

Camshaft and followers

Drive	Chain
Number of bearings	5
Endfloat:	
Standard:	
Carburettor models	0.115 to 0.188 mm
Fuel-injected models	0.070 to 0.143 mm
Service limit (all models)	0.20 mm
Camshaft lobe height:	
Inlet:	
Carburettor models	39.880 to 40.070 mm
Fuel-injected models	39.380 to 39.570 mm
Exhaust (all models)	39.880 to 40.070 mm
Bearing journal outer diameter:	
No 1 bearing	27.935 to 27.955 mm
Nos 2 to 5 bearings	23.935 to 23.955 mm
Camshaft cylinder head bearing journal internal diameter:	
No 1 bearing	28.000 to 28.021 mm
Nos 2 to 5 bearings	24.000 to 24.021 mm
Camshaft journal-to-bearing clearance:	
Standard	0.045 to 0.086 mm
Service limit	0.15 mm
Camshaft run-out:	
Standard	Less than 0.02 mm
Service limit	0.1 mm
Camshaft follower outer diameter	29.960 to 29.975 mm
Camshaft follower cylinder head bore internal diameter	30.000 to 30.021 mm
Camshaft follower-to-cylinder head bore clearance	0.025 to 0.061 mm

Lubrication system

Oil pump type	Gear-type, driven off crankshaft right-hand end
Minimum oil pressure at normal operating temperature:	
At idle	0.49 to 1.86 bar
At 3000 rpm	3.43 to 4.41 bar
Oil pump clearances:	
Outer gear-to-cover clearance	0.11 to 0.20 mm
Outer gear-to-crescent clearance	0.04 to 0.38 mm
Inner gear-to-crescent clearance	0.04 to 0.30 mm
Outer gear endfloat	0.05 to 0.11 mm
Inner gear endfloat	0.05 to 0.09 mm
Inner gear flange-to-cover bearing surface clearance	0.045 to 0.091 mm

Torque wrench settings

	Nm	lbf ft
Big-end bearing cap nuts:		
Stage 1	15	11
Stage 2 (if an angle tightening gauge is available)	Angle-tighten by 35 to 40°	18
Stage 2 (if an angle-tightening gauge is not available)	25	18
Camshaft bearing cap bolts	11	8
Camshaft sprocket retaining bolts	115	85
Centre member bolts	88	65
Crankshaft pulley bolt	142	105
Cylinder head bolts:		
Main bolts:		
Stage 1	29	21
Stage 2	59	44
Fully slacken all the bolts, then tighten through:		
Stage 3	29	21
Stage 4 (if an angle tightening gauge is available)	Angle-tighten by 50 to 55°	43 ± 4
Stage 4 (if an angle-tightening gauge is not available)	59 ± 5	6
6 mm bolts (to timing chain cover)	8	4
Cylinder head camshaft sprocket access cover nuts/bolts	5	3
Cylinder head cover bolts	4	
Engine-to-transmission fixing bolts:		
Bolts less than 30 mm in length	19	14
Bolts 30 mm in length and longer	35	26

Torque wrench settings (continued)	Nm	lbf ft
Front engine/transmission mounting bolts:		
Mounting bracket-to-engine bolts:		
Carburettor models	55	41
Fuel-injected models	70	52
Mounting-to-centre member bolts - Estate models	55	41
Through-bolt	70	52
Flywheel bolts	88	65
Left-hand engine/transmission mounting:		
Through-bolt	49	36
Mounting-to-transmission bolts	49	36
Lower timing chain front guide bolts	16	12
Lower timing chain rear guide pivot bolt	16	12
Lower timing chain tensioner bolts	9	7
Main bearing cap bolts	50	37
Oil pump:		
Cover retaining screws	5	4
Cover retaining bolt	8	6
Regulator valve bolt	50	37
Rear engine/transmission mounting:		
Mounting-to-centre member bolts	55	41
Through-bolt	69	51
Mounting bracket retaining bolts	69	51
Rear oil seal housing bolts	8	6
Right-hand engine/transmission mounting:		
Mounting-to-engine mounting bracket bolts	55	41
Through-bolt	49	36
Mounting upper bracket bolts	49	36
Sump drain plug	35	26
Sump nuts and bolts	8	6
Timing chain idler sprocket centre bolt	50	37
Upper timing chain front guide bolts - early models	8	6
Upper timing chain tensioner bolts	8	6
Upper timing chain top guide bolts - early models	11	8

1 General information

Using this Chapter

Chapter 2 is divided into three Parts; A, B and C. Repair operations that can be carried out with the engine in the car are described in Parts A (1.6 litre engine) and B (2.0 litre engine). Part C covers the removal of the engine/transmission as a unit, and describes the engine dismantling and overhaul procedures.

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

In Parts A and B, the assumption is made that the engine is installed in the car, with all ancillaries connected. If the engine has been removed for overhaul, the preliminary dismantling information which precedes each operation may be ignored.

Note: In certain Sections of this Chapter references are made to Phase I, Phase II and

Phase III models according to year of production. This classification has been necessary where modifications to the model range affect the repair procedure being described. The Phases relate to the model years as follows:

Phase I - 1990 to June 1993

Phase II - June 1993 to October 1996

Phase III - October 1996 to September 1999

Engine description

The 1.6 litre (1597 cc) engine is from the GA series of Nissan engines. It is of the sixteen-valve, in-line four-cylinder, double overhead camshaft (DOHC) type, mounted transversely at the front of the car with the transmission attached to its left-hand end.

The crankshaft runs in five main bearings. Thrustwashers are fitted to No 3 main bearing (upper half) to control crankshaft endfloat.

The connecting rods rotate on horizontally-split bearing shells at their big-ends. The pistons are attached to the connecting rods by gudgeon pins, which are a sliding fit in the connecting rod small-end eyes being retained by circlips. The aluminium-alloy pistons are fitted with three piston rings - two compression rings and an oil control ring.

The cylinder block is made of cast iron and the cylinder bores are an integral part of the block. On this type of engine the cylinder bores are sometimes referred to as having dry liners.

The inlet and exhaust valves are each closed by coil springs, and operate in guides pressed into the cylinder head; the valve seat inserts are also pressed into the cylinder head, and can be renewed separately if worn.

The camshaft is driven by a timing chain, and operates the sixteen valves via bucket-type followers. The followers are situated directly below the camshafts. Valve clearances are adjusted by shims. The camshafts rotate directly in the cylinder head.

Lubrication is by means of an oil pump, which is driven off the right-hand end of the crankshaft. It draws oil through a strainer located in the sump, and then forces it through an externally-mounted filter into galleries in the cylinder block/crankcase. From there, the oil is distributed to the crankshaft (main bearings) and camshaft. 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.

Repair operations possible with the engine in the car

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

- a) Compression pressure - testing.
- b) Cylinder head cover - removal and refitting.

- c) Timing chain cover - removal and refitting.
- d) Timing chains - removal and refitting.
- e) Timing chain tensioners, guides and sprockets - removal and refitting.
- f) Camshaft and followers - removal, inspection and refitting.
- g) Valve clearances - adjustment.
- h) Cylinder head - removal and refitting.
- i) Cylinder head and pistons - decarbonising (refer to Part C of this Chapter).
- j) Sump - removal and refitting.
- k) Oil pump - removal, overhaul and refitting.
- l) Crankshaft oil seals - renewal.
- m) Engine/transmission mountings - inspection and renewal.
- n) Flywheel - removal, inspection and refitting.

2 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 all the spark plugs must be removed (Chapter 1). The aid of an assistant will also be required.

3 Disable the ignition system by disconnecting the ignition coil HT lead from the distributor cap and earthing it on the cylinder block. Use a jumper lead or similar wire to make a good connection.

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.

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.

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; the presence of coolant in the engine oil will confirm this.

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

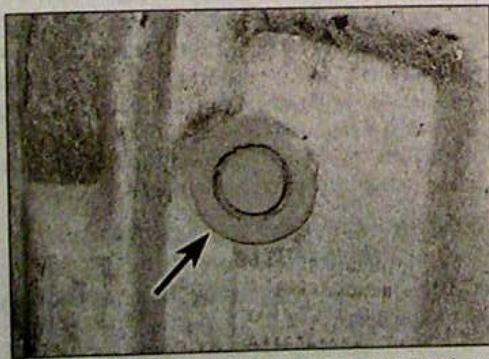
12 If the compression reading is unusually high, the combustion chambers are probably coated with carbon deposits. If this is the case, the cylinder head should be removed and decarbonised.

13 On completion of the test, refit the spark plugs and reconnect the ignition HT coil lead.

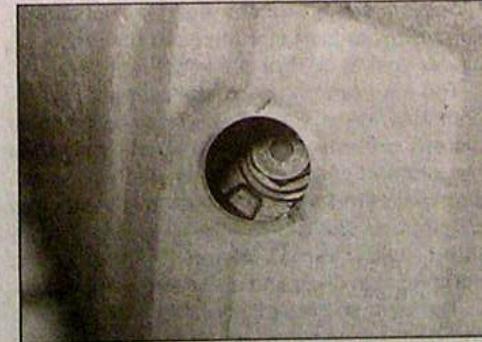
3 Top dead centre (TDC) for No 1 piston - locating



1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Section of this manual), then remove all the spark plugs as described in Chapter 1.



3.3a On some models, remove the rubber plug (arrowed) from the plastic cover ...



3.3b ... to gain access to the crankshaft pulley bolt

2 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. Unclip the distributor cover (where fitted) then undo the cap retaining screws, remove the cap and recover the seal.

3 Apply the handbrake and ensure that the transmission is in neutral, then jack up the front of the car and support it on axle stands (see *Jacking and vehicle support*). Remove the right-hand roadwheel. Undo the retaining screws and remove the plastic cover from underneath the wing to gain access to the crankshaft pulley bolt; on some models, the bolt can be accessed via a small hole in the cover (see illustrations).

4 The timing marks are in the form of notches on the crankshaft pulley rim which align with a pointer on the timing chain cover. The notches are spaced at intervals of 5°, and go from 20° before top dead centre (BTDC) to 5° after top dead centre (ATDC). The TDC mark is highlighted with yellow paint to aid identification.

5 Using a spanner (or socket and extension bar) applied to the crankshaft pulley bolt, rotate the crankshaft clockwise until the TDC notch on the crankshaft pulley rim is aligned with the pointer on the timing chain cover.

6 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°) clockwise until the arm points at the marked terminal. No 1 cylinder will then be at TDC on the compression stroke.

7 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 clockwise 180° at a time and following the firing order (see *Specifications*).

4 Cylinder head cover - removal and refitting



Removal

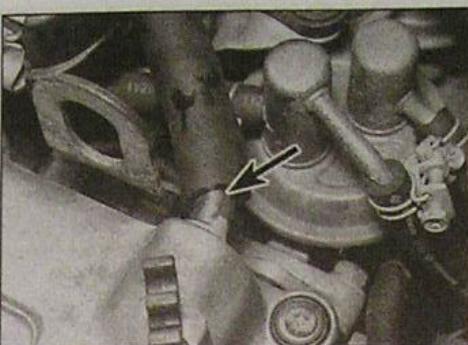
1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Section of this manual), then disconnect the spark plug (HT) leads from the plugs, and free them from their retaining clips on the top of the cover.

2 Release the retaining clips and disconnect the breather hoses from the rear of the cover (see illustrations).

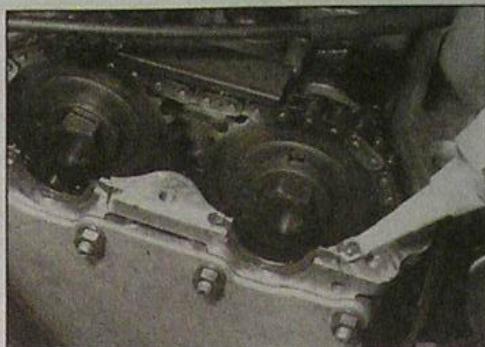
3 Working in the **reverse** of the sequence shown in illustration 4.11a, slacken and remove the cylinder head cover retaining screws and washers.



4.2a Release the retaining clips and disconnect the breather hoses from the right-hand ...



4.2b ... and left-hand end (arrowed) of the cylinder head cover



4.7a Apply a bead of sealant to the cylinder head cut-outs

4 Lift off the cylinder head cover, and recover the rubber seal from the outer edge of the cover, and the circular seal from each of the cover spark plug holes. On early models, also remove the two semi-circular rubbers from the cut-outs on the right-hand end of the cylinder head; on later models, the rubbers are an integral part of the cover seal.

5 Inspect the cover seals for signs of damage and deterioration, and renew as necessary.

Refitting

6 Carefully clean the cylinder head and cover mating surfaces, and remove all traces of oil.

7 Apply a bead of sealant to the circular cut-outs on the right-hand end of the cylinder head. On early models, fit both the semi-circular rubbers to the head, ensuring that they are positioned with their flat sides parallel to the head surface (see illustrations).

8 Fit the rubber seal to the cylinder head

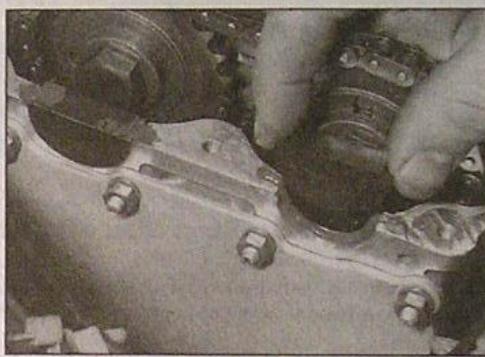
cover groove, ensuring that it is correctly located along its entire length, and install the four spark plug hole seals, ensuring that they are the correct way around. If necessary, the seals can be held in position using a smear of suitable sealant (see illustrations).

9 Apply a bead of sealant to the cover seal, approximately 1 cm either side of the left-hand exhaust camshaft bearing cap circular cut-out edges (see illustration).

10 Carefully refit the cylinder head cover to the engine, taking great care not to displace any of the rubber seals (see illustration).

11 Make sure the cover is correctly seated, then install the retaining screws and washers. Working in the sequence shown, tighten all the cover screws to the specified torque (see illustrations).

