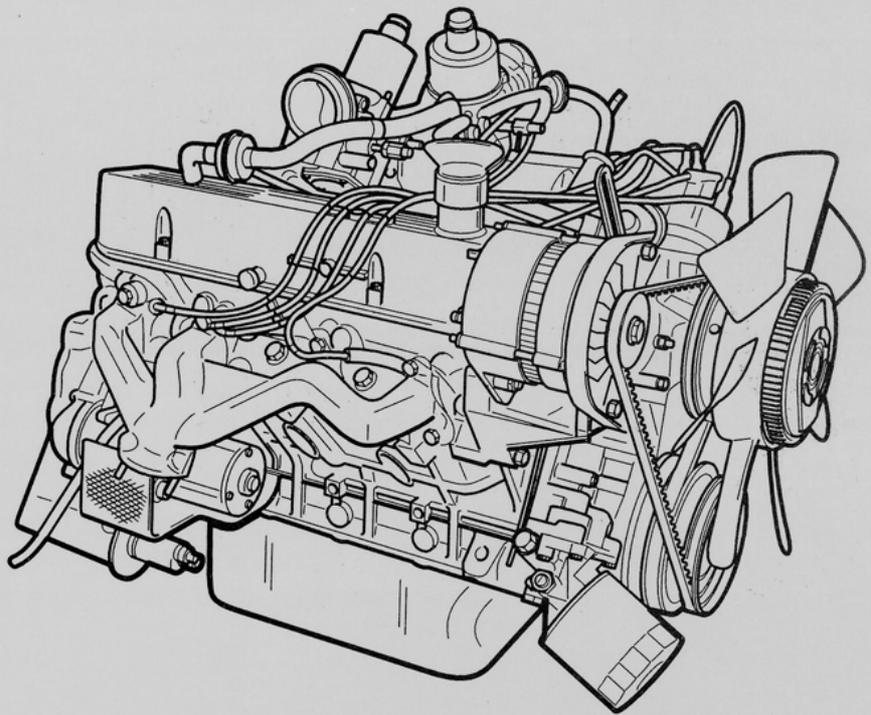


Service Workbook

V8 Petrol Engine





V8 ENGINE

Service Workbook

This Service Workbook covers the V8 engine fitted to 300 and 400 models. This engine has been supplied by Land Rover Limited and, to enable us to provide a comprehensive manual on this engine, we are indebted to Land Rover Limited for allowing us to reproduce sections of their manual without change. For this reason there may be references to Range Rover, and illustrations showing their installation which differ from the LDV installation.

This Service Workbook is primarily designed to assist skilled technicians in the efficient repair and maintenance of the V8 engine, but can also be used as a reference workbook for training purposes; it should always be consulted prior to servicing or repair work.

SPECIFICATION

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INTRODUCTION

This Service Workbook covers the V8 engine fitted to LDV 300 and 400 models. It is primarily designed to assist skilled technicians in the efficient repair and maintenance of V8 engines.

WARNINGS and **CAUTIONS** are given throughout this Service Workbook in the following form:

WARNING: Procedures which must be followed precisely to avoid the possibility of personal injury.

CAUTION: This calls attention to procedures which must be followed to avoid damage to components.

NOTE: This calls attention to methods which make a job easier to perform.

REFERENCES

References to the left-or right-hand side in the Service Workbook 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. To reduce repetition, operations covered in this Workbook do not include reference to testing the vehicle after repair. It is essential that work is inspected and tested after completion and if necessary a road test of the vehicle is carried out particularly where safety related items are concerned.

DIMENSIONS

The dimensions quoted are to design engineering specification. Alternative unit equivalents, shown in brackets following the dimensions, have been converted from the original specification.

During the period of running-in from new, certain adjustments may vary from the specification figures given in this Service Workbook. These adjustments will be re-set by the Dealer at the After Sales Service, and thereafter should be maintained at the figures specified in the Service Workbook.

REPAIRS AND REPLACEMENTS

When replacement parts are required, it is essential that only genuine LDV parts are used.

POISONOUS SUBSTANCES

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 CO₂GAS, 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 head-lamps 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 vehicles 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:

STEAMING: With the filler cap and tank unit removed, empty the tank. Steam the tank for at least two 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.

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 two hours.

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

SPECIFICATION

Purchasers are advised that the specification details set out in this Service Workbook apply to a range of vehicles and not to any one. For the specification of a particular vehicle, purchasers should consult their 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 Service Workbook, neither the Manufacturer nor the Dealer, by whom this Service Workbook is supplied, shall in any circumstances be held liable for any inaccuracy or the consequences thereof.



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 ³	Percentage	%
Cubic inch.....	in ³	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 ²
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 ²
Inches of mercury	in.Hg	Square inches.....	in ²
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 ²	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	SCREW THREADS	
Left-hand thread	LHThd	American Standard Taper Pipe.....	NPTF
Litres	litre	British Association	BA
Low compression	l.c.	British Standard Fine	BSF
Low tension.....	l.t.	British Standard Pipe	BSP
Maximum.....	max.	British Standard Whitworth.....	Whit.
Metre.....	m	Unified Coarse.....	UNC
Microfarad	mfd	Unified Fine.....	UNF



GENERAL SPECIFICATION DATA

ENGINE

Crankshaft

Main journal diameter	58.409–58.422 mm (2.2996–2.3001 in)
Minimum regrind diameter	57.393–57.406 mm (2.2596–2.2601 in)
Crankpin journal diameter	50.800–50.812 mm (2.0000–2.0005 in)
Minimum regrind diameter	49.784–49.797 mm (1.9600–1.9605 in)
Crankshaft end thrust	Taken on thrust washers of centre main bearing
Crankshaft end-float	0.10–0.20 mm (0.004–0.008 in)

Main bearings

Number and type	5, Vandervell shells
Material	Lead–indium
Diametrical clearance	0.010–0.048 mm (0.0004–0.0019 in)
Undersizes	0.254 mm, 0.508 mm (0.010 in, 0.020 in)

Connecting rods

Type	Horizontally split big-end, plain small-end
Length between centres	143.81–143.71 mm (5.662–5.658 in)

Big-end bearings

Type and material	Vandervell VP lead–indium
Diametrical clearance	0.015–0.055 mm (0.006–0.0022 in)
End-float on crankpin	0.15–0.36 mm (0.006–0.014 in)
Undersizes	0.254 mm, 0.508 mm (0.010 in, 0.020 in)

Gudgeon pins

Length	72.67–72.79 mm (2.861–2.866 in)
Diameter	22.215–22.220 mm (0.8746–0.8749 in)
Fit-in connecting rod	Press fit
Clearance in piston	0.002–0.007 mm (0.0001–0.0003 in)

Pistons

Clearance in bore, measured at bottom of skirt at right angles to gudgeon pin	0.018–0.033 mm (0.0007–0.0013 in)
---	-----------------------------------

Piston rings

Number of compression	2
Number of oil	1
No. 1 compression ring	Chrome parallel faced
No. 2 compression ring	Stepped to 'L' shaped and marked 'T' or 'TOP'
Width of compression rings	1.56–1.59 mm (0.0615–0.0625 in)
Compression ring gap	0.44–0.57 mm (0.017–0.022 in)
Oil ring type	Perfect circle, type 98-6
Oil ring width	4.811 mm (0.1894 in) max
Oil ring gap	0.38–1.40 mm (0.015–0.055 in)

Camshaft

Location	Central
Bearings	Non serviceable
Number of bearings	5
Drive	Chain 9.52 mm (0.375 in) pitch × 54 pitches



Tappets

Type Hydraulic, non adjustable

Valves

Length:

Inlet 116.59–117.35 mm (4.590–4.620 in)

Exhaust 116.59–117.35 mm (4.590–4.620 in)

Seat angle:

Inlet 45°–45½°

Exhaust 45°–45½°

Head diameter:

Inlet 39.75–40.00 mm (1.565–1.575 in)

Exhaust 34.226–34.480 mm (1.3475–1.3575 in)

Stem diameter:

Inlet 8.664–8.679 mm (0.3411–0.3417 in)

Exhaust 8.651–8.666 mm (0.3406–0.3412 in)

Stem to guide clearance:

Inlet 0.025–0.066 mm (0.0010–0.0026 in)

Exhaust 0.038–0.078 mm (0.0015–0.0031 in)

Valve lift (inlet and exhaust) 9.49 mm (0.374 in)

Valve spring length fitted 40.4 mm (1.590 in) at pressure of 29.5 kg (65 lb)

Lubrication

System Wet sump, pressure fed

System pressure, engine warm at 2400 rpm 2.1–2.8 kgf/cm² (30–40 lbf/in²)

Oil filter (external) Full-flow, self-contained cartridge

Oil filter (internal) Gauze. Pump intake filter

Oil pump type Gear

Oil pressure relief valve

Type Non adjustable

Relief valve spring:

Free length 81.2 mm (3.200 in)

Compressed length at 4.2 kg (9.3 lb) load 45.7 mm (1.800 in)

Oil filter by-pass valve

Type Non adjustable

By-pass valve spring:

Free length 37.5 mm (1.48 in)

Compressed length at 0.34 kg (0.75 lb) 22.6 mm (0.89 in)



FUEL SYSTEM

Carburettor type

Fitted to engine ident. Manual 25G 2 x Solex 175 CDSE
Automatic 26G

Fitted to engine ident. Manual 25G suffix B.....2 x SU HIF44
Automatic 26G suffix B

Fuel pump - make/type..... PIERBURG - low pressure (electrical) mounted on chassis frame

Pump delivery pressure..... 0.34 - 0.4 BAR (5 - 6 lbf/in²)

Fuel filter..... AC Delco CD600 - element ACD60

COOLING SYSTEM

Type..... Pressurized spill return system with thermostat control, pump and fan assisted.

Thermostat..... 88 °C

Type of pump..... Centrifugal

Expansion tank cap pressure..... 1 Bar (15 lbf/in²)

CLUTCH

Type..... Diaphragm spring

Centre plate diameter..... 241 mm (9.5 in)

IGNITION SYSTEM

Fitted with Solex 175 CDSE carburetters

Ignition module..... Lucas AB12, 12 volt electronic

Distributor type..... Lucas 35DM8 electronic

Coil..... Lucas 32 C5

Fitted with SU HIF 44 carburetters

Ignition module..... Lucas 9EM. 12 volt electronic, distributor mounted

Distributor type..... Lucas 35 DLM8

Coil..... Lucas 32 C5

Delay valve..... Colour code - orange

CAPACITIES

Engine refill and filter change 5.56 litres 10 pints

Manual gearbox 1.6 litres 2.8 pints

Automatic gearbox 9.1 litres 16 pints

Note: When draining the automatic gearbox oil will remain in the torque converter; therefore fill to level on dipstick.

Coolant (dry fill) 9.7 litres 17.1 pints

Note: Coolant must contain 50% anti-freeze i.e. 4.85 litres 8.5 pints

Fuel 90 octane (minimum)

Vehicle can be operated on unleaded fuel with a rating of 91 octane or over without any engine tune adjustments.



ENGINE TUNING DATA

Type	V8 Cylinder
Firing order	1-8-4-3-6-5-7-2
Cylinder number - left bank	1-3-5-7
- right bank	2-4-6-8
No. 1 cylinder location	Pulley end of left bank
Timing marks	On crankshaft vibration damper

Compression ratio 8.13:1

Valve timing

inlet opens	30° BTDC
inlet closes	75° ABDC
exhaust opens	68° BBDC
exhaust closes	37° ATDC
duration	285°
inlet valve peak	106° ATDC
exhaust valve peak	112° BTDC

Engine Identification

Manual.....25G
Automatic.....26G

Manual.....25G suffix B
Automatic.....26G suffix B

Carburettors

Type	2 x Solex 175CDSE
Specification number	4186
Needle	B1FC
Idle speed (engine hot)	700-800 rev/min
Fast idle speed (engine hot)	1050-1150 rev/min
Mixture setting - CO at idle	3.5% max pulsair connected

2 x SU HIF44
FZX 2005
BGC
700-800 rev/min
1050-1150 rev/min
0.5%-2.5%

Ignition

Distributor make/type	Lucas 35DM8 electronic	Lucas 35DLM8 electronic
Direction of rotation	Clockwise	Clockwise
Air gap	0.20-0.35mm(0.008-0.014in)	0.20-0.35mm(0.008-0.014in)
Distributor serial number	41894	42652
Spark plugs-make/type	Champion RN12YC	Champion RN12YC
gap	0,88 - 0,72mm (0.035 - 0.028 in)	0,88 - 0,72mm (0.035 - 0.028 in)

Centrifugal advance

Distributor decelerating speeds	(Vacuum pipes disconnected)	(Vacuum pipe disconnected)
Distributor advance at: 2300	10° 30' to 12° 30'	10° 30' to 12° 30'
1800	8° to 10°	8° to 10°
1200	3° 30' to 5° 30'	3° 30' to 5° 30'
No advance below	450 rev/min	450 rev/min

Vacuum unit

Advance 5 - 17 - 6	Advance 5 - 17 - 6
Retard 2 - 8 - 6	

Ignition timing

(Vacuum pipes disconnected)	(Vacuum pipe disconnected)
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For timing purposes engine idle speed must not be more than 750 rev/min	6° ± 1° BTDC at 600 rev/min	6° ± 1° BTDC at 750 rev/min
---	-----------------------------	-----------------------------

Fuel

90min octane	90 min octane
--------------	---------------



**APPROVED ENGINE OILS
(Including carburettor dashpots)**

Use oil meeting specification BLS.22.OL.07 or the requirements of CCMC G3 or API SF or SF/CD quality, having a viscosity band recommended for the temperature range of your locality.



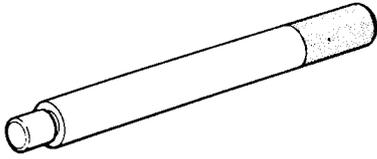
SERVICE SUMMARY - V8

	MILEAGE		
	1,000	12,000 36,000	24,000 48,000
RENEW ENGINE OIL AND FILTER	● NOT FILTER	●	●
ADJUST ALTERNATOR DRIVE BELT TENSION	●	●	● RENEW AT 48,000
TOP UP CARBURETTER DAMPERS	●	●	●
CHECK / ADJUST CARBURETTER FOR IDLE, FAST IDLE, EMISSION SETTING	●	●	●
RENEW SPARK PLUGS		●	●
CHECK / ADJUST IGNITION TIMING		●	●
CLEAN DISTRIBUTOR CAP AND CHECK LEADS FOR DETERIORATION		●	●
RENEW FUEL FILTER ELEMENT		●	●
RENEW AIR CLEANER ELEMENT		●	●
CLEAN OR RENEW ENGINE FLAME TRAP		●	●
CHECK CRANKCASE BREATHING SYSTEM FOR LEAKS, HOSES FOR SECURITY AND CONDITION		●	●
RENEW ANTI-FREEZE SOLUTION (50%) (NB USE 50% SOLUTION FOR TOPPING UP)		● TOP UP	●
RENEW ENGINE BREATHER FILTER			●



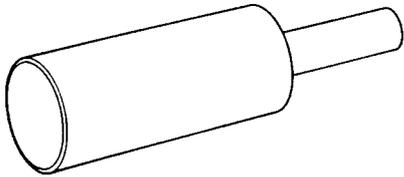
SPECIAL TOOLS

RO 274401



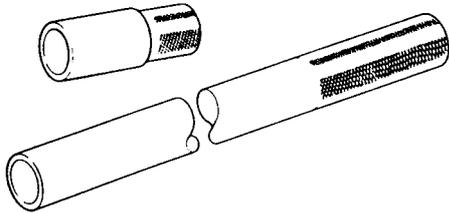
Valve guide remover

RO 600959



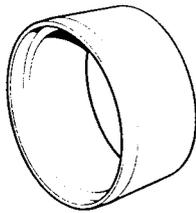
Valve guide replacer

RO 605351



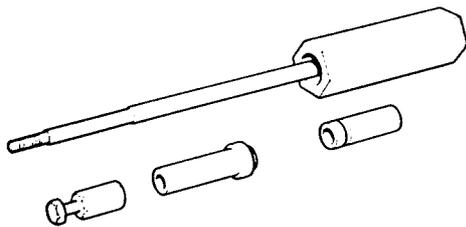
Guide bolts

RO 1014



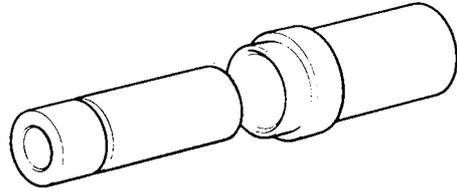
Crankshaft rear seal sleeve

18G 1150



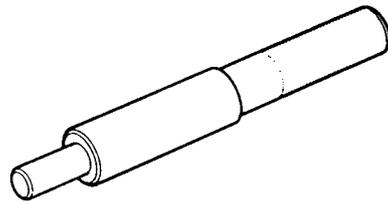
Gudgeon pin remover/replacer

18G 1150 E



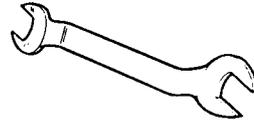
Gudgeon pin remover/replacer adaptor

18G 1195



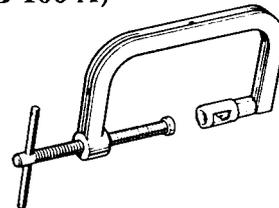
Clutch centralising tool

MS 1517



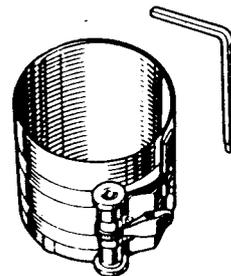
Fan pulley spanner

MS 1519 A
(Alt. 18G 106 A)



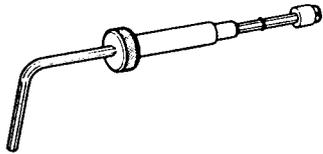
Valve spring compressor

MS 38 U3
(Alt. 18G 55 A)



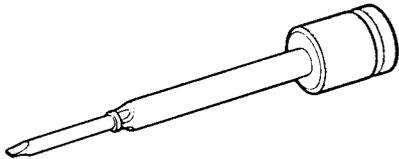
Piston ring compressor

MS 80



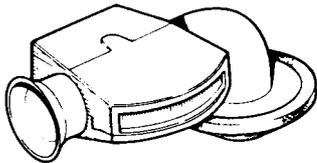
Mixture adjustment tool

MS 86



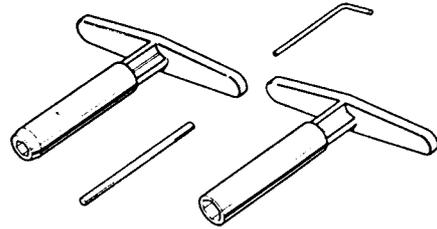
Carburettor adjusting wrench

B 89



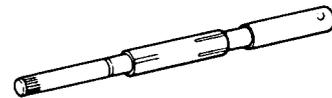
Carburettor balancer

MS 76 B



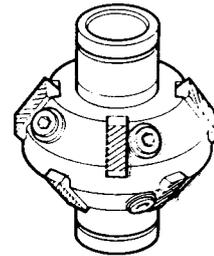
Valve seat cutter handle

MS 150-8.5



Expandable pilot

MS 621



Valve seat cutter



TORQUE WRENCH SETTINGS

	Nm	Lbf ft
Chainwheel to camshaft	54-61	40-45
Connecting rod bolt	47-54	35-40
Clutch attachment to flywheel	24-30	18-22
Cylinder head:		
Outer row	54-61	40-45*
Centre row	88-95	65-70*
Inner row	88-95	65-70*
Distributor clamp bolt	19-22	14-16
Exhaust manifold to cylinder heads	19-22	14-16
Fan to viscous unit	26-32	19-24
Flexible drive plate to crankshaft	74-81	55-60
Flywheel to crankshaft	74-81	55-60
Inlet manifold to cylinder heads	47-54	35-40
Main bearing cap bolts	68-75	50-55**
Main bearing cap rear bolts	88-95	65-70**
Manifold gasket clamp bolt	13.5-20	10-15
Oil pump cover to timing cover	11-14	8-10
Oil plug	24-30	18-22
Oil relief valve plug	40-47	30-35
Oil sump drain plug	40.6-47	30-35
Oil sump to cylinder block	8-11	5-8
Oil sump rear to cylinder block	17.6-20.3	13-15
Rocker cover to cylinder head	7	5
Rocker shaft bracket to cylinder head	34-40	25-30
Spark plug	13.8-16.2	10-12
Starter motor attachment	40.6-47.4	30-35
Damper to crankshaft	257-285	190-210
Timing cover to cylinder block	24-30	18-22***
Viscous unit to water pump hub	36-40	27-30
Water pump pulley to water pump hub	23	17***
Water pump timing cover to cylinder block	24-30	18-22

Lubricants/sealants have been specified in certain applications for assembly purposes.

* These bolts must have threads coated with Loctite 572 prior to assembly. For this purpose it is necessary to use an approved dispenser to apply the sealant/lubricant to the first three threads of the bolts.

** These bolts must have threads coated in lubricant EXP16A (Marston Lubricants) prior to assembly.

*** These bolts must have threads coated in sealant Loctite 572 prior to assembly.

It is essential that all bolts are securely tightened and it is imperative that the correct torque is adhered to.

V8 CYLINDER ENGINE

DISMANTLE AND OVERHAUL

Remove the engine from the vehicle and clean the exterior. In the interests of safety and efficient working secure the engine to a recognised engine stand. Drain and discard the sump oil.

REMOVE ANCILLARY EQUIPMENT

Before commencing, and whilst dismantling, make a careful note of the position of brackets, clips, harnesses, pipes, hoses, filters and other miscellaneous and non-standard items to facilitate reassembly.

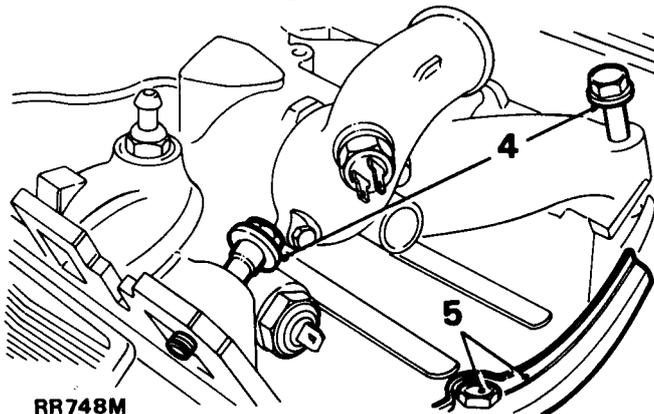
1. Remove the following items of equipment:
 Starter motor.
 Alternator and mounting bracket.
 Power steering pump.
 Disconnect spark plug H.T. leads and remove the distributor.
 Clutch.
 Fan blades, pulley and drive belt.
 Remove pulse air rails from cylinder heads.
 Dipstick and engine mounting brackets.

Remove exhaust manifolds

2. Bend back the lock tabs, and remove the eight bolts securing each manifold, and withdraw the manifolds.

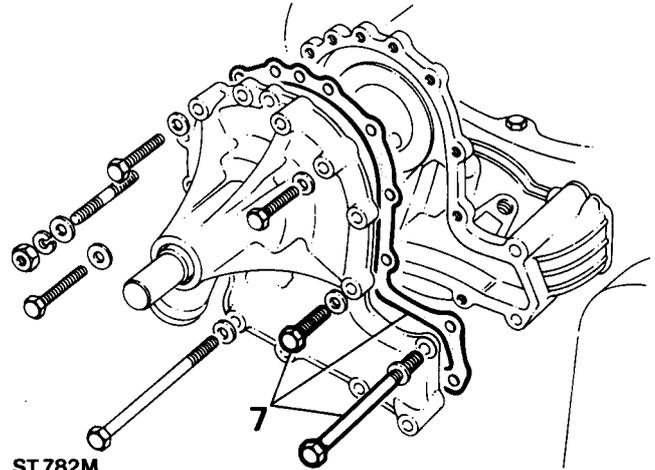
Remove intake manifold

3. Disconnect miscellaneous pipes and hoses from the intake manifold and the carburetters.
4. Evenly slacken and remove the twelve bolts and lift off the intake manifold complete with carburetters.
5. Wipe away any surplus coolant lying on the manifold gasket and remove the gasket clamp bolts and remove the clamps.
6. Lift off the manifold gasket and seals.



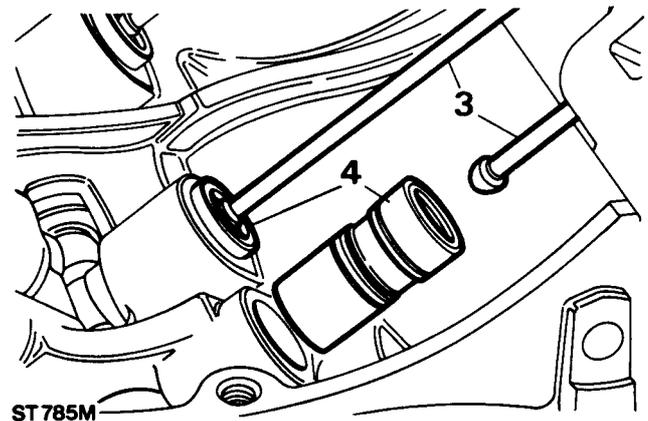
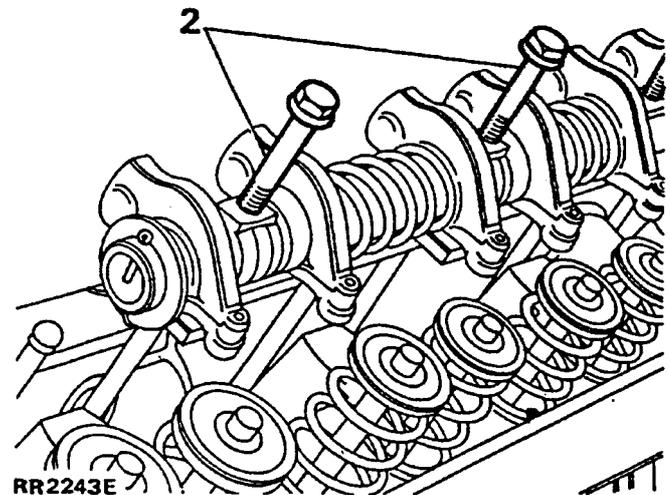
Remove water pump

7. Remove the fifteen bolts and withdraw the water pump and joint washer.



REMOVE AND OVERHAUL ROCKER SHAFTS AND VALVE GEAR

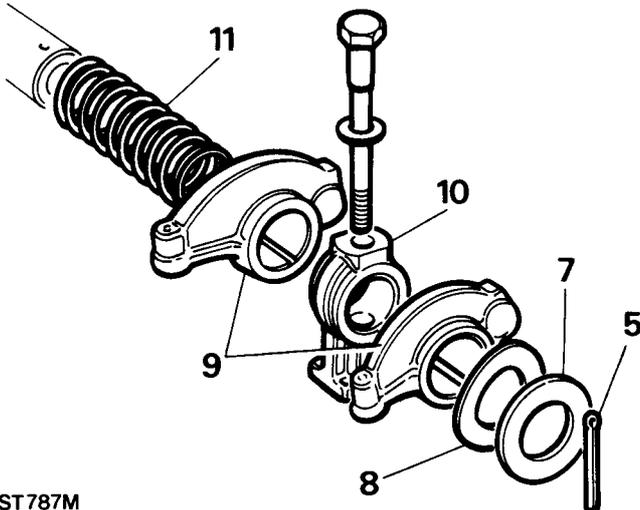
1. Remove the four screws and lift off the rocker covers.
2. Remove the four rocker shaft retaining bolts and lift off the assembly complete with baffle plate (if fitted).



3. Withdraw the pushrods and retain in the sequence removed.
4. Remove the hydraulic tappets and place to one side with their respective pushrods. If a tappet cannot be removed leave in position until the camshaft is removed.

Dismantle rocker shafts

5. Remove the split pin from one end of the rocker shaft.
6. Withdraw the following components and retain them in the correct sequence for reassembly:
 7. A plain washer.
 8. A wave washer.
 9. Rocker arms.
 10. Brackets.
 11. Springs.
12. Examine each component for wear, in particular the rockers and shafts. Discard weak or broken springs.

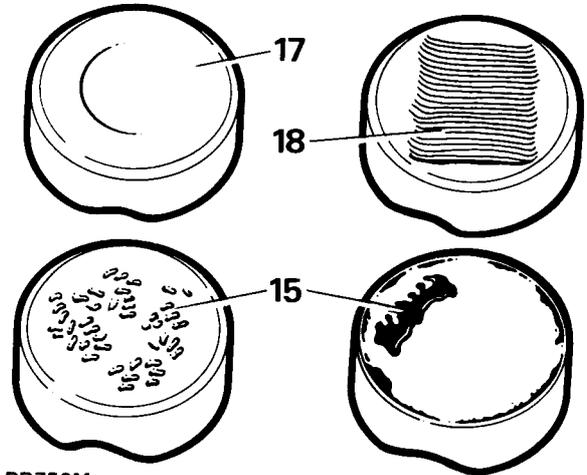


ST787M

Inspect tappets and pushrods

13. Hydraulic tappet: inspect inner and outer surfaces of body for blow holes and scoring. Replace hydraulic tappet if body is roughly scored or grooved, or has a blow hole extending through the wall in a position to permit oil leakage from lower chamber.
14. The prominent wear pattern just above lower end of body should not be considered a defect unless it is definitely grooved or scored. It is caused by side thrust of the cam against the body while the tappet is moving vertically in its guide.
15. Inspect the cam contact surface of the tappets. Fit new tappets if the surface is excessively worn or damaged.
16. A hydraulic tappet body that has been rotating will have a round wear pattern and a non-rotating tappet body will have a square wear pattern with a very slight depression near the centre.
17. Tappets **MUST** rotate and a circular wear condition is normal. Tappets with this wear pattern can be refitted provided there are no other defects.

18. In the case of a non-rotating tappet, fit a new replacement and check camshaft lobes for wear; also ensure the new tappet rotates freely in the cylinder block.



RR750M

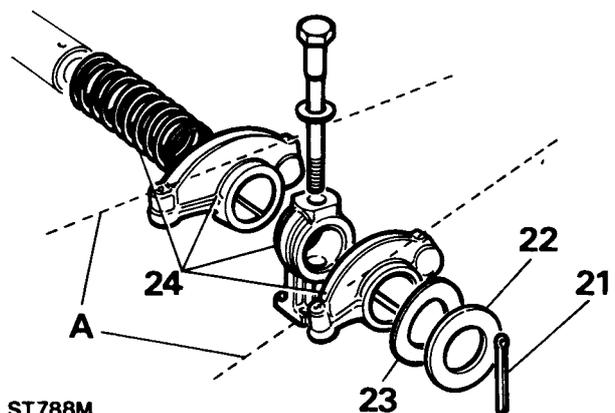
19. Fit a new hydraulic tappet if the area where the pushrod contacts is rough or otherwise damaged.
20. Renew any pushrod having a rough or damaged ball end or seat. Also bent rods must be renewed.

Assemble rocker shafts

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

NOTE: Two different rocker arms are used and must be fitted so that the valve ends of the arms slope away from the brackets, as indicated by the dotted lines 'A' on the illustration.

24. Assemble the rocker arms, brackets and springs to the rocker shaft.

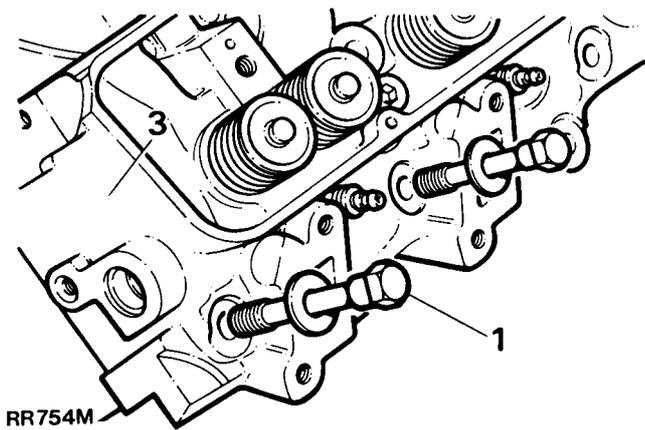


ST788M

25. Compress the springs, brackets and rockers, and fit a wave washer, plain washer and split pin to the end of the rocker shaft.
26. If fitted, locate the oil baffle plate in place over the rockers furthest from the notched end of the rocker shaft: fit the bolts through the brackets and place the assemblies to one side.

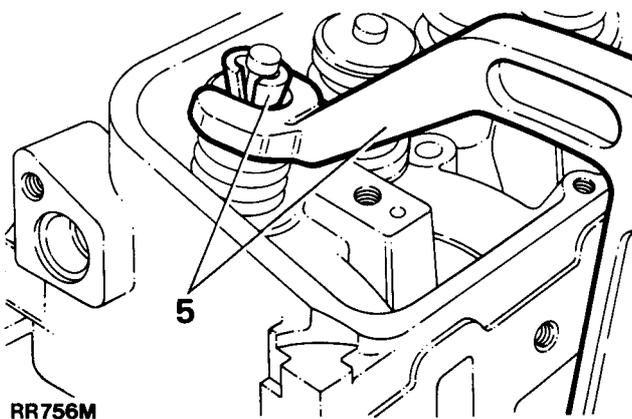
REMOVE AND OVERHAUL THE CYLINDER HEADS

1. Evenly slacken the fourteen cylinder head bolts reversing the tightening order.
2. Before removing the heads mark them relative to the LH and RH side of the engine.
3. Lift off the cylinder heads and discard the gasket.

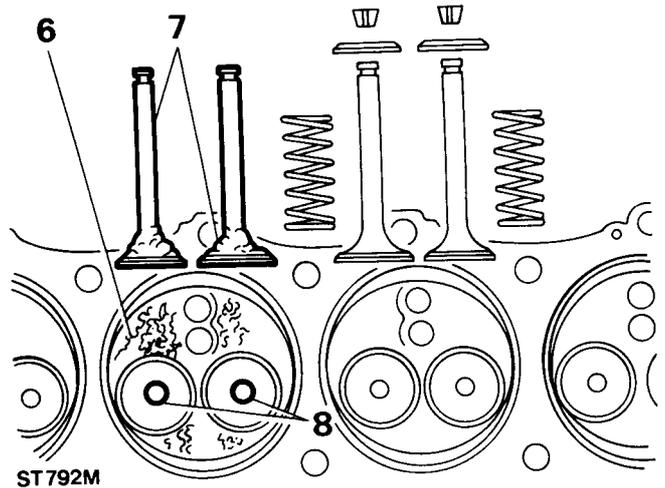


Dismantle cylinder heads

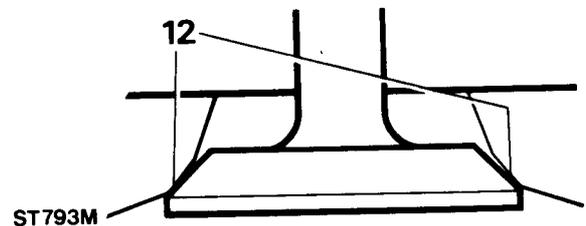
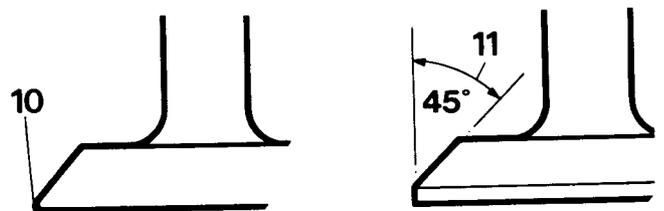
4. Remove the spark plugs.
5. Using the valve spring compressor 18G 106A or a suitable alternative, remove the valves and springs and retain in sequence for refitting.



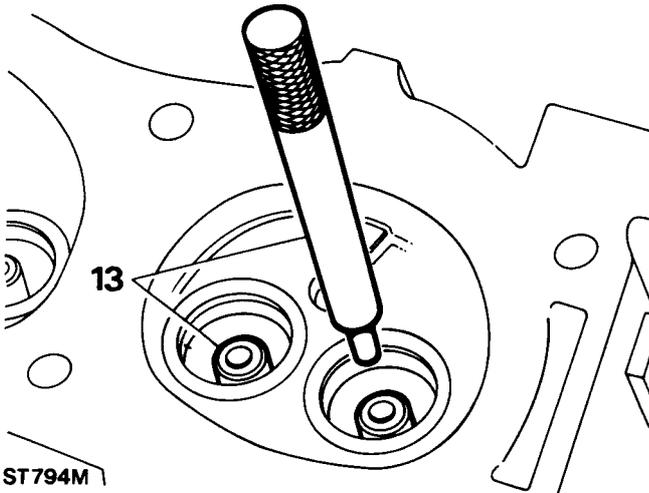
6. Clean the combustion chambers with a soft wire brush.
7. Clean the valves.
8. Clean the valve guide bores.



9. Regrind or fit new valves as necessary.
10. If a valve must be ground to a knife-edge to obtain a true seat, fit a new valve.
11. The correct angle for the valve face is 45 degrees.
12. The correct angle for the seat is $46 \pm \frac{1}{4}$ degrees and the seat witness should be towards the outer edge.



