

## 2.2L 4-CYL

### Article Text

1990 Honda Accord

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Tuesday, March 23, 1999 10:52AM

#### ARTICLE BEGINNING

1990-91 HONDA ENGINES

2.2L 4-Cylinder

Accord, Accord Coupe

#### \* PLEASE READ THIS FIRST \*

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

#### ENGINE IDENTIFICATION

Engine serial number is located on exhaust side of engine block, just below cylinder head water outlet. First 5 characters of engine serial number identify engine type.

#### ENGINE IDENTIFICATION CODES TABLE

AA

Application Engine Code

Accord & Accord Coupe

2.2L 4-Cylinder

Single Exhaust Manifold (DX & LX) ..... F22A1

Dual Exhaust Manifold (EX) ..... F22A4

Dual Intake Manifold (SE) ..... F22A6

AA

#### VALVE ARRANGEMENT

NOTE: The rear or flywheel side of engine is located on right side of vehicle chassis. Front or crankshaft pulley side of engine is located on left side of vehicle chassis.

Right Side - All Intake.

Left Side - All Exhaust.

#### VALVE CLEARANCE ADJUSTMENT

NOTE: Adjust valves clearance with cylinder head temperature less than 100°F (38°C).

1) Remove valve cover. Set No. 1 piston at TDC with UP mark at top. See Fig. 1. Ensure grooves in timing pulley align with top surface of cylinder head and distributor rotor points toward No. 1 plug wire.

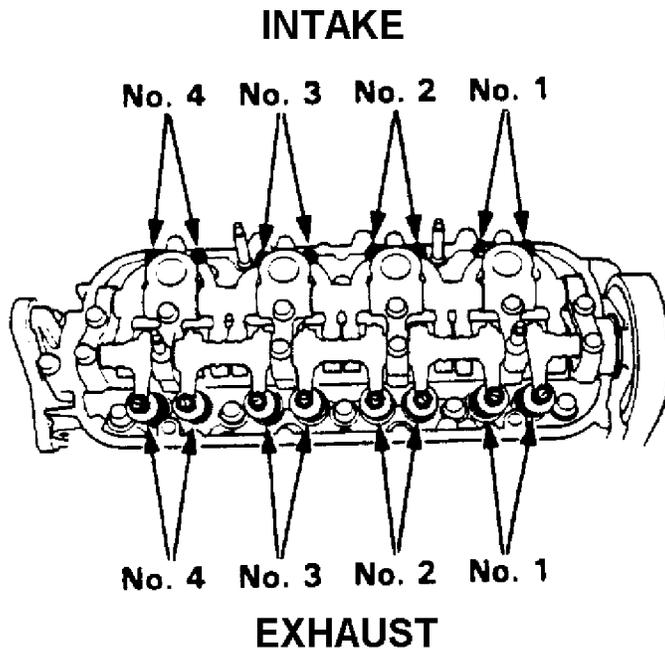
2) Adjust valves for No. 1 cylinder to specification. See VALVE CLEARANCE SPECIFICATIONS table. After adjusting valves, ensure



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**50E07579**

Fig. 2: Valve Layout

Courtesy of American Honda Motor Co., Inc.

### **FUEL PRESSURE RELEASE**

With ignition off, relieve fuel pressure by slowly loosening service bolt on fuel rail (about one turn). Relieve fuel pressure before disconnecting any fuel line. Place a shop towel over fuel filter to prevent pressurized fuel from spraying on engine. Remove fuel supply hose from fuel rail.

### **ENGINE R & I**

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

#### Removal

1) Disconnect battery (negative terminal first) and remove battery. Fix hood in vertical position. DO NOT remove hood. Raise and support vehicle. Drain engine oil and install drain plug.

2) Drain radiator coolant and transmission fluid. Lower vehicle. Remove air intake duct and air cleaner assembly. Remove battery tray. Relieve fuel pressure. See FUEL PRESSURE RELEASE.

3) Remove fuel supply hose from fuel line and fuel return hose from pressure control valve. Disconnect two connectors and remove control box from firewall. DO NOT disconnect vacuum hoses. Disconnect vacuum hose from charcoal canister. Disconnect charcoal canister hose from throttle body.

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4) Remove ground cable from transmission. Remove throttle cable by loosening lock nut. Slip throttle cable end out of throttle bracket and accelerator linkage.

NOTE: DO NOT bend throttle cable when removing it. DO NOT use pliers to remove cable from linkage. Replace cable if kinked or damaged.

5) Disconnect cruise control connector and vacuum hose. Remove cruise control actuator. Remove brake booster mount and vacuum hose from intake manifold.

6) Disconnect wire harness connectors (3) from main wire harness at right side of engine compartment. Remove engine wire harness terminal and starter cable terminal from clamps and relay box. Remove transmission ground terminal.

7) Disconnect engine wire harness connectors (2) from main wire harness and resistor at left side of engine compartment. Remove engine ground wire from valve cover. Remove power steering pump bracket.

8) Remove mounting bolts and "V" belt from power steering pump. Without disconnecting hoses, pull pump away from mounting bracket. Remove mounting bolts and "V" belt from air conditioning compressor. Without disconnecting hoses, pull compressor away from mounting bracket.

9) Disconnect heater inlet hose from cylinder head and heater outlet hose from connecting pipe. Disconnect hoses and connectors to remove radiator assembly.

10) Remove speed sensor. DO NOT disconnect hoses or wiring connector from sensor. Remove center support beam. Remove exhaust pipe self-locking nuts and bracket mounting bolts. Remove ball joints from tie-rod ends. Remove lower suspension control arms. Remove driveshaft. Remove following components:

Manual Transmission Vehicles

- \* Clutch release hose from clutch damper on transmission housing.
- \* Remove shift cable and select cable with bracket from transmission. See Figs. 3 and 4. DO NOT bend cable when removing it. DO NOT use pliers to remove cable. Always replace kinked or damaged cable.

Automatic Transmission Vehicles

- \* Engine stiffener brace.
- \* Torque convertor cover.
- \* Cable holder and shift control lever bolt.
- \* Shift control cable.

NOTE: DO NOT bend shift control cable when removing. DO NOT use pliers to remove cable. Always replace a kinked or damaged cable.

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11) Attach a chain hoist to engine and remove all slack. Remove rear engine mounting bolt. Remove front engine mounting bolt. Remove side transmission mount and mounting bolt. Remove side engine mount and mounting bolt.

12) Ensure engine/transaxle is completely free of vacuum hoses, fuel and coolant hoses, and electric wires. Slowly raise engine approximately 6 inches. Ensure all hoses and wires have been disconnected from engine/transaxle. Remove engine and transaxle. Remove rolling insulator from rear beam.

### Installation

1) To install, reverse removal procedures. After engine is in place in chassis, torque engine mounting bolts in sequence. Refer to Figs. 3 and 4, and also at the end of this article refer to the TORQUE SPECIFICATIONS. Ensure drive shaft spring clips click into place in transaxle. With heater valve open, bleed air from cooling system at bleed bolt.

2) Adjust throttle cable tension. Check clutch pedal free play. Ensure transmission smoothly shifts into gear. Adjust drive belt tension. Inspect for fuel leakage after installation with ignition on. Repeat procedure two or three times and ensure no fuel leaks exist.