12 Reconnect the breather hoses to the cylinder head cover, and secure them in position with the retaining clips.

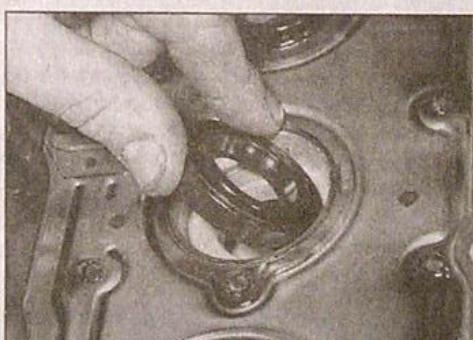


4.7b On early models, install both semi-circular rubbers in the head cut-outs

13 Connect the HT lead caps to the correct spark plugs, and clip the leads back into the retaining clips. Reconnect the battery negative lead.



4.8a Fit the rubber seal to the cover groove ...



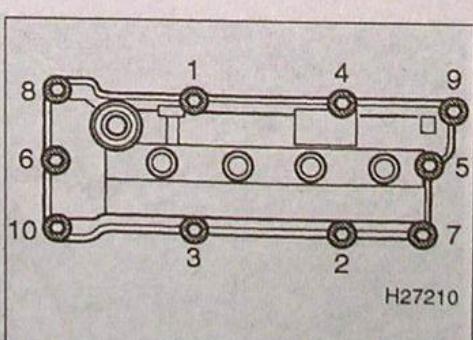
4.8b ... and fit the spark plug hole seals



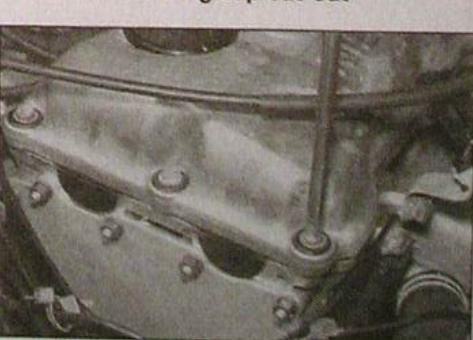
4.9 Apply a bead of sealant to the seal on 1 cm either side of the exhaust camshaft bearing cap cut-out



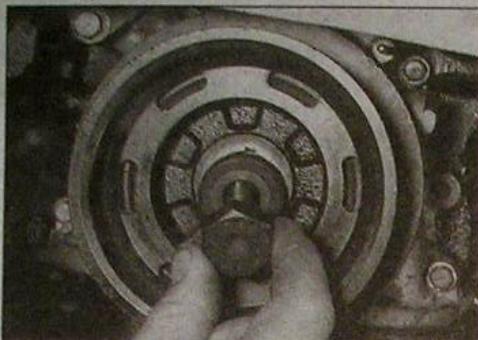
4.10 Refit the head cover, ensuring that the seals stay in position



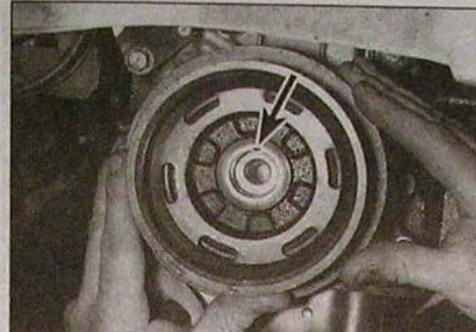
4.11a Cylinder head cover bolt tightening sequence



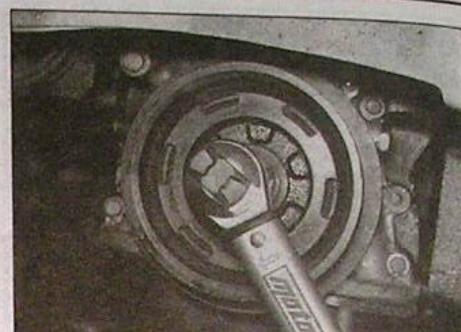
4.11b Working in the specified sequence, tighten the cover screws to the specified torque



5.4 Unscrew the pulley bolt and washer, and withdraw the crankshaft pulley



5.6 Align the pulley groove (arrowed) with the key, and slide the pulley onto the crankshaft



5.7 Refit the retaining bolt (and washer) and tighten to the specified torque

5 Crankshaft pulley - removal and refitting



Removal

- 1 Remove the auxiliary drivebelt(s) as described in Chapter 1.
- 2 If necessary, position No 1 cylinder at TDC on its compression stroke as described in Section 3.
- 3 To prevent crankshaft rotation while the pulley bolt is unscrewed, select top gear and have an assistant apply the brakes firmly. If the engine has been removed from the car, lock the flywheel using a tool similar to the one shown in illustration 15.2 (see Section 15).
- 4 Unscrew the pulley bolt, along with its washer, and remove the pulley from the

crankshaft (see illustration). If the pulley Woodruff key is a loose fit, remove it and store it with the pulley for safe-keeping.

Refitting

- 5 Refit the Woodruff key (where removed).
- 6 Align the crankshaft pulley groove with the key, then slide the sprocket onto the crankshaft, and refit the retaining bolt and washer (see illustration).
- 7 Lock the crankshaft by the method used on removal, and tighten the pulley retaining bolt to the specified torque setting (see illustration).
- 8 Refit the auxiliary drivebelt(s) and adjust them as described in Chapter 1.



6.4 Removing the power steering pump mounting bracket

6 Timing chain cover - removal and refitting



Note: If the timing chain cover is to be removed without disturbing the cylinder head, there is a slight risk of oil leakage from chain cover-to-cylinder head joint after refitting. Bearing in mind this information, it is up to the individual owner to decide whether or not it is worth renewing the head gasket when the chain cover is removed.

Removal

- 1 Remove the coolant pump as described in Chapter 3.
- 2 Remove the crankshaft pulley as described in Section 5.

3 Remove the sump and oil pump pick-up/strainer as described in Section 12.

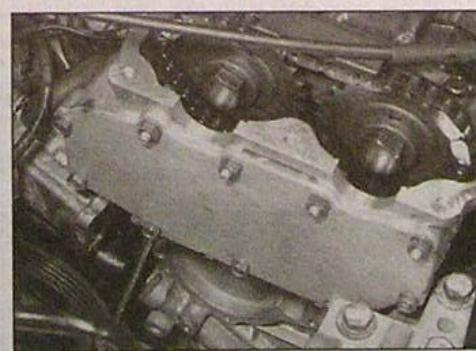
- 4 Undo the two bolts securing the power steering pump mounting bracket to the front of the timing chain cover, then undo the nut/bolt securing the bracket to the pump and remove the bracket (see illustration).

5 Slacken and remove the three retaining bolts, and remove the mounting bracket from the top of the right-hand engine/transmission mounting; where necessary, free the wiring from its retaining clips on the bracket. Unscrew the retaining nuts and bolts, and remove the camshaft sprocket access cover from the right-hand end of the cylinder head. Recover the cover gasket (where fitted) (see illustrations).

6 Unscrew the two retaining bolts, and remove the lower timing chain tensioner from the rear of the chain cover. Recover the tensioner gasket, noting which way up it is fitted (see illustration). **Note:** Do not rotate the engine whilst the chain tensioner is removed.

7 Slacken and remove the four bolts securing the right-hand end of the cylinder head to the top of the timing chain cover. On early models, it will be necessary to remove the upper timing chain front guide to gain access to one of the bolts.

8 Place a jack with interposed block of wood beneath the engine to take the weight of the engine. Alternatively, attach a hoist or support bar to the engine lifting eyes, and take the weight of the engine.



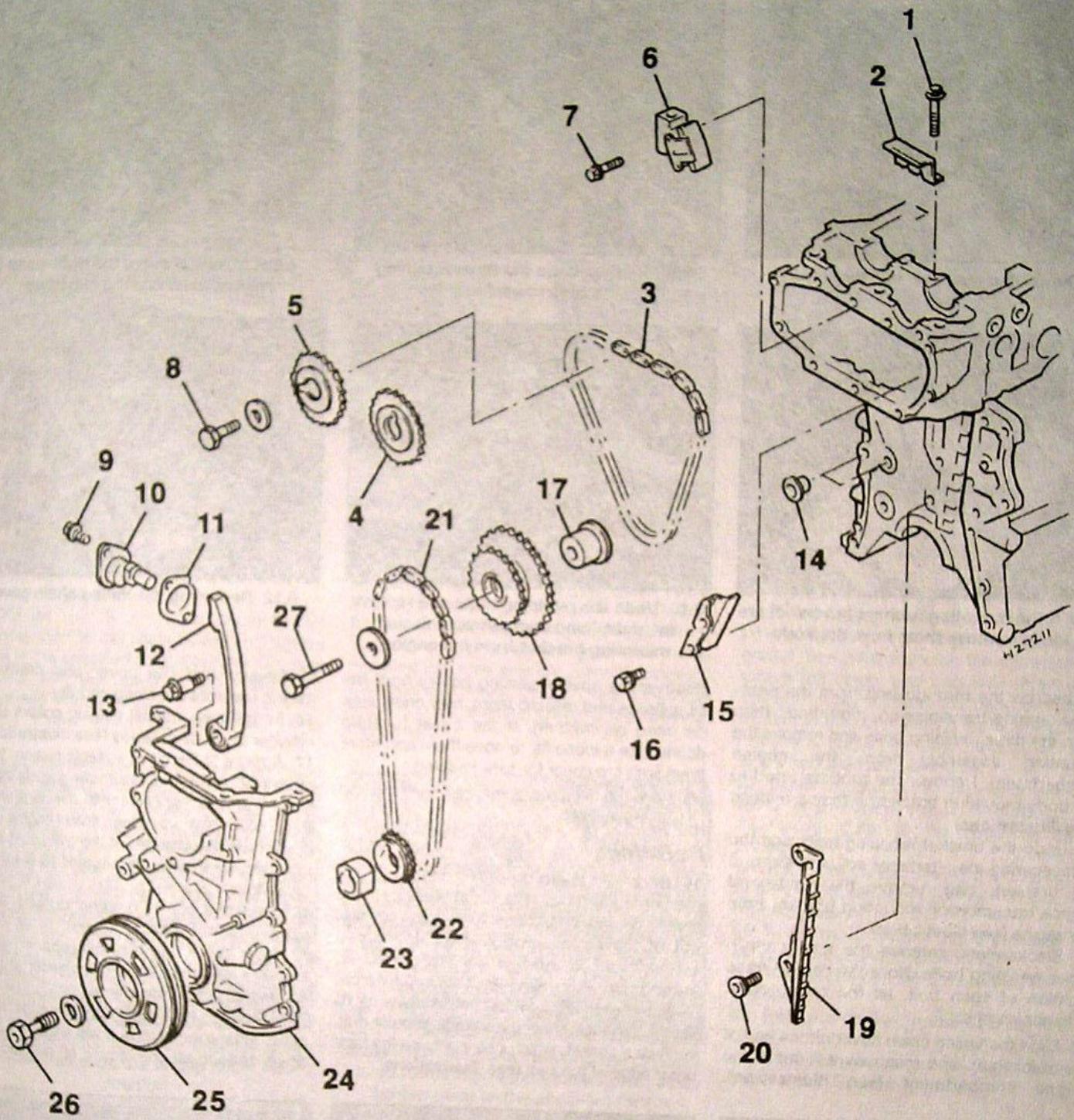
6.5b Undo the retaining nuts and bolts...



6.5a Undo the three retaining bolts (arrowed) and remove the bracket from the engine mounting



6.5c ... and remove the camshaft sprocket access cover (early model shown, complete with gasket)



6.6 Timing chains and associated components - early models shown (later models similar)

1 Upper chain top guide bolt*
 2 Upper chain top guide*
 3 Upper timing chain
 4 Exhaust camshaft sprocket
 5 Inlet camshaft sprocket
 6 Upper chain tensioner
 7 Upper chain tensioner bolt
 8 Camshaft sprocket bolt
 9 Lower chain tensioner bolt

10 Lower chain tensioner
 11 Lower chain tensioner gasket
 12 Lower chain rear guide
 13 Lower chain rear guide pivot bolt
 14 Locating dowel and O-ring
 15 Upper chain front guide*
 16 Upper chain front guide bolt*
 17 Idler sprocket shaft
 18 Idler sprocket
 19 Lower chain front guide

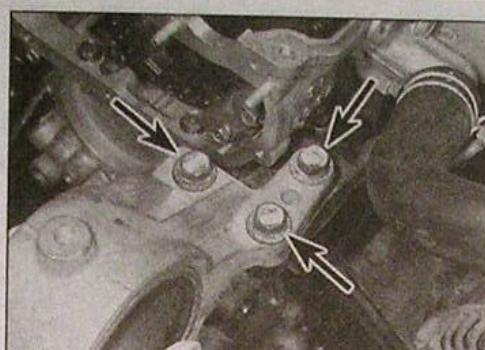
20 Lower chain front guide bolt
 21 Lower timing chain
 22 Crankshaft sprocket
 23 Oil pump drive spacer
 24 Timing chain cover
 25 Crankshaft pulley
 26 Crankshaft pulley bolt
 27 Idler sprocket bolt

*Fitted to early models only

**Fitted to early models only*



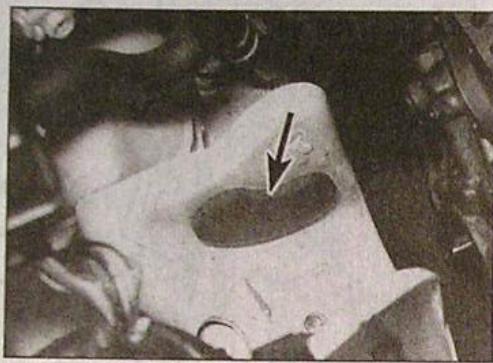
6.9a Slacken and remove the through bolt ...



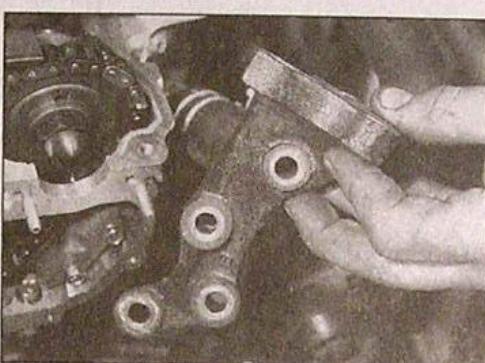
6.9b ... then undo the three retaining bolts (arrowed) ...



