Valves

	Inlet	Exhaust
Valve head diameter:		
1.6 litre engine	29.9 to 30.1 mm	23.9 to 24.1 mm
2.0 litre engine	34.0 to 34.2 mm	30.0 to 30.2 mm
Valve stem diameter:		
1.6 litre engine	5.465 to 5.480 mm	5.445 to 5.460 mm
2.0 litre engine (Phase I and Phase II models):		
SR20Di and SR20De engines	5.965 to 5.980 mm	5.945 to 5.960 mm
SR20DE engines	5.965 to 5.980 mm	6.945 to 6.960 mm
2.0 litre engine (Phase III models)	5.965 to 5.980 mm	5.945 to 5.960 mm
Overall length:		
1.6 litre engine (Phase I and Phase II models)	92.05 to 92.45 mm	92.42 to 92.82 mm
1.6 litre engine (Phase III models)	92.00 to 92.50 mm	92.37 to 92.87 mm
2.0 litre engine	101.19 to 101.61 mm	102.11 to 102.53 mm
Valve guide inner diameter:		
1.6 litre engine	5.500 to 5.515 mm	5.500 to 5.515 mm
2.0 litre engine (Phase I and Phase II models):		
SR20Di and SR20De engines	6.000 to 6.018 mm	6.000 to 6.018 mm
SR20DE engine	6.000 to 6.018 mm	7.000 to 7.018 mm
2.0 litre engine (Phase III models)	6.000 to 6.018 mm	6.000 to 6.018 mm
Valve stem-to-guide clearance:		
1.6 litre engine	0.020 to 0.050 mm	0.040 to 0.070 mm
2.0 litre engine	0.020 to 0.053 mm	0.040 to 0.073 mm
Valve spring free length:		
1.6 litre engine	40.00 mm	
2.0 litre engine	49.36 mm	
Valve spring out-of-square limit:		
1.6 litre engine	1.74 mm	
2.0 litre engine	2.20 mm	

Piston rings

	Standard	Service limit
Ring-to-groove clearance:		
Top compression ring	0.040 to 0.085 mm	0.2 mm
Second compression ring	0.030 to 0.070 mm	0.2 mm
End gaps:		
1.6 litre engine:		
Top compression ring	0.20 to 0.40 mm	0.49 mm
Second compression ring	0.35 to 0.55 mm	0.64 mm
Oil control ring	0.25 to 1.00 mm	1.09 mm
2.0 litre engine:		
Top compression ring	0.20 to 0.30 mm	1.00 mm
Second compression ring	0.35 to 0.55 mm	1.00 mm
Oil control ring	0.20 to 0.60 mm	1.00 mm

Piston and connecting rod

Piston diameter:	
1.6 litre engine (measured 9.5 mm up from the base of skirt):	
Standard piston:	
Grade 1	75.980 to 75.990 mm
Grade 2	75.990 to 76.000 mm
Grade 3	76.000 to 76.010 mm
0.5 mm oversize piston	76.490 to 76.510 mm
1.0 mm oversize piston	76.990 to 77.010 mm
2.0 litre engine (measured 13.0 mm up from the base of skirt):	
Standard piston:	
Grade 1	85.980 to 85.990 mm
Grade 2	85.990 to 86.000 mm
Grade 3	86.000 to 86.010 mm
0.2 mm oversize piston	86.180 to 86.210 mm
Piston-to-bore clearance	0.010 to 0.030 mm
Piston gudgeon pin bore diameter:	
1.6 litre engine	18.987 to 18.999 mm
2.0 litre engine (Phase I and Phase II models)	21.987 to 21.999 mm
2.0 litre engine (Phase III models)	21.993 to 22.005 mm
Gudgeon pin outer diameter:	
1.6 litre engine	18.989 to 19.001 mm
2.0 litre engine	21.989 to 22.001 mm
	-0.004 to 0.000 mm (ie. an interference fit)

Piston and connecting rod (continued)

Connecting rod small-end bush diameter:	
1.6 litre engine	19.000 to 19.012 mm
2.0 litre engine	22.000 to 22.012 mm
Connecting rod small-end bush-to-gudgeon pin clearance:	
Standard	0.005 to 0.017 mm
Service limit	0.023 mm
Connecting rod big-end bore diameter:	
1.6 litre engine	43.000 to 43.013 mm
2.0 litre engine	51.000 to 51.013 mm
Connecting rod big-end bearing side clearance:	
Standard:	
1.6 litre engine	0.20 to 0.47 mm
2.0 litre engine	0.20 to 0.35 mm
Service limit	0.5 mm

Crankshaft

Endfloat:	
Standard:	
1.6 litre engine	0.06 to 0.18 mm
2.0 litre engine	0.10 to 0.26 mm
Service limit	0.3 mm
Run-out:	
Standard:	
1.6 litre engine	Less than 0.040 mm
2.0 litre engine	Less than 0.025 mm
Service limit	0.05 mm
Main bearing journal diameter:	
1.6 litre engine:	
Grade 0	49.956 to 49.964 mm
Grade 1	49.948 to 49.956 mm
Grade 2	49.940 to 49.948 mm
2.0 litre engine:	
Grade 0	54.974 to 54.980 mm
Grade 1	54.968 to 54.974 mm
Grade 2	54.962 to 54.968 mm
Grade 3	54.956 to 54.962 mm
Journal ovality	Less than 0.005 mm
Journal taper:	
1.6 litre engine	Less than 0.002 mm
2.0 litre engine	Less than 0.005 mm
Big-end bearing journal diameter:	
1.6 litre engine:	
Grade 0	39.968 to 39.974 mm
Grade 1	39.962 to 39.968 mm
Grade 2	39.956 to 39.962 mm
2.0 litre engine:	
Grade 0	47.968 to 47.974 mm
Grade 1	47.962 to 47.968 mm
Grade 2	47.956 to 47.962 mm
Journal ovality	Less than 0.005 mm
Journal taper:	
1.6 litre engine	Less than 0.002 mm
2.0 litre engine	Less than 0.005 mm
Main bearing running clearance:	
1.6 litre engine:	
Standard	0.020 to 0.044 mm
Service limit	0.064 mm
2.0 litre engine:	
Standard	0.004 to 0.022 mm
Service limit	0.050 mm
Big-end bearing running clearance:	
1.6 litre engine:	
Standard	0.010 to 0.035 mm
Service limit	0.055 mm
2.0 litre engine:	
Standard	0.020 to 0.045 mm
Service limit	0.065 mm

Crankshaft (continued)

Main bearing shell thicknesses:

1.6 litre engine:

Standard:

Black	1.826 to 1.830 mm
Brown	1.830 to 1.834 mm
Green	1.834 to 1.838 mm
Yellow	1.838 to 1.842 mm
Blue	1.842 to 1.846 mm
0.25 mm undersize	1.960 to 1.964 mm
0.50 mm undersize	2.085 to 2.089 mm

2.0 litre engine:

Standard:

Black	1.977 to 1.980 mm
Brown	1.980 to 1.983 mm
Green	1.983 to 1.986 mm
Yellow	1.986 to 1.989 mm
Blue	1.989 to 1.992 mm
Pink	1.992 to 1.995 mm
White (or no colour)	1.995 to 1.998 mm
0.25 mm undersize	2.109 to 2.117 mm

Big-end bearing shell thicknesses:

1.6 litre engine:

Standard:

Black	1.505 to 1.508 mm
Brown	1.508 to 1.511 mm
Green	1.511 to 1.514 mm
0.08 mm undersize	1.540 to 1.548 mm
0.12 mm undersize	1.560 to 1.568 mm
0.25 mm undersize	1.625 to 1.633 mm

2.0 litre engine:

Standard:

Black	1.500 to 1.503 mm
Brown	1.503 to 1.506 mm
Green	1.506 to 1.509 mm
0.08 mm undersize	1.541 to 1.549 mm
0.12 mm undersize	1.561 to 1.569 mm
0.25 mm undersize	1.626 to 1.634 mm

Torque wrench settings

1.6 litre engines

Refer to Chapter 2A Specifications.

2.0 litre engine

Refer to Chapter 2B Specifications.

1 General information

Included in this Part of Chapter 2 are details of removing the engine from the vehicle, and general overhaul procedures for the cylinder head, cylinder block/crankcase and all other engine internal components.

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

After Section 6, all instructions are based on the assumption that the engine has been removed from the vehicle. For information concerning removal and refitting of those external components necessary for full overhaul, refer to Part A or B of this Chapter (as applicable) and to Section 6. Ignore any preliminary dismantling operations described in Part A (1.6 litre engine) or Part B (2.0 litre engine) that are no longer relevant once the engine has been removed from the vehicle.

Apart from torque wrench settings, which are given at the beginning of Part A or Part B, all specifications relating to engine overhaul are at the beginning of this Part of Chapter 2.

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*

2 Engine overhaul - general information

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

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

service. Conversely, a neglected engine may require an overhaul very early in its life.

3 Excessive oil consumption is an indication that piston rings, valve seals and/or valve guides are in need of attention. Make sure that oil leaks are not responsible before deciding that the rings and/or guides are worn. Perform a compression test, as described in Part A or B of this Chapter (as applicable), to determine the likely cause of the problem.

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

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

6 An engine overhaul involves restoring all internal parts to the specification of a new engine. During an overhaul, the pistons and the piston rings are renewed. New main and big-end bearings are generally fitted; if necessary, the crankshaft may be renewed, to restore the journals. The valves are also serviced as well, since they are usually in less-than-perfect condition at this point. While the engine is being overhauled, other components, such as the distributor, starter and alternator, can be overhauled as well. The end result should be an as-new engine that will give many trouble-free miles. **Note:** *Critical cooling system components such as the hoses, thermostat and water pump should be renewed when an engine is overhauled. The radiator should be checked carefully, to ensure that it is not clogged or leaking. Also, it is a good idea to renew the oil pump whenever the engine is overhauled.*

7 Before beginning the engine overhaul, read through the entire procedure, to familiarise yourself with the scope and requirements of the job. Overhauling an engine is not difficult if you follow carefully all of the instructions, have the necessary tools and equipment, and pay close attention to all specifications. It can, however, be time-consuming. Plan on the car being off the road for a minimum of two weeks, especially if parts must be taken to an engineering works for repair or reconditioning. Check on the availability of parts, and make sure that any necessary special tools and equipment are obtained in advance. Most work can be done with typical hand tools, although a number of precision measuring tools are required for inspecting parts to determine if they must be renewed. Often, the engineering works will handle the inspection of parts, and can offer advice concerning reconditioning and renewal. **Note:** *Always wait until the engine has been completely dismantled, and until all components (especially the cylinder block/ crankcase and the crankshaft) have been inspected, before deciding what service and repair operations must be performed by an engineering works. The condition of these components will be the major factor to consider when determining whether to overhaul the original engine, or to buy a reconditioned unit. Do not, therefore, purchase parts or have overhaul work done on other components until they have been thoroughly inspected.* As a general rule, time is the primary cost of an overhaul, so it does not pay to fit worn or sub-standard parts.

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

3 Engine removal - methods and precautions

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

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

3 Cleaning the engine compartment and engine/transmission before beginning the removal procedure will help keep tools clean and organised.

4 An engine hoist or A-frame will also be necessary. Make sure that the equipment is rated in excess of the combined weight of the engine and transmission. Safety is of primary importance, considering the potential hazards involved in removing the engine/transmission from the vehicle.

5 If this is the first time you have removed an engine, an assistant should ideally be available. Advice and aid from someone more experienced would also be helpful. There are many instances when one person cannot simultaneously perform all of the operations required when lifting the engine out of the vehicle.

6 Plan the operation ahead of time. Before starting work, arrange for the hire of, or obtain, all of the tools and equipment you will need. Some of the equipment necessary to perform engine/transmission removal and installation safely and with relative ease (in addition to an engine hoist) is as follows: a heavy-duty trolley jack, complete sets of spanners and sockets as described in the front of this manual, wooden blocks, and plenty of rags and cleaning solvent for mopping up spilled oil, coolant and fuel. If the hoist must be hired, make sure that you arrange for it in advance, and perform all of the operations possible without it beforehand. This will save you money and time.

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

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

9 The engine and transmission is removed from under the vehicle on all models described in this manual.

4 Engine and manual transmission - removal, separation and refitting

Removal

Note: *The engine can be removed from the car only as a complete unit with the transmission; the two are then separated for overhaul. The engine/transmission unit is lowered out of position, and withdrawn from under the vehicle. To allow adequate clearance underneath the vehicle, there should be at least 75 cm between the front bumper and the ground when the vehicle is raised and supported.*

1 Apply the handbrake, then jack up the front of the car and support it on axle stands bearing in mind the note at the start of this Section (see *Jacking and vehicle support*). Remove both front roadwheels.

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

3 Undo all the retaining screws, and remove the undershields from underneath and around the engine.

4 Remove the bonnet as described in Chapter 11.

5 Drain the cooling system (see Chapter 1), saving the coolant if it is fit for re-use.

6 Drain the transmission oil as described in Chapter 1. Refit the drain and filler plugs, and tighten them to their specified torque settings.

7 If the engine is to be dismantled, working as described in Chapter 1, drain the oil and if required remove the oil filter. Clean and refit the drain plug, tightening it to the specified torque.

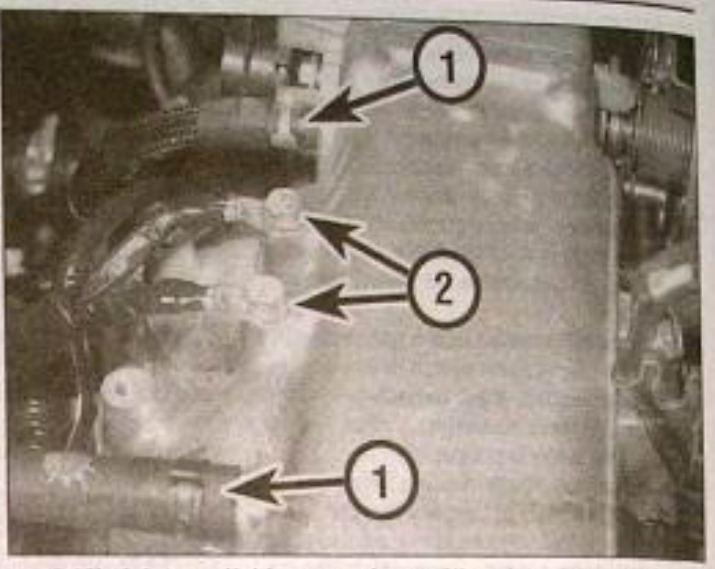
8 Remove the radiator, complete with hoses and cooling fans, as described in Chapter 3.

9 Working as described in Chapter 5, remove the alternator and disconnect the wiring from the starter motor.

10 Remove the power steering pump as described in Chapter 10.

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

4.13a Disconnect all the relevant fuel system wiring, and free it from the inlet manifold (2.0 litre Phase II model shown)



4.13b Inlet manifold vacuum hoses (1) and earth leads (2) - 2.0 litre Phase II model

a) Air cleaner housing.
b) 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).
c) Accelerator cable.
d) Carburettor wiring connector(s).
e) Vacuum servo unit vacuum hose, coolant hose, and all other relevant breather/vacuum hoses from the manifold and associated valves.
f) Remove the inlet manifold support bracket.
g) Remove the exhaust system front pipe.
h) On models with a catalytic converter, disconnect the exhaust gas sensor wiring connector.

12 On single-point injection engines, carry out the following operations as described in the Chapter 4B.

a) Remove the air cleaner housing.
b) Depressurise the fuel system, and disconnect the fuel feed and return hoses from the throttle body (plug all openings, to prevent loss of fuel and entry of dirt into the fuel system).
c) Disconnect the accelerator cable.
d) Disconnect the relevant electrical connectors from the throttle body, inlet manifold and associated components.
e) Disconnect the vacuum servo unit hose, coolant hose(s), and all the other relevant/breather hoses from the manifold and associated valves.
f) Remove the inlet manifold support bracket(s).
g) Remove the exhaust front pipe.

13 On multi-point injection engines, carry out the following operations as described in Chapter 4C.

a) Remove the air cleaner inlet duct.
b) 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).
c) Disconnect the accelerator cable.
d) Disconnect the relevant electrical connectors from the throttle housing, inlet manifold and associated components. Free the wiring from the manifold, and position it clear of the cylinder head so that it does not hinder removal **(see illustration)**.
e) Disconnect the vacuum servo unit hose, coolant hose(s), and all the other relevant/breather hoses from the manifold and associated valves **(see illustration)**.
f) Remove the inlet manifold support bracket(s).
g) Remove the exhaust front pipe.

14 Slacken the retaining clips, and disconnect the heater hoses and all other relevant cooling system hoses from the engine, noting each hose's correct fitted location.

15 On models with air conditioning, unbolt the compressor and position it clear of the engine. Support the weight of the compressor by tying it to the vehicle body, to prevent any excess strain being placed on the compressor lines whilst the engine is removed. **Do not** disconnect the refrigerant lines from the compressor (see the warnings given in Chapter 3, Section 10).

16 Referring to Chapter 5B, disconnect the wiring connectors from the distributor, ignition HT coil and the power transistor unit. Free the wiring loom from any relevant retaining clips, so that it is free from the cylinder head and will not hinder the removal procedure. Also undo the retaining bolts, and disconnect all the relevant earth leads from the head and inlet manifold **(see illustration)**.

17 Working as described in Chapter 8, remove the driveshafts.

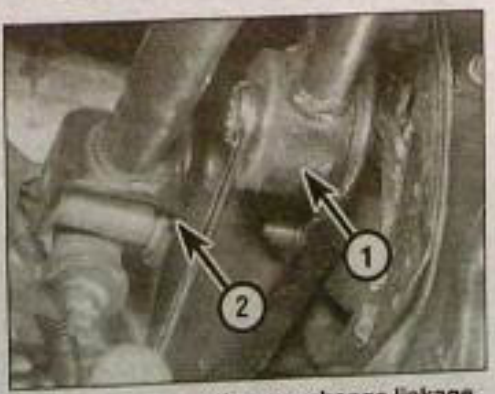
18 Disconnect the clutch cable from the transmission as described in Chapter 6.

19 Working as described in Chapter 7A, disconnect the gearchange linkage link rods, the speedometer cable and the wiring connector(s) from the transmission **(see illustration)**.

20 Manoeuvre the engine hoist into position, and attach it to the cylinder head using suitable lifting brackets. Raise the hoist until it is supporting the weight of the engine.

21 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. Slacken and remove the nut and withdraw the through-bolt from the mounting. Slacken and remove the nut and through-bolt from the rear engine/transmission mounting **(see illustrations)**.

4.16 Unscrew the bolt(s) and free all earth



4.19 Disconnect the gearchange linkage support rod (1) and selector rod (2) from

22 Slacken and remove the four bolts and washers securing the centre member to the vehicle body, and lower the assembly away from the engine **(see illustrations)**. On 2.0 litre engines, recover the stopper ring which is fitted between the rear engine/ transmission mounting and its bracket.

23 On 1.6 litre engines, undo the three retaining bolts and remove the mounting bracket from the top of the right-hand engine/ transmission mounting.

24 On all engines, unscrew the nut and through-bolt from the right-hand engine/ transmission mounting, then undo the retaining bolts and remove the mounting assembly from the engine compartment. Recover the rubbers which are fitted to each side of the body mounting bracket, if they are loose.

25 Slacken and remove the through-bolt from the left-hand engine/transmission mounting. Undo the three bolts securing the mounting to the transmission, and manoeuvre the mounting out of position. Recover the rubbers from each side of the mounting bracket, if they are loose.

26 Make a final check that any components which would prevent the removal of the engine/transmission from the car have been removed or disconnected. Ensure that components such as the gearchange link rods are secured so that they cannot be damaged on removal.

27 If available, a low trolley should be placed under the engine/transmission assembly, to facilitate its easy removal from under the vehicle. Lower the engine/transmission assembly, making sure that nothing is trapped or damaged. Enlist the help of an assistant during this procedure, as it may be necessary to tilt the assembly slightly to clear the body panels **(see illustration)**. Great care must be taken to ensure that no components are trapped and damaged during the removal procedure.

28 Withdraw the assembly from under the vehicle.

Separation

29 With the engine/transmission assembly removed, support the assembly on suitable blocks of wood, on a workbench (or failing that, on a clean area of the workshop floor).

30 Unscrew the retaining bolts, and remove the starter motor from the transmission.

31 Ensure that both engine and transmission are adequately supported, then slacken and remove the bolts securing the transmission housing to the engine. Note the correct fitted positions of each bolt (and, where fitted, the relevant brackets) as they are removed, to use as a reference on refitting.

32 Carefully withdraw the transmission from the engine, ensuring that the weight of the transmission is not allowed to hang on the input shaft while it is engaged with the clutch friction disc.

33 If they are loose, remove the locating dowels from the engine or transmission, and keep them in a safe place.

4.21a Prior to removal, mark the position of the front engine/transmission mounting through-bolt (arrowed) on its bracket

4.21b Slacken and remove the rear engine/transmission mounting through-bolt (arrowed)

4.22a Undo the four bolts and washers . . .

4.22b . . . and remove the centre member from underneath the engine/transmission

Refitting

34 If the engine and transmission have been separated, perform the operations described below in paragraphs 35 to 39. If not, proceed as described from paragraph 40 onwards.

35 Apply a smear of high-melting-point grease to the splines of the transmission input shaft. Do not apply too much, otherwise there is a possibility of the grease contaminating the clutch friction plate.

36 Ensure that the locating dowels are correctly positioned in the engine or transmission, and that the release bearing is correctly engaged with the fork.

37 Carefully offer the transmission to the engine, until the locating dowels are engaged. Ensure that the weight of the transmission is not allowed to hang on the input shaft as it is engaged with the clutch friction plate.

4.27 Carefully lower the engine/ transmission downwards and out of position

38 Refit the transmission housing-to-engine bolts, ensuring that all the necessary brackets are correctly positioned, and tighten them to the specified torque setting.

39 Refit the starter motor and tighten the retaining bolts.

40 Position the engine/transmission assembly under the vehicle, then reconnect the hoist and lifting tackle to the engine lifting brackets.

41 With the aid of an assistant, lift the assembly up into the engine compartment, making sure that it clears the surrounding components.

42 Refit the rubbers to the left-hand engine/ transmission mounting bracket, ensuring that their pins are correctly seated in the bracket holes. Manoeuvre the mounting into position, then fit the bolts securing it to the transmission and tighten them to the specified torque setting. Insert the through-bolt and nut, tightening it by hand only at this stage.

43 Fit the rubbers to the right-hand body mounting bracket, ensuring that their pins are correctly seated in the bracket holes. Refit the mounting to the top of its bracket, and tighten its retaining bolts to the specified torque setting. Insert the through-bolt and nut, tightening it by hand only at this stage.

44 Ensure that all the mounting rubbers are in position. On 2.0 litre engines, refit the stopper ring to the rear engine/transmission mounting. Manoeuvre the centre member into position, aligning it with the engine mountings, and refit its mounting bolts and washers. Tighten the centre member mounting bolts to the specified torque **(see illustration overleaf)**.

45 Refit the through-bolt and nut to the rear engine/transmission mounting, tightening it by hand only.

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

47 Rock the engine/transmission to settle it in position, then tighten the front, right- and left-hand mounting through-bolts to their specified torque settings.

48 On 1.6 litre engines, refit the mounting bracket to the top of the right-hand mounting, and tighten its retaining bolts to the specified torque.

49 The remainder of the refitting procedure is a direct reversal of the removal sequence, noting the following points:

a) Ensuring that the wiring harness is correctly routed and retained by all the relevant retaining clips, and all connectors are correctly and securely reconnected.
b) Prior to refitting the driveshafts to the transmission, renew the driveshaft oil seals as described in Chapter 7A.
c) Ensure that all coolant hoses are correctly reconnected and securely retained by their retaining clips.
d) Adjust the accelerator cable as described in the relevant Part of Chapter 4.
e) Connect and adjust the clutch cable as described in Chapter 6.
f) Refit and adjust the auxiliary drivebelt(s) as described in Chapter 1.
g) Refill the engine and transmission unit with correct quantity and type of lubricant, as described in the relevant Sections of Chapter 1.
h) Refill the cooling system as described in Chapter 1.
i) On completion, start the engine and check for leaks.

5 Engine and automatic transmission - removal, separation and refitting

Removal

Note: *The engine can be removed from the car only as a complete unit with the transmission; the two are then separated for overhaul. The engine/transmission is lowered out of position, and withdrawn from under the front of the vehicle. To allow adequate clearance underneath the vehicle, there should be at least 75 cm between the front bumper and the ground when the vehicle is raised and supported.*

1 Carry out the operations described in paragraphs 1 to 10 of Section 4.

2 On single-point injection engines, carry out the following operations as described in the Chapter 4B.

a) Remove the air cleaner housing.

4.44 Tighten the centre member mounting bolts to the specified torque

b) Depressurise the fuel system, and disconnect the fuel feed and return hoses from the throttle body (plug all openings, to prevent loss of fuel and entry of dirt into the fuel system).
c) Disconnect the accelerator cable.
d) Disconnect the relevant electrical connectors from the throttle body, inlet manifold and associated components.
e) Disconnect the vacuum servo unit hose, coolant hose(s) and all the other relevant/breather hoses from the manifold and associated valves.
f) Remove the inlet manifold support bracket(s).
g) Remove the exhaust front pipe.

3 On multi-point injection engines, carry out the following operations as described in Chapter 4C.

a) Remove the air cleaner inlet duct.
b) 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).
c) Disconnect the accelerator cable.
d) Disconnect the relevant electrical connectors from the throttle housing, inlet manifold and associated components. Free the wiring from the manifold, and position it clear of the cylinder head so that it does not hinder removal.
e) Disconnect the vacuum servo unit hose, coolant hose(s) and all the other relevant/breather hoses from the manifold and associated valves.
f) Remove the inlet manifold support bracket(s).
g) Remove the exhaust front pipe.

4 Slacken the retaining clips, and disconnect the heater hoses and all other relevant cooling system hoses from the engine, noting each hose's correct fitted location.

5 On models with air conditioning, unbolt the compressor and position it clear of the engine. Support the weight of the compressor by tying it to the vehicle body, to prevent any excess strain being placed on the compressor lines whilst the engine is removed. **Do not** disconnect the refrigerant lines from the compressor (see the warnings given in Chapter 3).

6 Working as described in Chapter 8, remove both driveshafts.

7 Carry out the following operations as described in Chapter 7B.

a) Disconnect the selector cable from the transmission.
b) Disconnect the kickdown cable from the throttle body/housing.
c) Disconnect the transmission wiring connectors.
d) Disconnect the fluid cooler hoses from the transmission.
e) Disconnect the speedometer cable.

8 Manoeuvre the engine hoist into position, and attach it to the cylinder head using suitable lifting brackets bolted. Raise the hoist until it is supporting the weight of the engine.

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

10 Slacken and remove the four bolts and washers securing the centre member to the vehicle body, and lower the assembly away from the engine. Recover the stopper ring which is fitted between the rear engine/transmission mounting and its bracket.

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

12 Slacken and remove the through-bolt from the left-hand engine/transmission mounting. Undo the three bolts securing the mounting to the transmission, and manoeuvre the mounting out of position. Recover the rubbers from each side of the mounting bracket.

