ARTICLE BEGINNING

1993 HONDA ENGINES
2.2L & 2.3L 4-Cylinder

Prelude

*** PLEASE READ THIS FIRST ***

NOTE: For engine repair procedures not covered in this article, see ENGINE OVERHAUL PROCEDURES - GENERAL INFORMATIONarticle in the GENERAL INFORMATION section.

ENGINE IDENTIFICATION

Engine serial number is located on exhaust side of engine block, near bellhousing. The first 5 characters of engine serial number are for engine identification. See ENGINE IDENTIFICATION CODE table.

ENGINE IDENTIFICATION CODES TABLE

Application	Engine Code
Prelude	
2.2L 4-Cylinder	
SOHC	**F22A1**
DOHC (VTEC)	**H22A1**
2.3L 4-Cylinder DOHC	**H23A1**

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

CAUTION: Always rotate engine in direction of normal rotation (counterclockwise as viewed from front of engine). Clockwise rotation may cause timing belt to slip.

2.2L SOHC

1) Adjust valves when engine temperature is 100°F (38°C) or less. Remove valve cover. Rotate crankshaft counterclockwise until No. 1 piston is at TDC of compression stroke. UP mark on camshaft pulley will be at top. See Fig. 1. Align grooves on camshaft pulley with top surface of cylinder head. Distributor rotor should point toward No. 1 spark plug wire.

2) Adjust clearance for valves on No. 1 cylinder to specification. Loosen lock nut. Turn adjuster screw until clearance is as specified. See VALVE CLEARANCE SPECIFICATIONS table. Tighten lock nut.

3) Rotate crankshaft 180 degrees counterclockwise (camshaft pulley will turn 90 degrees). UP mark on camshaft pulley will be on exhaust side of engine. Adjust clearance on valves for No. 3 cylinder.

4) Rotate crankshaft 180 degrees counterclockwise. Grooves on camshaft pulley will align with cylinder head surface, and UP mark will face downward. Adjust clearance on valves for No. 4 cylinder.

5) Rotate crankshaft 180 degrees counterclockwise. UP mark on camshaft pulley will be on intake side. Adjust clearance on valves for No. 2 cylinder. Tighten crankshaft pulley bolt to specification if it loosened during adjustment procedure.

6) Apply nonhardening sealant to rounded surfaces of front and rear camshaft caps before installing valve cover gasket. Install valve cover. Tighten nuts to specification. See TORQUE SPECIFICATIONS TABLE at the end of this article.

VALVE CLEARANCE SPECIFICATIONS TABLE

Application	In. (mm)
2.2L	
DOHC	
Intake Valves	**.006-.007 (.15-.19)**
Exhaust Valves	**.007-.008 (.17-.21)**
SOHC	
Intake Valves	**.009-.011 (.23-.28)**
Exhaust Valves	**.011-.012 (.27-.30)**
2.3L	
Intake Valves	**.004-.005 (.09-.13)**
Exhaust Valves	**.006-.007 (.15-.19)**

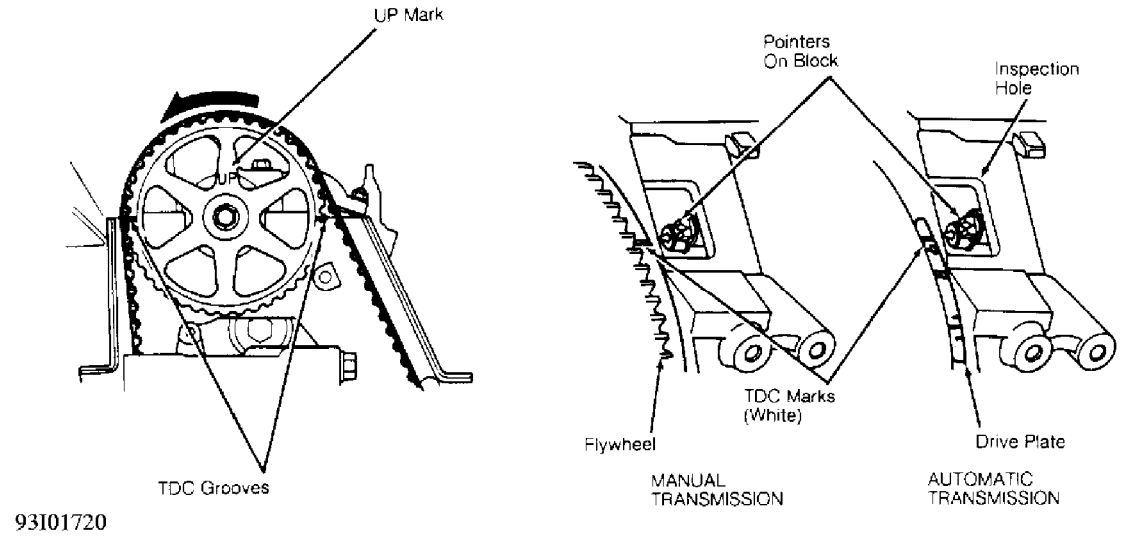

Fig. 1: Positioning Camshaft Sprocket For Valve Adjustment (2.2L SOHC)
Courtesy of American Honda Motor Co., Inc.

2.2L DOHC & 2.3L

1) Adjust valves when engine temperature is 100F (38oC) or less. Remove valve cover. Rotate crankshaft counterclockwise until No. 1 piston is at TDC of compression stroke.

2) Ensure UP marks on camshaft sprockets are at top, and TDC grooves on sprockets are aligned with cylinder head surface. See Fig. 2. Adjust clearance on valves for No. 1 cylinder. Loosen lock nut. Turn adjuster screw until clearance is as specified. See VALVE CLEARANCE SPECIFICATIONS table.

3) Rotate crankshaft 180 degrees counterclockwise (camshaft sprockets turn 90 degrees) until No. 3 piston is at TDC of compression stroke. The UP marks will be on exhaust side. Adjust clearance on valves for No. 3 cylinder.

4) Rotate crankshaft 180 degrees counterclockwise so No. 4 piston is at TDC of compression stroke. UP marks will be at the bottom. Adjust clearance on valves for No. 4 cylinder.

5) Rotate crankshaft 180 degrees counterclockwise so No. 2 piston is at TDC of compression stroke. UP marks will be on intake side. Adjust clearances on valves for No. 2 cylinder.

6) Tighten crankshaft pulley bolt if necessary. See TORQUE SPECIFICATIONS TABLE at the end of this article. Apply nonhardening sealant to rounded surfaces of front and rear camshaft caps before installing valve cover gasket. Install valve cover. Tighten nuts to specification.

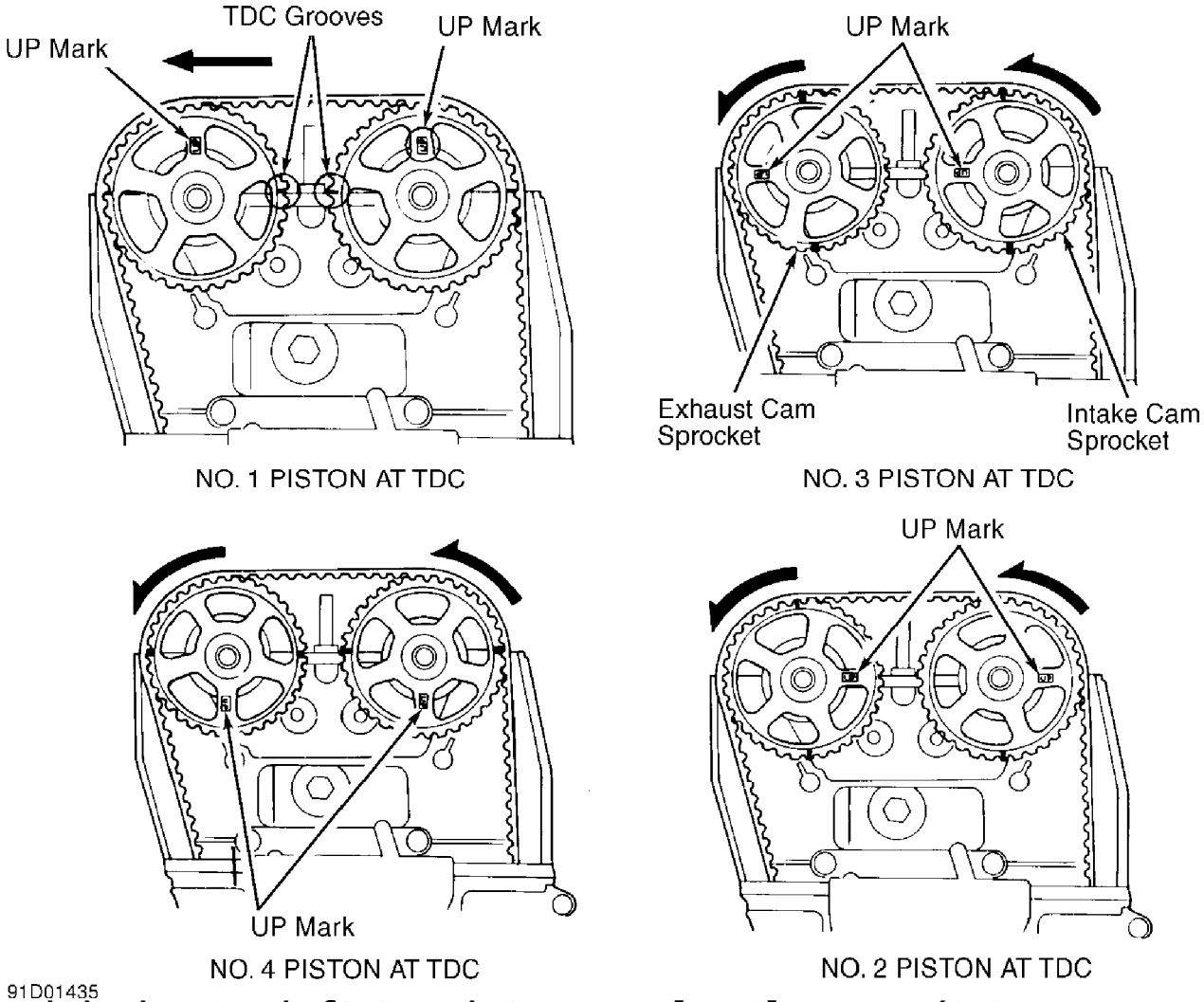

Fig. 2: Positioning Camshaft Sprockets For Valve Clearance (2.2L DOHC & 2.3L)
Courtesy of American Honda Motor Co., Inc.

TIMING BELT ADJUSTMENT

CAUTION: Always adjust timing belt tension with engine cold.

1) Rotate crankshaft counterclockwise until No. 1 piston is at TDC of compression stroke. See Fig. 1. Loosen, but do not remove, timing belt adjuster nut. See Fig. 3. Rotate crankshaft counterclockwise 3 teeth on camshaft pulley to create tension on timing belt.

2) Tighten adjuster bolt. Retighten crankshaft pulley bolt if it loosened while turning crankshaft. See TORQUE SPECIFICATIONS TABLE at the end of this article.

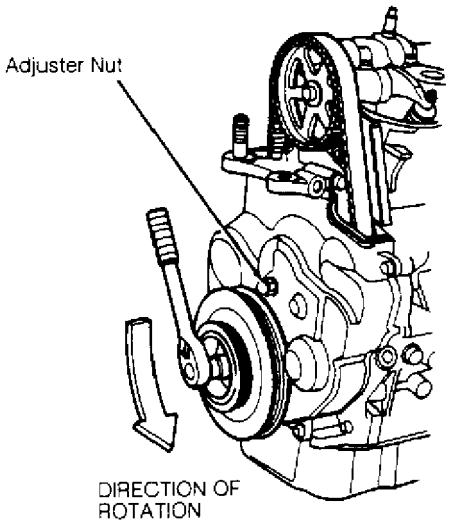

Fig. 3: Locating Timing Belt Adjuster Nut (Typical)
Courtesy of American Honda Motor Co., Inc.

REMOVAL & INSTALLATION

NOTE: For reassembly reference, label all electrical connectors, vacuum hoses, and fuel lines before removal. Also place mating marks on other major assemblies before removal.

NOTE: Radio/cassette or radio/CD player may be equipped with an anti-theft protection circuit. Whenever battery is disconnected, radio will go into anti-theft mode. When battery is reconnected, radio will display CODE, and will be inoperative until proper code number is entered. Obtain code number before disconnecting battery.

FUEL PRESSURE RELEASE

CAUTION: Fuel system is under pressure. Release pressure before servicing fuel system components.

Remove fuel tank filler cap. Place a shop towel on top of fuel filter. Slowly loosen fuel injection service bolt to release fuel injection system pressure. See Fig. 4.

