



Cylinder Head

REMOVAL & INSTALLATION

NOTE: When installing sliding parts such as rocker arms, camshafts and oil seals, be sure to apply clean engine oil on their friction surfaces. When tightening the cylinder head or rocker shaft bolts, apply clean engine oil to the bolt threads and seat surfaces.

Z24i Engine

1. Relieve the fuel system pressure, as described in Section 5.
2. Crank the engine until the No. 1 piston is at TDC of the compression stroke.
3. Disconnect the negative battery cable and drain the cooling system.
4. Remove the air cleaner and attending hoses.
5. Remove all drive belts. Remove the alternator and power steering pump.
6. Remove the radiator and heater hoses.
7. If equipped with air conditioning, unbolt the compressor and move it aside onto the fender.

WARNING

Do not detach any of the compressor lines; the escaping refrigerant will freeze any surface it contacts, including your skin.

8. Disconnect the exhaust pipe from the exhaust manifold.
9. Remove the fan and fan pulley.
10. Disconnect the fuel line, the return fuel line and any other vacuum lines or electrical leads.

NOTE: A good rule of thumb when disconnecting the rather complex engine wiring of today's vehicles is to put a piece of masking tape on the wire or hose and on the corresponding connection, then mark both pieces of tape 1, 2, 3, etc. When reattaching the wiring, simply match the pieces of tape.

11. Remove the EGR tube from around the rear of the engine.
12. Remove the intake manifold supports from under the manifold. Remove the PCV valve from the rear of the engine, if necessary.
13. Remove the spark plugs to protect them from damage. Remove the cylinder head cover.

NOTE: The spark plug leads may already be marked; however, it would be wise to mark them yourself.

14. Mark the relationship of the camshaft sprocket to the timing chain with paint or chalk. If this is done, it will not be necessary to locate the factory timing marks. Before removing the camshaft sprocket, it will be necessary to wedge the chain in place so that it will not fall down into the front cover. The factory procedure is to wedge the timing chain in place with a wooden wedge, as illustrated. The problem with this procedure is that it may allow the chain tensioner to move out far enough to cock itself against the chain. If this happens, you'll find that the chain won't go back over the sprocket after you've reinstalled the sprocket. In this case, you'll have to remove the front cover and push the tensioner back. After you've wedged the chain, unbolt the camshaft sprocket and remove it.
15. Working from both ends in, loosen the cylinder head bolts a little at a time and remove them. Remove the bolts securing the cylinder head to the front cover assembly.
16. Lift the cylinder head (with manifolds attached) off the engine block. It may be necessary to tap the head lightly with a rubber mallet to loosen it.

To install:

17. Thoroughly clean the cylinder block and head surfaces, then check both for warpage.

18. Fit the new head gasket. Don't use sealant. Install the cylinder head assembly. Make sure that no open valves are in the way of raised pistons, and never rotate the crankshaft or camshaft separately because of possible damage which might occur to the valves.
19. Temporarily tighten the two center right and left cylinder head bolts to 14 ft. lbs. (19 Nm).
20. Install the camshaft sprocket together with the timing chain (remove the wooden wedge) to the camshaft. Make sure the marks you made earlier line up with each other. If necessary, see the Timing Chain removal and installation procedures, later in this section.
21. Confirm that the No. 1 cylinder is set at TDC on its compression stroke. Make sure that the front knock pin is positioned at the upper surface of the camshaft. Set the chain on the camshaft sprocket by aligning each mating mark. Then, install the camshaft sprocket to the camshaft and tighten to 87–116 ft. lbs. (118–157 Nm). The camshaft sprocket should be installed by fitting the knock pin of the camshaft into its No. 2 hole — and the No. 2 timing mark must be used.

NOTE: Allow the rocker cover-to-cylinder head rubber plug to dry for 30 minutes before starting the engine. This will allow the liquid gasket sealer to cure properly.

22. Apply sealant to the sealant point of the cylinder head and install the rubber plug.
23. Install the cylinder head bolts and torque them to 22 ft. lbs. (29 Nm), then 40 ft. lbs., and then 58 ft. lbs. (78 Nm). Loosen all bolts completely and retighten to 22 ft. lbs. (29 Nm), and then to 54–61 ft. lbs. (74–83 Nm); or, if you have an angle torque wrench, give all bolts a final turn of 90–95 degrees. Tighten all bolts gradually, in the order shown.

