1999-2004 ENGINES

3.5L V6 - 3.5RL

ENGINE IDENTIFICATION

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

Engine identification code is stamped on block, below cylinder head mating surface. First 5 characters of code indicate engine type. See **ENGINE IDENTIFICATION CODES** table. Sixth and seventh digits identify emissions group. Last 5 digits represent engine serial number.

ENGINE IDENTIFICATION CODES

Application	Code
3.5L	C35A1

ENGINE MOUNT CONTROL SYSTEM

NOTE: Engine mount control system is designed to help control excessive engine vibration at idle. System is controlled by the PCM through the engine mount diaphragm actuator.

SYSTEM TESTS

Engine Mount Control System Check

1. Warm engine to normal operating temperature. Ensure idle speed is about 800 RPM. Adjust idle speed as necessary. With engine at idle, depress brake pedal. Place transmission is gear.
2. Have an assistant disconnect 6-pin engine mount control solenoid connector located near center of firewall. If sensed idle vibration changes noticeably, system is working properly. If sensed idle vibration does not change, check control solenoid circuit. See **CONTROL SOLENOID CIRCUIT CHECK**.

Engine Mount Diaphragm Actuator Check

Ensure engine mount diaphragm actuator is working properly. To test actuator diaphragm, use a hand-held vacuum pump and apply about 9 in. Hg to actuator diaphragm. Actuator rod should move smoothly and diaphragm should hold vacuum. Replace as necessary. If engine mount is okay, see **CONTROL SOLENOID CIRCUIT CHECK**.

Control Solenoid Circuit Check

1. Shift transmission to Park or Neutral. With engine at idle, disconnect engine mount control solenoid harness connector.
2. Check voltage between chassis ground and engine mount control solenoid harness connector terminal No. 3 (Black/Yellow wire). Battery voltage should be present. If battery voltage is present, go to next step. If

battery voltage is not present, check circuit between solenoid harness connector terminal No. 3 and PCM fuse.

3. Check voltage between engine mount solenoid harness connector terminals No. 3 (Black/Yellow wire) and No. 6 (Light Green wire). Battery voltage should be present. If battery voltage is present, go to next step. If battery voltage is not present, check circuit between solenoid harness connector terminal No. 6 and PCM. If circuit is okay, substitute a known-good PCM, and retest.
4. Increase engine to speed to greater than 1000 RPM. Check voltage between solenoid harness connector terminals No. 3 (Black/Yellow wire) and No. 6 (Light Green wire). Battery voltage should not be present. If battery voltage is not present, check engine mount vacuum supply. See **ENGINE MOUNT CONTROL SOLENOID VACUUM SUPPLY CHECK**. If battery voltage is present, go to next step.
5. Check for short to ground in Light Green wire between PCM and engine mount control solenoid harness connector. Repair as necessary. If circuit is okay, substitute a known-good PCM, and retest.

Engine Mount Vacuum Hose Check

1. Disconnect upper vacuum hose from engine mount control solenoid valve. Install a hand-held vacuum pump to upper vacuum hose. Apply 20 in. Hg. Vacuum should hold. If vacuum holds, go to next step. If vacuum does not hold, check vacuum hose for leaks. If vacuum hose is okay, go to next step.
2. Release and apply vacuum. Repeat a few times. If sensed idle vibration does not change with or without vacuum applied, replace affected engine mount. If sensed idle vibration changes noticeably with or without vacuum, test engine mount control solenoid valve. See **CONTROL SOLENOID CIRCUIT CHECK**.

Engine Mount Control Solenoid Vacuum Supply Check

Disconnect lower vacuum hose from engine mount control solenoid. Connect a vacuum gauge to hose. With engine at idle, manifold vacuum should be present. If manifold vacuum is present, replace engine mount control solenoid. If manifold vacuum is not present, check for leaking vacuum hose or plugged vacuum port.

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

NOTE: Hydraulic valve lifters are used. Valve clearance adjustment is not necessary.

THROTTLE CABLE ADJUSTMENT

1. Remove throttle linkage cover. Warm engine to normal operating temperature or until cooling fan comes on. With engine at idle, check throttle cable for binding or sticking. Replace as necessary. If throttle cable is okay, go to next step.
2. Turn engine off. Check throttle cable free play at throttle linkage. Cable deflection should be .39-.47" (10-12 mm). See **Fig. 1**. To adjust, loosen lock nut on cable bracket and turn adjusting nut until cable deflection is as specified. Retighten lock nut.
3. Check throttle valve to ensure it opens fully when accelerator pedal is fully depressed, and returns to idle position when accelerator pedal is released.

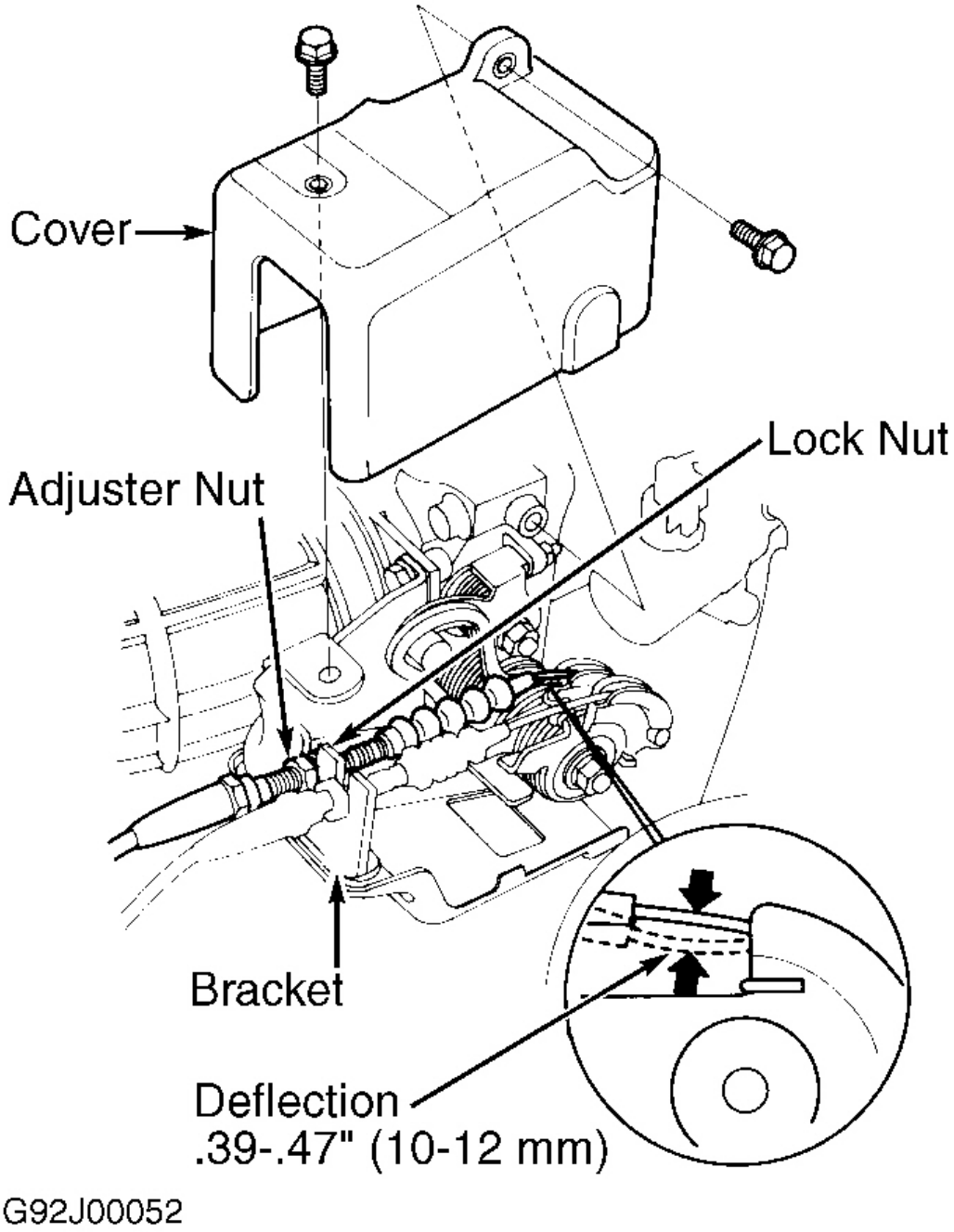


Fig. 1: Adjusting Throttle Cable
Courtesy of AMERICAN HONDA MOTOR CO., INC.

SHIFT LINK ADJUSTMENT (A/T)

1. Apply parking brakes and block drive wheels. Place transmission in Neutral. Remove center console. Remove lock pin from link adjuster. Insert a 0.16" (4.0 mm) pin into shift lever bracket through the "N" position cutout on shift lever position hole.
2. From under vehicle, verify control lever is in Neutral position on transmission. Turn ignition on. Verify "N" indicator light on instrument panel comes on.
3. Ensure hole in link adjuster is perfectly aligned with hole in link rod. There are 2 holes positioned 90 degrees apart on link rod to allow link adjustments in 1/4-turn increments. To align, loosen lock nut on link adjuster and adjust as required. Ensure lock pin is seated securely in adjuster. Replace lock pin if it does not snap securely over link adjuster.
4. Move shift lever to each gear, and verify gear position indicator follows gear position switch. Start engine and check shift lever in all gears. Install center console cover. Insert ignition key into key cylinder on gear position indicator panel and verify shift lock lever is released.

TIMING & BALANCER BELT TENSION ADJUSTMENT

CAUTION: Adjust timing belt with engine cold. DO NOT rotate crankshaft while belt tension adjuster bolt is loose.

1. Remove left upper cover. Inspect timing belt. Replace belt if cracked, or if oil or coolant soaked. Rotate crankshaft clockwise until No. 1 piston is at TDC of compression stroke.
2. For timing belt, rotate crankshaft 10 teeth clockwise on crankshaft pulley. Align Blue mark on crankshaft pulley with pointer on lower cover. See **Fig. 2**. Loosen timing belt tensioner adjusting bolt 1/2 turn (180 degrees), and then tighten bolt to 31 ft. lbs. (42 N.m).
3. For balancer belt, rotate crankshaft one revolution clockwise. Loosen balancer belt tensioner adjusting bolt 1/2 turn (180 degrees), and then tighten bolt to 32 ft. lbs. (44 N.m).

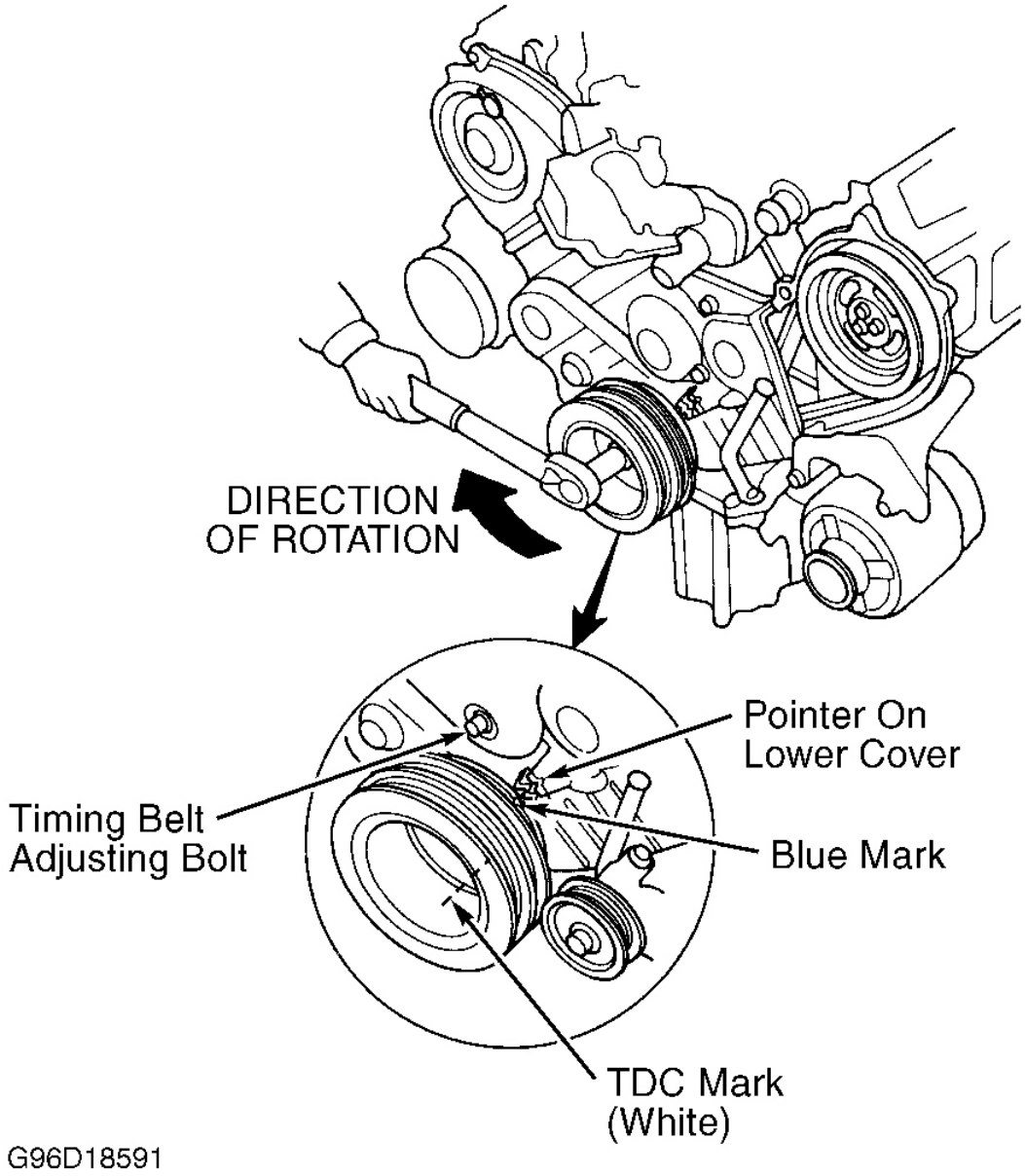


Fig. 2: Aligning Timing Marks For Timing Belt Tension Adjustment
Courtesy of AMERICAN HONDA MOTOR CO., INC.

TROUBLE SHOOTING

To trouble shoot mechanical engine components, see appropriate table in 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.

NOTE: For installation 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.

CAUTION: 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. Obtain radio anti-theft codes, if necessary, before disconnecting battery.

FUEL PRESSURE RELEASE

WARNING: Fuel system is under pressure. Pressure must be released before servicing fuel system components.

Disconnect negative battery cable. Remove fuel tank filler cap. Place shop towel over fuel filter to absorb excess fuel. Slowly loosen fuel filter service bolt one complete turn while holding banjo bolt. See **Fig. 3**. Fuel filter is located on left side of firewall.

NOTE: Replace washer between service bolt and banjo bolt whenever service bolt is loosened. Replace all washers if both bolts are removed.

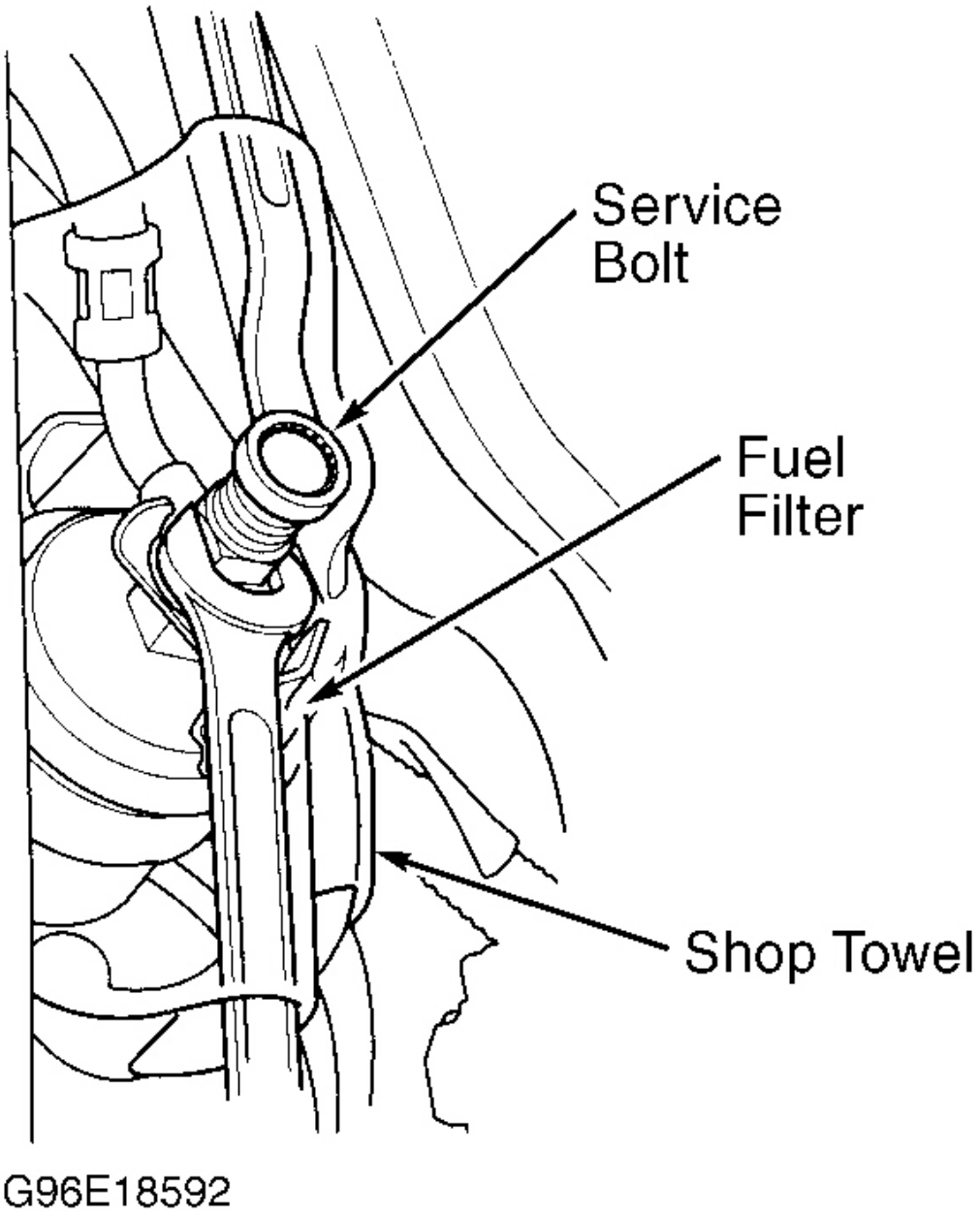


Fig. 3: Releasing Fuel System Pressure
Courtesy of AMERICAN HONDA MOTOR CO., INC.

BLEEDING COOLING SYSTEM

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

ENGINE

NOTE: Engine and transmission are removed as an assembly.