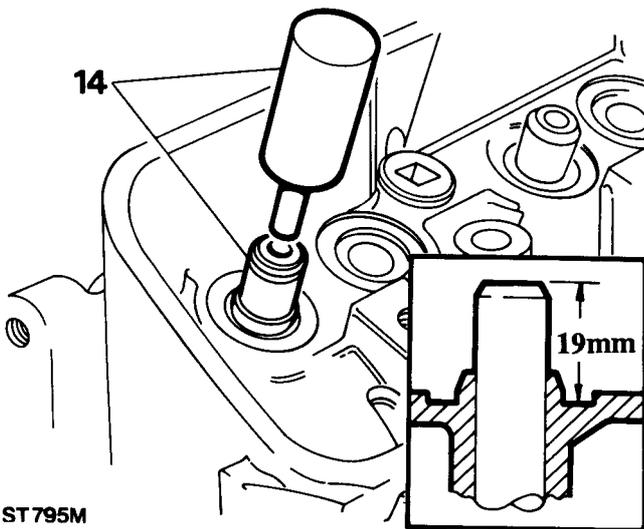
13. Check the valve guides and fit replacements as necessary. Using the valve guide remover 274401, drive out the old guides from the combustion chamber side.



Fit new valve guides

14. Lubricate the new valve guide and place in position. Using guide drift 600959 drive the guide into the cylinder head until it protrudes 19 mm (¾ in) above the valve spring recess in the head.

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



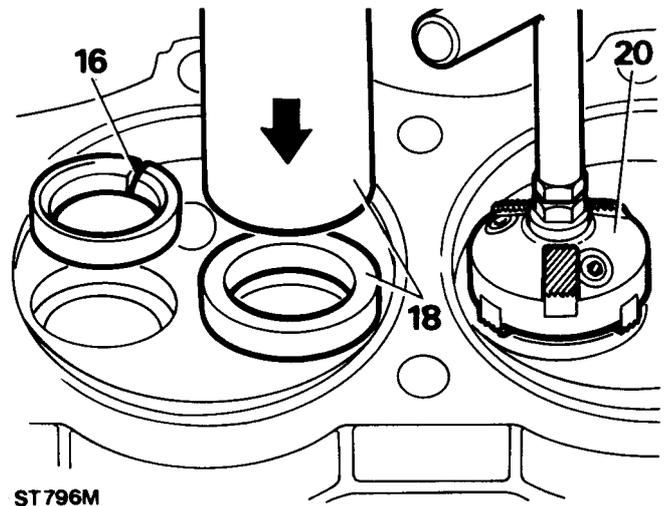
Examine and fit new valve seats

15. Check the valve seats for wear, pits and burning and renew the inserts if necessary.

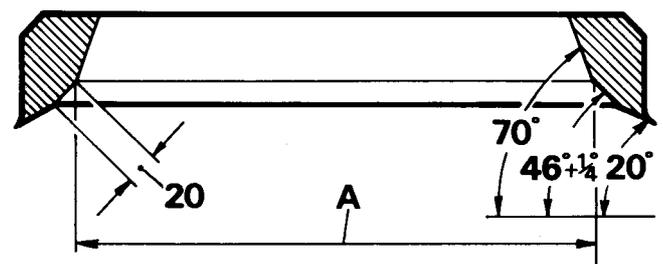
16. Remove the old seat inserts by grinding them away until they are thin enough to be cracked and prised out.
17. Heat the cylinder head evenly to approximately 65° C (150° F).
18. Press the new insert into the recess in the cylinder head.

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

19. If necessary, cut the valve seats to $46 \pm \frac{1}{4}$ degrees.
20. The nominal seat width is 1.5 mm (0.031 in). If the seat exceeds 2.0 mm (0.078 in) it should be reduced to the specified width by the use of 20° and 70° cutters.
21. The inlet valve seat diameter: 'A' is 37.03 mm (1.458 in) and the exhaust valve seat is 31.50 mm (1.240 in).

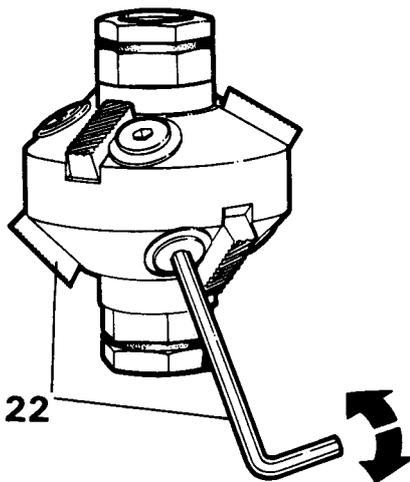


ST796M



ST797M

22. Ensure that the cutter blades are correctly fitted to the cutter head with the angled end of the blade downwards facing the work, as illustrated. Check that the cutter blades are adjusted so that the middle of the blade contacts the area of material to be cut. Use the key provided in the hand set MS76. Use light pressure and remove only the minimum material necessary.

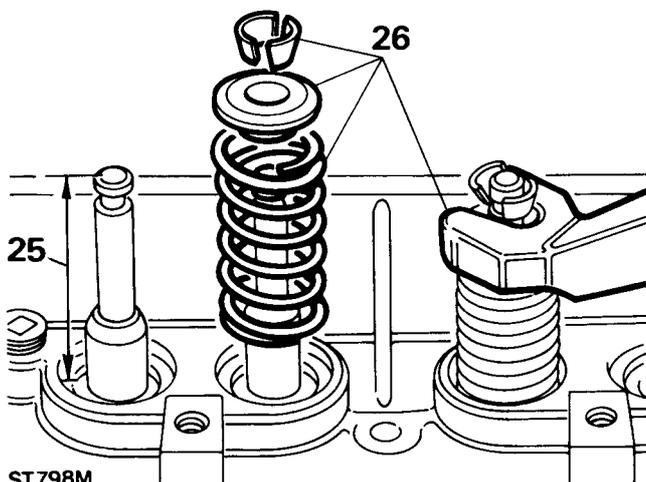


ST1024M

23. Smear a small quantity of engineers' blue round the valve seat and revolve a properly ground valve against the seat. A continuous fine line should appear round the valve. If there is a gap of not more than 12 mm it can be corrected by lapping.
24. Alternatively, insert a strip of cellophane between the valve and seat, hold the valve down by the stem and slowly pull out the cellophane. If there is a drag the seal is satisfactory in that spot. Repeat this in at least eight places. Lapping-in will correct a small open spot.

Assemble valves to cylinder head

25. Before fitting the valves and springs the height of each valve above the head must be checked. Insert each valve in turn in its guide and whilst holding the head firmly against the seat, measure the height of the stem above the valve spring seat surface. This dimension must not exceed 47.63 mm (1.875 in). If necessary renew the valve or grind the end of the valve stem.
26. Lubricate the valve stems and assemble the valves, springs and caps and secure with the collets using valve spring compressor 18G 106A.



ST798M

Reclaiming cylinder head threads

Damaged or stripped threads in the cylinder head can be salvaged by fitting Helicoils as follows:

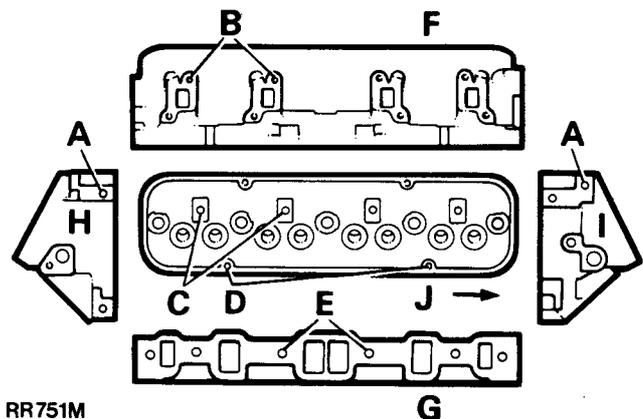
Holes A — These three holes may be drilled 0.3906 in dia. $\times 0.937 + 0.040$ in deep. Tapped with Helicoil Tap No. 6 CPB or 6CS $\times 0.875$ in (min) deep ($\frac{3}{8}$ UNC $1\frac{1}{2}$ D insert).

Holes B — These eight holes may be drilled 0.3906 in dia. $\times 0.812 + 0.040$ in deep. Tapped with Helicoil Tap No. 6 CBB 0.749 in (min) deep ($\frac{3}{8}$ UNC $1\frac{1}{2}$ D insert).

Holes C — These four holes may be drilled 0.3906 in dia. $\times 0.937 + 0.040$ in deep. Tapped with Helicoil Tap No. 6 CPB or 6CS $\times 0.875$ in (min) deep ($\frac{3}{8}$ UNC $1\frac{1}{2}$ D insert).

Holes D — These four holes may be drilled 0.261 in dia. $\times 0.675 + 0.040$ in deep. Tapped with Helicoil Tap No. 4 CPB or 4CS $\times 0.625$ in (min) deep ($\frac{1}{4}$ UNC $1\frac{1}{2}$ D insert).

Holes E — These six holes may be drilled 0.3906 in dia. $\times 0.937 + 0.040$ in deep. Tapped with Helicoil Tap No. 6 CPB or 6CS $\times 0.875$ in (min) deep ($\frac{3}{8}$ UNC $1\frac{1}{2}$ D insert).



RR751M

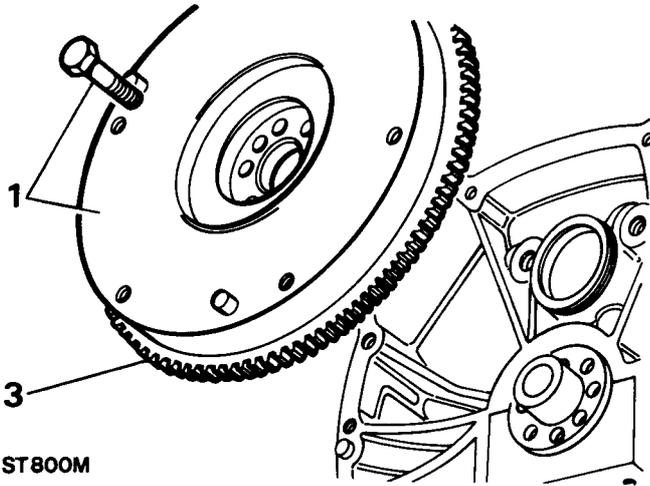
NOTE: Right-hand cylinder head illustrated. American projection.

- F Exhaust manifold face
- G Inlet manifold face
- H Front face
- I Rear face
- J Front of engine

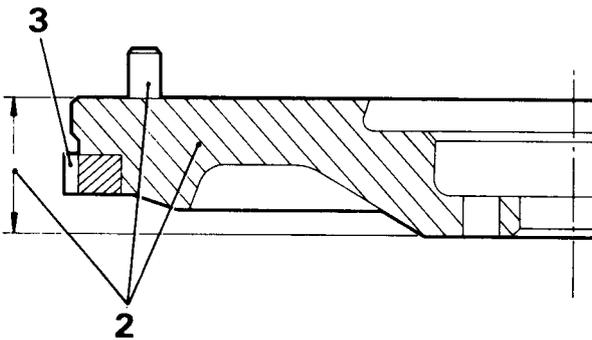


REMOVE AND OVERHAUL FLYWHEEL.

1. Remove the retaining bolts and withdraw the flywheel from the crankshaft.



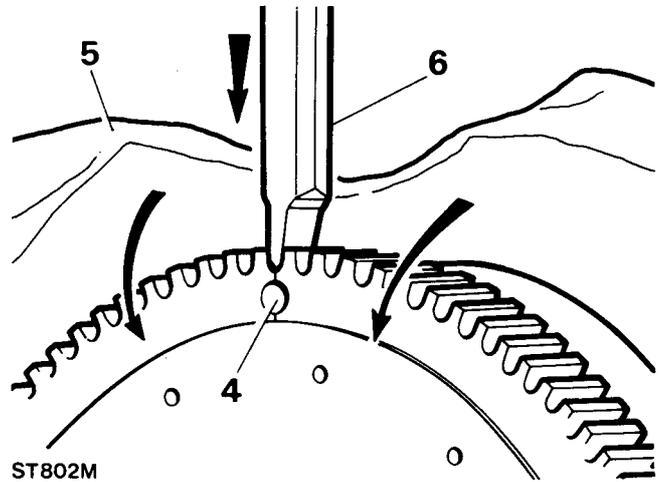
2. Examine the flywheel clutch face for cracks, scores and overheating. If the overall thickness of the flywheel is in excess of the minimum thickness i.e. 39.93 mm (1.572 in) it can be refaced provided that after machining it will not be below the minimum thickness. Remove the three dowels before machining.
3. Examine the ring gear and if worn or the teeth are chipped and broken it can be renewed as follows:



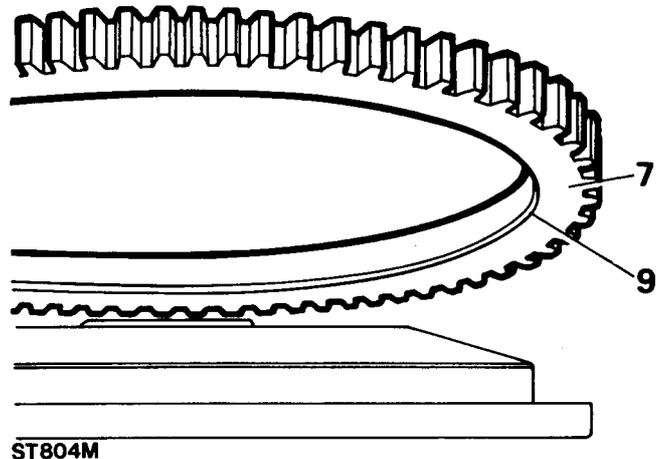
4. Drill a 10 mm (0.393 in) diameter hole axially between the root of any tooth and the inner diameter of the starter ring sufficiently deep to weaken the ring. Do NOT allow the drill to enter the flywheel.
5. Secure the flywheel in a vice fitted with soft jaws and place a cloth over the flywheel to protect the operator from flying fragments.

WARNING: Take adequate precautions against flying fragments when splitting the ring gear.

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

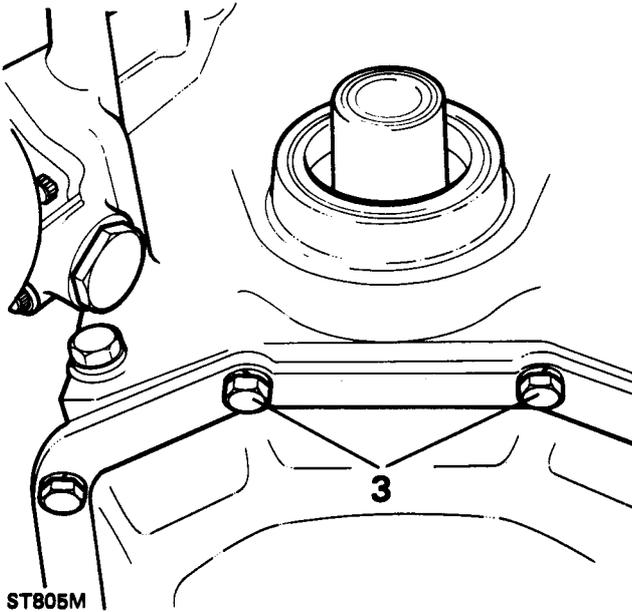


7. Heat the new ring gear uniformly to between 170° and 175° C (338° to 347° F) but do not exceed the higher temperature.
8. Place the flywheel, clutch side down, on a flat surface.
9. Locate the heated starter ring gear in position on the flywheel, with the chamfered inner diameter towards the flywheel flange. If the starter ring gear is chamfered both sides, it can be fitted either way round.
10. Press the starter ring gear firmly against the flange until the ring contracts sufficiently to grip the flywheel.
11. Allow the flywheel to cool gradually. Do NOT hasten cooling in any way or distorting may occur.
12. Fit new clutch assembly location dowels to the flywheel.

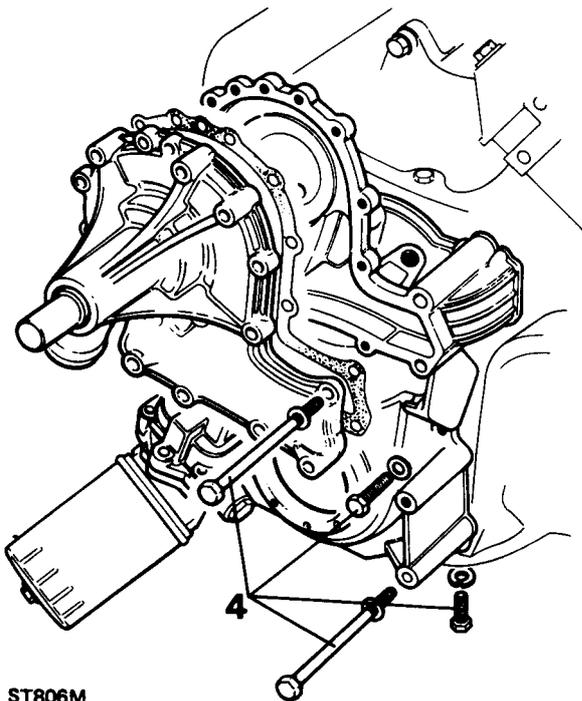


REMOVE TIMING GEAR COVER AND WATER PUMP

1. Place an oil drip-tray beneath the timing cover and remove the oil filter element.
2. Remove the crankshaft pulley bolt and special washer and withdraw the pulley.
3. Remove the two bolts securing the sump to the bottom of the timing cover.

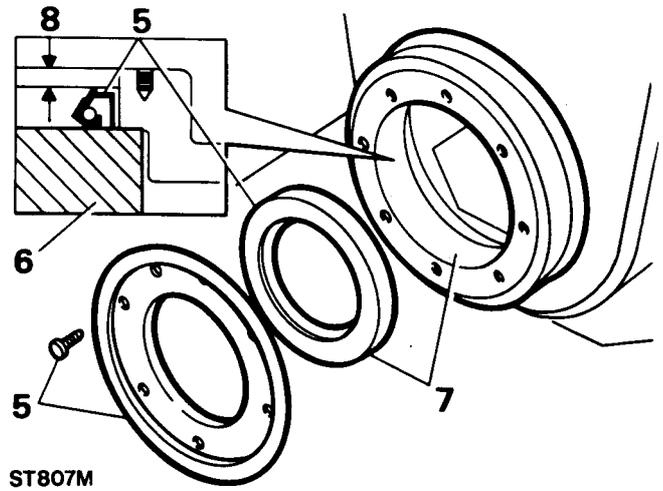


4. Remove the remaining timing cover retaining bolts and withdraw the cover complete with oil pump.



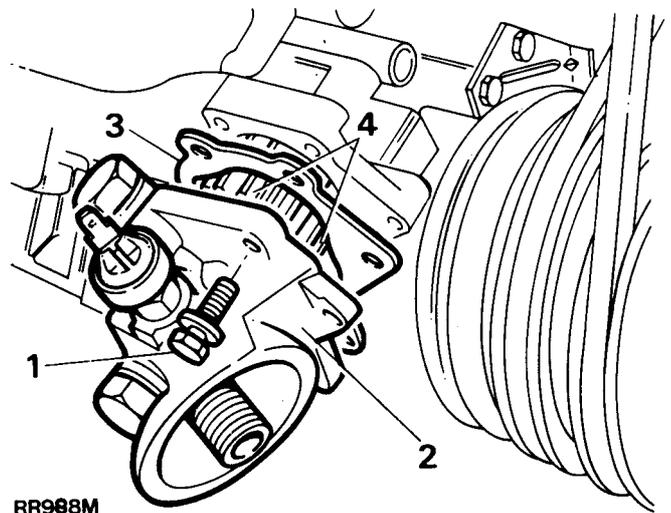
Renewing timing cover oil seal

5. Remove the eight drive screws and withdraw the mud shield and the oil seal.
6. Position the gear cover with the front face uppermost and the underside supported across the oil seal housing bore on a suitable wooden block.
7. Enter the oil seal, lip side leading, into the housing bore.
8. Press in the oil seal until the plain face is 1.5 mm (0.062in) approximately below the gear cover face.
9. Fit the mud shield and secure with the screws.



REMOVE AND OVERHAUL THE OIL PUMP

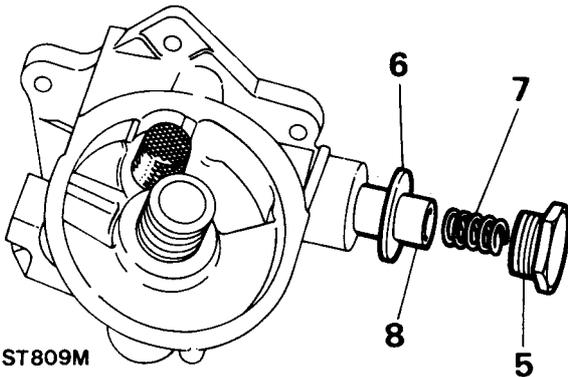
1. Remove the bolts from the oil pump cover.
2. Withdraw the oil pump cover.
3. Lift off the cover gasket.
4. Withdraw the oil pump gears.





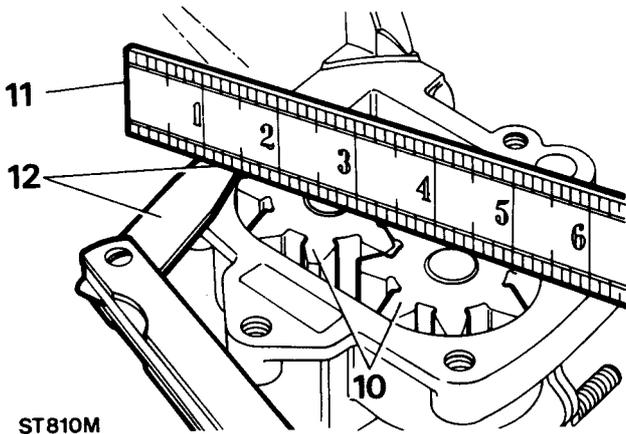
Dismantle pump

5. Unscrew the plug from the pressure relief valve.
6. Lift off the joint washer for the plug.
7. Withdraw the spring from the relief valve.
8. Withdraw the pressure relief valve.



Examine pump

9. Check the oil pump gears for wear or scores.
10. Fit the oil pump gears and shaft into the front cover.
11. Place a straight-edge across the gears.
12. Check the clearance between the straight-edge and the front cover. If less than 0.05 mm (0.0018 in), check the front cover gear pocket for wear.



13. Check the oil pressure relief valve for wear or scores.
14. Check the relief valve spring for wear at the sides or signs of collapse.
15. Clean the gauze filter for the relief valve.
16. Check the fit of the relief valve in its bore. The valve must be an easy slide fit with no perceptible side movement.

Assemble pump

17. Insert the relief valve spring.
18. Locate the sealing washer on to the relief valve plug.
19. Fit the relief valve plug and tighten to correct torque —see data section.
20. Fully pack the oil pump gear housing with petroleum jelly. Use only petroleum jelly; no other grease is suitable.
21. Fit the oil pump gears so that the petroleum jelly is forced into every cavity between the teeth of the gears.

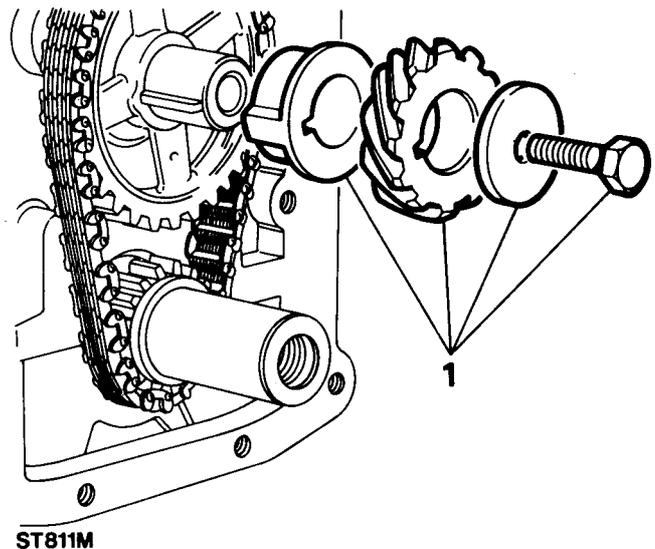
IMPORTANT: Unless the pump is fully packed with petroleum jelly it may not prime itself when the engine is started.

22. Place a new gasket on the oil pump cover.
23. Locate the oil pump cover in position.
24. Fit the special fixing bolts and tighten alternately and evenly to the correct torque.

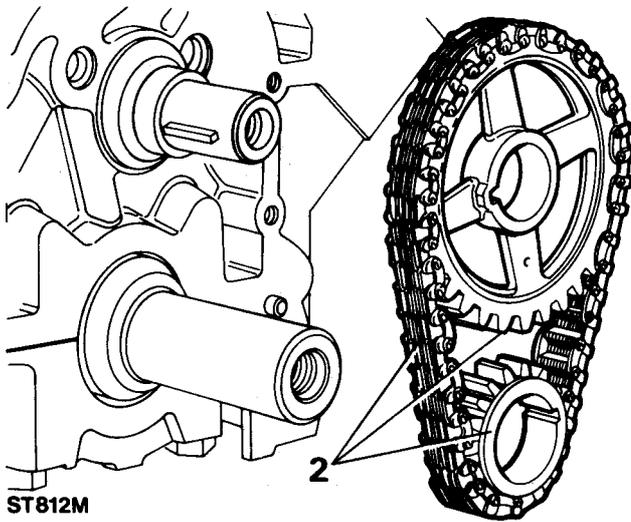
REMOVE TIMING CHAIN GEARS AND CAMSHAFT

CAUTION: If this operation is carried out with cylinder heads and rocker shafts in position the engine must NOT be rotated once the timing chain has been removed otherwise the pistons and valves will be damaged.

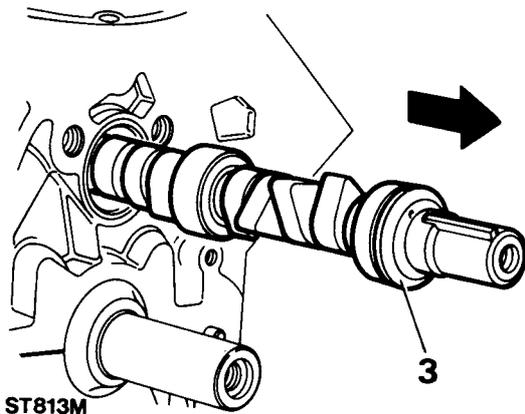
1. Remove the retaining bolt and washer and withdraw the distributor drive gear and spacer.



2. Withdraw the chain wheels complete with timing chain.



3. Withdraw the camshaft whilst taking particular care not to damage the bearings in the cylinder block.



Examine components

4. Visually examine all parts for wear. Check the camshaft bearing journals and cams for wear, pits, scores and overheating. Should any of these conditions be present the shaft should be renewed.
5. Examine the links and pins of the timing chain for wear and compare its condition with that of a new chain. Similarly the teeth of the chain wheels should be inspected and if necessary the wheels should be renewed.

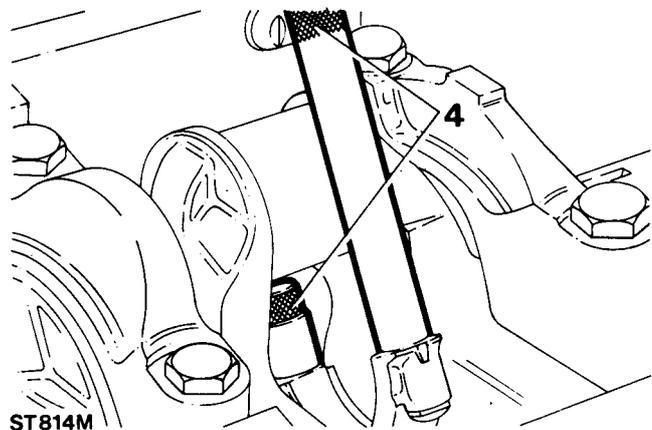
6. Measure the camshaft journals for overall wear, ovality and taper. The diameters of the five journals are as follows commencing from the front of the shaft:

Number 1 journal 1.786 to 1.785 in
 Number 2 journal 1.750 to 1.755 in
 Number 3 journal 1.726 to 1.725 in
 Number 4 journal 1.696 to 1.095 in
 Number 5 journal 1.666 to 1.665 in.

7. To check the camshaft for bow, rest the two end journals i.e. numbers 1 and 5 on 'V' blocks and mount a dial gauge on the centre journal. Rotate the shaft and note the reading. If the run out is more than 0.05 mm (0.002 in) it should be renewed.

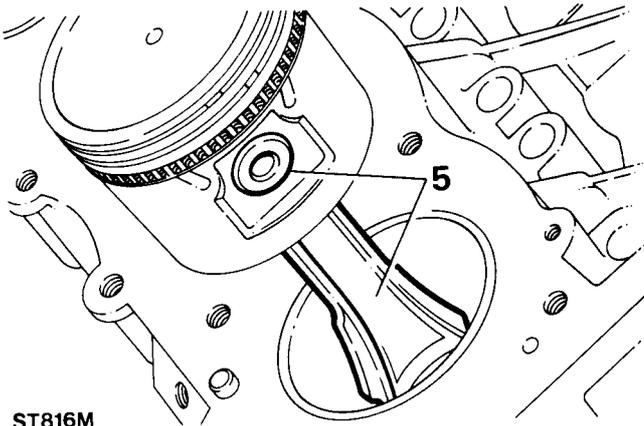
REMOVE AND OVERHAUL CONNECTING-RODS AND PISTONS

1. Withdraw the remaining bolts and remove the sump.
2. Remove the sump oil strainer.
3. Remove the connecting-rod caps and retain them in sequence for reassembly.
4. Screw the guide bolts 605351 onto the connecting-rods.





5. Push the connecting-rod and piston assembly up the cylinder bore and withdraw it from the top. Retain the connecting-rod and piston assemblies in sequence with their respective caps.
6. Remove the guide bolts 605351 from the connecting-rod.

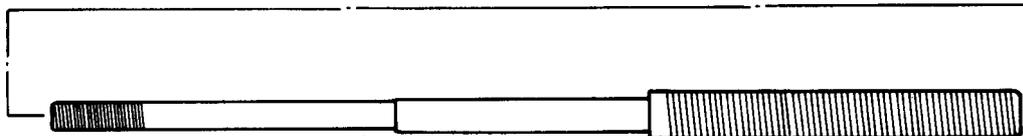
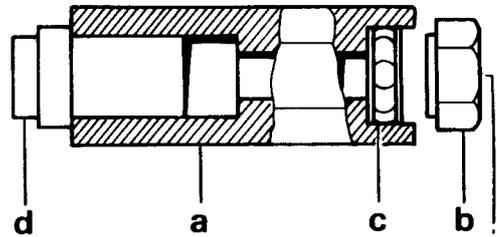
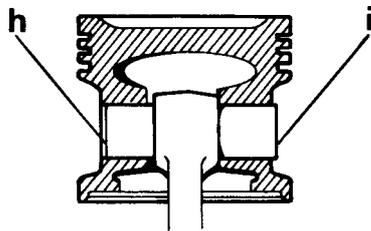
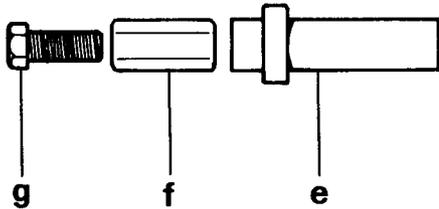
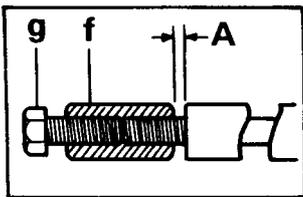


ST816M

Overhaul

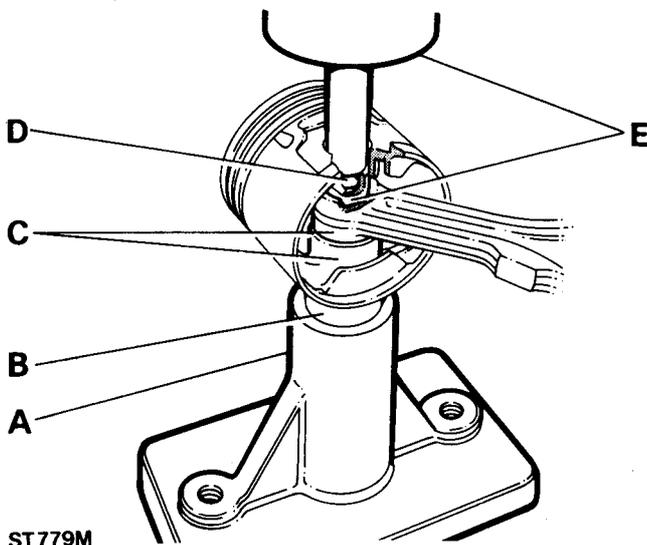
NOTE: The connecting-rods, caps and bearing shells must be retained in sets, and in the correct sequence. Remove the piston rings over the crown of the piston. If the same piston is to be refitted, mark it relative to its connecting-rod to ensure that the original assembly is maintained.

7. Withdraw the gudgeon pin, using tool 18G 1150 as follows:
 - a. Clamp the hexagon body of 18G 1150 in a vice.
 - b. Position the large nut flush with the end of the centre screw.
 - c. Push the screw forward until the nut contacts the thrust race.
 - d. Locate the piston adaptor 18G 1150 E with its long spigot inside the bore of the hexagon body.
 - e. Fit the remover/replacer bush of 18G 1150 on the centre screw with the flanged end away from the gudgeon pin.
 - f. Screw the stop-nut about half-way onto the smaller threaded end of the centre screw, leaving a gap 'A' of 3 mm (1/8 in) between this nut and the remover/replacer bush.
 - g. Lock the stop-nut securely with the lock screw.
 - h. Check that the remover/replacer bush is correctly positioned in the bore of the piston.
 - i. Push the connecting-rod to the right to expose the end of the gudgeon pin, which must be located in the end of the adaptor 'd'.
 - j. Screw the large nut up to the thrust race.
 - k. Hold the lock screw and turn the large nut until the gudgeon pin has been withdrawn from the piston. Dismantle the tool.



ST777M

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



ST779M

Original pistons

Remove the carbon deposits, particularly from the ring grooves.

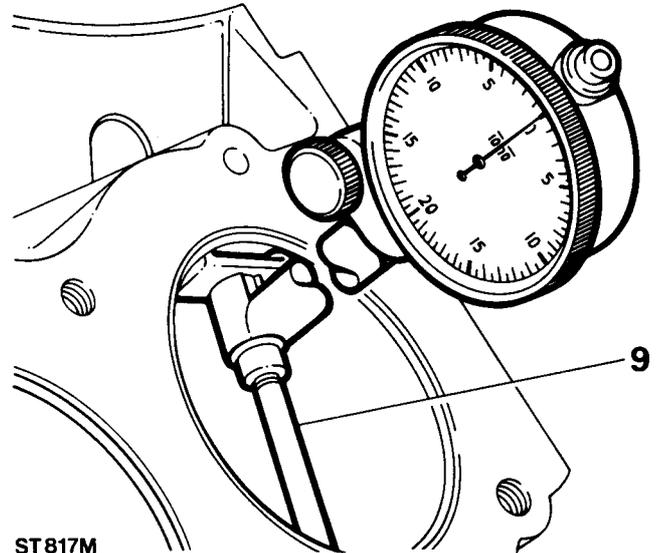
Examine the pistons for signs of damage or excessive wear; refer to 'new pistons' for the method of checking the running clearance. Fit new pistons if necessary.

New pistons

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

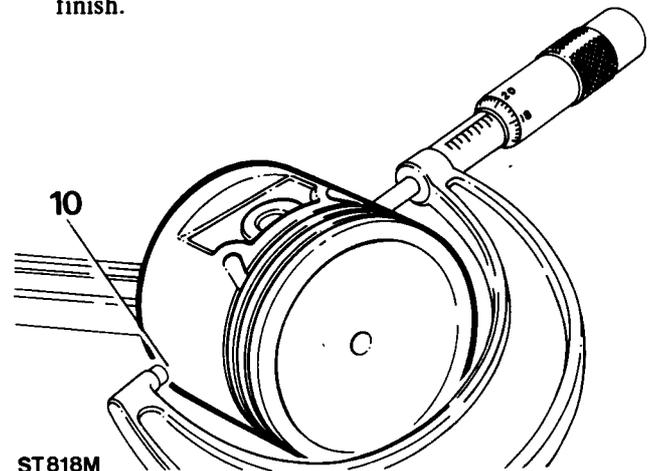
NOTE: The temperature of the piston and cylinder block must be the same to ensure accurate measurement. When reboring the cylinder block, the crankshaft main bearing caps must be fitted and tightened to the correct torque.

9. Check the cylinder bore dimension at right angles to the gudgeon pin, 40 to 50 mm (1½ to 2 in) from the top.



ST817M

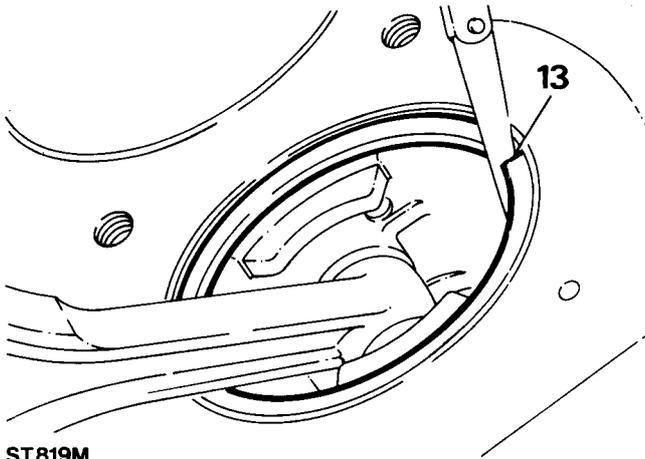
10. Check the piston dimension at right angles to the gudgeon pin, at the bottom of the skirt.
11. The piston dimension must be 0.018 to 0.033 mm (0.0007 to 0.0013 in) smaller than the cylinder.
12. If new piston rings are to be fitted without reboring, deglaze the cylinder walls with a hone, without increasing the bore diameter to provide a cross-hatch finish.



