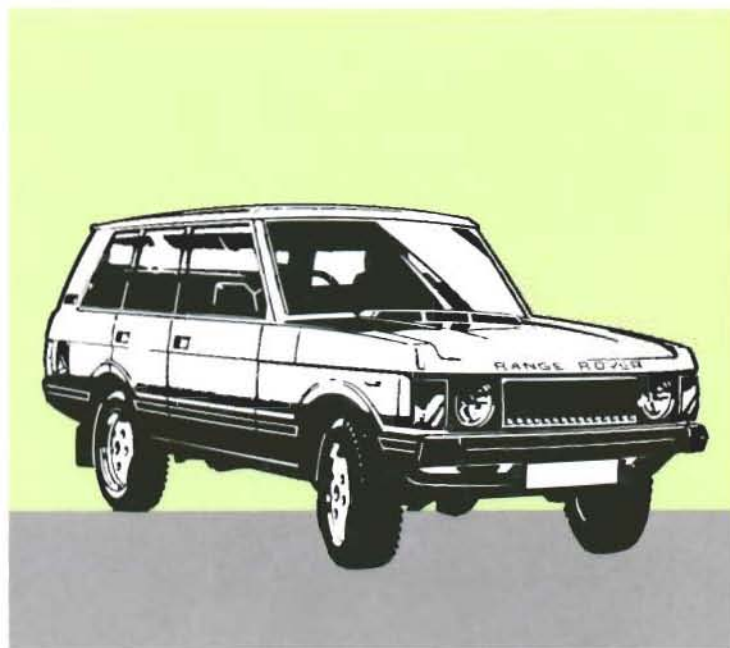


# Repair Operation Manual

1970-1985



---

Including Supplement for  
Five Speed Manual Gearbox  
& Automatic Gearbox

---

---

**RANGE ROVER**

---



BY APPOINTMENT TO HER MAJESTY THE QUEEN  
MANUFACTURERS OF LAND ROVERS AND RANGE ROVERS  
LAND ROVER UK LIMITED - SOLIHULL



BY APPOINTMENT TO HER MAJESTY QUEEN ELIZABETH  
THE QUEEN MOTHER  
MANUFACTURERS OF LAND ROVERS AND SHERPA VANS  
LAND ROVER UK LIMITED - SOLIHULL



BY APPOINTMENT  
TO H.R.H. THE PRINCE OF WALES  
VEHICLE MANUFACTURERS  
LAND ROVER UK LIMITED - SOLIHULL

# R A N G E R O V E R

## 1970 TO 1985

This manual contains supplements covering the Range Rover Five Speed manual gearbox, Transfer gearbox, Automatic gearbox and changes and additions to the Electrical equipment.

### Land-Rover Ltd

A Managing Agent for Land Rover UK Limited  
PUBLICATION No. AKM 3630 (EDITION 7)

Land Rover Limited  
Lode Lane  
Solihull  
West Midlands B92 8NW  
England

---

## CONTENTS

Preliminary . . . . .	01
General specification data . . . . .	04
Engine tuning data . . . . .	05
Torque wrench settings . . . . .	06
General fitting instructions . . . . .	07
Recommended lubricants, fuel and fluids – capacities . . . . .	09
Maintenance . . . . .	10
Engine . . . . .	12
Emission and Evaporative control . . . . .	17
Fuel system . . . . .	19
Cooling system . . . . .	26
Manifold and exhaust system . . . . .	30
Clutch . . . . .	33
Gearbox – Synchromesh . . . . .	37
Propeller shafts . . . . .	47
Rear axle and final drive . . . . .	51
Front axle and final drive . . . . .	54
Steering . . . . .	57
Front suspension . . . . .	60
Rear suspension . . . . .	64
Brakes . . . . .	70
Wheels and tyres . . . . .	74
Body . . . . .	76
Paintwork . . . . .	78
Heating and ventilation . . . . .	80
Air conditioning . . . . .	82
Wipers and washers . . . . .	84
Electrical . . . . .	86
Instruments . . . . .	88
Optional equipment . . . . .	90
Service tools . . . . .	99
Supplement for Automatic gearbox at rear of manual . . . . .	

Purchasers are advised that the specification details set out in this Manual apply to a range of vehicles and not to any particular vehicle. For the specification of any 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.

Whilst every effort is made to ensure the accuracy of the particulars contained in this Manual, neither the Manufacturer nor the Distributor or Dealer, by whom this Manual is supplied, shall in any circumstances be held liable for any inaccuracy or the consequences thereof.

© Rover Group Limited 1985

This book is published by Brooklands Books Limited under licence and is based upon text and illustrations protected by Copyright and first published in 1985 by Land Rover Limited and may not be reproduced, transmitted or copied by any means without the prior written permission of Rover Group Limited.

---

## INTRODUCTION

The purpose of this cumulative manual is to assist skilled mechanics in the efficient repair and maintenance of Range-Rover vehicles from their inception. The procedures detailed, carried out in the sequence given and using the appropriate service tools, will enable the operations to be completed in the time stated in the Repair Operation Times.

### Indexing

For convenience, this Manual is divided into a number of divisions. A contents page listing the titles and reference numbers of the various divisions is shown opposite.

A list of the operations within each of the divisions appears in alphabetical order on the contents page preceding each of the divisions.

### Operation Numbering

Each operation is followed by the number allocated to it in a master index. The number consists of six digits arranged in three pairs.

The master index of operations has been compiled for universal application to vehicles manufactured by BL Limited and therefore continuity of the numbering sequence is not maintained throughout the Manual. To assist with locating information, each division of the Manual is preceded by a contents page listing the operations in alphabetical order.

Each instruction within an operation has a sequence number and, to complete the operation in the minimum time it is essential that these instructions are performed in numerical sequence commencing at 1 unless otherwise stated. Where applicable the sequence numbers identify the components in the appropriate illustration.

Where performance of an operation requires the use of service tool, the tool number is quoted under the operation heading and is repeated in, or following the instruction involving its use.

An illustrated list of all service tools necessary to complete the operations described in the Manual is also included.

### References

References to the left or right hand side in the Manual are made when viewing the vehicle from the rear. With the engine and gearbox assembly removed, the water pump end of the engine is referred to as the front.

### Repairs and Replacements

When service parts are required it is essential that only genuine Land Rover replacements are used.

Attention is particularly drawn to the following points concerning repairs and the fitting of replacement parts and accessories.

Safety features embodied in the vehicle may be impaired if other than genuine parts are fitted.

In certain territories, legislation prohibits the fitting of parts not to the vehicle manufacturers' specification. Torque wrench setting figures given in the Repair Operation Manual must be strictly adhered to. Locking devices, where specified, must be fitted. If the efficiency of a locking device is impaired during removal it must be renewed.

Owners purchasing accessories while travelling abroad should ensure that the accessory and its fitted location on the car conform to mandatory requirements existing in their country of origin.

The vehicle warranty may be invalidated by the fitting of other than genuine Land Rover parts.

All Land Rover replacements have the full backing of the factory warranty.

Land Rover and Range Rover Distributors and Dealers are obliged to supply only genuine service parts.

---

## SAFETY

### POISONOUS SUBSTANCES

#### WARNING

Many liquids and other substances used in motor vehicles are poisonous and should under no circumstances be consumed and should as far as possible be kept away from open wounds. These substances among others include antifreeze, brake fluid, fuel, windscreen washer additives, lubricants and various adhesives.

### FUEL HANDLING PRECAUTIONS

The following information provides basic precautions which must be observed if petrol (gasoline) is to be handled safely. It also outlines the other areas of risk which must not be ignored.

This information is issued for basic guidance only, and in any case of doubt appropriate enquiries should be made of your local Fire Officer.

#### General

Petrol/gasoline vapour is highly flammable and in confined spaces is also very explosive and toxic.

When petrol/gasoline evaporates it produces 150 times its own volume in vapour, which when diluted with air becomes a readily ignitable mixture. The vapour is heavier than air and will always fall to the lowest level. It can readily be distributed throughout a workshop by air current, consequently, even a small spillage of petrol/gasoline is potentially very dangerous.

Always have a fire extinguisher containing FOAM CO<sub>2</sub> GAS or POWDER close at hand when handling or draining fuel, or when dismantling fuel systems and in areas where fuel containers are stored.

Always disconnect the vehicle battery BEFORE carrying out dismantling or draining work on a fuel system.

Whenever petrol/gasoline is being handled, drained or stored, or when fuel systems are being dismantled all forms of ignition must be extinguished or removed, any headlamps used must be flameproof and kept clear of spillage.

NO ONE SHOULD BE PERMITTED TO REPAIR COMPONENTS ASSOCIATED WITH PETROL/GASOLINE WITHOUT FIRST HAVING HAD SPECIALIST TRAINING.

#### Fuel Tank Draining

**WARNING: PETROL/GASOLINE MUST NOT BE EXTRACTED OR DRAINED FROM ANY VEHICLE WHILST IT IS STANDING OVER A PIT.**

Draining or extracting petrol/gasoline from vehicle fuel tank must be carried out in a well ventilated area.

The receptacle used to contain the petrol/gasoline must be more than adequate for the full amount of fuel to be extracted or drained. The receptacle should be clearly marked with its contents, and placed in a safe storage area which meets the requirements of local authority regulations.

**WHEN PETROL/GASOLINE HAS BEEN EXTRACTED OR DRAINED FROM A FUEL TANK THE PRECAUTIONS GOVERNING NAKED LIGHTS AND IGNITION SOURCES SHOULD BE MAINTAINED.**

#### Fuel Tank Removal

On vehicle where the fuel line is secured to the fuel tank outlet by a spring steel clip, it is recommended that such clips are released before the fuel line is disconnected or the fuel tank unit is removed. This procedure will avoid the possibility of residual petrol fumes in the fuel tank being ignited when the clips are released.

As an added precaution fuel tanks should have a PETROL/GASOLINE VAPOUR warning label attached to them as soon as they are removed from the vehicle.

#### Fuel Tank Repair

Under no circumstances should a repair to any tank involving heat treatment be carried out without first rendering the tank SAFE, by using one of the following methods:

- (a) **STEAMING:** With the filler cap and tank unit removed, empty the tank. Steam the tank for at least 2 hours with low pressure steam. Position the tank so that condensation can drain away freely, ensuring that any sediment and sludge not volatilised by the steam, is washed out during the steaming process.
- (b) **BOILING:** With the filler cap and tank unit removed, empty the tank. Immerse the tank completely in boiling water containing an effective alkaline degreasing agent or a detergent, with the water filling and also surrounding the tank for at least 2 hours.

After steaming or boiling a signed and dated label to this effect should be attached to the tank.

## ABBREVIATIONS AND SYMBOLS USED IN THIS MANUAL

Across flats (bolt size) . . . . .	AF	Midget edison screw . . . . .	MES
After bottom dead centre . . . . .	ABDC	Millimetre . . . . .	mm
After top dead centre . . . . .	ATDC	Miles per gallon . . . . .	mpg
Alternating current . . . . .	a.c.	Miles per hour . . . . .	mph
Ampere . . . . .	amp	Minimum . . . . .	min
Ampere-hour . . . . .	amp hr	minute (angle) . . . . .	'
Atmospheres . . . . .	Atm	Minus (of tolerance) . . . . .	—
Before bottom dead centre . . . . .	BBDC	Negative (electrical) . . . . .	—
Before top dead centre . . . . .	BTDC	Number . . . . .	No.
Bottom dead centre . . . . .	BDC	Ohms . . . . .	ohm
Brake mean effective pressure . . . . .	BMEP	Ounces (force) . . . . .	ozf
Brake horse power . . . . .	bhp	Ounces (mass) . . . . .	oz
British Standards . . . . .	BS	Ounce inch (torque) . . . . .	ozf.in.
Carbon monoxide . . . . .	CO	Outside diameter . . . . .	o.dia.
Centimetre . . . . .	cm	Paragraphs . . . . .	para.
Centigrade (Celsius) . . . . .	C	Part number . . . . .	Part No.
Cubic centimetre . . . . .	cm <sup>3</sup>	Percentage . . . . .	%
Cubic inch . . . . .	in <sup>3</sup>	Pints . . . . .	pt
Degree (angle) . . . . .	deg or °	Pints (US) . . . . .	US pt
Degree (temperature) . . . . .	deg or °	Plus (tolerance) . . . . .	+
Diameter . . . . .	dia.	Positive (electrical) . . . . .	+
Direct current . . . . .	d.c.	Pound (force) . . . . .	lbf
Fahrenheit . . . . .	F	Pounds feet (torque) . . . . .	lbf.ft.
Feet . . . . .	ft	Pounds inches (torque) . . . . .	lbf.in.
Feet per minute . . . . .	ft/min	Pound (mass) . . . . .	lb
Fifth . . . . .	5th	Pounds per square inch . . . . .	lb/in <sup>2</sup>
Figure (illustration) . . . . .	Fig.	Radius . . . . .	r
First . . . . .	1st	Rate (frequency) . . . . .	c/min
Fourth . . . . .	4th	Ratio . . . . .	:
Gramme (force) . . . . .	gf	Reference . . . . .	ref.
Gramme (mass) . . . . .	g	Revolution per minute . . . . .	rev/min
Gallons . . . . .	gal	Right-hand . . . . .	RH
Gallons (US) . . . . .	US gal	Right-hand steering . . . . .	RHStg
High compression . . . . .	h.c.	Second (angle) . . . . .	"
High tension (electrical) . . . . .	H.T.	Second (numerical order) . . . . .	2nd
Hundredweight . . . . .	cwt	Single carburetter . . . . .	SC
Independent front suspension . . . . .	i.f.s.	Specific gravity . . . . .	sp.gr.
Internal diameter . . . . .	i.dia.	Square centimetres . . . . .	cm <sup>2</sup>
Inches of mercury . . . . .	in.Hg	Square inches . . . . .	in <sup>2</sup>
Inches . . . . .	in	Standard . . . . .	std.
Kilogramme (force) . . . . .	kgf	Standard wire gauge . . . . .	s.w.g.
Kilogramme (mass) . . . . .	kg	Synchroniser/synchromesh . . . . .	synchro.
Kilogramme centimetre (torque) . . . . .	kgf.cm	Third . . . . .	3rd
Kilogramme per square centimetre . . . . .	kg/cm <sup>2</sup>	Top dead centre . . . . .	TDC
Kilogramme metres (torque) . . . . .	kgf.m	Twin carburetters . . . . .	TC
Kilometres . . . . .	km	United Kingdom . . . . .	UK
Kilometres per hour . . . . .	km/h	Vehicle Identification Number . . . . .	VIN
Kilovolts . . . . .	kV	Volts . . . . .	V
King pin inclination . . . . .	k.p.i.	Watts . . . . .	W
Left-hand steering . . . . .	LHStg		
Left-hand thread . . . . .	LHThd	<b>SCREW THREADS</b>	
Litres . . . . .	litre	American Standard Taper Pipe . . . . .	NPTF
Low compression . . . . .	l.c.	British Association . . . . .	BA
Low tension . . . . .	l.t.	Standard Standard Fine . . . . .	BSF
Maximum . . . . .	max.	British Standard Pipe . . . . .	BSP
Metre . . . . .	m	British Standard Whitworth . . . . .	Whit.
Microfarad . . . . .	mfd	Unified Coarse . . . . .	UNC
		Unified Fine . . . . .	UNF

**ENGINE**

Type	V8	
Number of cylinders	Eight, two banks of four	
Bore	88,90 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 pushrod	
<b>Main bearings</b>		
Number and type	5 Vandervell shells	
Material	Lead indium	
<b>Connecting rods</b>		
Type	Horizontally split big end, solid small end	
<b>Valve timing</b>		
Opens	Inlet 30° BTDC	Exhaust 68° BBDC
Closes	75° ABDC	37° ATDC
Duration	285°	285°
Valve peak	112.5° ATDC	105.5° BTDC
<b>Valve timing (9.35:1 engine, low lift camshaft)</b>		
Opens	Inlet 36° BTDC	Exhaust 74° BBDC
Closes	64° ABDC	26° ATDC
Duration	280°	280°
Valve peak	99° ATDC	119° BTDC
<b>Big end bearings</b>		
Type and material	Vandervell VP lead indium/aluminium tin	
<b>Pistons</b>		
Type	Aluminium alloy, concave crown. Plain skirt (early 8.25:1 engines) 'W' slot skirt (late 8.25:1, all 8.13:1 and 9.35:1 engines)	
<b>Gudgeon pin</b>		
Type	Press fit in connecting rod	
<b>Camshaft</b>		
Drive	Chain and sprocket from crankshaft	
Timing chain	9,52 mm (0.375 in) pitch 54 links x 22.22 mm (0.875 in) width	
<b>Tappets</b>		
Type	Hydraulic, non adjustable	
<b>Lubrication</b>		
System type	Wet sump, pressure fed	
System pressure	2,1 to 2,8 kg/cm <sup>2</sup> (30 to 40 lb/in <sup>2</sup> ) at 2400 rev/min	
Oil pump type	Gear	
Oil filter	Full-flow, self contained cartridge	
<b>COOLING SYSTEM</b>		
Type	Pressurized spill return system with thermostat control, pump and fan assisted	
Type of pump	Centrifugal	
<b>FUEL SYSTEM</b>		
Carburetter		
Make/type	Twin Zenith, 175 CD-SE Refer to engine tuning data for other details.	
<b>Fuel pump</b>		
Make/type	AC, mechanical (earlier models) or electrical (later model)	

## General Specification Data

### CLUTCH

Make/type	Borg & Beck, diaphragm type
Clutch plate diameter	266,5 mm (10.5 in)
Facing material	Raybestos WR7 or H.K. Porter 11046
Number of damper springs	6
Damper spring colour	Light grey/green
Clutch release bearing	Ball journal

### GEARBOX

#### Main gearbox

Type	Single helical constant mesh
Speeds	4 forward 1 reverse
Synchromesh	All forward speeds
Ratios	Fourth (Top)
	Third
	Second
	First
	Reverse

1:1
1.505:1
2.448:1
4.069:1
3.664:1

#### Transfer gearbox

Type	Two speed reduction on main gearbox output. Front and rear drive permanently engaged via a lockable differential
Ratios	Gearbox suffix
	High
	Low

'A' & 'B'	'C'	*	**
1.174:1	1.113:1	1.123:1	0.996:1
3.321:1	3.321:1	3.321:1	3.321:1

#### Overall ratios (Final drive)

Gearbox suffix
Fourth (Top)
Third
Second
First
Reverse

high transfer				low transfer
'A' & 'B'	'C'	*	**	All models
4.16:1	3.94:1	3.97:1	3.53:1	11.76:1
6.25:1	5.93:1	5.98:1	5.30:1	17.69:1
10.17:1	9.64:1	9.72:1	8.63:1	28.78:1
16.91:1	16.03:1	16.16:1	14.34:1	47.84:1
15.23:1	14.43:1	14.56:1	12.91:1	43.08:1

\* Suffix 'C' from gearbox No. 355 94060 C

\*\* Prefix '12C'

### PROPELLER SHAFTS

Type	Open type 50,8 mm (2 in) diameter
Universal joints	1310 type, wide angle variety on front shaft only (Gaiter fitted to sliding coupling of front shaft)

### REAR AXLE

Type	Spiral bevel, fully floating shafts
Ratio	3.54:1

### FRONT AXLE

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

### ROAD SPRING SPECIFICATION – 1981

(interchangeable only in sets for earlier vehicles)

STANDARD SUSPENSION	† SPECIFICATION	HEAVY DUTY SUSPENSION	† SPECIFICATION
RHD FRONT LHD FRONT	A (right side) A (left side) B	RHD FRONT LHD FRONT	E (right side) E (left side) F
RHD REAR LHD REAR	C (right side) C (left side) D	RHD REAR LHD REAR	G (right side) G (left side) H



**ROAD SPRING DATA – ALL VEHICLES**

† SPECIFICATION	PART NUMBER	COLOUR CODE	RATING	FREE LENGTH	NO. OF COILS
not current	90575625	yellow stripe	2321.5 kg/m (130 lb/in)	414.29mm (16.34 in)	7.11
not current	620101	yellow stripe	3035.86 kg/m (170 lb/in)	430.53mm (16.95 in)	8.85
C & E	NRC 2119	green stripe	2678.7 kg/m (150 lb/in)	409.70mm (16.13 in)	7.63
A	572315	blue stripe	2375.1 kg/m (133 lb/in)	391.16mm (15.4 in)	7.18
G	NRC 4234	green & yellow stripe	3035.86 kg/m (170 lb/in)	411.48mm (16.20 in)	7.00
H	NRC 4304	red & white stripe	3035.86 kg/m (170 lb/in)	450.53mm (16.95 in)	7.00
D & F	NRC 4305	red & yellow stripe	2678.7 kg/m (150 lb/in)	436.4mm (17.18 in)	7.65
B	NRC 4306	blue & white stripe	2375.1 kg/m (133 lb/in)	417.57mm (16.44 in)	7.55

**SHOCK ABSORBERS (DAMPERS)**

Type (internal valving modified 1981)

Hydraulic, double acting telescopic, 35mm bore  
(interchangeable only in sets for earlier vehicles)**LEVELLING UNIT**

Type

Boge Hydromat, self-energising

**STEERING****Manual steering**

Make/type

Ratio

Burman/recirculating ball, worm and nut  
Variable: straight ahead 18.2:1 (Non Tie Bar Type)  
20.55:1 (Tie Bar Type)

Steering wheel turns, lock-to-lock

4.99 early models, 5.55 later models

**Power steering**

Make/type

Ratio

Steering wheel turns, lock-to-lock

Steering wheel diameter

Front wheel alignment

Camber angle

Castor angle

Swivel pin inclination

Adwest Varamatic/linkage

Variable: straight ahead 17.5:1

3.375

431,8 mm (17 in)

1,2 to 2,4 mm (0.046 to 0.094 in) toe out

0° Check with vehicle in static unladen  
condition, that is, vehicle with water,3° oil and five gallons of fuel. Rock the  
vehicle up and down at the front to

7° allow it to take up a static position.