Removal

1. Remove hood support mount bolts. Support hood in a vertical position, and reinstall hood support in lower hole on hood. Disconnect negative battery cable. Disconnect positive battery cable, and remove battery. Remove strut brace. Remove engine cover from intake manifold. Remove intake air duct and air cleaner assembly.
2. Remove throttle cover. Disconnect throttle and cruise control cables. DO NOT bend cables. Replace cable if kinked. Remove coolant reservoir, then remove battery tray. Remove relay box, ground cable and engine wiring harness clamps. Remove vacuum hose and clamp from underhood fuse/relay box. Remove generator cable and battery cable from underhood fuse/relay box. Remove underhood fuse/relay box.
3. Disconnect engine wiring harness connector on left side of engine compartment. Remove connector and engine wiring harness clamp. Release fuel pressure. See **FUEL PRESSURE RELEASE**. Disconnect fuel feed hose and fuel return hose. Disconnect EVAP control canister hose and brake booster vacuum hose.
4. Disconnect transmission sub-harness connector and remove wiring harness clamp. Disconnect control box connector and remove control box. Disconnect engine wiring harness connectors on right side of engine compartment. Disconnect spark plug voltage detection module connector and remove engine ground cables. Remove vacuum hoses.
5. Loosen generator pulley mounting bolt, lock bolt and adjusting rod. Remove generator belt. Loosen idler pulley center nut and adjusting bolt. Remove A/C compressor belt. Disconnect power steering switch connector. Remove adjusting bolt, lock nut and mounting bolt. Remove power steering belt and pump. DO NOT disconnect power steering hoses.
6. Move passenger's seat fully forward. Pull back carpet under front passenger seat, exposing secondary heated O_2 sensor connector and disconnect connector. Remove radiator cap. Raise and support vehicle. Remove front wheels and engine splash shield.
7. Drain engine coolant, engine oil, differential oil and Automatic Transmission Fluid (ATF). Reinstall drain plugs using NEW washers. Remove damper forks. Disconnect suspension lower arm ball joints. Remove axle shafts. Coat finished surfaces with oil, and cover axle shaft ends with plastic bags. Disconnect A/C compressor clutch connector, and remove A/C compressor. DO NOT disconnect A/C hoses.
8. Disconnect Vehicle Speed Sensor (VSS) connector and remove VSS/power steering speed sensor. DO NOT disconnect fluid hoses. Remove transmission stop collars. Remove exhaust pipe "A". Remove wiring harness cover, grommet, three-way catalytic converter and heat shield. Remove and plug ATF cooler hoses and pipes.
9. Remove shift cable cover mounting bolts. Remove A/T gear position switch harness clamp and shift control solenoid valve/linear solenoid harness connector from shift cable cover. Remove shift cable cover from transmission housing. Remove shift cable and cable holder assembly from shift cable holder base. Remove control lever from control shaft.
10. Lower vehicle. Remove upper and lower radiator hoses and radiator. Remove heater hoses. Attach chain hoist to engine. Raise chain hoist to remove slack from chain. Remove shift cable guide bracket. Remove transmission beam. Remove transmission mount and transmission mount bracket.
11. Lower chain hoist. Separate left and right front engine mount brackets from left and right front mounts.

Separate right engine mount bracket from right engine mount and vacuum hose. Separate left engine mount bracket from left engine mount and vacuum hose.

12. Remove all slack from chain hoist by lowering or raising. Ensure engine and transmission are free of all hoses and wiring. Slowly raise engine approximately 6". Verify engine and transmission are still free from hoses and electrical wiring. Raise engine completely and remove engine and transmission from vehicle.

NOTE: Perform the following installation procedure in specified order to eliminate excessive noise and vibration, and to prevent reduction in bushing life.

Installation

1. To install, reverse removal procedure. Install transmission mount bracket, and tighten bolts. Install transmission mount, DO NOT tighten. Tighten center nut on right engine mount bracket and install vacuum hose. See **TORQUE SPECIFICATIONS**. Tighten center nut on left engine mount bracket, and install vacuum hose.
2. Install transmission beam and tighten bolts in sequence. See **Fig. 4**. Tighten left front mount bolt. See **TORQUE SPECIFICATIONS**. Tighten right front mount bolt.
3. When installing axle shafts, use NEW spring clips. Insert each axle shaft until spring clip clicks into groove of differential side gear. Ensure all wire harness connectors and hoses are connected properly.
4. Check throttle cable adjustment. See **THROTTLE CABLE ADJUSTMENT** under ADJUSTMENTS. Adjust transmission shift link. See **SHIFT LINK ADJUSTMENT (A/T)** under ADJUSTMENTS. Adjust accessory drive belt tension. Fill all fluids to proper level. Bleed air from cooling system. See **BLEEDING COOLING SYSTEM**. Check for fluid leaks.

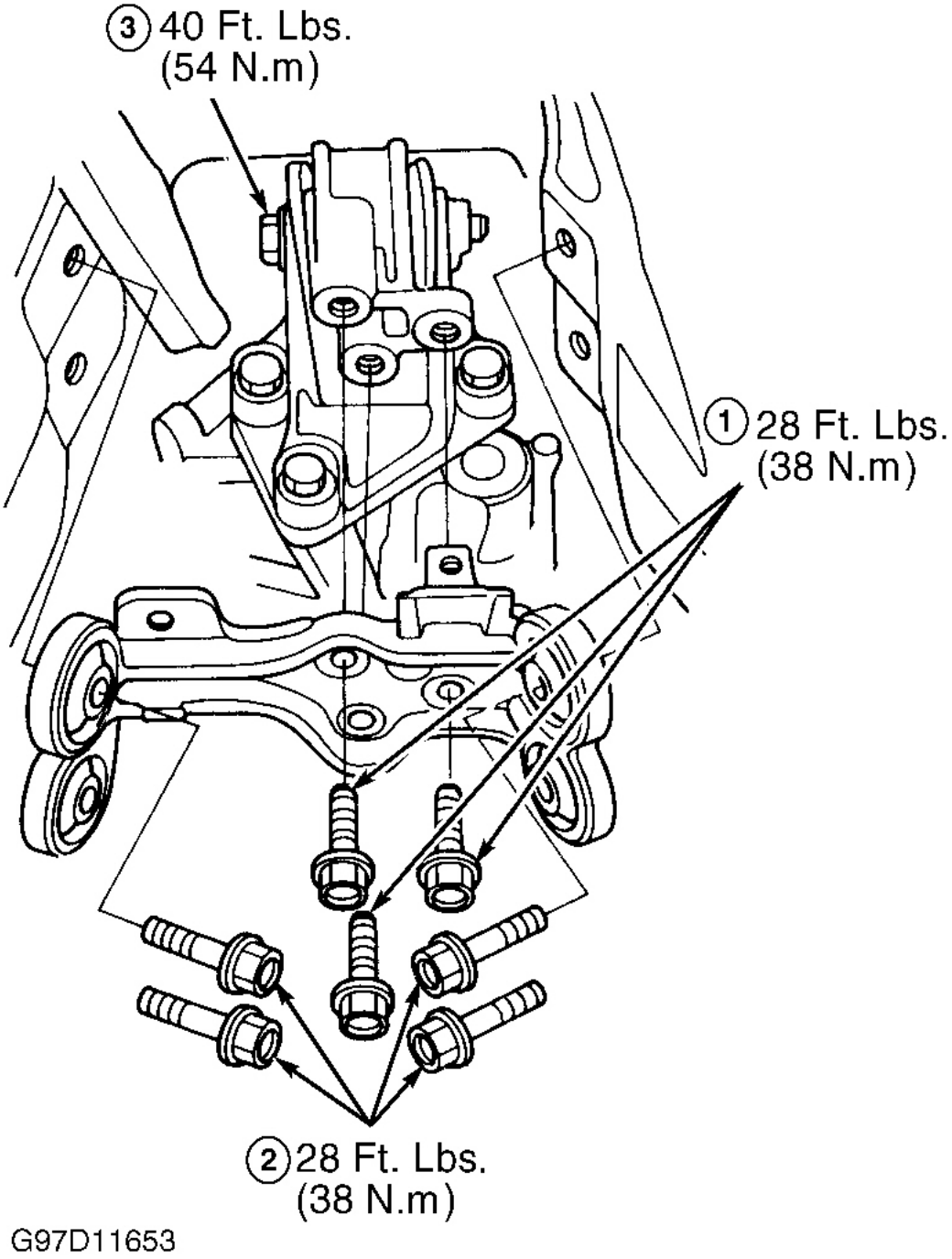


Fig. 4: Transmission Beam Tightening Sequence
Courtesy of AMERICAN HONDA MOTOR CO., INC.

INTAKE MANIFOLD

NOTE: Reference mark all emission hoses and harness connectors before disconnecting.

Removal

Allow engine to cool. Disconnect negative battery cable. Disconnect positive battery cable. Remove battery and battery tray. Disconnect all electrical harness connectors and hoses to intake manifold. Remove throttle cover. Remove throttle and cruise control cables. DO NOT bend cables. Remove air cleaner assembly and intake air duct. Remove intake manifold assembly. See **Fig. 5**.

Installation

To install, reverse removal procedure. Clean intake manifold gasket mating surfaces. Install NEW gaskets. Install and tighten manifold bolts to specification. See **TORQUE SPECIFICATIONS**. Check throttle cable adjustment. See **THROTTLE CABLE ADJUSTMENT** under ADJUSTMENTS. Fill and bleed air from cooling system. See **BLEEDING COOLING SYSTEM**.

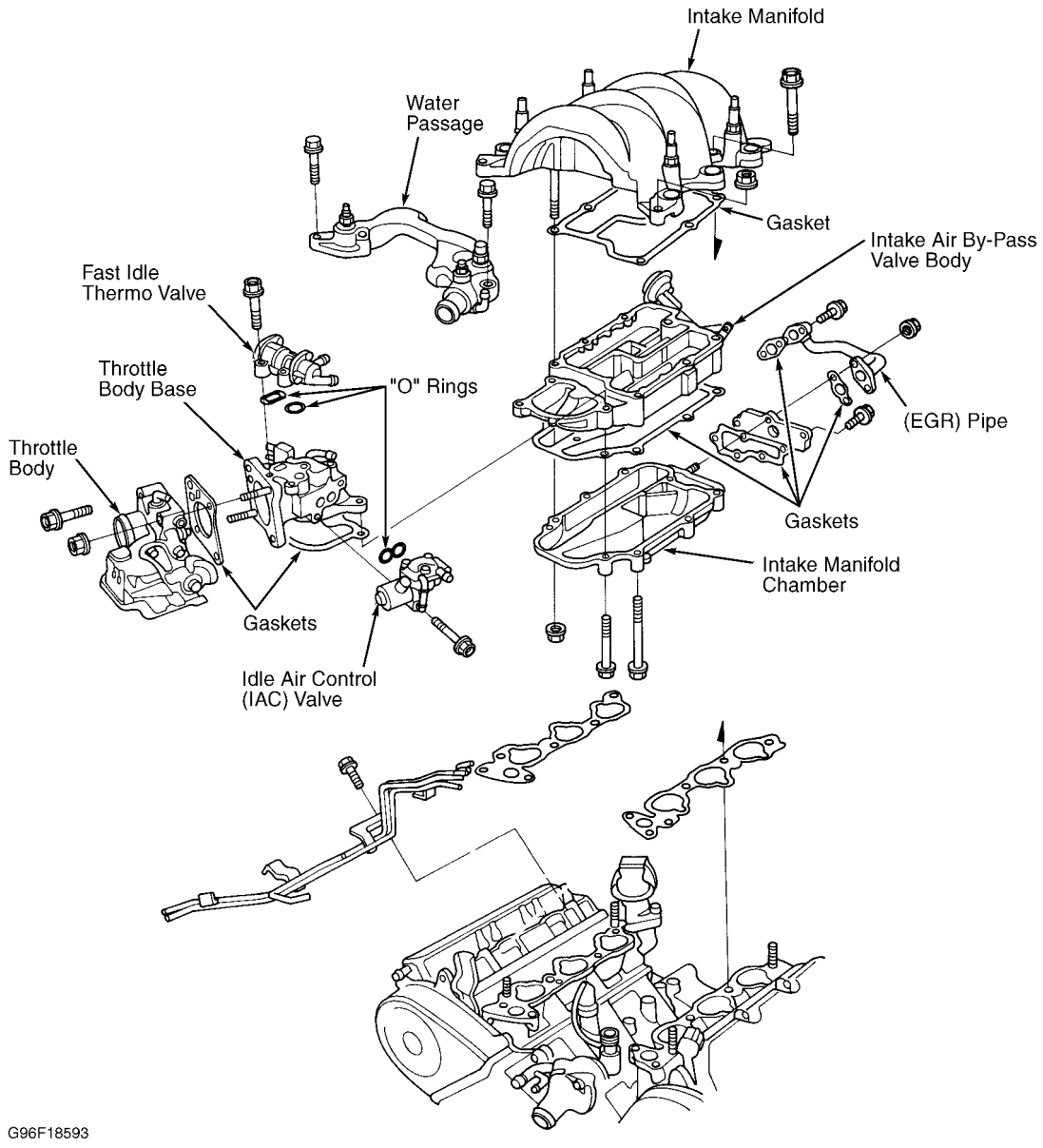
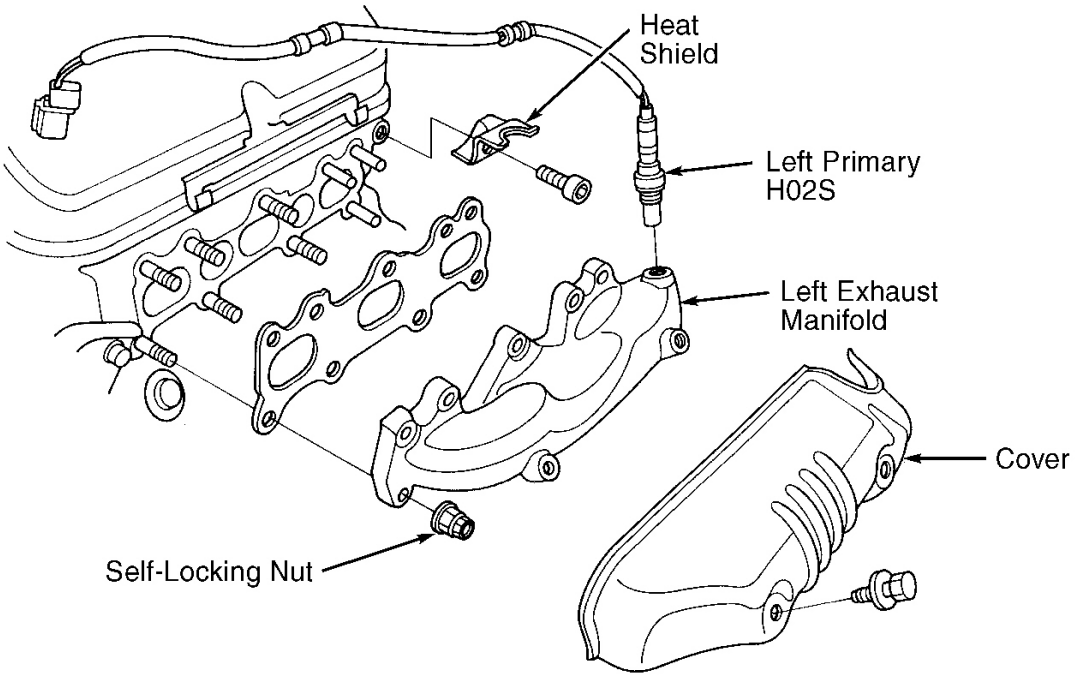


Fig. 5: Exploded View Of Intake Manifold Assembly
Courtesy of AMERICAN HONDA MOTOR CO., INC.

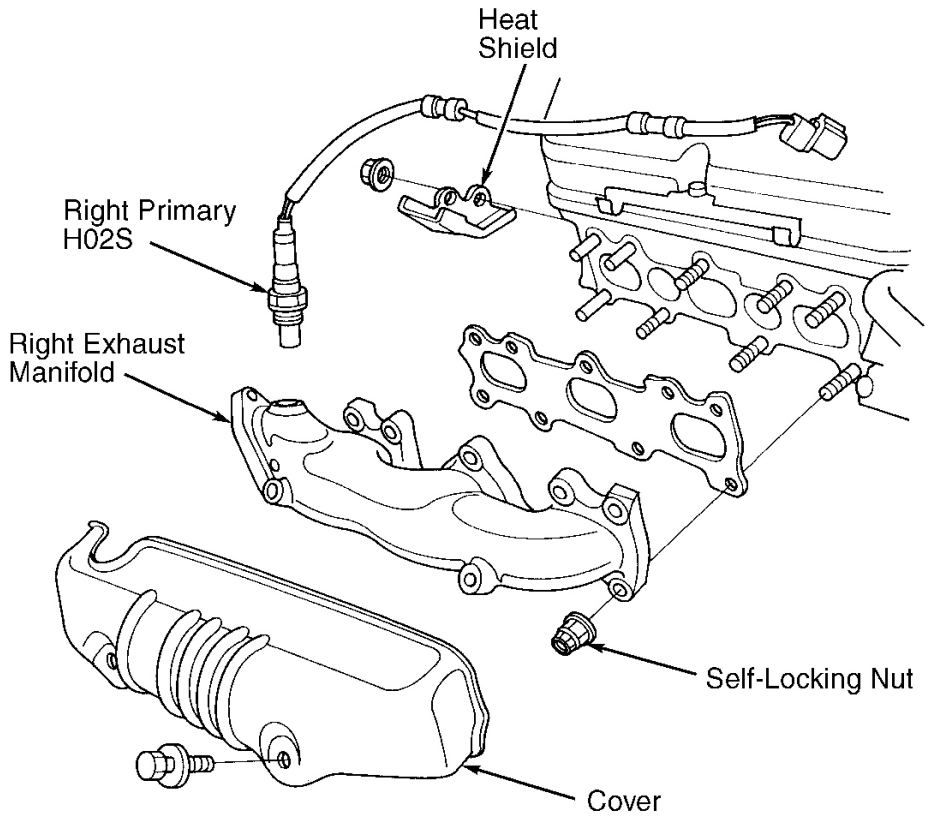
EXHAUST MANIFOLD

Removal & Installation

Allow engine to cool. Disconnect negative battery cable. Disconnect positive battery cable. Remove battery and battery tray. Disconnect primary heated oxygen sensor harness connectors. Disconnect exhaust pipe from manifold. Remove exhaust manifold assembly. See **Fig. 6**. To install, reverse removal procedure. Tighten exhaust manifold nuts and bolts to specification. See **TORQUE SPECIFICATIONS**.



LEFT SIDE



RIGHT SIDE

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Fig. 6: Exploded View Of Exhaust Manifold Assembly
Courtesy of AMERICAN HONDA MOTOR CO., INC.

CYLINDER HEAD

CAUTION: To prevent cylinder head damage, DO NOT remove cylinder head until coolant temperature is less than 100°F (38°C).

Removal

1. Drain coolant. Remove intake manifold. See **INTAKE MANIFOLD**. Remove exhaust manifolds. See **EXHAUST MANIFOLD**. Remove balancer timing belt and camshaft timing belt. See **TIMING & BALANCER BELT**. If reusing either timing belt, mark direction of belt rotation for installation reference.
2. Remove upper radiator hose and water by-pass hoses. Remove vacuum hoses, and then remove clamp from underhood fuse/relay box. Remove battery cables from underhood fuse/relay box, and then remove underhood fuse/relay box. Release fuel pressure. See **FUEL PRESSURE RELEASE**. Remove fuel feed hose and fuel return hose. Remove EVAP control canister hose and brake booster vacuum hose.
3. Disconnect connectors, and then remove control box. Remove vacuum hoses and breather hose. Remove ignition control module bracket. Disconnect all electrical harness connectors and hoses to cylinder head. Remove ignition coil packs from right and left cylinder head covers. Disconnect all hoses from cylinder head cover. Remove Intake Air By-pass (IAB) control solenoid assembly bracket. Remove wire harness mounting bolts. Remove bolt retaining A/T dipstick bracket.
4. Remove heater hose. Remove vacuum line mounting bolts, wire harness holder and PCV hose. Remove EVAP control canister hose, EVAP purge control solenoid valve and vacuum hose. Remove generator mounting bracket bolts and power steering pump mounting bracket bolts.
5. Remove left and right camshaft pulleys, and then remove left and right back covers. Remove crank/cylinder sensor from left cylinder head. Remove left and right cylinder head covers. Remove cylinder head bolts, in sequence, 1/3 turn at a time. Repeat procedure until all bolts are loose. See **Fig. 7**. Remove cylinder head.