13 Make a final check that any components which would prevent the removal of the engine/transmission from the car have been removed or disconnected. Ensure that components such as the driveshafts are secured so that they cannot be damaged on removal.

14 If available, a low trolley should be placed under the engine/transmission assembly to facilitate its easy removal from under the vehicle. Lower the engine/transmission assembly, making sure that nothing is trapped or damaged. Enlist the help of an assistant during this procedure, as it may be necessary to tilt the assembly slightly to clear the body panels. Great care must be taken to ensure that no components are trapped and damaged during the removal procedure.

15 Withdraw the assembly from under the vehicle.

Separation

16 With the engine/transmission assembly removed, support the assembly on suitable blocks of wood, on a workbench (or failing that, on a clean area of the workshop floor).

17 Unscrew the retaining bolts, and remove the starter motor from the transmission.

18 Undo the retaining bolts, and remove the cover plate from the sump flange to gain access to the torque converter retaining bolts. Slacken and remove the visible bolt then, using a socket and extension bar to rotate the crankshaft pulley, undo the remaining bolts securing the torque converter to the driveplate as they become accessible. There are four bolts in total.

19 To ensure that the torque converter does not fall out as the transmission is removed, secure it in position using a length of metal strip bolted to one of the starter motor bolt holes.

20 Ensure that both engine and transmission are adequately supported, then slacken and remove the bolts securing the transmission housing to the engine. Note the correct fitted positions of each bolt (and, where fitted, the relevant brackets) as they are removed, to use as a reference on refitting.

21 Carefully withdraw the transmission from the engine. If they are loose, remove the locating dowels from the engine or transmission, and keep them in a safe place.

Refitting

22 If the engine and transmission have been separated, perform the operations described below in paragraphs 23 to 26. If not, proceed as described from paragraph 29 onwards.

23 Prior to joining, ensure that the torque converter is correctly engaged with the transmission. This can be checked by measuring the distance from the converter mounting bolt holes to the transmission mating surface; if the converter is correctly seated, this distance will be at least 15.9 mm.

24 Ensure that the locating dowels are correctly positioned in the engine or transmission.

25 Carefully offer the transmission to the engine, and engage it on the locating dowels. Refit the transmission housing-to-engine bolts, ensuring that all the necessary brackets are correctly positioned, and tighten them to the specified torque settings.

26 Remove the torque converter retaining strap (where fitted) installed prior to removal. Align the torque converter holes with the those in the driveplate, and install the retaining bolts.

27 Tighten the torque converter retaining bolts to the specified torque setting, then refit the cover plate to the sump and securely tighten its retaining bolts.

28 Refit the starter motor and tighten the retaining bolts.

29 Position the engine/transmission assembly under the vehicle, then reconnect the hoist and lifting tackle to the engine lifting brackets.

30 With the aid of an assistant, lift the assembly up into the engine compartment, making sure that it clears the surrounding components.

31 Refit the rubbers to the left-hand engine/transmission mounting bracket, ensuring that their pins are correctly seated in the bracket holes. Manoeuvre the mounting into position, then fit the bolts securing it to the transmission and tighten them to the specified torque setting. Insert the through-bolt and nut, tightening it by hand only at this stage.

32 Fit the rubbers to the right-hand body mounting bracket, ensuring that their pins are correctly seated in the bracket holes. Refit the mounting to the top of its bracket, and tighten its retaining bolts to the specified torque setting. Insert the through-bolt and nut, tightening it by hand only at this stage.

33 Ensure that all the mounting rubbers are in position, and refit the stopper ring to the rear engine/transmission mounting. Manoeuvre the centre member into position, aligning it with the engine mounting, and refit its mounting bolts and washers. Tighten the mounting bolts to the specified torque.

34 Refit the through-bolt and nut to the rear engine/transmission mounting, tightening it by hand only.

35 Rock the engine/transmission to settle it in position, then tighten the front, right- and left-hand mounting through-bolts to their specified torque settings.

36 The remainder of the refitting procedure is a direct reversal of the removal sequence, noting the following points:

a) Ensuring that the wiring harness is correctly routed and retained by all the relevant retaining clips, and all connectors are correctly and securely reconnected.
b) Prior to refitting the driveshafts to the transmission, renew the driveshaft oil seals as described in Chapter 7B.
c) Ensure that all coolant hoses are correctly reconnected and securely retained by their retaining clips.
d) Adjust the accelerator cable as described in the relevant Part of Chapter 4.
e) Connect and adjust the selector and kick-down cables as described in Chapter 7B.
f) Refit and adjust the auxiliary drivebelt(s) as described in Chapter 1.
g) Refill the engine and transmission with correct quantity and type of lubricant, as described in the relevant Sections of Chapter 1.
h) Refill the cooling system as described in Chapter 1.
i) On completion, start the engine and check for leaks.

6.3a On 2.0 litre models, remove the oil filter housing . . .

6 Engine overhaul - dismantling sequence

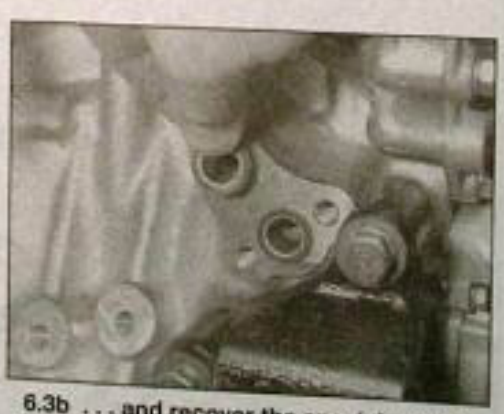
1 It is much easier to dismantle and work on the engine if it is mounted on a portable engine stand. These stands can often be hired from a tool hire shop. Before the engine is mounted on a stand, the flywheel should be removed, so that the stand bolts can be tightened into the end of the cylinder block/crankcase.

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

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

a) Alternator, power steering pump and/or air conditioning compressor mounting brackets (as applicable).
b) Distributor, HT leads and spark plugs (Chapters 1 and 5B).
c) Coolant pump and thermostat/coolant outlet housing(s) (Chapter 3).
d) The carburettor/fuel injection system components (see relevant Part of Chapter 4).
e) All electrical switches and sensors, and the engine wiring harness.
f) Inlet and exhaust manifolds (see relevant Part of Chapter 4).
g) Oil filter housing - 2.0 litre engines only.
h) Fuel pump - carburettor engines (Chapter 4A).
i) Engine mountings (Part A or B of this Chapter).
j) Flywheel/driveplate (Part A or B of this Chapter).

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



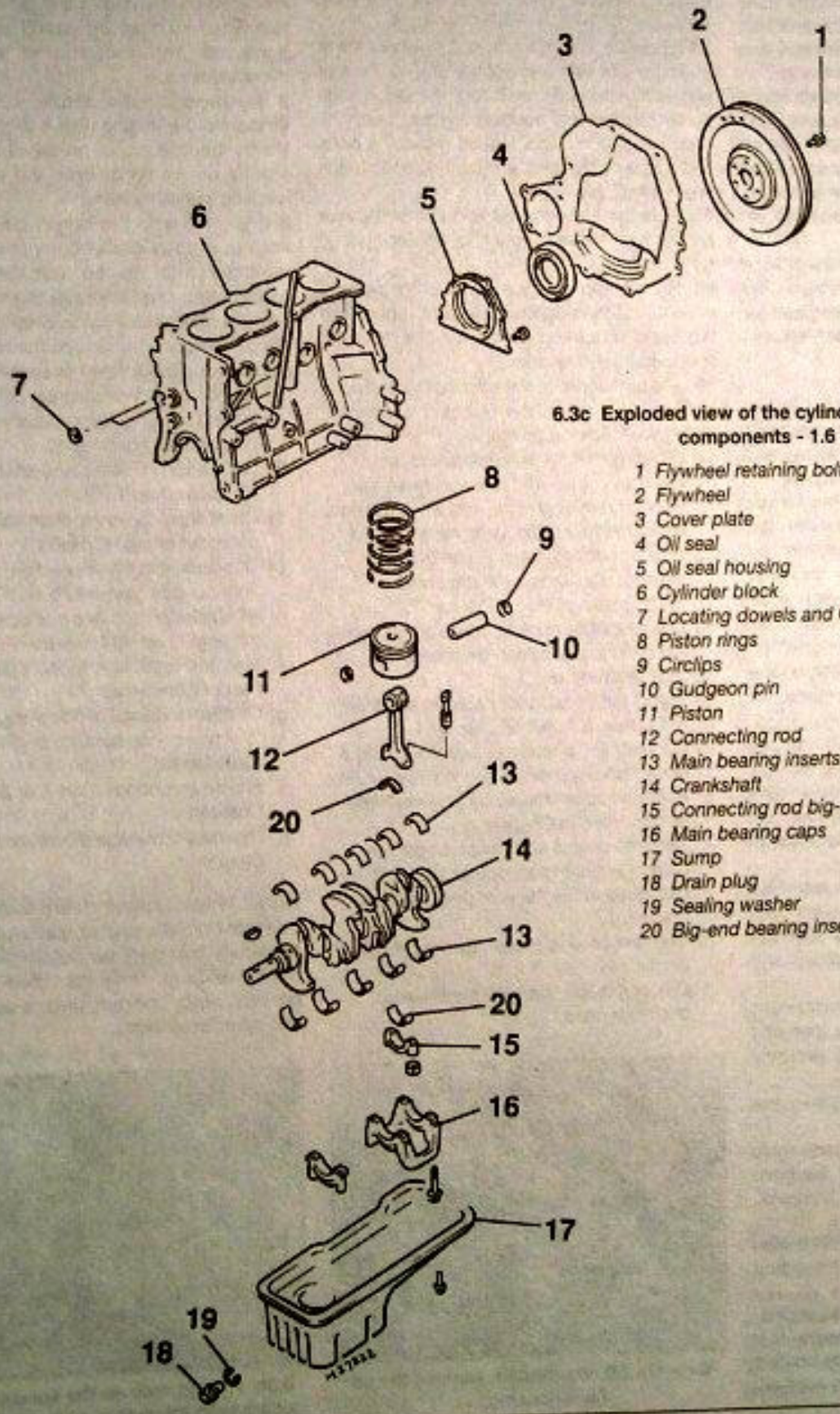
6.3b . . . and recover the special sealing collars from the cylinder block oil galleries

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

5 If you are planning a complete overhaul, the engine can be dismantled, and the internal components removed, in the order given below, referring to Part A or B of this Chapter unless otherwise stated.

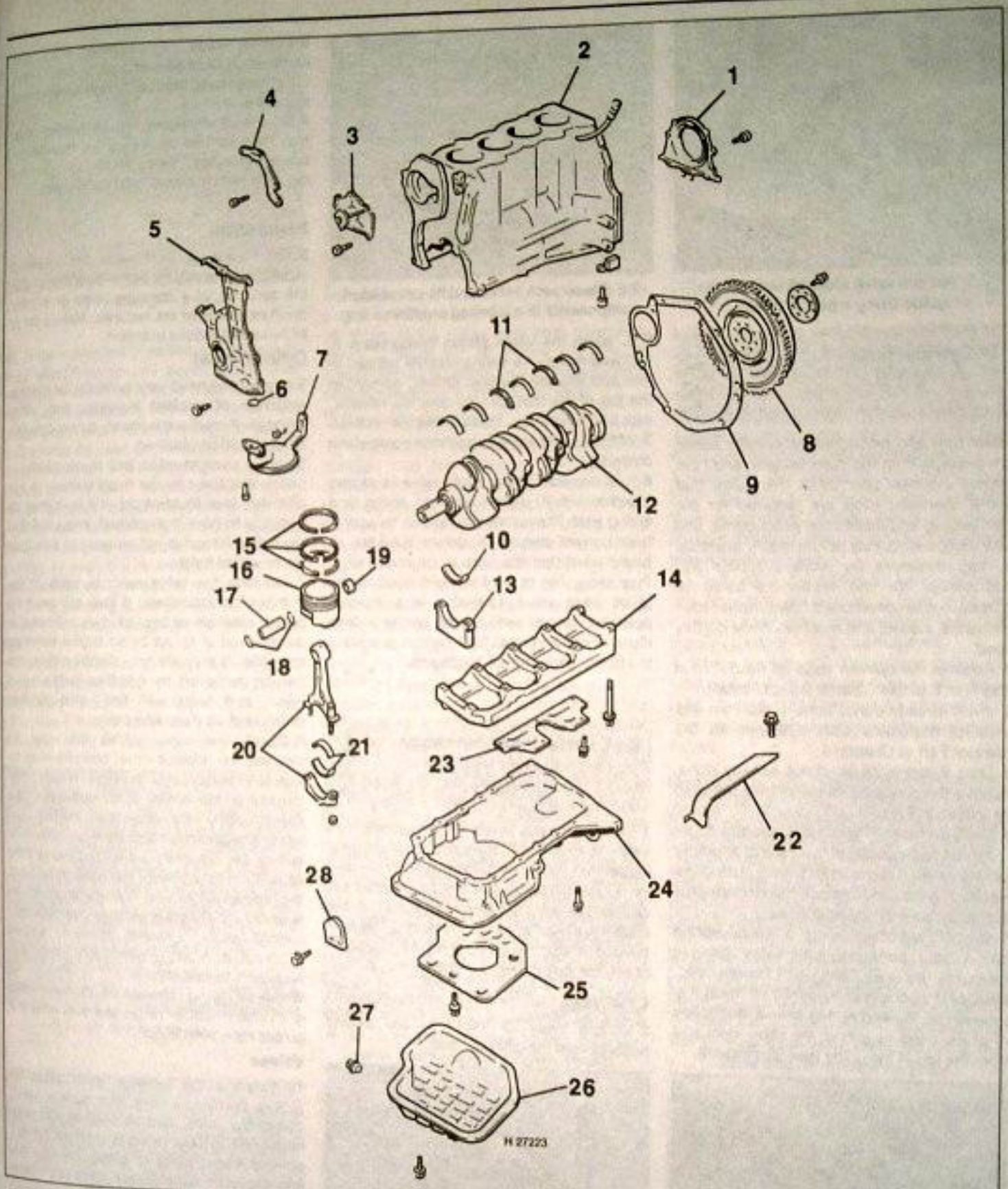
a) Inlet and exhaust manifolds (Chapter 4A, 4B or 4C).
b) Sump.
c) Timing chain(s) and sprockets.
d) Cylinder head.
e) Flywheel.
f) Piston/connecting rod assemblies.
g) Crankshaft.

6 Before beginning the dismantling and overhaul procedures, make sure that you have all of the correct tools necessary. Refer to *Tools and working facilities* at the end of this manual for further information.



6.3c Exploded view of the cylinder block and associated components - 1.6 litre engine

1 Flywheel retaining bolt
2 Flywheel
3 Cover plate
4 Oil seal
5 Oil seal housing
6 Cylinder block
7 Locating dowels and O-rings
8 Piston rings
9 Circlips
10 Gudgeon pin
11 Piston
12 Connecting rod
13 Main bearing inserts and thrustwashers
14 Crankshaft
15 Connecting rod big-end cap
16 Main bearing caps
17 Sump
18 Drain plug
19 Sealing washer
20 Big-end bearing inserts



6.3d Exploded view of the cylinder block and associated components - 2.0 litre (Phase II) engine

1 *Oil seal housing*
2 *Cylinder block*
3 *Coolant pump*
4 *Alternator bracket*
5 *Timing chain cover*
6 *O-ring*
7 *Oil pump pick-up/strainer*
8 *Flywheel/driveplate*
9 *Cover plate*
10 *Main bearing inserts*
11 *Crankshaft thrustwashers*
12 *Crankshaft*
13 *Main bearing caps*
14 *Main bearing ladder*
15 *Piston rings*
16 *Piston*
17 *Gudgeon pin*
18 *Circlips*
19 *Small-end bush*
20 *Connecting rod and big-end cap*
21 *Big-end bearing inserts*
22 *Oil baffle plate*
23 *Oil baffle plate*
24 *Aluminium sump*
25 *Baffle plate*
26 *Pressed-steel sump*
27 *Drain plug*
28 *Cover plate*

7.5 Pull the valve stem oil seal off the guide using a pair of pliers

7 Cylinder head - dismantling

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

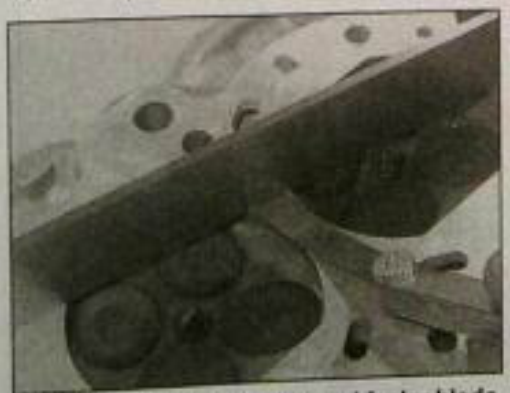
1 Remove the cylinder head as described in Part A or B of this Chapter (as applicable).

2 If not already done, remove the inlet and exhaust manifolds with reference to the relevant Part of Chapter 4.

3 On 1.6 litre engines, if not already done, remove the camshaft followers and shims as described in Part A.

4 On 2.0 litre engines, if not already done, remove the camshaft followers and hydraulic adjusters as described in Part B. Undo the retaining bolts, and remove the coolant pipe assembly from the cylinder head.

5 On all engines, using a valve spring compressor, compress each valve spring in turn until the split collets can be removed. Release the compressor, and lift off the spring retainer, spring and spring seat. Using a pair of pliers, carefully extract the valve stem seal from the top of the guide **(see illustration)**.



8.6 Using a straight edge and feeler blade to measure cylinder head gasket face distortion

7.8 Place each valve and its associated components in a labelled polythene bag

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

7 Withdraw the valve through the combustion chamber.

8 It is essential that each valve is stored together with its collets, retainer, spring, and spring seat. The valves should also be kept in their correct sequence, unless they are so badly worn that they are to be renewed. If they are going to be kept and used again, place each valve assembly in a labelled polythene bag or similar small container **(see illustration)**. Note that No 1 valve is nearest to the timing chain end of the engine.

8 Cylinder head and valves - cleaning and inspection

1 Thorough cleaning of the cylinder head and valve components, followed by a detailed inspection, will enable you to decide how much valve service work must be carried out during the engine overhaul. **Note:** *If the engine has been severely overheated, it is best to assume that the cylinder head is warped - check carefully for signs of this.*

Cleaning

2 Scrape away all traces of old gasket material from the cylinder head.

8.11 Measuring a valve stem diameter

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

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

Inspection

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

Cylinder head

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

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

7 Examine the valve seats in each of the combustion chambers. If they are severely pitted, cracked, or burned, they will need to be renewed or re-cut by an engine overhaul specialist. If they are only slightly pitted, this can be removed by grinding-in the valve heads and seats with fine valve-grinding compound, as described below.

8 Check the valve guides for wear by inserting the relevant valve, and checking for side-to-side motion of the valve. A very small amount of movement is acceptable. If the movement seems excessive, remove the valve. Measure the valve stem diameter (see below), and renew the valve if it is worn. If the valve stem is not worn, the wear must be in the valve guide, and the guide must be renewed. The renewal of valve guides is best carried out by a Nissan dealer or engine overhaul specialist, who will have the necessary tools available.

9 If renewing the valve guides, the valve seats are to be re-cut or re-ground only after the guides have been fitted.

Valves

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

11 If the valve appears satisfactory at this stage, measure the valve stem diameter at several points using a micrometer **(see illustration)**. Any significant difference in the readings obtained indicates wear of the valve stem. Should any of these conditions be apparent, the valve(s) must be renewed.

8.14 Grinding-in a valve

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

13 Valve grinding is carried out as follows. Place the cylinder head upside-down on a bench.

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

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

16 When all the valves have been ground-in, carefully wash off *all* traces of grinding compound using paraffin or a suitable solvent, before reassembling the cylinder head.

Valve components

17 Examine the valve springs for signs of damage and discoloration. The specified Nissan procedure for checking the condition of valve springs involves measuring the force necessary to compress each spring to a specified height. This is not possible without the use of the Nissan special test equipment, and therefore spring checking must be entrusted to a Nissan dealer. A rough idea of the condition of the spring can be gained by measuring the spring free length, and comparing it to the length given in this Chapter's Specifications.

18 Stand each spring on a flat surface, and position a square alongside the edge of the spring. Measure the gap between the upper edge of the spring and the square, and compare it to the out-of-square limit given in the Specifications.

19 If any of the springs are damaged, distorted or have lost their tension, obtain a complete new set of springs. It is normal to renew the valve springs as a matter of course if a major overhaul is being carried out.

20 Renew the valve stem oil seals regardless of their apparent condition.

9 Cylinder head - reassembly

1 Refit the spring seat then, working on the first valve, dip the new valve stem seal in fresh engine oil. Carefully locate it over the valve and onto the guide. Take care not to damage the seal as it is passed over the valve stem. Use a suitable socket or metal tube to press the seal firmly onto the guide **(see illustrations)**.

2 Lubricate the stems of the valves, and insert the valves into their original locations **(see illustration)**. If new valves are being fitted, insert them into the locations to which they have been ground.

3 Locate the valve spring on top of its seat, ensuring that the spring is fitted with its closer-pitched coils at the bottom, then refit the spring retainer **(see illustrations)**.

4 Compress the valve spring, and locate the split collets in the recess in the valve stem **(see illustration)**. Release the compressor, then repeat the procedure on the remaining valves.

9.1a Fit the spring seat . . .

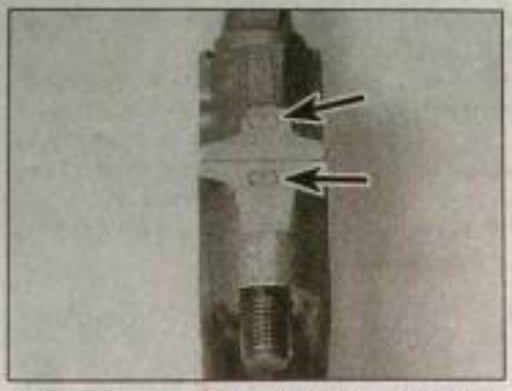
9.1b . . . and press a new oil seal onto the valve guide using a suitable socket

9.2 Lubricate the valve stem, and slide the valve into its respective guide

9.3a Fit the spring with its closer-pitched coils at the bottom . . .

9.3b . . . and fit the spring retainer

9.4 Install the collets, noting the use of grease to help keep the collets in position



10.3 Connecting rods should be stamped with their relevant cylinder number (arrowed)

10.5 Removing a big-end cap and shell (2.0 litre engine shown)

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Use a little dab of grease to hold the collets in position on the valve stem while the spring compressor is released.

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

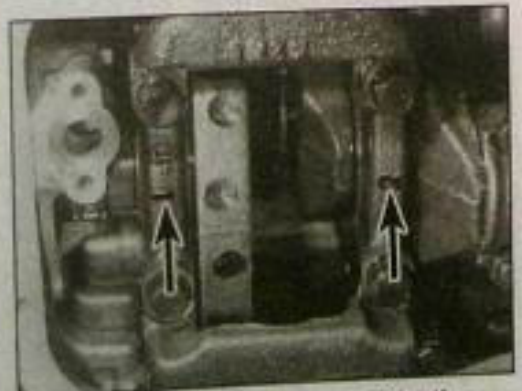
6 On 2.0 litre engines, ensure that the coolant pipe and head mating surfaces are clean and dry. Apply a bead of suitable sealant to the pipe mating surfaces and refit the pipe assembly, tightening its retaining bolts securely.

7 The cylinder head and associated components may now be refitted as described in Part A or B of this Chapter (as applicable).

10 Piston/connecting rod assembly - removal

1 Remove the sump, timing chain(s) and cylinder head as described in Part A or B of this Chapter (as applicable).

2 If there is a pronounced wear ridge at the top of any bore, it may be necessary to remove it with a scraper or ridge reamer, to avoid piston damage during removal. Such a ridge indicates excessive wear of the cylinder bore.



11.5 Main bearing cap identification

3 Each connecting rod and bearing cap should be stamped with its respective cylinder number, No 1 cylinder being at the timing chain end of the engine **(see illustration)**. If no markings are visible, using a hammer and centre-punch, paint or similar, mark each connecting rod and big-end bearing cap with its respective cylinder number on the flat machined surface provided.

4 Turn the crankshaft to bring pistons 1 and 4 to BDC (bottom dead centre).

5 Unscrew the nuts from No 1 piston big-end bearing cap. Take off the cap, and recover the bottom half bearing shell **(see illustration)**. If the bearing shells are to be re-used, tape the cap and the shell together.

6 To prevent the possibility of damage to the crankshaft bearing journals, tape over the connecting rod bolt threads.

7 Using a hammer handle, push the piston up through the bore, and remove it from the top of the cylinder block. Recover the bearing shell, and tape it to the connecting rod for safe-keeping.

8 Loosely refit the big-end cap to the connecting rod, and secure with the nuts - this will help to keep the components in their correct order.

9 Remove No 4 piston assembly in the same way.

10 Turn the crankshaft through 180° to bring pistons 2 and 3 to BDC (bottom dead centre), and remove them in the same way.

11 Crankshaft - removal

1 Remove the sump, timing chain(s) and flywheel as described in Part A or B of this Chapter (as applicable).

2 Remove the pistons and connecting rods, as described in Section 10. **Note:** *If no work is to be done on the pistons and connecting rods, there is no need to remove the cylinder head, or to push the pistons out of the cylinder bores. The pistons should just be pushed far enough up the bores that they are positioned clear of the crankshaft journals.*

3 Check the crankshaft endfloat as described in Section 14, then proceed as follows.

1.6 litre engines

4 Undo the retaining bolts, and remove the rear oil seal housing from the left-hand (flywheel) end of the cylinder block. If the locating dowels are a loose fit, remove them and store them with the housing for safe-keeping.

5 The main bearing caps should be numbered 1 to 5 from the timing chain end of the engine **(see illustration)**. If not, using white paint or a suitable marker pen, mark each cap in some way as 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.

6 Working in the **reverse** of the sequence shown in illustration 18.27, slacken the main bearing cap retaining bolts by a turn at a time. Once all bolts are loose, unscrew and remove them from the cylinder block.

7 Withdraw the bearing caps, and recover the lower main bearing shells. Tape each shell to its respective cap for safe-keeping.

8 Carefully lift out the crankshaft, taking care not to displace the upper main bearing shells.

9 Recover the upper bearing shells from the cylinder block, and tape them to their respective caps for safe-keeping. Remove the thrustwasher halves from the side of No 3 main bearing, and store them with the bearing cap.

2.0 litre engines

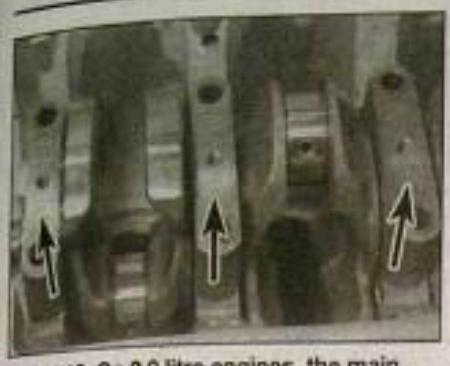
10 Undo the retaining bolts, and remove the rear oil seal housing from the left-hand (flywheel) end of the cylinder block. If the locating dowels are a loose fit, remove them and store them with the housing for safe-keeping.