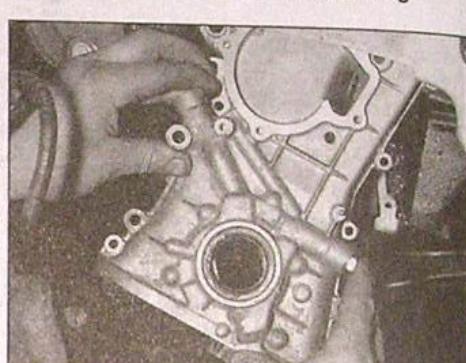
6.9c ... and remove the right-hand engine/transmission mounting



6.9d If the mounting rubbers (arrowed) are loose, remove them from the body



6.10 Undo the retaining bolts and remove the right-hand engine/transmission mounting bracket from the engine



6.12 Removing the timing chain cover

9 Unscrew the through-bolt from the right-hand engine/transmission mounting, then undo the three retaining bolts and remove the mounting assembly from the engine compartment. Recover the rubbers fitted to the body mounting bracket, if they are loose (see illustrations).

10 Undo the bracket retaining bolts and the bolt securing the alternator adjuster strap to the bracket, and remove the right-hand engine/transmission mounting bracket from the engine (see illustration).

11 Slacken and remove the timing chain cover retaining bolts. Note the correct fitted location of each bolt, as the bolts are of different lengths.

12 Slide the timing chain cover off the end of the crankshaft, and manoeuvre it out of the engine compartment (see illustration).

Recover the special sealing collars from the oil galleries and discard them; new ones must be used on refitting. If the cover locating dowels are a loose fit, remove them and store them with the cover for safe-keeping.

13 Slide the oil pump drive spacer off the end of the crankshaft.

Refitting

14 Prior to refitting the cover, it is recommended that the crankshaft oil seal should be renewed. Carefully lever the old seal out of the cover using a large flat-bladed screwdriver. Fit the new seal to the cover, making sure its sealing lip is facing inwards. Drive the seal 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 illustrations).



6.14a Lever out the crankshaft oil seal with a large screwdriver ...



6.14b ... and tap the new seal into position with a suitable socket

15 Ensure that the cover and crankcase mating surfaces are clean and dry.

16 Fit the new special sealing collars to the cylinder block oil galleries (see illustration).

17 Apply a thin coat of suitable sealant to the timing cover crankcase mating surface, not forgetting to apply sealant to the area around the coolant pump passage in the centre of the cover (see illustration). If the cylinder head is in position, also apply sealant to the upper face of the cover.

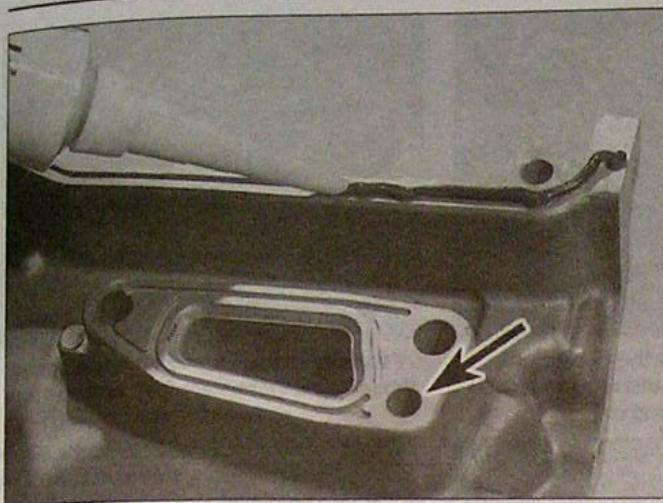
18 Refit the cover locating dowels to the cylinder block (where removed).

19 Align the oil pump drive spacer groove with the key, then slide the spacer onto the crankshaft (see illustration).

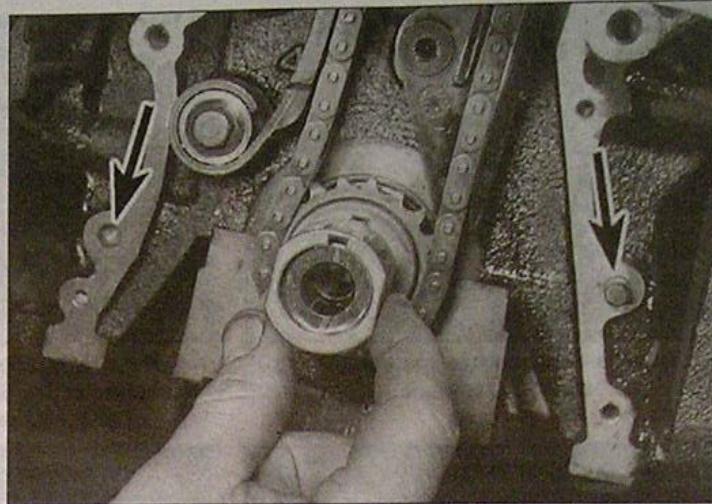
20 Offer up the cover, and position the oil pump inner rotor so that it will engage with the drive spacer as the cover is refitted (see



6.16 Fit the new special sealing collars to the cylinder block oil galleries



6.17 Apply sealant to the timing cover mating surface, not forgetting the area around the coolant pump passage (arrowed)



6.19 Align the oil pump drive spacer with the key, and slide it onto the crankshaft (cover locating dowel locations arrowed)

illustration). Slide the cover over the end of the crankshaft, taking great care not to damage the oil seal lip, and seat it on its locating dowels.

21 Refit the cover retaining bolts in their original locations and tighten them securely, working in several stages.

22 Fit the four 6 mm bolts securing the cylinder head to the chain cover, and tighten them to the specified torque setting. On early models, refit the upper timing chain front guide (see illustrations).

23 Fit a new gasket to the lower chain

tensioner, making sure it is fitted the correct way up so its cut-out is aligned with the tensioner oil hole. Install the tensioner and gasket, and tighten its retaining bolts to the specified torque setting (see illustrations).

24 Refit right-hand engine/transmission mounting bracket to the engine, and securely tighten its retaining bolts. Fit the rubbers to the body mounting bracket (where removed), ensuring that their pins are correctly seated in the bracket holes, and fit the mounting, tightening its retaining bolts to the specified torque setting.

25 Align the right-hand mounting with its body bracket, then insert the through-bolt and tighten its nut to the specified torque setting. Remove the jack from underneath the engine.

26 Ensure that the sprocket access cover and head mating surfaces are clean and dry. Where the cover was originally fitted with a gasket, fit a new gasket to the cylinder head; where the cover was originally fitted using sealant, apply a continuous bead of suitable sealant to the cover mating surface. Install the cover and tighten its retaining nuts and bolts to the specified torque setting.

27 Install the bracket to the top of the right-hand engine/transmission mounting, and tighten its bolts to the specified torque setting.

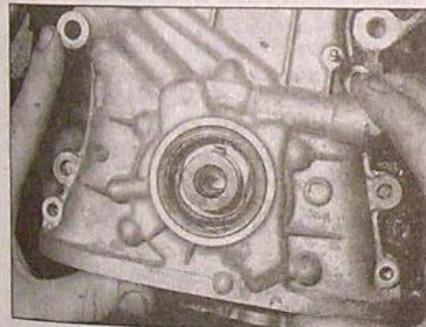
28 Refit the power steering pump to the engine, and securely tighten its mounting bracket bolts.

29 Install the oil pump pick-up/strainer and sump as described in Section 12.

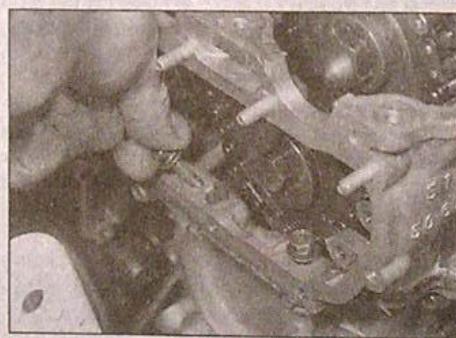
30 Refit the crankshaft pulley as described in Section 5.

31 Refit the coolant pump as described in Chapter 3.

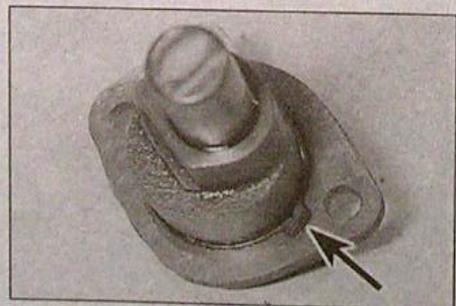
32 Replenish the engine oil and coolant as described in Chapter 1.



6.20 Engage the oil pump with the drive spacer, and slide the timing cover into position



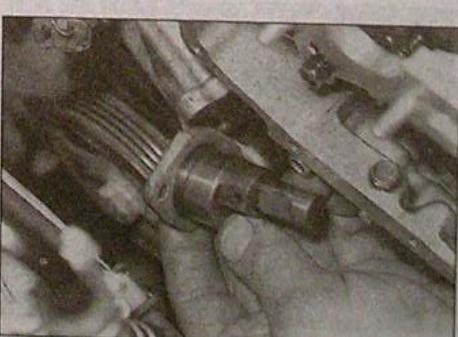
6.22a Refit the bolts securing the cylinder head to the top of the timing cover, and tighten them to the specified torque



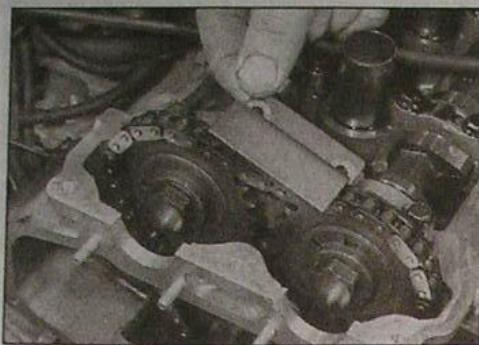
6.23a Fit the gasket, ensuring that its cut-out is correctly aligned with the tensioner oil hole (arrowed) ...



6.22b On early models, refit the upper timing chain front guide



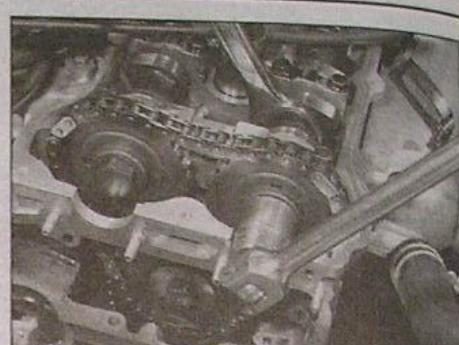
6.23b ... then refit the tensioner to the engine



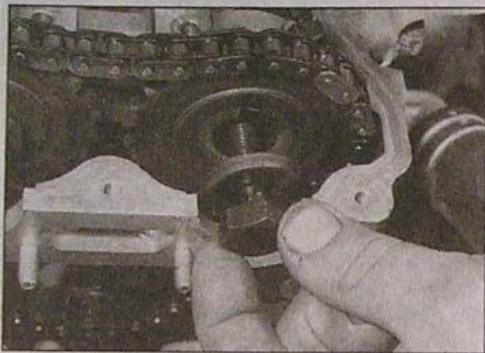
7.4a On early models, remove the top chain upper guide ...



7.4b ... then retract the tensioner as described in the text and remove it from the head



7.6a Slacken the sprocket retaining bolt whilst holding the camshaft with an open-ended spanner ...



7.6b ... then remove the bolt along with its washer



7.8 Manoeuvre the upper timing chain out through the head aperture

4 On early models, slacken and remove the bolts securing the upper chain top guide in position, and remove it from the head. Retract the upper chain tensioner, and retain it in the retracted position using the hook on the side of the tensioner. Undo the two retaining bolts, and remove the tensioner from the end of the cylinder head (see illustrations).

5 On later models, retract the upper chain tensioner, and hold it in position by inserting a small-diameter rod in front of the tensioner pad. Undo the two retaining bolts, and remove the tensioner from the end of the cylinder head.

6 Slacken the camshaft sprocket retaining bolts, whilst retaining the camshafts with a large open-ended spanner fitted to the flats on the right-hand end of each shaft. Remove each bolt along with its washer (see illustrations).

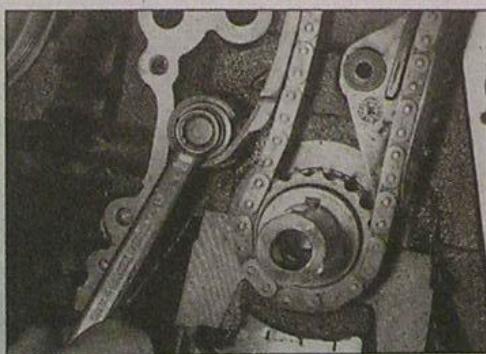
7 Timing chains - removal, inspection and refitting



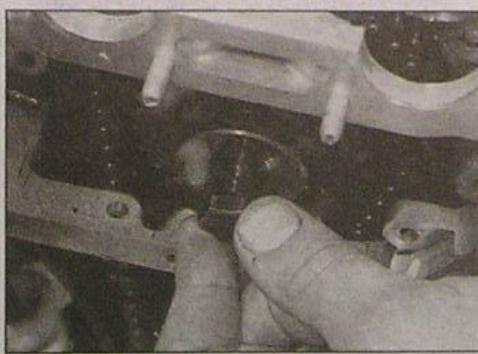
Note: The following section refers to early and later models. The two models can be distinguished from their upper timing chain components; early models have a top and front chain guide for the upper timing chain - these are omitted on later models.

Removal

- 1 Position No 1 cylinder at TDC on its compression stroke, as described in Section 3.
- 2 Remove the cylinder head cover as described in Section 4.
- 3 Remove the timing chain cover as described in Section 6.



7.9 Unscrew the pivot bolt, and remove the lower chain rear guide from the cylinder block



7.10 Unscrew the centre bolt and washer, and remove the idler sprocket from the engine

7 Disengage each sprocket from the end of its respective camshaft, and manoeuvre them out from the cylinder head. If the sprocket locating pins are a loose fit in the camshaft ends, remove them and store them with the sprockets.

8 Disengage the upper timing chain from the idler sprocket, and manoeuvre it out of the cylinder head (see illustration).