Inspection

1. Clean gasket mating surfaces. Check camshaft-to-holder oil clearance. Cylinder head cannot be resurfaced if clearance is not within specification. See **CAMSHAFT** table under ENGINE SPECIFICATIONS.
2. Measure cylinder head warpage. If warpage is less than 0.002" (0.05 mm), resurfacing is not required. If warpage is 0.002-0.008" (0.05-0.20 mm), resurface cylinder head. Maximum resurface limit is 0.008" (0.20 mm). Remove and clean oil control orifices. See **Fig. 8**.

Installation

1. To install, reverse removal procedures. Ensure cylinder heads and cylinder block surface are clean. Install oil control orifices using NEW "O" rings. Install cylinder head dowel pins with NEW cylinder head gaskets. Ensure oil control orifices and dowel pins are aligned.
2. Install cylinder heads on engine block. Apply clean engine oil to cylinder head bolt threads and washer

contact surfaces. Tighten cylinder head bolts to specification, in sequence, in 2 or 3 steps. See **Fig. 9**. See **TORQUE SPECIFICATIONS**.

3. Install left and right exhaust manifolds using NEW gaskets. Apply oil to threads of exhaust manifold self-locking nuts. Using crisscross pattern, tighten self-locking nuts to specification in 2 or 3 steps, starting with inner nut. See **TORQUE SPECIFICATIONS**. Install exhaust manifold covers.
4. Apply liquid gasket sealer to indicated areas (head mating surface of No. 1 and 5 camshaft holders). See **Fig. 10**. Install cylinder head covers. Adjust timing belt tension. See **TIMING & BALANCER BELT TENSION ADJUSTMENT** under ADJUSTMENTS. Fill and bleed cooling system. See **BLEEDING COOLING SYSTEM**.

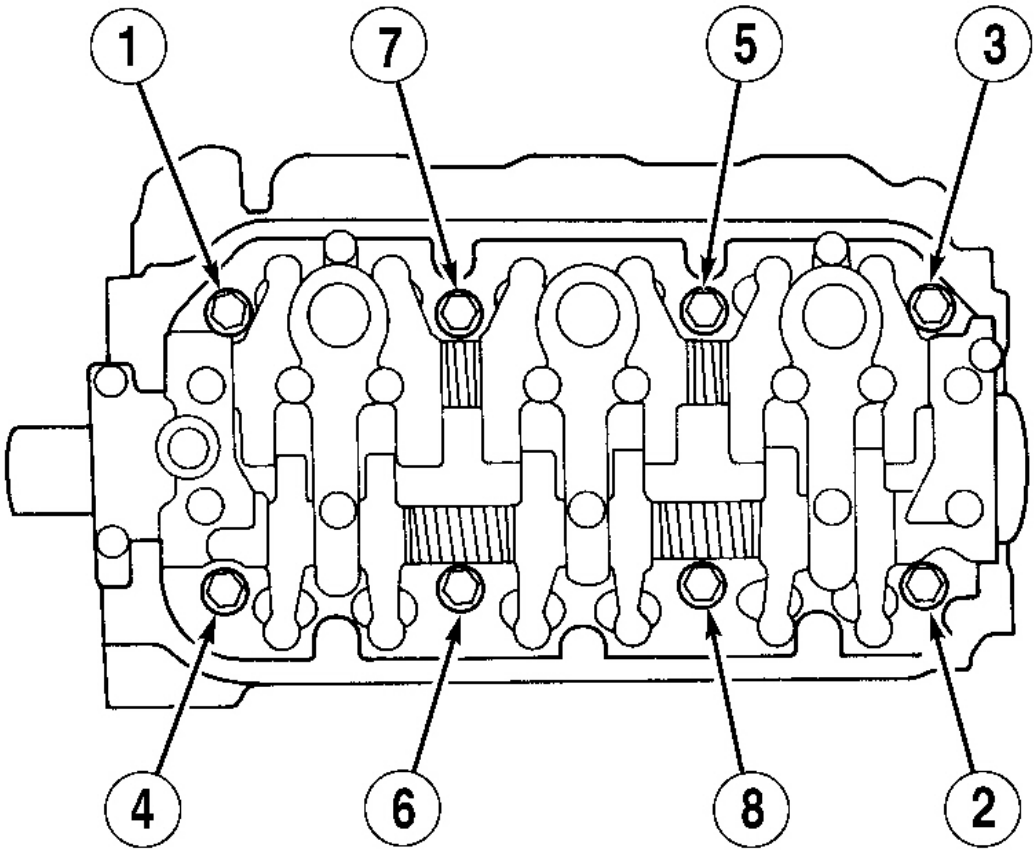


Fig. 7: Cylinder Head Bolt Removal Sequence
Courtesy of AMERICAN HONDA MOTOR CO., INC.

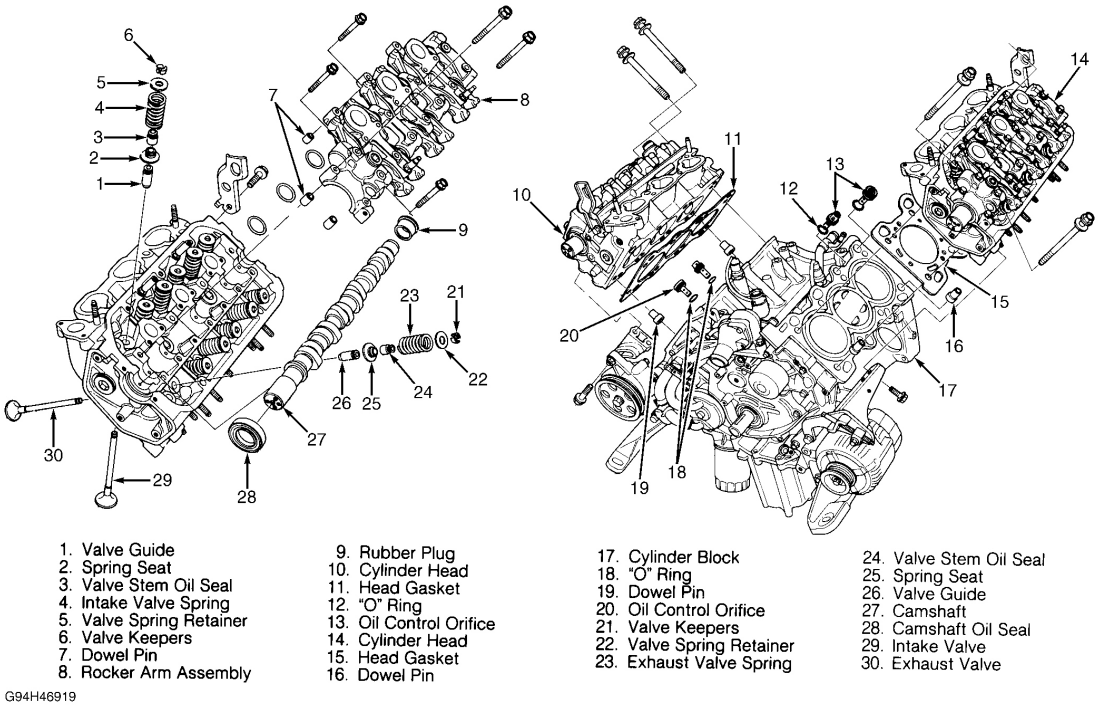


Fig. 8: Exploded View Of Cylinder Head Components
Courtesy of AMERICAN HONDA MOTOR CO., INC.

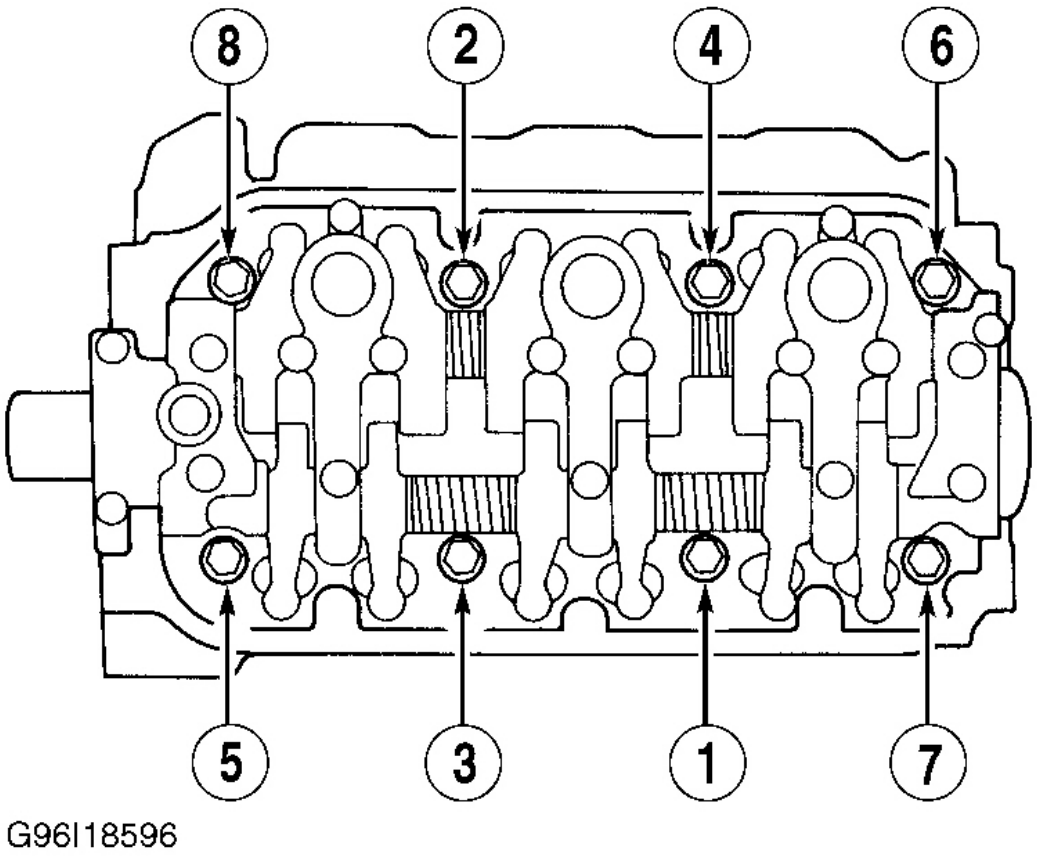


Fig. 9: Cylinder Head Bolt Tightening Sequence
Courtesy of AMERICAN HONDA MOTOR CO., INC.

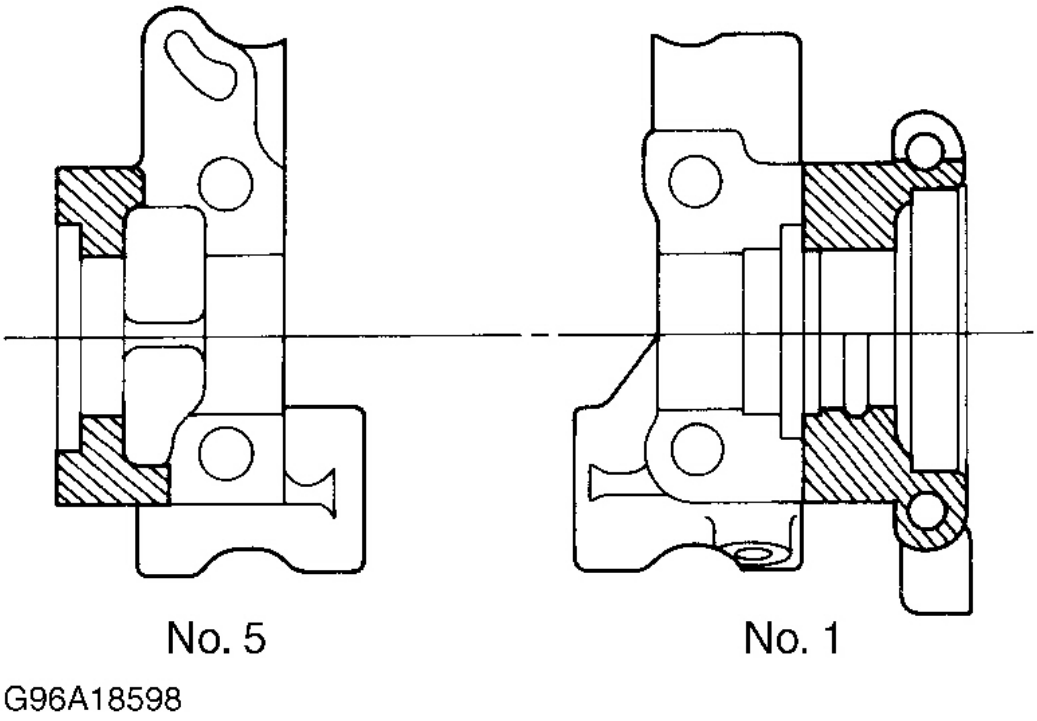


Fig. 10: Identifying Liquid Gasket Application Points
Courtesy of AMERICAN HONDA MOTOR CO., INC.

CRANKSHAFT FRONT OIL SEAL

Removal & Installation

Remove crankshaft pulley and timing belt. See **TIMING & BALANCER BELT**. Pry oil seal from oil pump housing. Apply light coating of grease to crankshaft and lip on new seal. Using Seal Driver (07749-0010000) and Support Collar (07948-S800101), install oil seal with part number facing out. Ensure seal is fully seated into housing and oil seal lip is not distorted. To complete installation, reverse removal procedure.

TIMING & BALANCER BELT

CAUTION: DO NOT turn crankshaft or camshafts with timing belt removed, as pistons may hit valves, causing damage.

Removal

1. Disconnect battery cables. Rotate crankshaft clockwise until No. 1 piston is at TDC of compression stroke. Remove engine cover. Remove intake air duct and air cleaner housing assembly. Loosen generator pulley mounting bolt, lock bolt and adjusting rod, and remove generator belt. Loosen idler pulley center

nut and adjusting bolt. Remove A/C compressor belt.

2. Remove Traction Control System (TCS) control valve upper and lower brackets. Remove adjusting bolt, lock nut and mounting bolt. Remove power steering pump belt. Disconnect TCS throttle sensor and actuator connectors. Remove TCS control valve assembly. See **Fig. 11**.
3. Disconnect vehicle speed sensor sub-harness connector, and remove wiring harness holder. Remove breather hose and vacuum hoses. Remove Ignition Control Module (ICM) bracket. Remove idler pulley, dipstick and tube.
4. Remove crankshaft pulley. Remove upper and lower timing belt covers. See **Fig. 12**. If reusing either timing belt, mark direction of belt rotation for installation reference. Loosen balancer timing belt adjuster bolt 180 degrees. Push on tensioner to release belt tension, then retighten adjusting bolt. Remove balancer timing belt.
5. Loosen camshaft timing belt adjuster bolt 180 degrees. Push on tensioner to release belt tension, then retighten adjusting bolt. Remove camshaft timing belt.

NOTE: For easier installation, turn right camshaft pulley clockwise about half a tooth from TDC position. Ensure crankshaft pulley and left camshaft pulley are at TDC.

Installation

1. To install, reverse removal procedure. Remove all spark plugs. Remove balancer belt drive pulley and timing belt guide plate. Ensure No. 1 piston is at TDC of compression stroke. Position crankshaft and camshaft pulleys as shown prior to timing belt installation. See **Fig. 13**.
2. Install timing belt onto crankshaft pulley, tension adjuster pulley, left camshaft pulley, water pump pulley, and right camshaft pulley in that order. See **Fig. 14**. Loosen and retighten timing belt idler pulley adjusting bolt to place tension on timing belt. Install crankshaft pulley. Rotate crankshaft clockwise 5-6 turns to properly position timing belt on pulleys. Adjust timing belt tension. See **TIMING & BALANCER BELT TENSION ADJUSTMENT** under ADJUSTMENTS.
3. Remove crankshaft pulley. Install timing belt guide plate and balancer belt drive pulley. Align balancer shaft maintenance hole to balancer shaft hole. Insert a 1.8" (6 mm) bolt into balancer shaft hole. Ensure alignment pointer on pulley and front case cover are aligned and cylinder No. 1 is at TDC.
4. Install balancer belt drive pulley and install belt. Loosen tensioner bolt to tension balancer belt. Remove bolt from balancer shaft hole. Install sealing bolt in maintenance hole using a NEW washer.
5. Install crankshaft pulley and rotate crankshaft 5-6 turns clockwise to properly position belt on pulley. Adjust balancer belt tension. See **TIMING & BALANCER BELT TENSION ADJUSTMENT** under ADJUSTMENTS.
6. Remove crankshaft pulley. Install lower cover. Install crankshaft pulley. Rotate crankshaft clockwise until No. 1 piston is at TDC of compression stroke. Verify timing marks are aligned. If timing marks are not aligned, repeat timing belt installation procedure. Adjust generator belt, A/C compressor belt, and power steering pump belt tension. To complete installation, reverse removal procedure.

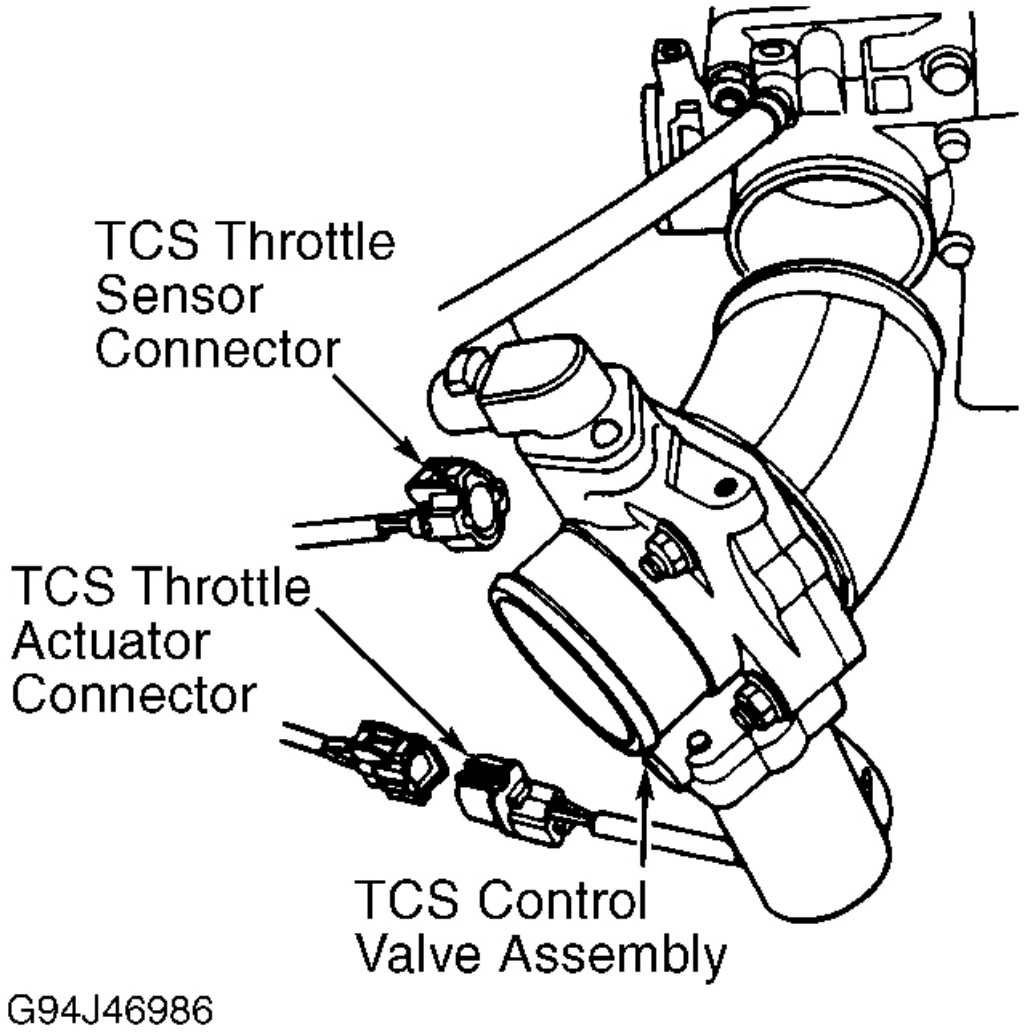


Fig. 11: Locating TCS Connectors & Control Valve Assembly
Courtesy of AMERICAN HONDA MOTOR CO., INC.