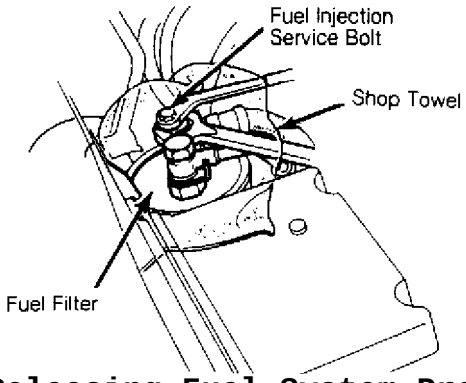

Fig. 4: Releasing Fuel System Pressure
Courtesy of American Honda Motor Co., Inc.

COOLING SYSTEM BLEEDING

1) Set heater controls to maximum heat. Fill cooling system with a 50/50 mixture of coolant and water to bottom of filler neck. Loosen bleed bolt, located on thermostat housing.

2) Tighten bleed bolt when coolant flows from bleed bolt in steady stream without bubbles. With radiator cap off, start and operate engine to normal operating temperature (fan comes on at least twice). Add coolant as necessary. Install radiator cap.

ENGINE

Removal

1) Disconnect battery cables. Remove battery and tray. Secure hood as far open as possible. Raise and support vehicle. Remove front wheels and splash shield. Drain engine oil, transaxle fluid, and coolant.

2) Lower vehicle. Remove air intake duct. Remove secondary Pulsed Air (PAIR) injection vacuum tank and bracket (if equipped). Remove battery, battery tray, battery cable, and starter cable. Release fuel pressure. See FUEL PRESSURE RELEASE. Disconnect fuel inlet hose.

3) Unplug connector from fuel injector resistor. Disconnect throttle cable at throttle body. Label and disconnect all terminals, clamps, and connectors on right side of engine compartment. Disconnect power cable from underhood fuse/relay box.

4) Disconnect brake booster hose and emission control hoses from intake manifold. Remove cruise control actuator. Disconnect engine ground cable at cylinder head. Remove power steering pump, leaving hoses connected. Remove A/C condenser fan shroud assembly. Install protective plate in place of shroud.

5) Remove A/C compressor, leaving hoses connected. Disconnect transmission cable. Disconnect A/T cooler lines (if equipped). Remove Vehicle Speed Sensor (VSS)/Power Steering (PS) speed sensor with

hydraulic lines attached.

6) On manual transaxles, remove select cable, shift cable and cable mounting bracket from transaxle. Remove clutch slave cylinder with hydraulic line attached. On automatic transaxles, remove shift cable. On all models, remove exhaust pipe and brace. Remove drive shafts. See FWD AXLE SHAFTS article in DRIVE AXLES.

7) Attach engine hoist chain to engine. Remove slack from chain. Remove front and rear engine mount brackets. Remove left engine mount. Remove transmission mount and bracket. Ensure engine is free of all attachments. Remove engine and transaxle from vehicle.

Installation

1) To install, reverse removal procedure. Tighten engine/transaxle mounts to specification, in sequence. See Fig. 5.

NOTE: Improper tightening of engine/transaxle mount bolts will cause engine vibration and premature engine mount failure.

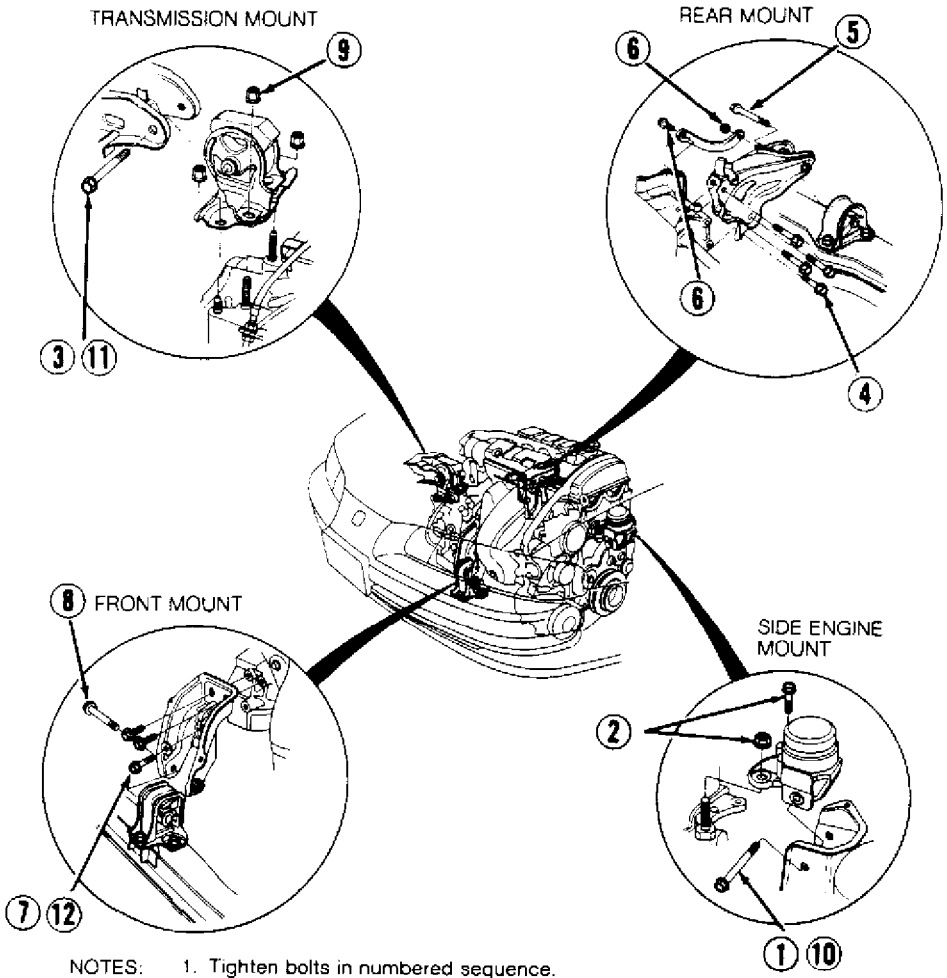

Fig. 5: Tightening Sequence For Engine/Transaxle Mounts Courtesy of American Honda Motor Co., Inc.

2) Use NEW spring clips when installing drive axles. Install drive axles until spring clip clicks in groove of differential side gear. Ensure all wires and hoses are connected properly. Adjust throttle cable tension.

3) On M/T models, adjust clutch pedal free play. See CLUTCH PEDAL under ADJUSTMENTS in CLUTCH in the CLUTCHES section. On A/T

models, ensure gear position agrees with shift indicator. On all models, adjust drive belt tension. Restore all fluids to proper level. Fill and bleed cooling system. See COOLING SYSTEM BLEEDING.

INTAKE MANIFOLD

Removal (2.2L SOHC)

1) Disconnect battery negative cable. Drain cooling system. Release fuel pressure. See FUEL PRESSURE RELEASE. Disconnect breather hose and vacuum tube. Remove air intake duct. Disconnect fuel hoses and charcoal canister hose. Disconnect brake booster and cruise control vacuum hoses.

2) Disconnect throttle cable at throttle body. On A/T models, disconnect throttle control cable. On all models, remove ignition coil, spark plug caps, and distributor. Unplug wiring at alternator. Disconnect all wiring at intake manifold. Disconnect radiator and heater hoses. Disconnect coolant by-pass hose and emission hoses from intake manifold. Remove thermostat housing.

3) Disconnect engine ground cable at cylinder head. Remove power steering pump, leaving hoses attached. Remove intake manifold bracket and manifold.

Removal (2.2L DOHC & 2.3L)

1) Disconnect battery negative cable. Drain cooling system. Release fuel pressure. See FUEL PRESSURE RELEASE. Remove air intake duct. Disconnect fuel hoses and charcoal canister hose. Disconnect brake booster and cruise control vacuum hoses.

2) Disconnect throttle cable at throttle body. On A/T models, disconnect throttle control cable. Unplug wiring at alternator. Disconnect all wiring from cylinder head. Remove power steering pump, leaving hoses attached. Remove ignition coil. Disconnect upper radiator hose. Disconnect heater hose at intake manifold.

3) Disconnect coolant by-pass hose and emission hoses from intake manifold. Remove thermostat housing. Remove Intake Air By-pass (IAB) valve body assembly. Remove intake manifold bracket and manifold.

Installation

Clean gasket surfaces. Install intake manifold, using NEW gasket. Tighten nuts to specification in 3 stages. Tighten in a crisscross pattern, starting with inner nuts. See TORQUE SPECIFICATIONS TABLE at the end of this article. To complete installation, reverse removal procedure.

EXHAUST MANIFOLD

Removal

Remove exhaust manifold heat shield. Disconnect exhaust pipe

from exhaust manifold. Unplug oxygen sensor electrical connector. Remove exhaust manifold bracket. Remove exhaust manifold retaining nuts and manifold. Remove gasket.

Installation

Clean gasket surfaces. Install exhaust manifold using NEW gasket. Using a crisscross pattern, tighten nuts to specification in 3 stages. See **TORQUE SPECIFICATIONS TABLE** at the end of this article.

CYLINDER HEAD

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

Removal (2.2L SOHC)

1) Disconnect battery negative cable. Drain cooling system. Release fuel pressure. See **FUEL PRESSURE RELEASE**. Disconnect breather hose and vacuum tube. Remove air intake duct. Disconnect fuel hoses and charcoal canister hose. Disconnect brake booster and cruise control vacuum hoses.

2) Disconnect throttle cable at throttle body. On A/T models, disconnect throttle control cable. On all models, remove ignition coil, spark plug caps, and distributor. Unplug wiring at alternator. Disconnect all wiring from cylinder head. Disconnect radiator and heater hoses. Disconnect coolant by-pass hose and emission hoses from intake manifold. Remove thermostat housing.

3) Disconnect engine ground cable at cylinder head. Remove power steering pump, leaving hoses attached. Remove intake manifold bracket and manifold.

4) Raise and support vehicle. Remove splash shield and front wheels. Remove heat insulator (A/C models). Disconnect exhaust pipe. Remove exhaust manifold bracket and exhaust manifold. Remove upper timing belt cover.

5) Loosen timing belt tension adjuster bolt. Push tensioner to release belt tension. Tighten adjuster bolt. Disengage timing belt from camshaft sprocket. Remove cylinder head bolts, 1/3 turn at a time, in reverse order of tightening sequence. SeeFig. 6. Remove cylinder head and gasket.

CAUTION: DO NOT crimp or bend timing belt more than 90 degrees or less than 1" (25 mm) radius.

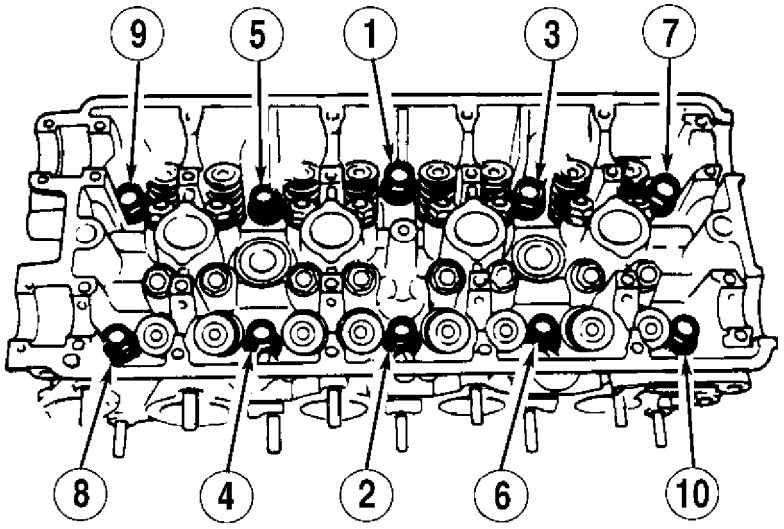

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Fig. 6: Tightening Sequence For Cylinder Head Bolts (2.2L SOHC) Courtesy of American Honda Motor Co., Inc.

Removal (2.2L DOHC & 2.3L)

1) Disconnect battery negative cable. Drain cooling system. Release fuel pressure. See FUEL PRESSURE RELEASE. Remove air intake duct. Disconnect fuel hoses and charcoal canister hose. Disconnect brake booster and cruise control vacuum hoses.

2) Disconnect throttle cable at throttle body. On A/T models, disconnect throttle control cable. Unplug wiring at alternator. Disconnect all wiring from cylinder head. Remove power steering pump, leaving hoses attached. Remove ignition coil. Disconnect upper radiator hose. Disconnect heater hose at intake manifold.