**HYDRAULIC DAMPERS**

Type

Bore diameter

Telescopic, double acting non adjustable  
35,47 mm (1.375 in)**BRAKES****Foot brake**

Type

Operation

Disc

Hydraulic, servo assisted, self adjusting

**Front brake**

Type

Disc diameter

Outboard discs with four pistons

298,17 mm (11.75 in)

## General Specification Data

---

### Rear brake

Type	Outboard discs with two pistons
Disc diameter	290,0 mm (11.42 in)
Total pad area	317,34 cm <sup>2</sup> (49.2 in <sup>2</sup> )
Total swept area	3199,2 cm <sup>2</sup> (496 in <sup>2</sup> )
Pad material	Ferodo F2430, F2431 or Don 230

### Transmission brake

Type	Mechanical, hand operated, duo-servo drum brake on rear of transfer gearbox output shaft
Diameter	184,05 mm (7.25 in)
Width	76,2 mm (3.0 in)
Lining material	Don Capasco 24

### WHEELS

Size/type	6.00 JK x 16
-----------	--------------

### Tyres

Size/type	205 x 16 Radial ply (tubed), Michelin X M + S, Goodyear 'Wingfoot', or Firestone Town and Country
-----------	---

### ELECTRICAL EQUIPMENT

System	12 volt, negative earth
Fuses	35 amp, blow rating

### Battery

Make/type – basic	Chloride (6TWL9Z1) 291
– heavy duty	Chloride (6TWZ13R) 369 or Lucas (OCP 13/11)389

### Starter motor

Make/type – early models	Lucas M45, pre-engaged
– later models	Lucas 3M100 pre-engaged

### Wiper motor

Make/type – Windscreen	Lucas 17W, two speed, self-switching
– Tailgate and headlamp	Lucas 14W single speed, self-switching

### Horns

Make/type	Lucas 6H or Mixo TR89
-----------	-----------------------

### Distributor

Refer to engine tuning data

## Alternator

<b>Manufacturer</b>	Lucas	Lucas	Lucas	Lucas
<b>Type</b>	16 ACR	18 ACR	25 ACR	133/65
<b>Polarity</b>	Negative earth	Negative earth	Negative earth	Negative earth
<b>Brush length</b>				
– New	12,70mm (0.5 in)	12,70mm (0.5 in)	12,70mm (0.5 in)	20mm (0.78 in)
– Worn, minimum free protrusion from brush box	5,00mm (0.2 in)	8,00mm (0.3 in)	8,00mm (0.3 in)	10mm (0.39 in)
<b>Brush spring pressure</b>				
– flush with brush box face	198 to 283 g (7 to 10 oz)	255 to 370 g (9 to 13 oz)	255 to 370 g (9 to 13 oz)	136 to 279 g (5 to 10 oz)
<b>Rectifier pack</b>				
– output rectification	6 diodes (3 live side and 3 earth side)	6 diodes (3 live side and 3 earth side)	6 diodes (3 live side and 3 earth side)	6 diodes (3 live side and 3 earth side)
– field winding supply rectification	3 diodes	3 diodes	3 diodes	3 diodes
<b>Stator windings</b>	3 phase–star connected	3 phase–delta connected	3 phase–delta connected	3 phase–delta connected
<b>Field winding rotor</b>				
– poles	12	12	12	12
– maximum speed	15,000 rev/min	15,000 rev/min	15,000 rev/min	15,000 rev/min
– shaft thread	9/16 in–18 U.N.F.	M16–1.5 g	M16–1.5 g	M15–1.5–6 g
– winding resistance at 20°C	4.3 ± 5% ohms	3.2 ohms	3.0 to 3.5 ohms	3.2 ohms
<b>Control</b>	Dual–battery sensed with machine sensed safety control	Dual–battery sensed with machine sensed safety control	Dual–battery sensed with machine sensed safety control	Dual–battery sensed with machine sensed safety control
<b>Regulation–type</b>	8 TR	8 TR	8 TR	15 TR
–voltage	14.1 to 14.5 volts	14.1 to 14.5 volts	14.1 to 14.5 volts	13.6 to 14.4 volts
<b>Nominal output</b>				
– condition	Hot	Hot	Hot	Hot
– alternator speed	6000 rev/min	6000 rev/min	6000 rev/min	6000 rev/min
– control voltage	14 volt	14 volt	14 volt	14 volt
– amp	34 amp	43 amp	65 amp	65 amp

Replacement Bulbs		Type
Headlamps . . . . .	Exterior lamps	Lucas No. SP472 60/55/W (Halogen type) . . .
Headlamps – France . . . . .		Phillips SP467 60/55W (Halogen type) . . . . .
Sidelamps . . . . .		Lucas No. 233, 12v, 4w . . . . .
Stop/tail lamps . . . . .		Lucas No. 380, 12v, 6/21w . . . . .
Reverse lamps . . . . .		Lucas No. 382, 12v, 21w . . . . .
Rear fog guard lamps . . . . .		Lucas No. 382, 12v, 21w . . . . .
Direction indicator lamps . . . . .		Lucas No. 382, 12v, 21w . . . . .
Side repeater lamps . . . . .		Lucas No. 989, 12v, 6w . . . . .
Number plate lamps . . . . .	Interior lamps	Lucas No. 233, 12v, 4w . . . . .
Instrument panel lamps and warning lamps . . . . .		Smith No. 4062110974, 12v, 2.2w capless . . .
Hazard warning switch lamp . . . . .		Lucas No. 281, 12v, 2w . . . . .
Interior roof lamp ‘festoon’ bulbs . . . . .		Lucas No. 254, 12v, 6w . . . . .
Differential lock warning lamp . . . . .		Lucas No. 987, 12v, 2.2w . . . . .
Clock illumination . . . . .		Lucas No. 281, 12v, 2w . . . . .
Under bonnet illumination . . . . .		Wedge base, 12v, 5w capless . . . . .

## General Specification Data

### Vehicle Dimensions

Overall length	4,47m (176 in)
Overall width	1,78m (70 in)
Overall height	1,78m (70 in)
Wheelbase	2,54m (100 in)
Track: front and rear	1,48m (58.5 in)
Ground clearance: under differential	190mm (7.5 in)
Turning circle	11,28m (37 ft)
Loading height	660mm (26 in)
Maximum cargo height	1,01m (40 in)
Rear opening height	1,01m (40 in)
Usable luggage capacity, rear seat folded	2,00 cu.m (70 cu.ft)
Usable luggage capacity, rear seat in use:	
– four door vehicles	1,02 cu.m (36.18 cu.ft)
– two door vehicles	1,17 cu.m (41.48 cu.ft)
Maximum roof rack load	75 kg (165 lb)

### Vehicle weights

Vehicle Type	UNLADEN WEIGHT			EEC KERB WEIGHT			GROSS VEHICLE WEIGHT		
	Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total
Four Door	909kg 2004lb	884kg 1949lb	1793kg 3953lb	928kg 2046lb	999kg 2202lb	1927kg 4248lb	1000kg 2205lb	1510kg 3329lb	2510kg 5534lb
Two Door	893kg 1969lb	869kg 1916lb	1762kg 3885lb	912kg 2011lb	983kg 2167lb	1895kg 4178lb	1000kg 2205lb	1510kg 3329lb	2510kg 5534lb

Note: UNLADEN WEIGHT is the minimum vehicle specification, excluding fuel and driver.  
 EEC KERB WEIGHT is the minimum vehicle specification, plus full fuel tank and 75 kg (165 lb) driver.  
 GROSS VEHICLE WEIGHT is the maximum all-up weight of the vehicle including driver, passengers, payload and equipment. This figure is liable to vary according to legal requirements in certain countries.

### Maximum permissible towed weights

	On-road	Off-road
Trailers without brakes	500kg 1100lb	500kg 1100lb
Trailers with overrun brakes	2000kg 4400lb	1000kg 2200lb
4-wheel trailers with continuous or semi-continuous brakes i.e. coupled brakes	4000kg 8800lb	1000kg 2200lb

Note: It is the Owner's responsibility to ensure that all regulations with regard to towing are complied with. This applies also when towing abroad. All relevant information should be obtained from the appropriate motoring organisation.

# ENGINE

Type	V8
Capacity	3528 cm <sup>3</sup> (215 in <sup>3</sup> )
Compression ratio (depending on market and model year)	8.25:1, 8.13:1 or 9.35:1
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 kg/cm <sup>2</sup> (135 lb/in <sup>2</sup> )
Timing marks	On crankshaft pulley
Valve clearance	Not adjustable

# IGNITION

Coil Make/type	Lucas 16 C 6 with ballast resistor
----------------	------------------------------------

# ENGINE TUNING

The following tables show the engine specification changes introduced from the inception of the Range Rover. One of the table headings is 'Tuning Procedure' with numbers 1 to 4 listed against each carburetter identification tag. The numbers 1 to 4 indicate which of the tuning procedures listed after the table should be used in each particular case. In the case of Suffix 'F' emission controlled engines use the tuning procedure 3 or 4 depending upon whether the carburetters are non-tamperproofed or tamperproofed type.

ENGINE NUMBER SUFFIX	*	CARBURETTER IDENTIFICATION TAG	CARBURETTER NEEDLES	NEEDLE ADJUSTMENT	TUNING PROCEDURE	DISTRIBUTOR	TIMING	FUEL OCTANE RATING (RON)	SPARK PLUG AND GAP	COMPRESSION RATIO
A & B	NE	3293	2AQ	Bottom	1	Rover No. 611390 Lucas No. 41325	3 Degrees B.T.D.C. T.D.C.	91-93 85	L87Y 0.025in (0.635mm)	8.25:1
A & B	NE	3394	2AQ	Bottom	1	Rover No. 611390 Lucas No. 41325	3 Degrees B.T.D.C. T.D.C.	91-93 85	L87Y 0.025in (0.635mm)	8.25:1
C	E	3318	B2AS	Top	3	Rover No. 611390 Lucas No. 41325	3 Degrees B.T.D.C. T.D.C.	91-93 85	L87Y 0.025in (0.635mm)	8.25:1
C	E	3677	B1DF	Bottom	2	Rover No. 614003 Lucas No. 41382	5 Degrees A.T.D.C. 8 Degrees A.T.D.C.	91-93 85	L87Y 0.025in (0.635mm)	8.25:1
D	NE	3394	2AQ	Bottom	1	Rover No. 614179 Lucas No. 41487	3 Degrees B.T.D.C. T.D.C.	91-93 85	L92Y 0.025in (0.635mm)	8.25:1
D	E	3753	B1DW	Top	2	Rover No. 614003 Lucas No. 41382	5 Degrees A.T.D.C. 8 Degrees A.T.D.C.	91-93 85	L92Y 0.025in (0.635mm)	8.25:1
E	NE	3394	2AQ	Bottom	1	Rover No. 614179 Lucas No. 41487	3 Degrees B.T.D.C. T.D.C.	91-93 85	L92Y 0.025in (0.635mm)	8.25:1
E	E	3753	B1DW	Top	3	Rover No. 614003 Lucas No. 41382	5 Degrees A.T.D.C. 8 Degrees A.T.D.C.	91-93 85	L92Y 0.025in (0.625mm)	8.25:1
F	NE	3881	I.E.L.	Bottom	1	Rover No. ERC3342 Lucas No. 41680A	6 Degrees B.T.D.C. 3 Degrees B.T.D.C.	91-93 85	N12Y 0.030in (0.80mm)	8.13:1
F	E	3854	B1EJ	Top	3 or 4	Rover No. ERC3341 Lucas No. 41681A	5 Degrees A.T.D.C. 8 Degrees A.T.D.C.	91-93 85	N12Y 0.030in (0.80mm)	8.13:1
Prefix 11D	E	4104	B1FH	Top	4	Rover No. ERC7131 Lucas No. 41873	6 Degrees B.T.D.C.	97	N12Y 0.030in (0.80mm)	9.35:1

\* NE – NON EMISSION ENGINES E – EMISSION CONTROLLED ENGINES

### TUNING PROCEDURE 1 (BOTTOM ADJUSTMENT)

#### Idle Setting

With engine at operating temperature (Warm Air Intake Valve Open, where fitted) the mixture change is effected by adjusting the jet assembly. Idle speed 550 to 650 rev/min.

### TUNING PROCEDURE 2 (BOTTOM ADJUSTMENT)

#### Idle Setting

With engine at operating temperature (Warm Air Intake Valve Open) the mixture change is effected by adjusting the jet assembly. Zenith tool, Part No. B 24667, is required for this operation.

#### Method

1. Locate the tool in the slots at the base of the jet assembly.
2. Turn in a clockwise direction to richen mixture, and anti-clockwise to weaken the mixture.

#### Mixture settings

Exhaust C.O. 3.0 to 4.5% Idle Speed 700 to 750 rev/min.

**NOTE:** On new engines idle speed will be lower for the initial running in period.

#### Fast idle

Operation of the choke from 'ON' to 'OFF' should result in a fast idle speed of  $1200 \pm 50$  rev/min when the choke control is approximately 12.70 mm (0.5 in) from the fully-in position.

Should adjustment be required, the following procedure must be used:—

1. Remove the L.H. carburetter from the engine.
2. Put the Starter Unit Adjusting Pin into the full choke position (pin in the groove).
3. With the Starter Unit held in the full choke position, it should be just possible to insert a 0.9 mm (No. 65) drill between the top edge of the throttle plate and the throttle barrel wall.
4. To adjust the setting, release the locknut on the dome head screw fitting in the throttle lever that contacts the Starter Unit Cam, adjust the screw to obtain the required setting, tighten the locknut and recheck the gap.
5. Replace the adjusting pin in the reduced choke position.
6. Refit the L.H. carburetter to the engine.

The following components are preset and non-adjustable.

- a. Temperature compensator.
- b. Poppet valve.

Should these units be suspected of malfunction they must be changed.

#### Fuel Deflector Plate

This must be fitted between the inlet manifold and the carburetter insulating block, with the saw teeth facing downstream of the carburetter. The plate will foul the carburetter butterfly plate if fitted between the carburetter and insulator.

### TUNING PROCEDURE 3 (TOP ADJUSTMENT)

#### Idle Speed and Mixture Setting

Exhaust C.O. 3.0 to 4.5% at 700 to 750 rev/min.

**NOTE:** On new engines idle speed will be lower for the running in period.

#### Fast Idle Setting

$1200 \pm 50$  rev/min with the engine at normal operating temperature.

#### Idle Mixture Setting

Before proceeding with adjustment the engine should be at normal operating temperature (Warm Air Intake Valve Open) and the Carburetters balanced.

Equipment required:—

CO Meter

Calibrated Tachometer

\*Mixture Adjustment Tool — Part No. S353 (Zenith B 20379) 'Allen' key type or Part No. MS 80 (Zenith B 25860) slotted socket type.

\*To meet certain new legislative requirements recent carburetters employ a raised blade instead of an 'Allen' key socket for adjusting the mixture needle. This necessitates the provision of alternative tools.

Mixture adjustment is made by changing the metering needle position relative to the fixed jet orifice using the appropriate adjustment tool, as follows:—

1. Remove the piston damper.
2. Insert the adjustment tool, into the piston guide rod, ensuring that the peg on the outer barrel of the tool engages in the slot in the guide rod, this prevents the piston from rotating and consequently damaging the diaphragm.
3. Push down the adjustment tool until it engages in the metering needle housing.
4. Turn the tool in a clockwise direction to richen the mixture, and anti-clockwise to weaken the mixture.

**NOTE:** The adjustment tool should be removed from the guide rod after every adjustment, to allow the engine to stabilise following the piston being depressed during adjustment. Run the engine for a few seconds at 2000 rev/min to aid stabilisation.

5. Refit the piston damper.
6. Slight adjustment to idle speed and/or carburetter balance may be required after refitting the piston damper, therefore run the engine at approximately 2000 rev/min for 20 seconds, make idle and balance adjustments, if necessary, before taking final C.O. reading.

**NOTE:** The metering needle will normally be set with the shoulder of the needle flush with the face of the piston; this is termed the datum position. If difficulty is experienced with carburation the needle should be set to this datum for investigation.

When using the adjustment tool, a positive stop will be felt when the needle reaches the fully rich position. In the anti-clockwise or weakening direction there is no stop and it is possible to disengage the needle from the adjustment screw if more than two turns are made from the datum position. Should disengagement occur, it can be rectified by applying light pressure in an upwards direction, to the shoulder of the needle at the piston face, while turning the adjustment tool in a clockwise direction.

#### Poppet Valve and Temperature Compensator

These assemblies are preset and non-adjustable. If a malfunction occurs on either component, the carburetter must be replaced.

#### Fast Idle Setting

Operation of the choke from 'ON' to 'OFF' should result in a fast idle speed of  $1200 \pm 50$  rev/min when the choke control is approximately 12.70 mm (0.5 in) from the fully-in position.

Should adjustment be required, proceed as follows:—

1. Slacken the choke cable clamping screw at the carburetter.
2. Pull the choke control knob out to a distance of approximately 12.70 mm (0.5 in) and turn to lock-in position.
3. Turn the fast idle cam, allowing the choke cable to slide through the trunnion until the punched mark on the cam flank aligns with the centre of the domed fast idle screw and tighten the clamping screw.
4. With the cam held in this position, adjust the fast idle screw to obtain a fast idle speed of  $1200 \pm 50$  rev/min and retighten the locknut.
5. Push the choke control knob fully home and check that normal idle speed is regained.

#### ADJUSTMENT PROCEDURE 4 (TOP ADJUSTMENT TAMPERPROOFED)

To comply with ECE exhaust emission regulations, all carburetters must be tamperproofed on the idle adjustment screws. Therefore, after mixture and speed tests have been finalised, the carburetter must be tamperproofed by fitting a cap to the nylon shroud on the idle adjusting screw.

Cap — Part No. ERC 3429

Cap fitting tool — Part No. ERC 3786

Should, for any reason, the cap require removal, this can be effected by piercing the cap with a sharp pointed tool and prising out.

The following tools will be required to adjust idle speed, mixture and tamperproof carburetter:—

Idle speed adjustment tool — Part No. MS 86 (Zenith B25243)

\*Idle Mixture adjustment tool — Part No. S353 (Zenith B20374) 'Allen' key type or Part No. MS 80 (Zenith B25860) slotted socket type

Tamperproof Cap fitting tool — Part No. ERC 3786

A numerical code exists for the tamperproofed cap and must be adhered to:

Cap fitted by Land Rover Service Departments: Part No. ERC 3429

\*To meet certain new legislative requirements, recent carburetters employ a raised blade instead of an 'Allen' key socket for adjusting the mixture needle. This necessitates the provision of alternative tools.

The carburettors will be preset by the manufacturers to engineering requirements and should not normally require adjustment.

However, should adjustment be required, the following method must be used.

Idle Setting – with engine to normal operating temperatures

Exhaust C.O. 3.0 to 4.5% (9.35:1 engine 2.0 to 3.5%) Idle Speed 700 to 750 rev/min.

Fast Idle Setting: 1200  $\pm$  50 rev/min

**NOTE:** On new engines idle speed will be lower for the initial running in period.

### Idle Mixture Adjustment

Engine should be at normal operating temperature (Warm Air Intake Valve Open).

Mixture adjustment is effected by changing the metering needle position, relative to the fixed jet orifice, using the appropriate adjustment tool.

1. Remove the piston damper.
2. Insert the adjustment tool into the piston guide rod, ensuring the peg on the outer barrel of the tool locates in the slot in the guide rod, this prevents the piston twisting with consequent damage to the diaphragm.
3. Push down the adjustment tool until it engages in the metering needle housing.
4. Turn the tool in a clockwise direction to rich the mixture and anti-clockwise to weaken the mixture.

**NOTE:** The adjustment tool should be removed from the guide rod after every adjustment, to allow the engine to stabilise, following the piston being depressed during adjustment. Run the engine for a few seconds at 2000 rev/min to aid stabilisation.

5. Refit the piston damper.
6. Slight adjustment to idle speed and/or carburetter balance may be required after refitting the piston damper, therefore run engine at approximately 2000 rev/min for 20 seconds, make idle and balance adjustments, if necessary before taking final C.O. reading.

**NOTE:** The metering needle will normally be set with the shoulder of the needle flush with the face of the piston, this is termed datum position. If difficulty is experienced with carburation the needle should be set to this datum for investigation.

When using the adjustment tool, a positive stop will be felt when the needle reaches the full rich position. In the anti-clockwise direction there is no stop and it is possible to disengage the needle from the adjusting screw, if more than two turns are made from the datum position. Should disengagement occur, it can be rectified by applying light pressure, in an upwards direction, to the shoulder of the needle at the piston face, while turning in a clockwise direction.

### Idle Speed Adjustment

To adjust the idle speed, the following procedure must be followed:—

1. Slacken the small bolts on the throttle levers to allow independent adjustment.
2. Using tool, Part No. MS86 (Zenith B25243) slacken the locknuts on the idle speed adjustment screws.
3. Adjust the screws to obtain correct idle speed and just nip the locknuts.
4. Check C.O. reading, check carburetter balance, correct if necessary.
5. When 3 and 4 are satisfactory, tighten the locknuts and reset the throttle.
6. Recheck the idle settings.
7. Fit cap, Part No. ERC 3428, using tool, Part No. ERC 3786 to the nylon shroud surrounding the adjusting screw.

### Fast Idle Setting

Operation of the choke from 'ON' to 'OFF' should result in a fast idle speed of 1200  $\pm$  50 rev/min when the choke control is approximately 12.70 mm (0.5 in) from the fully-in position.

Should adjustment be required, proceed as follows:—

1. Slacken the choke cable clamping screw at the carburetter.
2. Pull the choke control knob out and push in to a distance of approximately 12.70 mm (0.5 in) and lock in position.
3. Turn the starter cam, allowing the 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 the clamping screw.
4. With the cam held in this position, adjust the fast idle screws to obtain a speed of 1200  $\pm$  50 rev/min and retighten the locknut.
5. Push the choke cable fully home and check that normal idle speed is regained.



# **Vacuum Retard Switch European (Pre 1975) and all Australian Vehicles**

Setting: The gap between the cam and switch pad to be 0.900 to 1.02 mm (0.035 to 0.040 in).

Procedure:—

1. Slacken the nuts retaining the switch to the bracket.
2. Depress the switch pad fully.
3. Adjust the switch to correct the gap between the cam and the switch pad.
4. Tighten the switch retaining nuts.
5. Open the throttle fully, and close slowly to ensure the throttle is not propped open by the cam contacting the top edge of the switch pad. If the cam is propped, this will probably be due to misalignment of the switch pad to cam.

## **Vacuum Capsule Test**

To ensure that the vacuum capsule is functioning correctly, it is important that the following procedure is carried out: Remove the vacuum retard pipe from the distributor (this will increase the idle speed). If the vacuum capsule is functioning correctly, an advance to between 6 to 14 degrees B.T.D.C. should be noted. If this advance is not achieved the distributor should be changed.

