATA**

**FUEL SYSTEM**

Fuel pump	Facet electrical 31 KNm <sup>2</sup> Press (static)
Carburettor: Type	Two Zenith Stromberg European and Australian markets: CDSF
	Other markets: CDS3
Needle	Australian market: B1DW
	Other markets: B1EW
Air cleaner	European market: A.C.-Delco with replaceable paper element
	Other markets: A.C.-Delco cyclone type with replaceable element
Idle speed (engine hot)	Australian market: 750 to 850 rev/min
	Other markets: 725 ± 25 rev/min
Fast idle speed (engine cold)	1100 to 1300 rev/min
Mixture setting: CO level at idle	Australian market: 6% ± 1%
	Other markets: 4½%

**CLUTCH**

Make/type	Borg & Beck, diaphragm type
Clutch plate diameter	267,0 mm (10.5 in)
Facing material	H. K. Porter Thermoid 11046
Number of damper springs	6
Damper spring colour	Light-grey/green
Clutch release bearing	Ball journal
Clutch fluid	Refer to Division 09

**GEARBOX**

<b>Main gearbox</b>		
Type	Single helical constant mesh with synchromesh on all forward gears	
<b>Transfer box</b>		
Type	Two-speed reduction on main gearbox output. Front and rear drive permanently engaged via a lockable differential	
<b>Gear ratios</b>		
Main gearbox: Top	Direct	
Third	1.505:1	
Second	2.448:1	
First	4.069:1	
Reverse	3.664:1	
Transfer gearbox: High	1.336:1	
Low	3.321:1	
Overall ratio (final drive):	In high transfer	In low transfer
Top	4.73:1	11.76:1
Third	7.12:1	17.69:1
Second	11.58:1	28.78:1
First	19.24:1	47.81:1
Reverse	17.33:1	43.05:1

**PROPELLER SHAFTS**

Type: Front	Saginaw joint (Double Hookes) plus Single Hookes joint each with 1310-type universal joints
Rear	Open type, 51 mm (2 in) diameter with 1310-type universal joint. Gaiter fitted to sliding coupling

**GENERAL SPECIFICATION DATA**

**REAR AXLE**

Type	Salisbury 8HA
Ratio	3.54:1

**FRONT AXLE**

Type	Spiral bevel, enclosed constant velocity joints
Angularity of constant velocity joints on full lock	32°
Ratio	3.54:1

**SUSPENSION**

Type	Rigid axles, semi-elliptic springs
------	------------------------------------

**Springs**

<b>Front (Driver):</b>	
Length	920,7 mm (36.25 in)
Width	63,5 mm (2.5 in)
No. of leaves	11
Thickness	1 at 5,15 mm (0.203 in)
	10 at 4,36 mm (0.172 in)
Rate	314 kg cm (273 lb in)
Free camber	142,8 mm (5.625 in)
<b>Front (Passenger):</b>	
Length	920,7 mm (36.25 in)
Width	63,5 mm (2.5 in)
No. of leaves	11
Thickness	1 at 5,15 mm (0.203 in)
	10 at 4,36 mm (0.172 in)
Rate	314 kg cm (273 lb in)
Free camber	130,1 mm (5.125 in)
<b>Rear (Driver):</b>	
Length	1219 mm (48 in)
Width	63,5 mm (2.5 in)
No. of leaves	10
Thickness	1 at 6,3 mm (0.250 in.)
	2 at 9,5 mm (0.375 in)
	7 at 3,9 mm (0.156 in)
Rate	310 kg cm (270 lb in)
Free camber	134,9 mm (5.250 in)
<b>Rear (Passenger):</b>	
Length	1219 mm (48 in)
Width	63,5 mm (2.5 in)
No. of leaves	10
Thickness	1 at 6,3 mm (0.250 in)
	2 at 9,5 mm (0.375 in)
	7 at 3,9 mm (0.156 in)
Rate	310 kg cm (270 lb in)
Free camber	208,2 mm (8.200 in)



**GENERAL SPECIFICATION DATA**

**STEERING**

Type .....	Burman recirculating ball, worm and nut
Ratio .....	15.6 : 1 straight ahead, 23.8 : 1 full lock
Steering-wheel diameter .....	17 in
Number of turns lock to lock .....	3.3
Wheel camber .....	1° 30' Positive
Wheel castor .....	3°
Swivel pin inclination .....	7°
Front wheel toe-out .....	0.046 to 0.093 in (1.2 to 2.4 mm)
Steering damper .....	Fitted to drag-link

**BRAKES**

Type .....	Girling
Footbrake .....	Hydraulic, servo assisted
Brake drum diameter .....	11 in (279.4 mm)
Brake shoe width .....	Front 3 in (76.2 mm) Rear 2.25 in (57.1 mm)
Frictional lining area .....	222 in <sup>2</sup> (1432 cm <sup>2</sup> )
Handbrake .....	Mechanical, Lockheed 7.25 in (184 mm) diameter, 3 in (76 mm) width, duo-servo drum brake on rear of transfer box

**APPROXIMATE DIMENSIONS and WEIGHTS**

	V8 Station Wagon		V8 Cab Truck	
	Metric	Imperial	Metric	Imperial
Overall length .....	4.58 m	180.3 in	4.44 m	174.8
Overall width .....	1.68 m	66.1 in	1.68 m	66.1
Overall height .....	2.0 m	78.7 in	1.99 m	78.3
Wheelbase .....	2.77 m	109.0 in	2.77 m	109.0
Track front and rear .....	1.33 m	52.3 in	1.33 m	52.3
Ground clearance under differential .....	209 mm	8.25 in	209 mm	8.25 in
Turning circle .....	14.3 m	47 ft	14.3 m	47 ft
Loading height — approximate .....	736 mm	29.5 in	812 mm	32 in
Maximum cargo height .....	1.9 m	74.8 in		
Kerb weight, with water, oil and 22.5 litres (5 gallons) of fuel .....			1601 kg	3529.5 lb
10 seater .....	1809 kg	3988.12 lb		
12 seater .....	1828 kg	4030 lb		
Gross vehicle weight .....	2710 kg	5974.5 lb	2710 kg	5974.5 lb
Gross combination weight .....	6710 kg	1479.2 lb	6710 kg	1479.2 lb
Permissible trailer loads:				
Fully braked .....	4000 kg	8818.4 lb	4000 kg	8818.4 lb
With over-run brakes .....	2000 kg	4409.2 lb	2000 kg	4409.2 lb
Without brakes .....	500 kg	1102.3 lb	500 kg	1102.3 lb
Maximum weight on towing attachment .....	75 kg	165.3 lb	75 kg	165.3 lb
Maximum roof rack load .....	50 kg	112 lb		

**GENERAL SPECIFICATION DATA**

**WHEELS AND TYRES**

Type of wheel .....	Ventilated disc
Wheel size .....	5.50 in F × 16 in
No. of fixing studs .....	5 per wheel — M16 × 1.5
Tyre size .....	7.50 × 16 in

**Tyre pressures**

CONDITIONS	Pressure Unit	LADEN		UNLADEN	
		Front	Rear	Front	Rear
Below 112 km/h (70 m.p.h.)	kgf/cm <sup>2</sup>	1,8	2,5	1,8	1,8
	lbf/in <sup>2</sup>	25	36	25	25
	bar	1,72	2,48	1,72	1,72
Over 112 km/h (70 m.p.h.)	kgf/cm <sup>2</sup>	2,24	3,02	2,24	2,24
	lbf/in <sup>2</sup>	32	42	32	32
	bar	2,2	3,0	2,2	2,2
Towing	kgf/cm <sup>2</sup>	2,24	3,02	2,24	2,24
	lbf/in <sup>2</sup>	32	42	32	32
	bar	2,2	3,0	2,2	2,2
Cross-country	kgf/cm <sup>2</sup>	1,1	1,8	1,1	1,8
	lbf/in <sup>2</sup>	15	26	15	26
	bar	1,03	1,79	1,03	1,79

NOTE: For mixed running conditions where 112 km/h (70 m.p.h.) may be exceeded, use higher tyre pressures

**Recommended tyres:**

SIZE	MAKE	TYPE
7.50 × 16	GOODYEAR HI-MILER	6 PLY RATING
7.50 × 16	AVON RANGER Mk II HS. NYLON	6 PLY RATING
7.50 × 16	MICHELIN XCM + S4	RADIAL PLY
7.50 × 16	MICHELIN XS	RADIAL PLY

## GENERAL SPECIFICATION DATA

### ELECTRICAL EQUIPMENT

System .....	12 volt, negative earth
<b>Battery</b>	
Make/type .....	Lucas C9
Capacity .....	60 A at 20-hour rate
Weight .....	Wet 52 lb, dry 40 lb (charged)
<b>Alternator</b>	
Type .....	Lucas 18ACR battery sensed
Nominal output .....	4.5 amps at 6000 alternator rev/min
Field resistance .....	3.2 ohms @ 20°C (68°F)
Brush spring pressure .....	255 to 368 gf (9 to 13 ozf)
Brush minimum length .....	8 mm (0.312 in)
Regulating voltage .....	13.6 to 14.4 volts
<b>Starter motor</b>	
Petrol models	
Make/type .....	Lucas 3M100 pre-engaged
Brush spring tension .....	1020 gf (36 ozf)
Brush minimum length .....	9.5 mm (0.375 in)
<b>Wiper motor</b>	
Make/type .....	Lucas 14W/ two-speed
Armature end-float .....	0.05 to 0.25 mm (0.002 to 0.010 in)
Brush minimum length .....	4.8 mm (0.190 in)
Brush spring tension .....	150 to 250 gf (5.3 to 8 ozf)
Resistance of armature winding at 16°C (60°F) measured between adjacent commutator segments .....	0.23 to 0.35 ohms
Light running, rack disconnected, current at 13.5 V .....	1.4 amps max.
Distributor .....	For details refer to 'ENGINE TUNING DATA' 05-1
Ignition system .....	Ballasted coil, 7 volt, BA16C6
Fuses .....	2 × 35 amp, 2 × 17 amp, 2 spares
<b>Replacements bulbs and units</b>	
Headlamps with bulbs .....	Lucas 411, 12V 45/40W, Clear
Headlamps with sealed beam units:	
R. H. Stg. ....	Lucas 54521872 60/45W
L. H. Stg. Europe except France .....	Lucas 54523079 60/50W
L. H. Stg. except Europe .....	Lucas 54522231 50/40W
Sidelamps .....	Lucas 207, 12V 4W
Stop, tail lamps .....	Lucas 380, 12V 21/5W
Flasher lamps .....	Lucas 382, 12V 21W
Rear number plate lamp .....	Lucas 233, 12V 4W
Instrument panel lights .....	Lucas 987, 12V 2.2W M.E.S.
Warning lights .....	Lucas 987, 12V 2.2W M.E.S.
Warning light brakes .....	Lucas 280, 12V 1.5W
Warning light flashers .....	Lucas 281, 12V 2W
Interior light .....	Lucas 382, 12V 21W

### ENGINE TUNING DATA

#### ENGINE

Type .....	V8
Capacity .....	2528 cm <sup>3</sup> (215 in <sup>3</sup> )
Compression ratio .....	8.13 : 1
Firing order .....	1—8—4—3—6—5—7—2
Cylinder numbering system, front to rear:	
Left bank .....	1—3—5—7
Right bank .....	2—4—6—8
Compression pressure (minimum) .....	9.5 kgf/cm <sup>2</sup> (135 lbf/in <sup>2</sup> )
Timing marks .....	On crankshaft pulley
Valve clearance .....	Not adjustable

#### CARBURETTORS

Type .....	Two Zenith Stromberg
European Australian .....	CDSE
Other markets .....	CDS3
Needle:	
Australian .....	BIDW
Other markets .....	BIEW
Idle speed (engine hot):	
Australian .....	750 to 850 rev/min
Other markets .....	725 ± 25 rev/min
Fast idle speed (engine cold) .....	1100 to 1300 rev/min
Mixture setting — CO at idle:	
Australian .....	6% ± 1%
Other markets .....	4.5%

#### IGNITION

Coil make/type .....	Lucas BA16 C5 with ballast resistor
Primary resistance at 20°C (68°F) .....	1.2 to 1.4 ohms
Consumption, ignition on, at 2000 rev/min .....	1 amp
Spark plug type .....	Champion N12Y or Unipart GSP 131
Spark plug gap .....	0.80 mm (0.030 in)
Distributor contact breaker gap .....	0.35 mm to 0.40 mm (0.014 to 0.016 in)
Dwell angle .....	26° to 28° at 550 to 650 rev/min
Ignition timing, dynamic: models with emission control .....	1° B.T.D.C. mark on crankshaft pulley — using 91 to 93 octane fuel — 2 star rating in U.K.
Ignition timing, dynamic: non-emission engines .....	6° B.T.D.C. at 650 rev/min maximum
Ignition timing, static: all models .....	T.D.C.
Maximum power—B.H.P. ....	90.7
Maximum power—PS .....	92
Maximum power—kW .....	67.7
Maximum torque .....	166.4 lbf ft (23 mkg) @ 2000 rev/min

## ENGINE TUNING DATA

### DISTRIBUTOR

NOTE: Different distributors have been fitted according to market requirements. The information given below is for guidance only and the unit should be identified by the number stamped on the distributor body.

Make/type	Lucas 35D8
Rotation of rotor	Anti-clockwise
Dwell angle	26° to 28°
Contact breaker gap	0,36 to 0,40 mm (0.014 to 0.016 in)
Condenser capacity	0.18 to 0.25 microfarad

### Serial Number 41784 — U.K. and European Markets

Ignition timing: Static . . . T.D.C. Dynamic T.D.C. at 650 rev/min	Decelerating check with vacuum unit disconnected	
	Engine rev/min	Crankshaft angle
	850	No advance to occur
	1200	2°
	1600	5½°
	2800	14°
	4000	15½°

### Serial Number 41833 — Australian Market

Ignition timing: Static . . . T.D.C. Dynamic T.D.C. at 750 rev/min	Decelerating check with vacuum unit disconnected	
	Engine rev/min	Crankshaft angle
	1400	No advance to occur
	1600	2°
	2400	8½°
	3600	11°

### Serial Number 41680 — Other Markets

Ignition timing: Static . . . T.D.C. Dynamic 6° B.T.D.C. at 650 rev/min	Decelerating check with vacuum unit disconnected	
	Engine rev/min	Crankshaft angle
	600	No advance to occur
	1000	2°
	1400	5°
	3800	7°
4800	13°	

## TORQUE WRENCH SETTINGS

### TORQUE WRENCH SETTINGS

ENGINE	kgf m	lbf ft
Connecting rod cap nuts	4,0 to 4,9	30 to 35
Main bearing cap bolts, numbers one to four	7,0 to 7,6	50 to 55
Rear main bearing cap bolts	9,0 to 9,6	65 to 70
Cylinder head bolts:		
Nos. 1 to 10 } see Operation	9,0 to 9,6	65 to 70
Nos. 11 to 14 } 12.29.10	5,6 to 6,2	40 to 45
Rocker shaft bolts	3,5 to 4,0	25 to 30
Flywheel bolts	7,0 to 8,5	50 to 60
Oil pump cover bolts	1,4 to 2,0	10 to 15
Oil pressure relief valve	4,0 to 4,9	30 to 35
Timing chain cover bolts	2,8 to 3,5	20 to 25
Crankshaft starter dog	19,3 to 22,3	140 to 160
Distributor drive gear to camshaft bolt	5,5 to 6,2	40 to 45
Engine mounting rubbers	1,8 to 2,2	13 to 16
Water pump fixing bolts: ¼ in	0,9 to 1,4	7 to 10
½ in	2,2 to 2,7	16 to 20

### COOLING SYSTEM

Water pump housing bolts: ¼ in AF	0,8 to 1,0	6 to 8
½ in AF	2,8 to 3,5	20 to 25

### MANIFOLDS AND EXHAUST SYSTEM

Induction manifold bolts	3,5 to 4,0	25 to 30
Induction manifold gasket clamp bolts	1,4 to 2,0	10 to 15
Exhaust manifold bolts	1,4 to 2,0	10 to 15

### CLUTCH

Clutch cover bolts	4,9 to 5,0	35 to 38
Slave cylinder securing bolts	2,75	20

### GEARBOX

Bell housing to engine	3,5	25
Main gear lever retainer bolts	1,5	11
Front output flange nut	11,75	85
Rear output flange nut	11,75	85
Transmission brake shoe pivot bolts	5,9	43
Transmission brake back plate bolts	3,5	25
Gearbox casing to bell housing studs/bolts:		
Larger diameter	16,6	120
Smaller diameter	9,6	70
Gearbox differential rear casing to front casing	5,5 to 6,9	40 to 50

### PROPELLER SHAFTS

Coupling flange bolts	4,1 to 5,1	30 to 38
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**TORQUE WRENCH SETTINGS**

	kgf m	lbf ft
<b>REAR AXLE AND FINAL DRIVE</b>		
Hub driving flange bolts	4,2 to 5,2	30 to 38
Differential case bolts	9,1 to 10,4	66 to 75
Crown wheel bolts	13 to 14,5	95 to 105
Differential bearing cap bolts	12,9 to 14,5	93 to 105
Differential cover bolts	2,8 to 3,5	20 to 25
Stub axle bolts	4,2 to 5,2	30 to 38

<b>FRONT AXLE AND FINAL DRIVE</b>		
Hub driving flange bolts	4,2 to 5,2	30 to 38
Bevel pinion driving flange nut	11,75	85
Crown wheel bolts	6,3 to 7,6	45 to 55
Differential bearing cap bolts	7,0 to 8,9	50 to 65
Upper swivel pin bolts	7,0 to 8,9	50 to 65
Lower swivel pin nuts	7,0 to 8,9	50 to 65
Swivel seal retaining ring bolts	1,0 to 1,2	7 to 9
Stub axle bolts	4,2 to 5,2	30 to 38

<b>STEERING</b>		
Steering wheel nut	5,4	40
Ball joint nuts	4,0	30
Ball joint clamp bolts	1,1 to 1,5	8,5 to 10,5
Relay end cover bolts	0,6 to 0,8	5,0 to 6,0
Relay lever pinch bolts	7,6	55
Steering box to support bracket bolts	7,0 to 8,5	50 to 60
Steering box to support bracket to chassis bolts	2,0	15
Steering box drop-arm nut	8,5 to 11,0	60 to 80
Road wheel nuts	10,3 to 11,7	75 to 85

<b>SUSPENSION</b>		
Road spring 'U' bolts and nuts	9,5 to 11,0	70 to 80
Road spring shackle bolts and nuts	8,3 to 9,5	60 to 70

<b>BRAKES</b>		
Wheel cylinder bleed nipple	0,5 to 0,8	4 to 6
Master cylinder to servo nuts	2,2 to 2,6	16 to 19
Tipping valve retainer master cylinder	4,9 to 6,2	35 to 45
Brake failure switch end pipe union	2,2	16
Brake failure switch unit to housing	2,2	16
Fluid reservoir to master cylinder screws (dual line servo models)	0,3 to 0,4	2 to 3
Servo assembly securing nuts	1,2	9
Brake anchor plate bolts	4,2 to 5,2	30 to 38

<b>ELECTRICAL EQUIPMENT</b>		
Starter motor to engine bolts	4,0 to 4,9	30 to 35
Alternator shaft nut	3,5 to 4,0	25 to 30
Starter motor:		
Through-bolts	1,1	8,0
Solenoid fixing stud nut	0,6	4,5
Solenoid upper terminal nut	0,4	3,0
Reverse light switch	1,4 to 2,0	15 to 20

<b>WINDSCREEN WIPERS AND WASHERS</b>		
Wiper blade drive adaptor bolts	0,34 (34 kgf cm)	2,5 (30 lbf in)

**RECOMMENDED LUBRICANTS**

**RECOMMENDED SERVICE LUBRICANTS AND FLUIDS**

**RECOMMENDED LUBRICANTS AND FLUIDS — U.K.**

Capacities are specified separately, following these charts.

COMPONENT	UNIPART	BP	CASTROL	DUCKHAMS	ESSO	MOBIL	PETROFINA	SHELL	TEXACO
Engine and carburettor dashpots* Oils must meet B.L. Cars specification BLS 0L-02 or the requirements of the CCMC	Unipart Super Multigrade 13W/50	BP Super Viscosync 20-50	Castrol GTX 15W/50	Duckhams Q Motor Oil 20W/50	Esso Superlube 10W/40	Mobil Super 13W/50	Fina Supergrade Motor Oil 15W/40	Shell Super 13W/40	Marvone Motor Oil 15W/40
Main gearbox, transfer gearbox* Hydraulic winch supply tank	Unipart Super Multigrade 13W/50	BP Super Viscosync 20-50	Castrol GTX 15W/50	Duckhams Q Motor Oil 20W/50	Esso Superlube 10W/40	Mobil Super 13W/50	Fina Supergrade Motor Oil 15W/40	Shell Super 13W/40	Marvone Motor Oil 15W/40
Final drive units Swivel pin housings Steering box and relay Differentials (Front and Rear) Rear power take-off Pulley unit and capstan winch Hydraulic winch gearbox		BP Gear Oil S.A.E. 90 EP	Castrol Hypoq S.A.E. 90 EP	Duckhams Hypod 90	Esso Gear Oil GX 85W/140	Mobil Mobilube HD90	Fina Penionic (EP) S.A.E. 90	Shell Spirax 90 EP	Texaco Multigrade Lubricant EP 90
Lubrication nipples (ball joints, hubs, propeller shafts)			Castrol LM Grease	Duckhams LB 10	Esso Multi-Purpose Grease R	Mobilgrease MP	Fina Marson HTL 2	Shell Retinax A	Marfax All-purpose Grease
<b>FUEL AND FLUIDS</b>									
Fuel	91 to 93 Research Octane Fuel, 2-star grade in the United Kingdom.								
Windscreen washers	Unipart All Seasons Screen Washer Fluid.								
Brake and clutch reservoirs	Unipart Universal Brake Fluid or other brake fluids having a minimum boiling point of 280°C (500°F) and complying with FMVSS 116 DOT 3 or S.A.E. J1703 specification.								
Anti-freeze solution for engine cooling system	Use Unipart Universal Anti-freeze. If this is not available use an ethylene glycol based anti-freeze (containing no methanol) with non-phosphate corrosion inhibitors suitable for use in aluminium engines to ensure the protection of the cooling system against frost and corrosion. CAUTION: No other 'Universal' anti-freeze should be used with Unipart Universal Anti-freeze.								
Inhibitor solution for engine cooling system	Marson Lubricants SQ36 — Coolant inhibitor concentrate. For summer use only when frost precautions are not necessary.								

\*Unipart Super Multigrade Motor Oil is recommended for these applications.

**RECOMMENDED LUBRICANTS AND FLUIDS OTHER THAN U.K.**

Capacities are specified separately, following this chart.

Component	Service Classification		Ambient Temperature °C						
	Performance Level	S.A.E. Viscosity	-30	-20	-10	0	10	20	30
ENGINE AND CARBURETTER DASHPOTS	Unipart Super Multigrade Motor Oil OR other oils conforming to LYLELAND CARS SPECIFICATION BLS 22-0L-02 OR The requirements of CCMC or A.P.I. SERVICE LEVELS SE, SF/SE/CC, SE/CD, SF/CC or SF/CD	15W/20 15W/30 15W/40 10W/30 10W/40 10W/50 15W/40 15W/50 20W/40 20W/50	→	→	→	→	→	→	→
MAIN GEARBOX, TRANSFER GEARBOX AND HYDRAULIC WINCH SUPPLY TANK	BLS 22-0L-02 (or requirements of CCMC or API-SE)	20W/50	→	→	→	→	→	→	→
FINAL DRIVE UNITS, SWIVEL PIN HOUSINGS, STEERING BOX, STEERING RELAY, REAR POWER TAKE-OFF, PULLEY UNIT AND CAPSTAN WINCH, HYDRAULIC WINCH, GEARBOX	A.P.I. GL4 OR MIL-L-2105A	Hypod 80W  Hypod 90W	→	→	→	→	→	→	→
LUBRICATION NIPPLES (HUBS, BALL JOINTS etc.)	N-L-G-1—2 Multipurpose Lithium Based Grease.								
BRAKE AND CLUTCH RESERVOIRS	Unipart Universal Brake Fluid or other Brake Fluids having a minimum boiling point of 260°C (500°F) and complying with FMVSS 116 DOT 3 or S.A.E. J1703								
ENGINE COOLING SYSTEM	Permanent type ethylene glycol base with suitable inhibitor for aluminium engines. Where frost precautions are not necessary use Marson Lubricants SQ36 to prevent corrosion of the engine alloy.								
WINDSCREEN WASHERS	Unipart Screen Wash Fluid (All Seasons) or other proprietary screen washer fluids.								

CAPACITIES (Approx)	Litres	U.K. Unit	U.S. Unit
Engine sump oil	5.4 litres	9.5 pints	11.4 pints
Extra when refilling after fitting new filter	0.5 litre	1.0 pint	1.2 pints
Main gearbox oil	2.7 litres	4.7 pints	5.6 pints
Transfer gearbox oil	3.1 litres	5.5 pints	6.6 pints
Rear differential oil	2.6 litres	4.5 pints	5.4 pints
Front differential oil	1.7 litres	3.0 pints	3.6 pints
Swivel housing oil (each)	0.5 litre	1.0 pint	1.2 pints
Steering box oil	0.4 litre	0.75 pint	0.90 pint
Cooling system	9.66 litres	17.0 pints	20.4 pints
Fuel tank	68 litres	16 gallons	18 gallons
Windscreen washer reservoir	2.4 litres	4.2 pints	5.4 pints

RECOMMENDED FUEL

The Rover V8 engine is designed to operate on fuel having a minimum octane rating of 91 to 93 (Research Method); this is equivalent to the British 2-star rating.

Where such fuels are not available and it is necessary to use fuels of lower or unknown rating, the ignition timing must be retarded from the specified setting, just sufficiently to prevent audible detonation (pinking) under all operating conditions, otherwise damage to the engine may occur. Use exhaust gas analysis equipment to check the final engine exhaust emissions after resetting.

The use of lower octane fuels will result in the loss of engine power and efficiency.

In the interests of public health, and to assist in keeping undesirable exhaust emissions as low as possible, fuels of an octane rating higher than that recommended should not be used.

MAINTENANCE

Vehicle maintenance for the Land-Rover V8, whilst following the general pattern of that for other Land-Rover models, is specific to the V8 model.

Two Maintenance Summaries are given, one applicable to all markets except Australia and the other relating to Australian Market vehicles only. These Summaries are identical to those printed in the Owner's Handbooks and comply with local territory requirements.

Following the Maintenance Summaries are details of additional preventive maintenance for the braking system and the recommended procedures for completing the maintenance operations.

Maintenance Information — All Markets

The following items should be checked by the driver weekly or before a long journey:

Engine oil level	All washers reservoir water levels
Brake fluid level	All tyres for pressure and condition
Clutch fluid level	All lights for operation
Radiator coolant level	Horn for operation
Battery electrolyte level	All wipers and washers for operation

Stationary Running

If the vehicle is used exclusively in LOW transfer ratio or for stationary work, maintenance intervals must be based on either fuel consumption or hours running time. The following chart gives an approximate relationship of distance covered to fuel consumption to hours running time.

Distance Covered		Fuel Consumption — Petrol		Hours Running Time
Miles	Kilometres	Litres	Gallons	
3,000	5 000	900	200	120
6,000	10 000	1 800	400	240
9,000	15 000	2 700	600	360
12,000	20 000	3 600	800	480
15,000	25 000	4 500	1,000	600
18,000	30 000	5 450	1,200	720
21,000	35 000	6 350	1,400	840
24,000	40 000	7 250	1,600	960

MAINTENANCE SUMMARY—ALL MARKETS EXCEPT AUSTRALIA

MAINTENANCE SUMMARY—ALL MARKETS EXCEPT AUSTRALIA (Continued)

	First Service only 1600 km (1,000 miles)	Every 5000 km (3,000 miles) or 3 months	Every 10 000 km (6,000 miles) or 6 months	Every 20 000 km (12,000 miles) or 12 months
<b>ENGINE COMPARTMENT</b>				
Check for oil leaks	X	X	X	X
Check/top-up steering box	X			X
Check/top-up steering relay				X
Check/top-up clutch fluid reservoir	X	X	X	X
Check/top-up brake fluid reservoir	X	X	X	X
Check brake servo hose(s) for security and condition	X	X	X	X
Renew fuel filter element				X
Lubricate accelerator control linkage and pedal pivot —check operation	X		X	X
Top-up carburettor piston dampers	X		X	X
Check/adjust choke setting (Manual)		According to climate		
Check crankcase breathing system for leaks, hoses for security and condition	X		X	X
Renew engine flame trap				X
Renew engine breather filter				X
Check air intake temperature control system (where fitted)				X
Renew carburettor air intake cleaner element				X
Clean/adjust spark plugs			X	
Renew spark plugs				X
Check ignition wiring for chafing, fraying and deterioration	X			X
Check security of distributor vacuum unit line	X			X
Clean distributor cap: check for cracks and tracking				X
Lubricate distributor	X		X	X
Check distributor points; adjust or renew	X		X	X
Check/adjust ignition timing, using electronic equipment	X		X	X
Check/top-up cooling system	X	X	X	X
Check cooling and heater systems for leaks and hoses for security and condition	X	X	X	X
Check/adjust operation of all washers and top-up reservoirs	X	X	X	X
Check driving belt; adjust or renew	X	X	X	X
Check/top-up engine oil level		X		
<b>EXTERIOR</b>				
Inspect brake linings for wear, drums for condition			X	X
Check footbrake for operation; adjust to manufacturer's instructions	X		X	X
Check tyres comply with manufacturer's specification		X	X	X
Check tyre tread depth and visually for external cuts in fabric, exposure of ply or cord structure, lumps or bulges		X	X	X
Interchange road wheels (including spare)			X	X
Check/adjust tyre pressure (including spare)	X	X	X	X
Check/adjust headlamp alignment	X	X	X	X
Check, if necessary renew, wiper blades		X	X	X
Check/adjust front wheel alignment	X			X
Check condition of fuel filler cap seal				X
Check rear-view mirror(s) for cracks and crazing		X	X	X
Check operation of all door and bonnet locks	X			X
Check tightness of road wheel fastenings	X	X	X	X

continued

	First Service only 1600 km (1,000 miles)	Every 5000 km (3,000 miles) or 3 months	Every 10 000 km (6,000 miles) or 6 months	Every 20 000 km (12,000 miles) or 12 months
<b>UNDERBODY</b>				
Check for oil leaks	X	X	X	X
Check security of engine mountings	X			X
Renew engine oil	X		X	X
Renew engine oil filter			X	X
Drain flywheel housing if drain plug is fitted for wading		X	X	X
Check condition and security of steering unit joints, relays and gaiters	X	X	X	X
Check/top-up front axle oil			X	X
Renew front axle oil	X			
Check/top-up swivel pin housing oil			X	X
Renew swivel pin housing oil	X			
Clean electric fuel pump element		80 000 km (48,000 miles)		
Check/top-up main gearbox oil			X	X
Renew main gearbox oil	X			
Check/top-up transfer gearbox oil			X	X
Renew transfer gearbox oil	X			
Lubricate handbrake linkage and cable			X	X
Check handbrake operation, adjust to manufacturer's instructions (Manual)	X		X	X
Lubricate propeller shafts	X		X	X
Check tightness of propeller shaft coupling bolts	X			X
Check/top-up rear axle oil			X	X
Renew rear axle oil	X			
Check security of transmission mountings	X			
Check exhaust system, fuel, clutch and brake pipes and unions for leaks, chafing and corrosion	X	X	X	X
Clean axle case breathers				X
Check security of suspension fixings	X			X
<b>PASSENGER COMPARTMENT</b>				
Check/top-up battery electrolyte	X	X	X	X
Clean and grease battery connections			X	X
Check function of original equipment, i.e. interior and exterior lamps, horns, wipers and warning indicators	X	X	X	X
Check condition and security of seats and seat belts	X	X	X	X
Lubricate all locks and hinges (NOT steering lock)	X		X	X
Check operation of window controls	X			X
Ensure cleanliness of controls, door handles and steering wheel	X	X	X	X
<b>GENERAL</b>				
Road/roller test and check function of all instrumentation	X		X	X
Report additional work required		X	X	X

WARNING: Two-wheel roller tests must be restricted to 5 km/h (3 m.p.h.) because the Land-Rover V8 is in constant four-wheel drive.

continued

MAINTENANCE SUMMARY—ALL MARKETS EXCEPT AUSTRALIA (Continued)

At 24,000 mile intervals, the following operations should be carried out:

- i Lubricate propeller shaft sealed sliding joints.
- ii Renew gearbox oil.
- iii Renew transfer box oil.
- iv Renew front and rear axle oil.
- v Renew swivel pin housing oil.

At 36,000 mile intervals: Renew air filter in brake servo unit.

At 48,000 mile intervals: Clean fuel pump filter.

MAINTENANCE SUMMARY—AUSTRALIAN MARKET VEHICLES ONLY

Service Code Letter	Distance Kilometres × 1000										Monthly Intervals	
	1.5	5	15	25	35	45	55	65	75			
A	1.5											1
B		5	15	25	35	45	55	65	75			3
C			10	30		50		70				6
D				20			60					12
E					40			80				24

These service intervals are based on an annual distance covered of approximately 20 000 kilometres.

Should the vehicle complete substantially less distance than this, be used on a high proportion of short journeys or be operated in severe conditions, for example: dusty, wet or muddy terrain, frequent wading; it may require more frequent servicing or particular attention to specific items. A Leyland Dealer will be pleased to offer advise regarding particular service requirements under severe operating conditions.

In any event the period between services should NOT EXCEED THREE MONTHS.

Operation	Service				
	A	B	C	D	E
<b>ENGINE</b>					
Check for engine oil leaks	X	X	X	X	X
Check/top-up engine oil		X			
Renew engine oil	X		X	X	X
Renew engine oil filter			X	X	X
Lubricate accelerator control linkage and pedal pivot—check operation	X		X	X	X
Top-up carburetter piston dampers	X		X	X	X
Renew carburetter/air intake air cleaner element				X	X
Check/adjust choke settings	X			X	X
Check/adjust carburetter idle settings	X			X	X
Clean electric fuel pump filter			80 000 km		
Renew engine flame trap				X	X
Clean engine breather filter				X	
Renew engine breather filter and fuel filter element					X
Check driving belts; adjust or renew	X			X	X
Check security of engine mountings	X				
Check cooling and heater systems for leaks and hoses for security and condition	X	X	X	X	X
Check/top-up cooling system	X	X	X	X	X
Check/adjust operation of all washers and top-up reservoir(s)	X	X	X	X	X
Check crankcase breathing and evaporative loss systems hoses for security	X				
Check crankcase breathing and evaporative loss systems. Check hoses/pipes and restrictors for blockage, security and condition				X	X
Check security of E.G.R. valve operating lines	X				
Check E.G.R. system				X	X
Check air injection system hoses/pipes for security	X				
Check air injection system hoses/pipes for condition and security				X	X
Check operation of the check valve				X	X
Renew adsorption canister			80 000 km		

continued

MAINTENANCE SUMMARY—AUSTRALIAN MARKET VEHICLES ONLY  
(Continued)

Operation	Service				
	A	B	C	D	E
<b>IGNITION</b>					
Check ignition wiring for fraying, chafing and deterioration	X			X	X
Check security of distributor vacuum unit line and operation of vacuum unit	X			X	X
Lubricate distributor				X	X
Clean distributor cap; check for cracks and tracking				X	X
Renew distributor points				X	X
Renew spark plugs				X	X
Check coil performance on oscilloscope				X	X
Check/adjust ignition timing, using electronic equipment	X			X	X
<b>TRANSMISSION</b>					
Check/top-up clutch fluid reservoir	X	X	X	X	X
Check clutch pipes/hydraulic hoses visually for cracks, leaks and chafing	X	X	X	X	X
Lubricate clutch pedal pivot				X	X
Check for transmission oil leaks	X	X	X	X	X
Check/top-up gearbox oil			X	X	
Renew gearbox oil	X				X
Check/top-up transfer box oil			X	X	
Renew transfer box oil	X				X
Check/top-up front and rear axle oil			X	X	
Renew front and rear axle oil	X				X
Check tightness of propeller shaft coupling bolts	X			X	X
Lubricate propeller shaft	X		X	X	X
Lubricate propeller shaft sealed sliding joint					X
Drain flywheel housing if drain plug is fitted for wading		X	X	X	X
<b>STEERING AND SUSPENSION</b>					
Check security/condition of suspension fixings	X		X	X	X
Check security and condition of steering unit, joints, relays and gaiters	X	X	X	X	X
Check steering rack/gear for oil/fluid leaks	X	X	X	X	X
Check shock absorbers for fluid leaks	X	X	X	X	X
Check/top-up steering box	X			X	X
Check/adjust steering box	X	X	X	X	X
Check/top-up steering relay unit				X	X
Check/top-up swivel pin housing oil			X	X	
Renew swivel pin housing oil	X				X
Check/adjust front wheel alignment	X		X	X	X

continued

MAINTENANCE SUMMARY—AUSTRALIAN MARKET VEHICLES ONLY  
(Continued)

Operation	Service				
	A	B	C	D	E
<b>BRAKES</b>					
Check visually brake hydraulic hoses, pipes and unions for chafing, cracks, leaks and corrosion	X	X	X	X	X
Check/top-up brake fluid reservoir	X	X	X	X	X
Inspect brake linings for wear, drums for condition			X	X	X
Lubricate brake pedal pivot				X	X
Check footbrake operation; adjust to manufacturer's instructions	X	X	X	X	X
Lubricate handbrake mechanical linkage and cable guides (lever pivot)			X	X	X
Check handbrake security and operation; adjust to manufacturer's instructions	X	X	X	X	X
Check brake servo hose(s) for security and condition	X	X	X	X	X
Renew servo filter element			60 000 km		
<b>ELECTRICAL</b>					
Check function of original equipment, i.e. interior and exterior lamps, horns, wipers and warning indicators	X	X	X	X	X
Check/top-up battery electrolyte	X	X	X	X	X
Clean and grease battery connections			X	X	X
Check/adjust headlamp alignment	X	X	X	X	X
Check, if necessary renew, wiper blades		X	X	X	X
Check output of charging system	X				
Check brake system warning lights	X	X	X	X	X
<b>FUEL AND EXHAUST PIPES</b>					
Check fuel system for leaks, pipes and unions for chafing and corrosion	X	X	X	X	X
Check exhaust system for leaks and security	X	X	X	X	X
Check condition of fuel filler cap seal				X	X
<b>WHEELS AND TYRES</b>					
Check that tyres comply with manufacturer's specification		X	X	X	X
Check tyres for external cuts in tyre fabric, exposure of ply or cord structure, lumps, bulges or uneven wear	X				
Check tyres for tread depth and visually for external cuts in fabric, exposure of ply or cord structure, lumps, bulges or uneven wear		X	X	X	X
Interchange road wheels			X	X	X
Check tightness of road wheel fastenings	X	X	X	X	X
Check/adjust tyre pressures including spare	X	X	X	X	X
<b>IMPORTANT:</b> If tyres do not conform with legal requirements, report to owner.					

continued



MAINTENANCE SUMMARY—AUSTRALIAN MARKET VEHICLES ONLY  
(Continued)

Operation	Service				
	A	B	C	D	E
<b>BODY</b>					
Check rear view mirror(s) for security, cracks and crazing		X	X	X	X
Lubricate all locks, hinges and door check mechanism (not steering lock)	X		X	X	X
Check operation of all door, bonnet and tailgate locks	X		X	X	X
Check operation of all window controls	X		X	X	X
Check condition and security of seats and seat belts	X	X	X	X	X
Check operation of seat belt warning system	X	X	X	X	X
Check operation of seat belt inertia reel mechanism	X	X	X	X	X
Ensure cleanliness of controls, door handles and steering wheel	X	X	X	X	X
<b>GENERAL</b>					
Road/roller test and check function of all instrumentation	X	X	X	X	X
Report additional work required		X	X	X	X

**WARNING:** Two-wheel roller tests must be restricted to 5 km/h (3 m.p.h.) because the Land Rover V8 is in constant four-wheel drive.

**ADDITIONAL PREVENTIVE MAINTENANCE—ALL MARKETS**

In addition to the recommended periodical inspection of brake components it is advisable as the car ages, and as a precaution against the effects of wear and deterioration, to make a more searching inspection and renew parts as necessary.

It is recommended that:

1. Disc brake pads, drum brake linings, hoses and pipes should be examined at intervals no greater than those laid down in the Maintenance Summary.
2. Brake fluid should be changed completely every 18 months or 30 000 kilometres whichever is the sooner.
3. All fluid seals in the hydraulic system and all flexible hoses should be renewed every 3 years or 60 000 kilometres whichever is the sooner. At the same time the working surfaces of the piston and of the bores in the master cylinder, wheel cylinders and other slave cylinders should be examined and new parts fitted where necessary.

Care must be taken always to observe the following points:

- a. At all times use the recommended brake fluid.
- b. Never leave fluid in unsealed containers. It absorbs moisture quickly and can be dangerous if used in the braking system in this condition.
- c. Fluid drained from the system or used for bleeding is best discarded.
- d. The necessity for absolute cleanliness throughout cannot be over-emphasized.

**REPLACEMENT BRAKE PADS AND SHOES**

When it becomes necessary to renew the brake pads and shoes, it is essential that only genuine components with the correct grade of lining are used.

Always fit new pads or shoes as complete axle sets, never individually or as a single wheel set. Serious consequences could result from out-of-balance braking due to mixing of linings.

Replacement brake pads and shoes are obtainable from a Leyland Dealer.

For details of emission and evaporative loss control equipment refer to Section 17 of this publication.

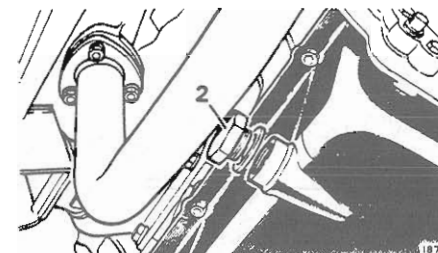
**Check/top-up engine oil**

1. Stand the car on level ground and allow the oil to drain back into the sump.
2. Withdraw the dipstick at left-hand side of engine; wipe it clean, re-insert to its full depth and remove a second time to take the reading.
3. Add oil as necessary through the screw-on filler cap marked 'ENGINE OIL' on the right-hand front rocker cover. Never fill above the 'High' mark on the dipstick.



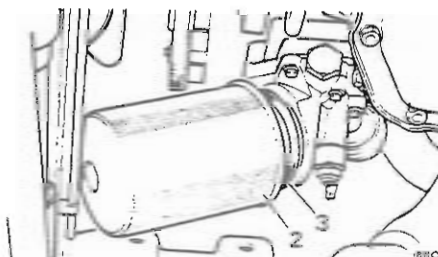
**Renew engine oil**

1. Run the engine to warm-up the oil; switch off the ignition.
2. Place an oil tray under the drain plug.
3. Remove the drain plug in the bottom of the sump at left-hand side. Allow oil to drain away completely and replace the plug.
4. Refill the engine sump with the correct quantity and grade of oil.
5. Run the engine to check for oil leaks at the drain plug.



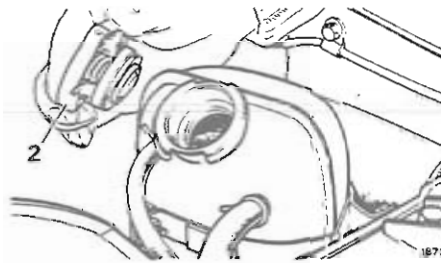
**Renew engine oil filter**

1. Place an oil tray under the engine.
2. Unscrew the filter anti-clockwise, using a strap spanner as necessary.
3. Smear a little clean engine oil on the rubber washer of the new filter, then screw the filter on clockwise until the rubber sealing ring touches of the oil pump cover face, then tighten a further half turn by hand only. Do not overtighten.
4. Check/top-up the engine oil level.
5. Run the engine to check for oil leaks at the filter.



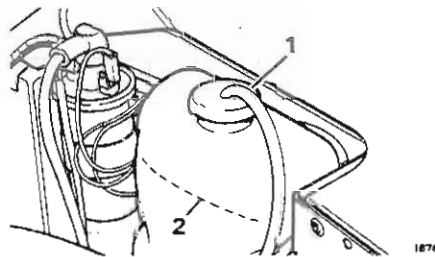
Check/top-up cooling system

1. Locate the cooling system expansion tank at the left-hand front of the engine compartment.
2. Remove the expansion tank filler cap.  
**WARNING:** Do not remove the filler cap when the engine is hot because the cooling system is pressurized and personal scalding could result.
3. Maintain the coolant level in the expansion tank at approximately half full.  
**NOTE:** To prevent corrosion of the aluminium alloy engine parts it is imperative that the cooling system is filled with a solution of water and anti-freeze, winter or summer, or water and inhibitor during the summer only. Never fill or top-up with plain water.



Check/adjust operation of all washers and top-up reservoir(s)

1. Remove reservoir caps by turning anti-clockwise or prising upwards.
2. Top-up reservoir to within approximately 25 mm (1 in) below bottom of filler neck.  
Use Clearalex windscreen washer powder in the bottle. This will remove mud, flies and road film. In cold weather, to prevent freezing of the water, add isopropyl alcohol. Do NOT use methylated spirits, which has a detrimental effect on the screen washer impeller.



Check driving belts; adjust or renew

1. Examine the following belts for wear and condition, and renew if necessary.
  - i. Crankshaft — water pump — alternator.
  - ii. Crankshaft — jockey pulley — air pump.
2. Each belt should be sufficiently tight to drive the appropriate auxiliary without undue load on the bearings.  
Correct tension: This is measured by allowing 0,4 mm movement on the slack side of the belt per 25,4 mm between pulley centres.  
E.g. Distance between pulley centres = 254 mm  
Tension =  $\frac{254 \times 0,4}{25,4}$  mm  
= 4,00 mm
3. Slacken the bolts securing the unit to its mounting bracket.
4. Slacken appropriate pivot bolt and the fixing at the adjustment link.
5. Pivot the unit inwards or outwards as necessary and adjust until the correct belt tension is obtained.
6. Tighten unit adjusting bolts.

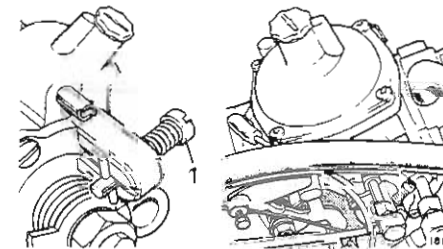
Check adjustment again, when a new belt is fitted, after approximately 1500 km running.

Renew carburettor/air intake air cleaner elements

Refer to Operation 19.10.08 in this publication.

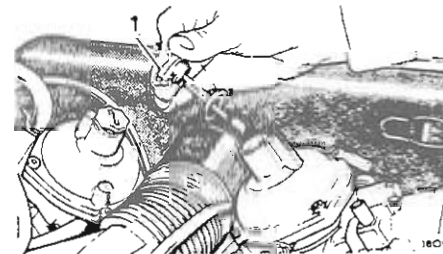
Carburettor choke adjuster

1. For starting at temperatures down to -18°C (0°F) push and turn the spring-loaded choke adjustment screw so that the peg is at right-angles to the slot as illustrated. Leave in this position. When starting at temperatures below -18°C (0°F) turn the screw until peg is recessed in slot.



Top-up carburettor piston dampers

1. Unscrew the cap on top of each suction chamber; withdraw cap and hydraulic damper. Replenish the damper reservoir as necessary with engine oil to within about 12 mm (0,5 in) from the top of the tube.
2. Replace the cap and hydraulic damper.



Check/adjust carburettor idle settings

Recommended idle and fast idle speeds are given in the General Specification and Tuning Data sections of this publication.

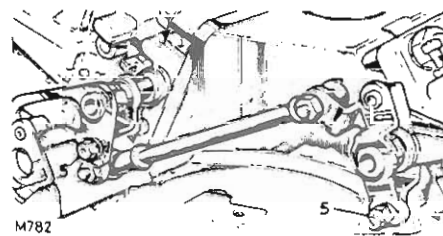
Idle speed and mixture adjustment

All markets except Australia

Service tool: 605330 carburettor balancer

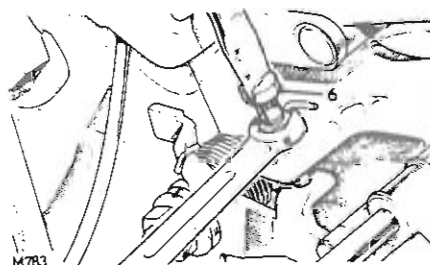
The service tool 605330 carburettor balancer must be used to adjust the carburettors. Primarily this instrument is for balancing the air flow through the carburettors, but it also gives a good indication of the mixture setting. Investigation has shown that incorrect mixture setting causes either stalling of the engine or a considerable drop in engine rev/min if the balancer is fitted when the mixture is too rich or a considerable increase in rev/min when used with the mixture setting too weak. Before balancing the carburettors it is most important therefore that the following procedure be carried out:

1. Check that the throttle control between the pedal and the carburettors is free and has no tendency to stick.
2. Check the throttle cable setting with the throttle pedal in the released position. The throttle linkage must not have commenced movement, but commences with the minimum depression of the pedal.
3. Run the engine until it attains normal operating temperature; that is, thermostat open.
4. Remove the air cleaner, see 19.10.01.
5. Slacken the screws securing the throttle adjusting levers on both carburettors.

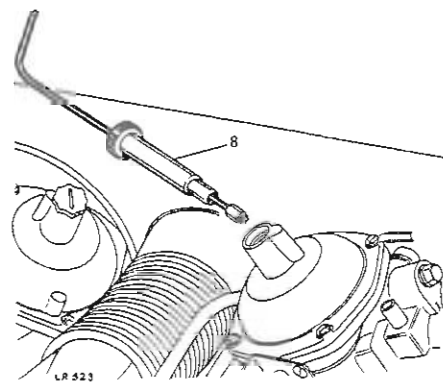


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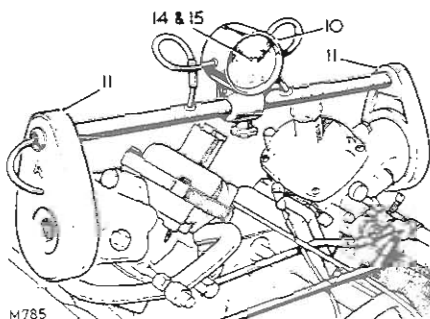
- Start the engine and check the idle speed. If necessary, adjust the throttle stop screws to give the correct idle speed. If a tamper-proof sleeve is fitted over this screw, the slow running speed can only be adjusted using a special tool supplied to authorized service outlets.



- Where applicable, check the mixture on each carburetter separately, by lifting the air valve 0.8 mm (.031 in). If the engine increases immediately, the mixture is too rich. If the engine speed decreases immediately, the mixture is too weak.
- Remove the piston damper plug and using special tool MS80, adjust the mixture. Locate the outer sleeve of the tool to engage a machined slot to prevent the air valve twisting. Turn the inner tool clockwise to enrich the mixture and anti-clockwise to weaken it.

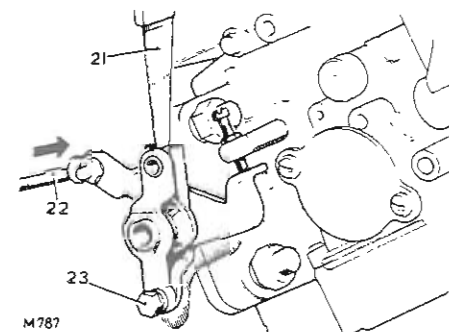
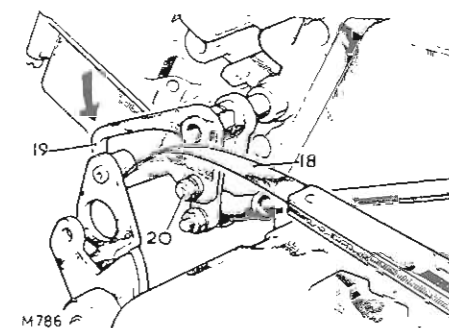


- When the mixture is correctly adjusted, the engine speed will remain constant or may fall slowly a slight amount as the air valve is lifted.
- Check, and if necessary, zero the gauge on tool 605330.
- Place tool 605330 onto the carburetter adaptors, ensuring that there are no air leaks. If the engine stalls or decreases considerably in speed, the mixture is too rich. If the engine speed increases, the mixture is too weak.
- If necessary, remove tool 605330 and readjust the mixture, then refit the tool.
- Check tool 605330 gauge reading.
- If the gauge pointer is in the 'zero' sector, no adjustment is required.
- If the gauge pointer moves to the right, decrease the air flow through the left-hand carburetter by unscrewing the throttle stop screw or increase the air flow through the right-hand carburetter by screwing in the throttle stop screw. Reverse the procedure if the pointer moves to the left.



continued

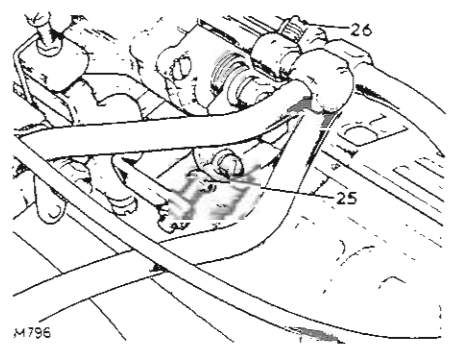
- If the engine idle speed rises too high or drops too low during balancing, adjust to the correct idle speed, maintaining the gauge pointer in the 'zero' sector.
- Remove tool 605330. With the mixture setting and carburetter balance correctly adjusted the difference in engine rev/min with the tool 605330 on or off will be negligible, approximately plus or minus 25 rev/min.  
**NOTE:** Using a recognised type CO meter, the exhaust gas analysis reading should not exceed 4% carbon monoxide or any other levels fixed by local territory legislation.
- On the left-hand carburetter, place a 0.15 mm (0.006 in) feeler between the underside of the roller on the countershaft lever and the throttle lever.
- Apply pressure to the throttle lever to hold the feeler.
- Tighten the screw to secure the throttle adjusting lever, then withdraw the feeler.
- On the right-hand carburetter, place a 0.15 mm (0.006 in) feeler between the left leg of the fork on the adjusting lever and the pin on the throttle lever.
- Apply light pressure to the linkage to hold the feeler.
- Tighten the screw to secure the throttle adjusting lever, then withdraw the feeler.
- Refit the air cleaner, see 19.10.01.



**Fast idle adjustment**

The fast idle adjustment is pre-set on the left-hand carburetter and should not normally require adjustment. If adjustment is required, the fast idle can be approximately set as follows, but this method is not recommended for ambient temperatures below 8°C (10°F).

- Set the fast idle adjustment screw against the cam to give the required engine speed.  
**NOTE:** On some carburetters a special tool, supplied to authorized service outlets, may be necessary to adjust the fast idle speed setting.



**Idle speed and mixture adjustment**  
*Australian market vehicles*

- Run the engine until normal operating temperature is reached.
- Remove the air cleaner, see 19.10.01.
- Disconnect the throttle linkage so that each carburetter operates independently

continued

## MAINTENANCE

### Adjusting idle speed and air-flow for balance

4. Ensure that the fast idle screw is clear of the fast idle cam.
5. Using an air-flow meter check that the air-flow through both carburetters is the same. If not, adjust as necessary.
6. If necessary, turn the throttle adjusting screws on both carburetters an equal amount to maintain the correct idle speed.
7. Increase the engine speed to 1600 rev/min and check the balance with the air-flow meter. If necessary, turn the throttle adjusting screws by equal amounts to achieve a balance.
8. Re-check the air-flow balance at idle speed.

### Checking and adjusting CO level at idle

9. Disconnect and plug the outlet hose from the air pump.
10. Maintain the engine at normal operating temperature and check that the idle speed is correct.
11. Check, and if necessary, adjust the ignition timing.
12. Re-check the idle speed.
13. Insert the gas analyser probe as far as possible into the exhaust pipe.
14. Check the CO reading.
15. Adjust the mixture if necessary—see 'Mixture adjustment'.
16. Check, and if necessary, adjust the idle speed.
17. Withdraw the analyser probe.
18. Switch off the ignition.
19. Unplug air injection hose and reconnect to the pump.

### Mixture adjustment

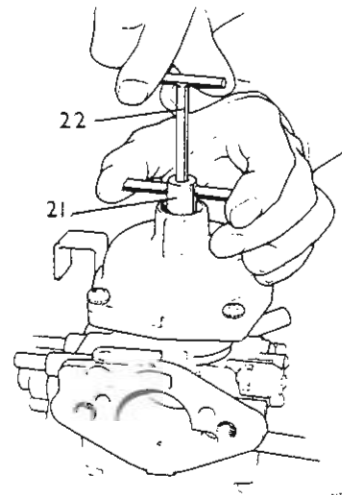
**CAUTION:** The setting **MUST ALWAYS** be checked by means of a non-dispersive infra-red exhaust gas analyser. For significant deviation outside the specified CO limits the mixture should be adjusted as follows.

20. Remove the piston damper from both carburetters.
21. Carefully insert special tool S 353 into the dashpot until the outer tool engages in the air valve and the inner tool engages the hexagon in the needle adjuster plug.

**CAUTION:** The outer tool must be correctly engaged and held in position otherwise damage to the diaphragm may result.

22. Holding the outer tool, turn the inner tool:
  - a. Clockwise to enrich the mixture.
  - b. Anti-clockwise to weaken.

continued



23. Repeat instructions 21 and 22 on the remaining carburettor, ensuring that the adjustment made is by the same amount.
24. Top-up the carburettor dampers—refer to Section 10.
25. Re-check the CO reading—adjust until the CO reading is within the specified limits.
26. Set the fast idle as follows:
  - a. Slacken choke cable clamping screw at carburettor.
  - b. Pull choke control knob out and push in to a distance of approximately 0.5 in and lock in position.
  - c. Turn starter cam, allowing choke cable to slide through the trunnion until the punched mark on the cam flank aligns with the centre of the domed screw on the starter/throttle lever, and tighten clamping screw.
  - d. With the cam held in this position adjust the fast idle screws to obtain a speed of  $1100 \pm 50$  rev/min and re-tighten locknut.
  - e. Push choke cable fully home and check that normal idle speed is regained.

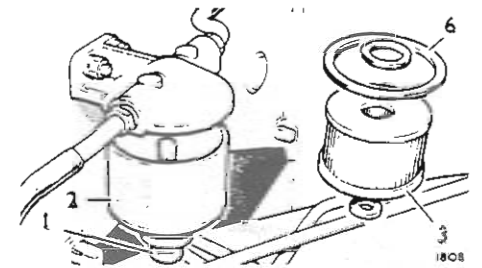
### RENEW FUEL FILTER ELEMENT

The element provides a filter between the pump and carburettor and is located on the rear engine compartment bulkhead.

**NOTE:** On all but U.K. European cars it will be necessary to remove the carburettor air cleaner to gain access to the fuel filter.

Replace the element as follows:

1. Unscrew the centre bolt.
2. Withdraw the filter bowl.
3. Remove the small sealing ring and remove the element.
4. Withdraw the large sealing ring from the underside of the filter body.
5. Discard the old element and replace with a new unit.
6. Ensure that the centre and top sealing rings are in good condition and replace as necessary.
7. Fit new element, small hole downwards.
8. Refit sealing rings.
9. Replace filter bowl and tighten the centre bolt.

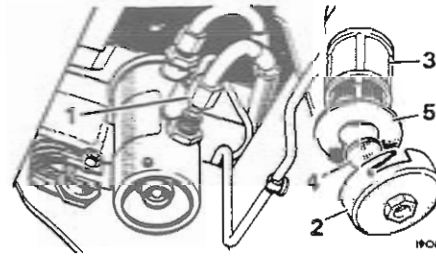


**Clean electric fuel pump filter**

The fuel pump is located on the right-hand chassis member approximately mid-way on the wheelbase.

To renew the pump filter:

1. From beneath the vehicle disconnect the fuel inlet pipe from the pump and blank the end of the pipe by suitable means to prevent fuel draining from the tank.
2. Release the end cover from the bayonet fixing.
3. Withdraw the filter and clean by using a compressed air jet from the inside of the filter.
4. Remove the magnet (where fitted) from the end cover and clean. Replace the magnet in the centre of the end cover.
5. Reassemble the fuel pump and refit the fuel inlet pipe. Use a new gasket for the end cover if necessary.



**Check/adjust ignition timing, using electronic equipment**

A pointer on the timing cover and marks on the crankshaft pulley indicate positions around T.D.C. on No. 1 cylinder (i.e. front cylinder on left-hand bank).

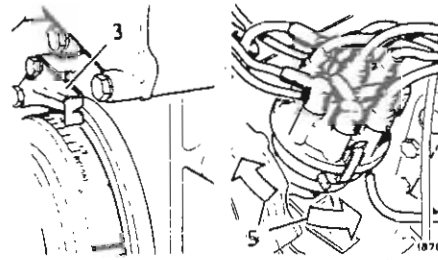
Refer to Tuning Data section of this publication for ignition timing values.

1. Connect a stroboscopic timing light as instructed by the manufacturer. The engine is timed on No. 1 cylinder.
2. Run the engine at idle speed.
3. Position the timing light to illuminate the crankshaft pulley and scale.

**WARNING:** Ensure that personnel and equipment are kept clear of the rotating cooling fan while using the timing light.

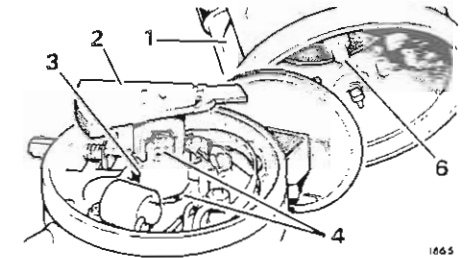
4. If the timing is correct the pulley mark indicated in the Tuning Data will show. If correct, instruction 5 may be ignored.
5. With the engine still running at idle speed, slacken the clamp bolt and carefully rotate the distributor body as required until the correct pulley mark shows. Tighten the clamp bolt with the unit in this position.

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



**Lubricate distributor**

1. Remove distributor cap.
2. Remove rotor arm.
3. Lightly smear the cam with clean engine oil.
4. Add a few drops of thin machine oil to lubricate the cam bearing and distributor shaft.
5. Wipe the inside and outside of the distributor cap with a soft, dry cloth.
6. Ensure that the carbon brush works freely in its holder.
7. Replace rotor arm and distributor cap.



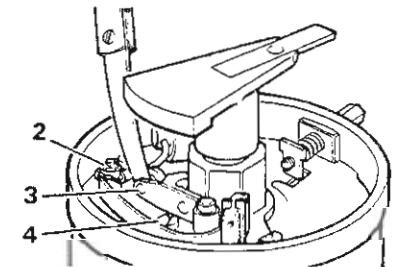
**Check/adjust or renew distributor points**

1. Remove distributor cap.
2. Remove the nut on the terminal block.
3. Lift off the spring and moving contact.
4. Remove adjustable contact, secured with a screw.
5. Add a smear of grease to contact pivot before fitting new contact points. Then carry out distributor maintenance, followed by setting the ignition timing and dwell angle. However, when it becomes necessary to change the contact points and specialized checking equipment is not available, they may be adjusted either by the feeler gauge or, alternatively, the timing lamp method. Proceed as follows:

**Checking contact points — feeler gauge method**

6. Turn the engine in direction of rotation until the contacts are fully open.
7. The clearance should be 0.35 to 0.40 mm (0.014 to 0.016 in), with the feeler gauge a sliding fit between the contacts.
8. Adjust by turning the adjusting nut clockwise to increase gap and anti-clockwise to reduce gap. When an adjusting nut facility is not provided, position the adjustable contact using a screwdriver in the slot provided.
9. Tighten the adjustable contact securing screw.
10. Replace the distributor cap. At the first available opportunity after the contact points have been adjusted as detailed above they must be finally set to the dwell angle using specialized equipment.