3) Disconnect coolant by-pass hose and emission hoses from intake manifold. Remove thermostat housing. Remove Intake Air By-pass (IAB) valve body assembly. Remove intake manifold bracket and manifold. Disconnect exhaust pipe. Remove heat insulator (A/C models). Remove exhaust manifold bracket and exhaust manifold.

4) Remove cylinder head belt cover. Loosen timing belt tension adjuster bolt. Push tensioner to release belt tension. Tighten adjuster bolt. Disengage timing belt from camshaft sprockets. Remove camshaft pulleys.

5) Loosen all valve clearance adjuster screws. On 2.2L DOHC models, remove VTEC solenoid valve. On all models, remove camshaft bearing caps and camshafts. Remove engine mount bracket brace. Remove timing belt back cover. Remove cylinder head bolts, 1/3 turn at a time, in reverse order of tightening sequence. SeeFig. 7. Remove cylinder head and gasket.

CAUTION: DO NOT crimp or bend timing belt more than 90 degrees or less than 1" (25 mm) radius.

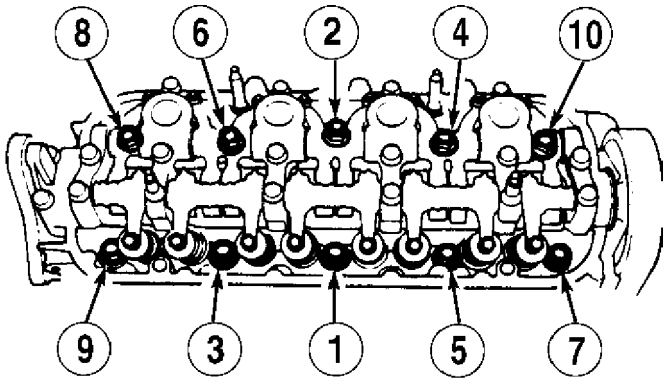

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Fig. 7: Tightening Sequence For Cylinder Head Bolts (2.2L DOHC & 2.3L)
Courtesy of American Honda Motor Co., Inc.

Inspection (All Models)

Ensure all mating surfaces are clean. Measure cylinder head for warpage. Resurfacing is not required if warpage is less than .002" (.05 mm). Resurface cylinder head if warpage is .002-.008" (.05-.20 mm). Maximum resurface limit is .008" (.20 mm). Ensure cylinder head dowel pins, oil control jet, and "O" ring are installed in block.

Installation (All Models)

1) Install NEW intake manifold gasket. Install intake manifold onto cylinder head. Tighten nuts to specification in a crisscross pattern, beginning with inner nuts. See TORQUE SPECIFICATIONS TABLE at the end of this article.

2) Ensure No. 1 piston and camshaft pulley are at TDC. Apply a light coating of engine oil to cylinder head bolts and washers. Install longer cylinder head bolt into position No. 3. Install remaining bolts. Tighten cylinder head bolts to specification in sequence, in 3 stages. See Fig. 6 or 7. See TORQUE SPECIFICATIONS TABLE at the end of this article.

3) To complete installation, reverse removal procedure. If reusing timing belt, install belt with arrow mark (made during removal procedure) in direction of original rotation. Adjust timing belt tension. See TIMING BELT ADJUSTMENT under ADJUSTMENTS.

4) Adjust valve clearance. See VALVE CLEARANCE ADJUSTMENT under ADJUSTMENTS. Fill and bleed air from cooling system. See COOLING SYSTEM BLEEDING under REMOVAL & INSTALLATION.

CRANKSHAFT FRONT SEAL

Removal & Installation

Remove camshaft and balance shaft drive belts. See TIMING & BALANCE SHAFT BELTS. Remove crankshaft/oil pump seal. Apply a light

coat of engine oil to crankshaft and lip of new seal. Install seal using Seal Driver (07749-0010000). Ensure seal is fully seated. To complete installation, reverse removal procedure. See TORQUE SPECIFICATIONS TABLE at the end of this article.

TIMING & BALANCE SHAFT BELTS

Removal

1) Position crankshaft with No. 1 piston at TDC of compression stroke. See Fig. 1 or 2. Disconnect battery negative cable. Remove splash shield. Remove cruise control actuator, leaving cable connected. Remove power steering pump, leaving hoses connected.

2) Disconnect alternator wiring. Remove wiring harness from valve cover. Remove alternator and A/C belts (if equipped). Remove valve cover and middle timing belt cover. Remove side engine mount. Remove engine oil dipstick and tube. Remove crankshaft pulley bolt. Remove side engine mount. Remove engine oil dipstick and tube. Remove crankshaft pulley.

3) Support engine. Remove 2 rear bolts from engine center support beam. Lower engine enough to permit removal of lower timing belt cover. Remove rubber seal from belt tension adjuster nut. Remove lower timing belt cover.

4) Lock timing belt adjuster arm into position by installing one lower cover retaining bolt. Loosen belt tension adjuster bolt. Push belt tensioner to release tension from belt. Tighten adjuster bolt. Remove balance shaft and camshaft timing belts.

CAUTION: DO NOT rotate crankshaft or camshaft when removing and installing timing belts.

Inspection

With belt or belt covers removed, inspect belts for wear, cracks, or oil soaking. Inspect belt teeth for wear. Replace belt if worn, oil soaked, or cracked.

Installation

1) Align White mark on flywheel or drive plate (flexplate) with pointer on block. Ensure camshaft(s) is at TDC for No. 1 cylinder. See Fig. 1 or 2. Install camshaft timing belt. See Fig. 8. Align rear timing balance shaft belt pulley by inserting a 6 x 100 mm bolt 2.9 inches (74 mm) into alignment access hole. Align groove on front balance shaft pulley with pointer on oil pump body.

2) Install balance shaft and cam belts. Adjust belt tension. See TIMING BELT ADJUSTMENT under ADJUSTMENTS. Reverse removal procedure to complete installation. Tighten crankshaft pulley bolt to specification. See TORQUE SPECIFICATIONS TABLE at the end of this article.

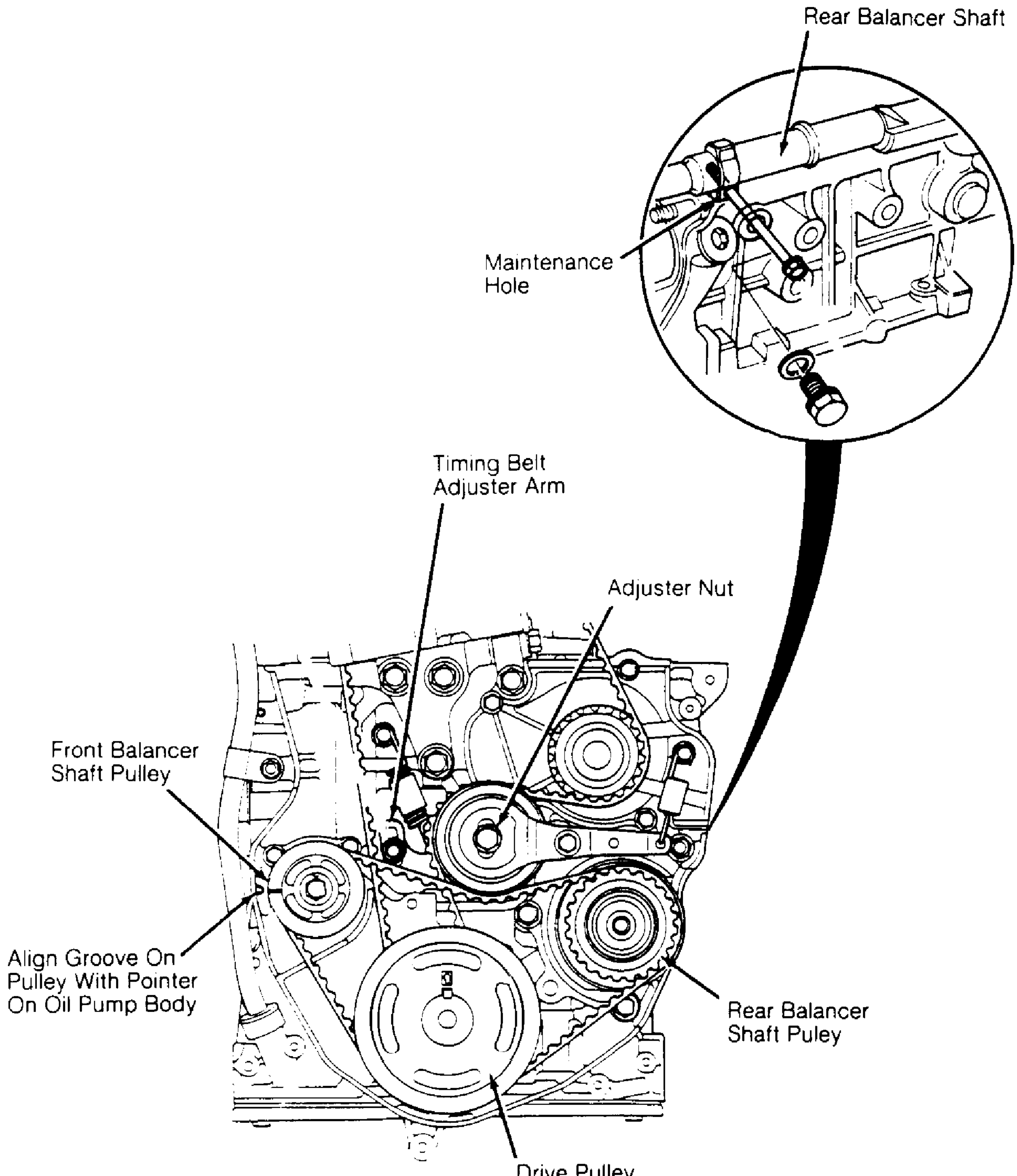

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Fig. 8: Removing/Installing Timing & Balance Shaft Belts
Courtesy of American Honda Motor Co., Inc.

ROCKER ARM

NOTE: DO NOT remove camshaft bearing cap (cam holder) bolts from

rocker arm assembly unless it is to be disassembled. The bolts keep cam holders, springs, and rocker arms on shaft.

Removal (2.2L SOHC)

1) Ensure No. 1 piston is at TDC of compression stroke. UP mark on camshaft pulley should be at top, and grooves on camshaft pulley should align with cylinder head surface. SeeFig. 1. Remove timing and balance shaft belts. See TIMING & BALANCE SHAFT BELTS.

2) Remove camshaft pulley retaining bolt, special washer, camshaft pulley, and key. Remove back cover. Place reference mark on distributor for installation reference. Remove distributor. Loosen all rocker arm adjuster screws.

3) Pry camshaft toward front of cylinder head. Attach dial indicator and zero it against pulley end of camshaft. Pry camshaft away from dial indicator to measure end play. See CAMSHAFT table under ENGINE SPECIFICATIONS. If end play exceeds limit, replace camshaft.

4) Unscrew camshaft bearing cap bolts by turning bolts 2 turns at a time in a crisscross pattern. DO NOT remove bearing cap (cam holder) bolts from rocker arm assembly. Bolts keep cam holders, springs, and rocker arms on shafts. SeeFig. 9. Remove rocker arm assembly.

NOTE: Mark rocker arm shaft assembly parts for installation reference.

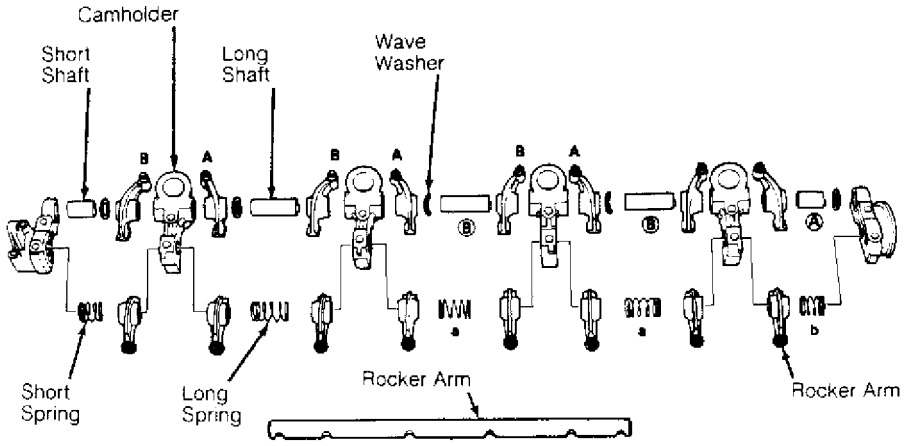

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Fig. 9: Exploded View Of Rocker Arm Assembly (2.2L SOHC)
Courtesy of American Honda Motor Co., Inc.

Installation (2.2L SOHC)

1) Clean all components. Lubricate all components at contact

points before installation. Align intake rocker shafts projections with cam holder indents.

