Chapter 1
Routine maintenance and servicing

Contents

Degrees of difficulty

Easy, suitable for novice with little experience

Fairly easy, suitable for beginner with some experience

Fairly difficult, suitable for competent DIY mechanic

Difficult, suitable for experienced DIY mechanic

Very difficult, suitable for expert DIY or professional

Servicing Specifications

Lubricants, fluids and capacities

Refer to the end of *"Weekly checks"*

Engine

Oil filter type	Champion F208
Valve clearances	
SOHC engine	
Inlet	0.17 to 0.22 mm
Exhaust	0.22 to 0.27 mm
DOHC engine	
Inlet	0.13 to 0.17 mm
Exhaust	0.15 to 0.19 mm

Cooling system

Antifreeze properties – 50 % antifreeze (by volume)	
Commences freezing	-36°C
Frozen solid	-48°C
Air conditioning compressor drivebelt deflection	9 to 11 mm @ 10 kg force

Fuel system

Idle speed – nominal value for reference purposes only	800 ± 50 rpm
Base idle speed – EACV disconnected	550 ± 50 rpm
CO level at idle speed – engine at normal operating temperature	
Without catalytic converter	
SOHC engine	0.2 to 1.0%
DOHC engine	0.2 to 0.8%
With catalytic converter	0.1% maximum

Ignition system

Firing order	1-3-4-2 (No 1 cylinder at timing belt end)
Direction of crankshaft rotation	Anti-clockwise (viewed from left-hand side of vehicle)
Direction of distributor rotor arm rotation	Clockwise (viewed from right-hand side of vehicle)
Ignition timing (at specified idle speed)	
SOHC engine	18° + 2° BTDC
DOHC engine	16° + 2° BTDC
Spark plug types	
SOHC engine	Champion RC9YCC or RC9YC4
DOHC engine	Champion RC7YCC or RC7YC4
Spark plug electrode gap	1.0 mm
HT lead maximum resistance (per lead)	25 000 ohms

Braking system

Front and rear brake pad friction material minimum thickness	3.0 mm
Rear brake shoe friction material minimum thickness	2.0 mm

Steering

Power steering pump drivebelt deflection	9 to 12 mm @ 10 kg force

Tyre pressures

Refer to the end of *"Weekly checks"*

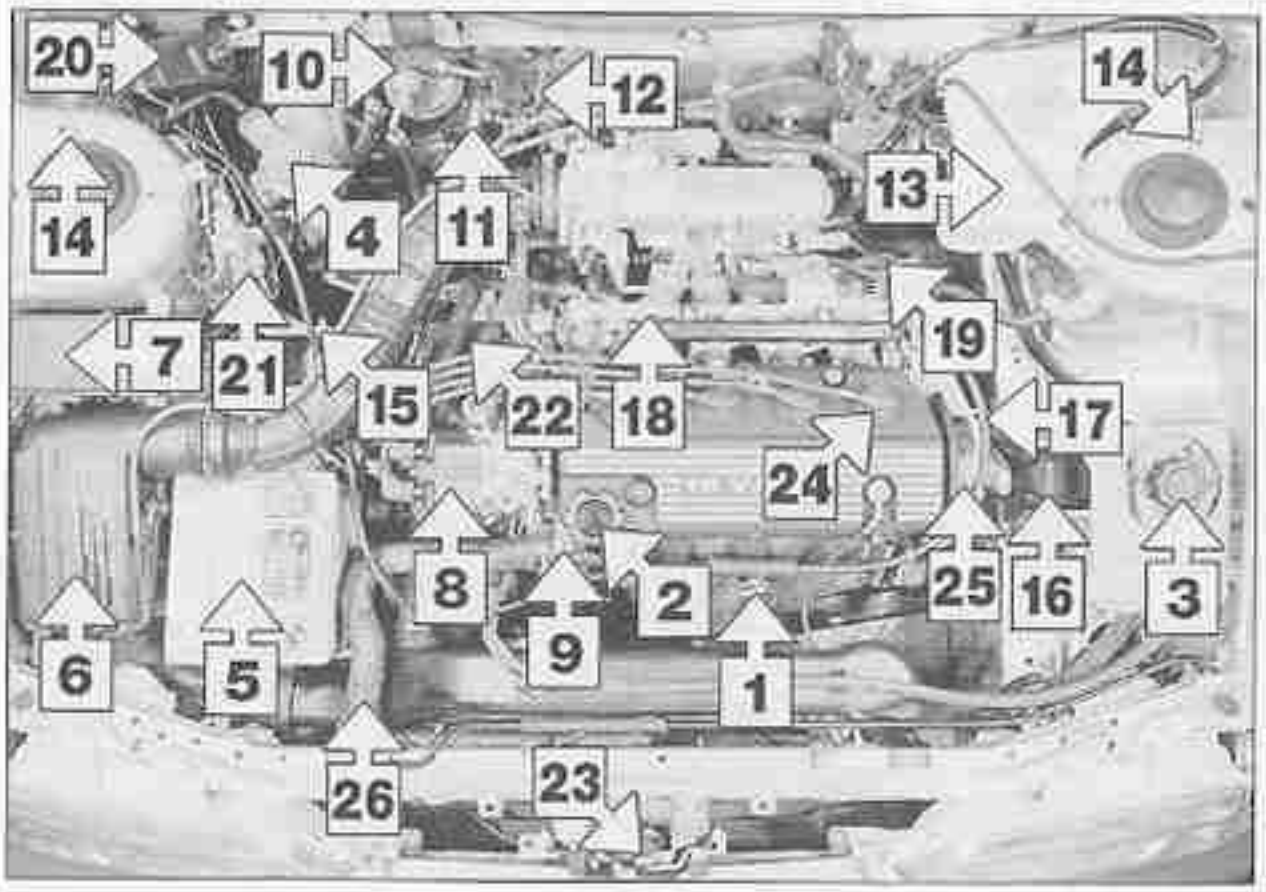
Electrical system

Alternator drivebelt deflection	9 to 11 mm @ 10 kg force
Wiper blade types – front and rear	Champion X-4503

Torque wrench settings

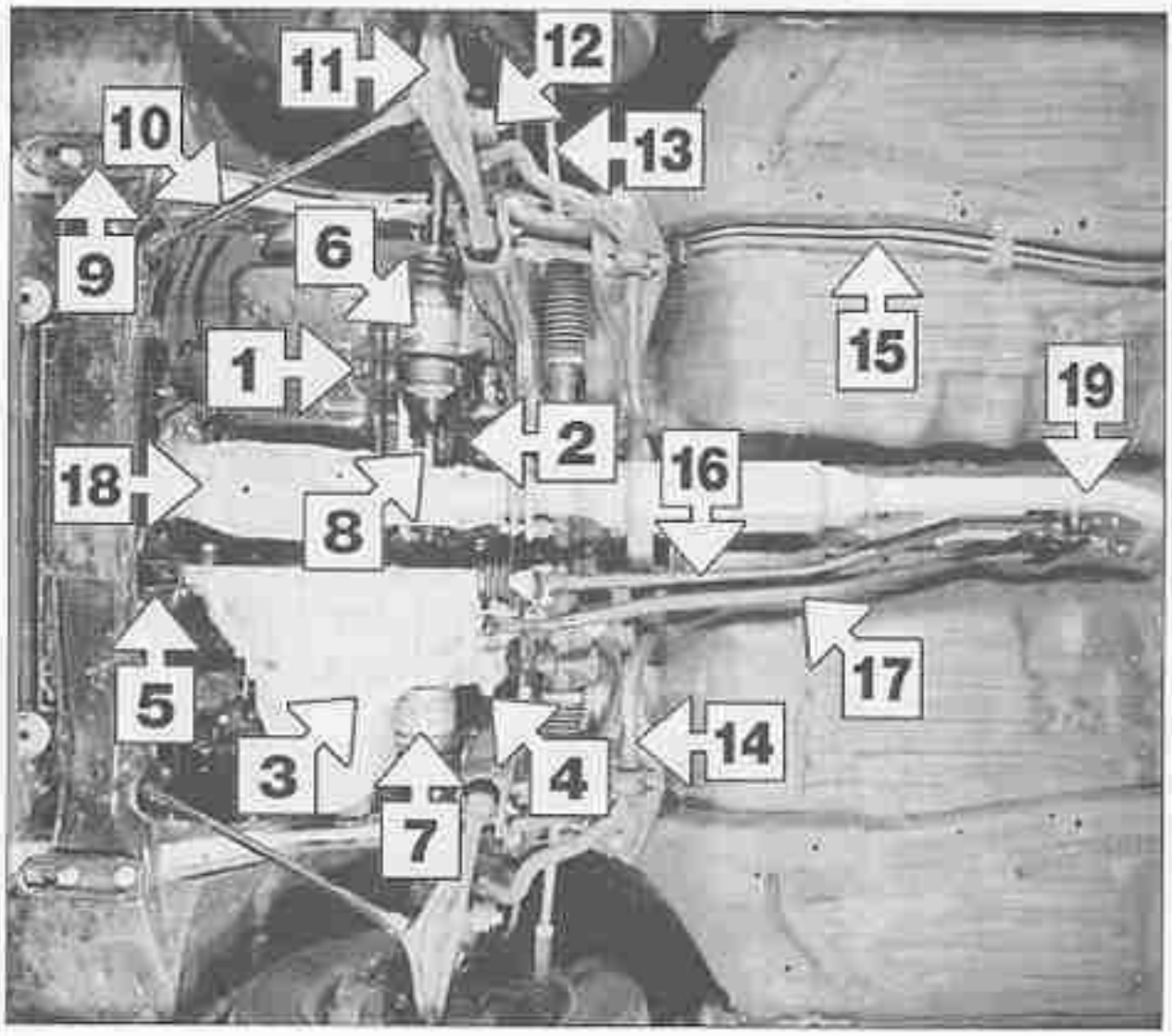
	Nm	lbf ft
Engine		
Oil drain plug	45	33
Rocker adjusting screw locknut	14	10
Cylinder block coolant drain plug	45	33
Air conditioning		
Compressor drivebelt adjuster pulley spindle bolt	48	35
Fuel system		
Filter mounting bolt	10	7
Filter outlet union nut	35	26
Filter inlet union nut	40	30
Ignition system		
Distributor mounting bolts	22	16
Spark plugs	18	13
Charging system		
Alternator pivot and adjusting link bolts	45	33
Manual gearbox		
Oil filler/level and drain plugs	45	33
Automatic transmission		
Oil drain plug	40	30
Steering		
Power steering pump		
Upper mounting bolt	45	33
Lower mounting bolt(s)	25	18
Roadwheel nuts	100	74

Underbonnet view of SOHC engine



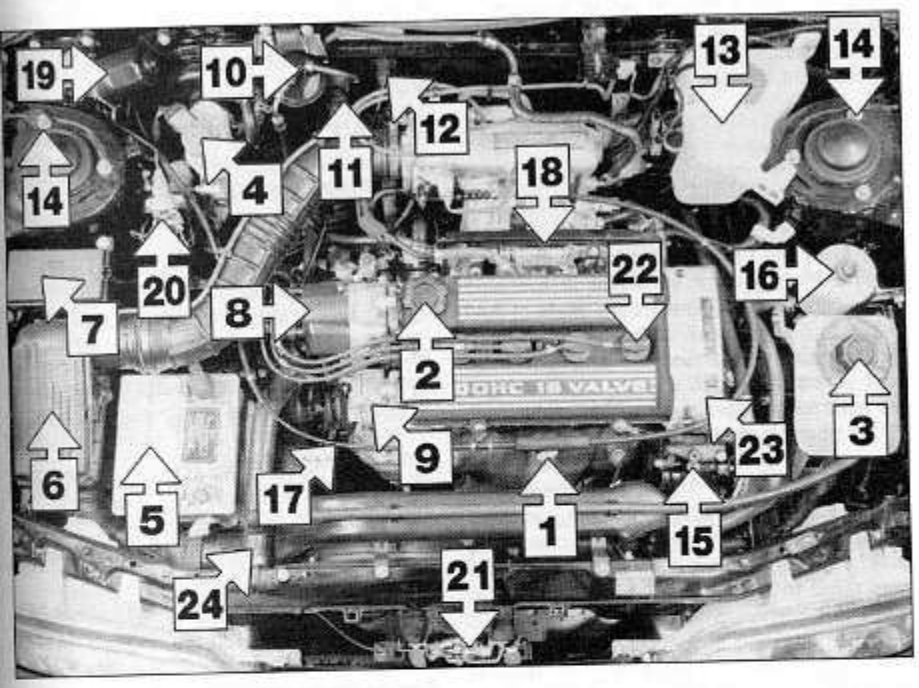
1 Engine oil level dipstick
2 Engine oil filler cap
3 Coolant expansion tank filler cap
4 Braking system fluid reservoir cap
5 Battery
6 Air cleaner housing
7 Engine compartment fusebox
8 Distributor
9 Cooling system bleed screw
10 Fuel filter
11 Clutch cable
12 Speedometer cable
13 Washer fluid reservoir
14 Front suspension strut mounting nuts
15 Right-hand engine/transmission mount
16 Left-hand engine/transmission mountin
17 Accelerator cable
18 Fuel rail and injectors
19 Alternator
20 Windscreen wiper motor
21 Braking system pressure-regulating val
– models without anti-lock brakes (ALB
22 Starter motor
23 Bonnet lock
24 No 1 cylinder HT lead
25 Timing belt cover
26 Radiator top hose

Front underbody view – undercover panel removed for clarity



1 Engine oil drain plug
2 Oil filter
3 Transmission oil drain plug
4 Transmission oil level plug
5 Front engine/transmission mounting
6 Left-hand driveshaft inner constant velocity joint
7 Right-hand driveshaft inner constant velocity joint
8 Intermediate shaft
9 Front towing eye
10 Front suspension tie-bar
11 Front suspension lower arm
12 Anti-roll bar connecting link
13 Steering gear track rod balljoint
14 Anti-roll bar
15 Fuel lines
16 Gearchange mechanism selector rod
17 Gearchange mechanism steady rod
18 Front exhaust pipe shield
19 Intermediate exhaust pipe

Underbonnet view of DOHC engine



1 Engine oil level dipstick
2 Engine oil filler cap
3 Coolant expansion tank filler cap
4 Braking system fluid reservoir cap
5 Battery
6 Air cleaner housing
7 Engine compartment fusebox
8 Distributor
9 Cylinder position sensor housing
10 Fuel filter
11 Clutch cable
12 Speedometer cable
13 Washer fluid reservoir
14 Front suspension strut mounting nuts
15 Power steering pump
16 Power steering fluid reservoir
17 Accelerator cable
18 Fuel rail and injectors
19 Windscreen wiper motor
20 Braking system pressure-regulating valve – models without anti-lock brakes (ALB)
21 Bonnet lock
22 No 1 cylinder HT lead
23 Timing belt cover
24 Radiator top hose

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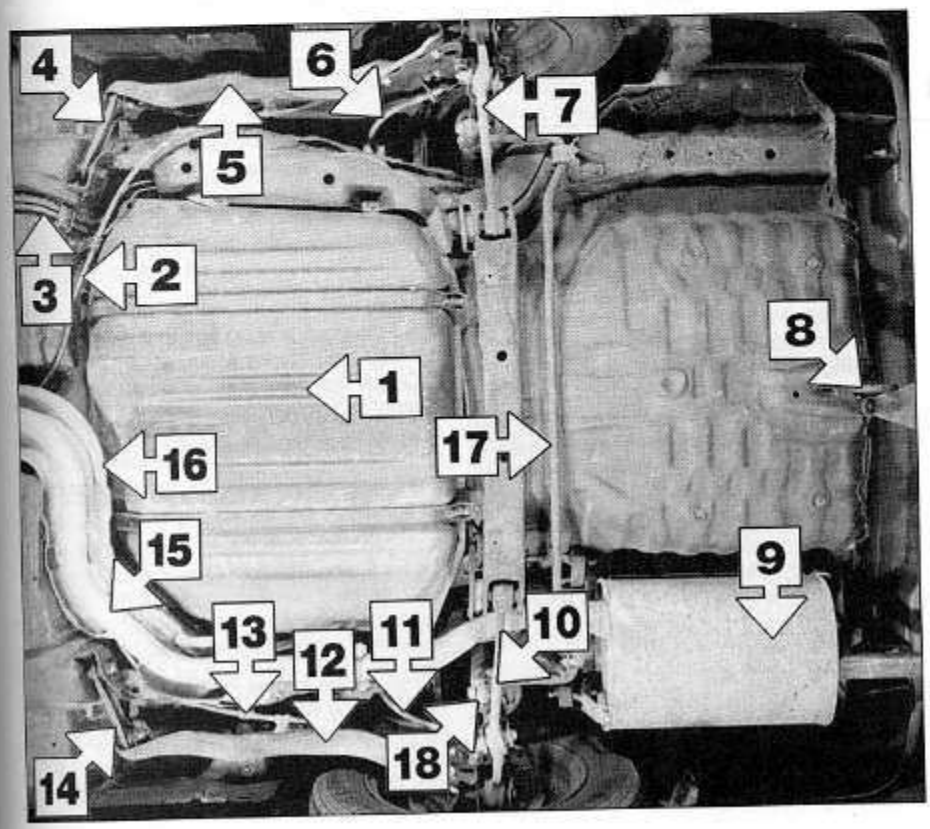
Rear underbody view



1 Fuel tank
2 Left-hand handbrake cable
3 Fuel lines
4 Rear suspension left-hand front lateral link
5 Rear suspension left-hand trailing arm
6 Flexible brake hose
7 Rear suspension left-hand rear lower lateral link
8 Rear towing eye
9 Exhaust tailpipe
10 Rear suspension right-hand rear lower lateral link
11 Flexible brake hose
12 Rear suspension right-hand trailing arm
13 Right-hand handbrake cable
14 Rear suspension right-hand front lateral link
15 Intermediate exhaust pipe
16 Exhaust heatshield
17 Rear suspension anti-roll bar
18 Rear suspension anti-roll bar connecting link

9 Engine oil and filter renewal

1 Before starting this procedure, gather together all the necessary tools and materials. Also make sure that you have plenty of clean rags and newspapers handy, to mop up any spills.

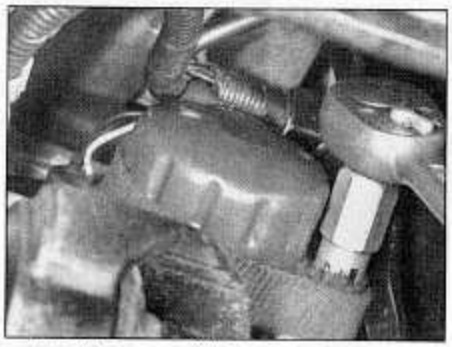
2 Ideally, the engine oil should be warm as it will drain better and more built-up sludge will be removed with it. Take care however, not to touch the exhaust or any other hot parts of the engine when working under the vehicle. To avoid any possibility of scalding and to protect yourself from possible skin irritants and other harmful contaminants in used engine oils, it is advisable to wear gloves when carrying out this work.

3 Remove the oil filler cap. The engine oil drain plug is located at the rear of the sump and is easily reached without having to raise the vehicle. Loosen the drain plug about half a turn. Position a container under the drain plug, then remove the plug completely.

> **HAYNES HiNT** ***Keep the plug pressed into the sump while unscrewing it by hand the last couple of turns. As the plug releases from the threads, move the plug away sharply so the stream of oil issuing from the sump runs into the container, not up your sleeve.***

4 Allow some time for the old oil to drain, noting that it may be necessary to reposition the container as the flow of oil slows to a trickle. Work can be speeded-up by removing the oil filter while the oil is draining.

5 After all the oil has drained, wipe off the drain plug with a clean rag and renew its sealing washer. Clean the area around the drain plug opening and refit the plug. Tighten the plug to the specified torque setting.



9.7 Using an oil filter removal tool to slacken the filter

6 Move the container into position under the oil filter, which is located above the drain plug on the rear of the engine.

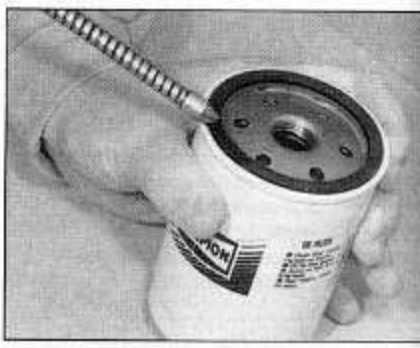
7 Use an oil filter removal tool to slacken the filter initially, then unscrew it by hand the rest of the way **(see illustration)**. Empty the oil in the old filter into the container and allow any residual oil to drain out of the engine.

8 Use a clean rag to remove all oil, dirt and sludge from the filter sealing area on the engine. Check the old filter to make sure that the rubber sealing ring has not stuck to the engine. If it has, carefully remove it.

9 Apply a light coating of clean engine oil to the new filter's sealing ring **(see illustration)** and screw the filter into position on the engine until it seats, then tighten it through a further half-turn. Tighten the filter by hand only.

10 Remove the old oil and all tools from under the vehicle.

11 Refill the engine with fresh oil of the correct grade and type. Pour in half the specified quantity of oil first, then wait a few minutes for the oil to fall to the sum Continue adding oil, a small quantity at a tim until the level is up to the lower mark on th dipstick. Adding approximately a further half litre will bring the level up to the upper ma on the dipstick.



9.9 Apply a light coating of clean oil to th oil filter sealing ring before fitting

12 Start the engine and run it for a fe minutes, then check for leaks around the filter seal and the sump drain plug.

13 Switch off the engine and wait a fe minutes for the oil to settle in the sump onc more. Now the new oil has circulated and th filter is completely full, recheck the level o the dipstick, adding more oil as necessary.

14 Dispose of the used engine oil safely.

OIL CARE FOLLOW THE FUEL

OIL BANK LINE 0800 66 33 66

Note: It is antisocial and illegal to dump o down the drain. To find the location of your local oil recyclin bank, call this number free.

12 000 Mile / 20 000 km Service

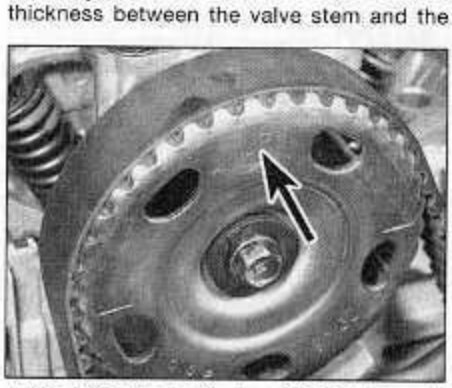
10 Valve clearance check and adjustment

Note: *Valve clearances must be checked and adjusted with the engine cold (cylinder head below 38°C).*

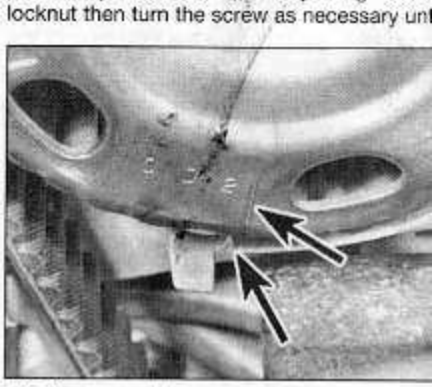
SOHC engine

1 Position No 1 piston at TDC, then remove the cylinder head cover and upper timing belt cover as described in Chapter 2. With No 1 piston at TDC, the lower mark on the camshaft sprocket will be aligned with the mark on the upper inner timing belt cover and the UP mark on the sprocket will be at the top **(see illustrations)**.

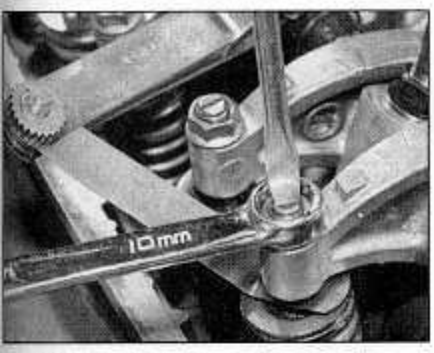
2 With the engine in this position, check that the clearances of No 1 cylinder's four valves are as specified. Clearances are checked by inserting a feeler blade of the correct thickness between the valve stem and the rocker adjusting screw. If adjustment i necessary, slacken the adjusting scre locknut then turn the screw as necessary unt



10.1a With No 1 cylinder at TDC, UP mark (arrowed) on the camshaft sprocket is at the top . . .



10.1b . . . and lower mark aligns with the pointer on the timing belt inner cover (arrowed) - SOHC engine



10.2 Adjusting a valve clearance - SOHC engine

the feeler blade is a light sliding fit **(see illustration)**. Once the correct clearance is obtained, hold the adjusting screw and tighten the locknut to the specified torque. Recheck the valve clearance and adjust again if necessary.

3 Once all No 1 cylinder's valves are correctly adjusted, rotate the crankshaft 180° in an anti-clockwise direction to bring No 3 piston to TDC. Note that the UP mark on the camshaft will move through 90° and will now be on the exhaust side of the sprocket. Check and, if necessary, adjust the clearances of No 3 cylinder's four valves as described in paragraph 2.

4 Once all No 3 cylinder's valves are correctly adjusted, rotate the crankshaft a further 180°, again in an anti-clockwise direction, to bring No 4 piston to TDC. The UP mark on the camshaft sprocket will move a further 90° and will now be at the bottom. Check and, if necessary, adjust the clearances of No 4 cylinder's four valves as described in paragraph 2.

5 Once all No 4 cylinder's valves are correctly adjusted, rotate the crankshaft a further 180°, again in an anti-clockwise direction, to bring No 2 piston to TDC. The UP mark will again move through a further 90° and will now be on the inlet side of the sprocket. Check and, if necessary, adjust the clearances of No 2 cylinder's four valves as described in paragraph 2.

6 With all valve clearances checked, refit the cylinder head cover and upper timing belt cover.

DOHC engine

7 Position No 1 piston at TDC and remove the cylinder head cover as described in Chapter 2. With No 1 piston at TDC, the UP marks on the camshaft sprockets will be in the 12 o'clock (uppermost) position and the index marks on each sprocket will align with the upper cylinder head mating surface in the 9 o'clock and 3 o'clock positions **(see illustration)**.

8 With the engine in this position, check the clearances of No 1 cylinder's four valves as described in paragraph 2, noting that the feeler blade should be inserted between the camshaft lobe and rocker arm bearing surface **(see illustration)**.

9 Once all No 1 cylinder valves are correctly adjusted, rotate the crankshaft 180° in an anti-clockwise direction to bring No 3 piston to TDC. Note that the UP marks on the camshaft sprockets will move through 90° and will now be aligned with the cylinder head mating surface on the exhaust side of each sprocket. Check and, if necessary, adjust the clearances of No 3 cylinder's four valves as described in paragraph 2.

10 Once all No 3 cylinder valves are correctly adjusted, rotate the crankshaft a further 180°, again in an anti-clockwise direction, to bring No 4 piston to TDC. The UP marks on the camshaft sprocket will move a further 90° and will now be in the 6 o'clock (lowest) position. Check and, if necessary, adjust the clearances of No 4 cylinder's four valves as described in paragraph 2.

11 Once all No 4 cylinder valves are correctly adjusted, rotate the crankshaft a further 180°, again in an anti-clockwise direction, to bring No 2 piston to TDC. The UP marks will again move through a further 90° and will now be aligned with the cylinder head mating surface on the inlet side of each sprocket. Check and, if necessary, adjust the clearances of No 2 cylinder's four valves as described in paragraph 2.

12 With all valve clearances checked, refit the cylinder head cover.

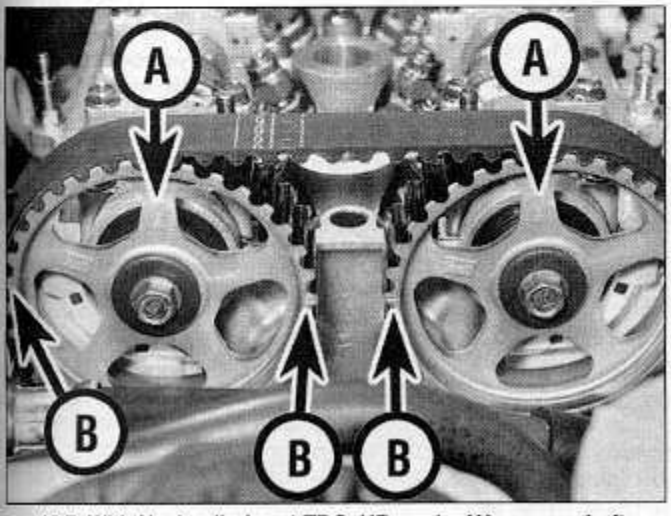
11 Coolant renewal

Warning: Wait until the engine is cold before renewing the coolant. Do not allow antifreeze to come in contact with your skin or painted surfaces of the vehicle. Rinse off spills immediately with plenty of water. Never leave antifreeze lying around in an open container, in a puddle in the driveway or on the garage floor. Children and pets are attracted by its sweet smell. Antifreeze is fatal if ingested.

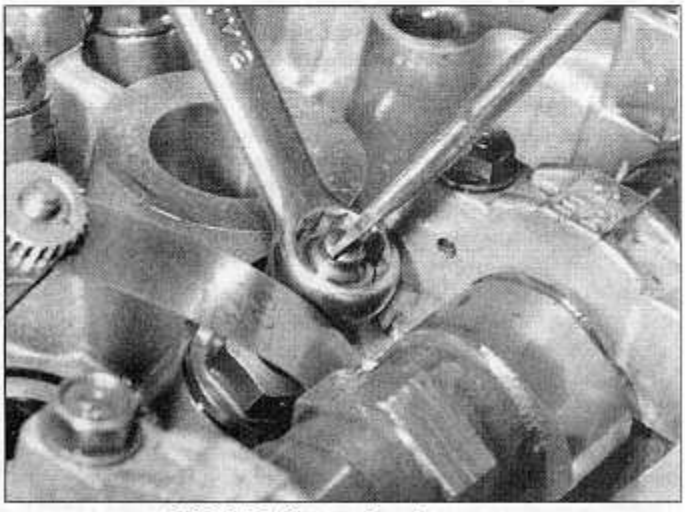
Antifreeze mixture

1 Antifreeze should always be renewed at the specified interval. This is necessary not only to maintain the antifreeze properties but also to prevent corrosion which would otherwise occur as the corrosion inhibitors (present in good-quality antifreeze) become progressively less effective.

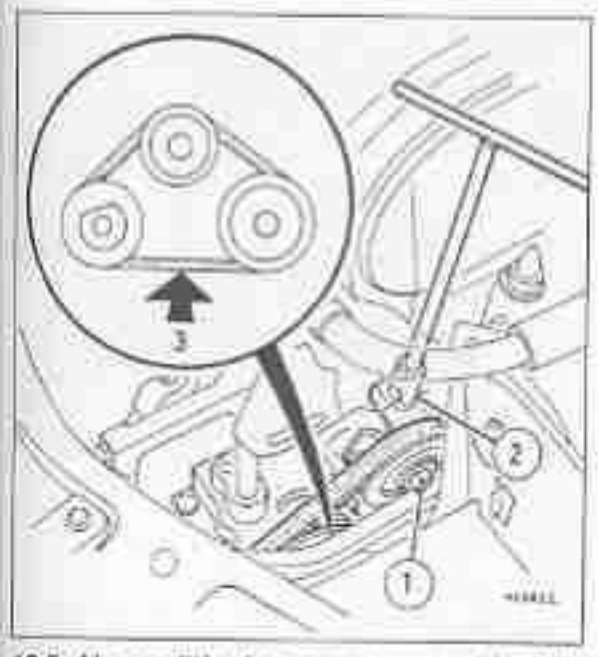
2 Always use an ethylene glycol-based antifreeze which is suitable for use in mixed-metal cooling systems. The type of antifreeze and levels of protection afforded are indicated in the Specifications. To give the recommended 50% concentration, 2.75 litres



10.7 With No 1 cylinder at TDC, UP marks (A) on camshaft sprockets are at the top and lines (B) on sprockets align with the cylinder head surface - DOHC engine



10.8 Adjusting a valve clearance - DOHC engine



12.5 Air conditioning compressor drivebelt adjustment

1 Adjuster (idler) pulley spindle bolt
2 Adjuster bolt
3 Drivebelt tension checking point

12 Air conditioning system compressor drivebelt check, adjustment and renewal

1 Where fitted, the air conditioning compressor is situated on the front left-hand end of the engine and is driven by the crankshaft pulley via a belt. Due to its function and material make-up, the drivebelt is prone to failure after a period of time and should therefore be inspected and adjusted periodically, as follows:

Checking

2 Apply the handbrake, then jack up the front of the vehicle and support it on axle stands (see *"Jacking and Vehicle Support"*). Remove the left-hand front roadwheel.

3 From underneath the front of the vehicle, remove the three bolts securing the bumper flange to the body. Remove the seven bolts securing the front undercover panel to the body and remove the panel.

4 Check the drivebelt for cracks, splitting, fraying or damage. Rotate the crankshaft using a suitable spanner applied to the crankshaft pulley retaining bolt so that the entire length of the belt is examined. Check also for signs of glazing (shiny patches) and for separation of the belt plies. Renew the belt if worn or damaged.

5 Drivebelt tension is checked by measuring the amount of deflection that takes place when a force equivalent to 10 kg is applied using a spring balance, or similar, midway between the crankshaft and air conditioning compressor pulleys on the belt's lower run. A rough check can be made using firm finger pressure. If the deflection measured is any more or less than that specified, the drivebelt must be adjusted as follows **(see illustration)**.