**NOTE:** When new contact points have been fitted the dwell angle must be checked after a further 1500 km (1,000 miles) running.

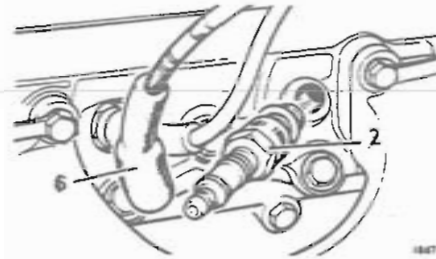


1803

To remove, clean, adjust and refit spark plugs

Removing

1. Withdraw leads by gripping end shrouds. **DO NOT pull-leads-alone.**  
**NOTE:** Remove the hot air pipe for access to the R.H. plugs as necessary.
2. Using special spanner and tommy bar supplied in vehicle tool kit, remove spark plugs and washers.

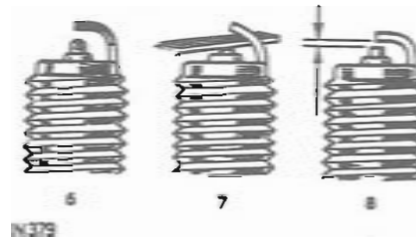


Cleaning

3. Fit plug in plug cleaning machine.
4. Wobble plug with circular motion while operating abrasive blast for a maximum of four seconds.

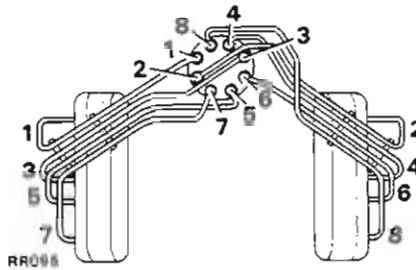
**CAUTION:** Excessive abrasive blasting will erode insulator nose.

5. Change to air blast only and continue to wobble plug for a minimum of thirty seconds to remove abrasive grit from plug cavity.
6. Wire-brush plug threads, open gap slightly.
7. Using point file, square off electrode surfaces.
8. Set electrode gap, see Tuning Data section of this publication.
9. Test plugs in accordance with cleaning machine manufacturer's instructions. If satisfactory, refit plugs in engine.



**IMPORTANT:** If new plugs are necessary, refer to Section 05.

10. Examine high tension leads, including coil to distributor lead, for insulation cracking or corrosion at end contacts. Fit new leads as necessary.
11. In addition to correct firing order, high tension leads must be fitted in correct relation to each other to avoid cross firing, as illustrated.
12. When pushing leads on plugs ensure ferrules within shrouds are firmly seated on plugs. A guide is that shroud ends are within 6 mm (0.250 in) of metal body of plugs.

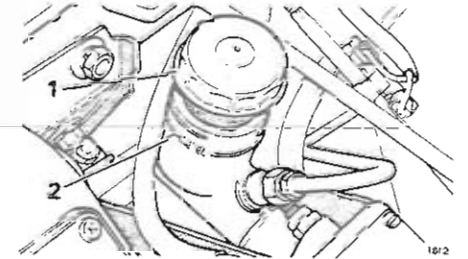


Check coil performance on oscilloscope

The Lucas 16C6 ignition coil fitted to this model has a primary winding resistance of 1.2 to 1.4 ohms at 20°C (68°F).

Check/top-up clutch fluid reservoir

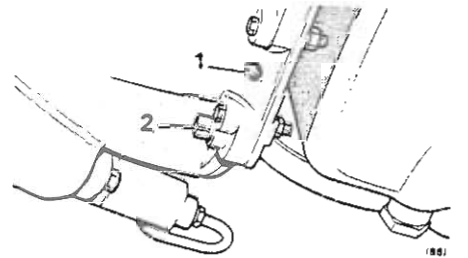
1. Wipe clean the surrounding area before removing the reservoir cap.
2. Top-up the reservoir as necessary, to the bottom of the filler neck.



Drain flywheel housing if drain plug is fitted for wading:

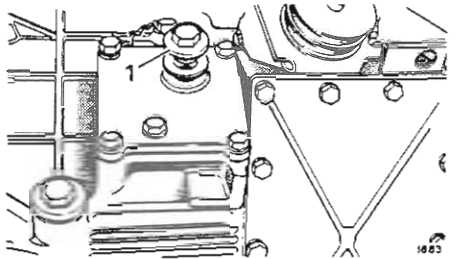
When in use for wading:

1. The flywheel housing can be completely sealed to exclude mud and water under severe wading conditions, by means of a plug fitted in the bottom of the housing.
2. The plug is screwed into the housing adjacent to the drain hole, and should only be fitted when the vehicle is expected to do wading or very muddy work. When the plug is in use it must be removed periodically and all oil allowed to drain off before the plug is replaced.



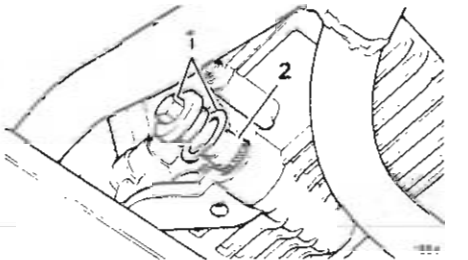
Check/top-up gearbox oil

1. From beneath the vehicle remove the filler/level plug at the side of the gearbox.
2. Add oil to the bottom of the filler plug orifice.
3. Wipe away surplus oil and refit the plug.



Renew gearbox oil

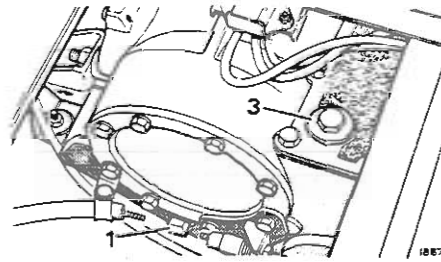
1. Immediately after a run when the oil is warm, drain off the oil by removing the drain plug and washer from the bottom of the gearbox casing.
2. Remove the oil filter.
3. Wash the filter in clean fuel; allow to dry and replace.
4. Refit drain plug and refill gearbox through the oil filler cap with the correct grade of oil to the 'H' level mark on the dipstick.



**Check/top-up transfer box oil level**

Check oil level daily, or weekly when operating under severe wading conditions.

1. To check oil level: remove the oil level plug, located on the rear of the transfer box casing. Oil should be level with the bottom of the hole.
2. To top-up: remove the centre seat cushion and the seat base cover-plate.
3. Remove the oil filler plug from the transfer box, and top-up as necessary. If significant topping-up is required, check for oil leaks at drain and filler plugs.

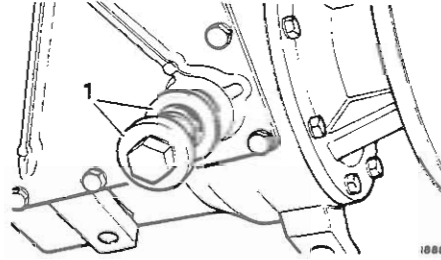


**Renew transfer gearbox oil**

Drain and refill monthly when operating under severe wading conditions.

To change the transfer box oil, proceed as follows:

1. Immediately after a run when the oil is warm, drain off the oil by removing the drain plug and washer from the bottom of the transfer box.
2. Replace the drain plug and washer and refill the transfer box through the oil filler plug, with the correct grade of oil, to the bottom of the oil level plug hole.

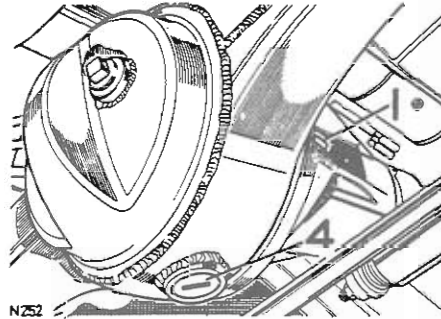


Refer to Data for capacity.

**IMPORTANT:** Do not overfill otherwise leakage may occur.

**Check/top-up front and rear axle oil**

1. From beneath the vehicle, remove the filler/level plug on the respective axle cover-plate.
2. Add oil to the bottom of the filler plug orifice.
3. Wipe away surplus oil and refit the plug.

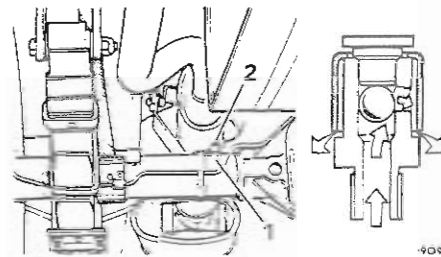


**Renew front and rear axle oil**

1. Drain the oil by removing the drain plug below the axle differential case.
2. Replace the plug and fill the axle to the level of the filler plug orifice.

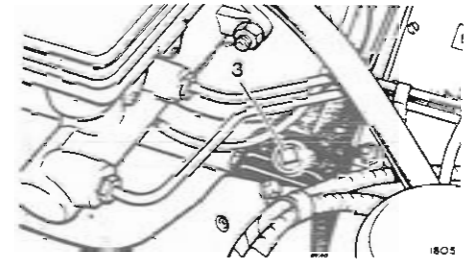
At 12,000 miles (20,000 km) intervals clean the axle case breathers, which are located on top of the axle case between the differential housing and the suspension spring, as follows:

1. Clean off the axle breathers and the surrounding surfaces of the axle cases, taking care to remove any gritty foreign matter.
2. Unscrew the axle breathers from their tapered threads in the axle tubes and soak in petrol or a suitable cleaning solvent for several minutes and clean with a soft brush.
3. Shake each breather to ensure the ball valve is free. If it is not, the breather valve must be renewed.
4. Lubricate the balls lightly with engine oil before replacing the breathers.



**Check/top up steering box**

1. Wipe clean the area around the filler plug before removing the plug.
2. Top up the oil level to the bottom of the filler plug hole.
3. Refit the filler plug.

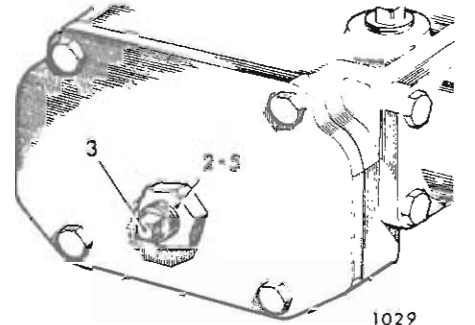


**Check/adjust steering box**

The adjuster is accessible after removing a cover inside the front wheel arch.

The procedure for adjusting the steering box is as follows:

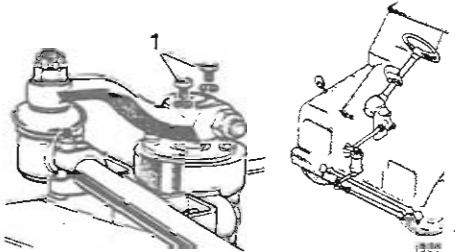
1. Set the road wheels in the straight ahead position.
2. Slacken the adjuster locknut.
3. Tighten the adjuster to reduce steering wheel backlash.
4. Tighten the locknut.



**Check/top up steering relay unit**

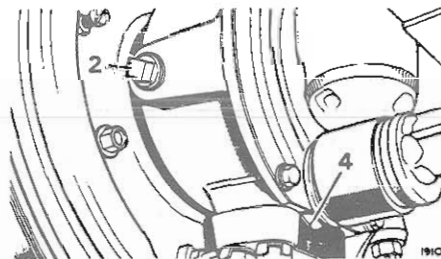
Check oil level and top-up if necessary until the oil is visible at the base of the filler and breather holes. If significant topping-up is required, check joints for leakage and fit new joint washers as necessary. To check oil level and top up, proceed as follows:

1. Remove two of the bolts securing the relay top cover.
2. 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.
3. Whilst filling, it is probable that oil will eject through the breather hole. If this occurs do not assume that the relay unit is full. Time must be given to allow the oil to find its way to the main chamber. Wait a few moments until the breather hole is clear of oil, then continue filling.
4. As the unit fills up, air is forced out usually in the form of an oil bubble, escaping through the breather hole, again giving the impression that the unit is full. Wait for the bubble to subside, then continue filling in this manner until the oil is clearly visible at the base of the filler and breather holes.
5. Replace the two top cover bolts. Refit the radiator grille and name plate.



**Check/top-up swivel pin housing oil level**

1. The front-wheel-drive universal joints and swivel pins receive their lubrication from the swivel pin housing.
2. Check oil level by removing the square-headed plug at the rear of the swivel pin housing; oil should be level with the bottom of the hole.
3. Top-up if necessary through the filler plug hole. If significant topping-up is required, check for oil leaks at plugs, joint faces, and oil seals.



**Renew swivel pin housing oil**

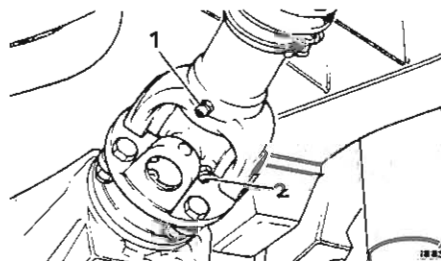
Drain and refill monthly operating under severe wading conditions.

To change the swivel pin housing oil, proceed as follows:

4. Immediately after a run, when the oil is warm, remove the drain plug from the bottom of each housing.
5. Allow the oil to drain away completely and replace drain plugs.
6. Refill with oil of the correct grade through the oil level filler plug hole. Refer to Data for the capacity.

**Lubricate propeller shaft**

1. Apply one of the recommended greases at the lubrication nipple on the sliding portion of the rear propeller shaft.
2. To the lubrication nipples fitted to the universal joints of both front and rear shafts, except the double joint at the rear end of the front shaft which is lubricated for life.



Lubricate the sliding spline on the front propeller shaft, with one of the recommended greases, as follows:

3. Disconnect one end of the propeller shaft.
4. Remove plug in sliding spline and fit a suitable grease nipple.

**IMPORTANT:** Compress propeller shaft at sliding joint to avoid over-filling, then apply grease.

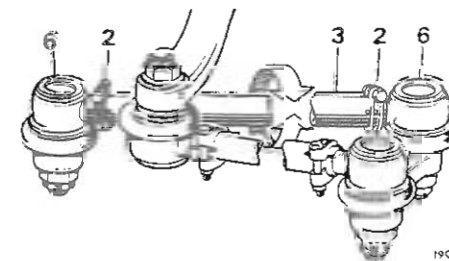
5. Replace grease nipple with plug and reconnect propeller shaft.

**Check/adjust front wheel alignment**

The alignment should be 1.2 to 2.5 mm (0.046 to 0.093 in) toe-out.

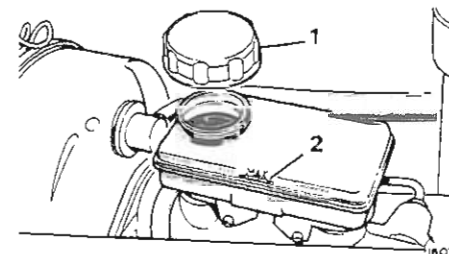
**To adjust:**

1. Set the vehicle on level ground with the road wheels in the straight-ahead position and push it forward a short distance.
2. Slacken the clamps securing the ball joints at each end of the track-rod.
3. Turn the track-rod to decrease or increase its effective length as necessary until the toe-out is correct.
4. Push the vehicle rearwards, turning the steering wheel from side to side to settle the ball joints, then the road wheels in the straight-ahead position, push the vehicle forward a short distance.
5. Re-check the toe-out; if necessary, carry out further adjustment.
6. When the toe-out is correct, lightly tap the track rod ball joints towards the rear of the vehicle to the maximum of their travel. This ensures full unrestricted movement of the track-rod. Then secure the ball joint clamps.



**Check/top-up brake fluid reservoir**

1. Inspect the brake fluid level against the mark on the side of the translucent reservoir.
2. If necessary, add new fluid via the filler cap on top of the reservoir.

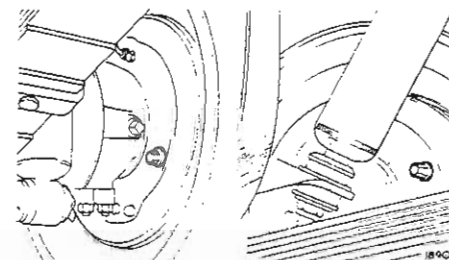


**Check footbrake operation; adjust to manufacturer's instructions**

Each shoe is independently set by means of a hexagon adjustment bolt. Two adjusters are provided on each road

**Adjusting procedure**

1. Apply the transmission brake.
2. Raise the applicable wheel.
3. Ensure that the wheel is free to rotate, back-off the adjuster(s) as necessary.
4. Turn the adjuster(s) until the brake shoe(s) contact(s) the wheel drum.
5. Slacken off each adjuster just sufficiently for the drum to rotate freely.
6. Lower the wheel.
7. Repeat for the other wheels in turn.

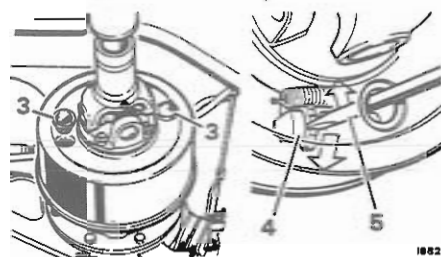




Check handbrake security and operation; adjust to manufacturer's instructions

If the handbrake movement is excessive, adjust as follows:

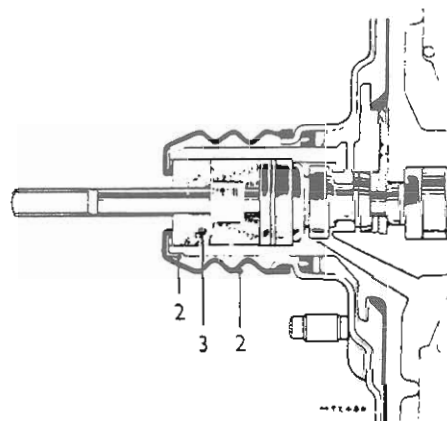
1. Set the vehicle on level ground.
2. Release the handbrake fully.
3. From beneath the vehicle, remove the rubber blanking plugs from the brake drum.
4. Move the vehicle either forwards or backwards until the adjuster can be seen through one of the apertures.
5. With a screwdriver turn the adjuster wheel until the brake shoes come into contact with the brake drum.
6. Turn the adjuster back two 'clicks' and replace blanking plugs.
7. Check that the handbrake operates correctly and holds the vehicle.



**Renew servo filter element**

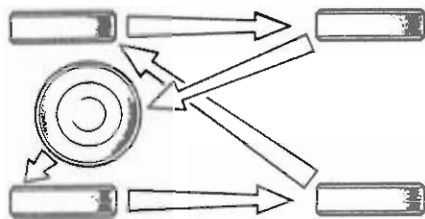
1. Remove the servo from the vehicle.
2. Slide the rubber boot and end-cap along the push-rod.
3. Remove the old filter from the neck of the diaphragm housing.
4. Sever the new filter obliquely from the periphery to the centre hole.
5. Fit the filter into the neck of the diaphragm housing.
6. Fit the end cap and rubber boot.

Alternatively, on some models it is possible to gain access to the filter cover (2) from inside the car. When fitting new filter, slice it diagonally to fit around the brake pedal operating rod before locating the filter in the servo and replacing the cover.



**Interchange road wheels**

1. Apply the handbrake and engage four-wheel-drive before jacking-up the vehicle and placing it safely onto stands.
2. Interchange the road wheels as illustrated, ensuring that if cross-country-type tyres are in use, the 'V' tread is directed to the front of the vehicle.



**Check tightness of road wheel fastenings**

If correct, these will be tightened to a torque of 10.3 to 11.7 kgf m.

**Check/adjust tyre pressures including spare**

The correct tyre pressures (cold) for this model are:

		LADEN		UNLADEN	
Speeds up to 112 km/h (70 mph)	Front	25 lbf/in <sup>2</sup>	1.8 kgf/cm <sup>2</sup>	25 lbf/in <sup>2</sup>	1.8 kgf/cm <sup>2</sup>
	Rear	36 lbf/in <sup>2</sup>	2.5 kgf/cm <sup>2</sup>	25 lbf/in <sup>2</sup>	1.8 kgf/cm <sup>2</sup>
Speeds over 112 km/h (70 mph)	Front	32 lbf/in <sup>2</sup>	2.24 kgf/cm <sup>2</sup>	32 lbf/in <sup>2</sup>	2.24 kgf/cm <sup>2</sup>
	Rear	42 lbf/in <sup>2</sup>	3.02 kgf/cm <sup>2</sup>	32 lbf/in <sup>2</sup>	2.24 kgf/cm <sup>2</sup>
Towing	Front	32 lbf/in <sup>2</sup>	2.24 kgf/cm <sup>2</sup>	32 lbf/in <sup>2</sup>	2.24 kgf/cm <sup>2</sup>
	Rear	42 lbf/in <sup>2</sup>	3.02 kgf/cm <sup>2</sup>	32 lbf/in <sup>2</sup>	2.24 kgf/cm <sup>2</sup>
Cross-country	Front	15 lbf/in <sup>2</sup>	1.1 kgf/cm <sup>2</sup>	15 lbf/in <sup>2</sup>	1.1 kgf/cm <sup>2</sup>
	Rear	26 lbf/in <sup>2</sup>	1.8 kgf/cm <sup>2</sup>	26 lbf/in <sup>2</sup>	1.8 kgf/cm <sup>2</sup>

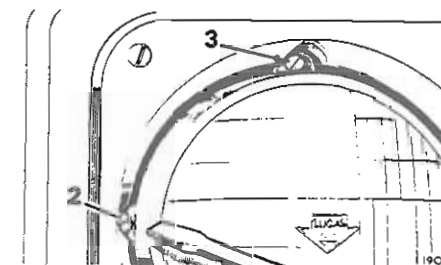
**Check/top-up battery electrolyte**

Remove the battery lid or plugs and add sufficient distilled water to raise the level to the top of the separators.

DO NOT OVERFILL

**Check/adjust headlamp alignment**

1. This operation requires special equipment and should be carried out by a Rover Distributor or Dealer.
2. In an emergency each headlamp can be adjusted by means of a headlamp horizontal adjusting screw and the headlamp vertical adjusting screw.
3. The adjusting screws are accessible through slots in the headlamp bezel.

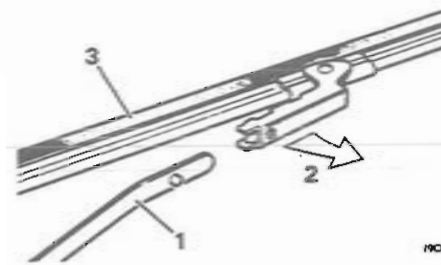


**Check, if necessary renew, wiper blades**

1. Check each wiper blade for damage.
2. Wet the glass and operate the wipers.
3. Renew any blade that is damaged or is smearing the glass as follows.

**Examine condition of wiper blades, replace as necessary**

1. Lift the wiper arm forwards, away from the windscreen.
2. Twist the wiper fixing bracket in the direction arrowed and disengage it from the wiper arm.
3. To fit a new blade locate its fixing bracket over the end of the wiper arm and push on until the retaining dowel is engaged.



**Check operation of seat belt inertia reel mechanism**

The following road test should only be carried out under maximum safe road conditions, i.e. on a dry straight, traffic-free road.

With the safety harness fitted to the driver and front seat passenger, drive the vehicle at 8 km/h, and ensuring that it is safe to do so, brake sharply.

The safety harness should lock automatically, holding both driver and front seat passenger securely in position.

**NOTE:** It is important that when braking the reactions of the seat belt wearers are normal, i.e. the body must not be thrown forward in anticipation, thus causing a 'snatching' action of the belt which might lock it.

Snatch test: Whilst seated, fasten the seat belt and grip the shoulder belt at approximately shoulder level with the opposite hand. Pull the belt sharply in a downwards direction. The belt should lock.

Replace any belt that fails to function satisfactorily.

ENGINE		
SYMPTOM	POSSIBLE CAUSE	CURE
ENGINE FAILS TO START	<ol style="list-style-type: none"> <li>1. Incorrect starting procedure</li> <li>2. Starter motor speed too slow</li> <li>3. Faulty ignition system</li> <li>4. Water or dirt in fuel system</li> <li>5. Carburetter(s) flooding</li> <li>6. Defective fuel pump system</li> <li>7. Defective starter motor</li> <li>8. Starter pinion not engaging</li> </ol>	<ol style="list-style-type: none"> <li>1. See Instruction Manual</li> <li>2. Check battery and connections</li> <li>3. See Group 86</li> <li>4. See Group 19</li> <li>5. See Group 19</li> <li>6. See Group 19</li> <li>7. See Group 86</li> <li>8. Remove starter motor and investigate</li> </ol>
ENGINE STALLS	<ol style="list-style-type: none"> <li>1. Low idling speed</li> <li>2. Faulty sparking plugs</li> <li>3. Faulty coil or condenser</li> <li>4. Faulty distributor points</li> <li>5. Incorrect mixture</li> <li>6. Foreign matter in fuel system</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust carburetter. See Group 19</li> <li>2. Clean and test; renew if necessary</li> <li>3. Renew</li> <li>4. Rectify or renew. See Group 86</li> <li>5. Adjust carburetter. See Group 19</li> <li>6. See Group 19</li> </ol>
LACK OF POWER	<ol style="list-style-type: none"> <li>1. Poor compression</li> <li>2. Badly seating valves</li> <li>3. Faulty exhaust silencer</li> <li>4. Incorrect ignition timing</li> <li>5. Leaks or restriction in fuel system</li> <li>6. Faulty sparking plugs</li> <li>7. Excessive carbon deposit</li> <li>8. Brakes binding</li> <li>9. Faulty coil, condenser or battery</li> </ol>	<ol style="list-style-type: none"> <li>1. If the compression is appreciably less than the correct figure, the piston rings or valves are faulty. Low pressure in adjoining cylinders indicates a faulty cylinder head gasket</li> <li>2. Rectify or renew</li> <li>3. Renew</li> <li>4. Rectify</li> <li>5. See Group 19</li> <li>6. Rectify</li> <li>7. Decarbonize</li> <li>8. See Group 70</li> <li>9. See Group 86</li> </ol>
ENGINE RUNS ERRATICALLY	<ol style="list-style-type: none"> <li>1. Faulty electrical connections</li> <li>2. Defective sparking plugs</li> <li>3. Low battery charge</li> <li>4. Defective distributor</li> <li>5. Foreign matter in fuel system</li> <li>6. Faulty fuel pump</li> <li>7. Sticking valves</li> <li>8. Defective valve springs</li> <li>9. Incorrect ignition timing</li> <li>10. Worn valve guides or valves</li> <li>11. Faulty cylinder head gaskets</li> <li>12. Damaged exhaust system</li> <li>13. Vacuum pipes disconnected at inlet manifold, distributor or gearbox</li> </ol>	<ol style="list-style-type: none"> <li>1. Rectify</li> <li>2. Renew or rectify</li> <li>3. Recharge battery</li> <li>4. Rectify</li> <li>5. See Group 19</li> <li>6. See Group 19</li> <li>7. Rectify or renew</li> <li>8. Renew</li> <li>9. Rectify</li> <li>10. Renew</li> <li>11. Renew</li> <li>12. Rectify or renew</li> <li>13. Refit pipes</li> </ol>
ENGINE STARTS, BUT STOPS IMMEDIATELY	<ol style="list-style-type: none"> <li>1. Faulty electrical connections</li> <li>2. Foreign matter in fuel system</li> <li>3. Faulty fuel pump</li> <li>4. Low fuel level in tank</li> </ol>	<ol style="list-style-type: none"> <li>1. Check HT leads for cracked insulation; check low tension circuit</li> <li>2. See Group 19</li> <li>3. See Group 19</li> <li>4. Replenish</li> </ol>
ENGINE FAILS TO IDLE	<ol style="list-style-type: none"> <li>1. Incorrect carburetter setting</li> <li>2. Faulty fuel pump</li> <li>3. Sticking valves</li> <li>4. Faulty cylinder head gasket(s)</li> </ol>	<ol style="list-style-type: none"> <li>1. See Group 19</li> <li>2. See Group 19</li> <li>3. Rectify or renew</li> <li>4. Renew</li> </ol>
ENGINE MISFIRES ON ACCELERATION	<ol style="list-style-type: none"> <li>1. Distributor points incorrectly set</li> <li>2. Faulty coil or condenser</li> <li>3. Faulty sparking plugs</li> <li>4. Faulty carburetter</li> <li>5. Vacuum pipes disconnected at inlet manifold</li> </ol>	<ol style="list-style-type: none"> <li>1. Rectify. See Group 86</li> <li>2. Renew</li> <li>3. Rectify</li> <li>4. See Group 19</li> <li>5. Check all vacuum connections</li> </ol>
ENGINE KNOCKS	<ol style="list-style-type: none"> <li>1. Ignition timing advanced</li> <li>2. Excessive carbon deposit</li> <li>3. Incorrect carburetter setting</li> <li>4. Unsuitable fuel</li> <li>5. Worn pistons or bearings</li> <li>6. Distributor advance mechanism faulty</li> <li>7. Defective sparking plugs</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust</li> <li>2. Decarbonise</li> <li>3. See Group 19</li> <li>4. Adjust ignition timing. See Group 86</li> <li>5. Renew</li> <li>6. Rectify. See Group 86</li> <li>7. Rectify or renew</li> </ol>

continued

SYMPTOM	POSSIBLE CAUSE	CURE
ENGINE BACKFIRES	<ol style="list-style-type: none"> <li>1. Ignition defect</li> <li>2. Carburetter defect</li> <li>3. Sticking valve</li> <li>4. Weak valve springs</li> <li>5. Badly seating valves</li> <li>6. Excessively worn valve stems and guides</li> <li>7. Excessive carbon deposit</li> <li>8. Incorrect sparking plug gap</li> <li>9. Air leak in induction or exhaust systems</li> </ol>	<ol style="list-style-type: none"> <li>1. See Group 86</li> <li>2. See Group 19</li> <li>3. Rectify</li> <li>4. Renew</li> <li>5. Rectify or renew</li> <li>6. Renew</li> <li>7. Decarbonize</li> <li>8. Reset</li> <li>9. Renew faulty gaskets or components</li> </ol>
BURNED VALVES	<ol style="list-style-type: none"> <li>1. Sticking valves</li> <li>2. Weak valve springs</li> <li>3. Excessive deposit on valve seats</li> <li>4. Distorted valves</li> <li>5. Excessive mileage between overhauls</li> </ol>	<ol style="list-style-type: none"> <li>1. Rectify</li> <li>2. Renew</li> <li>3. Re-cut</li> <li>4. Renew</li> <li>5. Decarbonize</li> </ol>
NOISY VALVE MECHANISM	<ol style="list-style-type: none"> <li>1. Excessive oil in sump, causing air bubbles in hydraulic tappets</li> <li>2. Worn or scored parts in valve operating mechanism</li> <li>3. Valves and seats cut down excessively, raising end of valve stem 1.27 mm (0.050 in) above normal position</li> <li>4. Sticking valves</li> <li>5. Weak valve springs</li> <li>6. Worn timing chain or chain wheels</li> </ol>	<ol style="list-style-type: none"> <li>1. Drain and refill to correct level</li> <li>2. Replace faulty parts</li> <li>3. Grind off end of valve stem or replace parts</li> <li>4. Rectify</li> <li>5. Renew</li> <li>6. Renew worn parts</li> </ol>
NOISE FROM HYDRAULIC TAPPETS	<ol style="list-style-type: none"> <li>1. Rapping noise only when engine is started</li> <li>2. Intermittent rapping noise</li> <li>3. Noise on idle and low speed</li> <li>4. General noise at all speeds</li> </ol>	<ol style="list-style-type: none"> <li>1. Drain and refill with correct grade</li> <li>2. Replace tappet</li> <li>3. Replace tappet</li> <li>4. Drain and refill to correct level</li> <li>5. Replace tappet</li> </ol>
<ol style="list-style-type: none"> <li>5. Loud noise at normal operating temperature only</li> </ol>	<ol style="list-style-type: none"> <li>1. Oil too heavy for prevailing temperature. Excessive varnish in tappet</li> <li>2. Leakage at check ball</li> <li>3. Excessive leakdown</li> <li>4. High oil level in sump</li> <li>5. Leakage at check ball</li> <li>6. Worn tappet body</li> <li>7. Worn camshaft</li> <li>8. Excessive leak-down rate or scored lifter plunger</li> </ol>	<ol style="list-style-type: none"> <li>1. Drain and refill to correct level</li> <li>2. Replace tappet</li> <li>3. Replace tappet</li> <li>4. Drain and refill to correct level</li> <li>5. Replace tappet</li> </ol>
MAIN BEARING RATTLE	<ol style="list-style-type: none"> <li>1. Low oil level</li> <li>2. Low oil pressure</li> <li>3. Excessive bearing clearance</li> <li>4. Burnt-out bearings</li> <li>5. Loose bearing caps</li> </ol>	<ol style="list-style-type: none"> <li>1. Replenish as necessary</li> <li>2. See next symptom</li> <li>3. Renew bearings; grind crankshaft</li> <li>4. Renew</li> <li>5. Tighten</li> </ol>
LOW OIL PRESSURE WARNING LIGHT REMAINS ON, ENGINE RUNNING	<ol style="list-style-type: none"> <li>1. Thin or diluted oil</li> <li>2. Low oil level</li> <li>3. Choked pump strainer</li> <li>4. Faulty release valve</li> <li>5. Excessive bearing clearance</li> <li>6. Oil pressure switch unserviceable</li> <li>7. Electrical fault</li> <li>8. Relief valve plunger sticking</li> <li>9. Weak relief valve spring</li> <li>10. Pump rotors excessively worn</li> <li>11. Excessively worn bearings; main, connecting rod, big end, camshaft, etc.</li> </ol>	<ol style="list-style-type: none"> <li>1. Drain and refill with correct oil</li> <li>2. Replenish</li> <li>3. Clean</li> <li>4. Rectify</li> <li>5. Rectify</li> <li>6. Renew</li> <li>7. Check circuit</li> <li>8. Remove and ascertain cause</li> <li>9. Renew</li> <li>10. Renew</li> <li>11. Ascertain which bearings and rectify</li> </ol>
RATTLE IN LUBRICATION SYSTEM	<ol style="list-style-type: none"> <li>1. Oil pressure relief valve plunger sticking</li> </ol>	<ol style="list-style-type: none"> <li>1. Remove and clean</li> </ol>
ENGINE OVERHEATING	<ol style="list-style-type: none"> <li>1. Low coolant level</li> <li>2. Faulty cooling system</li> <li>3. Faulty thermostat</li> <li>4. Incorrect timing</li> <li>5. Defective lubrication system</li> </ol>	<ol style="list-style-type: none"> <li>1. Check for leaks</li> <li>2. See Group 26</li> <li>3. Renew</li> <li>4. Rectify</li> <li>5. See Group 12</li> </ol>

## CAMSHAFT

—Remove and refit

12.13.01

## Removing

1. Drain the cooling system, see 26.10.01.
2. Remove the fan blades and pulley, see 26.25.01.
3. Remove the fan cowl, see 26.25.11.
4. Remove the radiator block, see 26.40.04.
5. Remove the radiator grille, see 76.55.03.
6. Remove the alternator, see 86.10.02.
7. Remove the air cleaner, see 19.10.01.
8. Remove the induction manifold, see 30.15.02.
9. Remove the valve gear, see 12.29.34.
10. Remove the timing chain cover, see 12.65.01.
11. Remove the timing chain, see 12.65.12.

**CAUTION:** Do not damage the bearings when withdrawing the camshaft.

12. Withdraw the camshaft.

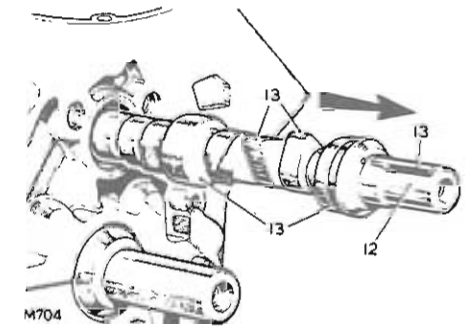
## Inspecting

13. Check all bearing surfaces for excessive wear and score marks. Also check cam lobes for excessive wear. Check key and keyway.

## Refitting

14. Reverse instructions 1 to 12.

**CAUTION:** During reassembly, it is essential that the camshaft key, spacer and distributor drive gear are all refitted as described in operation 12.65.12. Failure to observe these requirements may result in restriction or total blockage of oil passage to the timing gear.



CONNECTING RODS AND PISTONS

—Remove and refit 12.17.01

Service tool: 605351—Guide bolts for connecting rods

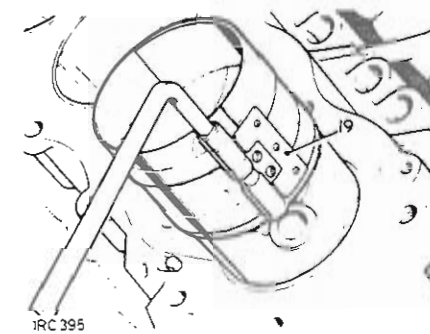
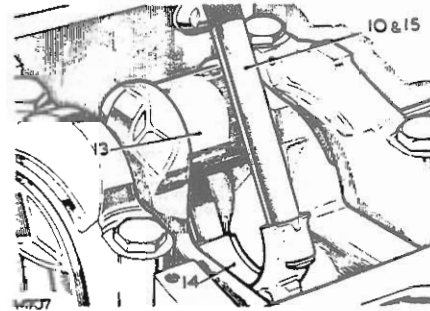
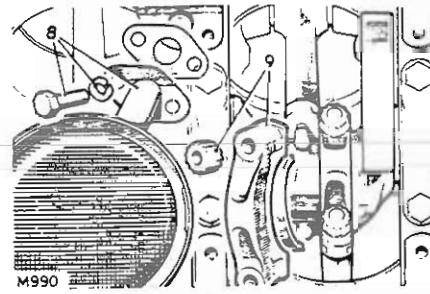
Removing

1. Drain the cooling system, see 26.10.01.
2. Remove the air cleaner, see 19.10.01.
3. Remove the alternator, see 86.10.02.
4. Remove the induction manifold, see 30.15.02.
5. Remove the valve gear, see 12.29.34.
6. Remove the cylinder heads, see 12.29.10.
7. Remove the oil sump, see 12.60.44.
8. Remove the sump oil strainer.
9. Remove the connecting rod caps and retain them in sequence for reassembly.
10. Screw the guide bolts 605351 onto the connecting rods.
11. Push the connecting rod and piston assembly up the cylinder bore and withdraw it from the top. Retain the connecting rod and piston assemblies in sequence with their respective caps.
12. Remove the guide bolts 605351 from the connecting rod.

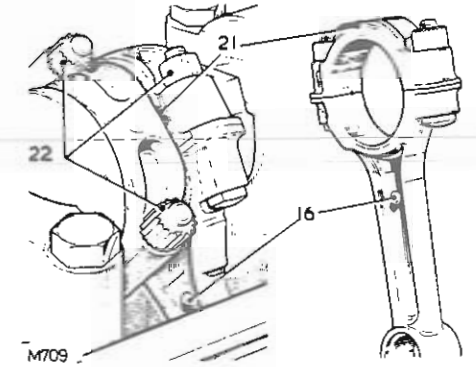
Refitting

13. Locate the applicable crankshaft journal at B.D.C.
14. Place the bearing upper shell in the connecting rod.
15. Retain the upper shell by screwing the guide bolts 605351 onto the connecting rods.
16. Insert the connecting rod and piston assembly into its respective bore, noting that the domed shape boss on the connecting rod must face towards the front of the engine on the right-hand bank of cylinders and towards the rear on the left-hand bank. When both connecting rods are fitted, the bosses will face inwards towards each other.
17. Position the oil control piston rings so that the ring gaps are all at one side, between the gudgeon pin and piston thrust face. Space the gaps in the ring rails approximately 25 mm (1 in) each side of the expander ring joint.
18. Position the compression rings so that their gaps are on opposite sides of the piston between the gudgeon pin and piston thrust face.
19. Using a piston ring compressor, locate the piston into the cylinder bore.

continued



20. Place the bearing lower shell in the connecting rod cap.
21. Locate the cap and shell on to the connecting rod, noting that the rib on the edge of the cap must be towards the front of the engine on the right-hand bank of cylinders and towards the rear on the left-hand bank.
22. Secure the connecting rod cap. Torque 4.0 to 4.9 kgf m (30 to 35 lbf ft).
23. Reverse instructions 1 to 8.



DATA

Standard size cylinder bore diameter ..... 88.861 to 88.900 mm (3.4985 to 3.5000 in)

Connecting rod:

Length between centres ..... 143.71 to 143.81 mm (5.658 to 5.662 in)  
 Bearings:  
 Clearance on crankshaft ..... 0.015 to 0.055 mm (0.0006 to 0.0022 in)  
 End-float on crankshaft ..... 0.15 to 0.37 mm (0.006 to 0.014 in)

Pistons and gudgeon pins:

Pistons:

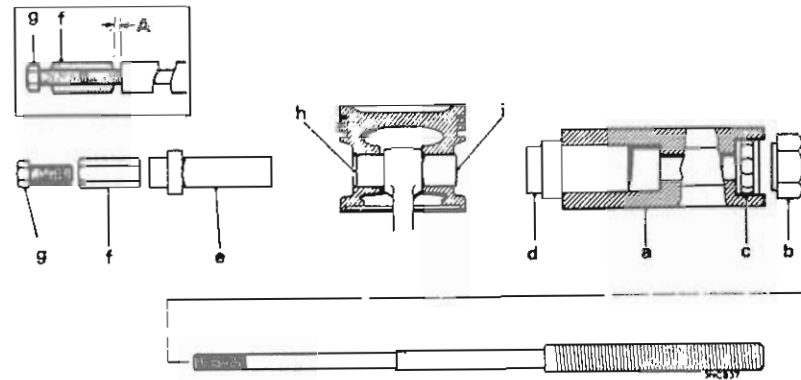
Type ..... Aluminium alloy, concave topped  
 Depth of concave ..... 5.21 to 5.31 mm (0.205 to 0.209 in)  
 Clearance at skirt bottom ..... 0.018 to 0.033 mm (0.0007 to 0.0013 in)

Piston rings:

No. 1 compression ring ..... Chrome faced  
 No. 2 compression ring ..... Stepped to 'L' shape and marked 'TOP'  
 Compression ring height ..... 1.71 to 1.73 mm (0.0615 to 0.0625 in)  
 Compression ring clearance in piston groove ..... 0.05 to 0.10 mm (0.002 to 0.004 in)  
 Compression ring gap ..... 0.44 to 0.56 mm (0.017 to 0.022 in)  
 Oil control ring ..... Two oil rings with separate spacer  
 Rail oil rings ..... Perfect circle 110-15  
 Spacer ..... Perfect circle 110-37

Gudgeon pins:

Length ..... 72.67 to 72.79 mm (2.861 to 2.866 in)  
 Diameter ..... 22.215 to 22.22 mm (0.8746 to 0.8748 in)  
 Fit in con rod ..... Press fit  
 Clearance in piston ..... 0.005 to 0.007 mm (0.0002 to 0.0003 in)



## CONNECTING RODS AND PISTONS

—Overhaul

12.17.10

Service tools: 18G 537, 18G 587, 18G 1150, 18G 1150 E or 605350

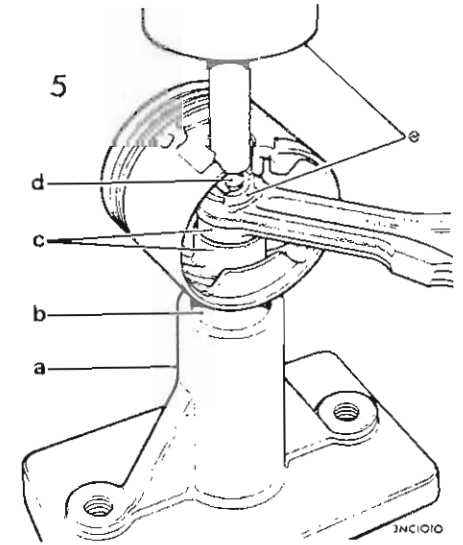
## Dismantling

1. Remove the connecting rods and pistons, see 12.17.01.  
**NOTE:** The connecting rods, caps and bearing shells must be retained in sets, and in the correct sequence.
2. Remove the piston rings over the crown of the piston.
3. If the same piston is to be refitted, mark it relative to its connecting rod to ensure that the original assembly is maintained.
4. Withdraw the gudgeon pin, using tool 18G 1150 as follows:
  - a. Clamp the hexagon body of 18G 1150 in a vice.
  - b. Position the large nut flush with the end of the centre screw.

- c. Push the screw forward until the nut contacts the thrust race.
- d. Locate the piston adaptor 18G 1150 E with its long spigot inside the bore of the hexagon body.
- e. Fit the remover/replacer bush of 18G 1150 on the centre screw with the flanged end away from the gudgeon pin.
- f. Screw the stop-nut about half-way onto the smaller threaded end of the centre screw, leaving a gap 'A' of 3 mm (1/4 in) between this nut and the remover/replacer bush.
- g. Lock the stop-nut securely with the lock screw.
- h. Check that the remover/replacer bush is correctly positioned in the bore of the piston.
- i. Push the connecting rod to the right to expose the end of the gudgeon pin, which must be located in the end of the adaptor 'd'.
- j. Screw the large nut up to the thrust race.
- k. Hold the lock screw and turn the large nut until the gudgeon pin has been withdrawn from the piston. Dismantle the tool.

continued

5. As an alternative to tool 18G 1150, press the gudgeon pin from the piston using a hydraulic press and the components which comprise tool 605350 as follows:
  - a. Place the base of tool 605350 on the bed of an hydraulic press which has a capacity of 8 tons (8 tonnes).
  - b. Fit the guide tube into the bore of the base with its countersunk face uppermost.
  - c. Push the piston to one side so as to expose one end of the gudgeon pin and locate this end in the guide tube.
  - d. Fit the spigot end of the small diameter mandrel into the gudgeon pin.
  - e. Press out the gudgeon pin, using the hydraulic press.



## Overhauling pistons

## Original pistons

6. Remove the carbon deposits, particularly from the ring grooves.
7. Examine the pistons for signs of damage or excessive wear; refer to 'new pistons' for the method of checking the running clearance. Fit new pistons if necessary.

## New pistons

Pistons are available in service standard size and in oversizes of 0.25 mm (0.010 in) and 0.50 mm (0.020 in). Service standard size pistons are supplied 0.0254 mm (0.001 in) oversize. When fitting new service standard size pistons to a cylinder block, check for correct piston to bore clearance, honing the bore if necessary. Bottom of piston skirt/bore clearance should be 0.018 to 0.033 mm (0.0007 to 0.0013 in).

**NOTE:** The temperature of the piston and cylinder block must be the same to ensure accurate measurement. When reboring the cylinder block, the crankshaft main bearing caps must be fitted and tightened to the correct torque.

continued

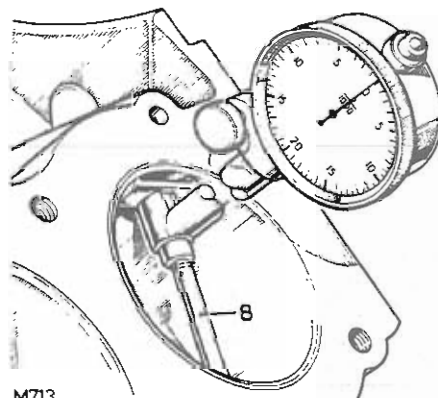
8. Check the cylinder bore dimension at right angles to the gudgeon pin, 40 to 50 mm (1½ to 2 in) from the top.
9. Check the piston dimension at right angles to the gudgeon pin, at the bottom of the skirt.
10. The piston dimension must be 0,018 to 0,033 mm (0,0007 to 0,0013) smaller than the cylinder.
11. If new piston rings are to be fitted without reboring, deglaze the cylinder walls with a hone, without increasing the bore diameter.

**IMPORTANT:** A deglazed bore must have a cross-hatch finish.

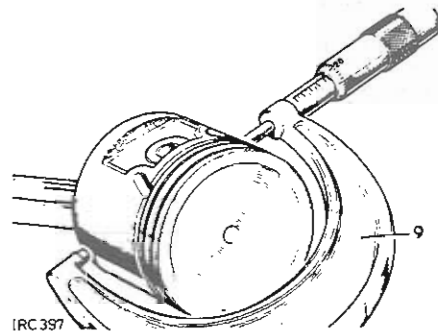
12. Check the compression ring gaps in the applicable cylinder, held square to the bore with the piston. Gap limits: 0,44 to 0,56 mm (0,017 to 0,022 in). Use a fine-cut flat file to increase the gap if required. Select a new piston ring if the gap exceeds the limit.

**NOTE:** Gapping does not apply to oil control rings.

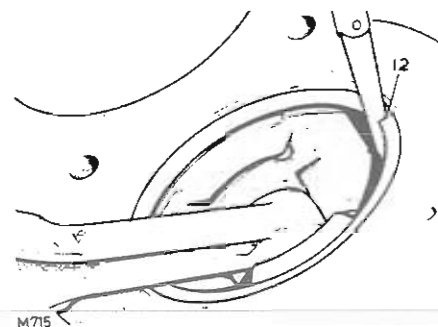
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M713



IRC 397

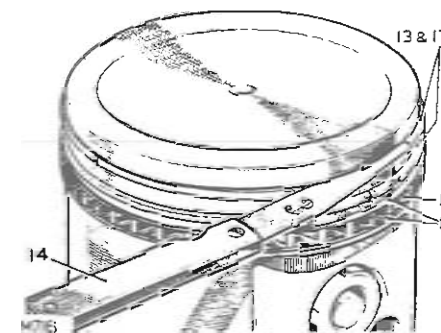


M715

13. Temporarily fit the compression rings to the piston. The ring marked 'TOP' must be fitted with the marking uppermost and into the second groove. The chrome ring is for the top groove and can be fitted either way round.
14. Check the compression ring clearance in the piston groove. Clearance limits: 0,05 to 0,10 mm (0,002 to 0,004 in).

#### Fitting piston rings

15. Fit the expander ring into the bottom groove making sure that the ends abut and do not overlap.
16. Fit two ring rails to the bottom groove, one above and one below the expander ring.
17. Fit the second compression ring with the marking 'TOP' uppermost and the chrome compression ring in the top groove, either way round.



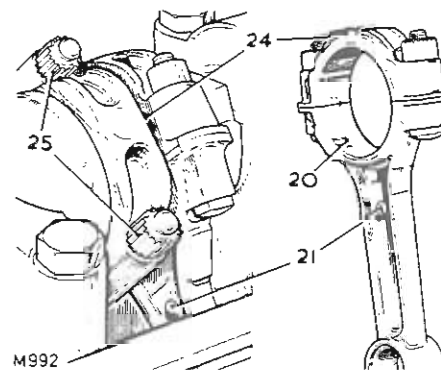
#### Connecting rods

18. Check the alignment of the connecting rod.
19. Check the connecting rod small end, the gudgeon pin must be an interference fit.

#### Big-end bearings

20. Locate the bearing upper shell into the connecting rod.
21. Locate the connecting rod and bearing on to the applicable crankshaft journal, noting that the domed shape boss on the connecting rod must face towards the front of the engine on the right-hand bank of cylinders and towards the rear on the left-hand bank. When both connecting rods are fitted, the bosses will face inwards towards each other.
22. Place a piece of Plastigauge 605238, across the centre of the lower half of the crankshaft journal.
23. Locate the bearing lower shell into the connecting rod cap.
24. Locate the cap and shell on to the connecting rod. Note that the rib on the edge of the cap must be the same side as the domed shape boss on the connecting rod.
25. Secure the connecting rod cap. Torque 4,0 to 4,9 kgf m (30 to 35 lbf ft).

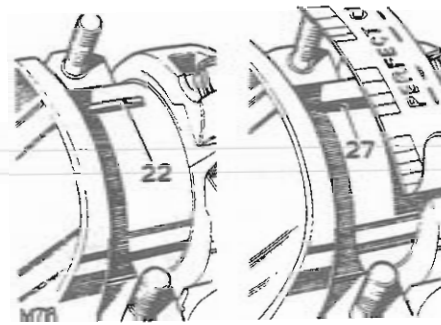
continued



M992

**IMPORTANT:** Do not rotate the crankshaft while the Plastigauge is fitted.

26. Remove the connecting rod cap and shell.
27. Using the scale printed on the Plastigauge packet, measure the flattened Plastigauge at its widest point. The graduation that most closely corresponds to the width of the Plastigauge indicates the bearing clearance.
28. The correct bearing clearance with new or overhauled components is 0,013 to 0,06 mm (0.0006 to 0.0022 in).
29. If a bearing has been in service, it is advisable to fit a new bearing if the clearance exceeds 0,08 mm (0.003 in).
30. If a new bearing is being fitted, use selective assembly to obtain the correct clearance.
31. Wipe off the Plastigauge with an oily rag. **DO NOT** scrape it off.

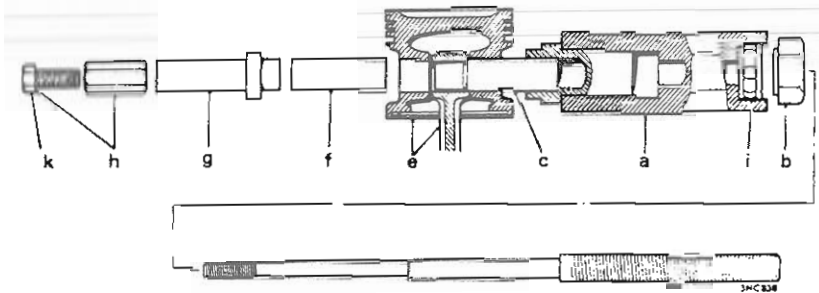
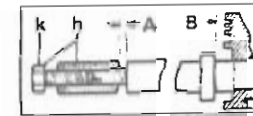
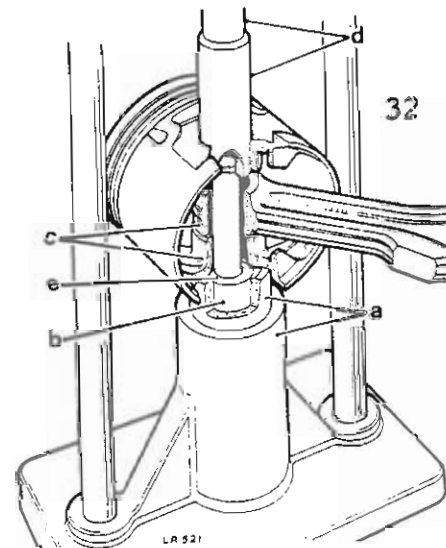


**IMPORTANT:** The connecting rods, caps and bearing shells must be retained in sets, and in the correct sequence.

#### Reassembling

32. If an hydraulic press and tool 605350 were used for dismantling, refit each piston to its connecting rod as follows:
  - a. Check that the base of tool 605350 and the guide tube are fitted as in 5a and 5b.
  - b. Fit the long mandrel inside the guide tube.
  - c. Fit the connecting rod into the piston with the markings together if the original pair are being used, then place the piston and connecting rod assembly over the long mandrel until the gudgeon pin boss rests on the guide tube.
  - d. Fit the gudgeon pin into the piston up to the connecting rod, and the spigot end of the small diameter mandrel into the gudgeon pin.
  - e. Press in the gudgeon pin until it abuts the shoulder of the long mandrel.

continued

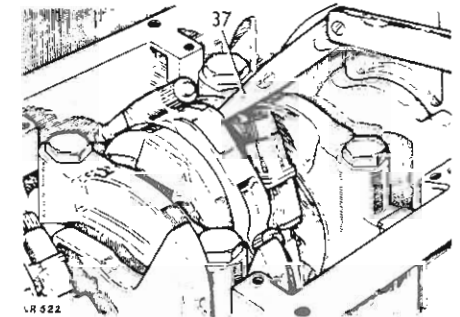


33. If tool 18G 1150 was used for dismantling, refit each piston to its connecting rod as follows:
  - a. Clamp the hexagon body of 18G 1150 in a vice, with the adaptor 18G 1150 E positioned as in 4d.
  - b. Remove the large nut of 18G 1150 and push the centre screw approximately 2 in (50 mm) into the body until the shoulder is exposed.
  - c. Slide the parallel guide sleeve, grooved end last, onto the centre screw and up to the shoulder.
  - d. Lubricate the gudgeon pin and bores of the connecting rod and piston with graphited oil (Acheson's Colloids 'Oildag'). Also lubricate the ball race and centre screw of 18G 1150.
  - e. Fit the connecting rod and the piston together onto the tool with the markings together if the original pair are being used and with the connecting rod around the sleeve up to the groove.
  - f. Fit the gudgeon pin into the piston bore up to the connecting rod.
  - g. Fit the remover/replacer bush 18G 1150/3 with its flanged end towards the gudgeon pin.
  - h. Screw the stop-nut onto the centre screw and adjust this nut to obtain a 1 mm (1/16 in) end-float 'A' on the whole assembly, and lock the nut securely with the screw.
  - i. Slide the assembly back into the hexagon body and screw on the large nut up to the thrust race.
  - j. Set the torque wrench 18G 537 to 12 lbf ft. This represents the minimum load for an acceptable interference fit of the gudgeon pin in the connecting rod.
  - k. Using the torque wrench and socket 18G 587 on the large nut, and holding the lock screw, pull the gudgeon pin in until the flange of the remover/replacer bush is 4 mm (0.160 in) 'B'

from the face of the piston. Under no circumstances must this flange be allowed to contact the piston.

**CAUTION:** If the torque wrench has not broken throughout the pull, the fit of the gudgeon pin to the connecting rod is not acceptable and necessitates the renewal of components. The large nut and centre screw of the tool must be kept well-oiled.

- l. Remove the tool.



34. Check that the piston moves freely on the gudgeon pin and that no damage has occurred during pressing.
35. Fit the connecting rods and pistons, see 12.17.01, carrying out the following checks during fitting.
36. Check that the connecting rods move freely sideways on the crankshaft. Tightness indicates insufficient bearing clearance or a misaligned connecting rod.
37. Check the end-float between the connecting rods on each crankshaft journal. Clearance limits: 0.15 to 0.37 mm (0.006 to 0.014 in).

## ENGINE

### CRANKSHAFT

—Remove and refit

12.21.33

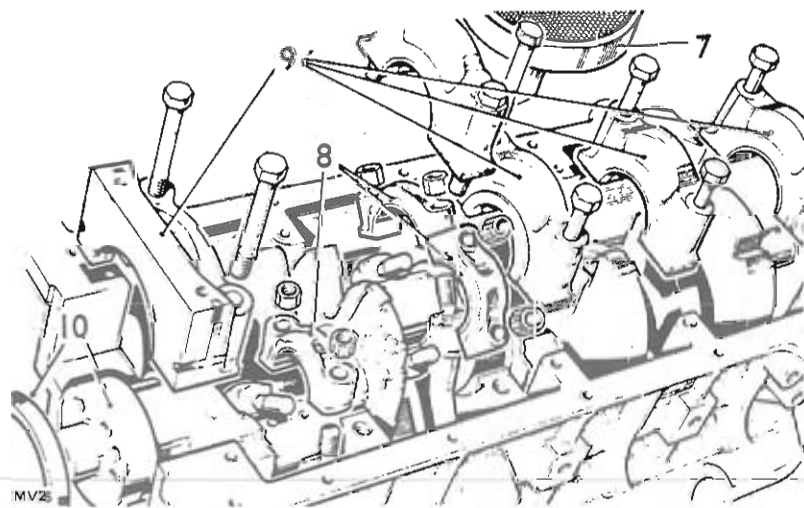
Service tools: 605351 Guide bolts for connecting rods, RO 1014 seal guide

#### Removing

1. Remove the engine assembly, see 12.41.01.
2. Remove the timing gear cover, see 12.65.01.
3. Remove the timing chain and gears, see 12.65.12.
4. Remove the clutch, see 33.10.01.
5. Remove the flywheel, see 12.53.07.
6. Remove the oil sump, see 12.60.44.
7. Remove the sump oil strainer.
8. Remove the connecting rod caps and lower bearing shells and retain in sequence.
9. Remove the main bearing caps and lower bearing shells and retain in sequence. (On later engines the bearing caps may be visually different to those shown.)

**IMPORTANT:** If the same bearing shells are to be refitted, retain them in pairs and mark them with the number of the respective journal.

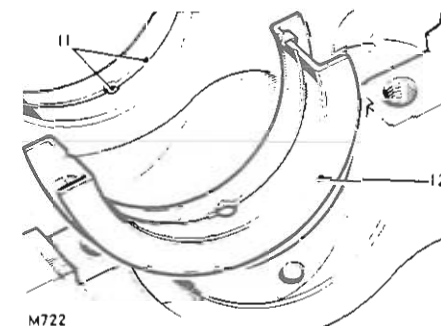
10. Withdraw the crankshaft and the rear oil seal.



MV2

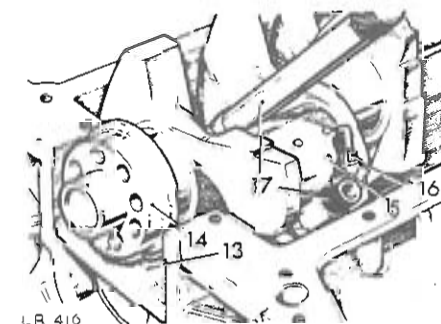
#### Refitting

11. Locate the upper main bearing shells into the cylinder block; these must be the shells with the oil drilling and oil grooves.
12. Locate the flanged upper main bearing shell in the centre position.



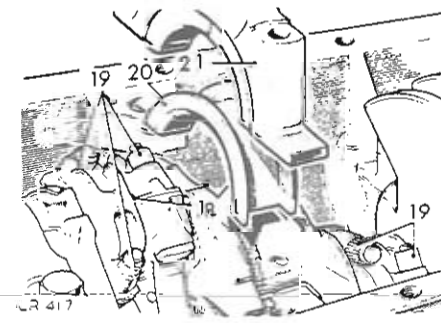
M722

13. Place suitable blocks, approximately 12.5 mm (0.500 in) thick, on to each end of the cylinder block so that they cover the front and rear upper main bearing shells.
14. Lift the crankshaft into position with the ends supported on the blocks.
15. Lubricate the crankshaft journals and bearing shells with engine oil.
16. Holding the connecting rods in position, remove one of the blocks and lower the crankshaft on to the connecting rod bearings. Repeat for the opposite end.
17. Where necessary, use the guide bolt 605351 to draw the connecting rods up to the crankshaft journal.



LR 410

18. Locate the bearing caps and lower shells on to the connecting rods, noting that the rib on the edge of the cap must be towards the front of the engine on the right-hand bank of cylinders, and towards the rear on the left-hand bank.
19. Secure the connecting rod caps. Torque: 4.0 to 4.9 kgf m (30 to 35 lbf ft).
20. Lubricate the lower main bearing shells with engine oil.
21. Fit numbers one to four main bearing caps and shells, leaving the fixing bolts finger tight at this stage.