2) Position camshaft (if removed) onto cylinder head with keyway facing upward and No. 1 piston at TDC. Install camshaft seal. Apply gasket sealer to mating surfaces of cam holders No. 1 and 6. Loosen valve clearance adjusters before installing rocker shaft assembly.

3) Position rocker shaft assembly onto cylinder head. Ensure all rockers align with valves. Tighten mounting bolts 2 turns at a time in sequence. See Fig. 10. Install back cover. Install pulley. Tighten camshaft pulley bolt to specification. See TORQUE SPECIFICATIONS TABLE at the end of this article.

4) To complete installation, reverse removal procedure. Adjust valves to specification. See VALVE CLEARANCE ADJUSTMENT under ADJUSTMENTS. Tighten all nuts and bolts to specification. See TORQUE SPECIFICATIONS TABLE at the end of this article.

Removal & Installation (2.2L DOHC & 2.3L)

For removal and installation of rocker arms, see CAMSHAFT.

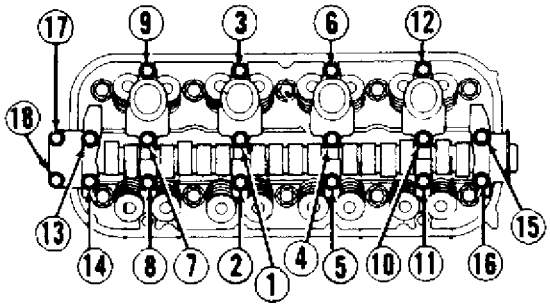

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Fig. 10: Tightening Sequence For Camshaft Bolts (2.2L SOHC) Courtesy of American Honda Motor Co., Inc.

CAMSHAFT

NOTE: On 2.2L SOHC, DO NOT remove camshaft bearing cap (cam holder) bolts from rocker arm assembly unless it is to be disassembled. The bolts keep cam holders, springs, and rocker arms on shaft.

Removal & Installation (2.2L SOHC)

Remove rocker arm assembly. See ROCKER ARM. Carefully lift

camshaft from cylinder head. To install camshaft, reverse removal procedure.

Removal (2.2L DOHC & 2.3L)

1) Ensure No. 1 piston is at TDC of compression stroke. Ensure UP marks on camshaft sprockets are at the top, and TDC grooves on camshaft sprockets align with cylinder head surface. SeeFig. 2. Disengage timing belt from camshaft sprockets. See TIMING & BALANCE SHAFT BELTS.

2) Remove camshaft sprockets. Place reference mark on distributor for installation reference. Remove distributor. Loosen rocker arm adjuster screws. Measure camshaft end play. If end play exceeds limit, replace camshaft. See CAMSHAFT table under ENGINE SPECIFICATIONS.

3) Remove camshaft bearing cap bolts by turning bolts 2 turns at a time in reverse order of tightening sequence. Remove camshafts. Label rocker arms for installation reference. Remove rocker arms (if necessary). See Fig. 11 or 12.

NOTE: If rocker arms are removed from 2.2L DOHC, secure each set of rocker arms and control pistons together with a rubber band and mark to ensure rockers remain properly assembled and are installed in original position.

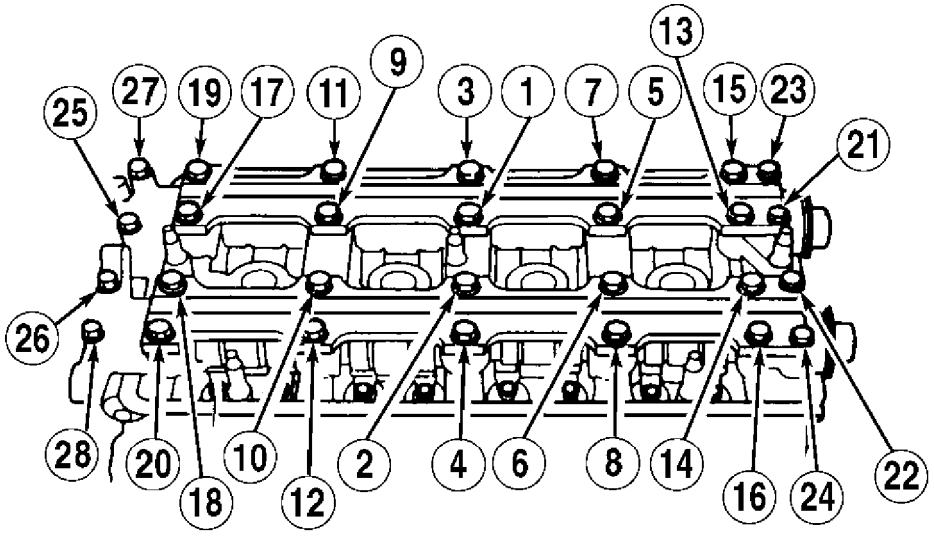

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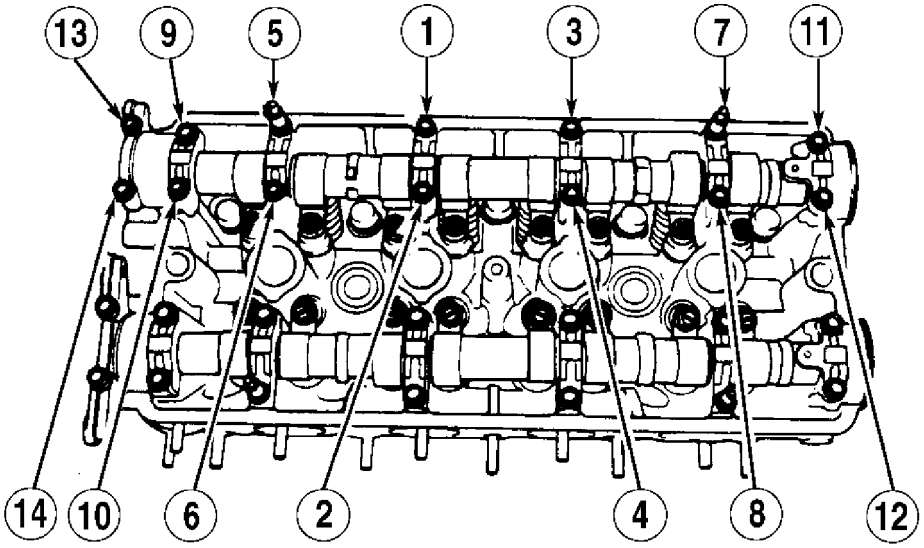
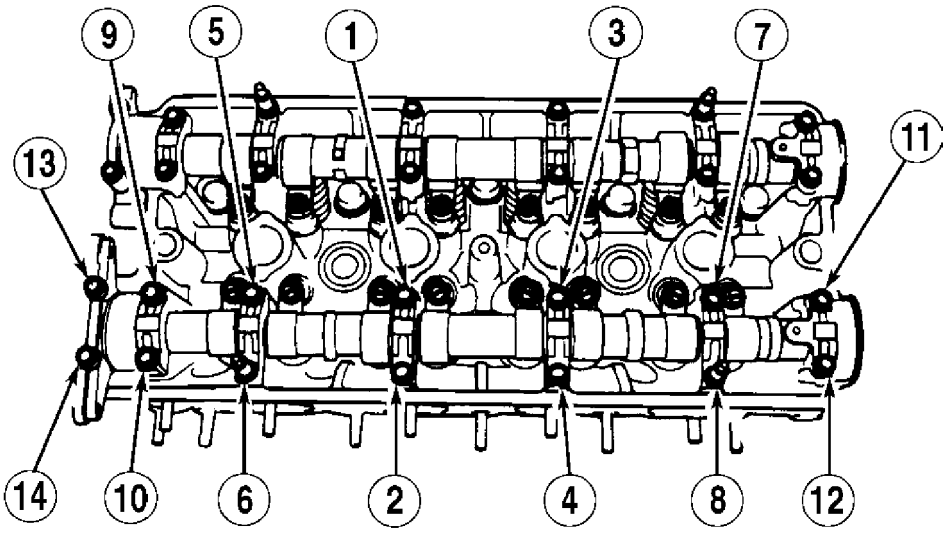
Fig. 11: Tightening Sequence For Camshaft Bolts (2.2L DOHC) Courtesy of American Honda Motor Co., Inc.



INTAKE



EXHAUST

NOTES:

1. On intake camshaft, tighten all bolts except No. 5 and 7 to 88 INCH lbs. (10 N.m). Tighten Bolts No. 5 and 7 to 106 INCH lbs. (12 N.m).
2. On exhaust camshaft, tighten all bolts except No. 6 and 8 to 88 INCH lbs. (10 N.m). Tighten Bolts No. 6 and 8 to 106 INCH lbs. (12 N.m).

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Fig. 12: Tightening Sequence For Camshaft Bolts (2.3L) Courtesy of American Honda Motor Co., Inc.

Installation (2.2L DOHC & 2.3L)

1) Lubricate camshaft journals and journal surfaces in caps and cylinder head. Install rocker arms, if removed, into their original positions. Install camshafts with keyway pointing upward (No. 1 piston at TDC).

2) Loosely install camshaft bearing caps at their original positions. Install new camshaft seals (if removed). Tighten each bolt in 2 stages, in sequence. See Fig. 11 or 12.

3) To complete installation, reverse removal procedure. Adjust valve clearance. See VALVE CLEARANCE ADJUSTMENT under ADJUSTMENTS. Adjust drive belt tension. See TIMING BELT ADJUSTMENT under ADJUSTMENTS.

BALANCE SHAFTS

Removal

1) Remove engine from vehicle. See ENGINE under REMOVAL & INSTALLATION. Remove oil pan, flywheel, and right side crankshaft oil seal cover. Remove timing belts. See TIMING & BALANCE SHAFT BELTS. Remove balance shaft drive gear case. Insert a screwdriver into front balance shaft to prevent rotation. Remove pulley.

2) Insert a bolt or dowel pin into maintenance hole of rear balance shaft. Remove baffle plate. Remove rear timing balance shaft gear. Remove oil pick-up and filter screen. Remove front cover/oil pump assembly. Remove thrust plate from rear balance shaft. Remove balance shafts.

Inspection

1) Measure balance shaft end play before removing end plates and front cover. See BALANCE SHAFTS table under ENGINE SPECIFICATIONS. If end play exceeds specification, inspect thrust plate and thrust surfaces. Thrust plates and thrust surface on oil pump body must not be changed by grinding or shimming.

2) Inspect surface of balance shaft journal and balance shaft bearing. Replace if worn, damaged, or discolored. When replacing front bearing on rear balance shaft, replace oil pump body. Measure diameter of front and rear ends of bearing journals. Taper should not exceed .002" (.05 mm). Using "V" blocks, support shaft on front and rear bearings. Measure journal runout and diameter. See BALANCE SHAFTS table under ENGINE SPECIFICATIONS.

Installation

1) Insert balance shafts into engine block. Install thrust plate onto front balance shaft. Install right side cover, using liquid gasket. Install parts within 20 minutes of gasket application. Allow 30 minutes after installation before filling engine with oil.

2) Lubricate balance shaft and inner oil pump seal. Install oil pump cover. Install oil pick-up and filter screen. Lubricate all

thrust surfaces of balance drive gears. Hold rear balance shaft with dowel, and install driven gear. Hold front balance shaft with a screwdriver, and install driven pulley.

3) Use dowel or bolt to align rear balance shaft. Align groove on balance shaft pulley with pointer on balance gear case. Install balance gear case. See Fig. 13. There is an additional mark on one pulley tooth for belt alignment.

4) To complete installation, reverse removal procedure. Tighten all nuts and bolts to specifications. See TORQUE SPECIFICATIONS TABLE at the end of this article.

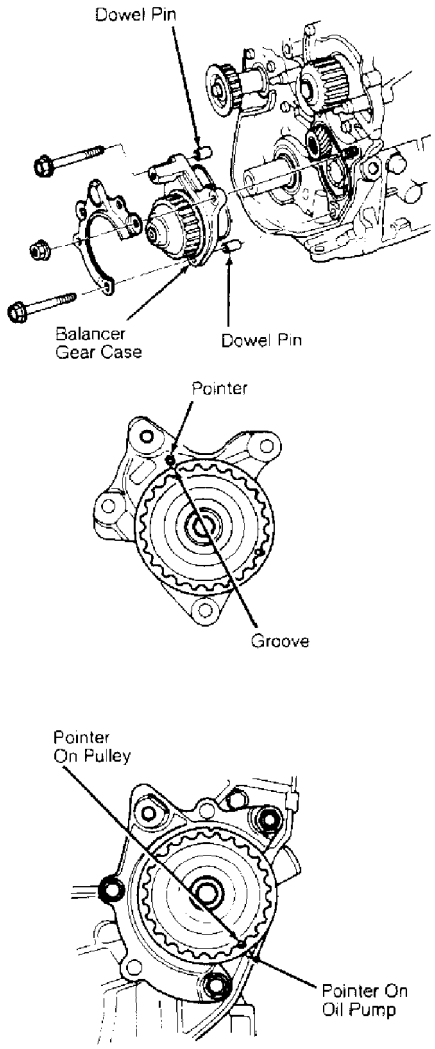

Fig. 13: Installing Balance Shafts
Courtesy of American Honda Motor Co., Inc.