Fig. 1: Removing the camshaft sprocket — 4-cylinder engines

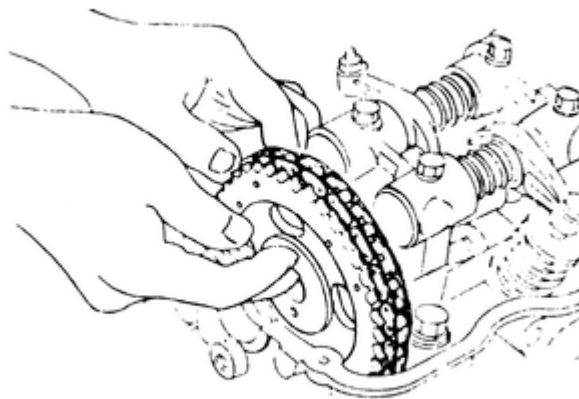


Fig. 2: Use a wooden wedge to support the timing chain — 4-cylinder engines

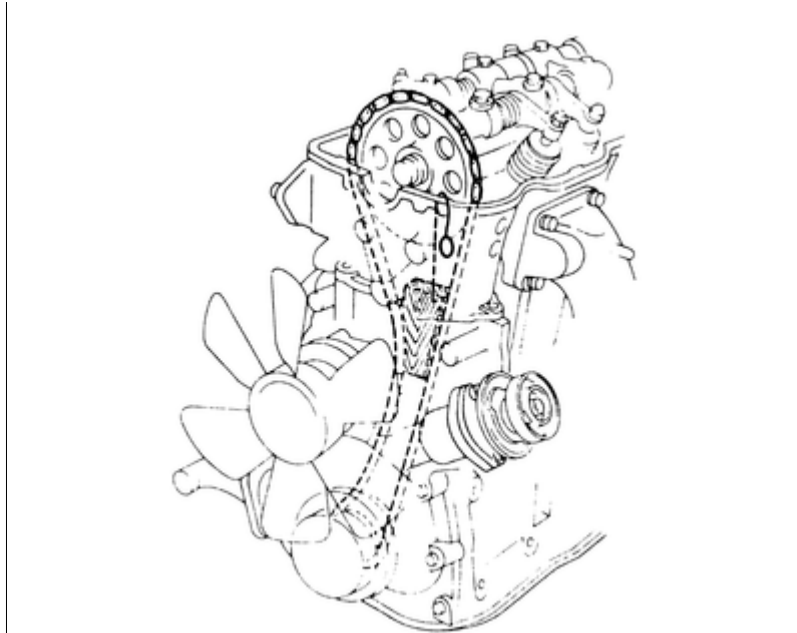


Fig. 3: Cylinder head loosening sequence — Z24i engine

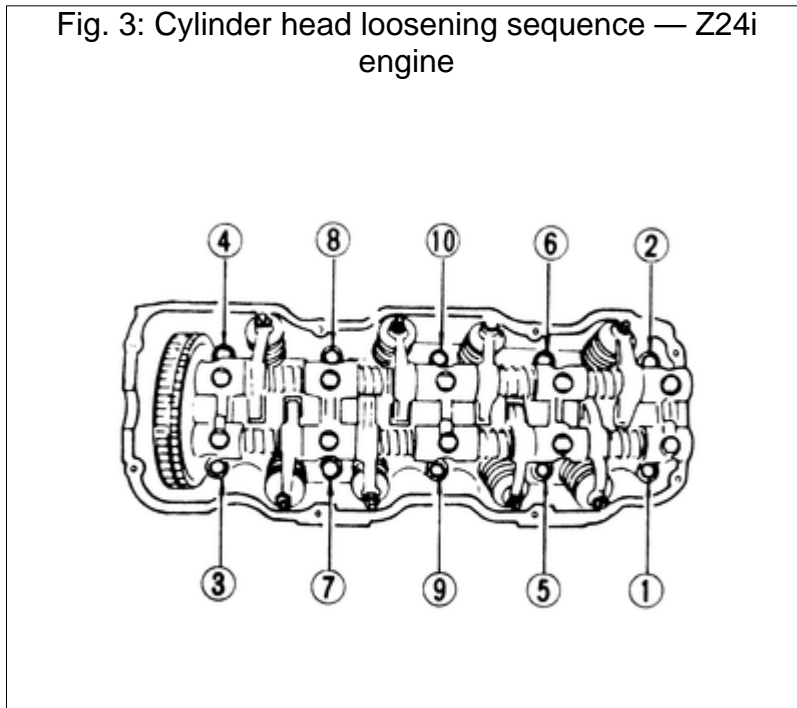


Fig. 4: Camshaft knockpin positioning — Z24i engine

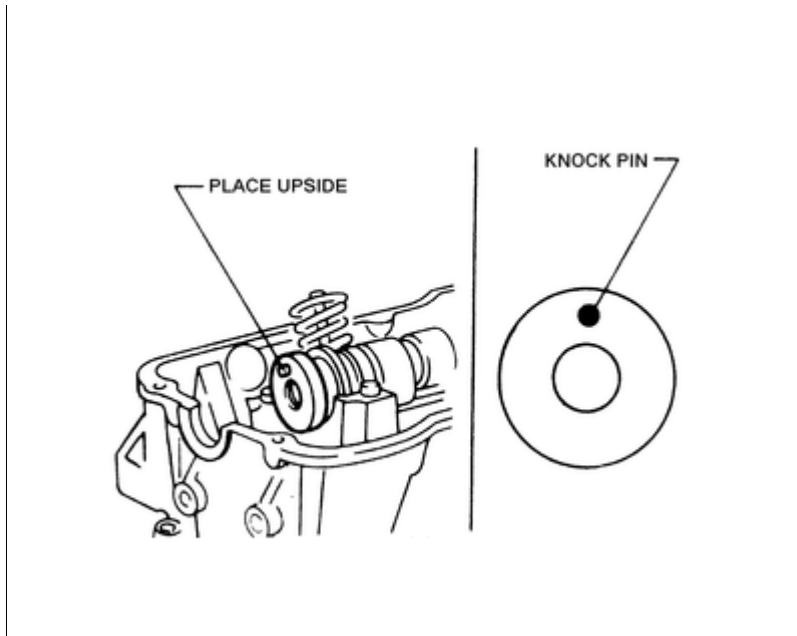


Fig. 5: Timing chain-to-camshaft sprocket alignment — Z24i engine

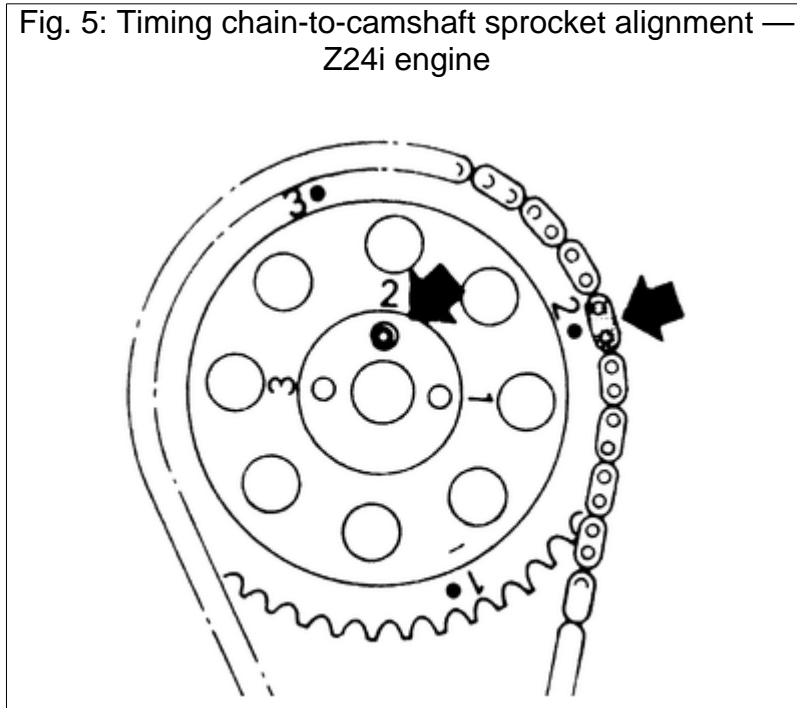


Fig. 6: Cylinder head bolt torque sequence — Z24i engine

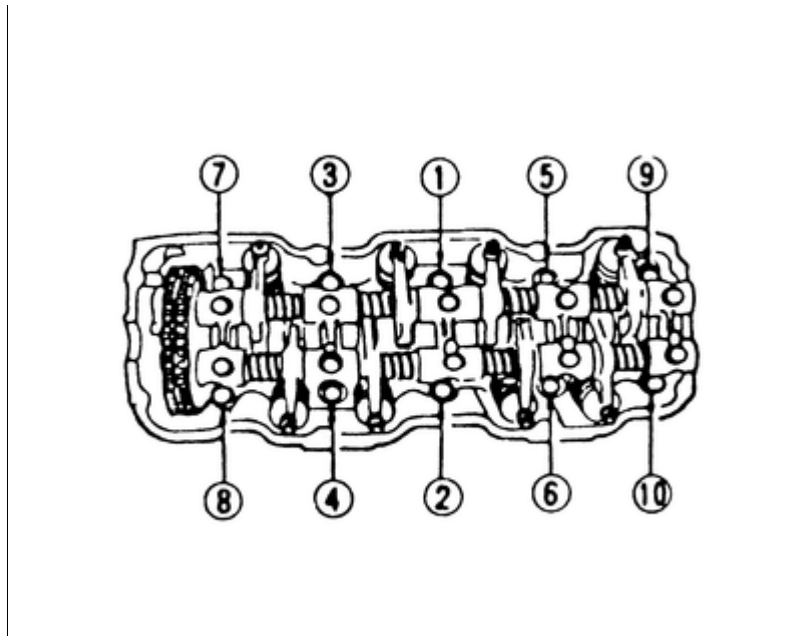
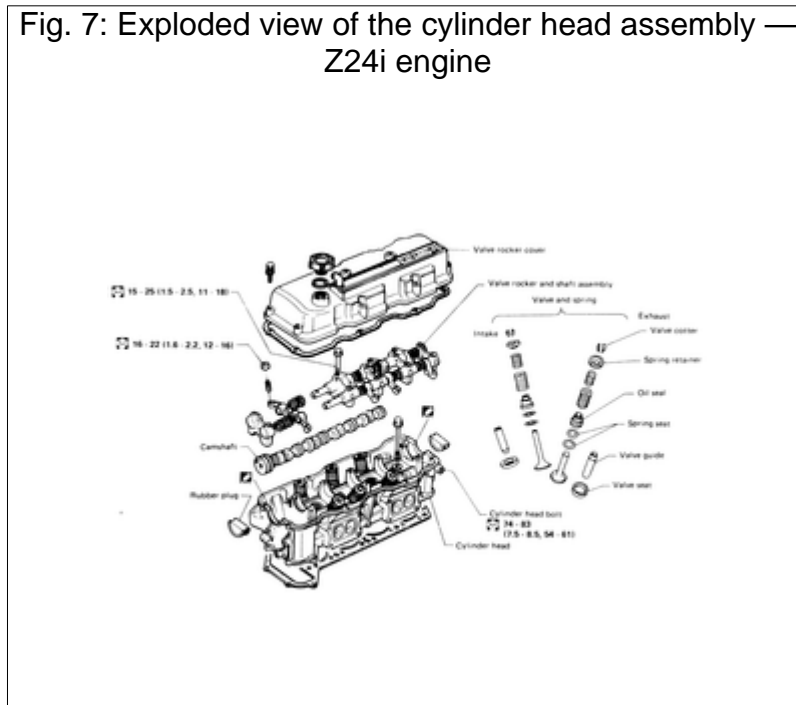


Fig. 7: Exploded view of the cylinder head assembly — Z24i engine



24. Clean and regap the spark plugs then install them in the cylinder head. Do not overtorque the spark plugs.
25. Temporarily install the cylinder head cover with a new gasket. Keep in mind that the cover will have to be removed to adjust valves later in the procedure.
26. Install the intake manifold supports to the manifold. Install the PCV valve if it was removed.
27. Connect the exhaust pipe to exhaust manifold.
28. Install the EGR tube from around the rear of the engine.
29. Connect the throttle linkage, the air cleaner or its intake hose assembly. Reconnect the fuel line, the return fuel line and any other vacuum lines or electrical leads.
30. Install the power steering pump and correctly adjust the drive belt.
31. Install the air conditioning compressor and correctly adjust the drive belt.
32. Install the alternator mounting bracket and alternator. Fasten the electrical connections to the alternator and adjust the drive belt.
33. Reconnect the heater and radiator hoses, then refill the cooling system.
34. Start the engine and run it until it reaches normal operating temperature. Stop the engine, then check for the correct coolant level and adjust as necessary.
35. Adjust the valves (adjustment should be made while engine is warm but not running), as described in Section 2.

NOTE: It is advisable to drain the crankcase oil and change the oil filter after the cylinder head assembly has been installed.

36. Check for leaks and road test the vehicle for proper operation.

KA24E Engine

NOTE: After completing this procedure, allow the rocker cover-to-cylinder head rubber plugs to dry for 30 minutes before starting the engine. This will allow the liquid gasket sealer to cure properly.

1. Relieve the fuel system pressure, as described in Section 5.
2. Disconnect the negative battery cable and drain the cooling system.
3. Remove the power steering drive belt, power steering pump, idler pulley and power steering brackets.
4. Tag and disconnect all vacuum hoses, water hoses, fuel tubes and wiring harnesses necessary to gain access to the cylinder head.
5. Disconnect the EGR tube at the exhaust manifold.