LR 417

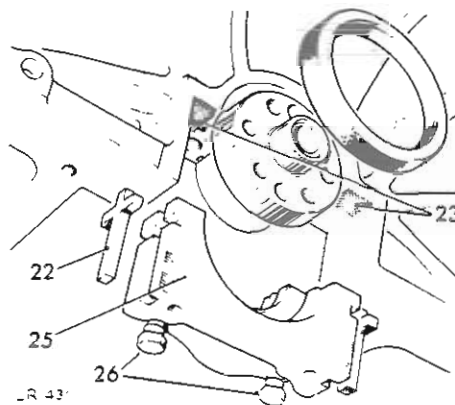
continued



## ENGINE

**CAUTION:** Do not handle the seal lip, visually check that it is not damaged and ensure that the outside diameter remains clean and dry.

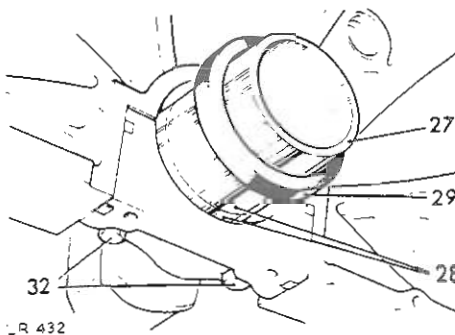
22. Fit the cruciform side seals to the grooves each side of the rear main bearing cap. Do not cut the side seals to length, they must protrude 1,5 mm (0.062 in) approximately above the bearing cap parting face.
23. Apply Hylomar PL32M jointing compound to the rear half of the rear main bearing cap parting face or, if preferred, to the equivalent area on the cylinder block as illustrated.
24. Lubricate the bearing half and bearing cap side seals with clean engine oil.
25. Fit the bearing cap assembly to the engine. Do not tighten the fixings at this stage but ensure that the cap is fully home and squarely seated on the cylinder block.
26. Tension the cap bolts equally by one-quarter turn approximately, then back off one complete turn on each fixing bolt.



27. Position the seal guide RO 1014 on the crankshaft flange.
28. Ensure that the oil seal guide and the crankshaft journal are scrupulously clean, then coat the seal guide and oil seal journal with clean engine oil.

**NOTE:** The lubricant coating must cover the seal guide outer surface completely to ensure that the oil seal lip is not turned back during assembly.

29. Position the oil seal, lipped side towards the engine, onto the seal guide. The seal outside diameter must be clean and dry.
30. Push home the oil seal fully and squarely by hand into the recess formed in the cap and block until it abuts against the machined step in the recess.
31. Withdraw the seal guide.
32. Tighten the rear main bearing cap fixings fully and evenly. Torque loading: 9,0 to 9,6 kgf m (65 to 70 lbf ft).
33. Check the crankshaft end-float. Limits: 0,10 to 0,20 mm (0.004 to 0.008 in)  
Reverse instructions 1 to 7.



**CAUTION:** Do not exceed 1,000 engine rev/min when first starting the engine, otherwise the crankshaft rear oil seal will be damaged.

## CRANKSHAFT

—Overhaul

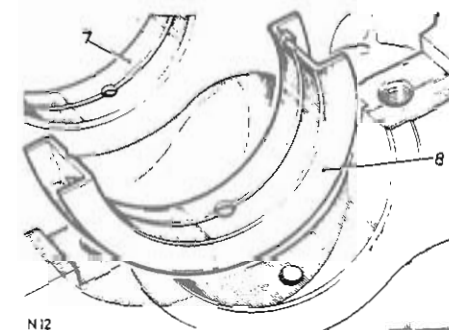
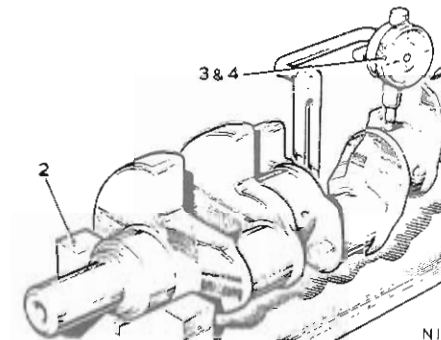
12.21.46

Service tools: 605238 Plastigauge

1. Remove the crankshaft, see 12.21.33.

### Inspecting

2. Rest the crankshaft on vee-blocks at numbers one and five main bearing journals.
3. Using a dial test indicator, check the run-out at numbers two, three and four main bearing journals. The total indicator readings at each journal should not exceed 0,08 mm (0.003 in).
4. While checking the run-out at each journal, note the relation of maximum eccentricity on each journal to the others. The maximum on all journals should come at very near the same angular location.
5. If the crankshaft fails to meet the foregoing checks it is bent and is unsatisfactory for service.
6. Check each crankshaft journal for ovality. If ovality exceeds 0,040 mm (0.0015 in), a reground or new crankshaft should be fitted.
7. Bearings for the crankshaft main journals and the connecting rod journals are available in the following undersizes:  
0,25 mm (0.010 in)  
0,50 mm (0.020 in)
8. The centre main bearing shell, which controls crankshaft thrust, has the thrust faces increased in thickness when more than 0,25 mm (0.010 in) undersize, as shown on the following chart.
9. When a crankshaft is to be reground, the thrust faces on either side of the centre main journal must be machined in accordance with the dimensions on the following charts.



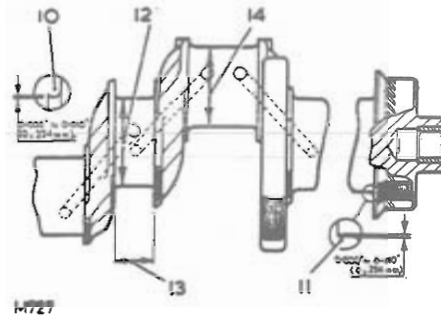
Main bearing journal size	Thrust face width
Standard	Standard
0,25 mm (0.010 in) undersize	Standard
0,50 mm (0.020 in) undersize	0,25 mm (0.010 in) oversize

For example: If a 0,50 mm (0.020 in) undersize bearing is to be fitted, then 0,12 mm (0.005 in) must be machined off each thrust face of the centre journal, maintaining the correct radius.

continued

**Crankshaft dimensions 10 to 14**

10. The radius for all journals except the rear main bearing is 1,90 to 2,28 mm (0.075 to 0.090 in).
11. The radius for the rear main bearing journal is 3,04 mm (0.120 in).
12. Main bearing journal diameter, see the following charts.
13. Thrust face width, see the following charts.
14. Connecting rod journal diameter, see the following charts.



**Crankshaft dimensions — millimetres**

Crankshaft Grade	Diameter '12'	Width '13'	Diameter '14'
Standard	58,400-58,413	26,975-27,026	50,800-50,812
0.254 U/S	58,146-58,158	26,975-27,026	50,546-50,559
0.508 U/S	57,892-57,904	27,229-27,280	50,292-50,305

**Crankshaft dimensions — inches**

Crankshaft grade	Diameter '12'	Width '13'	Diameter '14'
Standard	2.2992-2.2997	1.062-1.064	2.0000-2.0005
0.010 U/S	2.2892-2.2897	1.062-1.064	1.9900-1.9905
0.020 U/S	2.2792-2.2797	1.072-1.074	1.9800-1.9805

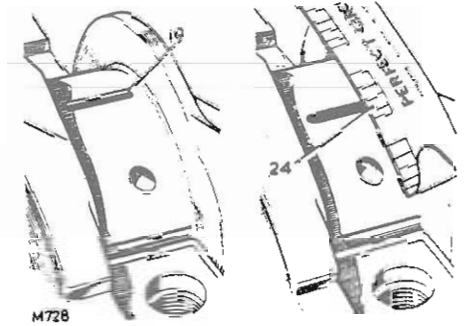
**Checking the main bearing clearance**

15. Remove the oil seals from the cylinder block and the rear main bearing cap.
16. Locate the upper main bearing shells into the cylinder block. These must be the shells with the oil drilling and oil grooves.
17. Locate the flanged upper main bearing shell in the centre position.
18. Place the crankshaft in position on the bearings.

continued

19. Place a piece of Plastigauge 605238 across the centre of the crankshaft main bearing journals.
20. Locate the bearing lower shell into the main bearing cap.
21. Fit numbers one to four main bearing caps and shells. Torque: 7,0 to 7,6 kgf m (50 to 55 lbf ft).
22. Fit the rear main bearing cap and shell. Torque: 9,0 to 9,6 kgf m (65 to 70 lbf ft).

**IMPORTANT:** Do not rotate the crankshaft while the Plastigauge is fitted.



23. Remove the main bearing caps and shells.
24. Using the scale printed on the Plastigauge packet, measure the flattened Plastigauge at its widest point. The graduation that most closely corresponds to the width of the Plastigauge indicates the bearing clearance.
25. The correct bearing clearance with new or overhauled components is 0,023 to 0,065 mm (0.0009 to 0.0025 in.).
26. If the correct clearance is not obtained initially, use selective bearing assembly.
27. Wipe off the Plastigauge with an oily rag. Do NOT scrape it off.

**IMPORTANT:** The bearing shells must be retained in **sets** and in the correct sequence.

28. If required, check the connecting rod big-end bearing clearance, see 12.17.10.
29. Refit the crankshaft, see 12.21.33.

**DATA**

**Crankshaft**

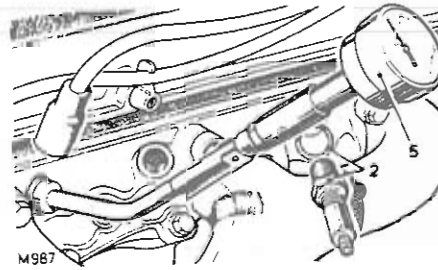
Material	Iron, spheroidal graphite
No. of main journals	5
End-thrust	Taken on No. 3
End-float	0.10 to 0.20 mm (0.004 to 0.008 in)
Crankpin journal diameter (standard)	50,800 to 50,812 mm (2.0000 to 2.0005 in)
<b>Main bearing:</b>	
Material and type	Vandervell lead-indium
Clearance	0.023 to 0.061 mm (0.0009 to 0.0024 in)
Journal diameter (standard)	58,400 to 58,413 mm (2.2992 to 2.2997 in)
Bearing overall length	20.24 to 20.49 mm (0.797 to 0.807 in) Nos. 1, 2, 4 and 5 26.82 to 26.87 mm (1.056 to 1.058 in) No. 3
Crankshaft vibration damper type	Torsional

## CYLINDER PRESSURES

—Check 12.25.01

## Checking

1. Run the engine until it attains normal operating temperature.
2. Remove all the sparking plugs.
3. Secure the throttle in the fully open position.
4. Check each cylinder in turn as follows:
5. Insert a suitable pressure gauge into the sparking plug hole.
6. Crank the engine with the starter motor for several revolutions and note the highest pressure reading obtainable.
7. If the compression is appreciably less than the correct figure or varies greater than 10% between cylinders, the piston rings or valves may be faulty.
8. Low pressure in adjoining cylinders may be due to a faulty cylinder head gasket.



## DATA

Starter motor cranking speed at 15°C (60°F) approximate ambient temperature	150 to 200 engine rev/min
Compression ratio	8.25 : 1 or 8.13 : 1
Compression pressure (minimum)	9,5 kgf/cm <sup>2</sup> (135 lbf/in <sup>2</sup> )

## CYLINDER HEADS

—Remove and refit 12.29.10  
 Left-hand cylinder head 12.29.11  
 Right-hand cylinder head 12.29.12

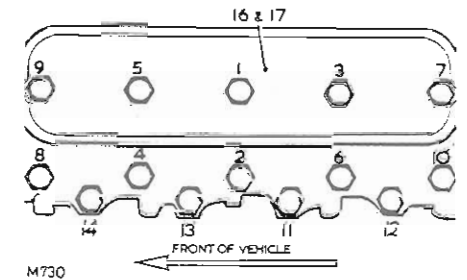
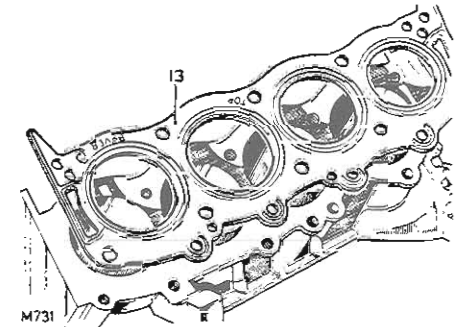
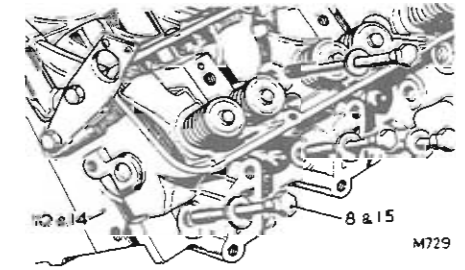
## Removing

1. Drain the cooling system, see 26.10.01.
2. Remove the air cleaner, see 19.10.01.
3. Remove the induction manifold, see 30.15.02.
4. Remove the rocker covers.
5. Remove the valve gear, see 12.29.34.
6. Disconnect the front exhaust pipes from the manifolds.
7. R.H. cylinder head: Remove the alternator, see 86.10.02.
8. Slacken the cylinder head bolts evenly.
9. If both cylinder heads are being removed, mark them relative to L.H. and R.H. sides of the engine.
10. Remove the cylinder heads and discard the gaskets.
11. If required, remove the exhaust manifolds, see 30.15.10, 30.15.11.

## Refitting

12. If removed, fit the exhaust manifolds, see 30.15.10, 30.15.11.
13. Fit new cylinder head gaskets with the word 'TOP' uppermost. Do NOT use sealant.
14. Locate the cylinder heads on the block dowel pins.
15. Clean the threads of the cylinder head bolts then coat them with Thread Lubricant-Sealant 3M EC776, Rover Part No. 605764.
16. Locate the cylinder head bolts in position:  
 Long bolts—1, 3 and 5.  
 Medium bolts—2, 4, 6, 7, 8, 9 and 10.  
 Short bolts—11, 12, 13 and 14.
17. Tighten the cylinder head bolts a little at a time in the sequence shown. Final torque:  
 Bolts 1 to 10, 9,0 to 9,6 kgf m (65 to 70 lbf ft).  
 Bolts 11 to 14, 5,6 to 6,2 kgf m (40 to 45 lbf ft).
18. When all bolts have been tightened, re-check the torque settings.
19. Reverse instructions 1 to 7.

continued

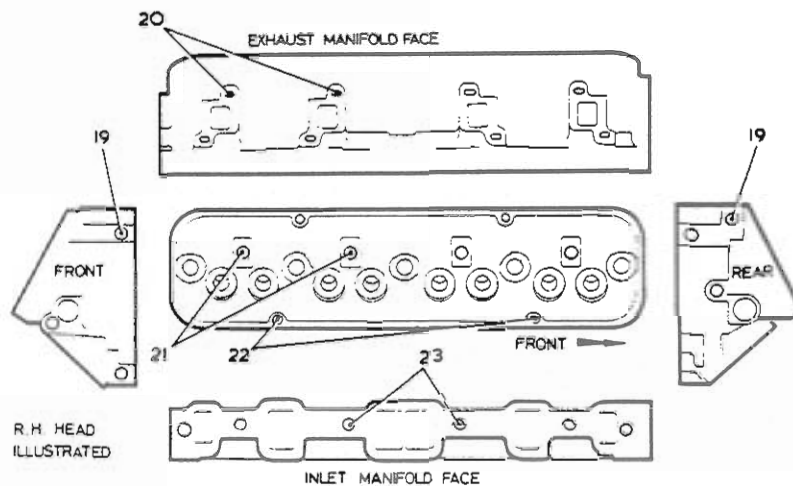


Cylinder head thread insert salvage instructions

19. These three holes may be drilled 0.3906 in dia.  $\times$  0.937 + 40 deep. Tapped with Helicoil Tap No. 6 CPB or 6CS  $\times$  0.875 in (min.) deep (3/8 U.N.C. 1 1/2 D insert).
20. These eight holes may be drilled 0.3906 in dia.  $\times$  0.812 + 40 deep. Tapped with Helicoil Tap No. 6 CBB 0.749 (min.) deep (3/8 U.N.C. 1 1/2 D insert).
21. These four holes may be drilled 0.3906 in dia.  $\times$  0.937 + 40 deep. Tapped with Helicoil Tap No. 6 CPB or 6CS  $\times$  0.875 (min.) deep (3/8 U.N.C. 1 1/2 D insert).
22. These four holes may be drilled 0.261 in dia.  $\times$  0.675 + 40 deep. Tapped with Helicoil Tap No. 4CPB or 4CS  $\times$  0.625 (min.) deep (1/4 U.N.C. 1 1/2 D insert).
23. These six holes may be drilled 0.3906 in dia.  $\times$  0.937 + 40 deep. Tapped with Helicoil Tap No. 6 CPB or 6CS  $\times$  0.875 (min.) deep (3/8 U.N.C. 1 1/2 D insert).

**CAUTION:** Any attempt to salvage the sparking plug threads in the cylinder head may result in breaking into the water jacket, rendering the head scrap.

continued



DATA

<b>Cylinder heads:</b>	
Material	Aluminium alloy
Type	Two heads with separate alloy inlet manifold
Inlet and exhaust valve seat material	Piston ring iron
Inlet and exhaust valve seat angle	46 + 1/4 degrees
<b>Valves:</b>	
<b>Valves, inlet:</b>	
Overall length	116.58 to 117.34 mm (4.590 to 4.620 in)
Actual overall head diameter	39.75 to 40.00 mm (1.565 to 1.575 in)
Angle of face	45 degrees
Stem diameter	8.640 to 8.666 mm (0.3402 to 0.3412 in) at the head and increasing to 8.653 to 8.679 mm (0.3407 to 0.3417 in)
Stem clearance in guide: Top	0.02 to 0.07 mm (0.001 to 0.003 in)
Bottom	0.013 to 0.063 mm (0.0005 to 0.0025 in)
<b>Valves, exhaust:</b>	
Overall length	116.58 to 117.34 mm (4.590 to 4.620 in)
Actual overall head diameter	34.226 to 34.480 mm (1.3475 to 1.3575 in)
Angle of face	45 degrees
Stem diameter	8.628 to 8.654 mm (0.3397 to 0.3407 in) at the head and increasing to 8.640 to 8.666 mm (0.3402 to 0.3412 in)
Stem clearance in guide: Top	0.038 to 0.088 mm (0.0015 to 0.0035 in)
Bottom	0.05 to 0.10 mm (0.002 to 0.004 in)
Valve lift	9.9 mm (0.39 in) both valves
Valve spring length	40.0 mm (1.577 in) at pressure of 30.16 to 33.34 kg (66.5 to 73.5 lb)

CYLINDER HEADS

—Overhaul	12.29.18
Left-hand cylinder head	12.29.19
Right-hand cylinder head	12.29.30

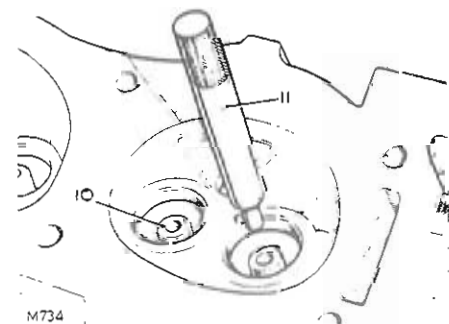
Service tools: 276102 Valve spring compressor, 274401 Valve guide remover, 600959 Valve guide drift

1. Remove the cylinder heads, see 12.29.10.

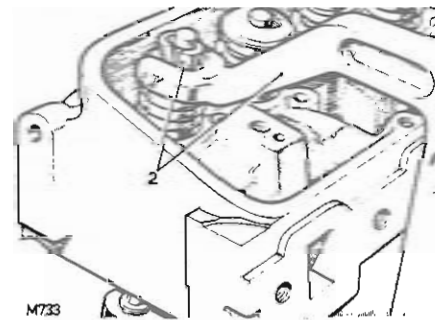
Dismantling

2. Using the valve spring compressor 276102, remove the valves and springs and retain in sequence for refitting.
3. Clean the combustion chambers with a soft wire brush.
4. Clean the valves.
5. Clean the valve guide bores.
6. Regrind or fit new valves as necessary.
7. If a valve must be ground to a knife-edge to obtain a true seat, fit a new valve.
8. The correct angle for the valve face is 45 degrees.
9. The correct angle for the seat is  $46 + \frac{1}{4}$  degrees, and the seat witness should be towards the outer edge.
10. Check the valve guides and fit replacements as necessary, see instructions 11 to 15.
11. Using the valve guide remover 274401, drive out the old guides from the combustion chamber side.
12. Clean the valve seat inserts to ensure freedom from burrs.

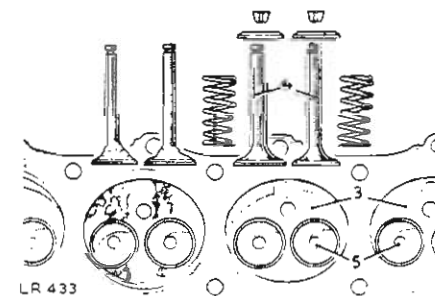
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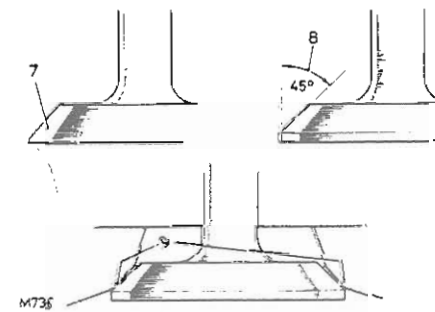
M734



M733



LR 433



M735

13. Lubricate the new valve guide.
14. Using the valve guide drift 600959, drive the valve guide into the cylinder head.
15. The fitted guide should stand 19 mm ( $\frac{3}{4}$  in) above the step surrounding the valve guide boss in the cylinder head.

**NOTE:** Service valve guides are 0.02 mm (0.001 in) larger on the outside diameter than the original equipment to ensure interference fit.

16. Check the valve seats and fit replacements as necessary, see instructions 17 to 19.
17. Remove the old seat inserts by grinding them away until they are thin enough to be cracked and prised out.
18. Heat the cylinder head evenly to approximately 65°C (150°F).
19. Press the new insert into the recess in the cylinder head.

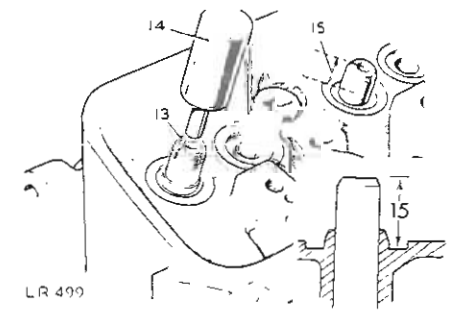
**NOTE:** Service valve seat inserts are available in two oversizes: 0.25 and 0.50 mm (0.010 and 0.020 in) larger on the outside diameter to ensure interference fit.

20. If necessary, cut the valve seats to  $46 + \frac{1}{4}$  degrees.
21. The nominal seat width is 1.5 mm (0.031 in). If the seat exceeds 2.0 mm (0.078 in) it should be reduced to the specified width by the use of 20 and 70 degree stones.
22. The inlet valve seat is 37.03 mm (1.458 in) diameter and 31.50 mm (1.240 in) diameter.
23. Check the height of the valve stems above the valve spring seat surface of the cylinder head. This **MUST NOT** exceed 47.63 mm (1.875 in). If necessary, grind the end of the valve stem or fit new parts.
24. Lubricate the valve stems and guides with engine oil and fit each valve as follows:
25. Insert the valve into its guide.
26. Place the valve spring in position.

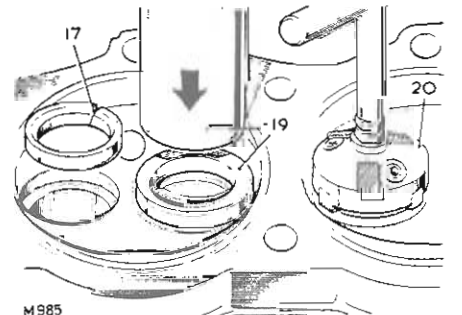
**CAUTION:** It is essential that the bottom of the valve spring is correctly located in the cylinder head recess.

27. Locate the cap on the spring.
28. Using the valve spring compressor 276102, fit the valve collets.
29. Refit the cylinder heads, see 12.29.10.

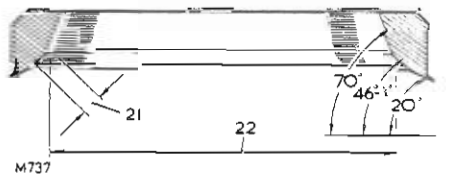
For final refer to operation 12.29.10.



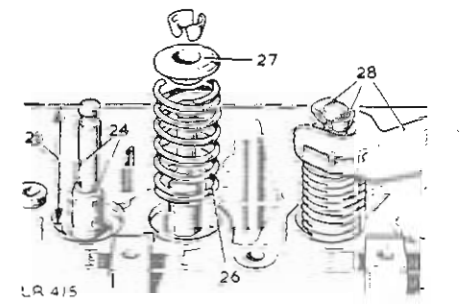
LR 499



M985



M737



LR 415

## VALVE GEAR

—Remove and refit 12.29.34

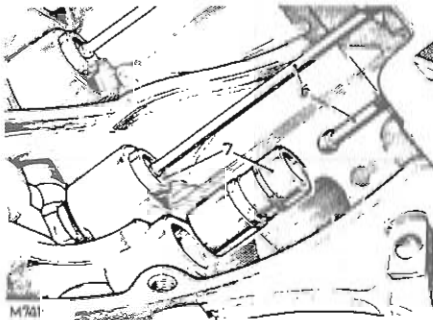
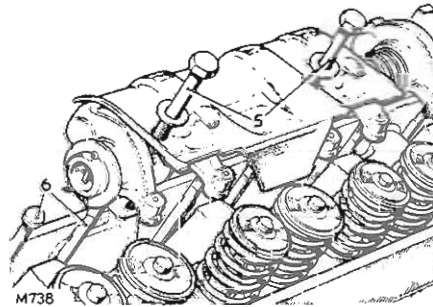
## ROCKER SHAFTS

—Remove and refit 2, 4, 5 and 30 to 37 12.29.54

## Removing

1. Drain the cooling system, see 26.10.01.
2. Remove the air cleaner, see 19.10.01.
3. Remove the induction manifold, see 30.15.02.
4. Remove the rocker covers.
5. Remove the rocker shaft assemblies.
6. Withdraw the push-rods and retain in the sequence removed.
7. Withdraw the tappets and retain with respective push-rods.

NOTE: If a tappet cannot be withdrawn, remove the camshaft and withdraw the tappet from the bottom.



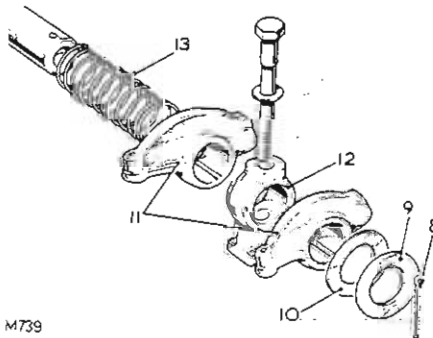
## Dismantling rocker shafts

8. Remove the split pin from one end of the rocker shaft. Withdraw the following components and retain them in the correct sequence for reassembly:
  9. A plain washer.
  10. A wave washer.
  11. Rocker arms.
  12. Brackets.
  13. Springs.

## Inspection of hydraulic tappets and push-rods

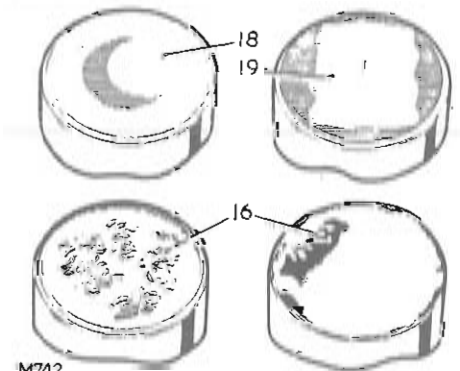
14. Hydraulic tappet: Inspect inner and outer surfaces of body for blow-holes and scoring. Replace hydraulic tappet if body is roughly scored or grooved, or has a blow-hole extending through the wall in a position to permit oil leakage from lower chamber.
15. The prominent wear pattern just above lower end of body should not be considered a defect unless it is definitely grooved or scored: it is caused by side thrust of cam against body while tappet is moving vertically in its guide.

continued



M739

16. Inspect the cam contact surface of the tappets. Fit new tappets if the surface is excessively worn or damaged.
17. A hydraulic tappet body that has been rotating will have a round wear pattern and a non-rotating tappet body will have a square wear pattern with a very slight depression near the centre.
18. Tappets MUST rotate and a circular wear condition is normal, and such bodies may be continued in use if the surface is free of defects.
19. In the case of a non-rotating tappet, fit a new replacement and check camshaft lobes for wear; also ensure new tappet rotates freely in the cylinder block.
20. Fit a new hydraulic tappet if the area where the push-rod contacts is rough or otherwise damaged.
21. Push-rod: Replace with new, any push-rod having a rough or damaged ball-end or seat.



M742

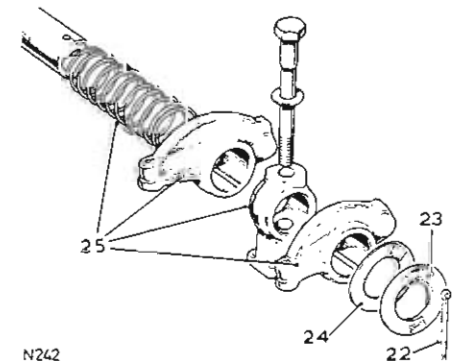
## Refitting

## Assembling rocker shafts instructions 22 to 28

22. Fit a split pin to one end of the rocker shaft.
23. Slide a plain washer over the long end of the shaft to abut the split pin.
24. Fit a wave washer to abut the plain washer.

NOTE: Two different rocker arms are used and must be fitted so that the valve ends of the arms slope away from the brackets.

25. Assemble the rocker arms, brackets and springs to the rocker shaft.
26. Compress the springs, brackets and rockers, and fit a wave washer, plain washer and split pin to the end of the rocker shaft.
27. Locate the oil baffle plates in place over the rockers furthest from the notched end of the rocker shaft.
28. Fit the bolts through the brackets and shaft so that the notch on the one end of the shaft is uppermost and towards the front of the engine on the right-hand side, and towards the rear on the left-hand side.



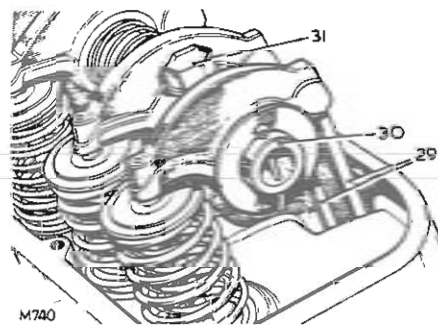
N242

continued

29. Fit the tappets and push-rods in the original sequence.

**IMPORTANT:** The rocker shafts are handed and must be fitted correctly to align the oilways.

30. Each rocker shaft is notched at one end and on one side only. The notch must be uppermost and towards the front of the engine on the right-hand side, and towards the rear on the left-hand side.
31. Fit the rocker shaft assemblies. Ensure that the push-rods engage the rocker cups and that the baffle plates are fitted to the front on the left-hand side, and to the rear on the right-hand side. Tighten the bolts evenly. Torque: 3,5 to 4,0 kgf m (25 to 30 lbf ft).

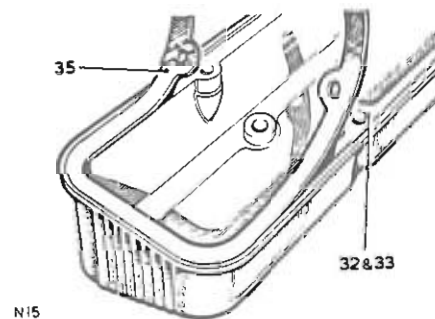


If it is necessary to fit a new rocker cover gasket, proceed as follows, instructions 32 to 36.

32. Clean and dry the gasket mounting surface, using Bostik cleaner 6001.
33. Apply Bostik 1775 impact adhesive, Rover Part No. 601736 to the seal face and the gasket, using a brush to ensure an even film.
34. Allow the adhesive to become touch-dry, approximately fifteen minutes.

**NOTE:** The gasket fits one way round only and must be fitted accurately first time; any subsequent movement would destroy the bond.

35. Place one end of the gasket into the cover recess with the edge firmly against the recess wall; at the same time hold the remainder of the gasket clear; then work around the cover, pressing the gasket into place ensuring that the outer edge firmly abuts the recess wall.
36. Allow the cover to stand for thirty minutes before fitting it to the engine.
37. Reverse instructions 1 to 4.



**NOTE: Tappet noise**

It should be noted that tappet noise can be expected on initial starting-up after an overhaul due to oil drainage from the tappet assemblies or indeed if the vehicle has been standing over a very long period. If excessive noise should be apparent after an overhaul, the engine should be run at approximately 2,500 rev/min for a few minutes, when the noise should be eliminated.

## ENGINE ASSEMBLY

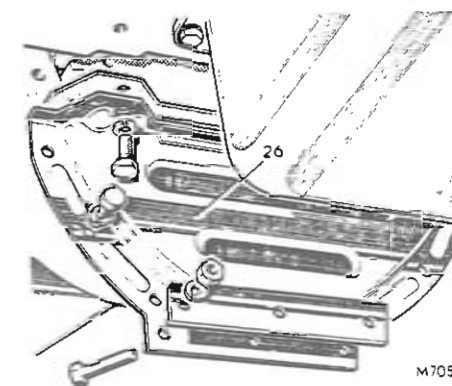
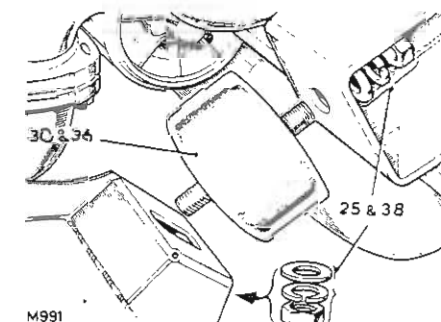
— Remove and refit

12.41.01

## Removing

1. Remove the bonnet, see 76.16.01.
2. Disconnect the battery earth lead.
3. Drain the cooling system, see 26.10.01.
4. Remove the fan blades, see 26.25.06.
5. Remove the fan cowl, see 26.25.11.
6. Remove the radiator block, see 26.40.04.
7. Remove the air cleaner, see 19.10.01.
8. Disconnect the inlet hose to the heater.
9. Disconnect the return hose from the heater.
10. Disconnect the throttle cable from the L.H. carburetter and induction manifold.
11. Disconnect the vacuum pipe to the gearbox.
12. Disconnect the choke cable from the L.H. carburetter.
13. Disconnect the fuel spill return pipe from the R.H. carburetter.
14. Disconnect the vacuum pipe for the brake servo.
15. Disconnect the leads from the alternator.
16. Disconnect the lead from the choke thermostat switch.
17. Disconnect the lead from the water temperature transmitter.
18. Disconnect the leads from the ignition coil.
19. Unclip the engine harness and draw it clear.
20. Disconnect the lead from the oil pressure switch.
21. Disconnect the leads from the starter motor.
22. Disconnect the earth strap from the engine.
23. Disconnect the fuel supply pipe from the fuel pump.
24. Disconnect the exhaust pipes from the manifolds.
25. Remove all the fixings from the engine front mounting rubbers.
26. Remove the cover-plate from the bell housing.

continued



## ENGINE

- 27 Remove the fixings securing the bell housing to the engine. The lower fixings are accessible from under the vehicle, and the upper fixings are accessible from the engine compartment.

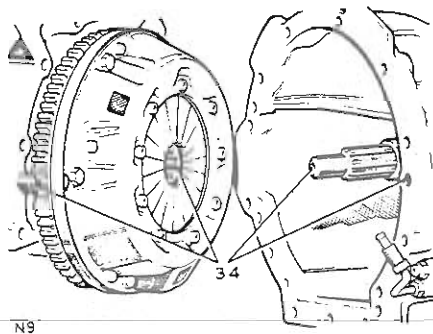
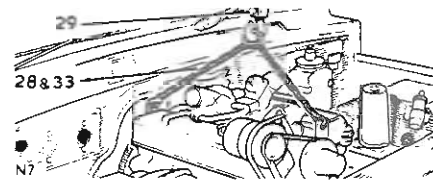
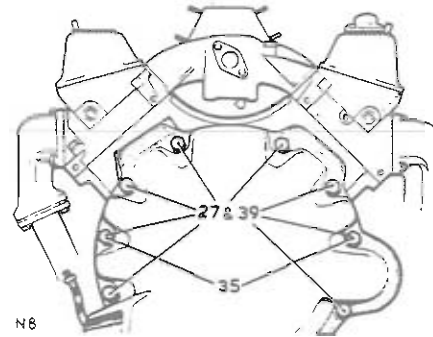
**CAUTION:** To overcome variations in installation, ensure that any ancillary items are disconnected before proceeding to lift engine.

28. Attach a suitable lifting chain and hoist to the engine lifting hooks.  
 29. Tension the hoist sufficient to lift the engine just clear of the front mounting rubbers.  
 30. Withdraw the engine front mounting rubbers.  
 31. Draw the engine forward to release it from the dowelled location to the bell housing, and to clear the primary pinion from the clutch.  
 32. Lift the engine clear.

### Refitting

Before refitting the engine smear the splines of the primary pinion, the clutch centre and the withdrawal unit abutment faces with molybdenum disulphide grease, Rocol MTS 1000. Smear the engine to gearbox joint faces with Unipart Universal jointing compound.

33. Attach a lifting chain and hoist to the engine lifting hooks.  
 34. Lower the engine into position, locating the primary pinion into the clutch and engage the bell housing dowels.  
 35. Secure the engine to the bell housing with at least two bolts.  
 36. Locate the engine front mounting rubbers in position.  
 37. Lower the engine on to the mountings and remove the lifting chain.  
 38. Secure the fixings at the engine front mounting rubbers.  
 39. Fit the remaining engine to bell housing fixings.  
 40. Apply a coating of Unipart Universal jointing compound to the vertical joint face of the bell housing cover-plate.  
 41. Locate the seal on to the bell housing cover-plate.  
 42. Fit the bell housing cover-plate and seal ensuring that the fillet is filled with jointing compound.  
 43. Reverse instructions 1 to 24.



## FLYWHEEL

— Remove and refit

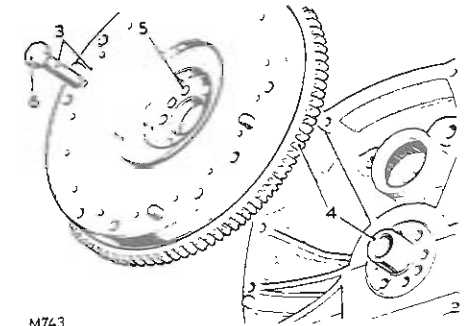
12.53.07

### Removing

1. Remove the engine assembly, see 12.41.01.
2. Remove the clutch assembly, see 33.10.01.
3. Remove the flywheel.

### Refitting

4. Locate the flywheel in position on the crankshaft spigot, with the ring gear towards the engine.
5. Align the flywheel fixing bolt holes which are off-set to prevent incorrect assembly.
6. Fit the flywheel fixing bolts and before finally tightening, take up any clearance by rotating the flywheel against the direction of engine rotation. Torque: 7.0 to 8.5 kgf m (50 to 60 lbf ft).
7. Reverse instructions 1 and 2.



## FLYWHEEL

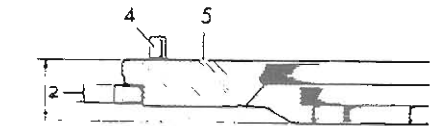
— Overhaul

12.53.10

1. Remove the flywheel, see 12.53.07.

### Procedure

2. Measure the overall thickness of the flywheel. Fit a new flywheel if it is less than the minimum overall thickness of 39.93 mm (1.572 in).
3. If the flywheel is above the minimum thickness, the clutch face can be refaced as follows.
4. Remove the dowels.
5. Reface the flywheel over the complete surface.
6. Check the overall thickness of the flywheel to ensure that it is still above the minimum thickness.
7. Refit the flywheel, see 12.53.07.





## STARTER RING GEAR

—Remove and refit

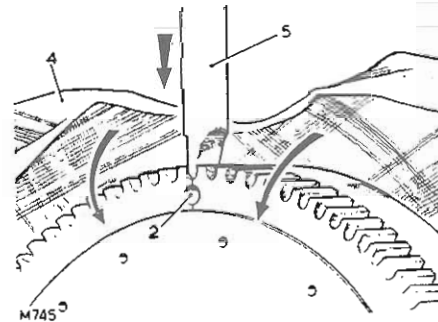
12.53.19

## Removing

1. Remove the flywheel, 12.53.07.
2. Drill a 10 mm (0.375 in) diameter hole axially between the root of any tooth and the inner diameter of the starter ring sufficiently deep to weaken the ring. Do NOT allow the drill to enter the flywheel.
3. Secure the flywheel in a vice fitted with soft jaws.
4. Place a cloth over the flywheel to protect the operator from flying fragments.

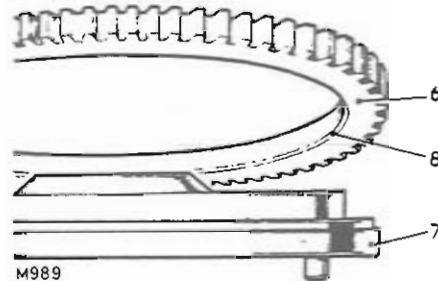
**WARNING:** Take adequate precautions against flying fragments as the starter ring gear may fly asunder when being split.

5. Place a chisel immediately above the drilled hole and strike it sharply to split the starter ring gear.



## Refitting

6. Heat the starter ring gear uniformly to between 170° and 175°C (338° to 347°F) but do not exceed the higher temperature.
7. Place the flywheel, flanged side down, on a flat surface.
8. Locate the heated starter ring gear in position on the flywheel, with the chamfered inner diameter towards the flywheel flange. If the starter ring gear is chamfered both sides, it can be fitted either way round.
9. Press the starter ring gear firmly against the flange until the ring contracts sufficiently to grip the flywheel.
10. Allow the flywheel to cool gradually. Do NOT hasten cooling in any way and thereby avoid the setting up of internal stresses in the ring gear which may cause fracture or failure in some respect.
11. Fit the flywheel, see 12.53.07.



## SPIGOT BEARING

—Remove and refit

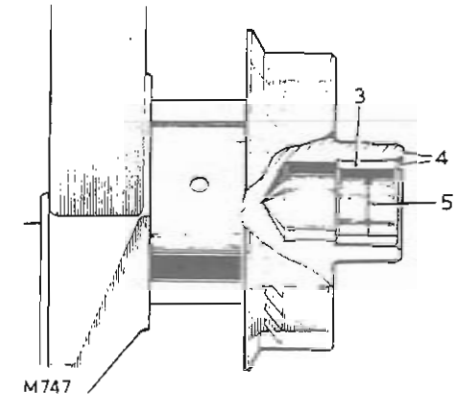
12.53.20

## Removing

1. Remove the engine assembly, see 12.41.01.
2. Remove the clutch assembly, see 33.10.01
3. Remove the spigot bearing.

## Refitting

4. Fit the spigot bearing flush with, or to a maximum of 1.6 mm (0.063 in) below the end face of the crankshaft.
5. Ream the spigot bearing to  $19.177 + 0.025$  mm ( $0.7504 + 0.001$  in) inside diameter. Ensure all swarf is removed.
6. Reverse instructions 1 and 2.



## OIL FILTER ASSEMBLY—EXTERNAL

—Remove and refit

12.60.01

## Removing

1. Unscrew the filter and discard.

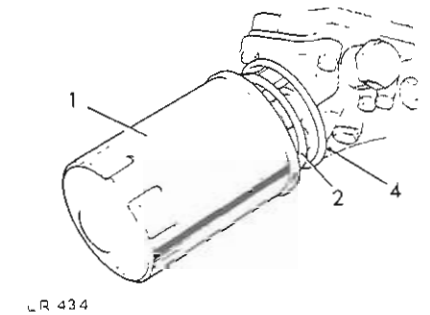
**NOTE:** If the filter is difficult to remove, use a strap spanner.

2. Withdraw the sealing washer and discard.

**CAUTION:** Do NOT delay fitting a new filter, otherwise the oil pump may drain and require priming (see 12.60.26) before running the engine.

## Refitting

3. Place a new sealing washer on to a new filter.
4. Fit the filter BY HAND until the sealing washer touches the oil pump cover face, then give a further half turn—do NOT overtighten.
5. Check, and if necessary replenish, the engine oil sump.
6. Run the engine and check the filter joint for leaks.
7. Check the oil sump level after the engine has been stopped for a few minutes, and replenish if necessary.



## ENGINE

### OIL PUMP

—Remove and refit 12.60.26

#### Removing

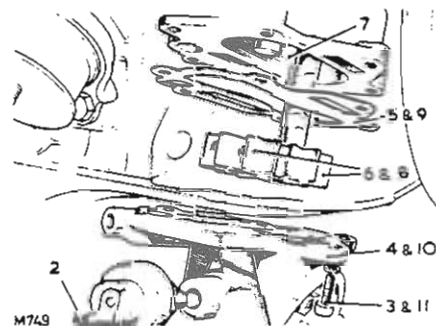
1. Remove the oil filter assembly, see 12.60.01.
2. Disconnect the electrical leads from the switches.
3. Remove the bolts from the oil pump cover.
4. Withdraw the oil pump cover.
5. Lift off the cover gasket.
6. Withdraw the oil pump gears

#### Refitting

7. Fully pack the oil pump gear housing with petroleum jelly. Use only petroleum jelly; no other grease is suitable.
8. Fit the oil pump gears so that the petroleum jelly is forced into every cavity between the teeth of the gears.

**IMPORTANT:** Unless the pump is fully packed with petroleum jelly it may not prime itself when the engine is started.

9. Place a new gasket on the oil pump cover.
10. Locate the oil pump cover in position.
11. Fit the special fixing bolts and tighten alternately and evenly. Torque: 1,4 to 2,0 kgf m (10 to 15 lbf ft).
12. Reverse instructions 1 and 2.
13. Check the oil level in the engine sump, and replenish as necessary.

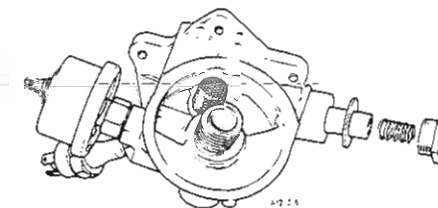


### OIL PUMP

—Overhaul 12.60.32

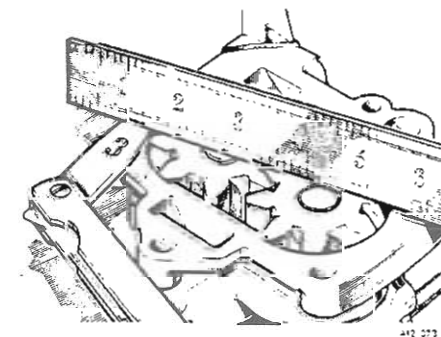
#### Dismantling

1. Remove the oil pump, see 12.60.26.
2. Unscrew the plug from the pressure relief valve.
3. Lift off the joint washer for the plug.
4. Withdraw the spring from the relief valve.
5. Withdraw the pressure relief valve.



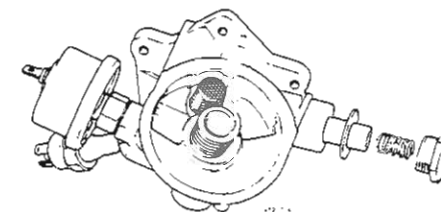
#### Inspecting

6. Check the oil pump gears for wear or scores.
7. Fit the oil pump gears and shaft into the front cover.
8. Place a straight-edge across the gears.
9. Check the clearance between the straight-edge and the front cover. If less than 0,05 mm (0,0018 in), check the front cover gear pocket for wear.
10. Check the oil pressure relief valve for wear or scores. Check the relief valve spring for wear at the sides or signs of collapse.
11. Clean the gauze filter for the relief valve.
12. Check the fit of the relief valve in its bore. The valve must be an easy slide fit with no perceptible side movement.



#### Reassembling

13. Insert the relief valve spring.
14. Locate the sealing washer on to the relief valve plug.
15. Fit the relief valve plug. Torque: 4,0 to 4,9 kgf m (30 to 35 lbf ft).
16. Refit the oil pump, see 12.60.26.



## OIL SUMP

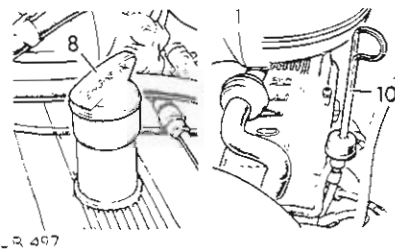
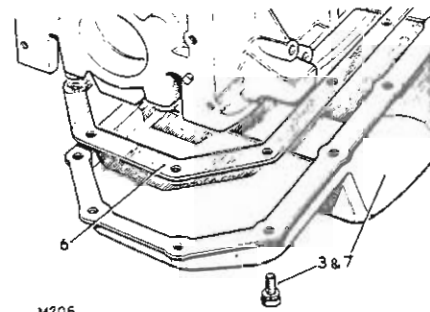
— Remove and refit 12.60.44

## Removing

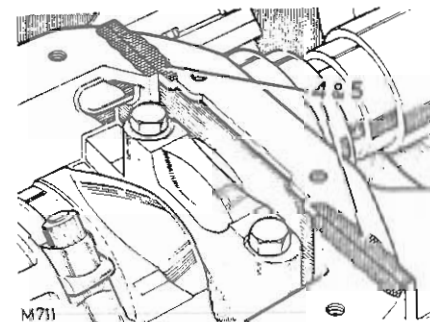
1. Remove the sump drain plug.
2. Allow all the oil to drain, then refit the plug and sealing washer.
3. Remove the sump.

## Refitting

4. Clean the sump mating surfaces at the join between the timing chain cover and the cylinder block.
5. Apply a coating of Hylomar SQ32M sealing compound across the join.
6. Place the sump gasket in position.
7. Fit the sump.
8. Unscrew the oil filler cap.
9. Using the correct grade oil, see 'LUBRICATION' — Group 09, replenish the sump.
10. Use the sump dipstick to set the final level. Do NOT fill above the 'HIGH' mark.
11. Start the engine and check that the oil pressure warning light goes out. If the light remains on, the engine must be stopped and the oil pump dismantled and primed, see 12.60.26.
12. Run the engine and check the sump joint for leaks.
13. Check the sump oil level after the engine has been stopped for a few minutes, and replenish if necessary.



12—34



## TIMING GEAR COVER

— Remove and refit 12.65.01

## Includes

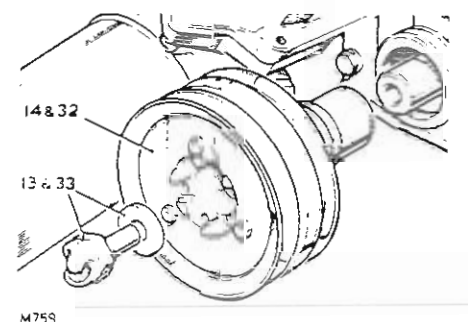
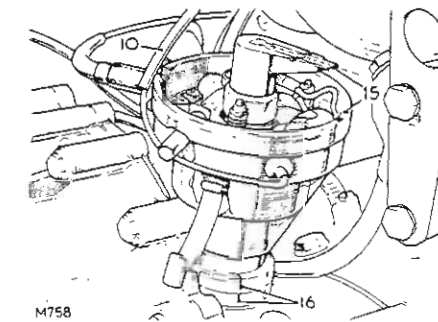
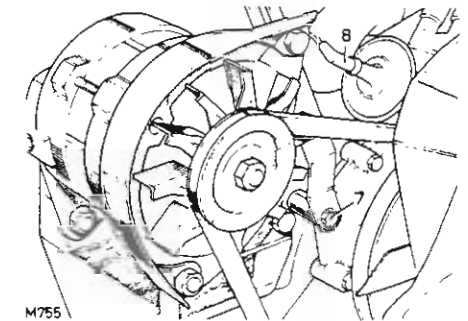
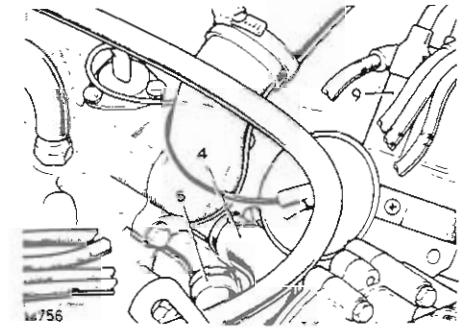
## GEAR COVER OIL SEAL

— Remove and refit 12.65.05

## Removing

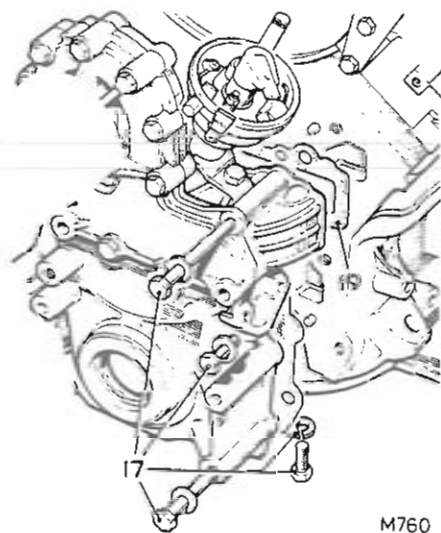
1. Drain the cooling system, see 26.10.01.
2. Remove the fan blades and pulley, see 26.25.01.
3. Remove the fan cowl, see 26.25.11.
4. Disconnect the by-pass hose from the thermostat.
5. Disconnect the heater return hose from the water pump.
6. Disconnect the inlet hose from the water pump.
7. Release the alternator adjusting link from the water pump housing.
8. Disconnect the vacuum pipe from the distributor.
9. Release the distributor cap, unclip the leads and move the cap to one side.
10. Disconnect the low tension lead from the ignition coil.
11. Disconnect the lead from the oil pressure switch.
12. Engage gear to prevent engine rotation.
13. Remove the starter dog.
14. Withdraw the crankshaft pulley and mud deflector.
15. Mark the distributor body relative to the centre line of the rotor arm.
16. If the distributor is to be removed, make corresponding marks on the distributor and timing cover.

continued



12—35

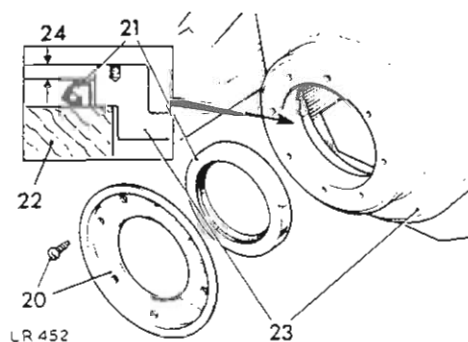
17. Remove the timing cover fixings, including two from the sump.
18. Withdraw the timing cover complete.
19. Remove the joint washer.



M760

Oil seal, remove and refit, instructions 20 to 24

20. Remove the fixings and withdraw the mudshield.
21. Remove the oil seal.
22. Position the gear cover with the front face uppermost and the underside supported across the oil seal housing bore on a suitable wooden block.
23. Enter the oil seal, open side first, into the housing bore.
24. Press in the oil seal until the plain face is 1.5 mm (0.062 in) approximately below the gear cover face. Reverse instruction 20.

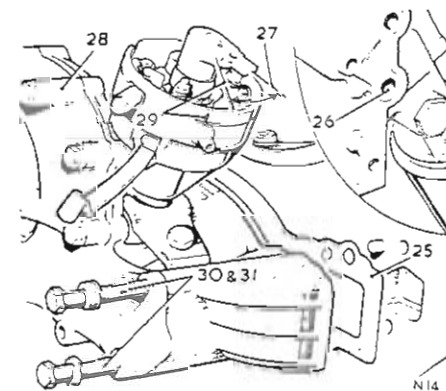


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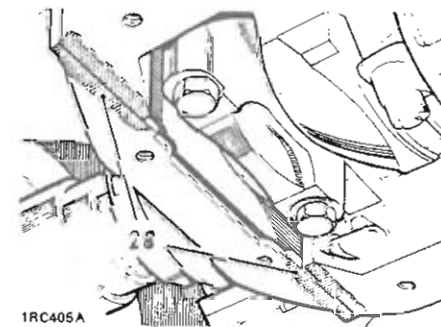
continued

Refitting

25. Place a new timing cover joint washer in position.
26. Prime the oil pump by injecting engine oil through the suction port.
27. Set the distributor rotor arm approximately 30 degrees before the final positioning mark, to compensate for the skew gear engagement.
28. Locate the timing cover in position, applying a coating of Hylomar PL32M about 13 to 19 mm (½ to ¾ in) wide in the area shown.
29. Check that the distributor marking alignment is correct.
30. Clean the threads of the timing cover securing bolts, then coat them with Thread Lubricant-Sealant 3M EC776.
31. Fit the timing cover securing bolts. Torque: 2.8 to 3.5 kgf m (20 to 25 lbf ft).
32. Fit the crankshaft pulley.
33. Fit the starter dog. Torque: 19.3 to 22.3 kgf m (140 to 160 lbf ft).
34. Reverse instructions 1 to 14.
35. Check, and if necessary adjust, the ignition timing, see 86.35.20.



N14



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## TIMING CHAIN AND GEARS

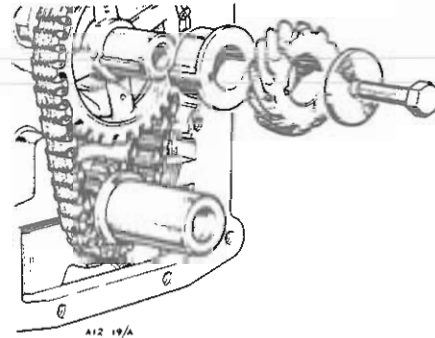
— Remove and refit

12.65.12

## Removing

1. Set the engine—No. 1 piston at T.D.C.
2. Remove the timing chain cover, see 12.65.01.
3. Check that No. 1 piston is still at T.D.C.
4. Remove the distributor drive gear.
5. Withdraw the spacer.
6. Withdraw the chain wheels complete with the chain.

**CAUTION:** Do NOT rotate the engine if the rocker shafts are fitted, otherwise the valve gear and pistons will be damaged.

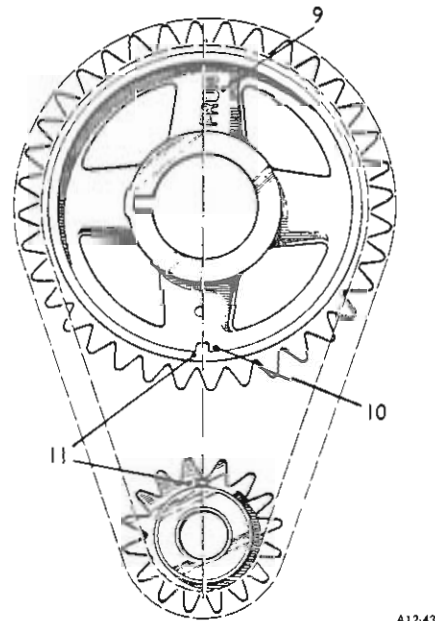


## Refitting

**NOTE:** If the crankshaft and/or camshaft have not been rotated, commence at item 12. If they have been rotated, commence at item 7.

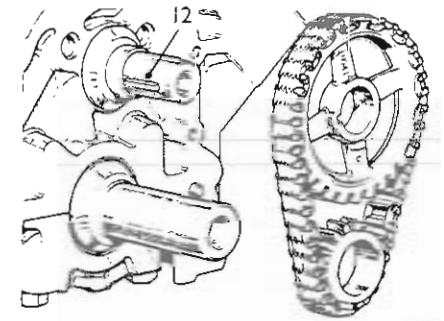
7. Remove the rocker shafts, see 12.29.54.
8. Set the engine—No. 1 piston at T.D.C.
9. Temporarily fit the camshaft chain wheel with the marking 'FRONT' outward.
10. Turn the camshaft until the mark on the camshaft chain wheel is at the six o'clock position, then remove the chain wheel without disturbing the camshaft.
11. Locate the chain wheels to the chain with the timing marks aligned.

continued



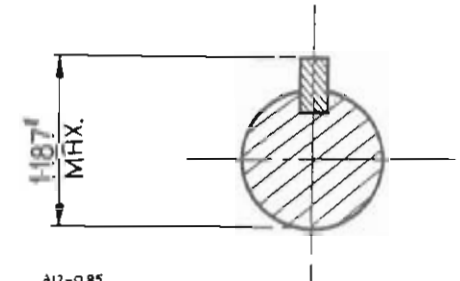
A12-43

12. Engage the chain wheel assembly on the camshaft and crankshaft key locations and check that the camshaft key is parallel to the shaft axis to ensure adequate lubrication of the distributor drive gear.



A12-46

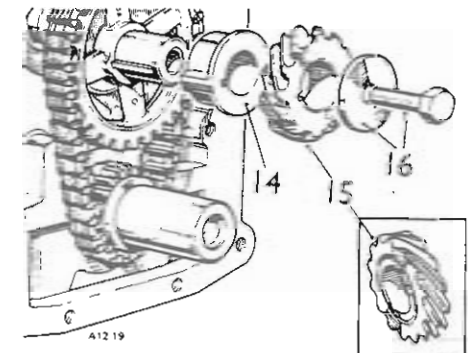
**CAUTION:** The space between the key and keyway acts as an oilway for lubrication of the drive gear. Ensure that the key is seated to the full depth of the keyway. The overall dimension of shaft and key must not exceed 30,15 mm (1.187 in).



A12-0 85

13. Check that the timing marks line-up.
14. Fit the spacer with the flange to the front.
15. Fit the distributor drive gear ensuring that the ANNULAR GROOVED SIDE is fitted TO THE REAR, that is, towards the spacer.
16. Secure the drive gear with the washer and bolt. Torque to 5,5 to 6,2 kgf m (40 to 45 lbf ft).
17. Fit the timing chain cover, see 12.65 01.

continued



A12 19

## ENGINE

### DATA

#### Timing chain and wheels:

Timing chain type .....	Inverted tooth
No. of links .....	54
Width .....	22,22 mm (0.875 in)
Pitch .....	9,52 mm (0.375 in)
Crankshaft chain wheel .....	Sintered iron
Camshaft chain wheel .....	Aluminium alloy, teeth covered with nylon

#### Valve timing:

	Inlet	Exhaust
Opens .....	10 degrees B.T.D.C.	68 degrees B.B.D.C.
Closes .....	75 degrees A.B.D.C.	37 degrees A.T.D.C.
Duration .....	285 degrees	285 degrees
Valve peak .....	112.5 degrees A.T.D.C.	105.5 degrees B.T.D.C.

## EMISSION AND EVAPORATIVE LOSS CONTROL EQUIPMENT

Land-Rover V8 vehicles are fitted during manufacture with various items of emission and evaporative loss control equipment to meet individual territory requirements. Therefore some operations listed in this section of the manual may not be applicable to all vehicles.

The purpose of the equipment is to reduce the emission of hydrocarbons, carbon monoxide and nitrous oxides from the vehicle fuel and exhaust systems to an acceptable level.