11 Working in the **reverse** of the sequence shown in illustration 18.35a, slacken the main bearing cap retaining bolts by a turn at a time. Once all bolts are loose, unscrew and remove them from the cylinder block.

12 On Phase I and Phase II models, lift the main bearing ladder off the main bearing caps, noting which way around it is fitted **(see illustration)**. Note that the main bearing ladder is not fitted to Phase III models.

13 The main bearing caps should be numbered 1 to 5 from the timing chain end of the engine **(see illustration)**. If not, using white paint or a suitable marker pen, mark

11.12 Removing the main bearing ladder - 2.0 litre (Phase II) engine



11.13 On 2.0 litre engines, the main bearing caps should be numbered 1 to 5 (arrowed)

11.15 Lifting the crankshaft out of position

12.7 Cleaning a cylinder block threaded hole using a suitable tap

each cap in some way as 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.

14 Withdraw the bearing caps, and recover the lower main bearing shells. Tape each shell to its respective cap for safe-keeping.

15 Carefully lift out the crankshaft, taking care not to displace the upper main bearing shells **(see illustration)**.

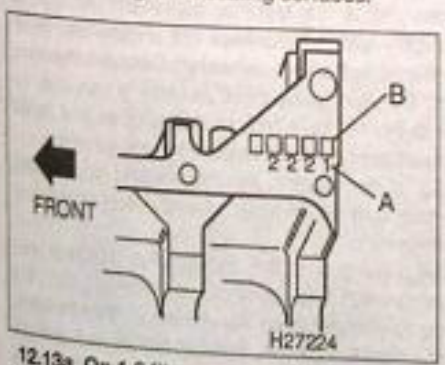
16 Recover the upper bearing shells from the cylinder block, and tape them to their respective caps for safe-keeping. Remove the thrustwasher halves from the side of No 3 main bearing, and store them with the bearing cap.

12 Cylinder block/crankcase - cleaning and inspection

Cleaning

1 Remove all external components and electrical switches/sensors from the block. For complete cleaning, the core plugs should ideally be removed. Drill a small hole in the plugs, then insert a self-tapping screw into the hole. Pull out the plugs by pulling on the screw with a pair of grips, or by using a slide hammer.

2 Scrape all traces of sealant from the cylinder block/crankcase, and from the main bearing ladder (where fitted), taking care not to damage the gasket/sealing surfaces.



12.13a On 1.6 litre models, cylinder bore grades can be determined from the four-digit code (A) stamped on the base of the block. The five-digit code (B) is for the main bearing bores

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

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

5 After the castings are returned, clean all oil holes and oil galleries one more time. Flush all internal passages with warm water until the water runs clear. Dry thoroughly, and apply a light film of oil to all mating surfaces and the cylinder bores, to prevent rusting. If you have access to compressed air, use it to speed up the drying process, and to blow out all the oil holes and galleries.

Warning: Wear eye protection when using compressed air!

6 If the castings are not very dirty, you can do an adequate cleaning job with hot (as hot as you can stand!), soapy water and a stiff brush. Take plenty of time, and do a thorough job. Regardless of the cleaning method used, be sure to clean all oil holes and galleries very thoroughly, and to dry all components well. Protect the cylinder bores as described above, to prevent rusting.

7 All threaded holes must be clean, to ensure accurate torque readings during reassembly. To clean the threads, run the correct-size tap into each of the holes to remove rust, corrosion, thread sealant or sludge, and to restore damaged threads **(see illustration)**. If possible, use compressed air to clear the holes of debris produced by this operation.

HAYNES HINT

A good alternative is to inject an aerosol water-dispersant lubricant into each hole, using the long tube usually supplied.

Warning: Wear eye protection when cleaning out these holes in this way!

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

9 If the engine is not going to be reassembled right away, cover it with a large plastic bag to keep it clean; protect all mating surfaces and the cylinder bores as described above, to prevent rusting.

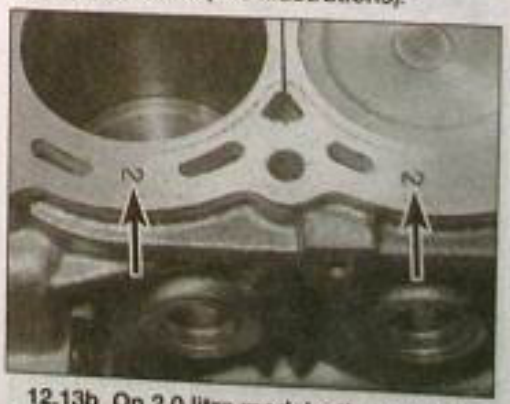
Inspection

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

11 Check each cylinder bore for scuffing and scoring. Check for signs of a wear ridge at the top of the cylinder, indicating that the bore is excessively worn.

12 Check the bore of each cylinder for scuffing and scoring.

13 Measure the diameter of each cylinder bore 10 mm from the top of the bore, both parallel to the crankshaft axis and at right-angles to it. Repeat the procedure measuring the bore diameter 60 mm from the top, and then 100 mm from the top, so that a total of six measurements are taken. Using the measurements obtained, calculate the cylinder taper and cylinder out-of-round dimensions. **Note:** *The cylinder bore grades are stamped on the cylinder block. On 1.6 litre engines, the grades are stamped on the flywheel end of the cylinder block base; there are two sets of codes - the four-digit code is for the cylinder bores, the first number in the sequence is for No 1 cylinder and the last for No 4 (the five-digit code is for the cylinder block main bearing bores - see Section 18). On 2.0 litre engines, the grades are stamped on the cylinder block upper gasket face, at the front of each bore* **(see illustrations)**.



12.13b On 2.0 litre models, the cylinder bore grades (arrowed) are stamped on the cylinder head mating surface

13.2 Using a feeler blade to ease piston ring removal

14 Check the pistons and rings as described in Section 13. The piston-to-bore clearance can be calculated by subtracting the piston diameter from the cylinder bore diameter measurement.

15 Compare all results with the Specifications at the beginning of this Chapter. If any measurement exceeds the service limit specified, the cylinder must be rebored, where possible, to the next oversize and new pistons fitted, or the cylinder block must be renewed. Seek the advice of an engine overhaul specialist as to the best course of action. On 1.6 litre engines, pistons are available in two oversizes - 0.5 mm and 1.0 mm; on 2.0 litre engines, pistons are available in only one oversize - 0.2 mm.

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

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

Gudgeon pin removal will be considerably eased if the piston is warmed (to approximately 60 to 70°C) first. Warm the piston by submerging it in a pan of hot water, then remove the assembly and press the gudgeon pin out, taking great care not to burn your hands

13 Piston/connecting rod assembly - inspection

1 Before the inspection process can begin, the piston/connecting rod assemblies must be cleaned, and the original piston rings removed from the pistons.

2 Carefully expand the old rings over the top of the pistons. The use of two or three old feeler blades will be helpful in preventing the rings dropping into empty grooves **(see illustration)**. Be careful not to scratch the piston with the ends of the ring. The rings are brittle, and will snap if they are spread too far. They're also very sharp - protect your hands and fingers. Always remove the rings from the top of the piston. Keep each set of rings with its piston if the old rings are to be re-used.

3 Scrape away all traces of carbon from the top of the piston. A hand-held wire brush (or a piece of fine emery cloth) can be used, once the majority of the deposits have been scraped away.

4 Remove the carbon from the ring grooves in the piston, using an old ring. Break the ring in half to do this (be careful not to cut your fingers - piston rings are sharp). Be careful to remove only the carbon deposits - do not remove any metal, and do not nick or scratch the sides of the ring grooves.

5 Once the deposits have been removed, clean the piston/connecting rod assembly with paraffin or a suitable solvent, and dry thoroughly. Make sure that the oil return holes in the ring grooves are clear.

6 Using a micrometer, measure the piston diameter at right-angles to the gudgeon pin axis (at the specified distance up from the bottom of the skirt), and compare the results with the Specifications at the beginning of this Chapter. The piston size grade is stamped onto the piston crown. Renew any piston which has worn beyond its specified limits.

7 Check the ring-to-groove clearance by inserting each ring from the outside, together with a feeler blade between the ring's top surface and the piston land. If the ring-to-groove clearance is excessive, renew the rings and recheck the clearance. If the clearance is still excessive, even with new piston rings, then the piston must be renewed.

8 Check the ring end gaps by inserting each ring into the cylinder bore and pushing it in with the piston crown to ensure that it is square in the bore. Push the ring down into the bore until the piston skirt is level with the block mating surface, then withdraw the piston. Using feeler blades, measure the piston ring end gap. If the ring end gap is excessive, renew the rings and repeat the checking procedure. If the clearance is still excessive, even with new piston rings, then the cylinder bores must be rebored/renewed (see Section 12).

9 Carefully inspect each piston for cracks around the skirt, around the gudgeon pin holes, and at the piston ring lands (between the ring grooves).

10 Look for scoring and scuffing on the piston skirt, holes in the piston crown, or burned areas at the edge of the crown. If the skirt is scored or scuffed, the engine may have been suffering from overheating, and/or abnormal combustion which caused excessively-high operating temperatures. The cooling and lubrication systems should be checked thoroughly. Scorch marks on the sides of the pistons show that blow-by has occurred. A hole in the piston crown, or burned areas at the edge of the piston crown, indicates that abnormal combustion (pre-ignition, knocking, or detonation) has been occurring. If any of the above problems exist, the causes must be investigated and corrected, or the damage will occur again. The causes may include incorrect ignition timing, inlet air leaks, or a faulty injector (as applicable).

11 Corrosion of the piston, in the form of pitting, indicates that coolant has been leaking into the combustion chamber and/or the crankcase. Again, the cause must be corrected, or the problem may persist in the rebuilt engine.

12 Examine each connecting rod carefully for signs of damage, such as cracks around the big-end and small-end bearings. Check that the rod is not bent or distorted. Damage is highly unlikely, unless the engine has been seized or badly overheated. Detailed checking of the connecting rod assembly can only be carried out by a Nissan dealer or engine repair specialist with the necessary equipment.

13 If necessary, the piston and connecting rods can be separated and reassembled as follows.

14 Using a small flat-bladed screwdriver, prise out the circlips, and push out the gudgeon pin **(see illustration)**. If necessary, support the piston, and tap the pin out using a suitable hammer and punch, taking great care not to mark the piston/connecting rod bores. Identify the piston, gudgeon pin and rod to ensure correct reassembly. Discard the circlips - new ones *must* be used on refitting.

13.14 Prise out the circlips, then press the gudgeon pin out of the piston

15 Examine the gudgeon pin, piston bore and connecting rod small-end bearing for signs of wear or damage. If the necessary measuring equipment is available, the amount of wear can be assessed by direct measurement, and the piston-to-gudgeon pin, and gudgeon pin-to-small-end clearances can be calculated.

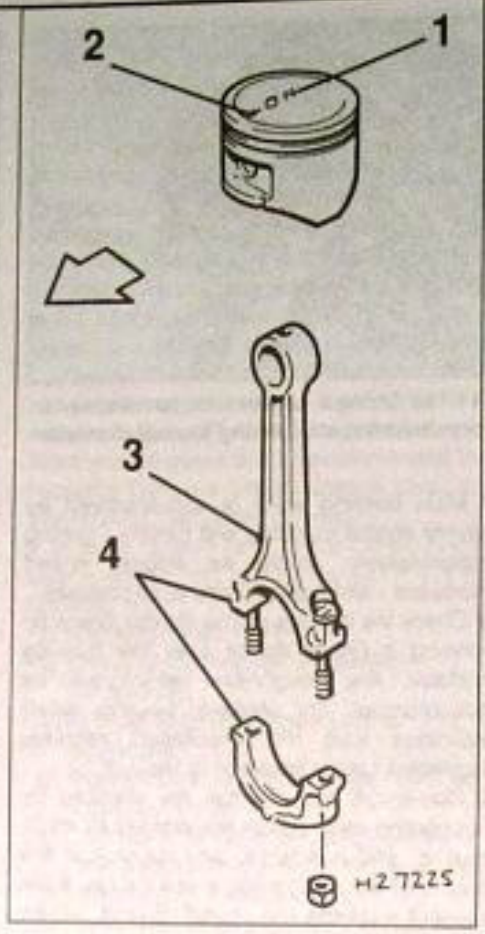
16 If the gudgeon pin and connecting rod small-end bush are worn or the specified clearance is exceeded, this can be cured by renewing both the pin and bush. Bush renewal, however, is a specialist job - press facilities are required, and the new bush must be reamed accurately.

17 If the gudgeon pin-to-piston clearance is greatly exceeded, both the piston and pin should be renewed as a matched pair. Note that this clearance is not as critical as the gudgeon pin-to-small-end clearance, since the pin is retained by circlips.

18 The connecting rods themselves should not need renewal, unless seizure or some other major mechanical failure has occurred. Check the alignment of the connecting rods visually, and if the rods are not straight, take them to an engine overhaul specialist for a more detailed check.

19 Examine all components, and obtain any new parts from your Nissan dealer.

20 Position the piston so that the front marking on the piston crown (either in the form of an arrow or a dot) is positioned correctly in relation to the oil hole in the connecting rod shaft **(see illustrations)**. With the piston and rod correctly mated, the piston front marking will face towards the timing chain end of the engine, and the connecting rod oil hole will face the rear of the cylinder block.

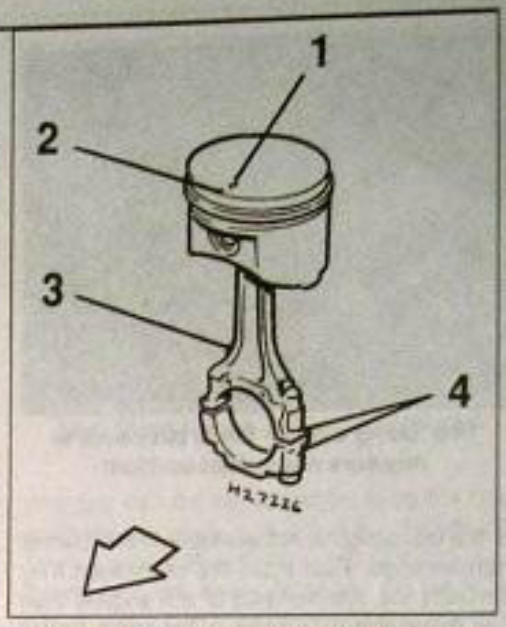


13.20a Correct connecting rod/piston fitting orientation - 1.6 litre models

1 Piston grade number
2 Front marking (arrowed)
3 Connecting rod oil hole
4 Connecting rod cylinder number marking (maybe on opposite side of rod)

21 Apply a smear of clean engine oil to the gudgeon pin. Slide it into the piston and through the connecting rod small-end **(see illustration)**. **Note:** *Gudgeon pin installation will be greatly eased if the piston is first warmed (see paragraph 14).* If necessary, tap the pin into position using a hammer and suitable punch, whilst ensuring that the piston is securely supported.

22 Check that the piston pivots freely on the rod, then secure the gudgeon pin in position with two new circlips **(see illustration)**. Ensure that each circlip is correctly located in its groove in the piston.



13.20b Correct connecting rod/piston fitting orientation - 2.0 litre models

1 Piston grade number
2 Front marking (arrowed)
3 Connecting rod oil hole
4 Connecting rod cylinder number marking (maybe on opposite side of rod)

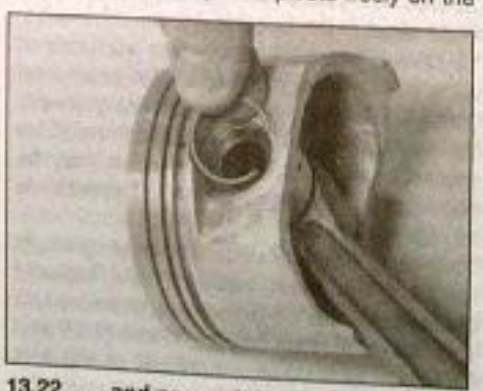
14 Crankshaft - inspection

Checking crankshaft endfloat

1 If the crankshaft endfloat is to be checked, this must be done when the crankshaft is still installed in the cylinder block/crankcase, but is free to move (see Section 11).

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

13.21 Ensure that the piston and connecting rod are correctly mated, then press the gudgeon pin into position . . .



13.22 . . . and secure it in position with two new circlips

14.2 Using a dial gauge to measure crankshaft endfloat

14.3 Using a feeler blade (arrowed) to measure crankshaft endfloat

14.11a Using a micrometer to measure a crankshaft main bearing journal diameter

14.11b Using a micrometer to measure a crankshaft big-end bearing journal diameter

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

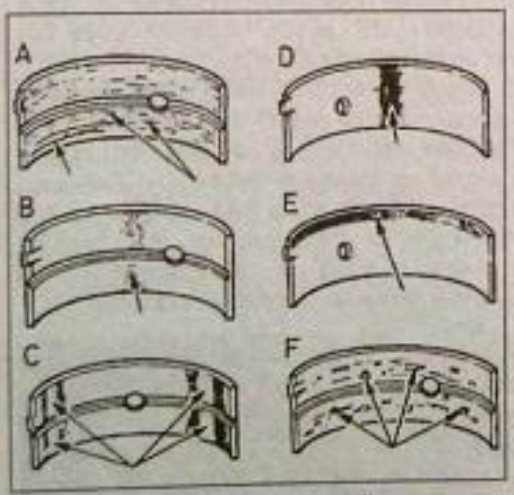
Inspection

4 Clean the crankshaft using paraffin or a suitable solvent, and dry it, preferably with compressed air if available.

Warning: Wear eye protection when using compressed air! Be sure to clean the oil holes with a pipe cleaner or similar probe, to ensure that they are not obstructed.

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

6 Big-end bearing wear is accompanied by distinct metallic knocking when the engine is running (particularly noticeable when the engine is pulling from low speed) and some loss of oil pressure.



15.2 Typical bearing failures

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

7 Main bearing wear is accompanied by severe engine vibration and rumble - getting progressively worse as engine speed increases - and again by loss of oil pressure.

8 Check the bearing journal for roughness by running a finger lightly over the bearing surface. Any roughness (which will be accompanied by obvious bearing wear) indicates that the crankshaft requires regrinding (where possible) or renewal.

9 Crankshaft run-out can be checked by supporting each end of the crankshaft 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 crankshaft will be required.

10 If the crankshaft has been reground, check for burrs around the crankshaft oil holes (the holes are usually chamfered, so burrs should not be a problem unless regrinding has been carried out carelessly). Remove any burrs with a fine file or scraper, and thoroughly clean the oil holes as described previously.

11 Using a micrometer, measure the diameter of the main and big-end bearing journals, and compare the results with the Specifications **(see illustrations)**. By measuring the diameter at a number of points around each journal's circumference, you will be able to determine whether or not the journal is out-of-round. Take the measurement at each end of the journal, near the webs, to determine if the journal is tapered. Compare the results obtained with those given in the Specifications.

12 Check the oil seal contact surfaces at each end of the crankshaft for wear and damage. If the seal has worn a deep groove in the surface of the crankshaft, consult an engine overhaul specialist. Repair may be possible, but otherwise a new crankshaft will be required.

13 Nissan produce undersize bearing shells for both the main bearings and big-end bearings. On the 1.6 litre engine, there are two undersizes of main bearing shells (0.25 and 0.50 mm) and three undersizes of big-end bearing shells (0.08, 0.12 and 0.25 mm). On the 2.0 litre engine, there is only one undersize of main bearing shell (0.25 mm) but there are three undersizes of big-end bearing shell available (0.08, 0.12 and 0.25 mm). Refer to your Nissan dealer for further information on parts availability. If undersize bearing shells are available, and the crankshaft has worn beyond the specified limits, providing that the crankshaft journals have not already been reground, it may be possible to have the crankshaft reconditioned, and to fit the undersize shells. Seek the advice of your Nissan dealer or engine specialist on the best course of action.

15 Main and big-end bearings - inspection

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

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

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

4 Dirt and other foreign matter gets into the engine in a variety of ways. It may be left in the engine during assembly, or it may pass through filters or the crankcase ventilation

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

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

6 Driving habits can have a definite effect on bearing life. Full-throttle, low-speed operation (labouring the engine) puts very high loads on bearings, tending to squeeze out the oil film. These loads cause the bearings to flex, which produces fine cracks in the bearing face (fatigue failure). Eventually, the bearing material will loosen in pieces, and tear away from the steel backing.

7 Short-distance driving leads to corrosion of bearings, because insufficient engine heat is produced to drive off the condensed water and corrosive gases. These products collect in the engine oil, forming acid and sludge. As the oil is carried to the engine bearings, the acid attacks and corrodes the bearing material.

8 Incorrect bearing installation during engine assembly will lead to bearing failure as well. Tight-fitting bearings leave insufficient bearing running clearance, and will result in oil starvation. Dirt or foreign particles trapped behind a bearing shell result in high spots on the bearing, which lead to failure.

9 Do not touch any shell's bearing surface with your fingers during reassembly; there is a risk of scratching the delicate surface, or of depositing particles of dirt on it.

10 As mentioned at the beginning of this Section, the bearing shells should be renewed as a matter of course during engine overhaul; to do otherwise is false economy. Refer to Section 17 for details of bearing shell selection.

16 Engine overhaul - reassembly sequence

1 Before reassembly begins, ensure that all new parts have been obtained, and that all necessary tools are available. Read through the entire procedure, to familiarise yourself with the work involved, and to ensure that all items necessary for reassembly of the engine are at hand. In addition to all normal tools and materials, thread-locking compound will be needed. A suitable tube of liquid sealant will also be required for the joint faces that are fitted without gaskets; it is recommended that Nissan's Genuine Liquid Gasket (available from your Nissan dealer) is used.

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

a) Crankshaft (Section 18).
b) Piston/connecting rod assemblies (Section 19).
c) Cylinder head (See Part A or B as applicable).
d) Timing chain(s) and cover (See Part A or B - as applicable).
e) Sump (See Part A or B - as applicable).
f) Flywheel (See Part A or B - as applicable).
g) Engine external components.

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

17 Piston rings - refitting

1 Before fitting new piston rings, the ring end gaps must be checked as follows.

2 Lay out the piston/connecting rod assemblies and the new piston ring sets, so that the ring sets will be matched with the same piston and cylinder during the end gap measurement and subsequent engine reassembly.

3 Insert the top ring into the first cylinder, and push it down the bore using the top of the piston. This will ensure that the ring remains square with the cylinder walls. Push the ring down into the bore until the piston skirt is level with the block mating surface, then withdraw the piston.

4 Measure the end gap using feeler gauges, and compare the measurements with the figures given in the Specifications **(see illustration)**.

5 If the gap is too small (unlikely if genuine Nissan parts are used), it must be enlarged, or the ring ends may contact each other during engine operation, causing serious damage. Ideally, new piston rings providing the correct end gap should be fitted. As a last resort, the

17.4 Measuring a piston ring end gap

end gap can be increased by filing the ring ends very carefully with a fine file. Mount the file in a vice with soft jaws, slip the ring over the file with the ends contacting the file face, and slowly move the ring to remove material from the ends. Take care, as piston rings are sharp, and are easily broken.

6 With new piston rings, it is unlikely that the end gap will be too large. If the gaps are too large, check that you have the correct rings for your engine and for the particular cylinder bore size.

7 Repeat the checking procedure for each ring in the first cylinder, and then for the rings in the remaining cylinders. Remember to keep rings, pistons and cylinders matched up.

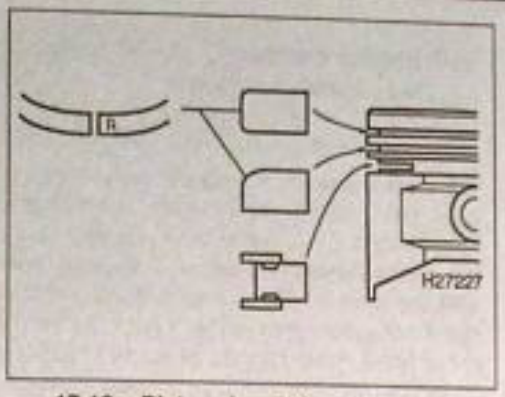
8 Once the ring end gaps have been checked and if necessary corrected, the rings can be fitted to the pistons. **Note:** *Always follow any instructions supplied with the new piston ring sets - different manufacturers may specify different procedures. Do not mix up the top and second compression rings, as they have different cross-sections.*

9 The oil control ring (lowest on the piston) is installed first. It is composed of three separate components. Slip the expander into the groove, then install the upper side rail into the groove between the expander and the ring land, then install the lower side rail in the same manner **(see illustrations)**.

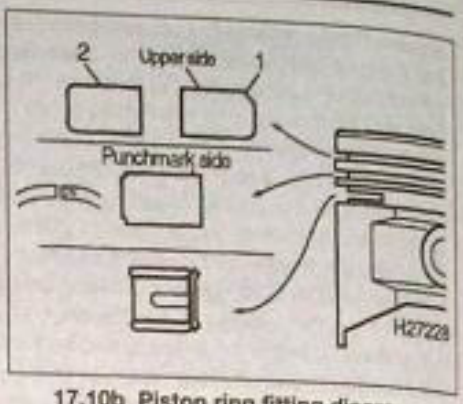
10 Install the second ring next. **Note:** *The second ring and top ring are different, and can be identified by their cross-sections.* Making sure the ring is the correct way up (on 2.0 litre engines, the ring identification marking should be facing upwards), fit the ring into the middle

17.9a Fit the oil control ring expander . . .

17.9b . . . then install the side rails as described in text

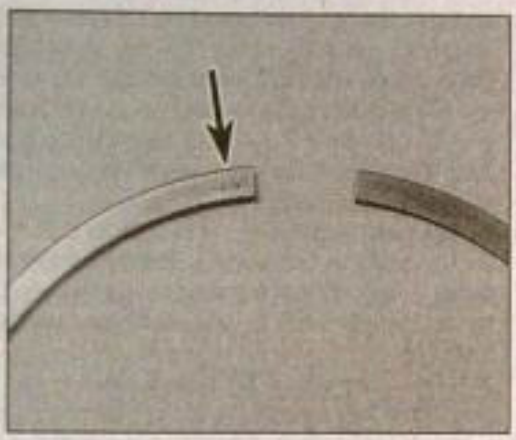


17.10a Piston ring fitting diagram - 1.6 litre engine

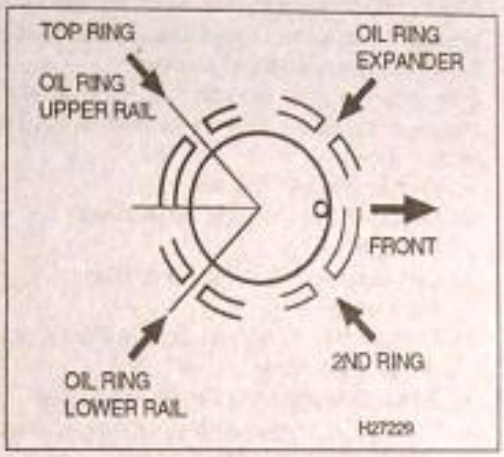


17.10b Piston ring fitting diagram - 2.0 litre engine

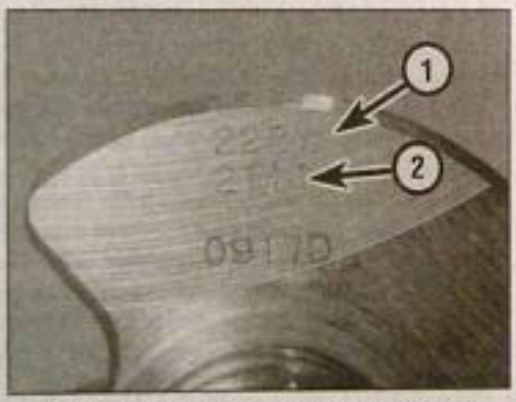
1 SR20DE engine
2 SR20Di and SR20De engines



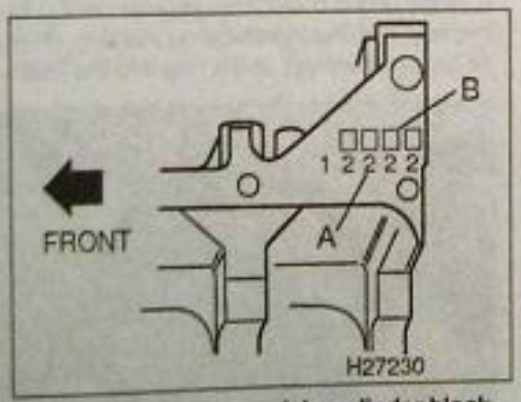
17.10c Where necessary, ensure that the rings are installed with their identification marking (arrowed) uppermost



17.12 Position the piston ring end gaps as shown



18.2 Crankshaft main bearing journal codes (1) and big-end bearing journal codes (2)



18.3a On 1.6 litre models, cylinder block main bearing bore grades can be determined from the five-digit code (A) stamped on the base of the block. The four-digit code (B) is for the cylinder bore grades

groove on the piston, taking care not to expand the ring any more than is necessary **(see illustrations)**.

