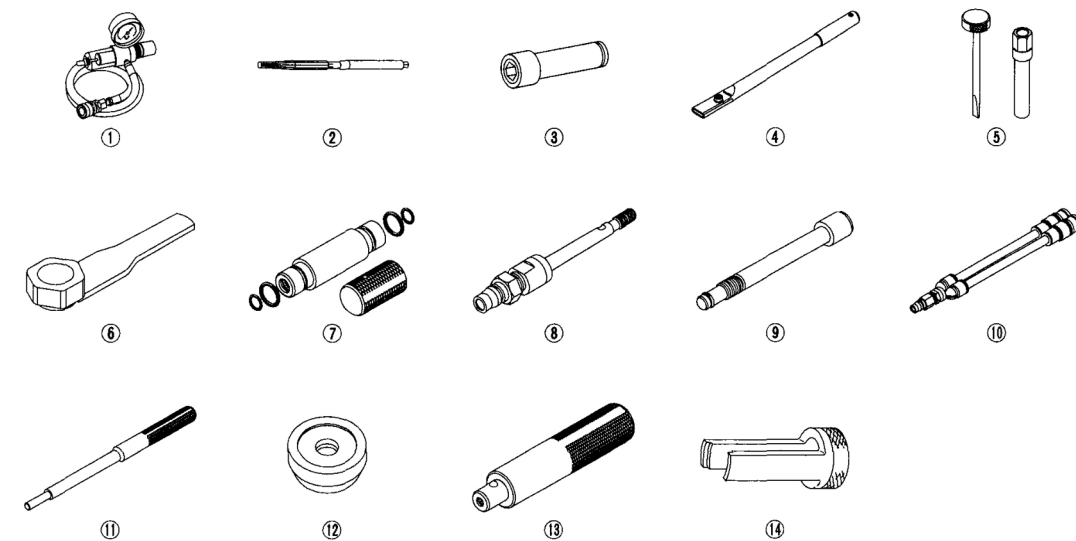


2003-06 ENGINE

Cylinder Head - Element

SPECIAL TOOLS

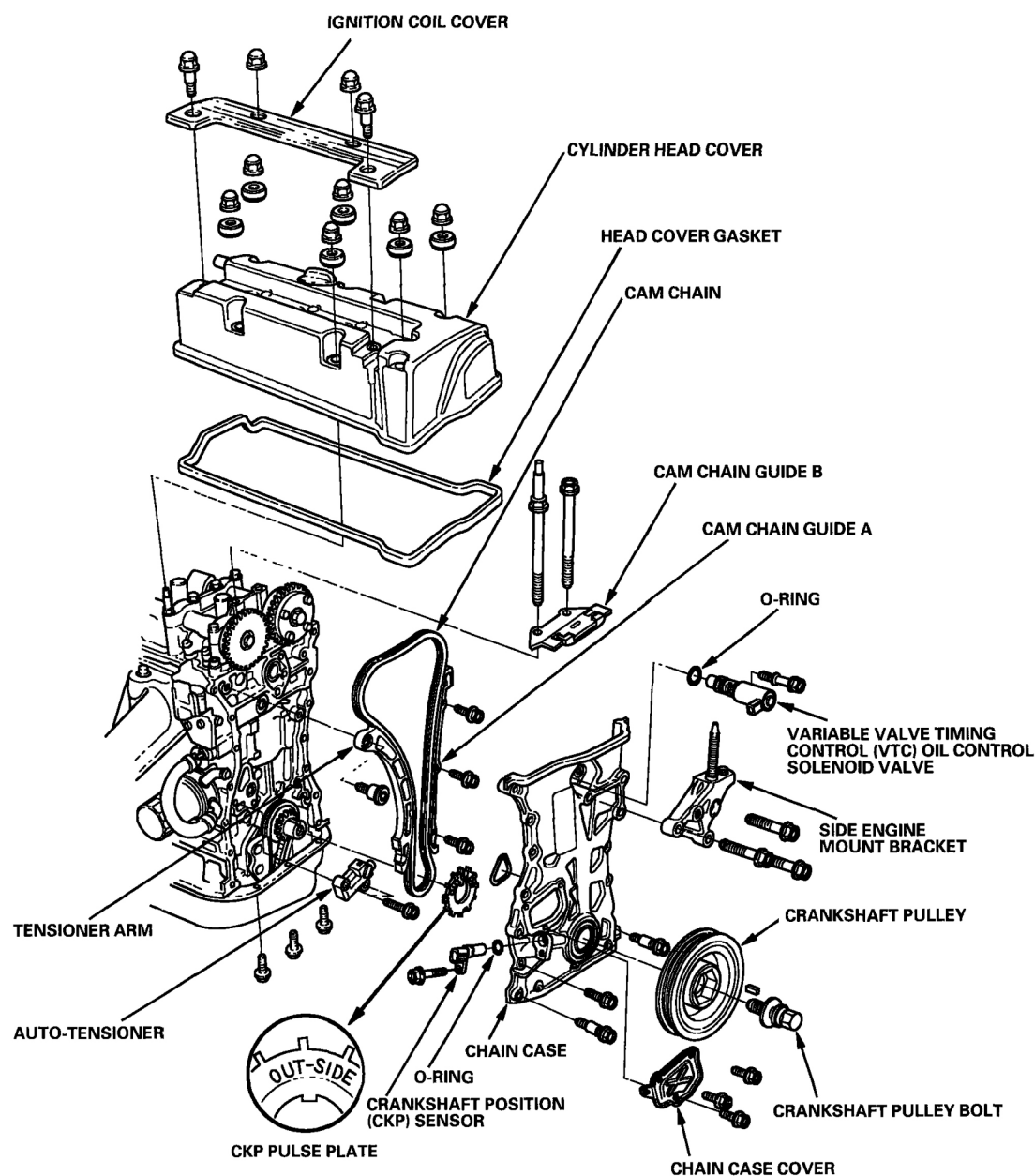
Ref. No.	Tool Number	Description	Qty
①	07AAJ-PNAA100	Air Pressure Regulator	1
②	07HAH-PJ7A10B	Valve Guide Reamer, 5.5 mm	1
③	07JAA-001020A	Socket, 19 mm	1
④	07JAB-001020B	Holder Handle	1
⑤	07MAA-PR70100	Tappet Adjust Wrench Set	1
⑥	07NAB-001040A	Holder Attachment, 50 mm	1
⑦	07PAD-0010000	Stem Seal Driver	1
⑧	07ZAJ-PNAA100	VTEC Air Adapter	2
⑨	07ZAJ-PNAA200	VTEC Air Stopper	1
⑩	07ZAJ-PNAA300	Air Joint Adapter	1
⑪	07742-0010100	Valve Guide Driver, 5.5 mm	1
⑫	07746-0010400	Attachment, 52 x 55 mm	1
⑬	07749-0010000	Driver	1
⑭	07757-PJ1010A	Valve Spring Compressor Attachment	1



G03677120

Fig. 1: View Of Special Service Tool And Description Chart
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

COMPONENT LOCATION INDEX

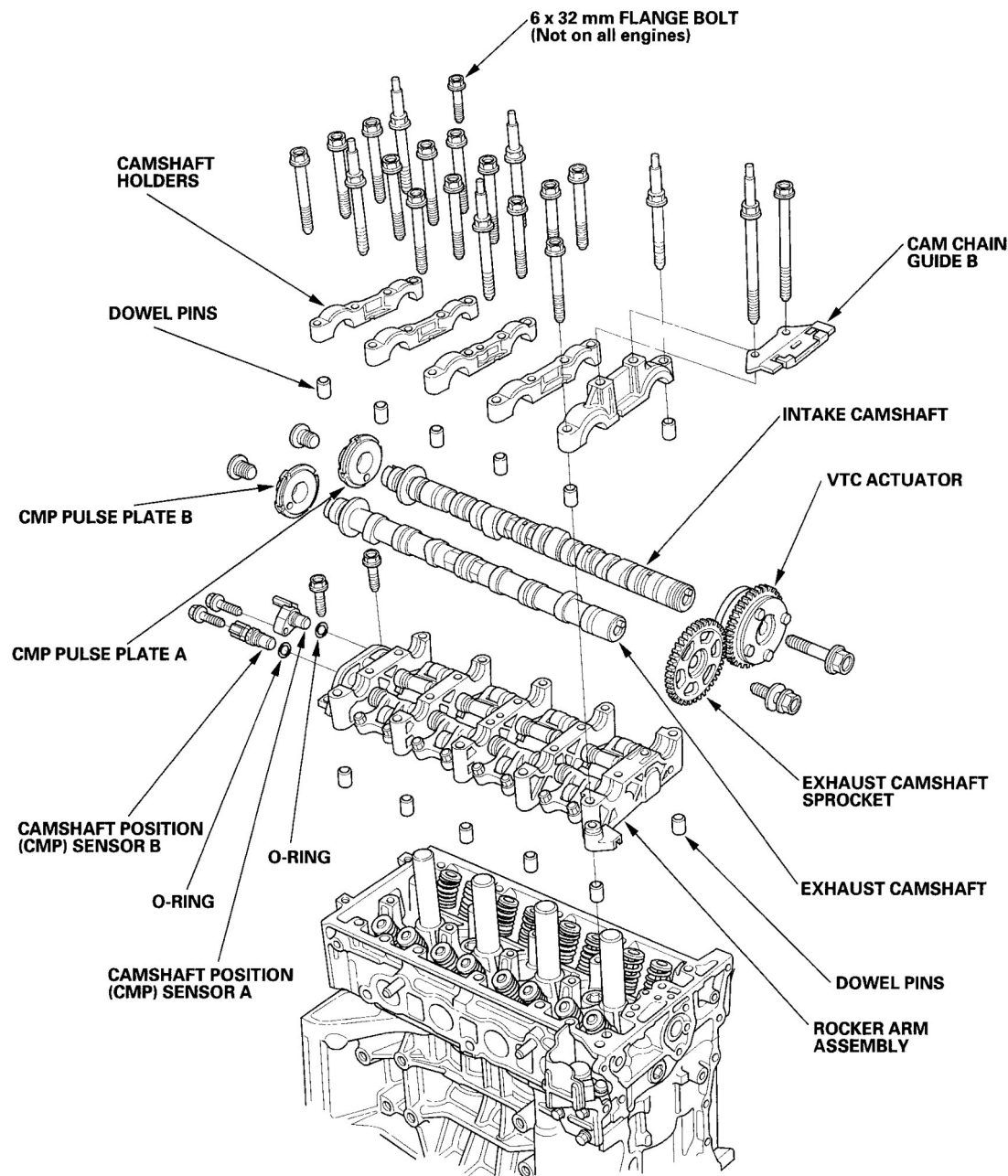


G03677121

Fig. 2: Exploded View Of Cylinder Head Components (1 Of 3)
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

2003 Honda Element DX

2003-06 ENGINE Cylinder Head - Element

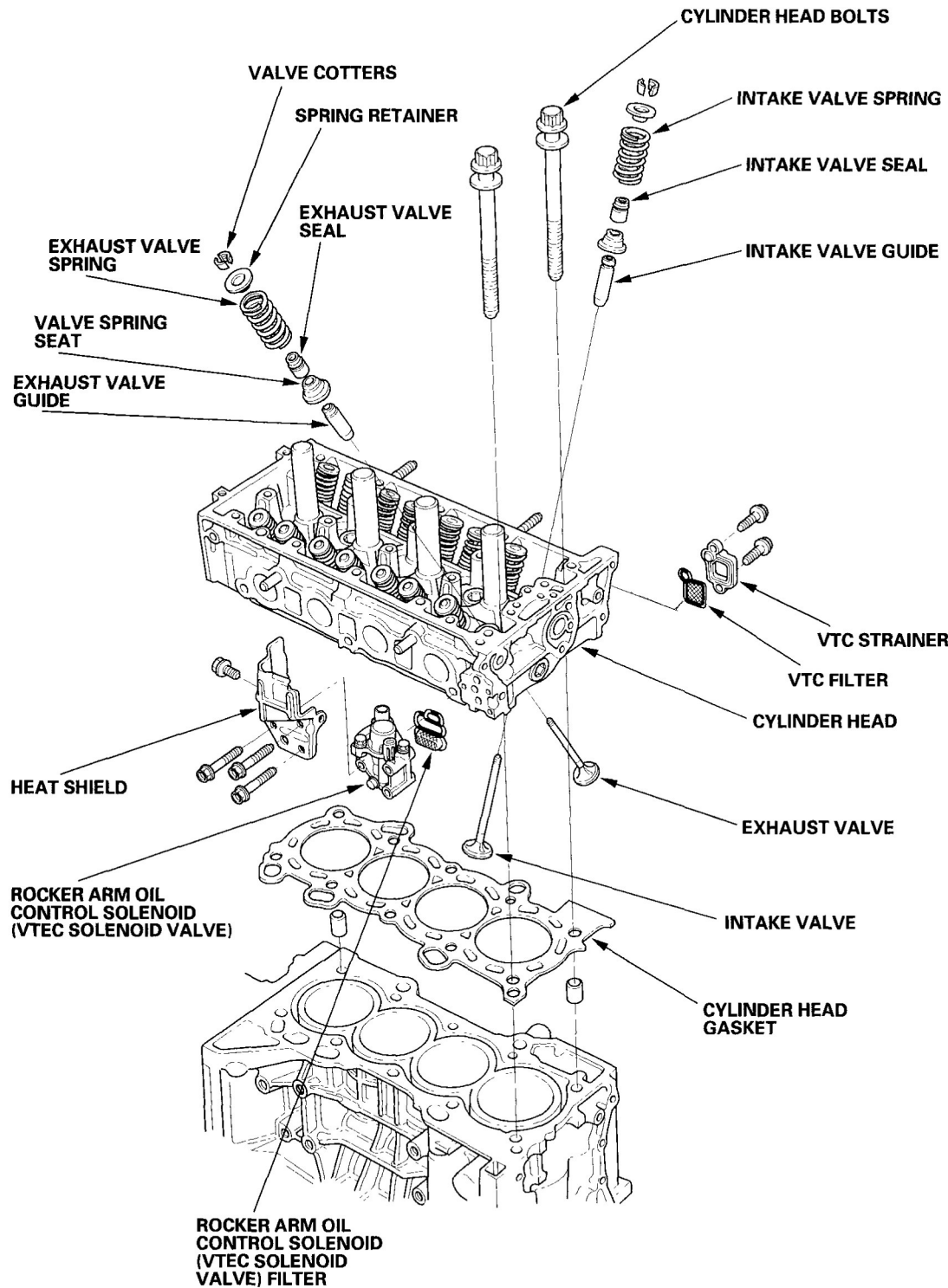


G03677122

Fig. 3: Exploded View Of Cylinder Head Components (2 Of 3)
Courtesy of AMERICAN HONDA MOTOR CO., INC.

2003 Honda Element DX

2003-06 ENGINE Cylinder Head - Element



G03677123

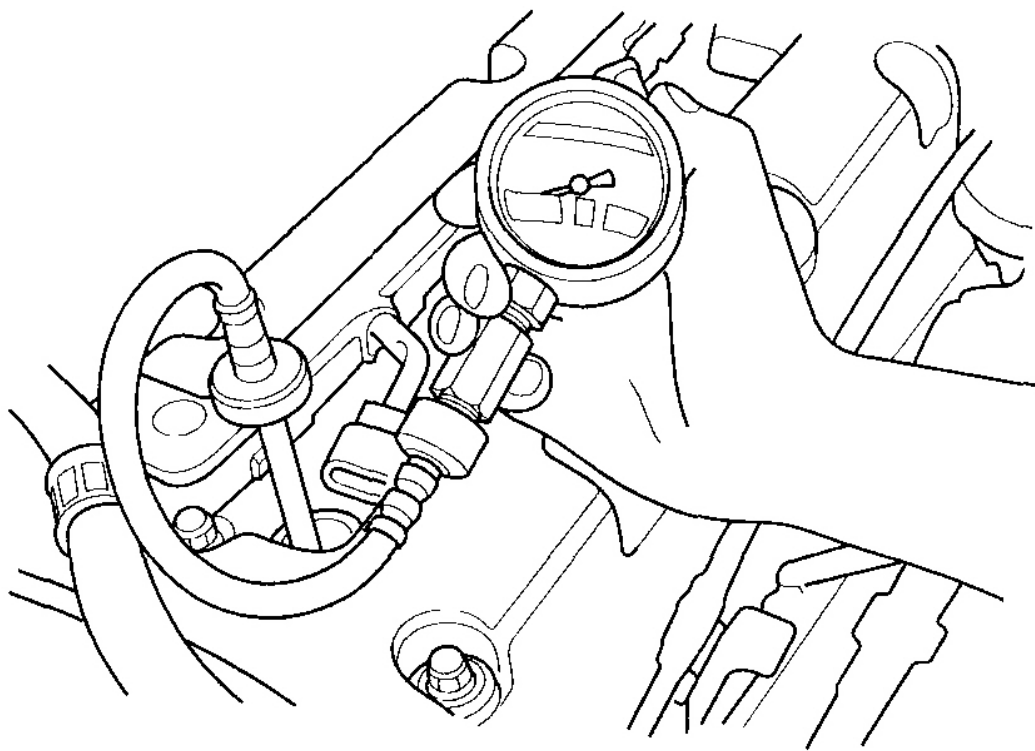
Fig. 4: Exploded View Of Cylinder Head Components (3 Of 3)
Courtesy of AMERICAN HONDA MOTOR CO., INC.

ENGINE COMPRESSION INSPECTION

NOTE: After this inspection, you must reset the engine control module (ECM)/powertrain control module (PCM), otherwise the ECM/PCM will continue to stop the injectors from functioning. Select ECM/PCM reset using the Honda Diagnostic System (HDS) (see

NOTE: HDS CLEAR COMMAND).

1. Warm up the engine to normal operating temperature (cooling fan comes on).
2. Turn the ignition switch OFF.
3. Connect the HDS to the data link connector (DLC) (see step 2 on HOW TO USE THE HDS (HONDA DIAGNOSTIC SYSTEM)).
4. Turn the ignition switch ON (II), then select PGM-FI, INSPECTION, and ALL INJECTORS OFF function on the HDS.
5. Remove the four ignition coils (see IGNITION COIL REMOVAL/INSTALLATION).
6. Remove the four spark plugs.
7. Attach the compression gauge to the spark plug hole.



G03677124

Fig. 5: Attaching Compression Gauge To Spark Plug Hole
Courtesy of AMERICAN HONDA MOTOR CO., INC.

8. Open the throttle fully, then crank the engine with the starter motor and measure the compression.

Compression Pressure:

Above 930 kPa (9.5 kgf/cm² , 135 psi)

9. Measure the compression on the remaining cylinders.

Maximum Variation:

Within 200 kPa (2.0 kgf/cm² , 28 psi)

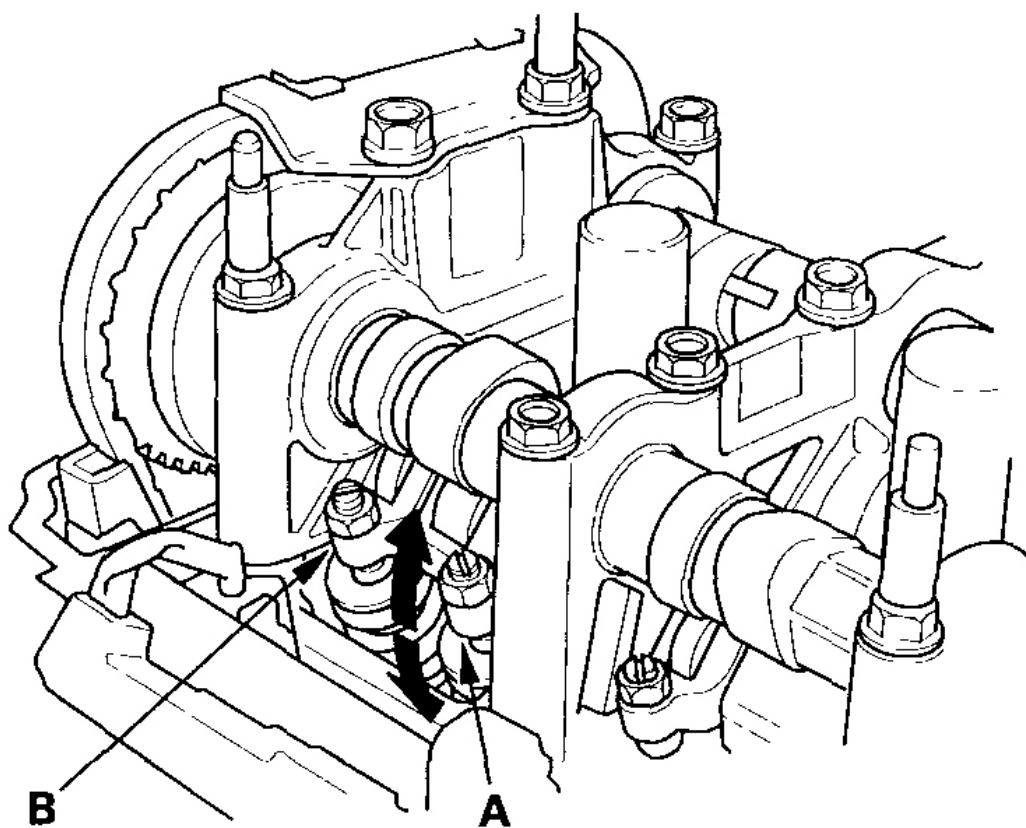
10. If the compression is not within specifications, check the following items, then re-measure the compression.
 - Damaged or worn valves and seats
 - Damaged cylinder head gasket

- Damaged or worn piston rings
 - Damaged or worn piston and cylinder bore
11. Remove the compression gauge from the spark plug hole.
 12. Install the four spark plugs (see **IGNITION COIL REMOVAL/INSTALLATION**).
 13. Select the ECM/PCM reset (see **ECM/PCM RESET**) to cancel ALL INJECTORS OFF.
 14. Do the ECM/PCM idle learn procedure (see **ECM/PCM IDLE LEARN PROCEDURE**).

VTEC ROCKER ARM TEST

Special Tools Required

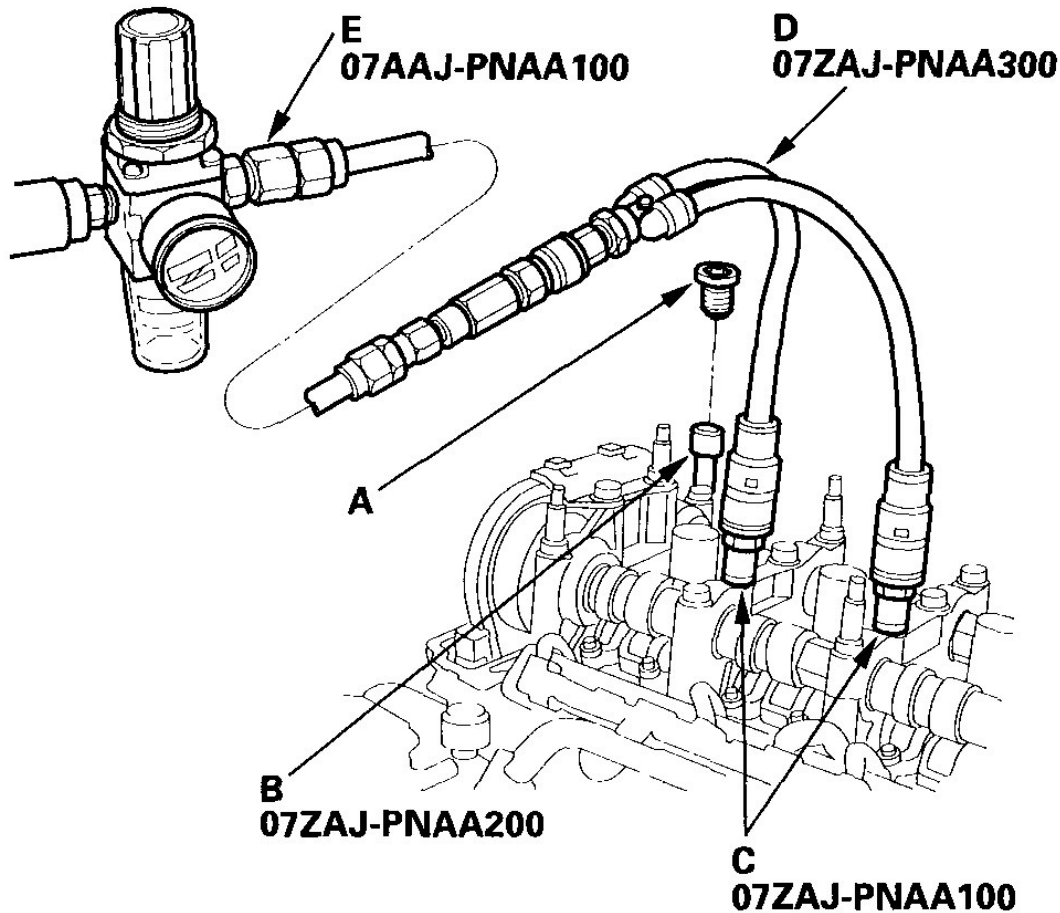
- Air pressure regulator 07AAJ-PNAA100
 - VTEC air adapter 07ZAJ-PNAA100
 - VTEC air stopper 07ZAJ-PNAA200
 - Air joint adapter 07ZAJ-PNAA300
1. Start the engine and let it run for 5 minutes, then turn the ignition switch OFF.
 2. Remove the cylinder head cover (see **CYLINDER HEAD COVER REMOVAL**).
 3. Set the No. 1 piston at top dead center (TDC) (see step 1).
 4. Verify that the intake primary rocker arm (A) moves independently of the intake secondary rocker arm (B).
 - If the intake primary rocker arm moves freely, go to step 5.
 - If the intake primary rocker arm does not move, remove the primary and secondary rocker arms as an assembly and check that the pistons in the secondary and primary rocker arms move smoothly. If any rocker arm needs replacing, replace the primary and secondary rocker arms as an assembly, and test.



G03677125

Fig. 6: Identifying Intake Primary Rocker Arm Movement
Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. Repeat step 4 on the remaining intake primary rocker arms with each piston at TDC. When all the primary rocker arms pass the test, go to step 6.
6. Inspect the valve clearance (see **VALVE CLEARANCE ADJUSTMENT**).
7. Check that the air pressure on the shop air compressor gauge indicates over 400 kPa (4.0 kgf/cm² , 57 psi).
8. Remove the sealing bolt (A) from the relief hole, and install the VTEC air stopper (B).



G03677126

Fig. 7: Removing Sealing Bolt From Relief Hole And Installing VTEC Air Stopper
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

9. Remove the No. 2 and No. 3 camshaft holder bolts, and install the VTEC air adapters (C) finger-tight.
10. Connect the air joint adapter (D) and air pressure regulator (E).
11. Loosen the valve on the regulator, and apply the specified air pressure.

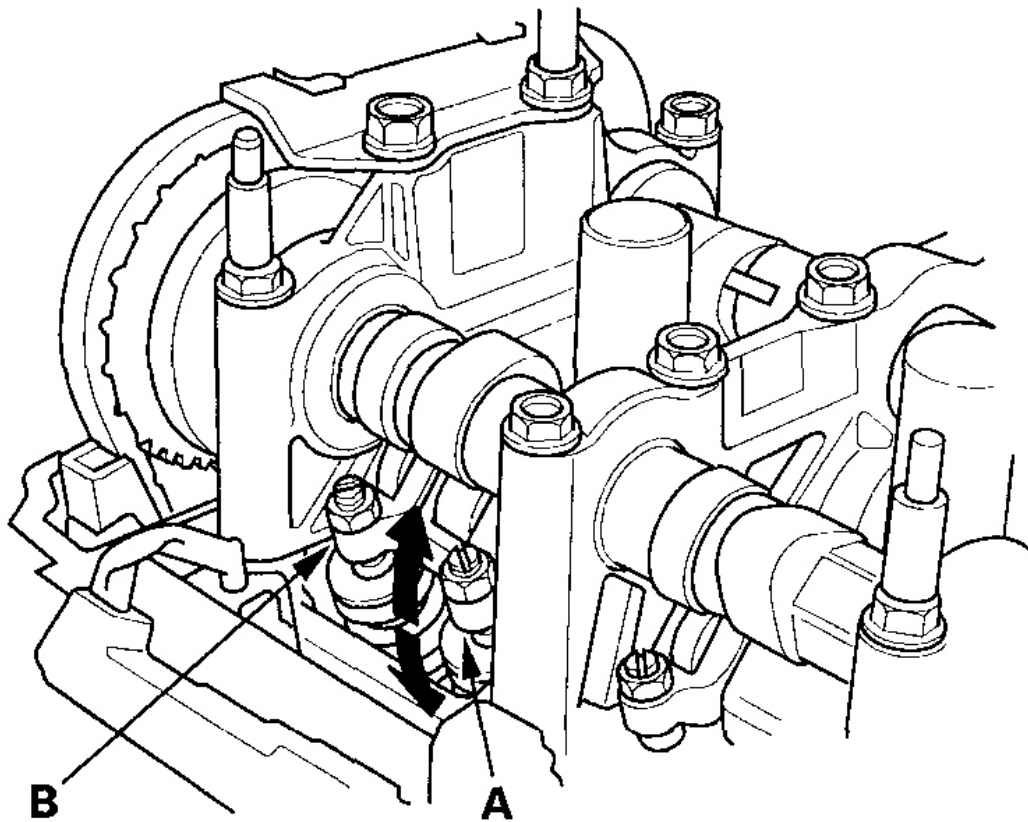
Specified Air Pressure:

290 kPa (3.0 kgf/cm² ,42 psi)

NOTE: If the synchronizing piston does not move after applying air pressure, move the primary or secondary rocker arm up and down manually by rotating the crankshaft clockwise.

12. With the specified air pressure applied, move the intake primary rocker arm (A) for the No. 1 cylinder. The primary rocker arm and secondary rocker arm (B) should move together.

If the intake secondary rocker arm does not move, remove the primary and secondary rocker arms as an assembly, and check that the pistons in the primary and secondary rocker arms move smoothly. If any rocker arm needs replacing, replace the primary and secondary rocker arms as an assembly, and test.



G03677127

Fig. 8: Identifying Intake Primary And Secondary Rocker Arm And Movement
Courtesy of AMERICAN HONDA MOTOR CO., INC.

13. Repeat steps 11 and 12 for the remaining cylinders. Be sure to set the cylinder's piston at TDC before beginning work.
14. Remove the special tools.
15. Tighten the camshaft holder mounting bolts to 22 N.m (2.2 kgf.m, 16 lbf.ft).
16. Tighten the sealing bolt to 20 N.m (2.0 kgf.m, 14 lbf.ft).
17. Install the cylinder head cover (see **CYLINDER HEAD COVER INSTALLATION**).

VTC ACTUATOR INSPECTION

1. Remove the cam chain (see **INSTALLATION**).
2. Loosen the rocker arm adjusting screws (see step 2).
3. Remove the camshaft holders (see step 3).
4. Remove the intake camshaft.
5. Check that the variable valve timing control (VTC) actuator is locked by turning the VTC actuator counterclockwise. If not locked, turn the VTC actuator clockwise until it stops, then recheck it. If it is still not locked, replace the VTC actuator.
6. Seal the advance holes (A) and retard holes (B) in the No. 1 camshaft journal with tape.

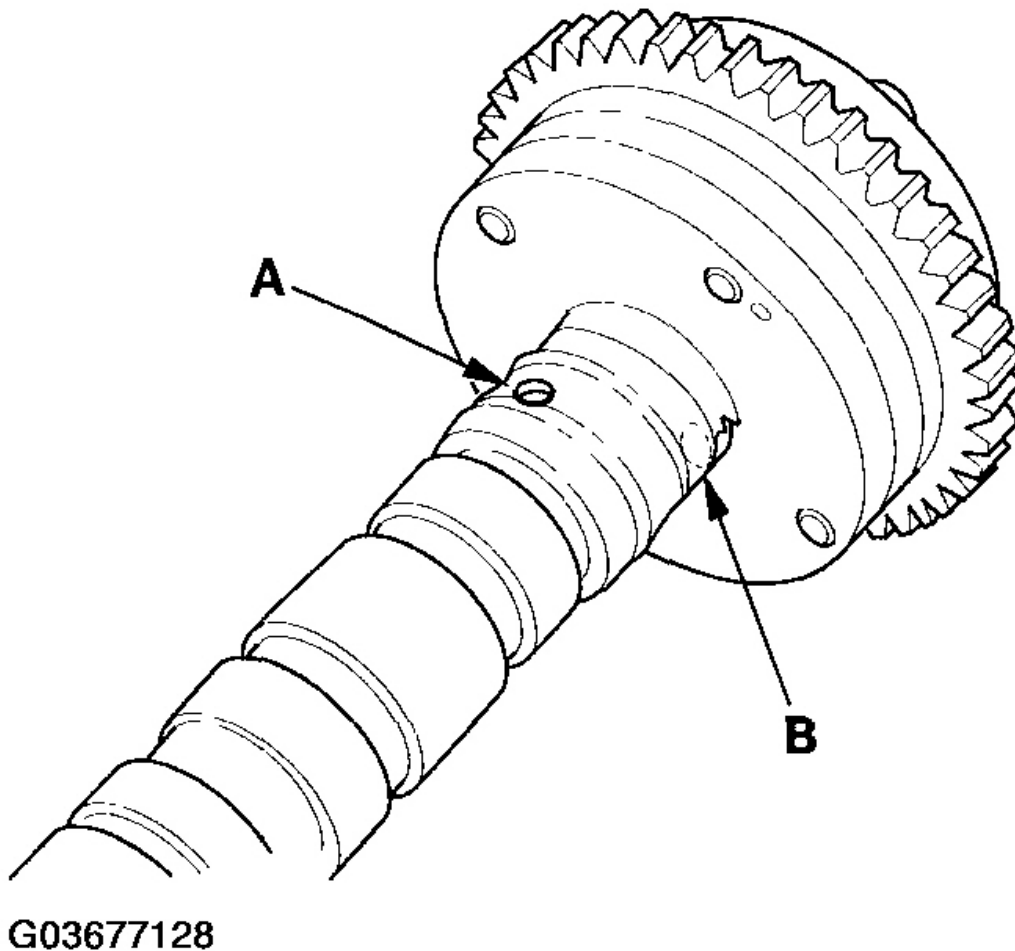
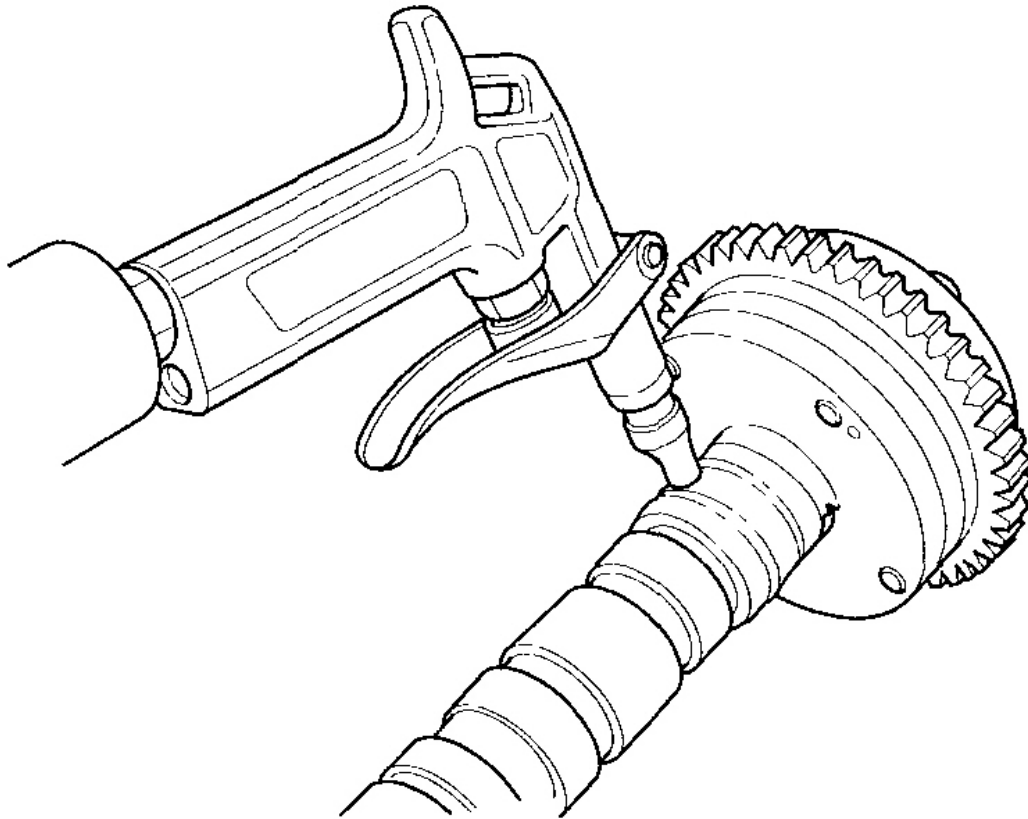


Fig. 9: Locating Advance And Retard Holes
Courtesy of AMERICAN HONDA MOTOR CO., INC.

7. Punch a hole in the tape over one of the advance holes.
8. Apply air to the advance hole to release the lock.



G03677129

Fig. 10: Applying Air To Advance Hole
Courtesy of AMERICAN HONDA MOTOR CO., INC.

9. Check that the VTC actuator moves smoothly. If the VTC actuator does not move smoothly, replace the VTC actuator.

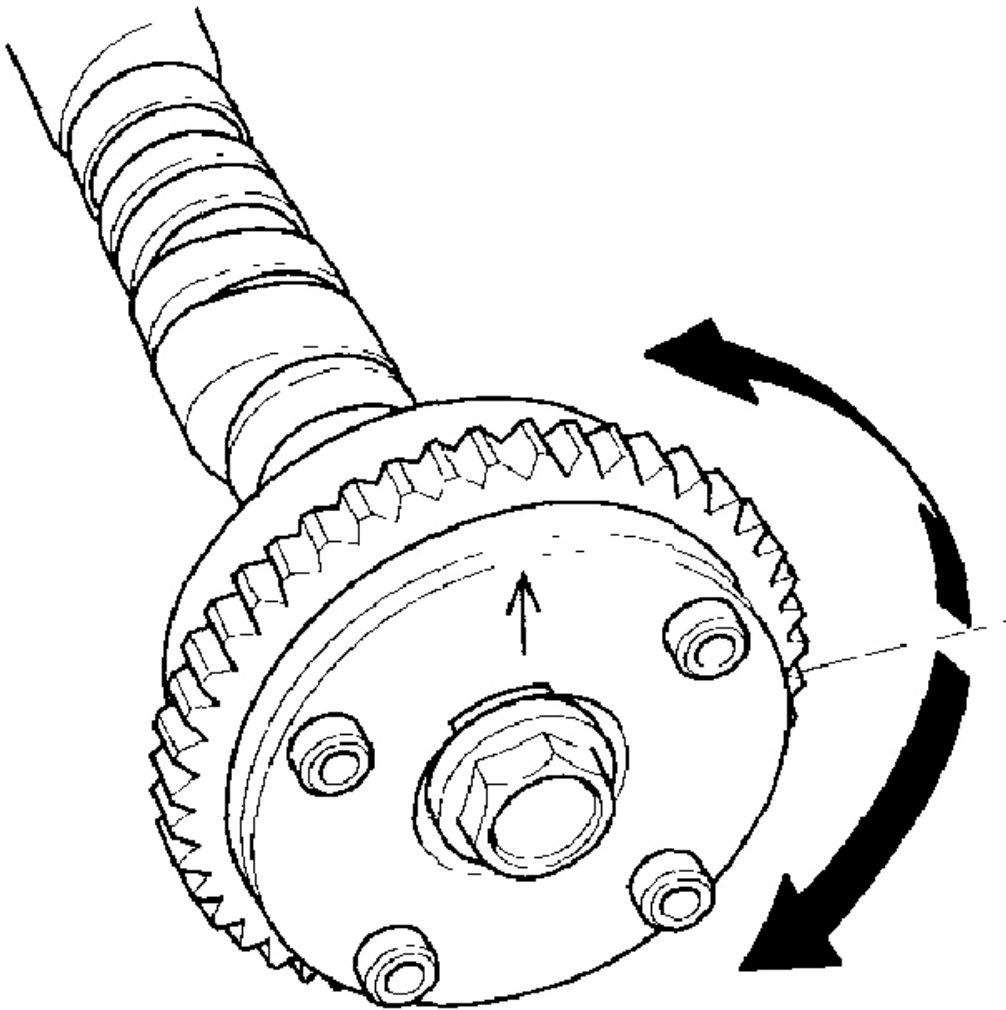
**G03677130**

Fig. 11: Identifying VTC Actuator Smooth Movement
Courtesy of AMERICAN HONDA MOTOR CO., INC.

10. Remove the tape from the No. 1 camshaft journal.
11. Make sure the punch marks on the VTC actuator and exhaust camshaft sprocket are facing up, then set the camshafts in the rocker shaft holder (see step 6).
12. Set the camshaft holders and chain guide B in place (see step 7).
13. Tighten the camshaft holder bolts to the specified torque (see step 8).
14. Hold the camshaft, and turn the VTC actuator clockwise until you hear it clicks. Make sure to lock the VTC actuator by turning it.

15. Install the cam chain (see CAM CHAIN INSTALLATION).
16. Adjust the valve clearance (see VALVE CLEARANCE ADJUSTMENT).

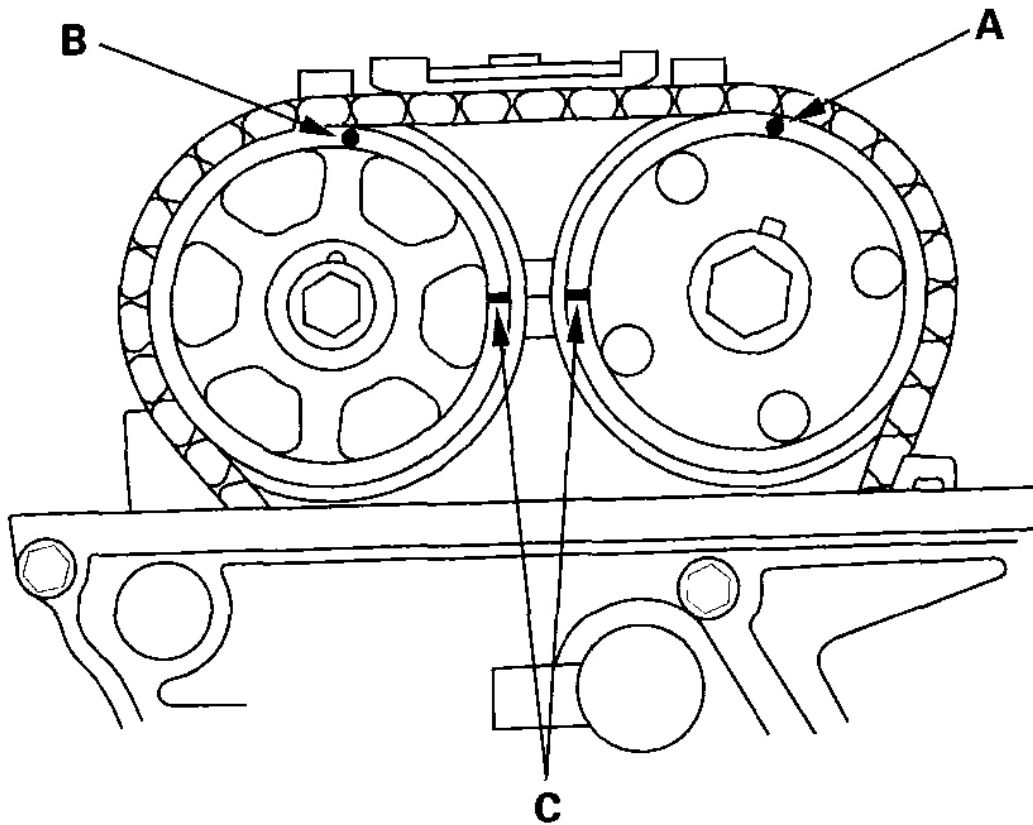
VALVE CLEARANCE ADJUSTMENT

Special Tools Required

Tappet adjust wrench set 07MAA-PR70100

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

1. Remove the cylinder head cover (see CYLINDER HEAD COVER REMOVAL).
2. Set the No. 1 piston at top dead center (TDC). The punch mark (A) on the variable valve timing control (VTC) actuator and the punch mark (B) on the exhaust camshaft sprocket should be at the top. Align the TDC marks (C) on the VTC actuator and exhaust camshaft sprocket.



G03677131

Fig. 12: Identifying Variable Valve Timing Control And Exhaust Camshaft Sprocket Punch Mark Position

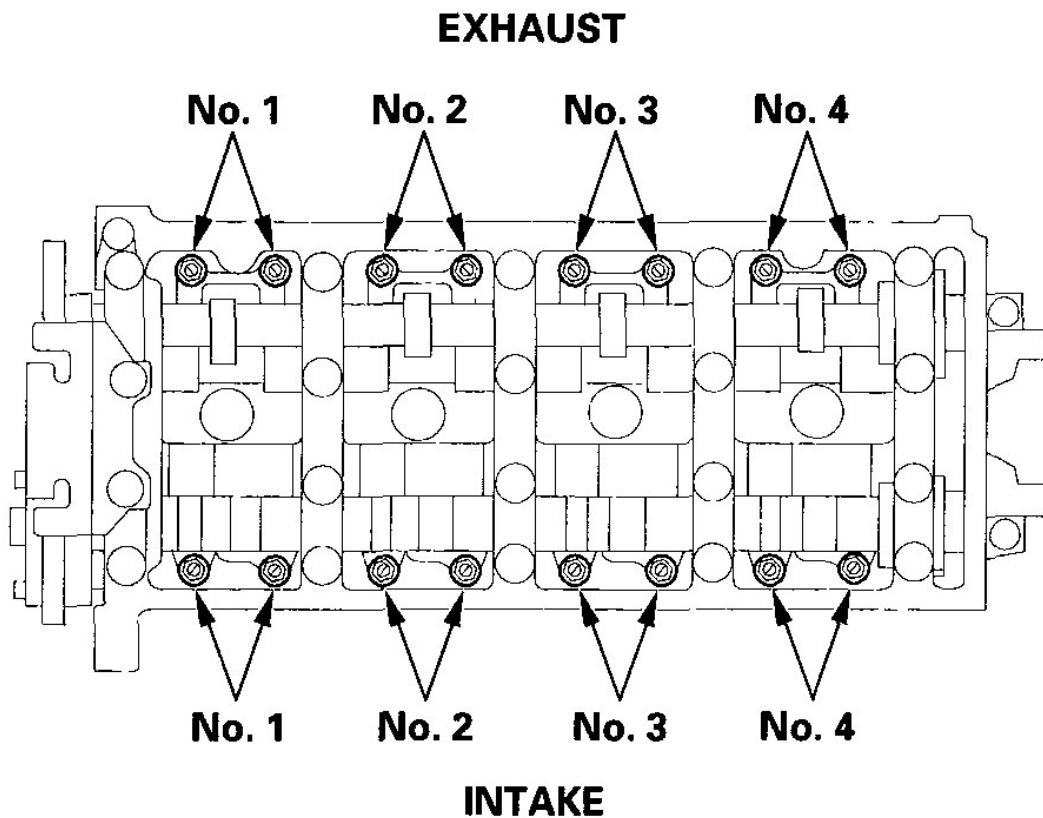
Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. Select the correct thickness feeler gauge for the valves you're going to check.

Valve Clearance

Intake: 0.21-0.25 mm (0.008-0.010 in.)

Exhaust: 0.28-0.32 mm (0.011-0.013 in.)

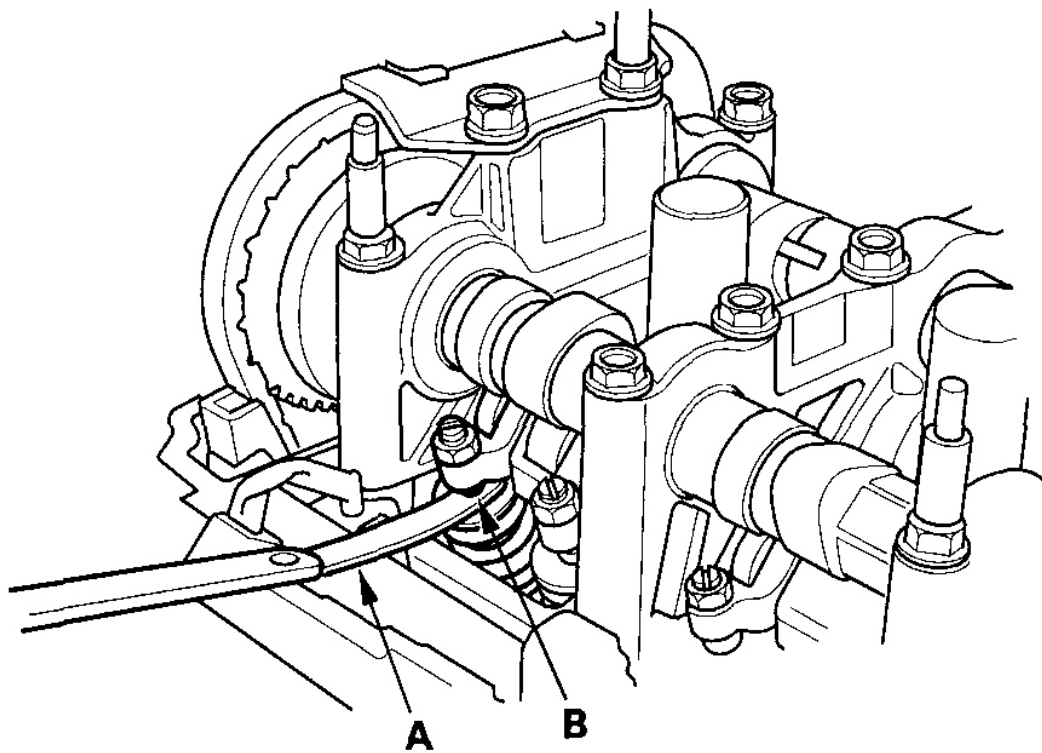


G03677132

Fig. 13: Locating Intake And Exhaust Valve

Courtesy of AMERICAN HONDA MOTOR CO., INC.

4. Insert the feeler gauge (A) between the adjusting screw (B) and the end of the valve stem, and slide it back and forth; you should feel a slight amount of drag.

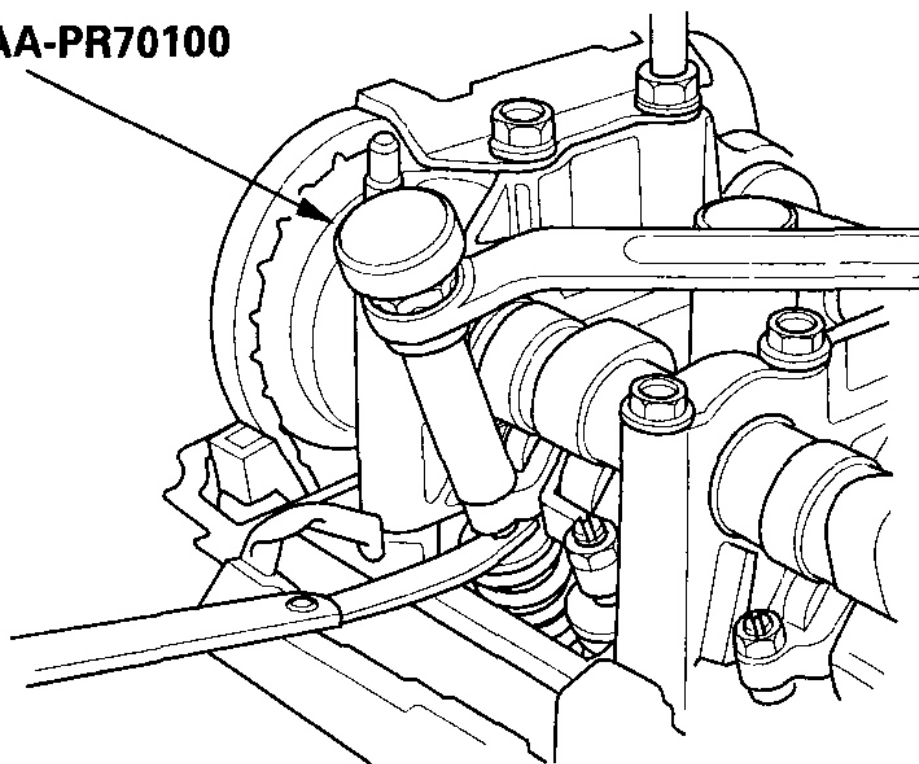


G03677133

Fig. 14: Inserting Feeler Gauge Between Adjusting Screw And Valve Stem End
Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. If you feel too much or too little drag, loosen the locknut with the special tools, and turn the adjusting screw until the drag on the feeler gauge is correct.

07MAA-PR70100



G03677134

Fig. 15: Loosening Lock Nut

Courtesy of AMERICAN HONDA MOTOR CO., INC.

6. Tighten the locknut to specified torque.

Specified Torque

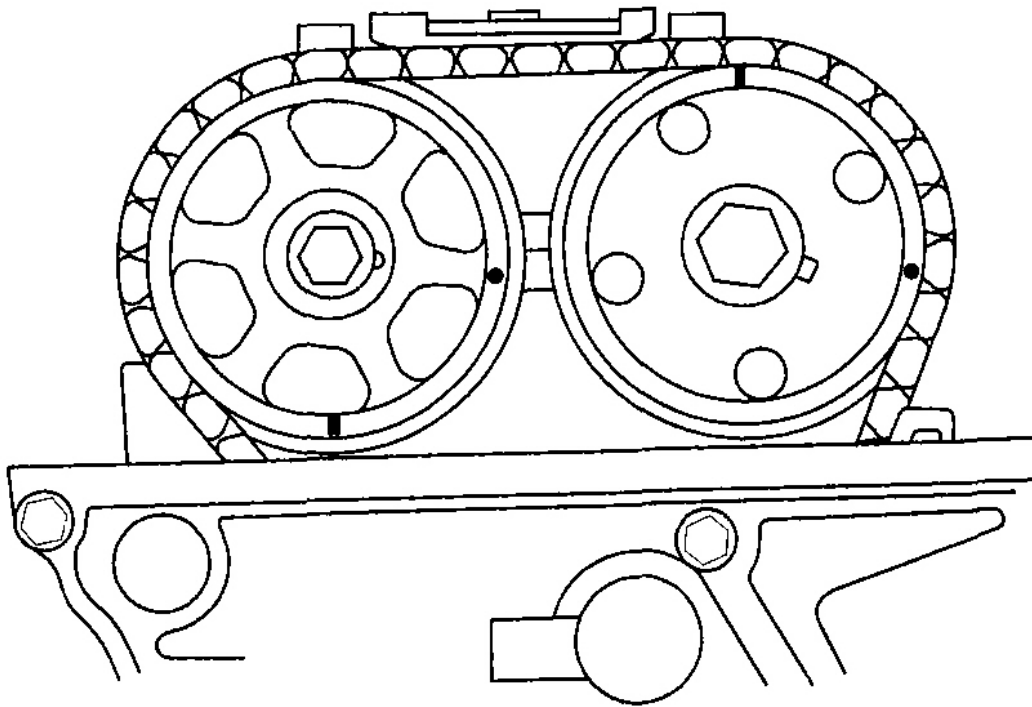
Intake: 20 N.m (2.0 kgf.m, 14 lbf.ft)

Apply engine oil to the nut threads.

Exhaust: 14 N.m (1.4 kgf.m, 10 lbf.ft)

Apply engine oil to the nut threads.

7. Recheck the valve clearance. Repeat the adjustment if necessary.
8. Rotate the crankshaft 180° clockwise (camshaft pulley turns 90°).



G03677135

Fig. 16: View Of Camshaft Pulley Position (1 Of 3)
Courtesy of AMERICAN HONDA MOTOR CO., INC.

9. Check and, if necessary, adjust the valve clearance on No. 3 cylinder.
10. Rotate the crankshaft 180° clockwise (camshaft pulley turns 90°).

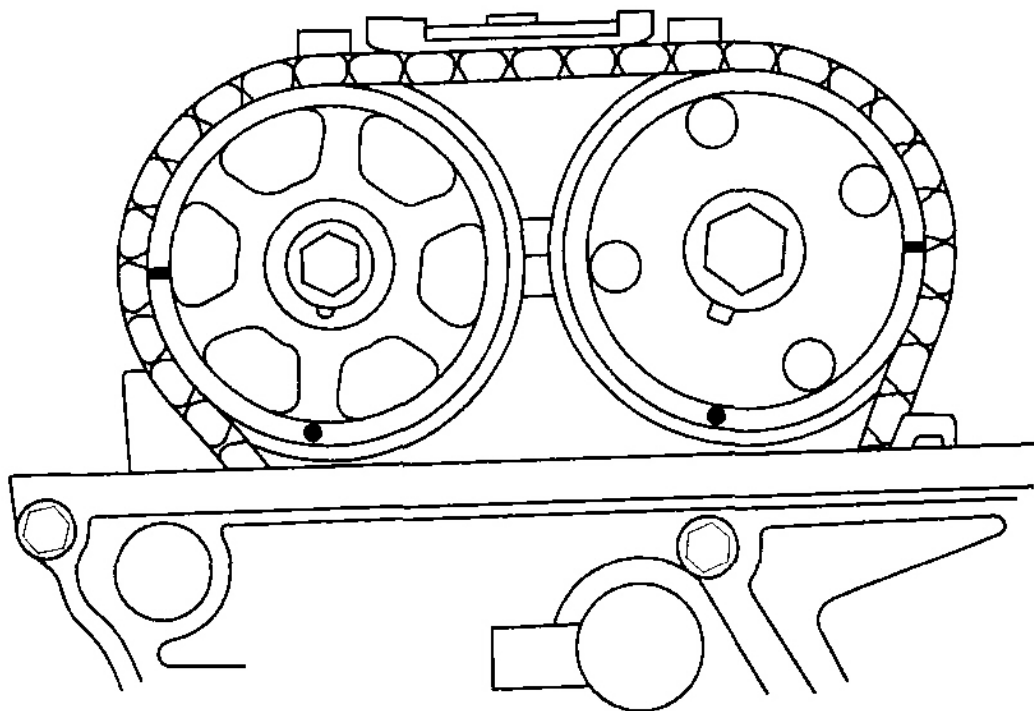
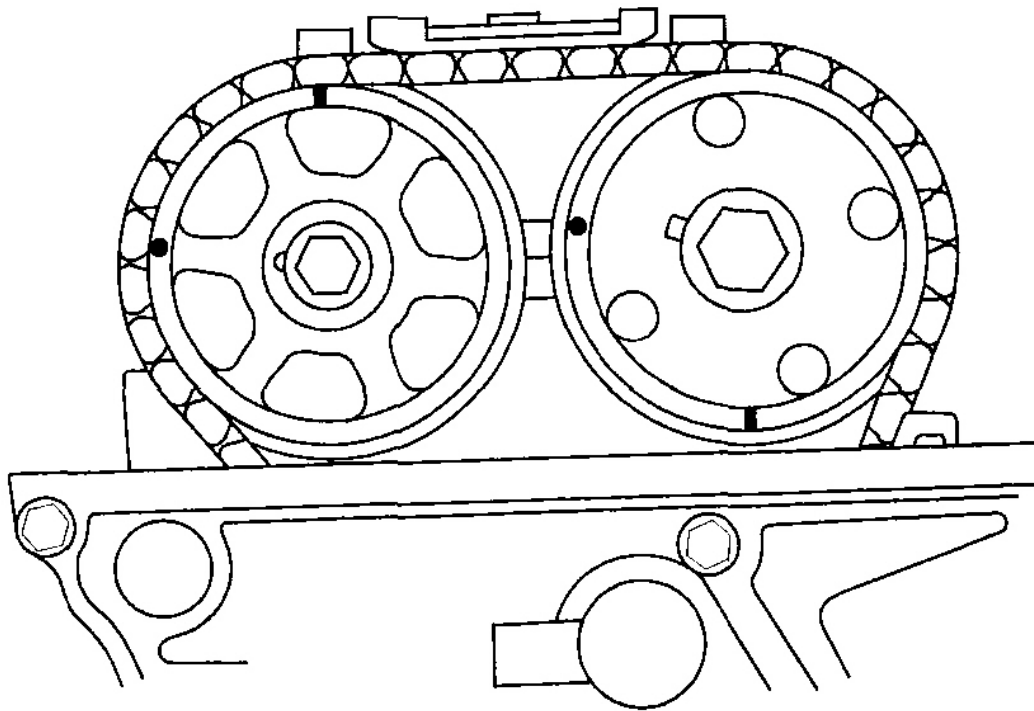
**G03677136**

Fig. 17: View Of Camshaft Pulley Position (2 Of 3)
Courtesy of AMERICAN HONDA MOTOR CO., INC.

11. Check and, if necessary, adjust the valve clearance on No. 4 cylinder.
12. Rotate the crankshaft 180° clockwise (camshaft pulley turns 90°).



G03677137

Fig. 18: View Of Camshaft Pulley Position (3 Of 3)
Courtesy of AMERICAN HONDA MOTOR CO., INC.

13. Check and, if necessary, adjust the valve clearance on No. 2 cylinder.
14. Install the cylinder head cover (see **CYLINDER HEAD COVER INSTALLATION**).

CRANKSHAFT PULLEY REMOVAL AND INSTALLATION

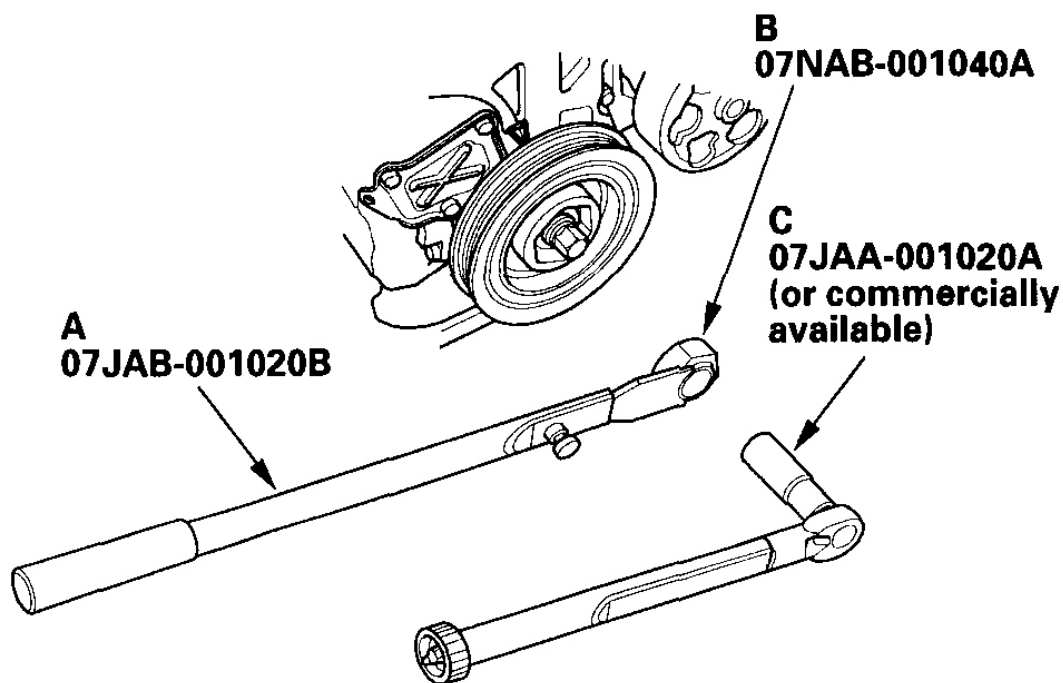
Special Tools Required

- Holder handle 07JAB-001020B
- Holder attachment, 50 mm 07NAB-001040A
- Socket, 19 mm 07JAA-001020A or a commercially available 19 mm socket

REMOVAL

1. Remove the right front wheel.
2. Remove the splash shield (see step 26 on **ENGINE REMOVAL**).
3. Remove the drive belt (see **DRIVE BELT REPLACEMENT**).

4. Hold the pulley with holder handle (A) and holder attachment (B).



G03677138

Fig. 19: Identifying Pulley Holder And Holder Attachment

Courtesy of AMERICAN HONDA MOTOR CO., INC.

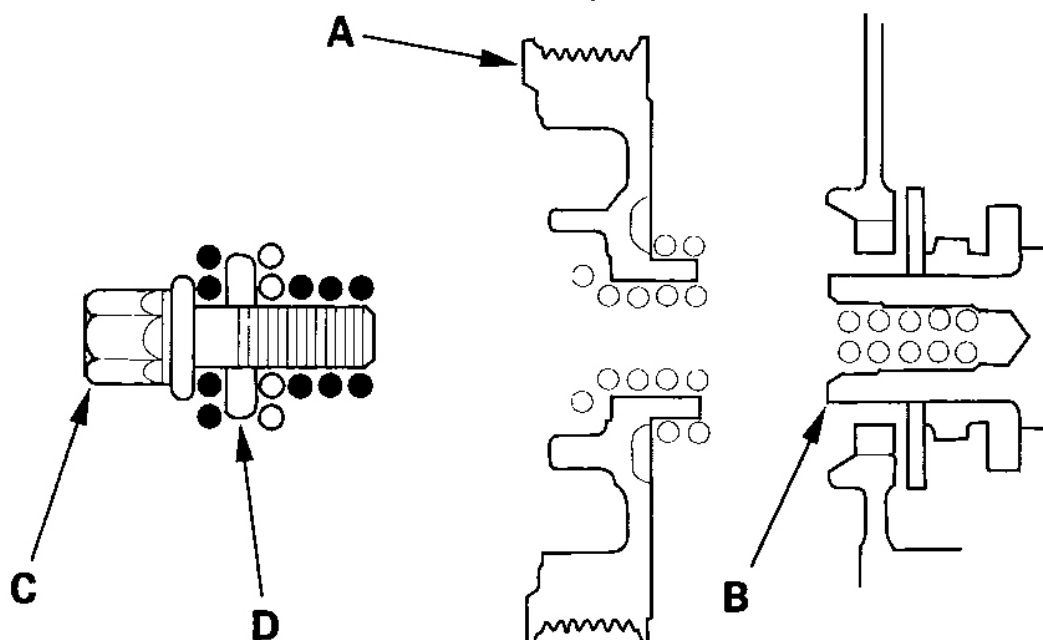
5. Remove the bolt with a 19 mm socket (C) and breaker bar, then remove the crankshaft pulley.

INSTALLATION

1. Clean the crankshaft pulley (A), crankshaft (B), bolt (C), and washer (D). Lubricate with the new engine oil as shown.

○: Clean

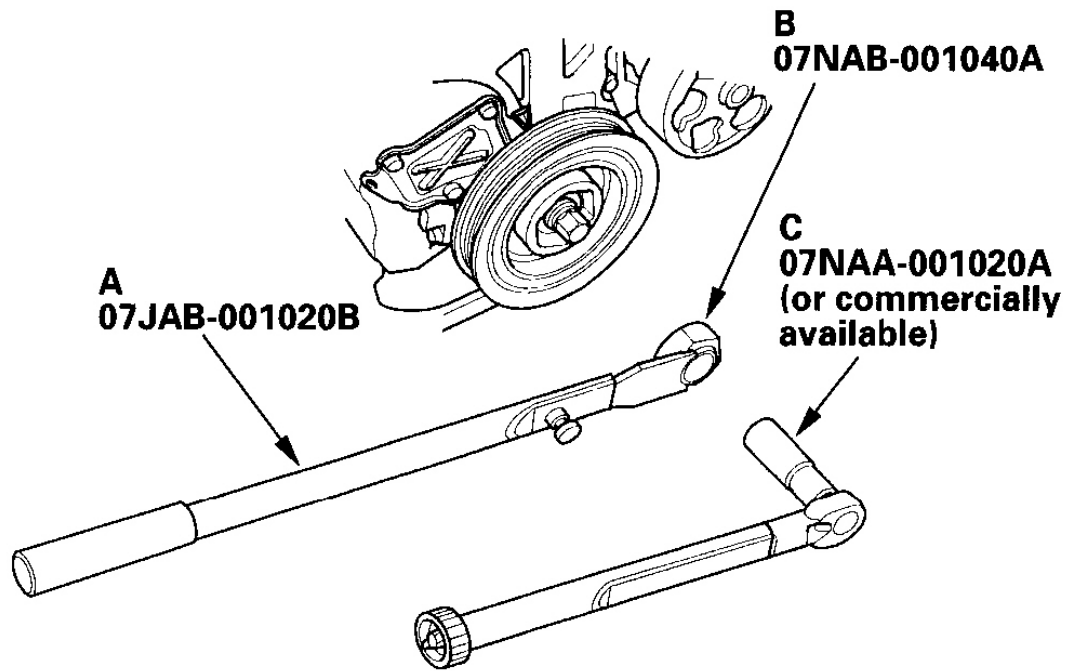
●: Lubricate with the new engine oil



G03677139

Fig. 20: Identifying Various Parts Cleaning And Lubricating Points
Courtesy of AMERICAN HONDA MOTOR CO., INC.

2. Install the crankshaft pulley, and hold the pulley with holder handle (A) and holder attachment (B).



G03677140

Fig. 21: Installing Crankshaft Pulley

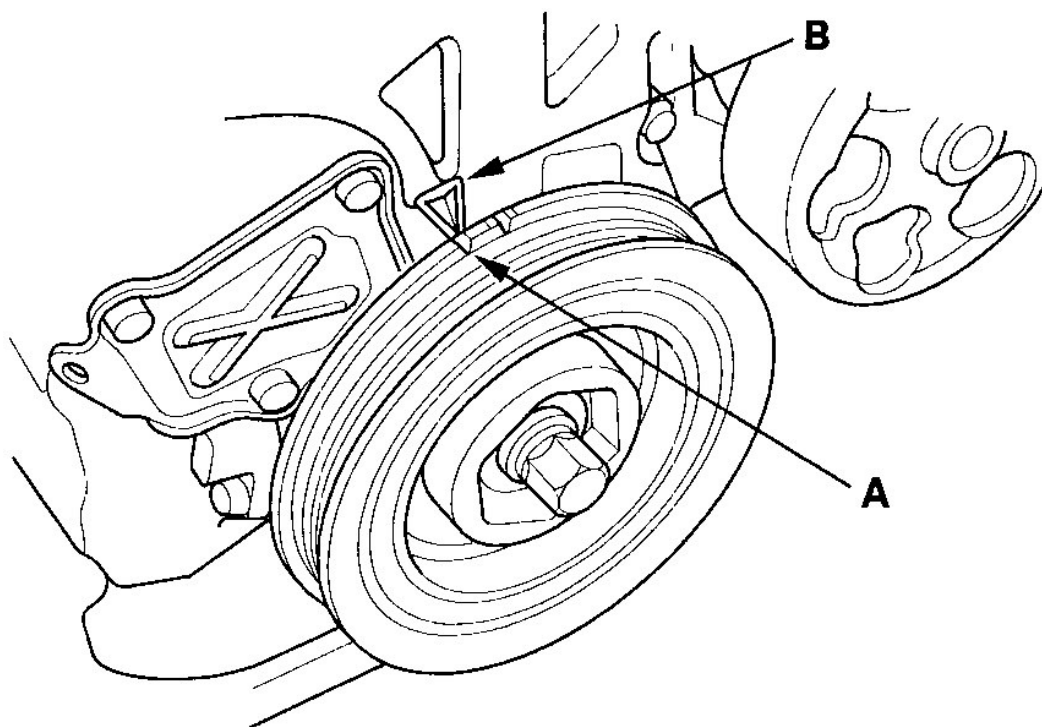
Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. Tighten the bolt to 49 N.m (5.0 kgf.m, 36 lbf.ft) with a torque wrench and 19 mm socket (C). Do not use an impact wrench.
4. Tighten the pulley bolt an additional 90°.
5. Install the drive belt (see **DRIVE BELT INSPECTION**).
6. Install the splash shield (see step 26 on **ENGINE INSTALLATION**).
7. Install the right front wheel.

CAM CHAIN REMOVAL

NOTE: Keep the cam chain away from magnetic fields.

1. Turn the crankshaft pulley so its top dead center (TDC) mark (A) lines up with the pointer (B).

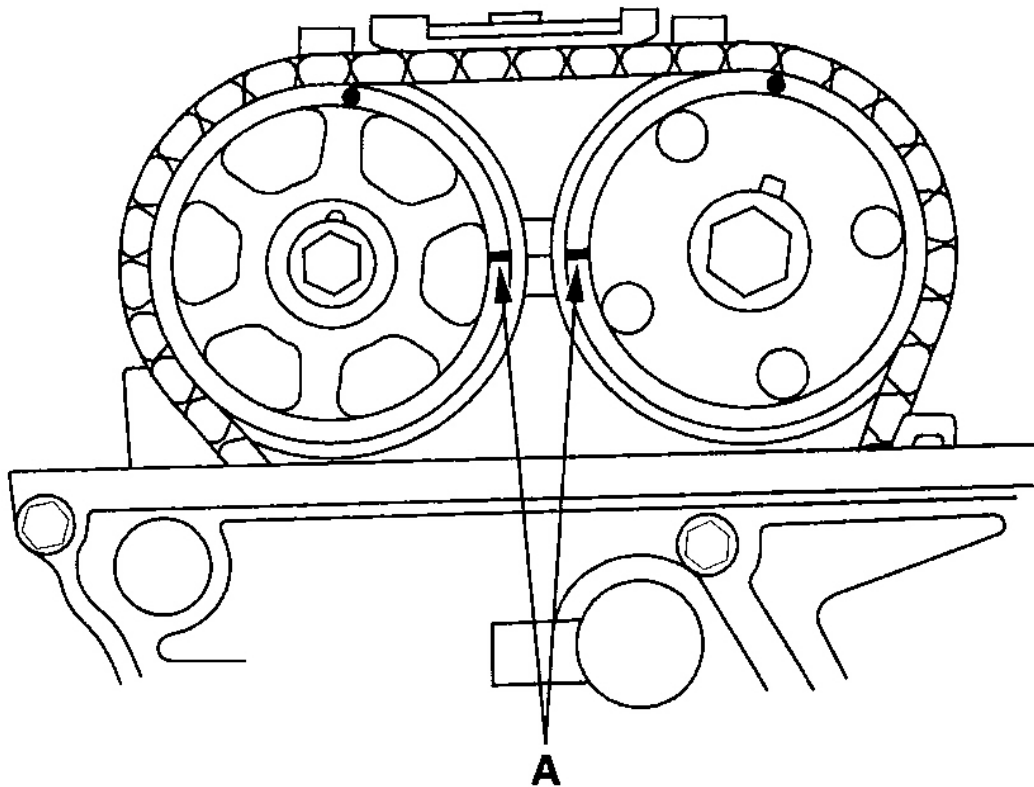


G03677141

Fig. 22: Identifying Crankshaft Pulley Position

Courtesy of AMERICAN HONDA MOTOR CO., INC.

2. Remove the right front wheel.
3. Remove the splash shield (see step 26 on **ENGINE REMOVAL**).
4. Remove the drive belt (see **DRIVE BELT REPLACEMENT**).
5. Remove the cylinder head cover (see **CYLINDER HEAD COVER REMOVAL**).
6. Check that the No. 1 piston TDC marks (A) on the variable valve timing control (VTC) actuator and exhaust camshaft sprocket are aligned.

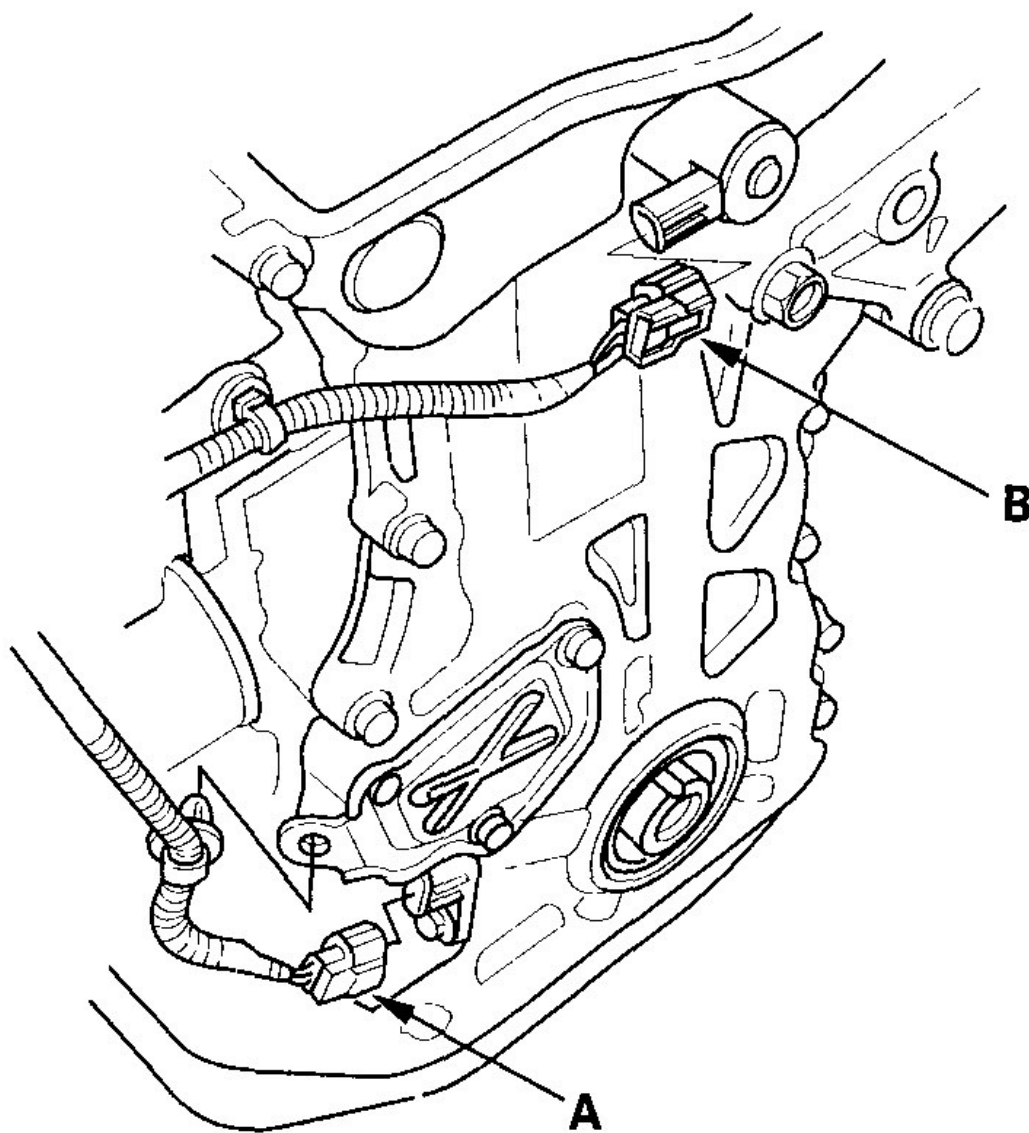


G03677142

Fig. 23: Identifying Aligned Variable Valve Timing Control And Exhaust Camshaft Sprocket Marks

Courtesy of AMERICAN HONDA MOTOR CO., INC.

7. Remove the crankshaft pulley (see **CRANKSHAFT PULLEY REMOVAL AND INSTALLATION**).
8. Disconnect the crankshaft position (CKP) sensor connector (A) and VTC oil control solenoid valve connector (B).

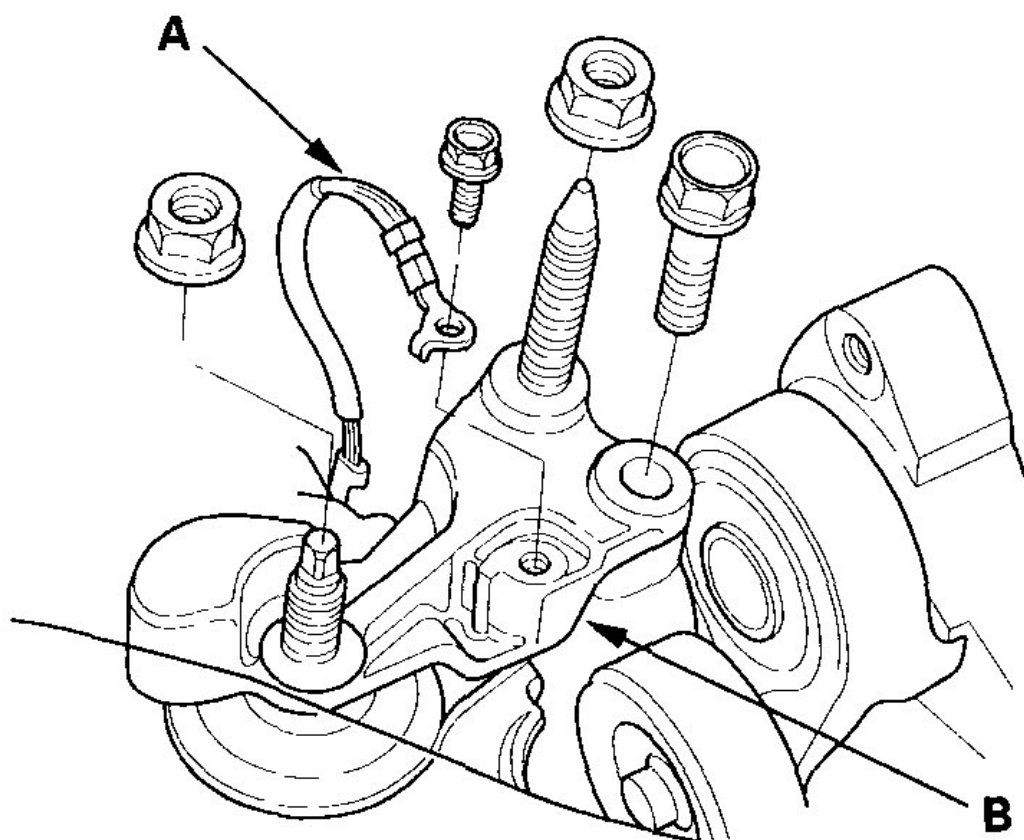


G03677143

Fig. 24: Disconnecting Crankshaft Position Sensor Connector And VTC Oil Control Solenoid Valve Connector

Courtesy of AMERICAN HONDA MOTOR CO., INC.

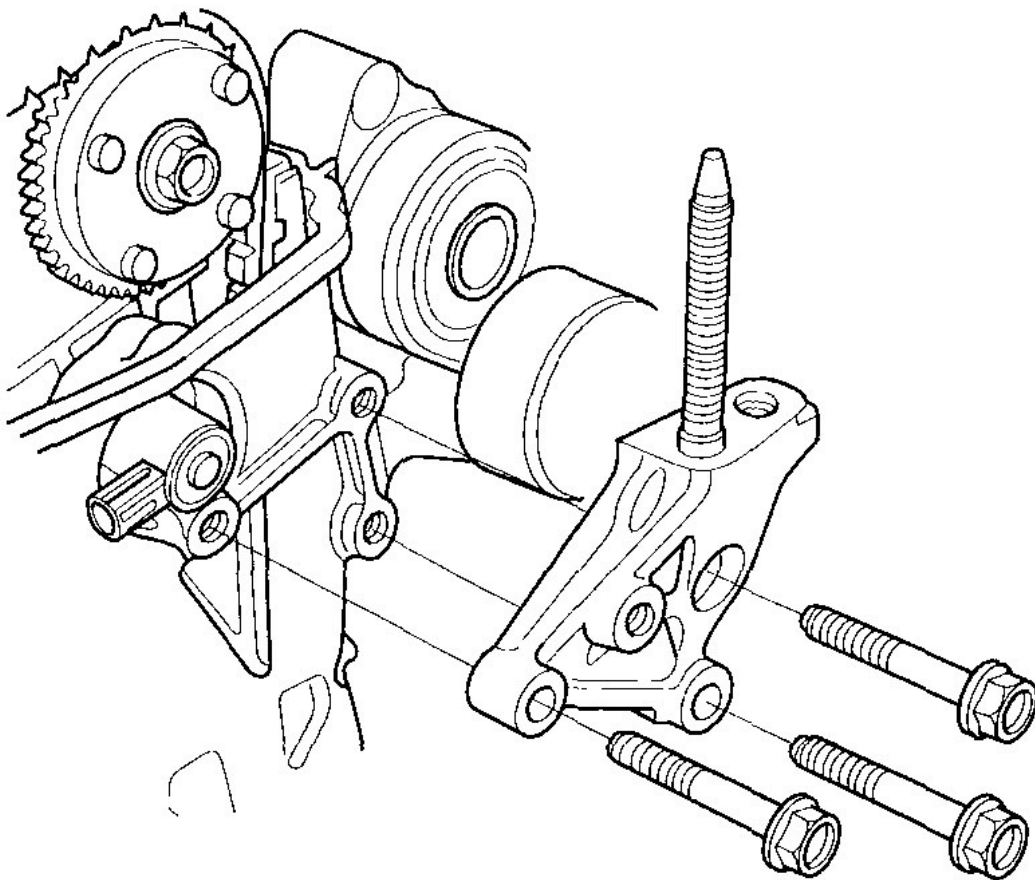
9. Remove the VTC oil control solenoid valve (see **VTC OIL CONTROL SOLENOID VALVE REMOVAL/TEST/I**).
10. Support the engine with a jack and wood block under the oil pan.
11. Remove the ground cable (A), and remove the upper engine mount bracket (B).