## **DISTRIBUTOR**

**NOTE:** Different distributors have been fitted according to model year and 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	Clockwise
Dwell angle	26° to 28°
Contact breaker gap	0,36 mm to 0,40 mm (0.14 in to 0.16 in)
Condenser capacity	0.18 to 0.25 microfarad

Engine suffix identification	A to C (Non-emission)	D & E (Non-emission)	C, D & E (Emission)
Serial number	41325	41487	41382
Idling speed	600 to 650 rev/min	650 to 750 rev/min	750 to 850 rev/min
Fast idle speed	1000 to 1200 rev/min	1100 to 1300 rev/min	1200 to 1250 rev/min
Ignition timing, static and dynamic at idling speed rev/min	3° BTDC for use with 91 to 93 research octane number fuel. TDC for use with 85 minimum research octane number fuel. Advance only (connected)	3° BTDC for use with 91 to 93 research octane number fuel. TDC for use with 85 minimum research octane number fuel. Advance only (connected)	5° ATDC for use with 91 to 93 research octane number fuel. 8° ATDC for use with 85 minimum research octane number fuel. Advance & Retard (connected)
Vacuum Capsule			
Decelerating check with vacuum unit disconnected			
engine rev/min	Crankshaft angle	Crankshaft angle	Crankshaft angle
4,800	27 to 31°	23 to 27°	22 to 26°
3,800	23 to 27°	18 to 22°	17 to 21°
1,800	15 to 19°	10 to 16°	2.5 to 6.5°
1,400	11 to 15°	6 to 10°	0 to 4°
1,000	5 to 9°	0 to 5°	no advance
600	3° below	no advance	no advance

Engine suffix identification	F (Non-emission)	F (Emission) – European	F (Emission) – Australian
Serial number	41680A	41681A	41681A
Idling speed	550 to 650 rev/min	700 to 750 rev/min	*850 to 950 rev/min
Fast idle speed	1100 to 1300 rev/min	1100 to 1300 rev/min	1400 to 1500 rev/min
Ignition timing, static and dynamic at idle speed rev/min	6° BTDC for use with 91 to 93 research octane number 3° BTDC for use with 85 minimum research octane number fuel. Advance only (connected)	5° ATDC for use with 92 Research octane number fuel.  Advance & retard (connected)	5° ATDC for use with 92 Research octane number fuel.  *750 to 800 rev/min (with diverter valve) Advance & retard (connected)
Vacuum Capsule			
Decelerating check with vacuum unit disconnected			
engine rev/min	Crankshaft angle	Crankshaft angle	Crankshaft angle
4,800	24 to 28°	22 to 26°	22 to 26°
3,800	20 to 24°	17 to 21°	17 to 21°
1,800	12 to 16°	2.5 to 6.5°	2.5 to 6.5°
1,400	8 to 12°	0 to 4°	0 to 4°
1,000	1 to 5°	No advance	No advance
600	No advance	No advance	No advance

continued

## Engine Tuning Data

### Distributor 35D8 (continued)

Engine prefix identification	11D (Emission)
Serial number	41873 (sliding contact type)
Idle speed	700 to 750 rev/min
Fast idle speed	1150 to 1250 rev/min
Ignition timing, static and dynamic at idling speed rev/min	6° BTDC for use with 97 research octane number fuel.
Vacuum Capsule	Advance & retard, retard disconnected
Decelerating check with vacuum retard pipe disconnected	
engine rev/min	Crankshaft angle
3,600	20 to 24°
3,080	19 to 23°
2,400	14 to 18°
1,200	8 to 12°
400	No advance

### ELECTRONIC DISTRIBUTOR

Make/type

Rotation of rotor

Lucas 35DM ELECTRONIC

Clockwise

### EUROPE AND AUSTRALIA

9.35:1 Compression ratio

(Emission controlled)

Engine prefix identification	15D, 16D, 17D, & 19D
Distributor serial number	42092 Electronic
Idle speed	700 to 750 rev/min
Fast idle speed	1150 to 1250 rev/min
Ignition timing, static and dynamic at idling speed rev/min	6° BTDC for use with 97 research octane number fuel.
Vacuum Capsule	Vacuum advance pipe disconnected
Decelerating check with vacuum pipe disconnected	
engine rev/min	Crankshaft angle
2900	12 to 16°
2400	8 to 12°
1600	2 to 6°
800	No advance

### SAUDI ARABIA AND GULF STATES

8.13:1 Compression ratio

(Emission controlled)

### ALL OTHER TERRITORIES

8.13:1 Compression ratio

(Non emission)

Engine prefix identification	20D & 21D
Distributor serial number	42056 Electronic
Idle speed	650 to 750 rev/min
Fast idle speed	1150 to 1250 rev/min
Ignition timing, static and dynamic at idling speed rev/min	6° BTDC for use with 90 to 93 research octane number fuel.
Vacuum Capsule	Advance & retard, retard disconnected
Decelerating check with vacuum retard pipe disconnected	
engine rev/min	Crankshaft angle
4600	21 to 25°
3600	16 to 20°
3000	12 to 16°
2400	7 to 11°
1600	1 to 5°
200	No advance

Engine prefix identification	13D & 18D
Distributor serial number	42092 Electronic
Idle speed	550 to 650 rev/min
Fast idle speed	1150 to 1250 rev/min
Ignition timing, static and dynamic at idling speed rev/min	6° BTDC for use with 90 to 93 research octane number fuel.
Vacuum Capsule	Advance pipe disconnected
Decelerating check with vacuum retard pipe disconnected	
engine rev/min	Crankshaft
4200	23 to 27°
3500	20 to 24°
3000	16 to 20°
2000	8 to 12°
1200	2 to 6°
400	No advance

**TORQUE WRENCH SETTINGS**

	kgf.m	lbf.ft
<b>ENGINE</b>		
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, numbers 1 to 10 +) see page	9,0 to 9,6	65 to 70
Cylinder head bolts, numbers 11 to 14 +) 12–22	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	1,2	9
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 – 1/4 in	0,9 to 1,4	7 to 10
Water pump fixing bolts – 5/16 in	2,2 to 2,7	16 to 20
<b>COOLING SYSTEM</b>		
Water pump housing bolts 7/16 in AF	0,8 to 1,0	6 to 8
Water pump housing bolts 1/2 in AF	2,8 to 3,5	20 to 25
<b>MANIFOLDS AND EXHAUST SYSTEM</b>		
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
<b>CLUTCH</b>		
Clutch cover bolts	4,9 to 5,2	35 to 38
<b>GEARBOX</b>		
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	70
Speedometer drive housing	3,1	22
<b>PROPELLER SHAFTS</b>		
Coupling flange bolts	4,1 to 5,1	30 to 38
<b>FRONT/REAR AXLE AND FINAL DRIVE</b>		
Differential input flange nut	9,6 to 16,5	70 to 120
Differential crownwheel bolts	5,5 to 6,2	40 to 45
Differential bearing cap bolts	6,9 to 9,0	50 to 65
Bearing sleeve to axle case	6,2	45
Axle flange to hub	4,1 to 5,1	30 to 38
Pinion housing to axle case	3,5 to 4,6	26 to 34
Road wheel to hub – steel wheels	10,0 to 11,7	75 to 85
Road wheel to hub – alloy wheels*	12,5 to 13,35	90 to 95
Swivel bearing housing to axle case	7,6 to 8,6	55 to 62
Oil seal retainer to swivel pin housing	1,0 to 1,2	7 to 9

\* Suitable only for latest universal hubs, see 74–4.

+ Coat first three threads with Loctite 572

## Torque Wrench Settings

---

### STEERING

	kgf.m	lbf.ft
Universal joint pinch bolt	3,5	25
Ball joint nuts	4,0	30
Steering box end cover bolts, manual steering	21 to 25	15 to 18
Drop arm nut	17,9	125
Track rod clamp bolts	1,4	10
Drag link clamp bolts	1,4	10
Steering wheel nut	3,8	28
Sector shaft cover bolts and nuts, power steering box	2,2 to 2,9	16 to 20
Flow control valve cap, power steering pump	4,0 to 4,9	30 to 35
Pulley bolt, power steering pump	1,4 to 1,6	10 to 12
Union bolt, inlet adaptor, power steering box	3,8 to 4,0	28 to 30

### SUSPENSION

#### Front

Hub cap and driving shaft bolts	4,1 to 5,1	30 to 38
Stub axle bolts	3,0 to 4,2	22 to 30
Swivel pin bolts	7,0 to 8,9	50 to 65
Oil seal retainer to swivel housing bolt	1,0 to 1,2	7 to 9
Swivel housing to axle case bolts	5,2 to 6,6	38 to 48

#### Rear

	4,1 to 5,1	30 to 38
Hub cap and driving shaft bolts	5,2 to 6,6	38 to 48
Hub bearing sleeve bolts	6,0	44
Ball pins to self-levelling unit	3,5	25
Ball joint nuts, self-levelling unit	7,0	50
Pivot bracket ball joint nut, self-levelling unit	17,9	130
Bottom link stem end	12,4	90

### BRAKES

Caliper mounting bolts	8,3	60
Caliper half joint bolts	8,3	60
Disc to hub bolts	5,0	38
Brake failure switch end plug	2,2	16
Brake failure switch to five-way connector	17,28 cmkg	15 lb in

### ELECTRICAL

Starter motor to cylinder block bolts	4,0 to 4,9	30 to 35
Alternator shaft nut	3,5 to 4,2	25 to 30
Wiper motor yoke through bolt	1,6 to 2,2	12 to 16
Wiper motor gearbox spacing ring	11,50 kgf.cm	10 lbf.in.

## GENERAL FITTING INSTRUCTIONS

### Precautions against damage

1. Always fit covers to protect wings before commencing work in engine compartment.
2. Cover seats and carpets, wear clean overalls and wash hands or wear gloves before working inside car.
3. Avoid spilling hydraulic fluid or battery acid on paint work. Wash off with water immediately if this occurs. Use Polythene sheets in boot to protect carpets.
4. Always use a recommended Service Tool, or a satisfactory equivalent, where specified.
5. Protect temporarily exposed screw threads by replacing nuts or fitting plastic caps.

### Safety Precautions

1. Whenever possible use a ramp or pit when working beneath car, in preference to jacking. Chock wheels as well as applying hand brake.
2. Never rely on a jack alone to support car. Use axle stands or blocks carefully placed at jacking points to provide rigid location.
3. Ensure that a suitable form of fire extinguisher is conveniently located.
4. Check that any lifting equipment used has adequate capacity and is fully serviceable.
5. Inspect power leads of any mains electrical equipment for damage and check that it is properly earthed.
6. Disconnect earth (grounded) terminal of car battery.
7. Do not disconnect any pipes in air conditioning refrigeration system, if fitted, unless trained and instructed to do so. A refrigerant is used which can cause blindness if allowed to contact eyes.
8. Ensure that adequate ventilation is provided when volatile de-greasing agents are being used.

**CAUTION:** Fume extraction equipment must be in operation when trachloride, methylene chloride, chloroform, or perchlorethylene are used for cleaning purposes.

9. Do not apply heat in an attempt to free stiff nuts or fittings; as well as causing damage to protective coatings, there is a risk of damage to electronic equipment and brake lines from stray heat.
10. Do not leave tools, equipment, spilt oil etc., around or on work area.
11. Wear protective overalls and use barrier creams when necessary.

### Preparation

1. Before removing a component, clean it and its surrounding areas as thoroughly as possible.
2. Blank off any openings exposed by component removal, using greaseproof paper and masking tape.
3. Immediately seal fuel, oil or hydraulic lines when separated, using plastic caps or plugs, to prevent loss of fluid and entry of dirt.
4. Close open ends of oilways, exposed by component removal, with tapered hardwood plugs or readily visible plastic plugs.
5. Immediately a component is removed, place it in a suitable container; use a separate container for each component and its associated parts.

6. Before dismantling a component, clean it thoroughly with a recommended cleaning agent; check that agent is suitable for all materials of component.
7. Clean bench and provide marking materials, labels, containers and locking wire before dismantling a component.

### Dismantling

1. Observe scrupulous cleanliness when dismantling components, particularly when brake, fuel or hydraulic system parts are being worked on. A particle of dirt or a cloth fragment could cause a dangerous malfunction if trapped in these systems.
2. Blow out all tapped holes, crevices, oilways and fluid passages with an air line. Ensure that any O-rings used for sealing are correctly replaced or renewed, if disturbed.
3. Mark mating parts to ensure that they are replaced as dismantled. Whenever possible use marking ink, which avoids possibilities of distortion or initiation of cracks, liable if centre punch or scriber are used.
4. Wire together mating parts where necessary to prevent accidental interchange (e.g. roller bearing components).
5. Wire labels on to all parts which are to be renewed, and to parts requiring further inspection before being passed for reassembly; place these parts in separate containers from those containing parts for rebuild.
6. Do not discard a part due for renewal until after comparing it with a new part, to ensure that its correct replacement has been obtained.

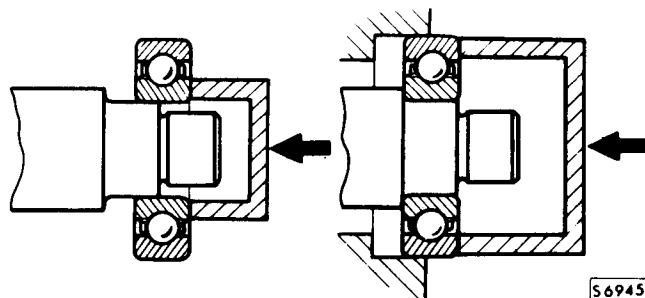
### Inspection – General

1. Never inspect a component for wear or dimensional check unless it is absolutely clean; a slight smear of grease can conceal an incipient failure.
2. When a component is to be checked dimensionally against figures quoted for it, use correct equipment (surface plates, micrometers, dial gauges, etc.) in serviceable condition. Makeshift checking equipment can be dangerous.
3. Reject a component if its dimensions are outside limits quoted, or if damage is apparent. A part may, however, be refitted if its critical dimension is exactly limit size, and is otherwise satisfactory.
4. Use 'Plastigauge' 12 Type PG-1 for checking bearing surface clearances; directions for its use, and a scale giving bearing clearances in 0.0001 in. (0.0025 mm) steps are provided with it.

### Ball and Roller Bearings

**NEVER REPLACE A BALL OR ROLLER BEARING WITHOUT FIRST ENSURING THAT IT IS IN AS-NEW CONDITION.**

1. Remove all traces of lubricant from bearing under inspection by washing in petrol or a suitable degreaser; maintain absolute cleanliness throughout operations.
2. Inspect visually for markings of any form on rolling elements, raceways, outer surface of outer rings or inner surface of inner rings. Reject any bearings found to be marked, since any marking in these areas indicates onset of wear.
3. Holding inner race between finger and thumb of one hand, spin outer race and check that it revolves absolutely smoothly. Repeat, holding outer race and spinning inner race.
4. Rotate outer ring gently with a reciprocating motion, while holding inner ring; feel for any check or obstruction to rotation, and reject bearing if action is not perfectly smooth.
5. Lubricate bearing generously with lubricant appropriate to installation.
6. Inspect shaft and bearing housing for discolouration or other marking suggesting that movement has taken place between bearings and seatings. (This is particularly to be expected if related markings were found in operation 2). If markings are found, use 'Loctite' in installation of replacement bearing.
7. Ensure that shaft and housing are clean and free from burrs before fitting bearing.
8. If one bearing of a pair shows an imperfection it is generally advisable to renew both bearings: an exception could be made if the faulty bearing had covered a low mileage, and it could be established that damage was confined to it only.
9. When fitting bearing to shaft, apply force only to inner ring of bearing, and only to outer ring when fitting into housing.

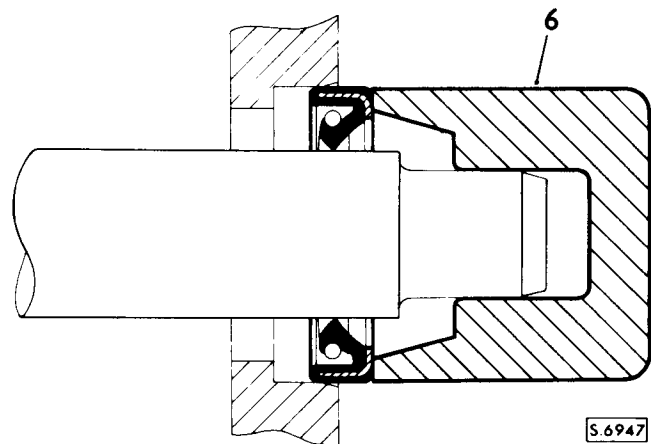
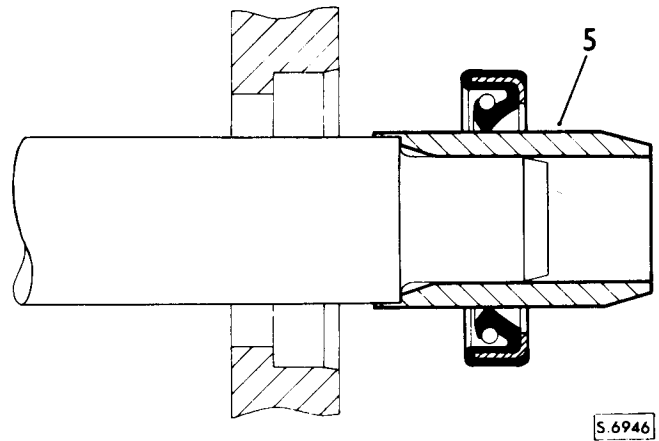


10. In the case of grease-lubricated bearings (e.g. hub bearings) fill space between bearing and outer seal with recommended grade of grease before fitting seal.
11. Always mark components of separable bearings (e.g. taper roller bearings) in dismantling, to ensure correct reassembly. Never fit new rollers in a used cup.

**Oil Seals**

1. Always fit new oil seals when rebuilding an assembly. It is not physically possible to replace a seal exactly when it has bedded down.
2. Carefully examine seal before fitting to ensure that it is clean and undamaged.
3. Smear sealing lips with clean grease; pack dust excluder seals with grease, and heavily grease duplex seals in cavity between sealing lips.
4. Ensure that seal spring, if provided, is correctly fitted.
5. Place lip of seal towards fluid to be sealed and slide into position on shaft, using fitting sleeve when possible to protect sealing lip from damage by sharp corners, threads or splines. If fitting sleeve is not available, use plastic tube or adhesive tape to prevent damage to sealing lip.
6. Grease outside diameter of seal, place square to housing recess and press into position, using great care and if possible a 'bell piece' to ensure that seal is not tilted. (In some cases it may be preferable to fit seal to housing before fitting to shaft.) Never let weight of unsupported shaft rest in seal.
7. If correct service tool is not available, use a suitable drift approximately 0.015 in. (0,4 mm) smaller than outside diameter of seal. Use a hammer **VERY GENTLY** on drift if a press is not suitable.
8. Press or drift seal in to depth of housing if housing is shouldered, or flush with face of housing where no shoulder is provided.

**NOTE:** Most cases of failure or leakage of oil seals are due to careless fitting, and resulting damage to both seals and sealing surfaces. Care in fitting is essential if good results are to be obtained.

**Joints and Joint Faces**

1. Always use correct gaskets where they are specified.
2. Use jointing compound only when recommended. Otherwise fit joints dry.
3. When jointing compound is used, apply in a thin uniform film to metal surfaces; take great care to prevent it from entering oilways, pipes or blind tapped holes.
4. Remove all traces of old jointing materials prior to reassembly. Do not use a tool which could damage joint faces.
5. Inspect joint faces for scratches or burrs and remove with a fine file or oil stone; do not allow swarf or dirt to enter tapped holes or enclosed parts.
6. Blow out any pipes, channels or crevices with compressed air, renewing any O-rings or seals displaced by air blast.

**Flexible Hydraulic Pipes, Hoses**

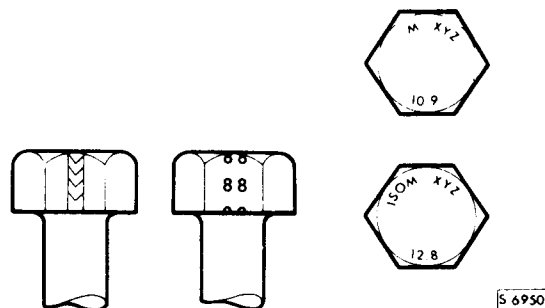
1. Before removing any brake or power steering hose, clean end fittings and area surrounding them as thoroughly as possible.
2. Obtain appropriate blanking caps before detaching hose end fittings, so that ports can be immediately covered to exclude dirt.

*continued*

3. Clean hose externally and blow through with airline. Examine carefully for cracks, separation of plies, security of end fittings and external damage. Reject any hose found faulty.
4. When refitting hose, ensure that no unnecessary bends are introduced, and that hose is not twisted before or during tightening of union nuts.
5. Containers for hydraulic fluid must be kept absolutely clean.
6. Do not store hydraulic fluid in an unsealed container. It will absorb water, and fluid in this condition would be dangerous to use due to a lowering of its boiling point.
7. Do not allow hydraulic fluid to be contaminated with mineral oil, or use a container which has previously contained mineral oil.
8. Do not re-use fluid bled from system.
9. Always use clean brake fluid to clean hydraulic components.
10. Fit a blanking cap to a hydraulic union and a plug to its socket after removal to prevent ingress of dirt.
11. Absolute cleanliness must be observed with hydraulic components at all times.
12. After any work on hydraulic systems, inspect carefully for leaks underneath the car while a second operator applies maximum pressure to the brakes (engine running) and operates the steering.

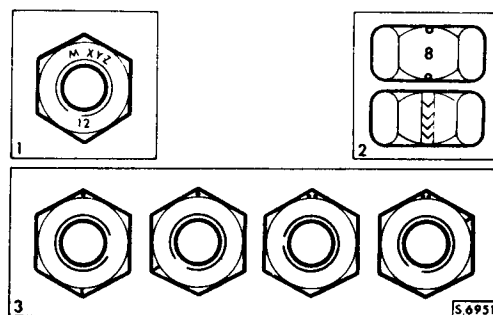
### Metric Bolt Identification

1. An ISO metric bolt or screw, made of steel and larger than 6 mm in diameter can be identified by either of the symbols ISO M or M embossed or indented on top of the head.
2. In addition to marks to identify the manufacture, the head is also marked with symbols to indicate the strength grade, e.g. 8.8, 10.9, 12.9 or 14.9, where the first figure gives the minimum tensile strength of the bolt material in tens of kg/sq mm.
3. Zinc plated ISO metric bolts and nuts are chromate passivated, a greenish-khaki to gold-bronze colour.