11 Install the top ring in the same way, making sure the ring is the correct way up. Where the ring is symmetrical, fit it with its identification marking facing upwards.

12 With all the rings in position on the piston, space the ring end gaps as shown **(see illustration)**.

13 Repeat the above procedure for the remaining pistons and rings.

18 Crankshaft - refitting and main bearing running clearance check

Selection of new bearing shells

Note: *This information applies only to standard size bearing shells. Undersize shells are not graded.*

1 New bearing shells are selected using the identification marks on the crankshaft and cylinder block.

2 The crankshaft markings are stamped on the side of No 1 cylinder crankweb (at the timing chain end of the crankshaft). The five-digit code refers to the main bearing journal diameters - the first number in the sequence is for No 1 bearing journal, and the last for No 5 journal **(see illustration)**. **Note:** *On some engines, there is also a four-digit code stamped on the web; these numbers are for the big-end bearing (crankpin) journals (see Section 19).*

3 The cylinder block markings are stamped on the flywheel end of the cylinder block base. On 1.6 litre engines, there are two sets of codes; the five-digit code is for the main bearing bores - the first number in the sequence is for No 1 main bearing journal, and the last for No 5 journal (the four-digit code is for the cylinder bore size grades). On 2.0 litre engines, there is only one five-digit code, the first number in the sequence is for No 1 bearing journal, and the last for No 5 journal **(see illustrations)**.

4 Obtain the identification number of both the relevant crankshaft journal and the cylinder block bearing bore, and select the correct grade of main bearing shell required for each journal, using the relevant following table. The grade of each shell is indicated by a dab of paint on the side of the shell.

Crankshaft code	Block code	Bearing shell grade
1.6 litre engine		
0	0	Black
0	1	Brown
0	2	Green
1	0	Brown
1	1	Green
1	2	Yellow
2	0	Green
2	1	Yellow
2	2	Blue

18.3b On 2.0 litre models, the cylinder block main bearing bore grades are stamped on the base of the block (arrowed)

Crankshaft code	Block code	Bearing shell grade
2.0 litre engine		
0	0	Black
0	1	Brown
0	2	Green
0	3	Yellow
0	0	Brown
1	1	Green
1	2	Yellow
1	3	Blue
1	0	Green
2	1	Yellow
2	2	Blue
2	3	Pink
2	0	Yellow
3	1	Blue
3	2	Pink
3	3	White (or no colour)

Main bearing running clearance check

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

6 Press the bearing shells into their locations, ensuring that the tab on each shell engages in the notch in the cylinder block/crankcase or main bearing ladder location. Take care not to touch any shell's bearing surface with your fingers. Note that all the upper bearing shells are grooved, and have oil holes in them; the lower shells are plain **(see illustrations)**. If the original bearing shells are being used for the check, ensure that they are refitted in their original locations. The clearance can be checked in either of two ways.

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

8 The second (and more accurate) method is to use an American product called Plastigauge. This consists of a fine thread of perfectly-round plastic, which is compressed between the bearing shell and the journal. When the shell is removed, the plastic is deformed, and can be measured with a special card gauge supplied with the kit. The running clearance is determined from this gauge. Plastigauge should be available from your Nissan dealer; otherwise, enquiries at one of the larger specialist motor factors should produce the name of a stockist in your area. The procedure for using Plastigauge is as follows.

9 With the main bearing upper shells in place, carefully lay the crankshaft in position. Do not use any lubricant; the crankshaft journals and bearing shells must be perfectly clean and dry.

18.6a Fit the upper grooved bearing shells, aligning their tabs with the crankcase cut-outs (arrowed) . . .

18.6b . . . and fit the lower plain shells to the caps, also aligning their tabs with the cap cut-outs (arrowed)

10 Cut several lengths of the appropriate-size Plastigauge (they should be slightly shorter than the width of the main bearings), and place one length on each crankshaft journal axis **(see illustration)**.

11 On 1.6 litre engines, with the main bearing lower shells in position, refit the main bearing caps using the identification markings to ensure each cap is fitted correctly. Refit the main bearing cap bolts and, working in the sequence shown in illustration 18.27, tighten them evenly and progressively to the specified torque setting. Take care not to disturb the Plastigauge, and do not rotate the crankshaft at any time during this operation.

12 On 2.0 litre engines, with the main bearing lower shells in position, refit the main bearing caps using the identification markings to ensure each cap is fitted correctly. Fit the main bearing ladder casting (where applicable), then install the retaining bolts and tighten them as described in paragraphs 35 to 37. Take care not to disturb the Plastigauge, and do not rotate the crankshaft at any time during this operation.

13 On all engines, working in reverse to the sequence shown in illustration 18.27 or 18.35a (as applicable), progressively slacken the bearing cap retaining bolts by one turn at a time. Once all bolts are loose, unscrew them and remove them from the cylinder block.

14 Remove the main bearing ladder/caps (as applicable), again taking great care not to disturb the Plastigauge, nor to rotate the crankshaft.

15 Compare the width of the crushed Plastigauge on each journal to the scale printed on the Plastigauge envelope, to obtain the main bearing running clearance. Compare the clearance measured with that given in the Specifications at the start of this Chapter **(see illustration)**.

16 If the clearance is not as specified, the bearing shells may be the wrong size (or excessively worn, if the original shells are being re-used). Before deciding that different-size shells are required, make sure that no dirt or oil was trapped between the bearing shells and the main bearing ladder or block when the clearance was measured. If the Plastigauge was wider at one end than at the other, the crankshaft journal may be tapered.

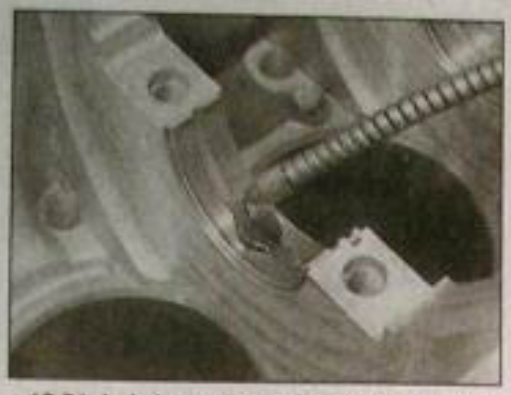
17 If the clearance is not as specified with the original bearing shells, repeat the checking procedure using new bearing shells. If the clearance is not as specified even with new bearing shells, then seek the advice of a Nissan dealer or suitable engine overhaul specialist. They will be able to advise you on the best course of action, and whether or not it will be necessary to have the crankshaft journals reground and fit undersize shells.

18 Where necessary, obtain the required grades of bearing shell, and repeat the running clearance checking procedure as described above.

19 On completion, carefully scrape away all traces of the Plastigauge material from the crankshaft and bearing shells. Use your fingernail, or a wooden or plastic scraper which is unlikely to score the bearing surfaces.

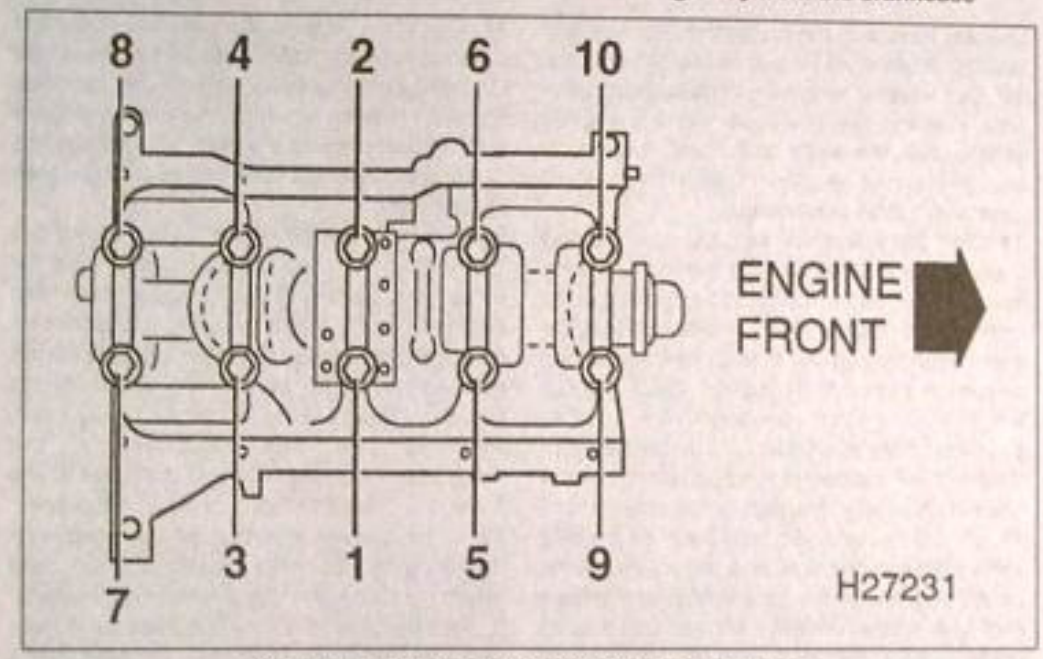
18.10 Plastigage in place on a crankshaft journal main bearing

18.15 Measuring the width of the deformed Plastigage using the scale on the card provided



18.21 Lubricate the main bearing shells with clean engine oil . . .

18.22 . . . then fit the thrustwasher halves, making sure that their grooved faces are facing away from the crankcase



18.27 Main bearing cap bolt tightening sequence - 1.6 litre engine

Final crankshaft refitting

1.6 litre engine

20 Carefully lift the crankshaft out of the cylinder block once more.

21 Place the bearing shells in their locations as described in paragraph 5 and 6. If new shells are being fitted, ensure that all traces of protective grease are cleaned off using paraffin. Wipe dry the shells and connecting rods with a lint-free cloth. Liberally lubricate each bearing shell in the cylinder block/crankcase with clean engine oil **(see illustration)**.

22 Using a little grease, stick the upper thrustwashers to each side of the No 3 main bearing upper location; ensure that the oilway grooves on each thrustwasher face outwards (away from the cylinder block) **(see illustration)**.

23 Lower the crankshaft into position, and check the crankshaft endfloat as described in Section 14.

18.34a On 2.0 litre engines, fit the main bearing caps using their markings to ensure each is correctly positioned . . .

18.34b . . . then (where applicable) refit the main bearing ladder, and install the retaining bolts and washers

24 Thoroughly degrease the mating surfaces of the cylinder block and the main bearing caps.

25 Lubricate the lower bearing shells in the main bearing caps with clean engine oil. Make sure that the locating lugs on the shells engage with the corresponding recesses in the caps.

26 Fit the main bearing caps, using the identification marks to ensure that they are installed in the correct locations and are fitted the correct way round. Insert the retaining bolts, tightening them by hand only.

27 Working in the sequence shown, tighten the bearing cap retaining bolts to approximately half the specified torque setting **(see illustration)**. Then go around in the same sequence and tighten the bolts to the full specified torque setting. Check that the crankshaft rotates freely before proceeding any further.

28 Fit the piston/connecting rod assemblies as described in Section 19.

29 Ensure that the mating surfaces of the rear oil seal housing and cylinder block are clean and dry. Note the correct fitted depth of the oil seal then, using a large flat-bladed screwdriver, lever the seal out of the housing.

30 Fit the new crankshaft seal to the housing, making sure that its sealing lip is facing inwards. Tap the seal squarely into the housing until it is positioned at the same depth as the original was noted prior to removal.

31 Apply a bead of suitable sealant to the oil seal housing mating surface, and make sure that the locating dowels are in position. Slide the housing over the end of the crankshaft, and into position on the cylinder block. Tighten the housing retaining bolts to the specified torque setting.

32 Refit the flywheel, timing chains and sump as described in Part A of this Chapter.

2.0 litre engine

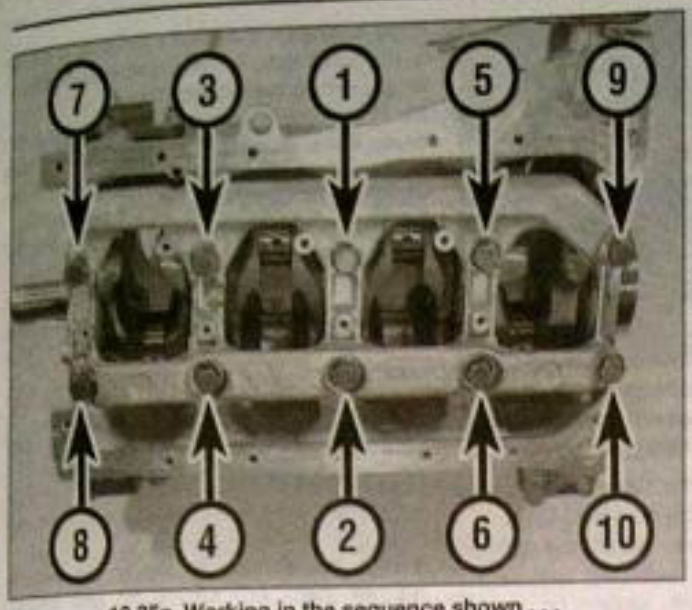
33 Carry out the operations described above in paragraphs 20 to 25.

34 Fit the main bearing caps, using the identification marks to ensure that they are installed in the correct locations and are fitted the correct way round. Refit the main bearing ladder casting, and install the retaining bolts, tightening them by hand only at this stage **(see illustrations)**.

35 Working progressively and in the sequence shown, tighten the main bearing retaining bolts to their Stage 1 torque setting, using a torque wrench and suitable socket **(see illustrations)**.

36 Working again in the specified sequence, tighten the main bearing cap bolts through the specified Stage 2 angle setting **(see illustration)**. On Phase I and Phase II models, if an angle-measuring gauge is not available, tighten the bolts in sequence to the specified Stage 2 torque setting.

37 On Phase III models, once the bolts have been tightened to the Stage 2 angle setting



18.35a Working in the sequence shown . . .

18.35b . . . tighten the main bearing cap bolts to the Stage 1 torque setting . . .

progressively slacken all the bolts completely working in the reverse of the tightening sequence. Again, working progressively and in the sequence shown, tighten the bolts to their Stage 3 torque setting. Finally tighten the bolts in sequence through the specified Stage 4 angle setting.

38 Check that the crankshaft rotates freely before proceeding, then install the remaining components as described in paragraphs 28 to 32.

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

Note: *This information applies only to standard size bearing shells. Undersize shells are not graded.*

Selection of new bearing shells

1 New bearing shells are selected using the identification marks on the crankshaft.

2 The crankshaft markings are stamped either on the side of No 1 cylinder crankweb (at the timing chain end of the crankshaft) or on the side of No 4 cylinder crankweb (at the flywheel/driveplate end of the crankshaft). The four-digit code refers to the big-end (crankpin) journal diameters - the first number in the sequence is for No 1 crankpin, and the last for No 4 crankpin. The five-digit code stamped on No 1 cylinder crankweb refers to main bearing journal sizes (see Section 18).

3 Obtain the identification number of both the relevant crankshaft journal and the cylinder block bearing bore, and select the correct grade of bearing shell required for each journal using the relevant following table. The grade of each shell is indicated by a dab of paint on the side of the shell.

Crankshaft code	Bearing shell grade
0	Black
1	Brown
2	Green

18.36 . . . and then tighten them through the specified Stage 2 angle setting as described in text

Big-end bearing running clearance check

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

5 Press the bearing shells into their locations, ensuring that the tab on each shell engages in the recess in the connecting rod and cap **(see illustration)**. Take care not to touch any shell's bearing surface with your fingers, and ensure that the shells are correctly installed so that the upper shell oil hole is correctly aligned with connecting rod oil hole. If the original bearing shells are being used for the check, ensure that they are refitted in their original locations. The clearance can be checked in either of two ways.

6 One method is to refit the big-end bearing cap to the connecting rod, ensuring that they are fitted the correct way round, with the bearing shells in place. With the cap retaining nuts correctly tightened, use an internal micrometer or vernier caliper to measure the internal diameter of each assembled pair of bearing shells. If the diameter of each corresponding crankshaft journal is measured and then subtracted from the bearing internal diameter, the result will be the big-end bearing running clearance.

7 The second, and more accurate, method is to use Plastigauge (see Section 18).

8 Ensure that the bearing shells are correctly fitted. Place a strand of Plastigauge on each (cleaned) crankpin journal.

9 Refit the (clean) piston/connecting rod assemblies to the crankshaft, and refit the big-end bearing caps, using the marks made or noted on removal to ensure that they are fitted the correct way round.

10 Tighten the bearing cap nuts as described below in paragraph 22. Take care not to disturb the Plastigauge, nor to rotate the connecting rod during the tightening sequence.

11 Dismantle the assemblies without rotating the connecting rods. Use the scale printed on the Plastigauge envelope to obtain the big-end bearing running clearance.

12 If the clearance is not as specified, the bearing shells may be the wrong size (or excessively worn, if the original shells are being re-used). Make sure that no dirt or oil was trapped between the bearing shells and

19.5 Fit each bearing shell to its connecting rod, aligning its tab with the rod cut-out (arrowed)

19.19 Ensure that the piston rings end gaps are correctly spaced, then clamp them in position with piston ring compressor

19.20 Insert the piston/connecting rod assembly into its respective cylinder, and gently tap it into position

the caps or connecting rods when the clearance was measured. If the Plastigauge was wider at one end than at the other, the crankpins may be tapered.

13 If the clearance is not as specified with the original bearing shells, repeat the checking procedure using new bearing shells. If the clearance is not as specified even with new bearing shells, then seek the advice of a Nissan dealer or suitable engine overhaul specialist. They will be able to advise you on the best course of action, and whether or not it will be necessary to have the crankpin journals reground and fit undersize shells.

14 Where necessary, obtain the required grades of bearing shell, and repeat the running clearance checking procedure as described above.

15 On completion, carefully scrape away all traces of the Plastigauge material from the crankshaft and bearing shells. Use your fingernail, or a wooden or plastic scraper which is unlikely to score the bearing surfaces.

Final piston/ connecting rod refitting

16 Note that the following procedure assumes that the crankshaft and main bearing ladder/caps are in place (see Section 18).

17 Ensure that the bearing shells are correctly fitted as described in paragraphs 4 and 5. If new shells are being fitted, ensure that all traces of the protective grease are cleaned off using paraffin. Wipe dry the shells and connecting rods with a lint-free cloth.

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

19 Start with assembly No 1. Make sure that the piston rings are still spaced as described in Section 17, then clamp them in position with a piston ring compressor **(see illustration)**.

20 Insert the piston/connecting rod assembly into the top of cylinder No 1. Ensure that the piston front marking (in the form of either an arrow or a dot) on the piston crown is on the timing chain side of the bore. Using a block of wood or hammer handle against the piston crown, tap the assembly into the cylinder until the piston crown is flush with the top of the cylinder **(see illustration)**.

21 Ensure that the bearing shell is still correctly installed. Liberally lubricate the crankpin and both bearing shells. Taking care not to mark the cylinder bores, tap the piston/connecting rod assembly down the bore and onto the crankpin. Refit the big-end bearing cap, tightening its retaining nuts finger-tight at first. Note that the faces with the identification marks must match (which means that the bearing shell locating tabs abut each other).

22 Tighten the bearing cap retaining nuts to their Stage 1 torque setting, using a torque wrench and suitable socket. Then tighten them either through the specified Stage 2 angle setting or, if an angle-measuring gauge is not available, to the specified Stage 2 torque setting **(see illustrations)**.

23 Rotate the crankshaft. Check that it turns freely; some stiffness is to be expected if new components have been fitted, but there should be no signs of binding or tight spots.

24 Refit the remaining three piston/connecting rod assemblies in the same way.

25 Refit the cylinder head, timing chain(s) and sump as described in Part A or B of this Chapter (as applicable).

19.22a Evenly and progressively tighten the big-end bearing cap retaining nuts to the specified Stage 1 torque setting . . .

19.22b . . . and then through the specified Stage 2 angle setting

20 Engine - initial start-up after overhaul

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

2 Remove the spark plugs, and disable the ignition system by disconnecting the ignition HT coil lead from the distributor cap, and earthing it on the cylinder block. Use a jumper lead or similar wire to make a good connection.

3 Turn the engine on the starter until the oil pressure warning light goes out. Refit the spark plugs, and reconnect the spark plug (HT) leads, referring to Chapter 1 for further information. Reconnect the HT leads to the distributor.

4 Start the engine, noting that this may take a little longer than usual, due to the fuel system components having been disturbed.

5 While the engine is idling, check for fuel, water and oil leaks. Don't be alarmed if there are some odd smells and smoke from parts getting hot and burning off oil deposits.

6 Assuming all is well, keep the engine idling until hot water is felt circulating through the top hose, then switch off the engine.

7 Check the ignition timing and the idle speed settings (as appropriate), then switch the engine off.

8 After a few minutes, recheck the oil and coolant levels as described in Chapter 1, and top-up as necessary.

9 If they were tightened as described, there is no need to re-tighten the cylinder head bolts once the engine has first run after reassembly.

10 If new pistons, rings or crankshaft bearings have been fitted, the engine must be treated as new, and run-in for the first 500 miles (800 km). *Do not* operate the engine at full-throttle, or allow it to labour at low engine speeds in any gear. It is recommended that the oil and filter be changed at the end of this period.

Chapter 2 Part C:
Engine removal and overhaul procedures

Contents

Degrees of difficulty

Easy, suitable for novice with little experience 

Fairly easy, suitable for beginner with some experience 

Fairly difficult, suitable for competent DIY mechanic 

Difficult, suitable for experienced DIY mechanic 

Very difficult, suitable for expert DIY or professional 

Specifications

Cylinder head

Maximum gasket face distortion	0.1 mm
Cylinder head height:	
1.6 litre engines	117.8 to 118.0 mm
2.0 litre engines	136.9 to 137.1 mm

Cylinder block

Cylinder bore diameter:	
1.6 litre engine:	
Grade 1	76.000 to 76.010 mm
Grade 2	76.010 to 76.020 mm
Grade 3	76.020 to 76.030 mm
Oversizes available	0.5 mm and 1.0 mm
2.0 litre engine:	
Grade 1	86.000 to 86.010 mm
Grade 2	86.010 to 86.020 mm
Grade 3	86.020 to 86.030 mm
Oversize available	0.2 mm

Chapter 2 Part C:
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Specifications

Cylinder head

Maximum gasket face distortion	0.1 mm
Cylinder head height:	
1.6 litre engines	117.8 to 118.0 mm
2.0 litre engines	136.9 to 137.1 mm

Cylinder block

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1.6 litre engine:	
Grade 1	76.000 to 76.010 mm
Grade 2	76.010 to 76.020 mm
Grade 3	76.020 to 76.030 mm
Oversizes available	0.5 mm and 1.0 mm
2.0 litre engine:	
Grade 1	86.000 to 86.010 mm
Grade 2	86.010 to 86.020 mm
Grade 3	86.020 to 86.030 mm
Oversize available	0.2 mm

Piston and connecting rod (continued)

Connecting rod small-end bush diameter:	
1.6 litre engine	19.000 to 19.012 mm
2.0 litre engine	22.000 to 22.012 mm
Connecting rod small-end bush-to-gudgeon pin clearance:	
Standard	0.005 to 0.017 mm
Service limit	0.023 mm
Connecting rod big-end bore diameter:	
1.6 litre engine	43.000 to 43.013 mm
2.0 litre engine	51.000 to 51.013 mm
Connecting rod big-end bearing side clearance:	
Standard:	
1.6 litre engine	0.20 to 0.47 mm
2.0 litre engine	0.20 to 0.35 mm
Service limit	0.5 mm

Crankshaft

Endfloat:	
Standard:	
1.6 litre engine	0.06 to 0.18 mm
2.0 litre engine	0.10 to 0.26 mm
Service limit	0.3 mm
Run-out:	
Standard:	
1.6 litre engine	Less than 0.040 mm
2.0 litre engine	Less than 0.025 mm
Service limit	0.05 mm
Main bearing journal diameter:	
1.6 litre engine:	
Grade 0	49.956 to 49.964 mm
Grade 1	49.948 to 49.956 mm
Grade 2	49.940 to 49.948 mm
2.0 litre engine:	
Grade 0	54.974 to 54.980 mm
Grade 1	54.968 to 54.974 mm
Grade 2	54.962 to 54.968 mm
Grade 3	54.956 to 54.962 mm
Journal ovality	Less than 0.005 mm
Journal taper:	
1.6 litre engine	Less than 0.002 mm
2.0 litre engine	Less than 0.005 mm
Big-end bearing journal diameter:	
1.6 litre engine:	
Grade 0	39.968 to 39.974 mm
Grade 1	39.962 to 39.968 mm
Grade 2	39.956 to 39.962 mm
2.0 litre engine:	
Grade 0	47.968 to 47.974 mm
Grade 1	47.962 to 47.968 mm
Grade 2	47.956 to 47.962 mm
Journal ovality	Less than 0.005 mm
Journal taper:	
1.6 litre engine	Less than 0.002 mm
2.0 litre engine	Less than 0.005 mm
Main bearing running clearance:	
1.6 litre engine:	
Standard	0.020 to 0.044 mm
Service limit	0.064 mm
2.0 litre engine:	
Standard	0.004 to 0.022 mm
Service limit	0.050 mm
Big-end bearing running clearance:	
1.6 litre engine:	
Standard	0.010 to 0.035 mm
Service limit	0.055 mm
2.0 litre engine:	
Standard	0.020 to 0.045 mm
Service limit	0.065 mm

service. Conversely, a neglected engine may require an overhaul very early in its life.

3 Excessive oil consumption is an indication that piston rings, valve seals and/or valve guides are in need of attention. Make sure that oil leaks are not responsible before deciding that the rings and/or guides are worn. Perform a compression test, as described in Part A or B of this Chapter (as applicable), to determine the likely cause of the problem.