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Fig. 25: Removing Ground Cable And Upper Engine Mount Bracket
Courtesy of AMERICAN HONDA MOTOR CO., INC.

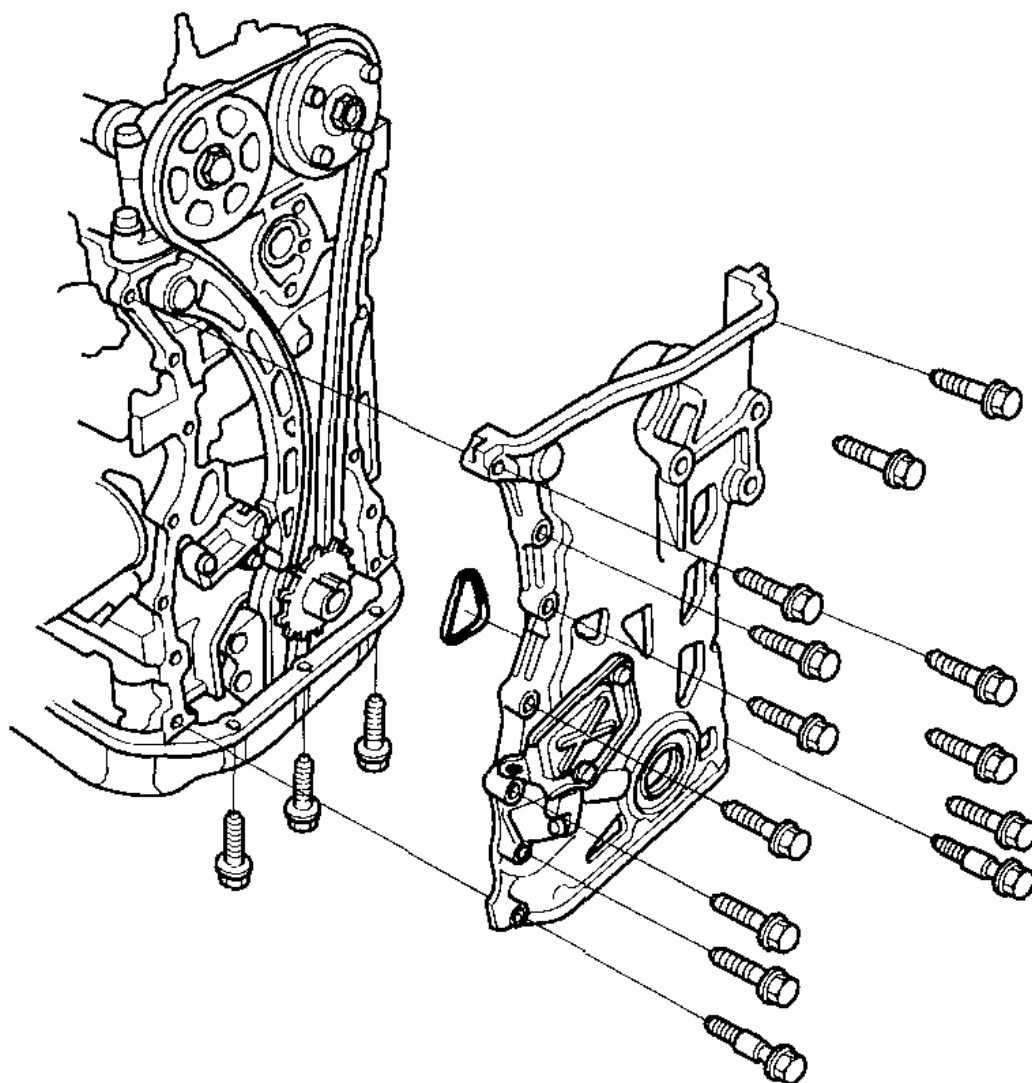
12. Remove the side engine mount bracket.



G03677145

Fig. 26: Removing Side Engine Mount Bracket
Courtesy of AMERICAN HONDA MOTOR CO., INC.

13. Remove the chain case.

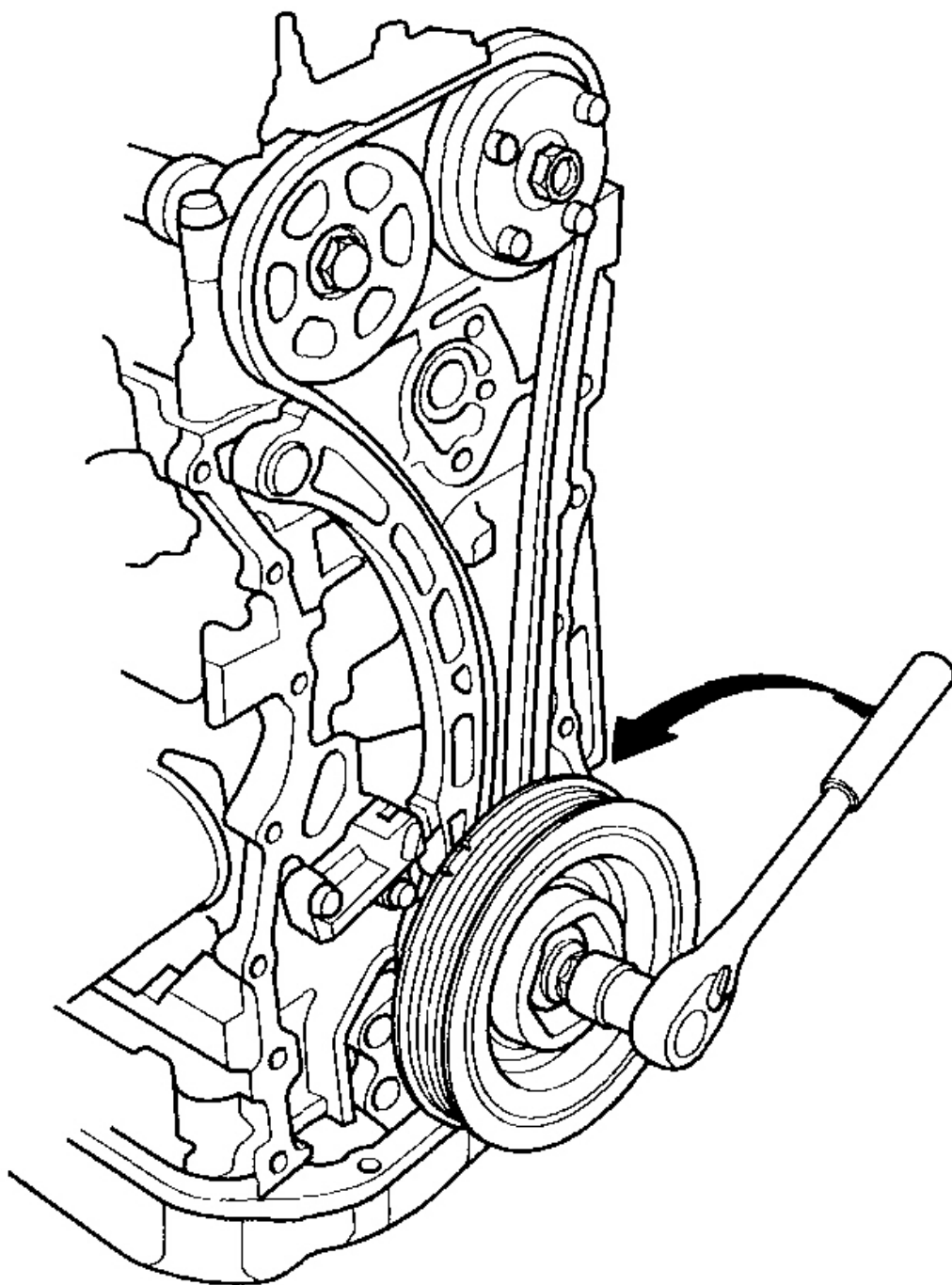


G03677146

Fig. 27: Removing Chain Case

Courtesy of AMERICAN HONDA MOTOR CO., INC.

14. Loosely install the crankshaft pulley.
15. Turn the crankshaft counterclockwise to compress the auto-tensioner.

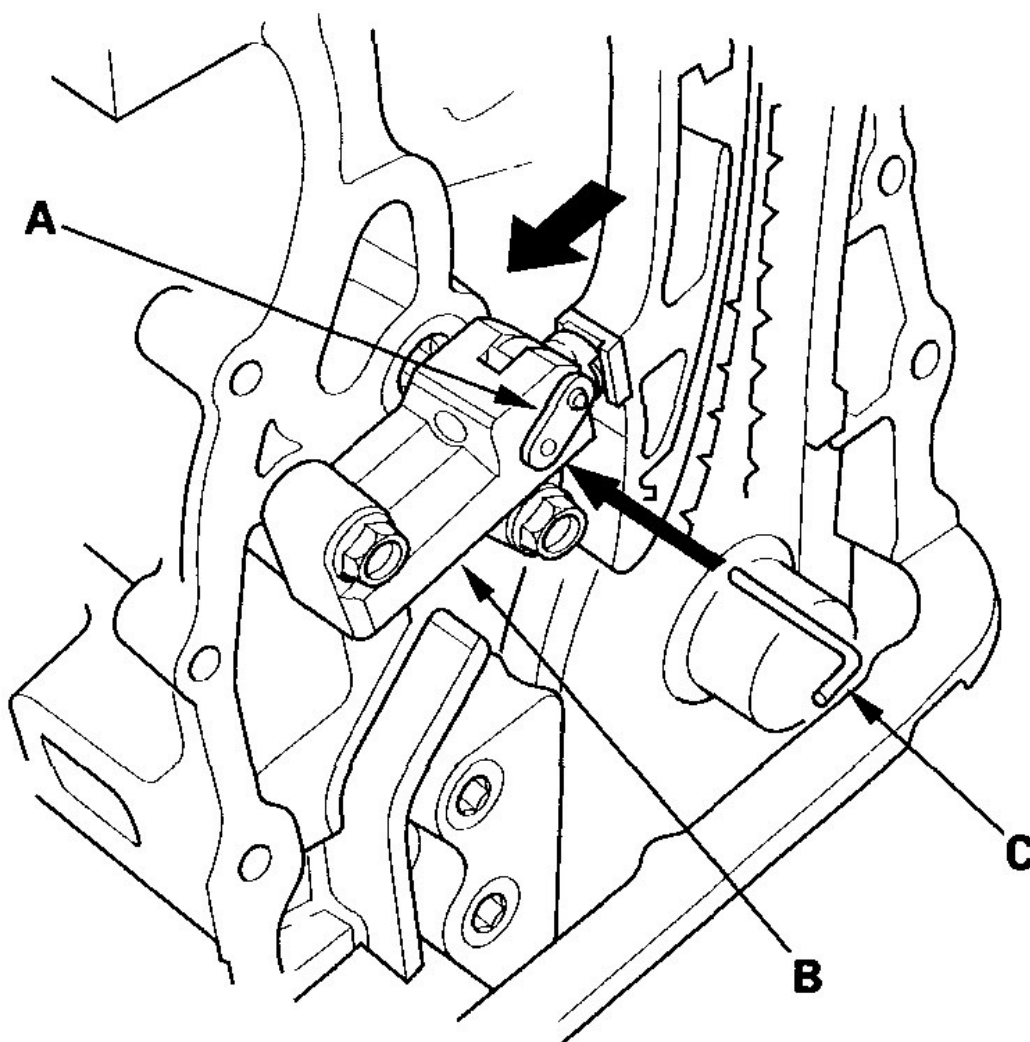


G03677147

Fig. 28: Turning Crankshaft Counterclockwise To Compress Auto-Tensioner

Courtesy of AMERICAN HONDA MOTOR CO., INC.

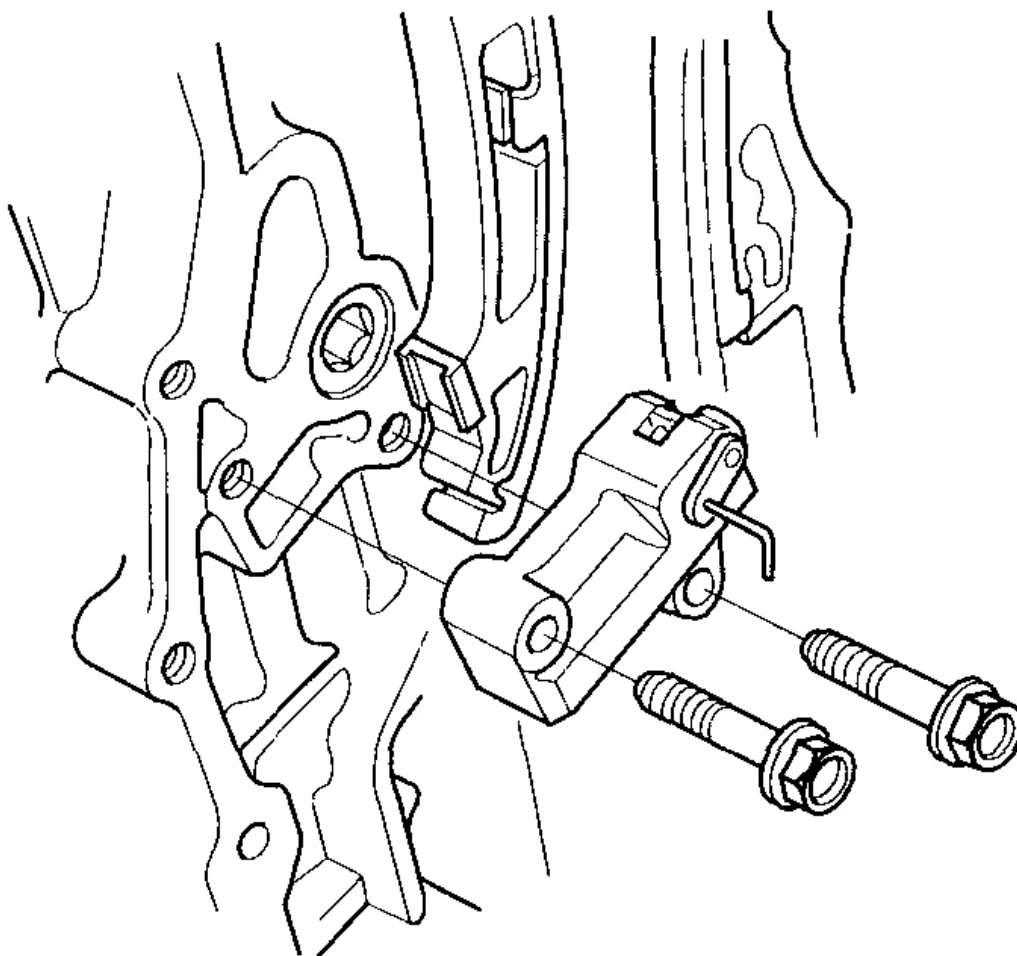
16. Align the holes on the lock (A) and the auto-tensioner (B), then insert a 1.5 mm (0.06 in.) diameter pin (C) into the holes. Turn the crankshaft clockwise to secure the pin.



G03677148

Fig. 29: Aligning Holes On Lock And Auto-Tensioner
Courtesy of AMERICAN HONDA MOTOR CO., INC.

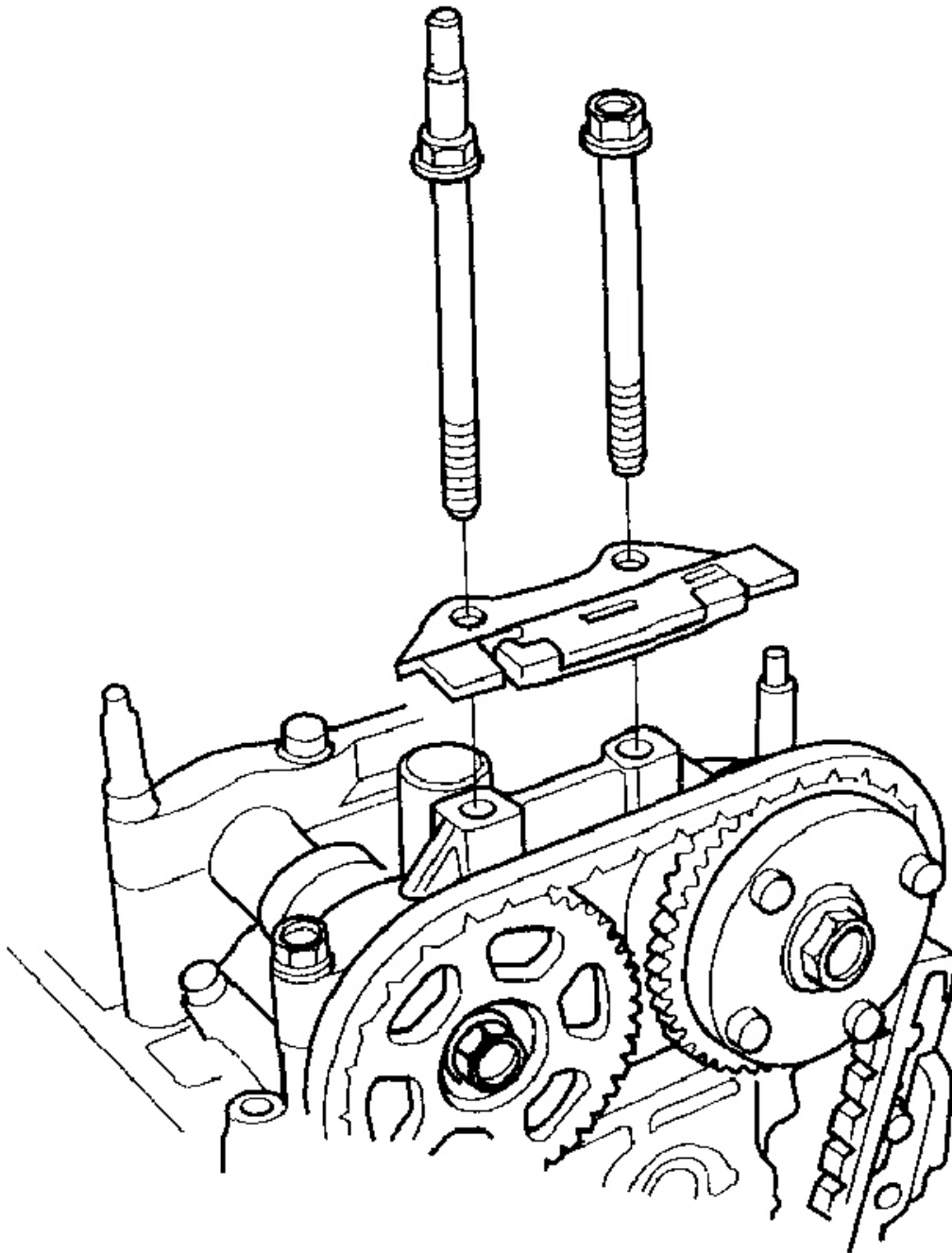
17. Remove the auto-tensioner.



G03677149

Fig. 30: Removing Auto-Tensioner
Courtesy of AMERICAN HONDA MOTOR CO., INC.

18. Remove the crankshaft pulley.
19. Remove the cam chain guide B.

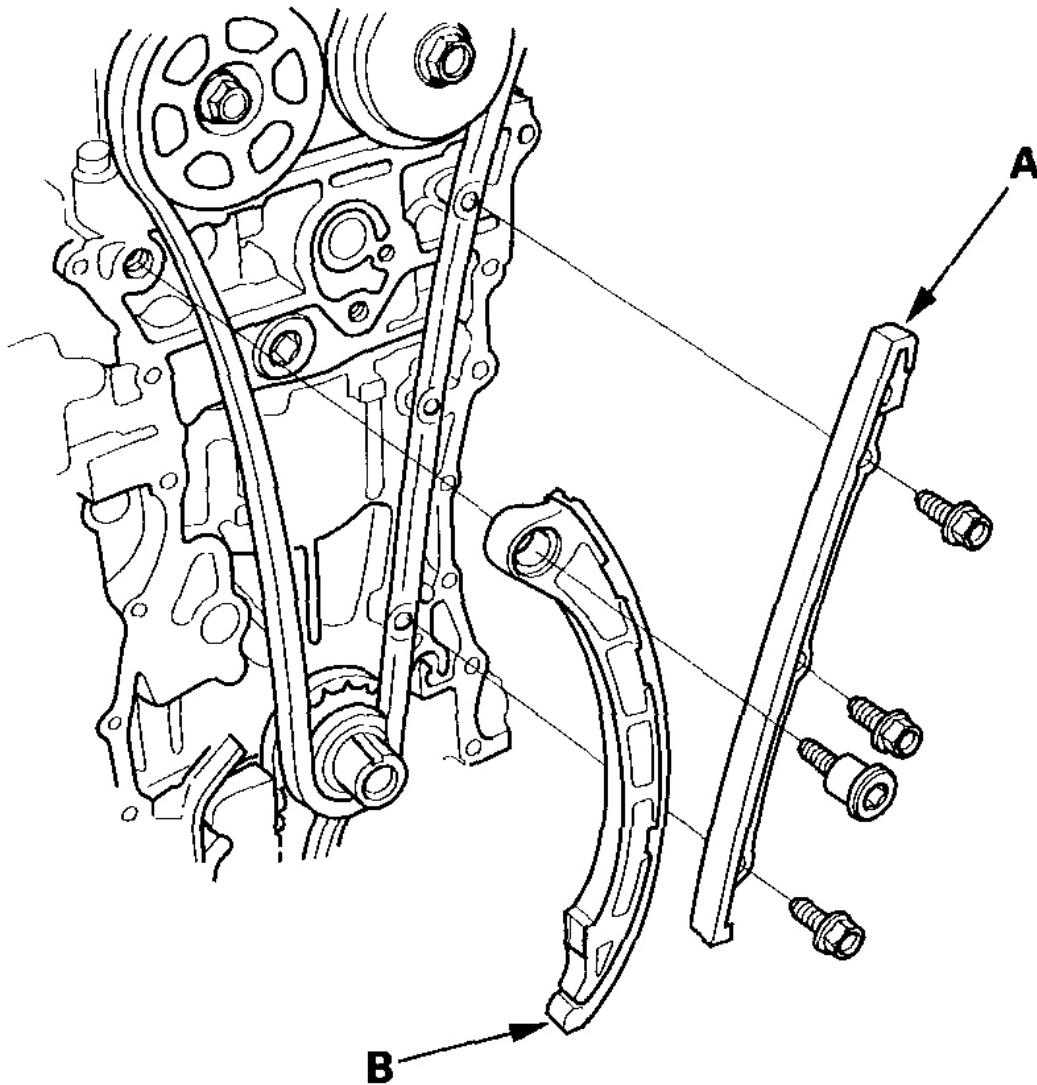


G03677150

Fig. 31: Removing Cam Chain Guide

Courtesy of AMERICAN HONDA MOTOR CO., INC.

20. Remove the cam chain guide A and tensioner arm (B).



G03677151

Fig. 32: Removing Cam Chain Guide A And Tensioner Arm
Courtesy of AMERICAN HONDA MOTOR CO., INC.

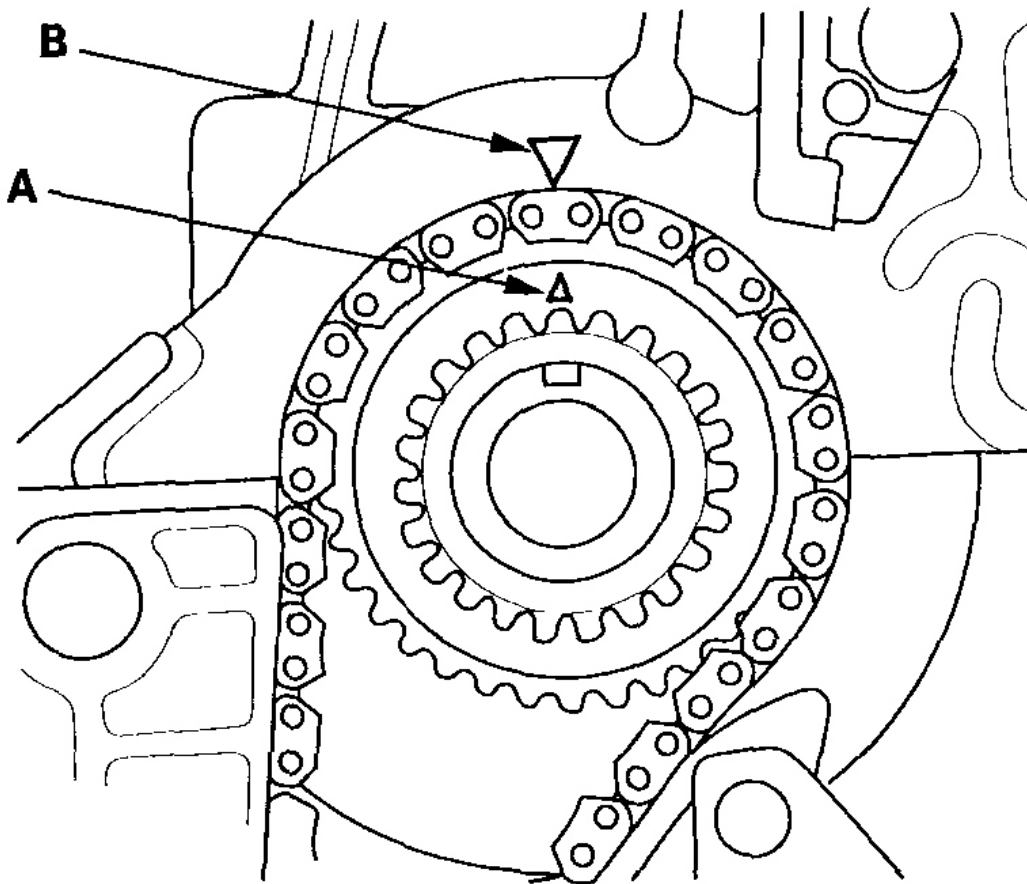
21. Remove the cam chain.

CAM CHAIN INSTALLATION

NOTE:

- Keep the cam chain away from magnetic fields.
- Before doing this procedure, check that the variable timing control (VTC) actuator is locked by turning the VTC actuator counterclockwise. If not locked, turn the VTC actuator clockwise until it stops, then recheck it. If it is still not locked, replace the VTC actuator.

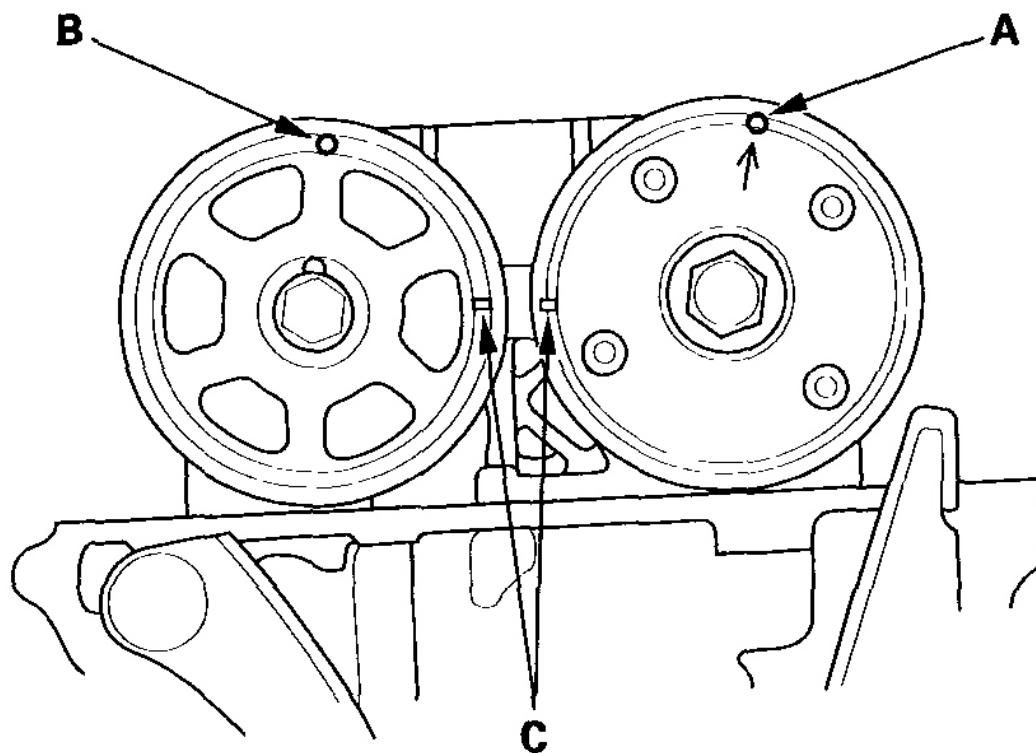
1. Set the crankshaft to top dead center (TDC). Align the TDC mark (A) on the crankshaft sprocket with the pointer (B) on the engine block.



G03677152

Fig. 33: Aligning TDC Mark On Crankshaft Sprocket With Pointer On Engine Block
Courtesy of AMERICAN HONDA MOTOR CO., INC.

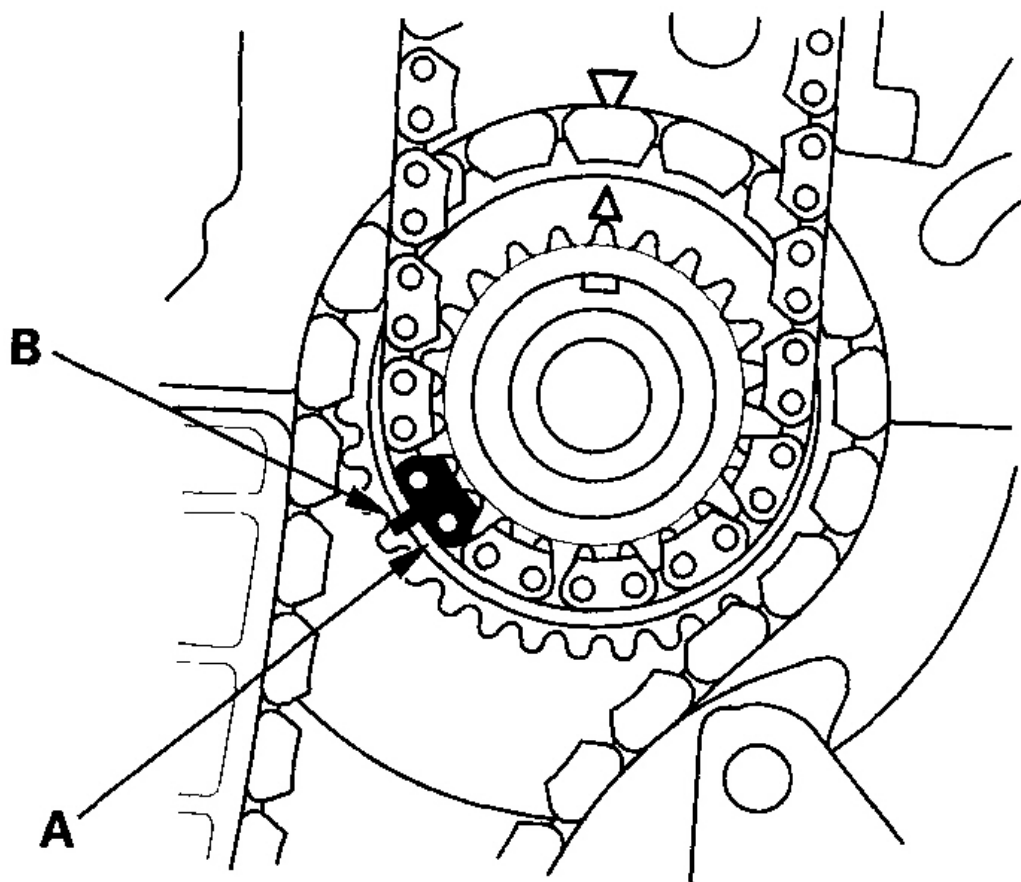
2. Set the camshafts to TDC. The punch mark (A) on the VTC actuator and the punch mark (B) on the exhaust camshaft sprocket should be at the top. Align the TDC marks (C) on the VTC actuator and exhaust camshaft sprocket.



G03677153

Fig. 34: Identifying VTC Actuator And Exhaust Camshaft Sprocket Punch Mark Position
Courtesy of AMERICAN HONDA MOTOR CO., INC.

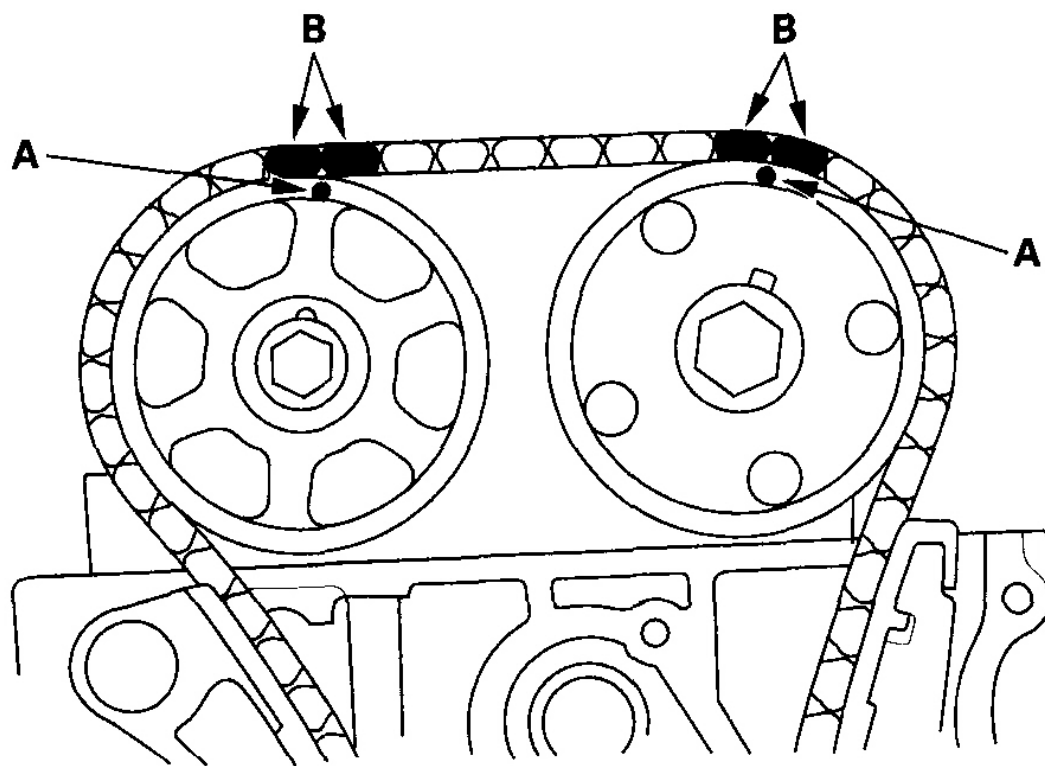
3. Install the cam chain on the crankshaft sprocket with the colored piece (A) aligned with the mark (B) on the crankshaft sprocket.



G03677154

Fig. 35: Installing Cam Chain On Crankshaft Sprocket
Courtesy of AMERICAN HONDA MOTOR CO., INC.

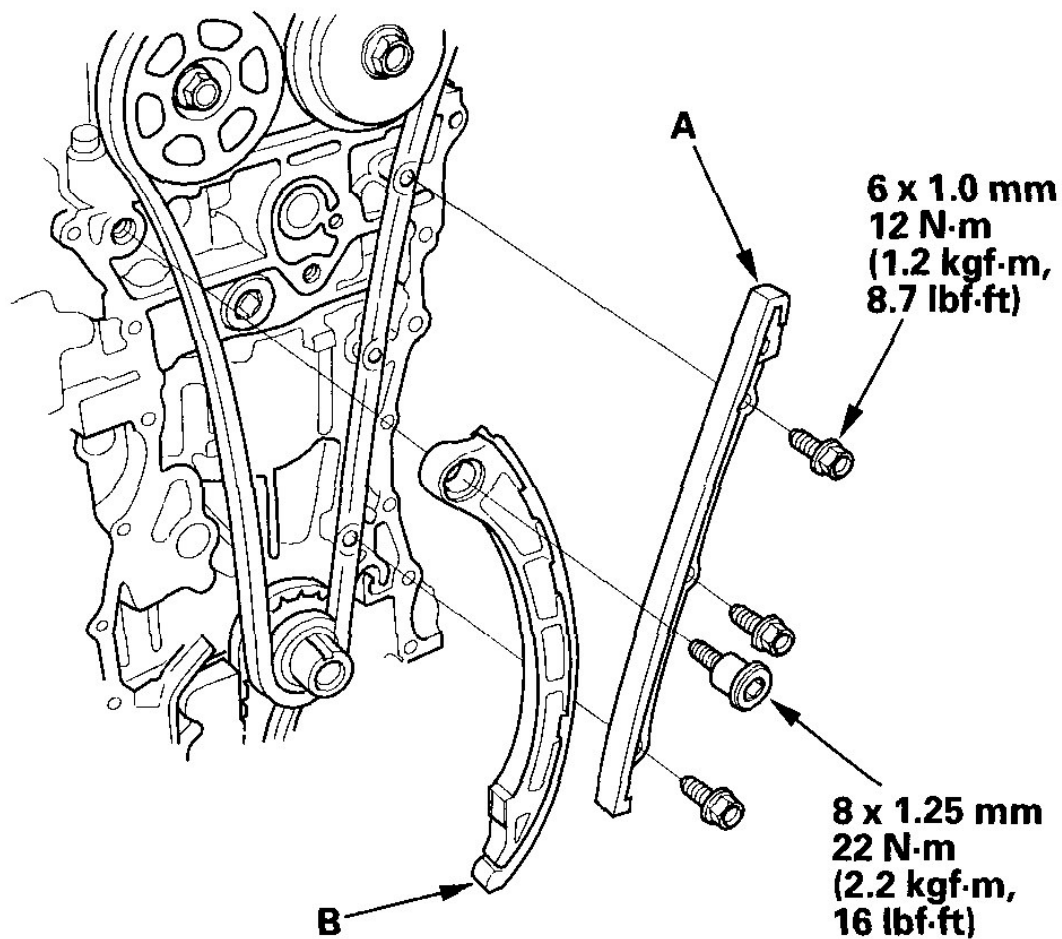
4. Install the cam chain on the VTC actuator and the exhaust camshaft sprocket with the punch marks (A) aligned with the center of the two colored pieces (B).



G03677155

Fig. 36: Installing Cam Chain On VTC Actuator And Exhaust Camshaft Sprocket
Courtesy of AMERICAN HONDA MOTOR CO., INC.

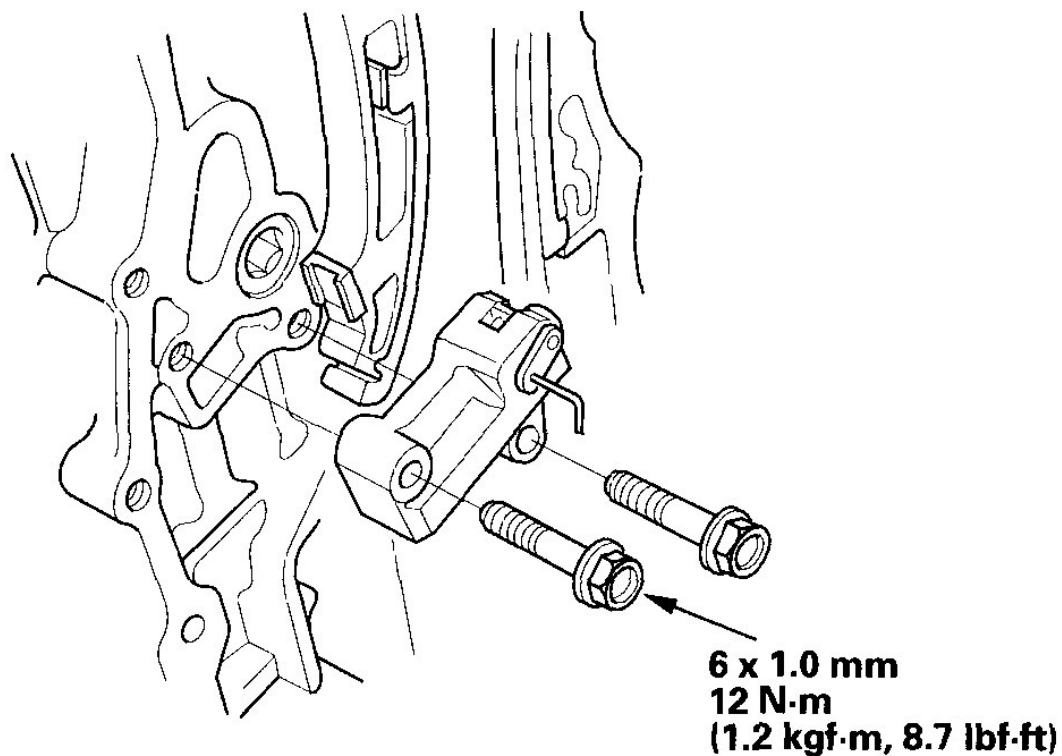
5. Install the cam chain guide A and tensioner arm (B).



G03677156

Fig. 37: Installing Cam Chain Guide A And Tensioner Arm With Specified Torques
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

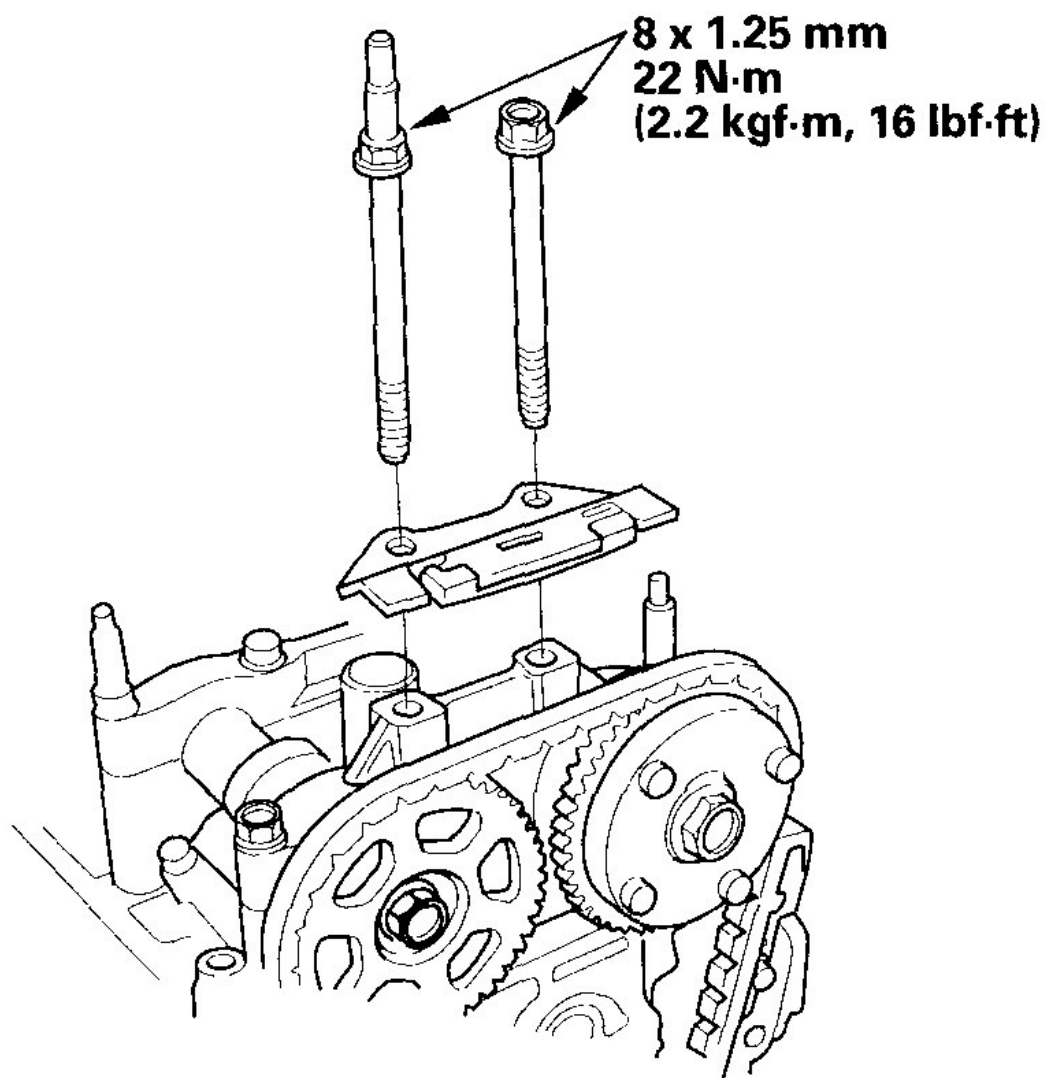
6. Install the auto-tensioner.



G03677157

Fig. 38: Installing Auto-Tensioner And Torque Specifications
Courtesy of AMERICAN HONDA MOTOR CO., INC.

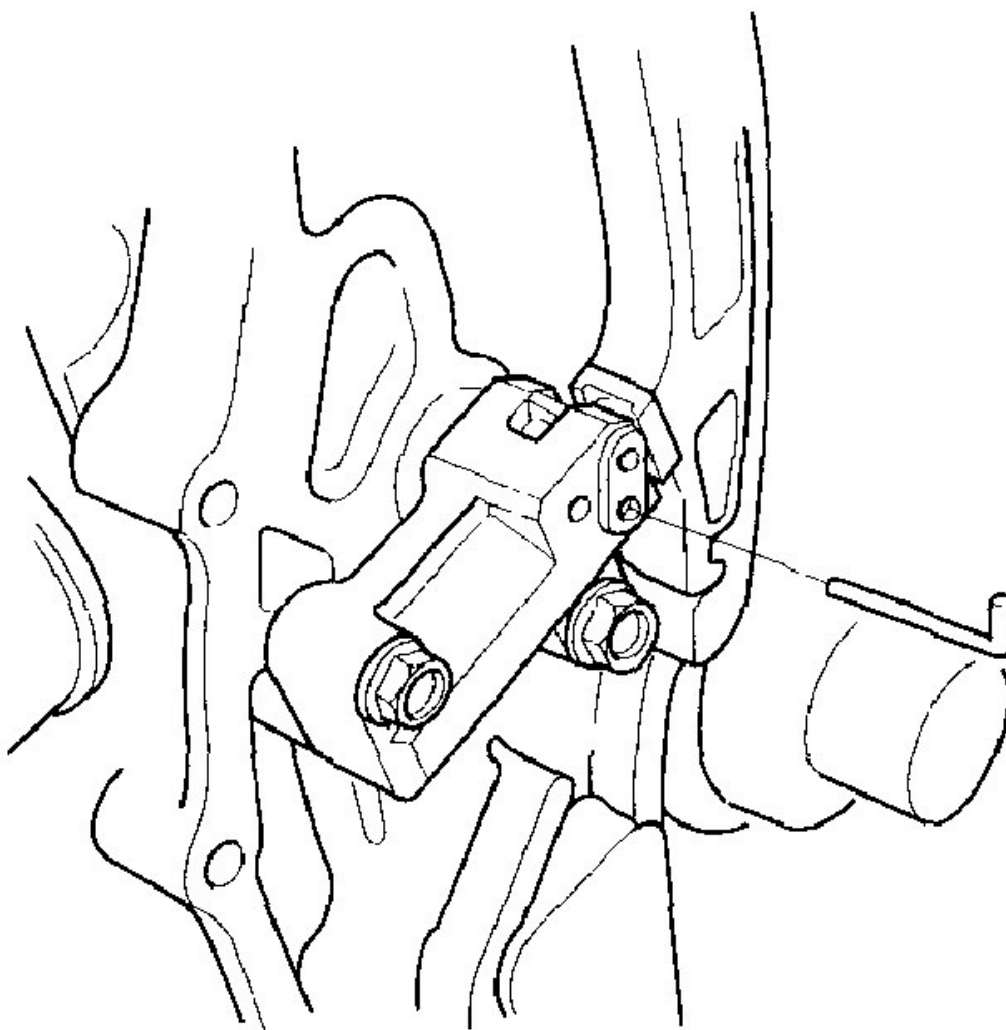
7. Install the cam chain guide B.



G03677158

Fig. 39: Installing Cam Chain Guide B And Torque Specifications
Courtesy of AMERICAN HONDA MOTOR CO., INC.

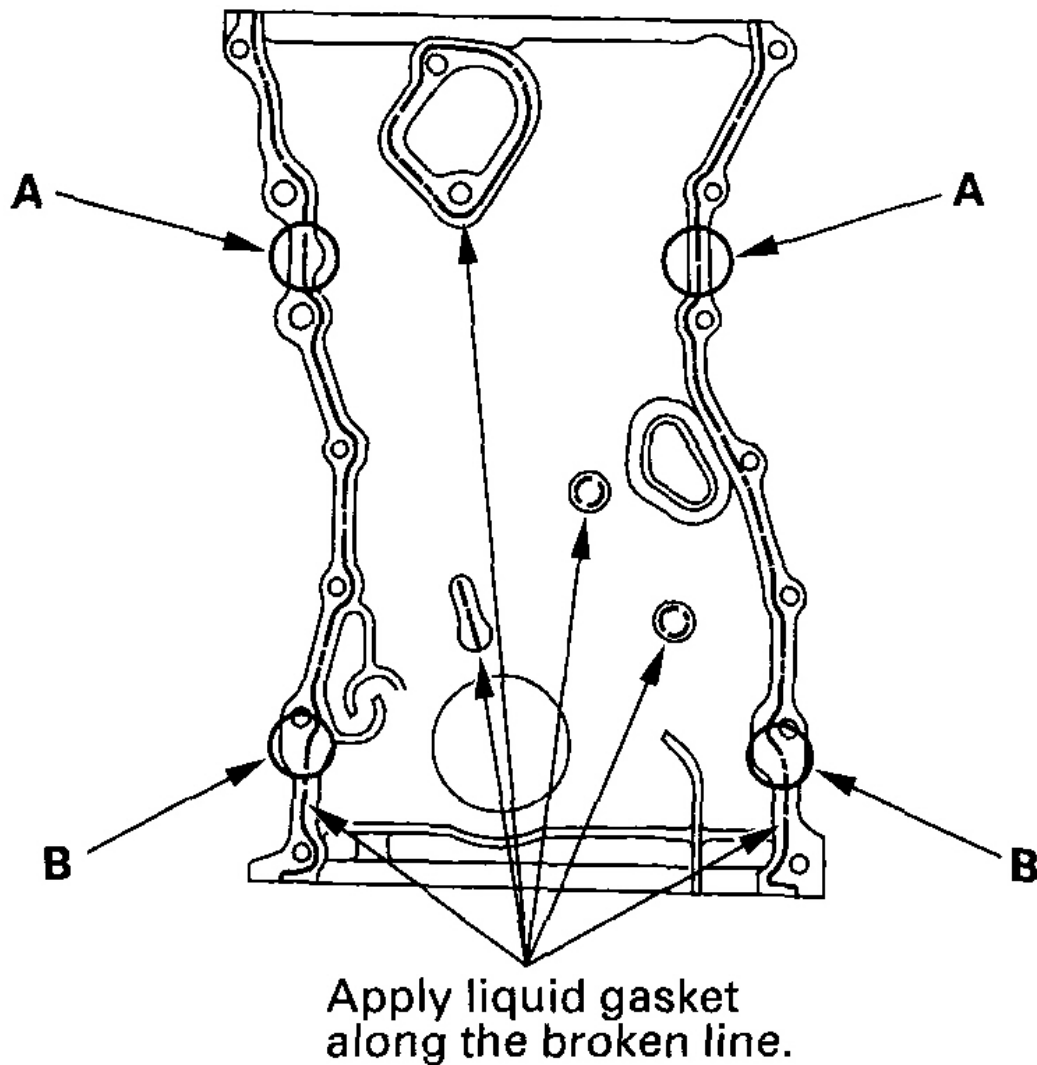
8. Remove the pin from the auto-tensioner.



G03677159

Fig. 40: Removing Pin From Auto-Tensioner
Courtesy of AMERICAN HONDA MOTOR CO., INC.

9. Check the chain case oil seal for damage. If the oil seal is damaged, replace the chain case oil seal (see **CHAIN CASE OIL SEAL INSTALLATION**).
10. Remove any old liquid gasket from the chain case mating surfaces, bolts, and bolt holes.
11. Clean and dry the chain case mating surfaces.
12. Apply liquid gasket, P/N 08717-0004, 08718-0001, 08718-0002, 08718-0003, or 08718-0009, evenly to the engine block mating surface of the chain case.



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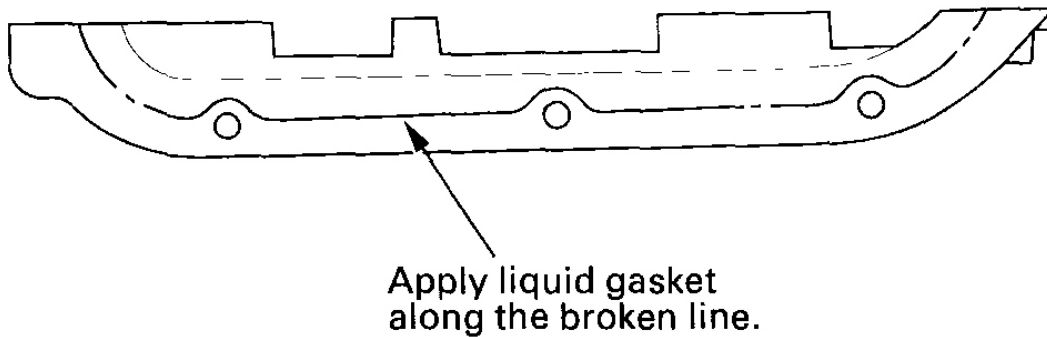
Fig. 41: Locating Sealing Gasket Applying Point (1 Of 2)

Courtesy of AMERICAN HONDA MOTOR CO., INC.

13. Apply liquid gasket to the engine block upper surface contact areas (A) on the chain case and lower block upper surface contact areas (B) on the chain case.
14. Apply liquid gasket, P/N 08717-0004, 08718-0001, 08718-0002, 08718-0003, or 08718-0009, evenly to the oil pan mating surface of the chain case.

NOTE: Do not install components if too much time has passed after applying the liquid gasket (for P/N 08718-0002, no more than 4 minutes, for all others,

no more than 5 minutes). Instead, remove the old residue and reapply the liquid gasket.



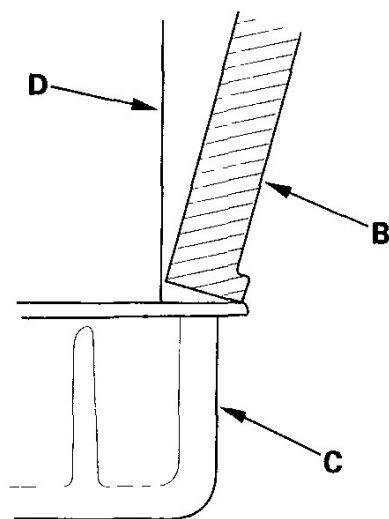
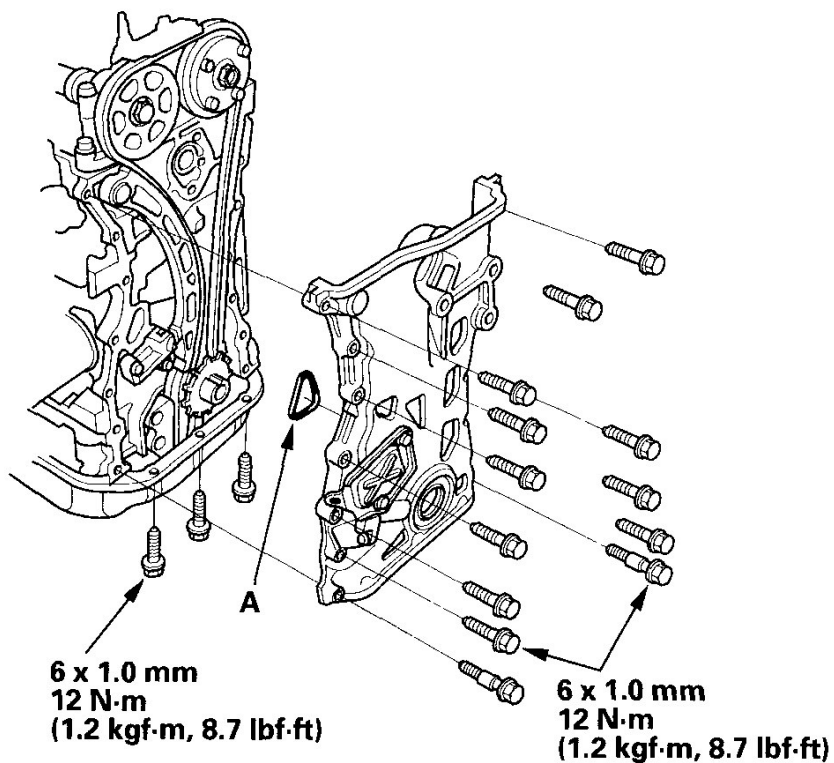
G03677161

Fig. 42: Locating Sealing Gasket Applying Point (2 Of 2)
Courtesy of AMERICAN HONDA MOTOR CO., INC.

15. Install the new O-ring (A) on the chain case. Set the edge of the chain case (B) to the edge of the oil pan (C), then install the chain case on the engine block (D). Wipe off excess liquid gasket on the oil pan and chain case mating area.

NOTE:

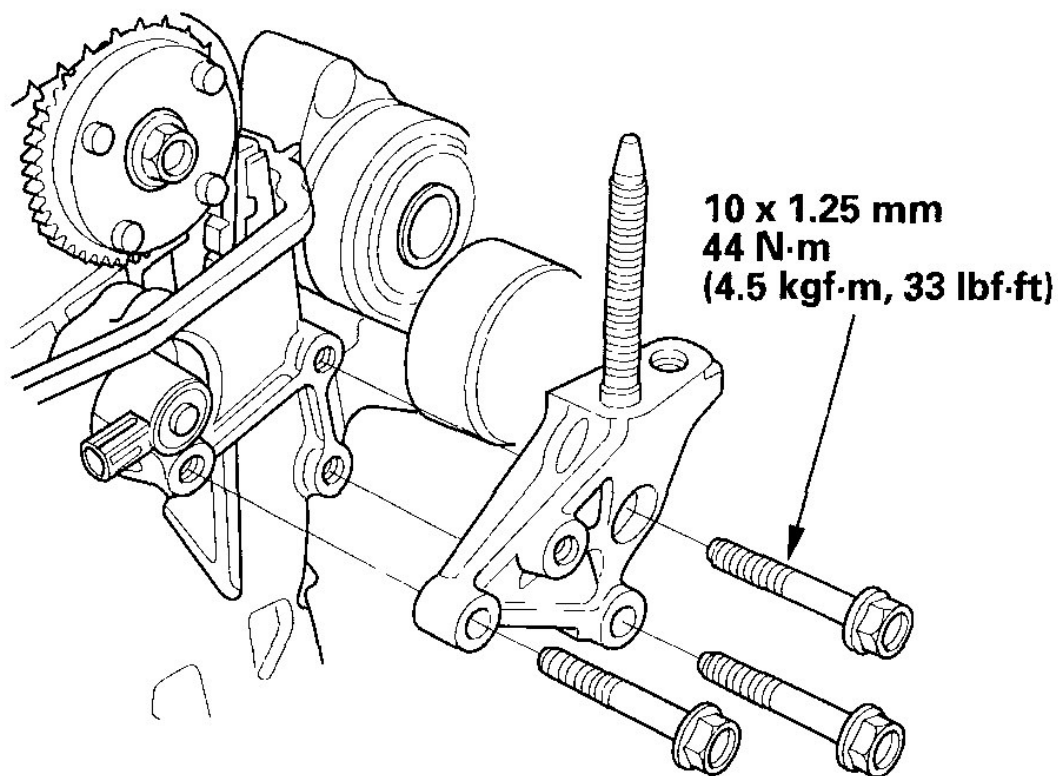
- When installing the chain case, do not slide the bottom surface on the oil pan mounting surface.
- Wait at least 30 minutes before filling the engine with oil.
- Do not run the engine for at least 3 hours after installing the chain case.



G03677162

Fig. 43: Installing O-Ring On Chain Case And Torque Specifications
Courtesy of AMERICAN HONDA MOTOR CO., INC.

16. Install the side engine mount bracket.



G03677163

Fig. 44: Installing Side Engine Mount Bracket And Torque Specifications
Courtesy of AMERICAN HONDA MOTOR CO., INC.

17. Install the upper engine mount bracket (A), then tighten the bolt/nuts in the numbered sequence shown.

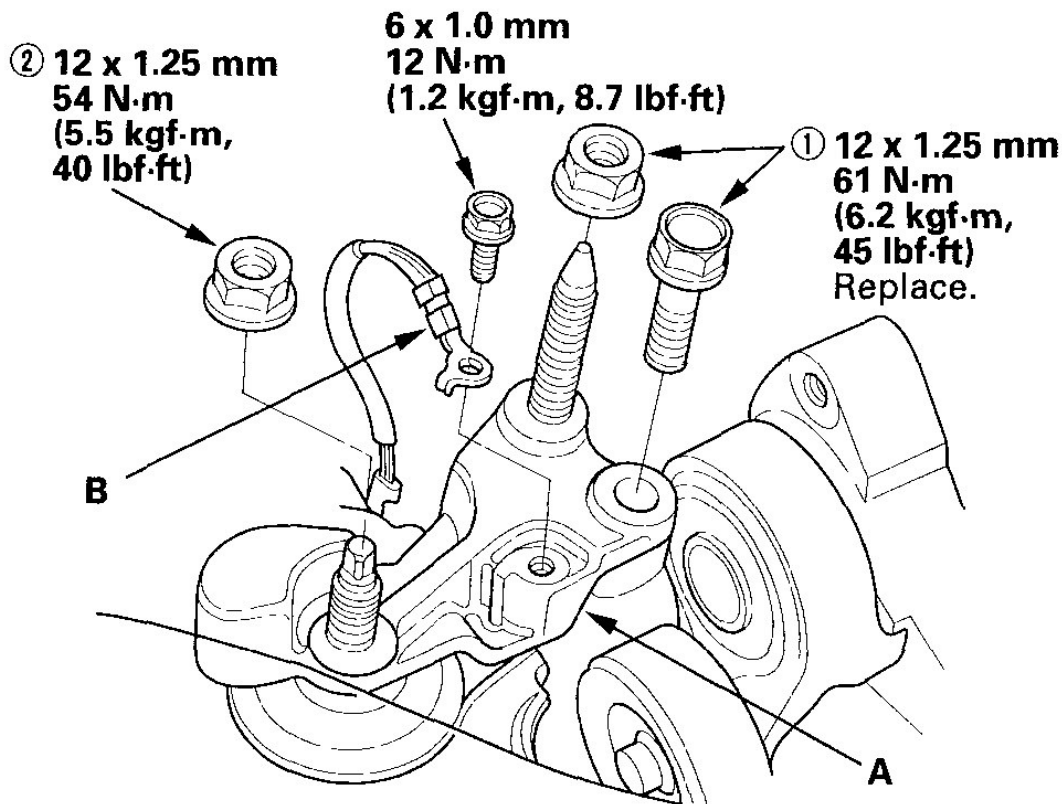
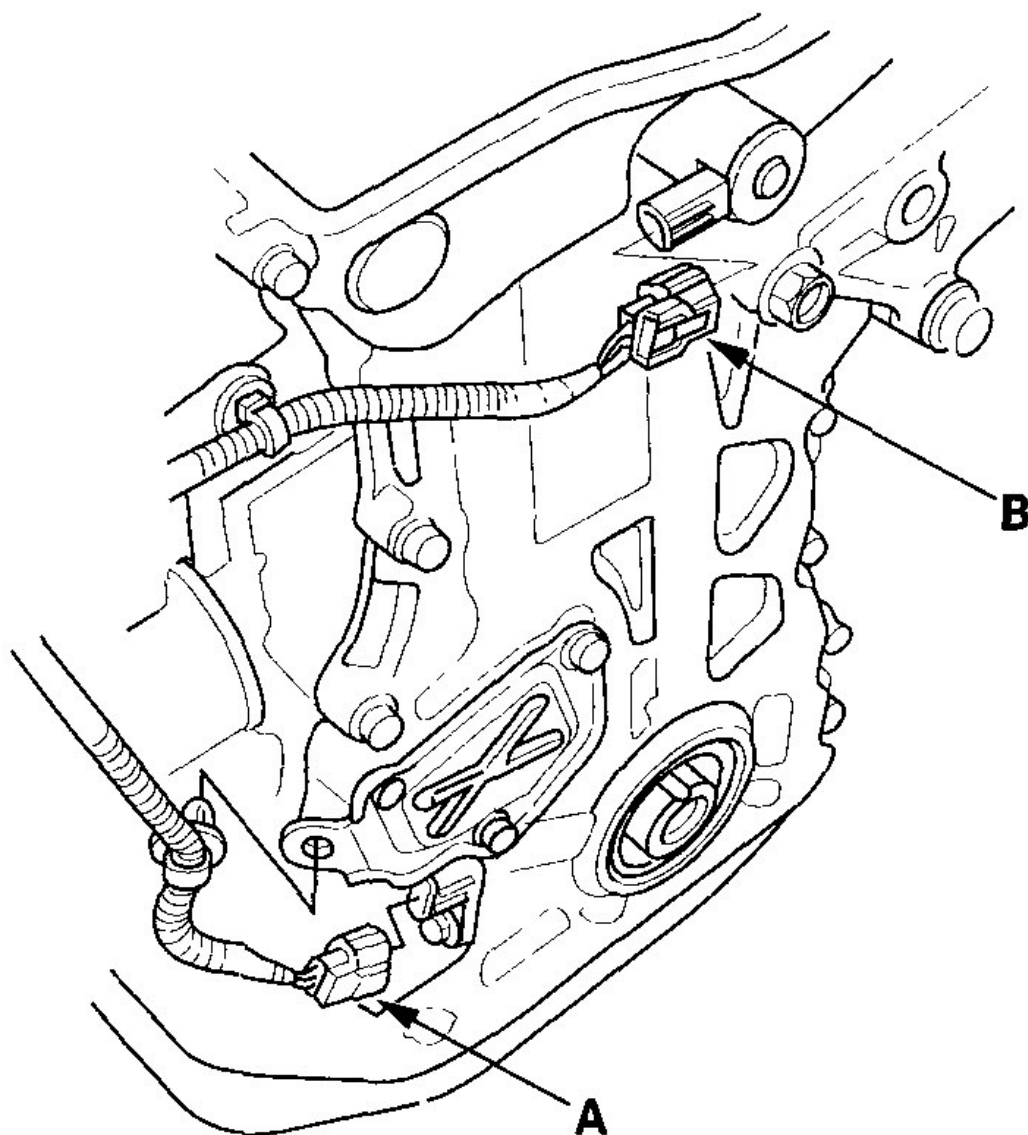


Fig. 45: Installing And Tightening Upper Engine Mount Bracket Bolt With Specified Torques
Courtesy of AMERICAN HONDA MOTOR CO., INC.

18. Install the ground cable (B).
19. Install the variable valve timing control (VTC) oil control solenoid valve (see **VTC OIL CONTROL SOLENOID VALVE REMOVAL/TEST/I**).
20. Connect the crankshaft position (CKP) sensor connector (A) and VTC oil control solenoid valve connector (B).



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Fig. 46: Connecting Crankshaft Position Sensor Connector And VTC Oil Control Solenoid Valve Connector

Courtesy of AMERICAN HONDA MOTOR CO., INC.

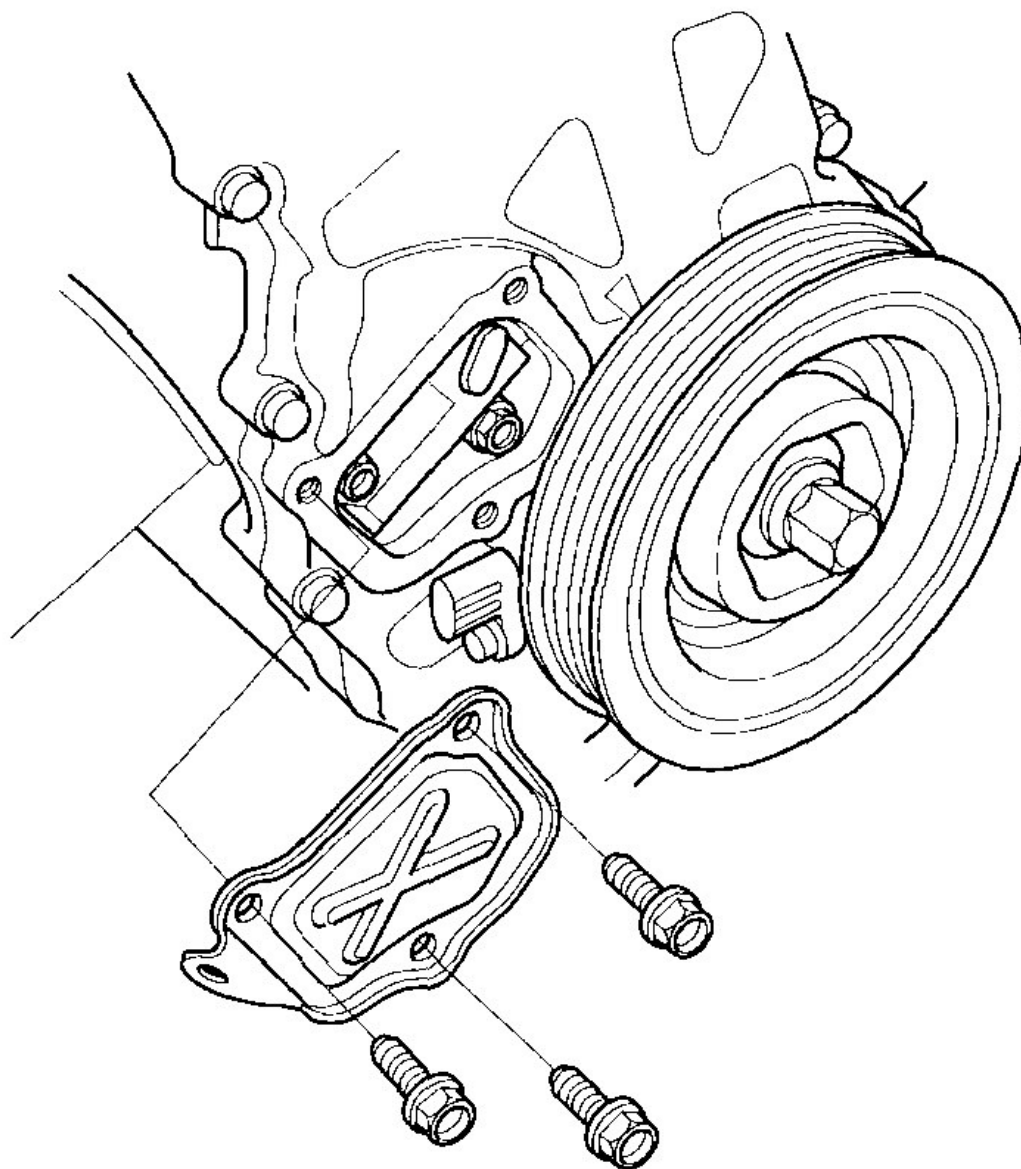
21. Install the crankshaft pulley (see **INSTALLATION**).
22. Install the cylinder head cover (see **CYLINDER HEAD COVER INSTALLATION**).
23. Install the drive belt (see **DRIVE BELT INSPECTION**).

24. Install the splash shield (see step 26 on **ENGINE INSTALLATION**).
25. Install the right front wheel.
26. Do the CKP pattern clear/CKP pattern learn procedure (see **HOW TO END A TROUBLESHOOTING SESSION (REQUIRED AFTER ANY TROUBLESHOOTING)**).

AUTO-TENSIONER REMOVAL AND INSTALLATION

REMOVAL

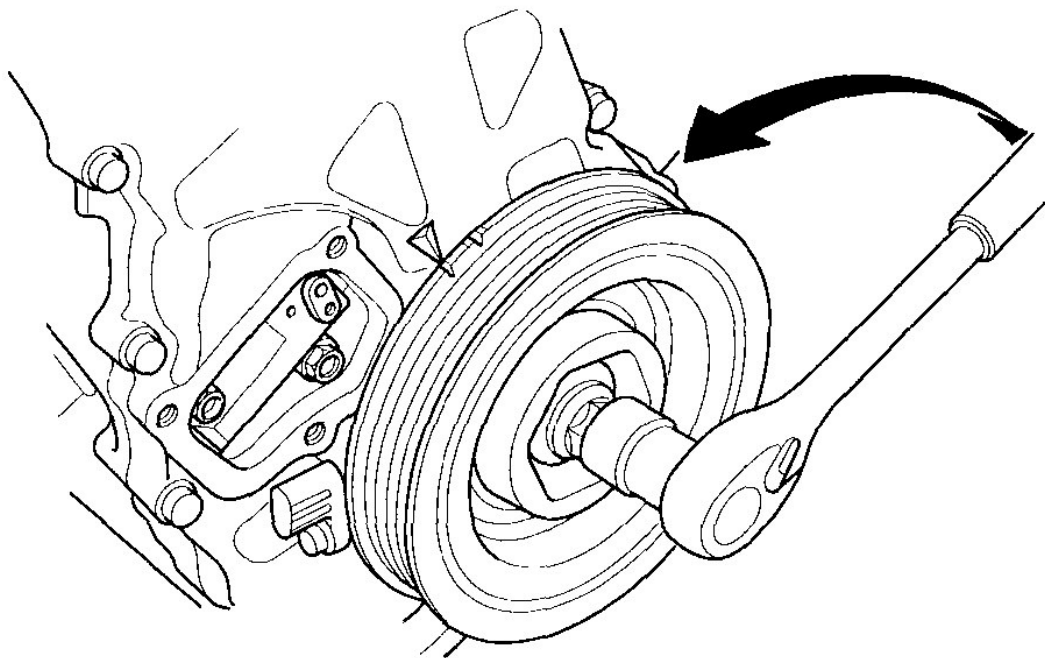
1. Remove the chain case cover.



G03677166

Fig. 47: Removing Chain Case Cover
Courtesy of AMERICAN HONDA MOTOR CO., INC.

2. Turn the crankshaft counterclockwise to compress the auto-tensioner.

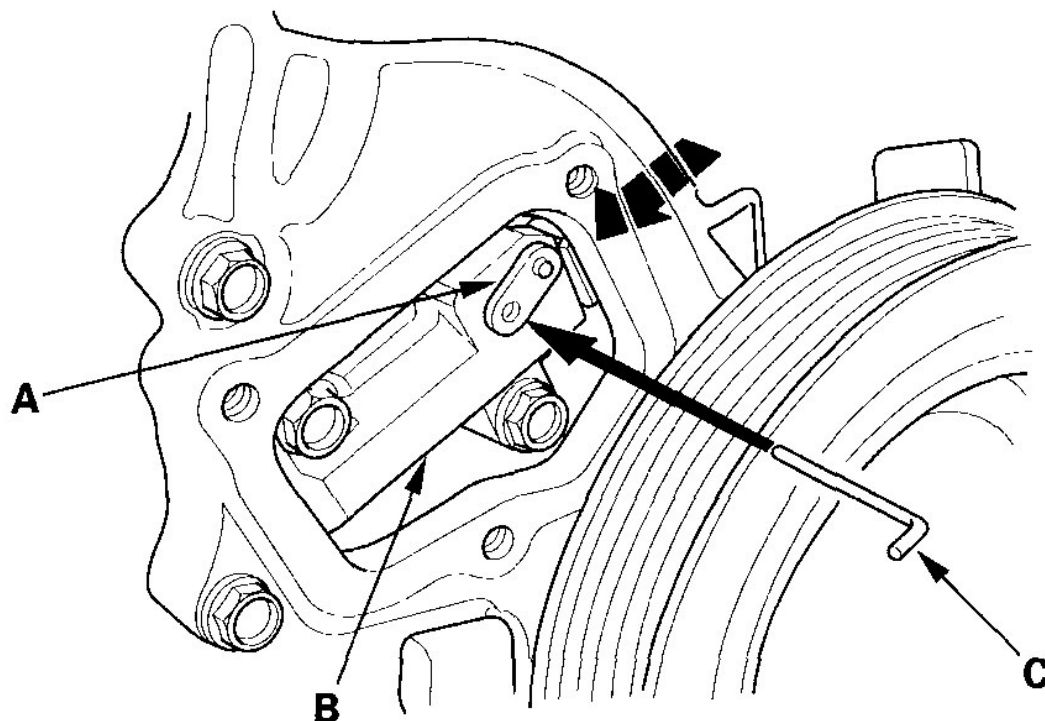


G03677167

Fig. 48: Compressing Auto-Tensioner

Courtesy of AMERICAN HONDA MOTOR CO., INC.

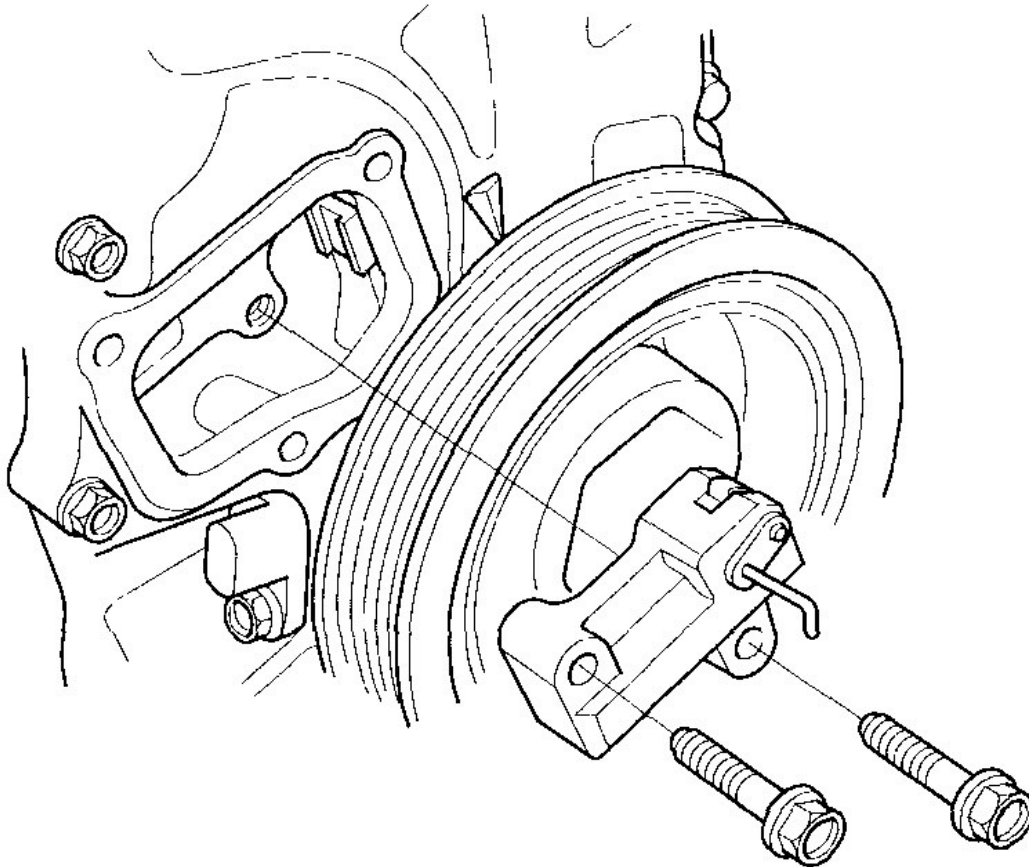
3. Align the holes on the lock (A) and the auto-tensioner (B), then insert a 1.5 mm (0.06 in.) diameter pin (C) into the holes. Turn the crankshaft clockwise to secure the pin.



G03677168

Fig. 49: Inserting Pin Into Lock And Auto-Tensioner Hole
Courtesy of AMERICAN HONDA MOTOR CO., INC.

4. Remove the auto-tensioner.

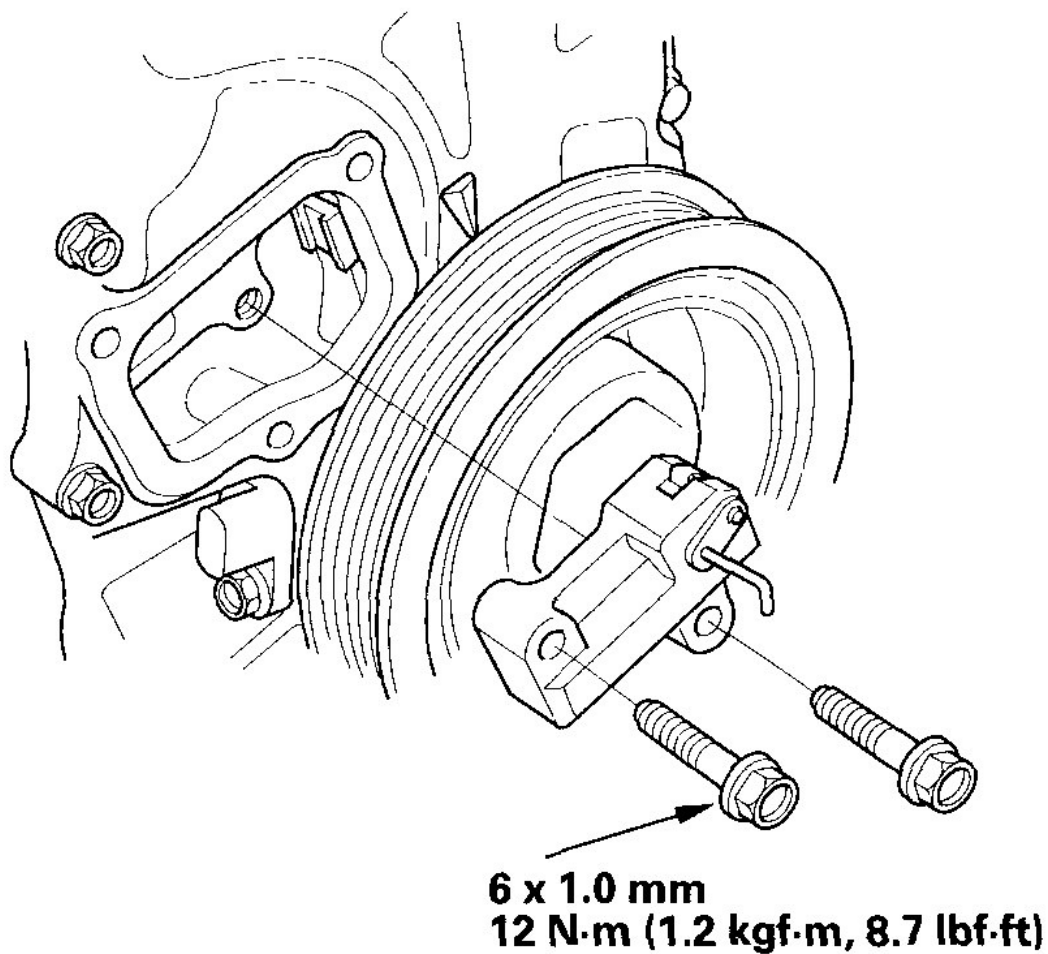


G03677169

Fig. 50: Removing Auto-Tensioner
Courtesy of AMERICAN HONDA MOTOR CO., INC.

INSTALLATION

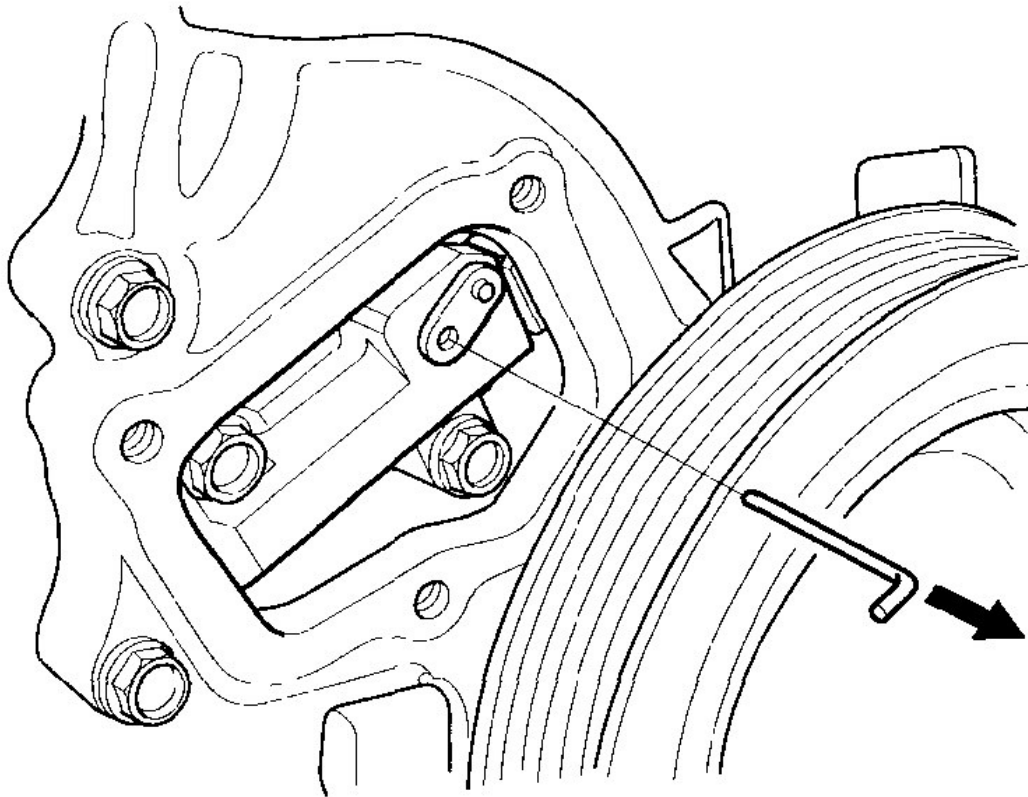
1. Install the auto-tensioner.



