2B

V8 ENGINES

Section

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1 General information

This Part of Chapter 2 is devoted to in-vehicle repair procedures for the 4.8L, 5.3L and 6.0L V8 engines. These engines utilize cast-iron blocks with eight cylinders arranged in a "V" shape at a 90-degree angle between the two banks. All V8 cylinder heads utilize an overhead valve arrangement. The 4.8L and 5.3L engines use aluminum cylinder heads with pressed-in valve guides and hardened valve seats, while 6.0L V8 engines use cast iron cylinder heads with integral valve guides and pressed-in valve seats. Hydraulic roller lifters actuate the valves through tubular pushrods and rocker arms. The oil pump is mounted at the front of the engine behind the timing chain cover and is driven by the crankshaft.

To positively identify these engines, locate the Vehicle Identification Number (VIN) on the left front corner of the instrument panel. The VIN is visible from the outside of the vehicle through the windshield. The eighth character in the sequence is the engine designation:

V = 4.8 liter V8 engine
B, T, Z = 5.3 liter V8 engine
U, N = 6.0 liter V8 engine

All information concerning engine removal and installation and engine block and cylinder head overhaul can be found in Part C of this Chapter. The following repair procedures are based on the assumption that the engine is installed in the vehicle. If the engine has been removed from the vehicle and mounted on a stand, many of the steps outlined in this Part of Chapter 2 will not apply.

The Specifications included in this Part of Chapter 2 apply only to the procedures contained in this Part. Part C of Chapter 2 contains the Specifications necessary for cylinder head and engine block rebuilding.

2 Repair operations possible with the engine in the vehicle

Many major repair operations can be accomplished without removing the engine from the vehicle.

Clean the engine compartment and the exterior of the engine with some type of pressure washer before any work is done. A clean engine will make the job easier and will help keep dirt out of the internal areas of the engine.

Depending on the components involved, it may be a good idea to remove the hood to improve access to the engine as repairs are performed (refer to Chapter 11 if necessary).

If oil or coolant leaks develop, indicating a need for gasket or seal replacement, the repairs can generally be made with the engine in the vehicle. The oil pan gasket, the cylinder head gaskets, intake and exhaust manifold gaskets, timing chain cover gaskets and the crankshaft oil seals are all accessible with the engine in place.

Exterior engine components, such as the water pump, the starter motor, the alternator, the distributor and the fuel injection components, as well as the intake and exhaust manifolds, can be removed for repair with the engine in place.

Since the cylinder heads can be removed without removing the engine, valve component servicing can also be accomplished with the engine in the vehicle.

Replacement of, repairs to or inspection of the timing chain and sprockets and the oil pump are all possible with the engine in place.

In extreme cases caused by a lack of necessary equipment, repair or replacement of piston rings, pistons, connecting rods and rod bearings is possible with the engine in the vehicle. However, this practice is not recommended because of the cleaning and preparation work that must be done to the components involved.

3 Top Dead Center (TDC) for number one piston - locating

Refer to illustration 3.6

1 Top Dead Center (TDC) is the highest point in the cylinder that each piston reaches as it travels up the cylinder bore. Each piston reaches TDC on the compression stroke and again on the exhaust stroke, but TDC generally refers to piston position on the compression stroke.

2 Positioning the piston(s) at TDC is an essential part of many procedures such as distributor and timing chain/sprocket removal.

3 Before beginning this procedure, be sure to place the transmission in Neutral and apply the parking brake or block the rear wheels. Also, disable the ignition system by disconnecting the primary electrical connectors at the ignition coil packs, then remove the spark plugs (see Chapter 1).

4 In order to bring any piston to TDC, the crankshaft must be turned using one of the methods outlined below. When looking at the front of the engine, normal crankshaft rotation is clockwise.

a) *The preferred method is to turn the crankshaft with a socket and ratchet attached to the bolt threaded into the front of the crankshaft. Apply pressure on the bolt in a clockwise direction only. Never turn the bolt counterclockwise.*

b) *A remote starter switch, which may save some time, can also be used. Follow the instructions included with the switch. Once the piston is close to TDC, use a socket and ratchet as described in the previous paragraph.*

c) *If an assistant is available to turn the ignition switch to the Start position in short bursts, you can get the piston close to TDC without a remote starter switch. Make sure your assistant is out of the vehicle, away from the ignition switch, then use a socket and ratchet as described in Paragraph (a) to complete the procedure.*

5 Place your finger partially over the number one spark plug hole and rotate the crankshaft using one of the methods described above until air pressure is felt at the spark plug hole. Air pressure at the spark plug hole indicates that the cylinder has started the compression stroke. Once the compression stroke has begun, TDC for the number one cylinder is obtained when the piston reaches the top of the cylinder

on the compression stroke.

6 To bring the piston to the top of the cylinder, insert a long screwdriver into the number one spark plug hole until it touches the top of the piston.

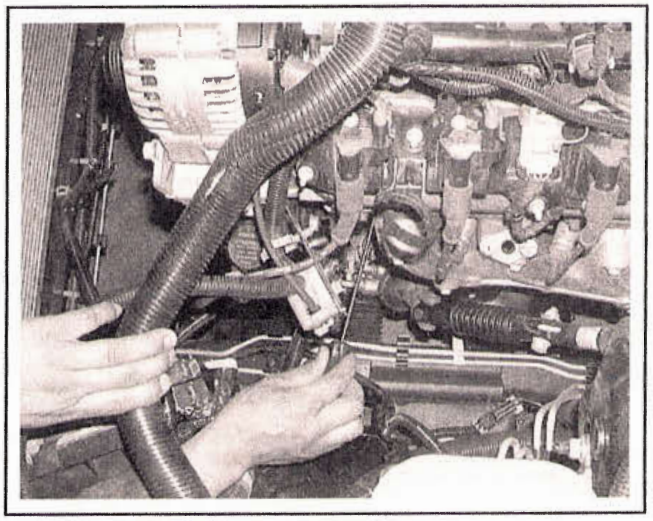
➡Note: Make sure to wrap the tip of the screwdriver with tape to avoid scratching the top of the piston and the cylinder walls.

Use the screwdriver (as a feeler gauge) to tell where the top of the piston is located in the cylinder while slowly rotating the crankshaft (see illustration). As the piston rises the screwdriver will be pushed out. The point at which the screwdriver stops moving outward is TDC.

➡Note: Always hold the screwdriver upright while the engine is being rotated so that the screwdriver will not get wedged as the piston travels upward.

7 If you go past TDC, rotate the crankshaft counterclockwise until the piston is approximately one inch below TDC, then slowly rotate the crankshaft clockwise again until TDC is reached.

8 After the number one piston has been positioned at TDC on the compression stroke, TDC for any of the remaining pistons can be located by turning the crankshaft 90-degrees (1/4 turn) at a time and following the firing order.



3.6 A long screwdriver inserted in the number one spark plug hole can be used to determine the highest point reached by that piston - make sure to wrap the tip of the screwdriver with tape to avoid scratching the top of the piston or the cylinder walls

4 Valve covers - removal and installation

REMOVAL

♦ Refer to illustrations 4.4 and 4.12

1 Disconnect the cable from the negative terminal of the battery.

✻✻ CAUTION:

On models equipped with the Theftlock audio system, be sure the lockout feature is turned off before performing any procedure which requires disconnecting the battery (see the front of this manual).

2 On models so equipped, remove the secondary air injection crossover pipe, then remove the air injection check valve and pipe assembly from the exhaust manifold on the side from which you wish to remove the valve cover (see Chapter 6). If both valve covers are being removed, both air injection check valves and pipe assemblies must be removed.

➡Note: On some later models you must first remove the plastic engine cover. It is secured with a single bolt.

Right side

3 Remove the filter housing (see Chapter 4).

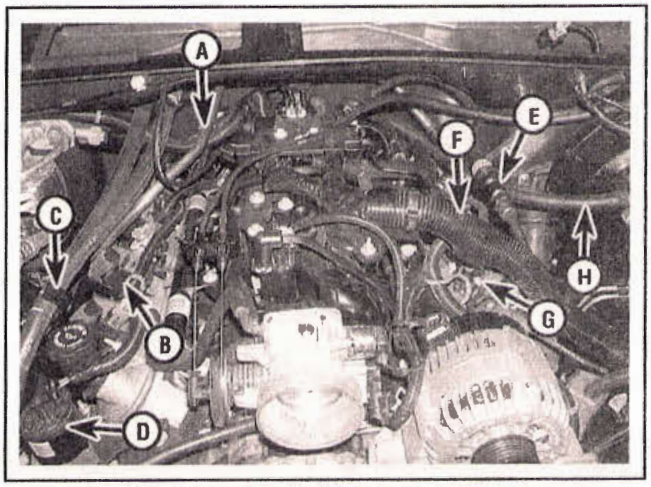
4 Remove the heater hose bracket bolt and move the heater hoses aside without disconnecting them (see illustration).

5 Disconnect the electrical connectors from the ignition coils and the EGR valve. Unclip the wiring harness from the ignition coil bracket and lay it aside.

6 Remove the ignition coils from the valve cover (see Chapter 5). Be sure each plug wire is labeled before removal to ensure correct reinstallation.

7 Remove the valve cover bolts, then detach the cover from the cylinder head.

➡Note: If the cover is stuck to the cylinder head, bump one end with a block of wood and a hammer to jar it loose. If that doesn't work, try to slip a flexible putty knife between the cylinder head and cover to break the gasket seal. Don't pry at the cover-to-head joint or damage to the sealing surfaces may occur (leading to oil leaks in the future).

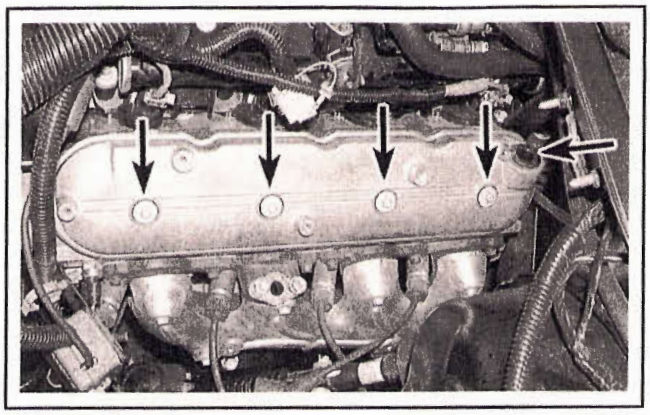


4.4 Detach or lay aside the following components for valve cover removal - 2000 Silverado shown

A Secondary Air Injection crossover pipe
B Ignition coils (passenger side)
C Heater hoses
D EGR valve
E Secondary Air Injection check valve and pipe assembly (driver side)
F Wiring harness
G Ignition coils (driver side)
H Power brake booster hose

Left side

8 Detach the clips securing the engine wiring harness to the valve



4.12 Valve cover mounting bolts (arrows) - arrow to the far right indicates location of the PCV valve (left valve cover shown)

4.15 Position the new gasket in the valve cover lip

cover and to positive battery cable junction block bracket and position the engine wiring harness aside.

9 Remove the power brake booster vacuum hose from the power brake booster.

10 Remove the ignition coils from the valve cover (see Chapter 5). Be sure each plug wire is labeled before removal to ensure correct reinstallation.

11 Disconnect the PCV valve from the valve cover.

12 Remove the valve cover bolts (see illustration), then detach the cover from the cylinder head.

➡Note: If the cover is stuck to the cylinder head, bump one end with a block of wood and a hammer to jar it loose. If that doesn't work, try to slip a flexible putty knife between the cylinder head and cover to break the gasket seal. Don't pry at the cover-to-head joint or damage to the sealing surfaces may occur (leading to oil leaks in the future).

INSTALLATION

♦ Refer to illustration 4.15

13 The mating surfaces of each cylinder head and valve cover must be perfectly clean when the covers are installed. Use a gasket scraper to remove all traces of sealant and old gasket material, then clean the mating surfaces with lacquer thinner or acetone. If there's sealant or oil on the mating surfaces when the cover is installed, oil leaks may develop.

14 Clean the mounting bolt threads with a die to remove any corrosion and restore damaged threads. Make sure the threaded holes in the cylinder head are clean - run a tap into them to remove corrosion and restore damaged threads.

15 The gaskets should be mated to the covers before the covers are installed. Position the gasket inside the cover lip (see illustration). If the gasket will not stay in place in the cover lip, apply a thin coat of RTV sealant to the cover flange, then and allow the sealant to set up so the gasket adheres to the cover.

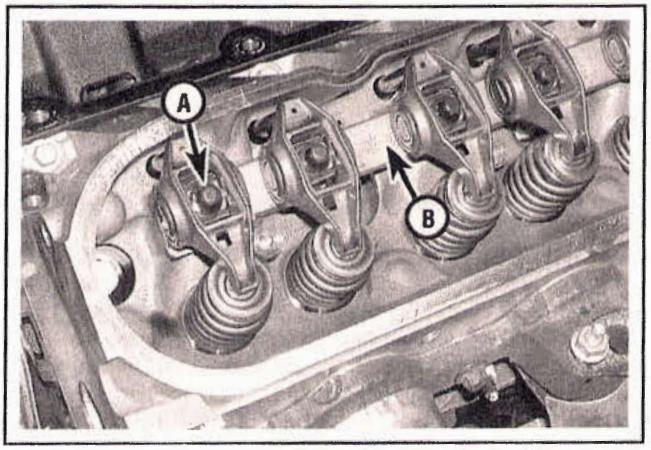
16 Inspect the valve cover bolt grommets for damage. If the grommets aren't damaged they can be reused. Carefully position the valve cover(s) on the cylinder head and install the bolts and grommets. On 2001 and later models, remove the oil filler tube and replace it with a new one.

