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

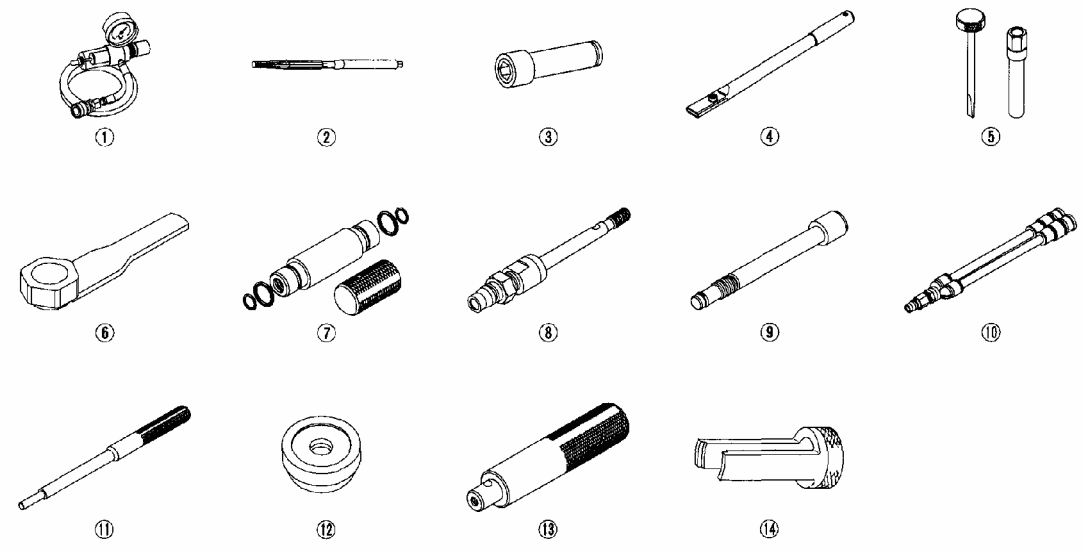

Fig. 1: View Of Special Service Tool And Description Chart
Courtesy of AMERICAN HONDA MOTOR CO., INC.

COMPONENT LOCATION INDEX

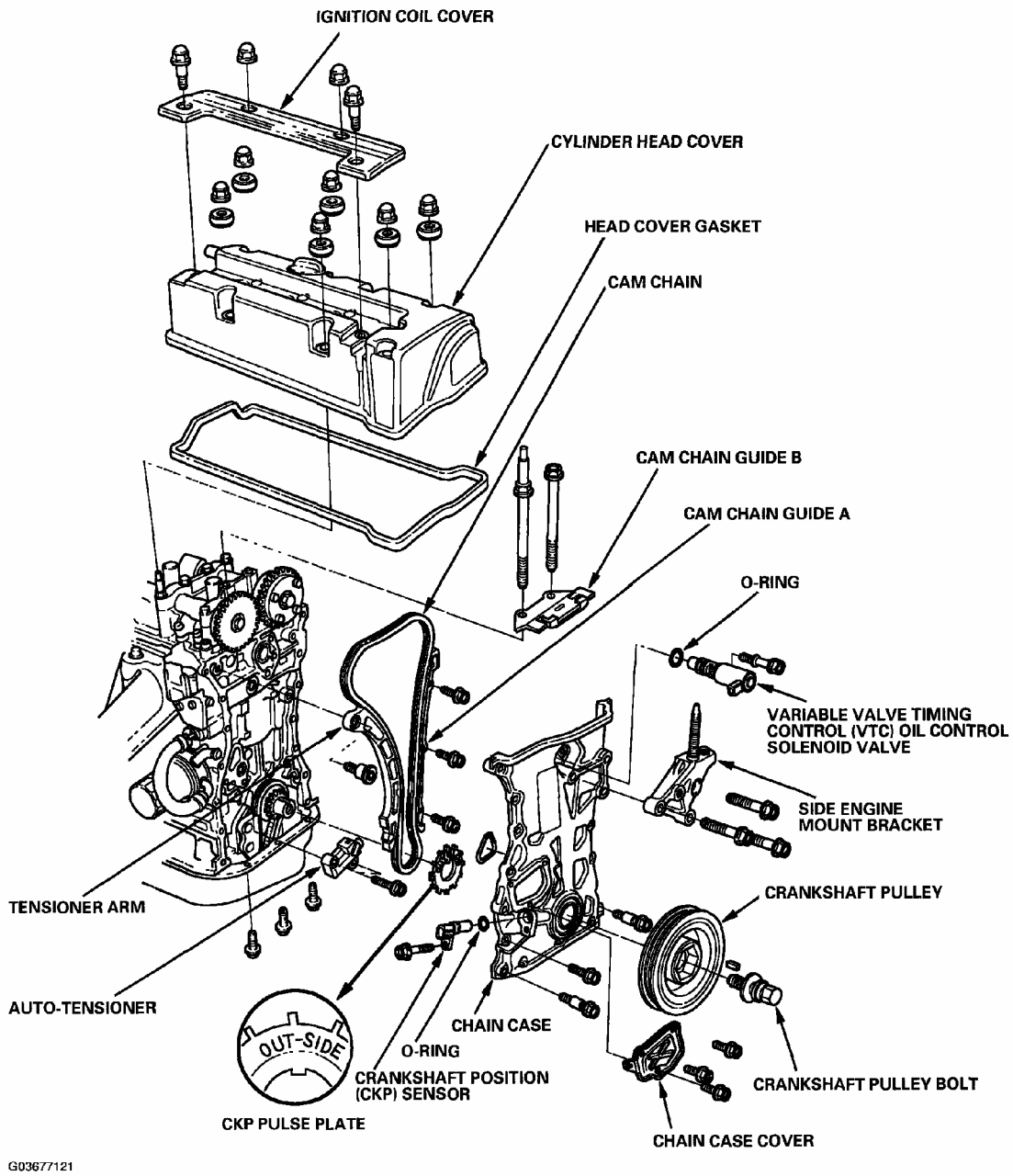

Fig. 2: Exploded View Of Cylinder Head Components (1 Of 3)
Courtesy of AMERICAN HONDA MOTOR CO., INC.

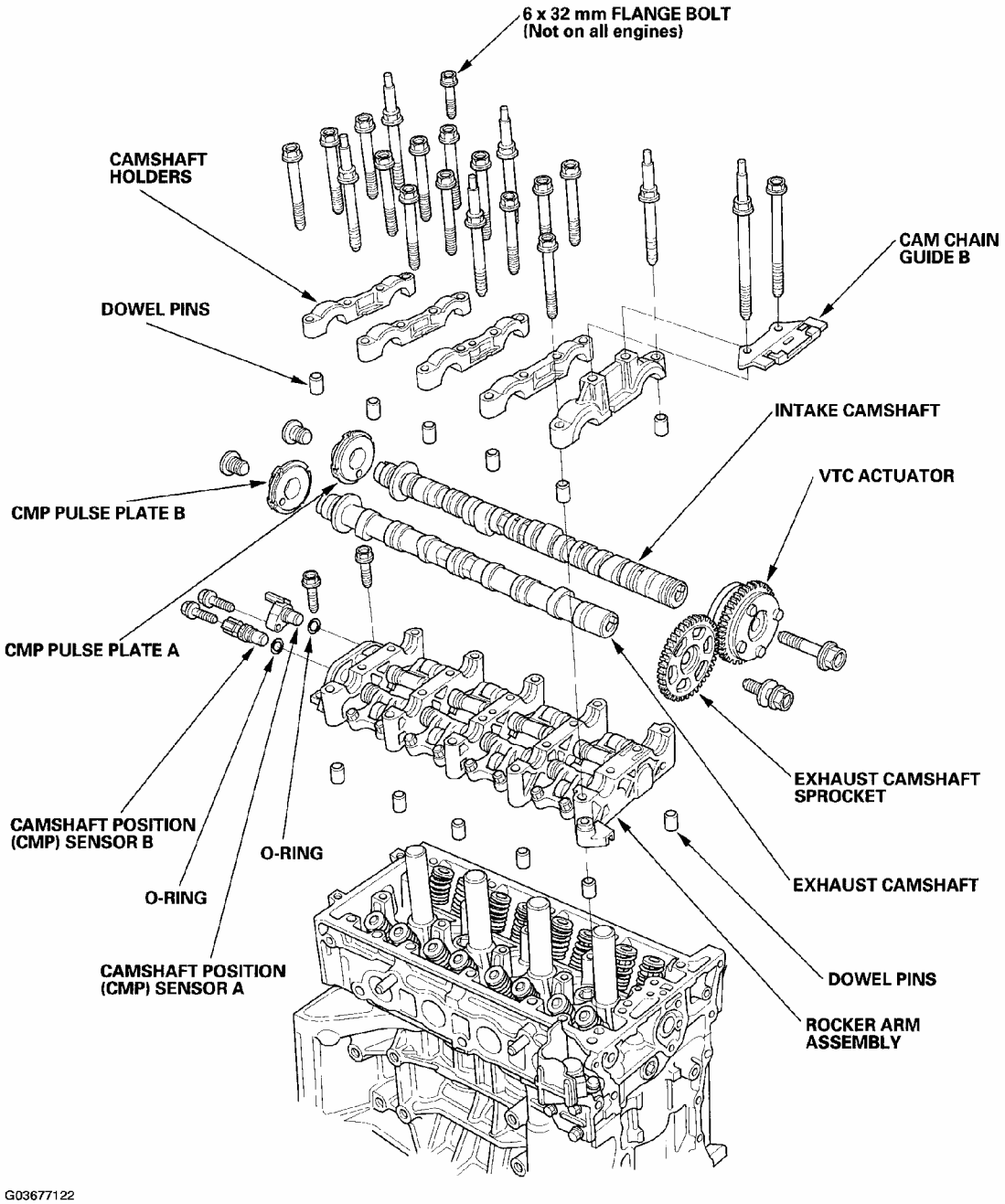

Fig. 3: Exploded View Of Cylinder Head Components (2 Of 3)
Courtesy of AMERICAN HONDA MOTOR CO., INC.

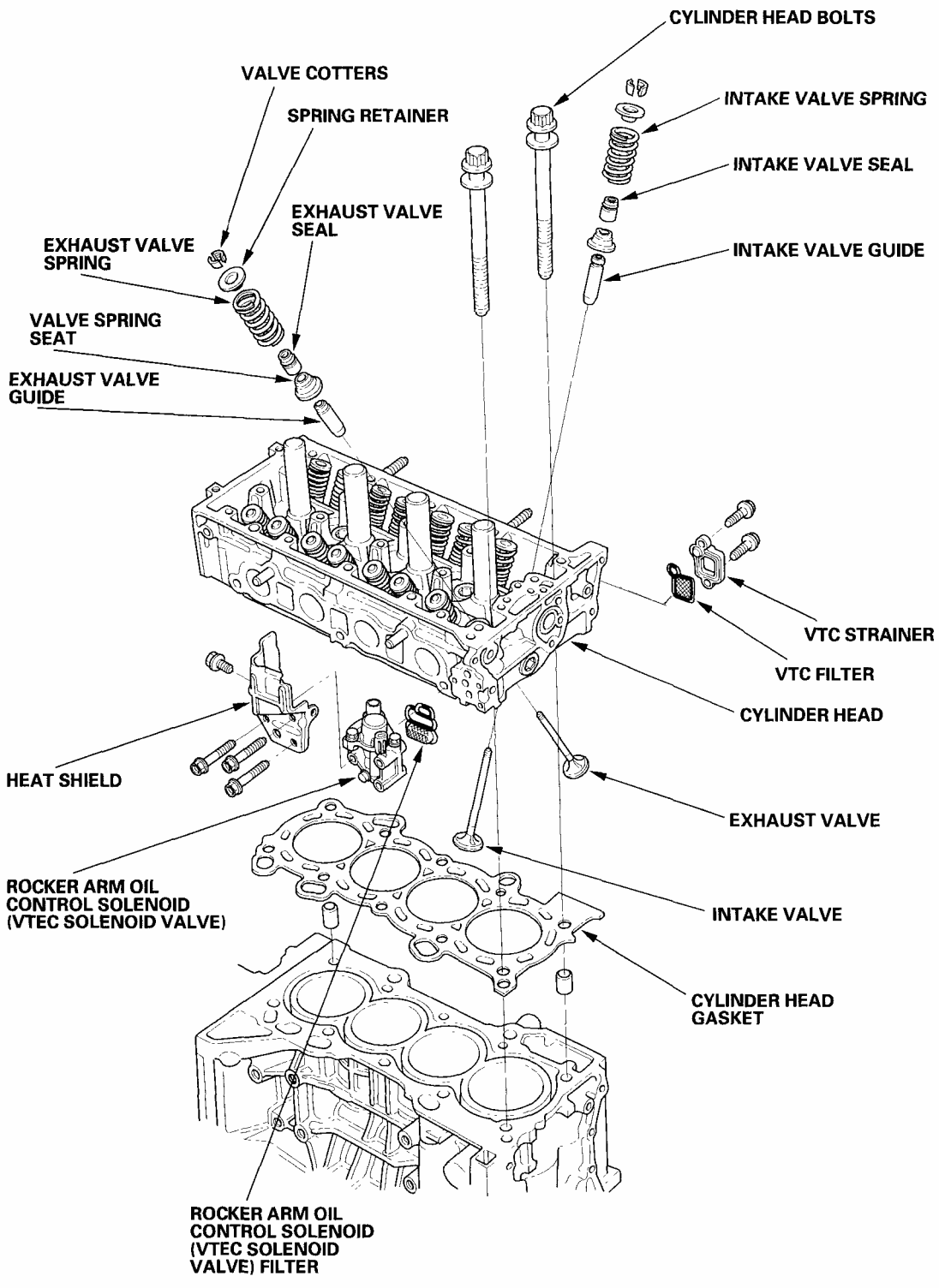

Fig. 4: Exploded View Of Cylinder Head Components (3 Of 3)
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

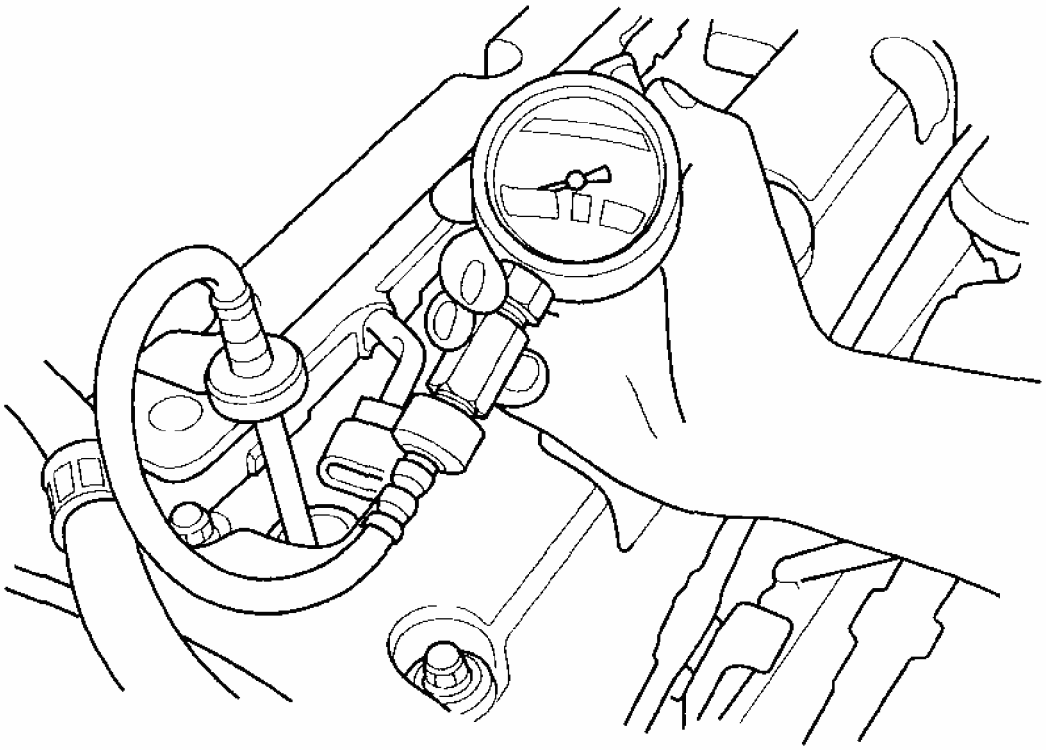

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Fig. 5: Attaching Compression Gauge To Spark Plug Hole
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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/cm^2 , 135 psi)

9. Measure the compression on the remaining cylinders.

   Maximum Variation:

   Within 200 kPa (2.0 kgf/cm^2 , 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.

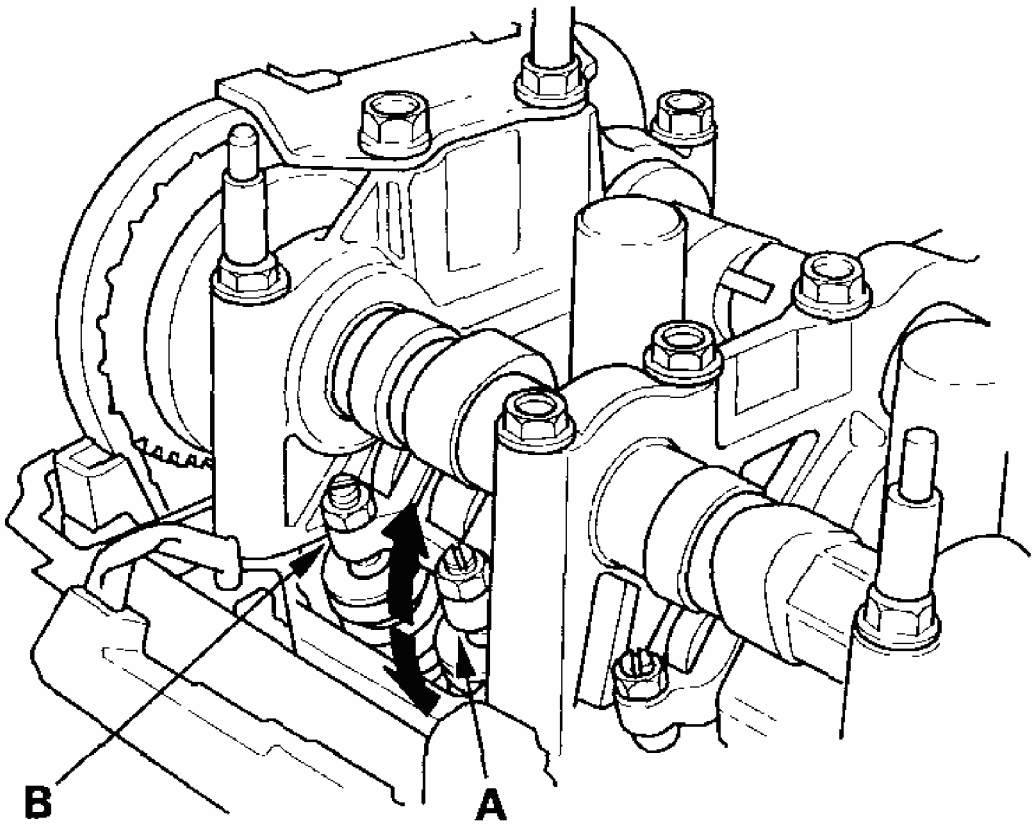

Fig. 6: Identifying Intake Primary Rocker Arm Movement
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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/cm^2 , 57 psi).
8. Remove the sealing bolt (A) from the relief hole, and install the VTEC air stopper (B).

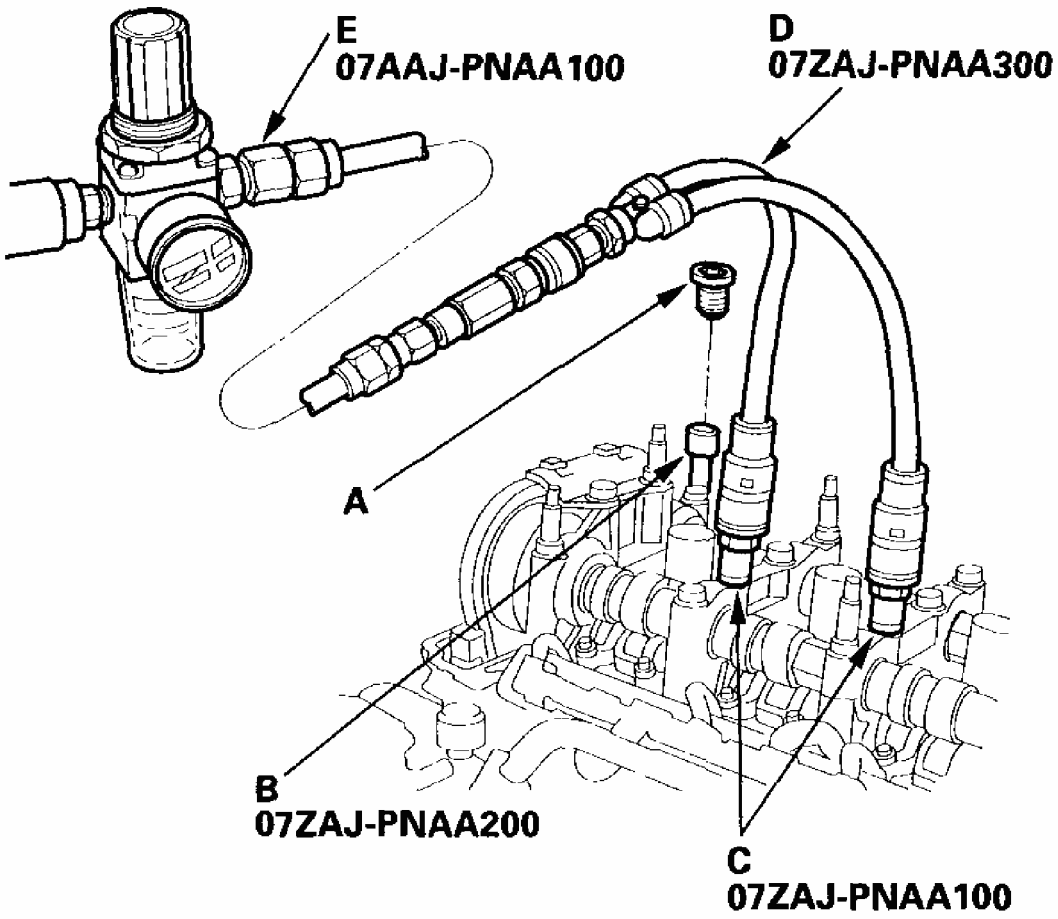

Fig. 7: Removing Sealing Bolt From Relief Hole And Installing VTEC Air Stopper
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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/cm^2 ,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.

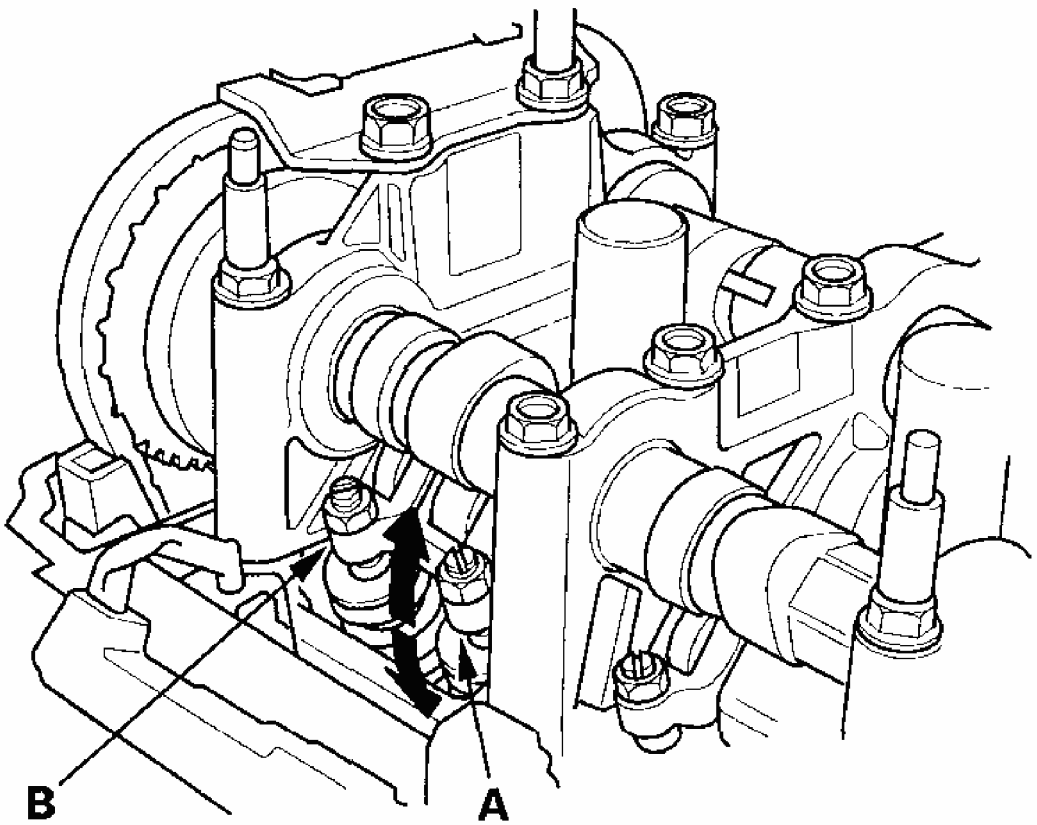

Fig. 8: Identifying Intake Primary And Secondary Rocker Arm And Movement
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

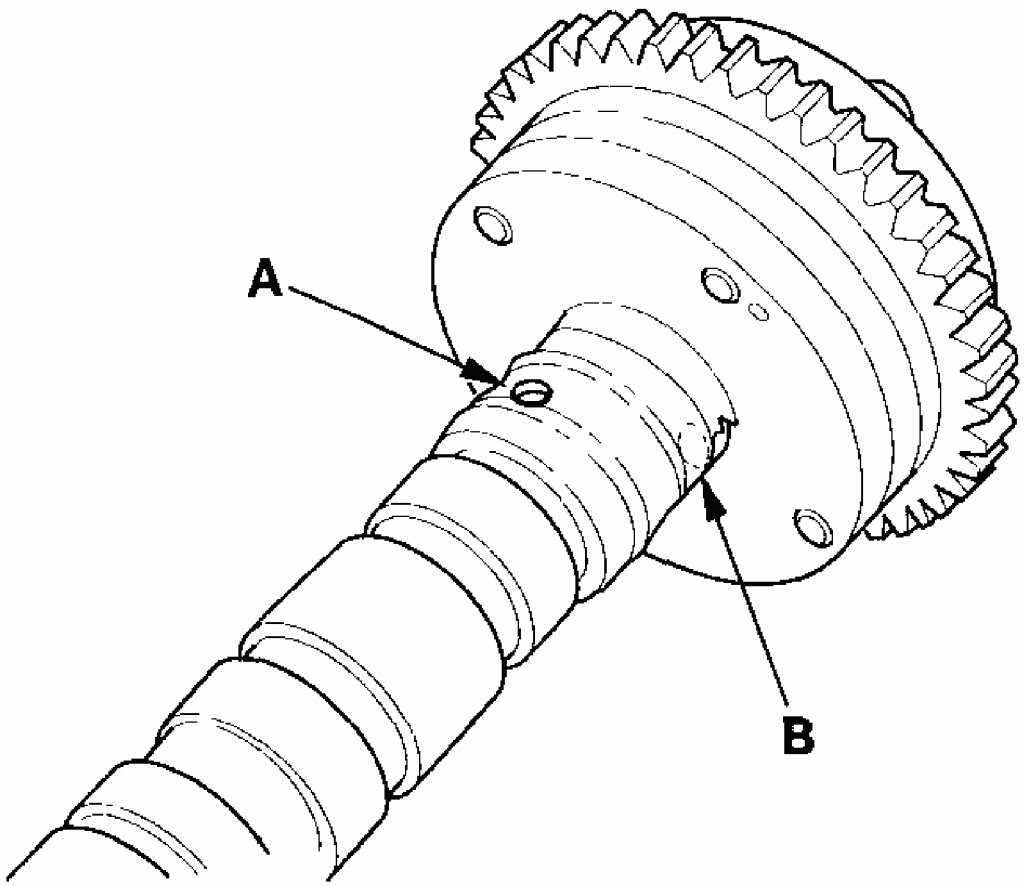

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Fig. 9: Locating Advance And Retard Holes
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

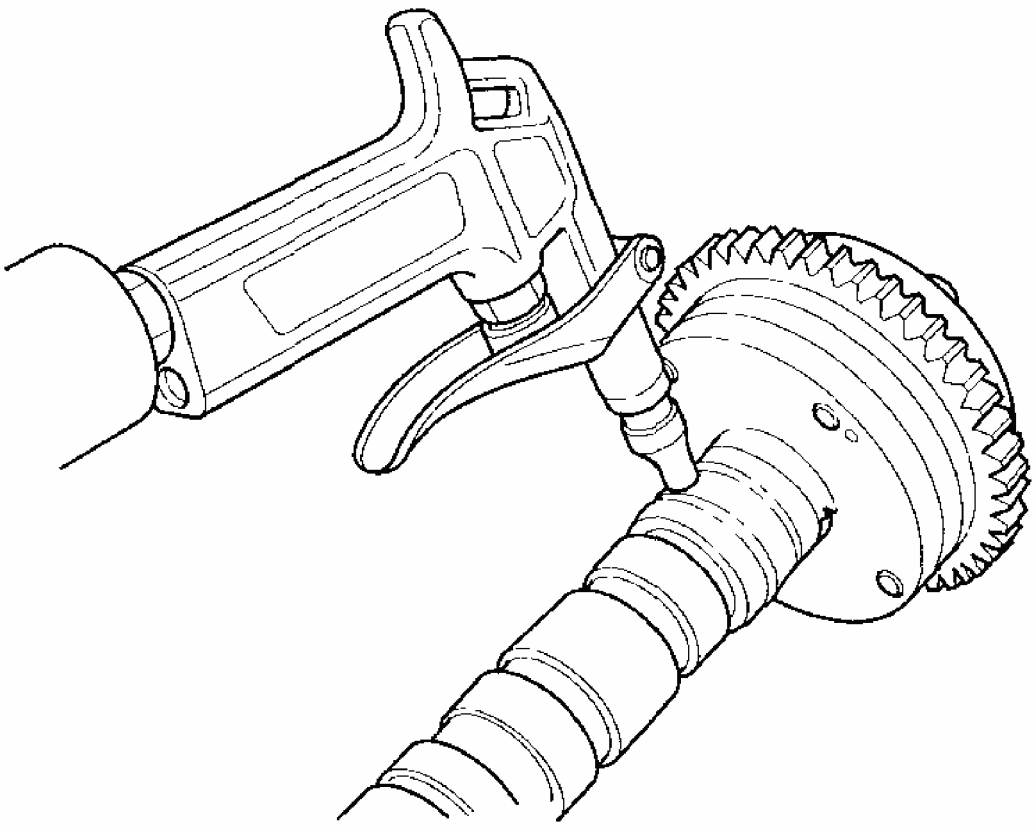

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Fig. 10: Applying Air To Advance Hole
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

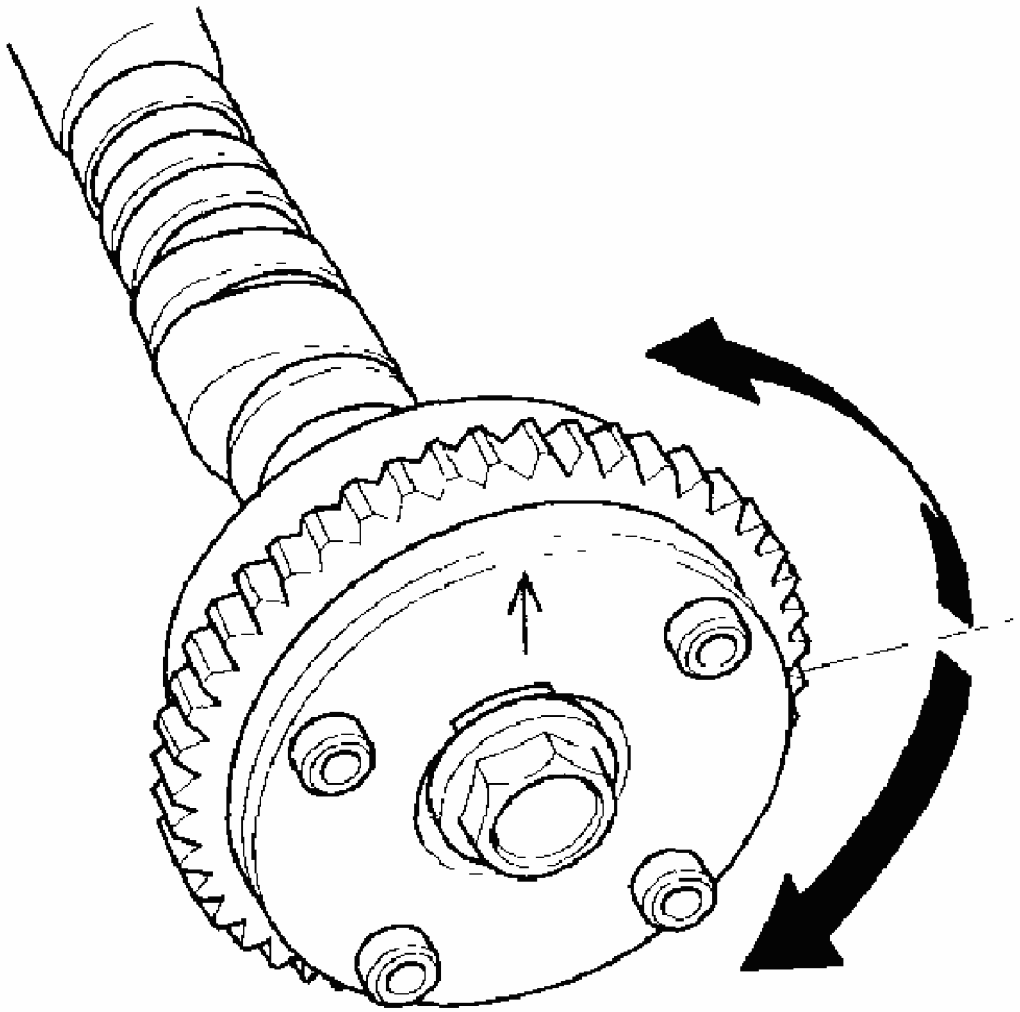

Fig. 11: Identifying VTC Actuator Smooth Movement
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

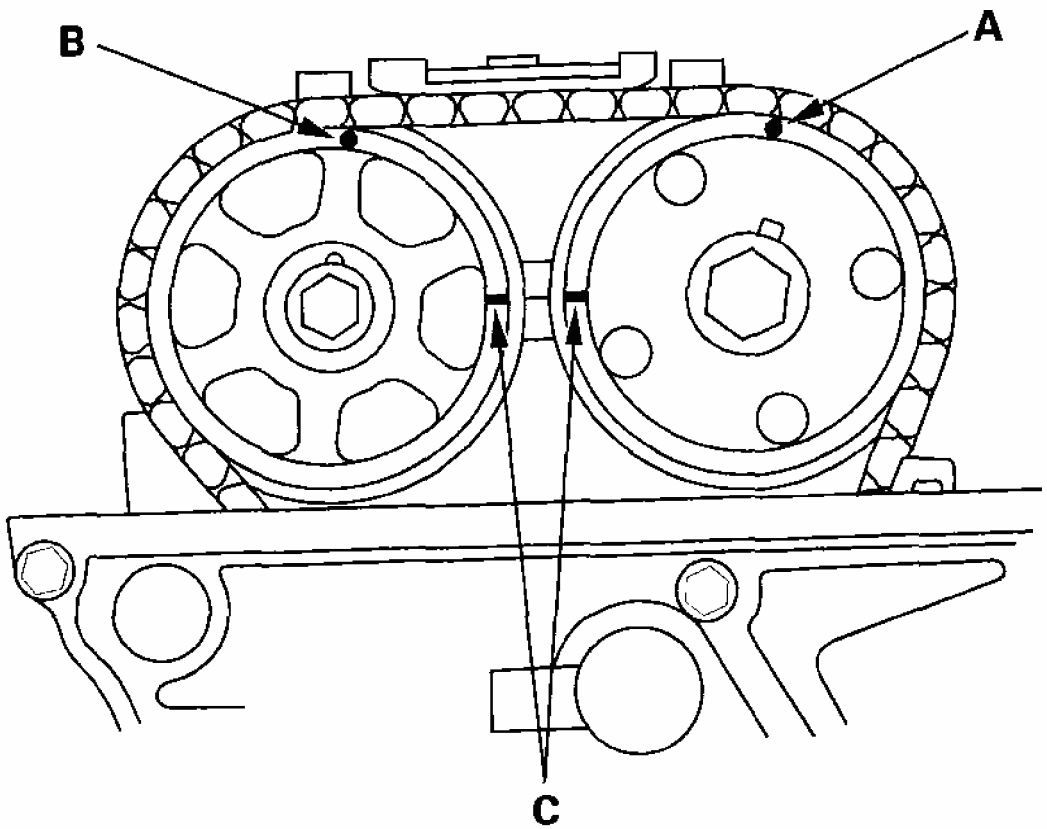

Fig. 12: Identifying Variable Valve Timing Control And Exhaust Camshaft

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.)

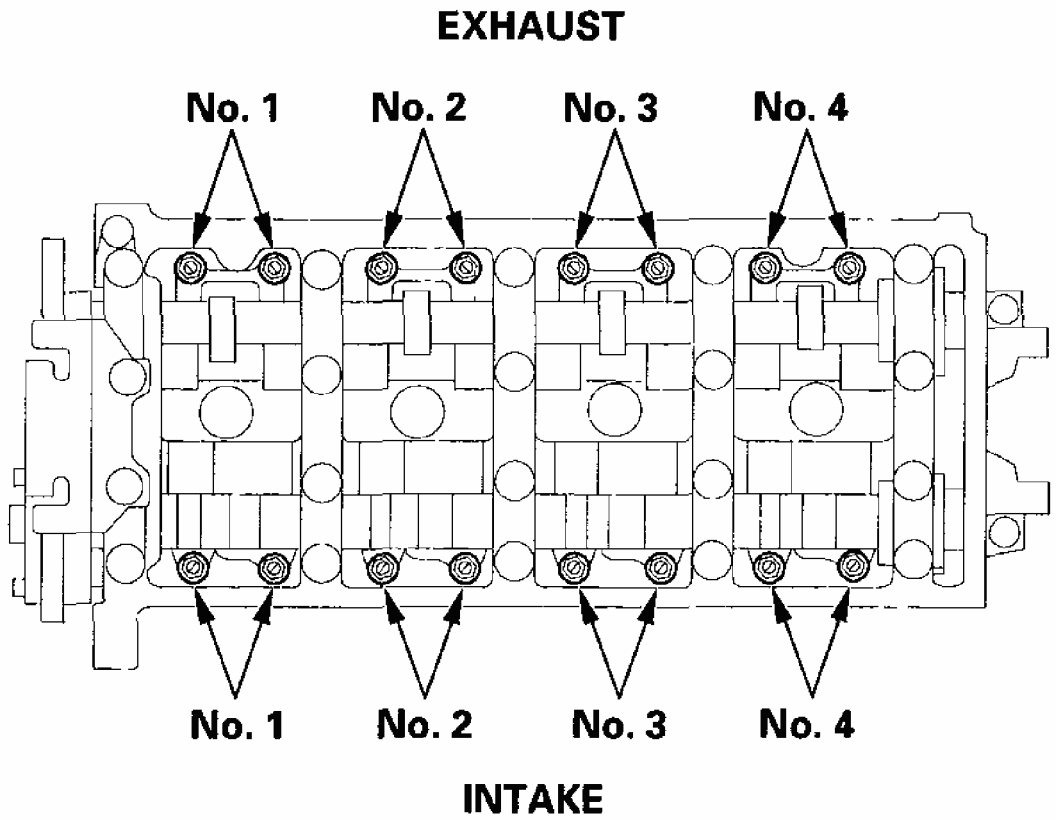

Fig. 13: Locating Intake And Exhaust Valve
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

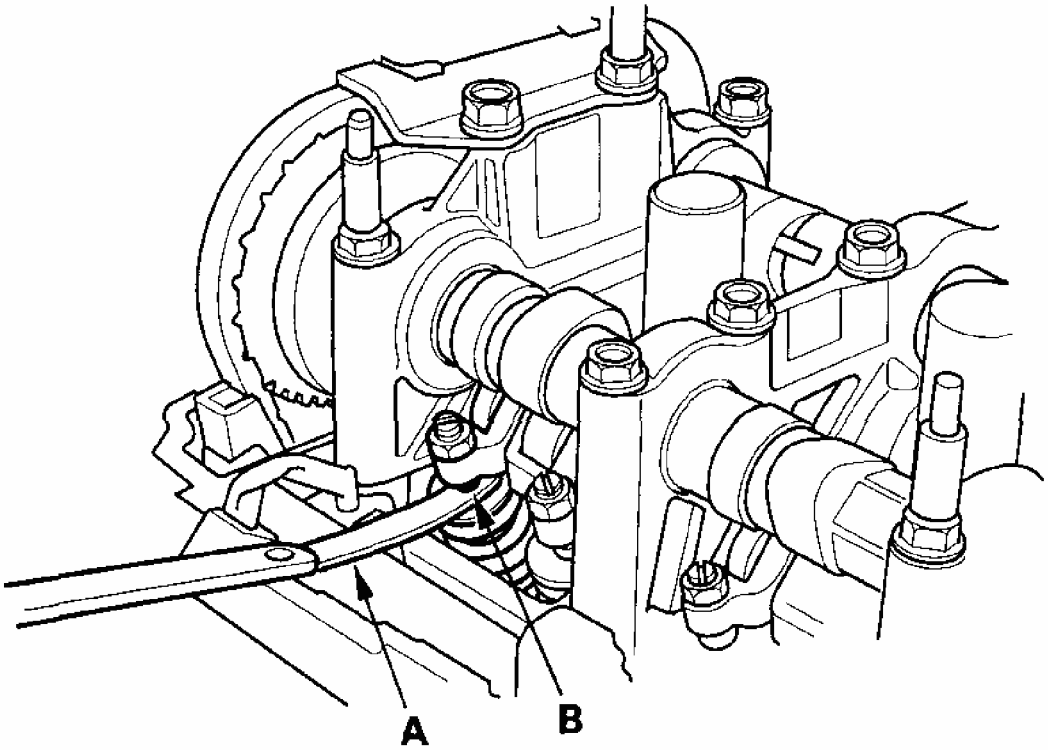

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Fig. 14: Inserting Feeler Gauge Between Adjusting Screw And Valve Stem End
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

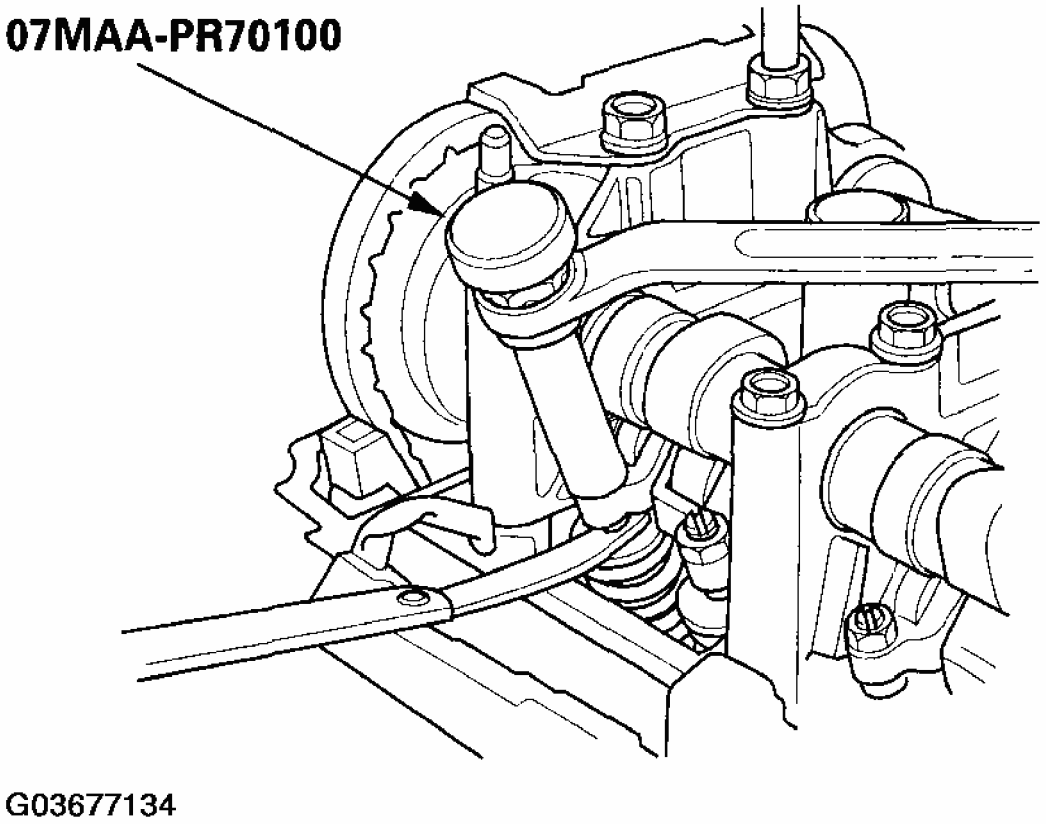

Fig. 15: Loosening Lock Nut
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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°).

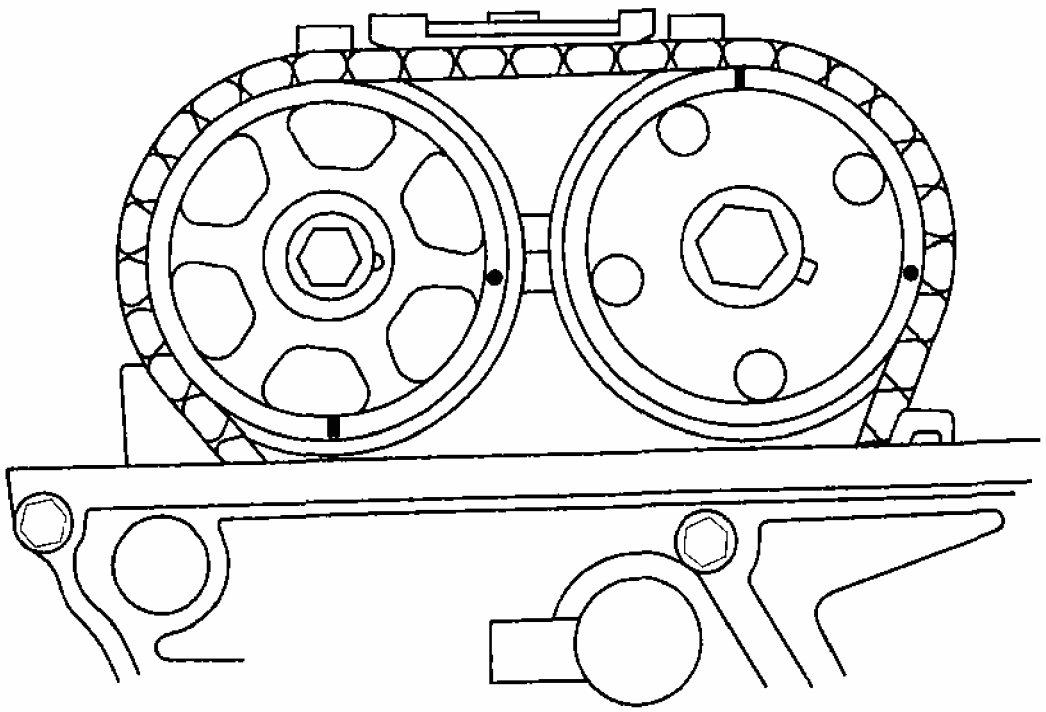

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Fig. 16: View Of Camshaft Pulley Position (1 Of 3)
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

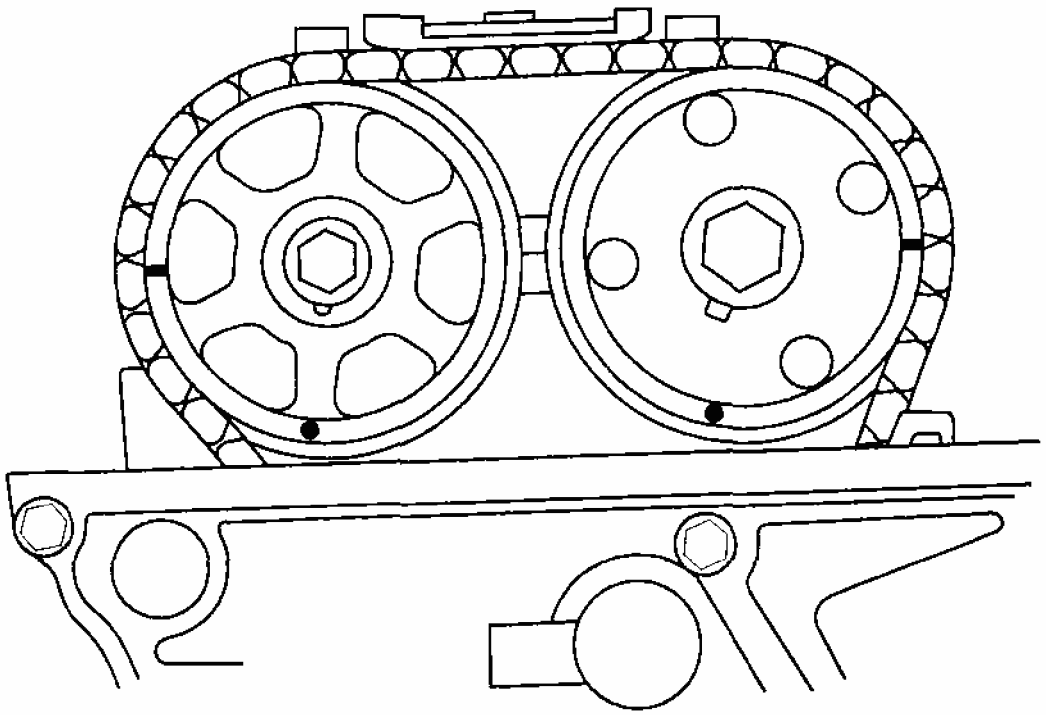

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Fig. 17: View Of Camshaft Pulley Position (2 Of 3)
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

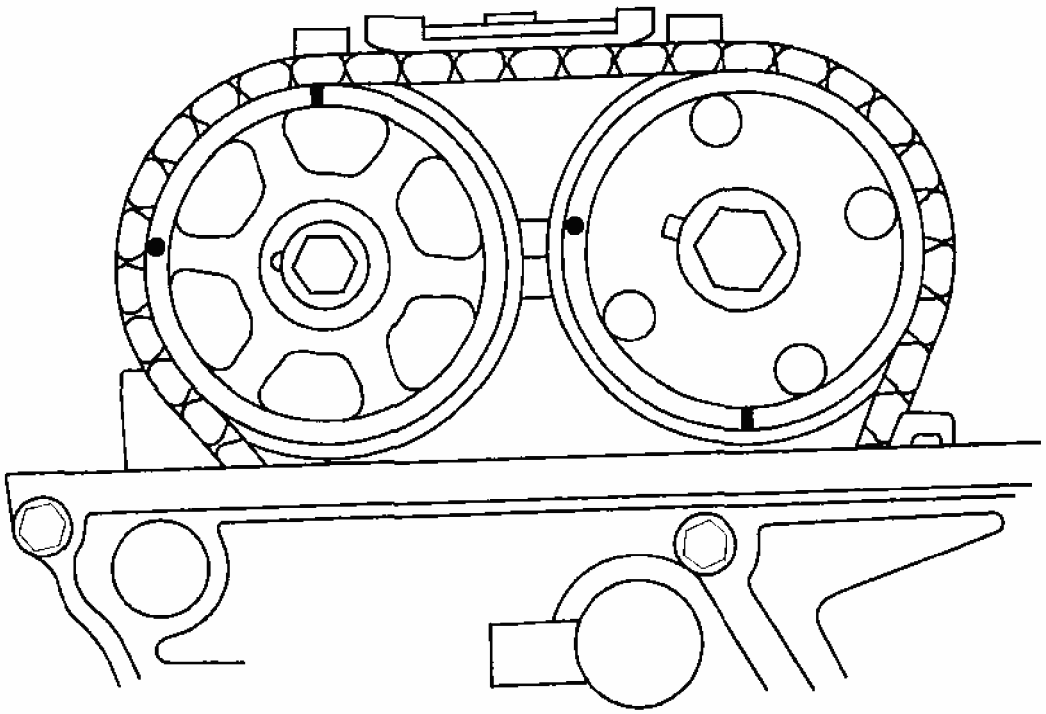

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Fig. 18: View Of Camshaft Pulley Position (3 Of 3)
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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).