G03677170

Fig. 51: Installing Auto-Tensioner And Torques Specifications
Courtesy of AMERICAN HONDA MOTOR CO., INC.

2. Remove the pin from the auto-tensioner.

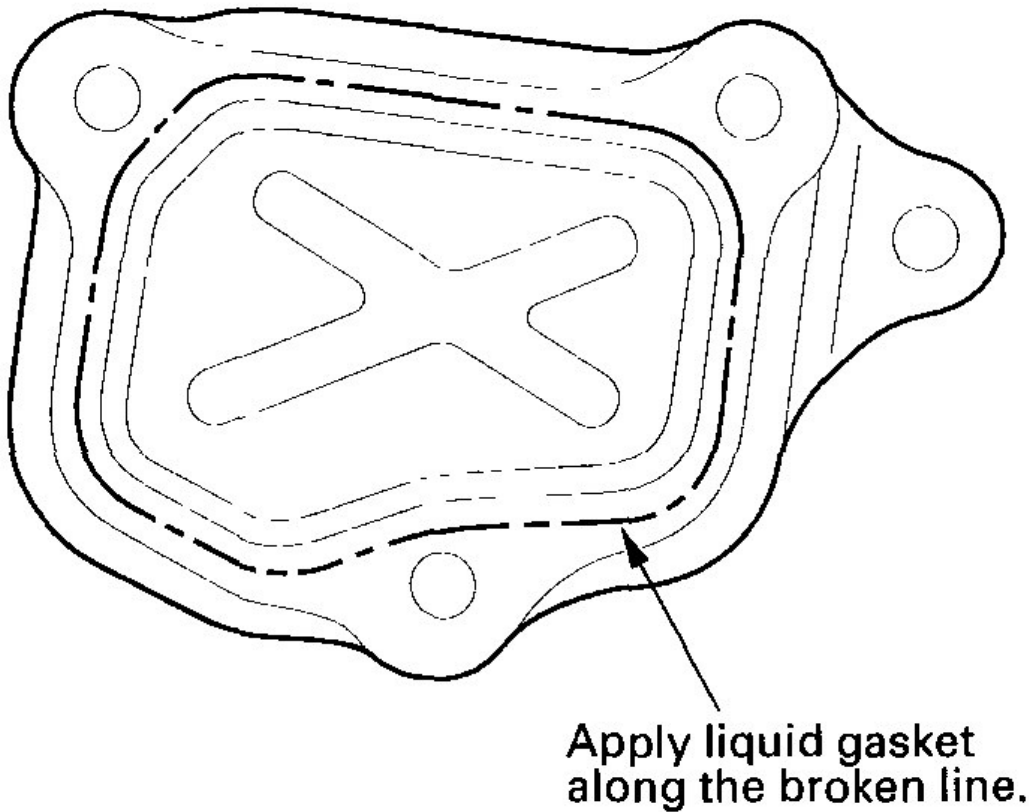


G03677171

Fig. 52: Removing Pin From Auto-Tensioner
Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. Remove any old liquid gasket from the chain case cover mating surfaces, bolts, and bolt holes.
4. Clean and dry the chain case cover mating surfaces.
5. Apply liquid gasket, P/N 08717-0004, 08718-0001, 08718-0002, 08718-0003, or 08718-0009, evenly to the chain case mating surface of the chain case cover.

NOTE: Do not install components if too much time has passed after applying the liquid gasket (for P/N 08718-0002, no more than 4 minutes, for all others, no more than 5 minutes). Instead, remove the old residue and reapply the liquid gasket.



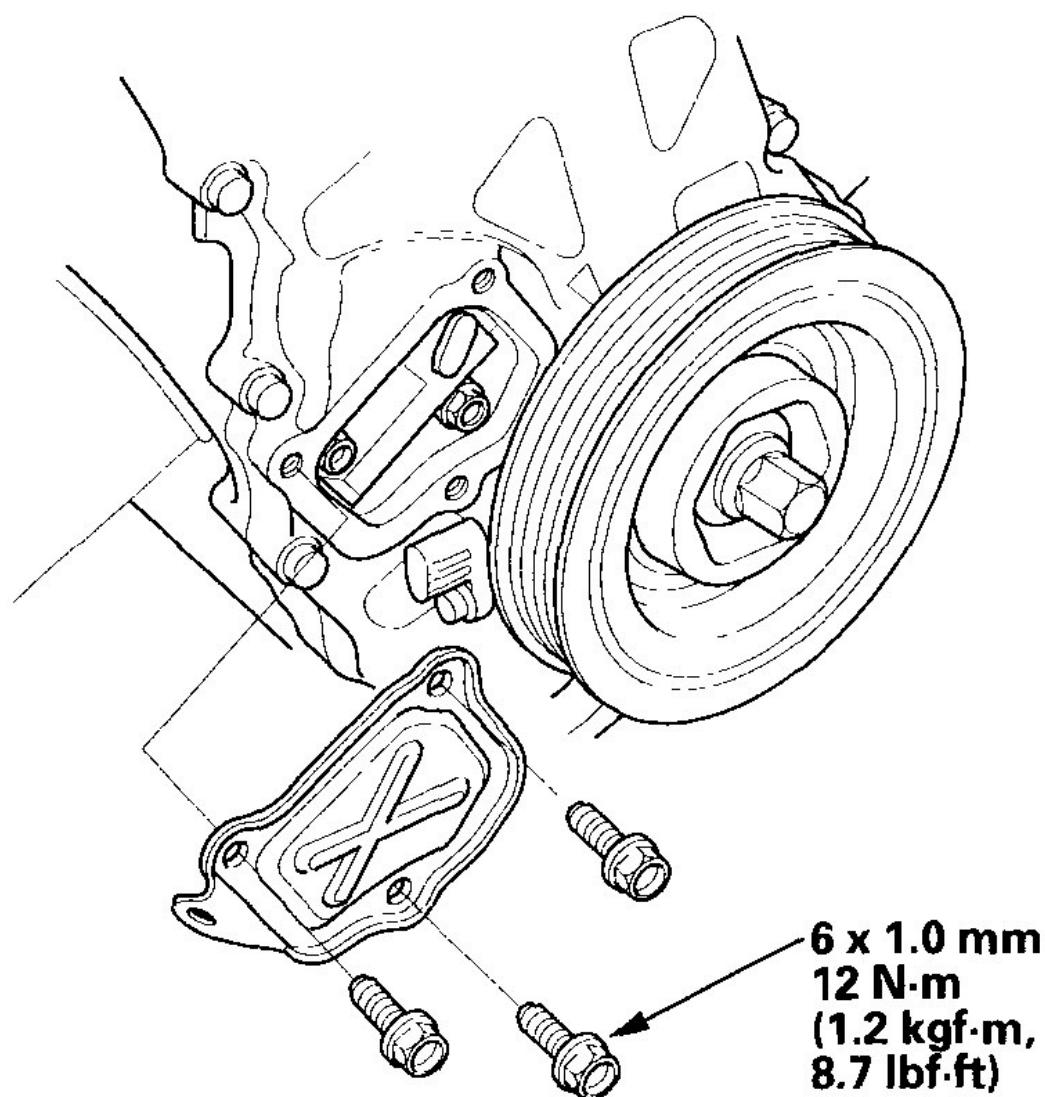
G03677172

Fig. 53: Locating Sealing Gasket Applying Point
Courtesy of AMERICAN HONDA MOTOR CO., INC.

6. Install the chain case cover.

NOTE:

- Wait for at least 30 minutes before filling the engine with oil.
- Do not run the engine for at least 3 hours after installing the chain cover.



G03677173

Fig. 54: Installing Chain Case Cover And Torque Specifications
Courtesy of AMERICAN HONDA MOTOR CO., INC.

CHAIN CASE OIL SEAL INSTALLATION

Special Tools Required

- Driver 07749-0010000
- Attachment, 52 x 55 mm 07746-0010400

1. Use the special tools to drive a new oil seal squarely into the chain case to the specified installed height.

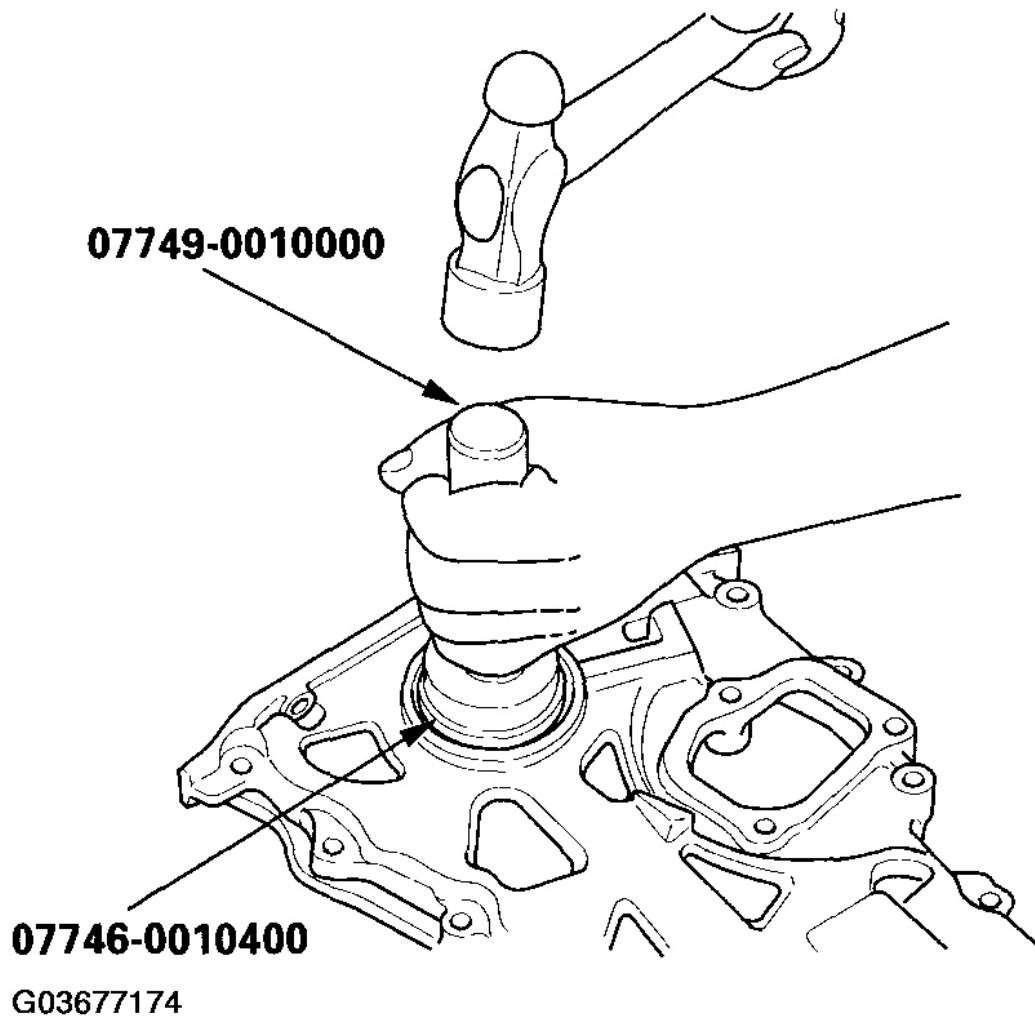
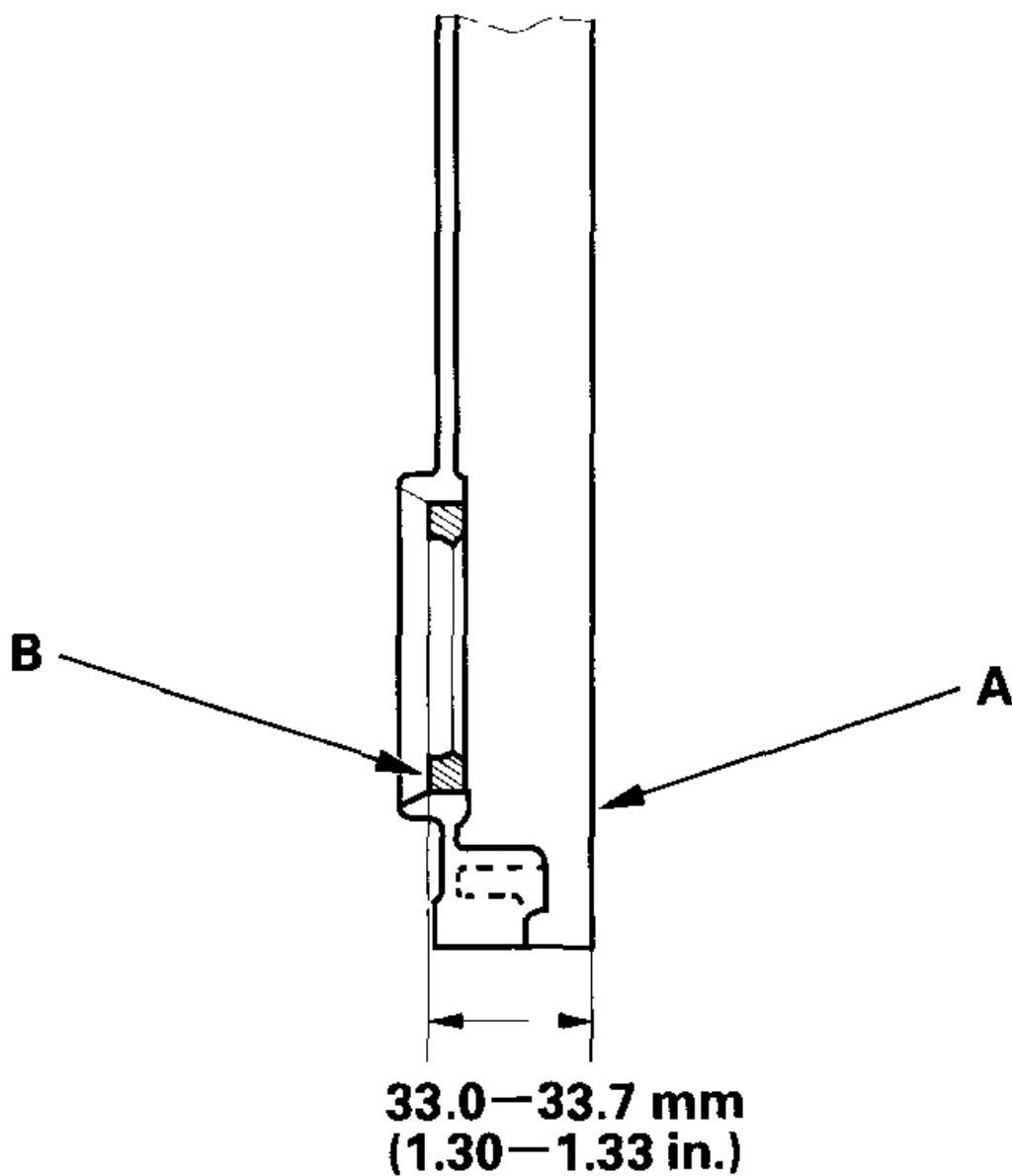


Fig. 55: Installing Oil Seal Into Chain Case
Courtesy of AMERICAN HONDA MOTOR CO., INC.

2. Measure the distance between the chain case surface (A) and oil seal (B).

Oil Seal Installed Height:

33.0-33.7 mm (1.30-1.33 in.)



G03677175

Fig. 56: Identifying Distance Between Chain Case Surface And Oil Seal
Courtesy of AMERICAN HONDA MOTOR CO., INC.

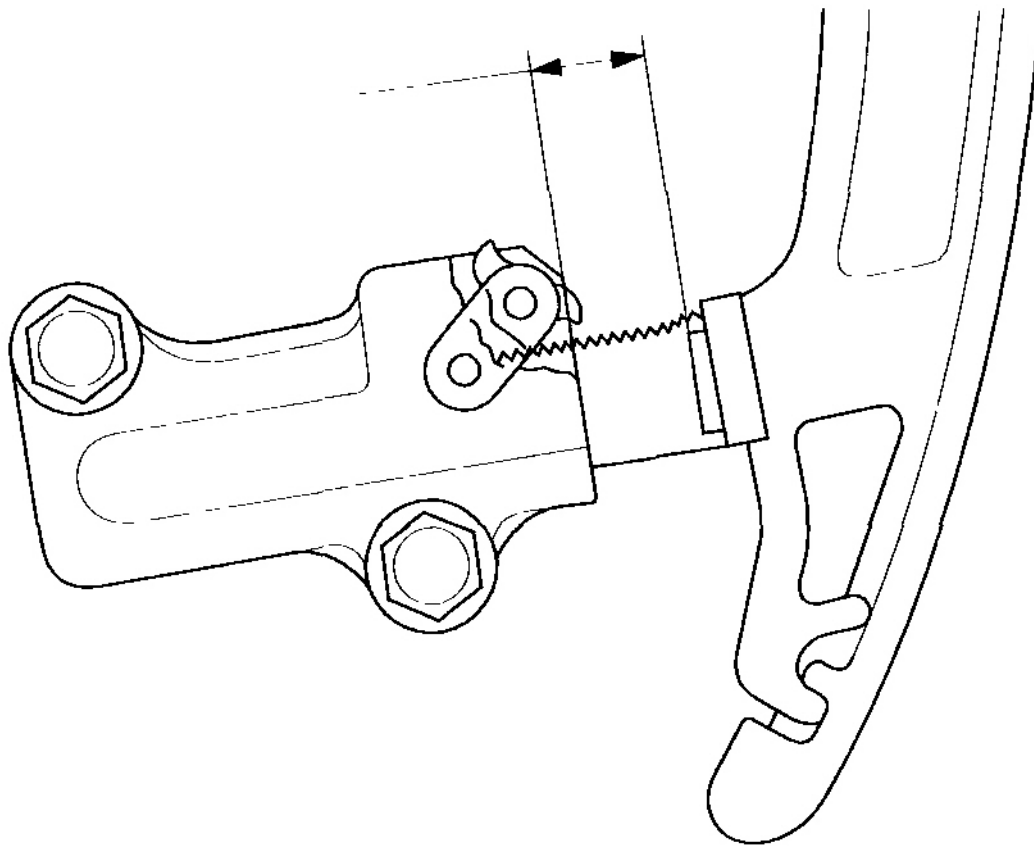
CAM CHAIN INSPECTION

1. Remove the right front wheel.

2. Remove the splash shield (see step 26 on **ENGINE REMOVAL**).
3. Remove the drive belt (see **DRIVE BELT REPLACEMENT**).
4. Remove the cylinder head cover (see **CYLINDER HEAD COVER REMOVAL**).
5. Remove the crankshaft pulley (see **CRANKSHAFT PULLEY REMOVAL AND INSTALLATION**).
6. Disconnect the crankshaft position (CKP) sensor connector and variable valve timing control (VTC) oil control solenoid valve connector (see step 8).
7. Remove the VTC oil control solenoid valve (see **VTC OIL CONTROL SOLENOID VALVE REMOVAL/TEST/INSTALLATION**).
8. Support the engine with a jack and wood block under the oil pan.
9. Remove the ground cable, and remove the upper bracket (see step 11).
10. Remove the side engine mount bracket (see step 12).
11. Remove the chain case (see step 13).
12. Measure the tensioner rod length between the tensioner body and bottom of the flat surface section on the tensioner rod. If the length is over the service limit, replace the cam chain and oil pump chain.

Tensioner Rod Length

Service Limit: 13.5 mm (0.53 in.)



G03677176

Fig. 57: Identifying Tensioner Rod Length

Courtesy of AMERICAN HONDA MOTOR CO., INC.

13. Check the chain case oil seal for damage. If the oil seal is damaged, replace the chain case oil seal (see **CHAIN CASE OIL SEAL INSTALLATION**).
14. Remove any old liquid gasket from the chain case mating surfaces, bolt and bolt holes.
15. Clean and dry the chain case mating surfaces.
16. Apply liquid gasket, P/N 08717-0004, 08718-0001, 08718-0002, 08718-0003, or 08718-0009, evenly to the engine block mating surface of the chain case (see step 12).
17. Apply liquid gasket to the engine block upper surface contact areas on the chain case and lower block upper surface contact areas on the chain case (see step 13).
18. Apply liquid gasket, P/N 08717-0004, 08718-0001, 08718-0002, 08718-0003 or 08718-0009, evenly to the oil pan mating surface of the chain case (see step 14).

NOTE: Do not install components if too much time has passed after applying the liquid gasket (for P/N 08718-0002, no more than 4 minutes, for all others,

no more than 5 minutes). Instead, remove the old residue and reapply the liquid gasket.

19. Install the new O-ring on the chain case. Set the edge of the chain case to the edge of the oil pan, then install the chain case on the engine block (see step 15). Wipe off the excess liquid gasket on the oil pan and chain case mating area.

NOTE:

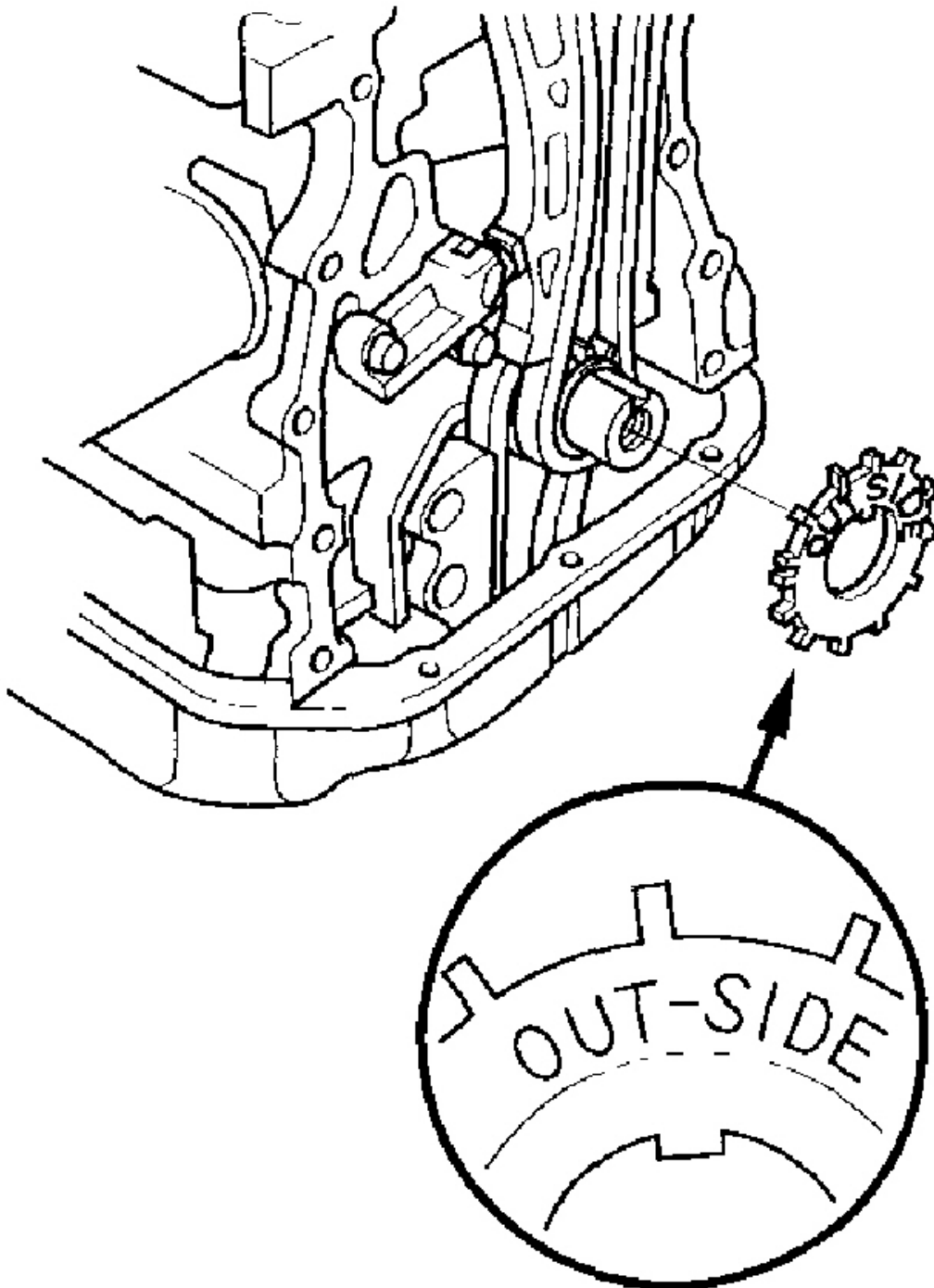
- **When installing the chain case, do not slide the bottom surface on the oil pan mounting surface.**
- **Wait at least 30 minutes before filling the engine with oil.**
- **Do not run the engine for at least 3 hours after installing the chain case.**

20. Install the side engine mount bracket (see step 16).
21. Install the upper bracket and the ground cable (see step 17).
22. Install the VTC oil control solenoid valve (see **VTC OIL CONTROL SOLENOID VALVE REMOVAL/TEST/INSTALLATION**).
23. Connect the CKP sensor connector and VTC oil control solenoid valve connector (see step 20).
24. Install the crankshaft pulley (see **INSTALLATION**).
25. Install the cylinder head cover (see **CYLINDER HEAD COVER INSTALLATION**).
26. Install the drive belt (see **DRIVE BELT INSPECTION**).
27. Install the splash shield (see step 26 on **ENGINE INSTALLATION**).
28. Install the right front wheel.
29. Do the CKP pattern clear/CKP learn procedure (see **HOW TO END A TROUBLESHOOTING SESSION (REQUIRED AFTER ANY TROUBLESHOOTING)**).

CKP PULSE PLATE REPLACEMENT

1. Remove the right front wheel.
2. Remove the splash shield (see step 26 on **ENGINE REMOVAL**).
3. Remove the drive belt (see **DRIVE BELT REPLACEMENT**).
4. Remove the cylinder head cover (see **CYLINDER HEAD COVER REMOVAL**).
5. Remove the crankshaft pulley (see **CRANKSHAFT PULLEY REMOVAL AND INSTALLATION**).
6. Disconnect the crankshaft position (CKP) sensor connector and variable valve timing control (VTC) oil control solenoid valve connector (see step 8).
7. Remove the VTC oil control solenoid valve (see **VTC OIL CONTROL SOLENOID VALVE REMOVAL/TEST/INSTALLATION**).
8. Support the engine with a jack and wood block under the oil pan.
9. Remove the ground cable, and remove the upper engine mount bracket (see step 11).
10. Remove the side engine mount bracket (see step 12).
11. Remove the chain case (see step 13).

12. Remove the CKP pulse plate.



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Fig. 58: Removing CKP Pulse Plate**Courtesy of AMERICAN HONDA MOTOR CO., INC.**

13. Install the CKP pulse plate.
14. Check the chain case oil seal for damage. If the oil seal is damaged, replace the chain case oil seal (see **CHAIN CASE OIL SEAL INSTALLATION**).
15. Remove any old liquid gasket from the chain case mating surfaces, bolt, and bolt holes.
16. Clean and dry the chain case mating surfaces.
17. Apply liquid gasket, P/N 08718-0004, 08718-0001, 08718-0002, 08718-0003, or 08718-0009, evenly to the engine block mating surface of the chain case (see step 12).
18. Apply liquid gasket to the engine block upper surface contact areas of the chain case and lower block upper surface contact areas of the chain case (see step 13).
19. Apply liquid gasket, P/N 08718-0004, 08718-0001, 08718-0002, 08718-0003, or 08718-0009, evenly to the oil pan mating surface of the chain case (see step 14).

NOTE: Do not install components if too much time has passed after applying the liquid gasket (for P/N 08718-0002, no more than 4 minutes, for all others, no more than 5 minutes). Instead, remove the old residue and reapply the liquid gasket.

20. Install the new O-ring on the chain case. Set the edge of the chain case to the edge of the oil pan, then install the chain case on the engine block (see step 15). Wipe off the excess liquid gasket on the oil pan and chain case mating area.

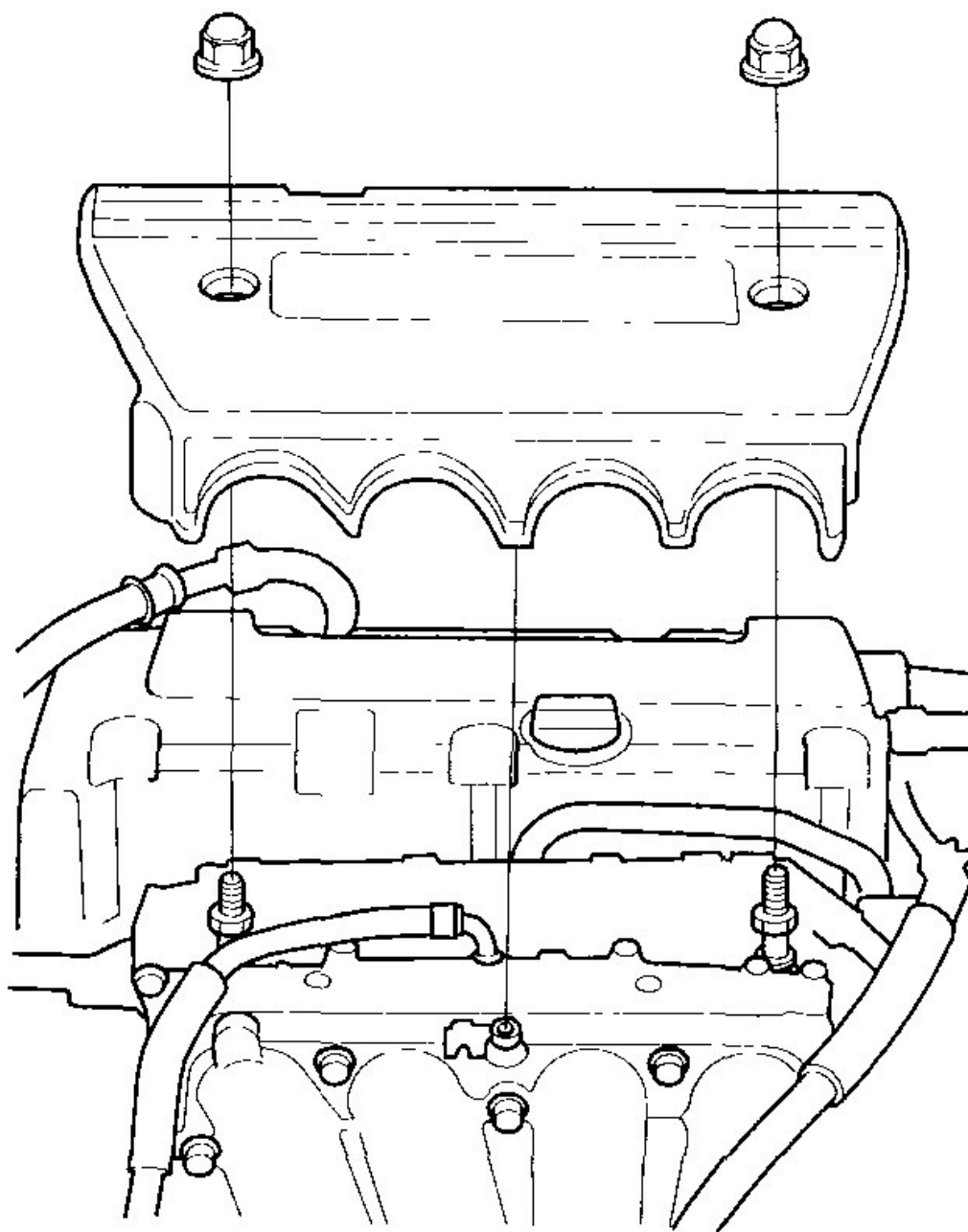
NOTE:

- When installing the chain case, do not slide the bottom surface on the oil pan mounting surface.
- Wait at least 30 minutes before filling the engine with oil.
- Do not run the engine for at least 3 hours after installing the chain case.

21. Install the side engine mount bracket (see step 16).
22. Install the upper engine mount bracket and the ground cable (see step 17).
23. Install the VTC oil control solenoid valve (see **VTC OIL CONTROL SOLENOID VALVE REMOVAL/TEST/INSTALLATION**).
24. Connect the CKP sensor connector and VTC oil control solenoid valve connector (see step 20).
25. Install the crankshaft pulley (see **INSTALLATION**).
26. Install the cylinder head cover (see **CYLINDER HEAD COVER INSTALLATION**).
27. Install the drive belt (see **DRIVE BELT INSPECTION**).
28. Install the splash shield (see step 26 on **ENGINE INSTALLATION**).
29. Install the right front wheel.
30. Do the CKP pattern clear/CKP learn procedure (see **HOW TO END A TROUBLESHOOTING SESSION (REQUIRED AFTER ANY TROUBLESHOOTING)**).

CYLINDER HEAD COVER REMOVAL

1. Remove the intake manifold cover.

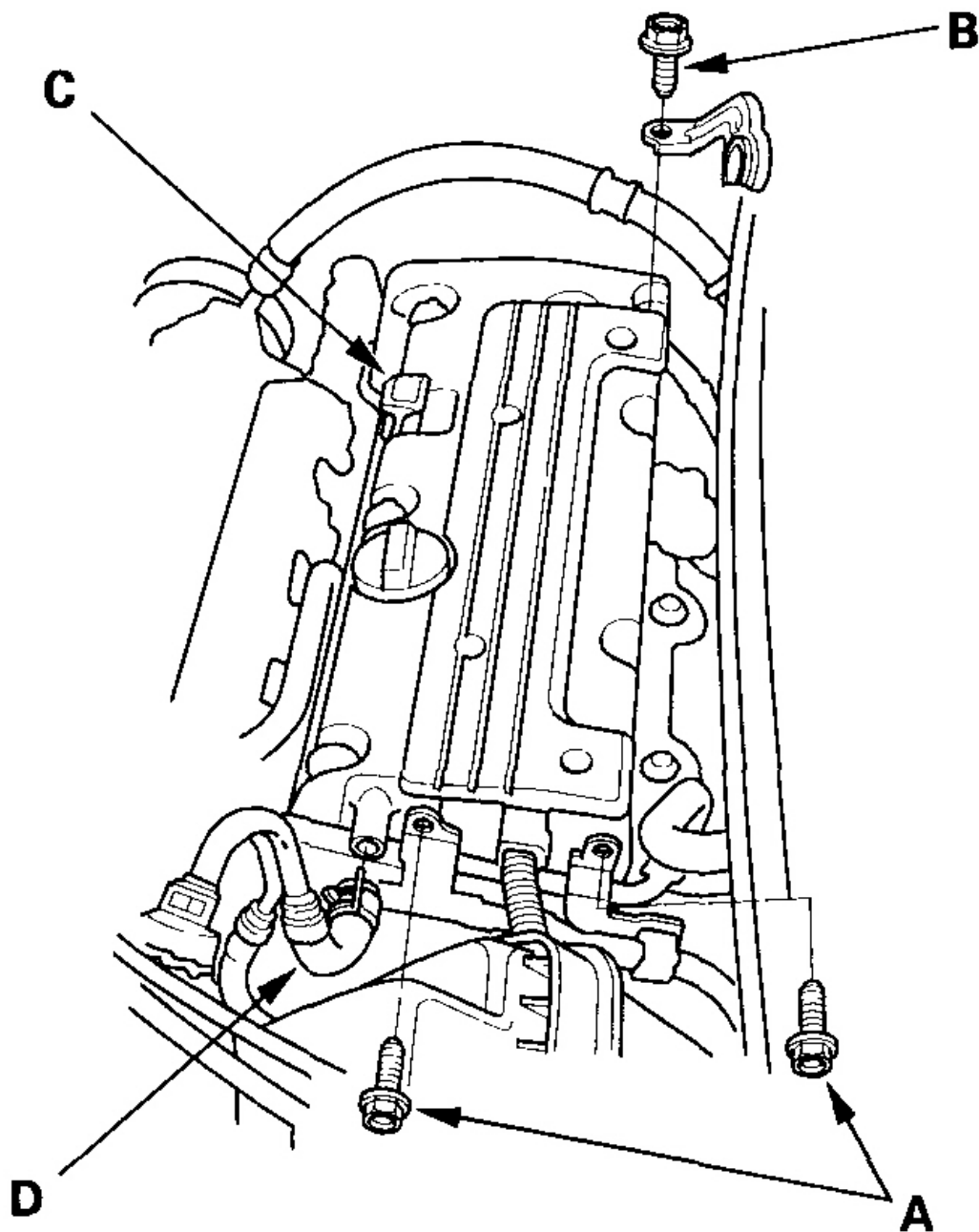


G03677178

Fig. 59: Removing Intake Manifold Cover

Courtesy of AMERICAN HONDA MOTOR CO., INC.

2. Remove the four ignition coils (see **IGNITION COIL REMOVAL/INSTALLATION**).
3. Remove the two bolts (A) securing the vacuum line.



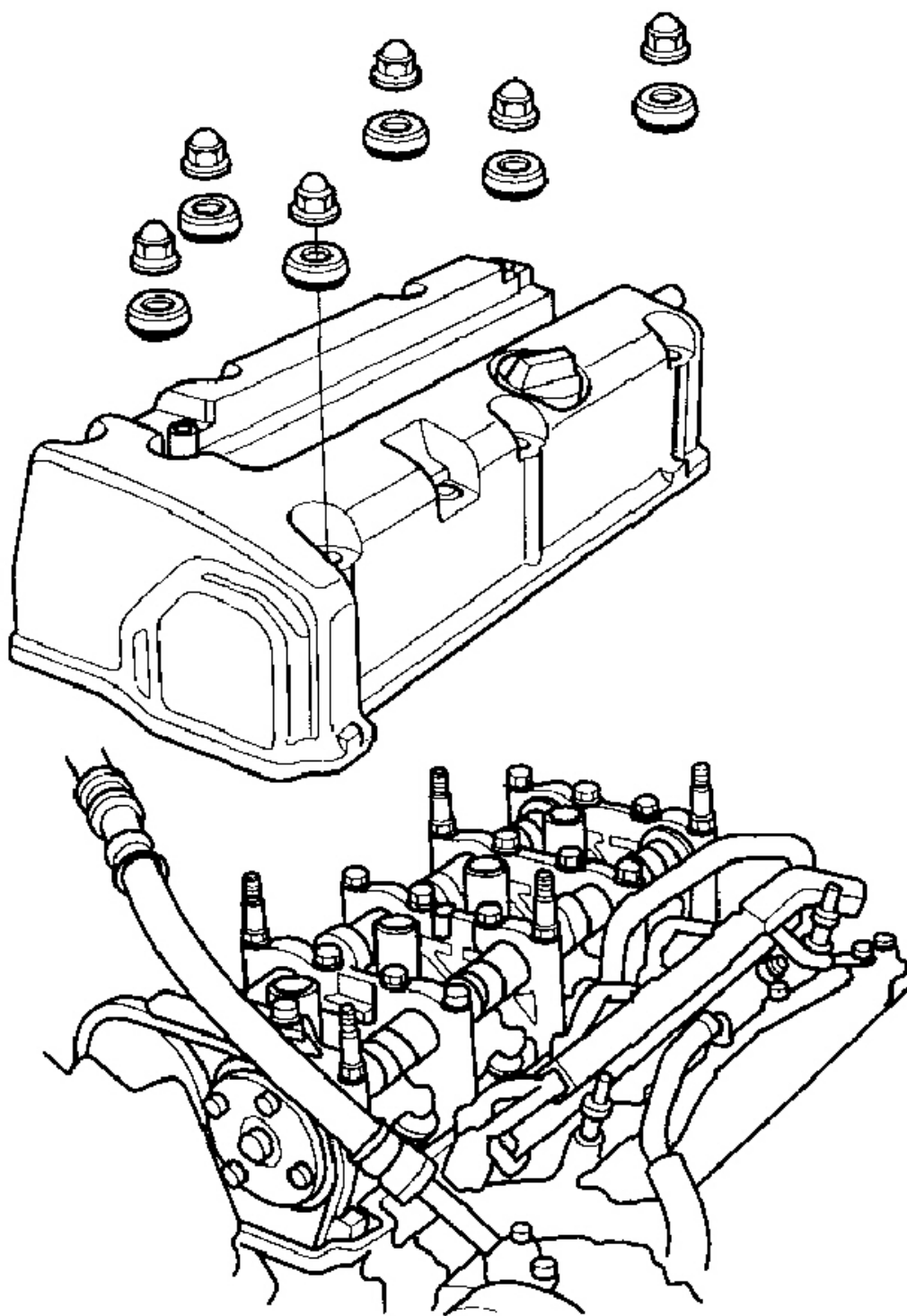
G03677179

Fig. 60: Removing Bolts Securing Vacuum Line
Courtesy of AMERICAN HONDA MOTOR CO., INC.

4. Remove the bolt (B) securing the power steering hose bracket.
5. Remove the dipstick (C) and breather hose (D).
6. Remove the cylinder head cover.

2003 Honda Element DX

2003-06 ENGINE Cylinder Head - Element



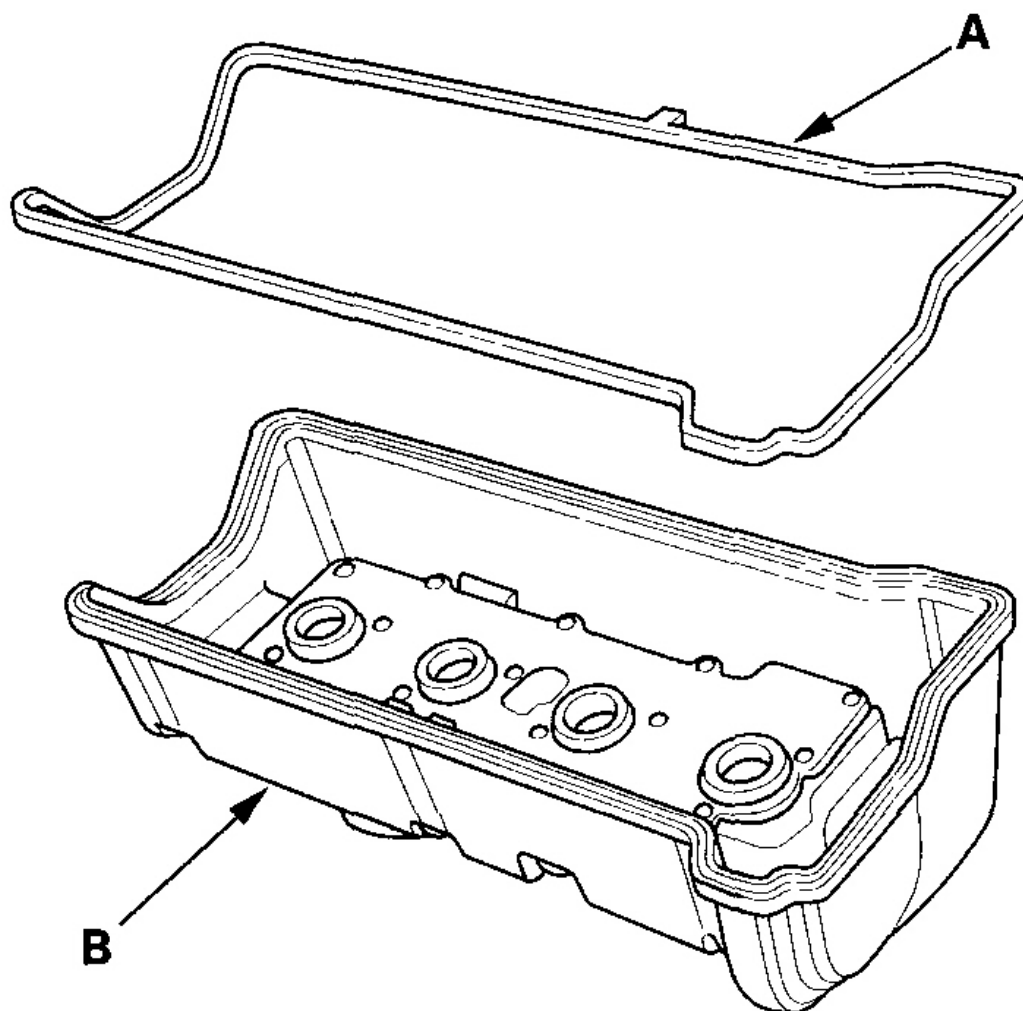
G03677180

Fig. 61: Removing Cylinder Head Cover

Courtesy of AMERICAN HONDA MOTOR CO., INC.

CYLINDER HEAD COVER INSTALLATION

1. Thoroughly clean the head cover gasket and the groove.
2. Install the head cover gasket (A) in the groove of the cylinder head cover (B).



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Fig. 62: Installing Cylinder Head Cover Gasket

Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. Check that the mating surfaces are clean and dry.
4. Apply liquid gasket, P/N 08717-0004, 08718-0001, 08718-0002, 08718-0003, or 08718-0009, on the chain case and the No. 5 rocker shaft holder mating areas.

NOTE: Do not install components if too much time has passed after applying the liquid gasket (for P/N 08718-0002, no more than 4 minutes, for all others, no more than 5 minutes). Instead, remove the old residue and reapply the liquid gasket.

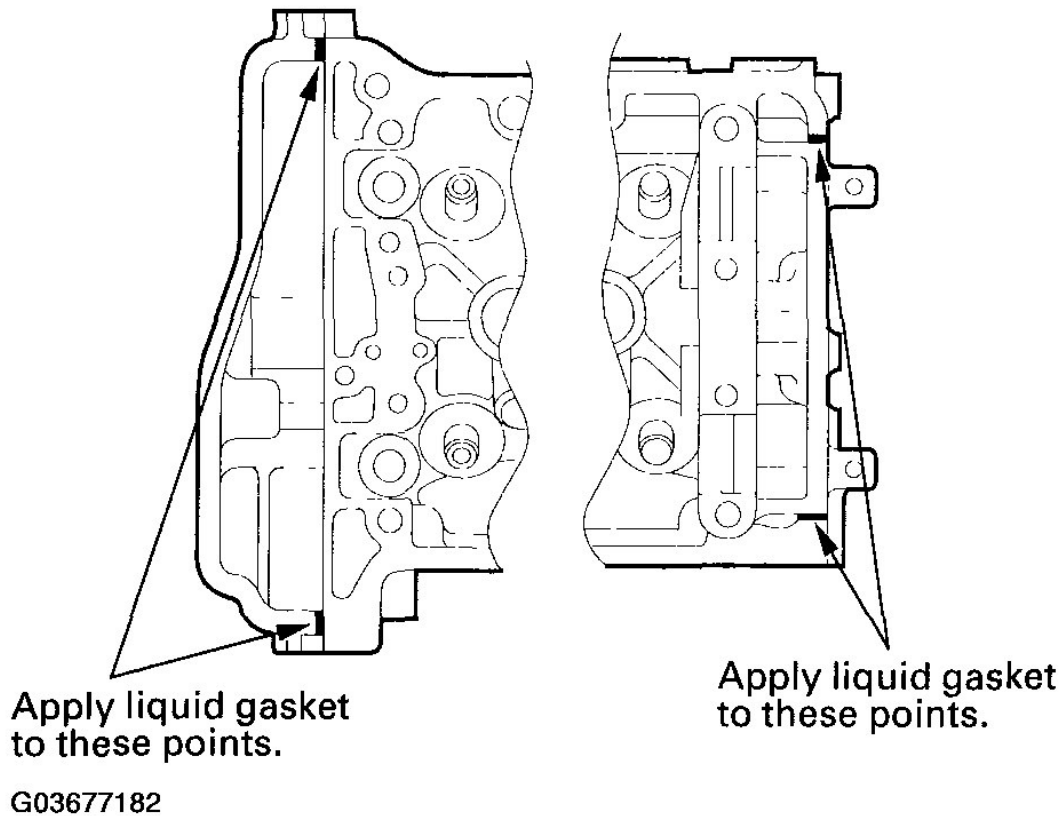
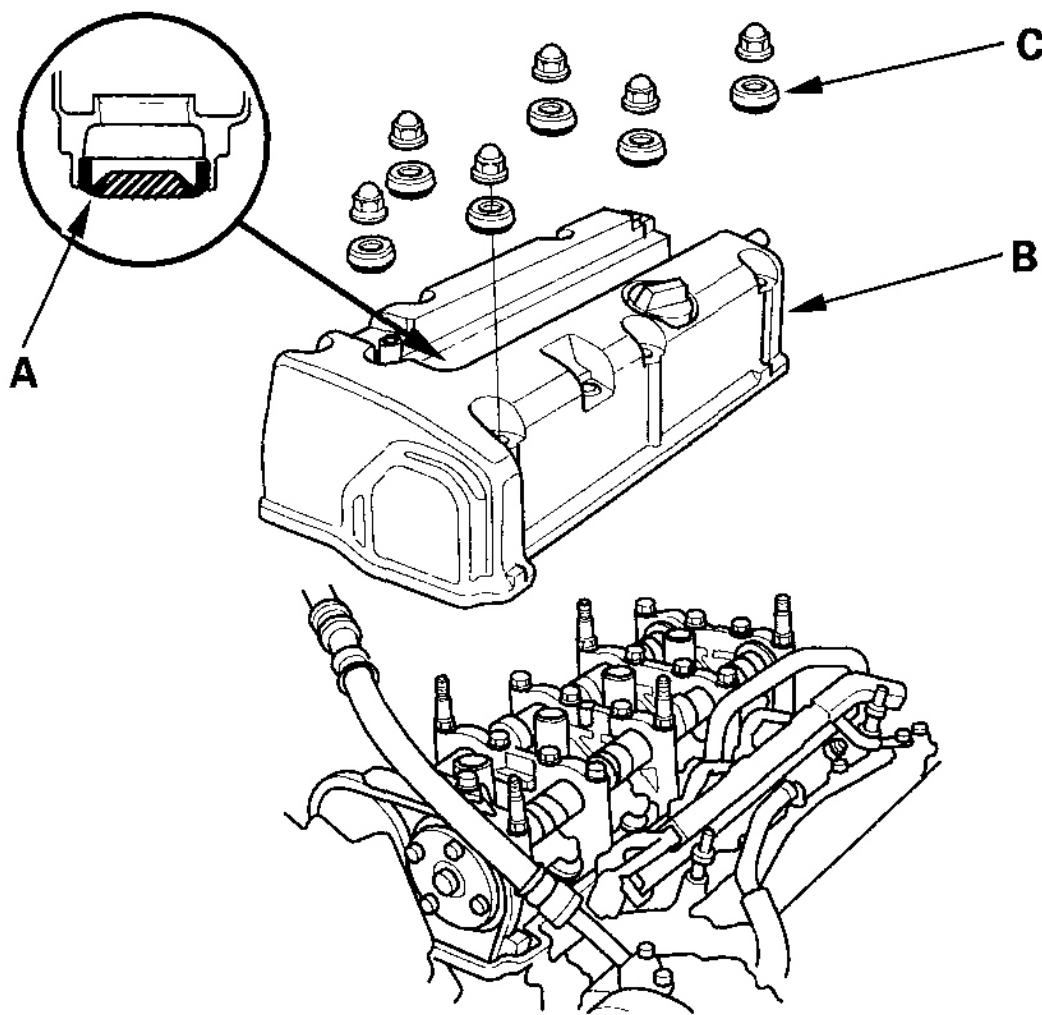


Fig. 63: Locating Sealing Gasket Applying Point
Courtesy of AMERICAN HONDA MOTOR CO., INC.

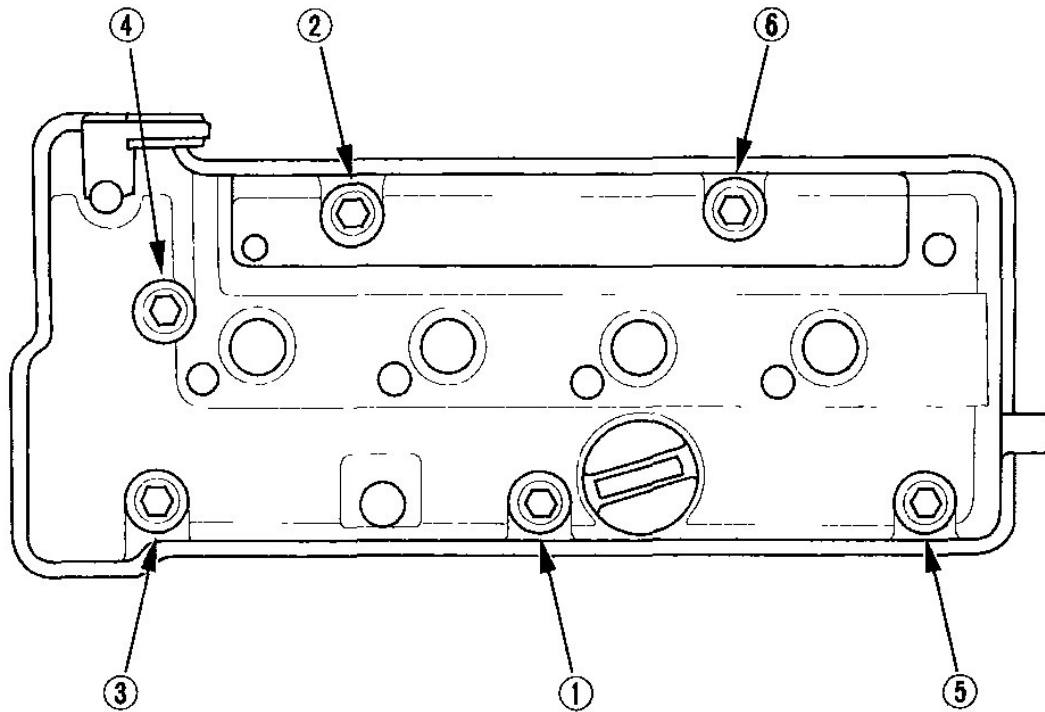
5. Set the spark plug seals (A) on the spark plug tubes. Place the cylinder head cover (B) on the cylinder head, then slide the cover slightly back and forth to seat the head cover gasket.



G03677183

Fig. 64: Placing Cylinder Head Cover On Cylinder Head
Courtesy of AMERICAN HONDA MOTOR CO., INC.

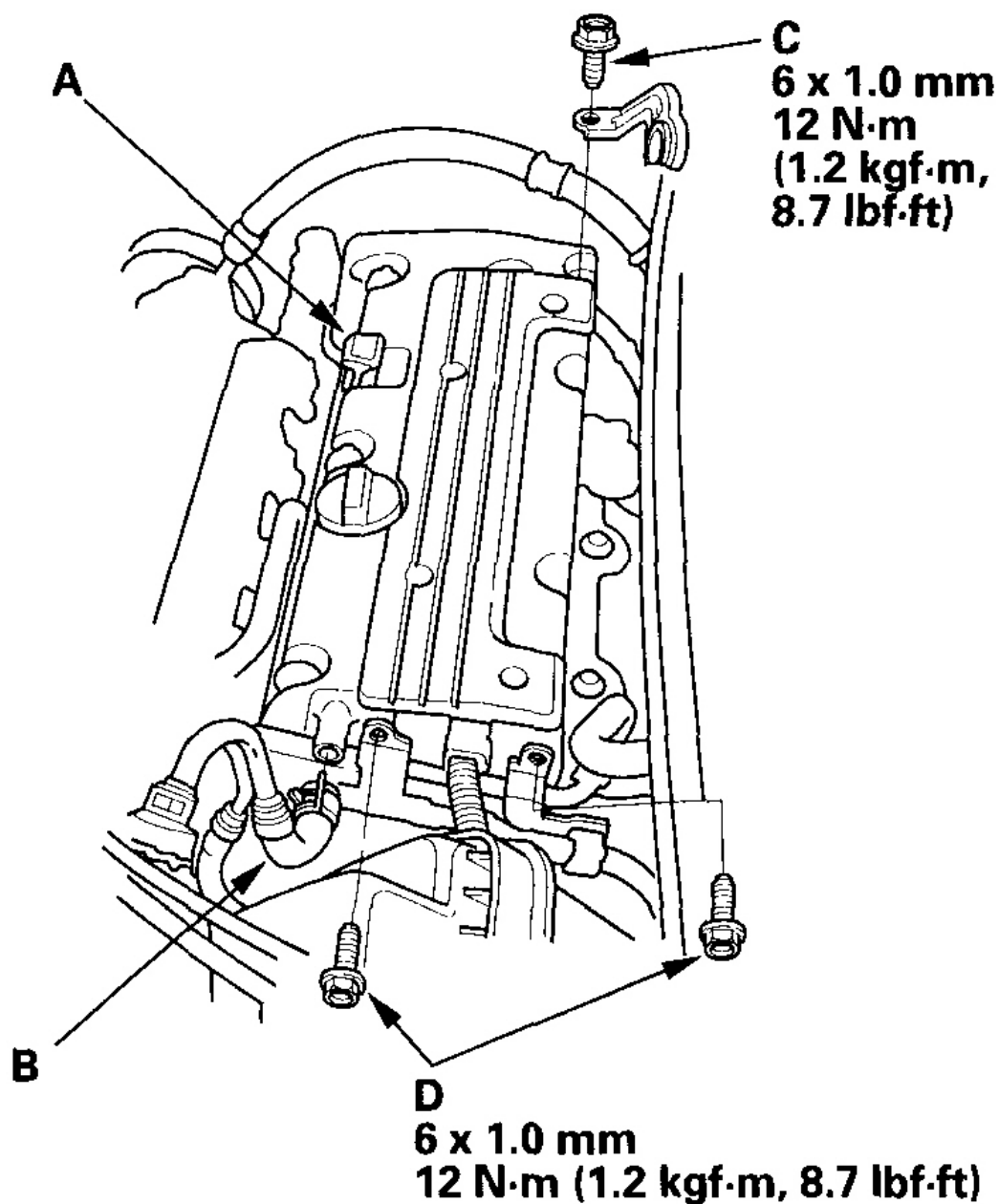
6. Inspect the cover washers (C). Replace any washer that is damaged or deteriorated.
7. Tighten the bolts in two or three steps. In the final step tighten all bolts, in sequence, to 12 N.m (1.2 kgf.m, 8.7 lbf.ft).



G03677184

Fig. 65: Tightening Cylinder Head Cover Bolts
Courtesy of AMERICAN HONDA MOTOR CO., INC.

8. Install the dipstick (A) and breather hose (B).



G03677185

Fig. 66: Installing Dipstick And Breather Hose
Courtesy of AMERICAN HONDA MOTOR CO., INC.

9. Tighten the bolt (C) securing the power steering hose bracket.
10. Tighten the two bolts (D) securing the vacuum line.

11. Install the four ignition coils (see **IGNITION COIL REMOVAL/INSTALLATION**).
12. Check that all tubes, hoses, and connectors are installed correctly.
13. Install the intake manifold cover.

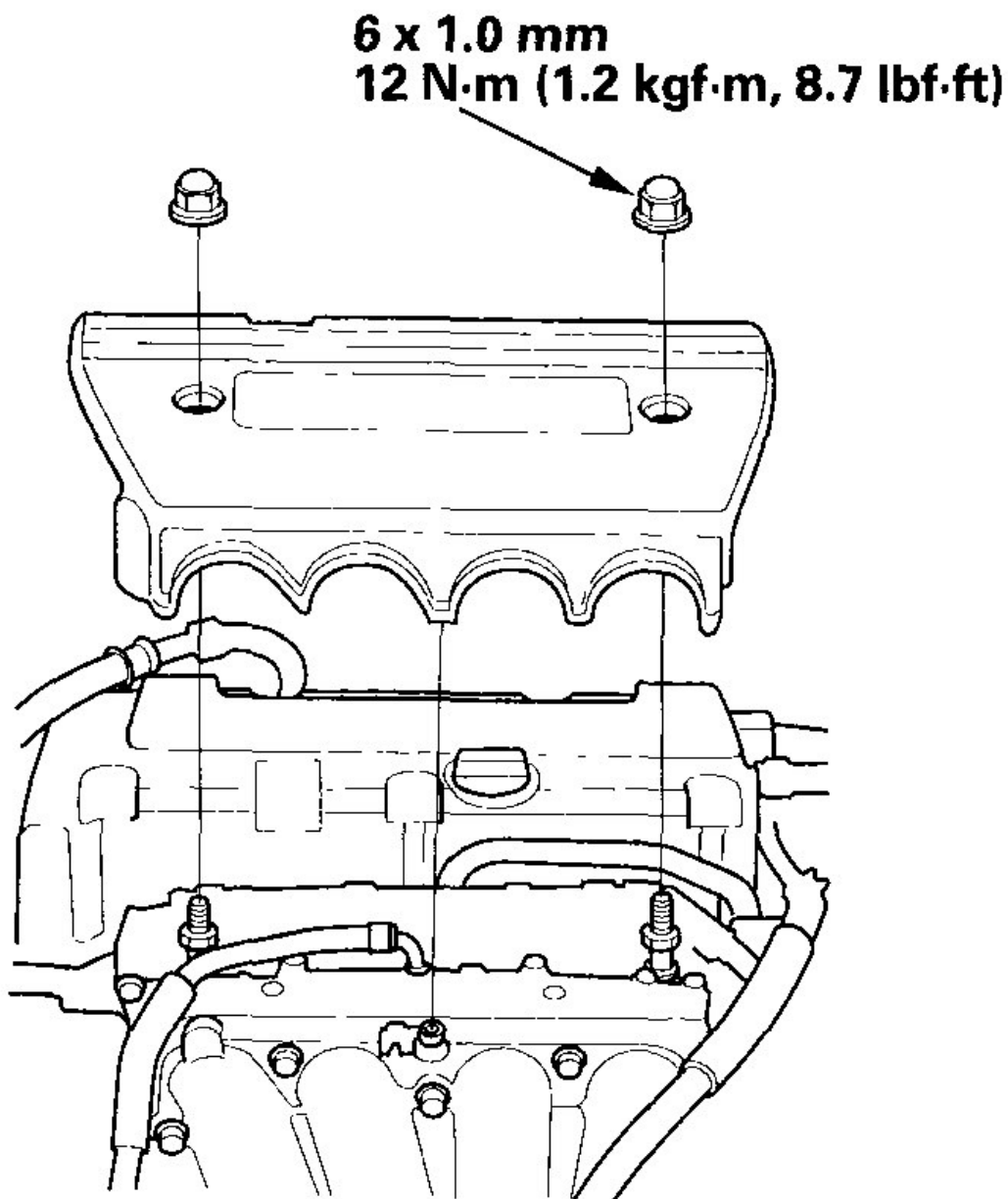
**G03677186**

Fig. 67: Installing Intake Manifold Cover And Torque Specifications
Courtesy of AMERICAN HONDA MOTOR CO., INC.

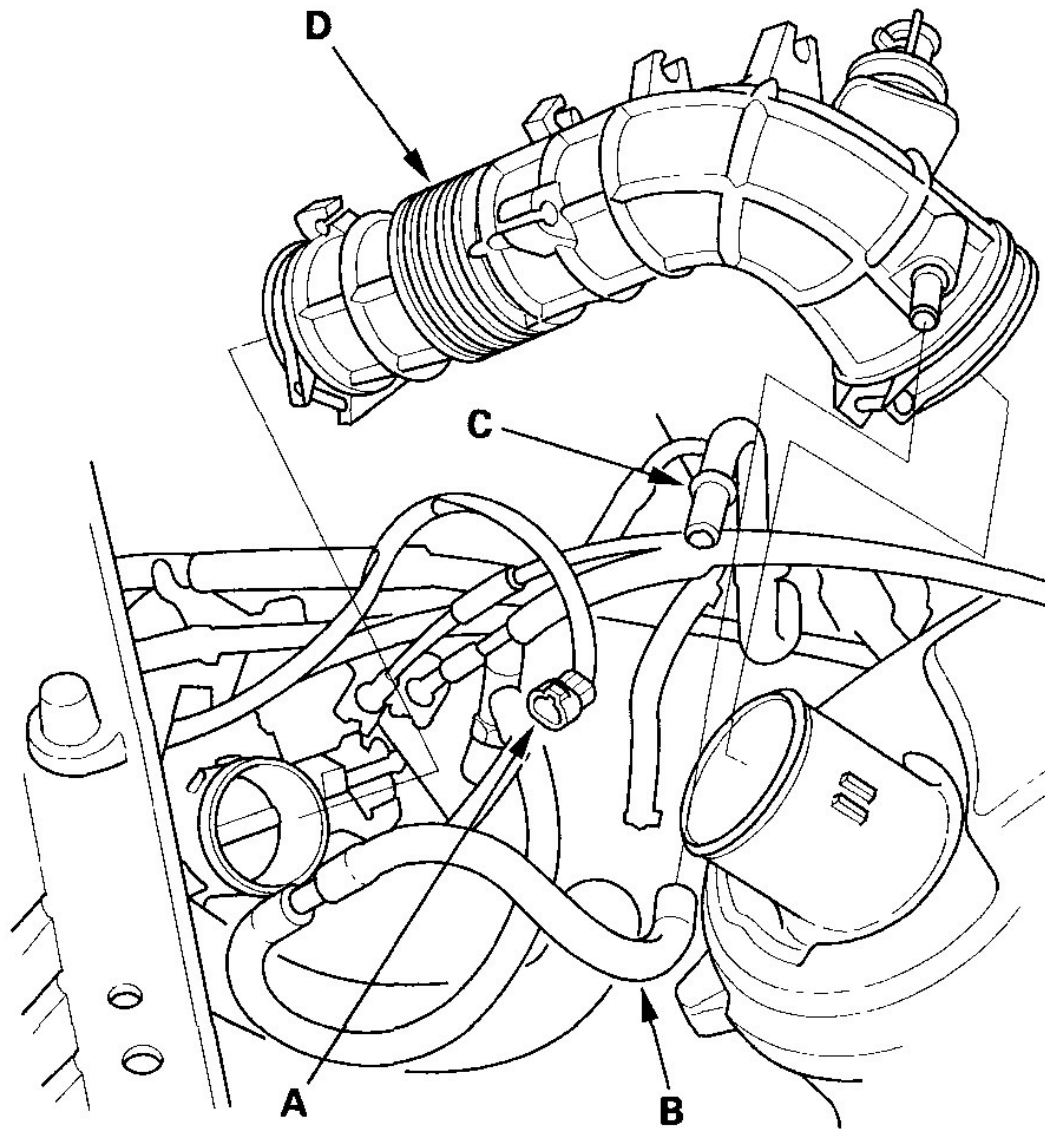
14. After assembly, wait at least 30 minutes before filling the engine with oil.

CYLINDER HEAD REMOVAL

NOTE:

- Use fender covers to avoid damaging the painted surfaces.
- To avoid damaging the wires and terminals, unplug the wiring connectors carefully while holding the connector portion.
- To avoid damaging the cylinder head, wait until the engine coolant temperature drops below 100°F (38°C) before loosening the cylinder head bolts.
- Mark all wiring and hoses to avoid misconnection. Also, be sure that they do not contact other wiring or hoses, or interfere with other parts.

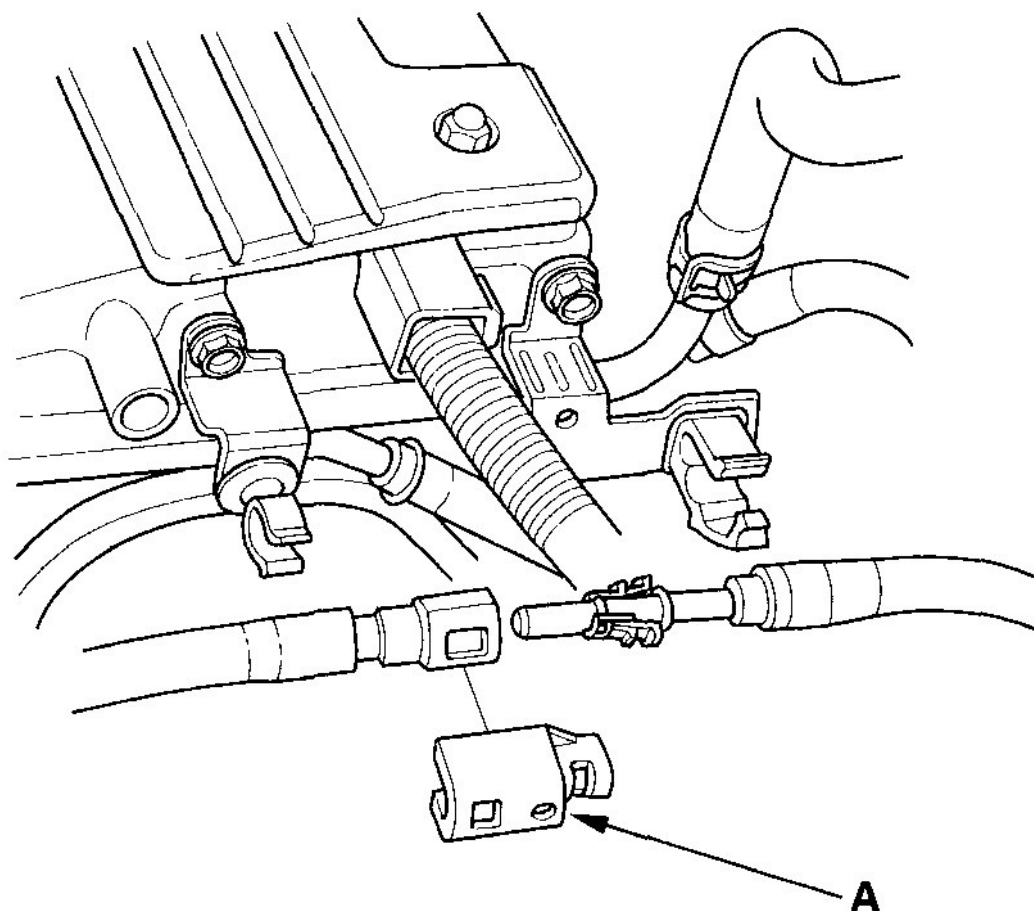
1. Relieve fuel pressure (see **FUEL PRESSURE RELIEVING**).
2. Drain the engine coolant (see **COOLANT CHECK**).
3. Remove the drive belt (see **DRIVE BELT REPLACEMENT**).
4. Disconnect the intake air temperature (IAT) sensor connector (A).



G03677187

Fig. 68: Disconnecting Intake Air Temperature Sensor Connector
Courtesy of AMERICAN HONDA MOTOR CO., INC.

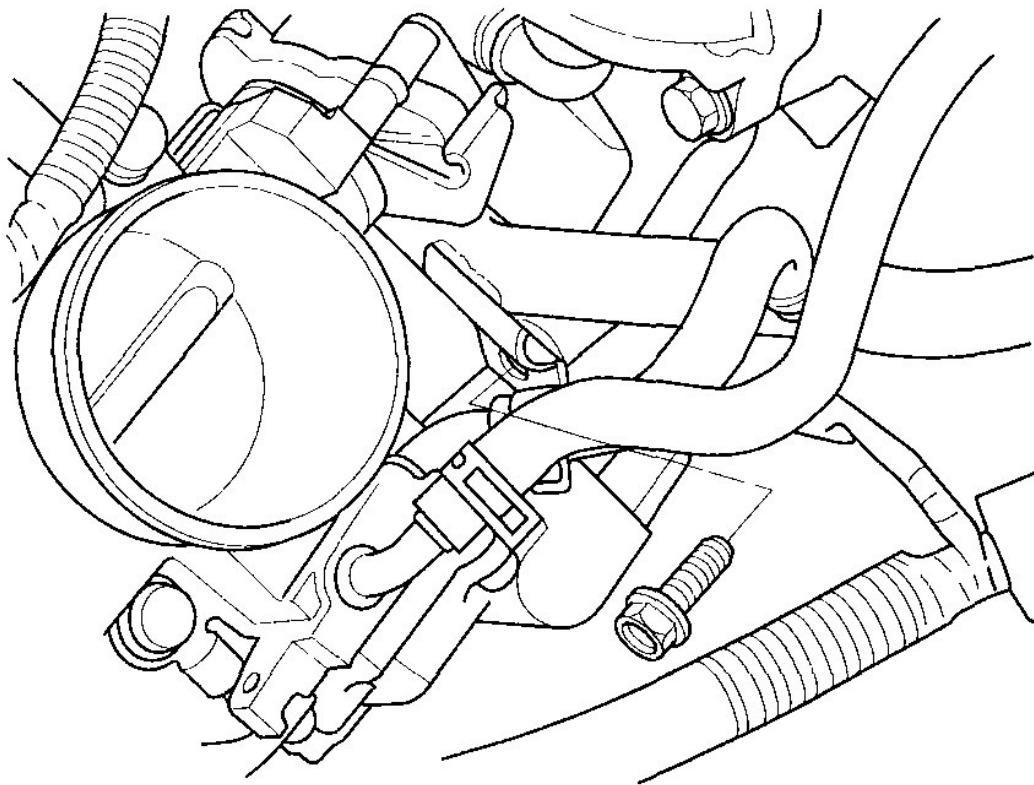
5. Remove the vacuum hose (B) and breather pipe (C), then remove the air intake duct (D).
6. Remove the quick-connect fitting cover (A), then disconnect the fuel feed hose (see **FUEL LINE/QUICK-CONNECT FITTING REMOVAL**).



G03677188

Fig. 69: Removing Quick-Connect Fitting Cover
Courtesy of AMERICAN HONDA MOTOR CO., INC.

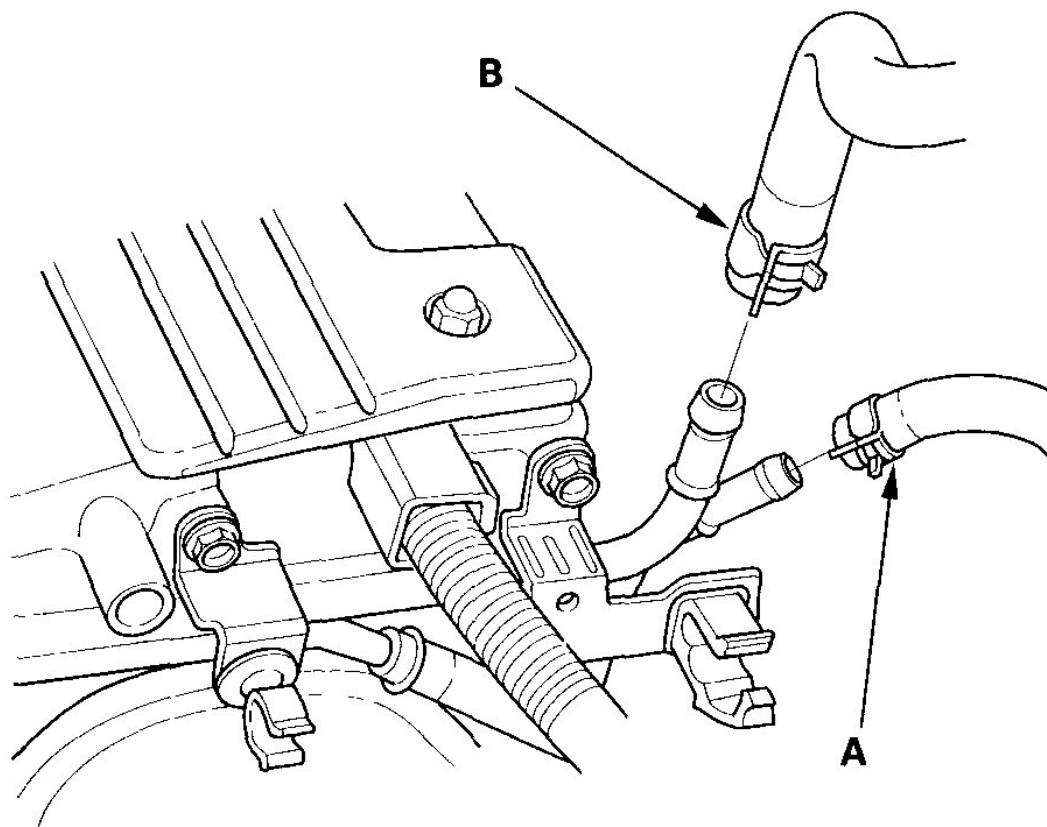
7. Remove the bolt securing the connecting pipe support bracket to the engine block.



G03677189

Fig. 70: Removing Bolt Securing Connecting Pipe Support Bracket To Engine Block
Courtesy of AMERICAN HONDA MOTOR CO., INC.

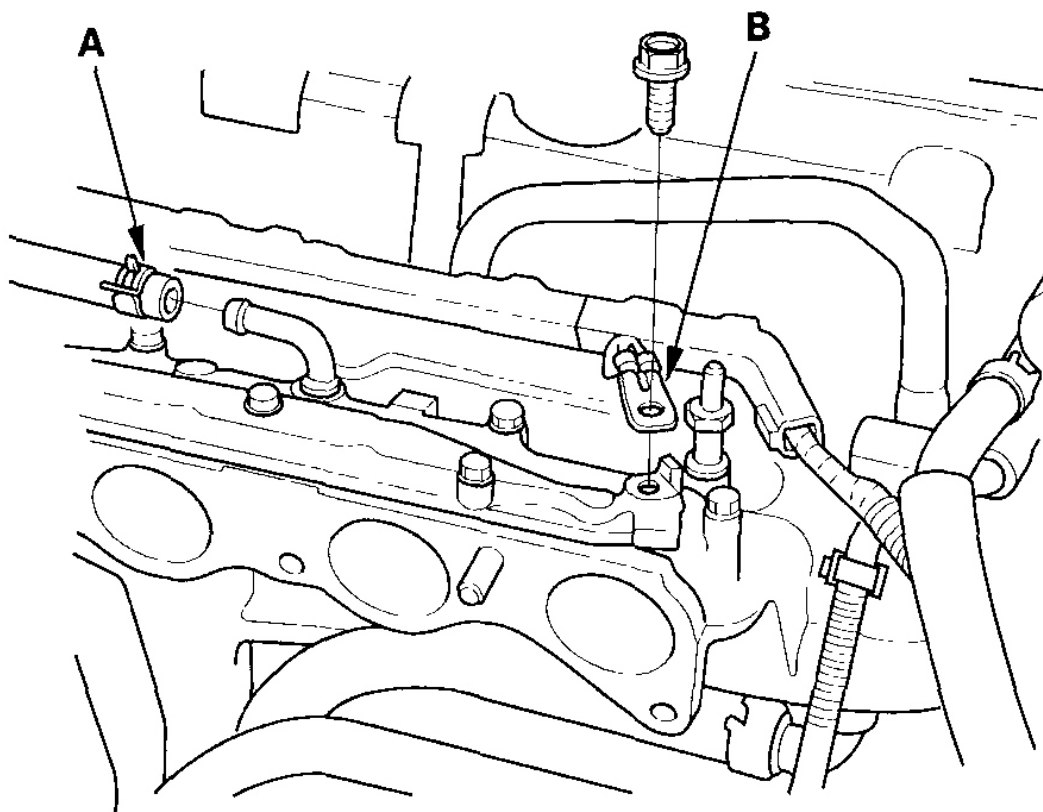
8. Remove the evaporative emission (EVAP) canister hose (A) and brake booster vacuum hose (B).



G03677190

Fig. 71: Removing Evaporative Emission Canister Hose And Brake Booster Vacuum Hose
Courtesy of AMERICAN HONDA MOTOR CO., INC.

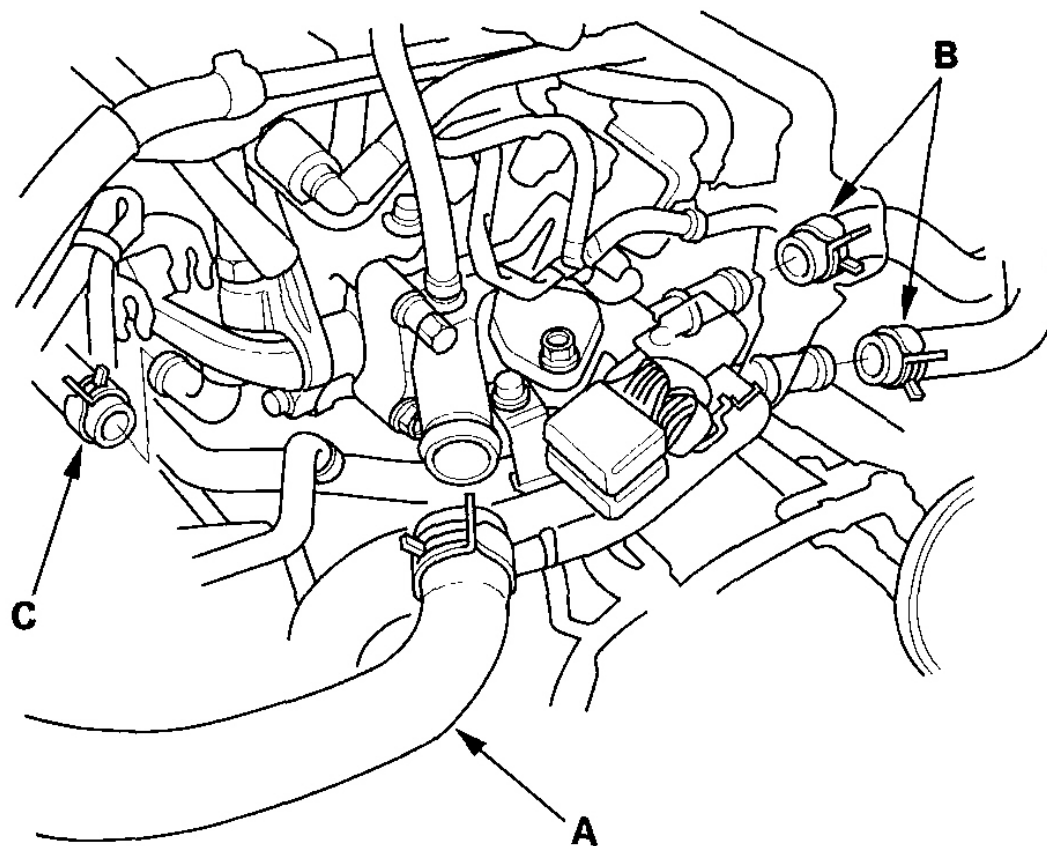
9. Remove the intake manifold (see **REMOVAL**).
10. Remove the exhaust manifold (see **EXHAUST MANIFOLD REMOVAL AND INSTALLATION**).
11. Remove the positive crankcase ventilation (PCV) hose (A) and ground cable (B).



G03677191

Fig. 72: Removing Positive Crankcase Ventilation Hose And Ground Cable
Courtesy of AMERICAN HONDA MOTOR CO., INC.

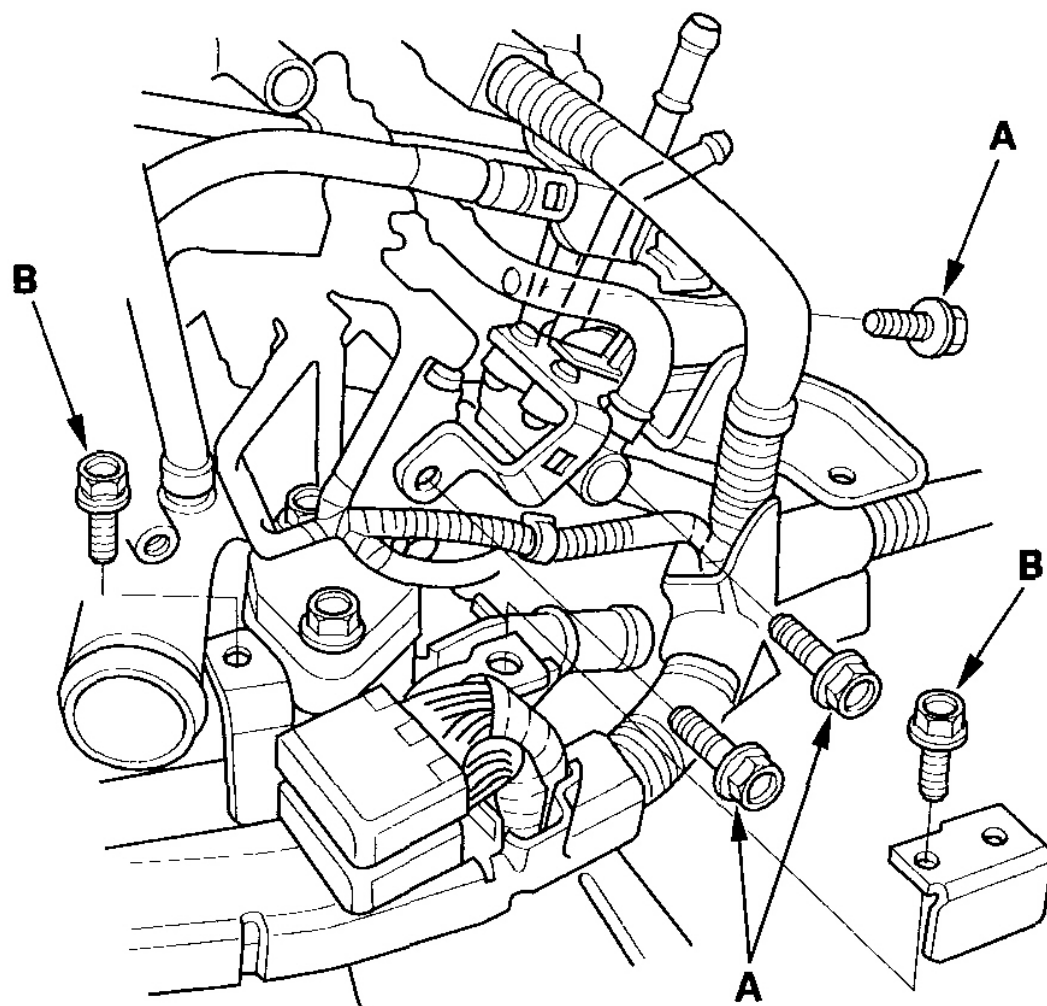
12. Remove the upper radiator hose (A), heater hoses (B), and water bypass hose (C).