Adjustment

6 Slacken the drivebelt adjuster (idler) pulley spindle nut and bolt, then rotate the adjuster bolt (situated on the upper side of the pulley assembly) clockwise or anti-clockwise, as required, to obtain the correct belt tension.

7 When the correct tension is achieved, tighten the adjuster pulley spindle bolt and nut to the specified torque setting, then rotate the crankshaft several times to settle the drivebelt. Recheck the belt tension, repeating the adjustment procedure if necessary.

8 Refit the undercover panel and roadwheel, then lower the vehicle to the ground.

Renewal

9 Carry out the operations in paragraphs 2 and 3. If the vehicle is also equipped with power steering, remove the power steering pump drivebelt.

10 Slacken the drivebelt adjuster (idler) pulley spindle nut and bolt, then slacken the adjuster bolt until the drivebelt can be slipped off the pulleys and removed from the vehicle.

11 Clean the belt pulleys carefully, removing all traces of oil or grease and checking that their grooves are clear.

12 Fit the new belt to the pulleys, tighten the adjuster bolt until the tension is approximately correct, then check and adjust the tension. Refit and adjust the power steering pump drivebelt.

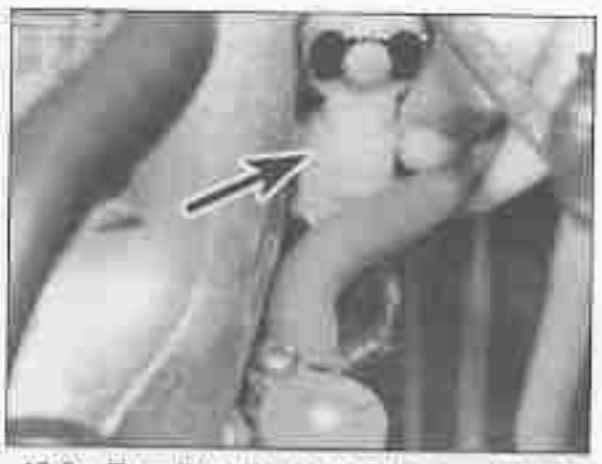
13 Start the engine, and allow it to idle at the specified speed for approximately 10 minutes to settle the drivebelt in position. Stop the engine, then recheck the drivebelt tension and, if necessary, repeat the adjustment procedure.

14 Refit the undercover panel and roadwheel, then lower the vehicle to the ground.

13 Base idle speed and idle mixture CO content check and adjustment

1 Before carrying out the following adjustments, check the following:

a) Check that the ignition timing is set accurately
b) Check that the spark plugs are in good condition and correctly gapped
c) Check that the throttle cable is correctly adjusted
d) Check that the crankcase breather hoses are sound, with no leaks, kinks or blockages
e) Check that the air cleaner filter element is clean and that the exhaust system is in good condition
f) If the engine is running very roughly, check the compression pressures and adjust the valve clearances
g) Check that the PGM-FI warning lamp/engine management ECU LED are not flashing



13.2a To adjust the base idle speed, first disconnect the wiring connector (arrowed) from the EACV

13.2b Base idle speed adjusting screw (arrowed) is situated on top of the throttle housing

Base idle speed

2 Start the engine, warm it up to normal operating temperature, then switch it off and disconnect the wiring connector from the idle speed electronic air control valve (EACV), which is mounted on the right-hand side of the rear of the inlet manifold. The base idle speed adjusting screw is situated on the top of the throttle housing **(see illustrations)**.

3 Start the engine, then slowly increase the engine speed to 2000 rpm and hold it there for ten seconds. Allow the engine to idle and check that it is idling at the specified base idle speed. If adjustment is required, turn the base idle speed adjusting screw in or out, as necessary.

4 Slowly raise the engine speed to 1000 rpm, then allow the engine to idle again and check that the engine speed returns to the specified base idle speed, adjusting again if necessary.

5 Once the base idle speed is correctly set, stop the engine. Remove the hazard warning lamp fuse from the engine compartment fusebox for ten seconds, to erase the EACV fault code from the engine management ECU memory.

6 Reconnect the EACV wiring connector, start the engine and raise the engine speed to 2000 rpm for ten seconds. Allow the engine to idle and check that it idles smoothly within the specified idle speed limits. Switch on the heated rear window and check that the idle speed remains within the specified limits. If all is well, switch off the engine. If the idle speed

HAYNES HiNT ***Even with the ignition system in first class condition, some engines may still occasionally experience poor starting, attributable to damp ignition components. To disperse moisture, use a water-repelling aerosol spray.***

Spark plug (HT) leads

1 The spark plug (HT) leads should be checked whenever new spark plugs are fitted.
2 Ensure that the leads are numbered before removing them, to avoid confusion when refitting. Pull the leads from the plugs by gripping the end fitting, not the lead, otherwise the lead connection may be fractured.
3 Check inside the end fitting for signs of corrosion, which will look like a white crusty powder. Push the end fitting back onto the spark plug, ensuring that it is a tight fit on the plug (there should be a soft 'click' as the lead is connected). If not, remove the lead again and use pliers to carefully crimp the metal connector inside the end fitting until it fits securely on the end of the spark plug.
4 Using a clean rag, wipe the entire length of the lead to remove any built-up dirt and grease. Once the lead is clean, check for burns, cracks and other damage. Do not bend the lead excessively or pull the lead lengthwise or the conductor inside might break.
5 Disconnect the other end of the lead from the distributor cap. Again, pull only on the end fitting. Check for corrosion and a tight fit in the same manner as the spark plug end. If an ohmmeter is available, check the resistance of the lead by connecting the meter between the spark plug end of the lead and the segment inside the distributor cap. Refit the lead securely on completion.
6 Check the remaining leads one at a time, in the same way.
7 If new spark plug (HT) leads are required, purchase a set for your specific vehicle and engine, referring to a Rover dealer in the first instance.

Distributor cap and rotor arm

8 Unscrew its retaining screws, then remove the distributor cap.
9 Wipe the cap clean and carefully inspect it inside and out for signs of cracks, carbon tracks (tracking) and worn, burnt or loose contacts. Check that the cap's carbon brush is unworn, free to move against spring pressure and making good contact with the rotor arm. Also, inspect the cap seal for signs of wear or damage and renew if necessary. Similarly, slacken the rotor arm retaining grub screw **(see illustration)** and remove the arm from the distributor shaft for inspection.
10 If checking components with a meter, note that the rotor arm has an in-built resistor. Renew any components which are found to be faulty. It is common practice to renew the cap and rotor arm whenever new spark plug (HT) leads are fitted. On refitting, tighten the rotor arm grub screw and the cap retaining screws securely.

17 Clutch check

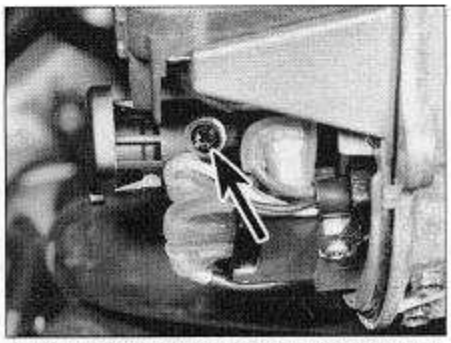
1 Check that the clutch pedal moves smoothly and easily through its full travel and that the clutch itself functions correctly, with no trace of slip or drag. Adjust the clutch cable as described in Chapter 6.
2 If excessive effort is required to operate the clutch, check first that the cable is correctly routed and undamaged, then remove the pedal to ensure that its pivot is properly greased, see Chapter 6.

18 Manual gearbox oil level check

1 Even though this makes access awkward, the oil level must be checked with the vehicle standing on its wheels on level ground. Also, the level must be checked before the vehicle is driven, or after waiting at least 5 minutes after the engine has been switched off.
Caution: If the oil is checked immediately after driving the vehicle, some of the oil will remain distributed around the gearbox components, resulting in an inaccurate level reading.
2 Wipe clean the area around the filler/level plug, which is located at the rear of the gearbox, next to the right-hand driveshaft inner constant velocity joint. Unscrew the plug and clean it, discarding the sealing washer.
3 The oil level should reach the lower edge of the filler/level hole **(see illustration)**. A certain amount of oil will have gathered behind the filler/level plug and will trickle out when it is removed. This does not necessarily indicate that the level is correct. To ensure that a true level is established, wait until the initial trickle has stopped, then add oil as necessary until a trickle of new oil can be seen emerging. The level will be correct when the flow ceases. Use only good-quality oil of the specified type (see *"Lubricants and fluids"*).
4 Replenishing the gearbox is an extremely awkward operation. Above all, allow plenty of time for the oil level to settle properly before checking it. If a large amount of oil has to be added to the gearbox and a large amount flows out on checking the level, refit the filler/level plug and take the vehicle on a short journey so that the new oil is distributed fully around the gearbox components, then recheck the level when it has settled again.
5 If the gearbox has been overfilled so that oil flows out as soon as the filler/level plug is removed, check that the vehicle is completely level (front-to-rear and side-to-side) and allow any surplus to drain off into a suitable container.
6 With the oil level correct, fit a new sealing washer to the filler/level plug and tighten the plug to the specified torque wrench setting. Wash off any spilt oil.

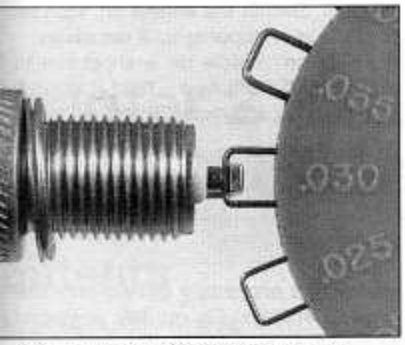
19 Automatic transmission fluid level check

1 Take the vehicle on a short journey to warm the transmission up to normal operating temperature, then park the vehicle on level ground. The fluid level is checked by using the dipstick located at the front of the transmission unit, next to the unit fluid cooler hoses. Note that the fluid level must be checked within one minute of returning from the warm-up journey.
2 Withdraw the dipstick from the tube and wipe all the fluid from its end with a clean rag or paper towel. Insert the clean dipstick back into the tube as far as it will go, then withdraw it once more. Note the oil level on the end of the dipstick. Add fluid as necessary until the level is between the upper (MAX) and

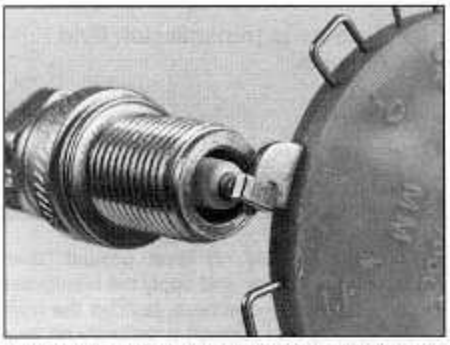


16.9 Distributor rotor arm is retained by a grub screw (arrowed)

18.3 Manual gearbox is refilled via filler/level plug hole (arrowed)



36.10a Measuring the spark plug electrode gap with a wire gauge



36.10b Adjusting the spark plug electrode gap with a special tool

m most motor accessory shops **(see strations)**.

tting

Before fitting the spark plugs, check that threaded connector sleeves on the plug s are tight and that the plug exterior faces and threads are clean. To make ure removal of the plugs easier, apply a ear of copper-based brake grease to the g threads.

Check the spark plug (HT) leads, then onnect them in their correct order and refit components removed for access.

7 Ignition timing check and adjustment

Warning: Voltages produced by an electronic ignition system are considerably higher than those produced by conventional ition systems. Extreme care must be en when working on a system with the ition switched on. Persons with gically-implanted cardiac pacemaker vices should keep well clear of the ition circuits, components and test uipment.

hecking

Position the front wheels on full left-hand k, then remove the rubber grommet from left-hand side of the undercover panel to n access to the crankshaft pulley bolt. ng a socket and extension bar, fit a socket o the crankshaft pulley bolt.

Clean the crankshaft pulley rim, rotating the ley anti-clockwise. The timing marks are as ows.

The pulley has a total of four notches - a all group of three, then a single notch just the right of the group of three. The single tch is the TDC indicator. The pulley marks gn with a pointer (in the form of a set of ghts") which are cast into the lower timing t cover. These "sights" work in the same y as the sights of a rifle, the upper pointer gning with a lower notch on the lower timing t.

With the single notch aligned with the pointer, the engine is at TDC with either No 1 or No 4 cylinder on compression.

5 The group of three notches form the ignition timing marks. When the centre notch (highlighted with red paint) is aligned with the pointer on the lower timing belt cover, the crankshaft is in the specified ignition timing position for cylinder Nos 1 and 4. The two marks on either side of the centre mark indicate the 2° ignition timing tolerance **(see illustration)**.

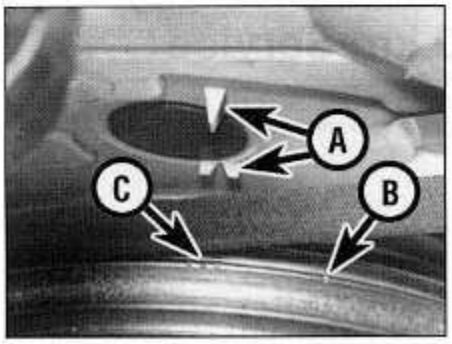
6 To check the ignition timing, first warm the engine up to normal operating temperature (until the cooling cuts in), then switch it off. Remove the yellow cap from the ignition timing adjuster wiring terminal (situated beside the windscreen washer reservoir pump) and connect the two terminal wires together by using a short piece of wire or a split pin **(see illustration)**. Connect a timing light to No 1 cylinder (nearest the timing belt end of the engine) HT lead, as described in the equipment manufacturer's instructions.

7 Start the engine and allow it to idle at the specified speed. Aim the timing light at the crankshaft pulley and check that the centre one of the three crankshaft pulley timing notches (highlighted in red), or one of the tolerance notches, aligns with the pointer on the timing belt lower cover.

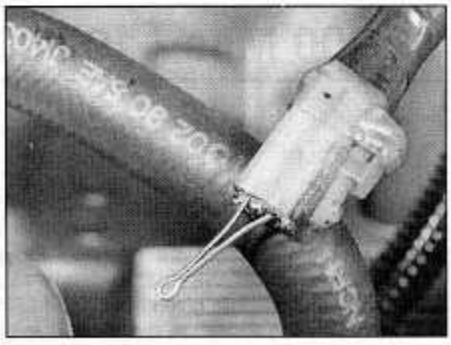
Adjustment

8 If adjustment is required, slacken the distributor mounting bolts until the distributor body is just able to rotate, then turn the body clockwise (viewed from the vehicle's right-hand side) to retard the ignition timing, or anti-clockwise to advance it, until the centre timing mark is aligned with the timing belt cover pointer. Tighten the bolts to their specified torque wrench setting, then recheck the ignition timing to ensure that it has not altered.

9 With the ignition timing correctly set, turn off the engine and disconnect the timing light. Remove the wire from the timing adjuster terminal and refit the terminal cap. Refit the grommet to the undercover panel.

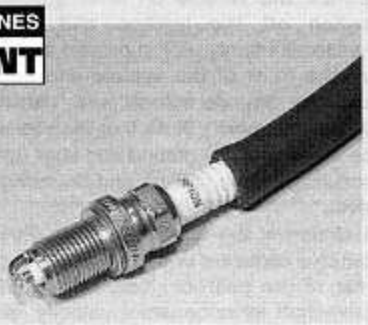


37.5 Timing belt cover pointer (A), crankshaft pulley TDC notch (B) and crankshaft pulley ignition timing marks (C)



37.6 Using a split pin to connect the ignition timing adjuster terminals together

HAYNES HiNT



It is often difficult to insert spark plugs into their holes without cross-threading them. To avoid this possibility, fit a short length of 5/16 inch internal diameter rubber hose over the end of the spark plug. This hose acts as a universal joint, to help align the plug with the plug hole. Should the plug begin to cross-thread, the hose will slip on the spark plug, thereby preventing thread damage to the aluminium cylinder head. Remove the rubber hose and tighten the plug to the specified torque using the spark plug socket and a torque wrench.

38 Manual gearbox oil renewal

Draining

1 Take the vehicle on a journey of sufficient length to warm the gearbox up to normal operating temperature.

1

Chapter 2 Part A:
Engine in-car repair procedures

Contents

Degrees of difficulty

Easy, suitable for novice with little experience

Fairly easy, suitable for beginner with some experience

Fairly difficult, suitable for competent DIY mechanic

Difficult, suitable for experienced DIY mechanic

Very difficult, suitable for expert DIY or professional

Specifications

General

ype	Sixteen-valve, four-cylinder, in-line, four-stroke, water-cooled
esignation	
Pre 1992 models	D16
Post 1992 SOHC with manual gearbox	D16A6
Post 1992 SOHC with automatic transmission	D16Z2
Post 1992 DOHC	D16A8
ore	75.00 mm
troke	90.00 mm
apacity	1590 cc
iring order	1 -3-4-2 (No 1 cylinder at timing belt end)
irection of crankshaft rotation	Anti-clockwise (viewed from the left-hand side of vehicle)
ompression ratio	
SOHC engine	9.1: 1
DOHC engine	9.5: 1
linimum compression pressure	10.3 bar
laximum compression pressure difference between cylinders	1.4 bar
laximum power (EEC)	
SOHC engine	116 PS (85 kW) @ 6300 rpm
DOHC engine with automatic transmission	124 PS (91 kW) @ 6800 rpm
DOHC engine with manual gearbox	130 PS (96 kW) @ 6800 rpm

Cylinder block

laterial	Aluminium alloy
ylinder bore diameter	
Standard	75.00 to 75.02 mm
Service limit	75.07 mm
1st oversize (0.25 mm)	75.25 to 75.27 mm
2nd oversize (0.50 mm)	75.50 to 75.52 mm
laximum cylinder bore ovality	N/A
laximum cylinder bore taper	0.05 mm
laximum gasket face distortion	0.10 mm

Crankshaft

Number of main bearings	5
Main bearing journal running clearance	
Standard	
Nos 1, 2, 4 and 5 journals	0.024 to 0.042 mm
No 3 journal	0.030 to 0.048 mm
Service limit - all journals	0.050 mm
Maximum difference between main bearing journal running clearances	0.010 mm
Crankpin (big-end) journal running clearance	
Standard	0.020 to 0.038 mm
Service limit	0.050 mm
Maximum difference between crankpin journal running clearances	0.030 mm
Crankshaft endfloat	
Standard	0.10 to 0.35 mm
Service limit	0.45 mm
Maximum difference between journal diameters (ovality/taper limit)	
Standard	0.0025 mm
Service limit	0.010 mm
Crankshaft main bearing journal run-out	
Standard	0.03 mm
Service limit	0.06 mm

Pistons and piston rings

Piston diameter	
Standard	74.98 to 74.99 mm
Service limit	74.97 mm
1st oversize (0.25 mm)	75.23 to 75.24 mm
2nd oversize (0.50 mm)	75.48 to 75.49 mm
Piston-to-bore clearance	
By direct measurement	
Standard	0.01 to 0.04 mm
Service limit	0.05 mm
Using feeler gauge	0.08 mm
Piston ring end gaps - fitted in bore	
Top compression ring	
Standard	0.015 to 0.030 mm
Service limit	0.6 mm
Second compression ring	
Standard	0.30 to 0.45 mm
Service limit	0.6 mm
Oil control ring	
Standard	0.2 to 0.6 mm
Service limit	0.8 mm
Piston ring-to-groove clearance	
Top compression ring	
Standard	0.03 to 0.06 mm
Service limit	0.13 mm
Second compression ring	
Standard	0.030 to 0.055 mm
Service limit	0.6 mm
Oil control ring	N/A

Gudgeon pins

Diameter	
Standard	18.994 to 19.000 mm
Oversize	18.997 to 19.003 mm
Maximum gudgeon pin-to-piston clearance	0.010 mm
Fit in connecting rod	Interference

Connecting rods

Big-end cap endfloat	
Standard	0.15 to 0.30 mm
Service limit	0.4 mm

Cylinder head

Material	Aluminium alloy
Minimum acceptable height after machining	
SOHC engine	94.8 mm
DOHC engine	131.8 mm
Maximum acceptable gasket face distortion	0.05 mm
Valve seat angle	45°
Valve seat width	
Standard - SOHC engine	
Inlet valve	0.85 to 1.15 mm
Exhaust valve	1.25 to 1.55 mm
Standard - DOHC engine	
Inlet and exhaust valves	1.25 to 1.55 mm
Service limit - SOHC engine	
Inlet valve	1.6 mm
Exhaust valve	2.0 mm
Service limit - DOHC engine	
Inlet and exhaust valves	2.0 mm
Seat cutter correction angle	
Upper	30°
Lower	60°
Valve guide protrusion	16.2 mm

Rocker shaft - SOHC engine

Running clearance	0.08 mm

Valves

Length - new	
Inlet	
SOHC engine	114.82 to 115.12 mm
DOHC engine	105.18 to 105.48 mm
Exhaust	
SOHC engine	118.60 to 118.90 mm
DOHC engine	104.47 to 104.77 mm
Head diameter - new	
Inlet	
SOHC engine	28.9 to 29.1 mm
DOHC engine	29.9 to 30.1 mm
Exhaust	
SOHC engine	24.9 to 25.1 mm
DOHC engine	26.9 to 27.1 mm
Head thickness	
Inlet – SOHC engine	
Standard	0.85 to 1.15 mm
Service limit	0.65 mm
Inlet – DOHC engine	
Standard	1.05 to 1.35 mm
Service limit	1.00 mm
Exhaust – SOHC engine	
Standard	1.05 to 1.35 mm
Service limit	0.95 mm
Exhaust – DOHC engine	
Standard	1.65 to 1.95 mm
Service limit	1.45 mm
Stem diameter	
Inlet – SOHC engine	
Standard	5.48 to 5.49 mm
Service limit	5.45 mm
Inlet – DOHC engine	
Standard	6.58 to 6.59 mm
Service limit	6.55 mm
Exhaust – SOHC engine	
Standard	5.45 to 5.46 mm
Service limit	5.42 mm
Exhaust – DOHC engine	
Standard	6.55 to 6.56 mm
Service limit	6.52 mm

Valves (continued)

Stem-to-guide clearance	
Inlet	
Standard	0.02 to 0.05 mm
Service limit	0.08 mm
Exhaust	
Standard	0.05 to 0.08 mm
Service limit	0.11 mm
Valve head movement - fitted in guide	
Inlet	
Standard	0.04 to 0.10 mm
Service limit	0.16 mm
Exhaust	
Standard	0.10 to 0.16 mm
Service limit	0.24 mm
Valve stem fitted height	
Inlet – SOHC engine	
Standard	46.985 to 47.455 mm
Service limit	47.705 mm
Inlet – DOHC engine	
Standard	45.780 mm
Service limit	46.625 mm
Exhaust – SOHC engine	
Standard	48.965 to 49.435 mm
Service limit	49.685 mm
Exhaust DOHC engine	
Standard	44.970 mm
Service limit	45.455 mm
Valve clearances	See Chapter 1

Camshaft(s)

Drive	Toothed belt
Number of bearings	6
Bearing journal running clearance	
Standard	0.050 to 0.089 mm
Service limit	0.15 mm
Lobe height - new	
Inlet	
SOHC engine	36.957 mm
DOHC engine	33.021 mm
Exhaust	
SOHC engine	36.996 mm
DOHC engine	32.382 mm
Camshaft run-out	
Standard	0.03 mm
Service limit	0.06 mm
Camshaft endfloat	
Standard	0.05 to 0.15 mm
Service limit	0.50 mm

Lubrication system

System pressure with engine idling	1.4 bar
Oil pump type	Eccentric rotor, driven off crankshaft left-hand end
Oil pump clearances	
Rotor endfloat	
Standard	0.03 to 0.08 mm
Service limit	0.15 mm
Outer rotor-to-body clearance	
Standard	0.100 to 0.175 mm
Service limit	0.2 mm
Rotor lobe clearance	
Standard	0.04 to 0.14 mm
Service limit	0.2 mm
Oil pressure warning lamp switch opening pressure	Below 0.3 to 0.5 bar
Pressure relief valve operating pressure	4.5 bar

Torque wrench settings

	Nm	lbf ft
Sump drain plug	45	33
Manual gearbox drain plug	45	33
Automatic transmission drain plug	40	30
Automatic transmission torque converter mounting bolts	12	9
Intermediate shaft bearing housing mounting bolts	40	33
Cylinder head cover nuts	10	7
Timing belt cover bolts	10	7
Crankshaft pulley retaining bolt	165	122
Air conditioning drivebelt adjuster (idler) pulley mounting plate bolts	24	18
Timing belt tensioner pulley bolt	45	33
Camshaft sprocket retaining bolt	38	28
Camshaft bearing cap bolts		
SOHC engine	22	16
DOHC engine	12	9
Cylinder head bolts		
Stage 1	30	22
Stage 2	65	48
Oil pump pick-up/strainer pipe		
Mounting bolts	11	8
Mounting nuts	24	18
Flywheel retaining bolts	120	89
Driveplate retaining bolts	75	55
Flywheel/driveplate cover nuts and bolts	12	9
Anti-twisting bracket		
Bracket-to-transmission bolts	40	30
Bracket-to-cylinder block bolt	2	18
Sump retaining nuts and bolts	12	9
Oil pump		
Pump-to-cylinder block bolts	11	8
Cover retaining screws	7	5
Relief valve piston threaded plug	30	22
Oil cooler centre bolt (DOHC engine)	10	7
Sump retaining nuts	12	9
Right-hand crankshaft seal housing bolts	12	9
Connecting rod big-end bearing cap nuts	32	24
Main bearing cap bolts	67	49
Engine/transmission front mounting		
Through-bolt	60	44
Mounting-to-engine/transmission bolts	55	41
Mounting-to-crossmember bolts	55	41
Engine/transmission rear mounting		
Through-bolt	60	44
Mounting bracket-to-engine/transmission bolts	55	41
Engine/transmission right-hand mounting		
Through-bolt	60	44
Mounting plate-to-transmission bolts	39	29
Mounting-to-mounting plate nuts and bolts	55	41
Engine/transmission left-hand mounting		
Through-bolt	55	41
Mounting-to-mounting bracket nut and bolt	39	29
Mounting bracket-to-engine bolts	45	33

1 General information

How to use this Chapter

This Part of the Chapter describes those repair procedures that can reasonably be carried out on the engine while it remains in the vehicle. If the engine has been removed from the vehicle and is being dismantled (as described in Part B of this Chapter), any preliminary dismantling procedures can be ignored.

Note that, while it may be physically possible to overhaul items such as the piston/connecting rod assemblies while the engine is in the vehicle, such tasks are not usually carried out as separate operations and usually require the execution of several additional procedures, not to mention the cleaning of components and of oilways. For this reason, all such tasks are classed as major overhaul procedures and are described in Part B of this Chapter.

Engine information

The engine is a four-cylinder, in-line unit, mounted transversely at the front of the vehicle, with the clutch and transmission on its right-hand end. The engine is available in two forms, a single overhead camshaft (SOHC) sixteen-valve engine and a double overhead camshaft (DOHC) sixteen-valve engine. The DOHC engine is fitted to the 416 GTi and 216 GTi Twin Cam models, whereas all other models are equipped with the SOHC engine. Apart from the different cylinder head designs, both engines are of identical construction.

The aluminium alloy cylinder block is of the dry-liner type which can be rebored to accept pistons up to 0,5 mm oversize. The crankshaft is supported within the cylinder block on five shell-type main bearings. Thrustwashers are fitted to No 4 main bearing to control crankshaft endfloat.

The connecting rods are attached to the crankshaft by horizontally split shell-type big-end bearings and to the pistons by interference-fit gudgeon pins. The aluminium alloy pistons are of the slipper type and are fitted with three piston rings, comprising two compression rings and a scraper-type oil control ring.

Each camshaft is mounted directly in the cylinder head and driven by the crankshaft via a toothed rubber timing belt, which also drives the coolant pump. The camshaft operates each valve via a rocker arm. On the SOHC engine, the rocker arms are mounted on a shaft above the camshaft. On DOHC engines, the rocker arms are located below the camshafts and are mounted directly into the cylinder head via a balljoint type arrangement.

Lubrication is by pressure-feed from a gear-type oil pump which is mounted on the left-hand end of the crankshaft. The pump draws oil through a strainer located in the sump and then forces it through an externally mounted full-flow cartridge-type filter. The oil flows into galleries in the main bearing cap bridge arrangement and cylinder block/crankcase, from where it is distributed to the crankshaft (main bearings) and camshaft(s). The big-end bearings are supplied with oil via internal drillings in the crankshaft, while the camshaft bearings also receive a pressurised supply. The camshaft lobes and valves are lubricated by splash, as are all other engine components. On DOHC engines, an oil cooler is mounted between the oil filter and cylinder block, to cool the oil as it passes through the filter. The oil cooler is supplied with engine coolant taken from the metal coolant pipe which runs along the rear of the cylinder block.

Repair operations possible with the engine in the vehicle

The following work can be carried out with the engine in the vehicle:

- *a) Compression pressure – testing.*
- *b) Cylinder head cover – removal and refitting.*
- *c) Crankshaft pulley – removal and refitting.*
- *d) Timing belt covers – removal and refitting.*
- *e) Timing belt – removal, refitting and adjustment.*
- *f) Timing belt tensioner and sprockets – removal and refitting.*
- *g) Camshaft oil seal(s) – renewal.*
- *h) Camshaft(s) and rocker arms – removal, inspection and refitting.*
- *i) Cylinder head – removal and refitting.*
- *j) Cylinder head and pistons – decarbonising.*
- *k) Sump – removal and refitting.*
- *l) Oil pump – removal, overhaul and refitting.*
- *m) Oil cooler – removal and refitting (DOHC engines only).*
- *n) Crankshaft oil seals – renewal.*
- *o) Engine/transmission mountings – inspection and renewal.*
- *p) Flywheel – removal, inspection and refitting.*

2 Engine oil and filter – renewal

1 Details of checking the engine oil level and renewing both the oil and filter are contained in *"Weekly checks"* and Chapter 1.

3 Compression test – description and interpretation

1 When engine performance is down, or if misfiring occurs which cannot be attributed to the ignition or fuel systems, a compression test can provide diagnostic clues as to the engine's condition. If the test is performed regularly, it can give warning of trouble before any other symptoms become apparent.

2 The engine must be fully warmed-up to normal operating temperature, the battery must be fully charged and the spark plugs must be removed. The aid of an assistant will also be required.

3 Disable the ignition system by removing the engine management/ignition system fuse (No 14) from the passenger compartment fusebox.

4 Fit a compression tester to the No 1 cylinder spark plug hole. The type of tester which screws into the plug thread is to be preferred **(see illustration)**.

5 Have the assistant hold the throttle wide open and crank the engine on the starter motor. After one or two revolutions, the compression pressure should build up to a maximum figure and then stabilise. Record the highest reading obtained.

6 Repeat the test on the remaining cylinders, recording the pressure in each.

7 All cylinders should produce very similar pressures. Any difference greater than that specified indicates the existence of a fault. Note that the compression should build up quickly in a healthy engine. Low compression on the first stroke, followed by gradually increasing pressure on successive strokes, indicates worn piston rings. A low compression reading on the first stroke, which does not build up during successive strokes, indicates leaking valves or a blown head gasket (a cracked head could also be the cause). Deposits on the undersides of the valve heads can also cause low compression.

3.4 **Measuring compression pressure**

8 If the pressure in any cylinder is reduced to the specified minimum or less, carry out the following test to isolate the cause. Introduce a teaspoonful of clean oil into that cylinder through its spark plug hole and repeat the test.

9 If the addition of oil temporarily improves the compression pressure, this indicates that bore or piston wear is responsible for the pressure loss. No improvement suggests that leaking or burnt valves, or a blown head gasket, may be to blame.

10 A low reading from two adjacent cylinders is almost certainly due to the head gasket having blown between them and the presence of coolant in the engine oil will confirm this.

11 If one cylinder is about 20 per cent lower than the others and the engine has a slightly rough idle, a worn camshaft lobe could be the cause.

12 If the compression reading is unusually high, the combustion chambers are probably coated with carbon deposits. If this is the case, the cylinder head should be removed and decarbonised.

13 On completion of the test, refit the spark plugs and refit the engine management/ignition fuse to the fusebox.

4 Top Dead Centre (TDC) for No 1 piston - locating

Note: *If the crankshaft pulley bolt slackens while the crankshaft is being rotated, then it must be tightened to the specified torque before proceeding further.*

1 In its travel up and down the cylinder bore, Top Dead Centre (TDC) is the highest point that each piston reaches as the crankshaft rotates. While each piston reaches TDC both at the top of the compression stroke and again at the top of the exhaust stroke, for the purpose of timing the engine, TDC refers to the piston position (usually No 1) at the top of its compression stroke.

2 No 1 piston (and cylinder) is at the left-hand (timing belt) end of the engine and its TDC position is located as follows. Note that the crankshaft rotates anti-clockwise when viewed from the left-hand side of the vehicle.

3 Disconnect the battery negative terminal and remove all the spark plugs.

4.6 Crankshaft pulley TDC notch (arrowed) aligned with timing belt cover pointer

4 Trace No 1 spark plug (HT) lead from the plug back to the distributor cap and use chalk or similar to mark the distributor body or engine casting nearest to the cap's No 1 terminal. Undo the distributor cap retaining screws and remove the cap and HT leads.