### Metric Nut Identification

1. A nut with an ISO metric thread is marked on one face or on one of the flats of the hexagon with the strength grade symbol 8, 12 or 14. Some nuts with a strength 4, 5 or 6 are also marked and some have the metric symbol M on the flat opposite the strength grade marking.
2. A clock face system is used as an alternative method of indicating the strength grade. The external chamfers or a face of the nut is marked in a position relative to the appropriate hour mark on a clock face to indicate the strength grade.
3. A dot is used to locate the 12 o'clock position and a dash to indicate the strength grade. If the grade is above 12, two dots identify the 12 o'clock position.





**Hydraulic Fittings – Metrication**

**WARNING:** Metric and Unified threaded hydraulic parts. Although pipe connections to brake system units incorporate threads of metric form, those for power assisted steering are of UNF type. It is vitally important that these two thread forms are not confused, and careful study should be made of the following notes.

Metric threads and metric sizes are being introduced into motor vehicle manufacture and some duplication of parts must be expected. Although standardisation must in the long run be good, it would be wrong not to give warning of the dangers that exist while UNF and metric threaded hydraulic parts continue together in service. Fitting UNF pipe nuts into metric ports and vice-versa should not happen, but experience of the change from BSF to UNF indicated that there is no certainty in relying upon the difference in thread size when safety is involved.

To provide permanent identification of metric parts is not easy but recognition has been assisted by the following means. (Illustrations 'A' metric, 'B' unified).

1. All metric pipe nuts, hose ends, unions and bleed screws are coloured black.
2. The hexagon area of pipe nuts is indented with the letter 'M'.
3. Metric and UNF pipe nuts are slightly different in shape.

The metric female nut is always used with a trumpet flared pipe and the metric male nut is always used with a convex flared pipe.

4. All metric ports in cylinders and calipers have no counterbores, but unfortunately a few cylinders with UNF threads also have no counterbore. The situation is, all ports with counterbores are UNF, but ports not counterbored are most likely to be metric.
5. The colour of the protective plugs in hydraulic ports indicates the size and the type of the threads, but the function of the plugs is protective and not designed as positive identification. In production it is difficult to use the wrong plug but human error must be taken into account.

The Plug colours and thread sizes are:

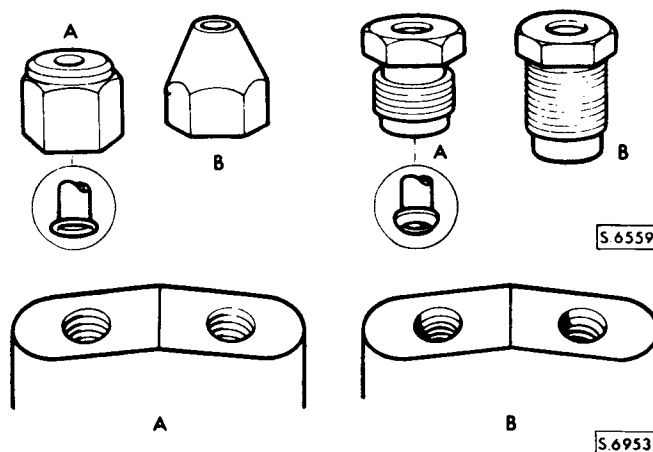
	UNF
RED	3/8 in. x 24 UNF
GREEN	7/16 in. x 20 UNF
YELLOW	1/2 in. x 20 UNF
PINK	7/8 in. x 18 UNF

	METRIC
BLACK	10 x 1 mm
GREY	12 x 1 mm
BROWN	14 x 1.5 mm

6. Hose ends differ slightly between metric and UNF.

Gaskets are not used with metric hoses. The UNF hose is sealed on the cylinder or caliper face by a copper gasket by the metric hose seals against the bottom of the port and there is a gap between faces of the hose and cylinder.

Pipe sizes for UNF are 3/16 in., 1/4 in., and 5/16 in. outside diameter.



*continued*

## General Fitting Instructions

Metric pipe sizes are 4.75 mm, 6 mm x 8 mm.

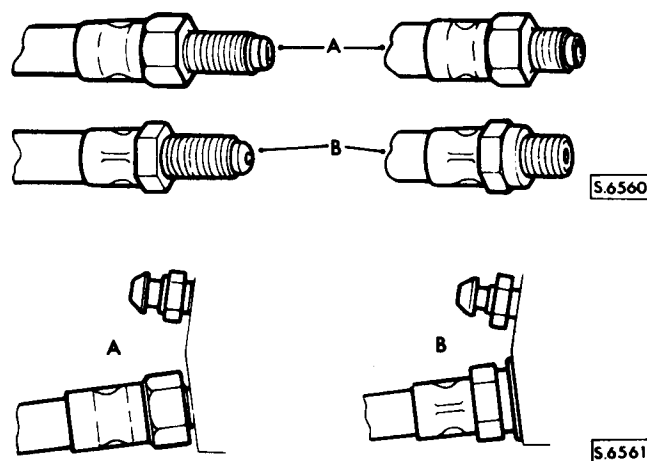
4.75 mm pipe is exactly the same as 3/16 in. pipe. 6 mm pipe is .014 in. smaller than 1/4 in. pipe. 8 mm pipe is .002 in. larger than 5/16 in. pipe.

Convex pipe flares are shaped differently for metric sizes and when making pipes for metric equipment, metric pipe flaring tools must be used.

The greatest danger lies with the confusion of 10 mm and 3/8 in. UNF pipe nuts used for 3/16 in. (or 4.75 mm) pipe. The 3/8 in. UNF pipe nut or hose can be screwed into a 10 mm port but is very slack and easily stripped. The thread engagement is very weak and cannot provide an adequate seal.

The opposite condition, a 10 mm nut in a 3/8 in. port, is difficult and unlikely to cause trouble. The 10 mm nut will screw in 1 1/2 or two turns and seize. It has a crossed thread 'feel' and it is impossible to force the nut far enough to seal the pipe. With female pipe nuts the position is of course reversed.

The other combinations are so different that there is no danger of confusion.



### Keys and Keyways

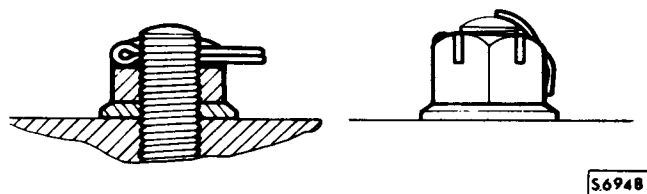
1. Remove burrs from edges of keyways with a fine file and clean thoroughly before attempting to refit key.
2. Clean and inspect key closely; keys are suitable for refitting only if indistinguishable from new, as any indentation may indicate the onset of wear.

### Tab Washers

1. Fit new washers in all places where they are used. Always renew a used tab washer.
2. Ensure that the new tab washer is of the same design as that replaced.

### Split Pins

1. Fit new split pins throughout when replacing any unit.
2. Always fit split pins where split pins were originally used. Do not substitute spring washers: there is always a good reason for the use of a split pin.
3. All split pins should be fitted as shown unless otherwise stated.



### Nuts

1. When tightening a slotted or castellated nut never slacken it back to insert split pin or locking wire except in those recommended cases where this forms part of an adjustment. If difficulty is experienced, alternative washers or nuts should be selected, or washer thickness reduced.
2. Where self-locking nuts have been removed it is advisable to replace them with new ones of the same type.

**NOTE:** Where bearing pre-load is involved nuts should be tightened in accordance with special instructions.

**Locking Wire**

1. Fit new locking wire of the correct type for all assemblies incorporating it.
2. Arrange wire so that its tension tends to tighten the bolt heads, or nuts, to which it is fitted.

**Screw Threads**

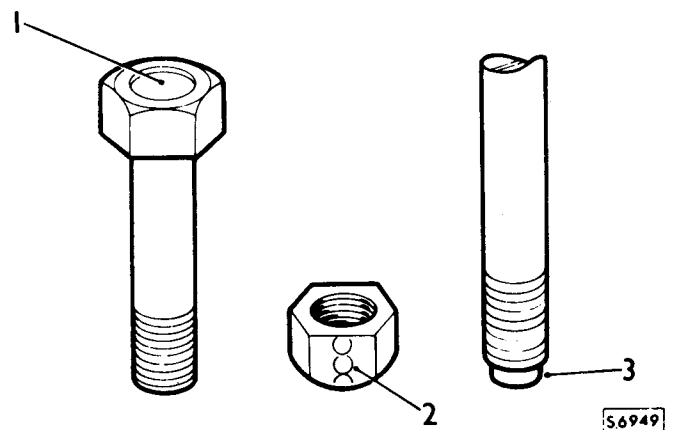
1. Both UNF and Metric threads to ISO standards are used. See below for thread identification.
2. Damaged threads must always be discarded. Cleaning up threads with a die or tap impairs the strength and closeness of fit of the threads and is not recommended.
3. Always ensure that replacement bolts are at least equal in strength to those replaced.
4. Do not allow oil, grease or jointing compound to enter blind threaded holes. The hydraulic action on screwing in the bolt or stud could split the housing.
5. Always tighten a nut or bolt to the recommended torque figure. Damaged or corroded threads can affect the torque reading.
6. To check or re-tighten a bolt or screw to a specified torque figure, first slacken a quarter of a turn, then re-tighten to the correct figure.
7. Always oil thread lightly before tightening to ensure a free running thread, except in the case of self-locking nuts.

**Five Thread Forms Replaced by – ISO Metric**

B.A.	B.S.W.	B.S.F.	U.N.C.	U.N.F.	Metric Size
2	3/16	3/16	10	10	M5
1	1/4	1/4	12	12	M6
0			1/4	1/4	
	5/16	5/16	5/16	5/16	M8
	3/8	3/8	3/8	3/8	M10
	7/16	7/16	7/16	7/16	
	1/2	1/2	1/2	1/2	M12

**Unified Thread Identification**

1. **Bolts**  
A circular recess is stamped in the upper surface of the bolt head.
2. **Nuts**  
A continuous line of circles is indented on one of the flats of the hexagon, parallel to the axis of the nut.
3. **Studs, Brake Rods, etc.**  
The component is reduced to the core diameter for a short length at its extremity.



S6949

## RECOMMENDED LUBRICANTS AND FLUIDS UK

These recommendations apply to temperate climates where operational temperatures may vary between  $-10^{\circ}\text{C}$  ( $14^{\circ}\text{F}$ ) and  $32^{\circ}\text{C}$  ( $90^{\circ}\text{F}$ )

COMPONENT	BP	CASTROL	DUCKHAMS	ESSO	MOBIL	PETROFINA	SHELL	TEXACO
Engine and carburettor dashpots Oils must meet BL Ltd. specification BLS-OL-02 or the requirements of the CCMC	BP Super Visco-Static 20-50	Castrol GTX 15W/50	Duckhams Q Motor Oil 20W/50	Esso Superlube 10W/40	Mobil Super 15W/40 or 10W/50	Fina Supergrade Motor Oil 15W/40 or 20W/50	Shell Super Motor Oil 15W/40	Havoline Motor Oil 15W/40
Main gearbox, overdrive, transfer gearbox	BP Super Visco-Static 20-50	Castrol GTX 15W/50	Duckhams Q Motor Oil 20W/50	Esso Superlube 10W/40	Mobil Super 15W/40	Fina Supergrade Motor Oil 15W/40	Shell Super Motor Oil	Havoline Motor Oil 15W/40
Final drive units Swivel pin housings Steering box	BP Gear Oil SAE 90EP	Castrol Hypoy SAE90EP	Duckhams Hypoid 90	Esso Gear Oil GX 85W/90	Mobil Mobilube HD 90	Fina Pontonic MP SAE 90	Shell Spirax 90EP	Texaco Multigear Lubricant EP 90
Power steering fluid reservoir, as applicable	BP Autran G	Castrol TQF	Duckhams Q-Matic	Essoglide	Mobil ATF210	Pursumatic 33G	Shell Donax TF	Texamatic Type G or F
Lubrication nipples (ball joints, hubs, propshafts)	BP Energrease L2	Castrol LM Grease	Duckhams LB 10	Esso Multi-Purpose Grease H	Mobilgrease MP	Fina Marson HTL 2	Shell Retinax A	Marfak All-purpose Grease
Windscreen Washers	All Seasons Screen Washer Fluid.							
Brakes and Clutch reservoirs	Brake fluids having a minimum boiling point of $260^{\circ}\text{C}$ ( $500^{\circ}\text{F}$ ) and complying with FMVSS 116 DOT3 specification.							
Engine cooling system	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.							
Inhibitor solution for engine cooling system	Marston Lubricants SQ36 – Coolant inhibitor concentrate. For summer use only when frost precautions are not necessary.							
Air Conditioning System Refrigerant Compressor Oil	METHYLCHLORIDE REFRIGERANTS MUST NOT BE USED. Use only with refrigerant 12. This includes 'Freon 12' and 'Arcton 12'. Shell Clavus 68 BP Energol LPT 68 Sunisco 4GS Texaco Capella E Wax Free 68							

## RECOMMENDED LUBRICANTS AND ANTI-FREEZE SOLUTIONS OTHER THAN UK

COMPONENT	SERVICE CLASSIFICATION		AMBIENT TEMPERATURE $^{\circ}\text{C}$							
	Performance Level	SAE Viscosity	-30	-20	-10	0	10	20	30	
Engine and Carburettor Dashpots	Oils conforming to BL Ltd. SPECIFICATION BLS-22-OL-02 or the requirements of CCMC or API-SE	5W/20	▶							
		5W/30	▶							
		5W/40	▶							
		10W/30								
		10W/40								
		10W/50								
		15W/40								
		15W/50								
		20W/40								
Main Gearbox, and Transfer Gearbox Overdrive where fitted	BLS-22-OL-02 or the requirements of CCMC or API-SE	10W/30	▶							
		10W/40	▶							
		10W/50	▶							
		10W/40								
		10W/50								
		15W/40								
		15W/50								
		20W/40								
Final Drive Units Swivel Pin Housings Steering Box	API GL4 or MIL-L-2105	90 EP or 80 W, EP	▶							
Power Steering	ATF M2C, 33G or 33F		▶							
Lubrication Nipples (Hubs, Ball Joints, etc.)	NLGI-2 Multipurpose Lithium grease									
Brake & Clutch Reservoirs	Brake Fluids having a minimum boiling point of $260^{\circ}\text{C}$ ( $500^{\circ}\text{F}$ ) and complying with FMVSS 1,16 DOT3.									
Engine Cooling System	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. Where frost precautions are not necessary use Marston Lubricant SQ36 to prevent corrosion of the engine alloy.									
Windscreen Washers	Screen Washer Fluid									
AIR CONDITIONING SYSTEM Refrigerant Compressor Oil	METHYLCHLORIDE REFRIGERANTS MUST NOT BE USED. Use only with refrigerant 12. This includes 'Freon 12' and 'Arcton 12'. Shell Clavus 68 BP Energol LPT 68 Sunisco 4GS Texaco Capella E Wax Free 68									

## ANTI-FREEZE

<b>Anti-Freeze Concentration</b>		50%
<b>Specific Gravity of Coolant at 15.5°C (60°F)</b>		1.076
<b>Anti-Freeze Quantity</b>	Litres	5.7
	Pints Imp.	10.0
	Pints U.S.A.	12.0
<b>Complete protection</b> Vehicle may be driven away immediately from cold		–36°C –33°F
<b>Safe Limit protection</b> Coolant in mushy state. Engine may be started and driven away after short warm-up period		–41°C –42°F
<b>Lower Protection</b> Prevents frost damage to cylinder head, block and radiator. Thaw out before starting engine		–47°C –53°F

## RECOMMENDED FUEL

With the exception of the 9.35:1 high compression (emission) engine which is designed to operate on 97 octane fuel (British 4 star rating) all other Range Rover engines are designed for fuel having a minimum octane rating of 91 to 93 (the British 2 star rating).

Where these 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. (See 'Engine Tuning', page 05–1 for details).

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

**CAUTION:** Do not use oxygenated fuels such as blends of methanol/gasolene or ethanol/gasolene (e.g. 'GASOHOL').

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.

<b>CAPACITIES (Approx)</b>	<b>Litres</b>	<b>Imperial Unit</b>	<b>US Unit</b>
Engine sump oil	5,1 litres	9 pints	10.5 pints
Extra when refilling after fitting new filter	0,56 litres	1 pint	1.25 pints
Main gearbox oil	2,6 litres	4.5 pints	5.5 pints
Transfer gearbox oil	3,1 litres	5.5 pints	6.5 pints
Rear differential oil	1,7 litres	3.0 pints	3.5 pints
Front differential oil	1,7 litres	3.0 pints	3.5 pints
Swivel housing oil (each)	0,26 litres	0.5 pints	0.5 pints
Steering box oil (manual)	0,40 litres	0.75 pints	0.75 pints
Cooling system	11,3 litres	20 pints	24 pints
Fuel tank	81,5 litres	18 gallons	21.5 gallons

## MAINTENANCE OPERATIONS

	Maintenance Operation No.
Routine Maintenance Operations – Excluding Australia	
1,000 miles (1,600 km) Free Service	10.10.03
6,000 miles (10,000 km) Service	10.10.12
12,000 miles (20,000 km) Service	10.10.24

Details for these operations are listed in a summary chart on pages 10–2 and 10–3.

### ROUTINE MAINTENANCE OPERATIONS – AUSTRALIA ONLY – ADR 27A

#### MAINTENANCE INTERVALS

Service	Km x 1000	
A	1.6	
B	5.15, 25, 35, 45, 55, 65, 75	10.10.03
C	10, 30, 50, 70	10.10.14
D	20, 60	10.10.26
E	40, 70	10.10.50

Details for these operations are listed in a summary chart on pages 10–4 and 10–5.

**NOTE:** The service schedules are based on an annual total of approximately 20,000 km. Should the vehicle complete substantially less kilometres than this per annum, it is recommended that a 'C' service is completed at six month intervals and a 'D' service at twelve month intervals.

## MAINTENANCE SUMMARY

The following should be checked weekly or before a long journey.

Engine oil level	Windscreen/Tailgate/Headlamp Washer. Reservoir level(s)	Operation of Horn
Brake fluid level	Battery Electrolyte level(s)	Operation of Washers and Wipers
Radiator coolant level	All Tyres for Pressure and Condition	Operation of all lights

## SUMMARY CHART – EXCLUDING AUSTRALIA

Maintenance Operation Number *Intervals in Miles x 1000 or time intervals in months. Intervals in Kilometres x 1000	10.10.03 1 1.6	10.10.12 6 10	10.10.24 12 20
<b>Operation Description</b>			
<b>ENGINE</b>			
Check for oil/fuel/fluid leaks . . . . .	X	X	X
Check/top up engine oil level . . . . .	X	X	X
Renew engine oil . . . . .	X	X	X
Renew engine oil filter . . . . .		X	X
Renew engine breather filter . . . . .			X
Renew carburettor air intake cleaner elements . . . . .			X
Check fuel system for leaks, pipes and unions for chafing and corrosion . . . . .	X	X	X
Check cooling/heater systems for leaks and hoses for security and condition . . . . .	X	X	X
Check/top up cooling system . . . . .	X	X	X
Check/adjust operation of all washers and top up reservoirs . . . . .	X	X	X
Check driving belts adjust or renew as necessary . . . . .	X	X	X
Lubricate accelerator control linkage and pedal pivot – check operation . . . . .	X	X	X
Check security of engine mountings . . . . .	X		
Check/top up carburettor piston dampers . . . . .	X	X	X
Check/adjust carburettor idle settings . . . . .	X	X	X
Check/adjust throttle control vacuum switch . . . . .			X
Renew fuel filter element/cartridge . . . . .		X	X
Check air injection system hoses/pipes for condition and security . . . . .			X
Clean/renew engine flame traps . . . . .			X
Check air intake temperature control system . . . . .			X
Check crankcase breathing and evaporative loss systems. Check hoses/pipes and restrictors for blockage, security and condition . . . . .	X		X
Clean electric fuel pump element . . . . .		48,000 miles (80,000 km)	
Check exhaust system for leakage and security . . . . .	X	X	X
<b>IGNITION</b>			
Clean/adjust spark plugs . . . . .		X	
Renew spark plugs . . . . .			X
Clean/adjust distributor contact breaker points (sliding contact type) . . . . .			X
Clean/adjust distributor contact breaker points (non-sliding contact type) . . . . .	X	X	
Renew distributor contact breaker points (sliding contact type) . . . . .		24,000 miles (40,000 km)	
Renew distributor contact breaker points (non-sliding contact type) . . . . .			X
Lubricate distributor . . . . .	X	X	
Check ignition wiring and high tension leads for fraying, chafing and deterioration . . . . .	X		X
Clean distributor cap. Check for cracks and tracking . . . . .			X
Check security of distributor vacuum unit line and operation of vacuum unit . . . . .	X		X
Check/adjust dwell angle and ignition timing using electronic equipment . . . . .	X		X
Check coil performance on oscilloscope . . . . .			X
<b>TRANSMISSION</b>			
Check for oil leaks . . . . .	X	X	X
Check/top up clutch fluid reservoir . . . . .	X	X	X
Check clutch pipes for chafing, leaks or corrosion . . . . .	X	X	X
Check/top up gearbox and transfer box oil levels . . . . .		X	X
Renew gearbox and transfer box oil . . . . .	X	24,000 miles (40,000 km)	
Check front and rear axle case breathers . . . . .			X
Check/top up front and rear axle oil levels . . . . .		X	X
Renew front and rear axle oil . . . . .	X	24,000 miles (40,000 km)	
Drain flywheel housing if drain plug is fitted for wading . . . . .	X	X	X
Check tightness of propeller shaft coupling bolts . . . . .	X	X	
Lubricate propeller shaft . . . . .	X	X	X
Lubricate propeller shaft sealed sliding joint . . . . .		24,000 miles (40,000 km)	

Maintenance Operation Number *Intervals in Miles x 1000 or time intervals in months. Intervals in Kilometres x 1000	10.10.03 1 1.6	10.10.12 6 10	10.10.24 12 20
<b>Operation Description</b>			
<b>STEERING AND SUSPENSION</b>			
Check condition and security of steering unit, joints, relays and gaiters . . . . .	X	X	X
Check steering rack/gear for oil/fluid leaks . . . . .	X	X	X
Check shock absorbers for fluid leaks . . . . .	X	X	X
Check power steering system for leaks, hydraulic pipes and unions for chafing, cracks and corrosion . . . . .	X	X	X
Check/top up fluid in power steering reservoir or manual steering box oil level . . . . .	X	X	X
Check/adjust front wheel alignment . . . . .	X	X	X
Check security of suspension fixings . . . . .	X		X
Check/adjust steering box . . . . .	X	X	X
Check/top up swivel pin housing oil levels . . . . .		X	X
Renew swivel pin housing oil . . . . .	X	24,000 miles (40,000 km)	
Check suspension self levelling unit for fluid leaks . . . . .	X	X	X
<b>BRAKES</b>			
Check visually, hydraulic pipes and unions for chafing, leaks and corrosion . . . . .	X	X	X
Check/top up brake fluid reservoir(s) . . . . .	X	X	X
Check footbrake operation; (Self adjusting) . . . . .	X	X	X
Check handbrake for security and operation; adjust if necessary . . . . .	X	X	X
Inspect brake pads for wear, discs for condition . . . . .		X	X
Lubricate handbrake mechanical linkage and cable guides (lever pivot) . . . . .		X	X
Check brake servo hose(s) for security and condition . . . . .	X	X	X
Renew hydraulic brake fluid . . . . .		Every 18 months 18,000 miles (30,000 km)	
Renew rubber seals in braking system, flexible hoses and servo air filter . . . . .		Every 36 months 36,000 miles (60,000 km)	
<b>WHEELS AND TYRES</b>			
Check/adjust tyre pressures including spare wheel . . . . .	X	X	X
Check tyres for tread depth and visually for external cuts in fabric, exposure of ply or cord structure, lumps or bulges . . . . .	X	X	X
Check that tyres comply with manufacturers specification . . . . .		X	X
Check tightness of road wheel fastenings . . . . .	X	X	X
<b>ELECTRICAL</b>			
Check function of electrical equipment . . . . .	X	X	X
Check/top up battery electrolyte . . . . .	X	X	X
Clean and grease battery connections . . . . .		X	X
Check headlamp alignment, adjust if necessary . . . . .	X	X	X
Check, if necessary renew, wiper blades . . . . .		X	X
<b>BODY</b>			
Lubricate all locks and hinges (Not steering lock) . . . . .	X	X	X
Check operation of window controls . . . . .	X		X
Check condition and security of seats and seat belts . . . . .	X	X	X
Check operation of seat belt inertia reel mechanism (where fitted) . . . . .	X	X	X
Check operation of all door, bonnet and tailgate locks . . . . .	X	X	X
Check rear view mirror(s) for cracks and crazing . . . . .		X	X
Ensure cleanliness of controls, door handles, steering wheel . . . . .	X	X	X
<b>GENERAL</b>			
Road/roller test and check function of all instrumentation . . . . .	X	X	X
Report additional work required . . . . .		X	X

\*The service schedules above are based on an annual total of approximately 12,000 miles (20,000 km). Should the vehicle complete substantially less miles/kilometres in any year it is recommended that service intervals are based on a proportional time basis.