REAR CRANKSHAFT OIL SEAL

Removal & Installation

1) Remove transaxle assembly. Remove flywheel or drive plate. See appropriate article in CLUTCH (manual transaxle) or TRANSMISSION SERVICING - A/T. Pry seal from rear seal plate. Clean crankshaft seal surface and seal plate. Lubricate seal lips and crankshaft with a light coating of oil.

2) Install seal with part number facing outward. Use Seal Driver (07749-0010000) to install seal into seal plate. Align hole in seal driver with pin on crankshaft. Drive seal in until driver bottoms against block. To complete installation, reverse removal procedure. Tighten all nuts and bolts to specifications. See TORQUE SPECIFICATIONS TABLE at the end of this article.

WATER PUMP

Removal

Disconnect battery negative cable. Drain cooling system. Remove timing and balance shaft belts. See TIMING & BALANCE SHAFT BELTS. Remove water pump bolts, water pump, and "O" ring.

Installation

Clean gasket surfaces. Install NEW "O" ring and water pump. To complete installation, reverse removal procedure. Tighten bolts to specifications. See TORQUE SPECIFICATIONS TABLE at the end of this article. Fill and bleed cooling system. See COOLING SYSTEM BLEEDING.

OIL PAN

Removal & Installation

Raise and support vehicle. Drain oil. Remove oil pan retaining bolts. Remove oil pan. Clean gasket surfaces. Before installing oil pan, apply nonhardening sealant to front and rear of gasket where curved area mates with side rail surfaces of oil pan gasket. Install oil pan. Tighten bolts to specification, in sequence. See Fig. 14. See TORQUE SPECIFICATIONS TABLE at the end of this article.

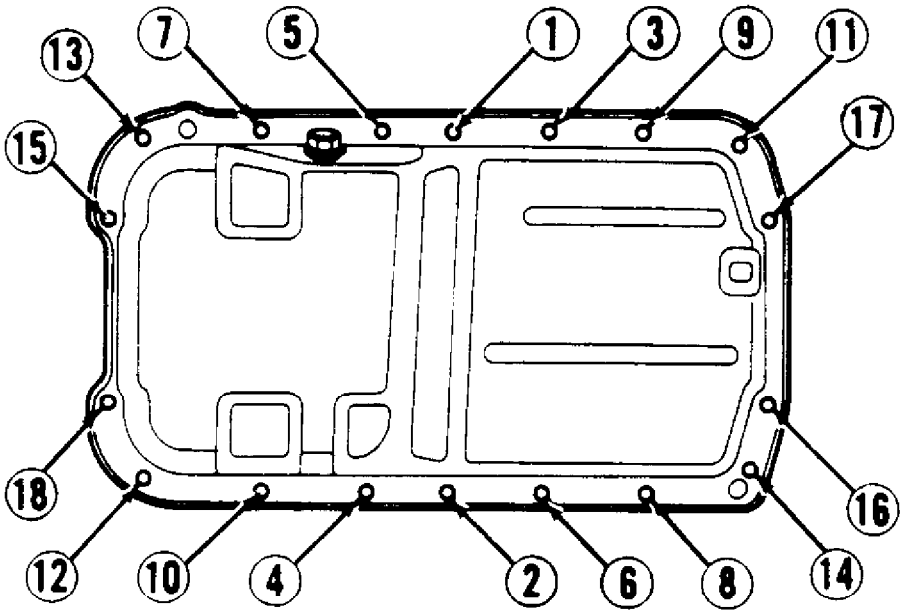

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Fig. 14: Tightening Sequence For Oil Pan Bolts
Courtesy of American Honda Motor Co., Inc.

OVERHAUL

CYLINDER HEAD

Cylinder Head

Ensure all mating surfaces are clean. Measure cylinder head warpage. If warpage is less than .002" (.05 mm), resurfacing is not required. If warpage is .002-.008" (.05-.20 mm), resurface cylinder head. Maximum resurface limit is .008" (.20 mm).

Valve Springs

Measure valve spring free length. Replace any spring shorter than minimum free length specification. See VALVE SPRING FREE LENGTH in appropriate VALVES & VALVE SPRINGS table under ENGINE SPECIFICATIONS. Install springs with closer coils toward cylinder head. See appropriate VALVES & VALVE SPRINGS table under ENGINE SPECIFICATIONS.

Valve Stem Oil Seal Replacement

Mark valves and valve springs for reassembly reference. Tap each valve stem with a plastic mallet to loosen valve keepers. Remove valve keepers, collar, and spring. Use a valve seal puller to remove valve seals from valve guides.

NOTE: Intake and exhaust valve stem seals are NOT interchangeable. Intake seals have a White spring, and exhaust seals have a Black spring around neck of seal.

Valve Guide Inspection

Measure valve guide clearance with a dial indicator placed on valve head. Lift valve .4" (10 mm) from seat. Rock valve stem from side to side. Valve guides can be replaced if valve stem oil clearance is not within specification. See appropriate CYLINDER HEAD table under ENGINE SPECIFICATIONS.

Valve Guide Removal

1) Use a hot plate or oven to heat cylinder head to 300°F (150°C). Use valve guide driver, or fabricate valve guide remover from an air impact chisel. Using an air hammer and valve guide remover, drive valve guide 5/64" (2 mm) toward combustion chamber.

CAUTION: DO NOT heat cylinder head with a torch, or heat cylinder head hotter than 300°F (150°C). Excessive temperature may loosen valve seats.

2) Turn head over. Working from combustion chamber side of head, drive valve guide out toward camshaft side of head. If valve guide does not move, drill valve guide, using a 5/16" drill bit, then try to drive it out again.

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

Valve Guide Installation

1) Chill new valve guides in freezer for about one hour. Remove new valve guides from freezer as needed. Slip a 15/64" (6 mm) steel washer over valve guide driver.

2) Install new valve guides from camshaft side of cylinder head. Drive each guide into heated head until washer bottoms against head. If replacing all valve guides, reheat cylinder head as necessary.

3) Valve guide installed height must be as specified. See appropriate CYLINDER HEAD table under ENGINE SPECIFICATIONS. Using cutting oil, ream new valve guides by rotating Valve Guide Reamer (07HAH-PJ7010B for 2.2L, or 07984-657010C for 2.3L) clockwise the full length of valve guide bore. Measure valve stem oil clearance. See appropriate CYLINDER HEAD table under ENGINE SPECIFICATIONS.

NOTE: Always reface valve seat after replacing valve guide.

Valve Seats

Replacement procedure is not available from manufacturer.

Valves

Inspect valve for wear or burning. Measure valve dimensions after refacing. Replace any valve that does not meet specification. See appropriate VALVES & VALVE SPRINGS table under ENGINE SPECIFICATIONS. Measure valve stem installed height after refinishing valve or seat. See appropriate CYLINDER HEAD table under ENGINE SPECIFICATIONS. Tap valve stems with plastic mallet after installation to seat spring retainers and keepers.

Valve Seat Correction Angles

Replace valve guides, if necessary, before refacing valve seats. After refacing, if seat width is too wide, use 60-degree stone to raise seat, or 30-degree stone to lower seat. Ensure valve seat margin is within specification. See appropriate CYLINDER HEAD table under ENGINE SPECIFICATIONS.

Valve Stem Installed Height

After servicing valves, measure valve stem installed height. See Fig. 15. If valve stem installed height exceeds specification for any valve, replace valve. See appropriate CYLINDER HEAD table under ENGINE SPECIFICATIONS. If valve stem installed height still exceeds limit, replace cylinder head.

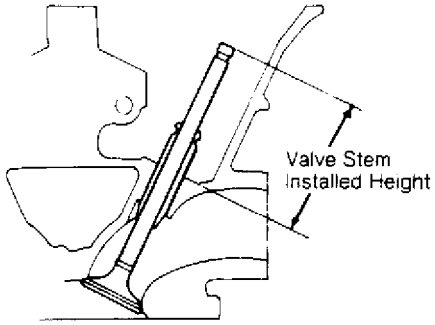

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Fig. 15: Measuring Valve Stem Installed Height
Courtesy of American Honda Motor Co., Inc.

VALVE TRAIN

Rocker Arm Shaft Assembly

Mark parts during disassembly for installation reference. Inspect rocker shafts (if equipped) and rocker arms for excessive wear or scoring. See Fig. 9. Service limit for clearance between rocker arm and rocker shaft is .003" (.08 mm). Replace shaft or rocker arms if

worn beyond specification. Inspect rocker arm contact points for wear or scoring. Replace defective parts as necessary. Lubricate contact areas with engine oil before assembly.

CYLINDER BLOCK ASSEMBLY

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

Piston & Rod Assembly

1) Each rod is sorted into one of 4 tolerance ranges. Size depends on crank journal bore. A number between 1 and 4 is stamped on side of rod big end. Any combination of numbers between 1 and 4 may be found in any engine.

2) Install piston and connecting rod so arrow on top of piston points toward timing belt, and connecting rod oil hole is toward intake manifold side of engine. See PISTON PIN INSTALLATION.

Fitting Pistons

1) Measure clearance between piston and cylinder bore. Piston clearance is difference between cylinder bore and piston diameter. See PISTONS, PINS, & RINGS table under ENGINE SPECIFICATIONS. If piston clearance exceeds service limit, rebore cylinder and install oversize piston.

2) Standard size pistons are marked with "A" or "B" on top of piston. For 2.2L SOHC, pistons are available in .010" (.25 mm) and .020" (.50 mm) oversize. For 2.2L DOHC and 2.3L, pistons are available in .010" (.25 mm) oversize. Standard cylinder block bore size is identified by letters "A" or "B" stamped on cylinder block.

3) Remove rings from piston. Clean piston thoroughly. Inspect piston for distortion and cracks. Measure piston diameter at location specified. If diameter is not within specification, replace piston. See PISTON, PINS & RINGS table under ENGINE SPECIFICATIONS.

Piston Rings

1) Using inverted piston, push new piston ring into cylinder bore .6-.8" (15-20 mm) from bottom. Measure piston ring end gap, using a feeler gauge. Repeat for each ring. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS.

2) Clean piston ring grooves thoroughly. Install piston rings with identification mark toward top of piston. Using a feeler gauge, measure piston ring side clearance between ring and ring land.

3) If ring lands are excessively worn, replace piston. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS. Align piston ring end gaps properly on piston. See Fig. 16.

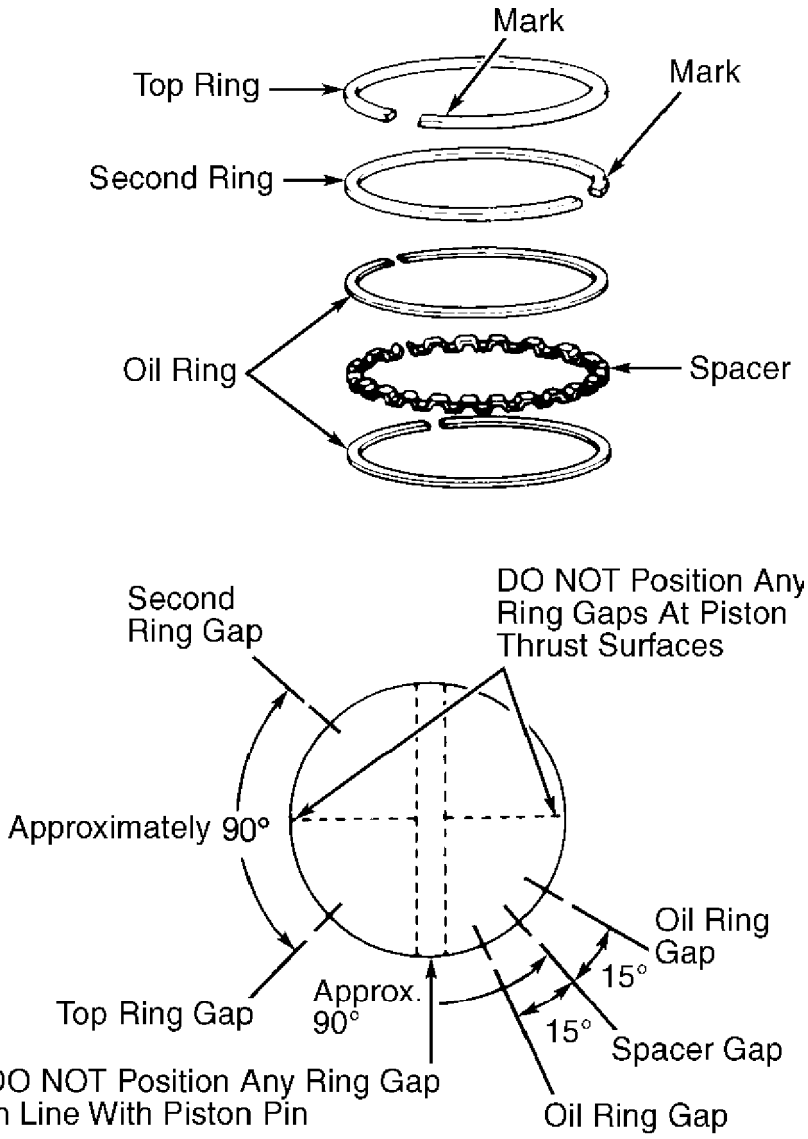

Fig. 16: Aligning Piston Rings
Courtesy of American Honda Motor Co., Inc.