5 Turn the steering onto full left lock, then remove the grommet from the front undercover panel to gain access to the crankshaft pulley retaining bolt.

6 Using a socket and extension bar applied to the crankshaft pulley bolt, rotate the crankshaft anti-clockwise until the single TDC notch on the crankshaft pulley rim is aligned with the pointer on the timing belt lower cover (see Chapter 1, *Ignition timing check and adjustment*, for details of the crankshaft pulley marks) **(see illustration)**.

7 With the crankshaft in this position, Nos 1 and 4 cylinders are now at TDC, one of them on the compression stroke. If the distributor rotor arm is pointing at (the previously-marked) No 1 terminal, then No 1 cylinder is correctly positioned. If the rotor arm is pointing at No 4 terminal, rotate the crankshaft one full turn (360°) anti-clockwise until the arm points at the marked terminal. No 1 cylinder will then be at TDC on the compression stroke.

8 Once No 1 cylinder has been positioned at TDC on the compression stroke, TDC for any of the other cylinders can then be located by rotating the crankshaft anti-clockwise 180° at a time and following the specified firing order.

5.2 Release retaining clip and disconnect cylinder head cover breather hose - SOHC engine shown

5 Cylinder head cover – removal and refitting

Removal

1 Disconnect the battery negative terminal.

2 Using a suitable pair of pliers, release the retaining clip and disconnect the breather hose from the rear of the cylinder head cover **(see illustration)**.

3 Carefully disconnect the ignition HT leads from the spark plugs, then free the leads from their retaining clips and position them clear of the cylinder head cover.

4 On DOHC engines, undo the two retaining bolts and remove the timing belt upper cover **(see illustration)**. Note the correct fitted position of the cover seal, the accelerator cable retaining clip and the earth lead.

5 On SOHC engines, free the accelerator cable from its retaining clips on the front edge of the cylinder head cover.

6 On all engines, remove the cylinder head cover retaining nuts and remove all the sealing washers, noting the earth lead which is fitted to the front left-hand stud. On DOHC engines, also note the accelerator cable retaining clip which is fitted the front right-hand stud and the HT lead retaining clips fitted to the centre studs.

5.4 Removing timing belt upper cover – DOHC engine

7 Carefully lift off the cylinder head cover.

Refitting

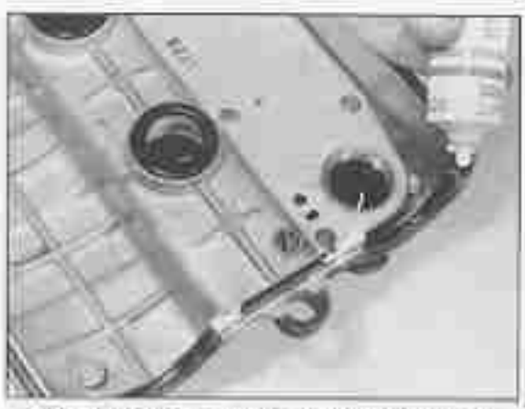
8 Inspect the cover gasket, spark plug hole sealing rings and cover retaining nut sealing washers for signs of wear or damage, and renew as required. If renewal of the gasket and/or sealing rings is necessary, remove the old gasket and/or sealing rings from the cover, then remove all traces of dirt and oil from the cover grooves. Fit the new gasket and/or sealing rings to the cover **(see illustration)**.

9 Ensure the cylinder head mating surface, gasket and sealing rings are clean and free from all traces of oil, and that all gaskets are securely located in the head cover. On DOHC engines, apply a smear of suitable sealant to the cylinder head cover gasket on each side of all the camshaft cut-outs **(see illustration)**.

10 On all engines, refit the cylinder head cover to the engine, taking great care to ensure that the gasket and sealing rings remain in position on the cover **(see illustration)**.

11 Once the cover is correctly seated, refit all the sealing washers and retaining nuts (not forgetting to position the accelerator cable

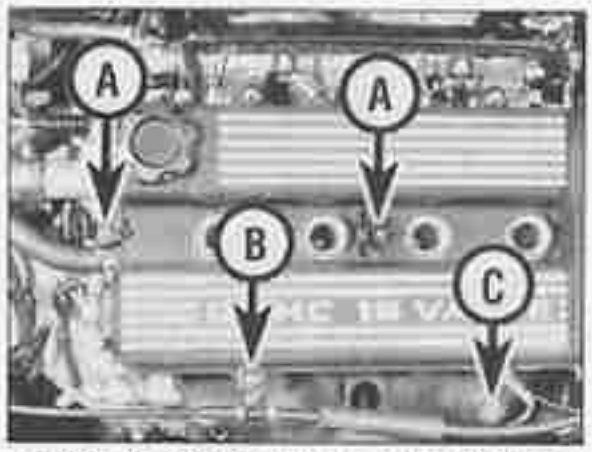
5.8 Ensure gasket and sealing rings are correctly located in cylinder head cover grooves - SOHC engine shown



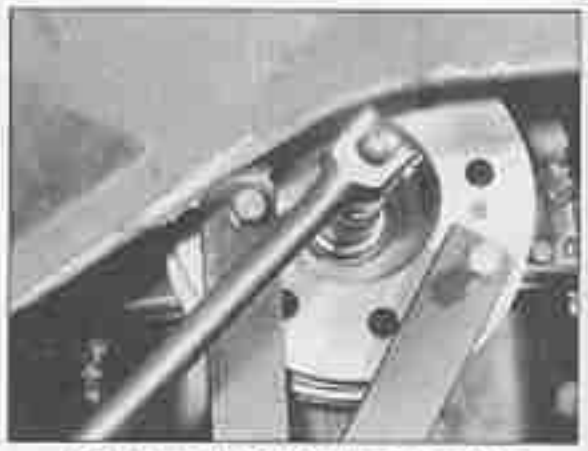
5.9 On DOHC engine, apply a smear of sealant to areas of cover gasket on either side of the camshaft cut-out

5.10 Fit cylinder head cover, ensuring gasket and sealing rings remain in position - SOHC engine shown

5.11a On SOHC engine, do not forget to fit earth lead beneath left-hand front cover retaining nut



5.11b On DOHC engine, ensure HT lead clips (A), accelerator cable clip (B) and earth lead (C) are fitted beneath correct cover retaining nuts



6.6 Using fabricated tool to retain crankshaft pulley while retaining bolt is slackened

retaining clip and/or earth lead, as applicable, beneath the relevant cover nuts) and tighten them to the specified torque **(see illustrations)**.

12 On DOHC engines, ensure that the timing belt upper cover seal is in position, then refit the timing belt cover. Position the accelerator cable retaining clip and earth lead under the front retaining bolts, then tighten both bolts to the specified torque.

13 Reconnect the HT leads to the relevant plugs; then refit the leads to all their retaining clips. Refit the accelerator cable to its retaining clips on the front of the head cover.

14 Reconnect the breather hose to the rear of the cylinder head cover, ensuring it is securely held in position by its retaining clip, then reconnect the battery negative terminal.

6 Crankshaft pulley – removal and refitting

Removal

1 Apply the handbrake, then jack up the front of the vehicle and support it on axle stands (see *"Jacking and Vehicle Support"*). Remove the left-hand roadwheel.

2 From underneath the front of the vehicle, remove the three bolts securing the bumper flange to the body. Remove the seven bolts securing the front undercover panel to the body, then remove the panel.

3 If necessary, rotate the crankshaft until the relevant timing marks align.

4 Remove the power steering pump, air conditioning compressor and/or alternator drivebelt(s), as applicable.

5 To prevent crankshaft rotation while the pulley bolt is unscrewed, select top gear and have an assistant apply the brakes hard. Alternatively, a holding tool similar to that shown **(see illustration)** can be fabricated from two strips of steel and a few bolts (see Section 9, paragraph 7). If the engine has been removed from the vehicle, lock the flywheel using the arrangement shown in illustration 19.2.

6 Remove the pulley retaining bolt and washer, noting that the washer is fitted with its tapered surface outermost, then withdraw the pulley from the crankshaft. Remove the Woodruff key from the crankshaft groove and store it with the pulley for safe keeping.

Refitting

7 Refit the Woodruff key to the crankshaft groove, then align the crankshaft pulley centre notch with the key and slide the pulley onto the crankshaft end. Apply a few drops of oil to the pulley retaining bolt threads, then refit the bolt and washer, ensuring that the washer is fitted with its tapered surface outermost **(see illustrations)**.

8 Lock the crankshaft by the method used on removal, then tighten the pulley retaining bolt to the specified torque setting.

9 Refit the power steering pump, air conditioning compressor and/or alternator drivebelt(s) (as applicable) and adjust them as described in Chapter 1.

10 Refit the undercover panel and roadwheel, then lower the vehicle to the ground.

7 Timing belt covers – removal and refitting

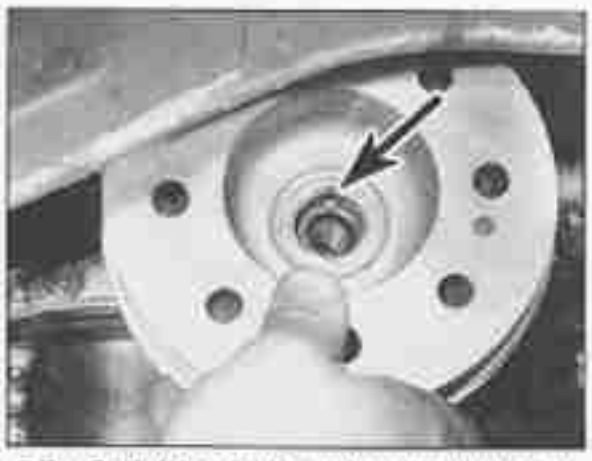
Removal

Upper cover – SOHC engine

1 Remove the cylinder head cover.

2 On models with power steering, remove the bolts securing the power steering pump to its mounting bracket. Undo the bolt which secures the pipe retaining clamp to the top of the pump and remove the clamp. Release the pump hoses from any relevant retaining clips, then free the pump pulley from its drivebelt and position the pump and hoses clear of the timing belt cover.

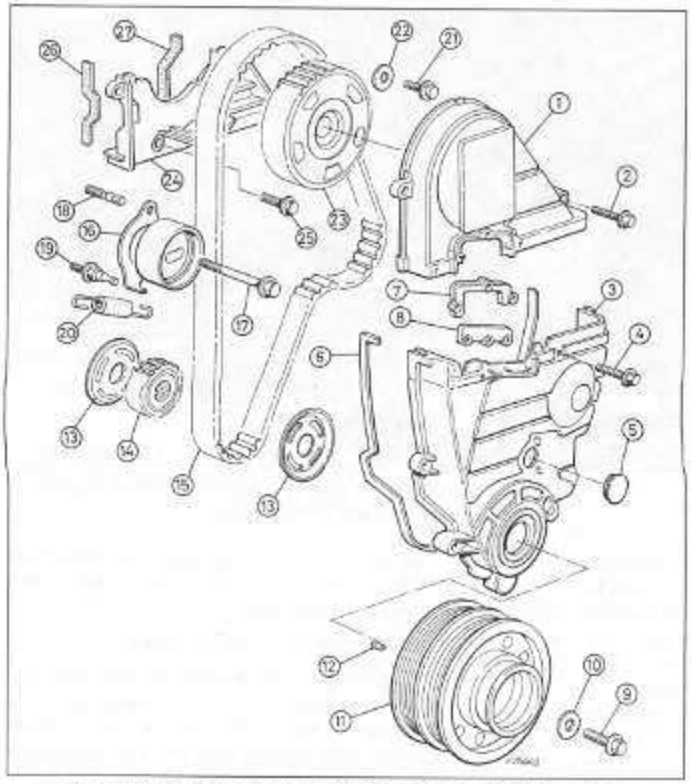
3 On all models, remove the two retaining bolts and withdraw the cover from the engine, along with its sealing strip **(see illustration)**.



6.7a Refit Woodruff key (arrowed) then fit crankshaft pulley, ensuring pulley notch engages correctly with key

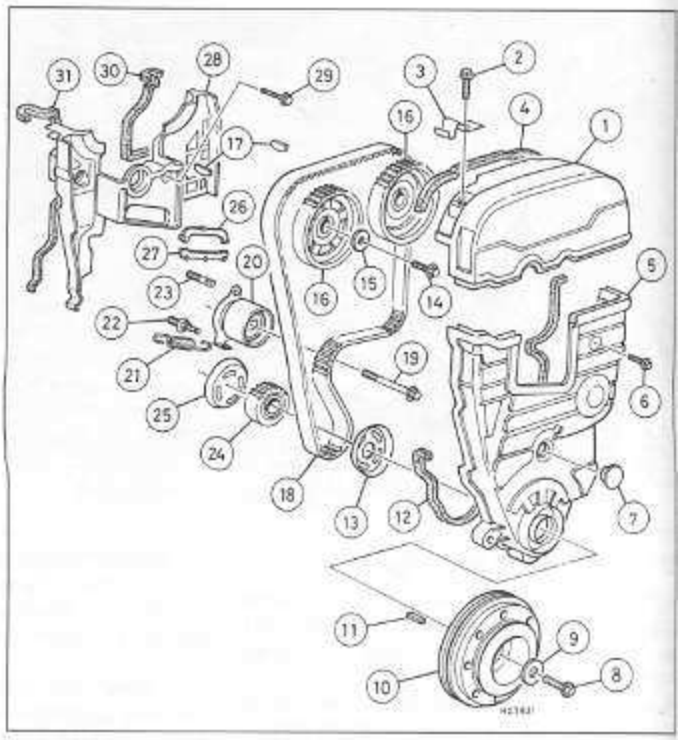
6.7b Refitting crankshaft pulley retaining bolt and special washer

7.3 Removing timing belt upper cover – SOHC engine



8.2a Timing belt, sprockets and covers – SOHC engine

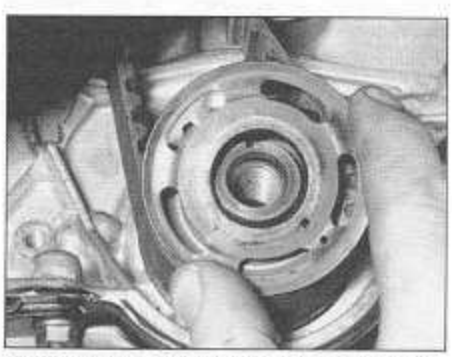
1 *Timing belt upper cover*
2 *Bolt – upper cover-to-cylinder head*
3 *Timing belt lower cover*
4 *Bolt – lower cover-to-cylinder block*
5 *Tensioner pulley access grommet*
6 *Lower cover seal*
7 *Seal – upper cover*
8 *Seal – lower cover*
9 *Crankshaft pulley retaining bolt*
10 *Washer*
11 *Crankshaft pulley*
12 *Woodruff key*
13 *Timing belt outer guide plate*
14 *Crankshaft sprocket*
15 *Timing belt*
16 *Timing belt tensioner pulley assembly*
17 *Tensioner pulley retaining bolt*
18 *Tensioner locating stud*
19 *Pillar bolt*
20 *Tensioner pulley spring*
21 *Camshaft sprocket retaining bolt*
22 *Washer*
23 *Camshaft sprocket*
24 *Timing belt inner cover*
25 *Bolt – inner cover-to-cylinder head*
26 *Inner cover seal*
27 *Inner cover seal*



8.2b Timing belt, sprockets and covers – DOHC engine

1 *Timing belt upper cover*
2 *Bolt – upper cover-to-cylinder head*
3 *Accelerator cable retaining clip*
4 *Upper cover seal*
5 *Timing belt lower cover*
6 *Bolt – lower cover-to-cylinder block*
7 *Tensioner pulley access grommet*
8 *Crankshaft pulley retaining bolt*
9 *Washer*
10 *Crankshaft pulley*
11 *Woodruff key*
12 *Lower cover seal*
13 *Timing belt outer guide plate*
14 *Camshaft sprocket retaining bolt*
15 *Washer*
16 *Camshaft sprocket*
17 *Camshaft sprocket Woodruff keys*
18 *Timing belt*
19 *Tensioner pulley retaining bolt*
20 *Tensioner pulley assembly*
21 *Spring*
22 *Pillar bolt*
23 *Tensioner locating stud*
24 *Crankshaft sprocket*
25 *Timing belt inner guide plate*
26 *Seal – upper cover*
27 *Seal – lower cover*
28 *Timing belt inner cover*
29 *Bolt – inner cover-to-cylinder head*
30 *Inner cover seal*
31 *Inner cover seal*

8.2c On DOHC engine, peg camshafts in position to prevent movement under valve spring pressure when timing belt is removed



8.3 Remove timing belt outer guide plate from crankshaft, noting which way around it is fitted

2 Position No 1 cylinder at TDC on its compression stroke, then remove the timing belt upper and lower covers **(see illustrations)**. Check that the camshaft and crankshaft sprocket marks align as described in paragraph 8. On DOHC engines, the camshafts can be held in the correct position by inserting two suitably-sized pegs or bolts through the holes in the top of the left-hand end camshaft bearing caps and into the camshafts. This will prevent the shafts moving under valve spring pressure when the timing belt is removed **(see illustration)**.

3 Slide the timing belt outer guide plate off the end of the crankshaft, noting that it is fitted with its concave surface facing outwards (away from the engine) **(see illustration)**.

4 Slacken the timing belt tensioner pulley bolt through half a turn and pull the pulley assembly downwards to remove all tension from the timing belt. Hold the tensioner pulley in this position and retighten the pulley bolt securely.

5 If the timing belt is to be re-used, use white paint or similar to mark the direction of rotation on the belt, then slip the belt off its sprocket(s). Do not rotate the crankshaft until the timing belt has been refitted.

6 If the belt is to be removed fully from the engine, it will be necessary to split the left-hand engine mounting as follows. Place a jack with interposed block of wood beneath the engine sump and gently raise the jack until it is supporting the weight of the engine. Undo the left-hand engine/transmission mounting through-bolt, then remove the nut and bolt securing the mounting to its engine bracket and remove the mounting block. On SOHC engines, remove the bolts securing the power steering pump mounting bracket or mounting bracket (as applicable) to the front of the cylinder block and side mounting, then remove the bracket. The belt can now be removed from the engine **(see illustrations)**.

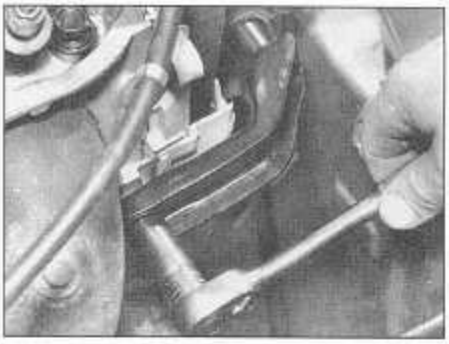
Inspection

7 Check the timing belt carefully for any signs of uneven wear, splitting or oil contamination, and renew it if there is the slightest doubt about its condition. If the engine is undergoing an overhaul and has covered more than 60 000 miles (100 000 km) since the original belt was fitted, renew the belt as a matter of course, regardless of its apparent condition. If signs of oil contamination are found, trace the source of the oil leak and rectify it, then wash down the engine timing belt area and all related components to remove all traces of oil.

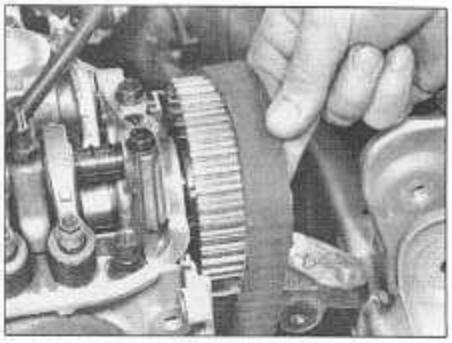
Refitting

8 On reassembly, thoroughly clean the timing belt sprockets, and check that they are aligned as follows **(see illustrations)**.

a) Camshaft sprocket – SOHC engine – The UP mark on the sprocket must be at the top and the line at the bottom of the sprocket must be aligned with the pointer on the timing belt inner cover.



8.6a On SOHC engines, remove left-hand mounting and front mounting bracket . . .



8.6b . . . to allow timing belt to be fully removed from engine

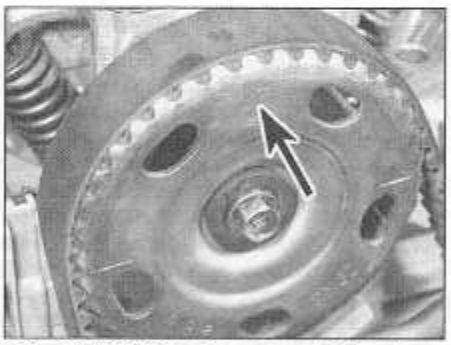
b) Camshaft sprockets – DOHC engine – Both the UP arrow marks on each sprocket must be in the 12 o'clock position (pointing directly upwards) with the index lines on each sprocket being directly aligned with the cylinder head upper mating surface in the 3 o'clock and 9 o'clock positions.

c) Crankshaft sprocket – The line scribed on the outer edge of the sprocket must be aligned with the arrow cast onto the face of the oil pump body.

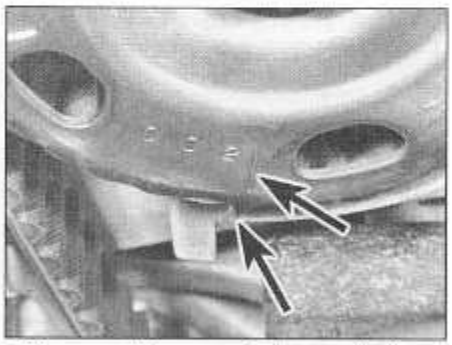
9 Fit the timing belt over the crankshaft and camshaft sprockets, ensuring that the belt front run (and, on DOHC engines, the top run) is taut (ie. all slack is on the tensioner pulley side of the belt), then fit the belt over the coolant pump sprocket and tensioner pulley **(see illustration)**. Do not twist the belt sharply while refitting it. Ensure that the belt teeth are correctly seated centrally in the sprockets and that the timing marks remain in alignment. If a used belt is being refitted, ensure that the arrow mark made on removal points in the normal direction of rotation, as before.

Adjustment

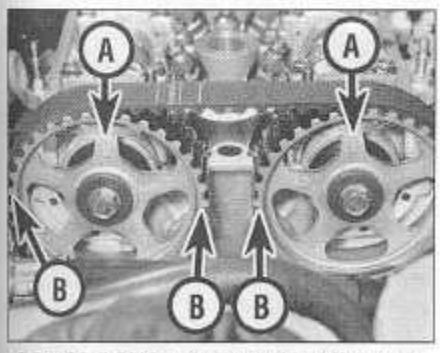
10 Slacken the tensioner pulley bolt and check that the tensioner pulley moves to tension the belt. If the tensioner assembly is not free to move under spring tension, then rectify the fault or the timing belt will not be correctly tensioned. On DOHC engines, remove the camshaft retaining pins/bolts from the camshaft bearing caps.



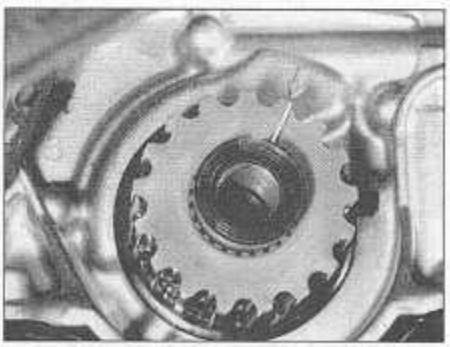
8.8a On SOHC engine, ensure UP mark on camshaft sprocket (arrowed) is at top . . .



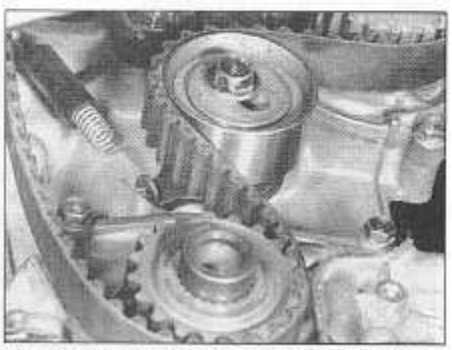
8.8b . . . and lower mark (arrowed) aligns with pointer on timing belt inner cover



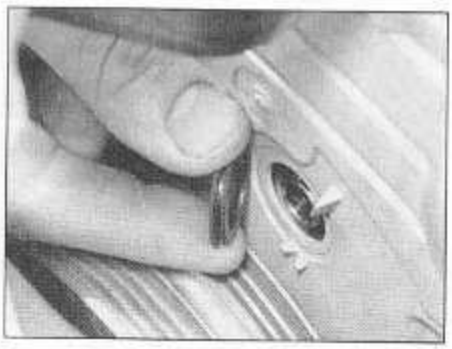
8.8c On DOHC engine, ensure UP marks on camshaft sprockets (A) are at top and lines on sprockets (B) align with cylinder head surface



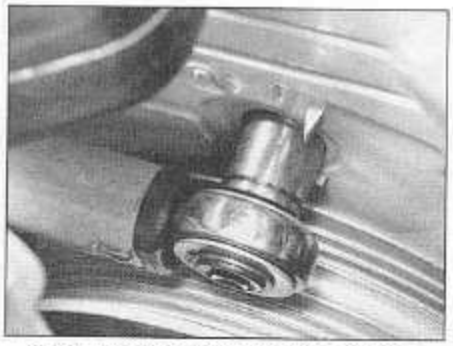
8.8d Ensure line on crankshaft sprocket is aligned with arrow cast onto oil pump surface



8.9 Timing belt lower run (viewed from underneath)



8.15a Remove rubber grommet from timing belt lower cover to gain access to tensioner pulley bolt



8.15b Tension timing belt then tighten tensioner pulley bolt to specified torque

11 Where removed, refit the power steering pump mounting bracket or bracket (SOHC engines only), then reassemble the left-hand engine/transmission mounting, tightening all nuts and bolts to their specified torque settings.

12 Refit the timing belt outer guide to the crankshaft, ensuring its concave surface is facing outwards (away from the engine).

13 Refit the timing belt lower cover, then fit the crankshaft pulley but do not fit the undercover panel or roadwheel.

14 With the pulley correctly fitted, check that the single TDC groove on the pulley rim is aligned with the pointer on the timing belt lower cover and that the camshaft sprocket marks are still positioned as described in paragraph 8. If all is well, rotate the crankshaft through 90° in an anticlockwise direction to tension the timing belt correctly.

15 Remove the rubber grommet from the lower timing cover to gain access to the tensioner pulley bolt and tighten the pulley bolt to the specified torque **(see illustrations)**. Carry on rotating the pulley anti-clockwise until No 1 piston is back at TDC on compression, then make a final check that the sprocket marks are correctly positioned. If all is well, refit the tensioner bolt grommet to the lower cover.

16 Refit the timing belt upper cover and cylinder head cover.

17 With all components correctly fitted, refit the undercover panel and roadwheel and lower the vehicle to the ground.

9 Timing belt tensioner and sprockets – removal, inspection and refitting

Removal

1 Firmly apply the handbrake, then jack up the front of the vehicle and support it on axle stands (see *"Jacking and Vehicle Support"*). Remove the left-hand roadwheel.

2 From underneath the front of the vehicle, remove the three bolts securing the bumper flange to the body. Remove the seven bolts securing the front undercover panel to the body and remove the panel.

3 Position No 1 cylinder at TDC on its compression stroke, then proceed as described under the relevant subheading.

Camshaft sprocket – SOHC engine

4 Remove the timing belt upper cover and check that the camshaft sprocket marks are positioned as described in Section 8, paragraph 8.

5 Remove the rubber grommet from the timing belt lower cover to gain access to the timing belt tensioner pulley bolt, then slacken the bolt through half a turn. Using a long flat-bladed screwdriver, carefully push down on the tensioner pulley mounting plate from above so as to move the pulley away from the belt and relieve the timing belt tension. Hold the pulley in this position while an assistant tightens the pulley retaining bolt securely. To avoid damaging the timing belt, ensure the screwdriver is resting on the tensioner assembly and not the timing belt before exerting any pressure on the screwdriver.

6 Disengage the belt from the camshaft sprocket, taking care not to twist it too sharply. Use fingers only to handle the belt. Do not rotate the crankshaft until the timing belt is refitted.

7 Slacken the camshaft sprocket retaining bolt while holding the sprocket with Rover service tool 18G 1521 to prevent the sprocket from rotating. If this tool is not available, an acceptable substitute can be fabricated from two lengths of steel strip (one long, the other short) and three nuts and bolts. One nut and bolt should form the pivot of the forked tool, with the remaining two nuts and bolts at the tips of the "forks" to engage with the sprocket spokes, as shown before refitting.

8 Remove the sprocket retaining bolt and washer, then slide the sprocket off the end of the camshaft **(see illustration)**.

Camshaft sprockets – DOHC engine

9 Remove the cylinder head cover.

10 Check the camshaft sprocket marks are positioned as described in Section 8, paragraph 8.

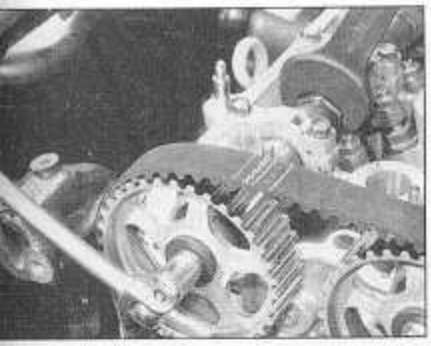
11 Remove the rubber grommet from the timing belt lower cover to gain access to the timing belt tensioner pulley bolt, then slacken the bolt through half a turn. To relieve the timing belt tension, press firmly down on the belt at the mid-point between the two camshaft sprockets until maximum belt free play is obtained **(see illustration)**. Hold the belt in this position while an assistant tightens the pulley retaining bolt securely.

12 Using a suitable open-ended spanner fitted to the hexagonal section of each camshaft, return both shafts to their previously-noted positions. Insert two suitably-sized pegs or bolts through the holes in the top of the left-hand end camshaft bearing caps and into the camshafts. Doing this will prevent the camshafts from moving under valve spring pressure when the timing belt is removed **(see illustration)**.

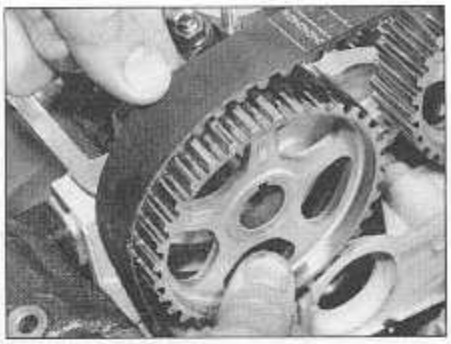
9.8 Remove retaining bolt and washer, then slide sprocket off camshaft end – SOHC engine

9.11 On DOHC engines, push on upper run of timing belt midway between camshaft pulleys to relieve timing belt tension

9.12 Using an open-ended spanner, retu camshafts to original positions and peg them in place with a suitable tool (arrowe



9.14a Slacken camshaft sprocket retaining bolt while holding camshaft with an open-ended spanner



9.14b Slide sprocket off camshaft end . . .

9.14c . . . and remove Woodruff key

13 Disengage the belt from the camshaft sprockets, taking care not to twist it too sharply. Use fingers only to handle the belt. Do not rotate the crankshaft until the timing belt is refitted.

14 Using a suitable open-ended spanner fitted to the hexagonal section of the camshaft, hold the camshaft and slacken the camshaft sprocket retaining bolt. Remove the bolt and washer, then slide the sprocket off the camshaft end. Remove the Woodruff key from the camshaft groove and store it with the sprocket for safe keeping **(see illustrations)**. If required, repeat the procedure for the remaining sprocket.

Crankshaft sprocket

15 Remove the timing belt.

16 Slide the crankshaft sprocket off the end of the crankshaft and, if necessary, remove the timing belt inner guide, noting that it is fitted with its concave surface facing inwards (towards the engine) **(see illustrations)**.

Tensioner assembly

17 Remove the timing belt.

18 Remove the pulley retaining bolt, then unhook the tensioner spring from its pillar bolt and slide the tensioner assembly off its locating stud.

Inspection

19 Clean thoroughly the camshaft/crankshaft sprockets and renew any that show signs of wear, damage or cracks.

20 Clean the tensioner assembly but do not use any strong solvent which may enter the pulley bearing. Check that the pulley rotates freely, with no sign of stiffness or of free play. Renew the assembly if there is any doubt about its condition or if there are any obvious signs of wear or damage. The same applies to the tensioner spring, which should be checked with great care as its condition is critical for the correct tensioning of the timing belt.

Refitting

Camshaft sprocket – SOHC engine

21 Refit the sprocket to the camshaft end so that its timing marks are facing outwards, then fit the retaining bolt and washer. Tighten the camshaft sprocket retaining bolt to the specified torque while using the method employed on removal to retain the sprocket **(see illustrations)**.

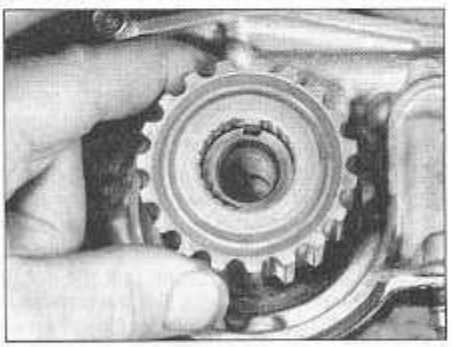
22 Ensure the TDC notch on the crankshaft pulley is still aligned with the pointer on the timing belt lower cover, then position the camshaft sprocket so the timing marks are as described in Section 8, paragraph 8.