17 Tighten the bolts in three or four steps to the torque listed in this Chapter's Specifications.

18 The remaining installation steps are the reverse of removal.

19 Start the engine and check carefully for oil leaks as the engine warms up.

5 Rocker arms and pushrods - removal, inspection and installation



5.2 Remove the mounting bolts (A) and rocker arms, then remove the pivot support pedestal (B)

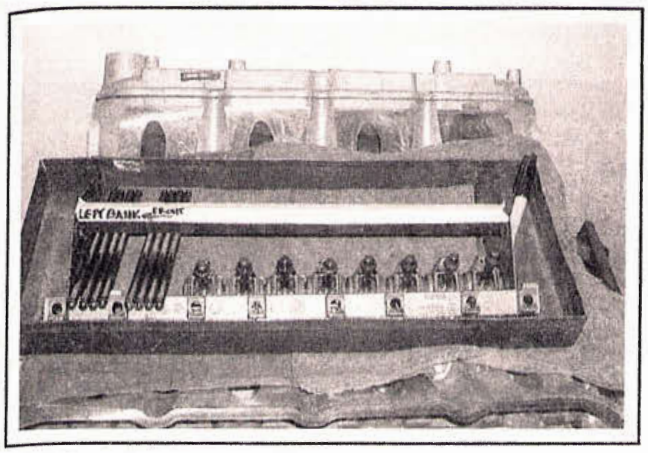
REMOVAL

♦ Refer to illustrations 5.2 and 5.3

1 Refer to Section 4 and detach the valve covers from the cylinder heads.

2 Loosen the rocker arm pivot bolts one at a time and detach the rocker arms and bolts, then detach the pivot support pedestal (see illustration). Keep track of the rocker arm positions, since they must be returned to the same locations. Store each set of rocker components separately in a marked plastic bag to ensure that they're reinstalled in their original locations.

3 Remove the pushrods and store them separately to make sure they don't get mixed up during installation (see illustration).



5.3 Store the pushrods and rocker arms in order to ensure they are reinstalled in their original locations - note the arrow indicating the front of the engine

INSPECTION

Refer to illustration 5.4

4 Check each rocker arm for wear, cracks and other damage, especially where the pushrods and valve stems contact the rocker arm (see illustration).

5 Check the pivot bearings for binding and roughness. If the bearings are worn or damaged, replacement of the entire rocker arm will be necessary.

Note: Keep in mind that there is no valve adjustment on these engines, so excessive wear or damage in the valve train can easily result in excessive valve clearance, which in turn will cause valve noise when the engine is running. Also check the rocker arm pivot support pedestal for cracks and other obvious damage.

6 Make sure the hole at the pushrod end of each rocker arm is open.

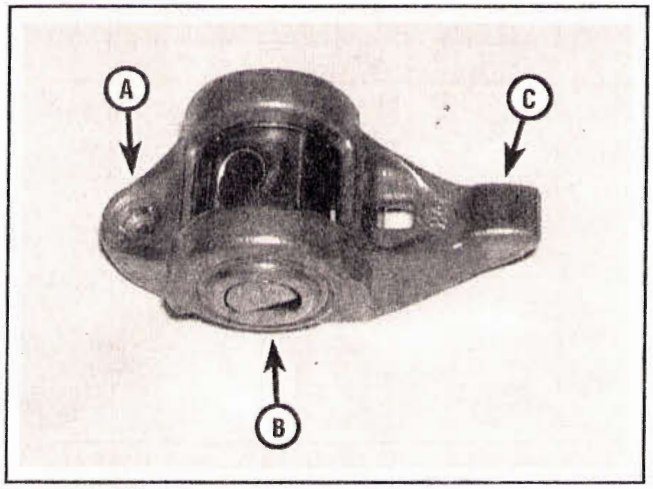
7 Inspect the pushrods for cracks and excessive wear at the ends, also check that the oil hole running through each pushrod is not clogged. Roll each pushrod across a piece of plate glass to see if it's bent (if it wobbles, it's bent).

INSTALLATION

Refer to illustration 5.9

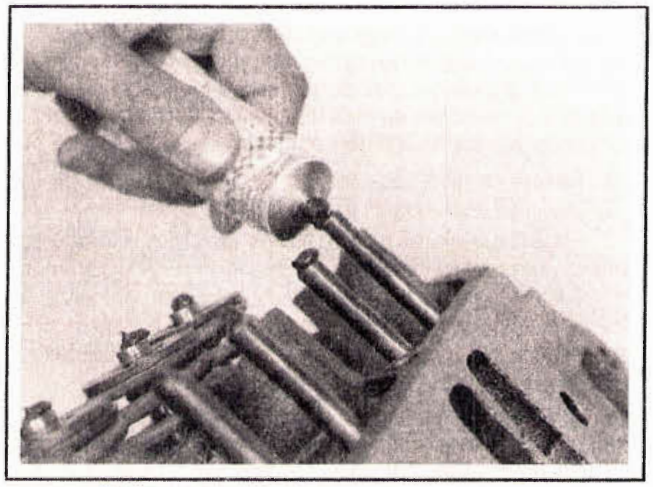
8 Lubricate the lower end of each pushrod with clean engine oil or engine assembly lube and install them in their original locations. Make sure each pushrod seats completely in the lifter socket.

9 Apply engine assembly lube to the ends of the valve stems and to the upper ends of the pushrods to prevent damage to the mating surfaces on initial start-up (see illustration). Also apply clean engine oil to the pivot shaft and bearing of each rocker arm and install the rocker arms loosely in their original locations. DO NOT tighten the bolts at this time!



5.4 Rocker arm wear points

A Pushrod socket
B Pivot bearings
C Valve stem contact point



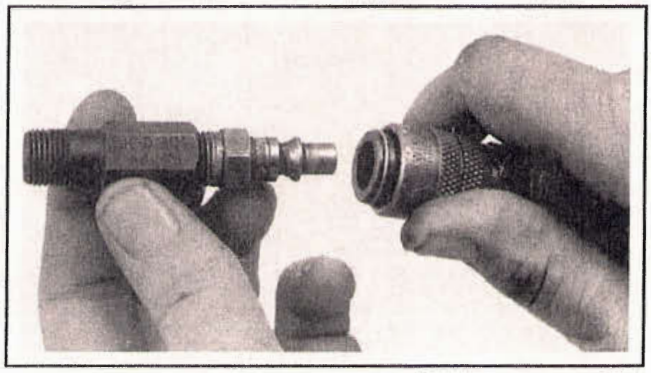
5.9 Lubricate the pushrod ends and the valve stems with engine assembly lube before installing the rocker arms

10 Rotate the crankshaft until the number one piston is at TDC (see Section 3). With the number one piston is at TDC, tighten the intake valve rocker arms for the Number 1, 3, 4, and 5 cylinders and the exhaust rocker arms for the Number 1, 2, 7, and 8 cylinders. Tighten each of the specified rocker arm bolts to the torque listed in this Chapter's Specifications.

11 Rotate the crankshaft 360 degrees. Tighten the intake valve rocker arms for the Number 2, 6, 7, and 8 cylinders and the exhaust rocker arms for the Number 3, 4, 5, and 6 cylinders. Tighten each of the rocker arm bolts to the torque listed in this Chapter's Specifications.

12 Refer to Section 4 and install the valve covers. Start the engine, listen for unusual valve train noses and check for oil leaks at the valve cover gaskets.

6 Valve springs, retainers and seals - replacement



6.5 This is what the air hose adapter that fits into the spark plug hole looks like - they're commonly available from auto parts stores

Refer to illustrations 6.5, 6.8, 6.10, 6.15a, 6.15b and 6.19

Note: Broken valve springs and defective valve stem seals can be replaced without removing the cylinder head. Two special tools and a compressed air source are normally required to perform this operation, so read through this Section carefully and rent or buy the tools before beginning the job.

1 Remove the spark plugs (see Chapter 1).

2 Remove the valve covers (see Section 4).

3 Rotate the crankshaft until the number one piston is at top dead center on the compression stroke (see Section 3).

4 Remove the rocker arms for the number 1 piston.

5 Thread an adapter into the spark plug hole and connect an air hose from a compressed air source to it (see illustration). Most auto parts stores can supply the air hose adapter.

Note: Many cylinder compression gauges utilize a screw-in fitting that may work with your air hose quick-disconnect fitting. If a cylinder compression gauge fitting is used it will be necessary to remove the schrader valve from the end of the fitting before using it in this procedure.

6 Apply compressed air to the cylinder. The valves should be held in place by the air pressure.

WARNING:

If the cylinder isn't exactly at TDC, air pressure may force the piston down, causing the engine to quickly rotate. DO NOT leave a wrench on the crankshaft balancer bolt or you may be injured by the tool.

7 Stuff shop rags into the cylinder head holes around the valves to prevent parts and tools from falling into the engine.

8 Using a socket and a hammer gently tap on the top of each valve spring retainer several times (this will break the seal between the valve keeper and the spring retainer and allow the keeper to separate from the valve spring retainer as the valve spring is compressed), then use a valve-spring compressor to compress the spring. Remove the keepers with small needle-nose pliers or a magnet (see illustration).

Note: Several different types of tools are available for compressing the valve springs with the head in place. One type grips the lower spring coils and presses on the retainer as the knob is turned, while the lever-type shown here utilizes the rocker arm bolt for leverage. Both types work very well, although the lever type is usually less expensive.

9 Remove the valve spring and retainer.

Note: If air pressure fails to retain the valve in the closed position during this operation, the valve face or seat may be damaged. If so, the cylinder head will have to be removed for repair.

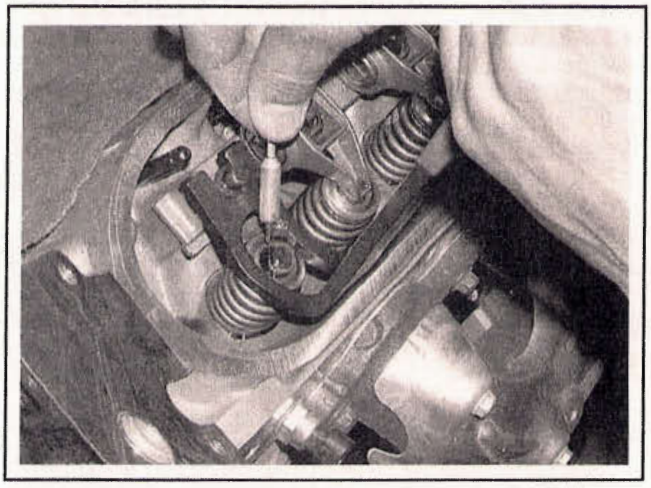
10 Remove the old valve stem seals, noting differences between the intake and exhaust seals (see illustration).

11 Wrap a rubber band or tape around the top of the valve stem so the valve won't fall into the combustion chamber, then release the air pressure.

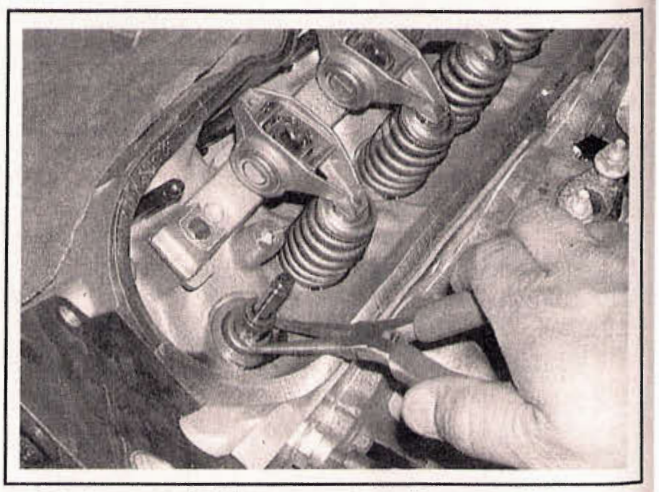
12 Inspect the valve stem for damage. Rotate the valve in the guide and check the end for eccentric movement, which would indicate that the valve is bent.

13 Move the valve up-and-down in the guide and make sure it does not bind. If the valve stem binds, either the valve is bent or the guide is damaged. In either case, the head will have to be removed for repair.

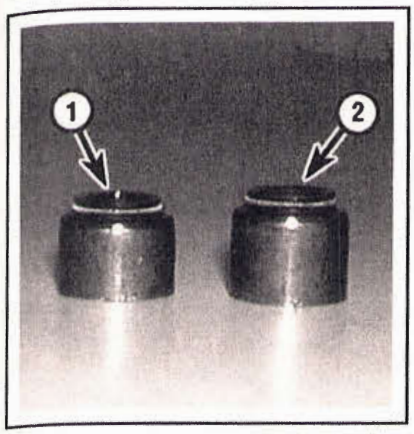
14 Reapply air pressure to the cylinder to retain the valve in the



6.8 Once the spring is depressed, the keepers can be removed with a small magnet or needle-nose pliers (a magnet is preferred to prevent dropping the keepers)

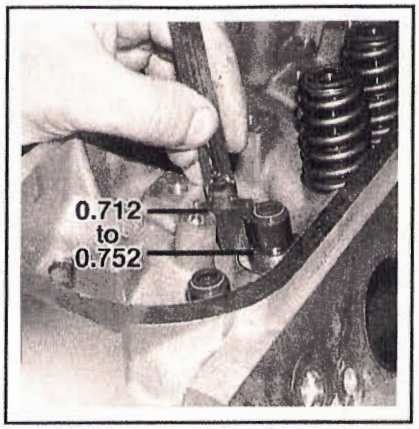


6.10 Use a pair of needle nose pliers to remove the valve seals

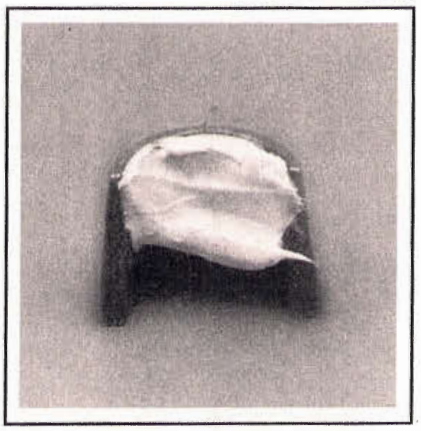


6.15a Be sure to install the seals on the correct valve stems

1 Intake valve seal
2 Exhaust valve seal



6.15b Install the intake and exhaust valve seals to the specified depth - measure from the spring seat to the top edge of the valve seal



6.19 Apply small dab of grease to each keeper as shown here before installation - it'll hold them in place on the valve stem as the spring is released

closed position, then remove the tape or rubber band from the valve stem.