## SUMMARY CHART – AUSTRALIAN – ADR 27A

Maintenance Operation Number		10.10.03	10.10.14	10.10.26	10.10.50
Service	A	B	C	D	E
Operation Description					
<b>ENGINE</b>					
Check for oil/fuel/fluid leaks . . . . .	X	X	X	X	X
Check/top up engine oil level . . . . .		X			
Renew engine oil . . . . .	X		X	X	X
Renew engine oil filter . . . . .			X	X	X
Renew engine breather filter . . . . .					X
Renew carburettor air intake cleaner elements . . . . .				X	X
Check fuel system for leaks, pipes and unions for chafing and corrosion . . . . .	X	X	X	X	X
Check cooling/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 reservoirs . . . . .	X	X	X	X	X
Check driving belts adjust or renew as necessary . . . . .	X			X	X
Lubricate accelerator control linkage and pedal pivot – check operation . . . . .	X		X	X	X
Check security of engine mountings . . . . .	X				
Check/top up carburettor piston dampers . . . . .	X			X	X
Check/adjust carburettor idle settings . . . . .	X			X	X
Check/adjust throttle control vacuum switch . . . . .				X	X
Check security of E.G.R. valve operating lines . . . . .	X				
Renew fuel filter element/cartridge . . . . .				X	X
Check air injection system hoses/pipes for condition and security . . . . .				X	X
Clean/renew engine flame traps . . . . .				X	X
Check air intake temperature control system . . . . .				X	X
Check crankcase breathing and evaporative loss systems. Check hoses/pipes and restrictors for blockage, security and condition . . . . .	X			X	X
Renew adsorption canister . . . . .					
Check E.G.R. system . . . . .					
Clean electric fuel pump element . . . . .					
Check exhaust system for leakage and security . . . . .	X				
<b>IGNITION</b>					
Renew spark plugs . . . . .				X	X
Renew distributor contact breaker points (sliding contact type) . . . . .					X
Renew distributor contact breaker points (non-sliding contact type) . . . . .					X
Lubricate distributor . . . . .			X		
Check ignition wiring and high tension leads for fraying, chafing and deterioration . . . . .	X			X	X
Clean distributor cap. Check for cracks and tracking . . . . .				X	X
Check security of distributor vacuum unit line and operation of vacuum unit . . . . .	X			X	X
Check/adjust dwell angle and ignition timing using electronic equipment . . . . .	X			X	X
Check coil performance on oscilloscope . . . . .				X	X
<b>TRANSMISSION</b>					
Check for oil leaks . . . . .	X	X	X	X	X
Check/top up clutch fluid reservoir . . . . .	X	X	X	X	X
Check clutch pipes for chafing, leaks or corrosion . . . . .	X	X	X	X	X
Check/top up gearbox and transfer box oil levels . . . . .			X	X	
Renew gearbox and transfer box oil . . . . .	X				X
Check front and rear axle case breathers . . . . .					X
Check/top up front and rear axle oil levels . . . . .			X	X	
Renew front and rear axle oil . . . . .	X				X
Drain flywheel housing if drain plug is fitted for wading . . . . .		X	X	X	X
Check tightness of propeller shaft coupling bolts . . . . .	X			X	
Lubricate propeller shaft . . . . .	X		X	X	X
Lubricate propeller shaft sealed sliding joint . . . . .					X

Maintenance Operation Number		10.10.03	10.10.14	10.10.26	10.10.50
Service	A	B	C	D	E
Operation Description					
STEERING AND SUSPENSION					
Check condition and security 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 power steering system for leaks, hydraulic pipes and unions for chafing, cracks and corrosion . . . . .	X	X	X	X	X
Check/top up fluid in power steering reservoir or manual steering box oil level . . . . .	X	X	X	X	X
Check/adjust front wheel alignment . . . . .	X		X	X	X
Check security of suspension fixings . . . . .	X			X	X
Check/adjust steering box . . . . .	X	X	X	X	X
Check/top up swivel pin housing oil levels . . . . .			X	X	
Renew swivel pin housing oil . . . . .	X				X
Check suspension self levelling unit for fluid leaks . . . . .	X	X	X	X	X
BRAKES					
Check visually, hydraulic pipes and unions for chafing, leaks and corrosion . . . . .	X	X	X	X	X
Check/top up brake fluid reservoir(s) . . . . .	X	X	X	X	X
Check footbrake operation (Self adjusting) . . . . .	X	X	X	X	X
Check handbrake for security and operation; adjust if necessary . . . . .	X	X	X	X	X
Inspect brake pads for wear, discs for condition . . . . .		X	X	X	X
Lubricate handbrake mechanical linkage and cable guides (lever pivot) . . . . .			X	X	X
Check brake servo hose(s) for security and condition . . . . .	X	X	X	X	X
Renew hydraulic brake fluid . . . . .		Every 18 months, 30,000 km			
Renew rubber seals in braking system, flexible hoses and servo air filter . . . . .		Every 36 months, 60,000 km			
WHEELS AND TYRES					
Check/adjust tyre pressures including spare wheel . . . . .	X	X	X	X	X
Check tyres for tread depth and visually for external cuts in fabric, exposure of ply or cord structure, lumps or bulges . . . . .	X	X	X	X	X
Check that tyres comply with manufacturers specification . . . . .		X	X	X	X
Check tightness of road wheel fastenings . . . . .	X	X	X	X	X
ELECTRICAL					
Check function of electrical equipment . . . . .	X	X	X	X	X
Check/top up battery electrolyte . . . . .	X	X	X	X	X
Clean and grease battery connections . . . . .			X	X	X
Check headlamp alignment, adjust if necessary . . . . .	X	X	X	X	X
Check, if necessary renew, wiper blades . . . . .		X	X	X	X
Check output of alternator charging system . . . . .	X		X	X	X
BODY					
Lubricate all locks and hinges (not steering lock) . . . . .	X		X	X	X
Check operation of window controls . . . . .	X			X	X
Check condition and security of seats and seat belts . . . . .	X	X	X	X	X
Check operation of seat belt inertia reel mechanism (where fitted) . . . . .	X	X	X	X	X
Check operation of all door, bonnet and tailgate locks . . . . .	X		X	X	X
Check rear view mirror(s) for cracks and crazing . . . . .		X	X	X	X
Ensure cleanliness of controls, door handles, steering wheel . . . . .	X	X	X	X	X
GENERAL					
Road/roller test and check function of all instrumentation . . . . .	X		X	X	X
Report additional work required . . . . .		X	X	X	X

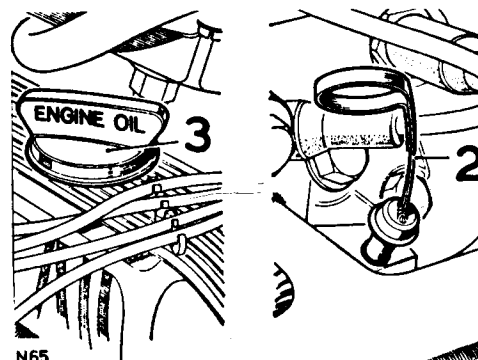
The summary charts on pages 10-2 to 10-5 give details of the intervals at which the following operations should be completed. The operations are listed in the sequence shown in the summary chart.

### ENGINE

#### Check for Oil/Fuel/Fluid Leaks.

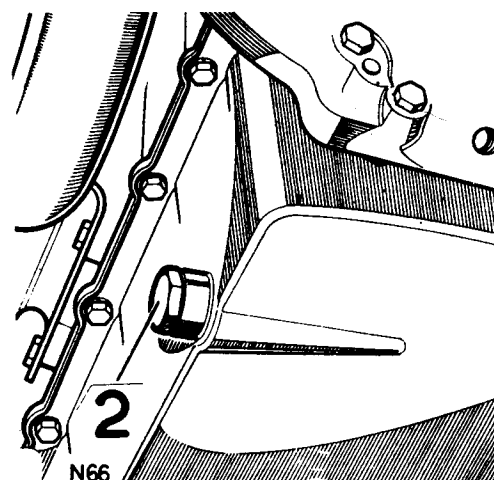
#### Check/Top up engine oil level.

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.



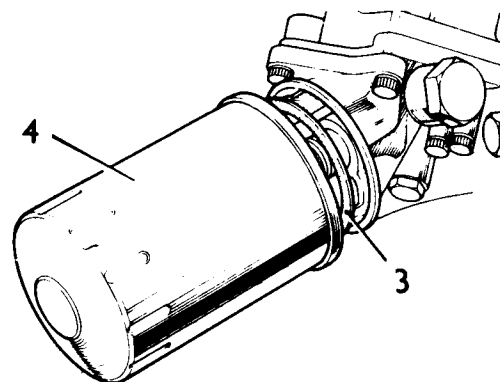
#### Renew Engine Oil.

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 — refer to Division 09.
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 by the hexagon on end of casing (early models) or using a strap spanner (later models).
3. Smear clean engine oil on the rubber washer of the new filter.
4. Fill the filter with new oil as far as possible, noting the angle at which the filter is to be fitted.
5. Screw on the filter until the sealing ring touches the oil pump cover face, then tighten it a further half turn by hand only. **Do not overtighten.**
6. Check/Top up the engine oil level.
7. Run the engine to check for oil leaks at the filter.



**Renew Engine Breather Filter.**

1. Remove the air cleaner 19.10.01.
2. Withdraw rear hose from the filter.
3. Slacken the filter clip.
4. Withdraw the filter from the clip and front hose.
5. Fit the new filter with end marked 'IN' facing forward. Alternatively, if the filter is marked with arrows, they must point rearward. Refit hoses and tighten clip.
6. Refit the air cleaner 19.10.01.

**Renew Carburettor Air Intake Cleaner Elements.**

Attention to the air cleaner is extremely important. Replace elements every 10,000 km (6,000 miles) under severe dusty conditions, as performance will be seriously affected if the car is run with an excessive amount of dust or industrial deposits in the element.

Two types of air cleaner can be fitted, follow the instructions as appropriate.

*European specification*

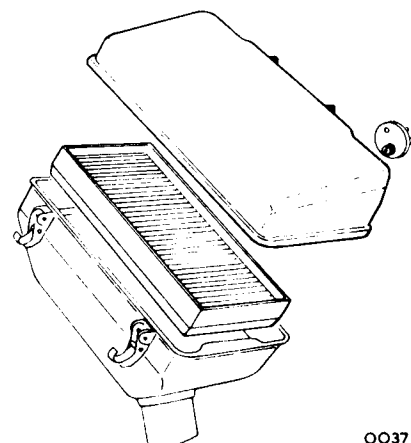
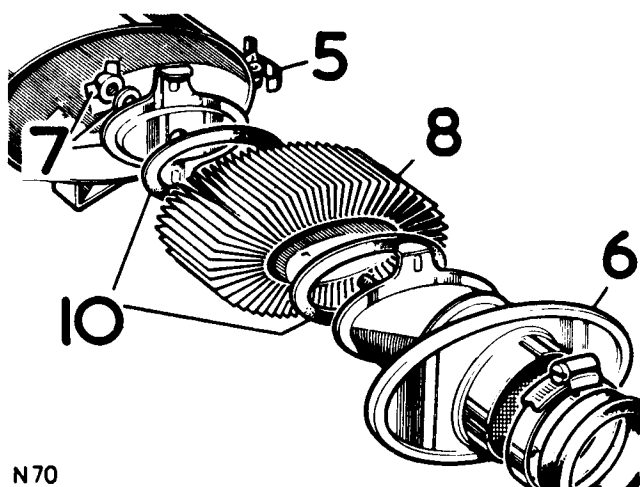
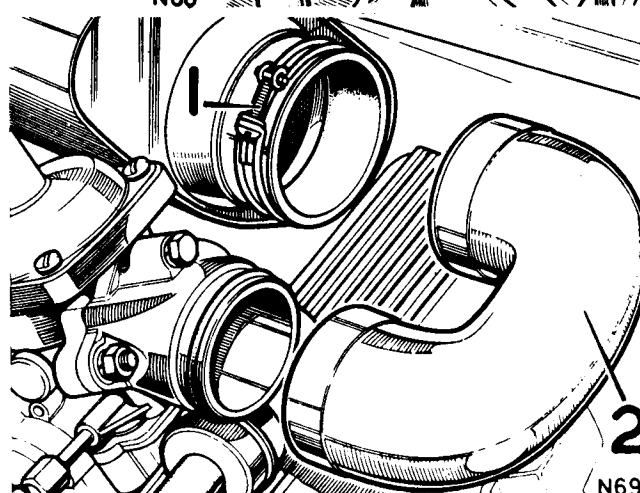
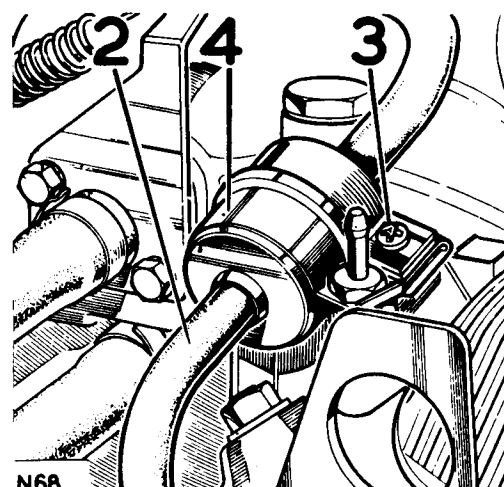
1. Release the hose clips each side of the air cleaner.
2. Withdraw the air cleaner elbows.
3. Detach the choke cable from the clip on the air cleaner.
4. Withdraw the air cleaner from the retaining posts, at the same time disconnecting the hose from the engine breather filter.
5. Release the end plate clips.
6. Withdraw the end plates complete with elements.
7. Remove the wing nut, washer and retaining plate for each element.
8. Then withdraw the elements.
9. Discard old elements and replace with new units.
10. Ensure that sealing washers on end plates and retaining plates are in good condition; if not replace.
11. Reassemble elements to air cleaner, and air cleaner to engine by reversing removal procedure.

*Australian specification*

1. Disconnect the balance pipe running between the air cleaners.
2. Disconnect the rocker cover breather pipe from the R.H. air cleaner.
3. Slacken the jubilee clips and disconnect the air intake temperature control systems from both air cleaners.
4. Disconnect the H.T. leads from the retaining clips located on the top of both air cleaners.
5. Disconnect the two pipes running into the temperature sensor on the R.H. air cleaner.
6. On both air cleaners, remove the four bolts securing the air cleaners to the air intake adaptor.
7. Remove the air cleaners.
8. Release the 4 clips on each air cleaner and extract the elements.
9. Fit new elements.

**NOTE:** when fitting new elements ensure that the plastic bevelled edge faces the air intake aperture.

10. For reassembly reverse the above procedure 1-6.



0037

Check fuel system for leaks, pipes and unions, for chafing and corrosion.

Check cooling/heater systems for leaks and hoses for security and condition.

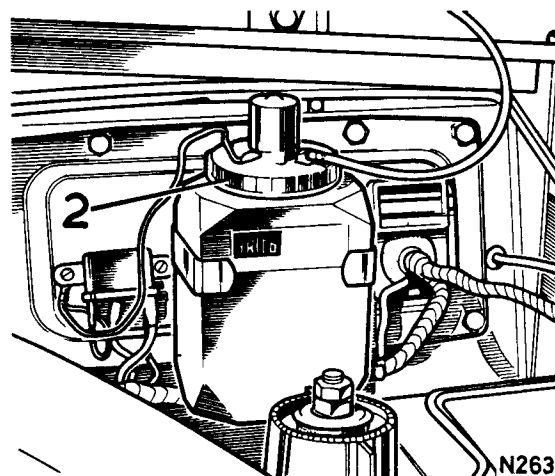
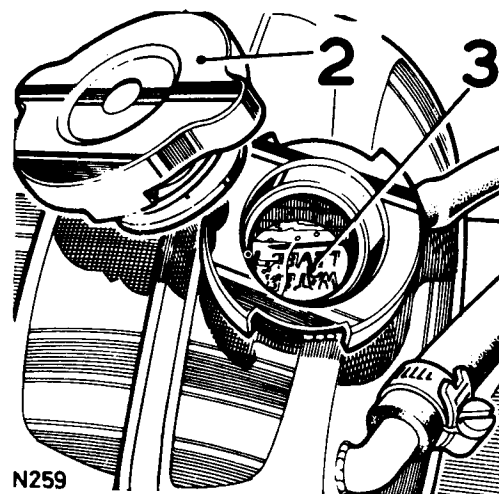
Cooling system hoses should be changed at the first signs of deterioration.

### Check/top up cooling system

1. 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.
2. The expansion tank filler cap is under the bonnet.
3. With a cold engine, the correct coolant level should be up to the 'Water Level' plate situated inside the expansion tank below the filler neck.

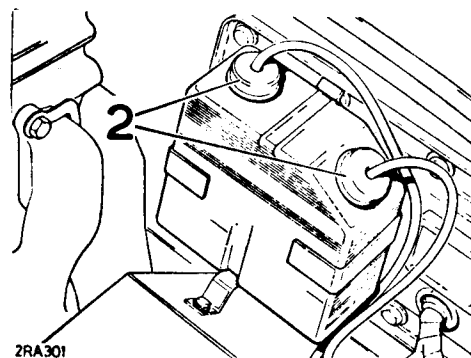
**WARNING.** Do not remove the filler cap when engine is hot because the cooling system is pressurised and personal scalding could result.

4. When removing the filler cap, first turn it anti-clockwise a quarter of a turn and allow all pressure to escape, before turning further in the same direction to lift it off.
5. When replacing the filler cap it is important that it is tightened down fully, not just to the first stop. Failure to tighten the filler cap properly may result in water loss, with possible damage to the engine through over-heating. Use soft water whenever possible, if local water supply is hard, rain-water should be used.



### Check/Adjust operation of all washers and top up reservoirs.

1. Check operation of windscreen, tailgate and headlamp washer. Adjust as necessary referring to section 84.
2. Remove reservoir caps by turning anti-clockwise.
3. 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 methyalted spirits, which has a detrimental effect on the screenwasher impeller.

**Check Driving Belts, Adjust or renew as necessary.**

1. Examine the following belts for wear and condition and renew if necessary.
  - (i) Crankshaft – water pump – alternator.
  - (ii) Water pump – jockey pulley – air pump.
  - (iii) Crankshaft – power steering.

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.

Ex Distance between pulley centres = 254 mm

$$\text{Tension} = \frac{254 \text{ mm} \times 0.4 \text{ mm}}{25.4}$$

$$= 4.00 \text{ mm.}$$

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 (1,000 miles) running.

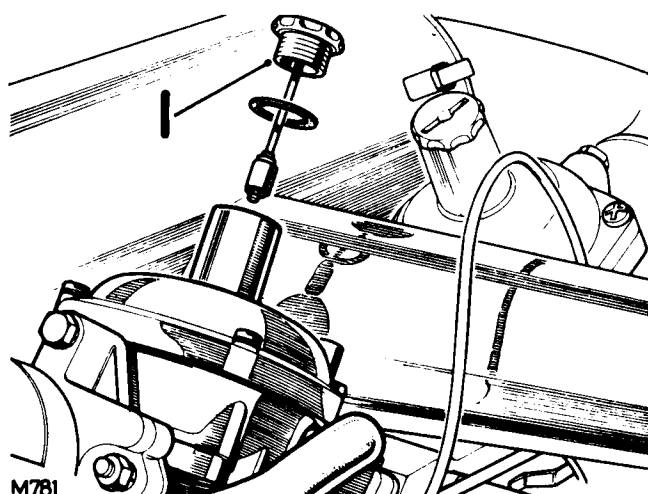
**Lubricate Accelerator Control Linkage and Pedal Pivot – Check Operation.**

The throttle linkage will not require adjustment during normal operation.

To ensure complete throttle closure a degree of 'lost motion' or slackness is incorporated into the linkage; no attempt must be made to eliminate this.

**Check security of Engine Mountings.****Check/Top up carburettor piston dampers.**

1. Unscrew and withdraw the plug and damper assembly from the top of each carburettor.
2. Top-up the damper chambers with the seasonal grade of engine oil.
3. The oil level is correct, when utilising the damper as a dipstick its threaded plug is 6mm above the dash pots and resistance is felt.
4. Screw down the damper plugs.



