

2003-05 ENGINES**Overhaul - 1.3L 4-Cylinder (Hybrid)****INTEGRATED MOTOR ASSIST (IMA) SYSTEM (IF ENGINE MAINTENANCE IS REQUIRED)**

IMA components are located in this area. The IMA is a high-voltage system. You must be familiar with the IMA system before working on or around it. Make sure you read the Service Precautions in the IMA system before performing repairs or service (see **SERVICE PRECAUTIONS**).

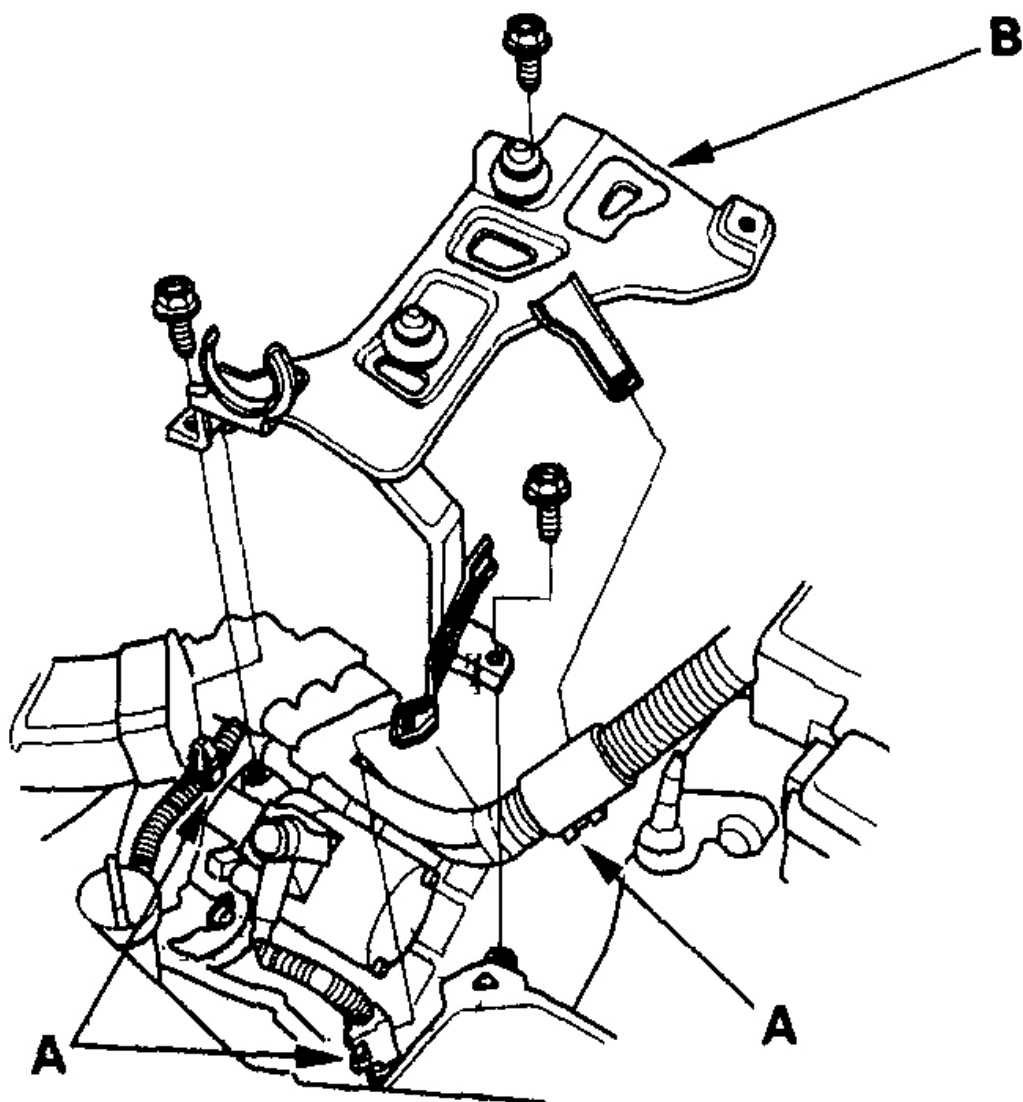
ENGINE REMOVAL**Special Tools Required**

Front subframe adapter EQS02C000011

NOTE:

- IMA system wires are located in this area. Make sure you read the Service Precautions in the IMA system before performing repairs or service (see **SERVICE PRECAUTIONS**).
- Use fender covers to avoid damaging painted surfaces.
- To avoid damage, unplug the wiring connectors carefully while holding the connector portion.
- 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. Turn the battery module switch OFF, and measure the voltage (see **TURNING OFF POWER TO THE HIGH VOLTAGE CIRCUIT**).
3. Secure the hood in the wide open position (support rod in the lower hole).
4. Make sure you have the anti-theft code for the radio, then write down the frequencies for the radio's preset buttons.
5. Disconnect the negative cable from the battery first, then the positive cable.
6. Remove the battery.
7. Remove the engine cover, then remove the resonator (see **RESONATOR REPLACEMENT**).
8. Remove the air cleaner housing (see **AIR CLEANER REMOVAL/INSTALLATION**).
9. Remove the harness clamps (A), then remove the air cleaner housing bracket (B).

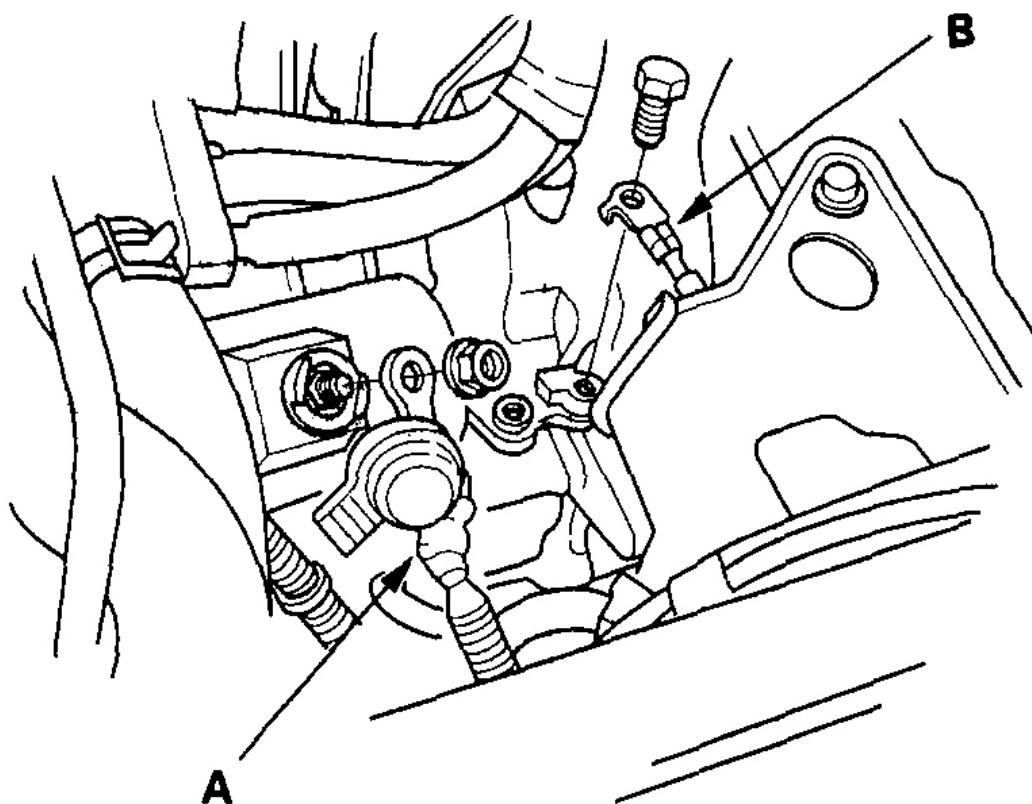


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Fig. 1: Removing Harness Clamps

Courtesy of AMERICAN HONDA MOTOR CO., INC.

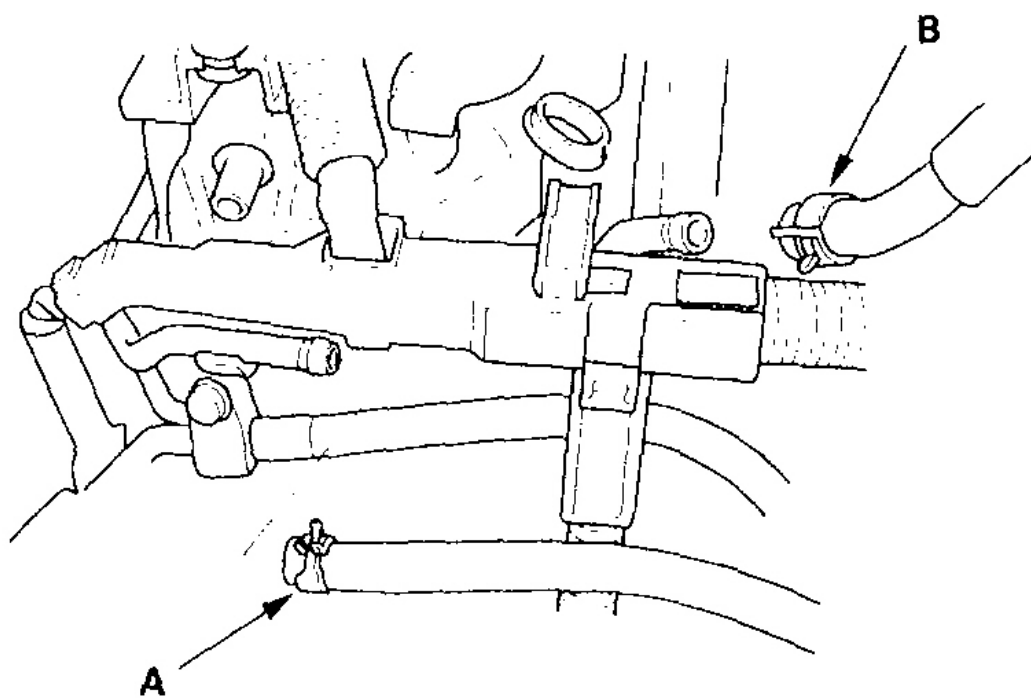
10. Remove the starter cable (A) and ground cable (B).



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Fig. 2: Removing Starter Cable & Ground Cable
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

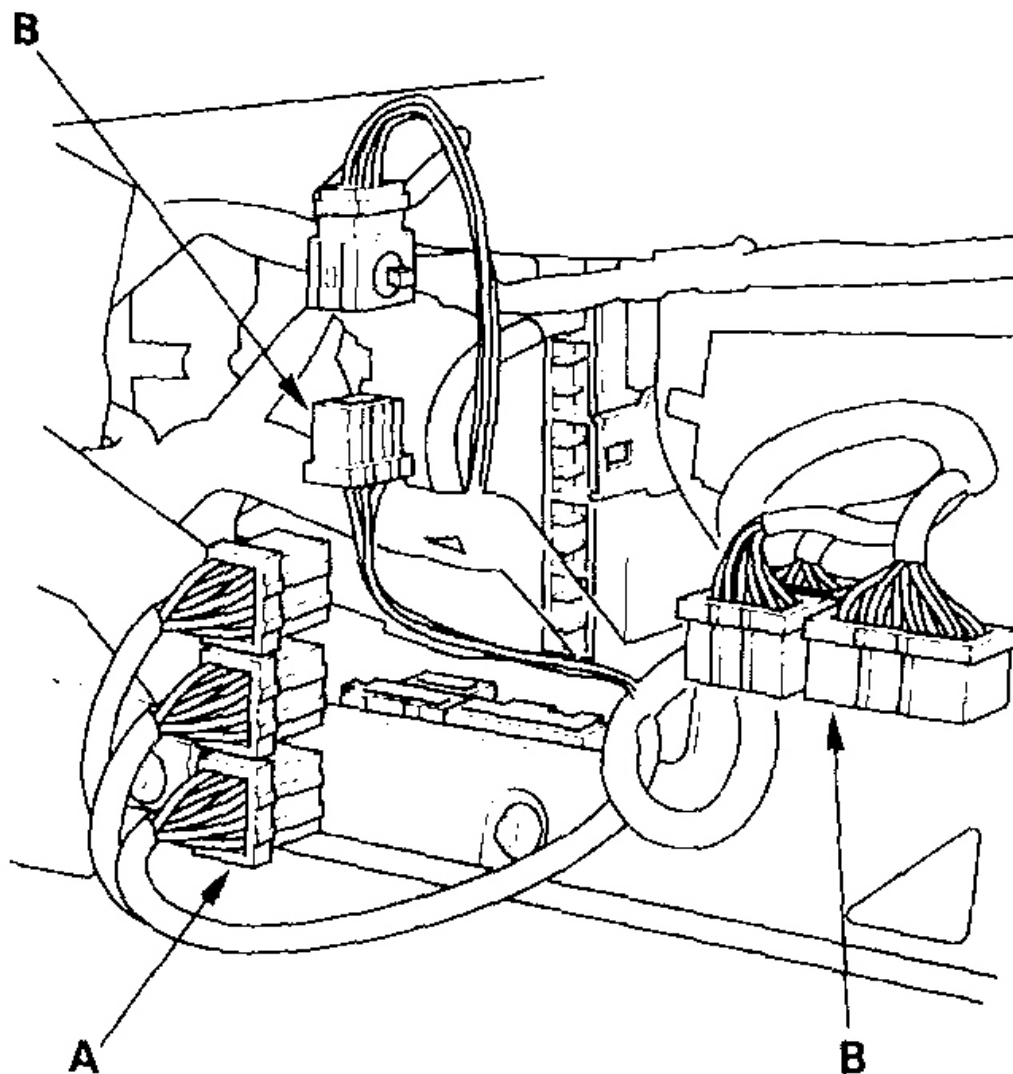


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Fig. 3: Removing EVAP Canister Hose

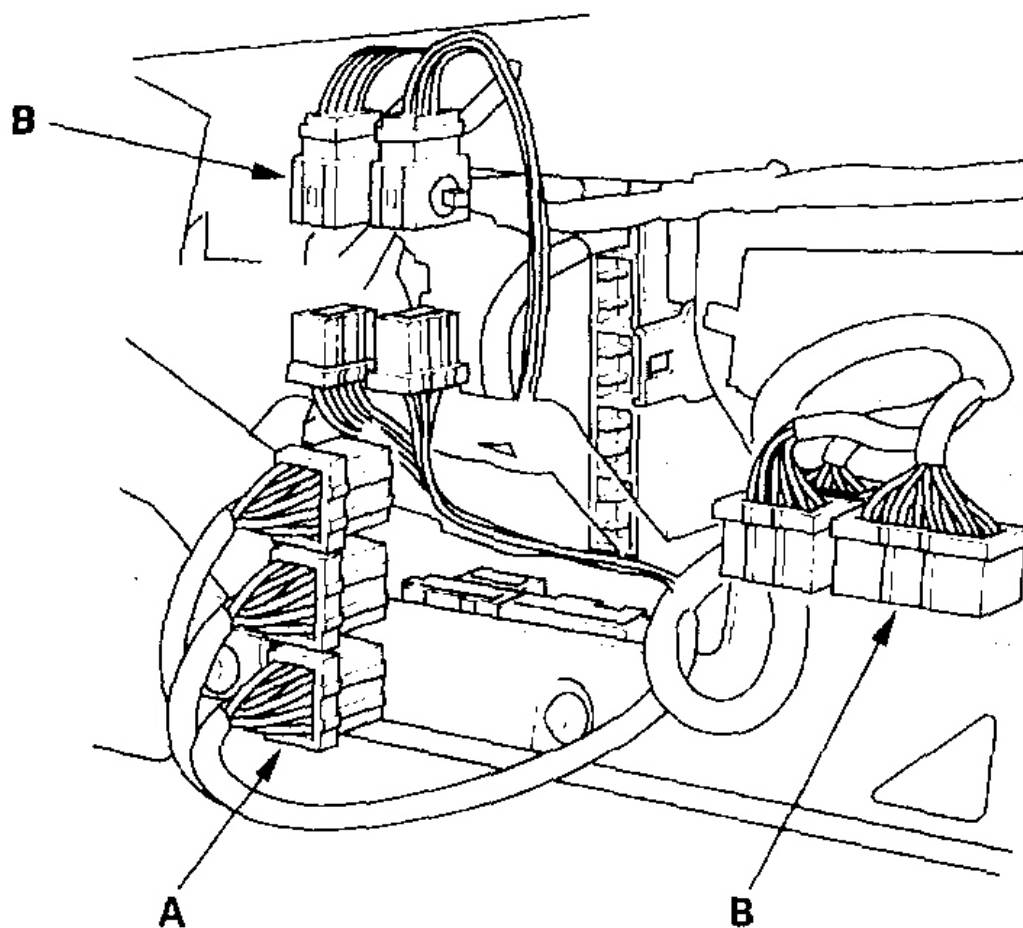
Courtesy of AMERICAN HONDA MOTOR CO., INC.

12. Disconnect the engine control module (ECM) connectors (A) and main wire harness connector (B).



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Fig. 4: Disconnecting ECM Connectors (M/T)
Courtesy of AMERICAN HONDA MOTOR CO., INC.



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Fig. 5: Disconnecting ECM Connectors (CVT)
Courtesy of AMERICAN HONDA MOTOR CO., INC.

13. Remove the harness clamps (A) and grommet (B), then pull the engine wire harness through the bulkhead.

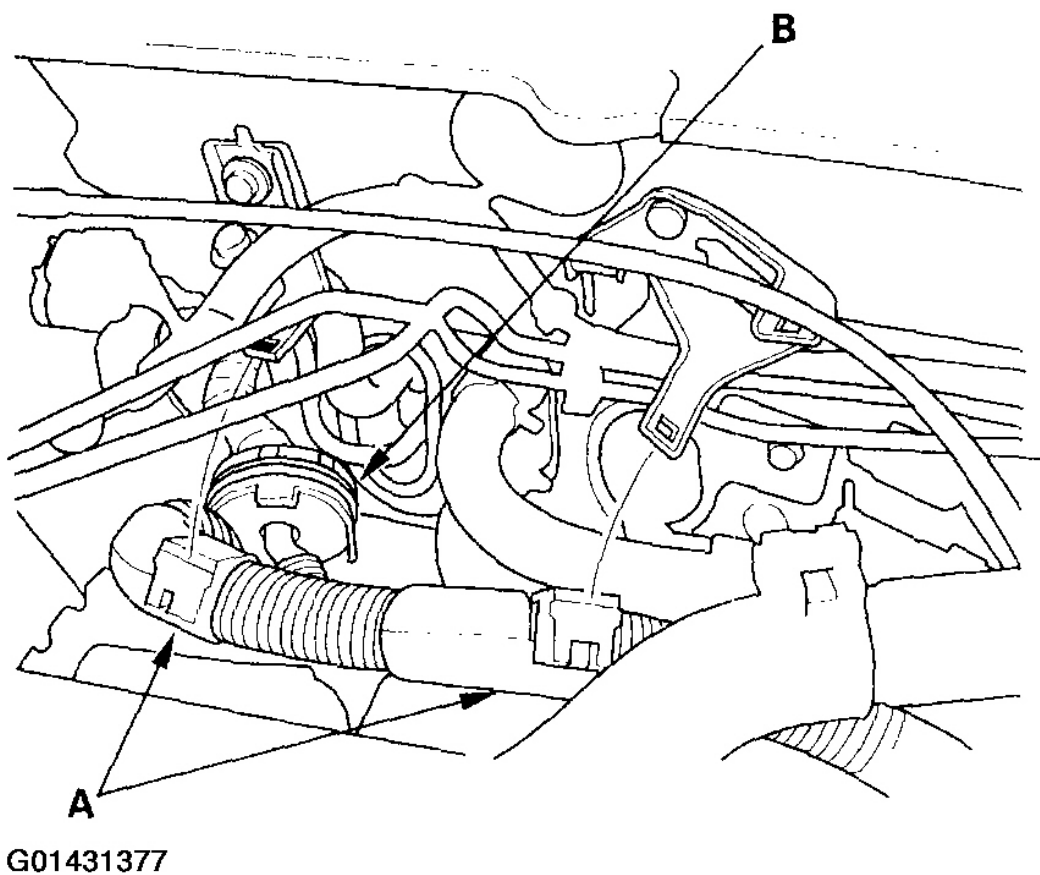
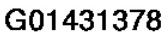


Fig. 6: Removing Harness Clamps & Grommet
Courtesy of AMERICAN HONDA MOTOR CO., INC.

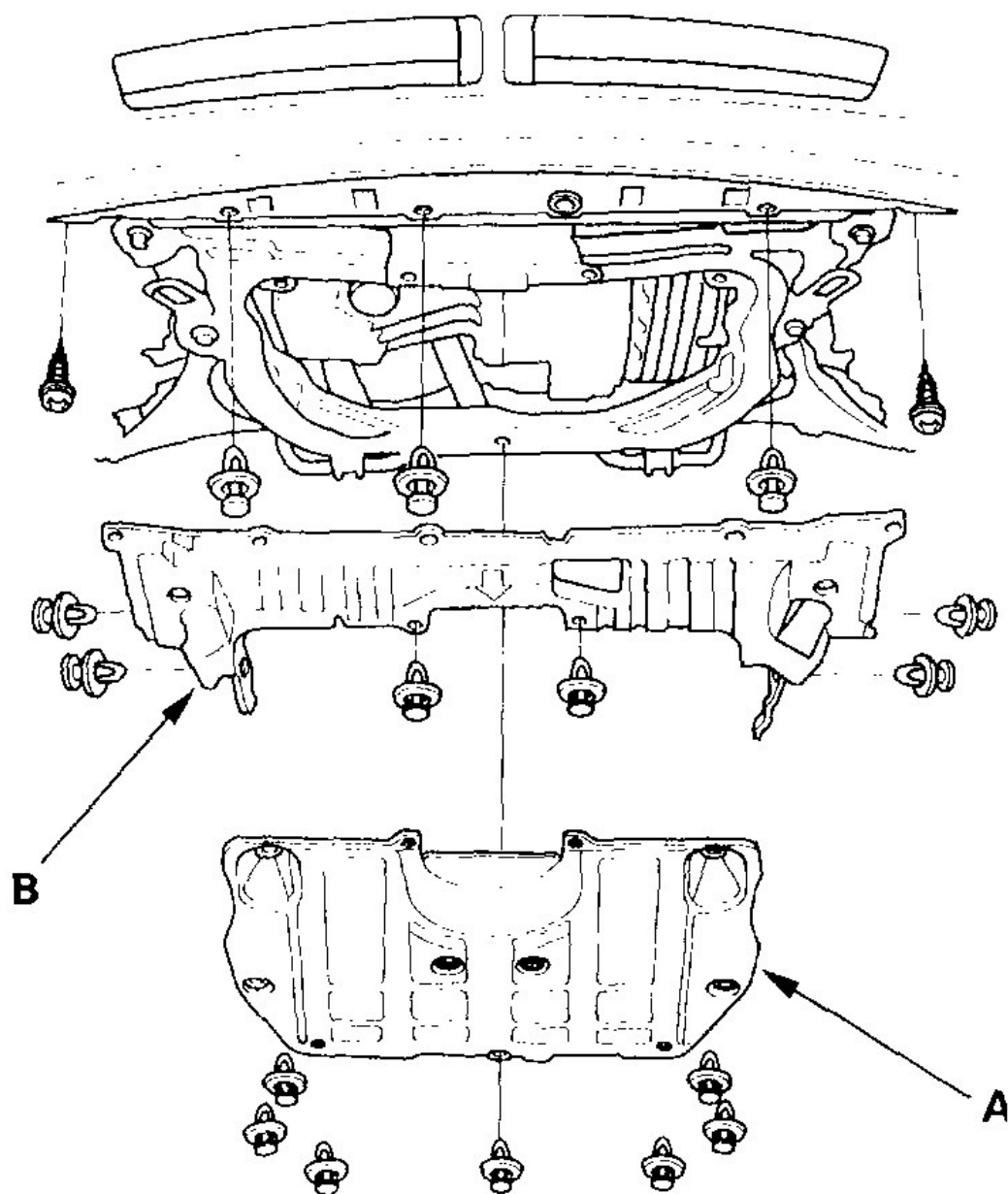
14. Remove the throttle cover (A). Fully open the throttle link and cruise control link by hand, then remove the throttle cable (B) and cruise control actuator cable (C) from the links. Loosen the locknuts (D), and remove the cables from the bracket.



Courtesy of AMERICAN HONDA MOTOR CO., INC.

Courtesy of AMERICAN HONDA MOTOR CO., INC.

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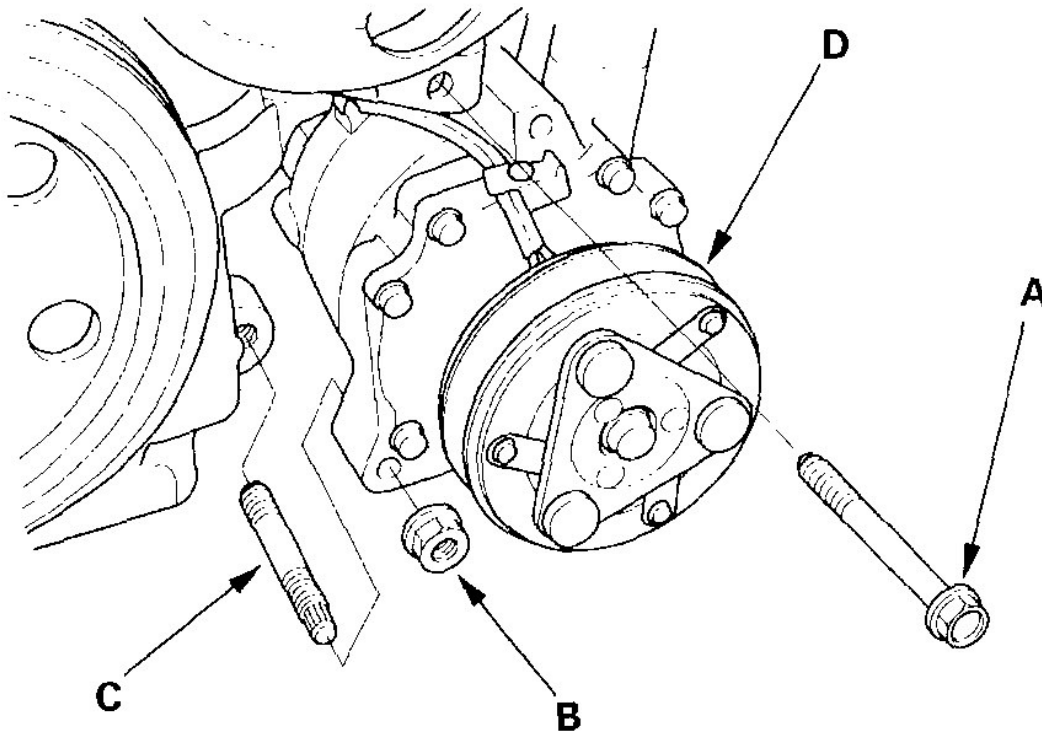
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Fig. 8: Removing Under-Cover & Splash Shield
Courtesy of AMERICAN HONDA MOTOR CO., INC.

23. Loosen the drain plug in the radiator to drain the engine coolant (see **COOLANT REPLACEMENT**).
24. Drain the transmission fluid:

- Manual transmission (see **TRANSMISSION FLUID INSPECTION AND REPLACEMENT**).
- CVT (see **ATF REPLACEMENT**).

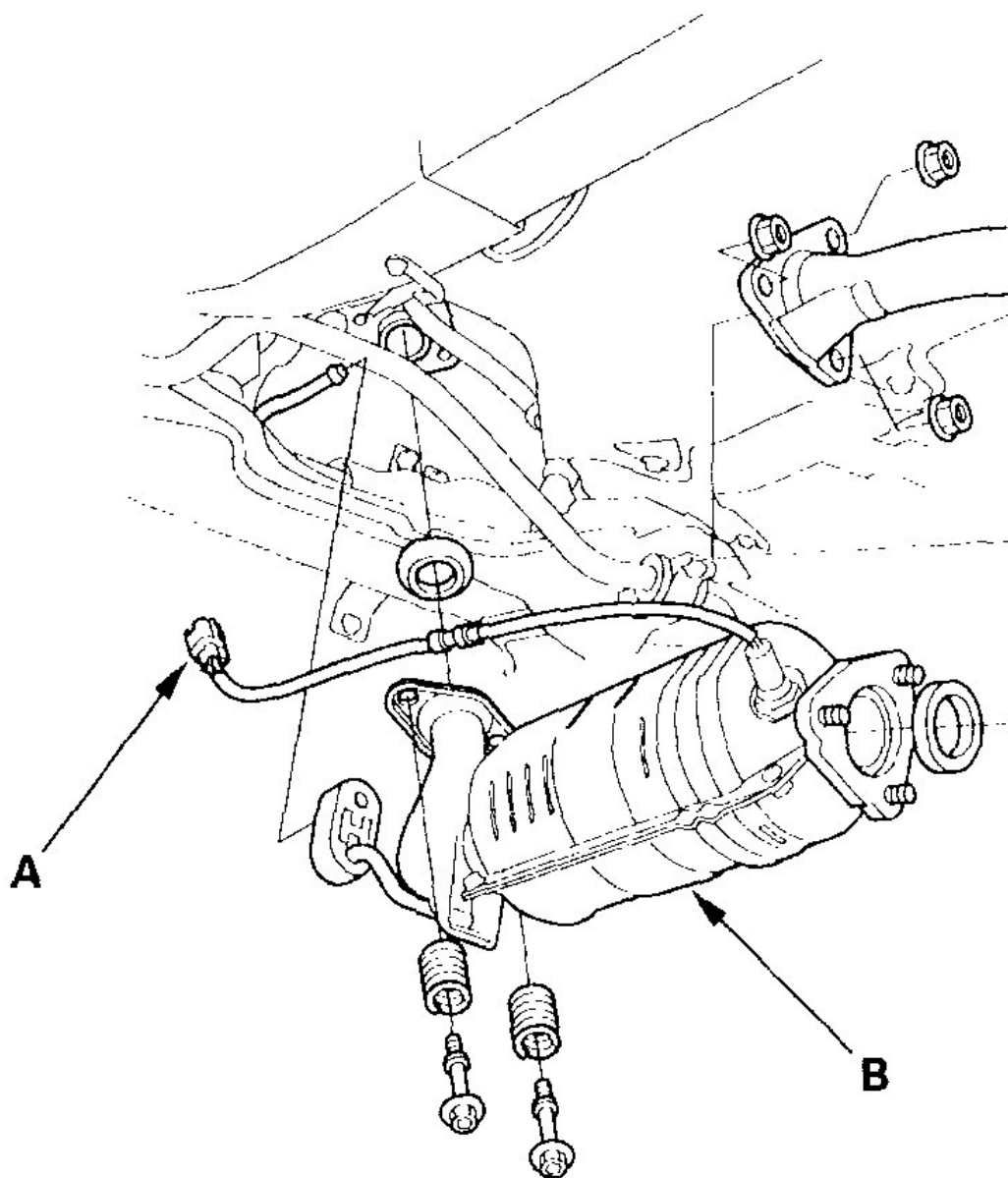
25. Remove the bolt (A) and nut (B) securing the A/C compressor.



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Fig. 9: Removing Bolt & Nut Securing A/C Compressor
Courtesy of AMERICAN HONDA MOTOR CO., INC.

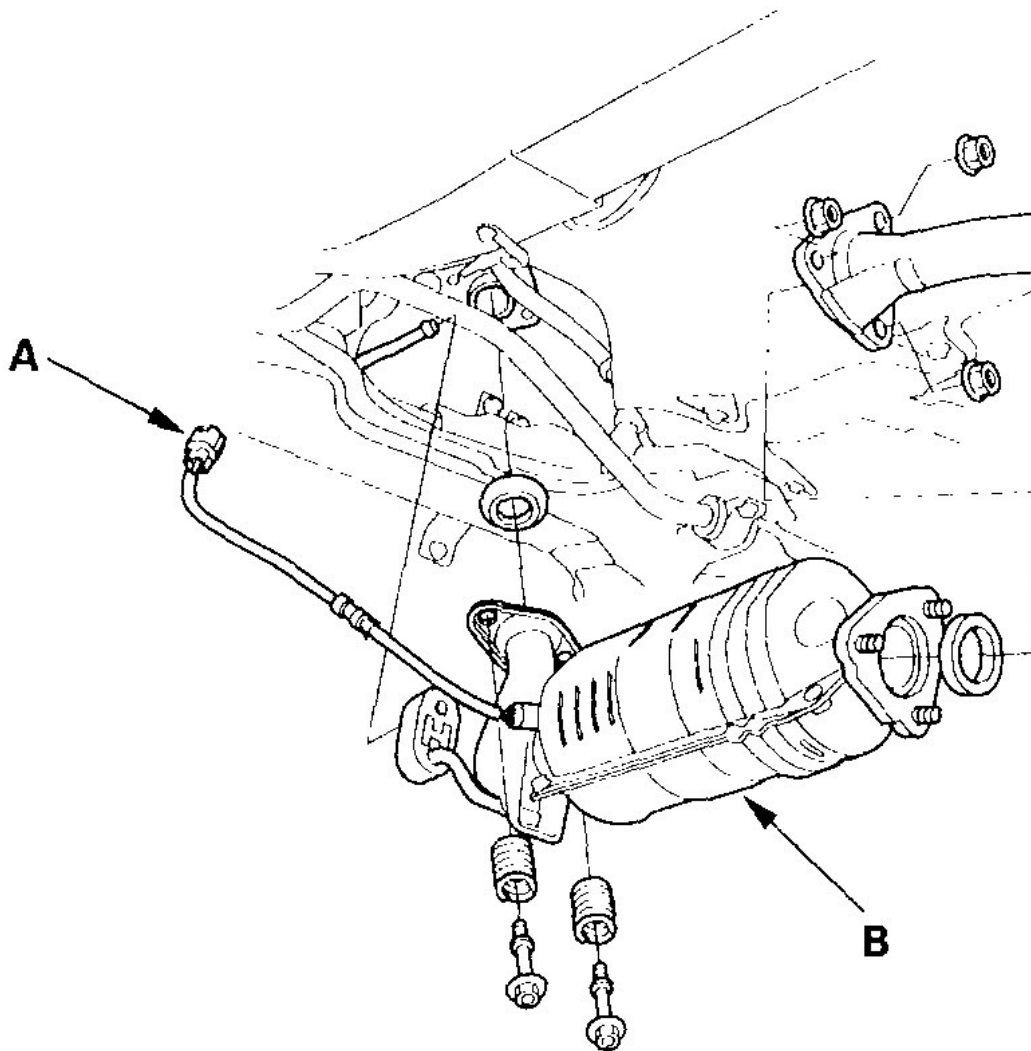
26. Remove the stud bolt (C), then remove the A/C compressor (D) without disconnecting the A/C hoses.
27. **Except SULEV model:** Disconnect the third heated oxygen sensor (third HO2S) connector (A), then remove the NOx adsorptive three way catalytic converter (NOx adsorptive TWC) (B).



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Fig. 10: Disconnecting Third HO2S Connector
Courtesy of AMERICAN HONDA MOTOR CO., INC.

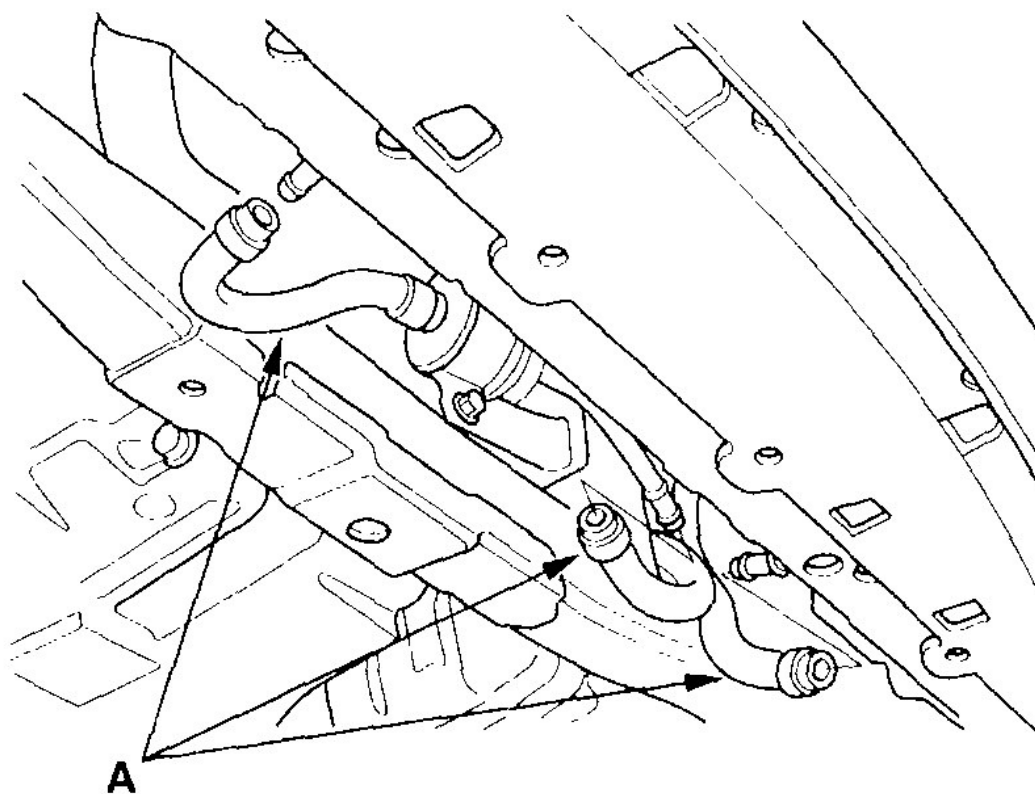
28. **SULEV model:** Disconnect the secondary heated oxygen sensor (secondary HO2S) connector (A), then remove the three way catalytic converter (TWC) (B).



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Fig. 11: Disconnecting Secondary HO2S Connector
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

29. Drain the engine oil (see **ENGINE OIL REPLACEMENT**).
30. Disconnect the stabilizer link (see **STABILIZER LINK**).
31. Disconnect the suspension lower arm ball joints (see **LOWER ARM**).
32. Remove the driveshafts (see **AXLE SHAFTS**). Coat all precision finished surfaces with clean engine oil. Tie plastic bags over the driveshaft ends.
33. Remove the automatic transmission fluid (ATF) cooler hoses (A), then plug the ATF cooler hoses and lines (CVT).



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Fig. 12: Removing ATF Cooler Hoses

Courtesy of AMERICAN HONDA MOTOR CO., INC.