23 Fit the timing belt over the camshaft sprocket, ensuring that the belt front run is taut (ie., all slack is on the tensioner pulley side of the belt). Do not twist the belt sharply while refitting it. Ensure that the belt teeth are correctly seated centrally in the sprockets and that the timing marks remain in alignment.

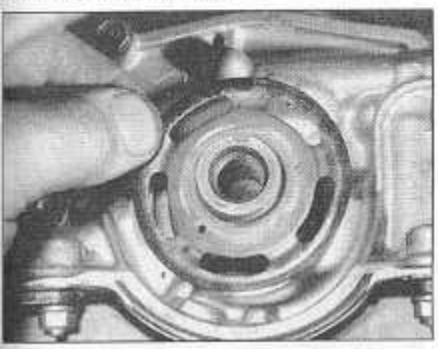
24 Slacken the tensioner pulley retaining bolt and check that the tensioner pulley moves to tension the belt. If the tensioner assembly is not free to move under spring tension, rectify the fault, or the timing belt will not be correctly tensioned.

25 If all is well, rotate the crankshaft through 90° in an anti-clockwise direction to tension the timing belt correctly, then tighten the tensioner pulley bolt to the specified torque. Carry on rotating the pulley anti-clockwise until No 1 piston is back at TDC on compression, then make a final check that the sprocket marks are correctly positioned. If all is well, refit the tensioner bolt grommet to the lower cover.

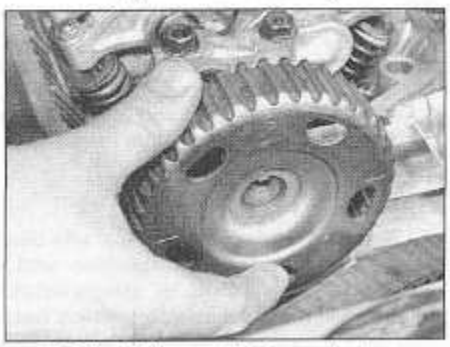
26 Refit the timing belt upper cover and cylinder head cover. With all components



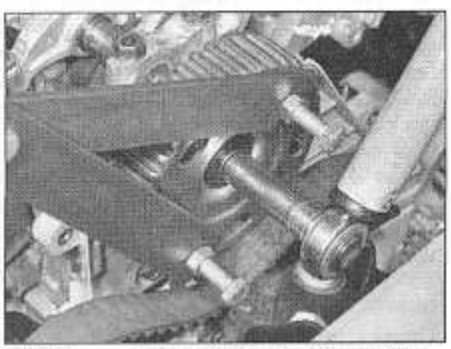
9.16a Remove crankshaft sprocket . . .



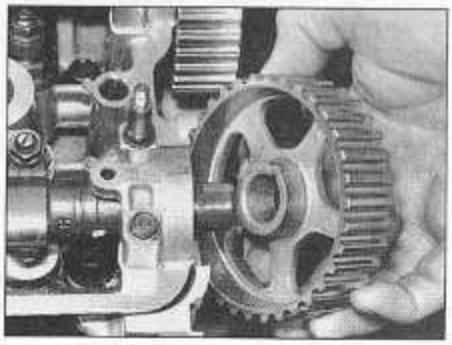
9.16b . . . and slide off timing belt inner guide plate, noting which way around it is fitted



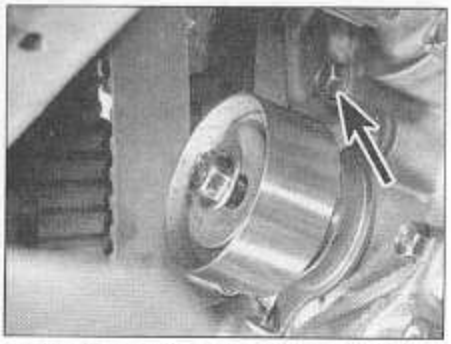
9.21a Refit camshaft sprocket . . .



9.21b . . . and tighten sprocket retaining bolt to specified torque. Fabricated sprocket holding tool shown



9.27 Refit Woodruff key to camshaft and slide sprocket into position - DOHC engine



9.34a Ensure hole in tensioner backplate is correctly engaged with locating stud (arrowed) . . .

9.34b . . . and spring is correctly located on pillar bolt (arrowed)

correctly fitted, refit the undercover panel and roadwheel, then lower the vehicle to the ground.

Camshaft sprockets – DOHC engine

27 Refit the Woodruff key to the groove in the camshaft, then slide the sprocket onto the camshaft **(see illustration)** whilst ensuring that the sprocket markings are facing outwards. Refit the sprocket retaining bolt and washer, then tighten it to the specified torque while holding the camshaft with an open-ended spanner.

28 Check that the crankshaft pulley TDC notch is still aligned with the pointer on the timing belt lower cover, then fit the timing belt over the camshaft sprockets. Ensure that the belt front and top runs are taut (ie. all slack is on the tensioner pulley side of the belt). Do not twist the belt sharply while refitting it. Ensure that the belt teeth are correctly seated centrally in the sprockets and that the timing marks remain in alignment.

29 Slacken the tensioner pulley retaining bolt and check that the tensioner pulley moves to tension the belt. If the tensioner assembly is not free to move under spring tension, then rectify the fault, or the timing belt will not be correctly tensioned. Check that the crankshaft pulley notch is correctly aligned, then remove the locating pins or bolts from the camshaft bearing caps.

30 Rotate the crankshaft through 90° in an anti-clockwise direction to tension the timing belt correctly, then tighten the tensioner pulley bolt to the specified torque. Carry on rotating the pulley anti-clockwise until No 1 piston is back at TDC on compression, then make a final check that the sprocket marks are correctly positioned. If all is well, refit the tensioner bolt grommet to the lower cover.

31 Refit the cylinder head and timing belt upper cover, then refit the undercover panel and roadwheel and lower the vehicle to the ground.

Crankshaft sprocket

32 Fit the timing belt inner guide onto the crankshaft, ensuring that its concave surface is facing inwards (towards the engine). Offer up the crankshaft sprocket, ensuring that its timing mark is facing outwards, then align the sprocket key with the crankshaft groove and slide the sprocket into position.

33 Refit the timing belt.

Tensioner assembly

34 Align the hole in the tensioner backplate with its locating stud and slide the tensioner assembly into position. Hook the spring over its pillar bolt and refit the tensioner pulley bolt. Pull the pulley fully downwards and tighten its retaining bolt securely to hold it in this position **(see illustrations)**.

35 Refit the timing belt.

10 Camshaft oil seal(s) – renewal

Note: *If an oil seal is to be renewed with the timing belt still in place, then check first that the belt is free from oil contamination and renew the belt if signs of oil contamination are found. Cover the belt to protect it from contamination by oil while work is in progress and ensure that all traces of oil are removed from the area before the belt is refitted.*

Removal

1 Remove the camshaft sprocket.

2 Punch or drill two small holes opposite each other in the oil seal. Screw a self-tapping screw into each hole and pull on the screws with pliers to extract the seal.

3 Clean the seal housing and polish off any burrs or raised edges which may have caused the seal to fail in the first place.

Refitting

4 Lubricate the lips of the new seal with clean engine oil and drive it into position until it seats on its locating shoulder, using a suitable tubular drift (such as a socket) which bears only on the hard outer edge of the seal **(see illustration)**. Take care not to damage the seal lips during fitting and note that the seal lips should face inwards.

5 On DOHC engines, if necessary, repeat the above procedure for the remaining oil seal.

6 Refit the camshaft sprocket(s).

11 Camshaft(s) and rocker arms – removal, inspection and refitting

Removal

SOHC engine

1 Remove the distributor.

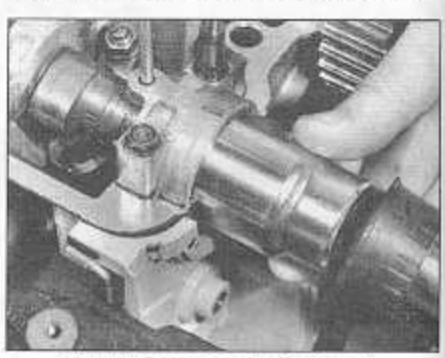
2 Remove the camshaft sprocket.

3 Slacken all the rocker arm adjusting screw locknuts, then unscrew the adjusting screws until all valve spring pressure has been relieved from the camshaft.

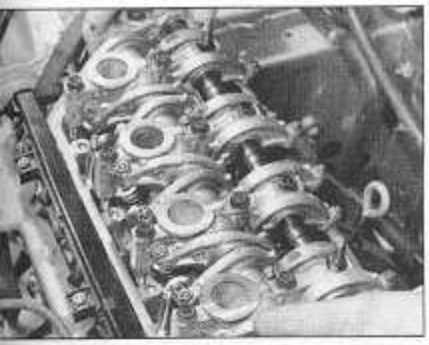
4 Set up a dial gauge on one end of the camshaft and measure the camshaft endfloat while moving the camshaft to and fro. If the endfloat exceeds the specified service limit, expert advice should be sought from a Rover dealer or an engine repair specialist.

5 Working in a reverse of the tightening sequence, evenly and progressively slacken the sixteen camshaft bearing cap retaining bolts. Fully unscrew all the bolts from the cylinder head but do not remove any bolts from the bearing caps. There is no need to disturb the distributor bearing cap on the right-hand end of the cylinder head.

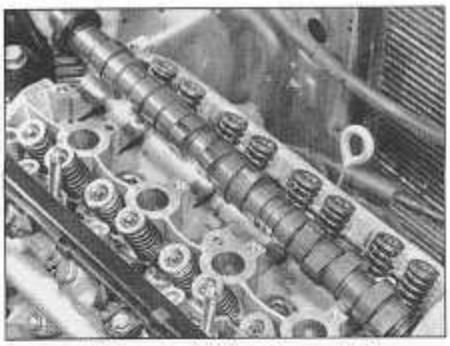
6 Lift the camshaft bearing cap/rocker arm



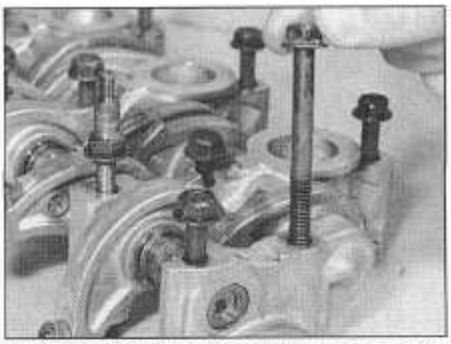
10.4 Fitting a camshaft oil seal - DOHC engine shown



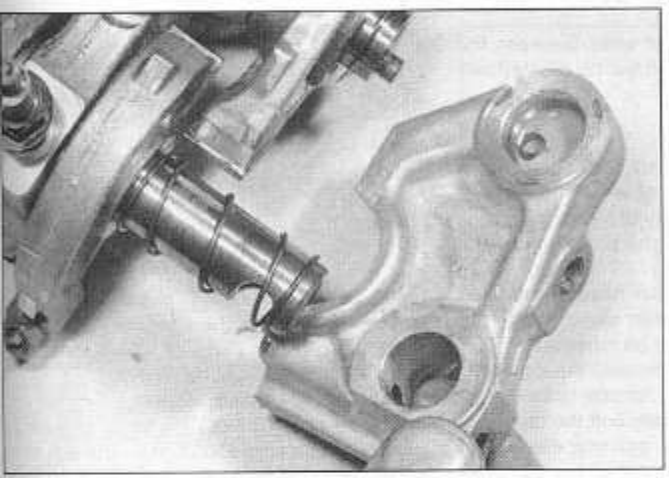
11.6 On SOHC engines, remove camshaft bearing cap/rocker arm assembly . . .



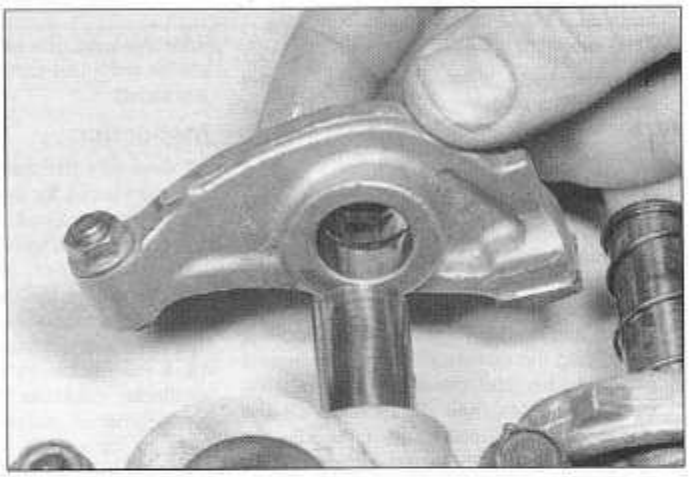
11.7 . . . and lift out camshaft



11.8a On SOHC engines, remove camshaft bearing cap bolts . . .



11.8b . . . and slide off bearing caps, springs . . .



11.8c . . . and rocker arms, keeping all components in correct fitted positions

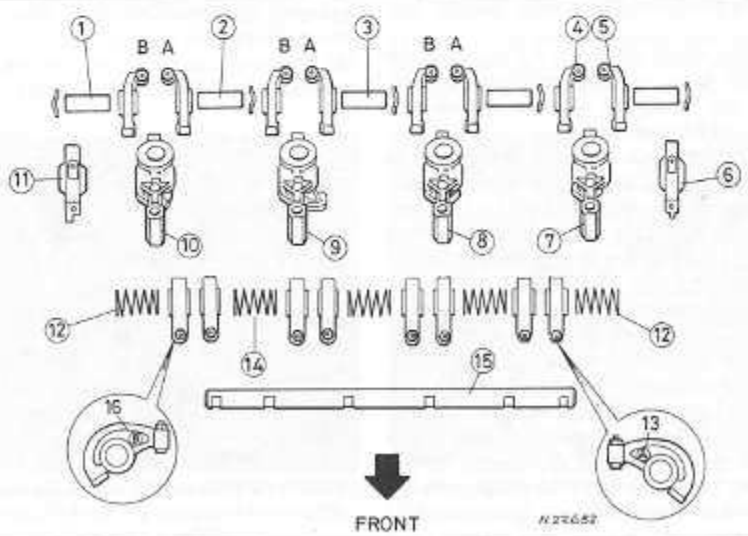
assembly clear of the cylinder head, ensuring that all retaining bolts remain in position in the caps **(see illustration)**. Remove the O-rings from the underside of the bearing caps and discard them. New O-rings must be used on refitting. Note the correct fitted positions of the bearing cap locating dowels and remove any that are loose.

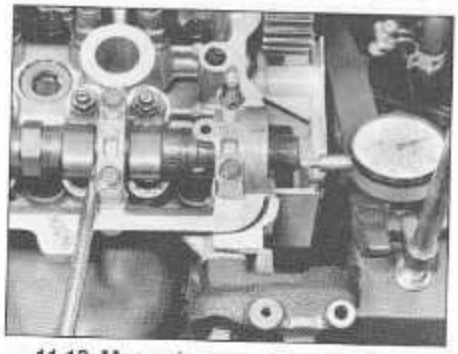
7 Lift the camshaft out of the cylinder head **(see illustration)** and discard the oil seal. A new seal must be used on refitting.

8 If necessary, the camshaft bearing cap/rocker arm assembly can be dismantled by removing the retaining bolts one at a time and sliding the various components off the end of the shafts **(see illustrations)**. Keeping all components in their correct fitted order, make a note of each component's correct fitted position as it is removed, to ensure it is positioned correctly on reassembly. Note that each bearing cap has an identification number, 1 to 6, cast onto its upper surface and each rocker arm has an identification letter, A or B, cast onto its side **(see illustration)**.

11.8d Rocker arms and shafts – SOHC engine

1 *Short inlet rocker arm shaft*
2 *Long inlet rocker arm shaft*
3 *Wave washer*
4 *Inlet rocker arm (B)*
5 *Inlet rocker arm (A)*
6 *No 1 camshaft bearing cap*
7 *No 2 camshaft bearing cap*
8 *No 3 camshaft bearing cap*
9 *No 4 camshaft bearing cap*
10 *No 5 camshaft bearing cap*
11 *No 6 camshaft bearing cap*
12 *Short exhaust rocker arm spring*
13 *Exhaust rocker arm (A)*
14 *Long exhaust rocker arm spring*
15 *Exhaust rocker shaft*
16 *Exhaust rocker arm (B)*





11.12 Measuring camshaft endfloat - DOHC engine shown

11.15 On DOHC engines, camshafts are marked to avoid confusion - exhaust camshaft shown

11.16 Rocker arms can simply be lifted out of cylinder head

DOHC engine

9 Remove the distributor and cylinder position sensor housing.

10 Remove the camshaft sprockets.

11 Remove the locating pins or bolts from the left-hand bearing caps, then slacken all the rocker arm adjusting screw locknuts and unscrew the adjusting screws until all valve spring pressure is relieved from the camshafts.

12 Set up a dial gauge on one end of the inlet camshaft and measure the camshaft endfloat while moving the camshaft to and fro. Repeat this procedure and measure the exhaust camshaft endfloat **(see illustration)**. If the endfloat of either camshaft exceeds the specified service limit, expert advice should be sought from a Rover dealer or an engine repair specialist.

13 Evenly and progressively slacken all the inlet camshaft bearing cap retaining bolts, then remove the bearing caps from the cylinder head, noting the identification marks cast onto the top surface of each cap. To avoid confusion on refitting, store the retaining bolts with their relevant bearing caps. Note the locating dowels which are fitted to each cap, remove any that are loose and store them with the bearing caps for safe keeping.

14 Lift the inlet camshaft out of the cylinder head and store it with the bearing caps. Discard the camshaft oil seal. A new seal must be used on refitting.

15 Repeating the operations in paragraphs 13 and 14, remove the exhaust camshaft and bearing caps. Note that the inlet and exhaust camshafts are not interchangeable and must be kept separate. The shafts are marked to avoid confusion **(see illustration)**.

16 Take a small box and divide it into sixteen separate compartments, or make up a cardboard template of the cylinder head. Remove each rocker arm from the cylinder head one at a time **(see illustration)**, and store it in its correct fitted position in the container or template (as applicable). This is necessary to ensure that the rocker arms are refitted to their original positions on reassembly. If the rocker arms are interchanged, the rate of wear between the rocker arms and camshaft will be dramatically increased.

Inspection

17 Examine the camshaft bearing surfaces and cam lobes for signs of wear and scoring. Renew the camshaft if any of these conditions are apparent. Examine the condition of the bearing surfaces, both on the camshaft journals and in the cylinder head. If the head bearing surfaces are worn excessively, the cylinder head will need to be renewed.

18 If the necessary measuring equipment is available, measure the outside diameter of each camshaft journal, then bolt the camshaft bearing caps onto the cylinder head and measure the inside diameter of the camshaft bearing journals. Subtract the camshaft journal outside diameter from the bearing inside diameter and calculate the camshaft journal running clearance. Also measure the height of each cam lobe **(see illustration)**. If any of the measurements exceed the specified wear limits, renew the camshaft and/or cylinder head.

19 Support the camshaft end journals on V-blocks and measure the run-out at the centre journal using a dial gauge. If the run-out exceeds the specified limit, the camshaft should be renewed.

20 Examine the rocker arm bearing surfaces which contact the camshaft lobes for wear and scoring. Renew any rocker arms on which these conditions are apparent.

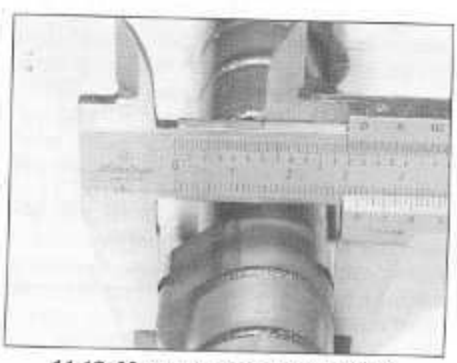
21 On SOHC engines, if the camshaft bearing cap/rocker arm assembly has been dismantled, examine the rocker arm and shaft bearing surfaces for wear and scoring. If the necessary measuring equipment is available, measure the inside diameter of the rocker arm and the outside diameter of the rocker shaft at the point where the rocker pivots, then calculate the running clearance. If the clearance exceeds the specified figure (or if there are obvious signs of wear), the rocker arm and/or shaft must be renewed.

22 On DOHC engines, inspect the rocker arm adjusting screw pivots for signs of wear or damage. If wear is found, then the adjusting screw must be renewed, along with its pivot seat, which is a screw fit in the cylinder head.

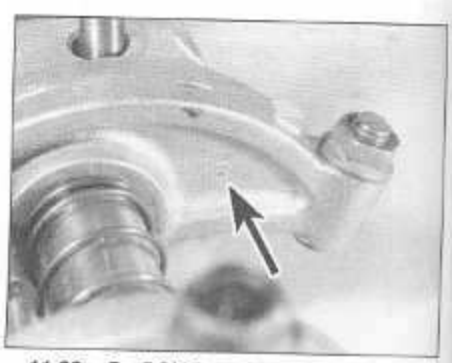
Refitting

SOHC engine

23 If the camshaft bearing cap/rocker arm assembly was dismantled, reassemble it by reversing the dismantling sequence, noting that the exhaust rocker shaft oilways must be facing downwards. If difficulties arise, use the rocker arm and bearing cap identification marks for reference. Prior to reassembly, apply a smear of clean engine oil to the shaft and rocker arm bearing surfaces **(see illustrations)**.



11.18 Measuring cam lobe height



11.23a On SOHC engines, reassemble camshaft bearing cap/rocker arm assembly using rocker arm . . .

24 Ensure the cylinder head and camshaft bearing surfaces are clean, then liberally oil the camshaft bearings and lobes and refit the camshaft. Position the shaft so that its sprocket keyway is in the 12 o'clock position (uppermost).

25 Check that all bearing cap locating dowels are in position, then fit new O-rings to the recesses in the base of the camshaft bearing caps. Carefully refit the camshaft bearing cap/rocker arm assembly to the cylinder head, taking great care to ensure that the O-rings remain in position on the bearing caps **(see illustration)**. Once the assembly is correctly seated, refit the camshaft bearing cap bolts, tightening them all by hand only.

26 Working in the sequence shown, tighten the camshaft bearing cap retaining bolts evenly and progressively to their specified torque setting **(see illustration)**.

27 Lubricate the lips of a new camshaft oil seal with clean engine oil and drive it into position until it seats on its locating shoulder. Use a suitable tubular drift (such as a socket) which bears only on the hard outer edge of the seal. Take care not to damage the seal lips during fitting and note that the seal lips should face inwards.

28 Refit the camshaft sprocket, noting that the valve clearances must be adjusted before the timing belt upper cover and cylinder head cover are fitted.

29 Refit the distributor.

DOHC engine

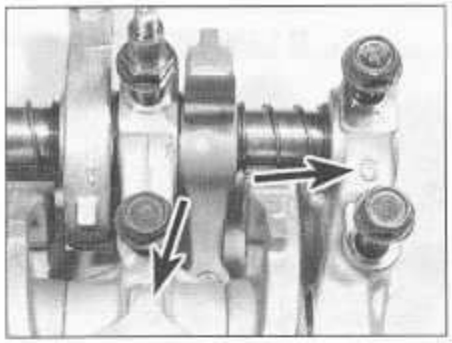
30 Apply a drop of oil to the rocker arm adjusting screw pivots, then refit all the rocker arms to their original locations in the cylinder head. Once fitted, ensure all the rocker arm grooves are correctly engaged with the valve stem ends.

31 Ensure the cylinder head and camshaft bearing surfaces are clean, then liberally oil the camshaft bearings and lobes. Refit both camshafts to the cylinder head, ensuring that the inlet and exhaust camshafts are not transposed. Position each shaft so that its sprocket keyway is in the 12 o'clock position (uppermost) **(see illustration)**.

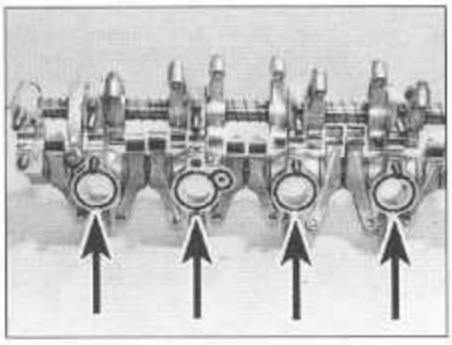
32 Ensure all the locating dowels are in position and that the cylinder head and camshaft bearing cap mating surfaces are clean and dry.

33 The bearing caps are marked for identification '11' to '16' and 'E1' to 'E6'. The caps marked '1' are the inlet camshaft bearing caps and the caps marked 'E' are the exhaust camshaft bearing caps. For both sets of caps, No 1 cap is the left-hand cap and No 6 the right-hand bearing cap (ie. bearing cap 11 is the left-hand inlet camshaft cap and cap E6 is the right-hand exhaust camshaft cap). All caps must be fitted with the arrow cast on the top of the cap (next to the identification mark) pointing towards the timing belt (left-hand) end of the engine **(see illustration)**.

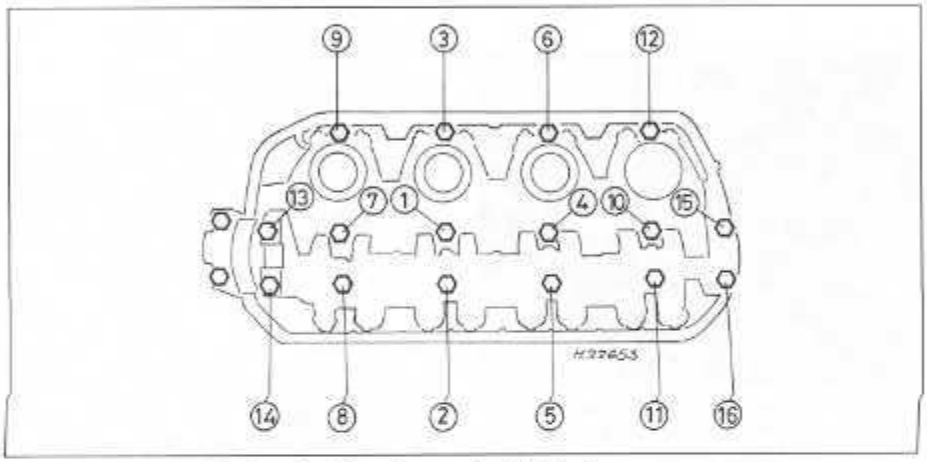
34 Apply a smear of suitable sealant to the mating surfaces of Nos 1 and 6 bearing caps (both inlet and exhaust), then, using the identification marks, refit the caps and bolts to their original positions. With all caps correctly seated, work in a diagonal sequence and tighten the cap retaining bolts to the specified torque setting **(see illustrations)**.



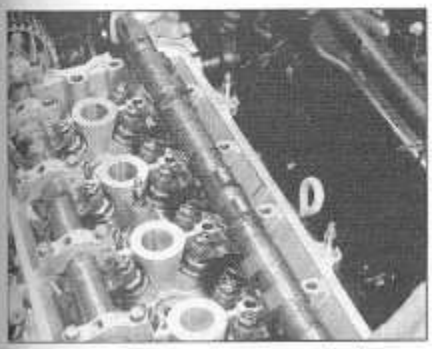
11.23b . . . and bearing cap identification marks (arrowed) to ensure components are correctly positioned



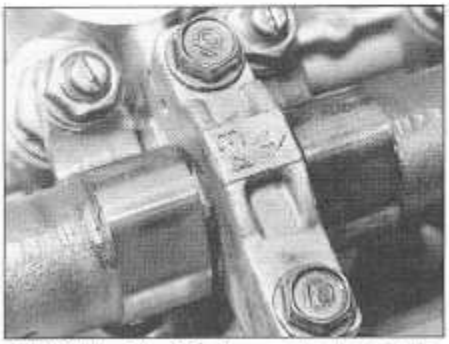
11.25 On SOHC engines, fit new O-rings (arrowed) to recesses in base of camshaft bearing caps



11.26 Camshaft bearing cap bolt tightening sequence – SOHC engine



11.31 Refitting exhaust camshaft – DOHC engine



11.33 Use identification marks to ensure all camshaft bearing caps are correctly positioned on refitting

11.34a Apply a smear of sealant to mating surfaces of specified bearing caps . . .

11.34b . . . then refit to cylinder head, ensuring locating dowels are in position (arrowed)

11.34c Tighten all camshaft bearing cap bolts to specified torque setting, working in a diagonal sequence

35 Lubricate the lips of a new inlet camshaft oil seal with clean engine oil and drive it into position until it seats on its locating shoulder. Use a suitable tubular drift (such as a socket) which bears only on the hard outer edge of the seal. Take care not to damage the seal lips during fitting and note that the seal lips should face inwards. Fit a new exhaust camshaft oil seal in the same way.

36 Using an open-ended spanner on the hexagonal section of each camshaft, position both shafts so that their sprocket keyways are in the 12 o'clock position, then insert two suitably-sized pegs or bolts through the holes in the left-hand bearing caps and into the camshafts to hold the shafts in this position.

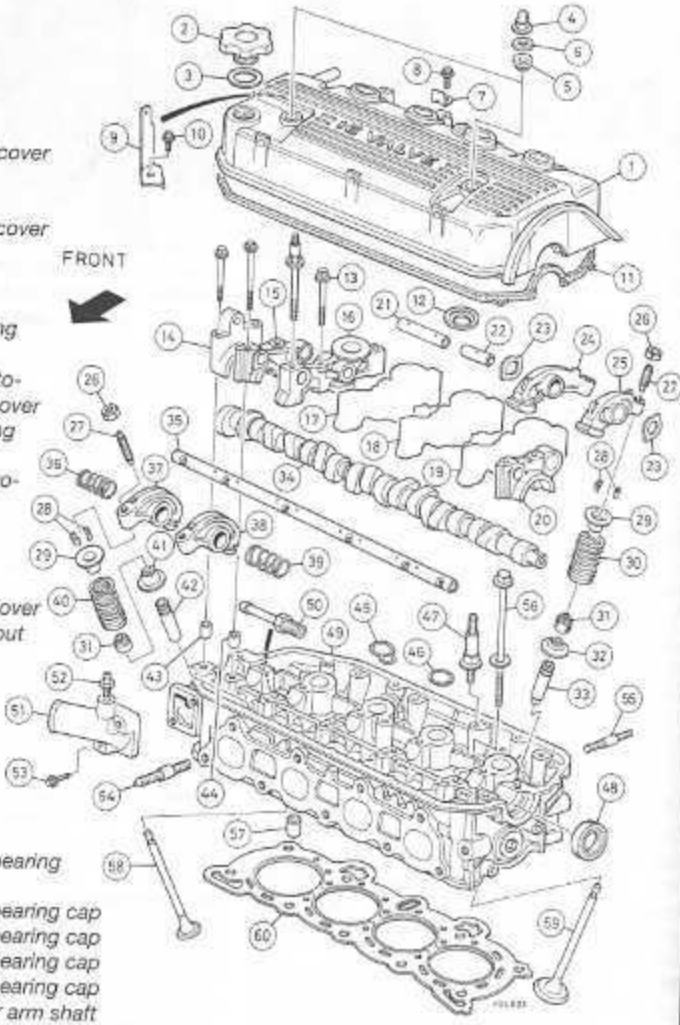
37 Refit the camshaft sprockets, noting that the valve clearances must be adjusted before the cylinder head cover is fitted.

38 Refit the distributor and cylinder position sensor housing.

12 Valve clearances – checking and adjustment

Refer to Chapter 1.

13.5 Cylinder head and associated components – SOHC engine



1 Cylinder head cover
2 Oil filler cap
3 O-ring
4 Cylinder head cover nut
5 Seal
6 Washer
7 HT lead retaining clip bracket
8 Bolt – bracket-to-cylinder head cover
9 HT lead retaining clip bracket
10 Bolt – bracket-to-cylinder head cover
11 Cylinder head cover seal
12 Cylinder head cover spark plug cut-out seal
13 Camshaft bearing cap bolt
14 Distributor clamp
15 No 6 camshaft bearing cap
16 No 5 camshaft bearing cap
17 No 4 camshaft bearing cap
18 No 3 camshaft bearing cap
19 No 2 camshaft bearing cap
20 No 1 camshaft bearing cap
21 Long inlet rocker arm shaft
22 Short inlet rocker arm shaft
23 Rocker arm wave washer
24 Inlet rocker arm (B)
25 Inlet rocker arm (A)
26 Rocker arm adjusting screw locknut
27 Rocker arm adjusting screw
28 Collets
29 Spring retainer
30 Inlet valve spring
31 Inlet valve spring seat
32 Inlet valve stem oil seal
33 Inlet valve guide
34 Camshaft
35 Exhaust rocker shaft
36 Short exhaust rocker arm spring
37 Exhaust rocker arm (B)
38 Exhaust rocker arm (A)
39 Long exhaust rocker arm spring
40 Exhaust valve spring
41 Exhaust valve stem oil seal
42 Exhaust valve guide
43 Distributor clamp dowel
44 Camshaft bearing cap dowel
45 Camshaft bearing cap O-ring
46 Camshaft bearing cap O-ring
47 Cylinder head cover stud
48 Camshaft oil seal
49 Cylinder head
50 Coolant hose adaptor union
51 Coolant top hose elbow
52 Cooling system bleed screw
53 Top hose elbow retaining bolt
54 Exhaust manifold stud
55 Inlet manifold stud
56 Cylinder head bolt
57 Cylinder head dowel
58 Exhaust valve
59 Inlet valve
60 Cylinder head gasket

13 Cylinder head – removal, inspection and refitting

HAYNES HINT

To prevent any carbon from entering the gap between the pistons and bores, smear a little grease in the gap.

