

2001-02 ENGINES

3.5L V6 - MDX

ENGINE IDENTIFICATION

NOTE: For repair procedures not covered in this article, see ENGINE OVERHAUL PROCEDURES article in GENERAL INFORMATION.

ENGINE IDENTIFICATION CODE

Engine	Code
3.5L	J35A3

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

NOTE: Adjust valves only when cylinder head temperature is less than 100°F (38°C).

1. Remove ignition coil cover and intake manifold cover. Remove EVAP control canister hose from throttle body. Remove vacuum hose, breather pipe and intake air duct. See **Fig. 1**.
2. Remove throttle cable and cruise control cable from throttle linkage. Avoid bending cables, or replacement will be required.
3. Remove brake booster vacuum hoses and PCV hose. Remove power steering hose clamp, and disconnect Intake Manifold Runner Control (IMRC) actuator connector, and remove IMRC actuator. Remove 2 bolts securing wiring harness holder, and remove joint connector. Remove the following connectors, and wiring harness clamps from intake manifold:
- Intake Air Temperature (IAT) sensor
 - Idle Air Control (IAC) valve
 - Throttle Position (TP) Sensor
 - Manifold Absolute Pressure (MAP) sensor
 - Evaporative Emission (EVAP) canister purge valve
4. Remove ignition coils. Remove upper cover. Remove intake manifold and spacer. See **INTAKE MANIFOLD**. Remove valve covers. Pivot front upper cover timing inspection port cover aside. Rotating crankshaft clockwise, ensure No. 1 piston is at TDC by aligning pointer mark on front cover inspection port with No. 1 piston TDC mark on front camshaft pulley. See **Fig. 2**.
5. Using feeler gauge, measure valve clearances for cylinder No. 1. See **VALVE CLEARANCE SPECIFICATIONS** table under ENGINE SPECIFICATIONS. If needed, loosen lock nut, then turn adjusting screw to set a slight amount of drag on proper size feeler gauge. See **Fig. 3** This will set proper clearance. Tighten lock nut and recheck valve clearance.
6. Turn crankshaft clockwise until pointer mark on front cover inspection port is aligned with No. 4 piston TDC mark on camshaft pulley. Check valve clearance for cylinder No. 4 and adjust as necessary.

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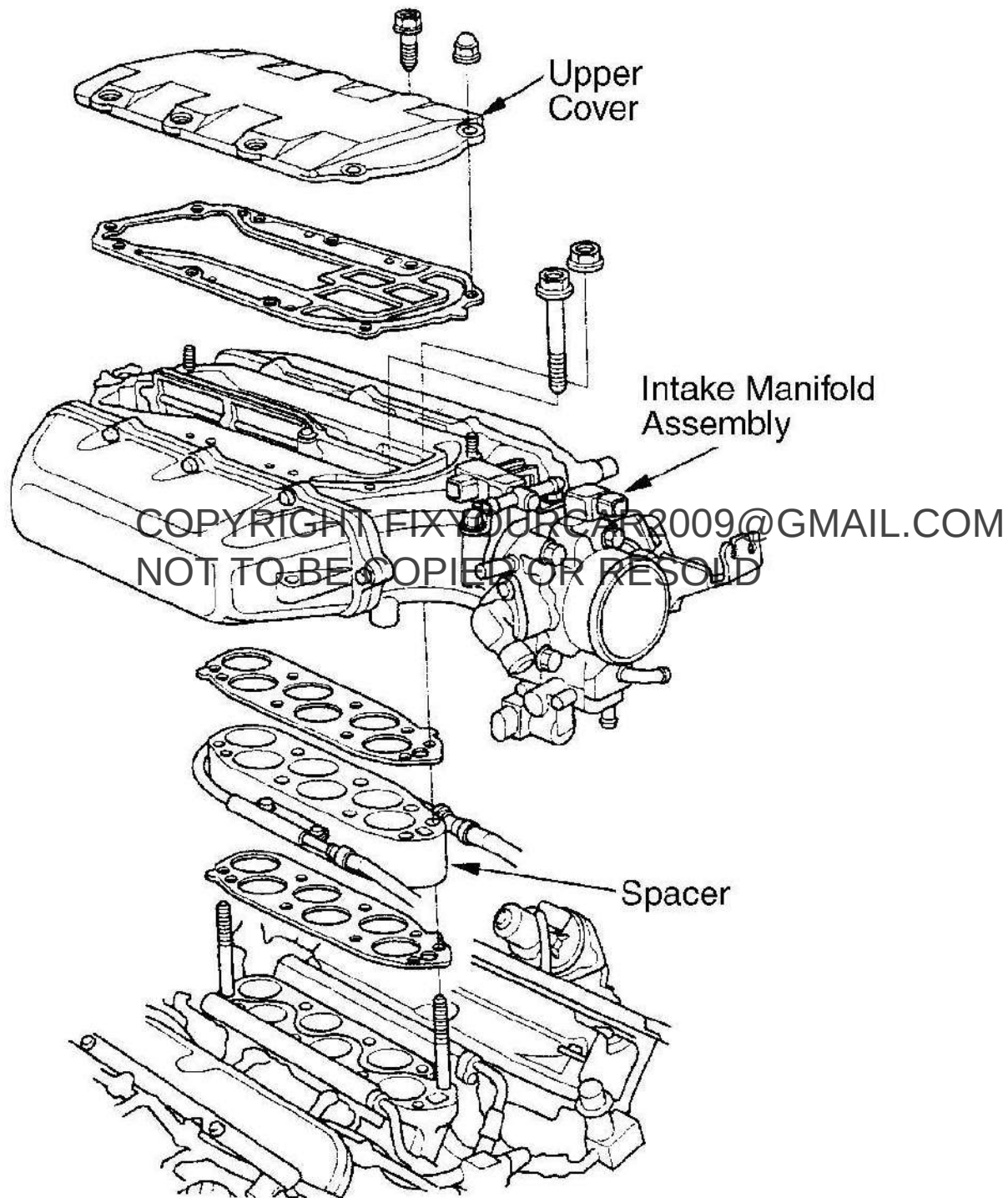
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7. Turn crankshaft clockwise until pointer mark on front cover inspection port is aligned with No. 2 piston TDC mark on camshaft pulley. Check valve clearance for cylinder No. 2 and adjust as necessary.
8. Turn crankshaft clockwise until pointer mark on front cover inspection port is aligned with No. 5 piston TDC mark on camshaft pulley. Check valve clearance for cylinder No. 5 and adjust as necessary.
9. Turn crankshaft clockwise until pointer mark on front cover inspection port is aligned with No. 3 piston TDC mark on camshaft pulley. Check valve clearance for cylinder No. 3 and adjust as necessary.
10. Turn crankshaft clockwise until pointer mark on front cover inspection port is aligned with No. 6 piston TDC mark on camshaft pulley. Check valve clearance for cylinder No. 6 and adjust as necessary.

VALVE CLEARANCE SPECIFICATIONS

Application	In. (mm)
Intake	.008-.009 (.20-.24)
Exhaust	.011-.013 (.28-.32)

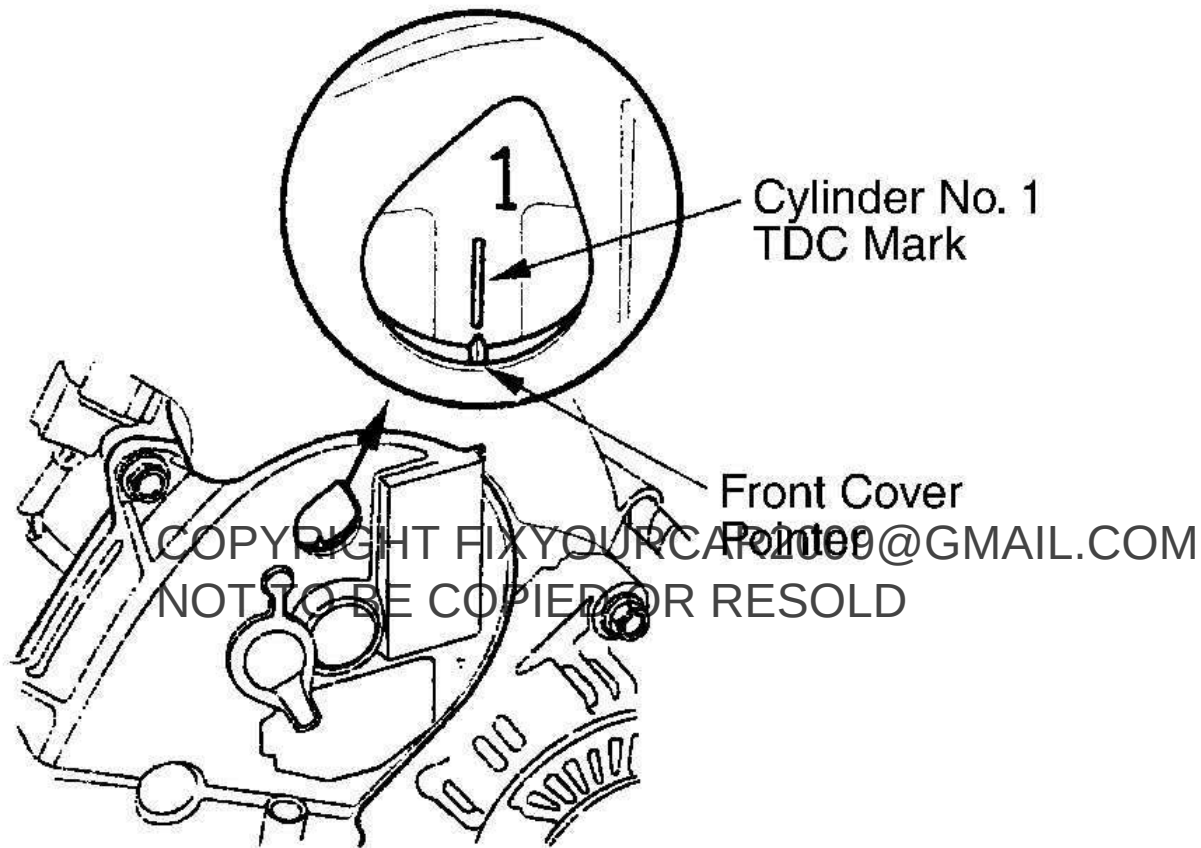
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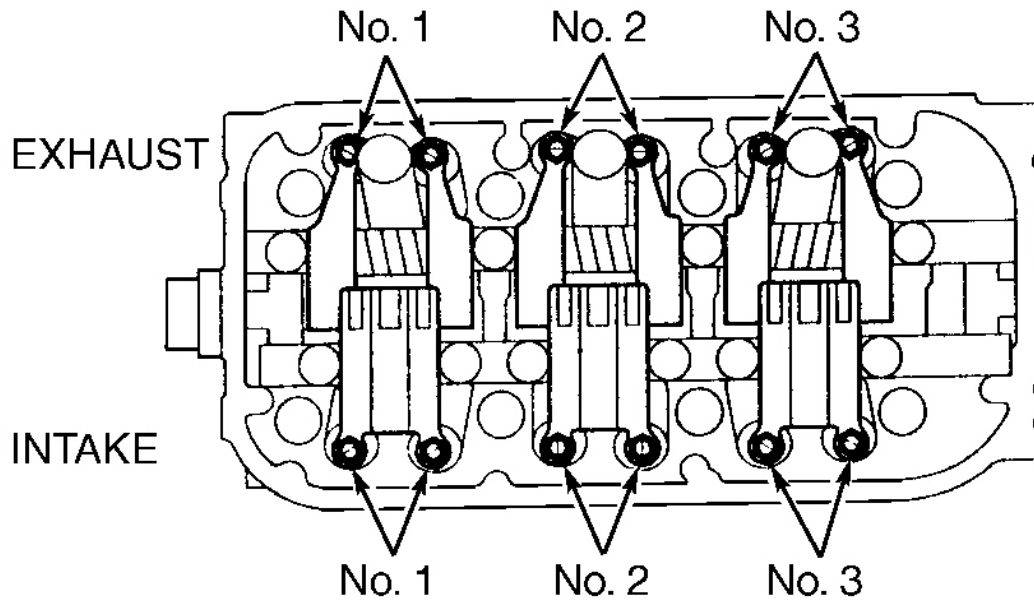
Fig. 1: Identifying Intake Air Components

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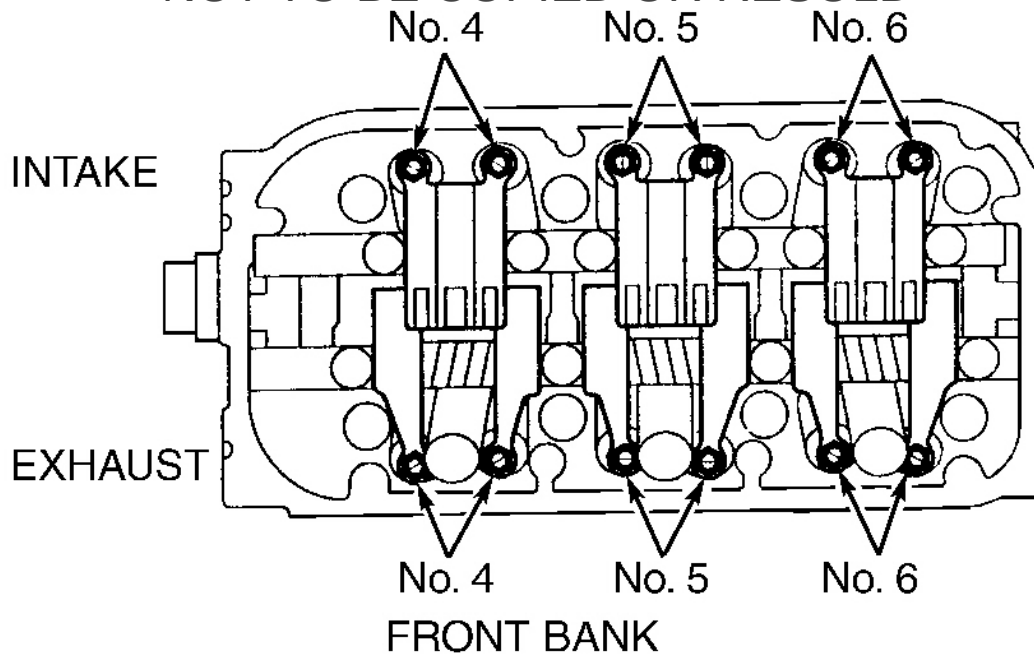
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Fig. 2: Identifying Front Cover Timing Pointer & Camshaft Pulley TDC Mark
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Fig. 3: Identifying Valve Adjusting Screw Locations
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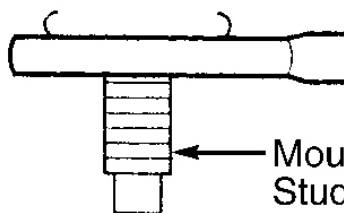
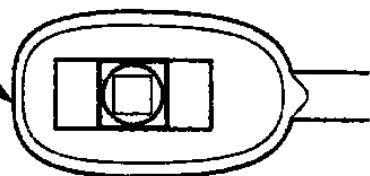
SHIFT CABLE ADJUSTMENT

1. Apply parking brake and block drive wheels. Place transmission in Reverse. Remove console panel and center console. Remove nut securing shift cable end, and separate end from shift lever assembly.

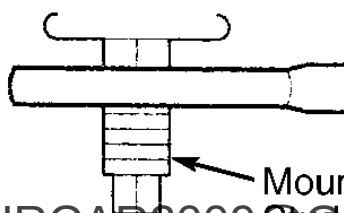
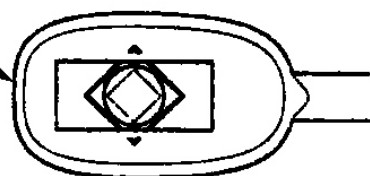
NOTE: **DO NOT remove shift cable by twisting shift cable guide.**

2. Rotate socket holder on shift cable 90 degrees counterclockwise, and slide holder to remove shift cable from shift lever bracket base. Push shift cable in until it stops, then release. Pull shift cable back one step so shift position in Reverse.
3. Turn ignition on, and verify Reverse position indicator illuminates. Turn ignition off.
4. Insert a .24" (6 mm) pin into positioning hole on shift lever bracket base through positioning hole on shift lever assembly. Rotate socket holder 90 degrees counter clockwise, and slide holder onto shift lever bracket base.
5. Install shift cable end onto mounting stud by aligning shift cable end square hole with square shape at bottom of mounting stud. See **Fig. 4** . Rotate socket holder 90 degrees to secure shift cable into shift cable bracket base. Tighten shift cable retaining nut to specification. See **TORQUE SPECIFICATIONS** .
6. Remove pin. Push shift lock release, and verify shift lever releases. Move shift lever through entire gear range, and verify gear position indicator follows transmission range switch. To complete installation, install center console and console panel. Tighten fasteners to specification. See **TORQUE SPECIFICATIONS** .

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Shift
Cable
EndMounting
Stud

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Shift
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Fig. 4: Installing Shift Cable End

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THROTTLE CABLE ADJUSTMENT

1. Remove Intake manifold cover. See **Fig. 1** . Start engine and run at 3000 RPM, with all accessories off, until radiator fan comes on. Allow engine to idle.
2. Hold throttle link to throttle lever and ensure there is no clearance. Check cable free play at throttle linkage. Cable deflection should be .36-.50" (9-13 mm). If necessary, loosen lock nut and turn adjusting nut until deflection is within range. See **Fig. 5** . Retighten lock nut.
3. With cable properly adjusted, ensure throttle valve opens fully with accelerator pedal fully depressed. Ensure throttle valve returns fully to idle position when pedal is released.

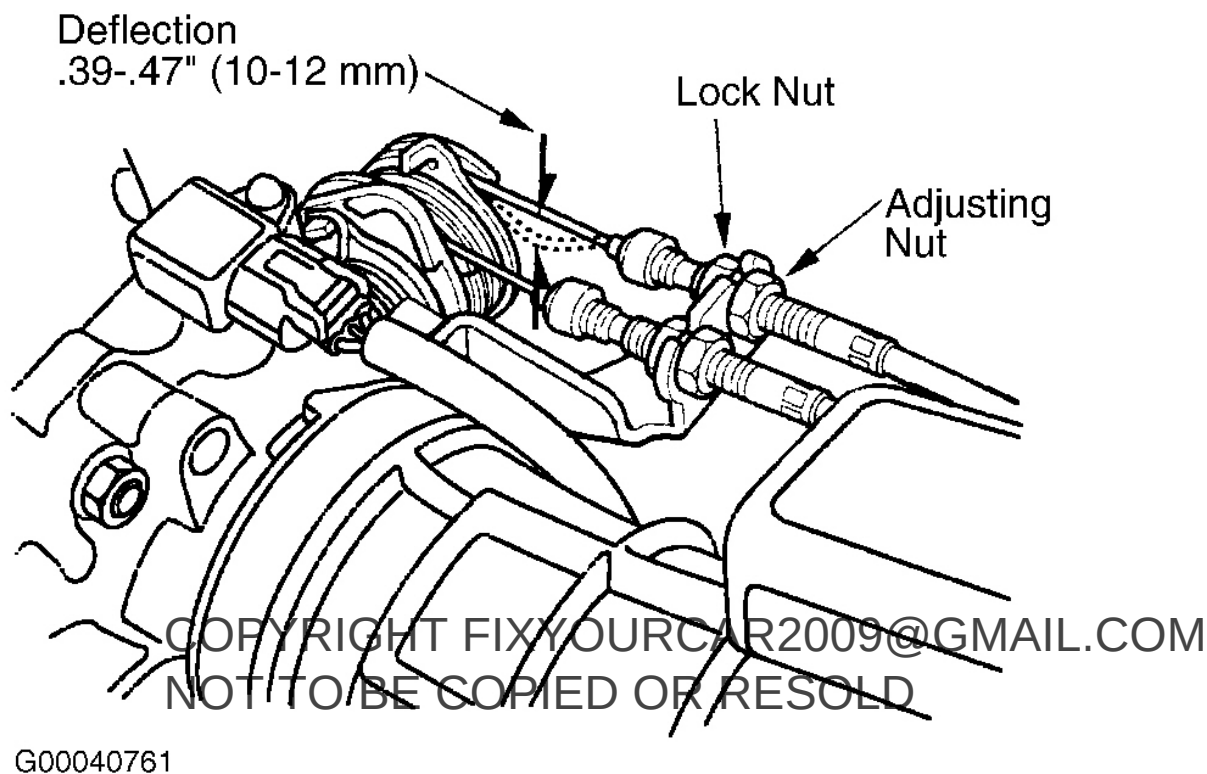
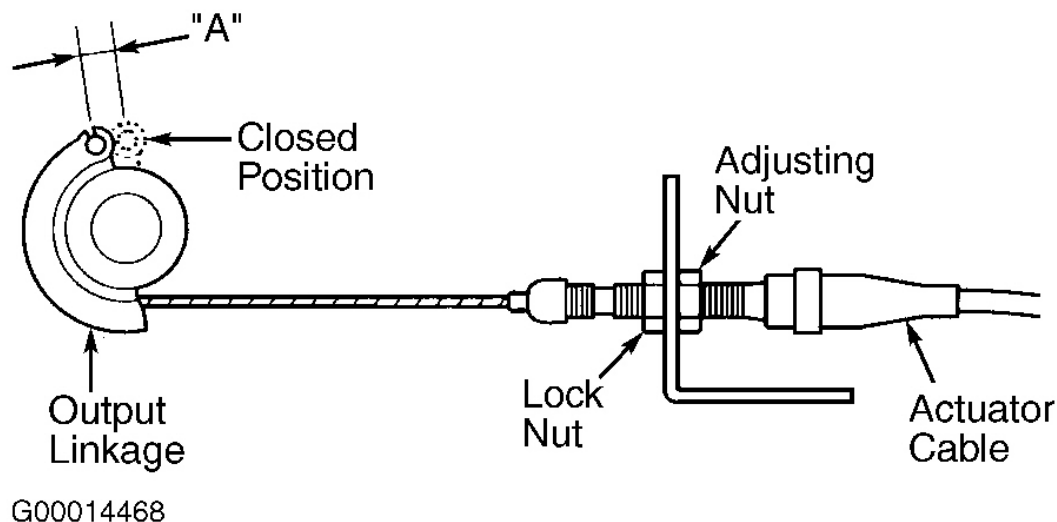


Fig. 5: Adjusting Throttle Cable

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CRUISE CONTROL CABLE ADJUSTMENT

1. Ensure cruise control cable moves smoothly with no binding. Start engine and run at 3000 RPM, with all accessories off, until radiator fan comes on. Allow engine to idle.
2. At first, linkage should be located at fully closed position. Measure amount of movement of output linkage necessary to cause engine speed starts to increase. Check free play at point "A". See **Fig. 6** . Free play should be .13-.17" (3.25-4.25 mm).
3. If free play is not within specified range, move cable until engine speed starts to increase. Loosen lock nut and adjusting nut. Turn adjusting nut until nut is .13-.17" (3.25-4.25 mm) away from cable bracket. Pull cable until adjusting nut touches bracket, then tighten lock nut.



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Fig. 6: Adjusting Cruise Control Actuator Cable
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TROUBLE SHOOTING

NOTE: To trouble shoot engine mechanical components, see **ENGINE MECHANICAL** in **BASIC TROUBLE SHOOTING** article in **GENERAL INFORMATION**.

REMOVAL & INSTALLATION

NOTE: For repair procedures not covered in this article, see **ENGINE OVERHAUL PROCEDURES** article in **GENERAL INFORMATION**. For reassembly reference, label all electrical connectors, vacuum hoses and fuel lines before removal. Also place mating marks on engine hood and other major assemblies before removal.

NOTE: Obtain radio anti-theft code prior to disconnecting battery power. When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See **COMPUTER RELEARN PROCEDURES** article in **GENERAL INFORMATION** before disconnecting battery.

FUEL PRESSURE RELEASE

WARNING: Always relieve fuel pressure before disconnecting any fuel injection-related component. **DO NOT** allow fuel to contact engine or electrical

components.

Disconnect negative battery cable. Remove fuel filler cap. Place shop rags around fuel pulsation damper (located on top of fuel rail). Slowly loosen damper one complete turn. Fuel pressure is now released. After repairs are complete, remove fuel pulsation damper and install NEW washers. Tighten damper to 16 ft. lbs. (22 N.m).