9 Unscrew the pivot bolt, and remove the lower chain rear guide from the crankcase (see illustration).

10 Slacken and remove the idler sprocket centre bolt and washer, then lower the sprocket out of position and remove it from the bottom of the cylinder head (see illustration). Recover the idler shaft from the rear of the sprocket.

11 Disengage the lower timing chain from the crankshaft sprocket, and remove it from the engine.

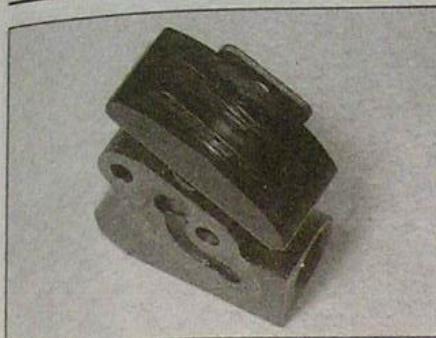
12 Slide the crankshaft sprocket off the end of the crankshaft. Remove the Woodruff key (if loose) from the crankshaft, and store it with the sprocket for safe-keeping. **Note:** Do not rotate the crankshaft or camshafts whilst the timing chains are removed.

Inspection

13 Examine the teeth on the camshaft, idler and crankshaft sprockets for any sign of wear or damage such as chipped, hooked or missing teeth. If there is any sign of wear or damage on either sprocket, all sprockets and both timing chains should be renewed as a set.

14 Inspect the links of the timing chains for signs of wear or damage on the rollers. The extent of wear can be judged by checking the amount by which the chain can be bent sideways; a new chain will have very little sideways movement. If there is an excessive amount of side play in either timing chain, it must be renewed.

15 Note that it is a sensible precaution to renew the timing chains, regardless of their apparent condition, if the engine has covered a high mileage, or if it has been noted that the chain(s) have sounded noisy when the engine is running. Although not strictly necessary, it is always worth renewing the chains and



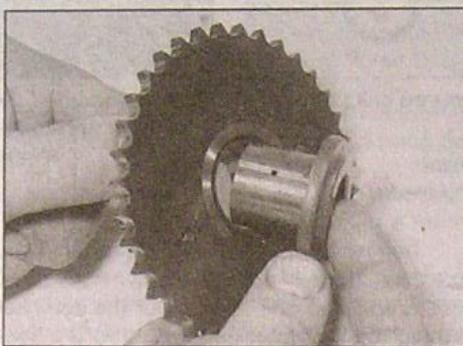
7.16 Examine the chain guides for signs of wear such as that shown



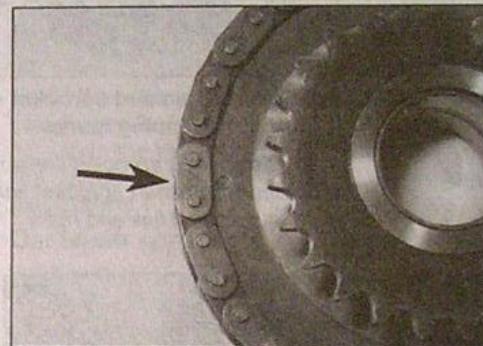
7.18 Ensure that the crankshaft is correctly positioned, then fit the Woodruff key (arrowed) ...



7.19 ... and slide on the crankshaft sprocket



7.20a Fit the shaft to the rear of the idler sprocket ...



7.20b ... then engage the sprocket with the timing chain, aligning its timing mark with one of the chain's coloured links (arrowed)

sprockets as a matched set, since it is false economy to run a new chain on worn sprockets and vice-versa. If there is any doubt about the condition of the timing chains and sprockets, seek the advice of a Nissan dealer service department, who will be able to advise you as to the best course of action, based on their previous knowledge of the engine.

16 Examine the chain guides for signs of wear or damage to their chain contact faces, renewing any which are badly marked (see illustration).

17 Check the upper chain tensioner pad for signs of wear, and check that the plunger is free to slide freely in the tensioner body. The condition of the tensioner spring can only be judged in comparison to a new component. Renew the tensioner if its pad is worn or there is any doubt about the condition of its tensioning spring.

Refitting

18 Check the crankshaft is still positioned at TDC (the keyway will be in the 12 o'clock position, seen from the right-hand end of the engine) and refit the Woodruff key to the crankshaft groove (see illustration).

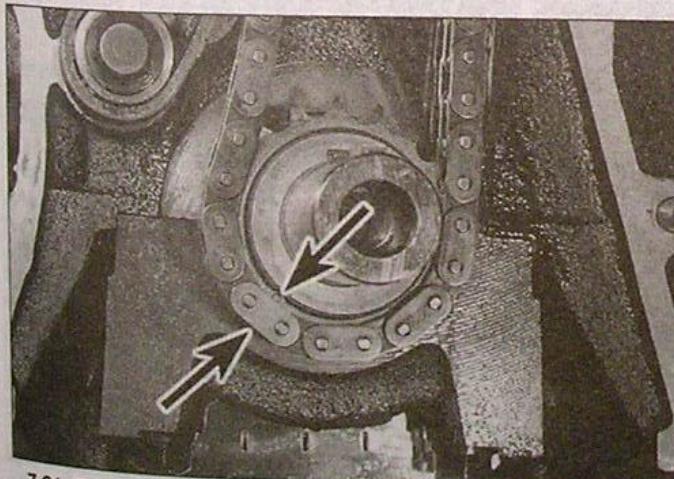
19 Ensure that the crankshaft sprocket is

positioned the correct way around, with its timing mark facing away from the crankcase, then align its groove with the key, and slide the sprocket onto the crankshaft (see illustration).

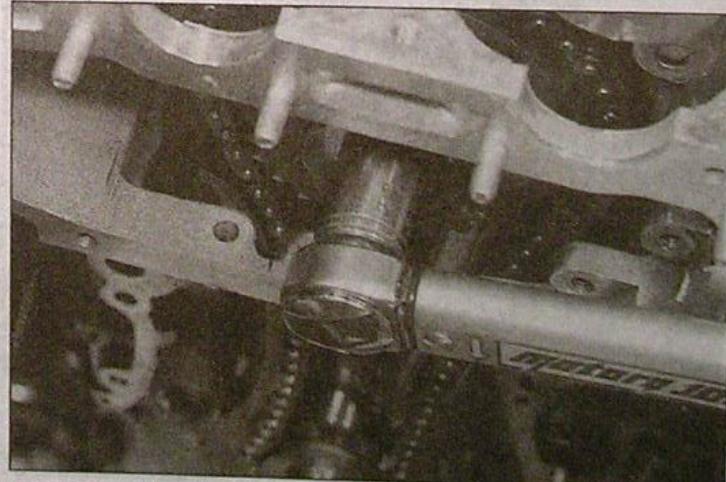
20 Apply a smear of clean engine oil to the idler sprocket shaft, and fit the shaft to the rear of the sprocket so that its flange is positioned between the sprocket and crankcase. Engage the idler sprocket with the lower timing chain, aligning its outer timing mark with one of the chain's coloured (silver) links (see illustrations).

21 Manoeuvre the chain and idler sprocket assembly into position, engaging the chain with the crankshaft sprocket so that its second coloured (silver) link is aligned with the timing mark on the crankshaft sprocket; the timing mark is in the form of a small cut-out on the sprocket hub (see illustration).

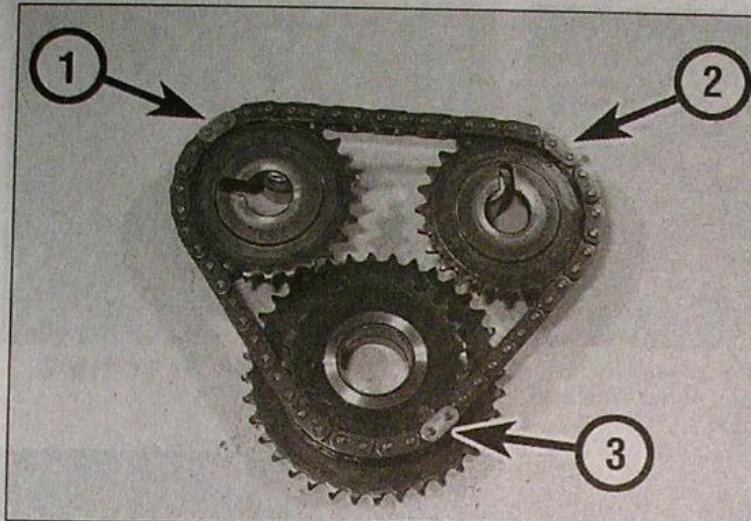
22 Check that the idler sprocket and crankshaft sprocket marks are still correctly aligned with the lower chain silver links, then install the idler sprocket centre bolt and washer, and tighten it to the specified torque setting (see illustration).



7.21 Engage the chain with the crankshaft sprocket so that its coloured link is correctly aligned with the sprocket timing mark (arrowed)

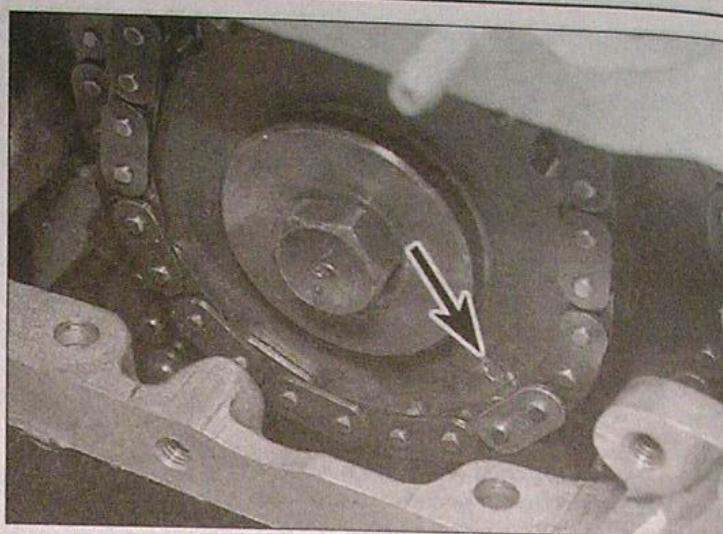


7.22 Check that the timing marks are correctly positioned then fit the idler sprocket bolt and washer, and tighten it to the specified torque

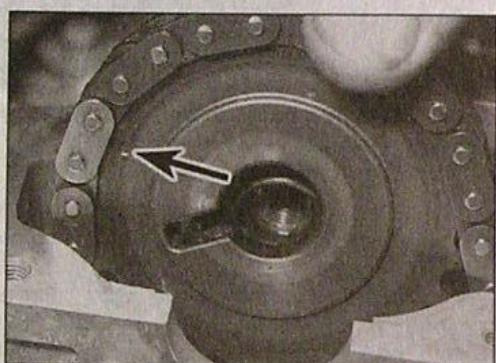


7.23 Upper timing chain and sprocket coloured links and timing marks

- 1 Inlet camshaft sprocket link and mark
- 2 Exhaust camshaft sprocket link and mark
- 3 Idler sprocket link and mark



7.24 Manoeuvre the upper chain into position, and engage it with the idler sprocket so that the relevant coloured link is correctly aligned with its timing mark (arrowed)



7.25a Engage the inlet camshaft sprocket with the chain, aligning its timing mark (arrowed) with the relevant coloured link ...

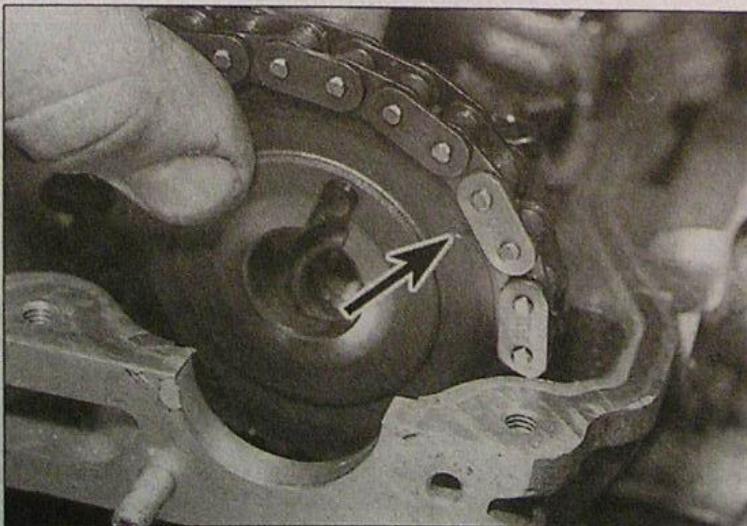
23 The upper timing chain has three coloured links, one for each of the sprocket timing marks. Note, however, that the links are not spaced at regular intervals. On early models, all three links are silver; the first (inlet camshaft sprocket) link and second (exhaust camshaft sprocket) link are 16 rollers apart, the second and third (idler sprocket) link are also 16 rollers apart, but the gap between the third silver link and the first link is 22 rollers (see illustration). On later models, the gaps between the links are the same, but the idler gear link is easily identified since it is gold in colour (camshaft sprocket links remain silver).

24 Bearing in mind paragraph 23, lower the upper chain into position, making sure its coloured links are facing outwards. Engage the chain with the idler sprocket, aligning its

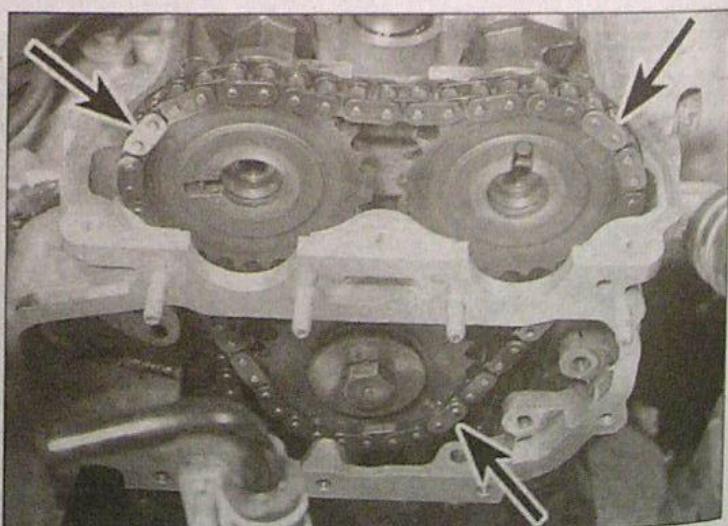
appropriate link with the sprocket inner timing mark (see illustration).