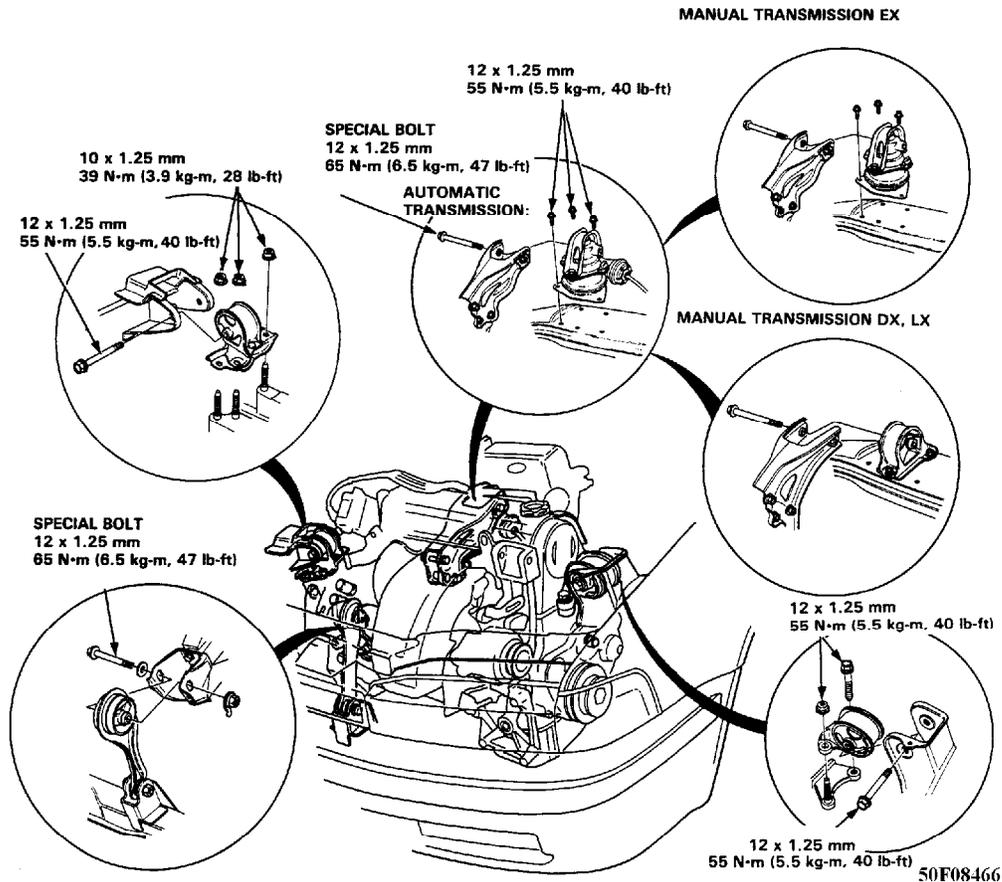


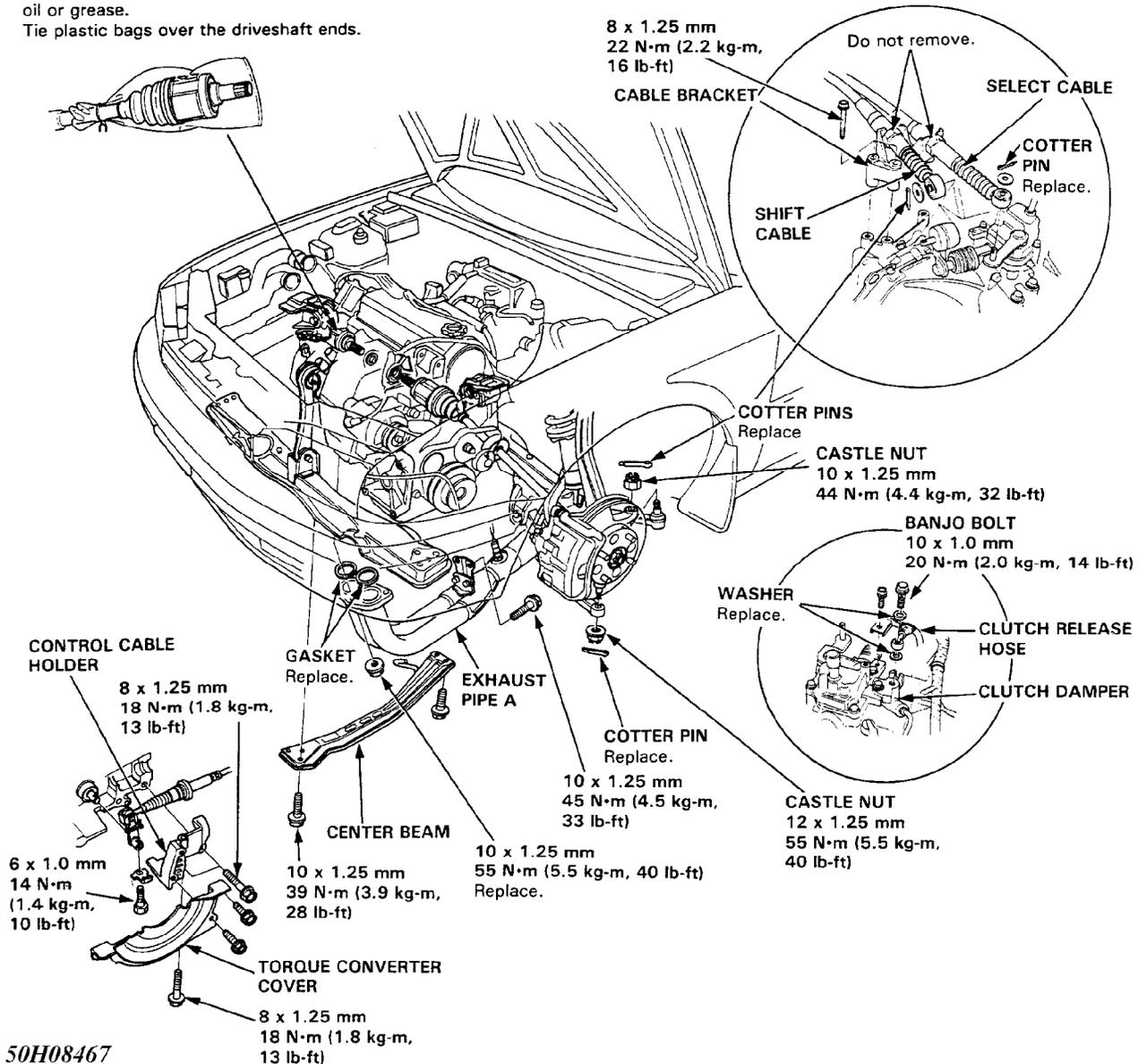
Fig. 3: Removing & Installing Engine Assembly (1 of 2)  
Courtesy of American Honda Motor Co., Inc.

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NOTE: Coat all precision finished surfaces with clean engine oil or grease.  
Tie plastic bags over the driveshaft ends.



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Fig. 4: Removing & Installing Engine Assembly (2 of 2)  
Courtesy of American Honda Motor Co., Inc.

### INTAKE MANIFOLD R & I

#### Removal & Installation

1) Disconnect negative battery terminal. Drain cooling system. Relief fuel pressure. See FUEL PRESSURE RELEASE in this article. Disconnect fuel supply line. Remove vacuum, breather and air inlet hoses. Remove water by-pass hose from cylinder head.

2) Remove charcoal canister hose from throttle body. Remove brake booster vacuum hose and bracket (A/T-equipped vehicles). Remove fuel return line and cruise control vacuum hose. Remove throttle cable from throttle body. On A/T-equipped vehicles, remove throttle control

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cable from throttle body.

3) Disconnect or remove wiring and sensor connectors from intake manifold as required. Remove upper radiator hose and heater inlet hose from cylinder head. Remove heater outlet pipe bracket bolt from intake manifold. Disconnect and remove cruise control servo.

4) From beneath vehicle, remove splash shield. Remove intake manifold bracket. Remove intake manifold. Remove throttle body and air control components from manifold as required. See Fig. 5. To install, reverse removal procedures. See TORQUE SPECIFICATIONS at end of article.

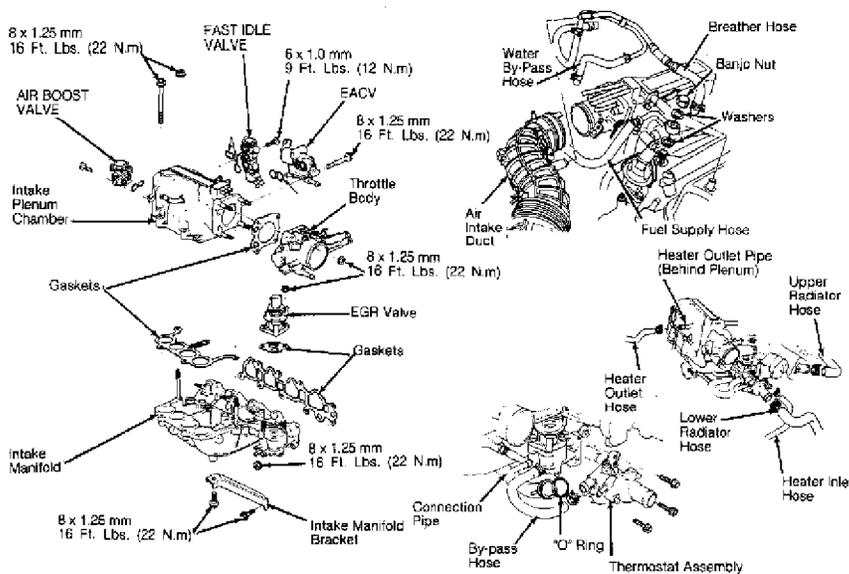


Fig. 5: Removing & Installing Intake Manifold  
Courtesy of American Honda Motor Co., Inc.

### EXHAUST MANIFOLD R & I

#### Removal & Installation

To access components on lower side of engine, raise vehicle and remove dust shield. Remove components as necessary to remove manifold. To install, reverse removal procedures. See Fig. 6. See TORQUE SPECIFICATIONS at end of article.