G03677192

Fig. 73: Removing Upper Radiator Hose, Heater Hoses And Water Bypass Hose
Courtesy of AMERICAN HONDA MOTOR CO., INC.

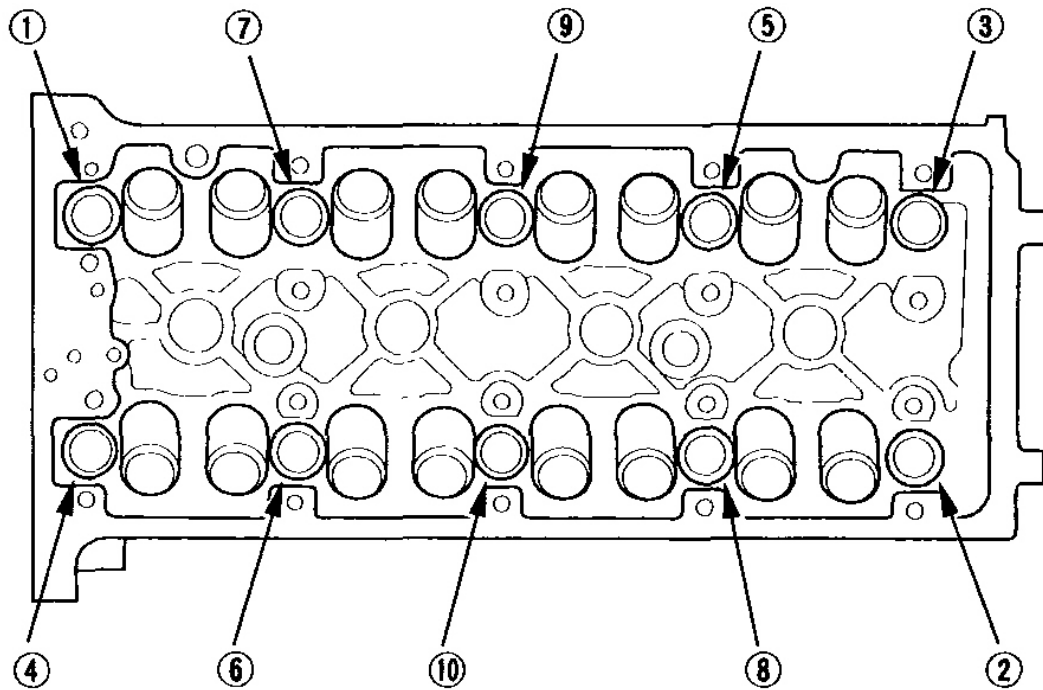
13. Remove the engine wire harness connectors and wire harness clamps from the cylinder head.
 - Four injector connectors
 - Engine coolant temperature (ECT) sensor connector
 - Camshaft position (CMP) sensor A connector (Intake side)
 - Camshaft position (CMP) sensor B connector (Exhaust side)
 - Rocker arm oil control solenoid (VTEC solenoid valve) connector
 - Rocker arm oil pressure switch (VTEC oil pressure switch) connector
14. Remove the three bolts (A) securing the EVAP canister purge valve bracket and remove the two bolts (B) securing the harness bracket.



G03677193

Fig. 74: Removing Bolts Securing EVAP Canister Purge Valve Bracket
Courtesy of AMERICAN HONDA MOTOR CO., INC.

15. Remove the cam chain (see **INSTALLATION**).
16. Remove the rocker arm assembly (see **ROCKER ARM ASSEMBLY REMOVAL**).
17. Remove the cylinder head bolts. To prevent warpage, unscrew the bolts in sequence 1/3 turn at a time; repeat the sequence until all bolts are loosened.



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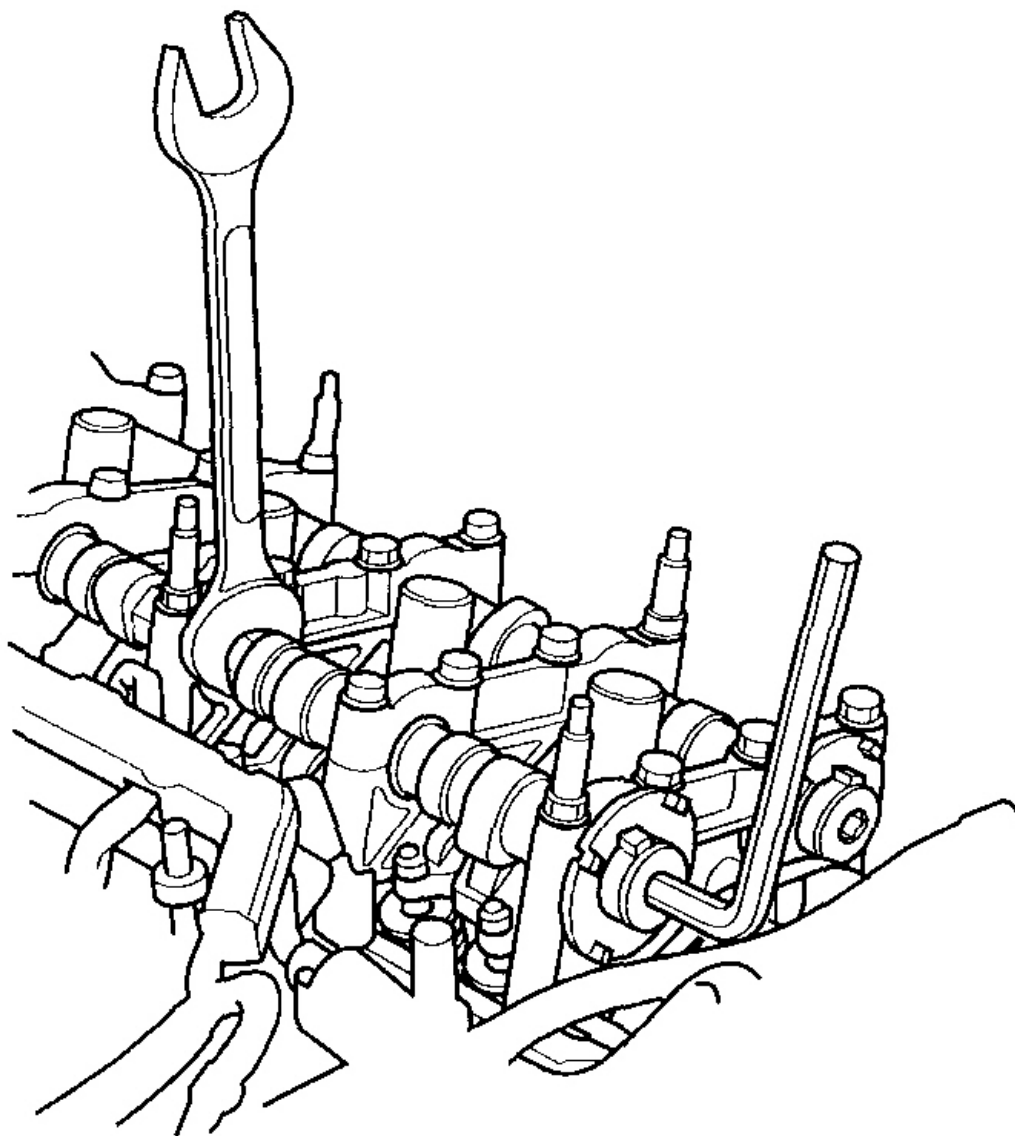
Fig. 75: Removing Cylinder Head Bolts

Courtesy of AMERICAN HONDA MOTOR CO., INC.

18. Remove the cylinder head.

CMP PULSE PLATE A REPLACEMENT

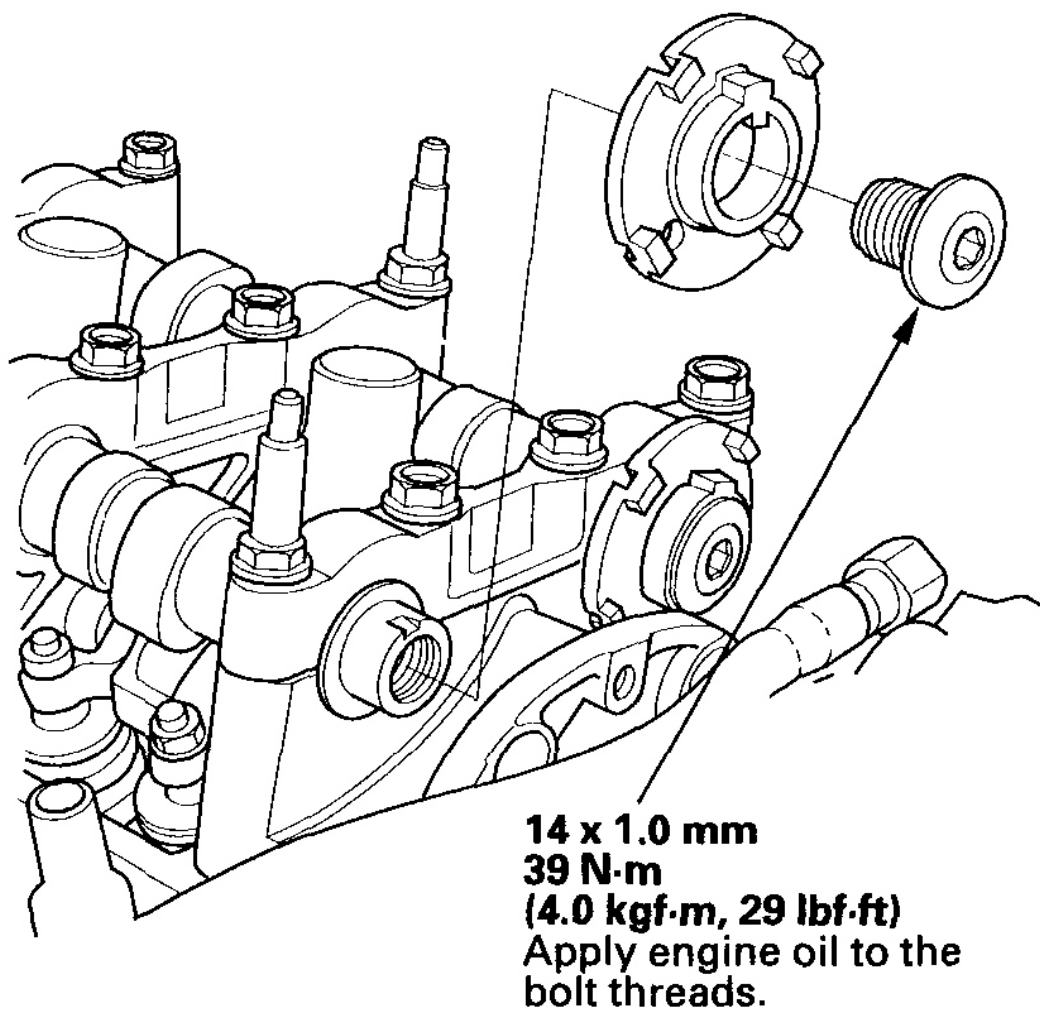
1. Remove the cylinder head cover (see CYLINDER HEAD COVER REMOVAL).
2. Hold the intake camshaft with an open-end wrench, then loosen the bolt.



G03677195

Fig. 76: Holding Intake Camshaft With Open-End Wrench
Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. Remove the camshaft position (CMP) pulse plate A.



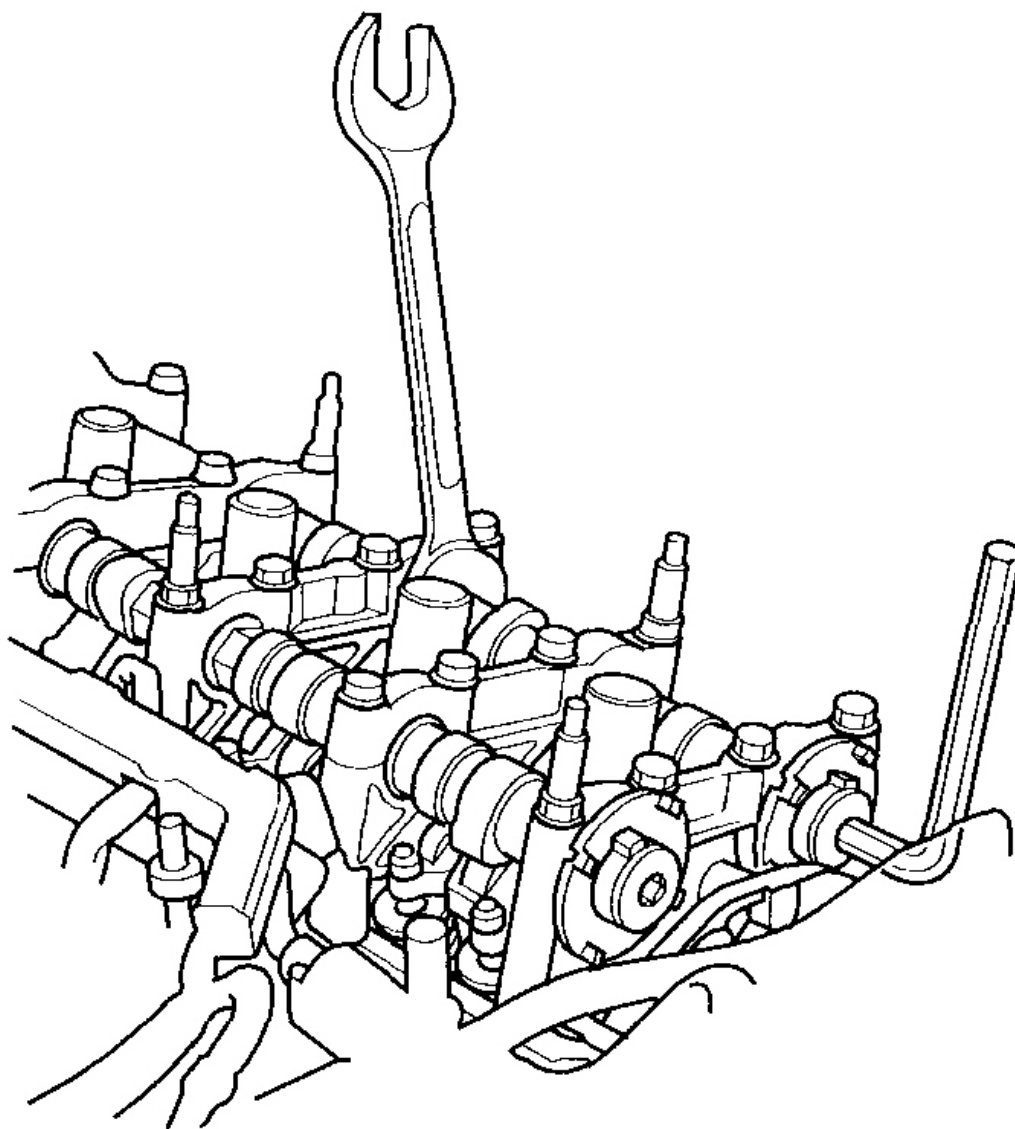
G03677196

Fig. 77: Removing Camshaft Position Pulse Plate A And Torque Specifications
Courtesy of AMERICAN HONDA MOTOR CO., INC.

4. Install the CMP pulse plate A in the reverse order of removal.

CMP PULSE PLATE B REPLACEMENT

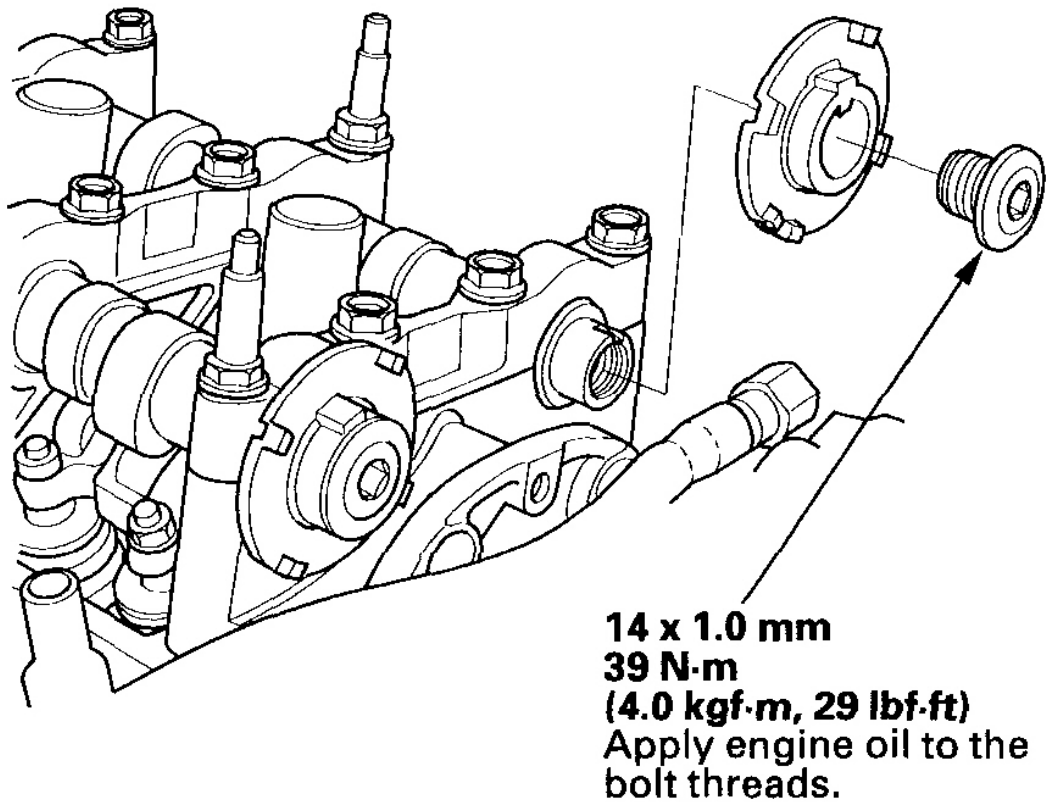
1. Remove the cylinder head cover (see CYLINDER HEAD COVER REMOVAL).
2. Hold the exhaust camshaft with an open-end wrench, then loosen the bolt.



G03677197

Fig. 78: Holding Exhaust Camshaft With Open-End Wrench To Loosen Bolt
Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. Remove the camshaft position (CMP) pulse plate B.



G03677198

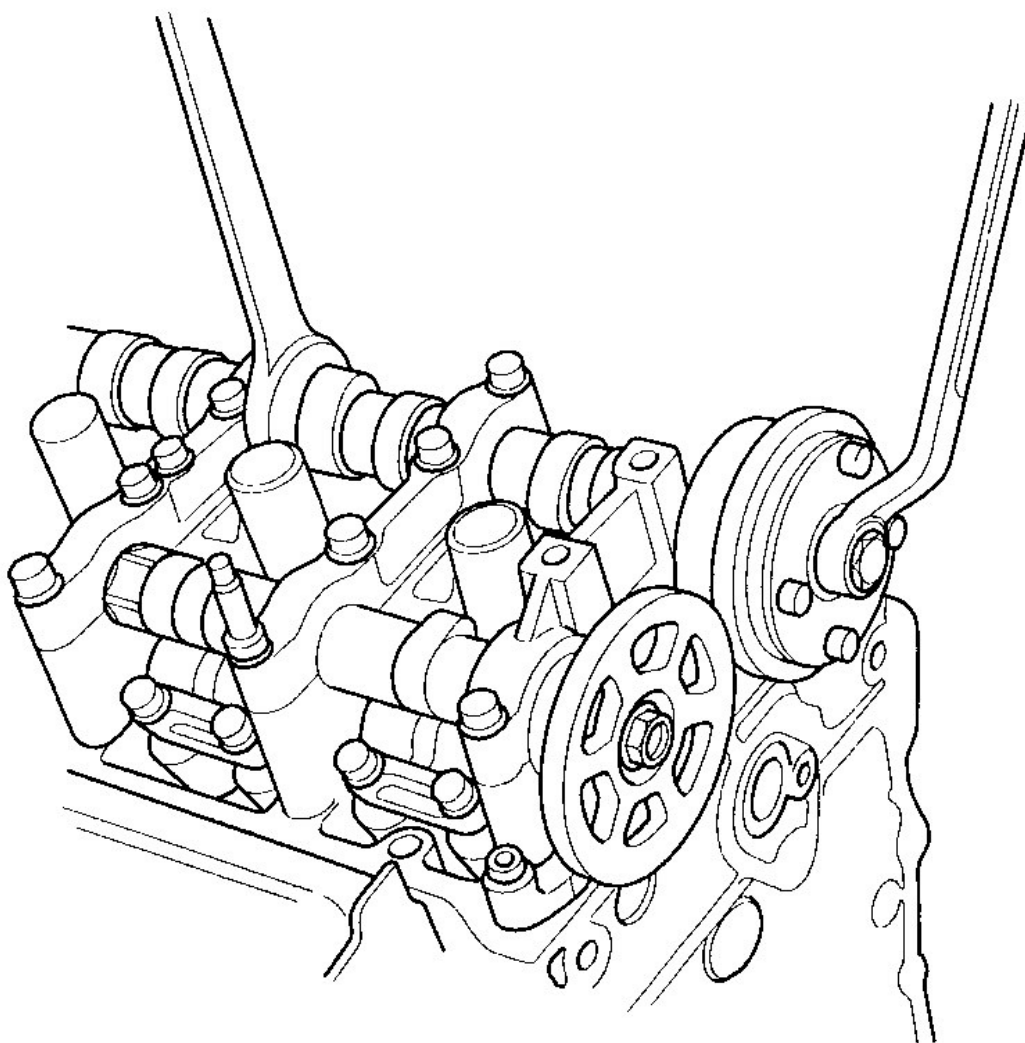
Fig. 79: Removing Camshaft Position Pulse Plate B And Torque Specifications
Courtesy of AMERICAN HONDA MOTOR CO., INC.

4. Install the CMP pulse plate B in the reverse order of removal.

VTC ACTUATOR, EXHAUST CAMSHAFT SPROCKET REMOVAL AND INSTALLATION

REMOVAL

1. Remove the cam chain (see **INSTALLATION**).
2. Hold the camshaft with an open-end wrench, then loosen the variable valve timing control (VTC) actuator mounting bolt and exhaust camshaft sprocket mounting bolt.



G03677199

Fig. 80: Loosening Variable Valve Timing Control Actuator And Exhaust Camshaft Sprocket Mounting Bolt

Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. If the VTC actuator will be reused, do the following steps.
 - 1 Remove the intake camshaft, and seal the advance holes and retard holes in the No. 1 camshaft journal with tape (see step 6).
 - 2 Punch a hole in the tape over one of the advance holes (see step 7).
 - 3 Apply air to the advance hole to release the lock (see step 8).
 - 4 Remove the tape from the No. 1 camshaft journal.

4. Remove the VTC actuator and exhaust camshaft sprocket.

INSTALLATION

1. Install the VTC actuator and exhaust camshaft sprocket.

NOTE: **Install the VTC actuator in the unlocked position.**

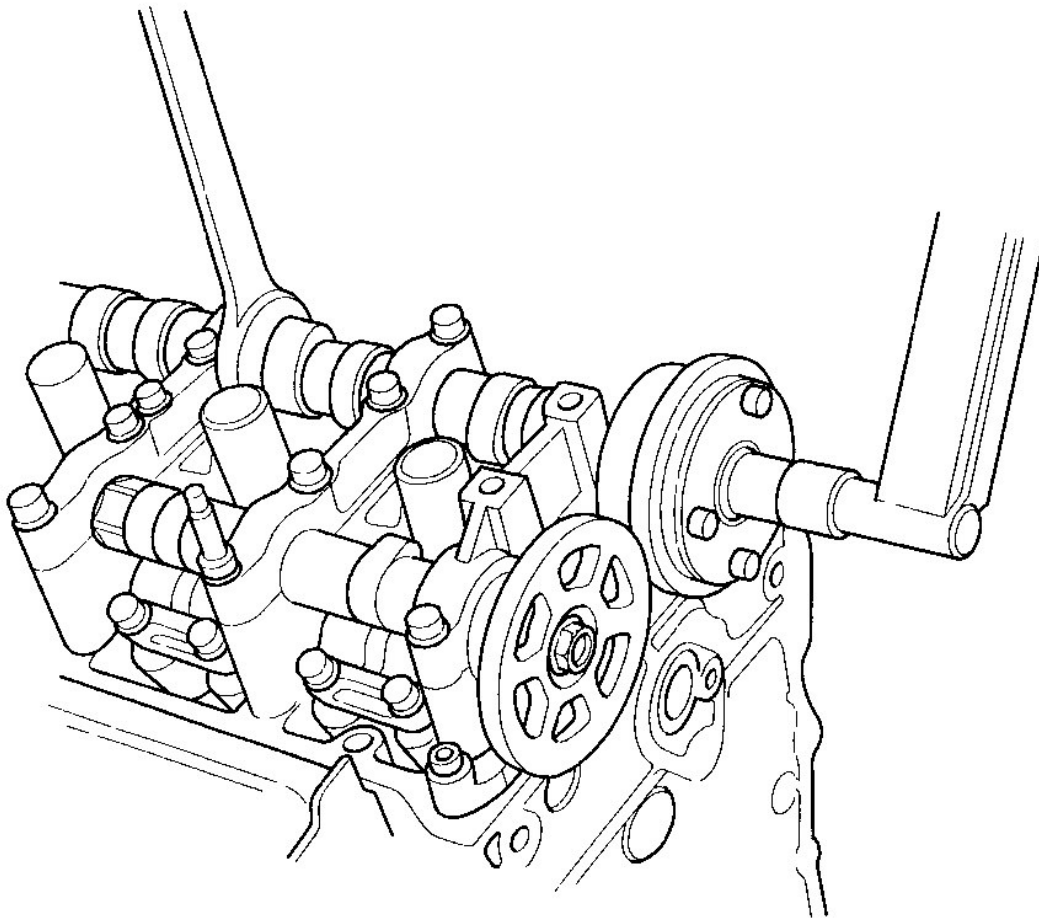
2. Apply engine oil to the threads of the VTC actuator mounting bolt and exhaust camshaft sprocket mounting bolt, then install them.
3. Hold the camshaft with an open-end wrench, then tighten the bolts.

Specified Torque**VTC Actuator Mounting Bolt:**

113 N.m (11.5 kgf.m, 83 lbf.ft)

Exhaust Camshaft Sprocket Mounting Bolt:

72 N.m (7.3 kgf.m, 53 lbf.ft)



G03677200

Fig. 81: Installing VTC Actuator And Exhaust Camshaft Sprocket
Courtesy of AMERICAN HONDA MOTOR CO., INC.

4. Hold the camshaft, and turn the VTC actuator clockwise until you hear it clicks. Make sure to lock the VTC actuator by turning it.
5. Install the cam chain (see **CAM CHAIN INSTALLATION**).

CYLINDER HEAD INSPECTION FOR WARPAGE

1. Remove the cylinder head (see **CYLINDER HEAD REMOVAL**).
2. Inspect the camshaft (see **CAMSHAFT INSPECTION**).
3. Check the cylinder head for warpage. Measure along the edges, and three ways across the center.
 - If warpage is less than 0.05 mm (0.002 in.), cylinder head resurfacing is not required.
 - If warpage is between 0.05 mm (0.002 in.) and 0.2 mm (0.008 in.), resurface the cylinder head.

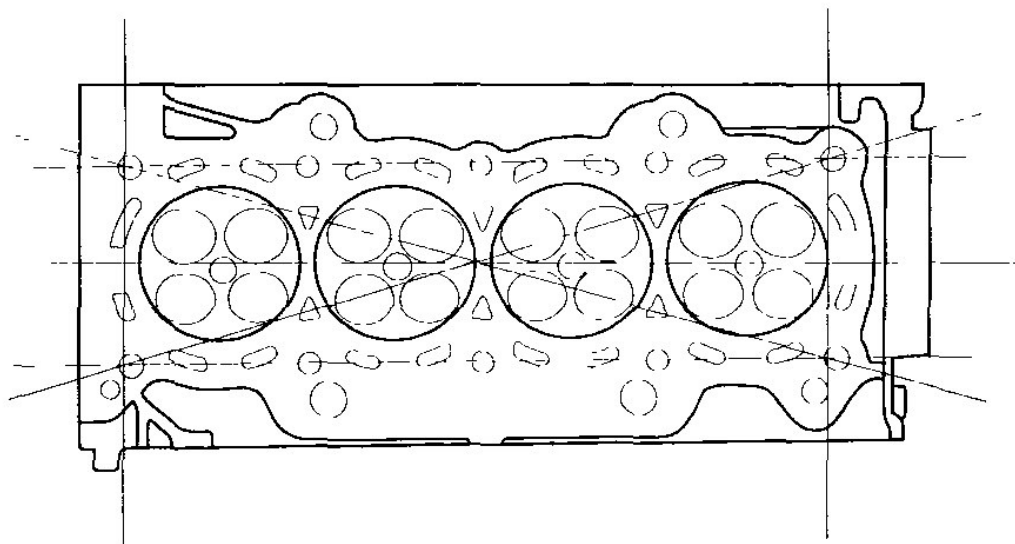
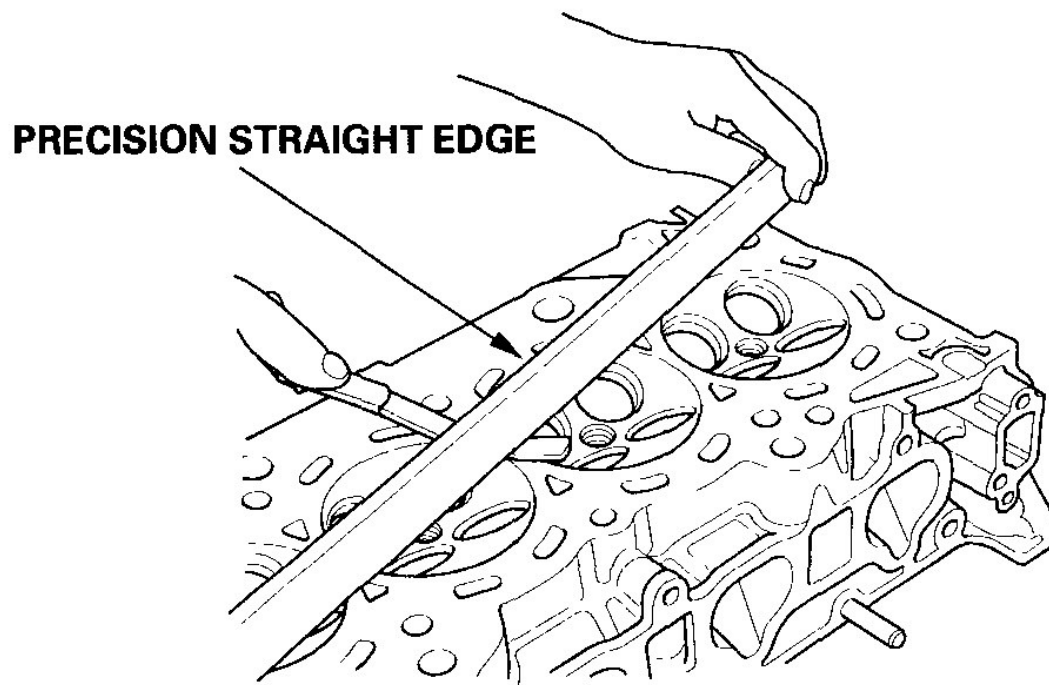
2003 Honda Element DX

2003-06 ENGINE Cylinder Head - Element

- Maximum resurface limit is 0.2 mm (0.008 in.) based on a height of 104 mm (4.09 in.).

Cylinder Head Height

Standard (New): 103.95-104.05 mm (4.093-4.096 in.)

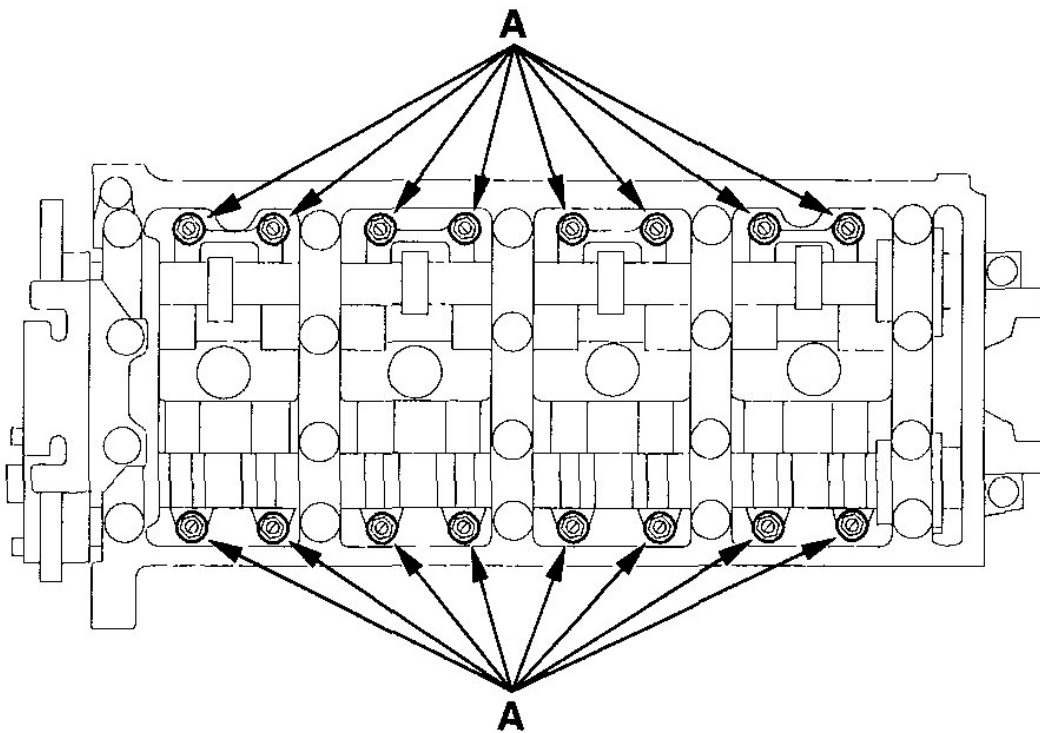


G03677201

Fig. 82: Measuring Cylinder Head Warpage
Courtesy of AMERICAN HONDA MOTOR CO., INC.

ROCKER ARM ASSEMBLY REMOVAL

1. Remove the cam chain (see **INSTALLATION**).
2. Loosen the rocker arm adjusting screws (A).

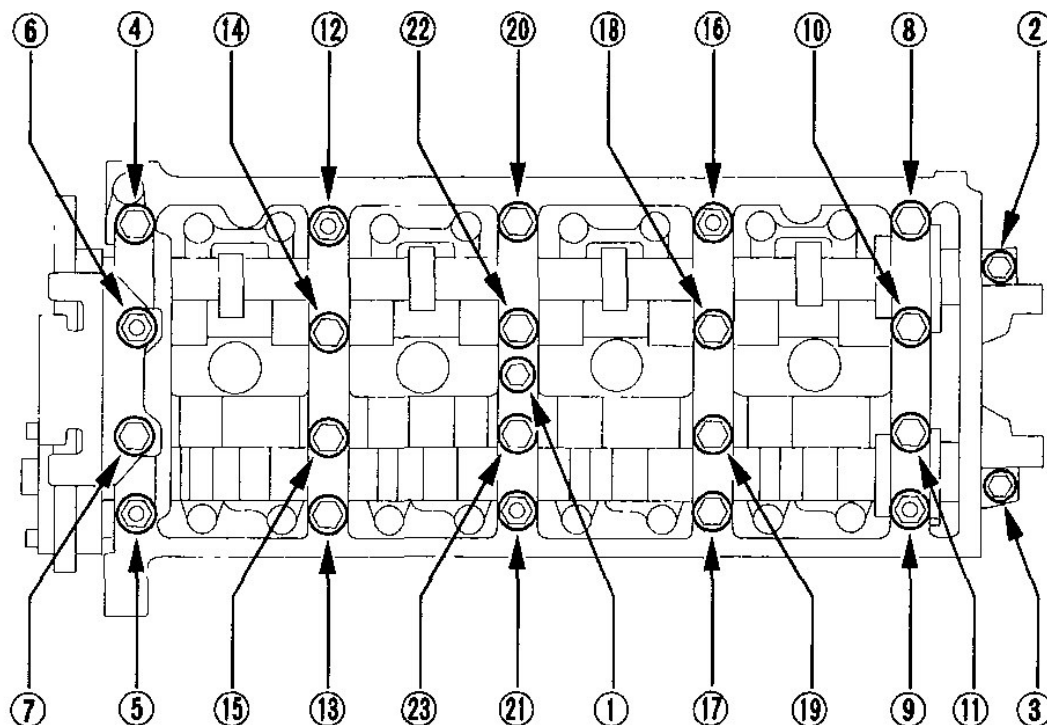


G03677202

Fig. 83: Loosening Rocker Arm Adjusting Screws
Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. Remove the camshaft holder bolts. To prevent damaging the camshafts, unscrew the bolts two turns at a time, in a crisscross pattern.

NOTE: Bolt ① is not on all engines.

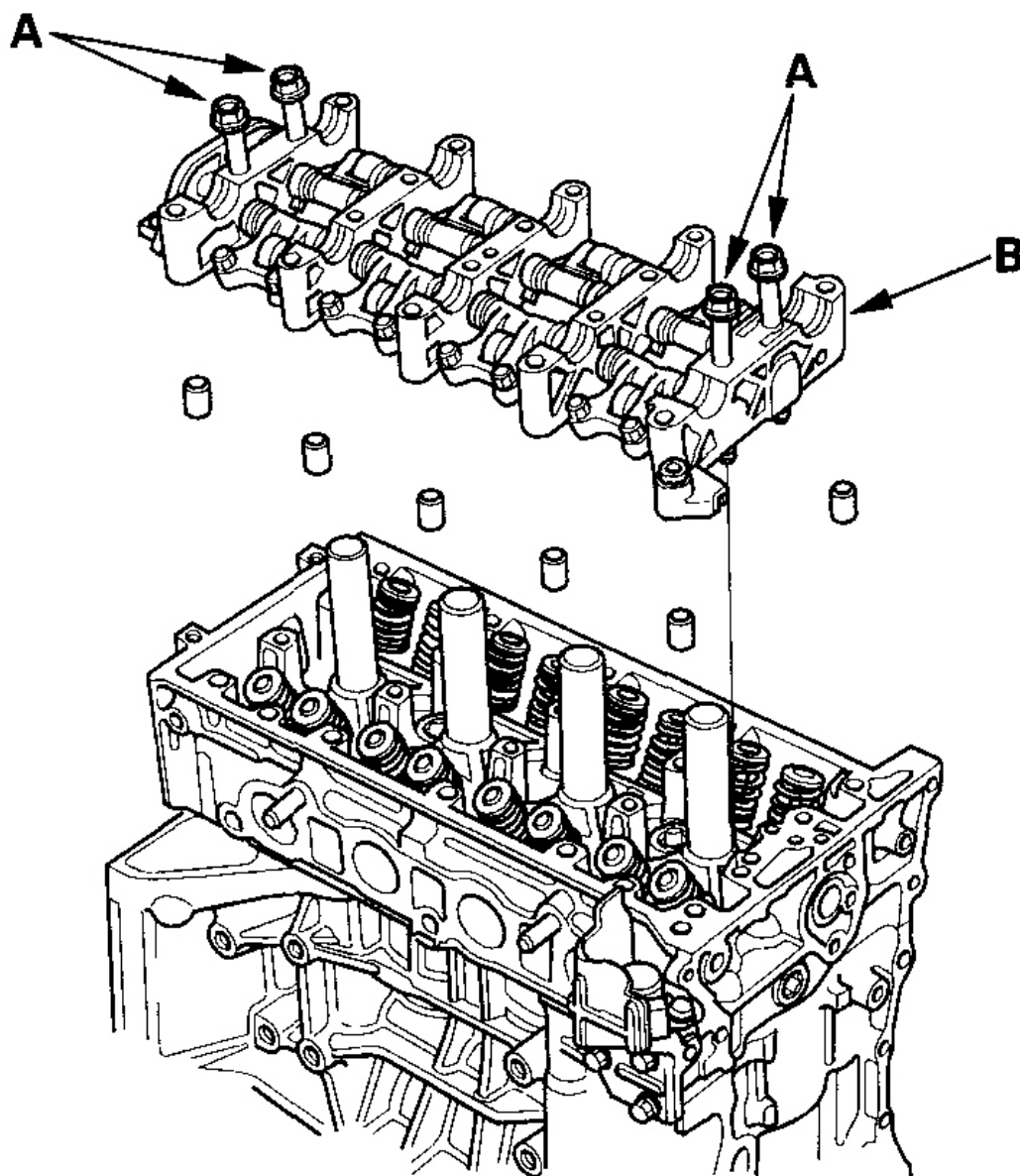


G03677203

Fig. 84: Removing Camshaft Holder Bolts

Courtesy of AMERICAN HONDA MOTOR CO., INC.

4. Remove the cam chain guide B, camshaft holders, and camshafts.
5. Insert the bolts (A) into the rocker shaft holder, then remove the rocker arm assembly (B).



G03677204

Fig. 85: Removing Rocker Arm Assembly

Courtesy of AMERICAN HONDA MOTOR CO., INC.

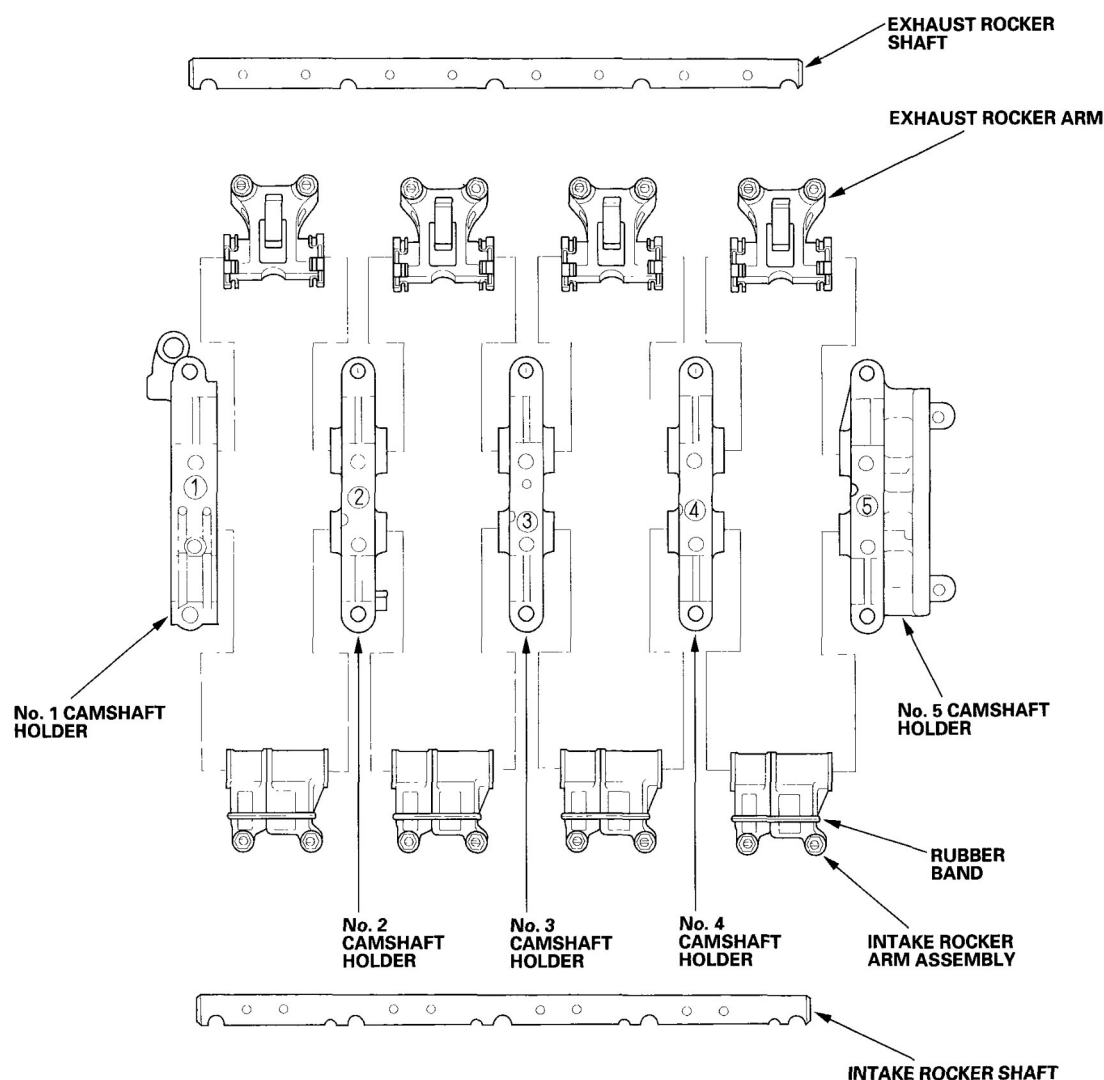
ROCKER ARM AND SHAFT DISASSEMBLY/REASSEMBLY

NOTE:

- Identify each part as it is removed so that each item can be reinstalled in

its original location.

- **Inspect the rocker arm shaft and rocker arms (see ROCKER ARM AND SHAFT INSPECTION).**
- **If reused, the rocker arms must be installed in the same positions.**
- **When removing or installing the rocker arm assembly, do not remove the camshaft holder bolts. The bolts will keep the holders and rocker arms on the shaft.**
- **Prior to reassembling, clean all the parts in solvent, dry them, and apply new engine oil to any contact points.**
- **Bundle the intake rocker arms with rubber bands to keep them together as a set.**
- **When replacing the intake rocker arm assembly, remove the fastening hardware from the new intake rocker arm assembly.**

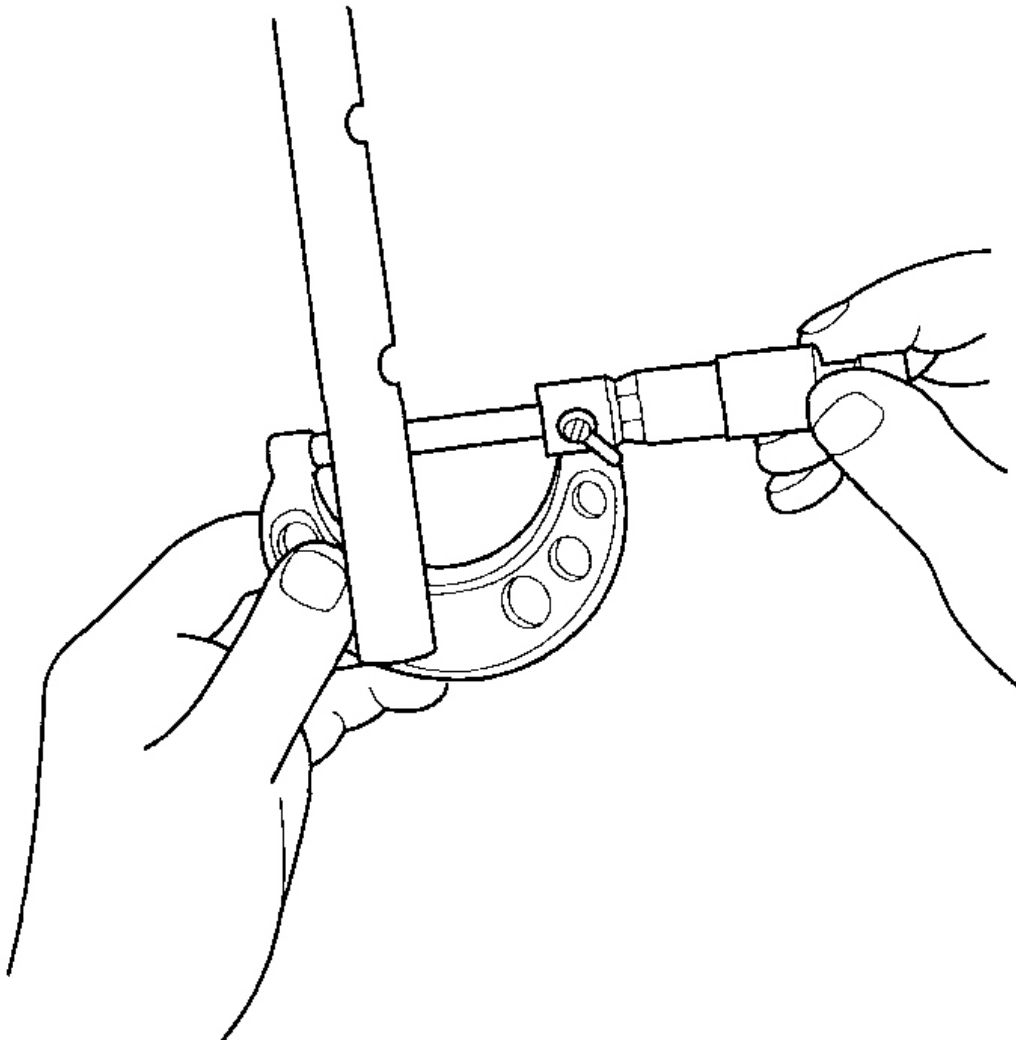


G03677205

Fig. 86: Assembling And Disassembling Rocker Arm And Shaft
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

ROCKER ARM AND SHAFT INSPECTION

1. Remove the rocker arm assembly (see **ROCKER ARM ASSEMBLY REMOVAL**), then disassemble the rocker arm assembly (see **ROCKER ARM AND SHAFT DISASSEMBLY/REASSEMBLY**).
2. Measure the diameter of the shaft at the first rocker location.

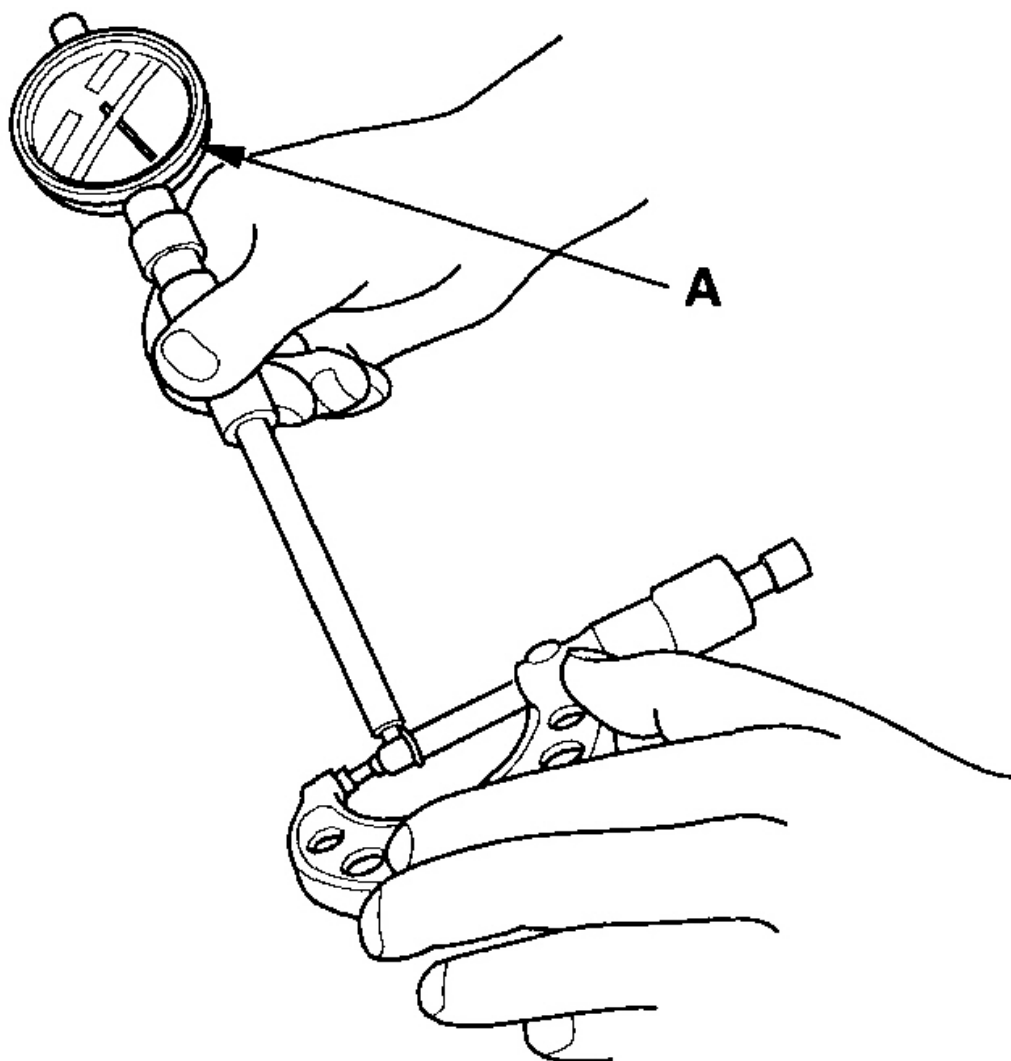


G03677206

Fig. 87: Measuring Shaft Diameter

Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. Zero the gauge (A) to the shaft diameter.



G03677207

Fig. 88: Attaching Gauge To Shaft Diameter

Courtesy of AMERICAN HONDA MOTOR CO., INC.

4. Measure the inside diameter of the rocker arm, and check it for an out-of-round condition.

Rocker Arm-to-Shaft Clearance

Standard (New):

2003 Honda Element DX

2003-06 ENGINE Cylinder Head - Element

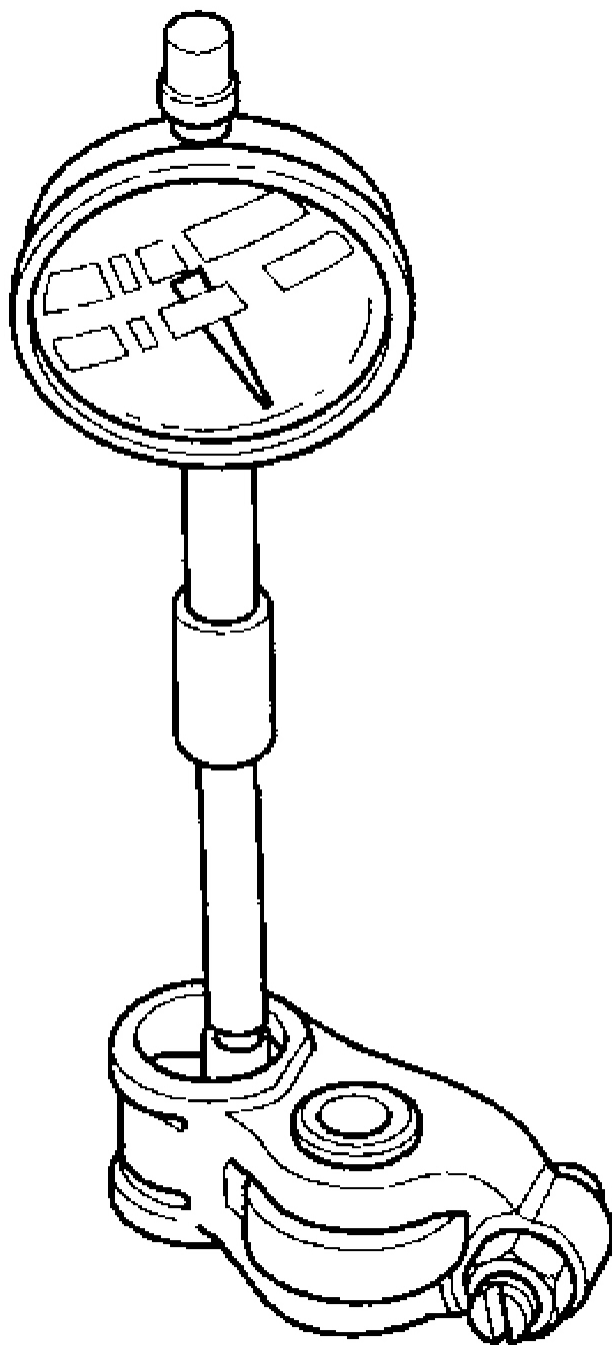
Intake: 0.025-0.052 mm

(0.0010-0.0020 in.)

Exhaust: 0.018-0.056 mm

(0.0007-0.0022 in.)

Service Limit: 0.08 mm (0.003 in.)



G03677208

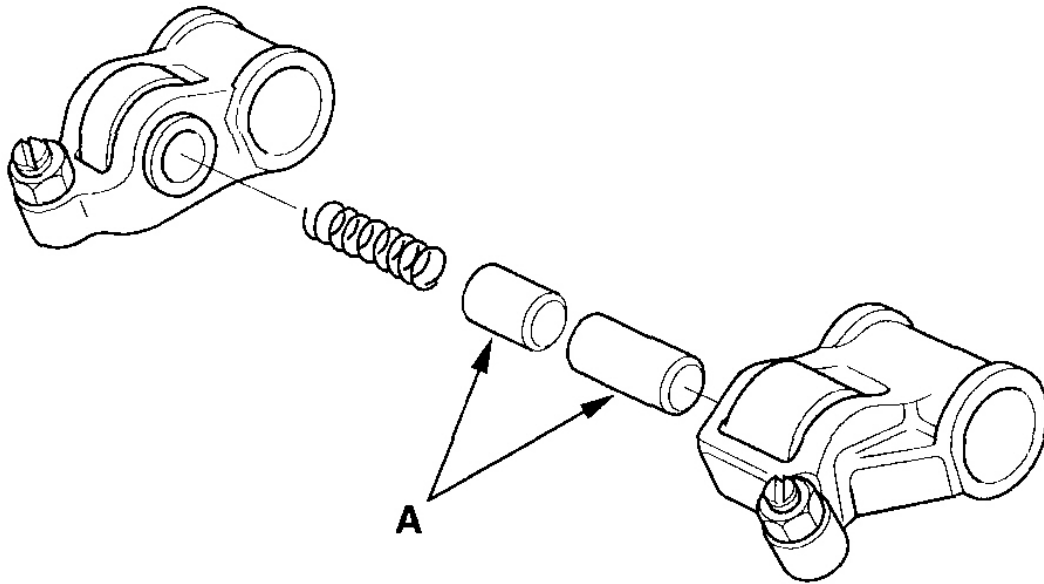
Fig. 89: Measuring Rocker Arm Inside Diameter
Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. Repeat for all rocker arms and both shafts. If the clearance is over the limit, replace the rocker shaft and all overtolerance rocker arms. If any VTEC rocker arm needs replacement, replace the rocker arms

(primary and secondary), as a set.

6. Inspect the rocker arm pistons (A). Push each piston manually. If it does not move smoothly, replace the rocker arms as a set.

NOTE: Apply new engine oil to the pistons when reassembling.



G03677209

Fig. 90: Inspecting Rocker Arm Pistons

Courtesy of AMERICAN HONDA MOTOR CO., INC.

7. Install the rocker arm assembly (see ROCKER ARM ASSEMBLY INSTALLATION).

CAMSHAFT INSPECTION

NOTE: Do not rotate the camshaft during inspection.

1. Remove the rocker arm assembly (see ROCKER ARM ASSEMBLY REMOVAL).
2. Put the rocker shaft holders, camshaft, and camshaft holders on the cylinder head, then tighten the bolts to the specified torque.

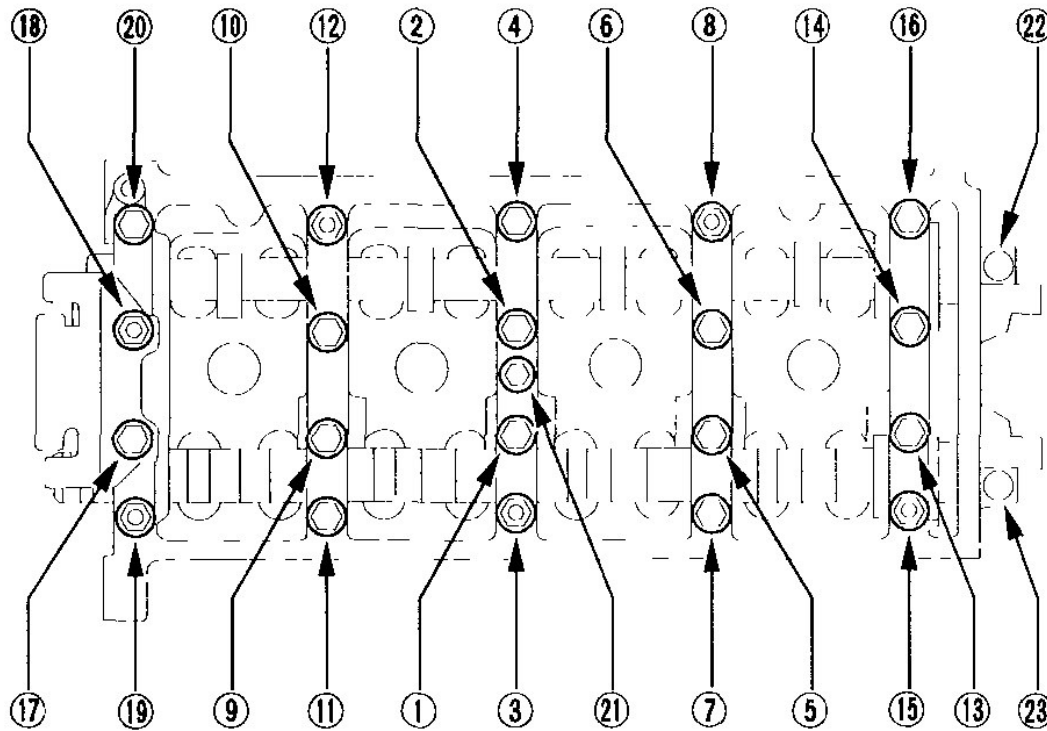
NOTE: If the engine does not have bolt 21, skip it and continue the torque sequence.

Specified Torque

8 mm Bolts: 22 N.m (2.2 kgf.m, 16 lbf.ft)

6 mm Bolts: 12 N.m (1.2 kgf.m, 8.7 lbf.ft)

6 mm Bolts: 21, 22, 23,



G03677210

Fig. 91: Tightening Camshaft Holder Bolts

Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. Seat the camshaft by pushing it away from the cam chain end of the cylinder head.
4. Zero the dial indicator against the end of the camshaft, then push the camshaft back and forth and read the end play. If the end play is beyond the service limit, replace the cylinder head and recheck. If it is still beyond the service limit, replace the camshaft.

Camshaft End Play

Standard (New): 0.05-0.20 mm

(0.002-0.008 in.)

Service Limit: 0.4 mm (0.02 in.)

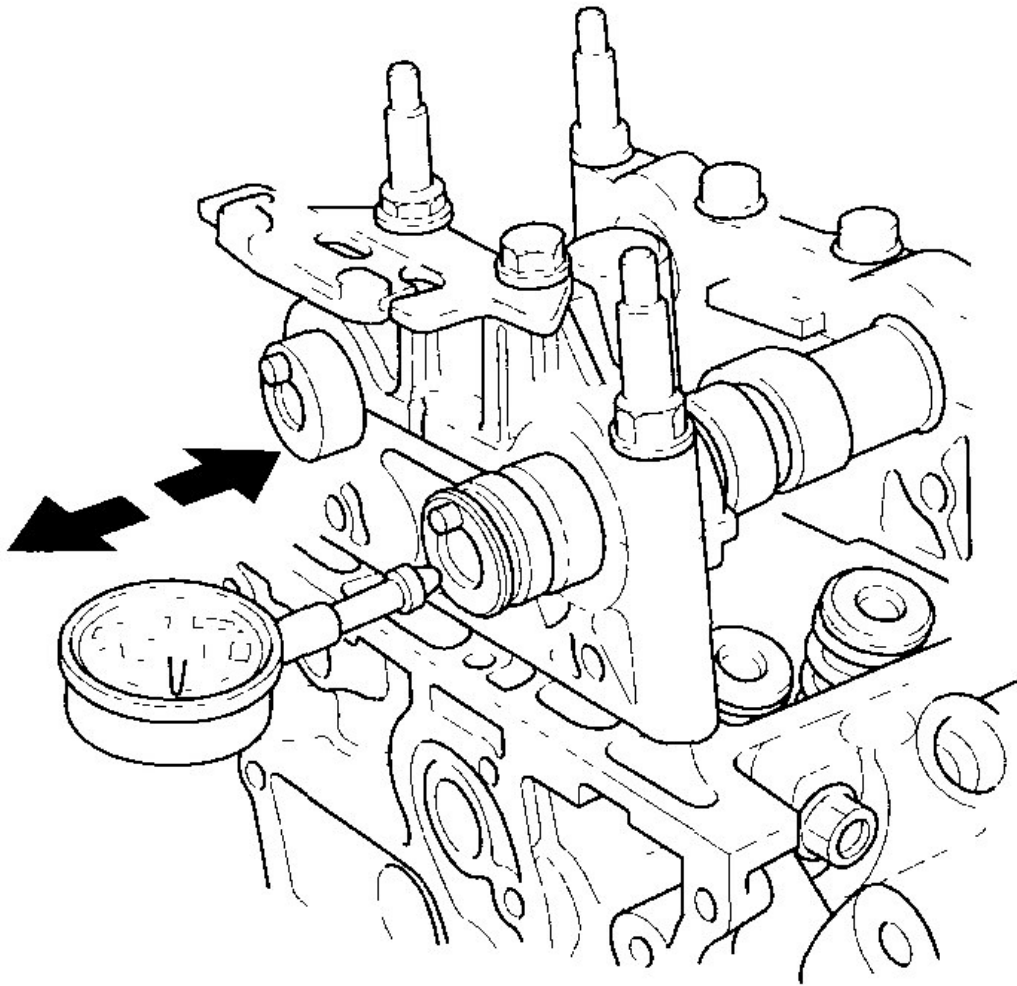
**G03677211**

Fig. 92: Attaching Dial Indicator To Camshaft End
Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. Unscrew the camshaft holder bolts two turns at a time, in a crisscross pattern. Then remove the camshaft holders from the cylinder head.
6. Lift the camshafts out of the cylinder head, wipe them clean, then inspect the lift ramps. Replace the camshaft if any lobes are pitted, scored, or excessively worn.
7. Clean the camshaft journal surfaces in the cylinder head, then set the camshafts back in place. Place a plastigage strip across each journal.
8. Install the camshaft holders, then tighten the bolts to the specified torque as shown in step 2 .
9. Remove the camshaft holders. Measure the widest part of plastigage on each journal.

- If the camshaft-to-holder clearance is within limits, go to step 11 .
- If the camshaft-to-holder clearance is beyond the service limit and the camshaft has been replaced, replace the cylinder head.
- If the camshaft-to-holder clearance is beyond the service limit and the camshaft has not been replaced, go to step 10.

Camshaft-to-Holder Oil Clearance**Standard (New):****No. 1 Journal: 0.030-0.069 mm****(0.001-0.003 in.)****No. 2,3,4,5 Journals: 0.060-0.099 mm****(0.002-0.004 in.)****Service Limit: 0.15 mm (0.006 in.)**

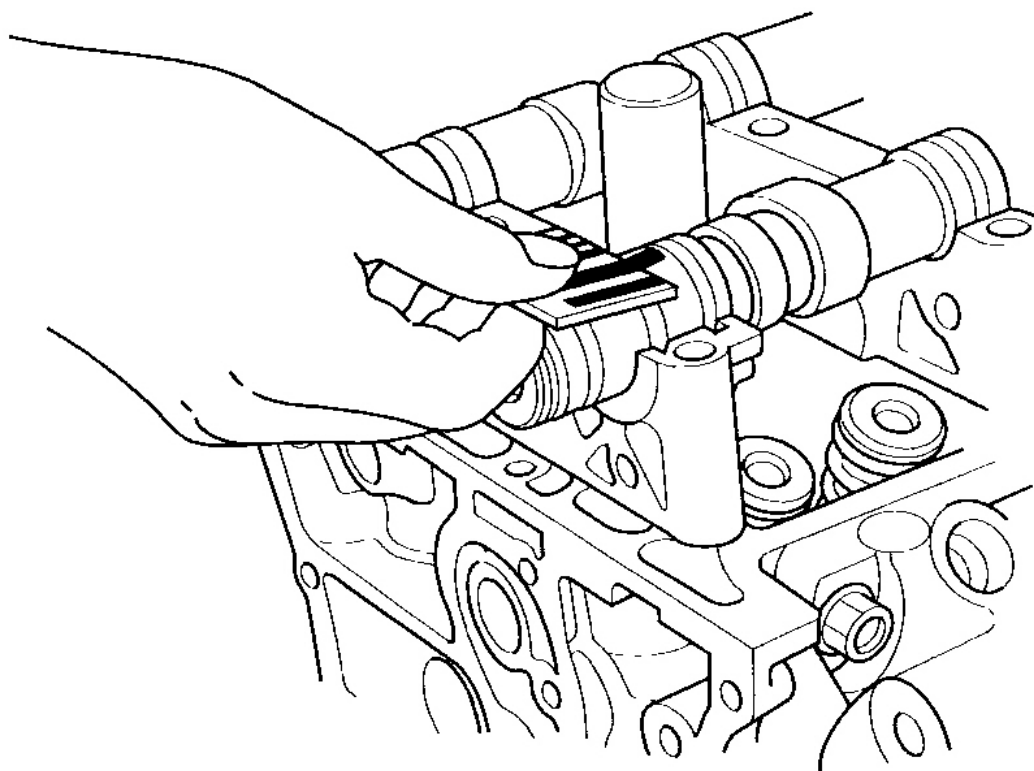
**G03677212**

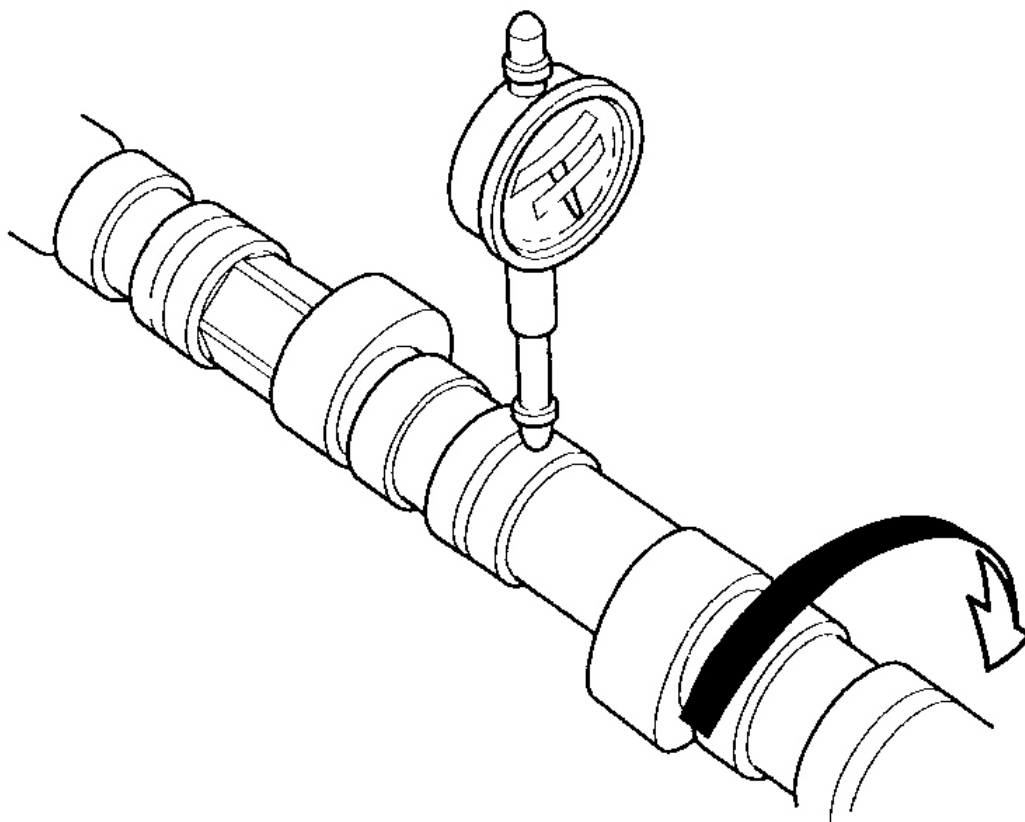
Fig. 93: Measuring Widest Part Of Plastigage On Journal
Courtesy of AMERICAN HONDA MOTOR CO., INC.

10. Check the total runout with the camshaft supported on V-blocks.
 - If the total runout of the camshaft is within the service limit, replace the cylinder head.
 - If the total runout is beyond the service limit, replace the camshaft and recheck the camshaft-to-holder oil clearance. If the oil clearance is still beyond the service limit, replace the cylinder head.

Camshaft Total Runout

Standard (New): 0.03 mm (0.001 in.) max.

Service Limit: 0.04 mm (0.002 in.)



G03677213

Fig. 94: Measuring Camshaft Runout
Courtesy of AMERICAN HONDA MOTOR CO., INC.

11. Measure cam lobe height.

CAM LOBE HEIGHT SPECIFICATIONS

	INTAKE	EXHAUST
PRI	33.925 mm (1.3356 in.)	34.092 mm (1.3422 in.)
SEC	29.638 mm (1.1668 in.)	
PRI: Primary	SEC: Secondary	C/C: Cam Chain

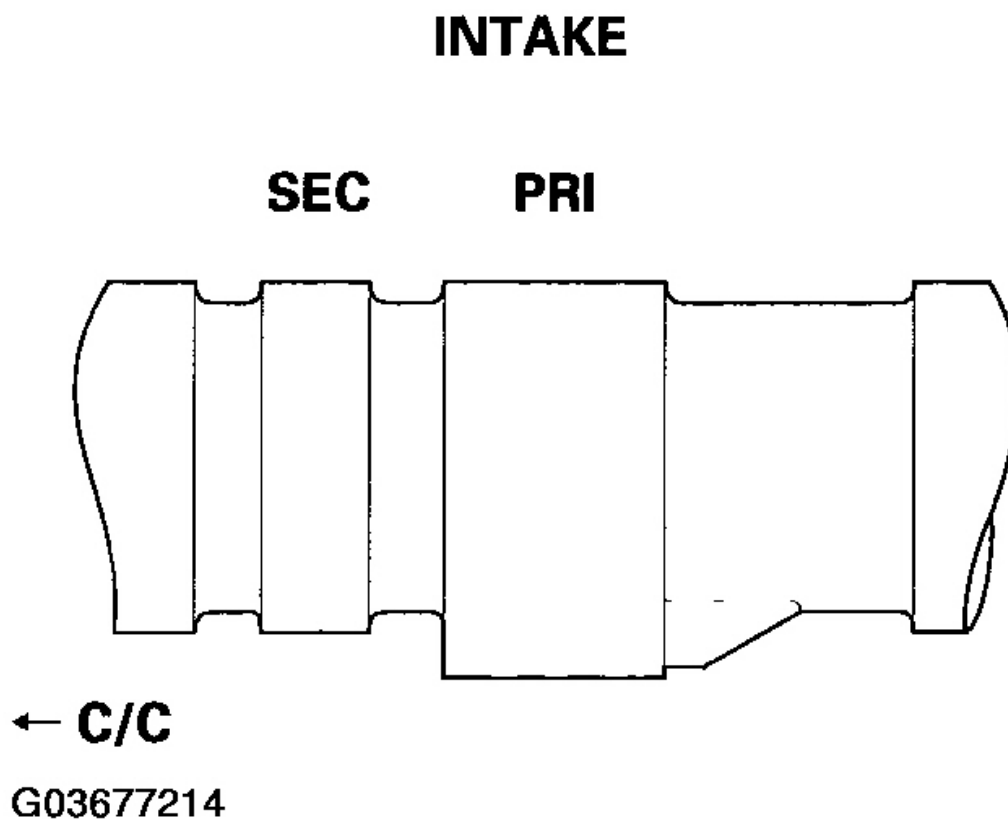


Fig. 95: Identifying Cam Lobe Height

Courtesy of AMERICAN HONDA MOTOR CO., INC.

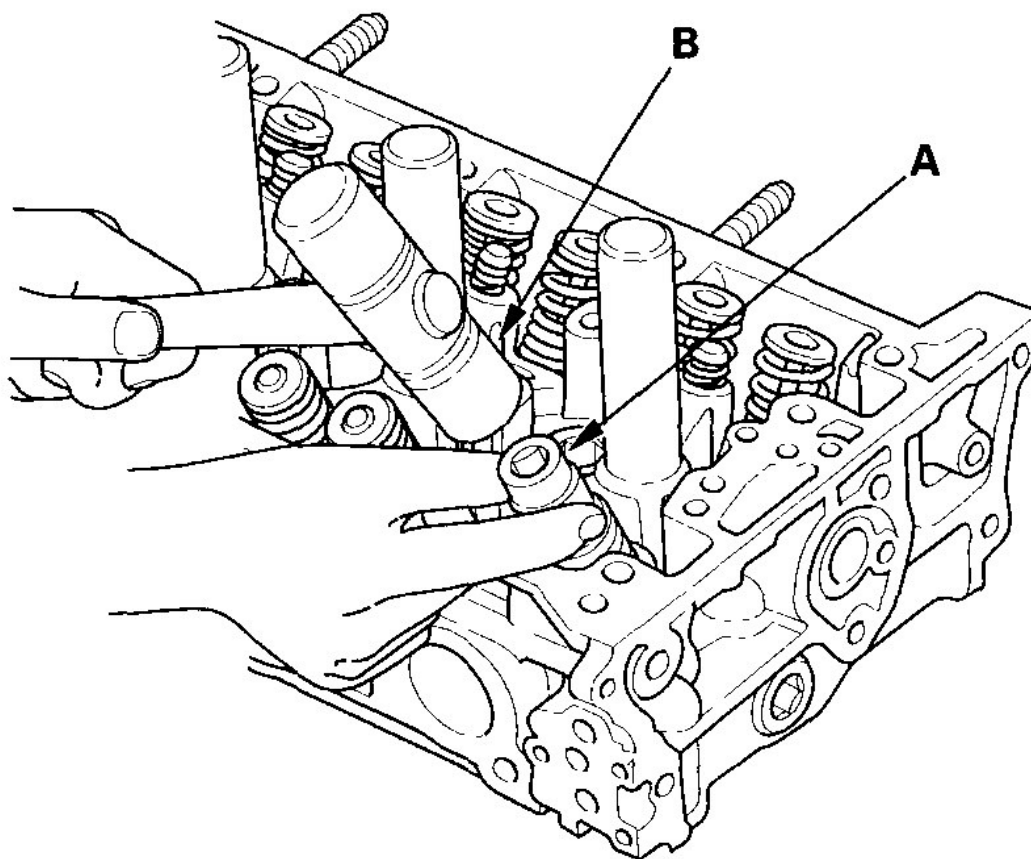
VALVE, SPRING, AND VALVE SEAL REMOVAL

Special Tools Required

Valve spring compressor attachment 07757-PJ1010A

Identify the valves and valve springs as they are removed so that each item can be reinstalled in its original position.

1. Remove the cylinder head (see **CYLINDER HEAD REMOVAL**).
2. Using an appropriate-sized socket (A) and plastic mallet (B), lightly tap the valve retainer to loosen the valve cotters.

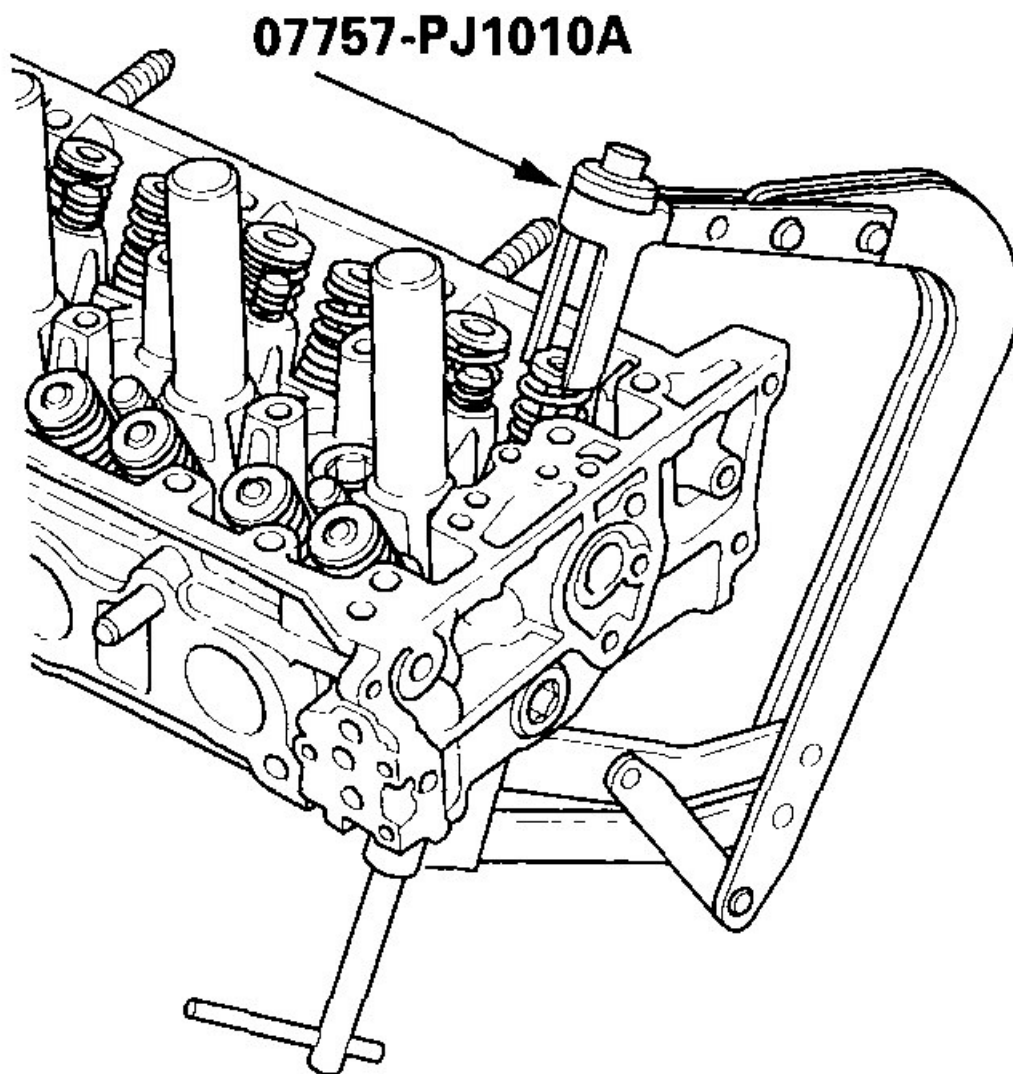


G03677215

Fig. 96: Tapping Valve Retainer

Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. Install the valve spring compressor attachment and valve spring compressor. Compress the spring and remove the valve cotteners.



G03677216

Fig. 97: Installing Valve Spring Compressor Attachment And Valve Spring Compressor
Courtesy of AMERICAN HONDA MOTOR CO., INC.

4. Remove the valve spring compressor, valve spring compressor attachment, spring retainer, and spring.
5. Install the valve guide seal remover.