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

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

6 An engine overhaul involves restoring all internal parts to the specification of a new engine. During an overhaul, the pistons and the piston rings are renewed. New main and big-end bearings are generally fitted; if necessary, the crankshaft may be renewed, to restore the journals. The valves are also serviced as well, since they are usually in less-than-perfect condition at this point. While the engine is being overhauled, other components, such as the distributor, starter and alternator, can be overhauled as well. The end result should be an as-new engine that will give many trouble-free miles. **Note:** *Critical cooling system components such as the hoses, thermostat and water pump should be renewed when an engine is overhauled. The radiator should be checked carefully, to ensure that it is not clogged or leaking. Also, it is a good idea to renew the oil pump whenever the engine is overhauled.*

7 Before beginning the engine overhaul, read through the entire procedure, to familiarise yourself with the scope and requirements of the job. Overhauling an engine is not difficult if you follow carefully all of the instructions, have the necessary tools and equipment, and pay close attention to all specifications. It can, however, be time-consuming. Plan on the car being off the road for a minimum of two weeks, especially if parts must be taken to an engineering works for repair or reconditioning. Check on the availability of parts, and make sure that any necessary special tools and equipment are obtained in advance. Most work can be done with typical hand tools, although a number of precision measuring tools are required for inspecting parts to determine if they must be renewed. Often, the engineering works will handle the inspection of parts, and can offer advice concerning reconditioning and renewal. **Note:** *Always wait until the engine has been completely dismantled, and until all components (especially the cylinder block/ crankcase and the crankshaft) have been inspected, before deciding what service and repair operations must be performed by an engineering works. The condition of these components will be the major factor to consider when determining whether to overhaul the original engine, or to buy a reconditioned unit. Do not, therefore, purchase parts or have overhaul work done on other components until they have been thoroughly inspected.* As a general rule, time is the primary cost of an overhaul, so it does not pay to fit worn or sub-standard parts.

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

3 Engine removal - methods and precautions

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

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

3 Cleaning the engine compartment and engine/transmission before beginning the removal procedure will help keep tools clean and organised.

4 An engine hoist or A-frame will also be necessary. Make sure that the equipment is rated in excess of the combined weight of the engine and transmission. Safety is of primary importance, considering the potential hazards involved in removing the engine/transmission from the vehicle.

5 If this is the first time you have removed an engine, an assistant should ideally be available. Advice and aid from someone more experienced would also be helpful. There are many instances when one person cannot simultaneously perform all of the operations required when lifting the engine out of the vehicle.

6 Plan the operation ahead of time. Before starting work, arrange for the hire of, or obtain, all of the tools and equipment you will need. Some of the equipment necessary to perform engine/transmission removal and installation safely and with relative ease (in addition to an engine hoist) is as follows: a heavy-duty trolley jack, complete sets of spanners and sockets as described in the front of this manual, wooden blocks, and plenty of rags and cleaning solvent for mopping up spilled oil, coolant and fuel. If the hoist must be hired, make sure that you arrange for it in advance, and perform all of the operations possible without it beforehand. This will save you money and time.

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

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

9 The engine and transmission is removed from under the vehicle on all models described in this manual.

4 Engine and manual transmission - removal, separation and refitting

Removal

Note: *The engine can be removed from the car only as a complete unit with the transmission; the two are then separated for overhaul. The engine/transmission unit is lowered out of position, and withdrawn from under the vehicle. To allow adequate clearance underneath the vehicle, there should be at least 75 cm between the front bumper and the ground when the vehicle is raised and supported.*

1 Apply the handbrake, then jack up the front of the car and support it on axle stands bearing in mind the note at the start of this Section (see *Jacking and vehicle support*). Remove both front roadwheels.

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

3 Undo all the retaining screws, and remove the undershields from underneath and around the engine.

4 Remove the bonnet as described in Chapter 11.

5 Drain the cooling system (see Chapter 1), saving the coolant if it is fit for re-use.

6 Drain the transmission oil as described in Chapter 1. Refit the drain and filler plugs, and tighten them to their specified torque settings.

7 If the engine is to be dismantled, working as described in Chapter 1, drain the oil and if required remove the oil filter. Clean and refit the drain plug, tightening it to the specified torque.

8 Remove the radiator, complete with hoses and cooling fans, as described in Chapter 3.

9 Working as described in Chapter 5, remove the alternator and disconnect the wiring from the starter motor.

10 Remove the power steering pump as described in Chapter 10.

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

22 Slacken and remove the four bolts and washers securing the centre member to the vehicle body, and lower the assembly away from the engine **(see illustrations)**. On 2.0 litre engines, recover the stopper ring which is fitted between the rear engine/ transmission mounting and its bracket.

23 On 1.6 litre engines, undo the three retaining bolts and remove the mounting bracket from the top of the right-hand engine/ transmission mounting.

24 On all engines, unscrew the nut and through-bolt from the right-hand engine/ transmission mounting, then undo the retaining bolts and remove the mounting assembly from the engine compartment. Recover the rubbers which are fitted to each side of the body mounting bracket, if they are loose.

25 Slacken and remove the through-bolt from the left-hand engine/transmission mounting. Undo the three bolts securing the mounting to the transmission, and manoeuvre the mounting out of position. Recover the rubbers from each side of the mounting bracket, if they are loose.

26 Make a final check that any components which would prevent the removal of the engine/transmission from the car have been removed or disconnected. Ensure that components such as the gearchange link rods are secured so that they cannot be damaged on removal.

27 If available, a low trolley should be placed under the engine/transmission assembly, to facilitate its easy removal from under the vehicle. Lower the engine/transmission assembly, making sure that nothing is trapped or damaged. Enlist the help of an assistant during this procedure, as it may be necessary to tilt the assembly slightly to clear the body panels **(see illustration)**. Great care must be taken to ensure that no components are trapped and damaged during the removal procedure.

28 Withdraw the assembly from under the vehicle.

Separation

29 With the engine/transmission assembly removed, support the assembly on suitable blocks of wood, on a workbench (or failing that, on a clean area of the workshop floor).

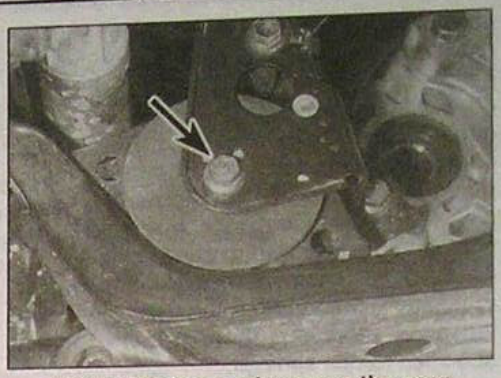
30 Unscrew the retaining bolts, and remove the starter motor from the transmission.

31 Ensure that both engine and transmission are adequately supported, then slacken and remove the bolts securing the transmission housing to the engine. Note the correct fitted positions of each bolt (and, where fitted, the relevant brackets) as they are removed, to use as a reference on refitting.

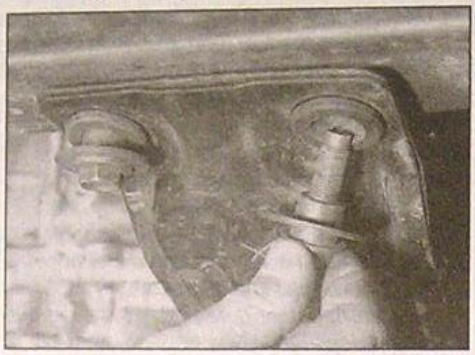
32 Carefully withdraw the transmission from the engine, ensuring that the weight of the transmission is not allowed to hang on the input shaft while it is engaged with the clutch friction disc.

33 If they are loose, remove the locating dowels from the engine or transmission, and keep them in a safe place.

4.21a Prior to removal, mark the position of the front engine/transmission mounting through-bolt (arrowed) on its bracket



4.21b Slacken and remove the rear engine/transmission mounting through-bolt (arrowed)



4.22a Undo the four bolts and washers . . .

4.22b . . . and remove the centre member from underneath the engine/transmission

Refitting

34 If the engine and transmission have been separated, perform the operations described below in paragraphs 35 to 39. If not, proceed as described from paragraph 40 onwards.

35 Apply a smear of high-melting-point grease to the splines of the transmission input shaft. Do not apply too much, otherwise there is a possibility of the grease contaminating the clutch friction plate.

36 Ensure that the locating dowels are correctly positioned in the engine or transmission, and that the release bearing is correctly engaged with the fork.

37 Carefully offer the transmission to the engine, until the locating dowels are engaged. Ensure that the weight of the transmission is not allowed to hang on the input shaft as it is engaged with the clutch friction plate.

4.27 Carefully lower the engine/ transmission downwards and out of position

38 Refit the transmission housing-to-engine bolts, ensuring that all the necessary brackets are correctly positioned, and tighten them to the specified torque setting.

39 Refit the starter motor and tighten the retaining bolts.

40 Position the engine/transmission assembly under the vehicle, then reconnect the hoist and lifting tackle to the engine lifting brackets.

41 With the aid of an assistant, lift the assembly up into the engine compartment, making sure that it clears the surrounding components.

42 Refit the rubbers to the left-hand engine/ transmission mounting bracket, ensuring that their pins are correctly seated in the bracket holes. Manoeuvre the mounting into position, then fit the bolts securing it to the transmission and tighten them to the specified torque setting. Insert the through-bolt and nut, tightening it by hand only at this stage.

43 Fit the rubbers to the right-hand body mounting bracket, ensuring that their pins are correctly seated in the bracket holes. Refit the mounting to the top of its bracket, and tighten its retaining bolts to the specified torque setting. Insert the through-bolt and nut, tightening it by hand only at this stage.

44 Ensure that all the mounting rubbers are in position. On 2.0 litre engines, refit the stopper ring to the rear engine/transmission mounting. Manoeuvre the centre member into position, aligning it with the engine mountings, and refit its mounting bolts and washers. Tighten the centre member mounting bolts to the specified torque **(see illustration overleaf)**.

18 Undo the retaining bolts, and remove the cover plate from the sump flange to gain access to the torque converter retaining bolts. Slacken and remove the visible bolt then, using a socket and extension bar to rotate the crankshaft pulley, undo the remaining bolts securing the torque converter to the driveplate as they become accessible. There are four bolts in total.

19 To ensure that the torque converter does not fall out as the transmission is removed, secure it in position using a length of metal strip bolted to one of the starter motor bolt holes.

20 Ensure that both engine and transmission are adequately supported, then slacken and remove the bolts securing the transmission housing to the engine. Note the correct fitted positions of each bolt (and, where fitted, the relevant brackets) as they are removed, to use as a reference on refitting.

21 Carefully withdraw the transmission from the engine. If they are loose, remove the locating dowels from the engine or transmission, and keep them in a safe place.

Refitting

22 If the engine and transmission have been separated, perform the operations described below in paragraphs 23 to 28. If not, proceed as described from paragraph 29 onwards.

23 Prior to joining, ensure that the torque converter is correctly engaged with the transmission. This can be checked by measuring the distance from the converter mounting bolt holes to the transmission mating surface; if the converter is correctly seated, this distance will be at least 15.9 mm.

24 Ensure that the locating dowels are correctly positioned in the engine or transmission.

25 Carefully offer the transmission to the engine, and engage it on the locating dowels. Refit the transmission housing-to-engine bolts, ensuring that all the necessary brackets are correctly positioned, and tighten them to the specified torque settings.

26 Remove the torque converter retaining strap (where fitted) installed prior to removal. Align the torque converter holes with the those in the driveplate, and install the retaining bolts.

27 Tighten the torque converter retaining bolts to the specified torque setting, then refit the cover plate to the sump and securely tighten its retaining bolts.

28 Refit the starter motor and tighten the retaining bolts.

29 Position the engine/transmission assembly under the vehicle, then reconnect the hoist and lifting tackle to the engine lifting brackets.

30 With the aid of an assistant, lift the assembly up into the engine compartment, making sure that it clears the surrounding components.

31 Refit the rubbers to the left-hand engine/transmission mounting bracket, ensuring that their pins are correctly seated in the bracket holes. Manoeuvre the mounting into position, then fit the bolts securing it to the transmission and tighten them to the specified torque setting. Insert the through-bolt and nut, tightening it by hand only at this stage.

32 Fit the rubbers to the right-hand body mounting bracket, ensuring that their pins are correctly seated in the bracket holes. Refit the mounting to the top of its bracket, and tighten its retaining bolts to the specified torque setting. Insert the through-bolt and nut, tightening it by hand only at this stage.

33 Ensure that all the mounting rubbers are in position, and refit the stopper ring to the rear engine/transmission mounting. Manoeuvre the centre member into position, aligning it with the engine mounting, and refit its mounting bolts and washers. Tighten the mounting bolts to the specified torque.

34 Refit the through-bolt and nut to the rear engine/transmission mounting, tightening it by hand only.

35 Rock the engine/transmission to settle it in position, then tighten the front, right- and left-hand mounting through-bolts to their specified torque settings.

36 The remainder of the refitting procedure is a direct reversal of the removal sequence, noting the following points:

a) Ensuring that the wiring harness is correctly routed and retained by all the relevant retaining clips, and all connectors are correctly and securely reconnected.
b) Prior to refitting the driveshafts to the transmission, renew the driveshaft oil seals as described in Chapter 7B.
c) Ensure that all coolant hoses are correctly reconnected and securely retained by their retaining clips.
d) Adjust the accelerator cable as described in the relevant Part of Chapter 4.
e) Connect and adjust the selector and kick-down cables as described in Chapter 7B.
f) Refit and adjust the auxiliary drivebelt(s) as described in Chapter 1.
g) Refill the engine and transmission with correct quantity and type of lubricant, as described in the relevant Sections of Chapter 1.
h) Refill the cooling system as described in Chapter 1.
i) On completion, start the engine and check for leaks.

6.3a On 2.0 litre models, remove the oil filter housing . . .

6 Engine overhaul - dismantling sequence

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

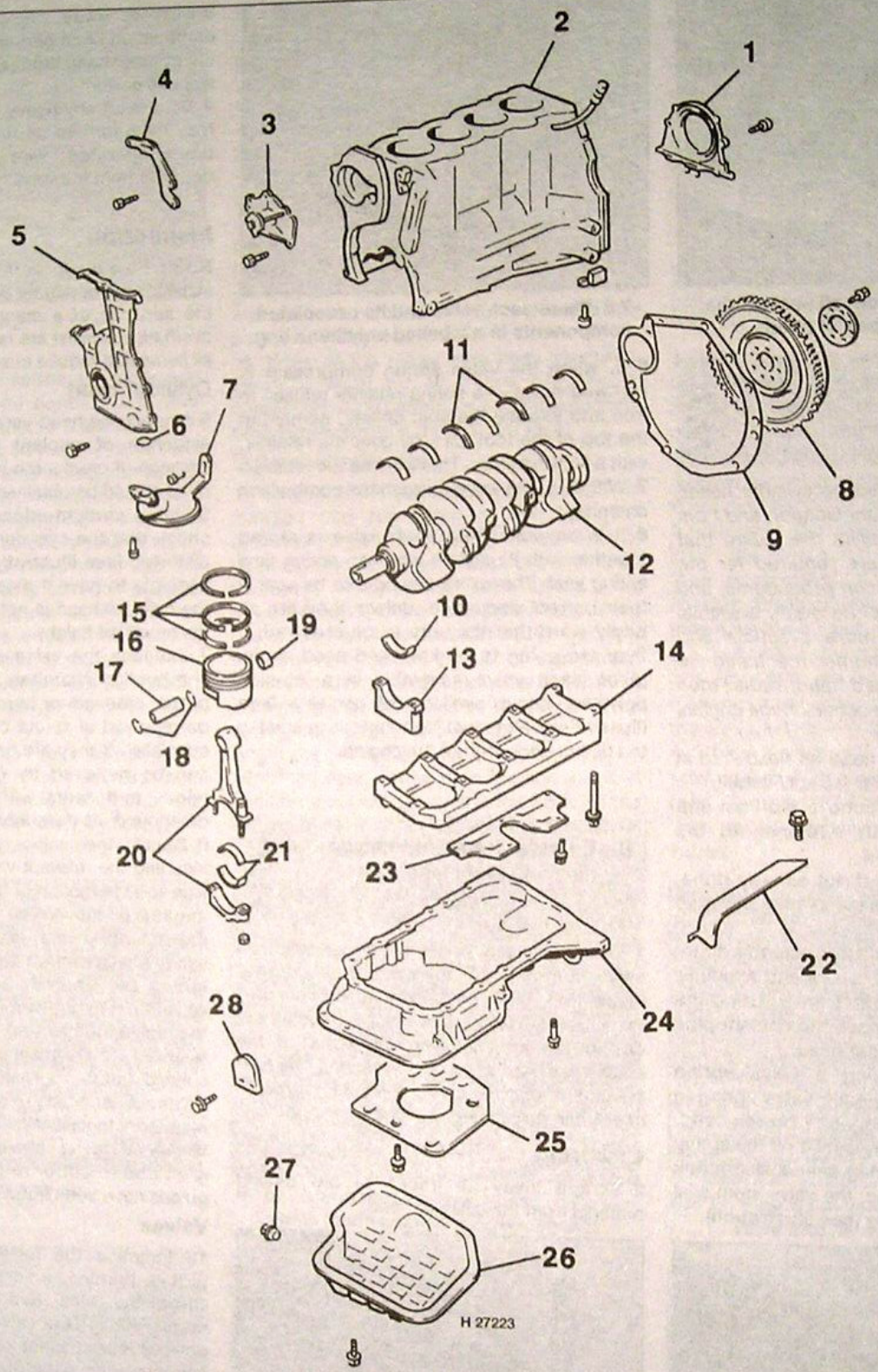
2 If a stand is not available, it is possible to dismantle the engine with it blocked up on a sturdy workbench, or on the floor. Be extra-careful not to tip or drop the engine when working without a stand.

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

a) Alternator, power steering pump and/or air conditioning compressor mounting brackets (as applicable).
b) Distributor, HT leads and spark plugs (Chapters 1 and 5B).
c) Coolant pump and thermostat/coolant outlet housing(s) (Chapter 3).
d) The carburettor/fuel injection system components (see relevant Part of Chapter 4).
e) All electrical switches and sensors, and the engine wiring harness.
f) Inlet and exhaust manifolds (see relevant Part of Chapter 4).
g) Oil filter housing - 2.0 litre engines only.
h) Fuel pump - carburettor engines (Chapter 4A).
i) Engine mountings (Part A or B of this Chapter).
j) Flywheel/driveplate (Part A or B of this Chapter).

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

6.3b . . . and recover the special sealing collars from the cylinder block oil galleries



6.3d Exploded view of the cylinder block and associated components - 2.0 litre (Phase II) engine

1 Oil seal housing
2 Cylinder block
3 Coolant pump
4 Alternator bracket
5 Timing chain cover
6 O-ring
7 Oil pump pick-up/strainer
8 Flywheel/driveplate
9 Cover plate
10 Main bearing inserts
11 Crankshaft thrustwashers
12 Crankshaft
13 Main bearing caps
14 Main bearing ladder
15 Piston rings
16 Piston
17 Gudgeon pin
18 Circlips
19 Small-end bush
20 Connecting rod and big-end cap
21 Big-end bearing inserts
22 Oil baffle plate
23 Oil baffle plate
24 Aluminium sump
25 Baffle plate
26 Pressed-steel sump
27 Drain plug
28 Cover plate

8.14 Grinding-in a valve

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

13 Valve grinding is carried out as follows. Place the cylinder head upside-down on a bench.

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

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

16 When all the valves have been ground-in, carefully wash off *all* traces of grinding compound using paraffin or a suitable solvent, before reassembling the cylinder head.

Valve components

17 Examine the valve springs for signs of damage and discoloration. The specified Nissan procedure for checking the condition of valve springs involves measuring the force necessary to compress each spring to a specified height. This is not possible without the use of the Nissan special test equipment, and therefore spring checking must be entrusted to a Nissan dealer. A rough idea of the condition of the spring can be gained by measuring the spring free length, and comparing it to the length given in this Chapter's Specifications.

18 Stand each spring on a flat surface, and position a square alongside the edge of the spring. Measure the gap between the upper edge of the spring and the square, and compare it to the out-of-square limit given in the Specifications.

19 If any of the springs are damaged, distorted or have lost their tension, obtain a complete new set of springs. It is normal to renew the valve springs as a matter of course if a major overhaul is being carried out.

20 Renew the valve stem oil seals regardless of their apparent condition.

9 Cylinder head - reassembly

1 Refit the spring seat then, working on the first valve, dip the new valve stem seal in fresh engine oil. Carefully locate it over the valve and onto the guide. Take care not to damage the seal as it is passed over the valve stem. Use a suitable socket or metal tube to press the seal firmly onto the guide **(see illustrations)**.

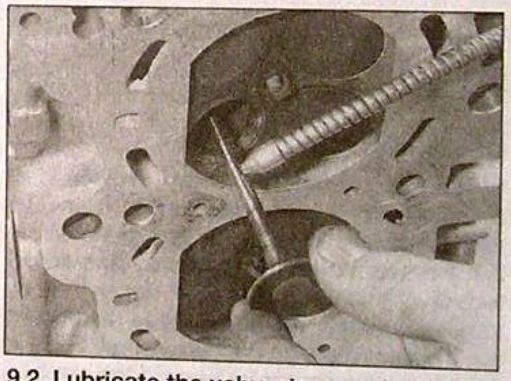
2 Lubricate the stems of the valves, and insert the valves into their original locations **(see illustration)**. If new valves are being fitted, insert them into the locations to which they have been ground.

3 Locate the valve spring on top of its seat, ensuring that the spring is fitted with its closer-pitched coils at the bottom, then refit the spring retainer **(see illustrations)**.

4 Compress the valve spring, and locate the split collets in the recess in the valve stem **(see illustration)**. Release the compressor, then repeat the procedure on the remaining valves.

9.1a Fit the spring seat . . .

9.1b . . . and press a new oil seal onto the valve guide using a suitable socket

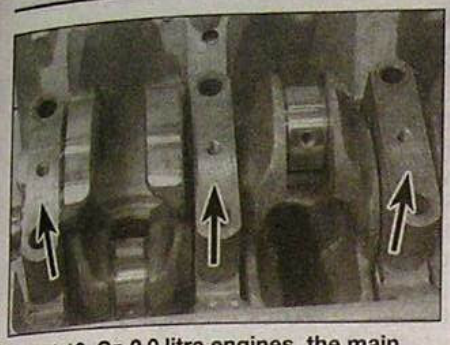


9.2 Lubricate the valve stem, and slide the valve into its respective guide

9.3a Fit the spring with its closer-pitched coils at the bottom . . .

9.3b . . . and fit the spring retainer

9.4 Install the collets, noting the use of grease to help keep the collets in position



11.13 On 2.0 litre engines, the main bearing caps should be numbered 1 to 5 (arrowed)

11.15 Lifting the crankshaft out of position

12.7 Cleaning a cylinder block threaded hole using a suitable tap

each cap in some way as 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.

14 Withdraw the bearing caps, and recover the lower main bearing shells. Tape each shell to its respective cap for safe-keeping.

15 Carefully lift out the crankshaft, taking care not to displace the upper main bearing shells **(see illustration)**.

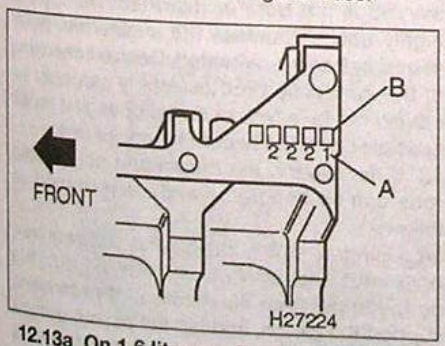
16 Recover the upper bearing shells from the cylinder block, and tape them to their respective caps for safe-keeping. Remove the thrustwasher halves from the side of No 3 main bearing, and store them with the bearing cap.

12 Cylinder block/crankcase - cleaning and inspection

Cleaning

1 Remove all external components and electrical switches/sensors from the block. For complete cleaning, the core plugs should ideally be removed. Drill a small hole in the plugs, then insert a self-tapping screw into the hole. Pull out the plugs by pulling on the screw with a pair of grips, or by using a slide hammer.

2 Scrape all traces of sealant from the cylinder block/crankcase, and from the main bearing ladder (where fitted), taking care not to damage the gasket/sealing surfaces.



12.13a On 1.6 litre models, cylinder bore grades can be determined from the four-digit code (A) stamped on the base of the block. The five-digit code (B) is for the main bearing bores

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

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

5 After the castings are returned, clean all oil holes and oil galleries one more time. Flush all internal passages with warm water until the water runs clear. Dry thoroughly, and apply a light film of oil to all mating surfaces and the cylinder bores, to prevent rusting. If you have access to compressed air, use it to speed up the drying process, and to blow out all the oil holes and galleries.

Warning: Wear eye protection when using compressed air!

6 If the castings are not very dirty, you can do an adequate cleaning job with hot (as hot as you can stand!), soapy water and a stiff brush. Take plenty of time, and do a thorough job. Regardless of the cleaning method used, be sure to clean all oil holes and galleries very thoroughly, and to dry all components well. Protect the cylinder bores as described above, to prevent rusting.

7 All threaded holes must be clean, to ensure accurate torque readings during reassembly. To clean the threads, run the correct-size tap into each of the holes to remove rust, corrosion, thread sealant or sludge, and to restore damaged threads **(see illustration).** If possible, use compressed air to clear the holes of debris produced by this operation.

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A good alternative is to inject an aerosol water-dispersant lubricant into each hole, using the long tube usually supplied.

Warning: Wear eye protection when cleaning out these holes in this way!

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

9 If the engine is not going to be reassembled right away, cover it with a large plastic bag to keep it clean; protect all mating surfaces and the cylinder bores as described above, to prevent rusting.

Inspection

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

11 Check each cylinder bore for scuffing and scoring. Check for signs of a wear ridge at the top of the cylinder, indicating that the bore is excessively worn.

12 Check the bore of each cylinder for scuffing and scoring.

13 Measure the diameter of each cylinder bore 10 mm from the top of the bore, both parallel to the crankshaft axis and at right-angles to it. Repeat the procedure measuring the bore diameter 60 mm from the top, and then 100 mm from the top, so that a total of six measurements are taken. Using the measurements obtained, calculate the cylinder taper and cylinder out-of-round dimensions. **Note:** *The cylinder bore grades are stamped on the cylinder block. On 1.6 litre engines, the grades are stamped on the flywheel end of the cylinder block base; there are two sets of codes - the four-digit code is for the cylinder bores, the first number in the sequence is for No 1 cylinder and the last for No 4 (the five-digit code is for the cylinder block main bearing bores - see Section 18). On 2.0 litre engines, the grades are stamped on the cylinder block upper gasket face, at the front of each bore* **(see illustrations)**.

12.13b On 2.0 litre models, the cylinder bore grades (arrowed) are stamped on the cylinder head mating surface

13.14 **Prise out the circlips, then press the gudgeon pin out of the piston**

15 Examine the gudgeon pin, piston bore and connecting rod small-end bearing for signs of wear or damage. If the necessary measuring equipment is available, the amount of wear can be assessed by direct measurement, and the piston-to-gudgeon pin, and gudgeon pin-to-small-end clearances can be calculated.