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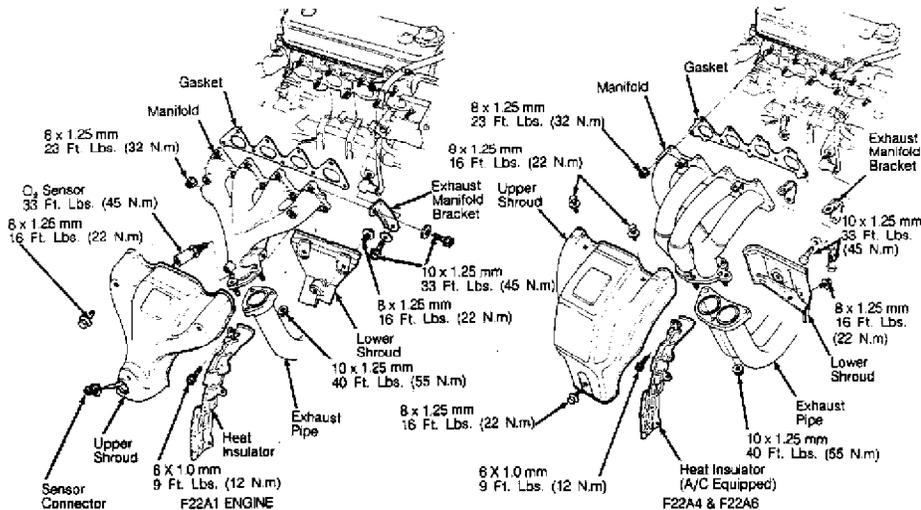


Fig. 6: Removing & Installing Exhaust Manifold  
Courtesy of American Honda Motor Co., Inc.

### CYLINDER HEAD R & I

**NOTE:** Engine removal is not required for this procedure. Inspect camshaft timing belt before removing cylinder head.

#### Removal

1) Turn crankshaft so No. 1 cylinder is at TDC of compression stroke. Mark all emission hoses before disconnecting or removing. Disconnect negative battery cable. Drain cooling system. Relieve fuel pressure. See FUEL PRESSURE RELEASE in this article. Disconnect fuel supply hose at fuel rail.

2) Remove vacuum, breather hose and air intake duct. Remove water by-pass hose from cylinder head. Remove charcoal canister hose from throttle body. On A/T-equipped vehicles, remove brake booster vacuum hose and vacuum hose mount from intake manifold. Remove fuel return hose.

3) Remove cruise control vacuum hose. Remove throttle cable from throttle body. On A/T-equipped vehicles, remove throttle control cable from throttle body.

**NOTE:** DO NOT bend cables when removing. DO NOT use pliers to remove cable from linkage. Always replace kinked or damaged cables.

4) Disconnect 2 distributor connectors. Disconnect ignition coil connector and TDC/CRANK/CYL sensor connector. Remove spark plug wiring and distributor. Remove emission control box. Disconnect connectors (2) before removing. DO NOT disconnect emission hoses from control box.

5) Disconnect alternator connector and remove engine wiring

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harness from valve cover. Disconnect engine wiring harness connectors. Remove harness clamps from cylinder head and intake manifold.

6) Disconnect injector connectors (4) and EACV connector. Disconnect TA (Temperature Air) sensor connector and thermostwitch (located on thermostat housing). Disconnect EGR valve lift sensor connector (A/T only). Disconnect throttle angle sensor and TW (Temperature Water) sensor connector.

7) Disconnect coolant temperature gauge sending unit. Remove upper radiator hose and heater inlet hose from cylinder head. Remove heater outlet pipe bracket bolt from intake manifold.

8) Remove thermostat assembly from intake manifold. Disconnect and remove cruise control actuator. Remove mounting bolts and "V" belt from power steering pump. Without disconnecting hoses, pull power steering pump from mounting bracket.

9) Raise and support vehicle. Remove front wheels and splash shield. Remove intake manifold bracket bolts and intake manifold. See INTAKE MANIFOLD R & I in this article.

10) Remove exhaust manifold and heat insulator. Remove valve cover and engine ground wire. Remove side engine mount bracket stay. See Figs. 3 and 4. Remove timing belt upper cover. Loosen timing belt adjusting bolt and push belt tensioner to release tension from belt. Retighten adjusting bolt. Remove timing belt from driven pulley.

11) Remove cylinder head bolts and cylinder head. Separate cylinder head from block with a flat-blade screwdriver. See Fig. 7.

#### Inspection

For information on checking cylinder head, refer to CYLINDER HEAD in this article.

#### Installation

1) To install cylinder head, reverse removal procedure. Ensure cylinder head and engine block are clean. Always use a NEW head gasket. Dowel pins and oil control jet must be properly aligned.

2) Ensure No. 1 cylinder is at TDC and camshaft pulley "UP" mark is at top. Lubricate cylinder head bolt with clean engine oil and tightened to specification in 3 steps:

- \* 1st step, 30 ft. lbs. (40 N.m)
- \* 2nd step, 52 ft. lbs. (70 N.m)
- \* 3rd step, 80 ft. lbs. (108 N.m)

3) Tighten intake and exhaust manifolds in a crisscross pattern in 2 or 3 steps. See TORQUE SPECIFICATIONS at end of article. Fill cooling system and bleed air at bleed bolt.

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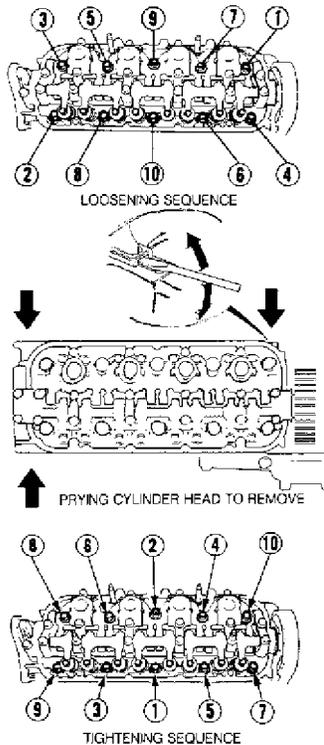


Fig. 7: Removing & Installing Cylinder Head  
Courtesy of American Honda Motor Co., Inc.

**TIMING & BALANCER SHAFT BELTS R & I**

**NOTE:** Camshaft timing and balancer shaft belts are located at front of engine, on left side of vehicle. Remove balance shaft drive belt for access to camshaft drive belt. Both belts must be timed to crankshaft rotation.

**Removal**

1) Position crankshaft with No. 1 cylinder at TDC of compression stroke. Disconnect battery negative terminal. Remove splash shield. Disconnect cruise control actuator and connector. DO NOT disconnect actuator cable. Remove power steering pump without disconnecting hoses.

2) Disconnect alternator wiring. Remove wiring harness from valve cover. Remove alternator and A/C (if equipped) belts. Remove valve cover and upper timing belt cover. Remove side engine mount stay (if equipped). See Figs. 3 and 4. Remove engine oil dipstick and pipe. Remove crankshaft pulley bolt and pulley.

3) Using an engine support, remove 2 rear bolts from engine center support and lower engine to allow lower belt cover removal. Release tension from timing belts by loosening belt tensioner. Retighten tensioner adjusting nut. Remove balancer and camshaft timing belts.

**CAUTION:** DO NOT rotate crankshaft or camshaft when removing timing

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belts.

### Inspection

With belt or belt covers removed, inspect belt for cracks or oil soaking. Inspect trailing edge of belt teeth for wear. Replace belt if oil soaked or cracked. Clean any oil or grease from belt.

### Installation

1) Ensure crankshaft and camshaft are at TDC position for No. 1 cylinder. Install camshaft timing belt. See Fig. 9. Align groove on front timing balancer belt driven pulley with pointer on oil pump body. Align rear timing balancer belt driven pulley by inserting a 6 x 100 mm bolt (or equivalent) 74 mm into alignment access hole.

2) Install balancer shaft belt. Loosen tensioner adjusting nut (if necessary) to install belt. Adjust belt tension. Reverse removal procedure to complete installation. Torque crankshaft pulley bolt to specification. See TORQUE SPECIFICATIONS at end of article.

### TENSION ADJUSTMENT

Ensure engine is cold. With valve cover removed, ensure piston No. 1 is at TDC and belt tensioner adjusting nut is loose. Rotate crankshaft COUNTERCLOCKWISE 3 teeth on camshaft pulley to apply tension to timing belt. Tighten belt tensioner adjusting nut to specification. See TORQUE SPECIFICATIONS at end of article.