Fig. 8: Cylinder head loosening sequence — KA24E engine

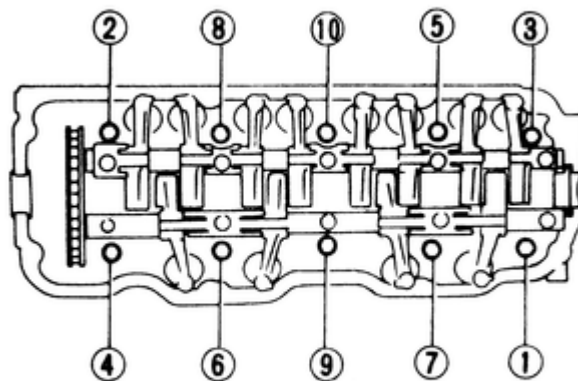


Fig. 9: Camshaft knockpin positioning — KA24E engine

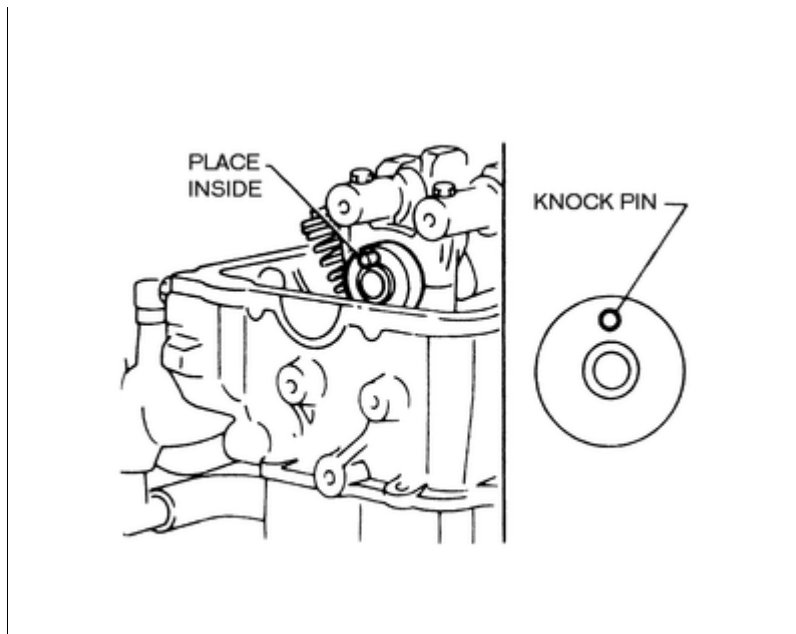


Fig. 10: Cylinder head torque sequence — KA24E engine

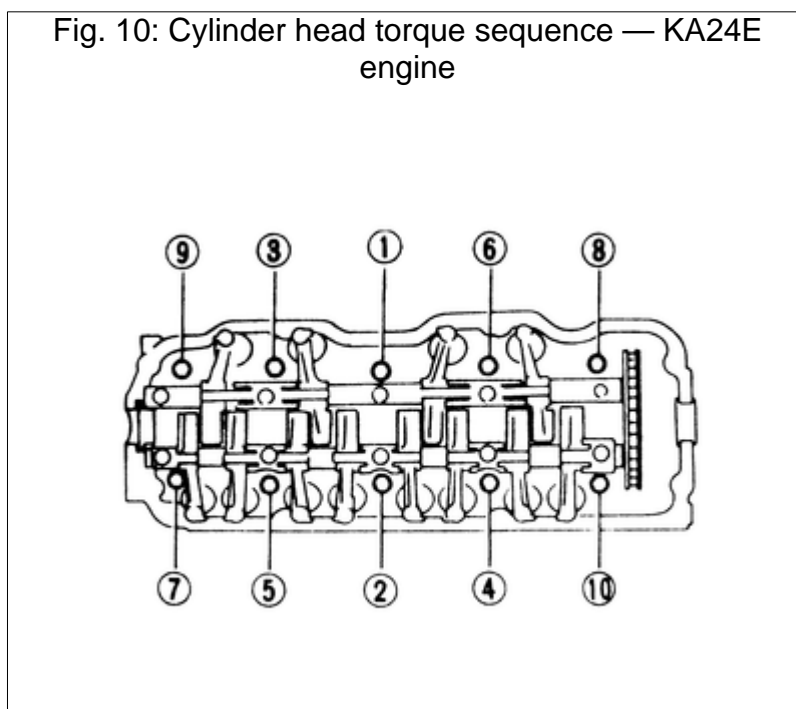


Fig. 11: Apply liquid sealant to the cylinder head plugs — 4-cylinder engines

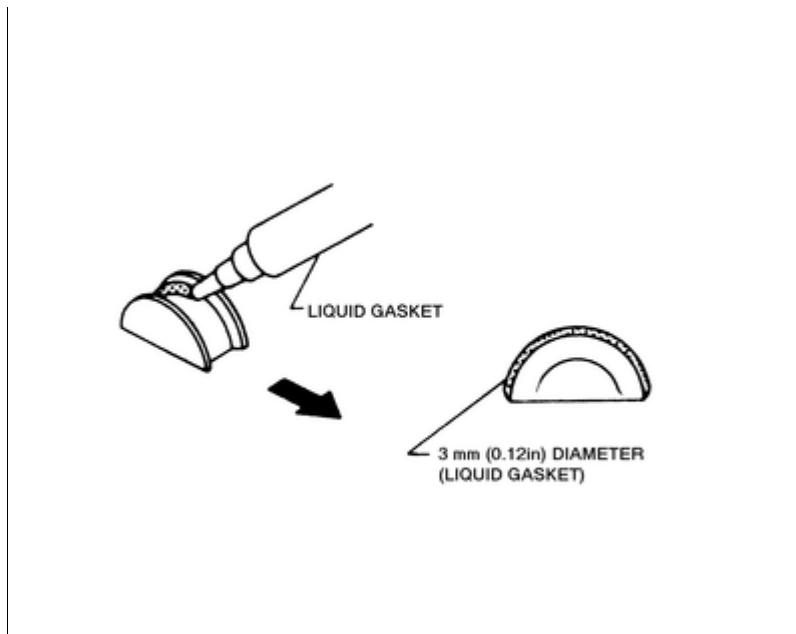


Fig. 12: Press the rubber plug into the cylinder head — 4-cylinder engines

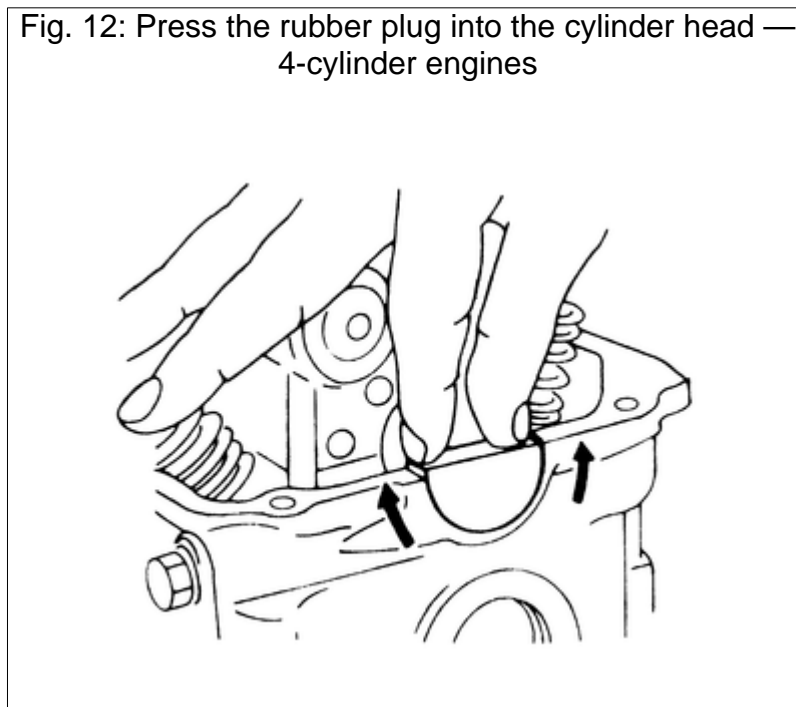


Fig. 13: Cylinder head plug positioning — 4-cylinder engines

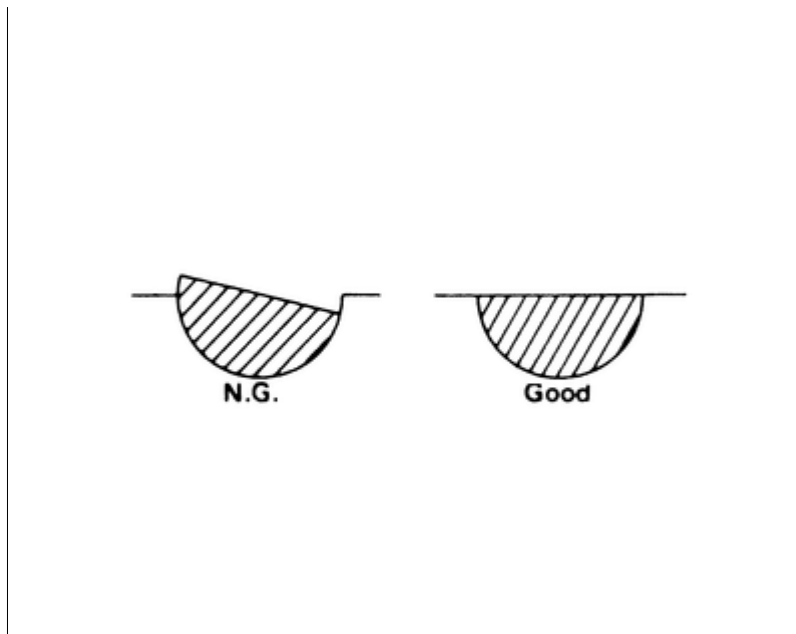
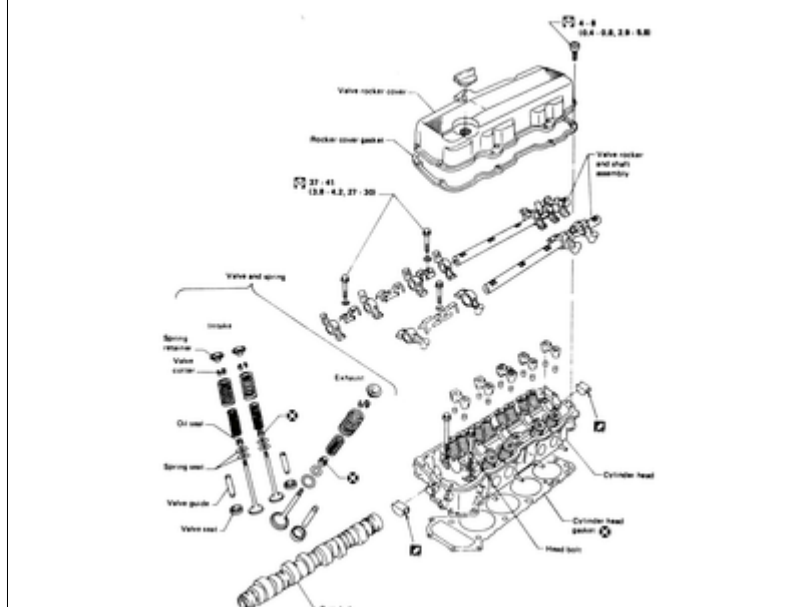


Fig. 14: Exploded view of the cylinder head assembly — KA24E engine



6. Disconnect the air induction hose.
7. Detach the accelerator bracket. If necessary, mark the position and remove the accelerator cable wire end from the throttle drum.
8. Remove the intake manifold.
9. Unplug the exhaust gas sensor, then remove the exhaust cover and exhaust pipe at the exhaust manifold connection. Remove the exhaust manifold from the cylinder head.
10. Remove the rocker cover. If it sticks to the cylinder head, tap the cover with a rubber mallet. Be careful not to strike the rocker arms when removing the rocker arm cover.

NOTE: After removing the rocker cover, matchmark the timing chain and the camshaft sprocket with paint or chalk. If this is done, it will not be necessary to locate the factory timing marks.

11. Remove the spark plugs to protect them from damage. Remove the cylinder head cover.

NOTE: The spark plug leads may already be marked; however, it would be wise to mark them yourself.

12. Set the No. 1 cylinder piston at TDC on its compression stroke. This piston will be at TDC when

the timing pointer is aligned with the red timing mark on the crankshaft pulley.