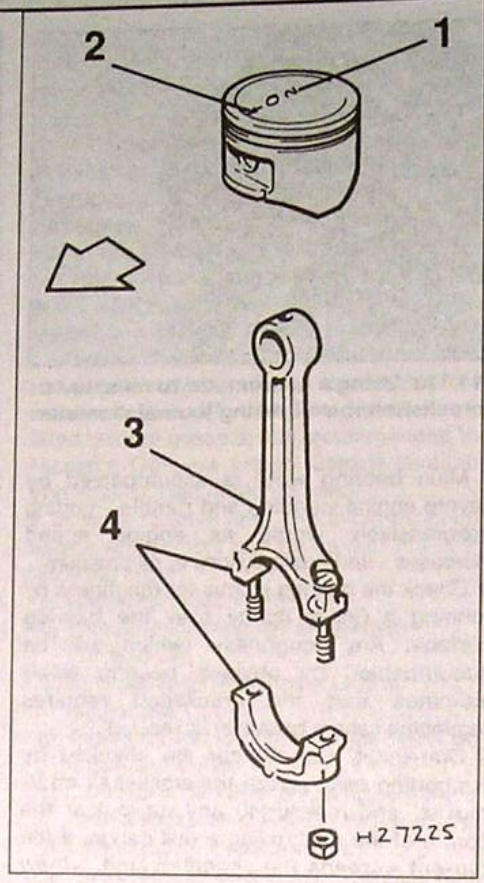
16 If the gudgeon pin and connecting rod small-end bush are worn or the specified clearance is exceeded, this can be cured by renewing both the pin and bush. Bush renewal, however, is a specialist job - press facilities are required, and the new bush must be reamed accurately.

17 If the gudgeon pin-to-piston clearance is greatly exceeded, both the piston and pin should be renewed as a matched pair. Note that this clearance is not as critical as the gudgeon pin-to-small-end clearance, since the pin is retained by circlips.

18 The connecting rods themselves should not need renewal, unless seizure or some other major mechanical failure has occurred. Check the alignment of the connecting rods visually, and if the rods are not straight, take them to an engine overhaul specialist for a more detailed check.

19 Examine all components, and obtain any new parts from your Nissan dealer.

20 Position the piston so that the front marking on the piston crown (either in the form of an arrow or a dot) is positioned correctly in relation to the oil hole in the connecting rod shaft **(see illustrations)**. With the piston and rod correctly mated, the piston front marking will face towards the timing chain end of the engine, and the connecting rod oil hole will face the rear of the cylinder block.

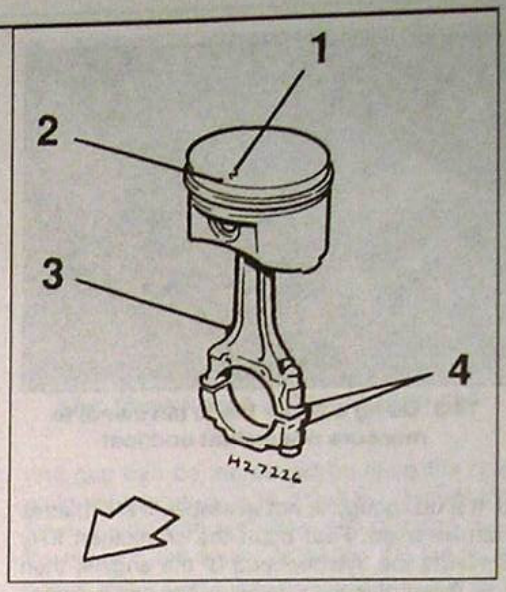


13.20a **Correct connecting rod/piston fitting orientation - 1.6 litre models**

1 Piston grade number
2 Front marking (arrowed)
3 Connecting rod oil hole
4 Connecting rod cylinder number marking (maybe on opposite side of rod)

21 Apply a smear of clean engine oil to the gudgeon pin. Slide it into the piston and through the connecting rod small-end **(see illustration)**. **Note:** *Gudgeon pin installation will be greatly eased if the piston is first warmed (see paragraph 14).* If necessary, tap the pin into position using a hammer and suitable punch, whilst ensuring that the piston is securely supported.

22 Check that the piston pivots freely on the rod, then secure the gudgeon pin in position with two new circlips **(see illustration)**. Ensure that each circlip is correctly located in its groove in the piston.



13.20b **Correct connecting rod/piston fitting orientation - 2.0 litre models**

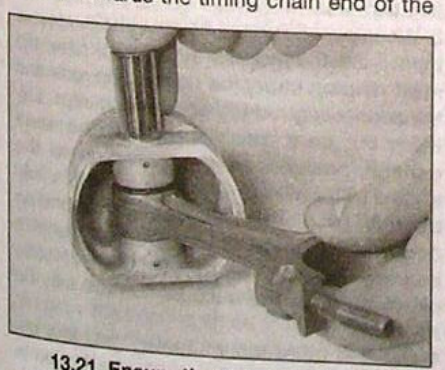
1 Piston grade number
2 Front marking (arrowed)
3 Connecting rod oil hole
4 Connecting rod cylinder number marking (maybe on opposite side of rod)

14 Crankshaft - inspection

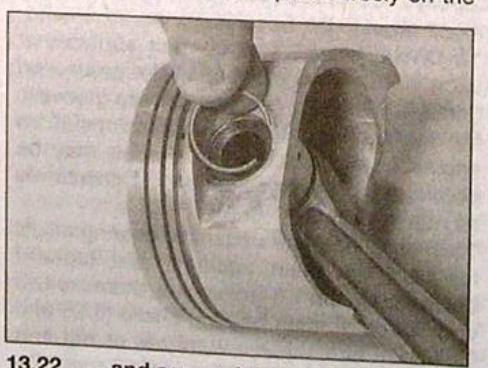
Checking crankshaft endfloat

1 If the crankshaft endfloat is to be checked, this must be done when the crankshaft is still installed in the cylinder block/crankcase, but is free to move (see Section 11).

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



13.21 **Ensure that the piston and connecting rod are correctly mated, then press the gudgeon pin into position . . .**



13.22 **. . . and secure it in position with two new circlips**

14.2 **Using a dial gauge to measure crankshaft endfloat**

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

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

6 Driving habits can have a definite effect on bearing life. Full-throttle, low-speed operation (labouring the engine) puts very high loads on bearings, tending to squeeze out the oil film. These loads cause the bearings to flex, which produces fine cracks in the bearing face (fatigue failure). Eventually, the bearing material will loosen in pieces, and tear away from the steel backing.

7 Short-distance driving leads to corrosion of bearings, because insufficient engine heat is produced to drive off the condensed water and corrosive gases. These products collect in the engine oil, forming acid and sludge. As the oil is carried to the engine bearings, the acid attacks and corrodes the bearing material.

8 Incorrect bearing installation during engine assembly will lead to bearing failure as well. Tight-fitting bearings leave insufficient bearing running clearance, and will result in oil starvation. Dirt or foreign particles trapped behind a bearing shell result in high spots on the bearing, which lead to failure.

9 *Do not* touch any shell's bearing surface with your fingers during reassembly; there is a risk of scratching the delicate surface, or of depositing particles of dirt on it.

10 As mentioned at the beginning of this Section, the bearing shells should be renewed as a matter of course during engine overhaul; to do otherwise is false economy. Refer to Section 17 for details of bearing shell selection.

16 Engine overhaul - reassembly sequence

1 Before reassembly begins, ensure that all new parts have been obtained, and that all necessary tools are available. Read through the entire procedure, to familiarise yourself with the work involved, and to ensure that all items necessary for reassembly of the engine are at hand. In addition to all normal tools and materials, thread-locking compound will be needed. A suitable tube of liquid sealant will also be required for the joint faces that are fitted without gaskets; it is recommended that Nissan's Genuine Liquid Gasket (available from your Nissan dealer) is used.

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

a) Crankshaft (Section 18).
b) Piston/connecting rod assemblies (Section 19).
c) Cylinder head (See Part A or B as applicable).
d) Timing chain(s) and cover (See Part A or B - as applicable).
e) Sump (See Part A or B - as applicable).
f) Flywheel (See Part A or B - as applicable).
g) Engine external components.

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

17 Piston rings - refitting

1 Before fitting new piston rings, the ring end gaps must be checked as follows.

2 Lay out the piston/connecting rod assemblies and the new piston ring sets, so that the ring sets will be matched with the same piston and cylinder during the end gap measurement and subsequent engine reassembly.

3 Insert the top ring into the first cylinder, and push it down the bore using the top of the piston. This will ensure that the ring remains square with the cylinder walls. Push the ring down into the bore until the piston skirt is level with the block mating surface, then withdraw the piston.

4 Measure the end gap using feeler gauges, and compare the measurements with the figures given in the Specifications **(see illustration)**.

5 If the gap is too small (unlikely if genuine Nissan parts are used), it must be enlarged, or the ring ends may contact each other during engine operation, causing serious damage. Ideally, new piston rings providing the correct end gap should be fitted. As a last resort, the

17.4 Measuring a piston ring end gap

end gap can be increased by filing the ring ends very carefully with a fine file. Mount the file in a vice with soft jaws, slip the ring over the file with the ends contacting the file face, and slowly move the ring to remove material from the ends. Take care, as piston rings are sharp, and are easily broken.

6 With new piston rings, it is unlikely that the end gap will be too large. If the gaps are too large, check that you have the correct rings for your engine and for the particular cylinder bore size.

7 Repeat the checking procedure for each ring in the first cylinder, and then for the rings in the remaining cylinders. Remember to keep rings, pistons and cylinders matched up.

8 Once the ring end gaps have been checked and if necessary corrected, the rings can be fitted to the pistons. **Note:** *Always follow any instructions supplied with the new piston ring sets - different manufacturers may specify different procedures. Do not mix up the top and second compression rings, as they have different cross-sections.*

9 The oil control ring (lowest on the piston) is installed first. It is composed of three separate components. Slip the expander into the groove, then install the upper side rail into the groove between the expander and the ring land, then install the lower side rail in the same manner **(see illustrations)**.

10 Install the second ring next. **Note:** *The second ring and top ring are different, and can be identified by their cross-sections.* Making sure the ring is the correct way up (on 2.0 litre engines, the ring identification marking should be facing upwards), fit the ring into the middle

17.9a Fit the oil control ring expander . . .

Crankshaft code	Block code	Bearing shell grade
2.0 litre engine		
0	0	Black
0	1	Brown
0	2	Green
0	3	Yellow
1	0	Brown
1	1	Green
1	2	Yellow
1	3	Blue
2	0	Green
2	1	Yellow
2	2	Blue
2	3	Pink
3	0	Yellow
3	1	Blue
3	2	Pink
3	3	White (or no colour)

Main bearing running clearance check

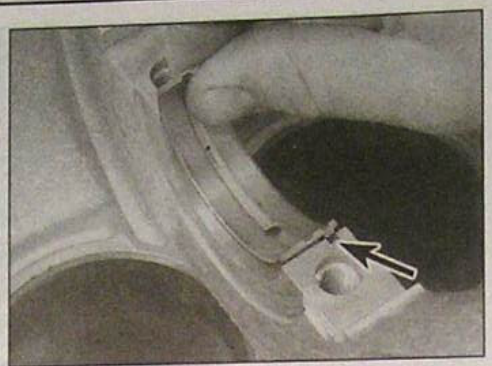
5 Clean the backs of the bearing shells, and the bearing locations in both the cylinder block and the main bearing caps.

6 Press the bearing shells into their locations, ensuring that the tab on each shell engages in the notch in the cylinder block/crankcase or main bearing ladder location. Take care not to touch any shell's bearing surface with your fingers. Note that all the upper bearing shells are grooved, and have oil holes in them; the lower shells are plain **(see illustrations)**. If the original bearing shells are being used for the check, ensure that they are refitted in their original locations. The clearance can be checked in either of two ways.

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

8 The second (and more accurate) method is to use an American product called Plastigauge. This consists of a fine thread of perfectly-round plastic, which is compressed between the bearing shell and the journal. When the shell is removed, the plastic is deformed, and can be measured with a special card gauge supplied with the kit. The running clearance is determined from this gauge. Plastigauge should be available from your Nissan dealer; otherwise, enquiries at one of the larger specialist motor factors should produce the name of a stockist in your area. The procedure for using Plastigauge is as follows.

9 With the main bearing upper shells in place, carefully lay the crankshaft in position. Do not



18.6a Fit the upper grooved bearing shells, aligning their tabs with the crankcase cut-outs (arrowed) . . .

18.6b . . . and fit the lower plain shells to the caps, also aligning their tabs with the cap cut-outs (arrowed)

use any lubricant; the crankshaft journals and bearing shells must be perfectly clean and dry.

10 Cut several lengths of the appropriate-size Plastigauge (they should be slightly shorter than the width of the main bearings), and place one length on each crankshaft journal axis **(see illustration)**.

11 On 1.6 litre engines, with the main bearing lower shells in position, refit the main bearing caps using the identification markings to ensure each cap is fitted correctly. Refit the main bearing cap bolts and, working in the sequence shown in illustration 18.27, tighten them evenly and progressively to the specified torque setting. Take care not to disturb the Plastigauge, and do not rotate the crankshaft at any time during this operation.

12 On 2.0 litre engines, with the main bearing lower shells in position, refit the main bearing caps using the identification markings to ensure each cap is fitted correctly. Fit the main bearing ladder casting (where applicable), then install the retaining bolts and tighten them as described in paragraphs 35 to 37. Take care not to disturb the Plastigauge, and do not rotate the crankshaft at any time during this operation.

13 On all engines, working in reverse to the sequence shown in illustration 18.27 or 18.35a (as applicable), progressively slacken the bearing cap retaining bolts by one turn at a time. Once all bolts are loose, unscrew them and remove them from the cylinder block.

14 Remove the main bearing ladder/caps (as applicable), again taking great care not to disturb the Plastigauge, nor to rotate the crankshaft.

18.10 Plastigage in place on a crankshaft journal main bearing

15 Compare the width of the crushed Plastigauge on each journal to the scale printed on the Plastigauge envelope, to obtain the main bearing running clearance. Compare the clearance measured with that given in the Specifications at the start of this Chapter **(see illustration)**.

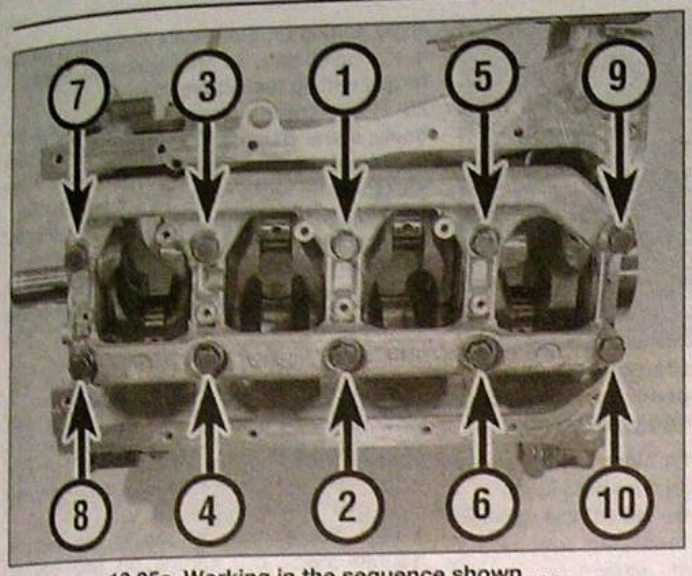
16 If the clearance is not as specified, the bearing shells may be the wrong size (or excessively worn, if the original shells are being re-used). Before deciding that different-size shells are required, make sure that no dirt or oil was trapped between the bearing shells and the main bearing ladder or block when the clearance was measured. If the Plastigauge was wider at one end than at the other, the crankshaft journal may be tapered.

17 If the clearance is not as specified with the original bearing shells, repeat the checking procedure using new bearing shells. If the clearance is not as specified even with new bearing shells, then seek the advice of a Nissan dealer or suitable engine overhaul specialist. They will be able to advise you on the best course of action, and whether or not it will be necessary to have the crankshaft journals reground and fit undersize shells.

18 Where necessary, obtain the required grades of bearing shell, and repeat the running clearance checking procedure as described above.

19 On completion, carefully scrape away all traces of the Plastigauge material from the crankshaft and bearing shells. Use your fingernail, or a wooden or plastic scraper which is unlikely to score the bearing surfaces.

18.15 Measuring the width of the deformed Plastigage using the scale on the card provided



18.35a Working in the sequence shown . . .

18.35b . . . tighten the main bearing cap bolts to the Stage 1 torque setting . . .

progressively slacken all the bolts completely working in the reverse of the tightening sequence. Again, working progressively and in the sequence shown, tighten the bolts to their Stage 3 torque setting. Finally tighten the bolts in sequence through the specified Stage 4 angle setting.

38 Check that the crankshaft rotates freely before proceeding, then install the remaining components as described in paragraphs 28 to 32.

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

Note: *This information applies only to standard size bearing shells. Undersize shells are not graded.*

Selection of new bearing shells

1 New bearing shells are selected using the identification marks on the crankshaft.

2 The crankshaft markings are stamped either on the side of No 1 cylinder crankweb (at the timing chain end of the crankshaft) or on the side of No 4 cylinder crankweb (at the flywheel/driveplate end of the crankshaft). The four-digit code refers to the big-end (crankpin) journal diameters - the first number in the sequence is for No 1 crankpin, and the last for No 4 crankpin. The five-digit code stamped on No 1 cylinder crankweb refers to main bearing journal sizes (see Section 18).

3 Obtain the identification number of both the relevant crankshaft journal and the cylinder block bearing bore, and select the correct grade of bearing shell required for each journal using the relevant following table. The grade of each shell is indicated by a dab of paint on the side of the shell.

Crankshaft code	Bearing shell grade
0	Black
1	Brown
2	Green

Big-end bearing running clearance check

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

5 Press the bearing shells into their locations, ensuring that the tab on each shell engages in the recess in the connecting rod and cap **(see illustration)**. Take care not to touch any shell's bearing surface with your fingers, and ensure that the shells are correctly installed so that the upper shell oil hole is correctly aligned with connecting rod oil hole. If the original bearing shells are being used for the check, ensure that they are refitted in their original locations. The clearance can be checked in either of two ways.

6 One method is to refit the big-end bearing cap to the connecting rod, ensuring that they are fitted the correct way round, with the bearing shells in place. With the cap retaining nuts correctly tightened, use an internal micrometer or vernier caliper to measure the internal diameter of each assembled pair of bearing shells. If the diameter of each corresponding crankshaft journal is measured and then subtracted from the bearing internal diameter, the result will be the big-end bearing running clearance.

7 The second, and more accurate, method is to use Plastigauge (see Section 18).

8 Ensure that the bearing shells are correctly fitted. Place a strand of Plastigauge on each (cleaned) crankpin journal.

9 Refit the (clean) piston/connecting rod assemblies to the crankshaft, and refit the big-end bearing caps, using the marks made or noted on removal to ensure that they are fitted the correct way round.

10 Tighten the bearing cap nuts as described below in paragraph 22. Take care not to disturb the Plastigauge, nor to rotate the connecting rod during the tightening sequence.

11 Dismantle the assemblies without rotating the connecting rods. Use the scale printed on the Plastigauge envelope to obtain the big-end bearing running clearance.

12 If the clearance is not as specified, the bearing shells may be the wrong size (or excessively worn, if the original shells are being re-used). Make sure that no dirt or oil was trapped between the bearing shells and

18.36 . . . and then tighten them through the specified Stage 2 angle setting as described in text

19.5 Fit each bearing shell to its connecting rod, aligning its tab with the rod cut-out (arrowed)

19.19 Ensure that the piston rings end gaps are correctly spaced, then clamp them in position with piston ring compressor

19.20 Insert the piston/connecting rod assembly into its respective cylinder, and gently tap it into position

the caps or connecting rods when the clearance was measured. If the Plastigauge was wider at one end than at the other, the crankpins may be tapered.

13 If the clearance is not as specified with the original bearing shells, repeat the checking procedure using new bearing shells. If the clearance is not as specified even with new bearing shells, then seek the advice of a Nissan dealer or suitable engine overhaul specialist. They will be able to advise you on the best course of action, and whether or not it will be necessary to have the crankpin journals reground and fit undersize shells.

14 Where necessary, obtain the required grades of bearing shell, and repeat the running clearance checking procedure as described above.

15 On completion, carefully scrape away all traces of the Plastigauge material from the crankshaft and bearing shells. Use your fingernail, or a wooden or plastic scraper which is unlikely to score the bearing surfaces.

Final piston/ connecting rod refitting

16 Note that the following procedure assumes that the crankshaft and main bearing ladder/caps are in place (see Section 18).

17 Ensure that the bearing shells are correctly fitted as described in paragraphs 4 and 5. If new shells are being fitted, ensure that all traces of the protective grease are cleaned off using paraffin. Wipe dry the shells and connecting rods with a lint-free cloth.

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

19 Start with assembly No 1. Make sure that the piston rings are still spaced as described in Section 17, then clamp them in position with a piston ring compressor **(see illustration)**.

20 Insert the piston/connecting rod assembly into the top of cylinder No 1. Ensure that the piston front marking (in the form of either an arrow or a dot) on the piston crown is on the timing chain side of the bore. Using a block of wood or hammer handle against the piston crown, tap the assembly into the cylinder until the piston crown is flush with the top of the cylinder **(see illustration)**.

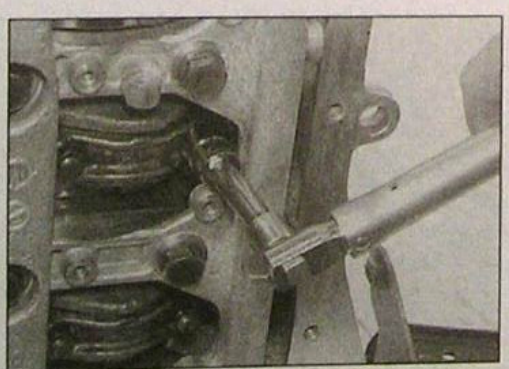
21 Ensure that the bearing shell is still correctly installed. Liberally lubricate the crankpin and both bearing shells. Taking care not to mark the cylinder bores, tap the piston/connecting rod assembly down the bore and onto the crankpin. Refit the big-end bearing cap, tightening its retaining nuts finger-tight at first. Note that the faces with the identification marks must match (which means that the bearing shell locating tabs abut each other).

22 Tighten the bearing cap retaining nuts to their Stage 1 torque setting, using a torque wrench and suitable socket. Then tighten them either through the specified Stage 2 angle setting or, if an angle-measuring gauge is not available, to the specified Stage 2 torque setting **(see illustrations)**.

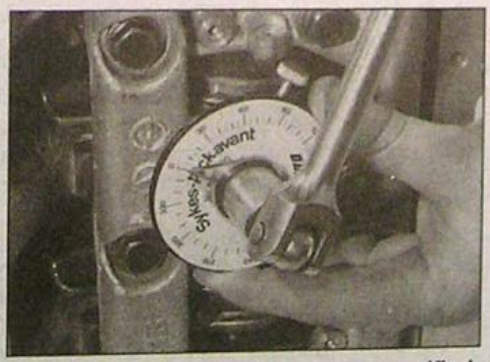
23 Rotate the crankshaft. Check that it turns freely; some stiffness is to be expected if new components have been fitted, but there should be no signs of binding or tight spots.

24 Refit the remaining three piston/connecting rod assemblies in the same way.

25 Refit the cylinder head, timing chain(s) and sump as described in Part A or B of this Chapter (as applicable).



19.22a Evenly and progressively tighten the big-end bearing cap retaining nuts to the specified Stage 1 torque setting . . .



19.22b . . . and then through the specified Stage 2 angle setting

20 Engine - initial start-up after overhaul

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

2 Remove the spark plugs, and disable the ignition system by disconnecting the ignition HT coil lead from the distributor cap, and earthing it on the cylinder block. Use a jumper lead or similar wire to make a good connection.

3 Turn the engine on the starter until the oil pressure warning light goes out. Refit the spark plugs, and reconnect the spark plug (HT) leads, referring to Chapter 1 for further information. Reconnect the HT leads to the distributor.

4 Start the engine, noting that this may take a little longer than usual, due to the fuel system components having been disturbed.

5 While the engine is idling, check for fuel, water and oil leaks. Don't be alarmed if there are some odd smells and smoke from parts getting hot and burning off oil deposits.

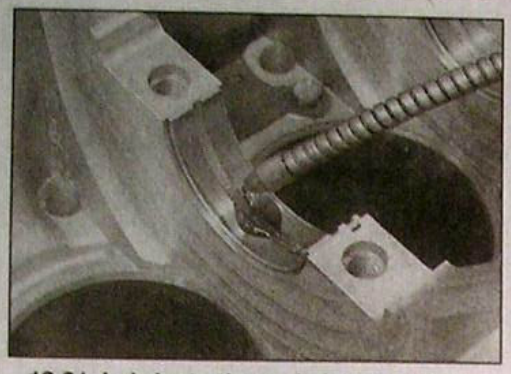
6 Assuming all is well, keep the engine idling until hot water is felt circulating through the top hose, then switch off the engine.

7 Check the ignition timing and the idle speed settings (as appropriate), then switch the engine off.

8 After a few minutes, recheck the oil and coolant levels as described in Chapter 1, and top-up as necessary.

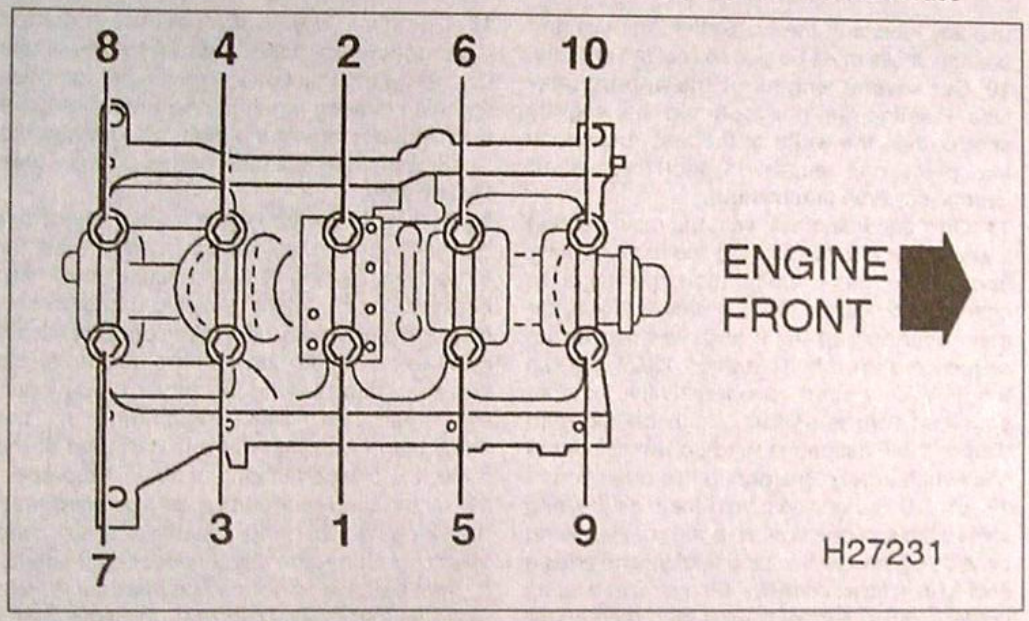
9 If they were tightened as described, there is no need to re-tighten the cylinder head bolts once the engine has first run after reassembly.