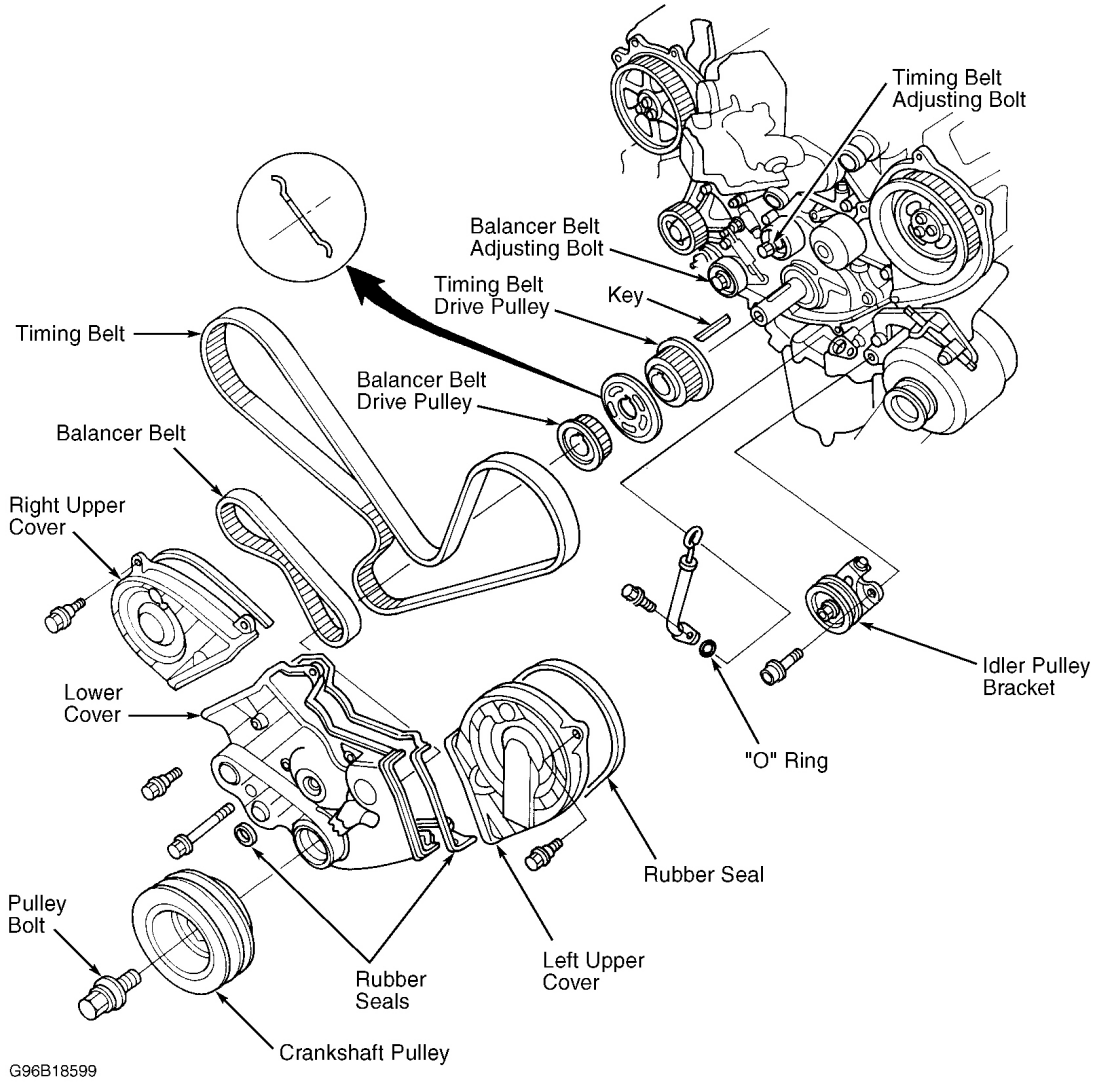


Fig. 12: Exploded View Of Timing & Balancer Belt Components
Courtesy of AMERICAN HONDA MOTOR CO., INC.

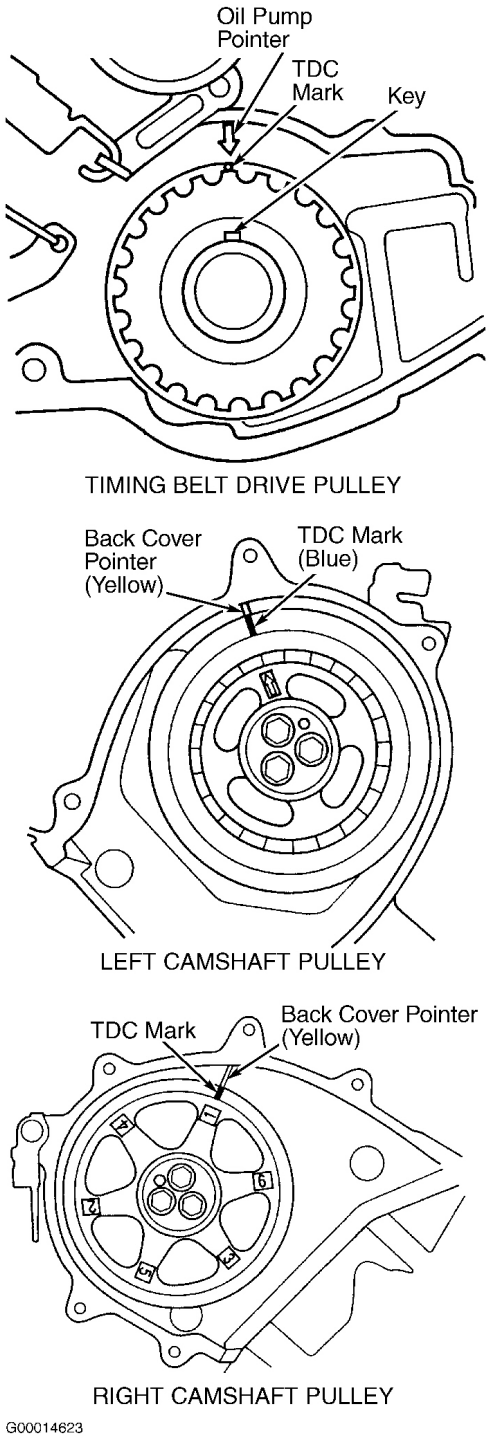


Fig. 13: Aligning TDC Timing Marks
Courtesy of AMERICAN HONDA MOTOR CO., INC.

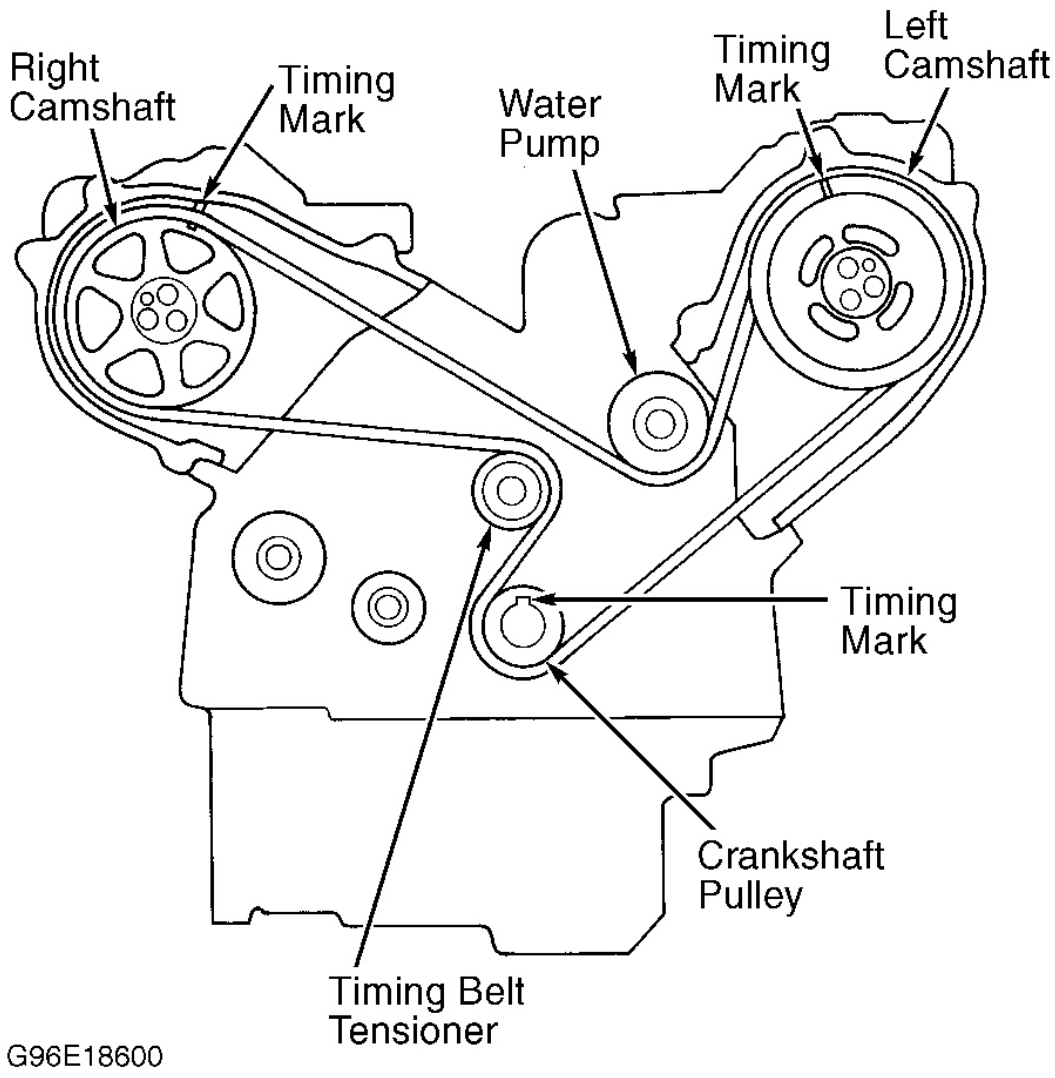


Fig. 14: Timing Belt Routing
Courtesy of AMERICAN HONDA MOTOR CO., INC.

CAMSHAFTS & ROCKER ARMS

Removal

Remove timing and balancer shaft belt. See **TIMING & BALANCER BELT**. Remove camshaft pulleys and back cover plates. Remove cylinder head covers. Loosen camshaft holder bolts, 2 turns at a time in crisscross pattern. When removing rocker arm assembly, DO NOT remove camshaft holder bolts. Bolts keep camshaft holders, springs and rocker arms on shaft. Remove camshaft and oil seal.

Inspection

1. DO NOT rotate camshaft during inspection. Remove rocker arms and shafts. Place camshaft and camshaft holders on cylinder head, and tighten bolts to specified torque. Seat camshaft by pushing it toward rear of cylinder head. Zero dial indicator against rear end. Measure end play by pushing camshaft back and forth. See **CAMSHAFT** table under ENGINE SPECIFICATIONS.
2. Remove bolts and camshaft holders from cylinder head. Remove camshaft from cylinder head, and wipe clean. Replace camshaft if lobes and bearing journals show excessive wear, pitting or scoring. Clean camshaft bearing surfaces in cylinder head, and set camshaft back in place. Insert Plastigage across each journal. Install camshaft holders and tighten bolts. See **TORQUE SPECIFICATIONS**.
3. Measure widest portion of Plastigage on each journal. If camshaft-to-holder oil clearance exceeds specification and camshaft has already been replaced, cylinder head must be replaced. If camshaft has not been replaced, place camshaft onto "V" blocks, and measure runout. See **CAMSHAFT** table under ENGINE SPECIFICATIONS. If runout is within specification, replace cylinder head. If runout exceeds specification, replace camshaft and recheck. If oil clearance still exceeds specification, replace cylinder head.
4. If rocker arms must be removed from rocker shafts, note location of rocker arms for installation reference. Measure diameter of intake and exhaust rocker shafts at first rocker arm location. Measure inside diameter of rocker arm, and check for out-of-round condition. Difference between the 2 measurements is rocker arm-to-shaft clearance. Repeat procedure for all rocker arms. If clearance exceeds specification, replace rocker shaft and any over-tolerance rocker arms. Inspect rocker arm faces for wear. Replace as necessary.

Installation

1. Ensure rocker arms are assembled correctly onto rocker shaft. See **Fig. 15**. If lifters were replaced or removed from rocker arms, bleed air from lifters. Fill container with 10W-30 oil. Place lifter into container. Using a thin wire and a vertical motion, pump lifter plunger until no air bubbles emerge from lifter.
2. Install and lubricate NEW "O" ring onto lifter. Install lifter into rocker arm. Lubricate camshaft journals and journal surfaces in caps and cylinder head. Position camshaft with pin hole at top. Install camshaft and camshaft seal. Apply liquid gasket sealer to cylinder head mating surfaces of No. 1 and 5 camshaft holders. See **Fig. 10**.
3. Install rocker arm assembly, and tighten bolts finger tight. Ensure rocker arms are properly positioned onto valve stems. Tighten camshaft bearing cap bolts to specification, in sequence, 2 turns at a time. See **Fig. 16**. See **TORQUE SPECIFICATIONS**. To complete installation, reverse removal procedure.

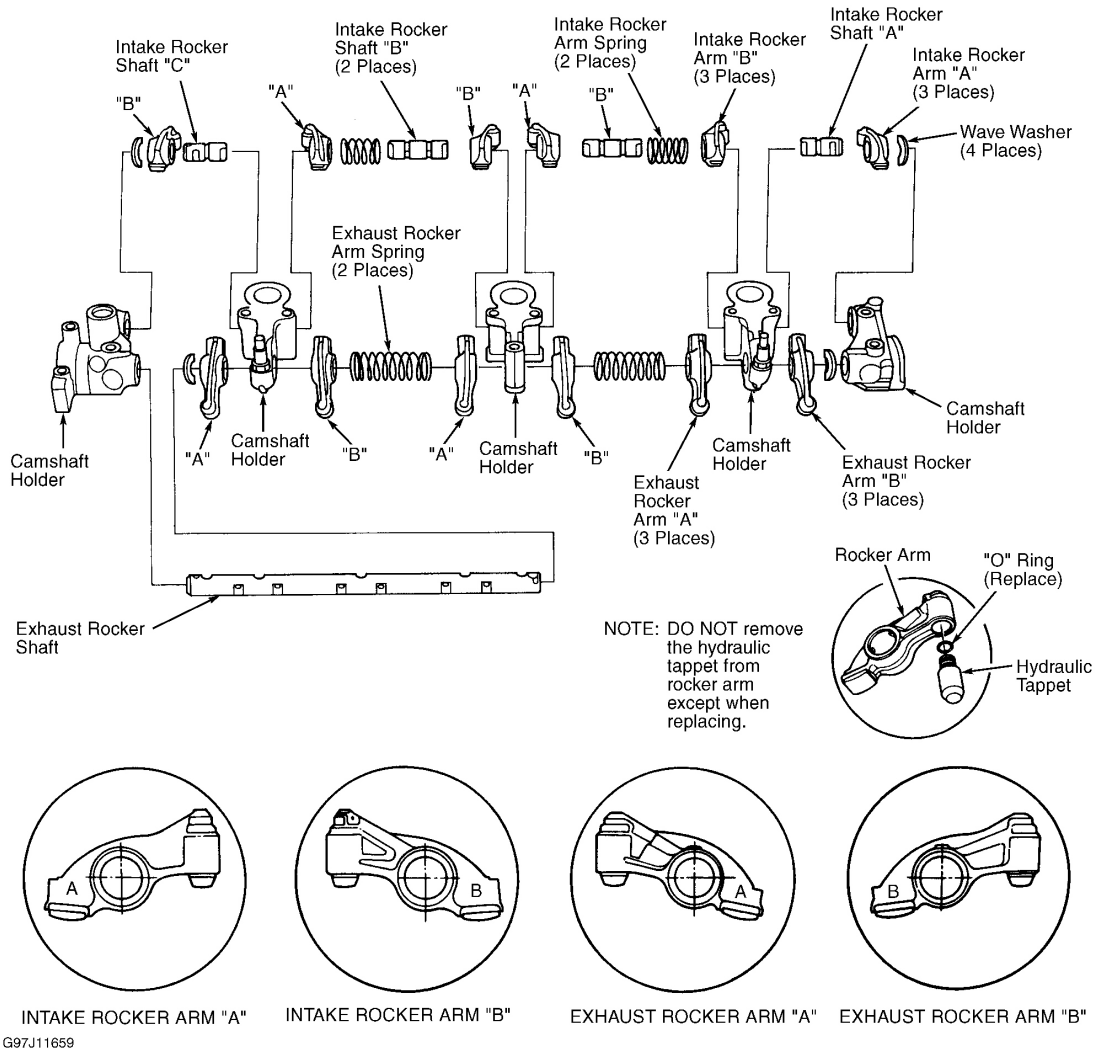


Fig. 15: Exploded View Of Rocker Arm Assembly
Courtesy of AMERICAN HONDA MOTOR CO., INC.

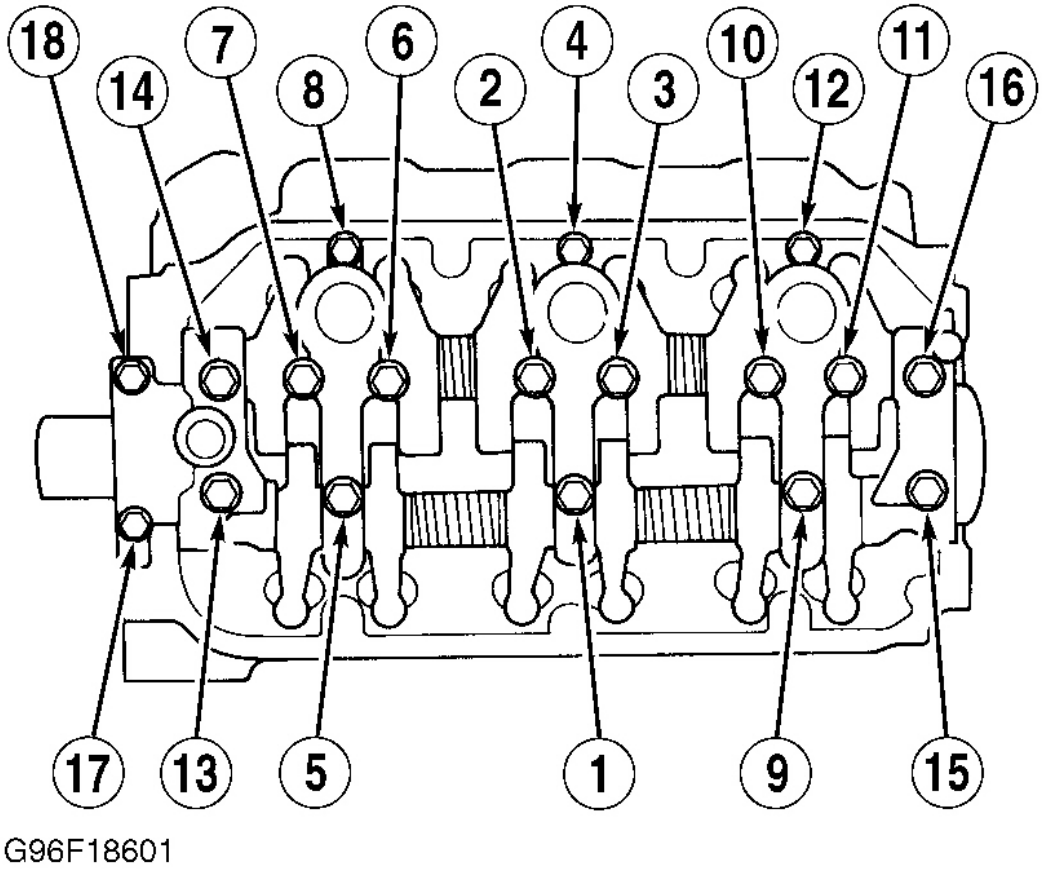


Fig. 16: Camshaft Bearing Cap Bolt Tightening Sequence
Courtesy of AMERICAN HONDA MOTOR CO., INC.