34. Remove the lower radiator hose joint pipe from the oil pan.

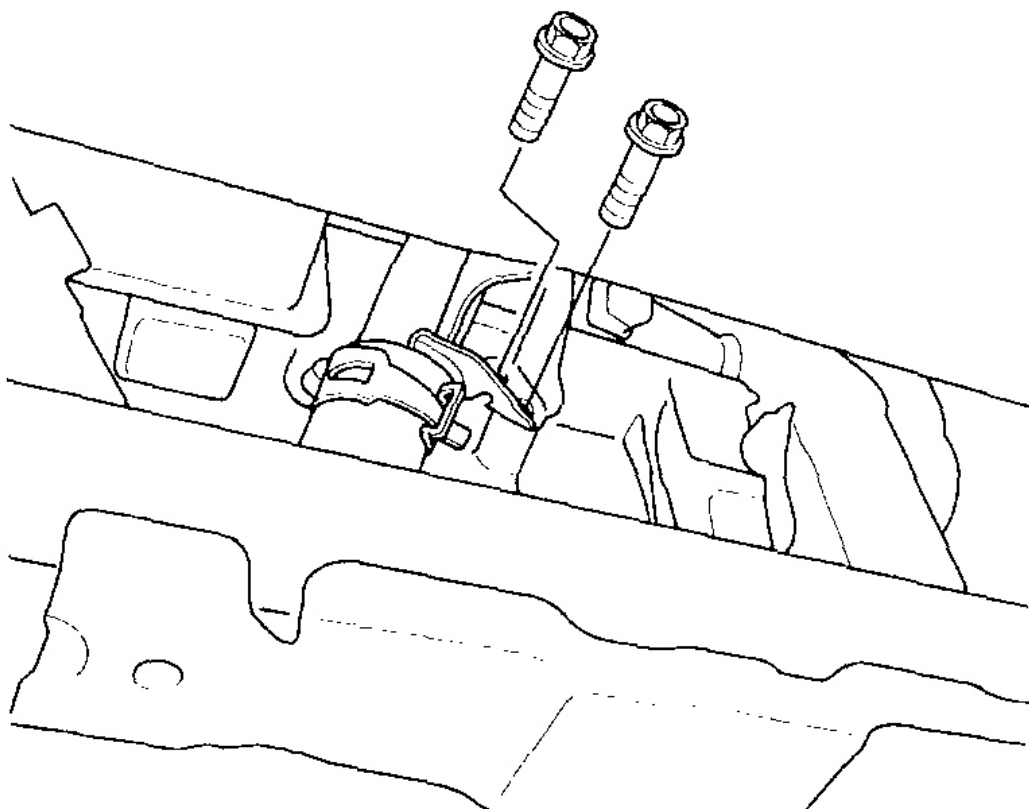
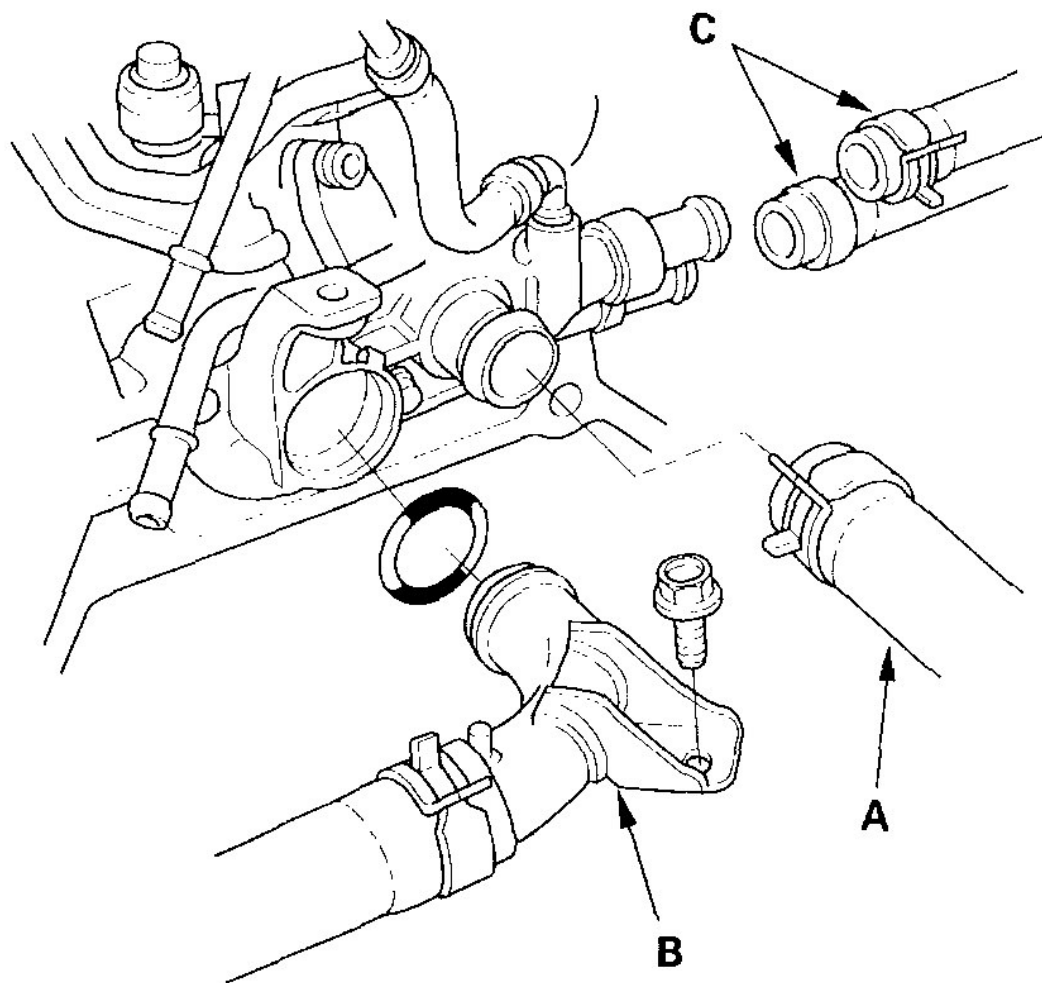
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Fig. 13: Removing Lower Radiator Hose Joint Pipe From Oil Pan
Courtesy of AMERICAN HONDA MOTOR CO., INC.

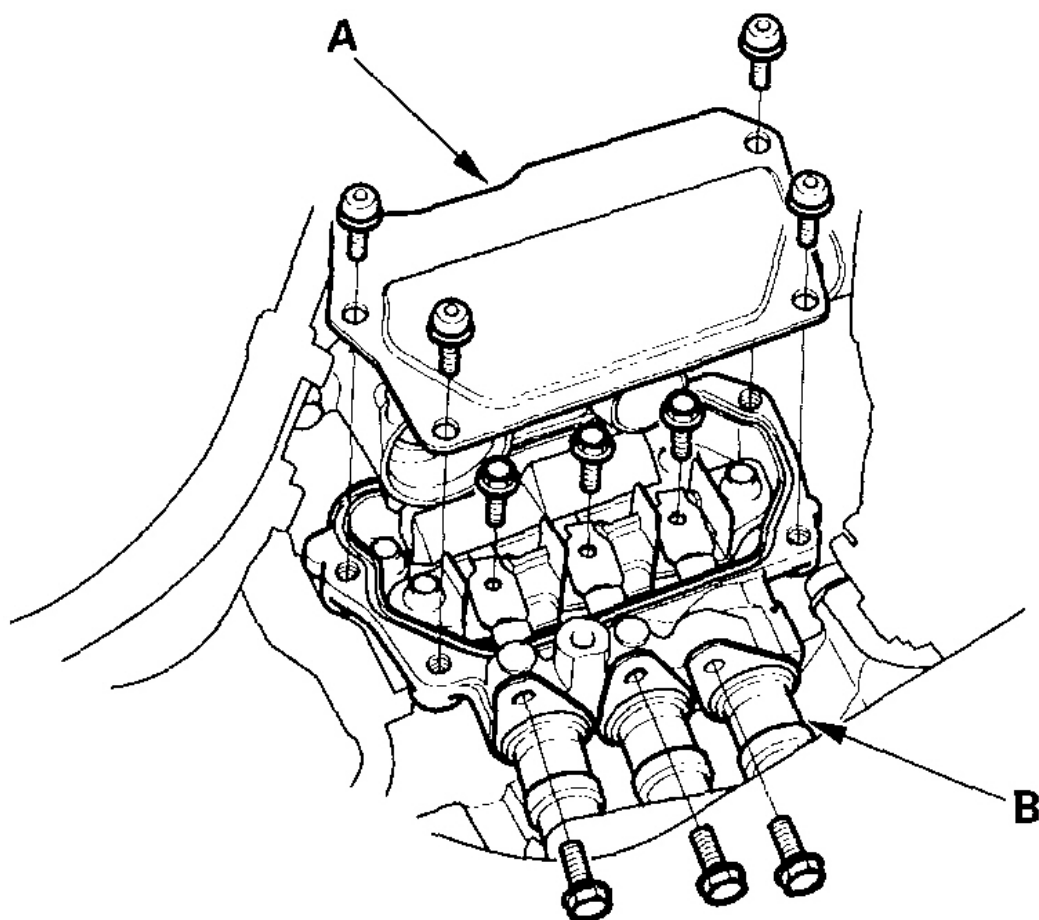
35. Lower the vehicle on the hoist.
36. Remove the upper radiator hose (A), lower radiator hose joint (B) and heater hoses (C).



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Fig. 14: Removing Upper Radiator Hose
Courtesy of AMERICAN HONDA MOTOR CO., INC.

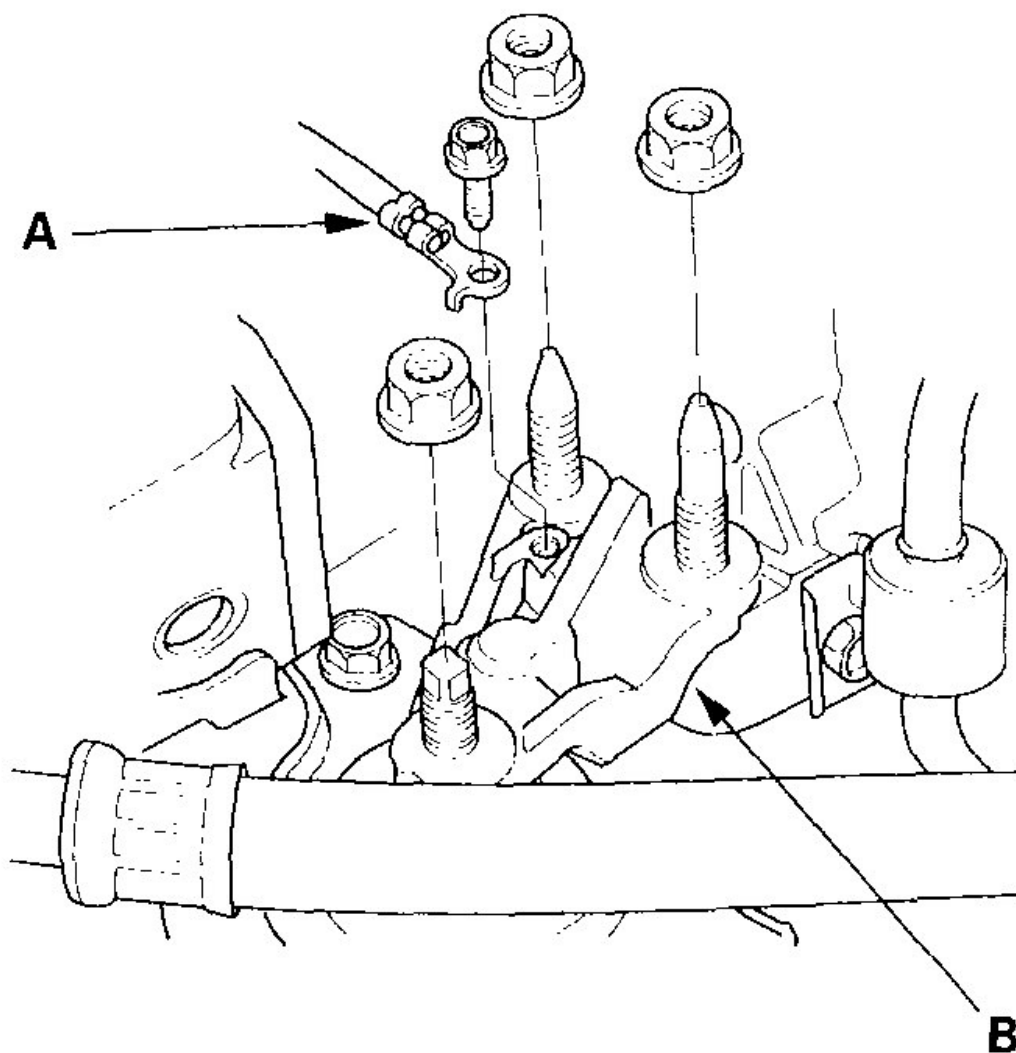
37. Remove the cover (A) and motor power cable (B).



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Fig. 15: Removing Cover & Motor Power Cable
Courtesy of AMERICAN HONDA MOTOR CO., INC.

38. Remove the ground cable (A), then remove the upper bracket (B).



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Fig. 16: Removing Ground Cable

Courtesy of AMERICAN HONDA MOTOR CO., INC.

39. Attach the chain hoist to the engine as shown.

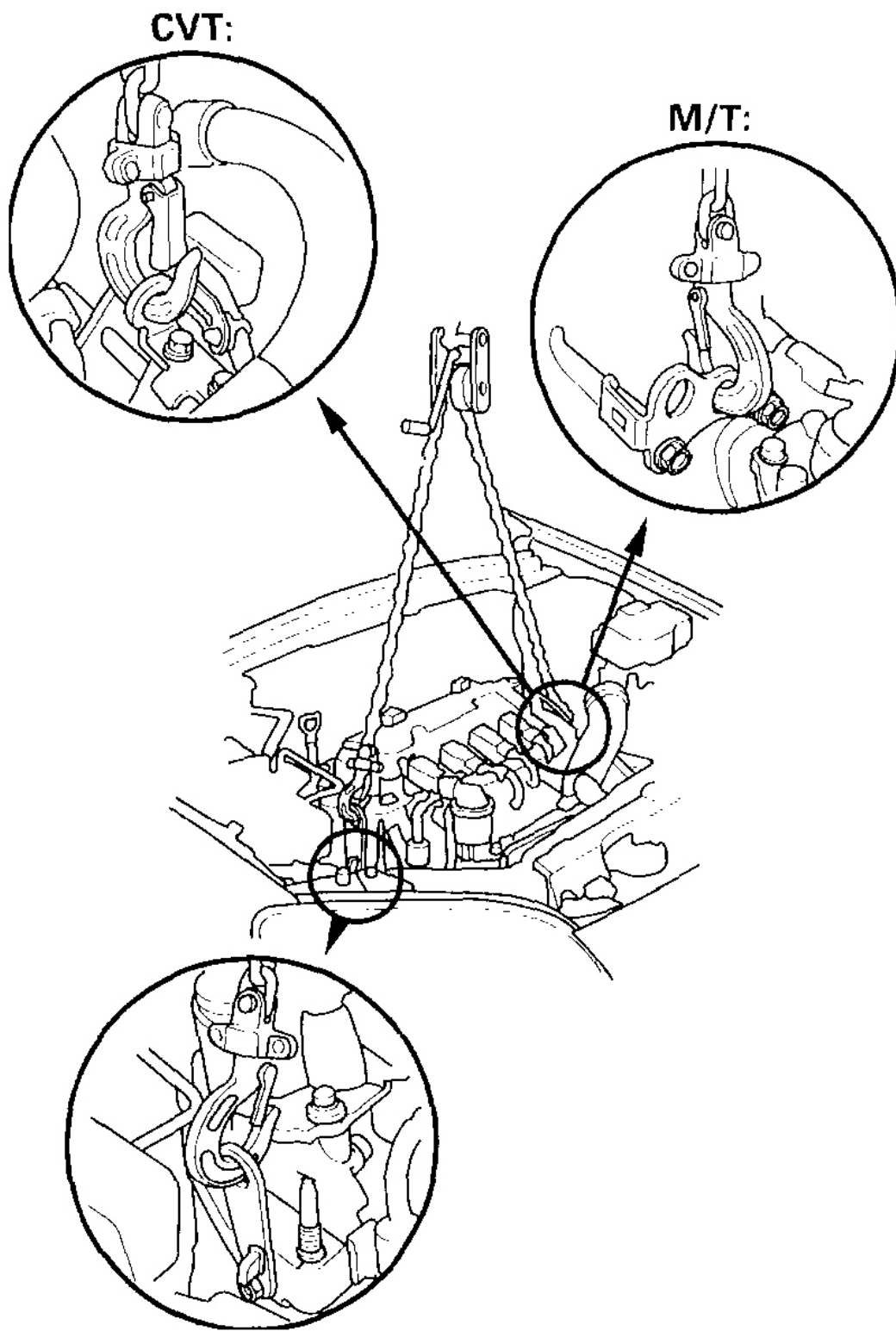
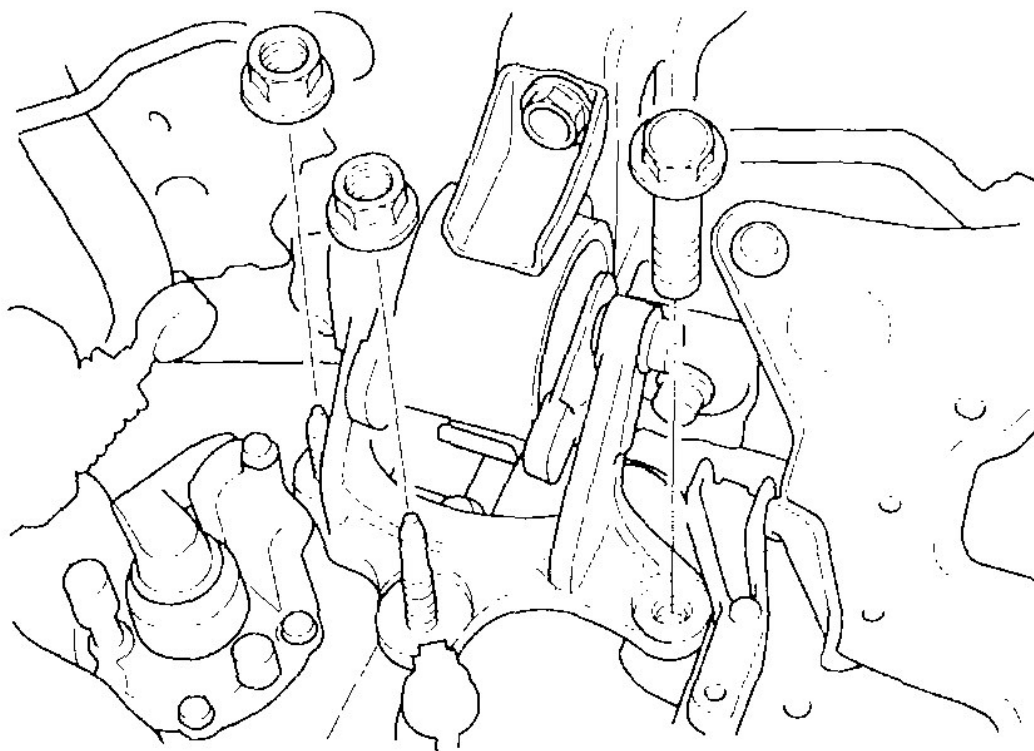


Fig. 17: Attaching Chain Hoist To Engine

Courtesy of AMERICAN HONDA MOTOR CO., INC.

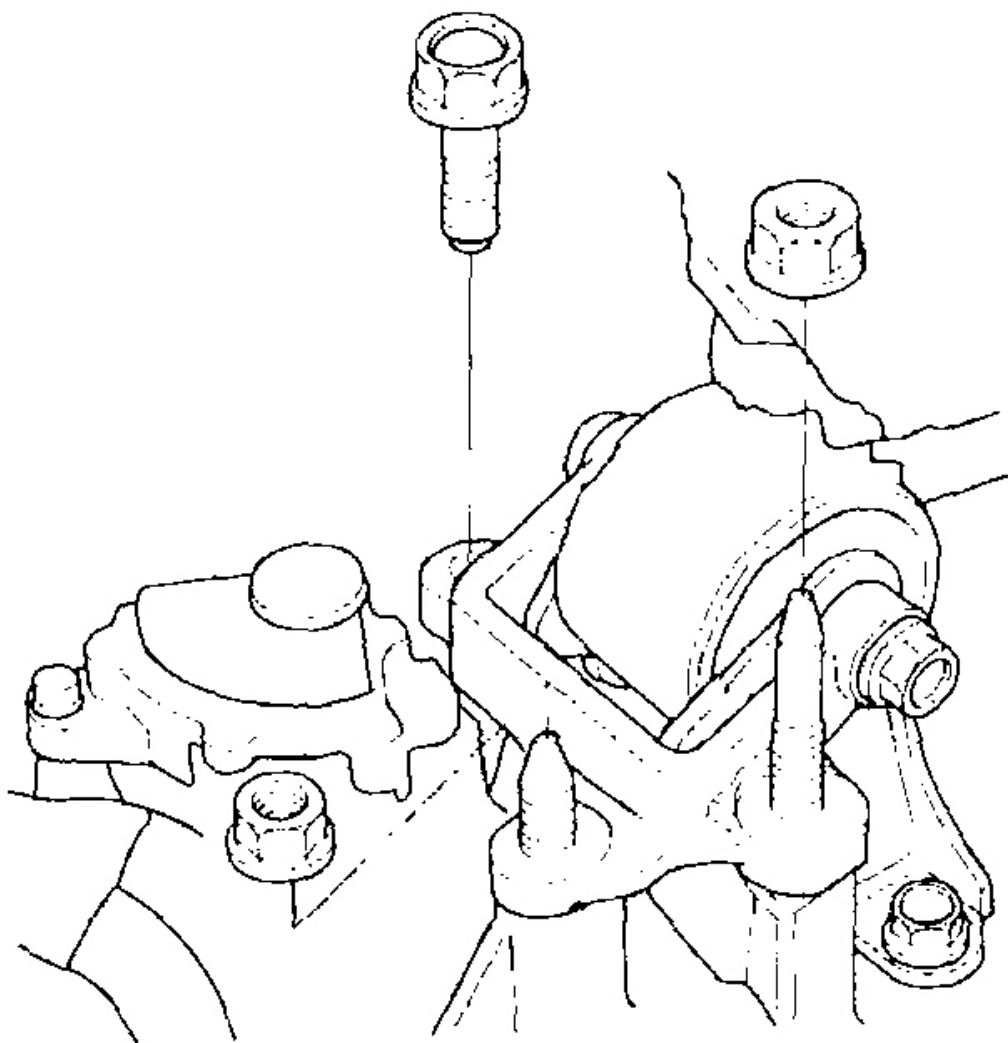
40. Remove the transmission mount bracket support bolt and nuts.



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Fig. 18: Removing Transmission Mount Bracket Support Bolt & Nuts (M/T)

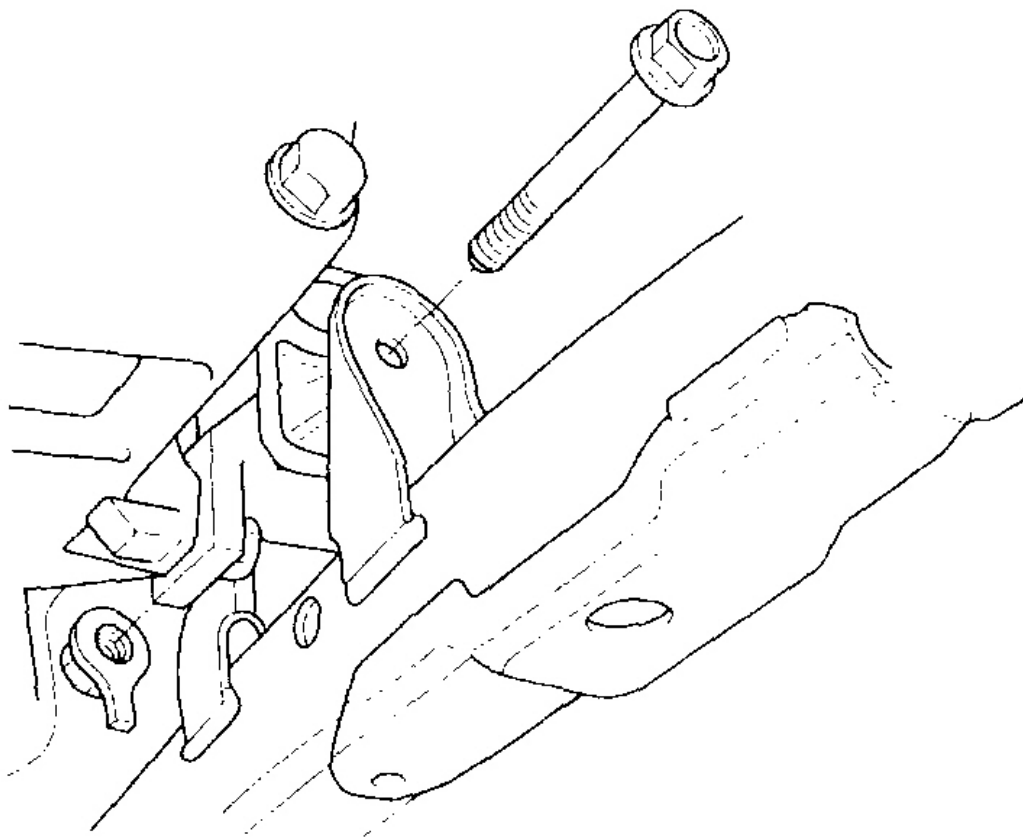
Courtesy of AMERICAN HONDA MOTOR CO., INC.



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Fig. 19: Removing Transmission Mount Bracket Support Bolt & Nuts (CVT)
Courtesy of AMERICAN HONDA MOTOR CO., INC.

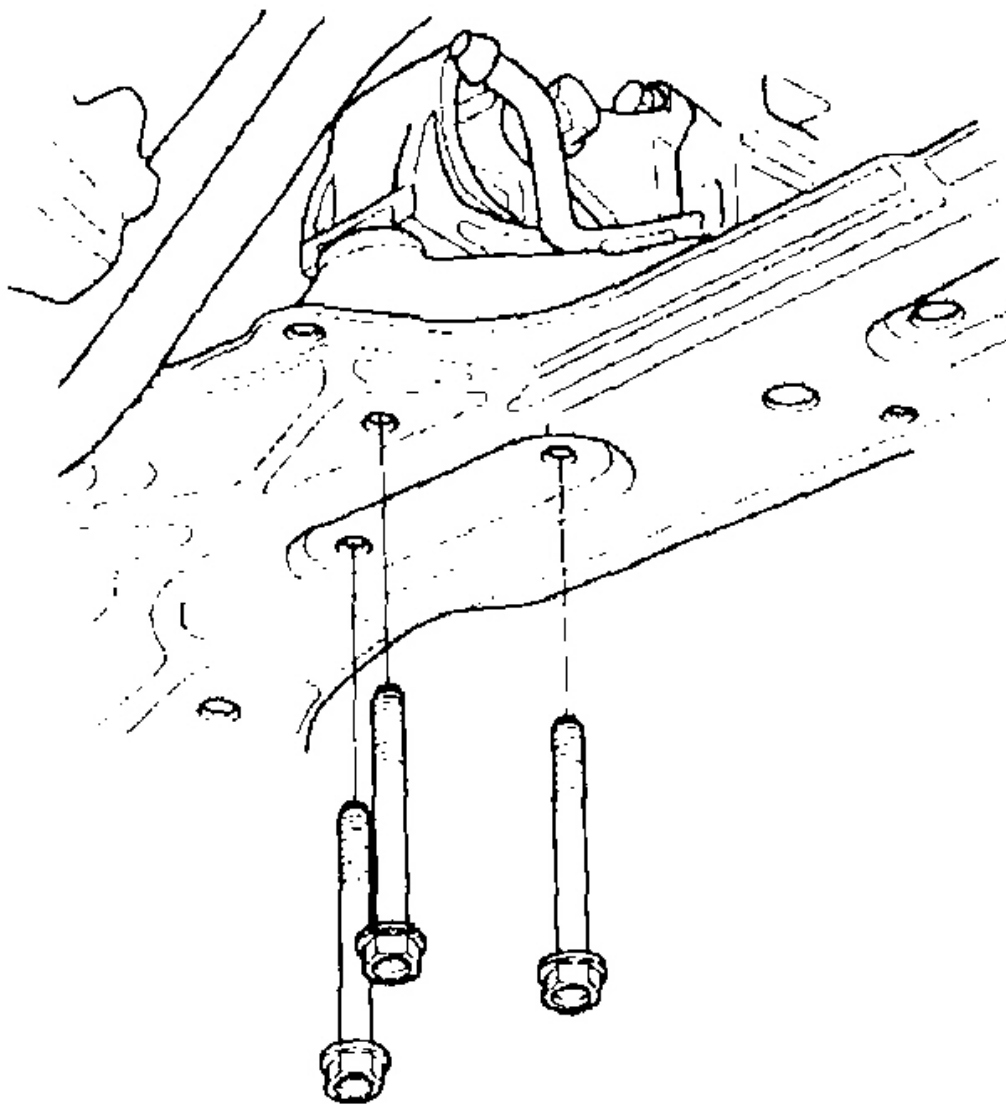
41. Make sure the hoist brackets are positioned properly. Raise the hoist to full height.
42. Remove the front mount mounting bolt.



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Fig. 20: Removing Front Mount Mounting Bolt
Courtesy of AMERICAN HONDA MOTOR CO., INC.

43. Remove the rear mount mounting bolts.



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Fig. 21: Removing Rear Mount Mounting Bolts
Courtesy of AMERICAN HONDA MOTOR CO., INC.

44. Use a marker to make alignment marks on the reference lines (A) that align with the centers (B) of the subframe rear mounting bolts (C).

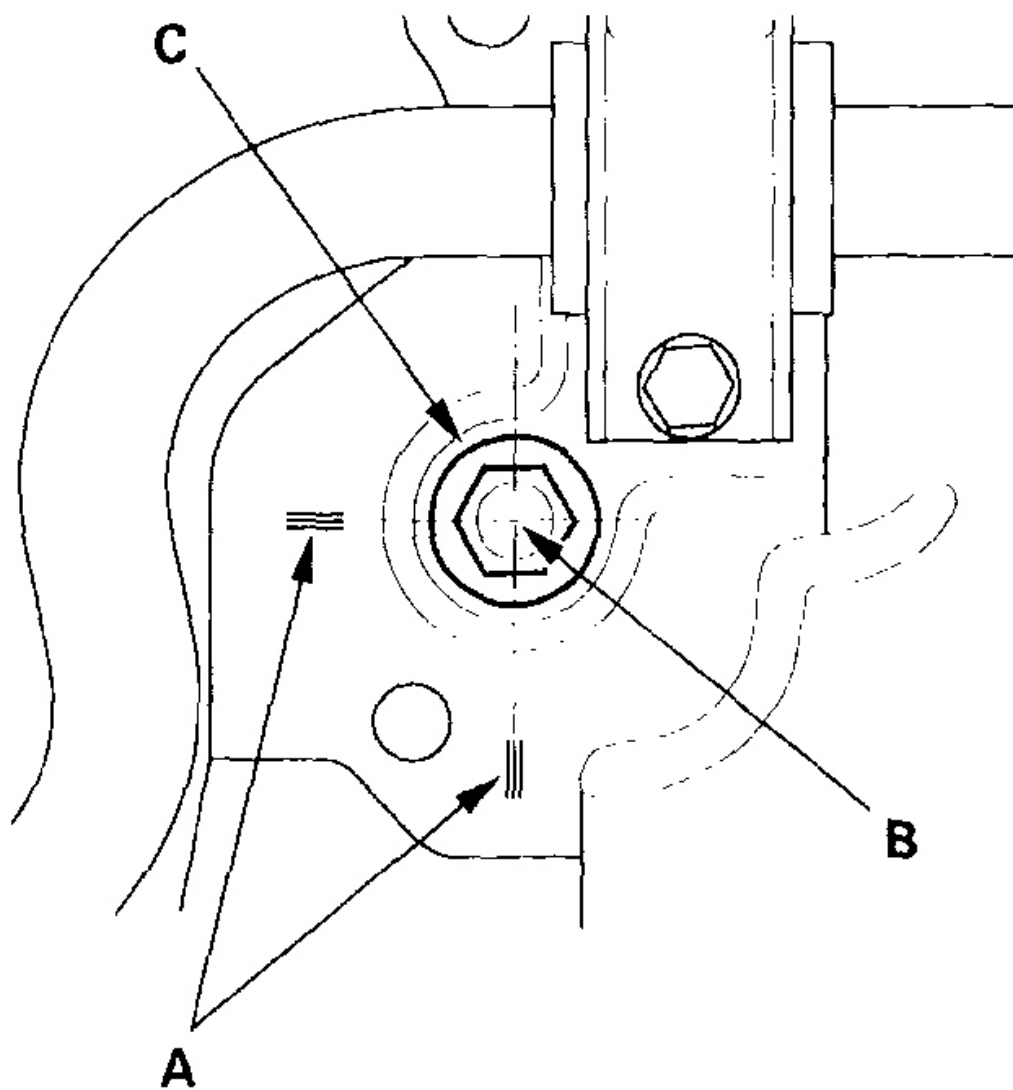
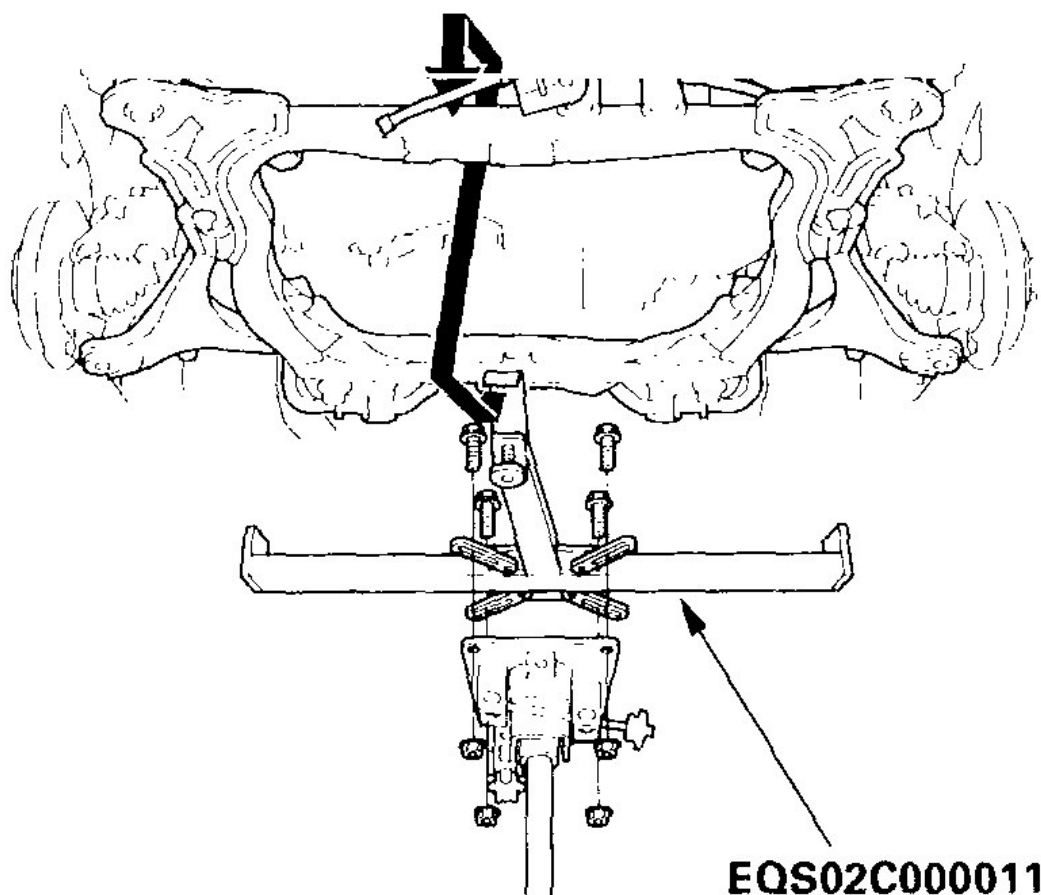
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Fig. 22: Making Alignment Marks On Reference Lines
Courtesy of AMERICAN HONDA MOTOR CO., INC.

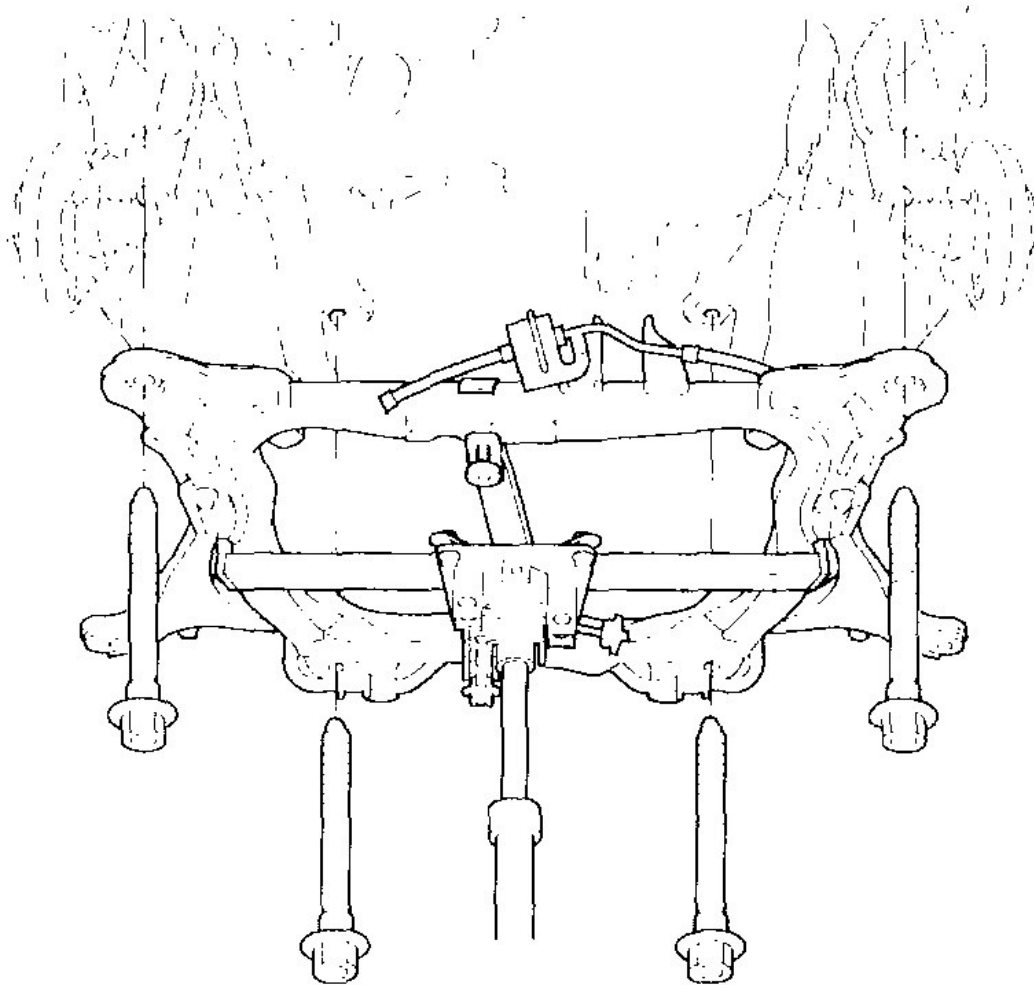
45. Attach the subframe adapter to the front of the subframe, then tighten the knurled knob.



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Fig. 23: Attaching Subframe Adapter To Front Of Subframe
Courtesy of AMERICAN HONDA MOTOR CO., INC.

46. Raise the jack. Line up the slots in the arms with the bolt holes on the corner of the jack base, then attach the adapter to the jack base with the bolts.
47. Remove the front subframe.

**G01431395****Fig. 24: Removing Front Subframe****Courtesy of AMERICAN HONDA MOTOR CO., INC.**

48. Check that the engine/transmission is completely free of vacuum hoses, fuel and coolant hoses, and electrical wiring.
49. Slowly lower the engine about 150 mm (6 in.). Check once again that all hoses and wires are disconnected from the engine/transmission.
50. Lower the engine/transmission assembly all the way up. Remove the chain hoist from the engine.
51. Remove the engine/transmission assembly from under the vehicle.