10 If new pistons, rings or crankshaft bearings have been fitted, the engine must be treated as new, and run-in for the first 500 miles (800 km). *Do not* operate the engine at full-throttle, or allow it to labour at low engine speeds in any gear. It is recommended that the oil and filter be changed at the end of this period.



18.21 Lubricate the main bearing shells with clean engine oil . . .

18.22 . . . then fit the thrustwasher halves, making sure that their grooved faces are facing away from the crankcase



18.27 Main bearing cap bolt tightening sequence - 1.6 litre engine

Final crankshaft refitting

1.6 litre engine

20 Carefully lift the crankshaft out of the cylinder block once more.

21 Place the bearing shells in their locations as described in paragraph 5 and 6. If new shells are being fitted, ensure that all traces of protective grease are cleaned off using paraffin. Wipe dry the shells and connecting rods with a lint-free cloth. Liberally lubricate each bearing shell in the cylinder block/crankcase with clean engine oil **(see illustration)**.

22 Using a little grease, stick the upper thrustwashers to each side of the No 3 main bearing upper location; ensure that the oilway grooves on each thrustwasher face outwards (away from the cylinder block) **(see illustration)**.

23 Lower the crankshaft into position, and check the crankshaft endfloat as described in Section 14.

18.34a On 2.0 litre engines, fit the main bearing caps using their markings to ensure each is correctly positioned . . .

18.34b . . . then (where applicable) refit the main bearing ladder, and install the retaining bolts and washers

24 Thoroughly degrease the mating surfaces of the cylinder block and the main bearing caps.

25 Lubricate the lower bearing shells in the main bearing caps with clean engine oil. Make sure that the locating lugs on the shells engage with the corresponding recesses in the caps.

26 Fit the main bearing caps, using the identification marks to ensure that they are installed in the correct locations and are fitted the correct way round. Insert the retaining bolts, tightening them by hand only.

27 Working in the sequence shown, tighten the bearing cap retaining bolts to approximately half the specified torque setting **(see illustration)**. Then go around in the same sequence and tighten the bolts to the full specified torque setting. Check that the crankshaft rotates freely before proceeding any further.

28 Fit the piston/connecting rod assemblies as described in Section 19.

29 Ensure that the mating surfaces of the rear oil seal housing and cylinder block are clean and dry. Note the correct fitted depth of the oil seal then, using a large flat-bladed screwdriver, lever the seal out of the housing.

30 Fit the new crankshaft seal to the housing, making sure that its sealing lip is facing inwards. Tap the seal squarely into the housing until it is positioned at the same depth as the original was noted prior to removal.

31 Apply a bead of suitable sealant to the oil seal housing mating surface, and make sure that the locating dowels are in position. Slide the housing over the end of the crankshaft, and into position on the cylinder block. Tighten the housing retaining bolts to the specified torque setting.

32 Refit the flywheel, timing chains and sump as described in Part A of this Chapter.

2.0 litre engine

33 Carry out the operations described above in paragraphs 20 to 25.

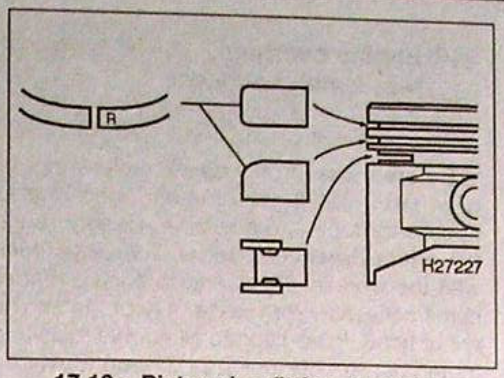
34 Fit the main bearing caps, using the identification marks to ensure that they are installed in the correct locations and are fitted the correct way round. Refit the main bearing ladder casting, and install the retaining bolts, tightening them by hand only at this stage **(see illustrations)**.

35 Working progressively and in the sequence shown, tighten the main bearing retaining bolts to their Stage 1 torque setting, using a torque wrench and suitable socket **(see illustrations)**.

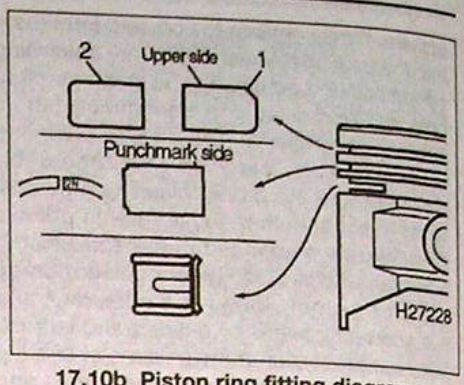
36 Working again in the specified sequence, tighten the main bearing cap bolts through the specified Stage 2 angle setting **(see illustration)**. On Phase I and Phase II models, if an angle-measuring gauge is not available, tighten the bolts in sequence to the specified Stage 2 torque setting.

37 On Phase III models, once the bolts have been tightened to the Stage 2 angle setting

17.9b . . . then install the side rails as described in text

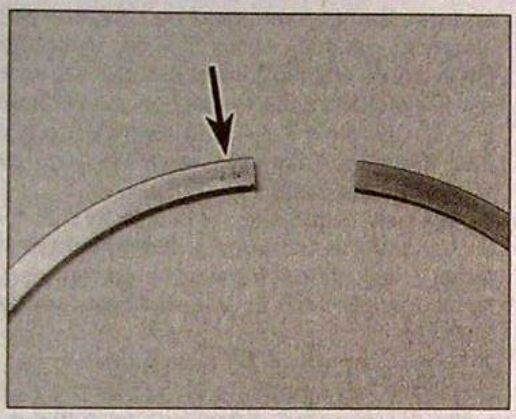


17.10a Piston ring fitting diagram - 1.6 litre engine

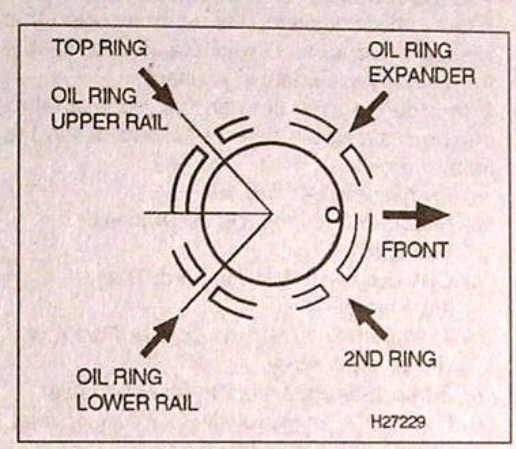


17.10b Piston ring fitting diagram - 2.0 litre engine

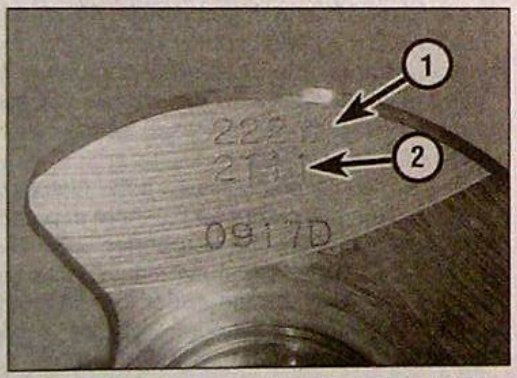
1 SR20DE engine
2 SR20Di and SR20De engines



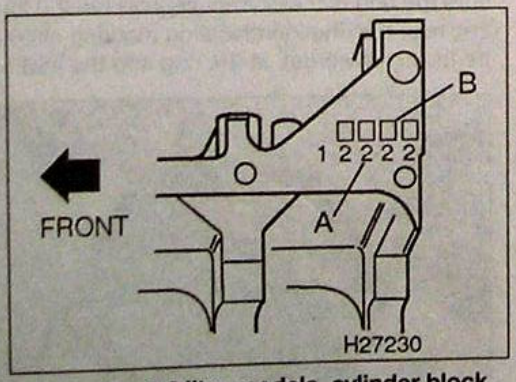
17.10c Where necessary, ensure that the rings are installed with their identification marking (arrowed) uppermost



17.12 Position the piston ring end gaps as shown



18.2 Crankshaft main bearing journal codes (1) and big-end bearing journal codes (2)



18.3a On 1.6 litre models, cylinder block main bearing bore grades can be determined from the five-digit code (A) stamped on the base of the block. The four-digit code (B) is for the cylinder bore grades

groove on the piston, taking care not to expand the ring any more than is necessary **(see illustrations)**.

11 Install the top ring in the same way, making sure the ring is the correct way up. Where the ring is symmetrical, fit it with its identification marking facing upwards.

12 With all the rings in position on the piston, space the ring end gaps as shown **(see illustration)**.

13 Repeat the above procedure for the remaining pistons and rings.

18 Crankshaft - refitting and main bearing running clearance check

Selection of new bearing shells

Note: *This information applies only to standard size bearing shells. Undersize shells are not graded.*

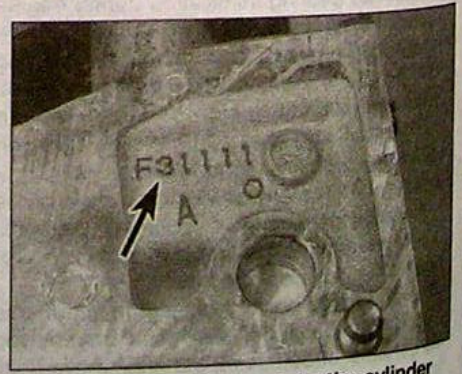
1 New bearing shells are selected using the identification marks on the crankshaft and cylinder block.

2 The crankshaft markings are stamped on the side of No 1 cylinder crankweb (at the timing chain end of the crankshaft). The five-digit code refers to the main bearing journal diameters - the first number in the sequence is for No 1 bearing journal, and the last for No 5 journal **(see illustration)**. **Note:** *On some engines, there is also a four-digit code stamped on the web; these numbers are for the big-end bearing (crankpin) journals (see Section 19).*

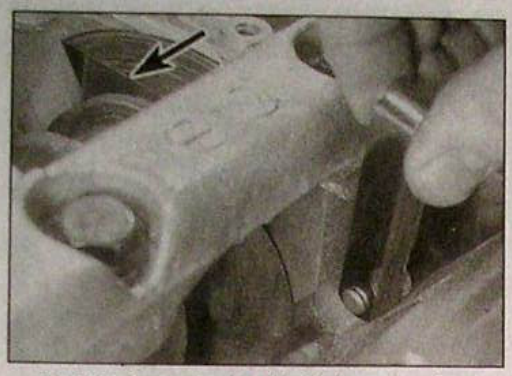
3 The cylinder block markings are stamped on the flywheel end of the cylinder block base. On 1.6 litre engines, there are two sets of codes; the five-digit code is for the main bearing bores - the first number in the sequence is for No 1 main bearing journal, and the last for No 5 journal (the four-digit code is for the cylinder bore size grades). On 2.0 litre engines, there is only one five-digit code, the first number in the sequence is for No 1 bearing journal, and the last for No 5 journal **(see illustrations)**.

4 Obtain the identification number of both the relevant crankshaft journal and the cylinder block bearing bore, and select the correct grade of main bearing shell required for each journal, using the relevant following table. The grade of each shell is indicated by a dab of paint on the side of the shell.

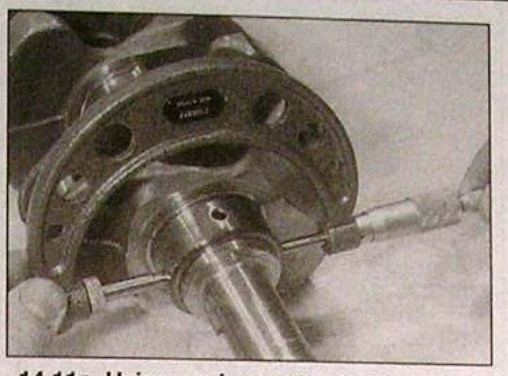
Crankshaft code	Block code	Bearing shell grade
1.6 litre engine		
0	0	Black
0	1	Brown
0	2	Green
1	0	Brown
1	1	Green
1	2	Yellow
2	0	Green
2	1	Yellow
2	2	Blue



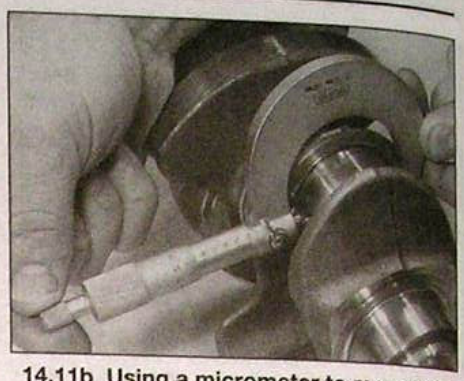
18.3b On 2.0 litre models, the cylinder block main bearing bore grades are stamped on the base of the block (arrowed)



14.3 Using a feeler blade (arrowed) to measure crankshaft endfloat



14.11a Using a micrometer to measure a crankshaft main bearing journal diameter



14.11b Using a micrometer to measure a crankshaft big-end bearing journal diameter

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

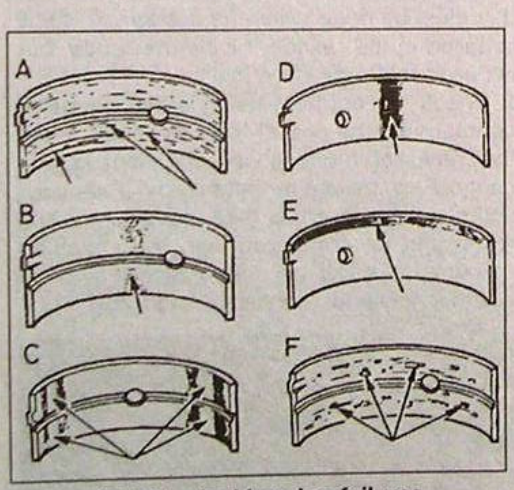
Inspection

4 Clean the crankshaft using paraffin or a suitable solvent, and dry it, preferably with compressed air if available.

Warning: Wear eye protection when using compressed air! Be sure to clean the oil holes with a pipe cleaner or similar probe, to ensure that they are not obstructed.

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

6 Big-end bearing wear is accompanied by distinct metallic knocking when the engine is running (particularly noticeable when the engine is pulling from low speed) and some loss of oil pressure.



15.2 Typical bearing failures

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

7 Main bearing wear is accompanied by severe engine vibration and rumble - getting progressively worse as engine speed increases - and again by loss of oil pressure.

8 Check the bearing journal for roughness by running a finger lightly over the bearing surface. Any roughness (which will be accompanied by obvious bearing wear) indicates that the crankshaft requires regrinding (where possible) or renewal.

9 Crankshaft run-out can be checked by supporting each end of the crankshaft 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 crankshaft will be required.

10 If the crankshaft has been reground, check for burrs around the crankshaft oil holes (the holes are usually chamfered, so burrs should not be a problem unless regrinding has been carried out carelessly). Remove any burrs with a fine file or scraper, and thoroughly clean the oil holes as described previously.

11 Using a micrometer, measure the diameter of the main and big-end bearing journals, and compare the results with the Specifications **(see illustrations)**. By measuring the diameter at a number of points around each journal's circumference, you will be able to determine whether or not the journal is out-of-round. Take the measurement at each end of the journal, near the webs, to determine if the journal is tapered. Compare the results obtained with those given in the Specifications.

12 Check the oil seal contact surfaces at each end of the crankshaft for wear and damage. If the seal has worn a deep groove in the surface of the crankshaft, consult an engine overhaul specialist. Repair may be possible, but otherwise a new crankshaft will be required.

13 Nissan produce undersize bearing shells for both the main bearings and big-end bearings. On the 1.6 litre engine, there are two undersizes of main bearing shells (0.25 and 0.50 mm) and three undersizes of big-end bearing shells (0.08, 0.12 and 0.25 mm). On the 2.0 litre engine, there is only one undersize of main bearing shell (0.25 mm) but there are three undersizes of big-end bearing shell available (0.08, 0.12 and 0.25 mm). Refer to your Nissan dealer for further information on parts availability. If undersize bearing shells are available, and the crankshaft has worn beyond the specified limits, providing that the crankshaft journals have not already been reground, it may be possible to have the crankshaft reconditioned, and to fit the undersize shells. Seek the advice of your Nissan dealer or engine specialist on the best course of action.

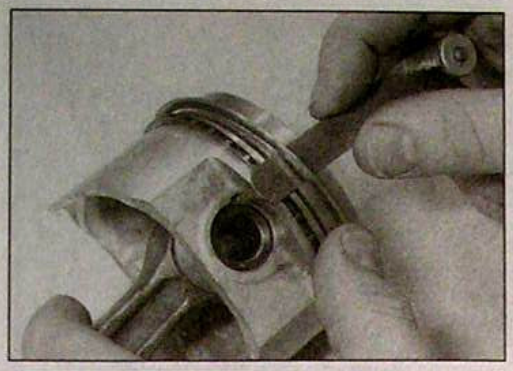
15 Main and big-end bearings - inspection

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

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

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

4 Dirt and other foreign matter gets into the engine in a variety of ways. It may be left in the engine during assembly, or it may pass through filters or the crankcase ventilation



13.2 Using a feeler blade to ease piston ring removal

14 Check the pistons and rings as described in Section 13. The piston-to-bore clearance can be calculated by subtracting the piston diameter from the cylinder bore diameter measurement.

15 Compare all results with the Specifications at the beginning of this Chapter. If any measurement exceeds the service limit specified, the cylinder must be rebored, where possible, to the next oversize and new pistons fitted, or the cylinder block must be renewed. Seek the advice of an engine overhaul specialist as to the best course of action. On 1.6 litre engines, pistons are available in two oversizes - 0.5 mm and 1.0 mm; on 2.0 litre engines, pistons are available in only one oversize - 0.2 mm.

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

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

HAYNES HINT

Gudgeon pin removal will be considerably eased if the piston is warmed (to approximately 60 to 70°C) first. Warm the piston by submerging it in a pan of hot water, then remove the assembly and press the gudgeon pin out, taking great care not to burn your hands

13 Piston/connecting rod assembly - inspection

1 Before the inspection process can begin, the piston/connecting rod assemblies must be cleaned, and the original piston rings removed from the pistons.

2 Carefully expand the old rings over the top of the pistons. The use of two or three old feeler blades will be helpful in preventing the rings dropping into empty grooves **(see illustration)**. Be careful not to scratch the piston with the ends of the ring. The rings are brittle, and will snap if they are spread too far. They're also very sharp - protect your hands and fingers. Always remove the rings from the top of the piston. Keep each set of rings with its piston if the old rings are to be re-used.

3 Scrape away all traces of carbon from the top of the piston. A hand-held wire brush (or a piece of fine emery cloth) can be used, once the majority of the deposits have been scraped away.

4 Remove the carbon from the ring grooves in the piston, using an old ring. Break the ring in half to do this (be careful not to cut your fingers - piston rings are sharp). Be careful to remove only the carbon deposits - do not remove any metal, and do not nick or scratch the sides of the ring grooves.

5 Once the deposits have been removed, clean the piston/connecting rod assembly with paraffin or a suitable solvent, and dry thoroughly. Make sure that the oil return holes in the ring grooves are clear.

6 Using a micrometer, measure the piston diameter at right-angles to the gudgeon pin axis (at the specified distance up from the bottom of the skirt), and compare the results with the Specifications at the beginning of this Chapter. The piston size grade is stamped onto the piston crown. Renew any piston which has worn beyond its specified limits.

7 Check the ring-to-groove clearance by inserting each ring from the outside, together with a feeler blade between the ring's top surface and the piston land. If the ring-to-groove clearance is excessive, renew the rings and recheck the clearance. If the clearance is still excessive, even with new piston rings, then the piston must be renewed.

8 Check the ring end gaps by inserting each ring into the cylinder bore and pushing it in with the piston crown to ensure that it is square in the bore. Push the ring down into the bore until the piston skirt is level with the block mating surface, then withdraw the piston. Using feeler blades, measure the piston ring end gap. If the ring end gap is excessive, renew the rings and repeat the checking procedure. If the clearance is still excessive, even with new piston rings, then the cylinder bores must be rebored/renewed (see Section 12).

9 Carefully inspect each piston for cracks around the skirt, around the gudgeon pin holes, and at the piston ring lands (between the ring grooves).

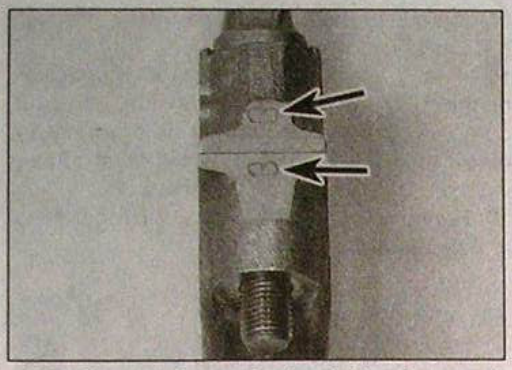
10 Look for scoring and scuffing on the piston skirt, holes in the piston crown, or burned areas at the edge of the crown. If the skirt is scored or scuffed, the engine may have been suffering from overheating, and/or abnormal combustion which caused excessively-high operating temperatures. The cooling and lubrication systems should be checked thoroughly. Scorch marks on the sides of the pistons show that blow-by has occurred. A hole in the piston crown, or burned areas at the edge of the piston crown, indicates that abnormal combustion (pre-ignition, knocking, or detonation) has been occurring. If any of the above problems exist, the causes must be investigated and corrected, or the damage will occur again. The causes may include incorrect ignition timing, inlet air leaks, or a faulty injector (as applicable).

11 Corrosion of the piston, in the form of pitting, indicates that coolant has been leaking into the combustion chamber and/or the crankcase. Again, the cause must be corrected, or the problem may persist in the rebuilt engine.

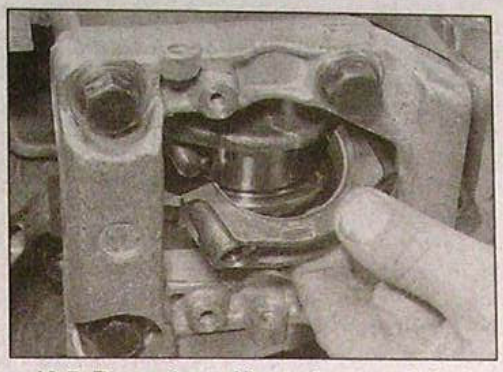
12 Examine each connecting rod carefully for signs of damage, such as cracks around the big-end and small-end bearings. Check that the rod is not bent or distorted. Damage is highly unlikely, unless the engine has been seized or badly overheated. Detailed checking of the connecting rod assembly can only be carried out by a Nissan dealer or engine repair specialist with the necessary equipment.

13 If necessary, the piston and connecting rods can be separated and reassembled as follows.

14 Using a small flat-bladed screwdriver, prise out the circlips, and push out the gudgeon pin **(see illustration)**. If necessary, support the piston, and tap the pin out using a suitable hammer and punch, taking great care not to mark the piston/connecting rod bores. Identify the piston, gudgeon pin and rod to ensure correct reassembly. Discard the circlips - new ones *must* be used on refitting.



10.3 Connecting rods should be stamped with their relevant cylinder number (arrowed)



10.5 Removing a big-end cap and shell (2.0 litre engine shown)

HAYNES HINT

Use a little dab of grease to hold the collets in position on the valve stem while the spring compressor is released.

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

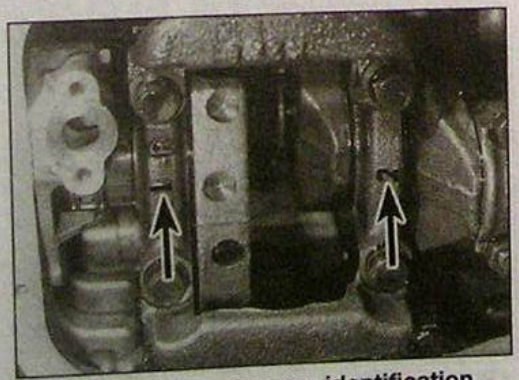
6 On 2.0 litre engines, ensure that the coolant pipe and head mating surfaces are clean and dry. Apply a bead of suitable sealant to the pipe mating surfaces and refit the pipe assembly, tightening its retaining bolts securely.

7 The cylinder head and associated components may now be refitted as described in Part A or B of this Chapter (as applicable).

10 Piston/connecting rod assembly - removal

1 Remove the sump, timing chain(s) and cylinder head as described in Part A or B of this Chapter (as applicable).

2 If there is a pronounced wear ridge at the top of any bore, it may be necessary to remove it with a scraper or ridge reamer, to avoid piston damage during removal. Such a ridge indicates excessive wear of the cylinder bore.



11.5 Main bearing cap identification numbers (arrowed) - 1.6 litre engine

3 Each connecting rod and bearing cap should be stamped with its respective cylinder number, No 1 cylinder being at the timing chain end of the engine **(see illustration)**. If no markings are visible, using a hammer and centre-punch, paint or similar, mark each connecting rod and big-end bearing cap with its respective cylinder number on the flat machined surface provided.

4 Turn the crankshaft to bring pistons 1 and 4 to BDC (bottom dead centre).

5 Unscrew the nuts from No 1 piston big-end bearing cap. Take off the cap, and recover the bottom half bearing shell **(see illustration)**. If the bearing shells are to be re-used, tape the cap and the shell together.

6 To prevent the possibility of damage to the crankshaft bearing journals, tape over the connecting rod bolt threads.

7 Using a hammer handle, push the piston up through the bore, and remove it from the top of the cylinder block. Recover the bearing shell, and tape it to the connecting rod for safe-keeping.

8 Loosely refit the big-end cap to the connecting rod, and secure with the nuts - this will help to keep the components in their correct order.

9 Remove No 4 piston assembly in the same way.

10 Turn the crankshaft through 180° to bring pistons 2 and 3 to BDC (bottom dead centre), and remove them in the same way.

11 Crankshaft - removal

1 Remove the sump, timing chain(s) and flywheel as described in Part A or B of this Chapter (as applicable).

2 Remove the pistons and connecting rods, as described in Section 10. **Note:** *If no work is to be done on the pistons and connecting rods, there is no need to remove the cylinder head, or to push the pistons out of the cylinder bores. The pistons should just be pushed far enough up the bores that they are positioned clear of the crankshaft journals.*

3 Check the crankshaft endfloat as described in Section 14, then proceed as follows.

1.6 litre engines

4 Undo the retaining bolts, and remove the rear oil seal housing from the left-hand (flywheel) end of the cylinder block. If the locating dowels are a loose fit, remove them and store them with the housing for safe-keeping.

5 The main bearing caps should be numbered 1 to 5 from the timing chain end of the engine **(see illustration)**. If not, using white paint or a suitable marker pen, mark each cap in some way as 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.

6 Working in the **reverse** of the sequence shown in illustration 18.27, slacken the main bearing cap retaining bolts by a turn at a time. Once all bolts are loose, unscrew and remove them from the cylinder block.

7 Withdraw the bearing caps, and recover the lower main bearing shells. Tape each shell to its respective cap for safe-keeping.