15 If you're working on an exhaust valve, install the new exhaust valve seal on the valve stem and press it down over the valve guide to the specified depth. Don't force the seal against the top of the guide (see illustrations).

➡Note: On aluminum heads be sure take this measurement from the steel spring seat to the top edge of the intake and exhaust valve seals, not from the aluminum seat on the head!

16 If you're working on an intake valve, install a new intake valve stem seal over the valve stem and press it down over the valve guide to the specified depth. Don't force the intake valve seal against the top of the guide.

CAUTION:

Do not install an exhaust valve seal on an intake valve, as high oil consumption will result.

17 Install the spring and retainer in position over the valve.

18 Compress the valve spring assembly only enough to install the keepers in the valve stem.

19 Position the keepers in the valve stem groove. Apply a small dab of grease to the inside of each keeper to hold it in place if necessary (see illustration). Remove the pressure from the spring tool and make sure the keepers are seated.

20 Disconnect the air hose and remove the adapter from the spark plug hole.

21 Repeat the above procedure on the remaining cylinders, following the firing order sequence (see this Chapter's Specifications). Bring each piston to top dead center on the compression stroke before applying air pressure (see Section 3).

22 Reinstall the rocker arm assemblies and the valve covers (see Sections 4 and 5).

23 Start the engine, then check for oil leaks and unusual sounds coming from the valve cover area. Allow the engine to idle for at least five minutes before revving the engine.

7 Intake manifold - removal and installation

WARNING:

Wait until the engine is completely cool before starting this procedure.

REMOVAL

Refer to illustrations 7.3, 7.7a, 7.7b, 7.8a, 7.8b and 7.8c

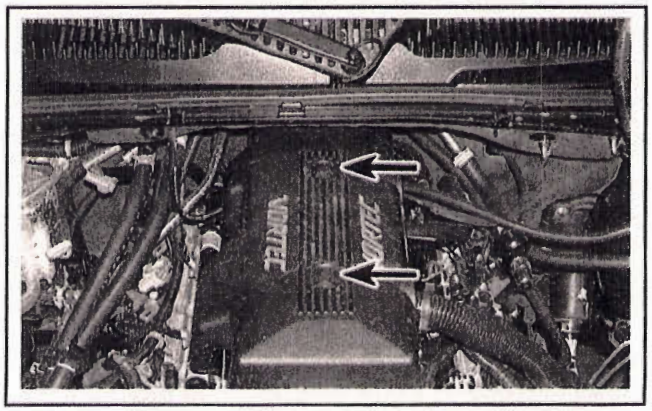
1 Disconnect the cable from the negative terminal of the battery.

CAUTION:

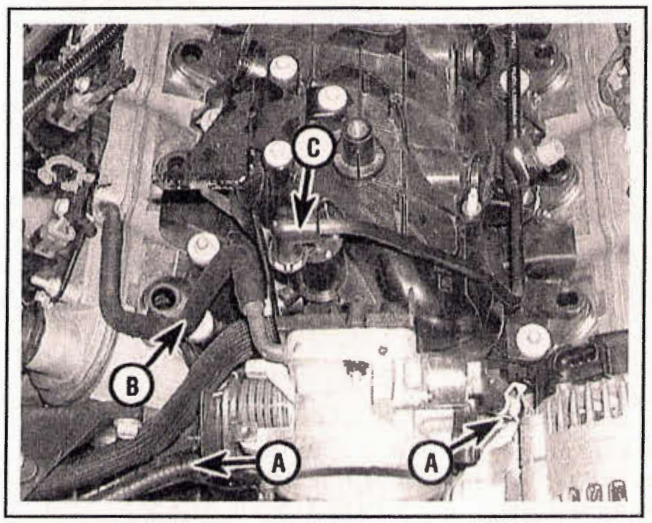
On models equipped with the Theftlock audio system, be sure the lockout feature is turned off before performing any procedure which requires disconnecting the battery (see the front of this manual).

2 Clamp off the coolant hoses leading to the throttle body.

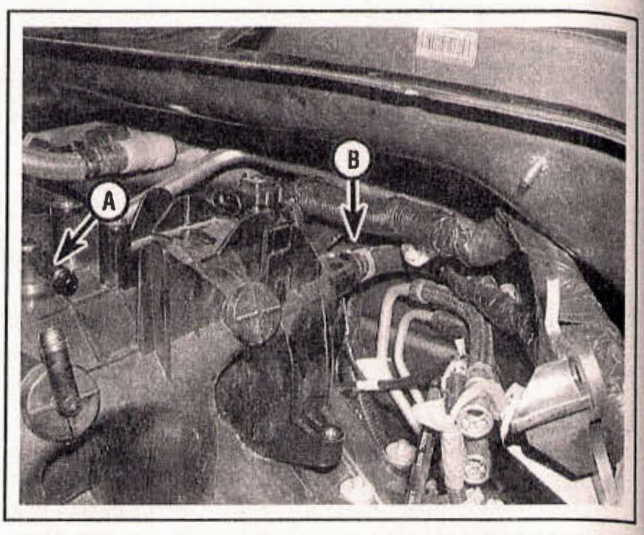
3 Remove the filter housing and the intake manifold cover (see illustration). Relieve the fuel system pressure (see Chapter 4).



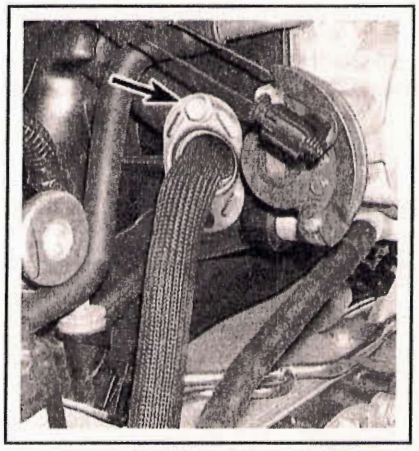
7.3 Typical intake manifold cover retaining screws (arrows)



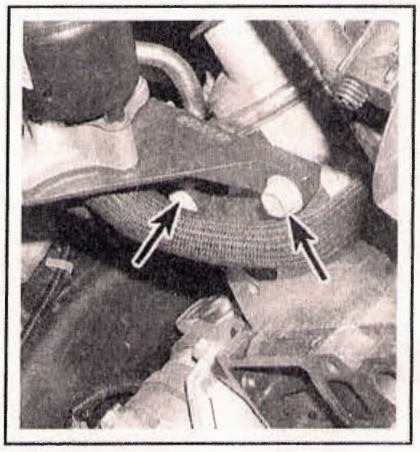
7.7a Disconnect the coolant hoses (A) and the crankcase breather hose (B) from the throttle body, then squeeze the retainer on the EVAP solenoid vent tube (C) and remove it from the top of the intake manifold



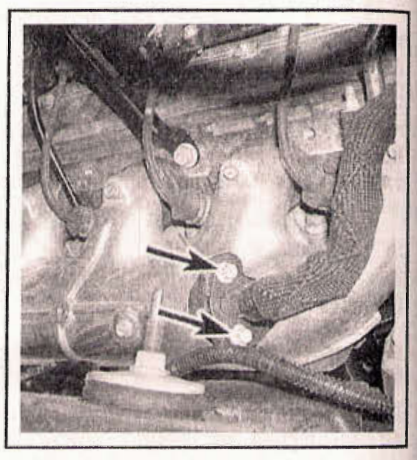
7.7b Detach the PCV hose (A) and the power brake booster vacuum hose (B) from the rear of the intake - PCV hose already removed in this photo



7.8a EGR pipe to intake manifold mounting bolts (arrows)



7.8b EGR valve mounting bracket to cylinder head mounting bolts (arrows)



7.8c EGR pipe to exhaust manifold mounting bolts (arrows)

4 Disconnect the accelerator linkage (see Chapter 4) and, if equipped, the cruise control linkage.

5 Disconnect the electrical connectors from the fuel injectors, EGR valve, EVAP solenoid, the MAP sensor and from the sensors on the throttle body. Label each connector clearly to aid in the reassembly process. Detach the large wiring harness bracket from the stud on the top of the intake manifold and lay the harness aside. Remove the MAP sensor if necessary for clearance.

6 Remove the fuel rails and injectors as an assembly (see Chapter 4). The two fuel rails can be pulled straight up with the injectors still attached, but it will take some force to dislodge the injectors from the intake manifold.

➡Note: This Step is not absolutely necessary but it will help prevent subsequent damage to the fuel injectors as the intake manifold is removed. Normally, the intake manifold is removed with the fuel injectors, fuel rails, and throttle body attached.

7 Disconnect any vacuum hoses attached to the intake manifold or throttle body such as the power brake booster, the PCV and the EVAP purge control solenoid. Also disconnect the coolant hoses from the throttle body (see illustrations). Remove the EVAP canister if necessary.

8 Remove the EGR valve and pipe assembly from the engine (see illustrations) if it interferes with intake manifold removal.

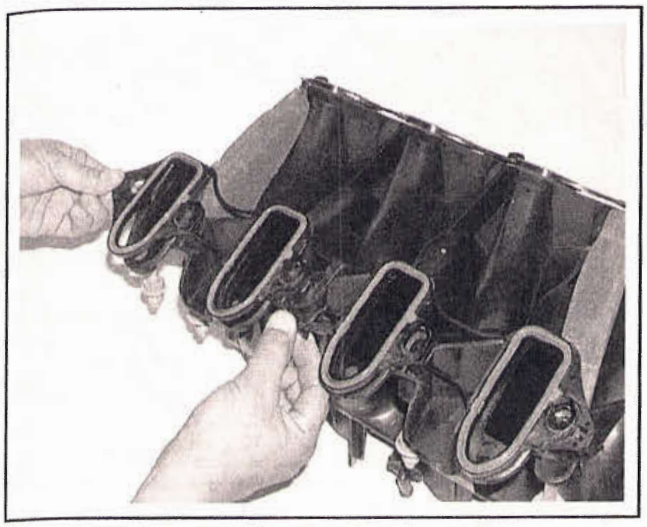
9 Disconnect any remaining electrical connectors or vacuum hoses connected to the intake manifold or throttle body.

10 Loosen the intake manifold mounting bolts in 1/4-turn increments in the reverse order of the tightening sequence until they can be removed by hand (see illustration 7.16). The manifold will probably be stuck to the cylinder heads and force may be required to break the gasket seal. A pry bar can be positioned between the front of the manifold and the valley tray to break the bond made by the gasket.

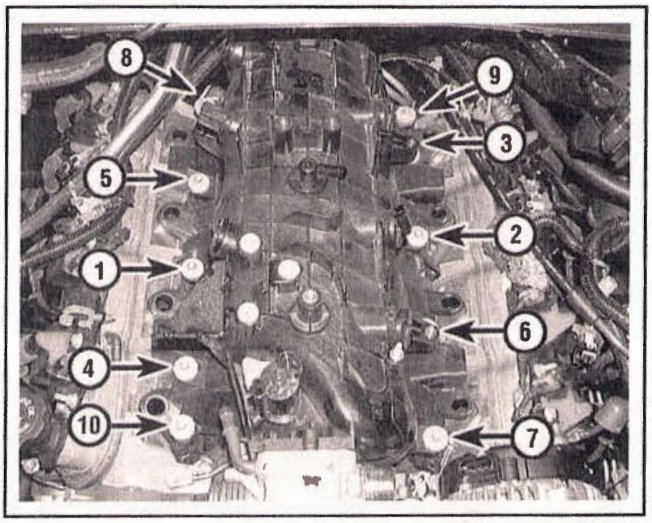
CAUTION:

Do not pry between the manifold and the heads or damage to the gasket sealing surfaces may result and vacuum leaks could develop. Also, don't use too much force - the manifold is made of a plastic composite and could crack.

11 Remove the intake manifold. As the manifold is lifted from the engine, be sure to check for and disconnect anything still attached to the manifold.



7.14 Align the tabs on the intake gaskets with the tabs on the manifold and snap the gasket into place



7.16 Intake manifold bolt tightening sequence - all V8 engines

INSTALLATION

Refer to illustrations 7.14 and 7.16

Note: The mating surfaces of the cylinder heads, block and manifold must be perfectly clean when the manifold is installed.

12 Carefully remove all traces of old gasket material. Note that the intake manifold is made of a composite material and the cylinder heads on 4.8L and 5.3L engines are made of aluminum, therefore aggressive scraping is not suggested and will damage the sealing surfaces. After the gasket surfaces are cleaned and free of any gasket material wipe the mating surfaces with a cloth saturated with safety solvent. If there is old sealant or oil on the mating surfaces when the manifold is installed, oil or vacuum leaks may develop. Use a vacuum cleaner to remove any gasket material that falls into the intake ports in the heads.

13 Use a tap of the correct size to chase the threads in the bolt holes, then use compressed air (if available) to remove the debris from the holes.

WARNING:

Wear safety glasses or a face shield to protect your eyes when using compressed air.

14 Position the new gaskets on the intake manifold (see illustration). Note that the gaskets are equipped with installation tabs that must snap into place on the intake manifold. The words "Manifold Side" may appear on the gasket, If so, this will ensure proper installation. Make sure the gaskets snap into place and all intake port openings align.

15 Carefully set the manifold in place.

16 Apply medium-strength threadlocking compound to the threads of the bolts. Install the bolts and tighten them following the recommended sequence (see illustration) to the torque listed in this Chapter's Specifications. Do not overtighten the bolts or gasket leaks may develop.

17 The remaining installation steps are the reverse of removal. Check the coolant level, adding as necessary (see Chapter 1). Start the engine and check carefully for vacuum leaks at the intake manifold joints.

8 Exhaust manifolds - removal and installation

REMOVAL

Refer to illustrations 8.4, 8.8 and 8.9

WARNING:

Use caution when working around the exhaust manifolds - the sheetmetal heat shields can be sharp on the edges. Also, the engine should be cold when this procedure is followed.