ST818M

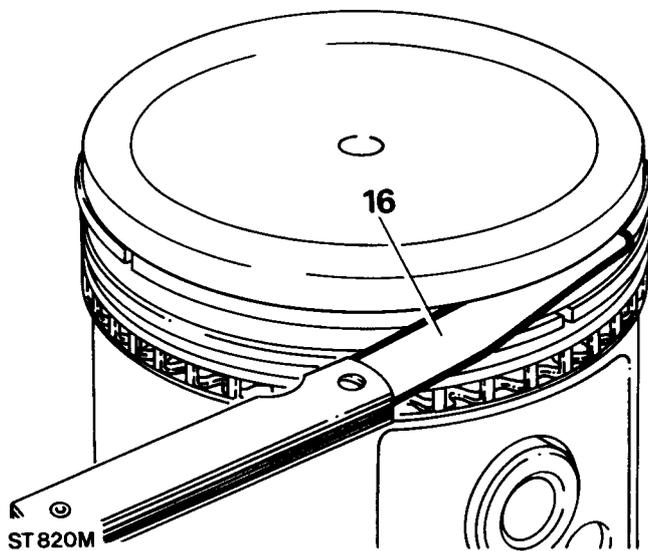
13. Check the compression ring gaps in the applicable cylinder, held square to the bore with the piston. Gap limits: 0.44 to 0.56 mm (0.017 to 0.022 in). Use a fine-cut flat file to increase the gap if required. Select a new piston ring if the gap exceeds the limit.

NOTE: Gapping does not apply to oil control rings.



ST819M

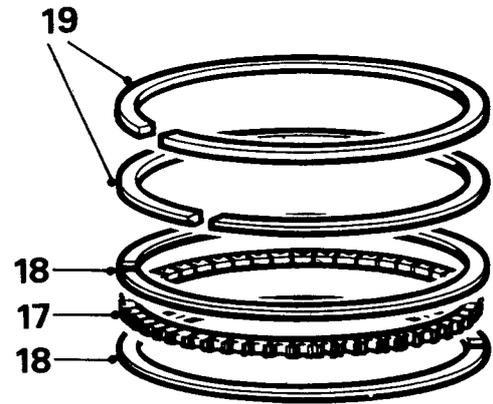
14. Temporarily fit the compression rings to the piston.
15. The ring marked 'TOP' must be fitted with the marking uppermost and into the second groove. The chrome ring is for the top groove and can be fitted either way round.
16. Check the compression ring clearance in the piston groove. Clearance limits: 0.05 to 0.10 mm (0.002 to 0.004 in).



ST820M

Fit piston rings

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



ST821M

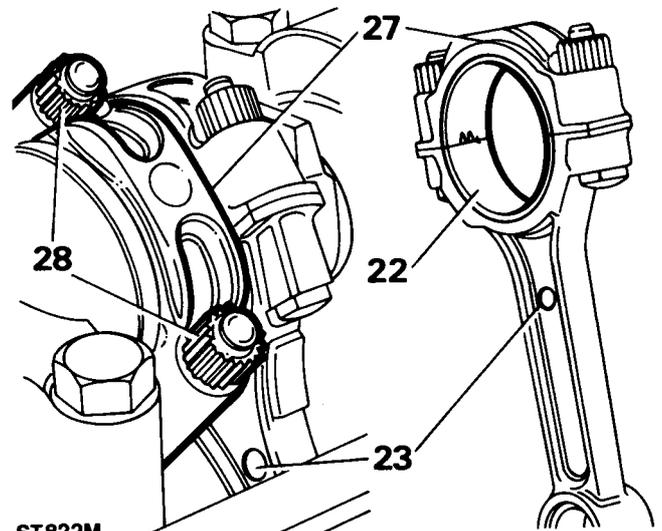
Examine connecting-rods

20. Check the alignment of the connecting-rod.
21. Check the connecting-rod small end, the gudgeon pin must be a press fit.

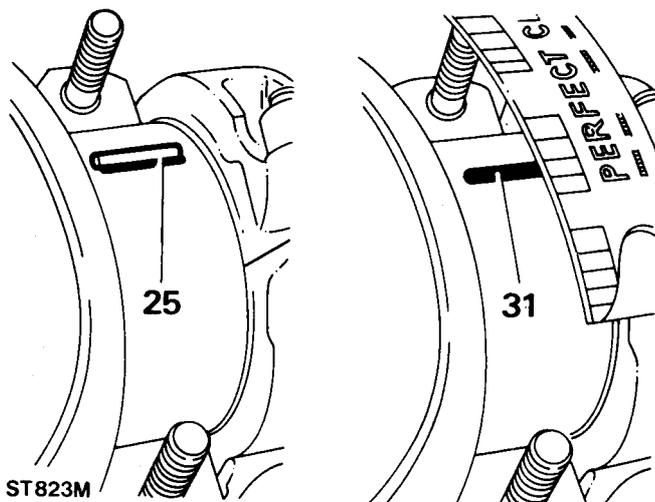
Check crankshaft bearings

It is important to provide the correct diametric clearance between each bearing journal and its shell bearing. The clearance can be adjusted by selectively fitting bearing shells as follows:

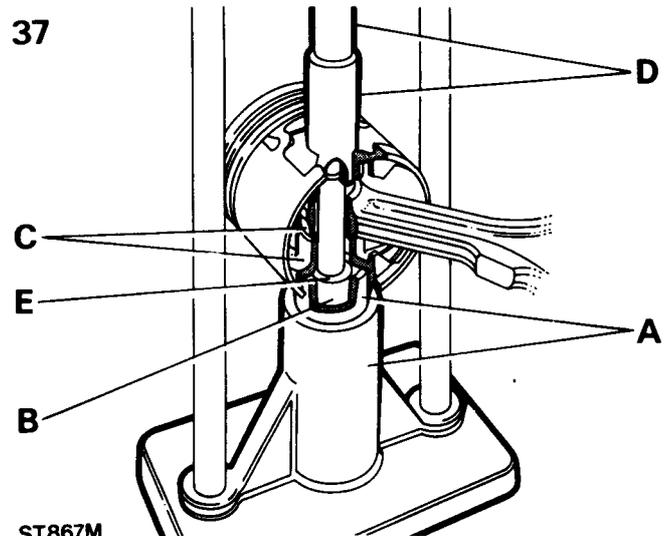
22. Locate the bearing upper shell into the connecting-rod.



ST822M



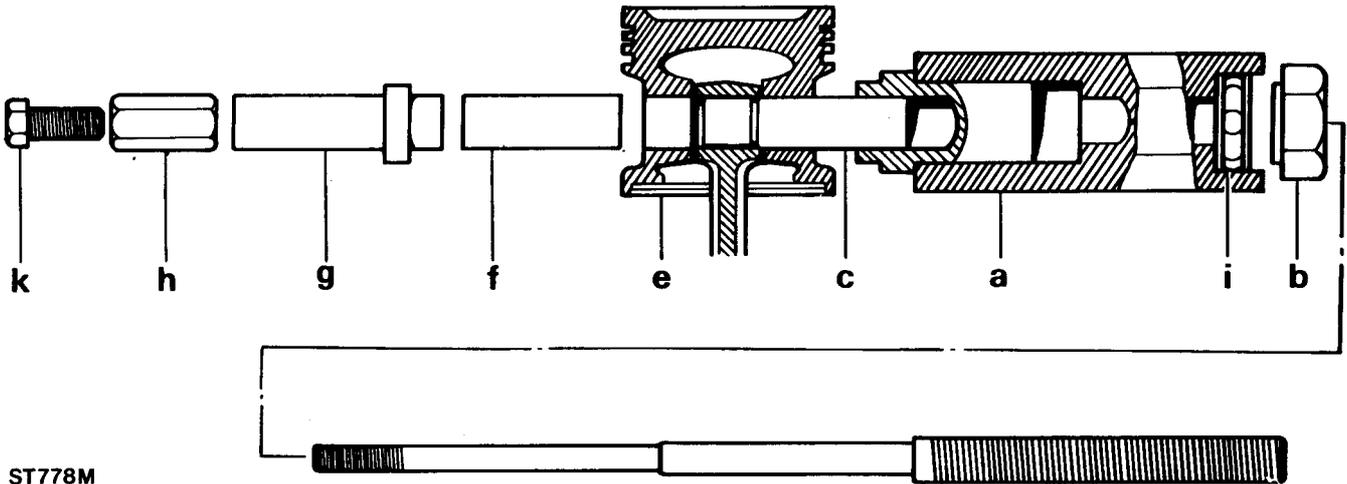
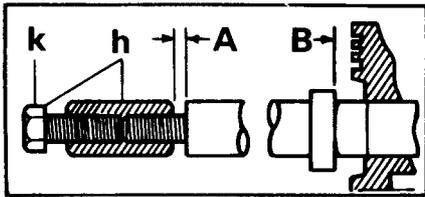
ST823M



ST867M

Assembling pistons to connecting-rods

23. Locate the connecting-rod and bearing onto the applicable crankshaft journal, noting that the domed shape boss on the connecting-rod must face towards the front of the engine on the right-hand bank of cylinders and towards the rear on the left-hand bank.
 24. When both connecting-rods are fitted, the bosses will face inwards towards each other.
 25. Place a piece of Plastigauge across the centre of the lower half of the crankshaft journal.
 26. Locate the bearing lower shell into the connecting-rod cap.
 27. Locate the cap and shell onto the connecting-rod. Note that the rib on the edge of the cap must be the same side as the domed shape boss on the connecting-rod.
 28. Secure the connecting-rod cap. Tighten to the correct torque, see data section.
 29. Do not rotate the crankshaft or connecting rod while the Plastigauge is in use.
 30. Remove the connecting-rod cap and shell.
 31. Using the scale printed on the Plastigauge packet, measure the flattened Plastigauge at its widest point.
 32. The graduation that most closely corresponds to the width of the Plastigauge indicates the bearing clearance.
 33. The correct bearing clearance with new or overhauled components is 0.013 to 0.06 mm (0.0006 to 0.0022 in).
 34. If a bearing has been in service, it is advisable to fit a new bearing if the clearance exceeds 0.08 mm (0.003 in).
 35. If a new bearing is being fitted, use selective assembly to obtain the correct clearance.
 36. Wipe off the Plastigauge with an oily rag. **DO NOT** scrape it off.
- IMPORTANT: The connecting rods, caps and bearing shells must be retained in sets, and in the correct sequence.**
37. If an hydraulic press and tool 605350 was used for dismantling, refit each piston to its connecting-rod as follows:
 - A. Check that the base of tool 605350 and the guide tube are fitted as follows:
Place the base of tool 605350 on the bed of an hydraulic press which has a capacity of 8 tons (8 tonnes).
Fit the guide tube into the bore of the base with its countersunk face uppermost.
 - B. Fit the long mandrel inside the guide tube.
 - C. Fit the connecting-rod into the piston with the markings together if the original pair are being used, then place the piston and connecting rod assembly over the long mandrel until the gudgeon pin boss rests on the guide tube.
 - D. Fit the gudgeon pin into the piston up to the connecting-rod, and the spigot end of the small diameter mandrel into the gudgeon pin.
 - E. Press in the gudgeon pin until it abuts the shoulder of the long mandrel.
 38. If tool 18G 1150 was used for dismantling, refit each piston to its connecting-rod as follows:
 - a. Clamp the hexagon body of 18G 1150 in a vice, with the adaptor 18G 1150 E positioned as in 7d.
 - b. Remove the large nut of 18G 1150 and push the centre screw approximately 50 mm (2 in) into the body until the shoulder is exposed.
 - c. Slide the parallel guide sleeve, grooved end last, onto the centre screw and up to the shoulder.
 - d. Lubricate the gudgeon pin and bores of the connecting-rod and piston with graphited oil (Acheson's Colloids 'Oildag'). Also lubricate the ball race and centre screw of 18G 1150.
 - e. Fit the connecting-rod and the piston together



ST778M

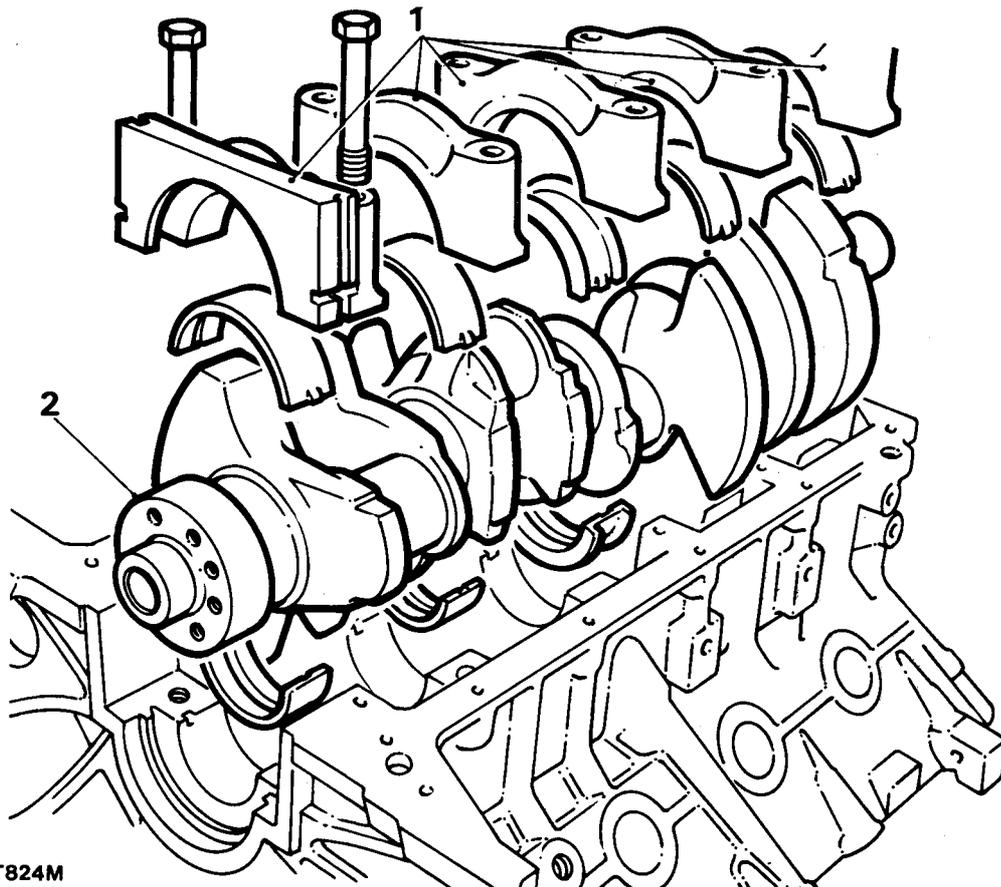
- onto the tool with the markings together if the original pair are being used and with the connecting-rod around the sleeve up to the groove.
- f. Fit the gudgeon pin into the piston bore up to the connecting-rod.
- g. Fit the remover/replacer bush 18G 1150/3 with its flanged end towards the gudgeon pin.
- h. Screw the stop-nut onto the centre screw and adjust this nut to obtain a 1 mm ($\frac{1}{32}$ in) end-float 'A' on the whole assembly, and lock the nut securely with the screw.
- i. Slide the assembly back into the hexagon body and screw on the large nut up to the thrust race.
- j. Set the torque wrench 18G 537 to 12 lbf/ft. This represents the minimum load for an acceptable interference fit of the gudgeon pin in the connecting-rod.
- k. Using the torque wrench and socket 18G 587 on the large nut, and holding the lock screw, pull the gudgeon pin in until the flange of the remover/replacer bush is 4 mm (0.160 in) 'B' from the face of the piston. Under no circumstances must this flange be allowed to contact the piston.

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

- 39. Remove the tool and check that the piston moves freely on the gudgeon pin and that no damage has occurred during pressing.

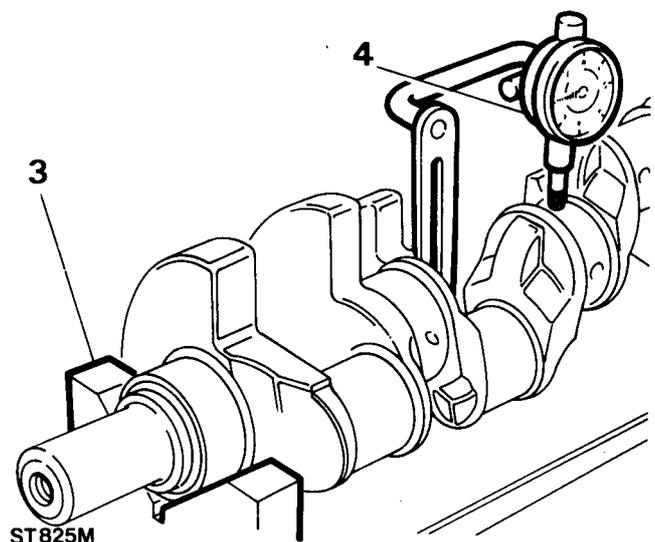
REMOVE AND OVERHAUL CRANKSHAFT

1. Remove the main bearing caps and lower bearing shells and retain in sequence. It is important to keep them in pairs and mark them with the number of the respective journal until it is decided if the bearing shells are to be refitted.
2. Lift out the crankshaft and rear oil seal.



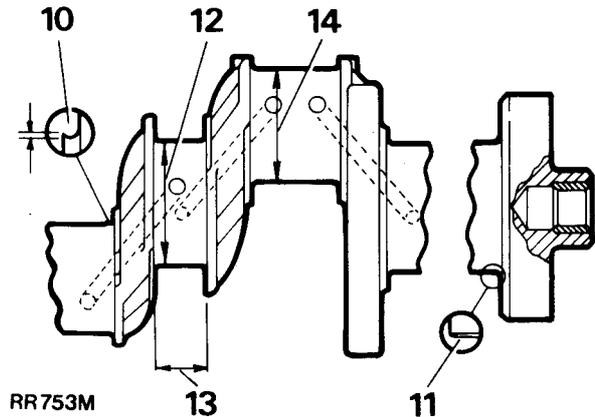
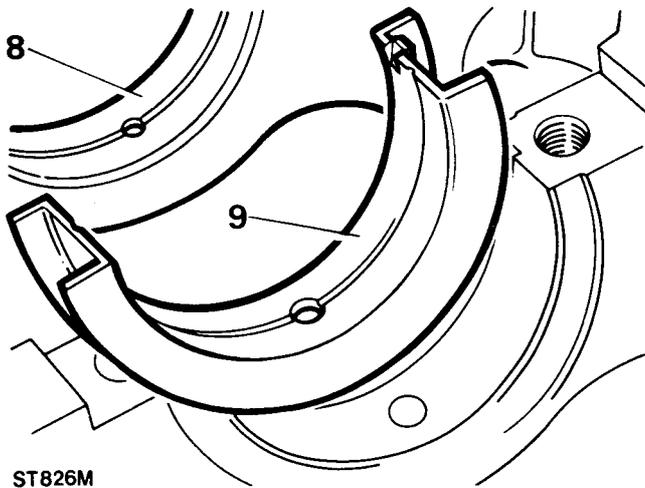
Inspect and overhaul crankshaft

3. Rest the crankshaft on vee-blocks at numbers one and five main bearing journals.
4. Using a dial test indicator, check the run-out at numbers two, three and four main bearing journals. The total indicator readings at each journal should not exceed 0.08 mm (0.003 in).
5. While checking the run-out at each journal, note the relation of maximum eccentricity on each journal to the others. The maximum on all journals should come at very near the same angular location.
6. If the crankshaft fails to meet the foregoing checks it is bent and is unsatisfactory for service.
7. Check each crankshaft journal for ovality. If ovality exceeds 0.040 mm (0.0015 in), a reground or new crankshaft should be fitted.





8. Bearings for the crankshaft main journals and the connecting-rod journals are available in the following undersizes:
 0.25 mm (0.010 in)
 0.50 mm (0.020 in)
9. The centre main bearing shell, which controls crankshaft thrust, has the thrust faces increased in thickness when more than 0.25 mm (0.010 in) undersize, as shown on the following chart.



Crankshaft dimensions—millimetres

Crankshaft Grade	Diameter '12'	Width '13'	Diameter '14'
Standard	58.400–58.413	26.975–27.026	50.800–50.812
0.254 U/S	58.146–58.158	26.975–27.026	50.546–50.559
0.508 U/S	57.892–57.904	27.229–27.280	50.292–50.305

Crankshaft dimensions—inches

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

10. When a crankshaft is to be reground, the thrust faces on either side of the centre main journal must be machined in accordance with the dimensions on the following charts.

Main bearing journal size	Thrust face width
Standard	Standard
0.25 mm (0.010 in) undersize	Standard
0.50 mm (0.020 in) undersize	0.25 mm (0.010 in) oversize

11. For example: If a 0.50 mm (0.020 in) undersize bearing is to be fitted, then 0.12 mm (0.005 in) must be machined off each thrust face of the centre journal, maintaining the correct radius.

Crankshaft dimensions

12. The radius for all journals except the rear main bearing is 1.90 to 2.28 mm (0.075 to 0.090 in).
 13. The radius for the rear main bearing journal is 3.04 mm (0.120 in).
 14. Main bearing journal diameter, see the following charts.
 15. Thrust face width, and connecting-rod journal diameter, see the following charts.

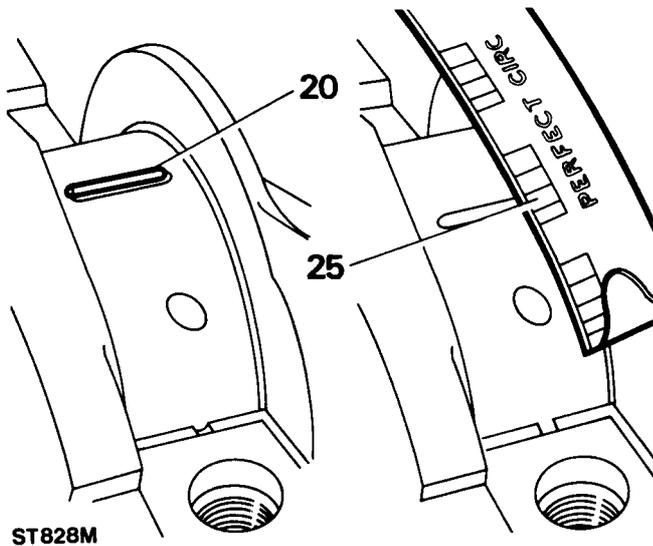
Check main bearing clearance

It is important to provide the correct diametric clearance between each bearing journal and its shell bearing. The clearance can be adjusted by selectively fitting bearing shells as follows:

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

Continued

20. Place a piece of Plastigauge across the centre of the crankshaft main bearing journals.
21. Locate the bearing lower shell into the main bearing cap.
22. Fit numbers one to four main bearing caps and shells, tighten to the correct torque, see data section.
23. Fit the rear main bearing cap and shell and tighten to the correct torque, see data section. Do not allow the crankshaft to be rotated while the Plastigauge is in use.
24. Remove the main bearing caps and shells.
25. Using the scale printed on the Plastigauge packet, measure the flattened Plastigauge at its widest point.

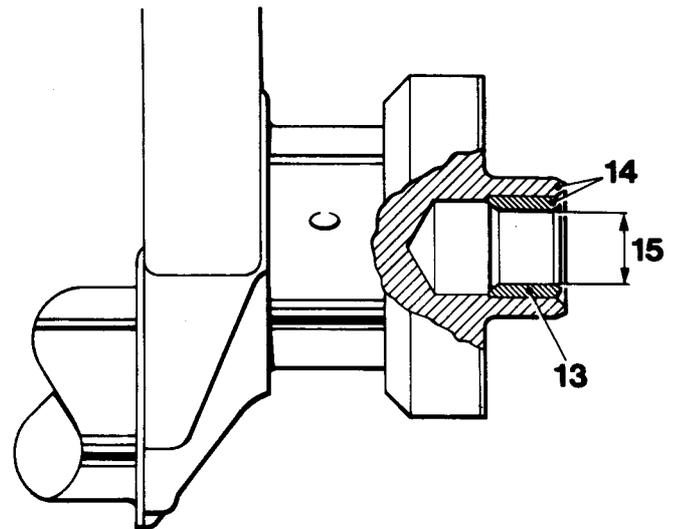


ST828M

26. The graduation that most closely corresponds to the width of the Plastigauge indicates the bearing clearance.
27. The correct bearing clearance with new or overhauled components is 0.023 to 0.065 mm (0.0009 to 0.0025 in).
28. If the correct clearance is not obtained initially, use selective bearing assembly.
29. Wipe off the Plastigauge with an oily rag. Do NOT scrape it off.
30. Maintain the bearing shells and caps in sets and in the correct sequence.

Renew spigot bearing

31. Carefully remove the old bearing.
32. Fit the spigot bearing flush with, or to a maximum of 1.6 mm (0.063 in) below the end face of the crankshaft.
33. Ream the spigot bearing to $19.177 + 0.025$ mm ($0.7504 + 0.001$ in) inside diameter. Ensure all swarf is removed.

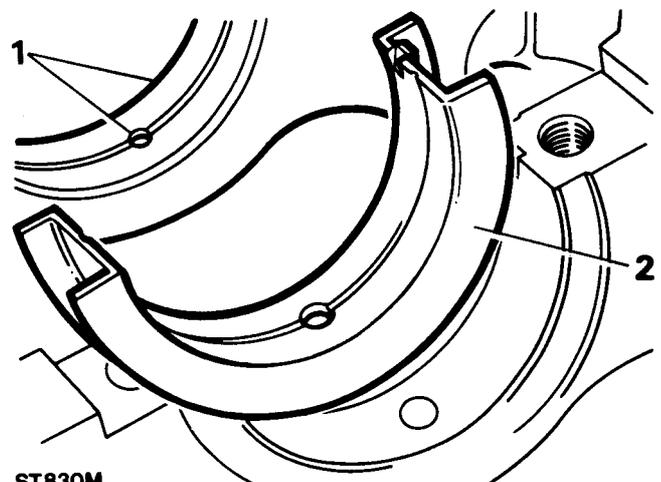


ST 829M

ASSEMBLING ENGINE

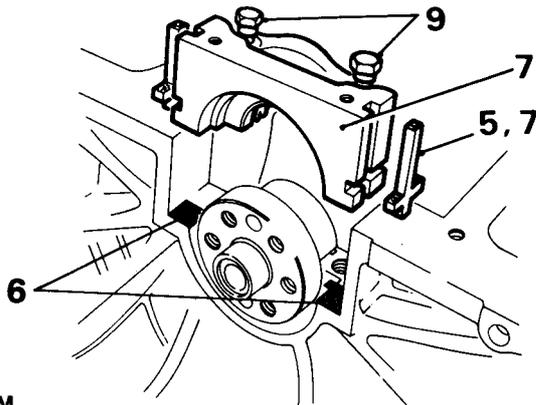
FIT CRANKSHAFT AND MAIN BEARINGS

1. Locate the upper main bearing shells into the cylinder block; these must be the shells with the oil drilling and oil grooves.
2. Locate the flanged upper main bearing shell in the centre position.
3. Lubricate the crankshaft main bearing journals and bearing shells with clean engine oil and lower the crankshaft into position.



ST830M

4. Lubricate the lower main bearing shells and fit numbers one to four main bearing caps and shells only, leaving the fixing bolts finger-tight at this stage.
5. Fit the cruciform side seals to the grooves each side of the rear main bearing cap. Do not cut the side seals to length, they must protrude 1.5 mm (0.062 in) approximately above the bearing cap parting face.
6. Apply Hylomar PL32M jointing compound to the rearmost half of the rear main bearing cap parting face or, if preferred, to the equivalent area on the cylinder block as illustrated.
7. Lubricate the bearing half and bearing cap side seals with clean engine oil.
8. Fit the bearing cap assembly to the engine. Do not tighten the fixings at this stage but ensure that the cap is fully home and squarely seated on the cylinder block.
9. Tension the cap bolts equally by one-quarter turn approximately, then back off one complete turn on each fixing bolt.



ST831M

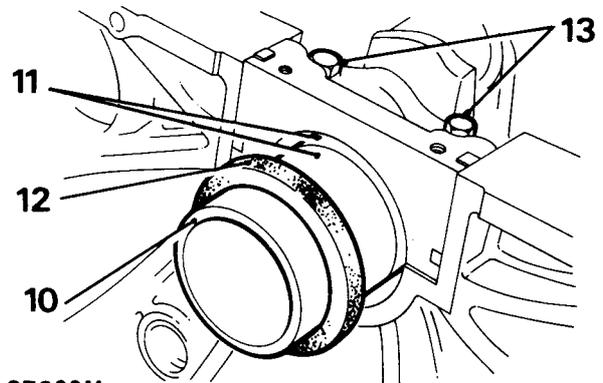
CAUTION: Do not handle the seal lip, visually check that it is not damaged and ensure that the outside diameter remains clean and dry.

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

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

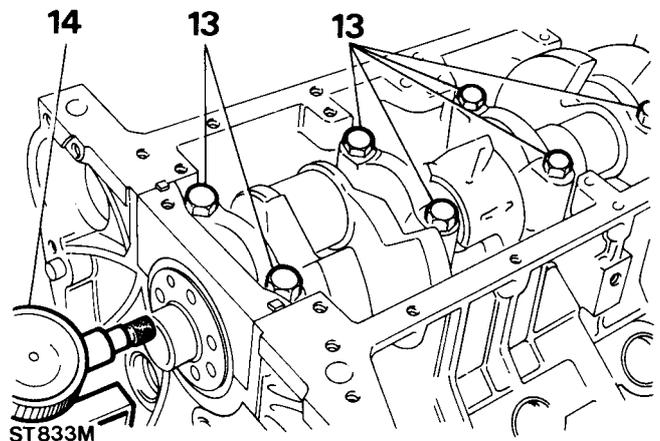
Position the oil seal, lipped side towards the engine, onto the seal guide. The seal outside diameter must be clean and dry.

12. Push home the oil seal fully and squarely by hand into the recess formed in the cap and block until it abuts against the machined step in the recess. Withdraw the seal guide.



ST832M

13. Tighten the main bearing cap bolts to the correct torque noting that the bolts for numbers one to four bearings have a different torque to number five bearing cap bolts.
14. Using a feeler gauge or a dial indicator check the crankshaft end-float, 0.10 to 0.20 mm (0.004 to 0.008 in).

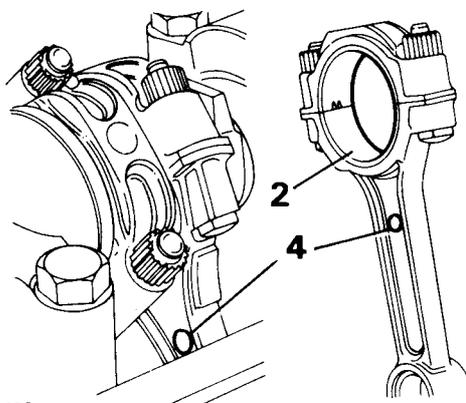


ST833M

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

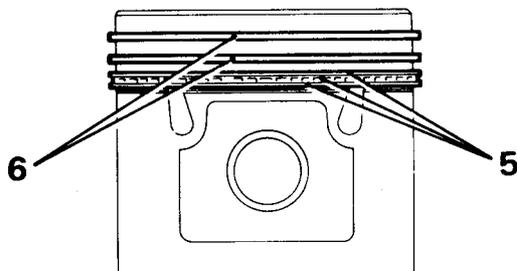
FIT CONNECTING-RODS AND PISTONS

1. Locate the applicable crankshaft journal at BDC.
2. Place the bearing upper shell in the connecting-rod.
3. Retain the upper shell by screwing the guide bolts 605351 onto the connecting-rods.
4. Insert the connecting-rod and piston assembly into its respective bore, noting that the domed shape boss on the connecting-rod must face towards the front of the engine on the right-hand bank of cylinders and towards the rear on the left-hand bank. When both connecting-rods are fitted, the bosses will face inwards towards each other.



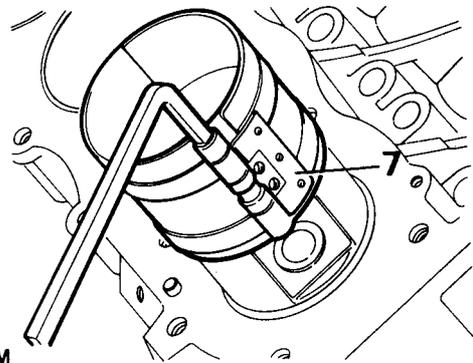
ST834M

5. Position the oil control piston rings so that the ring gaps are all at one side, between the gudgeon pin and piston thrust face. Space the gaps in the ring rails approximately 25 mm (1 in) each side of the expander ring joint.
6. Position the compression rings so that their gaps are on opposite sides of the piston between the gudgeon pin and piston thrust face.



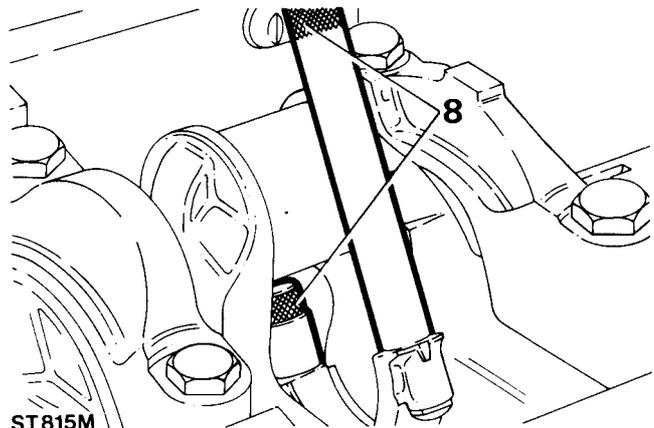
ST835M

7. Using a piston ring compressor, locate the piston into the cylinder bore, until the piston crown is just below the cylinder block top face.



ST836M

8. Pull the connecting rods on to the crankpins using the guide rods.

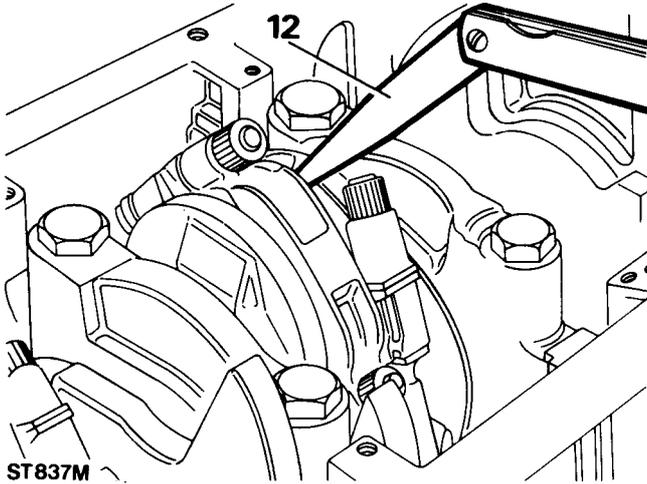


ST815M

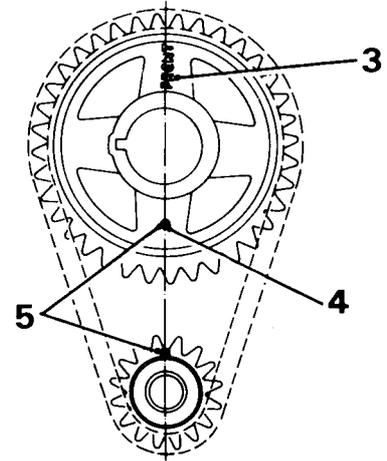
9. Place the bearing lower shell in the connecting-rod cap.
10. Locate the cap and shell onto the connecting-rod, noting that the rib on the edge of the cap must be towards the front of the engine on the right-hand bank of cylinders and towards the rear on the left-hand bank.
11. Check that the connecting-rods move freely sideways on the crankshaft. Tightness indicates insufficient bearing clearance or a misaligned connecting-rod.



12. Check the end-float between the connecting-rods on each crankshaft journal. Clearance limits: 0.15 to 0.37 mm (0.006 to 0.014 in).
13. Tighten the connecting-rod nuts to the correct torque. Fit the oil strainer and joint washer.



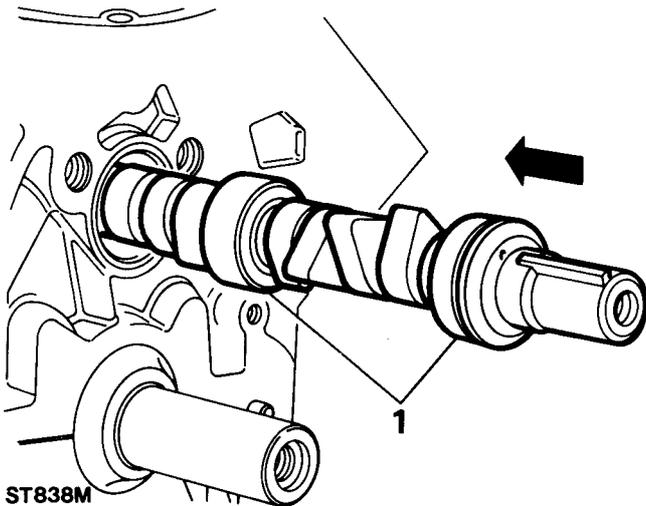
4. Turn the camshaft until the mark on the camshaft chain wheel is at the six o'clock position, then remove the chain wheel without disturbing the camshaft.
5. Encircle the chain wheels with the chain keeping the timing marks aligned.