REAR CRANKSHAFT OIL SEAL

Removal & Installation

1. Disconnect negative battery cable. Remove transmission. For A/T models, see TRANSMISSION REMOVAL & INSTALLATION article in TRANSMISSION SERVICING. For M/T models, see appropriate article in CLUTCHES.
2. Remove flexplate. Pry oil seal from rear oil seal cover. If oil seal cover is removed, use non-hardening liquid gasket to seal block mating surface. Apply light coat of oil to seal lip and crankshaft.
3. Align hole in Driver Attachment (07948-SB00101) with pin on crankshaft. Using Driver (07749-0010000) and Driver Attachment (07948-SB00101), drive crankshaft oil seal into rear cover with part number facing out. Using a feeler gauge, ensure there is an equal clearance of .01-.02" (.2-.5 mm) all around between oil seal and rear cover. To complete installation, reverse removal procedure.

WATER PUMP

Removal & Installation

Drain cooling system. Remove timing belt. See **TIMING & BALANCER BELT**. Remove left camshaft pulley and back cover. Remove water pump. To install, reverse removal procedure. Replace all "O" rings. Ensure "O" ring groove and mating surfaces are clean. Fill and bleed air from cooling system. See **BLEEDING COOLING SYSTEM** in SPECIFICATIONS article in ENGINE COOLING.

OIL PAN

Removal

1. Disconnect negative battery cable. Disconnect positive battery cable. Loosen idler pulley center nut and adjusting bolt. Remove A/C compressor belt. Disconnect power steering switch connector. Remove adjusting bolt, lock nut and mounting bolt. Remove power steering belt and pump. Remove left and right side exhaust manifold covers. Raise and support vehicle.
2. Remove front wheels and splash shield. Remove damper forks. Disconnect suspension lower arm ball joints. See appropriate article in SUSPENSION. Remove axle shafts and intermediate shaft. See FWD AXLE SHAFTS article in DRIVE AXLES.
3. Drain engine oil and differential oil. Install drain bolts using NEW washers. DO NOT overtighten drain bolts. Disconnect Vehicle Speed Sensor (VSS)/power steering speed sensor, but DO NOT disconnect fluid hoses. Remove lower plate from rear beam. Remove A/C compressor.
4. Attach chain hoist to engine. Remove left and right side engine mounts. Remove left and right front engine mount bolts. Place transmission in Park to lock secondary shaft. Remove 36-mm extension shaft sealing bolt. Disconnect extension shaft from differential using Extension Shaft Puller (07LAC-PW50101). Remove differential mounting bolts and 26-mm shim. Remove differential assembly. Remove engine stiffener. Remove drive plate cover. Remove oil pan and "O" rings. See **Fig. 17**.

Installation

1. To install, reverse removal procedure. Clean oil pan and cylinder block mating surface. Apply a continuous bead of Liquid Gasket Sealer (08718-0001) to engine block and inner threads of bolt holes. Apply liquid gasket sealer to bolt threads.
2. Coat NEW "O" rings with engine oil. Install oil pan and "O" rings. Tighten bolts in sequence as specified. See **Fig. 17**. See **TORQUE SPECIFICATIONS**. Fill or top off all fluids. Wait a minimum of 30 minutes before filling crankcase with engine oil.

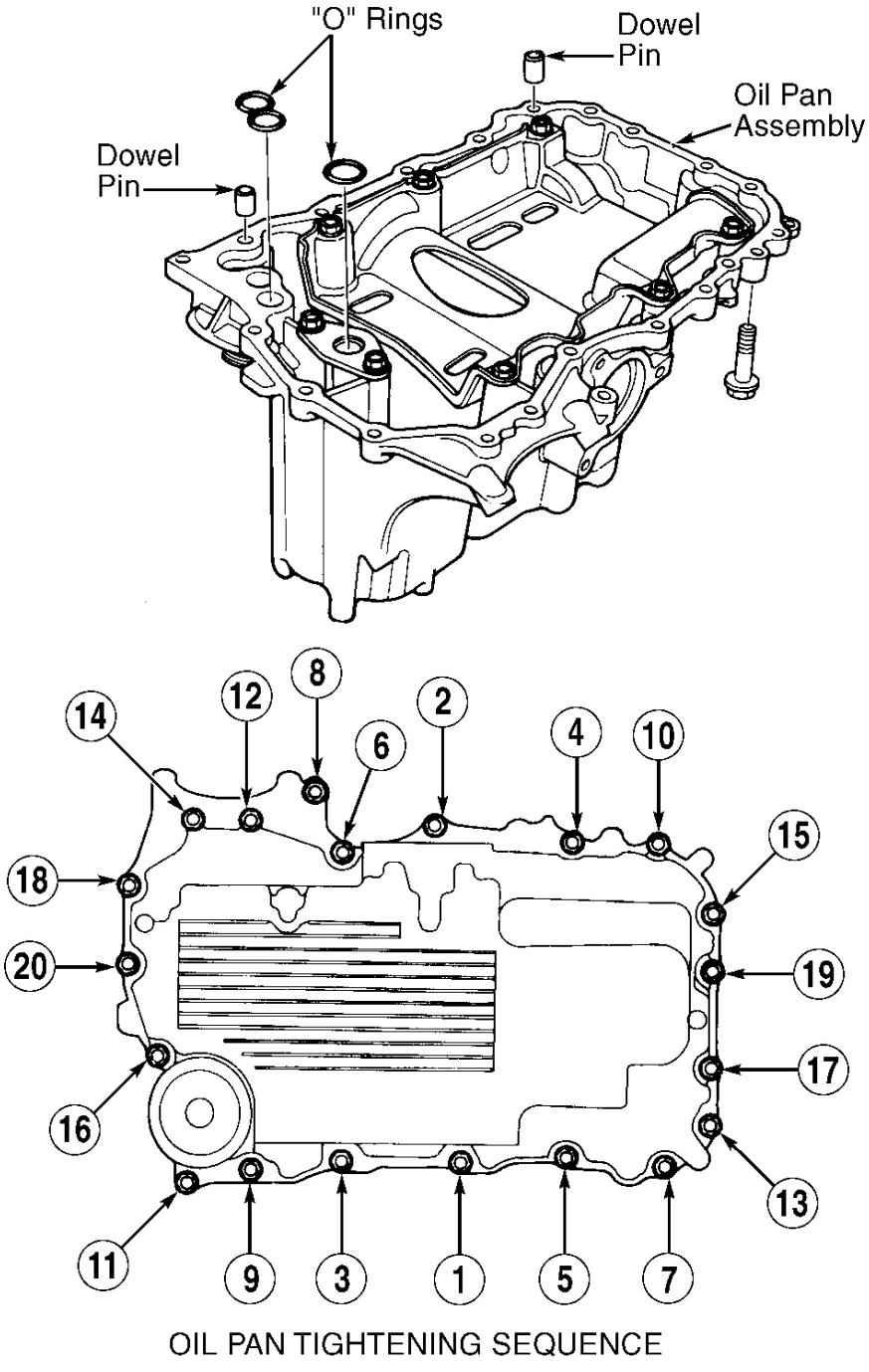


Fig. 17: Oil Pan Bolt Tightening Sequence
Courtesy of AMERICAN HONDA MOTOR CO., INC.

OVERHAUL

CYLINDER HEAD

Cylinder Head

1. After cylinder head has been disassembled, clean mating surfaces. Check camshaft-to-holder oil clearance. Cylinder head cannot be resurfaced if clearance is not within specification. See **CAMSHAFT** table under ENGINE SPECIFICATIONS.
2. Measure cylinder head warpage. Resurface cylinder head if warpage is 0.002-0.008" (0.05-0.20 mm). If warpage is less than 0.002" (0.05 mm), resurfacing is not required. Maximum resurface limit is 0.008" (0.20 mm).

NOTE: Identify and label valve and valve springs as they are removed so they may be reinstalled in their original position.

Valve Springs

Using a socket and plastic mallet, lightly tap valve retainer to loosen valve keeper. Using a valve spring compressor, remove valve keepers. Remove valve seal using valve guide seal remover. Measure free length of valve springs. If spring free length is not within specification, replace valve springs. See **VALVES & VALVE SPRINGS** table under ENGINE SPECIFICATIONS. Install springs with closely wound end toward cylinder head.

Valve Stem Oil Seals

Intake and exhaust valve stem seals are not interchangeable. Intake valve stem seals have a White spring around neck of seal. Exhaust valve stem seals have a Black spring around neck of seal.

Valve Guide Inspection

1. Place dial indicator against valve head. Lift valve 0.4" (10 mm) from seat. Rock valve stem from side to side, and measure valve wobble.
2. If wobble exceeds 0.006" (0.16 mm) for intake valves or 0.009" (0.22 mm) for exhaust valves, install new valve and recheck wobble. If wobble still exceeds limit, go to next step.
3. Measure Outside Diameter (O.D.) of valve stem and Inside Diameter (I.D.) of valve guide, in 3 places. Difference between valve stem O.D. and valve guide I.D. is stem-to-guide oil clearance. Subtract smallest measured valve stem O.D. from largest measured valve guide I.D. If difference exceeds service limit, replace valve and valve guide. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS.

CAUTION: DO NOT heat cylinder head with a torch, as head may warp. DO NOT heat cylinder head to greater than 300°F (150°C). This may loosen valve seats.

Valve Guide Replacement

1. Use an air hammer and Valve Guide Driver (07742-0010100) to remove and install valve guides. See **Fig. 18**. Chill replacement guides in a freezer for about an hour. Use a hot plate or oven to heat cylinder head evenly to 300°F (150°C).

CAUTION: Drill guides only in extreme cases. Cylinder head damage can occur if valve guide breaks.

2. Working from camshaft side, drive valve guide about 5/64" (2 mm) toward combustion chamber to dislodge carbon and make removal easier. Turn cylinder head over, and drive valve guide out toward camshaft side. If guide does not move, drill guide with 5/16" drill, and then try again.
3. Individually remove new guides, as needed, from freezer. Coat outside of new valve guide with a thin coat of engine oil. Using Valve Guide Driver (07742-0010100), install valve guide on heated cylinder head. Install guides from camshaft side of head. Valve guide (intake and exhaust) height should be 0.62-0.64" (15.75-16.25 mm).
4. If replacing all valve guides, reheat cylinder head as necessary. Using cutting oil, ream new valve guides by rotating Valve Guide Reamer (07HAH-PJ7010B) clockwise the full length of valve guide bore.
5. Continue rotating reamer clockwise while removing it from bore. Thoroughly wash guide in detergent and water to remove any cutting residue. Check valve stem-to-guide oil clearance. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS.

NOTE: Always reface valve seat after replacing valve guide.

Valve Seat

Valve seat replacement procedure is not available from manufacturer.

Valves

Measure valve stem diameter and margin. Replace valve if not within specifications. See **VALVES & VALVE SPRINGS** table under ENGINE SPECIFICATIONS.

Valve Stem Installed Height

1. Insert valve into cylinder head. Holding valve closed, measure valve stem installed height from base of valve guide to tip of valve stem. See **Fig. 19**.
2. If valve stem installed height is not within specification, replace valve and re-measure. See **VALVES & VALVE SPRINGS** table under ENGINE SPECIFICATIONS. If installed height is still not within specification, valve seat is too deep. Replace cylinder head.

Valve Seat Correction Angle

1. Using a valve seat cutter, carefully cut a 45-degree seat, removing only enough material to ensure a smooth and concentric seat. Bevel upper edge of seat with 30-degree cutter, and lower edge of seat with 60-degree cutter. Check width of seat and adjust accordingly. Make one more pass using 45-degree cutter lightly to remove burrs caused by other cutters. Verify seat width is within tolerance. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS.
2. After resurfacing valve seat, inspect for even valve seating. Apply Prussian Blue compound to valve face. Insert valve in its original location in head. Lift valve and snap closed against seat several times. Actual valve seating will be indicated by location of compound on seat. If valve seating is too high, make a second cut with 60-degree cutter. If valve seating is too low, make a second cut with 30-degree cutter.

After either cutter is used, make final cut using 45-degree cutter to restore seat width.

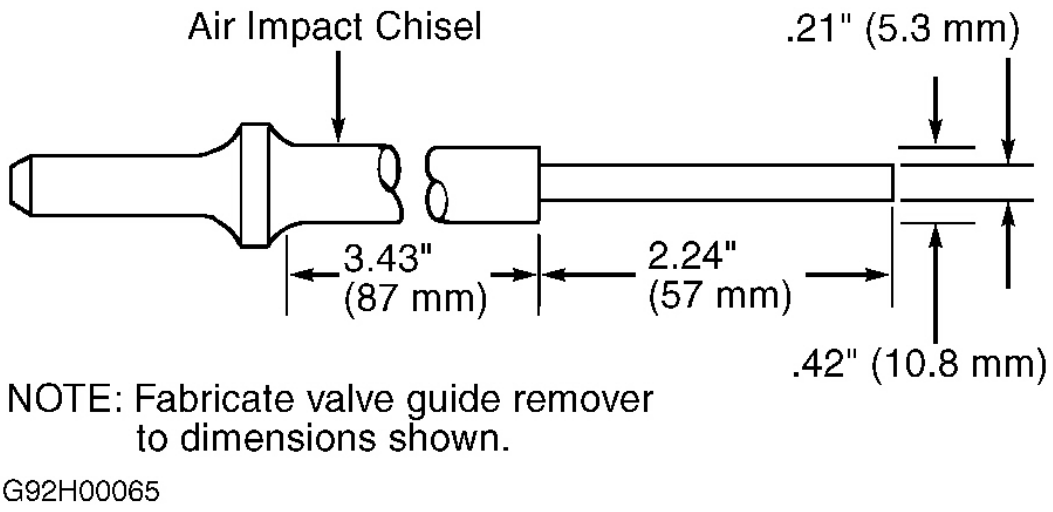


Fig. 18: Fabricating Valve Guide Driver
Courtesy of AMERICAN HONDA MOTOR CO., INC.

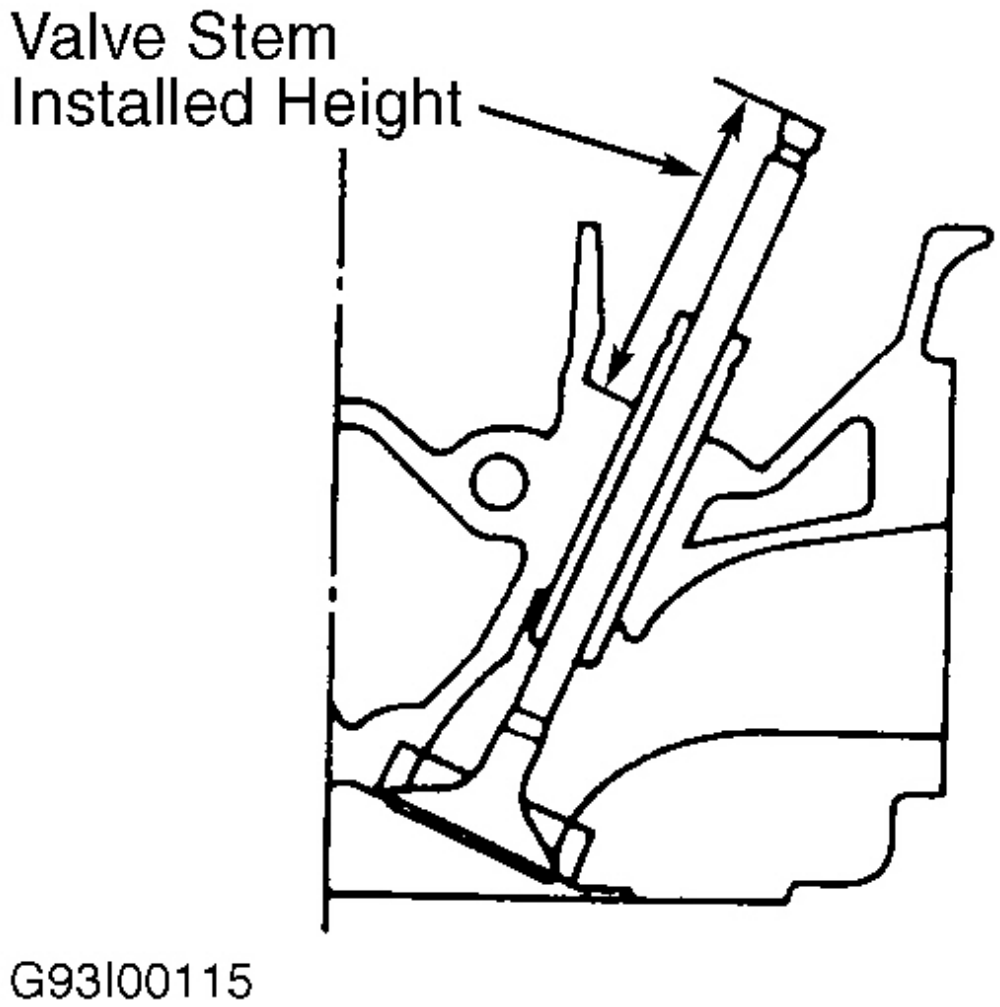


Fig. 19: Measuring Valve Stem Installed Height
Courtesy of AMERICAN HONDA MOTOR CO., INC.

CYLINDER BLOCK ASSEMBLY

Piston & Rod Assembly

1. Connecting rods are available in 4 tolerance ranges. Rod size depends on crank journal bore. A reference number between 1 and 4 is stamped on side of rod's big end bore. Any combination of numbers between 1 and 4 may be found in engine.

NOTE: Reference numbers are for big end bore code. Numbers do not indicate rod position in engine.

2. Nominal connecting rod big end bore is 2.24" (57 mm). Install piston and connecting rod with arrow on top of piston toward front of engine, and connecting rod oil hole toward offset mark on piston. See **Fig. 20**.

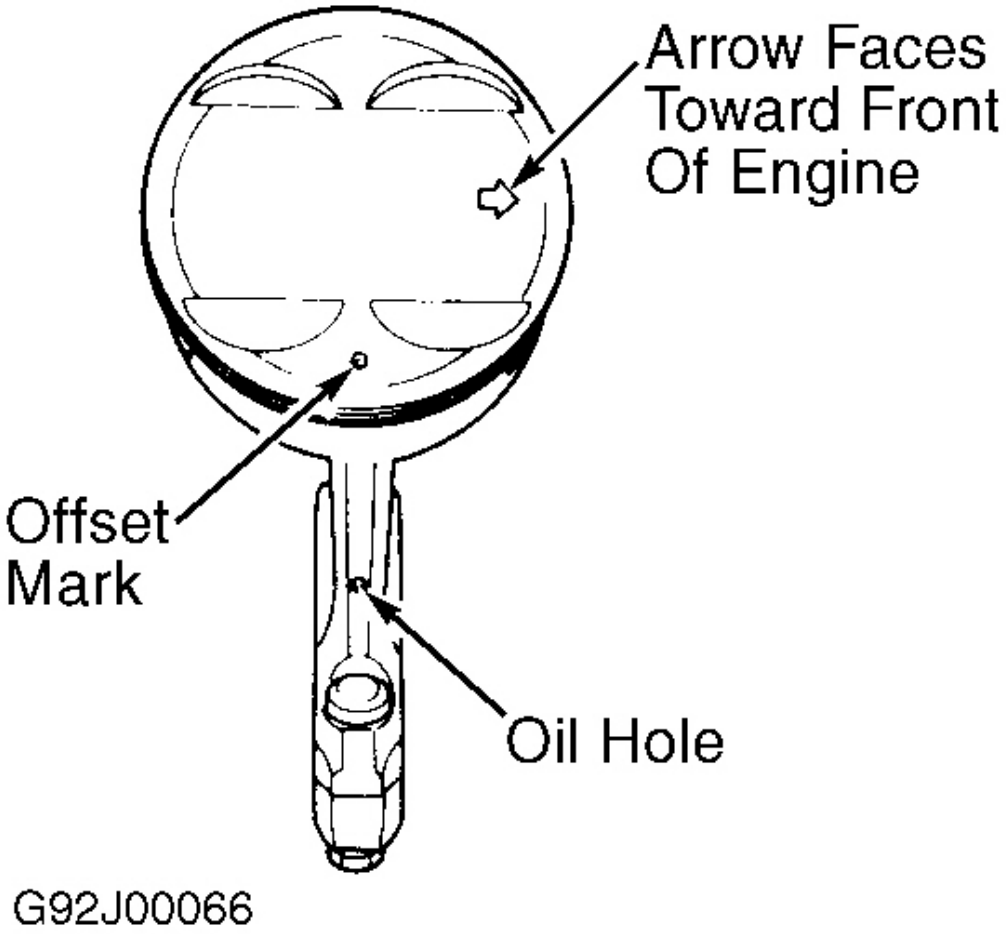


Fig. 20: Positioning Piston Onto Connecting Rod
Courtesy of AMERICAN HONDA MOTOR CO., INC.