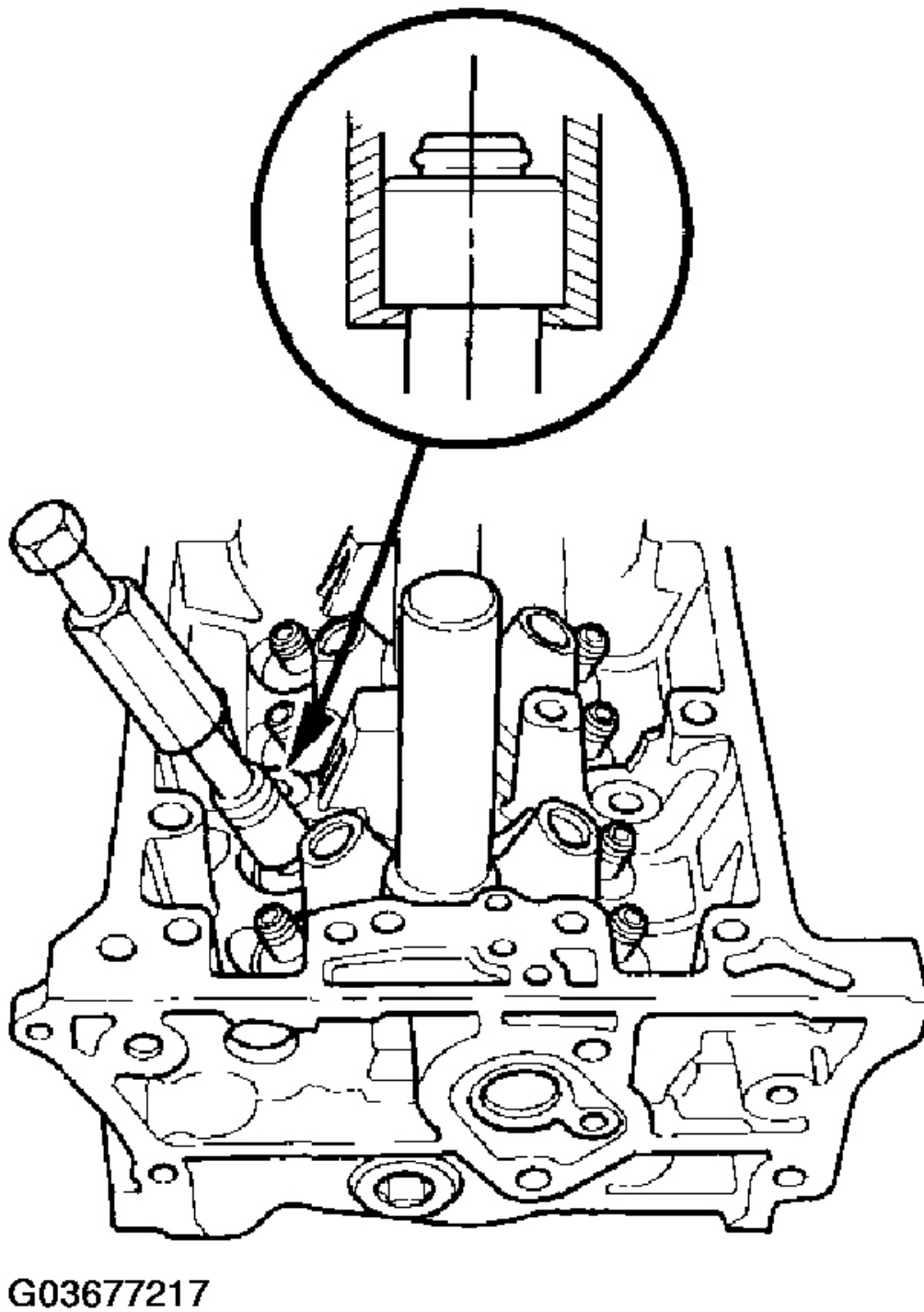
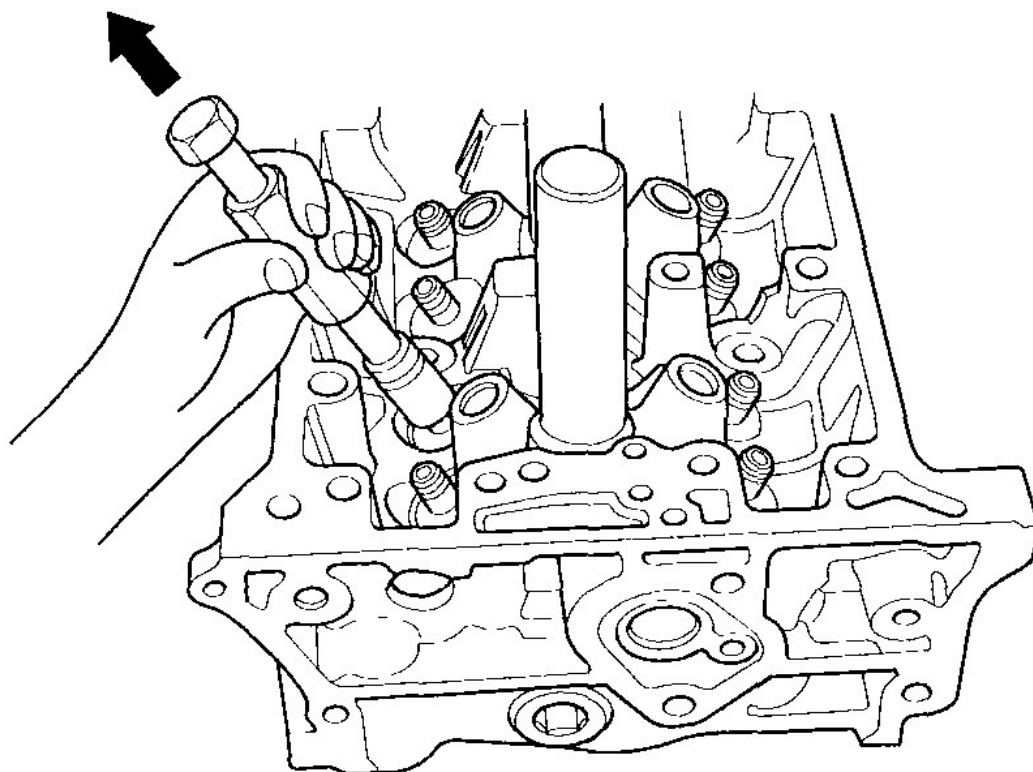


Fig. 98: Installing Valve Guide Seal Remover

Courtesy of AMERICAN HONDA MOTOR CO., INC.

6. Remove the valve seal.



G03677218

Fig. 99: Removing Valve Seal

Courtesy of AMERICAN HONDA MOTOR CO., INC.

7. Remove the valve spring seat and valve.

VALVE INSPECTION

1. Remove the valves (see VALVE, SPRING, AND VALVE SEAL REMOVAL).
2. Measure the valve in these areas.

Intake Valve Dimensions

A Standard (New): 34.85-35.15 mm

(1.372-1.384 in.)

B Standard (New): 108.7-109.5 mm

(4.280-4.311 in.)

C Standard (New): 5.475-5.485 mm

(0.2156-0.2159 in.)

C Service Limit: 5.445 mm (0.214 in.)

Exhaust Valve Dimensions

A Standard (New): 29.85-30.15 mm

(1.175-1.187 in.)

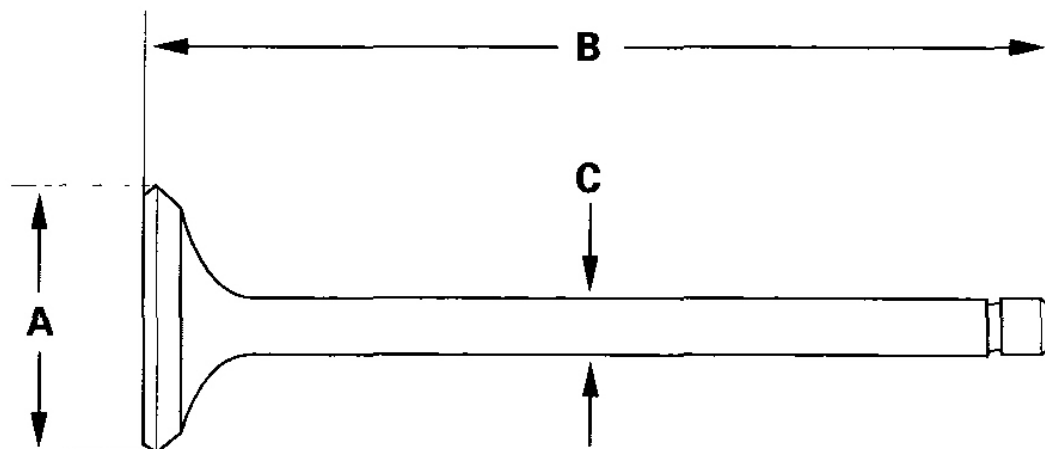
B Standard (New): 108.3-109.1 mm

(4.264-4.295 in.)

C Standard (New): 5.450-5.460 mm

(0.2146-0.2150 in.)

C Service Limit: 5.42 mm (0.213 in.)



G03677219

Fig. 100: Identifying Valve Dimensions**Courtesy of AMERICAN HONDA MOTOR CO., INC.****VALVE STEM-TO-GUIDE CLEARANCE INSPECTION**

1. Remove the valves (see **VALVE, SPRING, AND VALVE SEAL REMOVAL**).
2. Slide the valve out of its guide about 10 mm (3/8 in.), then measure the guide-to-stem clearance with a dial indicator while rocking the stem in the direction of normal thrust (wobble method).
 - If the measurement exceeds the service limit, recheck it using a new valve.
 - If the measurement is now within the service limit, reassemble using a new valve.
 - If the measurement with a new valve still exceeds the service limit, go to step 3.

Intake Valve Stem-to-Guide Clearance**Standard (New): 0.06-0.11 mm****(0.002-0.004 in.)****Service Limit: 0.16 mm (0.006 in.)****Exhaust Valve Stem-to-Guide Clearance****Standard (New): 0.11-0.16 mm****(0.004-0.006 in.)****Service Limit: 0.22 mm (0.009 in.)**

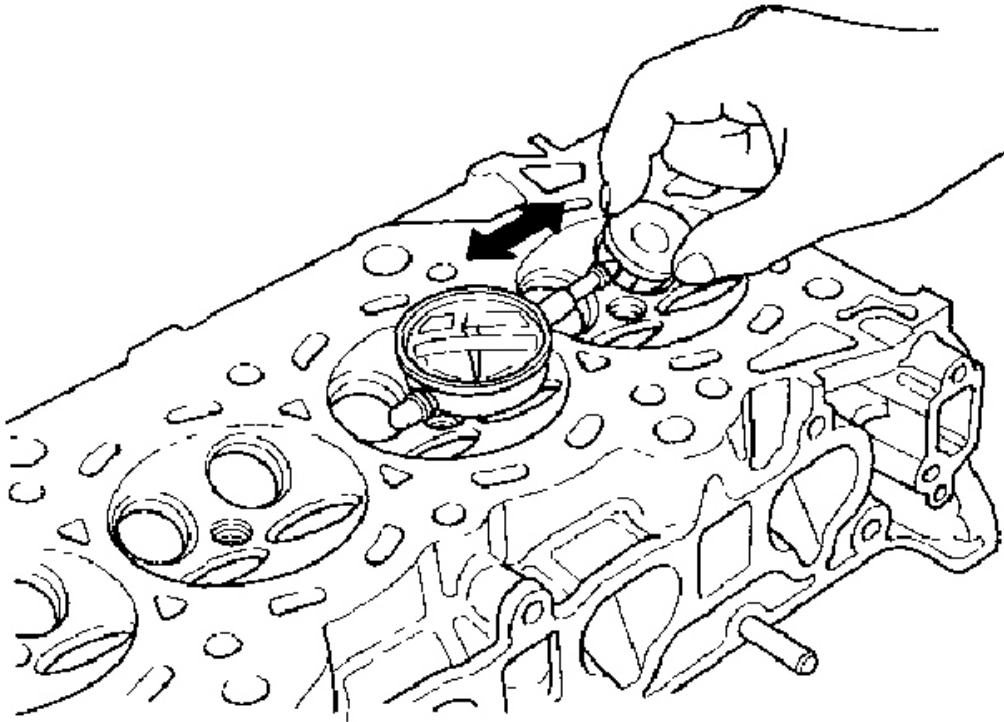
**G03677220**

Fig. 101: Measuring Valve Stem-To-Guide Clearance
Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. Subtract the O.D. of the valve stem, measured with a micrometer, from the I.D. of the valve guide, measured with an inside micrometer or ball gauge. Take the measurements in three places along the valve stem and three places inside the valve guide. The difference between the largest guide measurement and the smallest stem measurement should not exceed the service limit.

Intake Valve Stem-to-Guide Clearance

Standard (New): 0.030-0.055 mm

(0.0012-0.0022 in.)

Service Limit: 0.08 mm (0.003 in.)

Exhaust Valve Stem-to-Guide Clearance

Standard (New): 0.055-0.080 mm

(0.0022-0.0031 in.)

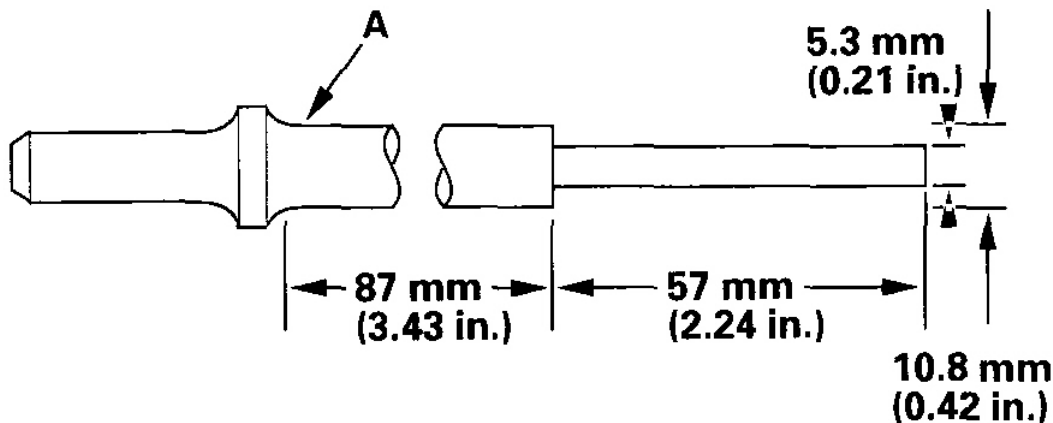
Service Limit: 0.11 mm (0.004 in.)

VALVE GUIDE REPLACEMENT

Special Tools Required

- Valve guide driver, 5.5 mm 07742-0010100
- Valve guide reamer, 5.5 mm 07HAH-PJ7010B

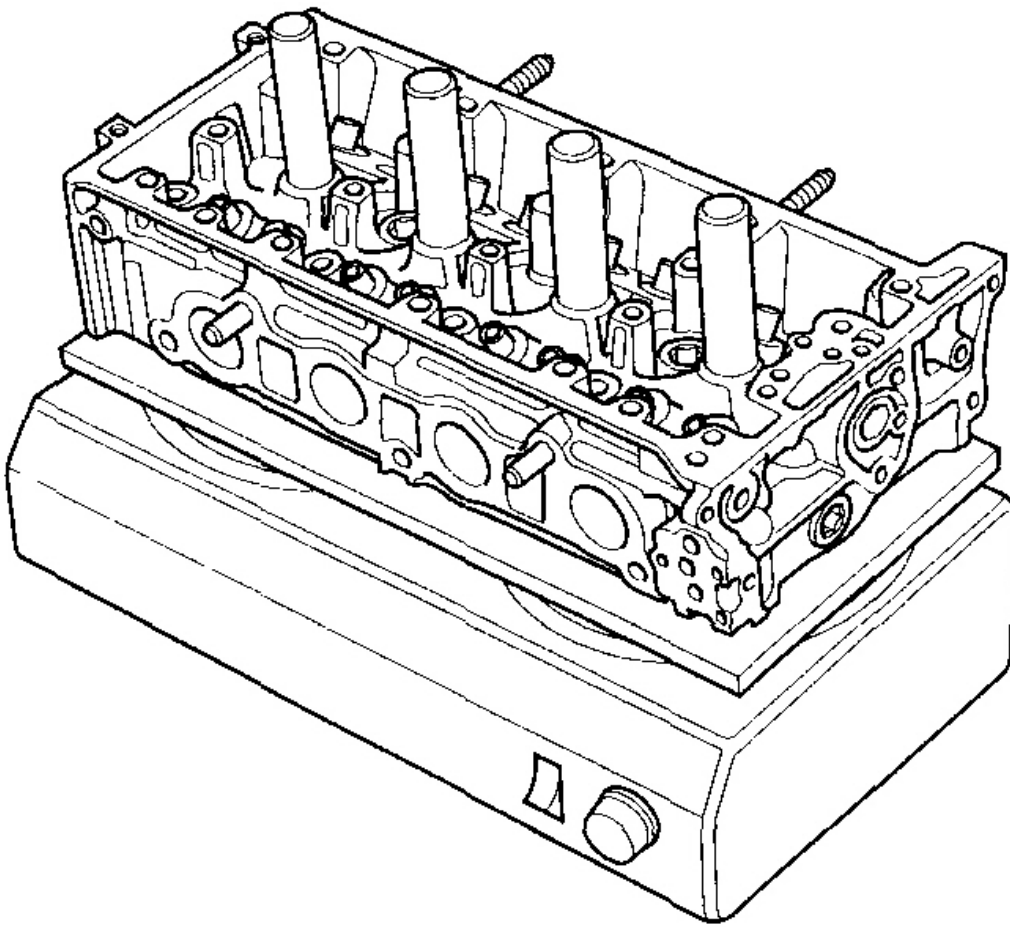
1. Inspect valve stem-to-guide clearance (see VALVE INSPECTION).
2. As illustrated, use a commercially available air-impact valve guide driver (A) modified to fit the diameter of the valve guides. In most cases, the same procedure can be done using the special tool and a conventional hammer.



G03677221

Fig. 102: Identifying Valve Guide Driver Dimensions
Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. Select the proper replacement guides, and chill them in the freezer section of a refrigerator for about an hour.
4. Use a hot plate or oven to evenly heat the cylinder head to 300°F (150°C). Monitor the temperature with a cooking thermometer. Do not get the head hotter than 300°F (150°C); excessive heat may loosen the valve seats.

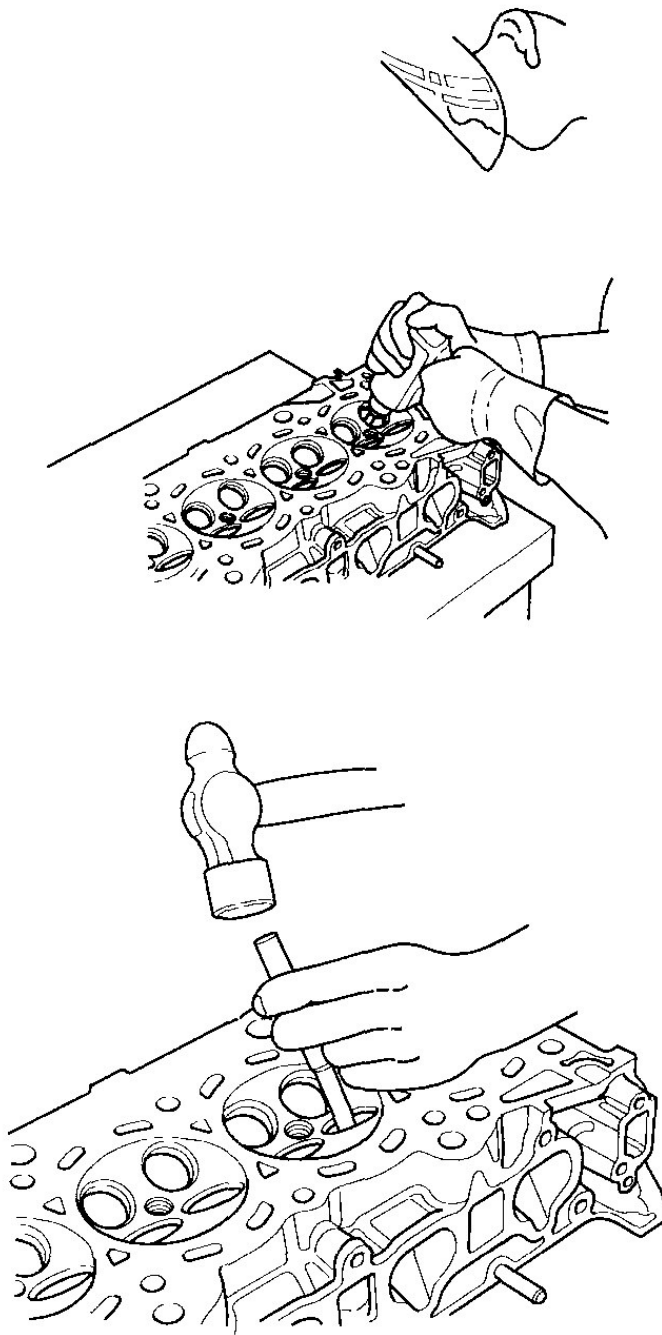


G03677222

Fig. 103: Heating Cylinder Head

Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. Working from the camshaft side, use the driver and an air hammer to drive the guide about 2 mm (0.1 in.) towards the combustion chamber. This will knock off some of the carbon and make removal easier. Hold the air hammer directly in line with the valve guide to prevent damaging the driver. Wear safety goggles or a face shield.
6. Turn the head over, and drive the guide out toward the camshaft side of the head.



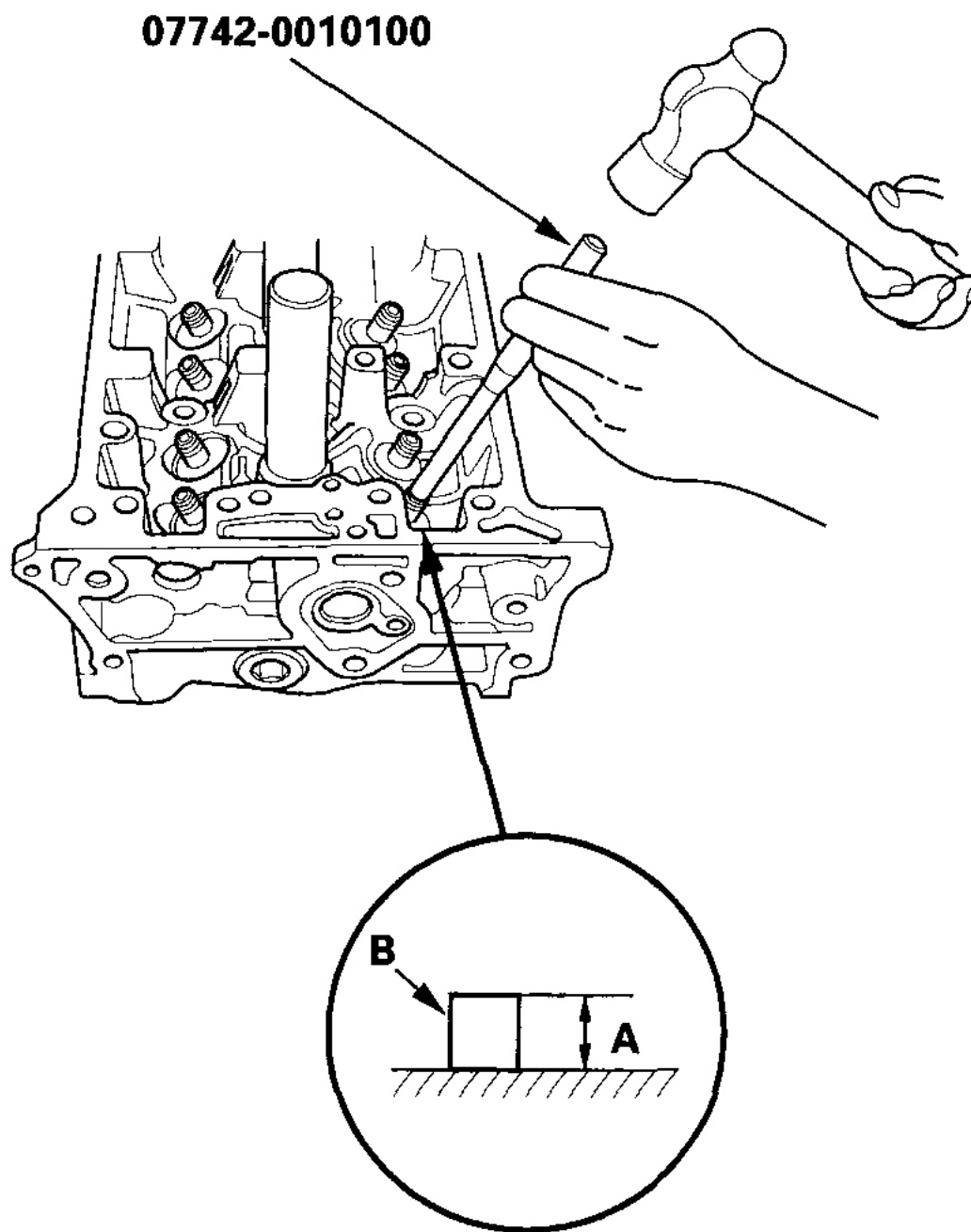
G03677223

Fig. 104: Removing Valve Guide**Courtesy of AMERICAN HONDA MOTOR CO., INC.**

7. If a valve guide won't move, drill it out with a 8 mm (5/16 in.) bit, then try again. Drill guides only in extreme cases; you could damage the cylinder head if the guide breaks.

8. Take out the new guide(s) from the freezer, one at a time, as you need them.
9. Apply a thin coat of new engine oil to the outside of the new valve guide. Install the guide from the camshaft side of the head; use the special tool to drive the guide into the specified installed height (A) of the guide (B). If you have all 16 guides to do, you may have to reheat the head.

Valve Guide Installed Height**Intake: 15.2-16.2 mm (0.598-0.638 in.)****Exhaust: 15.5-16.5 mm (0.610-0.650 in.)**



G03677224

Fig. 105: Installing Valve Guide

Courtesy of AMERICAN HONDA MOTOR CO., INC.

10. Coat both reamer and valve guide with cutting oil.

11. Rotate the reamer clockwise the full length of the valve guide bore.

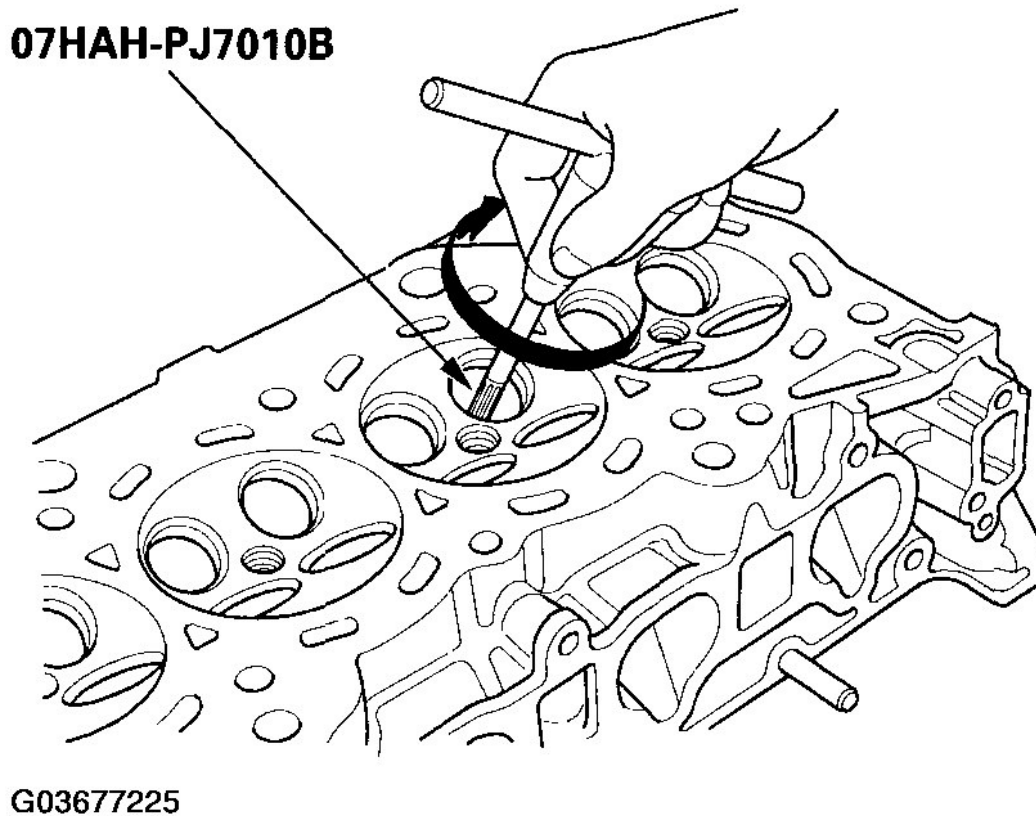


Fig. 106: Rotating Reamer Clockwise
Courtesy of AMERICAN HONDA MOTOR CO., INC.

12. Continue to rotate the reamer clockwise while drawing it from the bore.
13. Thoroughly wash the guide in detergent and water to remove any cutting residue.
14. Check the clearances with a valve (see **VALVE INSPECTION**). Verify that a valve slides in the intake and exhaust valve guides without being stuck.
15. Inspect the valve seating. If necessary, renew the valve seat using a valve seat cutter (see **VALVE SEAT RECONDITIONING**).

VALVE SEAT RECONDITIONING

1. Inspect valve stem-to-guide clearance (see **VALVE INSPECTION**). If the valve guides are worn, replace them (see **VALVE GUIDE REPLACEMENT**) before cutting the valve seats.
2. Renew the valve seats in the cylinder head using a valve seat cutter.

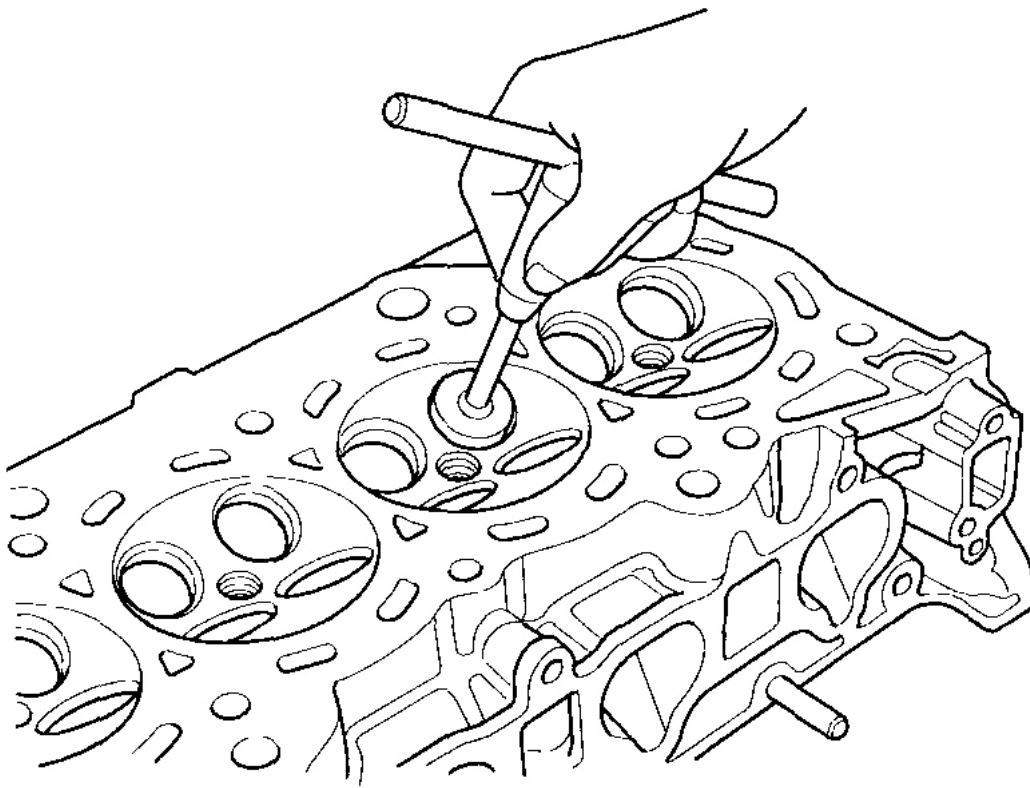
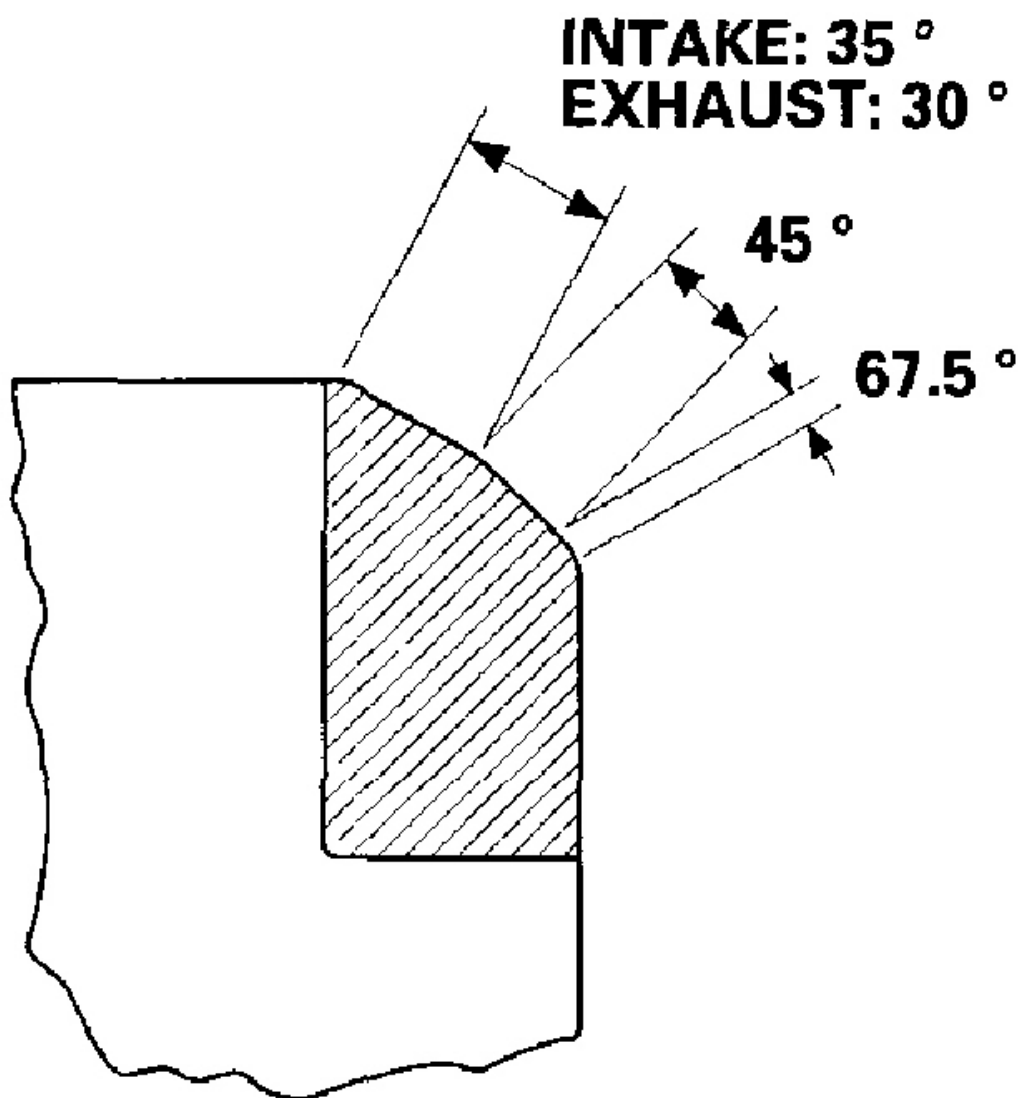
**G03677226**

Fig. 107: Reaming Valve Seat In Cylinder Head
Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. Carefully cut a 45° seat, removing only enough material to ensure a smooth and concentric seat.
4. Bevel the upper and lower edges at the angles shown in the illustration. Check the width of the seat and adjust accordingly.



G03677227

Fig. 108: Identifying Valve Cutting Angle

Courtesy of AMERICAN HONDA MOTOR CO., INC.

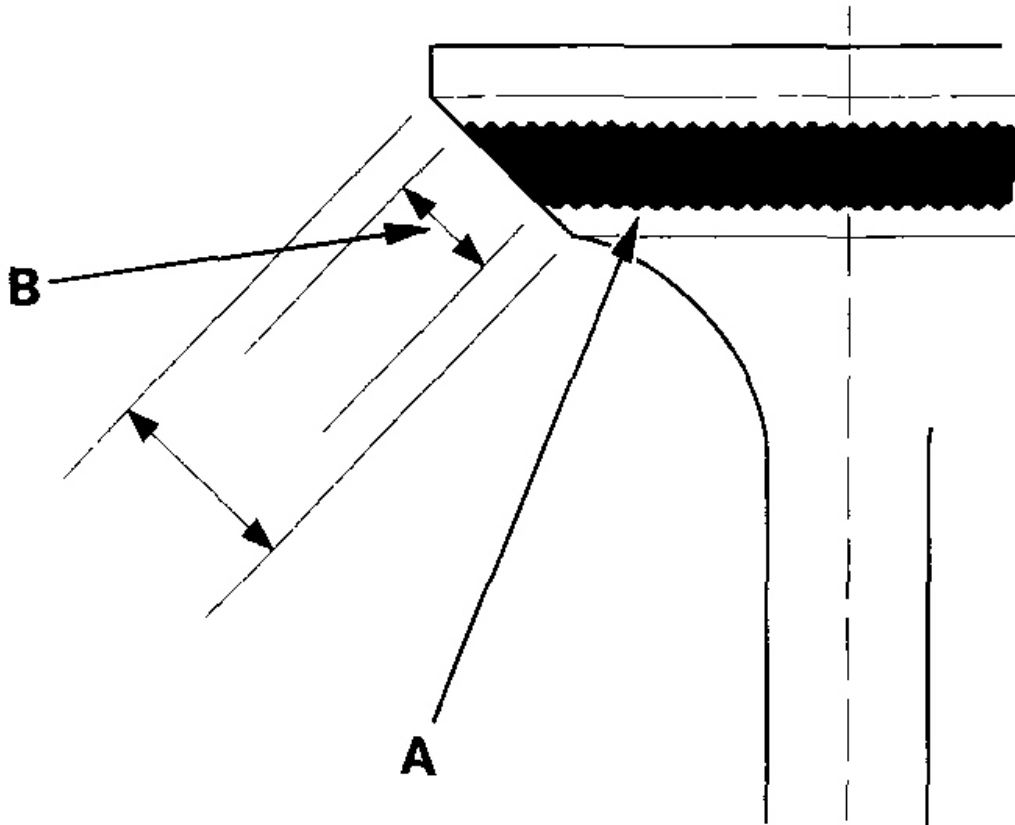
5. Make one more very light pass with the 45° cutter to remove any possible burrs caused by the other cutters.

Valve Seat Width

Standard (New): 1.25-1.55 mm (0.049-0.061 in.)

Service Limit: 2.00 mm (0.079 in.)

6. After resurfacing the seat, inspect for even valve seating. Apply Prussian Blue compound (A) to the valve face. Insert the valve in its original location in the head, then lift it and snap it closed against the seat several times.



G03677228

Fig. 109: Identifying Actual Valve Seating Surface Dimension
Courtesy of AMERICAN HONDA MOTOR CO., INC.

7. The actual valve seating surface (B), as shown by the blue compound, should be centered on the seat.
 - If it is too high (closer to the valve stem), you must make a second cut with the 67.5° cutter to move it down, then one more cut with the 45° cutter to restore seat width.
 - If it is too low (close to the valve edge), you must make a second cut with the 35° cutter (intake side) or the 30° cutter (exhaust side) to move it up, then make one more cut with the 45° cutter to

restore seat width.

NOTE: **The final cut should always be made with the 45° cutter.**

8. Insert the intake and exhaust valves in the head, and measure valve stem installed height (A).

Intake Valve Stem Installed Height

Standard (New): 44.0-44.5 mm

(1.73-1.75 in.)

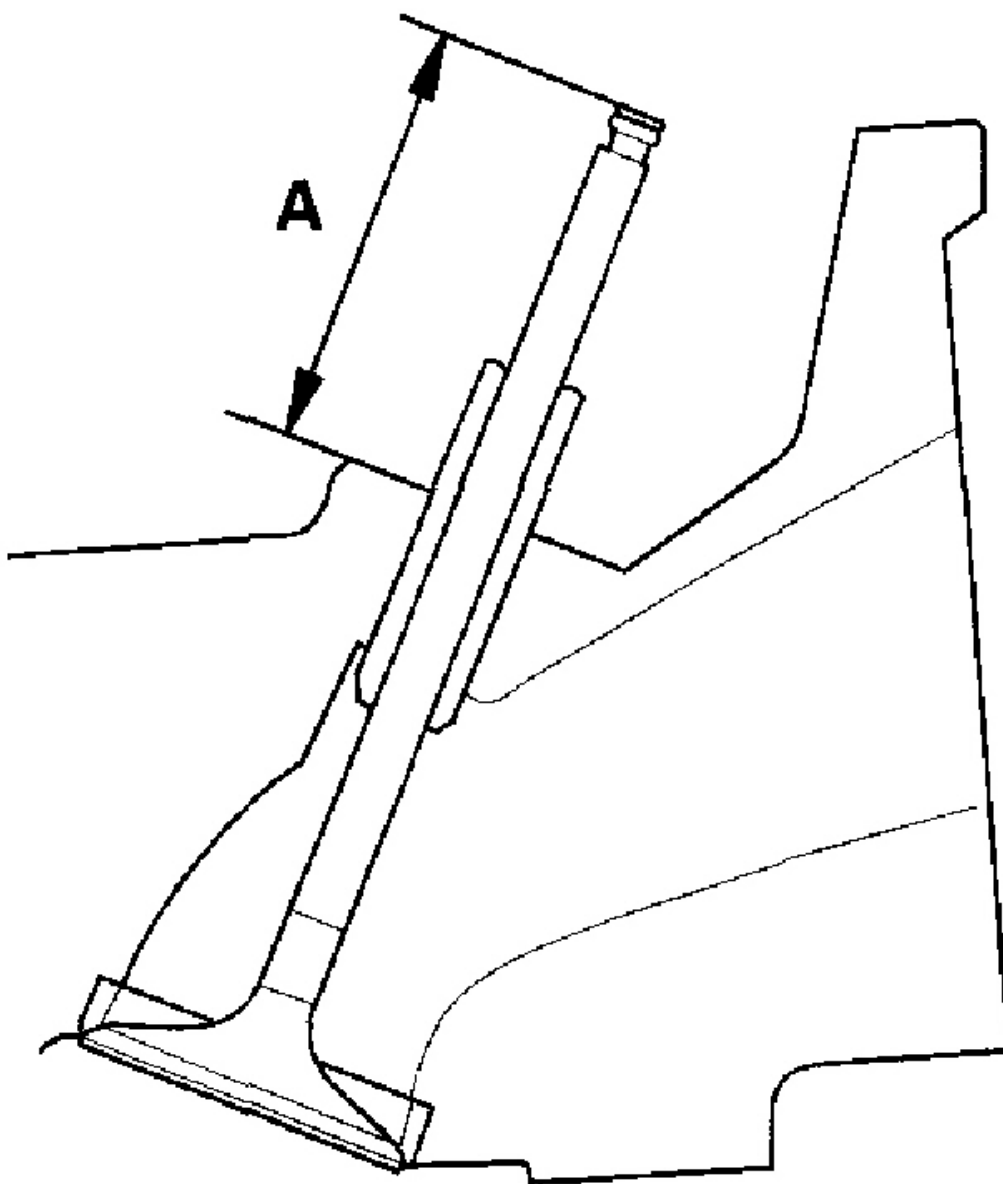
Service Limit: 44.7 mm (1.76 in.)

Exhaust Valve Stem Installed Height

Standard (New): 44.1-44.6 mm

(1.74-1.76 in.)

Service Limit: 44.8 mm (1.76 in.)



G03677229

Fig. 110: Identifying Valve Stem Installation Height
Courtesy of AMERICAN HONDA MOTOR CO., INC.

9. If valve stem installed height is over the service limit, replace the valve and recheck. If it is still over the service limit, replace the cylinder head; the valve seat in the head is too deep.

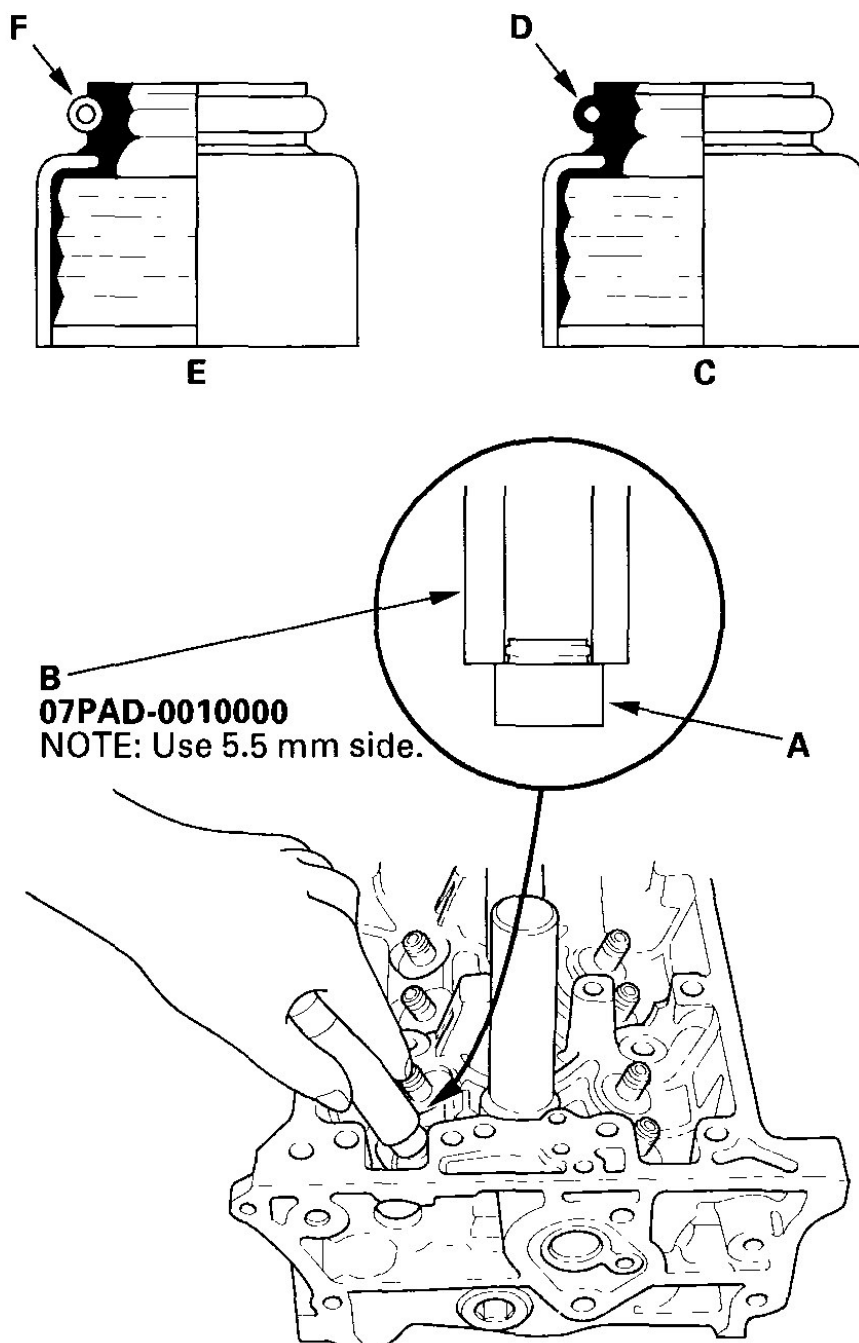
VALVE, SPRING, AND VALVE SEAL INSTALLATION

Special Tools Required

- Stem seal driver 07PAD-0010000
- Valve spring compressor attachment 07757-PJ1010A

1. Coat the valve stems with new engine oil. Install the valves in the valve guides.
2. Check that the valves move up and down smoothly.
3. Install the spring seats on the cylinder head.
4. Install the new valve seals (A) using the stem seal driver (B).

NOTE: **The exhaust valve seal (C) has a black spring (D), and the intake valve seal (E) has a white spring (F). They are not interchangeable.**



G03677230

Fig. 111: Installing Valve Seals

Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. Install the valve spring. Place the end of the valve spring with closely wound coils toward the cylinder head.

6. Install the valve retainer.
7. Install the valve spring compressor. Compress the spring, and install the valve cotters.

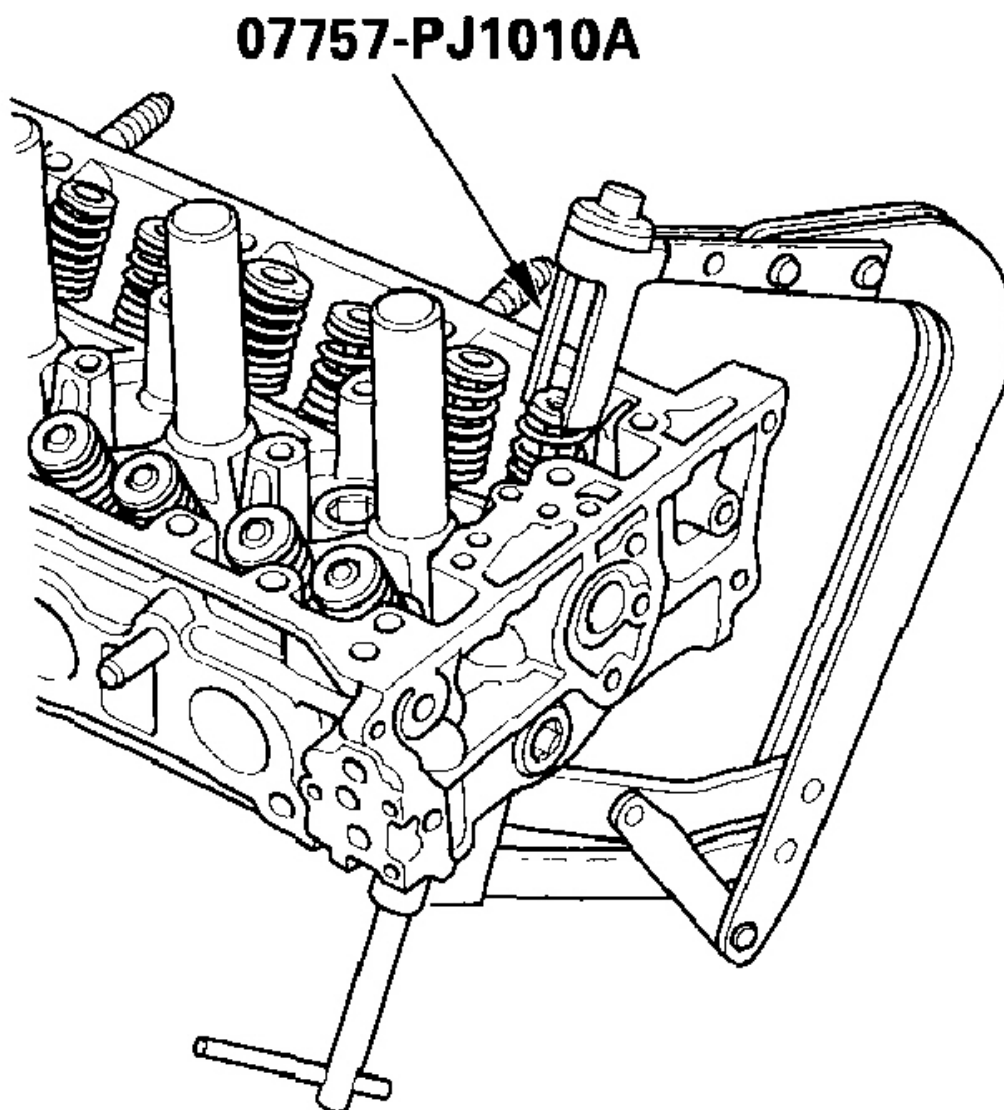
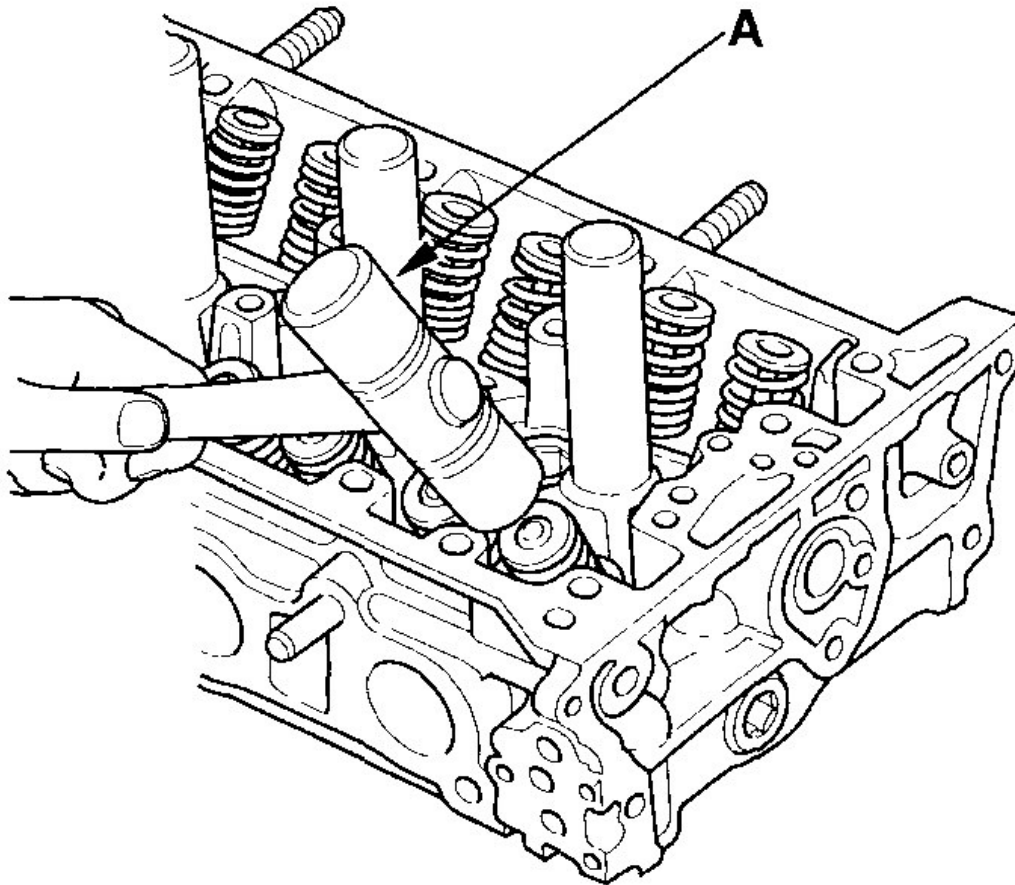


Fig. 112: Installing Valve Spring Compressor
Courtesy of AMERICAN HONDA MOTOR CO., INC.

8. Lightly tap the end of each valve stem two or three times with a plastic mallet (A) to ensure proper

seating of the valve and valve cotters. Tap the valve stem only along its axis so you do not bend the stem.



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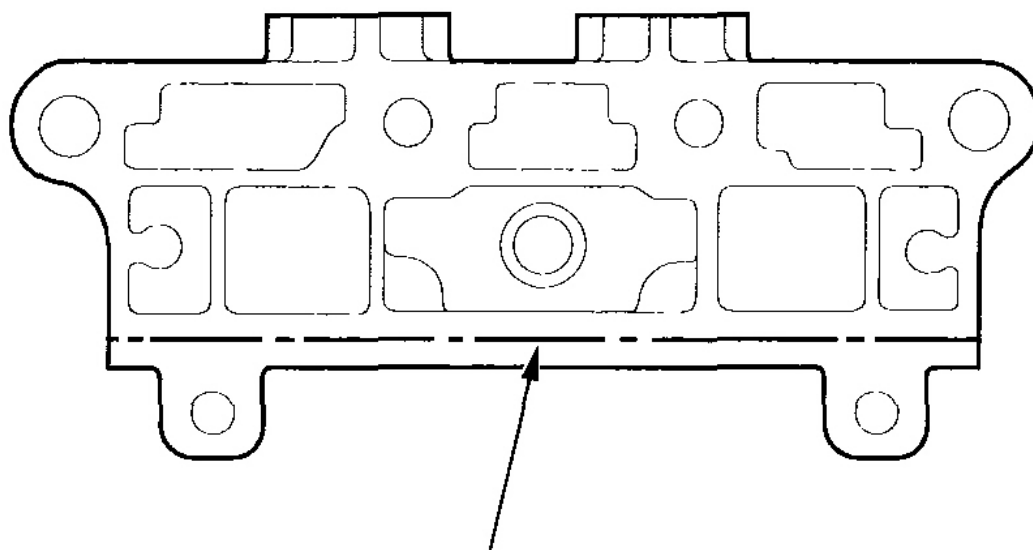
Fig. 113: Tapping Valve Stem End
Courtesy of AMERICAN HONDA MOTOR CO., INC.

ROCKER ARM ASSEMBLY INSTALLATION

1. Reassemble the rocker arm assembly (see **ROCKER ARM AND SHAFT DISASSEMBLY/REASSEMBLY**).
2. Clean and dry the No. 5 rocker shaft holder mating surface.
3. Apply liquid gasket, P/N 08717-0004, 08718-0001, 08718-0002, 08718-0003, or 08718-0009, evenly to the cylinder head mating surface of the No. 5 rocker shaft holder.

NOTE: Do not install components if too much time has passed after applying the

liquid gasket (for P/N 08718-0002, no more than 4 minutes, for all others, no more than 5 minutes). Instead, remove the old residue and reapply the liquid gasket.

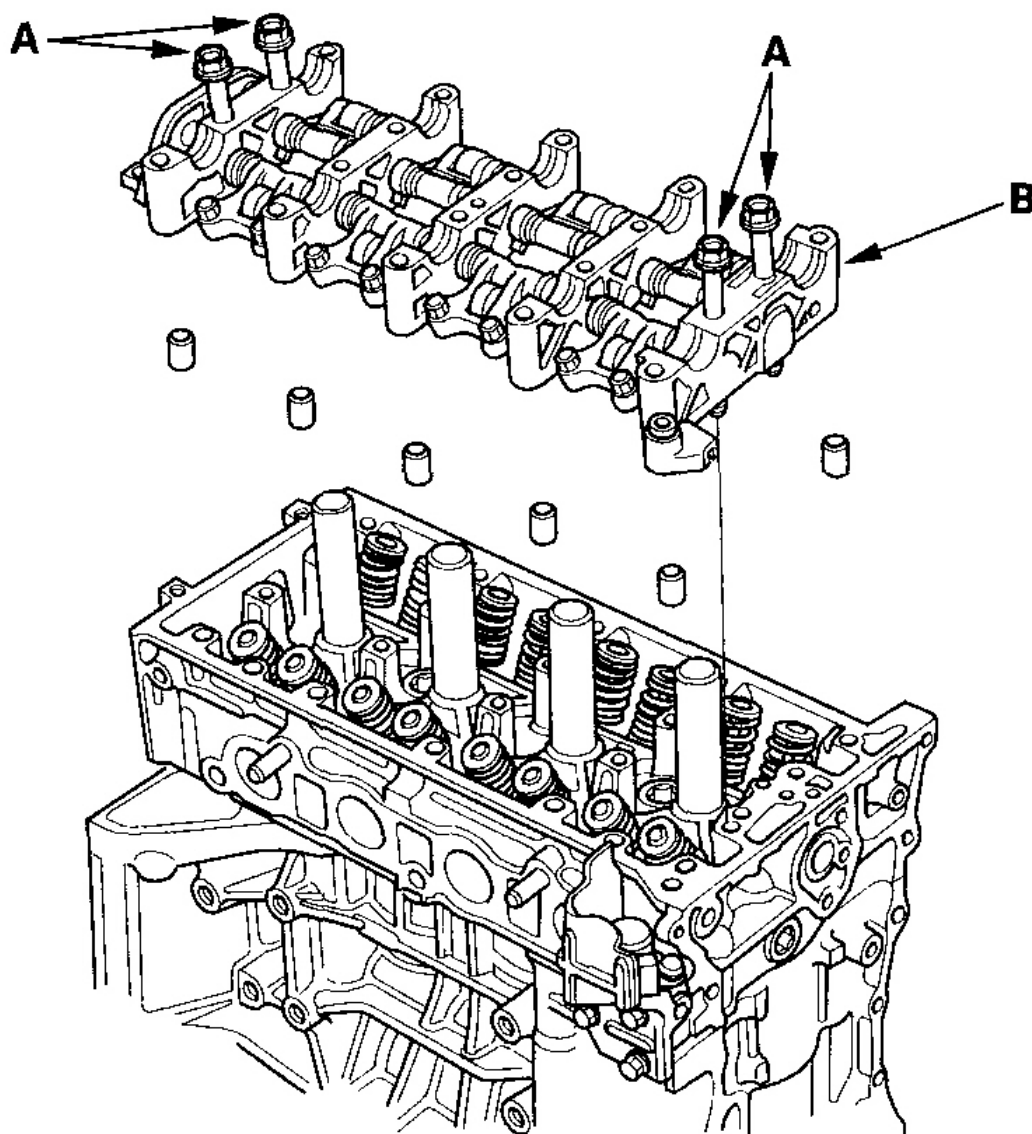


Apply liquid gasket
along the broken line.

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Fig. 114: Locating Liquid Gasket Applying Point
Courtesy of AMERICAN HONDA MOTOR CO., INC.

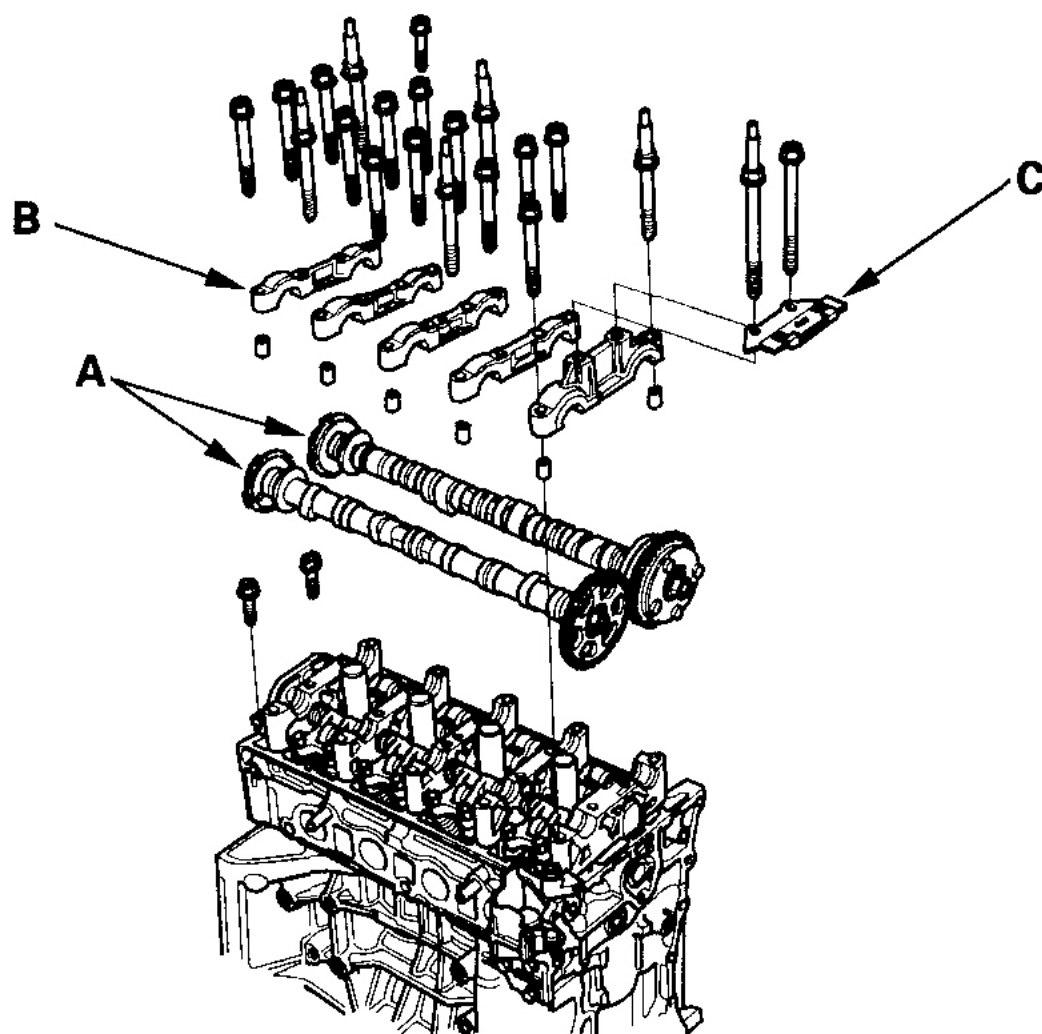
4. Insert the bolts (A) into the rocker shaft holder, then install the rocker arm assembly (B) on the cylinder head.



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Fig. 115: Installing Rocker Arm Assembly On Cylinder Head
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. Remove the bolts from the rocker shaft holder.
6. Make sure the punch marks on the variable valve timing control (VTC) actuator and exhaust camshaft sprocket are facing up, then set the camshafts (A) in the holder. Apply new engine oil to the camshaft journals and lobes.



G03677235

Fig. 116: Installing Camshafts

Courtesy of AMERICAN HONDA MOTOR CO., INC.

7. Set the camshaft holders (B) and cam chain guide B (C) in place.
8. Tighten the bolts in sequence to the specified torque.

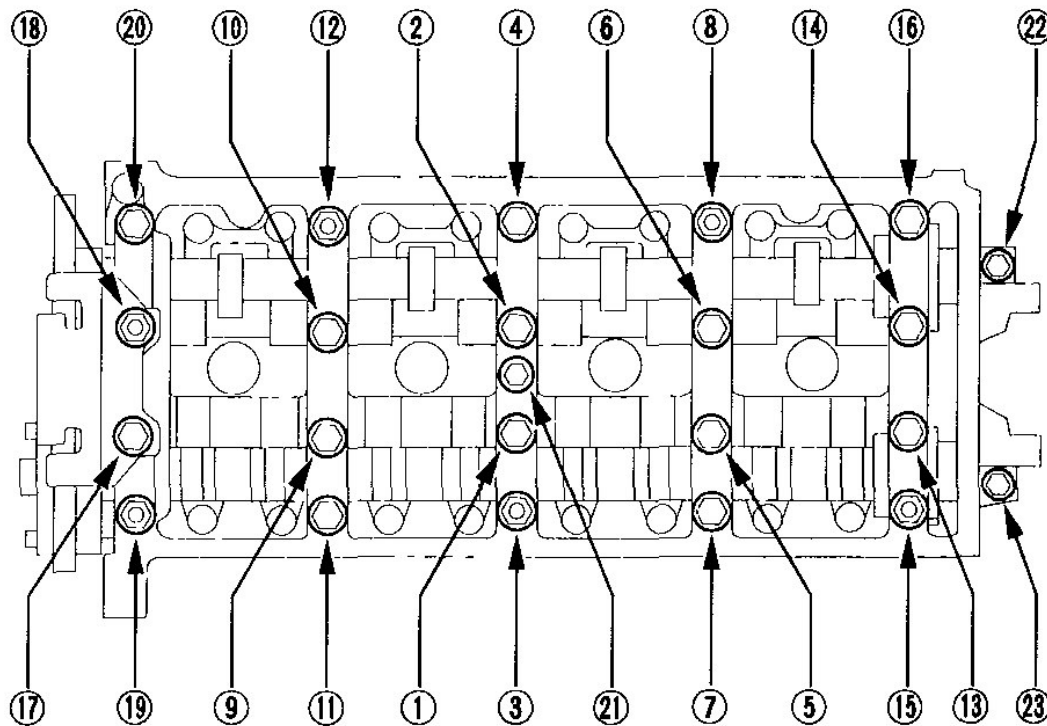
NOTE: If the engine does not have bolt (c), skip it and continue the torque sequence.

Specified Torque

8 mm Bolts: 22 N.m (2.2 kgf.m, 16 lbf.ft)

6 mm Bolts: 12 N.m (1.2 kgf.m, 8.7 lbf.ft)

6 mm Bolts: 21, 22, 23



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Fig. 117: Tightening Bolts In Sequence

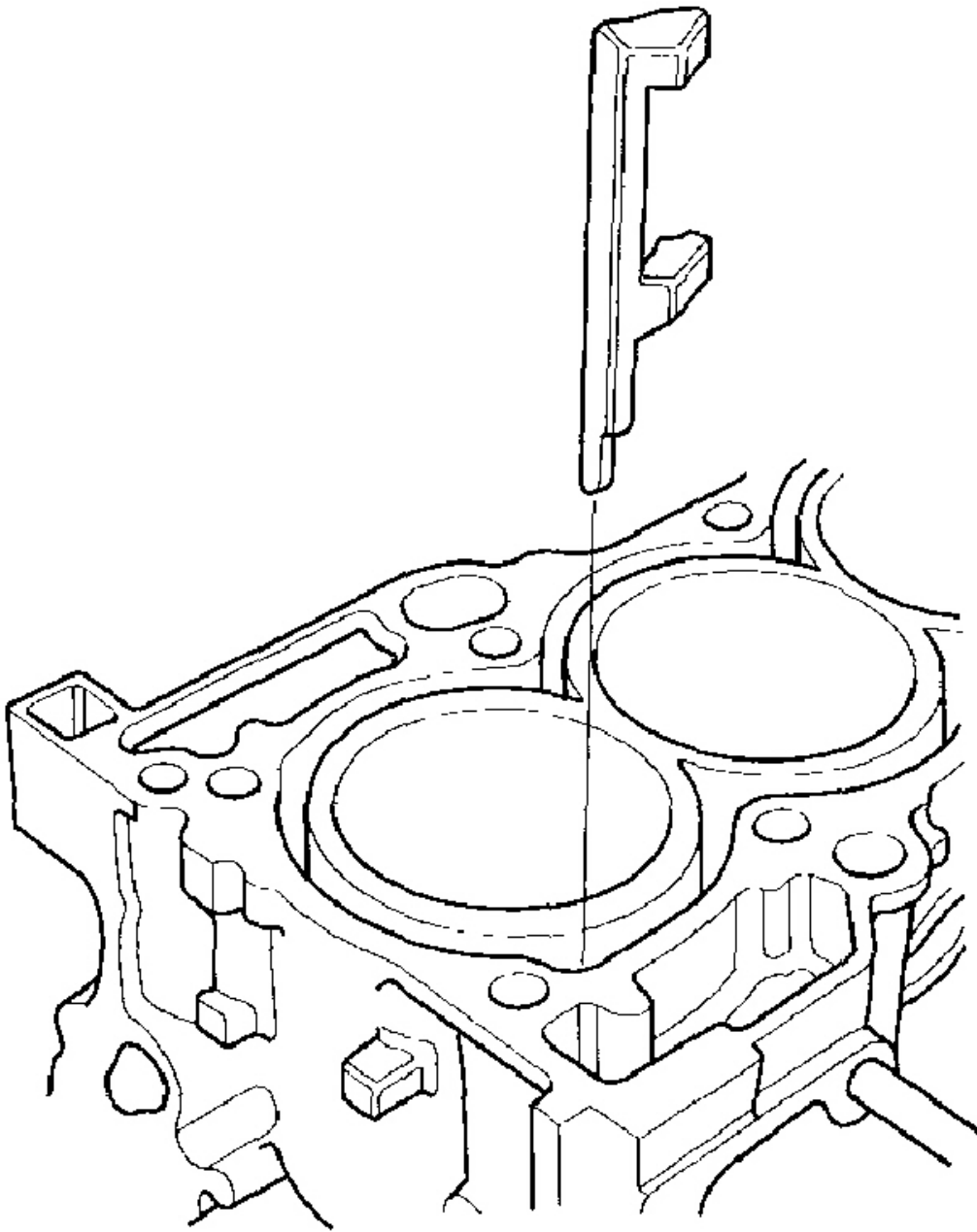
Courtesy of AMERICAN HONDA MOTOR CO., INC.

9. Install the cam chain (see CAM CHAIN INSTALLATION), and adjust the valve clearance (see VALVE CLEARANCE ADJUSTMENT).

CYLINDER HEAD INSTALLATION

Install the cylinder head in the reverse order of removal:

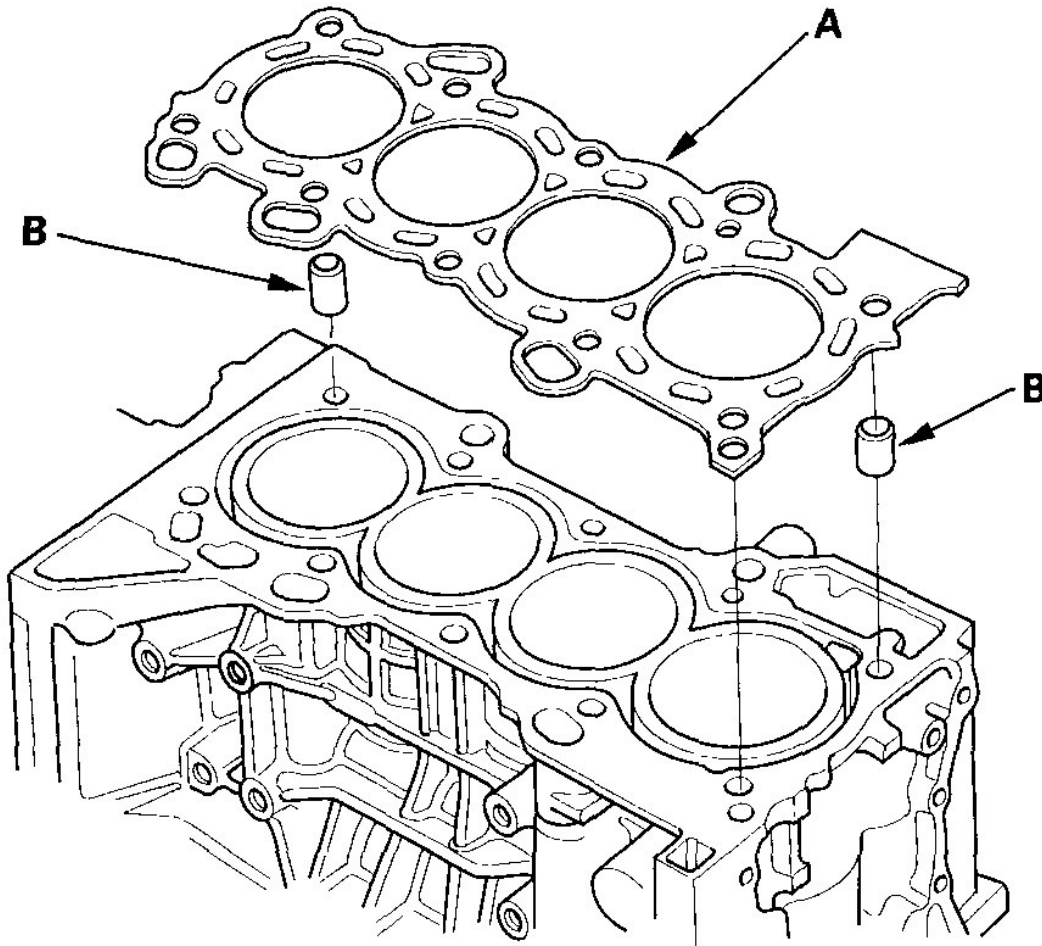
1. Install the new coolant separator in the engine block, when replacing the engine block.



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Fig. 118: Installing Coolant Separator In Engine Block
Courtesy of AMERICAN HONDA MOTOR CO., INC.

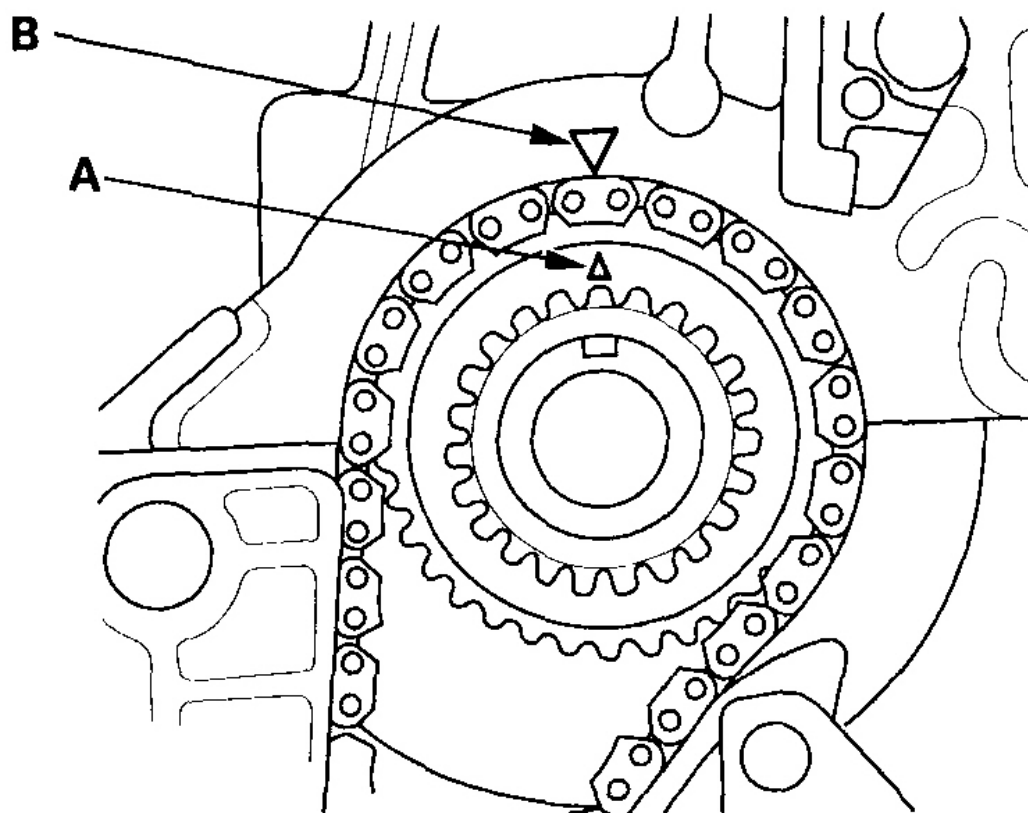
2. Clean the cylinder head and engine block surface.
3. Install the new cylinder head gasket (A) and dowel pins (B) on the engine block. Always use a new cylinder head gasket.



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Fig. 119: Installing Cylinder Head Gasket
Courtesy of AMERICAN HONDA MOTOR CO., INC.

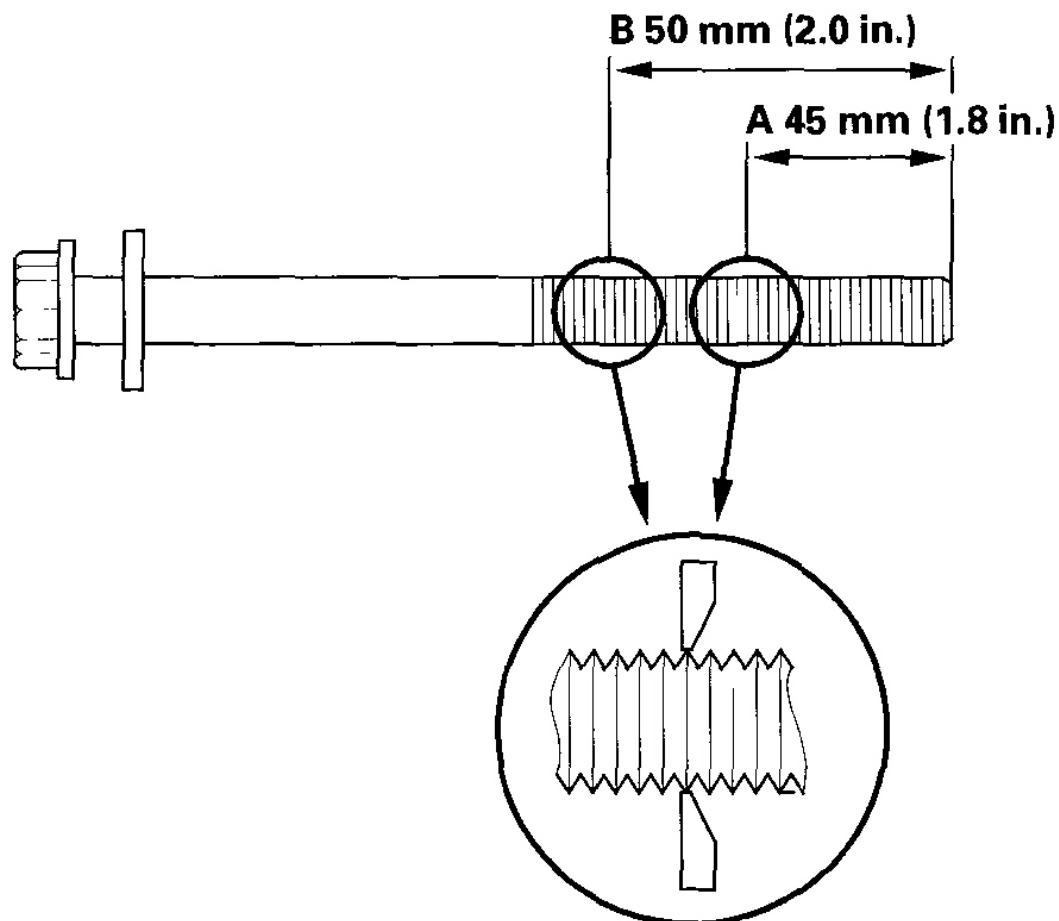
4. Set the crankshaft to top dead center (TDC). Align the TDC mark (A) on the crankshaft sprocket with the pointer (B) on the engine block.



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Fig. 120: Aligning TDC Mark On Crankshaft Sprocket With Pointer On Engine Block
Courtesy of AMERICAN HONDA MOTOR CO., INC.

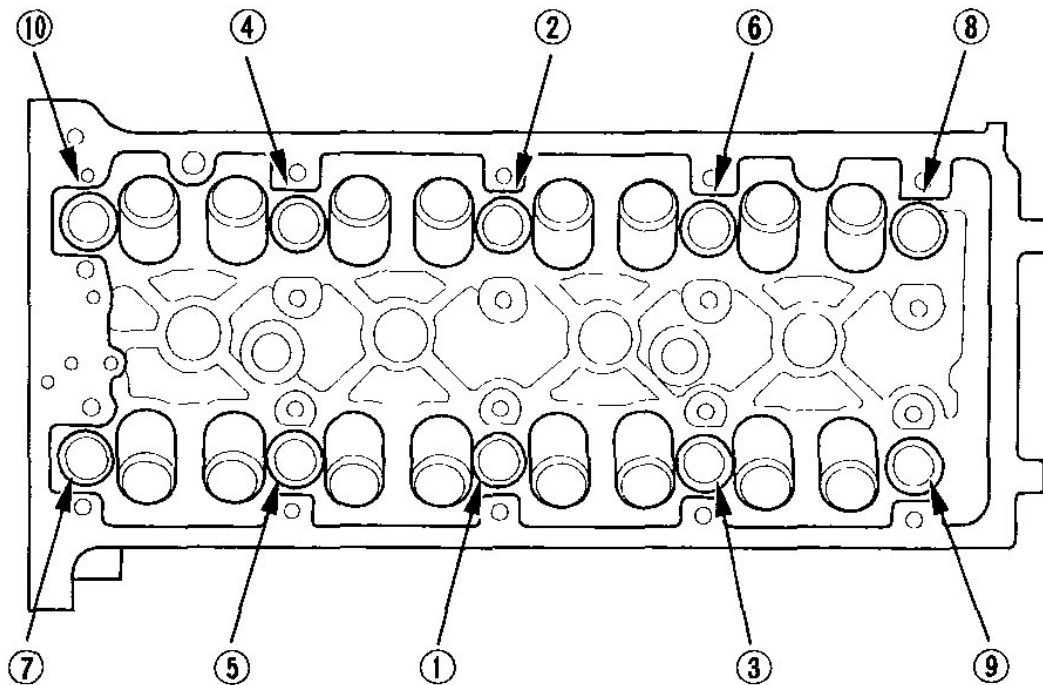
5. Install the cylinder head on the engine block.
6. Measure the diameter of each cylinder head bolt at point A and point B.



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Fig. 121: Identifying Cylinder Head Bolt Diameter
Courtesy of AMERICAN HONDA MOTOR CO., INC.

7. If either diameter is less than 10.6 mm (0.42 in.), replace the cylinder head bolt.
8. Apply new engine oil to the threads and flange of all the cylinder head bolts.
9. Tighten the cylinder head bolts in sequence to 39 N.m (4.0 kgf.m, 29 lbf.ft) using a beam-type torque wrench. When using a preset-type torque wrench, be sure to tighten slowly and do not overtighten. If a bolt makes any noise while you are torquing it, loosen the bolt and retighten it from the first step.



G03677241

Fig. 122: Tightening Cylinder Head Bolts In Sequence
Courtesy of AMERICAN HONDA MOTOR CO., INC.

10. After torquing, tighten all cylinder head bolts in two steps (90° per step) using a torque angle gauge. If you are using a new cylinder head bolt, tighten the bolt an extra 90°.

NOTE: Remove the cylinder head bolt if you tightened it beyond the specified angle, and go back to step 6 of the procedure. Do not loosen it back to the specified angle.