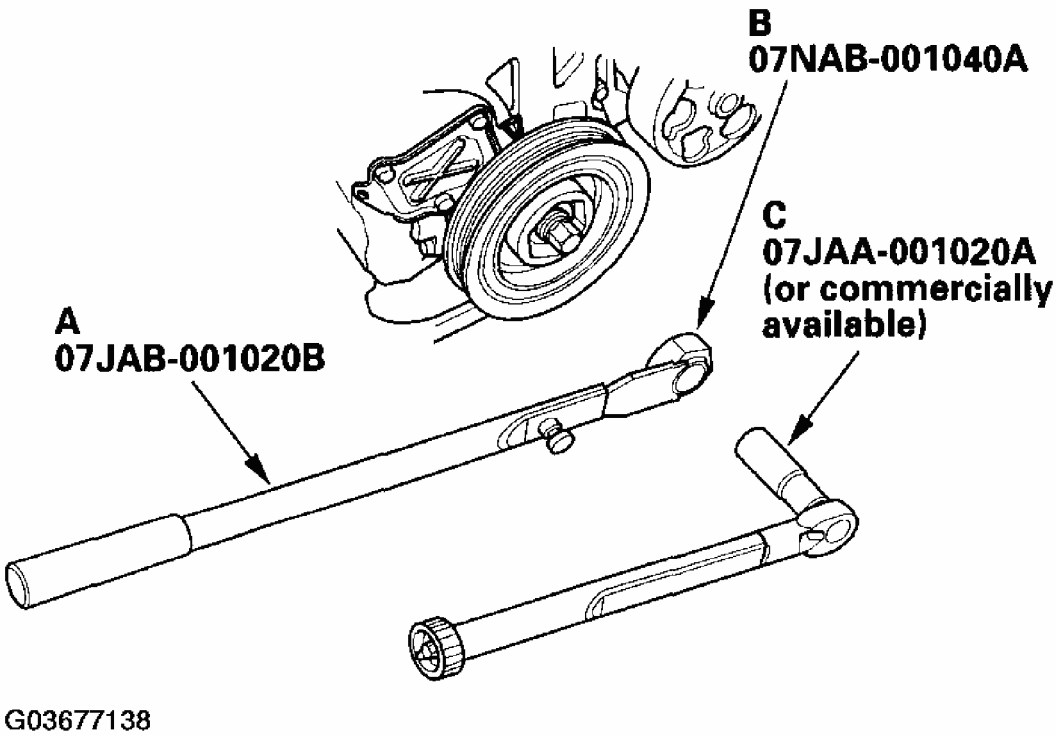

Fig. 19: Identifying Pulley Holder And Holder Attachment
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

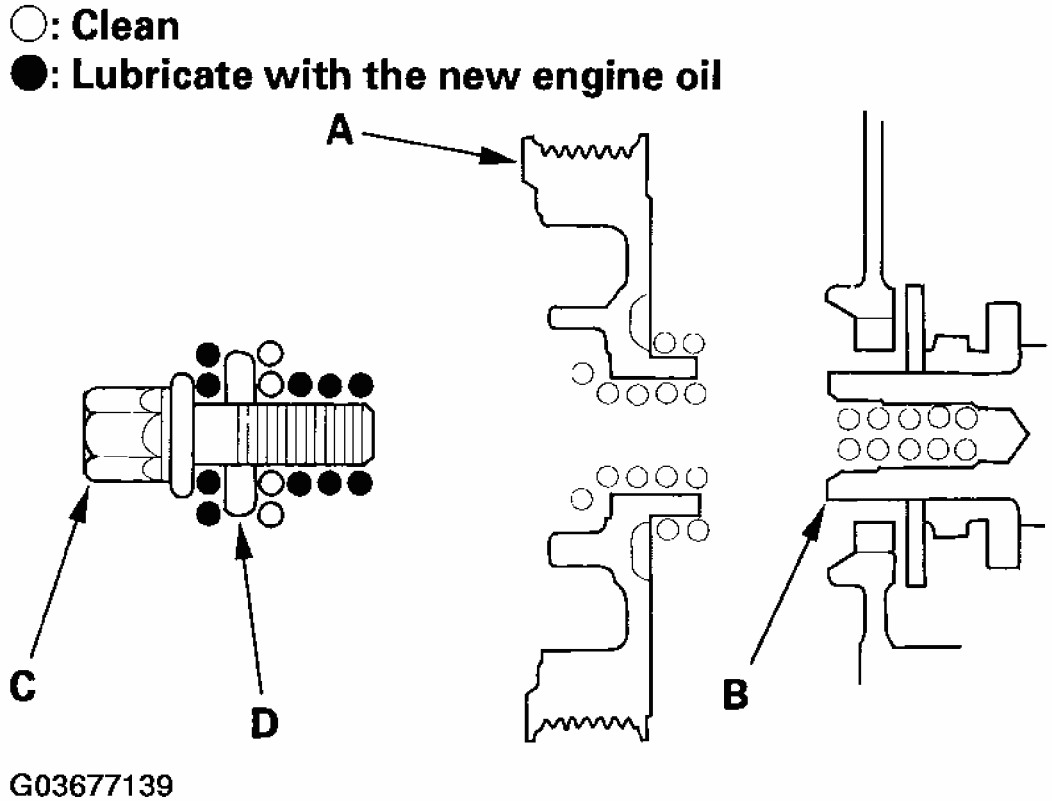

Fig. 20: Identifying Various Parts Cleaning And Lubricating Points
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

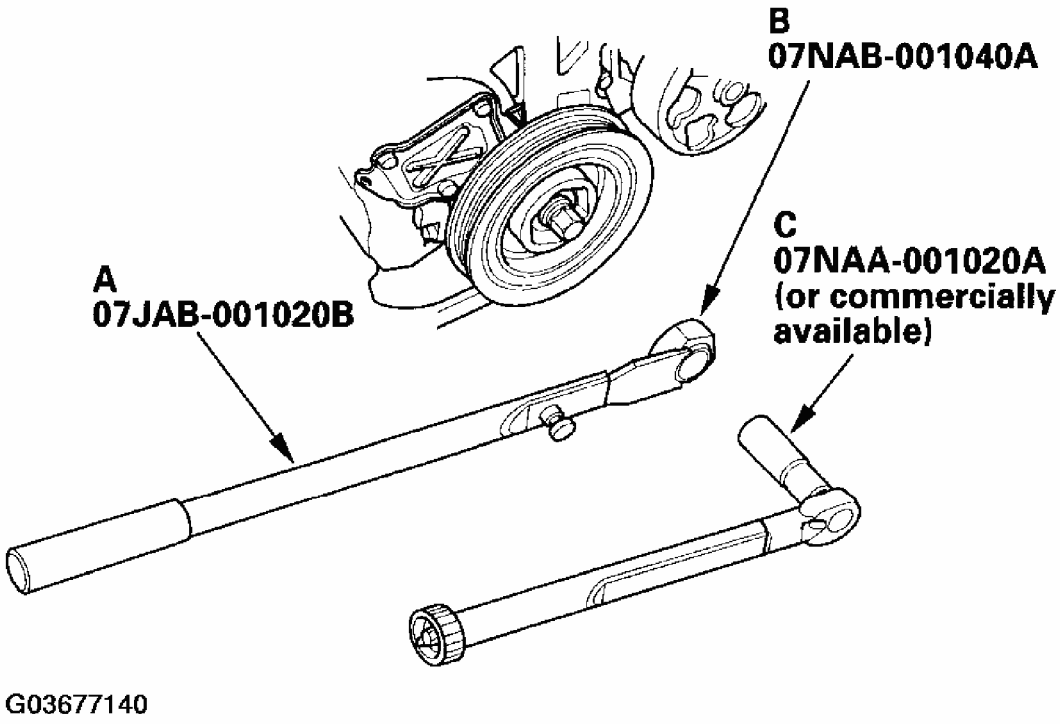

Fig. 21: Installing Crankshaft Pulley
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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).

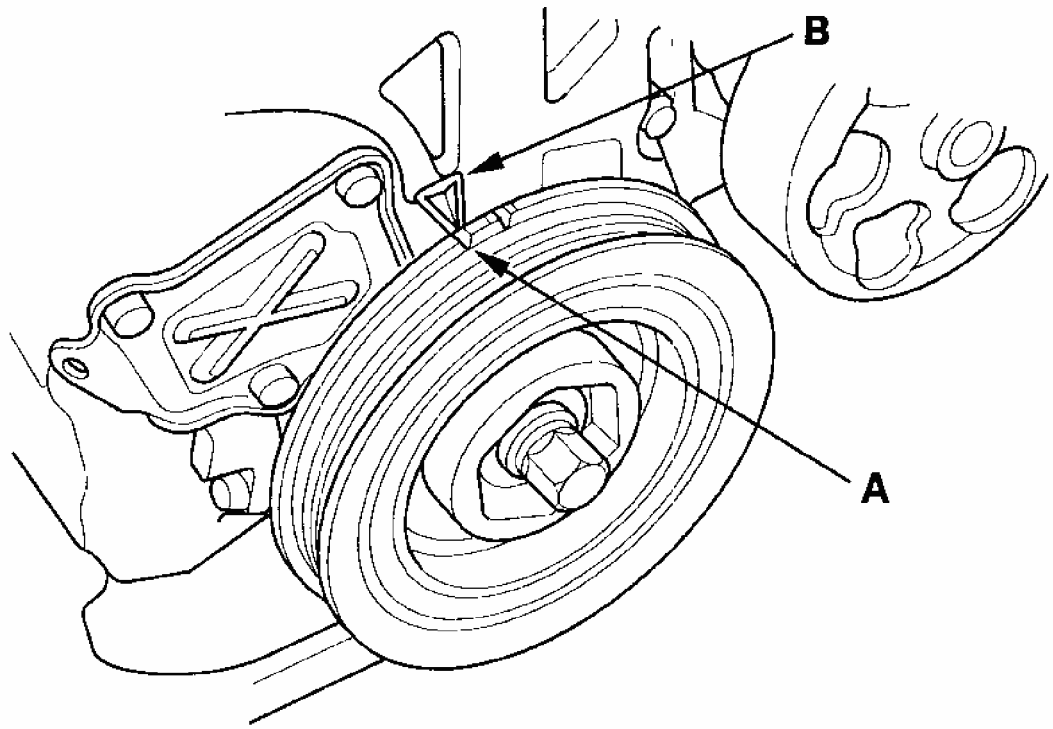

Fig. 22: Identifying Crankshaft Pulley Position
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

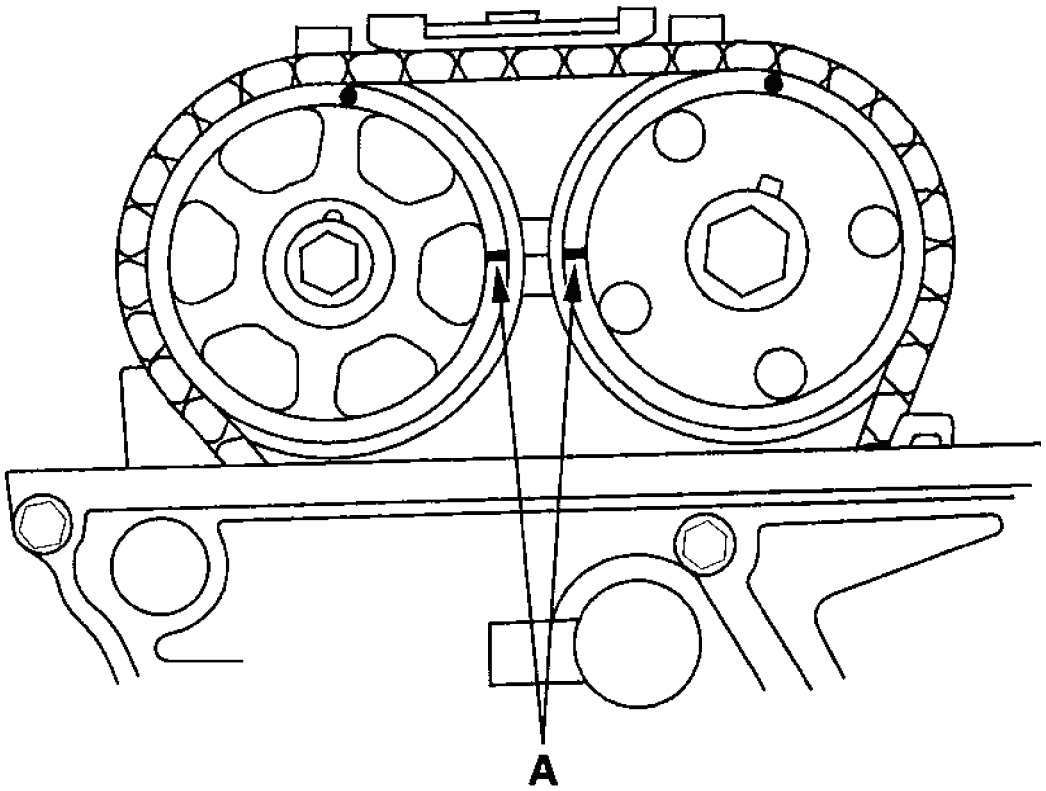

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Fig. 23: Identifying Aligned Variable Valve Timing Control And Exhaust Camshaft Sprocket Marks
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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).

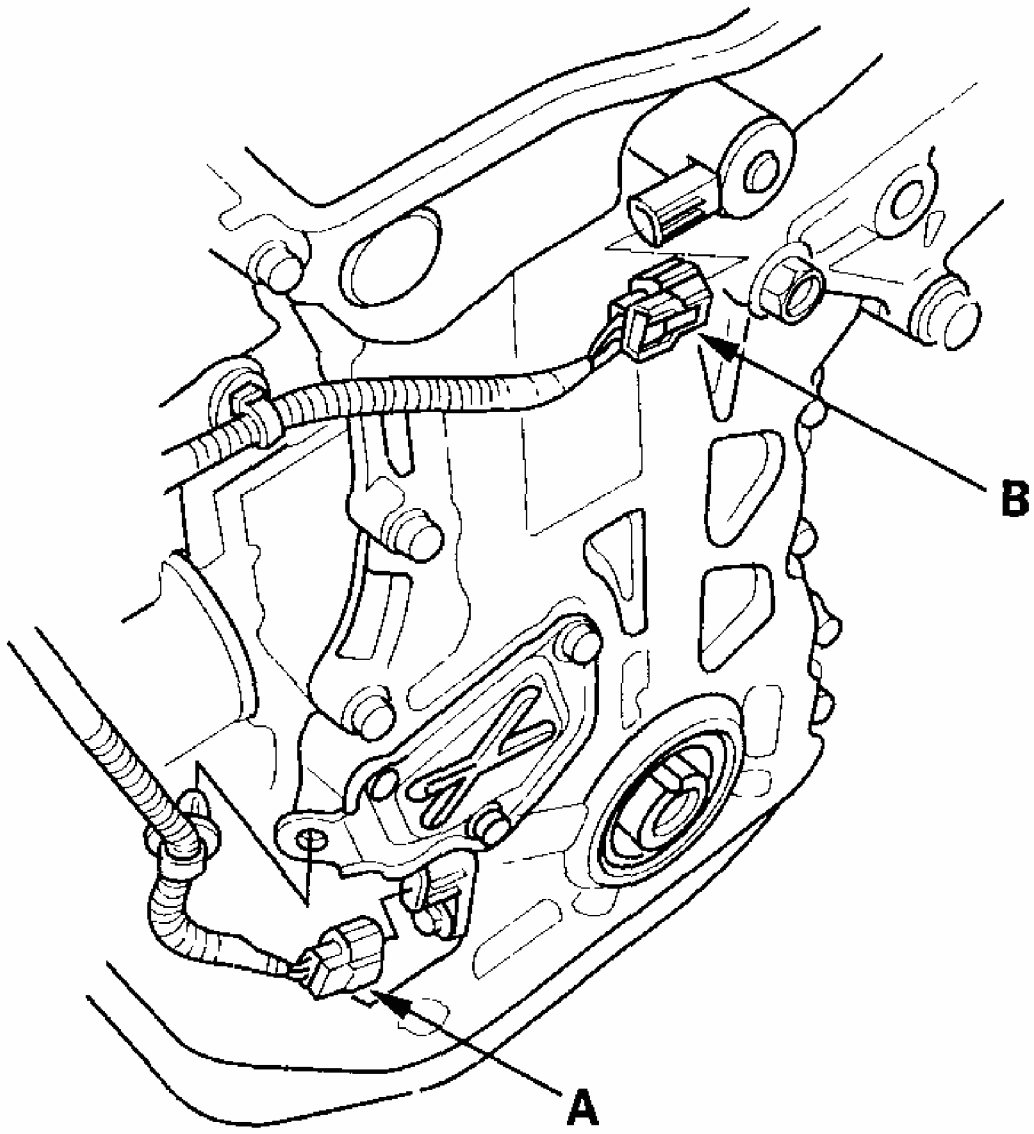

Fig. 24: Disconnecting Crankshaft Position Sensor Connector And VTC Oil Control Solenoid Valve Connector
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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).

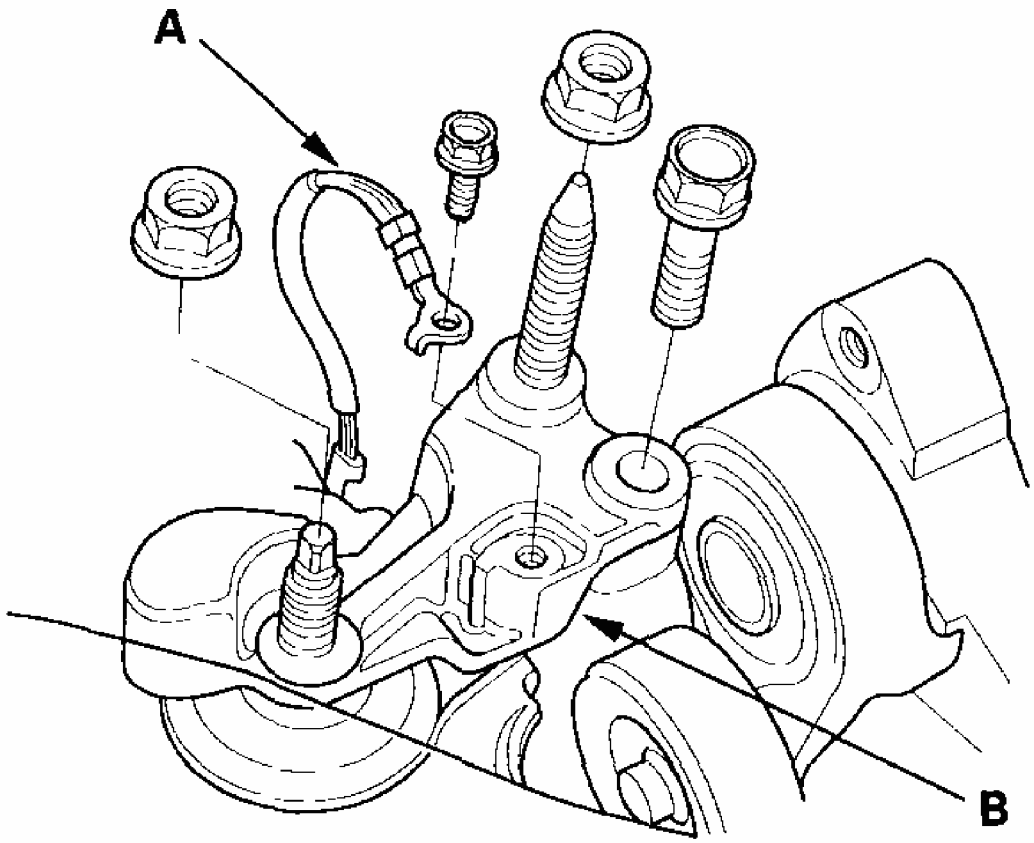

Fig. 25: Removing Ground Cable And Upper Engine Mount Bracket
Courtesy of AMERICAN HONDA MOTOR CO., INC.

12. Remove the side engine mount bracket.

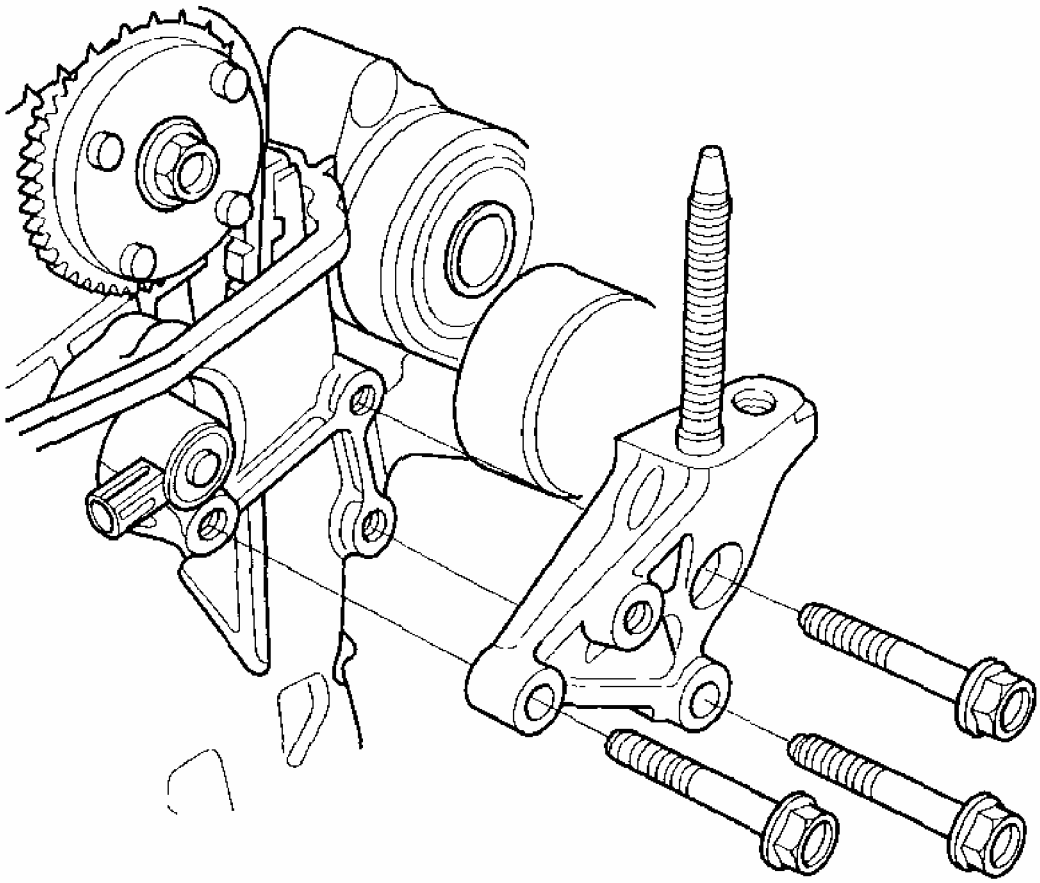

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Fig. 26: Removing Side Engine Mount Bracket
Courtesy of AMERICAN HONDA MOTOR CO., INC.

13. Remove the chain case.

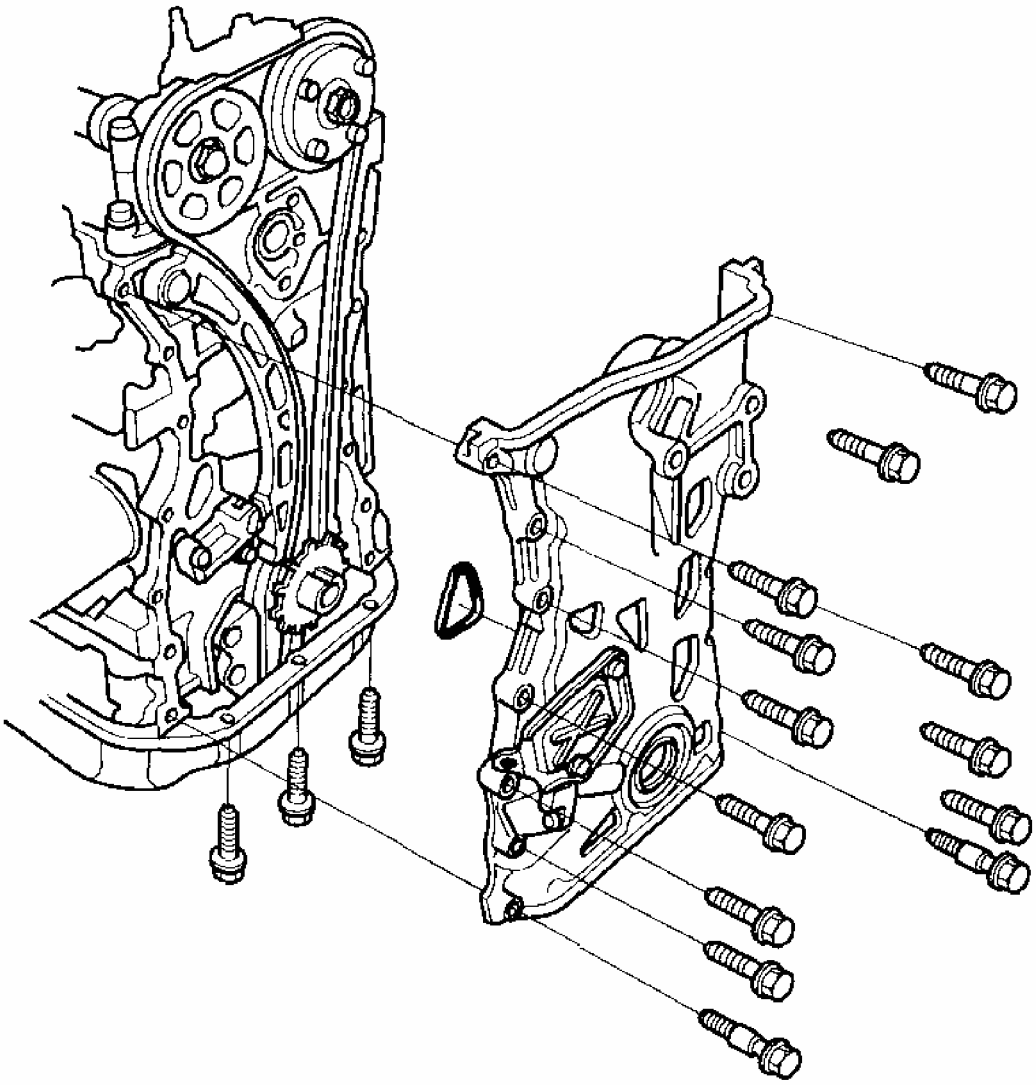

Fig. 27: Removing Chain Case
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

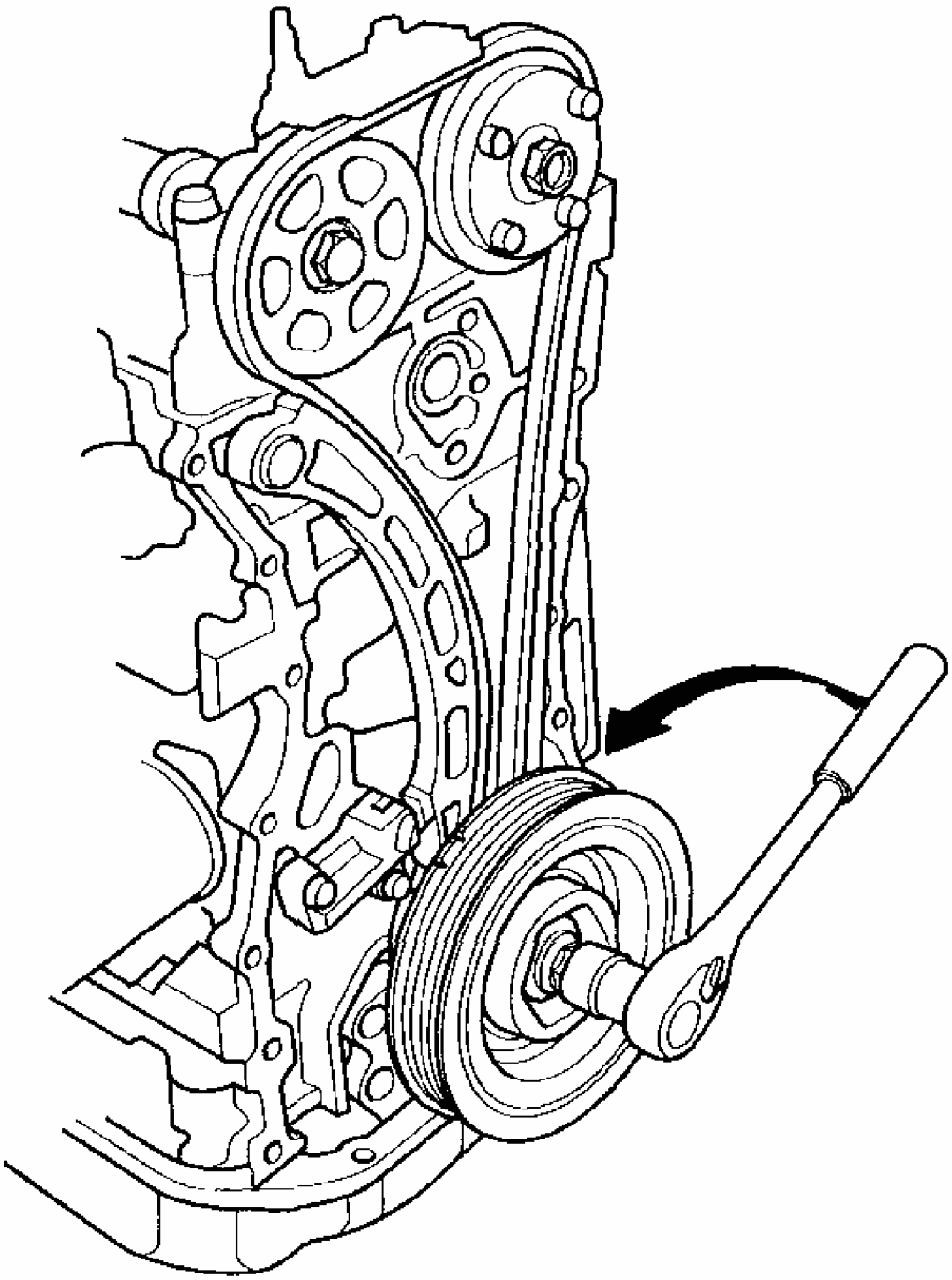

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Fig. 28: Turning Crankshaft Counterclockwise To Compress Auto-Tensioner
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

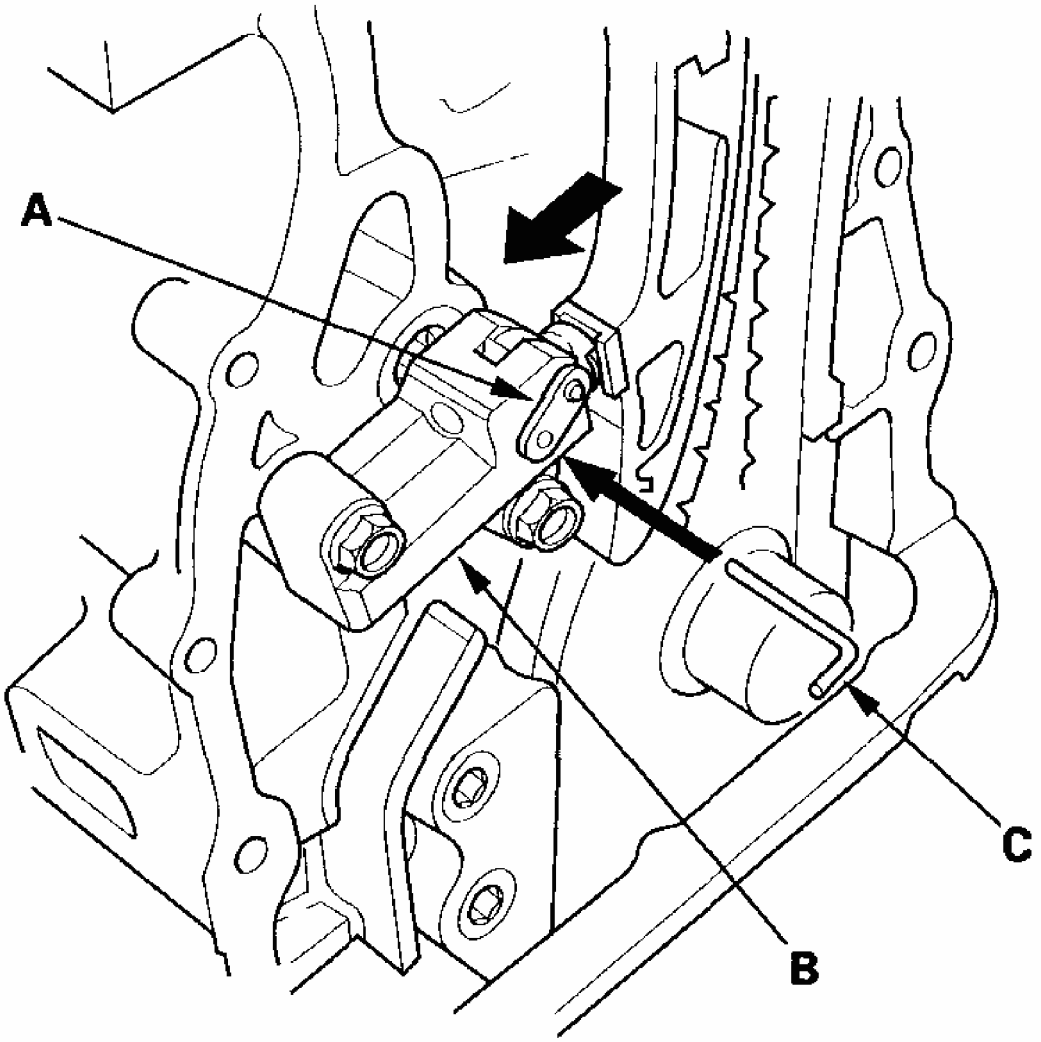

Fig. 29: Aligning Holes On Lock And Auto-Tensioner
Courtesy of AMERICAN HONDA MOTOR CO., INC.

17. Remove the auto-tensioner.

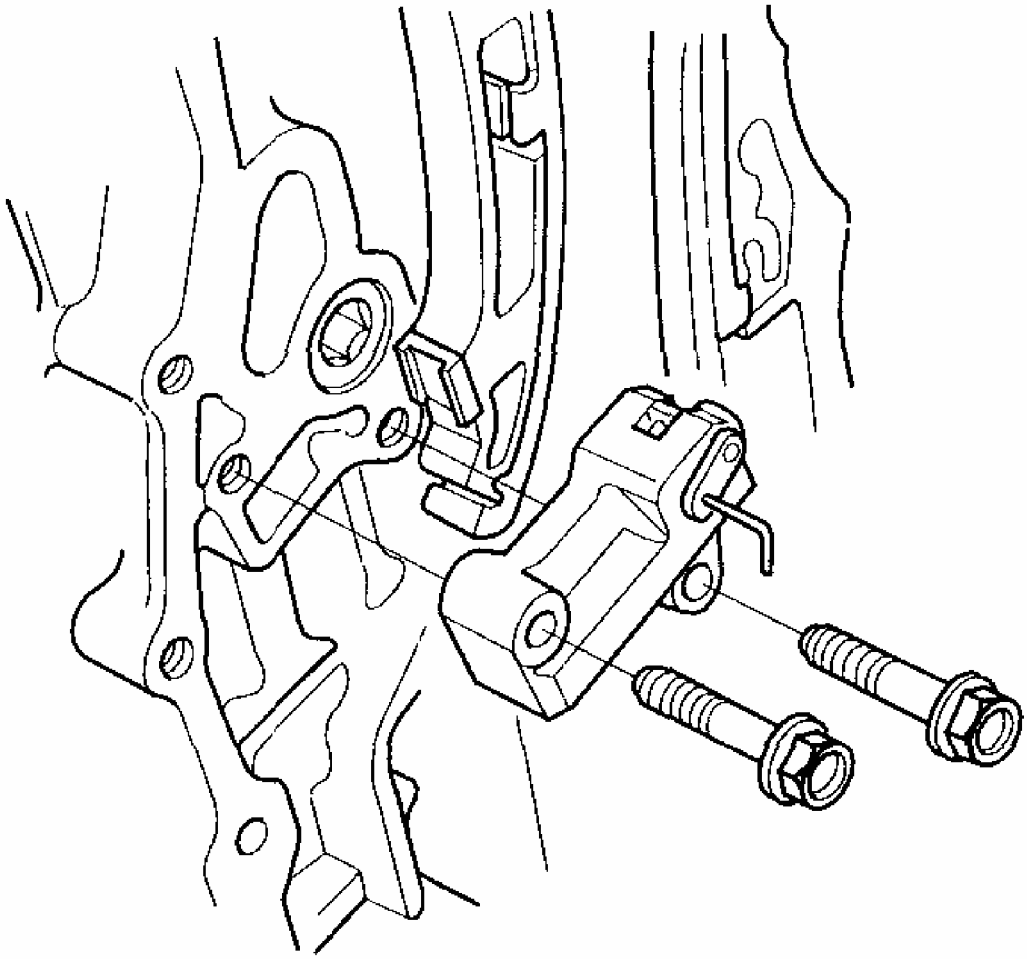

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Fig. 30: Removing Auto-Tensioner
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

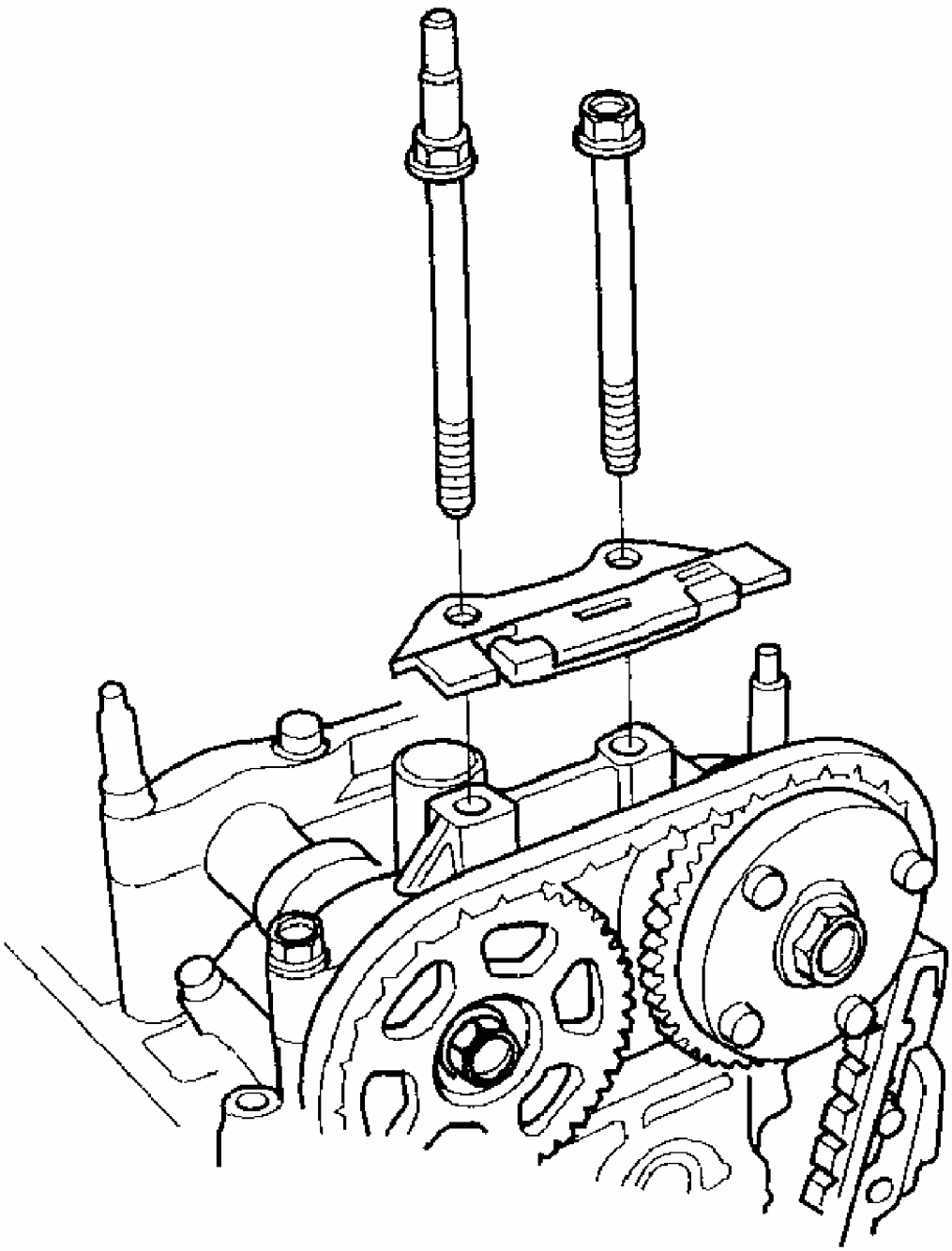

Fig. 31: Removing Cam Chain Guide
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

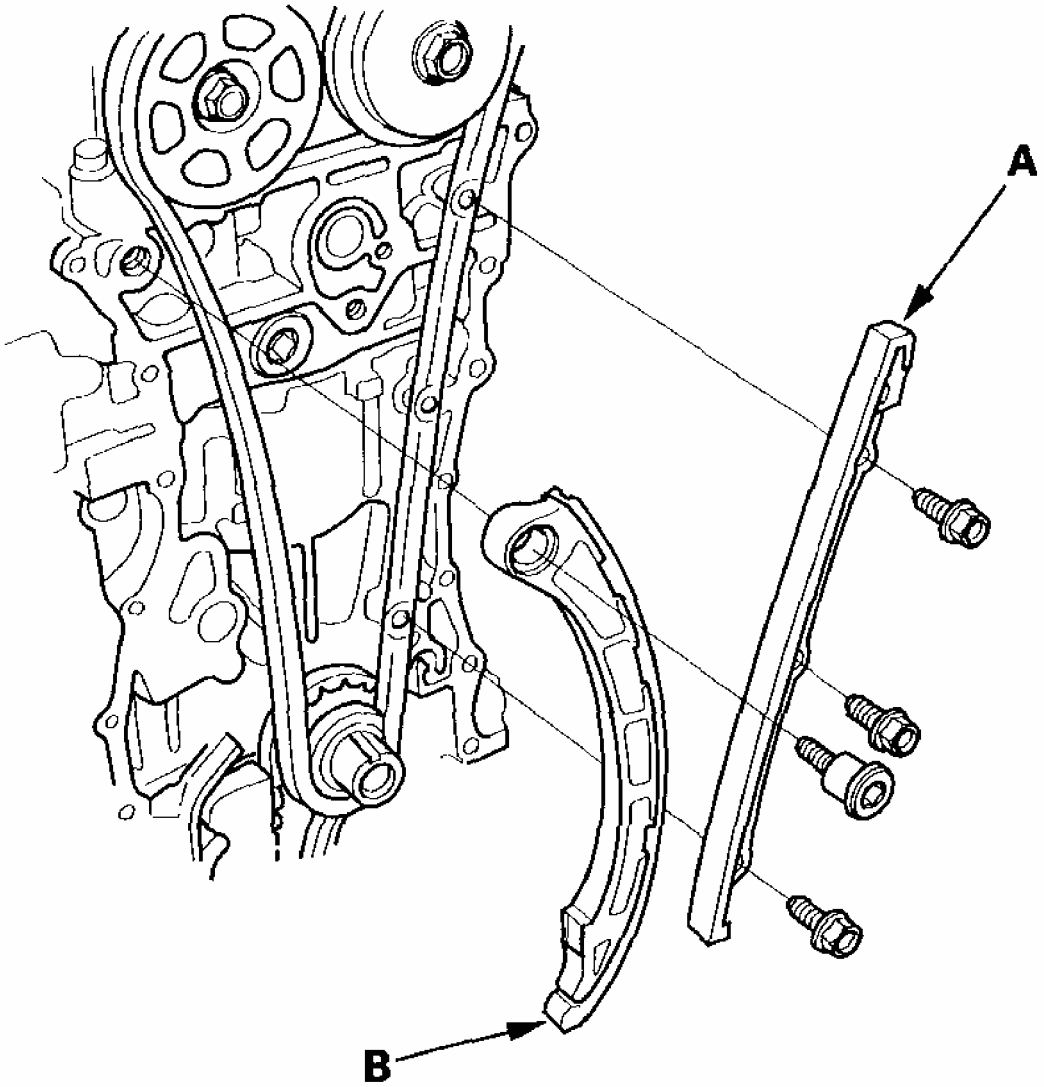

Fig. 32: Removing Cam Chain Guide A And Tensioner Arm
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

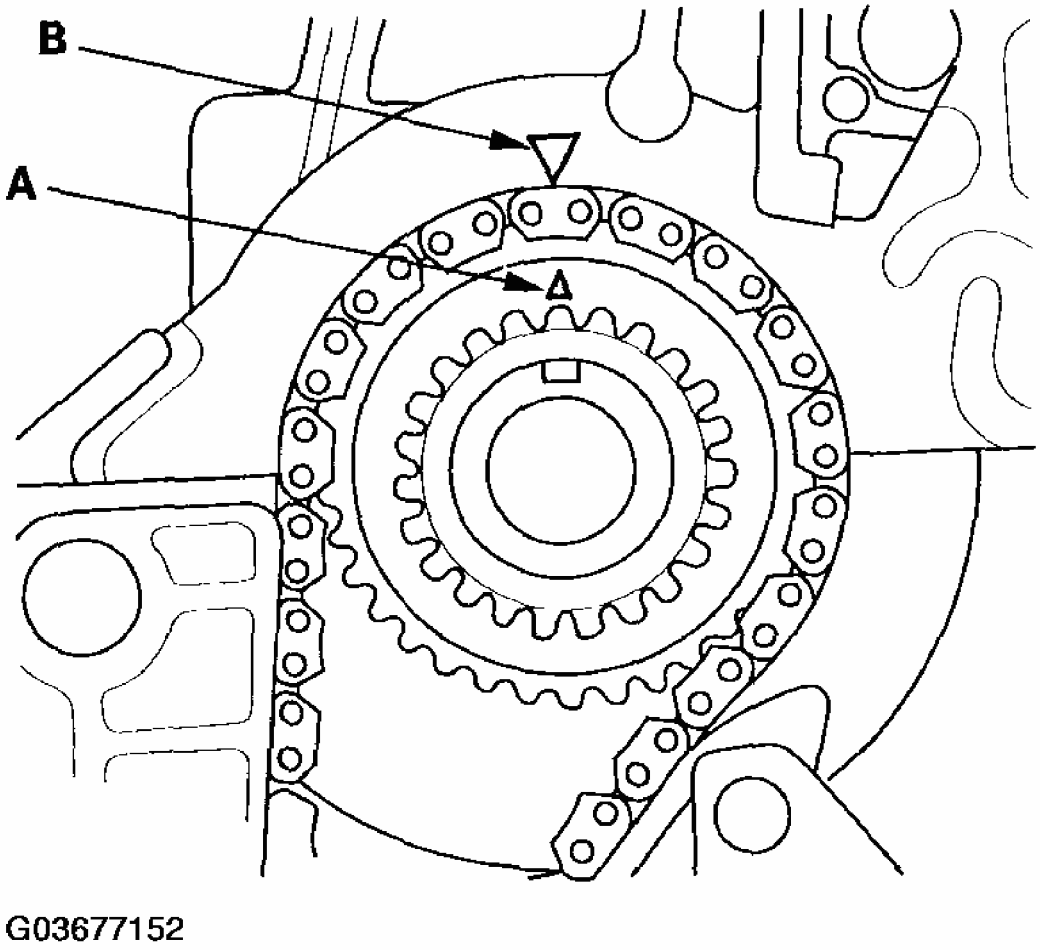

Fig. 33: Aligning TDC Mark On Crankshaft Sprocket With Pointer On Engine Block
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

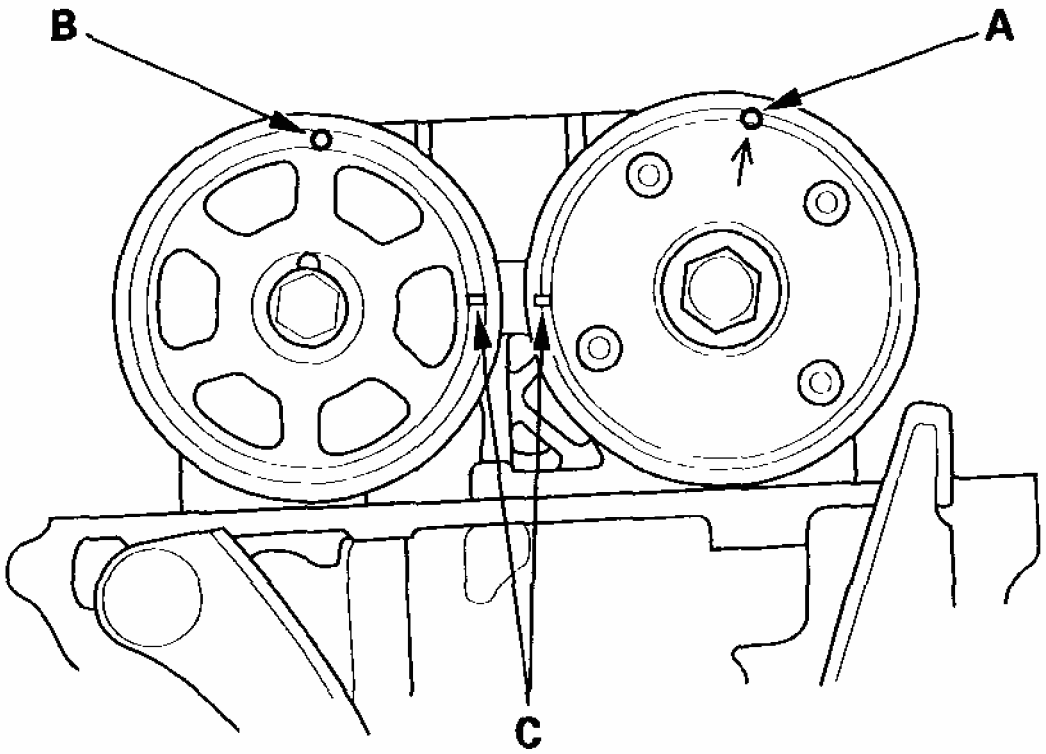

Fig. 34: Identifying VTC Actuator And Exhaust Camshaft Sprocket Punch Mark Position
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

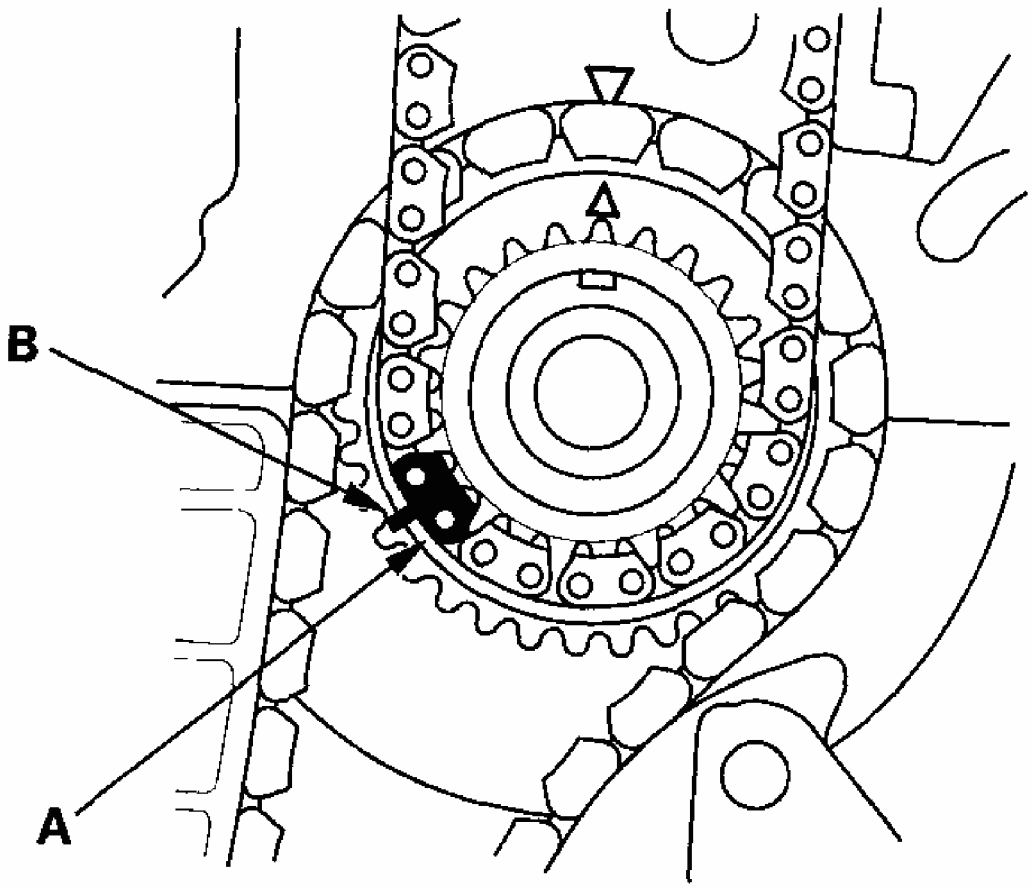

Fig. 35: Installing Cam Chain On Crankshaft Sprocket
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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).