Piston Pin Removal

1. Apply engine oil to piston pin snap rings and turn snap rings until end gaps are lined up with cutouts in piston pin bores. Carefully remove both snap rings by starting at cutout in piston pin bore. Do not lose

snap ring.

2. Using a hand-held heater, heat piston and connecting rod assembly to about 158°F (70°C), then remove piston pin.

NOTE: Inspect piston, piston pin and connecting rod when they are at room temperature. All replacement piston pins are oversize.

Piston Pin Inspection

1. Check piston for cracks or distortion. Measure diameter of piston pin. Measure piston pin bore in piston. Difference between the 2 measurements is pin-to-piston clearance.
2. Ensure clearance is -0.0002 to +0.0001" (-0.005 to +0.002 mm). If clearance is greater than 0.0002" (0.005 mm), install an oversize piston pin and re-measure clearance.
3. Measure difference between piston pin diameter and connecting rod's small end bore. Interference fit between piston pin and connecting rod should be 0.0002-0.0006" (0.005-0.015 mm).

Piston Pin Installation

1. Install one piston pin snap ring on piston. Heat piston to about 158°F (70°C). Coat piston pin bore, connecting rod bore and piston pin with engine oil.
2. Install piston with its offset mark and oil hole in connecting rod on the same side. See **Fig. 20**. Install piston pin. Install remaining piston pin snap ring.

Fitting Pistons

1. Using a feeler gauge, measure clearance between piston and cylinder bore. If clearance exceeds 0.003" (0.08 mm), recheck piston clearance by measuring diameter of each piston and cylinder bore.
2. Clean piston thoroughly and inspect for distortion and cracks. Measure piston diameter 0.55" (14.0 mm) from bottom of piston skirt. Replace piston if diameter is not within specification. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS.
3. Standard size pistons have no marking, or are stamped with letter "A" or "B" on piston top. Cylinder block bore size is determined by no marking, or letter "A" or "B" stamped on cylinder block. Identification letters on block read from front cylinder to rear cylinder. Letters for No. 1 through No. 3 cylinders are on first line, and letters for No. 4 through No. 6 cylinders are on second line. To maintain proper clearance, ensure letters on cylinder block and piston match.
4. Subtract piston diameter from cylinder bore diameter to obtain piston clearance. If clearance exceeds service limit, re-bore cylinder and install oversize piston. See **PISTONS, PINS & RINGS** table. See **CYLINDER BLOCK**. Pistons are available in 0.010" (0.25 mm) and 0.020" (0.50 mm) oversize.

Piston Rings

1. Using inverted piston, push NEW piston ring into cylinder bore 0.6-0.8" (15-20 mm) from bottom. Using a feeler gauge, measure ring end gap. If gap is too large, check cylinder bore diameter and re-bore if necessary. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS. If gap is too small, check if ring size is correct.
2. Clean piston ring grooves thoroughly. Install rings onto piston with identification mark toward top of

piston. Using a feeler gauge, measure side clearance between ring and ring groove.

3. If ring grooves are excessively worn, replace piston. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS. Ensure piston ring end gaps are properly spaced around piston. See **Fig. 21**.

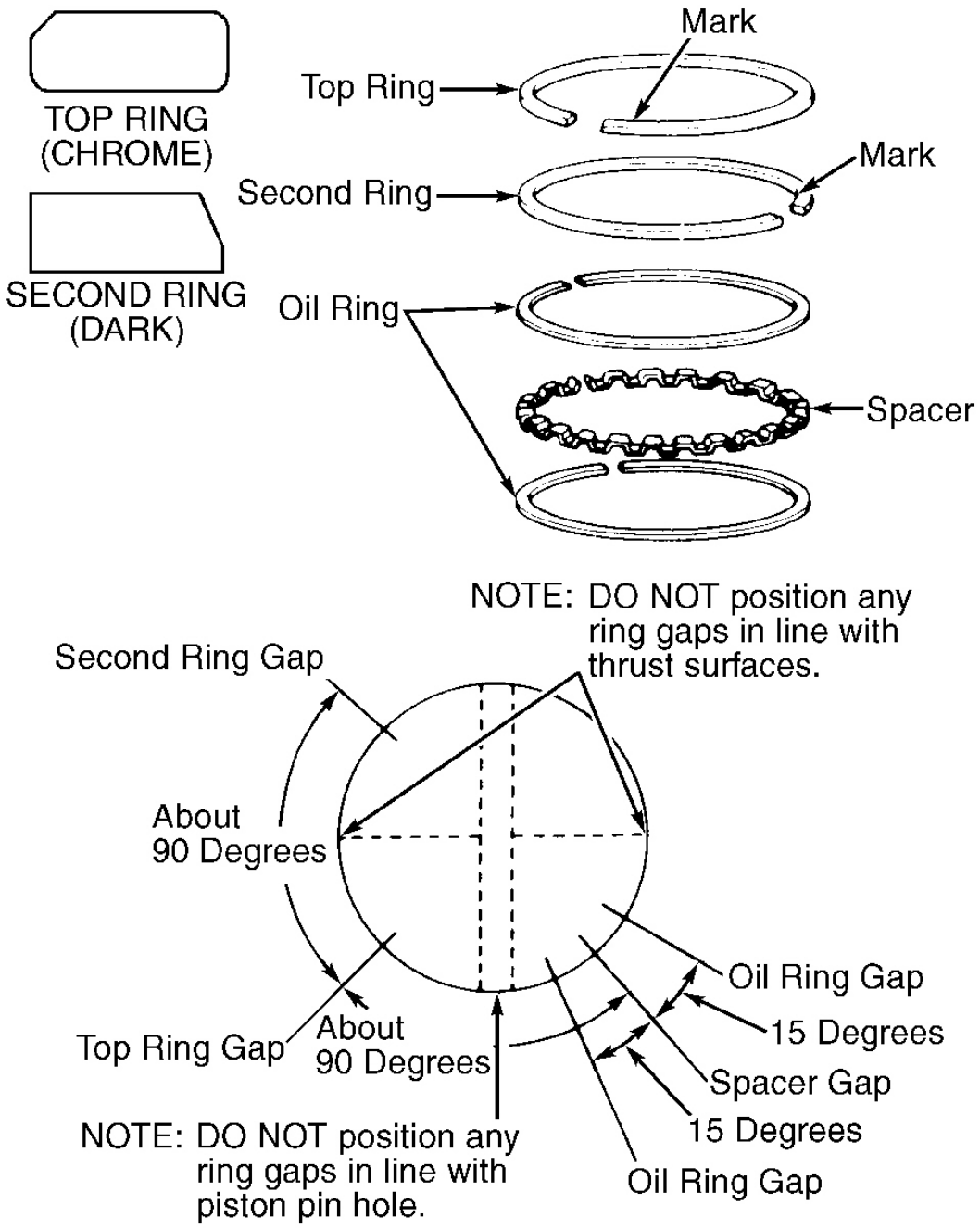
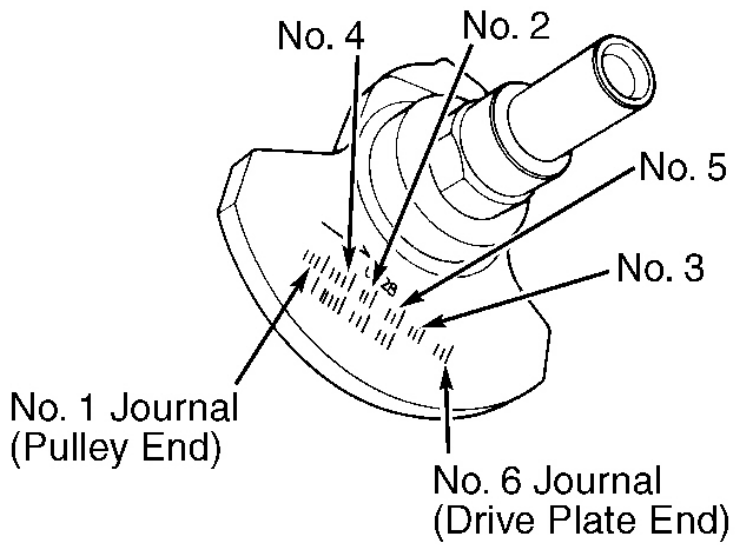


Fig. 21: Installing Piston Rings
Courtesy of AMERICAN HONDA MOTOR CO., INC.

Rod Bearings

1. Measure oil clearance using Plastigage. Tighten bearing cap to 33 ft. lbs. (44 N.m). If oil clearance is not within specification, install a new bearing set (same color code) and recheck oil clearance. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS. DO NOT shim or file cap to adjust oil clearance.
2. If oil clearance is still incorrect, try next larger or smaller bearing and measure oil clearance again. If proper oil clearance cannot be obtained using different size bearings, replace crankshaft and repeat procedure.

NOTE: A number code, indicating connecting bore, is stamped on side of each connecting rod and cap. Connecting rod journal diameter codes (letters) are stamped on front crankshaft counterweight pad. See Fig. 22. Use both codes when ordering replacement bearings.



Color Code Is On Edge Of Bearing

→ Larger Big End Bore

1 or I	2 or II	3 or III	4 or IIII

→ Small Bearing (Thicker)

Smaller Rod Journal

A or I	Pink	Pink Yellow	Yellow	Yellow Green
B or II	Pink Yellow	Yellow	Yellow Green	Green
C or III	Yellow	Yellow Green	Green	Green Brown
D or IIII	Yellow Green	Green	Green Brown	Brown
E or IIIII	Green	Green Brown	Brown	Brown Black
F or IIIIII	Green Brown	Brown	Brown Black	Black

Smaller Bearing (Thicker)

NOTE: On bearing sets with 2 colors, such as Green/Brown, it does not matter which color is in top or bottom as long as set has one of each bearing.

G92D00068

Fig. 22: Connecting Rod Journal & Bearing Identification Codes
Courtesy of AMERICAN HONDA MOTOR CO., INC.

Crankshaft & Main Bearings

1. Mark connecting rod and main bearing caps for identification. Remove all connecting rod caps and bearings. Remove main bearing caps and bearing halves. Lift crankshaft from block. DO NOT damage journals.
2. Using a lathe or "V" blocks to support crankshaft, measure crankshaft runout. Measure out-of-round and taper. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS. If any measurement exceeds service limit, replace crankshaft.
3. Install crankshaft into block. Measure main bearing oil clearance using Plastigage. If engine is in vehicle, support counterweights and measure only one bearing at a time. Tighten main bearing cap bolts in sequence to specification. See **Fig. 23**. See **TORQUE SPECIFICATIONS**.
4. If oil clearance is not within specification, install a new bearing set (same color code) and re-measure oil clearance. DO NOT file or shim bearing to adjust clearance. If oil clearance is still incorrect, try next larger or smaller bearing. If specified oil clearance cannot be obtained by using different size bearings, replace crankshaft and repeat procedure.

NOTE: A letter code, indicating main journal bore diameters, is stamped on cylinder block. Main journal diameter codes (numbers) are stamped on front crankshaft counterweight pad. See Fig. 24. Use both codes when ordering replacement bearings.

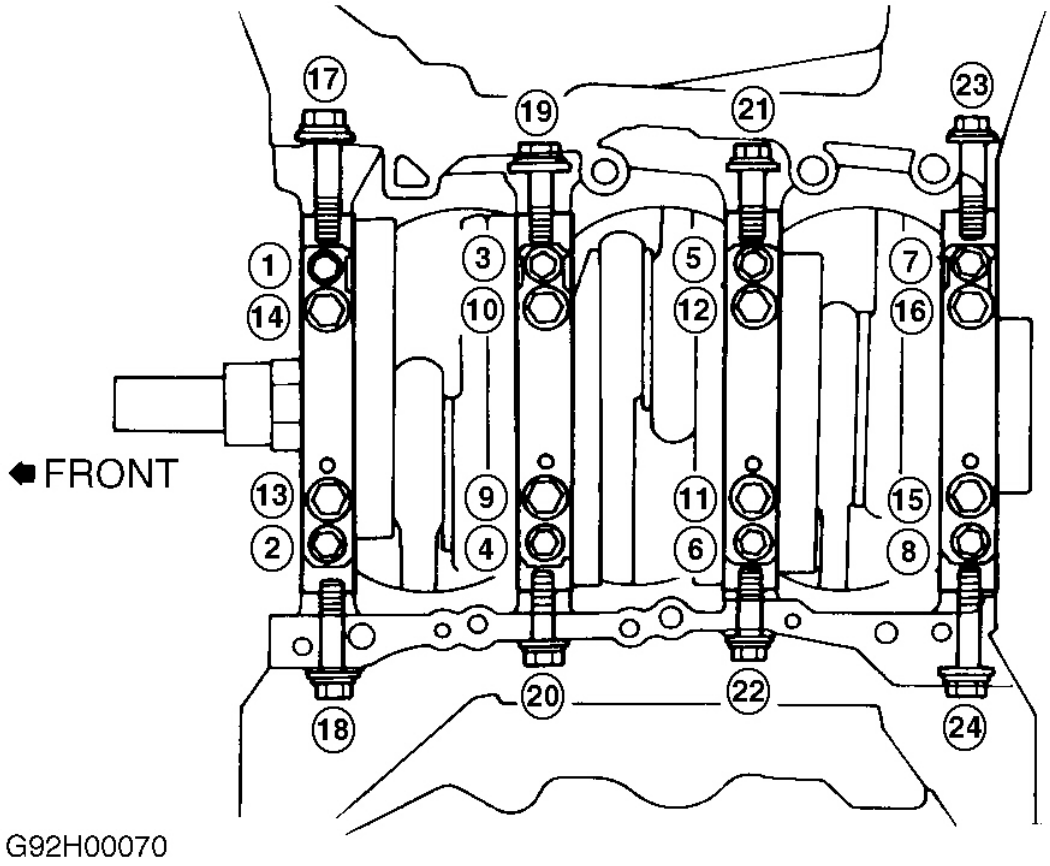


Fig. 23: Crankshaft Main Bearing Cap Bolt Tightening Sequence
Courtesy of AMERICAN HONDA MOTOR CO., INC.

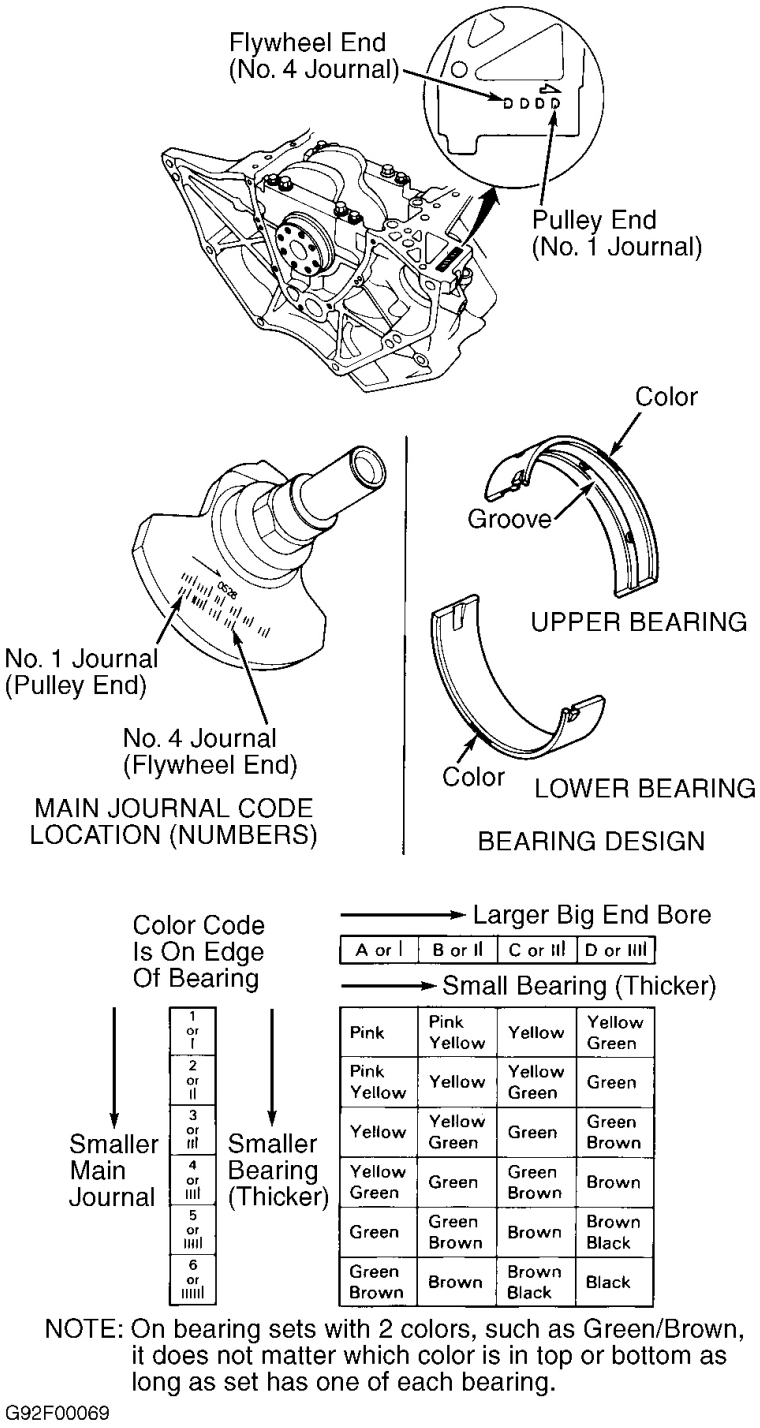


Fig. 24: Identifying Crankshaft Main Journal & Bearing Codes
Courtesy of AMERICAN HONDA MOTOR CO., INC.

Thrust Bearing

1. Measure crankshaft end play with a dial indicator. If end play exceeds specification, inspect thrust washers and thrust surface of crankshaft. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS. Crankshaft thrust washers are located at No. 4 main bearing journal.
2. Replace worn parts as necessary. Thrust washer thickness is fixed. DO NOT change thrust washer thickness by grinding or shimming. Install thrust washers with grooved side facing out.