ENGINE INSTALLATION

Special Tools Required

Front subframe adapter EQS02C000011

1. Install the accessory bracket, and tighten the bolts and nut to the specified torques.

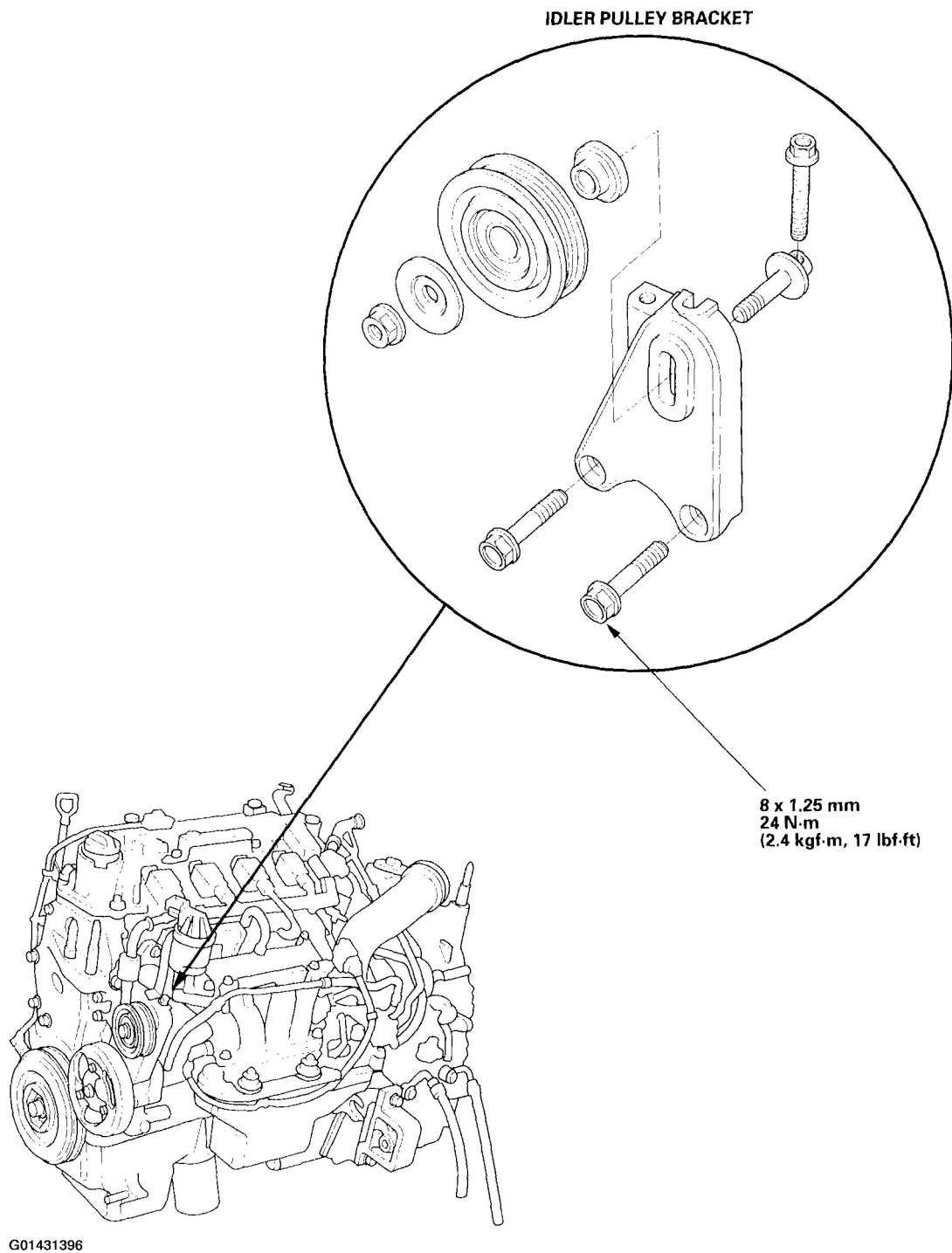


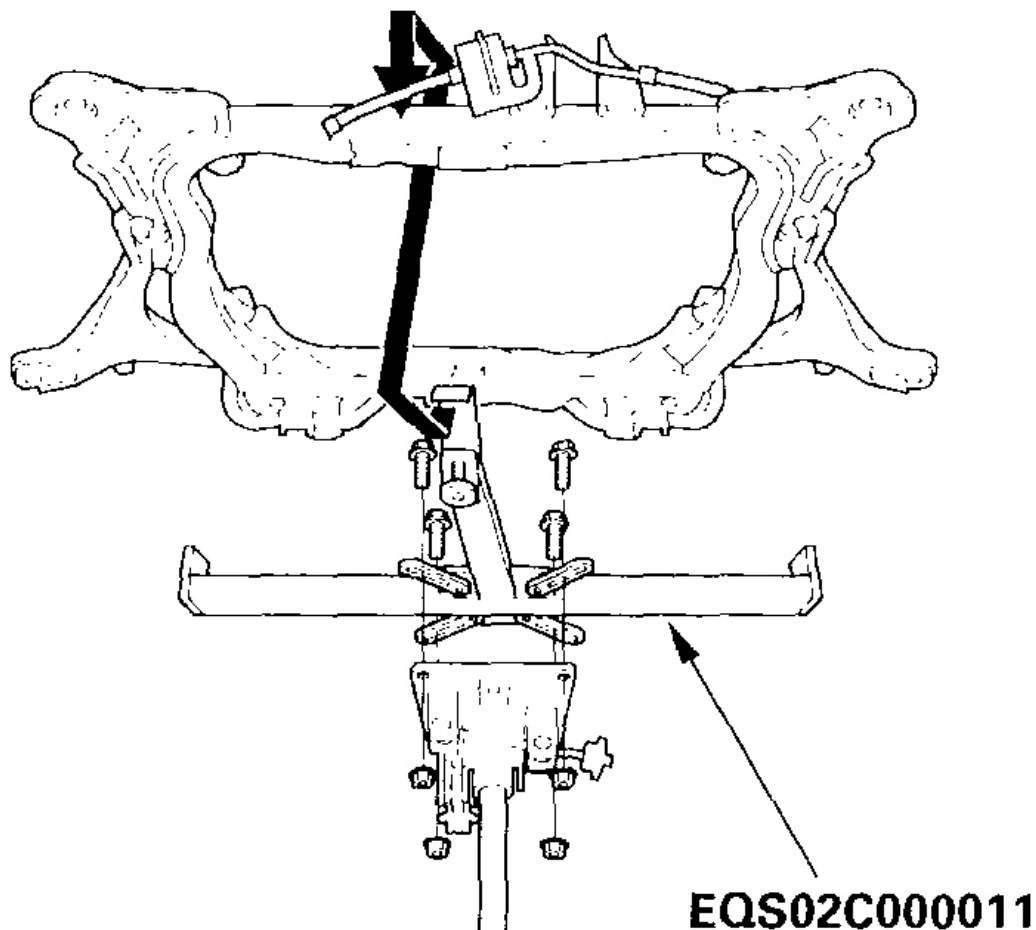
Fig. 25: Installing Accessory Bracket

Courtesy of AMERICAN HONDA MOTOR CO., INC.

2. Position the engine/transmission assembly under the vehicle. Attach the chain hoist to the engine, then lift the engine into position in the vehicle.

NOTE: Reinstall the mounting bolts/support nuts in the sequence given. Failure to follow this sequence may cause excessive noise and vibration, and reduce bushing life.

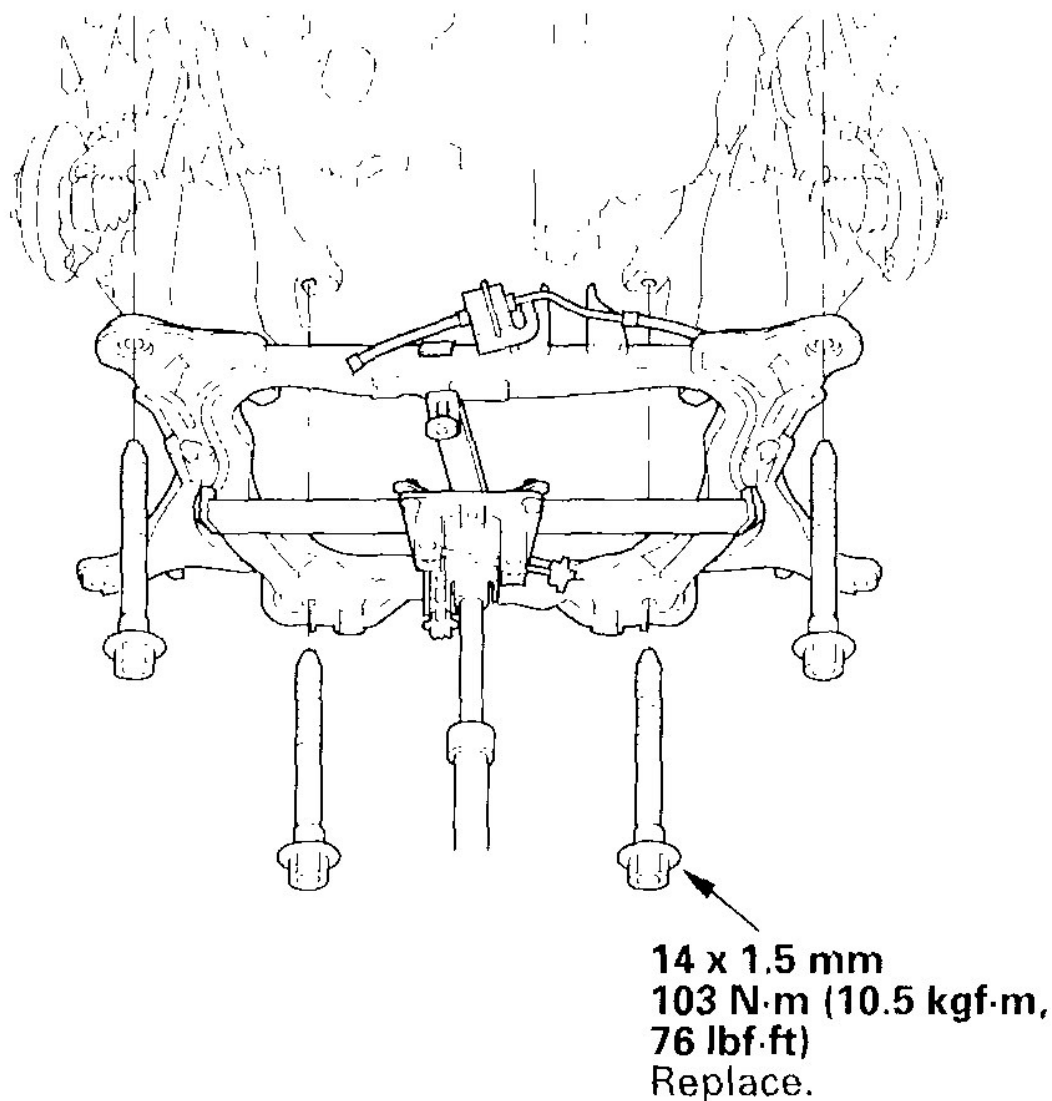
3. Support the subframe with the subframe adapter and a jack.



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Fig. 26: Supporting Subframe With Subframe Adapter & Jack
Courtesy of AMERICAN HONDA MOTOR CO., INC.

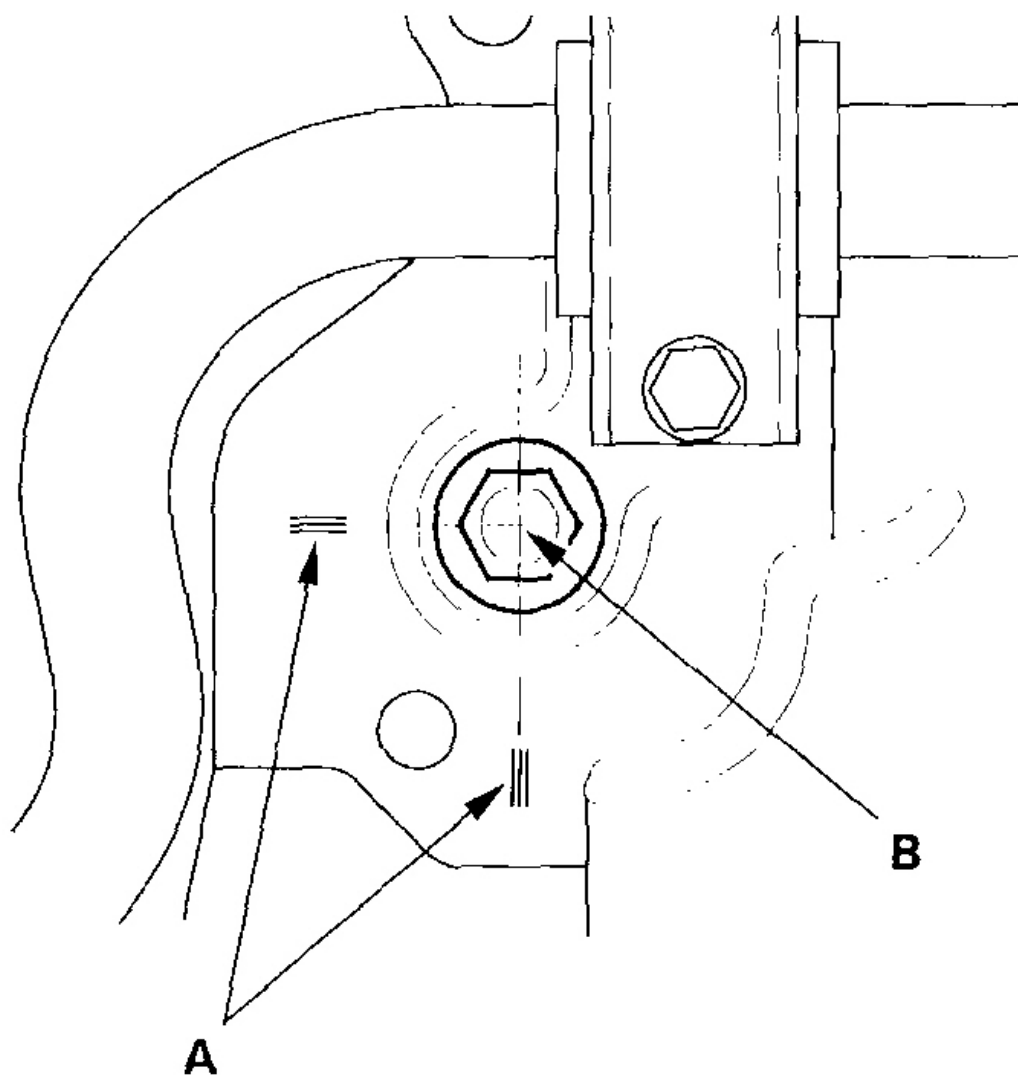
4. Loosely install the subframe mounting bolts.



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Fig. 27: Loosely Installing Subframe Mounting Bolts
Courtesy of AMERICAN HONDA MOTOR CO., INC.

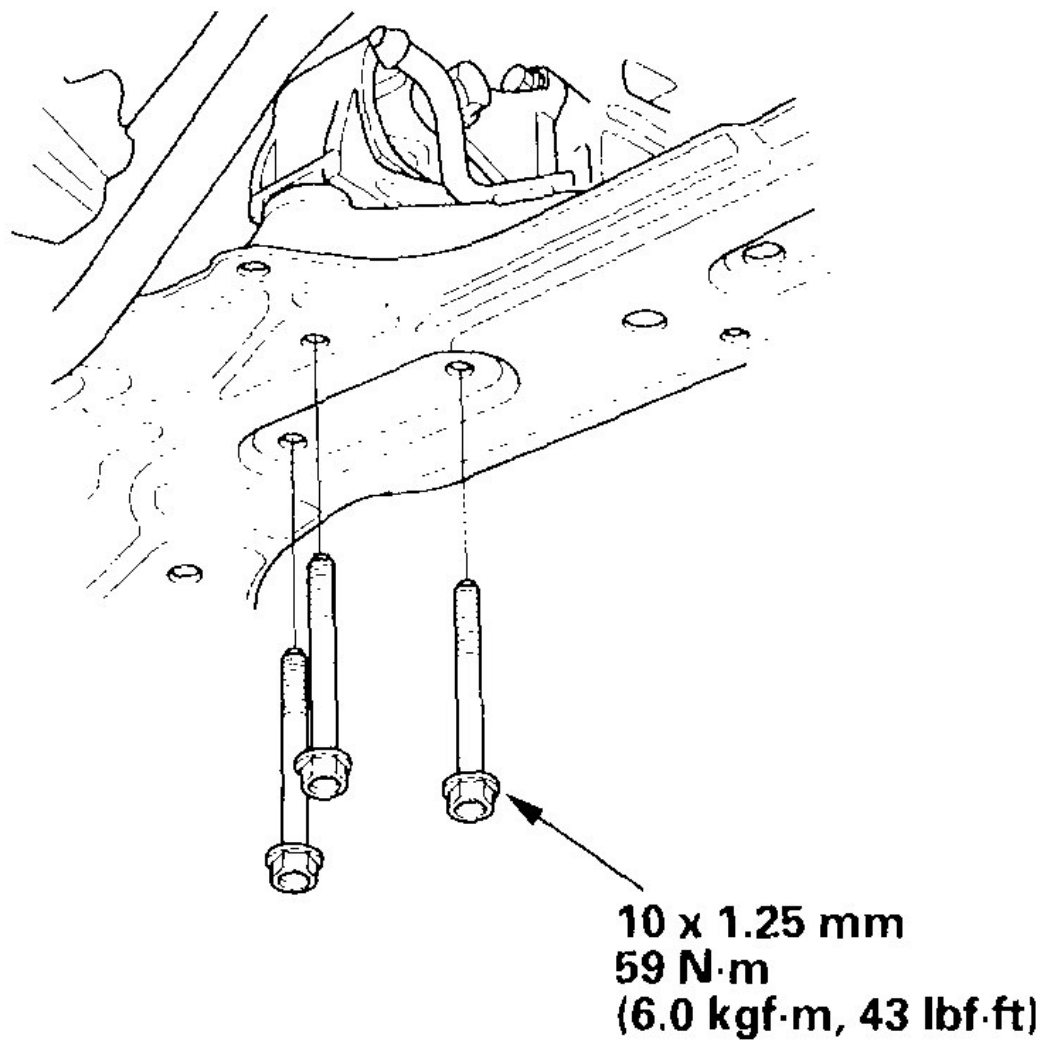
5. Align the reference marks (A) that you made on the subframe with the center (B) of the bolt heads, then tighten the bolts to the specified torque.



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Fig. 28: Aligning Reference Marks On Subframe With Center Of Bolt Heads
Courtesy of AMERICAN HONDA MOTOR CO., INC.

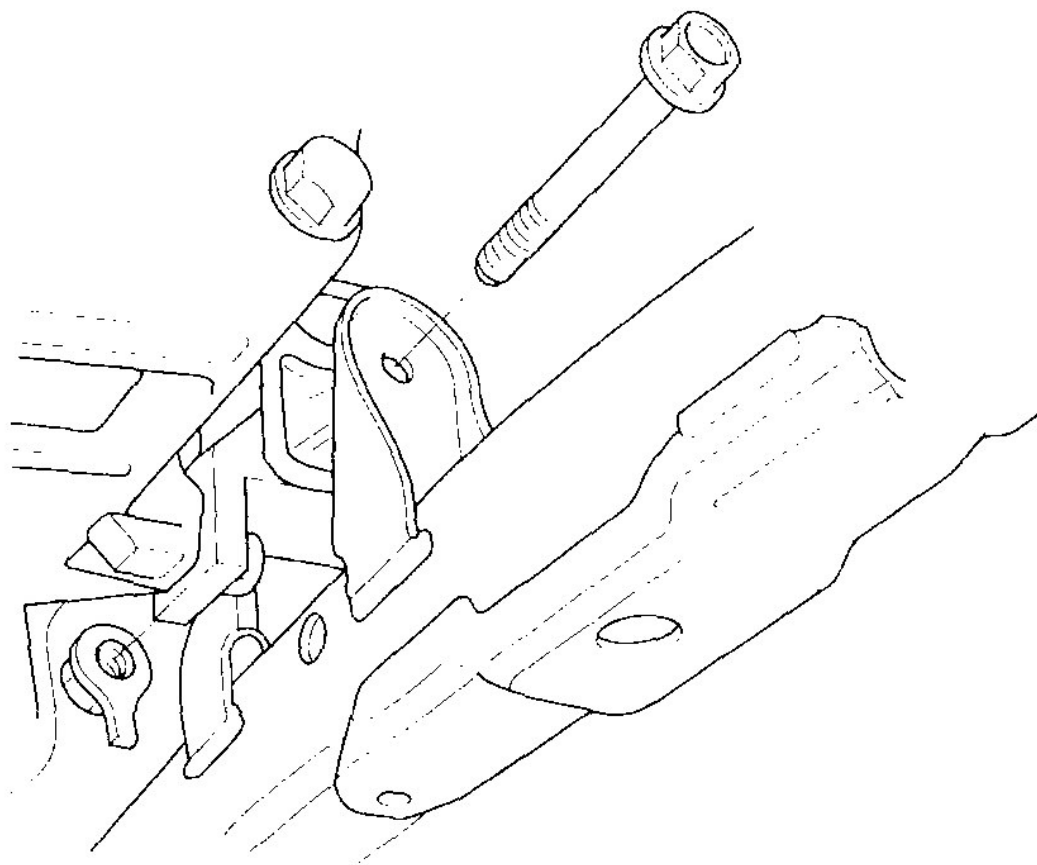
6. Remove the subframe adapter.
7. Tighten the rear mount mounting bolts.



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Fig. 29: Tightening Rear Mount Mounting Bolts
Courtesy of AMERICAN HONDA MOTOR CO., INC.

8. Loosely install the front mount mounting bolt.

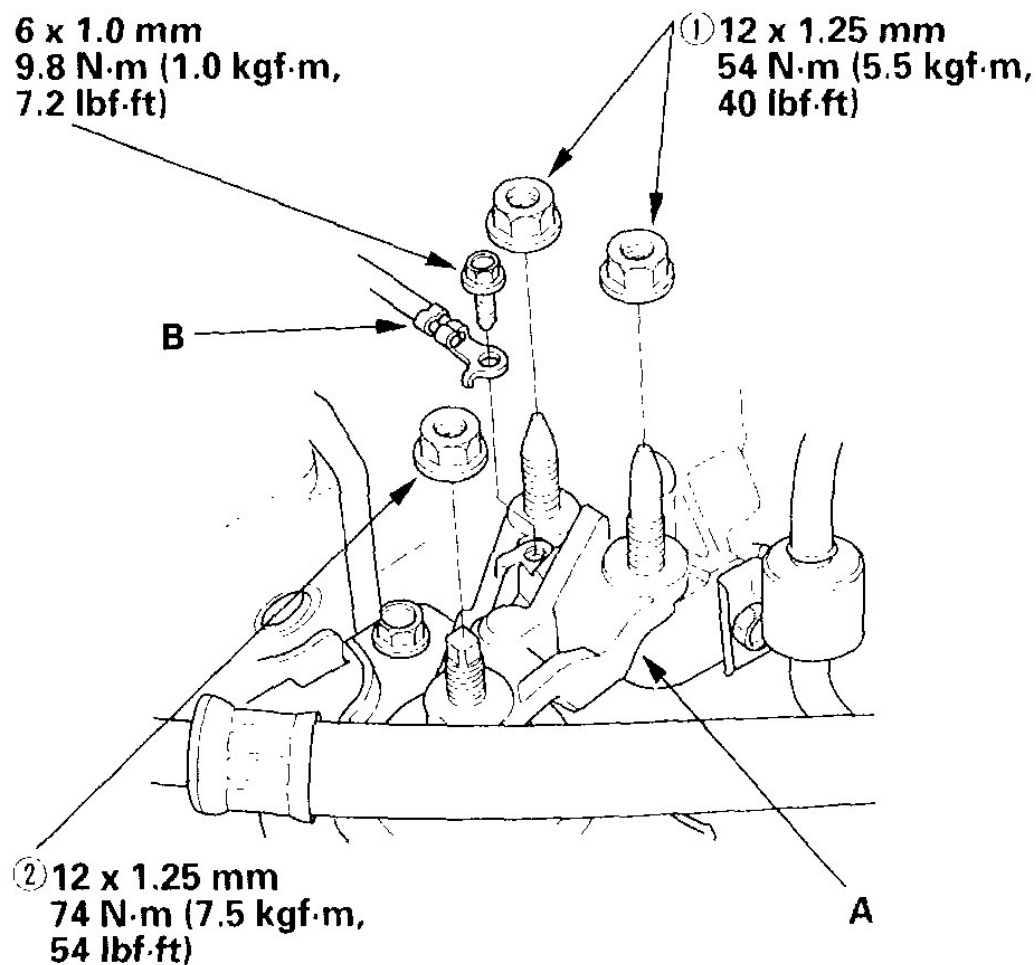


9. Lower the hoist.

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Fig. 30: Loosely Installing Front Mount Mounting Bolt
Courtesy of AMERICAN HONDA MOTOR CO., INC.

9. Lower the hoist.
10. Install the upper bracket (A), then tighten the mounting nuts in the numbered sequence shown.



11. Install the ground cable (B).

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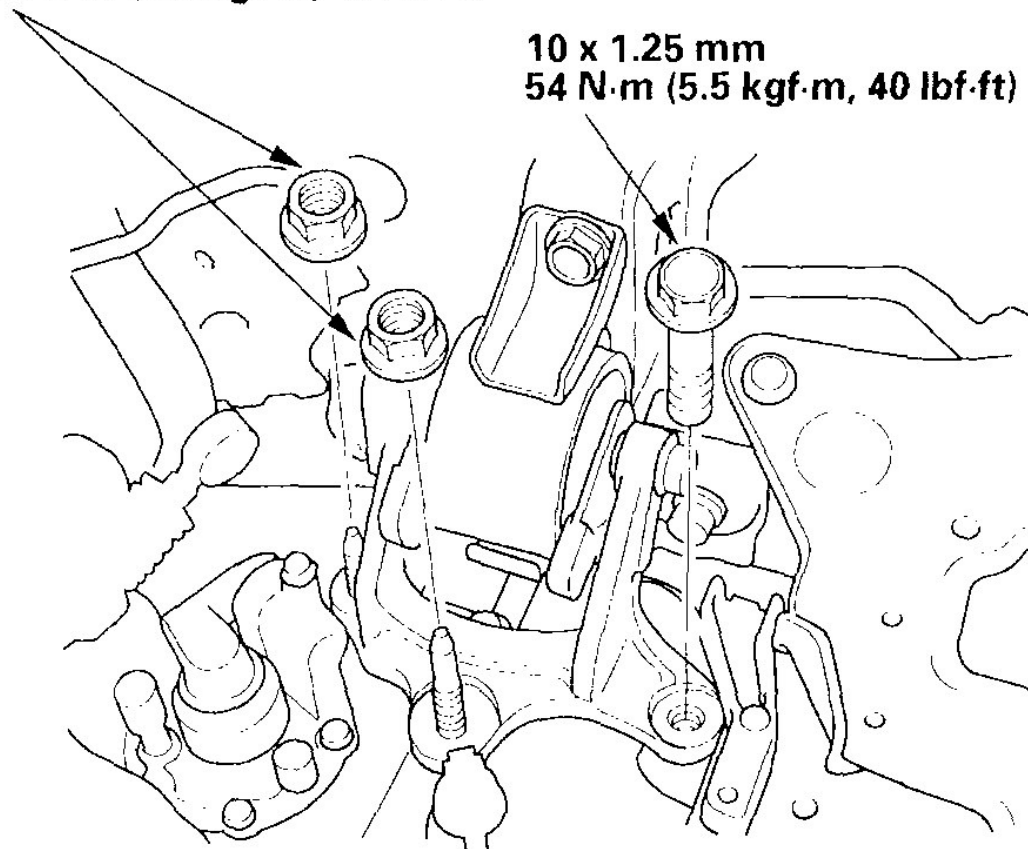
Fig. 31: Installing Upper Bracket

Courtesy of AMERICAN HONDA MOTOR CO., INC.

11. Install the ground cable (B).
12. Tighten the transmission mount bracket support bolt and nuts.

12 x 1.25 mm
54 N·m (5.5 kgf·m, 40 lbf·ft)

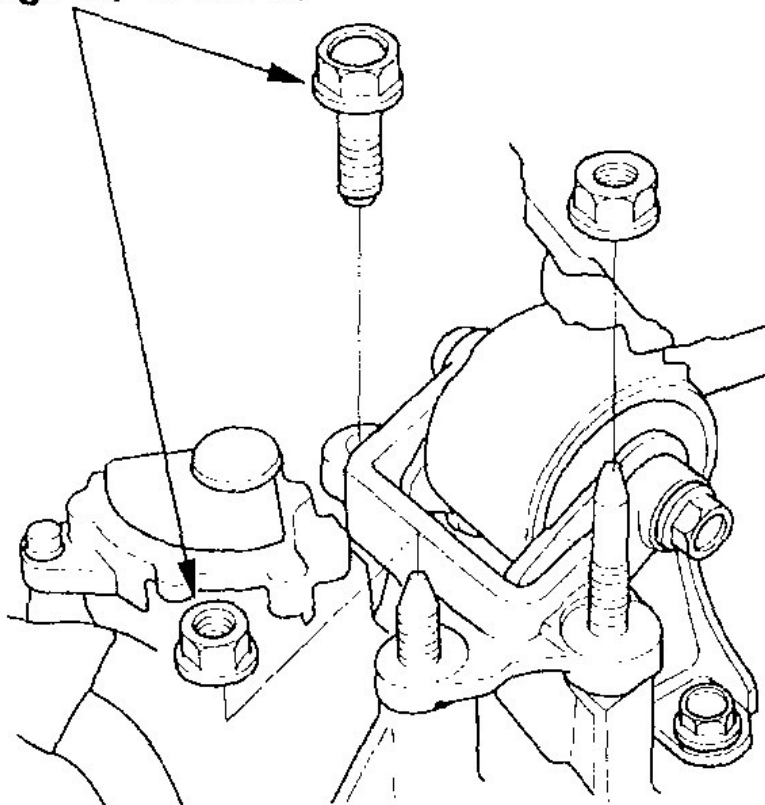
10 x 1.25 mm
54 N·m (5.5 kgf·m, 40 lbf·ft)



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Fig. 32: Tightening Transmission Mount Bracket Support Bolt & Nuts (M/T)
Courtesy of AMERICAN HONDA MOTOR CO., INC.

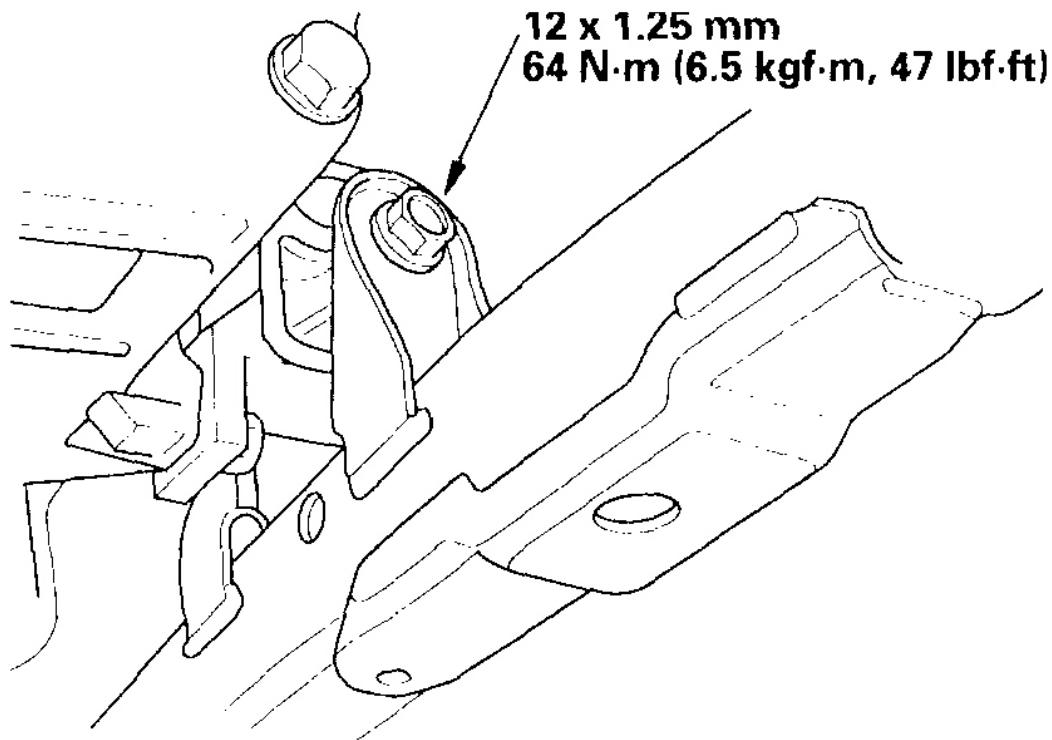
**12 x 1.25 mm
54 N·m (5.5 kgf·m, 40 lbf·ft)**



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Fig. 33: Tightening Transmission Mount Bracket Support Bolt & Nuts (CVT)
Courtesy of AMERICAN HONDA MOTOR CO., INC.

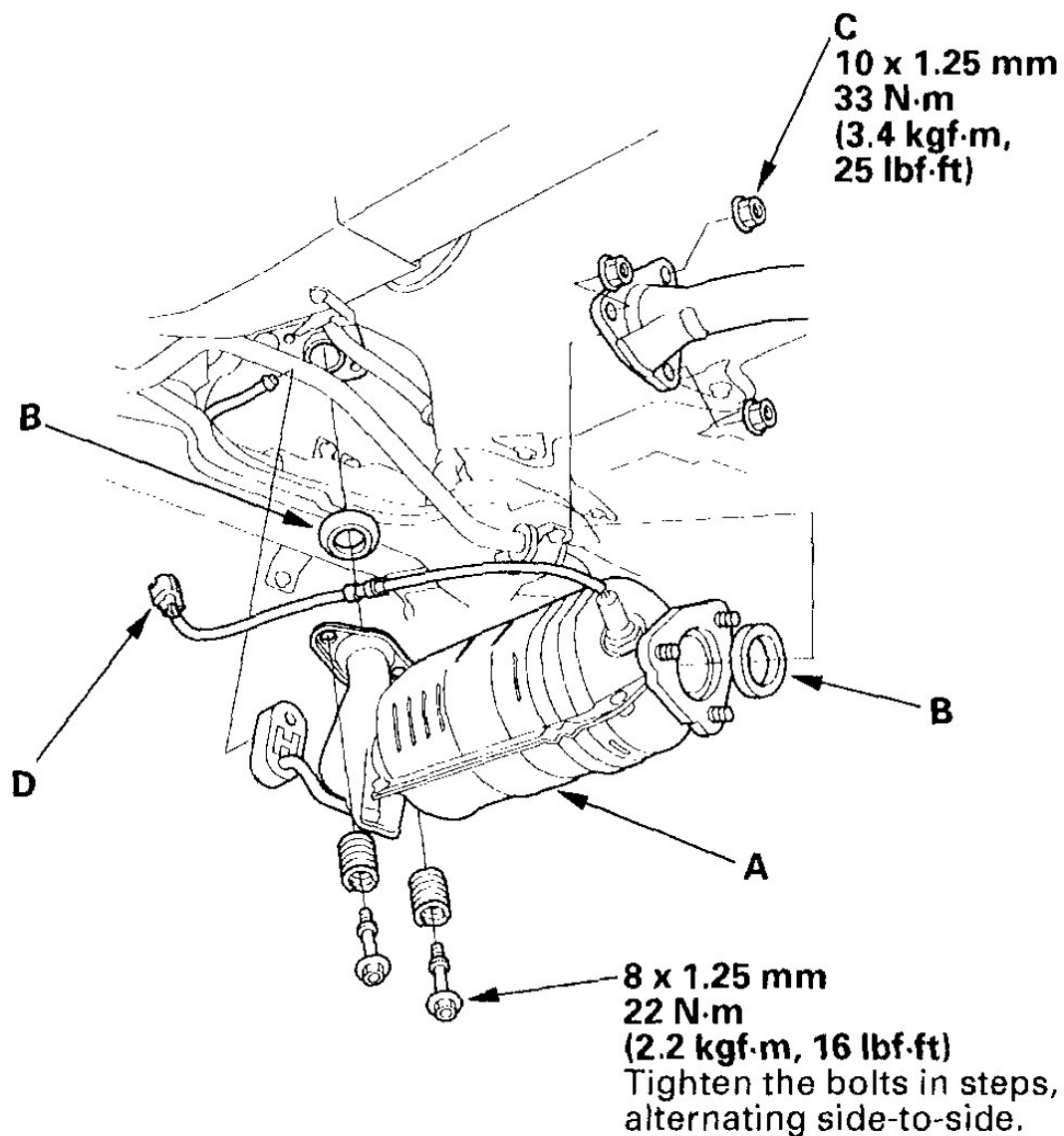
13. Tighten the front mount mounting bolt.



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Fig. 34: Tightening Front Mount Mounting Bolt
Courtesy of AMERICAN HONDA MOTOR CO., INC.

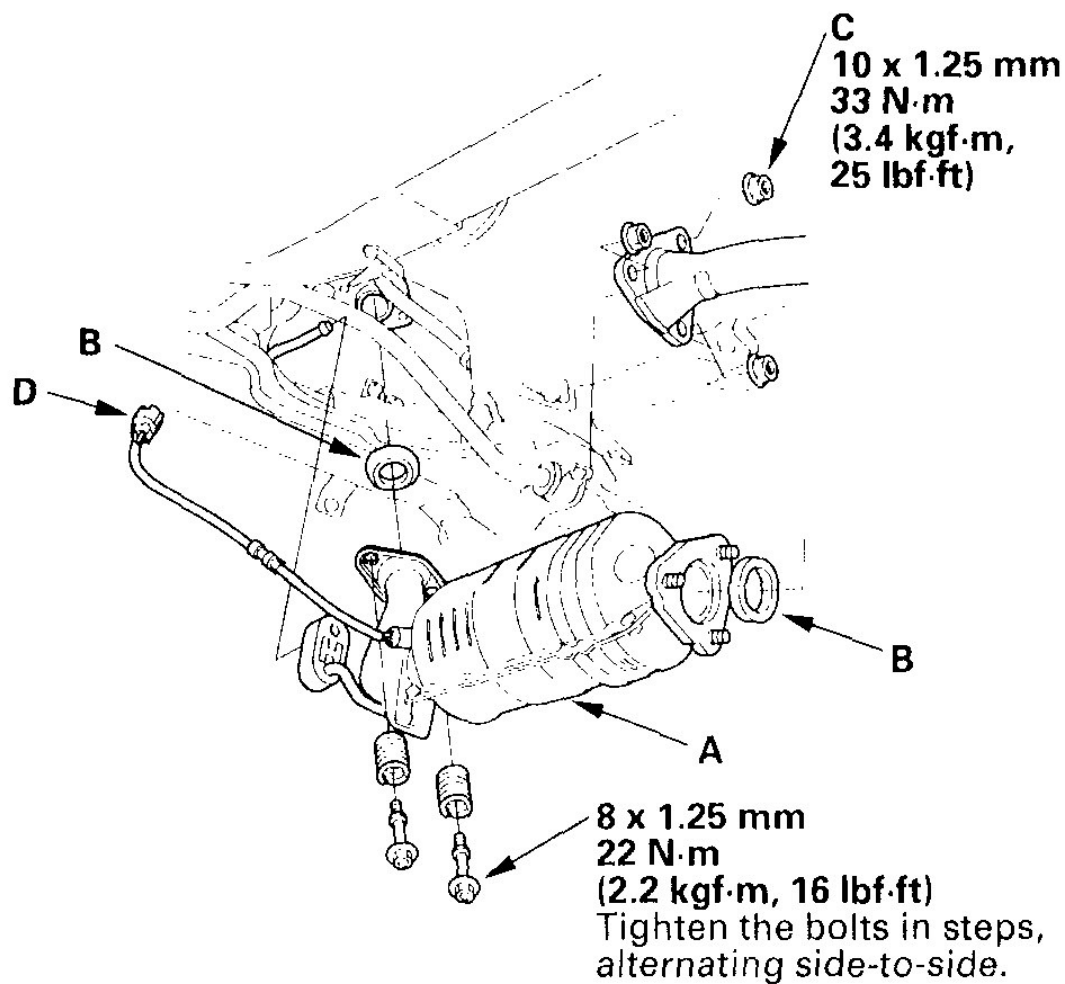
14. Remove the chain hoist from the engine.
15. Raise the hoist to full height.
16. Install a new spring clip on the end of each driveshaft, then install the driveshafts. Make sure each clip "clicks" into place in the differential and intermediate shaft.
17. Connect the suspension lower arm ball joints (see **LOWER ARM**).
18. Connect the stabilizer links (see **STABILIZER LINK**).
19. **Except SULEV model:** Install the NOx adsorptive three way catalytic converter (NOx adsorptive TWC) (A); use new gaskets (B) and new self locking nuts (C).



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Fig. 35: Installing NOx Adsorptive TWC
Courtesy of AMERICAN HONDA MOTOR CO., INC.

20. **Except SULEV model:** Connect the third heated oxygen sensor (third HO2S) connector (D).
21. **SULEV model:** Install the three way catalytic converter (TWC) (A); use new gaskets (B) and new self locking nuts (C).

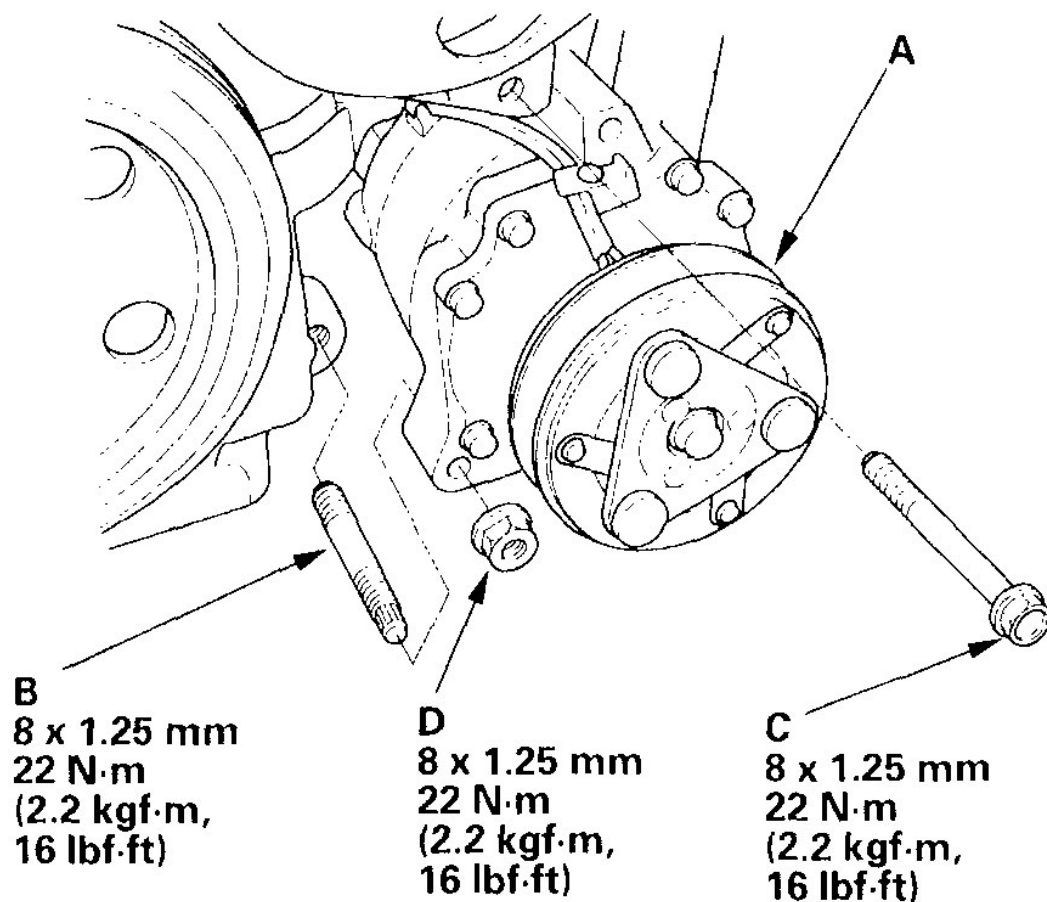


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Fig. 36: Installing TWC

Courtesy of AMERICAN HONDA MOTOR CO., INC.