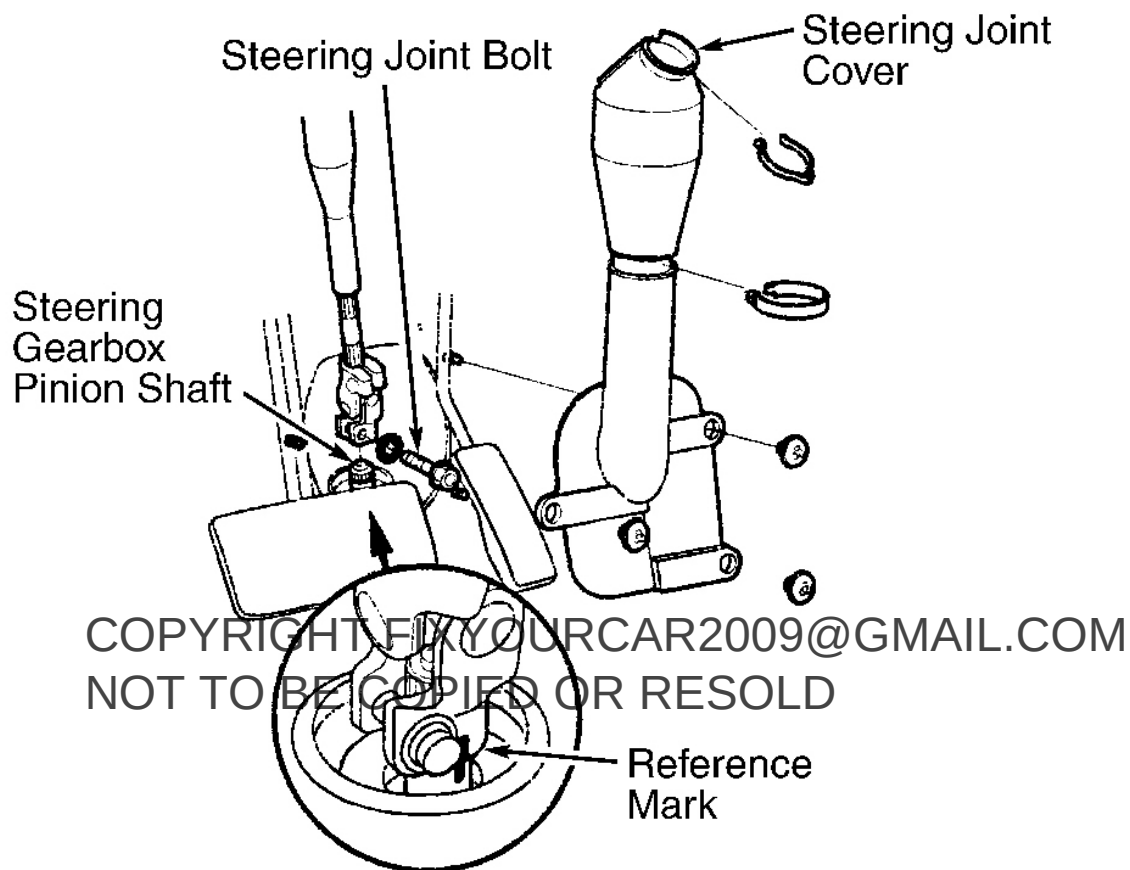
BLEEDING COOLING SYSTEM

See **BLEEDING COOLING SYSTEM** in SPECIFICATIONS article in ENGINE COOLING.

ENGINE**Removal**

NOTE: During removal of wiring and hoses, always label each connection for proper reinstallation.

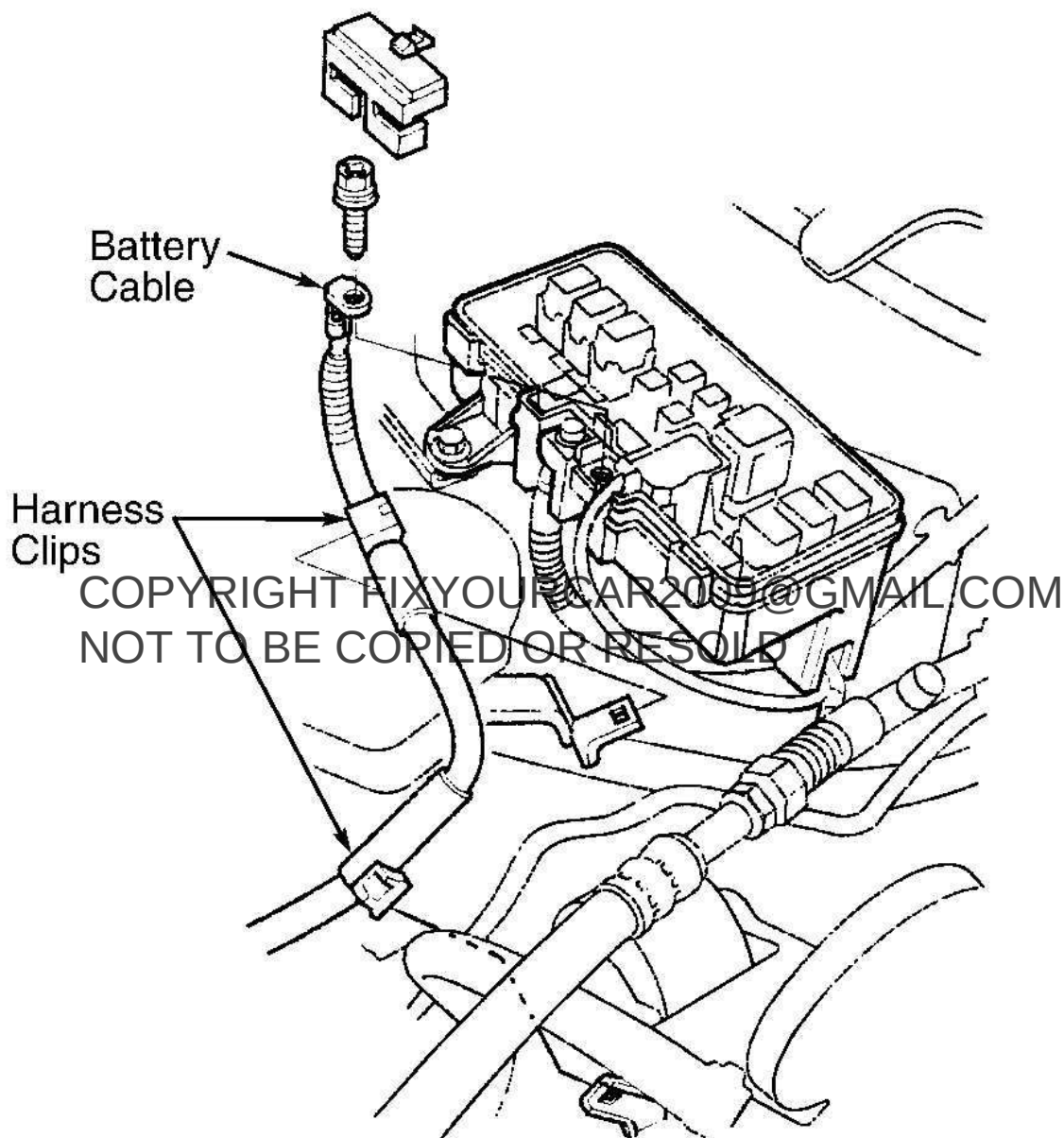
1. Remove hood strut supports and fix hood in vertical position. Drain power steering system. Disconnect negative battery cable, then positive battery cable. Remove battery and battery tray. Remove intake manifold cover and ignition coil cover.
2. Remove vacuum hoses from intake air duct and breather pipe. Remove intake air duct. Remove harness clips, and disconnect engine wiring harness connectors from left side of engine compartment. Remove battery cable ground strap from body. Remove battery tray. Remove wiring harness clip, and starter motor cable.
3. Loosen lock nuts, and remove throttle cable and cruise control cable from accelerator linkage. DO NOT bend cables. Release fuel pressure. See **FUEL PRESSURE RELEASE** . Remove fuel feed and fuel return hoses from engine connections. Remove EVAP control canister hose from throttle body.
4. Remove driver's side center console lower panel to access steering joint cover. Remove steering joint cover. Make a reference mark across steering joint and steering gearbox pinion shaft. Remove steering joint bolt, and disconnect steering joint from steering gearbox pinion shaft. See **Fig. 7** .



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Fig. 7: Disconnecting Steering Joint

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Fig. 8: Identifying Connections At Underhood Fuse/Relay Box
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5. Disconnect Powertrain Control Module (PCM) connectors (located behind lower driver's side instrument panel cover). Disconnect primary heated oxygen sensor connector and wiring harness clamps. Loosen grommet mounting nuts at cowl, turn grommet counterclockwise and pull PCM connector harness through opening. Remove brake booster vacuum hose.

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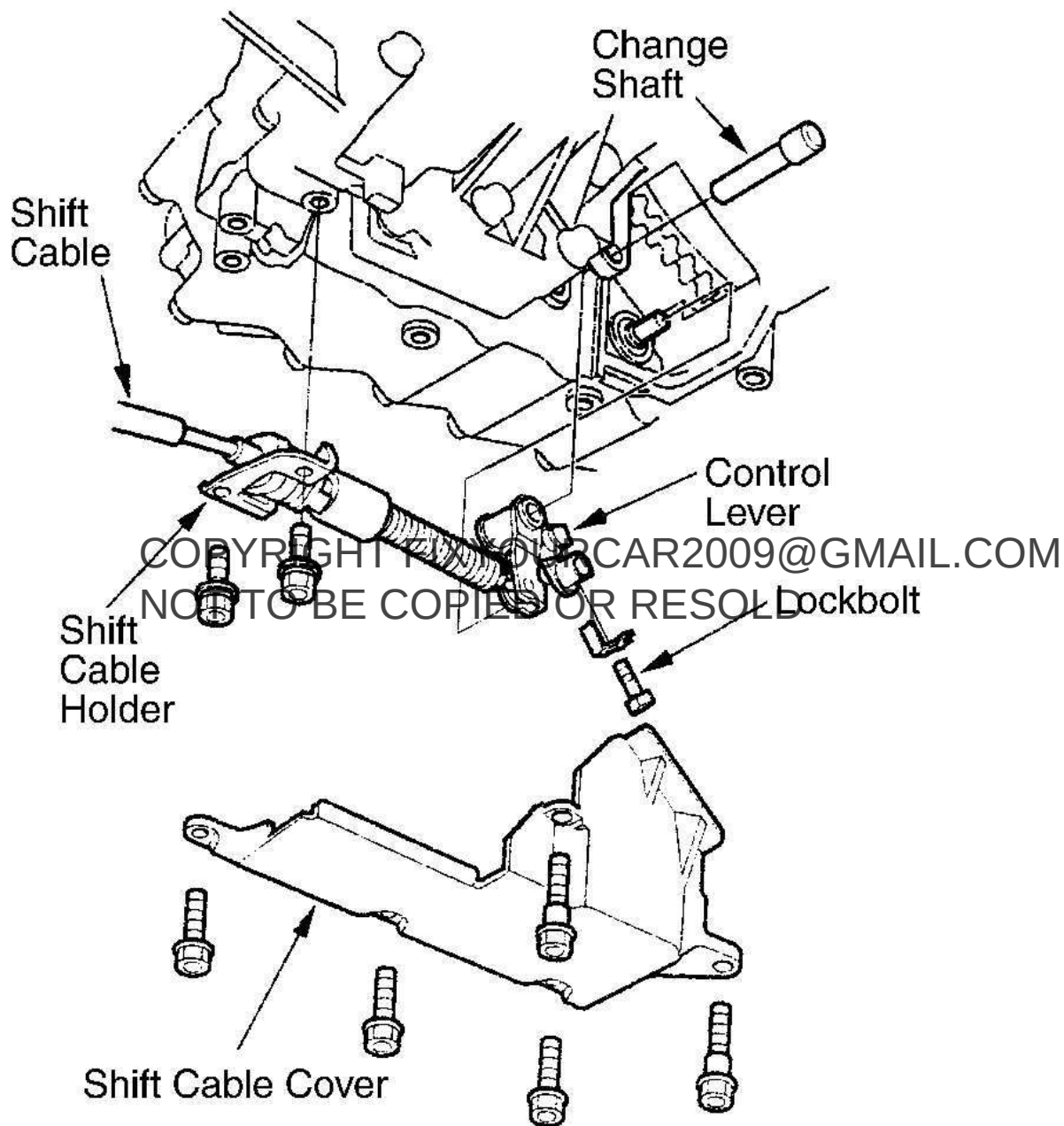
6. Remove power steering pump inlet and outlet hoses from power steering pump. Remove power steering hose clamp. Remove battery cable, and disconnect harness connector from underhood fuse/relay box. See **Fig. 8** . Loosen tension on generator belt auto tensioner. Remove generator belt. Remove radiator cap.

NOTE: Always use NEW washers on all drain plugs.

7. Raise and support vehicle on hoist. Remove front tire and wheels. Remove splash shield. Drain cooling system. Drain automatic transmission fluid. Drain engine oil.

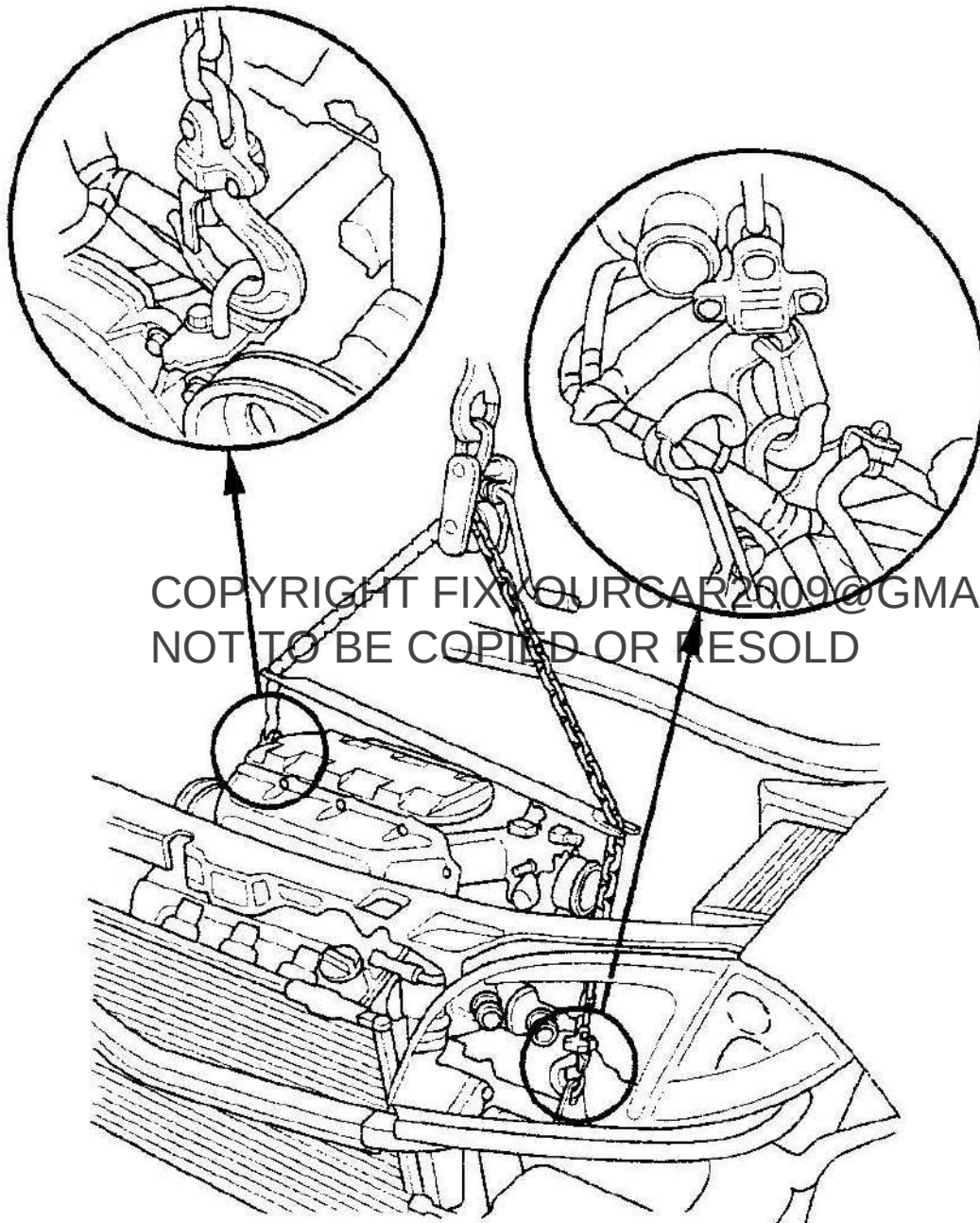
NOTE: Coat all precision finished surfaces with clean engine oil and tie plastic bags over ends of drive axles.

8. Remove front subframe stiffener. Remove exhaust pipe. Make reference mark on drive shaft and transfer shaft flange, and remove driveshaft. Remove shift control cable. See **Fig. 9** . Remove transfer assembly. See appropriate TRANSFER CASE article in TRANSMISSIONS. Disconnect tie rod end and lower control arm ball joints. Remove axle shafts. See AXLE SHAFTS - FRONT article in DRIVE AXLES. Remove power steering hose. Disconnect power steering pressure switch connector.
9. Remove lower transmission front mount, and transmission lower rear mount retaining nuts. Remove rear mount retaining bolts. Remove A/C compressor without disconnecting hoses and position aside.
10. Lower vehicle. Remove heater hoses. Remove upper and lower radiator hoses. Remove grounding cable. Remove automatic transmission cooler hoses, and plug cooler hoses and lines. Remove radiator. Attach chain hoist to engine. See **Fig. 10** . Remove side engine mount bracket bolts. Remove front mount bracket support nut. Ensure hoist brackets are positioned properly. Raise hoist to full height. Make reference marks onto body next to marks on front subframe. See **Fig. 11** . Remove front subframe. See **Fig. 12** . Ensure engine/transmission are free of any hoses and wiring. Slowly raise engine about 6" and check again to ensure there are no connected hoses or wiring. Lower engine/transmission completely from vehicle. Place engine/transmission onto a dolly. Remove engine/transmission from under vehicle. Separate engine from transmission.



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Fig. 9: Identifying Shift Control Cable Components
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Fig. 10: Installing Chain Hoist
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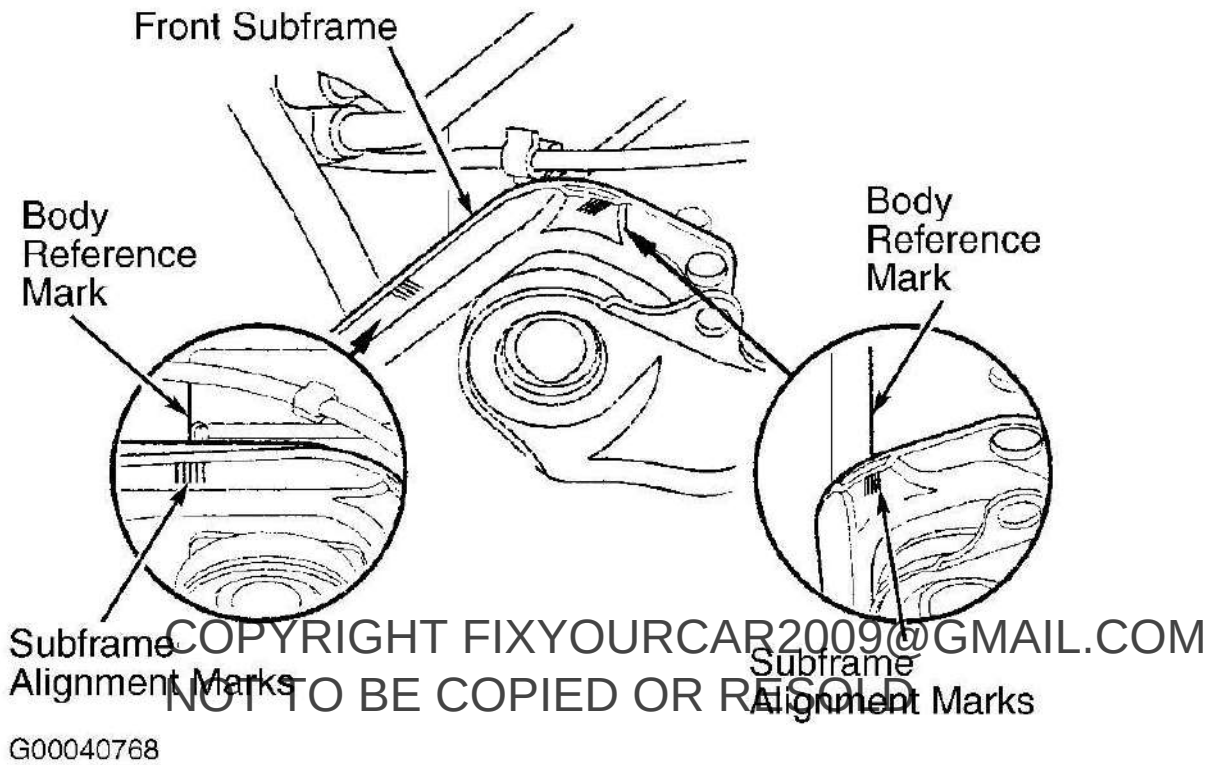
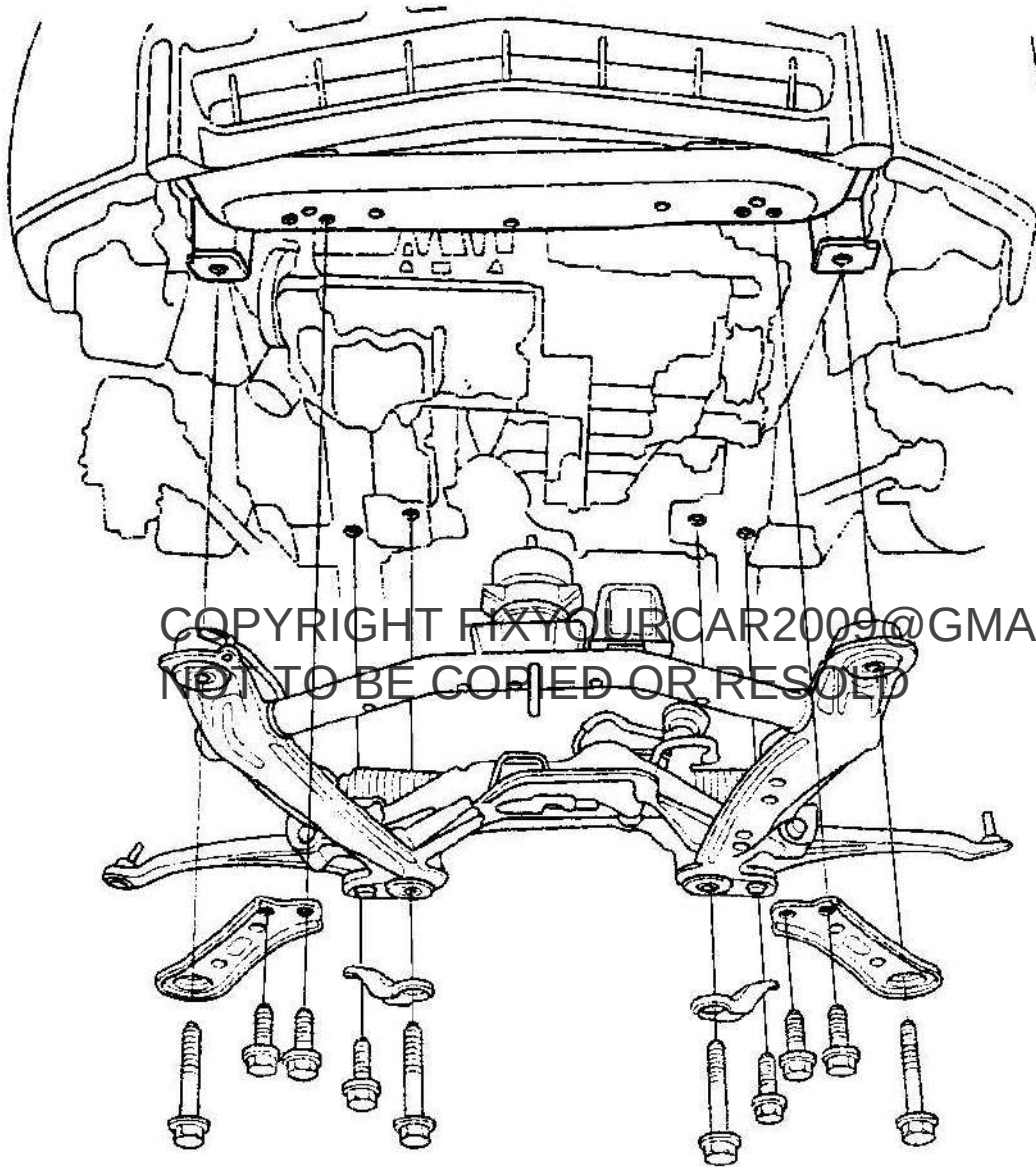


Fig. 11: Locating Front Subframe Alignment Marks
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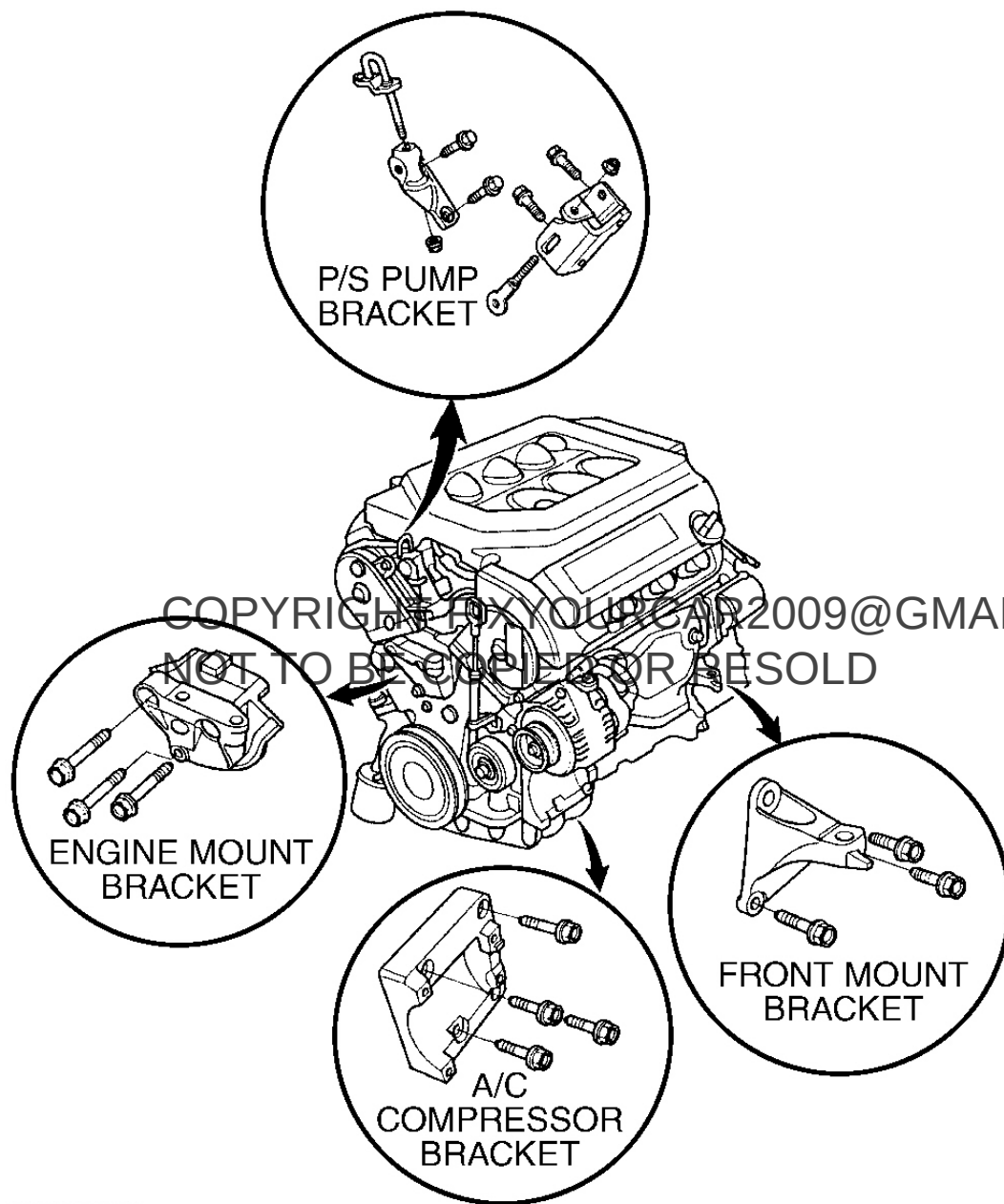
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Fig. 12: Removing Front Subframe

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Fig. 13: Identifying Engine Block Bracket Locations
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

Installation

1. If removed, install brackets to engine block for power steering pump, front mount bracket, A/C compressor bracket and engine mount bracket. See **Fig. 13**.