Cylinder Block

1. Measure cylinder bore taper. If taper exceeds specification, re-bore cylinder for oversize pistons. See **CYLINDER BLOCK** table under ENGINE SPECIFICATIONS. If any cylinder bore exceeds oversize bore limit, replace cylinder block.
2. Cylinders can be bored for 0.010" (0.25 mm) and 0.020" (0.50 mm) oversize. Maximum re-boring is 0.020" (0.50 mm). Check piston-to-cylinder bore clearance after re-boring. See **FITTING PISTONS** procedure.
3. Using feeler gauge and straightedge, measure cylinder block deck warpage. Replace cylinder block if warped beyond service limit. See **CYLINDER BLOCK** table under ENGINE SPECIFICATIONS.
4. If reusing cylinder block, hone cylinders to 60-degree crosshatch pattern. After honing, re-measure cylinder bores. Wash cylinder bore with hot soapy water. Air-dry cylinder bore, and apply engine oil to prevent rusting.

ENGINE OILING

ENGINE LUBRICATION SYSTEM

Oil pump draws oil from oil pan and delivers it under pressure to main and connecting rod bearings. An oil hole in each connecting rod supplies oil to thrust side of piston and cylinder wall. An oil passage carries oil to camshaft and rocker arms. Oil spray lubricates valve stems.

Oil Pressure

Minimum oil pressure with engine at idle should be 10 psi (0.7 kg/cm^2). Minimum oil pressure at 3000 RPM should be 50 psi (3.5 kg/cm^2).

OIL PUMP

IMPORTANT: To remove the oil pump, the engine MUST be removed from the vehicle and separated from the transmission. See ENGINE.

Removal & Disassembly

Raise and support vehicle. Remove balancer and timing belt. See **TIMING & BALANCER BELT** under REMOVAL & INSTALLATION. Remove balancer gear case assembly. Remove balancer shaft rear cover. Remove rear balancer weight. Pull out balancer shaft, then remove balancer shaft holder. Remove oil pan. See **OIL PAN** under REMOVAL & INSTALLATION. Remove oil pump assembly. See **Fig. 25**.

Inspection

Measure inner-to-outer rotor clearance. Measure housing-to-rotor axial clearance. Measure housing-to-outer rotor clearance. Replace components if not within specification. See **OIL PUMP SPECIFICATIONS** table. Inspect both rotors and pump housing for scoring or other damage and replace if necessary.

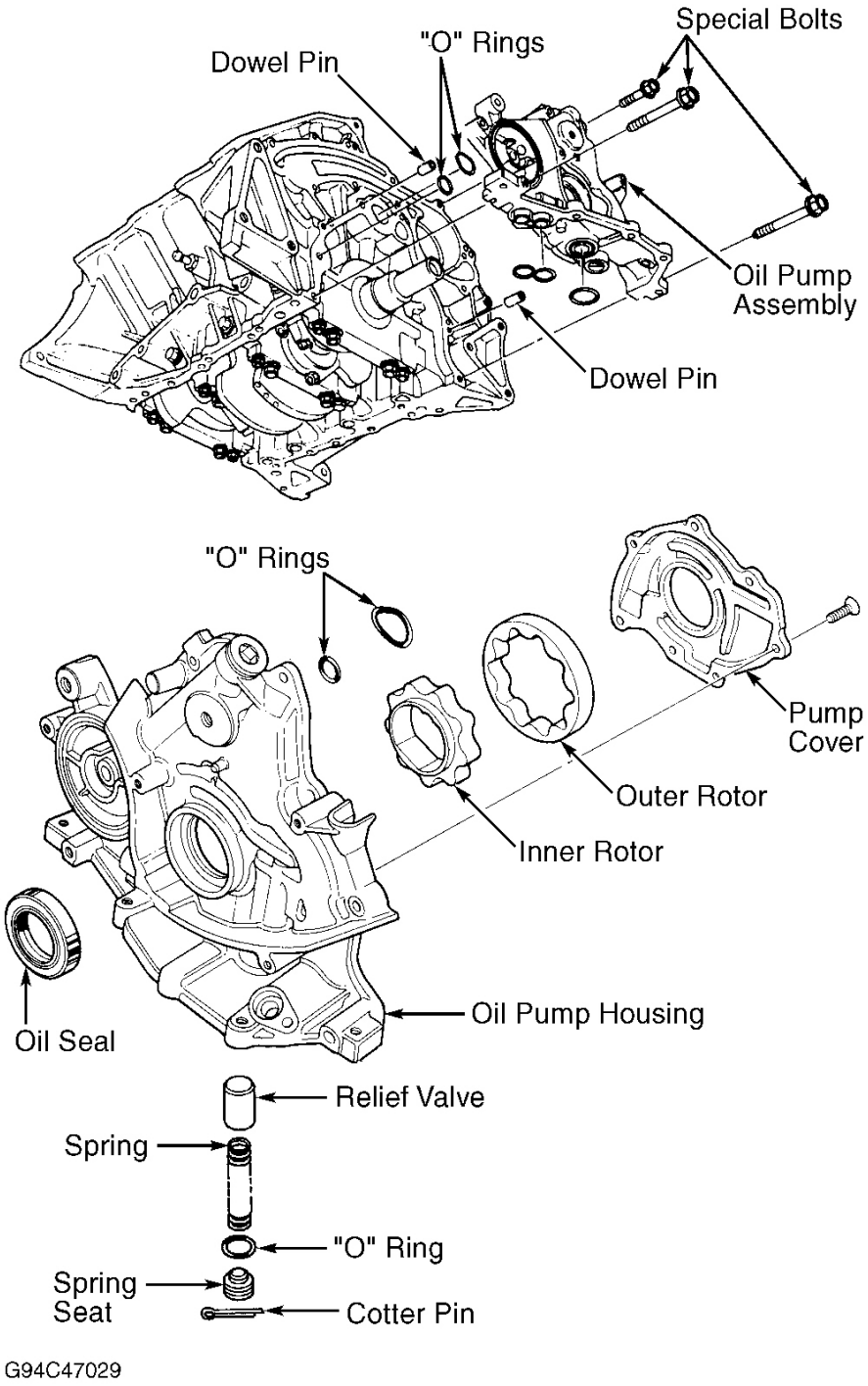


Fig. 25: Exploded View Of Oil Pump Assembly
Courtesy of AMERICAN HONDA MOTOR CO., INC.

OIL PUMP SPECIFICATIONS

Application	In. (mm)
Inner Rotor-To-Outer Rotor Clearance	
Standard (New)	0.001-0.006 (0.02-0.16)
Service Limit	0.008 (0.20)
Housing-To-Rotor Axial Clearance	
Standard (New)	0.001-0.003 (0.02-0.07)
Service Limit	0.005 (0.12)
Housing-To-Outer Rotor Clearance	
Standard (New)	0.004-0.007 (0.10-0.18)
Service Limit	0.008 (0.20)

Reassembly & Installation

1. Lightly coat crankshaft and lip of NEW seal with engine oil. Using Seal Driver (07749-0010000) and Attachment (07746-0010500), install oil seal. Ensure seal is fully seated into oil pump housing.
2. Reassemble oil pump. Apply Liquid Gasket Sealer (08718-0001) to pump housing screws. Ensure oil pump turns freely. Install dowel pins and NEW "O" rings into cylinder block. Clean oil pump and engine mating surfaces.
3. Apply liquid gasket sealer to oil pump and cylinder block mating surface. Apply sealer to bolt hole threads. Install oil pump before sealant dries. Install oil pan and balancer shaft. See **OIL PAN** under REMOVAL & INSTALLATION. Install balancer and timing belts. See **TIMING & BALANCER BELT** under REMOVAL & INSTALLATION. Wait at least 30 minutes before filling crankcase with oil. To complete installation, reverse removal procedure.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
A/C Compressor Mounting Bolts	16 (22)
Balance Shaft	
Belt Tension Adjuster Bolt	32 (44)
Rear Weight Bolt	18 (25)
Sealing Bolt (1)	15 (20)
Bracket-To-Engine Bolts	
Engine Stiffener Bolts	
8 x 1.25 mm	16 (22)
12 x 1.25 mm	55 (74)
Left Engine Mount Bracket Bolts	(54)
Left Front Mount Bracket Bolts	
8 x 1.25 mm	16 (22)
10 x 1.25 mm	32 (44)
Power Steering Pump Bracket Bolt	32 (44)

Right Engine Mount Bracket Bolts	
10 x 1.25 mm	28 (38)
12 x 1.25 mm	47 (64)
Right Front Mount Bracket Bolts	32 (44)
Engine Hanger Bolt	32 (44)
Camshaft Bearing Cap Bolts (2)	
6-mm Bolts	(3)
8-mm Bolts	16 (22)
Camshaft Pulley Bolts	23 (31)
Connecting Rod Cap Nuts	32 (44)
Crankshaft Pulley Bolt	181 (245)
Cylinder Head Bolts (4)	56 (76)
Differential-To-Oil Pan Bolts	47 (64)
Engine Block-To-Transmission Housing Bolts	47 (64)
Exhaust Manifold	
Self-Locking Nuts (5)	22 (30)
Cover Bolts	16 (22)
Exhaust Pipe Flange Nuts	40 (54)
Drain Bolt	32 (44)
Drive Plate Bolts (6)	55 (74)
Engine Oil Pressure Switch	13 (18)
Flexplate-To-Torque Converter Bolts	16 (22)
Fuel Feed Hose Bolt	20 (27)
Fuel Pressure Regulator	21 (29)
Genernator	
Lock Bolt	16 (22)
Mounting Bolt	32 (44)
Idle Air Control Valve Bolt	16 (22)
Idler Pulley	
Bracket Bolt	16 (22)
Center Nut	32 (44)
Intake Manifold Bolts/Nuts	16 (22)
Left & Right Engine Mount Nuts	47 (64)
Lower Plate-To-Rear Beam Bolts	28 (38)
Main Bearing Cap Bolts (7)	
9 x 1.25 mm	29 (39)
10 x 1.25 mm (Side Bolts)	36 (49)
11 x 1.50 mm	56 (76)
Oil Pan Bolts (8)	16 (22)
Oil Pump Housing Bolts	

6 x 1.00 mm	(3)
8 x 1.25 mm	16 (22)
Power Steering Pump	
Lock Nut	16 (22)
Mounting Bolt	32 (44)
Strut Brace Bolts/Nuts (Engine Compartment)	16 (22)
TCS Control Valve Bracket Bolts	
Lower Bracket	16 (22)
Upper Bracket	(3)
Thermostat Housing-To-Water Pump Bolt	16 (22)
Throttle Body Bolts & Nuts	16 (22)
Timing Belt Tension Adjuster Bolt	31 (42)
Transmission Beam Bolts (9)	28 (38)
Transmission Mount Bolt	40 (54)
Transmission Mount Bracket Bolts	28 (38)
Water Pump Bolts	
6 x 1.00 mm	(3)
8 x 1.25 mm	16 (22)
	INCH Lbs. (N.m)
Air Cleaner Housing Bolts	106 (12)
Balance Shaft	
Battery Brace Bolts	106 (12)
Front Gear Case Bolts	106 (12)
Rear Cover Bolt	106 (12)
Coolant Bleed Bolt	89 (10)
Coolant Passage Manifold Bolts	106 (12)
Crankshaft Baffle Plate Bolts	106 (12)
Crankshaft Position Sensor Bolt	106 (12)
Crankshaft Rear Seal Cover Bolts	106 (12)
Dipstick Bolt	106 (12)
EGR Pipe Bolts/Nuts	106 (12)
Electrical & Vacuum Harness Bracket Bolts	106 (12)
Engine Coolant Temperature Gauge Sender	80 (9)
Engine Cover Bolts/Nuts	89 (10)
Exhaust Pipe Heat Shield Bolts	89 (10)
Fan Shroud Bolt	80 (9)
Fuel Filter Service Bolt	106 (12)
Ignition Coil Bolts	106 (12)
Oil Breather Cover Bolts	106 (12)
Oil Screen Bolts	106 (12)

Shift Cable Cover Bolts	106 (12)
Shift Cable Holder Bolts	106 (12)
Splash Shield	89 (10)
Radiator Upper Bracket Bolts	89 (10)
Thermostat Cover Bolts	106 (12)
Throttle Cover Bolts	106 (12)
Timing Belt Cover Bolts	106 (12)
Torque Converter Cover Bolts	106 (12)
Valve Cover Nuts	106 (12)
VSS/Power Steering Speed Sensor Bolt	106 (12)

(1) Use NEW sealing bolt washer.

(2) Tighten bolts 2 turns at a time in sequence. See **Fig. 26**.

(3) Tighten to 106 INCH lbs. (12 N.m).

(4) Tighten in sequence, in 2-3 steps. See **Fig. 27**.

(5) Use NEW nuts only.

(6) Tighten in a crisscross pattern.

(7) Tighten in sequence. See **Fig. 28**.

(8) Tighten in sequence. See **Fig. 29**.

(9) Tighten in sequence. See **Fig. 30**.

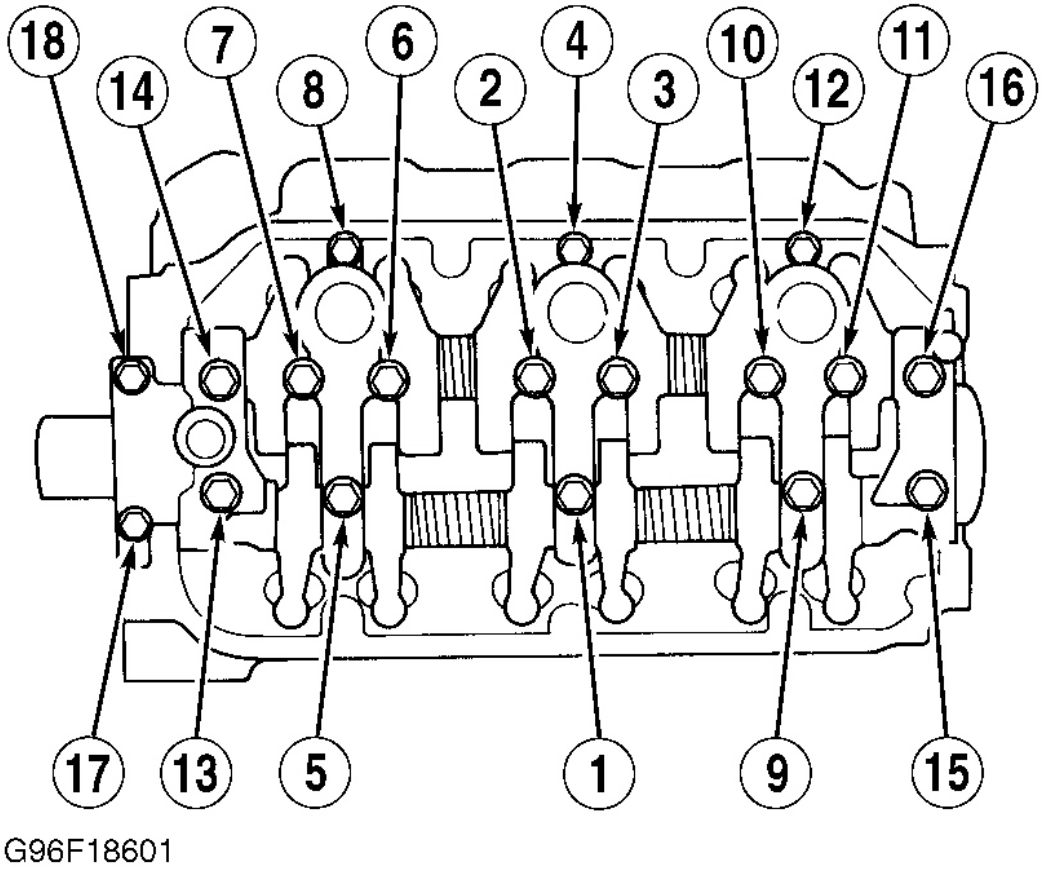


Fig. 26: Camshaft Bearing Cap Bolt Tightening Sequence
Courtesy of AMERICAN HONDA MOTOR CO., INC.

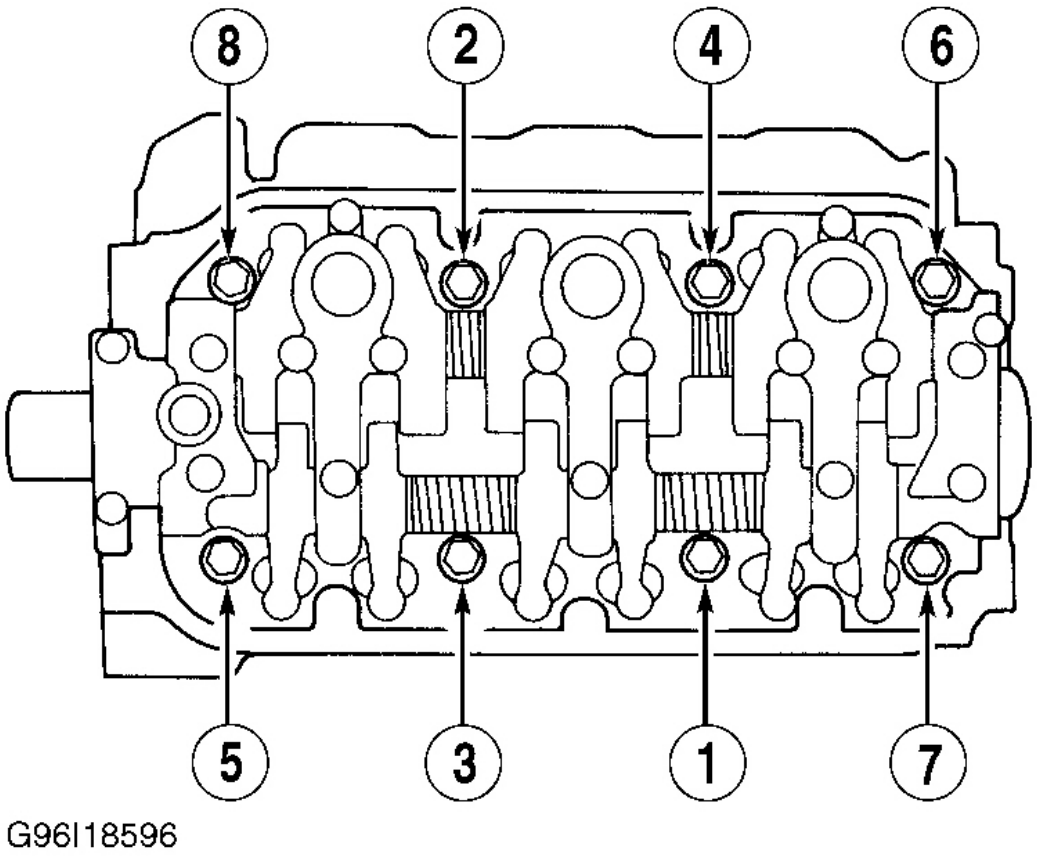


Fig. 27: Cylinder Head Bolt Tightening Sequence
Courtesy of AMERICAN HONDA MOTOR CO., INC.