Removal

1 Disconnect the battery negative terminal.

2 Drain the cooling system and remove the spark plugs.

3 Using a pair of pliers, release the retaining clip and disconnect the vacuum pipe from the throttle housing end of the air intake hose. Slacken the retaining clamp which secures the intake hose to the throttle housing and disconnect the intake hose. Working along the length of the intake hose, release the vacuum hoses from their retaining clips, then disconnect the intake hose from the air cleaner housing and remove it from the engine compartment.

4 Note that the following text assumes that the cylinder head will be removed with both inlet and exhaust manifolds attached, which makes the procedure easier but makes the head a bulky and heavy assembly to handle. If it is wished to first remove the manifolds, then proceed as described in the relevant Sections of Chapter 4.

5 On SOHC engines **(see illustration)**, remove the timing belt upper cover, then disengage the timing belt from the camshaft sprocket. Remove the distributor.

6 On DOHC engines **(see illustration)**, remove the timing belt, then the camshafts and rocker arms. Undo the single bolt securing the timing belt inner cover to the cylinder head and slide the cover along the mounting bracket to free it from the cylinder head.

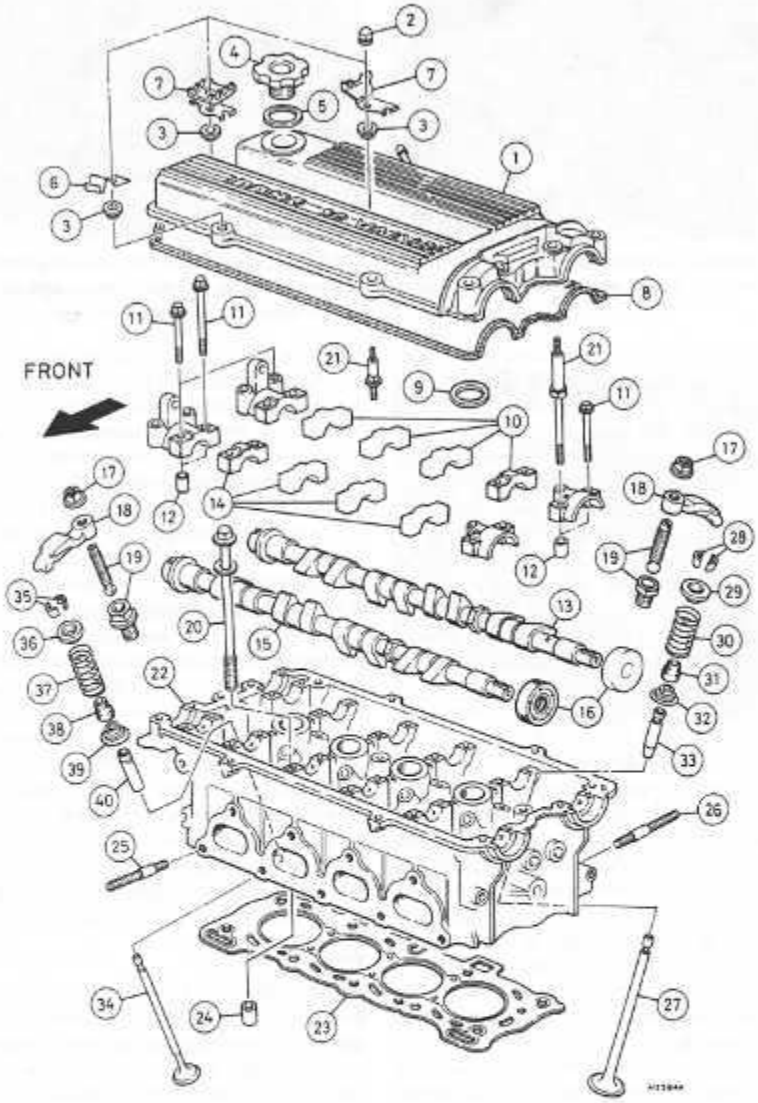
7 On all engines, carry out the following operations:

a) Depressurise the fuel system, then disconnect the outlet hose from the fuel filter and the return hose from the fuel pressure regulator.
b) Disconnect the accelerator cable.
c) Disconnect the kickdown cable (automatic transmission only).
d) Disconnect the injector wiring connectors.
e) Disconnect the PCV valve hose from the oil separator.
f) Disconnect all relevant coolant and vacuum hoses.
g) Disconnect all relevant wiring connectors.
h) Remove the inlet manifold support bracket.

8 Now carry out the following operations:

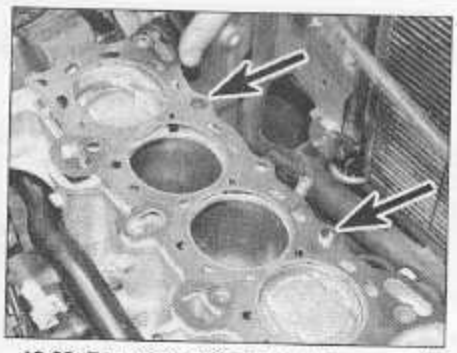
a) Remove the intake duct.
b) Disconnect the exhaust front pipe from the manifold.
c) Remove the lambda sensor (catalytic converter models).
d) Remove the exhaust manifold support bracket.

13.6 Cylinder head and associated components – DOHC engine



1 Cylinder head cover
2 Cylinder head cover nut
3 Seal
4 Oil filler cap
5 O-ring
6 Accelerator cable clip
7 HT lead retaining bracket and clip
8 Cylinder head cover seal
9 Cylinder head cover spark plug cutout seal
10 Inlet camshaft bearing cap
11 Camshaft bearing cap retaining bolts
12 Camshaft bearing cap dowels
13 Inlet camshaft
14 Exhaust camshaft bearing cap
15 Exhaust camshaft
16 Camshaft oil seal
17 Rocker arm adjusting screw locknut
18 Rocker arm
19 Rocker arm adjusting screw and pivot
20 Cylinder head bolt
21 Camshaft bearing cap bolt/cylinder head cover stud
22 Cylinder head
23 Cylinder head gasket
24 Cylinder head dowel
25 Exhaust manifold stud
26 Inlet manifold stud
27 Inlet valve
28 Inlet valve collets
29 Inlet valve spring retainer
30 Inlet valve spring
31 Inlet valve stem oil seal
32 Inlet valve spring
33 Inlet valve guide
34 Exhaust valve
35 Exhaust valve collets
36 Exhaust valve spring retainer
37 Exhaust valve spring
38 Exhaust valve stem oil seal
39 Exhaust valve spring
40 Exhaust valve guide

13.12 Remove oil control jet from cylinder block, noting which way around it is fitted



13.22 Ensure locating dowels (arrowed) are in position, then fit new cylinder head gasket

13.23 Refitting cylinder head – SOHC engine

9 Slacken the retaining clips and disconnect the heater and radiator top hose from the right-hand side of the cylinder head.

10 Disconnect the wiring connectors from the coolant temperature (TW) sensor and the coolant temperature gauge sender unit fitted to the right-hand end of the cylinder head.

11 Working in the reverse of the tightening sequence, progressively slacken the ten cylinder head bolts by half a turn at a time. Remove each bolt in turn, along with its washer, and store it in its correct fitted order by pushing it through a clearly marked cardboard template.

12 With all the cylinder head bolts removed, gently rock the head to break the gasket joint. When the joint is broken, lift the cylinder head away. Use assistance if possible as the head is a heavy assembly, especially if it is removed complete with manifolds. Remove the head gasket and discard it. Note the fitted positions of the two locating dowels and remove them for safe keeping if loose. Carefully remove the oil control jet from the rear of the cylinder block mating surface, noting which way around it is fitted, and discard its O-ring. The O-ring must be renewed whenever disturbed **(see illustration)**.

13 On SOHC engines, if the cylinder head is to be dismantled, then remove the rocker arms and camshaft.

Inspection

14 The mating faces of the cylinder head and cylinder block/crankcase must be perfectly clean before refitting the head. Use a hard plastic or wood scraper to remove all traces of gasket and carbon, and also clean the piston crowns. Take particular care, as the soft aluminium alloy is easily damaged. Also, ensure that carbon is not allowed to enter the oil and coolant passages. This is particularly important for the lubrication system, as carbon could block the oil supply to any of the engine's components. Using adhesive tape and paper, seal the coolant, oil and bolt holes in the cylinder block/crankcase. After cleaning each piston, use a small brush to remove all traces of grease and carbon from the gap, then wipe away the remainder with a clean rag.

15 Check all cylinder block/crankcase and cylinder head mating surfaces for nicks, deep scratches and other damage. If damage is slight, then it may be removed carefully with a file but if excessive, machining may be the only alternative to renewal.

16 If warpage of the cylinder head gasket surface is suspected, use a straight-edge to check it for distortion. Refer to Part B of this Chapter for further information.

17 Clean out all bolt holes in the block, using a rag and screwdriver. Ensure that all oil is removed, otherwise there is a possibility of the block being cracked by hydraulic pressure when the bolts are tightened.

18 Examine the bolt threads and the threads in the cylinder block for damage. Renew any cylinder head bolts which have damaged threads and, if necessary, use the correct-size tap to chase out the threads in the block. If it is thought likely that the head has been removed before, consider renewing all the head bolts as a matter of course.

Refitting

19 Position No 1 piston at TDC and wipe clean the mating faces of the head and block.

20 Check that the two locating dowels are in position at each end of the cylinder block/crankcase mating surface.

21 Fit a new O-ring to the oil control jet, then apply a smear of clean engine oil to the jet and (ensuring it is the correct way around) fit it to the cylinder block.

22 Fit a new cylinder head gasket to the block, ensuring that all coolant passages and oilways align correctly with those of the gasket **(see illustration)**.

23 Carefully refit the cylinder head, locating it on the dowels **(see illustration)**.

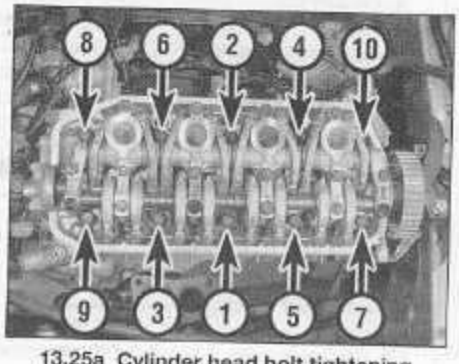
24 Ensure that, if the head bolts are being re-used, that they are refitted in their original locations. Wash all bolts in a suitable solvent, then wipe them dry, leaving them to dry fully before oiling and fitting. Very lightly oil under the head and on the threads of each bolt, then carefully insert them into their original holes and tighten, finger-tight only at this stage.

25 Working progressively and in the sequence shown, tighten all the cylinder head bolts to the specified Stage 1 torque setting. Again, working in the sequence shown, progressively tighten all the bolts to the specified Stage 2 torque setting **(see illustrations)**.

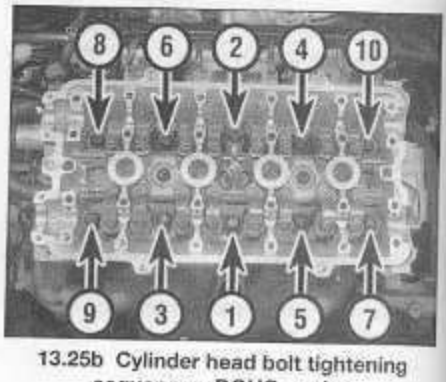
26 Reconnect the top hose and heater hose to the cylinder head, tightening their retaining clips securely. Reconnect the wiring to the coolant temperature sender and engine coolant temperature (TW) sensor.

27 Working as described in the relevant Sections of Chapter 4, connect or refit all disturbed wiring, hoses and control cable(s) to the inlet manifold and fuel system components, then adjust the throttle cable (and kickdown cable, where necessary).

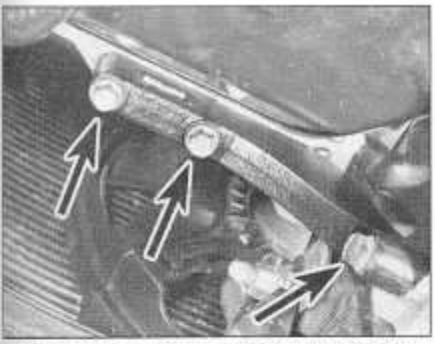
28 Working as described in Chapter 4, reconnect the exhaust system front pipe to



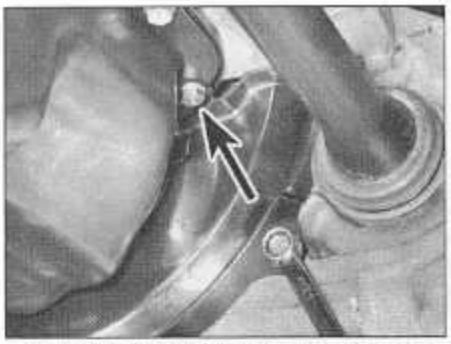
13.25a Cylinder head bolt tightening sequence – SOHC engine



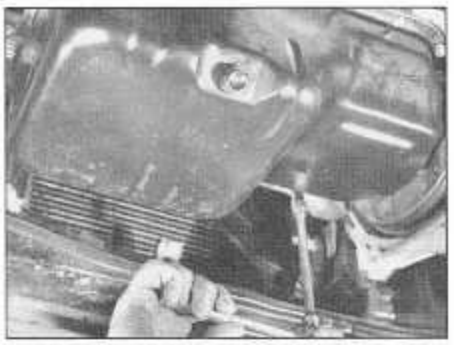
13.25b Cylinder head bolt tightening sequence – DOHC engine



14.5 Undo retaining bolts (arrowed) and remove anti-twisting bracket



14.6 Remove flywheel/driveplate cover retaining nuts/bolts (upper nut arrowed), then remove cover - manual gearbox shown



14.7a Undo sump retaining nuts and bolts . . .

the manifold and refit the manifold support bracket. Refit the lambda sensor (where applicable) and refit the intake duct and hose.

29 On SOHC engines, refit the camshaft and rocker arms (if removed), or refit the timing belt to the camshaft sprocket. Refit the distributor.

30 On DOHC engines, slide the timing belt inner cover into position on the cylinder head and tighten its retaining bolt securely. Refit the rocker arms and camshafts, then the timing belt.

31 Reconnect the battery negative terminal, then refit the spark plugs and refill the cooling system.

14 Sump – removal and refitting

Removal

1 Disconnect the battery negative terminal.

2 Drain the engine oil (see Chapter 1), then clean and refit the engine oil drain plug, tightening it to the specified torque wrench setting. If the engine is nearing the service interval when the oil and filter are due for renewal, then renew the filter.

3 Apply the handbrake, then jack up the front of the vehicle and support it on axle stands (see *"Jacking and Vehicle Support"*).

4 Remove the exhaust front pipe.

5 Undo the three bolts securing the anti-twisting bracket to the engine/ transmission and remove the bracket from the underside of the cylinder block **(see illustration)**.

6 Remove the flywheel/driveplate cover retaining nuts and/or bolts (as applicable), then remove the cover **(see illustration)**.

7 Progressively slacken and remove all the sump retaining nuts and bolts. Break the sump joint by striking the sump with the palm of the hand, then lower the sump away from the engine and withdraw it. Remove the gasket and discard it **(see illustrations)**.

8 With the sump removed, take the opportunity to unbolt the oil pump pick-up/strainer pipe **(see illustration)** and clean it, using a suitable solvent. Inspect the strainer mesh for signs of clogging or splitting and renew if necessary.

Refitting

9 Clean all traces of gasket from the mating surfaces of the cylinder block/crankcase and sump, then use a clean rag to wipe out the sump and the engine's interior. If the oil pump pick-up/strainer pipe was removed, fit a new gasket to its end **(see illustration)** and refit the pipe, tightening its retaining nuts and bolts to their specified torque settings.

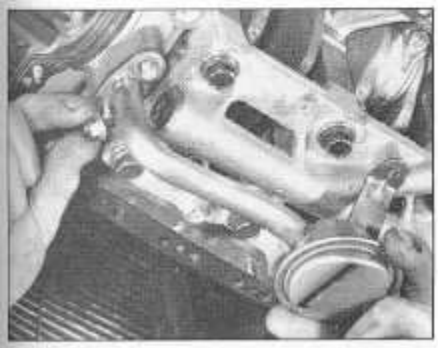
14.7b . . . and remove sump from engine

10 Apply a suitable sealant to the areas of the sump on each side of the semi-circular crankshaft cut-outs, then fit a new gasket to the sump **(see illustration)**. Apply the sealant to the same areas of the gasket upper surface.

11 Offer up the sump to the cylinder block/crankcase, then refit the sump retaining nuts and bolts, noting that on models fitted with a manual gearbox, it will not be necessary to refit the two right-hand sump nuts until the flywheel cover plate is fitted.

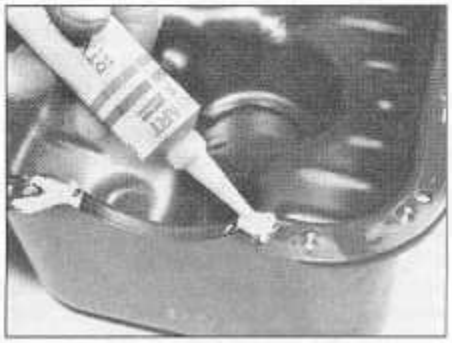
12 Working out from the centre in a diagonal sequence, progressively tighten the sump retaining nuts and bolts to their specified torque setting.

13 Refit the flywheel/driveplate cover and



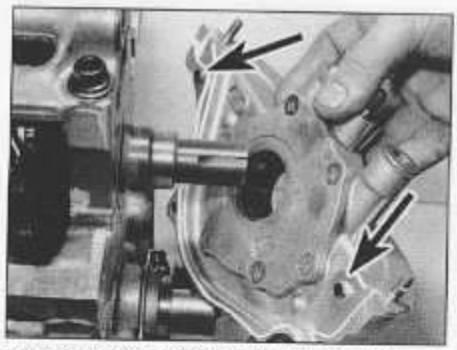
14.8 Unbolt oil pump pick-up pipe/strainer and remove from engine

14.9 Fitting a new oil pump pick-up pipe/strainer gasket

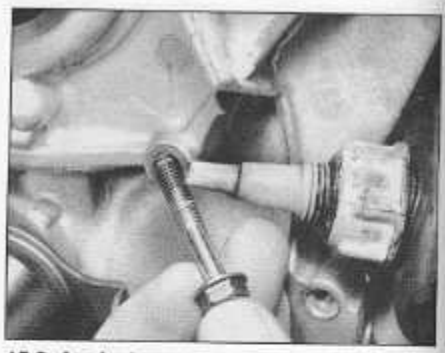


14.10 Apply sealant to sump and gasket upper surface on either side of crankshaft cut-outs

15.5 Fit new O-ring to oil pump recess



15.7 Apply thin bead of sealant to oil pump mating surface, then fit pump to engine, ensuring locating dowels (arrowed) are in position



15.8 Apply thread-locking compound to oil pump bolts and tighten to specified torque

tighten its retaining nuts and/ or bolts to the specified torque setting.

14 Fit the anti-twisting bracket and tighten its retaining bolts to their specified torque settings.

15 Refit the front exhaust pipe, then lower the vehicle to the ground and replenish the engine oil as described in Chapter 1.

15 Oil pump – removal and refitting

Removal

1 Remove the crankshaft sprocket.

2 Remove the sump and oil pump pick-up/strainer pipe.

3 Remove the four bolts securing the oil pump assembly to the cylinder block, then slide the pump off the end of the crankshaft, noting its two locating dowels. Remove the O-ring from the cylinder block and discard it. The O-ring must be renewed whenever disturbed.

Refitting

4 Remove all traces of gasket sealant from the mating surfaces of the oil pump and cylinder block, ensuring the surfaces are clean and dry.

5 Apply a thin bead of suitable sealant to the centre of the mating surface of the oil pump, then fit a new O-ring to the recess in the oil pump **(see illustration)**.

6 It is now essential that the pump is primed before fitting by injecting oil into it and turning it by hand.

7 Ensure that the locating dowels are in position, then apply a smear of oil to the lip of the pump oil seal and locate the pump on the end of the crankshaft. Locate the pump inner gear on the crankshaft flats and push the pump fully into position **(see illustration)**.

8 Apply a few drops of thread-locking compound to the threads of each oil pump retaining bolt, then fit the bolts and progressively tighten them to the specified torque setting **(see illustration)**.

9 Refit the oil pump pick-up/strainer pipe and sump.

10 Remove all traces of oil, then refit the crankshaft sprocket.

16 Oil pump – dismantling, inspection and reassembly

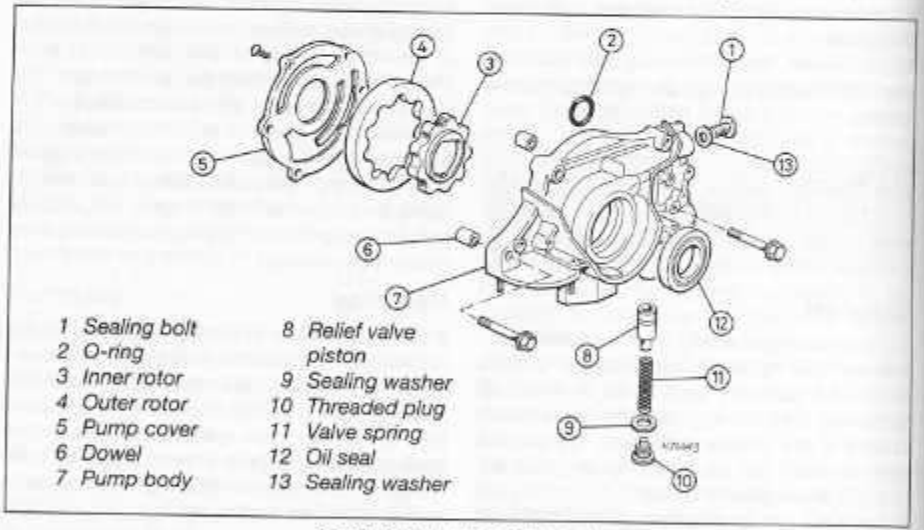
Dismantling

1 Remove the oil pump.

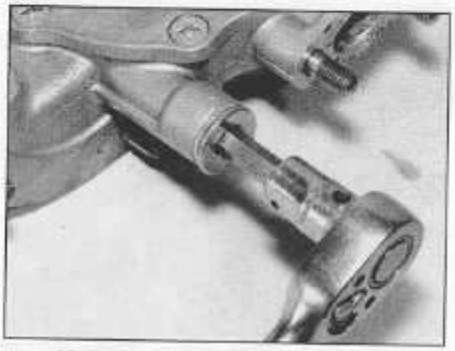
2 Undo the six pump cover retaining screws and remove the cover from the pump body.

3 Using a suitable marker pen, mark the outer surface of both the inner and outer rotors, then remove them from the pump body.

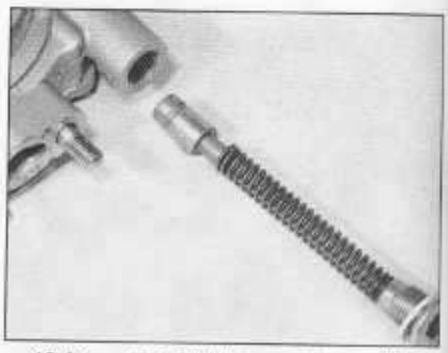
4 The oil pressure relief valve can be dismantled, if required, without disturbing the pump cover. To dismantle the valve, unscrew the threaded plug and recover the valve spring and plunger. Discard the plug's sealing washer **(see illustrations)**.



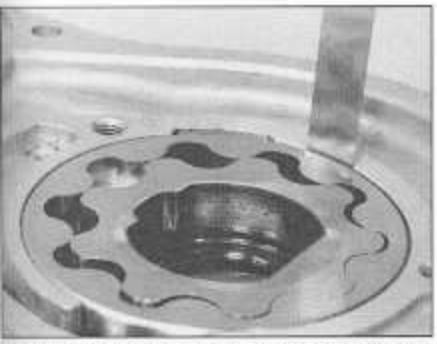
16.4a Oil pump components



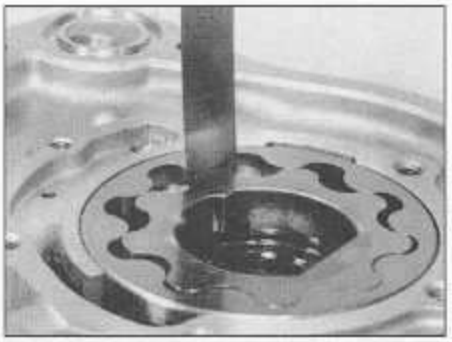
16.4b Unscrew threaded plug . . .



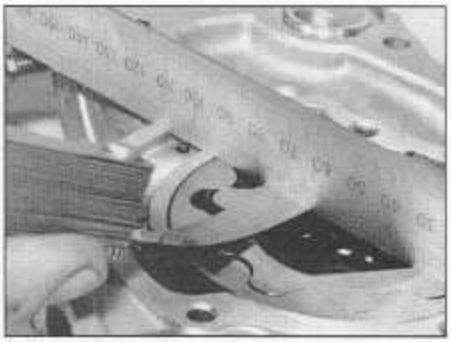
16.4c . . . and withdraw spring and oil pressure relief valve piston, noting which way around it is fitted



16.6a Measuring oil pump outer rotor-to-body clearance



16.6b Measuring oil pump rotor tip clearance



16.7 Measuring oil pump rotor endfloat

Inspection

5 Inspect the rotors for obvious signs of wear or damage and renew if necessary. If the pump body or cover plate is scored or damaged, the complete oil pump assembly must be renewed. If all appears to be well, refit the rotors to the pump and check the following.

6 Using feeler gauge blades, measure the clearance between the outer rotor and the pump body, and between the tips of the inner and outer rotor lobes **(see illustrations)**.

7 Using feeler gauge blades and a straightedge placed across the top of the pump body and rotors, measure the rotor endfloat **(see illustration)**.

8 If any measurement is outside the specified limits, the complete pump assembly must be renewed.

9 If the pressure relief valve plunger is scored, or if it does not slide freely in the pump body bore, the oil pump must be renewed as an assembly.

10 The pump oil seal should be renewed as a matter of course. The old seal can be carefully levered out of position by using a suitable flat-bladed screw and the new seal tapped into position by using a suitable tubular drift (such as a socket) which bears only on the hard outer edge of the seal. Fit the seal with its sealing lip facing inwards and tap it into the pump body until it seats on its locating shoulder **(see illustrations)**.

Reassembly

11 Lubricate the rotors with clean engine oil and refit them to the pump body, using the marks made on dismantling to ensure they are fitted the correct way around.

12 Ensure the pump body and cover mating surfaces are clean and dry, then refit the cover. Apply a few drops of thread-locking compound to the threads of each cover retaining screw, then fit the screws and tighten them to the specified torque setting **(see illustration)**.

13 Check that the pump rotors are free to turn smoothly, then prime the pump by injecting oil into its passages and rotating it. If the pump is not to be refitted immediately, prime it again before installation.

14 Lubricate the relief valve piston with clean engine oil, then refit the piston, ensuring that it is the correct way up. Refit the spring. Fit a new sealing washer to the threaded plug and tighten the plug to its specified torque setting.

17 Oil cooler (DOHC engine) – removal and refitting

Removal

1 Apply the handbrake, then jack up the front of the vehicle and support it on axle stands (see *"Jacking and Vehicle Support"*).

2 Remove the oil filter as described in Chapter 1. If the engine is nearing its service interval when the oil and filter are both due for renewal, then drain the engine oil. After reassembly, the engine can then be replenished with new oil and a new filter fitted.

3 Either drain the cooling system or be prepared for some coolant spillage during the following operation. Release the retaining clips and disconnect the coolant hoses from the oil cooler. Plug both hose ends to prevent the entry of dirt into the cooling system. Work quickly to minimise coolant loss if the system has not been drained.

4 Unscrew the oil cooler centre bolt and remove the cooler from the rear of the cylinder block. Remove the oil cooler O-ring and discard it. The O-ring must be renewed whenever disturbed.

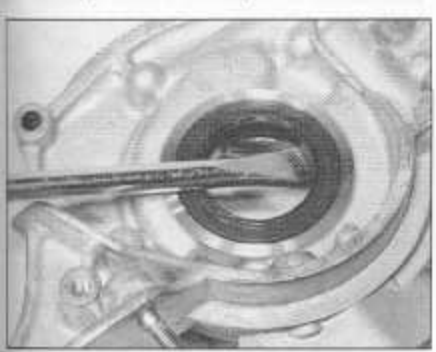
Refitting

5 Fit a new O-ring to the recess in the oil cooler and apply a smear of clean engine oil to the O-ring.

6 Offer up the oil cooler, refit the centre bolt and tighten it to the specified torque setting.

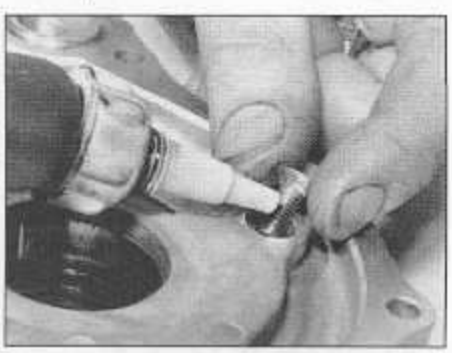
7 Refit the coolant hoses to the oil cooler and secure them in position with their retaining clips. Work quickly again to minimise coolant loss if the cooling system was not drained. Top-up or refill the cooling system as described in Chapter 1.

8 Fit the oil filter, then lower the vehicle to the ground and top-up or refill (as applicable) the cooling system and engine oil (see *"Weekly checks"*).

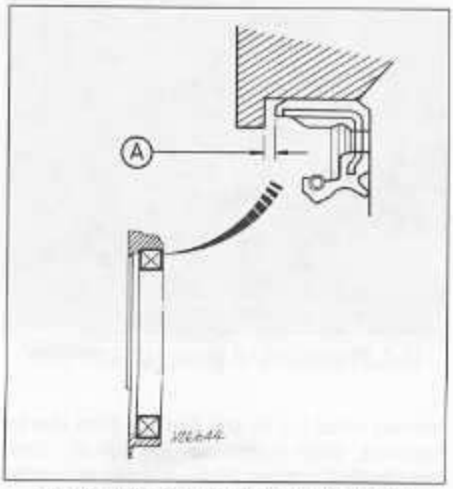


16.10a Removing oil pump seal with a flat-bladed screwdriver . . .

16.10b . . . and tapping new seal into position using a suitable tubular drift



16.12 Apply thread-locking compound to pump cover screws and tighten to specified torque

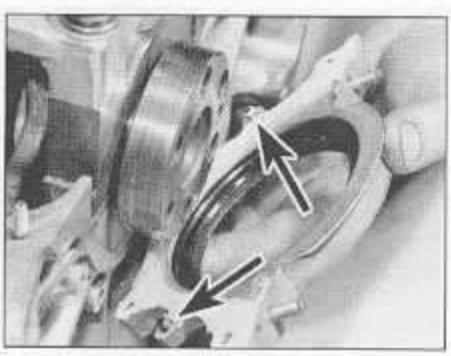


18.11a Crankshaft right-hand oil seal installation. Ensure gap 'A' between seal inner edge and cover is 0.2 to 0.5 mm

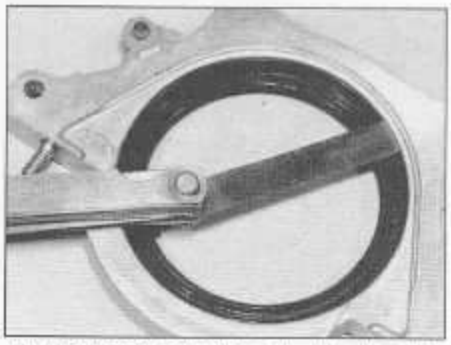
18 Crankshaft oil seals – renewal

Left-hand seal

1 Remove the crankshaft sprocket.
2 Punch or drill two small holes opposite each other in the seal. Screw a self-tapping screw into each and pull on the screws with pliers to extract the seal.
3 Clean the seal housing and polish off any burrs or raised edges which may have caused the seal to fail.
4 Lubricate the lips of the new seal with clean engine oil and drive it into position until it seats on its locating shoulder, using a suitable tubular drift (such as a socket) which bears only on the hard outer edge of the seal. Take care not to damage the seal lips during fitting. Use either grease or a thin layer of insulating tape to protect the seal lips from the edges of the crankshaft flats but be careful to remove all traces of tape and to lubricate the seal lips if the second method is used. Note that the seal lips should face inwards.