Unauthorized replacement or modification of the emission and evaporative loss control equipment may contravene local territory legislation and may render the vehicle user and/or repairer liable to legal penalties.

After any replacement of, or adjustment to, this equipment the exhaust emission levels should be checked to ensure that they comply to local territory requirements.

### CRANKCASE EMISSION CONTROL

—Description 17.10.00

The crankcase emission control system prevents leakage from the crankcase of combustion blow-by gases by maintaining a depression in the crankcase under all operating conditions.

The source of this depression is the 'constant' depression zone between the throttle plate and the piston within the carburetters. This depression rises with increasing engine load and speed, as does the quantity of crankcase emissions to be handled.

The crankcase is purged by air drawn from the air cleaner through an in-line filter into the crankcase. The crankcase fumes are piped from each rocker cover through a flame trap into the respective left- or right-hand carburetter intakes.

The blow-by gases are then burnt within the engine in the normal combustion process.

Australian Market vehicles purge the evaporative loss control system by linking it into the crankcase ventilation purge pipe.

## ENGINE BREATHER FILTER

—Remove and refit 17.10.02

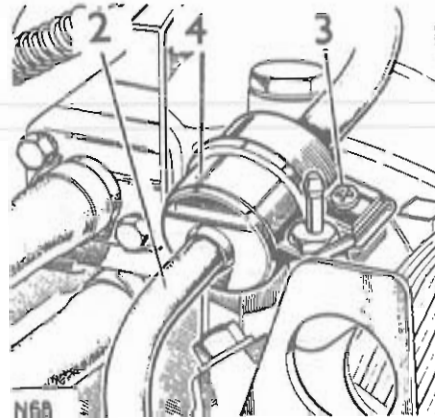
NOTE: Filters may have alternative locations according to territory build specification.

## Removing

1. Remove the air cleaner, see 19.10.01.
2. Withdraw the filter top hose.
3. Slacken the filter clip.
4. Withdraw the filter from the bottom hose.

## Refitting

5. Fit the filter with the end marked 'IN' or the arrows, relative to the direction of gas flow.
6. Connect the filter bottom hose.
7. Connect the filter top hose.
8. Secure the filter retaining clip.
9. Fit the air cleaner, see 19.10.02.



## ENGINE FLAME TRAPS

—Remove and refit 17.10.03

NOTE: Flame traps may have alternative locations according to territory build specification.

## Removing

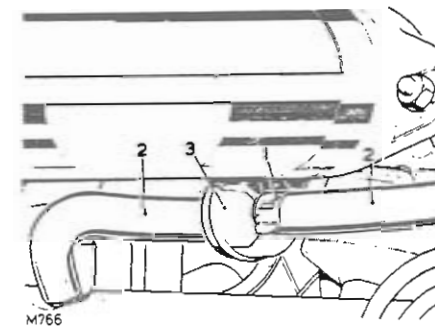
1. Pull the flame trap clip clear of the carburettor/air cleaner.
2. Remove the hoses from the flame traps.
3. Withdraw the flame traps.

## Cleaning

4. Wash the flame traps in clean petrol and allow to dry.

## Refitting

5. Reverse instructions 1 to 3.



## EVAPORATIVE EMISSION CONTROL SYSTEM

—Description 17.15.00

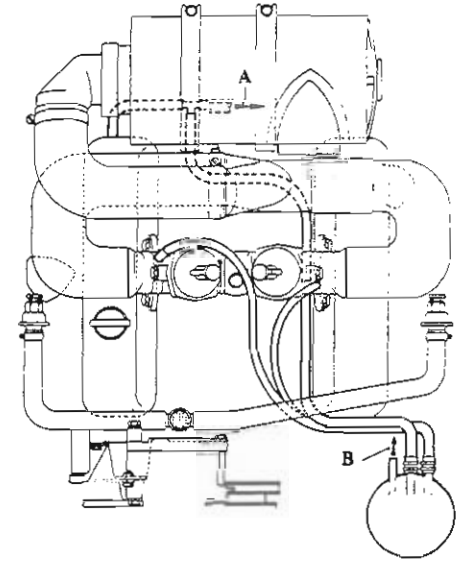
Evaporative emission control is achieved by venting the carburettor float chambers and the fuel tank through a charcoal adsorption canister to atmosphere. Refer to the schematic illustration.

The charcoal adsorption canister is mounted in the engine compartment and consists of a filter bed of activated charcoal with an enclosed space above and below. The carburettor, fuel tank and purge lines are connected to the upper space. The lower space is vented to atmosphere.

Vapour vented to the canister is adsorbed by the charcoal when the engine is not running. When the engine is running carburettor depression purges the canister by drawing filtered air through the charcoal bed of the canister into the crankcase ventilation system resulting in evaporative emissions being disposed of by the engine's normal combustion process.

An expansion tank ensures that thermal expansion of the fuel from the main tank cannot result in a surge of fuel reaching the canister and saturating the system. The function of the expansion tank is also to provide an overflow reservoir from the main tank as it is possible when the main tank is completely filled during high ambient temperature conditions for the fuel to expand, any thermal expansion occurring will be accommodated by the fuel travelling up the breather pipe into the expansion tank. The size of the expansion tank allows maximum fuel expansion, evaporative emissions being controlled by the expansion tank vent pipe, the pipe being connected between the charcoal canister and the tank vent positioned at the top of the expansion tank. The overflow fuel will eventually be drawn back into the tank as the expansion declines or the fuel is used.

The fuel tank filler cap is sealed to prevent evaporative loss.



A To air cleaner  
B From petrol tank

## ADSORPTION CANISTER

—Remove and refit 17.15.13

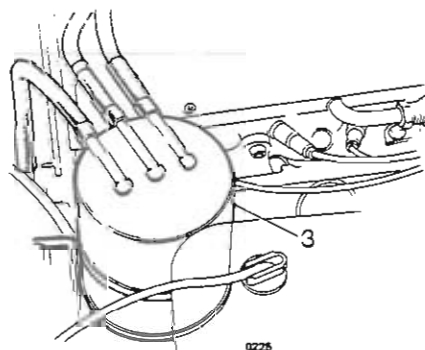
## Removing

1. Disconnect from the canister:
  - i. Canister line to fuel tank.
  - ii. Canister purge line.
  - iii. Carburettor vent pipe.
2. Slacken the clamp nut screw.
3. Remove the canister.

## Refitting

4. Secure the canister in the clamp.
5. Reverse instructions 1 and 2 above.

**WARNING:** The use of compressed air to clean an adsorption canister or clear a blockage in the evaporative system is very dangerous. An explosive gas present in a fully saturated canister may be ignited by the heat generated when compressed air passes through the canister.



## AIR INJECTION SYSTEM

—Description 17.20.00

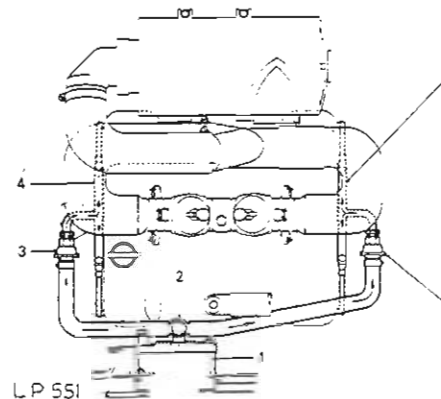
An engine-driven, vane-type air pump draws air from within the engine compartment through a centrifugal filter and delivers it through a pressure relief valve and through one-way check valves to the air manifolds on each cylinder head and thence to the injectors in the individual exhaust ports just downstream of the exhaust valves. The injectors are directed towards the valve head and face upstream. The injected air mixes with the exhaust gas leaving each cylinder and promotes secondary combustion within the exhaust ports, manifolds and exhaust system.

The air pump output is primarily controlled by engine speed/pulley ratio and pump capacity. Air delivery to the injectors is further controlled by exhaust back pressure and pressure relief valve setting.

The relief valve is mounted between the air pump and check valves, and dumps part of the air at high pump speeds to prevent pump damage.

The check valves, which are simple one-way flap valves, prevent exhaust gas from passing back through the air pump under adverse pressure conditions, and protects the pump in the event of pump drive failure.

17—4



Airflow (arrowed)

1. Air pump
2. Relief valve
3. Check valves
4. Air manifolds

## AIR PUMP

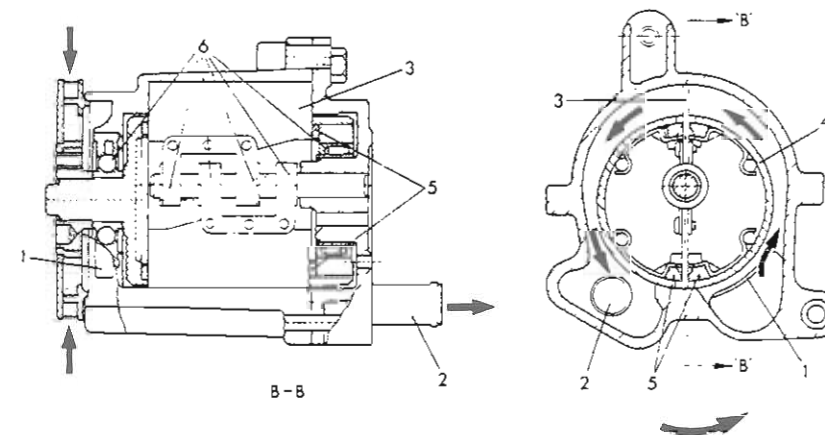
—Description 17.25.00

The rotary, vane-type air pump is fitted at the front of the engine and driven by a belt from a crankshaft pulley.

The pump delivers air under pressure to each of the four exhaust ports via a diverter valve (where fitted) a relief valve, check valve and air inlet manifold.

The pressurized air combines with the exhaust gases to continue and assist in making more complete the oxidization process in the exhaust system.

1. Inlet port
2. Exhaust port
3. Vanes
4. Rotor
5. Carbon sealing shoes
6. Bearings



17—5



## AIR PUMP

Remove and refit 17.25.07

## Removing

1. Release the air hoses from the pump.
2. Slacken the idler pulley mountings and lift the drive belt from the air pump pulley.
3. Loosen but do not remove the air pump mounting bolts.
4. Take the weight of the air pump and remove the mounting bolts.
5. Lift the pump from the engine.

## Refitting

6. Reverse instructions 1 to 5.
7. Check and adjust the drive belt tension, see 17.25.13.

## RELIEF VALVE

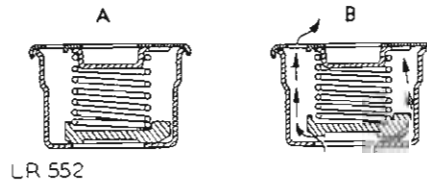
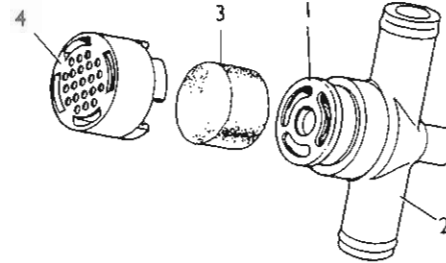
—Check operation 17.25.10

1. The relief valve allows excessive air pressure at high engine speed to discharge to the atmosphere.
2. Run the engine at high speeds and check the valve operation.
3. The valve cannot be adjusted and a defective unit should be replaced.

- 1 Relief valve
- 2 Relief valve body
- 3 Silencer
- 4 Cap

Valve closed A

Valve open B



LR 552

## RELIEF VALVE

—Remove and refit 17.25.11

## Removing

1. Disconnect the hoses from the valve.
2. Remove the valve.

## Refitting

3. Reverse instructions 1 and 2.

17—6

## AIR MANIFOLD

—Remove and refit 17.25.17

## Removing

1. Remove the carburettor air cleaners, see 19.10.01.
2. Release the manifold from the check valve.
3. Release the manifold from the cylinder head.  
NOTE: It may be more convenient to release the centre branches at the manifold junction.
4. Lift off the manifold.

## Refitting

5. Reverse instructions 1 to 4.
6. Run the engine and check for air leaks at the manifold.

## CHECK VALVE

—Remove and refit 17.25.21

## Removing

1. Disconnect the air hose from the check valve.
2. Use two open-ended spanners, one on the air distribution manifold hexagon to support the manifold, and the other to remove the check valve anti-clockwise.  
CAUTION: Do not impose any strain on the air manifold.

## Refitting

3. Reverse instructions 1 and 2.

## CHECK VALVE

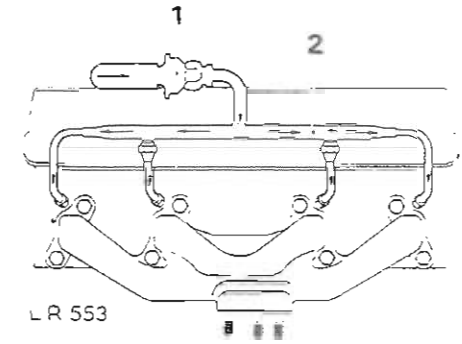
Check operation 17.25.22

The check valve is a one-way valve positioned to protect the pump from back-flow of exhaust gases. The valve closes if the pump pressure falls while the engine is running, should, for example, the drive belt brake.

## Testing

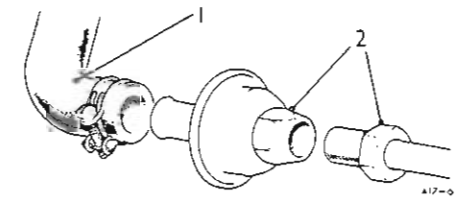
CAUTION: Do not use a pressure air supply for this test.

1. Remove the check valve, see 17.25.21.
2. Blow through the valve orally in both directions in turn. Air should only pass through the valve when blown from the hose connection end. Should air pass through the valve when blown from the air manifold end, renew the valve.
3. Refit the check valve, see 17.25.21.

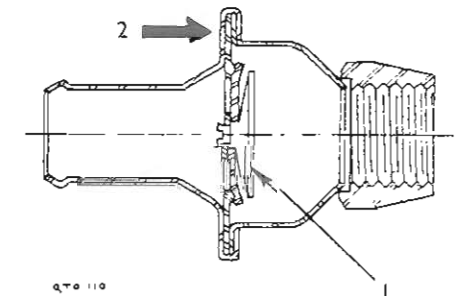


LR 553

1. Check valve
2. Air manifold



A17-0



A17-0

1. Valve diaphragm
2. Direction of flow

17—7

## AIR INTAKE TEMPERATURE CONTROL SYSTEM

—Description 17.30.00

The carburetors are tuned to function most efficiently at an air intake temperature of 100°F (38°C).

The temperature is maintained by a sensing device incorporated in the air cleaner intake. The sensor allows inlet manifold vacuum to operate a flap valve in the air cleaner intake. The valve controls the entry of cold air at under bonnet temperature and hot air drawn from a duct on the exhaust manifold.

The duct on the exhaust manifold is gasket sealed to the manifold and has a water tight hose connection to the valve, together with a raised air intake to the duct, to permit the vehicle to wade in water.

In order to maintain full vacuum influence on the flap valve when the manifold depression is temporarily destroyed during sudden throttle openings, a one-way valve is fitted in the vacuum line from the inlet manifold to the temperature sensor.

## AIR INTAKE TEMPERATURE CONTROL VALVE

—Check operation 17.30.01

1. Check operation of the mixing flap valves in the air cleaners by starting the engine from cold and observing the flap valves as the engine temperature rises.
2. The valves should start to open slowly within a few minutes of starting and continue to open until a stabilized position is achieved. This position and the speed of operation will be entirely dependent on prevailing ambient conditions.
3. Failure to operate indicates failure of either or both flap valve vacuum capsules or failure of the thermostatically controlled vacuum switch or both.
4. Check by connecting a pipe directly to the flap valves, thus by-passing the temperature sensor.
5. If movement of either flap valve is evident the temperature sensor is faulty. If no movement is detected, the vacuum capsule is faulty.
6. Fit new parts where necessary.

## AIR INTAKE TEMPERATURE CONTROL VALVE

—Remove and refit 17.30.15

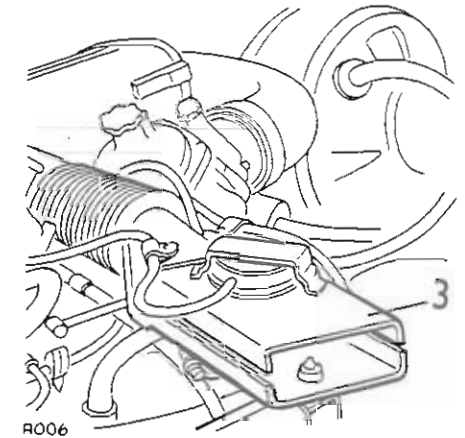
NOTE: Alternative valves may be fitted according to territory build specification.

## Removing

1. Disconnect the pipes and leads from the valve unit, noting their position for refitting.
2. Disconnect the hose to the air cleaner.
3. Disconnect the hot air box clamp (where fitted) and release the valve from the hot air box.
4. Release the valve from its support and lift it from the engine compartment.

## Refitting

5. Reverse instructions 1 to 4.



R006

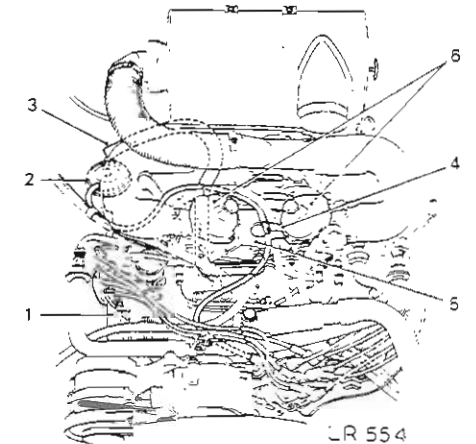
## EXHAUST GAS RECIRCULATION

—Description 17.45.00

To reduce the nitric oxide content in the exhaust, the peak combustion temperatures are lowered by recirculating a controlled quantity of the exhaust gases through the combustion process.

The E.G.R. valve is mounted on the right-hand exhaust manifold. A control signal, taken from a throttle edge tapping in the carburetter, gives no recirculation at idle or full load, but does allow an amount of recirculation, dependent on the vacuum signal and a metering profile of the valve, under part load conditions.

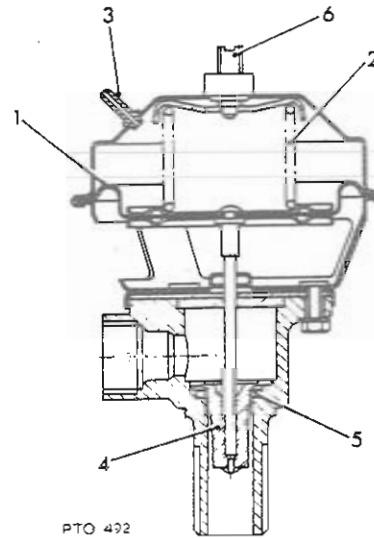
continued



LR 554

1. Exhaust manifold
2. E.G.R. valve
3. E.G.R. pipe (asbestos lagged)
4. Vacuum from carburetter
5. Inlet manifold
6. Carburetters

1. Diaphragm
2. Spring
3. To vacuum source
4. Metering pintle
5. Valve seat
6. Production adjustment—sealed after setting

**EXHAUST GAS RECIRCULATION VALVE**

—Remove and refit 17.45.01

**Removing**

1. Disconnect the vacuum pipe from the valve.
2. Disconnect the asbestos lagged pipe from the valve.
3. Unscrew the valve from the manifold.

**Refitting**

4. Reverse instructions 1 to 3, ensuring that the valve is securely sealed to the manifold.

**EXHAUST GAS RECIRCULATION VALVE**

—Check operation 17.45.20

1. Warm the engine to normal running temperature.
2. Ensure that the autochoke control is fully off.
3. Open and close the throttle several times (beware hot E.G.R. valve) and observe or feel the E.G. R. valve, which should:
  - a. open and close with changes in engine speed.
  - b. close instantly when the throttle is closed.

**FUEL SYSTEM****FUEL SYSTEM INTRODUCTION**

Some components in the Land Rover V8 fuel system are similar to those used on existing Land Rover models. For fuel tank operations, the instructions given in the Land Rover Repair Operation Manual for Series III Vehicles should be followed.

The Stromberg CDSE type carburettors are fitted with needles to suit the territories in which the vehicles are to operate. The fuel temperature compensating device and the butterfly poppet valve are omitted for some territories. Whilst the internal drillings and dimensions of this carburettor type vary according to territory requirements, the following repair operations cover all carburettors.

It is very important that only carburettors to the exact specification and part number for the territory concerned should be used as replacements. Failure to use the correct carburettor may lead to engine malfunction and significant changes to exhaust emission levels.

Two types of air cleaner may be fitted according to market specification, and these are detailed in the following operations.

Where emission or evaporative loss control equipment is fitted, reference should be made to Section 17 of this publication.

FAULT DIAGNOSIS

SYMPTOM	POSSIBLE CAUSE	CURE
DIFFICULT STARTING WHEN COLD	Insufficient choke action	Check action of cold start unit to ensure that the choke is being applied fully—adjust choke cable. Check position of cold start adjuster—move outward.
	Fast idle adjustment incorrect	Check and adjust fast idle setting. Check linkage between choke and throttle for distortion.
	Float chamber level too low	Check needle valve for sticking—(closed). Check float level setting. Check inlet connection filter for blockage. Check external fuel system in accordance with fuel system fault diagnosis.
	Carburettor flooding	Check needle valve for sticking—(open). Float punctured. Fuel pump pressure too high. Float level too high.
	No fuel supply to carburettor	Check filters and pump for blockage. Check fuel tank breather and fuel lines for blockage. Remove fuel pump and check operation. Overhaul or fit new pump.
DIFFICULT STARTING WHEN HOT	Choke sticking 'on'	Check to ensure choke is returning to fully 'off' position; reset as necessary.
	Blocked air cleaner	Fit new air cleaner elements.
	Float chamber level too high	Check float level setting. Check float arms for distortion. Check needle valve for sticking. Punctured float, fuel pump pressure too high.
LACK OF ENGINE POWER	No oil in damper or oil too thin	Check level of oil in damper, and fill to correct level with oil of a viscosity of S.A.E. 20.
	Piston sticking	Check piston assembly moves freely and returns under spring load — centre jet assembly. Check diaphragm for cracks or porosity.
	Water in fuel	If water is present in float chamber, the complete fuel system should be drained, fuel components should be dismantled, inspected for contamination, paying particular attention to filters.

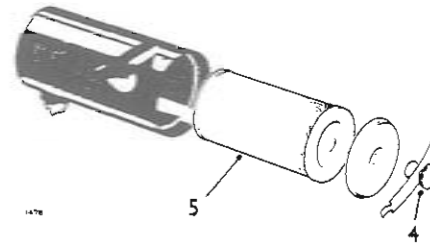
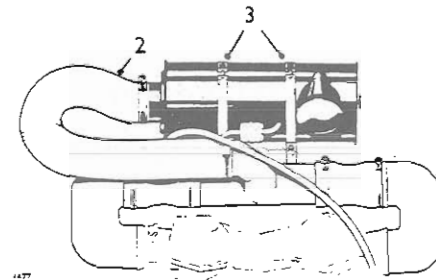
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SYMPTOM	POSSIBLE CAUSE	CURE
ERRATIC SLOW-RUNNING OR STALLING ON DECELERATION	Float level too low	Check float chamber level. Check for needle valve sticking.
	Incorrect jet setting	Check and reset jet settings in accordance with carburettor overhaul instructions.
	Carburettor air leaks	Check throttle spindle and bearings for wear.
	Manifold air leaks	Check inlet manifold gasket for leakage. Check inlet manifold for cracks and distortion of mating faces. Check gasket between carburettor and manifold. Check condition of vacuum advance pipe and connections. Check vacuum servo pipes and connections.
	Damper oil too thick. No oil in damper	Check and refill to correct level with oil specified.
EXCESSIVE FUEL CONSUMPTION	Blocked air cleaner	Fit new air cleaner elements.
	Damper oil too thick	Replace with correct grade.
	Incorrectly adjusted carburettor	Check and reset slow running in accordance with carburettor tune and adjust instructions.
	Float level too high	Check and reset float level.
	Worn jets and needle	Check and replace as necessary.
	Incorrect needle	Check needle type.
	Choke sticking 'on'	Check to ensure choke is returning to fully 'off' position; reset as necessary.
Engine fault	See Section 12.	

AIR CLEANER

- Remove and refit 1, 2, 3 and 6 19.10.01
- Renew elements 1 to 6 19.10.08

1. Disconnect engine breather filter.
2. Release air hose from air cleaner.
3. Release securing straps and lift air cleaner from engine compartment.
4. Release end clamp and remove the end plate from the air cleaner.
5. Withdraw the filter element from the air cleaner body.
6. Fit a new filter element and reverse instructions 1 to 4.



AIR CLEANER

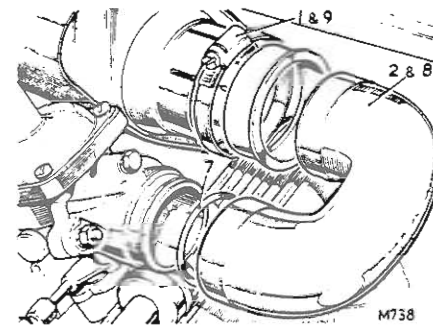
- Remove and refit 19.10.01

Removing

1. Release the hose clips each side of the air cleaner.
2. Withdraw the air cleaner elbows.
3. Detach the vacuum pipes and air intake temperature control hose.
4. Withdraw the air cleaner from the retaining posts, at the same time disconnecting the hose from the engine breather filter.

Refitting

5. Fit the air cleaner, locating the rubber mountings over the retaining posts.
6. Connect the engine breather hose at the underside of the air cleaner.
7. Smear the 'O' rings at the carburetter intakes with MS4 grease.
8. Fit the air cleaner elbows.
9. Secure the hose clips.
10. Refit the vacuum pipes and temperature control valve hose.



AIR CLEANER

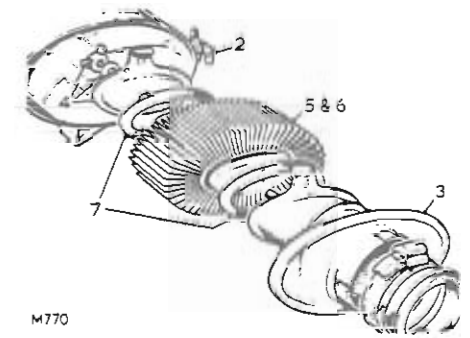
- Renew elements 19.10.08

Removing

1. Remove the air cleaner, see 19.10.01.
2. Release the end plate clips.
3. Withdraw the end plates.
4. Remove the wing nut, washer and retaining plate.
5. Withdraw the air cleaner elements.

Fitting

6. Fit new air cleaner elements.
7. Fit new sealing washers.
8. Reverse instructions 1 to 4.



CARBURETTERS

- Description 19.15.00

Variations in carburetters may be fitted to meet local territory legislation.

Tamperproofing

These carburetters may be externally identified by a tamperproof sealing tube fitted around the slow running adjustment screw.

The purpose of these carburetters is to more stringently control the air fuel mixture entering the engine combustion chambers and, in consequence, the exhaust gas emissions leaving the engine.

For this reason the only readily accessible external adjustment on these carburetters is to the throttle settings for fast idle speed and, on some later carburetters, this may require the use of a special tool to adjust the settings.

Emission Specifications

All carburetters fitted to the Land-Rover conform at the time of manufacture to particular territory requirements in respect of exhaust and evaporative emissions control. However, in some cases changes to the basic carburetters themselves have been necessary to achieve this, for example, the replacing of a manual choke with a temperature-actuated auto choke. Therefore some operations included in this section of the manual may not be applicable to all carburetters fitted to the model.

continued

## FUEL SYSTEM

**CAUTION:** Unauthorized breaking of tamperproofing devices, adjustment of carburetter settings or the fitting of incorrectly related parts may render the vehicle user liable to legal penalties according to local territory legislation. Whenever adjustments are made to the settings of tamperproof or emission-specification carburetters an approved type CO meter must be used to ensure that the final exhaust gas analysis meets with local territory requirements.

### CARBURETTERS

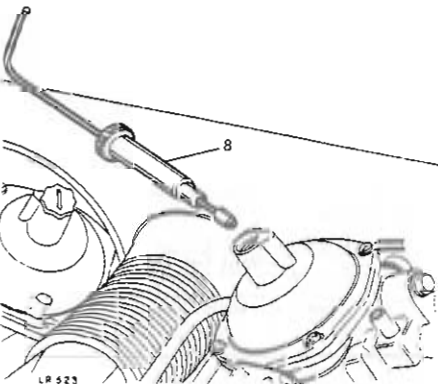
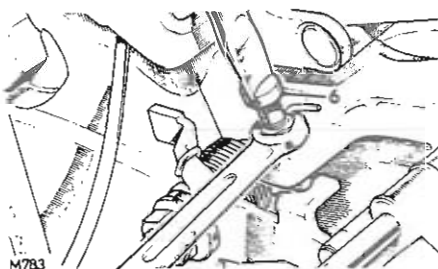
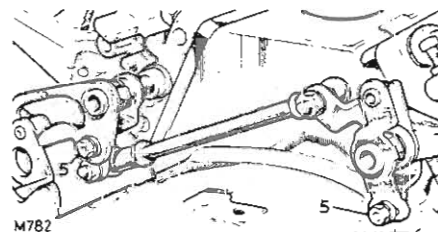
— Tune and adjust 19.15.02

Service tools: 605330 carburetter balancer, MS80 mixture adjusting tool (Zenith No. B25860).

The service tool 605330 carburetter balancer must be used to adjust the carburetters. Primarily, this instrument is for balancing the air-flow through the carburetters, but it also gives a good indication of the mixture setting. Investigation has shown that incorrect mixture setting causes either stalling of the engine or a considerable drop in engine rev/min if the balancer is fitted when the mixture is too rich or a considerable increase in rev/min when used with the mixture setting too weak. Before balancing the carburetters it is most important therefore that the following procedure be carried out:

1. Check that the throttle control between the pedal and the carburetters is free and has no tendency to stick.
2. Check the throttle cable setting with the throttle pedal in the released position. The throttle linkage must not have commenced movement, but commences with the minimum depression of the pedal.
3. Run the engine until it attains normal operating temperature; that is, thermostat open.
4. Remove the air cleaner, see 19.10.01.
5. Slacken the screws securing the throttle adjusting levers on both carburetters.
6. Start the engine and check the idle speed.
7. If necessary, adjust the throttle stop screws to give the correct idle speed, refer to Section 05. If a tamper-proof sleeve is fitted over this screw, the slow running speed can only be adjusted using special tool B25243 supplied to authorized service outlets.
8. Remove the piston damper plug, and using special tool MS80 adjust the mixture. Locate the outer sleeve of the tool to engage a machined slot to prevent the air valve twisting. Turn the inner tool clockwise to enrich the mixture and anti-clockwise to weaken it.

continued

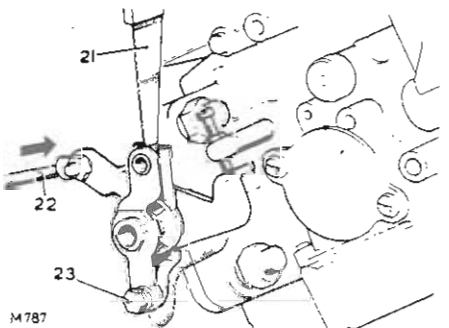
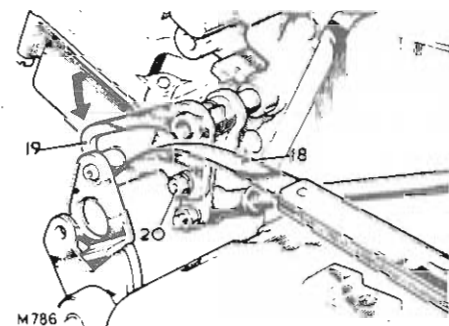
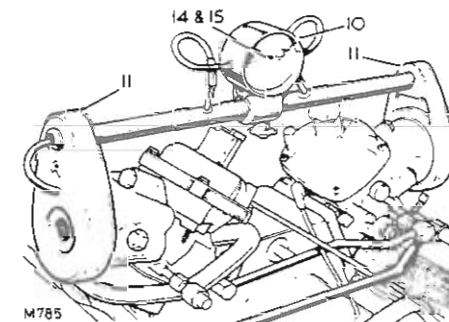


9. When the mixture is correctly adjusted, the engine speed will remain constant or may fall slowly a slight amount as the air valve is lifted.
10. Check, and if necessary, zero the gauge on tool 605330.
11. Place tool 605330 onto the carburetter adaptors, ensuring that there are no air leaks. If the engine stalls or decreases considerably in speed, the mixture is too rich. If the engine speed increases, the mixture is too weak.
12. If necessary, remove tool 605330 and readjust the mixture, then refit the tool.
13. Check tool 605330 gauge reading.
14. If the gauge pointer is in the 'zero' sector, no adjustment is required.
15. If the gauge pointer moves to the right, decrease the air-flow through the left-hand carburetter by unscrewing the throttle stop screw or increase the air-flow through the right-hand carburetter by screwing in the throttle stop screw. Reverse the procedure if the pointer moves to the left.
16. If the engine idle speed rises too high or drops too low during balancing, adjust to the correct idle speed, maintaining the gauge pointer in the 'zero' sector.
17. Remove tool 605330. With the mixture setting and carburetter balance correctly adjusted the difference in engine rev/min with the tool 605330 on or off will be negligible, approximately plus or minus 25 rev/min.

**NOTE:** Using a recognised type CO meter, the exhaust gas analysis reading should not exceed 4% carbon monoxide or any other levels fixed by local territory legislation.

18. On the left-hand carburetter, place a 0,15 mm (0.006 in) feeler between the underside of the roller on the countershaft lever and the throttle lever.
19. Apply pressure to the throttle lever to hold the feeler.
20. Tighten the screw to secure the throttle adjusting lever, then withdraw the feeler.
21. On the right hand carburetter, place a 0,15 mm (0.006 in) feeler between the left leg of the fork on the adjusting lever and the pin on the throttle lever.
22. Apply light pressure to the linkage to hold the feeler.
23. Tighten the screw to secure the throttle adjusting lever, then withdraw the feeler.
24. Refit the air cleaner, see 19.10.01.

continued



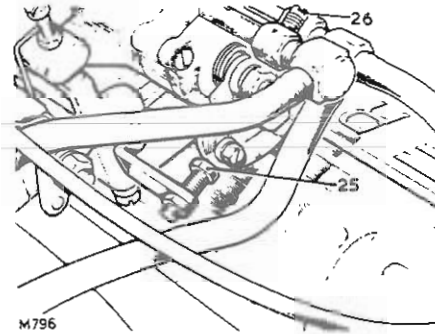
## FUEL SYSTEM

### Fast idle adjustment

The fast idle adjustment is pre-set on the left-hand carburetter and should not normally require adjustment. If adjustment is required, the correct procedure is to remove the left-hand carburetter and carry out items 82 to 87 detailed in 19.15.18. Alternatively, the fast idle can be approximately set as follows, but this alternative method is not recommended for ambient temperatures below  $-8^{\circ}\text{C}$  ( $10^{\circ}\text{F}$ ).

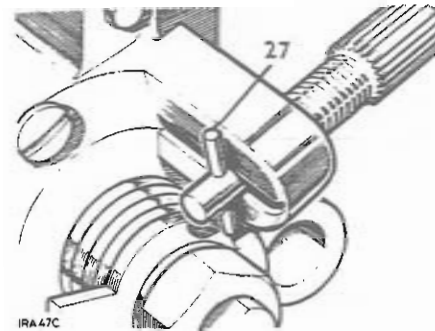
25. Set the fast idle adjustment screw against the cam to give an engine speed of 1000 to 1200 rev/min when the choke warning light just goes out.

**NOTE:** On some later carburetters a special tool, supplied to authorized service outlets, may be necessary to adjust the fast idle speed setting.



### Cold start unit

26. Set the cold start adjuster as necessary.
27. For starting at temperatures down to  $-18^{\circ}\text{C}$  ( $0^{\circ}\text{F}$ ) push and turn the spring-loaded choke adjustment screw so that the peg is at right angles to the slot as illustrated. Leave in this position. When starting at temperatures below  $-18^{\circ}\text{C}$  ( $0^{\circ}\text{F}$ ) turn the screw until peg is recessed in slot.



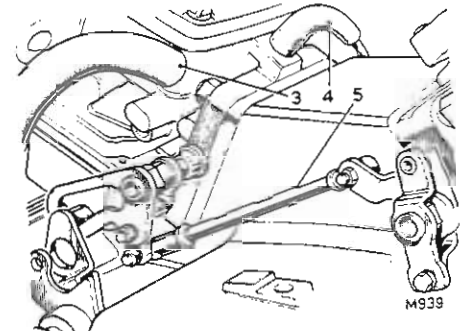
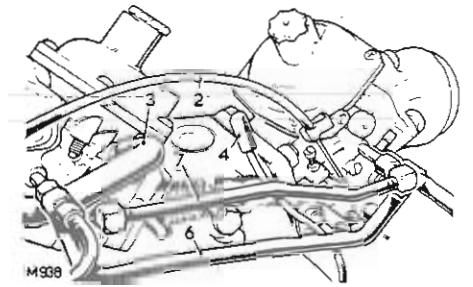
## CARBURETTERS

### — Remove and refit

19.15.1

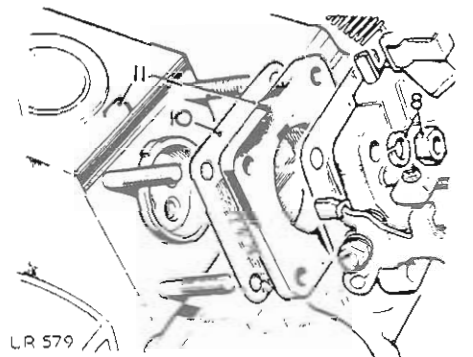
#### Removing

1. Remove the air cleaner, see 19.10.01.
2. Disconnect the choke cable.
3. Disconnect the emission control pipes.
4. Disconnect the distributor vacuum pipe.
5. Disconnect the throttle linkage.
6. Disconnect the main fuel supply pipe.
7. Disconnect the choke fuel supply pipe.
8. Remove the carburetters.
9. If required withdraw the joint washers, insulator and liner.



#### Refitting

10. Locate a joint washer on the inlet manifold.
11. Fit the insulator, aligning the arrows.
12. Locate a joint washer on the insulator.
13. Reverse instructions 1 to 8.
14. Fit the air cleaner, see 19.10.01.
15. Tune and adjust the carburetters, see 19.15.02.



CARBURETTERS

—Overhaul 19.15.18

1. Remove the carburetters, see 19.15.11.

Dismantling

Removing the piston assembly

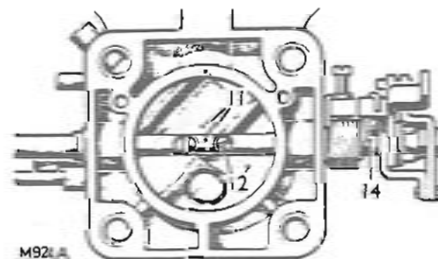
2. Remove the oil cap and damper.
3. Remove the top cover and spring.
4. Withdraw the air valve, shaft and diaphragm assembly.
5. Remove the metering needle, retained by a locking screw.
6. Remove the diaphragm from the air valve.

Removing the float chamber

7. The jet is a one-piece unit pressed into the carburetter body.
8. Remove the float chamber and gasket.
9. Unclip the float and arm complete with the spindle.
10. Remove the needle valve and washer from the carburetter body.

Dismantling the carburetter body

11. Add location marks to the throttle butterfly and spindle.
12. Remove the throttle butterfly, taking care not to damage the poppet valve.
13. Left-hand carburetter: Remove the throttle levers.
14. Withdraw the throttle spindle.
15. If required, remove the throttle stop and fast idle lever.
16. Remove the cold start assembly.
17. Dismantle the cold start assembly, but DO NOT remove the discs from the spindle.



Cleaning and inspection

Carburetter cleaning

18. When cleaning fuel passages do not use metal tools (files, scrapers, drills, etc.) which could cause dimensional changes in the drillings or jets. Cleaning should be effected using clean fuel and, where necessary, a moisture-free air blast.

Joint faces

19. Examine the faces for deep scores which would lead to leakage taking place when assembled.

Joint gasket and seals

20. New gaskets and seals should be used throughout carburetter rebuild. A complete set of gaskets is available for replacement purposes.
21. Inspect metering needle; it is machined to very close limits and should be handled with care. Examine for wear, bend and twist; renew if necessary.

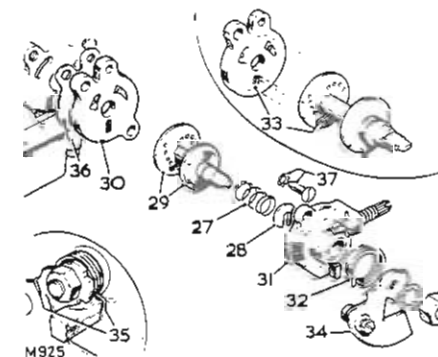
Diaphragm

22. In common with other products made from rubber compounds, any contact of the diaphragm with volatile cleaners should be avoided; use only CLEAN RAG. Examine for damage and deterioration.
23. Examine float for puncture or damage, chamber for corrosion, and retaining clips for wear.
24. Examine cold start bushes for wear; renew starter cover as necessary.
25. Examine clamping screw for two positions; renew as necessary.
26. Examine lifting pin for air valve for correct operation.

Reassembling

Assembling the cold start, L.H. carburetter

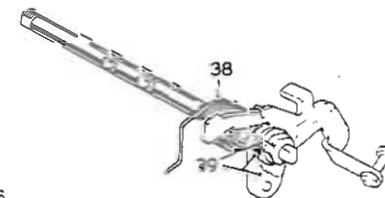
27. Place the spring on the cold start spindle.
28. Fit the spring retaining clip.
29. Check that the discs slide easily on the spindle.
30. Place the cold start spindle on the starter face.
31. Place the starter cover in position.
32. Fit the return spring over the spindle.
33. Rotate the spindle until the oval port in the end disc is aligned with the oval port in the starter face.
34. Fit the cold start lever.
35. Engage the return spring over the lug on the starter cover and the back of the cold start lever.
36. Place the cold start gasket onto the carburetter body.
37. Fit the cold start assembly to the carburetter body, then check for ease of operation.



Assembling the throttle spindles

Left-hand carburetter 38 and 39

38. Place the return spring over either end of the spindle.
39. Fit the throttle stop and fast idle lever.

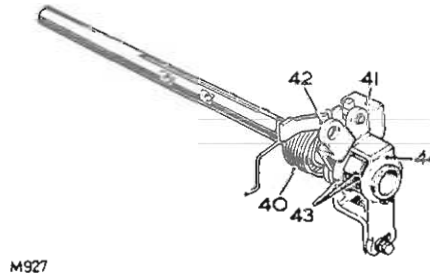


M926



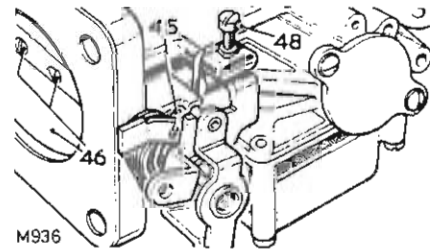
Right-hand carburetter 40 to 44

40. Place the return spring over the recessed end of the spindle
41. Fit the throttle stop and fast idle lever.
42. Fit the throttle lever.
43. Secure the assembly with a bushed washer, tab washer and nut. Engage the tab washer.
44. Fit the throttle adjusting lever.



M927

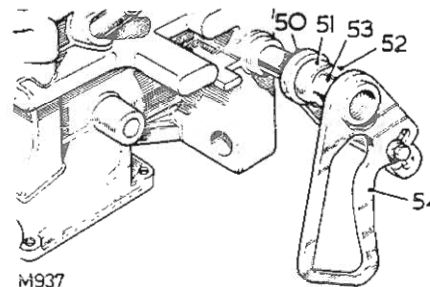
45. Insert the throttle spindle from the cold start side of the carburetter body (blank plate side on R.H. carburetter) fitting the throttle return spring on the fast idle adjustment holder, tension the spring half a turn.
46. Fit the throttle butterfly, maintaining the previously marked alignment. Leave the retaining screws loose.
47. Actuate the throttle several times to centralize the butterfly, then tighten the retaining screws and lock by peening ends.
48. Fit the throttle stop adjusting screw until it touches the stop, then turn a further one and a half turns and secure the locknut.



M936

Left-hand carburetters

49. Fit the fast idle adjustment screw and adjust to give slight clearance from the cold start lever, then secure the locknut.
50. Fit the throttle lever to the spindle.
51. Place the spacer on the spindle.
52. Place the tab washer on the spindle.
53. Fit the sleeve nut, sleeve end last, and engage the tab washer.
54. Fit the throttle adjusting lever.



M937

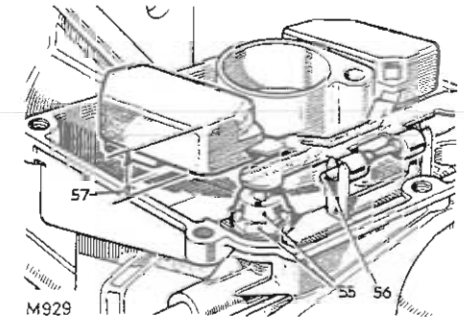
continued

Assembling the float chamber

55. Fit the needle valve and washer
56. Locate the spindle into the float arm and engage the assembly in the retaining clips.
57. With the needle valve on its seating and the tab on the float contacting the needle valve, measure the distance between the carburetter flange face and the highest point on the floats.
58. The dimension required for correct float level is 17 to 18 mm (0.67 to 0.71 in). Adjust by bending the tab on the float carrier or fitting an additional washer under the needle seating.

**NOTE:** The float carrier tab must be maintained at right angles to the needle in the closed position.

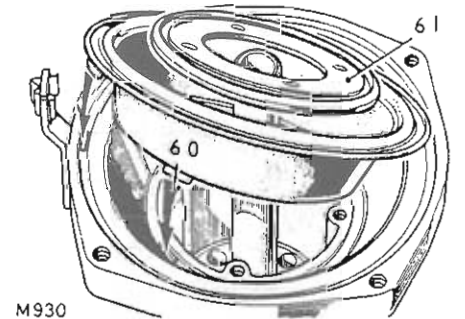
59. Fit the float chamber and gasket, but do not fully tighten the screws at this stage.



M929

Assembling air valve, shaft and diaphragm

60. Locate the diaphragm onto air valve with the tab engaged in the recess.
61. Fit the diaphragm retaining ring.
62. Locate the metering needle into the air valve.
63. Secure the needle in position and fit the damper.

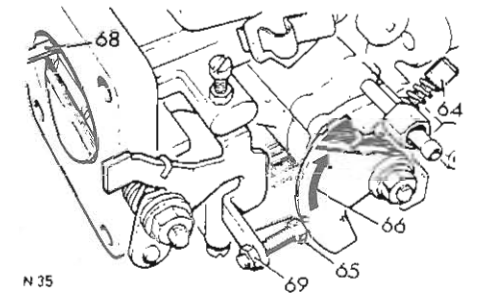


M930

Fast idle adjustment — as applicable

**NOTE:** On some later carburetters a special tool is required for this adjustment.

64. Set the cold start adjuster fully outward.
65. Slacken the fast idle adjusting screw.
66. Hold the cold start cam lever in the maximum position.
67. Adjust the fast idle adjusting screw against the cam lever until there is 0,61 to 0,66 mm (0.024 in to 0.026 in) gap between the top edge of the throttle butterfly and the carburetter barrel wall.
68. Use feeler gauges or a 0,65 mm diameter (No. 72) drill to measure the gap at the top edge of the throttle butterfly.
69. Secure the locknut on the fast idle adjusting screw without disturbing the adjustment.
70. Refit the carburetters, see 19.15.11.
71. Tune and adjust the carburetters, see 19.15.02.



N 35

For Data, refer to section 05.

FLOAT CHAMBER NEEDLE VALVE

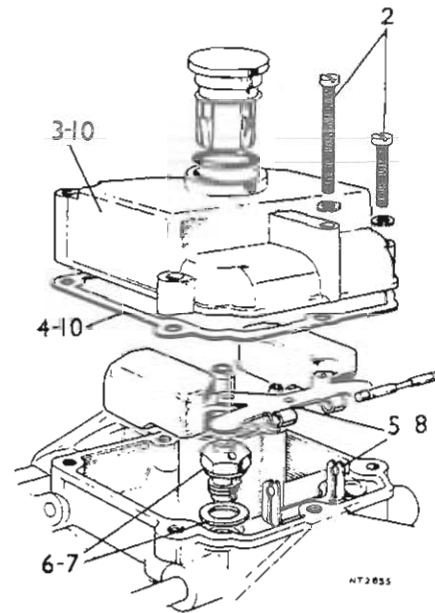
—Remove and refit 19.15.24

Removing

1. Remove the carburetters, see 19.15.11 or
2. Remove the six screws securing the float chamber to the body.
3. Remove the float chamber.
4. Remove the gasket.
5. Remove the float assembly by gently prising the spindle from the locating clips.
6. Remove the needle valve and washer.

Refitting

7. Fit the needle valve and renew the washer.
8. Fit the float assembly.
9. Check, and if necessary, adjust the height of both floats, see 19.15.32, instruction 6.
10. Renew the gasket and refit the float chamber.
11. Refit the carburetters, see 19.15.11.



FLOAT CHAMBER LEVELS

—Check and adjust 19.15.32

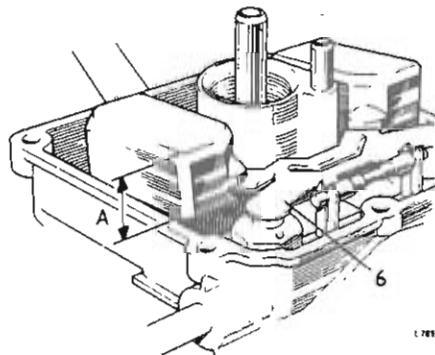
Checking

1. Remove the carburetters, see 19.15.11.
2. Remove the six screws securing the float chamber to the body.
3. Remove the float chamber.
4. Remove the gasket.
5. With the carburetter in the inverted position check the distance between the gasket face on the carburetter body to the highest point of each float 'A'.

NOTE: The height of both floats must be the same, i.e. 0.625 to 0.627 in (16 to 17 mm).

Adjusting

6. Bend the tab that contacts the needle valve but ensure that it sits at right angles to the valve to prevent the possibility of sticking.
7. Fit a new gasket and reverse instructions 1 to 3.



DIAPHRAGM

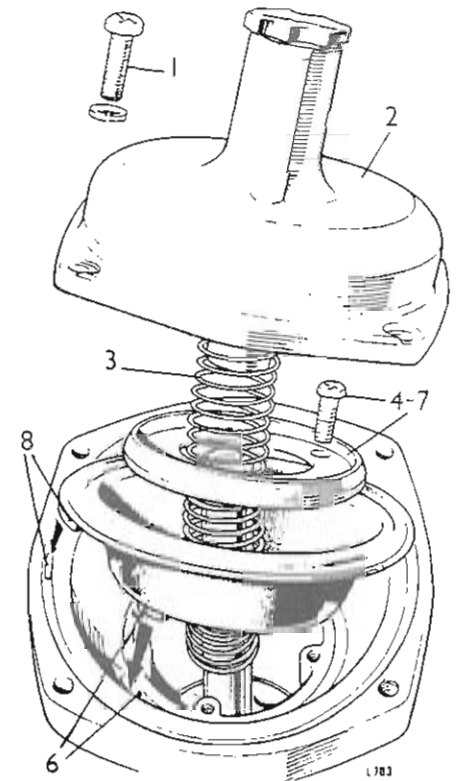
—Remove and refit 19.15.35

Removing

1. Remove the four screws securing the top cover to the carburetter body.
2. Lift off the top cover.
3. Remove the diaphragm spring.
4. Remove the diaphragm retaining plate.
5. Remove the diaphragm.

Refitting

6. Fit the diaphragm, locating the inner tag in the air valve recess.
7. Fit the retaining plate and ensure the correct diaphragm seating and tighten the screws.
8. Locate the diaphragm outer tag in the recess in the carburetter body.
9. Fit the top cover and evenly tighten the screw.
10. Check, and if necessary top-up the damper, see special instructions, Section 10.



THERMOSTAT SWITCH, CHOKE WARNING LIGHT

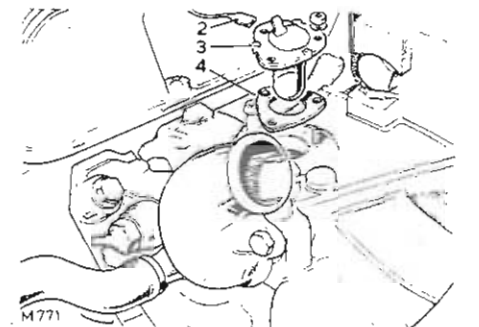
—Remove and refit 19.15.50

Removing

1. Disconnect the battery earth lead.
2. Disconnect the lead from the switch.
3. Remove the three bolts securing the switch to the thermostat housing.
4. Remove the thermostat switch and joint washer.

Refitting

5. Using a new joint washer, reverse instructions 1 to 4.



TEMPERATURE COMPENSATOR

—Remove and refit 19.15.59

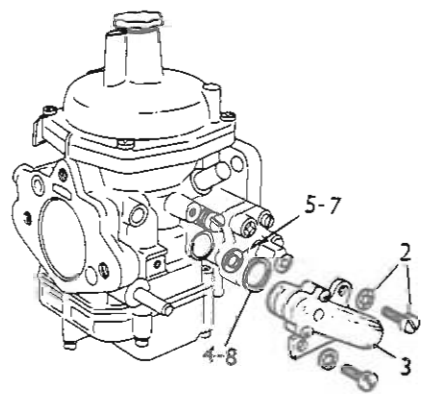
CAUTION: This component must only be renewed as a complete new unit.

Removing

1. Remove the air cleaner assembly, see 19.10.01.
2. Remove the two screws and shakeproof washers securing the temperature compensator to the carburetter.
3. Withdraw the compensator complete.
4. Remove and discard the outer rubber washer.
5. Remove the inner rubber washer from the carburetter body and discard.

Refitting

6. Clean the carburetter and temperature compensator mating faces.
7. Insert a new inner rubber washer into the bore in the carburetter body.
8. Fit a new outer rubber washer.
9. Fit the compensator to the carburetter and secure with the two screws and shakeproof washers.
10. Refit the air cleaner.



A19-65

DECELERATION AND BY-PASS VALVE (Where fitted)

—Remove and refit 19.15.64

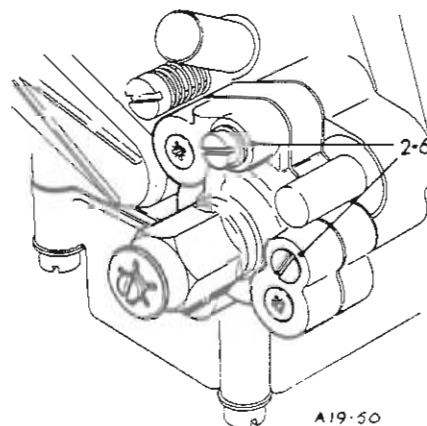
CAUTION: This component must only be renewed as a complete unit.

Removing

1. Remove the carburetters, see 19.15.11.
2. Remove the two cheese-headed screws and the single countersunk slotted screw (not cross-slotted) securing the by-pass valve assembly to the carburetter.
3. Withdraw the valve assembly complete.
4. Remove the gasket.

Refitting

5. Clean the carburetter and valve assembly mating faces.
6. Using a new gasket fit the assembly to the carburetter with the three screws and washers.
7. Refit the carburetters to the engine.



A19-50

THROTTLE CABLE

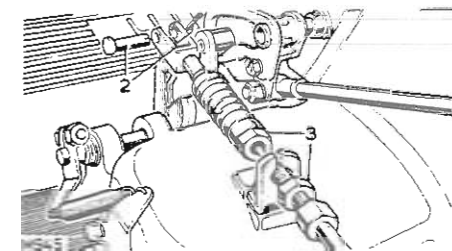
—Remove and refit 19.20.06

Removing

1. Remove the air cleaner, see 19.10.01.
2. Disconnect the cable from the carburetter.
3. Release the cable from the adjustment bracket.
4. Release the return spring.
5. Remove the clevis pin from the throttle pivot.
6. Release the cable from the bulkhead.
7. Withdraw the cable complete.

Refitting

8. Reverse instructions 2 to 7.
9. Adjust the cable with the throttle pivot in the released position. The throttle linkage must not have commenced movement, but commences with the minimum depression of the pedal.
10. Check the operation of the throttle mechanism. The pedal should touch the stop bolt without straining the cable and the carburetter must fully open and then close when the pedal is released.
11. Fit the air cleaner, see 19.10.01.



THROTTLE LINKAGE

—Remove and refit 19.20.07

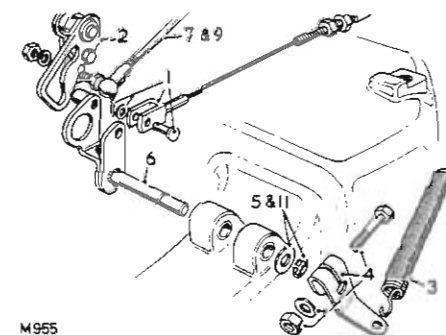
Removing

1. Disconnect the throttle cable.
  2. Remove the throttle adjusting lever.
  3. Disconnect the throttle return spring.
  4. Remove the return spring lever.
  5. Remove the circlip and plain washer from the countershaft.
  6. Withdraw the countershaft assembly.
  7. Remove the throttle link from between the carburetters.
- NOTE: For details of carburetter linkage 19.15.18 refers.

Refitting

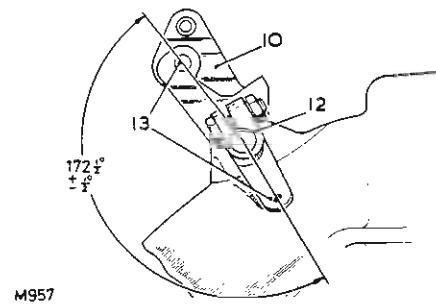
8. If the throttle link ball joints have been disturbed, they should be set at 122.55 mm (4.825 in) centres or 77.683 mm (3.0521 in) on later units.
9. Fit the throttle link.
10. Fit the countershaft assembly.
11. Secure the countershaft with a plain washer and circlip.

continued



M955

12. Fit the lever for the throttle return spring to abut the circlip.
13. Position the lever and countershaft assembly so that the holes for the throttle cable and return spring connection are at  $172\frac{1}{2}^{\circ} \pm \frac{1}{2}^{\circ}$ .
14. Reverse instructions 1 to 3.
15. Adjust the carburettor linkage, see 19.15.02.



M957

**FUEL MAIN FILTER**

— Remove and refit 19.25.02

**Removing**

1. Disconnect the fuel pipes.
2. Take precautions against fuel leaking from the tank.
3. Remove the two bolts, plain and spring washers securing filter to bulkhead.
4. Remove the filter complete.

**Refitting**

5. Reverse instructions 1, 3 and 4.

**FUEL MAIN FILTER ELEMENT**

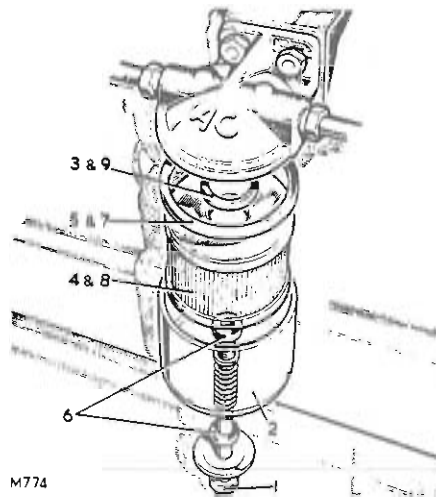
— Remove and refit 19.25.07

**Removing**

1. Unscrew the centre bolt.
2. Withdraw the filter bowl.
3. Remove the small sealing ring.
4. Remove the element.
5. Withdraw the large sealing ring from the underside of the filter body.

**Refitting**

6. Fit new centre sealing rings as necessary.
7. Fit new top sealing ring.
8. Fit new element, small hole downward.
9. Fit new small sealing ring.
10. Reverse instructions 1 and 2.



M774

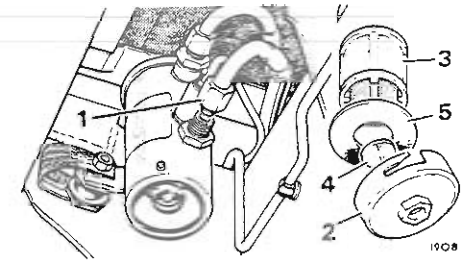
**FUEL PUMP FILTER**

— Remove, clean and refit 19.45.05

The electric fuel pump is located on the chassis right-hand side member-between-the-gearbox and rear axle.

To remove the filter for cleaning proceed as follows:

1. From beneath the vehicle disconnect the fuel inlet pipe from the pump and blank the end of the pipe by suitable means to prevent fuel draining from the tank.
2. Release the end cover from the bayonet fixing using a 0.625 in. AF spanner.
3. Withdraw the filter and clean by using a compressed air jet from the inside of the filter.
4. Remove the magnet from the end cover and clean. Replace the magnet in the centre of the end cover.
5. Reassemble the fuel pump and refit the fuel inlet pipe. Use a new gasket for the end cover if necessary.



1908

**FUEL PUMP**

— Remove and refit 19.45.08

**Removing**

1. Disconnect the fuel pump electric lead at the snap connector.
2. Disconnect the upper fuel pipe (outlet) from the pump.
3. Disconnect the lower pipe (inlet).
4. Cover the ends of the fuel pipes to prevent loss of fuel and ingress of dirt. Do NOT plug the pipe ends.
5. Remove the two nuts securing the pump and earth braid to the rubber mountings and remove the pump.

**Refitting**

6. Reverse instructions 1 to 5.

FUEL PUMP

—Overhaul

19.45.15

NOTE: The electrical components of the pump are sealed and cannot be repaired. Overhauling is therefore confined to the piston assembly.

Dismantling

1. Remove pump from the vehicle, see 19.45.08, and clean outside of pump before dismantling.
2. Release the end-cover from the bayonet fixing.
3. Withdraw the filter and rubber seal.
4. Carefully prise out the retaining clip.
5. The following parts will then be released:
  - a plain washer,
  - b rubber seal,
  - c one-way valve.
6. Withdraw the piston return spring with the piston. If the piston remains in the pump tube, hold the pump body vertically (in the fitted position) and tap the closed end until the piston is released from its magnetic hold and drops out.

NOTE: The piston is fitted with a one-way valve which should not be disturbed.

7. Remove the short rebound spring.
8. Clean all components in petrol.
9. Immerse pump body in petrol and use air-line inside pump tube.

Reassembling

10. Refit the rebound spring into the end of the piston.
11. Refit the return spring over the other end of the piston.
12. Slide the piston assembly into the pump tube.
13. Fit the one-way valve, rubber seal, and plain washer.
14. Retain the assembly with the spring clip.
15. Reverse instructions 2 and 3.