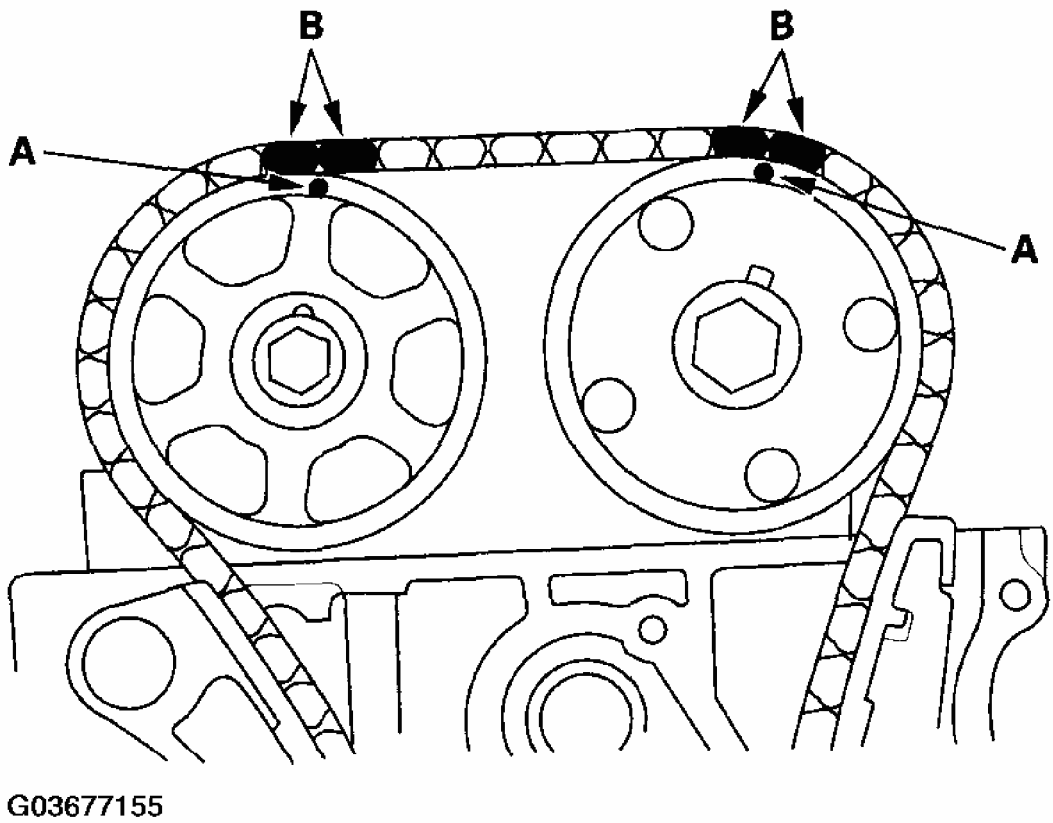

Fig. 36: Installing Cam Chain On VTC Actuator And Exhaust Camshaft Sprocket
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

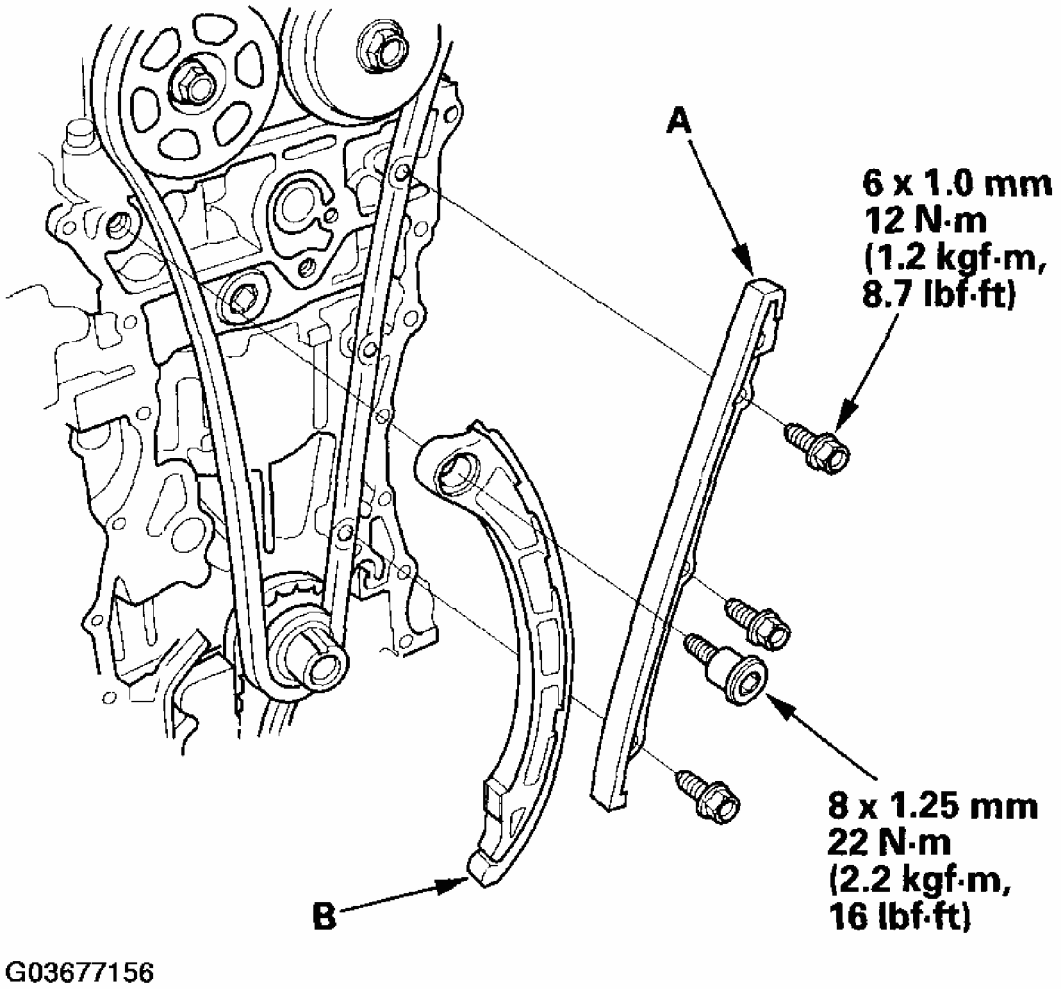

Fig. 37: Installing Cam Chain Guide A And Tensioner Arm With Specified Torques
Courtesy of AMERICAN HONDA MOTOR CO., INC.

6. Install the auto-tensioner.

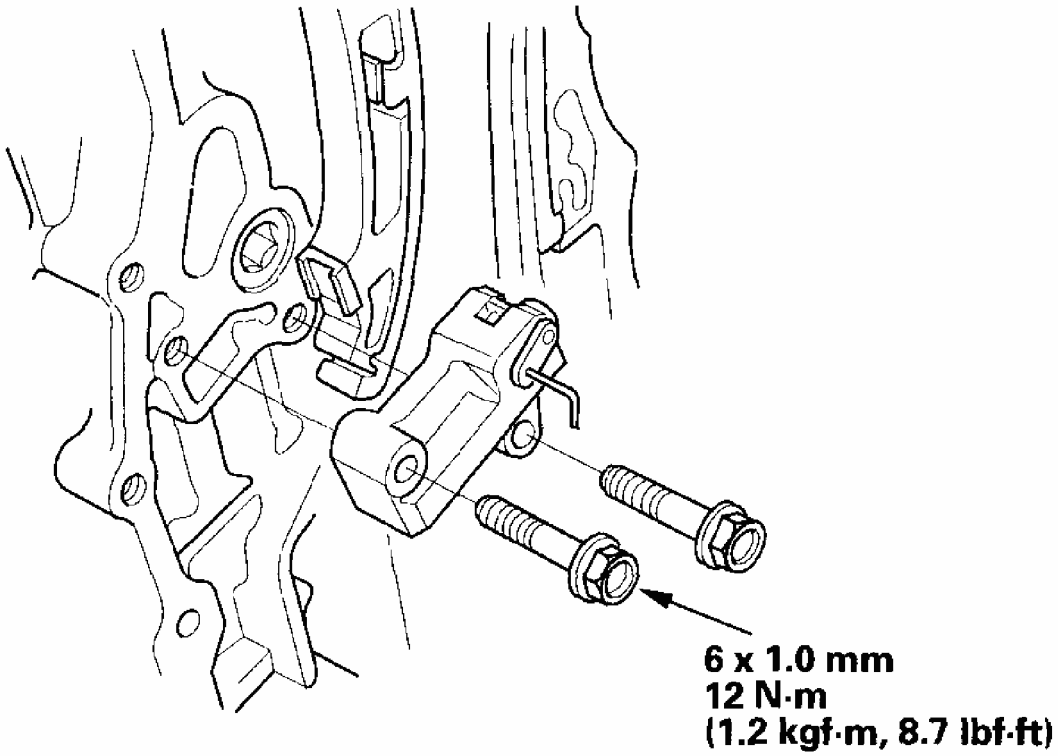

Fig. 38: Installing Auto-Tensioner And Torque Specifications
Courtesy of AMERICAN HONDA MOTOR CO., INC.

7. Install the cam chain guide B.

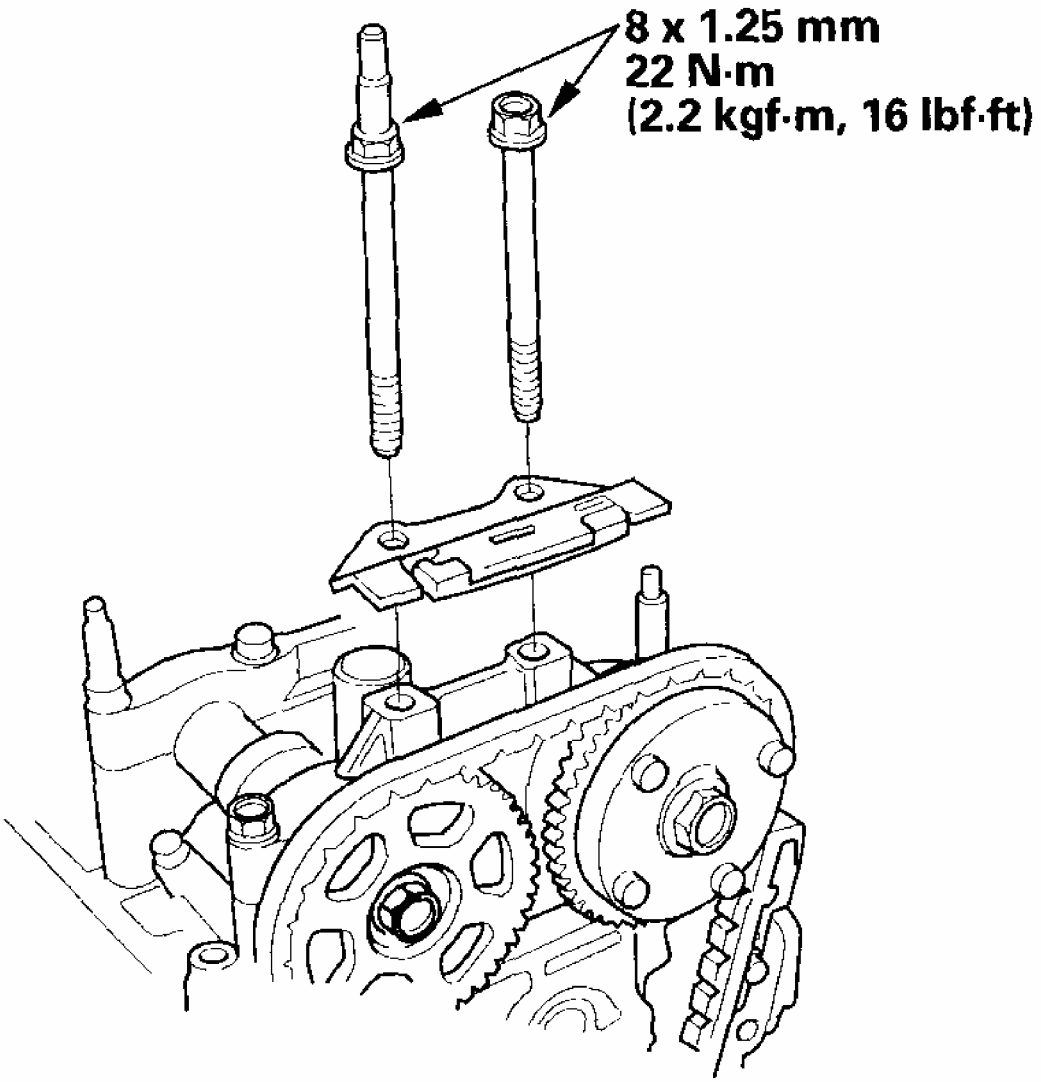

Fig. 39: Installing Cam Chain Guide B And Torque Specifications
Courtesy of AMERICAN HONDA MOTOR CO., INC.

8. Remove the pin from the auto-tensioner.

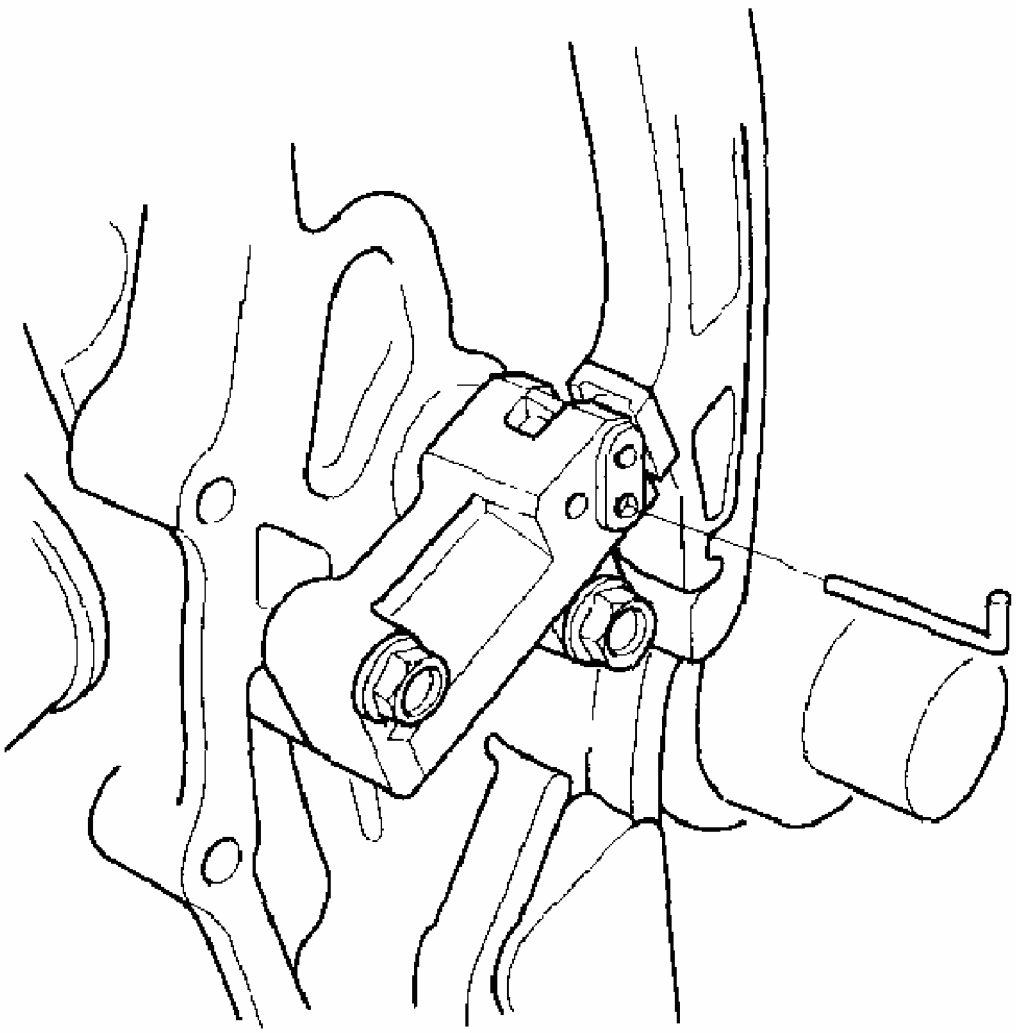

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Fig. 40: Removing Pin From Auto-Tensioner
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

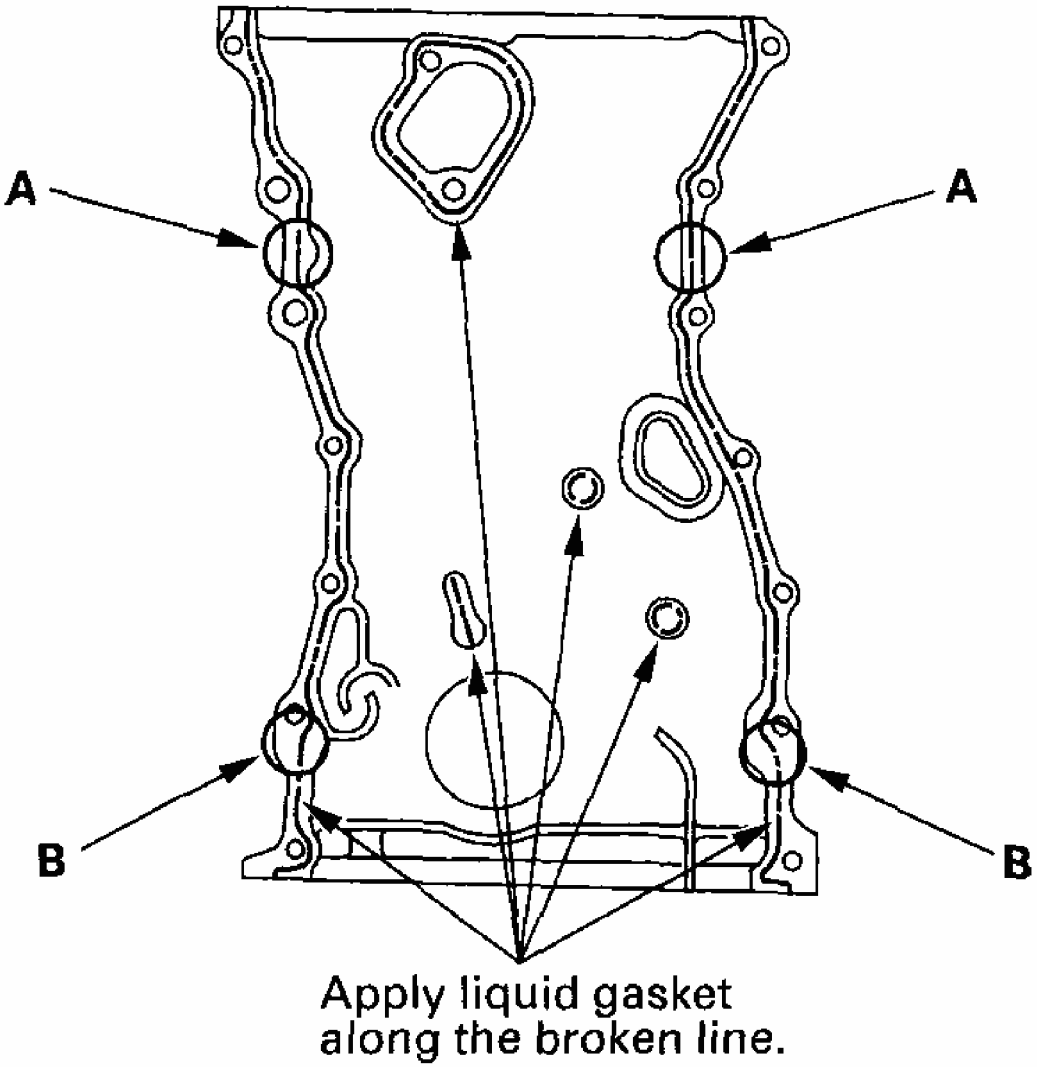

Fig. 41: Locating Sealing Gasket Applying Point (1 Of 2)
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

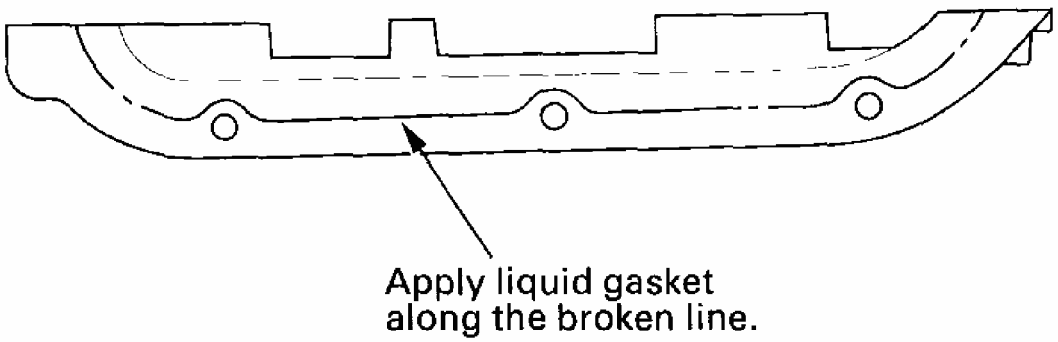

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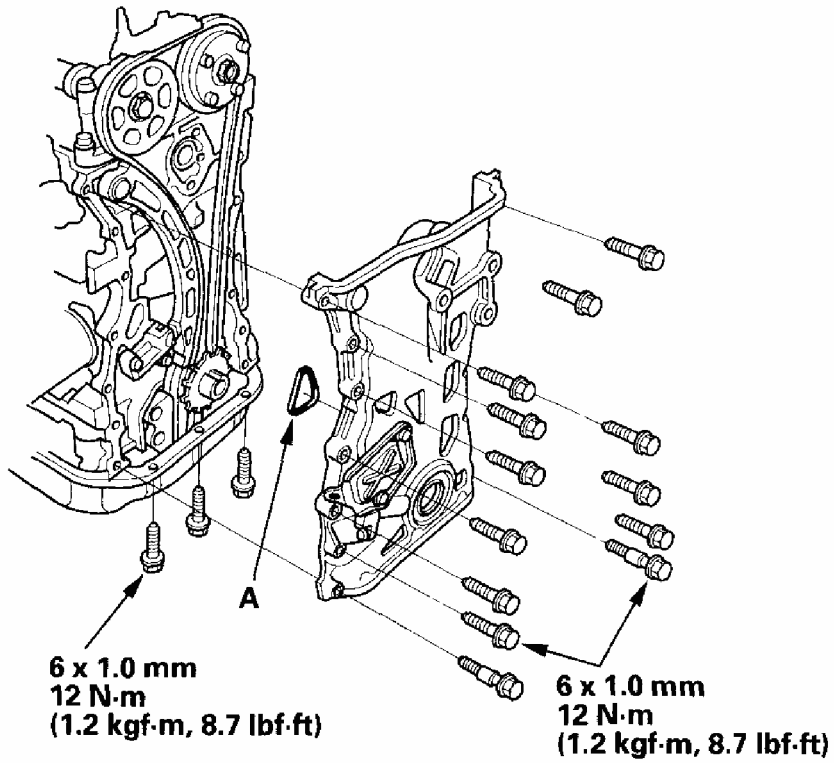
Fig. 42: Locating Sealing Gasket Applying Point (2 Of 2)
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.**



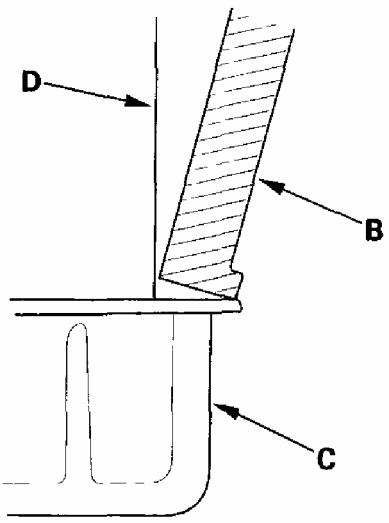


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Fig. 43: Installing O-Ring On Chain Case And Torque Specifications
Courtesy of AMERICAN HONDA MOTOR CO., INC.

16. Install the side engine mount bracket.

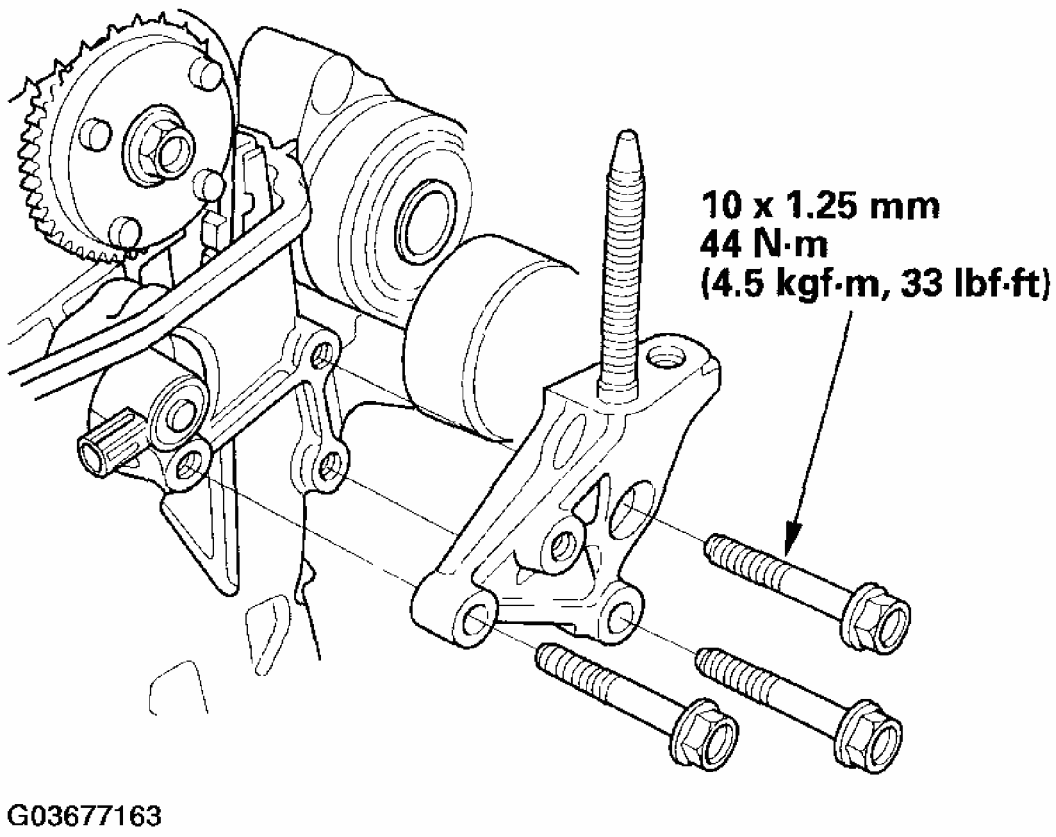

Fig. 44: Installing Side Engine Mount Bracket And Torque Specifications
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

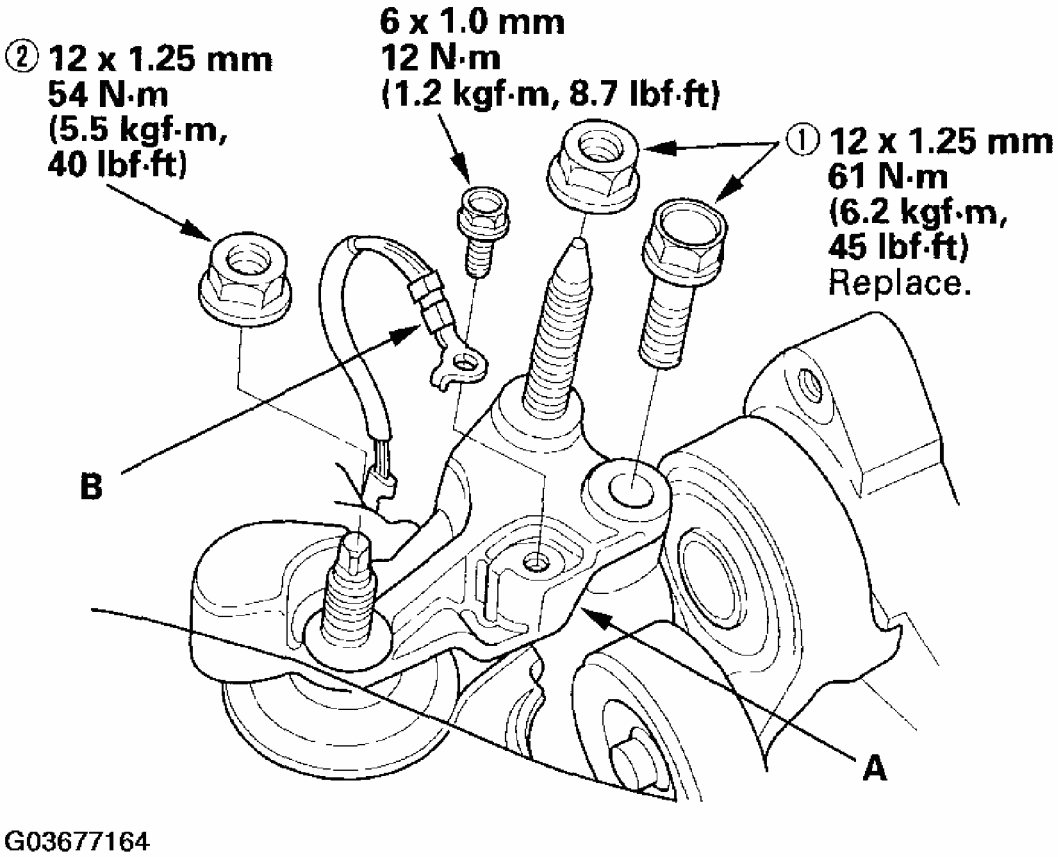

Fig. 45: Installing And Tightening Upper Engine Mount Bracket Bolt With Specified Torques
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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).

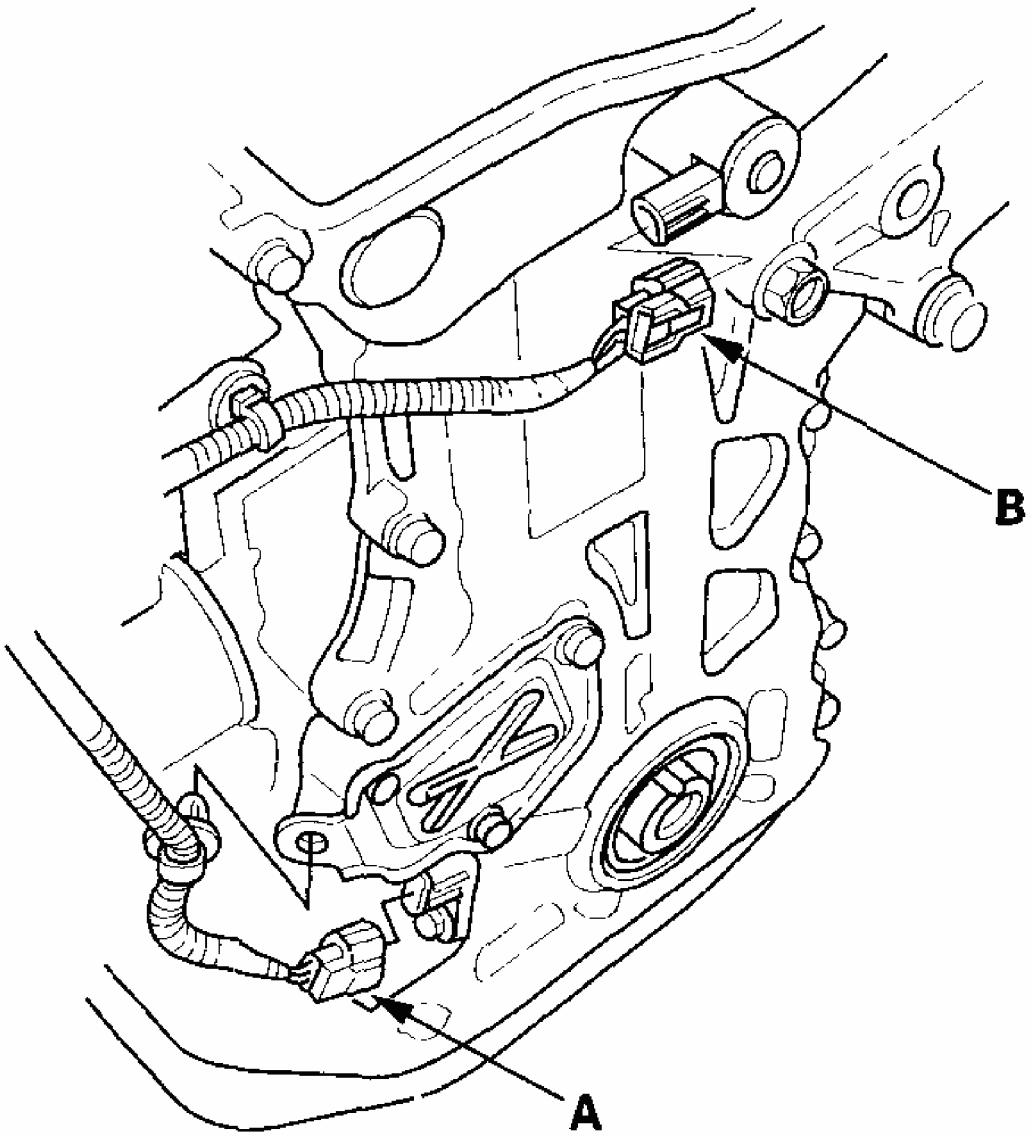

Fig. 46: Connecting Crankshaft Position Sensor Connector And VTC Oil Control Solenoid Valve Connector
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

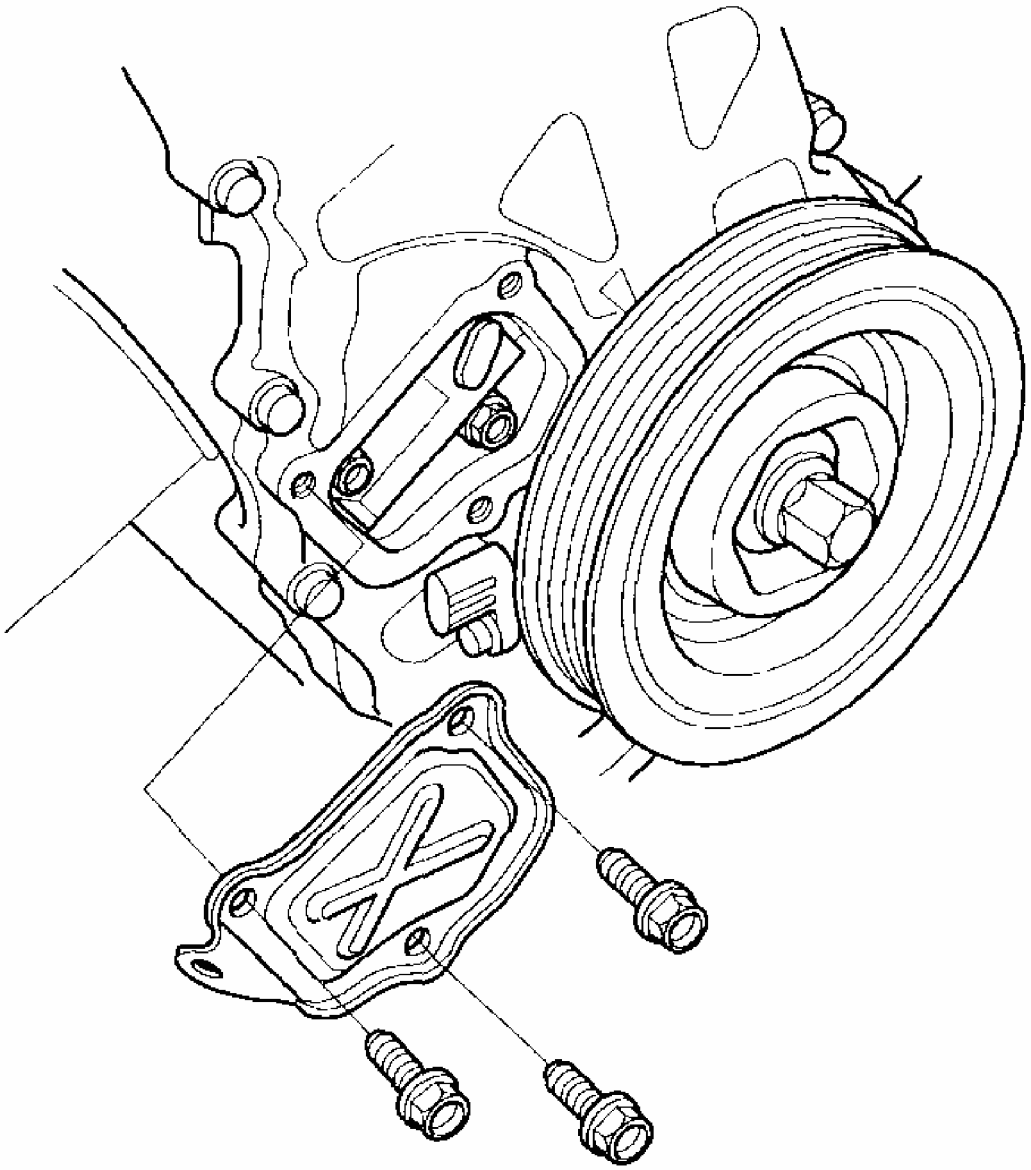

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Fig. 47: Removing Chain Case Cover
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

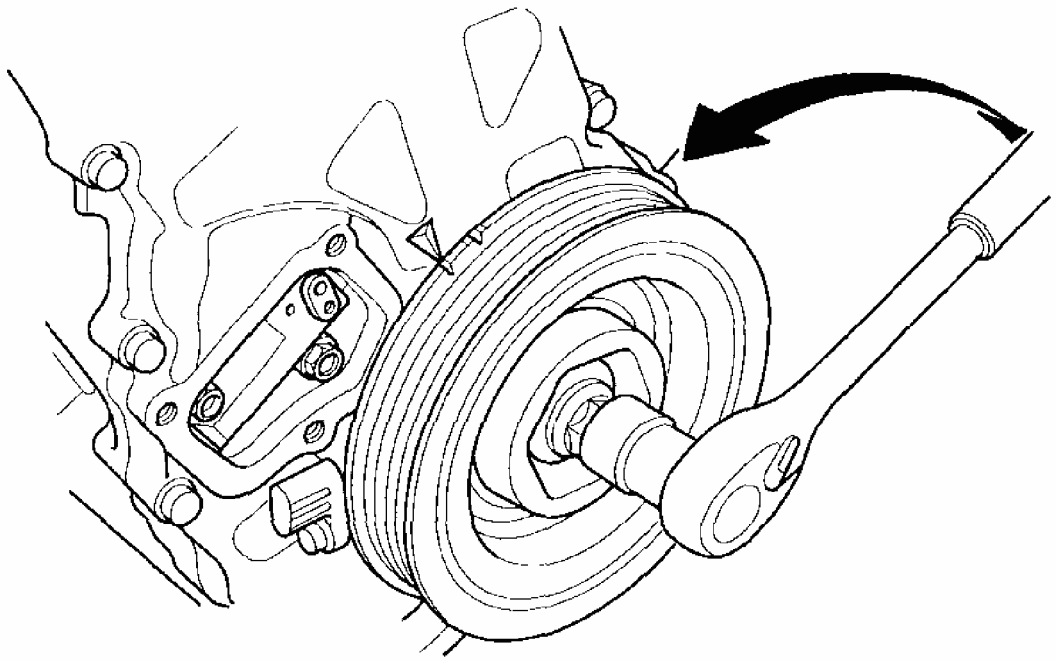

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Fig. 48: Compressing Auto-Tensioner
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

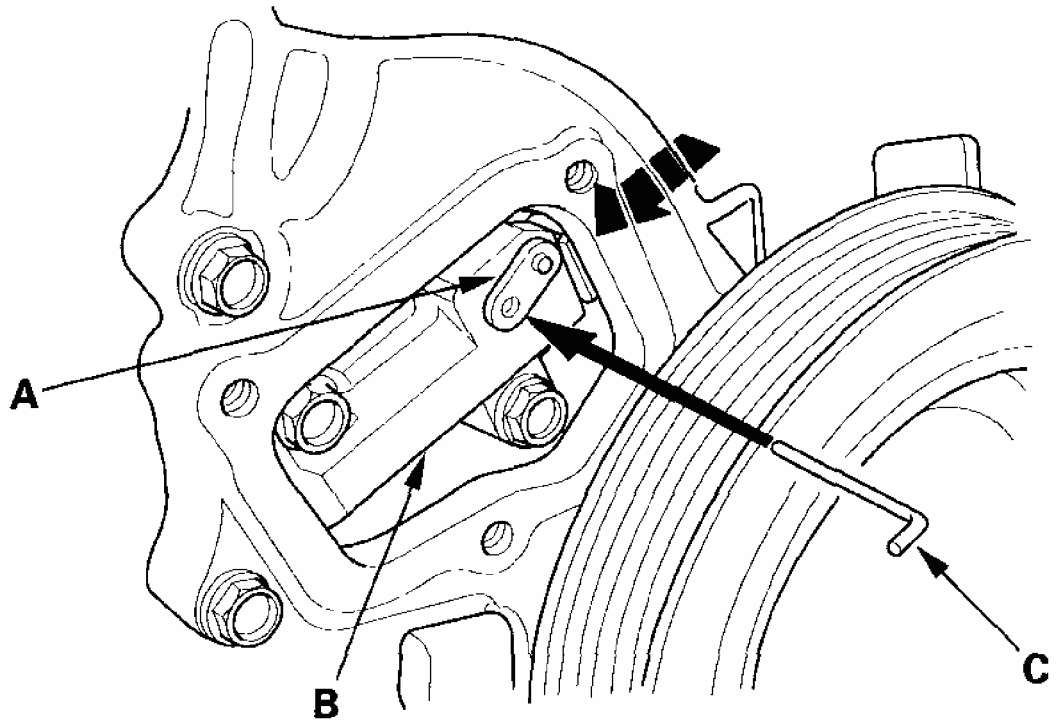

Fig. 49: Inserting Pin Into Lock And Auto-Tensioner Hole
Courtesy of AMERICAN HONDA MOTOR CO., INC.

4. Remove the auto-tensioner.

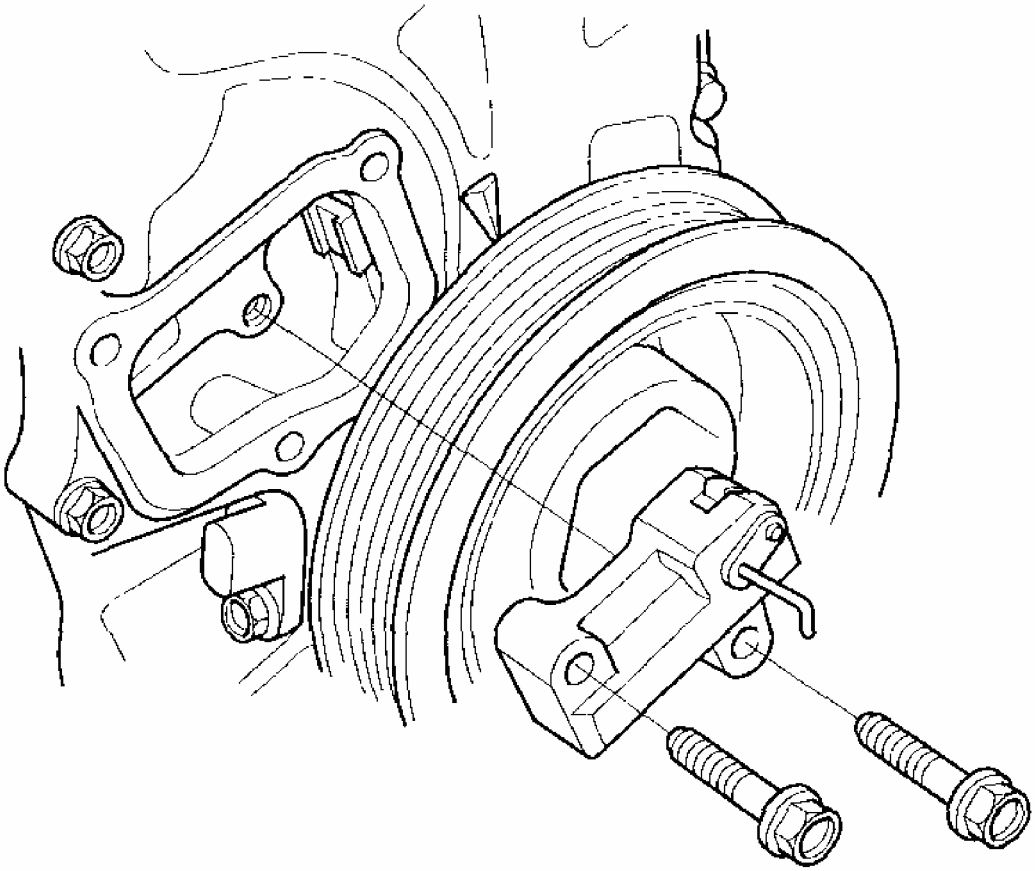

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Fig. 50: Removing Auto-Tensioner
Courtesy of AMERICAN HONDA MOTOR CO., INC.