25 Manoeuvre both the inlet and exhaust camshaft sprockets into position, ensuring that their timing marks are facing outwards. **Note:** Both sprockets are identical. Engage them with the chain, aligning the inlet sprocket timing mark with the first chain silver link and the exhaust timing mark with the second. Check that all the timing marks are correctly aligned with the upper chain links (see illustrations).

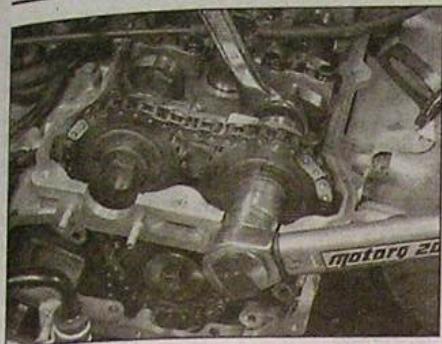
26 Locate the sprockets on the camshafts, aligning their cut-outs with the locating pins. Check that the chain silver links are correctly aligned with each sprocket's timing mark. If not, disengage the sprocket(s) from the chain, and make the necessary adjustments (see illustration).



7.25b ... then install the exhaust camshaft sprocket and align its timing mark (arrowed) with the last coloured link



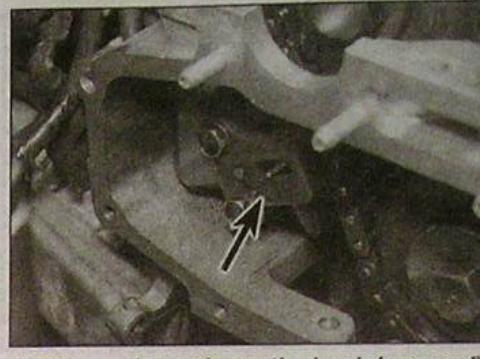
7.26 Locate the sprockets on the camshafts, and check that all the timing marks and coloured links are correctly aligned (arrowed)



7.27 Refit the sprocket retaining bolts and washers, and tighten them to the specified torque setting



7.29a On early models, fit the tensioner with its plunger held in the retracted position, and securely tighten its bolts ...



7.29b ... then release the hook (arrowed) and check that the plunger extends from the body

27 With the timing marks correctly positioned, install the camshaft sprocket retaining bolts and washers, and tighten them both to the specified torque (see illustration).

28 Fit the lower chain rear guide, and tighten its pivot bolt to the specified torque.

29 On early models, fit the upper chain top guide to the cylinder head, and tighten its retaining bolts to the specified torque setting. Ensure that the upper chain tensioner assembly is held in the retracted position by its hook, and fit the tensioner to the cylinder head. Tighten the tensioner retaining bolts to the specified torque, then release the hook and check that the tensioner pad is forced against the chain (see illustrations).

30 On later models, retract the tensioner pad and hold it in position with a suitable rod. Fit the tensioner to the cylinder head, and tighten its retaining bolts to the specified torque. Withdraw the rod, and check that the tensioner pad is forced against the chain.

31 Refit the cylinder head cover as described in Section 4.

32 Refit the timing chain cover as described in Section 6.

8 Timing chain tensioners, guides and sprockets - removal, inspection and refitting



Removal

Lower timing chain tensioner

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

2 From underneath the vehicle, unscrew the two retaining bolts and remove the lower timing chain tensioner from the rear of the chain cover. Recover the tensioner gasket, noting which way up it is fitted. **Note: Do not rotate the engine whilst the chain tensioner is removed.**

Upper timing chain tensioner

3 Slacken and remove the three retaining bolts, and remove the mounting bracket from the top of the right-hand engine/transmission mounting.

4 Unscrew the retaining nuts and bolts, and remove the camshaft sprocket access cover from the right-hand end of the cylinder head. Recover the cover gasket (where fitted).

5 On early models, retract the chain tensioner, and retain it in the retracted position using the hook on the side of the tensioner.

6 On later models, retract the chain tensioner, and hold it in position by inserting a small diameter rod in front of the tensioner pad.

7 Undo the two retaining bolts and remove the tensioner from the end of the cylinder head. **Note: Do not rotate the engine whilst the chain tensioner is removed.**

Lower timing chain front guide

8 Remove the timing chains as described in Section 7.

9 Slacken and remove the retaining bolts, and remove the lower chain front guide from the side of the crankcase.

Lower timing chain rear guide

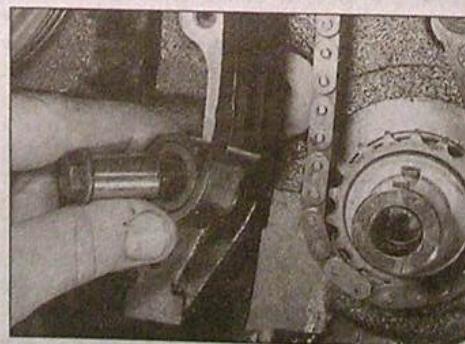
10 Remove the timing chain cover as described in Section 6.

11 Unscrew the pivot bolt, and remove the lower chain rear guide from the crankcase (see illustration).

Upper chain top guide (early models only)

12 Remove the cylinder head cover as described in Section 4.

13 Undo the two retaining bolts, and remove the guide from the top of the camshaft bearing cap.



8.11 Remove the pivot bolt, and withdraw the lower chain rear guide from the cylinder block

Upper chain front guide (early models only)

14 Remove the camshaft sprocket access cover from the cylinder head, as described in paragraphs 3 and 4.

15 Undo the two retaining bolts, and remove the guide from the cylinder head (see illustration).

Camshaft sprockets

16 Position No 1 cylinder at TDC on its compression stroke as described in Section 3.

17 Remove the cylinder head cover as described in Section 4.

18 Remove the camshaft sprocket access cover as described in paragraphs 3 and 4 of this Section.

19 Remove both camshaft sprockets and the upper timing chain as described in paragraphs 4 to 7 of Section 7.

2A

Idler sprocket and crankshaft sprocket

20 Remove the timing chains and sprockets as described in Section 7.

Inspection

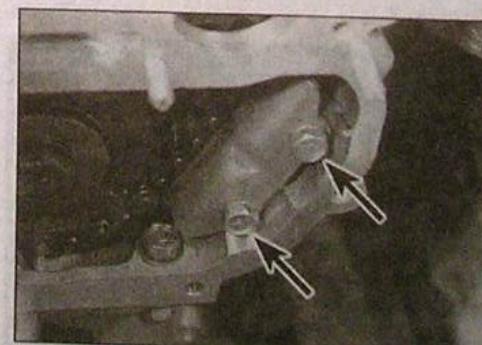
21 Refer to Section 7.

Refitting

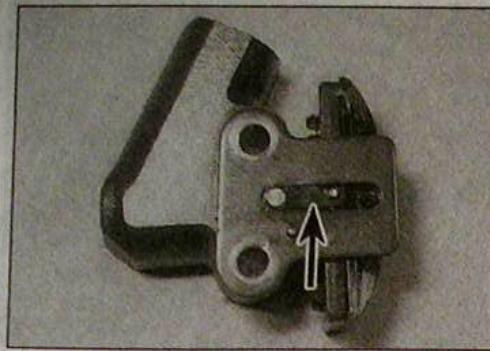
Lower timing chain tensioner

22 Ensure that the tensioner and cover mating surfaces are clean and dry.

23 Fit a new tensioner gasket to the cover, making sure it is fitted the correct way up so



8.15 The upper chain front guide is retained by two bolts (arrowed) - early models only



8.25 On early models, prior to refitting retract the plunger and secure it in position with the hook (arrowed)

its cut-out is aligned with the tensioner oil hole (see illustration 6.23a).

24 Install the chain tensioner, and tighten its retaining bolts to the specified torque setting.

Upper timing chain tensioner

25 On early models, ensure that the tensioner assembly is held in the retracted position by its hook, and fit it to the cylinder head. Tighten the tensioner retaining bolts to the specified torque, then release the hook and check that the tensioner pad is forced against the chain (see illustration).

26 On later models, retract the tensioner pad, and hold it in position with a suitable rod. Fit the tensioner to the head, and tighten its retaining bolts to the specified torque. Withdraw the rod, and check that the tensioner pad is forced against the chain.

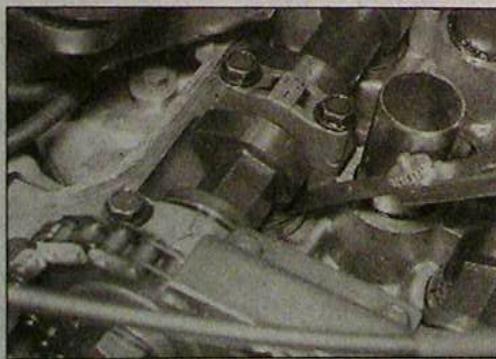
27 Ensure that the sprocket access cover and head mating surfaces are clean and dry. Where the cover was originally fitted with a gasket, fit a new gasket to the cylinder head; where the cover was originally fitted using sealant, apply a continuous bead of suitable sealant to the cover mating surface. Install the cover, and tighten its retaining nuts and bolts to the specified torque setting.

28 Install the bracket to the top of the right-hand engine/transmission mounting, and tighten its bolts to the specified torque setting.

Lower timing chain front guide

29 Fit the guide to the crankcase, and tighten its retaining bolts to the specified torque.

30 Refit the timing chains as described in Section 7.



9.5 Checking a valve clearance

Lower timing chain rear guide

31 Fit the guide to the crankcase, and tighten its pivot bolt to the specified torque.

32 Refit the timing chain cover as described in Section 6.

Upper chain top guide (early models only)

33 Fit the guide to the top of the camshaft bearing cap, and tighten its retaining bolts to the specified torque.

34 Refit the cylinder head cover as described in Section 4.

Upper chain front guide (early models only)

35 Fit the guide to the cylinder head and tighten its retaining bolts to the specified torque.

36 Refit the sprocket access cover as described in paragraphs 27 and 28.

Camshaft sprockets

37 Refit the camshaft sprockets and upper timing chain as described in paragraphs 23 to 27 of Section 7.

38 On early models, refit the top and front upper chain guides, and tighten the retaining bolts to their specified torque setting.

39 Refit the upper chain tensioner as described in paragraphs 25 to 28.

40 Refit the cylinder head cover as described in Section 4.

Idler sprocket and crankshaft sprocket

41 Refit the timing chains and sprockets as described in Section 7.

9 Valve clearances - checking and adjustment



Note: The valve clearances must always be checked with the engine hot. Although Nissan quote valve clearances for a hot and cold engine, the valve clearances should only be checked cold, prior to starting the engine after an overhaul. The valve clearances should then be checked again once the engine has been warmed up to normal operating temperature.

Note: This is not a routine operation. It should only be necessary at high mileage, after overhaul, or when investigating noise or power loss which may be attributable to the valve gear.

1 The importance of having the valve clearances correctly adjusted cannot be overstressed, as they vitally affect the performance of the engine. That being said, the check should not be regarded as routine maintenance, and should only be carried out when the valve gear has become noisy, after engine overhaul, or when trying to trace the cause of power loss which may be attributed to the valves. The clearances are checked as follows.

2 Draw the outline of the engine on a piece of paper, numbering the cylinders 1 to 4, with No 1

cylinder at the timing chain end of the engine. Show the position of each valve, together with the specified valve clearance. Above each valve, draw two lines for noting the actual clearance and the amount of adjustment required. **Note:** Nissan quote two sets of clearance tolerances; one for checking the clearance, and a second one to use when adjusting/setting the clearance. The checking tolerance is exceptionally large and, although not strictly necessary, it is desirable to have all valve clearances within the adjusting/setting tolerances.

3 Warm the engine up to normal operating temperature, then switch off. Remove the cylinder head cover as described in Section 4.

4 Position No 1 cylinder at TDC on its compression stroke, as described in Section 3.

5 Using feeler gauges, measure the clearance between the base of the cam and the follower of the following valves, recording each clearance on the paper (see illustration).

No 1 cylinder inlet and exhaust valves

No 2 cylinder inlet valves

No 3 cylinder exhaust valves

6 Rotate the crankshaft through one complete turn (360°) clockwise until the TDC notch on the crankshaft pulley is realigned with the pointer. No 4 cylinder is now at TDC on its compression stroke.

7 Check the clearances of the following valves, and record them on the paper.

No 2 cylinder exhaust valves

No 3 cylinder inlet valves

No 4 cylinder inlet and exhaust valves

8 Calculate the difference between each measured clearance and the desired value, and record it on the piece of paper. Where a valve clearance differs from the specified value, then the shim for that valve must be replaced with a thinner or thicker shim accordingly.

9 To remove the shim, the follower has to be pressed down against valve spring pressure just far enough to allow the shim to be slid out. To do this, make sure that the cam lobe of the valve on which the shim is to be removed is pointing away from the follower, then rotate the follower so that its notch is at a right-angle to the camshaft centre-line.

10 Using a suitable C-spanner or stout screwdriver, carefully lever down between the camshaft and the edge of the follower, until the follower is depressed sufficiently to allow the shim to be slid out of position. With the shim removed, slowly release the follower. If difficulty is experienced in removing the shims, it will be necessary to remove the camshaft(s) as described in Section 10.

11 The shim size is stamped on the bottom face of the shim (eg. 224 indicates the shim is 2.24 mm thick), but it is advisable to use a micrometer to measure the true thickness of any shim removed, as it may have been reduced by wear. **Note:** Shims are available in thicknesses between 2.00 mm and 2.98 mm, in steps of 0.02 mm. The size of shim required is calculated as follows.

12 If the measured clearance is less than specified, subtract the measured clearance from the specified clearance, and subtract the result from the thickness of the existing shim. For example:

Sample calculation -

inlet valve clearance too small

Clearance measured =	0.26 mm
Desired clearance =	0.36 mm
(0.32 to 0.40 mm)	
Difference =	0.10 mm
Shim thickness fitted =	2.50 mm
Shim thickness required =	2.50 - 0.10 = 2.40 mm

13 If the measured clearance is greater than specified, subtract the specified clearance from the measured clearance, and add the result to the thickness of the existing shim. For example:

Sample calculation -

exhaust valve clearance too big

Clearance measured =	0.51 mm
Desired clearance =	0.41 mm
(0.37 to 0.45 mm)	
Difference =	0.10 mm
Shim thickness fitted =	2.76 mm
Shim thickness required =	2.76 + 0.10 = 2.86 mm

14 Depress the follower, then slide the required size of shim into position, so that it is fitted with its marked face facing downwards. Ensure that the shim is correctly seated, then repeat the procedure (as required) for the remaining valve(s) which require adjustment.