Piston Pin Removal

1) Install Piston Base Head (07HAF-PL20102) and Piston Pin Base Insert (07GAF-PH60300) into Base (07973-6570500). Turn handle on Piston Pin Driver Head (07973-PE00320) so piston driver length is 2. 03" (51.5 mm).

2) Insert Piston Driver Shaft (07973-PE00310) into Pilot Collar (07GAF-PH70100). Place piston onto base. Press out piston pin. When removing or installing piston pin, place piston into press with embossed side facing up. Ensure recessed part of piston aligns with lugs on base insert.

NOTE: All replacement piston pins are oversize.

Piston Pin Inspection

1) Measure piston pin diameter. Measure piston pin bore in piston. Piston pin clearance is difference between the 2 measurements.

2) Piston pin clearance must be as specified in CONNECTING RODS table under ENGINE SPECIFICATIONS. If piston pin clearance is greater than specified, install an oversize piston pin and again measure clearance.

3) Determine difference between piston pin diameter and connecting rod small end bore. Interference fit between piston pin and connecting rod must be as specified in CONNECTING RODS table under ENGINE SPECIFICATIONS.

Piston Pin Installation

1) Ensure piston and connecting rod are positioned as shown. See Fig. 18. Turn handle on Piston Pin Driver (07973-PE00320) so piston driver length is 2.03" (51.5 mm).

2) Install Pilot Collar (07GAF-PR30100) into piston and connecting rod. Lubricate new piston pin lightly. Place piston onto base. Press in piston pin. See CONNECTING RODS table under ENGINE SPECIFICATIONS.

NOTE: A number code indicating connecting rod bore diameter is stamped on side of each connecting rod and cap. Connecting rod journal diameter codes (letters) are stamped on crankshaft counterweights. See Fig. 17. Use both codes when ordering replacement bearings.

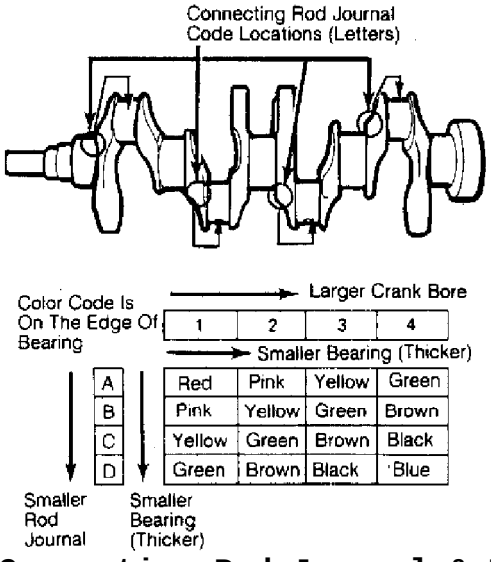

Fig. 17: Connecting Rod Journal & Bearing Identification Codes
Courtesy of American Honda Motor Co., Inc.

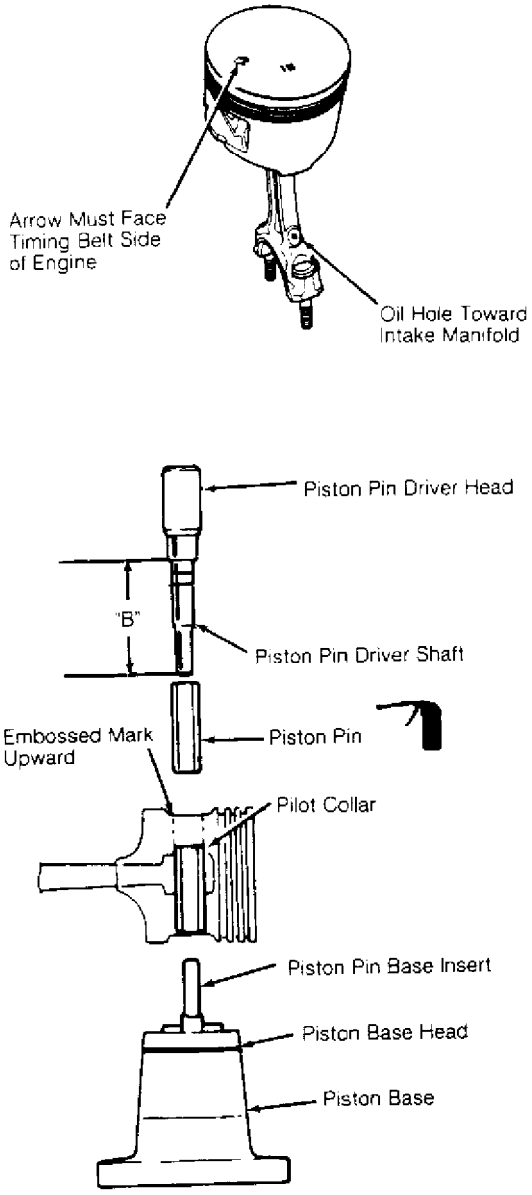

Fig. 18: Installing Piston Pin
Courtesy of American Honda Motor Co., Inc.

Rod Bearings

1) Using Plastigage, measure rod bearing oil clearance. Tighten bearing cap to 35 ft. lbs. (47 N.m). See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS.

2) If oil clearance is incorrect, install a new bearing set

(same color code) and again measure oil clearance. DO NOT shim or file cap to adjust oil clearance.

3) If oil clearance is still incorrect, try the next larger or smaller bearing. Measure oil clearance again. If proper oil clearance cannot be obtained by using larger or smaller bearings, replace crankshaft and repeat procedure.

Crankshaft & Main Bearings

1) Remove main bearing cap bridge and main bearing caps in reverse order of sequence shown in illustration. SeeFig. 19. Mark all bearing caps for reassembly reference. Lift crankshaft from block, being careful not to damage journals.

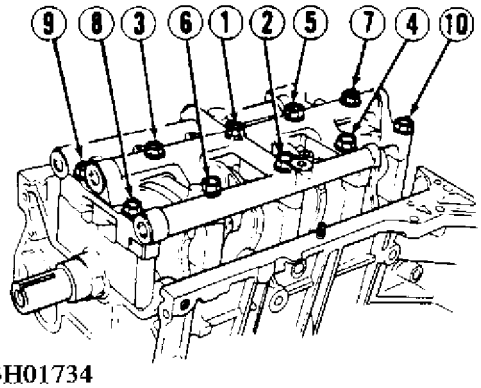

Fig. 19: Tightening Sequence For Main Bearings
Courtesy of American Honda Motor Co., Inc.

NOTE: A code consisting of a letter, number or a series of bars indicating main journal bore diameters is stamped on cylinder block, on oil pan mating surface. SeeFig. 20. Use these codes, together with crankshaft main journal diameter numbers, when ordering replacement bearings.

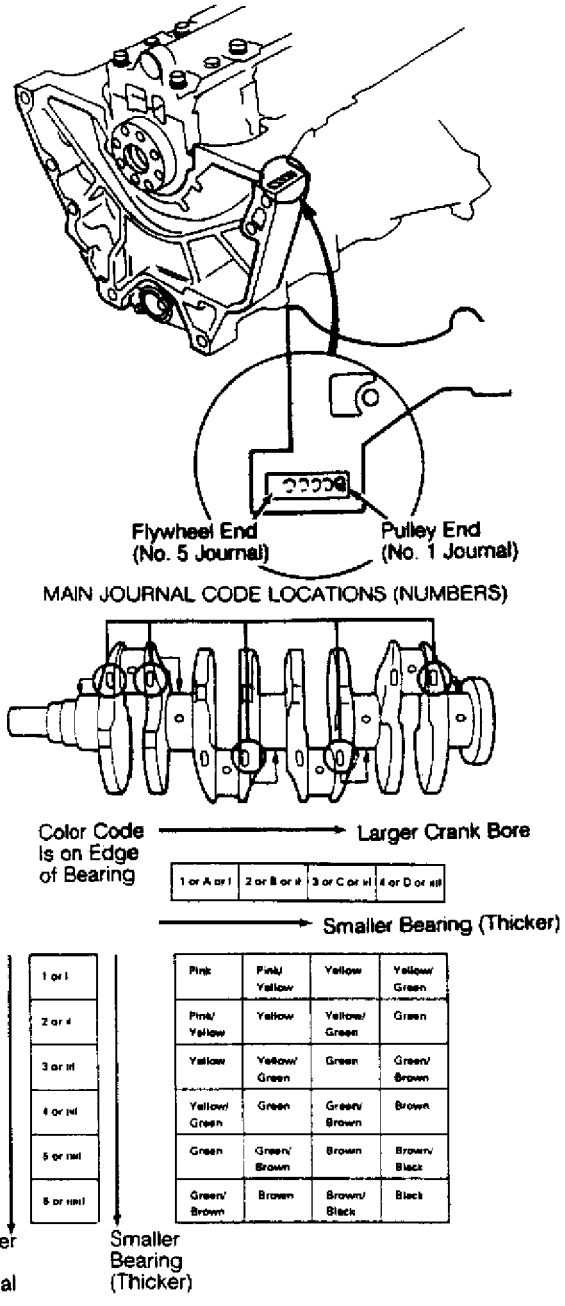

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Fig. 20: Main Bearing Identification Codes
Courtesy of American Honda Motor Co., Inc.

2) Using a lathe or "V" blocks to support crankshaft, measure crankshaft runout, out-of-round, and taper. If any measurement exceeds service limit, replace crankshaft. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS.

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. Before installing main bearing cap bolts, lubricate thrust washers and bolt threads. Tighten main bearing caps, in sequence, in 2 stages, first to 22 ft. lbs. (30 N.m), then to 55 ft. lbs. (75 N.m). SeeFig. 19.

4) If oil clearance is incorrect, install a new bearing set (same color code) and recheck oil clearance. If oil clearance is still incorrect, try next larger or smaller bearing and measure oil clearance once more. If proper oil clearance cannot be obtained by using larger or smaller bearings, replace crankshaft and repeat procedure.

Thrust Bearing

1) Measure crankshaft end play. If end play exceeds specification, inspect thrust washers and thrust surface of crankshaft. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS.

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 out.

CAUTION: After replacing any rod or main bearing, idle engine until it reaches normal operating temperature, then an additional 15 minutes.

Cylinder Block

1) Measure cylinder block deck surface warpage. Service limit is .004" (.10 mm). Measure cylinder bore out-of-round and taper. If out-of-round or taper exceeds .002" (.05 mm), rebore cylinder for oversize pistons. If any cylinder exceed oversize bore service limit, replace cylinder block. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS.

2) If cylinder block is okay, hone cylinders to obtain a 60-degree crosshatch pattern. After honing, wash cylinder bores with hot soapy water. Air-dry cylinder bores, and apply engine oil to prevent rusting.

ENGINE OILING

ENGINE LUBRICATION SYSTEM

A rotor-type 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 lubricates thrust side of piston and cylinder wall. An oil passage carries oil to camshaft and rocker arms. Oil spray lubricates valve stems.

Crankcase Capacity

On 2.2L SOHC, crankcase capacity, including oil filter, is 4. 0 qts. (3.8L). Capacity is 5.2 qts. (4.9L) after engine overhaul.On 2. 2L DOHC, crankcase capacity, including oil filter, is 5.1 qts. (4.8L). Capacity is 6.2 qts. (5.9L) after engine overhaul. On 2.3L, crankcase capacity is 4.5 qts. (4.3L). Capacity is 5.7 qts. (5.4L) after overhaul.

Oil Pressure

Measure oil pressure relief valve with engine temperature at 176oF (80oC). At idle, minimum oil pressure should be 10 psi (0.7 kg/cmy). At 3000 RPM, minimum oil pressure should be 50 psi (3.5 kg/cmy).