COOLING SYSTEM

FAULT DIAGNOSIS

SYMPTOM	POSSIBLE CAUSE	CURE
A—EXTERNAL LEAKAGE	<ol style="list-style-type: none"> <li>1. Loose hose clips</li> <li>2. Defective rubber hose</li> <li>3. Damaged radiator seams</li> <li>4. Excessive wear in the water pump</li> <li>5. Loose core plugs</li> <li>6. Damaged gaskets</li> <li>7. Leaks at the heater connections or plugs</li> <li>8. Leak at the water temperature gauge plug</li> </ol>	<ol style="list-style-type: none"> <li>1. Tighten</li> <li>2. Renew</li> <li>3. Rectify</li> <li>4. Renew</li> <li>5. Renew</li> <li>6. Renew</li> <li>7. Rectify</li> <li>8. Tighten</li> </ol>
B—INTERNAL LEAKAGE	<ol style="list-style-type: none"> <li>1. Defective cylinder head gasket</li> <li>2. Cracked cylinder wall</li> <li>3. Loose cylinder head bolts</li> </ol>	<ol style="list-style-type: none"> <li>1. Renew. Check engine oil for contamination and refill as necessary</li> <li>2. Renew cylinder block</li> <li>3. Tighten. Check engine for oil contamination and refill as necessary</li> </ol>
C—WATER LOSS	<ol style="list-style-type: none"> <li>1. Boiling</li> <li>2. Internal or external leakage</li> <li>3. Restricted radiator or inoperative thermostat</li> </ol>	<ol style="list-style-type: none"> <li>1. Ascertain the cause of engine overheating and correct as necessary</li> <li>2. See items A and B</li> <li>3. Flush radiator or renew the thermostat as necessary</li> </ol>
D—POOR CIRCULATION	<ol style="list-style-type: none"> <li>1. Restriction in system</li> <li>2. Insufficient coolant</li> <li>3. Inoperative water pump</li> <li>4. Loose fan belt</li> <li>5. Inoperative thermostat</li> </ol>	<ol style="list-style-type: none"> <li>1. Check hoses for crimps, reverse-flush the radiator, and clear the system of rust and sludge</li> <li>2. Replenish</li> <li>3. Renew</li> <li>4. Adjust</li> <li>5. Renew</li> </ol>
E—CORROSION	<ol style="list-style-type: none"> <li>1. Excessive impurity in the water</li> <li>2. Infrequent flushing and draining of system</li> <li>3. Incorrect anti-freeze mixtures</li> </ol>	<ol style="list-style-type: none"> <li>1. Use only soft, clean water together with correct anti-freeze or inhibitor mixture</li> <li>2. The cooling system should be drained and flushed thoroughly at least once a year</li> <li>3. Certain anti-freeze solutions have a corrosive effect on parts of the cooling system. Only recommended solutions should be used.</li> </ol>
F—OVERHEATING	<ol style="list-style-type: none"> <li>1. Poor circulation</li> <li>2. Dirty oil and sludge in engine</li> <li>3. Radiator fins choked with chaff, mud, etc.</li> <li>4. Incorrect ignition timing</li> <li>5. Insufficient coolant</li> <li>6. Low oil level</li> <li>7. Tight engine</li> <li>8. Choked or damaged exhaust pipe or silencer</li> <li>9. Dragging brakes</li> <li>10. Overloading vehicle</li> <li>11. Driving in heavy sand or mud</li> <li>12. Engine labouring on gradients</li> <li>13. Low gear work</li> <li>14. Excessive engine idling</li> <li>15. Inaccurate temperature gauge</li> <li>16. Defective thermostat</li> </ol>	<ol style="list-style-type: none"> <li>1. See item D</li> <li>2. Refill</li> <li>3. Use air pressure from the engine side of the radiator and clean out passages thoroughly</li> <li>4. See Group 86</li> <li>5. See item D</li> <li>6. Replenish</li> <li>7. New engines are very tight during the 'running-in' period and moderate speeds should be maintained for the first 1,000 miles (1,500 km)</li> <li>8. Rectify or renew</li> <li>9. See Group 70—adjust brakes</li> <li>10. In the hands of the operator</li> <li>11. In the hands of the operator</li> <li>12. In the hands of the operator</li> <li>13. In the hands of the operator</li> <li>14. In the hands of the operator</li> <li>15. Renew</li> <li>16. Renew</li> </ol>
G—OVERCOOLING	<ol style="list-style-type: none"> <li>1. Defective thermostat</li> <li>2. Inaccurate temperature gauge</li> </ol>	<ol style="list-style-type: none"> <li>1. Renew</li> <li>2. Renew</li> </ol>

COOLANT

— Drain and refill

26.10.01

Draining

**WARNING:** Do not remove the radiator filler cap when the engine is hot because the cooling system is pressurized and personal scalding could result.

1. Remove the radiator filler cap.
2. Remove the plug and drain the radiator. As the system is filled with a solution of anti-freeze or inhibitor, use a clean container if the coolant is to be re-used.
3. Refit the drain plug and washer.
4. Remove the drain plugs, one each side of the cylinder block. (located between the exhaust pipes and the cylinder block), and drain the engine.
5. Refit drain plugs and washers.

Coolant requirements

Frost precautions and engine protection

To prevent corrosion of the aluminium alloy engine parts it is imperative that the cooling system is filled with a solution of clean water and the correct type of anti-freeze, winter and summer, or water and inhibitor if frost precautions are not required. Never fill or top-up with water only, always add an inhibitor (Marstons SQ36) if anti-freeze is not used. NEVER use salt water with an inhibitor otherwise corrosion will occur. In certain territories where the only available water supply may have some salt content, use only clean rainwater or distilled water.

Recommended solutions are:

Anti-freeze — Unipart Universal Anti-freeze or permanent type ethylene glycol base with suitable inhibitor for aluminium engines.

Inhibitor — Marston Lubricants SQ36 Coolant inhibitor concentrate.

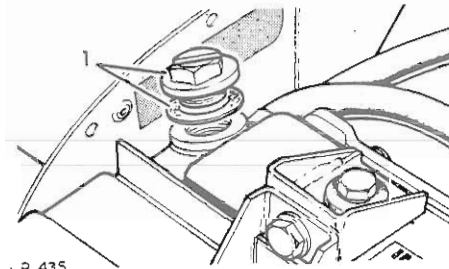
Use one part of anti-freeze to one part of water.

Use 50cc of inhibitor per litre of water.

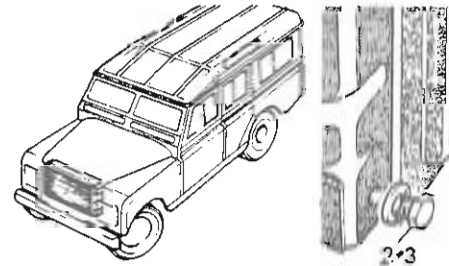
Anti-freeze can remain in the cooling system and will provide adequate protection for two years provided that the specific gravity of the coolant is checked before the onset of the second winter and topped-up with new anti-freeze as required.

All Land Rovers leaving the Rover factory have the cooling system filled with 50% of anti-freeze mixture. This gives protection against frost down to minus 47°C (minus 53°F). Vehicles so filled can be identified by the blue label affixed to the right-hand side of the windscreen and a blue label tied to the engine.

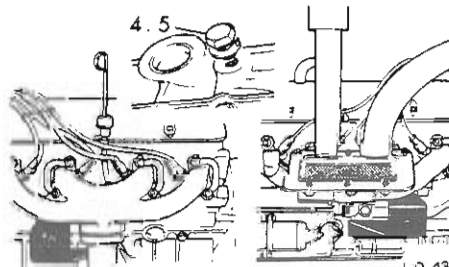
After the second winter the system should be drained and thoroughly flushed by using a hose inserted in the radiator filler orifice. Before adding new anti-freeze examine all joints and renew defective hoses to make sure that the system is leakproof. Inhibitor solution should be drained and flushed out and new inhibitor solution introduced every two years, or sooner where the purity of the water is questionable.



LR 435



LR 436



LR 437

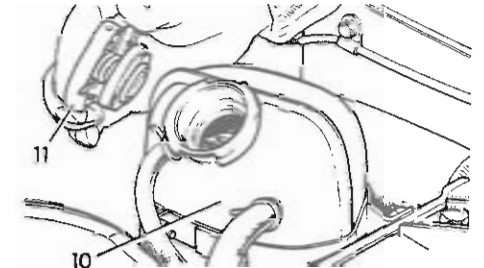
Use the correct anti-freeze mixture according to local climatic conditions, as follows:

Coolant system capacity	Frost precaution	Proportion of anti-freeze
9.66 litres	-36°C	50% 4.83 litres
17 Imperial pints	(-33°F)	8.5 Imperial pints
20.4 U.S. pints		10 U.S. pints

If frost precautions are not required, use 19cc of inhibitor per litre of water (3 fluid ounces of inhibitor per gallon of water).

Refilling

6. Pour 4½ litres (1 gallon) of water into the radiator.
7. Add the recommended quantity of anti-freeze or inhibitor.
8. Top-up radiator with water.
9. Fit the radiator filler plug and washer.
10. Add water to the expansion tank, up to half full.
11. Fit the expansion tank filler cap.
12. Run the engine until normal operating temperature is attained; that is, thermostat open.
13. Allow the engine to cool, then check the coolant level and top-up if necessary.



LR 438

EXPANSION TANK

— Remove and refit

26.15.01

Removing

**WARNING:** Do not remove the expansion tank filler cap when the engine is hot because the cooling system is pressurized and personal scalding could result.

1. Remove the expansion tank filler cap by first turning it anti-clockwise a quarter of a turn to allow pressure to escape, then turn it further in the same direction and lift off.
2. Disconnect the hose to the radiator.
3. Disconnect the overflow pipe.
4. Remove the pinch bolt.
5. Lift out the expansion tank.

Refitting

6. Reverse instructions 2 to 5.
7. Replenish the cooling system, see 26.10.01.

FAN BELT

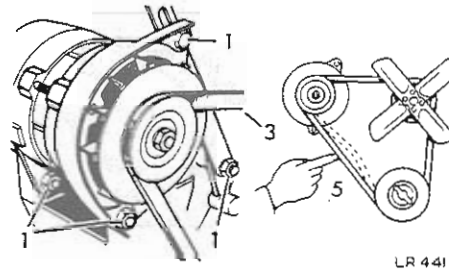
- Check and adjust tension 1 and 5 to 6 26.20.01
- Remove and refit 1 to 6 26.20.07

Removing

1. Slacken the alternator fixings.
2. Pivot the alternator inwards.
3. Lift off the fan belt.

Refitting

4. Locate the fan belt on the pulleys.
5. Using the alternator slotted fixing, adjust the fan belt tension to give 11 to 14 mm (0.437 to 0.562 in) free movement when checked midway between the alternator and crankshaft pulleys, by hand.
6. Secure the alternator fixings.



LR 441

FAN BLADES AND PULLEY

- Remove and refit 1 to 9 26.25.01

See Operation 26.25.06.

FAN BLADES

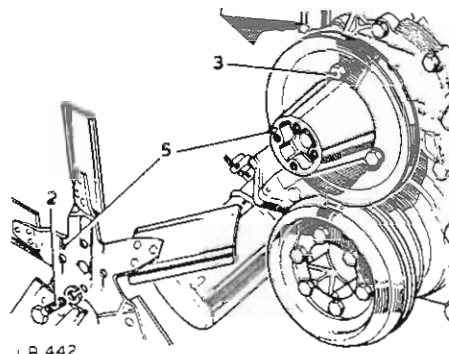
- Remove and refit 1, 2 and 10 26.25.06

Removing

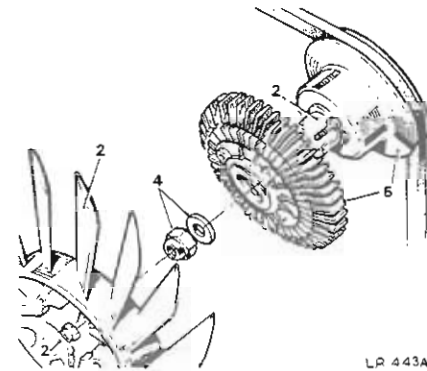
1. Release the fan cowl fixings and push the cowl towards the engine.
2. Remove the fan blades.
3. Standard type pulley: remove the pulley fixings.
4. Viscous coupling type pulley: remove the coupling fixings.
5. Slacken the alternator fixings, remove the fan belt and lift off the viscous coupling and/or the fan pulley.

Refitting

6. Reverse instructions 1 to 5, noting the following.
7. Standard type pulley: an offset dowel location ensures that the fixing bolt holes only align when the blades are the correct way round.
8. Viscous coupling type pulley: fit the fan blades with the larger diameter fixing bosses to the front.
9. Adjust the fan belt, see 26.20.01.
10. Reverse instructions 1 and 2.



LR 442



LR 443A

FAN COWL

- Remove and refit 26.25.11

Removing

1. Remove the fixings from the top of the fan cowl.
2. From inside the engine compartment remove the lower cowl fixings.
3. Remove the fan blades, see 26.25.06.
4. Lift out the fan cowl.

Refitting

5. Reverse instructions 1 to 4.

RADIATOR BLOCK

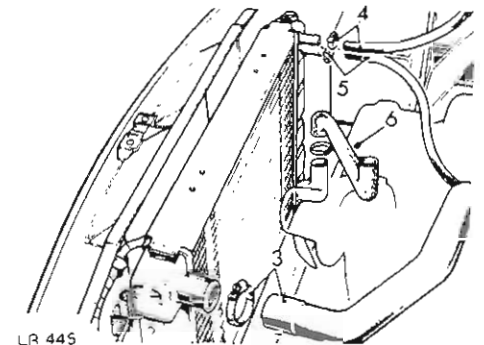
- Remove and refit 26.40.04

Removing

1. Drain the cooling system, see 26.10.01.
2. Release the fan cowl fixings and push the cowl towards the engine.
3. Disconnect the top hose from the radiator.
4. Disconnect the hose to the expansion tank.
5. Disconnect the hose to the induction manifold.
6. Disconnect the hose from the bottom of the radiator.
7. Remove the fixings from the top of the radiator.
8. Withdraw the radiator from the rubber-mounted spigots.

Refitting

10. Reverse instructions 1 to 8.



LR 445

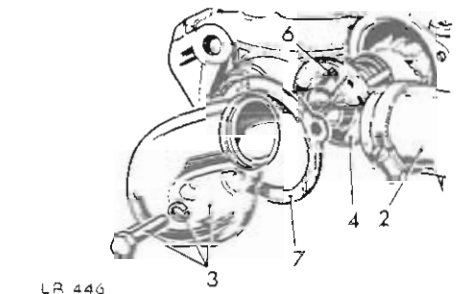
THERMOSTAT

- Remove and refit 26.45.01

Removing

1. Drain the cooling system, see 26.10.01, sufficient to drain the induction manifold.  
**NOTE:** If the engine is fitted with an air intake temperature control, release the air intake and move it to one side.
2. Disconnect the hose to the radiator.
3. Remove the outlet elbow and joint washer.
4. Withdraw the thermostat.

continued



LR 446

## COOLING SYSTEM

### Testing

- When immersed in hot water, the thermostat should commence opening between 78 to 83°C (173 to 182°F).

### Refitting

- Insert the thermostat with the jiggle pin uppermost (12 o'clock).
- Using a new joint washer, fit the outlet elbow. Reverse instructions 1 to 2.

## WATER PUMP

— Remove and refit

26.50.01

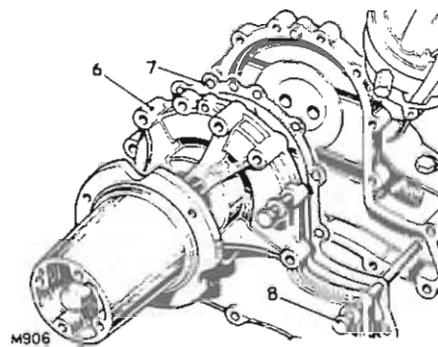
### Removing

**NOTE:** This operation applies to engines fitted with the basic or viscous-type fan pulley, but only the basic type is illustrated.

- Drain the engine cooling system, see 26.10.01.
- Remove the fan belt, see 26.20.07.
- Remove the fan blades and pulley, see 26.25.01.
- Release the alternator adjusting link from the water pump.
- Disconnect the inlet hose from the water pump.
- Remove the water pump.

### Refitting

- Lightly grease a new joint washer and place it in position on the timing cover.
- Clean the threads of the four long bolts and smear them with 3M-EC776 thread lubricant-sealant.
- Locate the water pump in position.
- Locate the alternator adjusting link on the water pump.
- Leave the alternator adjusting link loose and tighten the remaining water pump housing bolts gradually. Torque:  $\frac{1}{4}$  in A.F. bolts, 0,8 to 1,0 kgf m (6 to 8 lbf ft).  $\frac{1}{2}$  in A.F. bolts, 2,8 to 3,5 kgf m (20 to 25 lbf ft).
- Connect the inlet hose to the water pump.
- Fit the fan pulley.
- Fit and adjust the fan belt, see 26.20.07.
- Fit the fan blades, see 26.25.06.
- Refill the cooling system, see 26.10.01.



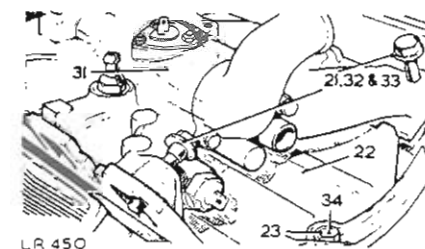
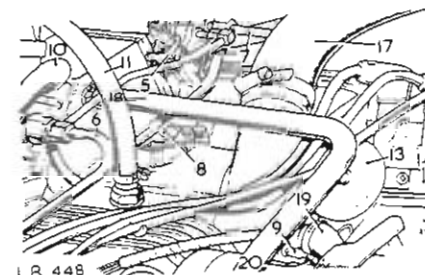
## INDUCTION MANIFOLD

— Remove and refit

30.15.02

### Removing

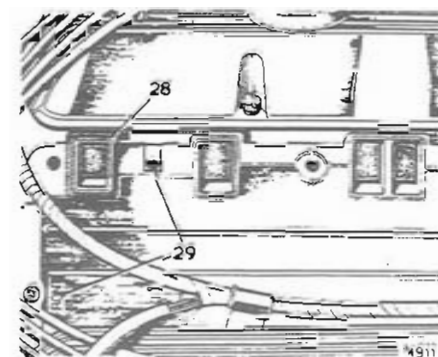
- Drain the cooling system, see 26.10.01.
- Remove the air cleaner, see 19.10.01.
- Remove the engine breather filter, see 17.10.02.
- Disconnect the throttle cable from the carburetter and manifold.
- Disconnect the choke cable from the carburetter.
- Disconnect the fuel spill return pipe from the R.H. carburetter.
- Remove the fuel supply pipe from the carburetters.
- Disconnect the lead from the choke thermostat switch and, where fitted, the E.G.R. valve connections.
- Disconnect the lead from the water temperature transmitter.
- Disconnect the flame trap hoses from the carburetters.
- Disconnect the vacuum pipe for the brake servo.
- Disconnect the vacuum pipe for the gearbox.
- Disconnect the vacuum pipe from the distributor.
- Release the distributor cap.
- Disconnect the inlet hose to the heater.
- Disconnect the return hose from the heater.
- Disconnect the return hose to the radiator.
- Disconnect the return hose from the top of the induction manifold.
- Disconnect the thermostat by-pass hose.
- Disconnect the heater return pipe from the manifold.
- Remove the induction manifold.
- Wipe away any coolant lying on the manifold gasket.
- Remove the gasket clamps.
- Lift off the gasket.
- Withdraw the gasket seals.



### Refitting

- Using new seals, smear them on both sides with silicon grease.
- Locate the seals in position with their ends engaged in the notches formed between the cylinder head and block.
- Apply 'Hylomar' sealing compound SQ32M on the corners of the cylinder head, manifold gasket and manifold, around the water passage joints.
- Fit the manifold gasket with the word 'FRONT' to the front and the open bolt hole at the front R.H. side.
- Fit the gasket clamps but do not fully tighten the bolts at this stage.

continued





31. Locate the manifold onto the cylinder head.
32. Clean the threads of the manifold securing bolts and then coat them with thread lubricant-sealant 3M EC776.
33. Fit all the manifold bolts and tighten them a little at a time, evenly, alternate sides working from the centre to each end. Torque: 3,5 to 4,0 kgf m (25 to 30 lbf ft).
34. Tighten the gasket clamp bolts. Torque: 1,4 to 2,0 kgf m (10 to 15 lbf ft).
35. Reverse instructions 1 to 20.
36. Where fitted, reconnect the E.G.R. valve.
37. Run the engine and check for water leaks.

EXHAUST MANIFOLD

—Remove and refit

Left-hand	30.15.10
Right-hand	30.15.11

Removing

1. Disconnect the front exhaust pipe from the manifold and (where fitted) remove the hot air box.
2. Tap back the bolt locking tabs and remove eight bolts with lock tabs and washers (later models).
3. Remove the manifold.

Refitting

4. Ensure that the mating surfaces of the cylinder head and exhaust manifold are clean and smooth.
5. Coat the exhaust manifold (cylinder head mating faces) with Foliac J 166 or Moly Paul anti-seize compound.  
Foliac J 166 is manufactured by Rocol Ltd., Rocol House, Swillington, Leeds, England.  
Moly Paul is manufactured by K. S. Paul Products Ltd., Nobel Road, London N18.
6. Place the manifold in position on the cylinder head and fit the securing bolts, lockplates and plain washers. The plain washers are fitted between the manifold and lockplates.
7. Tighten the manifold bolts evenly to 1,4 to 2,0 kgf m (10 to 15 lbf ft).
8. Bend over the lockplate tabs.

CLUTCH ASSEMBLY

—Remove and refit 33.10.01

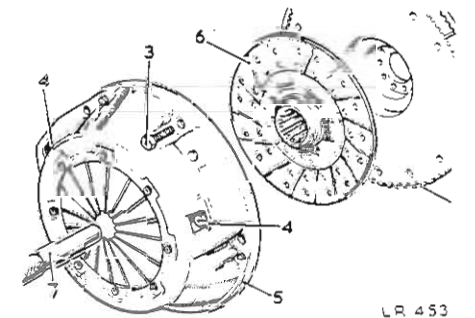
Service tool: 18G 79 Clutch centralizing tool

Removing

1. Remove the engine, see 12.41.01.
2. Mark the clutch cover fitted position relative to the flywheel.
3. Where clutch cover fixing bolt heads vary obviously in thickness, note their fitted positions for reference during refitting.
4. Do not disturb the three bolts located in the apertures in the clutch cover.
5. Remove the clutch assembly.
6. Withdraw the clutch driven plate.

Refitting

7. Reverse instructions 5 and 6, aligning the assembly marks, centralizing tool 18G 79.
8. Secure the cover fixings evenly, using diagonal selection. Torque load 4,9 to 5,0 kgf m (35 to 38 lbf ft).
9. Fit the engine, see 12.41.01.  
**NOTE:** As a precaution against the clutch plate sticking, lubricate the splines using Rocol MV 3 or Rocol MTS 1000 grease.



LR 453

CLUTCH ASSEMBLY

—Overhaul 33.10.08

Clutch assembly

The clutch assembly is of the diaphragm spring type and no overhaul procedures are applicable. Repair is by replacement only.

Clutch driven plate

Examine the clutch driven plate for wear and signs of oil contamination. Examine all rivets for pulling and distortion; rivets must be below the friction surface. If oil contamination is present on the friction linings or if they are appreciably worn, renew the clutch driven plate assembly complete or, alternatively, renew the friction linings following standard workshop practices.

DATA

Clutch driven plate diameter . . . . . 267,0 mm (10,5 in).

## HYDRAULIC SYSTEM

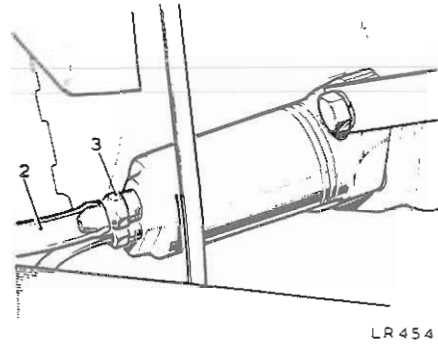
—Bleed

33.15.01

## Procedure

NOTE: During the following procedure, keep the fluid reservoir topped-up to avoid introducing air into the system. Use only the recommended hydraulic fluid, refer to Group 09.

1. Attach a length of suitable tubing to the slave cylinder bleed screw.
2. Place the free end of the tube in a glass jar containing clutch fluid.
3. Slacken the bleed screw.
4. Pump the clutch pedal, pausing at the end of each stroke, until the fluid issuing from the tubing is free of air with the tube free end below the surface of the fluid in the container.
5. Hold the tube free end immersed and tighten the bleed screw when commencing a pedal down stroke.



LR 45 4

## RELEASE BEARING ASSEMBLY

—Remove and refit

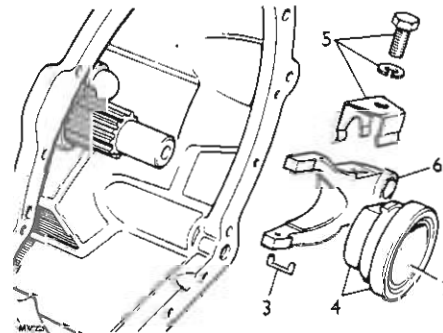
33.25.12

## Removing

1. Remove the engine, see 12.41.01.
2. Remove the clutch slave cylinder, see 33.35.01.
3. Withdraw the retainer staple.
4. Withdraw the bearing and sleeve. If required, press the bearing off the sleeve. Fit the replacement bearing with the domed face outwards from sleeve.
5. Remove the spring clip and fixings.
6. Withdraw the release lever assembly.

## Refitting

7. Reverse instructions 1 to 6. Lubricate the bearing sleeve inner diameter with a thin film of molybdenum disulphide base grease.



## SLAVE CYLINDER

—Remove and refit

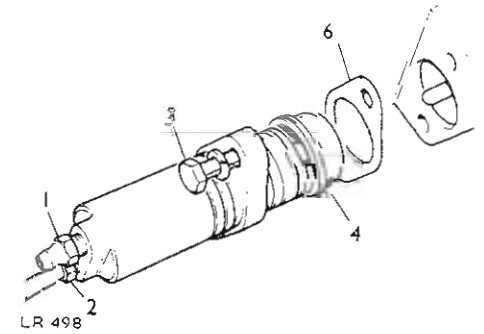
33.35.01

## Removing

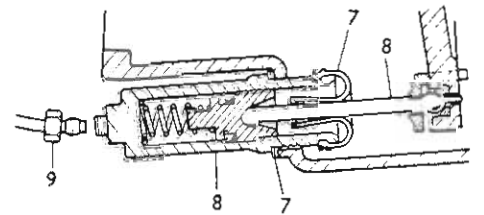
1. Evacuate the clutch system fluid at the slave cylinder bleed screw.
2. Disconnect the fluid pipe.
3. Remove the slave cylinder together with the backing plate.
4. If the dust cover is not withdrawn with the slave cylinder, withdraw it from the bell housing.

## Refitting

5. Withdraw the dust cover and backing plate from the slave cylinder.
6. Coat both sides of the backing plate with a waterproof jointing compound, such as Hylomar PL 32M.
7. Locate the backing plate and dust cover in position on the slave cylinder.
8. Fit the slave cylinder, engaging the push-rod through the centre of the dust cover and with the bleed screw uppermost. Tightening torque for securing bolts; 2,75 kgf m (20 lbf ft).
9. Re-connect the fluid pipe.
10. Replenish and bleed the clutch hydraulic system, see 33.15.01.
11. Check for fluid leaks with the pedal depressed and with the system at rest.



LR 498



LR 501

## SLAVE CYLINDER

—Overhaul

33.35.07

## Dismantling

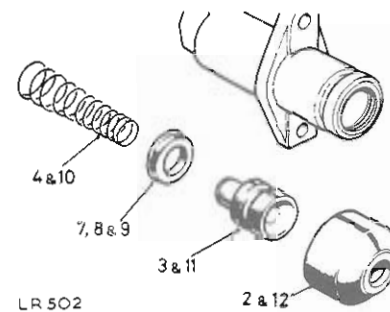
1. Remove the slave cylinder, 33.35.01.
2. Withdraw the dust cover.
3. Expel the piston assembly, applying low pressure air to the fluid inlet.
4. Withdraw the spring.

## Inspecting

5. Clean all components in clean clutch fluid and allow to dry.
6. Examine the cylinder bore and piston, ensure that they are smooth to the touch with no corrosion, score marks or ridges. If there is any doubt, fit new replacement.
7. The seal should be replaced with a new component.

## Reassembling

8. Smear the seal and internal items with clean clutch fluid.
9. Fit the seal, large diameter last, to the piston.
10. Locate the conical spring, small diameter first, over the front end of the piston.
11. Smear the piston with clean clutch fluid and insert the assembly, spring end first, into the cylinder.
12. Smear the inside of the dust cover with clean clutch fluid and fit the cover to the cylinder.
13. Refit the slave cylinder, see 33.35.01.



## GEARBOX

## FAULT DIAGNOSIS—MAIN GEARBOX

SYMPTOM	POSSIBLE CAUSE	CURE
Gearbox noisy in neutral	Insufficient oil in gearbox	Top-up as necessary
	Incorrect grade of oil	Drain and replenish
	Primary pinion bearing worn	Renew bearing
	Constant mesh gears worn	Renew primary pinion and layshaft
	Layshaft bearings worn	Renew bearings
Gearbox noisy in all gears except top	Layshaft, mainshaft or primary pinion bearings worn	Renew bearings
	Constant mesh gears worn	Renew primary pinion and layshaft
Gearbox noisy in one gear only	Worn or damaged gears or bearings	Renew gears and/or bearings
Gearbox noisy in all gears	Worn bearings on primary pinion, mainshaft or layshaft	Renew bearings
Oil leaks from gearbox	Gearbox over-filled with lubricating oil	Rectify oil level with vehicle standing on level floor
	Loose or damaged drain or level plugs	Tighten plugs. If damaged, fit new plugs and joint washer as required
	Obstructed breather	Clean breather
	Joint washers damaged, incorrectly fitted or missing	Fit new joint washer with general purpose grease smeared on both sides
	Oil seals damaged or incorrectly fitted	Fit new oil seal with Hylomar SQ 32M sealing compound smeared on the outside diameter
	Cracked or broken gearbox casings	Fit new casings
Difficulty in engaging forward gears	Weak springs or worn parts in synchromesh slide	Renew faulty parts
	Worn selector forks and/or interlock pins	Renew components as necessary
	Faulty clutch operation; clutch fluid leakage	Check clutch master and slave cylinders. Renew clutch components as necessary
Difficulty in engaging reverse gear	Reverse gear bearings worn or damaged	Renew bearings and shaft as necessary
	Faulty clutch operation; clutch fluid leakage	Check clutch master and slave cylinders. Renew clutch components as necessary
Difficulty in disengaging forward gears	Synchromesh cones worn; damaged gear dogs	Renew faulty parts
	Distorted or damaged springs	Renew components as necessary
Difficulty in disengaging reverse gear	Reverse gear seized on shaft	Renew parts as necessary
Gear lever going into reverse too easily and not into first	Weak reverse stop hinge plate spring	Renew the spring

FAULT DIAGNOSIS--TRANSFER GEARBOX

SYMPTOM	POSSIBLE CAUSE	CURE
Transfer of oil between main gearbox and transfer gearbox	Faulty 'O' ring seal on reverse idler shaft	Renew seal
	Faulty mainshaft oil seal	Renew seal
	Obstructed main gearbox breather	Clean breather
Oil leakage from gearbox to bell housing	Faulty joint washer(s) on gearbox front cover and oil pump	Renew joint washer(s)
	Faulty oil seal, primary pinion to front cover	Renew oil seal
	Damaged or porous gearbox front cover	Renew front cover
Transfer gearbox noisy	Insufficient oil in transfer box	Replenish
	Incorrect grade of lubricating oil	Drain and replenish with the correct grade oil. Refer to Recommended Lubricants, Group 09
	Excessive end-float on intermediate gears assembly	Adjust as required.
	Worn components in gearbox differential unit	Renew components
	Worn bearings in intermediate gears assembly	Renew bearings
Differential lock warning switch bulb fails to light up	Switch bulb failure	Renew bulb
	Air leakage in vacuum circuit	Renew leaking components
	Actuator housing not seated square on front output shaft housing	Slacken fixings, reseal housing, hold in position and tighten fixings

FRONT OUTPUT SHAFT AND HOUSING

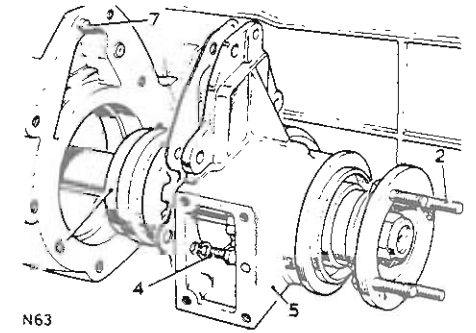
—Remove and refit 37.10.05

Removing

1. Remove the front floor, see 76.10.12.
2. Drain off the transfer gearbox oil. See 'MAINTENANCE', Group 10.
3. Disconnect the front propeller shaft at the gearbox, see 37.29.19.
4. Remove the six fixings.
5. Withdraw the output shaft and housing complete.
6. Lift out the lock-up dog clutch.

Refitting

7. Reverse instructions 1 to 6; note that the housing is dowel located.
- Refit the front floor, see 76.10.12.



FRONT OUTPUT SHAFT AND HOUSING

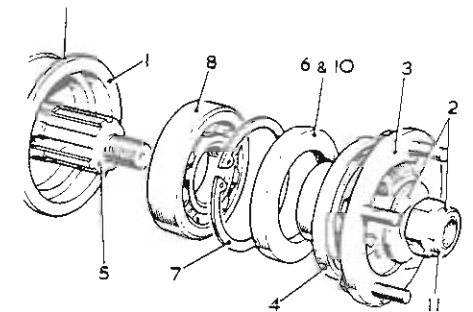
—Overhaul 37.10.06

Dismantling

1. Remove the front output shaft and housing, see 37.10.05.
2. Remove the locking nut and washer.
3. Withdraw the coupling flange complete with mudshield.
4. If required, press off the mudshield.
5. Press out the shaft toward the rear.
6. Withdraw the oil seal.
7. Remove the circlip.
8. Withdraw the output shaft bearing.

Reassembling

9. Reverse instructions 7 and 8.
10. Fit the oil seal, with the open side toward the bearing.
11. Reverse instructions 2 to 5. Torque loading for locking nut is 11.75 kgf m (85 lbf ft).
12. Refit the front output shaft and housing, see 37.10.05.



## BELL HOUSING

—Remove and refit

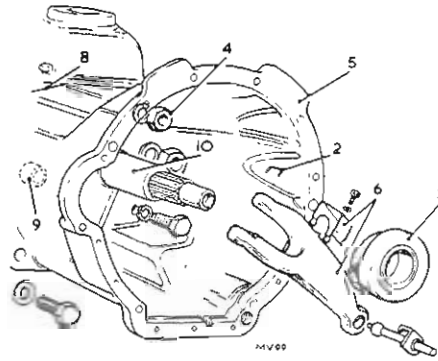
37.12.07

## Removing

1. Remove the gearbox, see 37.20.01
2. Withdraw the locating staple from the clutch release sleeve and release lever.
3. Lift out the release sleeve and bearing assembly.
4. Remove the bell housing fixings.
5. Withdraw the bell housing complete with clutch release lever.
6. If required, remove the push rod clip and the spring clip and withdraw the clutch release lever.

## Refitting

7. If removed, refit the clutch release lever and spring clip.
8. Apply a thin film of Hylomar PL 32M or other suitable jointing compound around the three selector shaft holes in the bell housing rear face.
9. Fit the bell housing, locating on the dowels.
10. Apply a thin film of molybdenum disulphide grease on to the front cover extension sleeve.
11. Reverse instructions 1 to 3.



## BEARING PLATE ASSEMBLY

—Remove and refit

37.12.22

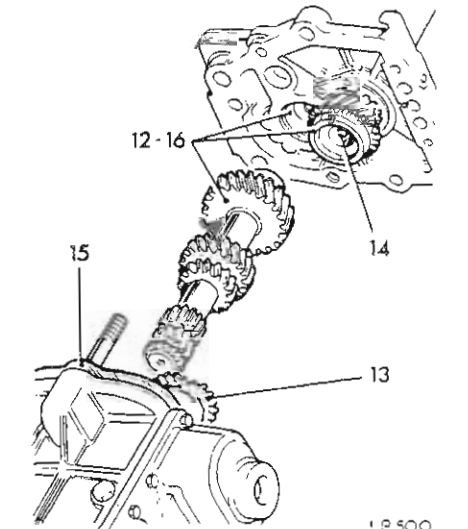
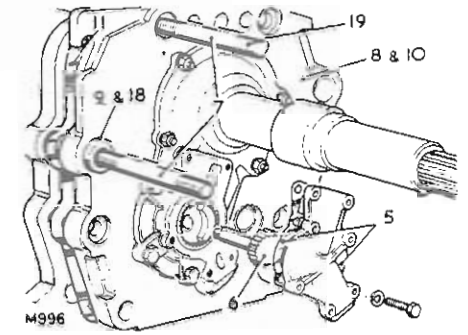
## Removing

1. Drain the gearbox oil.
2. Remove the gearbox, see 37.20.01.
3. Remove the bell housing, see 37.12.07.
4. Position the gearbox with the front end uppermost.
5. Remove the oil pump gears cover and joint washer.
6. Withdraw the oil pump drive gear.
7. Temporarily remove the four fixing studs from the gearbox front face.
8. Ease the bearing plate away from the gearbox.
9. Withdraw the two dowel sleeves which locate the bearing plate.
10. Withdraw the bearing plate assembly complete with primary pinion and layshaft.
11. Withdraw the joint washer.
12. Withdraw the layshaft.

## Refitting

NOTE: To replace a bearing plate, a bearing plate and gearbox casing mated assembly must be fitted.

13. Locate the cone into the third/fourth-speed synchromesh unit.
14. Lubricate the oil tube, using clean gearbox oil.
15. Position the joint washer.
16. Engage the layshaft with the primary pinion and front bearing outer member.
17. Fit the bearing plate and layshaft.
18. Align the bearing plate with the gearbox casing and slide home the dowel sleeves.
19. Refit the studs. Smear Loctite Studlock grade CVX, Rover Part No. 601 168, on the two upper stud securing threads before fitting.
20. Reverse instructions 1 to 6.



FRONT COVER AND OIL PUMP ASSEMBLY

—Remove and refit 37.12.34

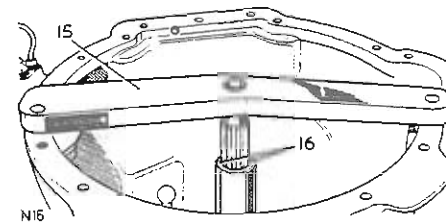
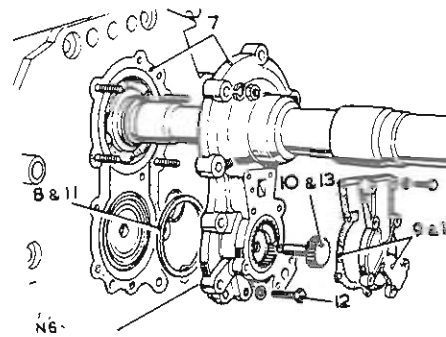
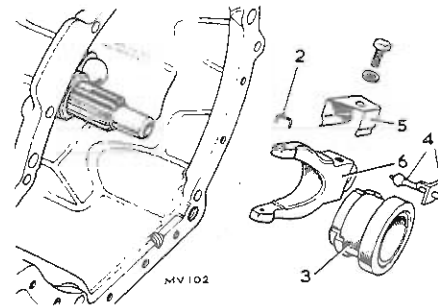
Service tools: RO 1005 centralizing tool for primary pinion

Removing

1. Remove the gearbox, see 37.20.01.
2. Lift out the retainer staple from the clutch release bearing assembly and the release lever.
3. Withdraw the release bearing assembly.
4. Remove the slave cylinder push-rod.
5. Remove the spring clip.
6. Withdraw the clutch release lever.
7. Remove the front cover assembly, complete with oil pump; and joint washer.
8. Remove the shim washer located between the front cover and the layshaft front bearing.

Refitting

9. Remove the oil pump cover.
10. Withdraw the oil pump drive gear.
11. Position the layshaft bearing shim washer.
12. Position the front cover assembly and loosely fit the fixings.
13. Fit the oil pump drive gear to engage the drive square in the layshaft.
14. Fit the oil pump cover and joint washer.
15. Fit the gauge RO 1005 to align the primary pinion with the bell housing.
16. Visually check that the front cover is concentric about the primary pinion. Adjust the front cover position about its fixings to suit.
17. When satisfactory, tighten the front cover fixings.
18. Reverse instructions 1 to 6.



FRONT COVER AND OIL PUMP ASSEMBLY

—Overhaul 37.12.37

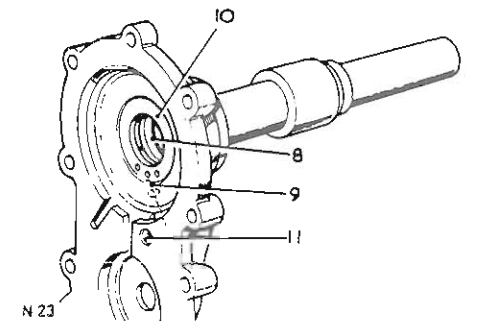
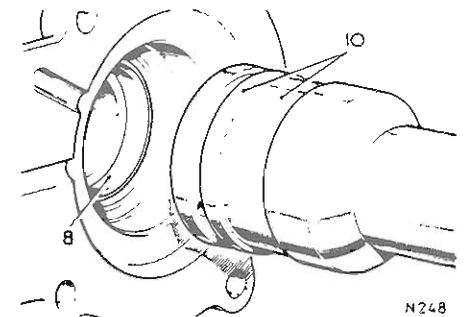
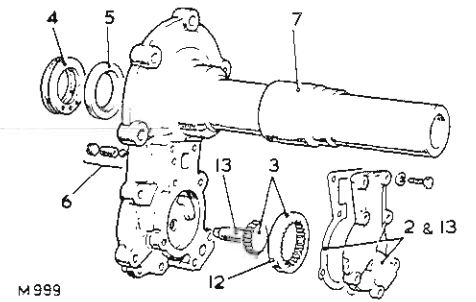
Service tools: 18G 134 guide and 18G 134 DG adaptor—assembly tool for fitting oil seal and oil feed ring

Dismantling

1. Remove the front cover and oil pump, see 37.12.34.
2. Remove the pump cover and gasket.
3. Withdraw the pump gears.
4. Remove the oil feed ring.
5. Withdraw the oil seal.
6. Remove the plug and withdraw the ball and spring from the relief valve housing.
7. If required, drift off the extension sleeve. Fit a replacement using Loctite 'AVV' grade, Rover Part No. 600303.

Reassembling

8. Press in the oil seal, plain face first, using 18G 134 guide and 18G 134 DG adaptor.
9. Align the centre hole of three in the oil feed ring with the oil delivery hole in the front cover.
10. Press in the oil feed ring, using 18G 134 guide and 18G 134 DG adaptor.
11. Fit the ball, spring and plug. When fitted, the plug must be flush with, or not more than, 0.25 mm (0.010 in) below the front cover rear face.
12. Fit the oil pump ring gear.
13. Fit the front cover and oil pump, see 37.12.34. During this operation the pump drive gear, cover and joint washer are fitted.



## GEAR-CHANGE SELECTORS, MAIN GEARBOX

—Remove and refit 37.16.31

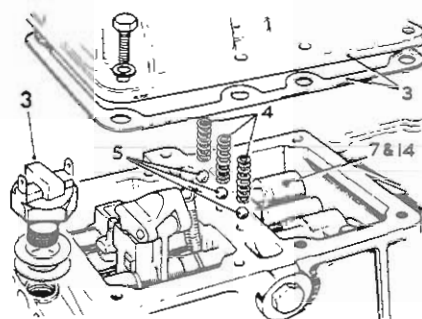
## Removing

1. Remove the gearbox, see 37.20.01.
2. Remove the bell housing, see 37.12.07.
3. Select neutral, remove the reverse light switch and remove the gearbox top cover and joint washer.
4. Lift out the detent springs.
5. Withdraw the detent balls, using a small magnet or an air blast.
6. Slacken the pinch bolt securing the reverse selector finger.
7. Drive out the four retaining pins until the shafts are free in the selectors.
8. Tap out the selector shafts.
9. Withdraw the selector jaws and forks.
10. Withdraw the two interlock plungers from the cross-drilling.
11. Remove the lock-wired pivot bolt.
12. Lift out the reverse cross-over lever.

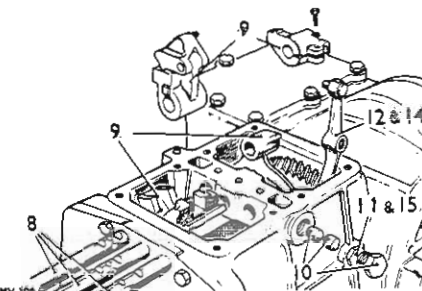
## Refitting

NOTE: During refitting, ensure that the retaining pins are an interference fit. Fit new pins as necessary.

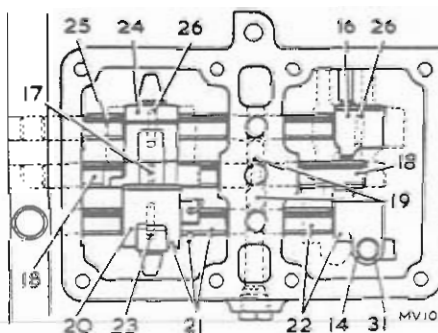
13. Withdraw the retaining pins from the selector jaws.
14. Position the reverse cross-over lever in the gearbox and locate the lever foot in the groove in the reverse idler gear.
15. Fit the pivot bolt and engage the cross-over lever tapping. Apply Loctite Studlock grade CVX, Rover Part No. 601168, to the bolt threads before screwing fully in. The Loctite must not enter the casing or run on the exposed bolt threads.
16. Locate the first/second gear selector fork in the groove in the outer member, with the boss on the fork to the rear. Position the boss to the R.H. side of the box.
17. Locate the third/fourth gear selector fork in the groove in the outer member. Position the fork with the retaining pin entry hole at the top R.H. side.
18. Fit the third/fourth gear selector shaft and interlock pin assembly and secure to the selector fork with a retaining pin.
19. Fit the two interlock pins to engage in the grooves each side of the third/fourth gear selector shaft.
20. Position the reverse stop hinge plate and selector jaw in the gearbox, adjacent to the third/fourth gear selector jaw.
21. Fit the reverse gear selector shaft and engage the selector jaw and hinge spring.
22. Push the shaft home and engage the reverse cross-over lever selector finger. Do not secure the pinch bolt at this stage.



LR 506



MV 104

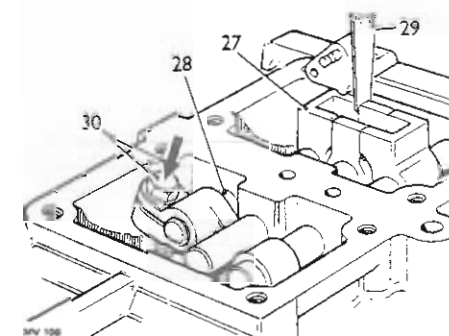


MV 105

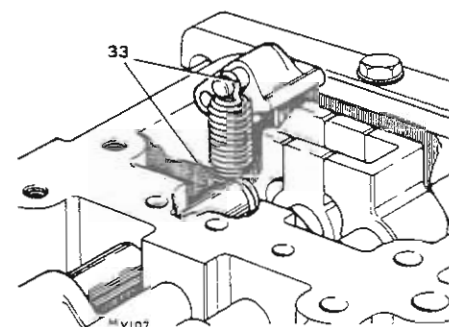
23. Secure the reverse gear selector jaw to the shaft with a retaining pin.
24. Position the first/second gear selector jaw in the gearbox.
25. Fit the first/second gear selector shaft; engage the selector jaw and selector fork as the shaft is pushed home.
26. Fit the retaining pins, fitting the rear pin first.
27. Move the reverse shaft forward until the selector jaw abuts the casing.
28. Holding the reverse shaft as described in the previous item, move the reverse selector finger forward on the shaft until it abuts the casing, then move it rearward until it is just clear of the casing.
29. Place a 0.25 mm (0.010 in) feeler gauge between the upper edges of the reverse and third/fourth selector jaws.

NOTE: The edges of the selector jaws taper slightly, therefore, it is important that the feeler gauge is positioned between the upper edges.

30. Hold the reverse and third/fourth selector jaws together to retain the feeler gauge, then rotate the reverse selector finger until it abuts the third/fourth selector shaft and tighten the pinch bolt.
31. Check the operation of the reverse gear selectors assembly. Ensure there is clearance between the cross-over lever and selector finger sufficient to prevent fouling during operation. If necessary, the 0.25 mm (0.010 in) clearance obtained in instruction 30 can be increased up to 0.5 mm (0.020 in) to produce a smooth gear-change.
32. Wire lock the cross-over lever pivot bolt.
33. When fitting the hinge spring to the reverse stop hinge, first engage the large hook around the selector shaft, as illustrated, before fitting the small hook to the reverse stop hinge pin.
- NOTE: A stronger spring, identified by a yellow paint mark, has been introduced to prevent the reverse selector detent ball sticking. The stronger spring can be fitted in place of the original on earlier gearboxes.
34. Reverse instructions 1 to 5.



MV 106



MV 107

## GEARBOX

### GEARBOX ASSEMBLY

—Remove and refit

37.20.01

The following procedure describes removing the gearbox from beneath the vehicle. The gearbox assembly is heavy and it is essential that a suitable cradle and lifting gear is used.

#### Removing

##### From inside the vehicle:

1. Disconnect the battery earth lead.
2. Remove the carpet and grommets to expose the gear-lever fixings, remove the fixing bolts and lift out the gear-lever.
3. Remove the centre panel from the seat base.
4. Ensure that the handbrake is off.

##### From under the bonnet:

5. Where necessary, remove the air cleaner to give access to the bell housing top fixings.
6. Disconnect the 'P' clip and release the gearbox breather pipes.
7. Remove all accessible bell housing bolts and displace the speedometer cable and clutch pipes on their respective brackets.

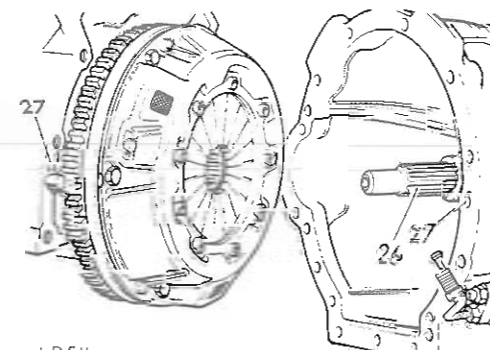
##### From beneath the vehicle (raised on a hydraulic lift):

8. If required, drain the lubricating oil from the main and transfer gearboxes.
9. Remove the four bolts and withdraw the detachable cross-member from the chassis.
10. Remove both front exhaust pipes and the branch pipe.
11. Disconnect the rear propeller shaft from the gearbox and displace to one side.
12. Disconnect the front propeller shaft from the gearbox and displace to one side.
13. Remove the clamp bolt and 'P' clip and disconnect the speedometer cable from the gearbox.
14. Disconnect the handbrake cable at the transmission brake clevis pin, 'P' clip and remove the bolts securing the adjuster bracket to the gearbox.
15. Remove the clamp bolt and disconnect the transfer gear-lever linkage.
16. Remove the two bolts and displace the clutch slave cylinder clear of the gearbox.
17. Remove the cover-plate from the front of the bell housing.
18. Place a suitable cradle and hydraulic lift under the gearbox.
19. Remove the three bolts securing each gearbox mounting to the chassis.
20. Disconnect the electrical leads from the gearbox differential actuator.

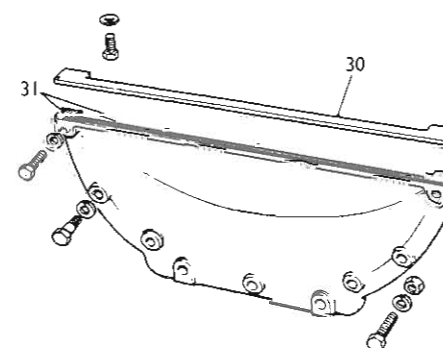
21. Disconnect the vacuum pipes from the gearbox differential actuator.
22. Check and release any remaining pipes, cables, wires.
23. Remove all remaining bell housing bolts.
24. Support the engine sump on a jack or stand.
25. Push the gearbox rearward to disengage it from the engine, then lower the gearbox and move it clear.

#### Refitting

26. Smear the splines of the primary pinion, the clutch centre and the withdrawal unit abutment faces with molybdenum disulphide grease, such as Rocol MTS 1000. Smear the engine to gearbox joint flanges with Unipart Universal jointing compound.
27. Mount the gearbox on a suitable cradle and lift and raise the gearbox into position, locating the primary pinion into the clutch and engage the bell housing dowels.
28. Secure the bell housing to the engine. Torque: 3,5 kgf m (25 lbf ft).
29. Reverse instructions 18 to 24.
30. If necessary, fit a new seal to the bell housing cover plate, using a cement such as Holdite 88.
31. Apply Unipart Universal jointing compound to the cover plate and seal, for the joints between the bell housing, cylinder block and rear main bearing cap.
32. Secure the cover plate to the engine and bell housing. Torque: 1,0 kgf m (8 lbf ft).
33. Reverse instructions 1 to 16.
34. Check the oil level in the main and transfer gearboxes and replenish as necessary.



LR 511



MV 97

continued



REVERSE IDLER GEAR AND SHAFT

—Remove and refit 37.20.13

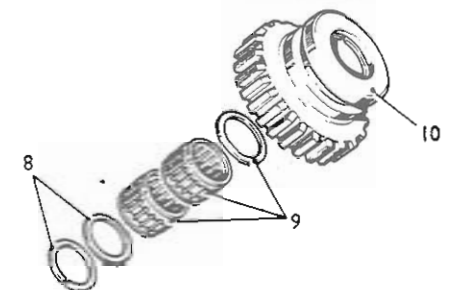
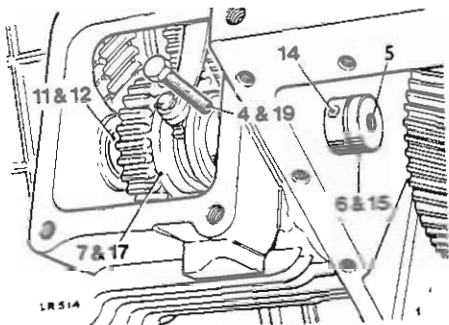
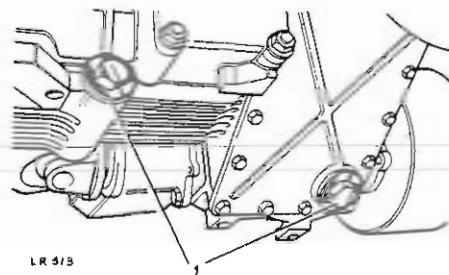
Service tool: 18G 1335 extractor for reverse shaft

Removing

1. Drain the main and transfer gearbox oils.
2. Remove the gearbox side cover.
3. Remove the gearbox bottom cover.
4. Remove the bolt securing the idler gear shaft in the gearbox casing.
5. Withdraw the idler gear shaft, utilizing extractor 18G 1335.
6. Remove the 'O' ring seal.
7. Lift out the reverse idler gear assembly.
8. Remove the circlip and plain washer.
9. Lift out the needle roller bearings and further plain washer.
10. Withdraw the remaining circlip.
11. If required, withdraw the shaft support bush.

Refitting

12. If removed, fit the shaft support bush, using Locquic primer grade 'T' and 'AVV' grade.
13. Reverse instructions 6 to 11.
14. Offer the idler shaft to the gearbox and align the retaining bolt holes.
15. Smear clean gearbox oil onto the 'O' ring seal.
16. Position the reverse idler assembly in the casing.
17. Engage the selector foot in the idler gear groove.
18. Drive in the idler gear shaft until the retaining bolt holes are aligned.
19. Before fitting the retaining bolt, treat the threads with Locquic primer grade 'T' and allow to dry. Then, fit the bolt using Loctite Studlock grade.
20. Reverse instructions 1 to 3.



MV 110

PRIMARY PINION

—Removing and refit 37.20.16

Removing

1. Drain the gearbox.
2. Remove the gearbox, see 37.20.01.
3. Remove the bell housing, see 37.12.07.
4. Remove the front cover and oil pump assembly, see 37.12.34.
5. Remove the bearing plate assembly, 37.12.22.
6. Remove the circlip.
7. Lift off the shim washer.
8. Press out the primary pinion.
9. Withdraw the bearing retaining plates and serrated bolts.
10. Press out the primary pinion bearing.

Refitting

11. Check that the orifice drilled in the oil tube is clear. During refitting, take care to avoid damage to the oil tube. Rotate the shaft in the bearing to ensure that the oil tube is straight.
12. Support the bearing plate using suitable wooden blocks. Position the blocks across the bearing housing aperture to act as assembly stops.
13. Press in the bearing until flush with the bearing plate.
14. Press in the primary pinion. Check that the bearing remains flush with the bearing plate.
15. Fit the retaining plates and serrated bolts.
16. Fit the shim washer and circlip.
17. Measure the clearance between the circlip and the shim washer. There must be a clearance of 0,05 mm (0.002 in) maximum.
18. If required, adjust the clearance by fitting a replacement shim washer. Shim range is 2,0 to 2,15 mm (0.079 to 0.085 in) in 0.05 mm (0.002 in) stages.
19. Reverse instructions 1 to 5.

DATA

End-float, primary pinion to bearing . . . . . 0,05 mm  
(0.002 in) maximum

LAYSHAFT

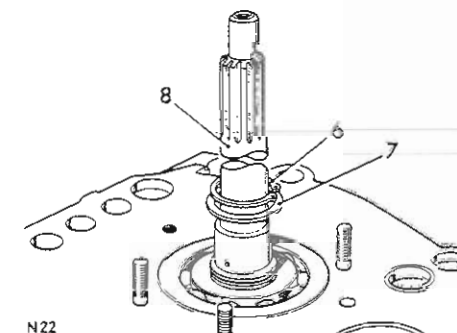
—Remove and refit 37.20.19

Removing

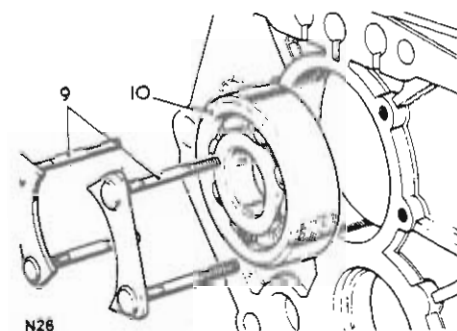
1. Remove the bearing plate assembly, see 37.12.22.
2. Withdraw the layshaft.

Refitting

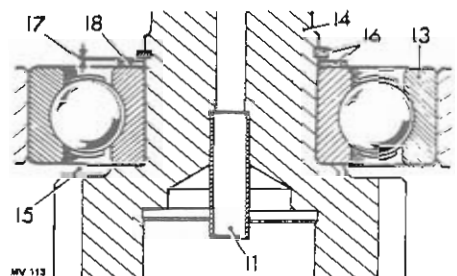
3. Reverse instructions 1 and 2.



N22



N26



MV 113

## GEARBOX

### LAYSHAFT BEARINGS

— Remove and refit

37.20.22

Service tools: RO 1004 extractor for mainshaft spacer; 18G 284 extractor and 18G 284 AR adaptor, extractor, layshaft rear bearing outer member; 18G 47 press and 18G 47 BA collars, extractor for layshaft bearing inner members

#### Removing

1. Drain the gearbox.
2. Remove the gearbox, 37.20.01.
3. Remove the bell housing, see 37.12.07.
4. Remove the front cover and oil pump assembly, see 37.12.34.
5. Remove the main gears selectors, see 37.16.31.
6. Remove the front bearing plate assembly, see 37.12.22.
7. Remove the mainshaft assembly, see 37.20.25.
8. Press out the layshaft front bearing outer member from the front bearing plate.
9. Extract the layshaft rear bearing outer member from the gearbox casing, extractor 18G 284 and adaptor 18G 284 AR.
10. Withdraw the bearing inner members from the layshaft. Extractor 18G 47 press and 18G 47 BA collars.

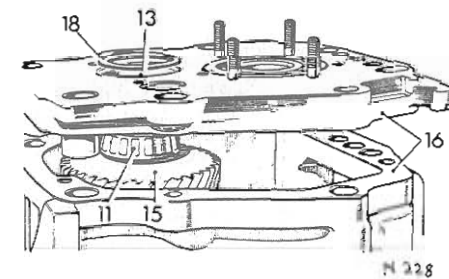
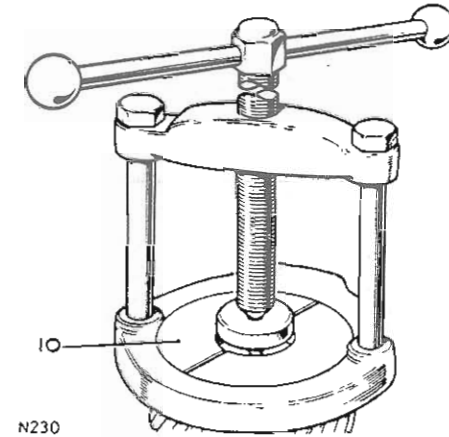
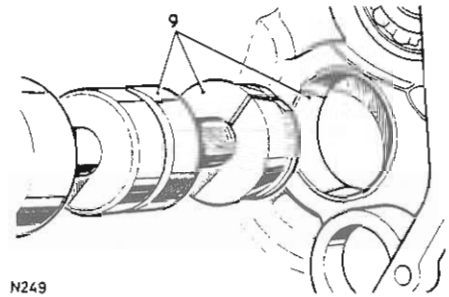
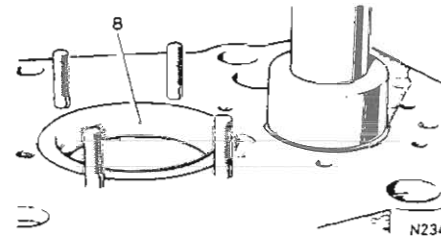
#### Checking the bearing pre-load

Replacement bearings inner and outer members are supplied as matched pairs and not as separate items.

The replacement bearings must not be degreased. Before fitting, lubricate with correct grade gearbox oil. Refer to Group 09.