2. Position engine/transmission under vehicle. Attach chain hoist from above. Lift engine/transmission into position. Install transmission lower rear mount first, then install rear engine mount bracket. Install A/C compressor to mounting bracket. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**.
3. Install frame subassembly and mounting bolts, using reference marks made during removal for alignment. Install and tighten mounting nuts for transmission lower rear mount and transmission lower front mount. See **Fig. 14**. See **TORQUE SPECIFICATIONS**

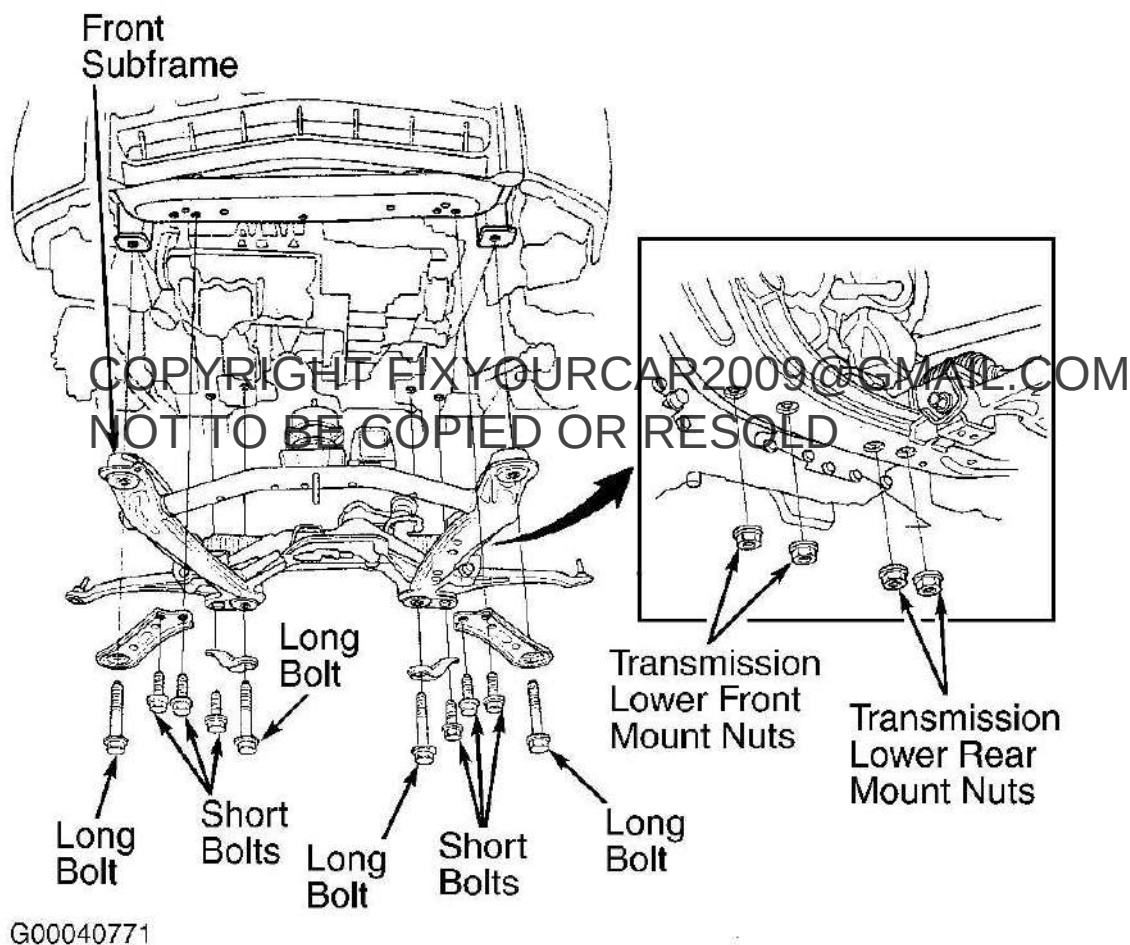


Fig. 14: Installing Subframe Assembly

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4. Tighten rear mount mounting bolts. Lower vehicle on hoist. Tighten front mount bracket support nut, and rear mount bracket support nut and bolt. Install side engine mount bracket. See **TORQUE SPECIFICATIONS**. Remove chain hoist from engine.
5. Raise vehicle on hoist. Install A/C compressor. Install power steering hose. Connect power steering pressure switch. Install NEW spring clip on end of each drive axle, then install axle shafts. Ensure clips click into place in differential and intermediate shaft. Tighten bolts and nuts to specification. See

TORQUE SPECIFICATIONS .

6. Connect and tighten ball joints and lower control arms. See **TORQUE SPECIFICATIONS** . Use NEW cotter pins. Install transfer case assembly. See appropriate TRANSFER CASE article in TRANSMISSIONS.
7. Install shift control cable onto control shaft. DO NOT bend cable more than necessary to install. Install cable end lock bolt with NEW lock washer. Bend over tab of lock washer. Install shift cable cover, then install cable holder onto cable cover. Install drive shaft. Install exhaust pipe using NEW gaskets and self-locking nuts. Tighten bolts and nuts to specification. See **TORQUE SPECIFICATIONS** .
8. Install subframe stiffener. Install splash shield. Install front wheels. Lower vehicle. Install radiator. Install ATF cooler hoses. Install upper and lower radiator hoses. Install heater hoses. Tighten bolts and nuts to specification. See **TORQUE SPECIFICATIONS** .
9. Install generator belt. Install power steering inlet hose, outlet hose, and clamps. Install battery cable onto underhood fuse/relay box, and install harness clips. See **Fig. 8** . Install brake booster vacuum hose
10. Push PCM connectors and harness through hole in cowl. Install and tighten grommet nuts. Install wiring harness clips. Connect primary oxygen sensor connector. Connect PCM connectors. Align reference mark on steering joint and steering gearbox pinion shaft. Install steering joint bolt. Install steering joint cover. Tighten bolts and nuts to specification. See **TORQUE SPECIFICATIONS** .
11. Install fuel feed hose, using NEW washers. Install fuel return and EVAP canister hoses. Install and adjust cruise control cable and throttle cable. See **ADJUSTMENTS** . Install starter cable and wiring harness clip. Install battery tray, relay bracket, wiring harness clip and ground cable. Install engine wiring harness connectors onto left side of engine compartment, and install clips onto battery tray.
12. Install intake air duct, then install vacuum hoses and breather pipe to air duct. Install ignition coil cover, and intake manifold cover.
13. Install battery. Refill engine oil, automatic transmission fluid, and cooling system fluid. Tighten plugs to specification. See **TORQUE SPECIFICATIONS** . Check all fluid levels. Check shift lever positions.
14. Turn ignition switch to ON position (DO NOT start engine) for about 2 seconds for fuel pump to pressurize fuel lines. Repeat 2-3 times. Check for any signs of fuel leakage. Re-enter radio anti-theft code. Start engine and check all operations. Check wheel alignment. See **SPECIFICATIONS & PROCEDURES** article in WHEEL ALIGNMENT.

INTAKE MANIFOLD

CAUTION: Release fuel pressure before disconnecting fuel lines. See FUEL PRESSURE RELEASE .

Removal & Installation

NOTE: Manufacturer does not provide specific removal and installation procedures for intake manifold. Note the following items:

- Intake manifold may be disassembled as shown. See **Fig. 15** .
- Replace components if any mating surface shows wear or damage. DO NOT resurface.
- Always use NEW gaskets and "O" rings during installation.

- Tighten intake manifold cover bolts in crisscross sequence, starting from center. See **Fig. 16** . Tighten in several steps to specification. See **TORQUE SPECIFICATIONS** .

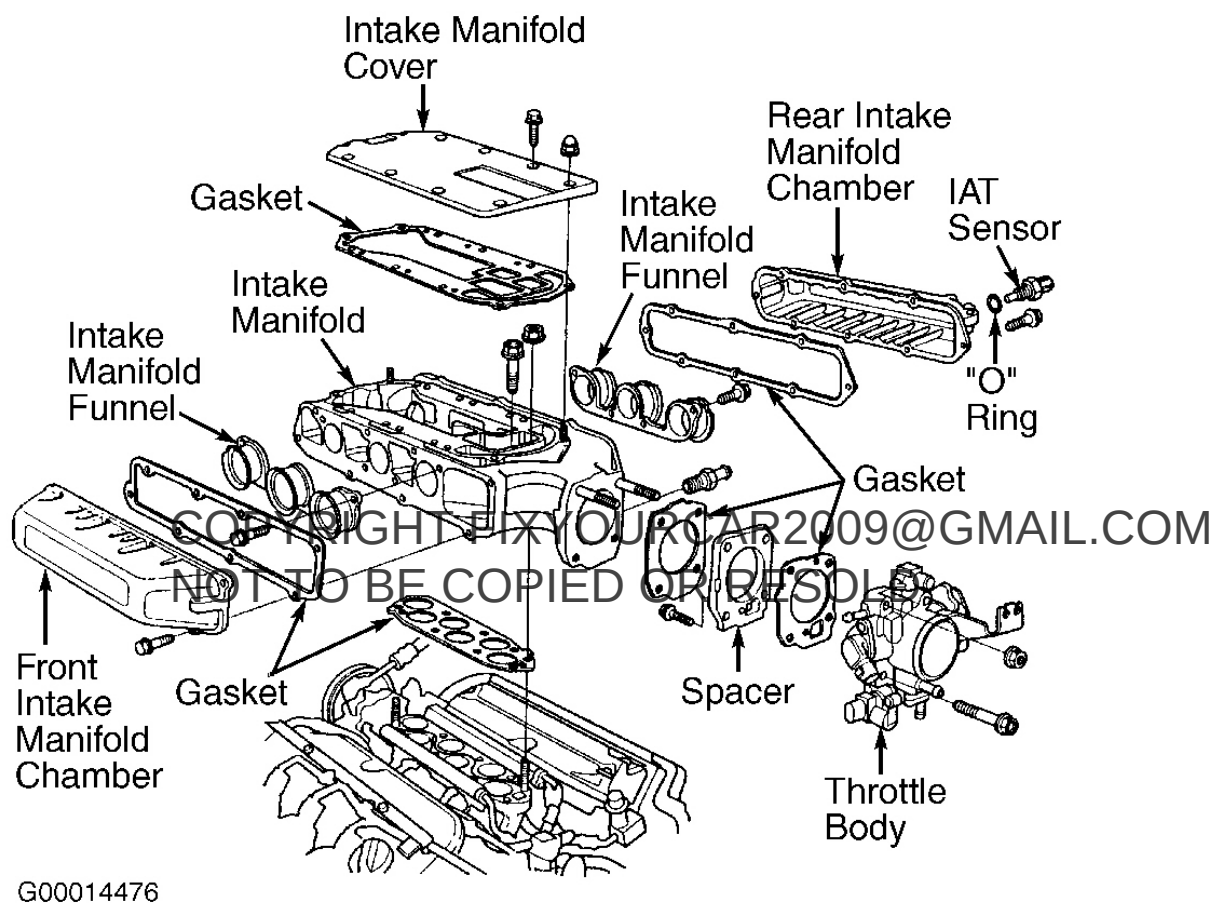
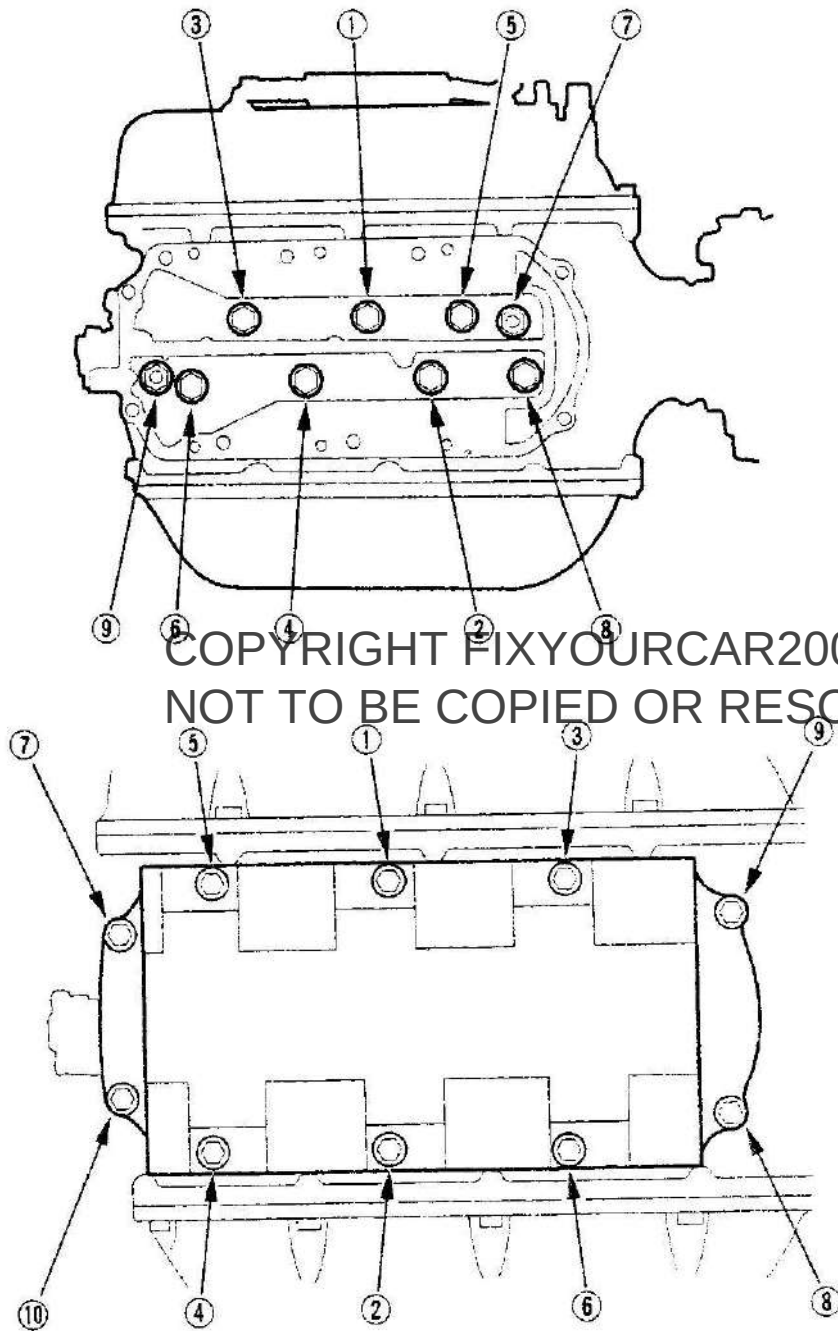


Fig. 15: Identifying Intake Manifold & Related Components
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Fig. 16: Intake Manifold & Intake Manifold Cover Bolt
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EXHAUST MANIFOLD

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Removal & Installation

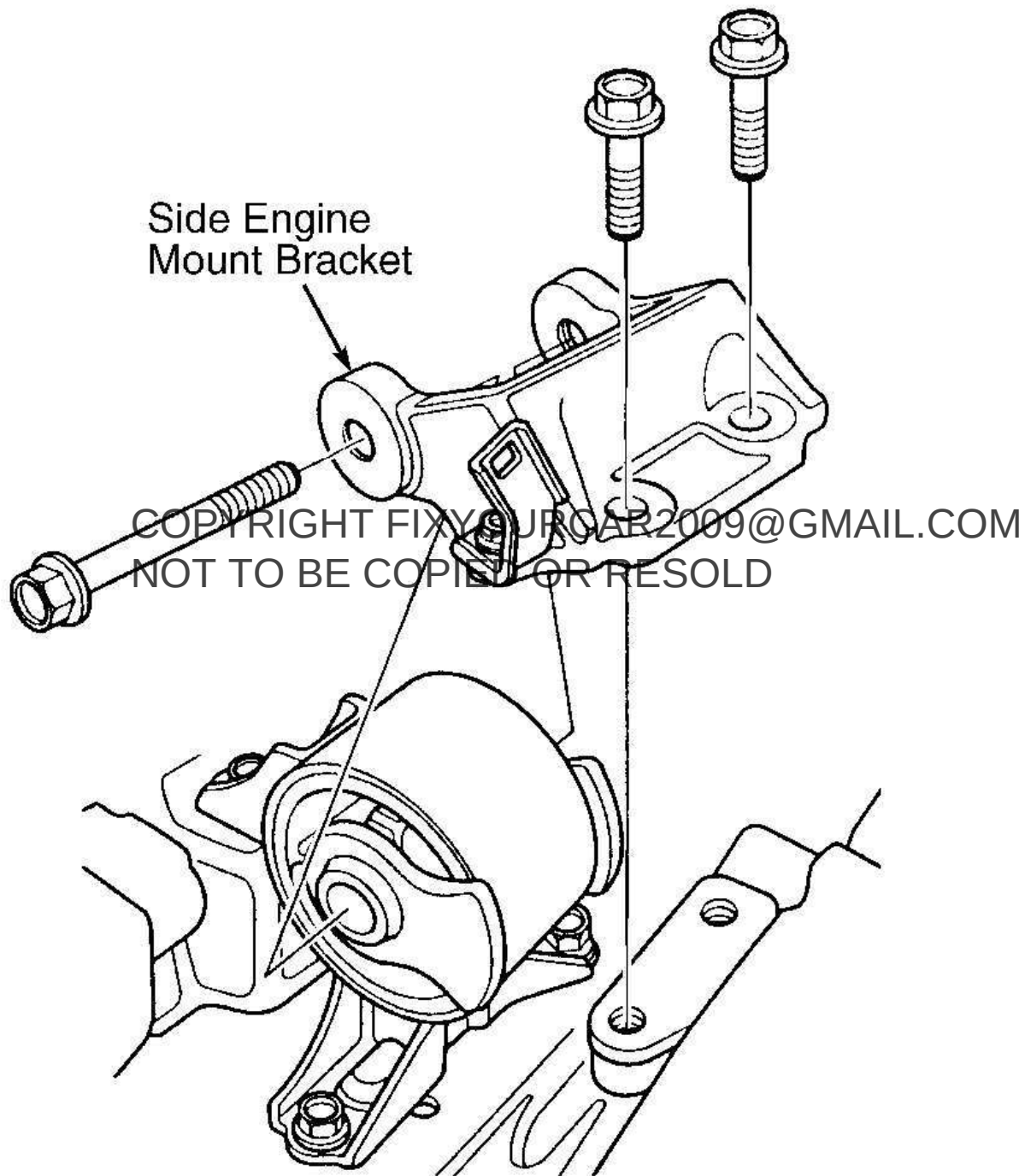
Remove exhaust manifold cover. Remove self-locking nuts and remove exhaust manifold. Use NEW gasket and NEW self-locking nuts during installation. Coat self-locking nuts with engine oil prior to installation. Tighten to specification. See **TORQUE SPECIFICATIONS** .

CYLINDER HEAD

NOTE: **Ensure cylinder head temperature is less than 100°F (38°C) before loosening cylinder head bolts. Obtain radio anti-theft code from customer before disconnecting battery.**

Removal

1. Disconnect negative battery cable. Drain engine coolant. Remove ignition coil covers and intake manifold cover. Remove EVAP canister hose from throttle body. Remove vacuum hose and breather pipe, then remove intake air duct. See **Fig. 1** .
2. Loosen lock nuts and remove throttle cable and cruise control cable from throttle linkage. Relieve fuel system pressure. See **FUEL PRESSURE RELEASE** . Remove fuel feed and return hoses. Remove brake booster vacuum hoses and PCV hose at cowl. Remove breather hose and water by-pass hoses. Remove power steering hose clamp, and disconnect Intake Manifold Runner Control (IMRC) actuator connector, and remove IMRC actuator.
3. Remove 2 bolts securing wiring harness holder, and remove joint connector. Support engine with jack and wood block under oil pan. Remove side engine mount bracket. See **Fig. 17** . Move auto tensioner to loosen generator belt. Remove belt.
4. Loosen power steering pump adjust nut. Remove lock nut and mounting bolt, then remove power steering pump and belt. DO NOT disconnect hoses. Remove hose retaining clamp. Position pump aside.
5. Remove generator. Label and disconnect all wiring harness connectors and clamps from cylinder heads and intake manifold.
6. Remove 6 ignition coils from front and rear cylinder head covers. Remove intake manifold. See **INTAKE MANIFOLD** .
7. Remove 6 fuel injector connectors. Remove fuel rails. Disconnect vacuum hoses from Fuel Injection Air (FIA) control valve. See **Fig. 18** . Remove timing belt. See **TIMING BELT** . Disconnect heater hoses and radiator hoses.
8. Remove both exhaust manifolds. See **EXHAUST MANIFOLD** . Remove water housing assembly from front of cylinder head.
9. Remove camshaft pulleys and back covers. Remove cylinder head covers. In sequence, and loosening each bolt 1/3 turn at a time, loosen cylinder head bolts. See **Fig. 19** . Remove cylinder heads.



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Fig. 17: Removing Side Engine Mount Bracket
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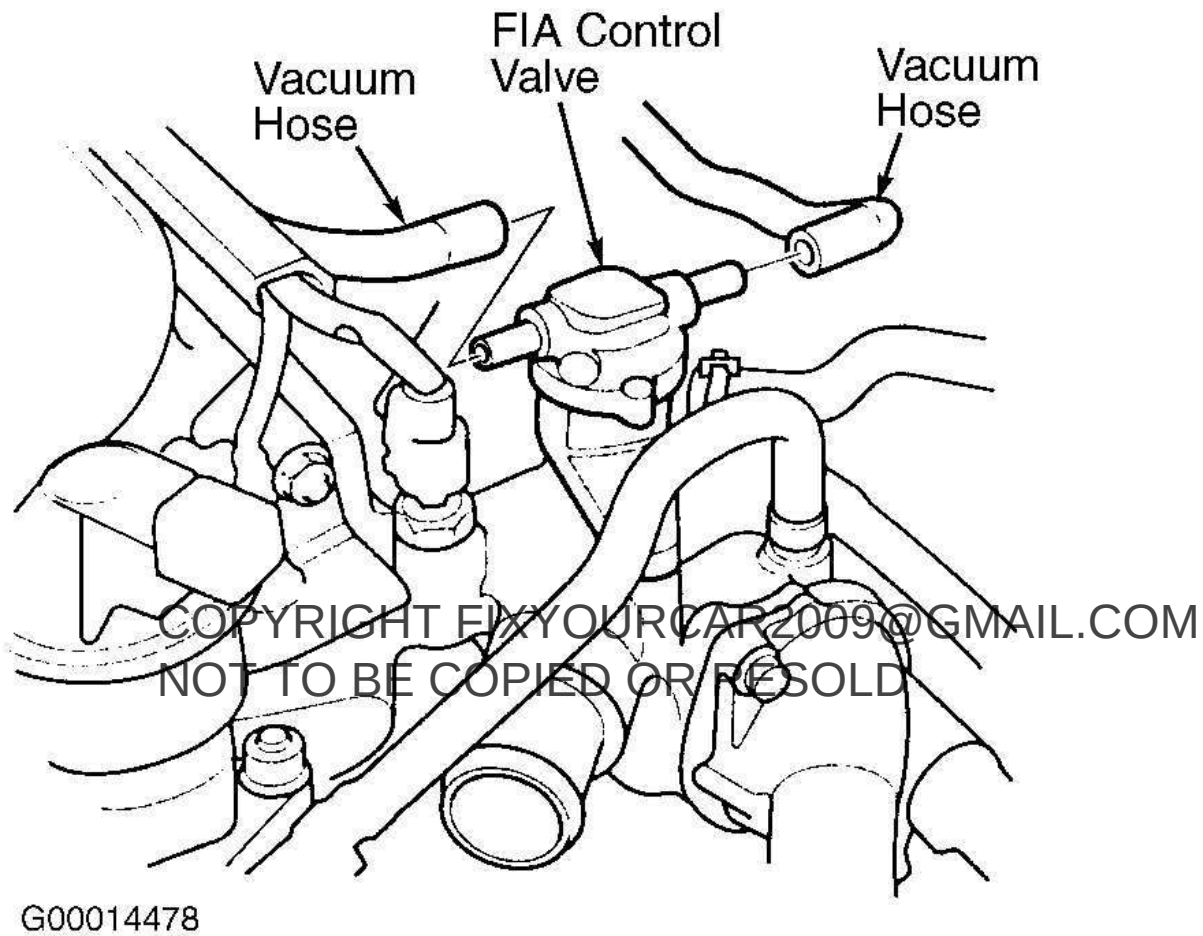


Fig. 18: Identifying Fuel Injection Air (FIA) Control Valve
Courtesy of AMERICAN HONDA MOTOR CO., INC.