13. Before removing the camshaft sprocket, it will be necessary to wedge the chain in place so that it will not fall down into the front cover. The factory procedure is to wedge the timing chain in place with a wooden wedge, as illustrated. The problem with this procedure is that it may allow the chain tensioner to move out far enough to cock itself against the chain. If this happens, you'll find that the chain won't go back over the sprocket after you've reinstalled the sprocket. In this case, you'll have to remove the front cover and push the tensioner back. After you've wedged the chain, unbolt the camshaft sprocket and remove it.
14. Working from both ends in, loosen the cylinder head bolts in steps and remove them. Remove the bolts securing the cylinder head to the front cover assembly.

NOTE: The cylinder head bolts should be loosened in two or three steps in the correct order to prevent head warpage or cracking.

15. Loosen and remove the cylinder head bolts a little at a time in the correct sequence. Lift the cylinder head off the engine block. It may be necessary to tap the head lightly with a rubber mallet to loosen it.

To install:

16. Thoroughly clean the cylinder block and head surfaces, and check both for warpage.
17. Fit the new head gasket. Don't use sealant. Install the cylinder head assembly. Make sure that no open valves are in the way of raised pistons, and never rotate the crankshaft or camshaft separately because of possible damage which might occur to the valves.
18. Confirm that the No. 1 piston is at TDC on its compression stroke as follows: Align the timing mark with the red (0 degree) mark on the crankshaft pulley. Make sure the distributor rotor head is set at No. 1 on the distributor cap. Confirm that the knock pin on the camshaft is set at the top position.
19. Install the cylinder head and torque the head bolts in numerical order using the following 5-step procedure:
 - A. Torque all bolts to 22 ft. lbs. (29 Nm).
 - B. Torque all bolts to 58 ft. lbs. (78 Nm).
 - C. Loosen all bolts completely.
 - D. Torque all bolts to 22 ft. lbs. (29 Nm).
 - E. Torque all bolts to 54–61 ft. lbs. (74–83 Nm), or if an angle wrench is used, turn all bolts 80–85 degrees clockwise.

NOTE: Do not rotate the crankshaft and camshaft separately, or valves will hit the tops of the pistons.