### Check/Adjust Carburettor Idle Settings

Refer to Operation 19.15.02

### Check/Adjust Throttle Control Vacuum Switch (Australian)

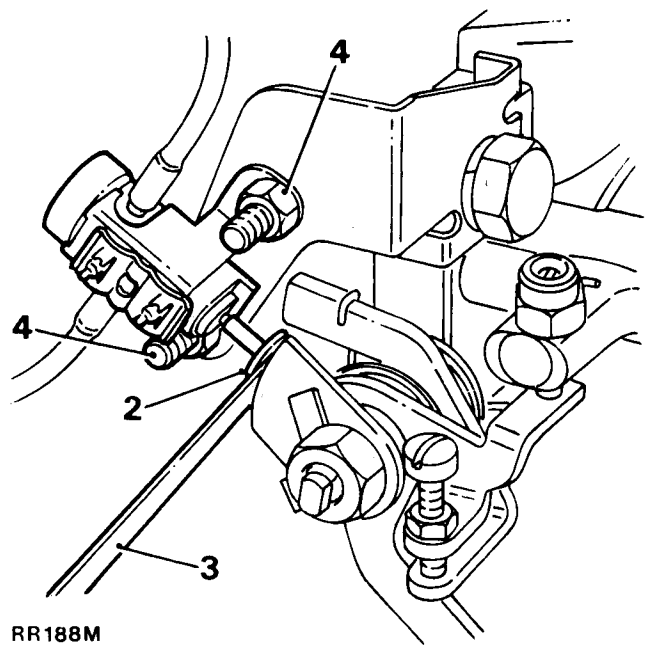
When fitted the vacuum switch enables normal advance characteristics to be obtained for quick acceleration, high speed driving and vehicle laden conditions.

The switch is activated by a cam fitted to the left-hand carburettor spindle and is set to interrupt the vacuum line between the manifold and the retard side of the distributor vacuum unit.

The following check and adjustment must only be carried out after the engine idle speed has been set correctly.

1. Ensure that the throttle linkage is fully in the idle position.
2. Push the plunger fully into the switch and hold in this position.
3. Measure the clearance between the plunger and the cam on the throttle linkage. This must be 0,76 mm (0.030 in.).
4. Adjust as necessary by slackening the fixings mounting the switch to the bracket and moving the switch in the required direction.
5. Recheck the clearance after adjustment to ensure that it has not been disturbed when tightening the fixings.

**NOTE:** After final adjustment ensure that the centre of the cam contacts the centre of the switch button.



RR188M

6. Start the engine and warm it to normal running temperature.
7. When the engine is idling steadily, disconnect the retard pipe at the distributor. A noticeable rise in engine speed should be apparent if the system is functioning.
8. When satisfied that the facility is operating correctly, reconnect the vacuum pipe to the distributor, ensuring a secure connection.

### Check Security of E.G.R. Valve Operating Lines (Australian)

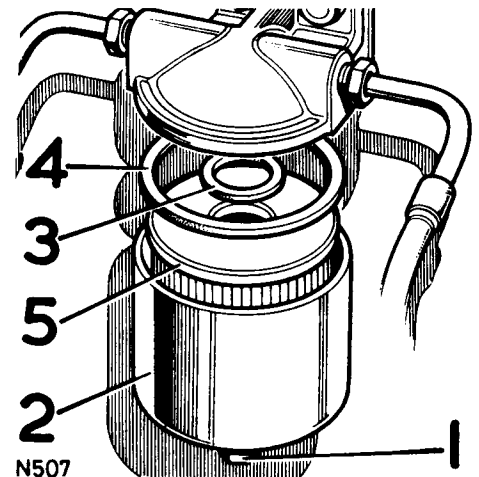
1. Check the following for security:—
  - (i) Line from carburettor to E.G.R. valve.
  - (ii) Pipe to inlet manifold from E.G.R. valve.
  - (iii) E.G.R. valve locknut.
2. Renew any pipes which show signs of deterioration.

### Renew Fuel Filter Element/Cartridge

The element provides a filter between the pump and carburettor and is located on the front LH wing.

Replace as follows:—

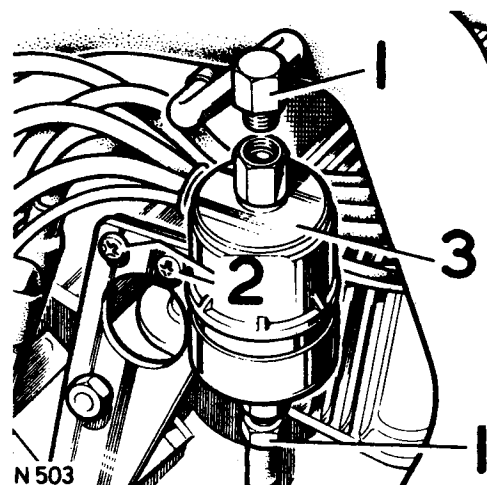
1. Unscrew the centre bolt.
2. Withdraw the filter bowl.
3. Remove the small sealing ring and remove element.
4. Withdraw the large sealing ring from the underside of the filter body.
5. Discard the old element and replace with a new unit.
6. Ensure that the centre and top sealing rings are in good condition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



The cartridge (fitted to earlier models only) provides an additional filter between pump and carburettor, located at the front of the LH rocker cover.

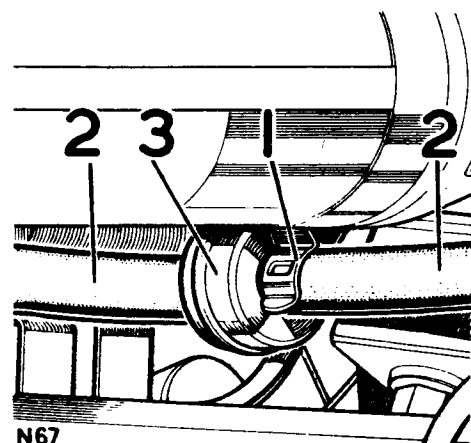
Replace as follows:—

1. Disconnect the fuel pipes from each end of the filter.
2. Slacken the securing clip.
3. Withdraw the filter.
4. Fit the new filter with end marked 'IN' downwards. Alternatively if the filter is marked with arrows, they must point upwards. Tighten securing clip and refit fuel pipes.



**Check air injection system hoses/pipes for condition and security**

1. Check the hoses between the air pump, check valves and relief valve.
2. Check for security, the two bolts securing the air pump outlet adaptor to the air pump.
3. Check the security of the nuts securing the air injection rails to the cylinder heads.



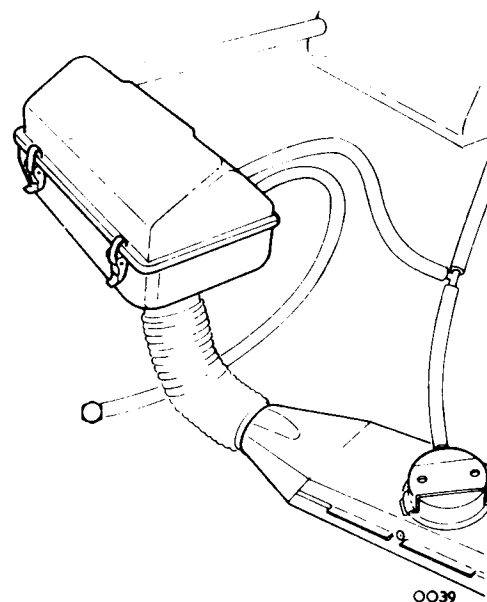
**Check/renew engine flame traps**

1. Pull the flame trap clip clear of the retainers.
2. Pull the hoses from the flame traps.
3. Withdraw the flame traps.
4. Wash in clean petrol and allow to dry.
5. Refit the flame traps, which are located in position by the hoses and clips.

**Check Air Intake Temperature Control System**

*The following check also applies to the Australian specification except that there are two hot boxes and two flap valves with vacuum capsules.*

1. Check operation of the mixing flap valve in the air cleaner by starting the engine from cold and observing the flap valve as the engine temperature rises.
2. The valve should start to open slowly within a few minutes of starting and continue to open until a stabilised 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 flap valve vacuum capsule or thermostatically controlled vacuum switch or both.
4. Check by connecting a pipe directly from the banjo on No. 8 point inlet manifold to the flap valves, thus by-passing the temperature sensor.
5. If movement of the 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.



0039



## Maintenance

---

### Check Crankcase Breathing and (Australian) Evaporative Loss Systems

#### Check Hoses/Pipes and Restrictors for blockage, security and condition

1. Check visually, the security of the following hoses:—
  - (i) Fresh air inlet from air cleaner to air filter and air filter to rocker cover.
  - (ii) Purge lines from canister to carburettor intake adaptors.
  - (iii) Both carburettor float chamber vent pipes.
  - (iv) Fuel tank vent pipe.
2. Disconnect the fresh air inlet pipe from the air cleaner.
3. Disconnect the purge lines from the carburettors.
4. Connect a low pressure air pipe to the fresh air inlet and blow through the system, checking for any restrictions.
5. Clear any blockage.
6. Refit the pipes ensuring that all connections are secure. Renew any doubtful hoses.

### Renew Adsorption Canister (Australian)

#### Removing

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

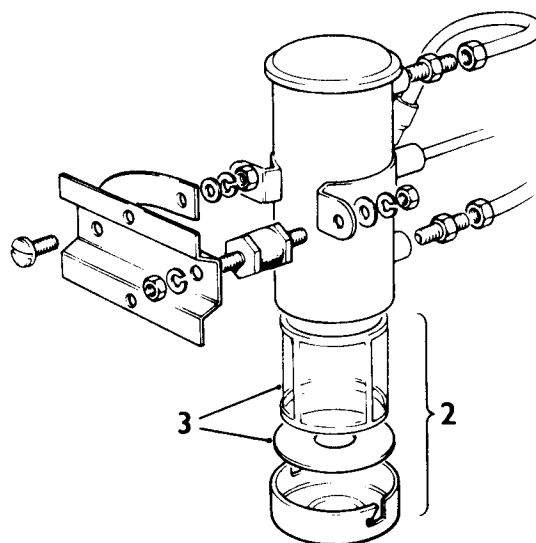
#### Refitting

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.

### Check E.G.R. System (Australian)

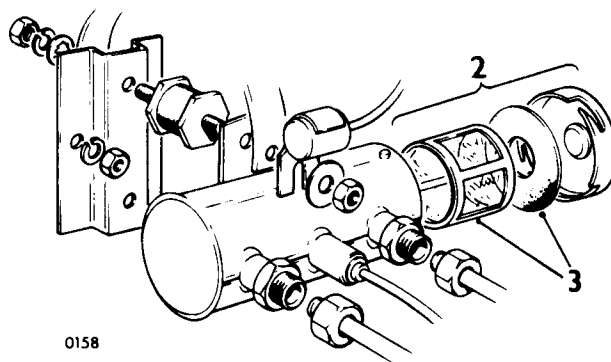
1. Disconnect the vacuum control from the top of the E.G.R. valve.
2. Slacken the unions securing the asbestos lagged pipe to the inlet manifold and the E.G.R. valve.
3. Remove the pipe.
4. Slacken the locknut at the base of the valve.
5. Unscrew the valve from the exhaust manifold.
6. Clean the assembly area of the valve with a wire brush. Use a standard spark plug machine to clean the valve and seat. Insert the valve opening into the machine and lift the diaphragm evenly. Blast the valve for approximately 30 seconds; remove and inspect. If necessary repeat until all the carbon deposits are removed. Use compressed air to remove all traces of carbon grit from the valve. Use a flexiwire brush to clean the steel pipe; blow clear of carbon grit.
7. Refit the E.G.R. valve and asbestos lagged pipe by reversing 2-5 above.
8. Reconnect the vacuum control line to the top of the E.G.R. valve.
9. Check the E.G.R. valve operating line and asbestos lagged pipe for security.
10. Renew any pipes which show signs of deterioration.
11. Check the function of the E.G.R. valve as follows:— Warm the engine to normal running temperature and ensure that the autochoke control is fully 'off'. Open and close the throttle several times and observe or feel the E.G.R. valve, which should open and close with the changes in engine speed. This valve should close instantly when the throttle is closed.



### Clean Electric Fuel Pump Element

Alternative fuel pumps can be fitted and may be located on the left chassis member to the front of the rear wheel or on the heelboard beneath the rear seat.

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.



0158

### Check Exhaust System for Leaks and Security

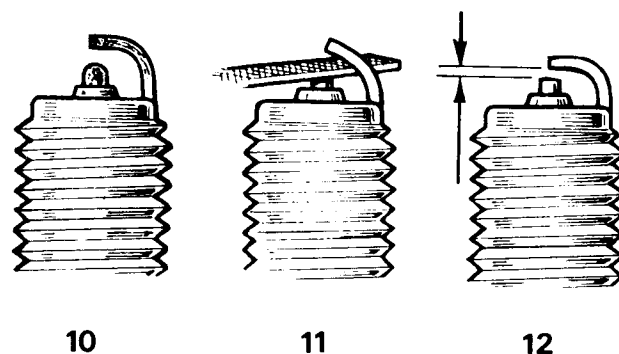
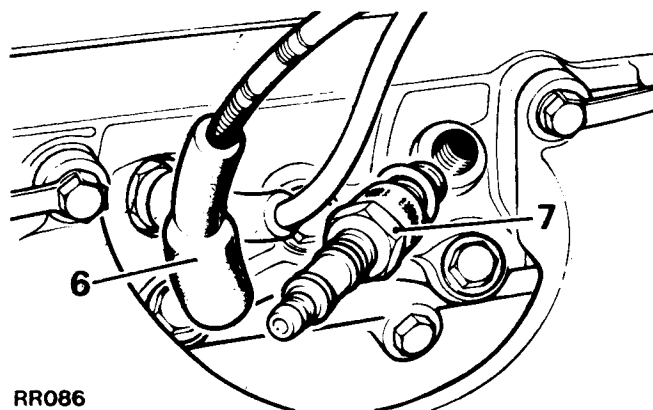
## IGNITION

### Clean/Adjust Spark Plugs

1. Use the special spark plug spanner and tommy bar supplied in the tool kit when removing or refitting spark plugs.
2. Take great care when fitting spark plugs not to cross-thread the plug, otherwise costly damage to the cylinder head will result.
3. Check or replace the spark plugs as applicable. If the plugs are in good condition, clean and reset the electrode gaps refer to Page 05-1. At the same time file the end of the central electrode until bright metal can be seen.
4. It is important that only the correct type of spark plugs are used for replacements.
5. Incorrect grades of plugs may lead to piston overheating and engine failure.

To remove spark plugs proceed as follows:—

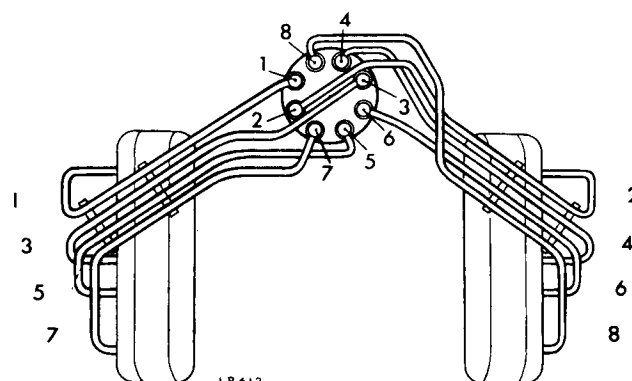
6. Remove the leads from the spark plugs.
7. Remove the plugs and washers.
8. To clean the spark plugs:—
  - (a) Fit the plug into a 14 mm adaptor of an approved spark plug cleaning machine.
  - (b) Wobble the plug in the adaptor with a circular motion for three or four seconds only with the abrasive blast in operation. Important: Excessive abrasive blasting will lead to severe erosion of the insulator nose. Continue to wobble the plug in its adaptor with air only, blasting the plug for a minimum of 30 seconds: this will remove abrasive grit from the plug cavity.
  - (c) Wire-brush the plug threads; open the gap slightly, and vigorously file the electrode sparking surfaces using a point file. This operation is important to ensure correct plug operation by squaring the electrode sparking surfaces.
  - (d) Wash new plugs in petrol to remove protective coating.
9. Set the electrode gap to the recommended clearance.
10. Shows dirty plug.
11. Filing plug electrodes.
12. Clean plug set to correct gap.
13. Test the plugs in accordance with the plug cleaning machine manufacturers' recommendations.
14. If satisfactory the plugs can be refitted.
15. When pushing the leads on to the plugs, ensure that the shrouds are firmly seated on the plugs.



LR 626

### Fitting H.T. leads

16. Ensure that replacement HT leads are refitted in their spacing cleats in accordance with the correct layout illustrated. Failure to observe this instruction may result in cross-firing between two closely fitted leads which are consecutive in the firing order.



## Renew distributor contact breaker points

### Fixed contact type (fitted to distributor with black cap)

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. Clean the new points with petrol to remove the protective coating.
6. Add a smear of grease to contact pivot before fitting.

### Sliding contact type (fitted to distributor with blue cap)

1. Release the clips and remove the distributor cap.
2. Remove the rotor arm from the cam spindle.
3. Remove the retaining screw and washers and lift the complete contact breaker assembly from the moveable plate.
4. Remove the nut and plastic bushes from the terminal post to release the leads and spring.
5. Discard the old contact breaker assembly.
6. Clean the new points with petrol to remove the protective coating.
7. Connect the leads to the terminal post in the following sequence:—
  - (a) lower plastic bush
  - (b) red lead tab
  - (c) contact breaker spring eye
  - (d) black lead tab
  - (e) upper plastic bush
  - (f) retaining nut.
8. Fit the contact breaker assembly to the moveable plate ensuring that the pegs underneath locate in the holes in the moveable plate.
9. The sliding contact actuating fork must also be located over the fixed peg in the adjustable base plate.
10. Fit the retaining screw plain and spring washer to secure the contact breaker assembly to the moveable plate.

### Check/adjust distributor contact breaker points

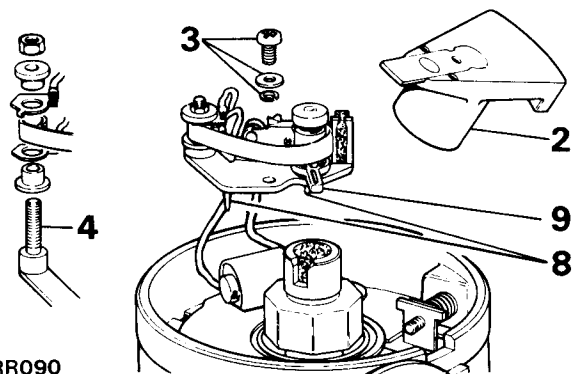
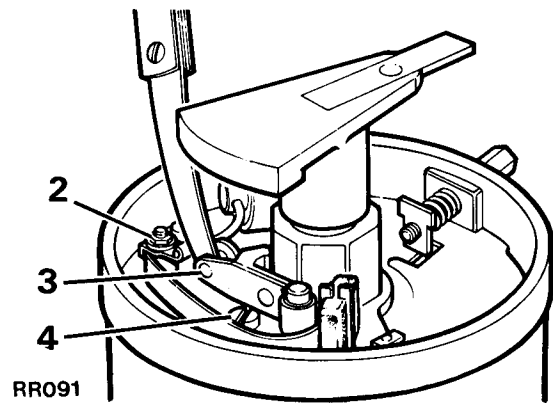
To obtain satisfactory engine performance it is most important that the contact points are adjusted to the dwell angle which is  $26^{\circ}$  to  $28^{\circ}$ , using suitable workshop equipment (See operation 86.35.20 for details). However, contact points may be adjusted provisionally or in circumstances where specialised checking equipment is not available, by one of the following methods:—

#### Feeler gauge method

1. Remove the distributor cap.
2. Turn the engine in direction of rotation until the contacts are fully open.
3. 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.
4. Adjust by turning the adjusting nut clockwise to increase gap or anti-clockwise to reduce gap.
5. Replace the distributor cap.

#### Timing lamp method

1. Remove the distributor cap.



2. Turn the engine in the direction of rotation until the contact breaker heel is on the peak of number one cylinder cam. Points should be fully open.
3. Connect a 12 volt timing lamp, or suitable voltmeter, across the contact breaker lead terminal and a suitable earth point.
4. Switch on the ignition.
5. Turn the distributor adjusting nut anti-clockwise until the timing lamp goes out or there is no reading on the voltmeter.
6. Continue a further two turns of the adjuster in an anti-clockwise direction.  
During this operation the adjusting nut should be pressed inwards with the thumb to assist the helical return spring.
7. Slowly the adjusting nut clockwise until the timing lamp just comes on, or there is a voltage shown on the voltmeter.
8. Noting the position of the flats on the adjusting nut, continue in a clockwise rotation for a further five flats.
9. Remove timing lamp or voltmeter and switch off ignition.
10. Replace the distributor cap.

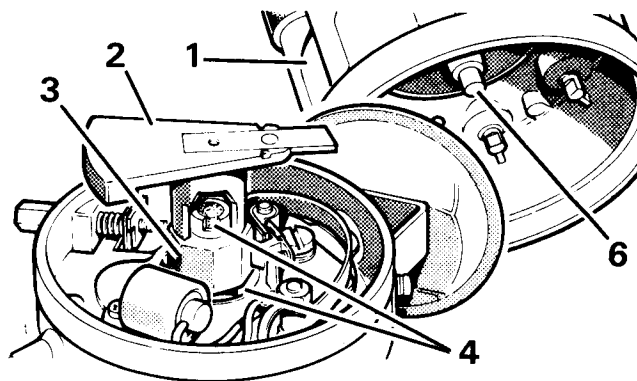
**IMPORTANT:** At the first available opportunity after the contacts have been adjusted as detailed above, they must be finally set to the dwell angle using specialised equipment.

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

### Lubricate Distributor (black cap)

#### Fixed contact type

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.