22. **SULEV model:** Connect the secondary heated oxygen sensor (secondary HO2S) connector (D).
23. Install the A/C compressor (A), then install the stud bolt(B).

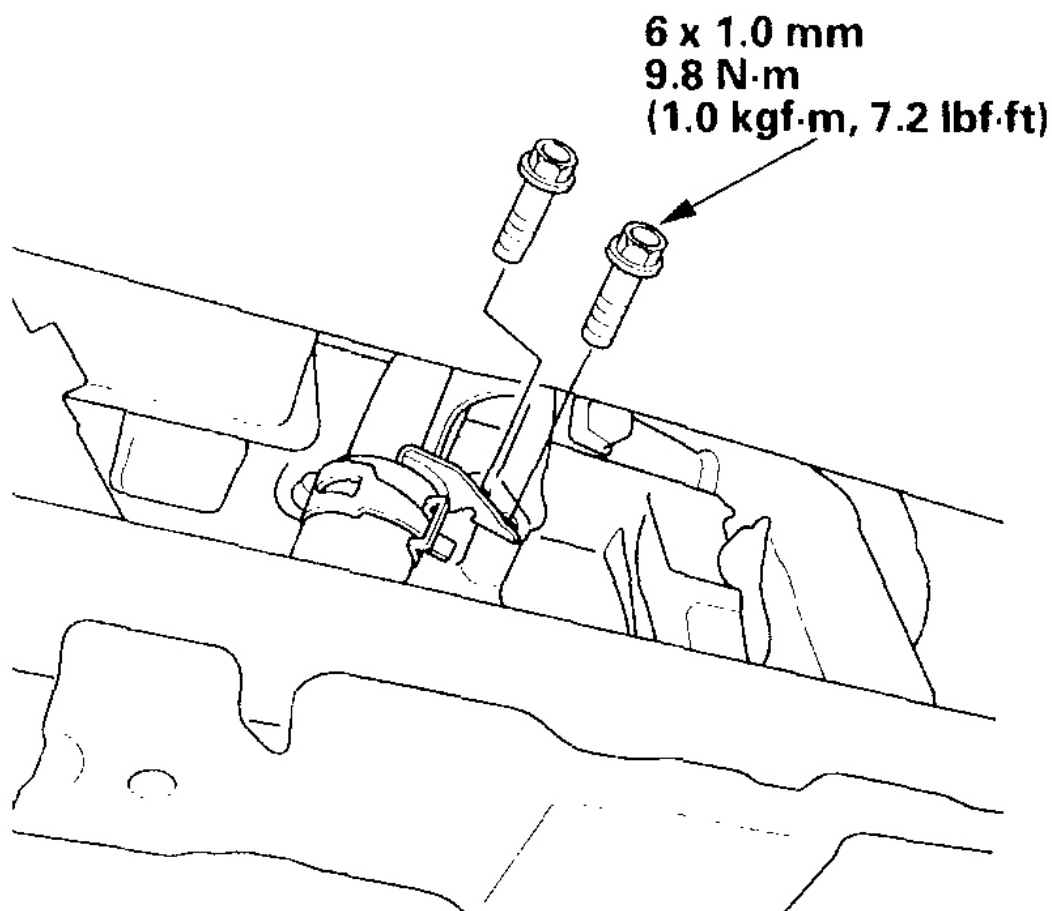


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Fig. 37: Installing A/C Compressor

Courtesy of AMERICAN HONDA MOTOR CO., INC.

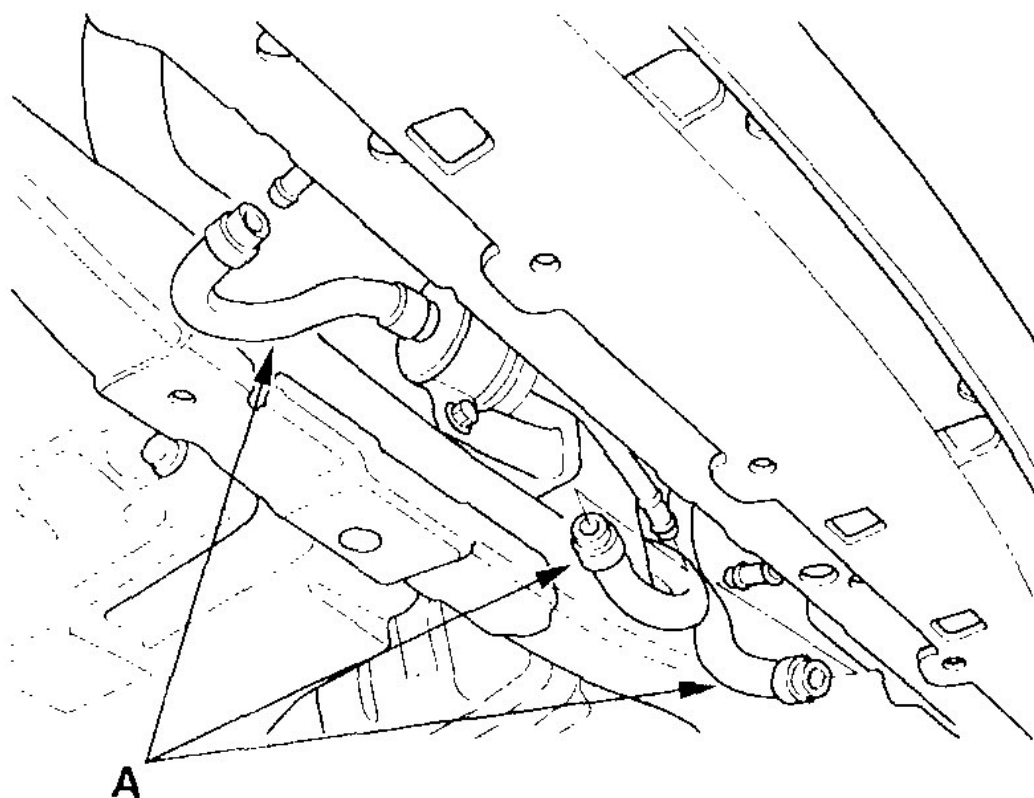
24. Tighten the bolt (C) and nut (D).
25. Install the lower radiator hose joint pipe.



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Fig. 38: Installing Lower Radiator Hose Joint Pipe
Courtesy of AMERICAN HONDA MOTOR CO., INC.

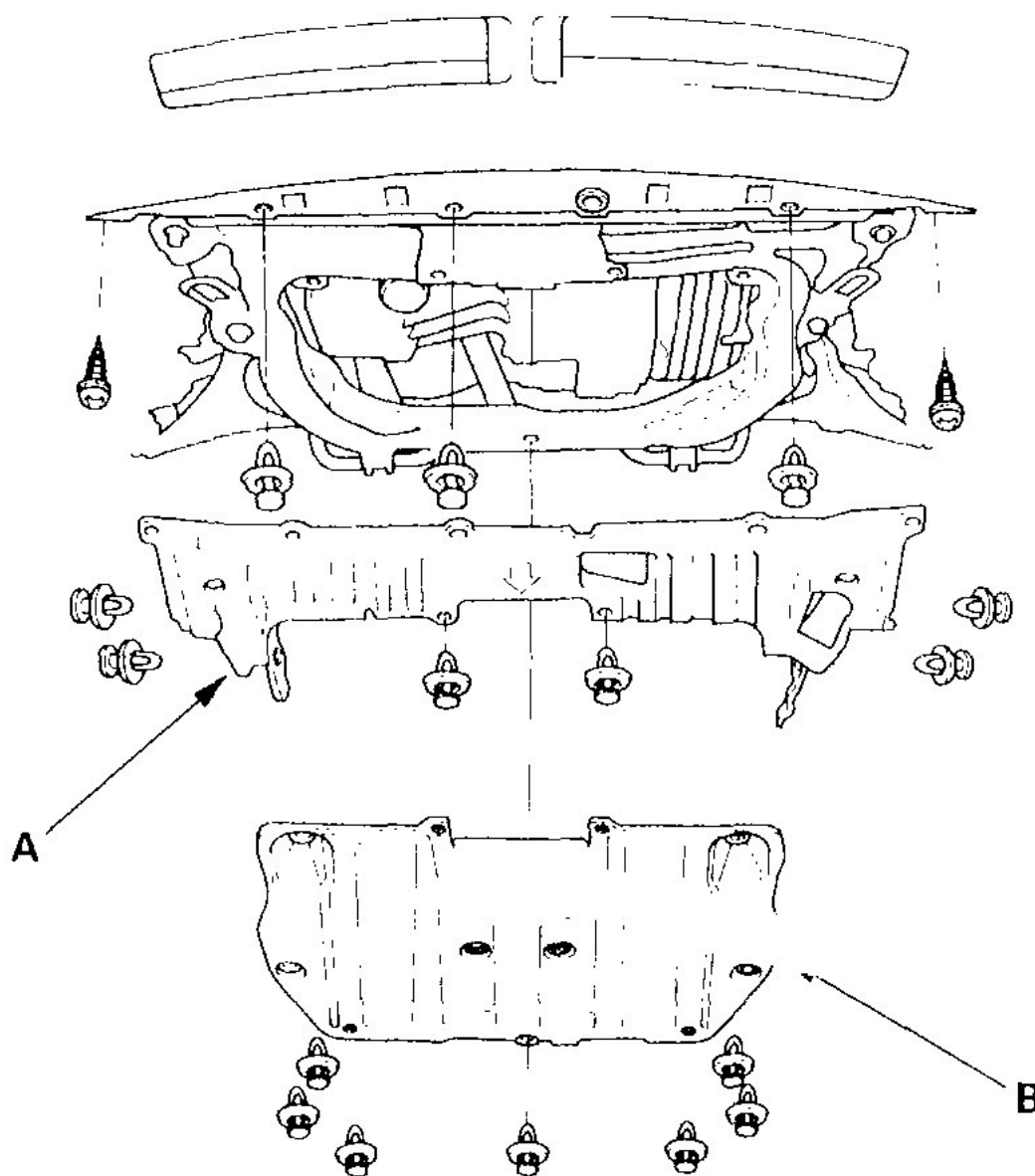
26. Install the automatic transmission fluid (ATF) cooler hoses (A) (CVT).



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Fig. 39: Installing ATF Cooler Hoses (CVT)
Courtesy of AMERICAN HONDA MOTOR CO., INC.

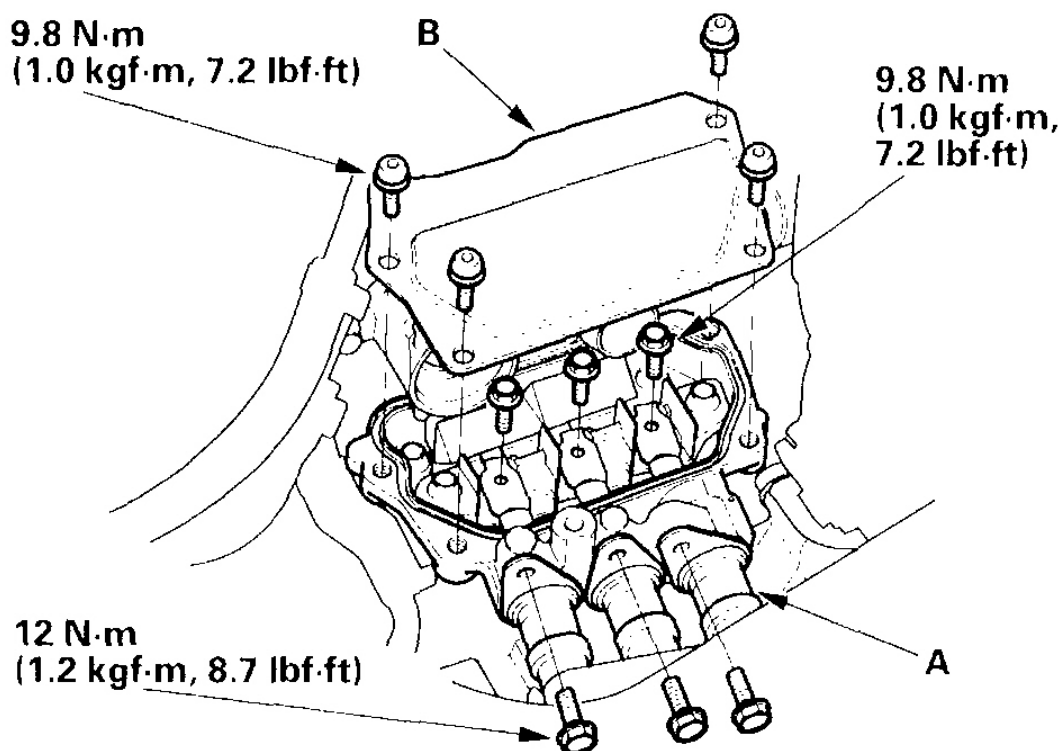
27. Install the splash shield (A) and under-cover (B).



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Fig. 40: Installing Splash Shield & Under-Cover
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

28. Lower the hoist.
29. Install the motor power cables (A).

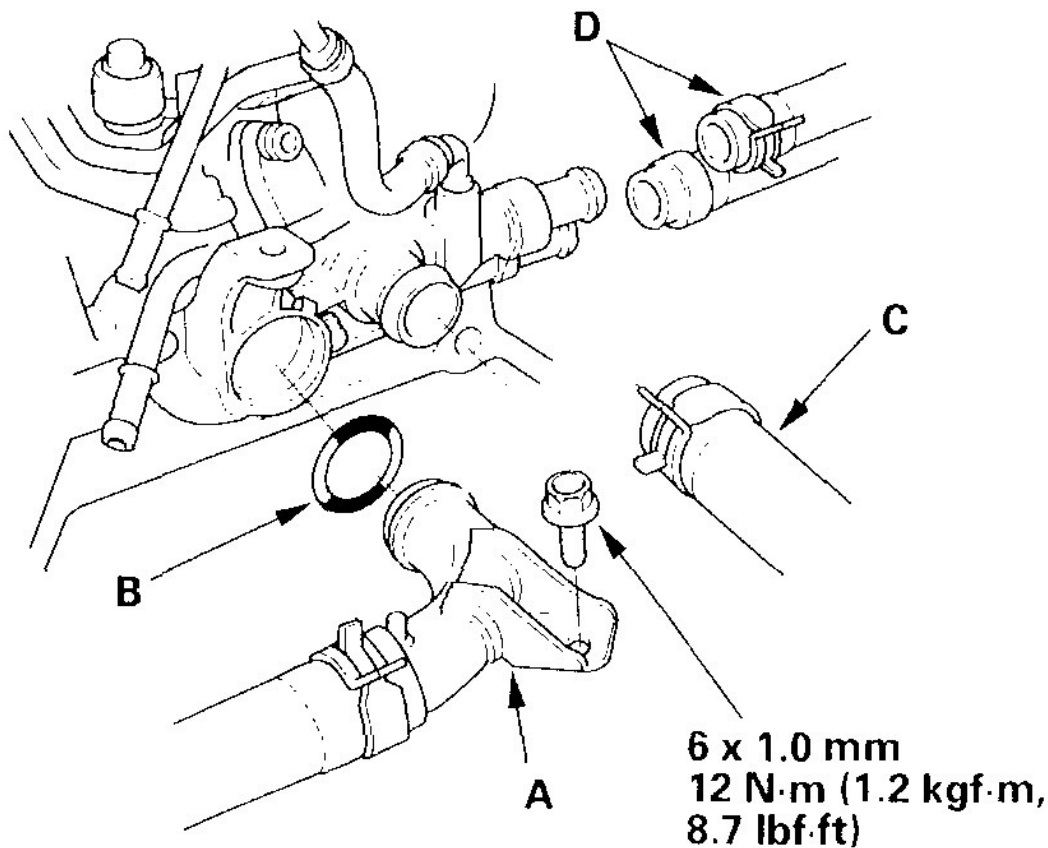


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Fig. 41: Installing Motor Power Cables

Courtesy of AMERICAN HONDA MOTOR CO., INC.

30. Clean and dry the motor power cable cover mating surfaces.
31. Apply liquid gasket, P/N 08718-0009, to the mating surfaces, then install the cover (B).
32. Install the lower radiator hose joint (A) with a new O-ring (B).



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Fig. 42: Installing Lower Radiator Hose Joint With New O-Ring
Courtesy of AMERICAN HONDA MOTOR CO., INC.

33. Install the upper radiator hose (C) and heater hoses (D).
34. Install the select cable and shift cable (M/T) (see step 21 on TRANSMISSION REMOVAL).
35. Install the clutch slave cylinder and clutch line bracket mounting bolt (M/T) (see step 23 on TRANSMISSION REMOVAL).
36. Install the shift cable (CVT) (see step 34 on TRANSMISSION INSTALLATION).
37. Push the engine control module (ECM) connectors through the bulkhead, then install the grommet (A).

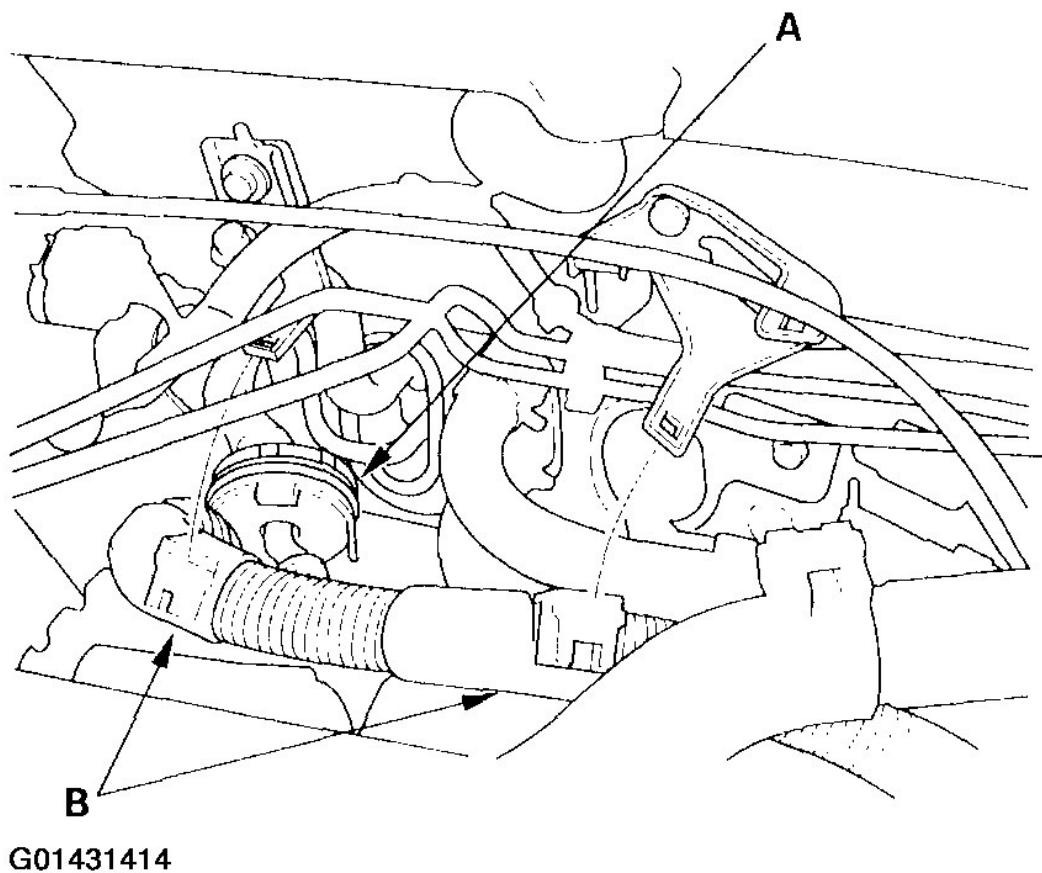


Fig. 43: Pushing ECM Connectors Through Bulkhead
Courtesy of AMERICAN HONDA MOTOR CO., INC.

38. Install the harness clamps (B).
39. Connect the ECM connectors (A) and main wire harness connector (B).

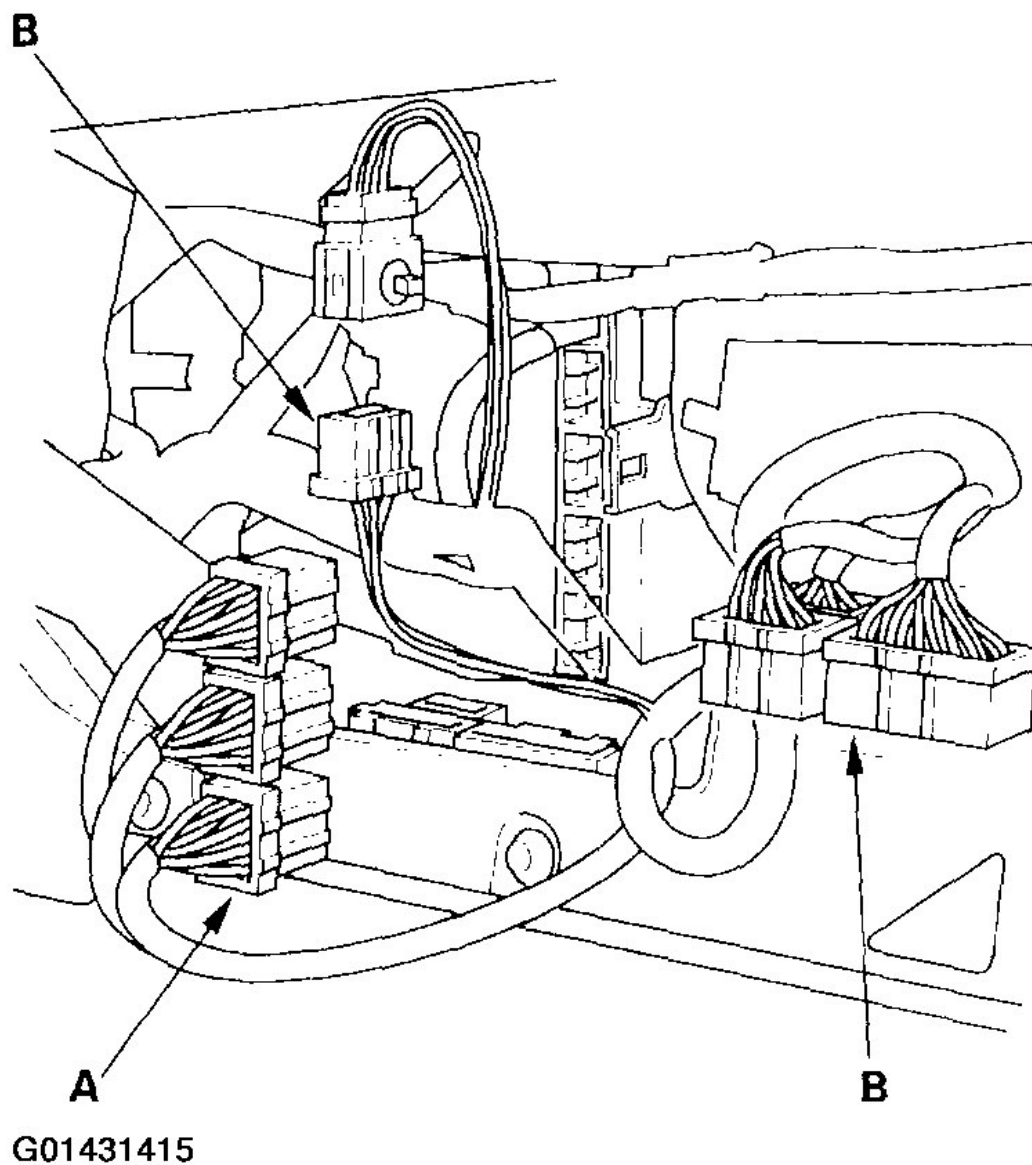
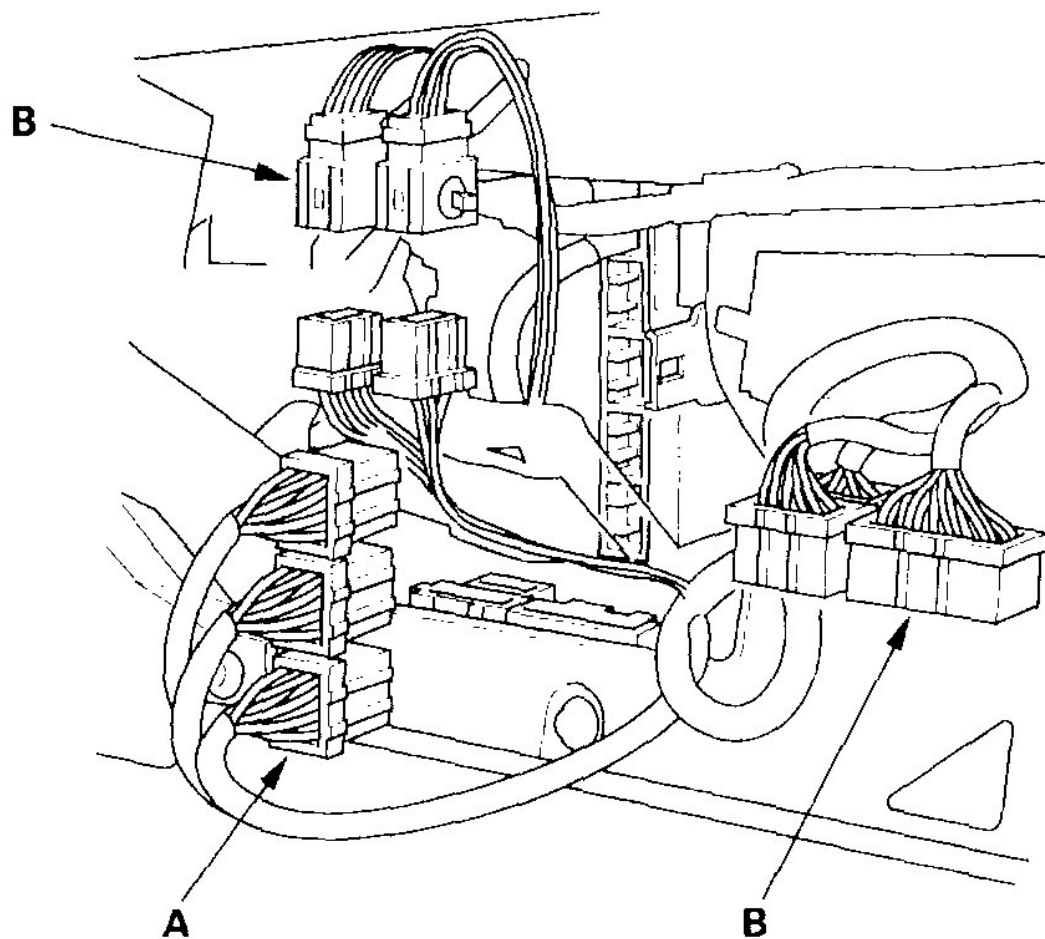


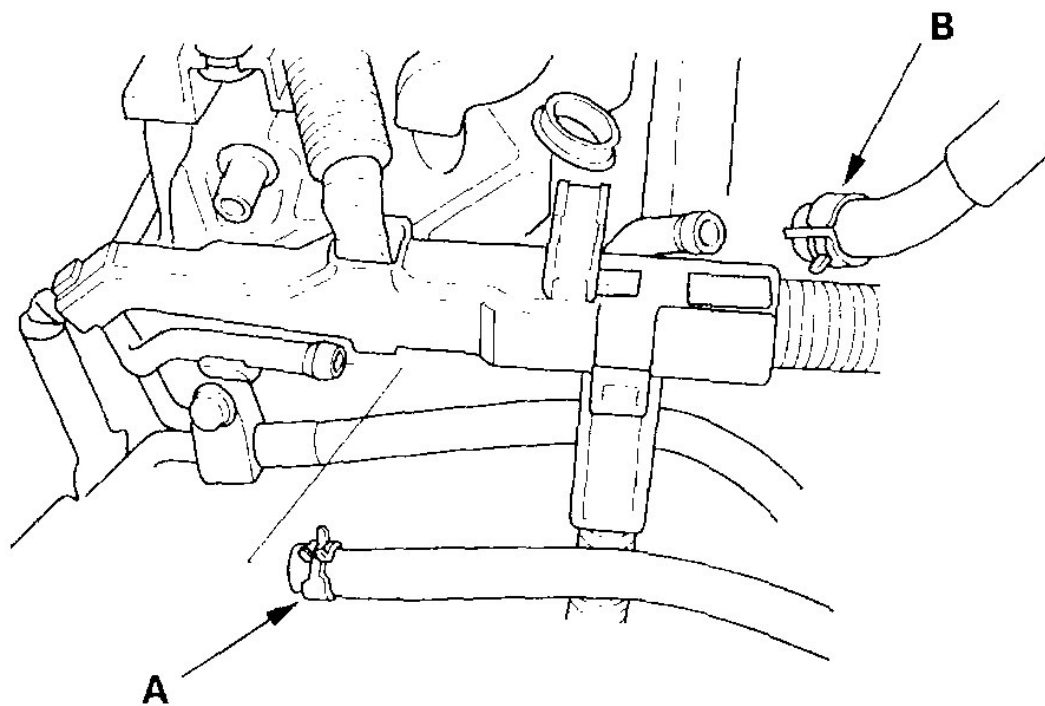
Fig. 44: Connecting ECM Connector & Main Wire Harness Connector (M/T)
Courtesy of AMERICAN HONDA MOTOR CO., INC.



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Fig. 45: Connecting ECM Connector & Main Wire Harness Connector (CVT)
Courtesy of AMERICAN HONDA MOTOR CO., INC.

40. Install the throttle cable (see **THROTTLE CABLE REMOVAL/INSTALLATION**), then adjust the cable (see **THROTTLE CABLE ADJUSTMENT**).
41. Install the cruise control actuator cable, then adjust the cable (see **CRUISE CONTROL ACTUATOR CABLE ADJUSTMENT**).
42. Install the evaporative emission (EVAP) canister hose (A) and brake booster vacuum hose (B).



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Fig. 46: Installing EVAP Canister Hose

Courtesy of AMERICAN HONDA MOTOR CO., INC.

43. Install the fuel feed hose (see **FUEL LINE/QUICK-CONNECT FITTING INSTALLATION**).
44. Install the drive belt, and adjust the belt tension (see **DRIVE BELT INSPECTION AND ADJUSTMENT**).
45. Install the starter cable (A) and ground cable (B).

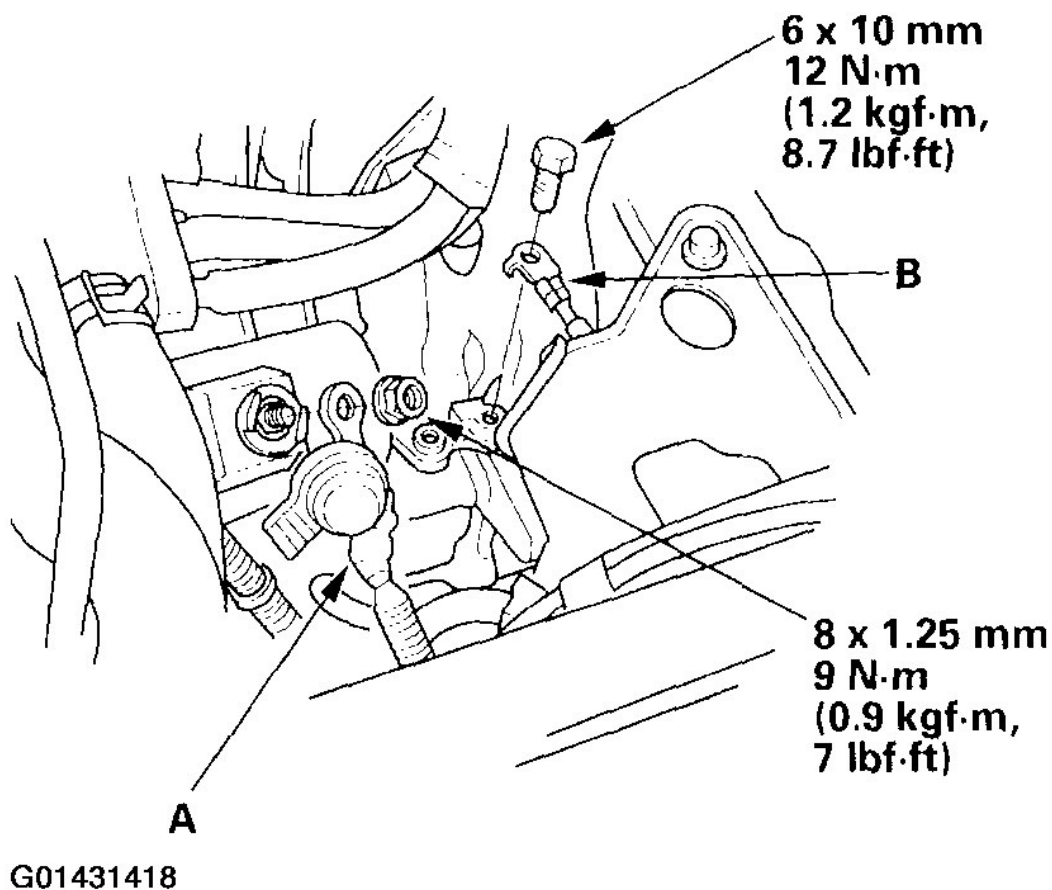
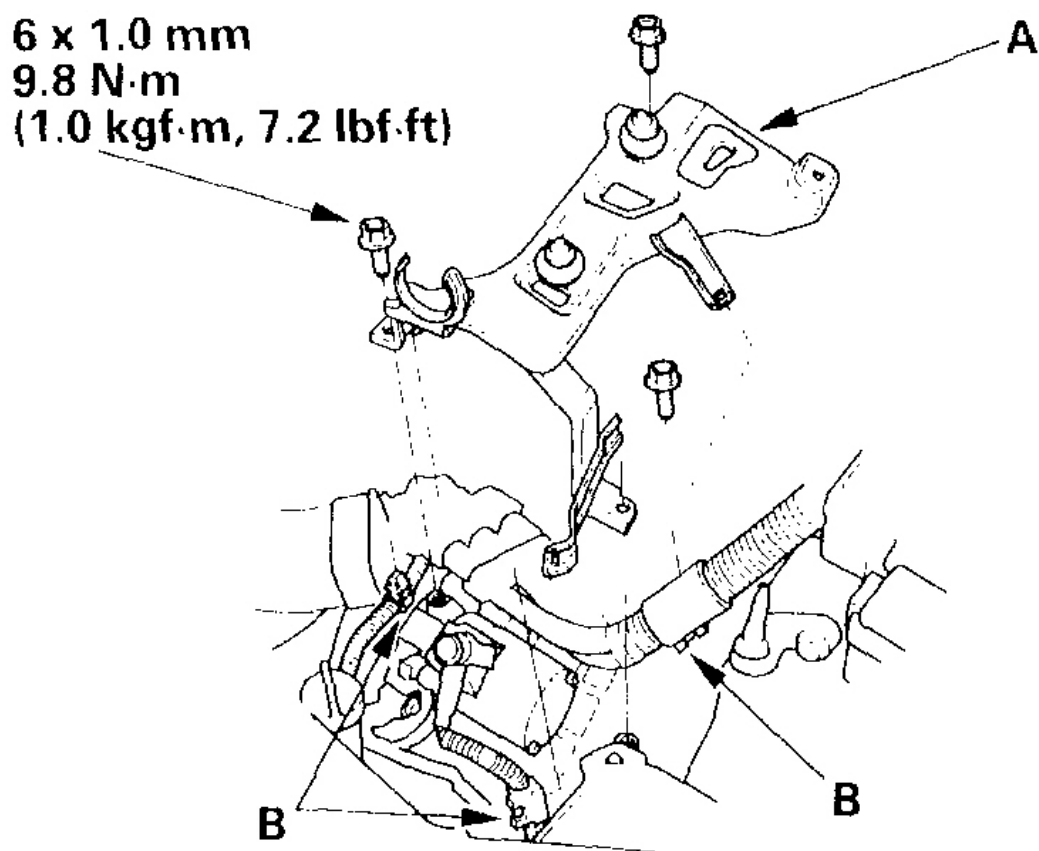


Fig. 47: Installing Starter Cable & Ground Cable
Courtesy of AMERICAN HONDA MOTOR CO., INC.

46. Install the air cleaner housing bracket (A), then install the harness clamps (B).



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Fig. 48: Installing Air Cleaner Housing Bracket
Courtesy of AMERICAN HONDA MOTOR CO., INC.

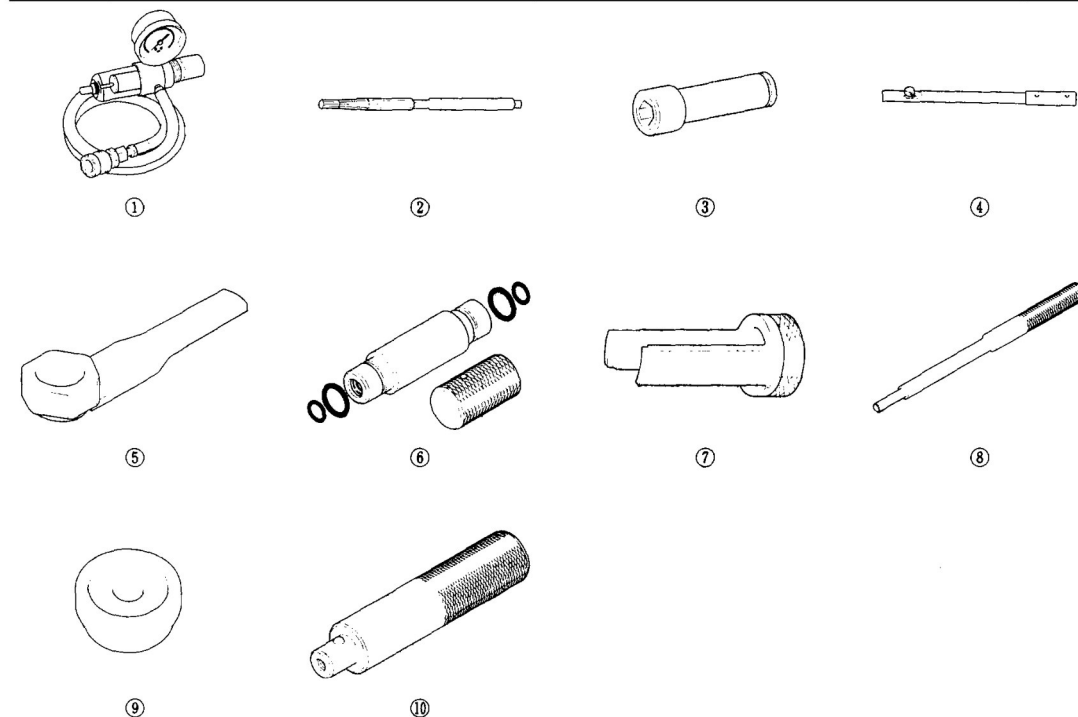
47. Install the air cleaner housing (see **AIR CLEANER REMOVAL/INSTALLATION**).
48. Install the resonator, then install the engine cover (see **RESONATOR REPLACEMENT**).
49. Install the battery. Clean the battery posts and cable terminals with sandpaper, then assemble them and apply grease to prevent corrosion.
50. Move the shift lever to each gear, and verify that the A/T gear position indicator follows the transmission range switch (CVT).
51. Check that the transmission shifts into gear smoothly (M/T).
52. 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.
53. Refill the engine with engine oil (see **ENGINE OIL REPLACEMENT**).
54. Refill the transmission with fluid:

- Manual transmission (see **TRANSMISSION FLUID INSPECTION AND REPLACEMENT**).
 - CVT (see **ATF REPLACEMENT**).
55. Refill the radiator with engine coolant, and bleed the air from the cooling system with the heater valve open (see step 8 on **COOLANT REPLACEMENT**).
 56. Perform the ECM idle learn procedure (see **ECM IDLE LEARN PROCEDURE**).
 57. Inspect and adjust the idle speed (see **IDLE SPEED ADJUSTMENT**).
 58. Inspect the ignition timing (see **IGNITION TIMING INSPECTION**).
 59. Check the wheel alignment (see **WHEEL ALIGNMENT**).

CYLINDER HEAD

SPECIAL TOOLS

Ref. No.	Tool Number	Description	Qty
①	07AAJ-PNAA100	Air Regulator	1
②	07HAH-PJ7010B	Valve Guide Reamer, 5.5 mm	1
③	07JAA-001020A	Socket, 19 mm	1
④	07JAB-001020A	Holder Handle	1
⑤	07NAB-001040A	Holder Attachment, 50 mm	1
⑥	07PAD-0010000	Stem Seal Driver	1
⑦	07757-PJ1010A	Valve Spring Compressor Attachment	1
⑧	07742-0010100	Valve Guide Driver, 5.5 mm	1
⑨	07746-0010400	Attachment, 52 x 55 mm	1
⑩	07749-0010000	Driver	1



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Fig. 49: Identifying Special Tools

Courtesy of AMERICAN HONDA MOTOR CO., INC.