20. Remove the wedge from the timing chain. Position the timing chain on the camshaft sprocket by aligning each matchmark. Install the camshaft sprocket to the camshaft.
21. Hold the camshaft sprocket stationary, and tighten the sprocket bolt to 87–116 ft. lbs. (118–157 Nm).
22. Install the front cover-to-cylinder head retaining bolts. Torque the 6mm bolts to 5–6 ft. lbs. (7–8 Nm) and the 8mm bolts to 12–15 ft. lbs. (16–21 Nm).
23. Clean and regap the spark plugs, then install them in the cylinder head. Do not overtorque the spark plugs.
24. Install the intake manifold and collector assembly with new gaskets.
25. Install the exhaust manifold with new gaskets.
26. Apply liquid gasket to the rubber plugs, then install the plugs in their correct location in the cylinder head. The seating surface of the rubber plugs must be clean and dry, and the plugs should be installed within 5 minutes of the sealant application. After the sealant is applied and the rubber plugs are in place, rock the plugs back and forth a few times to distribute the sealant evenly. Wipe the excess sealant from the cylinder head with a clean rag.
27. Install the rocker cover with a new gasket.
28. Attach the accelerator bracket and cable, if removed.
29. Attach all vacuum hoses, water hoses, fuel tubes and electrical connections that were removed to gain access to the cylinder head.
30. Reconnect the air induction hose.
31. Install the spark plugs wires in their correct location.
32. Install the power steering brackets, idler pulley, and power steering pump.

33. Install and adjust the drive belts.

NOTE: It is advisable to drain the crankcase oil and change the oil filter after the cylinder head assembly has been installed.

34. Fill and bleed the cooling system, and connect the negative battery cable.
35. Make all the necessary engine adjustments.

VG30i Engine

NOTE: To remove or install the cylinder head, you'll need a special hex head wrench ST10120000 (J24239 01) or equivalent. The distributor assembly is located in the left cylinder head; mark and remove it if necessary.

1. Relieve the fuel system pressure, as described in Section 5.
2. Disconnect the negative battery cable.
3. Remove the cylinder head covers.
4. Remove the front upper and lower timing belt covers.
5. Set the engine to TDC and then remove the timing belt.

NOTE: Do not rotate either the crankshaft or camshaft from this point onward, or the valves could be bent by hitting the pistons.

6. Drain the coolant from the engine. Tag and disconnect all the vacuum hoses and water hoses connected to the intake manifold.
7. Remove the intake manifold and fuel tube assembly.

Fig. 15: Cylinder head loosening sequence — VG30i and VG30E engines

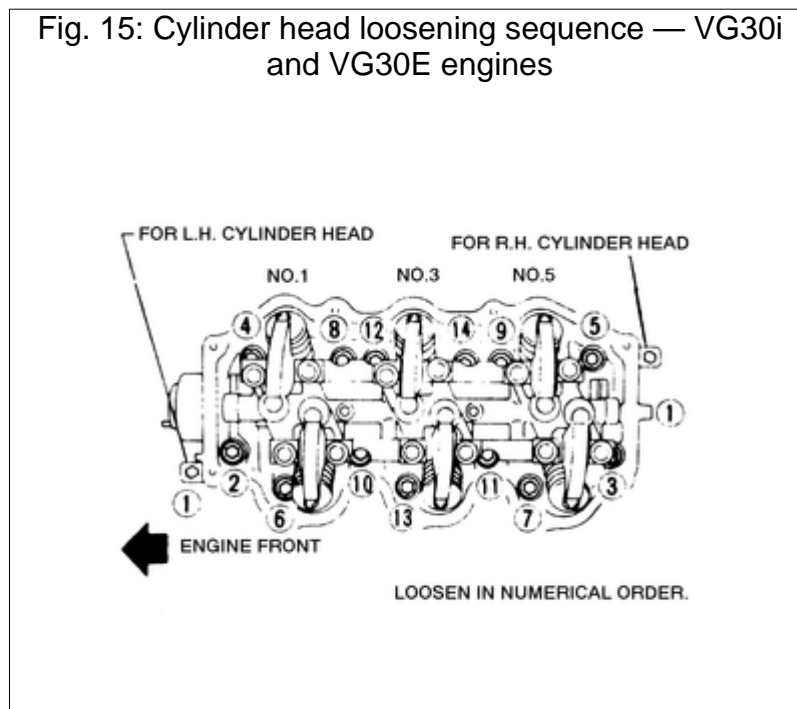


Fig. 16: Use new washers on the cylinder head bolts — the beveled side should face upward — VG30i and VG30E engines