INSTALLATION

1. Install the auto-tensioner.

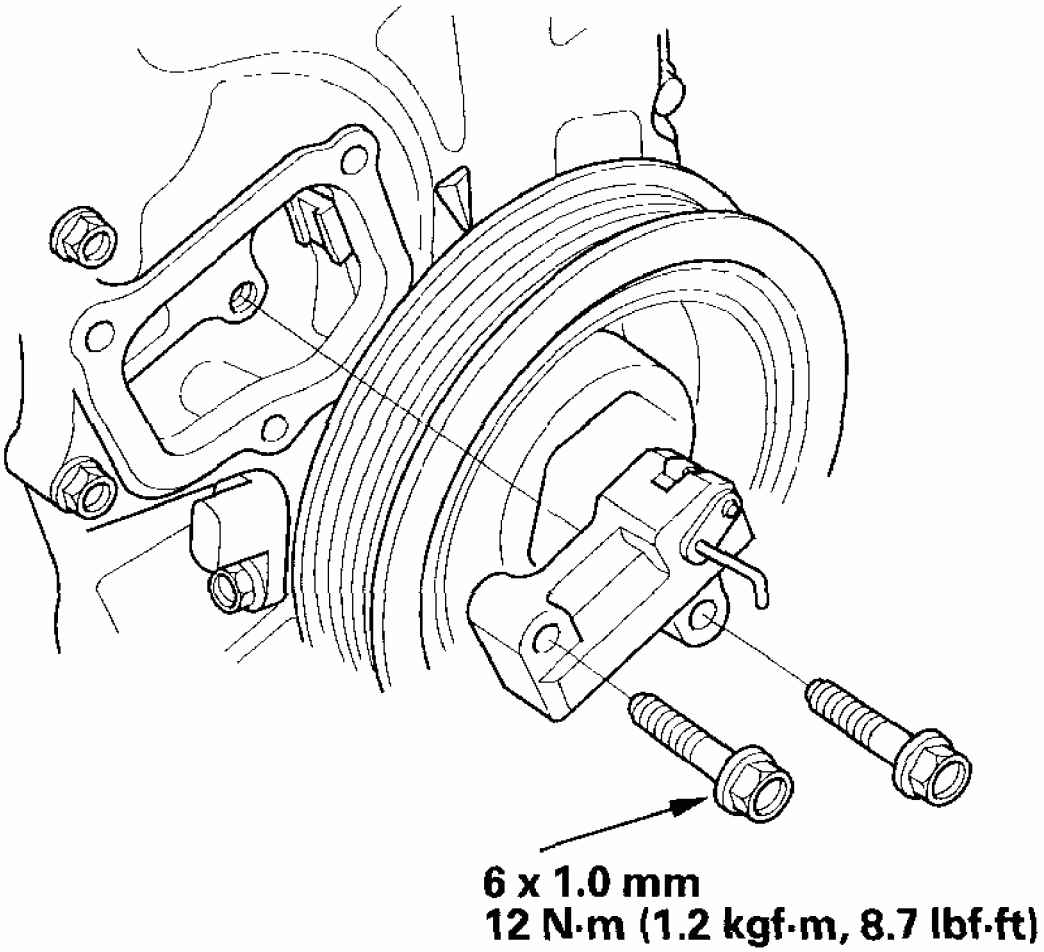

Fig. 51: Installing Auto-Tensioner And Torques Specifications
Courtesy of AMERICAN HONDA MOTOR CO., INC.

2. Remove the pin from the auto-tensioner.

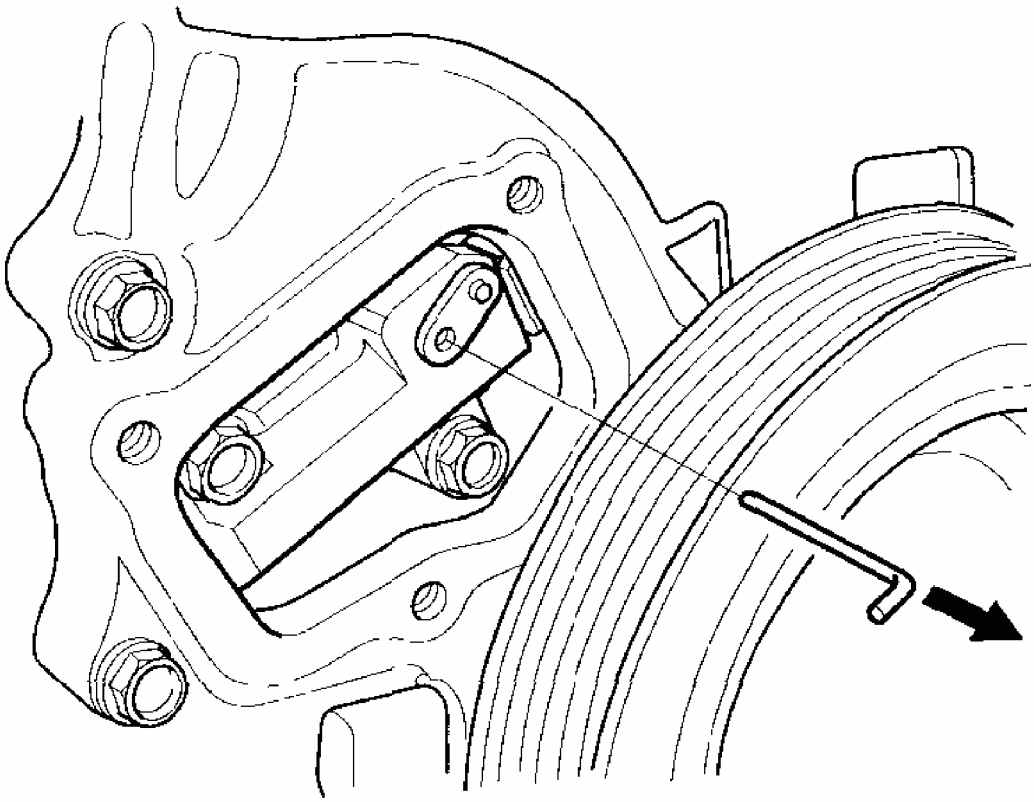

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Fig. 52: Removing Pin From Auto-Tensioner
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

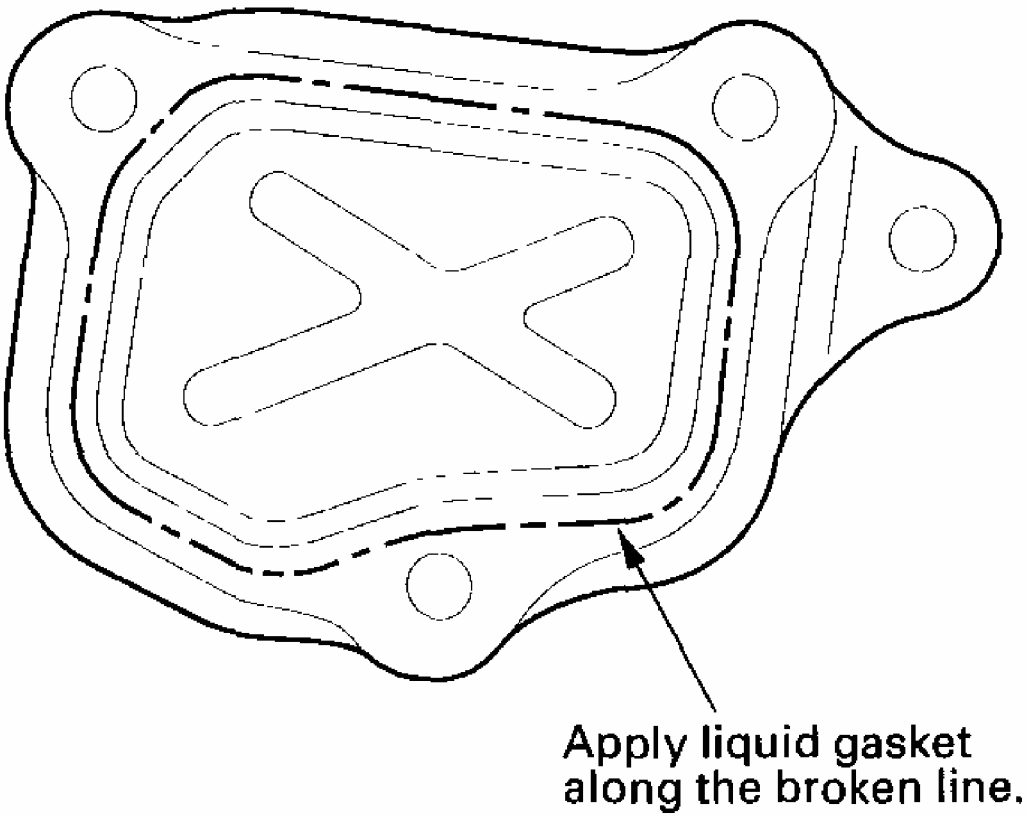

Fig. 53: Locating Sealing Gasket Applying Point
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.**

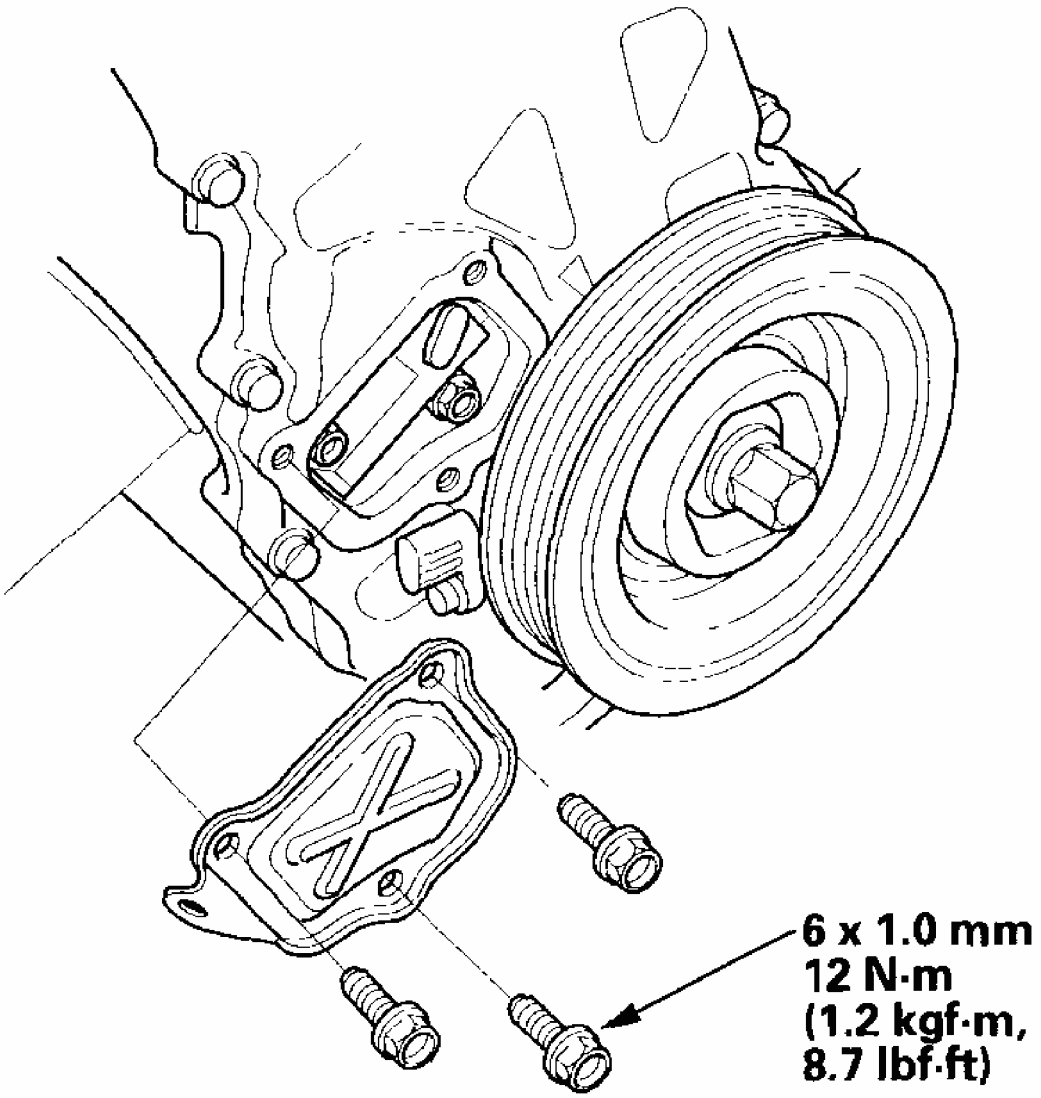

Fig. 54: Installing Chain Case Cover And Torque Specifications
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

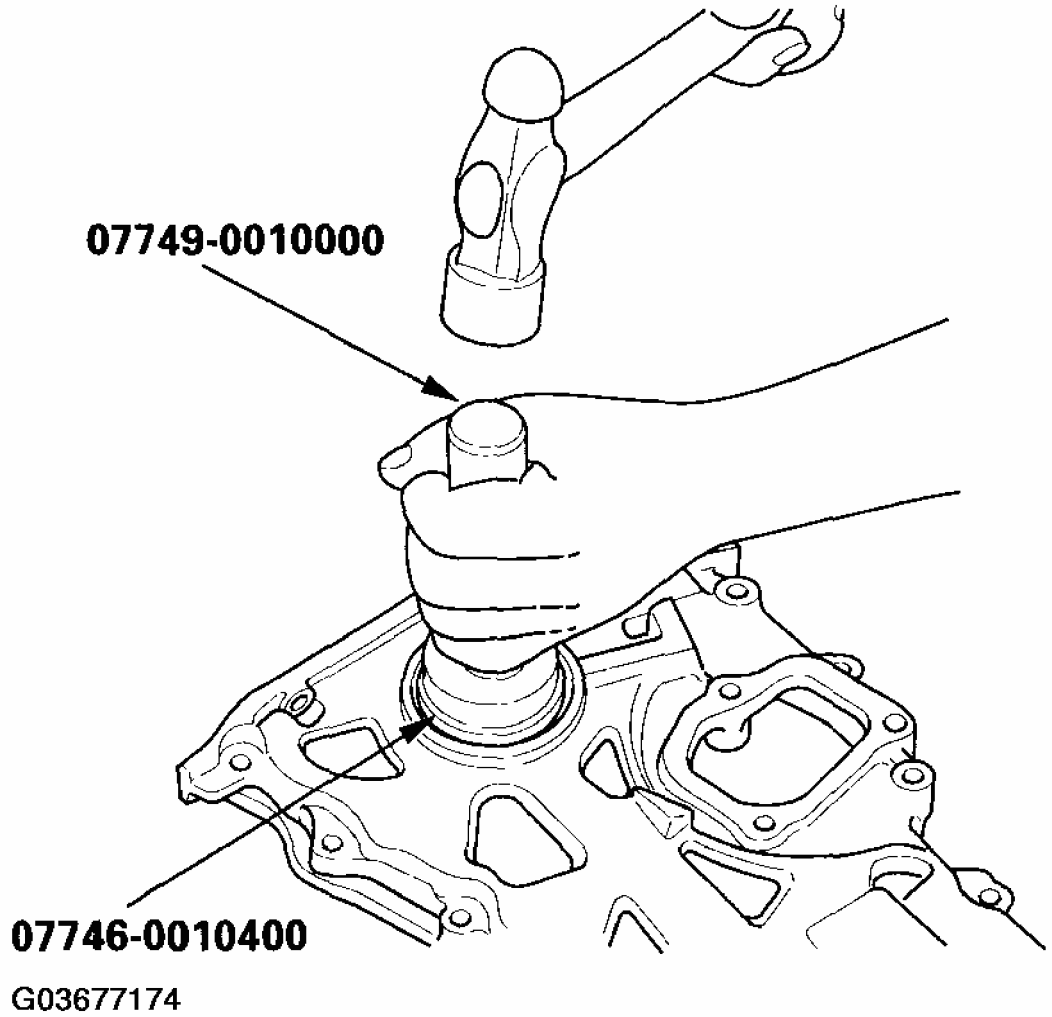

Fig. 55: Installing Oil Seal Into Chain Case
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.)

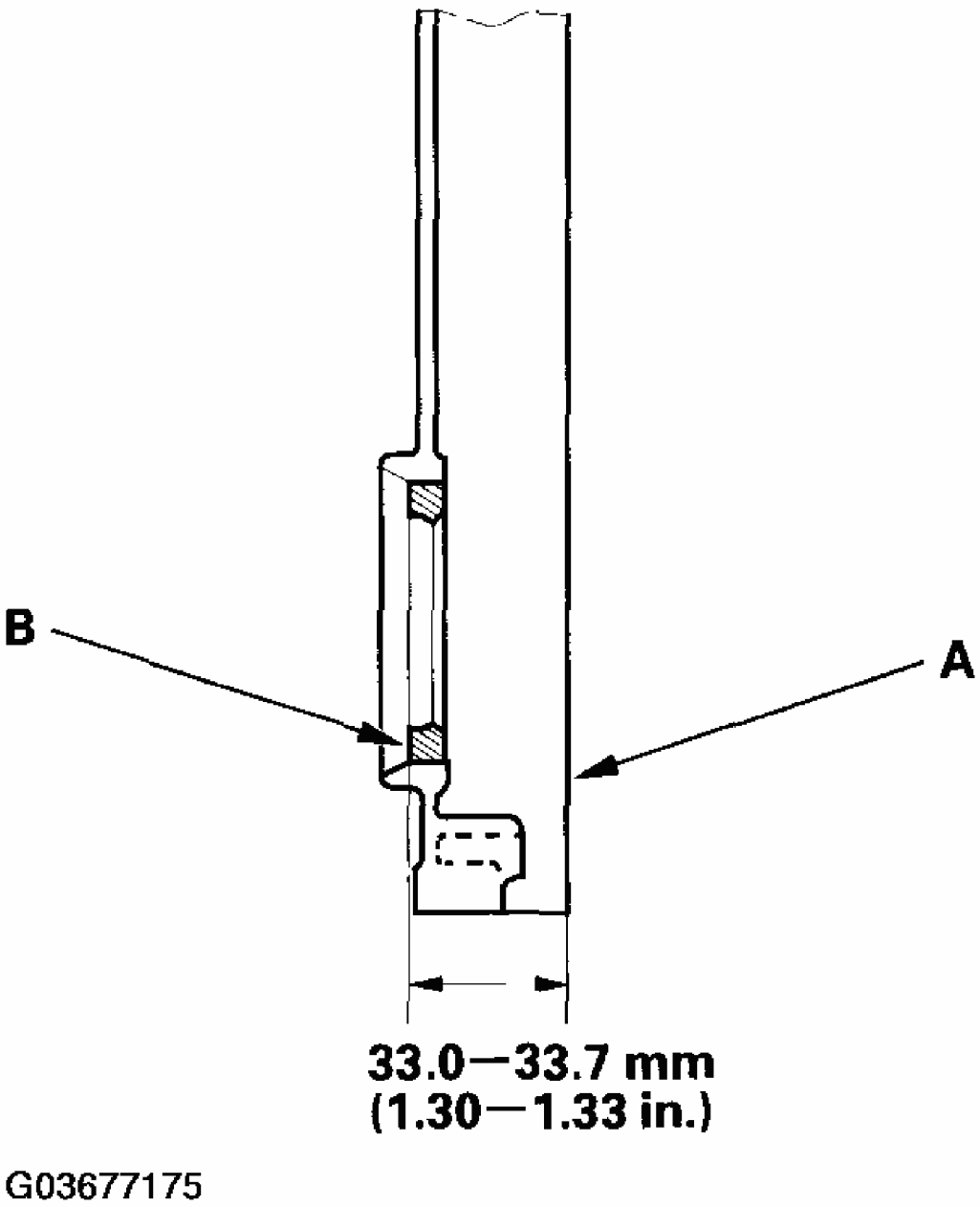

Fig. 56: Identifying Distance Between Chain Case Surface And Oil Seal
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.)

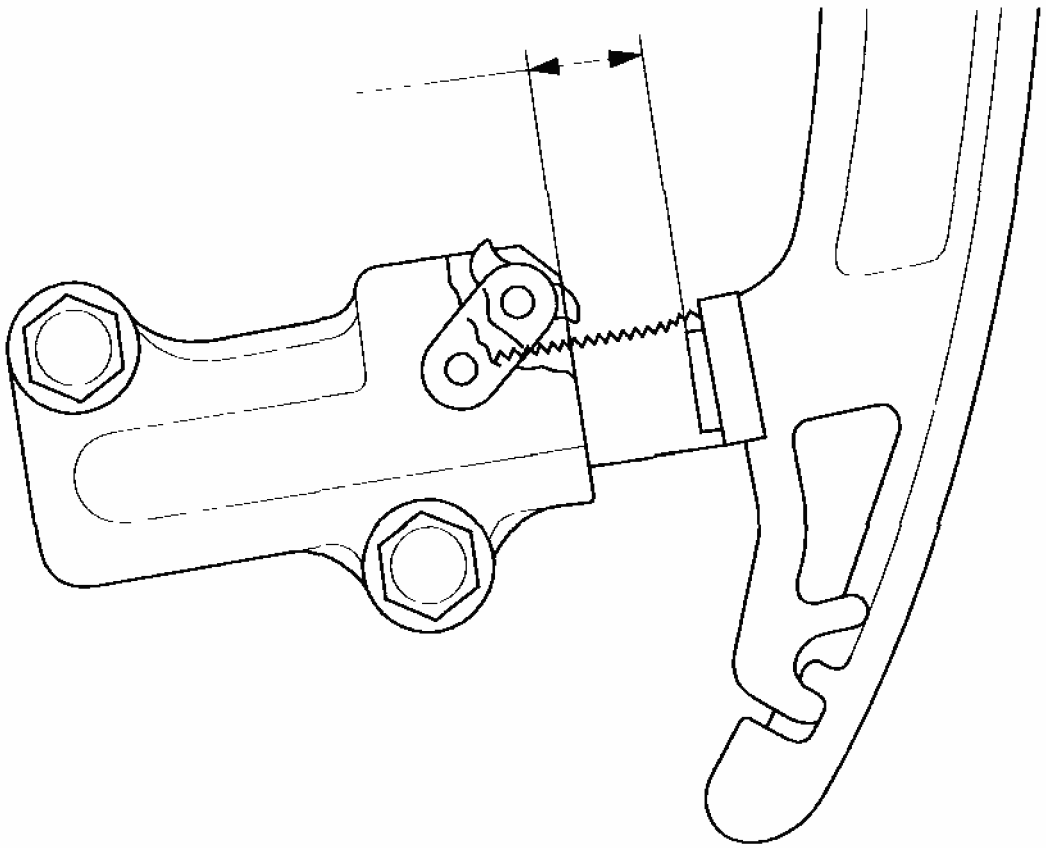

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Fig. 57: Identifying Tensioner Rod Length
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

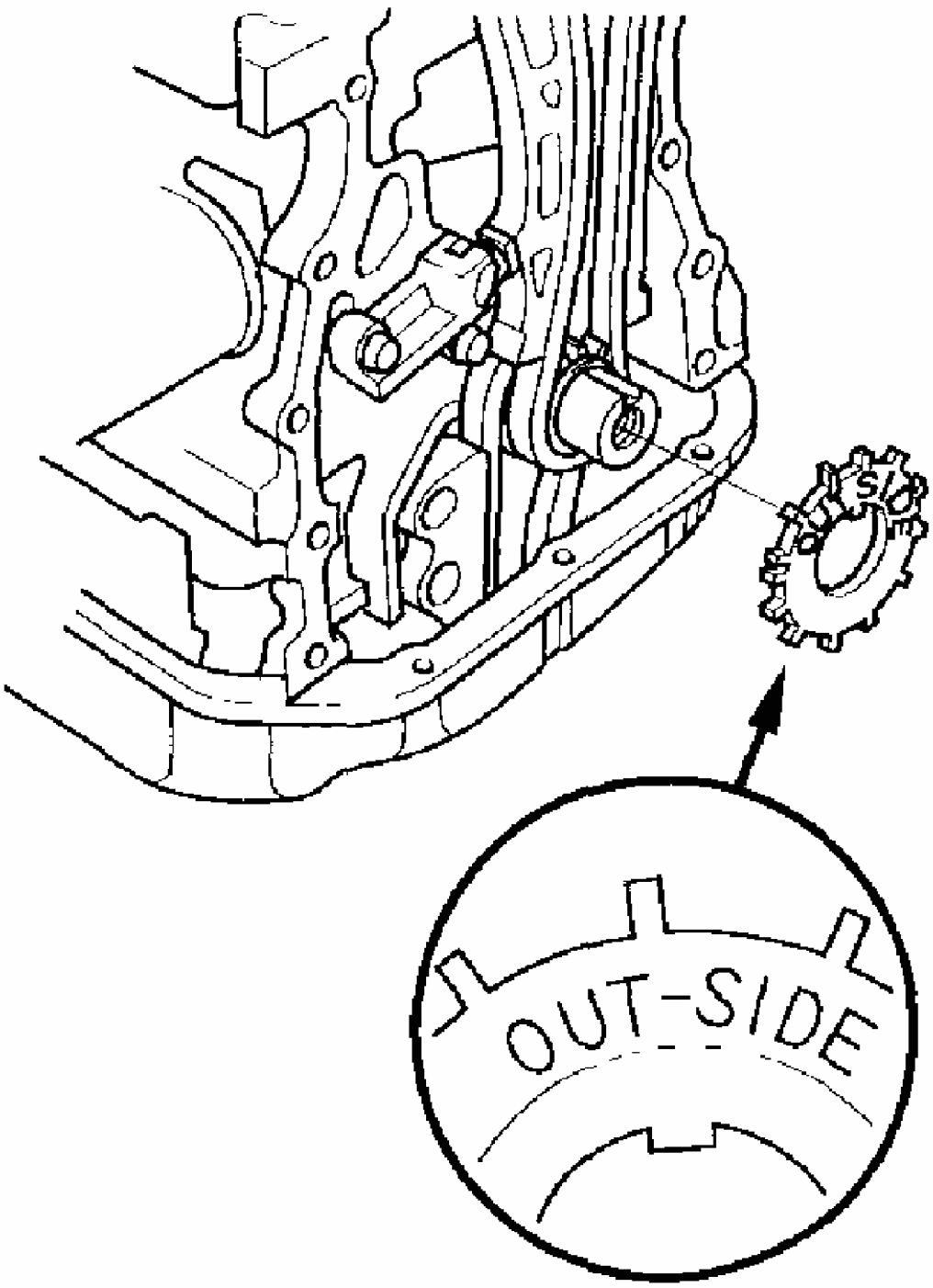

Fig. 58: Removing CKP Pulse Plate
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

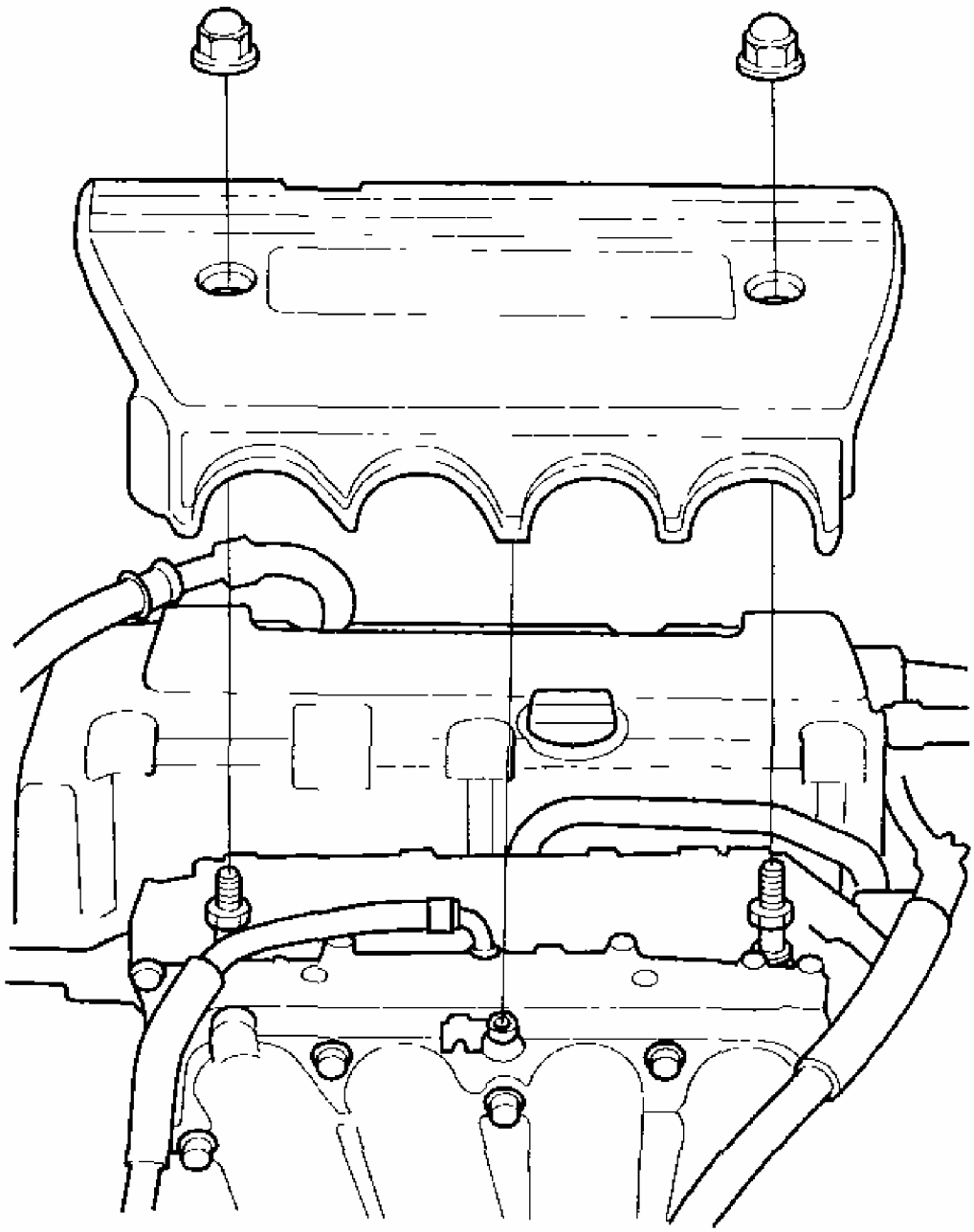

Fig. 59: Removing Intake Manifold Cover
Courtesy of AMERICAN HONDA MOTOR CO., INC.

2. Remove the four ignition coils (see **IGNITION COIL REMOVAL/INSTALLATION**).

3. Remove the two bolts (A) securing the vacuum line.

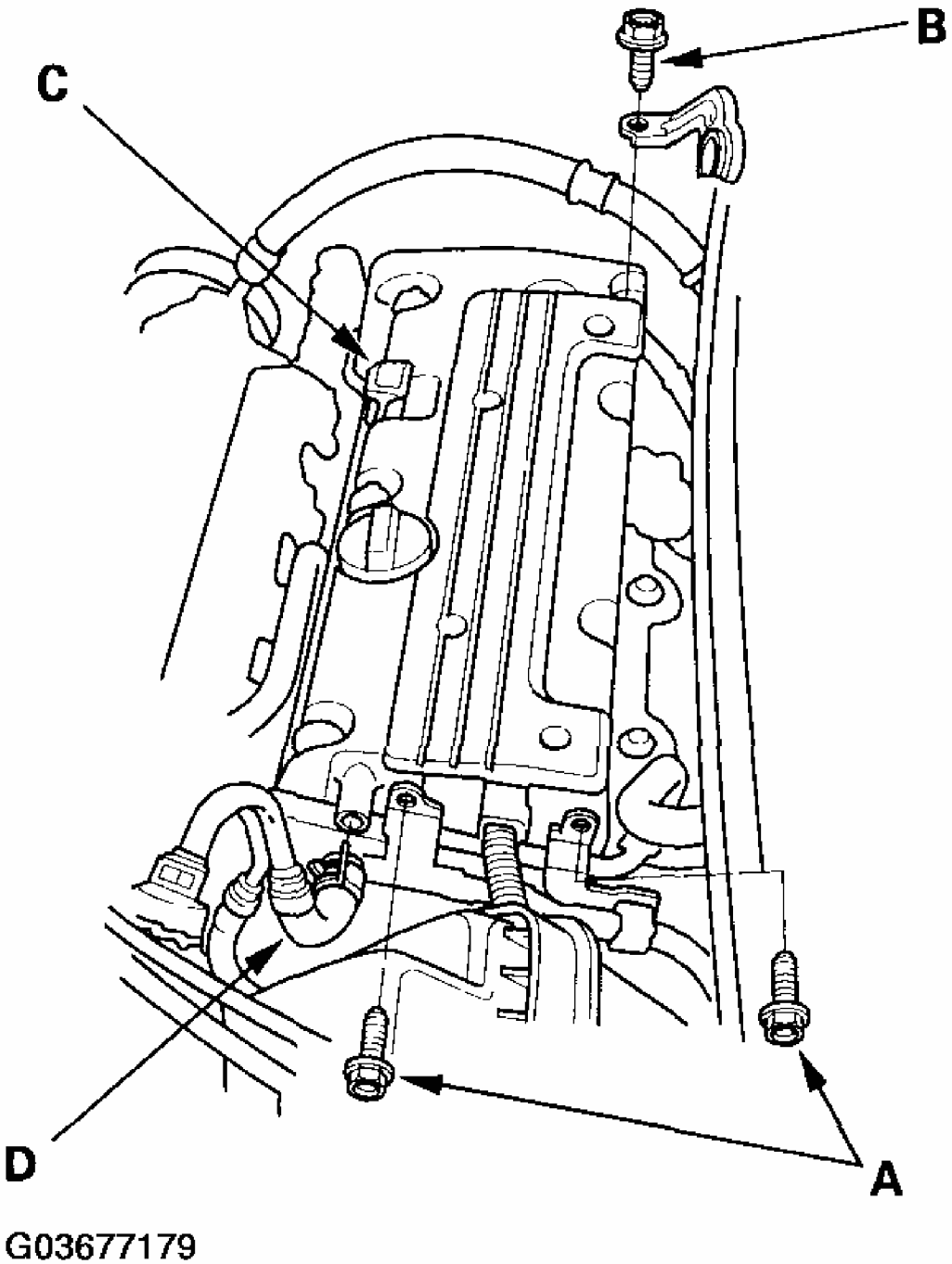

Fig. 60: Removing Bolts Securing Vacuum Line
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

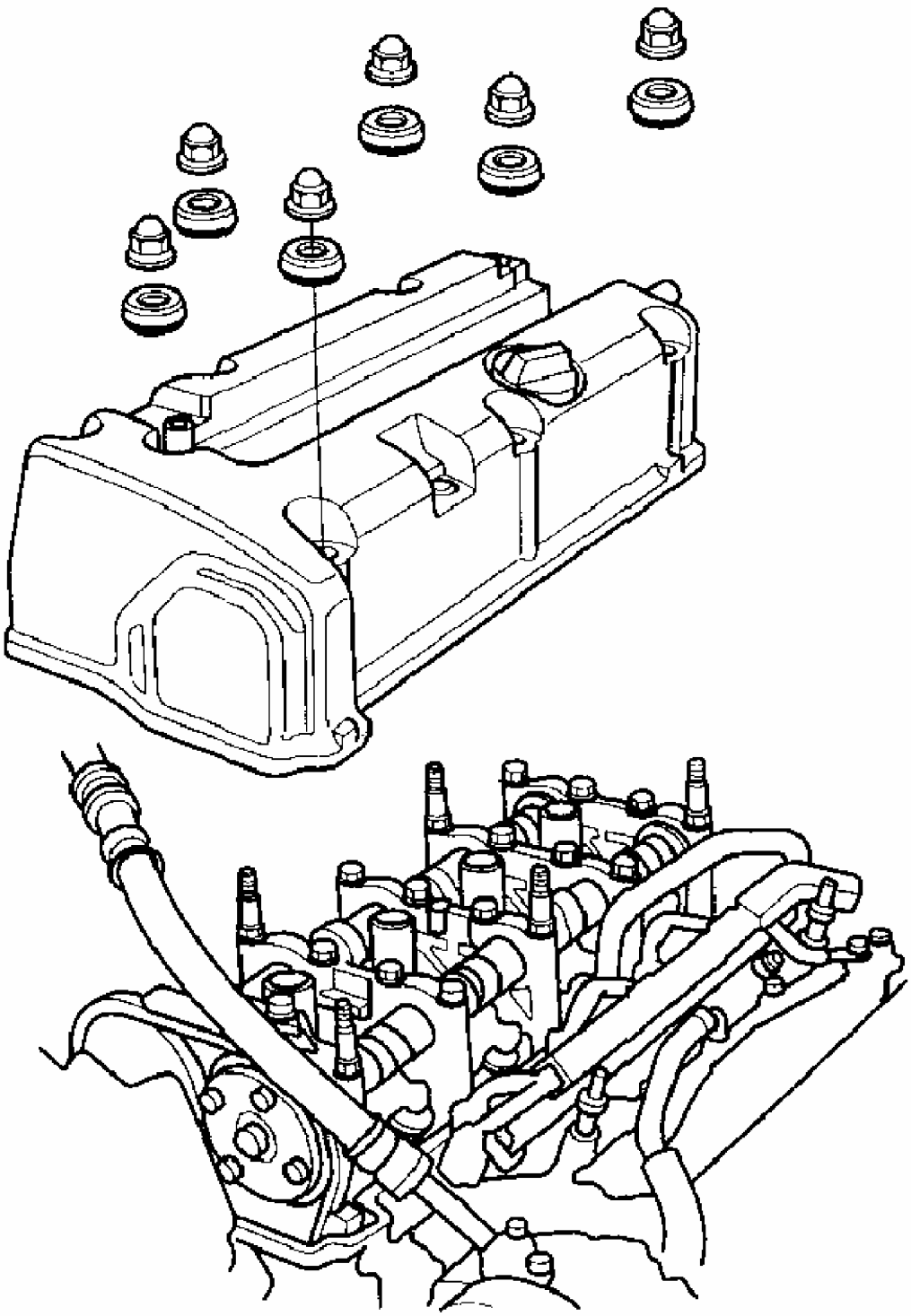

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Fig. 61: Removing Cylinder Head Cover

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).

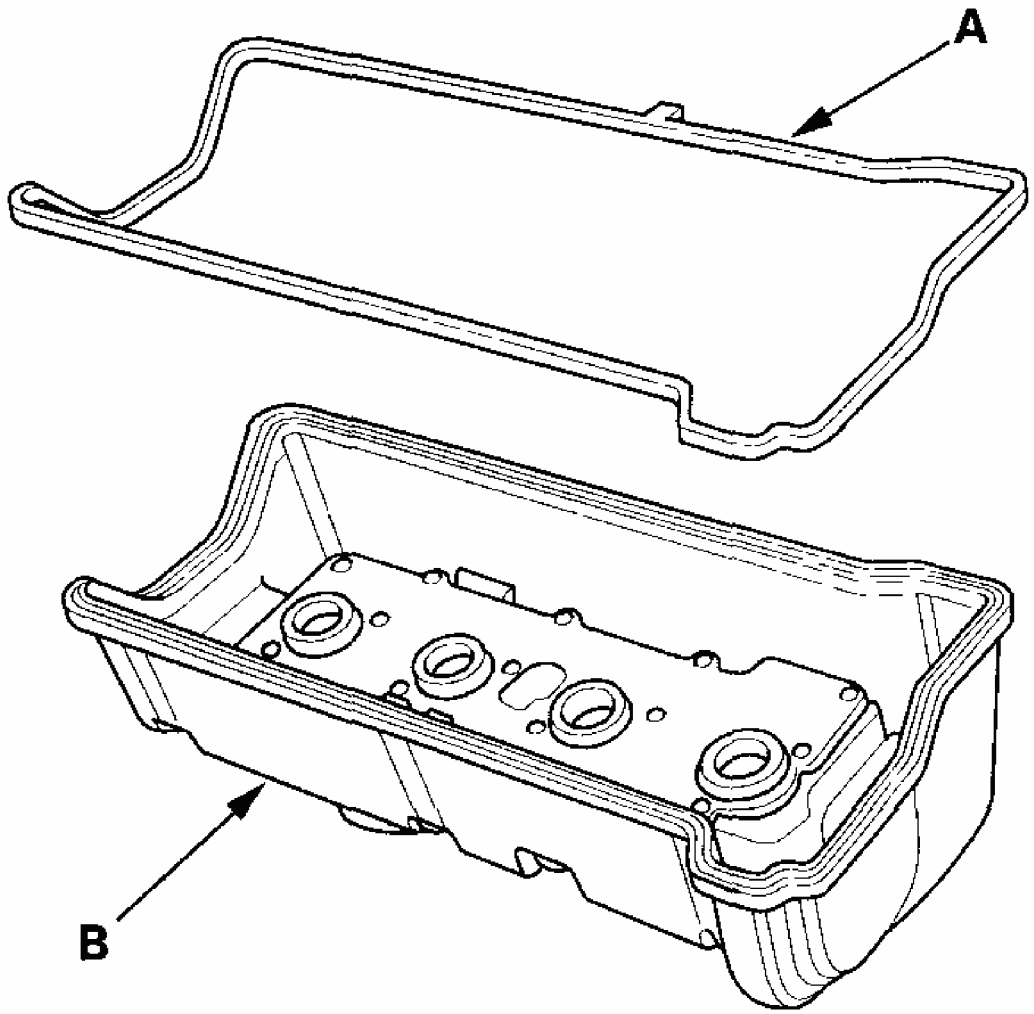

Fig. 62: Installing Cylinder Head Cover Gasket
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.**

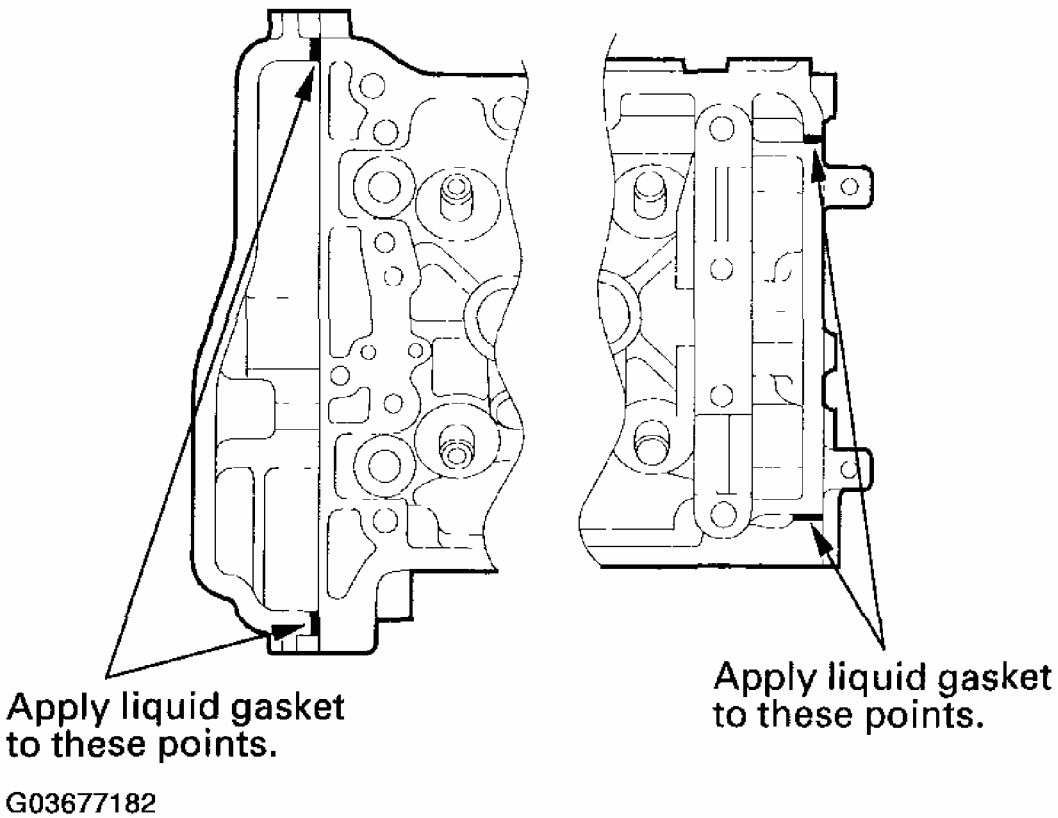

Fig. 63: Locating Sealing Gasket Applying Point
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

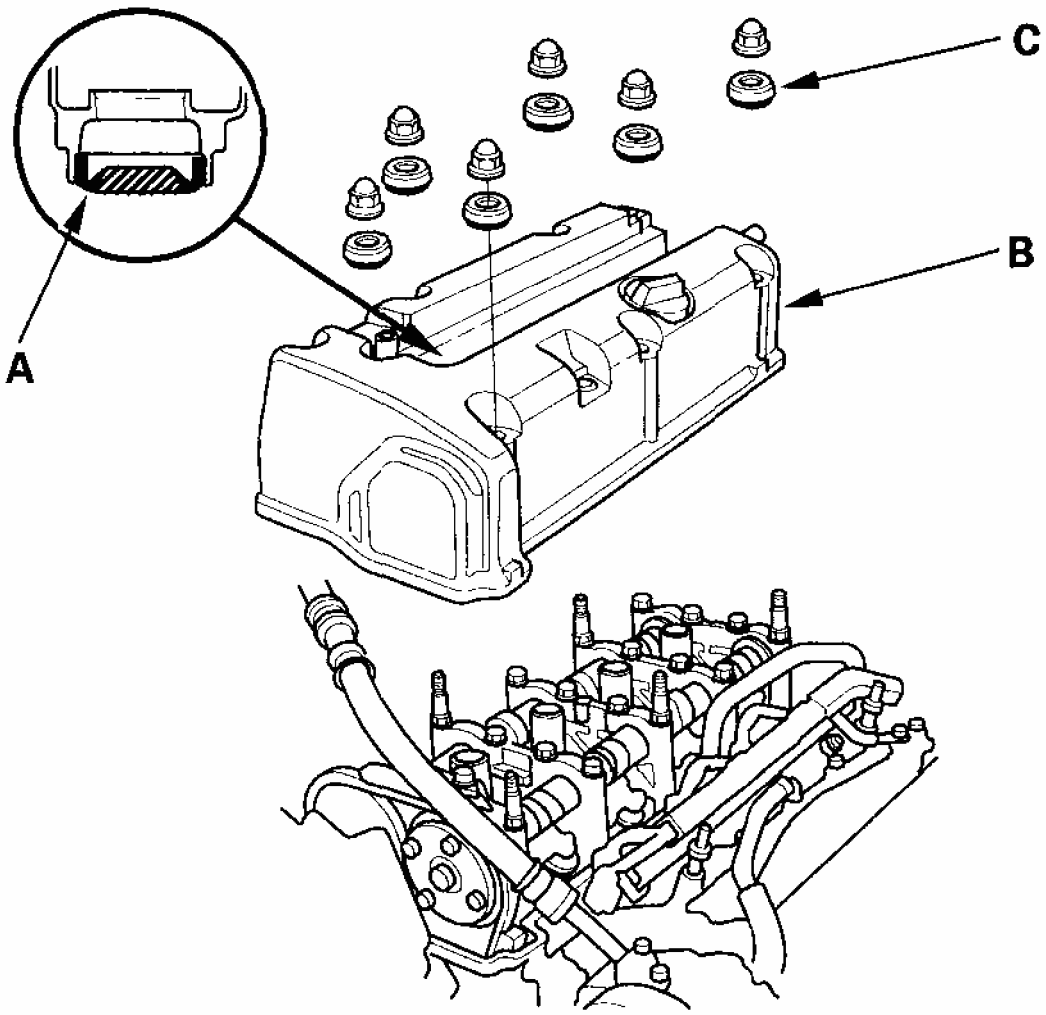

Fig. 64: Placing Cylinder Head Cover On Cylinder Head
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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).