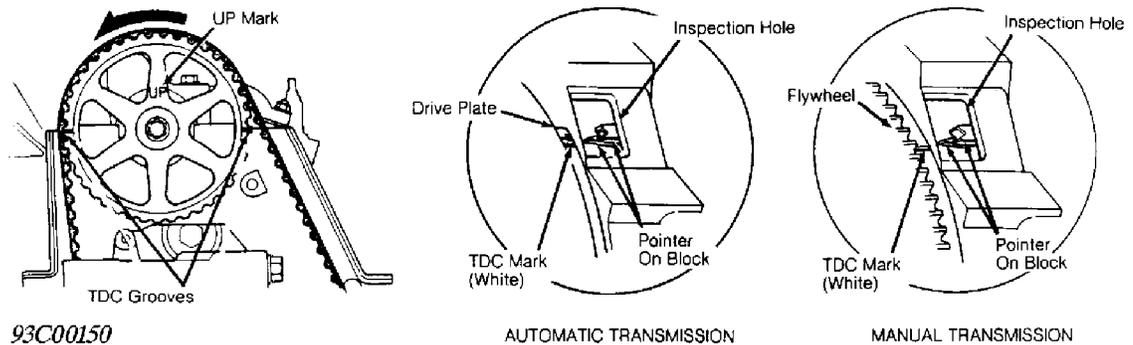


Fig. 8: Timing Belt Alignment  
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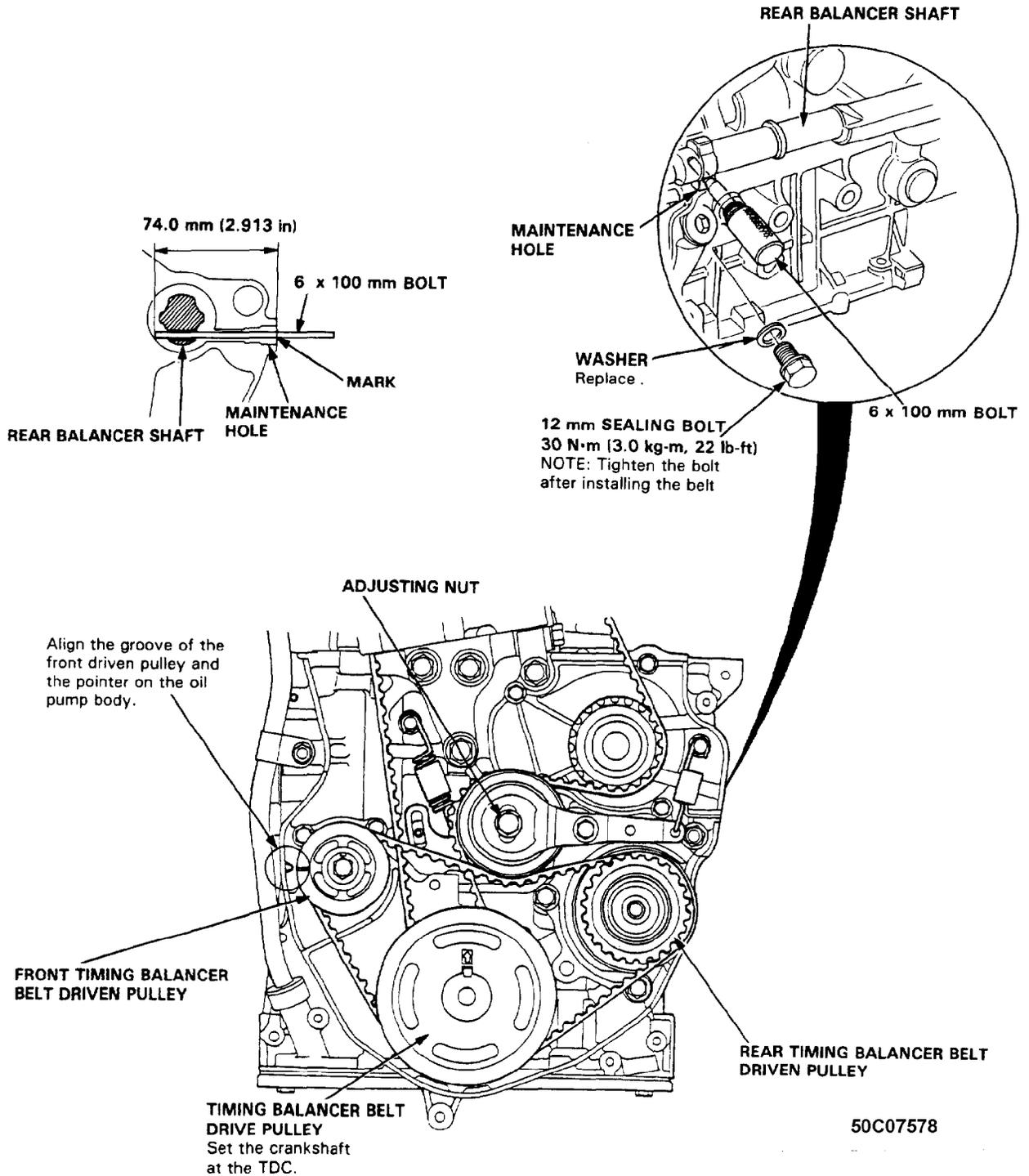


Fig. 9: Installing Timing & Balancer Belt  
Courtesy of American Honda Motor Co., Inc.

**CRANKSHAFT FRONT SEAL R & I**

NOTE: Front crankshaft seal can be replaced with engine installed.

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#### Removal & Installation

1) Turn crankshaft to align No. 1 piston at TDC of compression stroke. Remove drive belts and crankshaft pulley. Remove upper and lower timing belt covers. Remove balancer shaft timing belt and drive pulley. Remove camshaft timing belt and crankshaft pulley. Remove crankshaft/oil pump seal.

2) Use Seal Driver (#07LAD-PT3010A) to install new seal. Reinstall and align camshaft timing and balancer shaft drive belts. See TIMING & BALANCER SHAFT BELTS R & I in this article. To complete installation, reverse removal procedure. See Fig. 9. Refer to TORQUE SPECIFICATIONS at end of article.

#### ROCKER ARMS & CAMSHAFT R & I

##### Removal

1) Remove cylinder head. See CYLINDER HEAD R & I. Turn camshaft pulley until "UP" mark faces upward and TDC grooves align with valve cover surface. See Fig. 1. Remove camshaft pulley retaining bolt, special washer, camshaft pulley and key. Remove back cover. Loosen valve adjusting screws. Remove rocker arm assembly.

2) Loosen camshaft bearing bolts, two turns at a time (in a crisscross pattern) to prevent damage to valves or rocker arm assembly. DO NOT remove cam holder bolts when removing rocker arm assembly. Bolts keep cam holders, springs and rocker arms on shafts.

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

##### Inspection

1) Inspect rocker shafts and rocker arms. Lift camshaft from cylinder head. Clean camshaft and inspect lobes. Replace camshaft if lobes are pitted, scored or excessively worn. Clean camshaft bearing surfaces in cylinder head. Check camshaft fit in head and camshaft holders using Plastigage method. Use a dial indicator to check camshaft end play.

2) Measure both intake and exhaust rocker shafts. Rocker shafts should be checked for correct outside diameter, out-of-round and for straightness. Check rocker arm bore diameter.

NOTE: If camshaft bearing radial clearance is not within specification and camshaft has been replaced, replace cylinder head. If camshaft has not been replaced, check total runout with camshaft supported on "V" blocks. See CAMSHAFT SPECIFICATIONS TABLE at end of article. If camshaft runout is within specification, replace cylinder head. If camshaft runout is not within specification, replace camshaft and recheck. If bearing clearance is not within specification, replace cylinder head.

##### Installation

1) To assemble, install exhaust rocker shaft with oil holes downward. Align intake rocker shafts projections with cam holder

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indents. Ensure all components are cleaned and lubricated at contact points before installation.

2) Position camshaft in cylinder head with keyway facing upward (No.1 cylinder at TDC). Install camshaft seal. Apply gasket sealer to mating surfaces of cam holders No. 1 and No. 6. See Fig. 10. Ensure valve adjusting screw lock nuts and adjusting screws are backed off before installation.

3) Position rocker shaft assembly on cylinder head. Ensure all rockers align with valves. Tighten mounting bolts 2 turns at a time in sequence to ensure rockers do not bind on valves. Install back cover. Install key and camshaft pulley on camshaft. Torque camshaft pulley bolt to specification. See TORQUE SPECIFICATIONS at end of article.

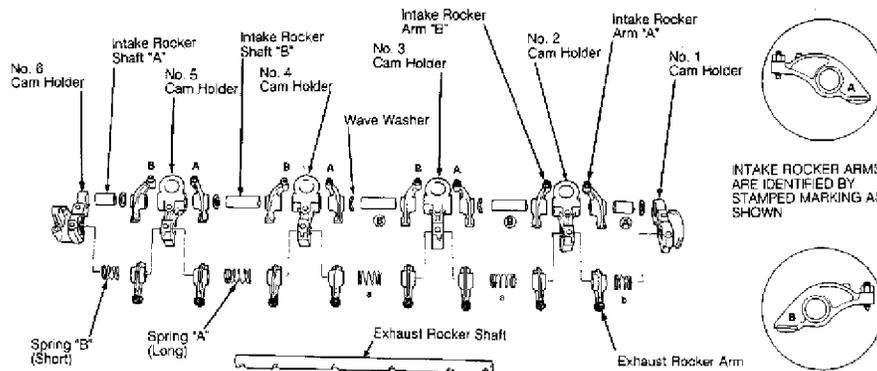


Fig. 10: Identifying Rocker Arm Shaft Components  
Courtesy of American Honda Motor Co., Inc.

### BALANCE SHAFTS R & I

NOTE: Remove engine from vehicle before removing balance shafts.

#### Removal

1) Remove oil pan, flywheel and right side (flywheel) crankshaft oil seal cover. Remove timing belts. Refer to TIMING & BALANCER SHAFT BELTS R & I in this article. Remove balancer shaft drive gear case. See Fig. 11. Insert a screwdriver into cross-drilled front balance shaft and remove driven pulley.