COMPONENT LOCATION INDEX

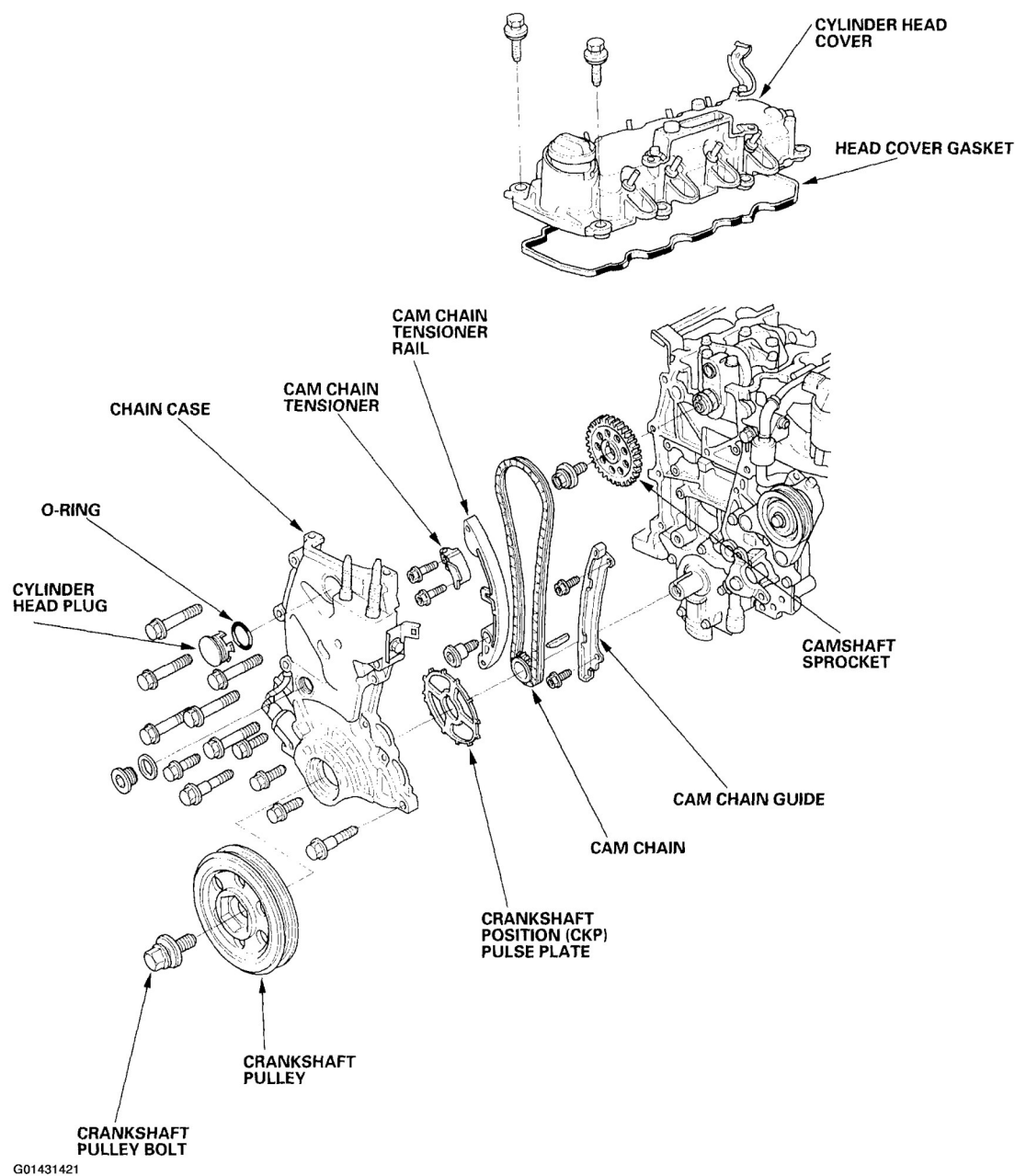
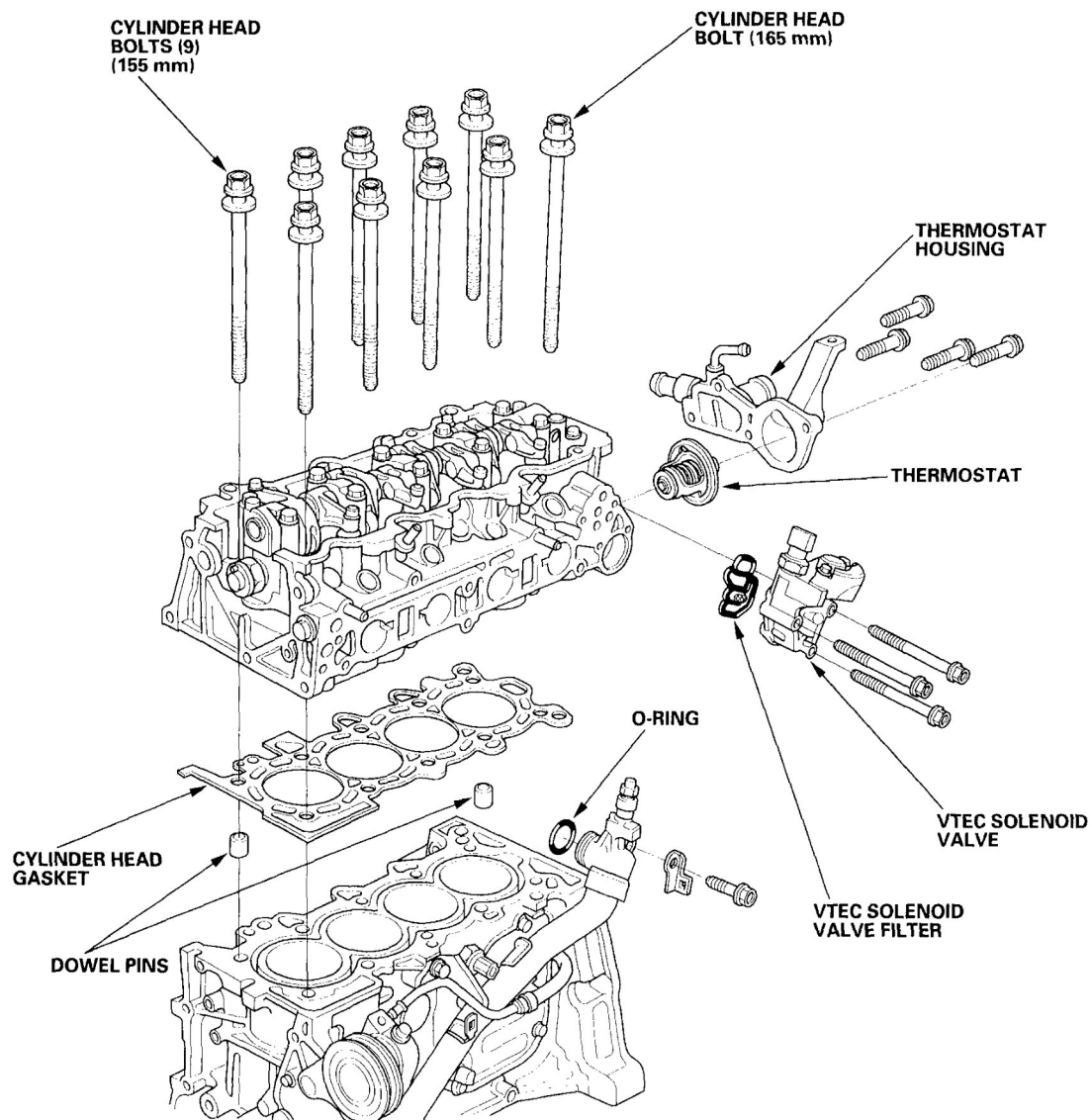
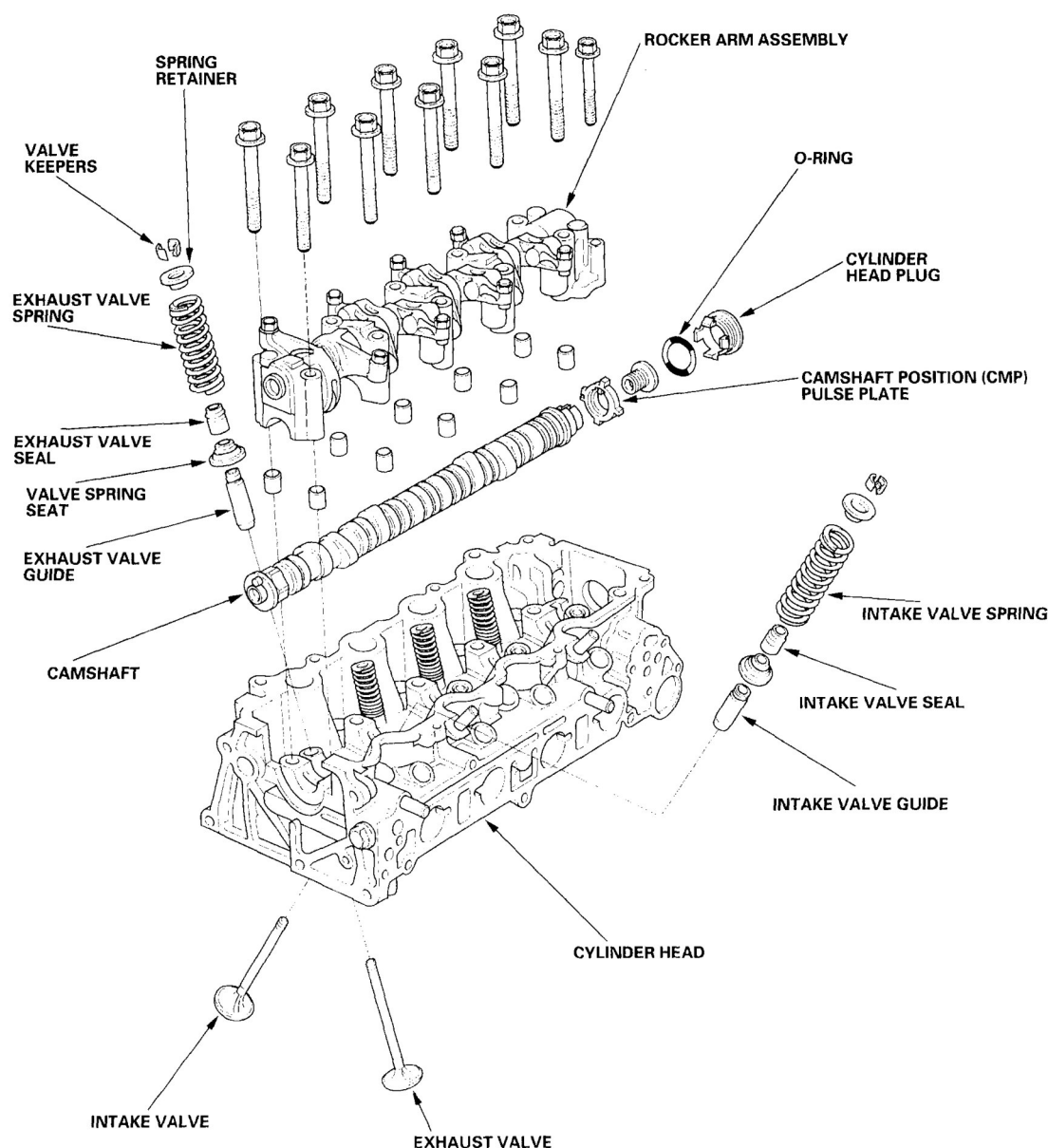


Fig. 50: Identifying Cylinder Head Components (1 Of 3)
 Courtesy of AMERICAN HONDA MOTOR CO., INC.



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Fig. 51: Identifying Cylinder Head Components (2 Of 3)
 Courtesy of AMERICAN HONDA MOTOR CO., INC.



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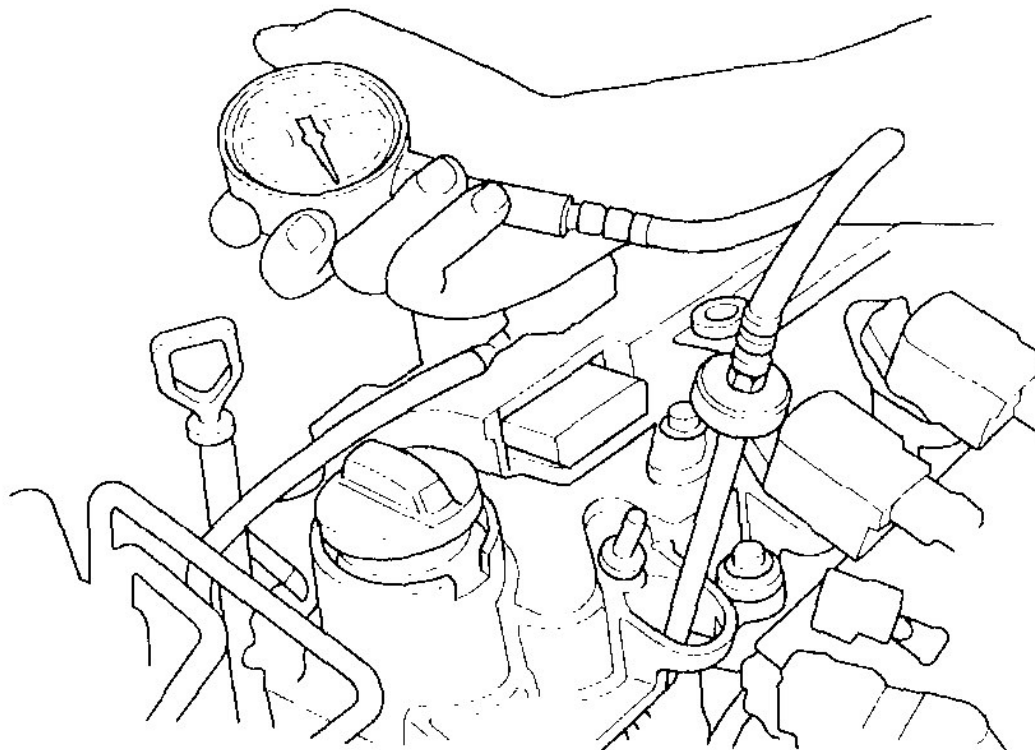
Fig. 52: Identifying Cylinder Head Components (3 Of 3)
Courtesy of AMERICAN HONDA MOTOR CO., INC.

ENGINE COMPRESSION INSPECTION

1. Warm up the engine to normal operating temperature (cooling fan comes on).
2. Turn the ignition switch OFF.
3. Remove the PGM-FI main relay 2.
4. Start the engine, and let it run until it stalls.
5. Remove the four front ignition coils (see **IGNITION COIL REMOVAL/INSTALLATION**).

6. Remove the four front spark plugs.
7. Attach the compression gauge to the spark plug hole.

NOTE: Use a compression gauge with a connecting length (between the edge and the flange) of less than 23 mm (0.9 in.).



G01431424

Fig. 53: Attaching Compression Gauge To Spark Plug Hole
Courtesy of AMERICAN HONDA MOTOR CO., INC.

8. Connect a tachometer.
9. Open the throttle fully, then crank the engine with the starter motor and measure the compression.
Compression Pressure: Above 980 kPa (10.0 kgf/cm² , 142 psi)
10. Measure the compression on the remaining cylinders.
Maximum variation: Within 200 kPa (2.0 kgf/cm² , 29 psi)
11. If the compression is not within specifications, check the following items, then remeasure the compression.
 - Loose rear spark plug

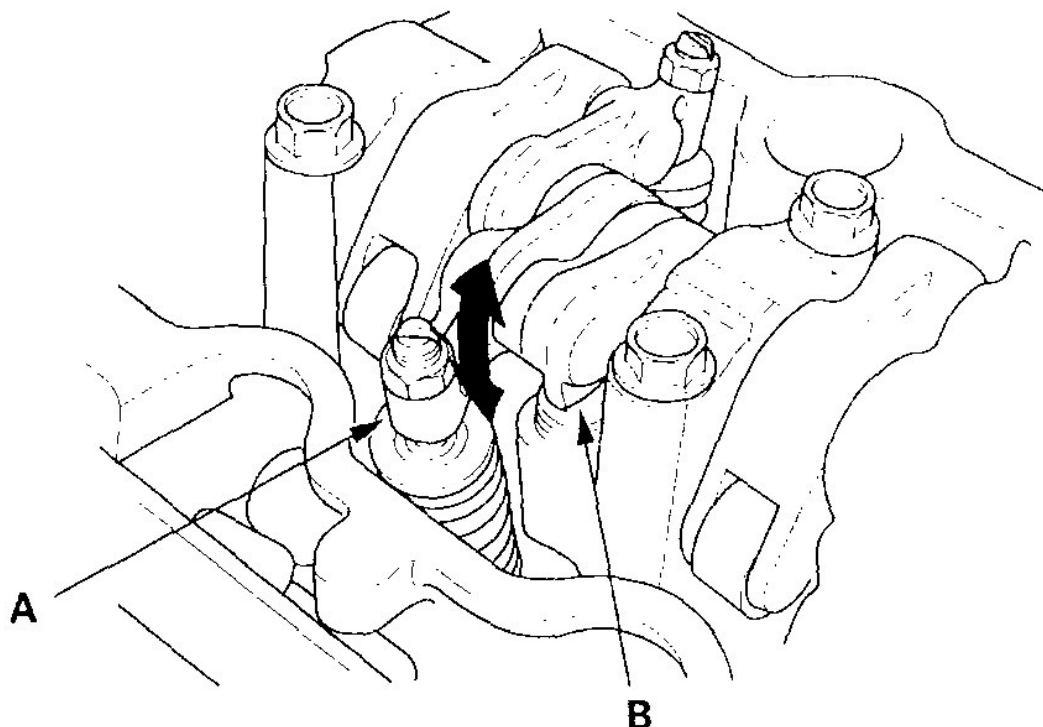
- Damaged or worn valves and seats
- Damaged cylinder head gasket
- Damaged or worn piston rings
- Damaged or worn piston and cylinder bore

VTEC ROCKER ARM TEST

Special Tools Required

Air regulator 07AAJ-PNAA100

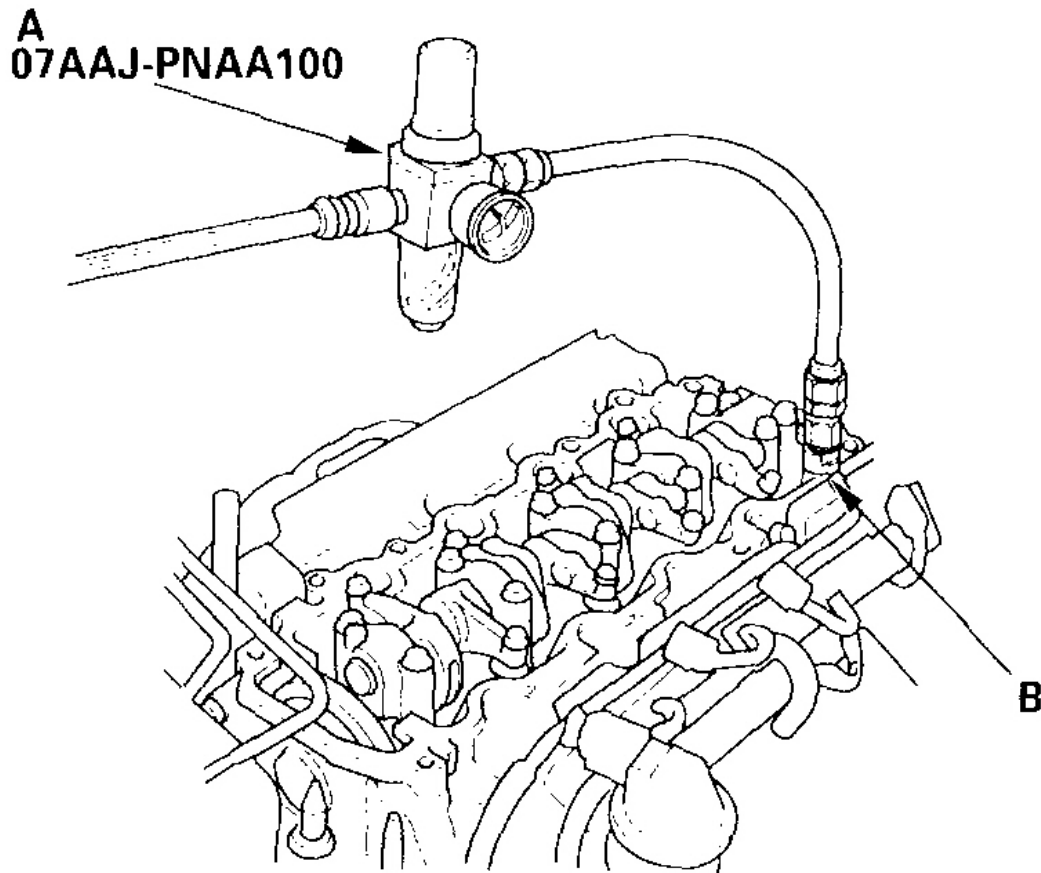
1. Start the engine and let it run for 5 minutes, then turn OFF the ignition switch.
2. Remove the cylinder head cover (see **Cylinder Head Cover Removal**).
3. Set the No. 3 piston at top dead center (TDC) (see step on **Valve Clearance Adjustment**).
4. Move the primary rocker arms (A) for the No. 3 cylinder. The primary rocker arm and secondary rocker arm (B) should move together.
 - If the 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.
 - If the primary rocker arm and secondary rocker arm move together, go to step 5.



G01431425

Fig. 54: Moving Primary Rocker Arms For No. 3 Cylinder
Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. Repeat step 4 on the No. 4 and No. 2 primary rocker arms with each piston at TDC. When all the primary rocker arms pass the test, go to step 6.
6. Check that the air pressure on the shop air compressor gauge indicates over 400 kPa (4 kgf/cm² , 57 psi).
7. Inspect the valve clearance (see **Valve Clearance Adjustment**).
8. Connect the air pressure regulator with a 0-100 psi gauge (A) to the inspection hole (B).



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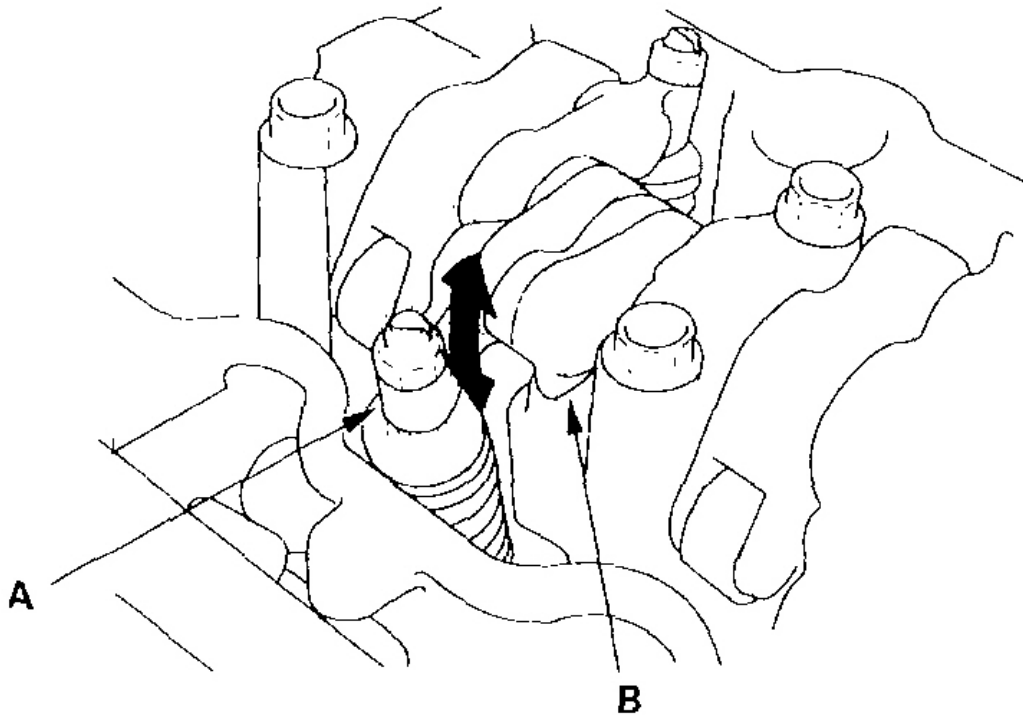
Fig. 55: Connecting Air Pressure Regulator With 0-100 psi Gauge
Courtesy of AMERICAN HONDA MOTOR CO., INC.

9. Loosen the valve on the regulator, and apply the specified air pressure.

Specified Air Pressure: 200 kPa (2.0 kgf/cm² , 29 psi)

10. With the specified air pressure applied, move the primary rocker arm (A) for the No. 3 cylinder. The primary rocker arm should move independently of the secondary rocker arm (B).

If the primary rocker arm does not move freely, 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.



G01431427

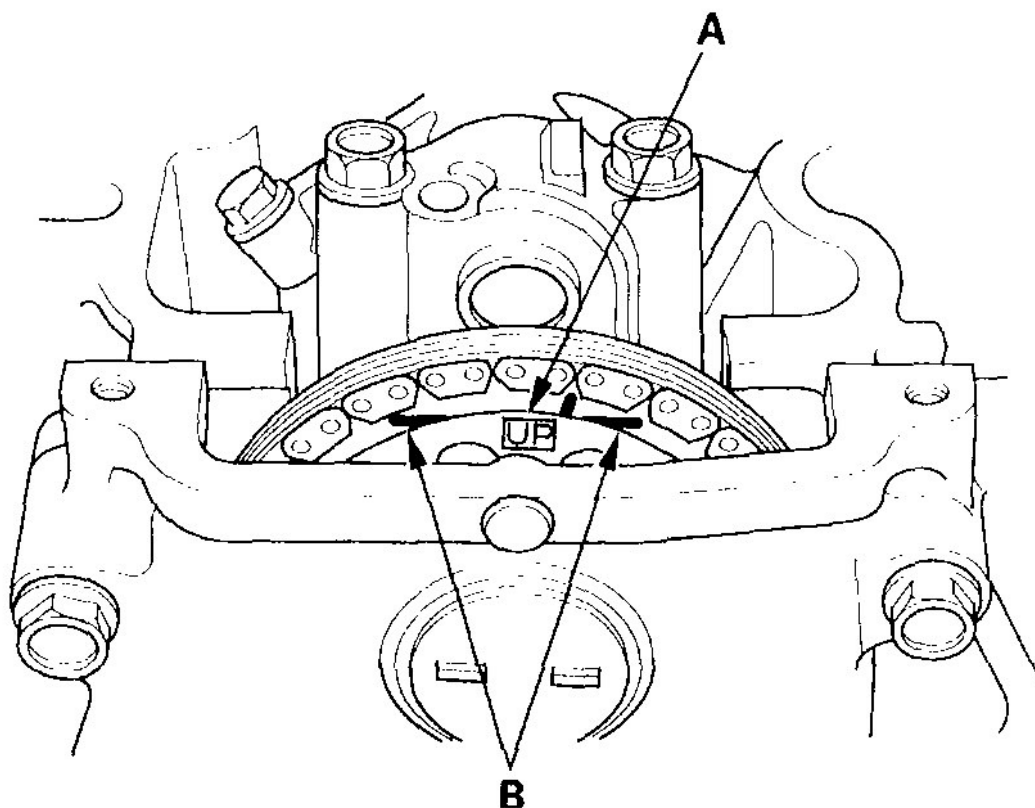
Fig. 56: Moving Primary Rocker Arm For No. 3 Cylinder
Courtesy of AMERICAN HONDA MOTOR CO., INC.

11. Repeat step 10 on the No. 4 and No. 2 primary rocker arms with each piston at TDC.
12. Remove the air pressure regulator.
13. Install the cylinder head cover (see Cylinder Head Cover Installation).

VALVE CLEARANCE ADJUSTMENT

NOTE: Valves should be adjusted 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 "UP" mark (A) on the camshaft sprocket should be at the top, and the TDC grooves (B) on the camshaft sprocket should line up with the top edge of the head.



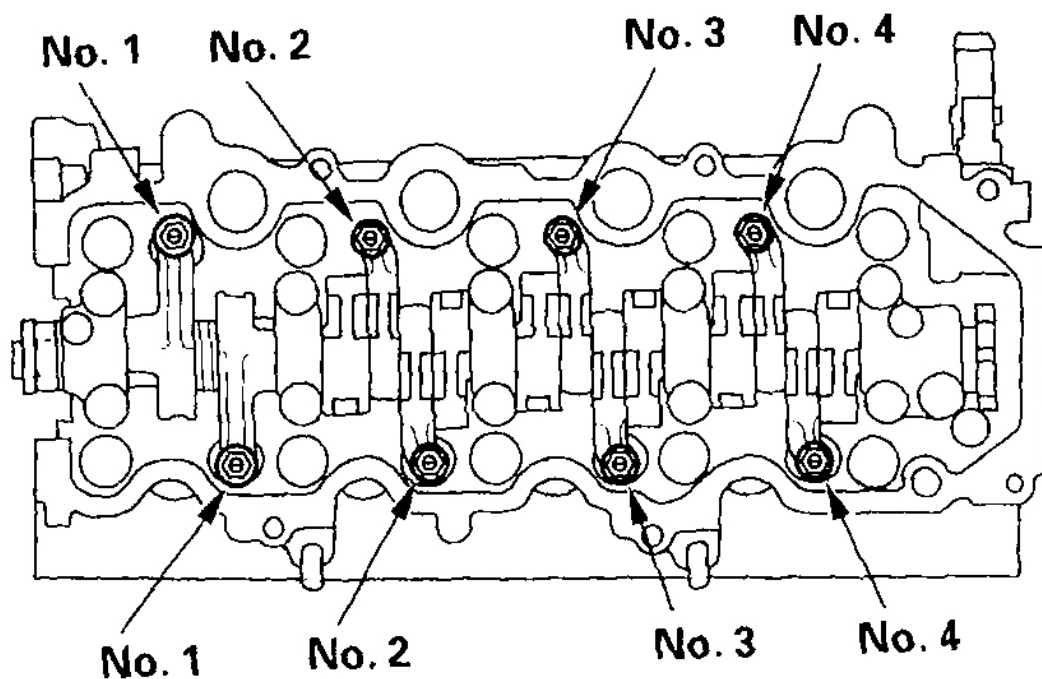
G01431428

Fig. 57: "UP" Marking On Camshaft Sprocket Should Be At Top
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

Intake: 0.15-0.19 mm (0.006-0.007 in.)

Exhaust: 0.24-0.28 mm (0.009-0.011 in.)

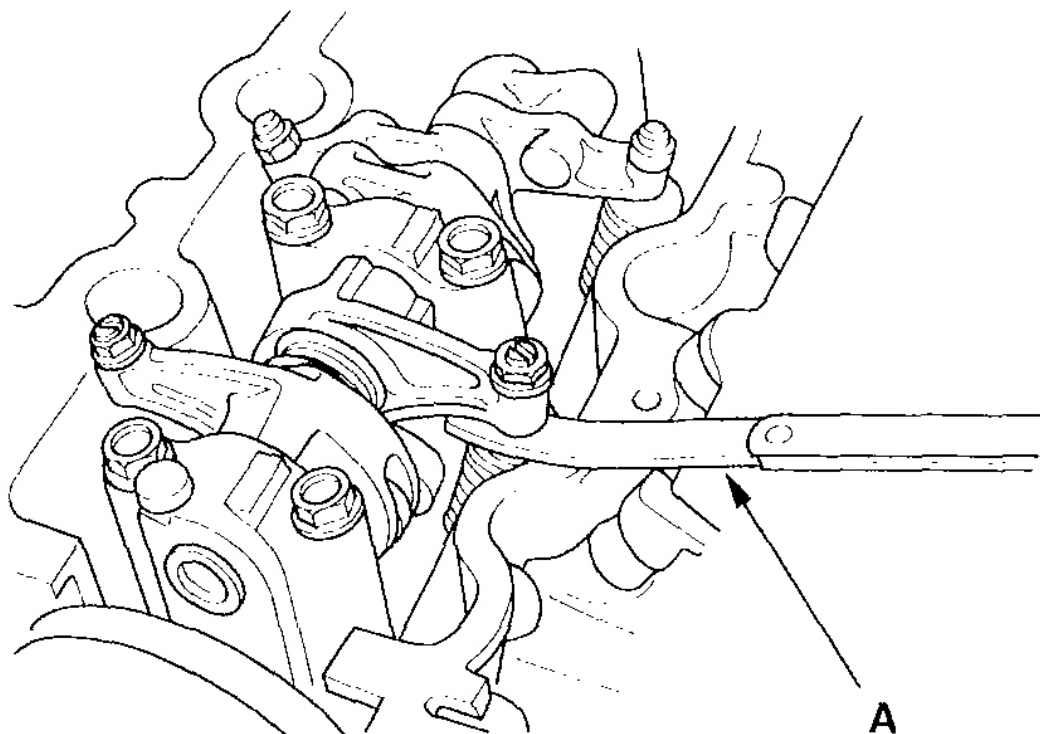


G01431429

Fig. 58: Adjusting Screw Locations (Exhaust & Intake)

Courtesy of AMERICAN HONDA MOTOR CO., INC.

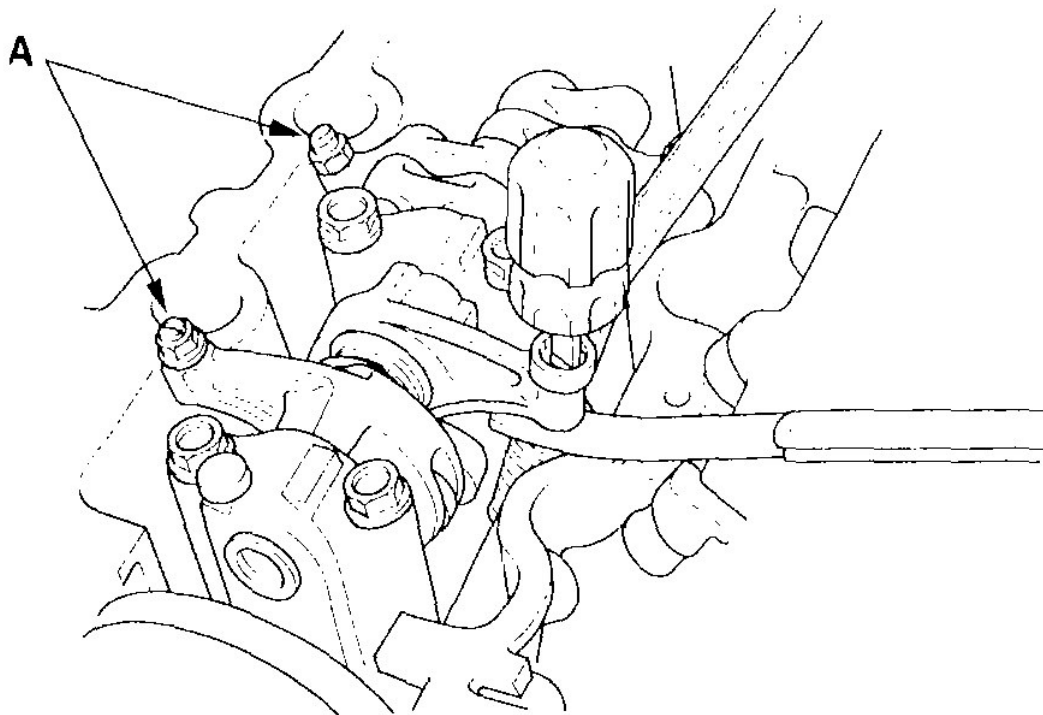
4. Insert the feeler gauge (A) between the adjusting screw and the end of the valve stem and slide it back and forth; you should feel a slight amount of drag.



G01431430

Fig. 59: Inserting Feeler Gauge Between Adjusting Screw
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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



G01431431

Fig. 60: Loosening Locknut

Courtesy of AMERICAN HONDA MOTOR CO., INC.

6. Tighten the locknut and recheck the clearance. Repeat the adjustment if necessary.

Specified torque

No. 1 rocker arms: 14 N.m (1.4 kgf.m, 10 lbf.ft) Apply new engine oil to the nut threads.

No. 2, 3, 4 rocker arms: 20 N.m (2.0 kgf.m, 14 lbf.ft) Apply new engine oil to the nut threads.

7. Rotate the crankshaft clockwise. Align the No. 3 piston TDC groove (A) on the camshaft sprocket with the top edge of the head.

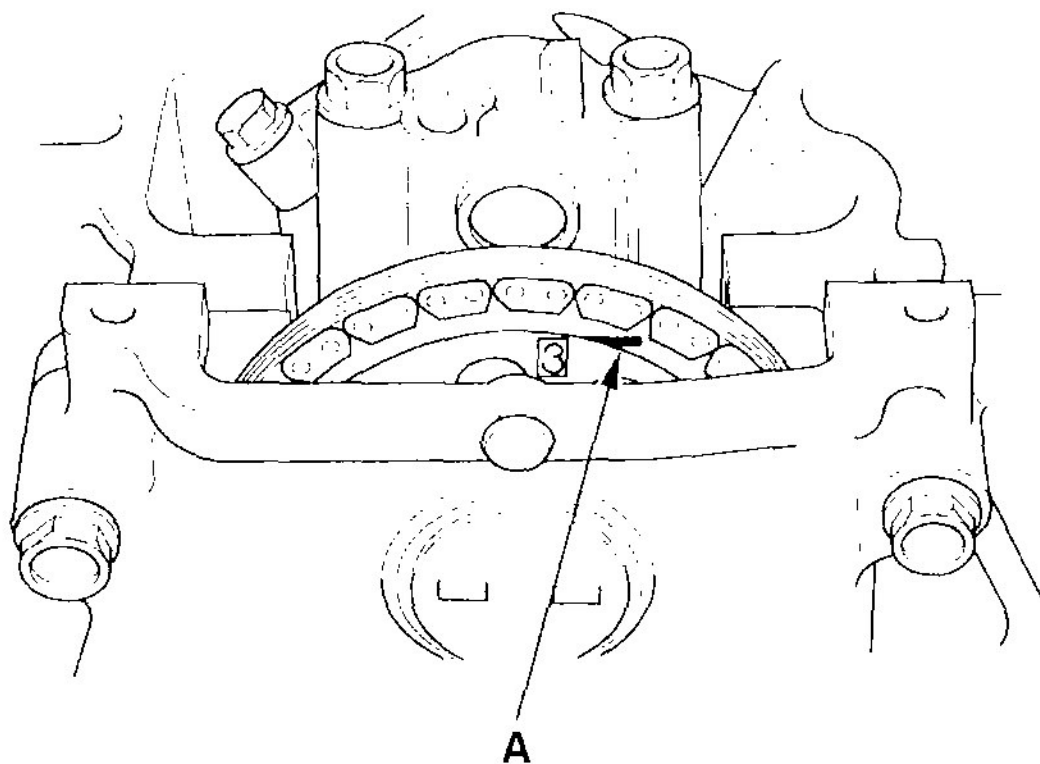
**G01431432**

Fig. 61: Aligning No. 3 Piston TDC Groove On Camshaft Sprocket With Tope Edge Of Head
Courtesy of AMERICAN HONDA MOTOR CO., INC.

8. Check and if necessary, adjust the valve clearance on No. 3 cylinder.
9. Rotate the crankshaft clockwise. Align the No. 4 piston TDC groove (A) on the camshaft sprocket with the top edge of the head.