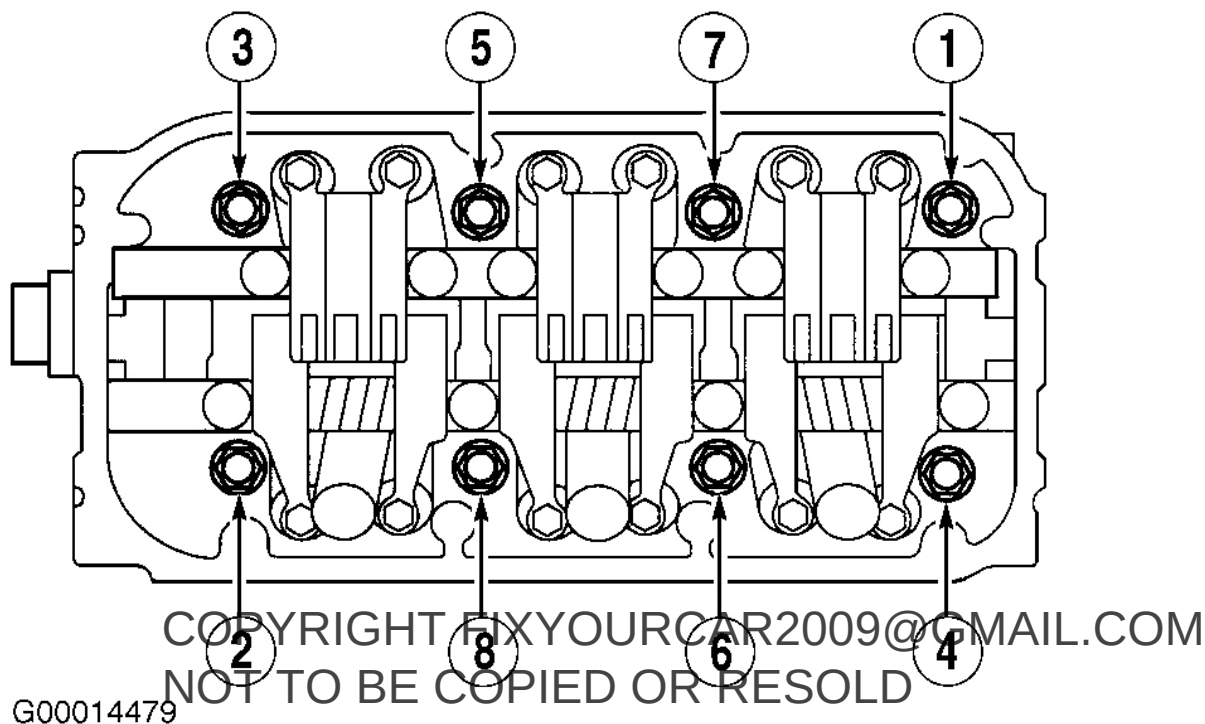


Fig. 19: Cylinder Head Bolt Loosening Sequence
Courtesy of AMERICAN HONDA MOTOR CO., INC.

Inspection

Check camshaft-to-holder oil clearance with a dial indicator measuring inside diameter of each camshaft bearing surface. If oil clearance is beyond service limit, replace camshaft. If oil clearance is within specification, check head surface for warpage. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS.

Installation

1. Clean cylinder head and block surface. Clean and install oil control orifices and NEW "O" rings. See **Fig. 20** . Install dowel pins and NEW cylinder head gaskets.
2. Clean timing belt drive pulley. Set drive pulley to TDC by aligning TDC mark on timing belt drive pulley with pointer mark on oil pump. See **Fig. 21** .
3. Clean camshaft pulleys. Set camshaft pulleys to TDC by aligning TDC marks on camshaft pulleys with pointers on back covers. See **Fig. 22** .
4. Apply engine oil to threads and flanges of cylinder head bolts. Install and tighten bolts sequentially in 3 steps. Perform each step twice. See **Fig. 23** . See **TORQUE SPECIFICATIONS** .

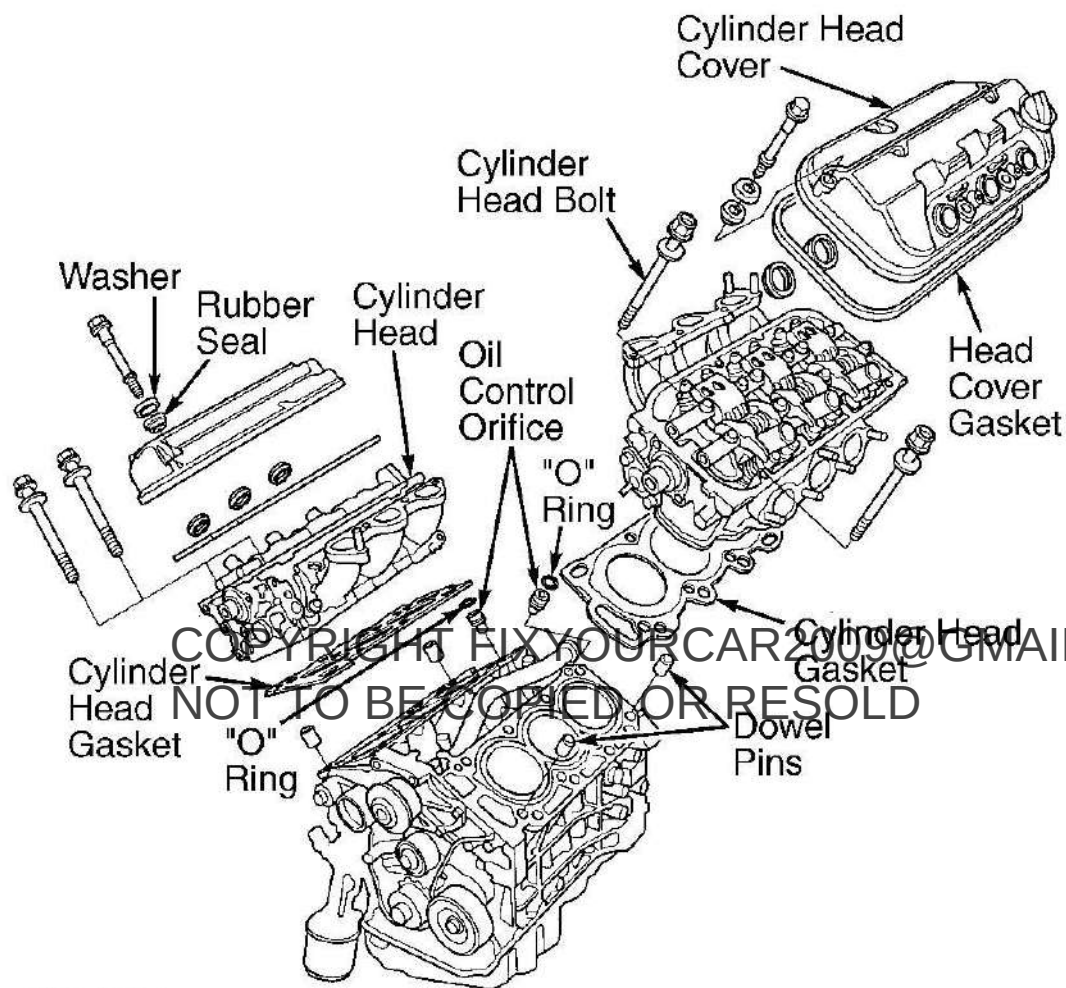
CAUTION: DO NOT overtighten bolts. If bolt makes any noise during tightening, loosen bolt and retighten from first step.

5. Install exhaust manifold using NEW gasket. Tighten nuts in crisscross pattern in 2-3 steps, starting with inner nut and working outward. Install front exhaust pipe and bracket. Install heat shield.
6. Install timing belt. See **TIMING BELT** . Adjust valve clearance. See **VALVE CLEARANCE ADJUSTMENT** under ADJUSTMENTS.
7. Clean and install cylinder head cover. Tighten bolts in 2-3 steps in crisscross pattern, starting from middle bolt and working outward. Install water passage assembly with NEW "O" ring and NEW gaskets.
8. Install intake manifold. Tighten bolts and nuts in 2-3 steps in sequence. See **Fig. 16** . Install intake manifold cover with NEW gasket. Tighten bolts in 2-3 steps in crisscross pattern, starting with middle bolt and working outward.
9. Install remaining components in reverse of removal procedure. After installation, ensure all tubes, hoses and connectors and properly installed. Enter radio anti-theft code.

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Fig. 20: Exploded View Of Cylinder Head Components
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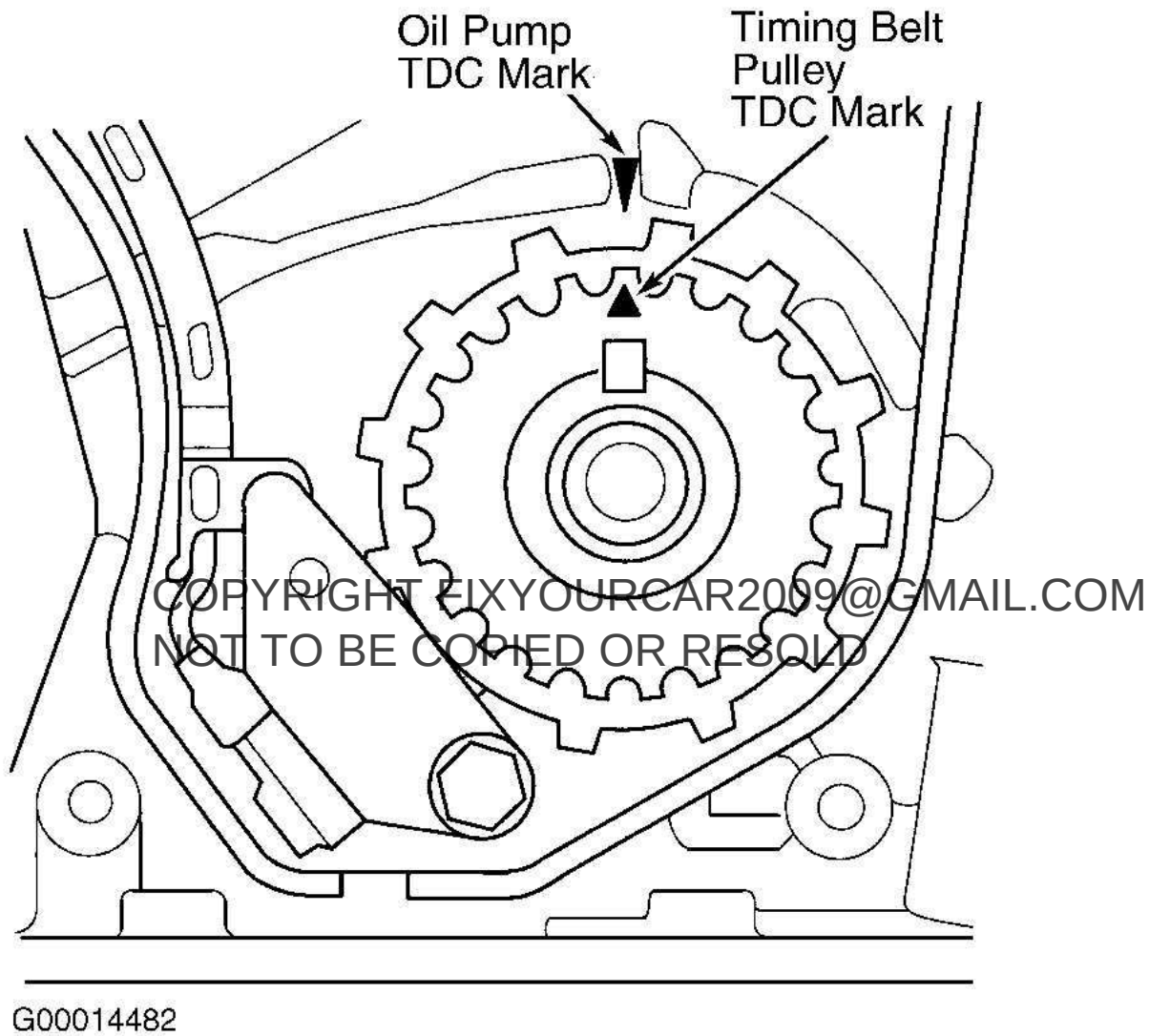


Fig. 21: Aligning TDC Marks On Timing Belt Pulley & Oil Pump
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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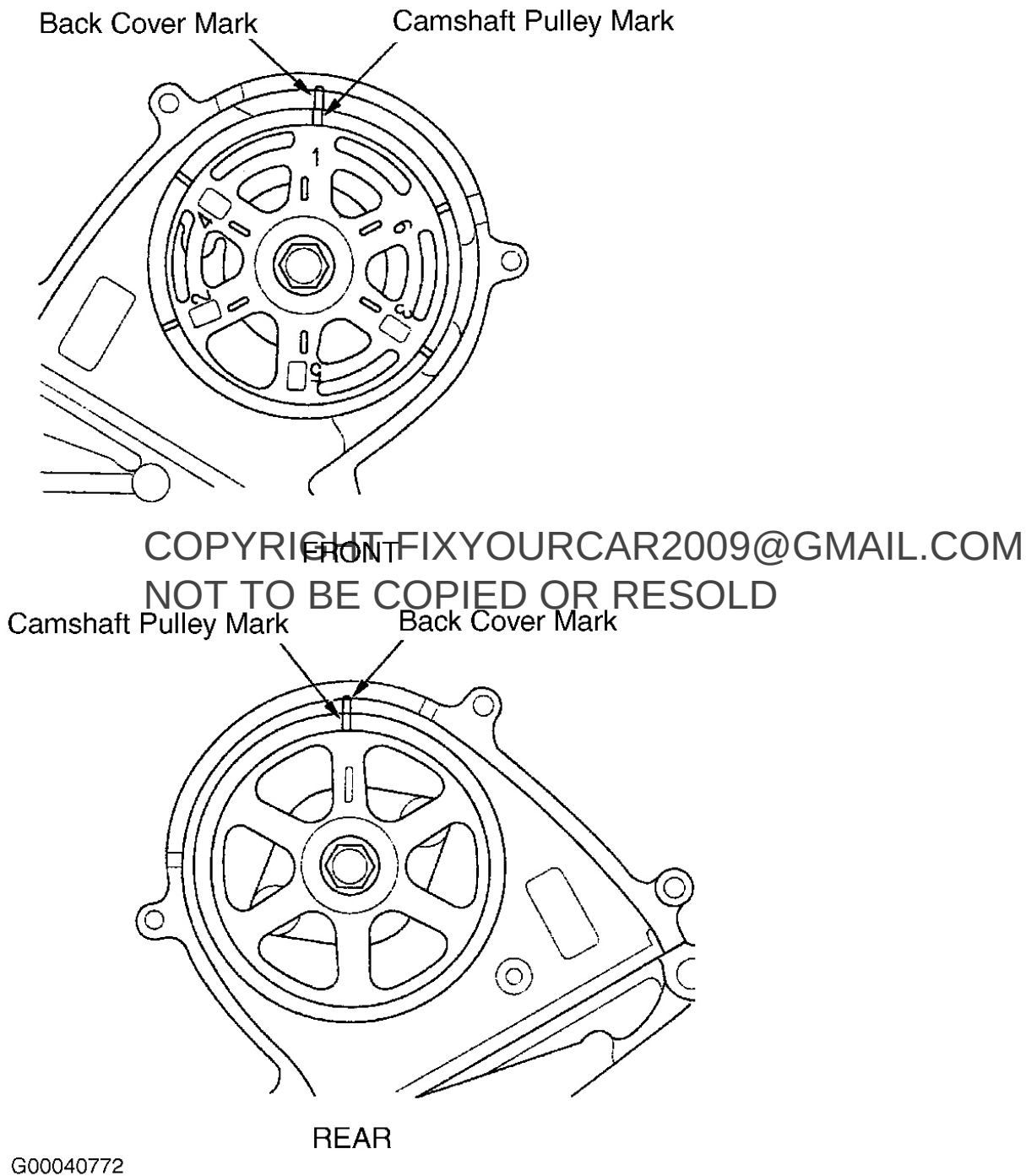


Fig. 22: Identifying Camshaft Pulley & Back Cover TDC
Courtesy of AMERICAN HONDA MOTOR CO., INC.

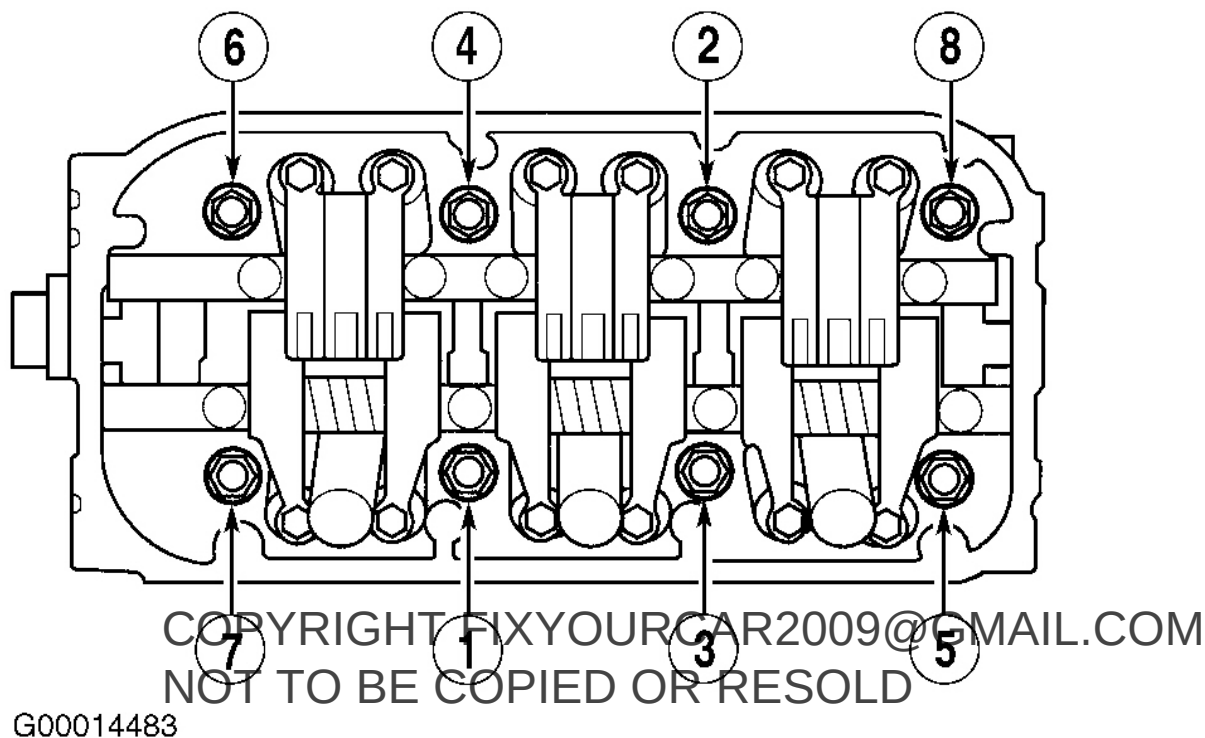


Fig. 23: Cylinder Head Bolt Tightening Sequence

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TDC SENSOR

Removal & Installation

1. Set No. 1 piston to TDC position (White mark on crankshaft aligns with pointer, and rear camshaft pulley mark and upper cover mark are aligned).
2. Remove upper timing belt covers. Grind end of a battery hold-down bolt to a slight bevel. Install and hand-tighten bolt to hold belt tension adjuster position.
3. Remove front camshaft pulley. Remove timing belt from front of camshaft pulley.
4. Disconnect TDC 1/TDC 2 sensor connector, then remove back cover. Remove sensor from back cover.
5. To install, reverse removal procedure.

CRANKSHAFT POSITION (CKP) SENSOR

1. Move auto-tensioner to remove tension from generator belt. Remove generator belt. Loosen power steering pump adjusting bolt, lock nut and mounting bolt. Remove power steering pump belt.
2. Remove dipstick and tube. Remove crankshaft pulley. Remove upper and lower timing belt covers.

Remove CKP sensor from oil pump.

3. To install, reverse removal procedure.

TIMING BELT

NOTE: To inspect belt to determine if replacement is needed, remove ignition coil cover and front upper timing belt cover. Inspect timing belt for cracks or signs of oil or coolant leakage onto belt. Replace belt if necessary.

Removal

1. Set No. 1 piston to TDC by turning crankshaft so White mark aligns with pointer. Check through front timing belt cover inspection port to ensure camshaft pulley mark and front cover pointer are aligned. See **Fig. 2**.
2. Raise vehicle and remove front wheels. Remove splash shield. Using lever tool, move auto tensioner to relieve tension from generator belt. Remove generator belt.
3. Loosen power steering pump adjusting nut, lock nut and mounting bolt. Remove power steering pump belt. Support engine with jack and wood block under oil pan. Remove side engine mount bracket. See **Fig. 17**.
4. Remove dipstick and tube. Discard "O" ring. Hold crankshaft pulley, and remove pulley bolt. Remove upper timing belt covers and lower timing belt cover. See **Fig. 24**.
5. Using a battery hold-down bolt, slightly grind threaded end of bolt to a bevel. Hand tighten bolt into timing belt adjuster to hold position. See **Fig. 25**.
6. Remove engine mount bracket on end of front cylinder head. Loosen idler pulley bolt about 5-6 turns, then remove timing belt.