OIL PUMP

Removal & Disassembly

Raise and support vehicle. Drain engine oil. Remove timing belts. See TIMING & BALANCE SHAFT BELTS under REMOVAL & INSTALLATION. Remove oil pan and pick-up screen. Remove pump housing/front cover assembly. Remove pump cover from pump rotors. Remove oil seals.

Inspection

Measure pump clearances. See OIL PUMP SPECIFICATIONS table. Remove rotors and examine for wear or damage.

Reassembly & Installation

Replace oil seals and "O" rings. Position rotors into pump housing. Install rotor cover on pump housing. Apply locking fluid to cover screws, and tighten to 62 INCH lbs. (7 N.m). Fit dowel pins and NEW "O" rings to housing. To complete installation, reverse removal procedure.

OIL PUMP SPECIFICATIONS TABLE

Application	Specification
Standard	
Radial Clearance	
Inner Rotor-To-Outer Rotor	**.001-.006" (.02-.16 mm)**
Pump Body-To-Rotor	**.004-.007" (.10-.19 mm)**
Side Clearance	
Pump Body-To-Rotor	**.001-.003" (.02-.07 mm)**
Service Limit	
Radial Clearance	
Inner Rotor-To-Outer Rotor	**.008" (.20 mm)**
Pump Body-To-Rotor	**.0083" (.21 mm)**
Side Clearance	

Pump Body-To-Rotor ..... .005" (.12 mm)

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
A/C Compressor Bracket Bolt	33 (45)
Alternator Bracket Adjuster Bolt	16 (22)
Alternator Bracket Bolt	33 (45)
Camshaft Pulley Bolt	27 (37)
Connecting Rod Nut	35 (47)
Crankshaft Pulley Bolt	162 (220)
Cylinder Head Bolt (1)	
Stage 1	29 (40)
Stage 2	52 (70)
Stage 3	74 (100)
Distributor Mount Bolts	13 (18)
EGR Pipe-To-Exhaust Manifold	44 (60)
Engine Mount Bolts	71 (2)
Exhaust Manifold Bracket Bolt	16 (22)
Exhaust Manifold Nut (3)	24 (32)
Exhaust Manifold-To-Exhaust Pipe Nut	41 (55)
Exhaust Manifold-To-Heat Shield Bolt	16 (22)
Flywheel Bolt (3)	77 (105)
Intake Manifold Chamber Bolt/Nut	16 (22)
Intake Manifold-To-Cylinder Head Nut (3)	16 (22)
Main Bearing Cap Bolt	
Stage 1	22 (30)
Stage 2	55 (75)
Oil Pan Drain Plug	33 (45)
Oxygen Sensor	33 (45)
Power Steering Belt Adjuster Nut	31 (42)
Power Steering Pump Bracket Bolt	33 (45)
Shift Cable Bracket Bolt	16 (22)
Throttle Body Nut	16 (22)
Timing Belt Tension Adjuster Nut	33 (45)
Torque Converter Drive Plate Bolt (3)	54 (75)
Valve Adjuster Lock Nut	
2.2L	14 (20)
2.3L	20 (27)
	INCH Lbs. (N.m)
Camshaft Bearing Cap Bolt	4)

EGR Pipe-To-Intake Manifold Nut	108 (12)
Fuel Filter Bracket Bolt	108 (12)
Oil Pan Bolt	108 (12)
Oil Pump Cover Screw	62 (7)
Oil Pump Housing Bolt	84 (9)
Oil Pump Screen Bolt	84 (9)
Thermostat Housing Bolt	108 (12)
Timing Belt Cover Bolt	108 (12)
Valve Cover Nut	90 (10)
Water Pump Bolt	108 (12)

(1) - Tighten in sequence. See Fig. 6 or 7.
(2) - Tighten in sequence. See Fig. 5.
(3) - Tighten in a crisscross pattern.
(4) - On 2.2L SOHC, tighten 6-mm bolts to 106 INCH lbs. (12 N.m), and tighten 8-mm bolts to 16 ft. lbs. (22 N.m). For 2.3L, see Fig. 12.

ENGINE SPECIFICATIONS

GENERAL ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS TABLE

Application	Specification
Displacement	
2.2L	132 Cu. In. (2.2L)
2.3L	138 Cu. In. (2.3L)
Bore	
2.2L	
DOHC	3.43" (87 mm)
SOHC	3.35" (85 mm)
2.3L	3.43" (87 mm)
Stroke	
2.2L	
DOHC	3.57" (90.7 mm)
SOHC	3.74" (95 mm)
2.3L	3.74" (95 mm)
Compression Ratio	
2.2L	
DOHC	10.0:1
SOHC	8.8:1
2.3L	9.8:1
Fuel System	PFI
Horsepower @ RPM	

```
 2.2L
 DOHC  ..........................................  190 @ 6800
 SOHC  ..........................................  135 @ 5200
 2.3L  ..........................................  160 @ 5800
Torque Ft. Lbs. @ RPM
 2.2L
 DOHC  ..........................................  158 @ 5300
 SOHC  ..........................................  142 @ 4000
 2.3L  ..........................................  156 @ 4500
```

CRANKSHAFT, MAIN & CONNECTING
ROD BEARINGS SPECIFICATION

CRANKSHAFT, MAIN & CONNECTING
ROD BEARINGS SPECIFICATION TABLE

Application	In. (mm)
Crankshaft	
End Play	
Standard	.004-.014 (.10-.35)
Service Limit	.018 (.45)
Runout	
Standard	.0012 (.030)
Service Limit	.0016 (.040)
Main Bearings	
Journal Diameter	
No. 1 & 2	1.9676-1.9685 (49.976-50.000)
No. 3	1.9674-1.9683 (49.972-49.996)
No. 4	1.9679-1.9688 (49.984-50.008)
No. 5	1.9680-1.9690 (49.988-50.012)
Journal Out-Of-Round	
Standard	.0002 (.005)
Service Limit	.0002 (.006)
Journal Taper	
Standard	.0002 (.005)
Service Limit	.0002 (.006)
Oil Clearance	
No. 1 & 2 Journals	
Standard	.0008-.0018 (.021-.045)
Service Limit	.002 (.050)
No. 3 Journal	
Standard	.0010-.0020 (.025-.049)
Service Limit	.0022 (.055)
No. 4 Journal	
Standard	.0005-.0015 (.013-.037)
Service Limit	.0020 (.050)

No. 5 Journal
Standard ..... .0004-.0013 (.009-.033)
Service Limit ..... .0016 (.040)
Connecting Rod Bearings
Journal Diameter 1.7707-1.7717 (44.976-45.000)
Journal Out-Of-Round
Standard ..... .0002 (.005)
Service Limit ..... .0002 (.006)
Journal Taper
Standard ..... .0002 (.005)
Service Limit ..... .0002 (.006)
Oil Clearance
2.2L SOHC
Standard ..... .0008-.0020 (.021-.049)
Service Limit ..... .0022 (.055)
2.2L DOHC & 2.3L
Standard ..... .0011-.0022 (.027-.055)
Service Limit ..... .0024 (.060)

CONNECTING RODS SPECIFICATIONS

CONNECTING RODS SPECIFICATION TABLE

Application	**In. (mm)**
Piston Pin Diameter	
Standard	**.8659-.8661 (21.994-22.000)**
Oversize	**.8660-.8663 (21.997-22.003)**
Piston Pin-To-Rod Interference	**.0005-.0013 (.012-.032)**
Piston Pin-To-Piston Clearance	
2.2L SOHC	**.0005-.0009 (.012-.024)**
2.2L DOHC & 2.3L	**.0005-.0010 (.012-.026)**

PISTONS, PINS & RINGS SPECIFICATIONS

PISTONS, PINS & RINGS SPECIFICATION TABLE

Application	**In. (mm)**
2.2L SOHC	
Piston Clearance	
Standard	**.0008-.0016 (.020-.040)**
Service Limit	**.002 (.05)**
Piston Diameter (1)	
Standard	
Size "A"	**3.3457-3.3461 (84.98-84.99)**

Size "B" 3.3453-3.3457 (84.97-84.98)
Service Limit
Size "A" 3.3453 (84.97)
Size "B" 3.3449 (84.96)
Piston Pin Clearance
Standard ..... .0005-.0009 (.012-.024)
Service Limit ..... .0009 (.024)
Rings
No. 1
End Gap
Standard ..... .008-.014 (.20-.35)
Service Limit ..... .024 (.60)
Side Clearance
Standard ..... .0014-.0024 (.035-.060)
Service Limit ..... .005 (.13)
No. 2
End Gap
Standard ..... .016-.022 (.40-.55)
Service Limit ..... .028 (.70)
Side Clearance
Standard ..... .0012-.0022 (.030-.055)
Service Limit ..... .005 (.13)
No. 3 (Oil)
End Gap ..... .008-.028 (.20-.71)

2.2L DOHC & 2.3L

Piston Clearance
Standard ..... .0003-.0012 (.007-.030)
Service Limit ..... .0016 (.04)
Piston Diameter (2)
Standard
Size "A" 3.4248-3.4253 (86.990-87.003)
Size "B" 3.4244-3.4249 (86.980-86.993)
Service Limit
Size "A" 3.4244 (86.980)
Size "B" 3.4240 (86.970)
Piston Pin Clearance
Standard ..... .0005-.0010 (.012-.026)
Service Limit ..... .0010 (.026)
Rings
No. 1
End Gap
Standard ..... .010-.014 (.25-.35)
Service Limit ..... .024 (.60)
Side Clearance
Standard ..... .0014-.0024 (.035-.060)
Service Limit ..... .005 (.13)
No. 2
End Gap

Standard ..... .024-.030 (.60-.75)
Service Limit ..... .028 (.90)
Side Clearance
Standard ..... .0014-.0022 (.035-.055)
Service Limit ..... .005 (.13)
No. 3 (Oil)
End Gap (3)
Standard ..... .008-.020 (.20-.50)
Service Limit (3) ..... .024 (.60)
End Gap (4)
Standard ..... .008-.028 (.20-.70)
Service Limit (4) ..... .031 (.80)

(1) - Measured .83" (21 mm) from bottom of piston skirt.
(2) - Measured .59" (15 mm) from bottom of piston skirt.
(3) - Teikoku manufacturer.
(4) - Riken manufacturer.

CYLINDER BLOCK SPECIFICATIONS

CYLINDER BLOCK SPECIFICATION TABLE

Application	**In. (mm)**
2.2L SOHC	
Cylinder Bore	
Standard Diameter	**3.346-3.347 (85.00-85.02)**
Service Limit	**3.349 (85.07)**
Maximum Taper	**.002 (.05)**
Maximum Deck Warpage	**.004 (.10)**
Maximum Rebore Limit	**.02 (.5)**
2.2L DOHC & 2.3L	
Cylinder Bore	
Standard Diameter	**3.425-3.426 (87.00-87.02)**
Service Limit	**3.428 (87.07)**
Maximum Taper	**.002 (.05)**
Maximum Deck Warpage	**.004 (.10)**
Maximum Rebore Limit	**.010 (.25)**

VALVES & VALVE SPRINGS SPECIFICATION - 2.2L DOHC

VALVES & VALVE SPRINGS SPECIFICATION TABLE - 2.2L DOHC

Application	**Specification**
Intake Valves	

Face Angle	45
Head Diameter	1.374-1.382" (34.90-35.10)
Margin	
Standard	.041-.053" (1.05-1.35 mm)
Service Limit	.033" (.85 mm)
Stem Diameter	
Standard	.2156-.2159" (5.475-5.483 mm)
Service Limit	.2144" (5.445 mm)
Exhaust Valves	
Face Angle	45
Head Diameter	1.177-1.185" (29.90-30.10 mm)
Margin	
Standard	.065-.078" (1.65-1.95 mm)
Service Limit	.057" (1.45 mm)
Stem Diameter	
Standard	.21556-.2159" (5.475-5.485 mm)
Service Limit	.2144" (5.445 mm)
Valve Spring	
Free Length	
Intake	
Inner	
Chuo Hatsujo	1.645" (41.78 mm)
Nihon Hatsujo	1.644" (41.75 mm)
Outer	
Chuo Hatsujo	1.778" (45.16 mm)
Nihon Hatsujo	1.802" (45.76 mm)
Exhaust	
Inner	
Chuo Hatsujo	1.548" (39.32 mm)
Nihon Hatsujo	1.546" (39.28 mm)
Outer	
Chuo Hatsujo	1.839" (46.72 mm)
Nihon Hatsujo	1.840" (46.74 mm)