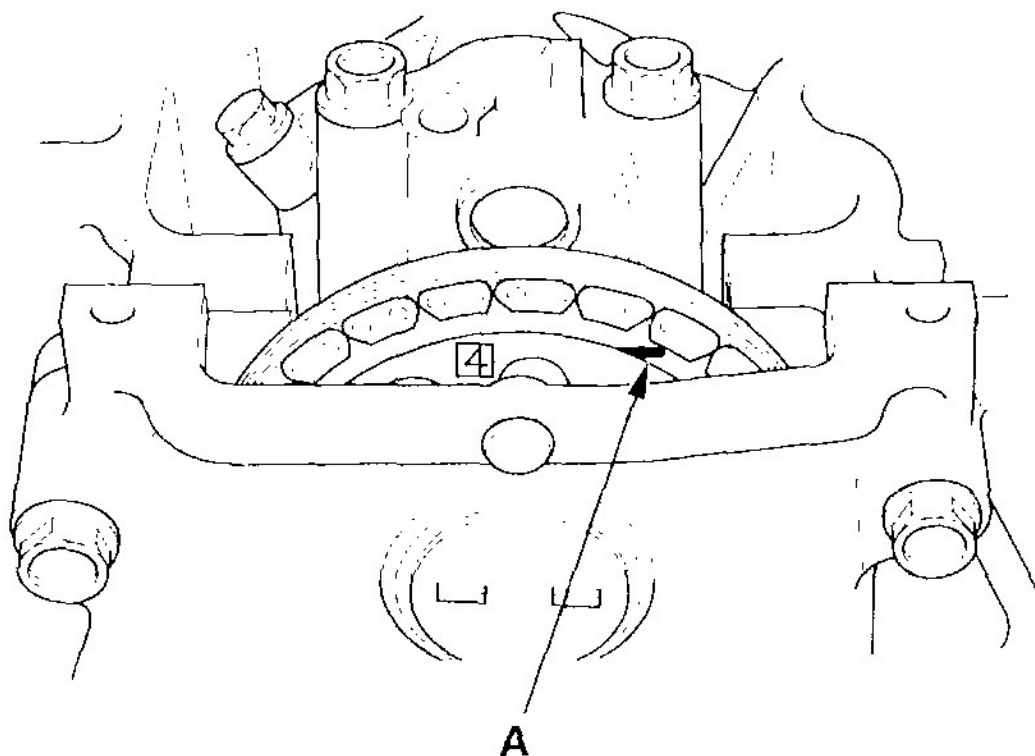
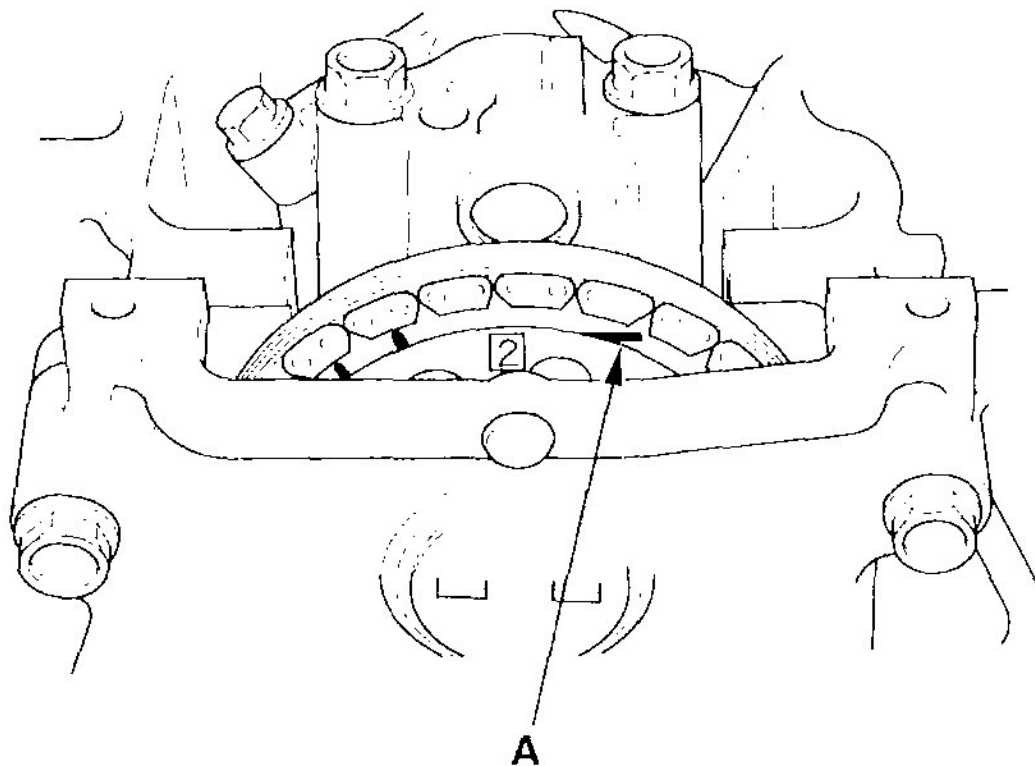
**G01431433**

Fig. 62: Aligning No. 4 Piston TDC Groove On Camshaft Sprocket With Tip Edge Of Head
Courtesy of AMERICAN HONDA MOTOR CO., INC.

10. Check and if necessary, adjust the valve clearance on No. 4 cylinder.
11. Rotate the crankshaft clockwise. Align the No. 2 piston TDC groove (A) on the camshaft sprocket with the top edge of the head.



G01431434

Fig. 63: Aligning No. 2 Piston TDC Groove On Camshaft Sprocket With Top Edge Of Head
Courtesy of AMERICAN HONDA MOTOR CO., INC.

12. Check and if necessary, adjust the valve clearance on No. 2 cylinder.
13. Install the cylinder head cover (see **Cylinder Head Cover Installation**).

CRANKSHAFT PULLEY REMOVAL AND INSTALLATION

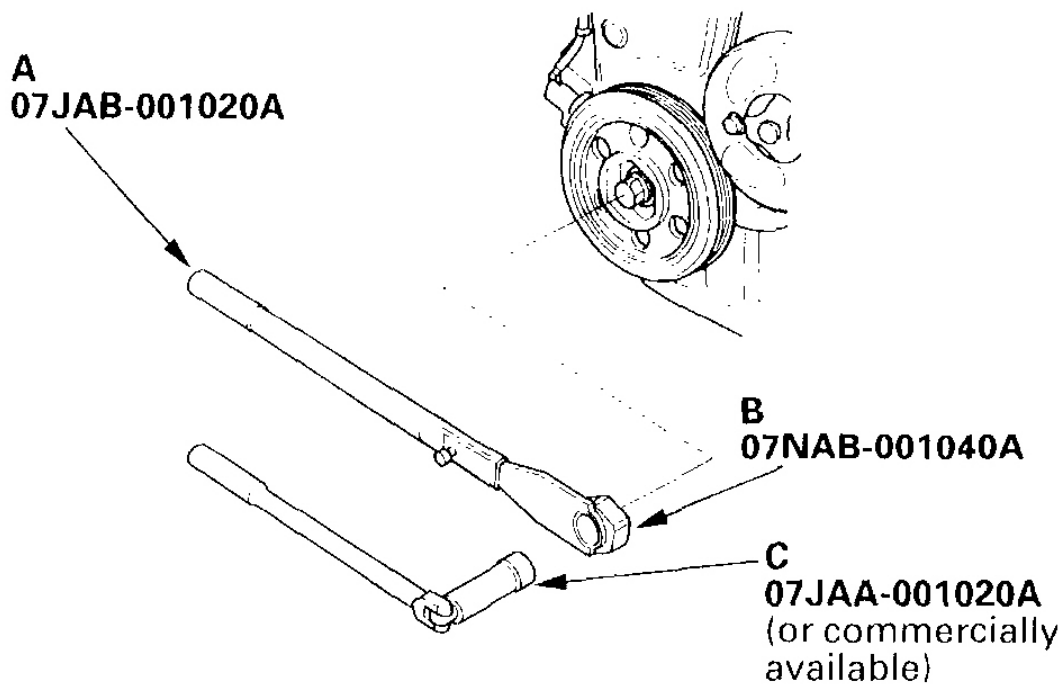
Special Tools Required

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

Removal

1. Remove the right front tire/wheel.
2. Remove the splash shield (see step 22 on **Engine Removal**).

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



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Fig. 64: Holding Pulley With Handle & Holder Attachment
Courtesy of AMERICAN HONDA MOTOR CO., INC.

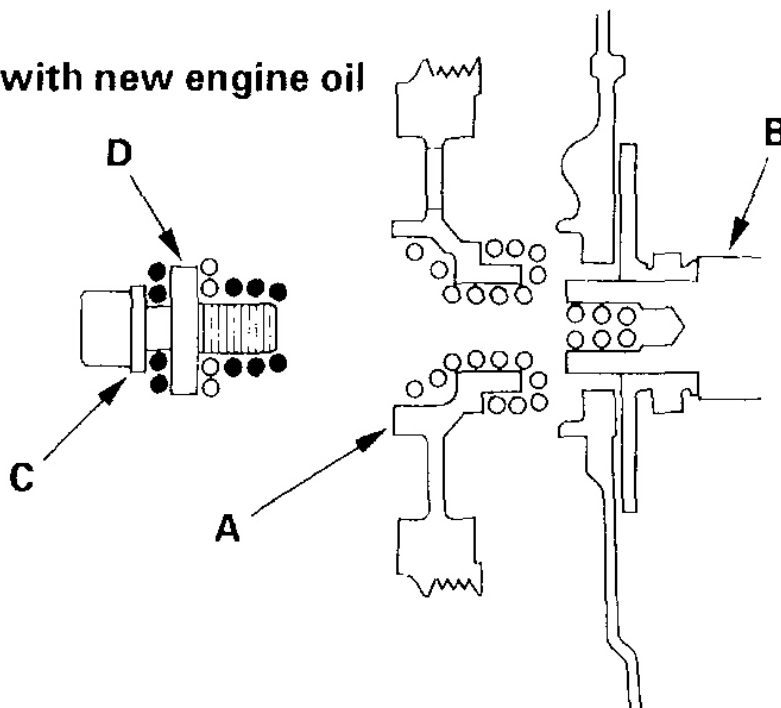
4. Remove the bolt with a 19 mm socket (C) and breaker bar.

Installation

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

○ : Clean

● : Lubricate with new engine oil

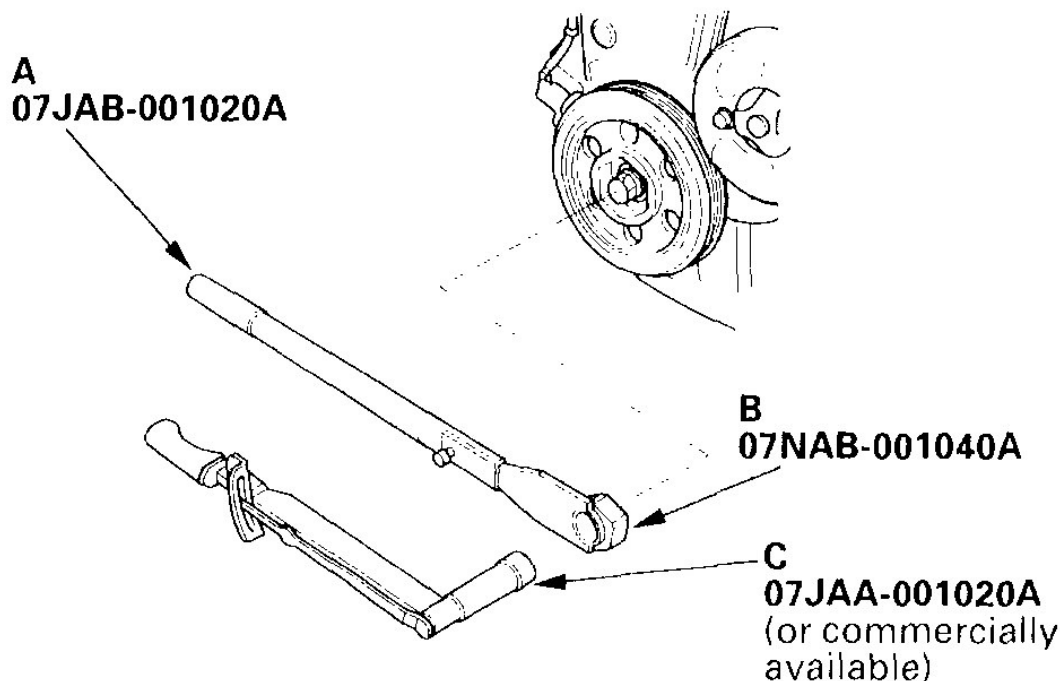


G01431436

Fig. 65: Cleaning Crankshaft Pulley

Courtesy of AMERICAN HONDA MOTOR CO., INC.

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



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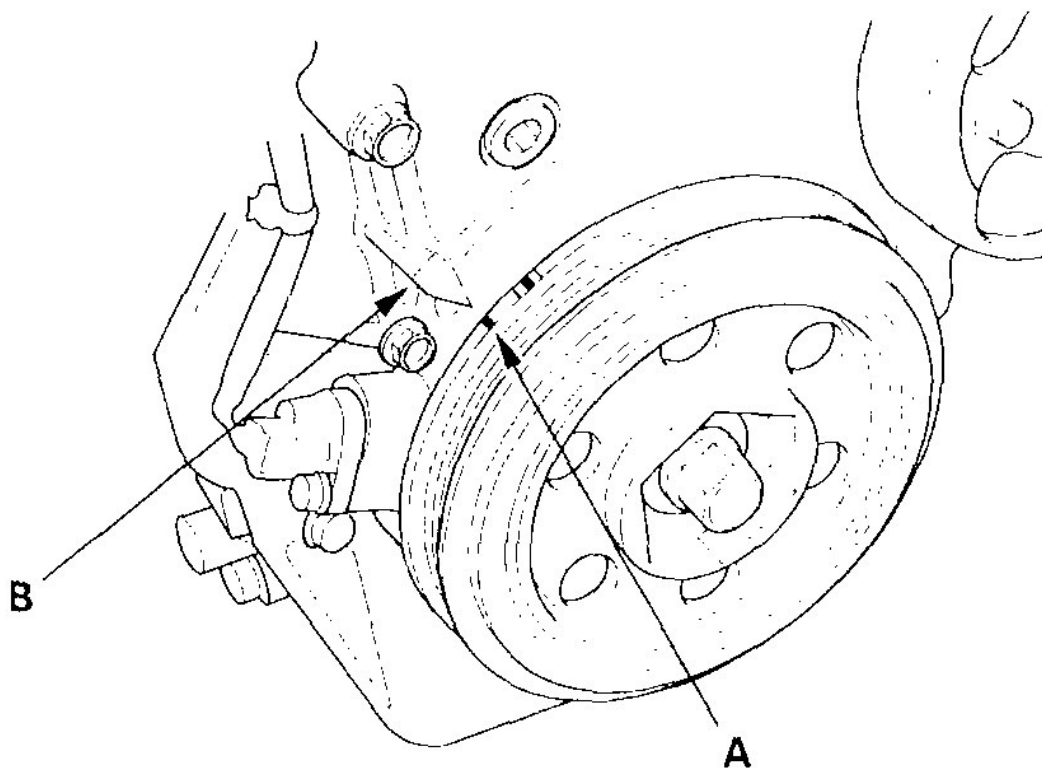
Fig. 66: Holding Pulley With Handle & Holder Attachment
Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. Tighten the bolt to 37 N.m (3.8 kgf.m, 27 lbf.ft) with a torque wrench and 19 mm socket (C). Do not use an impact wrench. If the pulley bolt or crankshaft are new, tighten the bolt to 177 N.m (18.0 kgf.m, 130 lbf.ft), then remove the bolt and tighten it to 37 N.m (3.8 kgf.m, 27 lbf.ft).
4. Tighten the pulley bolt an additional 90°.
5. Install the splash shield (see step 27 on **Engine Installation**).
6. Install the front tires/wheels.

CAM CHAIN REMOVAL

NOTE: Keep the cam chain away from magnetic fields.

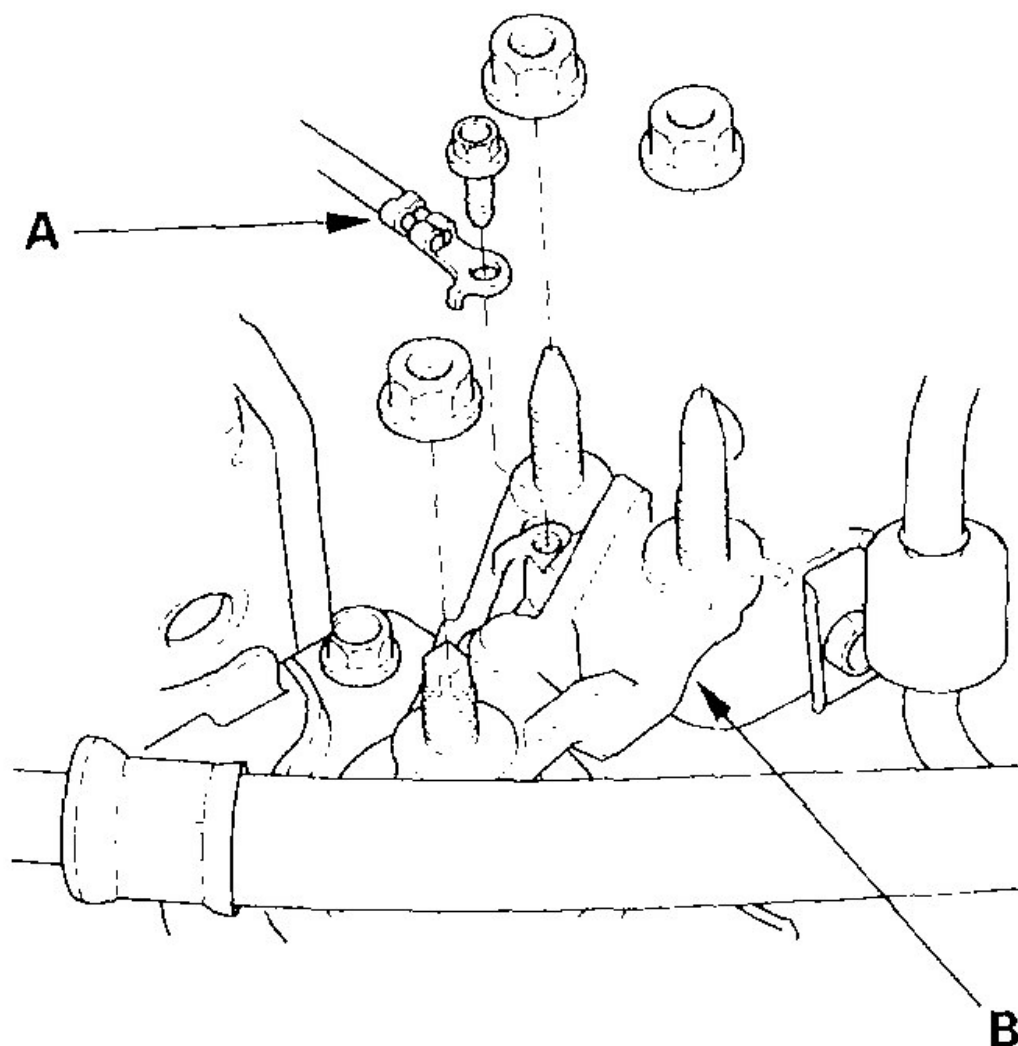
1. Remove the drive belt (see **DRIVE BELT REPLACEMENT**).
2. Turn the crankshaft pulley so its top dead center (TDC) mark (A) lines up with the pointer (B).



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Fig. 67: Turning Crankshaft Pulley So TDC Mark Lines Up With Pointer
Courtesy of AMERICAN HONDA MOTOR CO., INC.

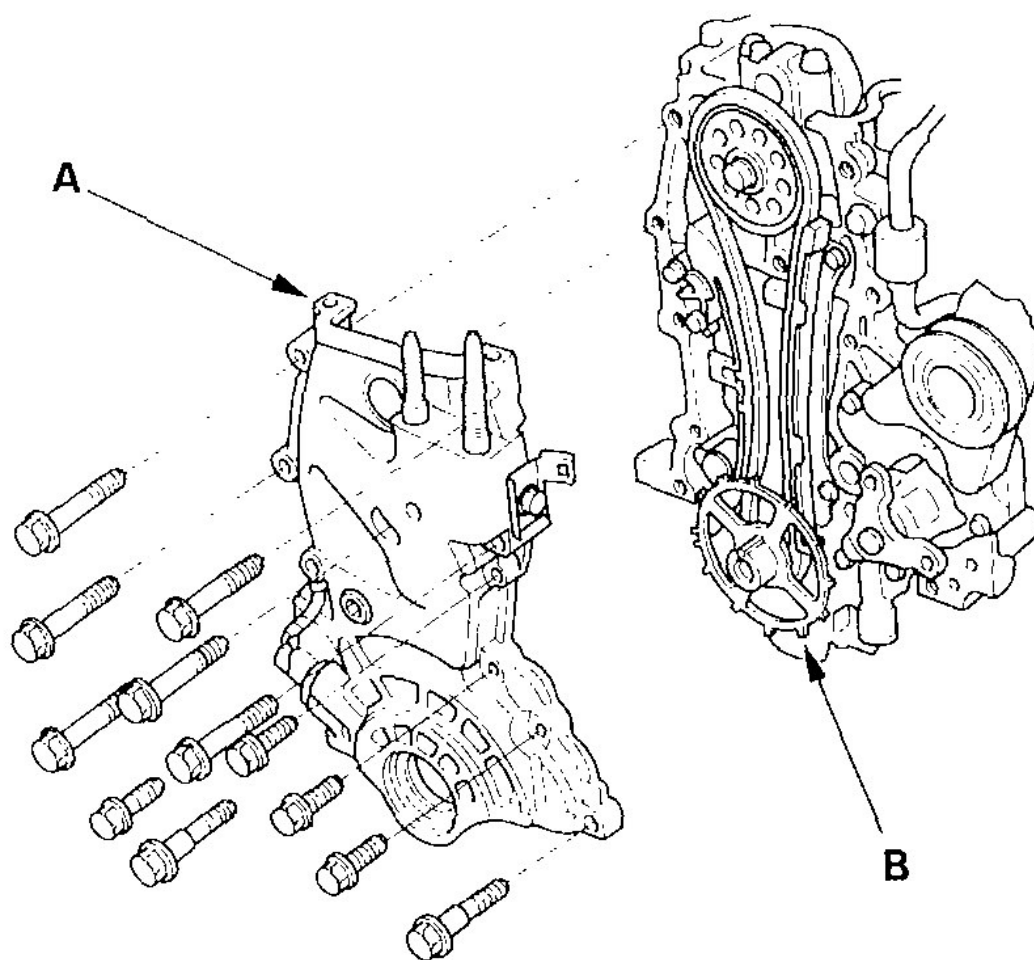
3. Remove the water pump pulley (see step on **WATER PUMP REPLACEMENT**).
4. Remove the cylinder head cover (see **Cylinder Head Cover Removal**).
5. Remove the crankshaft pulley (see **Crankshaft Pulley Removal and Installation**).
6. Remove the oil pan (see **Oil Pan Removal**).
7. Support the engine with a jack and wood block under the cylinder block.
8. Remove the ground cable (A), then remove the upper bracket (B).



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Fig. 68: Removing Ground Cable & Upper Bracket
Courtesy of AMERICAN HONDA MOTOR CO., INC.

9. Remove the chain case (A), then remove the pulse plate (B).



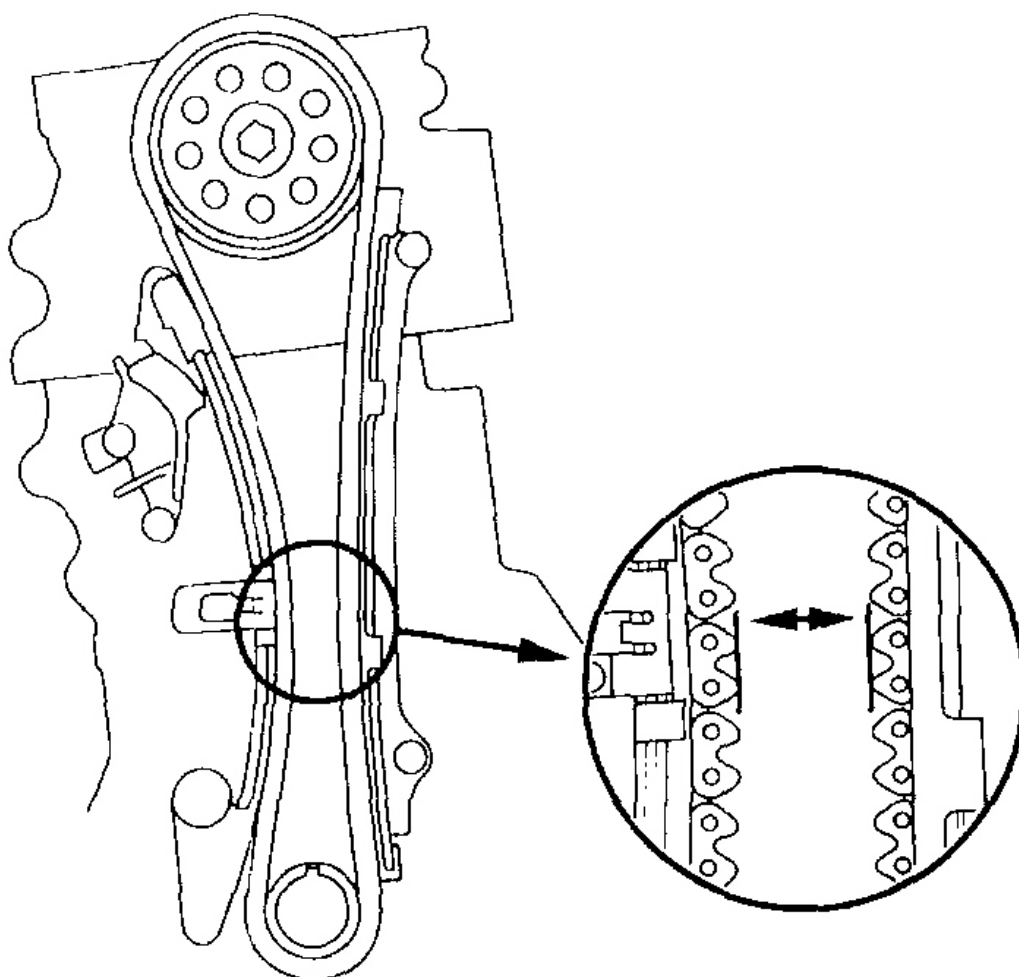
G01431440

Fig. 69: Removing Chain Case & Pulse Plate

Courtesy of AMERICAN HONDA MOTOR CO., INC.

10. Measure the cam chain separation. If the distance is less than the service limit, replace the cam chain and cam chain tensioner.

Standard Distance: 19 mm (0.75 in.)**Service Limit:** 15 mm (0.59 in.)

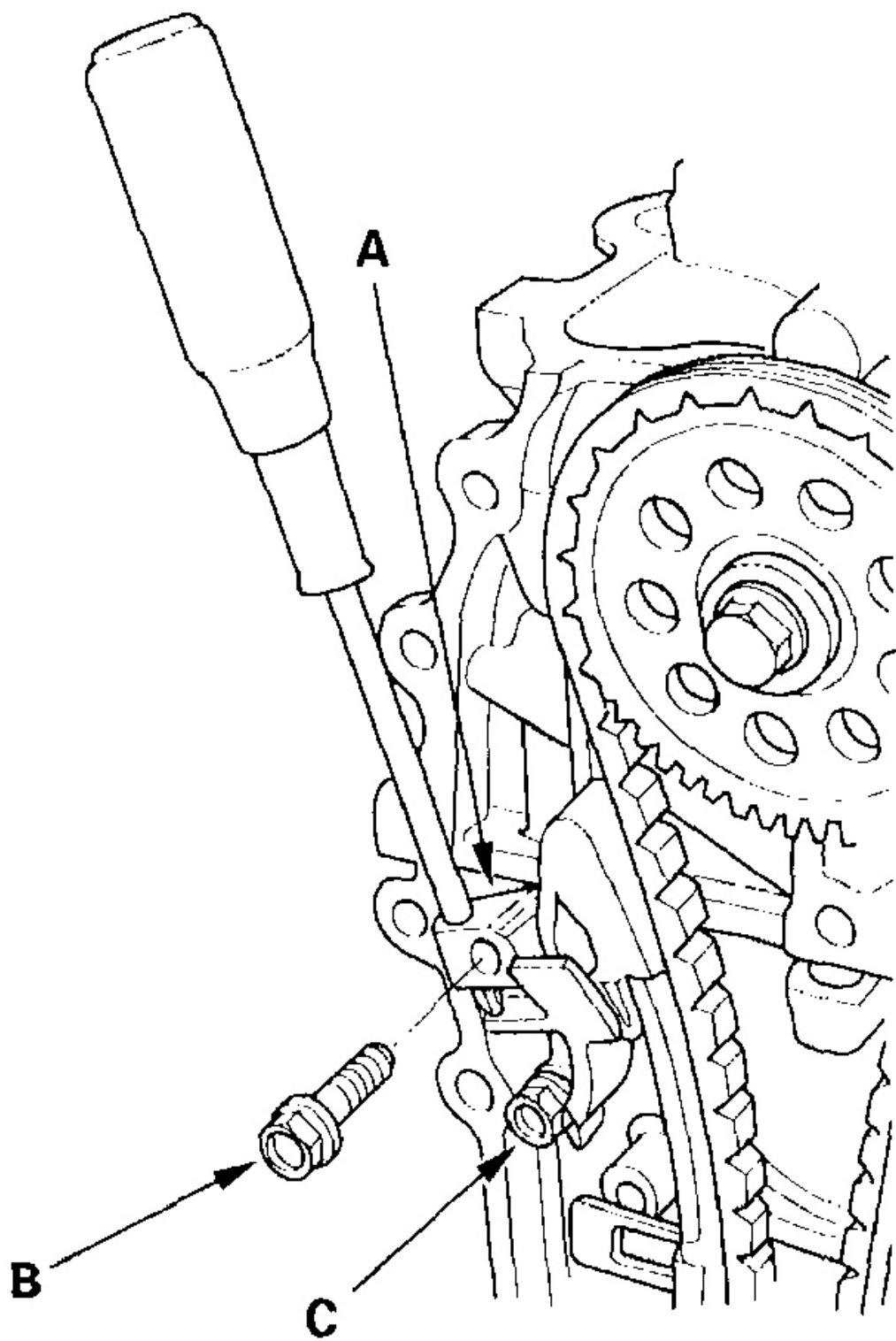


G01431441

Fig. 70: Measuring Cam Chain Separation

Courtesy of AMERICAN HONDA MOTOR CO., INC.

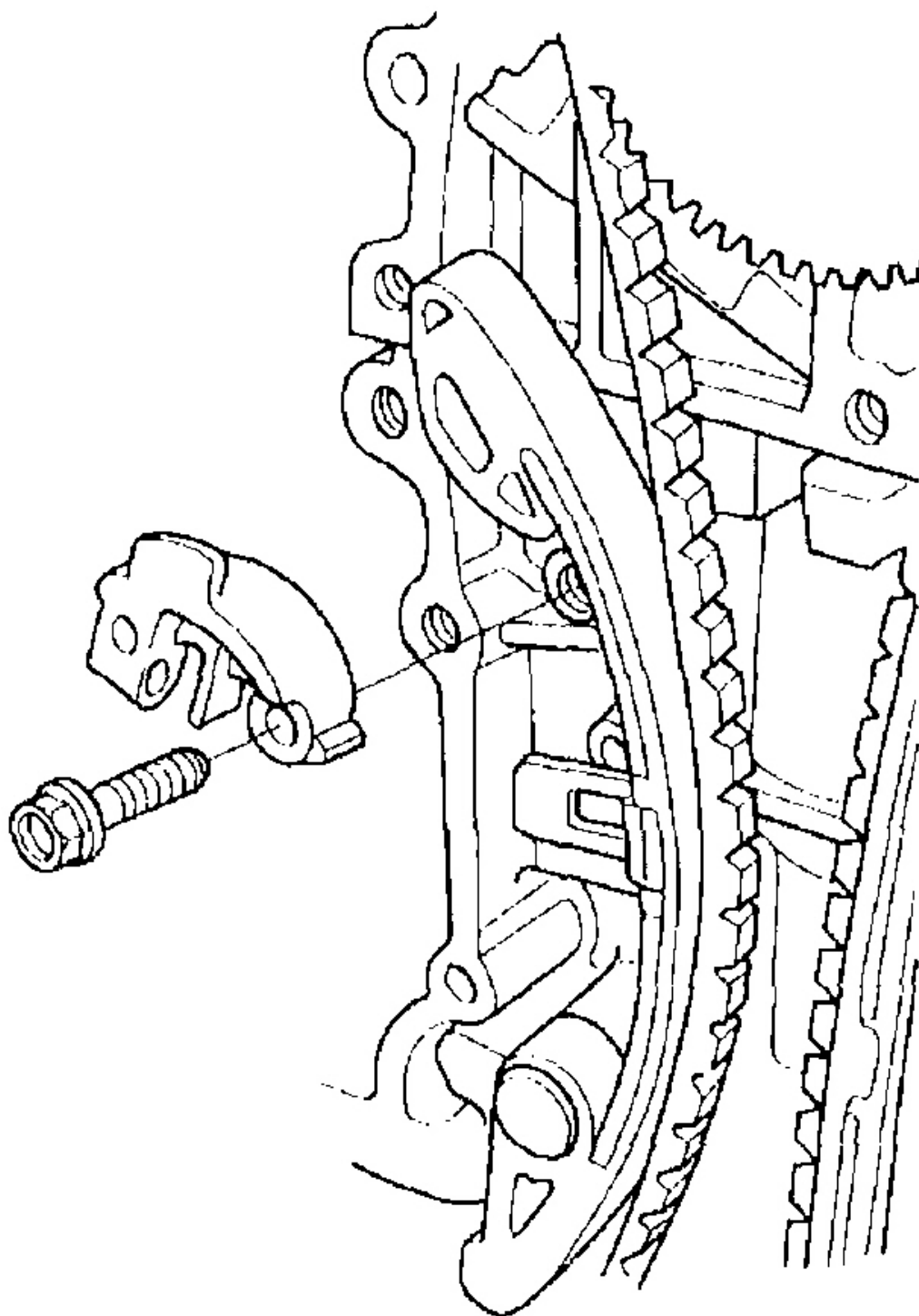
11. Apply new engine oil to the sliding surface of the cam chain tensioner (A).



G01431442

Fig. 71: Applying New Engine Oil To Sliding Surface Of Cam Chain Tensioner
Courtesy of AMERICAN HONDA MOTOR CO., INC.

12. Hold the cam chain tensioner with a screwdriver, then remove the bolt (B), and loosen the bolt (C).
13. Remove the cam chain tensioner.

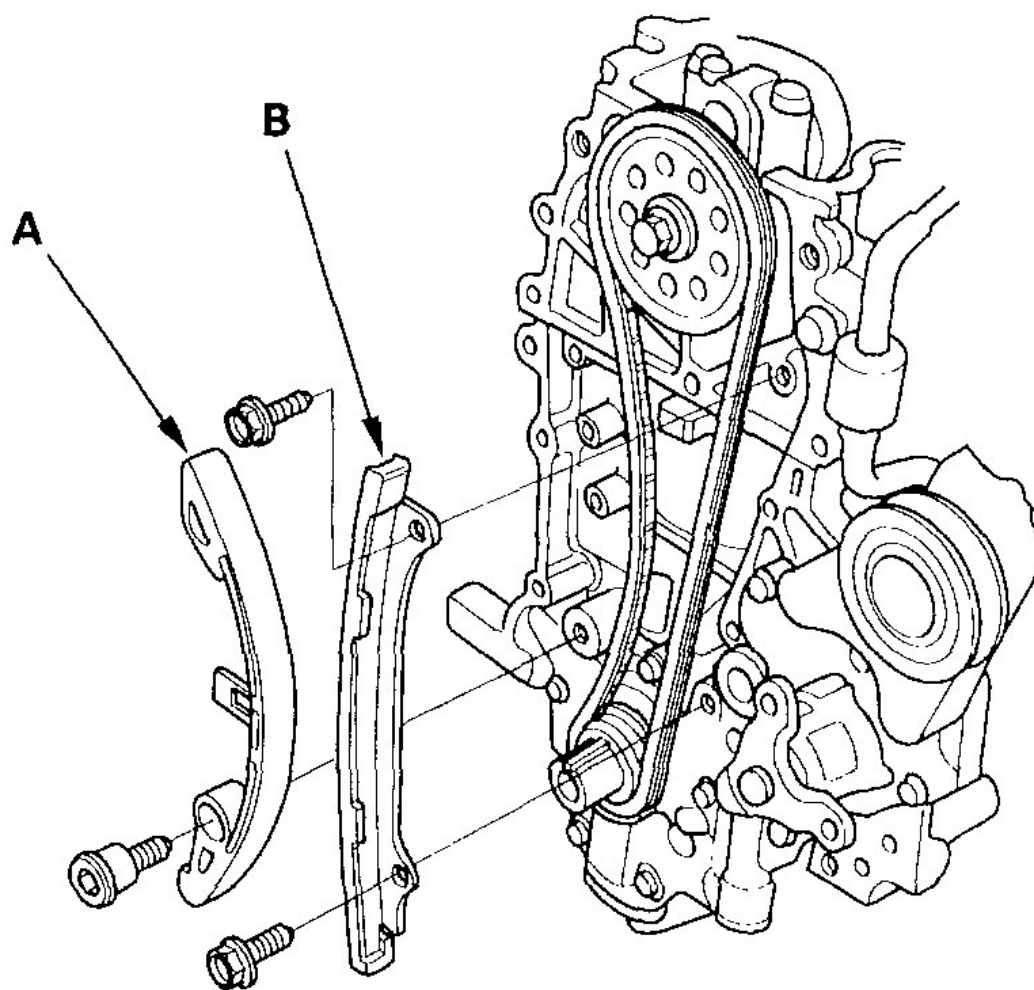


G01431443

Fig. 72: Removing Cam Chain Tensioner

Courtesy of AMERICAN HONDA MOTOR CO., INC.

14. Remove the cam chain tensioner rail (A) and cam chain guide (B).

**G01431444****Fig. 73: Removing Cam Chain Tensioner Rail**

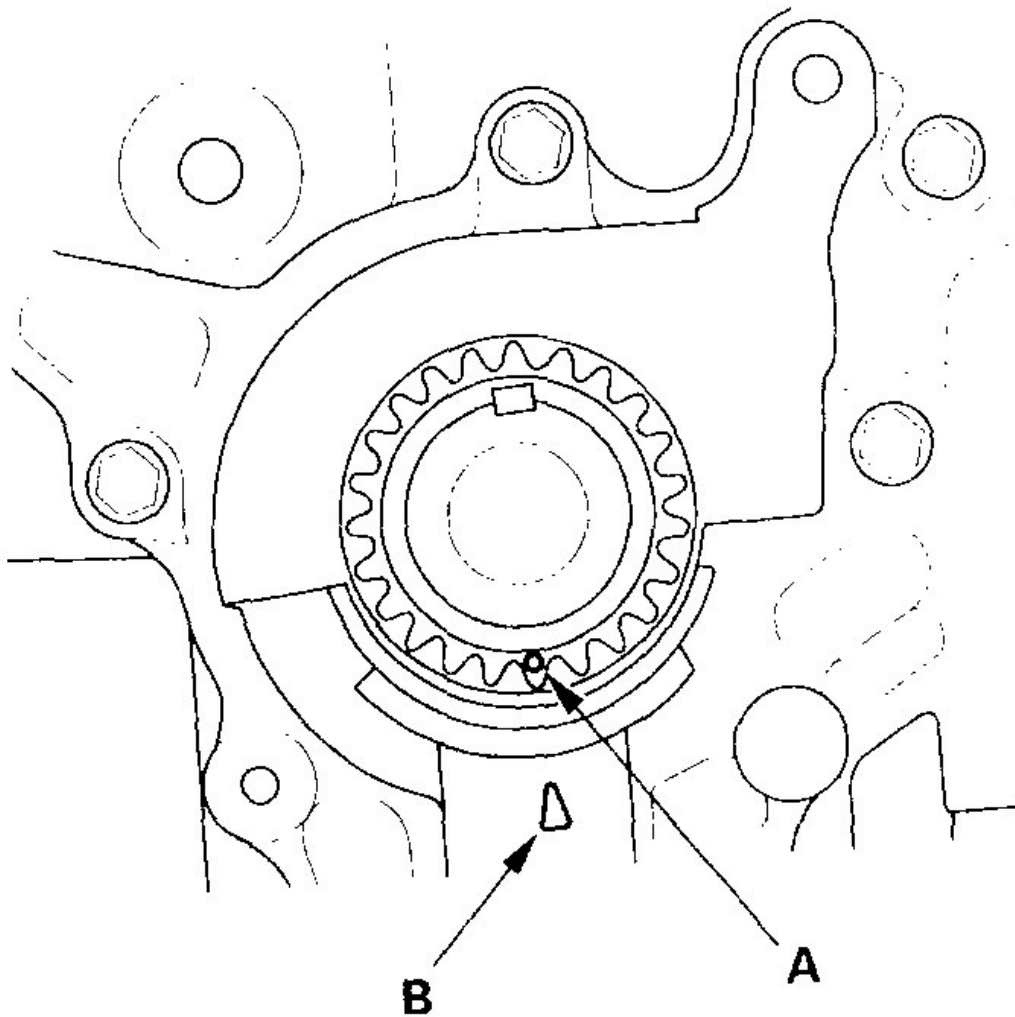
Courtesy of AMERICAN HONDA MOTOR CO., INC.

15. Remove the cam chain.

CAM CHAIN INSTALLATION

NOTE: Keep the cam chain away from magnetic fields.