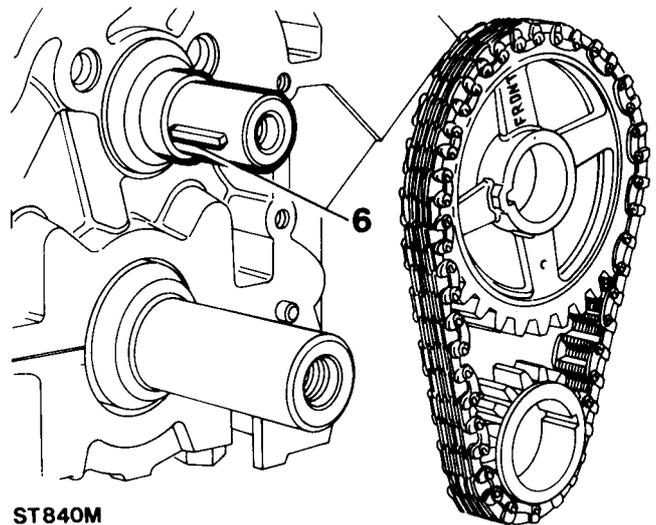
ST839M

FIT CAMSHAFT TIMING GEARS AND CHAIN

1. Lubricate the camshaft journals and carefully insert the camshaft into the cylinder block.



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

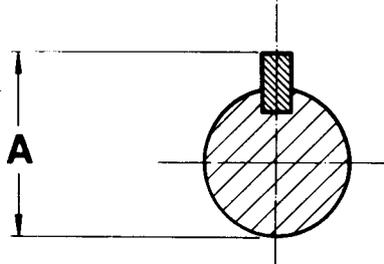


ST840M

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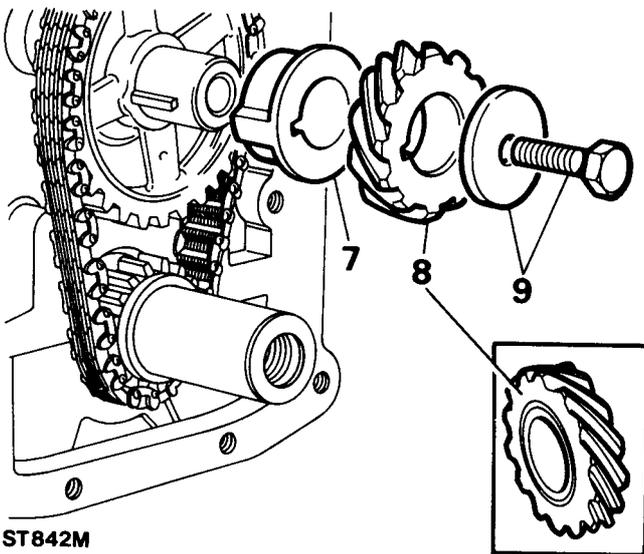
2. Turn the crankshaft to bring number one piston to TDC.
3. Temporarily fit the camshaft chain wheel with the marking 'FRONT' or 'F' outward.

CAUTION: The space between the key and keyway acts as an oilway for lubrication of the drive gear. Ensure that the key is seated to the full depth of the keyway. The overall dimension of shaft and key must not exceed 30.15 mm (1.187 in). Dimension A below.



ST841M

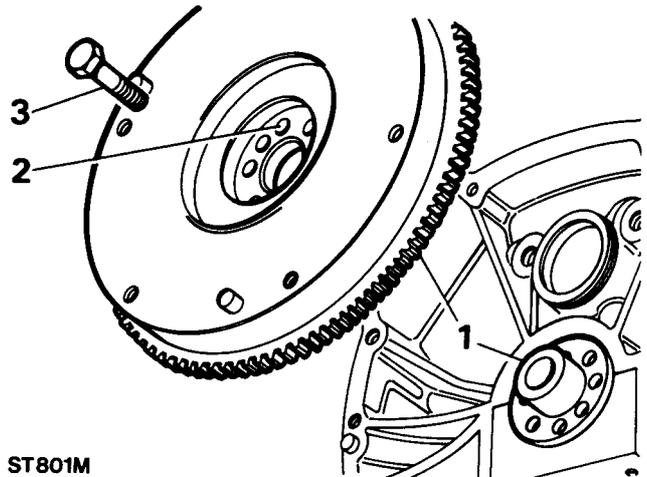
7. Check that the timing marks line-up and fit the spacer with the flange to the front.
8. Fit the distributor drive gear ensuring that the annular grooved side is fitted to the rear, that is towards the spacer.
9. Secure the drive gear and camshaft chain wheel assembly with the bolt and washer and tighten to the correct torque.



ST842M

FIT THE FLYWHEEL

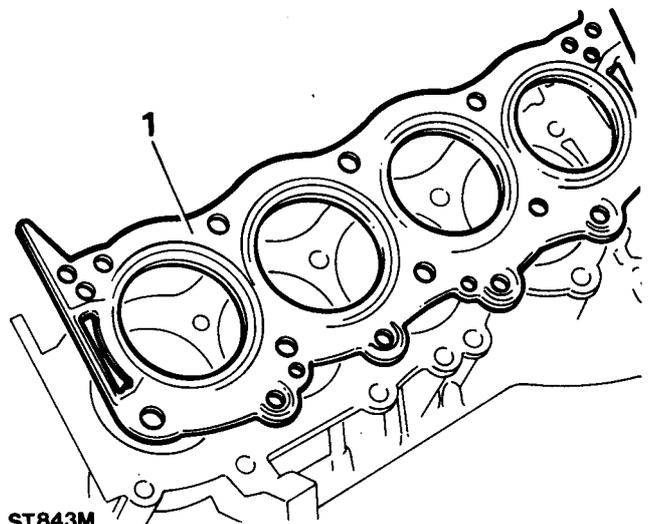
1. Locate the flywheel in position on the crankshaft spigot, with the ring gear towards the engine.
2. Align the flywheel fixing bolt holes which are off-set to prevent incorrect assembly.
3. Fit the flywheel fixing bolts and before finally tightening, take up any clearance by rotating the flywheel against the direction of engine rotation. Tighten the bolts evenly to the correct torque.



ST801M

FIT CYLINDER HEADS

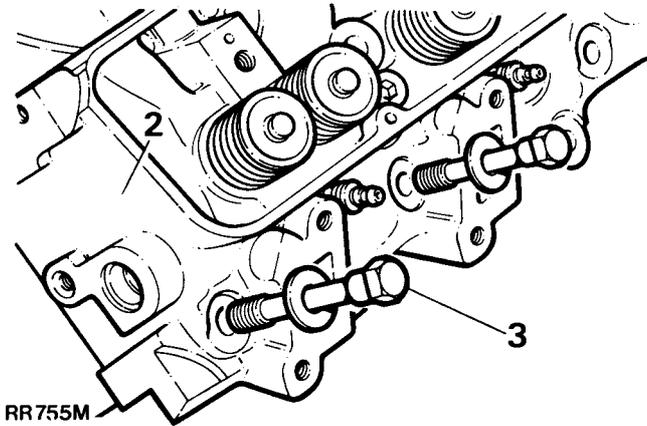
1. Fit new cylinder head gaskets with the word 'TOP' uppermost. Do NOT use sealant.



ST843M



2. Locate the cylinder heads on the block dowel pins.
3. Clean the threads of the cylinder head bolts then coat them with Thread Lubricant-Sealant Loctite 572.



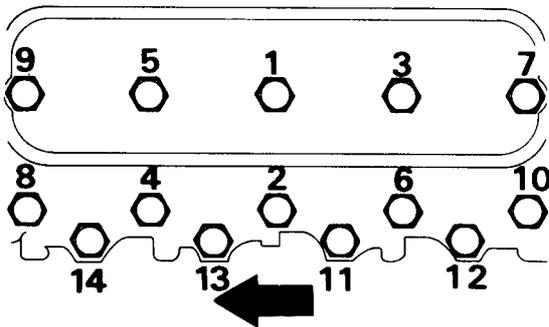
4. Locate the cylinder head bolts in position as illustrated and fit dipstick tube.

Long bolts—1, 3 and 5.

Medium bolts—2, 4, 6, 7, 8, 9 and 10.

Short bolts—11, 12, 13 and 14.

5. Tighten the cylinder head bolts a little at a time in the sequence shown. See data for correct tightening torque.
6. When all bolts have been tightened, re-check the torque settings.



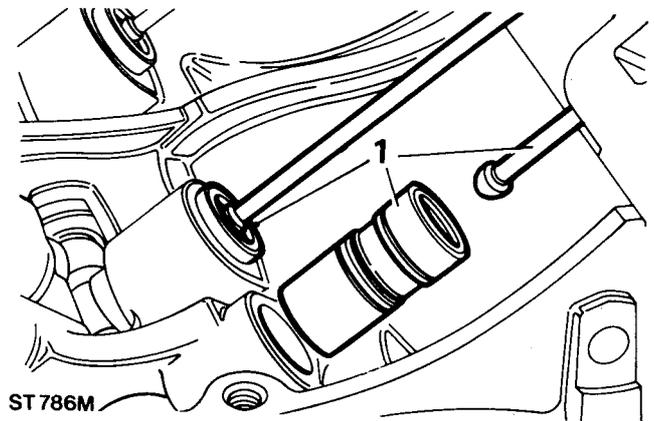
ST845M

Note: Left-hand cylinder head illustrated.
Arrow points to front of vehicle.

FIT TAPPETS, PUSH RODS AND ROCKER ASSEMBLIES

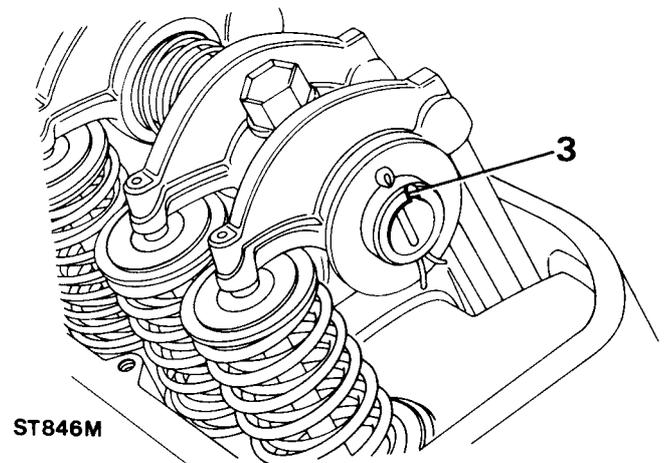
Fit tappets and push rods

1. Fit the tappets and push rods to their original locations. Ensure that the tappets move freely in their respective bores. Before fitting the tappets immerse them in clean engine oil to reduce tappet noise when the engine is first started after the overhaul.



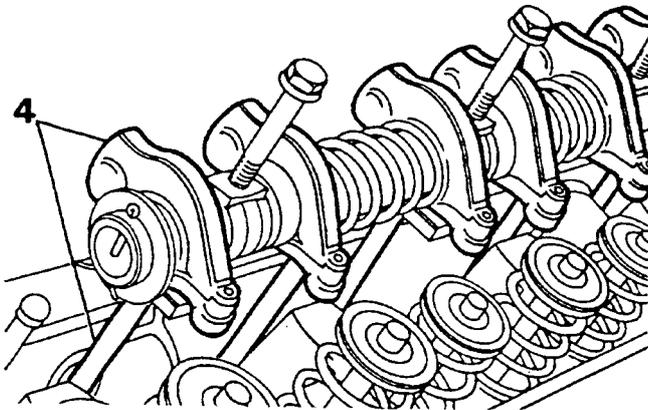
Fit the rocker assemblies

2. The rocker shafts are handed and must be fitted correctly to align the oilways.
3. Each rocker shaft is notched at one end and on one side only. The notch must be uppermost and towards the front of the engine on the right-hand side, and towards the rear on the left-hand side.



Continued

4. Fit the rocker shaft assemblies. Ensure that the push-rods engage the rocker cups and that the baffle plates (if fitted) are positioned to the front on the left-hand side and to the rear on the right-hand side. Tighten the bolts.

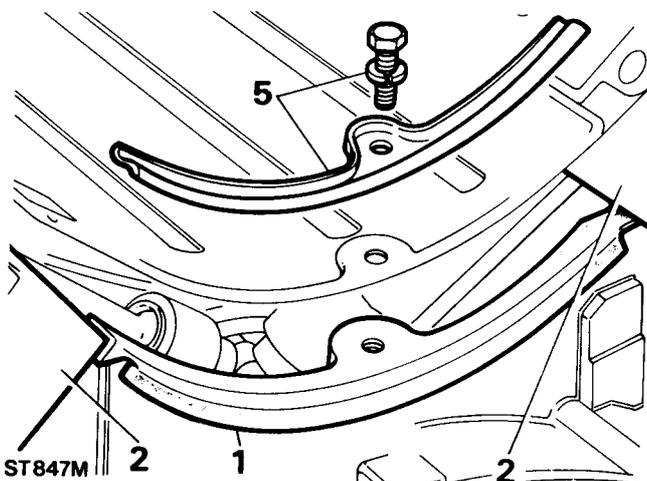


It should be noted that tappet noise can be expected on initial starting-up after an overhaul due to oil drainage from the tappet assemblies or indeed if the vehicle has been standing over a very long period. If excessive noise should be apparent after an overhaul, the engine should be run at approximately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

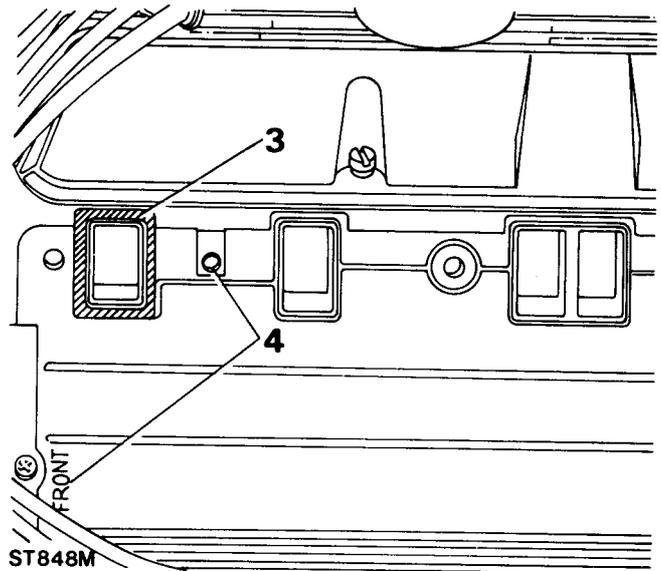
CAUTION: Do not exceed 1,000 engine rev/min when first starting the engine, otherwise the crankshaft rear oil seal will be damaged.

FIT THE INTAKE MANIFOLD

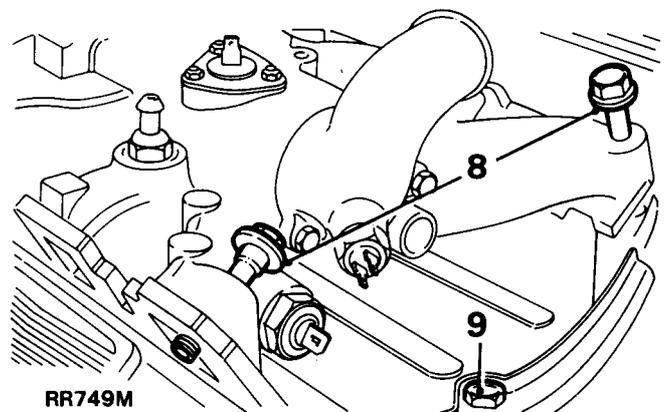
1. Coat both sides of new manifold gasket seals with silicon grease.
2. Locate the seals in position with their ends engaged in the notches formed between the cylinder head and block.



3. Apply 'Hylomar' sealing compound SQ32M on the corners of the cylinder head, manifold gasket and manifold, around the water passage joints.
4. Fit the manifold gasket with the word 'FRONT' to the front and the open bolt hole at the front R.H. side.
5. Fit the gasket clamps but do not fully tighten the bolts at this stage.

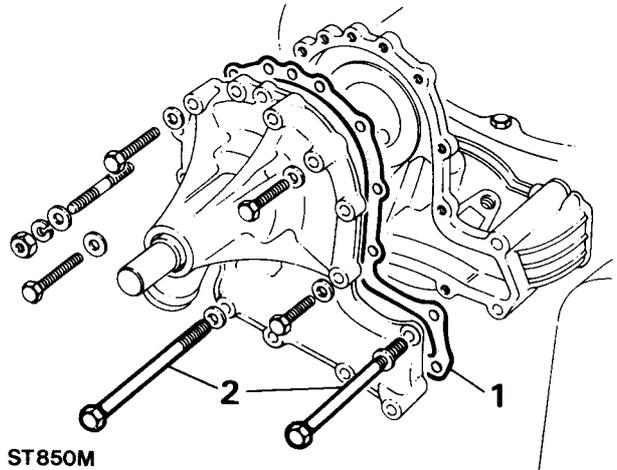


6. Locate the manifold onto the cylinder head.
7. Clean the threads of the manifold securing bolts.
8. Fit all the manifold bolts and tighten them a little at a time, evenly, alternate sides working from the centre to each end and finally tighten to the correct torque.
9. Tighten the gasket clamp bolts to the correct torque.



FIT THE TIMING COVER AND CRANKSHAFT PULLEY

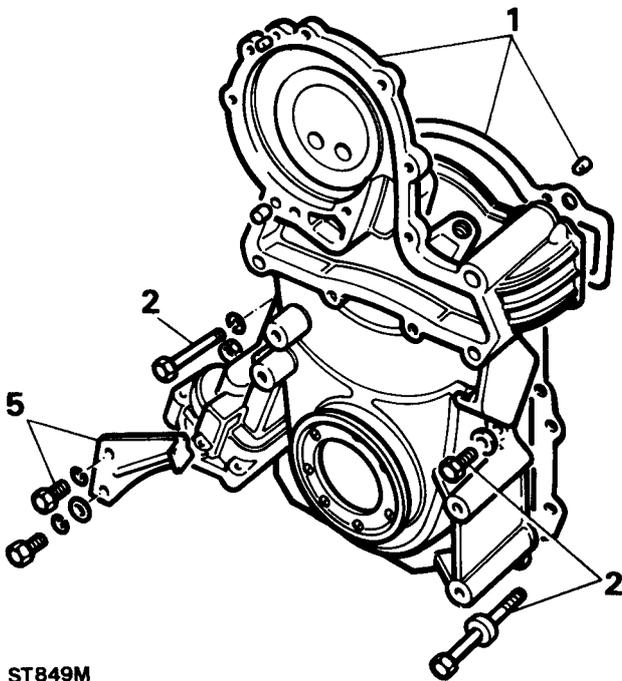
1. Place a new timing cover joint washer in position and fit the timing cover locating it on the two dowels.
2. Clean the threads of the timing cover securing bolts, then coat them with Thread Lubricant-Sealant Loctite 572.
3. Fit and evenly tighten the timing cover bolts to the correct torque figure.
4. Fit the crankshaft pulley and tighten the retaining bolt to the correct torque.
5. Fit timing pointer.



ST850M

FIT THE SUMP

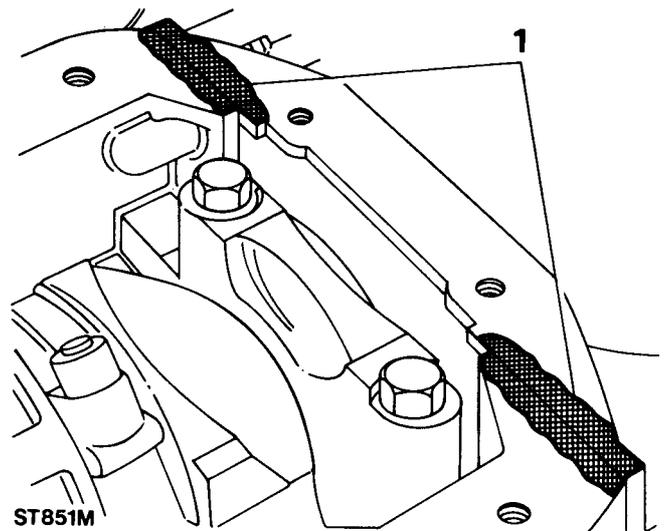
1. Clean the sump mating faces and at the joint between the timing cover and crankcase apply a coating of a universal jointing compound about 13 to 19 mm (½ to ¾ in) wide in the area illustrated.



ST849M

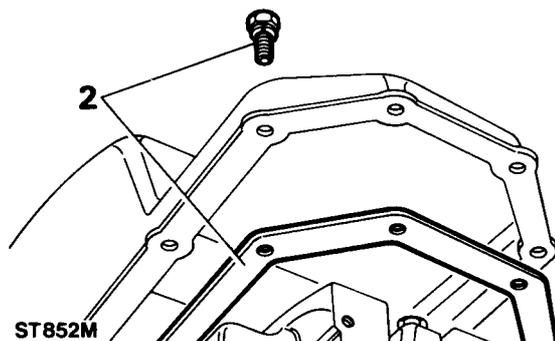
FIT THE WATER PUMP

1. Lightly grease a new joint washer and place it in position on the timing cover.
2. Clean the threads of the four long bolts and smear them with Loctite 572 thread lubricant sealant. Locate the water pump in position.
3. Locate the alternator adjusting link on the water pump.
4. Leave the alternator adjusting link loose and tighten the remaining water pump housing bolts evenly and to the correct torque.



ST851M

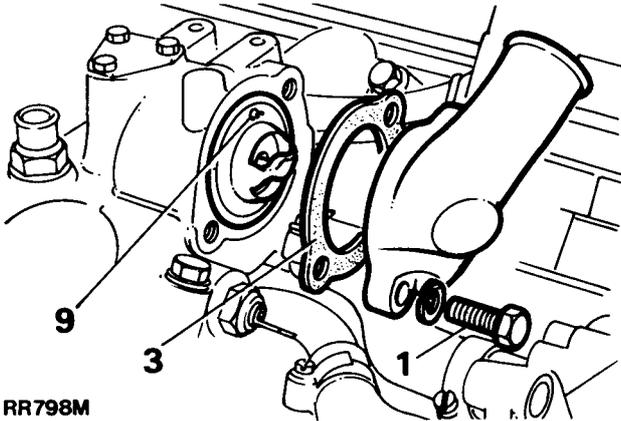
2. Place the sump gasket in position, fit the sump and evenly tighten the retaining bolts to the correct torque.



ST852M

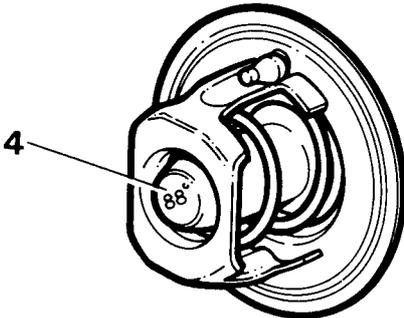
TEST AND FIT THERMOSTAT

1. Remove the two bolts securing the thermostat housing to the intake manifold.
2. Remove the housing gasket.
3. Withdraw the thermostat.



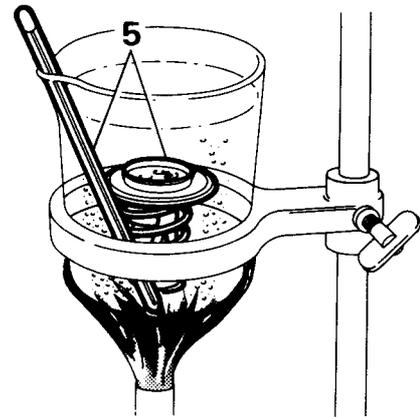
RR798M

4. Note the temperature stamped on the thermostat at which it should be fully open.



RR799M

5. Place the thermostat and a Centigrade thermometer in a laboratory beaker, or a suitable alternative, half full of water.
6. Heat the water and observe the temperature at which the thermostat opens.
7. If faulty discard the thermostat.

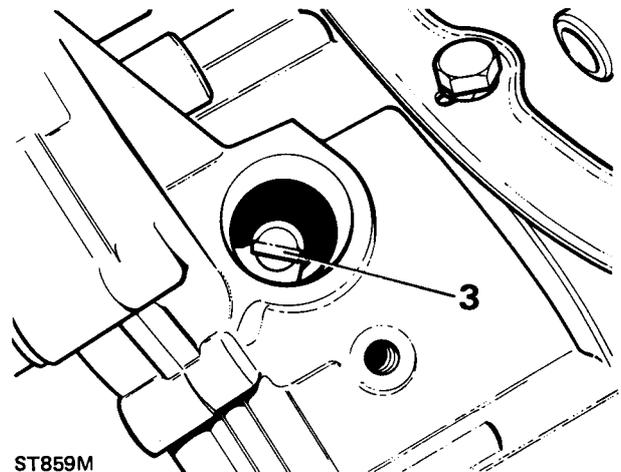


ST858M

8. Clean the intake manifold and thermostat housing mating faces.
9. Fit the thermostat with the jiggle pin uppermost at 12 o'clock.
10. Fit the housing using a new gasket, and tighten the two bolts to the correct torque, see 'data section'.

FIT THE DISTRIBUTOR

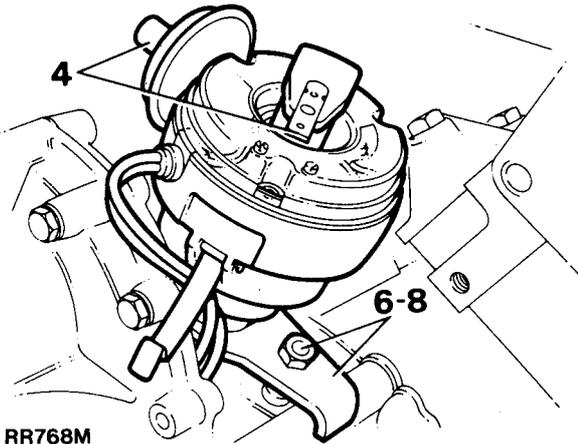
1. Turn the crankshaft to bring number one piston to TDC on the compression stroke (both valves closed number one cylinder).
2. Turn distributor drive until rotor arm is approximately 30° anti-clockwise from number one sparking plug lead position on cap.
3. Turn the oil pump and distributor common drive shaft so that the tongue is in the approximate position as illustrated.



ST859M



4. Fit distributor to engine and check that centre line of rotor arm is now in line with number one sparking plug lead in cap. Reposition distributor if necessary. The vacuum capsule should be at 90° to the camshaft.
5. If distributor does not seat correctly in front cover, oil pump drive is not engaged. Engage by lightly pressing down distributor while turning engine.
6. Fit clamp and bolt leaving both loose at this stage.



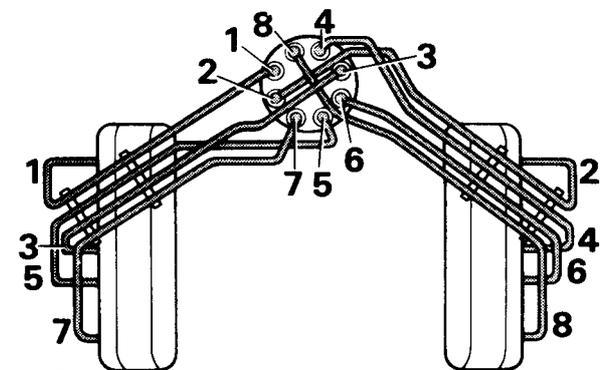
RR768M

7. Rotate distributor until the static timing is within 2–3° of TDC.

CAUTION: On no account must the engine be started before this operation is carried out.

8. Secure distributor in this position by tightening clamp bolt.
9. Fit the distributor cap and spark plugs and connect the H.T. leads in accordance with the illustration below.

NOTE: The above distributor setting is to enable the engine to be run so that the correct setting given in 'Engine Tuning Data' can be achieved once the engine is refitted to the vehicle.



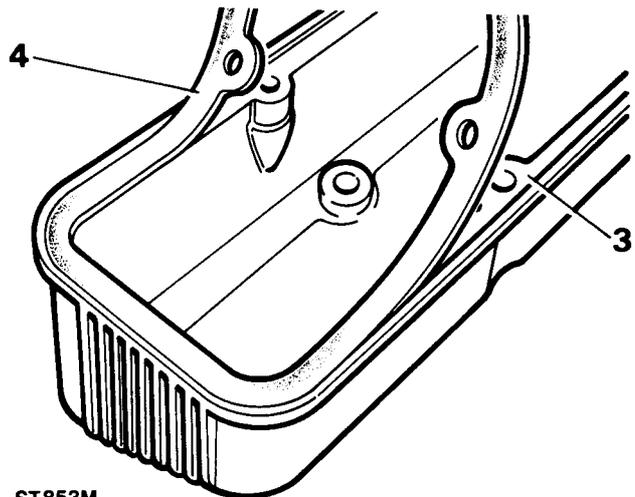
ST098

FIT ROCKER COVERS

1. Remove all traces of old gasket on the covers and cylinder heads.
2. Clean and dry the gasket mounting surface, using Bostik cleaner 6001.
3. Apply Bostik 1775 impact adhesive to the seal face and the gasket, using a brush to ensure an even film. Allow the adhesive to become touch-dry, approximately fifteen minutes.

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

4. Place one end of the gasket into the cover recess with the edge firmly against the recess wall: at the same time hold the remainder of the gasket clear; then work around the cover, pressing the gasket into place ensuring that the outer edge firmly abuts the recess wall.

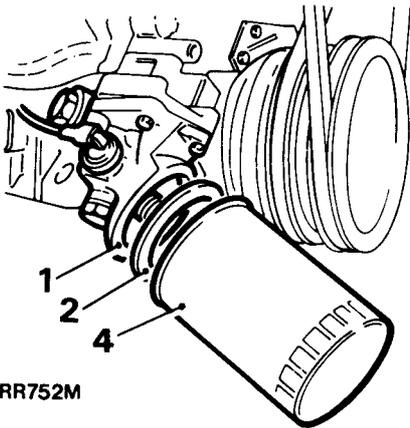


ST853M

5. Allow the cover to stand for thirty minutes before fitting it to the engine.
6. Secure the rocker covers to the engine with the four screws. Short screws—in board, long screws—out board.

FIT ENGINE OIL FILTER

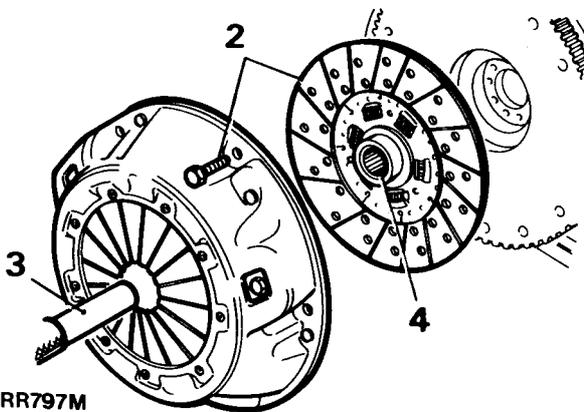
1. Clean oil pump mating face with filter.
2. Smear clean engine oil on the rubber washer of the new filter.
3. Fill the filter with new oil as far as possible, noting the angle at which the filter is to be fitted.
4. Screw on the filter until the sealing ring touches the oil pump cover face, then tighten it a further half turn by hand only. **Do not overtighten.**



RR752M

FIT THE CLUTCH

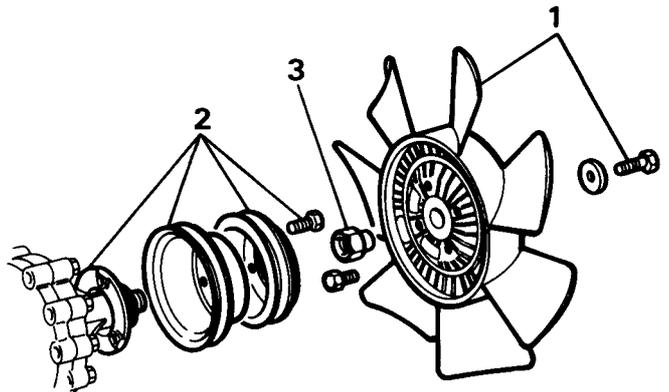
1. Clean the flywheel and clutch assembly pressure plate.
2. Fit the centre plate and the clutch assembly and loosely secure the flywheel with the retaining bolts.
3. Insert centralising tool 18G 1195 or a slave primary shaft and finally tighten the clutch assembly retaining bolts in a diagonal sequence, to the correct torque.
4. Smear the centre plate spines with Rocol MV3 or Rocol MTS 1000 grease.



RR797M

FIT THE FAN PULLEY, VISCOUS COUPLING AND FAN

1. Secure the fan to the viscous coupling with the four bolts and tighten evenly.
2. If removed, fit the pulley to hub assembly adaptor and secure with the three bolts and tighten to the correct torque.
3. Screw the viscous coupling onto the adaptor thread tighten to the correct torque—see data section.
4. Fit the fan belt and compressor belt if fitted.



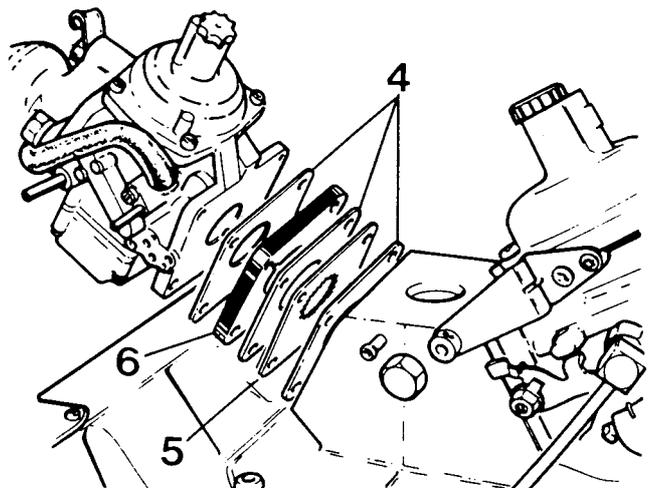
RR967M

FIT THE CARBURETTORS

If removed, fit the carburettors to the induction manifold, using new joint washers in the correct sequence as illustrated.

NOTE: Ensure the teeth are pointing towards the manifold penthouse when the deflector is refitted.

4. Fit the three joint washers.
5. Fit the saw toothed deflector.
6. Fit the insulator.



MISCELLANEOUS AND NON-STANDARD ITEMS

Fit any other items of equipment and miscellaneous hoses, pipes, filters, clips and brackets to the positions noted during dismantling.