2) Insert a dowel pin or special tool in maintenance hole of rear balance shaft. See Fig. 9. Remove rear timing balance shaft driven gear. Remove oil pick-up and filter screen. Remove front-cover/oil-pump assembly. Remove thrust plate from rear balancer shaft. Remove balancer shafts.

#### Inspection

1) Check balancer shaft end play before removing end plates and front cover. See BALANCE SHAFTS SPECIFICATIONS TABLE at end of article. If end play exceeds specification, check thrust plate and thrust surfaces. Thrust plates and thrust surface on oil pump body are fixed and must not be changed by grinding or shimming.

2) Inspect surface of balancer shaft journal and balancer

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shaft bearing. Replace if worn, damaged or discolored. When replacing front bearing on rear balance shaft, replace oil pump body. Measure front and rear edges of bearing journals. Taper should not exceed .002" (.05 mm). Using "V" blocks, support shaft on front and rear bearings. Check journal runout and journal diameter. Refer to BALANCE SHAFTS SPECIFICATIONS TABLE at end of article.

### Installation

1) Position balancer shafts in engine block. Install thrust plate on front balancer 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 balancer drive gears. Hold rear balancer shaft using special tool or dowel and install driven gear. Hold front balancer shaft with a screwdriver and install driven pulley.

3) Use special tool or dowel to align rear balance shaft. See Fig. 9. Align groove in balancer driven pulley with pointer on balancer gear case. Install balancer gear case on engine. An additional mark is on one of pulley teeth for belt alignment. See Fig. 11.

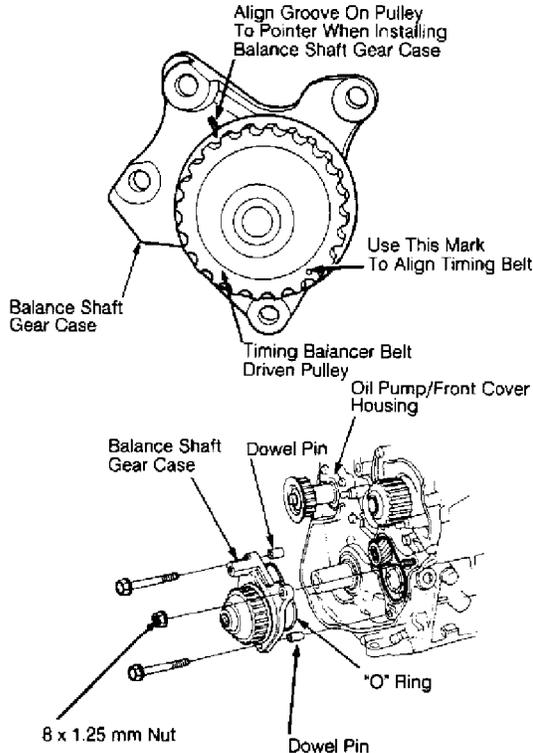


Fig. 11: Installing Balance Shafts  
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### REAR CRANKSHAFT SEAL R & I

NOTE: Engine removal is not required for this procedure. Remove transmission and flywheel.

#### Removal & Installation

1) Remove transmission and flywheel or drive plate. See appropriate article:

- \* TRANSMISSION REMOVAL & INSTALLATION - A/T
- \* CLUTCH

Pry seal from rear seal plate. Ensure crankshaft seal surface and seal plate are clean.

2) Lubricate seal lips and crankshaft with a light coat of grease. Install seal with part number facing outward. Use Seal Driver (07749-0010000) to install drive 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. See TORQUE SPECIFICATIONS at end of article.

### WATER PUMP R & I

#### Removal & Installation

Remove camshaft timing and balance shaft drive belts. See TIMING & BALANCER SHAFT BELTS R & I in this article. Remove pump from engine. Clean and inspect cylinder block mating surface. Apply sealant to water pump mating surface of new seal. Install water pump and torque bolts to specification. See TORQUE SPECIFICATIONS at end of article. To complete installation, reverse removal procedure.

### OIL PAN R & I

#### Removal & Installation

Raise and support vehicle. Remove exhaust pipe and center support beam for access to oil pan bolts. Drain engine oil from pan. Remove oil pan. To install, position new gasket on pan. Apply liquid gasket to oil pan gasket at corners of rear seal radius. Torque oil pan bolts in 2 steps in a crisscross pattern to specification. See TORQUE SPECIFICATIONS at end of article. Tighten oil pan drain plug to specification.

### CYLINDER HEAD SERVICE

Check camshaft bearing clearance. Refer to the CAMSHAFT SPECIFICATIONS TABLE at end of article. If clearance is not within specification, cylinder head must be replaced. Check cylinder head for warpage. See CYLINDER HEAD SPECIFICATIONS TABLE at end of article.

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**VALVE SPRINGS SERVICE**

Remove valve springs from cylinder head. See VALVE STEM OIL SEAL REPLACEMENT for valve spring removal. With valve springs removed, measure spring free length. Replace any spring shorter than minimum free length specification. Refer to MINIMUM VALVE SPRING FREE LENGTH table. Install springs with tightly wound coil end toward cylinder head. Manufacturer does not list an installed height for valve springs. See VALVE STEM INSTALLED HEIGHT table.

MINIMUM VALVE SPRING FREE LENGTH

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Application (1) In. (mm)

Intake Valve Spring

Chuo Hatsujo	2.1578 (54.81)
Nihon Hatsujo	2.1582 (54.82)
Chuo Hatsujo (2)	2.0929 (53.16)
Nihon Hatsujo (2)	2.0925 (53.15)

Exhaust Valve Spring

Chuo Hatsujo	2.1968 (55.80)
Nihon Hatsujo	2.2157 (56.28)
Chuo Hatsujo (2)	2.1968 (55.80)
Nihon Hatsujo (2)	2.1961 (55.78)

(1) - Further valve spring identification not available from manufacturer.

(2) - Dual intake manifold.

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VALVE STEM INSTALLED HEIGHT (1)

AA

Application In. (mm)

Intake Valve

New or Rebuild	1.8994-1.9179 (48.245-48.715)
Service Limit	1.9278 (48.965)

Exhaust Valve

New or Rebuild	1.9809-1.9994 (50.315-50.785)
Service Limit	2.0092 (51.035)

(1) - Measure from stem tip of installed valve to spring seat surface.

AA

NOTE: Cylinder head removal is not required during valve stem oil seal replacement. Use in-car Valve Spring Compressor (Snap-On YA8845 with YA8845-2A (7/8") attachment).

**VALVE STEM OIL SEAL REPLACEMENT**

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#### On-Bench

Mark valves and valve springs for reassembly reference. Tap each valve stem with a plastic mallet to loosen valve keepers before installing spring compressor. Install spring compressor. Compress spring and 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 gaiter spring and exhaust seals have a Black gaiter spring.

#### In Vehicle

1) Turn the crankshaft so that pistons No. 1 and No. 4 are at TDC. Remove the valve cover and the rocker arm assembly. Refer to ROCKER ARMS & CAMSHAFT R & I. When removing or installing rocker arm assembly, DO NOT remove cam holder bolts.

2) Remove fuel injectors and wiring harness. Using bolts (8 mm) supplied with tool, mount two uprights to cylinder head at end of cam holder location. The uprights fit over camshaft. Insert cross shaft through top hole location of two uprights.

CAUTION: DO NOT allow valve keepers to fall into oil passage. Cover oil passages with a shop towel.

3) Intake Valves - Select 7/8" diameter long compressor attachment and fasten attachment to No. 5 hole of lever arm with pin supplied. Position piston at TDC and insert air adaptor into spark plug hole. Pump air into cylinder to keep valve closed while compressing springs and removing valve keepers. Position lever arm under cross shaft so lever is perpendicular to shaft and compressor attachment rests on top of retainer for spring to shaft being compressed. Use front position slot on lever. Using a downward motion on lever arm, compress valve spring and remove keepers from valve stem. Slowly release pressure on spring. Install valve seals. Install springs, retainers and keepers in reverse order of removal.

4) Exhaust Valves - Select 7/8" diameter short compressor attachment and fasten attachment to No. 4 hole of lever arm with pin supplied. Position lever arm under cross shaft so lever is perpendicular to shaft and compressor attachment rests on top of retainer for spring being compressed. Use front position slot on lever. Ensure cylinder is full of air as described in step 3).

5) Using a downward motion on lever arm, compress valve spring and remove keepers from valve stem. Slowly release pressure on spring. Replace valve seals. Install springs, retainers and keepers in reverse order of removal. Rotate crankshaft 180 degrees so No. 2 and No. 3 pistons are at TDC. Repeat procedure as necessary.

#### VALVE GUIDES SERVICE

Measure guide-to-stem clearance using a dial indicator against head of valve with valve head approximately 10 mm off seat. If clearance exceeds service limit, recheck using a new valve. If

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clearance is excessive replace valve guide. Heat cylinder head to 302°F (150°C) in oven, chill guides, and replace using an air impact driver and Valve Guide Driver (07742-0010100). Measure installed valve guide height on camshaft side, from end of guide to cylinder head spring seat surface. Ensure installed height is within specification.