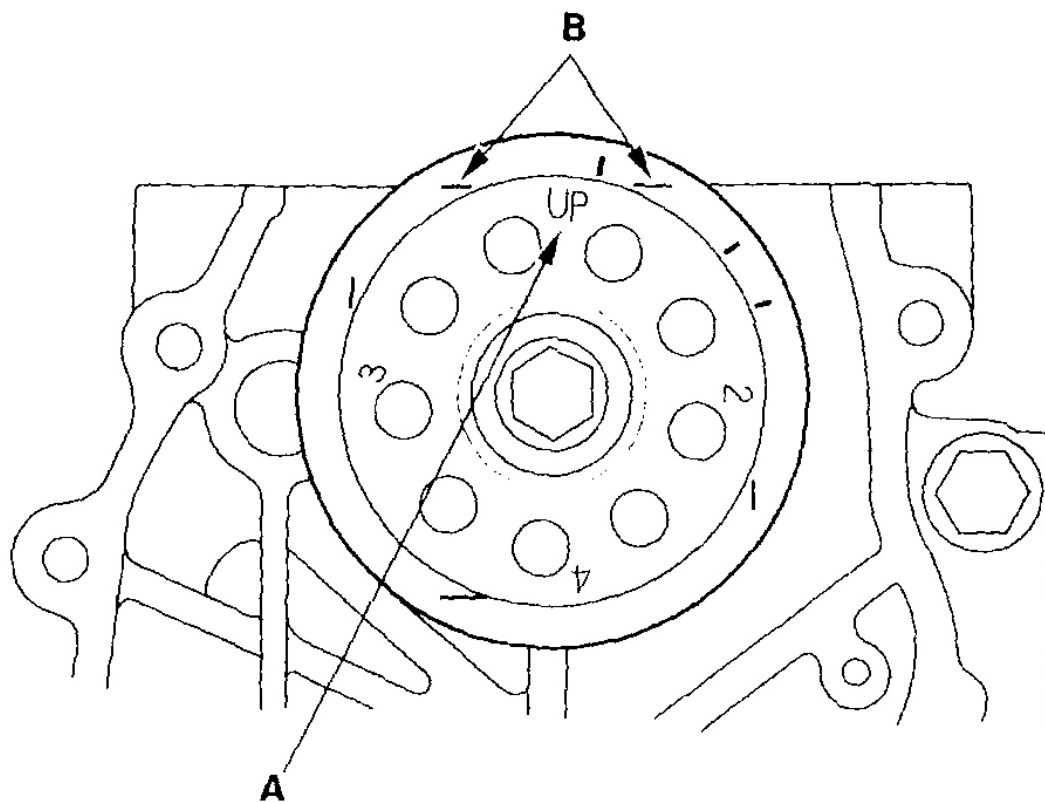
1. Set the crankshaft to top dead center (TDC). Align the TDC mark (A) on the crankshaft sprocket with the pointer (B) on the oil pump.



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Fig. 74: Aligning TDC Mark On Crankshaft Sprocket With Pointer On Oil Pump
Courtesy of AMERICAN HONDA MOTOR CO., INC.

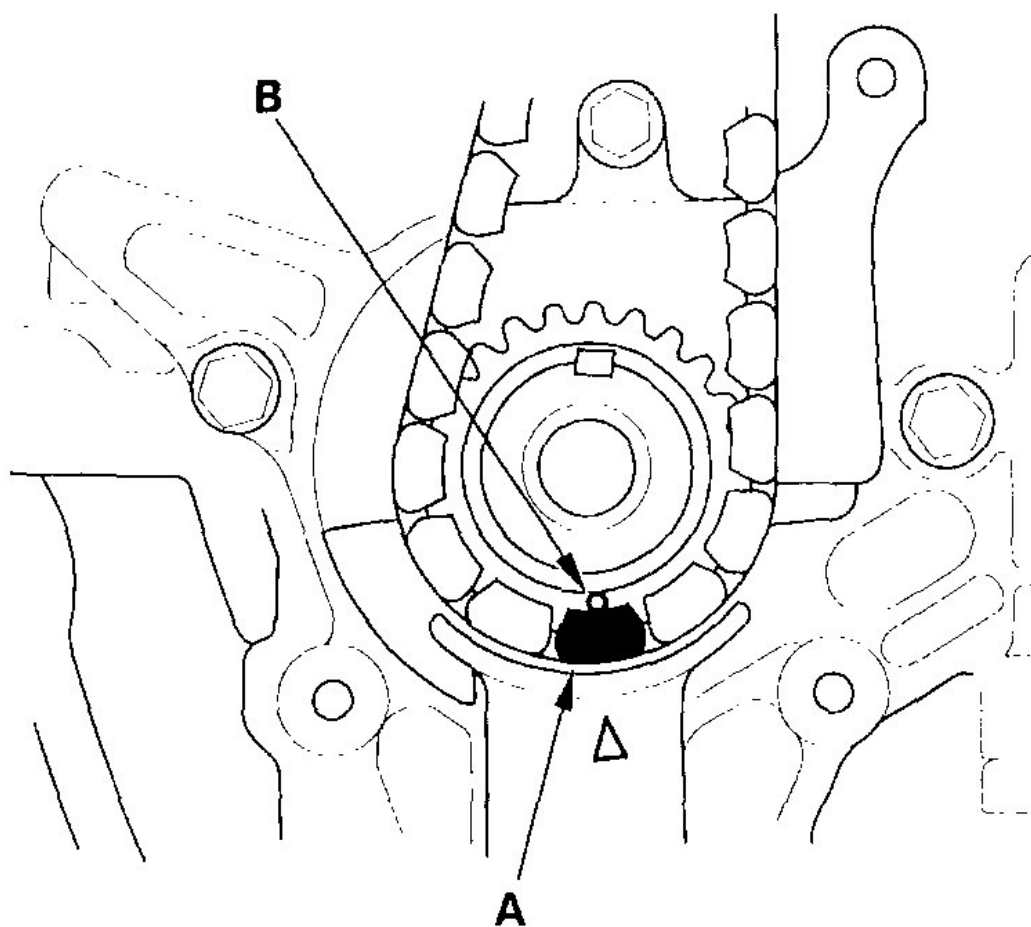
2. Set the No. 1 piston at TDC. The "UP" mark (A) on the camshaft sprocket should be at the top, and the TDC grooves (B) on the camshaft sprocket should line up with the top edge of the head.



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Fig. 75: "UP" Marking On Camshaft Sprocket Should Be At Top
Courtesy of AMERICAN HONDA MOTOR CO., INC.

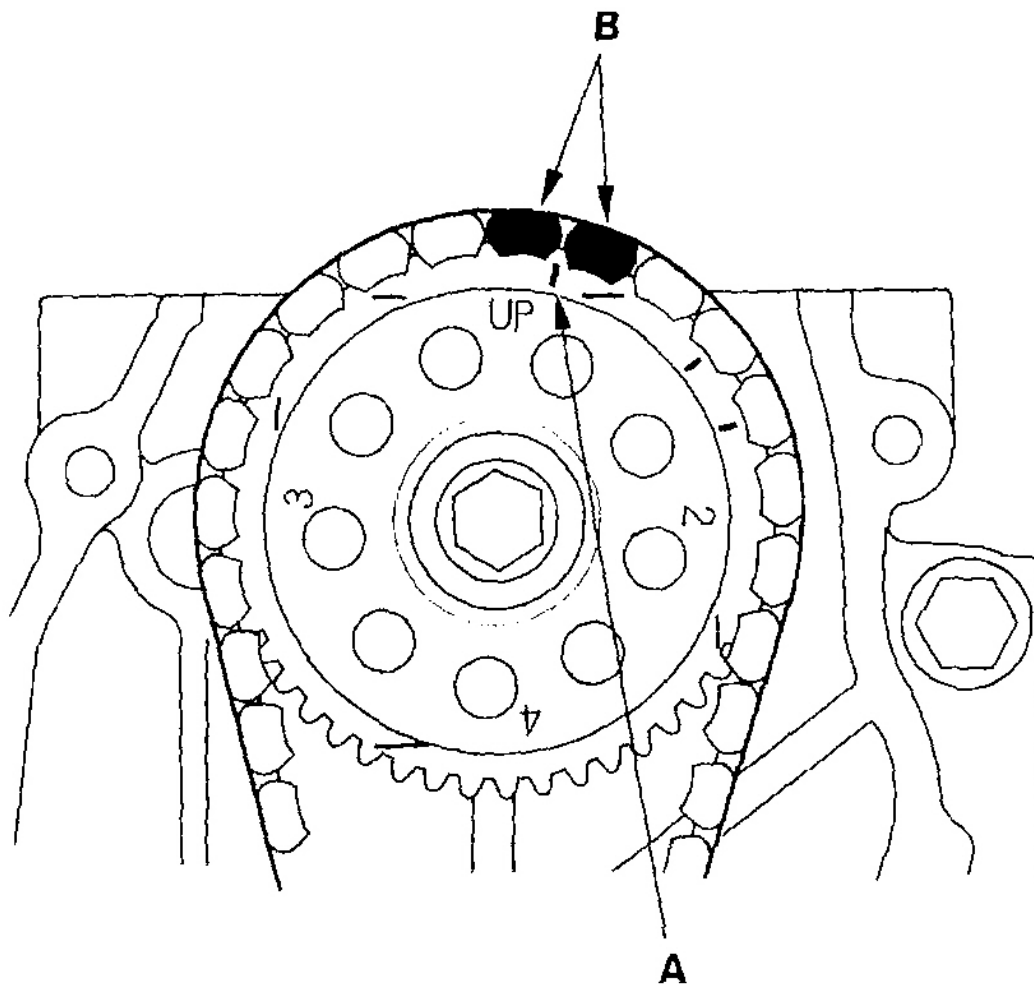
3. Install the cam chain on the crankshaft sprocket with the colored piece (A) aligned with the TDC mark (B) on the crankshaft sprocket.



G01431447

Fig. 76: Installing Cam Chain On Crankshaft Sprocket With Colored Piece
Courtesy of AMERICAN HONDA MOTOR CO., INC.

4. Install the cam chain on the camshaft sprocket with the pointer (A) aligned with the center of the two colored pieces (B).



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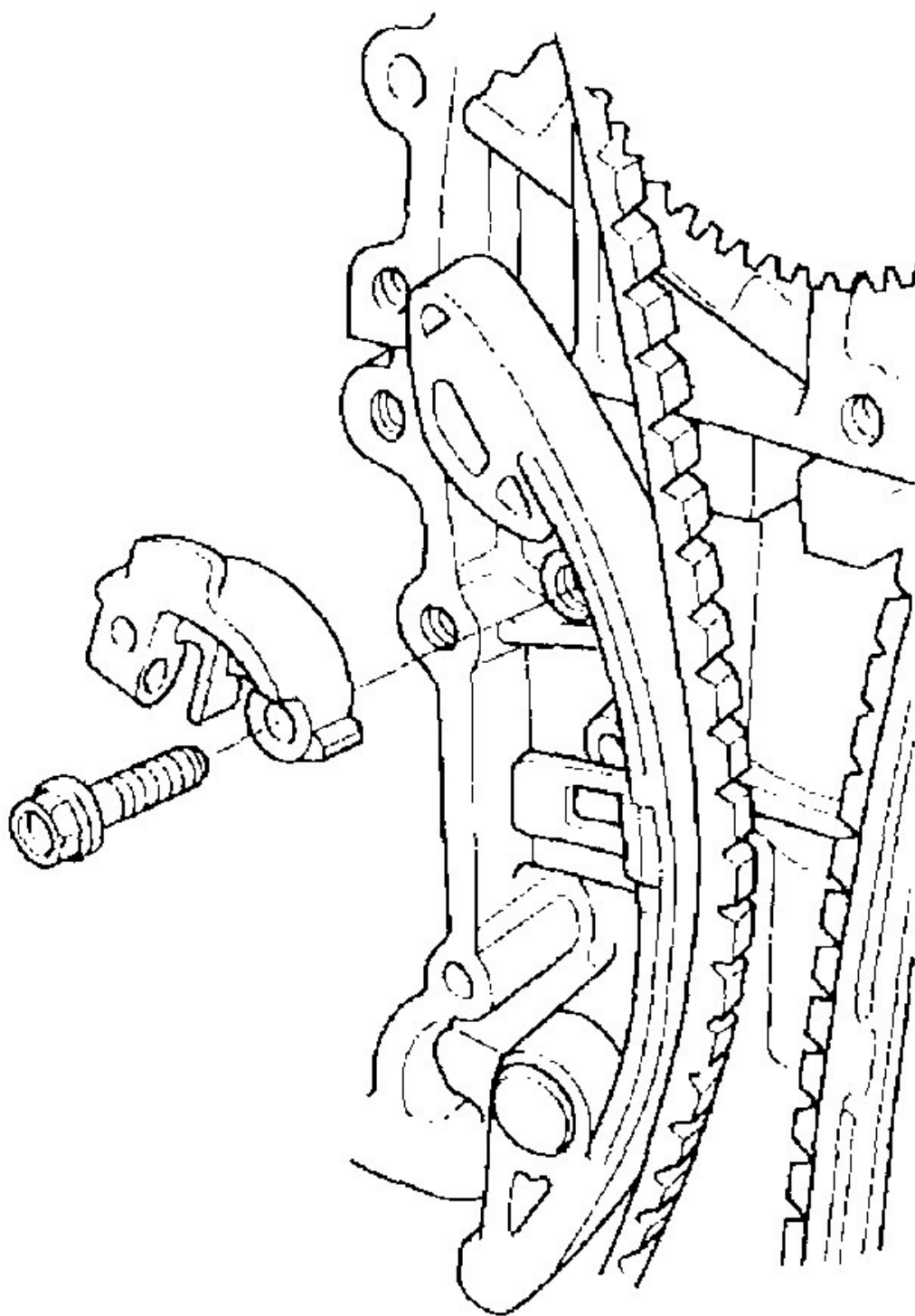
Fig. 77: Installing Cam Chain On Camshaft Sprocket With Pointer
Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. Apply new engine oil to the threads of the cam chain tensioner rail mounting bolt (A).



Fig. 78: Applying New Engine Oil To Threads Of Cam Chain Tensioner Rail Mounting Bolt
Courtesy of AMERICAN HONDA MOTOR CO., INC.

6. Install the cam chain tensioner rail (B) and cam chain guide (C).
7. Install the cam chain tensioner, and tighten the bolt loosely.



G01431450

Fig. 79: Installing Cam Chain Tensioner

Courtesy of AMERICAN HONDA MOTOR CO., INC.

8. Apply new engine oil to the sliding surface of the cam chain tensioner (A).

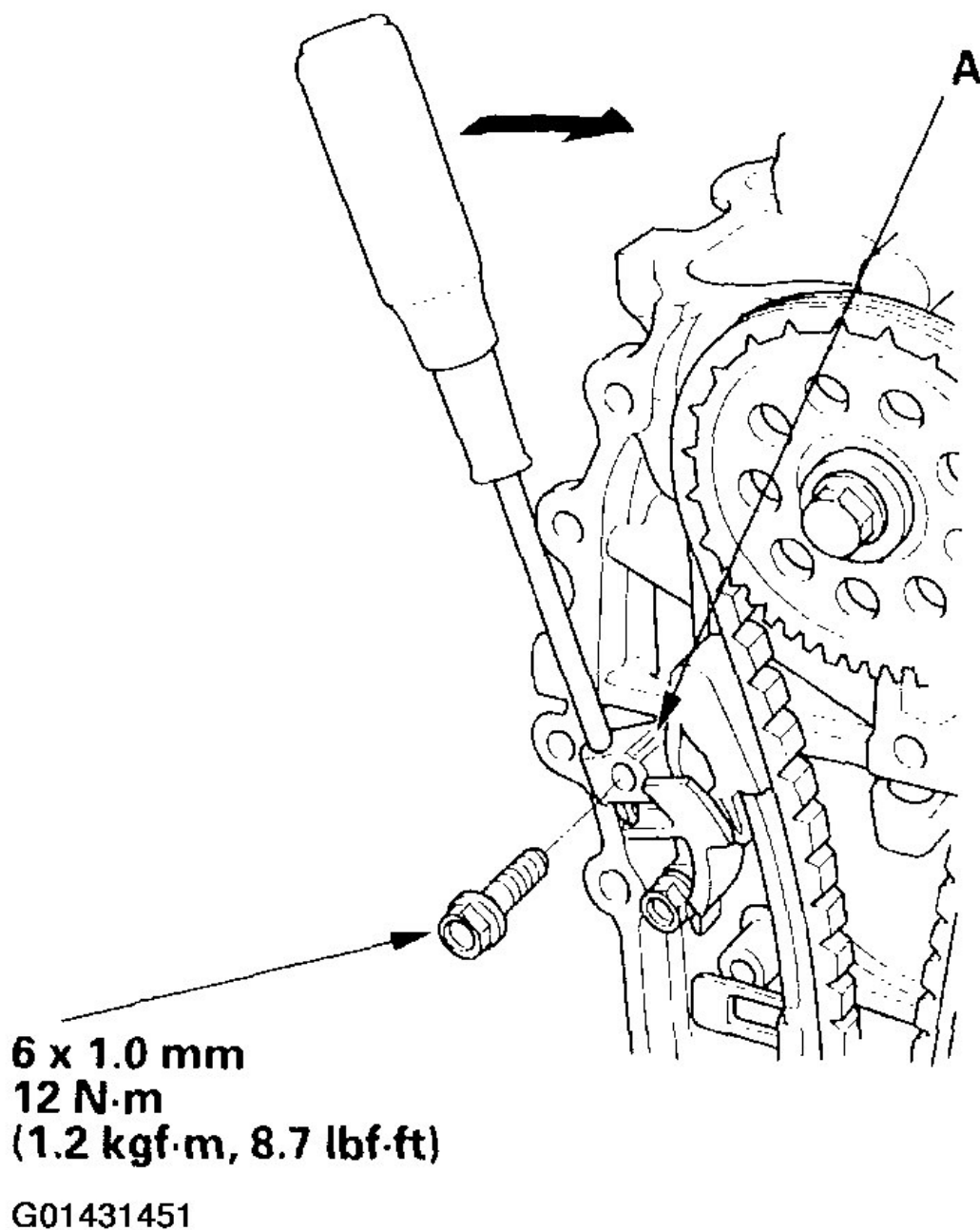


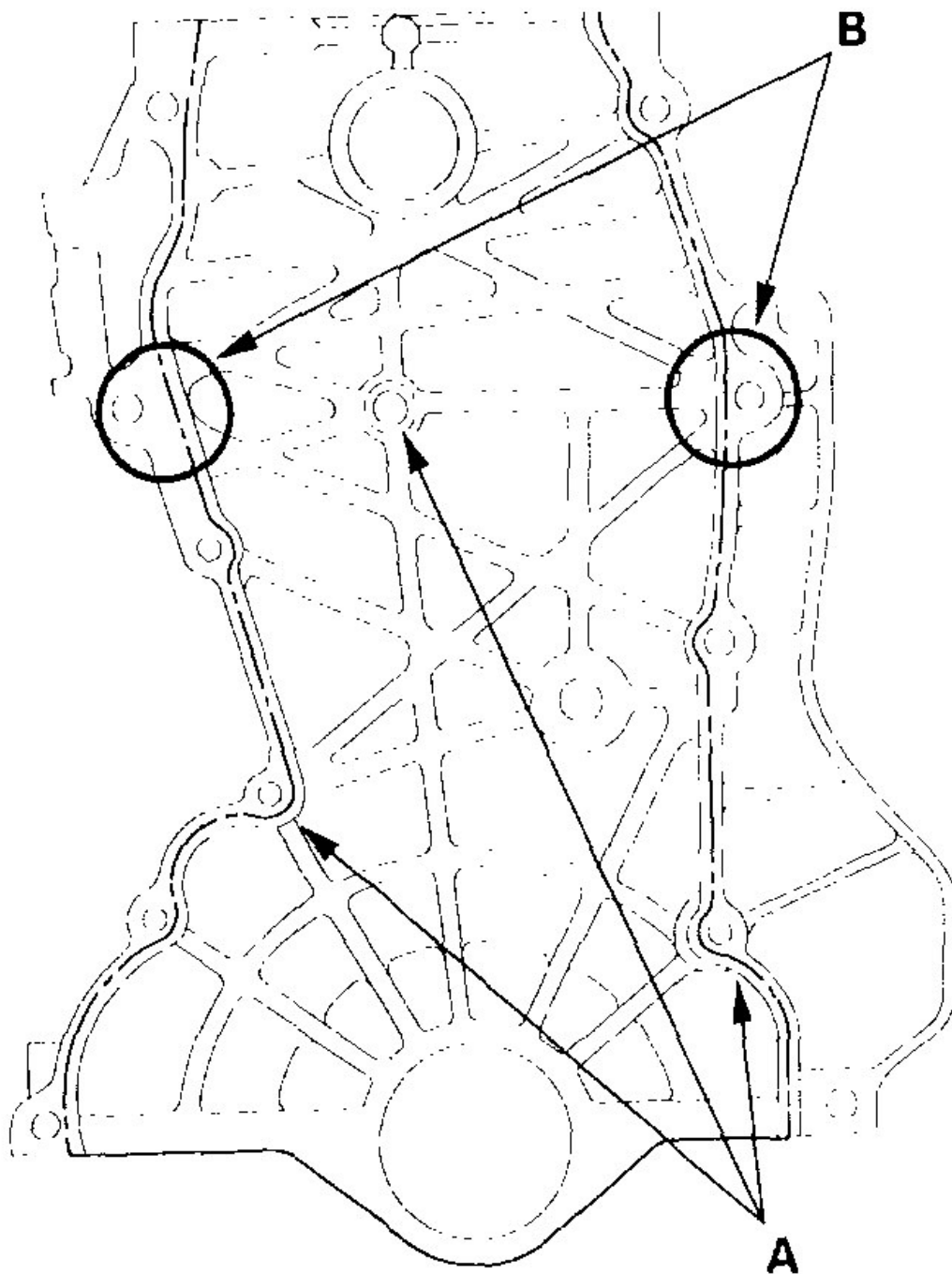
Fig. 80: Applying New Engine Oil To Sliding Surface Of Cam Chain Tensioner

Courtesy of AMERICAN HONDA MOTOR CO., INC.

9. Turn the cam chain tensioner clockwise to compress the cam chain tensioner rail. Install the remaining bolt, then tighten the bolts.
10. 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**).
11. Remove any old liquid gasket from the chain case mating surfaces, bolts, and bolt holes.
12. Clean and dry the chain case mating surfaces.
13. Apply liquid gasket, P/N 08718-0009, to the cylinder block mating surface of the chain case and the inner threads of the holes.

NOTE:

- **Apply a 1.5 mm wide bead of liquid gasket along the broken line (A).**
- **Apply a 3.0 mm wide bead of liquid gasket to the cylinder block upper surface contact areas (B) on the chain case.**
- **Do not install the parts if 4 minutes or more have elapsed since applying liquid gasket. Instead, reapply liquid gasket after removing the old residue.**



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Fig. 81: Applying Liquid Gasket Along Broken Line
Courtesy of AMERICAN HONDA MOTOR CO., INC.

14. Install the pulse plate (A) and chain case (B).

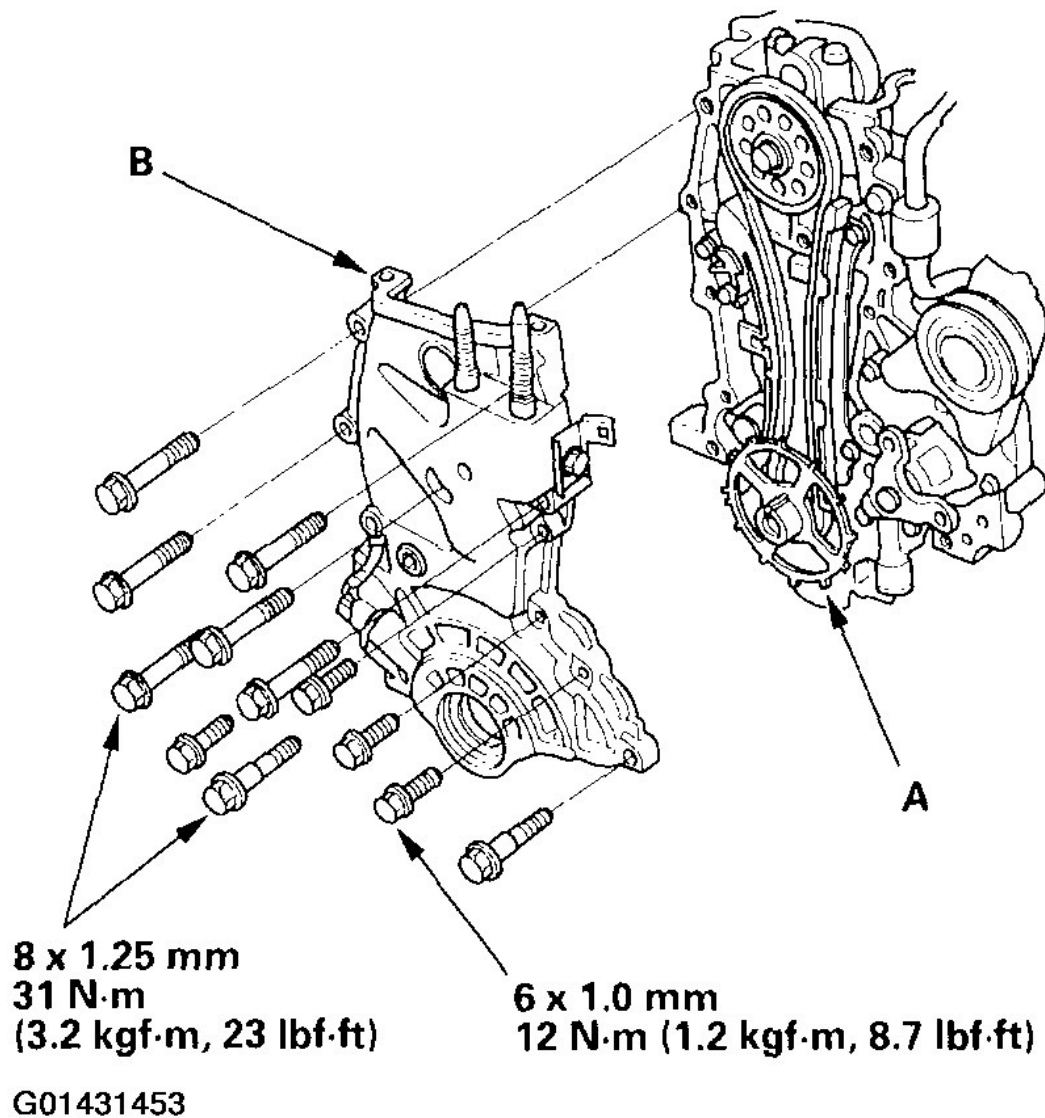
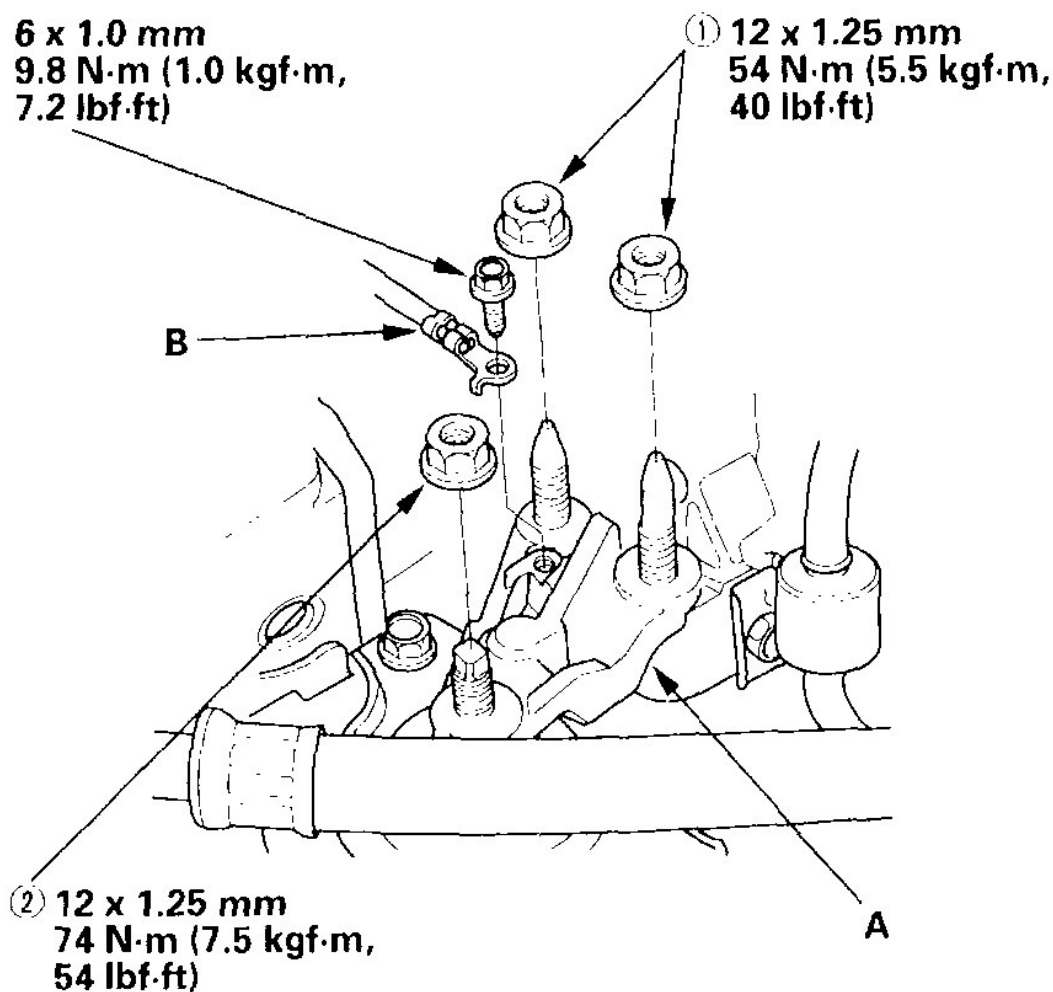


Fig. 82: Installing Pulse Plate & Chain Case
Courtesy of AMERICAN HONDA MOTOR CO., INC.

15. Install the upper bracket (A), then tighten the mounting nuts in the numbered sequence shown.



G01431454

Fig. 83: Installing Upper Bracket

Courtesy of AMERICAN HONDA MOTOR CO., INC.

16. Install the ground cable (B).
17. Install the oil pan (see **Oil Pan Installation**).
18. Install the crankshaft pulley (see **Crankshaft Pulley Removal and Installation**).
19. Install the cylinder head cover (see **Cylinder Head Cover Installation**).
20. Install the water pump pulley (see step on **WATER PUMP REPLACEMENT**).
21. Install the drive belt and adjust it (see **DRIVE BELT INSPECTION AND ADJUSTMENT**).

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.

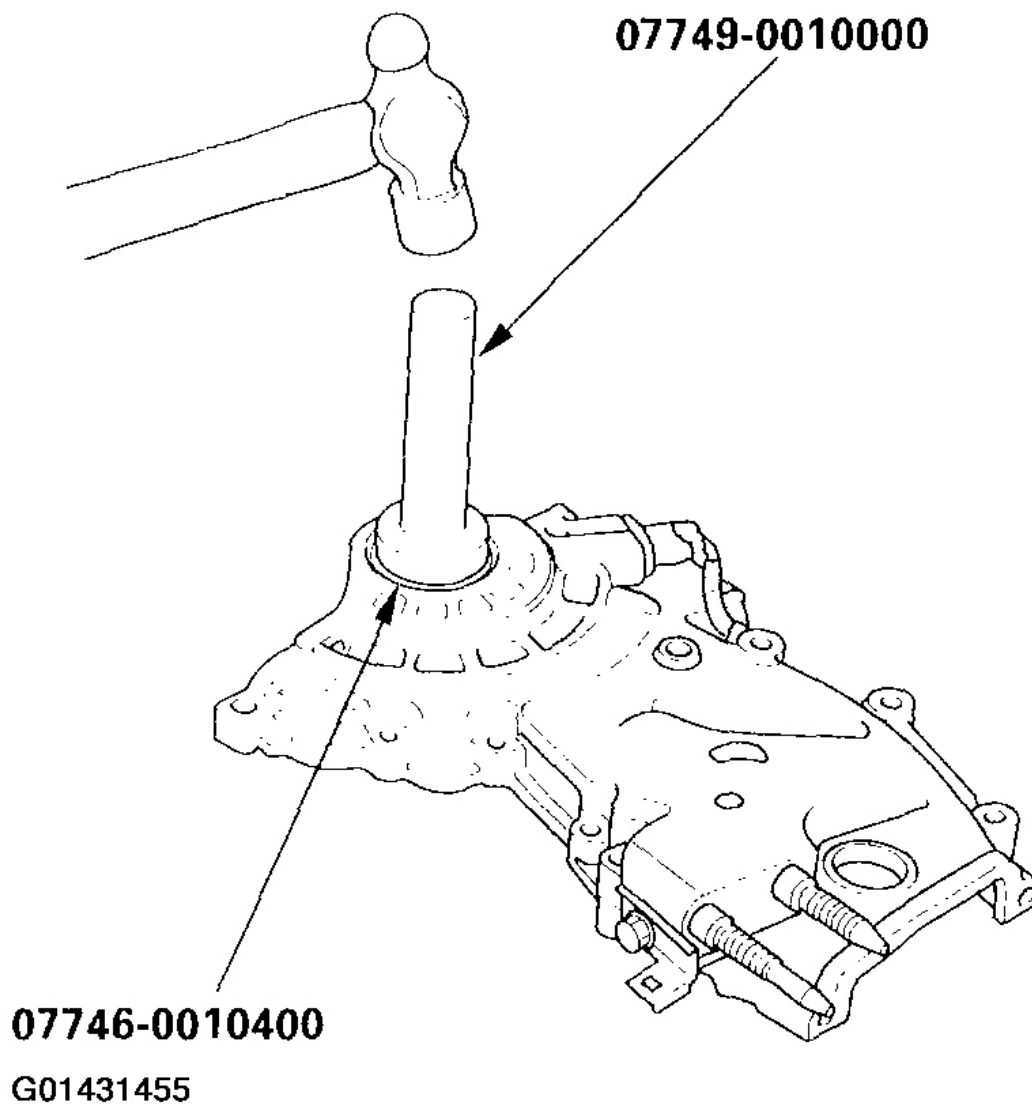
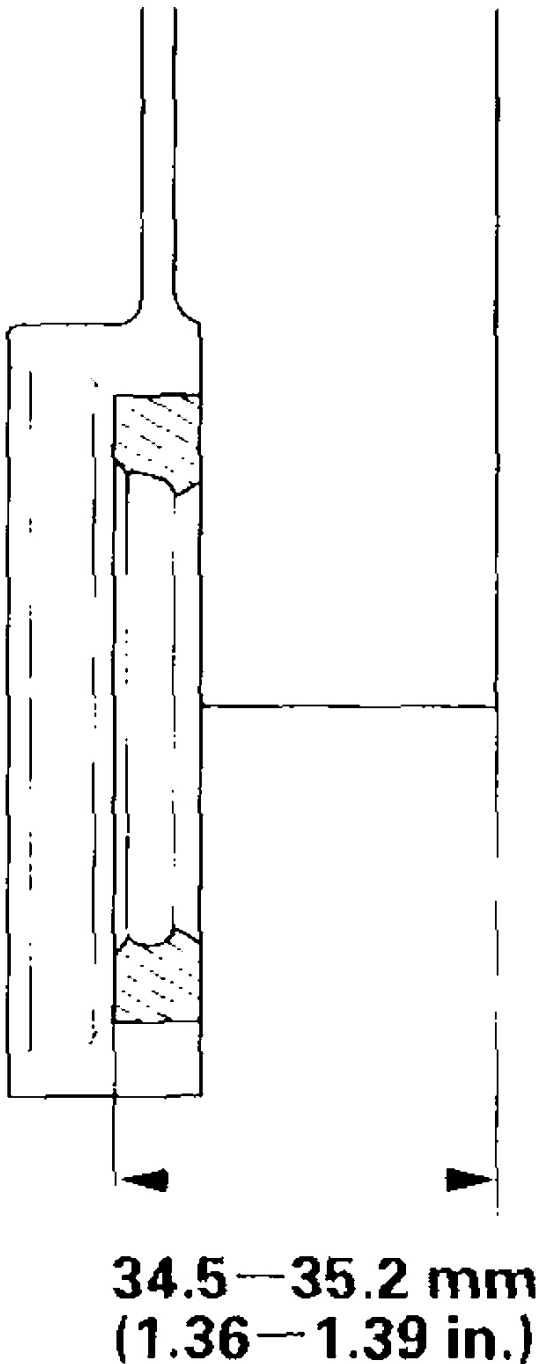


Fig. 84: Using Special Tools To Drive New Oil Seal Squarely Into Chain Case
Courtesy of AMERICAN HONDA MOTOR CO., INC.

2. Measure the distance between the chain case surface and oil seal.

Oil Seal Installed Height: 34.5–35.2 mm (1.36–1.39 in.)

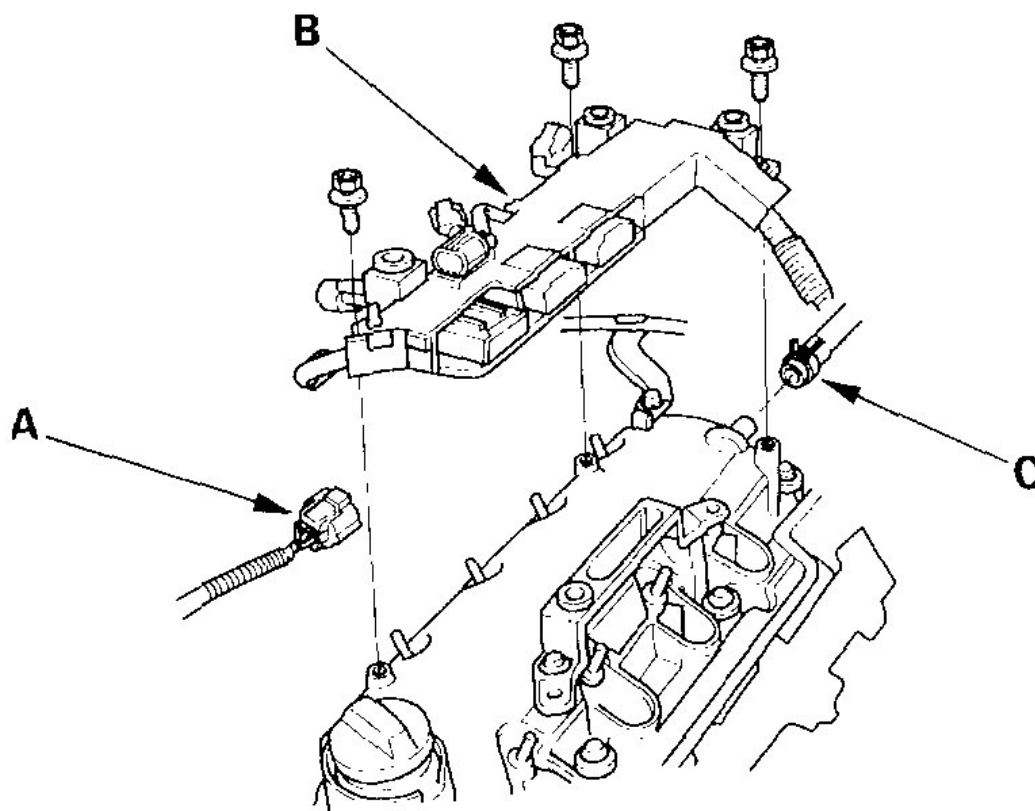


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Fig. 85: Measuring Distance Between Chain Case Surface & Oil Seal
Courtesy of AMERICAN HONDA MOTOR CO., INC.

CYLINDER HEAD COVER REMOVAL

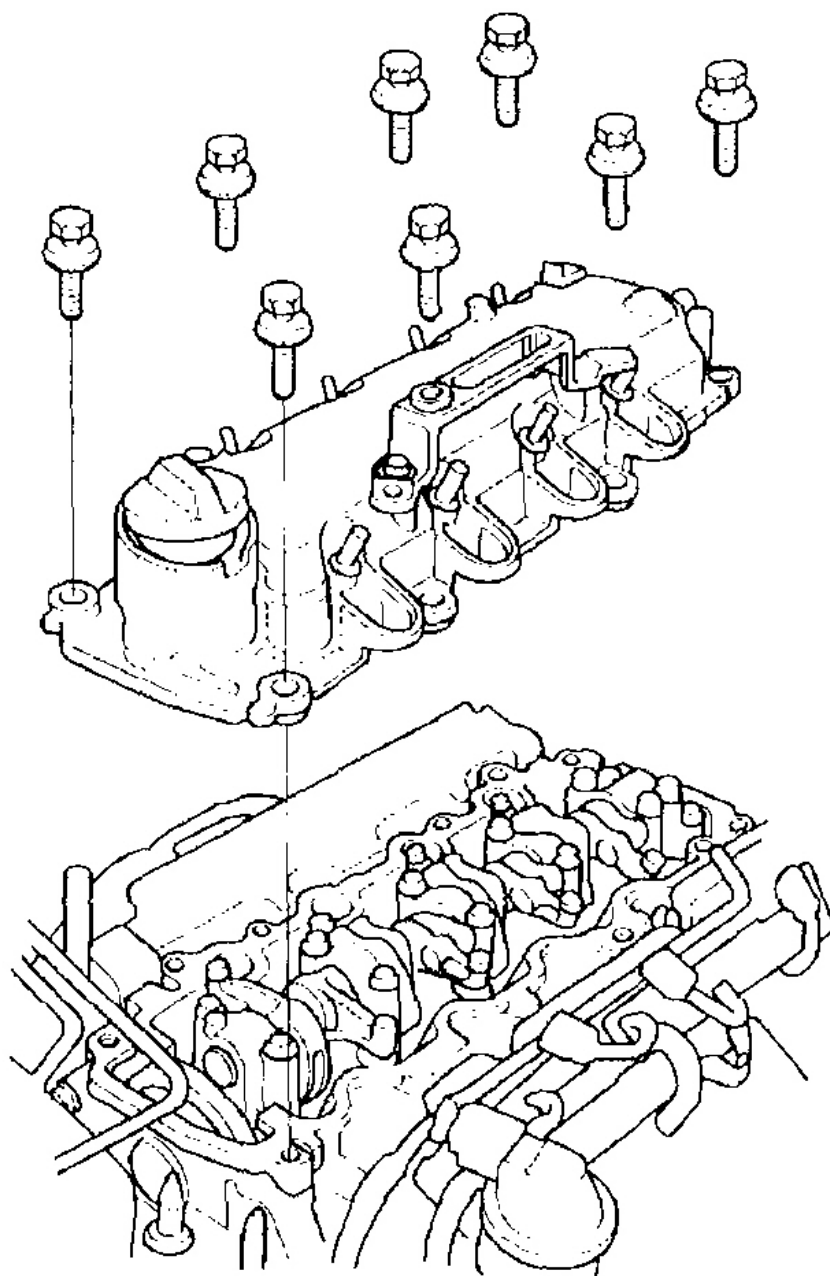
1. Remove the eight ignition coils (see **IGNITION COIL REMOVAL/INSTALLATION**).
2. Disconnect the subharness connector (A), then remove the harness holder (B) and breather hose (C).