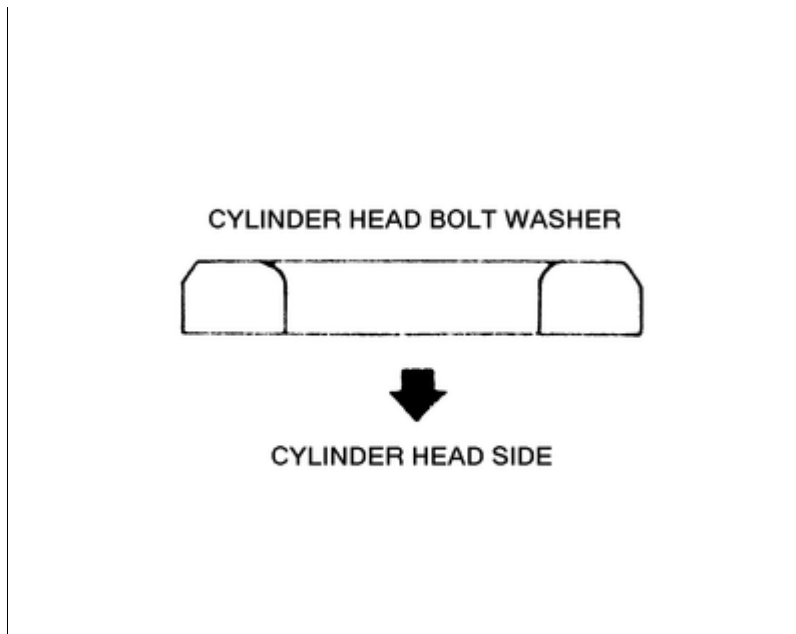


Fig. 17: Cylinder head torque sequence — VG30i and VG30E engines

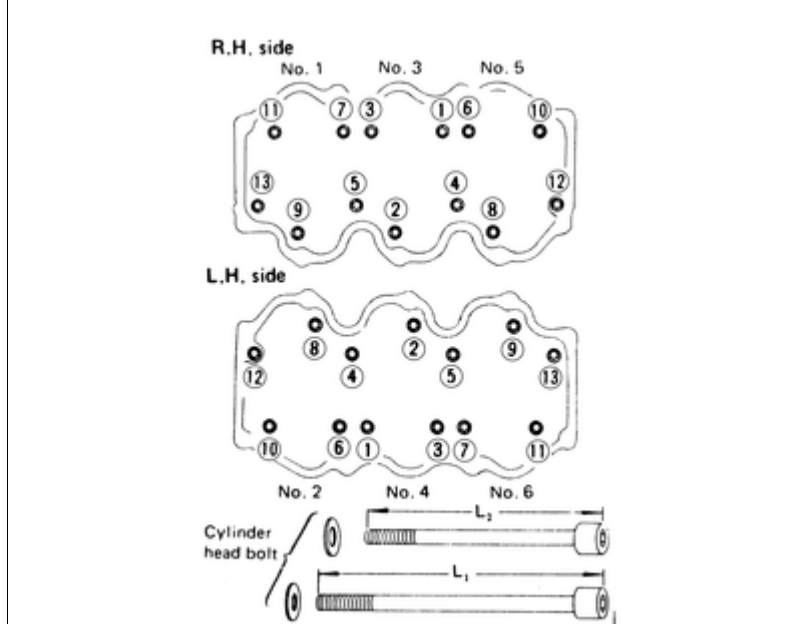


Fig. 18: Camshaft sprocket positioning and alignment — VG30i and VG30E engines

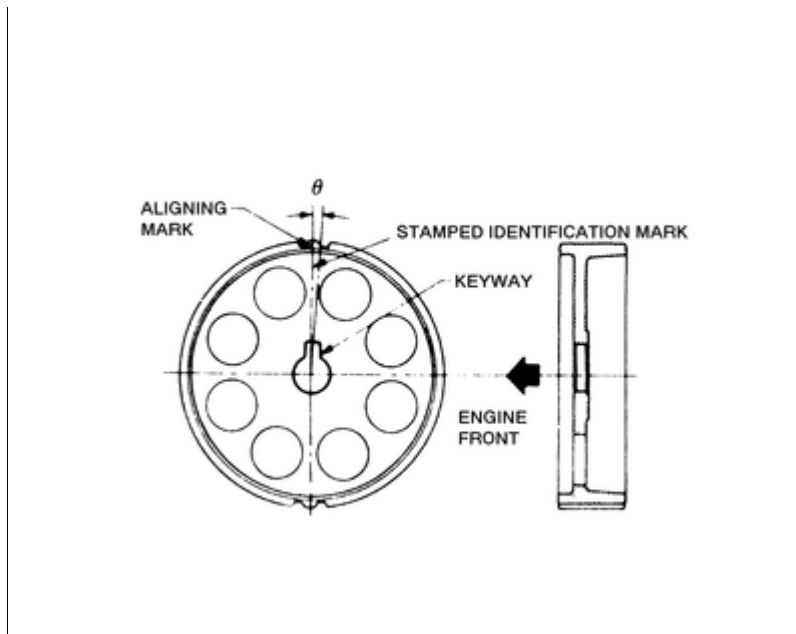
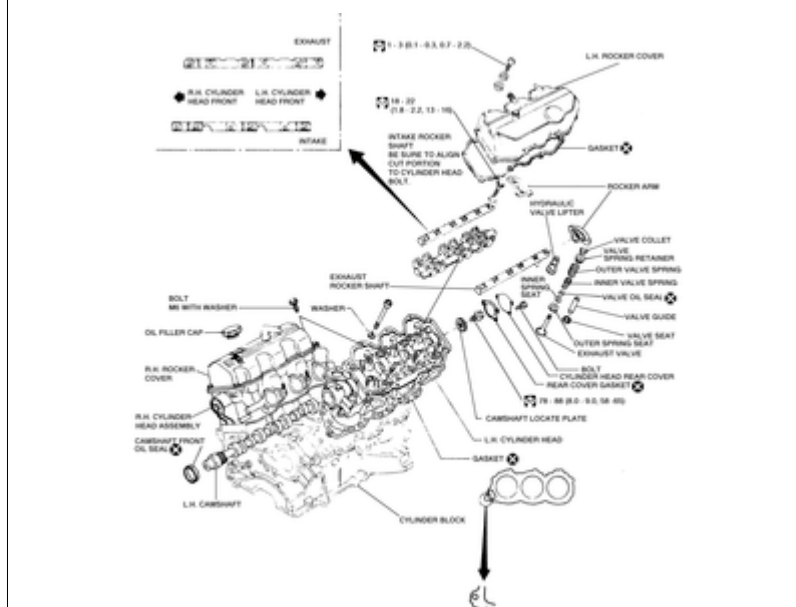


Fig. 19: Exploded view of the cylinder head assembly — VG30i engine



8. Remove the exhaust manifold covers. Disconnect the exhaust manifold where it attaches to the exhaust pipe (three bolts).
9. Remove the camshaft pulleys and the rear timing cover securing bolts.
10. Loosen and remove the cylinder head bolts a little at a time, in the order shown. When removing the cylinder head bolts, note their location for correct installation.
11. Remove the cylinder head with the exhaust manifold attached.

To install:

12. Check the positions of the timing marks and camshaft sprockets to make sure they have not shifted. The mark on the crankshaft should be aligned with the one on the oil pump body, and the camshaft knockpin should be at the top.
13. Install the cylinder head with a new gasket. Apply clean engine oil to the threads and seats of the bolts, then install the bolts with washers (beveled edges up) in the correct position. Note that bolts 4, 5, 12 and 13 measure 5.00 in. (127mm), and are longer than the others. Other bolts are 4.17 in. (106mm) long.
14. Tighten the bolts in the proper sequence, in the following stages:
 - A. Tighten all bolts, in order, to 22 ft. lbs. (29 Nm).
 - B. Tighten all bolts, in order, to 43 ft. lbs. (59 Nm).

- C. Loosen all bolts completely.
 - D. Tighten all bolts, in order, to 22 ft. lbs. (29 Nm).
 - E. Tighten all bolts, in order, to 40–47 ft. lbs. (54–64 Nm). Or, if you have an angle torque wrench available, tighten them an additional 60–65 degrees.
15. Install the rear timing cover bolts and the camshaft pulleys. Make sure the pulley marked **R3** goes on the right and the one marked **L3** goes on the left.
 16. Align the timing marks, if necessary, then install the timing belt and adjust the belt tension.
 17. Install the front upper and lower belt covers.
 18. Make sure that the cylinder head cover bolts, trays and washers are free of oil. Then, install the cylinder head covers.
 19. Install the intake manifold and fuel tube. Tighten manifold bolts and nuts in two or three stages in reverse order of removal.
 20. Install the exhaust manifold if removed from the cylinder head.
 21. Attach the exhaust manifold to the exhaust pipe connection. Install the exhaust manifold cover.
 22. Connect all the vacuum hoses and water hoses.