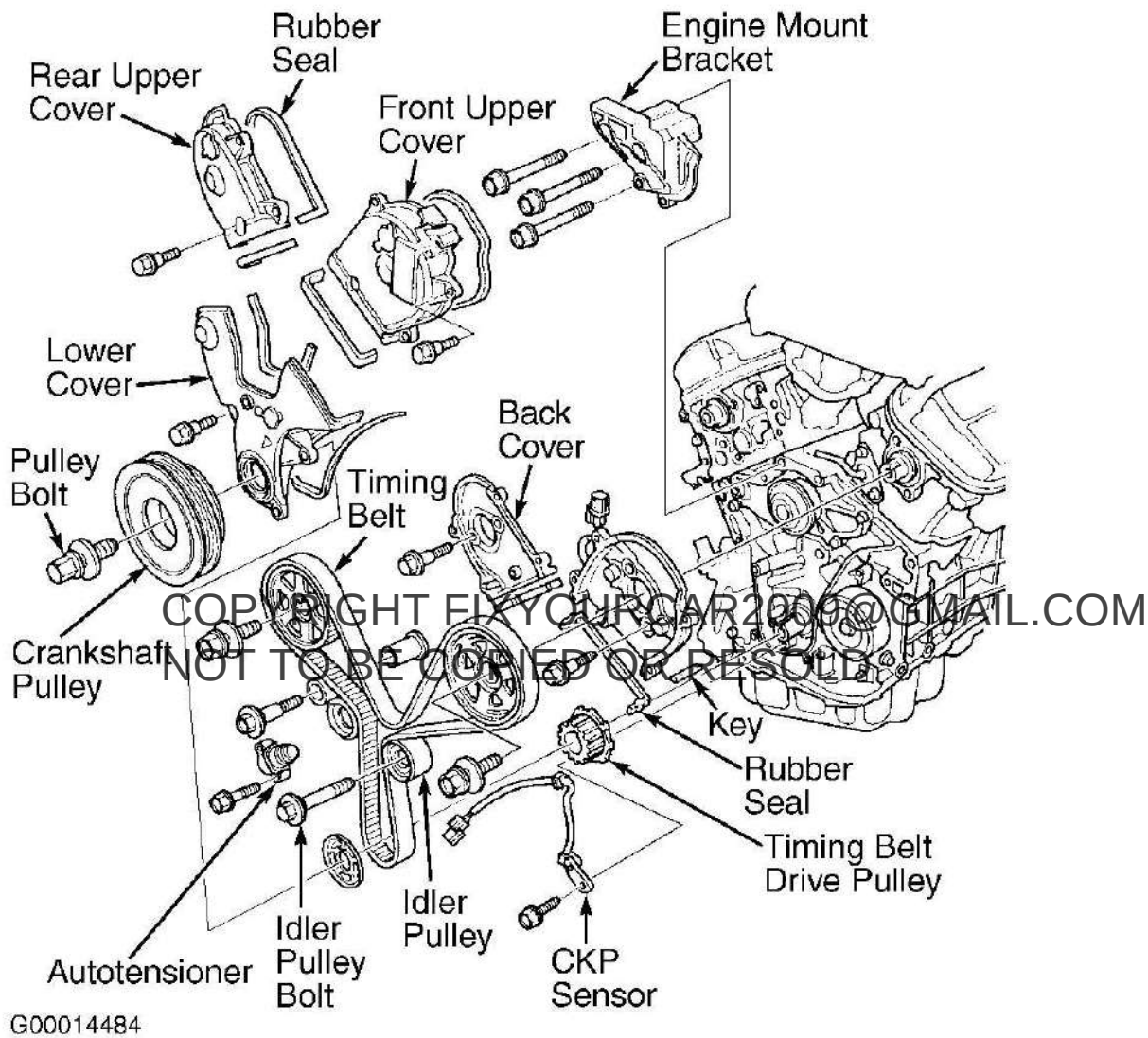
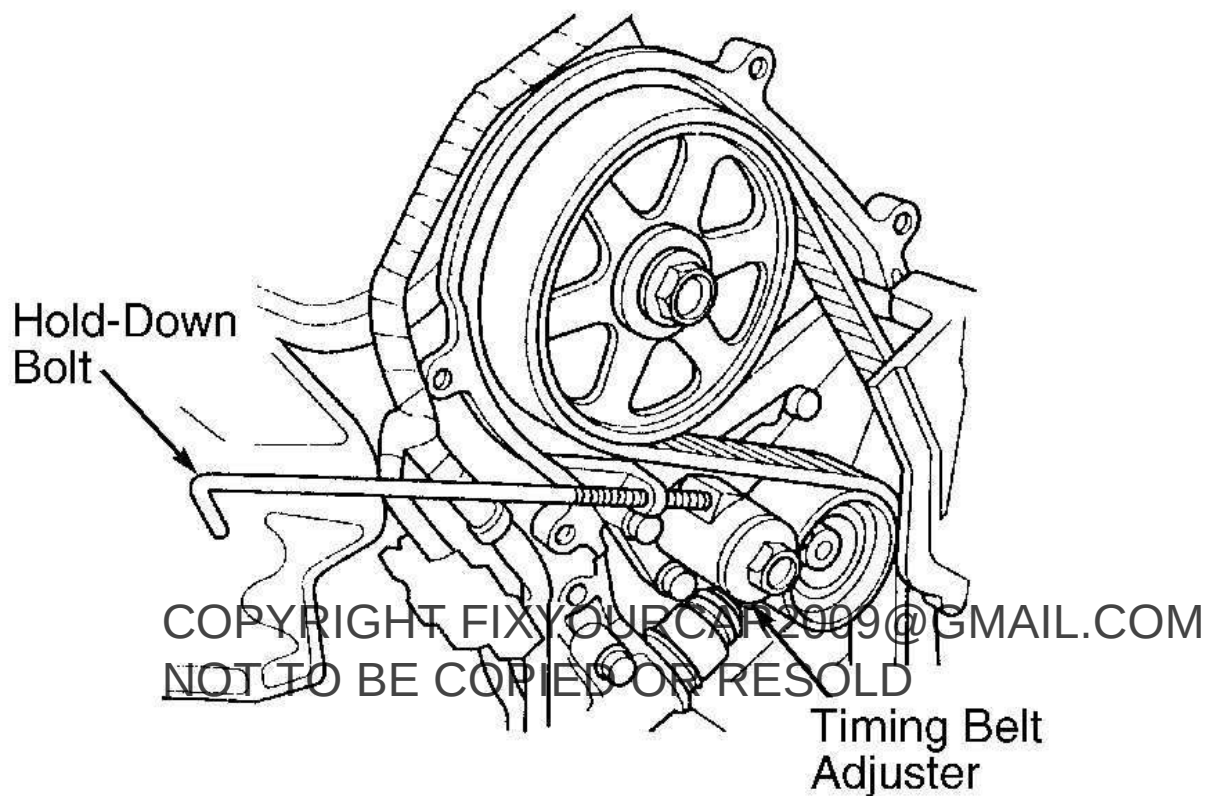


Fig. 24: Exploded View Of Timing Belt Components
 Courtesy of AMERICAN HONDA MOTOR CO., INC.



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Fig. 25: Installing Hold-Down Bolt To Hold Timing Belt Adjuster In Position
Courtesy of AMERICAN HONDA MOTOR CO., INC.

Inspection

Check belt teeth for cracks, damage and oil contamination. Inspect all sprockets for damage. Check tensioner pulley and idler pulley for grease leakage and roughness in rotation. Check sprockets and pulleys for wear, cracks or damage. Replace components if necessary.

Installation - New Belt

1. Clean timing belt pulleys and upper and lower covers. Ensure timing belt pulley is still set to TDC position. See **Fig. 21** . Clean camshaft pulleys. Set pulleys to TDC position by aligning TDC marks on camshaft pulleys with pointers on back covers. Remove battery hold-down bolt from back cover.
2. Remove auto tensioner. Ensure maintenance bolt is always pointing upward. Ensure no oil leaks or spills from auto tensioner during handling.
3. Align holes on rod and auto tensioner housing. Mount auto tensioner in press and slowly compress until a

holding pin can be placed through housing and rod.

4. Install auto tensioner. Install timing belt, working in counterclockwise direction, until belt is around all pulleys in the following order: crankshaft sprocket, idler pulley, front camshaft pulley, water pump pulley, rear camshaft pulley and tensioner adjusting pulley. See **Fig. 24** .
5. Tighten idler pulley bolt. See **TORQUE SPECIFICATIONS** . Pull out set pin of auto tensioner. Install engine mount bracket. Install upper and lower timing belt covers.
6. Clean crankshaft pulley and bolt. Lubricate pulley bolt and washer. Install crankshaft pulley, and tighten bolt while holding pulley. See **TORQUE SPECIFICATIONS** . Rotate crankshaft pulley about 5-6 turns clockwise so timing belt properly sets on all pulleys.
7. Turn crankshaft pulley to align TDC mark. Check TDC mark alignment of camshaft pulleys.
8. Install dipstick and tube with NEW "O" ring. Install and adjust tension of power steering belt. Install generator belt. Install side engine mount bracket, tighten shorter vertical mounting bolts first, then horizontal mounting bolt. See **TORQUE SPECIFICATIONS** .

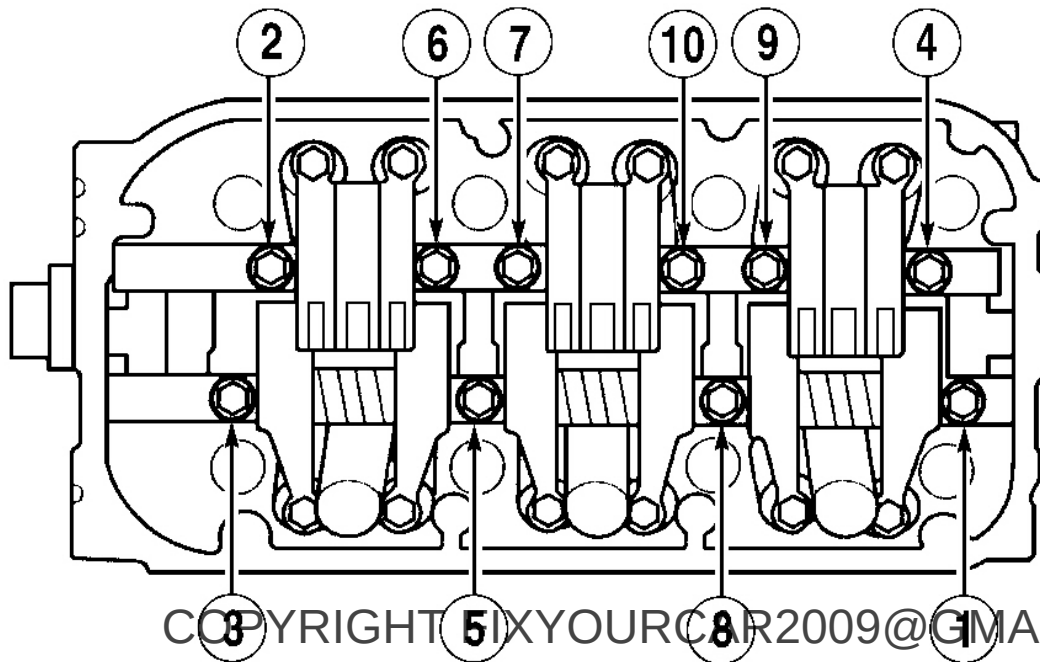
Installation - Used Belt

1. Clean timing belt pulleys and upper and lower covers. Ensure timing belt pulley is still set to TDC position. See **Fig. 21** . Clean camshaft pulleys. Set pulleys to TDC position by aligning TDC marks on camshaft pulleys with pointers on back covers.
2. If auto tensioner has extended and timing belt cannot be installed, remove and compress auto tensioner. Install auto tensioner.
3. Install timing belt, working in counterclockwise direction, until belt is around all pulleys in the following order: crankshaft sprocket, idler pulley, front camshaft pulley, water pump pulley, rear camshaft pulley and tensioner adjusting pulley. See **Fig. 24** .
4. Tighten idler pulley bolt. See **TORQUE SPECIFICATIONS** . Remove battery hold-down bolt from back cover. Install engine mount bracket. Install upper and lower timing belt covers.
5. Clean crankshaft pulley and bolt. Lubricate pulley bolt and washer. Install crankshaft pulley and tighten bolt while holding pulley. See **TORQUE SPECIFICATIONS** . Rotate crankshaft pulley about 5-6 turns clockwise so timing belt properly sets on all pulleys.
6. Turn crankshaft pulley to align TDC mark. Check TDC mark alignment of camshaft pulleys.
7. Install dipstick and tube with NEW "O" ring. Install and adjust tension of power steering belt. Install generator belt. Install side engine mount bracket, tighten shorter vertical mounting bolts first, then horizontal mounting bolt. See **TORQUE SPECIFICATIONS** .

CAMSHAFTS & ROCKER ARM

Removal

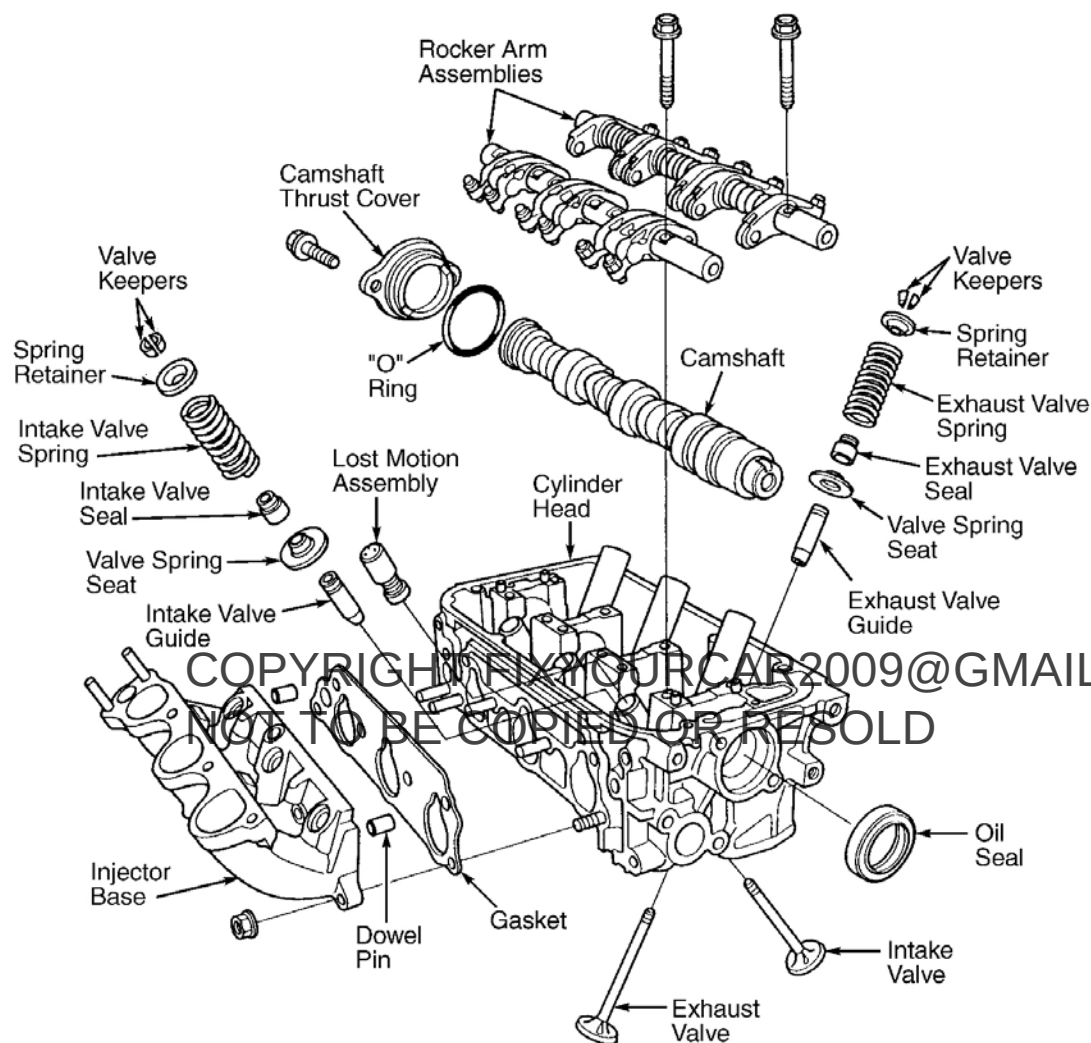
1. After removing cylinder head, loosen all rocker arm adjusting screws. Remove camshaft holder retaining bolts, in several steps in sequence shown. See **Fig. 26** . When removing rocker arm assembly, DO NOT remove rocker shaft mounting bolts, or springs and rocker arms will be released.
2. Keep rocker arms and shaft components in original order as removed. Remove rocker arm assemblies and camshafts. See **Fig. 27** .



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Fig. 26: Camshaft Holder Bolt Loosening Sequence
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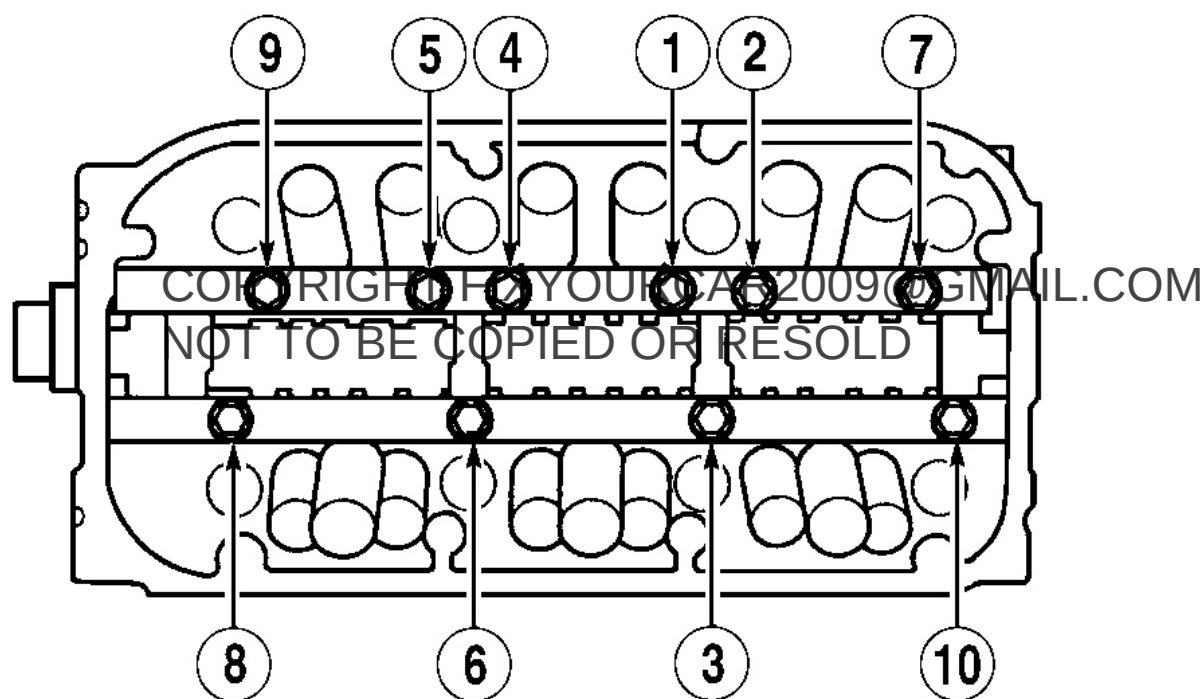
Fig. 27: Exploded View Of Cylinder Head

Courtesy of AMERICAN HONDA MOTOR CO., INC.

Inspection - Camshaft

1. Remove rocker arms from shafts. Put rocker shafts on cylinder head, then tighten bolts, in sequence, to specification. See **Fig. 28** . See **TORQUE SPECIFICATIONS** .
2. Seat camshaft by pushing it toward rear of cylinder head. Zero dial indicator against end of camshaft. Push camshaft back and forth. Rear end play. See **CAMSHAFTS & ROCKER ARMS** table under ENGINE SPECIFICATIONS.
3. Remove camshaft thrust cover, then pull out camshaft. Wipe camshaft clean. Inspect lobes. Replace camshaft if excessive wear or pitting is found.
4. Inspect each camshaft journal diameter using a micrometer. Clean camshaft bearing surface in cylinder head. Using dial indicator, measure inside diameter of each camshaft bearing surface. Check for out-of-

- round condition. If camshaft-to-holder oil clearance is within specification limits, go to step 6 .
5. If camshaft-to-holder oil clearance is beyond service limit and camshaft has been replaced, replace cylinder head. If camshaft-to-holder oil clearance is beyond service limit and camshaft has been replaced, go to next step.
 6. Set camshaft on "V" blocks, and check total runout. If total runout is within service limit, replace cylinder head. If total runout is beyond service limit, replace camshaft and recheck oil clearance. If oil clearance is still beyond service limit, replace cylinder head. See **CAMSHAFTS & ROCKER ARMS** table under ENGINE SPECIFICATIONS.



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Fig. 28: Camshaft Holder Bolt Tightening Sequence
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

Inspection - Rocker Arms & Shafts

1. Using a micrometer, measure diameter of rocker shafts at first rocker location. Measure inside diameter of rocker arm and check for out-of-round condition. See **CAMSHAFTS & ROCKER ARMS** table under ENGINE SPECIFICATIONS. Repeat procedure for each rocker and shaft.
2. If clearance exceeds limit, replace rocker shaft and all rocker arms beyond specification. If any intake rocker arm is to be replaced, replace all 3 rocker arms in that set.
3. Push each rocker arm piston manually. If it does not move smoothly, replace rocker arm assembly.

Installation

1. Apply light coat of oil around camshaft oil seal. Gently tap NEW oil seal into cylinder head to a depth of .02-.06" (.5-1.5 mm) above cylinder head surface.
2. Install camshaft into cylinder head. Install camshaft thrust cover with NEW "O" ring. Ensure oil seal lips are not distorted.
3. Loosen valve adjusting screws. Set rocker arm assembly in place and loosely install bolts. Ensure rocker arms are properly positioned to valve stems. Tighten each bolt, 2 turns at a time, in sequence. See **Fig. 28** . Install remaining components in reverse of removal procedure. See **TORQUE SPECIFICATIONS** .

WATER PUMP

Removal & Installation

Drain cooling system. Remove timing belt and tensioner. See **TIMING BELT** . Remove water pump mounting bolts. Remove water pump. To install, reverse removal procedure. Use NEW "O" ring. Ensure "O" ring groove is clean.

OVERHAUL

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NOTE:

For repair procedures not covered in this article, see **ENGINE OVERHAUL PROCEDURES** article in **GENERAL INFORMATION**.

CYLINDER HEAD

Cylinder Head

Inspect cylinder head for warpage at deck surface. Resurface cylinder head if warpage exceeds specification. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS. Replace cylinder head if camshaft bearing surface is damaged.

Valve Springs

1. Use an appropriate size socket and plastic hammer to tap valve retain and loosen valve keepers. Use valve spring compressor to remove keepers.
2. After valves are installed, install spring seats on cylinder head. Install NEW valve seals using valve guide seal installer. Ensure exhaust valve seals have Black spring and intake valve seals have White spring.
3. Install valve spring and retainer. Place end of spring with closely wound coils toward cylinder head. Install valve keepers using valve spring compressor. Lightly tap end of each valve stem 2-3 times with plastic hammer to ensure proper seating of valve and valve keepers.

Valves

1. With valves removed, measure valve stem diameter, valve length, valve margin and face width. Compare to specifications. See **VALVES & VALVE SPRINGS** table under ENGINE SPECIFICATIONS. Replace valves if necessary.

2. Slide valve about .4" (10 mm) off its seat. Measure guide-to-stem clearance, using a dial indicator place against outside diameter of valve head. Take measurement while rocking stem in normal thrust direction. Valve wobble should be less than .006" (.16mm) for intake valves, and less than .009" (.24mm) for exhaust guides.
3. If valve wobble is excessive, subtract outside diameter of valve stem from inside diameter of valve guide. Measure each dimension in 3 places. Difference between largest guide measurement and smallest stem measurement must be within service limit. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS.
4. After valve seat is reconditioned, insert valves into original positions and measure valve stem installed height from edge of valve guide bore to tip of stem. If stem installed height exceeds service limit, replace valve and recheck installed height. If height still exceeds service limit (valve seat in head is too deep), replace cylinder head .

Valve Guides

1. Select proper replacement guides and chill in freezer for about one hour. Using hot plate or oven, evenly heat cylinder head to 302°F (150°C). Overheating may loosen valve seats.
2. From camshaft side, use driver and air hammer (held directly in line with guide) to drive guide about .1" (2.5 mm) toward combustion chamber. This will loosen some carbon and make removal easier.
3. Turn head over and drive guide out toward camshaft side of head. If guide will not move, drill carefully with 5/16" (8 mm) bit, then repeat process. Avoid excessive drilling or head damage may result.
4. Remove NEW guides from freezer, one at a time, as ready to install. Apply thin coat of engine oil to outside of guide. Install guide from camshaft side, using appropriate drift to drive guide in to specified height. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS.
5. If several guides are being replaced, cylinder head may need to be reheated during process.
6. Coat reamer and valve guide with cutting oil. Rotate reamer clockwise full length of valve guide bore. Continue to rotate reamer clockwise while removing reamer from bore. Thoroughly wash guide in detergent and water to remove cutting residue.
7. Check valve guide-to-stem oil clearance. Ensure valve slides in and out of guide without pressure.

Valve Seats

NOTE: If valve guides are worn, replace them before cutting valve seats.

1. Carefully cut 45-degree seat, removing only enough material to ensure smooth and concentric seat. Bevel upper edge of seat with 30 degree cutter. Bevel lower edge of seat with 60-degree cutter exhaust side, and 67.5-degree cutter for intake side.
2. Check width of seat, and adjust as needed. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS.
3. Make one additional very light pass with 45-degree cutter to remove any burrs from other cuts.
4. After resurfacing seat, inspect for even valve seating by applying Prussian Blue compound to valve face. Insert valve in its original location, then lift valve and snap it closed several times. Actual seating surface will be shown by Blue compound and should be centered on seat.
5. If seating surface is too high (closer to valve stem), make a second cut with 60-degree cutter on exhaust

or 67.5-degree cutter on intake. Then, make one more cut with 45 degree cutter to restore seat width.

6. If seating surface is too low (closer to valve edge), make a second cut with 30-degree cutter on upper edge of seat. Then, make one more cut with 45-degree cutter to restore seat width.

CYLINDER BLOCK ASSEMBLY

Crankshaft End Play

1. With cylinder block inverted, measure connecting rod end play with a feeler gauge inserted between connecting rod and crankshaft. If end play exceeds service limits, install new connecting rod, and recheck end play. If end play still exceeds service limits, replace crankshaft.
2. Position dial indicator against front end of crankshaft. Push crankshaft firmly away from dial indicator. Zero dial against end of crankshaft. See **Fig. 29** . Pull crankshaft firmly back toward indicator. Dial reading (crankshaft end play) should not exceed service limit. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS.
3. In crankshaft end play exceeds service limits, inspect thrust washers and thrust surface on crankshaft. Replace parts as necessary. Thrust washer thickness is fixed and must not be changed by grinding or shimming.