VALVE GUIDE CLEARANCE

AA

Application In. (mm)

Measured at Valve Head (Dial Indicator)

Intake Valve  
New or Rebuild ..... .002-.004 (.05-.10)  
Service Limit ..... .006 (.16)  
Exhaust Valve  
New or Rebuild ..... .004-.006 (.11-.16)  
Service Limit ..... .009 (.24)

Measured at Stem (Micrometer & Ball Gauge)

Intake Valve  
New or Rebuild ..... .0010-.0020 (.025-.050)  
Service Limit ..... .0030 (.080)  
Exhaust Valve  
New or Rebuild ..... .0022-.0030 (.055-.080)  
Service Limit ..... .005 (.12)

AA

1991 VALVE GUIDE CLEARANCE

AA

Application In. (mm)

Measured At Valve Head (Dial Indicator)

Intake Valve  
Standard ..... .0014-.0034 (.04-.09)  
Service Limit ..... .006 (.16)  
Exhaust Valve  
Standard ..... .004-.006 (.11-.16)  
Service Limit ..... .009 (.24)

Measured at Stem (Micrometer & Ball Gauge)

Intake Valve  
Standard ..... .0007-.0017 (.020-.045)  
Service Limit ..... .0030 (.080)  
Exhaust Valve  
Standard ..... .0022-.0030 (.055-.080)  
Service Limit ..... .005 (.12)

AA

VALVE GUIDE INSTALLED HEIGHT

AA

Application In. (mm)

Intake ..... 0.95 (24.0)  
Exhaust ..... 0.60 (15.3)

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AA

**VALVE SEATS SERVICE**

Renew valve seats using a 3-angle cut. Check valve with Bluing compound to ensure seat is correct width and centered on valve face. Insert each valve into head and check installed stem height. If stem height exceeds specification replace valve and recheck. If stem height still exceeds specification, replace cylinder head. Manufacturer does not provide procedure for valve seat replacement.

**VALVE SEAT WIDTH SPECIFICATIONS**

AA

Application	In. (mm)
New or Rebuild .....	.049-.061 (1.25-1.55)
Service Limit .....	.079 (2.0)

AA

**VALVES SERVICE**

Check valve for wear or burning. Ensure valve dimensions are within specification. See VALVES & VALVE SPRINGS SPECIFICATIONS TABLE at end of article. Check installed height after refinishing valve or seat. When installing valves in cylinder head, coat valve stems with oil and ensure free movement in valve guide. Tap valve stems with plastic mallet after installation to ensure spring retainers and keepers are seated.

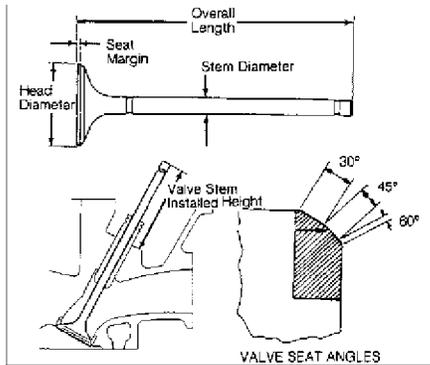


Fig. 12: Valve Guide, Valve Seat & Valve Specifications  
Courtesy of American Honda Motor Co., Inc.

**ROCKER ARM SHAFT ASSEMBLY SERVICE**

Mark parts during disassembly for installation reference. Check both rocker shafts and rocker arms for excessive wear or scoring. Measure OD of rocker shaft and ID of rocker arms. Service limit for shaft-to-rocker clearance is .003" (.08 mm). Replace shaft or rockers as necessary if worn beyond specification. Check rocker arm contact points for wear or scoring and replace as necessary. Rocker

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shaft MUST be installed with oil holes pointing down. Lubricate contact areas with engine oil during assembly. See Fig. 10.

**PISTON & ROD ASSEMBLY SERVICE**

Piston pin press fits into connecting rod. Piston pin-to-connecting rod interference is .0005-.0013" (.013-.032 mm). Use a press to disassemble or assemble piston/rod assembly. Inspect connecting rod for cracks or heat damage. Measure piston pin to piston clearance. All replacement piston pins are oversize. When installing piston on rod, ensure arrow on top of piston faces timing belt side of engine (front) and oil squirt hole on rod faces towards rear of vehicle (left or intake side of engine).

NOTE: The number (1-4) stamped at connecting rod big end split line references big end bore size. It DOES NOT indicate position of rod in cylinder.

PISTON-TO-ROD ASSEMBLY SPECIFICATIONS

Application	In. (mm)
Connecting Rod Big End ID	2.01 (51)
Piston Pin Diameter	
New or Rebuild	.8659-.8661 (21.994-22.000)
Oversize	.8660-.8663 (21.997-22.003)
Piston Pin-to-Connecting Rod	
Interference	.0005-.0013 (.013-.032)
Piston Pin-to-Piston Clearance	
Service Limit	.0005-.0009 (.012-.024)

**FITTING PISTONS**

Check preliminary clearance using a feeler gauge between piston skirt and cylinder with piston a bottom of bore. Service limit is .002" (.05 mm). If clearance exceeds service limit, check piston and bore for wear or scoring and measure piston and bore using a micrometer. Measure piston .83" (21 mm) from bottom of skirt. Measure cylinder bore for wear or taper. If piston pin bore-to-piston pin fit is correct it should be possible to push lubricated pin into piston with thumb pressure. Ensure piston ring grooves and bores are lubricated with engine oil prior to installation. Refer to the PISTON-TO-ROD ASSEMBLY SPECIFICATIONS and also refer to the PISTON-TO-BORE SPECIFICATIONS tables.

PISTON-TO-BORE SPECIFICATIONS

Application	In. (mm)
Piston-to-Bore Clearance	
New or Rebuild	.0008-.0016 (.020-.040)

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Service Limit .....	.002 (.05)
OEM Piston Diameter (Measured at Skirt)	
New or Rebuild	
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)
Oversize Piston Diameter	
.25 mm	
(1st Oversize) .....	3.3555-3.3559 (85.23-85.24)
.50 mm	
(2nd Oversize) .....	3.3653-3.3657 (85.48-85.49)
Piston Pin-to-Piston Clearance	
New or Rebuild .....	.0005-.0009 (.012-.024)

**PISTON RINGS SERVICE**

Ensure cylinder bore has been checked and sized. Using a piston, push a new ring into cylinder bore .6-.8" (15-20 mm) from bottom. Use a feeler gauge to measure ring end gap. If gap is less than specification, ensure rings are correct for bore diameter. If end gap exceeds specifications ensure cylinder bore is within wear limits. Use a ring expander to remove old rings from pistons. Clean ring grooves. DO NOT use a wire brush to clean ring lands or cut lands deeper with groove cleaning tool. Use a ring expander to install new rings in sequence. Measure ring-to-land clearance. Manufacturer's markings on ring face top of piston. Ensure rings rotate in piston grooves without binding. DO NOT position any ring gap in line with piston pin. See PISTONS, PINS & RINGS SPECIFICATIONS TABLE at end of article. See Fig. 13.

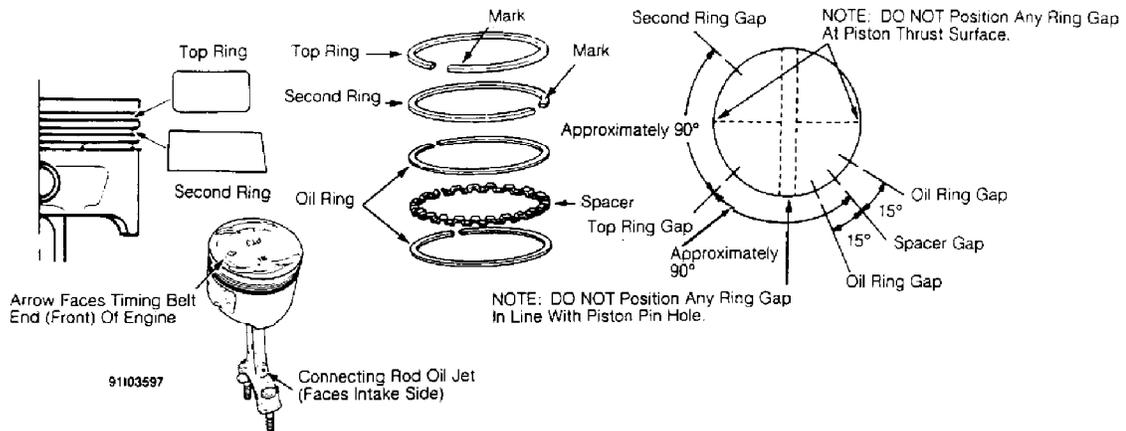


Fig. 13: Aligning Piston Rings  
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**ROD BEARINGS SERVICE**

Connecting rods are sized by manufacturer in 4 tolerance groups. Group number is stamped 1, 2, 3, 4 or I, II, III, IIII at big end split line. Any combination of these marked rods may be found. The difference in big end bore dimension between smallest (group 1) and largest (group 4) is .0009" (.024 mm). Connecting rod big end bore diameter is 2.001" (51.00 mm). These stamped numbers DO NOT indicate which cylinder these rods are fitted. Always check rod bearing clearance using Plastigage method. Alternative size bearings may be used (mixed or matched) to obtain correct clearance. Refer to CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS SPECS TABLE at end of article. When installing, ensure bearing recesses in big end and cap are on same side. Tighten connecting rod cap nuts to specification. See TORQUE SPECIFICATIONS at end of article.