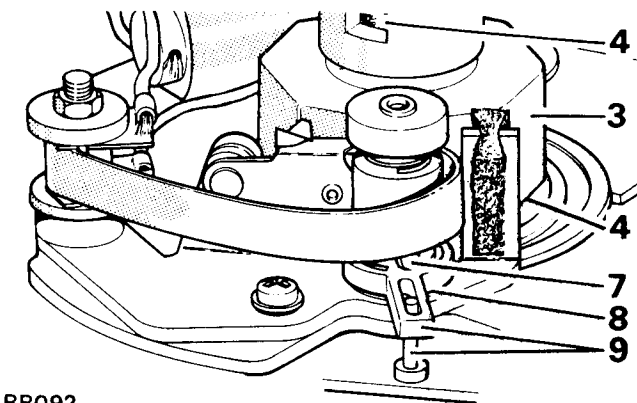


RR093

### Lubricate Distributor (blue cap)

#### Sliding contact type

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. Lubricate the actuator ramps and contact breaker heel ribs with Shell 'Retinax' or equivalent grease.
8. Grease the underside of the heel actuator.
9. Apply grease to the fixed pin and actuator fork.
10. Refit rotor arm and distributor cap.



RR092

#### Check

Check Ignition Wiring and High Tension Leads for Fraying, Chafing and Deterioration.

Clean Distributor Cap and check for Cracks and Tracking.

#### Check Security of Distributor Vacuum Unit Line and Operation of Vacuum Unit.

1. Check security of distributor vacuum unit line connections at the carburettor, throttle-controlled vacuum switch and distributor. Ensure that carburettor idle settings are correct.
2. Check/adjust the throttle-controlled vacuum switch as follows:—
  - (i) Ensure that the throttle linkage is fully returned to the idle position.
  - (ii) Push the plunger fully into the switch and hold it in this position.
  - (iii) Measure the clearance between the plunger and the cam on the throttle linkage. This must be 0,6 to 0,7 mm (0.025 to 0.030 in).
  - (iv) Adjust as necessary by slackening the fixings, mounting bracket to inlet manifold, and moving the switch and bracket complete in the required direction.
3. Start the engine and warm it to normal running temperature.
4. When the engine is idling steadily, disconnect the retard pipe at the distributor. A noticeable rise in engine speed should be apparent if the system is functioning.
5. When satisfied that the facility is operating correctly, reconnect the vacuum pipe to the distributor ensuring a secure connection.

#### Check

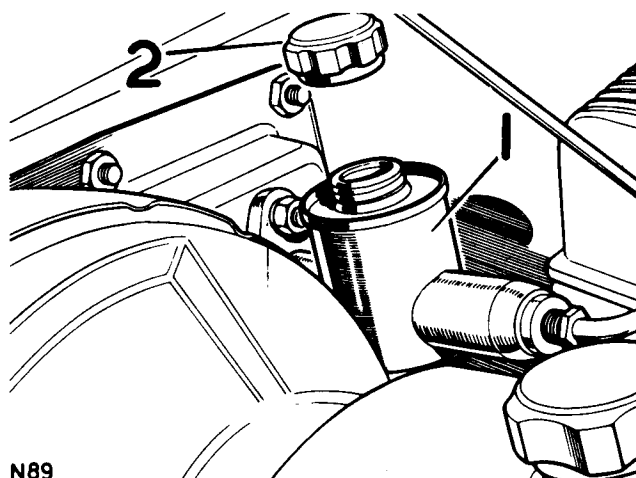
Check/Adjust Dwell Angle and Ignition Timing using Electronic Equipment (See 86.35.20 for details).

#### Coil Performance on an Oscilloscope

See 'Engine Tuning' page 05-1 for details.

**TRANSMISSION.****Check for Oil leaks.****Check/Top up Clutch Fluid Reservoir.**

1. Check the fluid level in the reservoir, mounted on the bulkhead adjacent to the brake servo.
2. Remove the cap, top up if necessary to bottom of filler neck. Refer to Division 09 for recommended fluids.



N89

**Check clutch pipes for chafing, leaks and corrosion.****Check/top up gearbox and transfer box oil levels.**

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

**Main gearbox oil levels**

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

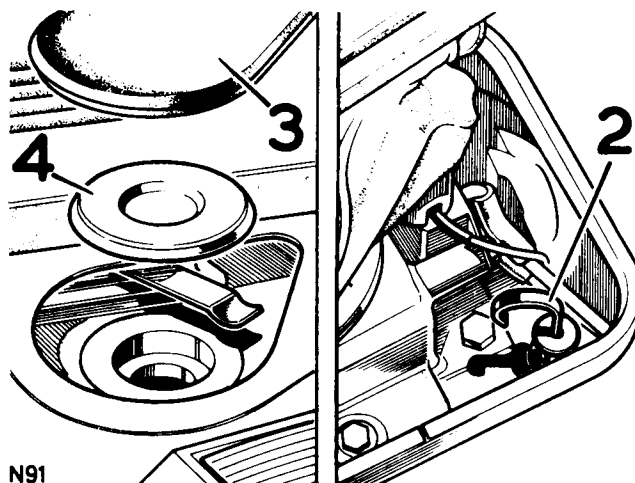
*Earlier Models*

1. Remove gearbox cover trim.
2. Remove oil level dipstick, located under the main gear lever sealing rubber, and check that oil level is up to the 'H' level mark on the dipstick. If oil is required, proceed as follows:
3. Remove the oval rubber blanking plug on the gearbox cover.
4. Remove the oil filler cap from the gearbox and top up as necessary. If significant topping up is required check for oil leaks at drain plug and filler cap, all joint faces and through drain hole in bell housing

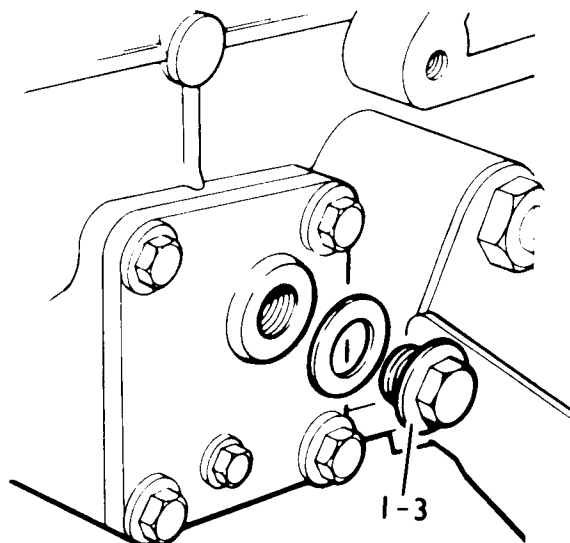
*Later Models*

1. From beneath the vehicle remove the filler/level plug at the side of the gearbox.
2. Add oil to the bottom of filler plug orifice.
3. Replace the filler plug.

*Continued*



N91



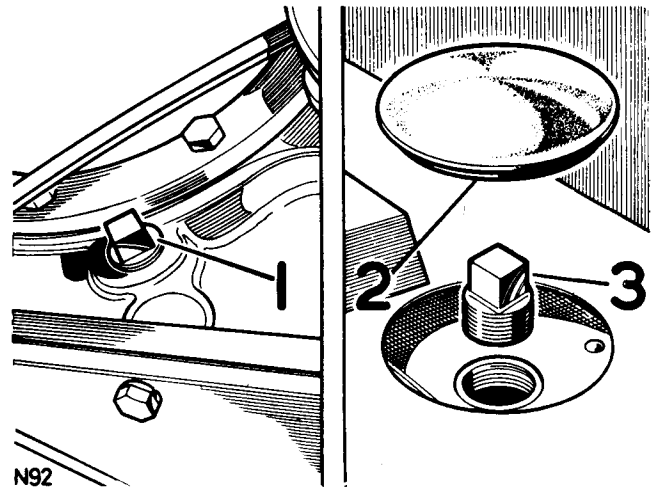
1391

## Transfer box oil level

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 round rubber blanking plug from the gearbox cover.
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.

**NOTE:** Except where the transfer box is removed from the vehicle it is more convenient to top-up through the level plug hole. Do not overfill otherwise leakage will occur.

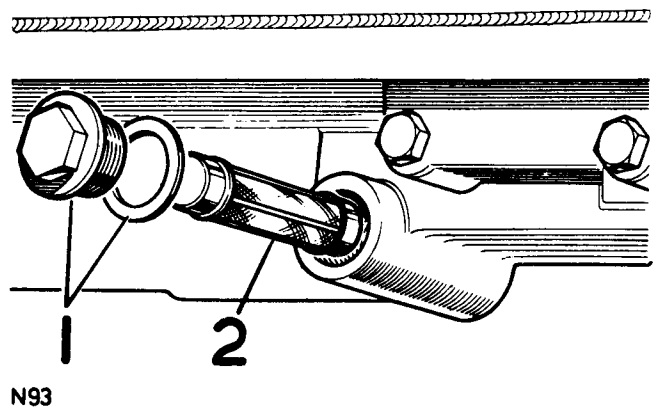


## Renew Gearbox and Transfer Box Oil

Drain and refill monthly when operating under severe wading conditions.

### Main gearbox oil changes

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 level/filler hole with the correct grade of oil to the bottom of the level/filler hole. On early gearboxes fill to the 'H' level mark on the dipstick.

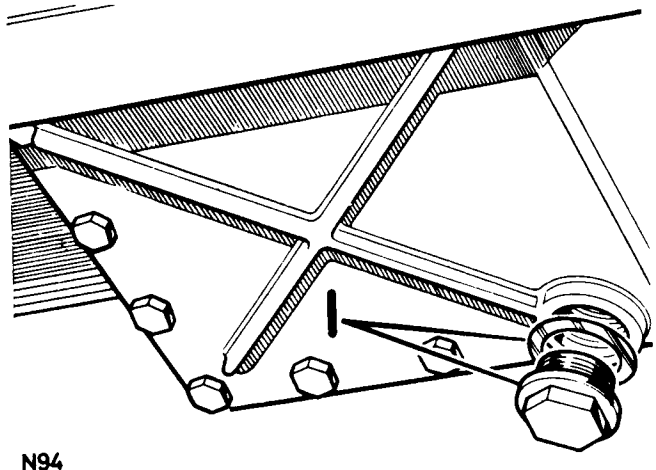


### Transfer gearbox oil changes

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

Refer to Division 09 for gearbox capacity.

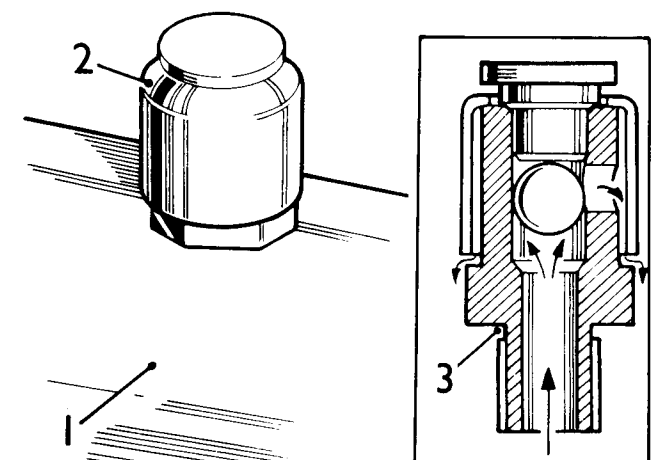
**NOTE:** Except where the transfer box is removed from the vehicle it is more convenient to refill through the level plug hole. Do not overfill otherwise leakage will occur.



### Axle case breathers

Clean the axle case breathers, one in each axle case.

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.



LR 813

## Check/top up front and rear axle oil levels

### Renew front and rear axle oil

1. Remove filler/level plug, check oil level and top up if necessary to the bottom of the filler plug hole. This is located on the side of the pinion housing on both axles.
2. The projecting square plug on the front axle 'banjo' casing should be disregarded.

**NOTE:** On later axles a recessed square threaded filler/level plug is fitted to front and rear axle 'banjo' casings.

3. If significant topping up is required, check for oil leaks at plugs, joint faces, and oil seals adjacent to axle shaft flanges and propeller shaft driving flange.

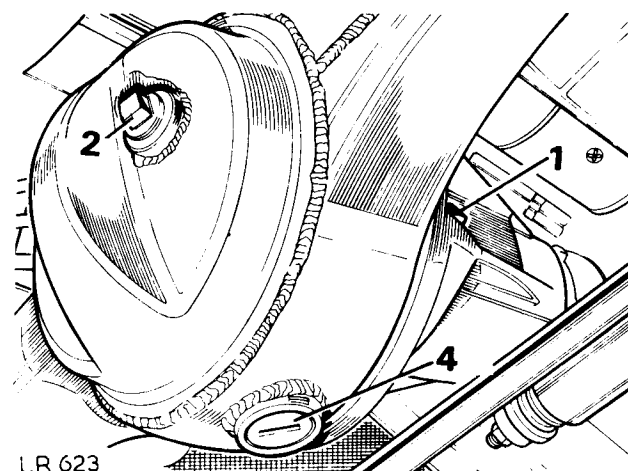
To change the differential oil, proceed as follows:—

4. Immediately after a run, when the oil is warm, drain off the oil by removing the respective drain plug.
5. Replace drain plug and refill with oil of the correct grade.

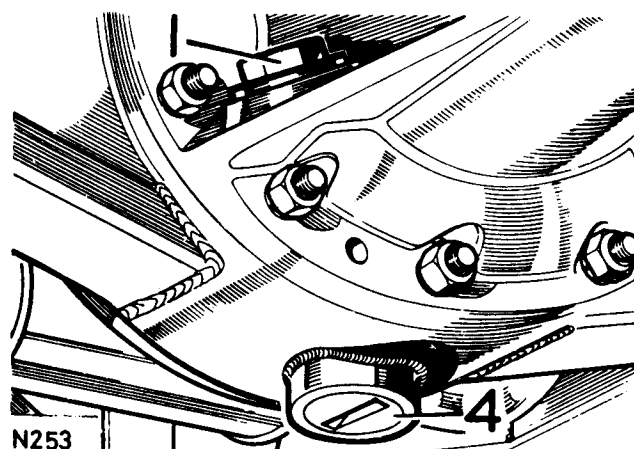
Refer to Division 09.

**Important.** Do not overfill otherwise damage to seals may occur. Drain plugs have slotted heads, which can be removed with the end of a single-ended spanner.

**NOTE:** On later axles a recessed square headed drain plug is fitted to front and rear axle banjo casings.



LR 623



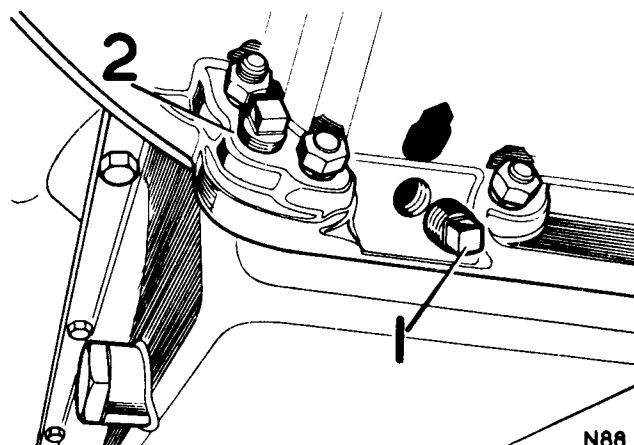
N253

Drain flywheel housing if drain plug is fitted for wading.

### Flywheel housing drain plug

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.



N88



### Check Tightness of Propeller Shaft Coupling Bolts.

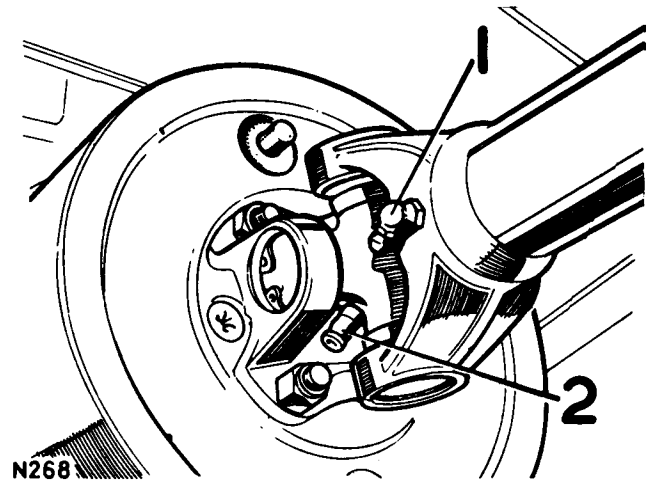
### Lubricate Propeller Shaft.

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.

### Lubricate Propeller Shaft Sealed Sliding Joint.

Lubricate the sliding spline of 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.
5. Important. Compress propeller shaft at sliding joint to avoid overfilling then apply grease.
6. Replace grease nipple with plug and reconnect propeller shaft.



## STEERING AND SUSPENSION

### Check Condition and Security of Steering Unit, Joints, Relays and Gaiters.

### Check Steering Rack/Gear for Oil/Fluid Leaks.

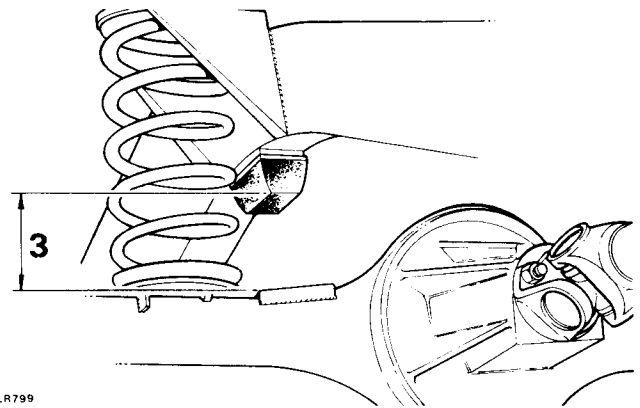
### Check Shock Absorbers for Fluid Leaks.

### Check Power Steering System for Leaks, Hydraulic Pipes and Unions for Chafing and Corrosion.

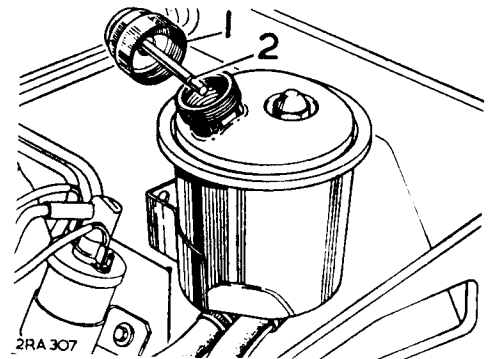
*continued*

Verify that the vehicle is being operated within the specified maximum loading capabilities. Drive the vehicle on to level ground and remove all loads. Should the vehicle lean to one side it indicates a fault with the springs or shock absorbers, **not** the self-levelling unit. If the levelling unit is believed to be at fault, the procedure below should be followed:—

1. Check the levelling unit for excessive oil leakage and if present the unit must be changed. Slight oil seepage is permissible.
2. Remove any excessive mud deposits and loose items from the rear seat and load area.
3. Measure the clearance between the rear axle bump pad and the bump stop rubber at the front outer corner on both sides of the vehicle. The average clearance should be in excess of 67 mm (2.8 in.). If it is less than this figure remove the rear springs and check their free length against the 'Road Spring Data' (see page 04–2). Replace any spring whose free length is more than 20 mm (0.787 inches) shorter than the figure given. If after replacing a spring the average bump clearance is still less than 67 mm (2.8 in.), replace the levelling unit.
4. With the rear seat upright, load 450 kg (992 lb) into the rear of the vehicle, distributing the load evenly over the floor area. Check the bump stop clearance, with the driving seat occupied.
5. Drive the vehicle for approximately 5 km (3 miles) over undulating roads or graded tracks. Bring the vehicle to rest by light brake application so as not to disturb the vehicle loading. With the driving seat occupied, check the bump stop clearance again.
6. If the change in clearance is less than 20 mm (0.787 in.) the levelling unit must be replaced.



LR799



2RA 307

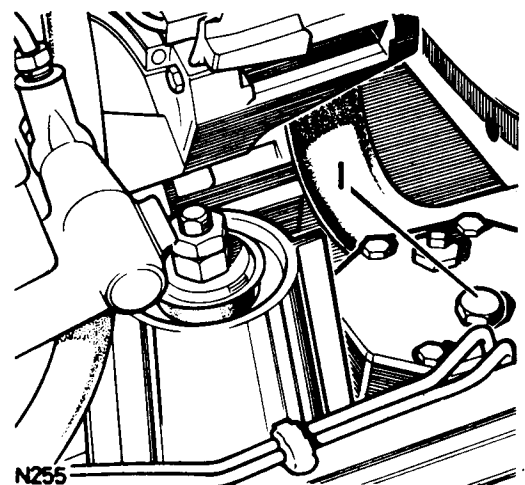
### Check/Top up Fluid in Power Steering Reservoir or Manual Steering Box Oil Level

#### Power Steering Fluid Reservoir

1. Unscrew the fluid reservoir cap.
2. Check that the fluid is up to the mark on the dipstick.
3. If necessary, top up using one of the recommended grades of fluid.

#### Steering box oil level

1. Check oil level and top-up if necessary to the bottom of the filler plug hole on the top of the cover plate.
2. If significant topping-up is required check for oil leaks at joint faces and rocker shaft oil seal. Access to the filler plug is gained by lifting the bonnet panel.



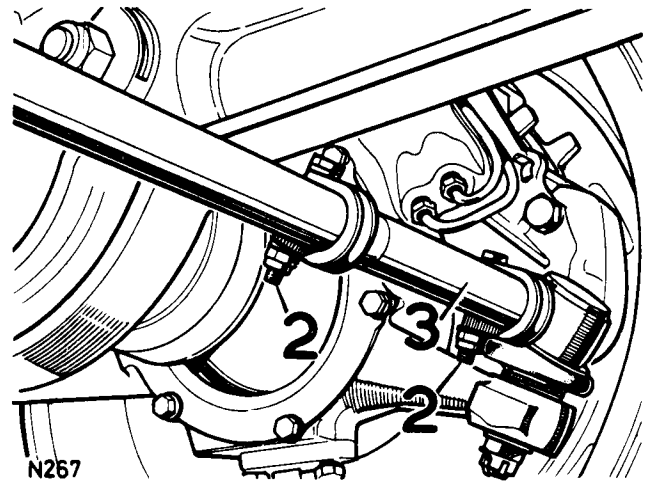
N255

### Check/adjust front wheel alignment

Refer to page 04—3 for Data.

#### To adjust.

1. Set the vehicle on level ground, with the road wheels in the straightahead position, and push it forward a short distance.
2. Slacken the clamps securing the adjusting shaft to the track rod.
3. Turn the adjusting shaft to decrease or increase the effective length of the track rod, as necessary, until the toe-out is correct.
4. Re-tighten the clamps.
5. 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.
6. Recheck the toe-out. If necessary carry out further adjustment.