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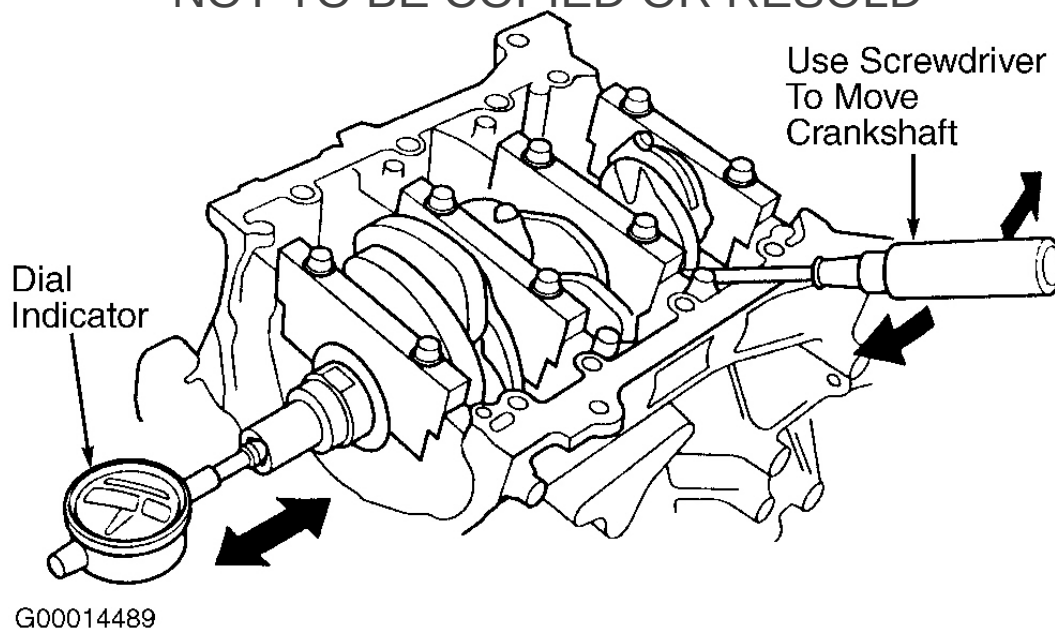


Fig. 29: Checking Crankshaft End Play
Courtesy of AMERICAN HONDA MOTOR CO., INC.

Crankshaft Main Bearing Clearance

NOTE: For this procedure, if engine is still in vehicle when checking clearance, weight of crankshaft and drive plate will flatten Plastigage further than only torque of cap bolt. This will result in an incorrect reading. To ensure accurate reading, support crank with jack placed under counterweights. Check only one bearing at a time.

1. Remove main bearing caps and lower bearing halves. Clean each main journal and bearing half. Place one strip of Plastigage across each main journal. Install bearing halves and caps and tighten bolts to 14 ft. lbs. (19 N.m). Place paint mark on connecting rod and bolt head and turn bolt an additional 90 degrees. DO NOT rotate crankshaft.
2. Remove cap and bearing half for each journal and measure widest parts of Plastigage. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS.
3. If Plastigage is too wide or too narrow, remove crankshaft and remove upper half of bearing. Install a new bearing pair with same color code. Recheck clearance. DO NOT file, shim or scrape bearings or caps to adjust clearance.
4. If Plastigage shows clearance is still incorrect, insert next larger or smaller bearing. Recheck clearance. If proper clearance cannot be obtained with this adjustment, replace crankshaft and repeat clearance check.

NOTE: Letters or bars are stamped on end of engine block as code for size of each main journal bore. Use these identifiers, plus numbers stamped on crankshaft, to choose correct bearings. See Fig. 30 , Fig. 31 and Fig. 32 .

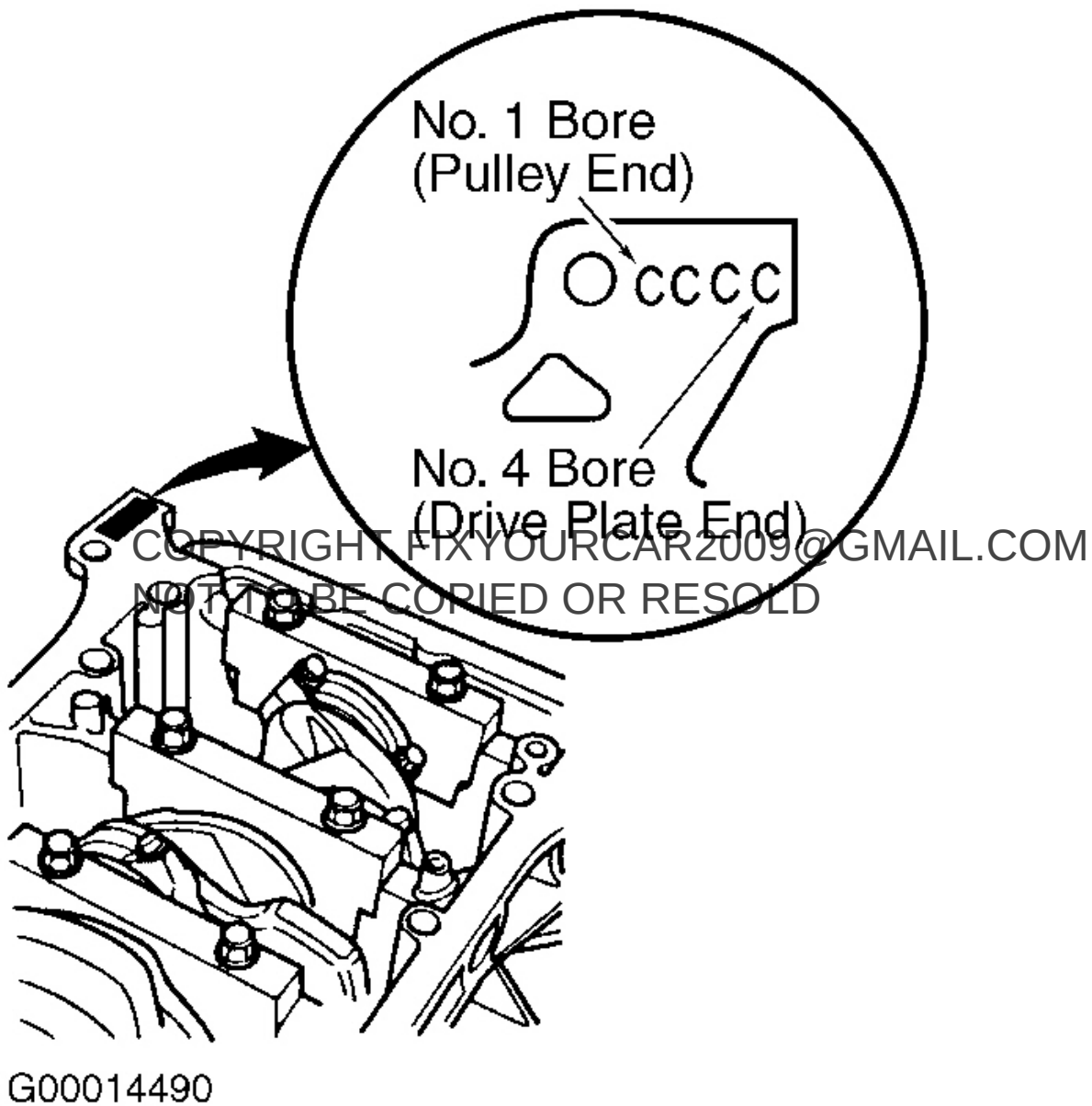
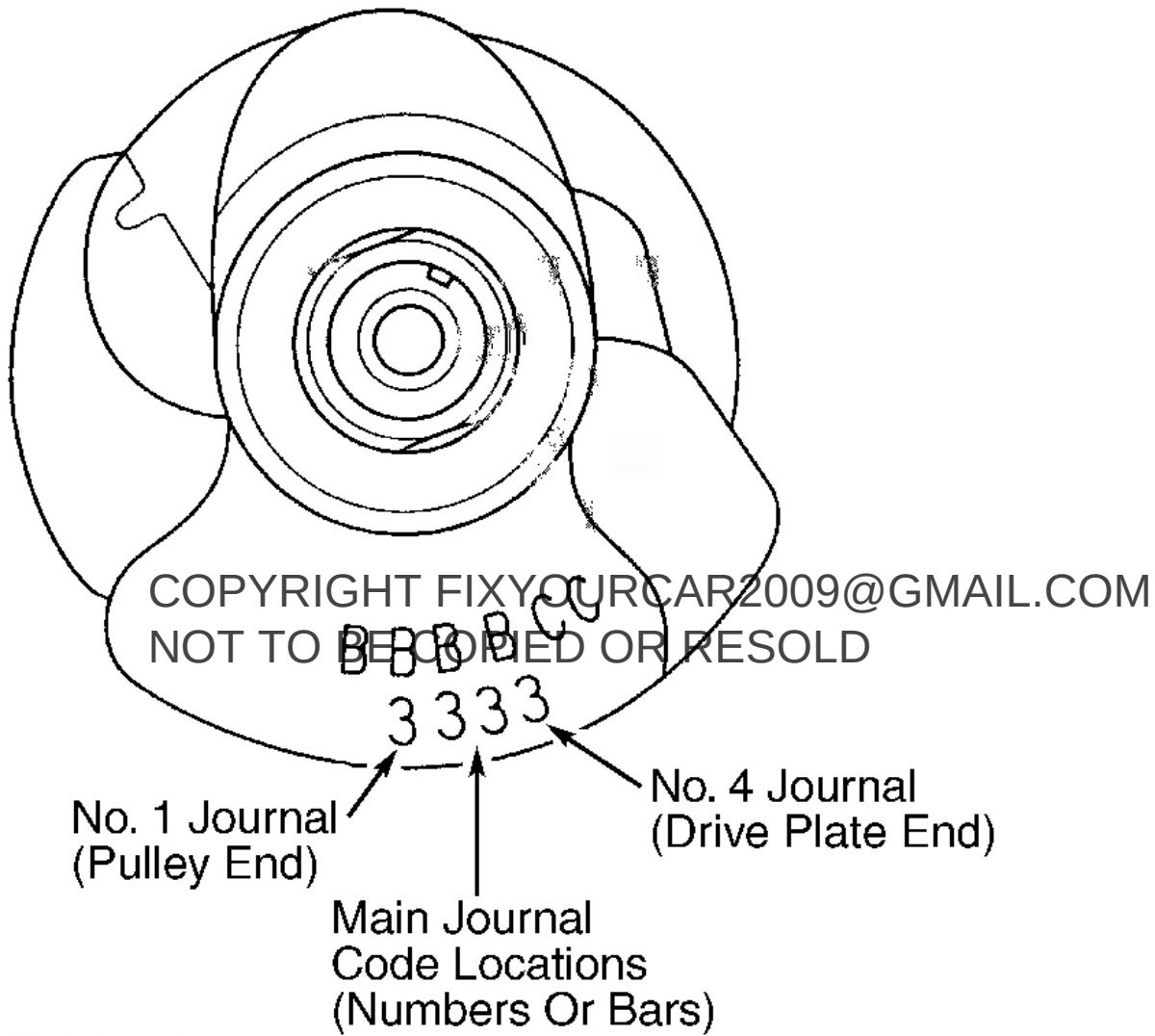
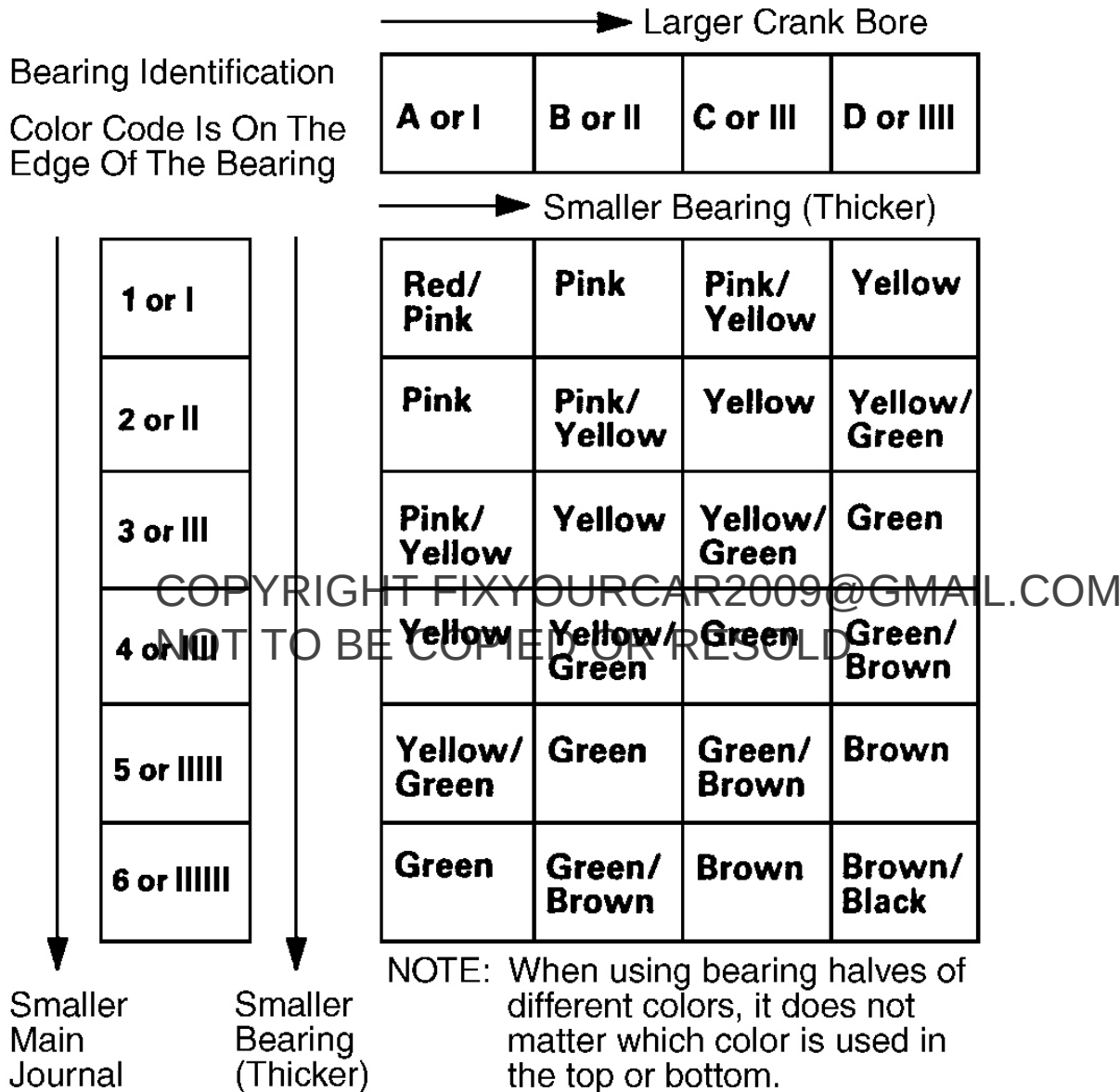


Fig. 30: Locating Engine Block Crankshaft Bore Codes
Courtesy of AMERICAN HONDA MOTOR CO., INC.



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Fig. 31: Locating Crankshaft Main Journal Bore Codes
Courtesy of AMERICAN HONDA MOTOR CO., INC.



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Fig. 32: Crankshaft Bearing Identification Code Chart
Courtesy of AMERICAN HONDA MOTOR CO., INC.

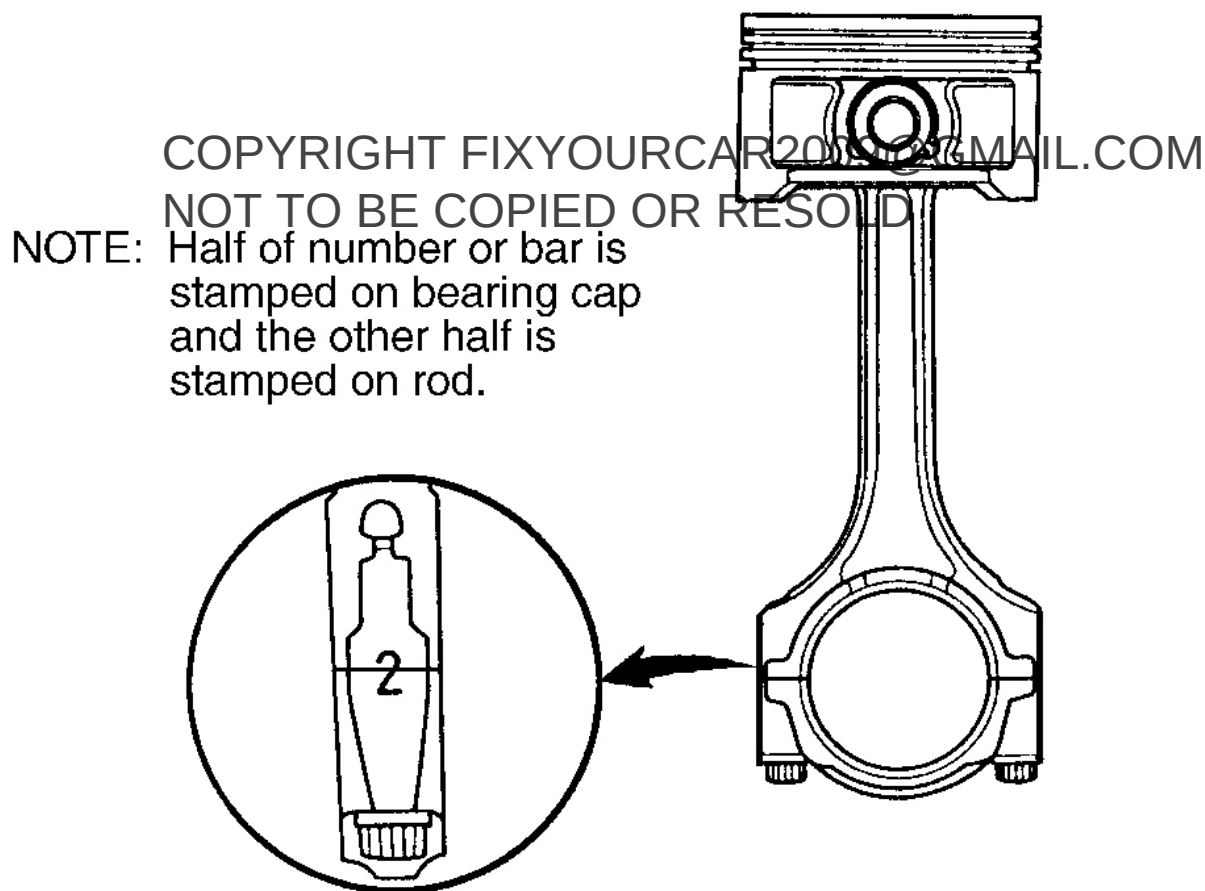
Connecting Rod Bearing Clearance

1. Remove connecting rod cap and bearing half. Clean crankshaft rod journal and bearing half. Place one strip of Plastigage across rod journal. Install bearing half and cap and tighten bolts to 14 ft. lbs. (19 N.m). Place paint mark on connecting rod and bolt head and turn bolt an additional 90 degrees. DO NOT rotate

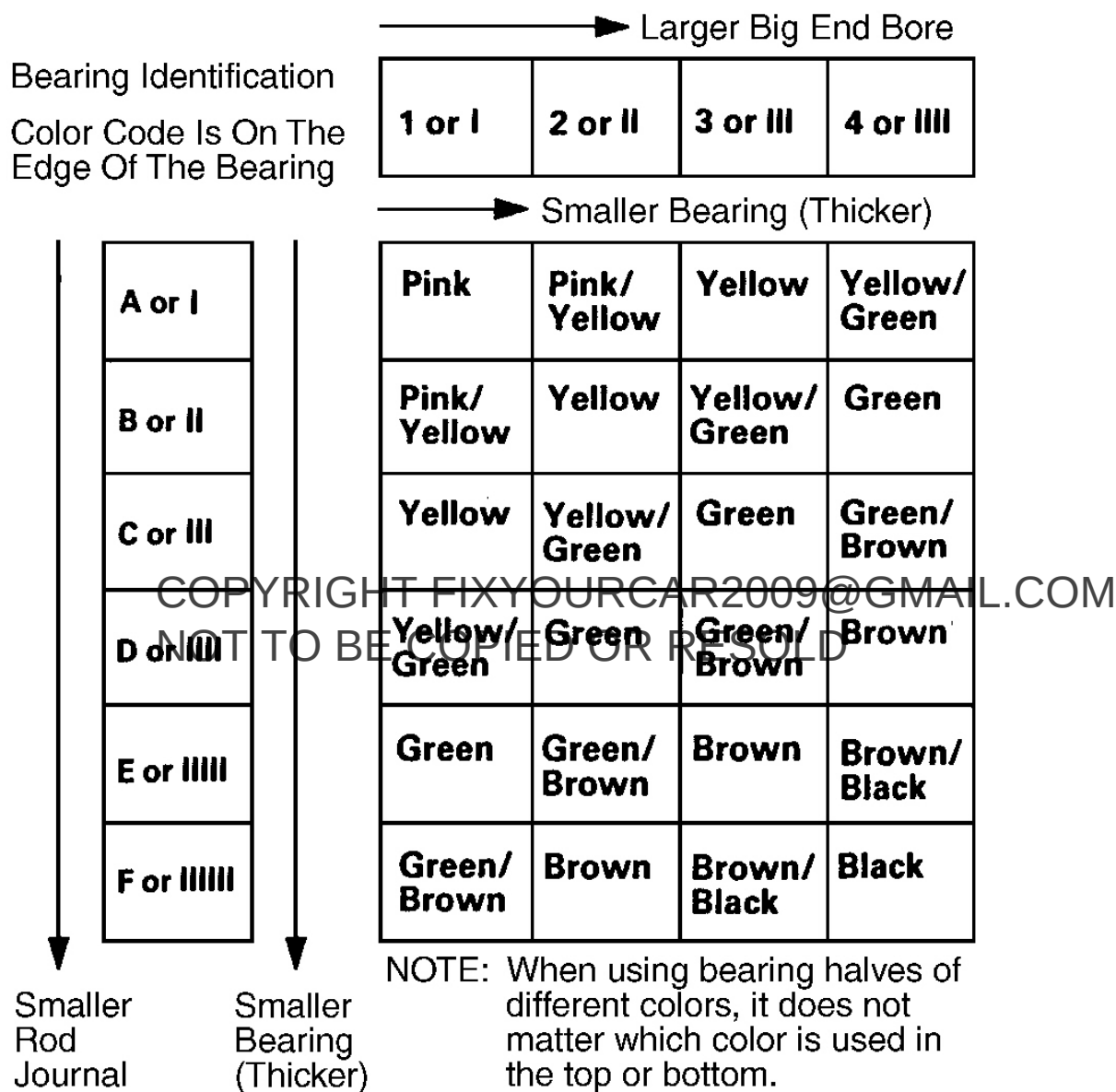
crankshaft.

2. Remove rod cap and bearing half and measure widest parts of Plastigage. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS.
3. If Plastigage is too wide or too narrow, remove upper half of bearing. Install a new bearing pair with same color code. Recheck clearance. DO NOT file, shim or scrape bearings or caps to adjust clearance.
4. If Plastigage shows clearance is still incorrect, insert next larger or smaller bearing. Recheck clearance. If proper clearance cannot be obtained with this adjustment, replace crankshaft and repeat clearance check.

NOTE: Letters or bars are stamped on end of engine block as code for size of each main journal bore. Use these identifiers, plus numbers stamped on crankshaft, to choose correct bearings. See Fig. 30 , Fig. 33 and Fig. 34 .



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Fig. 34: Connecting Rod Bearing Identification Code Chart
Courtesy of AMERICAN HONDA MOTOR CO., INC.

Crankshaft & Piston Removal

1. Remove CKP sensor from oil pump. Remove lower timing belt drive pulley. Remove oil pan. Remove engine block end cover. Remove oil screen baffle plate and oil pump. See **Fig. 35**.
2. Remove carbon ridge around top of any cylinder to avoid damage to piston. Remove pistons from block.

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See **ENGINE OVERHAUL PROCEDURES** article in GENERAL INFORMATION.

3. Remove bearing cap bolts and bearing cap side bolts, then remove bearing caps. Lift crankshaft out of block. DO NOT damage journals. Ensure main caps and bearing (if reusing) are installed in original locations.