1 Disconnect the cable from the negative terminal of the battery.

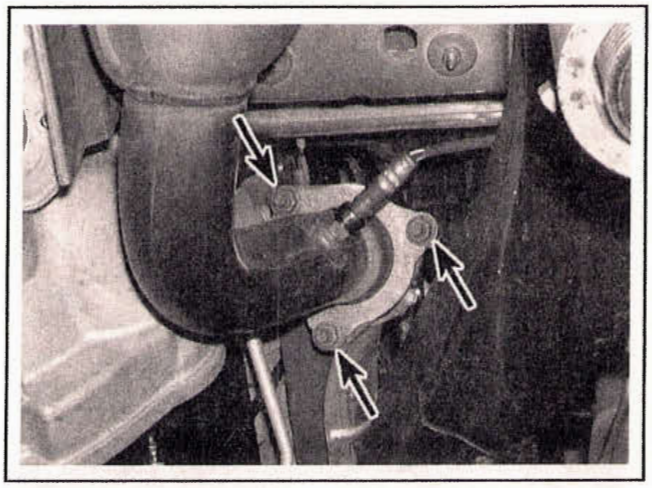
CAUTION:

On models equipped with the Theftlock audio system, be sure the lockout feature is turned off before performing any procedure which requires disconnecting the battery (see the front of this manual).

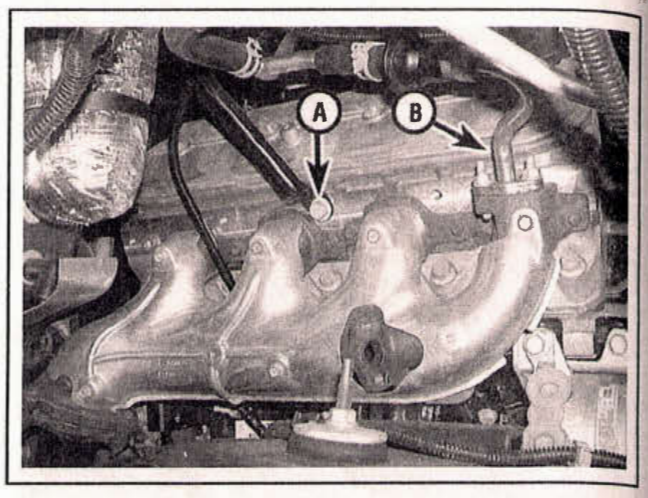
2 Raise the vehicle and support it securely on jackstands.

3 Working under the vehicle, apply penetrating oil to the exhaust pipe-to-manifold studs and nuts (they're usually rusty). Disconnect the electrical connector for oxygen sensor.

4 Remove the nuts retaining the exhaust pipe(s) to the manifold(s)



8.4 Remove the exhaust pipe-to-manifold nuts



8.8 Remove the oil dipstick tube mounting bolt (A) and tube - (B) indicates the secondary air injection check valve and pipe assembly on the right manifold

(see illustration). Note that both exhaust manifolds are more easily accessed with the front tires and the inner fenderwells removed, but it's not absolutely necessary (see Chapter 11).

5 Detach the spark plug wires and remove the spark plugs from the side being worked on (see Chapter 1), If both manifolds are being removed, detach all the spark plug wires and remove all the spark plugs.

6 Remove the secondary air injection pipe (if equipped) from the exhaust manifold being removed (see Chapter 6).

Right side manifold

7 On early models, remove the air cleaner assembly if it interferes (see Chapter 4).

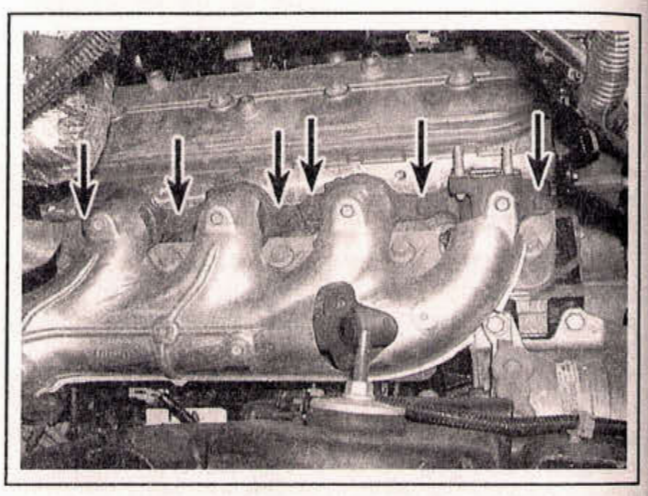
8 The oil dipstick tube also must be removed from early models (see illustration).

9 If the vehicle has the EGR valve attached to the exhaust manifold, it must be removed along with the EGR pipe (see illustrations 7.8a, 7.8b and 7.8c). Remove the mounting bolts and separate the exhaust manifold from the cylinder head (see illustration). Remove the heat shields from the manifold after the manifold has been removed.

Left side manifold

10 Disconnect the electrical connector from the Engine Coolant Temperature (ECT) sensor (see Chapter 6).

11 Remove the mounting bolts and separate the exhaust manifold from the cylinder head. Remove the heat shields from the manifold after the manifold has been removed.



8.9 Exhaust manifold fastener locations (right side shown, left side similar)

INSTALLATION

12 Check the manifold for cracks and make sure the bolt threads are clean and undamaged. The manifold and cylinder head mating surfaces must be clean before the manifolds are reinstalled - use a gasket scraper to remove all carbon deposits and gasket material.

➡Note: The cylinder heads on 4.8L and 5.3L engines are made of aluminum, therefore aggressive scraping is not suggested and will damage the sealing surfaces.

13 Install the heat shields, then install the bolts and gaskets onto the manifold. Retaining tabs surrounding the gasket bolt holes should hold the assembly together as the manifold is installed.

14 Starting at the fourth thread, apply a 1/4-inch wide band of medium-strength threadlocking compound to the threads of the bolts.

➡Note: The manufacturer recommends not applying threadlocking compound on the first three threads.

15 Place the manifold on the cylinder head and install the mounting bolts finger tight.

16 When tightening the mounting bolts, work from the center to the ends and be sure to use a torque wrench. Tighten the bolts in two steps to the torque listed in this Chapter's Specifications. If required, bend the exposed end of the exhaust manifold gasket back against the cylinder head.

17 The remaining installation steps are the reverse of removal. Always use new O-rings and gaskets on the EGR valve and pipe assembly.

18 Start the engine and check for exhaust leaks.

9 Cylinder heads - removal and installation

➡Note: It will be necessary to purchase a new set of 11 mm head bolts before or during this procedure.

REMOVAL

▸ Refer to illustrations 9.2, 9.6 and 9.8

1 Disconnect the cable from the negative terminal of the battery and drain the cooling system (see Chapter 1).

⁂ CAUTION:

On models equipped with the Theftlock audio system, be sure the lockout feature is turned off before performing any procedure which requires disconnecting the battery (see the front of this manual).

2 Remove the intake manifold (see Section 7) and the coolant pipe (see illustration).

3 Detach both exhaust manifolds from the cylinder heads (see Section 8). It is not necessary to disconnect the manifolds from the exhaust pipes.

4 Remove the valve covers (see Section 4).

5 Remove the rocker arms and pushrods (see Section 5).

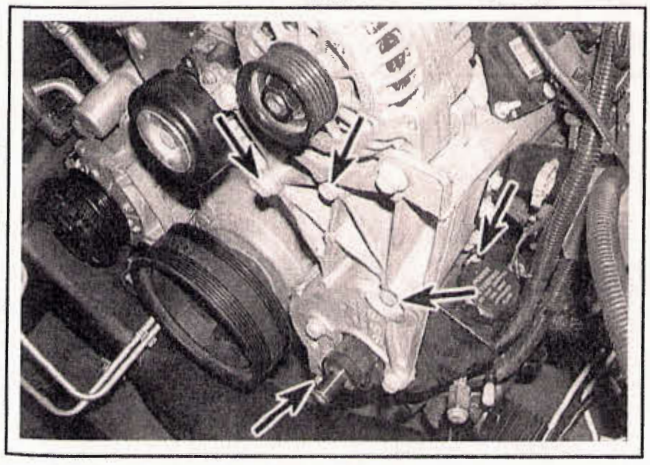
⁂ CAUTION:

Again, as mentioned in Section 5, keep all the parts in order so they are reinstalled in the same location.

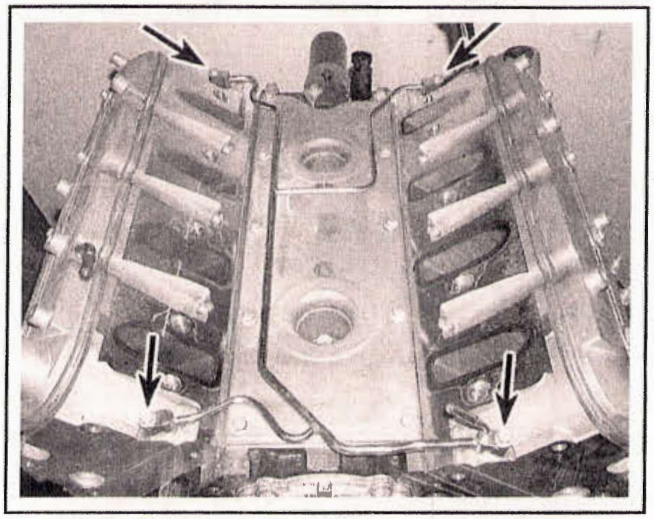
6 Disconnect the wiring from the back of the alternator, then remove the power steering pump/alternator mounting bracket from the engine. Lay the bracket aside (with the components attached), without disconnecting the lines from the steering pump (see illustration).

7 Loosen the head bolts in 1/4-turn increments in the reverse order of the tightening sequence (see illustration 9.17) until they can be removed by hand.

➡Note: There will be different length and size head bolts for different locations. Make a note of the different sizes and lengths and where they go when removing the bolts to ensure correct installation of the new bolts.



9.6 Alternator/power steering pump mounting bracket bolts (arrows) - remove the bolts and lay the bracket aside with the components attached



9.2 The coolant pipe is retained by two bolts at the front and two bolts at the rear of the cylinder heads (arrows)

8 Lift the heads off the engine. If resistance is felt, do not pry between the head and block as damage to the mating surfaces will result. To dislodge the head, place a pry bar or long screwdriver into the intake port and carefully pry the head off the engine (see illustration). Store the heads on blocks of wood to prevent damage to the gasket sealing surfaces.

9 Cylinder head disassembly and inspection procedures are covered in detail in Chapter 2, Part C.

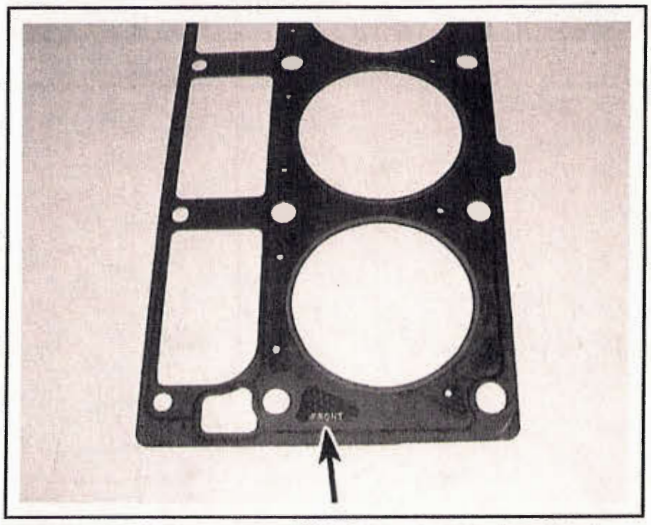
INSTALLATION

▸ Refer to illustrations 9.14, 9.17 and 9.18

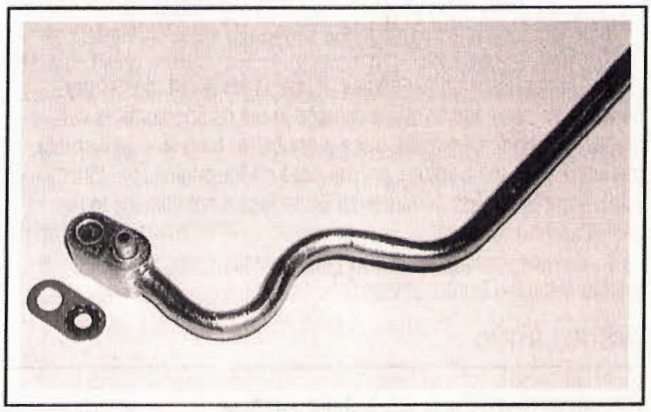
10 The mating surfaces of the cylinder heads and block must be perfectly clean when the heads are installed. Gasket removal solvents are available at auto parts stores and may prove helpful.

11 Use a gasket scraper to remove all traces of carbon and old gasket material, then wipe the mating surfaces with a cloth saturated with lacquer thinner or acetone.

9.8 Using a prybar inserted into an intake port to break the head loose - do not use excessive force or damage to the head may result



9.14 Position the head gasket over the dowels at each end of the cylinder head with the mark (arrow) facing the front of the vehicle



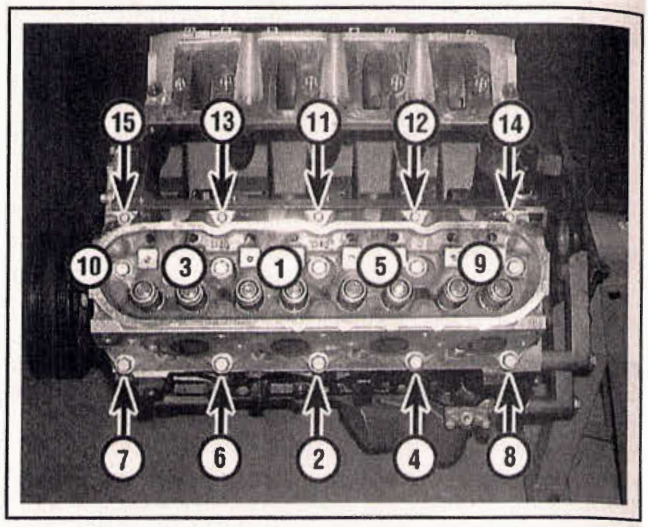
9.18 Be sure to use new gaskets at each cylinder head-to-coolant pipe joint - position the O-ring seal over the coolant pipe nipple

➡Note: The cylinder heads on 4.8L and 5.3L engines are made of aluminum, therefore aggressive scraping is not suggested and will damage the sealing surfaces.