VALVES & VALVE SPRINGS SPECIFICATION - 2.2L SOHC

VALVES & VALVE SPRINGS SPECIFICATION TABLE - 2.2L SOHC

Application	Specification
Intake Valves	
Face Angle	45
Head Diameter	1.335-1.343" (33.9-34.10)
Margin	
Standard	.033-.045" (.85-1.15 mm)
Service Limit	.026" (.65 mm)
Stem Diameter	

```
 Standard  ..................  .2159-.2163" (5.485-5.495 mm)
 Service Limit  .........................  .2148" (5.455 mm)
Exhaust Valves
 Face Angle  ..............................................  45°
 Head Diameter  ..............  1.138-1.146" (28.90-29.10 mm)
 Margin
 Standard  ......................  .041-.053" (1.05-1.35 mm)
 Service Limit  ............................  .037" (.95 mm)
 Stem Diameter
 Standard  ..................  .2146-.2150" (5.450-5.460 mm)
 Service Limit  .........................  .2134" (5.420 mm)
Valve Spring
 Free Length
  Intake
  Chuo Hatsujo  .......................  2.1578" (54.810 mm)
  Nihon Hatsujo  ......................  2.1582" (54.820 mm)
  Exhaust
  Chuo Hatsujo  .......................  2.1968" (55.800 mm)
  Nihon Hatsujo  ......................  2.2157" (56.280 mm)
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VALVES & VALVE SPRINGS SPECIFICATION - 2.3L

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VALVES & VALVE SPRINGS SPECIFICATION TABLE - 2.3L
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Application                                          Specification

Intake Valves
 Face Angle  ..............................................  45°
 Head Diameter  ...............  1.335-1.343" (33.90-34.10)
 Margin
 Standard  ......................  .033-.045" (.85-1.15 mm)
 Service Limit  ............................  .026" (.65 mm)
 Stem Diameter
 Standard  ..................  .2591-.2594" (6.580-6.590 mm)
 Service Limit  .........................  .2579" (6.550 mm)
Exhaust Valves
 Face Angle  ..............................................  45°
 Head Diameter  ..............  1.138-1.146" (28.90-29.10 mm)
 Margin
 Standard  ......................  .041-.053" (1.05-1.35 mm)
 Service Limit  ............................  .033" (.85 mm)
 Stem Diameter
 Standard  ..................  .2579-.2583" (6.55-6.56 mm)
 Service Limit  .........................  .2567" (6.520 mm)
Valve Spring
 Free Length
  Intake & Exhaust  ..................  1.8504" (47.14 mm)
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CYLINDER HEAD SPECIFICATION - 2.3L

CYLINDER HEAD SPECIFICATION TABLE - 2.3L

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Application	Specification
Cylinder Head	
Height	5.195-5.199" (131.95-132.05 mm)
Maximum Warpage	(1) .002-.008" (.05-.20 mm)
Valve Seats	
Intake & Exhaust Valve	
Seat Angle	45
Seat Width	
Standard	.049-.061" (1.25-1.55 mm)
Service Limit	.079" (2.00 mm)
Valve Guide Installed Height	
Intake	.52-.54 (13.2-13.7)
Exhaust	.54-.56 (13.7-14.2)
Valve Guide Oil Clearance	
Measured At Valve Head (Dial Indicator)	
Intake Valve	
Standard	.002-.004 (.04-.10)
Service Limit	.006 (.16)
Exhaust Valve	
Standard	.004-.006 (.10-.16)
Service Limit	.009 (.22)
Measured At Stem (Micrometer & Ball Gauge)	
Intake Valve	
Standard	.001-.002 (.02-.05)
Service Limit	.003 (.08)
Exhaust Valve	
Standard	.002-.003 (.05-.08)
Service Limit	.004 (.11)
Valve Stem Installed Height (2)	
Intake Valve	
Standard	1.550-1.568 (39.36-39.83)
Service Limit	1.578 (40.08)
Exhaust Valve	
Standard	1.542-1.560 (39.16-39.63)
Service Limit	1.570 (39.88)

(1) - Maximum resurface limit is .008" (.20 mm).

(2) - Measured from stem tip of installed valve to spring seat surface.

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CYLINDER HEAD SPECIFICATION TABLE - 2.3L

Application	Specification
Cylinder Head	
Height	5.195-5.199" (131.95-132.05 mm)
Maximum Warpage (1)	.002-.008" (.05-.20 mm)
Valve Seats	
Intake & Exhaust Valve	
Seat Angle	45
Seat Width	
Standard	.049-.061" (1.25-1.55 mm)
Service Limit	.079" (2.00 mm)
Valve Guide Installed Height	
Intake	.52-.54 (13.2-13.7)
Exhaust	.54-.56 (13.7-14.2)
Valve Guide Oil Clearance	
Measured At Valve Head (Dial Indicator)	
Intake Valve	
Standard	.002-.004 (.04-.10)
Service Limit	.006 (.16)
Exhaust Valve	
Standard	.004-.006 (.10-.16)
Service Limit	.009 (.22)
Measured At Stem (Micrometer & Ball Gauge)	
Intake Valve	
Standard	.001-.002 (.02-.05)
Service Limit	.003 (.08)
Exhaust Valve	
Standard	.002-.003 (.05-.08)
Service Limit	.004 (.11)
Valve Stem Installed Height (2)	
Intake Valve	
Standard	1.550-1.568 (39.36-39.83)
Service Limit	1.578 (40.08)
Exhaust Valve	
Standard	1.542-1.560 (39.16-39.63)
Service Limit	1.570 (39.88)

(1) - Maximum resurface limit is .008" (.20 mm).
(2) - Measured from stem tip of installed valve to spring seat surface.

CYLINDER HEAD SPECIFICATION TABLE - 2.2L DOHC

Application	Specification
Cylinder Head	
Height	5.589-5.593" (141.95-142.05 mm)
Maximum Warpage (1)	.002-.008" (.05-.20 mm)
Valve Seats	
Intake & Exhaust Valve Seat Angle	45°
Seat Width	
Standard	.049-.061" (1.25-1.55 mm)
Service Limit	.079" (2.00 mm)
Valve Guide Installed Height	
Intake	.52-.54 (13.2-13.7)
Exhaust	.54-.56 (13.7-14.2)
Valve Guide Oil Clearance	
Measured At Valve Head (Dial Indicator)	
Intake Valve	
Standard	.002-.004 (.05-.11)
Service Limit	.006 (.16)
Exhaust Valve	
Standard	.004-.006 (.10-.16)
Service Limit	.009 (.22)
Measured At Stem (Micrometer & Ball Gauge)	
Intake Valve	
Standard	.001-.002 (.02-.05)
Service Limit	.003 (.08)
Exhaust Valve	
Standard	.002-.003 (.05-.08)
Service Limit	.004 (.11)
Valve Stem Installed Height (2)	
Intake Valve Standard	1.475-1.494 (37.465-37.935)
Service Limit	1.503 (38.185)
Exhaust Valve Standard	1.463-1.482 (37.165-37.635)
Service Limit	1.492 (37.885)

(1) - Maximum resurface limit is .008" (.20 mm).
(2) - Measured from stem tip of installed valve to spring seat surface.

CYLINDER HEAD SPECIFICATION - 2.2L SOHC

CYLINDER HEAD SPECIFICATION TABLE - 2.2L SOHC

Application	Specification
Cylinder Head	
Height	3.935-3.939" (99.95-100.05 mm)
Maximum Warpage (1)	.002-.008" (.05-.20 mm)
Valve Seats	
Intake & Exhaust Valve	
Seat Angle	45°
Seat Width	
Standard	.049-.061" (1.25-1.55 mm)
Service Limit	.079" (2.00 mm)
Valve Guide Installed Height	
Intake	.935-.955 (23.75-24.25)
Exhaust	.593-.620 (15.05-15.75)
Valve Guide Oil Clearance	
Measured At Valve Head (Dial Indicator)	
Intake Valve	
Standard	.0016-.0034 (.04-.09)
Service Limit	.006 (.16)
Exhaust Valve	
Standard	.004-.006 (.11-.16)
Service Limit	.009 (.22)
Measured At Stem (Micrometer & Ball Gauge)	
Intake Valve	
Standard	.0008-.0018 (.020-.045)
Service Limit	.003 (.08)
Exhaust Valve	
Standard	.002-.003 (.055-.080)
Service Limit	.005 (.12)
Valve Stem Installed Height (2)	
Intake Valve	
Standard	1.8994-1.9179 (48.245-48.715)
Service Limit	1.9278 (48.965)
Exhaust Valve	
Standard	1.9809-1.9994 (50.315-50.785)
Service Limit	2.0092 (51.035)

(1) - Maximum resurface limit is .008" (.20 mm).
(2) - Measured from stem tip of installed valve to spring seat surface.

CYLINDER HEAD SPECIFICATION - 2.3L

CYLINDER HEAD SPECIFICATION TABLE - 2.3L

Application	Specification

Cylinder Head
Height ..... 5.195-5.199" (131.95-132.05 mm)
Maximum Warpage ..... (1) .002-.008" (.05-.20 mm)
Valve Seats
Intake & Exhaust Valve
Seat Angle ..... 45°
Seat Width
Standard ..... .049-.061" (1.25-1.55 mm)
Service Limit ..... .079" (2.00 mm)
Valve Guide Installed Height
Intake ..... .52-.54 (13.2-13.7)
Exhaust ..... .54-.56 (13.7-14.2)
Valve Guide Oil Clearance
Measured At Valve Head (Dial Indicator)
Intake Valve
Standard ..... .002-.004 (.04-.10)
Service Limit ..... .006 (.16)
Exhaust Valve
Standard ..... .004-.006 (.10-.16)
Service Limit ..... .009 (.22)
Measured At Stem (Micrometer & Ball Gauge)
Intake Valve
Standard ..... .001-.002 (.02-.05)
Service Limit ..... .003 (.08)
Exhaust Valve
Standard ..... .002-.003 (.05-.08)
Service Limit ..... .004 (.11)
Valve Stem Installed Height (2)
Intake Valve
Standard 1.550-1.568 (39.36-39.83)
Service Limit 1.578 (40.08)
Exhaust Valve
Standard 1.542-1.560 (39.16-39.63)
Service Limit 1.570 (39.88)

(1) - Maximum resurface limit is .008" (.20 mm).
(2) - Measured from stem tip of installed valve to spring seat surface.

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CAMSHAFT SPECIFICATIONS

CAMSHAFT SPECIFICATIONS TABLE

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Application	**In. (mm)**
2.2L DOHC	
2nd Valve	

Standard ..... .002-.006 (.05-.15)
Service Limit ..... .020 (.50)
Journal Runout
Standard ..... .0012 (.03)
Service Limit ..... .002 (.06)
Oil Clearance
Standard ..... .002-.004 (.050-.089)
Service Limit ..... .006 (.15)
Lobe Height
Intake
Primary 1.3402 (34.041)
Mid 1.4510 (36.856)
Secondary 1.3768 (34.971)
Exhaust
Primary 1.3285 (33.745)
Mid 1.4300 (36.323)
Secondary 1.3655 (34.683)

2.2L SOHC

End Play
Standard ..... .002-.006 (.05-.15)
Service Limit ..... .020 (.50)
Journal Runout
Standard ..... .0006 (.015)
Service Limit ..... .001 (.03)
Oil Clearance
Except Exhaust Journal No. 3
Standard ..... .002-.004 (.050-.089)
Service Limit ..... .006 (.15)
Exhaust Journal No. 3
Standard ..... .0039-.0055 (.100-.139)
Service Limit ..... .008 (.20)
Lobe Height
Intake 1.5167 (38.526)
Exhaust 1.5266 (38.778)

2.3L

End Play
Standard ..... .002-.006 (.05-.15)
Service Limit ..... .020 (.50)
Journal Runout
Standard ..... .0012 (.03)
Service Limit ..... .002 (.06)
Oil Clearance
Standard ..... .002-.004 (.050-.089)
Service Limit ..... .006 (.15)
Lobe Height
Intake 1.3252 (33.661)
Exhaust 1.3278 (33.725)

BALANCE SHAFTS SPECIFICATIONS

BALANCE SHAFTS SPECIFICATIONS TABLE

Application	In. (mm)
End Play	
Front	**.0040-.0138 (.100-.350)**
Rear	**.0024-.0070 (.060-.180)**
Runout	**.0008 (.020)**
Oil Clearance	
No. 1 Journal (Rear)	
Standard	**.0020-.0030 (.050-.075)**
Service Limit	**.0035 (.090)**
No. 1 Journal (Front)	
Standard	**.0026-.0046 (.066-.118)**
Service Limit	**.0047 (.120)**
No. 2 Journal	
Standard	**.0030-.0050 (.076-.128)**
Service Limit	**.0051 (.130)**
No. 3 Journal	
Standard	**.0026-.0046 (.066-.118)**
Service Limit	**.0047 (.120)**

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