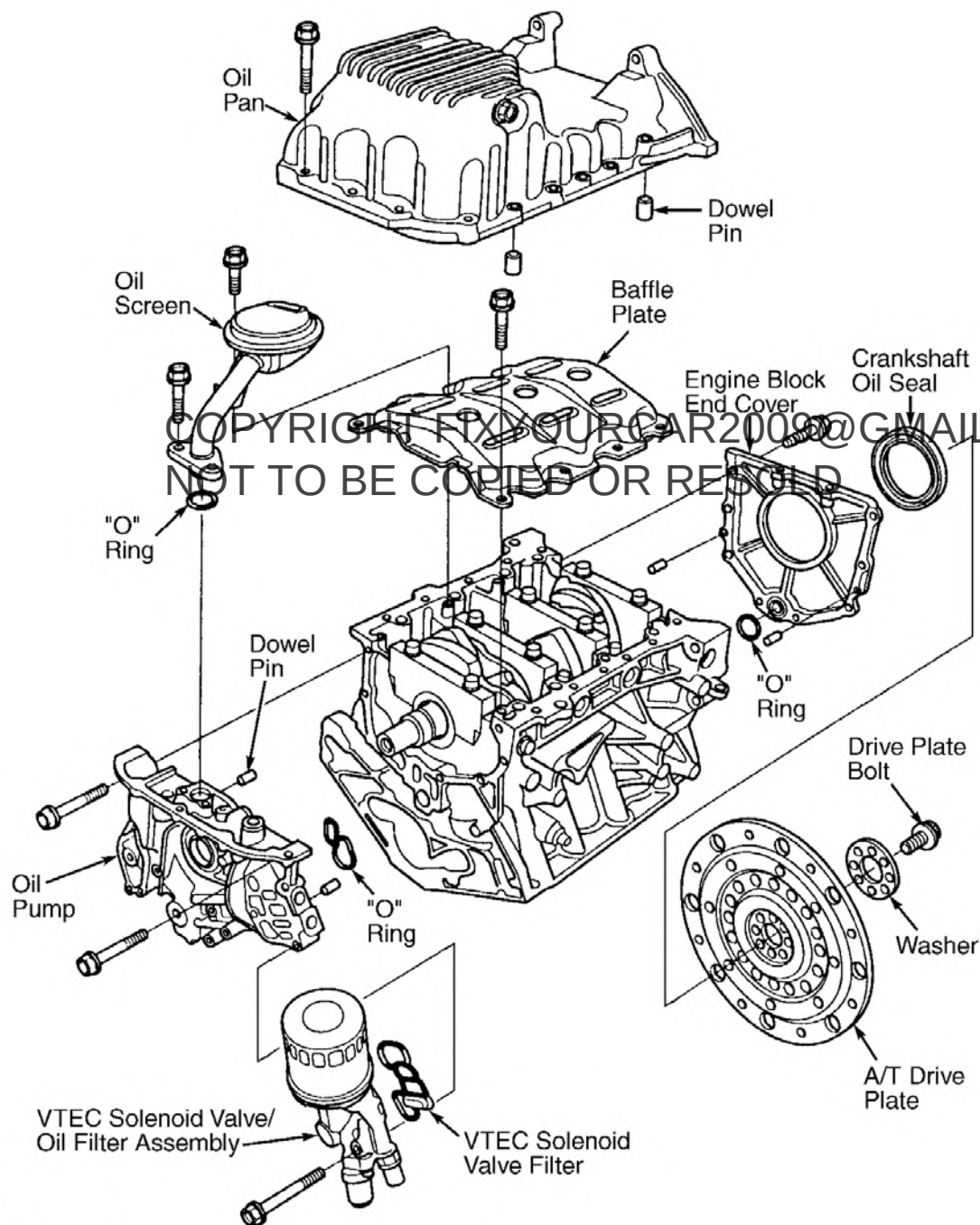


Fig. 35: Exploded View Of Cylinder Block & Components

Courtesy of AMERICAN HONDA MOTOR CO., INC.

Crankshaft Inspection

1. Clean crankshaft oil passages. Check keyway and threads. Support crankshaft with "V" blocks. Measure runout on all main journals. Rotate crankshaft 2 revolutions. Difference between measurements on each journal must not exceed service limit. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS.
2. Measure out-of-round at middle of each rod and main journal in 2 places. Difference between measurements on each journal must not exceed service limit. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS.
3. Measure taper at edges of each rod and main journal. Difference between measurements on each journal must not exceed service limit. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS.

Block & Piston Inspection

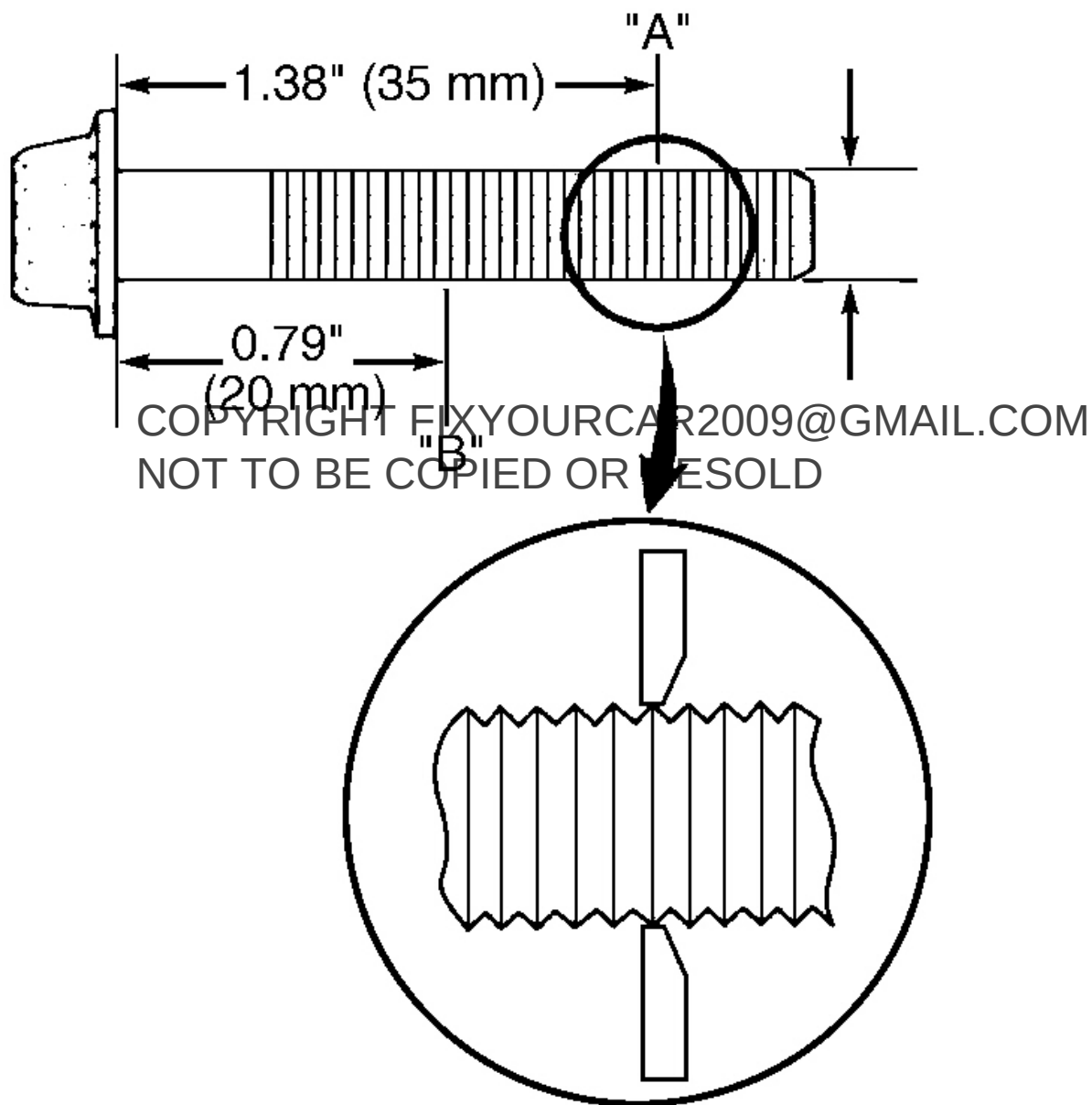
1. Check piston for distortion or cracks. Measure piston diameter perpendicular to pin bore and .63" (16.0 mm) from bottom of piston skirt. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS.
2. Measure wear and taper of cylinder bores. Measure in axial direction and perpendicular to axial direction. If measurements in any cylinder exceeds oversize bore service limit, replace cylinder block. See **CYLINDER BLOCK** table under ENGINE SPECIFICATIONS.
3. Hone scored or scratched cylinder bores. Using straightedge, check top of cylinder block for warpage. Measure diagonally and straight along bolt hole mating surfaces.
4. Calculate difference between cylinder bore diameter and piston diameter to determine piston-to-block clearance. If clearance exceeds service limit, select proper size oversize piston, and recheck clearance. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS.

Piston & Rod Disassembly & Reassembly

1. Apply engine oil to piston pin snap rings. Turn snap rings in grooves until end gaps line up with cutouts in pin bores. Carefully remove snap rings.
2. Heat piston and rod assembly to approximately 158°F (70°C), then remove piston pin. Allow components to return to room temperature.
3. Using a micrometer, measure piston pin diameter. Zero a dial indicator to piston pin diameter. Use dial indicator to check difference between piston pin diameter and piston pin hole diameter. Measure pin-to-connecting rod clearance. If any component measurement is outside service limits, replace as necessary. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS.
4. Install one piston pin snap ring. Coat pin bore in piston and connecting rod with engine oil. Heat piston to approximately 158°F (70°C). Install piston pin. Assemble piston and connecting rod with embossed marks on same side. Install remaining snap ring.

Connecting Rod Bolt Inspection

Measure diameter of each connecting rod bolt at points "A" and "B" as shown. See **Fig. 36** . Calculate difference in diameter between measurement at point "A" and point "B". If difference exceeds .004" (.10 mm), replace connecting rod bolt.



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Fig. 36: Locating Measuring Points For Connecting Rod Bolts

Courtesy of AMERICAN HONDA MOTOR CO., INC.

Piston Ring Installation & Checking

1. Using a piston, push a NEW piston ring into cylinder bore to .6-.8" (15-20 mm) from bore bottom. See **Fig. 37** .
2. Measure piston ring end gap using a feeler gauge. If gap is too small, ensure proper ring is installed for this engine. If gap is too large, recheck cylinder bore diameter-to-wear limit specification. If bore exceeds service limits, rebore or replace cylinder block. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS.
3. Using ring expander, remove old piston rings. Clean ring grooves thoroughly (DO NOT use wire brush or hard tool that will cut ring grooves).
4. Install NEW rings. Top ring have "1C" mark. Second ring has "2C" mark. Keep marks facing upward. Using feeler gauge, measure ring-to-groove clearance. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS.
5. Rotate rings to ensure rings do not bind. Position ring gaps as shown. See **Fig. 38** and **Fig. 39** .

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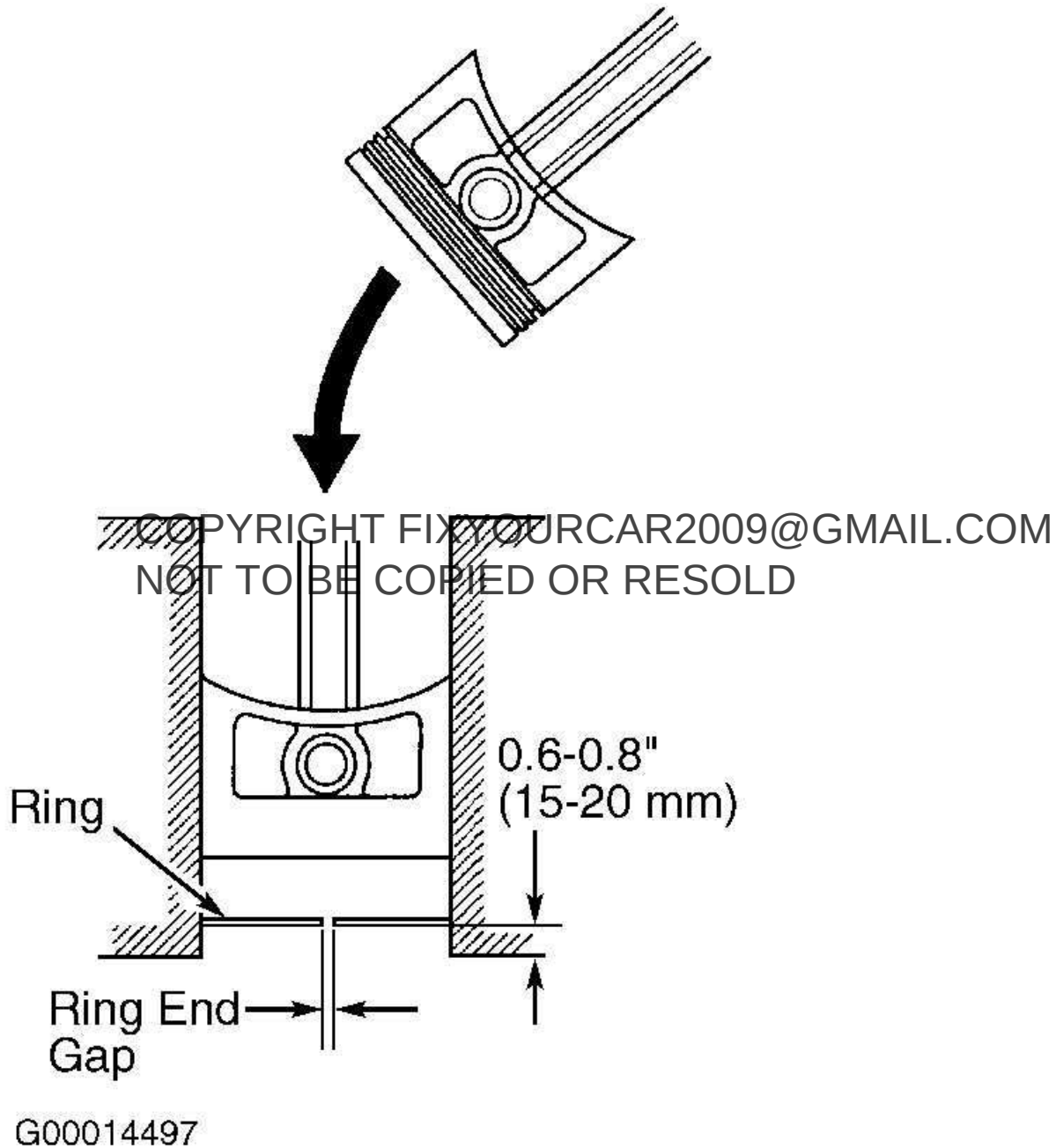
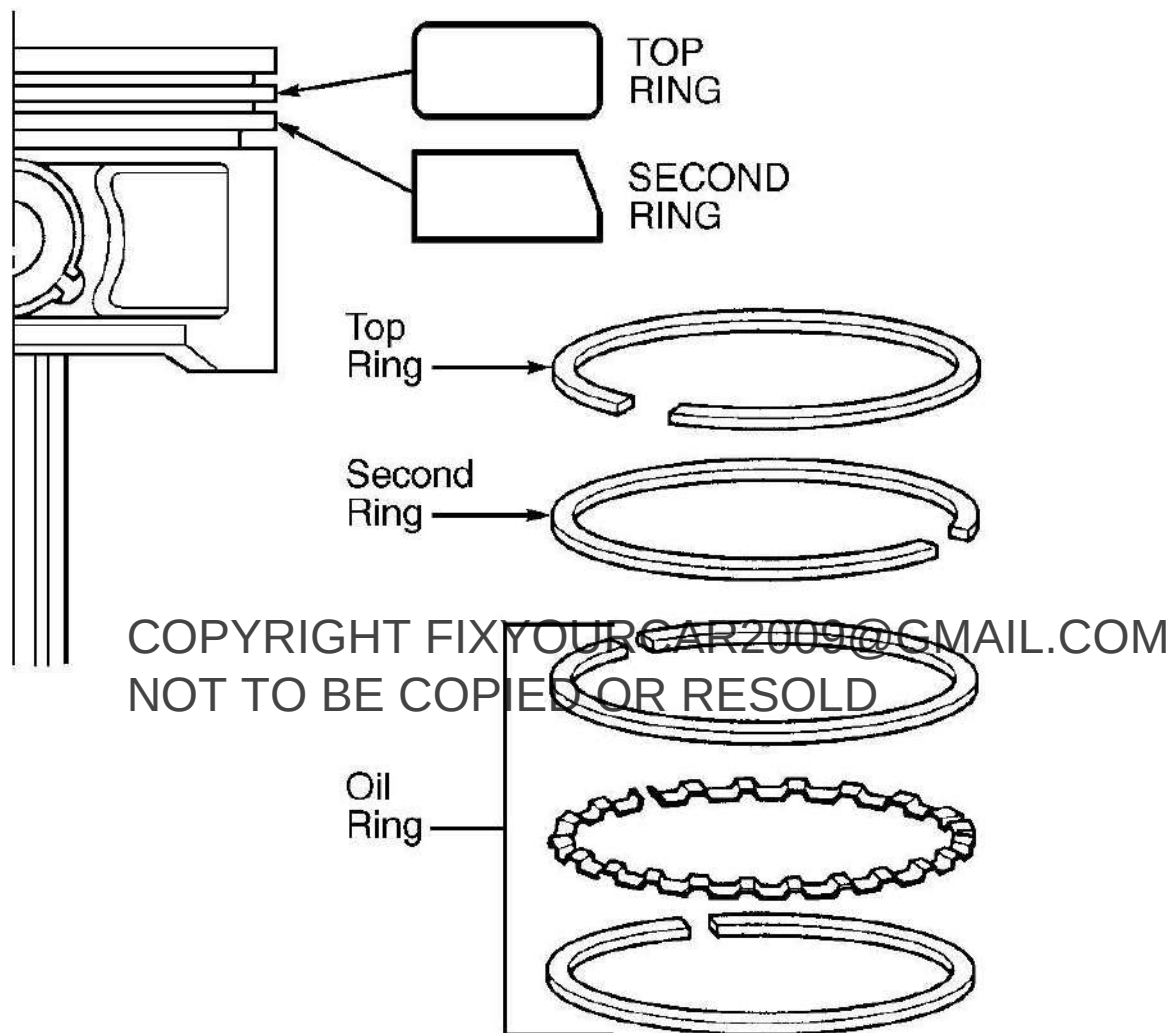


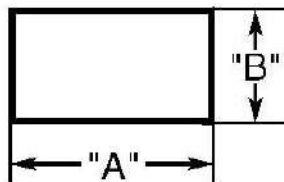
Fig. 37: Measuring Piston Ring End Gap
Courtesy of AMERICAN HONDA MOTOR CO., INC.



PISTON RING DIMENSIONS:

Top Ring (Standard): A: 0.12" (3.1 mm)
B: 0.05" (1.2 mm)

Second Ring (Standard): A: 0.13" (3.4 mm)
B: 0.05" (1.2 mm)



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Fig. 38: Identifying & Installing Piston Rings
Courtesy of AMERICAN HONDA MOTOR CO., INC.

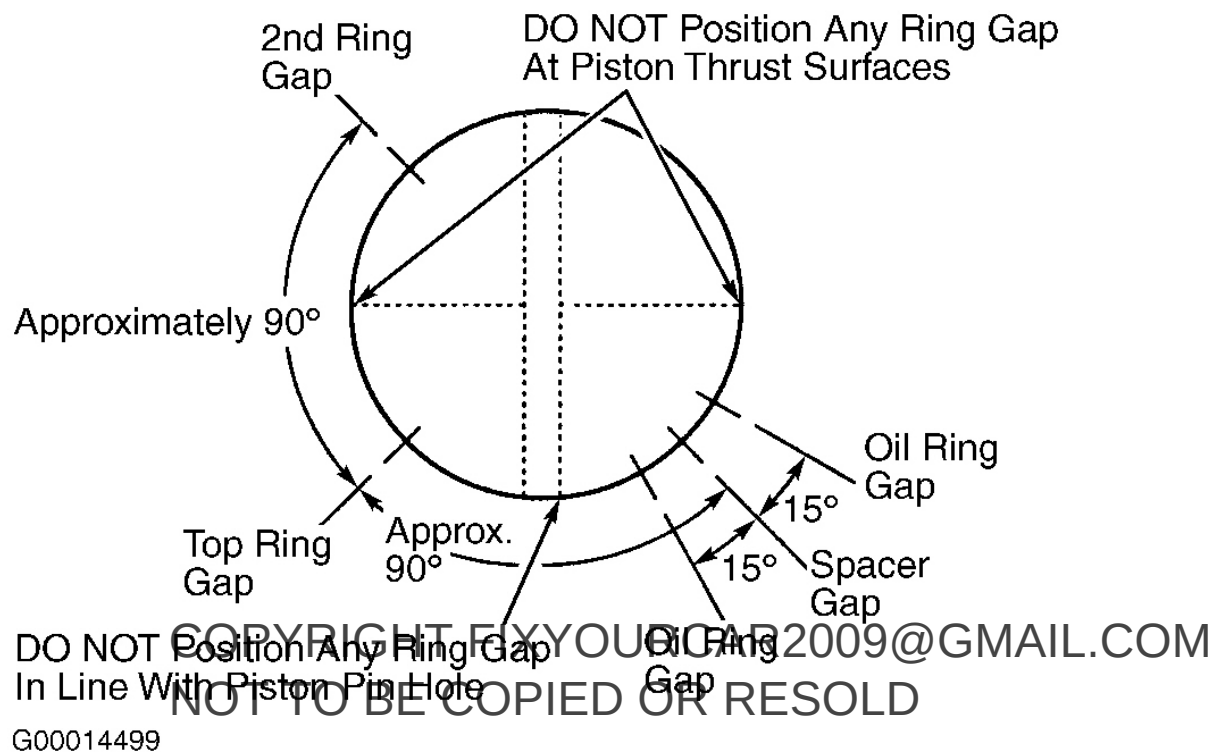


Fig. 39: Positioning Piston Ring End Gaps
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

Crankshaft & Piston Installation

1. Apply engine oil to main bearings and rod bearings. Install bearing halves into cylinder block and connecting rods. Position crankshaft into block. Install thrust washers in No. 3 journal. Apply engine oil to thrust washer surfaces.
2. Check main bearing clearance with Plastigage. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS.
3. Install bearings and bearing caps. Ensure arrow marks point toward front of engine. Bearing caps are marked with numbers. Ensure numbers are in sequential order, with "1" at front cylinder and "4" at rear cylinder.
4. Position and install piston with arrow on top of piston facing forward end of engine.
5. Check connecting rod bearing clearance with Plastigage. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS.
6. Align number marks on connecting rod and cap, then install cap. Apply engine oil to cap bolt threads, then tighten to specification. See **TORQUE SPECIFICATIONS**. Place a paint reference mark on connecting rod and bolt head. Use this reference point to tighten cap bolt an additional 90 degrees.
7. Tighten main bearing cap bolts, then tighten bearing cap side bolts. See **TORQUE SPECIFICATIONS**.

Tighten bolts in sequence. See **Fig. 40** .

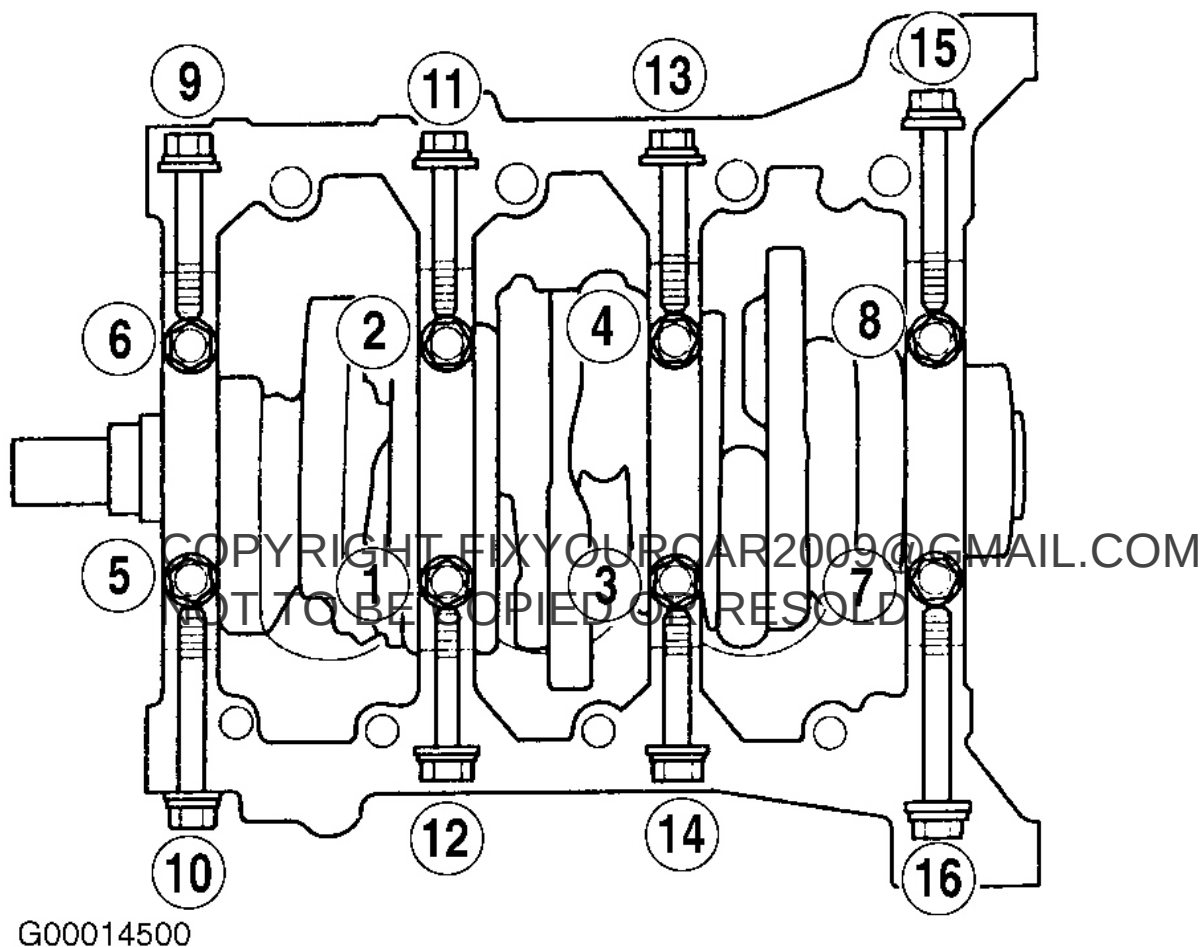


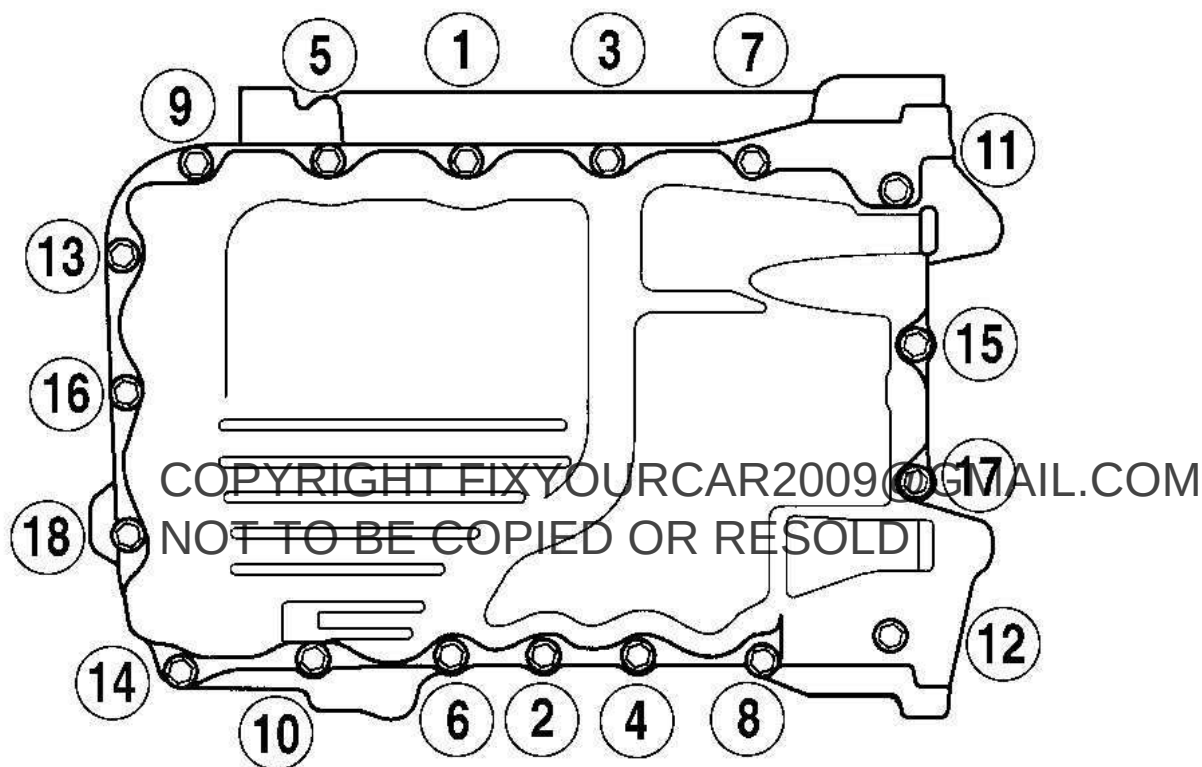
Fig. 40: Main Bearing Cap Bolt Tightening Sequence
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

Crankshaft Rear Oil Seal

1. Ensure seal mating surface on engine block end cover is clean and dry. Apply light coat of grease to crankshaft and to lip of seal. Drive NEW oil seal squarely into engine block end cover. Use proper installer tool to ensure seal is square and properly seated. Ensure clearance is equal all around seal edge.
2. Clean and dry engine block front end cover mating surface. Apply liquid gasket evenly to block mating surface and to inner threads of bolt holes. Within 5 minutes of applying liquid gasket, install dowel pins, NEW "O" ring, and end cover. See **Fig. 34** . Wait at least 30 minutes before refilling engine with oil.