11. Press the bearing inner members onto the layshaft.
12. Press the rear bearing outer member into the gearbox casing.
13. Enter the front bearing outer member into the front bearing plate. Do not fit fully in at this stage.
14. Remove the primary pinion from the bearing plate, see 37.20.16.
15. Position the layshaft in the gearbox casing.
16. Temporarily fit the front bearing plate and joint washer.
17. Press in the front bearing outer member until there is no end-float on the layshaft and no end-load on the bearings.
18. On the bearing outer member position a shim washer of a thickness suitable to stand 0,25 mm (0.010 in) approximately proud of the front bearing plate. This shim thickness may be subsequently adjusted depending on the amount of bearing pre-load it affords.

continued



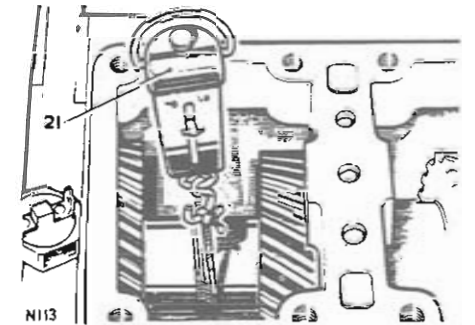
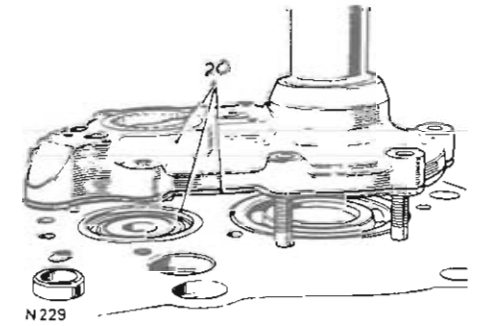
19. Temporarily remove the oil pump top cover and withdraw the pump drive gear.
20. Temporarily fit the front cover and new joint washer to the bearing plate. Ensure that the shim washer remains in position.
21. Measure the rolling resistance of the layshaft, using a spring balance and a cord coiled around the layshaft larger diameter.
22. The rolling resistance must be 7 to 10 kgf (6 to 8.5 lbf).
23. To adjust the pre-load, fit a replacement shim of suitable thickness to the front bearing outer member. Shim range is from 1,55 mm (0.059 in) to 2,50 mm (0.098 in) in 0,05 mm (0.002 in) increments.
24. When the pre-load is satisfactory, remove the front cover assembly.
25. Remove the front bearing plate.
26. Fit the primary pinion, see 37.20.16.
27. Fit the oil pump cover and drive gear.

#### Refitting

28. Reverse 1 to 6.

#### DATA

Layshaft rolling resistance . . . . . 7 to 10 kgf (6 to 8.5 lbf)



MAINSHAFT ASSEMBLY

—Remove and refit 37.20.25

Service tool: RO 1004, extractor for mainshaft spacer

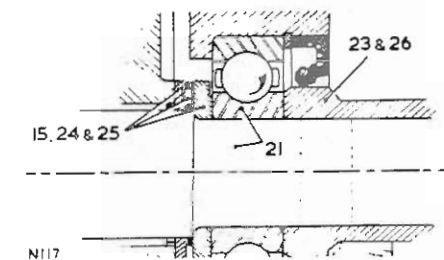
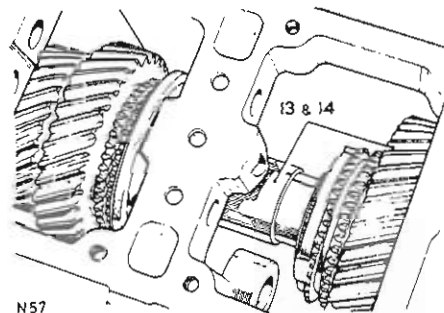
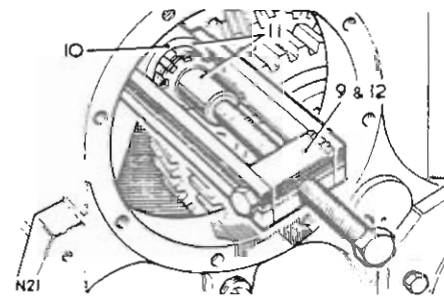
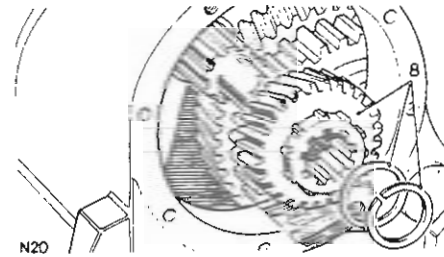
Removing

1. Drain the gearbox.
2. Remove the gearbox, see 37.20.01.
3. Remove the bell housing, see 37.12.07.
4. Remove the front bearing plate, see 37.12.22.
5. Remove the main gearchange selectors, see 37.16.31.
6. Remove the mainshaft rear bearing housing and roller bearing.
7. Remove the bottom cover from the transfer gearbox.
8. Remove the snap-ring, shim washer and mainshaft transfer gear.
9. Fit extractor RO 1004 to transfer gear spacer.
10. Withdraw the spacer along the mainshaft until the larger diameter on the spacer reaches the transfer gear lever cross-shaft.
11. Alternately tap the mainshaft forward and withdraw the spacer.
12. When the spacer is free on the mainshaft remove the extractor.
13. Withdraw the mainshaft assembly, allowing the first-speed gear to remain behind to avoid fouling on the casing.
14. Lift out the first-speed gear.
15. Refit the first-speed gear, scalloped thrust washer, thrust needle bearing and stepped thrust washer, stepped face outwards.
16. Withdraw the mainshaft spacer.

Refitting

17. Position the gearbox with the R.H. side downwards to aid refitting.
18. Remove the gearbox side cover.
19. Temporarily move the first-speed gear toward the rear of the shaft.
20. Offer the assembled mainshaft to the gearbox and manoeuvre the first-speed gear past the reverse idler gear.
21. Engage the shaft into the main bearing.
22. Engage the first/second gear synchromesh outer member and the reverse idler gear.
23. Push the mainshaft home sufficient to allow the mainshaft spacer to be located on the rear end, with the spacer larger diameter forward of the transfer gear lever cross-shaft.
24. Re-position the first-speed gear, thrust washers and thrust needle bearing correctly on the mainshaft.
25. Push the mainshaft fully home, ensuring that the thrust washers and needle bearing remain correctly located against the first-speed gear.

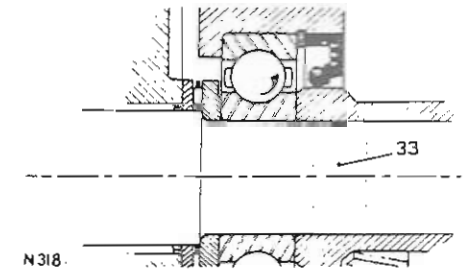
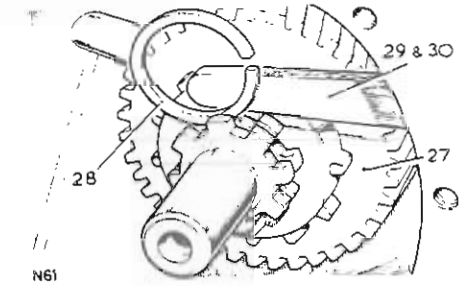
continued



26. Move the mainshaft spacer along the shaft, and into the oil seal, to abut the main bearing.
27. Temporarily fit the mainshaft transfer gear.
28. Position the snap-ring in the groove in the mainshaft.
29. Hold the mainshaft fully to the rear and measure the clearance between the snap-ring and the transfer gear.
30. Select a shim washer to allow 0,050 mm (0.002 in) max. clearance between the snap-ring and transfer gear when fitted. Shim range 1,8 to 2,0 mm (0.071 to 0,079 in) in 0,05 mm (0.002 in) increments.
31. Temporarily remove the snap-ring and the mainshaft transfer gear.
32. Slide back the mainshaft spacer as far as the transfer gear lever cross-shaft will allow.
33. Apply a thin coating of Loctite AVV grade, Rover Part No. 600303, to the exposed area of the mainshaft.
34. Push home the mainshaft spacer.
35. Fit the mainshaft transfer gear.
36. Fit the previously selected shim washer and secure with the snap-ring.
37. Reverse instructions 1 to 7.

DATA

Transfer gear end-float . . . . . 0,05 mm (0.002 in) max.



MAINSHAFT TRANSFER GEAR

—Remove and refit 37.20.28

Removing

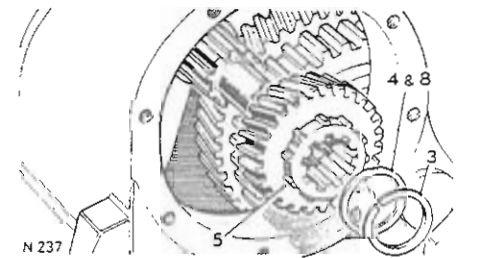
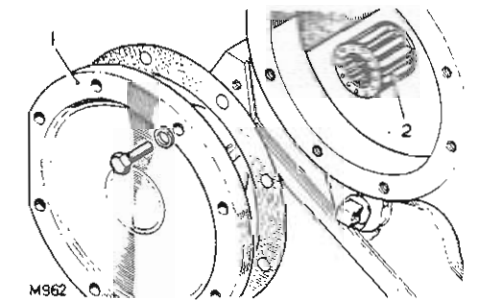
1. Remove the mainshaft rear bearing housing.
2. Lift out the roller bearing.
3. Remove the snap-ring.
4. Withdraw the shim washer.
5. Lift out the transfer gear.

Refitting

6. Fit the transfer gear to the mainshaft.
7. Fit the shim washer and snap-ring.
8. Check the end-float between the shim washer and snap-ring. End-float to be 0,050 mm (0.002 in) max. Shim washer range 1,8 to 2,0 mm (0.071 to 0.079 in) in 0,05 mm (0.002 in) stages.
9. Fit the roller bearing and rear bearing housing.

DATA

Transfer gear end-float . . . . . 0,05 mm (0.002 in) max.



MAINSHAFT ASSEMBLY

—Overhaul 37.20.31

1. Remove the mainshaft assembly, see 37.20.25.

Dismantling

2. Withdraw the first-speed gear, thrust washers and roller bearings from the rear of the shaft.
3. Remove the snap-ring and shim washer from the front of the shaft.
4. Lift off the third/fourth gears synchromesh assembly.
5. Withdraw the third and second-speed gears and the associated thrust washers and needle-roller bearings.
6. Dismantle the third/fourth gears synchromesh assembly, first pushing down the sliding blocks to free the synchromesh balls from the retaining groove in the outer member.
7. Dismantle the first/second gears synchromesh assembly in a similar manner, particularly noting their position for refitting.
8. Withdraw the oil seal from the bore in the mainshaft front end.

Assembling

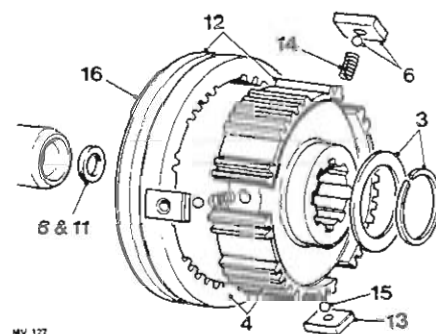
9. Replacement thrust washers and roller bearings must not be degreased.
10. Lubricate all items before assembly, using clean main gearbox oil. Group 09 refers.
11. Fit the oil seal to the mainshaft front end.

Assembling the synchromesh units

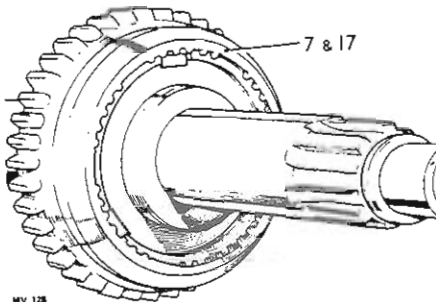
12. Fit together the third/fourth gear synchromesh outer and inner members, outer member coned face toward inner member plain face.
13. Fit the sliding blocks, radiused face outward.
14. Locate the springs through the sliding blocks into the housing bores in the inner member.
15. Position the balls on the spring ends; press home in sequence and retain by hand.
16. Lift the outer member to retain the balls. Continue lifting until the balls spring home into the annular groove in the outer member.
17. Assemble the first/second gear synchromesh unit in the manner described for third/fourth gear unit. Fit the outer member coned face toward the front end of the mainshaft.

Assembling the mainshaft front end

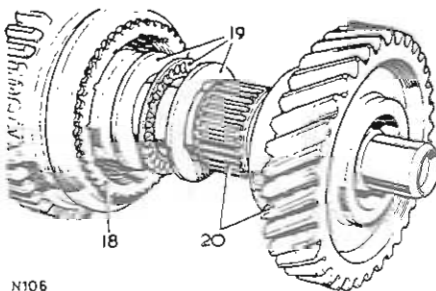
18. Fit a synchromesh cone to the first/second gear synchromesh outer member.
19. Position a chamfered thrust washer, a thrust needle bearing and a scalloped thrust washer on the mainshaft.
20. Fit a radial needle bearing and the second-speed gear.



MV 127



MV 128



N106

21. Fit a scalloped thrust washer, a thrust needle bearing and a further scalloped thrust washer.
22. Fit a radial needle bearing and the third-speed gear.
23. Fit a scalloped thrust washer, a thrust needle bearing and a further scalloped thrust washer.
24. Position a synchromesh cone on to the third-speed gear.
25. Fit the synchromesh unit, coned face to rear.

Setting the gears end-float

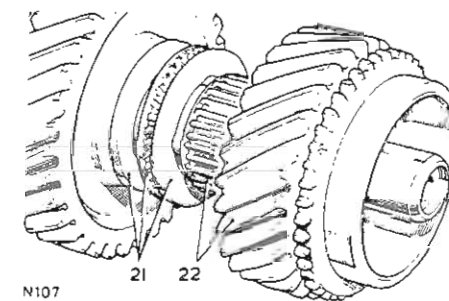
26. Position the mainshaft assembly vertical, front end uppermost.
27. Apply a light loading on the gears to remove end-float.
28. Position the snap-ring in the mainshaft groove.
29. Measure the distance between the snap-ring lower edge and the synchromesh unit inner member.
30. Select a shim to reduce the measured clearance to 0,025 to 0,150 mm (0.001 to 0.006 in) when fitted. Shim range is 1,85 to 2,45 mm (0.073 to 0.096 in) in 0,15 mm (0.006 in) increments.
31. Fit the selected shim washer and the snap-ring.

Assembling the mainshaft rear end

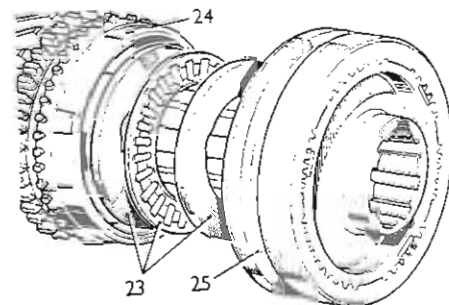
32. Fit a synchromesh cone to the first/second gear synchromesh outer member.
33. Position a chamfered thrust washer, a thrust needle bearing and a scalloped thrust washer on the mainshaft.
34. Fit the first-speed gear and bearing.
35. Fit a scalloped thrust washer, a thrust needle bearing and the stepped thrust washer, stepped face outwards.
36. The mainshaft spacer, transfer gear, shim washer and snap-ring are fitted during mainshaft refitting.
37. Refit the mainshaft, see 37.20.25.

DATA

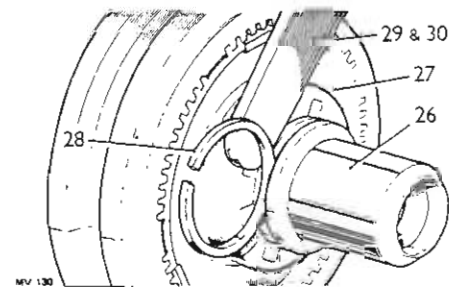
End float on gears ..... 0,025 to 0,150 mm.  
(0.001 to 0.006 in)



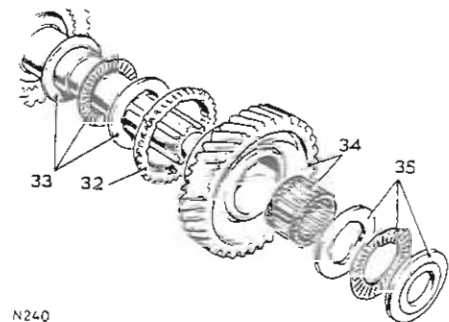
N107



MV 129



MV 130



N240

## REAR OUTPUT SHAFT OIL SEAL

—Remove and refit

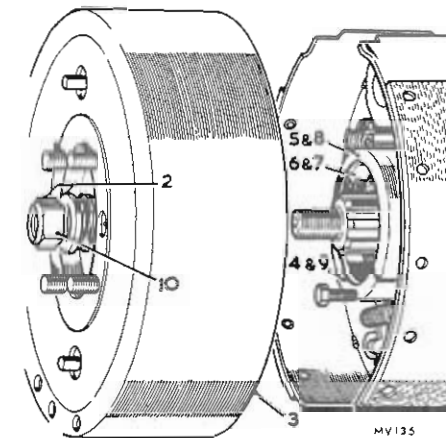
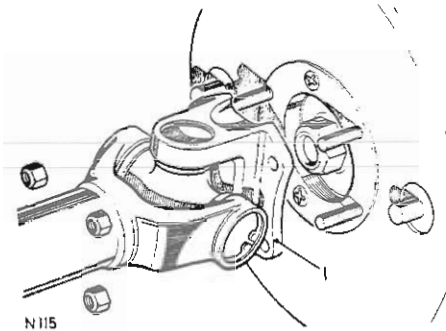
37.23.01

## Removing

1. Disconnect the rear propeller shaft at the transmission brake.
2. Remove the locking nut, washer and (later models) the felt rubber oil seal.
3. Withdraw the transmission brake drum complete with rear coupling flange.
4. Remove the oil catcher.
5. Prise off the oil shield.
6. Withdraw the oil seal.

## Refitting

7. Press in the oil seal, open face first, until the seal plain face just clears the chamfer on the seal housing bore.
8. Fit the oil shield, which must be a close fit on the speedometer housing.
9. Fit the oil catcher, applying Bostik compound 771 to seal the oil catcher against the brake back plate.
10. Reverse instructions 1 to 3. Torque loading for locking nut: 11,75 kgf m (85 lbf ft).



## FRONT OUTPUT SHAFT OIL SEAL

—Remove and refit

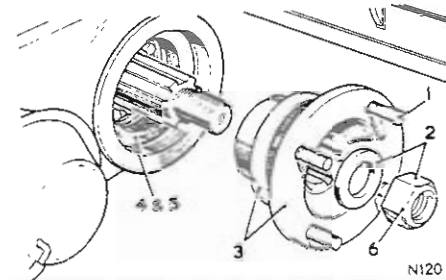
37.23.06

## Removing

1. Disconnect the front propeller shaft.
2. Remove the coupling flange locknut and washer.
3. Withdraw the coupling flange complete with mudshield.
4. Withdraw the oil seal.

## Refitting

5. Fit the oil seal, open side first.
6. Reverse items 1 to 3. Torque load for locknut: 11,75 kgf m (85 lbf ft).



## SPEEDOMETER DRIVE HOUSING

—Remove and refit

37.25.09

## Removing

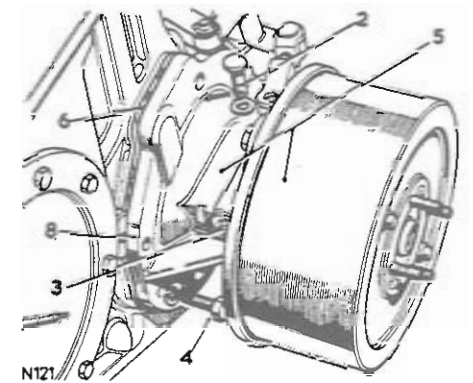
**CAUTION:** Check the vehicle wheels before commencing this operation as it is necessary to release the parking brake during the following procedure.

1. Disconnect the rear propeller shaft at the transmission brake.
2. Remove the clevis pin to disconnect the handbrake linkage.
3. Disconnect the speedometer drive cable.
4. Remove the fixings, speedometer drive housing to gearbox casing.
5. Withdraw the speedometer drive housing complete with transmission.

## Refitting

**NOTE:** If a replacement speedometer drive housing is being fitted, carry out the 'Differential bearings pre-load check' in 'Speedometer drive housing—overhaul', 37.25.13.

6. Position the joint washer.
7. Offer the drive housing to the gearbox and engage the rear output shaft splines in the differential unit.
8. Position the flat on the drive housing adjacent to the flat on the intermediate shaft.
9. Reverse instructions 1 to 4. Torque load for the propeller shaft fixings is 4,8 kgf m (35 lbf ft). Torque load for speedometer drive housing fixings is 3,1 kgf m (22 lbf ft).



SPEEDOMETER DRIVE HOUSING

—Overhaul 37.25.13

Dismantling

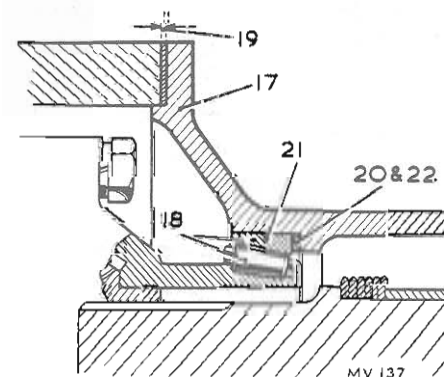
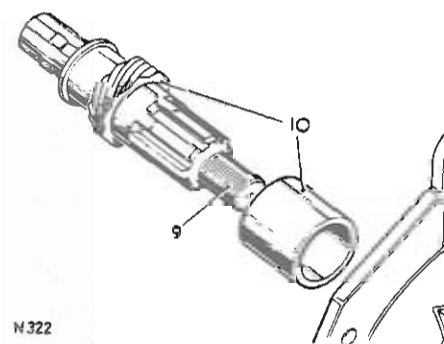
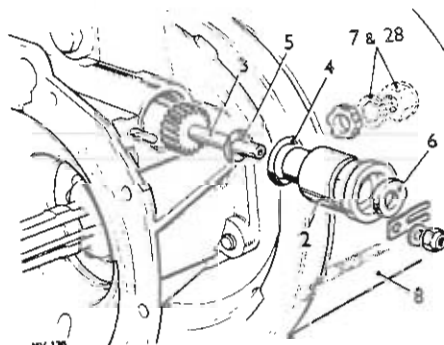
1. Remove the speedometer drive housing, see 37.25.09.
2. Remove the speedometer spindle housing.
3. Lift out the driven gear and spindle.
4. Take off the 'O' ring seal.
5. Remove the thrust washer.
6. Withdraw the oil seal.
7. Remove the locking nut, washer and felt seal, output coupling flange to output shaft.
8. Withdraw the brake drum and coupling flange complete.
9. Drive out the rear output shaft, using a hide mallet on the threaded end.
10. Slide off the spacer and speedometer worm.
11. Remove the oil catcher.
12. Withdraw the oil shield.
13. Withdraw the oil seal.
14. Remove the circlip.
15. Tap out the ball bearing.

Differential bearing pre-load check, instructions 16 to 22 inclusive

This check must be carried out if a replacement speedometer drive housing is to be fitted. The check is also required if a replacement gearbox, differential unit or differential unit bearing is being fitted.

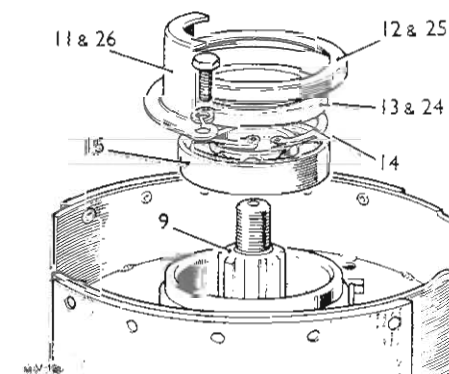
16. Measure and record the thickness of the new joint washer for the speedometer drive housing.
17. Offer the speedometer housing, less joint washer, to the gearbox.
18. Engage the differential unit bearing inner member with the outer member in the drive housing.
19. Measure the clearance between the drive housing and gearbox joint faces. This must be 0,05 mm (0,002 in) more than the recorded thickness of the new joint washer.
20. To adjust the joint face clearance, adjust the thickness of shimming fitted behind the rear bearing outer face as follows: instructions 21 and 22.
21. Drive out the bearing outer race.
22. Withdraw the shim washer and select a replacement of the required thickness. Shim thickness range is 1,65 to 2,80 mm (0,065 to 0,110 in) in 0,05 mm (0,002 in) stages.

continued



Reassembling

23. Reverse instructions 14 and 15.
24. Press in the output coupling flange oil seal, open face first, until the seal plain face just clears the chamfer on the seal housing bore.
25. Fit the oil shield, which must be a close fit on the speedometer housing.
26. Fit the oil catcher, applying Bostik compound 771 to seal the oil catcher against the brake backplate.
27. Reverse instructions 8, 9 and 10.
28. Fit the felt seal, plain washer and locking nut to secure the output flange. Torque: 16,5 kgf m (120 lbf ft).
29. Reverse instructions 1 to 6.



REVERSE LIGHT SWITCH

—Remove and refit 37.27.01

Removing

1. Lift aside the main gear lever grommet.
2. Disconnect the electrical leads.
3. Unscrew the reverse light switch.

Refitting

4. Engage reverse gear.
5. Connect the electrical leads to the switch.
6. Switch the ignition 'ON'.
7. Screw in the switch, less shim washers, until the switch contacts are made.
8. Screw in a further half turn.
9. Measure the clearance between the switch lower face and the gearbox.
10. Select shim washers to suit the clearance. Shim thicknesses are 0,5 mm (0,020 in) and 0,127 mm (0,005 in).
11. Fit the selected shim washer/s and switch. Tighten to a torque of 1,4 to 2,0 kgf m (15 to 20 lbf ft).
12. Fit the main gear lever grommet.

## DIFFERENTIAL LOCK ACTUATOR SWITCH

—Remove and refit 37.27.05

## Removing

1. Disconnect the electrical leads at the switch.
2. Unscrew the switch.

## Refitting

3. Start the engine.
4. Move the differential lock vacuum control valve to the 'up' position.
5. Connect the electrical leads to the actuator switch.
6. Screw in the switch, less shim washers, until the switch contacts are made.
7. Screw in a further half turn.
8. Measure the clearance between the switch lower face and the housing.
9. Select shim washers to suit the clearance. Shim thicknesses are 0,5 mm (0.020 in) and 0,127 mm (0.005 in).
10. Fit the selected shim washer/s and the switch.
11. Reverse instructions 3 and 4.

## GEAR LEVER AND CROSS-SHAFT, TRANSFER GEARBOX

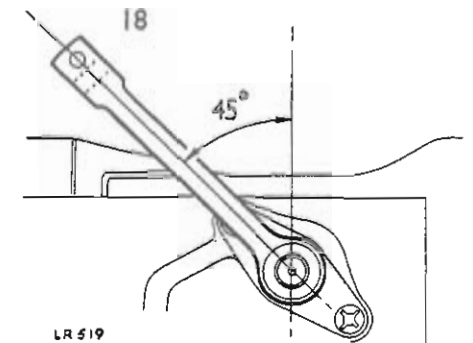
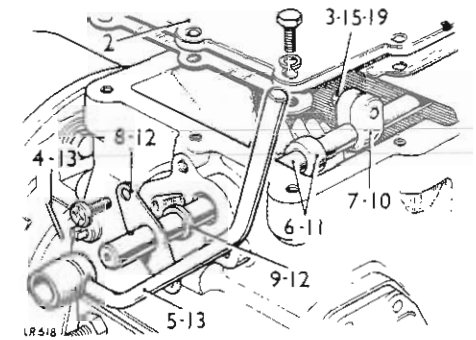
—Remove and refit 37.29.01

## Removing

1. Remove the gearbox, see 37.20.01.
2. Remove the top cover.
3. Slacken the selector finger pinch bolt.
4. Drive out the retaining pin, gear lever to cross-shaft.
5. Withdraw the gear lever.
6. Withdraw the cross-shaft and distance collar.
7. Lift out the selector finger.
8. Remove the retaining plates.
9. Withdraw the sealing rings.

## Refitting

10. Position the selector finger in the gearbox.
11. Fit the cross-shaft and spacing collar and engage the selector finger.
12. Fit the sealing ring and retaining plate at the R.H. side of the gearbox.
13. Fit the gear lever and retaining pin.
14. Fit the remaining sealing ring and retaining plate.
15. Tighten the selector finger pinch bolt.
16. Select 'High' transfer range, that is, the larger intermediate gear engaged.
17. Slacken the selector finger bolt.
18. Rotate the cross-shaft until the gear lever is inclined 45 degrees rearward of the vertical position.
19. Tighten the selector finger pinch bolt.
20. Reverse instructions 1 and 2.



GEAR SELECTORS AND SHAFT,  
TRANSFER GEARBOX

— Remove and refit 37.29.04

Removing

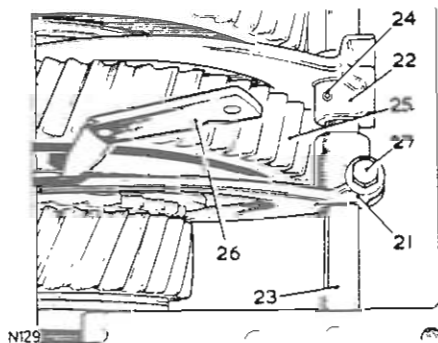
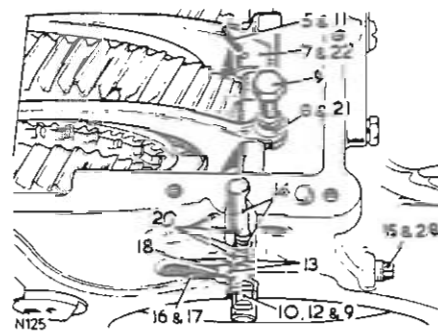
1. Remove the gearbox tunnel cover and the centre panel from the seat base.
2. Remove the speedometer drive housing, see 37.25.09.
3. Remove the transfer gearbox top cover.
4. Select 'Low' range transfer gear.
5. Drive out the retaining pin from the front selector fork sufficient to free the fork.
6. Ease the differential unit to the rear.
7. Push the forward selector fork forward on the shaft.
8. Pull to the rear on the rear selector fork to move the selector shaft out of engagement with the detent balls in the casing rear face.
9. Remove the pinch bolt on the rear fork.
10. Partially withdraw the selector shaft and lift out the selector forks.
11. Remove the retaining pin from the front fork.
12. Withdraw the selector shaft, closing the shaft housing by hand to prevent the detent balls from dropping into the casing.
13. Withdraw the two detent balls.
14. Lift out the spacing rod and spring.
15. Remove the closing plug.
16. Withdraw the detent spring from the cross drilling.

Refitting

17. Position the detent spring in the inner bore in the cross drilling.
18. Locate the detent ball on the spring.
19. Enter the selector shaft, push the ball against the spring and push in the shaft.
20. Fit the detent ball, spring and spacing rod to the vertical drilling.
21. Position the rear selector fork, plain face to rear, in the gearbox.
22. Position the front selector fork, extended boss to the rear, in the gearbox.
23. Align the retaining pin holes and engage the selector shaft in the selector forks.
24. Fit the retaining pin, front fork to shaft.
25. Set transfer gears in 'Neutral' position.
26. Adjust the rear fork position until there is 0,12 to 0,25 mm (0.005 to 0.010 in) clearance between the front face of the rear fork and the rear face of the input gear inner member.
27. Tighten the rear fork pinch bolt.
28. Fit the closing plug to the cross drilling.
29. Reverse instructions 1 to 3.

DATA

Clearance for selectors . . . . . 0,12 to 0,25 mm  
(0.005 to 0.010 in)



INTERMEDIATE GEARS ASSEMBLY

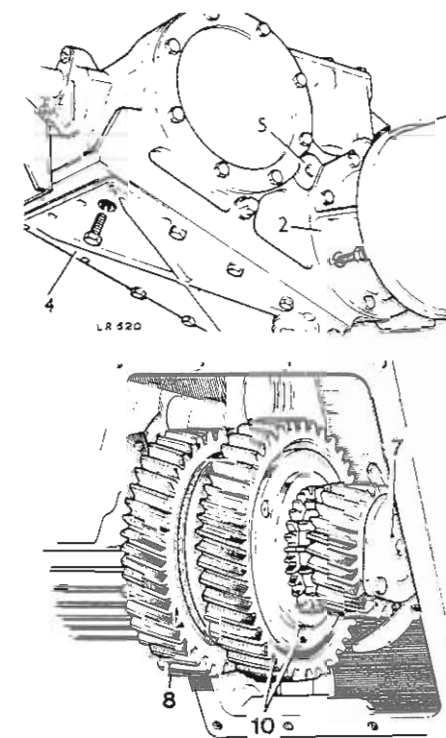
— Remove and refit 37.29.10

Service tool: RO 1003 slave intermediate shaft

Removing

1. Drain the transfer gearbox oil.
2. Remove the speedometer drive housing, see 37.25.09.
3. If necessary, remove the intermediate exhaust pipe.
4. Remove the gearbox bottom cover.
5. Screw a suitable extractor into the 8 mm threaded hole provided in the intermediate gear shaft.
6. Hold the intermediate gear cluster in position and withdraw the shaft.
7. Insert the slave shaft RO 1003 to retain together the gears assembly.
8. Withdraw the intermediate gears assembly.
9. Slide the thrust washers, bearings and gears from the slave shaft.
10. The input gear and outer member is a riveted assembly and no dismantling is permitted.
11. Remove the 'O' ring seal from the intermediate gear shaft.

continued





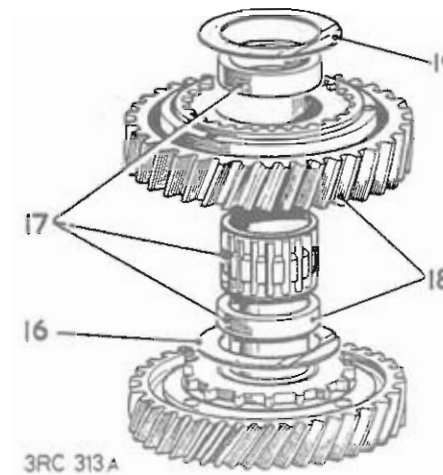
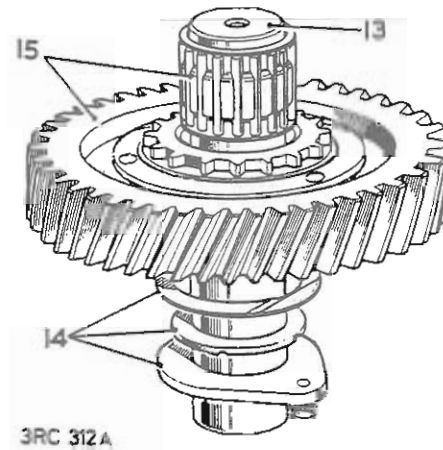
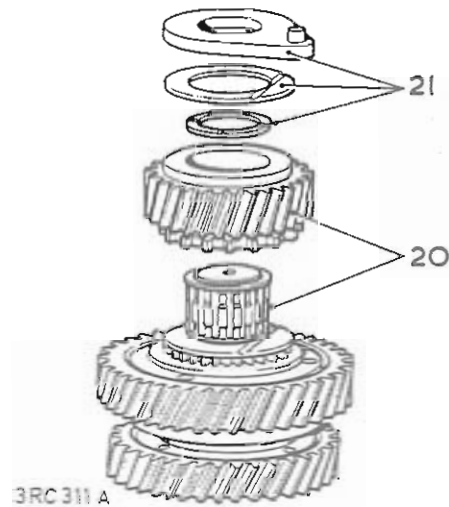
Inspecting

- 12 Examine all parts for wear, damage and general condition. Renew as necessary.

Refitting

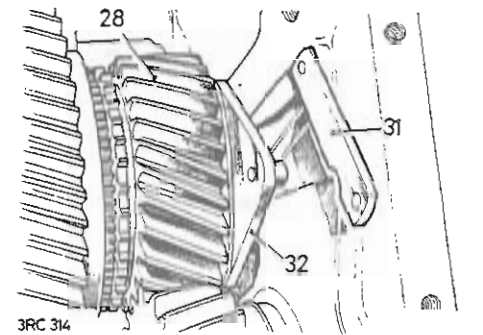
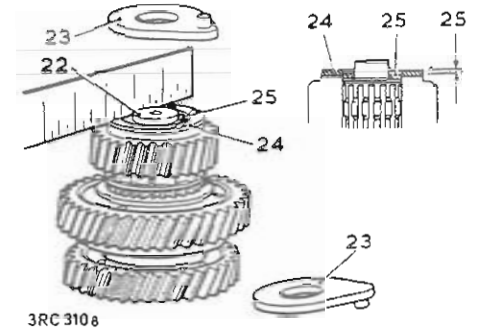
- 13 Place the slave shaft on the bench, extractor thread end uppermost.
- 14 Fit a pear-shaped thrust washer, inner ring and a thrust bearing washer to the shaft (ring grooved face downwards).
- 15 Fit a needle-roller bearing and the 'high' gear (plain face first) to the shaft.
- 16 Position a thrust bearing washer on the 'high' gear.
- 17 Fit a spacer, needle-roller bearing and a further spacer to the input gear inner member.
- 18 Position the assembled input gear on the shaft and engage the lower spacer in the previously positioned thrust bearing washer.
- 19 Locate a thrust bearing washer over the upper spacer.
- 20 Fit a needle roller bearing and the 'low' gear (plain side last) to the shaft.
- 21 Fit the remaining thrust needle bearing, inner ring and thrust washer (ring grooved face upwards).

continued



The following procedure, instructions 22 to 27, must be completed before refitting the intermediate gears into the transfer gearbox, to ensure that there is sufficient running clearance for the bearings.

- 22 With the intermediate transfer gear assembly located on the slave shaft RO 1003, place the complete assembly on a surface plate with the low gear uppermost.
  - 23 Remove the two pear-shaped thrust washers, one situated at each end of the gear assembly.
  - 24 Place a suitable straight-edge across the thrust bearing washer.
  - 25 Check that a clearance (end-float) exists between the straight-edge and the inner ring, to ensure a running clearance when the assembly is installed.
- CAUTION:** DO NOT refit the assembly with the needle-roller bearings in a pre-load condition.
- 26 If there is no clearance between the straight-edge and the inner ring, use selective assembly of alternative components to obtain the required condition.
  - 27 In event of selective assembly not giving clearance, it is permissible to face down each spacer on a surface plate to a maximum of 0.13 mm (0.005 in).
  - 28 When the foregoing bearing clearance check has been completed, slide the gears and slave shaft assembly into the transfer gearbox and engage the selector forks.
  - 29 Withdraw the slave shaft and lubricate the bearings through the shaft aperture.
  - 30 Fit the intermediate shaft and 'O' ring seal with the flat on the shaft toward the differential unit.
  - 31 Measure the clearance between the rear thrust washer and the gear casing. This must be 0,15 to 0,23 mm (0.006 to 0.009 in).
  - 32 Adjustment is carried out by substituting one or both of the thrust washers. The washers are available in 3,55 mm (0.139 in), 3,63 mm (0.143 in) and 3,74 mm (0.147 in) thicknesses.
  - 33 Refit the gearbox bottom cover.
  - 34 Refit the speedometer drive housing, see 37.25.09.
  - 35 Refit the intermediate exhaust pipe.
  - 36 Refill the transfer gearbox to the correct level.



DATA

Gears end-float	0,15 to 0,23 mm (0.006 to 0.09 in)
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DIFFERENTIAL UNIT

—Remove and refit 37.29.13

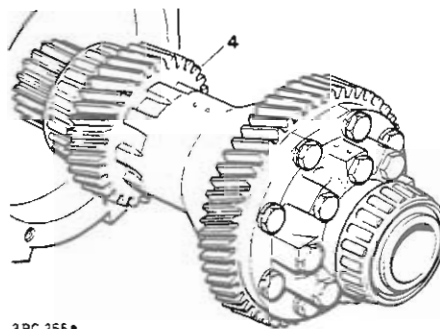
Removing

1. Remove the differential lock actuator assembly, see 37.29.19.
2. Remove the front output shaft and housing, see 37.10.05.
3. Remove the speedometer drive housing, see 37.25.09.
4. Withdraw the differential unit.

Refitting

5. Refit the differential unit.
6. Refit the speedometer drive housing, see 37.25.09.
7. Refit the front output shaft and housing, see 37.10.05.
8. Refit the differential lock actuator assembly, see 37.29.19.

NOTE: If a replacement differential unit is being fitted, carry out the 'Differential bearing pre-load check', described in 'Speedometer drive housing—overhaul', 37.25.13.



3RC 256a

DIFFERENTIAL UNIT

—Overhaul 37.29.16

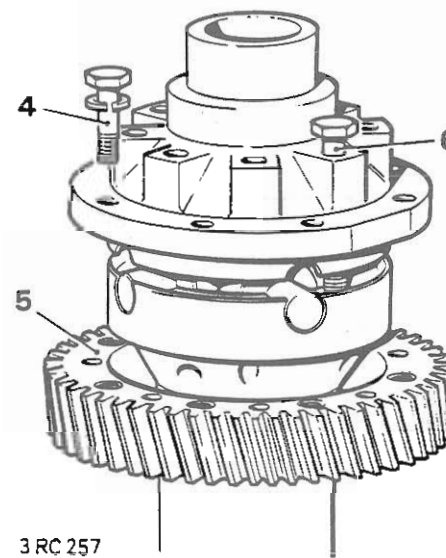
Service tool: 18G 47 BB bearing extractor

Dismantling

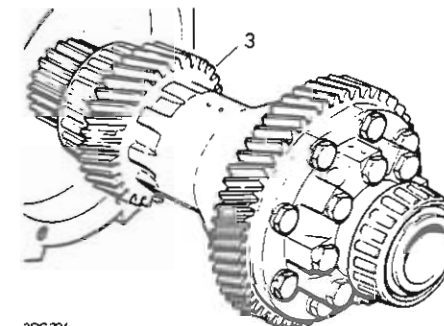
NOTE: During dismantling it is essential that all components are marked in their original position and relative to other components, so that if original components are refitted, their initial setting is maintained.

1. Remove the differential unit, see 37.29.13.
2. Press off the roller bearings using tool 18G 47 BB.
3. Withdraw the high-speed gear.
4. Remove the fixings, low-speed gear to casing.
5. Withdraw the gear.
6. Remove the casing securing bolts.

continued



3RC 257



3RC 334

7. Lift off the rear case assembly.
8. Withdraw the side gear.
9. Slide out the cross-shafts and remove the bevel pinions and thrust washers from the front case assembly.
10. Withdraw the side gear to dismantle the front case assembly.

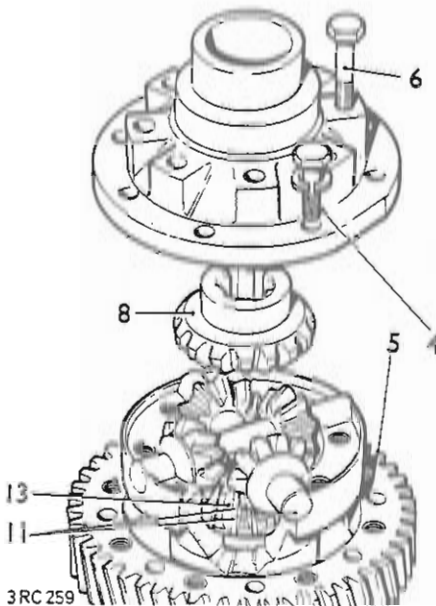
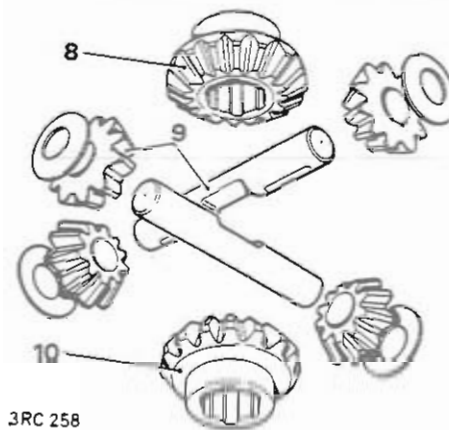
**Inspecting**

NOTE: If replacements are required, replace the following items 11 and 12 as sets.

11. Bevel pinions and side gears (set of six).
  12. Cross-shafts (set of two).
  13. Check the gear teeth for damage.
  14. Check all parts for satisfactory general condition.
- NOTE: The differential case halves are a matched pair, and halves must not be changed individually.

**Reassembling**

15. Fit a side gear into the rear casing.
  16. Fit a side gear into the front casing.
  17. Fit the bevel pinions, thrust washers and cross-shafts into the front casing.
  18. Fit the rear casing to the front casing. Tighten the bolts evenly in sequence. Torque load 5,6 to 6,2 kgf m (40 to 45 lbf ft).
  19. Offer the low gear to the differential casing.
  20. Align the fixing holes and fit the bolts evenly in sequence. Torque load 5,8 to 6,5 kgf m (44 to 47 lbf ft).
  21. Fit the roller bearings and refit the differential unit.
- NOTE: If the differential case or bearings have been replaced, carry out the 'Differential bearing pre-load check', 37.25.13.



**DIFFERENTIAL LOCK ACTUATOR ASSEMBLY**

- Remove and refit 1 to 3 and 10 37.29.19
- Overhaul 4 to 10 37.29.22

**Removing**

1. Note the vacuum supply hose positions, then disconnect the hoses.
  2. Remove the fixings and withdraw the assembly from the housing.
- NOTE: If necessary, remove the right-hand front exhaust pipe to improve access.
3. Withdraw the detent spring and ball.

**Dismantling**

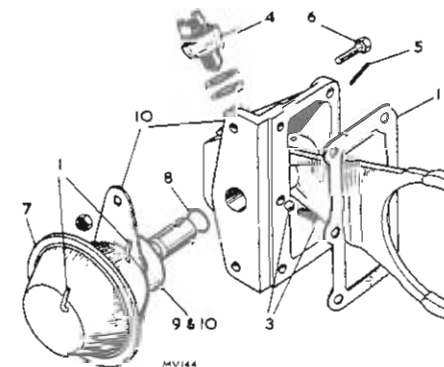
4. Remove the differential lock warning switch.
5. Drive out the retaining pin.
6. Remove the actuator fixings.
7. Withdraw the actuator and shaft.
8. Withdraw the 'O' ring seal.
9. Withdraw the joint washer.

**Reassembling**

10. Reverse instructions 4 to 9; coat both sides of the joint washer with Hylomar PL 32M jointing compound.

**Refitting**

11. Reverse instructions 1 to 3. Apply Hylomar PL 32M jointing compound between the actuator and housing joint faces and to the joint washer.



## FRONT PROPELLER SHAFT

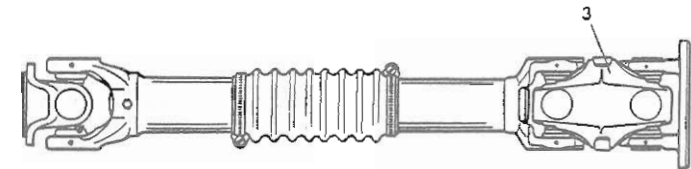
—Remove and refit 47.15.02

## Removing

1. Disconnect the propeller shaft from the front axle and gearbox, marking the respective flanges for refitting purposes.
2. Withdraw the propeller shaft.

## Refitting

3. Locate the propeller shaft in position with the double Hooke's Cardan universal joint towards the rear of the vehicle.
4. Align the axle and gearbox flange markings and fit the securing nuts and bolts.  
Torque 4,2 to 5,2 kgf m (30 to 38 lbf ft).



LP 524

## FRONT PROPELLER SHAFT

—Overhaul 47.15.11

## Dismantling

1. Remove the propeller shaft from the vehicle, see 47.15.02.
2. Dismantle the gaiter, sliding joint and conventional front universal joint, as described in the main Repair Operation Manual (operation 47.15.11, instructions 1 to 3 and 5 to 9).

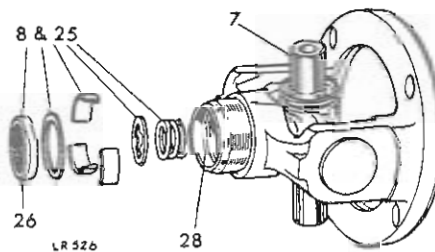
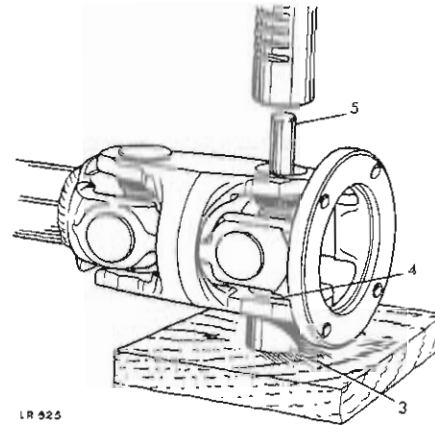
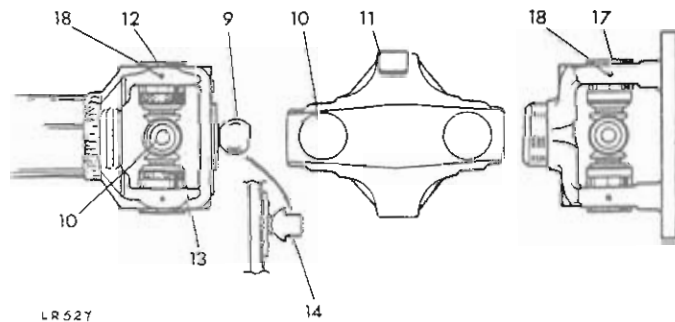
**NOTE:** To dismantle the rear double Hooke's Cardan joint the internally moulded plastic rings retaining the respective bearing cups in the yokes must be sheared by pressing out the bearing cups. This will necessitate the use of a mandril or hydraulic press. It is important to mark one side of the flange yoke, coupling yoke and shaft yoke before dismantling, to identify their relative positions so that propeller shaft balance can be retained on reassembly.

The original production bearing cups and universal joint 'spiders' cannot be reassembled and should be discarded. Service replacement bearing cups are provided with grooves for retaining with conventional circlips. Remove the bearing cups in the order described below.

continued

3. Locate a 1 1/2 in (30 mm) socket on the base of the press to be used, open end upwards.
4. Support the rear part of the propeller shaft assembly horizontally, lining up one of the rearmost coupling yoke bearing cups over the socket on the press base.
5. Use a distance piece of suitable diameter to allow the opposite bearing cup to pass downwards into the coupling yoke when the press is operated to shear the internal plastic seals.
6. Having removed the first bearing cup rotate the propeller shaft 180 degrees and repeat the operation, pressing out the opposite bearing cup.
7. Disengage the trunnions of the 'spider' from the coupling yoke and pull the flange yoke and 'spider' assembly from the centring ball (on the shaft yoke). The ball socket is pressed into the flange yoke.
8. Inspect the ball socket components. These comprise a seal, large washer, ball seats, small washer and a coil spring. If any parts show indications of excessive wear or are broken, prise out the seal and replace them.  
Alternatively, if assembled sockets are available, drift out the old socket and replace the whole assembly in one operation.
9. Inspect centring ball surface. If it shows signs of wear beyond smooth polish it should be replaced by carrying out the following procedure.
10. Using the press remove the two bearing cups remaining in the coupling yoke (see instructions 3 to 6).
11. Remove the coupling yoke by disengaging it from the 'spider' trunnions.
12. Similarly remove the two bearing cups remaining in the shaft yoke which carries the centring ball.
13. Disengage the 'spider' trunnions from the shaft yoke and remove the spider.
14. Carefully grind a flat on each side of the centring ball equally to a minimum of 13 mm (1/2 in) across the flats ensuring that the centring ball mounting stud is not damaged.
15. Grip the flats of the centring ball assembly in a vice to hold and crack the ball and pass a suitable length of rod through the bearing cup holes in the shaft yoke to provide a lever.

continued

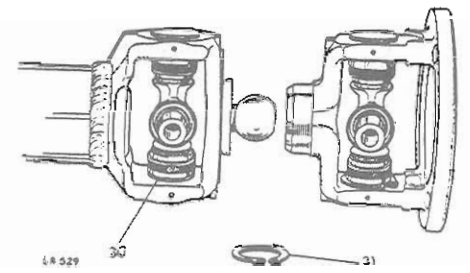
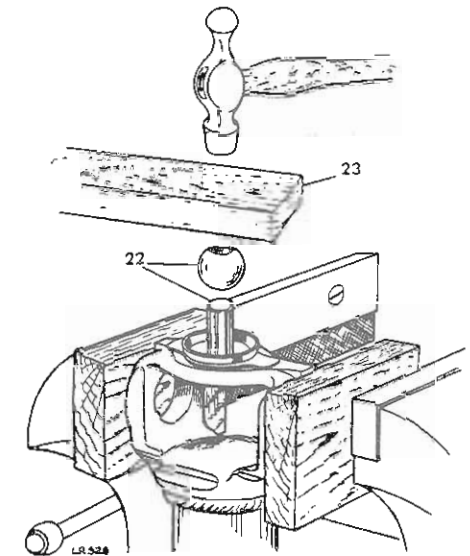


16. Using the lever, loosen and remove the centring ball.
17. If necessary remove the spider from the flange yoke by pressing out the bearing cups (see instructions 3 to 6).
18. Remove remnants of plastic from the grooves of all yokes. This is facilitated by driving a small pin through the individual injection holes used in original production.

Reassembling

19. Assemble the conventional universal joint to the front propeller shaft sliding member as described in the main Repair Operation Manual, operation 47.15.11, instructions 12 to 21.
20. Assemble the double Hooke's Cardan universal joint to the rear part of the propeller shaft in the order described below.
21. Support the propeller shaft vertically on a block of hardwood.  
**NOTE:** If a vice is used as a support, great care must be taken not to burr the shaft yoke. Under no circumstances should the tubular section be clamped.
22. Locate the new centring ball on its mounting stud, which is an integral part of the shaft yoke.
23. Using another block of hardwood to protect the surface finish of the centring ball, hammer the ball onto the mounting stud until it seats firmly against the shoulder at its base. It is most important that the centring ball is correctly seated if the double Hooke's joint is to function efficiently.
24. Ensure that the centring ball socket in the flange yoke is clean.
25. Lubricate the socket components and insert them in the socket cavity in the following sequence: coil spring, small washer, three ball seats (large openings outward to receive ball and joints aligned with the tongues on the inside of the small washer) and the large washer.
26. Apply Hylomar PL 32M to the outer edge of the seal.
27. Lubricate the seal lip and press the seal into the socket until it is flush. The sealing lip should be inclined inwards.  
**NOTE:** Alternatively, if assembled sockets are available the original socket can be drifted out and replaced with the complete assembly in one operation.
28. Finally, fill the socket cavity with grease.
29. Assemble the new 'spiders' and grooved bearing caps into the flange and shaft yokes respectively. The procedure is the same as for the assembly of the conventional universal joint flange yoke detailed in the main Repair Operation Manual, operation 47.15.11 from instructions 12 to 18.
30. However, due to differences in yoke design it is only necessary to press each bearing cup into its yoke until the circlip groove is completely exposed on the inside of the yoke.

continued



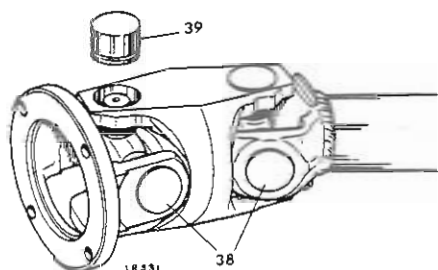
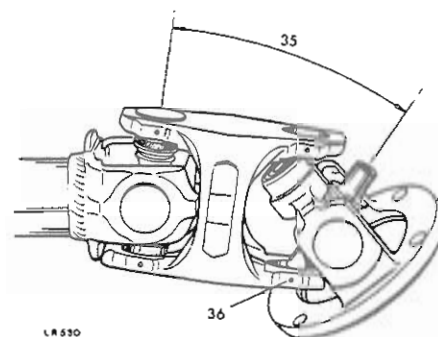
31. Locate and snap each retaining circlip in position.
32. Ensure that the alignment marks on the yokes are correctly positioned.
33. Fit the coupling yoke over the 'spider' trunnions in the shaft yoke, assembling the grooved bearing cups as described above.

**NOTE:** To complete the assembly of the double Hooke's joint the flange yoke and 'spider' assembly is fitted to the coupling yoke in a similar manner. However, since this operation also involves the engagement of the centring ball socket (pressed into the flange yoke) the following procedure should be adopted.

34. Make sure that the alignment marks on the coupling and flange yoke are correctly positioned.
35. To engage the trunnions in the flange yoke into the 'ears' of the coupling yoke and the socket over the centring ball both 'spiders' in the coupling and flange yokes should first be cocked to their limit in the same direction.
36. Engage the forward cocked trunnion first, simultaneously pressing the socket over the ball.
37. Cock the coupling and flange yokes in the opposite direction to enable the other trunnion to be located in the 'ear' of the coupling yoke.
38. To facilitate the installation of bearing cups cock the coupling yoke to its limit as shown so that the centring ball socket spring is unbraked.
39. Work both bearing cups into the 'ears' of the coupling yokes and over the trunnions. Ensure that both bearing cups are started straight and true.
40. Press against opposite bearing cups, moving the 'spider' to ensure free movement of the trunnions. If there is sudden resistance, stop pressing and check whether any needle rollers have become displaced.
41. As soon as one bearing cup retaining groove clears the inside of the yoke, fit the circlip.
42. Continue to press until the opposite bearing cup circlip can be fitted.

**NOTE:** If difficulties are experienced in fitting these circlips, strike the side of the particular yoke 'ear' sharply with a hammer.

43. Check the freedom of rotation of all trunnions. If too tight, a few sharp raps with the hammer on the sides and roots of the yokes will loosen the bearings. The flange yoke should snap over-centre, up and down or left and right, freely if the double Hooke's joint is correctly assembled.
44. Lubricate and fit the front sliding member and gaiter to the propeller shaft as described in the main Repair Operation Manual, operation 45.15.11, instructions 22, 24 to 26, 28 and 29.



AXLE CASE OIL SEAL

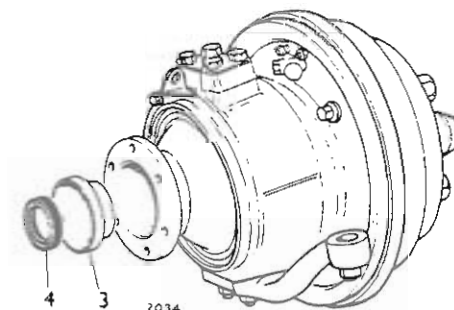
—Remove and refit 54.15.04

Removing

1. Remove the half-shaft, see 54.20.07.
2. Remove the swivel from the axle case, see 54.20.01.
3. Prise out the oil seal retaining plate from the swivel housing.
4. Prise out the oil seal.

Refitting

5. Press the seal into the retaining plate, lip towards axle case.
6. Press the retaining plate and seal into the swivel housing.
7. Refit the swivel to the axle case.
8. Refit the half-shaft, see 54.20.07.



HALF-SHAFT AND SWIVEL AXLE

—Remove and refit 54.20.01

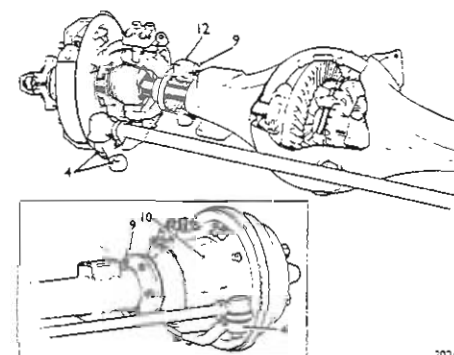
Service tool: 601763 ball joint extractor

Removing

1. Slacken the road wheel nuts associated with the half-shaft to be removed.
2. Jack up the front of the vehicle and support securely on stands.
3. Remove the road wheel.
4. Disconnect the track-rod end from the track arm, using tool 601763. If the swivel axle to be removed is on the steering wheel side of the vehicle disconnect also the drag-link from the steering arm.
5. Disconnect the brake pipe union nut from the flexible brake hose.
6. Disconnect the flexible brake hose from its bracket.
7. Seal the brake pipe and hose to prevent loss of fluid and to prevent the ingress of foreign matter.
8. Note the location of the steering stop bracket and the jack stop plate fitted to the axle flange.
9. Remove the six bolts and nuts clamping the swivel axle/front axle flanges.
10. Withdraw the half-shaft and swivel axle assembly.

Refitting

11. Thoroughly clean the swivel axle and front axle flanges.
12. Using jointing compound fit a new gasket to the axle flange.
13. Reverse instructions 1 to 10
14. Bleed the brakes.



## HALF-SHAFT

— Remove and refit

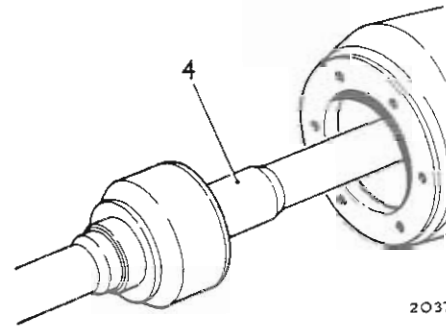
54-20.07

## Removing

1. Drain the swivel housing.
2. Remove the wheel hub, see 60.25.01.
3. Remove the stub axle, see 60.25.22.
4. Withdraw the axle half-shaft complete.

## Refitting

5. Fit the half-shaft, long end first, taking care to avoid damaging the oil seal in the swivel housing.
6. Reverse instructions 1 to 3.



## STEERING RELAY

— Remove and refit

57-50.02

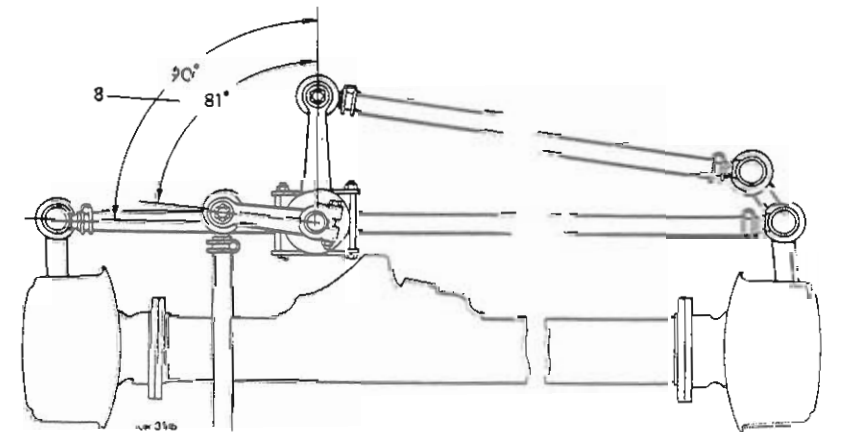
## Removing

1. From under the bonnet, remove the pinch bolt and withdraw the upper lever from the relay shaft.
2. Remove the two upper nuts and bolts securing the relay to the chassis.
3. From under the vehicle, remove the pinch bolt and withdraw the lower lever from the relay shaft.
4. Support the relay and remove the two lower nuts and bolts securing the relay to the chassis.
5. Withdraw the steering relay.

## Refitting

6. Ensure that the relay unit is filled with the correct oil.
7. Locate the relay in position on the chassis with the off-set in the securing lugs downward and secure the assembly with the four nuts and bolts.
8. Fit the upper and lower relay levers and their respective securing bolts and nuts. The angular relationship of the upper and lower relay levers should be 81 degrees. This can be checked by setting the road wheels in the straight ahead position, at which point the relay lower lever should be at 90 degrees to the track rod. The relay upper lever should be inclined forward of the track rod, 9 degrees out of alignment with the track rod.

NOTE: A left-handed-steering arrangement is illustrated; right-hand-steering is symmetrically opposite.