FAULT DIAGNOSIS

SYMPTOM	POSSIBLE CAUSE	CURE
ENGINE FAILS TO START	<ol style="list-style-type: none"> 1. Incorrect starting procedure 2. Starter motor speed too slow 3. Faulty ignition system 4. Water or dirt in fuel system 5. Carburetter(s) flooding 6. Defective fuel pump 7. Defective starter motor 8. Starter pinion not engaging 	See owners handbook Check battery and connections Check each component in system Flush out system with clean fuel Check float chamber needle valve Remove, overhaul or renew Overhaul or renew Remove starter motor and overhaul
ENGINE STALLS	<ol style="list-style-type: none"> 1. Low idling speed 2. Faulty sparking plugs 3. Faulty coil 4. Faulty reluctor 5. Incorrect mixture 6. Foreign matter in fuel system 	Adjust carburetter(s) Clean and test; renew if necessary Renew Renew Adjust carburetter(s) Investigate source of foreign matter and clean as necessary
LACK OF POWER	<ol style="list-style-type: none"> 1. Poor compression 2. Badly seating valves 3. Faulty exhaust silencer 4. Incorrect ignition timing 5. Leaks or restriction in fuel system 6. Faulty sparking plugs 7. Excessive carbon deposit 8. Brakes binding 9. Faulty coil or battery 	If the compression is appreciably less than the correct figure, the piston rings or valves are faulty. Low pressure in adjoining cylinders indicates a faulty cylinder head gasket Overhaul cylinder head(s) Renew Check and adjust using electronic equipment Check through system Clean, test and renew if necessary Decarbonize Adjust brakes or overhaul Determine which component and renew
ENGINE RUNS ERRATICALLY	<ol style="list-style-type: none"> 1. Faulty electrical connections 2. Defective sparking plugs 3. Low battery charge 4. Defective distributor 5. Foreign matter in fuel system 6. Faulty fuel pump 7. Sticking valves 8. Defective valve springs 9. Incorrect ignition timing 10. Worn valve guides or valves 11. Faulty cylinder head gaskets 12. Damaged exhaust system 13. Vacuum pipes, disconnected at inlet manifold, distributor or gearbox 	Check security of all ignition connections Clean, test and renew if necessary Recharge battery and test for condition Remove and overhaul Determine source of dirt and clean system Remove and overhaul or renew Overhaul cylinder head(s) Overhaul cylinder head(s) Check timing with electronic equipment, if possible Overhaul cylinder head(s) Renew gaskets Rectify or renew Refit pipes
ENGINE STARTS, BUT STOPS IMMEDIATELY	<ol style="list-style-type: none"> 1. Faulty electrical connections 2. Foreign matter in fuel system 3. Faulty fuel pump 4. Low fuel level in tank 	Check HT leads for cracked insulation, check low tension circuit Determine source of matter and clean system Remove, overhaul or renew Replenish
ENGINE FAILS TO IDLE	<ol style="list-style-type: none"> 1. Incorrect carburetter setting 2. Faulty fuel pump 3. Sticking valves 4. Faulty cylinder head gasket(s) 	Adjust as necessary Remove, overhaul or renew Overhaul cylinder head(s) Renew
ENGINE MISFIRES ON ACCELERATION	<ol style="list-style-type: none"> 1. Distributor incorrectly set 2. Faulty coil 3. Faulty sparking plugs 4. Faulty carburetter(s) 5. Vacuum pipes disconnected at inlet manifold 	Adjust Renew Clean, test or renew Overhaul Check all vacuum connections. Renew faulty pipes
ENGINE KNOCKS	<ol style="list-style-type: none"> 1. Ignition timing advanced 2. Excessive carbon deposit 3. Incorrect carburetter setting 4. Unsuited fuel 5. Worn pistons or bearings 6. Distributor advance mechanism faulty 7. Defective sparking plugs 	Adjust using electronic equipment Decarbonise Adjust Adjust ignition timing to suit octane rating Overhaul engine Renew capsule and re-check Clean, test and renew if necessary
ENGINE BACKFIRES	<ol style="list-style-type: none"> 1. Ignition defect 2. Carburetter defect 3. Sticking valve 4. Weak valve springs 5. Badly seating valves 6. Excessively worn valve stems and guides 7. Excessive carbon deposit 8. Incorrect sparking plug gap 9. Air leak in induction or exhaust systems 	Check all ignition components and timing Overhaul carburetter(s) } Overhaul cylinder head Clean and reset Renew faulty gaskets or components



FAULT DIAGNOSIS

SYMPTOM	POSSIBLE CAUSE	CURE
BURNED VALVES	<ol style="list-style-type: none"> 1. Sticking valves 2. Weak valve springs 3. Excessive deposit on valve seats 4. Distorted valves 5. Excessive mileage between overhauls 	<p>} Overhaul cylinder head</p>
NOISY VALVE MECHANISM	<ol style="list-style-type: none"> 1. Excessive oil in sump, causing air bubbles in hydraulic tappets 2. Worn or scored parts in valve operating mechanism 3. Valves and seats cut down excessively, raising end of valve stem, 1.27 mm (0.050 in) above normal position 4. Sticking valves 5. Weak valve springs 6. Worn timing chain or chain wheels 	<p>Drain and refill to correct level on dipstick</p> <p>Replace faulty parts</p> <p>Grind off end of valve stem or replace parts</p> <p>} Overhaul cylinder head</p> <p>Renew worn parts</p>
NOISE FROM HYDRAULIC TAPPETS <ol style="list-style-type: none"> 1. Rapping noise only when engine is started 2. Intermittent rapping noise 3. Noise on idle and low speed 4. General noise at all speeds <ol style="list-style-type: none"> 5. Loud noise at normal operating temperature only 	<ol style="list-style-type: none"> 1. Oil too heavy for prevailing temperature Excessive varnish in tappet 2. Leakage at check ball 3. Excessive leak-down 4. High oil level in sump Leakage at check ball Worn tappet body Worn camshaft 5. Excessive leak-down rate or scored lifter plunger 	<p>Drain and refill with correct grade</p> <p>Replace tappet</p> <p>Replace tappet</p> <p>Replace tappet</p> <p>Drain and refill to correct level on dipstick</p> <p>Replace tappet</p> <p>Replace tappet</p> <p>Replace camshaft</p> <p>Replace tappet</p>
MAIN BEARING RATTLE	<ol style="list-style-type: none"> 1. Low oil level in sump 2. Low oil pressure 3. Excessive bearing clearance 4. Burnt-out bearings 5. Loose bearing caps 	<p>Replenish as necessary to high mark on dipstick</p> <p>Worn bearings</p> <p>Renew bearings; grind crankshaft</p> <p>Renew and investigate reason for failure</p> <p>Tighten to correct torque</p>
LOW OIL PRESSURE WARNING LIGHT REMAINS ON, ENGINE RUNNING ON, ENGINE RUNNING	<ol style="list-style-type: none"> 1. Thin or diluted oil 2. Low oil level 3. Choked pump strainer 4. Faulty release valve 5. Excessive bearing clearance 6. Oil pressure switch unserviceable 7. Electrical fault 8. Relief valve plunger sticking 9. Weak relief valve spring 10. Pump rotors excessively worn 11. Excessively worn bearings; main connecting rod, big end, camshaft, etc 	<p>Drain and refill with correct oil and renew filter</p> <p>Replenish to high mark on dipstick</p> <p>Clean</p> <p>Rectify</p> <p>Rectify</p> <p>Renew</p> <p>Check circuit</p> <p>Remove and ascertain cause</p> <p>Renew</p> <p>Overhaul oil pump</p> <p>Ascertain which bearings and rectify</p>
RATTLE IN LUBRICATION SYSTEM	<ol style="list-style-type: none"> 1. Oil pressure relief valve plunger sticking 	<p>Remove and clean</p>
ENGINE OVERHEATING	<ol style="list-style-type: none"> 1. Low coolant level 2. Faulty cooling system 3. Faulty thermostat 4. Incorrect timing 5. Defective lubrication system 	<p>Check for leaks. Check expansion tank level</p> <p>Check fan and belt, pump, radiator fins not blocked</p> <p>Test and renew if necessary</p> <p>Check and adjust using electronic equipment</p> <p>Renew filter. Check pump. Clean strainer.</p> <p>Check oil circulation</p>
MECHANICAL NOISES: Medium low pitch knock Low pitch thud High pitch tap Intermittent thuds Continual slapping	<p>Big end bearing slack or run</p> <p>Main bearing slack or run</p> <p>Worn gudgeon pins</p> <p>Loose flywheel or excessive crankshaft end-float</p> <p>Piston clearance excessive—more apparent when engine cold, may disappear when engine hot</p>	

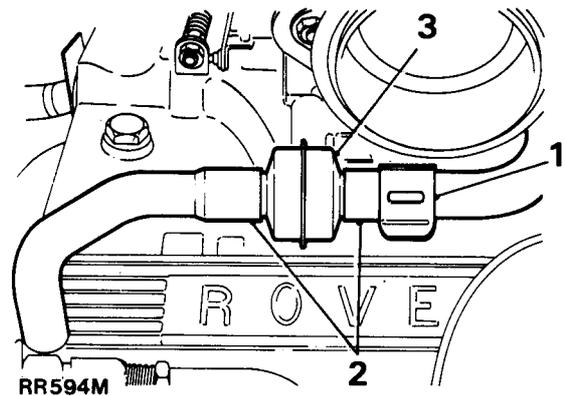


CRANKCASE BREATHING SYSTEM

Description

The 'blow-by' gases from the crankcase are vented into the combustion system to be burned with the fuel/air mixture. The system provides positive emission control under all conditions. During engine running, crankcase fumes which may collect in the crankcase are vented to the carburettor or plenum chamber via hoses and flame traps.

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

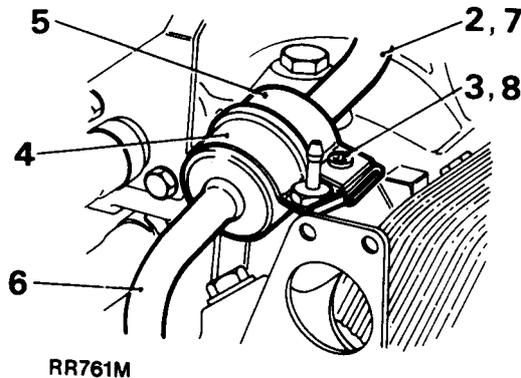


ENGINE BREATHER FILTER—carburettor models

Remove and refit

Removing

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



Refitting

5. Fit the filter with the end marked 'IN' facing forward.
6. Connect the filter bottom hose.
7. Connect the filter top hose.
8. Secure the filter retaining clip.
9. Fit the air cleaner.

ENGINE FLAME TRAPS—carburettor models

Remove and refit

Removing

1. Pull the flame trap hoses out of the retaining clips.
2. Pull the hoses from the flame trap.
3. Withdraw the flame trap.

4. Visually inspect the wire gauze inside the flame trap, if in poor condition, renew the unit. If the unit is in a satisfactory condition, clean as follows:
5. Immerse the flame trap in a small amount of petrol, allow time for the petrol to dissolve and loosen any debris.
6. Remove the flame trap from the petrol bath and allow it to dry in still air.

WARNING: Do not use a compressed air line to dry or clean the flame traps as this could cause fire or personnel injury.

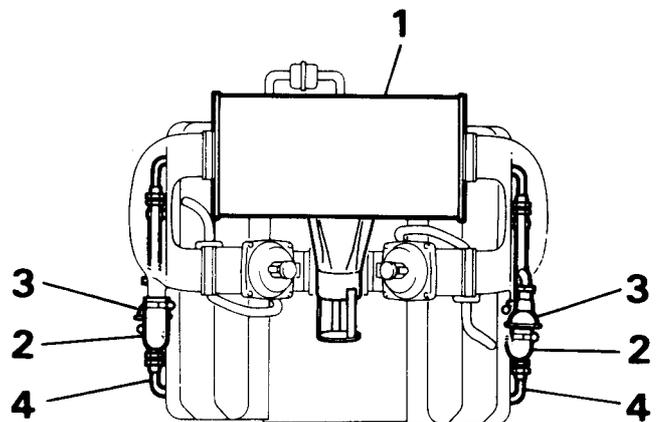
Refitting

7. Push the hoses onto the flame trap and ensure that they are secure.
8. Locate the hoses in their respective retaining clips.

PULSAIR AIR INJECTION

(Fitted to engines with Solex carburettors)

1. Air cleaner.
2. Connecting hoses.
3. Pulsair valves.
4. Air manifolds.

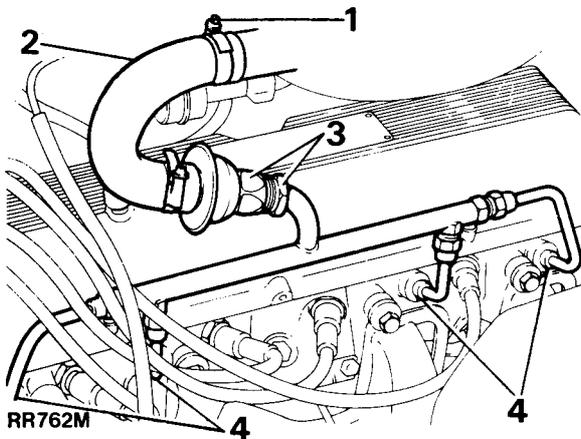


PULSAIR MANIFOLD

Remove and refit

Removing

1. Release the hose clip securing the hose at the air intake elbow.
2. Pull the hose from the elbow.
3. Release the check valve from the manifold.
4. Release the manifold from the cylinder head.
5. Lift off the manifold.



Refitting

6. Reverse the removal procedure.
7. Run the engine and check for air leaks at the manifold.

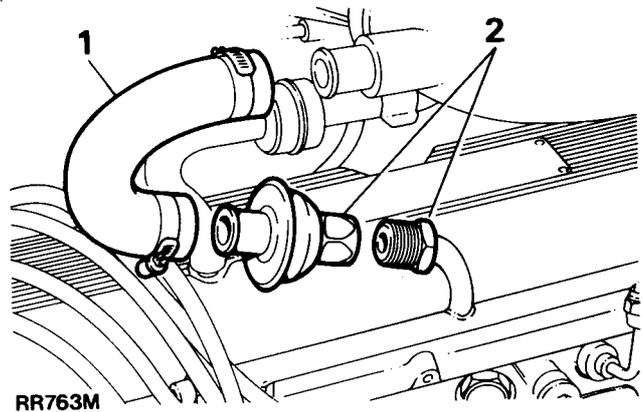
PULSAIR CHECK VALVE

Remove and refit

Removing

1. Disconnect the hose from the check valve/pulse air valve.
2. Using two open-ended spanners—one on the air distribution manifold hexagon, to support the manifold, and the other to remove the valve anti-clockwise.

CAUTION: Do not impose any strain on the air manifold.



Refitting

3. Reverse instructions 1 and 2.

NOTE: The pulsair valve is identified by a pink paint spot and the part number 4974-196 on the face.

PULSAIR CHECK VALVE

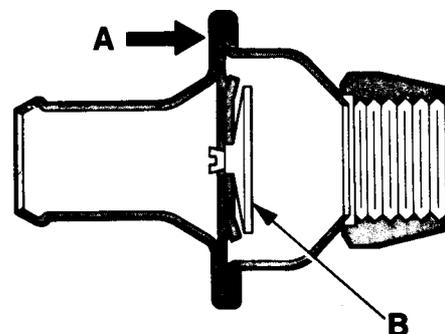
Test

The check valve is a one-way valve positioned to prevent the back-flow of exhaust gases.

Testing

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

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



- A. Direction of flow.
B. Valve diaphragm.

3. Refit the pulsair check valve.



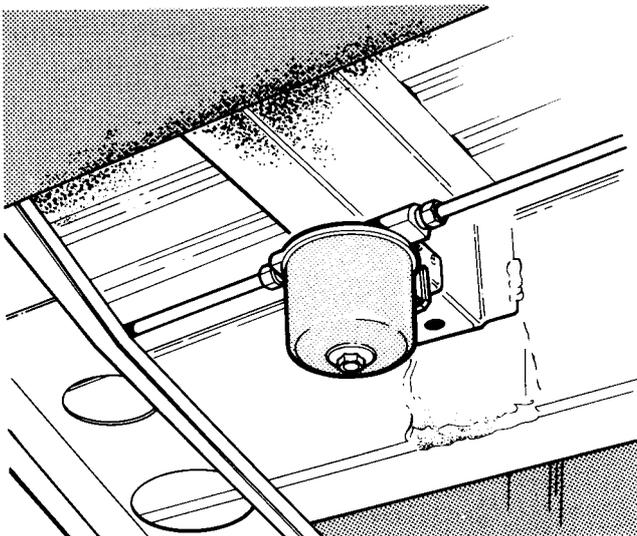
FUEL SYSTEM

Description

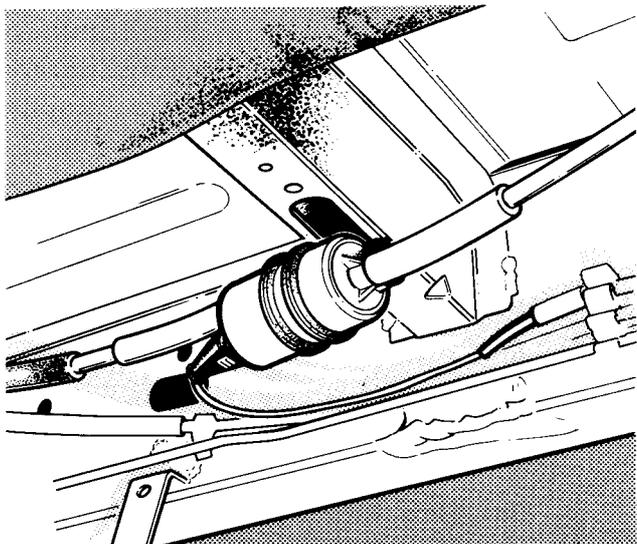
On engines identified by the number 25G (manual) and 26G (automatic), fuel is delivered to the engine via 2 x 175 CDSE Solex carburettors, fitted together with a Pulsair air injection system.

On engines numbered 25G suffix B (manual) and 26G suffix B (automatic) the Solex carburettors have been replaced by 2 x HIF 44 SU carburettors, without the Pulsair system.

Both types of carburetter operate on a constant depression principle, using a moveable tapered needle in a fixed jet to meter the fuel. Mixture adjustment of the Solex is made by moving the position of the needle relative to the jet. The SU mixture is adjusted by moving the jet relative to the fixed needle.



Fuel filter



Fuel pump

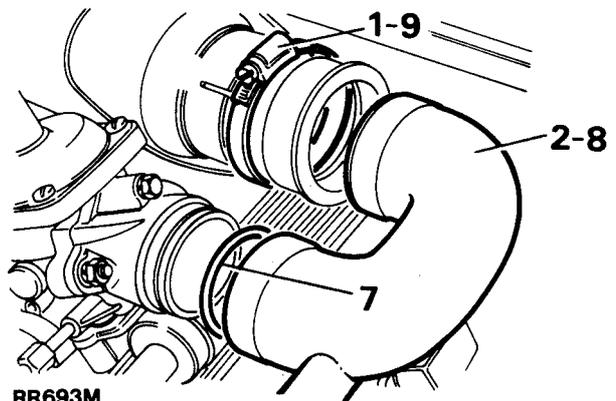
Fuel is drawn from the tank by an electric fuel pump, passing first through a replaceable element fuel filter mounted on the chassis just forward of the tank.

The electric fuel pump is also mounted on the chassis frame forward of the filter.

FUEL SYSTEM—CARBURETTER

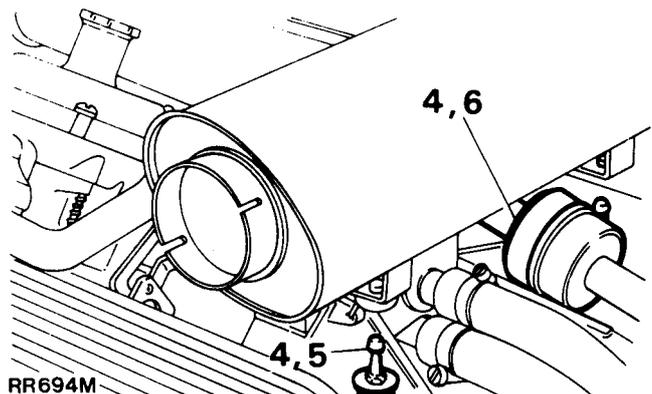
Remove the Air Filter

1. Release the hose clips each side of the air cleaner.
2. Withdraw the air cleaner elbows.



RR693M

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.



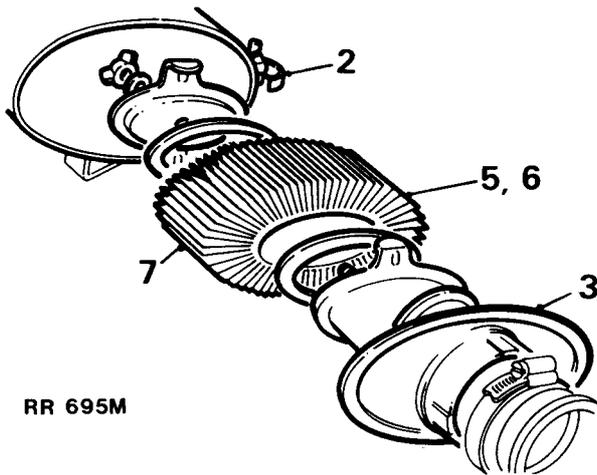
RR694M

Refitting

5. Fit the air cleaner, locating the rubber mountings over the retaining posts.
6. Connect the engine breather hose at the underside of the air cleaner.
7. Smear the 'O' rings at the carburetter intakes with MS4 grease.
8. Fit the air cleaner elbows.
9. Secure the hose clips.
10. Retain the choke cable in the clip at the front of the air cleaner.

RENEW THE AIR CLEANER ELEMENT

1. Remove the air cleaner.
2. Release the end plate clips.
3. Withdraw the end plates.
4. Remove the wing nut, washer and retaining plate.
5. Withdraw the air cleaner elements.
6. Fit new air cleaner elements.
7. Fit new sealing washers.



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8. Reverse 1 to 4.

CARBURETTERS

SOLEX 175 CDSE

Tamperproofing

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

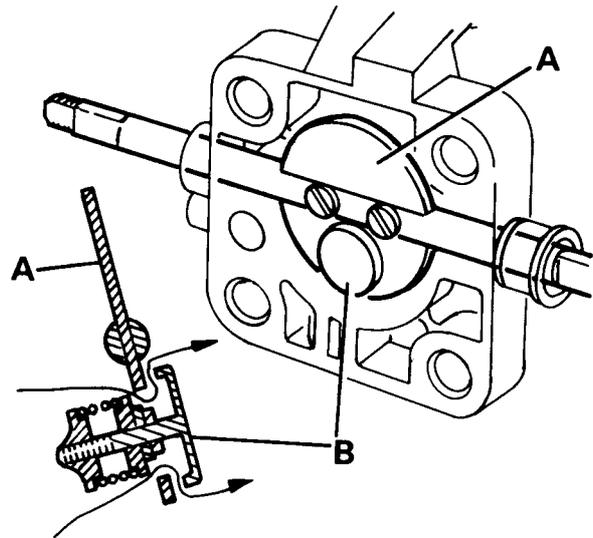
The purpose of these carburetters is to more stringently control the air fuel mixture entering the engine combustion chambers and in consequence the exhaust gas emissions leaving the engine.

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

On all carburetters a deceleration (poppet) valve is incorporated in the throttle (butterfly) disc (A) and consists of a precisely set, spring-loaded plate valve (B). With low manifold depression, the valve remains closed. Under high induction manifold depression conditions, for instance during over-run with the throttle closed, the valve opens thereby slightly reducing the depression, allowing a correct quantity of fuel and air mixture to sustain engine running which improves the combustion of fuel during these

conditions and helps to prevent high-value hydrocarbon emissions.

The deceleration valve is not adjustable (See fault diagnosis).



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ENGINE TUNING PROCEDURE—CARBURETTER

Before carrying out 'Engine Tuning' to carburetters it is important that all other engine related setting procedures are undertaken first, i.e. sparking plugs correctly set, hoses and air cleaner correctly fitted and secure. When the engine is running at its normal operating temperature i.e. thermostat open, the following additional checks can be made.

Check and adjust ignition timing

Equipment required:

- Calibrated tachometer
- Stroboscopic timing lamp

1. Couple stroboscopic timing lamp and tachometer to engine, following the manufacturers instructions.
2. Disconnect the vacuum pipe from the distributor.
3. Start engine, with no load and not exceeding 3000 rev/min run engine until normal operating temperature is reached. Check that normal idle speed falls within that specified (see 'Engine Tuning Data' for required idle speed dependent upon market).
4. Idle speed should not exceed 750 rev/min and this speed should be achieved by removing a breather hose. **NOT** by adjusting the carburetter idle screws.



5. If adjustment is necessary, slacken the distributor clamping bolt and rotate the distributor (clockwise to retard or anti-clockwise to advance) until the timing flash coincides with the timing pointer and correct timing mark on the torsional vibration clamper.
6. Re-tighten the distributor clamping bolt securely and re-check the timing setting.
7. Refit vacuum pipe (for vehicle specification see 'Engine Tuning Data' section).

ADJUSTMENT PROCEDURE—CARBURETTER

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

Should, for any reason, the cap require removal, this can be affected 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.

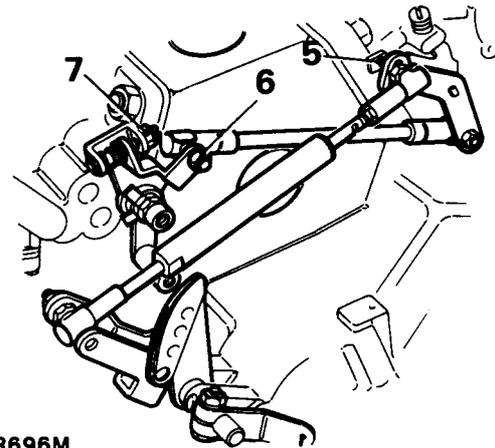
- Carburetter adjusting wrench—MS 86
- Carburetter jet adjusting tool—MS 80
- Tamperproof cap fitting tool—ERC 3786

A numerical code exists for the tamperproofed cap and must be adhered to. Cap fitted by Land Rover Service Departments—ERC 3429.

SLOW RUNNING (IDLE) ADJUSTMENT—Manual and Automatic

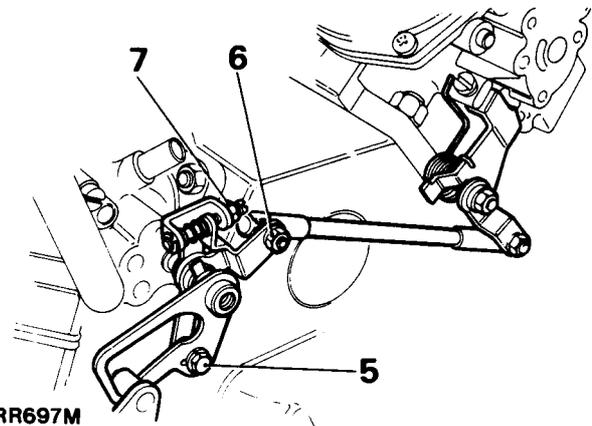
Assuming that mixture levels are correct

1. Check that the throttle control between the pedal and the carburetters is free and has no tendency to stick.
2. Check the throttle cable setting with the throttle pedal in the released position. The throttle linkage must not have commenced movement but commences with the minimum depression of the pedal.
3. Run the engine until it reaches normal operating temperature—thermostat open.
4. Turn ignition off and remove the air cleaner.
5. Slacken the nut which secures the kickdown cable to carburetter inter-connecting link at the right-hand carburetter lever (Automatic only).
Slacken the screw securing the throttle cam to the left-hand carburetter lever (Manual only).



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Automatic Version

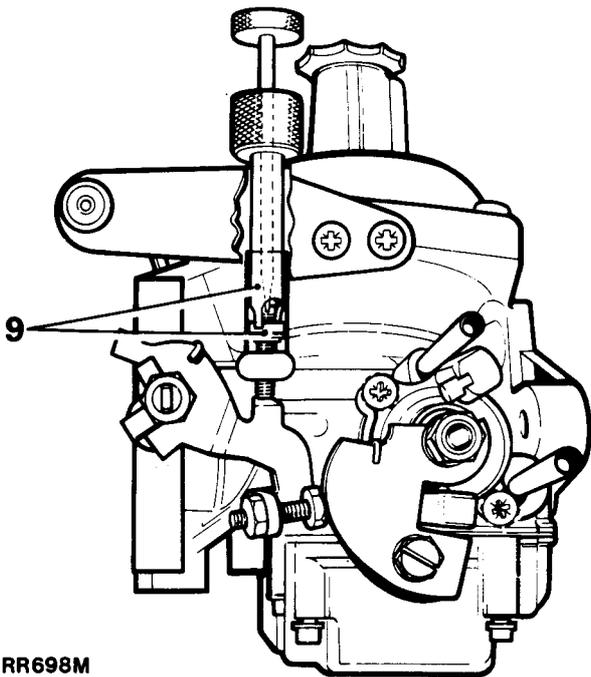


RR697M

Manual Version

6. Disconnect the inter-connecting link between the carburetters, at the left-hand carburetter.
7. Slacken the locknut and release the lost motion adjusting screw on the left-hand carburetter, ensuring that the screw is well clear of the spring loaded pad.
8. Place suitable carburetter balancing equipment across the carburetter intake apertures.
9. Remove the tamperproof caps from the carburetter idle screws. Using idle screw adjustment tool MS 86 release the locknuts.

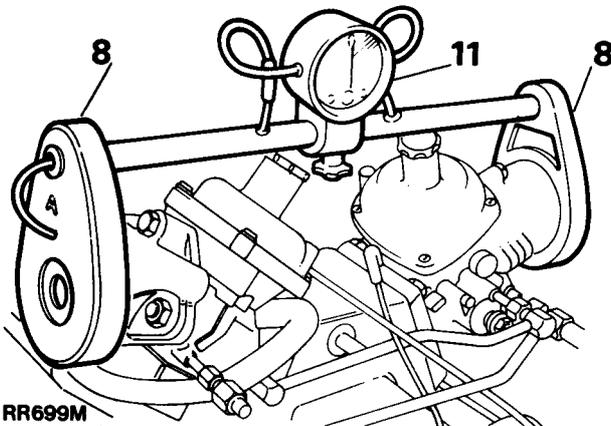
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RR698M

10. Start the engine and check the idle speed using a reliable proprietary tachometer.
11. Check balancer gauge reading.

NOTE: Synchrocheck B 89 can be used in place of balancer illustrated.



RR699M

12. If the gauge pointer is in the 'zero' sector no adjustment is required to balance carburetter.
13. If the gauge pointer moves to the right, decrease the air flow through the left-hand carburetter by unscrewing the left-hand idle adjustment screw or increase the air flow through the right-hand carburetter by turning the right-hand idle adjustment screw clockwise. Reverse the procedure if the pointer moves to the left.
14. If the engine idle speed rises too high or drops too low, re-adjust the idle screws on both carburetters ensuring that the pointer on the balancing gauge remains in the 'zero' sector.
15. When items 13 and 14 are satisfactory, tighten the idle screw locknuts.

16. Re-connect the inter-connecting link to the left-hand carburetter.
17. Hold the throttle lever against the throttle lever stop on the right-hand carburetter and adjust the lost motion screw until contact is made with the spring loaded pad and tighten the locknut.
18. Re-check idle speed and balance. Correct if necessary repeating checks 13 and 14.
19. Check idle CO level.
20. If all checks and adjustments are satisfactory; fit new tamperproof caps—part number ERC 3429 using tool—part number ERC 3786.
21. **Automatic version**—Ensuring that the right-hand carburetter countershaft lever is against the idle stop, tighten the inter-connecting link securing nut.
Manual version—Ensure that the roller in the throttle cam on the left-hand carburetter is seated in the corner of the cam slot, tighten the cam lever securing screw.

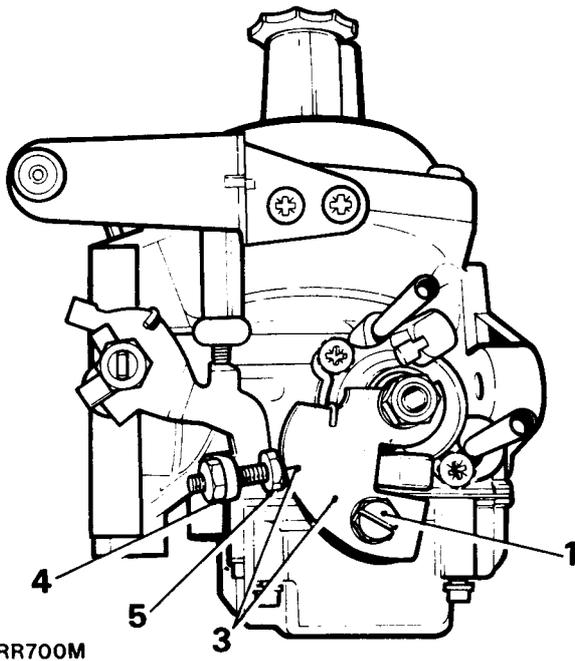
FAST IDLE ADJUSTMENT—LH carburetter only

Automatic and Manual

Operation of the choke control from 'on' to 'off' should result in a fast idle speed of 1100 rev/min \pm 50 when the choke control is approximately 12.7 mm (0.5 in) from the choke off position.

Check and adjust

1. Slacken choke cable clamping screw at the left-hand carburetter.
2. Pull the choke control knob out and push it into a distance of approximately 12.7 mm (0.5 in) and lock in position.
3. Rotate 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 screw on the throttle lever, tighten the choke cable clamping screw.
4. With the cam held in this position release the fast idle adjustment screw locknut.
5. Turn the adjustment screw until contact is made with the face of the fast idle cam, continue adjusting until the specified fast idle speed is achieved. Tighten the locknut.



6. Push the choke control knob fully home and check that normal idle speed is regained.

IDLE MIXTURE ADJUSTMENT

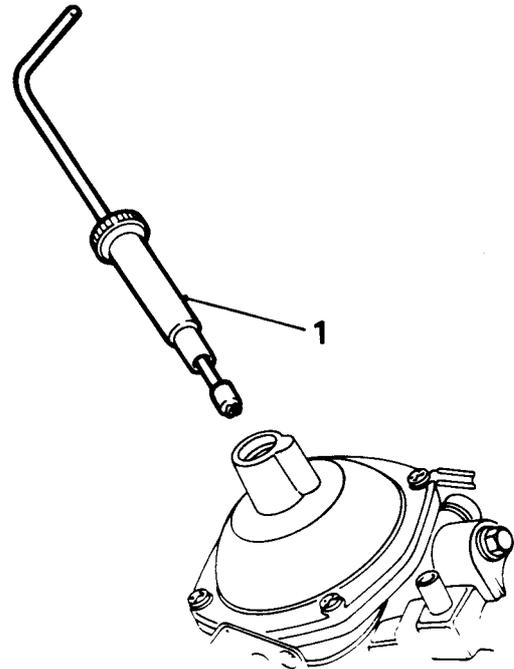
Automatic and Manual

Service Tools—MS 80 Mixture Adjustment Tool.
Carburettor Balancing Gauge.

Mixture adjustment should be carried out when the vehicle is up to normal operating temperature, i.e. warm air intake valve open.

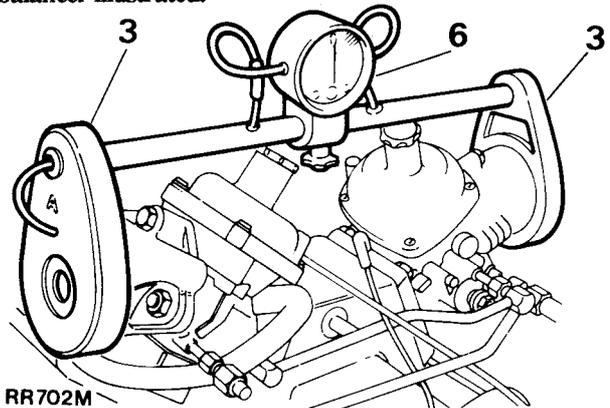
Check and adjust

1. Remove the piston damper plug, and using special tool MS 80 adjust the mixture. Locate the outer sleeve of the tool to engage a machined slot to prevent the air valve twisting. Turn the inner tool clockwise to enrich the mixture and anti-clockwise to weaken it. After every adjustment the tool should be removed from the carburettor to allow engine to stabilise. Run engine at 2000 rev/min to aid stabilisation.
2. When the mixture is correctly adjusted, the engine speed will remain constant or may fall slowly a small amount as the air valve is lifted.



3. Place balancer on the carburettor adaptors, ensuring that there are no air leaks. If the engine stalls or decreases considerably in speed, the mixture is too rich. If the engine speed increases, the mixture is too weak.
4. If necessary, remove balancer and re-adjust the mixture, then refit the tool.

NOTE: Synchrocheck B 89 can be used in place of balancer illustrated.



5. Check balancer gauge reading.
6. If the gauge pointer is in the 'zero' sector, no adjustment is required.
7. If the gauge pointer moves to the right, decrease the air flow through the left-hand carburettor by unscrewing the slow running screw or increase the air flow through the right-hand carburettor by turning clockwise the slow running screw. Reverse the procedure if the pointer moves to the left.
8. If the engine idle speed (slow running) rises too high or drops too low during balancing adjust to the correct idle speed, whilst maintaining the gauge pointer in the zero sector.

9. Remove balancer. With the mixture setting and carburetter balance correctly adjusted the difference in engine rev/min with the balancing tool on or off will be negligible, approximately ± 25 rev/min.
10. Check CO levels.

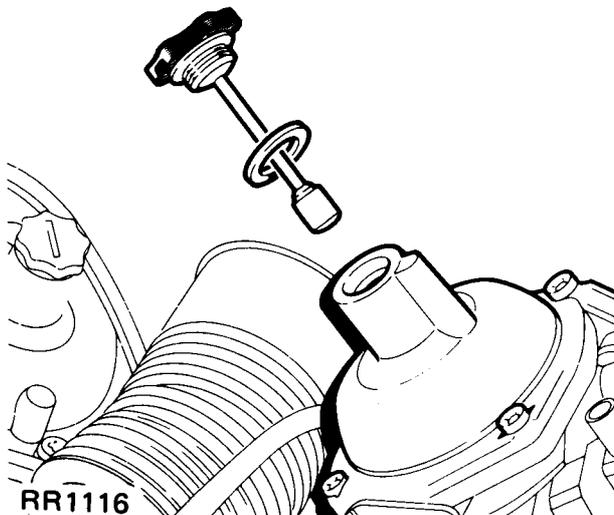
NOTE: The flow test of the carburetter may require the needle to be set within the limits of $\pm \frac{1}{2}$ turn of adjuster from a 'flush' condition. Before any needle component is changed the setting of the needle from 'flush' should be noted and reproduced when refitting. If difficulty is experienced with carburation the needle should be set with the shoulder flush with the face of the piston for investigation.

When using the adjusting tool a positive stop will be felt when the needle reaches 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, whilst turning in a clockwise direction.

CHECK CO LEVEL

Use a proprietary non-dispersive infra-red exhaust gas analyser.

11. Insert the probe of the analyser as far as possible into the exhaust tail pipe, start the engine and allow a one to one and a half minute stabilisation period.
12. Check that the correct idle speed (slow running) is maintained and observe the CO reading against that given in the data section. If necessary re-adjust the mixture setting to achieve the correct CO level.

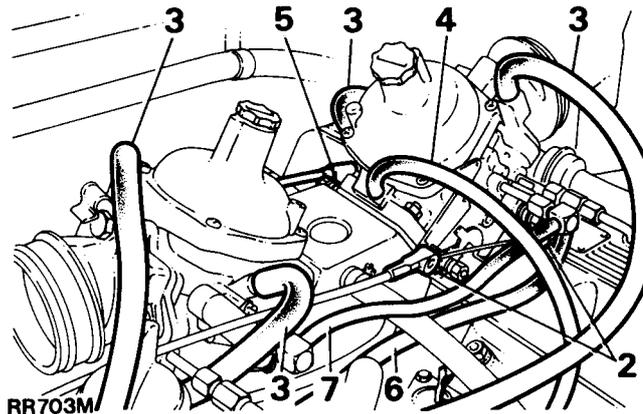


Top up the damper reservoir as necessary with engine oil to within about 12 mm (1/2 in.) from the top of the tube.