18.14 . . . and refit housing to engine, ensuring locating dowels (arrowed) are correctly positioned

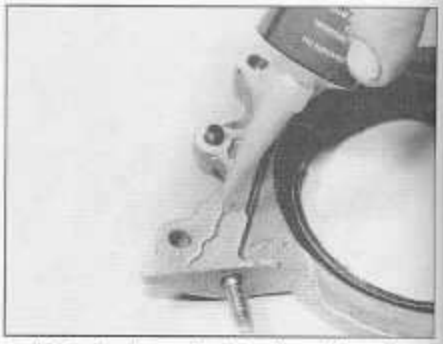


18.11b Using feeler blade to check right-hand oil seal-to-housing clearance

5 Wash off any traces of oil, then refit the crankshaft sprocket.

Right-hand seal

6 Note that although it is possible to renew this oil seal with its housing in position on the engine, the position of the oil seal in its housing is critical. Without access to Rover special tool 18G 1485 with which to fit the new seal, it will be very difficult to ensure that the seal is correctly positioned. For this reason, it is recommended that the seal housing is removed from the engine to facilitate seal renewal.
7 Remove the flywheel/driveplate.
8 Remove the sump.
9 Remove the four bolts securing the seal housing to the cylinder block and slide the housing off the end of the crankshaft, noting its two locating dowels.
10 Using a large flat-bladed screwdriver, carefully lever the old seal out of its housing. Clean the seal housing and polish off any burrs or raised edges which may have caused the seal to fail in the first place.
11 Lubricate the outer edge of the new seal and tap the seal gently into place in the housing until the chamfer of the seal outer surface is correctly lined up with the inner chamfer of the oil seal housing. Note that the seal sealing lip must be facing inwards. With the seal in this position, use feeler blades to check that the clearance between the inner edge of the seal and the locating shoulder of its housing is 0.2 to 0.5 mm **(see illustrations)**. Note that the gap must also be equal all the way around the circumference of the seal. If necessary, carefully adjust the position of the seal by gently levering it out or tapping it into the housing (as applicable).
12 Remove all traces of sealant from the cylinder block and housing mating surfaces, ensuring the surfaces are clean and dry.
13 Apply a thin coating of suitable sealant to the housing mating surface **(see illustration)** and lubricate the oil seal lip with a smear of engine oil.
14 Check that the locating dowels are in position, then carefully ease the oil seal housing over the crankshaft end, pushing it fully into position on the cylinder block. Refit the housing retaining bolts and tighten them to the specified torque setting **(see illustration)**.
15 Refit the sump and flywheel/driveplate.

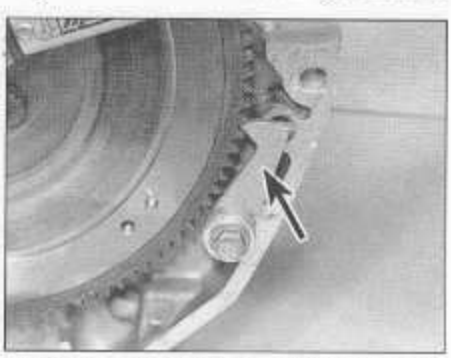


18.13 Apply sealant to oil seal housing mating surface . . .

19 Flywheel/driveplate – removal, inspection and refitting

Removal

1 Remove the transmission. On manual gearbox models, also remove the clutch assembly.
2 Prevent the flywheel/driveplate from turning by locking the ring gear teeth as shown **(see illustration)** or by bolting a strap between the flywheel and the cylinder block/crankcase.
3 Mark the relationship between the flywheel/driveplate and crankshaft, then remove the flywheel/driveplate retaining bolts. On automatic transmission models, also remove the driveplate retaining bolt spacer.
4 Remove the flywheel/driveplate **(see illustration)**. It is very heavy, so do not drop it.



19.2 Use fabricated tool (arrowed) to lock flywheel/driveplate

Inspection

5 On manual gearbox models, examine the flywheel for scoring of the clutch face and for wear or chipping of the ring gear teeth. If the clutch face is scored, the flywheel may be machined until flat but renewal is preferable. If the ring gear is worn or damaged, the flywheel must be renewed as it is not

19.4 Removing the flywheel

19.5 Tap flywheel centre bearing into position using a hammer and suitable tubular drift

possible to renew the ring gear separately. Inspect the centre bearing for signs of free play and check that its inner race rotates smoothly without any sign of roughness. If necessary, the bearing can be renewed individually. The old bearing can be drifted out of position and the new one tapped into place using a suitable tubular drift (such as a socket) which bears only on the bearings outer race **(see illustration)**.

6 On automatic transmission models, check the torque converter driveplate carefully for signs of distortion and for any hairline cracks around the bolt holes or radiating outwards from the centre. Inspect the ring gear teeth for signs of wear or chipping. If any sign of wear or damage is found, the driveplate must be renewed.

Refitting

7 Ensure the mating surfaces of the flywheel/driveplate and crankshaft are clean, then refit the flywheel/driveplate, using the marks made on removal to ensure it is correctly positioned.

8 Refit the flywheel retaining bolts or the driveplate retaining bolts and spacer (as applicable), tightening them to the specified torque setting while using the method employed on dismantling to lock the flywheel/driveplate.

9 Refit the clutch (manual gearbox), then remove the locking tool and refit the transmission.

20 Engine/transmission mountings – inspection and renewal

Inspection

1 If improved access is required, raise the front of the vehicle and support it securely on axle stands (see *"Jacking and Vehicle Support"*). Inspect each mounting as follows.

2 Check the mounting rubber to see if it is cracked, hardened or separated from the metal at any point. Renew the mounting if any such damage or deterioration is evident.

3 Check that the mounting fasteners are securely tightened.

4 Using a large screwdriver or a pry bar, check for wear in the mounting by carefully levering against it to check for free play. Where this is not possible, enlist the aid of an assistant to move the engine/transmission unit back and forth, or from side to side, while you watch the mounting. While some free play is to be expected even from new components, excessive wear should be obvious. If excessive play is found, check first that the fasteners are correctly secured, then renew any worn components as described below.

Renewal

Right-hand mounting

5 Disconnect the battery negative terminal. Firmly apply the handbrake, then jack up the front of the vehicle and support it on axle stands (see *"Jacking and Vehicle Support"*).

6 To improve access to the mounting, use a pair of pliers to release the retaining clip then disconnect the vacuum pipe from the throttle housing end of the air intake hose. Slacken the retaining clamp which secures the intake hose to the throttle housing and disconnect the intake hose. Working along the length of the intake hose, release the vacuum hoses from their retaining clips, then disconnect the intake hose from the air cleaner housing and remove it from the engine compartment.

7 Support the weight of the engine/transmission unit with a trolley jack, using a wooden spacer to prevent damage to the sump, then remove the mounting through-bolt. Undo the two nuts (accessed from underneath) and the single bolt which secure the mounting to its mounting plate, then lower the engine/transmission unit slightly and remove the mounting. If necessary, undo the three mounting plate retaining bolts and remove the plate from the top of the transmission **(see illustrations)**.

8 Check all components for signs of wear or damage and renew as necessary.

9 On reassembly, refit the mounting plate (where removed) to the top of the transmission and tighten its retaining bolts to the specified torque setting. Refit the mounting to the mounting plate and tighten its retaining nuts and bolt to the specified torque.

10 Use the trolley jack to position the engine/transmission unit at the correct height, then refit the through-bolt and tighten it to the specified torque setting.

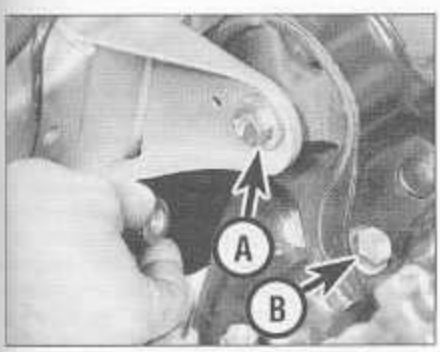
11 Remove the trolley jack from underneath the vehicle and lower the vehicle to the ground.

12 Refit the air intake hose and securely tighten its retaining clamp. Ensure the vacuum pipe and hoses are properly routed and retained by all the necessary clips. Reconnect the battery.

Left-hand mounting

13 Disconnect the battery negative terminal.

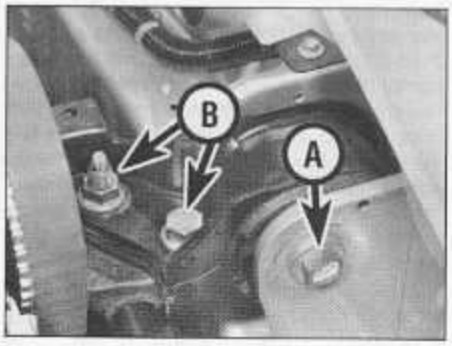
14 Support the weight of the engine/transmission unit with a trolley jack, using a wooden spacer to prevent damage to



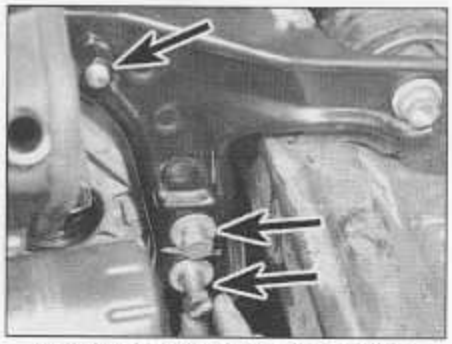
20.7a Remove right-hand mounting through-bolt (A) and mounting-to-mounting plate bolt (B) . . .

20.7b . . . and two mounting plate retaining nuts (viewed from underneath)

20.7c Right-hand mounting plate is retained by three bolts



20.14 Left-hand mounting through-bolt (A) and mounting retaining nut and bolt (B)



20.22a Remove three bolts (arrowed) securing rear mounting to transmission . . .

20.22b . . . then undo mounting through-bolt and withdraw mounting bracket - manual gearbox shown

the sump. Remove the mounting through-bolt, then undo the nut and bolt securing the mounting to its engine mounting bracket **(see illustration)** and remove the mounting from the vehicle.

15 To dismantle the engine mounting bracket, first remove the timing belt lower cover. The bracket assembly can then be unbolted from the cylinder block.

16 Check all components for signs of wear or damage and renew as necessary.

17 On reassembly, refit the engine mounting bracket assembly (if removed), tightening all its fasteners to the specified torque, then refit the timing belt cover.

18 Manoeuvre the mounting into position, then refit its retaining nut and bolt, tightening them to the specified torque setting.

19 Use the trolley jack to raise the engine to the correct height, then refit the mounting through-bolt, tightening it to the specified torque setting.

20 Lower the vehicle to the ground, then remove the trolley jack and reconnect the battery.

Rear mounting

21 Disconnect the battery negative terminal. Apply the handbrake, then jack up the front of the vehicle and support it securely on axle stands (see *"Jacking and Vehicle Support"*).

22 Support the weight of the engine/transmission unit with a trolley jack, using a wooden spacer to prevent damage to the transmission casing. Remove the three bolts securing the rear mounting bracket to the transmission. Undo the mounting through-bolt and manoeuvre the mounting bracket out of position **(see illustrations)**.

23 Undo the three bolts securing the mounting to the rear crossmember, then remove the mounting from the vehicle.

24 Check all components for signs of wear or damage and renew as necessary.

25 On reassembly, fit the mounting to the crossmember and tighten its retaining bolts to the specified torque.

26 Manoeuvre the mounting bracket into position, then fit the through-bolt, tightening it by hand only. Refit the three mounting bracket-to-transmission bolts, tightening them to the specified torque. Now tighten the mounting through-bolt to the specified torque.

27 Lower the vehicle to the ground and reconnect the battery.

Front mounting

28 Disconnect the battery negative terminal. With the handbrake firmly applied, jack up the front of the vehicle and support it securely on axle stands (see *"Jacking and Vehicle Support"*).

29 From underneath the front of the vehicle, remove the three bolts securing the bumper flange to the body. Remove the seven bolts securing the front undercover panel to the body and remove the panel.

30 Support the weight of the engine/transmission unit with a trolley jack, using a wooden spacer to prevent damage to the transmission casing, then remove the front mounting through-bolt. Undo the two bolts securing the mounting to the cylinder block and remove it from under the vehicle **(see illustration)**.

31 Check the mounting for signs of wear or deterioration and renew if necessary.

32 Offer up the mounting, then refit the two bolts which secure it to the cylinder block, tightening them to the specified torque. Fit the through-bolt, tightening it to the specified torque setting.

33 Refit the undercover panel, then lower the vehicle to the ground and reconnect the battery.

20.30 Front engine/transmission mounting viewed from underneath

Chapter 2 Part B:
Engine removal and general overhaul procedures

Contents

Degrees of difficulty

Easy, suitable for novice with little experience

Fairly easy, suitable for beginner with some experience

Fairly difficult, suitable for competent DIY mechanic

Difficult, suitable for experienced DIY mechanic

Very difficult, suitable for expert DIY or professional

Specifications

Refer to Part A of this Chapter

1 General information

Included in this part of the Chapter are details of removing the engine/ transmission unit from the vehicle and general overhaul procedures for the cylinder head, cylinder block/crankcase and all other engine internal components **(see illustration overleaf)**.

The information given ranges from advice concerning preparation for an overhaul and the purchase of replacement parts, to detailed step-by-step procedures covering removal, inspection, renovation and refitting of engine internal components.

After Section 5, all instructions are based on the assumption that the engine has been removed from the vehicle. For information concerning in-car engine repair, as well as the removal and refitting of those external components necessary for full overhaul, refer to Part A of this Chapter and to Section 5. Ignore any preliminary dismantling operations described in Part A that are no longer relevant once the engine has been removed from the vehicle.

2 Engine overhaul – general information

It is not always easy to determine when, or if, an engine should be completely overhauled, as a number of factors must be considered.

High mileage is not necessarily an indication that an overhaul is needed, while low mileage does not preclude the need for an overhaul. Frequency of servicing is probably the most important consideration. An engine which has had regular and frequent oil and filter changes, as well as other required maintenance, should give many thousands of miles of reliable service. Conversely, a neglected engine may require an overhaul very early in its life.

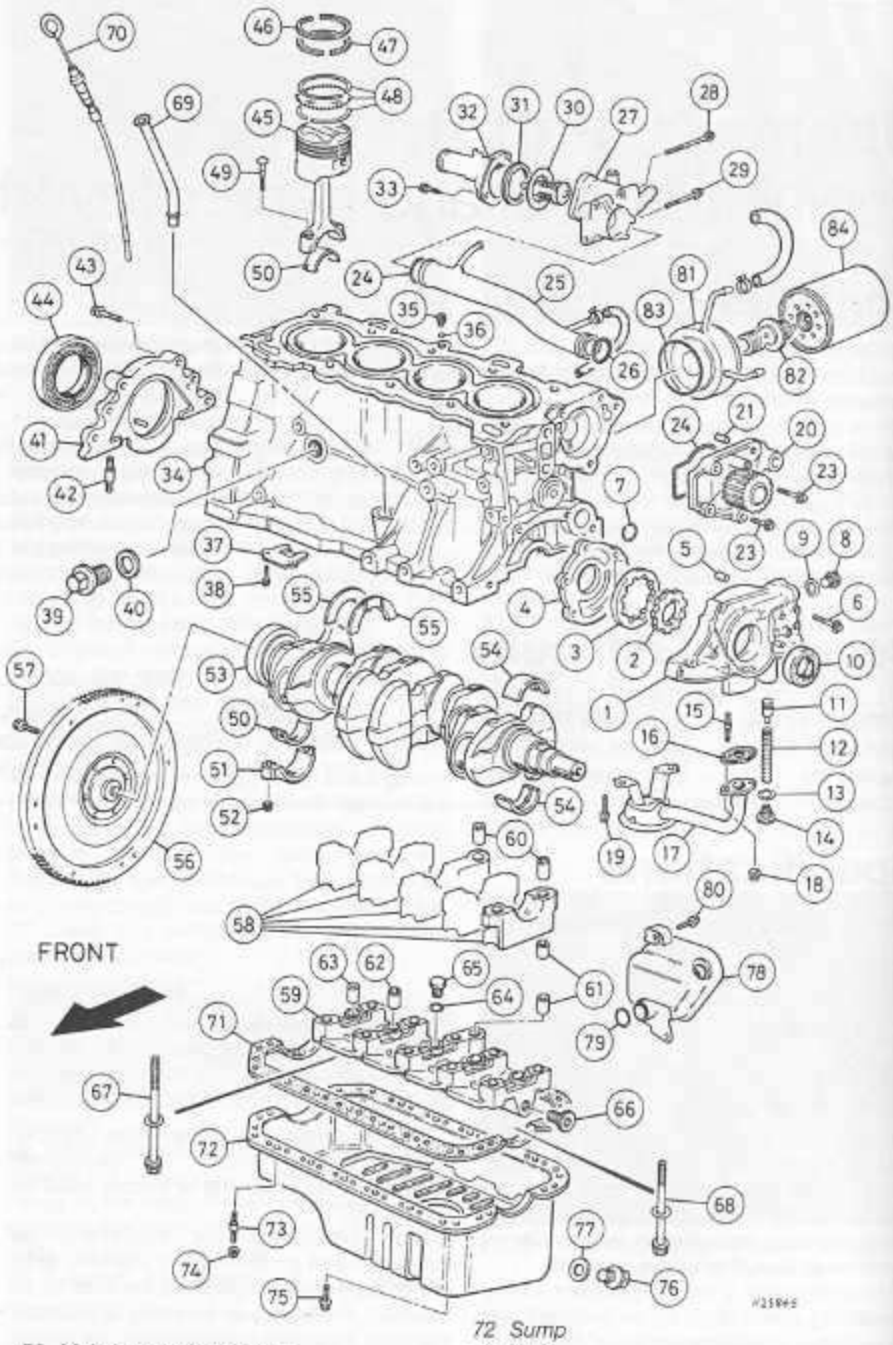
Excessive oil consumption is an indication that piston rings, valve seals and/or valve guides are in need of attention. Ensure that oil leaks are not responsible before deciding that the rings and/or guides are worn. Perform a compression test to determine the likely cause of the problem.

Check the oil pressure with a gauge fitted in place of the oil pressure switch and compare it with that specified. If it is extremely low, the main and big-end bearings and/or the oil pump are probably worn out.

Loss of power, rough running, knocking or metallic engine noises, excessive valve gear noise and high fuel consumption may also point to the need for an overhaul, especially if they are all present at the same time. If a complete service does not remedy the situation, major mechanical work is the only solution.

An engine overhaul involves restoring all internal parts to the specification of a new engine. During an overhaul, the pistons and the piston rings are renewed and, if necessary, the cylinder block is rebored. New main and big-end bearings are generally fitted and if necessary, the crankshaft may be renewed to restore the journals. The valves are also serviced, since they are usually in less than perfect condition at this point. While the engine is being overhauled, other components, such as the distributor, starter and alternator can be overhauled as well. The end result should be an as-new engine that will give many trouble-free miles.

1.1 Engine bottom end components



1 Oil pump housing
2 Oil pump inner rotor
3 Oil pump outer rotor
4 Oil pump cover
5 Oil pump dowel
6 Bolt – oil pump-to-cylinder block
7 O-ring
8 Sealing bolt
9 Sealing washer
10 Crankshaft left-hand oil seal
11 Oil pump relief valve piston
12 Oil pump relief valve spring
13 Sealing washer
14 Threaded plug
15 Stud
16 Gasket – oil pump- to-pick-up/strainer
17 Oil pick-up/strainer pipe
18 Nut – pick-up/strainer pipe-to-oil pump
19 Bolt – pick-up/strainer pipe-to-main bearing bridge
20 Coolant pump
21 Dowel
22 O-ring
23 Bolt – coolant pump-to-cylinder block
24 O-ring
25 Coolant pipe – thermostat housing-to-coolant pump
26 O-ring
27 Thermostat housing
28 Bolt – thermostat housing-to-cylinder block
29 Bolt – thermostat housing-to-cylinder block
30 Thermostat
31 Thermostat seal
32 Thermostat housing cover
33 Bolt – thermostat cover-to-housing
34 Cylinder block
35 Oil control jet
36 O-ring
37 Breather cover plate
38 Bolt – breather cover plate-to-cylinder block
39 Coolant drain plug
40 Sealing washer
41 Right-hand crankshaft oil seal housing
42 Stud
43 Bolt – oil seal housing-to-cylinder block
44 Right-hand crankshaft oil seal
45 Piston and connecting rod assembly
46 Top compression ring
47 Second compression ring
48 Oil control ring
49 Connecting rod big-end cap bolt
50 Connecting rod big-end bearing shell
51 Connecting rod big-end bearing cap
52 Connecting rod big-end bearing cap nut
53 Crankshaft
54 Crankshaft main bearing shell
55 Crankshaft thrustwashers
56 Flywheel/driveplate
57 Bolt flywheel/driveplate-to-crankshaft
58 Main bearing caps
59 Main bearing cap bridge
60 Dowel
61 Dowel
62 Dowel
63 Dowel
64 O-ring
65 Threaded plug
66 Threaded plug
67 Main bearing cap bolt
68 Main bearing cap bolt
69 Dipstick tube
70 Dipstick
71 Sump gasket
72 Sump
73 Stud
74 Nut – sump-to-cylinder block
75 Bolt – sump-to-cylinder block
76 Sump drain plug
77 Sealing washer
78 Oil separator
79 O-ring
80 Bolt oil separator-to-cylinder block
81 Oil cooler – DOHC engine only
82 Oil cooler centre bolt – DOHC engine only
83 O-ring – DOHC engine only
84 Oil filter

Critical cooling system components such as the hoses, thermostat and coolant pump should be renewed when an engine is overhauled. The radiator should be checked carefully to ensure that it is not clogged or leaking. Also, it is a good idea to renew the oil pump whenever the engine is overhauled.

Before beginning the engine overhaul, read through the entire procedure to familiarize yourself with the scope and requirements of the job. Overhauling an engine is not difficult if you follow carefully all of the instructions, have the necessary tools and equipment, and pay close attention to all specifications. However, it can be time-consuming. Plan on the vehicle being off the road for a minimum of two weeks, especially if parts must be taken to an engineering works for repair or reconditioning. Check on the availability of parts and ensure that any necessary special tools and equipment are obtained in advance. Most work can be done with typical hand tools, although a number of precision measuring tools are required for inspecting parts to determine if they must be renewed. Often an engineering works will handle the inspection of parts and offer advice concerning reconditioning and renewal.

Always wait until the engine has been completely dismantled and all components, especially the cylinder block/crankcase, the cylinder liners and the crankshaft have been inspected before deciding what service and repair operations must be performed by an engineering works. Since the condition of these components will be the major factor to consider when determining whether to overhaul the original engine or buy a reconditioned unit, do not purchase parts or have overhaul work done on other components until they have been thoroughly inspected. As a general rule, time is the primary cost of an overhaul, so it does not pay to fit worn or substandard parts.

As a final note, to ensure maximum life and minimum trouble from a reconditioned engine, everything must be assembled with care, in a spotlessly-clean environment.

3 Engine/transmission removal – methods and precautions

If you have decided that the engine must be removed for overhaul or major repair work, several preliminary steps should be taken.

Locating a suitable place to work is extremely important. Adequate work space, along with storage space for the vehicle, will be needed. If a shop or garage is not available, at the very least a flat, level, clean work surface is required.

Cleaning the engine compartment and engine/transmission unit before beginning the removal procedure will help keep things clean and organized.

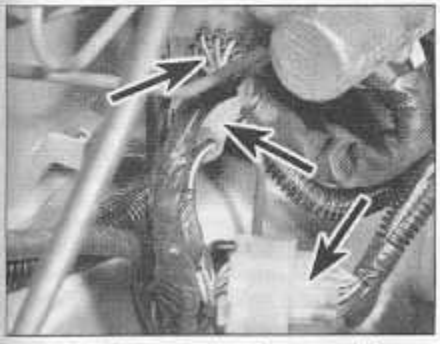
An engine hoist or A-frame will also be necessary. Ensure the equipment is rated well in excess of the combined weight of the engine and transmission (350 lb/160 kg approximately). Safety is of primary importance, considering the potential hazards involved in lifting the engine/transmission unit out of the vehicle.

If the engine/transmission unit is being removed by a novice, then a helper should be available. Advice and aid from someone more experienced would also be helpful. There are many instances when one person cannot simultaneously perform all of the operations required when lifting the engine out of the vehicle.

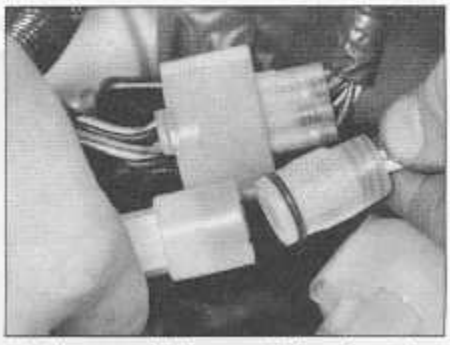
Plan the operation ahead of time. Before starting work, obtain all of the tools and equipment you will need. Some of the items necessary to perform engine/transmission removal and refitting safely and with relative ease are, in addition to an engine hoist, a heavy-duty trolley jack, a complete set of spanners and sockets, wooden blocks and plenty of rags and cleaning solvent for mopping-up spilled oil, coolant and fuel. If the hoist must be hired, ensure that you arrange for it in advance and perform all of the operations possible without it beforehand. This will save you money and time.

Plan for the vehicle to be out of use for quite a while. An engineering works will be required to perform some of the work which the do-it-yourselfer cannot accomplish without special equipment. These places often have a busy schedule, so it would be a good idea to consult them before removing the engine in order to accurately estimate the amount of time required to rebuild or repair components that may need work.

Always be extremely careful when removing and refitting the engine/transmission unit. Serious injury can result from careless actions. Plan ahead, take your time and a job of this nature, although major, can be accomplished successfully.



4.11a Release engine harness wiring connectors (arrowed) from mounting bracket in right-hand corner of engine compartment . . .



4.11b . . . and disconnect them from the main loom

4 Engine/transmission – removal and refitting

Note: *The engine can be removed from the vehicle only as a complete unit with the transmission.*

Removal

1 Park the vehicle on firm, level ground, then remove the bonnet.

2 If the engine is to be dismantled, drain the oil and remove the oil filter, then clean and refit the drain plug, tightening it to its specified torque setting (see Chapter 1).

3 Firmly apply the handbrake, then jack up the front of the vehicle and support it securely on axle stands (see *"Jacking and Vehicle Support"*). Remove both front roadwheels.

4 From underneath the front of the vehicle, remove the three bolts securing the bumper flange to the body. Remove the seven bolts securing the front undercover panel to the body and remove the panel.

5 Drain the transmission oil, then clean and refit the drain plug, tightening it to its specified torque setting (see Chapter 2A Specifications).

6 Drain the cooling system (see Chapter 1).

7 Remove the battery, battery tray and support bracket.

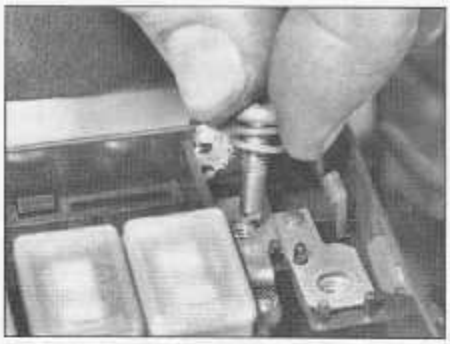
8 Remove the two bolts securing the intake duct to the bonnet locking platform, then release the expansion tank hose from its duct retaining clips. Disconnect the duct from the intake hose, then free its lower retaining clip from the radiator and remove the duct from the engine compartment.

9 Remove the starter motor.

10 Remove the distributor.

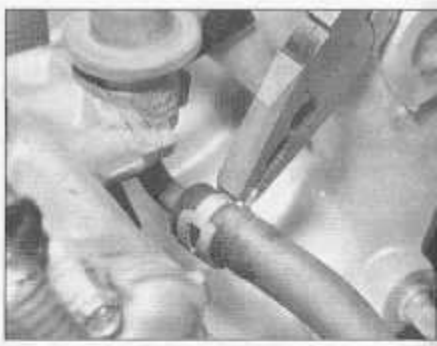
11 Trace the engine wiring harness back from the engine to the right-hand corner of the engine compartment and undo the bolt securing the harness retaining clip to the body. Disconnect the three engine harness wiring connectors and release them from the mounting bracket so that the engine harness is free to be removed with the engine/transmission unit **(see illustrations)**.

12 Unclip the engine compartment fusebox lid and remove the fusible link cover plate.



4.12 Undo the retaining screw and disconnect the battery lead to the fusebox terminal

4.14a Disconnect the outlet hose from the fuel filter. Note sealing washers (arrowed)



4.14b Release the retaining clip and disconnect the return hose from the fuel pressure regulator

Remove the screw which secures the battery lead to the fusebox terminal and remove the lead from the underside of the box. Refit the screw loosely to the fusebox terminal for safe keeping **(see illustration)**.

13 Undo the retaining screw and free the earth lead from the bonnet locking platform.

14 Depressurise the fuel system, then unscrew the fuel filter outlet union bolt and disconnect the outlet hose from the filter. Discard the union sealing washers, as they must be renewed whenever disturbed. Using pliers, release its retaining clip then disconnect the return hose from the base of the fuel pressure regulator **(see illustrations)**. Plug all fuel unions, to minimise the loss of fuel and prevent the entry of dirt into the fuel system.

15 Disconnect the accelerator cable from the throttle housing. Free the cable from all of its retaining clips and place it clear of the engine/transmission unit.

16 On SOHC engine models with power steering, undo the bolt securing the power steering pump hose retaining bracket to the pump and remove the bracket. Undo the three pump mounting bolts, then disengage the drivebelt from the pump pulley and remove it from the engine. Release the hoses from any retaining clips and place the pump clear of the engine.

17 On DOHC engines with power steering, where necessary, remove the bolt securing the air conditioning pipe to the pump mounting bracket. Unscrew the pump adjusting bolt, then remove the pump mounting bolts and remove the power steering pump drivebelt. Release the pump hoses from any retaining clips and place the pump clear of the engine.

18 On all models with air conditioning, slacken the drivebelt adjuster (idler) pulley centre bolt, then slacken the adjuster bolt until the drivebelt can be slipped off the pulleys and removed. Undo the four bolts securing the air conditioning compressor to the engine, then place the compressor clear of the engine, tying it to the body so that it will not hinder engine/transmission removal.

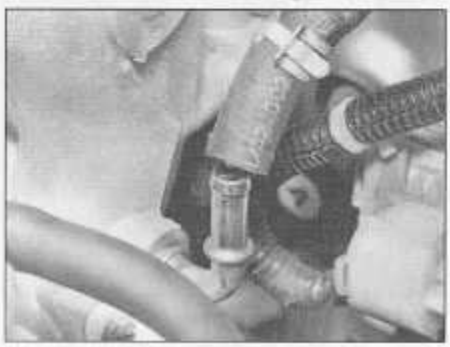
19 On manual gearbox models, slide the gearbox selector shaft gaiter towards the gearbox, then remove the roll pin retaining clip from the gearbox end of the gearchange selector rod. Using a hammer and suitable punch, tap the roll pin out of the selector rod and disconnect the rod from the gearbox. Remove the bolt which secures the steady rod to its gearbox mounting bracket and free the rod from the bracket. Turn the clutch cable adjusting nut anti-clockwise to obtain maximum clutch cable free play, then raise the gearbox clutch release lever and disconnect the cable from the lever. Free the cable from its bracket and place it clear of the gearbox.

20 On automatic transmission models, disconnect the selector cable from the transmission. Disconnect the wiring connector from the transmission lock-up control solenoid, which is situated on the top surface of the transmission. Where necessary, slacken the two fluid cooler hose retaining clips and disconnect both hoses from the transmission. Plug both the hose and transmission pipe ends to prevent the entry of dirt into the hydraulic system.

21 On all models, remove the gaiter from the lower end of the speedometer cable and slide the gaiter up the cable. Carefully remove the cable retaining clip and withdraw the cable from the drivegear housing.

22 Remove the exhaust front pipe and (where fitted) the lambda sensor.

23 Disconnect the resonator vacuum hose from the manifold and the MAP sensor vacuum hose from the top of the throttle housing. Using pliers, release the retaining clip and disconnect the brake vacuum servo unit hose from the left-hand side of the inlet manifold **(see illustration)**.



4.23 Disconnect the braking system vacuum servo hose from the manifold

24 Trace the engine wiring harness back to the injector resistor pack, which is mounted onto the left-hand side of the engine compartment bulkhead, and disconnect the two wiring connectors. Free the engine harness from any relevant retaining clips or ties, so that it is free to be removed with the engine/transmission unit.

25 Slacken the retaining clips and disconnect the heater hose and the radiator top hose from the right-hand end of the cylinder head.

26 Remove the bolt and washer securing the anti-roll bar connecting link to the right-hand lower suspension arm, then the two bolts securing the tie-bar to the lower suspension arm.

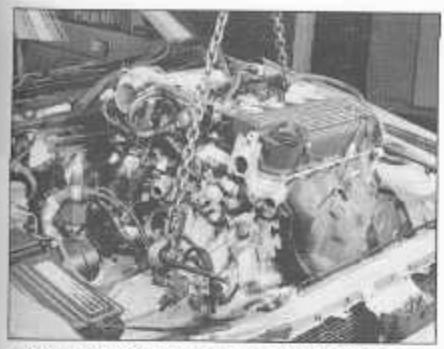
27 Extract the split pins and undo the nuts securing the steering gear track rod end balljoint and the right-hand lower suspension arm balljoint to the swivel hub. Remove the nuts and release the balljoint tapered shanks using a universal balljoint separator.

28 Insert a suitable flat bar between the right-hand inner constant velocity joint and transmission housing, then carefully lever the joint out of position, taking great care not to damage the transmission housing.