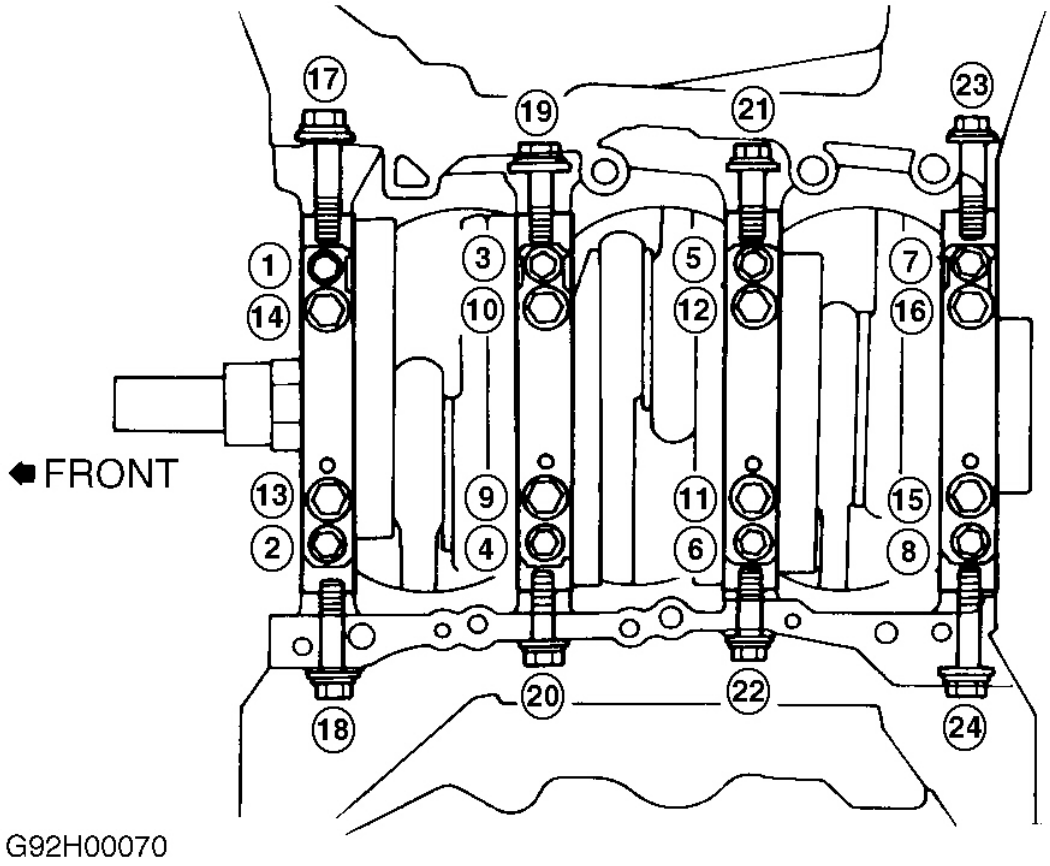


Fig. 28: Crankshaft Main Bearing Cap Bolt Tightening Sequence
Courtesy of AMERICAN HONDA MOTOR CO., INC.

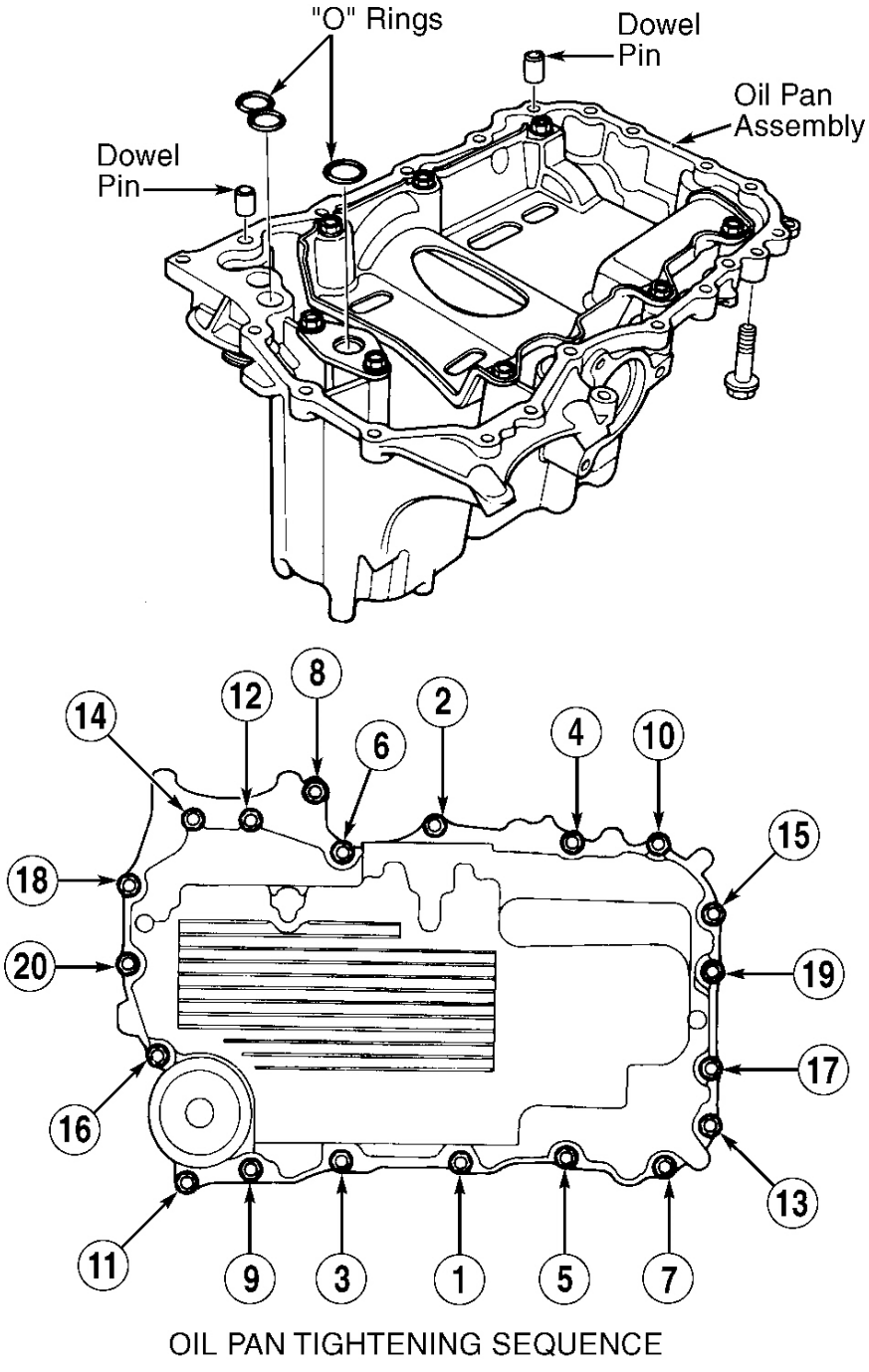


Fig. 29: Oil Pan Bolt Tightening Sequence
Courtesy of AMERICAN HONDA MOTOR CO., INC.

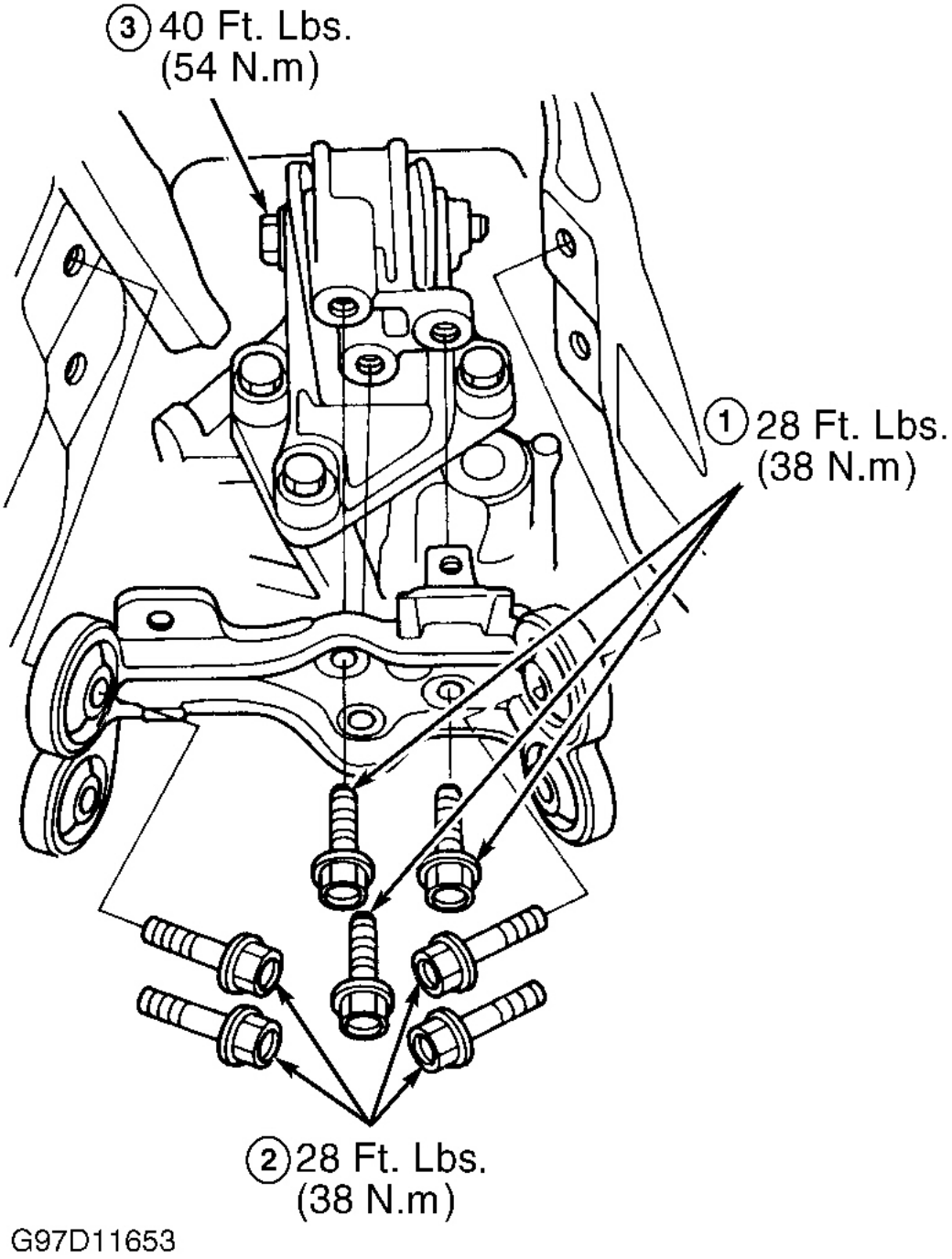


Fig. 30: Transmission Beam Tightening Sequence
Courtesy of AMERICAN HONDA MOTOR CO., INC.

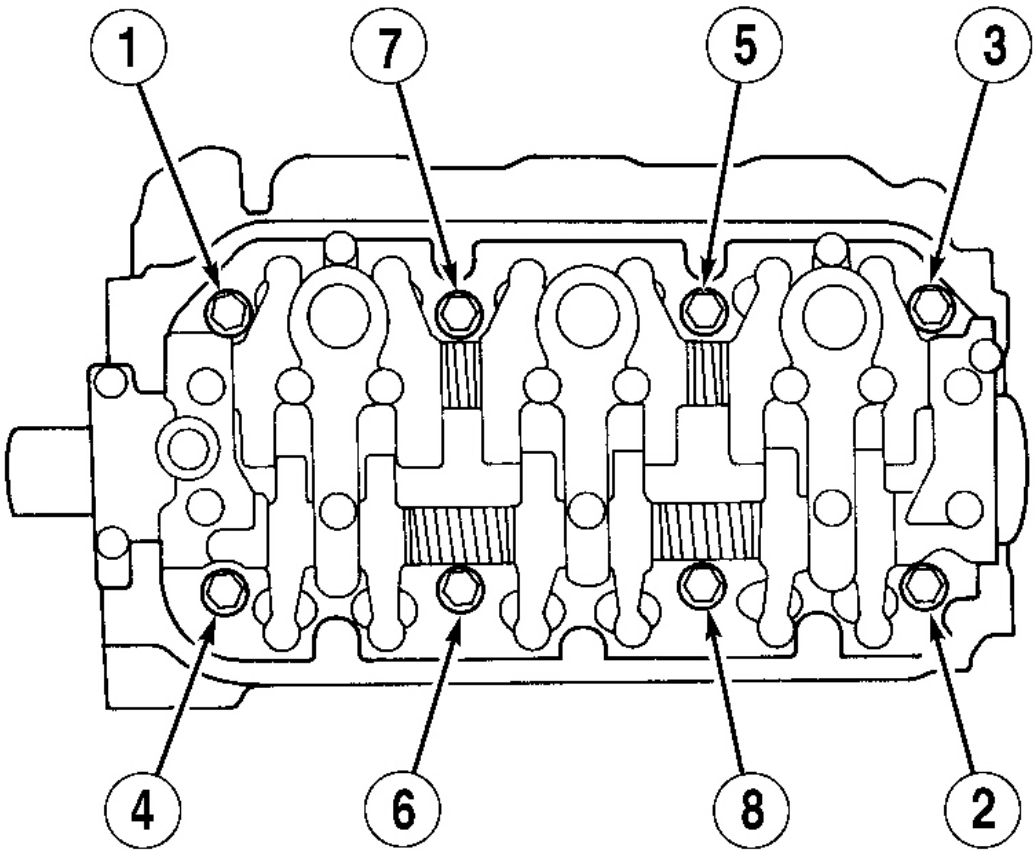


Fig. 31: Cylinder Head Bolt Removal Sequence
Courtesy of AMERICAN HONDA MOTOR CO., INC.

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Application	Specification
Displacement	211 Cu. In. (3.5L)
Bore	3.54" (90 mm)
Stroke	3.58" (91 mm)
Compression Ratio	9.6:1
Fuel System	PGM-FI

CRANKSHAFT, MAIN BEARINGS & CONNECTING ROD BEARINGS SPECIFICATIONS

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS

Application	In. (mm)
Crankshaft	
End Play	
Standard	0.004-0.011 (0.10-0.29)
Service Limit	0.018 (0.45)
Journal Out-Of-Round	
Standard	0.0002 (0.005)
Service Limit	0.0004 (0.010)
Journal Taper	
Standard	0.0002 (0.005)
Service Limit	0.0004 (0.010)
Runout	
Standard	0.0008 (0.020)
Service Limit	0.0012 (0.030)
Main Bearings	
Journal Diameter	2.6762-2.6772 (67.976-68.000)
Oil Clearance	
Standard	0.0008-0.0017 (0.020-0.044)
Service Limit	0.002 (0.05)
Connecting Rod Bearings	
Journal Diameter	2.1248-2.1257 (53.970-53.994)
Oil Clearance	
Standard	0.0009-0.0018 (0.022-0.046)
Service Limit	0.002 (0.05)

CONNECTING RODS SPECIFICATIONS

CONNECTING RODS

Application	In. (mm)
Bore Diameter	
Crank Pin Bore	2.24 (57.0)
Rod Pin Bore	0.8650-0.8652 (21.970-21.976)
End Play	
Standard	0.006-0.012 (0.15-0.30)
Service Limit	0.016 (0.40)

PISTONS, PISTON PINS & PISTON RINGS SPECIFICATIONS

PISTONS, PINS & RINGS

Application	In. (mm)
Pistons	
Clearance	
Standard	0.001-0.002 (0.02-0.04)
Service Limit	0.003 (0.08)
Diameter	
Standard (1)	
"A" Or No Marking Piston	3.5425-3.5429 (89.980-89.990)
Service Limit	3.5421 (89.970)
"B" Piston	3.5421-3.5425 (89.970-89.980)
Service Limit	3.5417 (89.960)
Oversize	
.010" (0.25 mm)	3.5524-3.5527 (90.230-90.240)
.020" (0.50 mm)	3.5622-3.5626 (90.480-90.490)
Piston Pins	
Diameter	
Standard	0.8646-0.8648 (21.961-21.965)
Service Limit	0.8643 (21.953)
Pin-To-Piston Clearance	-0.0002-0.0001 (-0.005-0.002)
Rod Interference Fit	
Standard	0.0002-0.0006 (0.005-0.015)
Service Limit	0.0008 (0.020)
Rings	
No. 1	
End Gap	
Standard	0.010-0.016 (0.25-0.40)
Service Limit	0.028 (0.70)
Side Clearance	0.0022-0.0031 (0.055-0.080)
Service Limit	0.005 (0.13)
No. 2	
End Gap	
Standard	0.016-0.022 (0.40-0.55)
Service Limit	0.033 (0.85)
Side Clearance	0.0012-0.0022 (0.030-0.055)
Service Limit	0.005 (0.13)
No. 3 (Oil)	
End Gap	
Standard (2)	0.008-0.028 (0.20-0.70)

Standard (3)	0.008-0.020 (0.20-0.50)
Service Limit	0.031 (0.80)

(1) Piston identification letter is located on top of piston.

(2) RIKEN manufactured piston ring.

(3) TEIKOKU manufactured piston ring.

CYLINDER BLOCK SPECIFICATIONS

CYLINDER BLOCK

Application	In. (mm)
Cylinder Bore	
Standard (1)	
"A" Cylinder	3.5437-3.5441 (90.010-90.020)
Service Limit	3.5461 (90.070)
"B" Cylinder	3.5433-3.5437 (90.000-90.010)
Service Limit	3.5461 (90.070)
Oversize	
.010" (0.25 mm)	3.5531-3.5539 (90.250-90.270)
.020" (0.50 mm)	3.5630-3.5638 (90.500-90.520)
Maximum Taper	0.002 (0.05)
Maximum Rebore Limit	0.02 (0.5)
Deck Warpage	
Standard	0.003 (0.08)
Service Limit	0.004 (0.10)

(1) Cylinder bore identification letter is located on top of cylinder.

ENGINE VALVES & VALVE SPRINGS SPECIFICATIONS

VALVES & VALVE SPRINGS

Application	Specification
Intake Valves	
Face Angle	45°
Head Diameter	1.295-1.303" (32.90-33.10 mm)
Margin	
Standard	0.033-0.045" (0.85-1.15 mm)
Service Limit	0.026" (0.65 mm)
Stem Diameter	
Standard	0.2157-0.2161" (5.480-5.490 mm)
Service Limit	0.215" (5.45 mm)
Valve Length	4.472-4.483" (113.58-113.88 mm)

Valve Stem Installed Height	
Standard	1.8478-1.8671" (46.935-47.425 mm)
Service Limit	1.8750" (47.625 mm)
Exhaust Valves	
Face Angle	45°
Head Diameter	1.098-1.106" (27.90-28.10 mm)
Margin	
Standard	0.053-0.065" (1.35-1.65 mm)
Service Limit	0.045" (1.15 mm)
Stem Diameter	
Standard	0.2146-0.2150" (5.450-5.460 mm)
Service Limit	0.213" (5.42 mm)
Valve Length	4.568-4.580" (116.03-116.33 mm)
Valve Stem Installed Height	
Standard	1.8852-1.9045" (47.885-48.375 mm)
Service Limit	1.9124" (48.575 mm)
Valve Springs Free Length	
Intake	
NH (1)	2.018" (51.25 mm)
CH (2)	2.022" (51.35 mm)
Exhaust	
NH (1)	2.210" (56.13 mm)
CH (2)	2.208" (56.09 mm)
(1) NIHON HATSUJO manufactured valve spring.	
(2) CHUO HATSUJO manufactured valve spring.	

CYLINDER HEAD SPECIFICATIONS

CYLINDER HEAD

Application	Specification
Cylinder Head Height	3.935-3.939" (99.95-100.05 mm)
Maximum Warpage (1)	0.002" (0.05 mm)
Valve Seats	
Intake & Exhaust	
Seat Angle	45°
Seat Width	
Intake	
Standard	0.031-0.039" (0.80-1.00 mm)
Service Limit	0.060" (1.50 mm)
Exhaust	

Standard	0.049-0.061" (1.25-1.55 mm)
Service Limit	0.080" (2.00 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	0.620-0.640" (15.75-16.25 mm)
Valve Stem-To-Guide Oil Clearance	
Intake	
Standard	0.001-0.002" (0.02-0.05 mm)
Service Limit	0.003" (0.08 mm)
Exhaust	
Standard	0.002-0.003" (0.05-0.08 mm)
Service Limit	0.004" (0.11 mm)
(1) Maximum resurface limit is 0.008" (0.20 mm).	

CAMSHAFT SPECIFICATIONS

CAMSHAFT

Application	**In. (mm)**
End Play	
Standard	0.002-0.006 (0.05-0.15)
Service Limit	0.006 (0.15)
Journal Runout	
Standard	0.001 (0.03)
Service Limit	0.002 (0.05)
Lobe Height	
Intake	1.5817 (40.175)
Exhaust	1.4913 (37.878)
Oil Clearance	
Standard	0.0020-0.0035 (0.05-0.09)
Service Limit	0.004 (0.10)