CARBURETTERS—Manual & Automatic

Removing

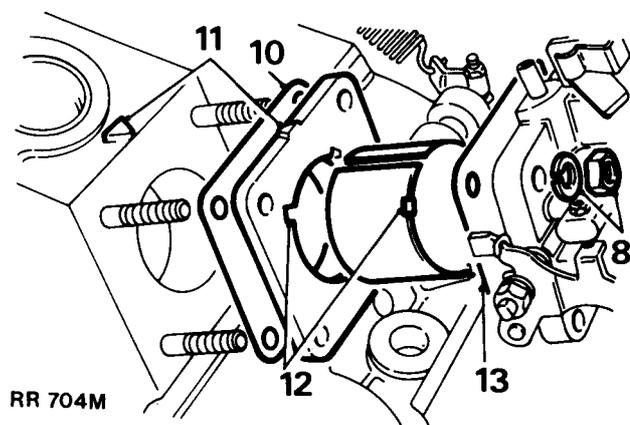
1. Remove the air cleaner.
2. Disconnect the choke cable.
3. Disconnect the emission control pipes.
4. Disconnect the distributor vacuum pipe.
5. Disconnect the throttle linkages.



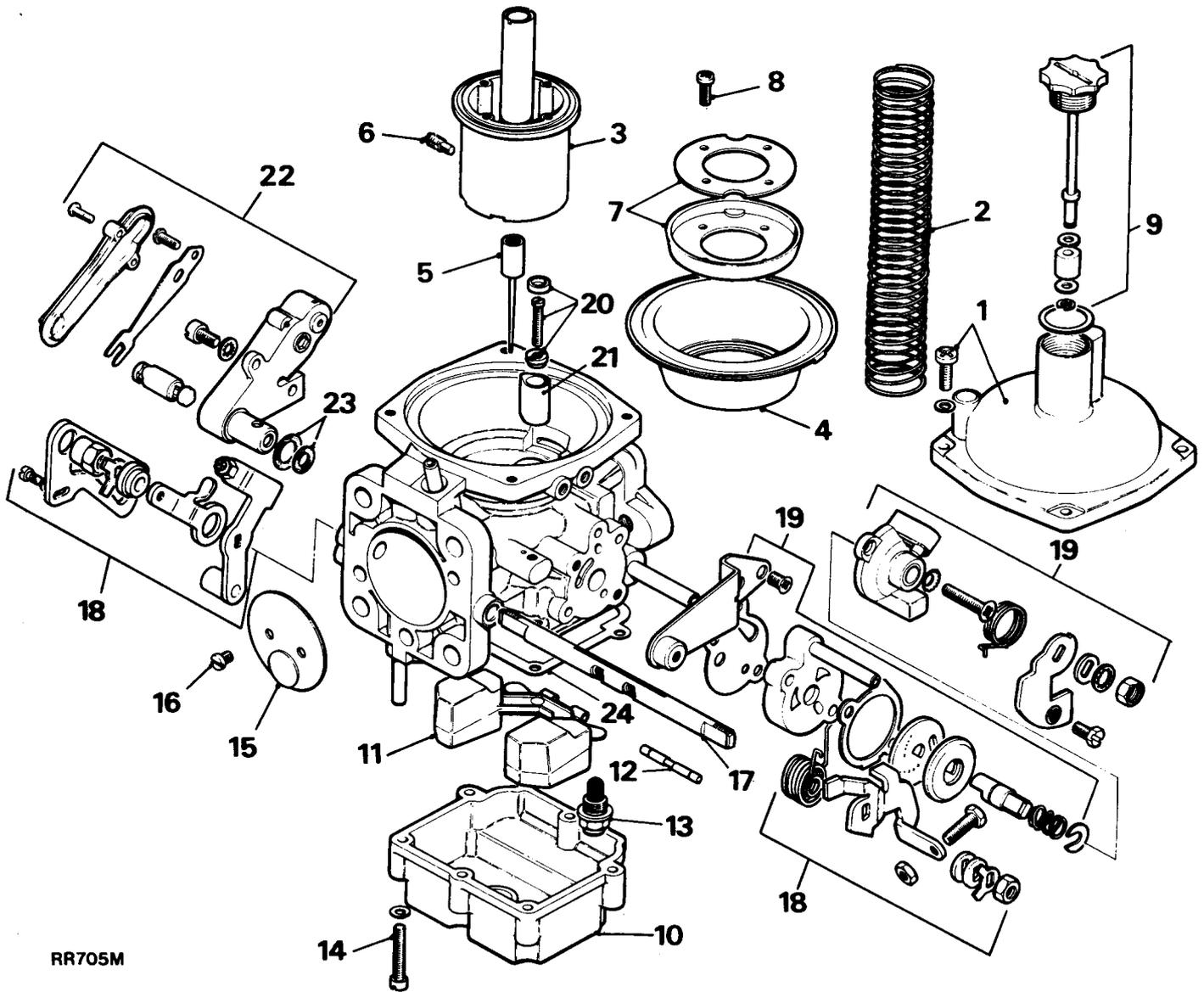
6. Disconnect the main fuel supply pipe.
7. Disconnect the choke fuel supply pipe.
8. Remove the eight retaining nuts and lift off the carburetters.
9. Withdraw the joint washers, insulator and liner.

Refitting

10. Locate a new joint washer on the inlet manifold.
11. Fit the insulator, aligning the arrows.
12. Fit the liner fully into the insulator, engaging the three tabs into the recesses.
13. Locate a joint washer on the insulator.



14. Reverse 1 to 8.
15. Fit the air cleaner.
16. Tune and adjust the carburetters.



RR705M

KEY TO LH CARBURETTER

- | | |
|---|--|
| 1. Top cover and retaining screws | 14. Float chamber retaining screws (6 off) |
| 2. Air valve return spring | 15. Butterfly |
| 3. Air valve | 16. Butterfly retaining screws (2 off) |
| 4. Diaphragm | 17. Butterfly (throttle) spindle |
| 5. Metering needle | 18. Throttle spindle lever assembly |
| 6. Metering needle retaining screw | 19. Cold start assembly (left-hand carburetter only) |
| 7. Diaphragm retaining ring and plate | 20. Slow running screw assembly |
| 8. Screw (4 off) retaining diaphragm to air valve | 21. Tamper-proof sleeve |
| 9. Damper assembly | 22. Temperature compensator assembly |
| 10. Float chamber | 23. Temperature compensator rubber seals (large and small) |
| 11. Float assembly | 24. Float chamber joint washer |
| 12. Float assembly spindle | |
| 13. Needle valve | |

CARBURETTER OVERHAUL

DISMANTLE

Remove the piston assembly

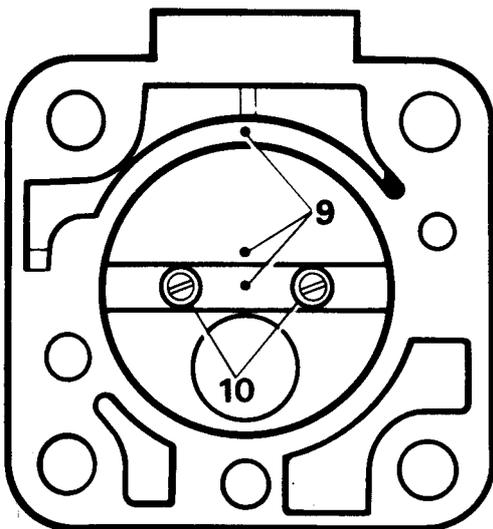
1. Remove the carburetters from the engine.
2. Release the four screws and withdraw the top cover and spring.
3. Withdraw the air valve, shaft and diaphragm assembly.
4. Remove the metering needle retained by a locking screw.
5. Release the four screws and separate the diaphragm from the air valve.

Remove the float chamber

6. Release the six screws and remove the float chamber and joint washer.
7. Release the float assembly and spindle from the two clips.
8. Unscrew the needle valve and washer from carburetter body.

Dismantle carburetter body

9. Make location marks, as illustrated, to assist correct assembly, on the throttle butterfly, spindle and carburetter body.
10. Right-hand carburetter. Release the two screws and remove the butterfly and withdraw the spindle.



ST1119M

11. Left-hand carburetter. Remove the left-hand lever assembly. Release the two screws, remove the butterfly and withdraw the spindle.
12. Left-hand carburetter. Release the two retaining screws and shake-proof washers and remove the cold start assembly and joint washers.

13. Dismantle the cold start assembly but DO NOT remove the discs from the spindle.
14. If necessary, dismantle the throttle spindle lever assemblies from both carburetters.

Slow running adjustment screws

Do not attempt to remove these screws or break the tamper-proof seals. See Cautionary note under 'Tune and Adjust'.

Remove temperature compensator

15. Release the two screws and withdraw the temperature compensator unit complete.
16. Remove the large and small rubber washers.

CLEANING AND INSPECTION

Cleaning

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

Joint washers and seals

18. New gaskets and seals should be used throughout carburetter rebuild. A complete set of gaskets is available for replacement purposes.
Inspect metering needle; it is machined to very close limits and should be handled with care. Examine for wear, bend and twist; renew if necessary.
19. Examine the faces for deep scores which would lead to leakage taking place when assembled.

Diaphragm

20. Examine the diaphragm for deterioration, damage and punctures. Do not use any cleaning chemicals on the diaphragm only clean lint free rag.

Float assembly

21. Examine the two plastic floats and check for punctures and damage.
22. Check the spindle and retaining clips for wear.
23. Inspect the needle valve assembly for wear. Renew the valve if there is any tendency for the needle to stick.

Cold start assembly

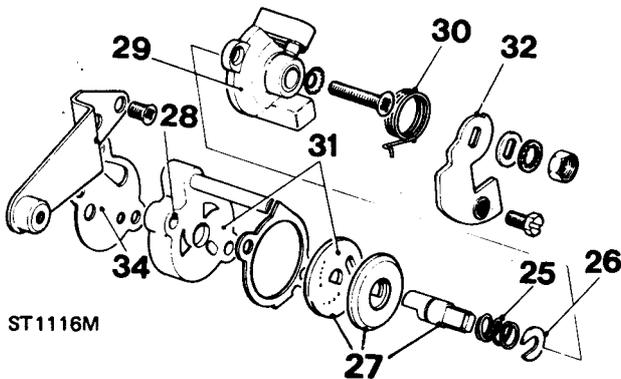
24. Examine all the cold start components for wear and corrosion and the machined faces for scores.



ASSEMBLE CARBURETTERS

Cold start—LH carburetter

25. Place the spring on the cold start spindle.
26. Fit the spring retaining clip.
27. Check that the discs slide easily on the spindle.
28. Place the cold start spindle on the starter face.
29. Place the starter cover in position.
30. Fit the return spring over the spindle.
31. Rotate the spindle until the oval port in the end disc is aligned with the oval port in the starter face.
32. Fit the cold start lever.
33. Engage the return spring over the lug on the starter cover and the back of the cold starter lever.
34. Place the cold start gasket onto the carburetter body.



35. Fit the cold start assembly to the carburetter body, and check for ease of operation.

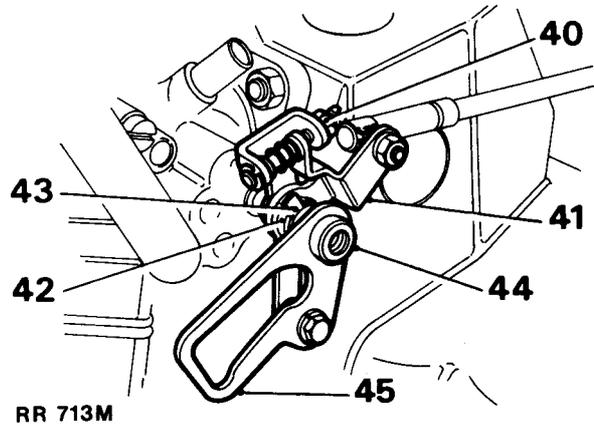
Throttle spindle, LH carburetter

36. Place the return spring over either end of the spindle.
37. Fit the throttle stop and fast idle lever and secure with spacers, tab washer and nut.
38. Insert the throttle spindle from the cold start side of the carburetter body and fit the throttle return spring on the fast idle adjustment lug. Tension the spring half a turn.

NOTE: To enable the throttle butterfly to be centralised, remove the tamperproof cap (if fitted) from the idle adjustment screw, slacken the screw until the lever is free to move without restrictions.

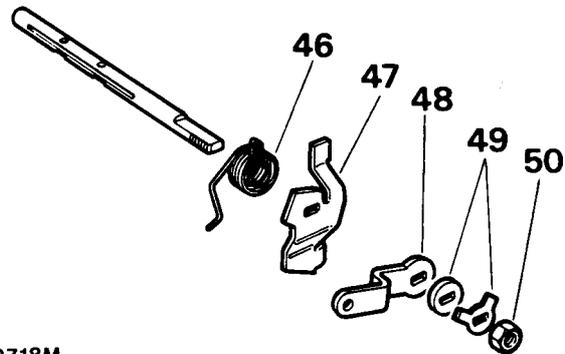
39. Fit the throttle butterfly, maintaining the previously marked alignment. Leave the retaining screws loose. Actuate the throttle several times to centralize the butterfly, then tighten the retaining screws and lock by peening ends.
40. Fit the lost motion lever to the opposite end of the spindle.
41. Fit the throttle lever locating the raised tab between the spring loaded pad and adjustment screw.
42. Place the spacer on the spindle.

43. Place the tab washer on the spindle.
44. Fit the sleeve nut, sleeve end first, and engage the tab washer.
45. Fit the throttle adjusting lever (automatic gearbox carburetter versions are not fitted with this lever).



Throttle spindle—RH carburetter

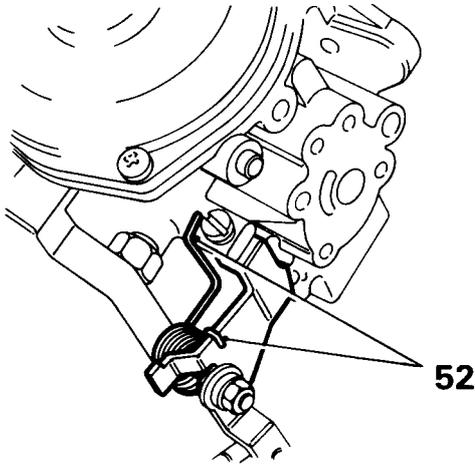
46. Place the return spring over the threaded end of the spindle.
47. Fit the throttle stop lever.
48. Fit the throttle lever.
49. Fit the spacer and tab washer.
50. Fit the retaining nut.



51. Secure the assembly to the shaft with the tab washer.

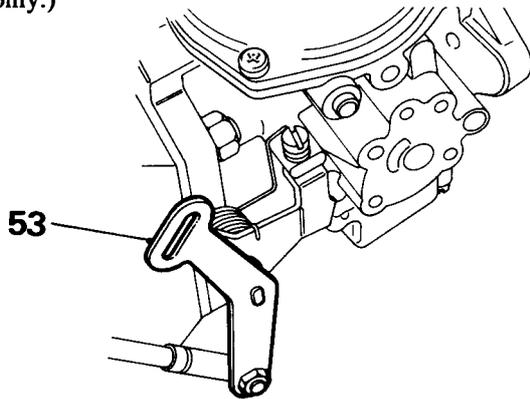
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52. Fit the spindle to the carburettor and assemble the throttle butterfly as described in instruction 39. (See note preceding instruction 39.) Anchor the return spring as illustrated.



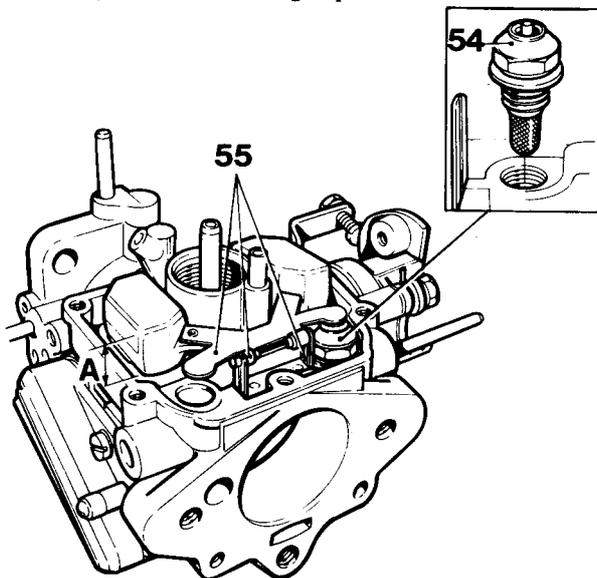
RR 719M

53. Fit the kick-down lever. (Automatic gearbox versions only.)



Float chamber assembly

54. Fit the needle valve and new washer.
55. Locate the spindle in the float arm and fit the assembly into the retaining clips.

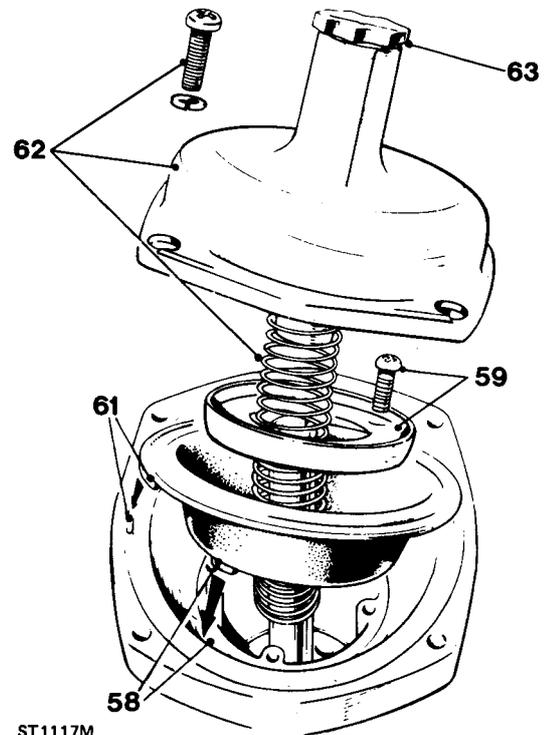


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56. Invert the carburettor so that the needle is on its seating and the float tab is contacting the needle. Measure the dimension 'A' between the carburettor gasket face and the highest point on the floats. The correct measurement should be 17 to 18 mm (0.67 to 0.71 in). Adjust by bending the float tab. This dimension must be the same for both floats. The float carrier tab must be maintained at right angles to the needle in the closed position.
57. Fit the float chamber and new gasket and evenly tighten the retaining screws.

Air valve and diaphragm

58. Fit the diaphragm to the air valve with the inner tag locating in the air valve recess.
59. Fit the diaphragm retaining ring and secure with the four screws.
60. Fit the metering needle into the air valve and secure with the locking screw.
61. Insert the air valve and needle into the carburettor and locate the diaphragm outer tag into the recess in the carburettor body.
62. Fit the spring and top cover and secure with the four screws.
63. Fit the damper.



ST1117M

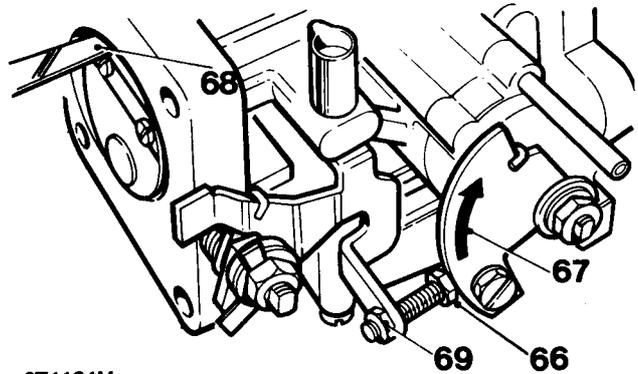


Temperature compensator

64. Clean the carburetter and compensator mating faces.
65. Fit a new inner and outer rubber washer and secure the temperature compensator with the two screws and shake-proof washers.

Fast idle adjustment—LH carburetter only

66. Slacken the fast idle adjusting screw.
67. Hold the cold start cam lever in the maximum position.
68. Adjust the fast idle adjusting screw against the cam lever until there is 0.61 to 0.66 mm (0.024 to 0.026 in) gap between the top edge of the throttle butterfly and the carburetter barrel wall. Use feeler gauges or a 0.65 mm diameter (No. 72) drill to measure the gap.
69. Secure the locknut on the fast idle adjusting screw without disturbing the adjustment.



V8 ENGINE CARBURETTER (SOLEX)		
FAULT DIAGNOSIS		
SYMPTOM	POSSIBLE CAUSE	CURE
DIFFICULT STARTING WHEN COLD	Insufficient choke action	Check action of cold start unit to ensure that the choke is being applied fully—adjust choke cable. Check position of cold start adjuster—move outward.
	Fast idle adjustment incorrect	Check and adjust fast idle setting. Check linkage between choke and throttle for distortion.
	Float chamber level too low	Check needle valve for sticking—(closed). Check float level setting. Check inlet connection filter for blockage. Check external fuel system in accordance with fuel system fault diagnosis.
	Carburettor flooding	Check needle valve for sticking—(open). Float punctured. Fuel pump pressure too high. Float level too high.
	No fuel supply to carburettor	Check filters and pump for blockage. Check fuel tank breather and fuel lines for blockage. Remove fuel pump and check operation. Overhaul or fit new pump.
	No oil in damper or oil too thin	Check level of oil in damper, and fill to correct level with oil of a viscosity of S.A.E. 20.
DIFFICULT STARTING WHEN HOT	Choke sticking 'on'	Check to ensure choke is returning to fully 'off' position; reset as necessary.
	Blocked air cleaner	Fit new air cleaner elements.
	Float chamber level too high	Check float level setting. Check float arms for distortion. Check needle valve for sticking. Punctured float, fuel pump pressure too high.
LACK OF ENGINE POWER	No oil in damper or oil too thin	Check level of oil in damper, and fill to correct level with oil of a viscosity of S.A.E. 20.
	Air valve sticking	Check air valve assembly moves freely and returns under spring load—centre jet assembly. Check diaphragm for cracks or porosity.
	Water in fuel	If water is present in float chamber, the complete fuel system should be drained, fuel components should be dismantled, inspected for contamination, paying particular attention to filters.
ERRATIC SLOW RUNNING OR STALLING ON DECELERATION	Float level too low	Check float chamber level. Check for needle valve sticking.
	Incorrect jet setting	Check and reset jet settings in accordance with carburettor overhaul instructions.
	Carburettor air leaks	Check throttle spindle and bearings for wear.
	Manifold air leaks	Check inlet manifold gasket for leakage. Check inlet manifold for cracks and distortion of mating faces. Check gasket between carburettor and manifold. Check condition of vacuum advance pipe and connections. Check vacuum servo pipes and connections.
	Damper oil too thick. No oil in damper	Check and refill to correct level with oil specified.
	Air valve sticking	Check air valve assembly moves freely and returns under spring load—centre jet assembly. Check diaphragm for cracks or porosity.
EXCESSIVE FUEL CONSUMPTION	Blocked air cleaner	Fit new air cleaner elements.
	Damper oil too thick	Replace with correct grade.
	Incorrectly adjusted carburettor	Check and reset slow running in accordance with carburettor tune and adjust instructions.
	Float level too high	Check and reset float level.
	Incorrect needle	Check needle type.
	Worn jets and needle	Check and replace as necessary.
	Choke sticking 'on'	Check to ensure choke is returning to fully 'off' position, reset as necessary.
	Engine fault	See 'Engine Fault' diagnosis.



CARBURETTER OVERHAUL-S.U. HIF 44

Right hand (Horizontal integral float chamber)

DISMANTLE

1. Remove the carburetters from the engine and clean the exteriors with a suitable solvent.
2. Remove the two nuts and spring washers and withdraw the air intake adaptor and joint washer.
3. Unscrew and remove the piston damper assembly and drain the oil.
4. Remove the three screws and lift-off the suction chamber complete with piston and spring.
5. Remove the spring clip from the top of the piston rod and withdraw the piston and spring.
6. Unscrew the metering needle guide locking screw. Attempt to remove assy with fingers. If difficulty is experienced then holding the needle as close to the piston as possible in a soft jawed vice with a sharp pull, withdraw the needle, guide and spring assembly.
7. Remove the four screws and withdraw the float chamber cover plate and sealing ring.
8. Remove jet adjusting lever retaining screw and spring.
9. Withdraw the jet complete with the bi-metal lever and separate the lever from the jet.
10. Unscrew and remove the float pivot spindle and plain washer, and remove the float.
11. Lift-out the needle valve.
12. Unscrew and remove the needle valve and filter.
13. Unscrew and remove the jet bearing nut.
14. Invert the carburetter body to allow the jet bearing to fall out. If the bearing sticks, carefully tap it out from the bridge side.
15. Remove the piston guide peg.
16. Remove the suction chamber-to-body sealing ring.
17. Unscrew and remove the mixture adjusting screw and seal. Use thin nosed pliers to finally withdraw the screw.
18. Bend-back the cam lever nut lock tabs and remove the nut and lock washer.
19. Remove the cam lever and spring.
20. Remove the end seal cover and seal.
21. Remove the two screws and withdraw the cold start valve body and seal together with the valve spindle. Also collect the paper joint washer.
22. Note the position of the throttle levers and return spring.
23. Bend-back the lock washer tabs and remove the throttle lever nut.
24. Remove the lock washer, bush washer and throttle actuating lever.
25. Release the throttle return spring and remove the throttle adjusting lever from the throttle butterfly spindle and remove the return spring.
26. Hold the butterfly closed and mark the relationship of the butterfly to the carburetter flange.
27. Remove the butterfly two retaining screws and withdraw the butterfly from the spindle.
28. Withdraw the throttle butterfly spindle from the carburetter body together with the two seals.
29. Clean all components with petrol or de-natured alcohol ready for inspection. Do not use abrasives for the removal of stains or deposits.

INSPECTION

30. Examine the throttle spindle and bearings for excessive axial clearance.
31. Check the float needle and seating for wear and the float for punctures and renew if necessary.
32. Check the condition of all rubber seals, 'O' rings and joint washers and renew if necessary. The float cover plate seal must be renewed.
33. Examine the carburetter body for cracks and damage.
34. Ensure that the inside of the suction chamber is clean and fit the piston into the chamber without the spring. Hold the assembly horizontally and spin the piston. The piston should spin freely in the suction chamber without any tendency to stick.
35. Inspect the metering needle for wear, scores and distortion. Check also that it has the correct designation number - see Engine Tuning Data, Section 05.

36. Examine the bi-metal jet lever for cracks.
37. Check all springs for cracks and distortion.

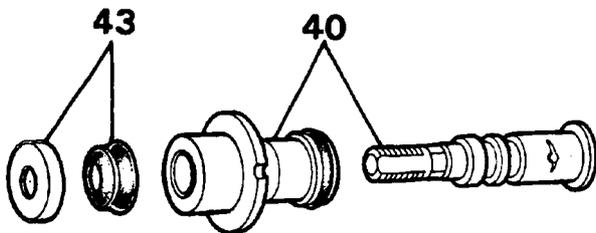
ASSEMBLE

Fit throttle butterfly

38. Fit the throttle spindle to the carburettor body and insert the throttle disc into the spindle in its original position. Secure the disc with new screws and ensure that before tightening the throttle disc is correctly positioned and closes properly. Splay the split ends of the screws to prevent turning.
39. Fit new seals to both ends of the throttle spindle ensuring that they are fitted the correct way round.

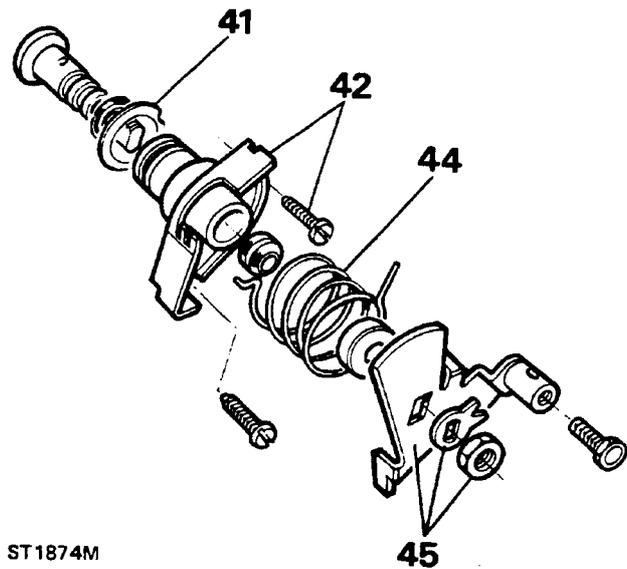
Fit cold start assembly

40. Fit a new 'O' ring to the valve body and assemble the valve spindle to the valve body.
41. Fit a new paper joint washer to the valve noting that the half-moon cut-out in the washer is clearance for the top retaining screw.
42. Fit the starter assembly to the carburettor body and secure with the two screws.
43. Fit the end seal and cover.



ST1873M

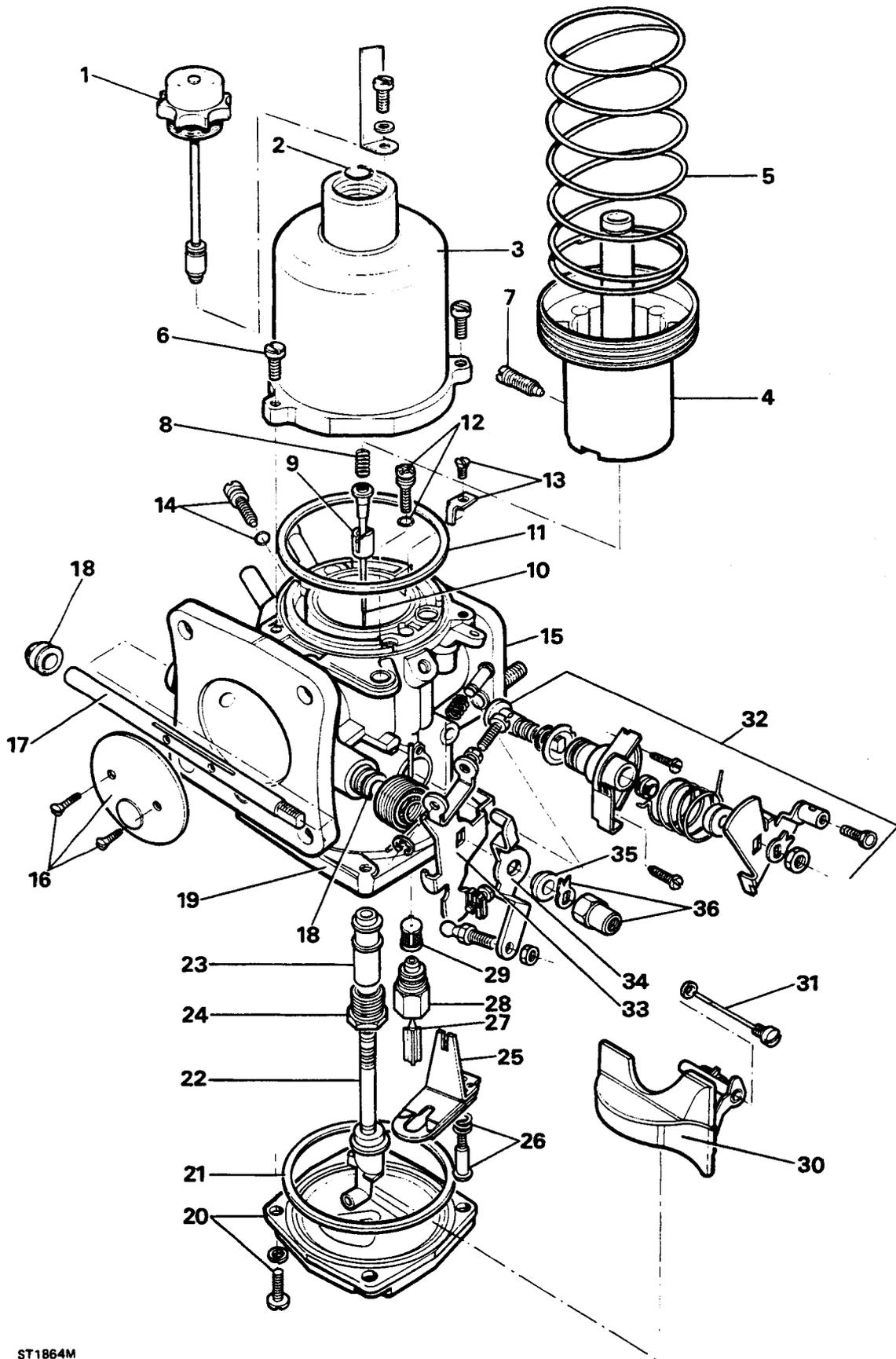
44. Fit the return spring.
45. Fit the cam lever and tension the spring. Fit a new lock washer and secure with the nut and bend the tabs over a convenient flat.
46. Adjust the coils of the spring, if necessary, to prevent coil binding.



ST1874M

KEY TO S.U. CARBURETTER COMPONENTS

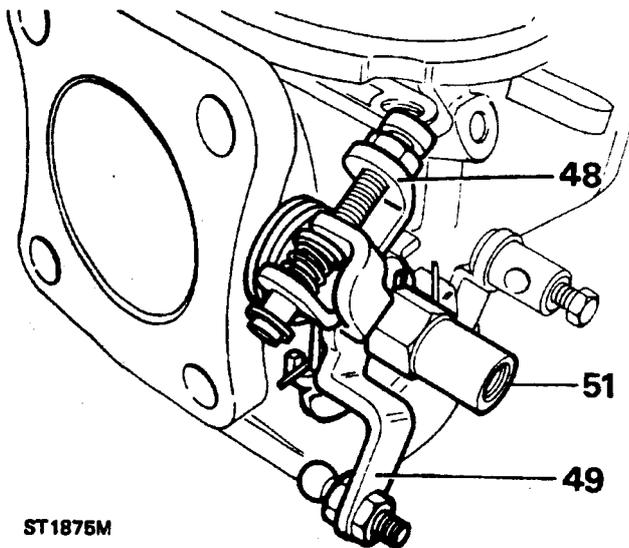
1. Piston damper.
2. Spring clip.
3. Suction chamber.
4. Piston.
5. Piston spring.
6. Suction chamber retaining screws - 3 off.
7. Needle retaining screw.
8. Needle bias spring.
9. Needle guide.
10. Needle.
11. Suction chamber sealing ring.
12. Throttle adjusting screw and seal.
13. Piston key and retaining screw.
14. Mixture adjusting screw and seal.
15. Carburettor body.
16. Throttle butterfly and retaining screws.
17. Throttle spindle.
18. Throttle spindle seals - 2 off.
19. Float chamber.
20. Float chamber cover and retaining screws.
21. Float chamber cover seal.
22. Jet assembly.
23. Jet bearing.
24. Jet bearing nut.
25. Bi-metal jet lever.
26. Jet retaining screw and spring.
27. Float needle.
28. Float needle seat.
29. Float needle seat filter.
30. Float.
31. Float pivot spindle.
32. Cold start and cam lever assembly.
33. Throttle adjusting lever and lost motion assembly.
34. Throttle actuating lever.
35. Bush washer.
36. Throttle lever assembly retaining nut and lock washer.



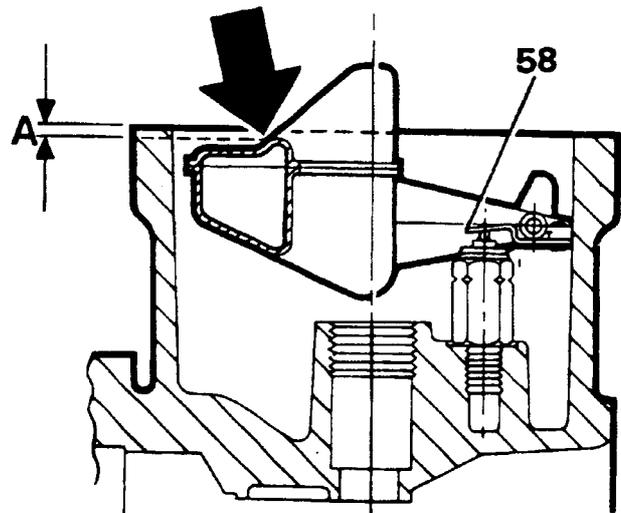
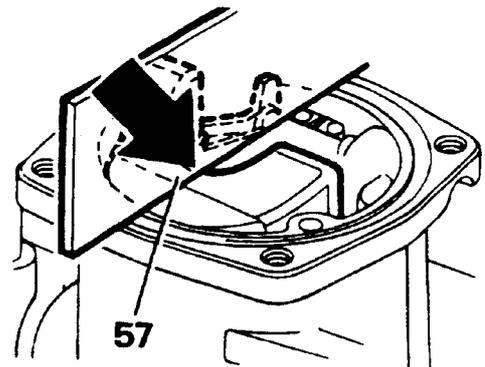
ST1864M

Fit throttle lever assembly

47. Fit the return spring so that the longest leg rests against the throttle adjusting screw housing.
48. Fit the throttle adjusting lever and lost motion assembly and tension the return spring.
49. Fit the throttle actuating lever.
50. Fit the bush washer and lock washer.
51. Fit and tighten the special nut and bend the lock tabs over a convenient flat.



ST1876M

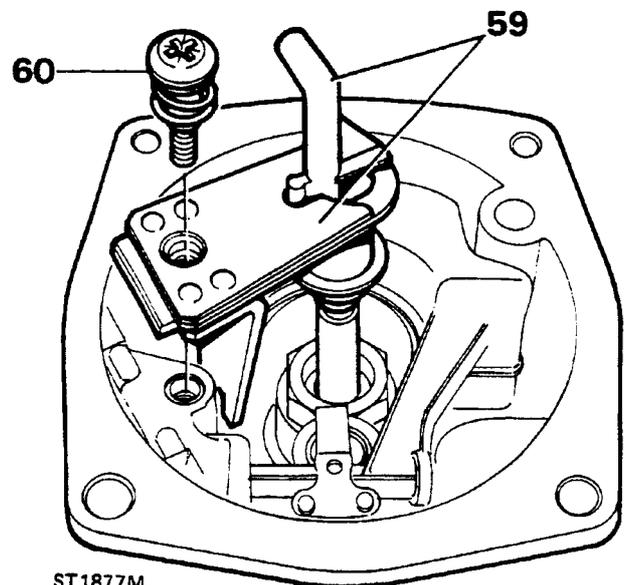


ST1876M

Fit jet and float assembly

52. Fit the jet bearing, long end towards the float.
53. Fit the jet bearing nut.
54. Clean or renew the filter and fit the float needle seat.
55. Fit the needle valve, spring loaded pin uppermost.
56. Fit the float and secure with the pivot pin.
57. Hold the carburetter in the inverted position so that the needle valve is closed by the weight of the float only. Check using a straight edge that the point on the float, arrowed on the illustration, is 0.5 to 1.5mm (0.020 to 0.059 in) below the level of the float chamber face, dimension 'A'.
58. Adjust the float position by carefully bending the brass pad until the correct dimension is achieved. After adjustment, check that the float pivots freely about the spindle.