29 Withdraw the right-hand inner constant velocity joint from the transmission, supporting the driveshaft to avoid damaging the constant velocity joints or gaiters.

30 Repeating the operations described in paragraphs 26 to 29, disengage the left-driveshaft from the intermediate shaft.

31 The cylinder head has a tapped hole provided at the left-hand rear end. Using a suitable 10 mm bolt, attach a lifting bracket to the cylinder head at this point, noting that a suitable spacer of approximately 20 mm in length should be positioned between the lifting bracket and the cylinder head. The spacer will prevent the lifting chains contacting the cylinder head cover as the engine is lifted. The second lifting bracket is already fitted on the top surface of the transmission. Attach the lifting chains to the brackets then take the weight of the engine/transmission unit on the hoist while



4.38 Lifting out the engine/transmission unit - SOHC engine shown

checking that the chains do not come into contact with any other components.

32 Remove the two bolts securing the front mounting bracket to the engine/transmission unit. Do not slacken the mounting through-bolt, as the mounting is stepped and, if left in its original position, is very useful to use as an alignment point when lowering the engine/transmission unit back into the vehicle.

33 On manual gearbox models, undo the three bolts which secure the rear mounting bracket to the engine/transmission unit. Remove the mounting through-bolt, then manoeuvre the mounting bracket out of position and away from the gearbox.

34 On automatic transmission models, undo the three bolts securing the rear mounting bracket to the top of the transmission unit. Slacken the mounting through-bolt and pivot the bracket upwards and away from the transmission so that it will not hinder removal.

35 On all models, remove the right-hand mounting through-bolt, then lower the engine/transmission unit slightly. Undo the two nuts and single bolt which secure the mounting to its mounting plate, then remove the mounting. Undo the three mounting plate retaining bolts, then remove the plate from the top of the transmission and raise the unit back to its original height.

36 Remove the left-hand mounting through-bolt, then undo the nut and bolt which secure the mounting to its engine bracket. Remove the mounting from the engine.

37 Make a final check that all components which can prevent removal of the engine/transmission unit from the vehicle have been removed or disconnected and are positioned clear of the unit so that they will not hinder removal.

38 Lift the engine/transmission unit out of the vehicle, ensuring that nothing is trapped or damaged. Once the unit is high enough, lift it out over the front of the vehicle body and lower it to the ground **(see illustration)**.

39 If the engine and transmission are to be separated for overhaul, first undo the three bolts securing the intermediate shaft bearing housing to the cylinder block, then carefully lever the shaft out of the transmission, taking great care not damage the transmission oil seal.

40 *On manual gearbox models, undo the two* bolts which secure the anti-twisting bracket to the underside of the cylinder block, then the single bolt which secures it to the gearbox, then remove the bracket. Undo the flywheel lower cover plate retaining nuts and bolt, then remove the plate from the gearbox. Remove the remaining bolts securing the gearbox housing to the engine unit, noting the correct fitted positions of the bolts to use as a reference on refitting. Move the gearbox squarely away from the engine unit to release it from its locating dowels and separate the two. If necessary, also remove the clutch.

41 On automatic transmission models, first disconnect the kickdown cable from the transmission and throttle housing. Remove the visible bolt(s) which secure the torque converter to the driveplate. Using a spanner or socket and extension bar on the crankshaft pulley bolt, rotate the engine anti-clockwise and undo the remaining bolts as they become accessible through the lower cover plate aperture, noting that there are eight in total. Undo the remaining bolts securing the transmission housing to the engine unit, noting the correct fitted positions of the bolts for reference on refitting. Move the transmission squarely away from the engine unit to release it from its locating dowels and separate the two, ensuring that the torque converter remains in position on the transmission.

Refitting

42 Refitting is the reverse of removal, following where necessary the instructions given in other Chapters of this Manual. Note the following additional points:

a) On manual gearbox models, prior to assembling the engine and transmission, overhaul and lubricate the clutch components as described in Chapter 6.

b) On automatic transmission models, when assembling the engine and transmission, note that the torque converter mounting bolts must be tightened to the specified torque setting in a diagonal sequence.

c) With the intermediate shaft fitted and its bearing housing bolts tightened to the specified torque, lower the engine/transmission unit into the engine compartment and align it with the front mounting bracket. Fit the front mounting bracket bolts first, then refit the remaining engine/transmission mountings.

d) Tighten all nuts and bolts to their specified torque wrench settings.

e) Ensure all hoses/pipes are securely reconnected to their original positions and, where necessary, are securely held in position with their retaining clips.

f) Adjust the accelerator cable as described in Chapter 4.

g) On automatic transmission models, adjust the kickdown cable as described in Chapter 7.

h) On completion, refill the engine and transmission with the specified type and amount of oil, then refill the cooling system (see Chapter 1).

5 Engine overhaul – dismantling sequence

Note: *When removing external components from the engine, pay close attention to details that may be helpful or important during refitting. Note the fitted position of gaskets, seals, spacers, pins, washers, bolts and other small items.*

1 It is much easier to dismantle and work on the engine if it is mounted on a portable engine stand. These stands can often be obtained from a tool hire shop. Before the engine is mounted on a stand, the flywheel/driveplate should be removed so that the stand bolts can be tightened into the end of the cylinder block/crankcase.

2 If a stand is not available, it is possible to dismantle the engine with it blocked up on a sturdy workbench, or on the floor. Be extra careful not to tip or drop the engine when working without a stand.

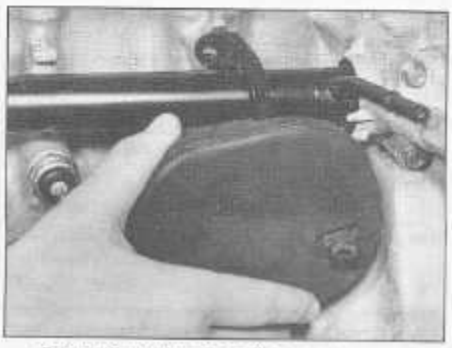
3 If you are going to obtain a reconditioned engine, all external components must be removed first to be transferred to the replacement engine (just as they will if you are doing a complete engine overhaul yourself). These components include the following:

a) Alternator mounting brackets.

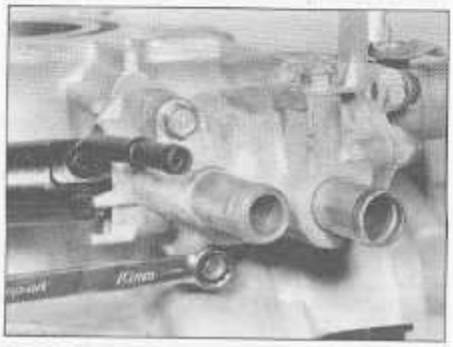
b) Power steering pump and air conditioning compressor brackets (where fitted).

c) Oil separator ***(see illustration)****.*

d) Thermostat housing ***(see illustration)*** *and coolant rail.*



5.3a Removing the oil separator . . .



5.3b . . . and the thermostat housing

e) All electrical switches and sensors.
f) Inlet and exhaust manifolds.
g) Oil cooler – DOHC engine only.
h) Engine mounting brackets.
i) Flywheel/driveplate.

4 If you are obtaining a "short" engine, which consists of the engine cylinder block/crankcase, crankshaft, pistons and *connecting rods all assembled, then the* cylinder head, sump, oil pump, and timing belt will also have to be removed.

5 If you are planning a complete overhaul, the engine can be dismantled and the internal components removed in the following order:

a) Inlet and exhaust manifolds.
b) Timing belt, sprockets, tensioner and timing belt inner cover.
c) Cylinder head.
d) Flywheel/driveplate.
e) Sump.
f) Oil pump.
g) Crankshaft.
h) Piston/connecting rod assemblies.

6 Before beginning the dismantling and overhaul procedures, ensure that you have all of the correct tools necessary. Refer to *"Tools and working facilities"* in the Reference Chapter of this Manual for further information.

6 Cylinder head – dismantling

HAYNES HINT ***If, when the valve spring compressor is screwed down, the spring retainer refuses to free and expose the split collets, gently tap the top of the tool, directly over the retainer, with a light hammer. This will free the retainer.***

Note: *New and reconditioned cylinder heads are available from the manufacturer and from engine overhaul specialists. Bearing in mind that several specialist tools are required for the dismantling and inspection procedures, and that new components may not be readily available, it may be more practical and economical for the home mechanic to purchase a reconditioned head rather than dismantle, inspect and recondition the original.*

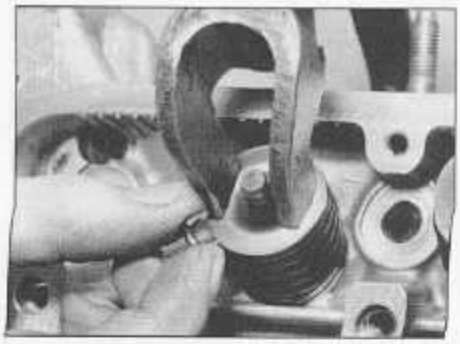
1 Remove the camshaft(s) and rocker arms.

2 Remove the cylinder head.

3 Using a valve spring compressor, compress each valve spring in turn until the split collets can be removed **(see illustration)**. Release the compressor and lift off the spring retainer and spring, then use a pair of pliers to extract the stem seal and remove the lower spring seat.

4 Withdraw the valve through the combustion chamber.

5 It is essential that each valve is stored



6.3 Compress the valve spring and remove the collets

together with its collets, retainer and spring, and that all valves are in their correct sequence, unless they are so badly worn that they are to be renewed. If they are going to be kept and used again, place each valve assembly in a labelled polythene bag or similar small container **(see illustration)**.

7 Cylinder head and valves – cleaning and inspection

Note: *If the engine has been severely overheated, it is best to assume that the cylinder head is warped and to check carefully for signs of this.*

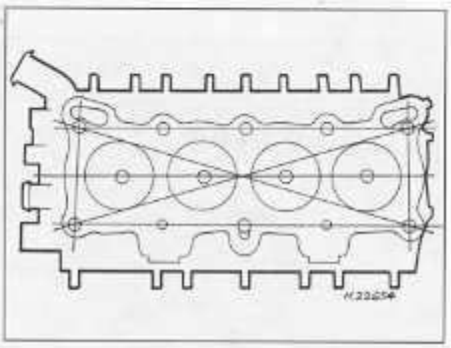
Note: *Be sure to perform all inspection procedures before concluding that the services of a machine shop or engine overhaul specialist are required. List all items that require attention.*

1 Thorough cleaning of the cylinder head and valve components, followed by a detailed inspection, will enable you to decide how much valve service work must be carried out during engine overhaul.

Cleaning

2 Remove all traces of old gasket material and sealing compound from the cylinder head.

3 Remove all carbon from the combustion chambers and ports, then wash the cylinder head thoroughly with paraffin or a suitable solvent.



7.6 Check the cylinder head for warpage along the lines shown

6.5 Use a labelled plastic bag to keep together and identify valve components

4 Scrape off any heavy carbon deposits that may have formed on the valves, then use a power-operated wire brush to remove deposits from the valve heads and stems.

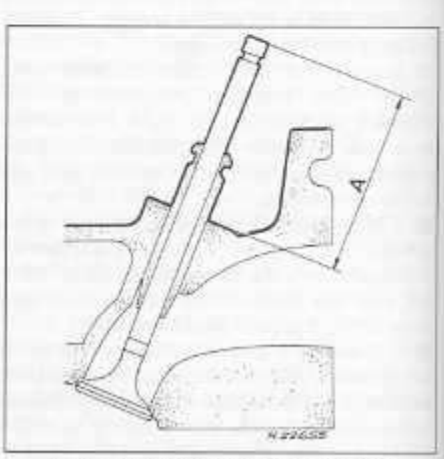
Inspection

Cylinder head

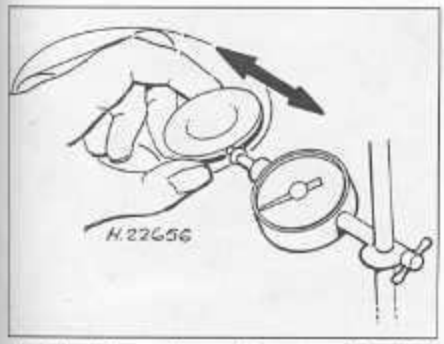
5 Inspect the head very carefully for cracks, evidence of coolant leakage and other damage. If cracks are found, a new cylinder head should be obtained.

6 Use a straight-edge and feeler blade to check that the cylinder head surface is not distorted **(see illustration)**. If the head is distorted, then it may be possible to resurface it, provided that the specified reface limit is not exceeded and the head is not reduced to less than the specified height.

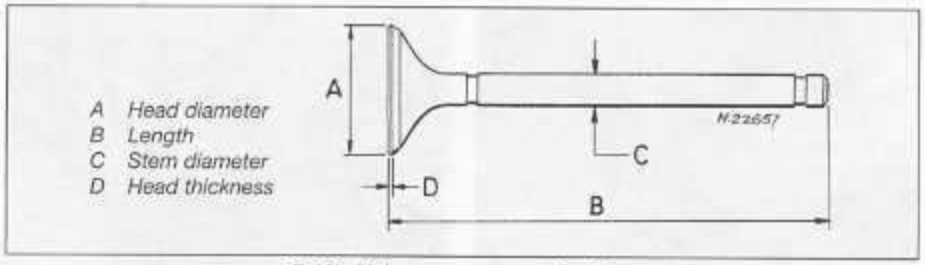
7 Examine the valve seats in each of the combustion chambers. If they are severely pitted, cracked or burned, then they will need to be renewed or recut by an engine overhaul specialist. If they are only slightly pitted, this can be removed by grinding-in the valve heads and seats with fine valve-grinding compound, as described below. To check whether they are excessively worn, refit the valve and measure the fitted height of its stem tip above the cylinder head upper surface **(see illustration)**. If the measurement is above the specified limit, repeat the test using



7.7 Check the valve seat wear by measuring the valve stem fitted height (A)



7.8 Checking valve guide wear with a dial gauge



7.12a Valve measurement points

a new valve. If the measurement is still excessive, the valve seat is excessively worn and the cylinder head must be renewed.

8 If the valve guides are worn (indicated by a side-to-side motion of the valve and accompanied by excessive blue smoke in the exhaust when running) new guides must be fitted. Measure the diameter of the existing valve stems (see below) and the bore of the guides, then calculate the clearance and compare the result with the specified value. An alternative method is to measure the amount of side play with the valve fitted in its guide by using a dial gauge. To do this, refit the valve in its original position in the cylinder head and hold it approximately 10 mm above the cylinder head surface. Position the dial gauge on the edge of the valve head and measure the side play while moving the valve to and fro **(see illustration)**. If either method shows valve stem/guide wear to be excessive, renew the valves or guides as necessary.

9 Renewal of the valve guides is best carried out by an engine overhaul specialist. If the work is to be carried out at home, use a stepped, double-diameter drift to drive out the worn guide towards the combustion chamber. On fitting the new guide, place it first in a deep-freeze for one hour, then drive it into its cylinder head bore from the camshaft side until it projects the specified amount above the cylinder head surface.

10 If the valve seats are to be re-cut, this must be done only after the guides have been renewed.

Valves

11 Examine the head of each valve for pitting, burning, cracks and general wear, then check the valve stem for scoring and wear ridges. Rotate the valve and check for any obvious indication that it is bent. Look for pitting and excessive wear on the tip of each valve stem. Renew any valve that shows any such signs of wear or damage.

12 If each valve appears satisfactory at this stage, use a micrometer and vernier calipers to measure the dimensions of the valve **(see illustration)**, noting that the valve stem diameter should be measured at several points along its length **(see illustration)**. If any of the measurements obtained exceed the specified service limit, or are significantly different to the measurements for a new valve, the valve(s) must be renewed.

13 If all valves are in satisfactory condition, they should be ground (lapped) into their respective seats, to ensure a smooth gas-tight seal. If the seat is only lightly pitted, or if it has been re-cut, fine grinding compound only should be used to produce the required finish. Coarse valve-grinding compound should not be used unless a seat is badly burned or deeply pitted. If this is the case, the cylinder head and valves should be inspected by an expert to decide whether seat re-cutting, or even the renewal of the valve or seat insert, is required.

14 Valve grinding is carried out as follows. First, position the cylinder head upside-down on a bench.

15 Smear a trace of the appropriate grade of valve-grinding compound on the seat face and press a suction grinding tool onto the valve head. With a semi-rotary action, grind the valve head to its seat, lifting the valve occasionally to redistribute the grinding compound. A light spring placed under the valve head will greatly ease this operation.

16 If coarse grinding compound is being used, work only until a dull, matt even surface is produced on both the valve seat and the valve, then wipe off the used compound and repeat the process with fine compound. When a smooth unbroken ring of light grey matt finish is produced on both the valve and seat, the grinding operation is complete. Do not grind in the valves any further than absolutely necessary, or the seat will be prematurely sunk into the cylinder head.

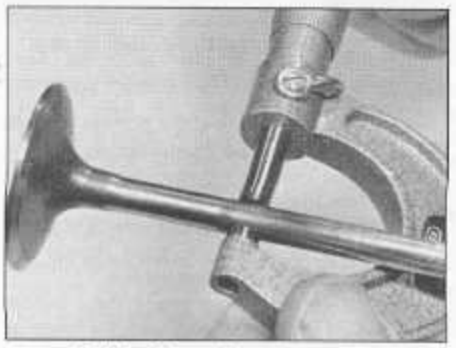
17 To check that the seat has not been over-ground, measure the valve stem fitted height, as described in paragraph 7.

18 When all the valves have been ground-in, carefully wash off all traces of grinding compound with paraffin or a suitable solvent before reassembly of the cylinder head.

Valve components

19 Examine the valve springs for signs of damage and discoloration. If possible, also compare the existing spring free length with new components.

20 Stand each spring on a flat surface and check it for squareness. If any of the springs are damaged, distorted or have lost their tension, obtain a complete new set of springs.



7.12b Measuring valve stem diameter

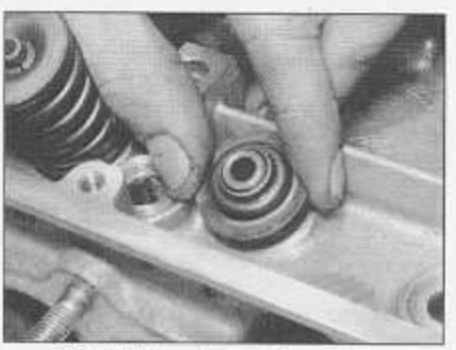
8 Cylinder head – reassembly

Note: *The inlet and exhaust valve stem oil seals are different and not interchangeable. The inlet valve seals are fitted with a white spring and the exhaust valve seals with a black spring.*

1 Lubricate the stem of each valve and insert the valves into their original locations. If new valves are being fitted, insert them into the locations to which they have been ground.

2 Working on the first valve, refit the lower spring seat. Dip the valve stem seal in clean engine oil then carefully locate it over the valve and onto the guide. Take care not to damage the seal as it is passed over the valve stem. Use a suitable socket or metal tube to press the seal firmly onto the guide **(see illustrations)**.

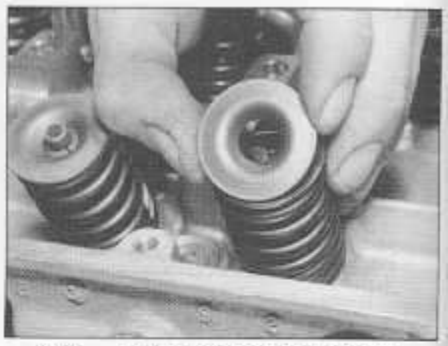
3 Locate the spring on the seat, ensuring its



8.2a Fit the valve spring seat . . .

8.2b . . . then fit the valve stem oil seal

8.3a Fit the valve spring, ensuring its closest-wound coils are at the bottom . . .



8.3b . . . then fit the spring retainer - SOHC engine shown

closest-wound coils are at the bottom, then fit the spring retainer **(see illustrations)**.

4 Compress the valve spring and locate the split collets in the recess in the valve stem. Use a little grease to hold the collets in place. Release the compressor, then repeat the procedure on the remaining valves.

5 With all valves fitted, place the cylinder head flat on the bench and, using a hammer and interposed block of wood, tap the end of each valve stem to settle the components.

9 Piston/connecting rod assembly – removal

1 Remove the timing belt and timing belt tensioner (see Chapter 2A).

2 Remove the cylinder head (see Chapter 2A).

3 Remove the crankshaft (see Section 10).

4 Push each piston/connecting rod assembly upwards and remove it from the top of the cylinder bore.

5 Remove the ridge of carbon from the top of each cylinder bore and ensure that the connecting rod big-ends do not mark the bore walls.

6 Immediately refit the bearing cap, shells and nuts to each piston/connecting rod assembly, so that they are all kept together as a matched set.

10 Crankshaft – removal

1 Remove the timing belt, timing belt tensioner and crankshaft sprocket (see Chapter 2A).

2 Remove the camshaft(s) and rocker arms (see Chapter 2A).

3 Remove the oil pump (see Chapter 2A).

4 Undo the four bolts securing the right-hand (rear) oil seal housing to the cylinder block and carefully slide the housing off the end of the crankshaft.

5 Check the crankshaft endfloat.

6 Rotate the crankshaft so that Nos 2 and 3 cylinders are at BDC (Bottom Dead Centre), then progressively slacken the ten main bearing cap retaining bolts by half a turn at a time. Remove the bolts, along with their washers, and store them in their original fitted positions in a cardboard template.

7 Carefully free the main bearing cap bridge from the caps and remove it from the engine whilst noting the fitted positions of its locating dowels. Remove the O-ring from the centre of the bridge and discard it. This O-ring must be renewed whenever disturbed.

8 Note the identification marks on each of the main bearing caps, then carefully remove each cap from the cylinder block, ensuring that the lower main bearing shell remains in position in the cap. Note the fitted positions of the cap locating dowels, remove any that are loose and store them with the relevant cap for safe keeping.

9 Using a hammer and centre-punch or quick-drying paint, mark each connecting rod big-end bearing cap with its respective cylinder number on the machined-flat surface provided. If the engine has been dismantled before, note carefully any identifying marks made previously **(see illustration)**. Note that No 1 cylinder is at the timing belt end of the engine.

10 Before removing the connecting rod big-end caps, use a feeler blade to check the amount of endfloat between the caps and crankshaft webs **(see illustration)**. If the endfloat exceeds the specified limit, then the connecting rod must be renewed.

11 Remove the big-end bearing cap nuts then withdraw the cap, complete with the lower bearing shell, from each of the four connecting rods. Push the connecting rods up and off their crankpins, then remove the upper bearing shell. Keep the cap, nuts and (if they are to be refitted) the bearing shells together in their correct sequence.

12 Lift the crankshaft out of the cylinder block and withdraw the two thrustwashers from No 4 main bearing upper location. Remove the upper main bearing shells, which must be kept with their correct respective main bearing cap and lower shell, so that all shells can be identified and (if necessary) refitted in their original locations.

10.9 Always mark big-end caps and connecting rods prior to removal

11 Cylinder block/crankcase – cleaning and inspection

Cleaning

1 For complete cleaning, remove all external components and electrical switches/sensors.

2 Remove all traces of gasket from the cylinder block/crankcase, taking great care not to damage the gasket/sealing surfaces.

3 Remove all oil gallery plugs (where fitted). The plugs are usually very tight and may have to be drilled out and the holes re-tapped. Use new plugs when the engine is reassembled.

4 If any of the castings are extremely dirty, all should be steam-cleaned.

5 After the castings are returned, clean all oil

10.10 Checking connecting rod big-end side play

holes and oil galleries one more time. Flush all internal passages with warm water until the water runs clear, then dry thoroughly and apply a light film of oil to all cylinder bore surfaces to prevent rusting. If you have access to compressed air, use it to speed up the drying process and to blow out all the oil holes and galleries.

Warning: Wear eye protection when using compressed air!

6 If the castings are not very dirty, you can do an adequate cleaning job with very hot soapy water and a stiff brush. Take plenty of time and do a thorough job.

7 All threaded holes must be clean to ensure accurate torque readings during reassembly. To clean all threads, run the proper size tap into each of the holes to remove rust, corrosion, thread sealant or sludge, and to restore damaged threads. If possible, use compressed air to clear the holes of debris produced by this operation. A good alternative is to inject aerosol-applied water-dispersant lubricant into each hole, using the long spout usually supplied.

HAYNES HINT

Regardless of the cleaning method used, be sure to clean all oil holes and galleries very thoroughly and to dry all components well.

8 Apply suitable sealant to the new oil gallery plugs and insert them into the holes in the block, tightening them securely.

9 If the engine is not going to be reassembled right away, cover it with a large plastic bag to keep it clean. Protect the cylinder bores as described in paragraph 5 to prevent rusting.

Inspection

10 Inspect the castings for cracks and corrosion. Look for stripped threads in the threaded holes. If there has been any history of internal coolant leakage, it may be worthwhile having an engine overhaul specialist check the cylinder block/crankcase with special equipment. If defects are found, have them repaired if possible, or renew the assembly.

11 Check the bore of each cylinder liner for scuffing and scoring.

12 Measure the diameter of each cylinder bore at its top (just below the wear ridge), centre and bottom, both parallel to the crankshaft axis and at right angles to it, so that a total of six measurements are taken.

13 If any one measurement exceeds the service limit specified, the cylinder block must be rebored if possible, or renewed and new piston assemblies fitted.

14 Measure the piston diameter at right angles to the gudgeon pin axis, 16 mm up from the bottom of the skirt. Compare the results with the service limit specified.

15 To measure the piston-to-bore clearance, either measure the bore and piston skirt as described above and subtract the skirt diameter from the bore measurement, or insert each piston into its original bore, then select a feeler blade and slip it into the bore along with the piston. The piston must be aligned exactly in its normal attitude and the feeler blade must be between the piston and bore, on one of the thrust faces, approximately 20 mm up from the bottom of the bore.

16 If the clearance is excessive, a new piston will be required. If the piston binds at the lower end of the bore and is loose towards the top, the bore is tapered. If tight spots are encountered as the piston/feeler blade is rotated in the bore, the bore is out-of-round.

17 Repeat this procedure for the remaining pistons and cylinder bores.

18 If the cylinder bores are badly scuffed or scored, or if they are excessively worn, out-of-round or tapered, then the cylinder block must be rebored (if possible) or renewed. New pistons will also be required.

19 If the bores are in reasonably good condition and not worn to the specified limits, and if the piston-to-bore clearances can be maintained properly, then it may only be necessary to renew the piston rings.

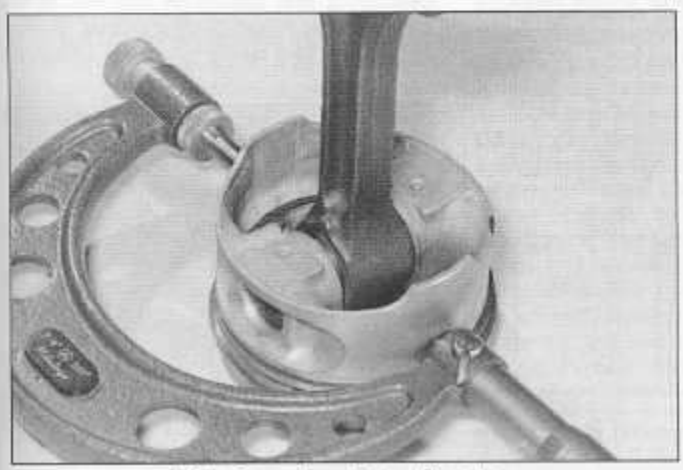
20 If this is the case, the bores should be honed to allow the new rings to bed in correctly and provide the best possible seal. The conventional type of hone has spring-loaded stones and is used with a power drill. You will also need some paraffin (or honing oil) and rags. The hone should be moved up and down the bore to produce a crosshatch pattern and plenty of honing oil should be used. Ideally, the crosshatch lines should intersect at approximately a 60° angle. Do not take off more material than is necessary to produce the required finish. If new pistons are being fitted, the piston manufacturers may specify a finish with a different angle, so their instructions should be followed. Do not withdraw the hone from the bore while it is still being turned but stop it first. After honing a bore, wipe out all traces of the honing oil. If equipment of this type is not available, or if you are not sure whether you are competent to undertake the task yourself, an engine overhaul specialist will carry out the work at moderate cost.

12 Piston/connecting rod assembly - inspection

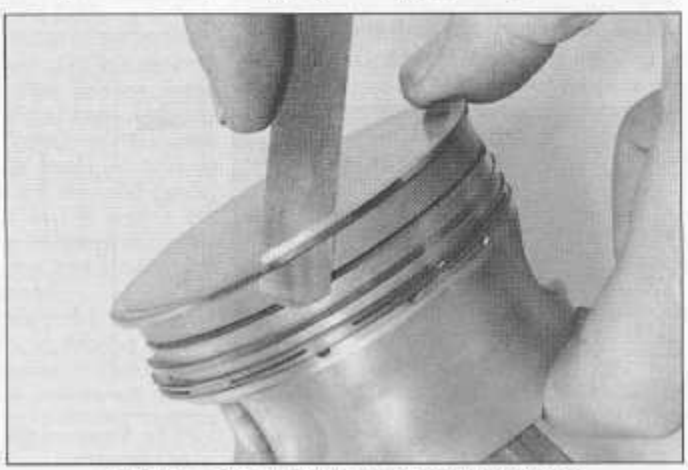
1 Examine the pistons for ovality, scoring and scratches, and for wear of the piston ring grooves. Use a micrometer to measure the pistons **(see illustration)**.

2 If the pistons or connecting rods are to be renewed, it is necessary to have this work carried out by a Rover dealer or suitable engine overhaul specialist, who will have the necessary tooling to remove and fit the gudgeon pins.

3 If new rings are to be fitted to the original pistons, expand the old rings over the top of the pistons. The use of two or three old feeler blades will be helpful in preventing the rings dropping into empty grooves **(see illustration)**.



12.1 Measuring piston diameter



12.3 Removing piston rings using feeler blades

12.5a Measuring piston ring-to-groove clearance

12.5b Measuring piston ring end gap

4 When the original piston rings have been removed, ensure that the ring grooves in the piston are free of carbon by cleaning them using an old ring. Break the ring in half to do this.

5 Check the ring-to-groove clearance by inserting each ring from the outside together with a feeler blade between the ring's top surface and the piston land. Check the ring end gaps by inserting each ring into the cylinder bore, pushing it in with the piston crown to ensure that it is square in the bore and 15 to 20 mm from the top. Use feeler blades to measure the gap **(see illustrations)**.

6 Note that each piston should be considered as being matched to its respective bore and they must not be interchanged.

13.3 Checking crankshaft endfloat with feeler blades

13.6 Using a penny to check the condition of a crankshaft journal

13 Crankshaft – inspection

Checking endfloat

1 If crankshaft endfloat is to be checked, then this must be done with the crankshaft still fitted in the cylinder block/crankcase but free to move.

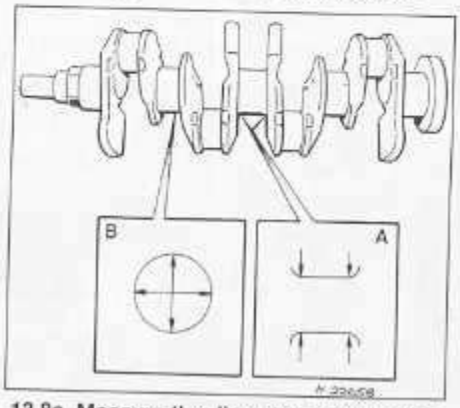
2 Check endfloat by using a dial gauge in contact with the end of the crankshaft. Push the crankshaft fully one way and then zero the gauge. Push the crankshaft fully the other way and check the endfloat. The result can be compared with the specified amount and will give an indication as to whether new thrustwashers are required **(see illustration)**.

3 If a dial gauge is not available, feeler blades can be used. First push the crankshaft fully towards the flywheel end of the engine, then use feeler blades to measure the gap between the web of No 4 crankpin and the thrustwasher **(see illustration)**.

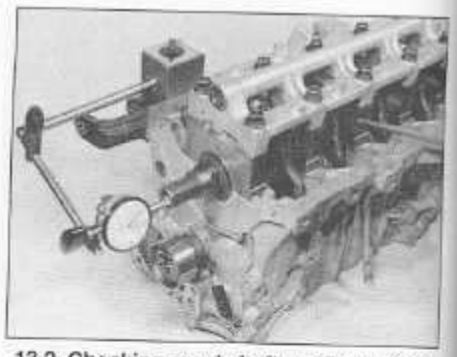
Inspection

4 Clean the crankshaft and dry it with compressed air, if available.

Warning: Wear eye protection when using compressed air! Be sure to clean all oil holes with a pipe cleaner or similar probe.



13.8a Measure the diameter at each edge of crankshaft journal (A) then repeat at a point 90° away from first measurement (B)



13.2 Checking crankshaft endfloat with a dial gauge

5 Check the main and crankpin (big-end) bearing journals for uneven wear, scoring, pitting and cracking.

6 Rub a penny across each journal several times **(see illustration)**. If a journal picks up copper from the penny, it is too rough.