If there is oil on the mating surfaces when the heads are installed, the gaskets may not seal correctly and leaks may develop. When working on the block, use a vacuum cleaner to remove any debris that falls into the cylinders.

12 Check the block and head mating surfaces for nicks, deep scratches and other damage. If damage is slight, it can be removed with emery cloth. If it is excessive, machining may be the only alternative.

13 Use a tap of the correct size to chase the threads in the head bolt holes in the block. If a tap is not available, spray a liberal amount of brake cleaner into each hole. Use compressed air (if available) to remove the debris from the holes.



9.17 Cylinder head bolt tightening sequence - all V8 engines

WARNING:

Wear safety glasses or a face shield to protect your eyes when using compressed air.

All cylinder head bolts should be replaced with **new** bolts

14 Position the new gaskets over the dowels in the block (see illustration).

15 Carefully position the heads on the block without disturbing the gaskets.

16 Before installing the 8mm head bolts, coat the threads with a medium-strength threadlocking compound. Then install the **new** 8mm head bolts (bolts 11 through 15).

17 Install **new** 11 mm head bolts (bolts 1 through 10) and tighten them finger tight. Following the recommended sequence (see illustration), tighten the bolts in four steps to the torque listed in this Chapter's Specifications.

WARNING:

DO NOT reuse head bolts - always replace them with new ones.

18 Install the coolant pipe, using new gaskets, onto the cylinder heads (see illustration). Tighten the bolts to the torque listed in this Chapter's Specifications.

19 The remaining installation steps are the reverse of removal.

20 Add coolant and change the oil and filter (see Chapter 1). Start the engine and check for proper operation and coolant or oil leaks.

10 Crankshaft balancer - removal and installation

Refer to illustrations 10.5, 10.6 and 10.9

Note: This procedure requires a special balancer installation tool that is available through specialized tool manufacturers only and a new crankshaft balancer bolt. Read through the entire procedure and obtain the tool and materials before proceeding.

1 Disconnect the cable from the negative terminal of the battery.

CAUTION:

On models equipped with the Theftlock audio system, be sure the lockout feature is turned off before performing any procedure which requires disconnecting the battery (see the front of this manual).

2 Raise the front of the vehicle and support it securely on jackstands. Then apply the parking brake.

3 Remove the drivebelt (see Chapter 1) and the cooling fan (see Chapter 3).

4 Working under the vehicle, remove the stone shield from below the engine (if equipped).

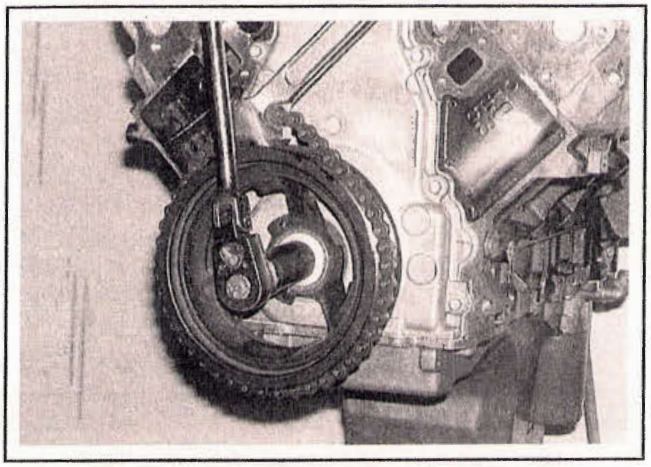
5 Use a strap wrench around the crankshaft pulley to hold it while using a breaker bar and socket to remove the crankshaft pulley center bolt (see illustration).

6 Pull the balancer off the crankshaft with a puller (see illustration).

CAUTION:

The jaws of the puller must only contact the hub of the balancer - not the outer ring.

Note: A long Allen-head bolt should be inserted into the crankshaft nose for the puller's tapered tip to push against to prevent damage to the crankshaft threads.



10.5 Use strap wrench to hold the crankshaft balancer while removing the center bolt (a chain-type wrench may be used if you wrap a section of old drivebelt or rag around the balancer first)

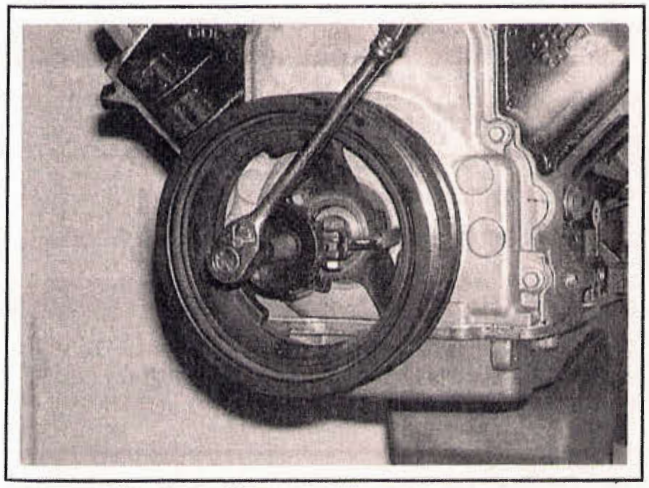
7 Position the crankshaft pulley/balancer on the crankshaft and slide it on as far as it will go. Note that the slot (keyway) in the hub must be aligned with the Woodruff key in the end of the crankshaft.

8 Using the specialized crankshaft balancer installation tool, press the crankshaft pulley/balancer onto the crankshaft.

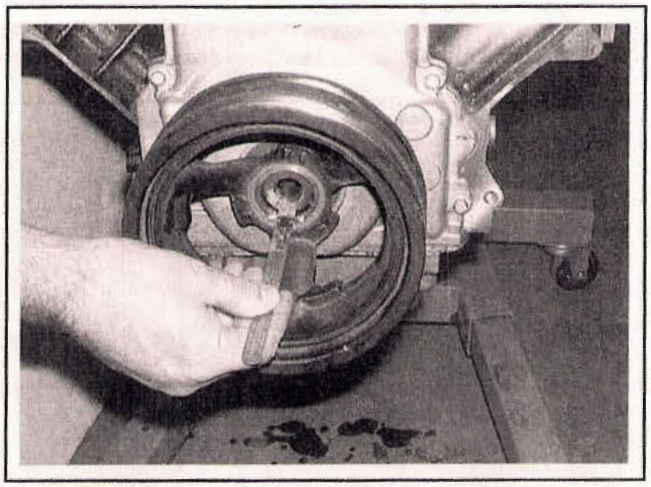
9 Install the old crankshaft balancer bolt and tighten the crankshaft bolt to 240 ft-lbs. Remove the old bolt and measure the distance from the snout of the crankshaft to the balancer hub (see illustration). When properly installed, the balancer hub should extend 3/32 to 11/64-inch past the crankshaft snout. If the measurement is incorrect, reinstall the balancer installation tool and press the balancer on the crankshaft until the measurement is correct.

10 Install a **new** crankshaft balancer bolt and tighten it in two steps to the torque and angle of rotation listed in this Chapter's Specifications.

11 The remaining installation steps are the reverse of removal.



10.6 The use of a three jaw puller will be necessary to remove the crankshaft balancer - always place the puller jaws around the hub, not the outer ring



10.9 Before the new crankshaft bolt is installed and tightened, the balancer must be measured for proper installation - when properly installed, the balancer hub should extend 3/32 to 11/64-inch past the crankshaft snout

11 Crankshaft front oil seal - removal and installation

Refer to illustrations 11.2, 11.4 and 11.5

1 Remove the crankshaft balancer (see Section 10).

2 Note how the seal is installed - the new one must be installed to the same depth and facing the same way. Carefully pry the oil seal out of the cover with a seal puller or a large screwdriver (see illustration). Be very careful not to distort the cover or scratch the crankshaft! Wrap electrician's tape around the tip of the screwdriver to avoid damage to the crankshaft.

3 If the seal is being replaced with the timing chain cover removed, support the cover on top of two blocks of wood and drive the seal out from the backside with a hammer and punch.

CAUTION:

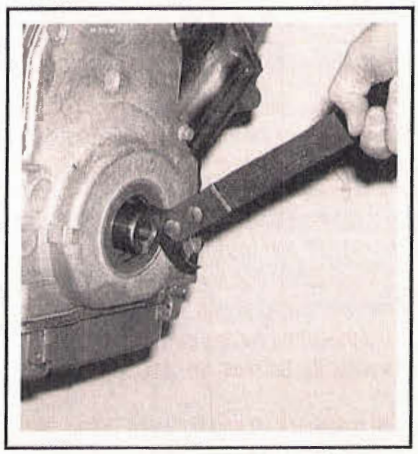
Be careful not to scratch, gouge or distort the area that the seal fits into or a leak will develop.

4 Apply clean engine oil or multi-purpose grease to the outer edge of the new seal, then install it in the cover with the lip (spring side) facing IN. Drive the seal into place (see illustration) with a large socket and a hammer (if a large socket isn't available, a piece of pipe will also work). Make sure the seal enters the bore squarely and stop when the front face is at the proper depth.

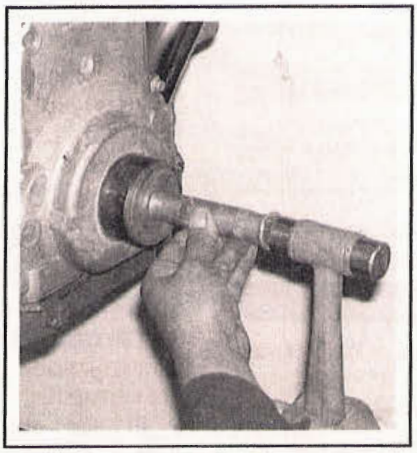
5 Check the surface on the balancer hub that the oil seal rides on. If the surface has been grooved from long-time contact with the seal, a press-on sleeve may be available to renew the sealing surface (see illustration). This sleeve is pressed into place with a hammer and a block of wood and is commonly available at auto parts stores for various applications.

6 Lubricate the balancer hub with clean engine oil and reinstall the crankshaft balancer as described in Section 10.

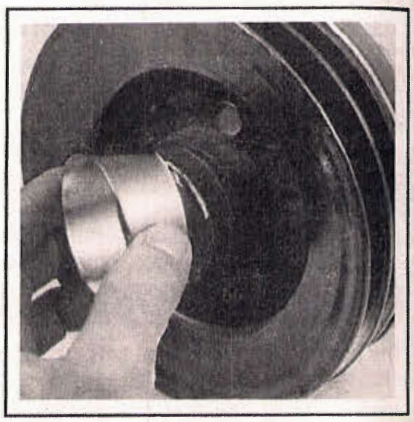
7 The remainder of installation is the reverse of the removal.



11.2 Carefully pry the old seal out of the timing chain cover - don't damage the crankshaft in the process

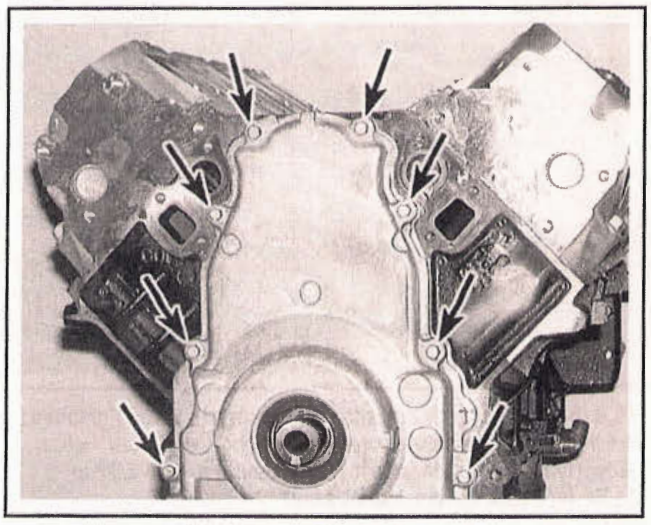


11.4 Drive the new seal into place with a large socket and hammer



11.5 If the sealing surface of the pulley hub has a wear groove from contact with the seal, repair sleeves are available at most auto parts stores

12 Timing chain - removal, inspection and installation



12.6 Timing chain cover mounting bolts (arrows)

REMOVAL AND INSPECTION

Refer to illustrations 12.6, 12.9 and 12.12

1 Disconnect the cable from the negative terminal of the battery.

CAUTION:

On models equipped with the Theftlock audio system, be sure the lockout feature is turned off before performing any procedure which requires disconnecting the battery (see the front of this manual).

2 Refer to Chapter 1 and drain the cooling system and engine oil.

3 Refer to Chapter 3 and remove the upper and lower fan shrouds, drivebelt, cooling fan and water pump.

4 Remove the crankshaft balancer (see Section 10).

5 Remove the oil pan (see Section 14).

6 Remove the timing chain cover mounting bolts and separate the

timing chain cover from the block (see illustration). The cover may be stuck; if so, use a putty knife to break the gasket seal. Since the cover is made of aluminum it can easily be damaged, so DO NOT attempt to pry it off.

7 Remove the oil pick-up tube and the oil pump (see Section 15).

8 Measure the timing chain freeplay. If it is more than 5/8 inch, the chain and both sprockets should be replaced.

9 Loosen the camshaft sprocket bolts one turn, then screw the crankshaft balancer bolt into the end of the crankshaft and rotate the crankshaft in the normal direction of rotation (clockwise) until the timing marks align (see illustration). Verify that the number one piston is at TDC.