8 Carefully lift out the crankshaft, taking care not to displace the upper main bearing shells.

9 Recover the upper bearing shells from the cylinder block, and tape them to their respective caps for safe-keeping. Remove the thrustwasher halves from the side of No 3 main bearing, and store them with the bearing cap.

2.0 litre engines

10 Undo the retaining bolts, and remove the rear oil seal housing from the left-hand (flywheel) end of the cylinder block. If the locating dowels are a loose fit, remove them and store them with the housing for safe-keeping.

11 Working in the **reverse** of the sequence shown in illustration 18.35a, slacken the main bearing cap retaining bolts by a turn at a time. Once all bolts are loose, unscrew and remove them from the cylinder block.

12 On Phase I and Phase II models, lift the main bearing ladder off the main bearing caps, noting which way around it is fitted **(see illustration)**. Note that the main bearing ladder is not fitted to Phase III models.

13 The main bearing caps should be numbered 1 to 5 from the timing chain end of the engine **(see illustration)**. If not, using white paint or a suitable marker pen, mark

11.12 Removing the main bearing ladder - 2.0 litre (Phase II) engine

7.5 Pull the valve stem oil seal off the guide using a pair of pliers

7 Cylinder head - dismantling

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

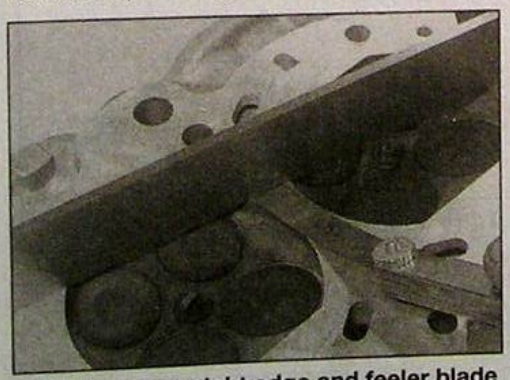
1 Remove the cylinder head as described in Part A or B of this Chapter (as applicable).

2 If not already done, remove the inlet and exhaust manifolds with reference to the relevant Part of Chapter 4.

3 On 1.6 litre engines, if not already done, remove the camshaft followers and shims as described in Part A.

4 On 2.0 litre engines, if not already done, remove the camshaft followers and hydraulic adjusters as described in Part B. Undo the retaining bolts, and remove the coolant pipe assembly from the cylinder head.

5 On all engines, using a valve spring compressor, compress each valve spring in turn until the split collets can be removed. Release the compressor, and lift off the spring retainer, spring and spring seat. Using a pair of pliers, carefully extract the valve stem seal from the top of the guide **(see illustration)**.



8.6 Using a straight edge and feeler blade to measure cylinder head gasket face distortion

7.8 Place each valve and its associated components in a labelled polythene bag

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

7 Withdraw the valve through the combustion chamber.

8 It is essential that each valve is stored together with its collets, retainer, spring, and spring seat. The valves should also be kept in their correct sequence, unless they are so badly worn that they are to be renewed. If they are going to be kept and used again, place each valve assembly in a labelled polythene bag or similar small container **(see illustration)**. Note that No 1 valve is nearest to the timing chain end of the engine.

8 Cylinder head and valves - cleaning and inspection

1 Thorough cleaning of the cylinder head and valve components, followed by a detailed inspection, will enable you to decide how much valve service work must be carried out during the engine overhaul. **Note:** *If the engine has been severely overheated, it is best to assume that the cylinder head is warped - check carefully for signs of this.*

Cleaning

2 Scrape away all traces of old gasket material from the cylinder head.

8.11 Measuring a valve stem diameter

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

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

Inspection

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

Cylinder head

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

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

7 Examine the valve seats in each of the combustion chambers. If they are severely pitted, cracked, or burned, they will need to be renewed or re-cut by an engine overhaul specialist. If they are only slightly pitted, this can be removed by grinding-in the valve heads and seats with fine valve-grinding compound, as described below.

8 Check the valve guides for wear by inserting the relevant valve, and checking for side-to-side motion of the valve. A very small amount of movement is acceptable. If the movement seems excessive, remove the valve. Measure the valve stem diameter (see below), and renew the valve if it is worn. If the valve stem is not worn, the wear must be in the valve guide, and the guide must be renewed. The renewal of valve guides is best carried out by a Nissan dealer or engine overhaul specialist, who will have the necessary tools available.

9 If renewing the valve guides, the valve seats are to be re-cut or re-ground only *after* the guides have been fitted.

Valves

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

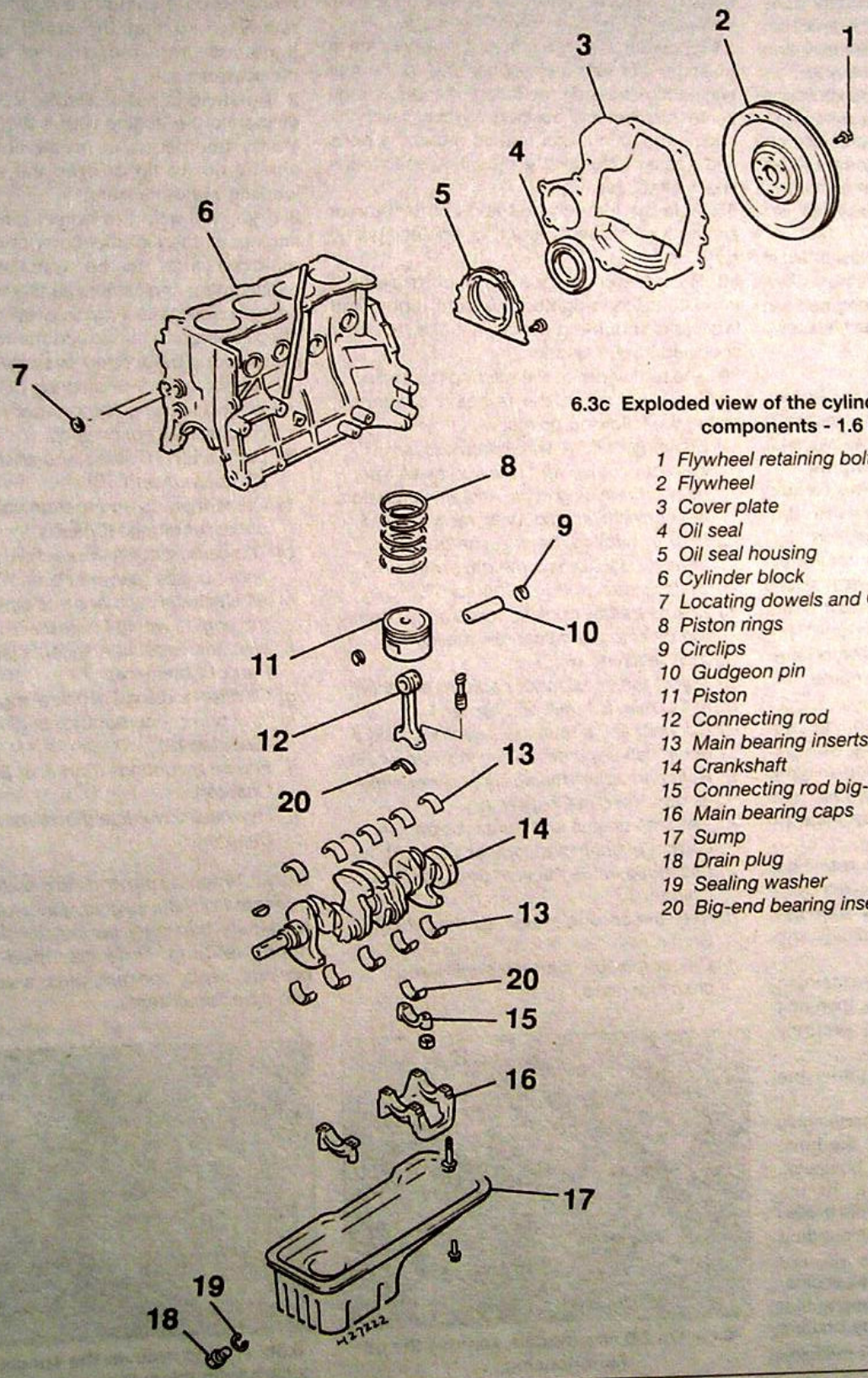
11 If the valve appears satisfactory at this stage, measure the valve stem diameter at several points using a micrometer **(see illustration)**. Any significant difference in the readings obtained indicates wear of the valve stem. Should any of these conditions be apparent, the valve(s) must be renewed.

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

5 If you are planning a complete overhaul, the engine can be dismantled, and the internal components removed, in the order given below, referring to Part A or B of this Chapter unless otherwise stated.

a) Inlet and exhaust manifolds (Chapter 4A, 4B or 4C).
b) Sump.
c) Timing chain(s) and sprockets.
d) Cylinder head.
e) Flywheel.
f) Piston/connecting rod assemblies.
g) Crankshaft.

6 Before beginning the dismantling and overhaul procedures, make sure that you have all of the correct tools necessary. Refer to *Tools and working facilities* at the end of this manual for further information.



6.3c Exploded view of the cylinder block and associated components - 1.6 litre engine

1 Flywheel retaining bolt
2 Flywheel
3 Cover plate
4 Oil seal
5 Oil seal housing
6 Cylinder block
7 Locating dowels and O-rings
8 Piston rings
9 Circlips
10 Gudgeon pin
11 Piston
12 Connecting rod
13 Main bearing inserts and thrustwashers
14 Crankshaft
15 Connecting rod big-end cap
16 Main bearing caps
17 Sump
18 Drain plug
19 Sealing washer
20 Big-end bearing inserts

45 Refit the through-bolt and nut to the rear engine/transmission mounting, tightening it by hand only.

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

47 Rock the engine/transmission to settle it in position, then tighten the front, right- and left-hand mounting through-bolts to their specified torque settings.

48 On 1.6 litre engines, refit the mounting bracket to the top of the right-hand mounting, and tighten its retaining bolts to the specified torque.

49 The remainder of the refitting procedure is a direct reversal of the removal sequence, noting the following points:

a) Ensuring that the wiring harness is correctly routed and retained by all the relevant retaining clips, and all connectors are correctly and securely reconnected.
b) Prior to refitting the driveshafts to the transmission, renew the driveshaft oil seals as described in Chapter 7A.
c) Ensure that all coolant hoses are correctly reconnected and securely retained by their retaining clips.
d) Adjust the accelerator cable as described in the relevant Part of Chapter 4.
e) Connect and adjust the clutch cable as described in Chapter 6.
f) Refit and adjust the auxiliary drivebelt(s) as described in Chapter 1.
g) Refill the engine and transmission unit with correct quantity and type of lubricant, as described in the relevant Sections of Chapter 1.
h) Refill the cooling system as described in Chapter 1.
i) On completion, start the engine and check for leaks.

5 Engine and automatic transmission - removal, separation and refitting

Removal

Note: *The engine can be removed from the car only as a complete unit with the transmission; the two are then separated for overhaul. The engine/transmission is lowered out of position, and withdrawn from under the front of the vehicle. To allow adequate clearance underneath the vehicle, there should be at least 75 cm between the front bumper and the ground when the vehicle is raised and supported.*

1 Carry out the operations described in paragraphs 1 to 10 of Section 4.

2 On single-point injection engines, carry out the following operations as described in the Chapter 4B.

a) Remove the air cleaner housing.

4.44 Tighten the centre member mounting bolts to the specified torque

b) Depressurise the fuel system, and disconnect the fuel feed and return hoses from the throttle body (plug all openings, to prevent loss of fuel and entry of dirt into the fuel system).
c) Disconnect the accelerator cable.
d) Disconnect the relevant electrical connectors from the throttle body, inlet manifold and associated components.
e) Disconnect the vacuum servo unit hose, coolant hose(s) and all the other relevant/breather hoses from the manifold and associated valves.
f) Remove the inlet manifold support bracket(s).
g) Remove the exhaust front pipe.

3 On multi-point injection engines, carry out the following operations as described in Chapter 4C.

a) Remove the air cleaner inlet duct.
b) 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).
c) Disconnect the accelerator cable.
d) Disconnect the relevant electrical connectors from the throttle housing, inlet manifold and associated components. Free the wiring from the manifold, and position it clear of the cylinder head so that it does not hinder removal.
e) Disconnect the vacuum servo unit hose, coolant hose(s) and all the other relevant/breather hoses from the manifold and associated valves.
f) Remove the inlet manifold support bracket(s).
g) Remove the exhaust front pipe.

4 Slacken the retaining clips, and disconnect the heater hoses and all other relevant cooling system hoses from the engine, noting each hose's correct fitted location.

5 On models with air conditioning, unbolt the compressor and position it clear of the engine. Support the weight of the compressor by tying it to the vehicle body, to prevent any excess strain being placed on the compressor lines whilst the engine is removed. **Do not** disconnect the refrigerant lines from the compressor (see the warnings given in Chapter 3).

6 Working as described in Chapter 8, remove both driveshafts.

7 Carry out the following operations as described in Chapter 7B.

a) Disconnect the selector cable from the transmission.
b) Disconnect the kickdown cable from the throttle body/housing.
c) Disconnect the transmission wiring connectors.
d) Disconnect the fluid cooler hoses from the transmission.
e) Disconnect the speedometer cable.

8 Manoeuvre the engine hoist into position, and attach it to the cylinder head using suitable lifting brackets bolted. Raise the hoist until it is supporting the weight of the engine.

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

10 Slacken and remove the four bolts and washers securing the centre member to the vehicle body, and lower the assembly away from the engine. Recover the stopper ring which is fitted between the rear engine/transmission mounting and its bracket.

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

12 Slacken and remove the through-bolt from the left-hand engine/transmission mounting. Undo the three bolts securing the mounting to the transmission, and manoeuvre the mounting out of position. Recover the rubbers from each side of the mounting bracket.

13 Make a final check that any components which would prevent the removal of the engine/transmission from the car have been removed or disconnected. Ensure that components such as the driveshafts are secured so that they cannot be damaged on removal.

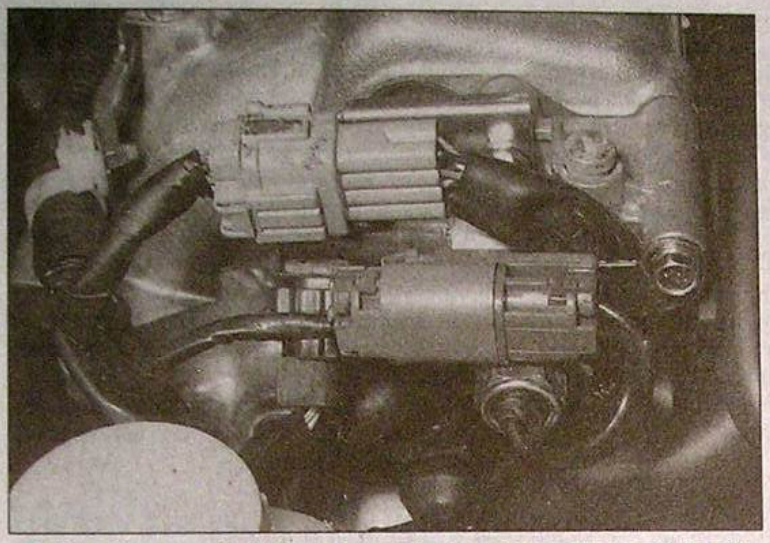
14 If available, a low trolley should be placed under the engine/transmission assembly to facilitate its easy removal from under the vehicle. Lower the engine/transmission assembly, making sure that nothing is trapped or damaged. Enlist the help of an assistant during this procedure, as it may be necessary to tilt the assembly slightly to clear the body panels. Great care must be taken to ensure that no components are trapped and damaged during the removal procedure.

15 Withdraw the assembly from under the vehicle.

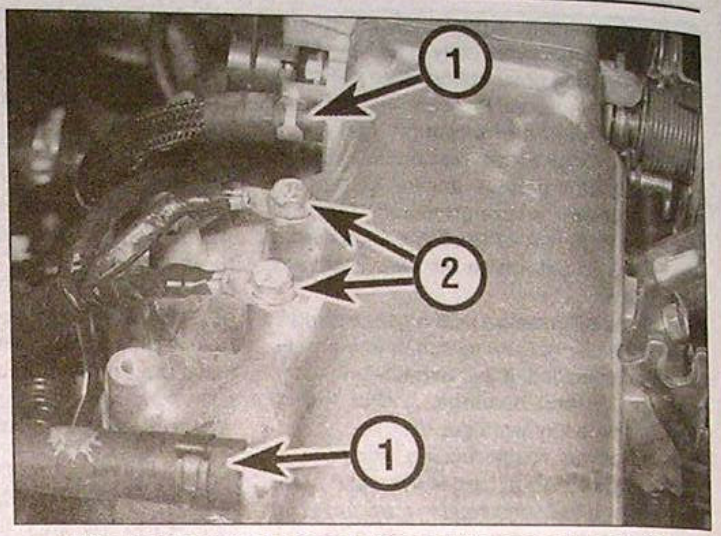
Separation

16 With the engine/transmission assembly removed, support the assembly on suitable blocks of wood, on a workbench (or failing that, on a clean area of the workshop floor).

17 Unscrew the retaining bolts, and remove the starter motor from the transmission.



4.13a Disconnect all the relevant fuel system wiring, and free it from the inlet manifold (2.0 litre Phase II model shown)



4.13b Inlet manifold vacuum hoses (1) and earth leads (2) - 2.0 litre Phase II model

a) Air cleaner housing.
b) 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).
c) Accelerator cable.
d) Carburettor wiring connector(s).
e) Vacuum servo unit vacuum hose, coolant hose, and all other relevant breather/vacuum hoses from the manifold and associated valves.
f) Remove the inlet manifold support bracket.
g) Remove the exhaust system front pipe.
h) On models with a catalytic converter, disconnect the exhaust gas sensor wiring connector.

12 On single-point injection engines, carry out the following operations as described in the Chapter 4B.

a) Remove the air cleaner housing.
b) Depressurise the fuel system, and disconnect the fuel feed and return hoses from the throttle body (plug all openings, to prevent loss of fuel and entry of dirt into the fuel system).
c) Disconnect the accelerator cable.
d) Disconnect the relevant electrical connectors from the throttle body, inlet manifold and associated components.
e) Disconnect the vacuum servo unit hose, coolant hose(s), and all the other relevant/breather hoses from the manifold and associated valves.
f) Remove the inlet manifold support bracket(s).
g) Remove the exhaust front pipe.

13 On multi-point injection engines, carry out the following operations as described in Chapter 4C.

a) Remove the air cleaner inlet duct.
b) 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).
c) Disconnect the accelerator cable.
d) Disconnect the relevant electrical connectors from the throttle housing, inlet manifold and associated components. Free the wiring from the manifold, and position it clear of the cylinder head so that it does not hinder removal **(see illustration)**.
e) Disconnect the vacuum servo unit hose, coolant hose(s), and all the other relevant/breather hoses from the manifold and associated valves **(see illustration)**.
f) Remove the inlet manifold support bracket(s).
g) Remove the exhaust front pipe.

14 Slacken the retaining clips, and disconnect the heater hoses and all other relevant cooling system hoses from the engine, noting each hose's correct fitted location.

15 On models with air conditioning, unbolt the compressor and position it clear of the engine. Support the weight of the compressor by tying it to the vehicle body, to prevent any excess strain being placed on the compressor lines whilst the engine is removed. **Do not** disconnect the refrigerant lines from the compressor (see the warnings given in Chapter 3, Section 10).

16 Referring to Chapter 5B, disconnect the wiring connectors from the distributor, ignition HT coil and the power transistor unit. Free the wiring loom from any relevant retaining clips, so that it is free from the cylinder head and will not hinder the removal procedure. Also undo the retaining bolts, and disconnect all the relevant earth leads from the head and inlet manifold **(see illustration)**.

17 Working as described in Chapter 8, remove the driveshafts.

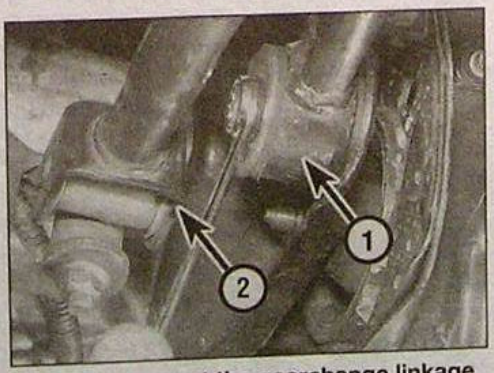
18 Disconnect the clutch cable from the transmission as described in Chapter 6.

19 Working as described in Chapter 7A, disconnect the gearchange linkage link rods, the speedometer cable and the wiring connector(s) from the transmission **(see illustration)**.

20 Manoeuvre the engine hoist into position, and attach it to the cylinder head using suitable lifting brackets. Raise the hoist until it is supporting the weight of the engine.

21 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. Slacken and remove the nut and withdraw the through-bolt from the mounting. Slacken and remove the nut and through-bolt from the rear engine/transmission mounting **(see illustrations)**.

4.16 Unscrew the bolt(s) and free all earth lead(s) from the cylinder head



4.19 Disconnect the gearchange linkage support rod (1) and selector rod (2) from the transmission

Crankshaft (continued)

Main bearing shell thicknesses:	
1.6 litre engine:	
Standard:	
Black	1.826 to 1.830 mm
Brown	1.830 to 1.834 mm
Green	1.834 to 1.838 mm
Yellow	1.838 to 1.842 mm
Blue	1.842 to 1.846 mm
0.25 mm undersize	1.960 to 1.964 mm
0.50 mm undersize	2.085 to 2.089 mm
2.0 litre engine:	
Standard:	
Black	1.977 to 1.980 mm
Brown	1.980 to 1.983 mm
Green	1.983 to 1.986 mm
Yellow	1.986 to 1.989 mm
Blue	1.989 to 1.992 mm
Pink	1.992 to 1.995 mm
White (or no colour)	1.995 to 1.998 mm
0.25 mm undersize	2.109 to 2.117 mm
Big-end bearing shell thicknesses:	
1.6 litre engine:	
Standard:	
Black	1.505 to 1.508 mm
Brown	1.508 to 1.511 mm
Green	1.511 to 1.514 mm
0.08 mm undersize	1.540 to 1.548 mm
0.12 mm undersize	1.560 to 1.568 mm
0.25 mm undersize	1.625 to 1.633 mm
2.0 litre engine:	
Standard:	
Black	1.500 to 1.503 mm
Brown	1.503 to 1.506 mm
Green	1.506 to 1.509 mm
0.08 mm undersize	1.541 to 1.549 mm
0.12 mm undersize	1.561 to 1.569 mm
0.25 mm undersize	1.626 to 1.634 mm

Torque wrench settings

1.6 litre engines

Refer to Chapter 2A Specifications.

2.0 litre engine

Refer to Chapter 2B Specifications.

1 General information

Included in this Part of Chapter 2 are details of removing the engine from the vehicle, and general overhaul procedures for the cylinder head, cylinder block/crankcase and all other engine internal components.

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

After Section 6, all instructions are based on the assumption that the engine has been removed from the vehicle. For information concerning in-car engine repair, as well as the removal and refitting of those external components necessary for full overhaul, refer to Part A or B of this Chapter (as applicable) and to Section 6. Ignore any preliminary dismantling operations described in Part A (1.6 litre engine) or Part B (2.0 litre engine) that are no longer relevant once the engine has been removed from the vehicle.

Apart from torque wrench settings, which are given at the beginning of Part A or Part B, all specifications relating to engine overhaul are at the beginning of this Part of Chapter 2.

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*

2 Engine overhaul - general information

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

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

Valves

	Inlet	Exhaust
Valve head diameter:		
1.6 litre engine	29.9 to 30.1 mm	23.9 to 24.1 mm
2.0 litre engine	34.0 to 34.2 mm	30.0 to 30.2 mm
Valve stem diameter:		
1.6 litre engine	5.465 to 5.480 mm	5.445 to 5.460 mm
2.0 litre engine (Phase I and Phase II models):		
SR20Di and SR20De engines	5.965 to 5.980 mm	5.945 to 5.960 mm
SR20DE engines	5.965 to 5.980 mm	6.945 to 6.960 mm
2.0 litre engine (Phase III models)	5.965 to 5.980 mm	5.945 to 5.960 mm
Overall length:		
1.6 litre engine (Phase I and Phase II models)	92.05 to 92.45 mm	92.42 to 92.82 mm
1.6 litre engine (Phase III models)	92.00 to 92.50 mm	92.37 to 92.87 mm
2.0 litre engine	101.19 to 101.61 mm	102.11 to 102.53 mm
Valve guide inner diameter:		
1.6 litre engine	5.500 to 5.515 mm	5.500 to 5.515 mm
2.0 litre engine (Phase I and Phase II models):		
SR20Di and SR20De engines	6.000 to 6.018 mm	6.000 to 6.018 mm
SR20DE engine	6.000 to 6.018 mm	7.000 to 7.018 mm
2.0 litre engine (Phase III models)	6.000 to 6.018 mm	6.000 to 6.018 mm
Valve stem-to-guide clearance:		
1.6 litre engine	0.020 to 0.050 mm	0.040 to 0.070 mm
2.0 litre engine	0.020 to 0.053 mm	0.040 to 0.073 mm
Valve spring free length:		
1.6 litre engine	40.00 mm	
2.0 litre engine	49.36 mm	
Valve spring out-of-square limit:		
1.6 litre engine	1.74 mm	
2.0 litre engine	2.20 mm	

Piston rings

	Standard	Service limit
Ring-to-groove clearance:		
Top compression ring	0.040 to 0.085 mm	0.2 mm
Second compression ring	0.030 to 0.070 mm	0.2 mm
End gaps:		
1.6 litre engine:		
Top compression ring	0.20 to 0.40 mm	0.49 mm
Second compression ring	0.35 to 0.55 mm	0.64 mm
Oil control ring	0.25 to 1.00 mm	1.09 mm
2.0 litre engine:		
Top compression ring	0.20 to 0.30 mm	1.00 mm
Second compression ring	0.35 to 0.55 mm	1.00 mm
Oil control ring	0.20 to 0.60 mm	1.00 mm

Piston and connecting rod

Piston diameter:	
1.6 litre engine (measured 9.5 mm up from the base of skirt):	
Standard piston:	
Grade 1	75.980 to 75.990 mm
Grade 2	75.990 to 76.000 mm
Grade 3	76.000 to 76.010 mm
0.5 mm oversize piston	76.490 to 76.510 mm
1.0 mm oversize piston	76.990 to 77.010 mm
2.0 litre engine (measured 13.0 mm up from the base of skirt):	
Standard piston:	
Grade 1	85.980 to 85.990 mm
Grade 2	85.990 to 86.000 mm
Grade 3	86.000 to 86.010 mm
0.2 mm oversize piston	86.180 to 86.210 mm
Piston-to-bore clearance	0.010 to 0.030 mm
Piston gudgeon pin bore diameter:	
1.6 litre engine	18.987 to 18.999 mm
2.0 litre engine (Phase I and Phase II models)	21.987 to 21.999 mm
2.0 litre engine (Phase III models)	21.993 to 22.005 mm
Gudgeon pin outer diameter:	
1.6 litre engine	18.989 to 19.001 mm
2.0 litre engine	21.989 to 22.001 mm
Piston-to-gudgeon pin clearance	-0.004 to 0.000 mm (ie. an interference fit)