### Check security of suspension fixings

#### Check/adjust steering box

Refer to operation 57.10.13 – Power Steering

Refer to operation 57.35.01 – Manual Steering

### Check/top up swivel pin housing oil levels

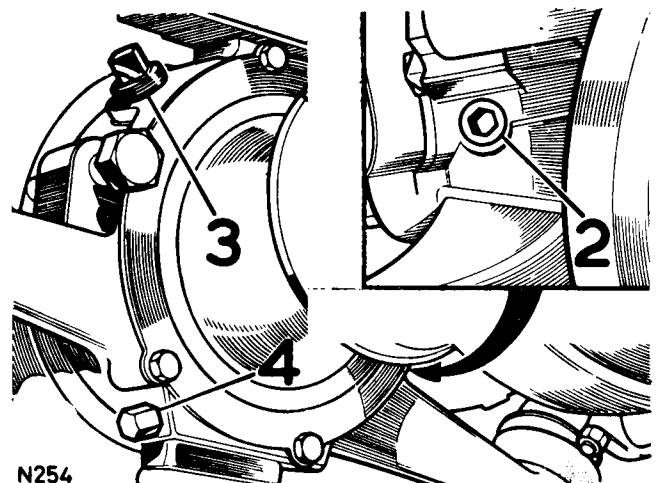
#### Renew swivel pin housing oil

##### Check

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 small grub screw at the rear of the swivel pin housing, oil should be level with bottom of hole.
3. Top up if necessary through the filler plug hole at the front of the housing.  
If significant topping up is required, check for oil leaks at plugs, joint faces and oil seals.

##### Renew

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. Refit with oil of correct grade.  
The capacity of each housing is approximately 0.26 litres, 5 US pint (.5 Imperial pint).



### Check suspension self levelling unit for fluid leaks

## BRAKES

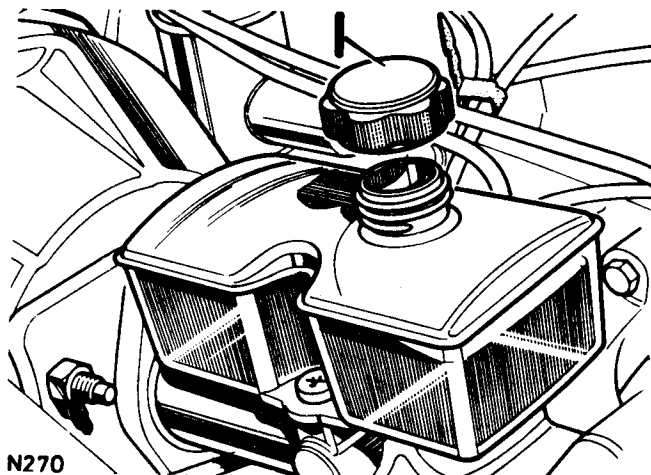
Check visually, hydraulic pipes and unions for chafing, leaks and corrosion.

### Check/top up brake fluid reservoir.

The tandem brake reservoir is integral with the servo unit and master cylinder.

1. Remove cap to check fluid level; top up if necessary until the fluid reaches the bottom of the filter neck. Refer to Section 09 for recommended fluids.
2. If significant topping up is required check master cylinder, brake disc cylinders and brake pipes and connections for leakage; any leakage must be rectified immediately.

**Caution.** When topping up the reservoir, care should be taken to ensure that brake fluid does not come into contact with any paintwork on the vehicle.



### Check footbrake operation

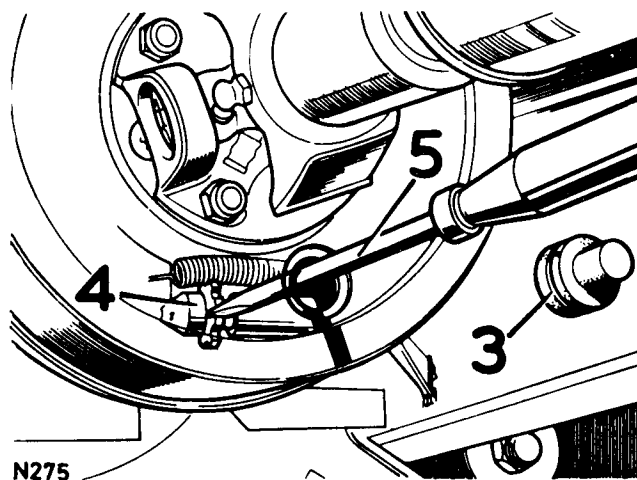
If footbrake travel is excessive, check brake pad and caliper condition.

If footbrake is "spongy" bleed brake system. 70.25.02.

### Check handbrake for security and operation; adjust if necessary.

The handbrake lever acts on a transmission brake at the rear of the gearbox unit, adjust as follows:-

1. Set the vehicle on level ground.
2. Release the hand brake 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. Turn the adjuster until the brake shoes expand to prevent drum rotation.
6. Turn the adjuster back two 'clicks' and replace blanking plugs.
7. Check that the handbrake operates correctly and holds the vehicle.



### Inspect Brake Pads for wear and Discs for condition.

Hydraulic disc brakes are fitted at the front and rear, and the correct brake adjustment is automatically maintained; no provision is therefore made for adjustment.

1. Check the thickness of the front brake pads and renew if the minimum thickness is less than 3.0 mm (.125 in.).
2. Check the thickness of the rear brake pads and renew if the minimum thickness is less than 1.5 mm (0.062 in.). Refer to Division 70.
3. Also check for oil contamination on brake pads and discs.
4. If replacement or rectification is necessary, this should be carried out by your local Rover Distributor or Dealer.
5. Check brake hoses and pipes for security, fracture, leakage and change as applicable.

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.

**Lubricate Handbrake Mechanical Linkage and Cable Guides (lever pivot).**

**Check Brake Servo Hose(s) for Security and Condition.**

### Renew Hydraulic Brake Fluid.

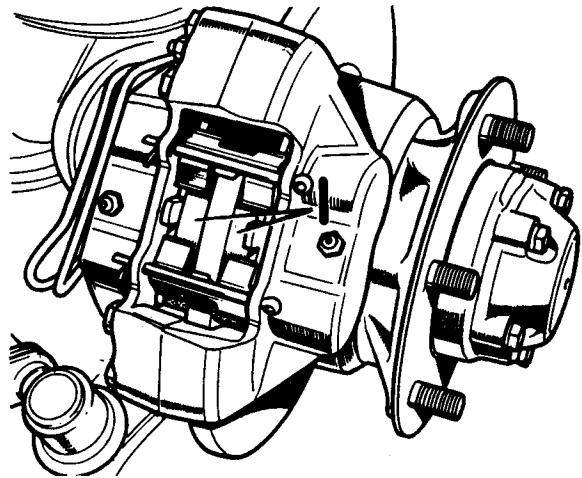
Brake fluid absorbs water and in time the boiling point of the fluid will be lowered sufficiently to cause the fluid to be vapourised by the heat generated when the vehicle brakes are applied. This will result in loss of braking efficiency or in extreme cases brake failure.

Therefore all fluid in the brake system should be changed every eighteen months or 18,000 miles (30,000 km) whichever is the sooner. It should also be changed before touring in mountainous areas if not done in the previous nine months. Bleed all fluid from the system and refill – 70.25.02.

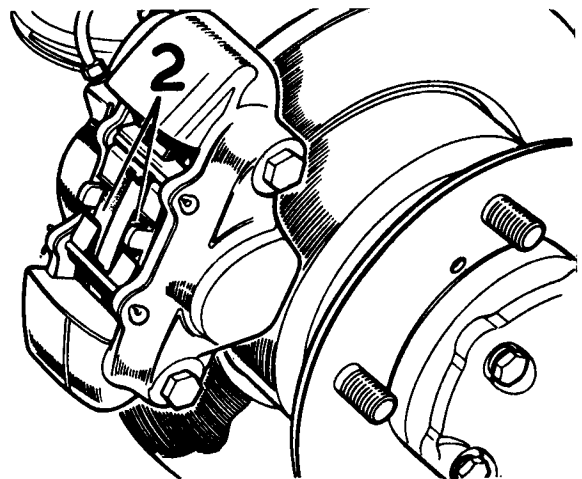
Refer to Division 09 for recommended fluids.

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-emphasised.



N271



N272

**Renew rubber seals in braking system, flexible hoses and servo air filter.**

Brake system pressure are very high, up to 2000 lb/in<sup>2</sup>, when the brakes are applied. Brake master cylinder and caliper seals deteriorate with time as do the flexible hoses. Therefore the seals, flexible hoses and the brake servo air filter should be changed at the recommended intervals.

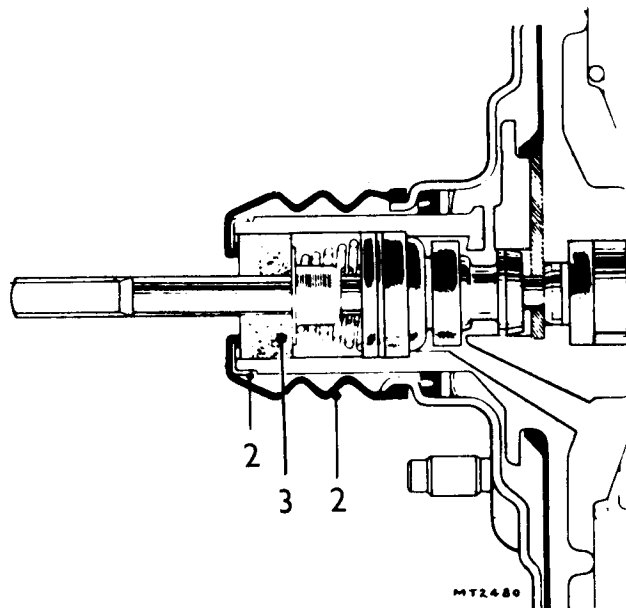
**Renew brake master cylinder seals** Refer to 70.30.09

**Renew brake caliper seals** Refer to 70.55.13/14

#### Renewing brake servo filter

1. Remove the servo from the car. 70.50.01.
2. Slide the rubber boot and end cap along the pushrod.
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.



## WHEELS AND TYRES

### Check/adjust tyre pressures including spare wheel.

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

### Check/adjust tyre pressures including spare

2. These should be checked at least every month for normal road use and at least weekly, preferably daily, if the vehicle is used off the road or high-speed touring.
3. Whenever possible check with the tyres cold, as the pressure is about 0,2 kg/cm<sup>2</sup> (3 lb/sq.in.) 0,21 bars higher at running temperature.
4. Replace the valve caps, as they form a positive seal. Check that pressures on all tyres, including the spare, are correct. Any unusual pressure loss in excess of 0,05 to 0,20 kg/cm<sup>2</sup> (1 to 3 lb/sq.in.) 0,07 to 0,21 bars per week should be investigated and corrected.

#### Normal on- and off-road use

All speeds and loads

	Front	Rear
kg/cm <sup>2</sup>	1,8	2,5
lb.in <sup>2</sup>	25	35
bars	1,72	1,24

**NOTE:** For extra comfort rear tyre pressures can be reduced to 1,5 kg/cm<sup>2</sup>, 25 lb/in<sup>2</sup>, 1.72 bars, when the rear axle weight does not exceed 1250 kg (2755 lb).

#### Off-road emergency soft use

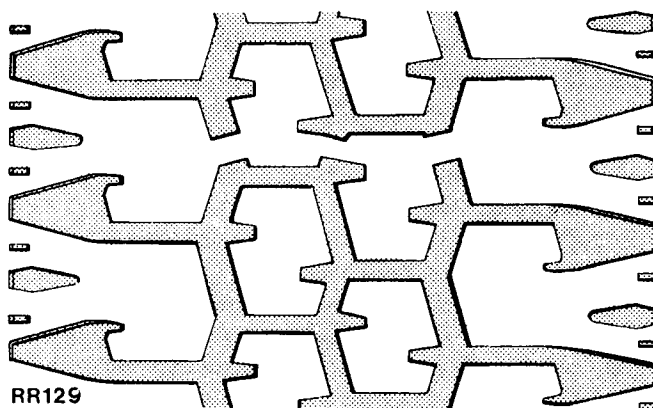
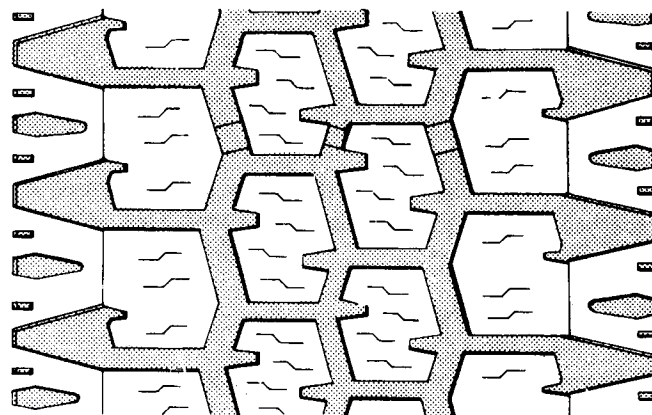
Maximum speed of 64 kph (40 mph)

	Front	Rear
kg/cm <sup>2</sup>	1,1	1,5
lb.in <sup>2</sup>	15	25
bars	1,03	1,72

As soon as reasonable conditions are reached, pressures should be restored as for normal 'on and off-road use. When high speed touring the tyre pressures should be checked much more frequently, even to the extent of a daily check.

**Check tyres for tread depth and visually for external cuts in the fabric, exposure of ply or cord structure**

1. Most tyres fitted to Range Rovers as original equipment include wear indicators in their tread pattern. When the tread has worn to a remaining depth of 1,6 mm (1/16in.) the indicators appear at the surface as bars which connect the tread pattern across the full width of the tyre, as in the Goodyear tyre section illustrated. When the indicator appear in two or more adjacent grooves, at three locations around the tyre, a new tyre should be fitted. If the tyres do not have wear indicators, the tread should be measured at every maintenance inspection and when the tread has worn to a remaining depth of 1,6 mm (1/16in.), new tyres should be fitted. Do not continue to use tyres that have worn to the recommended limit or the safety of the vehicle could be affected and legal regulations governing tread depth may be broken.
2. Check that there are no lumps or bulges in the tyres or exposure of the ply or cord structure.
3. Clean off any oil or grease, using white spirit sparingly. At the same time remove embedded flints, etc. from the treads with the aid of a penknife or similar tool, and check that the tyres have no 'breaks' in the fabric or cuts to sidewalls, etc.



## ELECTRICAL

**Check Function of all Electrical Equipment**

**Check/Top up Battery Electrolyte**

**Clean and grease battery connections.**

**Battery acid level**

The specific gravity of the electrolyte should be checked at every maintenance attention.

Readings should be:—

Temperate climates below 80°F (26.5°C) as commissioned for service, fully charged 1.270 to 1.290 specific gravity.

As expected during normal service three-quarter charged 1.230 to 1.250 specific gravity.

If the specific gravity should read between 1.190 to 1.210, half-charged, the battery must be bench charged and the electrical equipment on the vehicle should be checked.

Tropical climate, above 80°F (26.5°C) as commissioned for service, fully charged 1.210 to 1.230 specific gravity.

As expected during normal service three-quarter charged 1.170 to 1.190 specific gravity.

If the specific gravity should read between 1.130 to 1.150, half-charged, the battery must be bench charged and the electrical equipment on the vehicle should be checked.

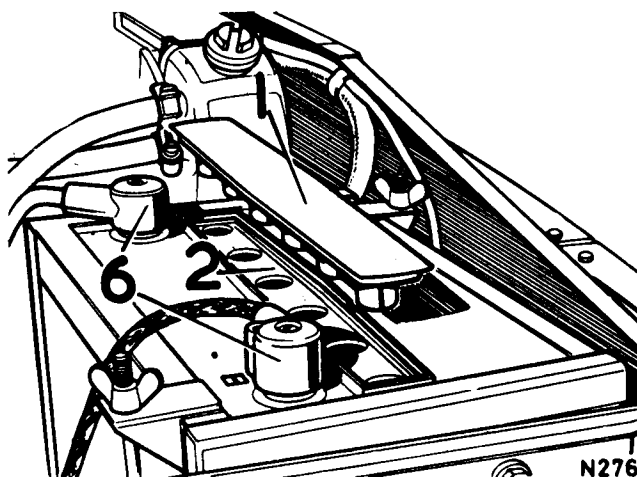
The battery is located under the bonnet at the right-hand front side.

**Check acid level as follows:—**

1. Remove the battery cell cover(s).
2. If necessary add sufficient distilled water to raise the level to the top of the separators; do NOT overfill.
3. Avoid the use of naked lights when examining the cells.
4. In very cold weather it is essential that the vehicle is used immediately after topping up to ensure that the distilled water is thoroughly mixed with the electrolyte. Neglect of this precaution may result in the distilled water freezing and causing damage to the battery.

**Battery terminal**

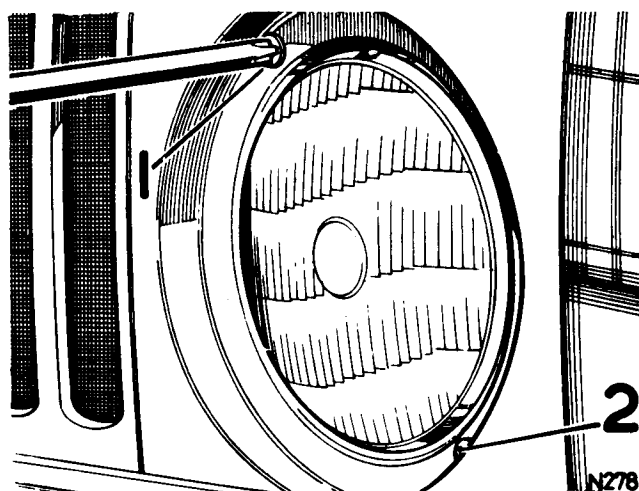
6. Remove battery terminals, clean, grease and refit.
7. Replace terminal screw; do not overtighten. Do not use the screw for pulling down the terminal.
8. Do NOT disconnect the battery cables while the engine is running or damage to alternator semiconductor devices may occur. It is also inadvisable to break or make any connection in the alternator charging and control circuits while the engine is running.
9. It is essential to observe the polarity of connections to the battery, alternator and regulator, as any incorrect connections made when reconnecting cables may cause irreparable damage to the semiconductor devices.

**Check Headlamp Alignment, adjust if necessary**

This operation requires special equipment.

In an emergency each headlamp unit can be adjusted by means of:

1. The headlamp lateral adjusting screw.
2. The headlamp vertical adjusting screw.





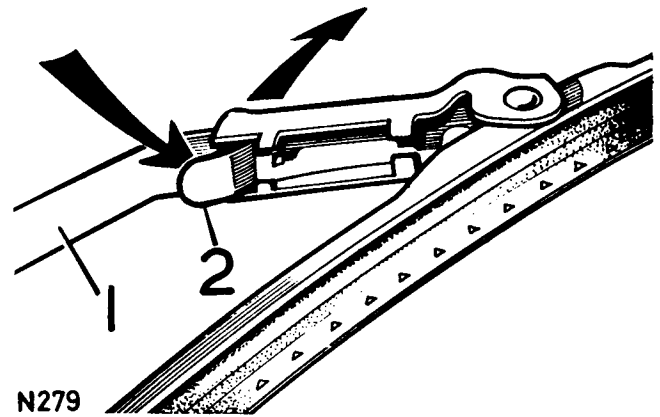
## Maintenance

### Check, if necessary renew, wiper blades

Operate the washer and wipers. Renew the wiper blades if they are damaged or the glass is smeared.

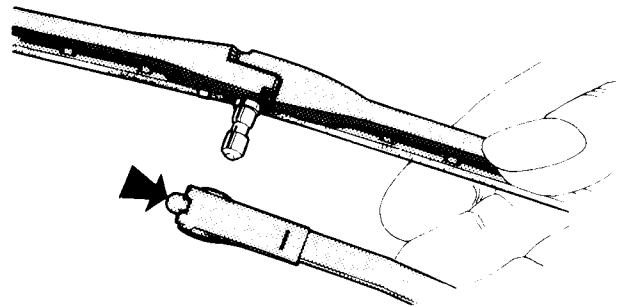
#### To replace windscreen or tailgate wiper blades

1. Pull wiper arm away from the glass.
  2. Lift spring clip (arrowed) and withdraw blade from wiper arm.
  3. To fit new blade reverse removal procedure.
- To replace headlamp wiper blades, refer to 84.25.06.



### Check output of alternator charging system

1. The alternator is a sealed unit, and requires no lubrication or maintenance.
2. Check and ensure that any dirt or oil which may have collected around the apertures in the slip-ring end bracket and moulded cover is wiped clear.
3. Using proprietary equipment, check the alternator output. Refer to page 04-4.



## BODY

### Lubricate all Locks and Hinges (NOT Steering Lock)

### Check Operation of Window Controls

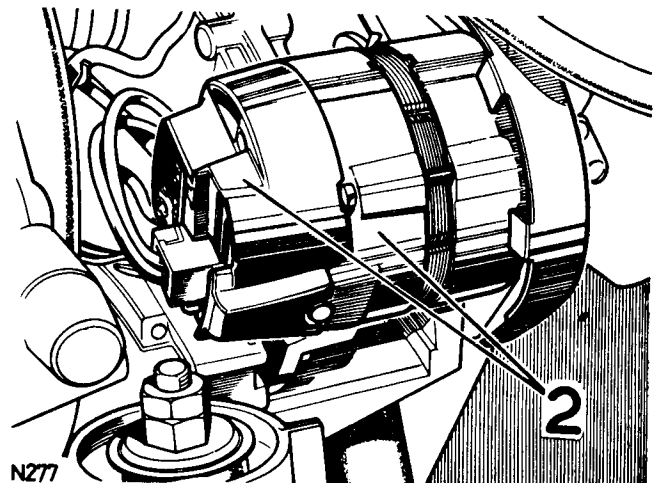
### Check Condition and Security of Seats and Seat Belts

### Check Operation of Seat Belt Inertia Reel Mechanism

**Seats:** Check security of seats in runners and runners to floor.

**Seat Belts:** Check seat belt mounting bolts for security. The wearing of seat belts is advisable for all journeys in the vehicle, no matter how short the journey, and is compulsory in some territories. The belts themselves must be in good condition and the inertia mechanism in sound working order to afford the full designed protection to the seat belt wearer.

Renew the unit if the belt is damaged, the inertia mechanism is defective or the belt has not been in use when the vehicle was involved in an impact accident.



### Check Operation of all Door, Bonnet and Tailgate Locks

### Check rear view mirror(s) for cracks and crazing

## ROAD TEST

During the road test the function of the engine, transmission, brakes, steering and seat belts should be checked together with the function of all instrumentation.