NOTE: It is advisable to drain the crankcase oil and change the oil filter after the cylinder head assembly has been installed.

23. Refill and bleed the cooling system. Start the engine, then check the engine timing. After the engine reaches the normal operating temperature, check for the correct coolant level.
24. Road test the vehicle for proper operation.

VG30E Engine

1. Relieve the fuel system pressure, as described in Section 5.
2. Disconnect the negative battery cable.
3. Set the engine to TDC and then remove the timing belt.

NOTE: Do not rotate either the crankshaft or camshaft from this point onward, or the valves could be bent by hitting the pistons.

4. Drain the coolant from the engine.
5. Tag and separate the Automatic Speed Control Device (ASCD) and accelerator control wire from the intake manifold collector.
6. Remove the collector cover and the collector. Tag and detach all harness connectors attached to the collector. Disconnect and remove the water and heater hoses at the collector. Disconnect the PCV line. Tag and disconnect all vacuum lines, then remove the EGR tube and the air duct hose.
7. Remove the fuel feed and fuel return hoses from the injector fuel tube assembly.
8. Tag and separate all injector harness connectors, then remove the injector fuel tube assembly.
9. Remove the intake manifold.
10. Remove the camshaft pulleys and the rear timing cover securing bolts.

Fig. 20: Exploded view of the cylinder head assembly —
VG30E engine

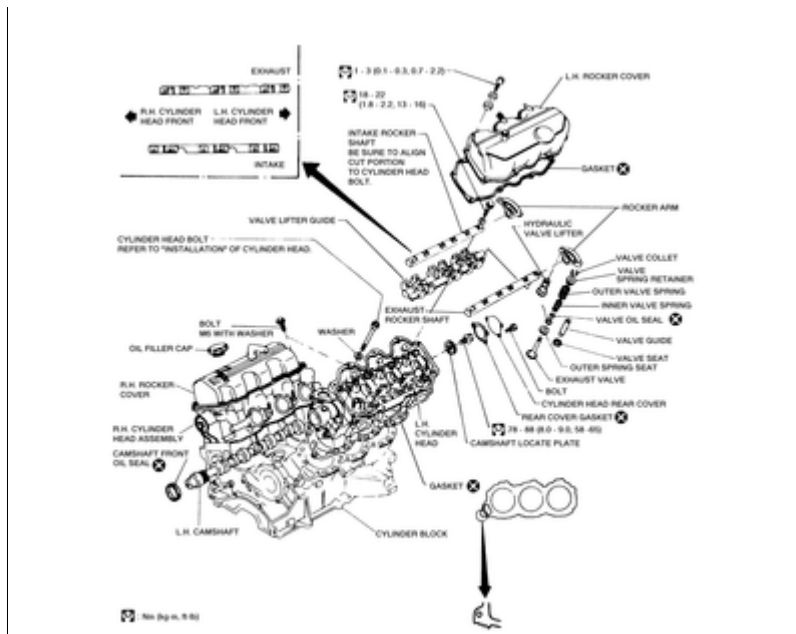


Fig. 21: When removing the cylinder head bolts use a proper tool to loosen the bolts evenly — VG30E engine



Fig. 22: Remove the cylinder head assembly — VG30E engine



Fig. 23: The cylinder head gasket must be replaced upon installation — VG30E engine



Fig. 24: Always use a torque wrench when installing cylinder head bolts, and follow the designated service procedure — VG30E engine



11. Remove the distributor and the ignition wires.
12. Remove the harness clamp from the right-side cylinder head cover.
13. Unbolt the forward exhaust pipe at the manifold and move it out of the way.
14. Remove the drive belts, then remove the A/C compressor and alternator. Remove the mounting bolts and then remove the compressor bracket.
15. Remove the cylinder head covers.
16. Loosen and remove the cylinder head bolts a little at a time, in the order shown.
17. Remove the cylinder head with the exhaust manifold attached.

To install:

18. Check the positions of the timing marks and camshaft sprockets to make sure they have not shifted. The mark on the crankshaft should be aligned with the one on the oil pump body, and the camshaft knockpin should be at the top.
19. Install the cylinder head with a new gasket. Apply clean engine oil to the bolt threads and seats, then install the bolts with washers (beveled edges up) in the correct position. Note that bolts 4, 5, 12 and 13 measure 5.00 in. (127mm), and are longer than the others. The other bolts are 4.17 in. (106mm) long.
20. Tighten the bolts in the proper sequence, in the following stages:
 - A. Tighten all bolts, in order, to 22 ft. lbs. (29 Nm).
 - B. Tighten all bolts, in order, to 43 ft. lbs. (59 Nm).
 - C. Loosen all bolts completely.
 - D. Tighten all bolts, in order, to 22 ft. lbs. (29 Nm).
 - E. Tighten all bolts, in order, to 40–47 ft. lbs. (54–64 Nm). Or, if you have an angle torque wrench available, tighten them an additional 60–65 degrees.
21. Check the hydraulic valve lifter by pushing the plunger forcefully with your finger (be sure that the rocker arm is in the free position, NOT on the lobe). If the lifter moves more than 0.04 in. (1mm), it must be bled, as described at the end of this procedure and in Section 2 of this manual.
22. Install the cylinder head covers and tighten to 1–2 ft. lbs. (1.4–3 Nm).
23. Fasten the compressor bracket, then install the A/C compressor and alternator.
24. Connect the forward exhaust pipe to the manifold.
25. Install the rear timing cover bolts and then install the camshaft pulleys. Make sure the pulley marked **R3** goes on the right and the one marked **L3** goes on the left.
26. Align the timing marks, if necessary, then install the timing belt and adjust the belt tension.
27. Install the distributor by aligning the mark on the distributor shaft with the protruding mark on the housing. The distributor rotor tip should be at the 11 o'clock position.
28. Install the intake manifold and injector fuel tube assembly.
29. Fasten the injector harness connectors.
30. Install the fuel feed and return hoses to the injector fuel tube assembly.
31. Install the intake manifold collector.
32. Reconnect the ASCD and accelerator control wire.

33. Connect all the vacuum hoses and water hoses to the intake collector.

NOTE: It is advisable to drain the crankcase oil and change the oil filter after the cylinder head assembly has been installed.

34. Connect the negative battery cable and refill the cooling system. Start the engine and check the engine timing. After the engine reaches the normal operating temperature, check for the correct coolant level.
35. If the hydraulic valve lifters require bleeding, run the engine at about 1000 rpm, under no load, for about 10 minutes. If the lifter is still noisy after bleeding, replace it and bleed it again.
36. Road test the vehicle for proper operation.