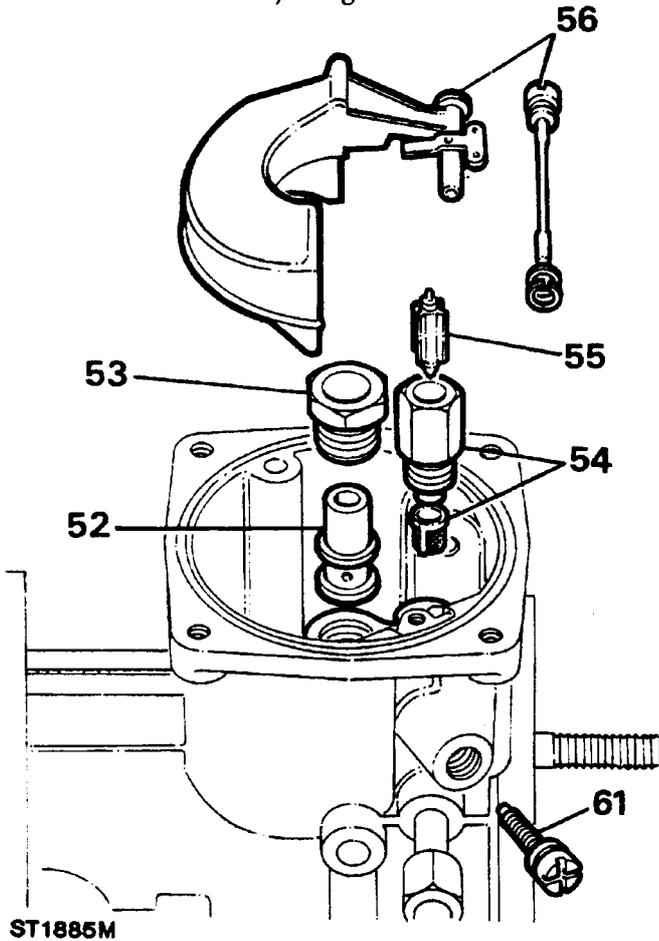
59. Assemble the jet to the bi-metal jet lever and ensure that the jet head moves freely in the cut-out.
60. Fit the jet and bi-metal jet lever to the carburetter and secure with the spring loaded jet retaining screw.



ST1877M

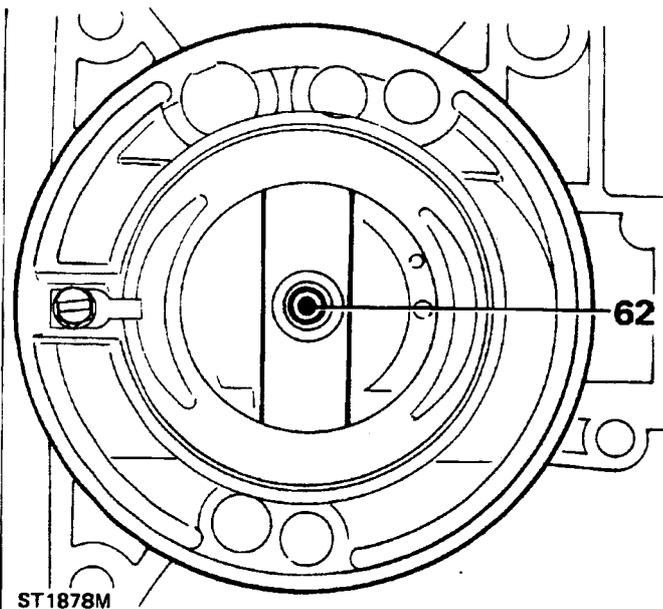


61. Fit the mixture adjusting screw.



ST1885M

62. Adjust until the jet is flush with the carburettor bridge, then re-adjust jet three and one-half turns clockwise.

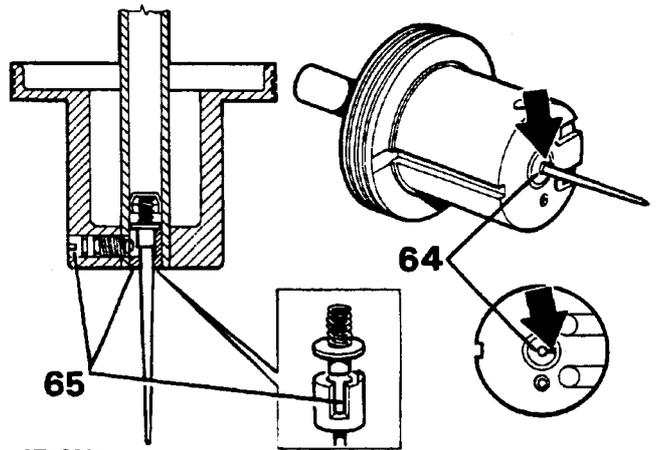


ST1878M

63. Using a new sealing ring, fit the float chamber cover, noting that it can only be fitted one way. Secure with the four screws and spring washers and evenly tighten.

Fit piston and suction chamber

64. Fit the needle, spring and guide assembly to the piston ensuring that the etched arrow head on the needle locating guide is aligned between the piston transfer holes, as illustrated.
65. Secure and ensure that when the screw is tightened the guide is flush with the piston and that the screw locates in the guide slot.



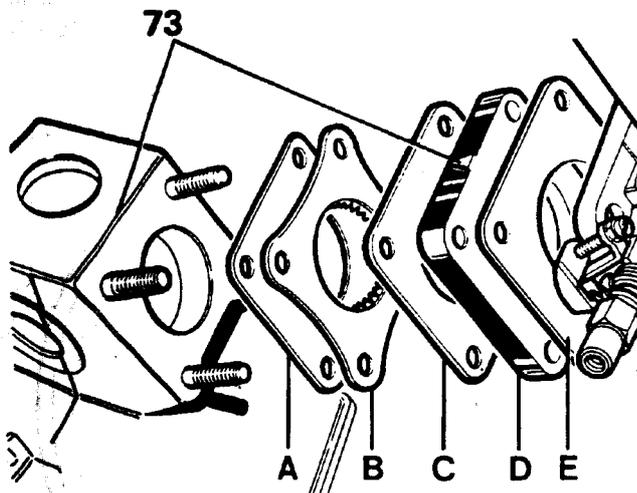
ST1879M

66. Fit the piston key to the carburettor body using a new screw. Tighten the screw and splay the end.
67. Fit a new suction chamber sealing ring to the groove in the carburettor body.
68. To prevent the piston spring being 'wound-up' during assembly, temporarily fit the piston and suction chamber less the spring to the body, and pencil mark the relationship of the chamber to the body. Remove the suction chamber and fit the spring to the piston. Hold the suction chamber above the spring and piston, align the pencil marks and lower the chamber over the spring and piston, taking care not to rotate the suction chamber. Secure the chamber to the body with the three screws, tightening evenly and check that the piston moves freely.
69. Hold the piston at the top of its stroke and fit the spring clip.
70. Fit the piston damper.
71. Using a new joint washer, fit the air intake adaptor and secure with the two nuts and spring washers.

72. Fit the carburetters to the inlet manifold ensuring that the joint washers, deflector and insulator are fitted in the sequence illustrated. The insulator must be fitted with the arrow head uppermost and pointing inwards towards the manifold. Secure with the four nuts and spring washers and tighten evenly to the correct torque.

- A. Joint washer.
- B. Deflector-teeth pointing inwards.
- C. Joint washer.
- D. Insulator.
- E. Joint washer.

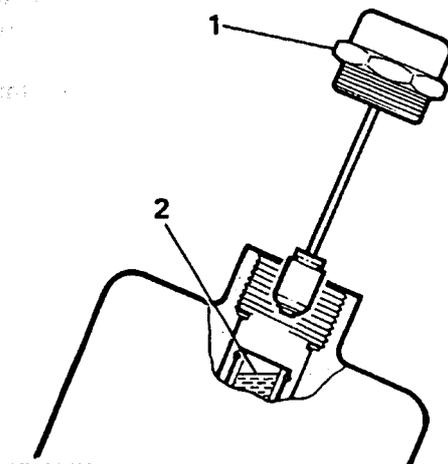
73. Connect the linkages, tune and adjust the carburetters.



ST1880M

CARBURETTER DAMPER- Topping up

1. Unscrew the cap from the top of the carburetter suction chamber and withdraw the cap and plunger.
2. Top-up with clean engine oil to bring the level to the top of the hollow piston rod.
3. Screw the cap firmly into the carburetter.



ST1884M

TUNE AND ADJUST - SU HIF 44 CARBURETTERS

Special tools:

Carburetter balancer B89 Non -
dispersive infra - red exhaust gas analyser.

General Requirements Prior To Tuning Carburetters.

Accurate engine speed is essential during carburetter tuning, therefore the distributor pick up air gap and ignition timing must be checked together with the vacuum advance system.

Whenever possible the ambient air temperature of the tuning environment should be between 15° to 26° C (60° to 80° F). When checking engine speed, use an independent and accurate tachometer.

Idling adjustments should be carried out on a fully warmed up engine, that is, at least 5 minutes after the thermostat has opened. This should be followed by a run of one minute duration at an engine speed of approximately 2,500 rev/min before further adjustments or checks are carried out. This cycle may be repeated as often as required. It is important that the above cycle is adhered to, otherwise overheating may result and settings may be incorrect. The piston dampers must always be kept topped-up with the correct grade of oil.

Before any attempt is made to check settings a thorough check should be carried out to ensure that the throttle linkage between the pedal and carburetters is free and has no tendency to stick. Ensure that the choke control lever is pushed fully down.

NOTE: References to left and right hand are as from the drivers seat.

TAMPER - PROOFING

To comply with E.C.E regulations the idle speed and mixture adjusting screws must be tamper - proofed following any adjustments. A red blanking plug; Part number - JZX 1258 must be fitted into the mixture screw recess and a red cap; Part number - JZX 1197 fitted over the idle adjustment screw (throttle adjustment screw).

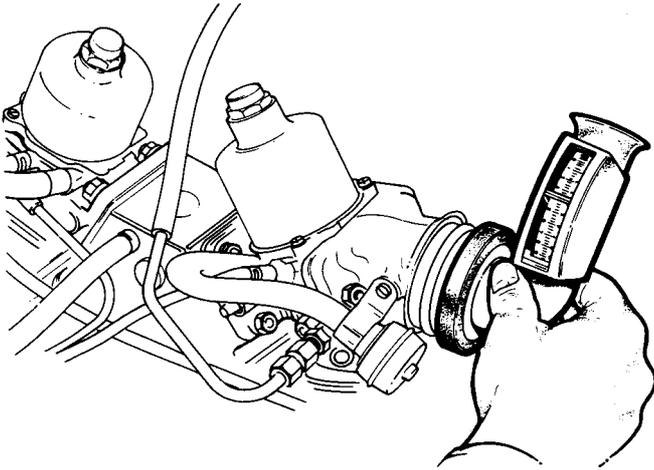


TUNE AND ADJUST

The following instructions apply to both carburetters unless otherwise stated.

CARBURETTER BALANCE

Using balancer B89

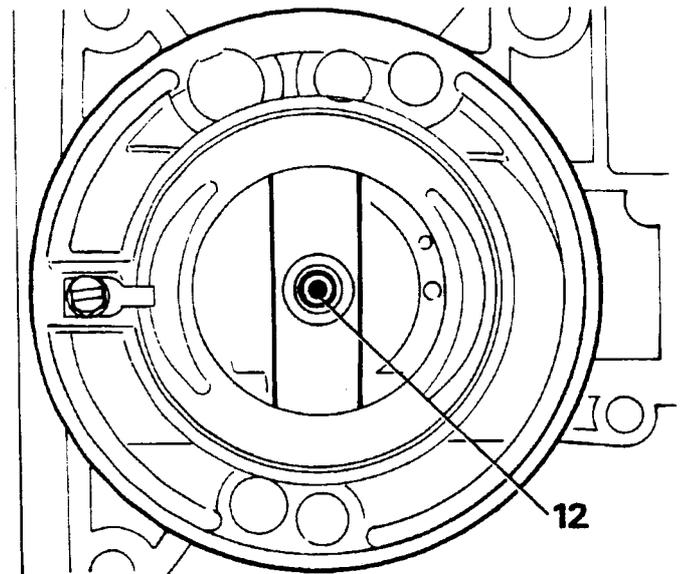


1. Remove the air cleaner.
2. Start the engine, and if necessary allow it to reach normal operating temperature.
3. Disconnect the inter-connecting throttle link between the two carburetters.
4. Back-off the idle adjusting screw on each carburetter, clear of the throttle lever.
5. Turn each throttle adjusting screw so that it just touches the throttle lever, then turn the screws by equal amounts to achieve an approximate idle speed of 700 to 800 rev/min.
6. Press the balancer firmly over the carburetter intake. Press or withdraw the control on the side of the balancer to adjust the meter needle reading to approximately half scale, and note the reading.
7. Without altering the position of the balancer control, place the balancer on the second carburetter intake and adjust the idle screw as necessary to achieve the same reading.
8. Alternately, adjust and check the balance of both carburetters until an idle speed of 700 to 800 rev/min is obtained.

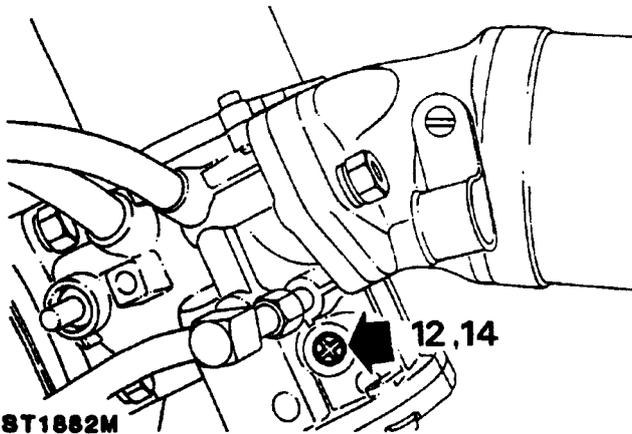
9. Reconnect the throttle inter connecting link, and again check the idle speed and balance.

MIXTURE SETTING

10. Ensure that the engine is at normal operating temperature. Remove the air cleaner, air intake elbows and mixture adjustment screw blanking plugs.
11. Mark the relationship of the suction chamber to the carburetter body, remove the retaining screws and lift off the suction chamber complete with pistons.
12. To achieve a datum setting for the mixture screw, turn it anti - clockwise until the jet is level with the carburetter bridge. Check by placing a straight edge across the bridge and adjust as necessary so that the jet just touches the straight edge.



13. Refit the suction chamber and piston, evenly tighten the retaining screws. Check that the piston moves freely without sticking. Top - up the piston damper.
14. Turn the mixture adjustment screw three and one-half turns.



8T1882M

15. Insert the probe of an infra - red exhaust gas analyser as far as possible up the exhaust pipe, start the engine and allow a one and one half minute stabilisation period.
16. Adjust the mixture screw on both carburetters by equal amounts, rich or weak to achieve a CO reading of 0.5 to 2.5%.
17. If after approximately two minutes the CO level is not satisfactory run the engine at 2000 rev/min for one minute to stabilise the equipment, continue the setting procedure until a stable CO reading of 0.5 to 2.5% at an idle speed of 700 - 800 rev/min is obtained.

IDLE SPEED AND LINKAGE ADJUSTMENT

18. Check that the engine is at normal operating temperature.
19. **Manual gearbox models-** Slacken the nut, at the left hand carburetter securing the inter-connecting link ball to the throttle cam lever. **Automatic gear box models-** Slacken the lower nut, securing the inter - connecting link ball to the throttle lever at the right hand carburetter.
20. Disconnect the inter - connecting link between the carburetters at the left hand carburetter.
21. At the right hand carburetter, release the lock nut and slacken off the lost motion adjustment screw, until it is well clear of the spring loaded pad.
22. If necessary adjust the idle screw to maintain the correct idle speed. Check the CO level and carburetter balance, adjust if required.

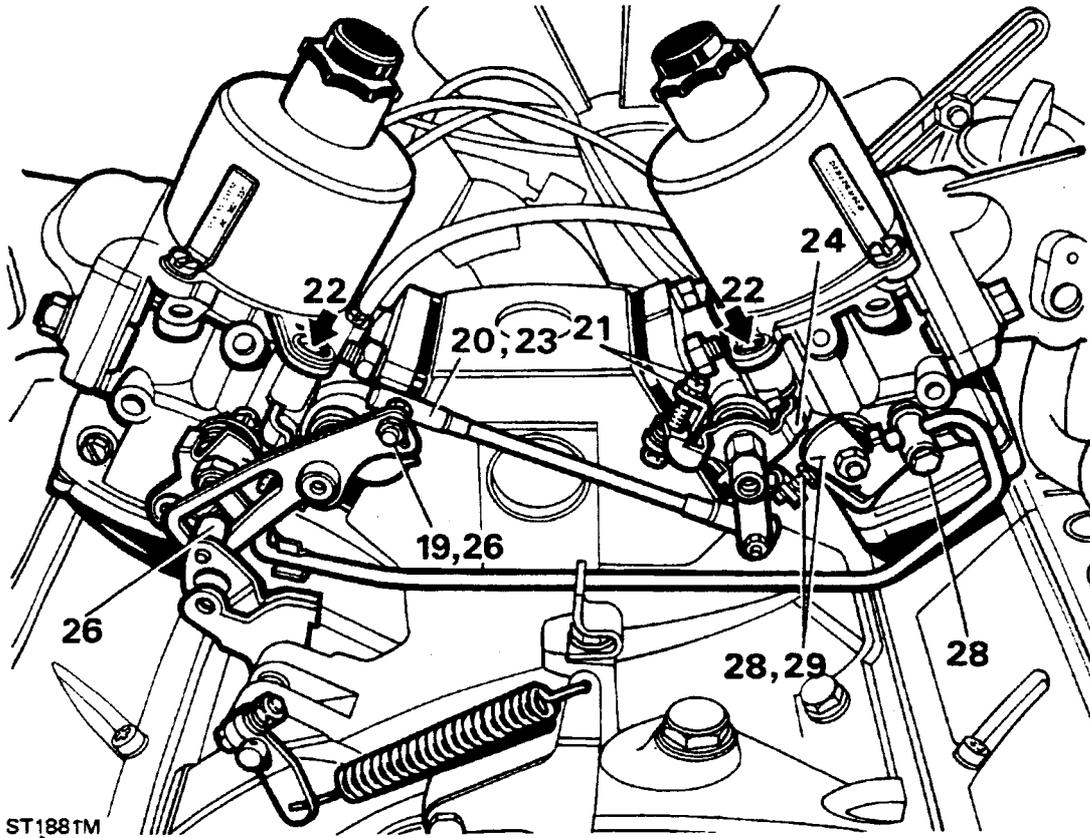
23. Re - connect the inter - connecting link to the left hand carburetter.
24. Hold the right hand throttle lever against the idle screw stop and adjust the lost motion screw until contact is made with the spring loaded pad, tighten the lock nut.
25. Check the idle speed and balance. Adjust the lost motion screw to restore balance if necessary.
26. **Manual gearbox models-**Ensuring that the roller is firmly seated in the lower corner of the cam lever, tighten the nut which secures the inter - connecting link ball to the cam lever.
Automatic gearbox models-Ensuring that the kick down cable linkage is firmly on its idle stop, tighten the inter - connecting link ball securing nut at the right hand carburetter.

FAST IDLE ADJUSTMENT

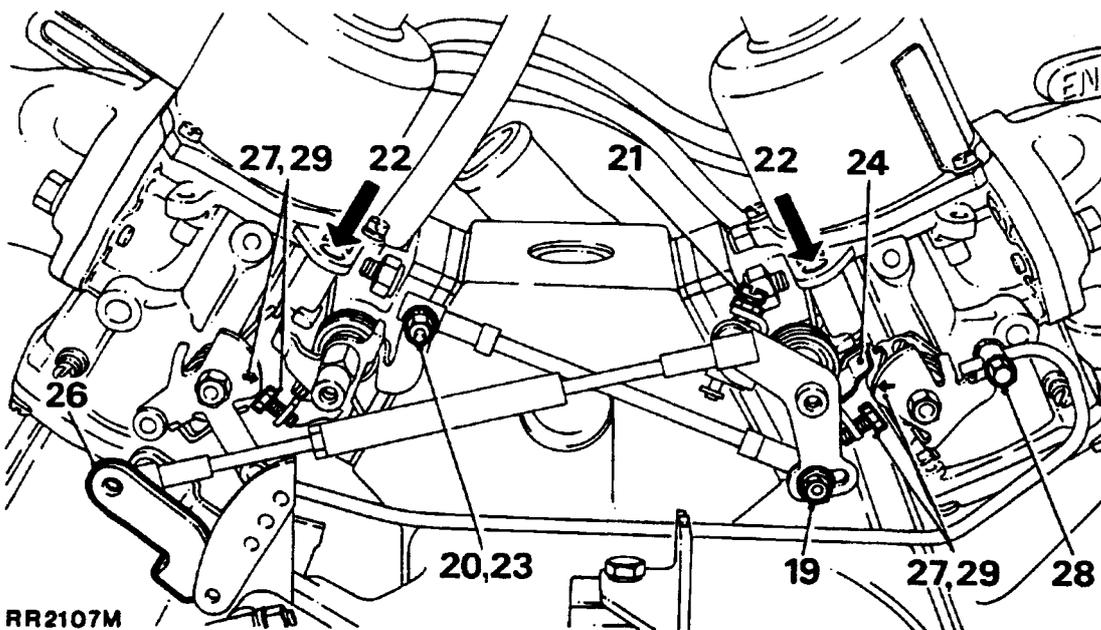
27. Pull out the cold start control (choke) until the scribed line on the left hand fast idle cam is in-line with the centre of the fast idle screw head.
28. Check that the scribed line on the right hand fast idle cam is similarly in-line with the fast idle screw head. If there is mis-alignment, slacken the fast idle cam link rod screw at the right hand carburetter and move the cam until the scribed line coincides with the centre of the screw head. Tighten the cam rod screw.
29. Turn each fast idle screw clockwise until just clear of the cam.
30. Turn the fast idle screw of the leading (left-hand) carburetter down (clockwise) until a slight change in engine speed is noted.
31. Similarly turn the fast idle screw of the second carburetter (right-hand) down until a further slight change of engine speed is noted.
32. Adjust the fast idle screws of both carburetters by equal amounts to achieve a fast idle speed of 1100 to 1150 rev/min.
33. Push the cold start (choke) fully home then pull it out again to its full extent and re-check the fast idle speed.



MANUAL GEARBOX MODELS



AUTOMATIC GEARBOX MODELS



34. Fit the appropriate blanking plug and cap to the mixture screw recess and idle adjusting screw.

35. Fit the carburettor air intake elbows and air cleaner.

COOLING SYSTEM

WATER PUMP

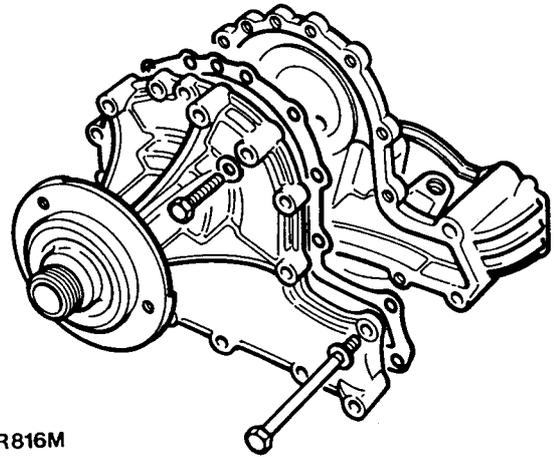
Remove and refit

Removing

1. Drain the engine cooling system.
2. Remove all drive belts.
3. Remove the bonnet locking platform and pull the radiator forward.
4. Remove the fan using spanner. MS 1519.
NOTE: Left hand thread.
5. Release the alternator adjusting link.
6. Disconnect the inlet hose from the water pump.
7. Remove the water pump.

Refitting

8. Lightly grease a new joint washer and place it in position on the timing cover.



RR816M

9. Clean the threads of the four long bolts and smear with Loctite 572 thread lubricant-sealant.
10. Locate the water pump in position.
11. Locate the alternator adjusting link.
12. Leave the alternator adjusting link loose and tighten the remaining water pump housing bolts evenly and to the correct torque.
13. Connect the inlet hose to the water pump.
14. Apply Loctite to the fan pulley spindle and fit the fan using MS 1519.
15. Fit and adjust the drive belts.
16. Refit the bonnet locking platform.
17. Refill the cooling system.



COOLING SYSTEM FAULT DIAGNOSIS

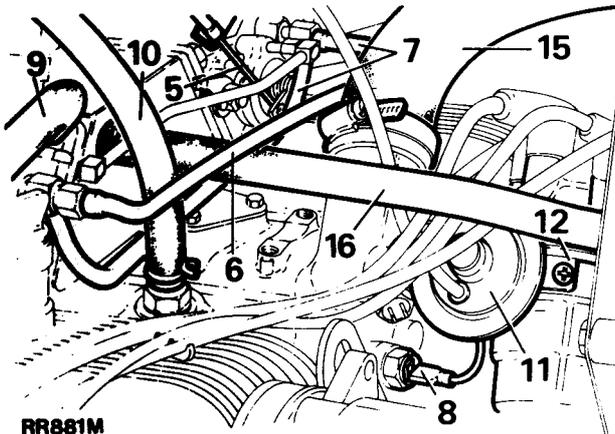
SYMPTOM	POSSIBLE CAUSE	CURE
A—EXTERNAL LEAKAGE	<ol style="list-style-type: none"> 1. Loose hose clips 2. Defective rubber hose 3. Damaged radiator seams 4. Excessive wear in the water pump 5. Loose core plugs 6. Damaged gaskets 7. Leaks at the heater connections or plugs 8. Leak at the water temperature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

INDUCTION MANIFOLD

Remove and refit

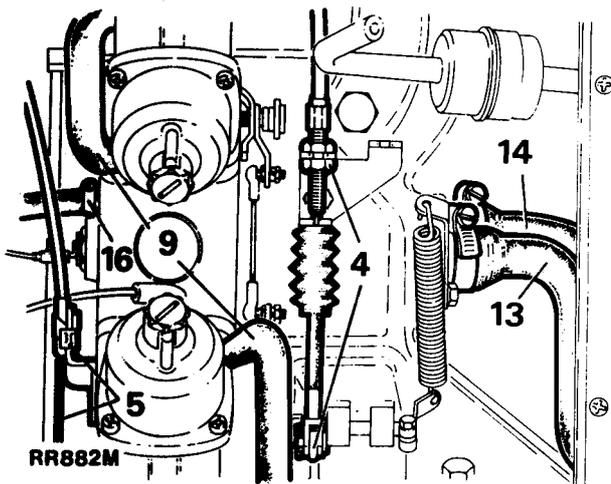
Removing

1. Drain the cooling system.
2. Remove the air cleaner.
3. Remove the engine breather filter.
4. To disconnect the throttle cable from the carburettor, remove the slotted throttle lever, and disconnect the cable from the linkage and from the manifold.



RR881M

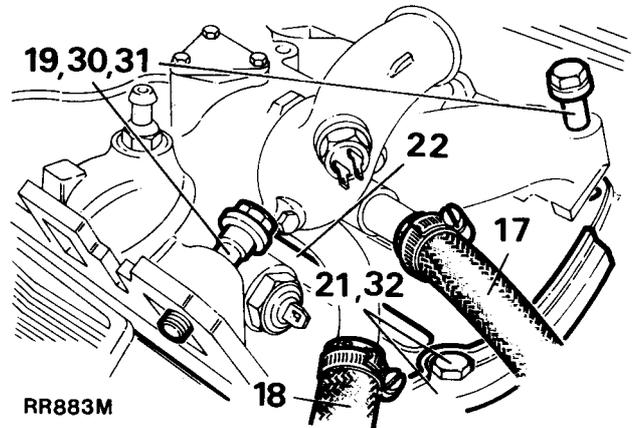
5. Disconnect the choke cable from the carburettor.
6. Disconnect the fuel spill return pipe from the RH carburettor.
7. Remove the fuel supply pipe from the carburettors.



RR882M

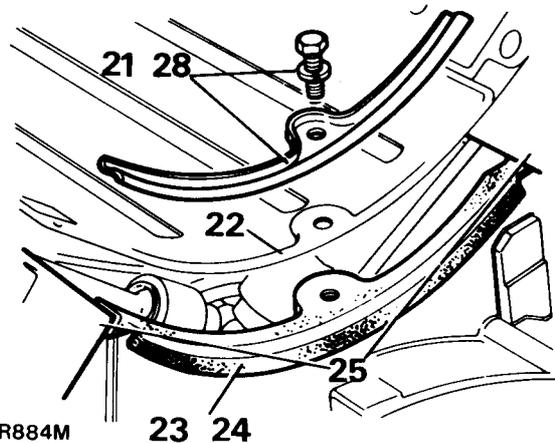
8. Disconnect the lead from the water temperature transmitter.
9. Disconnect the flame trap hoses from the carburettors.
10. Disconnect the vacuum pipe for the brake servo.
11. Disconnect the vacuum pipe from the distributor.
12. Release the distributor cap.

13. Disconnect the inlet hose to the heater.
14. Disconnect the return hose from the heater.
15. Disconnect the return hose to the radiator.
16. Disconnect the return hose from the top of the induction manifold.



RR883M

17. Disconnect the outlet hose from the manifold.
18. Disconnect the heater return hose from the manifold.
19. Evenly slacken and withdraw twelve bolts and remove the manifold.
20. Wipe away any coolant lying on the manifold gasket.
21. Remove the gasket clamps.
22. Lift off the gasket.
23. Withdraw the gasket seals.



RR884M

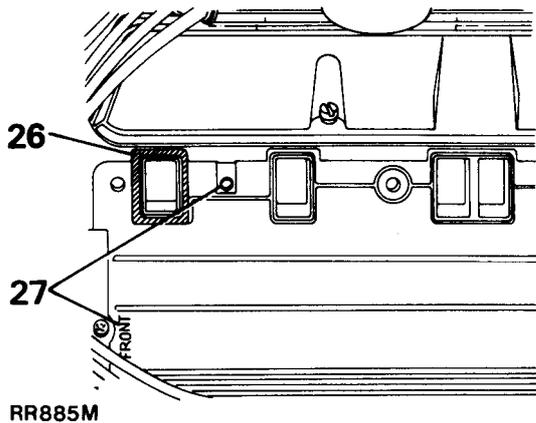
Refitting

24. Using new seals, smear them on both sides with silicon grease.
25. Locate the seals in position with their ends engaged in the notches formed between the cylinder head and block.
26. Apply 'Hylomar' sealing compound SQ32M on the corners of the cylinder head, manifold gasket and manifold, around the water passage joints.
27. Fit the manifold gasket with the word 'FRONT' to the front and the open bolt hole at the front RH side.

Continued

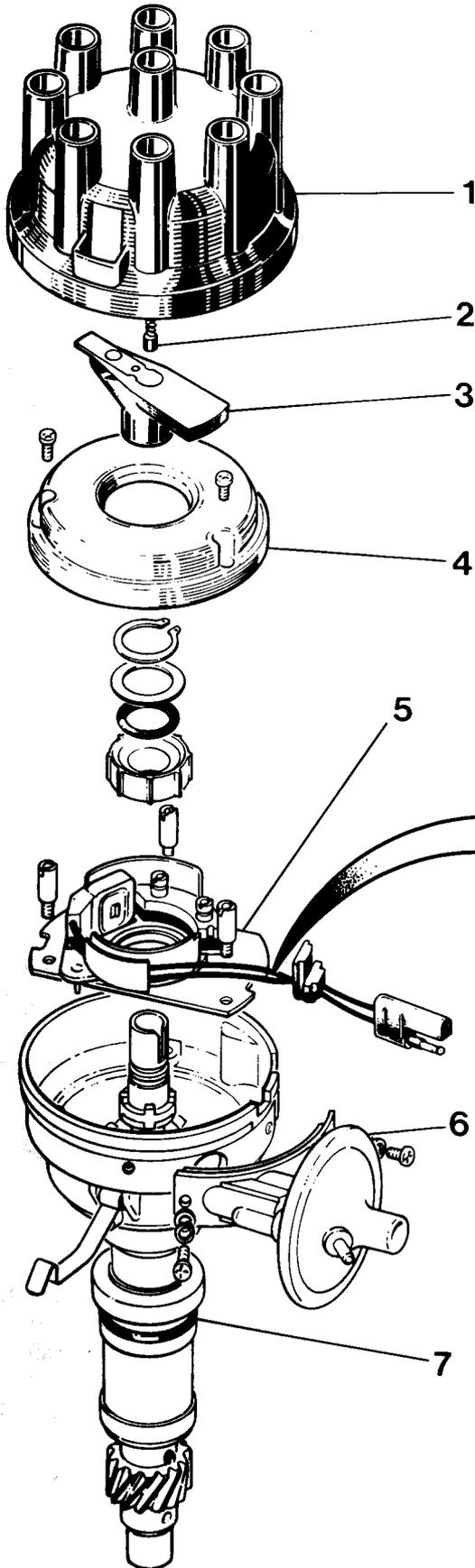


28. Fit the gasket clamps but do not fully tighten the bolts at this stage.
29. Locate the manifold onto the cylinder head.
30. Clean the threads of the manifold securing bolts and then coat them with Thread Lubricant-sealer 3M EC776.
31. Fit all the manifold bolts and tighten them a little at a time, evenly, alternate sides working from the centre to each end. Finally tighten to the correct torque, see Data section.



32. Tighten the gasket clamp bolts to the correct torque, see Data section.
33. Reverse 1 to 18.
34. Run the engine and check for water leaks.

ELECTRONIC IGNITION



**DISTRIBUTOR
LUCAS 35 DM8**

Fitted to engines with Solex 175 CDSE carburetters.

Distributor has a separate amplifier unit mounted under the ignition coil.

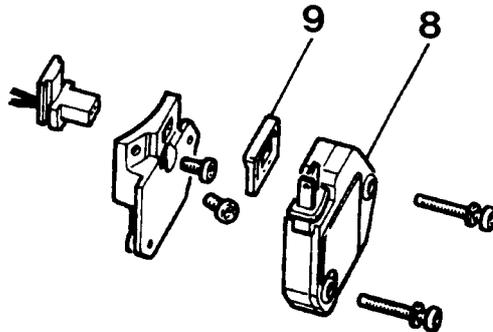
Service Parts

1. Cap
2. H.T. brush and spring
3. Rotor arm
4. Insulation cover (Flash shield)
5. Pick-up and base plate assembly
6. Vacuum unit
7. 'O' ring oil seal

**DISTRIBUTOR
LUCAS 35 DLM8**

Fitted to engines with SU HIF44 carburetters.

Distributor incorporates amplifier.



8. Amplifier.
9. Gasket.



ELECTRONIC IGNITION

Engines with Solex 175 CDSE carburettors are fitted with a Lucas 35 DM8 distributor. It has an advance/retard vacuum unit and a centrifugal advance mechanism. The amplifier unit is located under the coil.

Engines with SU HIF44 carburettors are fitted with Lucas 35 DLM8 distributor. This unit does not have a retard mechanism on the vacuum unit, and the amplifier is fitted to the side of the distributor body.

A pick-up module, in conjunction with a rotating timing reluctor inside the distributor body, generates timing signals. These are applied to the electronic ignition amplifier module.

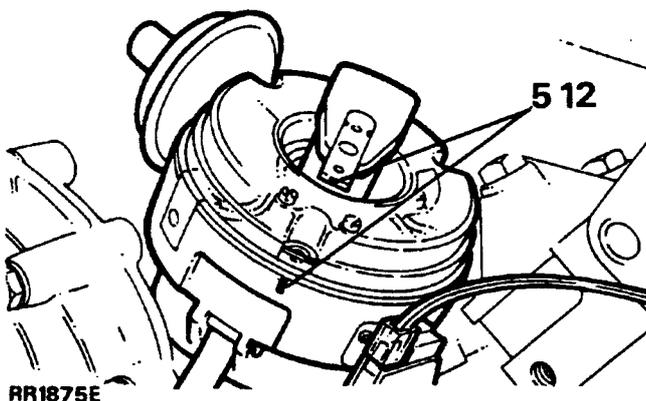
NOTE: The pick-up air gap is factory set. Do not adjust the gap unless the pick-up is being changed or the base plate has been moved. Use a non-ferrous feeler gauge to set the air gap.