10 Remove the three bolts from the end of the camshaft, then detach the camshaft sprocket and chain as an assembly.

11 Inspect the camshaft and crankshaft sprockets for damage or wear.

12 If replacement of the timing chain is necessary, remove the sprocket on the crankshaft with a two-or three-jaw puller, but be careful not to damage the threads in the end of the crankshaft (see illustration).

INSTALLATION

Refer to illustrations 12.15, 12.19 and 12.20

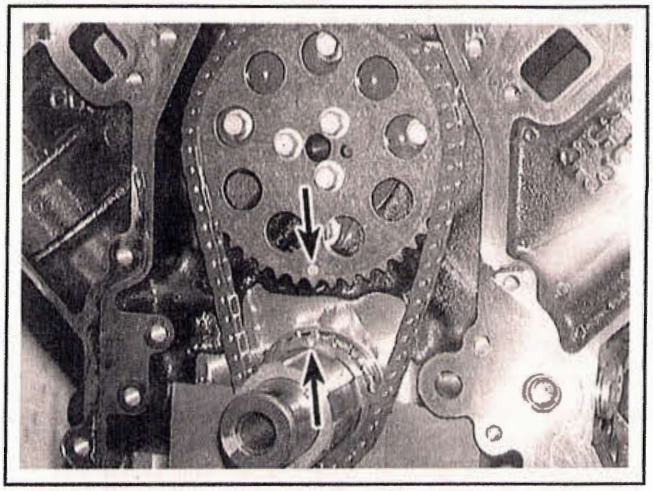
Note: Timing chains must be replaced as a set with the camshaft and crankshaft sprockets. Never put a new chain on old sprockets.

13 Use a gasket scraper to remove all traces of old gasket material and sealant from the cover and engine block.

14 Align the crankshaft sprocket with the Woodruff key and press the sprocket onto the crankshaft (if removed) with the vibration damper bolt, a large socket and some washers or tap it gently into place until it is completely seated.

CAUTION:

If resistance is encountered, do not hammer the sprocket onto the crankshaft. It may eventually move onto the shaft, but it may be cracked in the process and fail later, causing extensive engine damage.



12.9 Timing chain alignment marks (arrows) - when properly aligned, the crankshaft gear should be in the 12 o'clock position, the camshaft gear should be in the 6 o'clock position and the number one piston should be at TDC

15 Loop the new chain over the camshaft sprocket, then turn the sprocket until the timing mark is at the bottom (see illustration). Mesh the chain with the crankshaft sprocket and position the camshaft sprocket on the end of the camshaft. If necessary, turn the camshaft so the dowel in the camshaft fits into the hole in the sprocket with the timing mark in the 6 o'clock position (see illustration 12.9). When the chain is installed, the timing marks MUST align as shown.

16 Apply a thread locking compound to the camshaft sprocket bolt threads and tighten the bolts to the torque listed in this Chapter's Specifications.

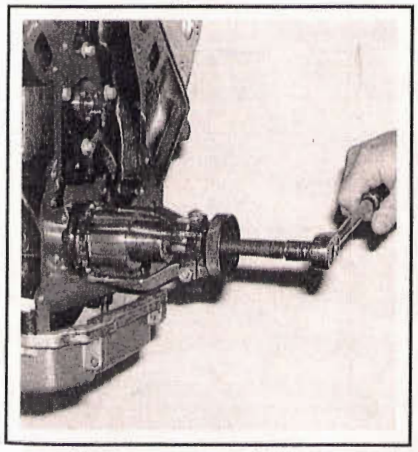
17 Lubricate the chain with clean engine oil.

18 Install the oil pump and the oil pick up tube onto the engine (see Section 15). Now would be a good time to replace the crankshaft front oil seal (see Section 11).

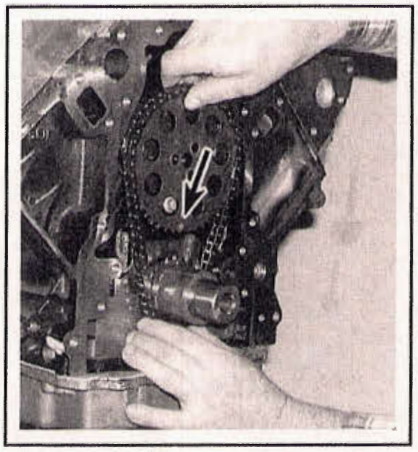
19 Install the timing chain cover on the engine loosely using a new gasket (see illustration).

20 Align the timing chain cover as follows:

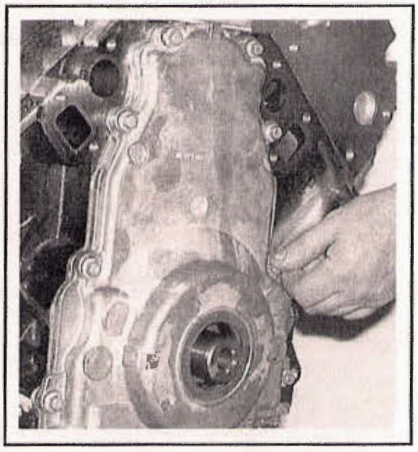
a) Install the crankshaft balancer on the engine as described in Sec-



12.12 The sprocket on the crankshaft can be removed with a two or three-jaw puller



12.15 Slip the chain and camshaft sprocket in place over the crankshaft sprocket with the camshaft sprocket timing mark (arrow) at the bottom



12.19 Install the front cover with a new gasket onto the engine block LOOSELY - the cover must be aligned properly before final installation

tion 10. This Step will align the front oil seal with the balancer hub.

b) Place a straightedge on the engine block oil pan rail. Measure the distance on each side of the block from the oil pan rail to the timing chain cover with a feeler gauge (see illustration). This Step measures the difference between the sealing surface of the oil pan and the sealing surface of the timing chain cover in relationship to each other.

c) Tilt the front timing cover as necessary to achieve an even measurement on each side. This Step properly aligns the front timing cover to oil pan sealing surfaces. Typically 0.000 to 0.020 inch is an acceptable tolerance.

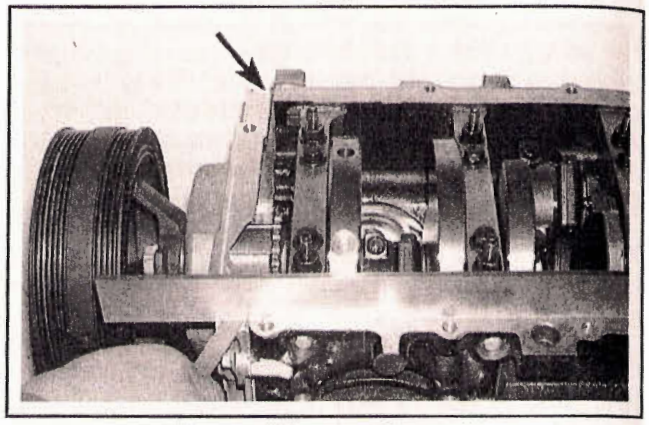
➡Note: Ideally the timing chain cover should be flush with the oil pan rail, but because of the differences in seal thickness, this may not always be obtainable. That is why there is a tolerance of 0.000 to 0.020 inch. Always let the front seal center itself around the crankshaft balancer hub and tilt the cover from side to side to even up the measurement at both oil pan rails. Never push downward on the front timing cover in an attempt to make the oil pan sealing surface flush, as this will distort the front oil seal and eventually lead to an oil leak!

d) With the timing chain cover properly aligned, tighten the cover bolts to the torque listed in this Chapter's Specifications.

21 Apply a thin layer of RTV sealant to the areas where the timing chain cover and cylinder block meet, then install the oil pan as described in Section 14.

22 The remaining installation steps are the reverse of removal.

23 Add coolant and oil to the engine (see Chapter 1). Run the engine and check for oil and coolant leaks.



12.20 With the crankshaft balancer in place and the front cover bolts installed LOOSELY, measure the distance between the oil pan rail and the front cover sealing surface on each side (arrows) - then adjust the cover so the measurements are even on both sides before tightening the cover bolts

13 Camshaft and lifters - removal and installation

➡Note 1: The camshaft should always be thoroughly inspected before installation and camshaft endplay should always be checked prior to camshaft removal. Refer to Chapter 2C for the camshaft and lifter inspection procedures.

➡Note 2: If the camshaft is being replaced, always install new lifters as well. Do not use old lifters on a new camshaft.

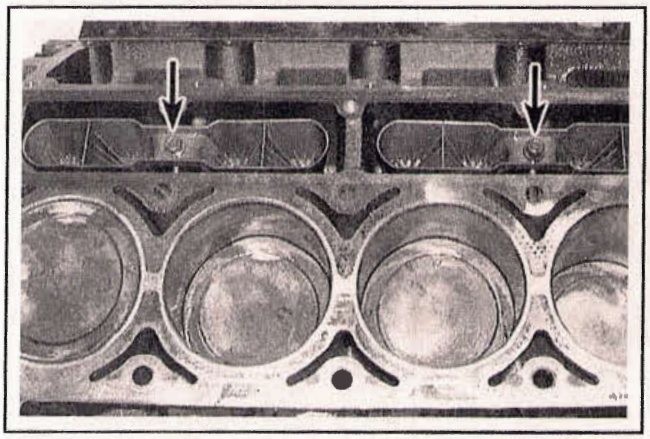
REMOVAL

♦ Refer to illustrations 13.2a, 13.2b and 13.4

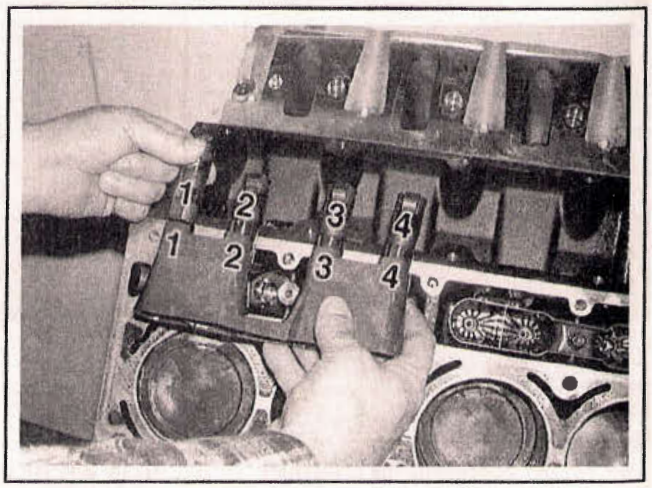
1 Refer to the appropriate Sections and remove the intake manifold, valve covers, rocker arms, pushrods, timing chain and the cylinder heads. Also remove the radiator and air conditioning condenser (see Chapter 3) and the camshaft position sensor (see Chapter 6).

2 Before removing the lifters, arrange to store them in a clearly labeled box to ensure that they're reinstalled in their original locations. Remove the lifter retainers and lifters and store them where they won't get dirty (see illustrations). DO NOT attempt to withdraw the camshaft with the lifters in place.

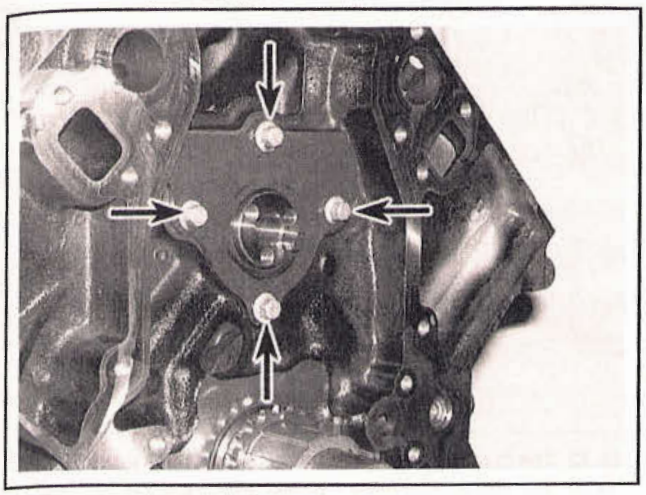
3 If the lifters are built up with gum and varnish they may not come out with the retainer. If so, there are several ways to extract the lifters from the bores. A special tool designed to grip and remove lifters



13.2a The roller lifters are held in place by retainers - remove the retainer bolts and remove the retainers and the lifters as an assembly - note that each retainer houses four individual lifters and they must be installed back in their original locations if they're going to be reused



13.2b Once the lifters and retainers are removed from the block they can be marked (for location and installation purposes) and inspected



13.4 Remove the bolts (arrows) and take off the camshaft retainer plate, noting which side faces the block

is manufactured by many tool companies and is widely available, but it may not be required in every case. On newer engines without a lot of varnish buildup, the lifters can often be removed with a small magnet or even with your fingers. A machinist's scribe with a bent end can be used to pull the lifters out by positioning the point under the retainer ring in the top of each lifter.

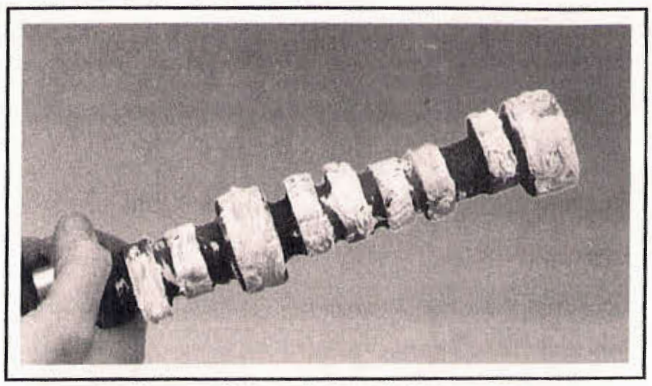
CAUTION:

Don't use pliers to remove the lifters unless you intend to replace them with new ones. The pliers will damage the precision machined and hardened lifters, rendering them useless.

4 Remove the bolts and the camshaft retainer plate, noting which direction faces the block (see illustration).

5 Thread three 6-inch long bolts into the camshaft sprocket bolt holes to use as a "handle" when removing the camshaft from the block.