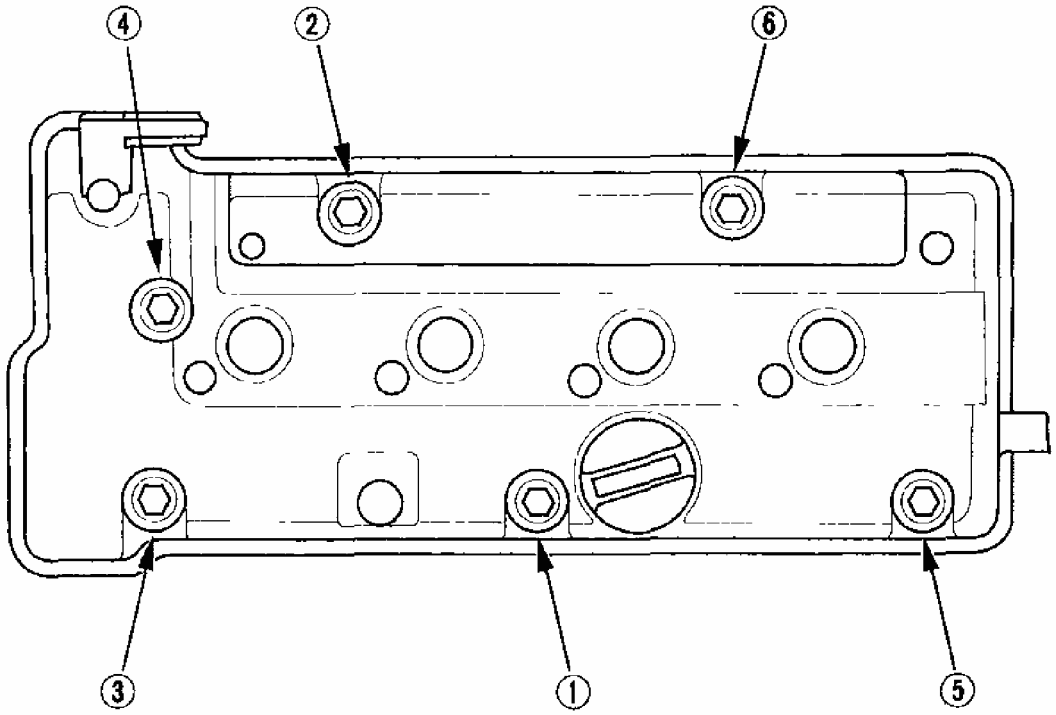

Fig. 65: Tightening Cylinder Head Cover Bolts
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

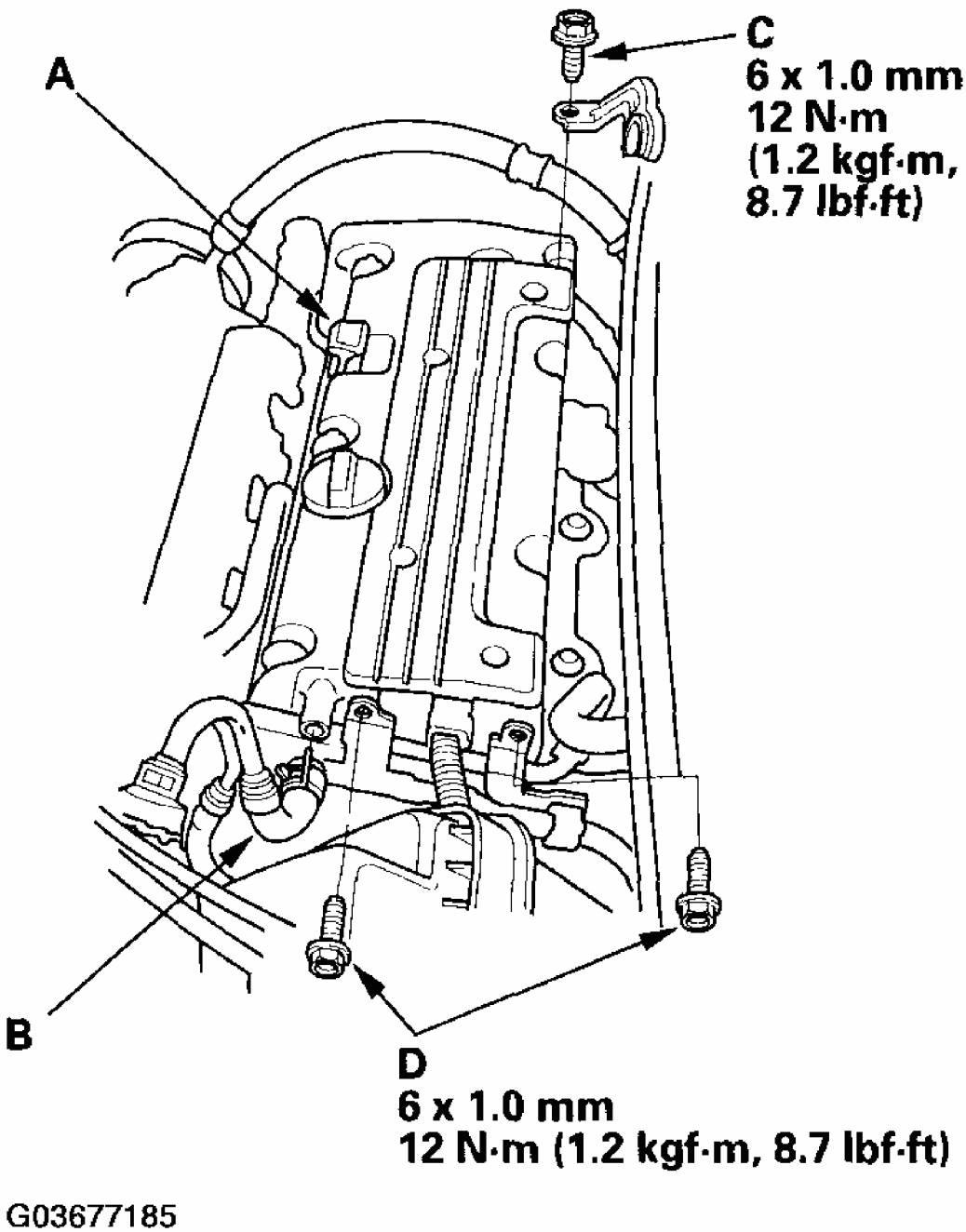

Fig. 66: Installing Dipstick And Breather Hose
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

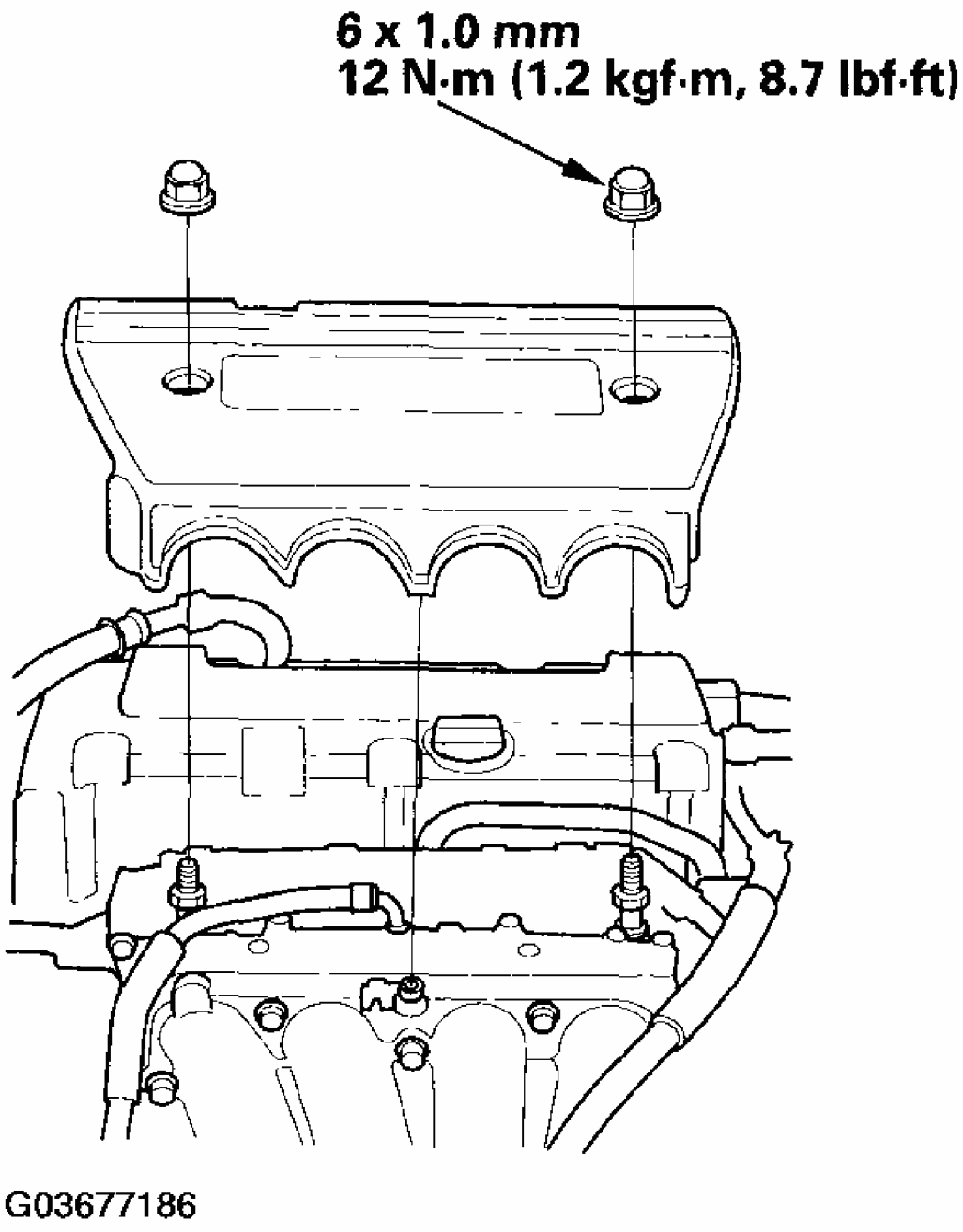

Fig. 67: Installing Intake Manifold Cover And Torque Specifications
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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).

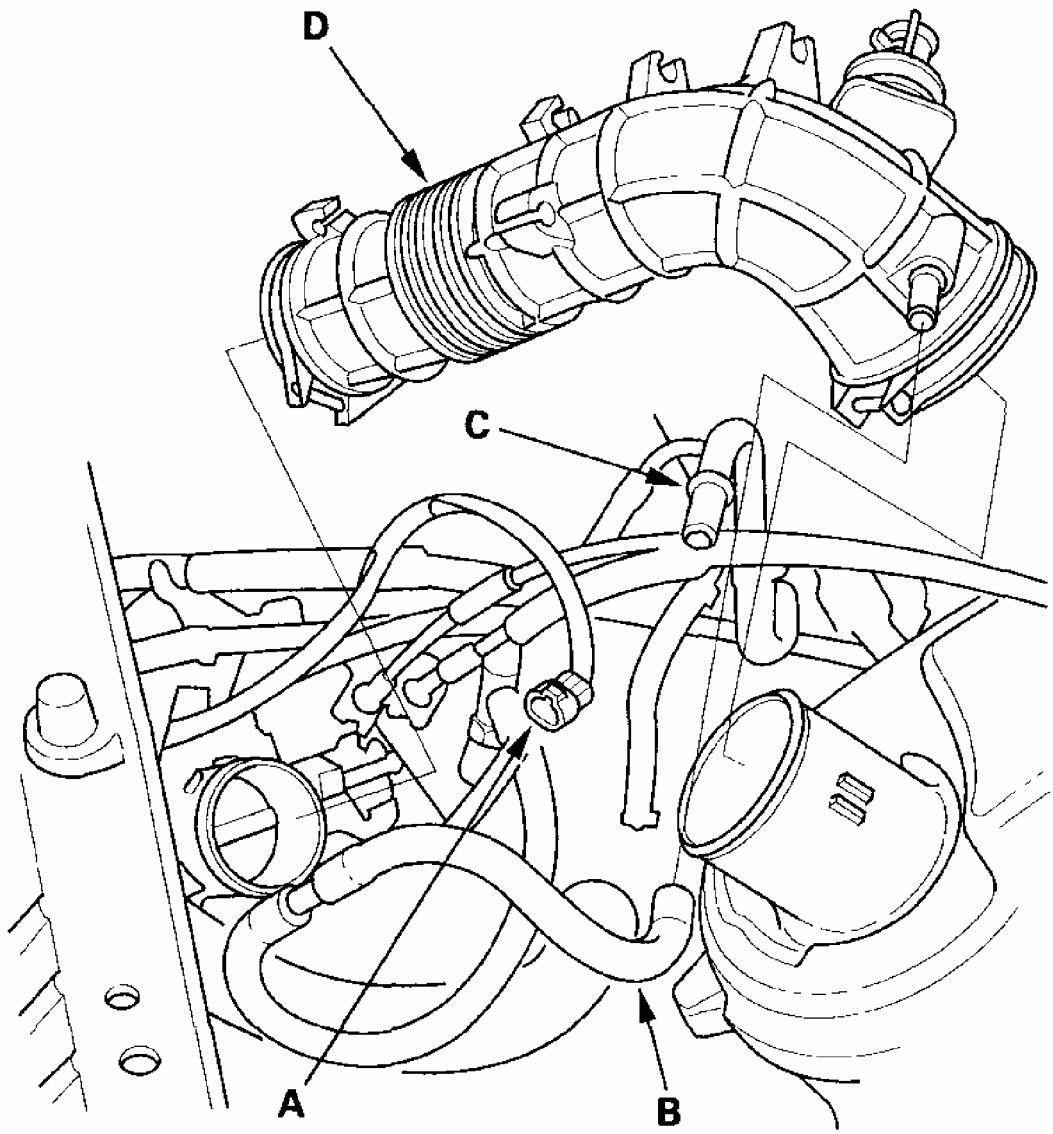

Fig. 68: Disconnecting Intake Air Temperature Sensor Connector
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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**).

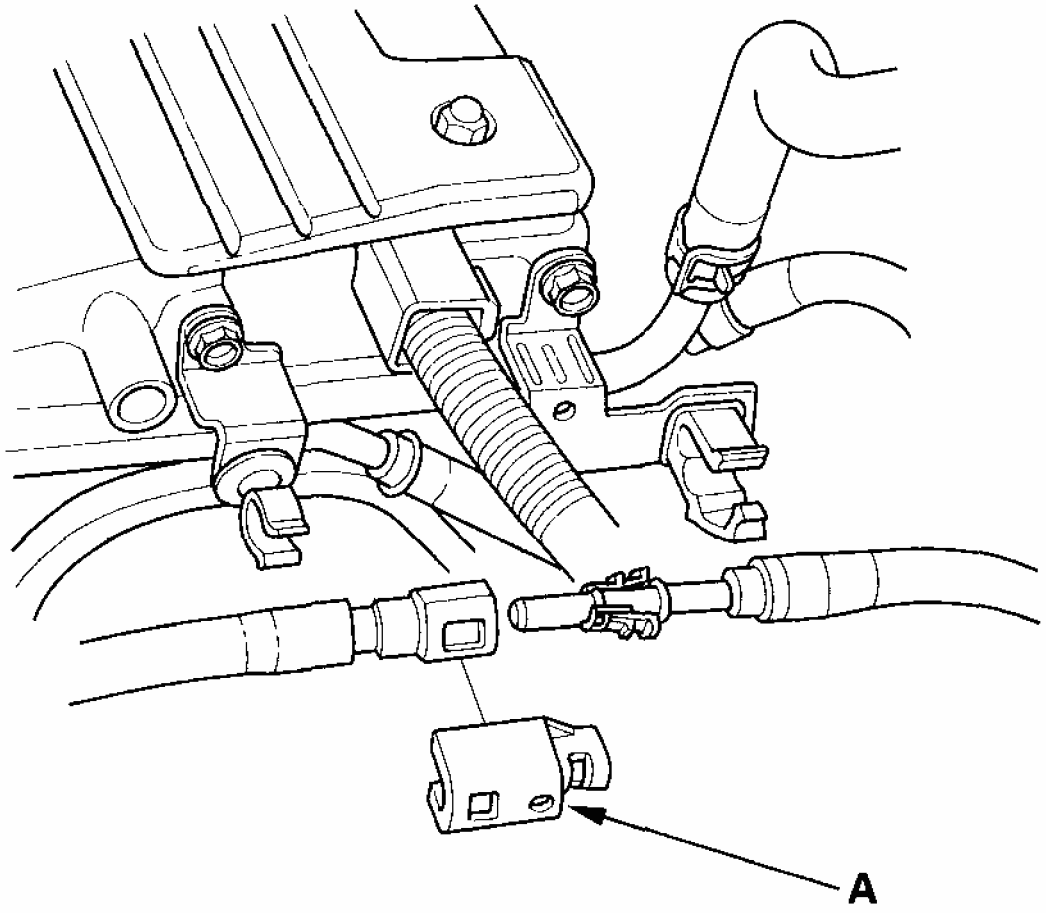

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Fig. 69: Removing Quick-Connect Fitting Cover
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

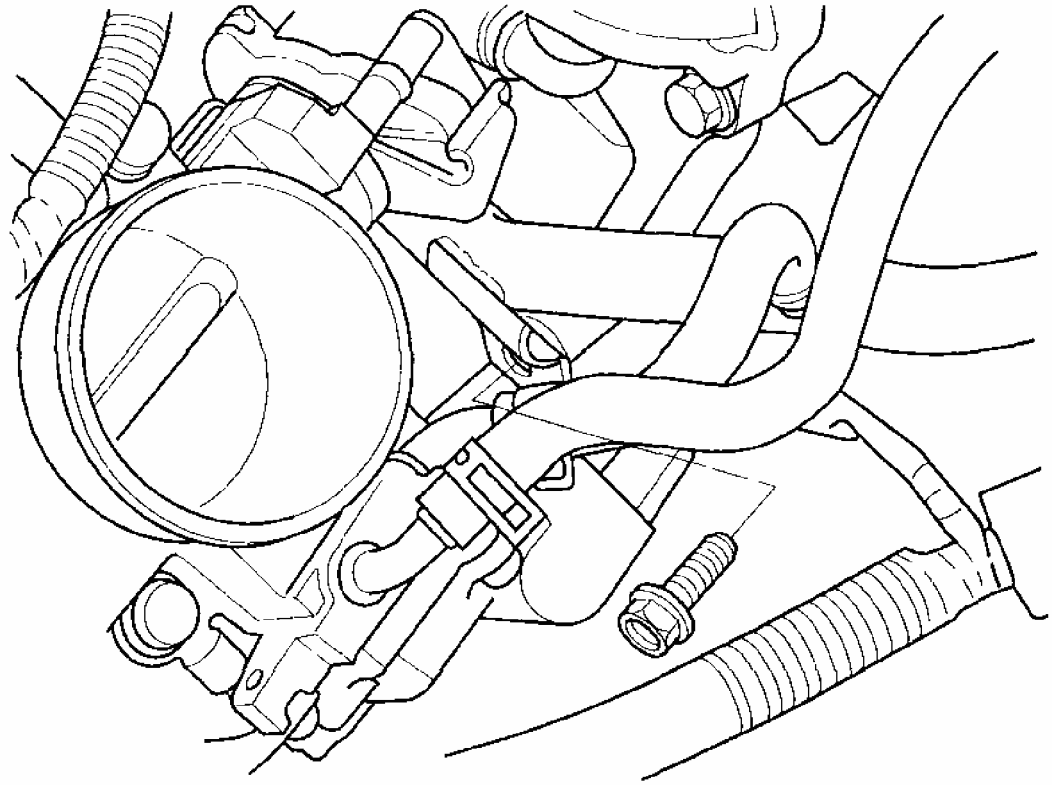

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Fig. 70: Removing Bolt Securing Connecting Pipe Support Bracket To Engine Block
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

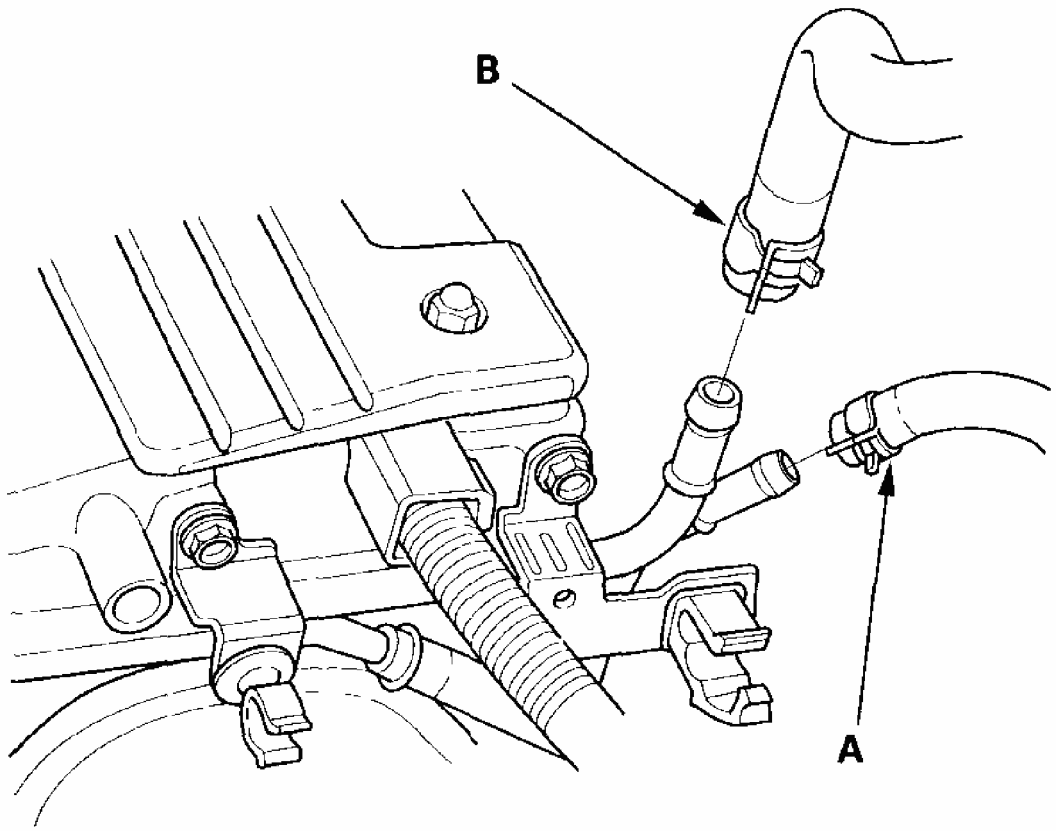

Fig. 71: Removing Evaporative Emission Canister Hose And Brake Booster Vacuum Hose
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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).

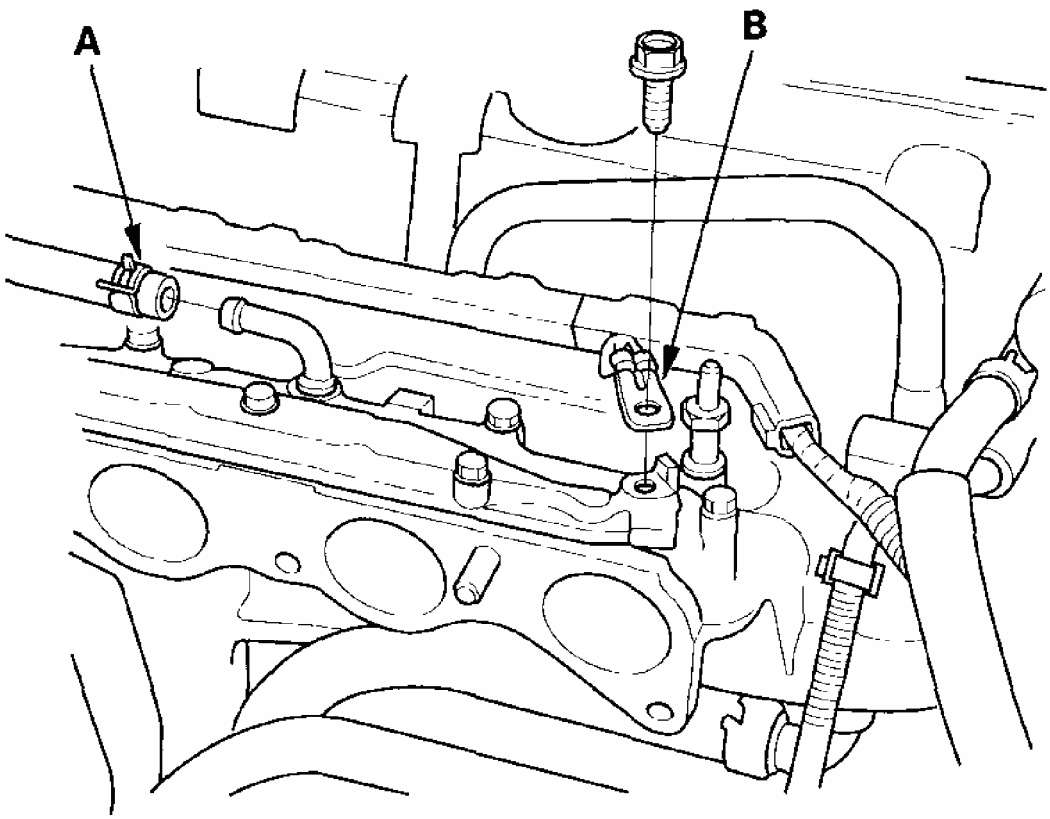

Fig. 72: Removing Positive Crankcase Ventilation Hose And Ground Cable
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

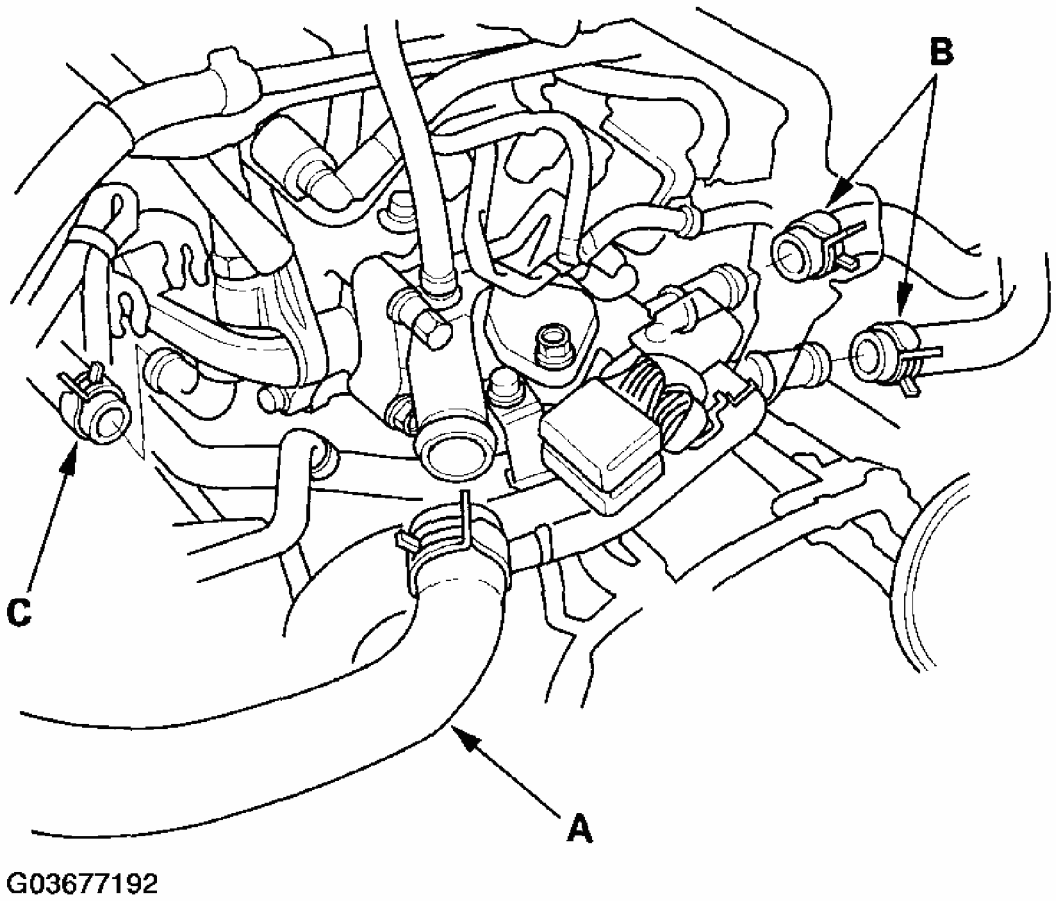

Fig. 73: Removing Upper Radiator Hose, Heater Hoses And Water Bypass Hose
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

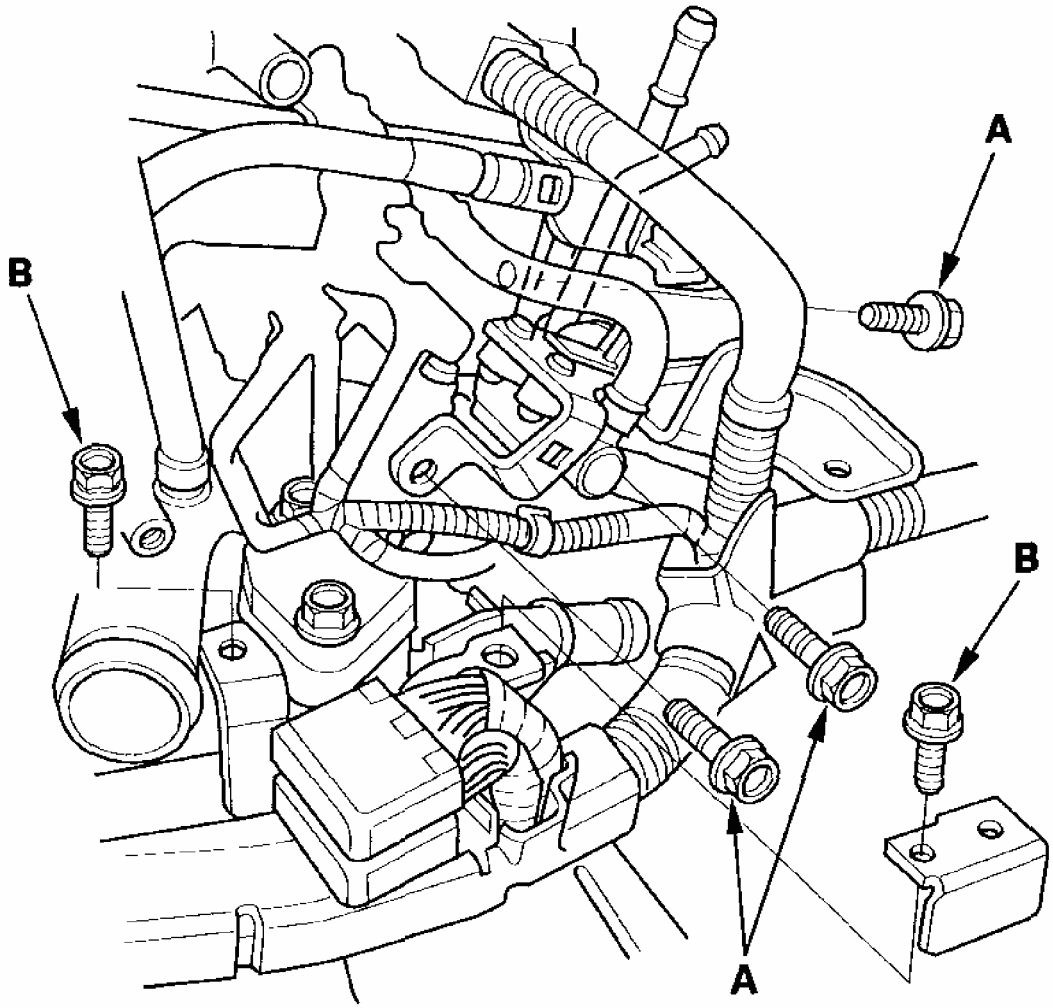

Fig. 74: Removing Bolts Securing EVAP Canister Purge Valve Bracket
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

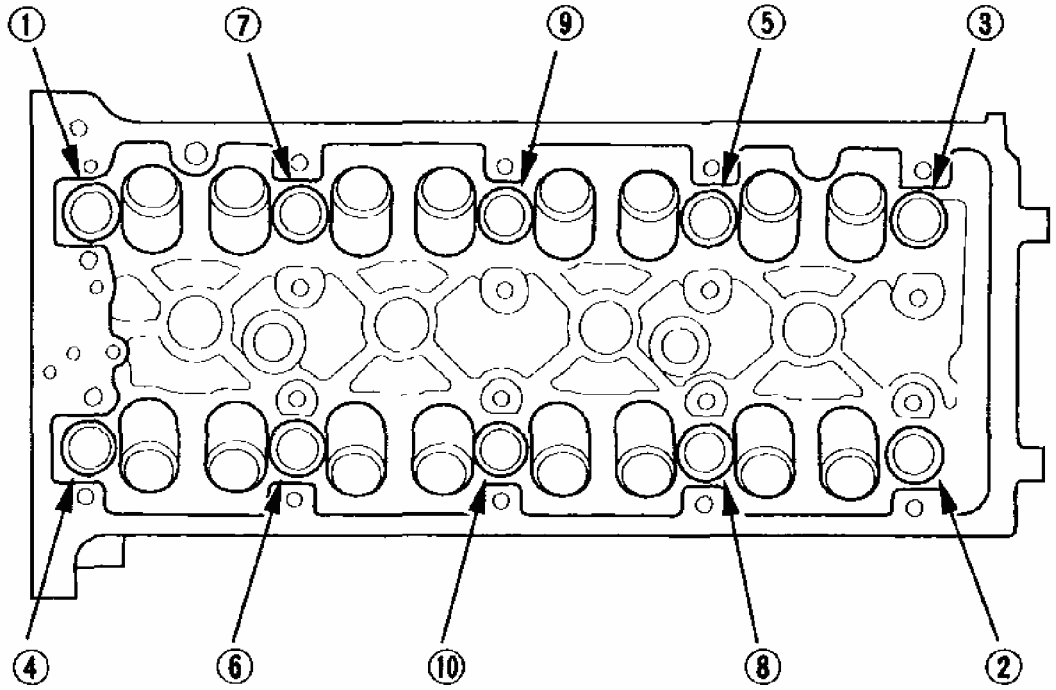

Fig. 75: Removing Cylinder Head Bolts
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

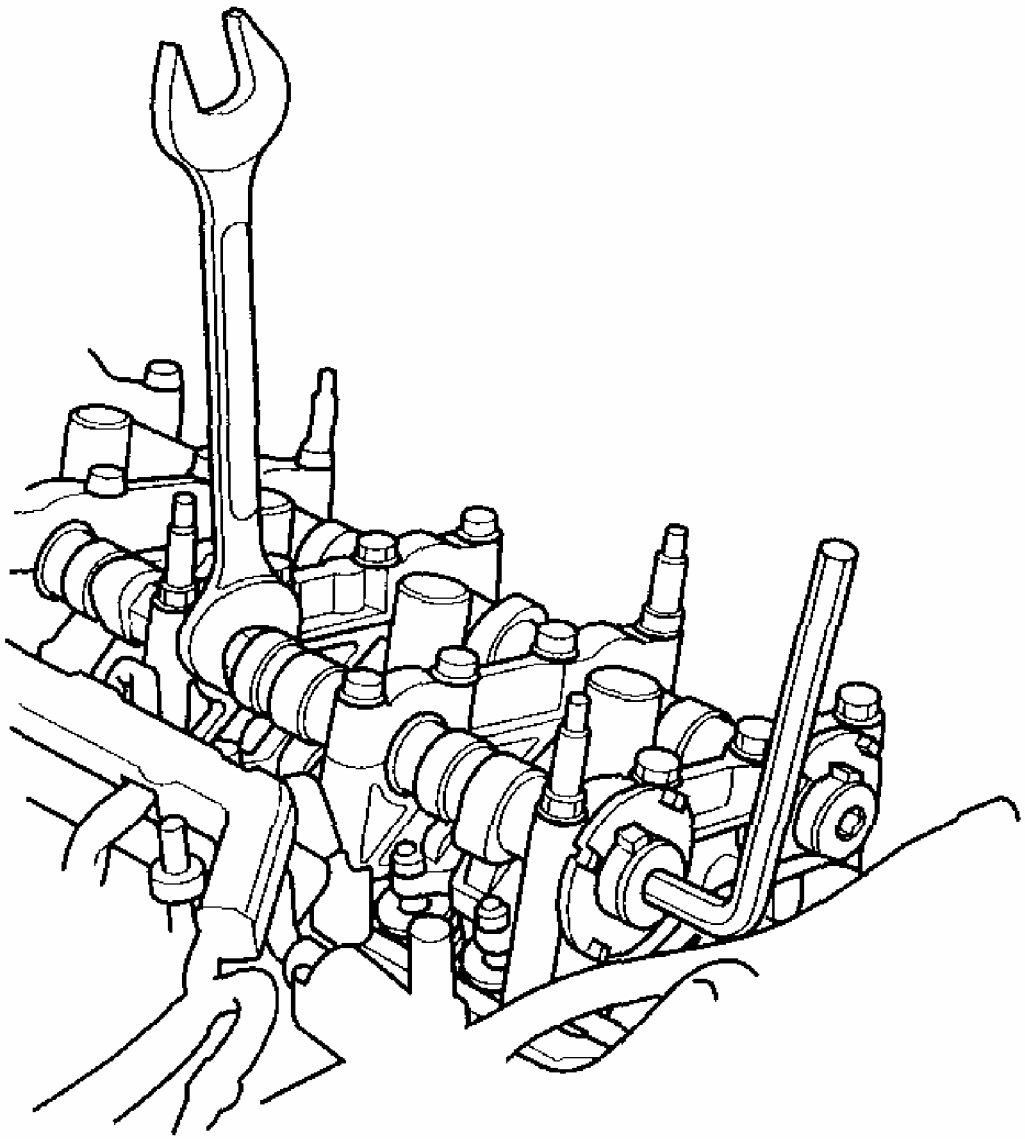

Fig. 76: Holding Intake Camshaft With Open-End Wrench
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

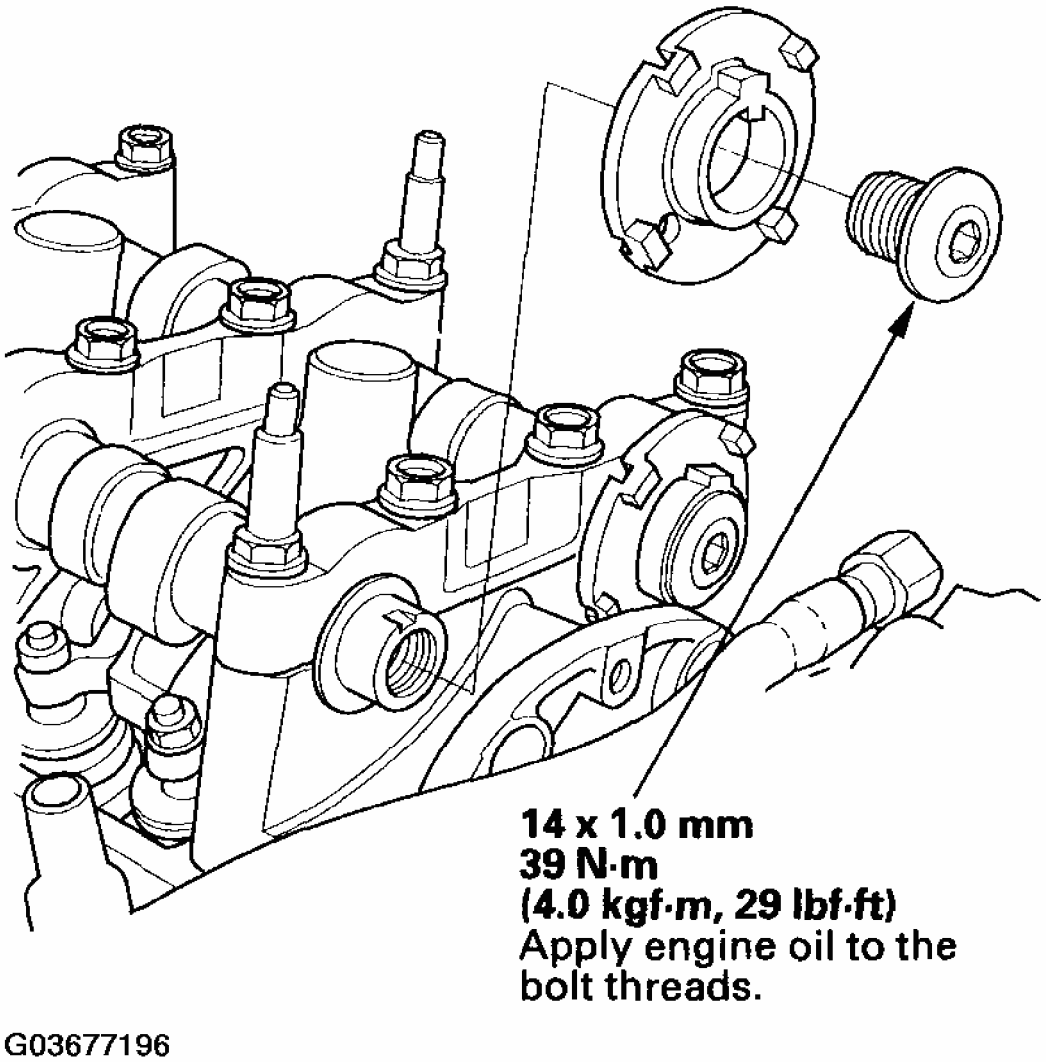

Fig. 77: Removing Camshaft Position Pulse Plate A And Torque Specifications
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

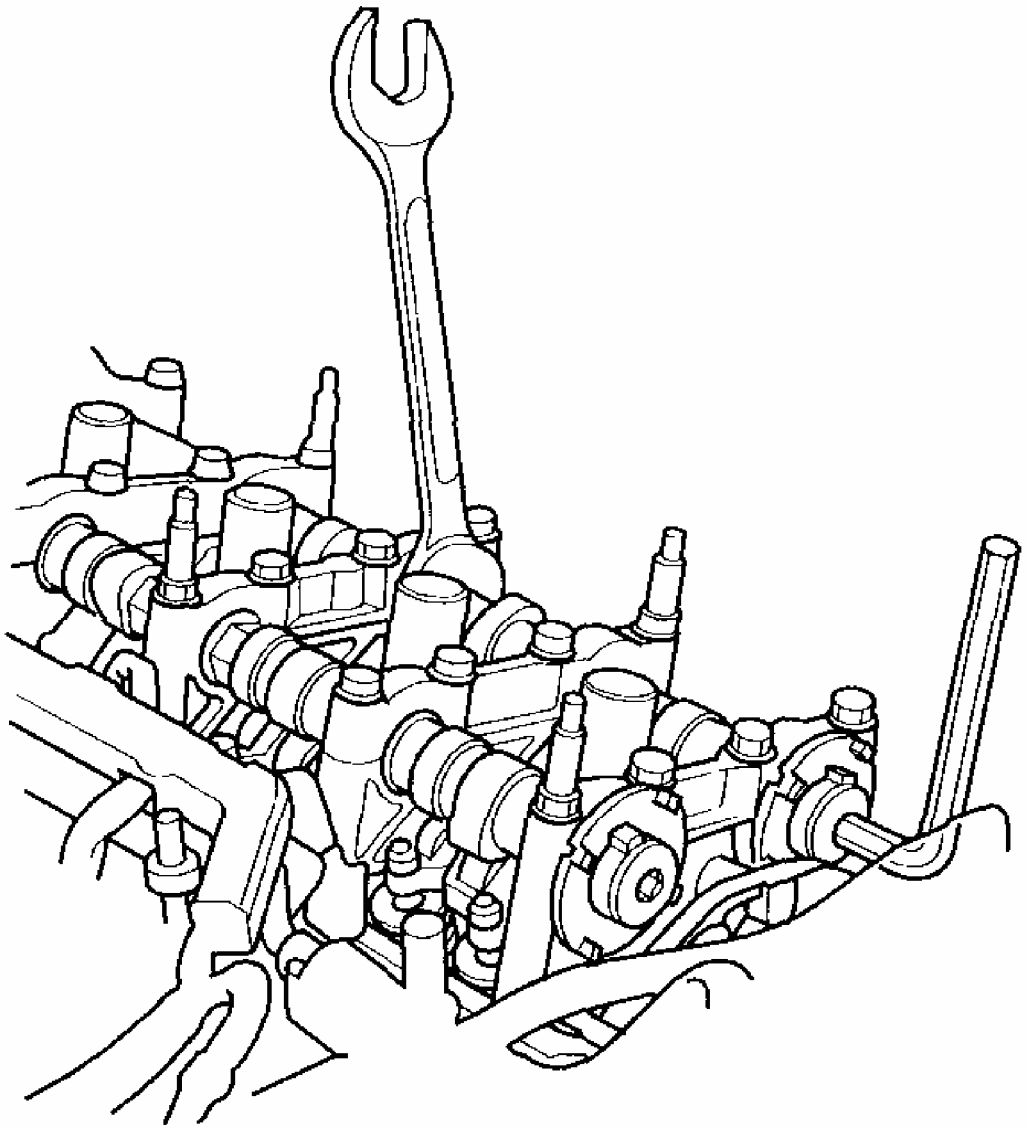

Fig. 78: Holding Exhaust Camshaft With Open-End Wrench To Loosen Bolt
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

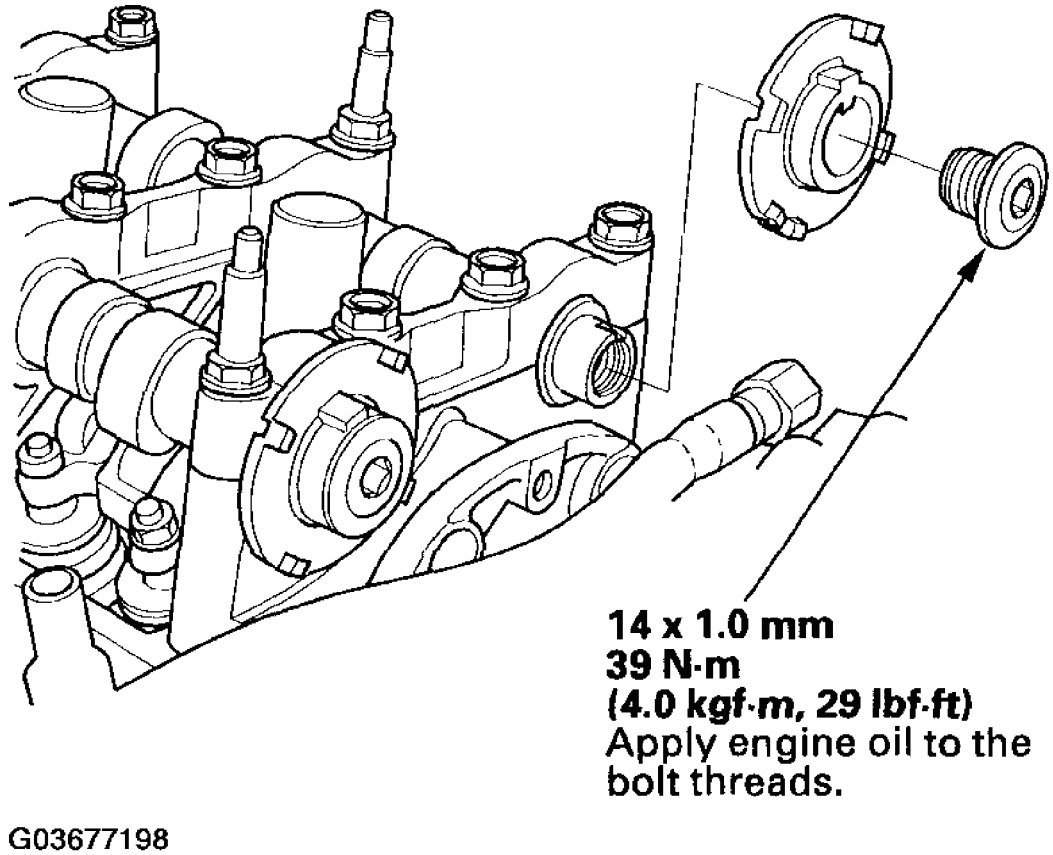

Fig. 79: Removing Camshaft Position Pulse Plate B And Torque Specifications
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

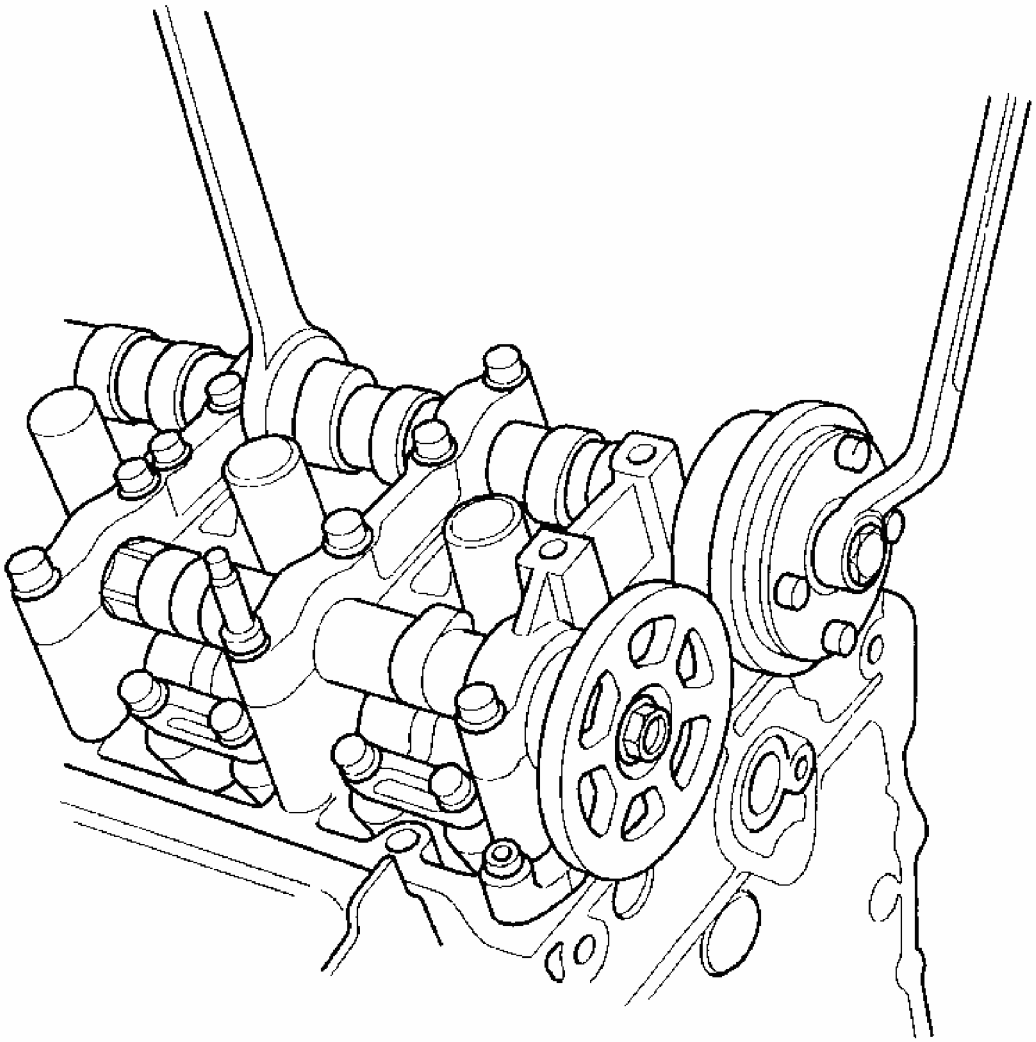

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Fig. 80: Loosening Variable Valve Timing Control Actuator And Exhaust Camshaft Sprocket Mounting Bolt
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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)

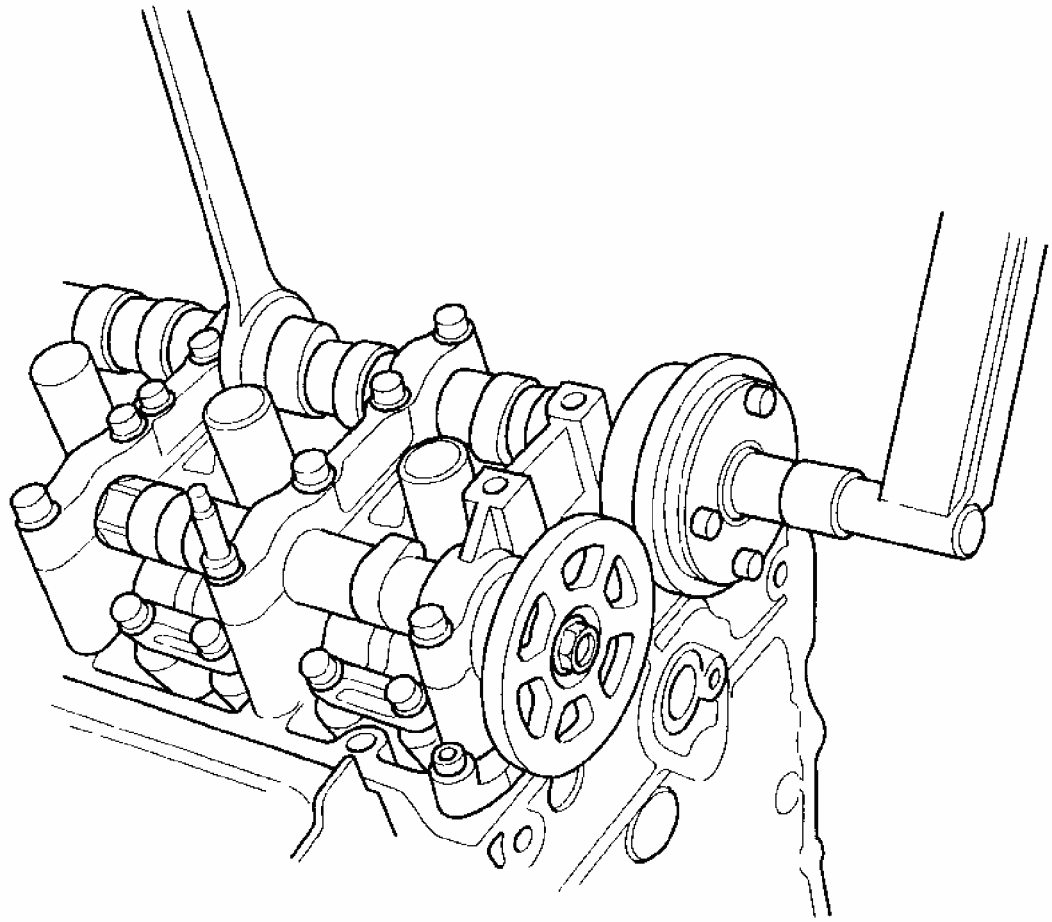

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Fig. 81: Installing VTC Actuator And Exhaust Camshaft Sprocket
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.
- 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.)