DISTRIBUTOR

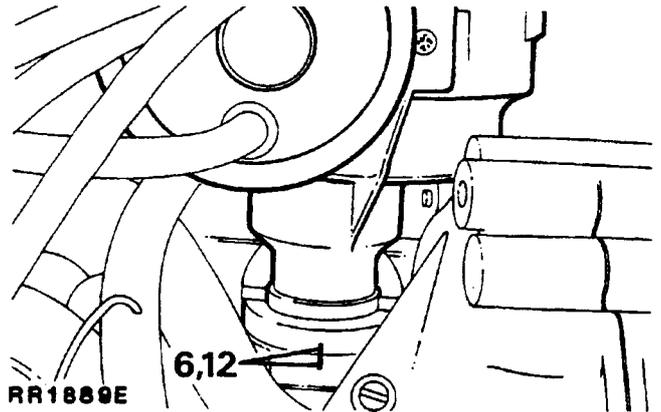
Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Disconnect the vacuum pipe.
3. Remove the distributor cap.
4. Disconnect low tension lead from the coil.
5. Mark distributor body in relation to centre line of rotor arm.



6. Add alignment marks to distributor and front cover.

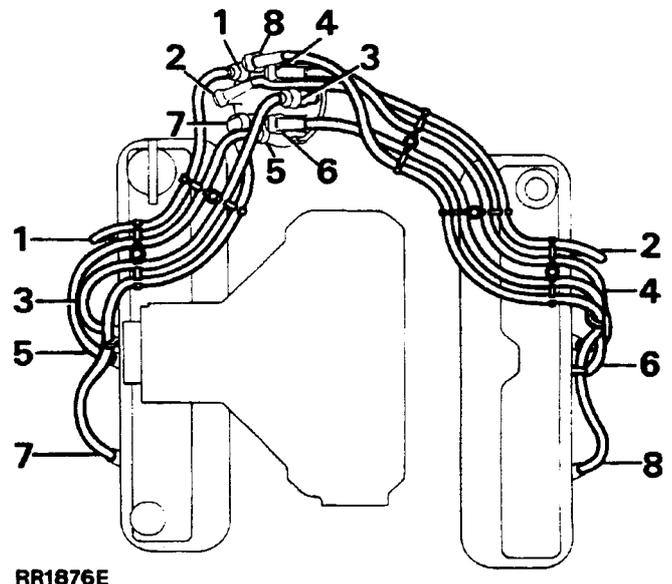


NOTE: Marking the distributor enables refitting in exact original position, but if engine is turned while distributor is removed, complete ignition timing procedure must be followed.

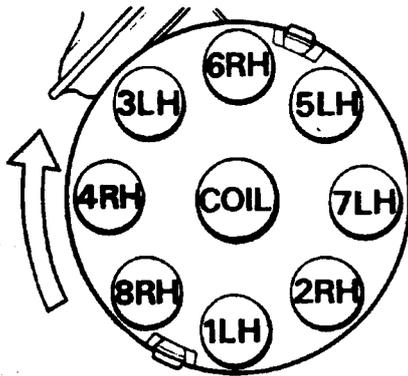
7. Release the distributor clamp and remove the distributor.

Refitting

NOTE: If a new distributor is being fitted, mark body in same relative position as distributor removed.



8. Leads for distributor cap should be connected as illustrated. Figures 1 to 8 inclusive indicate plug lead numbers. RH-Right hand side of engine, when viewed from the rear. LH-Left hand side of engine, when viewed from the rear.

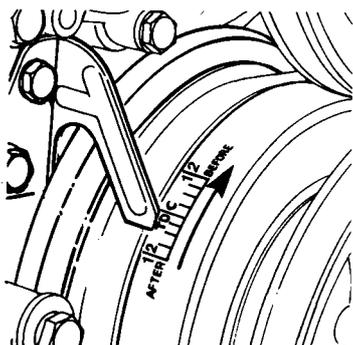


RR616M

9. If engine has not been turned whilst distributor has been removed, proceed as follows (Items 10 to 17). Alternatively proceed to instruction 18.
10. Fit new 'O' ring seal to distributor housing.
11. Turn distributor drive until centre line of rotor arm is 30° anti-clockwise from mark made on top edge of distributor body.
12. Fit distributor in accordance with alignment markings.

NOTE: It may be necessary to align oil pump drive shaft to enable distributor drive shaft to engage in slot.

13. Fit clamp and bolt. Secure distributor in exact original position.
14. Connect vacuum pipe to distributor and low tension lead to coil.
15. Fit distributor cap.
16. Reconnect battery.
17. Using suitable electronic equipment, set the ignition timing, see **IGNITION TIMING-Adjust.**
18. If, with distributor removed, engine has been turned it will be necessary to carry out the following procedure.
19. Set engine-No. 1 piston to static ignition timing figure (see Engine Tuning Data- Section 05) on compression stroke.
20. Turn distributor drive until rotor arm is approximately 30° anti-clockwise from number one sparking plug lead position on cap.



21. Fit distributor to engine.
22. Check that centre line of rotor arm is now in line with number one sparking plug lead on cap. Reposition distributor if necessary.
23. If distributor does not seat correctly in front cover, oil pump drive is not engaged. Engage by lightly pressing down distributor while turning engine.
24. Fit clamp and bolt leaving both loose at this stage.
25. Set the ignition timing statically to within 2°-3° of T.D.C.
26. Connect the vacuum pipe to the distributor.
27. Fit low tension lead to coil.
28. Fit distributor cap.
29. Reconnect the battery.
30. Using suitable electronic equipment set the ignition timing, see **IGNITION TIMING-Adjust.**

DISTRIBUTOR-LUCAS 35DLM8

(Amplifier fitted to distributor body).

Overhaul

DISTRIBUTOR COVER

1. Unclip and remove the cover.
2. Renew the cover if known to be faulty.
3. Clean the cover and HT brush with a nap free cloth.

ROTOR ARM

4. Pull rotor arm from shaft.
5. Renew rotor arm if known to be faulty.

INSULATION COVER (Flash shield)

6. Remove cover, secured by three screws.
7. Renew cover if known to be faulty.

VACUUM UNIT

8. Remove two screws from vacuum unit securing bracket, disengage vacuum unit connecting rod from pick-up base plate connecting peg, and withdraw vacuum unit from distributor body.



AMPLIFIER MODULE (see note below)

9. Remove two screws and withdraw the module.
10. Remove the gasket.
11. Remove two screws securing the cast heatsink and remove the heatsink.

WARNING: The amplifier module is a sealed unit containing Beryllia. This substance is extremely dangerous if handled. Do not attempt to open or crush the module.

NOTE: Engines with Solex carburettors are fitted with a separate amplifier mounted behind the coil.

The amplifier is not serviceable; in the event of a fault a new amplifier must be fitted.

PICK-UP AND BASE PLATE ASSEMBLY

12. Use circlip pliers to remove the circlip retaining the reluctor on rotor shaft.
13. Remove the flat washer and then the 'O' ring recessed in the top of the reluctor.
14. Gently withdraw the reluctor from the shaft, taking care not to damage the teeth.

NOTE: Coupling ring fitted beneath reluctor.

15. Remove three support pillars and cable grommet. Lift out the pick-up and base plate assembly.

NOTE: Do not disturb the two barrel nuts securing the pick-up module, otherwise the air gap will need re-adjustment.

16. Renew pick-up and base plate assembly if module is known to be faulty, otherwise check pick-up winding resistance (2k-5k ohm).

RE-ASSEMBLY

17. This is mainly a reversal of the dismantling procedure, noting the following points:

LUBRICATION

Apply clean engine oil:

- a. Three drops to felt pad reservoir in rotor shaft.

Apply Omnilube 2 (or equivalent) grease.

- b. Auto advance mechanism.
- c. Pick-up plate centre bearing.
- d. Pre tilt spring and its rubbing area (pick-up and base plate assembly).
- e. Vacuum unit connecting peg (pick-up and base plate assembly).
- f. The connecting peg hole in vacuum unit connecting rod.

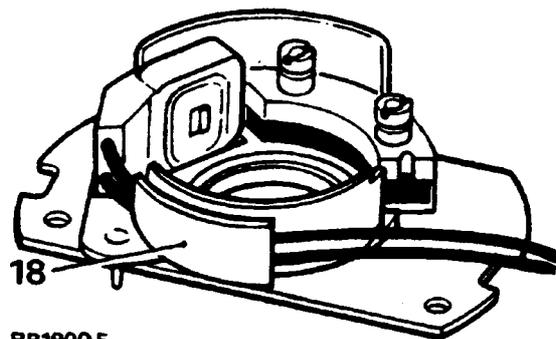
Apply Rocal MHT (or equivalent) grease:

- g. Vacuum unit connecting rod seal (located in vacuum unit where connecting rod protrudes).

NOTE: Applicable only to double acting vacuum units.

FITTING PICK-UP AND BASE PLATE ASSEMBLY

18. Pick-up leads must be prevented from fouling the rotating reluctor. Both leads should be located in plastic carrier as illustrated. Check during re-assembly.



REFITTING RELUCTOR

19. Slide reluctor as far as it will go on rotor shaft, then rotate reluctor until it engages with the coupling ring beneath the pick-up base plate. The distributor shaft, coupling ring and reluctor are 'keyed' and rotate together.



PICK-UP AIR GAP ADJUSTMENT

20. The air gap between the pick-up limb and retractor teeth must be set within the specified limits, using a non-ferrous feeler gauge.

NOTE: When the original pick-up and base plate assembly has been refitted the air gap should be checked, and adjusted if necessary.

When renewing the assembly the air gap will require adjusting to within the specified limits.

Refer to 'Engine Tuning Data'

AMPLIFIER MODULE

(Applies to models with amplifier fitted to distributor body).

21. Before fitting the module, apply MS4 Silicone grease or equivalent heat-conducting compound to the amplifier module backplate, the seating face on distributor body and both faces of the heatsink casting.

IGNITION TIMING

Adjust

1. It is essential that the following procedures are adhered to. Inaccurate timing can lead to serious engine damage and additionally create failure to comply with emission regulations. If the engine is being checked in the vehicle and is fitted with an air conditioning unit the compressor must be isolated.
2. On initial engine build, or if the distributor has been disturbed for any reason, the ignition timing must be set statically to within 2°-3° of T.D.C.

(This sequence is to give only an approximation in order that the engine may be started) **ON NO ACCOUNT MUST THE ENGINE BE STARTED BEFORE THIS OPERATION IS CARRIED OUT**

Equipment required

Calibrated Tachometer
Stroboscopic lamp

3. Couple stroboscopic timing lamp and tachometer to engine following the manufacturer's instructions.

4. Disconnect the vacuum pipe(s) from the distributor.
5. Start engine, with no load and not exceeding 3,000 rev/min run engine until normal operating temperature is reached. (Thermostat open). Check that the normal idling speed falls within the tolerance specified in the data section.
6. Idle speed for timing purposes must not exceed figure given in tuning data.
7. With the distributor clamping bolt slackened turn distributor until the timing flash coincides with the timing pointer and the correct timing mark on the rim of the torsional vibration damper as shown in the engine tuning section.
8. Retighten the distributor clamping bolt securely. Recheck timing in the event that retightening has disturbed the distributor position.
9. Refit vacuum pipe(s)
10. Disconnect stroboscopic timing lamp and tachometer from engine.

LUCAS CONSTANT ENERGY IGNITION SYSTEM 35DLM8-PRELIMINARY CHECKS

Inspect battery cables and connections to ensure they are clean and tight. Check battery state of charge if in doubt as to its condition.

Inspect all LT connections to ensure that they are clean and tight. Check the HT leads are correctly positioned and not shorting to earth against any engine components. The wiring harness and individual cables should be firmly fastened to prevent chaffing.

PICK-UP MODULE AIR GAP SETTINGS

Air gap settings vary according to vehicle application.

NOTE: The gap is set initially at the factory and will only require adjusting if tampered with or when the pick-up module is replaced.

⚠ WARNING: Before commencing work on an ignition system, all high tension terminals, adaptors and diagnostic equipment for testing should be inspected to ensure that they are adequately insulated and shielded to prevent accidental personal contacts and minimize the risk of shock. Wearers of surgically implanted pacemaker devices should not be in close proximity to ignition circuits or diagnostic equipment.



Test Notes

- (i) The ignition must be switched on for all checks.
- (ii) Key to symbols used in the charts for Tests 2.

- C** Correct Reading
- H** High Reading
- L** Low Reading

(iii) Use feeler gauges manufactured from a non-magnetic material when setting air gaps.

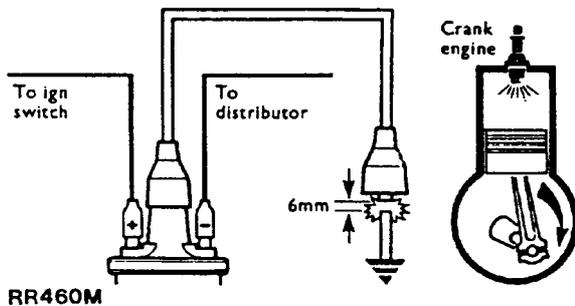
TEST 1:

Check HT Sparking

Remove coil/distributor HT lead from distributor cover and hold approximately 6mm (0.25 in) from the engine block. Switch the ignition 'On' and operate the starter.

If regular sparking occurs, proceed to Test 6. If no sparking proceed to Test 2.

Test 1



RR460M

TEST 2:

Amplifier Static Checks

Switch the ignition 'On'

- (a) Connect voltmeter to points in the circuit indicated by the arrow heads and make a note of the voltage readings.

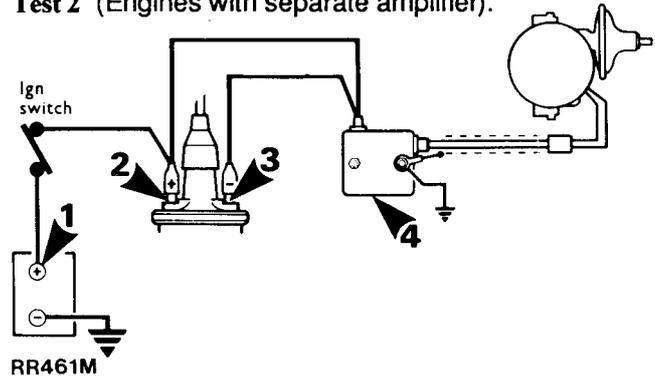
NOTE: Only move the voltmeter POSITIVE lead during tests 2,3, and 4.

- (b) Compare voltages obtained with the specified values listed below:

EXPECTED READINGS

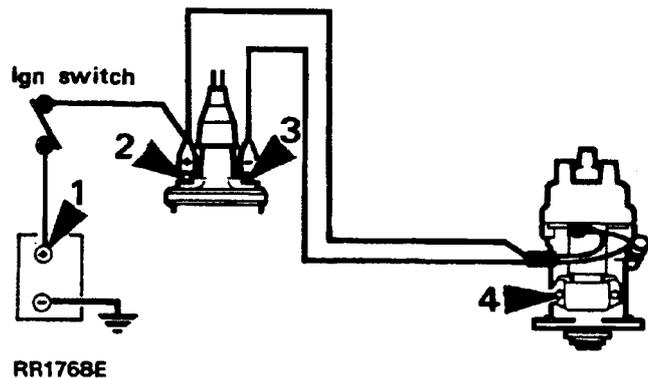
1. More than 11.5 volts.
2. 1 volt max below volts at point 1 in test circuit.
3. 1 volt max below volts at point 1 in test circuit.
4. 0 volt-0.1 volt.

Test 2 (Engines with separate amplifier).



RR461M

Test 2 (Amplifier fitted to distributor body)



RR1768E

- (c) If all readings are correct proceed to Test 3.
- (d) Check incorrect reading(s) with chart to identify area of possible faults, i.e. faults listed under heading 'Suspect'.

1	2	3	4	SUSPECT
L	C	C	C	DISCHARGED BATTERY
C	L	L	C	IGN. SWITCH AND/OR WIRING
C	C	L	C	COIL OR AMPLIFIER
C	C	C	H	AMPLIFIER EARTH

TEST 3:

Check Amplifier Switching

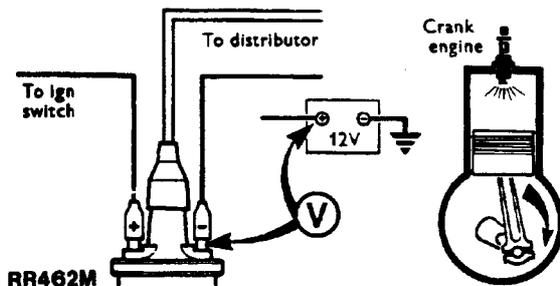
Disconnect the high tension lead between the coil and distributor.

Connect the voltmeter between positive (+ ve) terminal and H.T. coil negative (- ve) terminal, the voltmeter should register zero volts.

Switch the ignition 'On' then crank the engine. The voltmeter reading should increase just above zero, in which case proceed with Test 5.

If there is no increase in voltage during cranking proceed to Test 4.

Test 3



RR462M

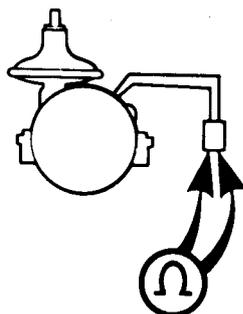
TEST 4:

Pick-Up Coil Resistance Applications with Separate Amplifier.

Disconnect the pick-up leads at the harness connector. Connect the ohmmeter leads to the two pick-up leads in the plug.

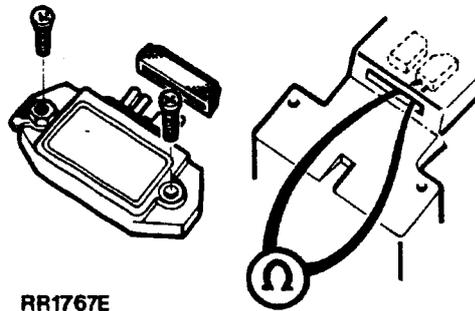
The ohmmeter should register between 2k and 5k ohm if pick-up is satisfactory. Change the amplifier if ohmmeter reading is correct. If the engine still does not start carry out Test 5.

Test 4 (Engines with separate amplifier).



RR463M

Test 4



RR1767E

Change the pick-up if ohmmeter reading is incorrect. If the engine still does not start proceed to Test 5.

TEST 5:

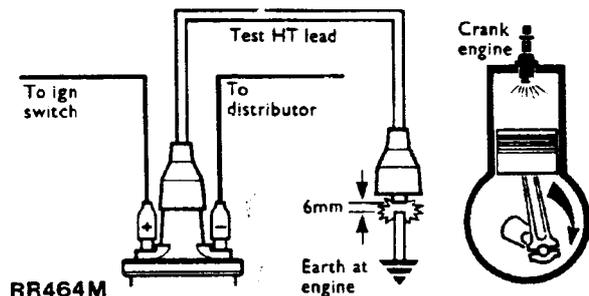
Check H.T. Sparking

Remove existing coil/distributor H.T. lead and fit test H.T. lead to coil chimney. Hold free end about 6mm (0.25 in) from the engine block and crank the engine.

H.T. sparking good, repeat test with original H.T. lead, if then no sparking, change H.T. lead. If sparking is good but engine will not start, proceed to Test 6.

If no sparking, replace coil. If engine will not start carry out Test 6.

Test 5



RR464M



TEST 6:

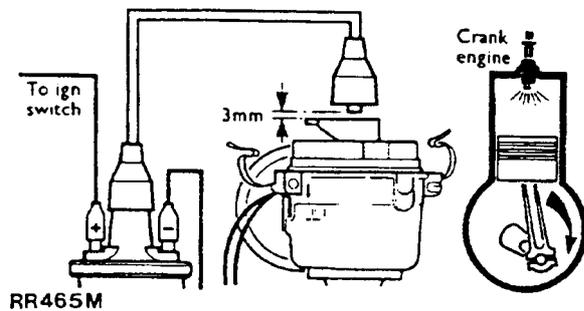
Check Rotor Arm

Remove distributor cover. Disconnect coil H.T. lead from cover and hold about 3mm (0.13 in) above rotor arm electrode and crank the engine. There should be no H.T. sparking between rotor and H.T. lead. If satisfactory carry out Test 7.

H.T. sparking, replace rotor arm.

If engine will not start carry out Test 7.

Test 6



TEST 7:

Visual and H.T. Cable Checks

Examine:	Should be:
1. Distributor Cover	Clean, dry, no tracking marks
Coil Top	Clean, dry, no tracking marks.
3. HT Cable Insulation	Must not be cracked, chafed or perished
4. HT Cable Continuity	Must not be open circuit
5. Sparking Plugs	Clean, dry, and set to correct gap

NOTE:

1. Reluctor	Must not foul pick-up or leads
2. Rotor and Insulation Cover	Must not be cracked or show signs of tracking marks

V8 Engine



V8 ENGINE CHANGES

A number of running improvements have been progressively introduced on the V8 engine by Land Rover Ltd, and those changes which affect service procedures are detailed below.

SPARK PLUGS

RN11YCC spark plugs are now fitted on production. These improved plugs have a service life of 24,000 miles (38,000 km) and do not require cleaning or adjustment at intervening service intervals.

If any other type of spark plug is fitted as a service replacement it must be renewed at 12,000 mile (20,000 km) intervals.

NOTE: When disconnecting high tension (HT) leads from the spark plugs, always grip the plug boot and not the HT lead to ensure the leads are not damaged.

CYLINDER HEADS / GASKETS

Revised cylinder heads and gaskets are now fitted, having fewer securing bolts and a new tightening procedure.

The change is easily identifiable, having two rows of cylinder head bolts instead of three.

The following points must be borne in mind:

- The new gasket is thicker than the old gasket, and therefore longer bolts are used.
- The new gasket can be fitted on early engines, but to do this requires the following:
 - Both cylinder head gaskets must be replaced.
 - The cylinder head bolts must be replaced by the new, longer bolts.

Cylinder Head Fitting Procedure

NOTE: New cylinder head bolts must be used each time.

1. Inspect the cylinder block to check that the gasket surfaces, cylinder bores and bolt holes are clean.
2. Fit the gasket dry with the word 'TOP' uppermost, on the dowels in the block.
3. Carefully position the cylinder head on the dowels.

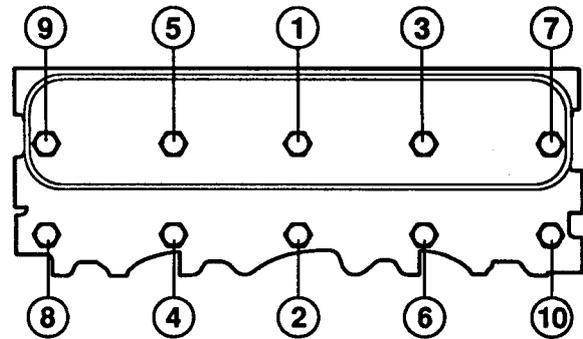


Fig.1 Cylinder head bolt tightening sequence

4. Two lengths of bolt are used:
 - Flange bolt length 66 mm are fitted to holes 2, 4, 6, 7, 8, 9 and 10.
 - Flange bolt length 96 mm are fitted to holes 1, 3 and 5..

Using new bolts, lightly oil the bolt threads, then fit and tighten in 3 stages as follows, and in the sequence shown in the illustration:

Stage 1 Tighten all to 20 Nm (15 lbf ft).

Stage 2 Tighten all a further $90^\circ \pm 5^\circ$.

Stage 3 Tighten all a further $90^\circ \pm 5^\circ$.

TIMING COVER

The timing cover mud shield (in front of the crankshaft oil seal) has been deleted.

Fit the seal as before, i.e. 1.5 mm behind the cover outer face.



SUMP

A revised sump is now fitted which does not require a gasket.

NOTE: When removing the sump every attempt should be made to do this without the use of levers. If levers are used, the sump mating face must then be examined for damage or distortion and repaired / renewed as necessary.

Fit the sump as follows:

1. Clean off all traces of sealant from the cylinder block and sump mating faces using a suitable solvent or a flat, wide bladed tool (not a screwdriver).
2. Apply a suitable degreasing agent to the mating faces.

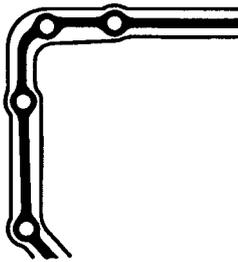


Fig.2 Applying sealant

3. Apply RTV sealant to the raised section of the sump mating face and around the bolt holes as shown in fig.2.

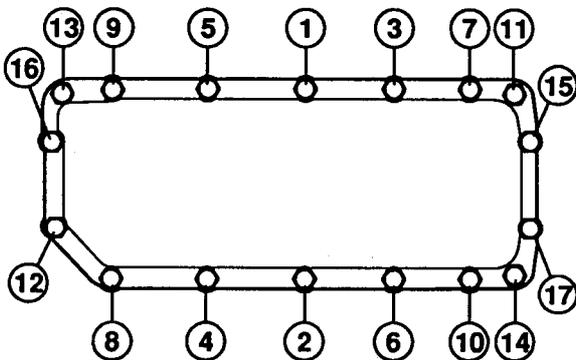


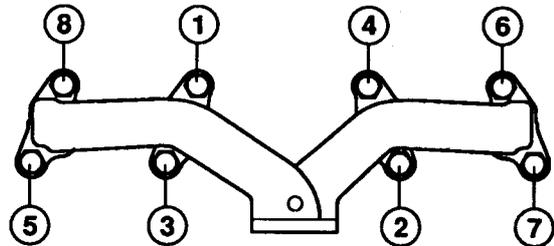
Fig.3 Sump bolt tightening sequence

4. Fit the sump and tighten the securing bolts in the sequence shown in fig.3 to 20 – 27 Nm (15 – 20 lbf ft).

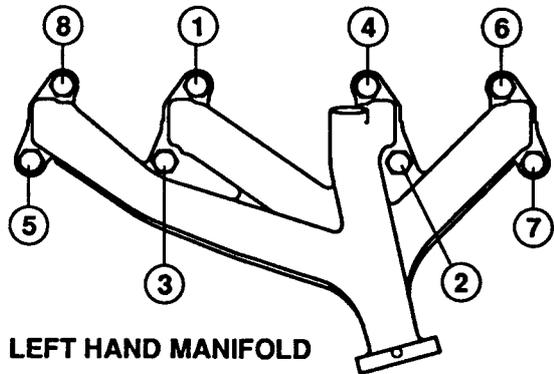
EXHAUST MANIFOLDS

Revised exhaust manifolds have been fitted incorporating gaskets between the manifolds and the cylinder heads. Fit both manifolds as follows:

1. Fit a new manifold gasket with its green coloured side facing the manifold.
2. Fit the manifold and secure finger tight with the bolts using new lock plates.
3. Pre-tighten the bolts in any sequence to 15 Nm.



RIGHT HAND MANIFOLD



LEFT HAND MANIFOLD

Fig.4 Manifold bolt tightening sequence

4. Tighten the bolts in the sequence shown in fig.4 to 39 – 42 Nm (29 – 31 lbf ft). Bend up the lock plate tabs to secure the bolts.

INLET MANIFOLD

A revised manifold gasket is fitted which can be used retrospectively on early engines. Fit the gasket and the inlet manifold as follows:

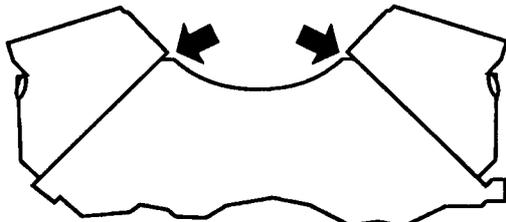


Fig.5 Sealant application points - cylinder head 'notches'.

1. Degrease the 2 areas at each end of the cylinder head where sealant is to be applied, i.e. the 'notches created at the meeting points of the cylinder heads and block (fig.5, arrowed).

CAUTION: Ensure sealant cannot enter the tappet chamber.

Apply a globule of Loctite sealant to those 4 points.

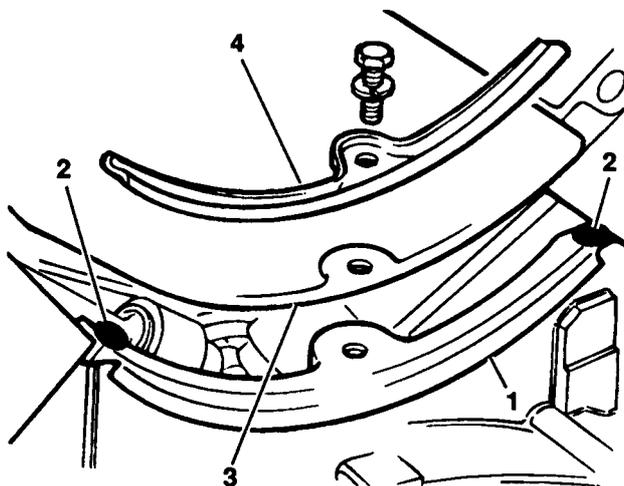


Fig.6 Fitting manifold gasket

1. End seal
 2. Sealant
 3. Inlet manifold gasket
 4. Gasket clamp
2. Fit a new manifold gasket end seal (fig.6, 1) at each end of the cylinder head, ensuring that the seal ends locate correctly in the 'notches'.

3. Apply a globule of Loctite sealant (fig.6, 2) on top of the seals directly above where they fit into the 'notches'.
4. Fit the inlet manifold gasket (fig.6, 3), either way round. Fit the gasket clamps (fig.6, 4), and tighten the clamp bolts finger tight.

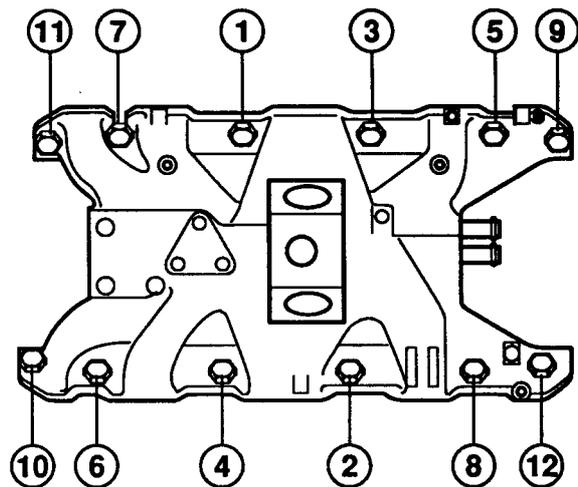


Fig.7 Inlet manifold bolt tightening sequence

5. Fit the inlet manifold, and check that the manifold gasket, clamps and inlet manifold are correctly positioned.
6. Start the manifold securing bolts into the cylinder heads.

NOTES:

1. Two lengths of bolt are used, 35 mm and 48 mm. Ensure the two longer bolts locate in positions 10 and 11 (see fig.7).
2. The bolts do not align at right angles to the manifold / head faces, and this may give the illusion of misalignment.
7. Torque tighten all bolts as follows:

NOTE: Ensure that the clamps do not move during the tightening operation.

 - a. Tighten both gasket clamp bolts to 0,5 – 1 Nm (0.4 – 0.7 lbf ft).
 - b. Pre-tighten the manifold bolts in the sequence shown (fig.7) to 10 Nm (7 lbf ft).

(Continued)



Inlet Manifold (..... Continued)

- c. Tighten the manifold bolts in the same sequence to 48 – 54 Nm (35 – 40 lbf ft).
- d. Tighten both gasket clamp bolts to 14 – 20 Nm (10 – 15 lbf ft).

MAIN BEARING CAP TORQUING PROCEDURE

An important torquing procedure has been introduced for the crankshaft main bearing caps as follows:

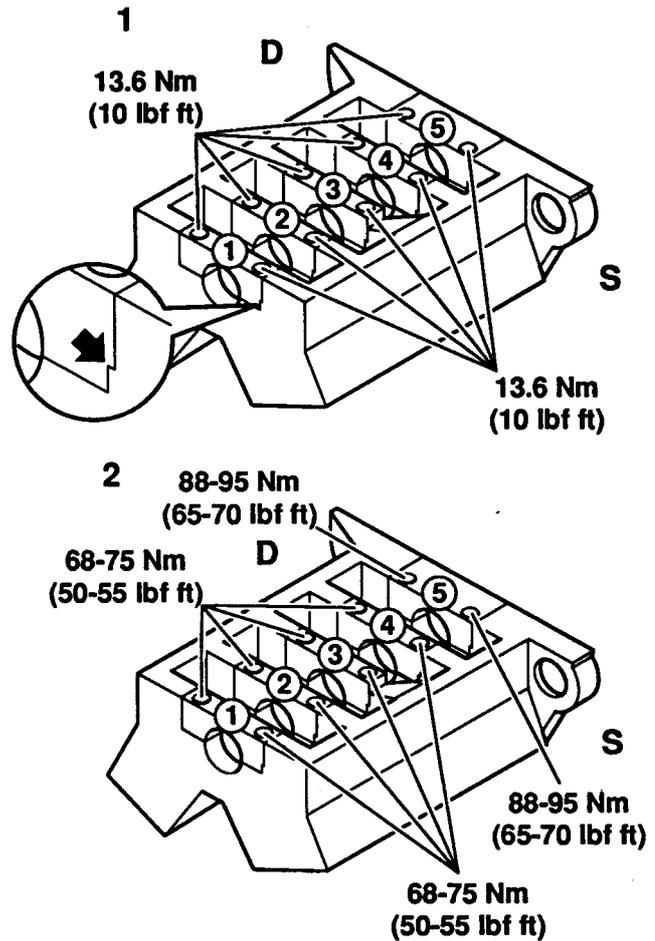


Fig.8 Main bearing caps

1. **NOTE:** 'D' = Dipstick side
'S' = Suction side
Snug all the mains to 13.6 Nm (10 lbf ft) in the following sequence:
D3-S3, D4-S4, D2-S2, D1-S1, D5-S5.
2. Torque the following mains in the sequence as indicated:
 - a. To 68 to 75 Nm (50 to 55 lbf ft):
D3-S3, D4-S4, D2-S2, D1-S1.
 - b. To 88 to 95 Nm (65 to 70 lbf ft):
D5-S5.

TORQUE CONVERTER ATTACHMENT TO ENGINE

The component arrangement of the starter ring gear and torque converter drive plate is shown in fig. 9.

Before dismantling, mark all the components in relation to one another, to ensure that on reassembly the original balance is not affected.

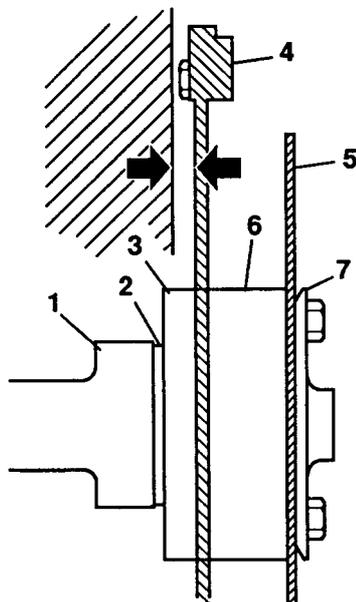
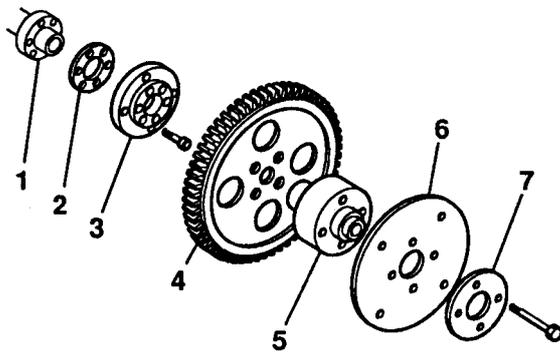


Fig.9

1. Crankshaft
2. Adjustment shim
3. Crankshaft adaptor
4. Starter ring gear and drive plate
5. Spacer / spigot aligner
6. Flexible drive plate
7. Chamfered clamping plate.

If any of the spacers or components on the rear of the crankshaft are renewed, it is very important that:

- The distance (arrowed) between the rear face of the cylinder block and the front face of the starter ring drive plate is maintained at 8,09 to 8,10 mm (0.318 to 0.323 in.). A range of shims is available to provide adjustment.
- When reassembling, ensure that the clamping plate (fig.9, 7) is fitted with the chamfered outer edge towards the flexible drive plate, and that the threads of the 4 retaining bolts are coated with Loctite 270 (Studlock) and tightened to the correct torque.



TORQUE WRENCH SETTINGS

There have been a number of changes to torque figures and the following is a current list.

	Nm	Lbf ft
Chainwheel to camshaft	45-55	33-41
Connecting rod bolt	47-54	35-40
Clutch attachment to flywheel	24-30	18-22
Cylinder head		
- Stage 1	20	15
- Stage 2	A further 90° ± 5°	
- Stage 3	A further 90° ± 5°	
Damper / pulley to crankshaft	258-285	190-210
Distributor clamp bolt	19-22	14-16
Exhaust manifolds to cylinder head		
- Pretighten	15	11
- Tighten	39-42	29-31
Fan to viscous unit	32-40	24-30
Fan / viscous unit to water pump	50-62	37-46
Flexible drive plate to crankshaft (Automatic)	75-81	55-60
Flywheel to crankshaft (manual)	75-81	55-60
Inlet manifold to cylinder heads		
- Pretighten	10	7
- Tighten	48-54	35-40
Main bearing cap bolts		
- Pretighten	13.6	10
- Tighten (except rear cap)	68-75	50-55
- Tighten (rear cap only)	88-95	65-70
Oil pressure switch to front cover	14-16	10-12
Rocker cover to cylinder head	7-10	5-7
Rocker shaft bracket to cylinder head	34-41	25-30
Spark plugs	19-22	14-16
Starter motor attachment	41-47	30-35
Sump drain plug	40-45	30-33
Sump to cylinder block	20-27	15-20
Thermostat housing to inlet manifold	24-30	18-22
Timing cover to cylinder block	20-23	15-17
Inlet manifold gasket clamp bolts	14-20	10-15
Water pump pulley to water pump hub	19-25	15-19
Water pump to cylinder block	20-23	15-17
Water pump to timing cover	22-28	16-21