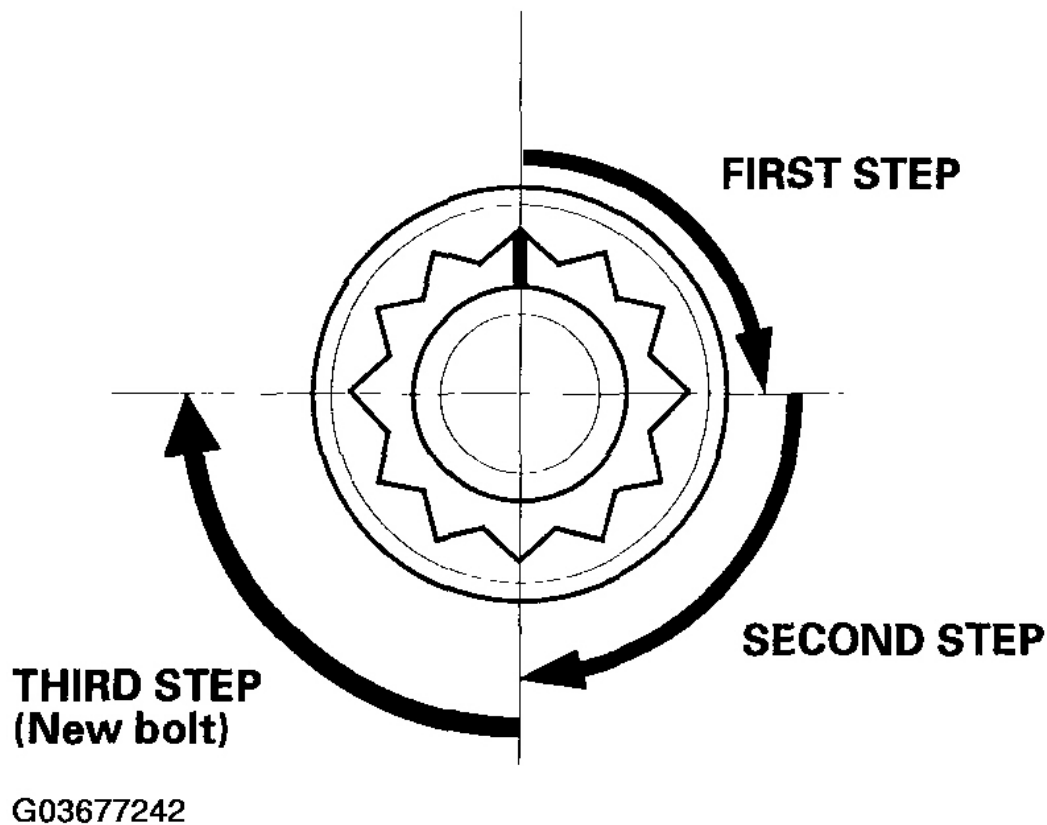
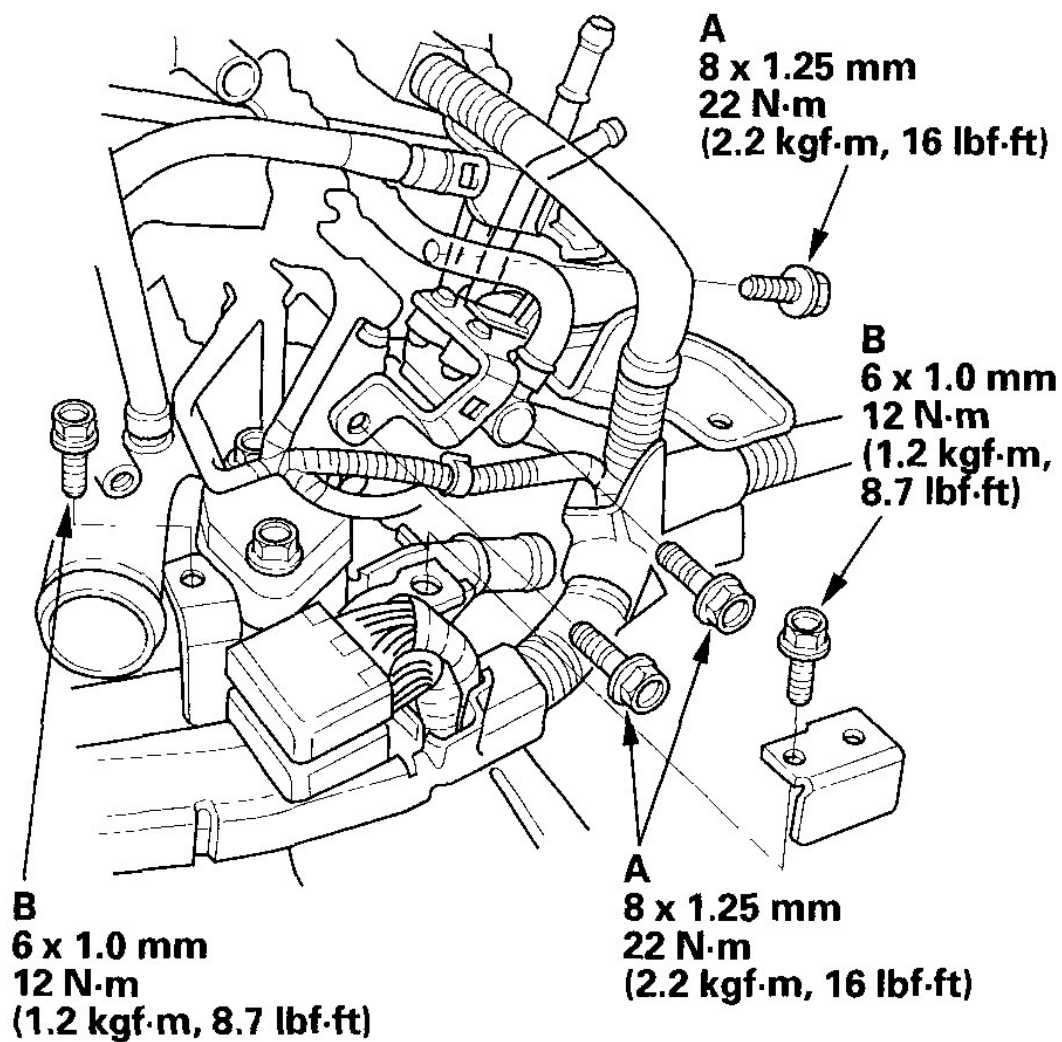


Fig. 123: Cylinder Head Bolts Tightening Instructions
Courtesy of AMERICAN HONDA MOTOR CO., INC.

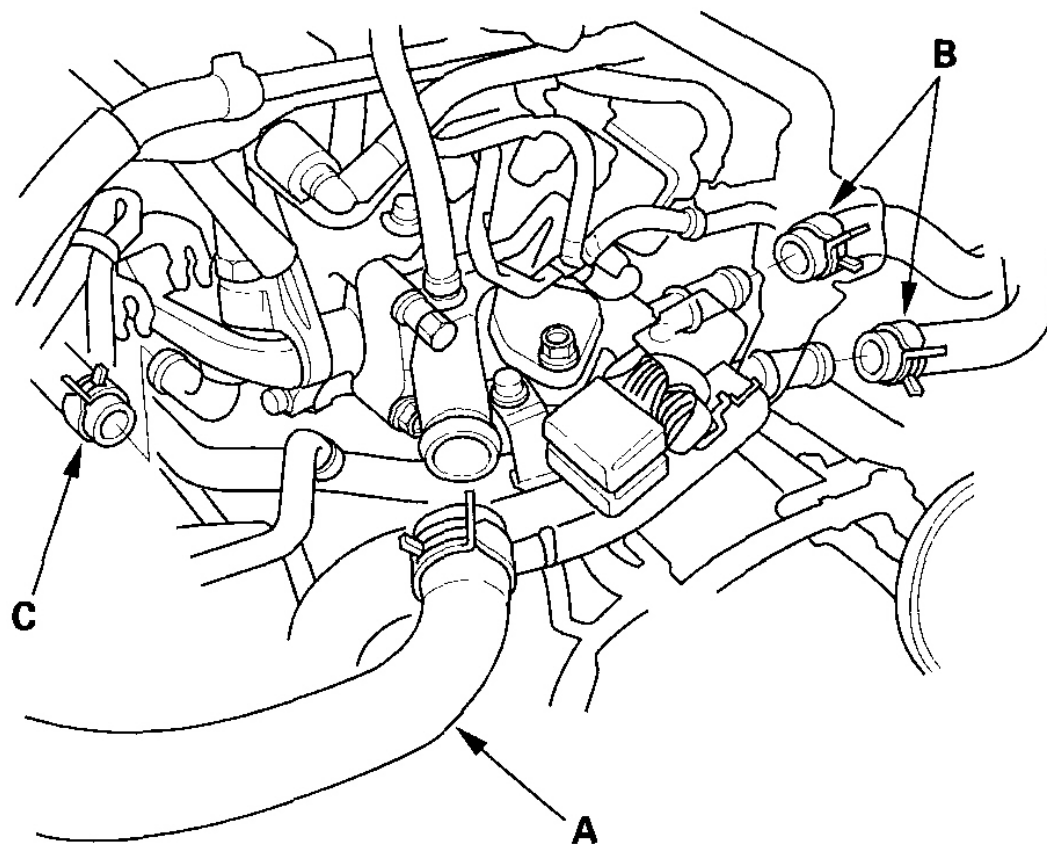
11. Install the rocker arm assembly (see **ROCKER ARM ASSEMBLY INSTALLATION**).
12. Install the cam chain (see **CAM CHAIN INSTALLATION**).
13. Tighten the three bolts (A) securing the evaporative emission (EVAP) canister purge valve bracket, and tighten the two bolts (B) securing the harness brackets.



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Fig. 124: Tightening Bolts Securing Evaporative Emission Canister Purge Valve Bracket
Courtesy of AMERICAN HONDA MOTOR CO., INC.

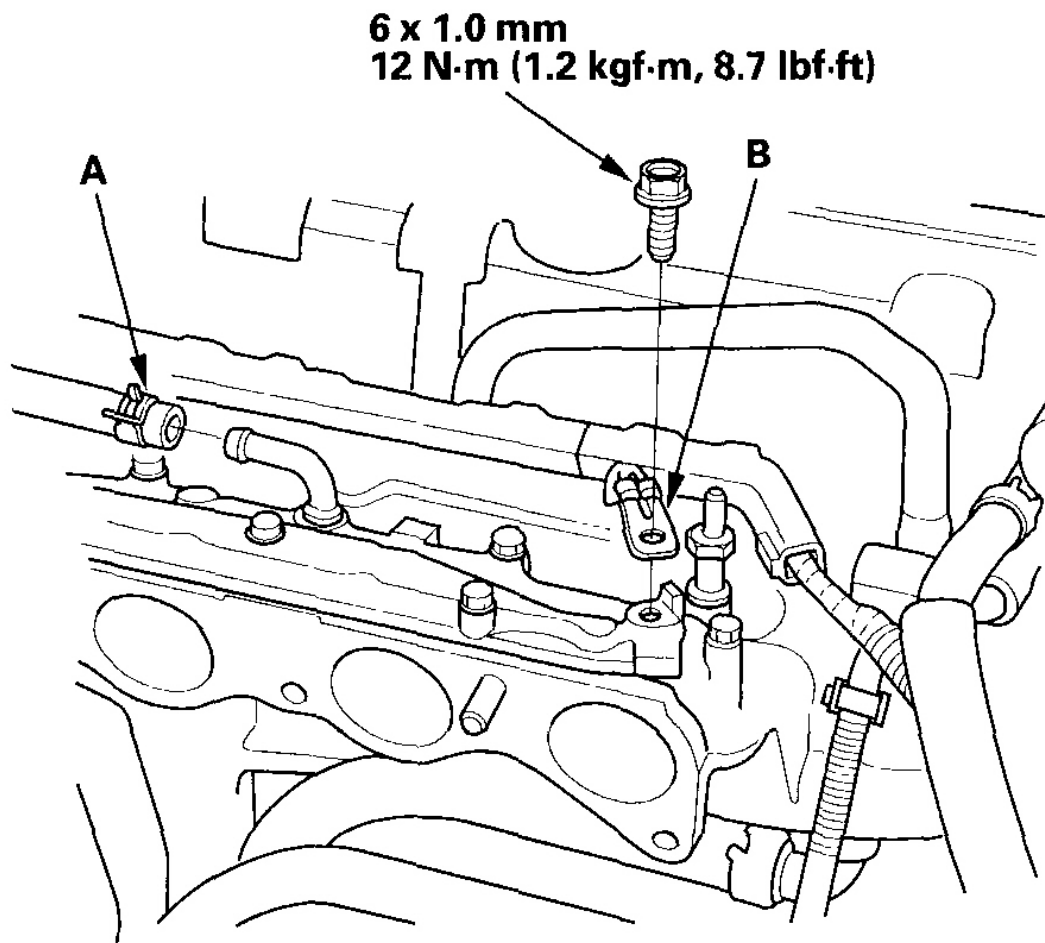
14. Install the upper radiator hose (A), heater hoses (B), and water bypass hose (C).



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Fig. 125: Installing Upper Radiator Hose, Heater Hoses And Water Bypass Hose
Courtesy of AMERICAN HONDA MOTOR CO., INC.

15. Install the positive crankcase ventilation (PCV) hose (A) and ground cable (B).

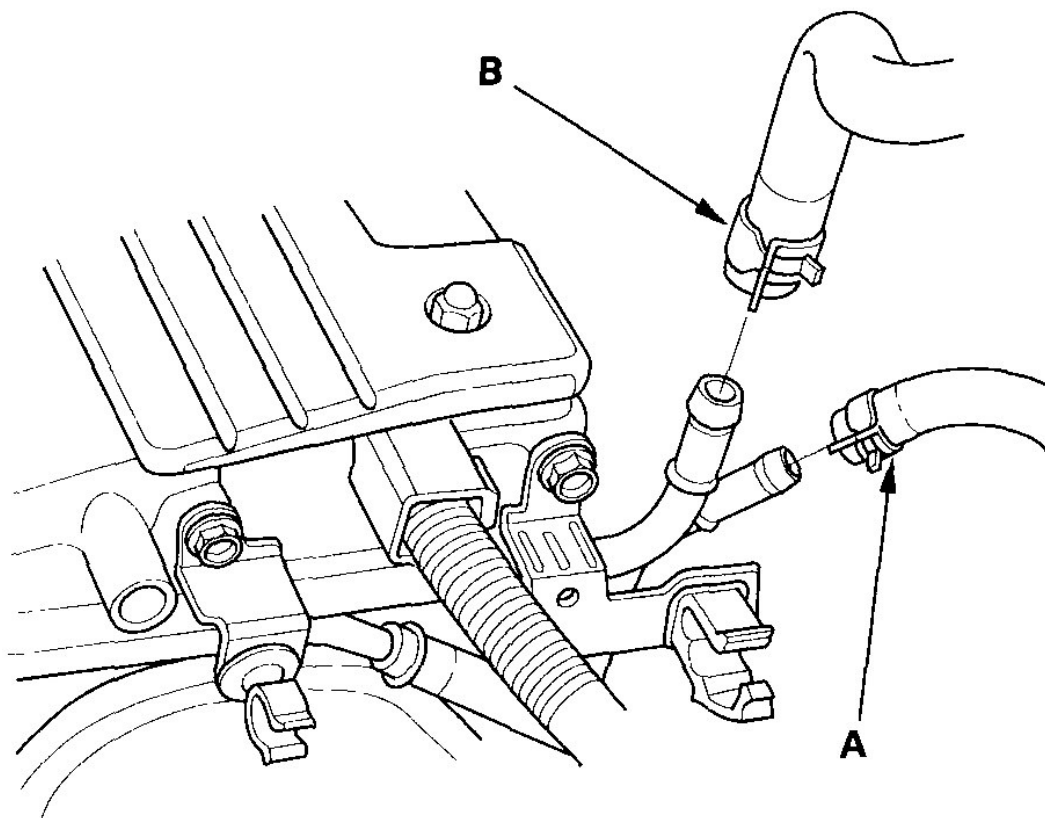


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Fig. 126: Installing Positive Crankcase Ventilation Hose And Ground Cable With Specified Torques

Courtesy of AMERICAN HONDA MOTOR CO., INC.

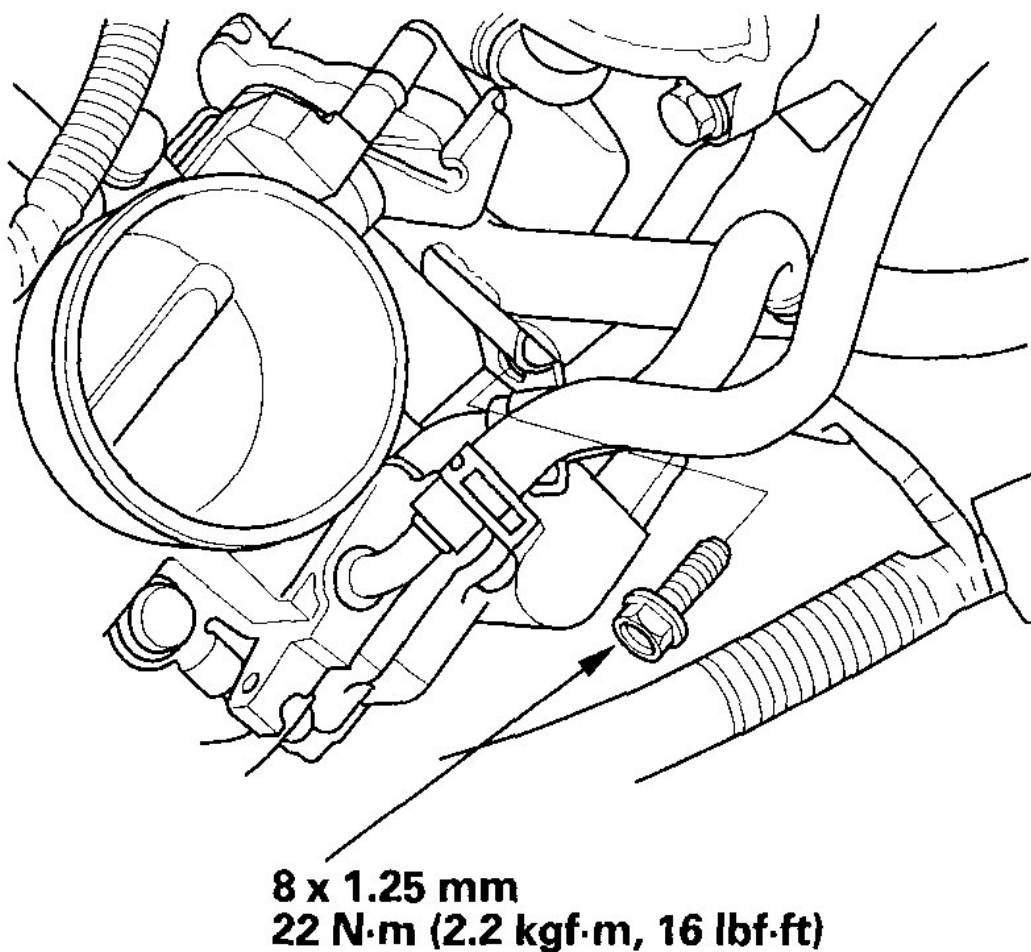
16. Install the exhaust manifold (see **EXHAUST MANIFOLD REMOVAL AND INSTALLATION**).
17. Install the intake manifold (see **INSTALLATION**).
18. Install the EVAP canister hose (A) and brake booster vacuum hose (B).



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Fig. 127: Installing EVAP Canister Hose And Brake Booster Vacuum Hose
Courtesy of AMERICAN HONDA MOTOR CO., INC.

19. Tighten the bolt securing the connecting pipe support bracket to the engine block.

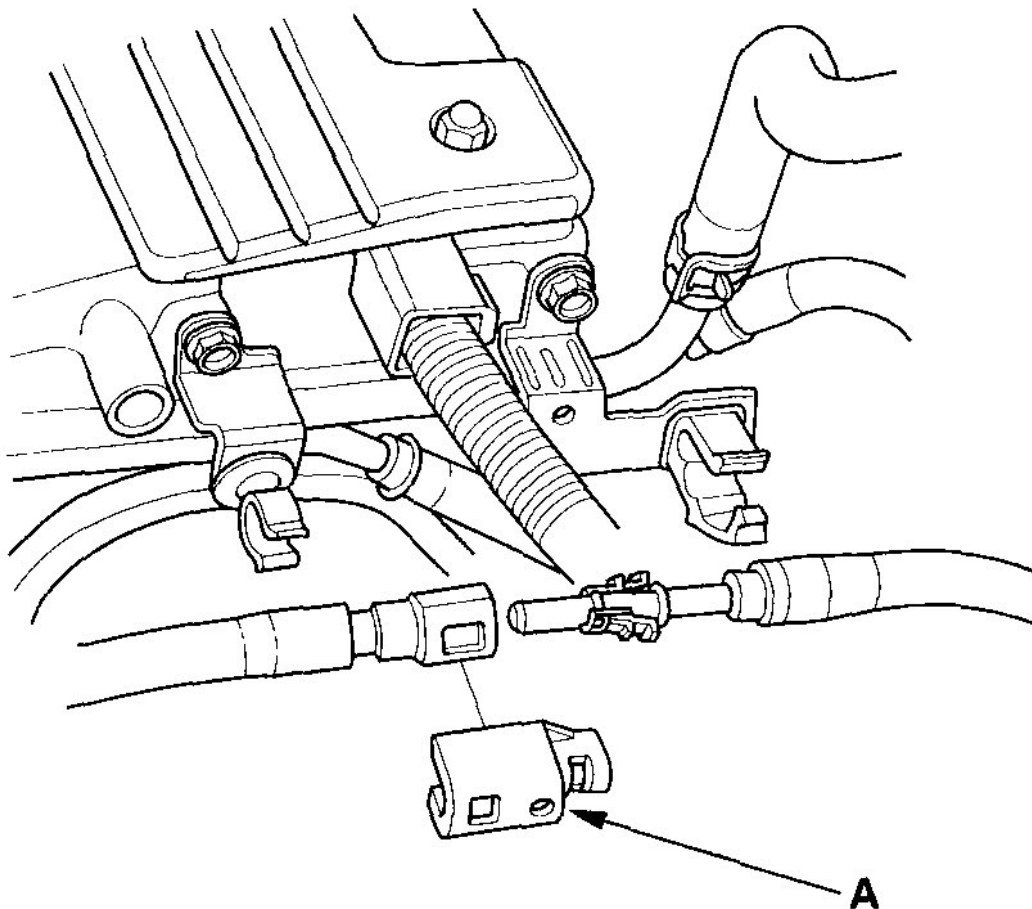


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Fig. 128: Tightening Bolt Securing Connecting Pipe Support Bracket To Engine Block And Torque Specifications

Courtesy of AMERICAN HONDA MOTOR CO., INC.

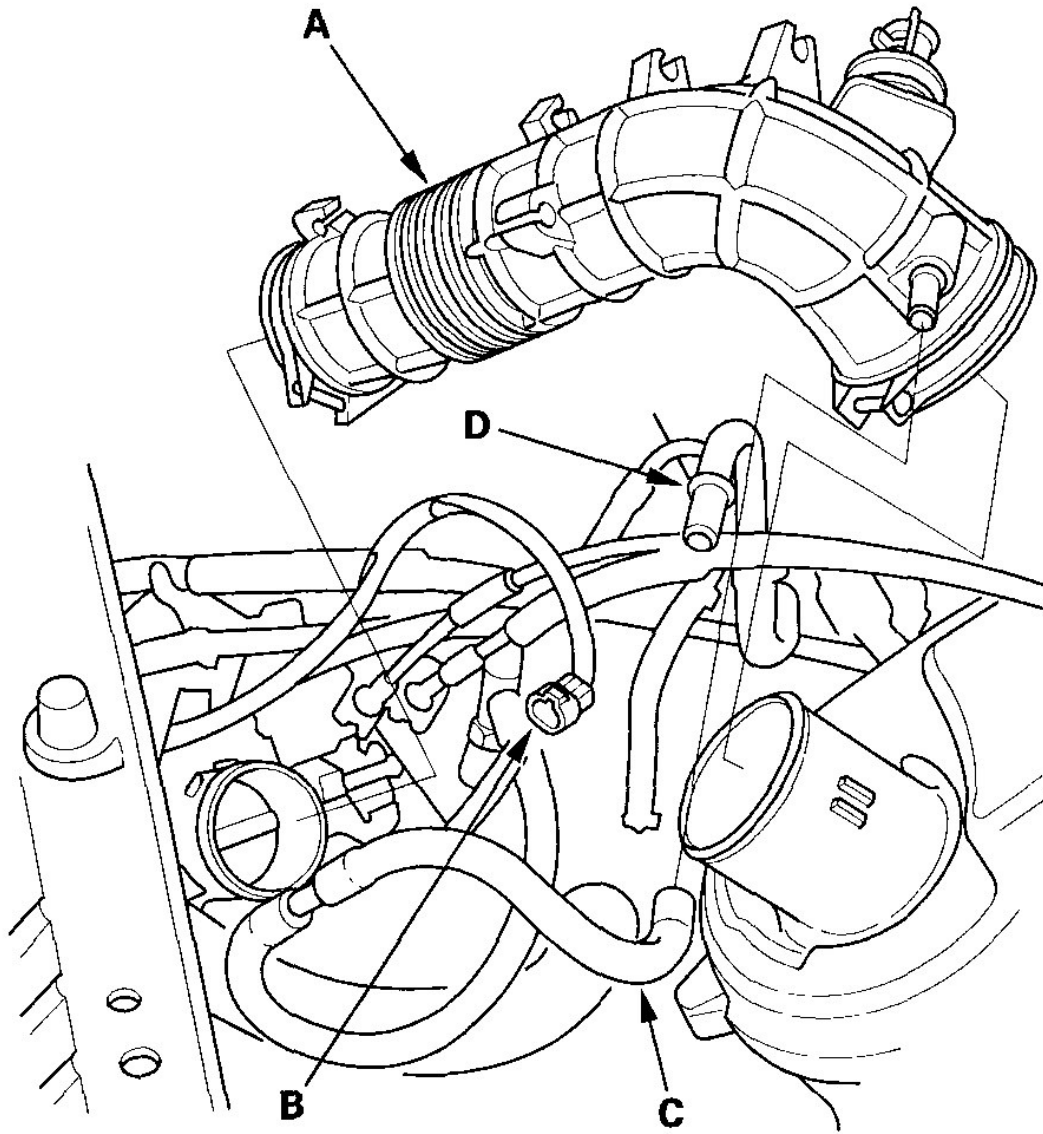
20. Connect the fuel feed hose (see **FUEL LINE/QUICK-CONNECT FITTING INSTALLATION**), then install the quick-connect fitting cover (A).



G03677248

Fig. 129: Connecting Fuel Feed Hose And Installing Quick-Connect Fitting Cover
Courtesy of AMERICAN HONDA MOTOR CO., INC.

21. Install the air intake duct (A), then connect the intake air temperature (IAT) sensor connector (B), and install the vacuum hose (C) and breather pipe (D).



G03677249

Fig. 130: Connecting Intake Air Temperature Sensor Connector And Installing Vacuum Hose And Breather Pipe

Courtesy of AMERICAN HONDA MOTOR CO., INC.

22. Install the drive belt (see **DRIVE BELT INSPECTION**).
23. After installation, check that all tubes, hoses, and connectors are installed correctly.
24. Inspect for fuel leaks. Turn the ignition switch ON (II) (do not operate the starter) so the fuel pump runs for about 2 seconds and pressurizes the fuel line. Repeat this operation two or three times, then check for fuel leakage at any point in the fuel line.

2003 Honda Element DX

2003-06 ENGINE Cylinder Head - Element

25. Refill the radiator with engine coolant, and bleed air from the cooling system with the heater valve open (see **COOLANT CHECK**).
26. Do the crankshaft position (CKP) pattern clear/CKP pattern learn procedure (see **HOW TO END A TROUBLESHOOTING SESSION (REQUIRED AFTER ANY TROUBLESHOOTING)**),
27. Inspect the idle speed (see **IDLE SPEED INSPECTION**).
28. Inspect the ignition timing (see **IGNITION TIMING INSPECTION**).

2003 Honda Element DX

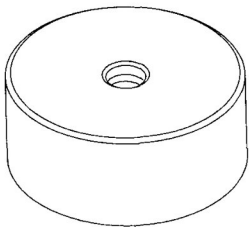
2003-06 ENGINE Engine Block - Element

2003-06 ENGINE

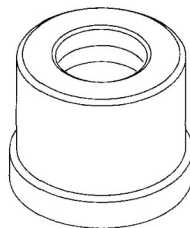
Engine Block - Element

SPECIAL TOOLS

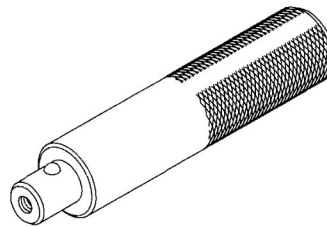
Ref. No.	Tool Number	Description	Qty
①	07ZAD-PNAA100	Oil Seal Driver Attachment 96	1
②	07746-0010700	Attachment, 24 x 26 mm	1
③	07749-0010000	Driver	1



①



②

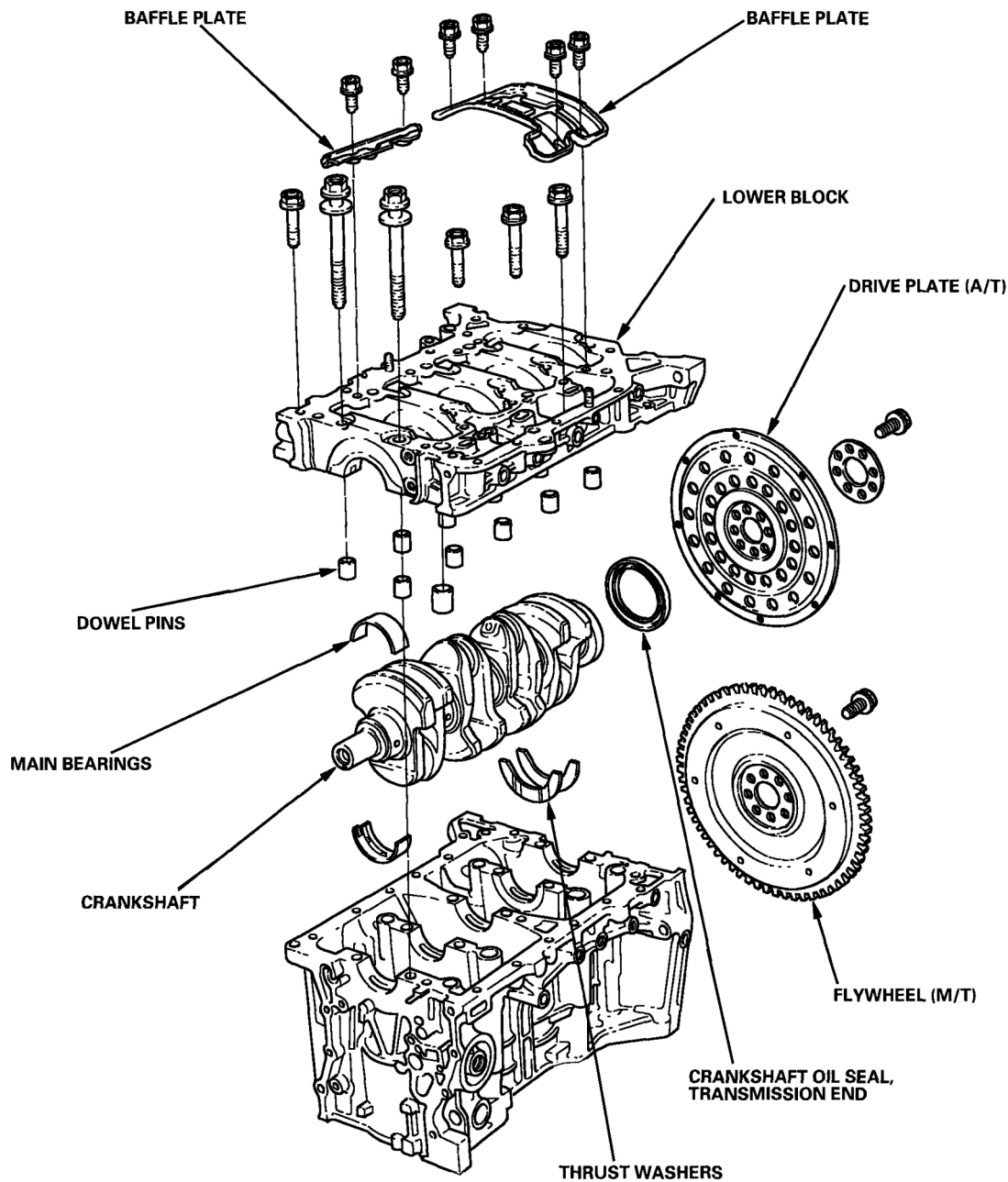


③

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Fig. 1: View Of Special Tools And Description Chart
Courtesy of AMERICAN HONDA MOTOR CO., INC.

COMPONENT LOCATION INDEX

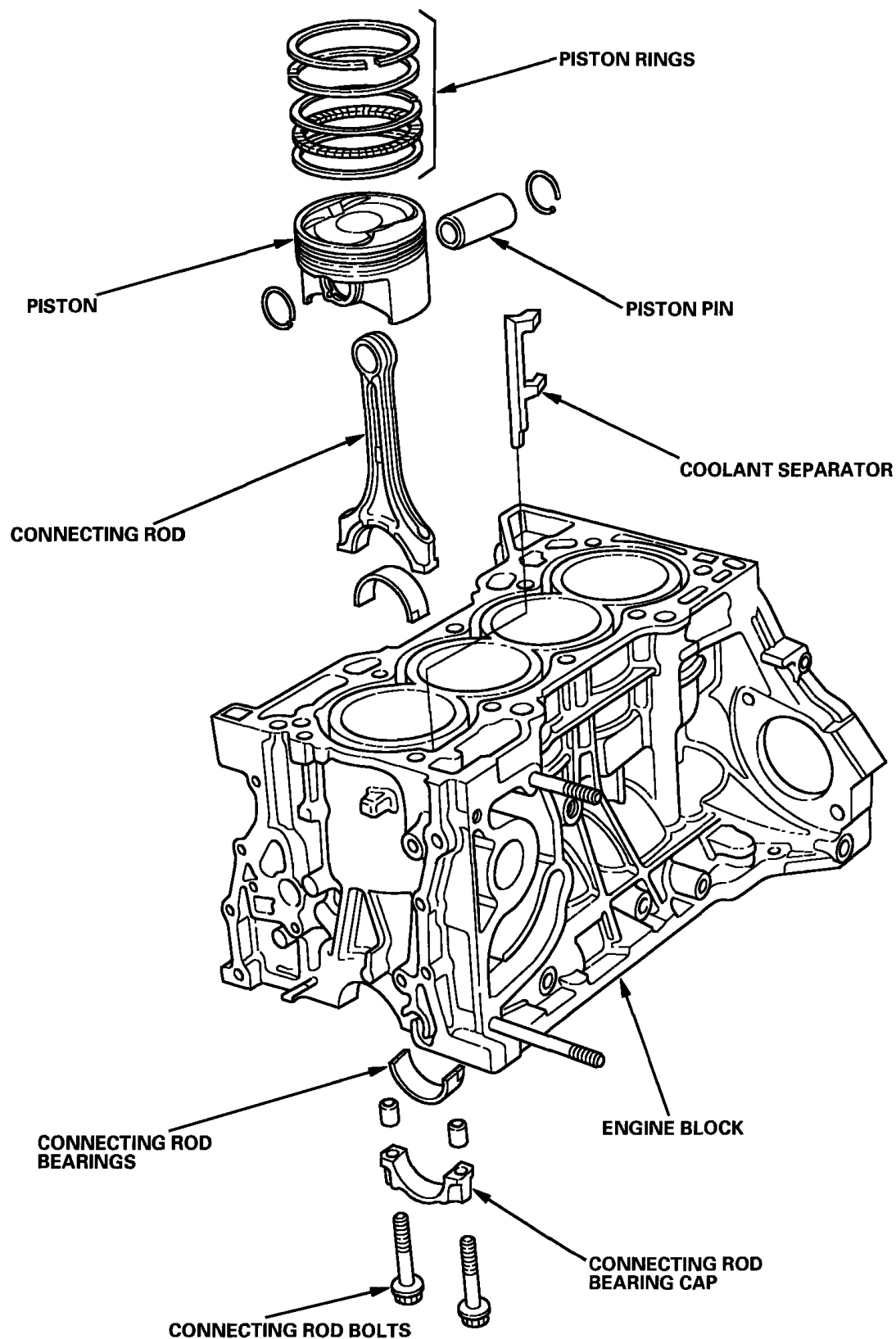


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Fig. 2: Identifying Cylinder Block And Related Components (1 Of 2)
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

2003 Honda Element DX

2003-06 ENGINE Engine Block - Element



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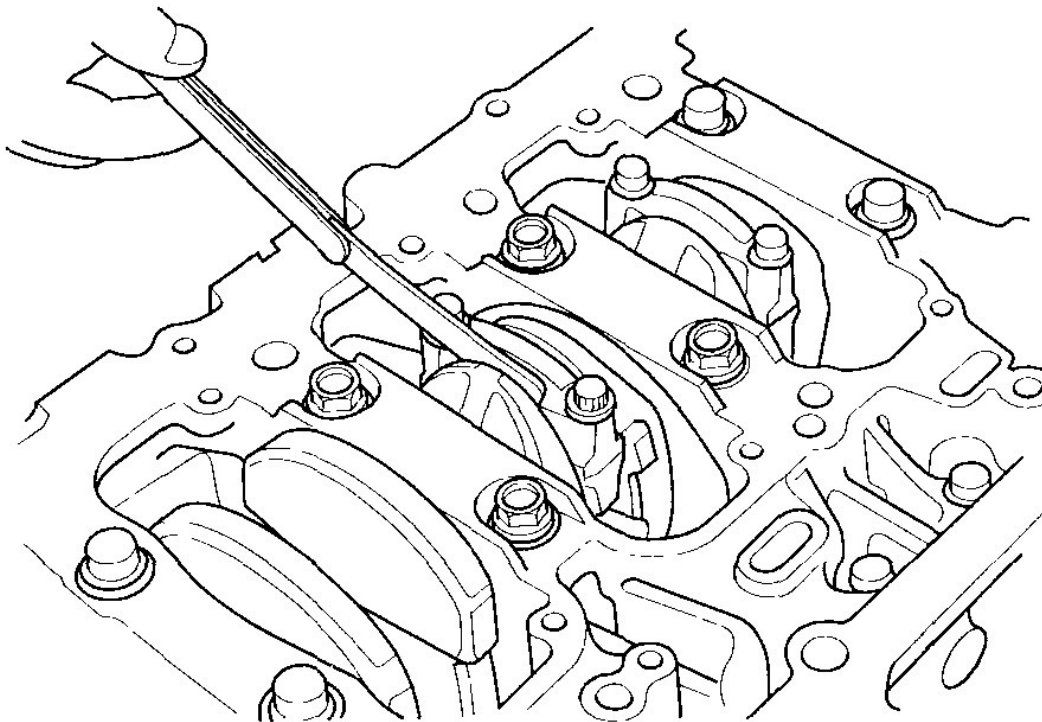
Fig. 3: Identifying Cylinder Block And Related Components (2 Of 2)

Courtesy of AMERICAN HONDA MOTOR CO., INC.

CONNECTING ROD AND CRANKSHAFT END PLAY INSPECTION

1. Remove the oil pump (see **OIL PUMP REMOVAL**).
2. Remove the baffle plates (see step 8).
3. Measure the connecting rod end play with a feeler gauge between the connecting rod and crankshaft.

Connecting Rod End Play

Standard (New): 0.15-0.35 mm (0.006-0.014 in.)**Service Limit: 0.40 mm (0.016 in.)**

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Fig. 4: Measuring Connecting Rod End Play

Courtesy of AMERICAN HONDA MOTOR CO., INC.

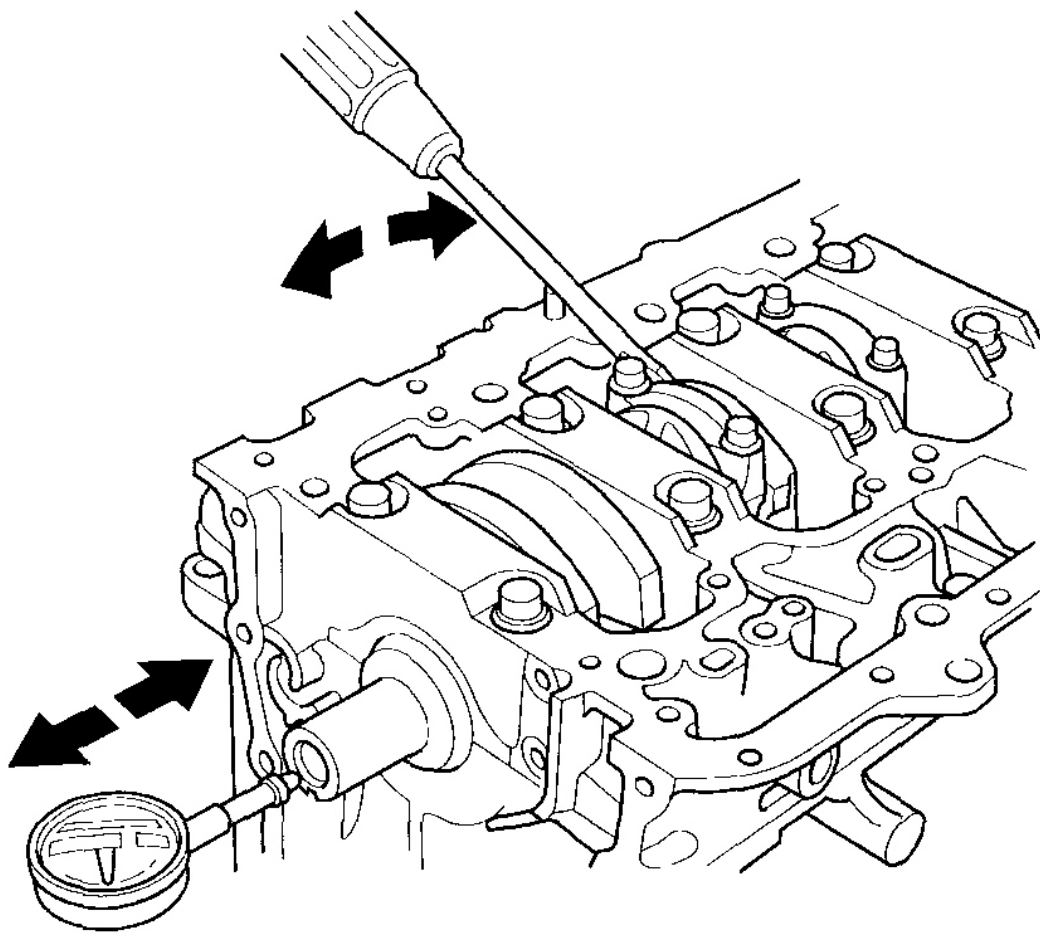
4. If the connecting rod end play is out-of-tolerance, install a new connecting rod, and recheck. If it is still out-of-tolerance, replace the crankshaft (see **CRANKSHAFT AND PISTON REMOVAL**).

5. Push the crankshaft firmly away from the dial indicator, and zero the dial against the end of the crankshaft. Then pull the crankshaft firmly back toward the indicator; the dial reading should not exceed the service limit.

Crankshaft End Play

Standard (New): 0.10-0.35 mm (0.004-0.014 in.)

Service Limit: 0.45 mm (0.018 in.)



G03677254

Fig. 5: Attaching Dial Indicator

Courtesy of AMERICAN HONDA MOTOR CO., INC.

6. If the crankshaft end play is out-of-tolerance, replace the thrust washers, and recheck. If it is still out-of-tolerance, replace the crankshaft (see **CRANKSHAFT AND PISTON REMOVAL**).

CRANKSHAFT MAIN BEARING REPLACEMENT

MAIN BEARING CLEARANCE INSPECTION

1. Remove the lower block and bearing halves (see CRANKSHAFT AND PISTON REMOVAL).
2. Clean each main journal and bearing half with a clean shop towel.
3. Place one strip of plastigage across each main journal.
4. Reinstall the bearings and lower block, then torque the bolts to 29 N.m (3.0 kgf.m, 22 lbf.ft) + 56° using a commercially available torque angle gauge.

NOTE: **Do not rotate the crankshaft during inspection.**

5. Remove the lower block and bearings again, and measure the widest part of the plastigage.

Main Bearing-to-Journal Oil Clearance

No. 1,2,4,5 Journals:

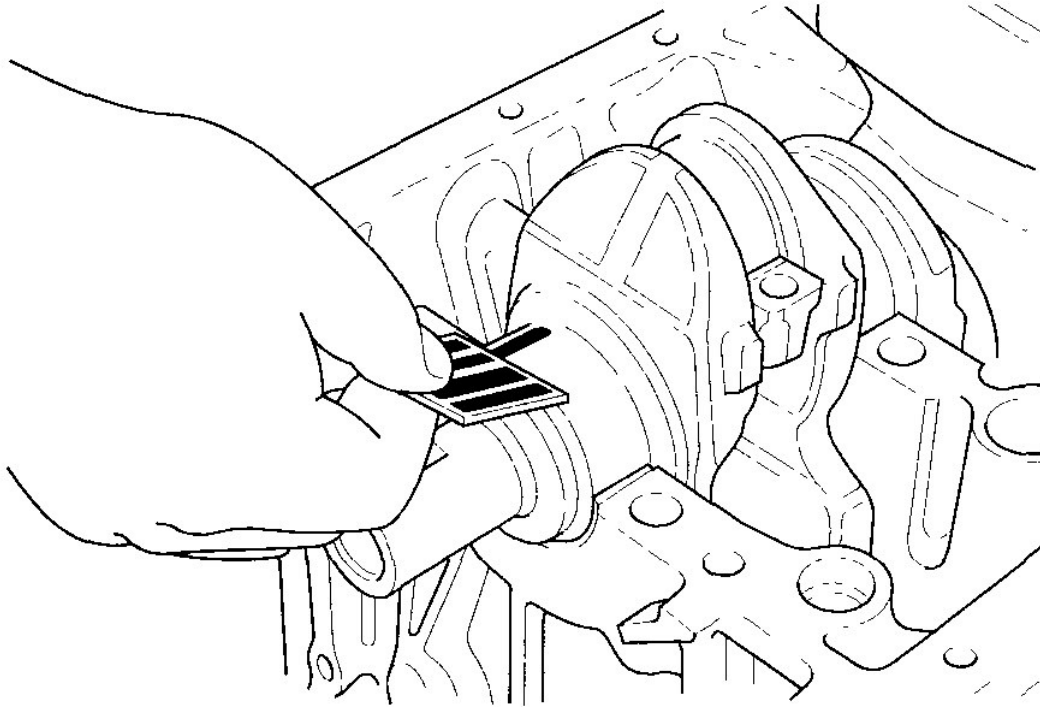
Standard (New): 0.017-0.041 mm (0.0007-0.0016 in.)

Service Limit: 0.050 mm (0.0020 in.)

No. 3 Journal:

Standard (New): 0.025-0.049 mm (0.0010-0.0019 in.)

Service Limit: 0.055 mm (0.0022 in.)



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Fig. 6: Measuring Main Bearing Clearance**Courtesy of AMERICAN HONDA MOTOR CO., INC.**

6. If the plastigage measures too wide or too narrow, remove the crankshaft, and remove the upper half of the bearing. Install a new, complete bearing with the same color code(s), and recheck the clearance. Do not file, shim, or scrape the bearings or the caps to adjust clearance.
7. If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing (the color listed above or below that one), and check again. If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crankshaft and start over.

MAIN BEARING SELECTION

Crankshaft Bore Code Location

1. Numbers or letters or bars have been stamped on the end of the engine block as a code for the size of each of the five main journal bores. Write down the crank bore codes. If you can't read the codes because of accumulated dirt and dust, do not scrub them with a wire brush or scraper. Clean them only with solvent or detergent.

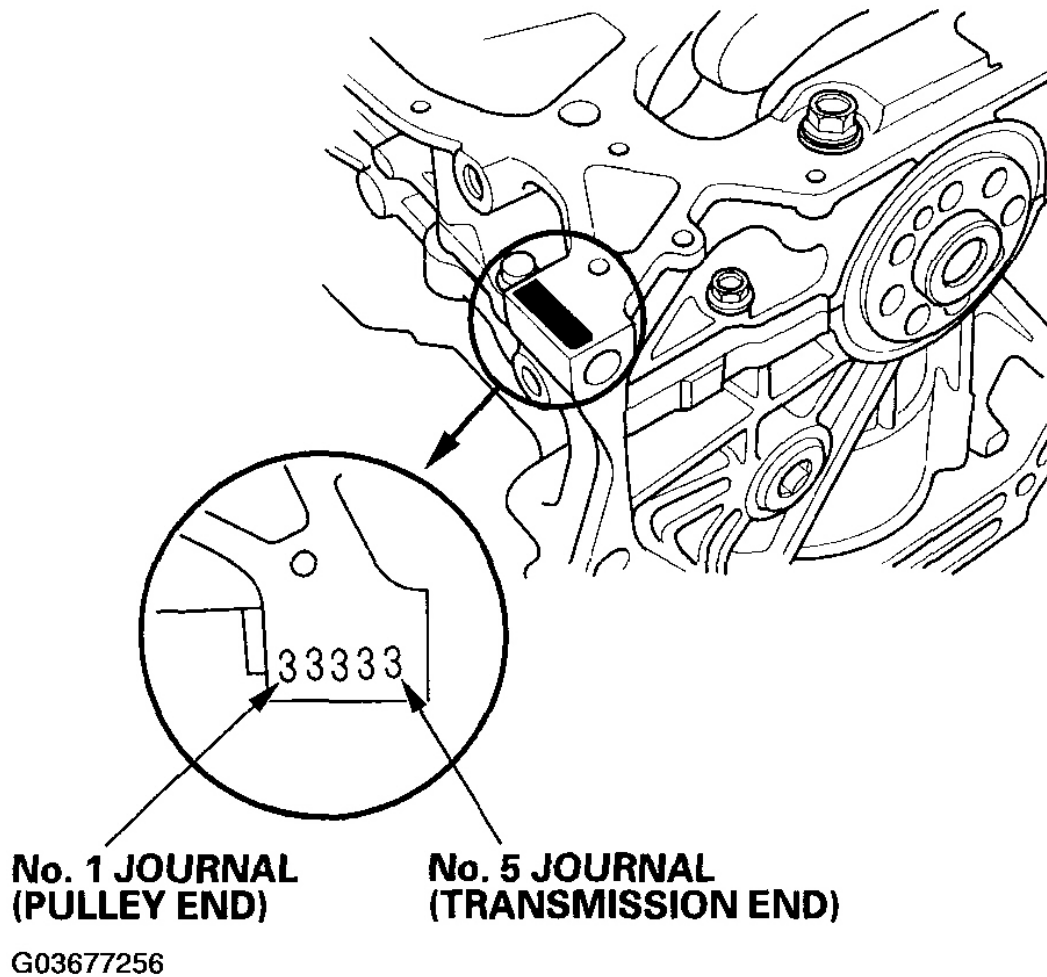


Fig. 7: Locating Crankshaft Bore Code

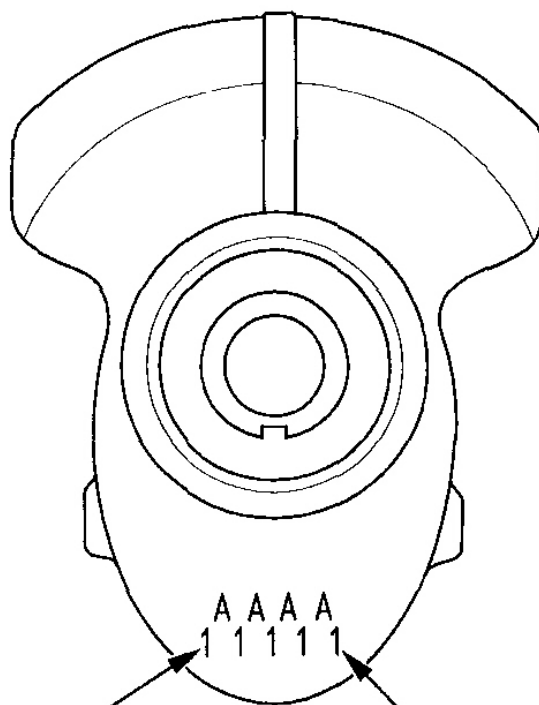
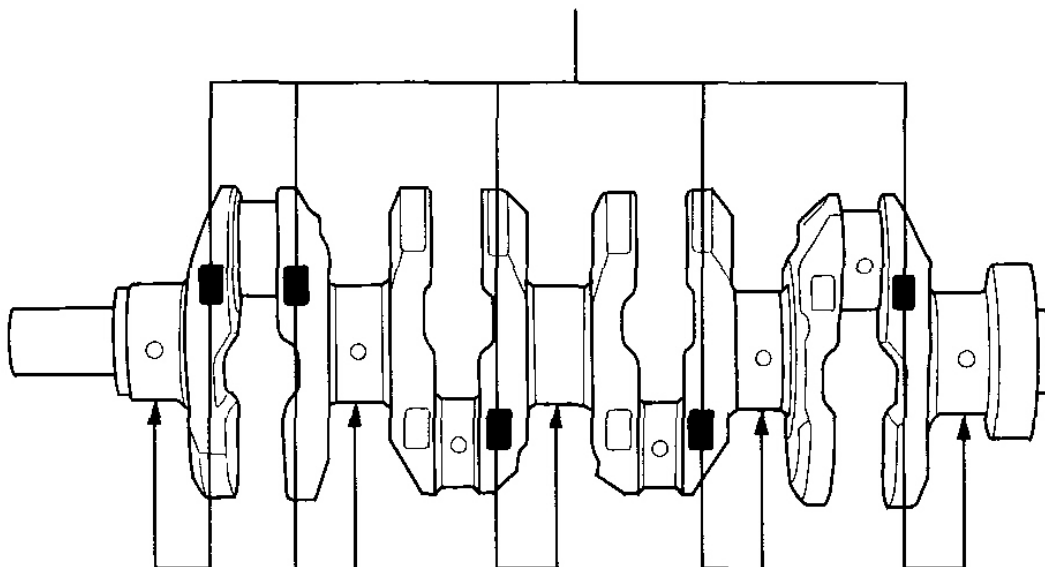
Courtesy of AMERICAN HONDA MOTOR CO., INC.

Main Journal Code Location

2. The main journal codes are stamped on the crankshaft in either location.

2003 Honda Element DX

2003-06 ENGINE Engine Block - Element



No. 1 JOURNAL

No. 5 JOURNAL

G03677257

Fig. 8: Locating Main Journal Code

Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. Use the crank bore codes and crank journal codes to select the appropriate replacement bearings from the following table.

NOTE:

- The color code is on the edge of the bearing.
- When using bearing halves of different colors, it does not matter which color is used in the top or bottom.

Main journal code	Crank bore code	Larger crank bore			
		1 or A or I	2 or B or II	3 or C or III	4 or D or IIII
		Smaller bearing (Thicker)			
1		Pink	Pink/Yellow	Yellow	Green
2		Pink/Yellow	Yellow	Green	Green/Brown
3		Yellow	Green	Green/Brown	Brown
4		Green	Green/Brown	Brown	Black
5		Green/Brown	Brown	Black	Black/Blue
6		Brown	Black	Black/Blue	Blue

Smaller main journal

Smaller bearing (Thicker)

G03677258

Fig. 9: Crank Bore Codes And Crank Journal Codes Specifications

Courtesy of AMERICAN HONDA MOTOR CO., INC.

CONNECTING ROD BEARING REPLACEMENT

ROD BEARING CLEARANCE INSPECTION

1. Remove the oil pump (see **OIL PUMP REMOVAL**).
2. Remove the baffle plates (see step 8).
3. Remove the connecting rod cap and bearing half.
4. Clean the crankshaft rod journal and bearing half with a clean shop towel.
5. Place plastigage across the rod journal.
6. Reinstall the bearing half and cap, and torque the bolts to 20 N.m (2.0 kgf.m, 14 lbf.ft) + 90° using a commercially available torque angle gauge.

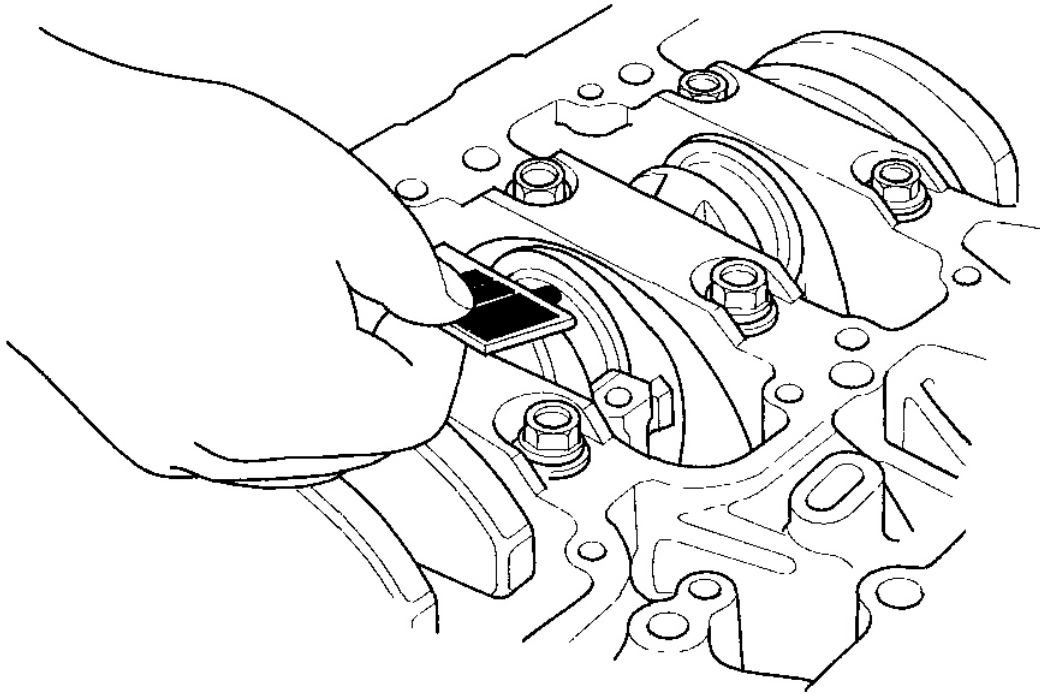
NOTE: **Do not rotate the crankshaft during inspection.**

7. Remove the rod cap and bearing half, and measure the widest part of the plastigage.

Connecting Rod Bearing-to-Journal Oil Clearance

Standard (New): 0.020-0.050 mm (0.0008-0.0020 in.)

Service Limit: 0.060 mm (0.0024 in.)



G03677259

Fig. 10: Measuring Connecting Rod Bearing Clearance
Courtesy of AMERICAN HONDA MOTOR CO., INC.

8. If the plastigage measures too wide or too narrow, remove the upper half of the bearing, install a new, complete bearing with the same color code(s), and recheck the clearance. Do not file, shim, or scrape the bearings or the caps to adjust clearance.
9. If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing (the color listed above or below that one), and check clearance again. If the proper clearance cannot be obtained by using the appropriate larger or smaller bearing, replace the crankshaft and start over.

ROD BEARING SELECTION

1. Inspect each connecting rod for cracks and heat damage.

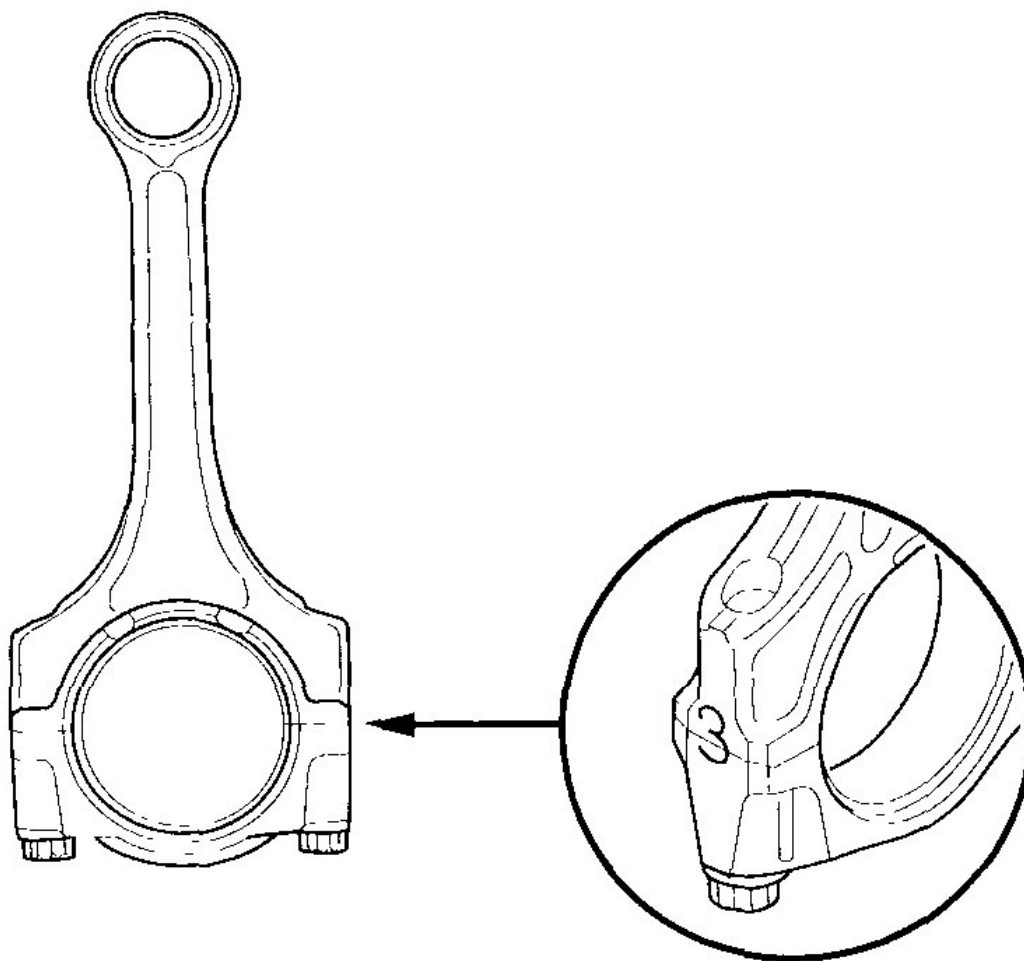
Connecting Rod Big End Bore Code Locations

2. Each rod has a tolerance range from 0 to 0.024 mm (0.0009 in.), and in 0.006 mm (0.0002 in.) increments, depending on the size of its big end bore. It's then stamped with a number or bar (1, 2, 3, or 4/I, II, III, or IV) indicating the range. You may find any combination of numbers and bars in any engine. (Half the number or bar is stamped on the bearing cap, the other half is on the rod.)

If you can't read the code because of an accumulation of oil and varnish, do not scrub it with a wire brush

or scraper. Clean it only with solvent or detergent.

Normal Bore Size: 51.0 mm (2.01 in.)



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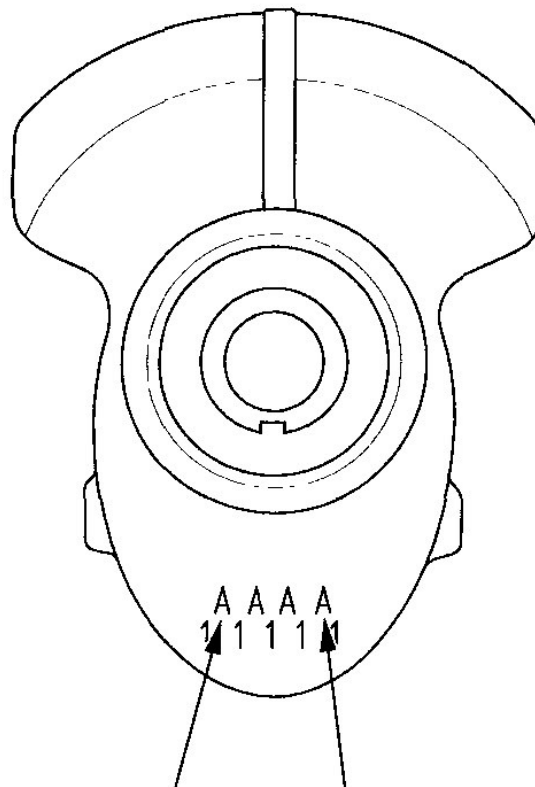
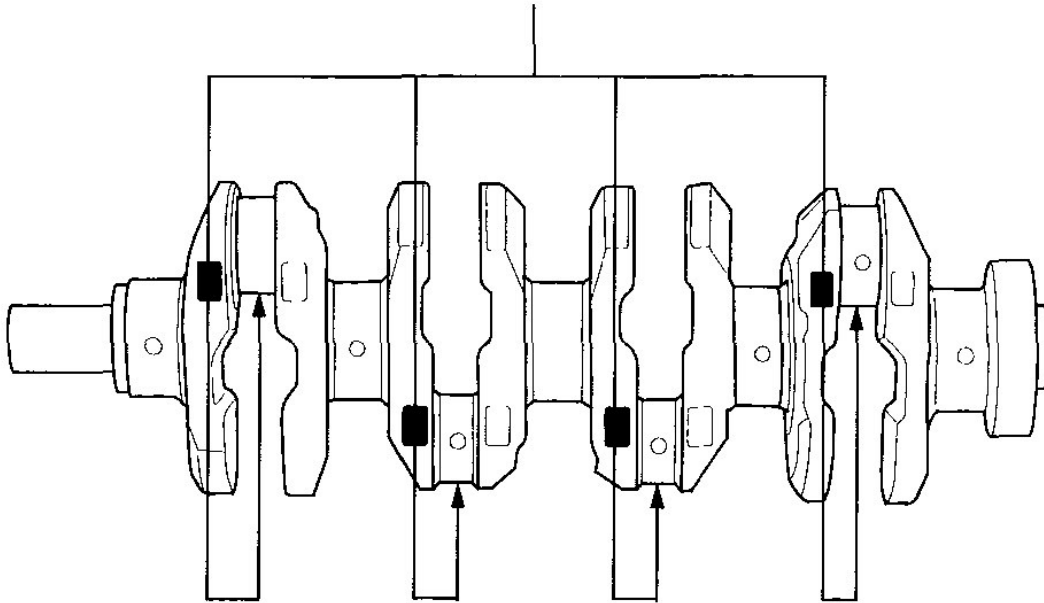
Fig. 11: Locating Connecting Rod Big End Bore Code
Courtesy of AMERICAN HONDA MOTOR CO., INC.

Connecting Rod Journal Code Location

3. The connecting rod journal codes are stamped on the crankshaft in either location.

2003 Honda Element DX

2003-06 ENGINE Engine Block - Element

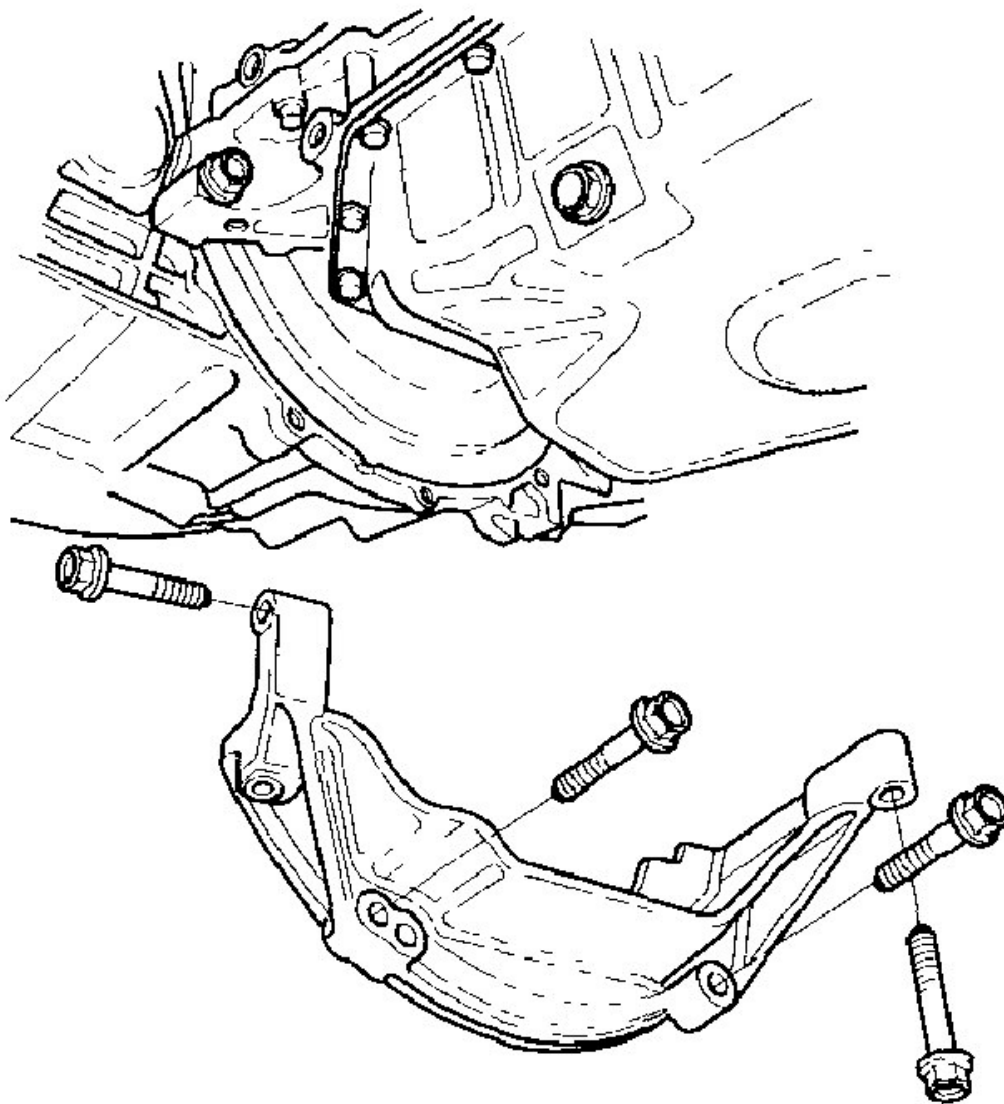


No. 1 JOURNAL No. 4 JOURNAL

G03677261

OIL PAN REMOVAL

1. Drain the engine oil (see '**ENGINE OIL REPLACEMENT**').
2. If the engine is still in the vehicle, remove the subframe.
 - 1 Attach the engine support hanger to the engine (see step 44 on **ENGINE REMOVAL**).
 - 2 Disconnect the suspension lower arm ball joints (see **LOWER ARM REPLACEMENT**).
 - 3 Remove the rear mount mounting bolts (see step 50 on **ENGINE REMOVAL**).
 - 4 Remove the front mount mounting bolt (see step 51 on **ENGINE REMOVAL**).
 - 5 A/T model: Remove the automatic transmission fluid (ATF) filter mounting bolt (see step 37 on **ENGINE REMOVAL**).
 - 6 Make the appropriate reference lines at positions A and B that line up with the center of the subframe mounting bolts (see step 52 on **ENGINE REMOVAL**).
 - 7 Attach the special tool to the subframe, then attach the jack to the special tool (see step 53 on **ENGINE REMOVAL**).
 - 8 Remove the front subframe mounting bolts, then lower the subframe (see step 55 on **ENGINE REMOVAL**).
3. M/T model: Remove the stiffener.

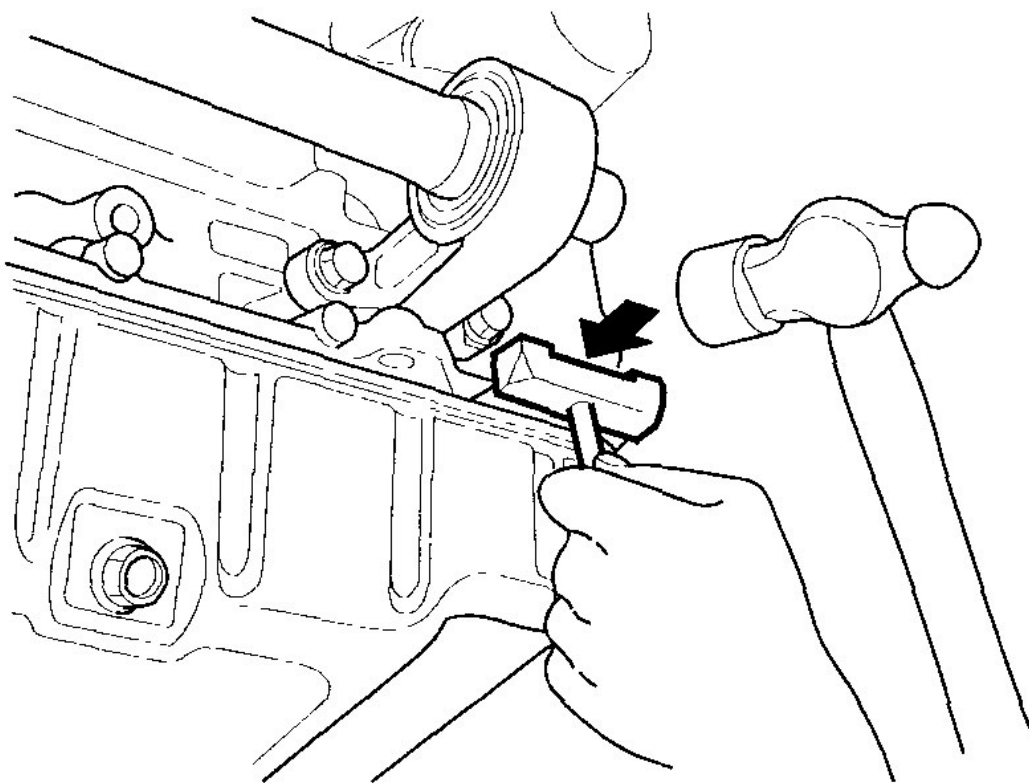


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Fig. 14: Removing Stiffener (M/T Model)

Courtesy of AMERICAN HONDA MOTOR CO., INC.

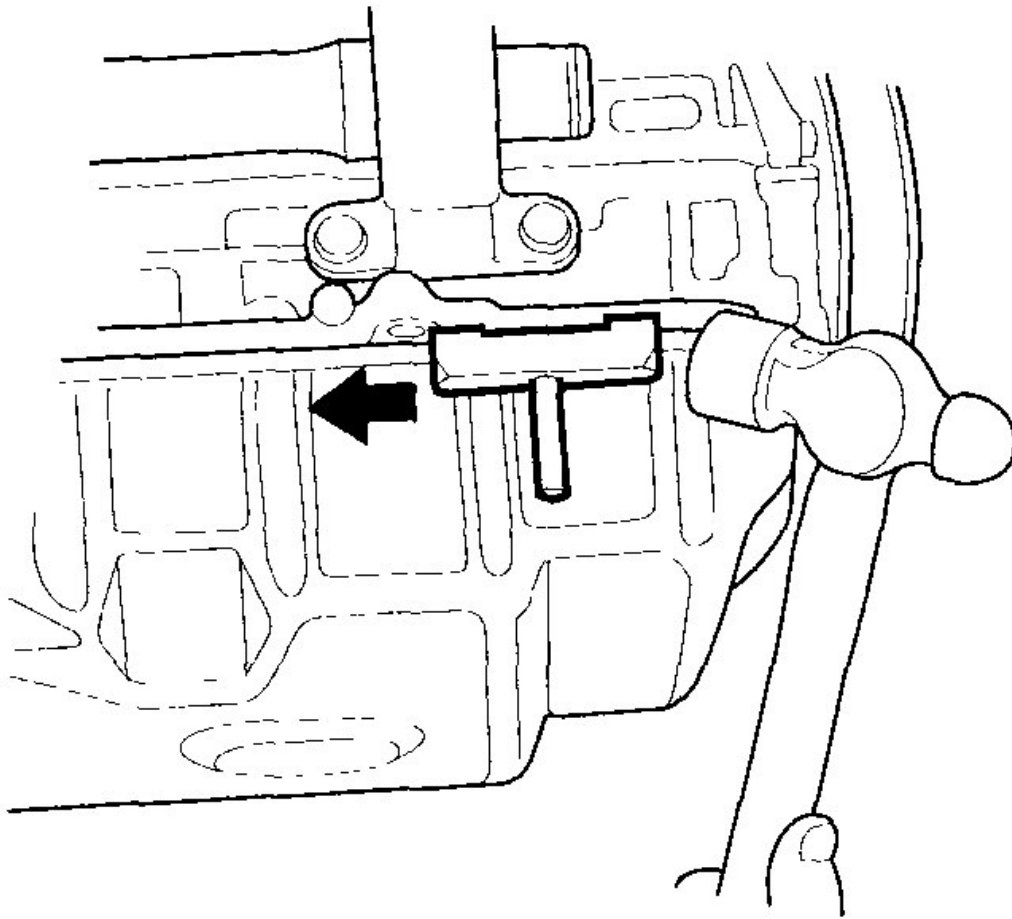
4. Remove the bolts/nuts securing the oil pan.
5. Drive an oil pan seal cutter between the oil pan and engine block.



G03677264

Fig. 15: Inserting Oil Pan Seal Cutter Between Oil Pan And Engine Block
Courtesy of AMERICAN HONDA MOTOR CO., INC.

6. Cut the oil pan seal by striking the side of the cutter to slide the cutter along the oil pan.



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Fig. 16: Cutting Oil Pan Seal

Courtesy of AMERICAN HONDA MOTOR CO., INC.

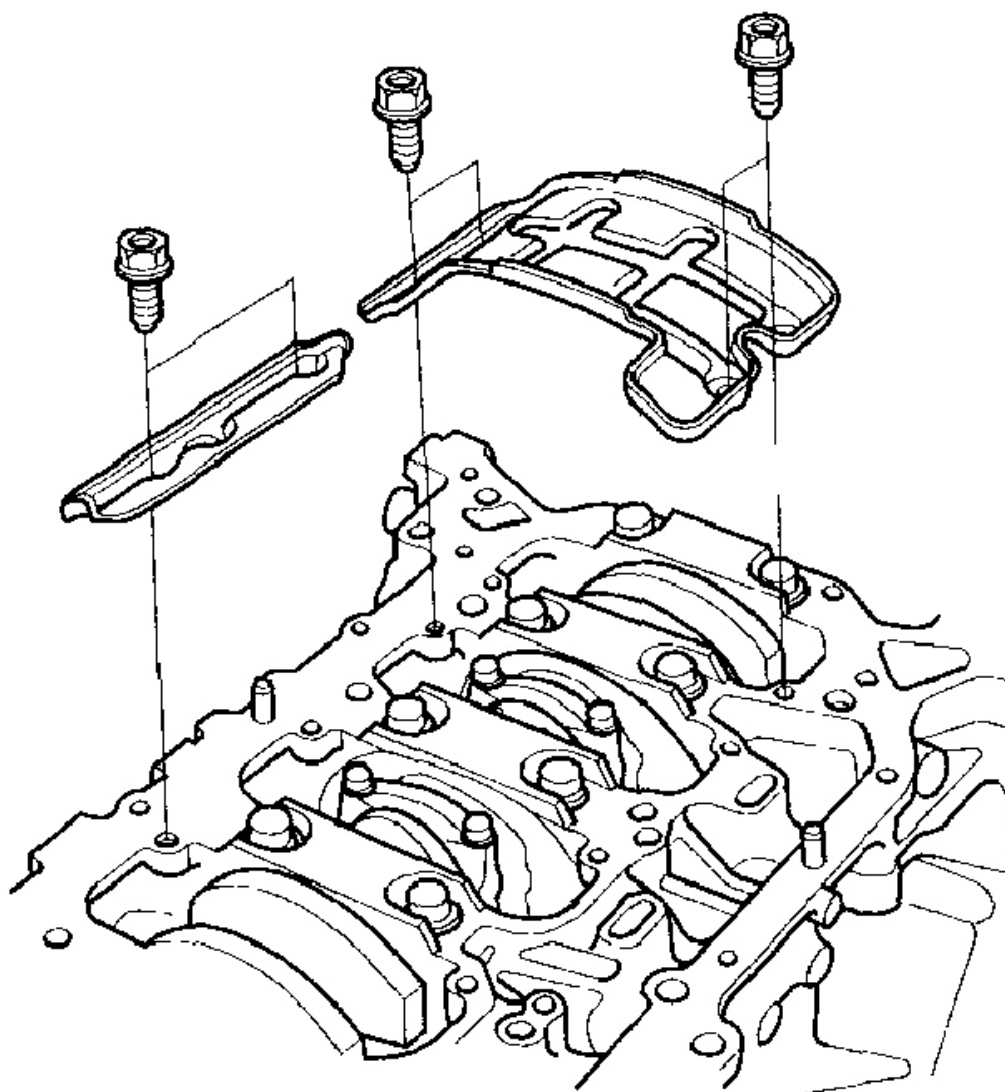
7. Remove the oil pan.

CRANKSHAFT AND PISTON REMOVAL

1. Remove the engine assembly (see ENGINE REMOVAL).
2. Remove the transmission:
 - Manual transmission (see TRANSMISSION REMOVAL)
 - Automatic transmission (see TRANSMISSION REMOVAL)
3. M/T model: Remove the pressure plate (see PRESSURE PLATE AND CLUTCH DISC REMOVAL),

clutch disc (see **PRESSURE PLATE AND CLUTCH DISC REMOVAL**), and flywheel (see **FLYWHEEL INSPECTION**).

4. A/T model: Remove the drive plate (see **DRIVE PLATE REMOVAL AND INSTALLATION**).
5. Remove the oil pan (see **OIL PAN REMOVAL**).
6. Remove the oil pump (see **OIL PUMP REMOVAL**).
7. Remove the cylinder head (see **CYLINDER HEAD REMOVAL**).
8. Remove the baffle plates.

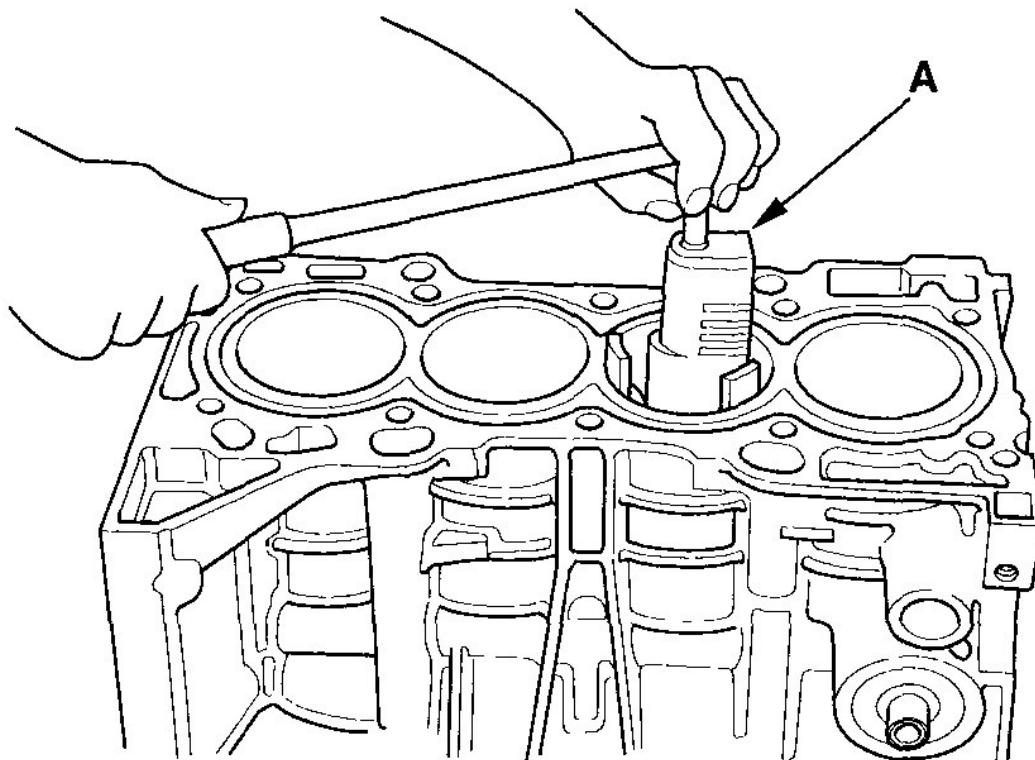


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Fig. 17: Removing Baffle Plates

Courtesy of AMERICAN HONDA MOTOR CO., INC.

9. If you can feel a ridge of metal or hard carbon around the top of each cylinder, remove it with a ridge reamer (A). Follow the reamer manufacturer's instructions. If the ridge is not removed, it may damage the pistons as they are pushed out.

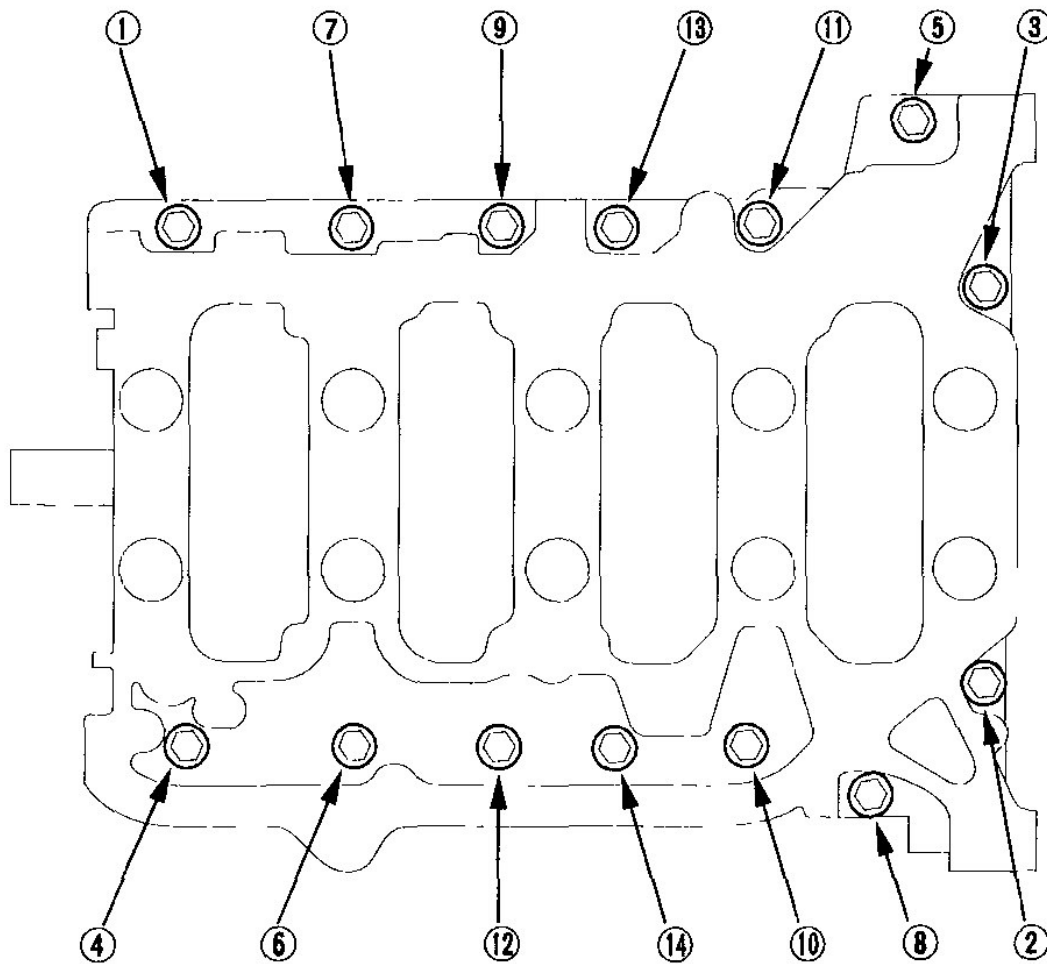


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Fig. 18: Removing Metal Ridge

Courtesy of AMERICAN HONDA MOTOR CO., INC.