## STEERING

### STEERING RELAY

—Overhaul 57.50.08

1. Remove the relay assembly from the vehicle, see 57 50 02

#### Dismantling

2. Remove two of the securing bolts from the relay top cover. Invert the relay and allow the oil to drain.
3. Locate the relay assembly horizontally in a vice.
4. Remove the four bolts securing the relay lower cover.
5. Remove the lower cover complete with oil seal, gasket and thrust washer. Discard the gasket.
6. The relay shaft now has to be drifted through the lower end of the relay housing. Refer to the sectioned illustration of the relay assembly. Note that items 'A' are split bushes with an internal tapered face, against which they are held by a compression spring.

**WARNING:** The relay split bushes and spring will fly apart when released from the housing. Protection must be provided to prevent injury.

Enclose the lower end of the relay assembly with stout material leaving within the material sufficient space to accommodate the relay shaft. Secure the material to the relay housing to form a safety sheath.

7. Gently tap the relay shaft into the safety sheath.
8. Remove the safety sheath and collect the relay shaft, split bushes, spring and washers.
9. Remove the bolts securing the relay upper cover and remove the upper cover complete with oil seal, gasket and thrust washer. Discard the gasket. Remove the oil seal.
10. Remove the oil seal from the relay lower cover.

#### Inspecting

11. Thoroughly clean all components and examine for wear and damage. Renew components as necessary. The free length of the spring should be 184 mm (7.250 in).

#### Reassembling

The following additional parts are required for temporary use during reassembly.

Two 6mm socket head set pins, 15mm long.

Two plain washers 20mm outside diameter and to fit the set pins.

Two 50mm diameter hose clips.

12. Apply jointing compound to the outer periphery of the new oil seals. Fit the oil seals to the relay upper and lower covers (seal lips towards relay housing).
13. Fit the two 6mm set pins and 20mm diameter plain washers to the bottom of the relay housing diametrically opposite to each other.

continued

14. Adjust the two hose clips to a diameter that will retain the split bushes at a slightly smaller diameter than the internal bore of the housing, then place the clips aside.
15. Insert a washer for the spring and the spring into the housing so that they locate on the 20mm washers attached to the bottom of the housing.
16. Fit a split bush and one of the previously adjusted hose clips to a cone on the relay shaft.
17. Locate the second washer for the spring onto the shaft and insert the assembly into the housing.
18. Press the shaft and bush assembly into the housing, compressing the spring until the shaft protrudes from the other end of the housing sufficient to allow the other split bush to be fitted. During this operation the hose clip will slide off the top split bush.
19. Using the second hose clip, secure the lower split bush in position on the shaft.
20. Release the press and remove the steering relay.
21. Remove the set pins retaining the two 20 mm washers and pull the washers from between the relay spring and the split bush.

22. Smear general purpose grease on both sides of a joint washer and fit it to the top of the housing together with the thrust washer and top cover and seal.
23. Apply Loctite Grade 542 to the threads of the end cover bolts and fit the bolts and plain washers to secure the end cover. Torque 0,6 to 0,8 kgf m (5.0 to 6.0 lbf ft).
24. Drive the shaft and lower bush into position in the housing.
25. Fill the housing with the correct grade oil.
26. Fit the joint washer, thrust washer bottom cover and seal to the housing as previously described.

continued



27. Hold the relay unit in a vice.
28. Temporarily attach the upper relay lever and use a suitable spring balance to check resistance to rotation of the relay shaft. The resistance, measured on the spring balance, must not be less than 5,4 kgf (12 lbf) and should not exceed 7,3 kgf (16 lbf). If the resistance is less than 5,4 kgf (12 lbf), fit a new spring. If the resistance is excessive, remove the oil seal retainers and thrust washers, then use a suitable piece of tube to push each split bush in turn clear of its cone, and inject lubricating oil. Reassemble and recheck.
29. Fit the relay assembly to the vehicle, see 57.50.02.

**DATA**

Relay spring free length	184 mm (7.250 in)
Resistance to rotation, relay shaft	5,4 to 7,3 kgf (12 to 16 lbf) measured using a spring balance

**TRACK ROD BALL JOINTS**

— Remove and refit 6 to 9 **57.55.08**

**TRACK ROD**

— Remove and refit 1 to 5 and 10 to 14 **57.55.09**

Service tool: 601763, ball joint extractor

**Removing track rod**

1. Jack up the vehicle front end and support on stands.
2. Remove the front road wheels.
3. Remove the fixings from both ball joints.
4. Extract the ball joints, using 601763.
5. Withdraw the track rod and ball joints.

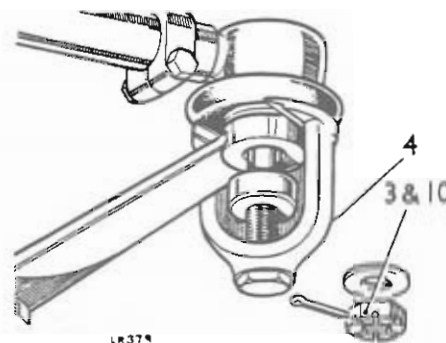
**Removing ball joints**

6. Slacken the ball joints clamp fixings.
7. Unscrew the ball joints, L.H. and R.H. thread.

**Refitting ball joints**

8. Screw the ball joints equally until the overall dimension between the ball joint centres is 1157 to 1160 mm (45.56 to 45.68 in).
9. Position the ball joint clamps 1,6 to 3,2 mm (0.062 to 0.125 in) from the track rod ends; do not tighten the clamp bolts at this stage.

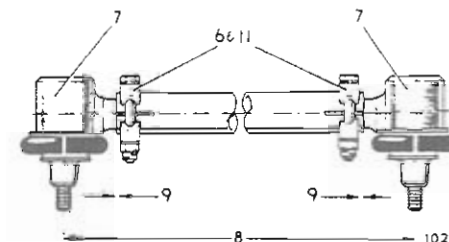
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**Refitting track rod**

10. Reverse instructions 3 to 5. Torque for ball joint fixings 4,0 kgf m (30 lbf ft).
11. Check and if necessary adjust the wheel alignment, see 57.65.01, leaving the clamp fixings slackened.
12. Lightly tap the ball joint cups in the direction illustrated to the maximum of their travel to ensure full unrestricted movement of the track rod.
13. Tighten the ball joint clamps. Torque load 1,1 to 1,5 kgf m (8.5 to 10.5 lbf ft).
14. Reverse instructions 1 and 2.

109 in 1 ton models are fitted with a two-piece track rod. Note that the cranked member must be fitted to provide maximum clearance for the front axle differential housing.



**DATA**

Initial setting dimension for track rod and ball joints	1157 to 1160 mm (45.56 to 45.68 in) measured between ball joint centres
Position of ball joint clamps	1,6 to 3,2 mm (0.062 to 0.125 in) from track rod ends

**LONGITUDINAL STEERING TUBE BALL JOINTS**

— Remove and refit 1 to 20 **57.55.12**

**LONGITUDINAL STEERING TUBE**

— Remove and refit 1 to 8 and 13 to 20 **57.55.13**

Service tool: 601763

**Removing**

1. Prop open the bonnet.
2. Remove the fixings from the ball joint connecting the longitudinal tube to the steering box drop-arm.
3. Using service tool 601763 extract the ball joint from the steering box drop-arm.

**Right-hand steering**

4. Remove the fixings from the ball joint connecting the longitudinal tube to the relay lever.
5. Using service tool 601763 extract the ball joint from the relay lever and withdraw the longitudinal steering tube from the vehicle.

**Left-hand steering**

6. Remove the fixings securing the upper relay lever to the relay unit and prise the lever clear.
7. Withdraw the longitudinal steering tube and relay lever assembly from the vehicle.
8. Remove the fixings and extract the ball joint from the upper relay lever, using service tool 601763.

Removing ball joints

9. Slacken the ball joint clamp fixings.
10. Unscrew the ball joints, L.H. and R.H. thread.

Refitting ball joints

11. Screw in the ball joints equally until the overall dimension between ball joint centres is 621,4 to 624,6 mm (24.46 to 24.59 in).
12. Position the clamps 1,58 to 3,17 mm (0.062 to 0.125 in) from the longitudinal tube ends; do not tighten the clamp fixings at this stage.

Refitting the longitudinal tube

13. Refit by reversing the removal procedure.
14. Torque tighten ball joint fixings 4,0 kgf m (30 lbf ft) and secure with a new split pin.

Left-hand steering

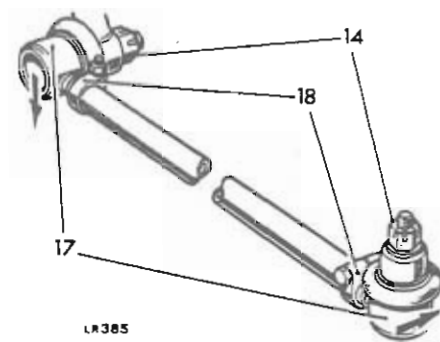
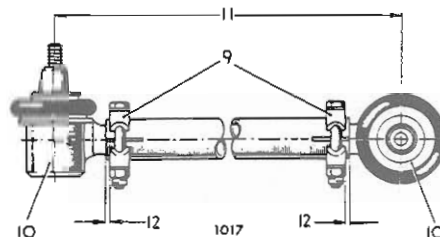
15. Place the front wheels in the straight ahead position and the steering wheel in the intermediate position; then connect the upper relay lever to the relay unit; the longitudinal arm may require adjusting slightly to align the splines of the relay lever and unit.
16. Tighten the lever pinch bolt. Torque 7,6 kgf m (55 lbf ft).

All vehicles

17. Using a mallet, lightly tap the ball joint cups in the direction indicated to the maximum of their travel, to ensure full unrestricted movement of the longitudinal arm. Right-hand steering is illustrated, left-hand steering is symmetrically opposite.
18. Secure both ball joint clamps. Torque load 1,1 to 1,5 kgf m (8.5 to 10.5 lbf ft).
19. Check the steering lock stops setting, see 57.65.03.
20. Check the steering, lock-to-lock, for correct functioning. If necessary, adjust the overall length of the longitudinal arm by slackening the ball joint clamps and screwing the arm in or out, as required, then resecure the clamps.

DATA

Initial setting dimension for longitudinal tube and ball joints .....	621,4 to 624,6 mm (24.46 to 24.59 in) measured between ball joint centres
Position of ball joint clamps .....	1,6 to 3,2 mm (0.062 to 0,125 in) from tube ends



FRONT WHEEL ALIGNMENT

—Check and adjust 57.65.01

Checking

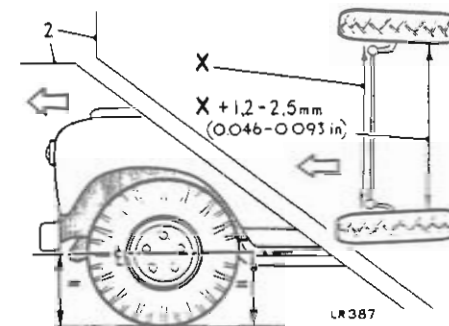
1. Set the vehicle on level ground with the road wheels in the straight-ahead position, and push it forward a short distance.
2. Measure the toe-out with the aid of a tracking stick or suitable proprietary equipment; it should be 1,2 to 2,5 mm (0.046 to 0.093 in) measured at the horizontal centre-line of the road wheels.
3. If necessary, adjust the toe-out as follows:

Adjusting

4. Slacken the clamps securing the ball joint at each end of the track-rod.
5. Turn the track rod to decrease or increase its effective length as necessary, until the toe-out is correct.
6. Push the vehicle rearwards turning the steering wheel from side to side to settle the ball joints. Then, with the road wheels in the straight ahead position, push the vehicle forward a short distance.
7. Recheck the toe-out. If necessary carry out further adjustment.
8. When the toe-out is correct, lightly tap the track-rod ball joints in the direction indicated to the maximum of their travel, to ensure full unrestricted movement of the track-rod.
9. Secure the ball joint clamps. Torque load 1,1 to 1,5 kgf m (8.5 to 10.5 lbf ft).

DATA

Front wheel toe-out .....	1,2 to 2,5 mm (0.046 to 0.093 in) measured at the horizontal centre-line of the road wheels
---------------------------	---



STEERING GEOMETRY

—Check 57.65.02

General

No adjustment is provided for castor, camber or swivel pin inclination. For front wheel alignment (toe-out) refer to operation 57.65.01.

It is essential that there is equal thread engagement of all steering tube ends (ball joints).

With the road wheels in the straight-ahead position and the steering wheel centralized the steering column lock should engage within + or - 20 degrees.

Steering box movement exceeds that required to obtain full lock to lock steering movement. This excess movement must be evenly divided between right hand and left hand locks and must not be less than 90 degrees steering wheel movement before the stops in the steering box are operative. This adjustment must be made in the drag link only.

DATA

Vehicle in static unladen condition with coolant, oils and 22.7 litres (5 Imperial gallons) of fuel, tyres at recommended pressures:

Castor angle	3°
Camber angle	1¼° positive
Swivel pin inclination	7°
Front wheel toe-out	1,2 to 2,5 mm (0.046 to 0.093 in)

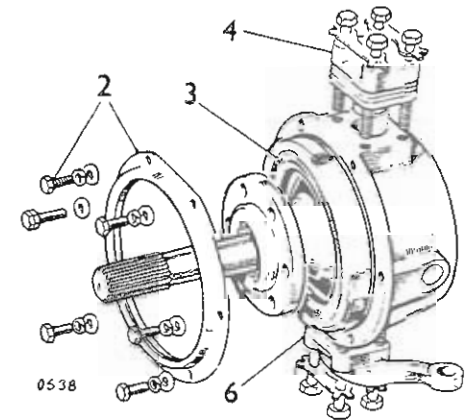
SWIVEL PIN HOUSING ASSEMBLY

—Overhaul 60.18.23

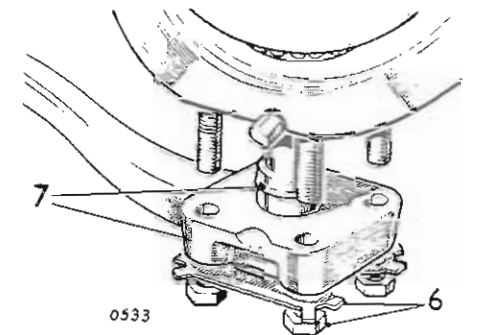
1. Remove the swivel pin housing assembly from the vehicle 60.15.20.

Dismantling

2. Remove the bolts, spring and plain washers securing the inboard oil seal cover. Note the position of the steering stop bracket, brake hose bracket, and if the swivel unit is fitted to the right-hand side of the vehicle, the position of the jack location plate. Withdraw the oil seal cover.
3. Prise out and discard the oil seal.



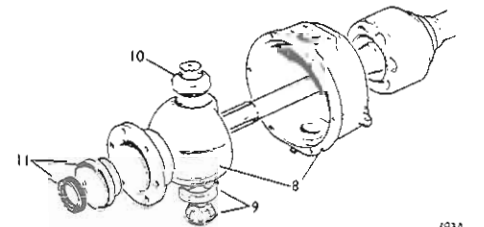
4. Release the lock tabs from the upper swivel pin bolts and remove the bolts and lock plates.
5. Withdraw the upper swivel pin and shims.
6. Release the lock tabs from the track arm nuts and remove the nuts and lock plates.
7. Withdraw the track arm complete with the lower swivel pin. Remove and discard the 'O' ring.



8. Separate the swivel pin inner and outer housings.
9. Remove the lower swivel pin roller bearing and bearing track.
10. Press out the Railko bush housing.
11. Prise out the oil seal and retainer.

Inspection

12. Clean and examine all components for wear and damage. Note that fuel or any cleaning fluid must not be applied to the Railko bush as this would impair the damping characteristics of the bush. Renew all components as necessary.

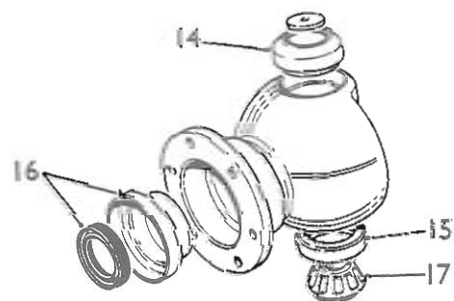


continued

## FRONT SUSPENSION

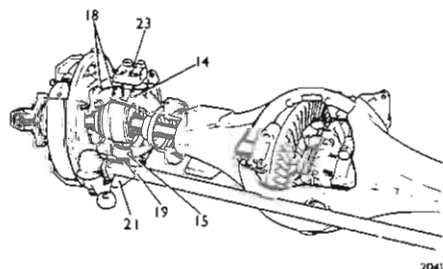
### Reassembling

13. Using an oil recommended for the swivel pin housing (refer to Division 09) lubricate the Railko bush. Ensure that the thrust disc is in position in the bottom of the bush.
14. Fit the Railko bush and housing.
15. Fit the lower swivel bearing track and lubricate.
16. Fit the oil seal into the retainer and press the assembly into the inner swivel housing.
17. Fit the lower swivel pin roller bearing.
18. Fit the inner swivel housing to the outer swivel housing.



2040

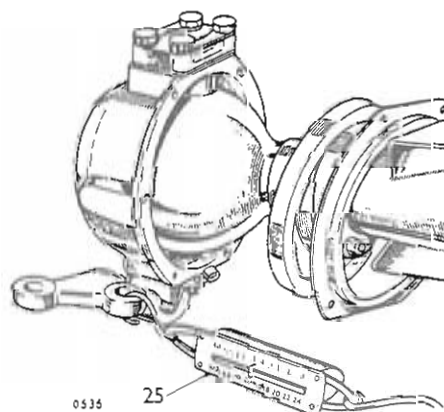
19. Fit a new 'O' ring to the lower swivel pin/track arm assembly.
20. Smear the mating faces of the outer swivel pin housing and lower swivel pin/track arm assembly with jointing compound. Also, apply Loctite Studlock 270 to the track-arm studs.
21. Fit the lower swivel pin/track arm assembly. Ensure that the track arm points to the front of the vehicle.
22. Fit the lock plates and nuts. Evenly tighten the nuts. Torque 7,0 to 8,9 kgf m (50 to 65 lbf ft). Bend the lock tabs to secure the nuts.
23. Fit the upper swivel pin, original shim(s), lock plates and bolts.
24. Evenly tighten the bolts. Torque 7,0 to 8,9 kgf m (50 to 65 lbf ft) but do not bend the lock tabs at this stage.



2041

25. Using a spring balance attached to the track-rod eye check the resistance to swivel pin movement. This should be within 3,6 to 4,5 kgf (8 to 10 lbf) when the initial inertia load is overcome. Adjust by adding or removing shims at the top swivel as required.

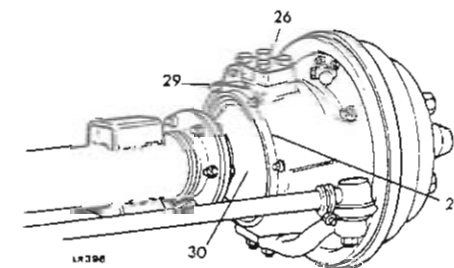
continued



0534

25

26. Engage the lock tabs at the top swivel bolts.
27. Pack the inboard seal with heavy grease. Fit the seal to the outer swivel housing.
28. Fit the seal retaining ring, brake hose bracket, steering stop bracket and if applicable (R.H. swivel only), the jack location plate.
29. Evenly tighten the bolts. Torque 1,0 to 1,2 kgf m (7 to 9 lbf ft).
30. Check that the seal effectively wipes the spherical face of the inner swivel housing. Adjust if necessary by repositioning the seal retaining ring within the limits of the bolt holes.
31. Fit the swivel pin housing assembly to the vehicle, see 60.15.20.



14296

## FRONT ROAD SPRING

— Remove and refit

60.20.01

### Removing

1. Front road springs, driver's side and passenger's side, must not be interchanged. A stiffer spring is fitted to the driver's side. Springs can be identified by the increased camber of the spring fitted to the driver's side and by the part number stamped on the underside of the third leaf.
2. Jack the vehicle and support the chassis securely.
3. Remove the road wheel.
4. With the jack positioned under the front axle relieve the road spring of load.
5. Remove the road spring 'U' bolts and ease the lower end of the shock absorbers and spring plate clear of the spring.
6. Remove the shackle bolt nuts.
7. Slacken the rear upper shackle bolt. Note that the rear shackle bolts are screwed to the tapped holes of the inner shackle link.
8. Remove the spring shackle bolts.
9. Remove the road springs.

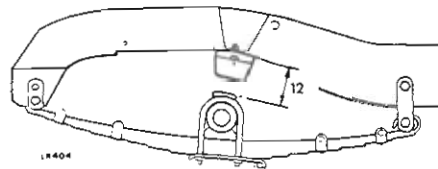
### Refitting

10. Reverse instructions 4 to 9 but do not tighten the shackle bolts or shackle bolt nuts. Ensure that the axle is properly located in the spring centre bolt before fitting and tightening the 'U' bolts to a torque of 9,3 to 11,0 kgf m (70 to 80 lbf ft).

continued

Spring setting procedure:

11. The shackle bolts which clamp the centre member of the road spring and hangar bracket bushes must not be tightened until the spring is positioned in the mid-point of its deflection range. This ensures that excessive rotation/shear forces are not imparted to the bush centres. Failure to observe this instruction can adversely affect bush life, especially in off-road conditions which produces large spring deflections.
12. Deflect the spring towards the chassis until a dimension of 118 to 122 mm (4.700 to 4.800 in) is obtained. Tighten the front spring shackle bolts and nuts. Torque 8.3 to 9.6 kgf m (60 to 70 lbf ft).
13. The spring may be deflected to the required dimension using a length of chain passed over the chassis and under the lifting trolley jack, or alternatively by lowering the vehicle on its wheels and loading the vehicle.



FRONT HUB ASSEMBLY

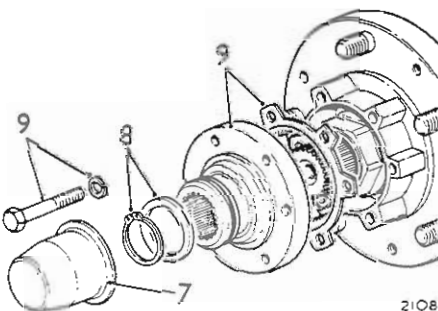
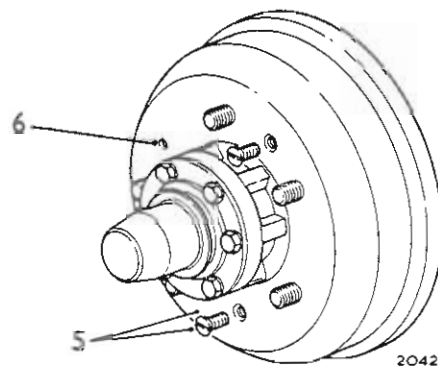
— Remove and refit 60.25.01

Service tool: 606435A spanner for hub nuts

Removing

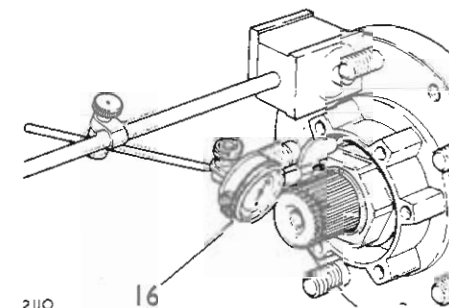
1. Slacken the road wheel nuts.
2. Jack up the front of the vehicle and support on a stand.
3. Remove the road wheels.
4. Slacken off the brake shoe adjusters.
5. Remove the brake drum, noting the provision of an extractor tapping, instruction 6.
6. If difficulty is experienced in removing the drum, fit one of the drum fixing screws into the extractor tapping and tighten the screw whilst using a mallet to dislodge the drum.
7. Using grips, twist off the hub cap.
8. Remove the circlip and shim from the axle shaft.
9. Remove the hub driving member and joint washer.
10. Remove the locknuts, lock washer and bearing washer securing the hub, using tool 606435A.
11. Hold the outer roller bearing in position.
12. Withdraw the hub and bearings.

continued



Refitting

13. Ensure that the hub bearings are packed with fresh grease. Do not pack the hub centre with grease.
14. Install the hub on the stud axle complete with inner and outer bearings and oil seal.
15. Fit the tongued washer and adjusting nut.
16. Spin the hub to settle the bearings and, using spanner 606435A, tighten the adjusting nut sufficient to provide hub end-float of 0.05 to 0.12 mm (0.002 to 0.005 in). This can be checked using a dial gauge.
17. Fit the lock washer and lock nut.
18. Tighten the lock nut. Bend the lock washer to secure both the lock and adjusting nuts. Recheck end-float.
19. Apply general purpose grease to both sides of the joint washer and locate it in position on the hub driving member.
20. Coat the threads of the hub driving member securing bolts with Loctite 270.
21. Fit the hub driving member and joint washer, and tighten the bolts. Torque: 4.2 to 5.2 kgf m (30 to 38 lbf ft).
22. Temporarily refit the circlip, omitting the shim.
23. Draw the axle shaft as far as possible through the hub driving member, by using a suitable bolt screwed into the tapped hole provided in the end of the axle shaft.
24. Using feeler gauges, measure the clearance between the circlip and the hub driving member. The correct clearance is 0.07 to 0.2 mm (0.003 to 0.008 in).
25. Adjust as necessary by selecting a suitable shim from the range available. Shim range 1.12 to 3.10 mm (0.044 to 0.122 in) in 0.15 mm (0.006 in) stages.
26. Remove the circlip, fit the selected shim and refit the circlip. Recheck the clearance with the shim fitted to ensure that it is within the specified limits.
27. Reverse instructions 5 to 7.
28. Adjust the brakes.
29. Reverse instructions 1 to 3.



DATA

Front hub end-float	0.05 to 0.12 mm (0.002 to 0.005 in)
Front drive shaft end-float	0.07 to 0.2 mm (0.003 to 0.008 in)
Shim range	1.12 to 3.10 mm (0.044 to 0.122 in) in 0.15 mm (0.006 in) stages

## FRONT HUB ASSEMBLY

—Overhaul 60.25.07

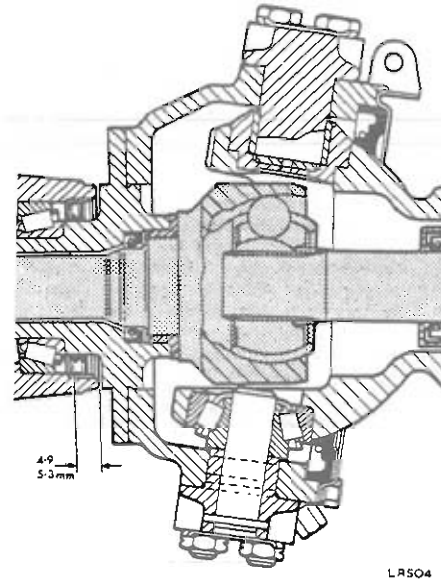
Service tool: 18G 1349 hub oil seal fitting tool

## Dismantling

1. Remove the front hub assembly, see 60.25.01.
2. Withdraw the outer bearing.
3. Remove the inner bearing and oil seal. Discard the oil seal.
4. Remove the inner and outer bearing tracks.
5. Thoroughly clean the hub and bearings.

## Refitting

6. Fit the inner and outer bearing tracks.
7. Pack the roller bearings with fresh grease of the correct grade (see Section 09). DO NOT pack the hub centre with grease.
8. Fit the inner roller bearing.
9. Liberally smear (not pack) the cavity between the lips of the oil seal with grease, as used for the hub bearings.
10. Using service tool 18G 1349, press the oil seal into the hub as illustrated.  
**IMPORTANT:** The seal must be recessed to the dimension illustrated to ensure correct location and avoid damage.
11. Fit the outer roller bearing.
12. Refit the front hub, adjusting the hub and drive shaft end-float, see 60.25.01.



LRS04

## FRONT HUB STUB AXLE

—Remove and refit 60.25.22

—Overhaul 60.25.24

## Removing

1. Remove the front hub, see 60.25.01, instructions 1 to 12.
2. Disconnect the brake pipe at the wheel cylinder. Plug the wheel cylinder and brake pipe to prevent ingress of foreign matter.
3. Remove the bolts securing the brake backplate and stub axle to the swivel housing.
4. Detach the brake backplate from the stub axle.
5. Remove the stub axle and gasket. Discard the gasket.

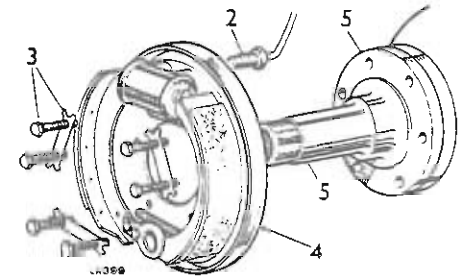
## Overhauling

6. Examine the stub axle for wear and damage. Check the area of the shaft that forms the running surface of the hub oil seal lip. Wear or ridging will result in rapid oil seal deterioration and ineffectiveness. If necessary, fit a new stub axle complete.
7. Examine the bush and oil seal in the inner end of the stub axle. If either component shows signs of wear, fit a new oil seal and bush; they should not be renewed individually.

**NOTE:** The bush can be extracted using Special Tool 18G 284 AQ, but the tool must first be modified by grinding the flange end face flat when in its widest position.

## Refitting

8. Grease and fit a new stub axle flange gasket.
9. Reverse instructions 1 to 5.  
Tightening torques:  
Brake anchor plate and stub axle to swivel housing bolts 4,2 to 5,2 kgf m (30 to 38 lbf ft).  
Front hub driving member bolts 4,2 to 5,2 kgf m (30 to 38 lbf ft).
10. Bleed the brakes.



REAR HUB ASSEMBLY

—Overhaul 64.15.07

Service tool: 18G 1349 hub oil seal fitting tool

Dismantling

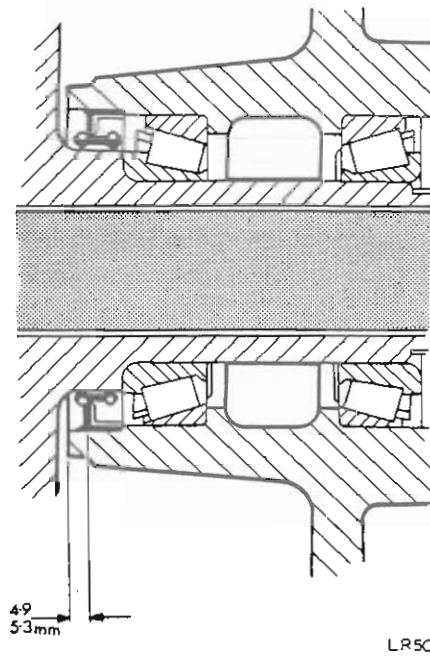
1. Remove the rear hub, see 64.15.01.
2. Withdraw the outer bearing.
3. Remove the inner bearing and oil seal. Discard the oil seal.
4. Remove the inner and outer bearing tracks.
5. Thoroughly clean the hub and bearings.

Refitting

6. Fit the inner and outer bearing tracks.
7. Pack the roller bearings with fresh grease of the correct grade (see Section 09). DO NOT pack the hub centre with grease.
8. Fit the inner roller bearing.
9. Liberally smear (not pack) the cavity between the lips of the oil seal with grease, as used for the hub bearings.
10. Using service tool 18G 1349, press the oil seal into the hub as illustrated.  
**IMPORTANT:** The seal must be recessed to the dimension illustrated to ensure correct location and avoid damage.
11. Fit the outer roller bearing.
12. Refit the rear hub, adjusting the hub end-float, see 64.15.01.

DATA

Rear hub end-float ..... 0,05 to 0,12 mm  
(0.002 to 0.005 in)



REAR ROAD SPRING

—Remove and refit 64.20.01

Removing

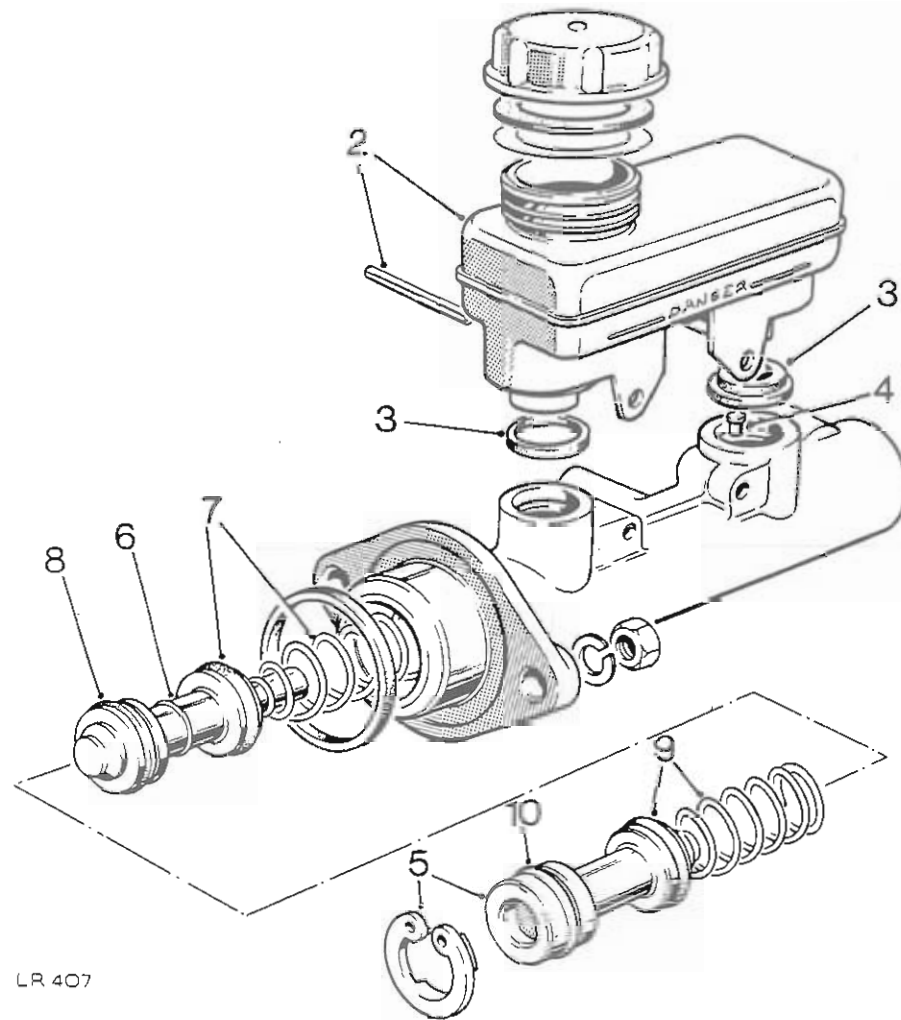
1. Rear springs, driver's side and passenger's side must not be interchanged. Springs can be identified by the increased camber of the spring fitted to the driver's side and by the part number stamped on the underside of the third leaf.
2. Jack up the vehicle and support the chassis securely.
3. Remove the road wheel.
4. With the jack positioned under the rear axle relieve the road springs of load.
5. Remove the road spring 'U' bolts and spring bottom plate.
6. Remove the shackle bolt nuts.
7. Slacken the rear, upper shackle bolt. The rear shackle bolts are screwed to the inner shackle links.
8. Remove the spring shackle bolts.
9. Remove the road spring.

Refitting

10. Reverse instructions 4 to 9 but do not tighten the shackle bolts or shackle bolt nuts. Ensure that the axle is properly located in the spring centre bolt before fitting and tightening the 'U' bolts to a torque of 9,5 to 11,0 kgf m (70 to 80 lbf ft).

Spring setting procedure

11. The shackle bolts which clamp the centre member of the road spring and hangar bracket bushes must not be tightened until the spring is positioned in the mid-point of its deflection range. This ensures that excessive rotation/shear forces are not imparted to the bush centres. Failure to observe this instruction can adversely affect bush life, especially in off-road conditions which produces large spring deflections.
12. Deflect the spring towards the chassis until a dimension of 158 to 162 mm (6.225 to 6.375 in) is obtained, then tighten the shackle bolts and nuts. Torque 8,3 to 9,5 kgf m (60 to 70 lbf ft).
13. The spring may be deflected to the required dimension using a length of chain passed over the axle and under the lifting trolley jack or, alternatively, by lowering the vehicle on its wheels and loading the vehicle.



LR 407

MASTER CYLINDER

—Overhaul

70.30.02

Dismantling

1. Remove the master cylinder, see 70.30.01.
2. Remove the retaining pins and withdraw the fluid reservoir.
3. Lever out the seals.
4. Push the plunger fully down the cylinder bore and withdraw the secondary plunger stop pin.
5. Remove the circlip and withdraw the primary plunger assembly.
6. Tap the cylinder on a soft or wooden surface to remove the secondary plunger assembly.
7. Remove the secondary plunger spring, seal retainer, recuperating seal and washer. Keep the plunger and its spring together at all times.
8. Remove the seal from the plunger.
9. Remove the primary plunger spring, seal retainer, recuperating seal and washer. Keep the plunger and its spring together at all times.
10. Remove the seal from the plunger.

Inspecting

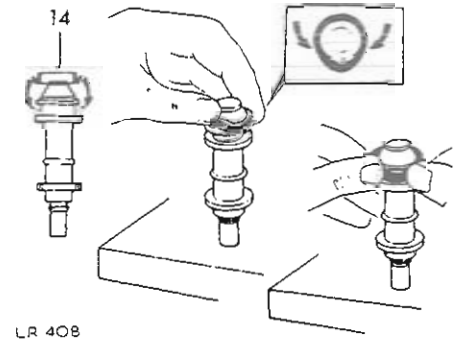
11. Clean all components in Girling cleaning fluid and allow to dry.
12. Examine the cylinder bore and pistons; ensure that they are smooth to the touch with no corrosion, score marks or ridges. If there is any doubt, fit new replacements.
13. The seals should be replaced. These items are included in the master cylinder overhaul kit.

Reassembling

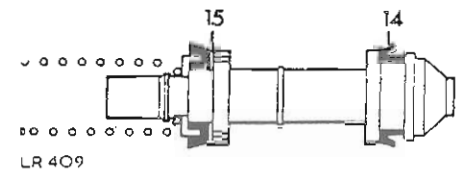
14. Fit a new seal into the groove in the secondary plunger, as follows. Squeeze the seal into an ellipse, then press the raised part of the seal over the flange.
15. Fit the washer, new recuperating seal, seal retainer and spring to the secondary plunger.
16. Fit the seal into the groove in the primary plunger as previously described.
17. Fit the washer, new recuperating seal, seal retainer and primary spring. Ensure that the seals are fitted as illustrated.

**NOTE:** It is vital that the following instructions are carried out precisely and that generous amounts of unused brake fluid are used to lubricate the cylinder bore and plunger seals to prevent damage to the seals during assembly.

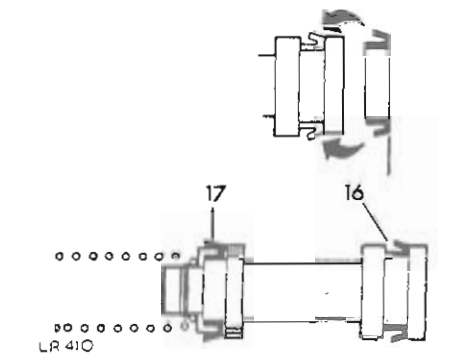
18. Clamp the cylinder in a bench vice, lubricate the secondary plunger seals and the cylinder bore.



LR 408



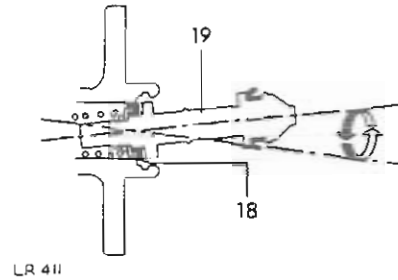
LR 409



LR 410

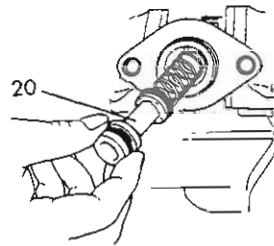


19. Offer the plunger assembly to the cylinder until the recuperation seal is resting centrally in the mouth of the bore. Then, ensuring that the seal does not become trapped, gently introduce the plunger with a circular rocking motion as illustrated to ease in the seal, then slowly push the plunger down the bore in one continuous movement.



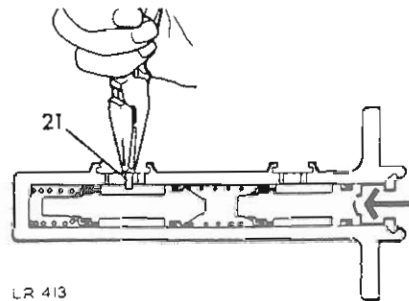
LR 411

20. Repeat the lubricating and fitting procedure for the primary plunger assembly and fit the retaining circlip.  
21. Using a clean screwdriver, slowly press the plunger fully down the bore to enable the secondary plunger stop pin to be fitted in its correct position.



LR 412

22. Lubricate new seals with unused brake fluid and fit one in each inlet port.  
23. Lubricate the seals and press the fluid reservoir into position on the cylinder and secure with the retaining pins.  
24. Refit the master cylinder, see 70.30.01.



LR 413

### TRANSMISSION BRAKE, HAND LEVER AND LINKAGE

— Remove and refit

70.45.01

#### Removing

1. Remove the centre seat cushion and lid panel from the seat base.
2. Disconnect the cable from the hand brake lever.
3. Disconnect the cable from the support bracket for the hand brake lever.
4. Release the 'P' clip at the transfer gearbox.
5. Disconnect the cable from the lever at the transmission brake.
6. Release the cable adjuster from the transfer gearbox.
7. Withdraw the cable from the vehicle.
8. Remove the fixings and withdraw the hand brake lever.

#### Refitting

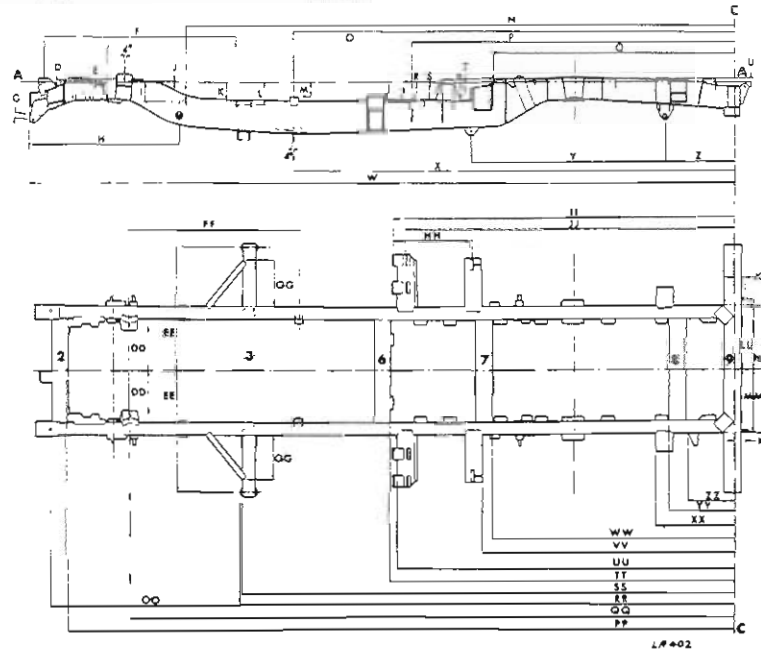
9. Refit by reversing the removal procedure. Adjust the cable to give three clicks on the ratchet when applying the hand brake.

BODY

CHASSIS FRAME

—Alignment check

76.10.02



CHASSIS FRAME DIMENSIONS

Ref.		mm	inches	Ref.	mm	inches
AA	Frame Datum	—		DD	269.5	10.610
BB	Centre Line Datum	—		EE	750.9	29.562
CC	Rear Datum	—		FF	636.0(min)	25.039
D		12.0	0.472	GG	277.0	10.905
E		12.7	0.5	HH	489.0	19.251
F		1153.5	45.413	II	2059.0	81.062
G		35.0	1.374	JJ	1981.0	77.992
H		879.5	34.625	KK	62.0	2.440
I		120.6	4.748	LL	432.0	17.007
J		11.0	0.43	MM	387.0	15.236
K		111.5	4.401	NN	787.0	30.984
L		136.5	5.374	OO	1142.5	44.980
M		82.5	3.248	PP	4014.5	158.051
N		3270.0	128.740	QQ	3637.5	143.208
O		2630.0	103.543	RR	2969.0	116.889
P		1933.0	76.102	SS	2962.0	116.614
Q		1446.0	56.929	TT	2075.0	81.692
R		101.6	4.000	UU	2034.0	80.078
S		103.2	4.062	VV	1522.0	59.921
T		12.7	0.5	WW	1455.0	57.283
U		20.6	0.811	XX	475.0	18.700
V		29.4	1.157	YY	398.0	15.669
W		4241.0	166.968	ZZ	274.0	10.787
X		2626.0	103.385			
Y		1149.5	45.255			
Z		424.0	16.692			

Bolt-on cross-member  
Chassis cross-member

NOTE: The vehicle bumper (not illustrated) is regarded as No. 1 cross-member

ELECTRICAL EQUIPMENT

—General

86.00.00

The electrical system is negative earth, and it is most important to ensure correct polarity of the electrical connections at all times. Any incorrect connections made when reconnecting cables may cause irreparable damage to the semi-conductor devices used in the alternator and regulator. Incorrect polarity would also seriously damage any transistorised equipment such as radio and tachometer etc.

Before carrying out any repairs or maintenance to an electrical component, always disconnect the battery.

The V-drive fan belt used with alternators is not the same as that used with d.c. machines. Use only the correct Rover replacement fan belt. Occasionally check that the engine and alternator pulleys are accurately aligned.

It is essential that good electrical connections are maintained at all times. Of particular importance are those in the charging circuit (including those at the battery) which should be occasionally inspected to see that they are clean and tight. In this way any significant increase in circuit resistance can be prevented.

Do not disconnect battery cables while the engine is running or damage to the semi-conductor devices may occur. It is also inadvisable to break or make any connections in the alternator charging and control circuits while the engine is running.

The electronic voltage regulator employs micro-circuit techniques resulting in improved performance under difficult service conditions. The whole assembly is encapsulated in silicone rubber and housed in an aluminium heat sink, ensuring complete protection against the adverse affects of temperature, dust, and moisture, etc.

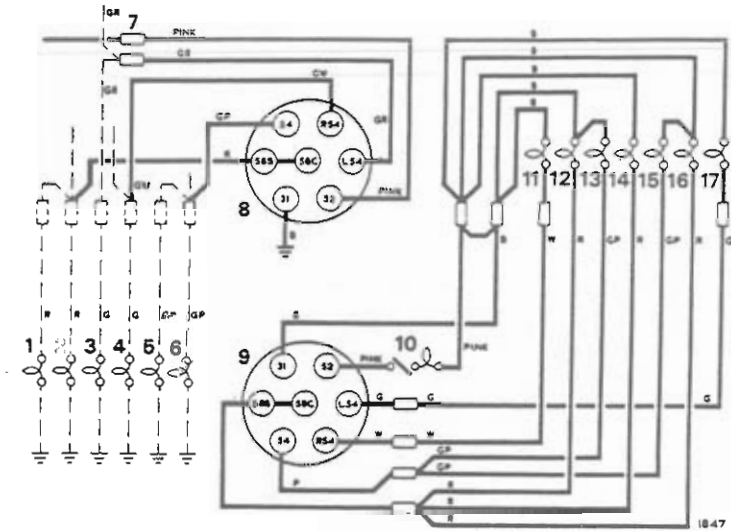
The regulating voltage is set during manufacture to give the required regulating voltage range of 14.1 to 14.5 volts, and no adjustment is necessary. The only maintenance needed is the occasional check on terminal connections and wiping with a clean dry cloth.

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

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

## ELECTRICAL EQUIPMENT DATA

<b>Alternator</b>	
Type .....	Lucas 18ACR battery sensed with transistorized current-voltage regulator
Nominal voltage .....	12 volts
Regulating voltage .....	13.6 to 14.4 volts
Cut-in voltage .....	13.5 volts at 2100 rev/min
Polarity .....	Negative
Maximum output .....	45 amperes at 6000 alternator rev/min
Maximum output speed .....	12 400 rev/min
Rotor winding resistance .....	3.2 ohms at 20°C (68°F)
Brush spring pressure .....	225 to 368 gf (9 to 13 ozf)
Minimum brush length .....	8 mm (0.312 in)
<b>Battery</b>	
Type .....	Lucas C9
Capacity .....	60 Ah at 20-hr rate
<b>Distributor</b>	
Type .....	Lucas 35D8
<b>Ignition Coil</b>	
Type .....	Lucas BA16C6
Voltage .....	7 volt ballasted coil
<b>Starter Motor</b>	
Type .....	Lucas 3M100PE
Brush spring tension .....	1026 gf (36 ozf)
Minimum brush length .....	9,5 mm (0.375 in)
<b>Bulb and Sealed Beam</b>	
Headlamps with bulbs .....	Lucas 411, 12V 45/40W clear
Headlamps with sealed beam units:	
R.H. Stg. ....	Lucas 54521872 60/45W
L.H. Stg. Europe except France .....	Lucas 54523079 60/50W
L.H. Stg. except Europe .....	Lucas 54522231 50/40W
Sidelamps .....	Lucas 207, 12V 4W
Stop, tail lamps .....	Lucas 380, 12V 21/5W
Flasher lamps .....	Lucas 382, 12V 21W
Rear number-plate lamp .....	Lucas 233, 12V 4W
Instrument panel lights .....	Lucas 987, 12V 2.2W MES
Warning lights .....	Lucas 987, 12V 2.2W MES
Warning light, brakes .....	Lucas 280, 12V 1.5W
Warning light, flashers .....	Lucas 281, 12V 2W
Interior light .....	Lucas 382, 12V 21W



CIRCUIT DIAGRAM, TRAILER LIGHTING, NEGATIVE EARTH

**Vehicle**

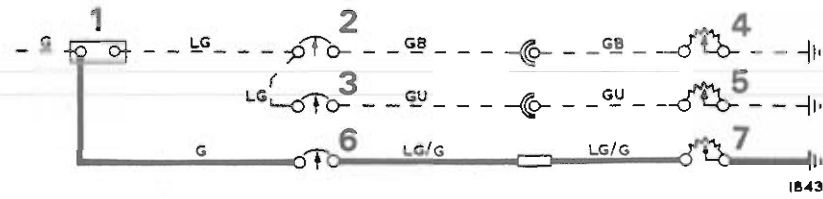
1. Tail lamp, R.H.
2. Tail lamp, L.H.
3. Flasher lamp, L.H.
4. Flasher lamp, R.H.
5. Stop lamp, R.H.
6. Stop lamp, L.H.
7. To fuse box
8. Socket on vehicle

**Trailer**

9. Socket on trailer
10. Interior lamp & switch
11. Flasher lamp R.H.
12. Tail lamp, R.H.
13. Stop lamp, R.H.
14. Number-plate illumination
15. Stop lamp, L.H.
16. Tail lamp, L.H.
17. Flasher lamp, L.H.

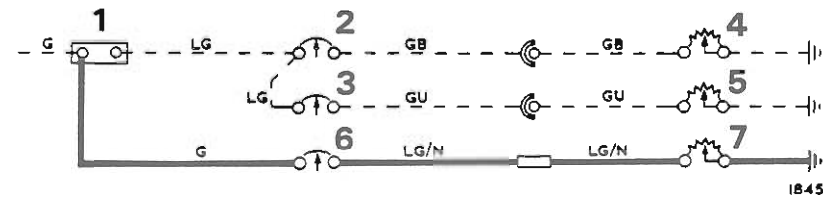
**KEY TO CABLE COLOURS**

B. Black	P. Purple
N. Brown	V. Blue
W. White	R. Red
G. Green	L. Light



**Oil Temperature Gauge**

1. Stabilizer unit
2. Fuel gauge
3. Water temperature gauge
4. Fuel tank unit
5. Water temperature transmitter
6. Oil temperature gauge
7. Oil temperature transmitter

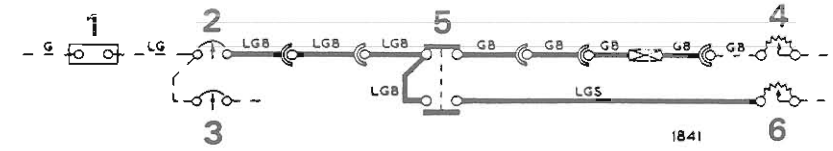


**Oil Pressure Gauge**

1. Stabilizer unit
2. Fuel gauge
3. Water temperature gauge
4. Fuel tank unit
5. Water temperature transmitter
6. Oil pressure gauge
7. Oil pressure transducer

**KEY TO CABLE COLOURS**

B. Black	P. Purple
N. Brown	V. Blue
W. White	R. Red
G. Green	L. Light



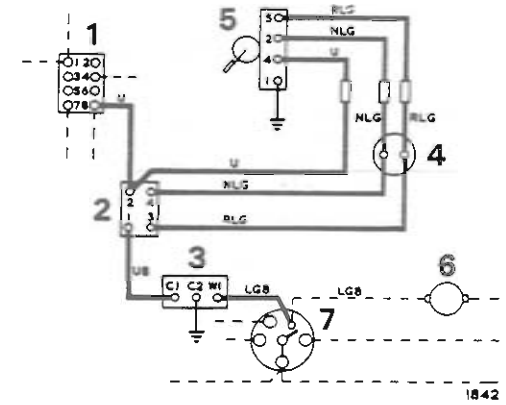
**Additional L.H. Fuel Tank**

**Existing components**

1. Stabilizer unit
2. Fuel gauge
3. Water temperature gauge
4. Rear tank unit

**New components**

5. Fuel change-over switches
6. L.H. side tank unit



**Headlamp Wiper-Washer System**

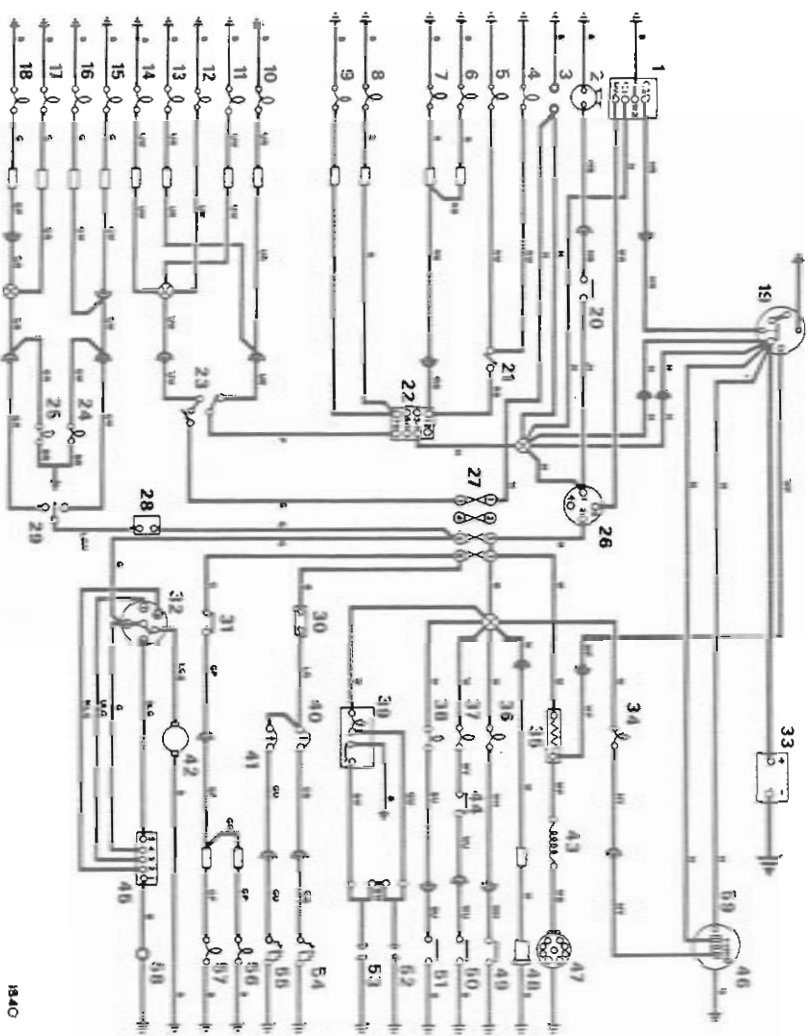
1. Lighting switch
2. Headlamp wiper delay unit
3. Headlamp wiper relay
4. Headlamp washer pump motor
5. Headlamp wiper motor
6. Screen washer pump motor
7. Screen washer switch

**KEY TO CABLE COLOURS**

B. Black	P. Purple
N. Brown	U. Blue
W. White	R. Red
G. Green	L. Light
S. Slate	

## CIRCUIT DIAGRAM, V8 MODELS, R.H. &amp; L.H. STEERING, NEGATIVE EARTH

Early models with no rear fog lamps



1840

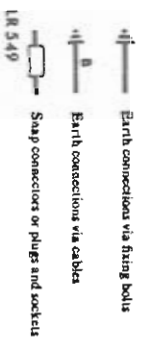
## KEY TO CIRCUIT DIAGRAM, V8 MODELS, R.H. &amp; L.H. STEERING, NEGATIVE EARTH

Early models with no rear fog lamps

- |   |  |  |
|---|--|--|
| 1. Starter relay                          | 21. Panel light switch                   | 41. Water temperature gauge                |
| 2. Horn                                   | 22. Lighting switch                      | 42. Screenwash motor                       |
| 3. Inspection sockets                     | 23. Headlamp flash and dip switch        | 43. Coil                                   |
| 4. Speedometer panel illumination         | 24. R.H. indicator warning light         | 44. Choke switch                           |
| 5. Group of instrument panel illumination | 25. L.H. indicator warning light         | 45. Screen wiper motor                     |
| 6. L.H. tail lamp                         | 26. Ignition switch                      | 46. Alternator                             |
| 7. R.H. tail lamp                         | 27. Fuse unit                            | 47. Distributor                            |
| 8. L.H. side lamp                         | 28. Indicator unit                       | 48. Electric fuel pump                     |
| 9. R.H. side lamp                         | 29. Indicator switch                     | 49. Oil pressure switch                    |
| 10. L.H. headlamp dip beam                | 30. Voltage stabiliser unit              | 50. Choke thermostat switch                |
| 11. L.H. headlamp main beam               | 31. Stop lamp switch                     | 51. Differential lock warning light switch |
| 12. Main beam warning light               | 32. Two-speed wiper/wash switch          | 52. Shuttle valve switch                   |
| 13. R.H. headlamp dip beam                | 33. Battery                              | 53. Vacuum low switch                      |
| 14. R.H. headlamp main beam               | 34. Ignition warning light               | 54. Fuel tank unit                         |
| 15. R.H. near indicator                   | 35. Ballast resistor                     | 55. Water temperature unit                 |
| 16. R.H. front indicator                  | 36. Oil pressure warning light           | 56. L.H. stop lamp                         |
| 17. L.H. indicator                        | 37. Choke warning light                  | 57. 3.H. stop lamp                         |
| 18. L.H. rear indicator                   | 38. Differential lock warning light      | 58. 3.H. indicator socket                  |
| 19. Starter motor (Type 33/100)           | 39. Warning light and test button switch | 59. Battery warning light                  |
| 20. Horn push                             | 40. Fuel gauge                           |  |

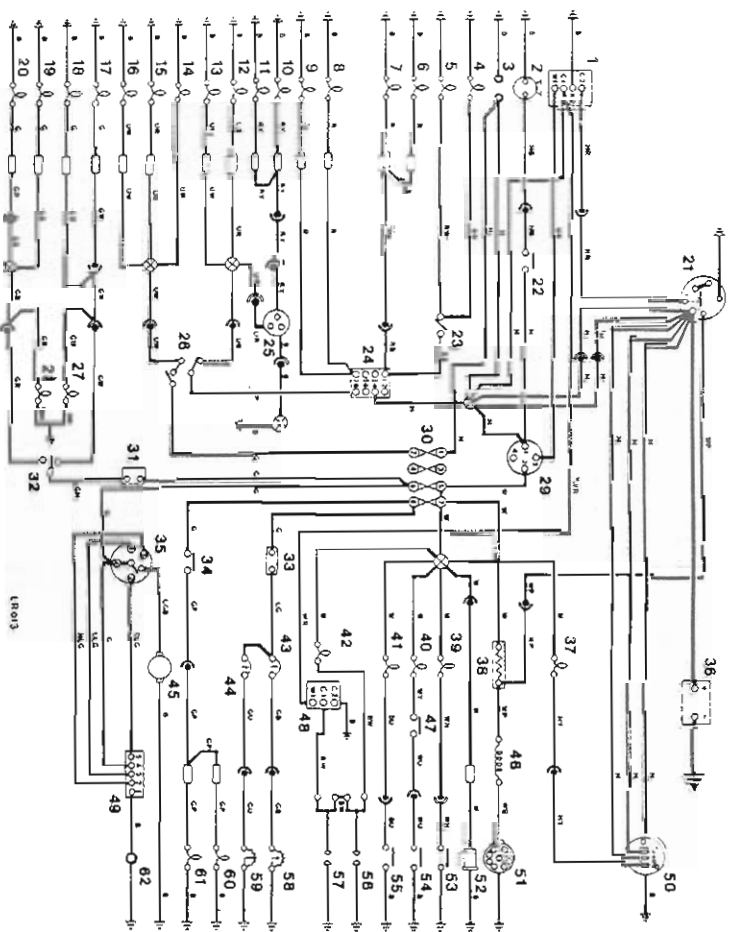
**CABLE COLORS**

B. Black  
 P. Purple  
 Br. Brown  
 U. Yellow  
 W. White  
 R. Red  
 G. Green  
 L. Light



## CIRCUIT DIAGRAM, V8 MODELS, R.H. &amp; L.H. STEERING, NEGATIVE EARTH

Models with rear fog lamps



## KEY TO CIRCUIT DIAGRAM, V8 MODELS, R.H. &amp; L.H. STEERING, NEGATIVE EARTH

Models with rear fog lamps

- |  |  |
|--|--|
| 1. Starter relay                           | 31. Indicator unit                         |
| 2. Horn                                    | 32. Indicator switch                       |
| 3. Inspection sockets                      | 33. Voltage stabilizer unit                |
| 4. Speedometer panel illumination          | 34. Stop lamp switch                       |
| 5. Grouped instrument panel illumination   | 35. Two-speed wiper/wash switch            |
| 6. L.H. tail lamp                          | 36. Battery                                |
| 7. R.H. tail lamp                          | 37. Ignition warning light                 |
| 8. L.H. side lamp                          | 38. Ballast resistor                       |
| 9. R.H. side lamp                          | 39. Oil pressure warning light             |
| 10. R.H. rear fog lamp                     | 40. Choke warning light                    |
| 11. L.H. rear fog lamp (urban fitted)      | 41. Differential lock warning light        |
| 12. L.H. headlamp dip beam                 | 42. Warning light and test button switch   |
| 13. L.H. headlamp main beam                | 43. Fuel gauge                             |
| 14. Main beam warning light                | 44. Water temperature gauge                |
| 15. R.H. headlamp dip beam                 | 45. Screen wash motor                      |
| 16. R.H. headlamp main beam                | 46. Coil                                   |
| 17. R.H. rear indicator                    | 47. Choke switch                           |
| 18. R.H. front indicator                   | 48. Electric fuel pump                     |
| 19. L.H. indicator                         | 49. Screen wiper motor                     |
| 20. L.H. rear indicator                    | 50. Alternator                             |
| 21. Starter motor (type 3M100)             | 51. Distributor                            |
| 22. Horn-push                              | 52. Electric fuel pump                     |
| 23. Panel light switch                     | 53. Oil pressure switch                    |
| 24. Lighting switch                        | 54. Choke thermostat switch                |
| 25. Rear fog lamp switch and warning light | 55. Differential lock warning light switch |
| 26. Headlamp flash and dip switch          | 56. Switch brake fluid pressure            |
| 27. R.H. indicator warning light           | 57. Brake servo vacuum loss switch         |
| 28. L.H. indicator warning light           | 58. Fuel tank unit                         |
| 29. Ignition switch                        | 59. Water temperature unit                 |
| 30. Fuse unit                              | 60. L.H. stop lamp                         |
|  | 61. R.H. stop lamp                         |
|  | 62. Inhibitor socket                       |

## CABLE COLOURS

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

Earth connections via fusing bolts

Earth connection via cable

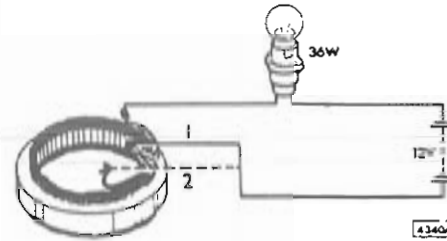
Snap connector or plug and socket

LR 549

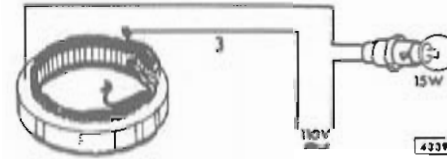
## (c) STATOR—Testing

Equipment required: A 12-volt battery and 36-watt test lamp. A 110-volt a.c. supply and a 15-watt test lamp.