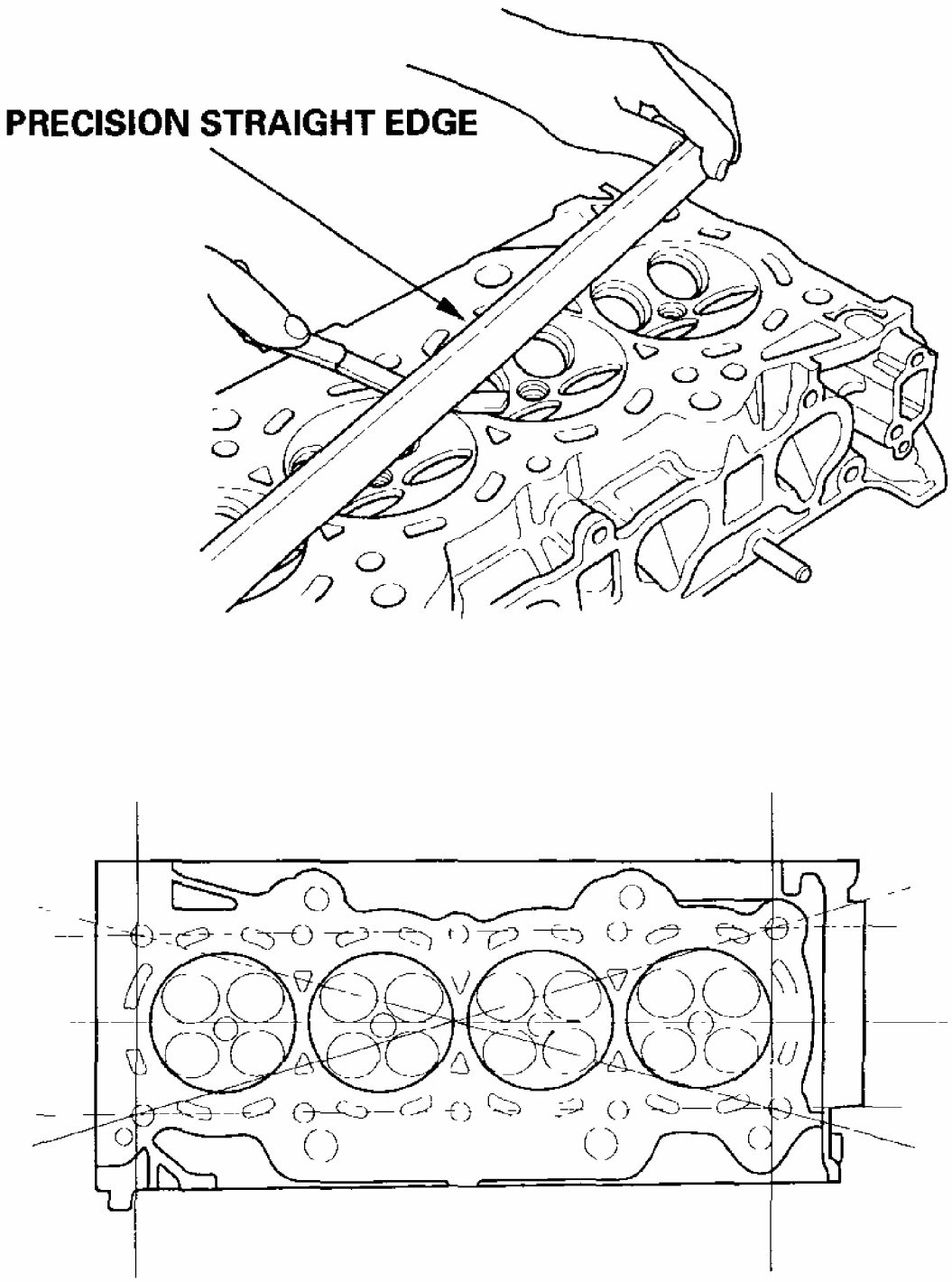

Fig. 82: Measuring Cylinder Head Warpage
Courtesy of AMERICAN HONDA MOTOR CO., INC.

ROCKER ARM ASSEMBLY REMOVAL

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

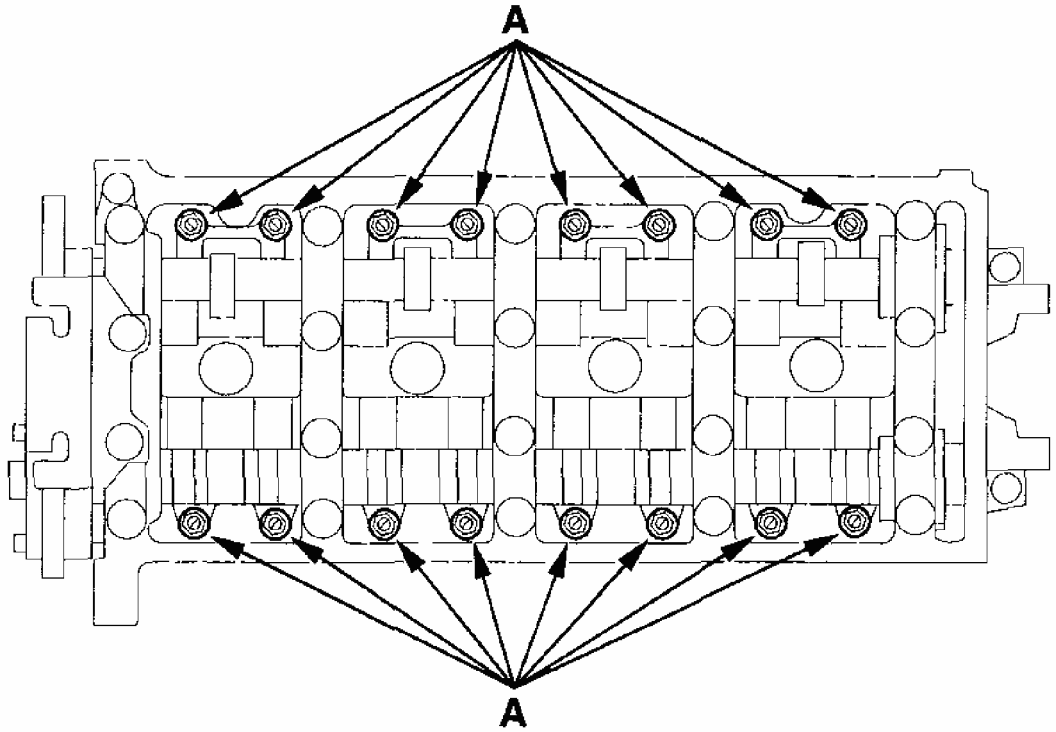

Fig. 83: Loosening Rocker Arm Adjusting Screws
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

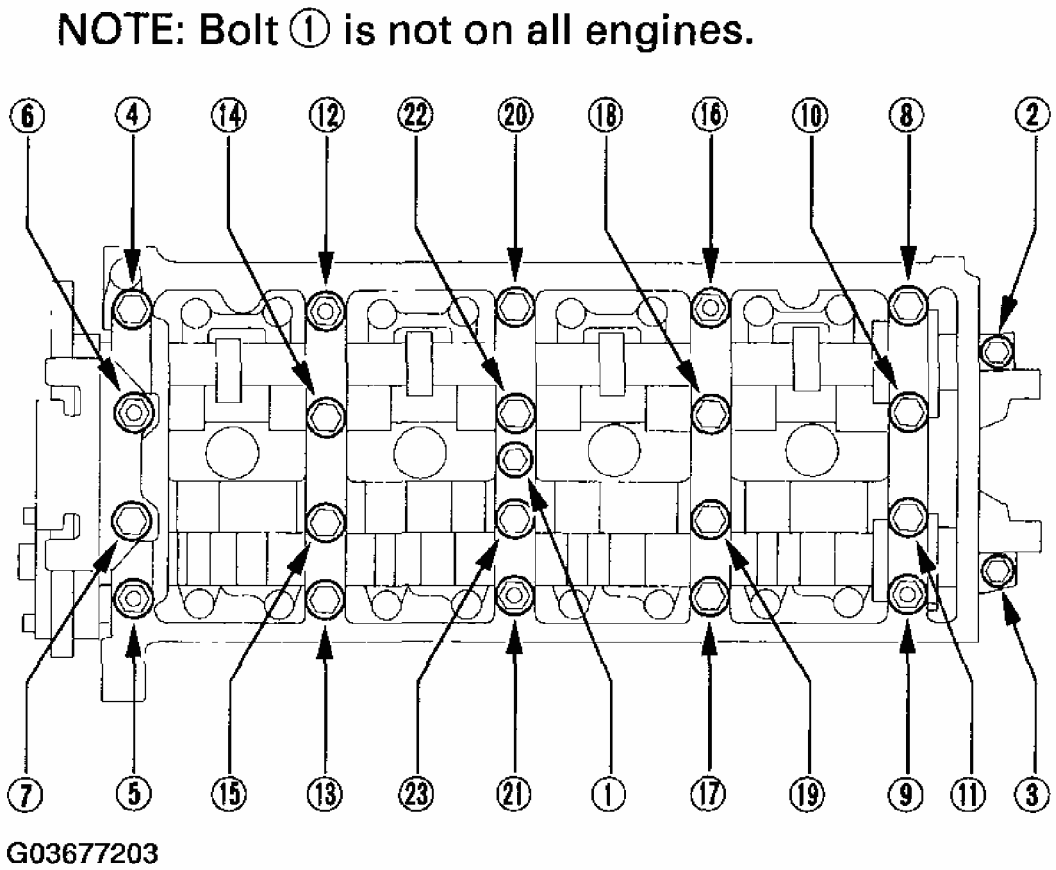

Fig. 84: Removing Camshaft Holder Bolts
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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).

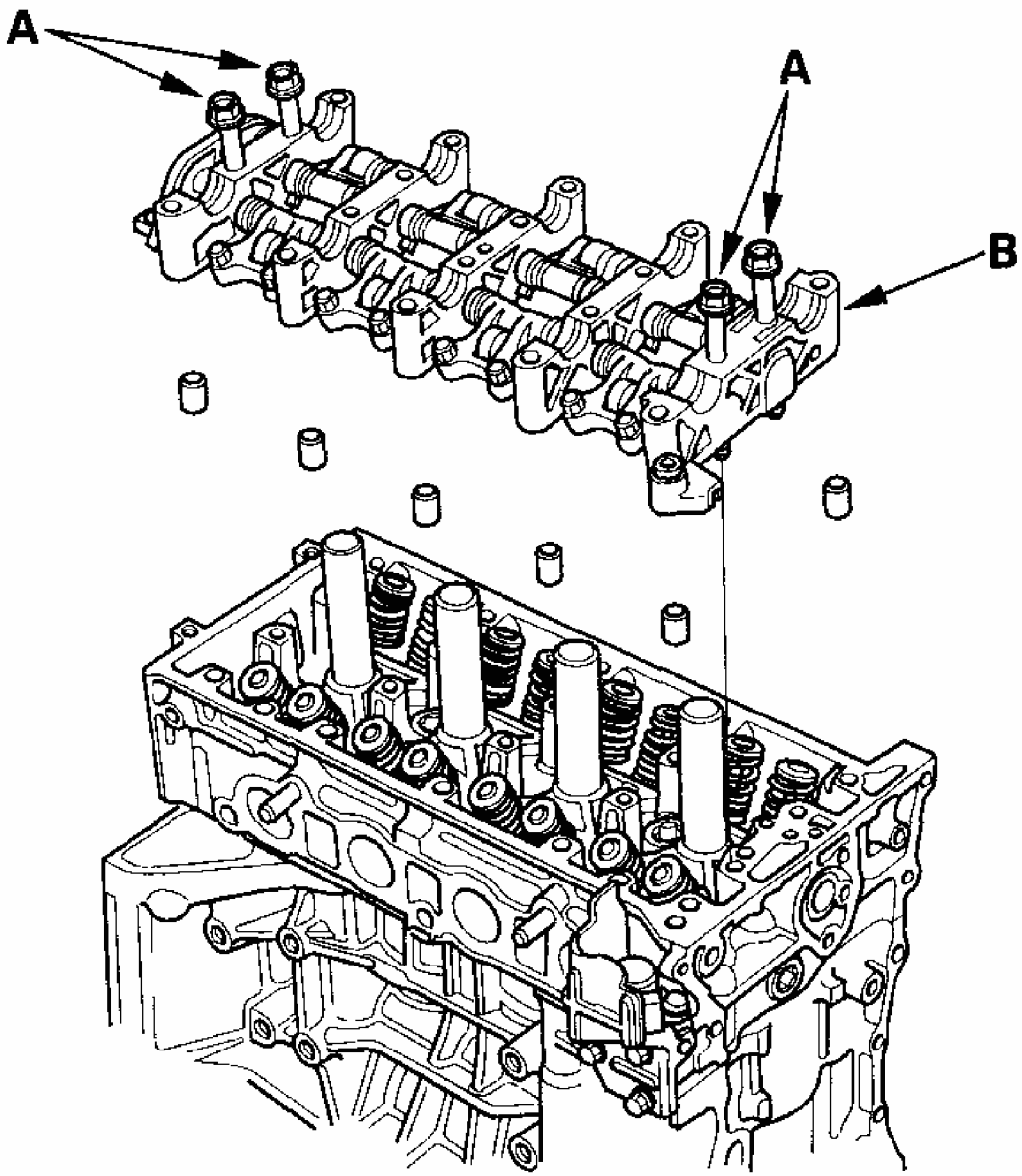

Fig. 85: Removing Rocker Arm Assembly
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

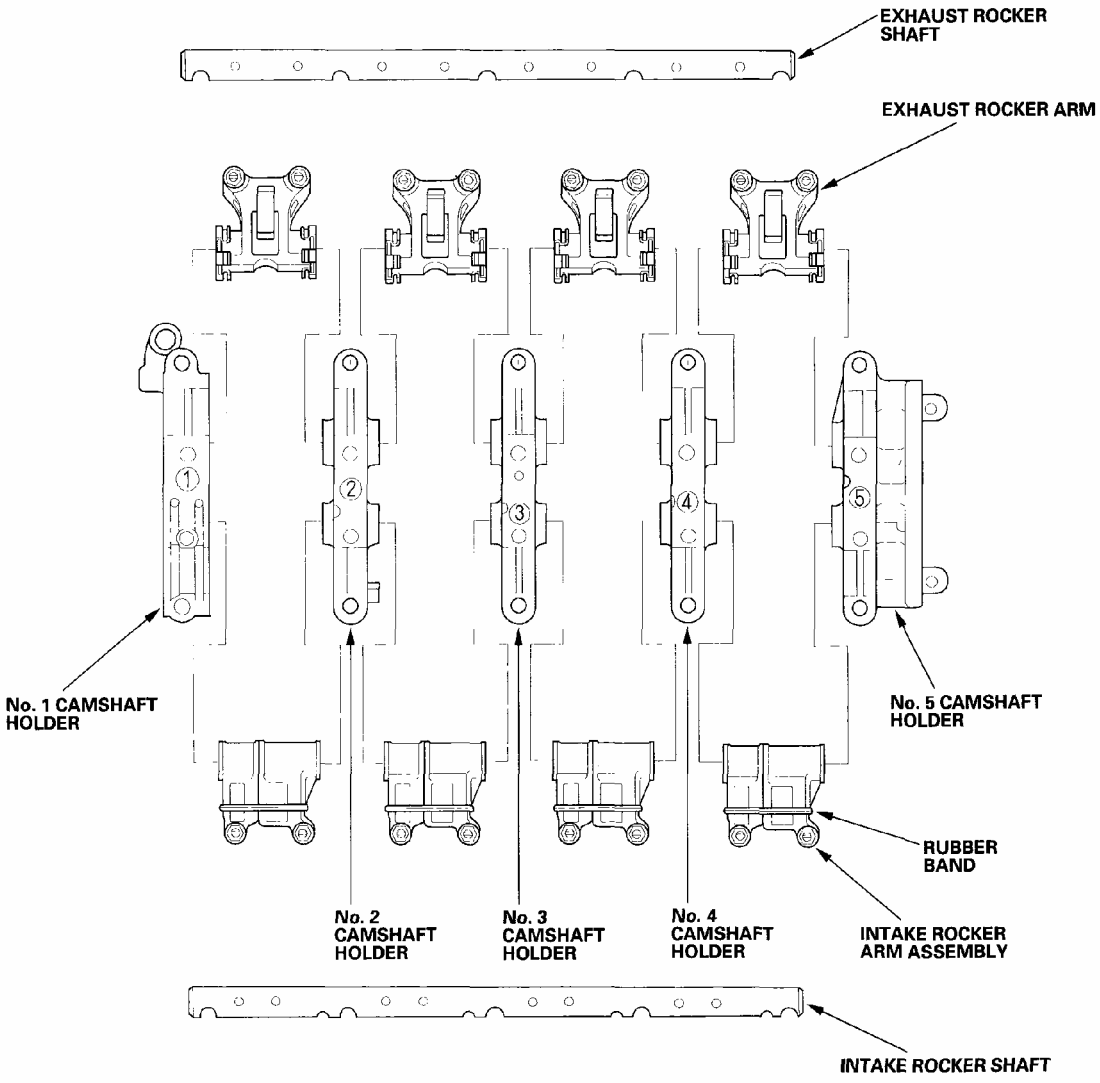

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Fig. 86: Assembling And Disassembling Rocker Arm And Shaft
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

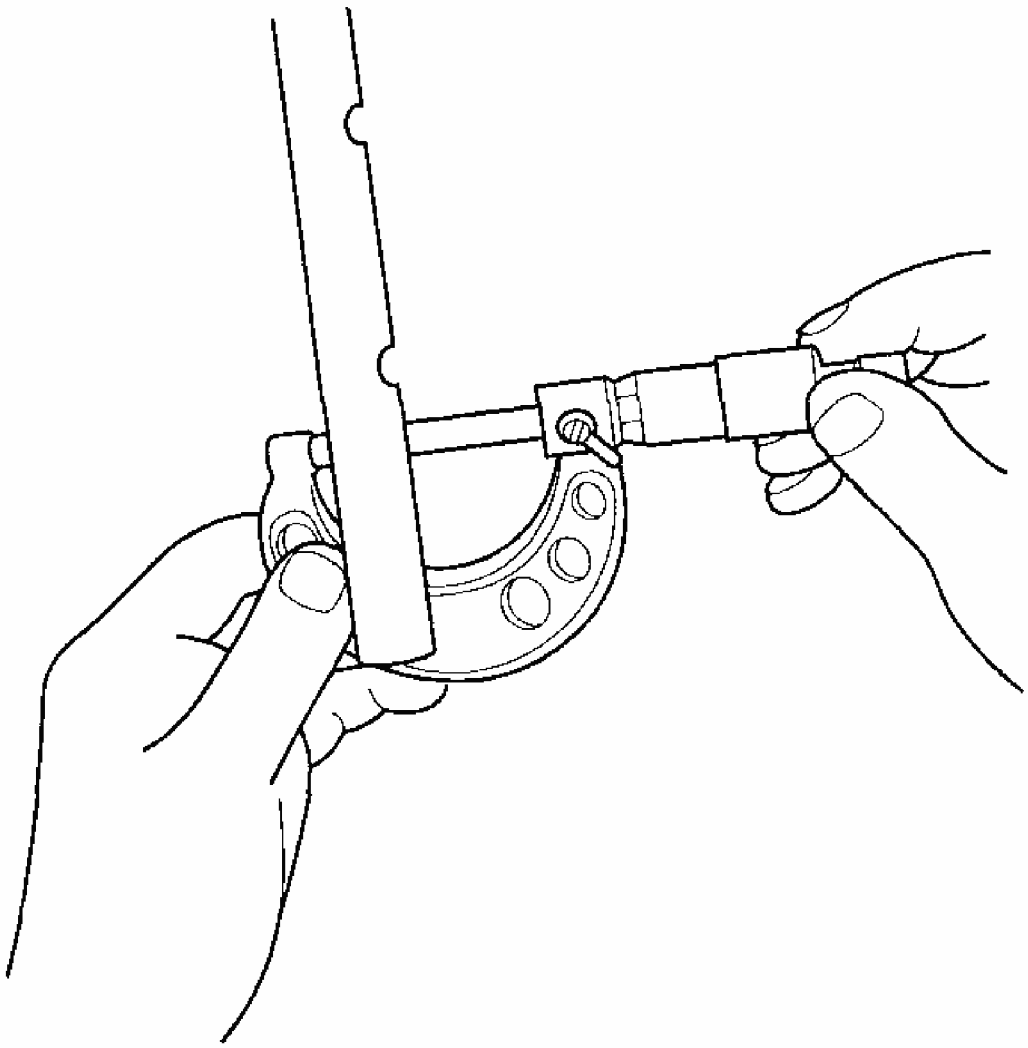

Fig. 87: Measuring Shaft Diameter
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

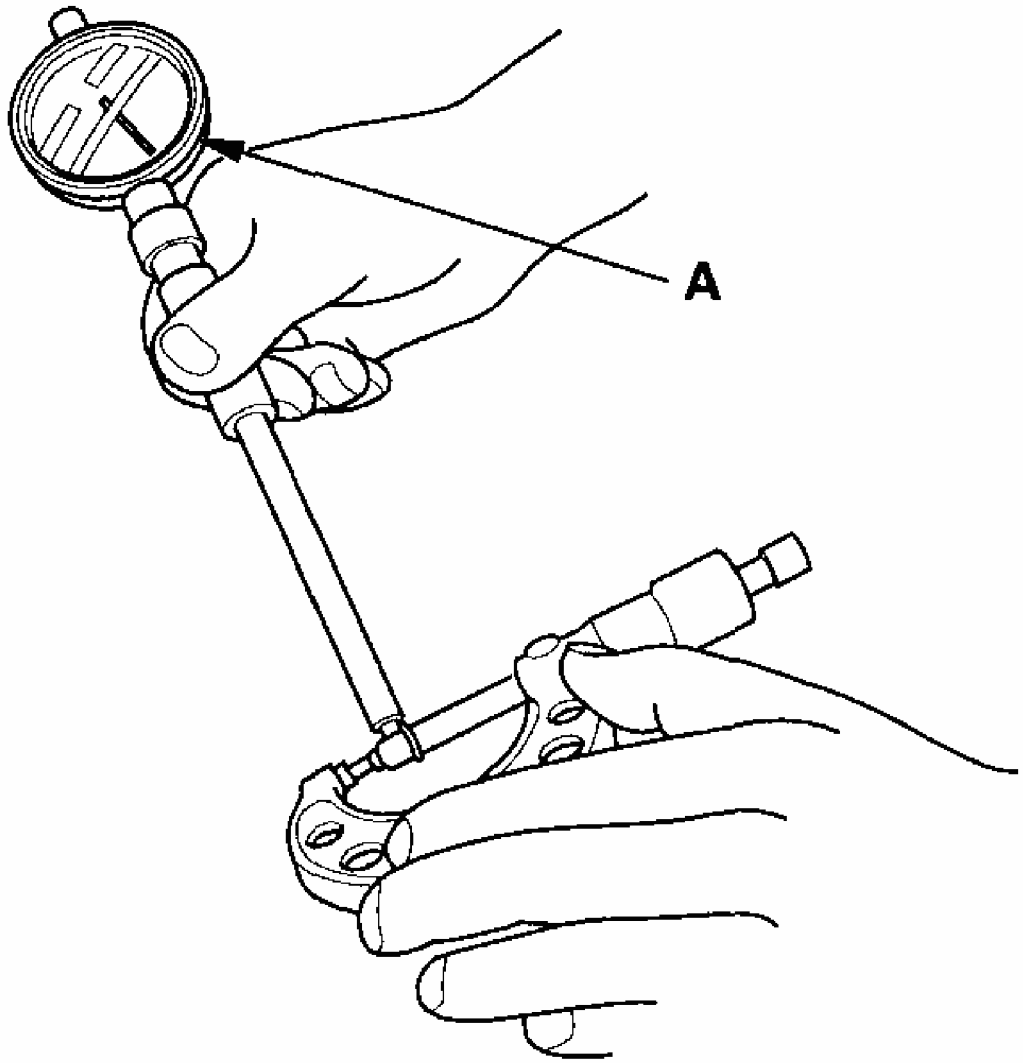

Fig. 88: Attaching Gauge To Shaft Diameter
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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):

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.)

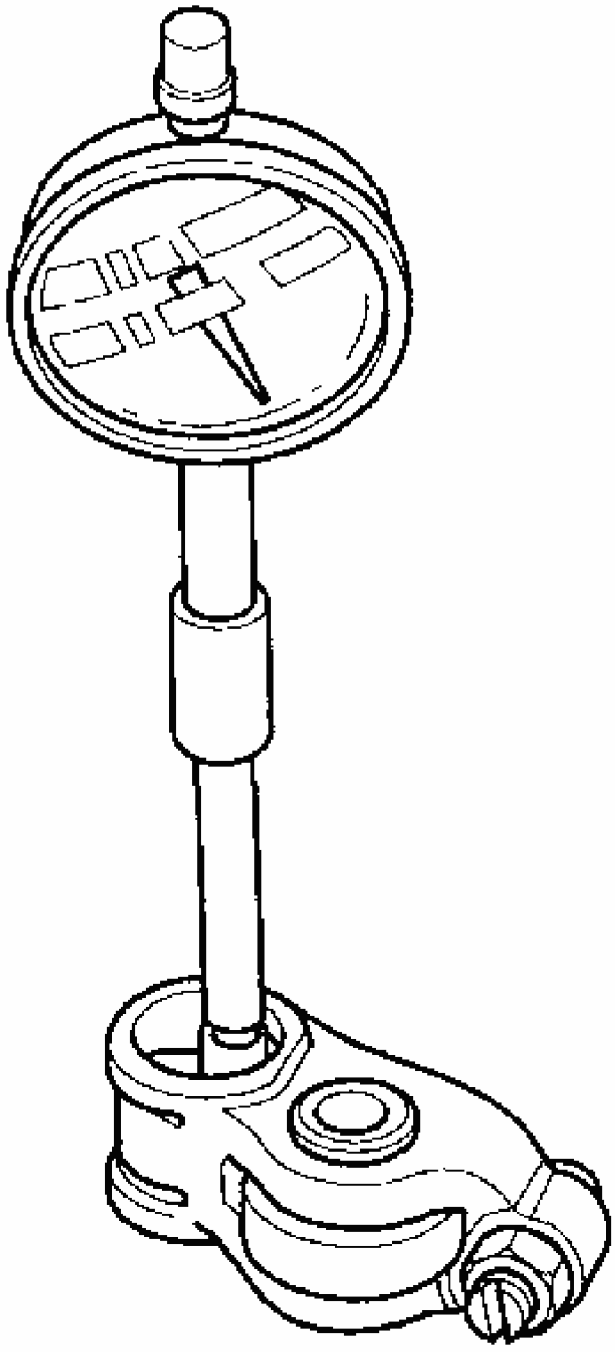

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Fig. 89: Measuring Rocker Arm Inside Diameter
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

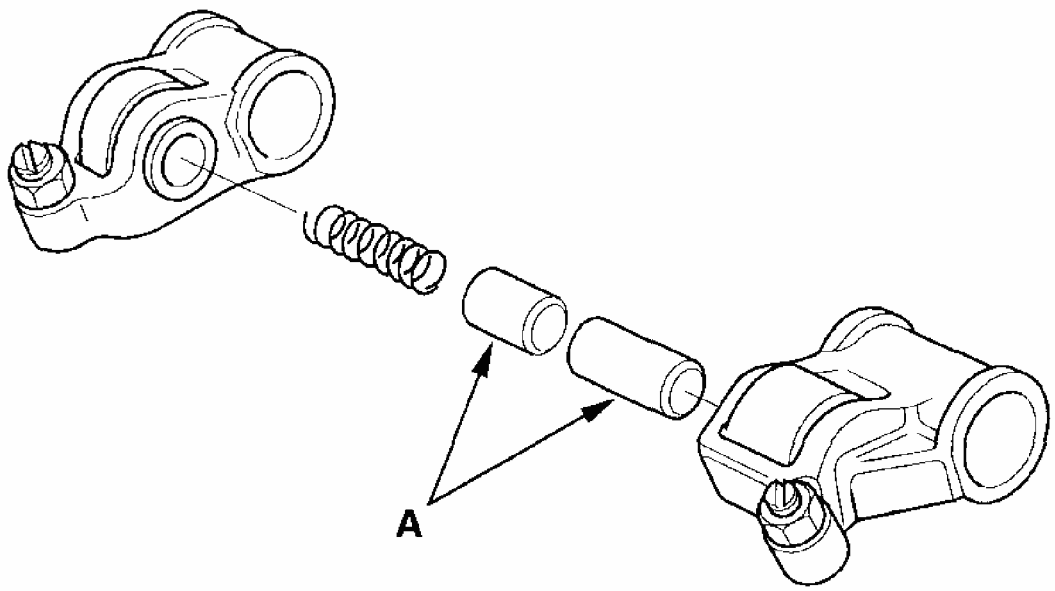

Fig. 90: Inspecting Rocker Arm Pistons
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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,

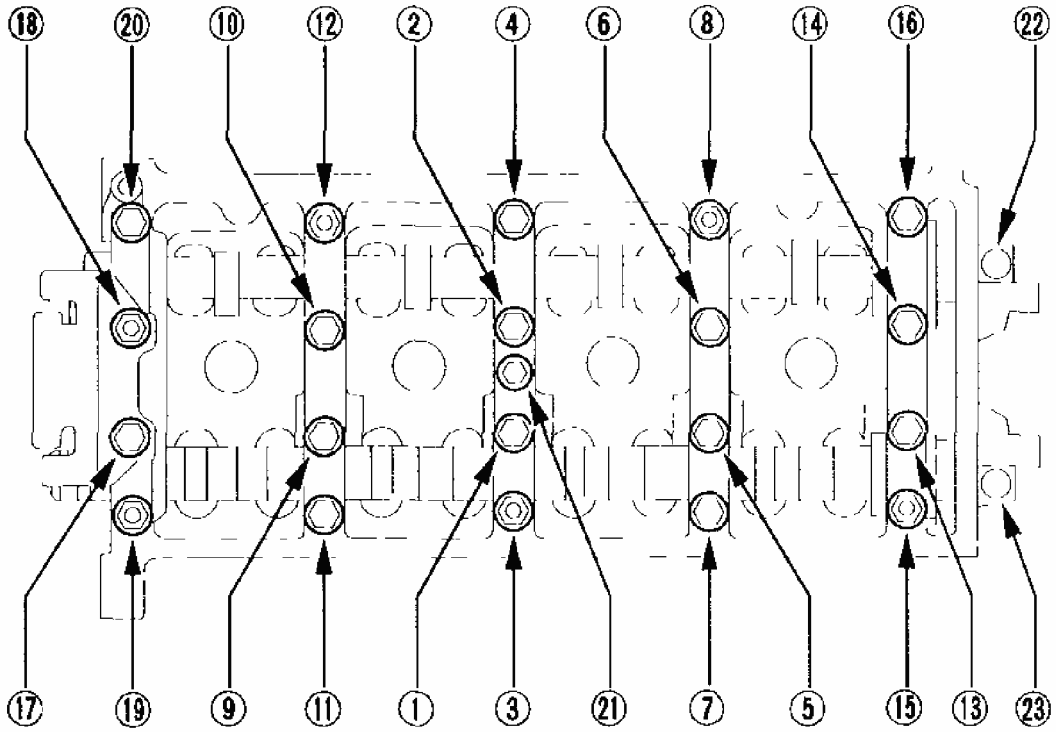

Fig. 91: Tightening Camshaft Holder Bolts
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.)

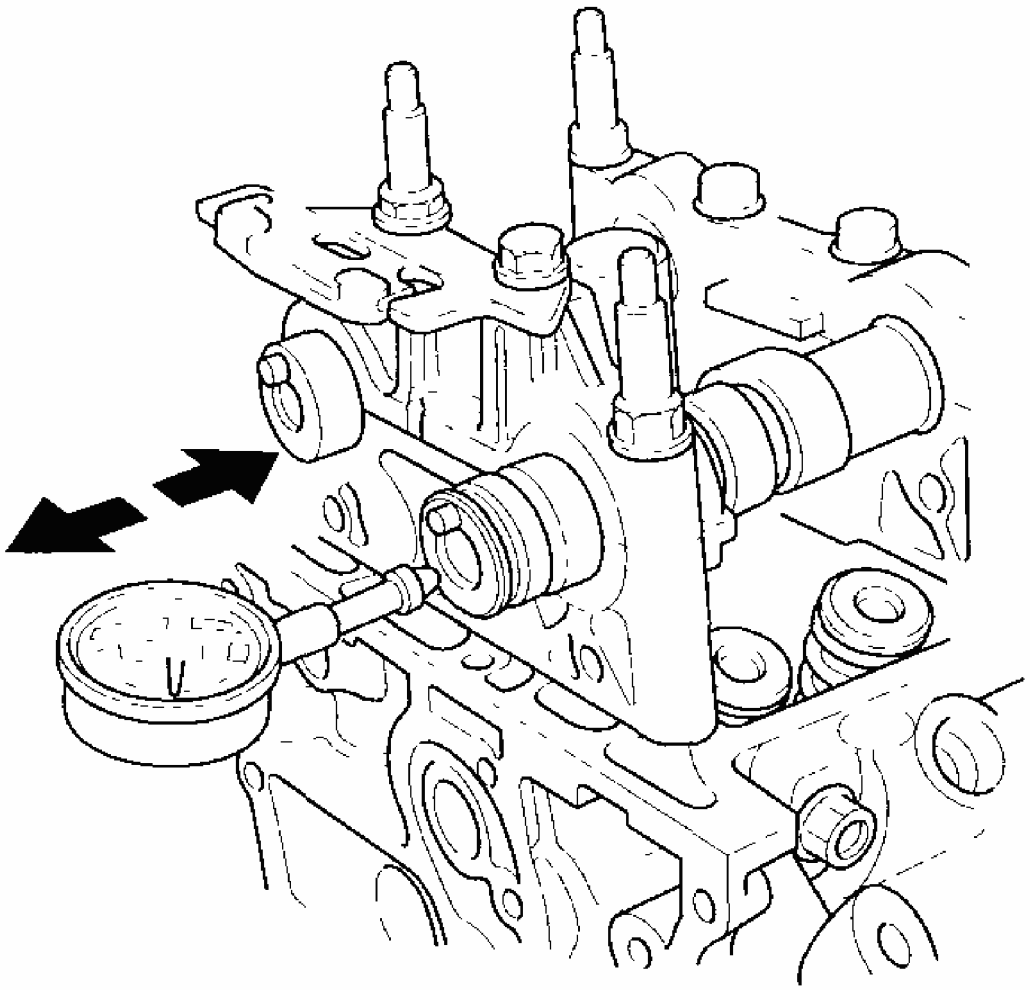

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Fig. 92: Attaching Dial Indicator To Camshaft End
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.)

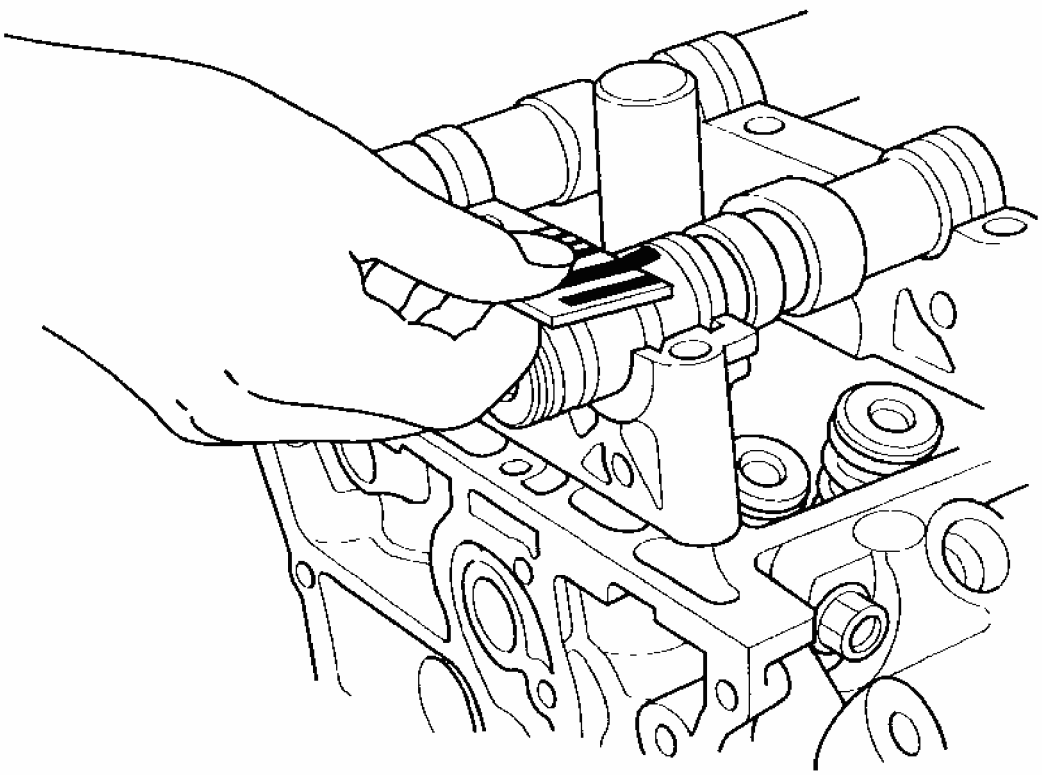

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Fig. 93: Measuring Widest Part Of Plastigage On Journal
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.)

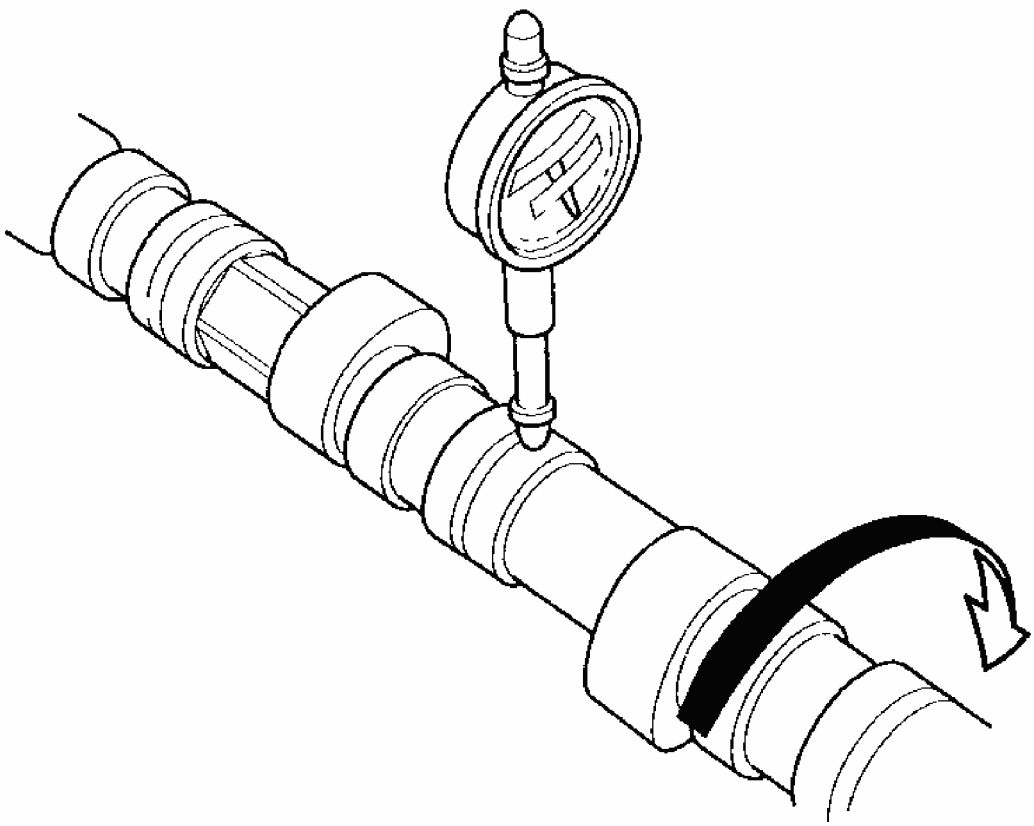

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Fig. 94: Measuring Camshaft Runout
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

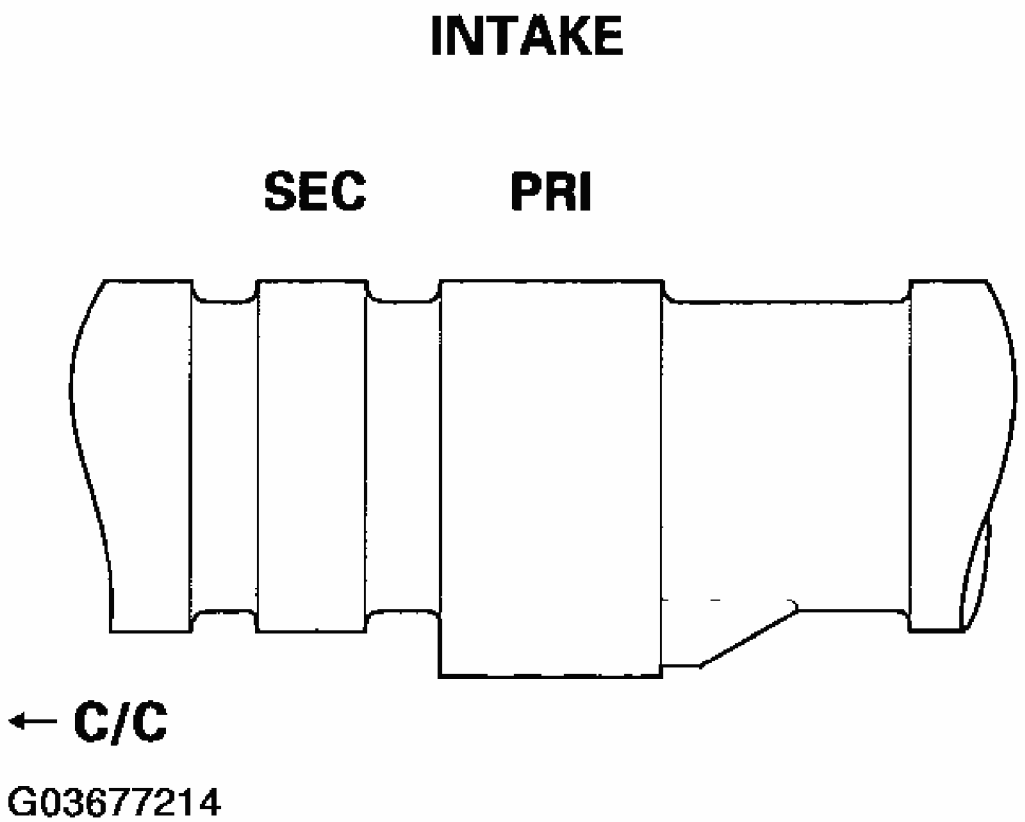

Fig. 95: Identifying Cam Lobe Height
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

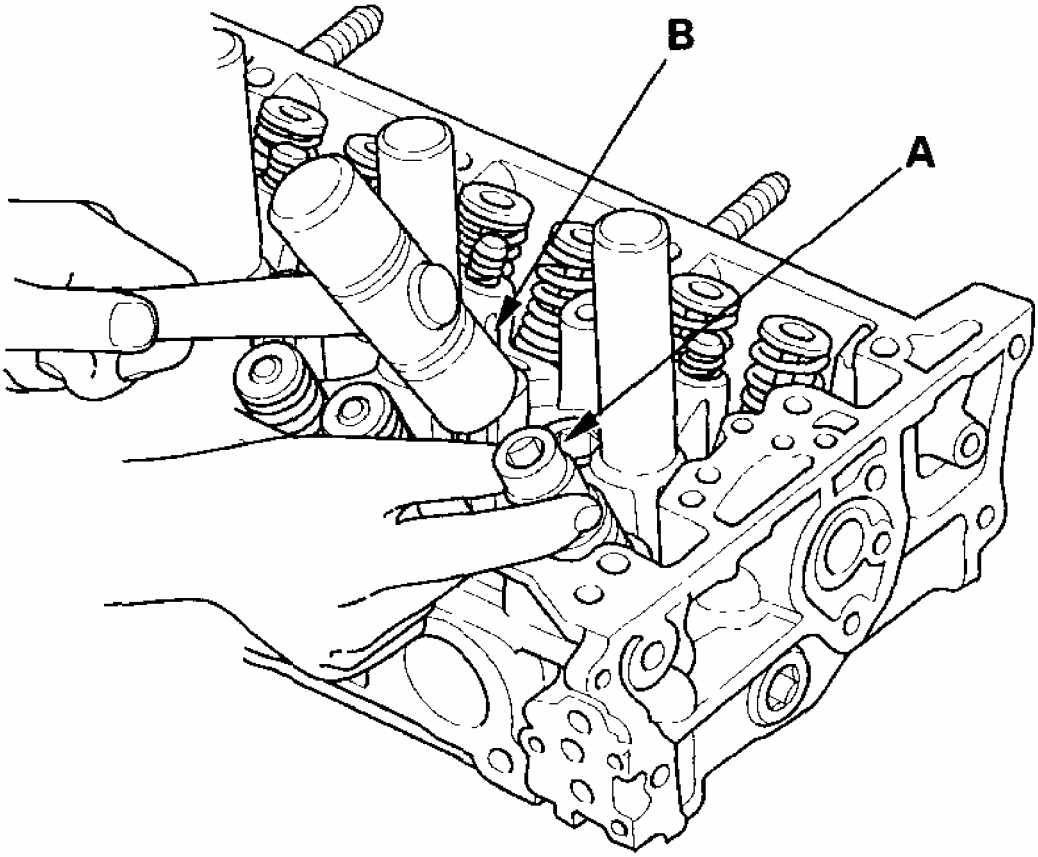

Fig. 96: Tapping Valve Retainer
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

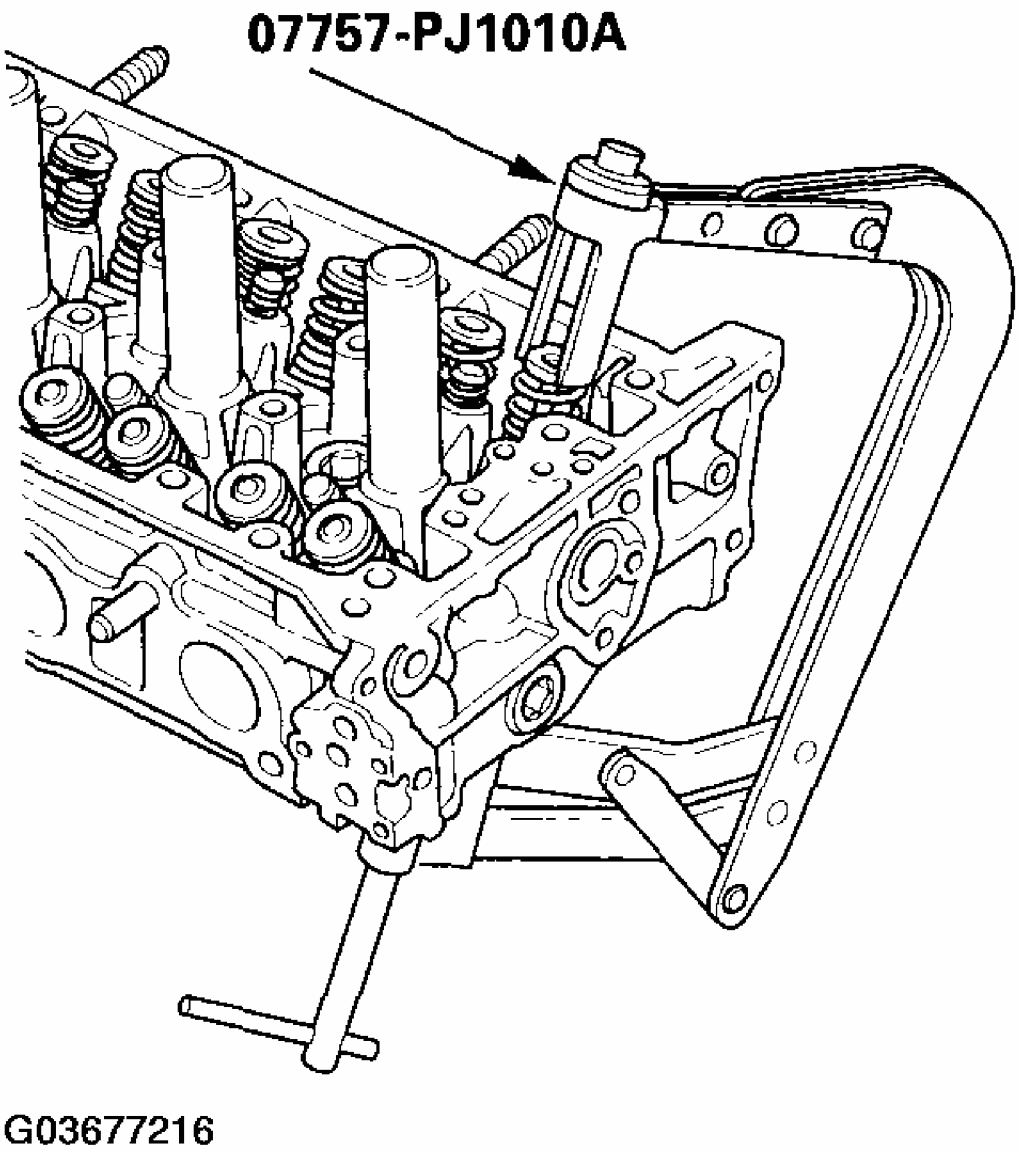

Fig. 97: Installing Valve Spring Compressor Attachment And Valve Spring Compressor
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

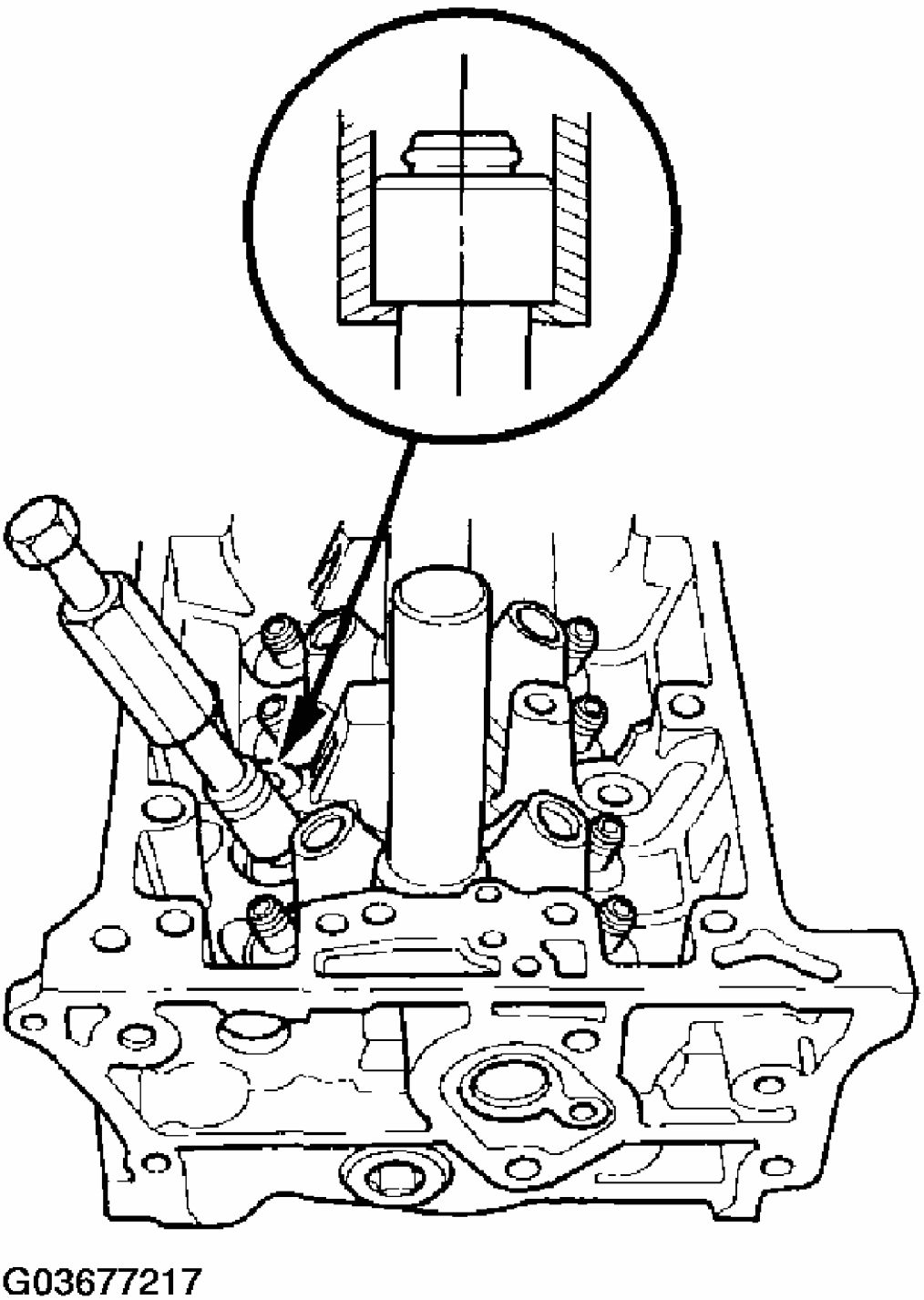

Fig. 98: Installing Valve Guide Seal Remover
Courtesy of AMERICAN HONDA MOTOR CO., INC.