15 Once all valves have been adjusted, rotate the crankshaft through at least four complete turns in the correct direction of rotation, to settle all disturbed shims in position, then recheck the clearances as described above.

16 With all valve clearances correctly adjusted, refit the cylinder head cover as described in Section 4, and refit all components removed to gain access to the crankshaft pulley.

10 Camshafts and followers - removal, inspection and refitting



Removal

1 Remove the distributor as described in Chapter 5.

2 Remove the camshaft sprockets as described in Section 8.

3 The camshaft right- and left-hand end bearing caps are noticeably different to the others, however, the other bearing caps are all similar. On later models, the caps have identification markings cast into the top of each centre bearing cap; the exhaust camshaft caps are marked E2 to E5 and the inlet camshaft caps are marked I2 to I5; the No 2 caps being fitted nearest the timing chain end of the engine (see illustration). On early models, the caps may not be marked, and suitable identification marks should be

made prior to removal. Using white paint or a suitable marker pen, mark each cap in some way to indicate its correct fitted orientation and position. This will avoid the possibility of installing the caps in the wrong positions and/or the wrong way around on refitting.

4 Working in the **reverse** of the sequence shown in illustration 10.23, evenly and progressively slacken the camshaft bearing cap retaining bolts by one turn at a time, to relieve the pressure of the valve springs on the bearing caps gradually and evenly. Once the valve spring pressure has been relieved, the bolts can be fully unscrewed and removed. Remove the end bearing caps first, then remove the exhaust camshaft caps followed by the inlet camshaft caps.

5 Lift the camshafts out of the cylinder head.

6 Obtain sixteen small, clean plastic containers, and number them 1 to 16. Alternatively, divide a larger container into sixteen compartments. Using a rubber sucker, withdraw each shim and follower in turn, and place it in its respective container. Do not interchange the cam followers, or the rate of wear will be increased.

Inspection

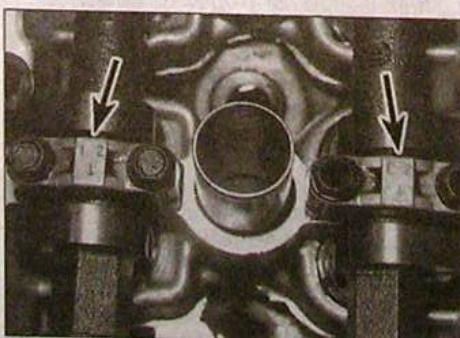
7 Inspect the cam bearing surfaces of the head and the bearing caps. Look for score marks and deep scratches. Check the camshaft lobes for heat discolouration (blue appearance), score marks, chipped areas or flat spots.

8 Camshaft run-out can be checked by supporting each end of the camshaft on V-blocks, and measuring any run-out at the centre of the shaft using a dial gauge. If the run-out exceeds the specified limit, a new camshaft will be required.

9 Measure the height of each lobe with a micrometer, and compare the results to the figures given in the Specifications at the start of this Chapter. If damage is noted or wear is excessive, new camshaft(s) must be fitted.

10 The camshaft bearing oil clearance should now be checked. There are two possible ways of checking this; the first method is by direct measurement (see paragraphs 11 and 16) and the second by the use of a product called Plastigauge (see paragraphs 12 to 16).

11 If the direct measurement method is to be used, fit the bearing caps to the head, using



10.3 Inlet and exhaust camshaft bearing cap markings (arrowed)

the marks made on removal to ensure that they are correctly positioned. Tighten the retaining bolts to the specified torque in the sequence shown in illustration 10.23. Measure the diameter of each bearing cap journal, and compare the measurements obtained with the results given in the Specifications at the start of this Chapter. If any journal is worn beyond the service limit, the cylinder head must be renewed. The camshaft bearing oil clearance can then be calculated by subtracting the camshaft bearing journal diameter from the bearing cap journal diameter.

12 If the Plastigauge method is to be used, clean the camshafts, the bearing surfaces in the cylinder head and the bearing caps with a clean, lint-free cloth, then lay the cams in place in the cylinder head.

13 Cut strips of Plastigauge, and lay one piece on each bearing journal, parallel with the camshaft centreline. Ensuring that the camshafts are not rotated at all, refit both camshafts as described in paragraphs 19 to 23, ignoring the remark about applying sealant to the bearing cap.

14 Now unscrew the bolts as described in paragraph 4 and carefully lift off the bearing caps, again making sure the camshafts are not rotated.

15 To determine the oil clearance, compare the crushed Plastigauge (at its widest point) on each journal to the scale printed on the Plastigauge container.

16 Compare the results to this Chapter's Specifications. If the oil clearance is greater than specified, measure the diameter of the cam bearing journal with a micrometer. If the journal diameter is less than the specified limit, renew the camshaft and recheck the clearance. If the clearance is still too great, replace the cylinder head and bearing caps with new parts.

17 Check the cam follower and cylinder head bearing surfaces for signs of wear or damage. If the necessary measuring equipment is available, the amount of wear can be assessed by direct measurement. Compare the measurement of each follower and its cylinder head bore with the measurements given in the Specifications at the start of this Chapter. Renew worn components as necessary.

Refitting

18 Liberally oil the cylinder head cam follower bores and the followers. Carefully refit the followers to the cylinder head, ensuring that each follower is refitted to its original bore. Some care will be required to enter the followers squarely into their bores. Ensure that all the shims are correctly seated in the top of each follower, then liberally oil the camshaft bearing and lobe contact surfaces.

19 Refit the camshafts to their correct locations in the cylinder head. The exhaust camshaft is easily distinguished by the distributor drive slot on its left-hand end. On later models, the shafts also have identification markings - the inlet camshaft is marked I and the exhaust camshaft E.

20 Check that the crankshaft pulley TDC notch is still aligned with the pointer on the timing chain cover. Position each camshaft so that its No 1 cylinder lobes are pointing away from their valves. With the shafts in this position, the sprocket locating pin in the inlet camshaft's right-hand end will be in the 9 o'clock position when viewed from the right-hand end of the engine, while that of the exhaust camshaft will be in the 12 o'clock position.

21 Ensure that the bearing cap and head mating surfaces are completely clean, unmarked and free from oil. Apply a smear of suitable sealant to the exhaust camshaft's left-hand end bearing cap mating surface.

22 Refit the bearing caps, using the identification marks made or noted on removal to ensure that each is installed the correct way round and in its original location.

23 Working in the sequence shown (see illustration), evenly and progressively tighten the camshaft bearing cap bolts by one turn at a time until the caps touch the cylinder head. Then go round again and tighten all the bolts to the specified torque setting. Work only as described, to impose the pressure of the valve springs gradually and evenly on the bearing caps.

24 Refit the camshaft sprockets as described in Section 8. **Note:** If the cylinder head/camshafts have been overhauled, check the valve clearances cold prior to refitting the cylinder head cover (see Section 9).

25 Refit the distributor as described in Chapter 5.

26 Check the valve clearances as described in Section 9.

11 Cylinder head - removal and refitting



To aid refitting, make notes on the locations of all relevant brackets and the routing of hoses and cables before removal.

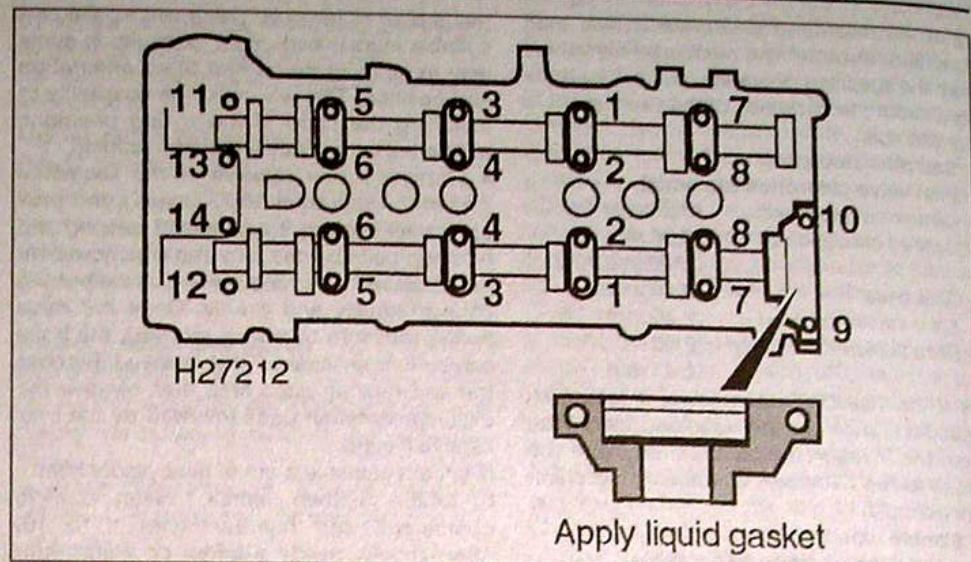
Removal

1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Section of this manual).

2 Remove the timing chains as described in Section 7.

3 Remove the camshafts as described in Section 10.

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



10.23 Camshaft bearing cap bolt tightening sequence. Apply sealant to the shaded area of the left-hand exhaust camshaft bearing (inset) cap prior to refitting

5 Working as described in the relevant Part of Chapter 4, disconnect the exhaust system front pipe from the manifold.

6 Remove the air cleaner assembly as described in Chapter 4.

7 On carburettor engines, disconnect the following from the carburettor and inlet manifold, as described in Chapter 4A:

- Fuel feed hose and return hose from the fuel pump (plug all openings, to prevent loss of fuel and the entry of dirt into the system).
- Accelerator cable.
- Carburettor wiring connector(s).
- Vacuum servo unit vacuum hose, coolant hose and all other relevant breather/vacuum hoses from the manifold and associated valves.
- Remove the inlet manifold support bracket.
- On models with a catalytic converter, disconnect the exhaust gas sensor wiring connector.

8 On fuel-injected engines, carry out the following operations as described in the relevant Part of Chapter 4.

- Depressurise the fuel system, and disconnect the fuel feed and return hoses from the fuel rail (plug all openings, to prevent loss of fuel and entry of dirt into the fuel system).
- Disconnect the accelerator cable.
- Disconnect the relevant electrical connectors from the throttle housing, inlet manifold and associated components.
- Disconnect the vacuum servo unit hose, coolant hose(s) and all the other relevant/breather hoses from the manifold and associated valves.
- Remove the inlet manifold support brackets.
- On models with a catalytic converter, disconnect the exhaust gas sensor wiring connector.

9 Slacken the retaining clip(s) and disconnect the coolant hose(s) from the cylinder head.

10 Slacken and remove the 6 mm bolt from the front, left-hand corner of the cylinder head.

11 Working in the **reverse** of the sequence shown in illustration 11.25, progressively slacken the ten main cylinder head bolts by half a turn at a time, until all bolts can be unscrewed by hand.

12 Lift out the cylinder head bolts and recover the washers, noting which way around they are fitted.

13 Lift the cylinder head away; seek assistance if possible, as it is a heavy assembly (especially if complete with manifolds). Remove the gasket from the top of the block, noting the two locating dowels and the oil jet fitted to the top of the cylinder block. If they are a loose fit in the block, remove the locating dowels and oil jet, noting which way round they are fitted, and store them with the head for safe-keeping.

14 If the cylinder head is to be dismantled for overhaul, then refer to Part C of this Chapter.

Preparation for refitting

15 Check the condition of the cylinder head bolts, and particularly their threads, whenever they are removed. Wash the bolts and wipe dry, then check each for any sign of visible wear or damage, renewing any bolt if necessary. Although Nissan do not actually specify that the bolts must be renewed, it is strongly recommended that the bolts should be renewed as a complete set whenever they are disturbed.

16 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; also clean the piston crowns. Take particular care, as the surfaces are damaged easily. Also, make sure that the

carbon is not allowed to enter the oil and water 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 water, oil and bolt holes in the cylinder block/crankcase. To prevent carbon entering the gap between the pistons and bores, smear a little grease in the gap. 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. Clean all the pistons in the same way.

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

18 If warpage of the cylinder head gasket surface is suspected, use a straight-edge to check it for distortion. Refer to Part C of this Chapter if necessary.

Refitting

19 Wipe clean the mating surfaces of the cylinder head and cylinder block/crankcase. Check that the two locating dowels are in position at each end of the cylinder block/crankcase surface, and refit the oil jet to the centre of the block.

20 Fit a new gasket to the cylinder block/crankcase surface, aligning it with the oil jet and locating dowels.

21 With the aid of an assistant, carefully refit the cylinder head assembly to the block, aligning it with the locating dowels.

22 Apply a smear of clean oil to the threads, and to the underside of the heads, of the ten main cylinder head bolts.

23 Fit the washer to each head bolt, making sure it is fitted with its tapered edge uppermost.

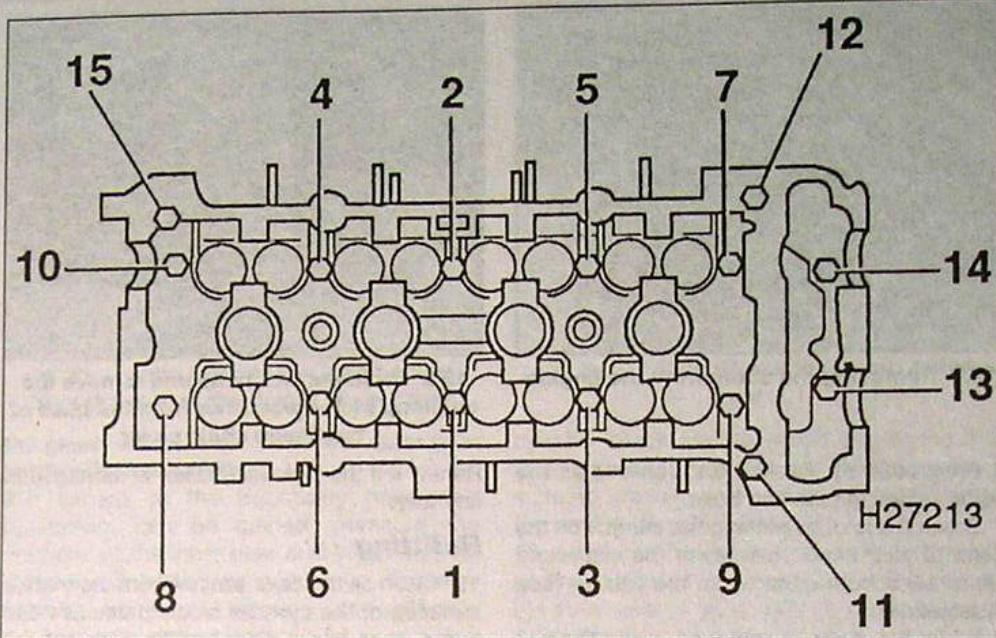
24 Carefully enter each bolt into its relevant hole (*do not drop them in*) and screw in, by hand only, until finger-tight.