1. Check continuity of stator windings between any pair of wires by connecting in series a 12-volt battery and test lamp of not less than 36 watts. Failure of the test lamp to light means that part of the stator winding is open-circuit and a replacement stator must be fitted.

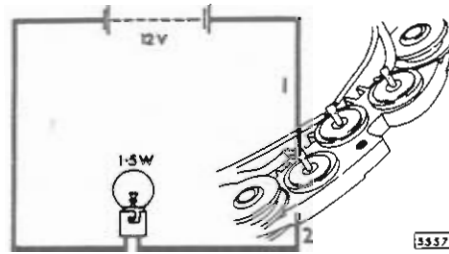


2. Test stator insulation with 110-volt test lamp. Connect test leads to laminated yoke and any one of the three stator cables. If the lamp lights, the stator coils are earthed. A replacement stator must be fitted.



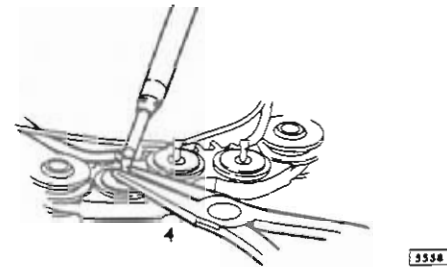
## (d) DIODES—Testing

1. Connect one battery terminal to the heatsink under test.
2. Connect the other battery terminal in series with the test lamp and each diode pin in turn.
3. Reverse connections to heatsinks and diode pins. The lamp should light in one direction only. Should the lamp light in both tests, or not light at all the diode is defective and a new rectifier heatsink assembly must be fitted.



4. To prevent damage to diode assemblies during soldering operations it is important that a thermal shunt is used.

NOTE: Only 'M' grade 45-55 tin-lead solder should be used.



## CONTROL UNIT

—Remove and refit 86.10.24

## Removing

1. Disconnect battery.
2. Remove alternator.
3. Remove alternator end cover by withdrawing two retaining screws.
4. Unsolder stator winding connections at rectifier diodes.  
CAUTION: It is essential to use a thermal shunt and a lightweight soldering iron.
5. Note position of cables at rectifier plates and disconnect.
6. Remove three hexagon headed screws securing brush moulding and regulator to slip-ring end bracket.
7. Remove brush gear and regulator from alternator.

## Refitting

Reverse instructions 1 to 7.

## BATTERY

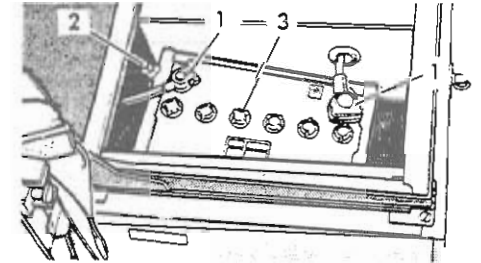
—Remove and refit 86.15.01

## Removing

1. Disconnect the battery.
2. Remove wing nuts and battery retaining frame.
3. Remove battery.

## Refitting

4. Reverse removal procedure, taking care when refitting the battery frame to avoid contact with the battery terminals.



LR 420

## BATTERIES

## Preparation of batteries for service

## Preparation of dry-charged batteries

Batteries intended for export markets are supplied 'dry-charged' and must be filled with electrolyte of the correct specific gravity (s.g.) according to the climate before being put into service.

Dry-charged batteries leave the manufacturer in a fully charged state but may slowly discharge whilst in storage.

Batteries should not be filled with electrolyte until required for service.

Initial charging after filling is not normally necessary; but a freshening charge at the specified recharging rate for four hours may be advantageous.

Remove the vent covers and fill each cell with electrolyte of the correct specific gravity to the top of the perforated separator guard in one operation.

The temperature of the charging room, battery and electrolyte should be maintained between 15.6°C and 37.7°C (60°F and 100°F). If the battery has been stored in a cool place, it should be allowed to warm up to room temperature before filling.

If the temperature of any cell rises above the permissible maximum, the charge must be interrupted until the temperature has fallen to 5.5°C (10°F) below that figure.

During charging, ensure that the electrolyte is level with the top of the separator guard, by the addition of electrolyte of the same specific gravity as used in the initial filling of the battery, until the specific gravity and voltage readings have remained constant for five successive hourly readings.

If the charging continues when the specific gravity has remained constant for five hours, top-up the battery to the level of the separator guard with distilled water. Electrolyte 'frothing' may occur during the first few hours of charging. This can be overcome by REDUCING the charging current.

On completion of charging, check the specific gravity in each cell, to ensure that it is within the specified units at 15.5°C (60°F).

If any cell requires adjustment, some of the electrolyte must be syphoned off and replaced, either by distilled water, or by electrolyte of the specific gravity used originally in the filling of the battery, depending on whether the specific gravity is too high or low.

**NEVER TRANSFER ELECTROLYTE FROM ONE BATTERY OR CELL TO ANOTHER.**

Continue the charging for an hour to ensure adequate mixing of the electrolyte, and again check the specific gravity readings. If necessary, repeat the adjustment process until the desired specific gravity reading is obtained in each cell. Allow the battery to cool and syphon off any electrolyte above the top of the separator guard.

## Electrolyte filling precautions

When dry, uncharged batteries are filled, heat is created from the mixing of the filling acid with moisture in the plates, and also as a result of chemical action on the negative plates.

With batteries in moulded containers this heat may crack the containers; therefore batteries must be filled in two stages.

In the first stage the battery should be half-filled and allowed to cool for 6 to 12 hours.

The battery should then be filled to the level of the separator guard and allowed to cool for a further two hours to complete the second stage.

## Initial charging

Ensure that the battery has stood for 12 hours before commencing the initial charging procedure. Ascertain the electrolyte level is correct prior to charging.

The initial charging rate is given in the Specification section.

Charge the battery at the specified rate until the voltage and specific gravity readings show no increase over five successive hourly readings.

The charging duration is from 48 to 80 hours, dependent upon the storage period of the battery. Maximum permissible electrolyte temperature during charge is:  
Climates below 26.6°C (80°F): 37.7°C (100°F).  
Climates over 26.6°C (80°F): 48.8°C (120°F).

Keep the current constant by varying the series resistance of the circuit. This charge should not be broken by long rest periods.

## Preparation of electrolyte

Approximately 790 cc (1½ pint) of sulphuric acid is required for each two-volt cell.

The specific gravity (s.g.) of the electrolyte required when filling is:

Climates normally below 26.6°C (80°F)—1.260 (corrected to 15.5°C (60°F)).  
Climates normally above 26.6°C (80°F)—1.210 (corrected to 15.5°C (60°F)).

Electrolyte is prepared by mixing distilled water and concentrated sulphuric acid to the required specific gravity (usually s.g. 1.840).

The mixing of the electrolyte must be carried out either in a lead-lined tank or in a suitable glass or earthenware vessel.

**SLOWLY** add the acid to the distilled water. **NEVER ADD THE WATER TO THE ACID**, as the resultant chemical reaction causes violent spurring of the sulphuric acid.

The approximate proportion of sulphuric acid and distilled water is as follows:

To obtain a specific gravity (corrected to 15.5°C (60°F)) of:

1.260

1.210

Add 1 vol. of acid of 1.840 specific gravity (corrected to 15.5°C (60°F)) to

3.2 volumes of water (1.260 specific gravity)

4.3 volumes of water (1.210 specific gravity).

Heat is produced by the mixture of acid and water, therefore the electrolyte should be allowed to cool before taking hydrometer readings and pouring the electrolyte into the battery.

## Hydrometer tests

The specific gravity (s.g.) of acid is measured using a hydrometer. Never take a hydrometer reading immediately after replenishing the battery with distilled water. The readings given by each cell should be approximately the same. If one cell differs appreciably from the others, an internal fault in the cell is indicated. The appearance of the electrolyte drawn into the hydrometer gives an indication of the state of the plates. If the electrolyte is very dirty, or contains small particles in suspension, the plates may be in a poor condition.

The electrolyte specific gravity varies with temperature. All calculations are always corrected to 15.5°C (60°F). This is known as the reference temperature.

**NOTE:** The temperature must be that indicated by a thermometer actually immersed in the electrolyte and not the air temperature.

For every 2.8°C (5°F) BELOW 15.5°C (60°F), DEDUCT 0.002 from the specific gravity reading to obtain the true specific gravity at 15.5°C (60°F).

For every 2.8°C (5°F) ABOVE 15.5°C (60°F), ADD 0.002 from the specific gravity reading, to obtain the true specific gravity at 15.5°C (60°F).

## Recharging from an external supply

If a high discharge rate test indicates that the battery is nearly discharged, and is otherwise in good condition, it should be recharged, either on the vehicle by a period of daytime running, or on a bench from an external supply.

If the battery is to be charged on the bench, the charging rate should not exceed 5 amperes.

The battery is fully charged when the specific gravity of the electrolyte and voltage show no increase over three successive hourly readings. During the charge, the electrolyte level should be checked regularly and replenished as necessary with distilled water.

## Boost charging

Boost charging must be regarded as an emergency measure only.

Boost charging must be limited to a maximum period of one hour only, with a charge rate not greater than the ampere-hour capacity of the battery.

As the battery state-of-charge rises, the charging rate will fall, but must NOT be re-adjusted to the original state.

Ah Rating of Battery	At 10 hr Rate	At 20 hr Rate	MAXIMUM Boost Charging Rate
60Ah	6A	3A	6A

## Maintenance precautions

The maintenance is identical for each type of battery. Wipe away any foreign matter or moisture from the top of the batteries. Use diluted ammonia on a lint-free cloth to neutralize acid spillage or sulphation. Ensure all connections are clean and tight.

Remove the battery vent covers and check the electrolyte level.

Clean the surfaces of the battery connectors and posts; and lightly coat them with petroleum jelly. Each day, inspect the level of electrolyte in the cells.

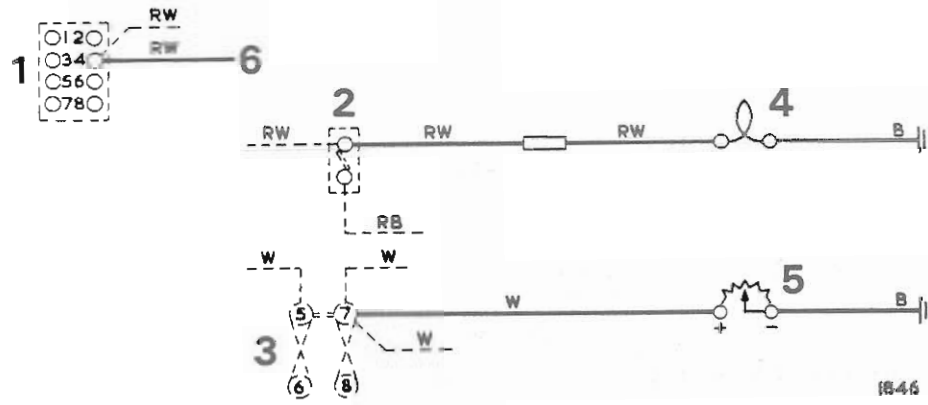
**NOTE:** Never use a naked light when examining a battery, as the mixture of oxygen and hydrogen given off by the battery on charge, and to a lesser extent when standing idle, can be dangerously explosive.

If necessary, add distilled water to bring the level of electrolyte to the top of the perforated separator guard.

Distilled water should always be used for topping-up. Clean rain water or melted snow can be used in an emergency.

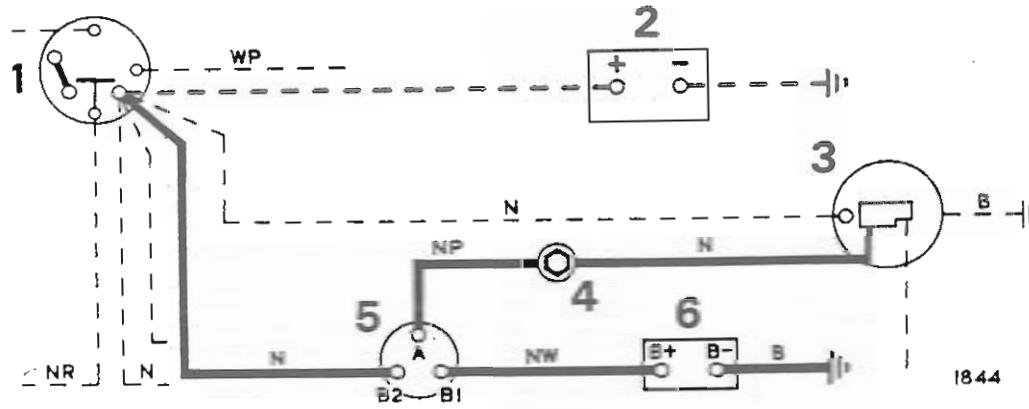
The following **MUST NOT BE USED**: salt water, chlorinated water, chemically softened water, boiled water or stagnant water.





Battery Voltmeter

1. Lighting switch
2. Panel light switch
3. Fuse unit
4. Voltmeter illumination
5. Battery voltmeter
6. To voltmeter illumination

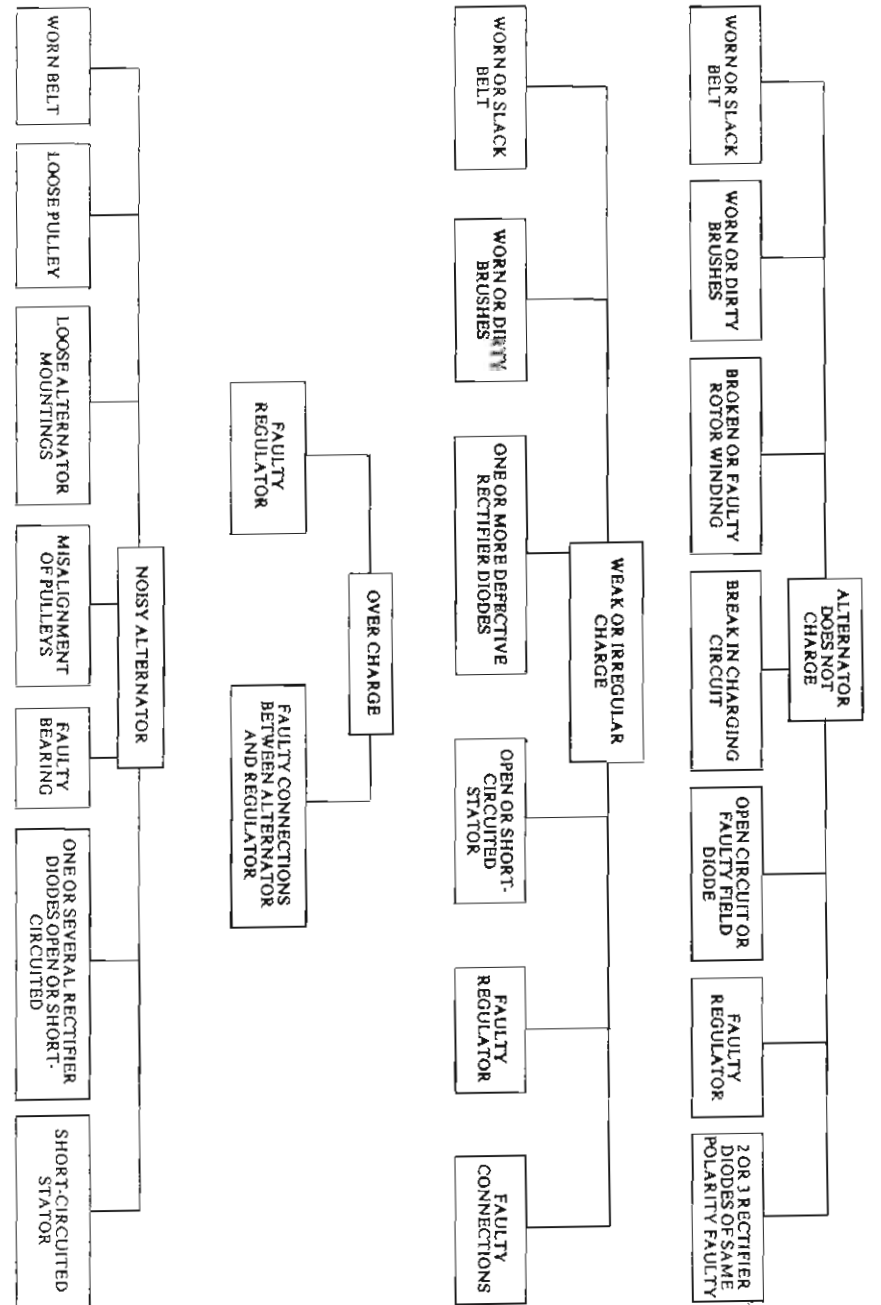


Split Charge System

1. Starter motor
2. Battery
3. Alternator
4. Terminal post
5. Split charge diode Lucas type 485D
6. Terminal box

- KEY TO CABLE COLOURS
- |          |           |
|----------|-----------|
| B. Black | P. Purple |
| N. Brown | U. Blue   |
| W. White | R. Red    |
| G. Green | L. Light  |
| S. Slate |           |

SYMPTOM AND DIAGNOSIS CHART



CHECK EACH ITEM IN TURN AND RECTIFY IF NECESSARY BEFORE PROCEEDING TO NEXT ITEM.

## ALTERNATOR

—Description 86.10.00

The Lucas alternator type 18ACR fitted to the vehicle is a high output, three-phase machine which produces current at idling speed.

The heatsink-rectifier, terminal block assembly can be removed complete. There are six silicon diodes connected to form a full wave rectifier bridge circuit, and three silicon diodes which supply current to the rotor winding. Individual diodes cannot be removed from the heatsink assemblies. Regulation is by a Lucas type 8TRD control unit mounted in the slip-ring end bracket. There is no provision for adjustment in service.

Individual connectors are used to connect external wiring to the alternator. The alternator's main negative terminals are connected internally to the body of the machine. Provision is made for the connection of external negative wiring if required.

## ALTERNATOR—18ACR

—Test (in situ) 86.10.01

## (a) Output Test

Equipment required: A moving-coil ammeter or multi-range test meter on range 0 to 75 amperes.

This test should be carried out with the alternator at normal temperature. Run cold engine at 3000 rev/min for 3 to 4 minutes.

1. Disconnect battery earth lead.
2. Connect ammeter in series with alternator main output cable and starter solenoid.
3. Remove connectors from alternator. Remove moulded end cover and re-make connectors.
4. Connect jumper lead to short out the 'F' and '-' terminals of the control unit.  
(This makes regulator inoperative by effectively linking 'F' green lead to alternator frame.)
5. Re-connect battery earth lead.
6. Switch on all vehicle lighting, headlights on main beam. Switch on ignition and check warning light is on.
7. Start engine, slowly increase speed to 3000 rev/min. Ammeter reading should equal maximum rated output of:  
45 amperes—ACR18.

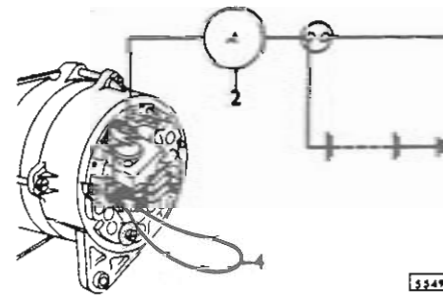
## Surge Protection Device

The surge protection device is a special avalanche-diode, fitted to the outer face of the slip-ring end bracket (not to be confused with a suppression capacitor, similarly fitted in the end bracket). The avalanche-diode is connected between terminal 'IND' and frame and its purpose is to protect the regulator from damage by absorbing high transient voltages which occur in the charging system due to faulty cable connections, or if the cables are temporarily disconnected at the battery whilst the engine is running. (The surge protection device is intended to provide limited protection for the regulator under normal working conditions and therefore the service precaution not to disconnect any of the charging system cables, particularly those at the battery, whilst the engine is running, should still be observed.)

**CAUTION:** No part of the charging circuit should be connected or disconnected while the engine is running.

When using electric arc welding equipment in the vicinity of the engine take the following precautions to avoid damage to the semi-conductor devices used in the alternator and control unit and also the ignition system.

Disconnect battery earthed lead.  
Disconnect alternator output cables.



5349

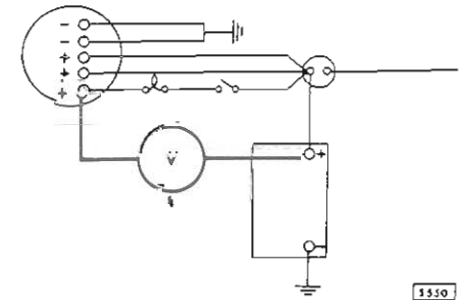
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## (b) Voltage Drop Test (in situ)

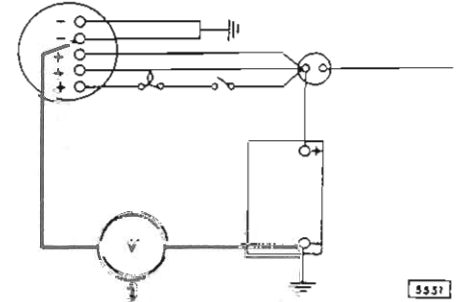
Equipment required: A moving-coil voltmeter multi-range test meter on 0 to 30 volt range.

To check for high resistance in the charging circuit.

1. Connect voltmeter between battery +ve terminal and alternator main output terminal.
2. Switch on all vehicle lighting, headlights on main beam.  
Start engine and run at 3000 rev/min. Note voltmeter reading. Stop engine.
3. Transfer voltmeter connections to battery earth and alternator negative terminal.
4. Repeat instruction 2. Note voltmeter reading.
5. Voltage should not exceed 0.5 volts for positive side. Higher readings indicate high resistance in the circuit.



5350



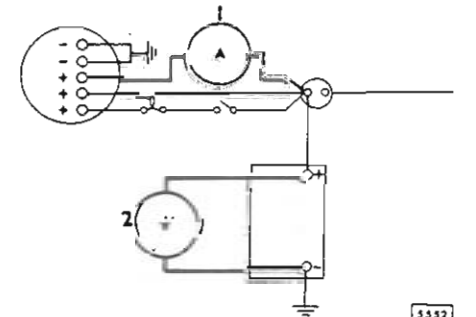
5351

## (c) Control Unit Test

Equipment required: A moving-coil ammeter and moving-coil voltmeter or multi-range test meters.

Circuit wiring must be in good condition and all connections clean and secure. The battery must be in a well charged condition or be temporarily replaced by a charged unit.

1. Connect ammeter in series with starter solenoid and alternator main output cable.
2. Connect voltmeter between battery terminals.
3. Start engine and run at 3000 rev/min until the ammeter reads less than 10 amperes. Voltmeter reading should be between 13.6 volts and 14.4 volts.
4. An unstable reading or a reading outside the specified limits indicates a faulty control unit.



5352

## ALTERNATOR—18ACR

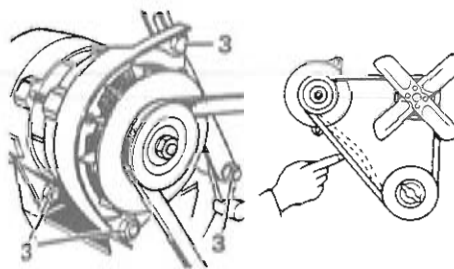
—Remove and refit 86.10.02

## Removing

1. Disconnect battery earth lead.
2. Disconnect leads from alternator.
3. Slacken alternator fixings, pivot alternator inwards and remove fan belt.
4. Remove alternator.

## Refitting

5. Attach the alternator lower fixing bolts and nuts.  
NOTE: The fan guard is attached to the front fixing.
6. Slacken the alternator adjustment bracket and attach the alternator to the bracket.  
NOTE: The fan guard is attached to the adjustment bracket bolt.
7. Fit the fan belt and adjust the belt tension, see 86.10.05.
8. Connect the wiring plug to the alternator.
9. Connect the battery.



LR 418

## ALTERNATOR DRIVE BELT

Remove and refit 86.10.03

## Removing

1. Slacken the alternator fixings.
2. Pivot the alternator inwards.
3. Lift off the fan belt.

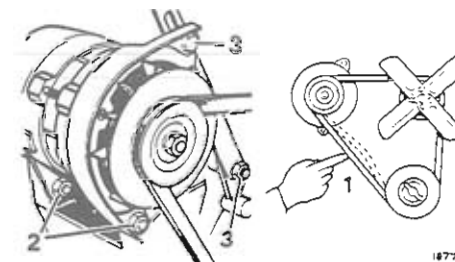
## Refitting

4. Locate the fan belt on the pulleys.
5. Using the alternator slotted fixing, adjust the fan belt tension to give 11 to 14 mm (0.437 to 0.562 in) free movement when checked midway between the alternator and crankshaft pulleys, by hand.
6. Secure the alternator fixings.

## ALTERNATOR DRIVE BELT

—Check and adjust tension 86.10.05

1. Check by thumb pressure between alternator and crankshaft pulleys. Movement should be: 11 to 14 mm (0.437 to 0.562 in).  
If necessary, adjust as follows:
2. Slacken the bolts securing the alternator to the mounting bracket.
3. Slacken the fixings at the top and bottom of the adjustment link.
4. Pivot the alternator inwards or outwards as necessary and adjust until the correct tension is obtained, tighten the bolt at the top of the adjustment link.
5. Finally tighten the nut securing the bottom of the adjustment link and the two mounting bracket bolts.



1877

## ALTERNATOR—18ACR

Overhaul 86.10.08

## Dismantling

1. Withdraw two retaining screws and remove moulded slip-ring end cover.
2. Note positions of stator winding connections to rectifier connecting pins.
3. Using thermal shunt and lightweight soldering iron (25 watt), unsolder connections.
4. Note position of cable connectors to rectifier plates.
5. Disconnect cables.
6. Withdraw three hexagon headed screws securing brushbox and regulator to slip-ring end bracket.
7. Remove brushbox moulding and regulator assembly.
8. Slacken rectifier securing nut and remove rectifier.

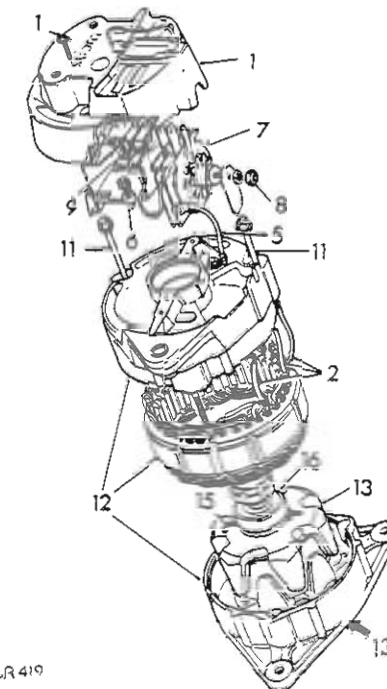
## Brushgear

9. Renew brush and spring assemblies if brushes are worn to 0.312 in (8 mm).
10. Check brush spring pressure with push-type spring gauge to end of brush. Spring pressure should be 9 to 13 ozf (255 to 368 gf or 2.5 to 3.6 N) when brush is flush with moulding.

## Slip-rings

If necessary, clean slip-rings with petrol moistened cloth or very fine glass paper.  
NOTE: Do not use emery cloth or similar abrasive.

continued



LR 419

## Further dismantling

11. Withdraw three through-bolts.
12. Separate alternator into its major components.
  - a Slip-ring end bracket.
  - b Drive end bracket, rotor, fan and pulley.
  - c Stator laminations and windings.
13. Separate rotor from drive end bracket by removing pulley, fan and shaft key. Press rotor shaft from bearing.
14. Inspect bearings and if satisfactory pack with grease, Shell Alvania 'RA'.
 

NOTE: To pack slip-ring end bearing with grease it is first necessary to remove slip-ring moulding.

## Bearings

## Slip-ring end:

15. Unsolder field windings from slip-ring moulding.
16. Remove slip ring moulding.
17. Press bearing from shaft.

## Drive end:

18. Remove circlip and retaining plate from drive end bearing.
19. Press out bearing.

## Reassembly

Reverse instructions 1 to 19.

## ALTERNATOR

## —Inspection and testing

86.10.14

## Brush gear and slip-ring inspection

The serviceability of the brushes is gauged by the length protruding beyond the brush moulding in the free position. This amount should exceed 0.3 in (8 mm). If renewal is necessary care must be taken to replace the leaf spring at the side of the inner brush.

The surface of the slip-rings should be smooth and free from grease or dirt. Servicing is confined to cleaning with a petrol-moistened cloth or finest grade glass-paper.

NOTE: Emery cloth or similar abrasive must not be used. The slip-rings cannot be machined.

## (a) Brush replacement

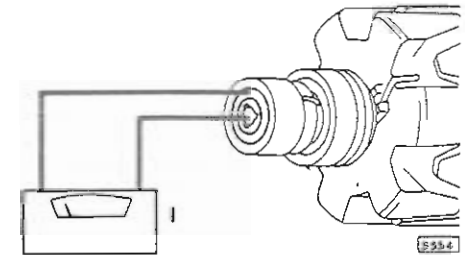
1. Remove the small screws securing the brush retaining plates and regulator cables.
2. Replace brushes with new units and refit brush retaining plates and regulator cables.
3. Brush spring pressure should be checked with a push-type spring tension gauge. This should indicate 9 to 13 ozf (255 to 368 gf) when brush face is flush with the moulding.

continued

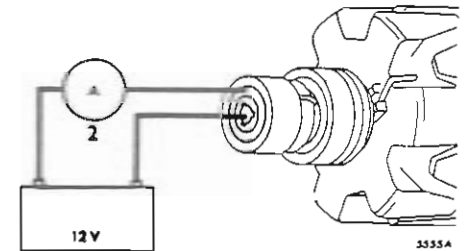
## (b) ROTOR—Testing

Equipment required: An ohmmeter, or a 12-volt battery and ammeter. A 110-volt a.c. supply and a 15-watt test lamp.

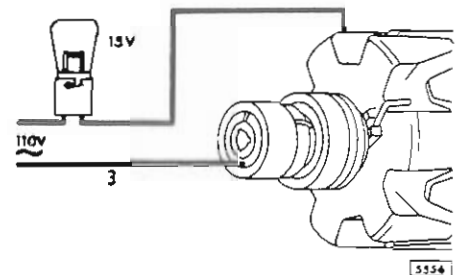
1. Connect the ohmmeter between the slip-rings. Resistance should be 3.2 ohms at 20°C.



2. Alternatively, connect ammeter and battery between slip-rings. The ammeter should read approximately 3 amperes.



3. To test for defective insulation between slip-rings and rotor poles connect the 110-volt supply and 15-watt test lamp between slip-rings and rotor poles in turn. If the lamp lights, the coil is earthed to the rotor core. A replacement rotor, slip-ring assembly should be fitted.



## SPARK PLUGS

— Remove, clean, adjust and refit

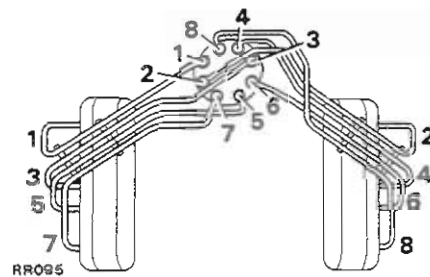
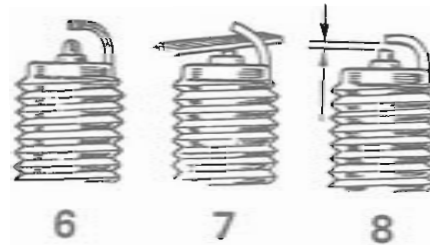
86.35.01

## Removing

1. Withdraw leads by gripping end shrouds. DO NOT pull leads alone.
- NOTE: Remove the hot air pipe for access to the R.H. plugs as necessary.
2. Using special spanner and tommy bar supplied in vehicle tool kit, remove spark plugs and washers.

## Cleaning

3. Fit plug in plug cleaning machine.
  4. Wobble plug with circular motion while operating abrasive blast for a maximum of four seconds.
- CAUTION: Excessive abrasive blasting will erode insulator nose.
5. Change to air blast only and continue to wobble plug for a minimum of thirty seconds to remove abrasive grit from plug cavity.
  6. Wire-brush plug threads, open gap slightly.
  7. Using point file, square off electrode surfaces.
  8. Set electrode gap: 0,80 mm (0.030 in).
  9. Test plugs in accordance with cleaning machine manufacturer's instructions. If satisfactory, refit plugs in engine.
- IMPORTANT: If new plugs are necessary, refer to Section 0,5
10. Examine high tension leads, including coil to distributor lead, for insulation cracking or corrosion at end contacts. Fit new leads as necessary.
  11. In addition to correct firing order, high tension leads must also be fitted in correct relation to each other to avoid cross firing. Figures in arrowed circles show plug lead numbers.
  12. Leads at distributor cap must be connected as illustrated.
- Figures 1 to 8 inclusive indicate plug lead numbers.  
RH—Right-hand side of engine when viewed from rear.  
LH—Left-hand side of engine when viewed from rear.
13. When pushing leads on plugs ensure ferrules within shrouds are firmly seated on plugs. A guide is that shroud ends are within 6 mm (0.250 in) of metal body of plugs.



## DISTRIBUTOR

— Remove and refit

86.35.10

## Removing

1. Disconnect battery.
2. Disconnect vacuum pipe.
3. Remove distributor cap.
4. Disconnect low tension lead from coil.
5. Mark distributor body in relation to centre line of rotor arm.
6. Add alignment marks to distributor and front cover.

NOTE: Marking distributor enables refitting in exact original position, but if engine is turned while distributor is removed, complete ignition timing procedure must be followed.

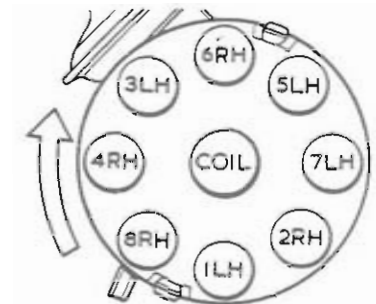
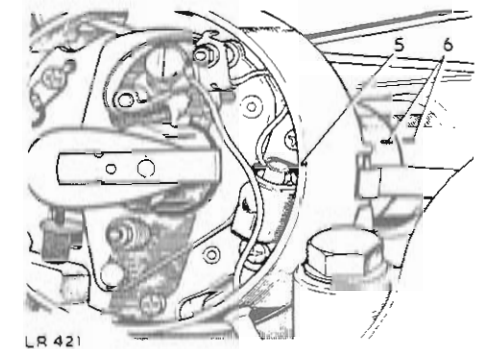
7. Release the distributor clamp and remove the distributor.

## Refitting

NOTE: If a new distributor is being fitted, mark body in same relative position as distributor removed.

8. Leads for distributor caps should be connected as illustrated.
- Figures 1 to 8 inclusive indicate plug lead numbers.  
RH—Right-hand side of engine when viewed from the rear.  
LH—Left-hand side of engine when viewed from the rear.
9. If engine has not been turned whilst distributor has been removed, proceed as follows (instructions 10 to 17).
  10. Fit new 'O' ring seal to distributor housing.
  11. Turn distributor drive until centre line of rotor arm is 30° anti-clockwise from mark made on top edge of distributor body.
  12. Fit distributor in accordance with alignment markings.
- NOTE: It may be necessary to align oil pump drive shaft to enable distributor drive shaft to engage in slot.
13. Fit clamp and bolt. Secure distributor in exact original position.
  14. Connect vacuum pipe to distributor and low tension lead to coil.
  15. Fit distributor cap.
  16. Reconnect battery.
  17. Using suitable electronic equipment, set dwell angle and ignition timing as follows.
  18. If, with distributor removed, engine has been turned it will be necessary to carry out the following procedure.

continued



19. Set engine—No. 1 piston to static ignition timing figure (see Section 05) on compression stroke.
20. Turn distributor drive until rotor arm is approximately 30° anti-clockwise from number one spark plug lead position on cap.
21. Fit distributor to engine.
22. Check that centre line of rotor arm is now in line with number one spark plug lead on cap. Reposition distributor if necessary.
23. If distributor does not seat correctly in front cover, oil pump drive is not engaged. Engage by lightly pressing down distributor while turning engine.
24. Fit clamp and bolt, leaving both loose at this stage.
25. Turn engine back until crankshaft pulley static ignition timing mark passes timing pointer on front cover, then turn engine forward until pointer aligns with the static ignition timing value.
26. Rotate distributor anti-clockwise until contact points just start to open.
27. Secure distributor in this position by tightening clamp bolt.
28. Connect vacuum pipe to distributor and low tension lead to coil.
29. Fit distributor cap.
30. Reconnect battery.
31. Using suitable electronic equipment, set dwell angle and ignition timing as follows:

#### Ignition timing and dwell angle settings

Ignition timing: Refer to Section 05.

Dwell angle: 26° to 28° (58 to 62%)

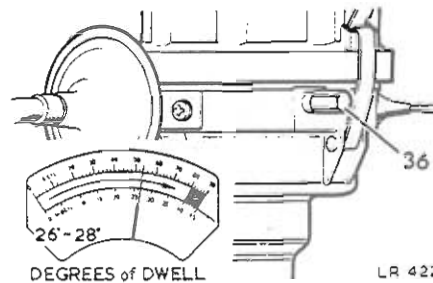
NOTE: It is essential that the following procedure is adhered to. Inaccurate timing can lead to serious engine damage.

32. Set ignition timing statically, prior to engine being run, by basic lamp timing method. (This sequence is to give only an approximation in order that engine may be run. On no account should engine be started before this check is carried out.)
33. Start engine and set idling speed to 650 rev/min as detailed in Section 05.

#### Set dwell angle as follows:

34. Set selector knob to 'calibrate' position. Adjust calibration knob to give a zero reading on meter.
35. Couple up Tach-dwell meter to engine following manufacturer's instructions.
36. Set selector knob to 8-cylinder position and Tach-dwell selector knob to 'dwell'. Adjust distributor dwell angle by turning hexagon headed adjustment screw on distributor body until meter reads 26° to 28°. If meter used does not have an 8-cylinder position, set selector knob to 4-cylinder position and adjust at distributor until meter reads 52° to 56°. Uncouple Tach-dwell meter.

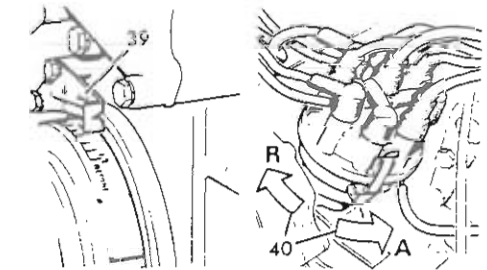
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#### Set ignition timing as follows:

37. Couple stroboscopic timing lamp to engine following manufacturer's instructions, with high tension lead attached into No. 1 cylinder plug lead.  
NOTE: The vacuum pipes must not be disconnected from the distributor.
38. Check distributor clamping bolt is slack and engine idle speed is 650 rev/min.
39. Check ignition timing. Stroboscopic lamp must synchronize timing pointer and timing mark on crankshaft pulley to value indicated in Section 05.
40. If necessary, adjust timing. Turn distributor clockwise to retard or anti-clockwise to advance.
41. Tighten distributor clamping bolt.
42. Disconnect stroboscopic timing lamp.

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



#### Automatic ignition advance mechanism

The distributor incorporates two automatic ignition advance mechanisms—a vacuum-controlled unit related to carburetter choke depression and a centrifugally-controlled unit related to engine speed. Both units are connected to the contact breaker assembly, and operate independently, progressively moving the contact breaker through a small arc about the cam.

A loss of engine performance, particularly a sudden loss, could be due to a malfunction of either of the automatic advance mechanisms, and where suitable electronic engine tuning and testing equipment is available, both units can be checked against the figures detailed in Section 05—Engine Tuning Data.

The test should commence at maximum advance conditions and be checked during deceleration.

## DISTRIBUTOR

—Overhaul

86.35.26

NOTE: Four slightly varying designs of distributor may be fitted. The instructions below are generally applicable to all units unless otherwise stated.

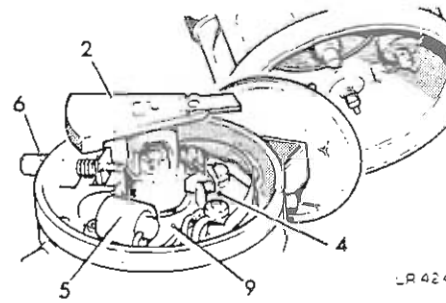
## Dismantling

1. Unclip and remove distributor cap.
2. Withdraw rotor arm and felt lubricating pad.
3. Remove contact spring or remove the nut and lift off the insulating bush together with the low tension and capacitor leads.
4. Remove the Quikafit contact set.
5. Remove the capacitor.
6. Remove the dwell angle adjuster screw and spring.
7. Remove the earth lead from the centrifugal advance cover-plate.
8. Remove the vacuum unit and grommet.
9. Remove the contact breaker base plate.
10. Remove the centrifugal advance cover-plate.
11. Carefully withdraw the two springs from the centrifugal advance unit.
12. Remove the screw from inside the cam and lift off the cam and cam foot.
13. Remove the two weights.
14. Drive out the pin securing the driving gear and remove the gear and tab washer.
15. Check all parts for wear or damage and replace as necessary.

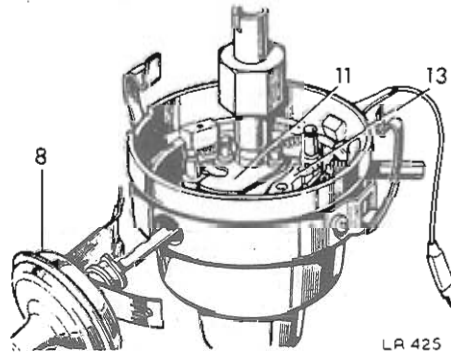
## Assembling

16. Reassemble the distributor by reversing the dismantling instructions.  
NOTE: It will assist reassembly if the vacuum advance lever is located to the base plate by the Quikafit contacts before the vacuum unit is secured to the distributor body.
17. When fitting the centrifugal governor springs, take care not to stretch them.
18. When fully assembled the points can be set to a clearance of 0,35 to 0,40 mm (0.014 to 0.016 in) as an initial guide before refitting to the engine.

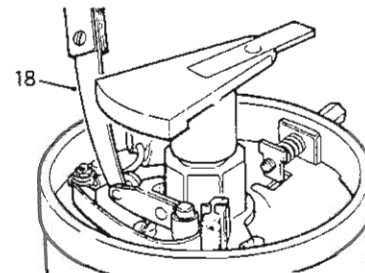
NOTE: It is most important that the dwell angle is adjusted to 26° to 28° using specialized equipment when the distributor has been refitted.



LR 424



LR 425



LR 426

## DIFFERENTIAL LOCK ILLUMINATION LAMP

—Remove and refit

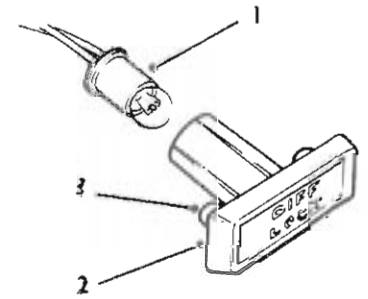
86.45.42

## Removing

1. From behind the fascia withdraw the warning light bulb.
2. Gently press the warning lamp body forward until it can be withdrawn from the fascia.

## Refitting

3. Reverse instructions 1 and 2, ensuring that the locating lugs are correctly positioned.



0093

## BRAKE FAILURE WARNING/TEST BULB

—Remove and refit

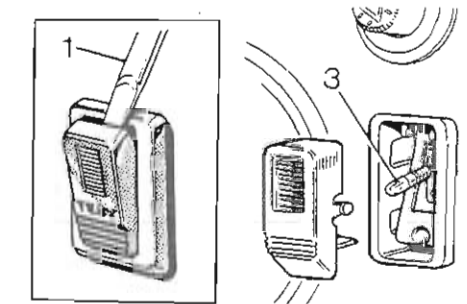
86.45.69

## Removing

1. Depress the lower edge of the rocker switch ('on' position) and insert the blade of a screwdriver between the exposed upper edge of the rocker switch and the switch body.
2. Gently prise off the rocker switch to expose the bulb.
3. Unscrew the bulb.

## Refitting

4. Fit a new bulb.
5. Press the rocker switch into position in the switch body.



LR 347

## STARTER MOTOR

—Remove and refit 86.60.01

## Removing

1. Place the car on a suitable ramp.
2. Disconnect the battery.
3. Disconnect the leads from the solenoid and starter motor and remove the exhaust heat shield where fitted.
4. Remove the two bolts securing the starter motor to the flywheel housing.
5. Remove starter motor from underneath the vehicle.

## Refitting

6. Reverse the removal procedure.
7. Tighten the bolts securing the starter motor to cylinder block to a torque of 4.0 to 4.9 kgf m (30 to 35 lbf ft).

## STARTER SOLENOID

—Remove and refit 86.60.08

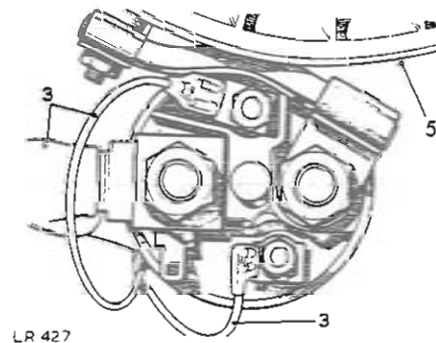
## Removing

1. Place the car on a suitable ramp.
2. Disconnect the battery.
3. Disconnect the leads from the solenoid and starter motor.
4. Remove the two bolts securing the starter motor to the flywheel housing.
5. Remove the starter motor from underneath the vehicle.

NOTE: The starter solenoid is integral with the starter motor. Refer to the starter motor overhaul procedure for dismantling.

## Refitting

6. Reverse the removal procedure.
7. Tighten the bolts securing the starter motor to cylinder block to a torque of 4.0 to 4.9 kgf m (30 to 35 lbf ft).



LR 427

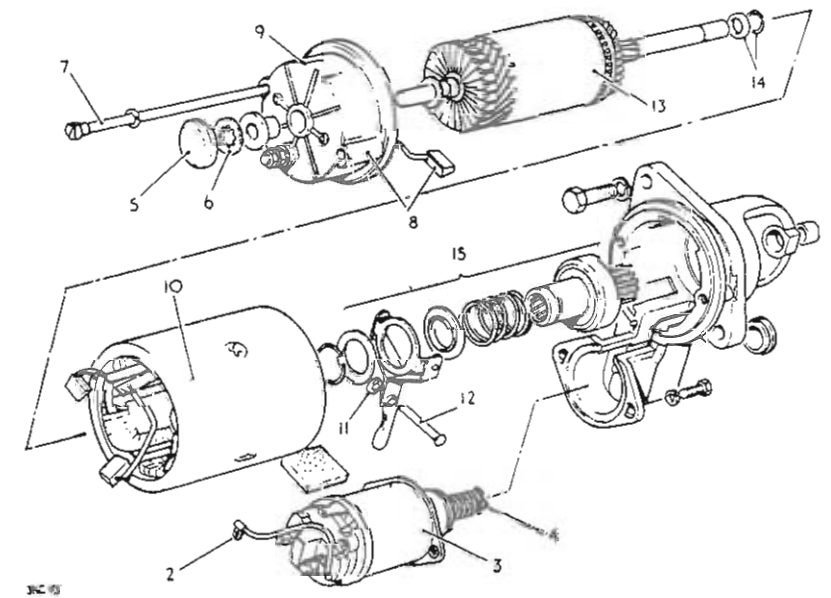
## STARTER MOTOR—Lucas 3M100PE

—Overhaul 86.60.13

## Dismantling

1. Remove the starter motor, see 86.60.01.
2. Remove the connecting link between the starter and the solenoid terminal 'STA'.
3. Remove the solenoid from the drive end bracket.
4. Grasp the solenoid plunger and lift the front end to release it from the top of the drive engagement lever.
5. Remove the end cap seal.
6. Using an engineer's chisel, cut through a number of the retaining ring claws until the grip on the armature shaft is sufficiently relieved to allow the retaining ring to be removed.

7. Remove the two through-bolts.
8. Partially withdraw the commutator end cover and disengage the two field coil brushes from the brush box.
9. Remove the commutator end cover.
10. Withdraw the yoke and field coil assembly.
11. Remove the retaining ring from the drive engagement lever pivot pin, using the method previously described.
12. Withdraw the pivot pin.
13. Withdraw the armature.
14. Using a suitable tube, remove the collar and jump ring from the armature shaft.
15. Slide the thrust collar and the roller clutch drive and lever assembly off the shaft.



continued



## Inspecting

## Clutch

16. Check that the clutch gives instantaneous take-up of the drive in one direction and rotates easily and smoothly in the other direction.
17. Ensure that the clutch is free to move round and along the shaft splines without any tendency to bind. **NOTE:** The roller clutch drive is sealed in a rolled steel cover and cannot be dismantled.
18. Lubricate all clutch moving parts with Shell SB 2628 grease for cold and temperate climates or Shell Retinax 'A' for hot climates.

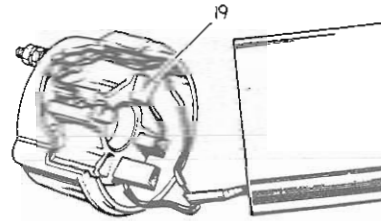
## Brushes

19. Check that the brushes move freely in the brush box moulding. Rectify sticking brushes by wiping with a petrol-moistened cloth.
20. Fit new brushes if they are damaged or worn to approximately 9,5 mm (0.375 in).
21. Using a push-type spring gauge, check the brush spring pressure. With new brushes pushed in until the top of the brush protrudes about 1,5 mm (0.065 in) from the brush box moulding, the spring pressure reading should be 1,0 kgf (36 ozf).
22. Check the insulation of the brush springs by connecting a 110V a.c. 15W test lamp between a clean part of the commutator end cover and each of the springs in turn. The lamp should not light.

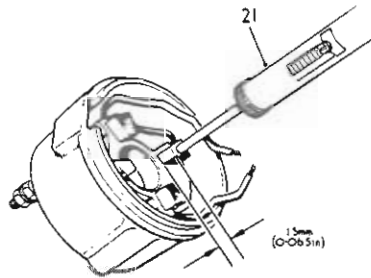
## Armature

23. Check the commutator. If cleaning only is necessary, use a flat surface of very fine glass paper, and then wipe the commutator surface with a petrol-moistened cloth.
24. If necessary, the commutator may be machined providing a finished surface can be obtained without reducing the thickness of the commutator copper below 3,5 mm (0.140 in), otherwise a new armature must be fitted. **Do not undercut the insulation slots.**
25. Check the armature insulation by connecting 110V a.c. 15W test lamp between any one of the commutator segments and the shaft. The lamp should not light; if it does light, fit a new armature.

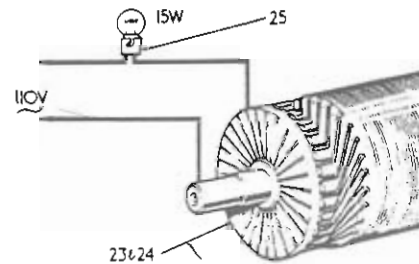
continued



3RC94



3RC95



3RC96

## Field coil insulation

26. Disconnect the end of the field winding where it is riveted to the yoke, by filing away the riveted over end of the connecting-eyelid securing rivet, sufficient to enable the rivet to be tapped out of the yoke.
27. Connect a 110V a.c. 15W test lamp between the disconnected end of the winding and a clean part of the yoke.
28. Ensure that the brushes or bare parts of their flexibles are not touching the yoke during the test.
29. The lamp should not light; if it does light, fit a new field coil assembly.
30. Re-secure the end of the field winding to the yoke.

## Field coil continuity

31. Connect a 12V battery-operated test lamp between each of the brushes in turn and a clean part of the yoke.
32. The lamp should light; if it does not light, fit a new field coil assembly.

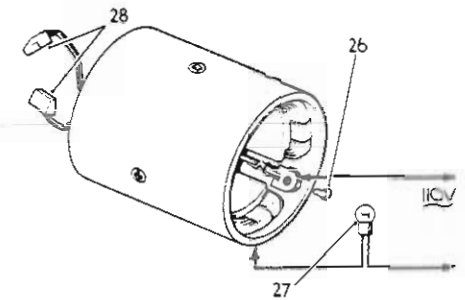
## Solenoid

33. Disconnect all cables from the solenoid terminals and connectors.
34. Connect a 12V battery and a 12V 60W test lamp between the solenoid main terminals. The lamp should not light; if it does light, fit new solenoid contacts or a new solenoid complete.
35. Leave the test lamp connected and, using the same 12V battery supply, energize the solenoid by connecting 12V between the small solenoid operating Lucar terminal blade and a good earth point on the solenoid body.
36. The solenoid should be heard to operate and the test lamp should light with full brilliance, otherwise fit new solenoid contacts or a new solenoid complete.

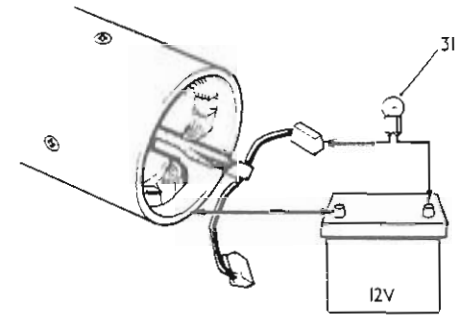
## Reassembling

37. Reverse instructions 1 to 15, including the following:
38. Fit the commutator end cover before refitting the solenoid to facilitate assembly of the block-shaped grommet which, when assembled, is compressed between the yoke, solenoid and fixing bracket.
39. Ensure that the internal thrust washer is fitted to the commutator end of the armature shaft.
40. Tightening torques:
 

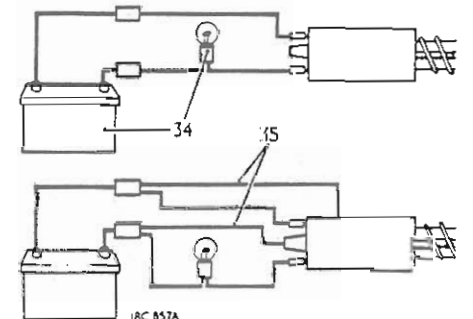
Through-bolts	1.1 kgf m (8.0 lbf ft).
Solenoid fixing stud nuts	0.6 kgf m (4.5 lbf ft).
Solenoid upper terminal nuts	0.4 kgf m (3.0 lbf ft).
41. Set the armature end-float by driving the retaining ring on the armature shaft into a position that provides a maximum of 0.25 mm (0.010 in) clearance between the retaining ring and the bearing bush shoulder.



3RC97



3RC98



3RC 857A

## ELECTRICAL EQUIPMENT

### CHOKE WARNING LIGHT SWITCH

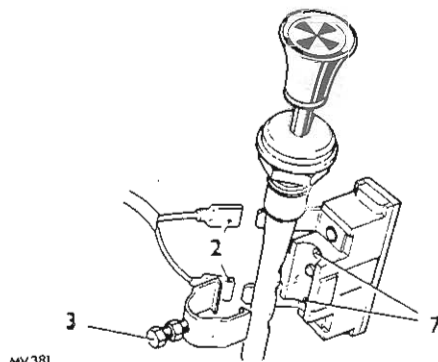
—Remove and refit 86.65.53

#### Removing

1. Disconnect the battery.
2. Disconnect the electrical leads from the choke switch.
3. Release the clip securing the switch to the choke cable.
4. Remove the switch.

#### Refitting

5. Check that the choke inner cable is adjusted to provide a minimal clearance behind the knob when the knob is pushed in.
6. Check the switch to ensure that the spring loaded plunger projects and is free to move in the switch body.
7. Pull out the choke knob and locate the switch operating plunger in the centre hole in the sleeve of the choke outer cable; the two locating dowels engage in the outer holes.
8. Secure the switch in position and tighten the securing bolt and locknut. Ensure that the bolt is not over-tightened to the extent where it will cause the plunger to jam.
9. Connect the switch leads.
10. Connect the battery.
11. Check switch and light operation.



### OIL PRESSURE WARNING SWITCH

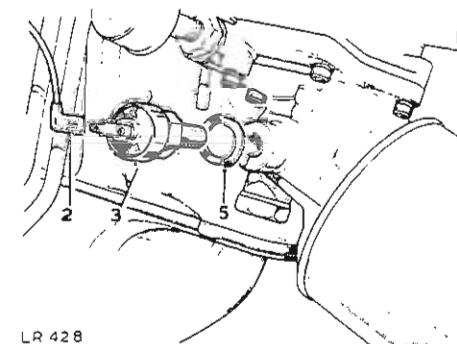
—Remove and refit 88.25.08

#### Removing

1. Disconnect the battery.
2. Disconnect the electrical lead from the switch.
3. Unscrew the switch unit.
4. Remove the switch and sealing washer.

#### Refitting

5. Reverse the removal procedure, using a new sealing washer.



### COOLANT TEMPERATURE TRANSMITTER

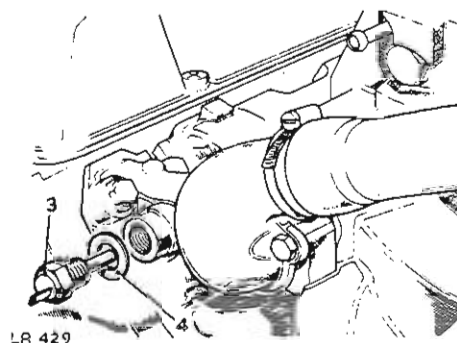
—Remove and refit 88.25.20

#### Removing

1. Disconnect the battery.
2. Disconnect the electrical lead from the transmitter and (later models) the air cleaner hose.
3. Remove the transmitter from the inlet manifold.

#### Refitting

4. Reverse the removal procedure, using a new joint washer.



### SPEEDOMETER CABLE

—Remove and refit

Cable complete 1, 2, 4, 5 and 6 88.30.06

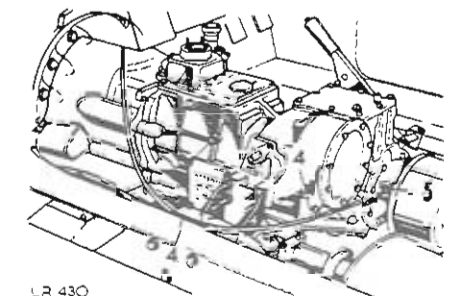
Inner cable 1, 2, 3 and 6 88.30.07

#### Removing

1. Withdraw the instrument panel and disconnect the speedometer cable from instrument.
2. Withdraw the speedometer cable end into the engine compartment.
3. Withdraw the inner cable from the outer.
4. Detach the speedometer cable grommets from the securing clips at the engine, flywheel housing, chassis sidemember and transfer gearbox.
5. Disconnect the cable at the gearbox.

#### Refitting

6. Reverse instructions 1 to 5 as applicable. When replacing the inner cable, grease sparingly with general-purpose grease. Ensure that the inner cable is engaged in the drive slot at the gearbox.



CENTRE POWER TAKE-OFF

—Description

A centre power take-off, marketed by Messrs. Fairy Winches Ltd, South Station Yard, Whitchurch Road, Tavistock, Devon, fits to the rear of the transfer gearbox, replacing the existing mainshaft rear bearing housing. It is secured by the bearing housing bolts and operated by a slider control situated above the gearbox cover by the driver's seat.

CENTRE POWER TAKE OFF

—Remove and refit 90.15.02

Removing

1. Remove the exhaust heat shield and silencer.
2. Disconnect any belt drive to the power take-off pulley.
3. Remove the cotter pin to disconnect the control rod.
4. Remove the bolts securing the power take-off unit to the transfer gearbox.
5. Lift off the power take-off unit.

Refitting

6. Renew the gasket if damaged.
7. Reverse instructions 1 to 5, ensuring that the power take-off is in the disengaged position before refitting.

Service Tools mentioned in this Manual must be obtained direct from the tool manufacturers:

Messrs. V. L. Churchill & Co. Ltd.,  
P.O. Box 3,  
London Road,  
DAVENTRY,  
Northants,  
England.  
Telephone: 03-272 4461  
Telex: 31326  
Telegrams: Garaquip Daventry Northants Telex

Zenith Carburetter Co. Ltd.,  
Honeypot Lane,  
STANMORE,  
Middlesex,  
England.  
Telephone: 01-204 3388  
Telex: 23571  
Telegrams: Zenicarbur, Norphone, London

Tool No.	Description
<b>ENGINE</b>	
605351	Connecting rod guide rods
605350	Gudgeon pin remover-replacer main tool
18G 1150	Gudgeon pin remover-replacer
18G 115 E	Gudgeon pin remover-replacer adaptor
18G 537	Gudgeon pin remover-replacer torque wrench
18G 587	Gudgeon pin remover-replacer socket spanner
605238	Plastigauge
RO 1014	Rear main oil seal guide
276102	Valve spring compressor
274401	Valve guide remover
600959	Valve guide drift
605774	Distance piece for 600959

**FUEL SYSTEM**

605330	Carburetter balancer
MS80	Mixture adjusting tool (Zenith No. B25860)
B 25243	Idle speed adjusting tool

**CLUTCH**

18G 79	Clutch centralizing tool
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continued

## SERVICE TOOLS

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Tool No.	Description
<b>GEARBOX</b>	
RO 1005	Primary pinion centralizing tool
18G 134 DG	Oil seal and feed ring assembly tool
18G 134 (530)	Assembly tool for 18G 134 DG
18G 1335	Reverse shaft extractor
RO 1004	Mainshaft spacer extractor
18G 284	Impulse extractor (general purpose tool)
18G 284 AR	Layshaft bearing extractor
18G 47	General purpose press
18G 47 BA	Layshaft bearing remover adaptor
RO 1003	Dummy shaft intermediate gears
18G 47 BB	Gearbox differential bearing extractor

### FRONT AXLE AND FINAL DRIVE

601763	Ball joint extractor
18G 1349	Hub oil seal fitting tool

### FRONT SUSPENSION

606435 A	Hub nut spanner
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Refer to the main Repair Operation Manual for details of tools that are common to all Land-Rover models