10. Remove the 8 mm bolts from the lower block in criss-cross pattern shown.

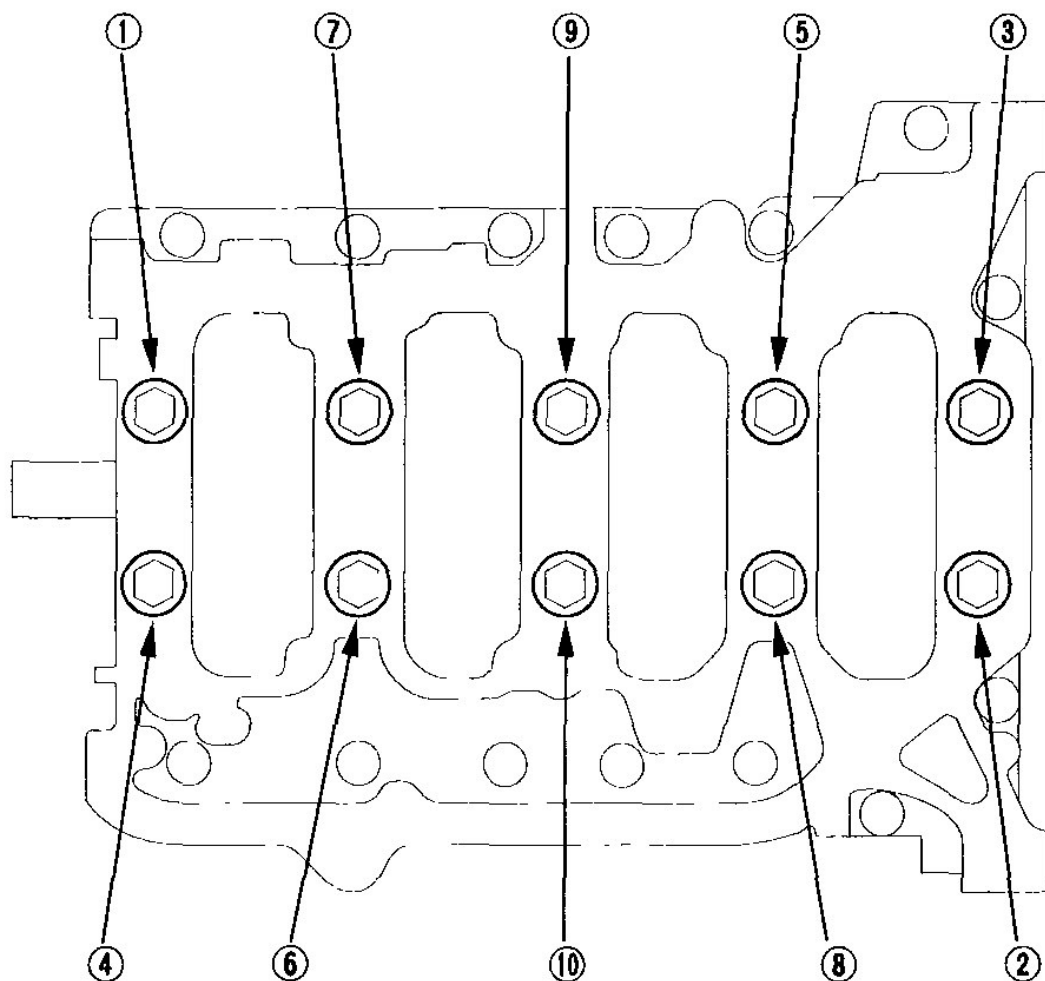


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Fig. 19: Removing Bolts From Lower Block In Crisscross Pattern

Courtesy of AMERICAN HONDA MOTOR CO., INC.

11. Remove the bearing cap bolts. To prevent warpage, unscrew the bolts in sequence 1/3 turn at a time. Repeat the sequence until all bolts are loosened.

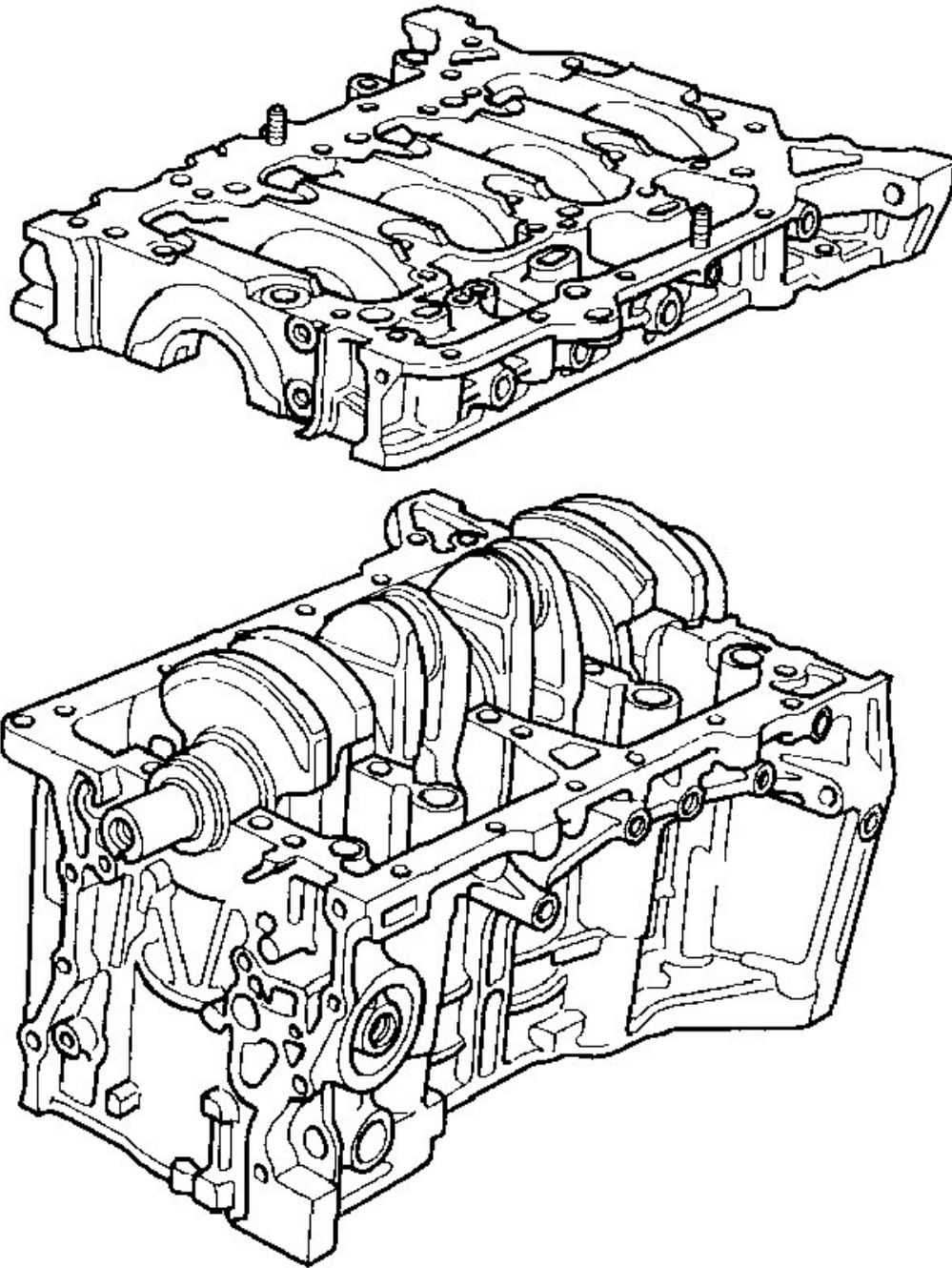


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Fig. 20: Removing Bearing Cap Bolts

Courtesy of AMERICAN HONDA MOTOR CO., INC.

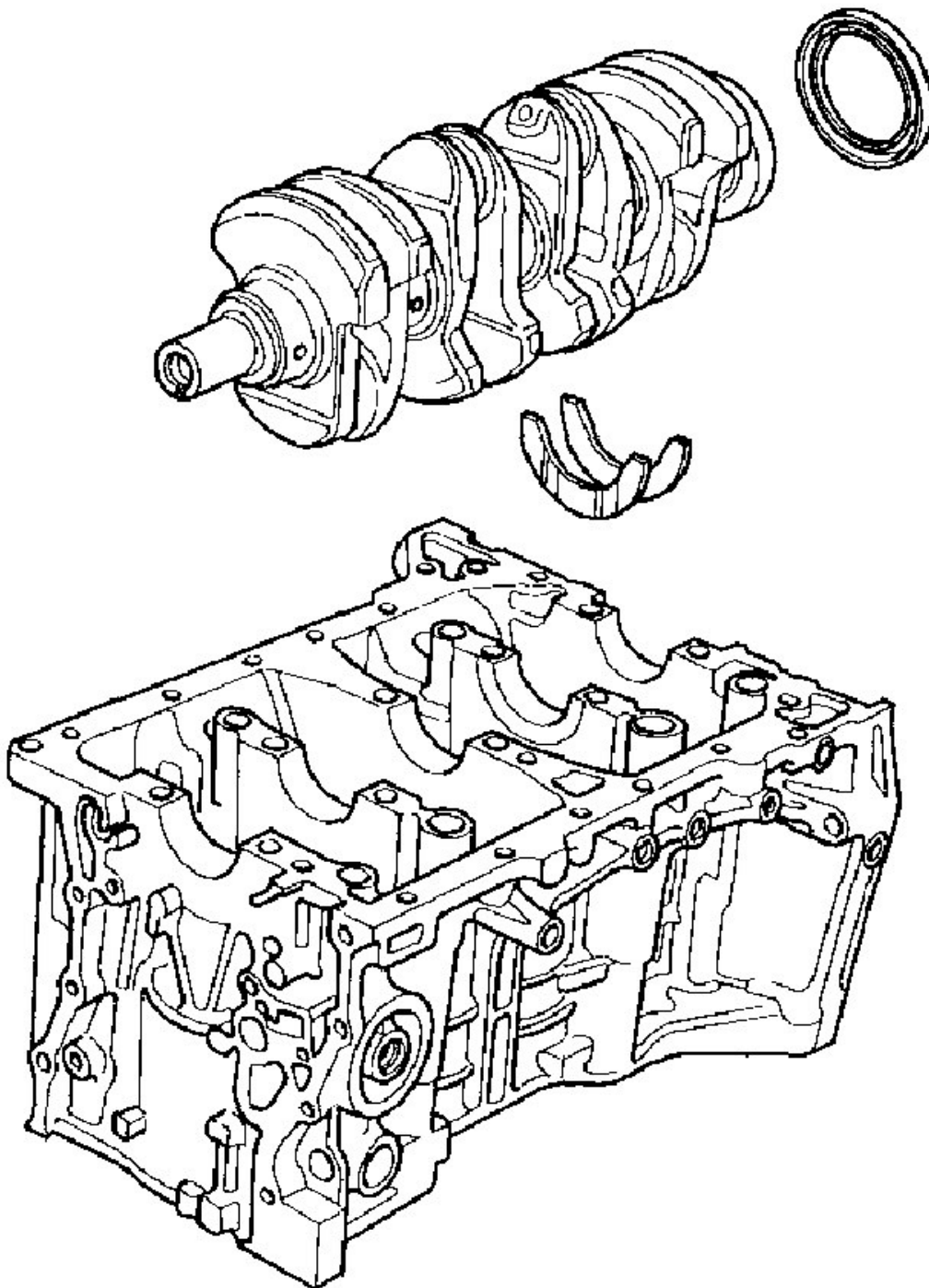
12. Remove the lower block and bearings. Keep all bearings in order.



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Fig. 21: Removing Lower Block And Bearings
Courtesy of AMERICAN HONDA MOTOR CO., INC.

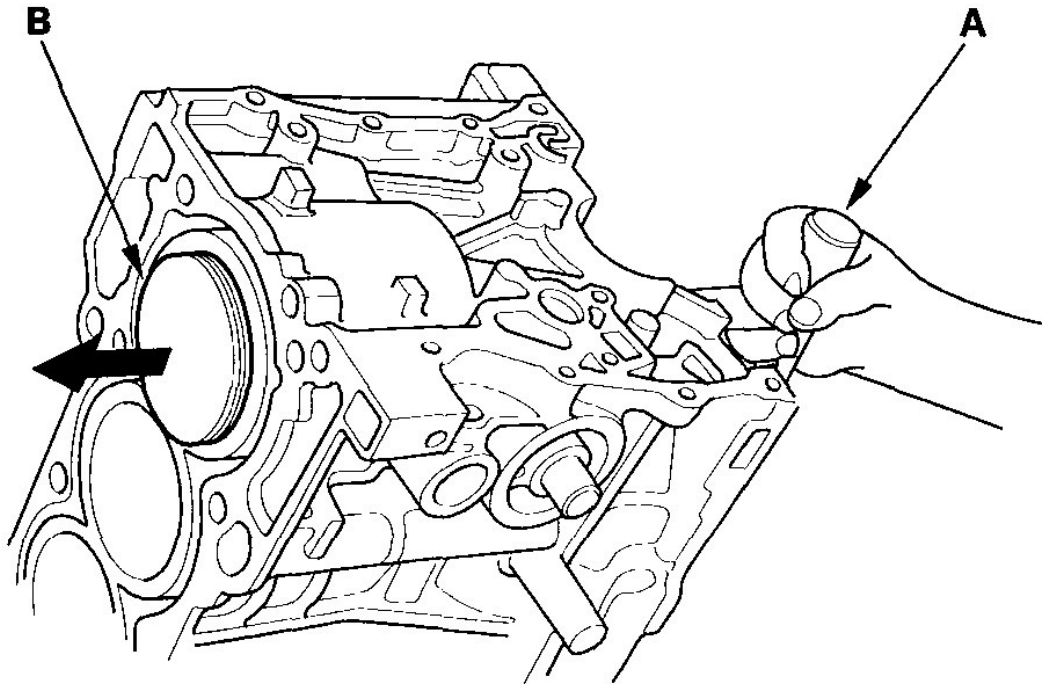
13. Remove the rod caps/bearings. Keep all caps/bearings in order.
14. Lift the crankshaft out of the engine, being careful not to damage the journals.



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Fig. 22: Removing Crankshaft Out Of Engine
Courtesy of AMERICAN HONDA MOTOR CO., INC.

15. Remove the upper bearing halves from the connecting rods, and set them aside with their respective caps.
16. Use the wooden handle of a hammer (A) to drive out the piston/connecting rod assembly (B).



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Fig. 23: Removing Piston/Connecting Rod Assembly
Courtesy of AMERICAN HONDA MOTOR CO., INC.

17. Reinstall the lower block and bearings on the engine in the proper order.
18. Reinstall the connecting rod bearings and caps after removing each piston/connecting rod assembly.
19. To avoid mix up on reassembly, mark each piston/connecting rod assembly with its cylinder number.

NOTE: The existing number on the connecting rod does not indicate its position in the engine, it indicates the rod bore size.

CRANKSHAFT INSPECTION

OUT-OF-ROUND AND TAPER

1. Remove the crankshaft from the engine block (see **CRANKSHAFT AND PISTON REMOVAL**).

2. Clean the crankshaft oil passages with pipe cleaners or a suitable brush.
3. Clean the keyway and threads.
4. Measure out-of round at the middle of each rod and main journal in two places. The difference between measurements on each journal must not be more than the service limit.

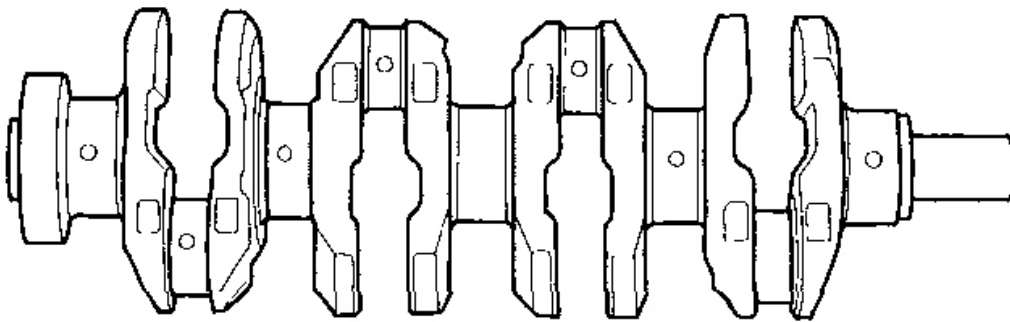
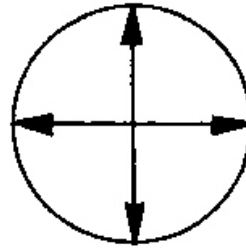
Journal Out-of-Round

Standard (New): 0.005 mm (0.0002 in.) max.

Service Limit: 0.010 mm (0.0004 in.)

2003 Honda Element DX

2003-06 ENGINE Engine Block - Element



G03677273

Fig. 24: Measuring Out-Of Round At Middle Of Connecting Rod And Main Journal
Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. Measure taper at the edges of each rod and main journal. The difference between measurements on each journal must not be more than the service limit.

Journal Taper

Standard (New): 0.005 mm (0.0002 in.) max.

Service Limit: 0.010 mm (0.0004 in.)

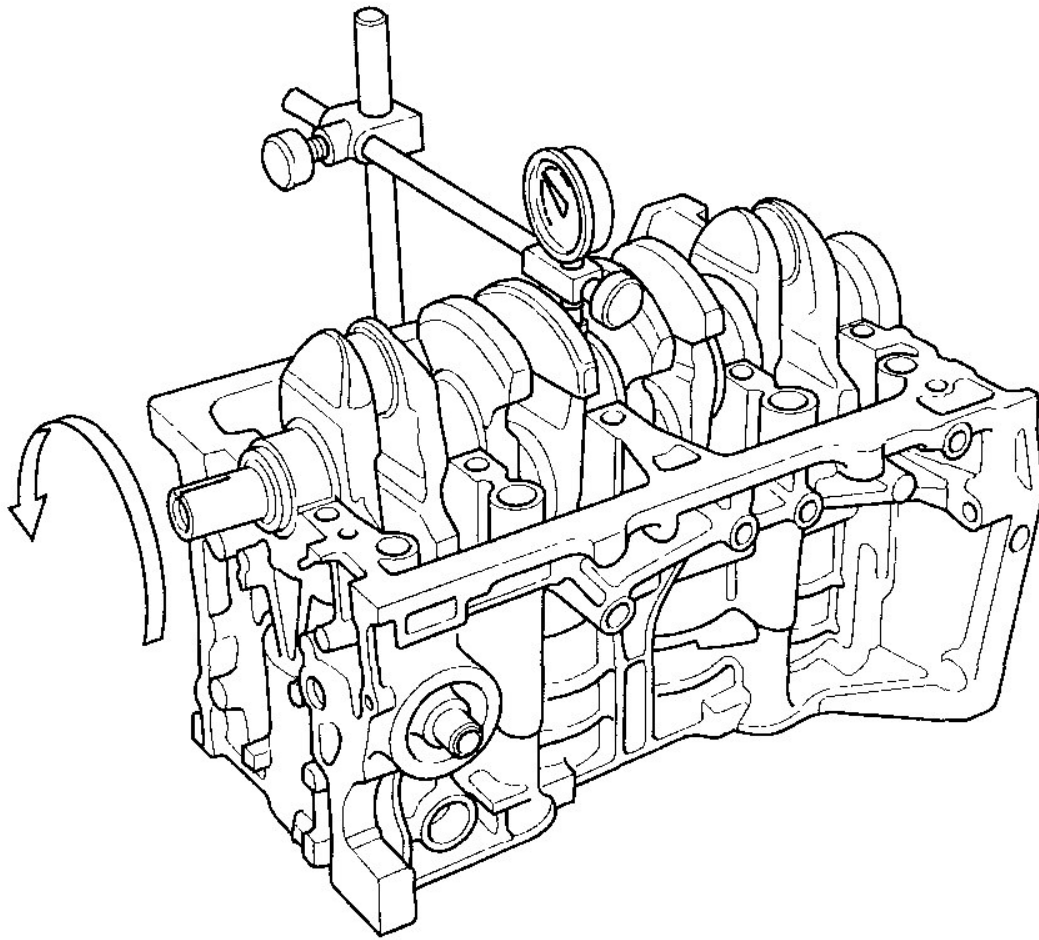
STRAIGHTNESS

1. 6) Place the engine block on the surface plate.
2. 7) Clean and install the bearings on the No. 1 and No. 5 journals of the engine block.
3. 8) Lower the crankshaft into the engine block.
4. 9) Measure the runout on all of the main journals. Rotate the crankshaft two complete revolutions. The difference between measurements on each journal must not be more than the service limit.

Crankshaft Total Runout

Standard (New): 0.03 mm (0.0012 in.) max.

Service Limit: 0.04 mm (0.0016 in.)



G03677274

Fig. 25: Measuring Main Journals Runout
Courtesy of AMERICAN HONDA MOTOR CO., INC.

BLOCK AND PISTON INSPECTION

1. Remove the crankshaft and pistons (see **CRANKSHAFT AND PISTON REMOVAL**).
2. Check the piston for distortion or cracks.
3. Measure the piston diameter at a point 13 mm (0.5 in.) from the bottom of the skirt. There are two standard-size pistons (No Letter or A, and B). The letter is stamped on the top of the piston. Letters are also stamped on the engine block as cylinder bore sizes.

Piston Diameter

Standard (New):

2003 Honda Element DX

2003-06 ENGINE Engine Block - Element

No Letter (or A): 86.980-86.990 mm (3.4244-3.4248 in.)

B: 86.970-86.980 mm (3.4240-3.4244 in.)

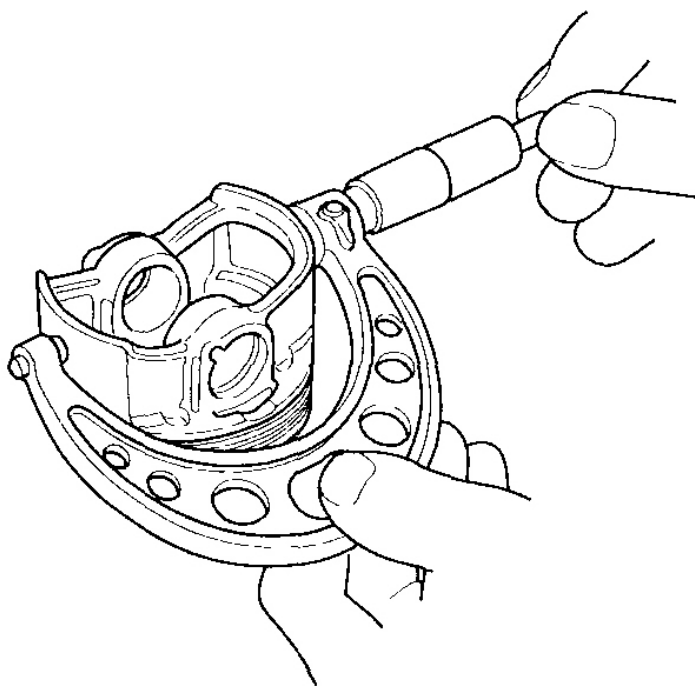
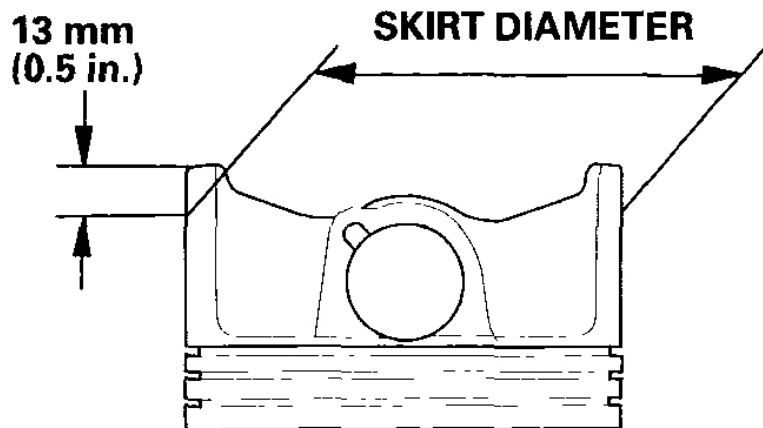
Service Limit:

No Letter (or A): 86.930 mm (3.4224 in.)

B: 86.920 mm (3.4220 in.)

Oversize Piston Diameter

0.25: 87.230-87.240 mm (3.4342-3.4346 in.)



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Fig. 26: Measuring Skirt Diameter

Courtesy of AMERICAN HONDA MOTOR CO., INC.

4. Measure wear and taper in direction X and Y at three levels in each cylinder as shown. If measurements in any cylinder are beyond the Oversize Bore Service Limit, replace the engine block. If the engine block

is to be rebored, refer to step 7 after reboring.

Cylinder Bore Size**Standard (New):**

A or I: 87.010-87.020 mm (3.4256-3.4260 in.)

B or II: 87.000-87.010 mm (3.4252-3.4256 in.)

Service Limit: 87.070 mm (3.4279 in.)

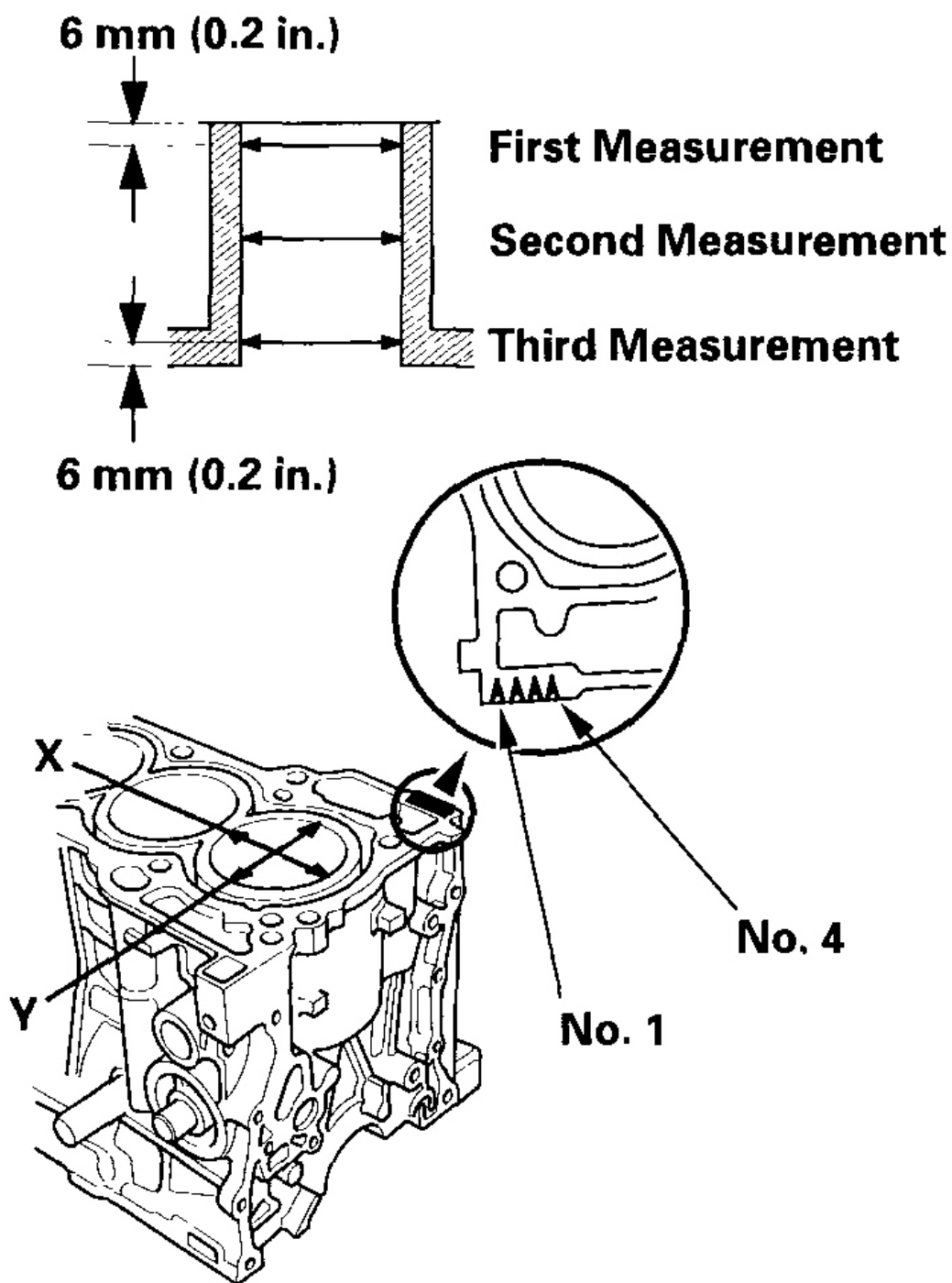
Oversize

0.25: 87.250-87.260 mm (3.4350-3.4354 in.)

Reboring Limit: 0.25 mm (0.01 in.) max.

Bore Taper

Limit: (Difference between first and third measurement) 0.05 mm (0.002 in.)



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Fig. 27: Measuring Cylinder Bore Size

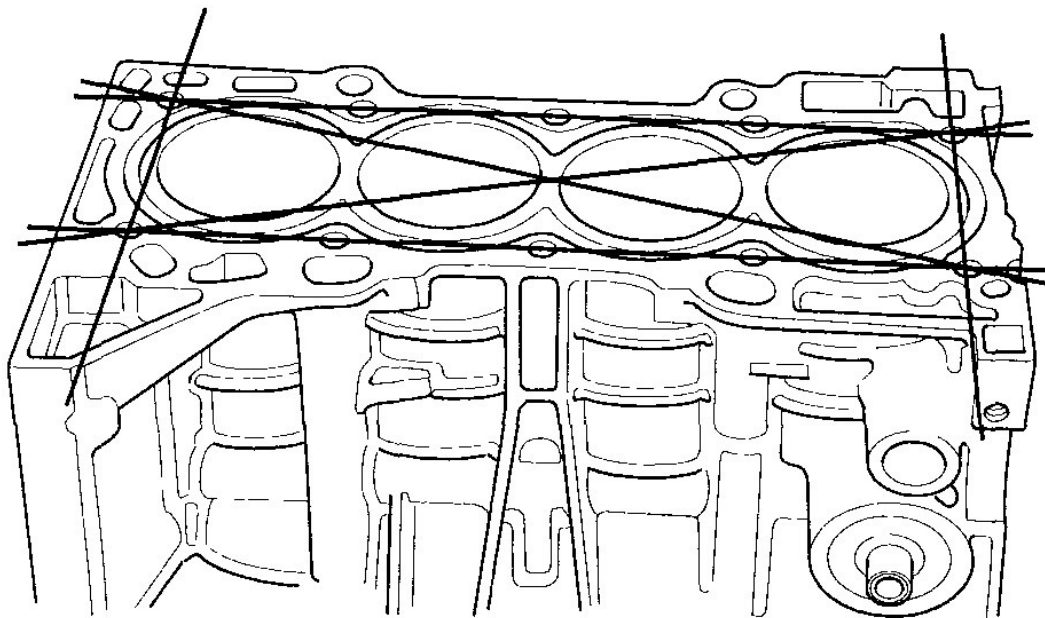
Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. Scored or scratched cylinder bores must be honed.
6. Check the top of the engine block for warpage. Measure along the edges and across the center as shown.

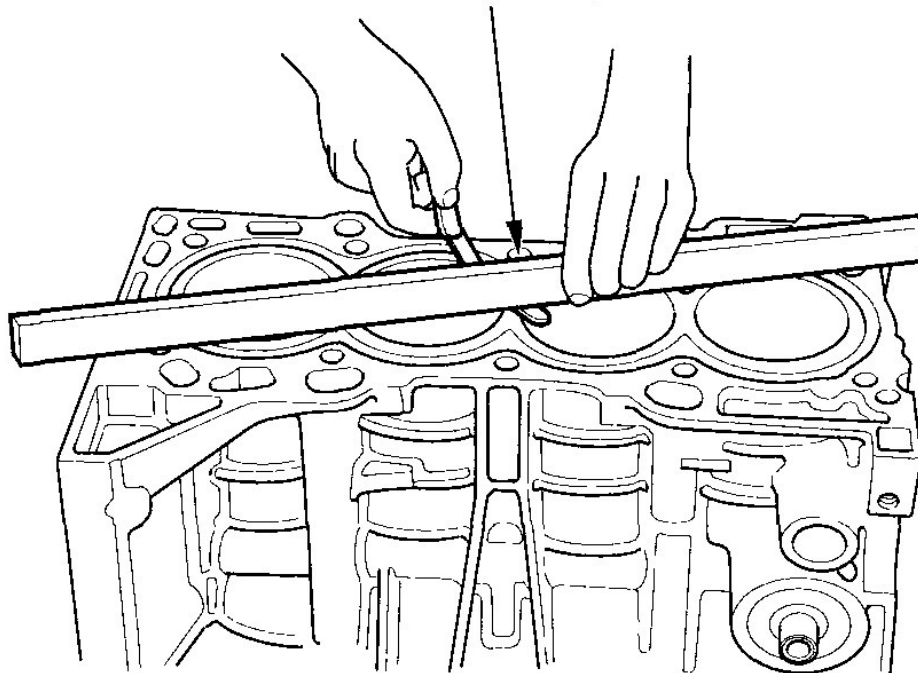
Engine Block Warpage

Standard (New): 0.07 mm (0.003 in.) max.

Service Limit: 0.10 mm (0.004 in.)



PRECISION STRAIGHT EDGE



G03677277

Fig. 28: Measuring Engine Block Warpage

Courtesy of AMERICAN HONDA MOTOR CO., INC.

7. Calculate the difference between the cylinder bore diameter and the piston diameter. If the clearance is near or exceeds the service limit, inspect the piston and cylinder bore for excessive wear.

Piston-to-Cylinder Bore Clearance

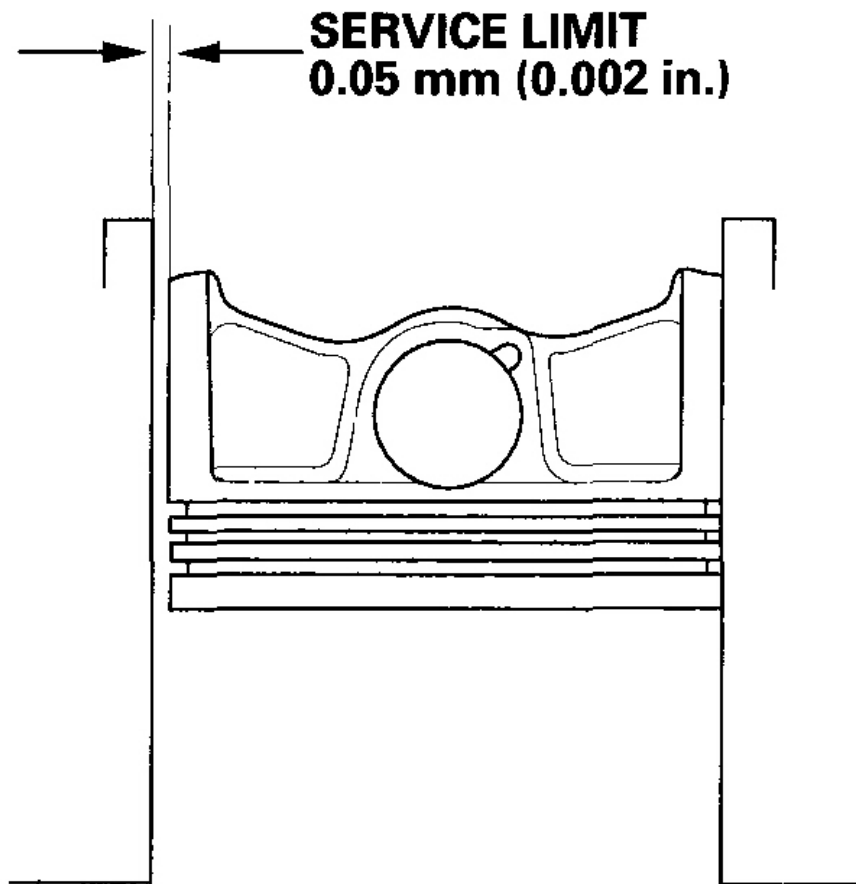
Standard (New): 0.020-0.040 mm (0.0008-0.0016 in.)

Service Limit: 0.05 mm (0.002 in.)

Piston-to-Cylinder Bore Clearance

Standard (New): 0.020—0.040 mm
(0.0008—0.0016 in.)

Service Limit: 0.05 mm (0.002 in.)



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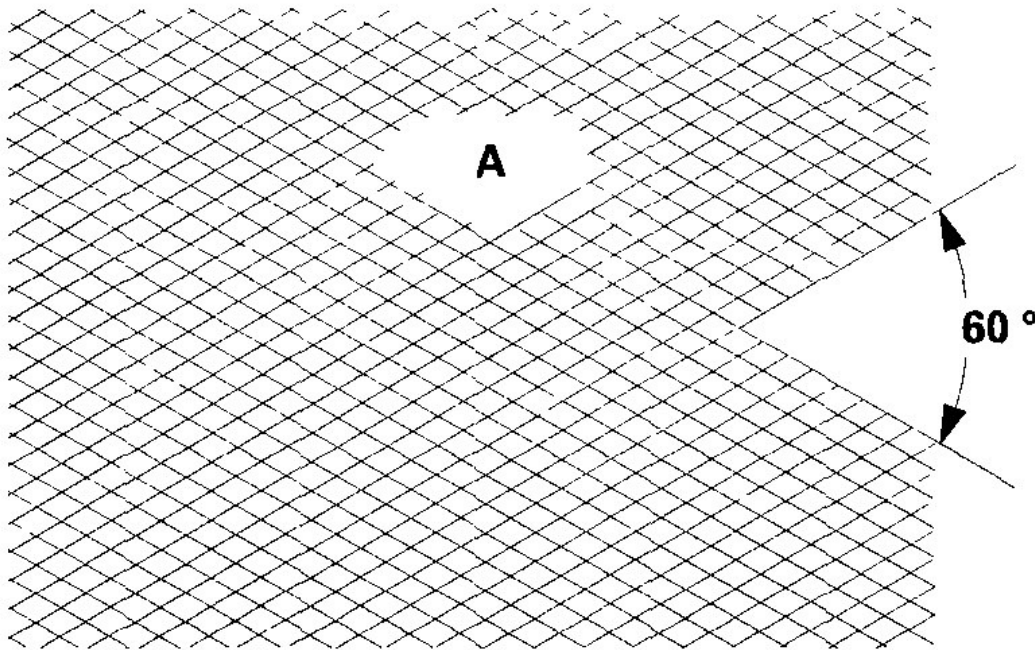
Fig. 29: Identifying Piston-To-Cylinder Bore Clearance
Courtesy of AMERICAN HONDA MOTOR CO., INC.

CYLINDER BORE HONING

Only a scored or scratched cylinder bore must be honed.

1. Measure the cylinder bores (see **BLOCK AND PISTON INSPECTION**). If the engine block is to be reused, hone the cylinders and remeasure the bores.
2. Hone the cylinder bores with honing oil and a fine (400 grit) stone in a 60 degree cross-hatch pattern (A).

NOTE: Use only a rigid hone with 400 grit or finer stone such as Sunnen, Ammco, or equivalent. Do not use stones that are worn or broken.



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Fig. 30: Identifying Cylinder Honing Angle

Courtesy of AMERICAN HONDA MOTOR CO., INC.

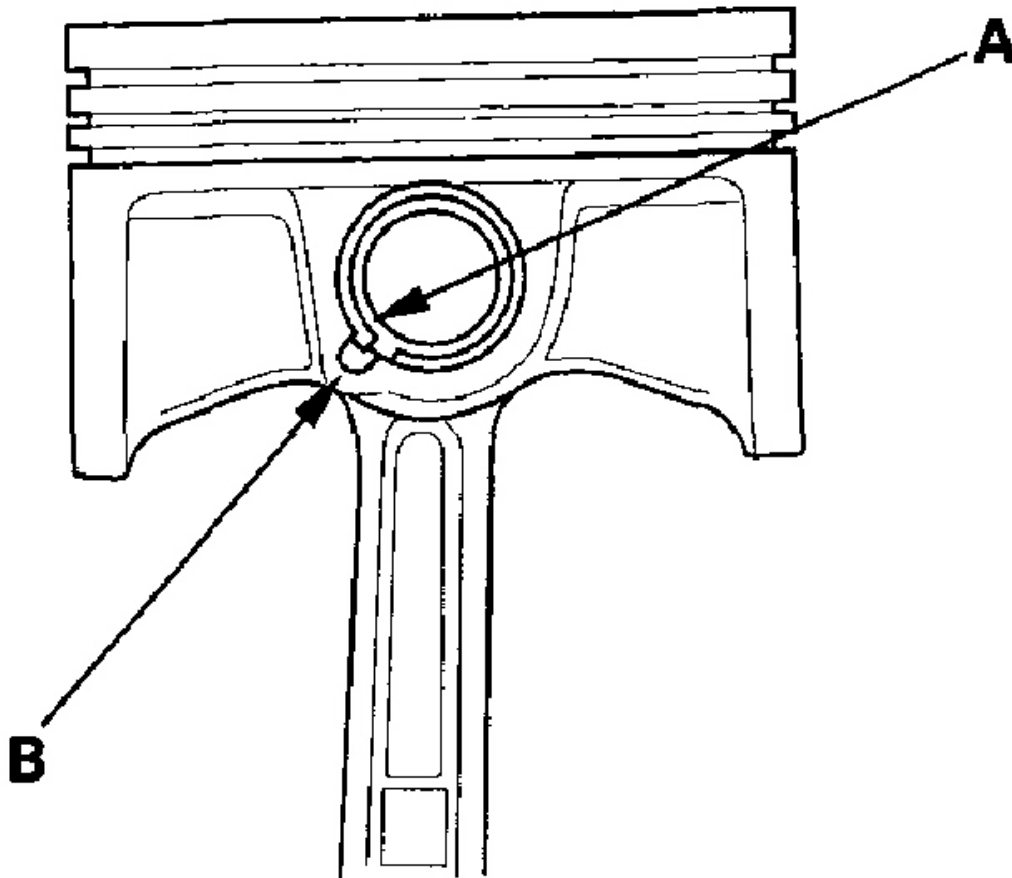
3. When honing is complete, thoroughly clean the engine block of all metal particles. Wash the cylinder bores with hot soapy water, then dry and oil them immediately to prevent rusting. Never use solvent, it will only redistribute the grit on the cylinder walls.
4. If scoring or scratches are still present in the cylinder bores after honing to the service limit, rebore the engine block. Some light vertical scoring and scratching is acceptable if it is not deep enough to catch your fingernail and does not run the full length of the bore.

PISTON, PIN, AND CONNECTING ROD REPLACEMENT

DISASSEMBLY

1. Remove the piston from the engine block (see CRANKSHAFT AND PISTON REMOVAL).
2. Apply new engine oil to the piston pin snap rings (A), and turn them in the ring grooves until the end gaps are lined up with the cutouts in the piston pin bores (B).

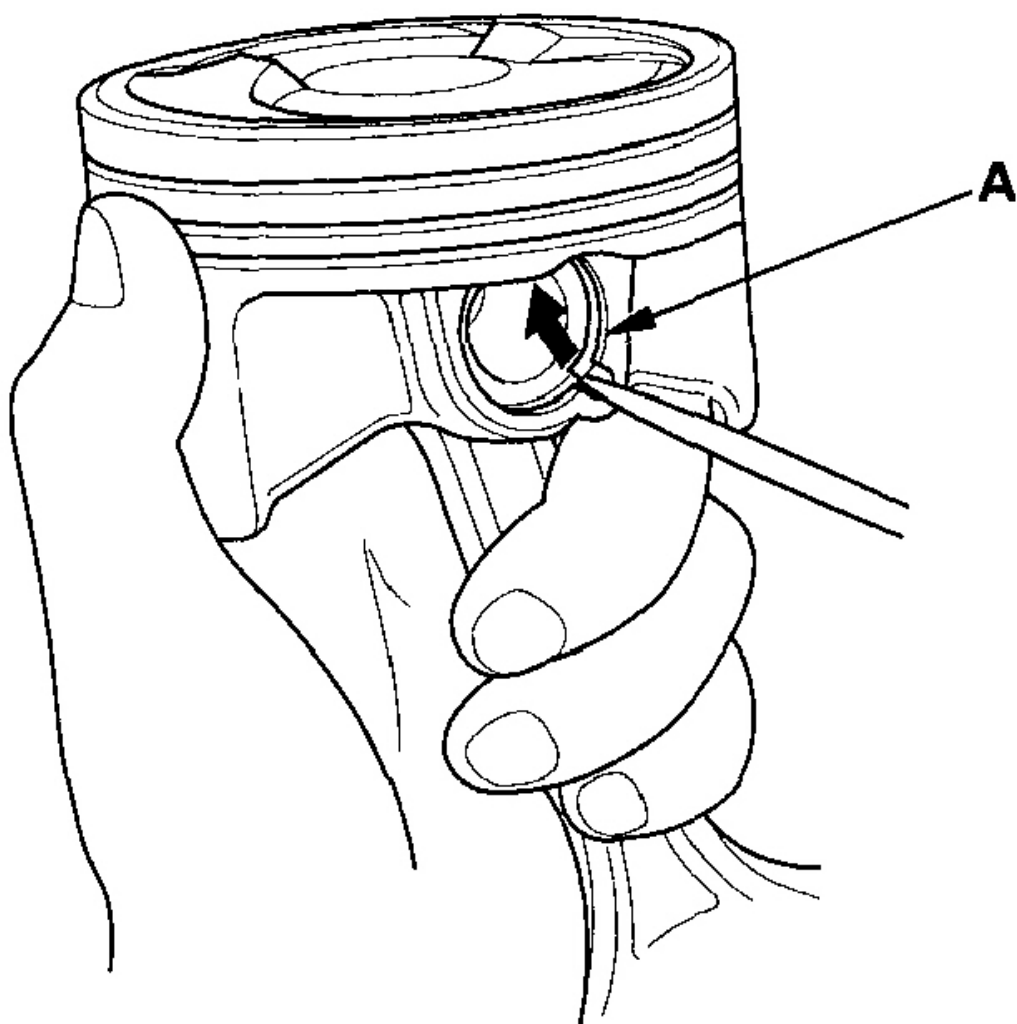
NOTE: Take care not to damage the ring grooves.



G03677280

Fig. 31: Locating Engine Oil Applying Point To Piston Pin Snap Ring
Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. Remove both snap rings (A). Start at the cutout in the piston pin bore. Remove the snap rings carefully so they do not go flying or get lost. Wear eye protection.

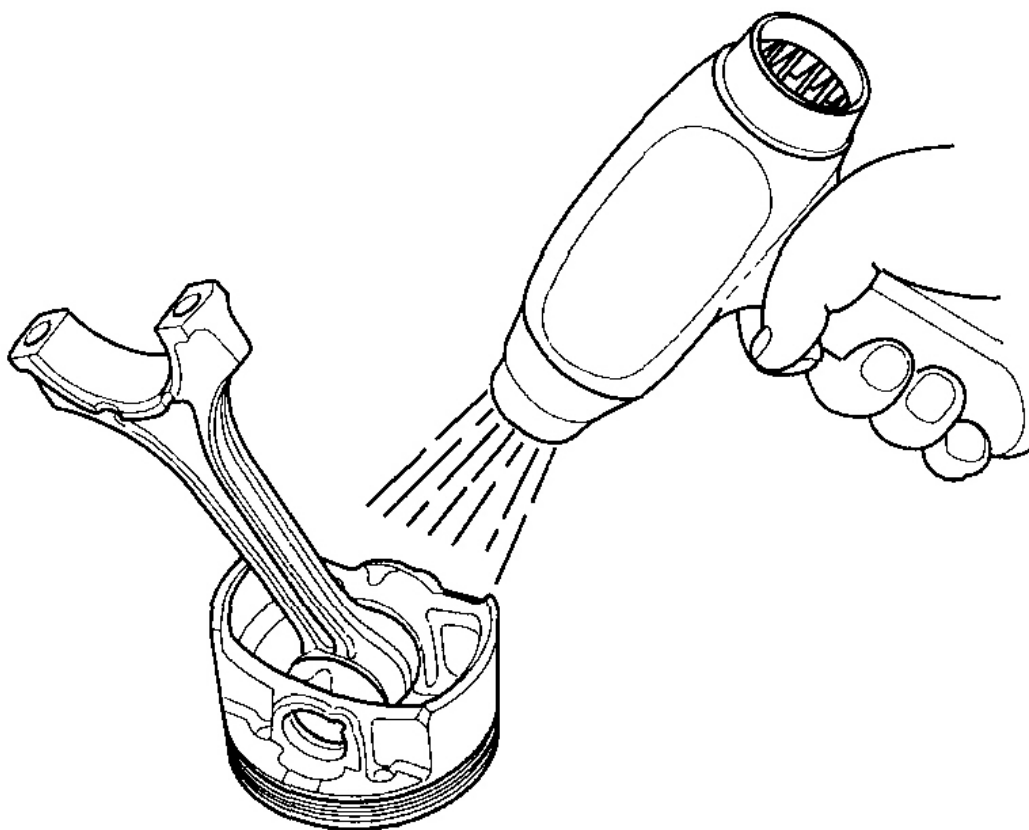


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Fig. 32: Removing Snap Rings

Courtesy of AMERICAN HONDA MOTOR CO., INC.

4. Heat the piston and connecting rod assembly to about 158°F (70°C), then remove the piston pin.



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Fig. 33: Heating Piston And Connecting Rod Assembly
Courtesy of AMERICAN HONDA MOTOR CO., INC.

INSPECTION

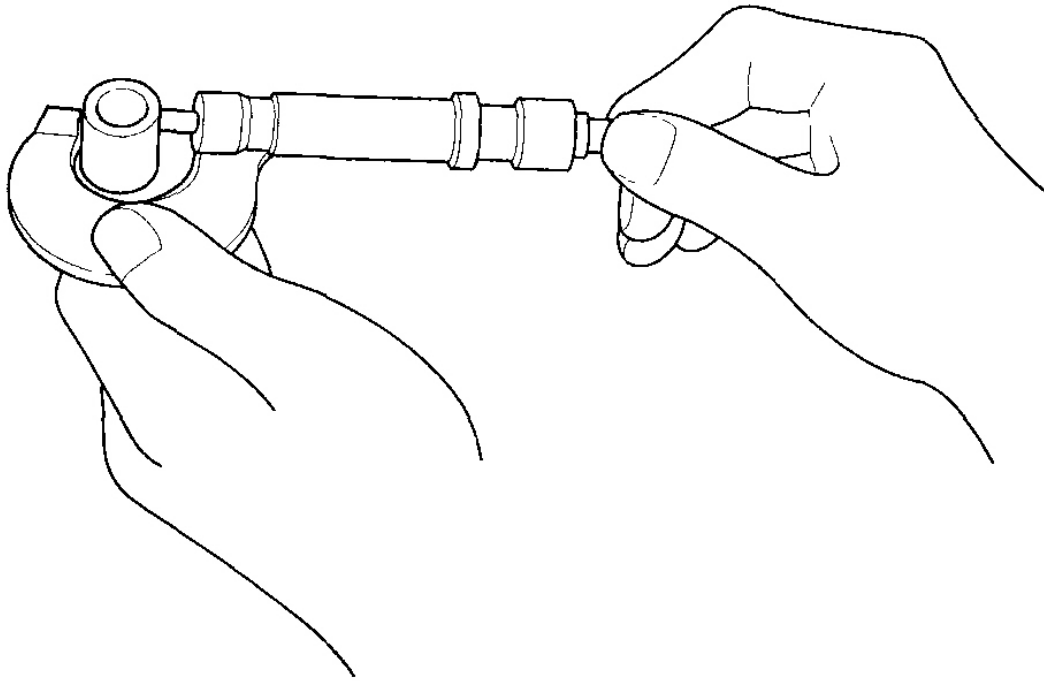
NOTE: Inspect the piston, piston pin, and connecting rod when they are at room temperature.

1. Measure the diameter of the piston pin.

Piston Pin Diameter

Standard (New): 21.961-21.965 mm (0.8646-0.8648 in.)

Service Limit: 21.953 mm (0.8643 in.)

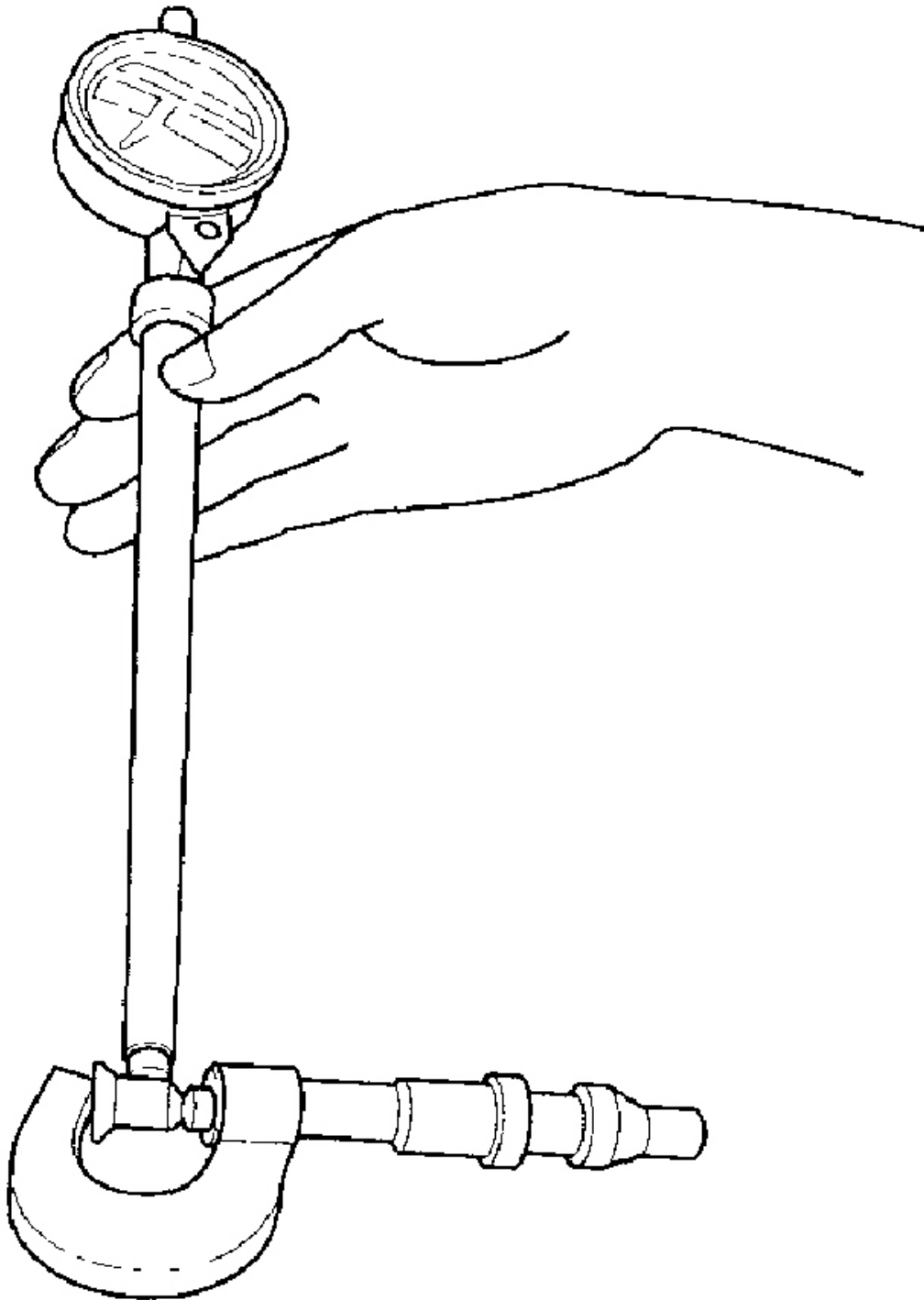


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Fig. 34: Measuring Piston Pin Diameter

Courtesy of AMERICAN HONDA MOTOR CO., INC.

2. Zero the dial indicator to the piston pin diameter.

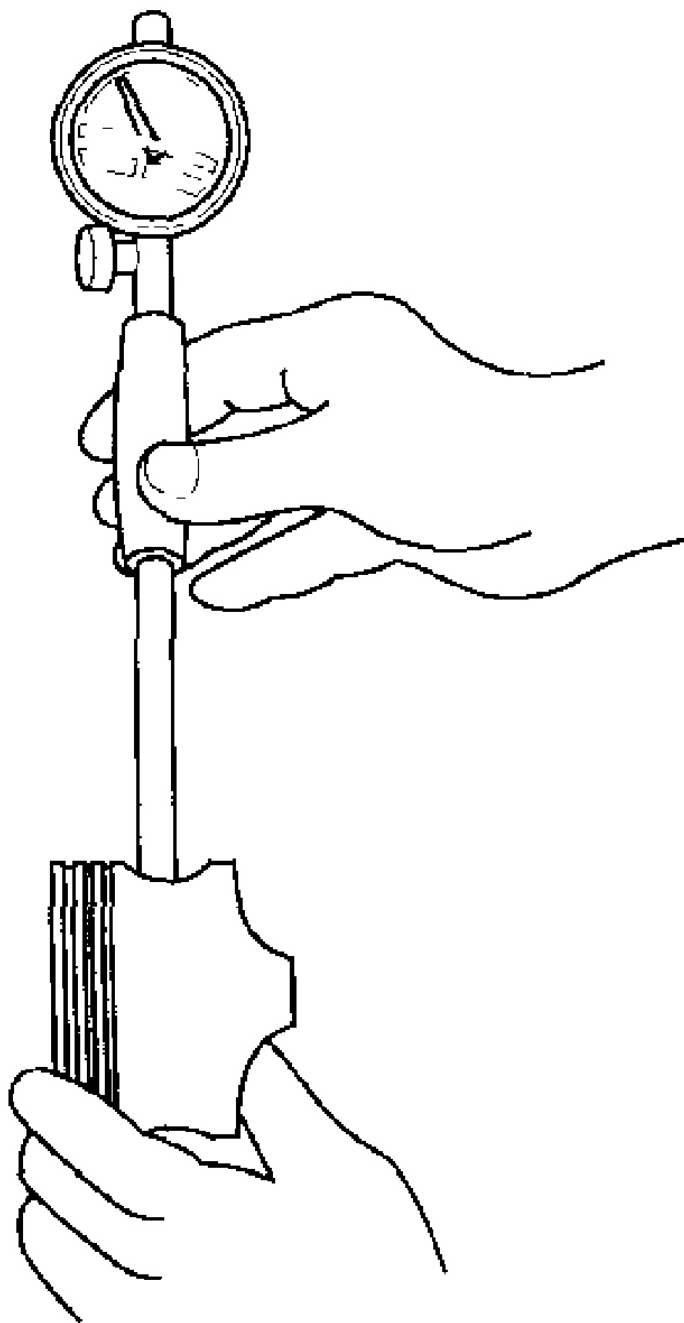


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Fig. 35: Attaching Dial Indicator To Piston Pin Diameter**Courtesy of AMERICAN HONDA MOTOR CO., INC.**

3. Check the difference between the piston pin diameter and piston pin hole diameter in the piston.

Piston Pin-to-Piston Clearance**Standard (New): -0.005 to +0.002 mm (-0.00020 to +0.00008 in.)****Service Limit: 0.005 mm (0.0002 in.)**



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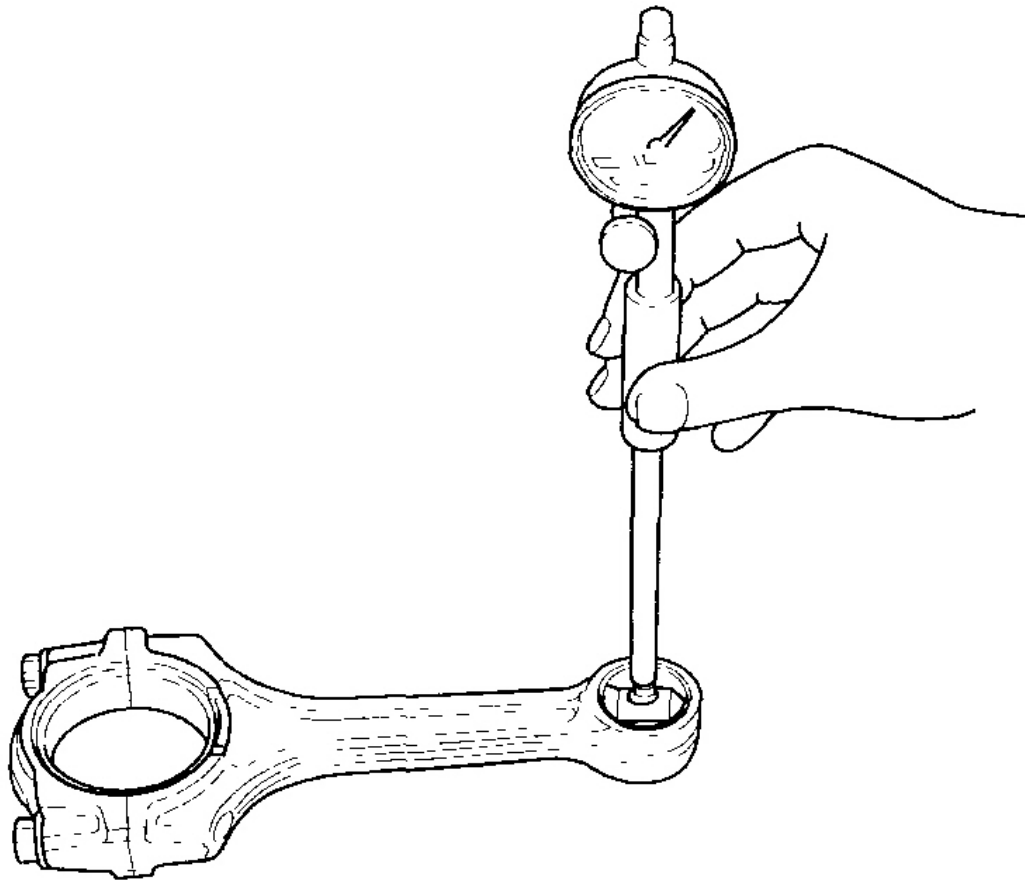
Fig. 36: Checking Difference Between Piston Pin Diameter And Piston Pin Hole Diameter In Piston
Courtesy of AMERICAN HONDA MOTOR CO., INC.

4. Measure the piston pin-to-connecting rod clearance.

Piston Pin-to-Connecting Rod Clearance

Standard (New): 0.005-0.015 mm (0.0002-0.0006 in.)

Service Limit: 0.02 mm (0.0008 in.)

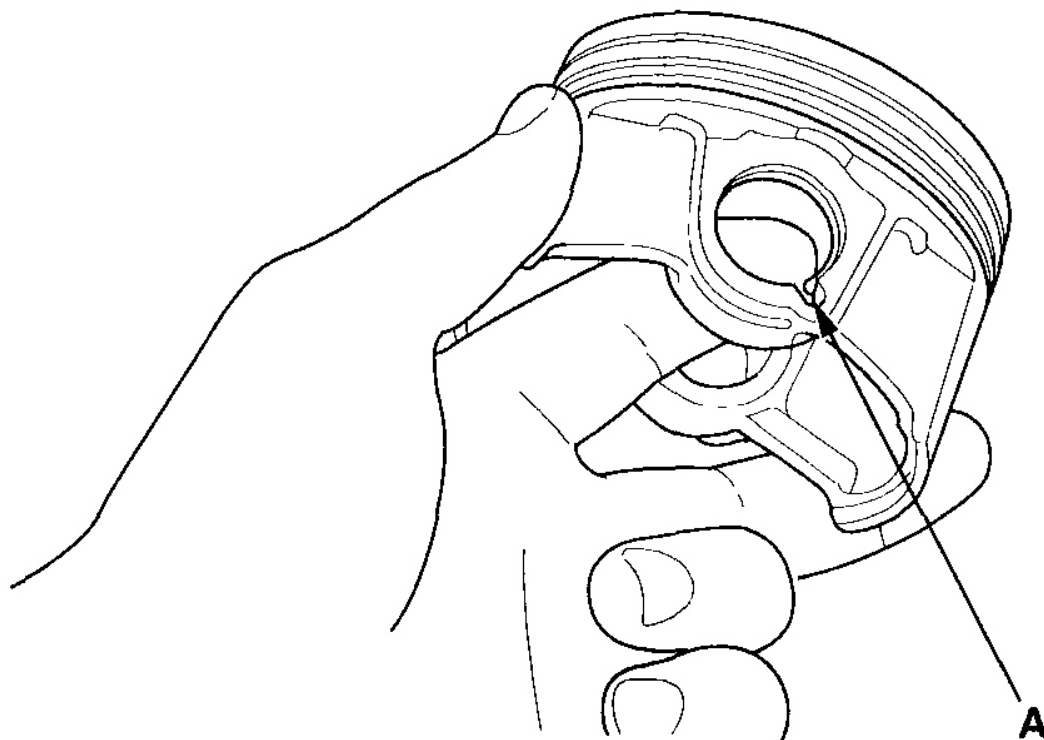


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Fig. 37: Measuring Piston Pin-To-Connecting Rod Clearance
Courtesy of AMERICAN HONDA MOTOR CO., INC.

REASSEMBLY

1. Install a piston pin snap ring (A) only one side.



G03677287

Fig. 38: Installing Piston Pin Snap Ring

Courtesy of AMERICAN HONDA MOTOR CO., INC.

2. Coat the piston pin bore in the piston, the bore in the connecting rod, and the piston pin with new engine oil.
3. Heat the piston to about 158°F (70°C).

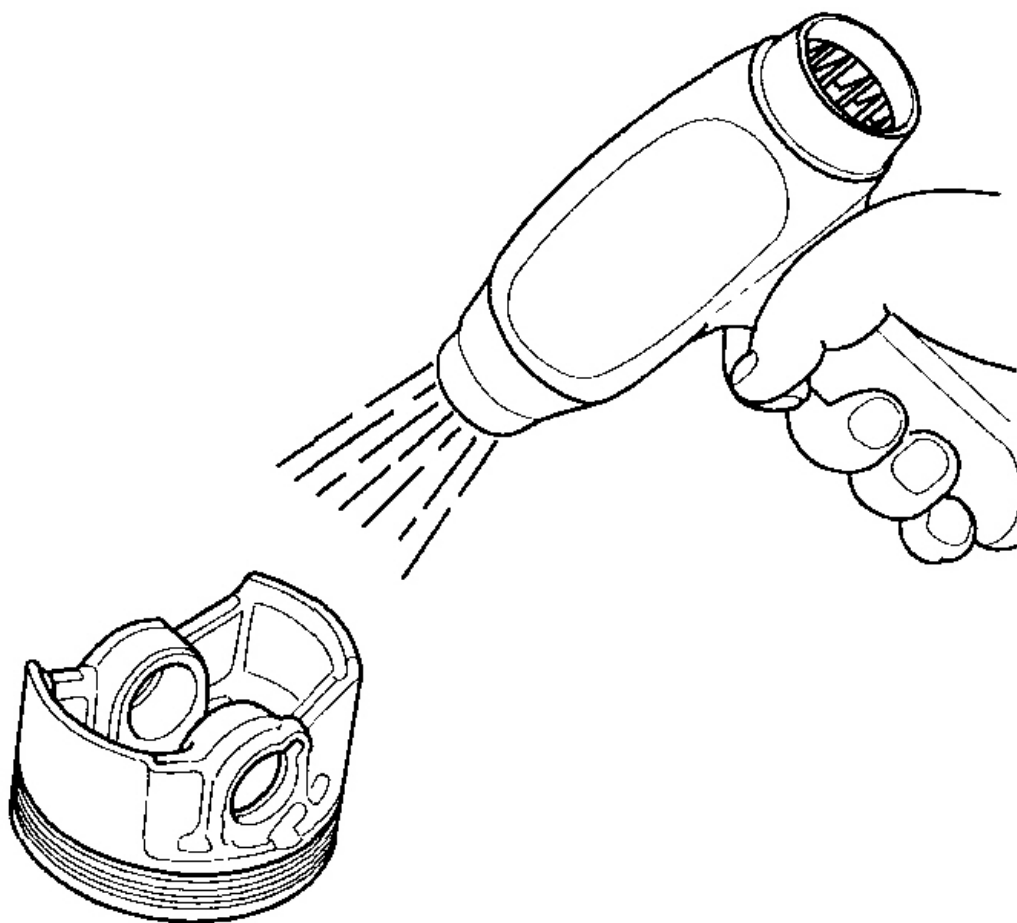
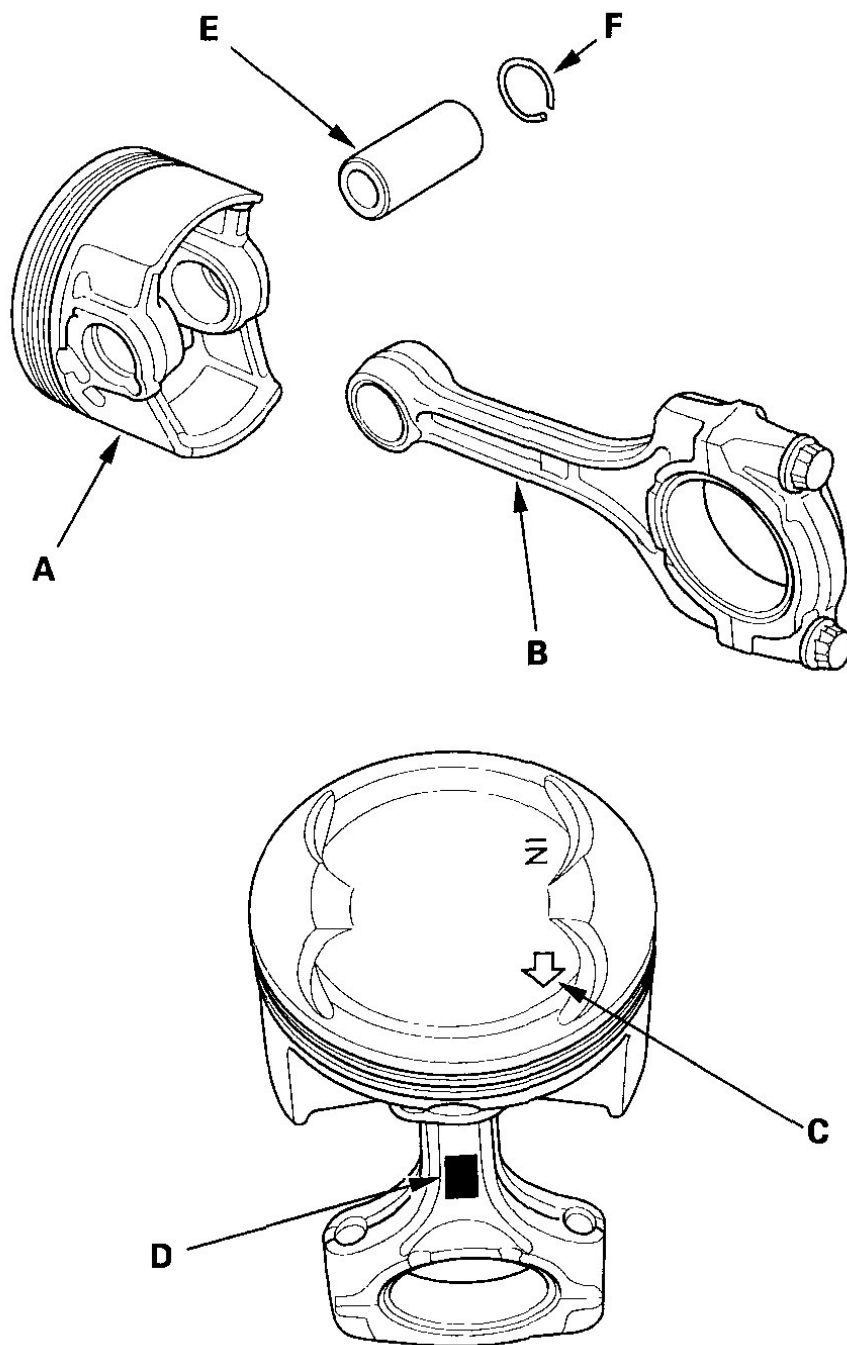
**G03677288**

Fig. 39: Heating Piston

Courtesy of AMERICAN HONDA MOTOR CO., INC.

4. Assemble the piston (A) and connecting rod (B) with the arrow (C) and the embossed mark (D) on the same side. Install the piston pin (E).



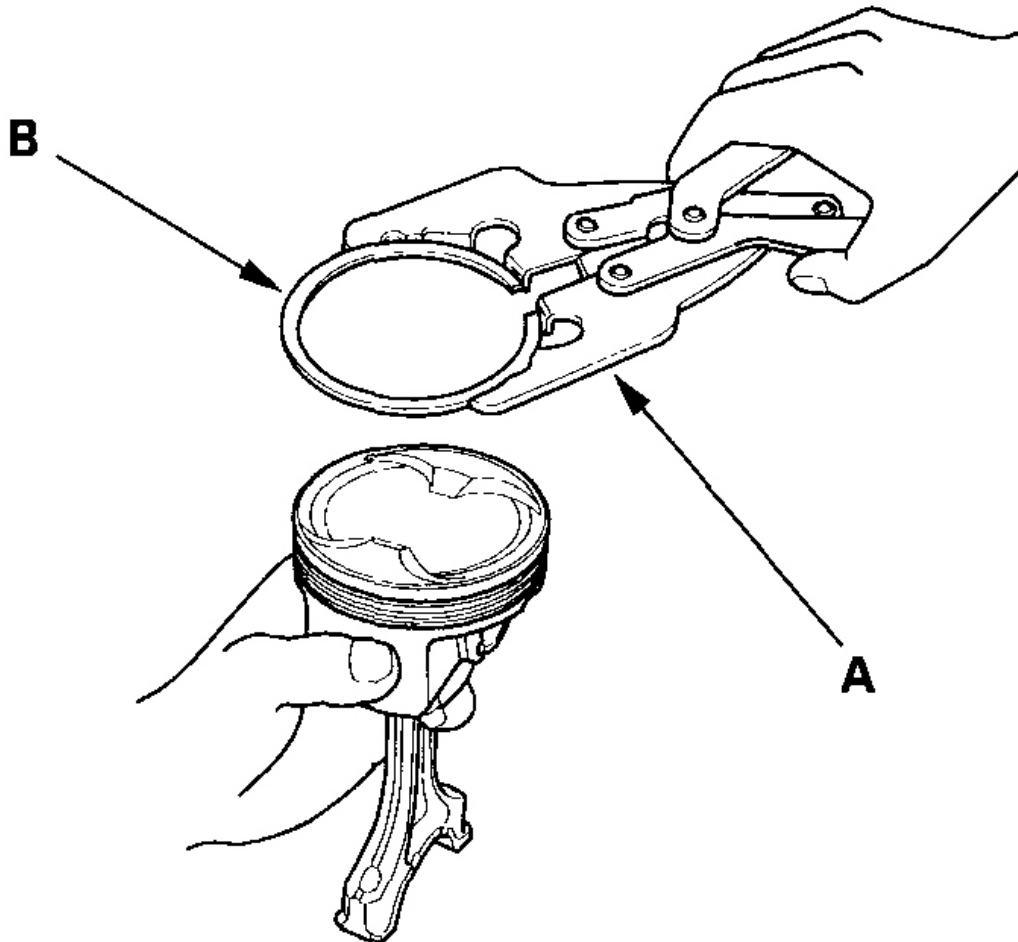
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Fig. 40: Assembling Piston And Connecting Rod
Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. Install the remaining snap ring (F).
6. Turn the snap rings in the ring grooves until the end gaps are positioned at the bottom of the piston.

PISTON RING REPLACEMENT

1. Remove the piston from the engine block (see CRANKSHAFT AND PISTON REMOVAL).
2. Using a ring expander (A), remove the old piston rings (B).



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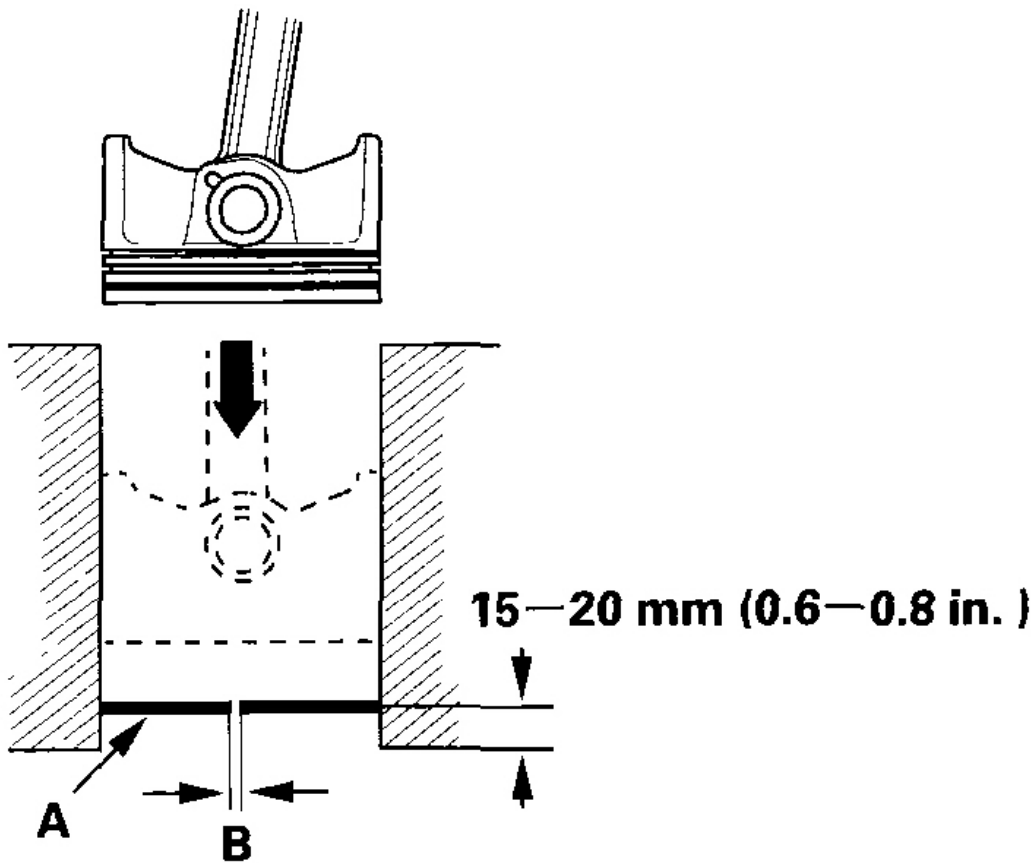
Fig. 41: Removing Piston Rings

Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. Clean all ring grooves thoroughly with a squared-off broken ring or ring groove cleaner with a blade to fit the piston grooves. The top and 2nd ring grooves are 1.2 mm (0.05 in.) wide. The oil ring groove is 2.0 mm (0.08 in.) wide. File down a blade if necessary. Do not use a wire brush to clean the ring grooves, or cut the ring grooves deeper with the cleaning tools.

NOTE: If the piston is to be separated from the connecting rod, do not install new rings yet.

4. Using a piston, push a new ring (A) into the cylinder bore 15-20 mm (0.6-0.8 in.) from the bottom.



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Fig. 42: Pushing Ring Into Cylinder Bore

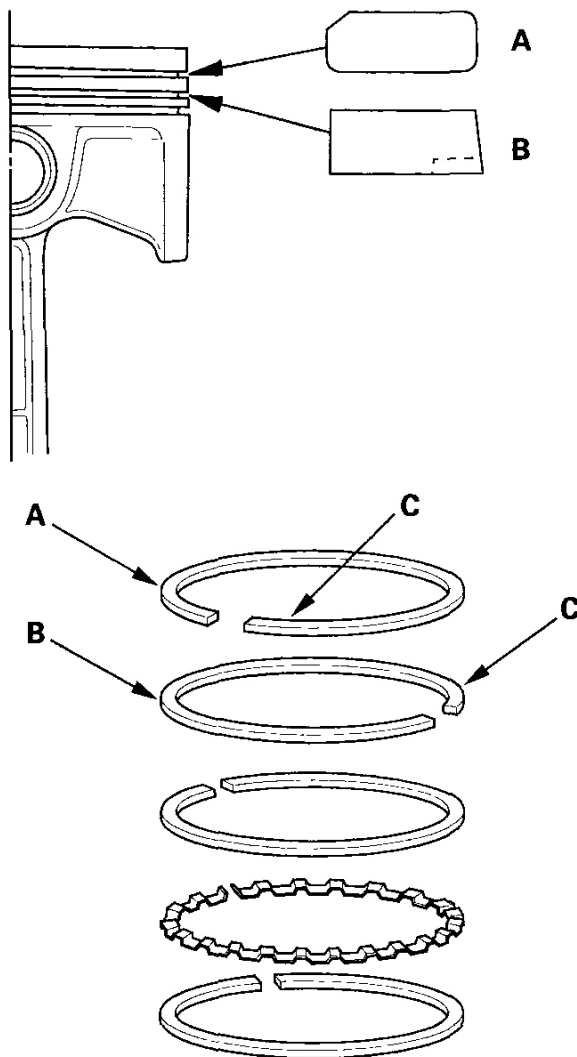
Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. Measure the piston ring end-gap (B) with a feeler gauge:
- If the gap is too small, check to see if you have the proper rings for your engine.
 - If the gap is too large, recheck the cylinder bore diameter against the wear limits (see **BLOCK AND PISTON INSPECTION**). If the bore is over the service limit, the engine block must be rebored.

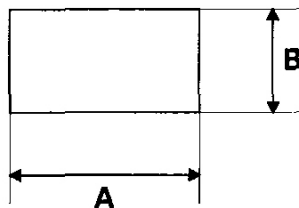
Piston Ring End-Gap

Top Ring:**Standard (New): 0.20-0.35 mm (0.008-0.014 in.)****Service Limit: 0.60 mm (0.024 in.)****Second Ring:****Standard (New): 0.40-0.55 mm (0.016-0.022 in.)****Service Limit: 0.70 mm (0.028 in.)****Oil Ring:****Standard (New): 0.20-0.70 mm (0.008-0.028 in.)****Service Limit: 0.80 mm (0.031 in.)**

6. Install the top ring and second ring as shown. The top ring (A) has a 1R or 1Z mark and the second ring (B) has a 2R mark. The manufacturing marks (C) must be facing upward.



Piston Ring Dimensions:



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Top Ring (Standard)

A: 3.1 mm (0.12 in.)

B: 1.2 mm (0.05 in.)

Second Ring (Standard)

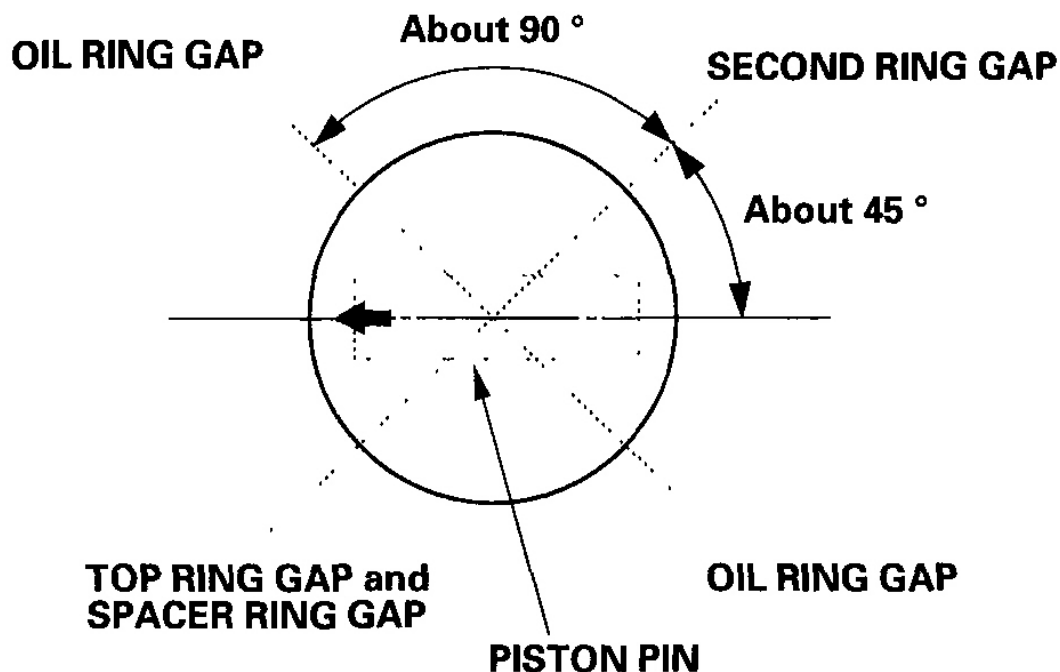
A: 3.4 mm (0.13 in.)