**CRANKSHAFT, THRUST & MAIN BEARINGS SERVICE**

Check crankshaft end play. Inspect thrust surfaces and bearing, replace as necessary. Install thrust washers with grooves outward. DO NOT grind or shim thrust washers to alter clearance. Check crankshaft journal bearing clearance using Plastigage method. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS SPECS TABLE at end of article. Check crankshaft for runout and journals for out-of-round and taper. Bearings installed by manufacturer are color coded by size. Each block and crankshaft is measured and coded by main journal or main bearing bore size. Clean marked areas with detergent or cleaning solvent only. Bearings may be mixed or matched to obtain correct bearing clearance. Torque all bolts of main bearing cap bridge in a 2-step sequence to specification. See TORQUE SPECIFICATIONS at end of article. Coat all thrust surfaces and bolt threads with oil.

CAUTION: After replacing any rod or main bearing, warm engine at idle to operating temperature and allow to idle an additional 15 minutes.

**CYLINDER BLOCK SERVICE**

Measure each cylinder bore for wear and taper. Refer to CYLINDER BLOCK SPECIFICATIONS TABLE at end of article. Check top of block for warpage. If bore dimensions exceed service limit, cylinders must be bored oversized. Maximum bore oversize is .020" (.50 mm). If reusing cylinder block, hone to a 60-degree pattern with a No. 400 grit stone and recheck.

**CRANKCASE CAPACITY TABLE**

CRANKCASE CAPACITY

Application Quarts (Liters)

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Oil Change Without Filter .....	3.7 (3.5)
Oil Change Including Filter .....	4.0 (3.8)
Engine Overhaul .....	5.2 (4.9)

AA

**OIL PRESSURE**

Oil pressure relief valve should be checked with engine temperature at 176°F (80°C). At idle, minimum oil pressure should be 10 psi (0.7 kg/cm<sup>2</sup>). At 3000 RPM, minimum oil pressure should be 50 psi (3.5 kg/cm<sup>2</sup>).

**OIL PUMP R & I**

Removal & Disassembly

Raise and support the vehicle. Drain the engine oil. Align the No. 1 cylinder at TDC and remove the timing belts. Refer to TIMING & BALANCER SHAFT BELTS R & I. Remove oil pan and pick-up screen. Remove pump housing/front cover assembly. See Fig. 14. Remove pump cover from pump rotors. Remove oil seals.

Inspection

Check 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 torque 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

AA

Application	Specification
Capacity (1) .....	46.4 qts. (43.9L)
New or Rebuild	
Radial Clearance	
Inner Rotor-to-Outer Rotor .....	.0008-.0063" (.020-.160 mm)
Pump Body-to-Rotor .....	.0040-.0075" (.100-.190 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)

(1) - Volume per minute at 6000 RPM.

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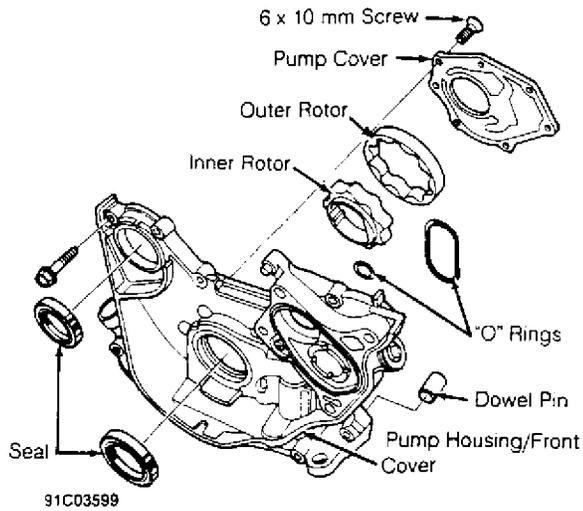
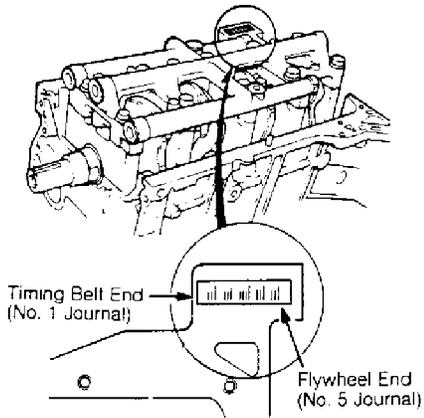


Fig. 14: Exploded View of Oil Pump/Front Cover  
Courtesy of American Honda Motor Co., Inc.

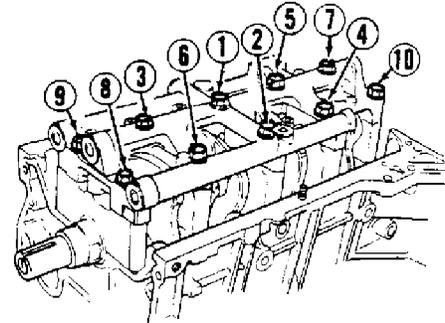
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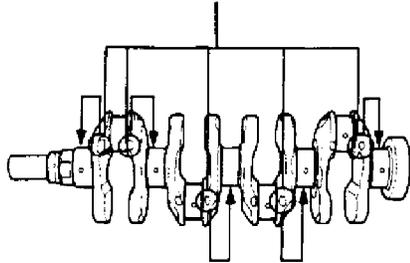
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MAIN BEARING JOURNAL CODE LOCATIONS



MAIN BEARING TIGHTENING SEQUENCE

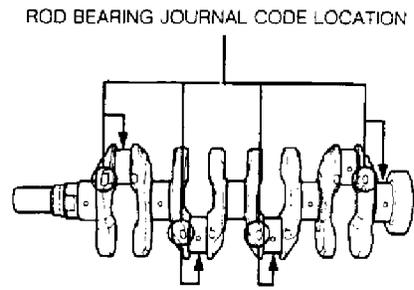


BEARING IDENTIFICATION: Color Code Is On Edge Of Bearing.

	→ Larger Crank Bore Diameter			
	A or I	B or II	C or III	D or IIII
	→ Smaller Bearing I.D.			
JOURNAL MARKING	1 or I	2 or II	3 or III	4 or IIII
	Pink	Pink/ Yellow	Yellow	Yellow/ Green
	Pink/ Yellow	Yellow	Yellow/ Green	Green
	Yellow	Yellow/ Green	Green	Green/ Brown
	Yellow/ Green	Green	Green/ Brown	Brown
	Green	Green/ Brown	Brown	Brown/ Black
	Green/ Brown	Brown	Brown/ Black	Black

Smaller Main Journal  
 Smaller Bearing I.D.

91A03598



ROD BEARING JOURNAL CODE LOCATION

BEARING IDENTIFICATION: Color Code Is On Edge Of Bearing.

	→ Larger Big End Bore Diameter			
	1 or I	2 or II	3 or III	4 or IIII
	→ Smaller Bearing I.D.			
JOURNAL MARKING	A or I	B or II	C or III	D or IIII
	Red	Pink	Yellow	Green
	Pink	Yellow	Green	Brown
	Yellow	Green	Brown	Black
	Green	Brown	Black	Blue

Smaller Rod Journal  
 Smaller Bearing I.D.

Fig. 15: Main & Rod Bearing Sizes  
 Courtesy of American Honda Motor Co., Inc.