6 Carefully pull the camshaft out. Support the cam near the block so the lobes don't nick or gouge the bearings as it's withdrawn.



13.7 Be sure to apply camshaft assembly lube to the cam lobes and bearing journals before installing the camshaft

INSTALLATION

Refer to illustration 13.7

7 Lubricate the camshaft bearing journals and cam lobes with camshaft and lifter assembly lube (see illustration).

8 Slide the camshaft into the engine. Support the cam near the block and be careful not to scrape or nick the bearings.

9 Turn the camshaft until the dowel pin is in the 3 o'clock position, and install the camshaft thrust plate, tighten the bolts to the torque listed in this Chapter's Specifications. Make sure the gasket surface on the camshaft thrust plate and the engine block are free from oil and dirt.

10 Install the timing chain and sprockets (see Section 12). Also install the camshaft position sensor using a new O-ring (see Chapter 6).

11 Lubricate the lifters with clean engine oil and install them in the lifter retainers. Be sure to align the flats on the lifters with the flats in the lifter retainers. Install the retainer and lifters into the engine block as an assembly. If the original lifters are being reinstalled, be sure to return them to their original locations. If a new camshaft is being installed, install new lifters as well. Tighten the lifter retainer bolts to the torque listed in this Chapter's Specifications.

12 The remaining installation steps are the reverse of removal.

13 Before starting and running the engine, change the oil and install a new oil filter (see Chapter 1).

14 Oil pan - removal and installation

REMOVAL

Refer to illustrations 14.4 and 14.8

1 Disconnect the cable from the negative terminal of the battery.

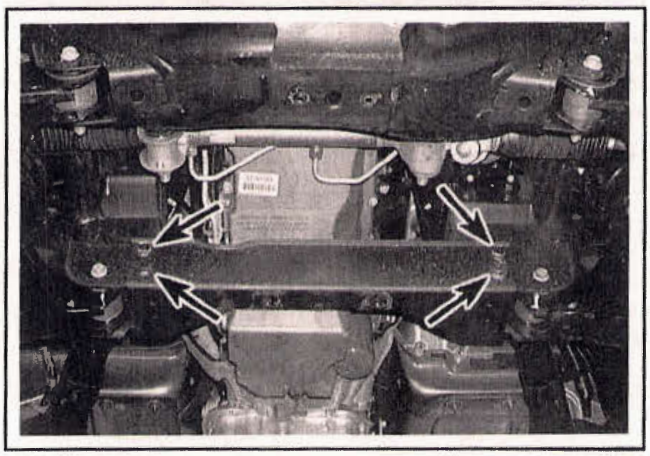
CAUTION:

On models equipped with a Delco Loc II audio system, be sure the lockout feature is turned off before performing any procedure which requires disconnecting the battery.

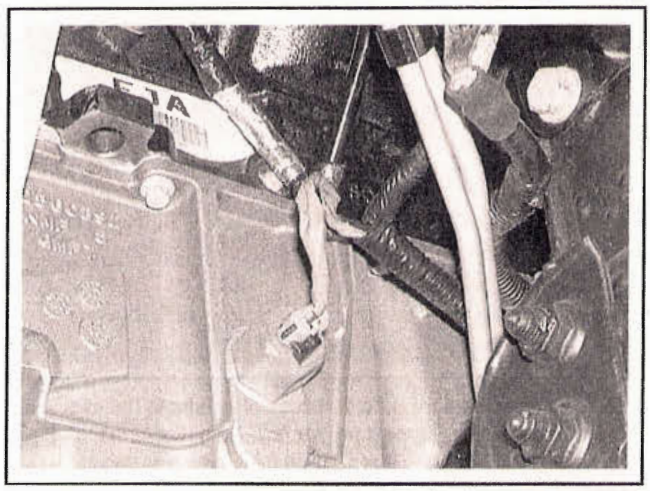
2 Raise the vehicle and support it securely on jackstands, then refer to Chapter 1 and drain the engine oil and remove the oil filter.

3 Remove the oil pan skid plate, if equipped.

4 Remove the lower control arm crossmember from below the oil pan, if equipped (see illustration).



14.4 Remove the bolts (arrows) and the lower control arm support crossmember



14.8 The oil level sensor is located on the passenger side of the oil pan

5 On 4WD vehicles, unbolt and lower the front differential carrier with a floorjack (see Chapter 8).

6 Disconnect the front exhaust Y pipe from the engine and the exhaust system and remove it from the vehicle. This step is not absolutely necessary, but it will help facilitate removal of the oil pan.

7 Remove the starter motor (see Chapter 5). Also remove the plastic bellhousing covers (see illustrations 8.8a and 8.8b in Chapter 7B).

8 Remove the wiring harness bracket from the front of the oil pan and the bracket on the passenger side of the oil pan securing the transmission oil cooler lines (if equipped) and the starter motor wiring. Also disconnect the electrical connector from the oil level sensor (see illustration).

9 Remove the transmission to oil pan bolts (see Chapter 7).

10 If the vehicle is equipped with an engine oil cooler, remove the engine oil cooler lines and adapter from the driver's side of the oil pan.

11 Remove the access plugs covering the nuts at the rear of the oil pan (if equipped). On 2001 and later models with a 4L80-E automatic transmission, remove the converter cover bolts, and on models with the 4L60-E automatic, remove the stud and bolt on the right side.

12 Remove all the oil pan bolts, then lower the pan from the engine. The pan will probably stick to the engine, so strike the pan with a rubber mallet until it breaks the gasket seal.

CAUTION:

Before using force on the oil pan, be sure all the bolts have been removed. Carefully slide the oil pan down and out, to the rear.

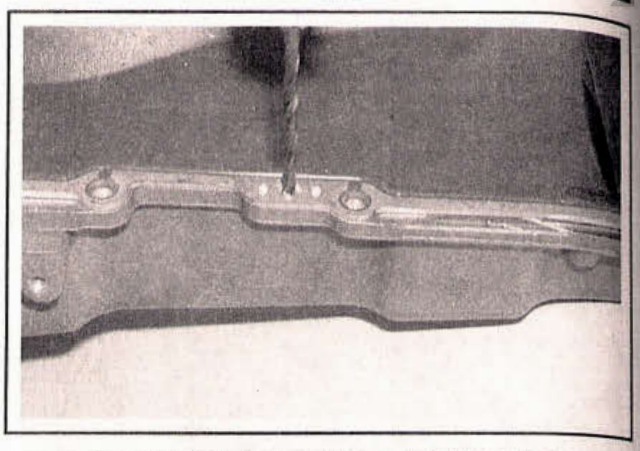
INSTALLATION

Refer to illustrations 14.13 and 14.16

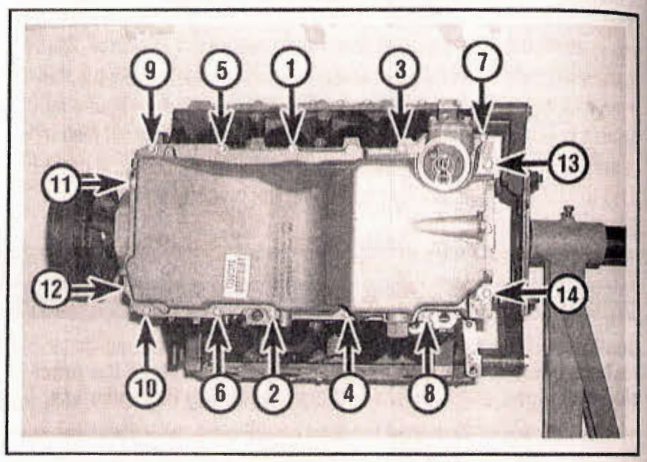
13 Drill out the rivets securing the oil pan gasket to the oil pan and remove the old gasket (see illustration). Wash out the oil pan with solvent.

14 Thoroughly clean the mounting surfaces of the oil pan and engine block of old gasket material and sealer. Wipe the gasket surfaces clean with a rag soaked in lacquer thinner, acetone or brake system cleaner.

15 Apply a 3/16-inch wide, one inch long bead of RTV sealant to the corners of the block where the front cover and the rear cover meet the engine block. Then attach the new gasket to the pan, install the pan and tighten the bolts finger-tight. Be sure the oil gallery passages in the pan and the gasket are aligned properly.



14.13 The manufacturer uses rivets to hold the gasket to the oil pan during assembly - carefully drill them out (it isn't necessary to rivet the new gasket to the oil pan)



14.16 Oil pan TIGHTENING sequence - all V8 engines

Note: Oil pan gasket rivets do not need to be installed on assembly.

16 The alignment of the rear face of the aluminum pan to the rear of the block is important. Measure between the rear face of the pan and the front face of the transmission bellhousing with feeler gauges. Clearance should ideally be flush, but a gap of up to 0.010-inch is allowable. If the clearance is OK, tighten the pan bolts/studs in sequence to the torque listed in this Chapter's Specifications (see illustration). If the clearance is not acceptable, install the two lower oil pan-to-bellhousing bolts and tighten them finger tight. This should draw the oil pan flush with the bellhousing.

CAUTION:

The rear of the oil pan should never protrude rearward of the bellhousing plane of the block.

17 The remainder of installation is the reverse of removal. Tighten the bolts to the torque listed in this Chapter's Specifications.

18 Add the proper type and quantity of oil (see Chapter 1), start the engine and check for leaks before placing the vehicle back in service.

15 Oil pump - removal, inspection and installation

REMOVAL

Refer to illustrations 15.2a, 15.2b and 15.3

1 Refer to the Section 12, Steps 1 through 6 and remove the timing chain cover.

2 Remove the oil pump pick-up tube mounting nuts and bolts and lower the pick-up tube and screen assembly from the vehicle (see illustrations).

3 Remove the oil pump retaining bolts and slide the pump off the end of the crankshaft (see illustration).

INSPECTION

Refer to illustration 15.4

4 Remove the oil pump cover and withdraw the rotors from the pump body (see illustration). Clean the components with solvent, dry them thoroughly and inspect for any obvious damage. Also check the bolt holes for damaged threads and the splined surfaces on the crankshaft sprocket for any apparent damage. If any of the components are scored, scratched or worn, replace the entire oil pump assembly. There are no serviceable parts currently available.

INSTALLATION

Refer to illustration 15.8

5 Prime the pump by pouring clean motor oil into the pick-up tube hole, while turning the pump by hand.

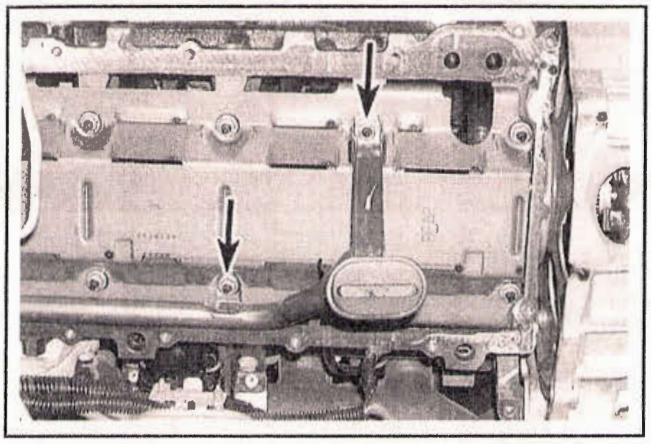
6 Position the oil pump over the end of the crankshaft and align the teeth on the crank-shaft sprocket with the teeth on the oil pump drive gear. Making sure the pump is fully seated against the block.

7 Install the oil pump mounting bolts and tighten them to the torque listed in this Chapter's Specifications.

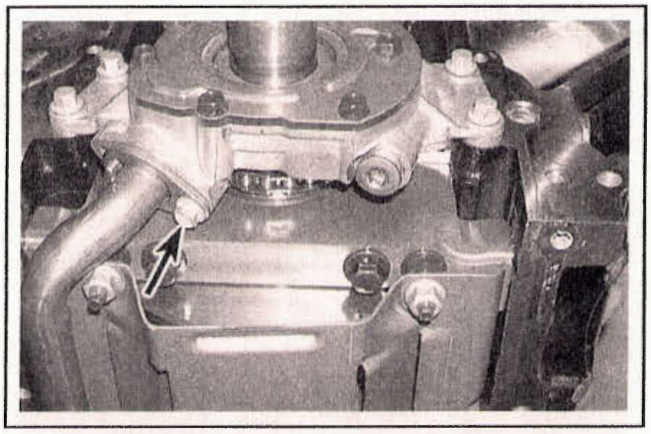
8 Install a new O-ring on the oil pump pick-up tube, then fasten it to the oil pump and the engine block main studs (see illustration).

CAUTION:

Be absolutely certain that the pick-up tube-to-oil pump bolts are properly tightened so that no air can be sucked into the oiling system at this connection.



15.2a Oil pick-up tube-to-main stud retaining nuts (arrows)

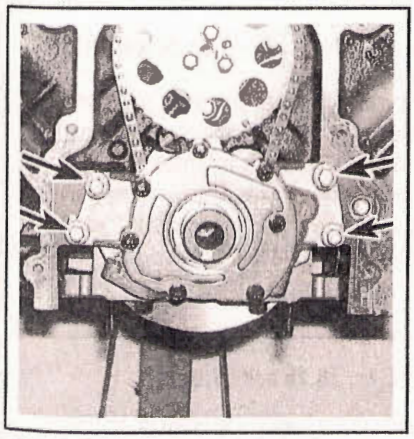


15.2b Remove the bolt (arrow) securing the oil pick-up tube to the oil pump and remove it from the engine

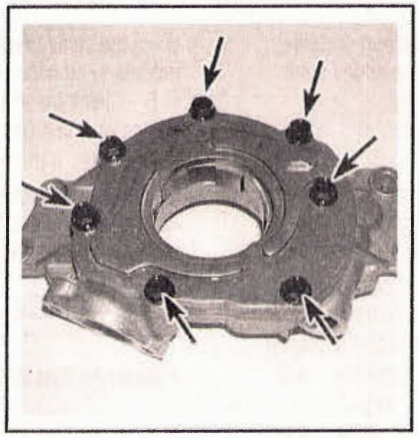
9 Install and align the timing chain cover, then install the oil pan. Refer to Sections 12 and 14 for the installation procedures.