25 Working progressively and in the sequence shown, tighten the **ten main** cylinder head bolts (Nos 1 to 10 in the accompanying illustration) to their Stage 1 torque setting, using a torque wrench and suitable socket (see illustration). **Note:** Bolts 11 to 15 in the sequence (the 6 mm bolts) should not be tightened now, but only after the ten main bolts have been tightened to Stage 4.

26 Once the ten main bolts have been tightened to their Stage 1 setting, go around again in the specified sequence and tighten them to the specified Stage 2 torque setting.

27 Leave the bolts a minute then, working in the **reverse** of the specified sequence, progressively slacken the head bolts by half a turn at a time, until all bolts can be unscrewed by hand.

28 Tighten the ten main bolts again by hand, then go around again in the specified sequence and tighten these ten bolts to the specified Stage 3 torque setting.



11.25 Cylinder head bolt tightening sequence

29 Finally, go around again in the specified sequence and tighten the ten main head bolts either through the specified Stage 4 angle setting or, if an angle-measuring gauge is not available, to the specified Stage 4 torque setting.

30 With the main cylinder head bolts correctly tightened, fit the five 6 mm bolts (Nos 11 to 15 in the tightening sequence) and tighten them in sequence to their specified torque setting.

31 Reconnect the coolant hose to the cylinder head and securely tighten its retaining clip.

32 Working as described in the relevant Part of Chapter 4, carry out the following tasks:

- Refit all disturbed wiring, hoses and control cable(s) to the inlet manifold and fuel system components.
- Reconnect and adjust the accelerator cable.
- Reconnect the exhaust system front pipe to the manifold. Where applicable, reconnect the exhaust gas sensor wiring connector.
- Refit the air cleaner assembly and inlet duct.

33 Refit the camshafts to the head as described in Section 10.

34 Fit the timing chains and sprockets as described in Section 7. **Note:** If the cylinder head has been overhauled, check the valve clearances cold prior to refitting the cylinder head cover (see Section 9).

35 Start the engine and warm it up to normal operating temperature, then check the valve clearances as described in Section 9.

2A

12 Sump - removal and refitting



Removal

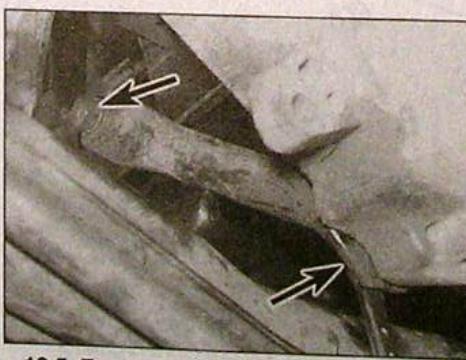
1 Apply the handbrake, then jack up the front of the car and support it on axle stands (see *Jacking and vehicle support*). Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Section of this manual).

2 To improve access, slacken and remove the retaining screws and remove the plastic undershield(s) from beneath the engine.

3 Drain the engine oil, then clean and refit the engine oil drain plug, tightening it to the specified torque. If the engine is nearing its service interval when the oil and filter are due for renewal, it is recommended that the filter is also removed, and a new one fitted. After reassembly, the engine can then be refilled with fresh oil. Refer to Chapter 1 for further information.

4 Remove the exhaust system front pipe as described in the relevant Part of Chapter 4.

5 Undo the retaining bolts, and remove the small support bars linking the transmission to the cylinder block, from the front and rear of the block (see illustration).



12.5 Engine/transmission front support bar fixings (arrowed)



12.7 Removing the sump from the engine



12.8 Undo the two bolts and remove the oil pump pick-up/strainer from the base of the timing chain cover



12.11 Fit a new O-ring (arrowed) to the oil pump pick-up/strainer recess

6 Progressively slacken and remove all the sump retaining nuts and bolts.

7 Break the joint by striking the sump with the palm of your hand, then lower the sump and withdraw it from underneath the vehicle (see illustration).

8 While the sump is removed, undo the two retaining bolts and remove the oil pump pick-up/strainer and O-ring from the base of the timing cover (see illustration).

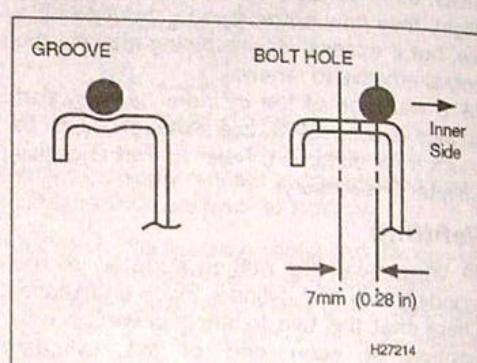
9 Wash the strainer in a suitable solvent, and check it for signs of clogging or splitting.

Renew it if the pick-up/strainer is damaged in any way.

Refitting

10 Clean all traces of sealant 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.

11 Fit a new O-ring to the recess in the top of the pick-up/strainer, and fit the strainer to the base of the timing cover (see illustration). Securely tighten the strainer bolts.



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12.12 Apply sealant to the groove between the sump mounting bolt holes, and to the inner side of each hole

12 Ensure that the sump and cylinder block/crankcase mating surfaces are clean and dry. Apply a continuous bead of suitable sealant to the mating surface of the sump. Apply the sealant to the groove in the centre of the mating surface between the holes, and around the inner edge of each bolt hole (see illustration).

13 Offer up the sump, locating it on its retaining studs, and refit its retaining nuts and bolts. Tighten the nuts and bolts evenly and progressively to the specified torque.

14 Refit the support bars, tightening their retaining bolts securely.

15 Refit the exhaust front pipe as described in the relevant Part of Chapter 4.

16 Refit the undershields (if removed) and securely tighten their retaining screws.

17 Replenish the engine oil as described in Chapter 1.

13 Oil pump - removal, inspection and refitting

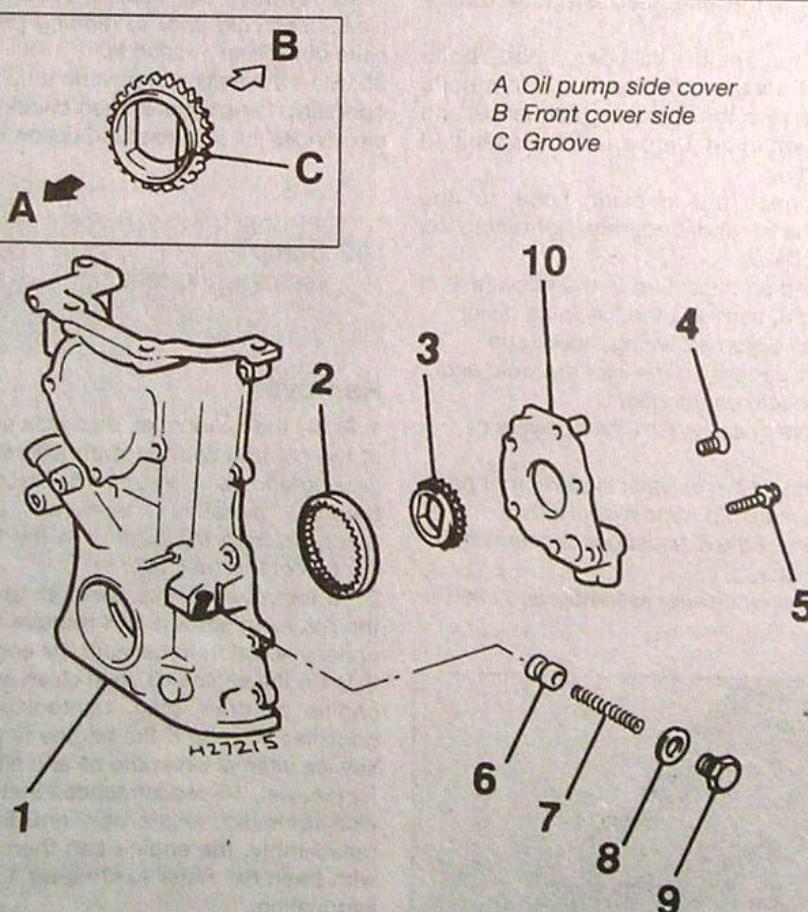


Removal

1 The oil pump is an integral part of the timing chain cover (see illustration). Remove the cover as described in Section 6.

Inspection

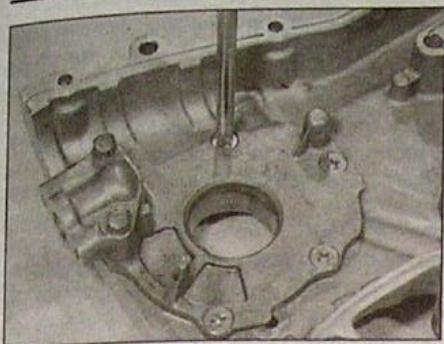
2 Unscrew the retaining screws and bolt, and remove the pump cover from the rear of the timing chain cover (see illustrations).



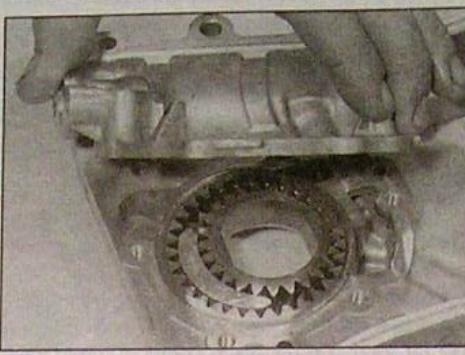
13.1 Exploded view of the oil pump components

- 1 Timing chain cover
- 2 Outer gear
- 3 Inner gear
- 4 Pump cover screw

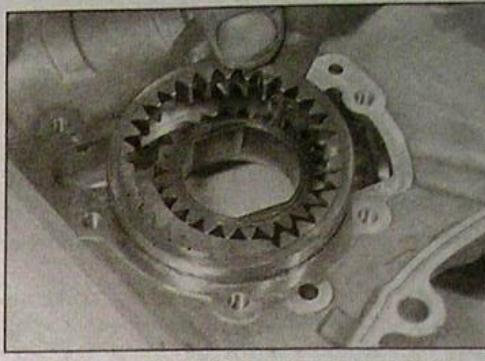
- 5 Pump cover bolt
- 6 Oil pressure regulator valve piston
- 7 Spring
- 8 Sealing washer
- 9 Oil pressure regulator valve bolt
- 10 Pump cover



13.2a Undo the retaining screws and bolts ...



13.2b ... and remove the pump cover from the rear of the timing chain cover



13.3a ... then lift out the pump outer gear ...

3 Remove both the oil pump gears from the cover (see illustrations).

4 Unscrew the oil pressure regulator valve bolt from the front edge of the cover, and recover its sealing washer. Withdraw the spring and the valve piston, noting which way around the piston is fitted (see illustrations).

Note: If necessary, the pressure regulator valve can be dismantled without removing the timing cover from the engine.

5 Inspect the pump gears, regulator valve piston and the cover for obvious signs of wear or damage.

6 Fit the gears to the cover and, using feeler blades of the appropriate thickness, measure the clearance between the outer gear and cover, and between the tips of inner and outer gear teeth and the crescent which is positioned between them (see illustrations).

7 Using feeler gauge blades and a straight-edge placed across the top of the cover and

the gears, measure the inner and outer gear endfloat (see illustration).

8 If access to the necessary measuring equipment can be gained, measure the diameter of the inner gear and cover bearing surfaces. Subtract the gear outer diameter from the cover inner diameter, and calculate the gear-to-housing clearance.

9 If any measurement is outside the specified limits, or the gears, valve or cover is damaged, the complete timing chain cover assembly should be renewed.

10 If the pump is found to be worn, also check the oil pressure relief valve. To gain access to the relief valve, unscrew the oil filter from the front of the cylinder block. Inspect the valve ball for signs of wear or damage. Depress the valve ball, and check that it moves smoothly and easily, and returns quickly under spring pressure. If not the valve must be renewed. Pull the valve out from the

cylinder block, noting which way round it is fitted. Press the new one into position using a suitable tubular spacer. Fit a new oil filter to the engine (see Chapter 1).

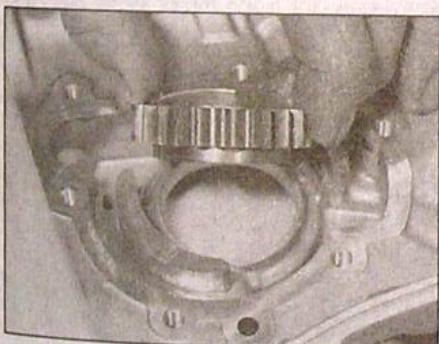
11 Lubricate the gears with clean engine oil, and refit them to the pump body. Ensure that the inner gear is fitted with its flange towards the cover.

12 Ensure that the mating surfaces are clean and dry, and refit the pump cover. Fit the cover retaining bolt and screws, and tighten them to the specified torque settings.

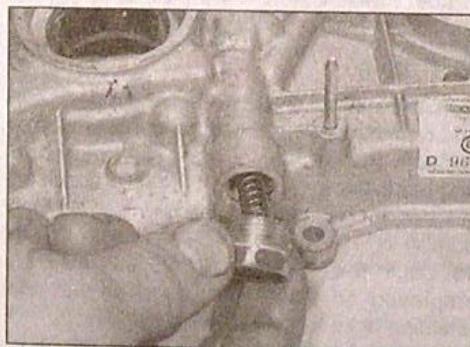
13 Fit the pressure regulator valve, piston ensuring it is the correct way around, and install the spring. Fit a new sealing washer to the valve bolt, and tighten the bolt to the specified torque setting.