**TORQUE SPECIFICATIONS**

TORQUE SPECIFICATIONS TABLE

AA

Application	Ft. Lbs. (N.m)
Balance Shaft Pulley Bolt (8 x 1.25 mm) . . . . .	22 (30)
Belt Tensioner Adjusting Nut . . . . .	33 (45)
Belt Tensioner Stud Bolt . . . . .	48 (65)

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Camshaft Bearing/Rocker Arm	
6 mm Bolt .....	9 (12)
8 mm Bolt .....	16 (22)
Camshaft Pulley Bolt .....	28 (38)
Connecting Rod Nuts .....	34 (47)
Crankshaft Pulley Bolt .....	170 (230)
Crankshaft Pulley Bolt (1991) .....	162 (220)
Cylinder Head Bolts (3 Steps)	
1st Step .....	29 (40)
2nd Step .....	51 (70)
3rd Step .....	78 (108)
Drive Plate (Automatic Transmission) .....	55 (75)
Exhaust Manifold Nuts .....	23 (32)
Flywheel Bolts (Manual Transmission) .....	77 (105)
Intake Manifold Nuts .....	16 (22)
Main Bearing Cap Bridge (2 Steps)	
1st Step .....	22 (30)
2nd Step .....	53 (72)
Oil Pan Bolts .....	10 (14)
Oil Pan Drain Plug .....	33 (45)
Rocker Arm Adjusting Lock Nut .....	14 (20)

INCH Lbs. (N.m)

Oil Pump Cover Plate .....	62 (7)
Valve Cover Cap Nuts .....	62 (7)
Valve Cover Cap Nuts (1991) .....	90 (10)
Water Pump Bolts .....	106 (12)

AA

**ENGINE SPECIFICATIONS**

**GENERAL ENGINE SPECIFICATIONS**

GENERAL ENGINE SPECIFICATIONS TABLE

AA

Application	Specification
-------------	---------------

2.2L

Displacement .....	132 Cu. In.
Bore .....	3.35" (85.0 mm)
Stroke .....	3.74" (95.0 mm)
Compression Ratio .....	8.8:1
Fuel System .....	PFI
Horsepower @ RPM	
DX & LX .....	125 @ 5200
EX .....	130 @ 5200
SE .....	140 @ 5600
Torque Ft. Lbs. @ RPM	
DX & LX .....	137 @ 4000
EX .....	142 @ 4000
SE .....	142 @ 4500

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1991 CRANKSHAFT, MAIN &  
ROD BEARINGS SPECIFICATIONS

1991 CRANKSHAFT, MAIN & ROD  
BEARINGS SPECIFICATIONS TABLE

AA

Application In. (mm)

Crankshaft End Play

New or Rebuild ..... .004-.014 (.10-.35)  
Service Limit ..... 0.18 (.45)

Crankshaft-to-Main Bearing Clearance

New or Rebuild  
No. 1 & 2 ..... .0008-.0018 (.021-.045)  
No. 3 ..... .0010-.0019 (.025-.049)  
No. 4 & 5 ..... .0005-.0015 (.013-.037)  
Service Limit  
No. 1 & 2 ..... .0020 (.050)  
No. 3 ..... .0021 (.054)  
No. 4 & 5 ..... .0020 (.050)

Crankshaft Runout

New or Rebuild ..... .0012 (.03)  
Service Limit ..... .0016 (.04)

Crankshaft Out-of-Round

New or Rebuild (Maximum) ..... .0002 (.005)  
Service Limit ..... .0004 (.010)

Journal Taper

New or Rebuild (Maximum) ..... .0002 (.005)  
Service Limit ..... .0004 (.010)

Connecting Rod Bearings

Journal Clearance  
New or Rebuild ..... .0008-.0019 (.021-.049)  
Service Limit ..... .002 (.05)

AA

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS SPECS

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS SPECS TABLE

AA

Application In. (mm)

Crankshaft

End Play  
Standard ..... .004-.014 (.10-.36)  
Service Limit ..... .018 (.45)

Runout

Standard ..... .0012 (.03)  
Service Limit ..... .0016 (.04)

Main Bearings

Journal Diameter

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No. 1 & 2	1.9676-1.9685	(49.976-50.000)
No. 3	1.9674-1.9683	(49.972-49.996)
No. 4 & 5	1.9665-1.9688	(49.948-50.008)
Journal Out-Of-Round		
Standard	.0002	(.005)
Service Limit	.0004	(.010)
Journal Taper		
Standard	.0002	(.005)
Service Limit	.0004	(.010)
Oil Clearance		
No. 1 & No. 2 Journal		
Standard	.0008-.0018	(.021-.045)
Service Limit	.002	(.05)
No. 3 Journal		
Standard	.0010-.0019	(.025-.049)
Service Limit	.002	(.05)
No. 4 & No. 5 Journal		
Standard	.0005-.0015	(.013-.037)
Service Limit	.002	(.05)
Connecting Rod Bearings		
Journal Diameter	1.7710-1.7717	(44.976-45.000)
Journal Out-Of-Round		
Standard	.0002	(.005)
Service Limit	.0004	(.010)
Journal Taper		
Standard	.0002	(.005)
Service Limit	.0004	(.010)
Oil Clearance		
Standard	.0008-.0019	(.021-.049)
Service Limit	.002	(.05)

CONNECTING RODS SPECIFICATIONS

CONNECTING RODS SPECIFICATIONS TABLE

Application	In. (mm)
Bore Diameter	
Pin Bore	.8649-.8654 (21.968-21.981)
Pin-to-Rod	
Interference Fit	.0005-.0013 (.013-.032)
Crankpin Bore	2.001 (51.00)
Side Play	
New or Rebuild	.006-.012 (.15-.30)
Service Limit	.016 (.40)

PISTONS, PINS & RINGS SPECIFICATIONS

PISTONS, PINS & RINGS SPECIFICATIONS TABLE

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Application	In. (mm)
<b>Pistons</b>	
Clearance	
New or Rebuild	.0008-.0016 (.020-.040)
Service Limit	.0019 (.050)
Diameter (1)	
Piston Size "A"	
New or Rebuild	3.3456-3.3460 (84.980-84.990)
Service Limit	3.3452 (84.970)
Piston Size "B"	
New or Rebuild	3.3452-3.3456 (84.970-84.980)
Service Limit	3.3448 (84.960)
Ring Groove Widths	
Top & 2nd Ring	.047 (1.20)
Oil Control Ring	.110 (2.80)
<b>Pins</b>	
Diameter	.8659-.8661 (21.994-22.000)
Piston Fit	.0005-.0009 (.013-.023)
Rod Fit	.0005-.0013 (.013-.032)
<b>Rings</b>	
Top Ring	
End-Gap	
New or Rebuild	.008-.014 (.20-.35)
Service Limit	.024 (.60)
Side Clearance	
New or Rebuild	.0014-.0024 (.035-.060)
Service Limit	.005 (.13)
2nd Ring	
End-Gap	
New or Rebuild	.016-.022 (.40-.55)
Service Limit	.028 (.70)
Side Clearance	
New or Rebuild	.0012-.0022 (.030-.055)
Service Limit	.005 (.13)
Oil Control Ring	
End-Gap	
New or Rebuild	.008-.028 (.20-.70)
Service Limit	.031 (.80)
Side Clearance	Not Applicable

(1) - Measure piston skirt diameter .83" (21.0 mm) from bottom of skirt.

(2) - Information not available from manufacturer.

AA

**CYLINDER BLOCK SPECIFICATIONS**

CYLINDER BLOCK SPECIFICATIONS TABLE

AA

Application	In. (mm)
-------------	----------

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Cylinder Bore		
New or Rebuild	.....	3.3465-3.3472 (85.00-85.02)
Service Limit	.....	3.3492 (85.07)
1st Oversize		
(.25 mm)	.....	3.3563-3.3571 (85.25-85.27)
2nd Oversize		
(.50 mm)	.....	3.3661-3.3669 (85.50-85.52)
Maximum Taper	.....	.002 (.05)
Maximum Out-of-Round	.....	.002 (.05)
Maximum Deck Warpage		
New or Rebuild (Maximum)	.....	.003 (.07)
Service Limit	.....	.004 (.10)
AA		

**VALVES & VALVE SPRINGS SPECIFICATIONS**

VALVES & VALVE SPRINGS SPECIFICATIONS TABLE

AA

Application	In. (mm)
Intake Valves	
Face Angle	..... 45°
Head Diameter	..... 1.335-1.343 (33.90-34.10)
Overall Length	..... 4.405-4.417 (111.88-112.18)
Stem Diameter	
Standard	..... .2159-.2163 (5.485-5.495)
New or Rebuild	..... .2157-.2161 (5.480-5.490)
Service Limit	..... .2146 (5.450)
Seat Margin	
New or Rebuild	..... .033-.045 (.85-1.15)
Service Limit	..... .026 (.65)
Exhaust Valves	
Face Angle	..... 45°
Head Diameter	..... 1.138-1.146 (28.9-29.1)
Overall Length	..... 4.856-4.868 (123.35-123.65)
Overall Length	..... 4.809-4.821 (122.15-122.45)
Stem Diameter	
New or Rebuild	..... .2146-.2150 (5.450-5.460)
Service Limit	..... .2134 (5.420)
Seat Margin	
New or Rebuild	..... .041-.053 (1.05-1.35)
Service Limit	..... .037 (.95)
AA	

**CYLINDER HEAD SPECIFICATIONS**

CYLINDER HEAD SPECIFICATIONS TABLE

AA

Application	In. (mm)
Cylinder Head	
Head Thickness	..... 3.932-3.939 (99.8-100.05)



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Application In. (mm)

Journal Diameter

No.1

Front Shaft ..... 1.6820-1.6824 (42.722-42.734)

Rear Shaft ..... .8243-.8248 (20.938-20.950)

No. 2 ..... 1.5241-1.5246 (38.712-38.724)

No. 3 ..... 1.3670-1.3675 (34.722-34.734)

End Play

Front Balancer Shaft ..... .004-.014 (.10-.35)

Rear Balancer Shaft ..... .002-.007 (.06-.18)

Runout (Maximum) ..... .0008 (.020)

AA

**END OF ARTICLE**