6. Remove the valve seal.

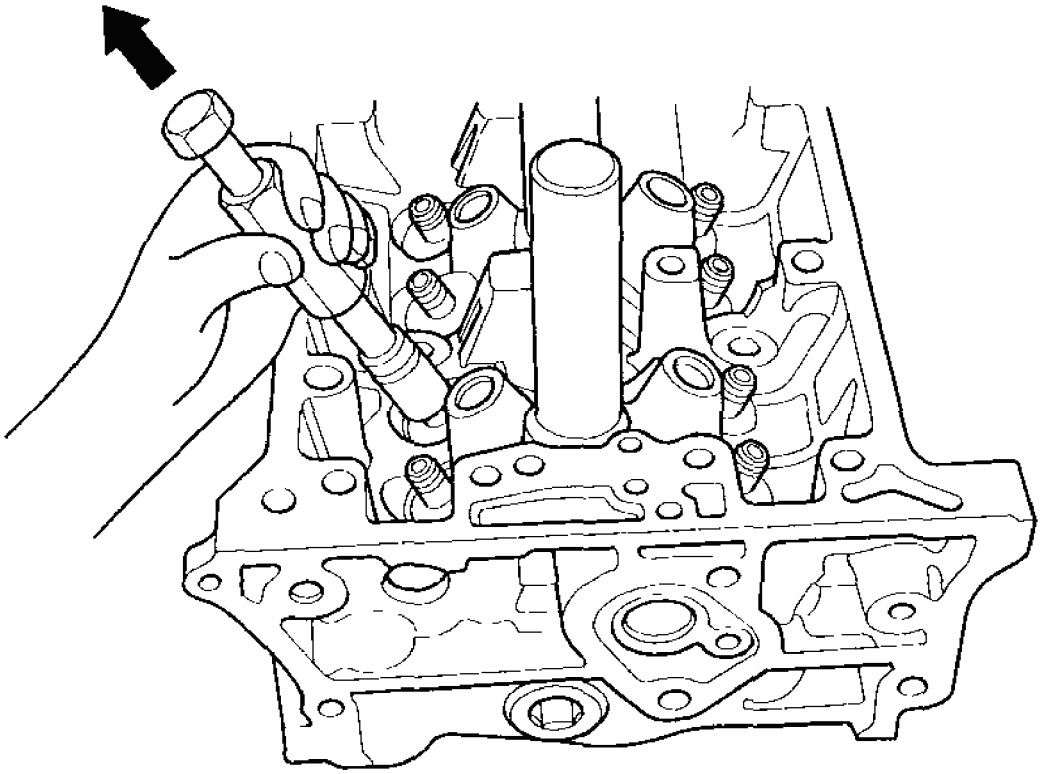

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Fig. 99: Removing Valve Seal
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.)

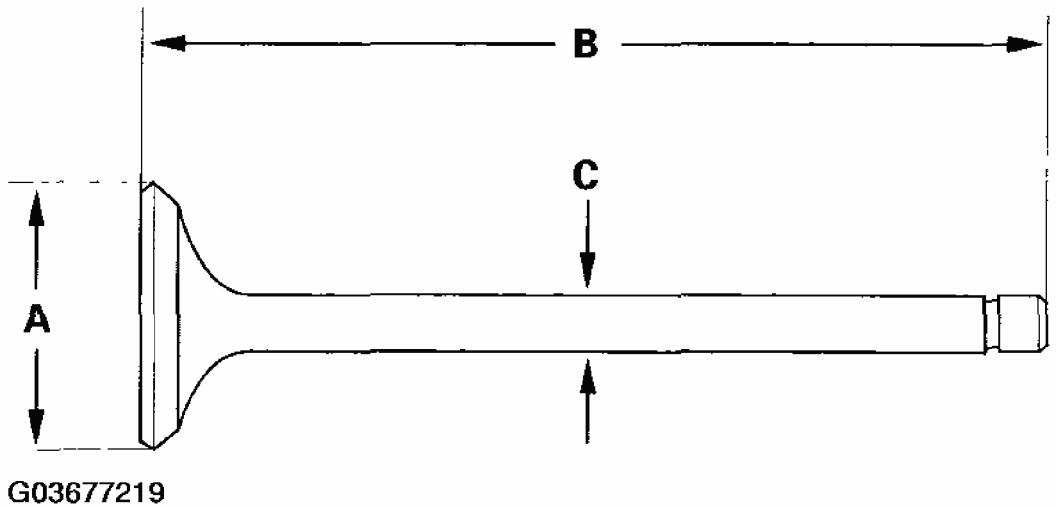

Fig. 100: Identifying Valve Dimensions
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.)

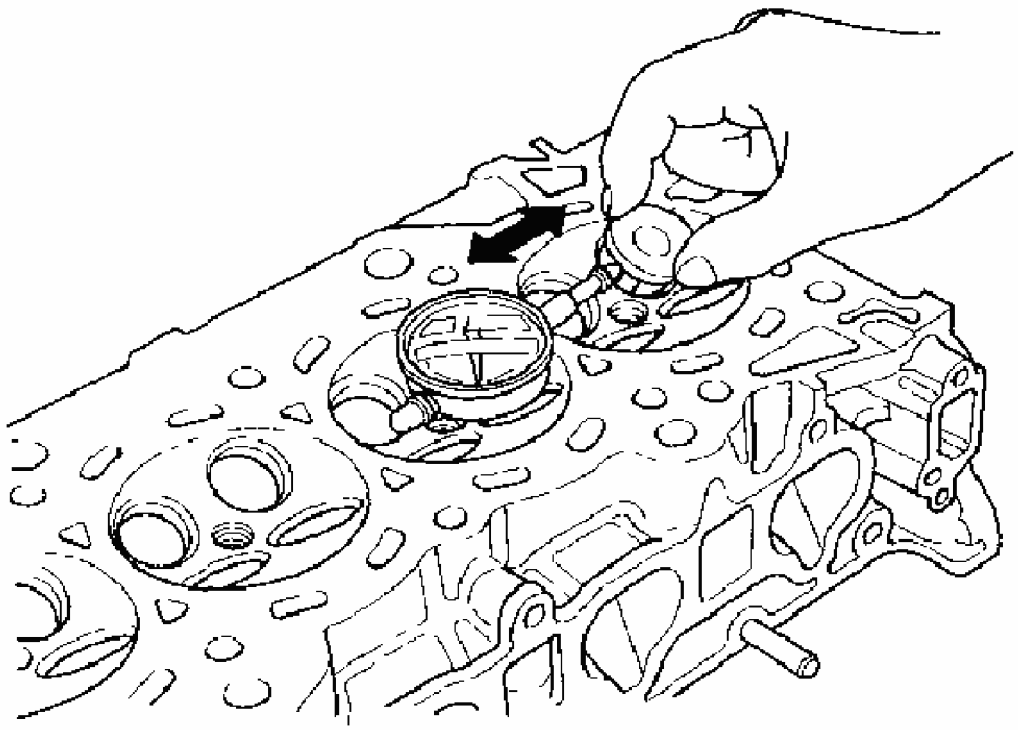

Fig. 101: Measuring Valve Stem-To-Guide Clearance
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

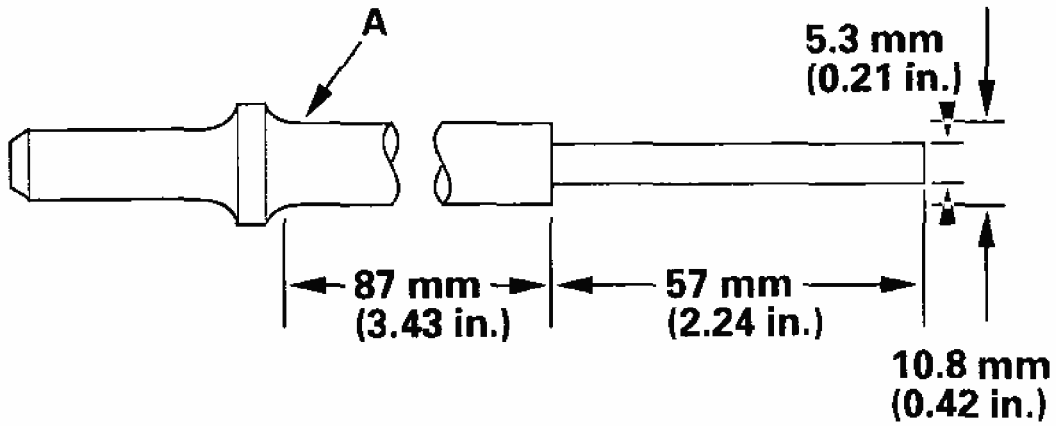

Fig. 102: Identifying Valve Guide Driver Dimensions
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

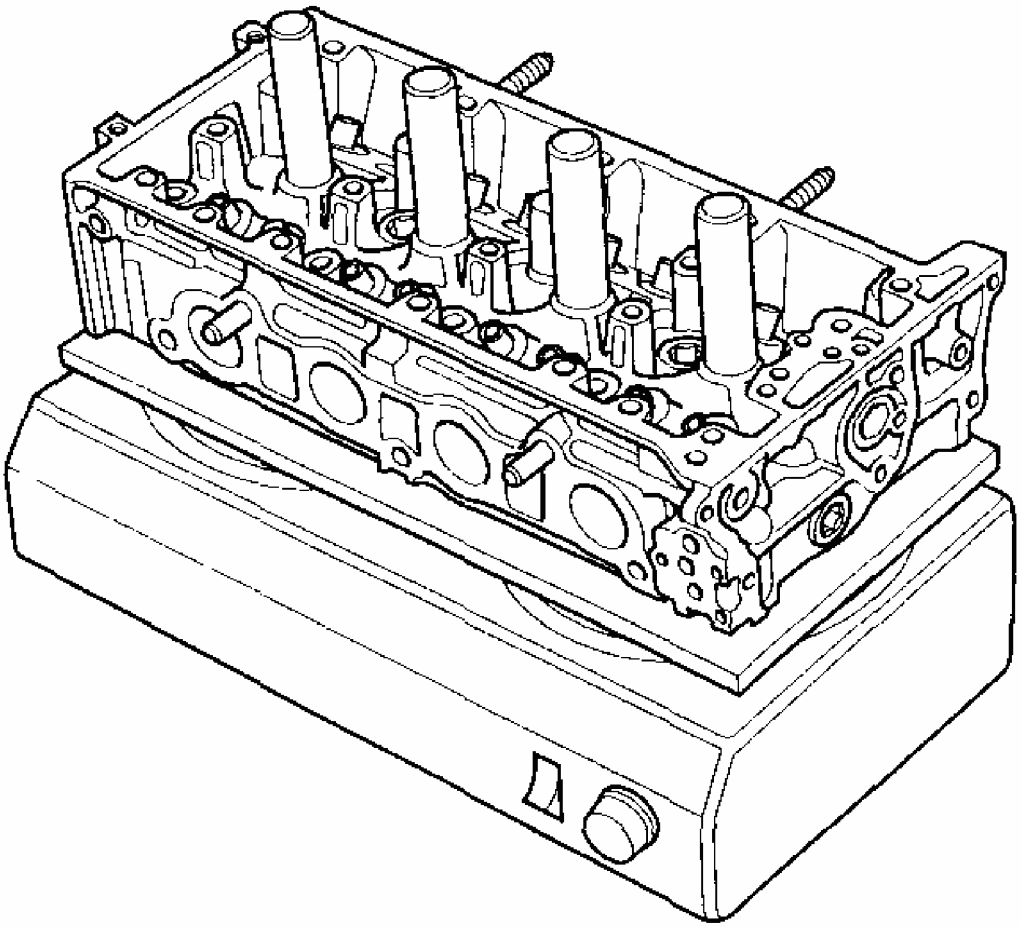

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Fig. 103: Heating Cylinder Head
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

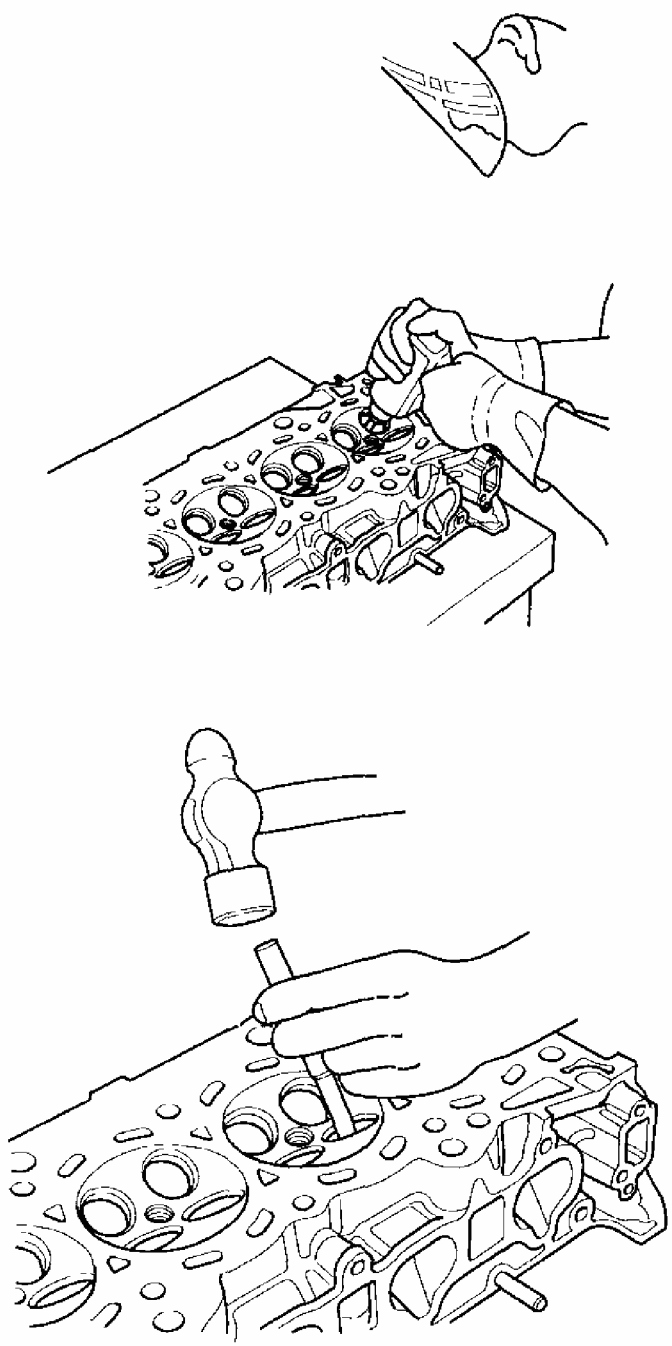

Fig. 104: Removing Valve Guide
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.)

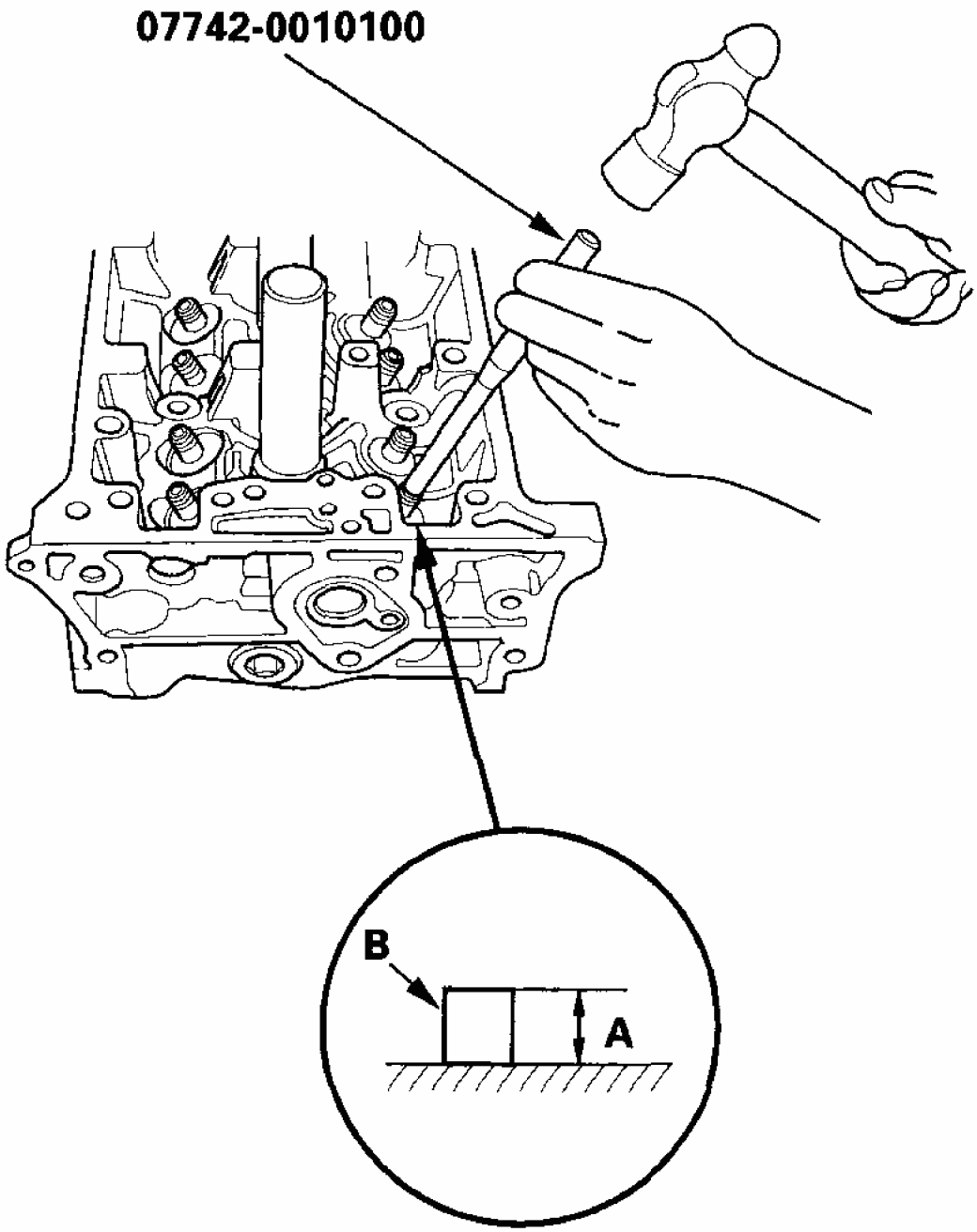

Fig. 105: Installing Valve Guide
Courtesy of AMERICAN HONDA MOTOR CO., INC.

10. Coat both reamer and valve guide with cutting oil.
11. Rotate the reamer clockwise the full length of the valve guide bore.

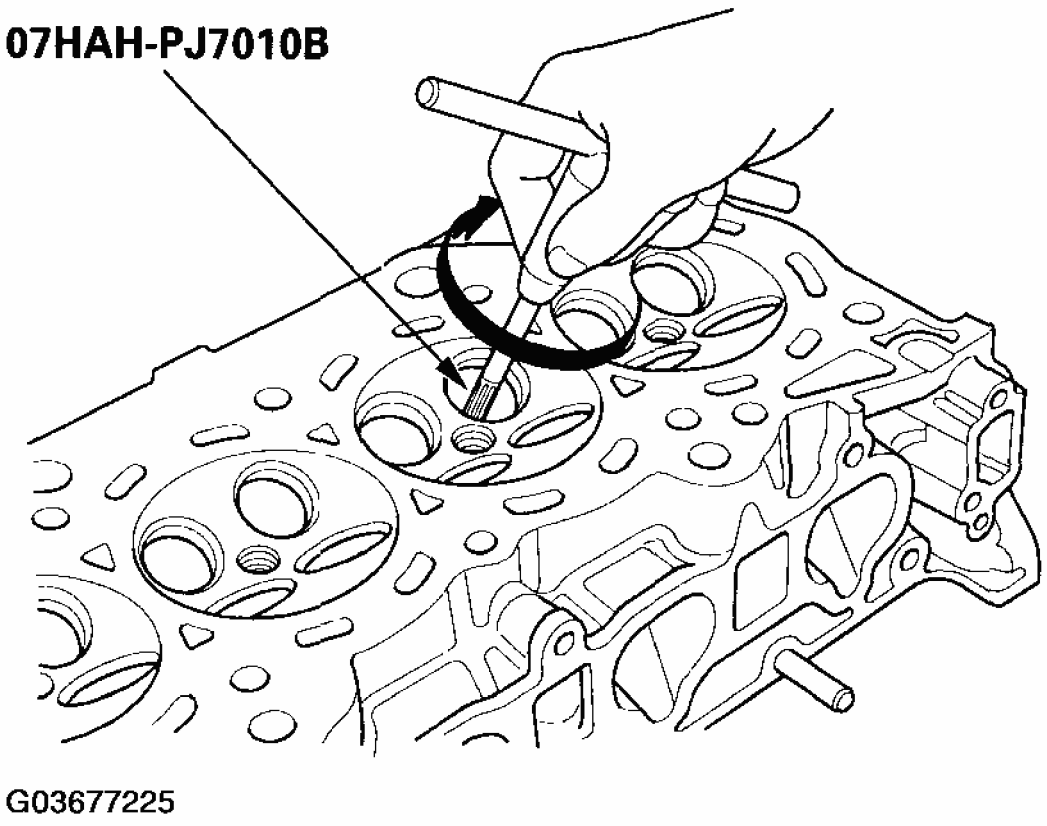

Fig. 106: Rotating Reamer Clockwise
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

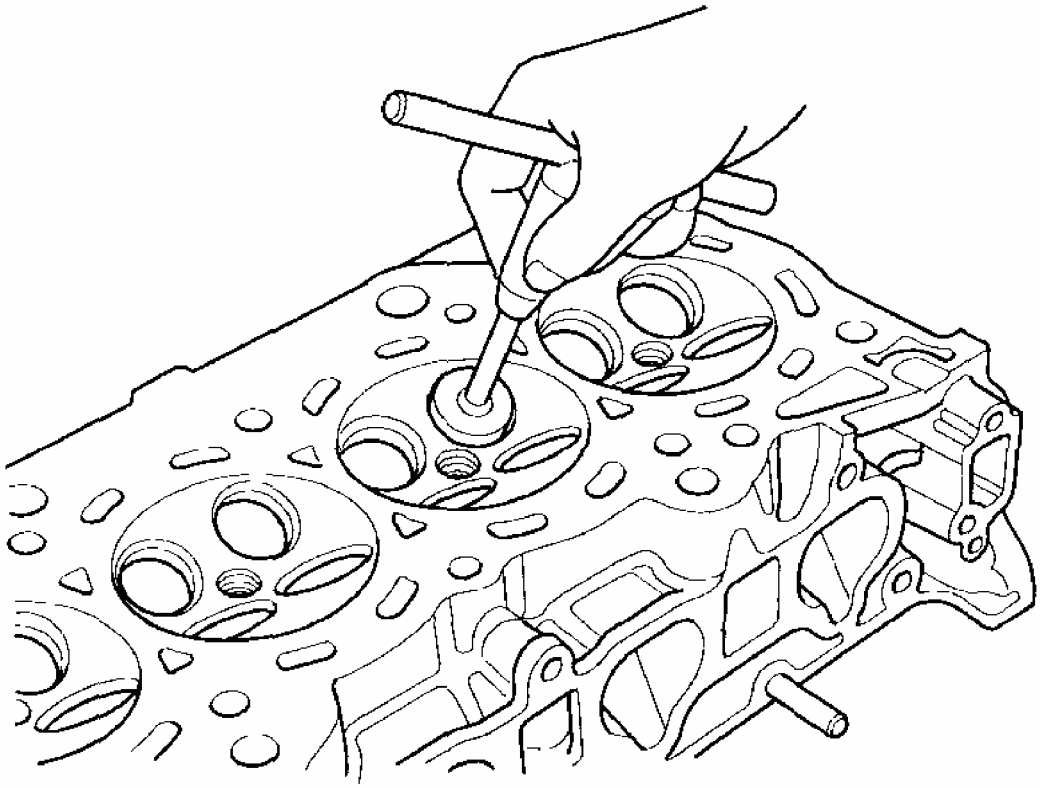

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Fig. 107: Reaming Valve Seat In Cylinder Head
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

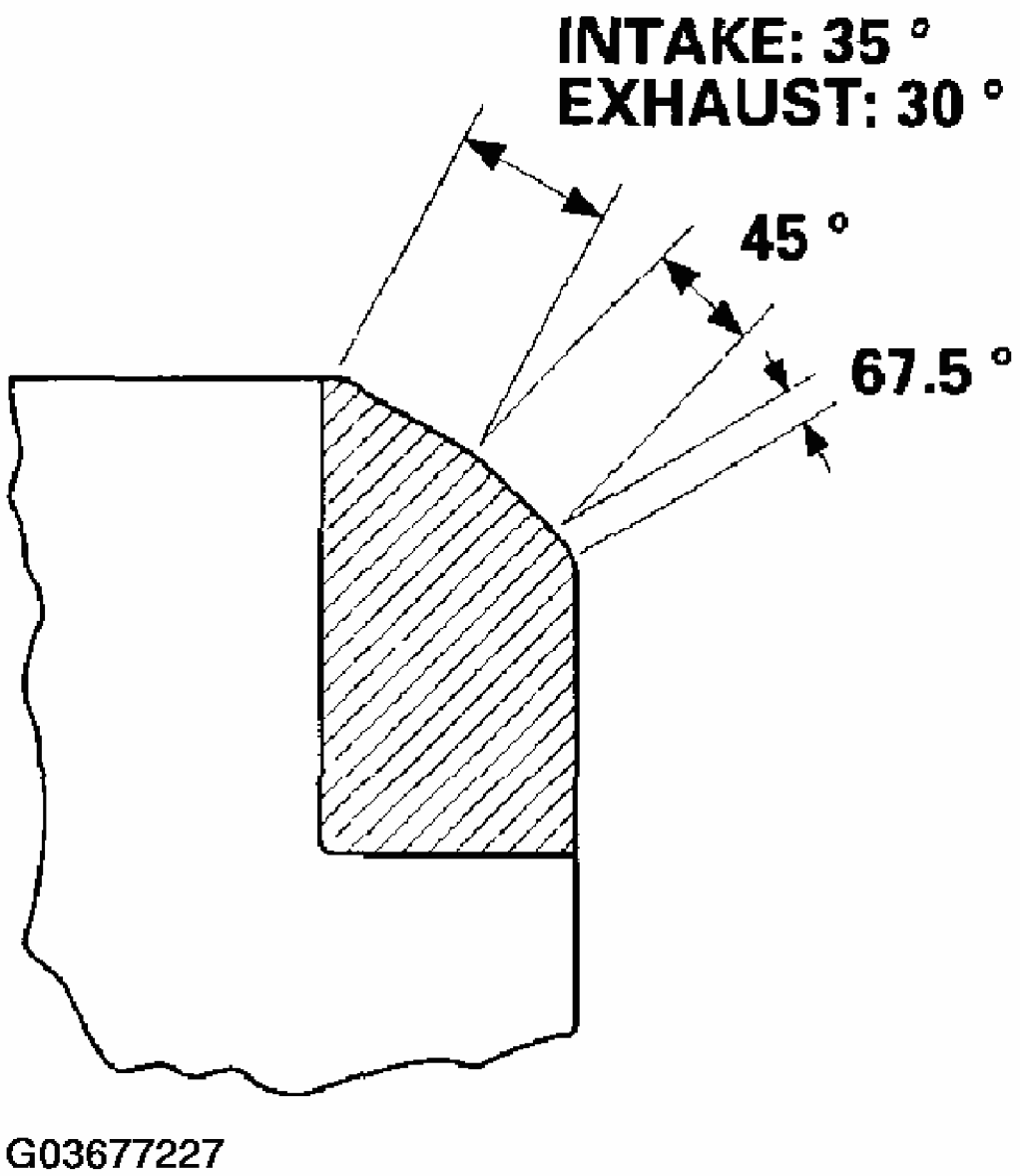

Fig. 108: Identifying Valve Cutting Angle
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

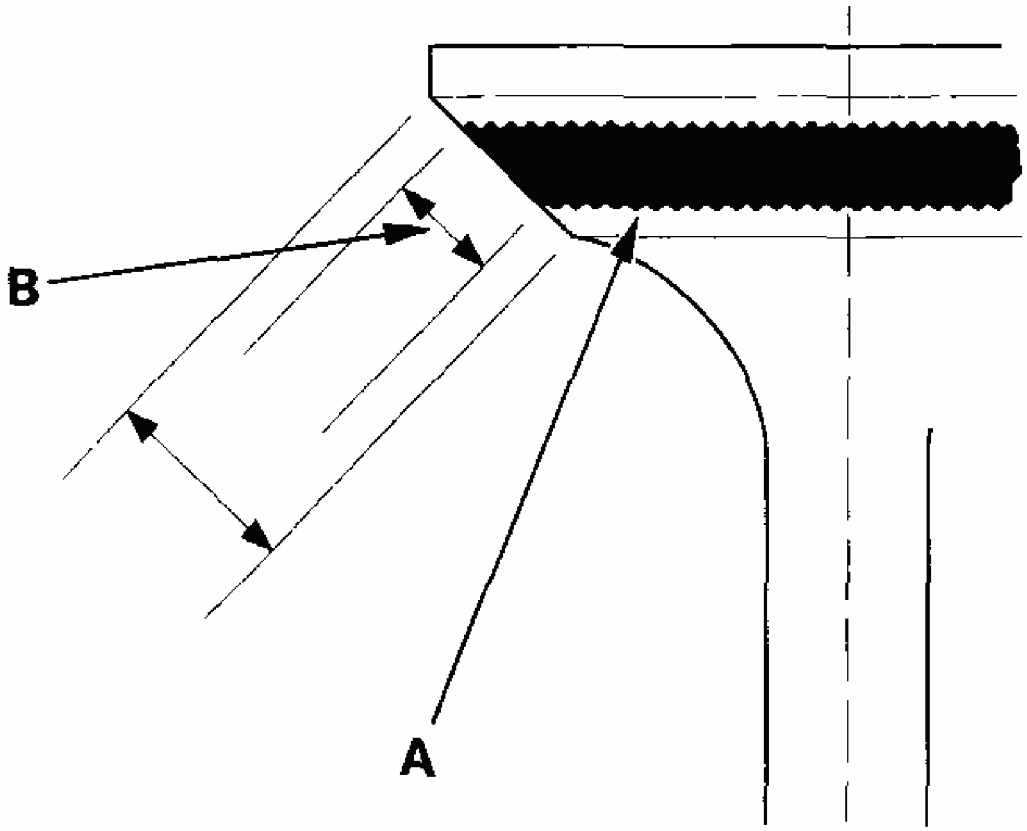

Fig. 109: Identifying Actual Valve Seating Surface Dimension
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.)

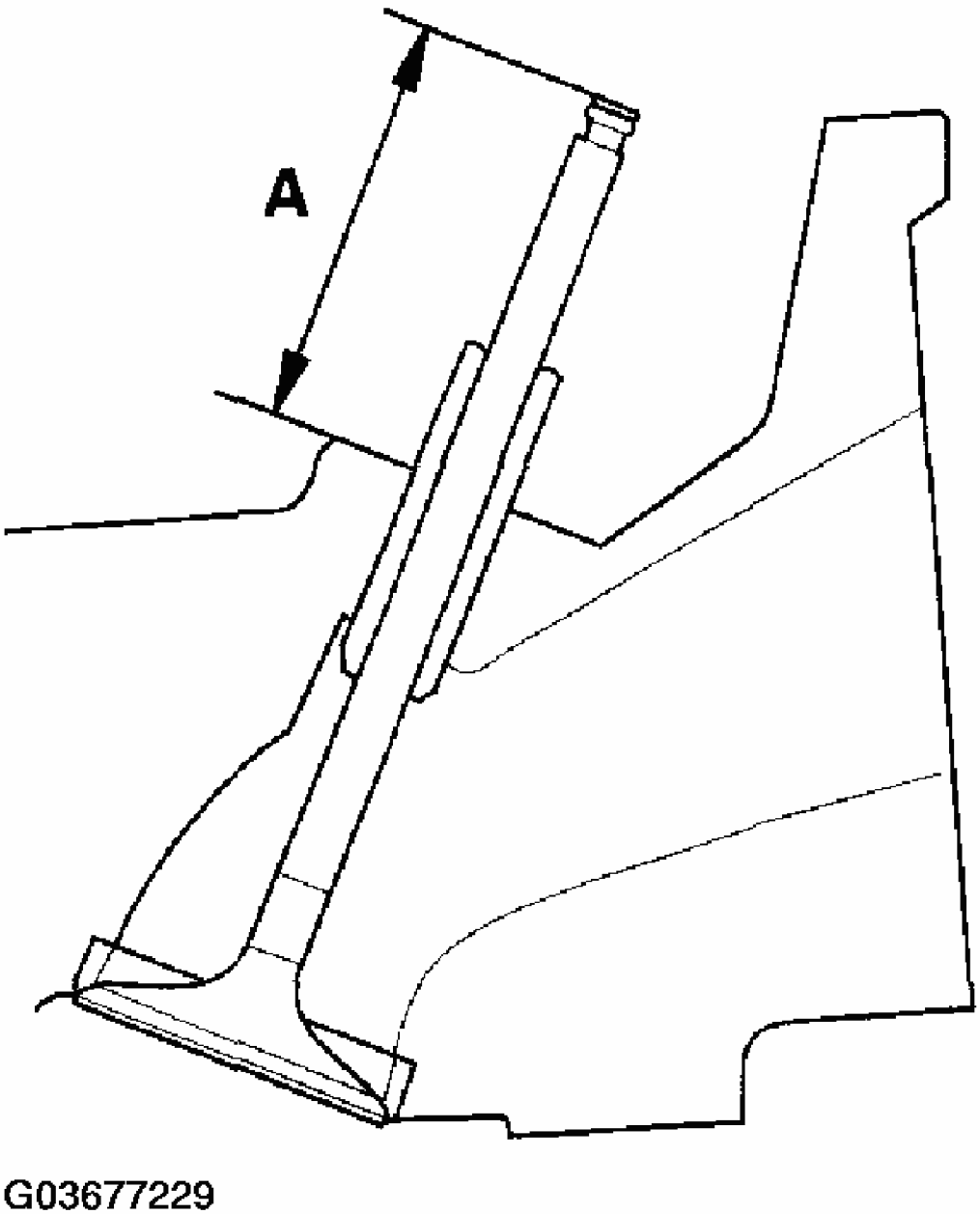

Fig. 110: Identifying Valve Stem Installation Height
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

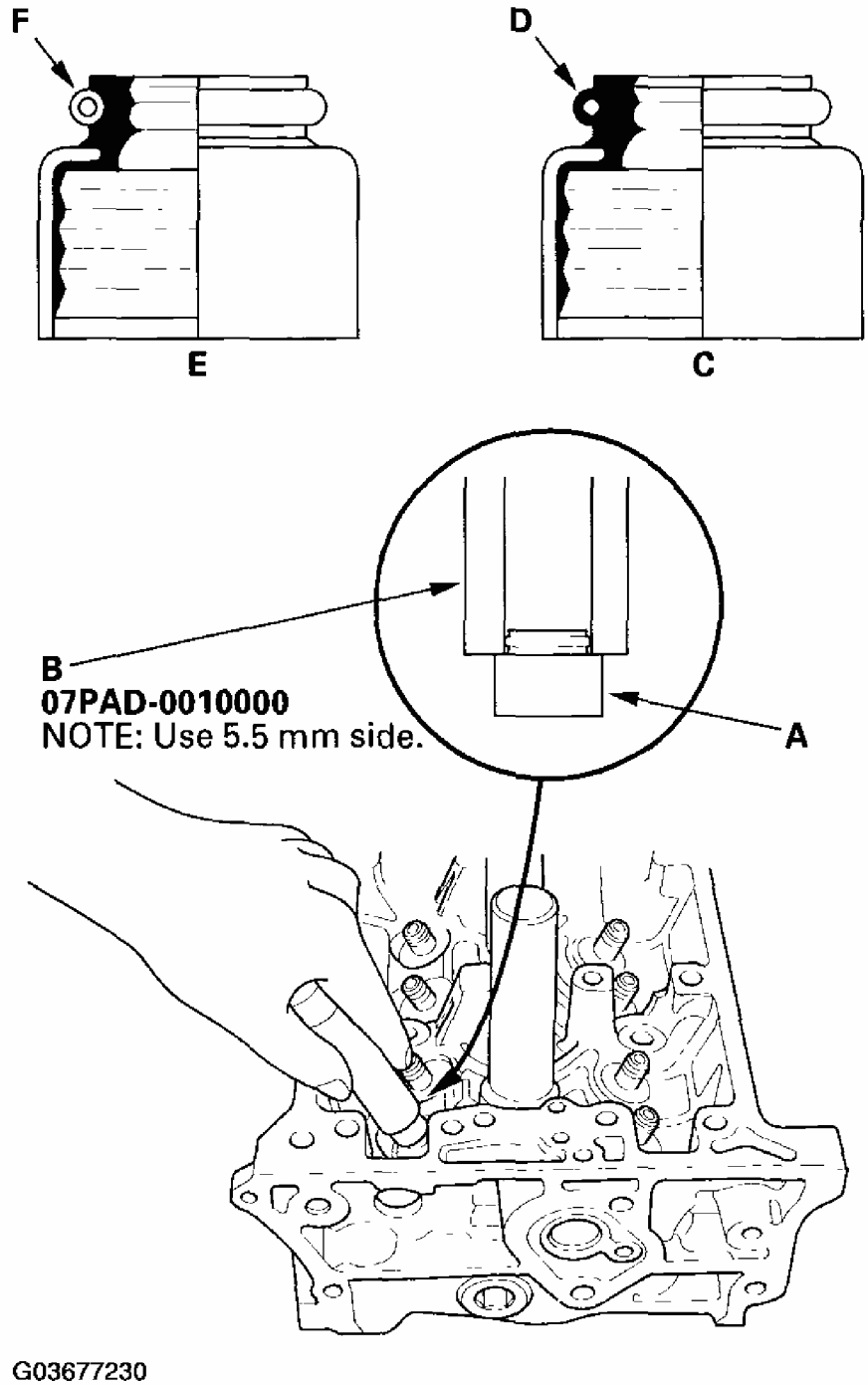

Fig. 111: Installing Valve Seals
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

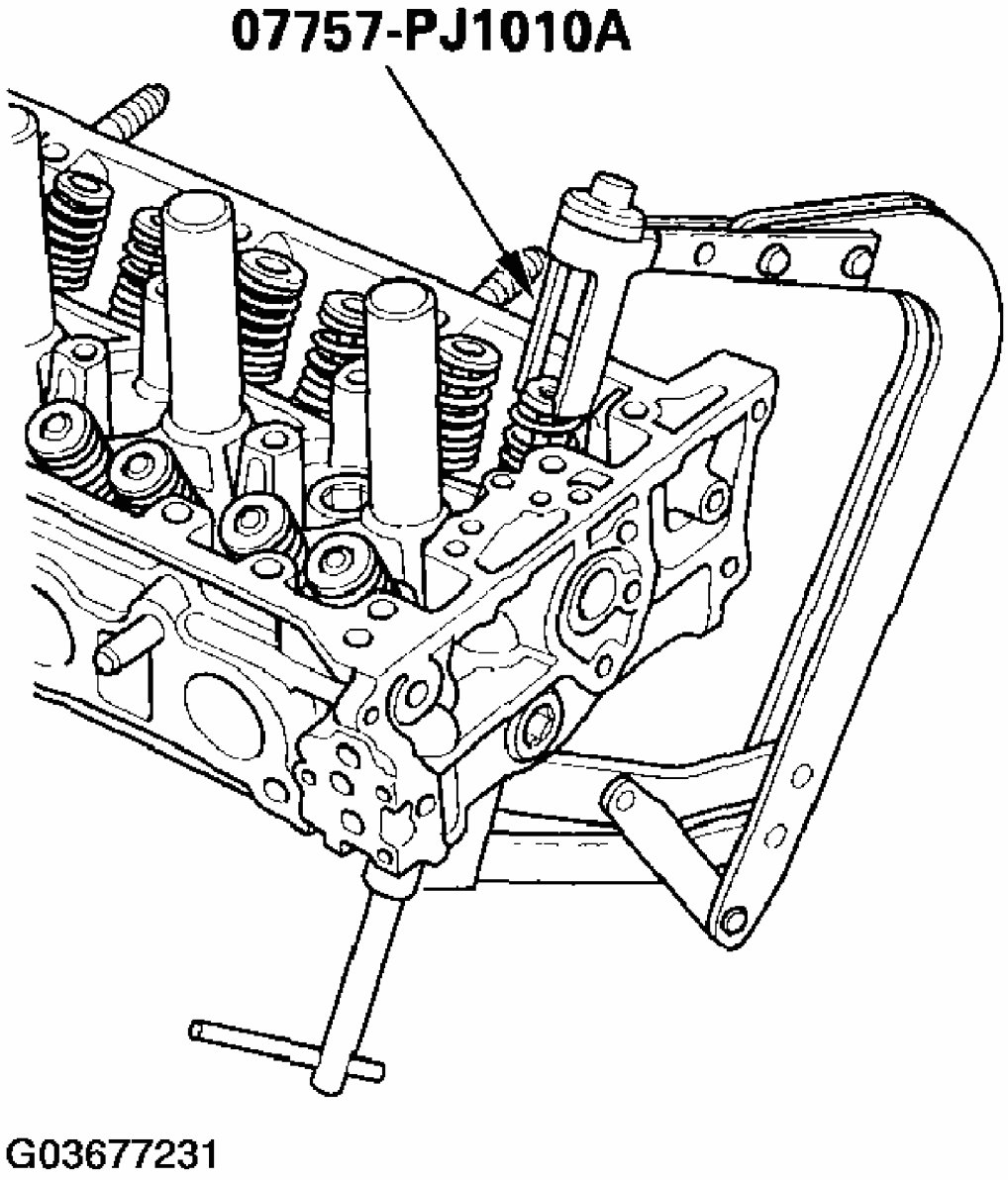

Fig. 112: Installing Valve Spring Compressor
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

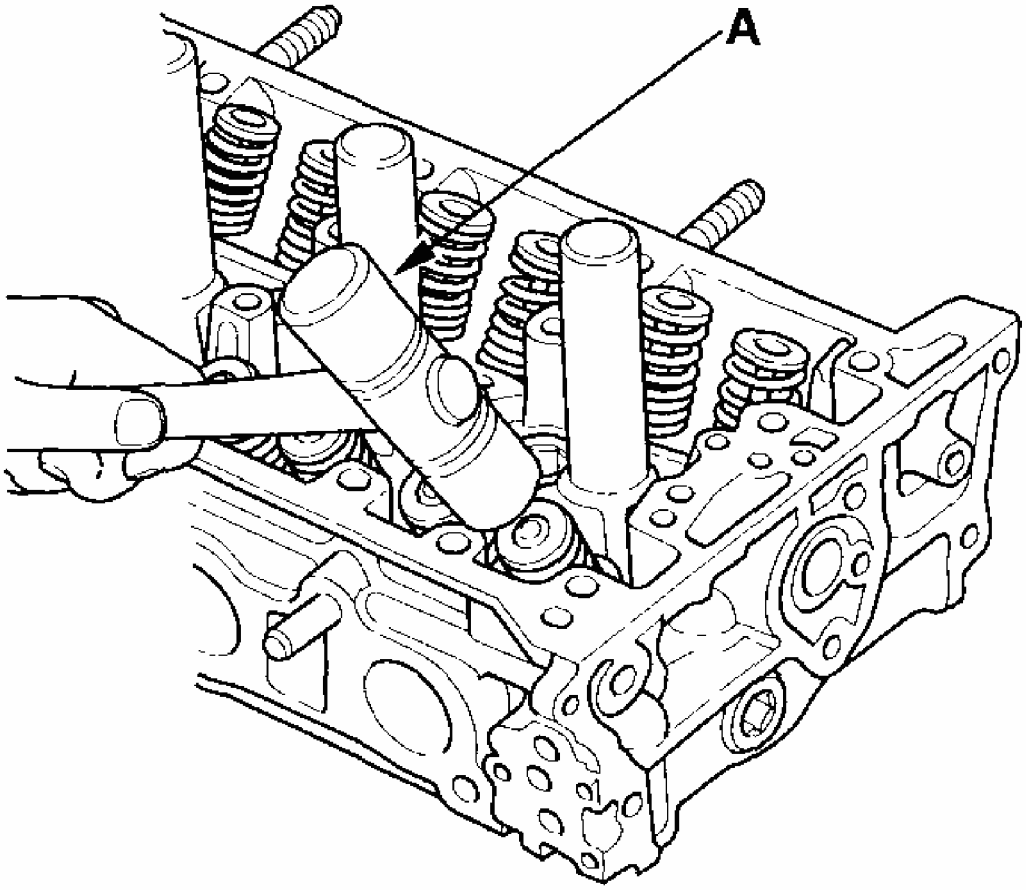

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Fig. 113: Tapping Valve Stem End
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

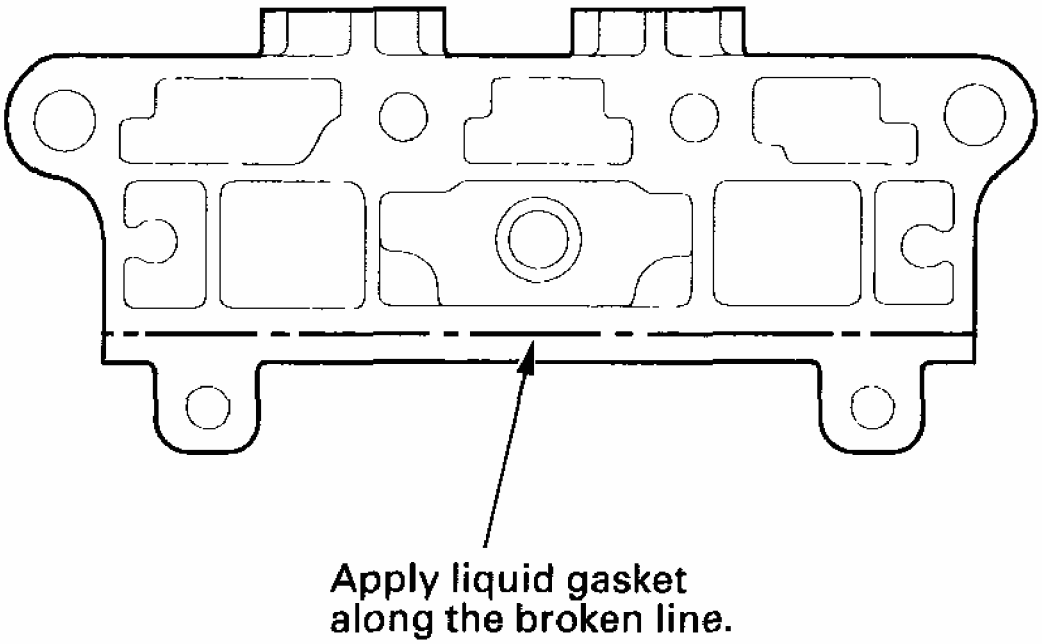

Fig. 114: Locating Liquid Gasket Applying Point
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