Oil Pan Installation

Clean and dry oil pump mating surfaces. Install oil pump. See **OIL PUMP ASSEMBLY** under ENGINE OILING. Install baffle plate and oil screen. Apply liquid gasket evenly to oil pan mating surface. Install oil pan. Tighten oil pan bolts in 2-3 steps in sequence. See **Fig. 41**.



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Fig. 41: Oil Pan Bolt Tightening Sequence

Courtesy of AMERICAN HONDA MOTOR CO., INC.

ENGINE OILING

ENGINE LUBRICATION SYSTEM

Timing belt-driven oil pump is mounted in front cover. Assembly uses a relief spring and plunger, located in oil pump case. See **OIL PUMP ASSEMBLY**.

Crankcase Capacity

Fill capacity including oil filter change is 5.0 qts. (4.7L), or 5.8 qts. (5.5L) following engine overhaul.

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Oil Pressure

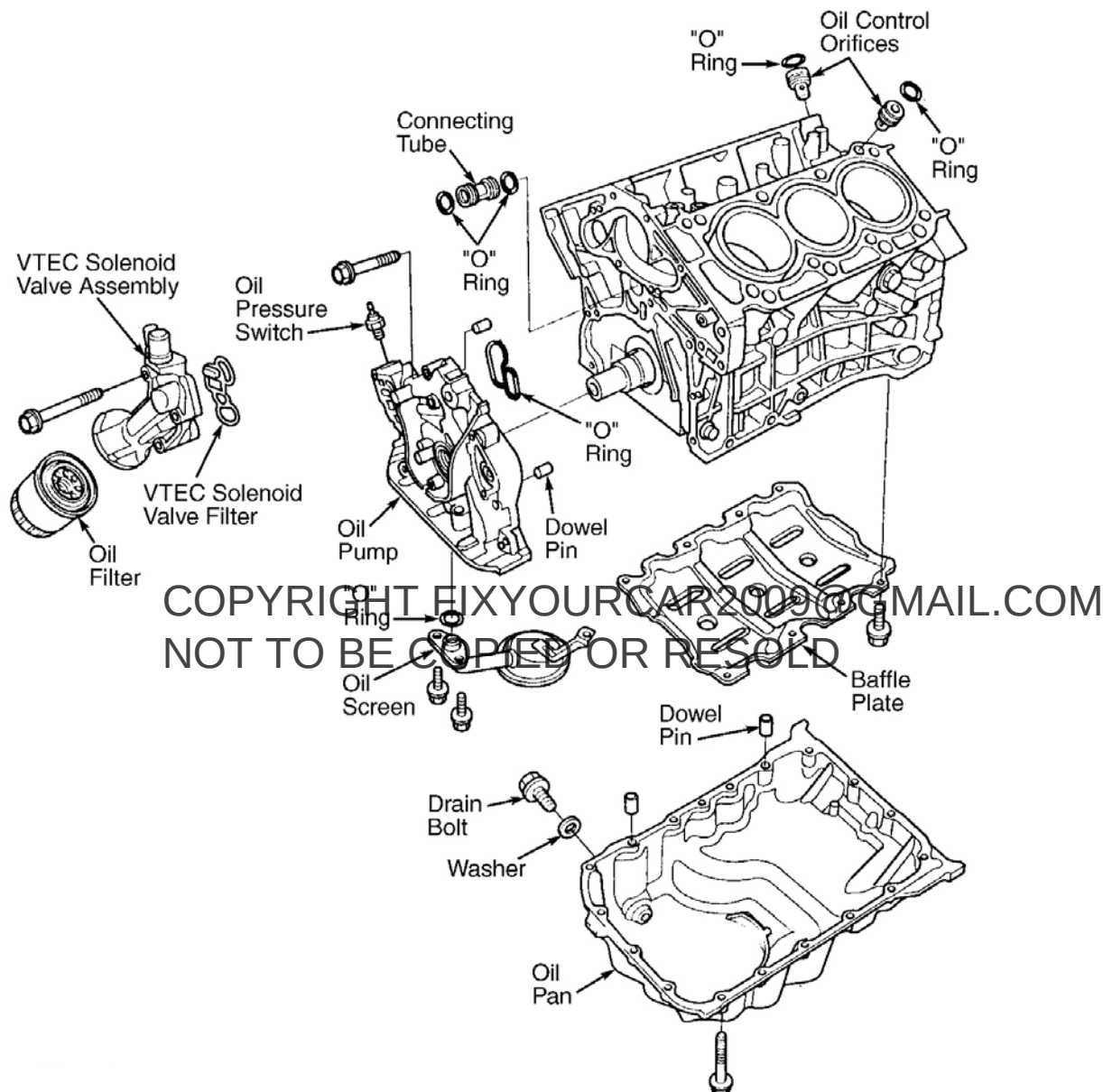
At curb idle and with oil temperature at 176°F (80°C), normal oil pressure should be at least 10 psi (0.7 kg/cm²). At 3000 RPM, normal oil pressure should be 71 psi (kg/cm²)

OIL PUMP ASSEMBLY

Removal

1. Raise vehicle. Drain engine oil. Turn crankshaft so pointer aligns with pulley mark to indicate No. 1 piston is at TDC.
2. Remove timing belt. See **TIMING BELT** under REMOVAL & INSTALLATION. Remove idler pulley.
3. Remove CKP sensor, then remove timing belt drive pulley. Remove VTEC solenoid valve and oil filter assembly. See **Fig. 42**. Remove oil pan and oil screen.
4. Remove mounting bolts, and remove oil pump assembly. Remove screws from pump housing. Separate housing and cover to check internal components.

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Fig. 42: Exploded View Of Engine Lubrication System Components
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

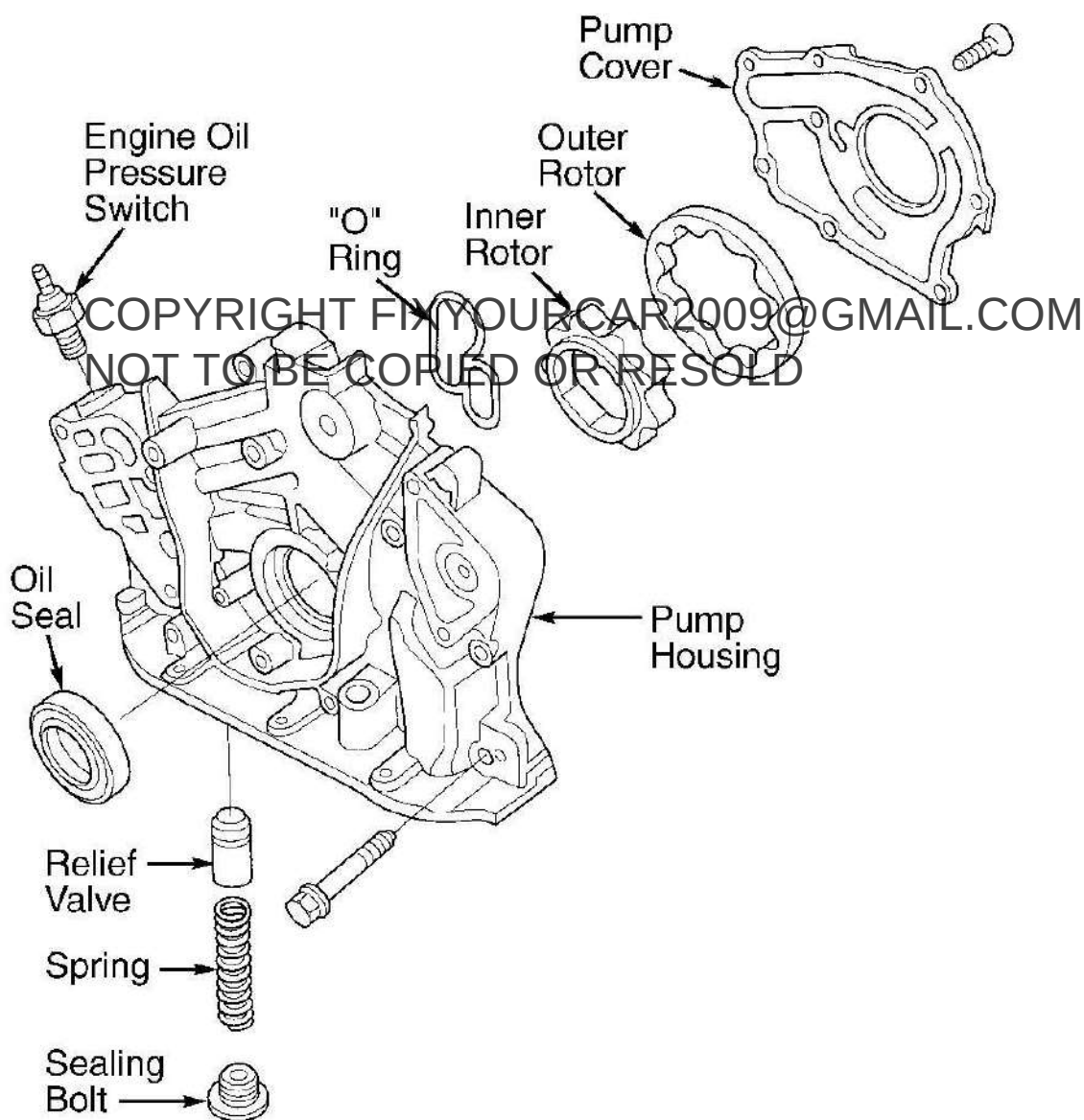
Inspection

1. Using feeler gauge, check inner-to-outer rotor radial clearance. If clearance exceeds service limit, replace oil pump assembly. See **OIL PUMP** table under ENGINE SPECIFICATIONS.
2. Using straightedge and feeler gauge, check housing-to-rotor axial clearance. If clearance exceeds service limit, replace oil pump assembly.

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3. Using feeler gauge, check housing-to-outer rotor radial clearance. If clearance exceeds service limit, replace oil pump assembly.
4. Inspect both rotors and pump housing for scoring or other damage. Replace parts as needed. Remove old oil seal from oil pump. Gently tap NEW seals into place using appropriate driver. Ensure seals bottom in grooves on pump.
5. Apply engine oil to pump rotors. Reassemble oil pump. Apply liquid thread lock to pump housing screws, and install cover. Ensure pump rotates freely.



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Fig. 43: Exploded View Of Oil Pump Assembly
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

OIL PUMP

Application	In. (mm)
Housing-To-Outer Rotor Radial Clearance	
Standard	.0055-.0074 (.14-.19)
Service Limit	.008 (.20)
Housing-To-Rotor Axial Clearance	
Standard	.0008-.0027 (.02-.07)
Service Limit	.005 (.13)
Inner Rotor-To-Outer Rotor Radial Clearance	
Standard	.0015-.0062 (.04-.16)
Service Limit	.008 (.20)

Installation

1. Clean and dry oil pump mating surface. Apply liquid gasket evenly to block mating surface of oil pump and to inner threads of bolt holes.
2. Grease lip of oil seal and apply oil to NEW "O" rings. Install dowel pins, then align inner rotor with crankshaft, and install oil pump. Tighten mounting bolts to specification. See **TORQUE SPECIFICATIONS** . Clean excess grease from crankshaft. Check seal for distortion.
3. Install oil screen. Clean and dry oil pan mating surfaces. Apply liquid gasket to pan mating surface on engine block and to inner threads of bolt holes. Install oil pan. Tighten mounting bolts in sequence, in 2-3 steps. See [Fig. 41](#) .

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Lbs. (N.m)
A/C Compressor	
Bracket-To-Block Bolt	33 (44)
Compressor Mounting Bolt	16 (22)
Camshaft	
Pulley Bolt	67 (90)
Thrust Cover Mounting Bolt	16 (22)
Connecting Rod Bearing Cap Bolt	14 (19)
Crankshaft Pulley Nut	181 (245)
Cylinder Head Bolt ⁽¹⁾	
1st Step	29 (39)
2nd Step	51 (69)
3rd Step	72 (98)

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Drain Plug	29 (39)
Engine Drive Plate Mounting Bolt	(3) 54 (74)
Engine Ground Cable Bolt	33 (44)
Engine Mount Bracket-To-Block Bolt	33 (44)
Engine Radius Rod Flange Bolt	119 (161)
Exhaust Manifold	
Cover Bolt	16 (22)
Self-Locking Nut	23 (31)
Frame Sub-Assembly	
Damper Bolt	16 (22)
Front Mounting Bolt Long & Short	76 (103)
Rear Bracket Bolt	76 (103)
Rear Bracket-To-Body Bolt	86 (117)
Steering Gearbox Stiffener Bolt	28 (38)
Front Exhaust Pipe	
Pipe-To-Catalytic Converter Self-Locking Nut	28 (38)
Pipe-To-Manifold Self-Locking Nut	40 (54)
Vacuum Tube Bracket Bolt	28 (38)
Front Mount	
Bracket-To-Block Bolt	28 (38)
Bracket-To-Support Nut	40 (54)
Fuel Injector Base Nut	16 (22)
Fuel Pulsation Damper	16 (22)
Intake Air Temperature Sensor	13 (18)
Intake Manifold	
Mounting Bolt/Nut	(2) 16 (22)
Vacuum Nipple	20 (27)
Knock Sensor	23 (31)
Main Bearing Caps (1)	
Side Bolt	36 (49)
Top Bolt	56 (76)
Oil Filter Housing Mounting Bolt	16 (22)
Oil Pan Mounting Bolt	(1)
Oil Pressure Switch	13 (18)
Oil Pump Relief Valve Sealing Bolt	29 (39)
Power Steering Pump Bracket Bolt	16 (22)
Rear Mount	
Bracket-To-Block Bolt	28 (38)
Bracket-To-Support Nut	40 (54)
Rocker Shaft Mounting Bolt	(2) 17 (23)

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Shift Control Lever Cable Cover Bolt	16 (22)
Side Engine Mount Bracket	
Bracket-To-Body Vertical Bolt	33 (44)
Bracket-To-Support Horizontal Bolt	40 (54)
Steering Joint Bolt	16 (22)
Subframe Stiffener Bolt	40 (54)
Throttle Body Mounting Bolt/Nut	16 (22)
Timing Belt	
Idler Pulley Bolt	33 (44)
Rear Upper Cover Bolt	16 (22)
Transmission Lower Rear Mount Bolt	28 (38)
Valve Adjusting Screw Lock Nut	14 (19)
VSP Speed Sensor Mount Bolt	16 (22)
Water Passage Assembly Mounting Bolt	16 (22)
	INCH Lbs. (N.m)
Cylinder Head Cover Bolt	⁽²⁾ 106 (12)
Crankshaft Position Sensor Bolt	106 (12)
Engine Rear Cover Bolt	106 (12)
Engine Upper Cover Bolt	106 (12) ⁽²⁾
Ignition Coil Mounting Bolt	106 (12)
Intake Manifold Cover Bolt/Nut	106 (12)
Intake Manifold Runner Control Bracket Bolt	106 (12)
Oil Pan Baffle Plate Bolt	106 (12)
Oil Pump	
Oil Pump Cover Screws	53 (6)
Oil Pump Mounting Bolt	106 (12)
Oil Screen Mounting Bolt	106 (12)
Radiator Upper Mounting Bolt	89 (10)
Rear Seal Cover Bolt	106 (12)
Shift Control Lever End Bolt	124 (14)
Shift Cable Holder Bolt	106 (12)
Thermostat Housing Bolt	106 (12)
Timing Belt	
Auto Tensioner Mounting Bolt	106 (12)
Lower Cover Bolt	106 (12)
Front Upper Cover Bolt	106 (12)
VTEC Solenoid Valve Mounting Bolt	106 (12)
Water Pump Mounting Bolt	106 (12)

(1) Tighten in sequence shown in illustration. See **Fig. 23**.

Tighten in 2-3 steps.

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(2)

(3) Tighten in crisscross pattern.

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS

Application	Specification
Displacement	222 Cu. In. (3.5L)
Bore	3.50" (89 mm)
Stroke	3.66" (93 mm)
Compression Ratio	10:1
Fuel System	PGM-FI

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS

Application	In. (mm)
Crankshaft	
End Play	
Standard	.004-.014 (.10-.36)
Service Limit	.018 (.46)
Runout	
Standard	.0008 (.020)
Service Limit	.0012 (.03)
Main Bearings	
Journal Diameter	2.8337-2.8346 (71.976-72.000)
Journal Out-Of-Round	
Standard	.0002 (.005)
Service Limit	.0004 (.010)
Journal Taper	
Standard	.0002 (.005)
Service Limit	.0004 (.010)
Oil Clearance	
Standard	.0008-.0017 (.020-.043)
Service Limit	.0020 (.050)
Connecting Rod Bearings	
Journal Diameter	2.1644-2.1654 (54.976-55.001)
Journal Out-Of-Round	
Standard	.0002 (.005)
Service Limit	.0004 (.010)
Journal Taper	
Standard	.0002 (.005)

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Service Limit	.0004 (.010)
Oil Clearance	
Standard	.0008-.0017 (.020-.043)
Service Limit	.0020 (.050)

CONNECTING RODS

Application	In. (mm)
End Play On Crankshaft	
Standard	.0002-.0006 (.005-.015)
Service Limit	.018 (.46)
Pin-To-Rod Clearance	
Standard	.0002-.0006 (.005-.015)
Service Limit	.0007 (.017)
Small End Bore Diameter	.8650-.8652 (21.971-21.976)
Large End Bore Diameter	2.28 (58.0)

PISTONS, PINS & RINGS

Application	In. (mm)
Pistons	
Clearance In Cylinder	
Standard	.0006-.0016 (.015-.040)
Service Limit	.003 (.08)
Diameter ⁽¹⁾	
Standard	3.5029-3.5033 (88.975-88.985)
Service Limit	.003 (.08)
Piston Pins	
Outside Diameter	
Standard	.8646-.8648 (21.962-21.965)
Service Limit	.8643 (21.954)
Pin-To-Piston Clearance	
Standard	-.00020- +.00004 (-.0050- +.0010)
Service Limit	.0002 (.005)
Rings	
Ring Groove Width	
Top	
Standard	.0488-.0492 (1.240-1.250)
Service Limit	.049 (1.25)
Second	
Standard	.0480-.0484 (1.220-1.230)
Service Limit	.049 (1.25)
Oil	

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Standard	.1104-.1112 (2.805-2.825)
Service Limit	.112 (2.85)
Ring-To-Groove Side Clearance	
Top	
Standard	.0022-.0031 (.055-.080)
Service Limit	.005 (.13)
Second	
Standard	.0012-.0022 (.030-.055)
Service Limit	.005 (.13)
Ring End Gap	
Top	
Standard	.008-.014 (.20-.35)
Service Limit	.024 (.60)
Second	
Standard	.016-.022 (.40-.55)
Service Limit	.028 (.70)
Oil	
Standard	.008-.028 (.20-.70)
Service Limit	.031 (.79)
(1) Measure .63" (16 mm) from bottom of piston skirt.	

CYLINDER BLOCK

Application	In. (mm)
Cylinder Bore	
Standard ⁽¹⁾	3.5039-3.5045 (89.000-89.014)
Service Limit	3.5065 (89.065)
Maximum Taper	.002 (.05)
Maximum Rebore Limit	.02 (.5)
Deck Warpage	
Standard	.003 (.08)
Service Limit	.004 (.10)
(1) Cylinder bore identification letter is located on top of cylinder.	

VALVES & VALVE SPRINGS

Application	Specification
Intake Valves	
Face Angle	45°
Head Diameter	1.374-1.382" (34.90-35.10 mm)
Margin	
Standard	

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	(1)
Service Limit	(1)
Stem Diameter	
Standard	0.2159-0.2163" (5.485-5.495 mm)
Service Limit	0.2148" (5.455 mm)
Valve Length	4.555-4.579" (115.70-116.30 mm)
Valve Stem Installed Height	
Standard	1.841-1.872" (46.76-47.55 mm)
Service Limit	1.882" (47.80 mm)
Exhaust Valves	
Face Angle	45°
Head Diameter	1.177-1.185" (29.90-30.10 mm)
Margin	
Standard	(1)
Service Limit	(1)
Stem Diameter	
Standard	0.2146-0.2150" (5.450-5.460 mm)
Service Limit	0.2134" (5.420 mm)
Valve Length	4.484-4.508" (113.90-114.50 mm)
Valve Stem Installed Height	
Standard	1.838-1.869" (46.68-47.48 mm)
Service Limit	1.879" (47.73 mm)
Valve Springs Free Length	
Intake	2.029" (51.54 mm)
Exhaust	2.010" (51.06 mm)
(1) Information not available from manufacturer.	

CYLINDER HEAD

Application	Specification
Cylinder Head Height	4.762-4.766" (120.95-121.05 mm)
Maximum Warp ⁽¹⁾	0.002" (0.05 mm)
Valve Seats	
Intake & Exhaust	
Seat Angle	45°
Seat Width	
Intake	
Standard	0.049-0.061" (1.25-1.55 mm)
Service Limit	0.080" (2.0 mm)
Exhaust	

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Standard	0.049-0.061" (1.25-1.55 mm)
Service Limit	0.080" (2.0 mm)
Valve Guides	
Intake & Exhaust	
Valve Guide I.D.	
Standard	0.217-0.218" (5.51-5.53 mm)
Service Limit	0.219" (5.55 mm)
Valve Guide Installed Height	
Intake	.835-.874" (21.21-22.20)
Exhaust	.812-.852" (20.62-21.64)
Valve Stem-To-Guide Oil Clearance	
Intake	
Standard	0.008-0.0018" (0.020-0.045 mm)
Service Limit	0.003" (0.08 mm)
Exhaust	
Standard	0.002-0.003" (0.055-0.080 mm)
Service Limit	0.005" (0.13 mm)
(1) Maximum resurface limit is 0.008" (0.20 mm).	

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CAMSHAFTS & ROCKER ARMS

Application	In. (mm)
End Play	
Standard	.002-.008 (.05-.20)
Service Limit	.008 (.20)
Journal Runout	
Standard	.001 (.03)
Service Limit	.002 (.04)
Lobe Height (Standard)	
Intake	
Primary	1.3676 (34.737)
Middle	1.4348 (36.445)
Secondary	1.3748 (34.919)
Exhaust (All)	1.4302 (36.326)
Camshaft-To-Holder Oil Clearance	
Standard	.0020-.0035 (.050-.089)
Service Limit	.006 (.15)
Rocker Arm-To-Shaft Clearance	
Intake	
Standard	.0010-.0026 (.026-.067)
Service Limit	.0026 (.067)

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Exhaust	
Standard	.0010-.0030 (.030-.077)
Service Limit	.0030 (.077)

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