Refitting

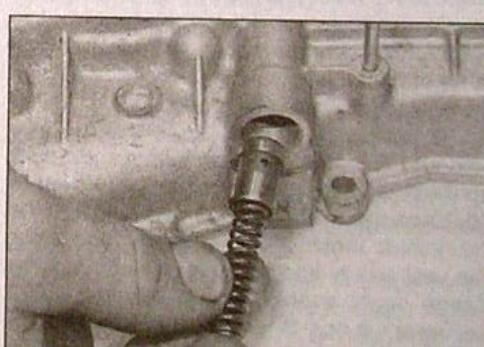
14 Refit the timing chain cover as described in Section 6.



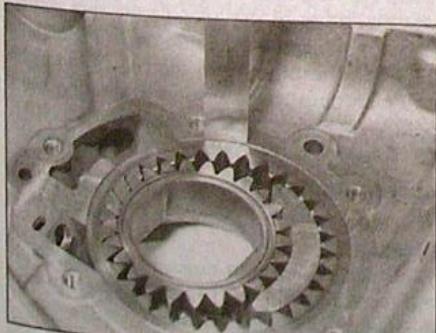
13.3b ... and inner gear



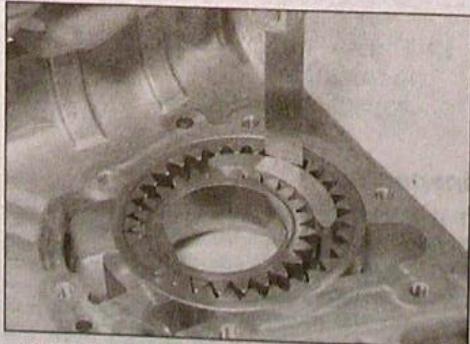
13.4a Unscrew the pressure regulator valve bolt and sealing washer ...



13.4b ... and withdraw the spring and piston from the cover



13.6a Measuring outer gear-to-cover clearance



13.6b Measuring outer gear-to-crescent clearance



13.7 Checking gear endfloat with a straight edge and feeler gauge

14 Crankshaft oil seals - renewal



Right-hand (timing chain cover) oil seal

1 Remove the crankshaft pulley as described in Section 5.

2 Carefully lever the oil seal out of position, using a large flat-bladed screwdriver, taking care not to damage the oil pump gears or timing cover.

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.

4 Lubricate the lips of the new seal with a smear of grease and offer up the seal, ensuring its sealing lip is facing inwards. Carefully ease the seal into position, taking care not to damage its sealing lip. Drive the seal 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. Note that the seal lips should face inwards.

5 Wash off any traces of oil, then refit the crankshaft pulley as described in Section 5.

Left-hand (flywheel) oil seal

6 Remove the flywheel as described in Section 15.

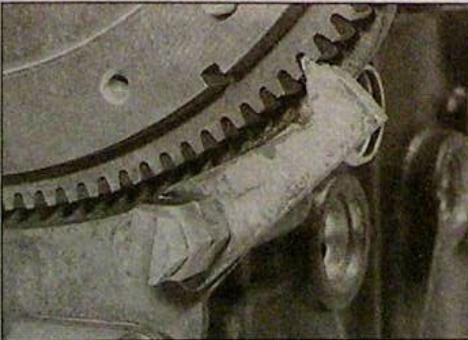
7 Taking care not to mark either the crankshaft or any part of the cylinder block/crankcase, lever the seal evenly out of its housing using a large flat-bladed screwdriver.

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

9 Lubricate with grease the lips of the new seal and the crankshaft shoulder, then offer up the seal to the cylinder block/crankcase.

10 Ease the sealing lip of the seal over the crankshaft shoulder by hand only, and press the seal evenly into its housing until its outer flange seats evenly on the housing lip. If necessary, a soft-faced mallet can be used to tap the seal gently into place.

11 Wash off any traces of oil, then refit the flywheel as described in Section 15.



15.2 Use the fabricated tool shown to lock the flywheel ring gear and prevent crankshaft rotation

15 Flywheel - removal, inspection and refitting



Removal

1 Remove the transmission as described in Chapter 7A, then remove the clutch assembly as described in Chapter 6.

2 Prevent the flywheel from turning by locking the ring gear teeth with a similar arrangement to that shown (see illustration). Alternatively, bolt a strap between the flywheel and the cylinder block/crankcase.

3 Slacken and remove the flywheel retaining bolts, and remove the flywheel. Do not drop it, as it is very heavy.

4 If necessary, remove the cover plate from the cylinder block, noting which way round it is fitted. If the cover plate dowels are a loose fit in the block, remove them and store them with the plate for safe-keeping.

Inspection

5 If the flywheel's clutch mating surface is deeply scored, cracked or otherwise damaged, the flywheel must be renewed. However, it may be possible to have it surface-ground; seek the advice of a Nissan dealer or engine reconditioning specialist.

6 If the ring gear is badly worn or has missing teeth, it must be renewed. This job is best left to a Nissan dealer or engine reconditioning specialist. The temperature to which the new ring gear must be heated for installation is critical and, if not done accurately, the hardness of the teeth will be destroyed.

Refitting

7 Install the locating dowels (where removed) and refit the cover plate to the cylinder block.

8 Clean the mating surfaces of the flywheel and crankshaft.

9 Offer up the flywheel, and refit the retaining bolts.

10 Lock the flywheel using the method employed on dismantling, and tighten the retaining bolts to the specified torque.

11 Refit the clutch as described in Chapter 6. Remove the locking tool, and refit the transmission as described in Chapter 7A.

16 Engine/transmission mountings - inspection and renewal



Inspection

1 If improved access is required, apply the handbrake, then jack up the front of the car and support it on axle stands (see *Jacking and vehicle support*).

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 all the mounting's fasteners are securely tightened; use a torque wrench to check if possible.

4 Using a large screwdriver or a crowbar, 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 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 free 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 (refer to *Disconnecting the battery* in the Reference Section of this manual).

6 Place a jack beneath the engine, with a block of wood on the jack head. Raise the jack until it is supporting the weight of the engine.

7 Slacken and remove the three retaining bolts, and remove the mounting bracket from the top of the right-hand engine/transmission mounting.

8 Unscrew the nut and through-bolt, then undo the three retaining bolts and remove the right-hand mounting assembly from the engine compartment. Recover the rubbers which are fitted to each side of the body mounting bracket.

9 If necessary, undo the retaining bolts and remove the right-hand engine/transmission mounting bracket from the engine.

10 Check carefully for signs of wear or damage on all components, and renew them where necessary.

11 On refitting, fit the mounting bracket (where removed) to the engine, and securely tighten its retaining bolts.

12 Fit the rubbers to the body mounting bracket, ensuring that their pins are correctly seated in the bracket holes. Fit the mounting to the top of the engine bracket, tightening its retaining bolts to the specified torque setting.

13 Align the right-hand mounting with the body bracket, then insert the through-bolt and tighten its nut to the specified torque setting. Remove the jack from underneath the engine.

14 Refit the bracket to the top of the right-hand engine/transmission mounting, and tighten its bolts to the specified torque setting.

15 Reconnect the battery negative terminal.

Left-hand mounting

16 Remove the battery as described in Chapter 5.

17 Place a jack and block of wood beneath the transmission, and raise the jack to take the weight of the transmission.

18 Slacken and remove the through-bolt, then undo the three bolts and remove the left-hand mounting from the transmission.

Recover the rubbers from each side of the mounting bracket and, if necessary, unbolt the mounting bracket from the vehicle body.

19 Check carefully for signs of wear or damage on all components, and renew them where necessary.

20 On refitting, fit the mounting bracket (where removed) and securely tighten its retaining bolts.

21 Refit the rubbers to the mounting bracket, ensuring that their pins are correctly seated in the bracket holes, and manoeuvre the mounting into position. Fit the bolts securing the mounting to the transmission, and tighten them to the specified torque setting.

22 Align the left-hand mounting with its bracket, then insert the through-bolt and tighten its nut to the specified torque setting.

23 Remove the jack from underneath the engine, and refit the battery.

Front mounting - Phase I and Phase II Saloon and Hatchback models and all Phase III models

24 If not already done, apply the handbrake, then jack up the front of the car and support it on axle stands (see *Jacking and vehicle support*). Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Section of this manual), then undo the retaining screws and, if necessary, remove the engine undershields to improve access.

25 Using a suitable marker pen, mark the outline of the front engine/transmission through-bolt on the mounting bracket to use as a guide on refitting.

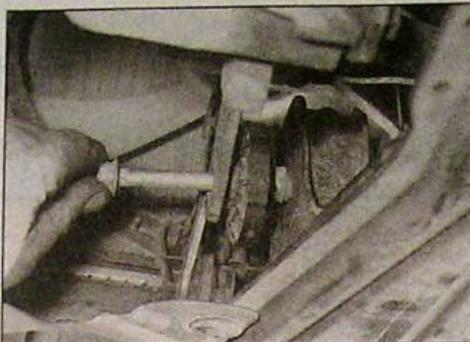
26 Place a jack beneath the engine, with a block of wood on the jack head. Raise the jack until it is supporting the weight of the engine.

27 Slacken and remove the nut and through-bolt from mounting.

28 Undo the retaining bolts, and remove the mounting bracket from the front of the engine.

29 Check carefully for signs of wear or damage on all components, and renew them where necessary. If renewal of the mounting rubber is necessary, press the original out from the centre member. Install the new rubber; coating the rubber with soapy water (or washing-up liquid) to ease installation.

30 On refitting, fit the mounting bracket to



16.34a Withdraw the front mounting through bolt ...



16.34b ... then free the damper assembly from the mounting bracket

the engine, and tighten its retaining bolts to the specified torque.

31 Refit the through-bolt to the mounting, and lightly tighten its nut. Position the engine/transmission so that the front mounting through-bolt is correctly aligned with the mark made prior to removal, then tighten the through-bolt to the specified torque setting.

32 Remove the jack from underneath the transmission.

33 Refit the undershields, tighten their fasteners securely, then lower the vehicle to the ground and reconnect the battery.

Front mounting - Phase I and Phase II Estate models

34 Carry out the operations described above in paragraphs 24 to 27 (see illustrations).

35 Undo the two retaining bolts, and remove the mounting and movement damper assembly from the centre member.

36 If necessary, undo the retaining bolts and remove the mounting bracket from the front of the engine.

37 Check carefully for signs of wear or damage on all components, and renew as necessary.

38 On refitting, where removed, fit the mounting bracket to the engine, and tighten its retaining bolts to the specified torque.

39 Fit the damper assembly to the centre member, and tighten its retaining bolts to the specified torque.

40 Fit the through-bolt to the mounting, ensuring that the bolt passes correctly through the damper and mounting rubber, and lightly tighten its nut.

41 Position the engine/transmission so that

the front mounting through-bolt is correctly aligned with the mark made prior to removal, then tighten it to the specified torque setting.

42 Remove the jack from underneath the transmission.

43 Refit the undershields, tighten their fasteners securely, then lower the vehicle to the ground and reconnect the battery.

Rear mounting

44 If not already done, apply the handbrake, then jack up the front of the car and support it on axle stands (see *Jacking and vehicle support*). Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Section of this manual).

45 Slacken and remove the through-bolt from the rear engine/transmission mounting.

46 Undo the bolts securing the mounting bracket in position, and manoeuvre it away from the engine/transmission.

47 Undo the two retaining bolts, and remove the mounting assembly from the centre member.

48 Check carefully for signs of wear or damage on all components, and renew them where necessary.

49 On reassembly, fit the rear mounting to the centre member, and tighten its retaining bolts to the specified torque.

50 Refit the mounting bracket and tighten its retaining bolts to the specified torque.

51 Align the rear mounting with its bracket, then insert the through-bolt and tighten its nut to the specified torque setting.

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

Chapter 2 Part A:

1.6 litre engine in-car repair procedures

Contents

Camshafts and followers - removal, inspection and refitting	10	General engine checks	See Chapter 1
Compression test - description and interpretation	2	General information	1
Crankshaft oil seals - renewal	14	Oil pump - removal, inspection and refitting	13
Crankshaft pulley - removal and refitting	5	Sump - removal and refitting	12
Cylinder head - removal and refitting	11	Timing chain cover - removal and refitting	6
Cylinder head cover - removal and refitting	4	Timing chain tensioners, guides and sprockets - removal, inspection and refitting	8
Engine oil and filter renewal	See Chapter 1	Timing chains - removal, inspection and refitting	7
Engine oil level check	See Weekly checks	Top dead centre (TDC) for No 1 piston - locating	3
Engine/transmission mountings - inspection and renewal	16	Valve clearances - checking and adjustment	9
Flywheel - removal, inspection and refitting	15		

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	
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Specifications

Engine (general)

Designation	GA
Engine code:	
Carburettor models	GA16DS
Fuel-injected models	GA16DE
Capacity	1597 cc
Bore	76.0 mm
Stroke	88.0 mm
Direction of crankshaft rotation	Clockwise (viewed from right-hand side of vehicle)
No 1 cylinder location	At timing chain end of block
Firing order	1-3-4-2
Compression ratio	9.8 : 1
Cylinder compression pressures:	
Standard:	
Carburettor models	13.7 bar
Fuel-injected models	13.2 bar
Minimum:	
Carburettor models	11.8 bar
Fuel-injected models	11.3 bar
Maximum difference between cylinders (all models)	1.0 bar

Valve clearances

Cold engine*:	
Inlet	0.25 to 0.33 mm
Exhaust	0.32 to 0.40 mm
Hot engine:	
For checking:	
Inlet	0.21 to 0.49 mm
Exhaust	0.30 to 0.58 mm
For adjusting:	
Inlet	0.32 to 0.40 mm
Exhaust	0.37 to 0.45 mm

*The valve clearances must always be checked with the engine hot. Although Nissan quote valve clearances for a hot and cold engine, the valve clearances should only be checked cold, prior to starting the engine after an overhaul. The valve clearances should then be checked with the engine hot once it has been warmed up to normal operating temperature.