7 Remove any burrs from the crankshaft oil holes with a stone, file or scraper.

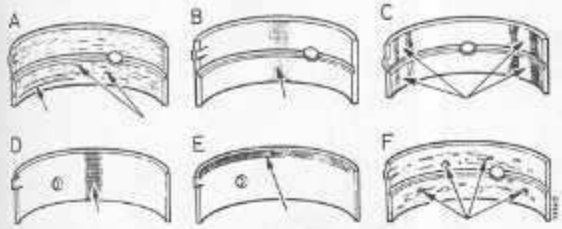
8 Using a micrometer, measure the diameter of each main bearing and crankpin journal at each edge of the journal at the same point. Measure the same journal at each edge again but at a point 90° away from the first point of measurement **(see illustrations)**. Use the measurements to calculate the journal taper at both points and the ovality of the journal. Compare the results with the specified dimensions.

9 If the crankshaft journals are damaged, tapered, or out-of-round, then the crankshaft must be renewed, unless an engine overhaul specialist can be found who will regrind it and supply the necessary undersize bearing shells.

10 Check the oil seal journals at each end of the crankshaft for wear and damage. If either seal has worn an excessive groove in its journal, consult an engine overhaul specialist, who will be able to advise whether a repair is possible or whether a new crankshaft is necessary.

11 Set the crankshaft up in V-blocks and position a dial gauge on the top of the crankshaft No 1 main bearing journal. Zero the dial gauge, then slowly rotate the crankshaft

13.8b Measuring the diameter of a crankshaft journal



A Scratched by dirt - dirt embedded into bearing material
B Lack of oil - overlay wiped out
C Improper seating - bright (polished) sections
D Tapered journal - overlay gone from entire surface
E Radius ride
F Fatigue failure - craters or pockets

14.2 Typical bearing shell failures

through two complete revolutions, noting the journal run-out. Repeat the procedure on the remaining four main bearing journals, so that a run-out measurement is available for all main bearing journals. If the difference between the run-out of any two journals exceeds the service limit specified, then the crankshaft must be renewed.

14 Main and big-end bearings – inspection

1 Even though the main and big-end bearings should be renewed during engine overhaul, the old bearings should be retained for close examination, as they may reveal valuable information about the condition of the engine. The bearing shells are graded by thickness, the grade of each shell being indicated by the colour code marked on it.

2 Bearing failure can occur due to lack of lubrication, the presence of dirt or other foreign particles, overloading the engine, or corrosion **(see illustration)**. Regardless of the cause of bearing failure, it must be corrected (where appropriate) before the engine is reassembled, to prevent it from happening again.

3 When examining the bearing shells, remove them from the cylinder block/crankcase along with the main bearing caps, the connecting rods and the connecting rod big-end bearing caps, then lay them out on a clean surface in the same general position as their location in the engine. This will enable you to match any bearing problems with the corresponding crankshaft journal. Do not touch any shell's bearing surface with your fingers while checking it, or the delicate surface may be scratched.

4 Dirt and other foreign particles get into the engine in a variety of ways. Dirt may be left in the engine during assembly, or it may pass through filters or the crankcase ventilation system. It may get into the oil and from there into the bearings. Metal chips from machining operations and normal engine wear are often present. Abrasives are sometimes left in engine components after reconditioning, especially when parts are not thoroughly cleaned using the proper cleaning methods. Whatever the source, these foreign objects often end up embedded in the soft bearing material and are easily recognized. Large particles will not embed in the bearing but will score or gouge the bearing and journal. The best prevention for this cause of bearing failure is to clean all parts thoroughly and to keep everything spotlessly clean during engine assembly. Frequent engine oil and filter changes are recommended.

5 Lack of lubrication or lubrication breakdown has a number of interrelated causes. Excessive heat (which thins the oil), overloading (which squeezes the oil from the bearing face) and oil leakage (from excessive bearing clearances, worn oil pump or high engine speeds) all contribute to lubrication breakdown. Blocked oil passages, which usually are the result of misaligned oil holes in a bearing shell, will also oil-starve a bearing and destroy it. When lack of lubrication is the cause of bearing failure, the bearing material is wiped or extruded from the steel backing of the bearing. Temperatures may increase to the point where the steel backing turns blue from overheating.

6 Driving habits can have a definite effect on bearing life. Full-throttle, low-speed operation (labouring the engine) puts very high loads on bearings, which tends to squeeze out the oil film. These loads cause the bearings to flex, which produces fine cracks in the bearing face (fatigue failure). Eventually, the bearing material will loosen in pieces and tear away from the steel backing. Short-distance driving leads to corrosion of bearings, because insufficient engine heat is produced to drive off the condensed water and corrosive gases. These products collect in the engine oil, forming acid and sludge. As the oil is carried to the engine bearings, the acid attacks and corrodes the bearing material.

7 Incorrect bearing fitting during engine assembly will also lead to bearing failure. Tight-fitting bearings leave insufficient bearing running clearance and will result in oil starvation. Dirt or foreign particles trapped behind a bearing shell result in high spots on the bearing which lead to failure. Do not touch any shell's bearing surface with your fingers during reassembly as there is a risk of scratching the delicate surface or depositing particles of dirt on it.

15 Engine overhaul – reassembly sequence

1 Before reassembly begins, ensure that all new parts have been obtained and that all necessary tools are available. Read through the entire procedure to familiarise yourself with the work involved and to ensure that all items necessary for reassembly of the engine are at hand. In addition to all normal tools and materials, a thread-locking compound will be needed. A tube of liquid sealant will also be required for the joint faces that are fitted without gaskets.

2 In order to save time and avoid problems, carry out engine reassembly in the following order:

a) Crankshaft.
b) Piston/connecting rod assemblies.
c) Oil pump.
d) Sump.
e) Flywheel/driveplate.
f) Cylinder head.
g) Timing belt tensioner and sprockets, and timing belt.
h) Engine external components.

3 At this stage, all engine components should be absolutely clean and dry (with all faults repaired) and should be laid out (or placed in individual containers) on a completely-clean work surface.

16 Piston rings – refitting

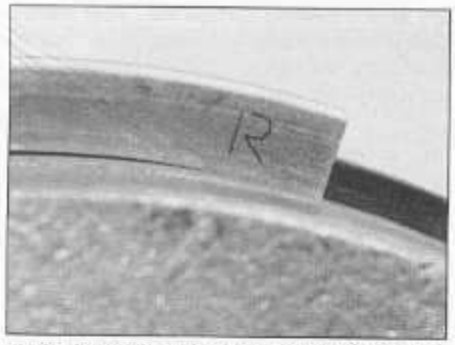
1 Before fitting new piston rings, check the ring end gaps and the ring-to-groove clearance.

2 When measuring new rings, lay out each piston set with a piston/connecting rod assembly and keep them together as a matched set from now on.

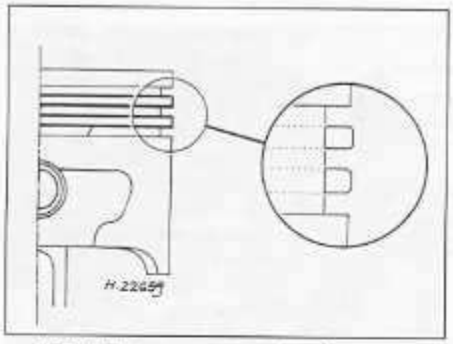
3 If the end gap of a new ring is found to be too large or too small, double-check to ensure that you have the correct rings before proceeding. If the end gap is still too small, it must be opened up by careful filing of the ring ends using a fine file. If it is too large, this is not as serious, unless the specified service limit is exceeded, in which case very careful checking is required of the dimensions of all components, as well as of the new parts.

4 Once all rings have been checked, they can be fitted. Ensure that each ring is refitted only to its matched piston and bore.

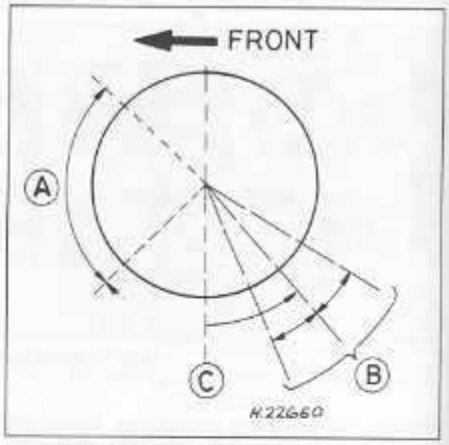
5 Fit the new rings by placing them over the top of the piston, starting with the oil control ring spring. Note that the compression rings must be fitted with the manufacturer's



16.5a Compression rings must be fitted to piston so that their markings are uppermost



16.5b Ensure compression rings are correctly fitted. Second ring is easily identified due to its chamfered outer edges



16.6 Piston ring end gap spacing

A Top and second compression ring end gaps – spaced approximately 90° apart
B Oil control ring end – outer rail end gaps should be positioned on either side of the centre ring
C Gudgeon pin axis

markings uppermost **(see illustration)**. The second compression ring is easily identifiable from the top ring due to its chamfered outer edges **(see illustration)**.

6 With all rings in position, space the ring gaps **(see illustration)**. Note that the end gaps must not be positioned on the thrust side of the piston, or in line with the gudgeon pin axis.

17 Piston/connecting rod assembly – refitting and big-end bearing running clearance check

Selection of bearing shells

1 The big-end bearing running clearance is controlled in production by selecting one of seven grades of bearing shell. The grades are indicated by a colour-coding marked on the edge of each shell which governs the shell's thickness. In order, from the thinnest to the thickest, the shell grades are Red, Pink, Yellow, Green, Brown, Black and Blue.

2 If the bearing shells are to be renewed, first check and record the number stamped across one face of each big-end bearing cap and connecting rod. The number, between 1 and 4, is the size code of the connecting rod big-end bore inside diameter. No 1 indicates the smallest possible inside diameter and No 4 the largest **(see illustration)**.

3 Secondly, check and record the crankpin/big-end journal code letters stamped on the crankshaft's web, on the left-hand side of each big-end journal. The letter, between A and D, indicates the outside diameter of the crankpin/big-end journal. "A" indicates the largest possible outside diameter and "D" the smallest **(see illustration)**.

4 Match the relevant connecting rod code with its crankshaft code, then select a new set of bearing shells using the following table. The crankshaft codes are listed down the left-hand side and the connecting rod codes along the top, whereas the required bearing grade is indicated in the box where the two columns intersect.

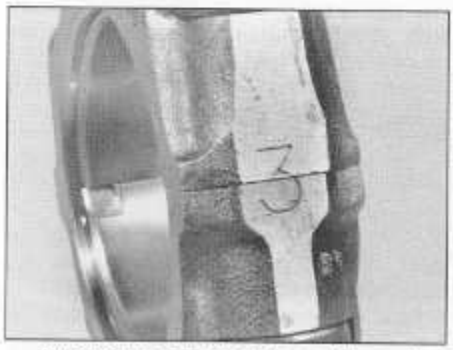
	1	2	3	4
A	Red	Pink	Yellow	Green
B	Pink	Yellow	Green	Brown
C	Yellow	Green	Brown	Black
D	Green	Brown	Black	Blue

Big-end bearing running clearance check

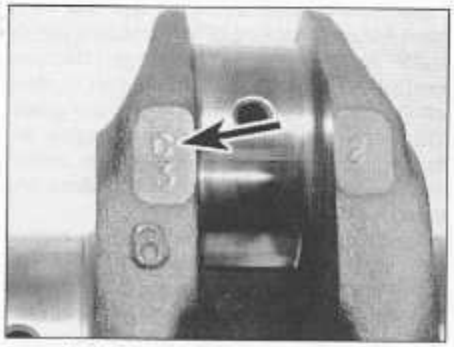
5 Refit the upper main bearing shells to the cylinder block and temporarily lay the crankshaft in position.

6 Clean the backs of the bearing shells and the bearing locations in both the connecting rod and bearing cap.

7 Press the bearing shells into their locations, ensuring that the tab on each shell engages in the notch in the connecting rod/bearing cap. Take care not to touch any shell's bearing surface with your fingers.



17.2 Connecting rod big-end journal identification number

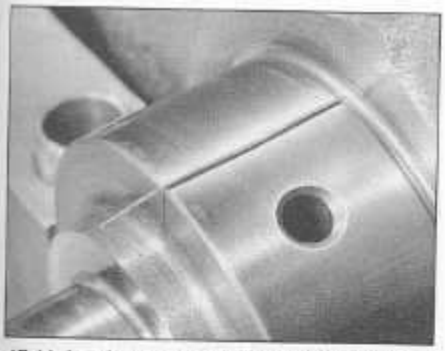


17.3 Crankshaft big-end journal identification letter (arrowed)

8 The big-end bearing running clearance should be checked if there is any doubt about crankshaft wear. The running clearance should also be checked if the crankshaft has been reground and is to be refitted with non-genuine undersized bearing shells, or if non-genuine bearing shells are to be fitted. If the original crankshaft or a genuine Rover replacement part is to be fitted, the shell selection procedure given above will produce the correct clearances and a further check will not be necessary. If the clearance is to be checked, it can be done in either of the two following ways.

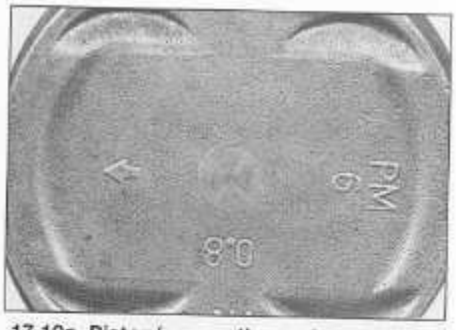
9 One method (which will be difficult to achieve without a range of internal micrometers or internal/external expanding calipers) is to refit the big-end bearing cap to the connecting rod with the bearing shells in place. With the cap retaining nuts tightened to the specified torque, use an internal micrometer or vernier caliper to measure the inside diameter of each assembled pair of bearing shells. If the diameter of each corresponding crankshaft journal is measured and then subtracted from the bearing inside diameter, the result will be the big-end bearing running clearance.

10 The second (and more accurate) method is to use a product known as Plastigauge. This consists of a fine thread of perfectly round plastic which is compressed between the bearing shell and the crankpin/journal. When the shell is removed, the plastic is deformed and can be measured with a special card gauge supplied with the kit. The running clearance is determined from this gauge. Plastigauge is sometimes difficult to obtain but enquiries at one of the larger specialist quality motor factors should produce the name of a stockist in your area. The procedure for using Plastigauge is as follows.



17.11 Lay length of Plastigauge on journal to be measured, parallel to crankshaft centre-line

17.12 Use the scale provided to check the width of the crushed Plastigauge (at its widest point), giving bearing running clearance



17.19a Piston/connecting rod assemblies must be fitted so that arrow on piston crown points towards timing belt end of engine . . .

11 Cut several lengths of the appropriate size Plastigauge, slightly shorter than the width of the crankpin/journal. Place a strand of Plastigauge on each (cleaned) crankpin journal and refit the (clean) piston/connecting rod assemblies, shells and big-end bearing caps **(see illustration)**. Tighten the bearing cap nuts to the specified torque wrench setting, ensuring that the crankshaft does not rotate. Take care not to disturb the Plastigauge. Slacken the bearing cap nuts and remove the connecting rod assemblies, again taking great care not to rotate the crankshaft.

12 Compare the width of the crushed Plastigauge on each journal against the scale printed on the Plastigauge envelope to obtain the big-end bearing running clearance **(see illustration)**.

13 If the clearance is not as specified, the bearing shells may be the wrong grade (or excessively worn, if the original shells are being re-used). Before deciding that different grade shells are needed, ensure that no dirt or oil was trapped between the bearing shells and the connecting rod or bearing cap when the clearance was measured. If the Plastigauge is wider at one end than at the other, the journal may be tapered.

14 Carefully scrape away all traces of Plastigauge from the crankpin/journal and bearing shells, using a fingernail or other object which is unlikely to score the shells. Remove the crankshaft and bearing shells, taking great care to keep the shells in their original positions.

Final piston/connecting rod assembly refitting

15 Clean the backs of the bearing shells and the bearing recesses in both the connecting rod and the big-end bearing cap. If new shells are being fitted, ensure that all traces of protective grease are cleaned off, using paraffin. Wipe the shells and connecting rods dry with a lint-free cloth.

16 Press the bearing shells into their locations, ensuring that the tab on each shell engages in the notch in the connecting rod or big-end bearing cap. Take care not to touch any shell's bearing surface with your fingers.

17 Lubricate the cylinder bores, the pistons and piston rings, then lay out each piston/connecting rod assembly in its respective position.

18 Starting with No 1 assembly, ensure that the piston rings are still correctly spaced, then clamp them in position with a piston ring compressor.

19 Insert the piston/connecting rod assembly into the top of No 1 bore, ensuring that the arrow on the piston crown faces the timing belt end of the engine. Note that the oilway on the connecting rod shaft should face the rear (oil filter side) of the engine. Using a block of wood or hammer handle against the piston crown, tap the assembly into the liner until the piston crown is flush with the top of the liner **(see illustrations)**.

20 Repeat the procedure for the remaining three piston/connecting rod assemblies, then refit the crankshaft.

18 Crankshaft – refitting and main bearing running clearance check

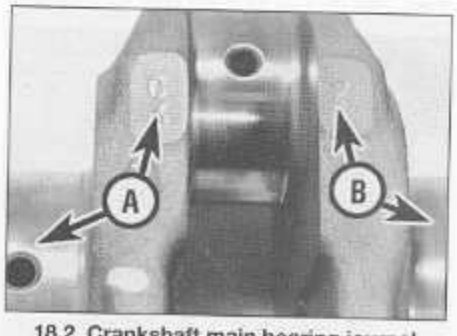
Selection of bearing shells

1 The main bearing running clearance is controlled in production by selecting one of seven grades of bearing shell. The grades are indicated by a colour-coding marked on the edge of each shell, which governs the shell's thickness. In order, from the thinnest to the thickest, the shell grades are Red, Pink, Yellow, Green, Brown, Black and Blue.

2 If the bearing shells are to be renewed, first check and record the number stamped on the crankshaft adjacent to each main bearing journal. The number, between 1 and 4, is the size code of the adjacent main bearing journal outside diameter. No 1 indicates the largest-possible outside diameter and No 4 the smallest. No 1 (timing belt end of the engine) bearing code is situated to the right of the journal, whereas all other codes are on the left-hand side of the relevant journal **(see illustration)**.

17.19b . . . and connecting rod oilway is facing rearwards

17.19c Use a piston ring compressor to clamp rings in position, then gently tap pistons into cylinder bores



18.2 Crankshaft main bearing journal identification numbers. (A) is for left-hand end journal, and (B) is for journal to right of number

18.3 Cylinder block main bearing journal identification letters. Left-hand letter is for No 1 bearing, right-hand letter for No 5 bearing

3 Secondly, check and record the main bearing journal code letters which are stamped on the right-hand end of the cylinder block, just below the block upper mating surface. Reading the letters with the block inverted, No 1 main bearing's code is at the top, with the remainder following in order from the timing belt end of the engine. The letter, between A and D, indicates the main bearing bore inside diameter, "A" indicates the smallest-possible inside diameter and "D" the largest **(see illustration)**.

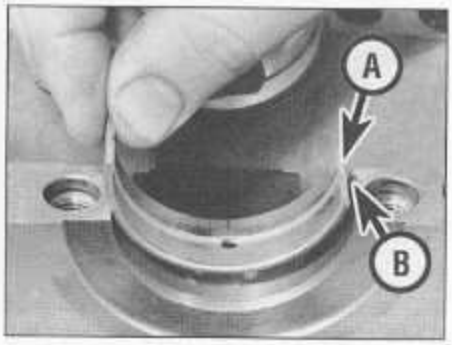
4 Match the relevant main bearing bore code with its crankshaft journal code, then select a new set of bearing shells by using the following table. The crankshaft codes are listed down the left-hand side and the main bearing bore codes along the top, whereas the required bearing grade is indicated in the box where the two columns intersect:

	1	2	3	4
A	Red	Pink	Yellow	Green
B	Pink	Yellow	Green	Brown
C	Yellow	Green	Brown	Black
D	Green	Brown	Black	Blue

Main bearing running clearance check

5 Clean the backs of the bearing shells and the bearing locations in both the cylinder block/crankcase and the main bearing caps.

6 Press the bearing shells into their locations, ensuring that the tab on each shell engages in the notch in the cylinder block/crankcase or main bearing cap location **(see illustration)**.



18.6 When fitting bearing shells, ensure tab (A) is correctly located in cylinder block notch (B)

Take care not to touch any shell's bearing surface with your fingers. If the original bearings are being re-used, ensure they are refitted to their original positions.

7 The main bearing running clearance should be checked if there is any doubt about crankshaft wear. The running clearance should also be checked if the crankshaft has been reground and is to be refitted with non-genuine undersize bearing shells or if non-genuine bearing shells are to be fitted. If the original crankshaft or a genuine Rover replacement part is to be fitted, the shell selection procedure given above will produce the correct clearances and a further check will not be necessary. If the clearance is to be checked, it can be done in either of the two following ways.

8 One method (which will be difficult to achieve without a range of internal micrometers or internal/external expanding calipers) is to refit the main bearing caps to the cylinder block/crankcase, with bearing shells in place, and refit the bearing cap bridge. With the bearing cap retaining bolts tightened to the specified torque, measure the inside diameter of each assembled pair of bearing shells. If the diameter of each corresponding crankshaft journal is measured and then subtracted from the bearing inside diameter, the result will be the main bearing running clearance.

9 The second (and more accurate) method is to use Plastigauge. Ensure the bearing surfaces and crankshaft journals are perfectly clean, then, with all the upper bearing shells in position in the cylinder block, carefully lay the crankshaft in position. Place a strand of Plastigauge on e crankshaft main bearing journal, then refit bearing caps and shells to their orig positions. Refit the bearing cap bridge tighten the retaining bolts to their speci torque setting, ensuring that the crankshaft d not rotate. Once all the bolts are tight, u them again and carefully remove the bea cap bridge and bearing caps. Take great c not to turn the crankshaft or to disturb Plastigauge and again store all caps bearings in their fitted positions. Compare width of the crushed Plastigauge on e journal to the scale printed on the Plastiga envelope to obtain the main bearing runn clearance. On completion of the measurem carefully scrape off all traces of Plastigauge f the journal and shells, using a fingernail or o object which will not score the components.

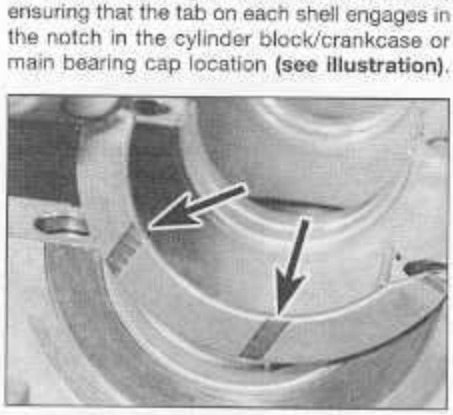
10 If the clearance is not as specified, bearing shells may be the wrong grade excessively worn, if the original shells being re-used). Before deciding that differ grade shells are needed, ensure that no dir oil was trapped between the bearing sh and the connecting rod or bearing cap wh the clearance was measured. If Plastigauge is wider at one end than at other, the journal may be tapered.

11 Remove the crankshaft and main bear shells from the cylinder block, again tak great care to ensure that the shells are sto in their correct fitted positions.

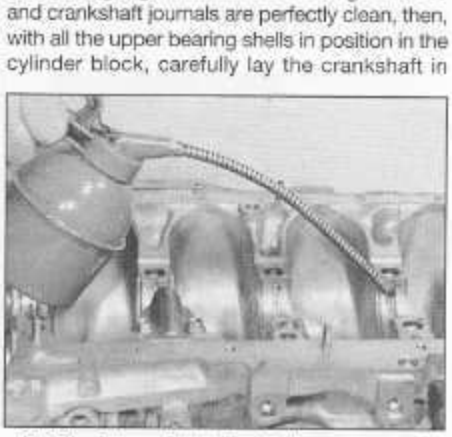
Final crankshaft refitting

12 Fit the bearing shells as described paragraphs 5 and 6. If new shells are be fitted, ensure that all traces of the protect grease are cleaned off, using paraffin. Wh necessary, also refit the upper bearing sh to their correct fitted positions in connecting rods.

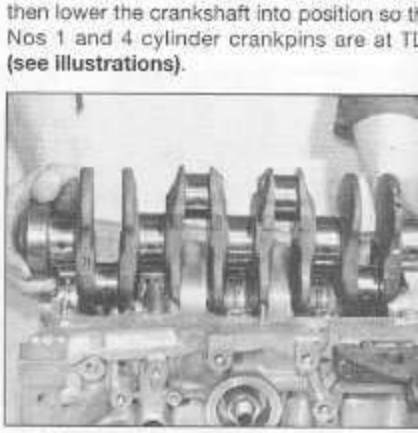
13 Using a little grease, stick thrustwashers to each side of No 4 m bearing upper location. Ensure that the oilw grooves on each thrustwasher face outwar Wipe the shells and crankshaft journals with a lint-free cloth. Liberally lubricate ea bearing shell in the cylinder block/crankca then lower the crankshaft into position so t Nos 1 and 4 cylinder crankpins are at TD **(see illustrations)**.



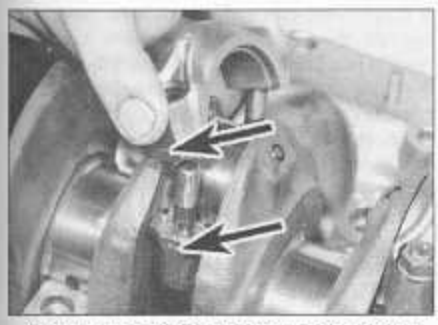
18.13a Fit the thrustwashers to cylinder block/crankcase, ensuring grooved oilways (arrowed) are facing outwards



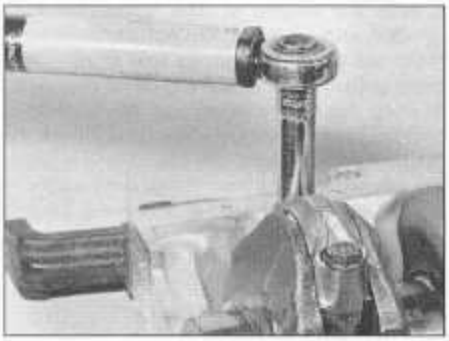
18.13b Liberally lubricate the upper main bearing shells with clean engine oil . . .



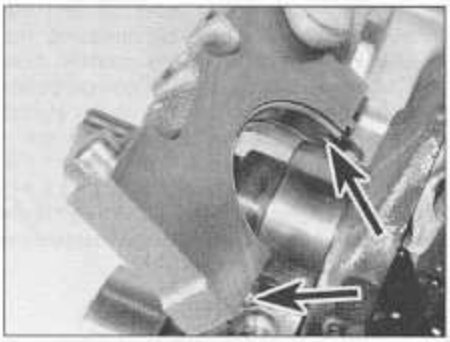
18.13c . . . and lay the crankshaft in position



18.14a Push the connecting rods down onto the big-end journals, then fit the bearing caps using marks made on removal (arrowed)



18.14b Fit the bearing cap nuts and progressively tighten to the specified torque



18.15a Ensure the locating dowels (arrowed) and bearing shell are correctly located . . .

14 Ensure that the connecting rod bearing shell is still correctly fitted. Taking care not to mark the cylinder bores, liberally lubricate the crankpin and both bearing shells with clean engine oil, then pull the piston/connecting rod assembly down its bore and onto the crankpin. Note that the faces with the stamped marks must match. Refit the big-end bearing cap and both its retaining nuts. Progressively tighten the big-end bearing cap retaining nuts to the specified torque setting, then repeat the procedure for the three remaining piston/connecting rod assemblies **(see illustrations)**.

15 Ensure that the locating dowels and bearing shells are in their correct fitted positions in the main bearing caps, then, using the identification marks, refit the bearing caps to their original positions. With the exception of the centre cap, the caps are numbered 1 to 5 (No 1 being at the timing belt end of the engine). All the arrows on the caps must point towards the timing belt end of the engine **(see illustrations)**. The centre cap is easily identifiable and must be fitted with its large dowel hole at the rear.

16 Fit a new O-ring to the recess in the centre of the main bearing cap bridge, using a smear of grease to hold it in position. Ensure all the locating dowels are correctly positioned, then refit the bridge to the bearing caps, taking great care to ensure that the O-ring remains firmly seated in its recess **(see illustrations)**.

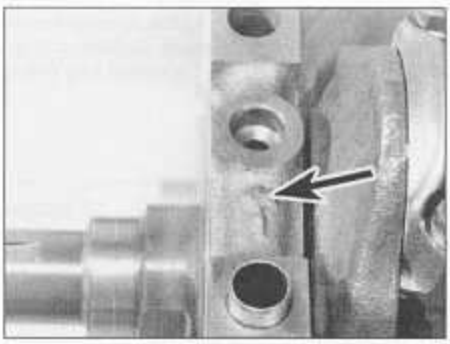
17 Apply a smear of clean engine to oil to the threads and underneath the heads of the main bearing cap bolts. Refit the bolts and washers to their original positions, noting the two longer bolts are fitted to the centre bearing cap, then tighten them all by hand. Working in a diagonal sequence from the centre outwards, progressively tighten the main bearing cap bolts to the specified torque setting **(see illustrations)**. Check that the crankshaft is free to rotate smoothly. If excessive pressure is required to turn the crankshaft, investigate the cause before proceeding further.

18 Renew the right-hand crankshaft oil seal and refit the seal housing.

19 Refit the oil pump and sump.

20 Refit the cylinder head (where removed), camshaft(s) and rocker arms

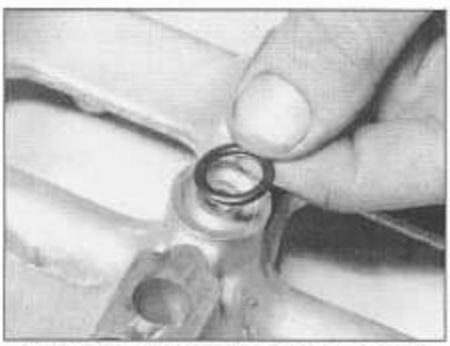
21 Refit the crankshaft sprocket timing belt tensioner and timing belt.



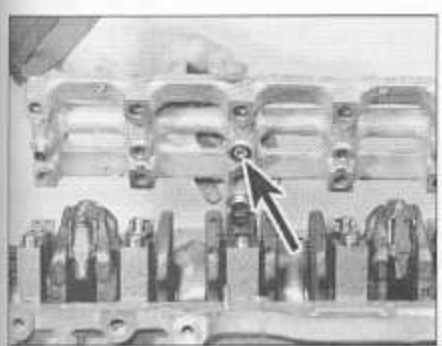
18.15b . . . then refit the main bearing caps using the identification marks (arrowed) to ensure correct positioning

19 Engine – initial start-up after overhaul

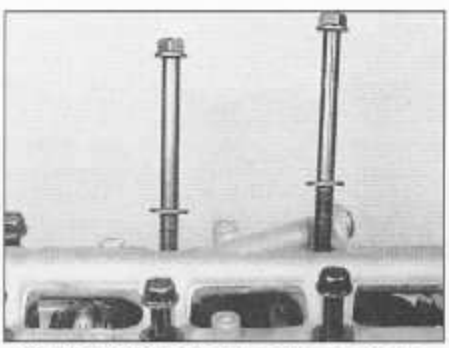
1 With the engine refitted in the vehicle, double-check the engine oil and coolant levels (see *"Weekly checks"*). Make a final check that everything has been reconnected and that there are no tools or rags left in the engine compartment.



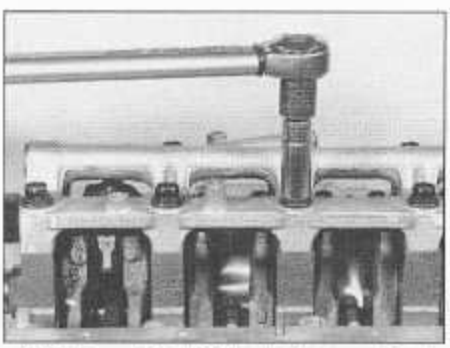
18.16a Fit a new O-ring to the recess in the main bearing cap bridge . . .



18.16b . . . and refit the bridge to the main bearing caps, ensuring the O-ring remains in position (arrowed)



18.17a Refit the main bearing cap bolts, noting the two longer bolts fitted to the centre bearing cap . . .



18.17b . . . then tighten to the specified torque setting

2 With the spark plugs removed and the ignition system disabled by removing the engine management/ignition system fuse (No 14) from the passenger compartment fusebox, turn the engine over on the starter until the oil pressure warning lamp goes out.
3 Refit the spark plugs and connect all the spark plug (HT) leads. Refit fuse No 14.
4 Start the engine, noting that this may take a little longer than usual due to the fuel system components being empty.
5 With the engine at idle, check for fuel, coolant and oil leaks. Do not be alarmed if there are some odd smells and smoke from parts getting hot and burning off oil deposits.
6 Keep the engine idling until hot coolant is felt circulating through the top hose. Check the ignition timing, base idle speed and mixture (as appropriate) then switch the engine off.
7 After a few minutes, recheck the oil and coolant levels and top-up as necessary (see *"Weekly checks"*).
8 If tightened correctly, there is no need to re-tighten the cylinder head bolts once the engine has first run after reassembly.
9 If new pistons, rings or crankshaft bearings have been fitted, the engine must be run-in for the first 500 miles (800 km). Do not operate the engine at full-throttle nor allow it to labour in any gear during this period. It is recommended that the oil and filter be changed at the end of this period (see Chapter 1).