10 The remainder of installation is the reverse of removal.

11 Add oil and coolant as necessary. Run the engine and check for oil and coolant leaks. Also check the oil pressure as described in Chapter 2C.



15.3 Oil pump mounting bolts (arrows)



15.4 Oil pump cover-to-oil pump housing mounting bolts (arrows)

15.8 Always install a new O-ring on the oil pump pick up tube

16 Flywheel/driveplate - removal and installation

The flywheel/driveplate replacement for V8 engines is identical to the flywheel/driveplate replacement procedure for the V6 engines. Refer to Chapter 2 Part A for the procedure and use the torque figures in this Chapter's Specifications.

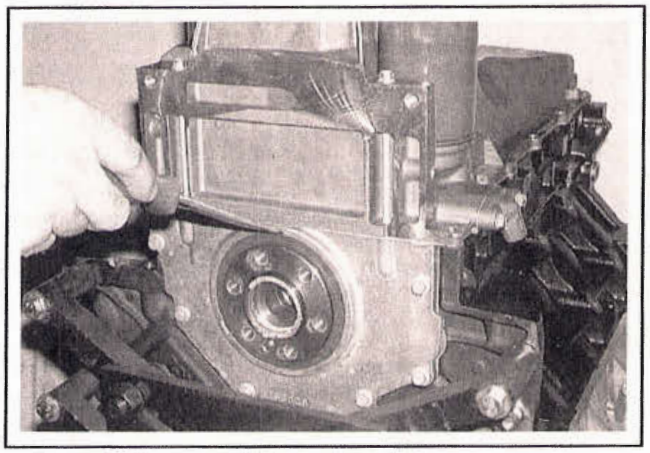
➡Note: If the spacer between the driveplate and the crankshaft must be removed and it's stuck, insert bolts (M11 bolts, 1.5 mm long) into the two threaded holes in the spacer. Tightening the bolts will force the spacer off the crankshaft.

17 Rear main oil seal - replacement

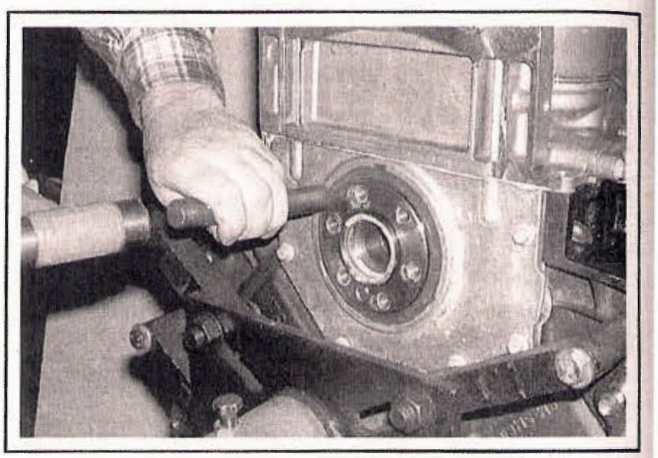
◗ Refer to illustrations 17.3 and 17.4

➡Note: If you're installing a new rear seal during a complete engine overhaul, refer to the procedure in Chapter 2C.

1 Remove the transmission (see Chapter 7).
2 Remove the flywheel/driveplate (see Section 16).
3 Pry the oil seal from the rear cover with a screwdriver (see illustration). Be careful not to nick or scratch the crankshaft or the seal bore. Be sure to note how far it's recessed into the housing bore before removal so the new seal can be installed to the same depth. Thoroughly clean the seal bore in the block with a shop towel. Remove all traces of oil and dirt.
4 Lubricate the outside diameter of the seal and install the seal over the end of the crankshaft. Make sure the lip of the seal points toward the engine. Preferably, a seal installation tool (available at most auto parts store) should be used to press the new seal back into place. If the proper seal installation tool is unavailable, use a large socket, section of pipe or a blunt tool and carefully drive the new seal squarely into the seal bore and flush with the rear cover (see illustration).
5 Install the flywheel/driveplate (see Section 16).
6 Install the transmission (see Chapter 7).



17.3 Carefully pry the old seal out with a screwdriver at the notches provided in the rear cover



17.4 The rear oil seal can be pressed into place with a seal installation tool, a section of pipe or a blunt object shown here - in any case be sure the seal is installed squarely into the seal bore and flush with the rear cover

18 Engine mounts - check and replacement

1 Engine mounts seldom require attention, but broken or deteriorated mounts should be replaced immediately or the added strain placed on the driveline components may cause damage.

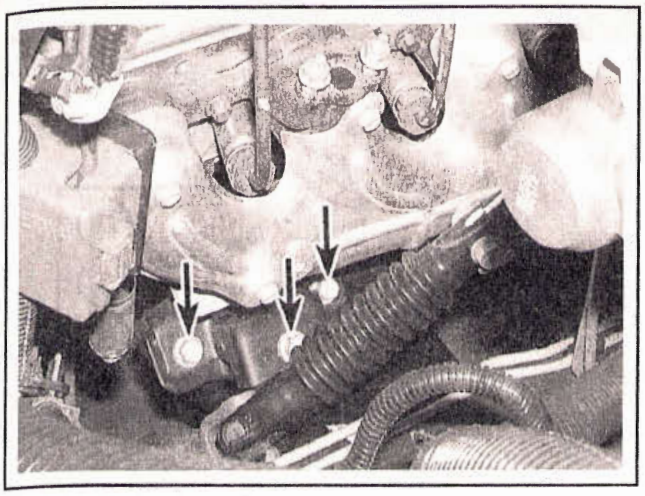
CHECK

2 During the check, the engine must be raised slightly to remove the weight from the mounts.
3 Raise the vehicle and support it securely on jackstands, then position the jack under the engine oil pan. Place a large block of wood between the jack head and the oil pan, then carefully raise the engine just enough to take the weight off the mounts. Do not use the jack to support the entire weight of the engine.
4 Check the mounts to see if the rubber is cracked, hardened or separated from the metal plates. Sometimes the rubber will split right down the center. Rubber preservative or WD-40 can be applied to the mounts to slow deterioration.
5 Check for relative movement between the mount plates and the engine or frame (use a large screwdriver or prybar to attempt to move the mounts). If movement is noted, check the tightness of the mount fasteners first before condemning the mounts. Usually when engine mounts are broken, they are very obvious as the engine will easily move away from the mount when pried or under load.

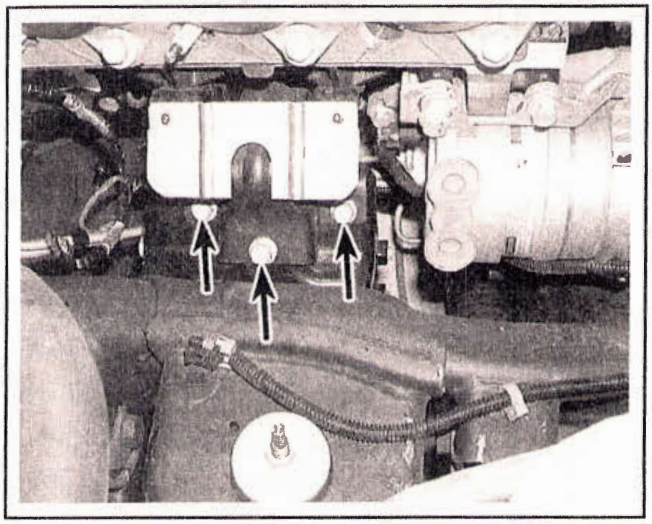
REPLACEMENT

◗ Refer to illustrations 18.7a, 18.7b and 18.9

6 Disconnect the cable from the negative terminal of the battery, then raise the vehicle and support it securely on jackstands.



18.7a Driver's side engine mount-to-frame bracket bolts (arrows)



18.7b Passenger side engine mount-to-frame bracket bolts (arrows)

CAUTION:

On models equipped with the Theftlock audio system, be sure the lockout feature is turned off before performing any procedure which requires disconnecting the battery (see the front of this manual).

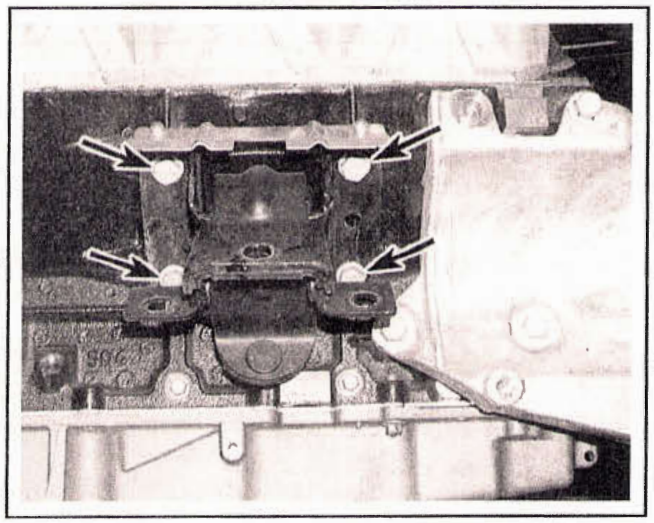
7 Working in the engine compartment remove the engine mount-to-frame bracket bolts. There are three bolts on each side securing the mounts to the frame bracket (see illustrations).

8 Attach an engine hoist to the top of the engine for lifting; do not use a jack under the oil pan to support the entire weight of the engine or the oil pump pick-up could be damaged.

➡Note: If a hoist is not available, casting lugs on each side of the engine block can be used to support the entire weight of the engine while the engine mounts are being replaced.

9 Raise the engine slightly until the engine mount can be unbolted from the block. Unbolt the mount from the engine block and remove it from the vehicle (see illustration).

10 Installation is the reverse of removal. Use non-hardening thread-locking compound on the mount bolts and be sure to tighten them to the torque listed in this Chapter's Specifications.

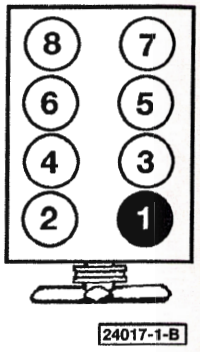


18.9 Engine mount-to-engine block mounting bolts (arrows)

Specifications

General

Displacement	
4.8L	293 cubic inches
5.3L	325 cubic inches
6.0L	364 cubic inches
Bore and stroke	
4.8L	3.779 x 3.268 inches
5.3L	3.779 x 3.622 inches
6.0L	4.001 x 3.622 inches
Cylinder numbers (front-to-rear)	
Left (driver's) side	1-3-5-7
Right side	2-4-6-8
Firing order	1-8-7-2-6-5-4-3
Cylinder compression pressure	
Minimum	100 psi
Maximum variation between cylinders	25 percent from the highest reading



Cylinder numbering - V8 engines

Camshaft

Journal diameters	2.164 to 2.166 inches
Camshaft endplay	0.001 to 0. 012 inch
Lobe Lift	
1999 and 2000 (all)	
Intake	0.268 inch
Exhaust	0.274 inch
2001	
Intake	0.274 inch
Exhaust	0.281 inch
2002 and later models	
4.8L and 5.3L engines	
Intake	0.268 inch
Exhaust	0.274 inch
6.0L engines	
Intake	0.274 inch
Exhaust	0.281 inch

Torque specifications*	Ft-lbs (unless otherwise indicated)
Camshaft sprocket bolts	26
Camshaft retainer bolts	18
Crankshaft balancer bolt	
Step one (use old bolt)	240
Step two (use new bolt)	37
Step three (use new bolt)	Tighten an additional 140 degrees
Cylinder head bolts (in sequence - see illustration 9.17)	
1999 through 2003 models	
Step 1	
All 11 mm bolts	22
Step 2	
All 11 mm bolts	Tighten an additional 90 degrees
Step 3	
11 mm bolts (1 through 8)	Tighten an additional 90 degrees
11 mm bolts (9 and 10)	Tighten an additional 50 degrees
Step 4	
All 8 mm bolts (11 through 15)	22
2004 and later models	
Design I (equipped with two different length 11mm bolts; 3.94 inch and 6.1 inch)	
Step 1	
All 11 mm bolts	22
Step 2	
All 11 mm bolts	Tighten an additional 90 degrees
Step 3	
11 mm bolts (1 through 8)	Tighten an additional 90 degrees
11 mm bolts (9 and 10)	Tighten an additional 50 degrees
Step 4	
All 8 mm bolts (11 through 15)	22
Design II (equipped with one length 11mm bolt; 3.94 inch)	
Step 1	
All 11 mm bolts (1 through 10)	22
Step 2	
All 11 mm bolts (1 through 10)	Tighten an additional 90 degrees
Step 3	
All 11 mm bolts (1 through 10)	Tighten an additional 70 degrees
Step 4	
All 8 mm bolts (11 through 15)	22
Engine mount retaining bolts	37
Exhaust manifold bolts	
Step one	132 in-lbs
Step two	18
Exhaust manifold heat shield bolt	80 in-lbs
Exhaust pipe flange nuts	20 to 25
Flywheel/driveplate bolts	
Step one	15
Step two	37
Step three	74

Torque specifications* (continued)	Ft-lbs (unless otherwise indicated)
Intake manifold bolts	
Step one	44 in-lbs
Step two	89 in-lbs
Oil pan baffle bolts	106 in-lbs
Oil pan drain plug	18
Oil pan rear access plugs	80 in-lbs
Oil pan bolts	
Step 1 (to engine and front cover)	18
Step 2 (to rear cover)	106 in-lbs
Step 3 (bellhousing, converter cover and transmission bolts)	37
Oil pump cover bolts	106 in-lbs
Oil pump mounting bolts	18
Rocker arm bolts	22
Front timing chain cover bolts	18
Valve cover bolts	106 in-lbs
Vapor vent pipe bolts	106 in-lbs

***Note: Refer to Part C for additional specifications.**