B: 1.2 mm (0.05 in.)

Fig. 43: Installing Top Ring And Second Ring
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

7. Rotate the rings in their grooves to make sure they do not bind.

8. Position the ring end gaps as shown:



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Fig. 44: Positioning Ring End Gaps

Courtesy of AMERICAN HONDA MOTOR CO., INC.

9. After installing a new set of rings, measure the ring-to-groove clearances:

Top Ring Clearance

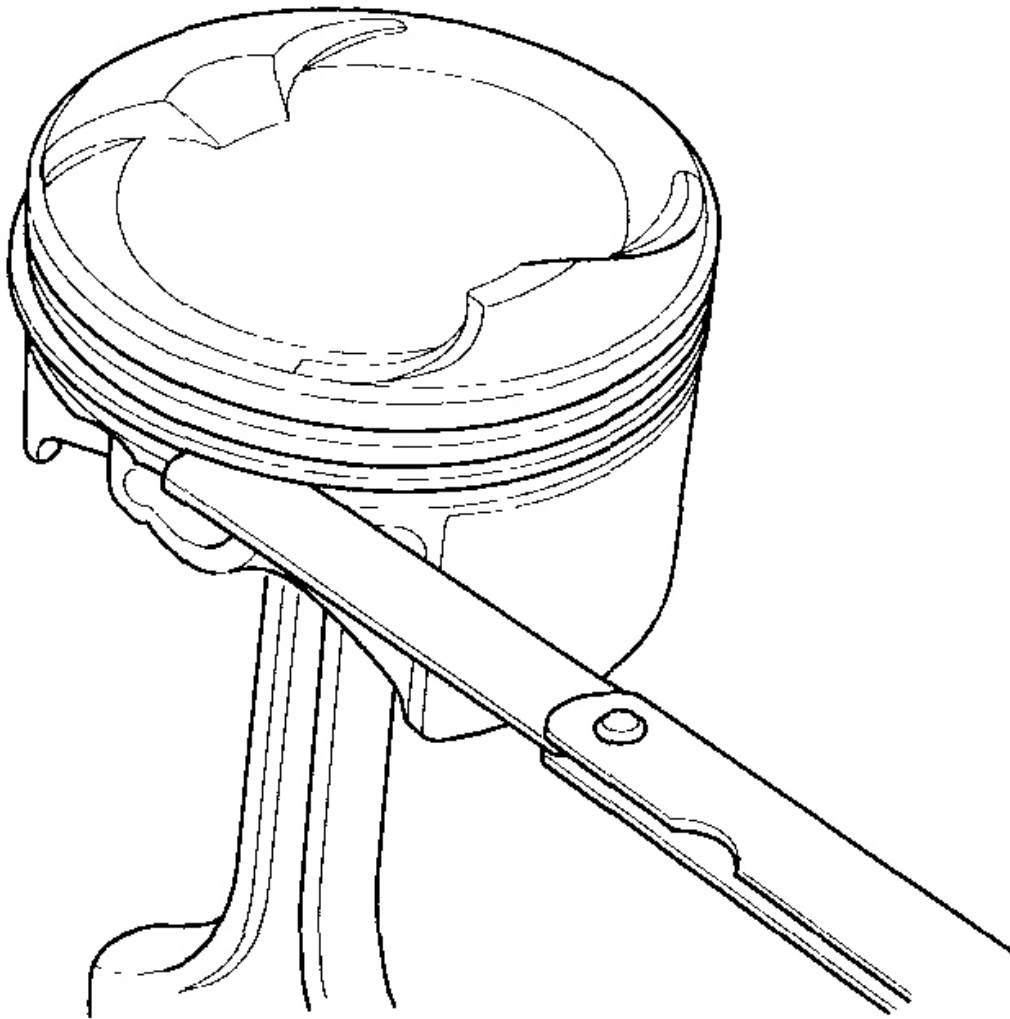
Standard (New): 0.045-0.070 mm (0.0018-0.0028 in.)

Service Limit: 0.13 mm (0.005 in.)

Second Ring Clearance

Standard (New): 0.050-0.075 mm (0.0020-0.0030 in.)

Service Limit: 0.13 mm (0.005 in.)



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Fig. 45: Measuring Ring-To-Groove Clearance
Courtesy of AMERICAN HONDA MOTOR CO., INC.

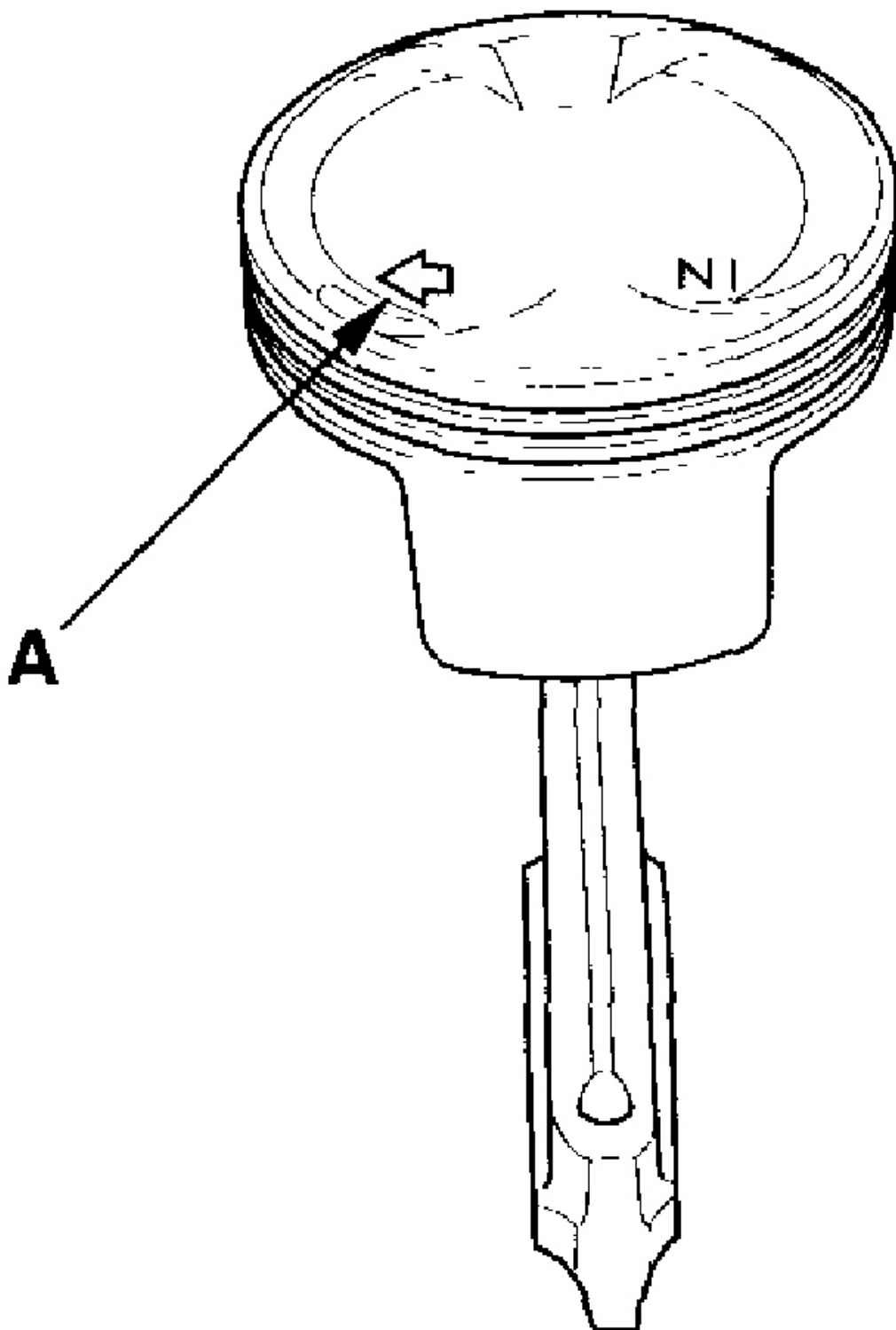
PISTON INSTALLATION

IF THE CRANKSHAFT IS ALREADY INSTALLED

1. Set the crankshaft to bottom dead center (BDC) for the cylinder you are installing the piston in.
2. Remove the connecting rod caps. Check that the bearing is securely in place.
3. Apply new engine oil to the piston, inside of the ring compressor, and cylinder bore, then attach the ring

compressor to the piston/connecting rod assembly.

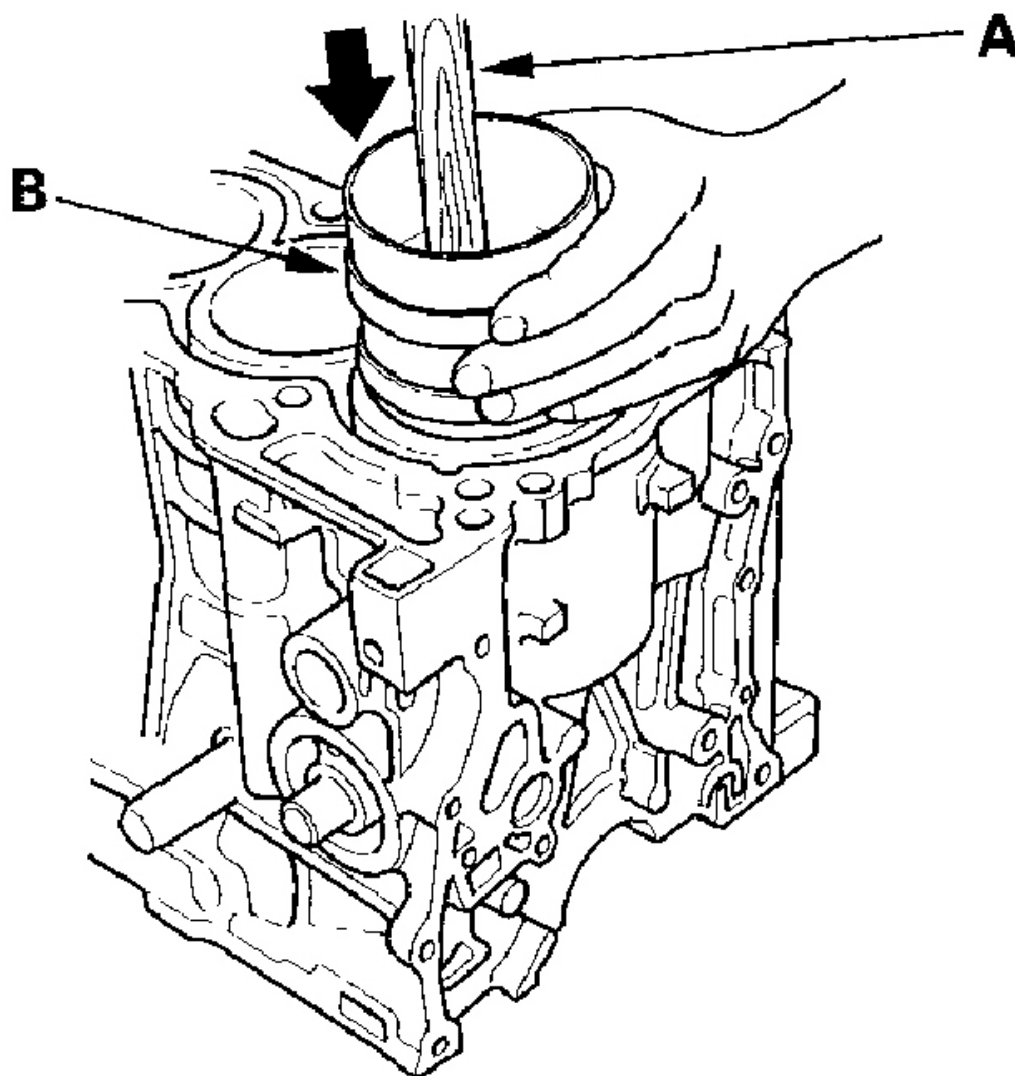
4. Position the mark (A) to face the cam chain side of the engine.



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Fig. 46: Positioning Mark To Face Cam Chain Side Of Engine
Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. Position the piston/connecting rod assembly in the cylinder, and tap it in using the wooden handle of a hammer (A). Maintain downward force on the ring compressor (B) to prevent the rings from expanding before entering the cylinder bore.



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Fig. 47: Positioning Piston/Connecting Rod Assembly In Cylinder
Courtesy of AMERICAN HONDA MOTOR CO., INC.

6. Stop after the ring compressor pops free, and check the connecting rod-to-crank journal alignment before pushing the piston into place.
7. Check the connecting rod bearing clearance with plastigage (see **CONNECTING ROD BEARING REPLACEMENT**).
8. Inspect the connecting rod bolts (see **IF THE CRANKSHAFT IS NOT INSTALLED**).
9. Apply new engine oil to the bolt threads, then install the rod caps with bearings. Torque the bolts to 20 N.m (2.0 kgf.m, 14 lbf.ft).
10. Tighten the connecting rod bolts an additional 90°.

NOTE: **Remove the connecting rod bolt if you tightened it beyond the specified angle, and go back to step 8 of the procedure. Do not loosen it back to the specified angle.**

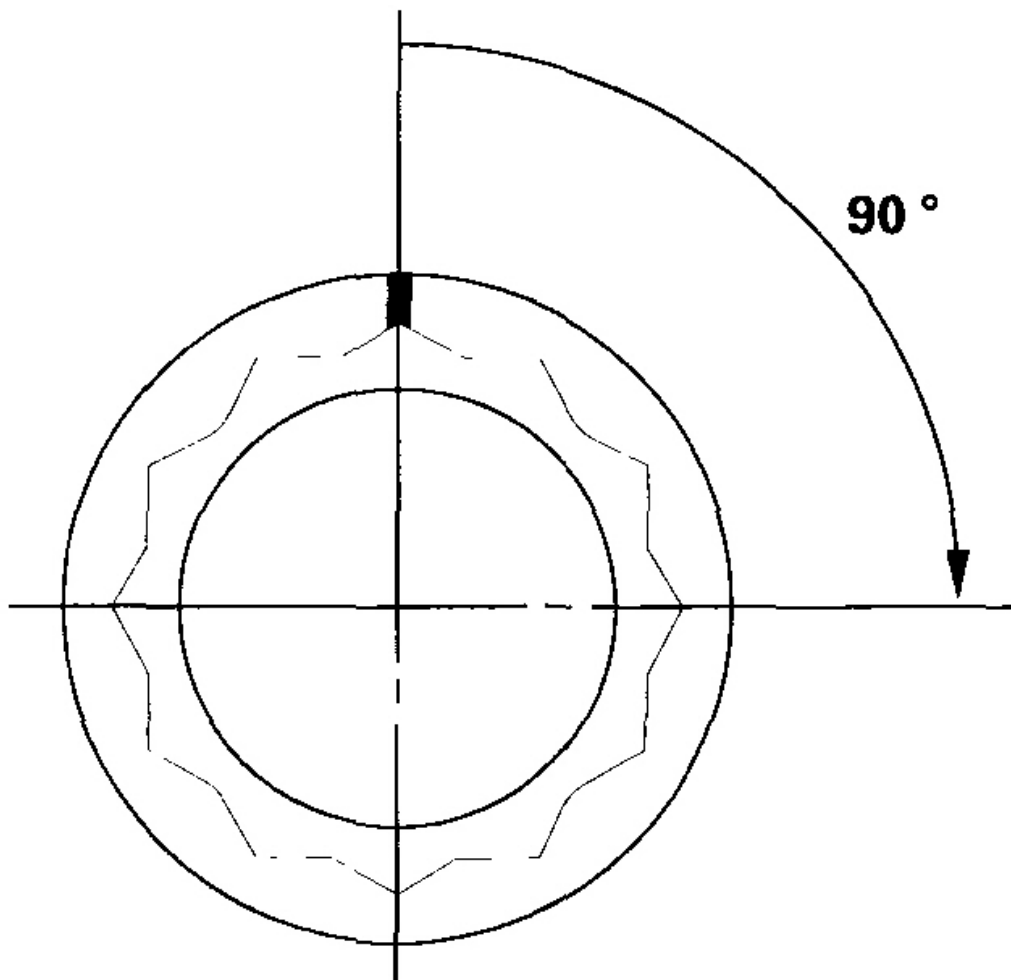
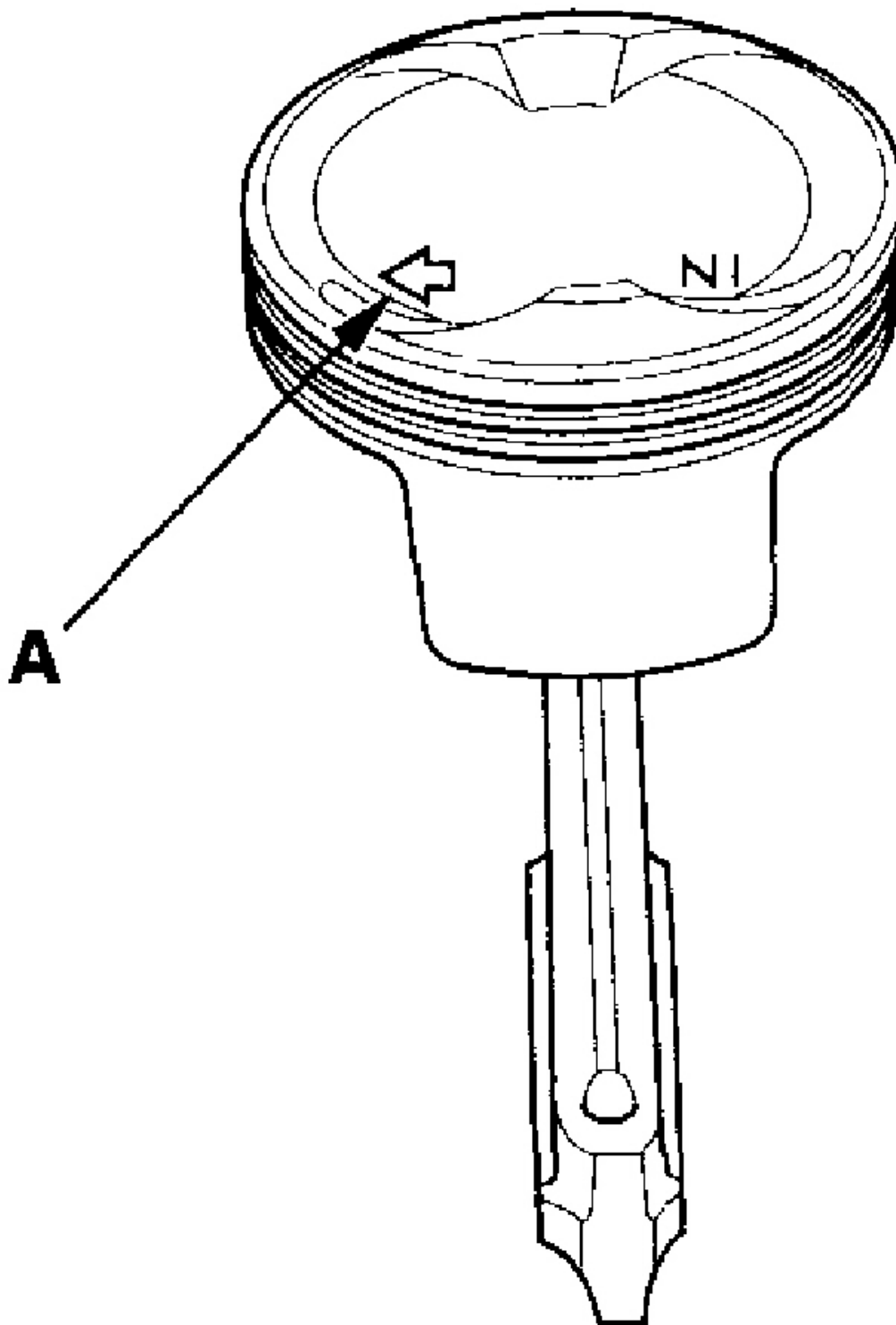
**G03677297**

Fig. 48: Connecting Rod Bolts Tightening Directions
Courtesy of AMERICAN HONDA MOTOR CO., INC.

IF THE CRANKSHAFT IS NOT INSTALLED

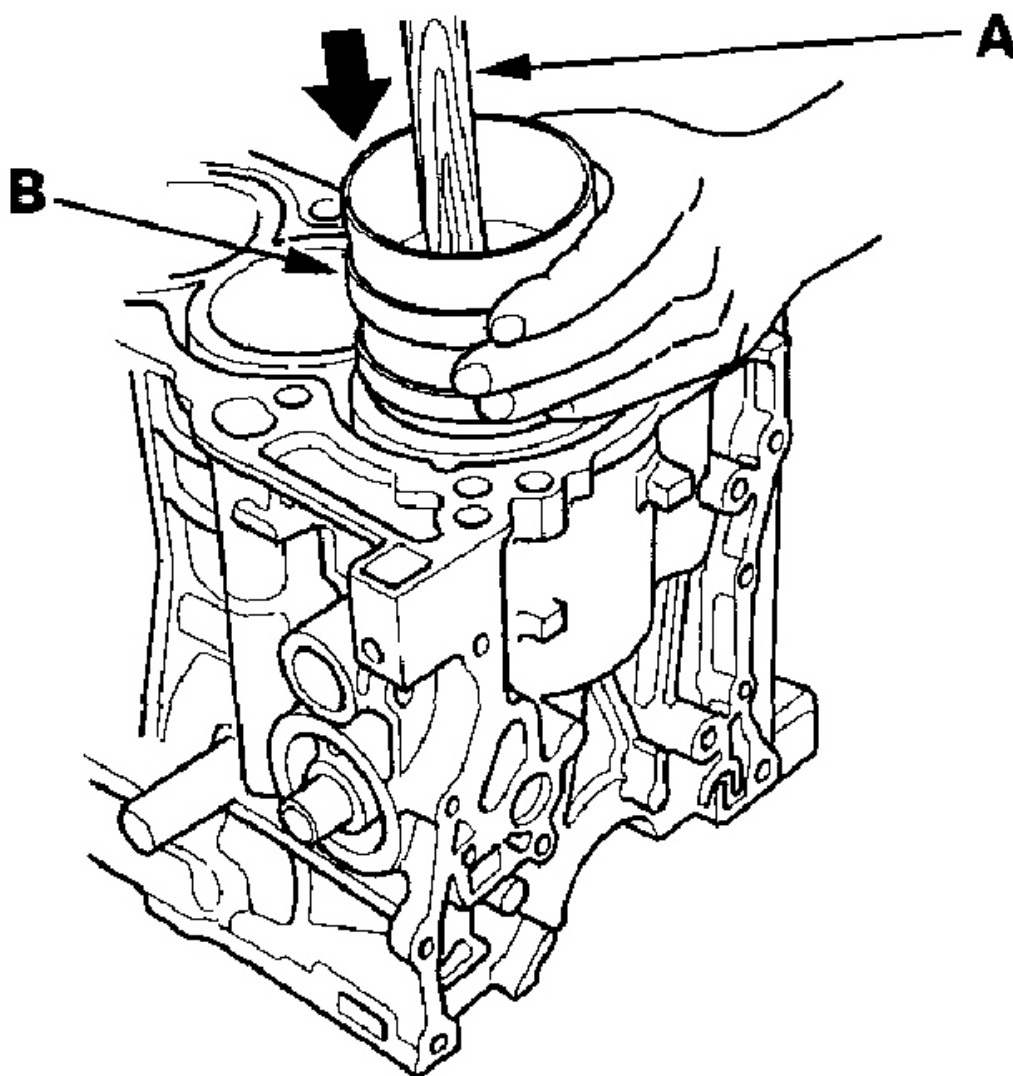
1. Remove the connecting rod caps. Check that the bearing is securely in place.
2. Apply new engine oil to the piston, inside of the ring compressor, and cylinder bore, then attach the ring compressor to the piston/connecting rod assembly.
3. Position the mark (A) to face the cam chain side of the engine.



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Fig. 49: Positioning Mark To Face Cam Chain Side Of Engine
Courtesy of AMERICAN HONDA MOTOR CO., INC.

4. Position the piston/connecting rod assembly in the cylinder, and tap it in using the wooden handle of a hammer (A). Maintain downward force on the ring compressor (B) to prevent the rings from expanding before entering the cylinder bore.



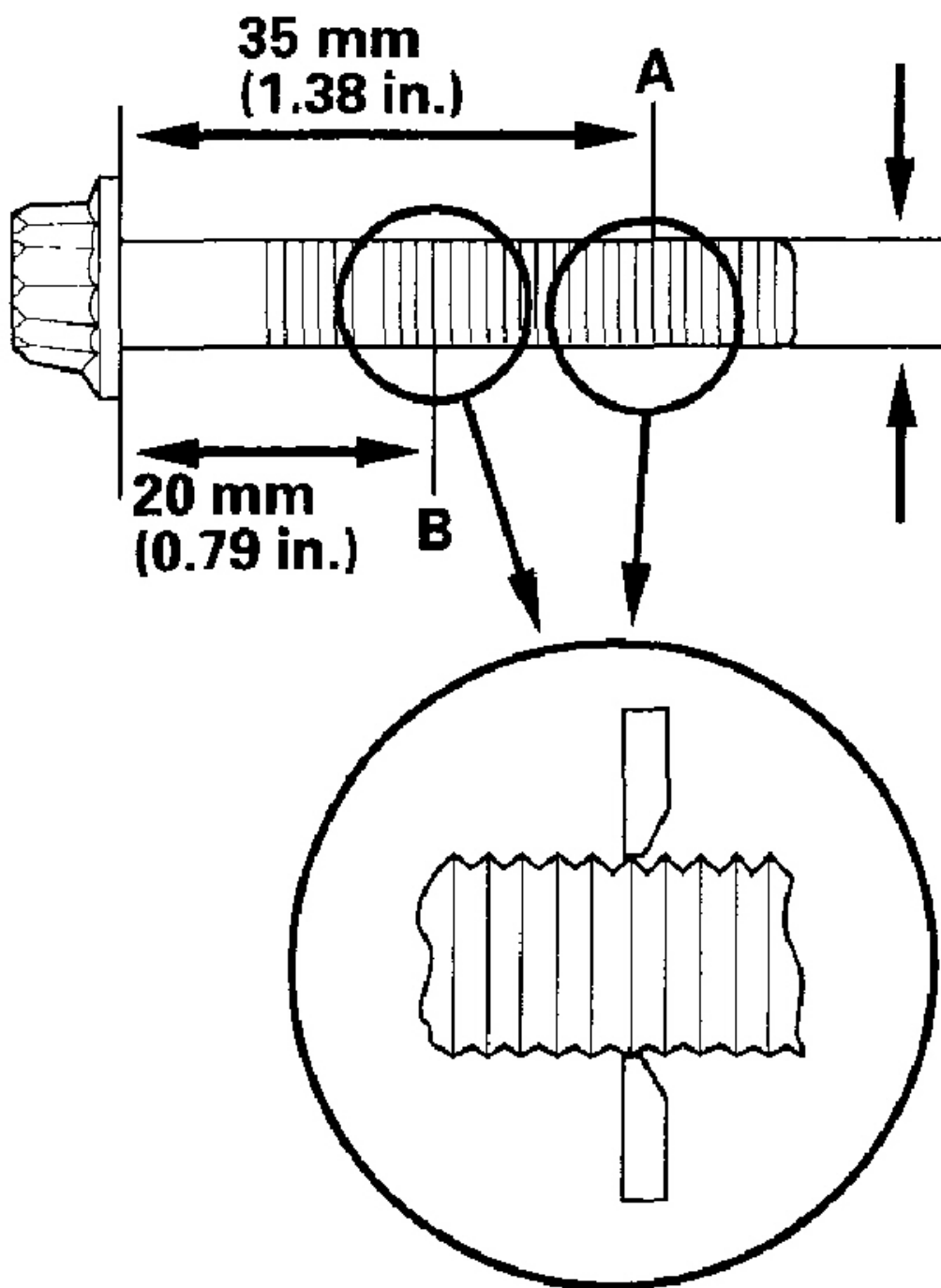
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Fig. 50: Positioning Piston/Connecting Rod Assembly In Cylinder
Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. Position all pistons at top dead center (TDC).

CONNECTING ROD BOLT INSPECTION

1. Measure the diameter of each connecting rod bolt at point A and point B.



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Fig. 51: Measuring Connecting Rod Bolt Diameter

Courtesy of AMERICAN HONDA MOTOR CO., INC.

2. Calculate the difference in diameter between point A and point B.

Point A-Point B = Difference in Diameter

Difference in Diameter:

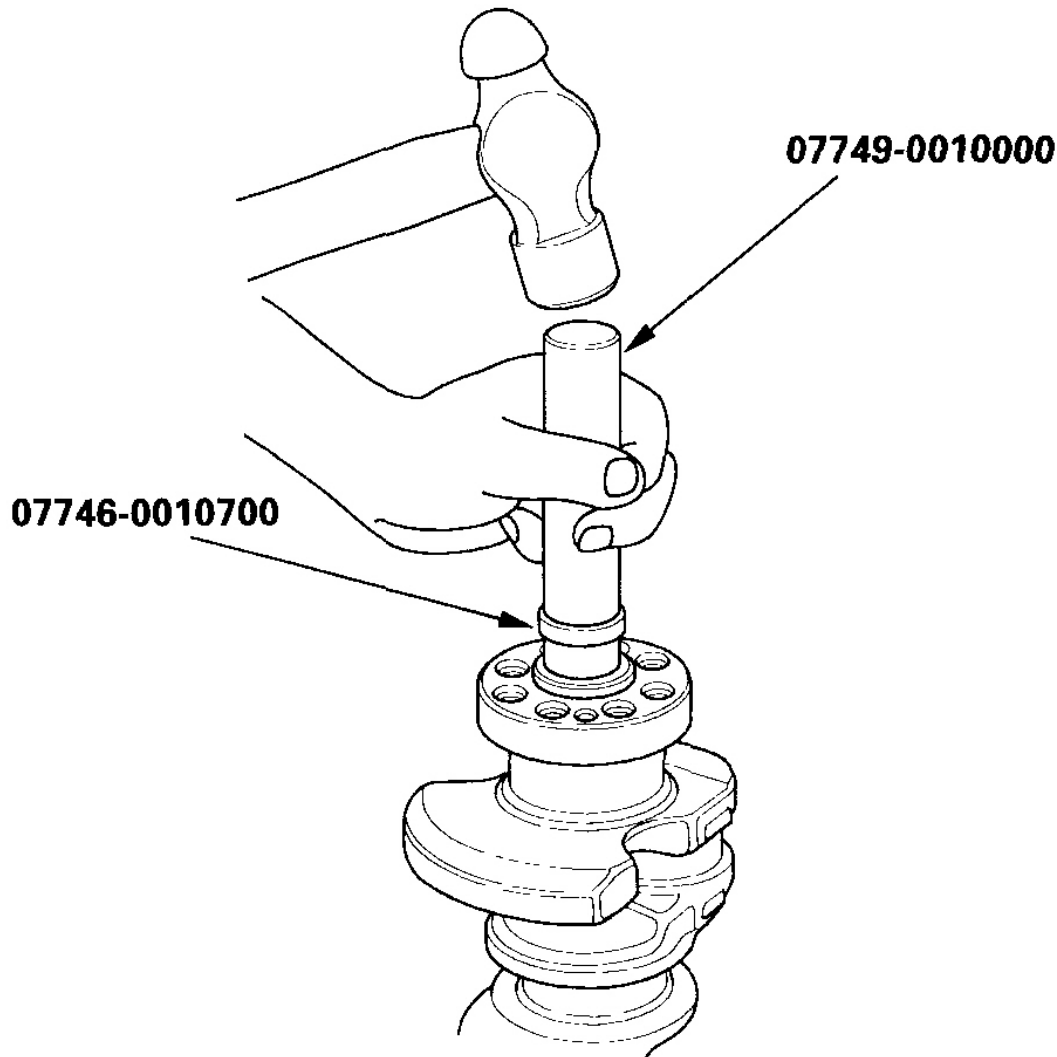
Specification: 0-0.1 mm (0-0.004 in.)

3. If the difference in diameter is out of tolerance, replace the connecting rod bolt.

CRANKSHAFT INSTALLATION

Special Tools Required

- Driver 07749-0010000
 - Attachment, 24 x 26 mm 07746-0010700
 - Oil seal driver attachment 96 07ZAD-PNAA100
1. M/T model: Install the crankshaft end bushing when replacing the crankshaft. Using the special tools, drive in the crankshaft end bushing until the special tools bottom against the crankshaft.



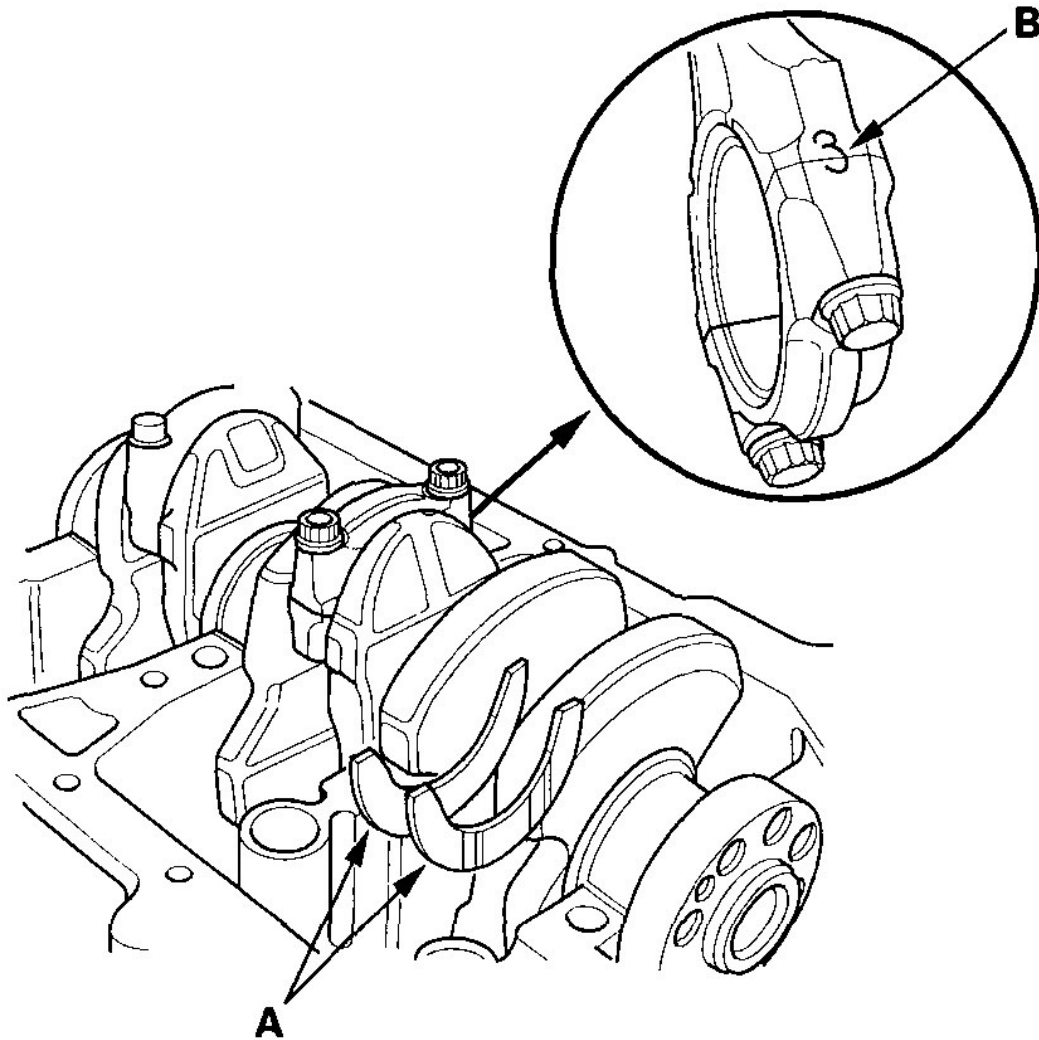
G03677301

Fig. 52: Installing Crankshaft End Bushing

Courtesy of AMERICAN HONDA MOTOR CO., INC.

2. Check the connecting rod bearing clearance with plastigage (see **CONNECTING ROD BEARING REPLACEMENT**).
3. Check the main bearing clearance with plastigage (see **CRANKSHAFT MAIN BEARING REPLACEMENT**).
4. Install the bearing halves in the engine block and connecting rods.
5. Apply a coat of new engine oil to the main bearings and rod bearings.
6. Hold the crankshaft so rod journal No. 2 and rod journal No. 3 are straight up, and lower the crankshaft into the engine block.

7. Apply new engine oil to the thrust washer surfaces. Install the thrust washers (A) in the No. 4 journal of the engine block.



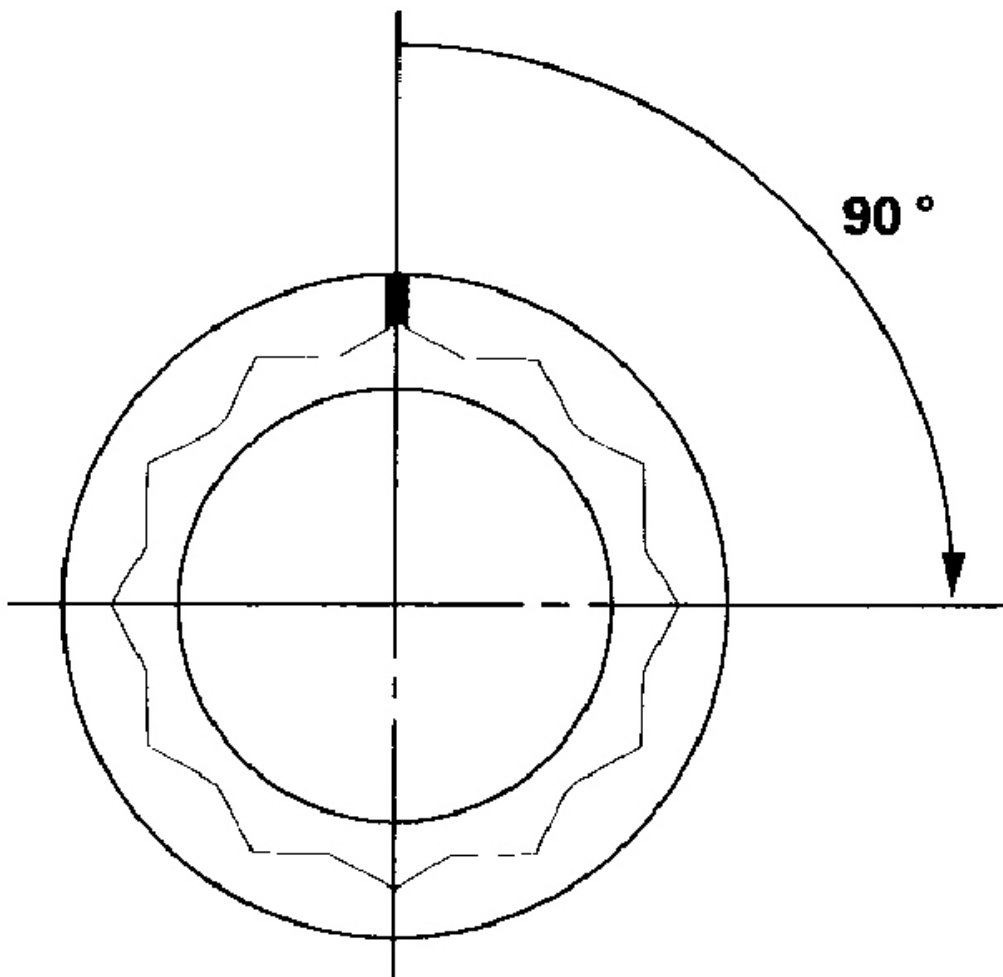
G03677302

Fig. 53: Installing Thrust Washers In Engine Block No. 4 Journal
Courtesy of AMERICAN HONDA MOTOR CO., INC.

8. Inspect the connecting rod bolts (see **IF THE CRANKSHAFT IS NOT INSTALLED**).
9. Apply new engine oil to the threads of the connecting rod bolts.
10. Seat the rod journals into connecting rod No. 1 and connecting rod No. 4. Line up the mark (B) on the connecting rod and cap, then install the caps and bolts finger-tight.
11. Rotate the crankshaft clockwise, and seat the journals into connecting rod No. 2 and connecting rod No.

3. Line up the mark on the connecting rod and cap, then install the caps and bolts finger-tight.
12. Tighten the connecting rod bolts to 20 N.m (2.0 kgf.m, 14 lbf.ft).
13. Tighten the connecting rod bolts an additional 90°.

NOTE: Remove the connecting rod bolt if you tightened it beyond the specified angle, and go back to step 8 of the procedure. Do not loosen it back to the specified angle.

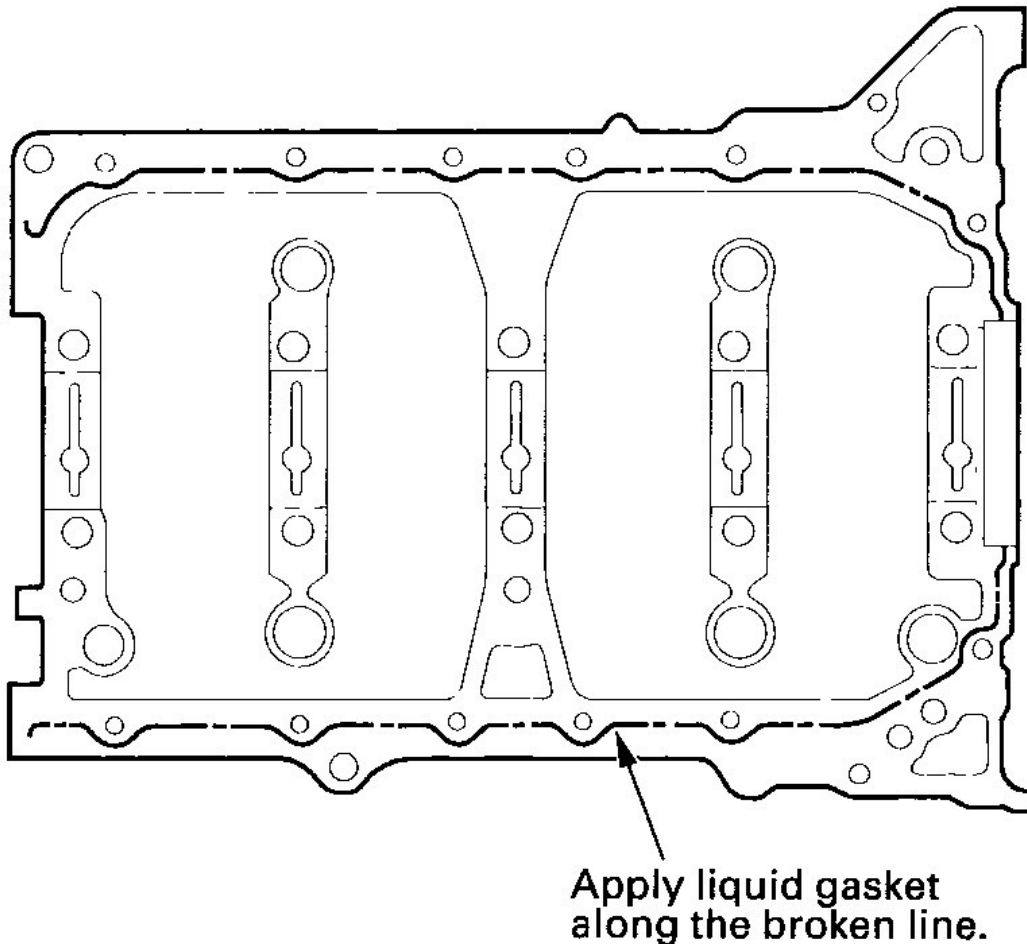


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Fig. 54: Connecting Rod Bolts Tightening Directions
Courtesy of AMERICAN HONDA MOTOR CO., INC.

14. Remove all of the old liquid gasket from the lower block mating surfaces, bolts, and bolt holes.
15. Clean and dry the lower block mating surfaces.
16. Apply liquid gasket, P/N 08717-0004, 08718-0001, 08718-0002, 08718-0003, or 08718-0009, evenly to the engine block mating surface of the lower block.

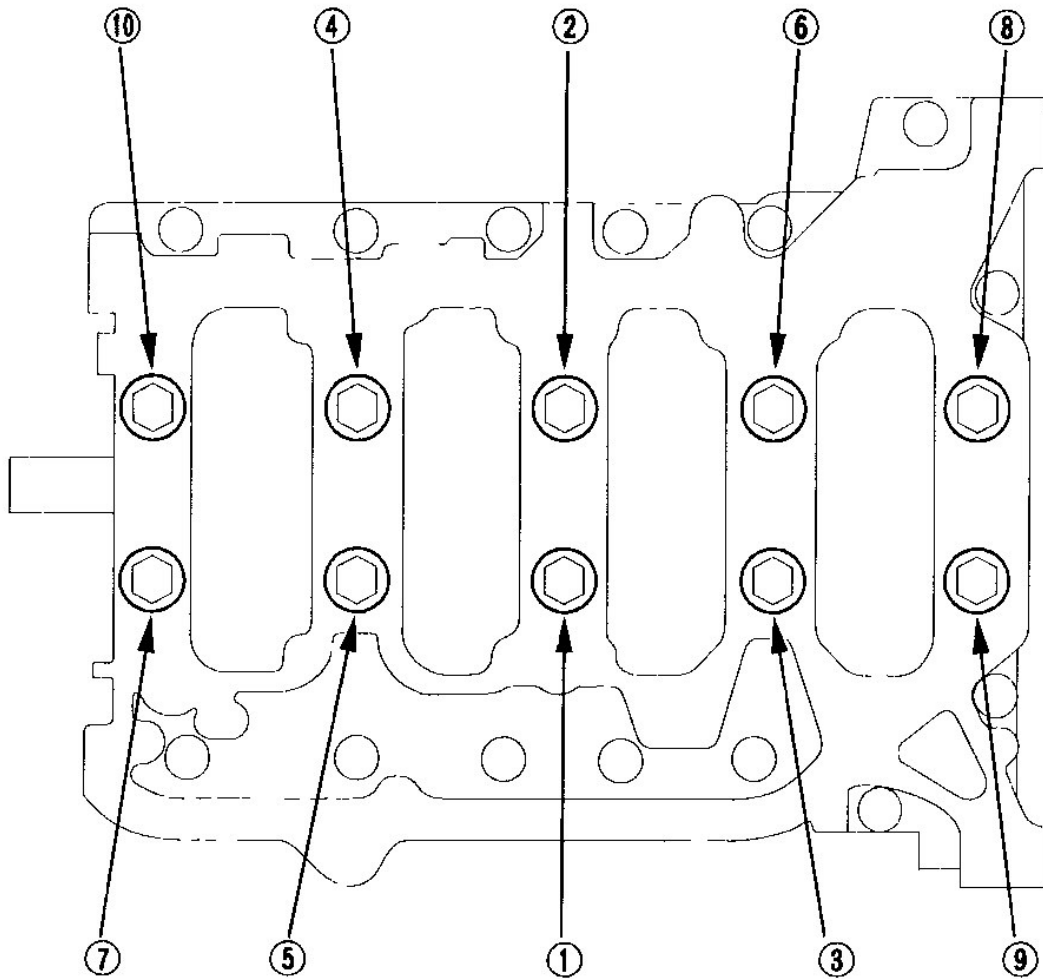
NOTE: Do not install components if too much time has passed after applying the liquid gasket (for P/N 08718-0002, no more than 4 minutes, for all others, no more than 5 minutes). Instead, remove the old residue and reapply the liquid gasket.



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Fig. 55: Locating Liquid Gasket Applying Point
Courtesy of AMERICAN HONDA MOTOR CO., INC.

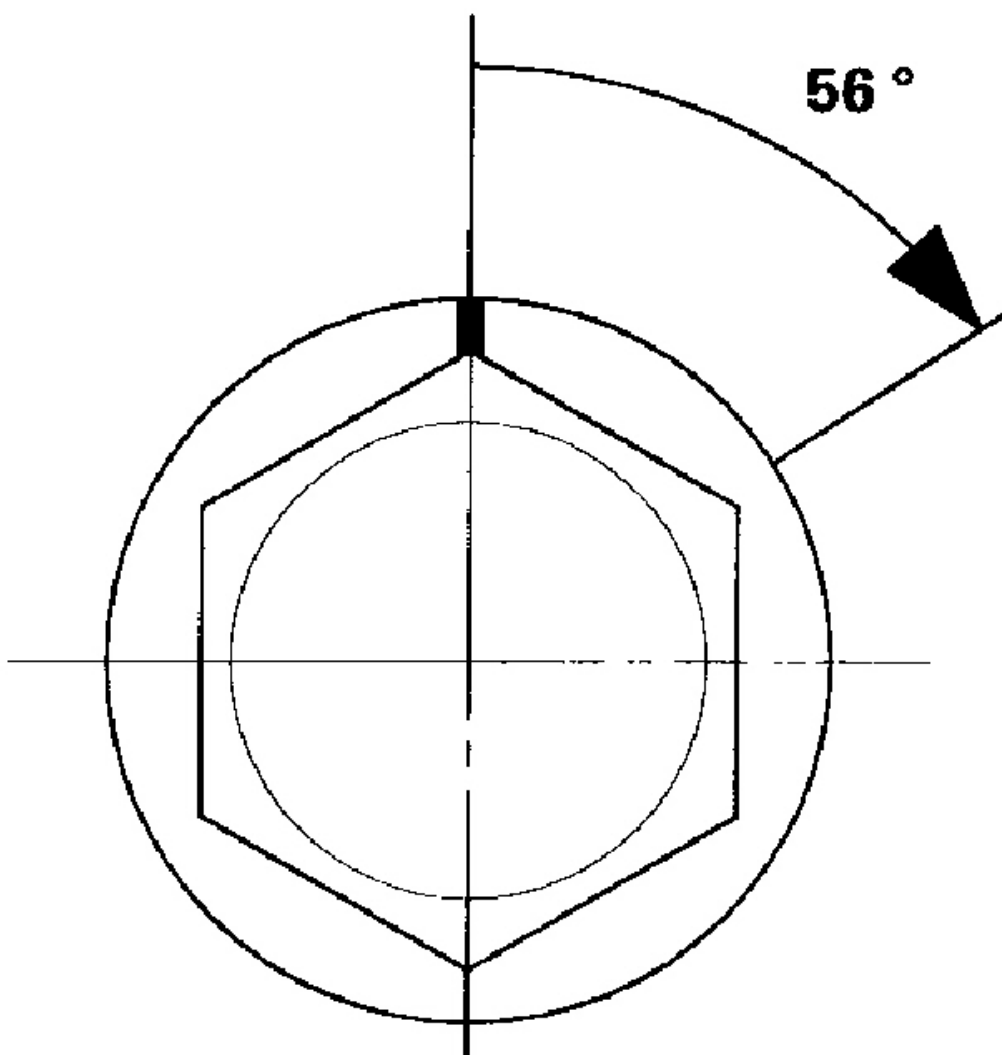
17. Put the lower block on the engine block.
18. Apply new engine oil to the bearing cap bolts. Tighten the bearing cap bolts in sequence to 29 N.m (3.0 kgf.m, 22 lbf.ft).



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Fig. 56: Tightening Bearing Cap Bolts In Sequence
Courtesy of AMERICAN HONDA MOTOR CO., INC.

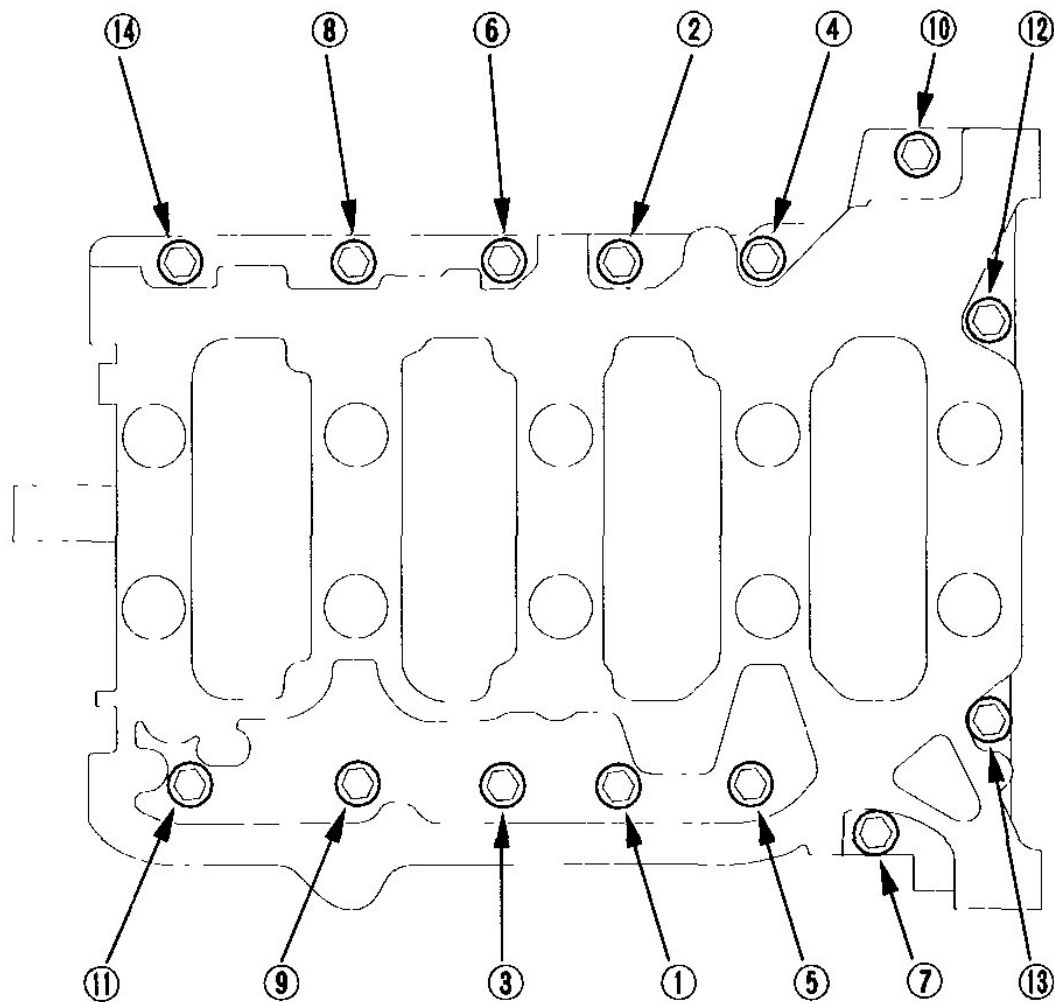
19. Tighten the bearing cap bolts an additional 56°.



G03677306

Fig. 57: Bearing Cap Bolts Tightening Directions
Courtesy of AMERICAN HONDA MOTOR CO., INC.

20. Tighten the 8 mm bolts in sequence to 22 N.m (2.2 kgf.m, 16 lbf.ft).



G03677307

Fig. 58: Tightening Bolts In Sequence

Courtesy of AMERICAN HONDA MOTOR CO., INC.

21. Use the special tools to drive a new crankshaft oil seal squarely into the engine block to the specified installed height.

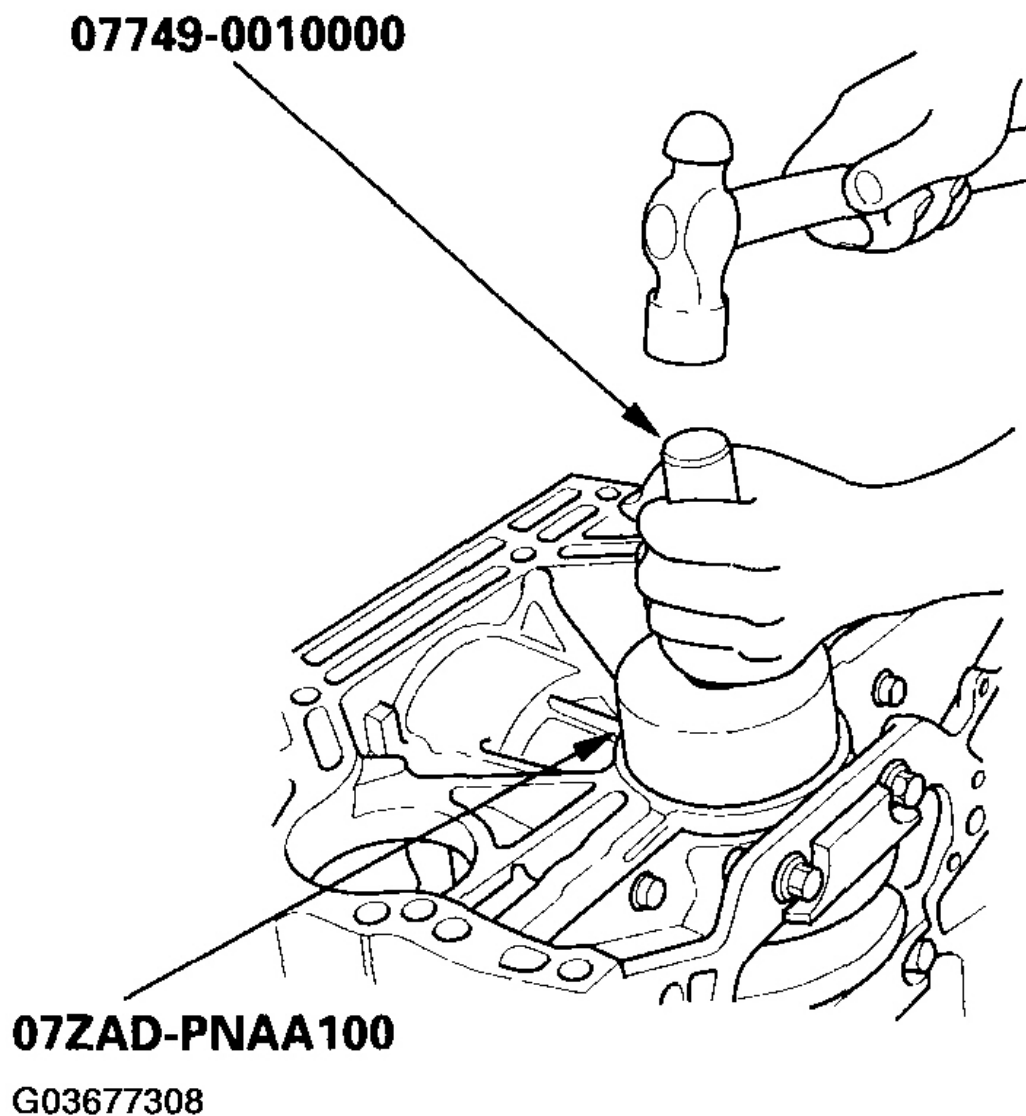


Fig. 59: Installing Crankshaft Oil Seal Into Engine Block
Courtesy of AMERICAN HONDA MOTOR CO., INC.

22. Measure the distance between the engine block (A) and crankshaft oil seal (B).

Crankshaft Oil Seal Installed Height:

0.2-1.2 mm (0.001-0.047 in.)

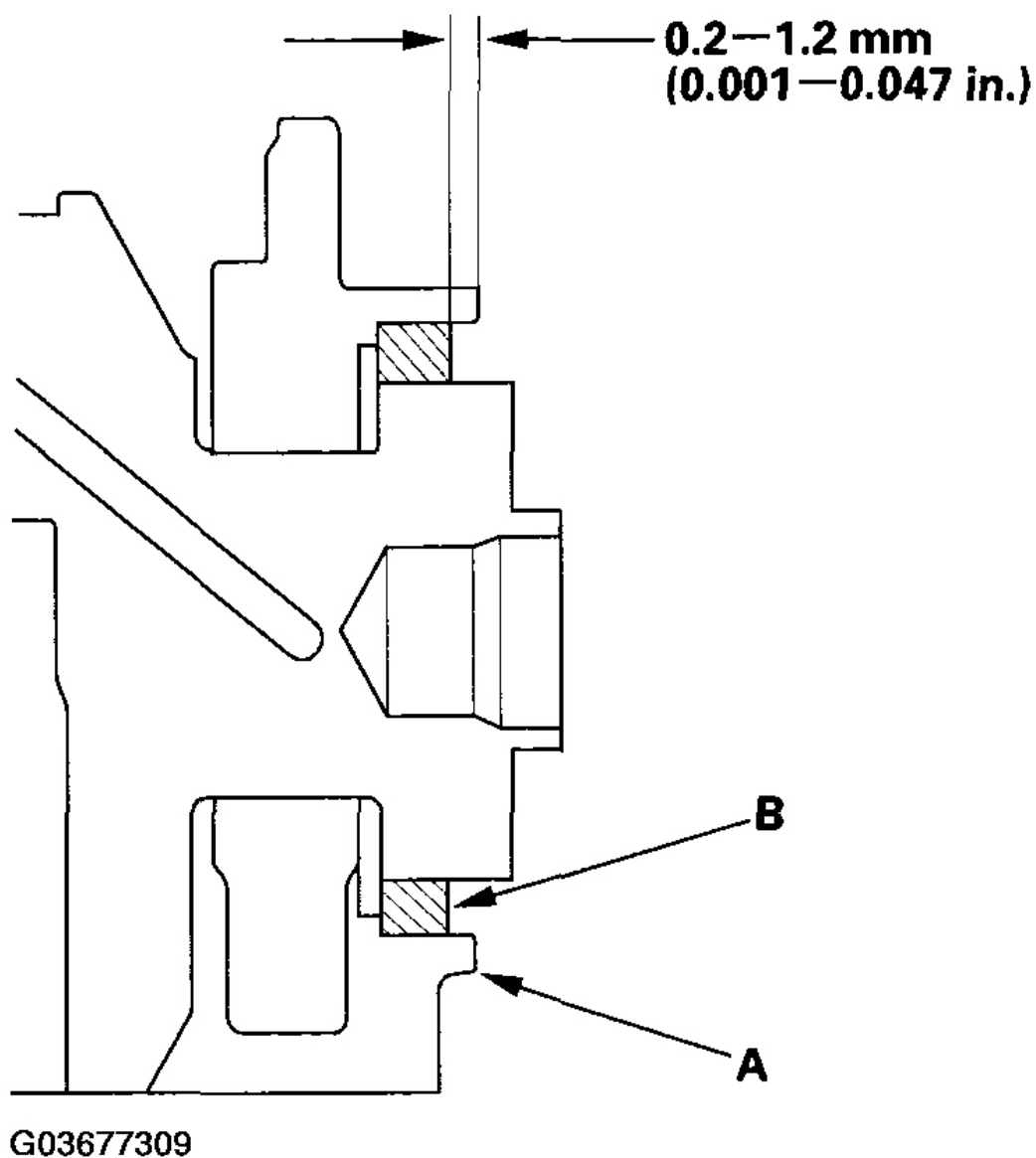
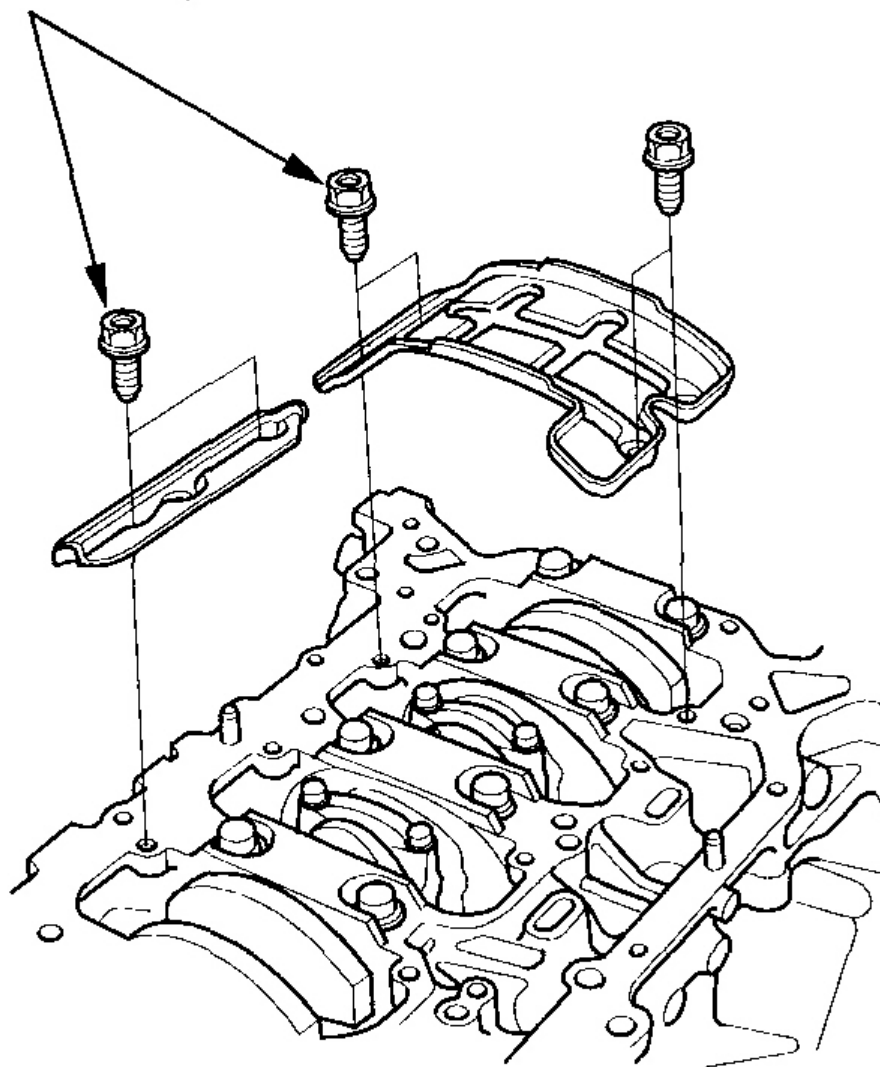


Fig. 60: Measuring Distance Between Engine Block And Crankshaft Oil Seal
Courtesy of AMERICAN HONDA MOTOR CO., INC.

23. Install the baffle plates.

**6 x 1.0 mm
12 N·m (1.2 kgf·m, 8.7 lbf·ft)**



G03677310

Fig. 61: Installing Baffle Plates And Torque Specifications
Courtesy of AMERICAN HONDA MOTOR CO., INC.

24. Install the oil pump (see **OIL PUMP INSTALLATION**).
25. Install the oil pan (see **OIL PAN INSTALLATION**).
26. Install the cylinder head (see **CYLINDER HEAD INSTALLATION**).

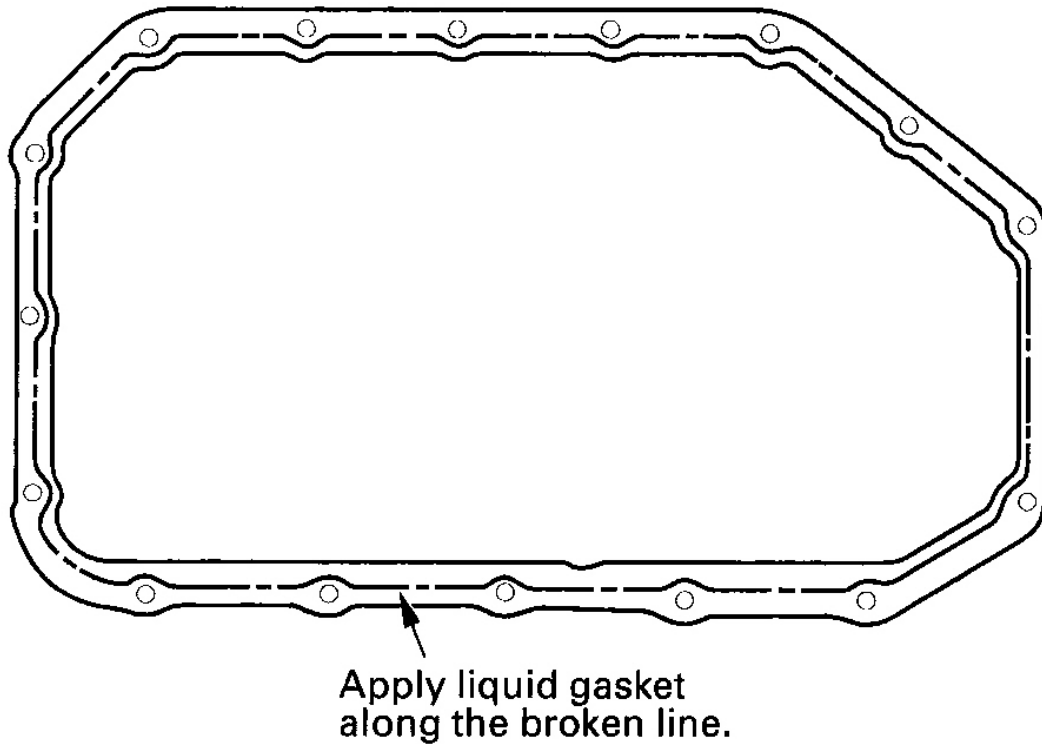
27. M/T model: Install the flywheel (see **FLYWHEEL INSPECTION**) clutch disc (see **CLUTCH DISC AND PRESSURE PLATE INSTALLATION**), and pressure plate (see **CLUTCH DISC AND PRESSURE PLATE INSTALLATION**).
28. A/T model: Install the drive plate (see **DRIVE PLATE REMOVAL AND INSTALLATION**).
29. Install the transmission:
 - Manual transmission (see **TRANSMISSION INSTALLATION**)
 - Automatic transmission (see **TRANSMISSION INSTALLATION**)
30. Install the engine assembly (see **ENGINE INSTALLATION**).

NOTE: Whenever any crankshaft or connecting rod bearing is replaced, it is necessary after reassembly to run the engine at idling speed until it reaches normal operating temperature, then continue to run it for about 15 minutes.

OIL PAN INSTALLATION

1. Remove all of the old liquid gasket from the oil pan mating surfaces, bolts, and bolt holes.
2. Clean and dry the oil pan mating surfaces.
3. Apply liquid gasket, P/N 08717-0004, 08718-0001, 08718-0002, 08718-0003, or 08718-0009, evenly to the engine block mating surface of the oil pan.

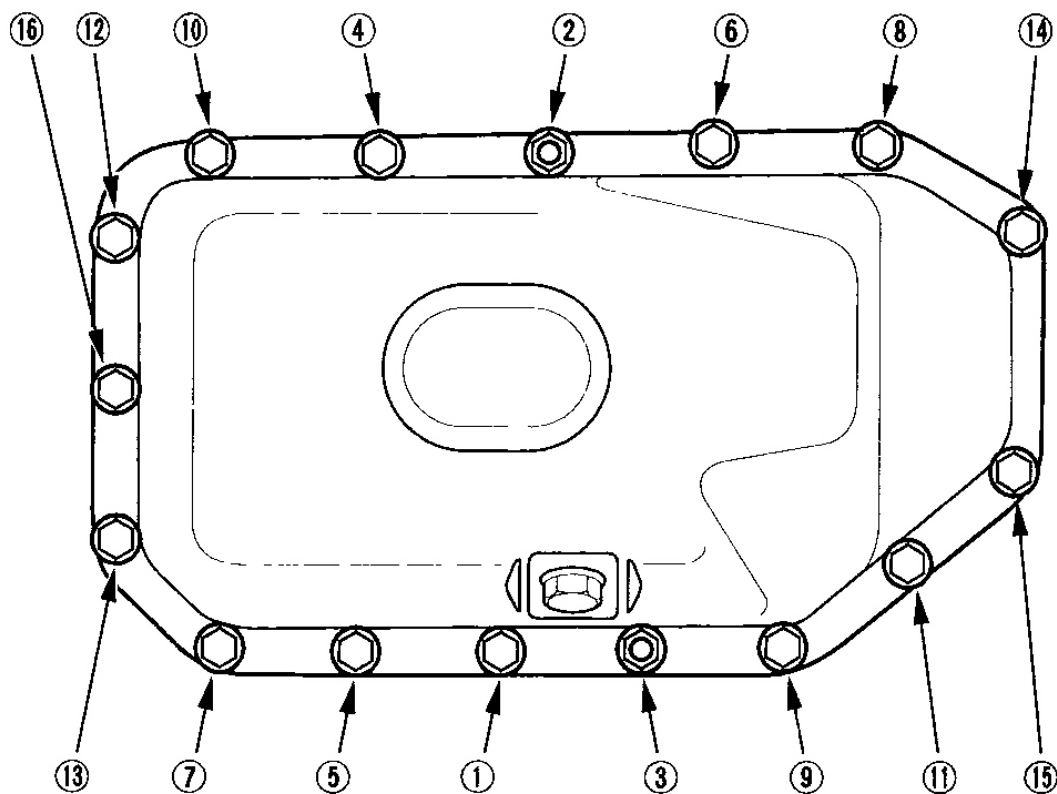
NOTE: Do not install components if too much time has passed after applying the liquid gasket (for P/N 08718-0002, no more than 4 minutes, for all others, no more than 5 minutes). Instead, remove the old residue and reapply the liquid gasket.



G03677311

Fig. 62: Locating Liquid Gasket Applying Point
Courtesy of AMERICAN HONDA MOTOR CO., INC.

4. Install the oil pan.
5. Tighten the bolts/nuts in two or three steps. In the final step, tighten all bolts, in sequence, to 12 N.m (1.2 kgf.m, 8.7 lbf.ft).

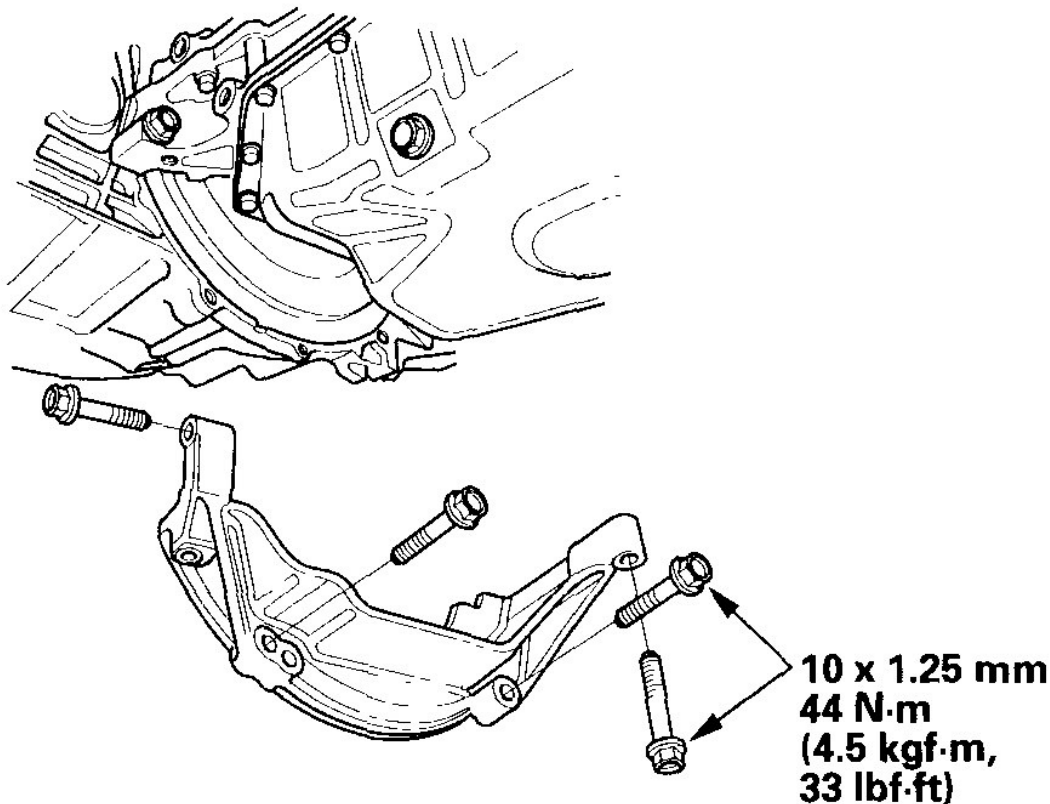


G03677312

Fig. 63: Tightening Bolts/Nuts In Sequence

Courtesy of AMERICAN HONDA MOTOR CO., INC.

6. M/T model: Install the stiffener.



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Fig. 64: Installing Stiffener (M/T Model) And Torque Specifications
Courtesy of AMERICAN HONDA MOTOR CO., INC.

7. If the engine is still in the vehicle, install the subframe.
 - 1 Support the subframe with the special tool and a jack, and lift it up to body, then loosely install the new subframe mounting bolts (see step 4 on ENGINE INSTALLATION).
 - 2 Align the reference marks with the center of the subframe mounting bolts, then tighten the bolts to the specified torque (see step 6 on ENGINE INSTALLATION).
 - 3 A/T model: Install the automatic transmission fluid (ATF) filter mounting bolt (see step 37 on ENGINE INSTALLATION).
 - 4 Tighten the rear mount mounting bolts (see step 8 on ENGINE INSTALLATION).
 - 5 Tighten the front mount mounting bolt (see step 18 on ENGINE INSTALLATION).
 - 6 Connect the suspension lower arm ball joints (see LOWER ARM REPLACEMENT).
8. After assembly, wait at least 30 minutes before filling the engine with oil.

TRANSMISSION END CRANKSHAFT OIL SEAL INSTALLATION - IN CAR

Special Tools Required

- Driver 07749-0010000
- Oil seal driver attachment 96 07ZAD-PNAA100

1. Clean and dry the crankshaft oil seal housing.
2. Apply a light coat of multipurpose grease to the crankshaft and to the lip of the seal.
3. Use the special tools to drive a new oil seal squarely into the engine block to the specified installed height.

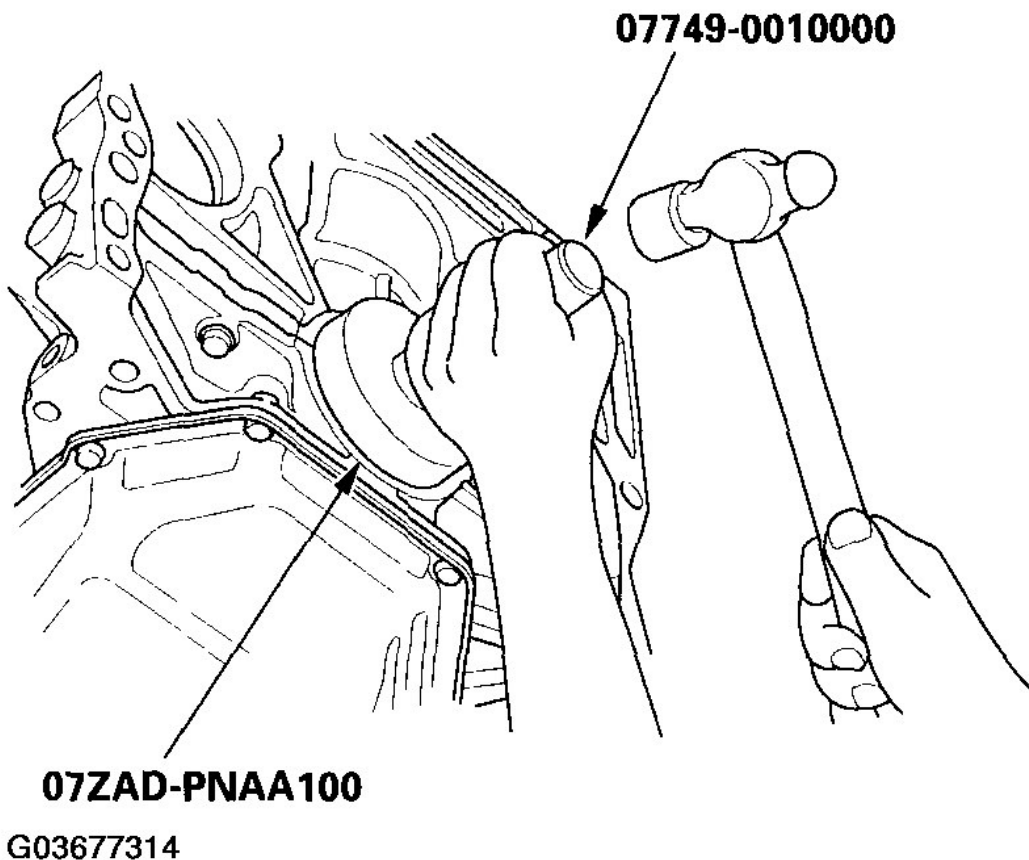


Fig. 65: Installing Oil Seal Into Engine Block
Courtesy of AMERICAN HONDA MOTOR CO., INC.

4. Measure the distance between the engine block (A) and crankshaft oil seal (B).

Crankshaft Oil Seal Installed Height:

0.2-1.2 mm (0.001-0.047 in.)

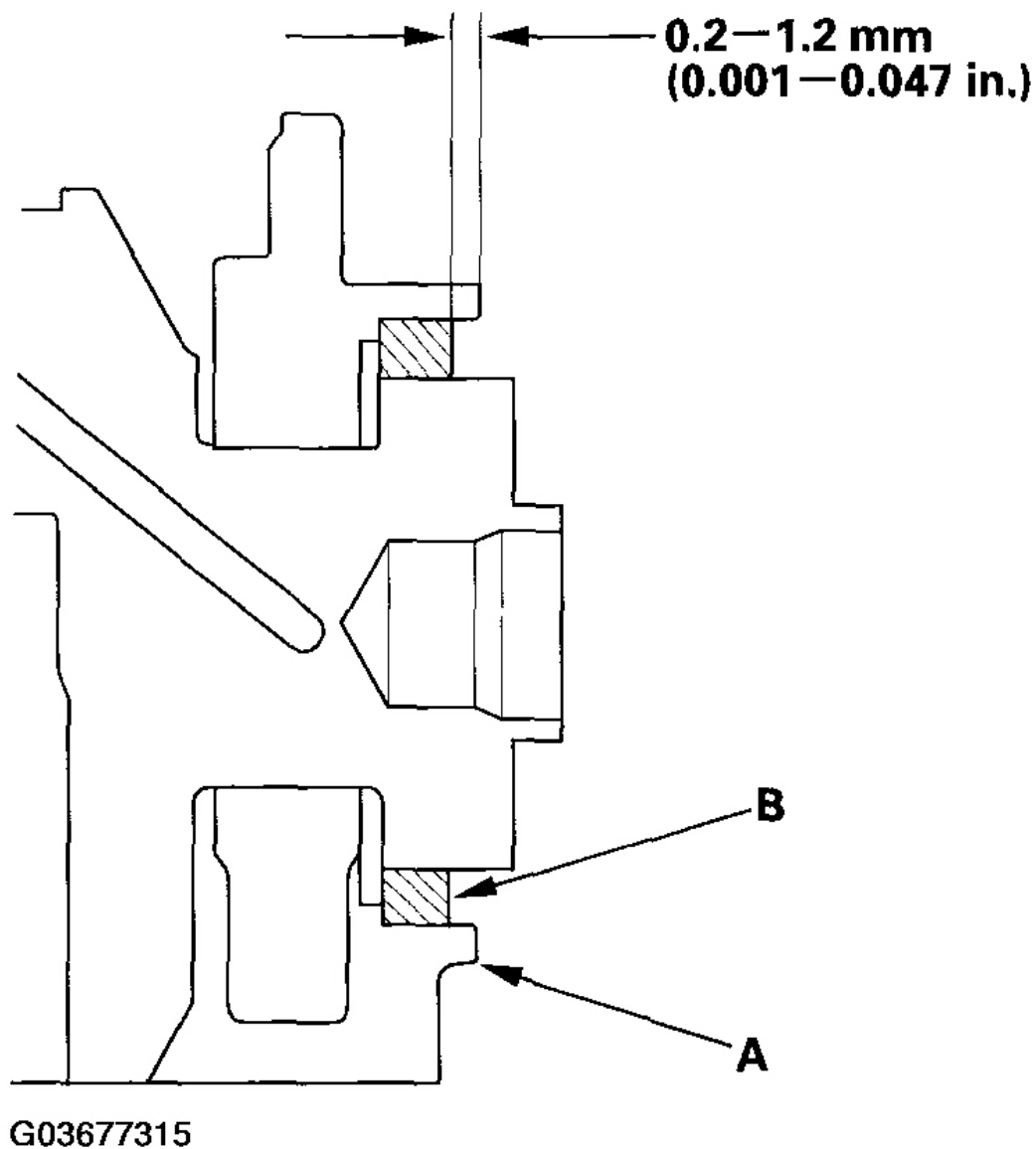


Fig. 66: Identifying Distance Between Engine Block And Crankshaft Oil Seal
Courtesy of AMERICAN HONDA MOTOR CO., INC.