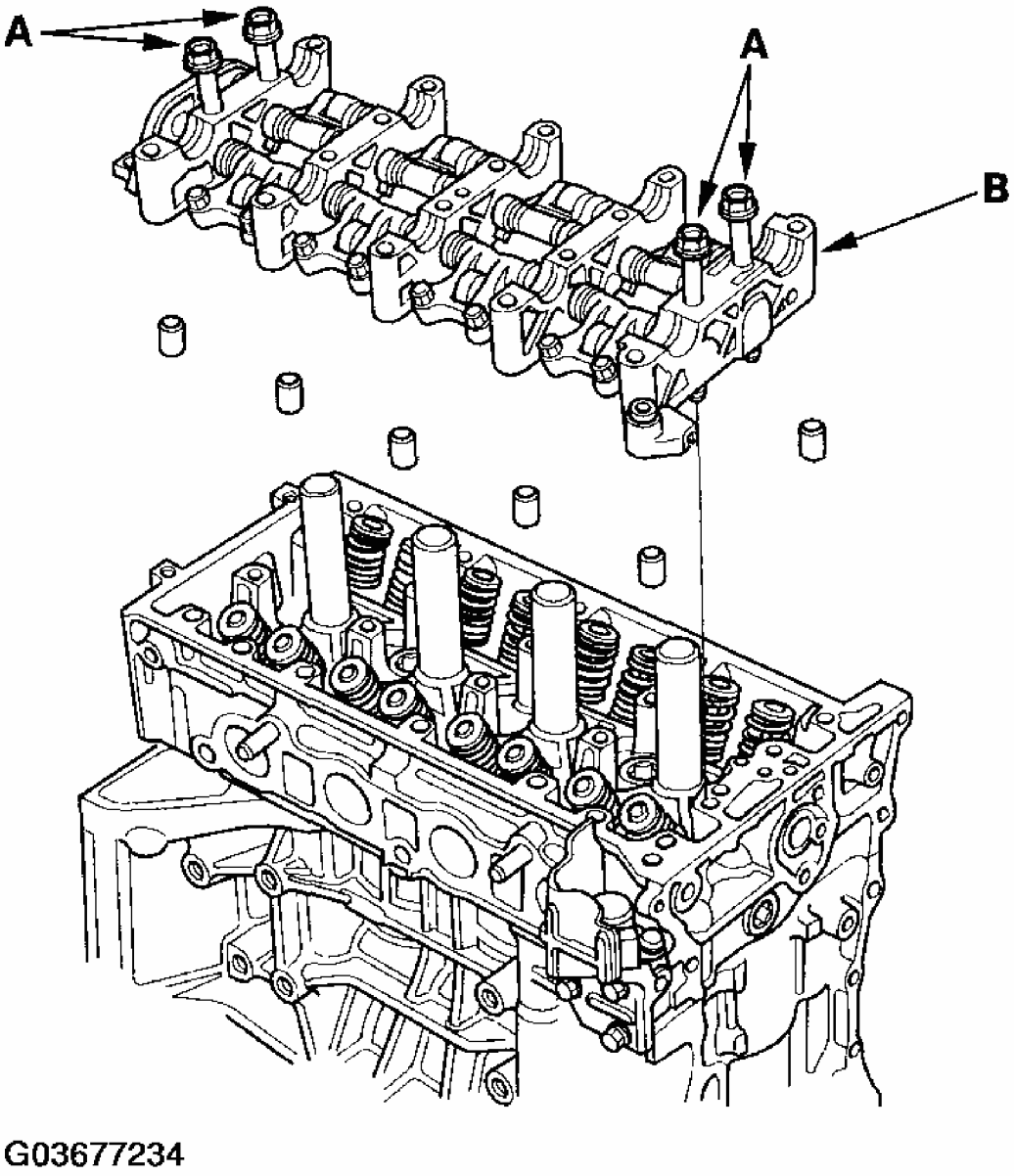

Fig. 115: Installing Rocker Arm Assembly On Cylinder Head
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

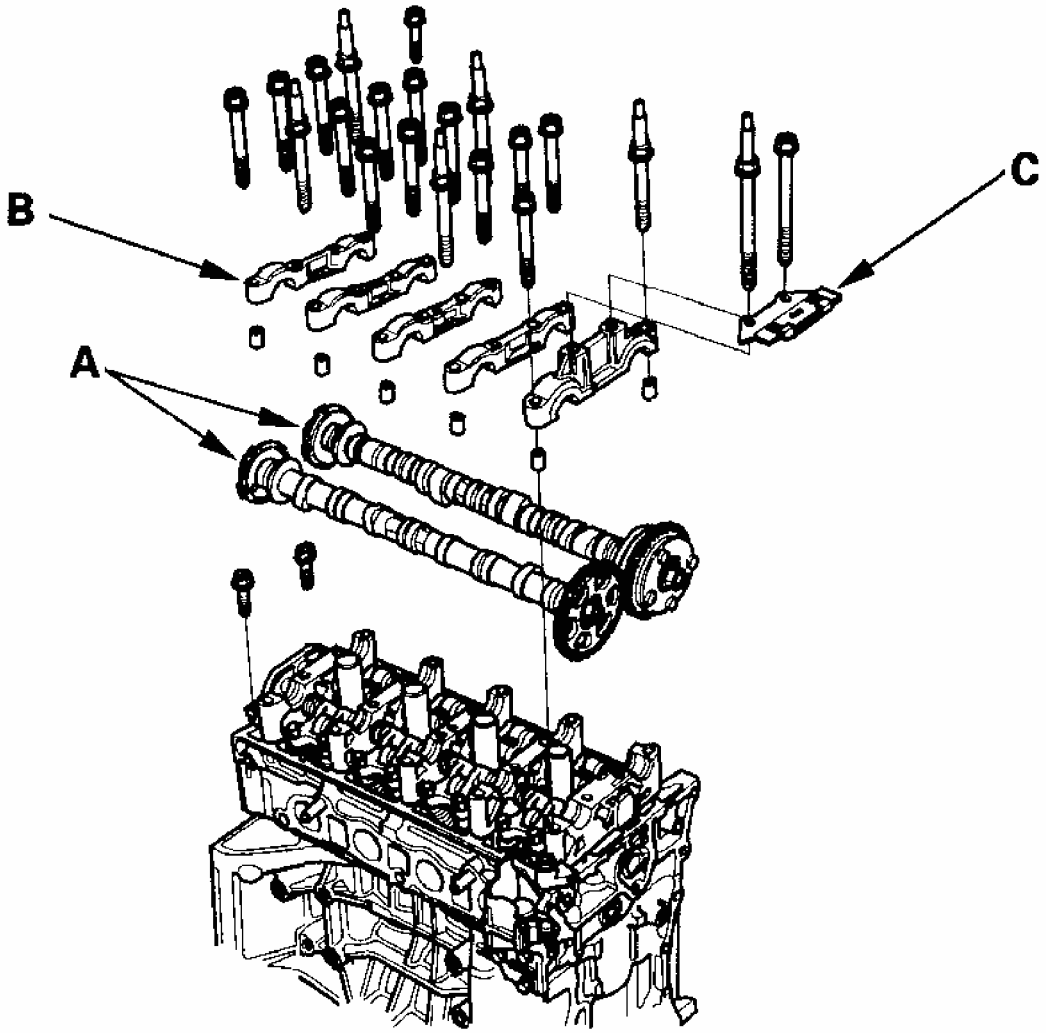

Fig. 116: Installing Camshafts
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

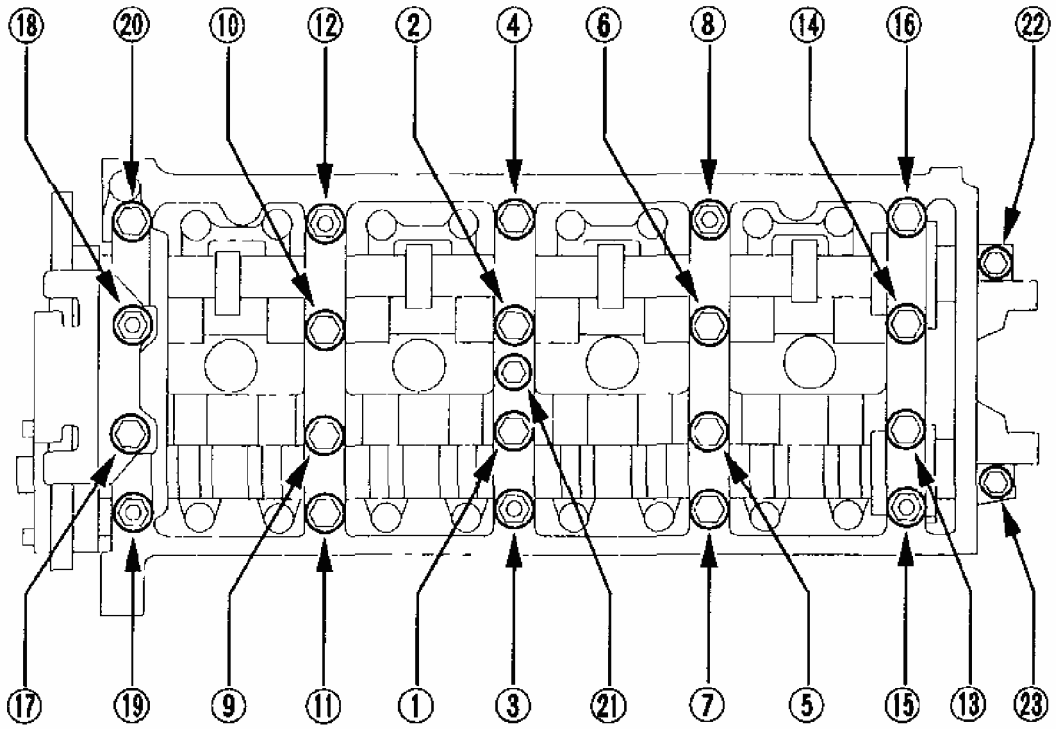

Fig. 117: Tightening Bolts In Sequence
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

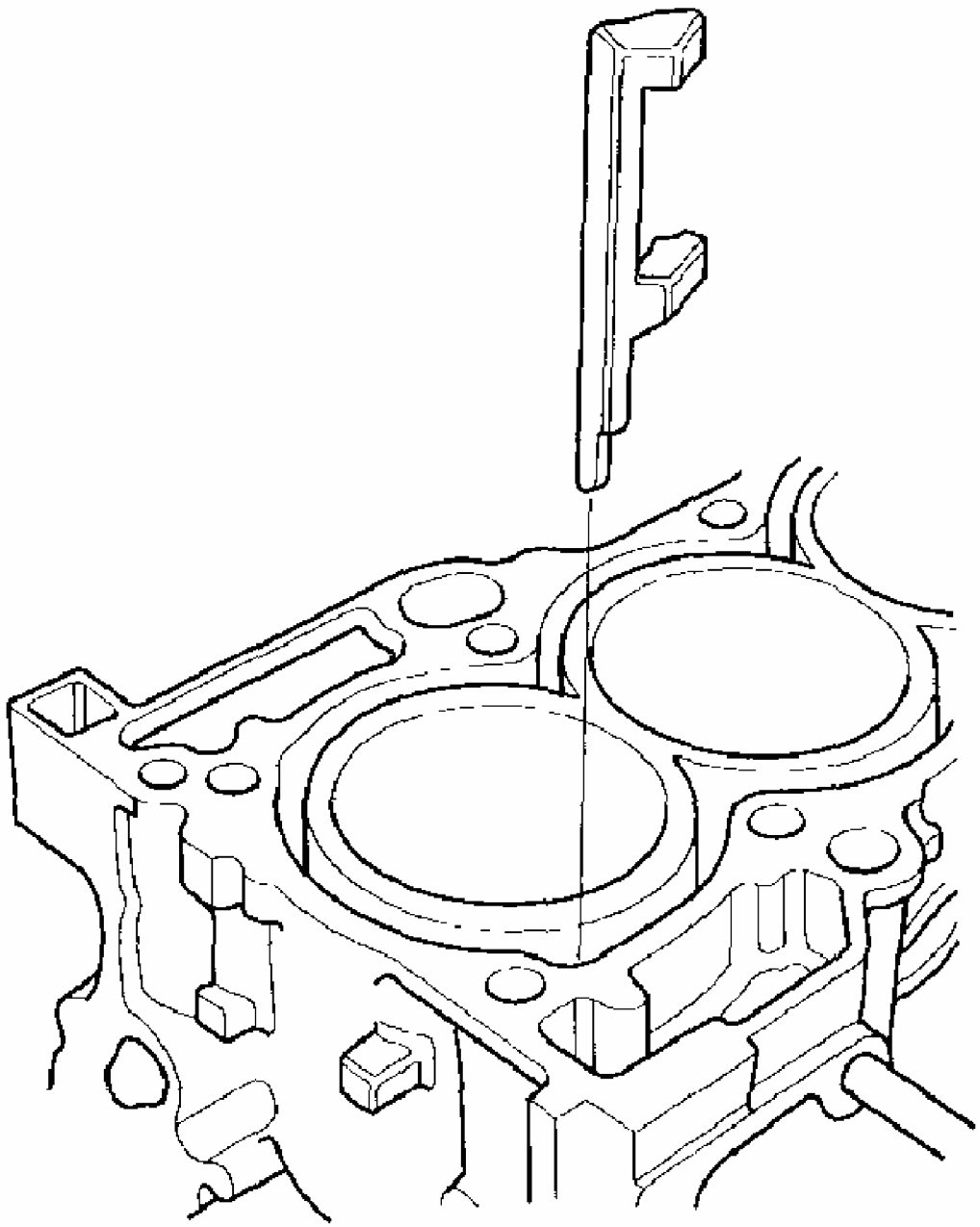

Fig. 118: Installing Coolant Separator In Engine Block
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

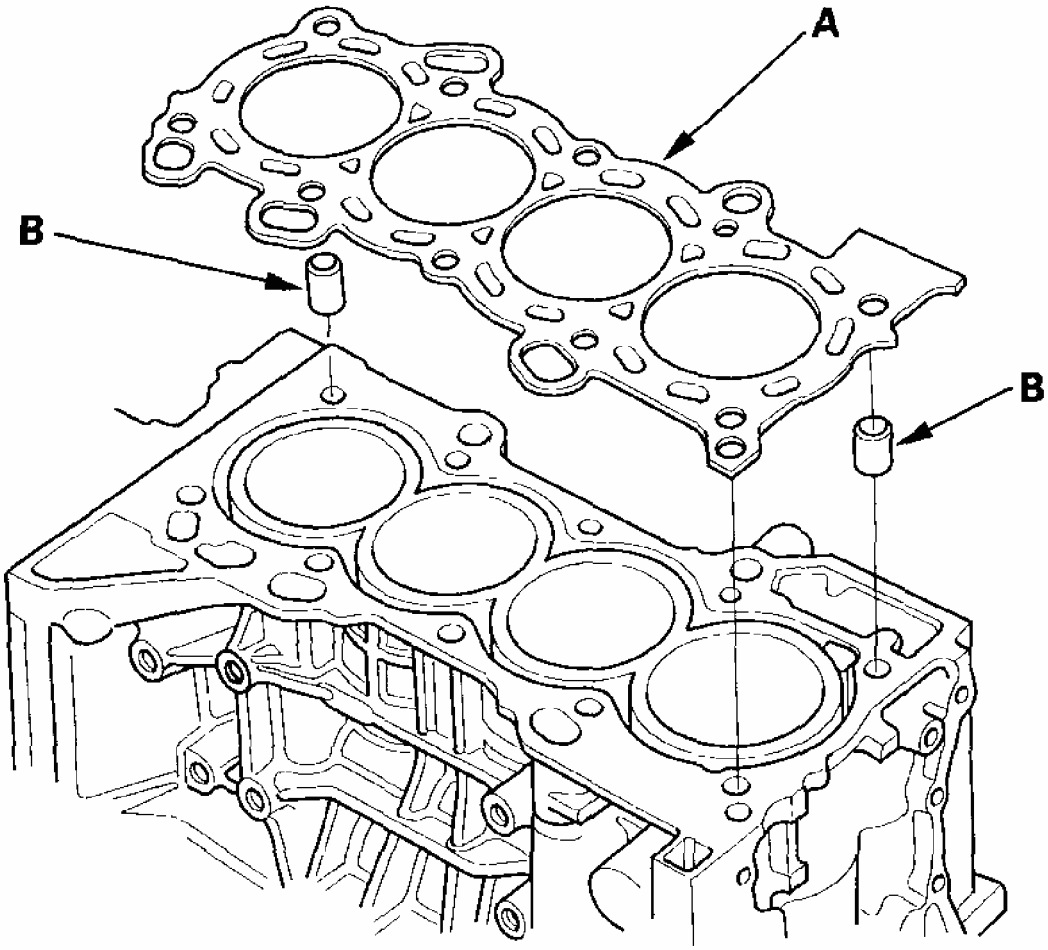

Fig. 119: Installing Cylinder Head Gasket
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

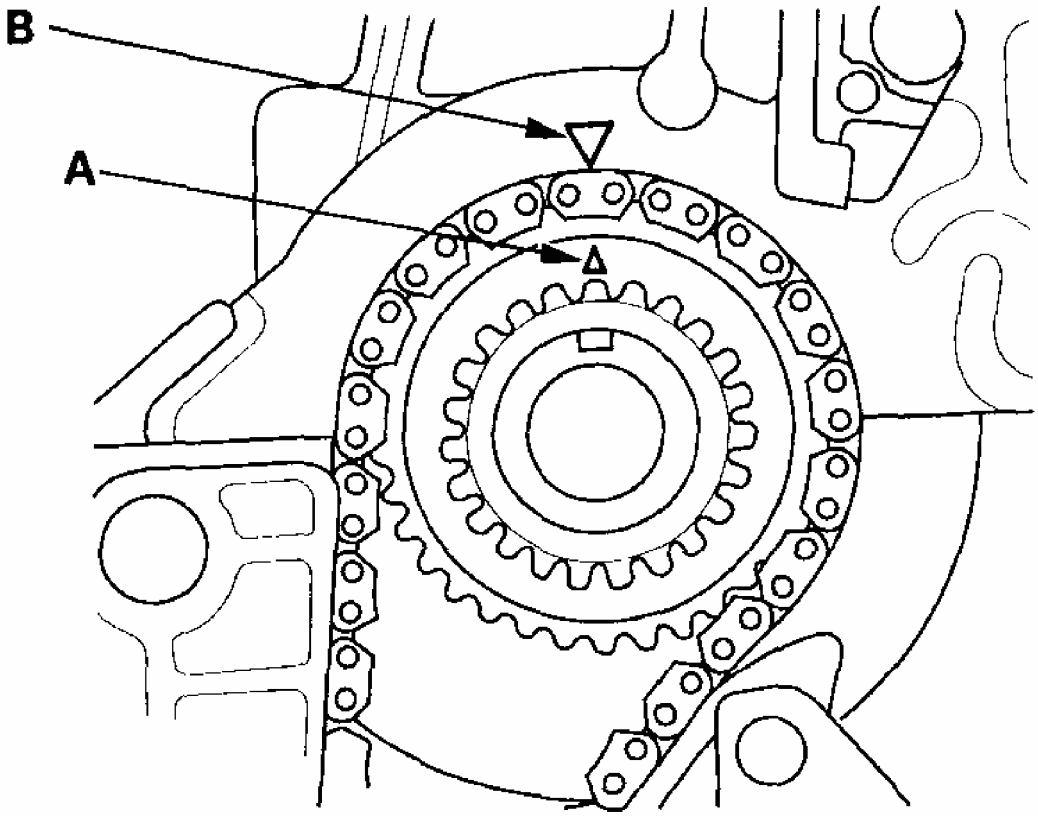

Fig. 120: Aligning TDC Mark On Crankshaft Sprocket With Pointer On Engine Block
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

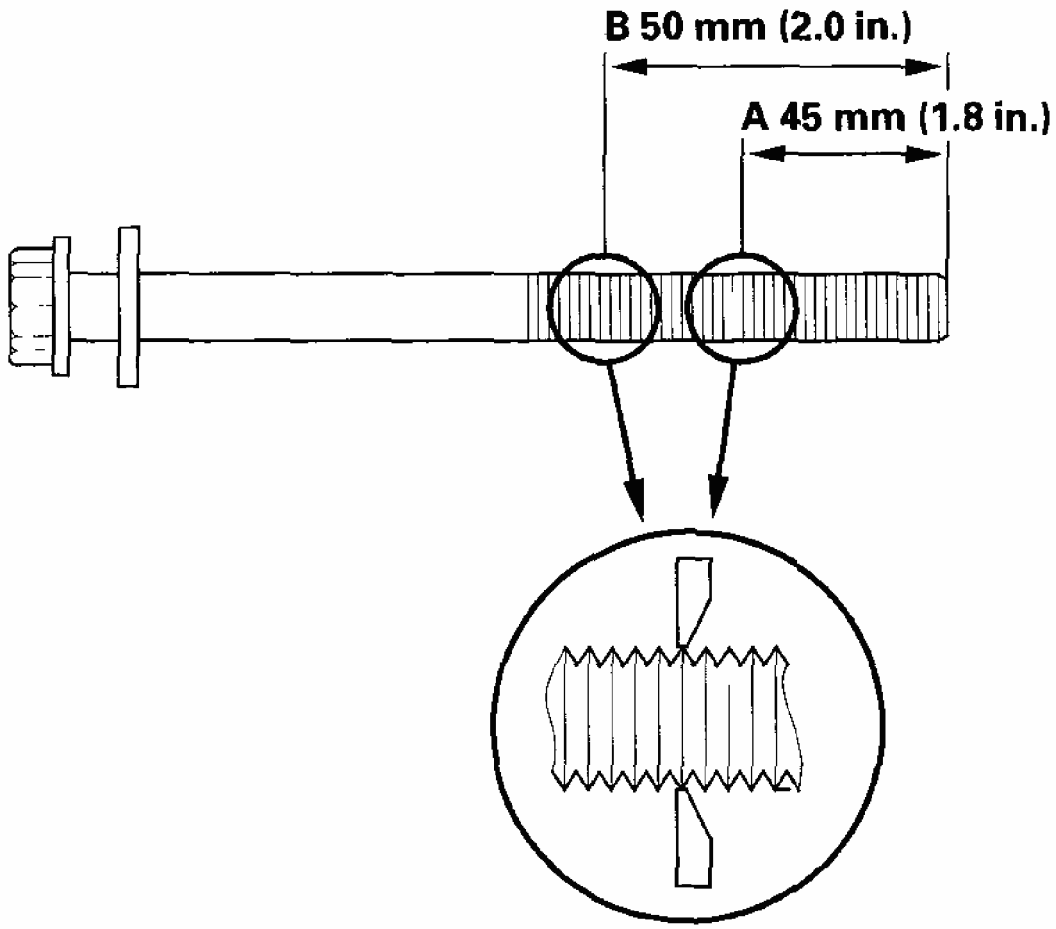

Fig. 121: Identifying Cylinder Head Bolt Diameter
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

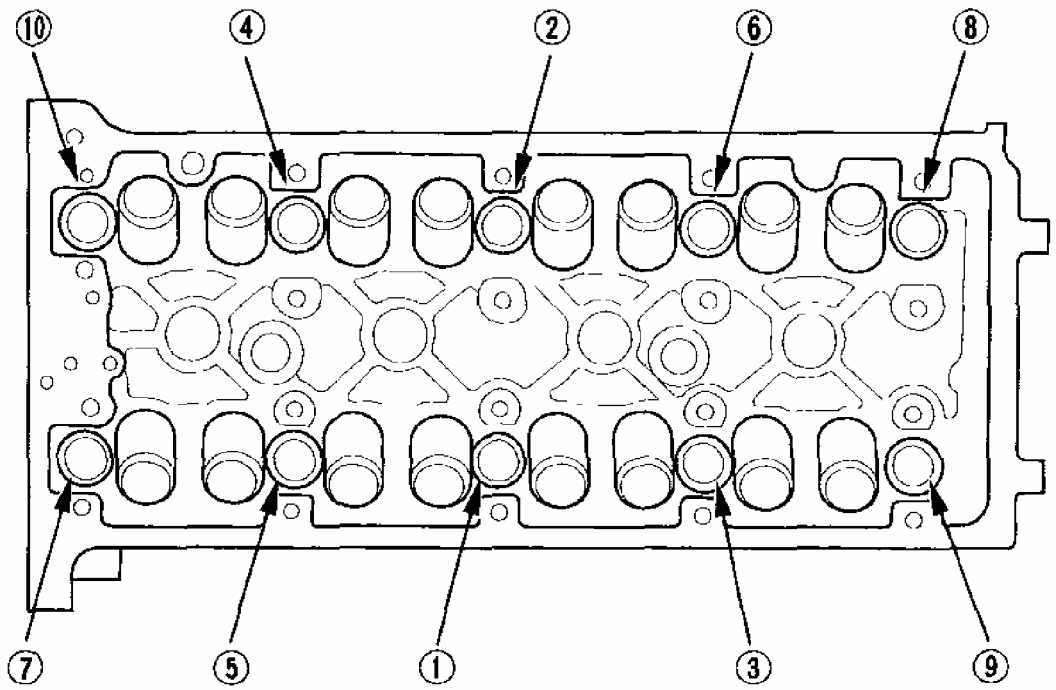

Fig. 122: Tightening Cylinder Head Bolts In Sequence
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

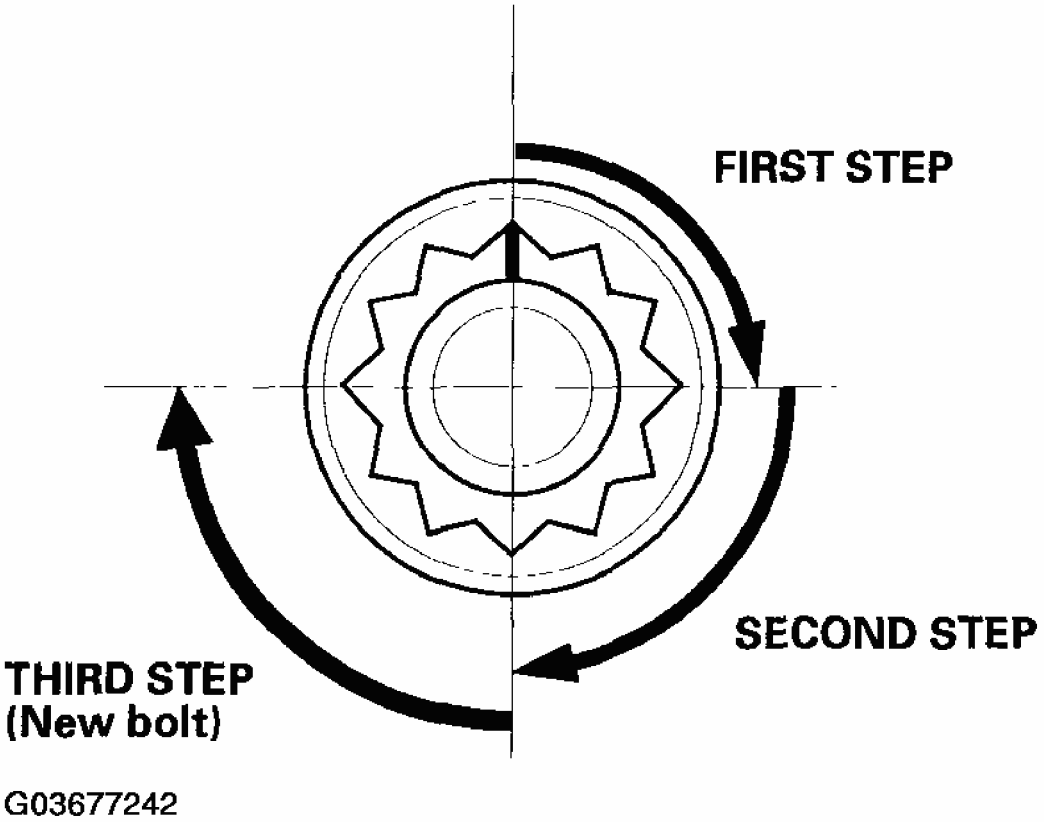

Fig. 123: Cylinder Head Bolts Tightening Instructions
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.

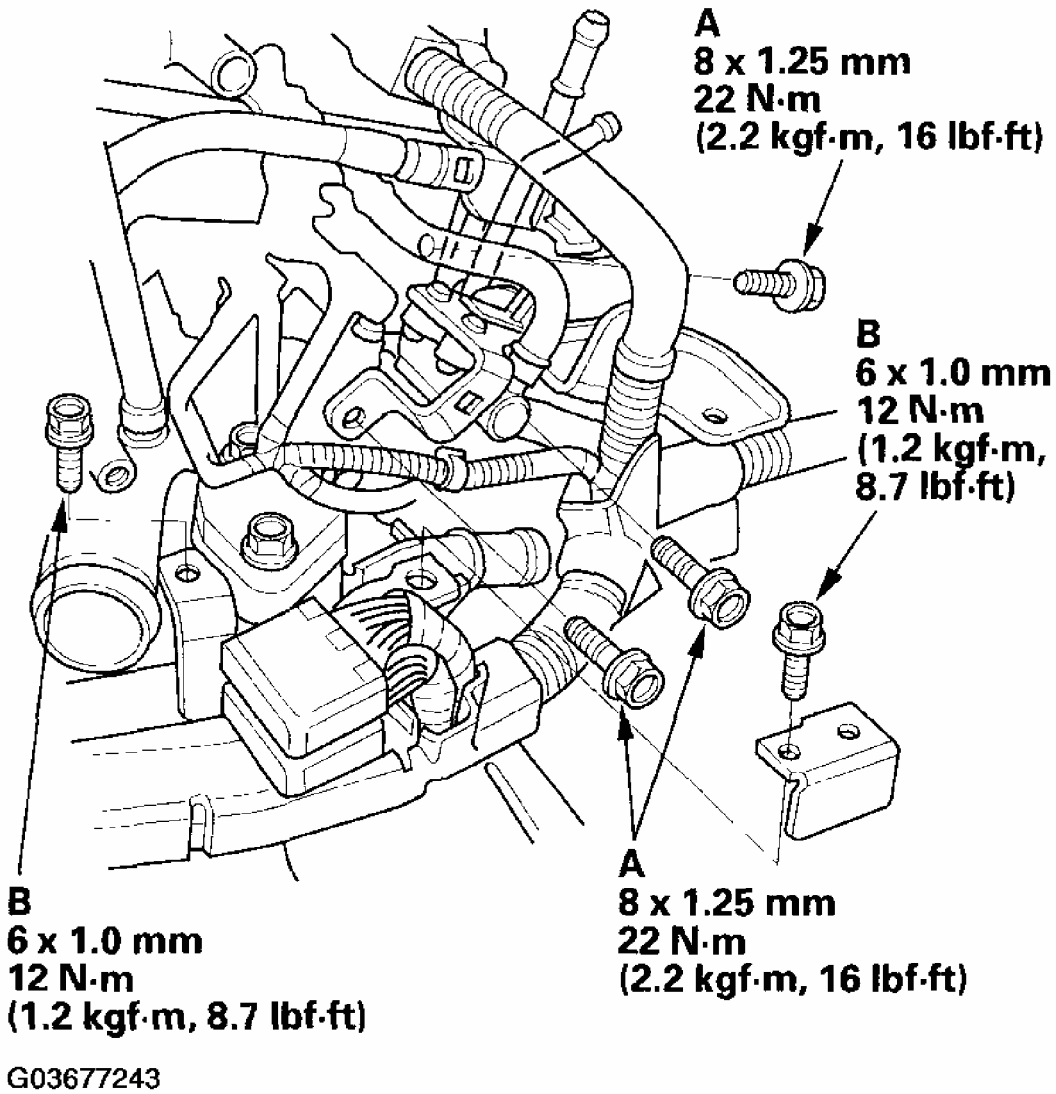

Fig. 124: Tightening Bolts Securing Evaporative Emission Canister Purge Valve Bracket
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

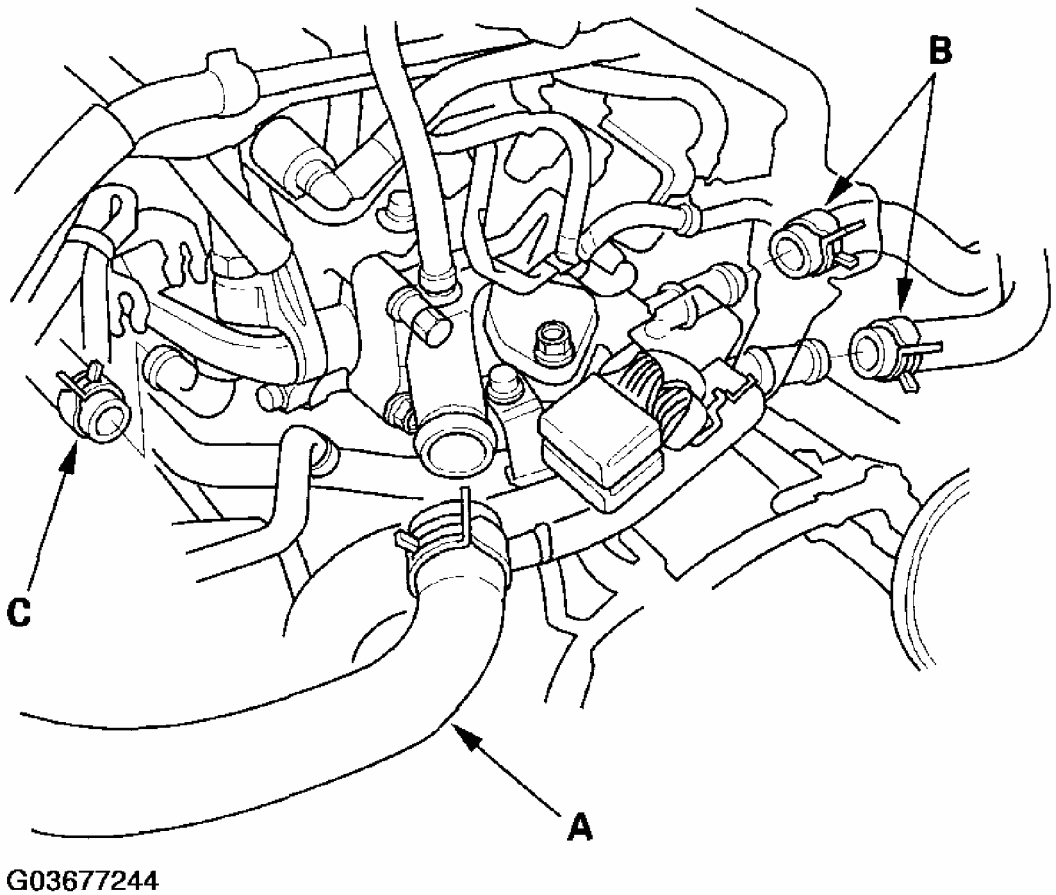

Fig. 125: Installing Upper Radiator Hose, Heater Hoses And Water Bypass Hose
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

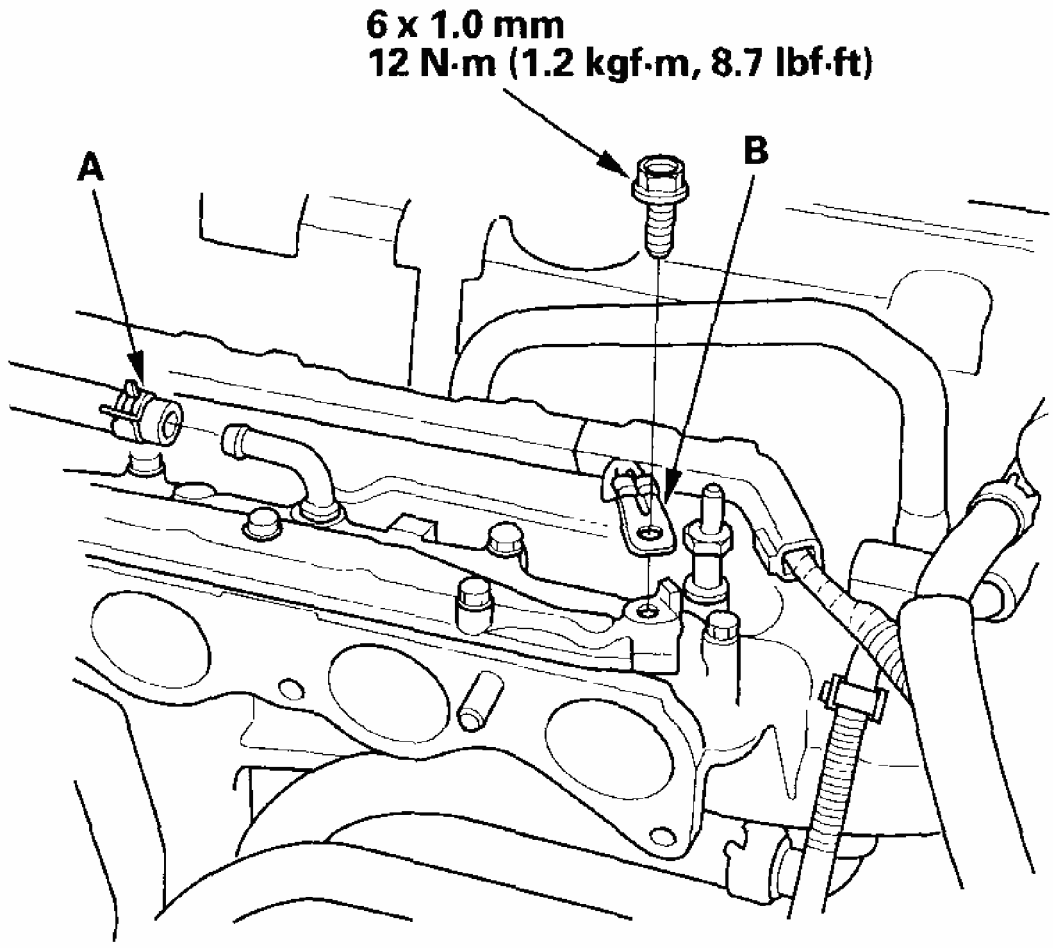

Fig. 126: Installing Positive Crankcase Ventilation Hose And Ground Cable With Specified Torques
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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).

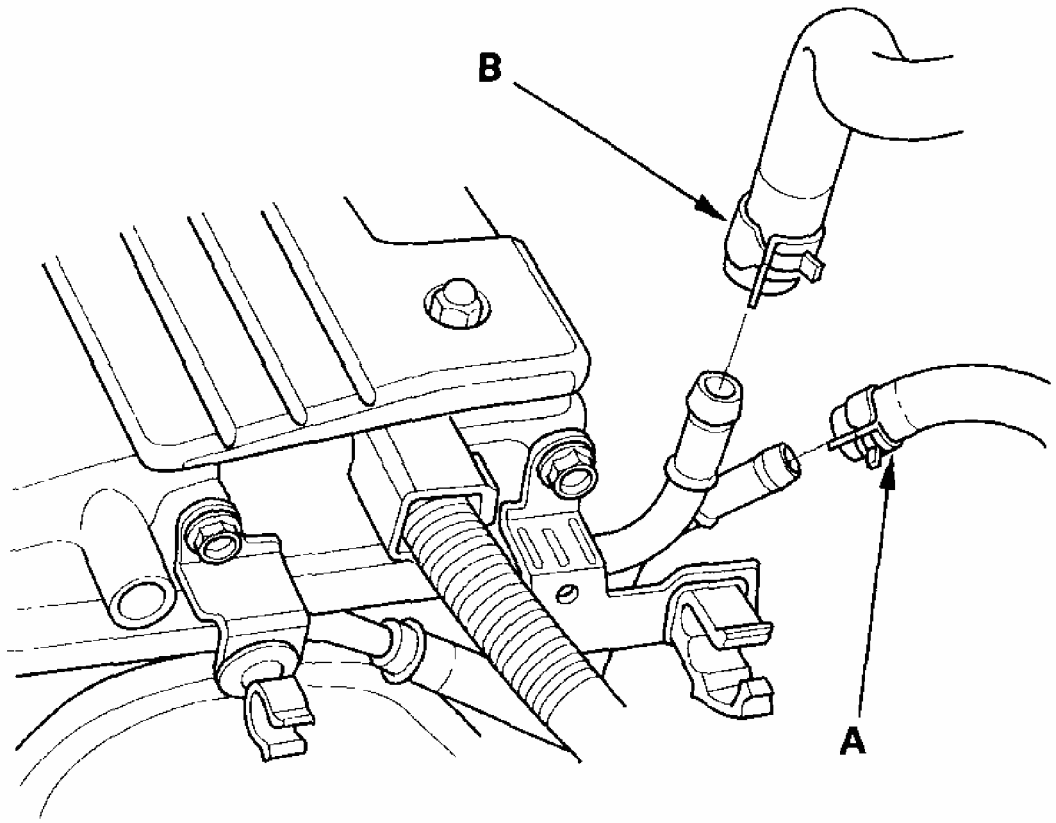

Fig. 127: Installing EVAP Canister Hose And Brake Booster Vacuum Hose
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

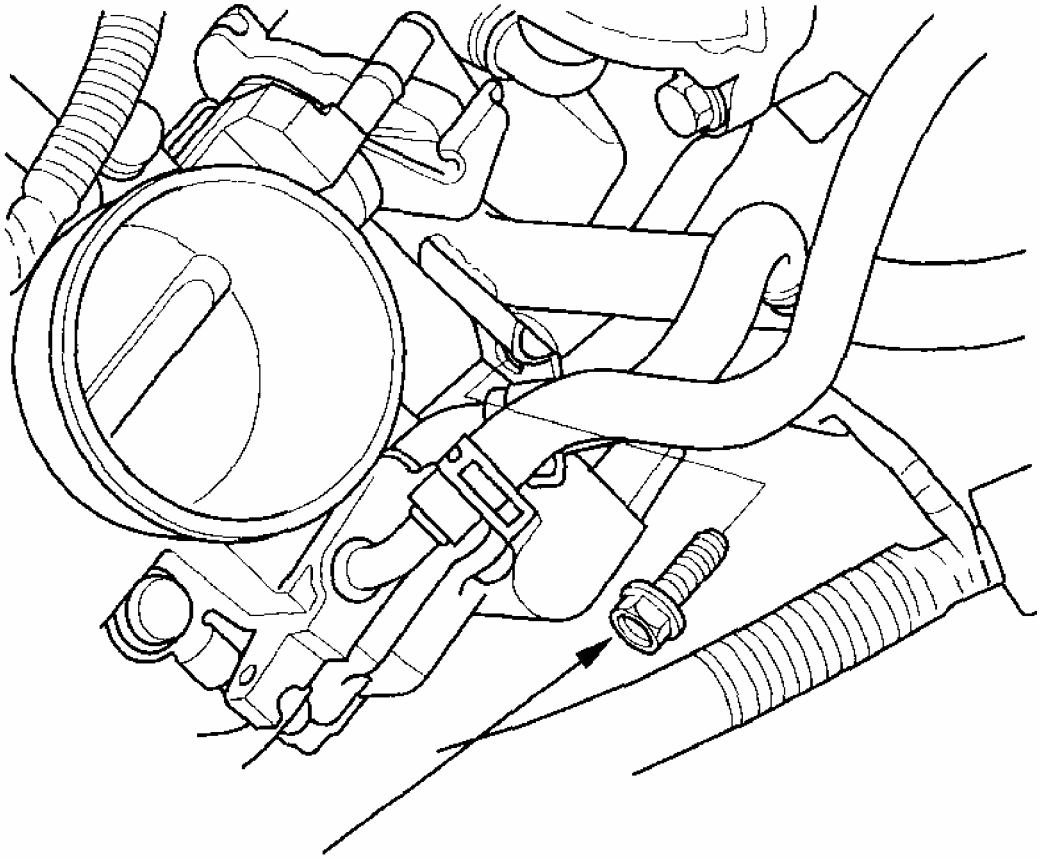

Fig. 128: Tightening Bolt Securing Connecting Pipe Support Bracket To Engine Block And Torque Specifications
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

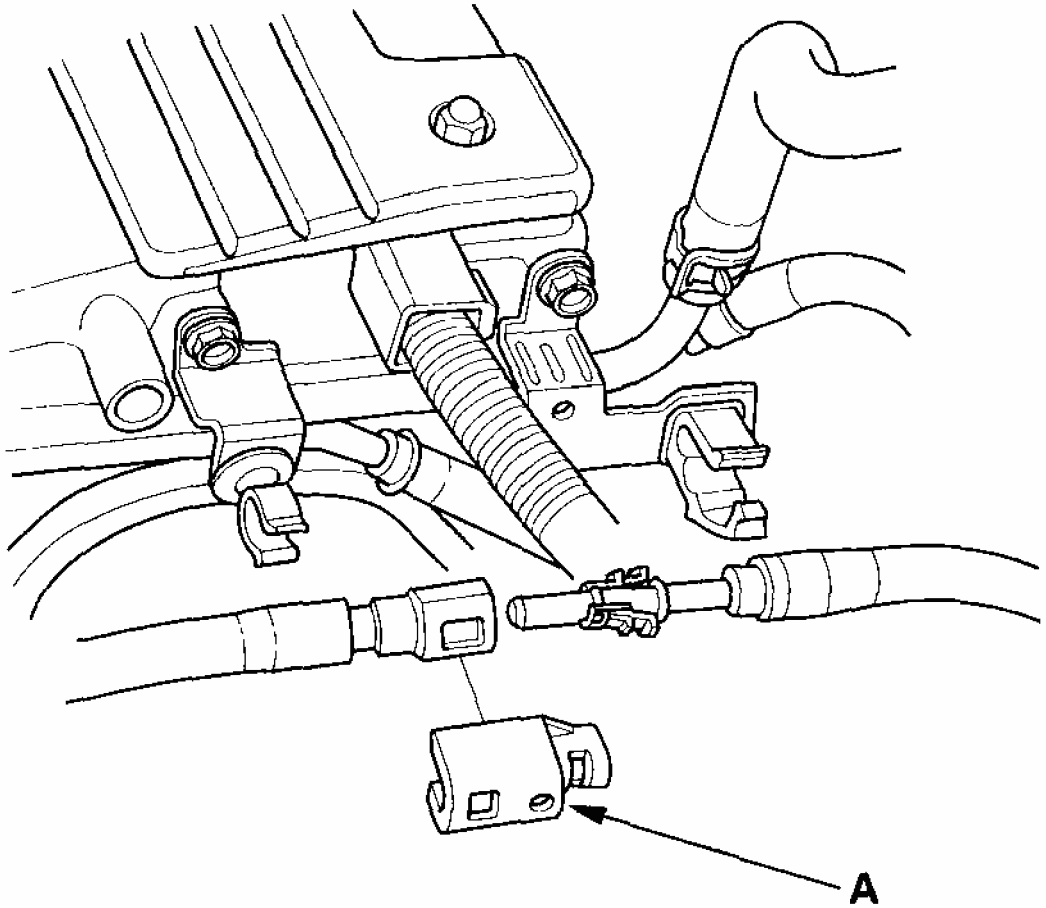

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Fig. 129: Connecting Fuel Feed Hose And Installing Quick-Connect Fitting Cover
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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).

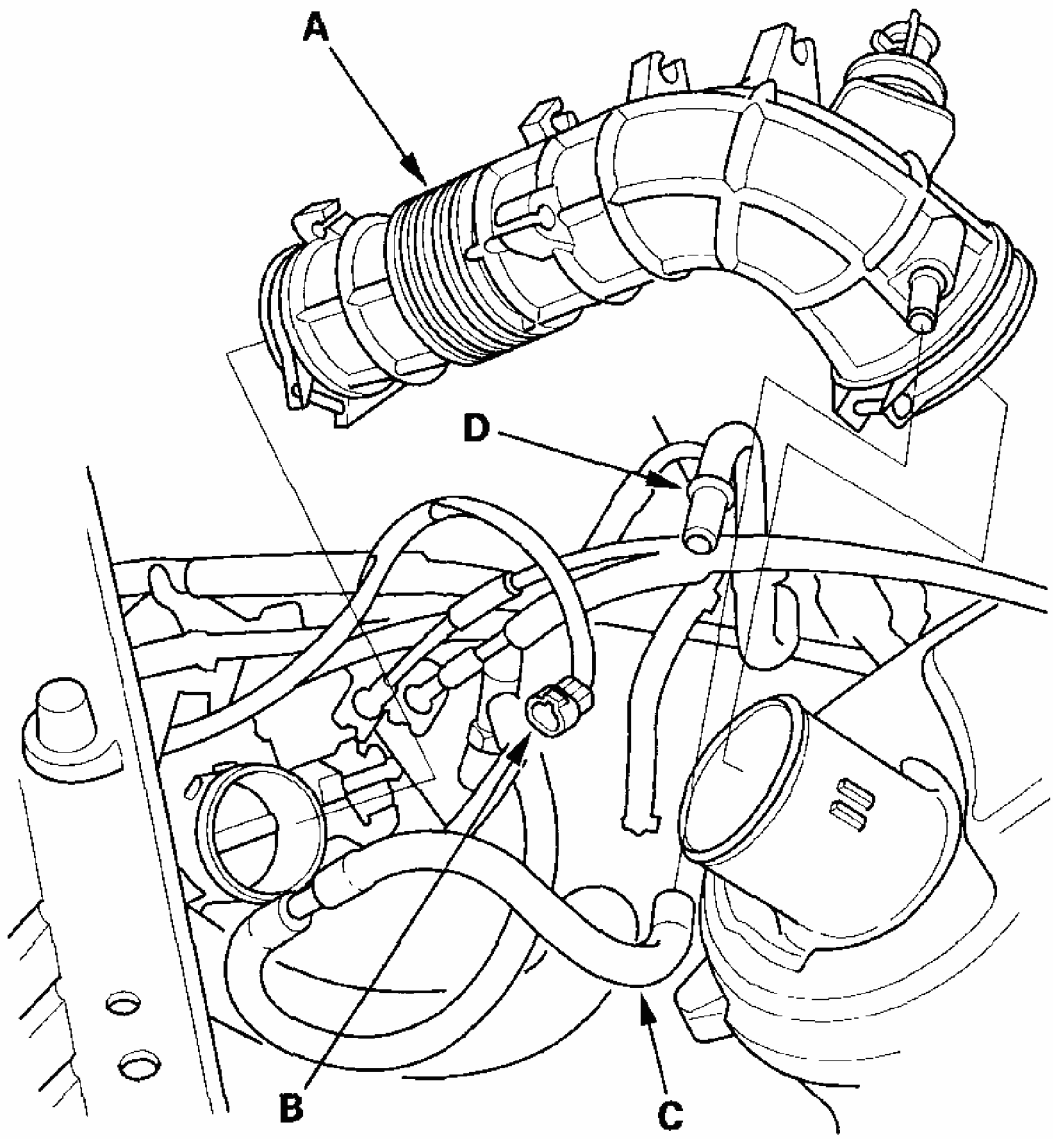

Fig. 130: Connecting Intake Air Temperature Sensor Connector And Installing Vacuum Hose And Breather Pipe
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.
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**).