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Fig. 86: Disconnecting Subharness Connector
Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. Remove the cylinder head cover.



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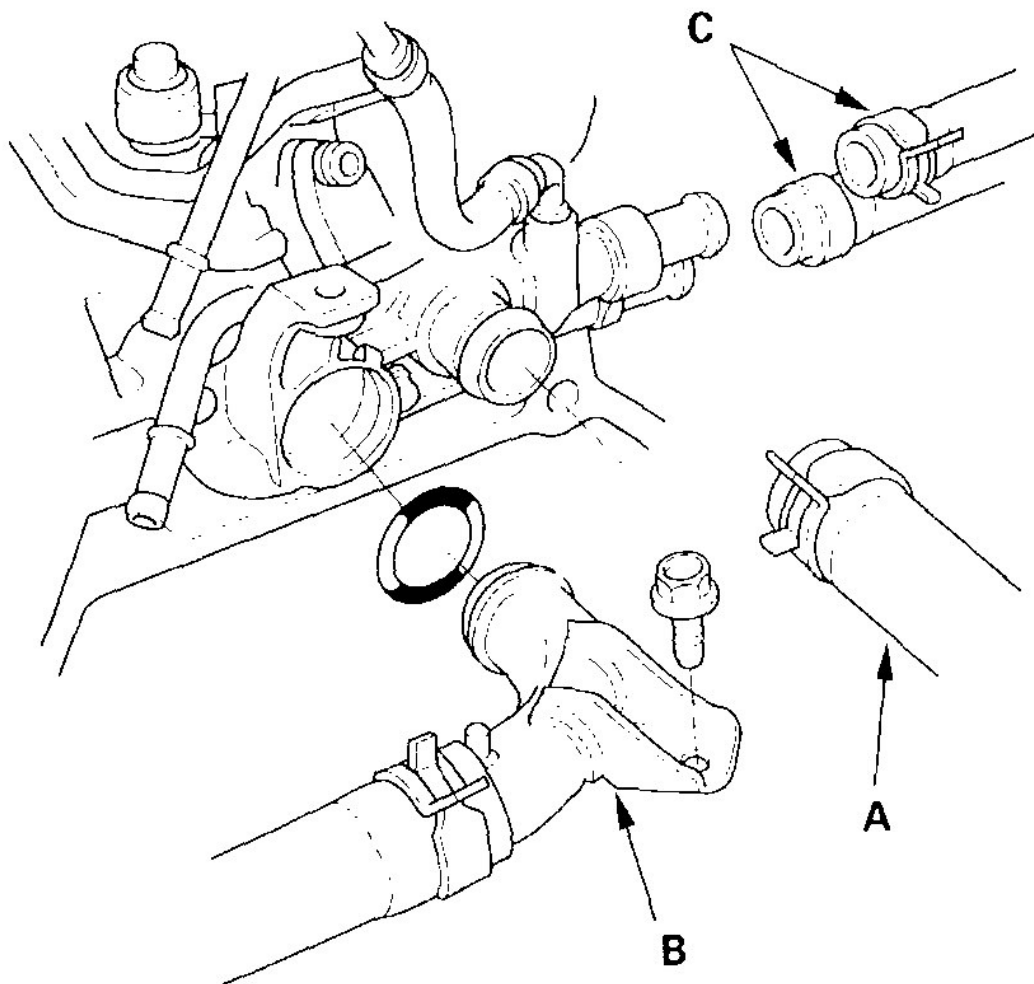
Fig. 87: Removing Cylinder Head Cover
Courtesy of AMERICAN HONDA MOTOR CO., INC.

CYLINDER HEAD REMOVAL

NOTE:

- Use fender covers to avoid damaging painted surfaces.
- To avoid damage, 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.
- Keep the cam chain away from magnetic fields.

1. Drain the engine coolant (see COOLANT REPLACEMENT).
2. Remove the air cleaner housing (see AIR CLEANER REMOVAL/INSTALLATION).
3. Relieve fuel pressure (see FUEL PRESSURE RELIEVING).
4. Remove the intake manifold (see Intake Manifold Removal and Installation).
5. Remove the exhaust manifold (see Exhaust Manifold Removal and Installation).
6. Remove the upper radiator hose (A), lower radiator hose joint (B) and heater hoses (C).

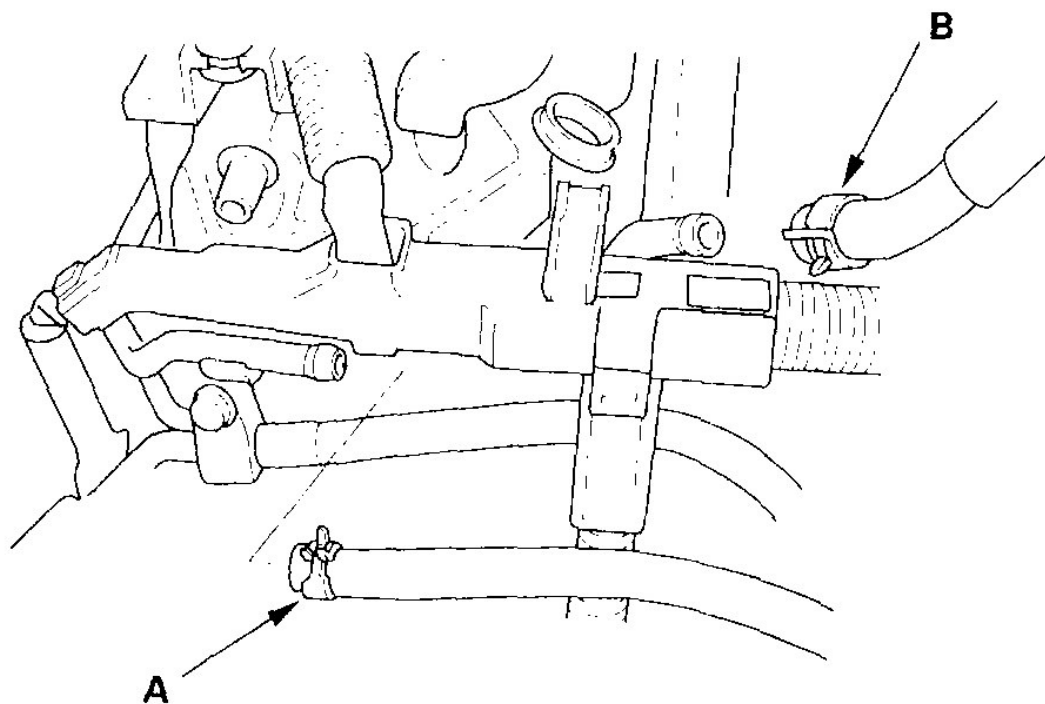


G01431459

Fig. 88: Removing Upper Radiator Hose

Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

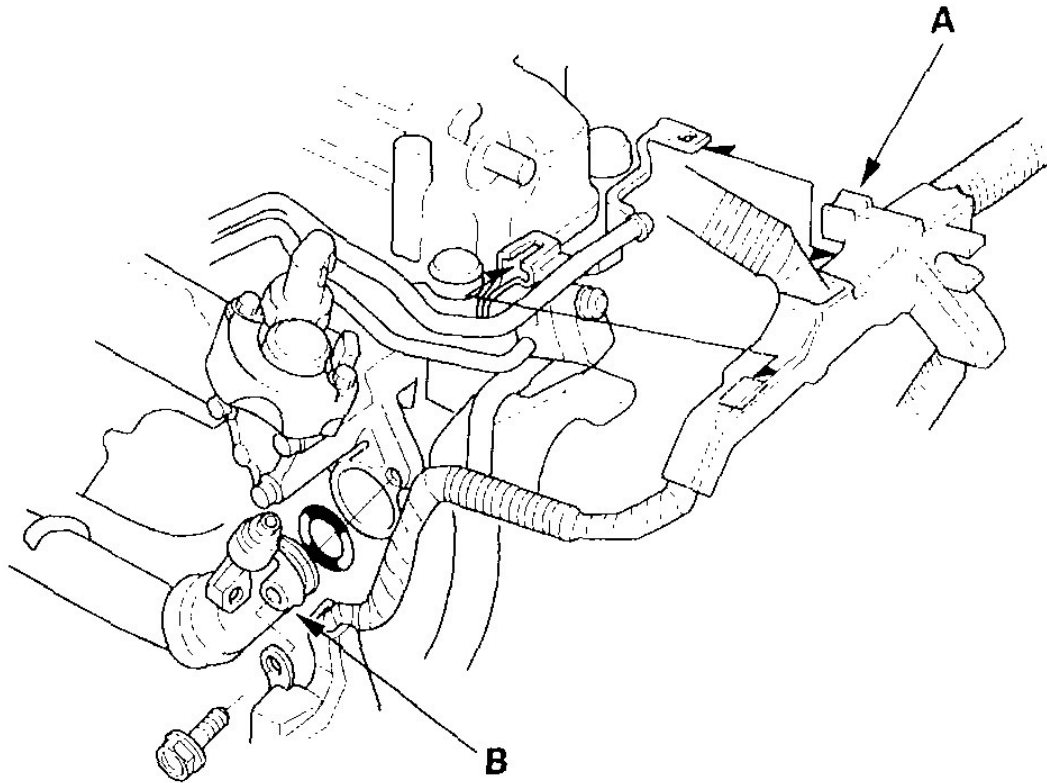


G01431460

Fig. 89: Removing EVAP Canister Hose

Courtesy of AMERICAN HONDA MOTOR CO., INC.

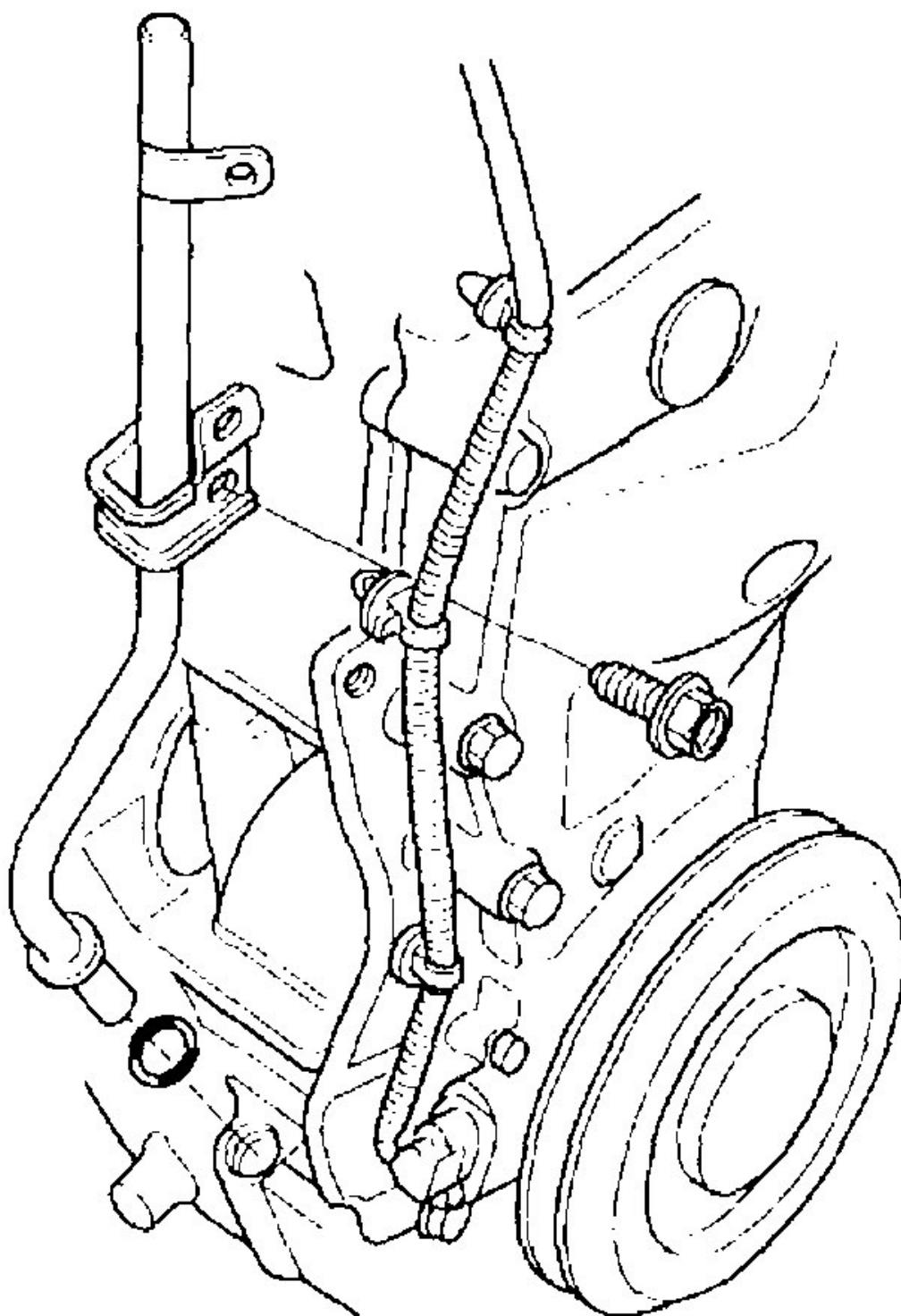
8. Remove the engine wire harness connectors and wire harness clamps from the cylinder head.
 - Four injector connectors
 - Engine coolant temperature (ECT) sensor connector
 - Camshaft position (CMP) sensor connector
 - VTEC solenoid valve connector
 - Engine oil pressure (EOP) sensor connector
9. Remove the harness holder (A).



G01431461

Fig. 90: Removing Harness Holder
Courtesy of AMERICAN HONDA MOTOR CO., INC.

10. Remove the connecting pipe (B) from the cylinder head.
11. Remove the drive belt (see **DRIVE BELT REPLACEMENT**).
12. Turn the crankshaft pulley so its TDC mark lines up with the pointer (see **Cam Chain Removal**).
13. Remove the water pump pulley (see step on **WATER PUMP REPLACEMENT**).
14. Remove the cylinder head cover (see **Cylinder Head Cover Removal**).
15. Remove the crankshaft pulley (see **Crankshaft Pulley Removal and Installation**).
16. Support the engine with a jack and wood block under the oil pan.
17. Remove the ground cable, then remove the upper bracket (see step 8 on **Cam Chain Removal**).
18. Remove the dipstick tube.

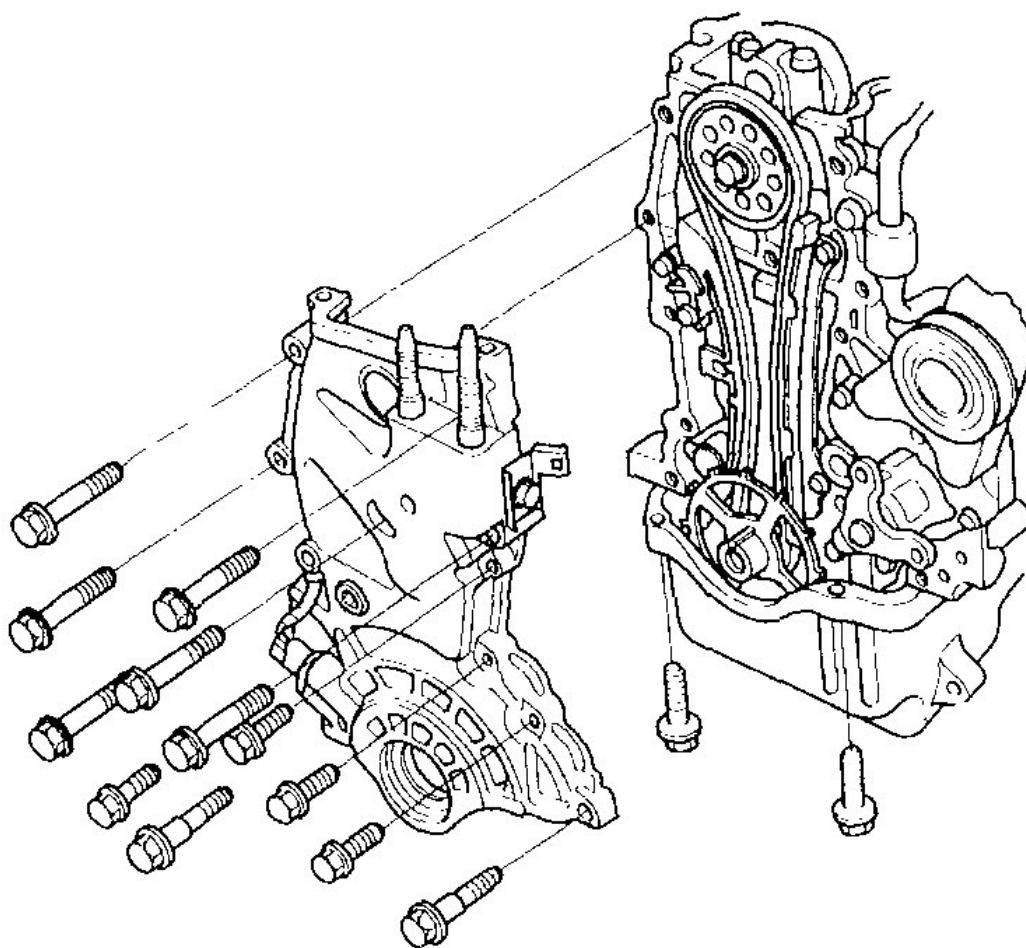


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Fig. 91: Removing Dipstick Tube

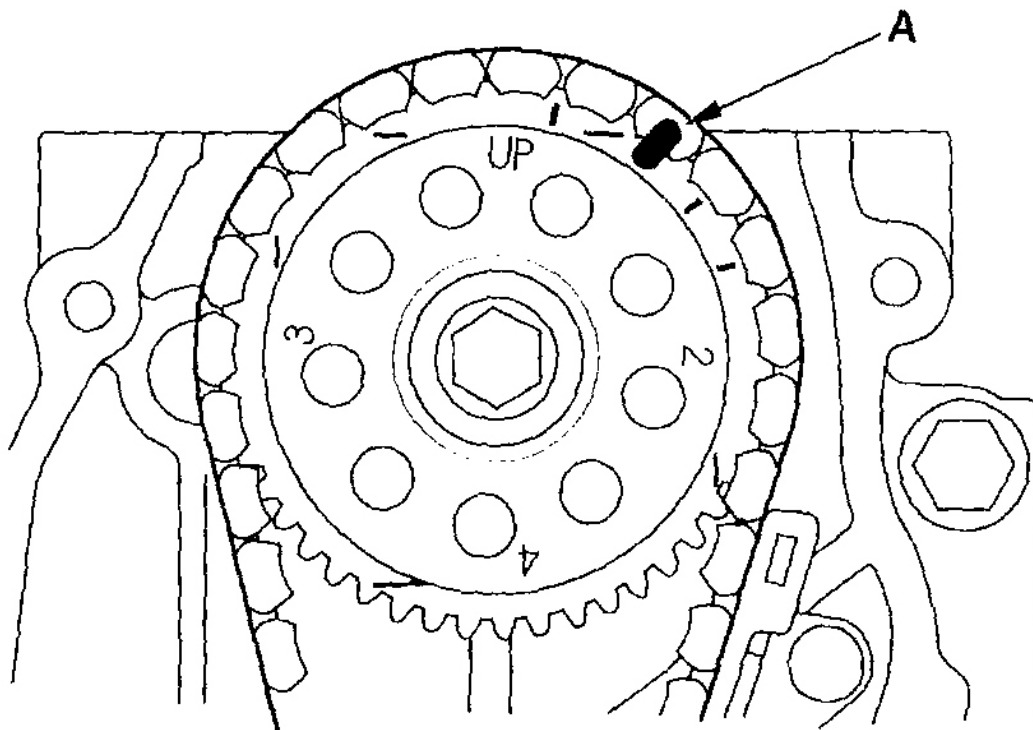
Courtesy of AMERICAN HONDA MOTOR CO., INC.

19. Remove the chain case.

**G01431463****Fig. 92: Removing Chain Case**

Courtesy of AMERICAN HONDA MOTOR CO., INC.

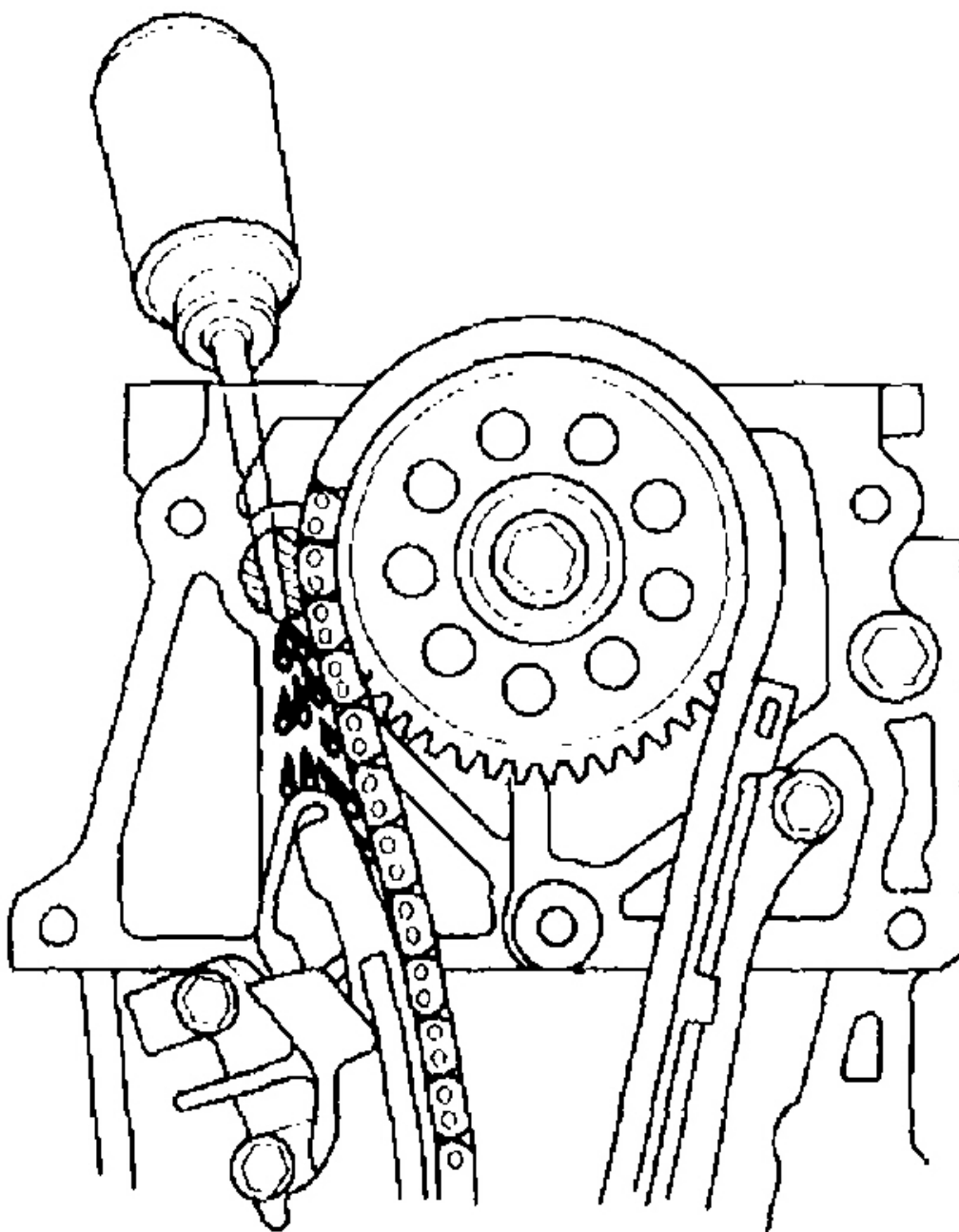
20. Make a reference mark (A) across the camshaft sprocket and cam chain.



G01431464

Fig. 93: Making Reference Mark Across Camshaft Sprocket & Cam Chain
Courtesy of AMERICAN HONDA MOTOR CO., INC.

21. Loosely install the crankshaft pulley.
22. Apply new engine oil to the sliding surface of the cam chain tensioner through the oil return hole in the cylinder head.



G01431465

Fig. 94: Applying New Engine Oil To Sliding Surface Of Cam Chain Tensioner Through Oil Return Hole In Cylinder Head

Courtesy of AMERICAN HONDA MOTOR CO., INC.

23. Hold the crankshaft pulley and set the socket wrench (A) on the camshaft sprocket bolt.

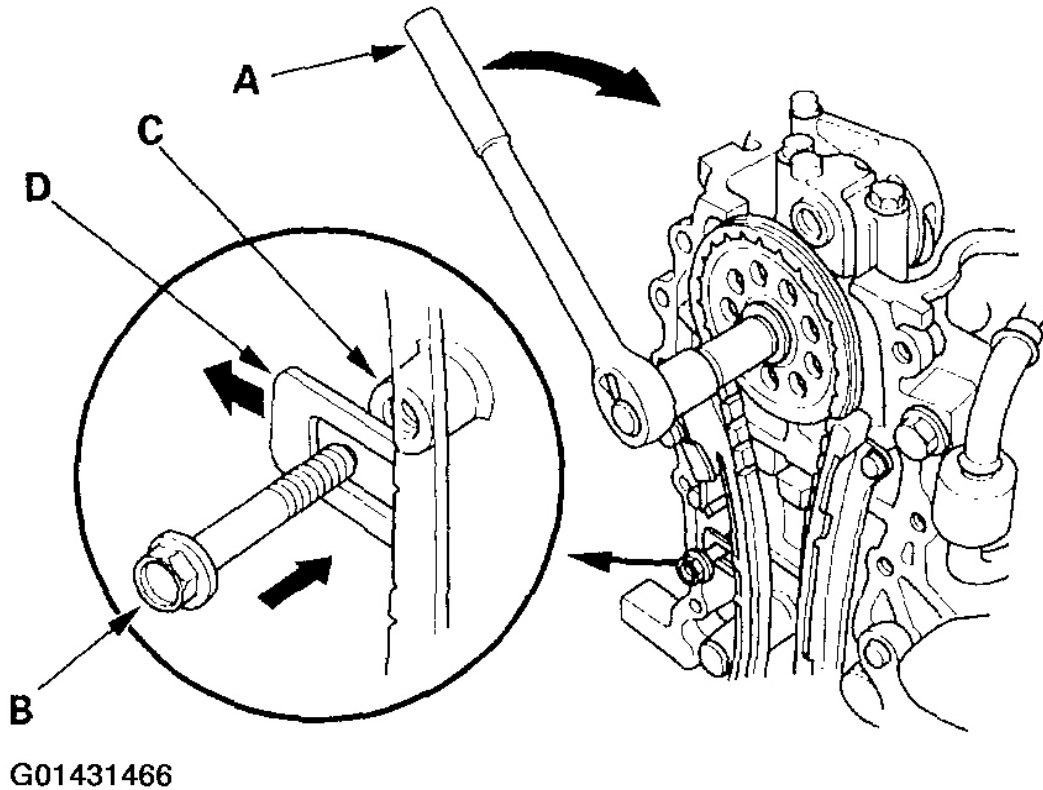


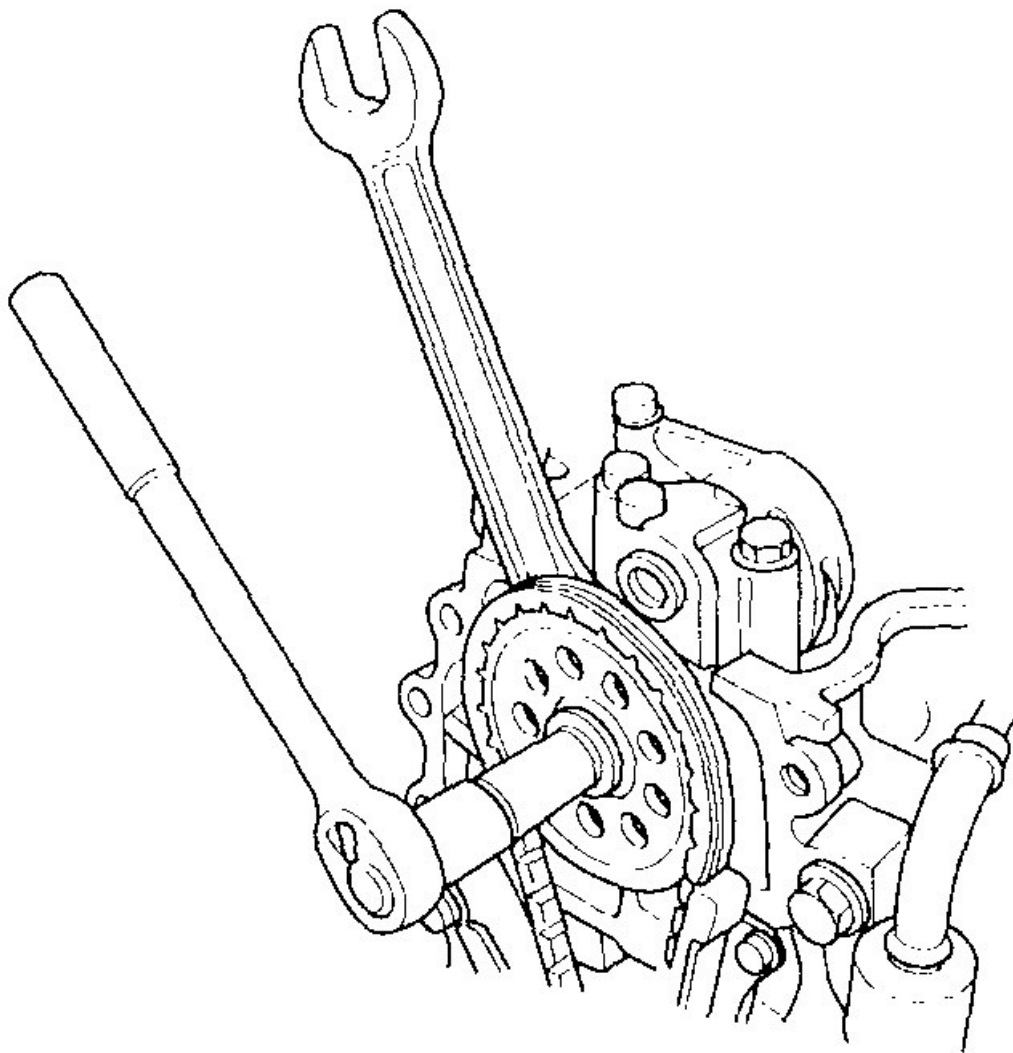
Fig. 95: Holding Crankshaft Pulley & Setting Socket Wrench On Camshaft Sprocket Bolt
Courtesy of AMERICAN HONDA MOTOR CO., INC.

24. Turn the camshaft clockwise to compress the cam chain tensioner rail, then install the 6 x 1.0 mm bolt (B) in the bolt hole (C) in the cylinder block through the cam chain tensioner rail (D).

NOTE:

- Turning torque should not exceed 44 N.m
(4.5 kgf.m, 33 lbf.ft), when turning the camshaft.
- Do not turn the camshaft counterclockwise.

25. Hold the camshaft with an open-end wrench, then remove the camshaft sprocket.



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Fig. 96: Removing Camshaft Sprocket
Courtesy of AMERICAN HONDA MOTOR CO., INC.

26. Remove the top bolt that secures the cam chain guide.

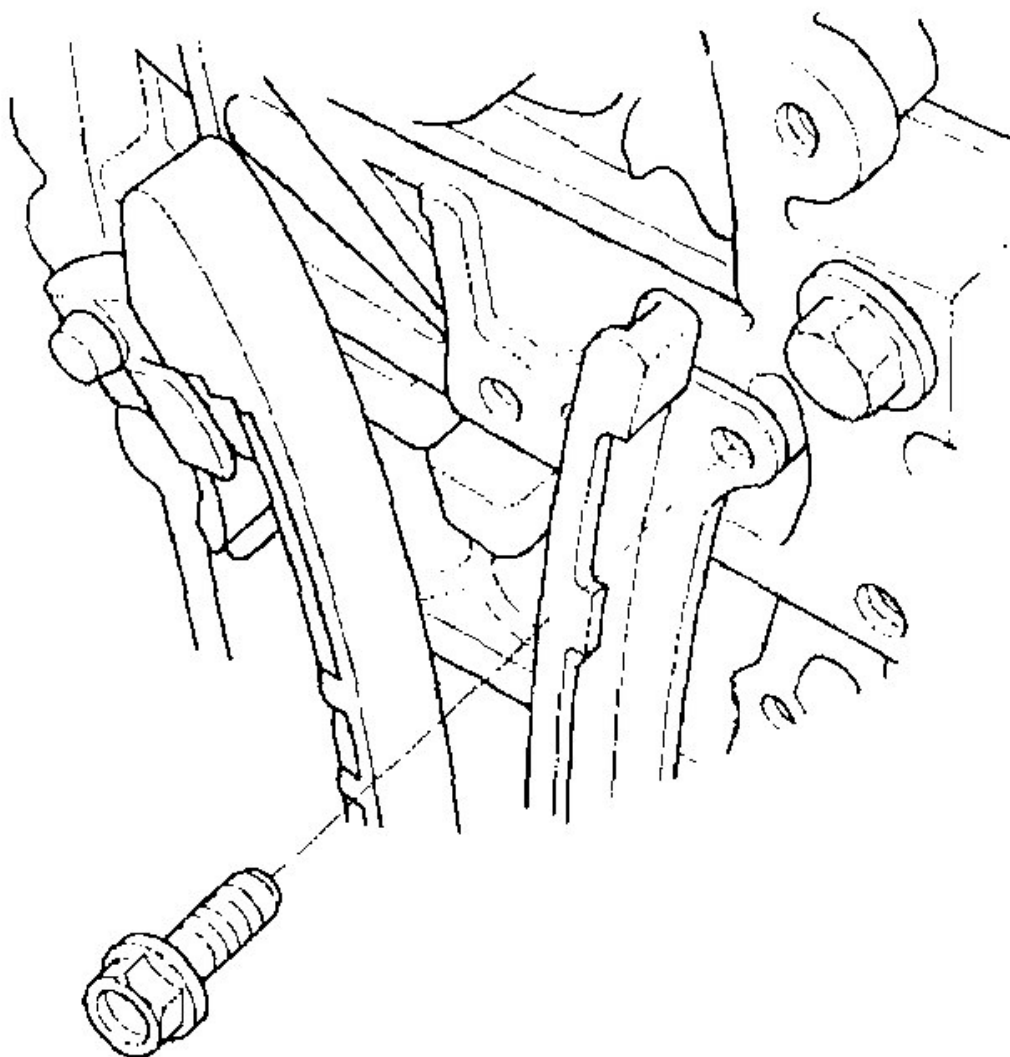
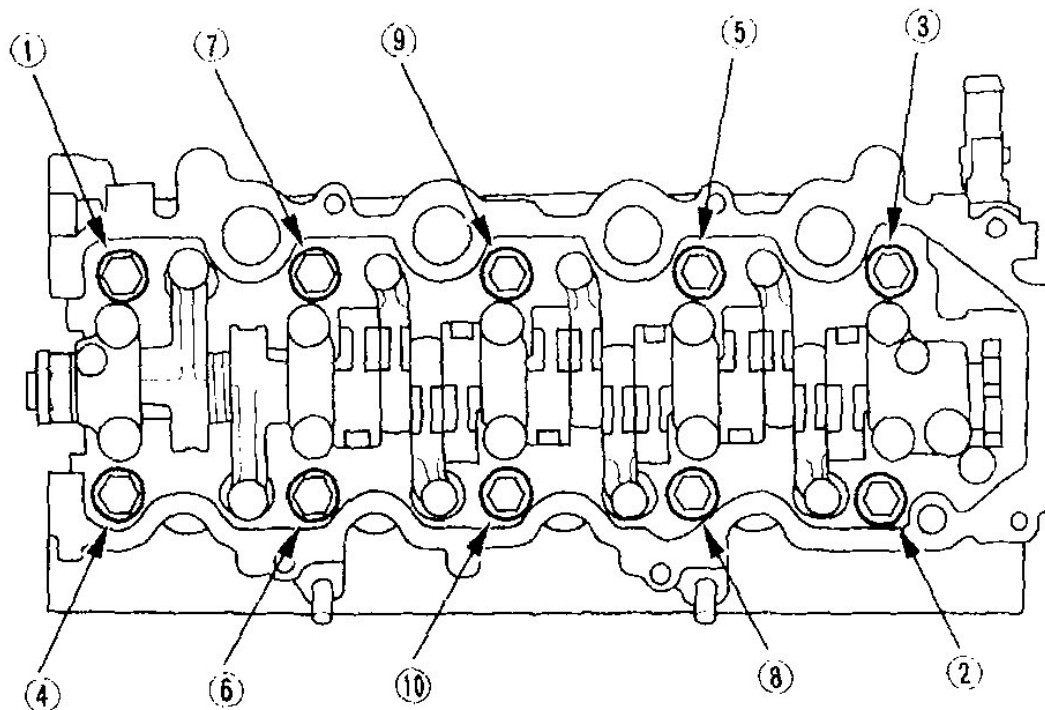
**G01431468**

Fig. 97: Removing Top Bolt Securing Cam Chain Guide
Courtesy of AMERICAN HONDA MOTOR CO., INC.

27. Remove the cylinder head bolts. To prevent warpage, unscrew the bolts in sequence 1/3 turn at a time; repeat the sequence until all bolts are loosened.



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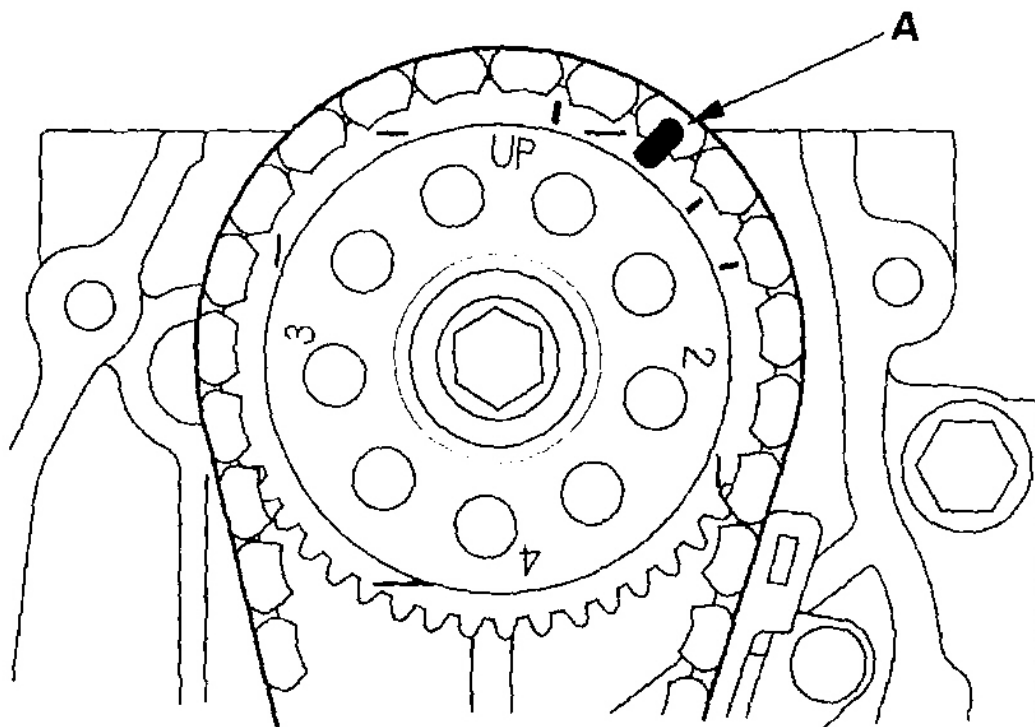
Fig. 98: Removing Cylinder Head Bolts In Sequence
Courtesy of AMERICAN HONDA MOTOR CO., INC.

28. Remove the cylinder head.

CAMSHAFT SPROCKET REMOVAL

NOTE: Keep the cam chain away from magnetic fields.

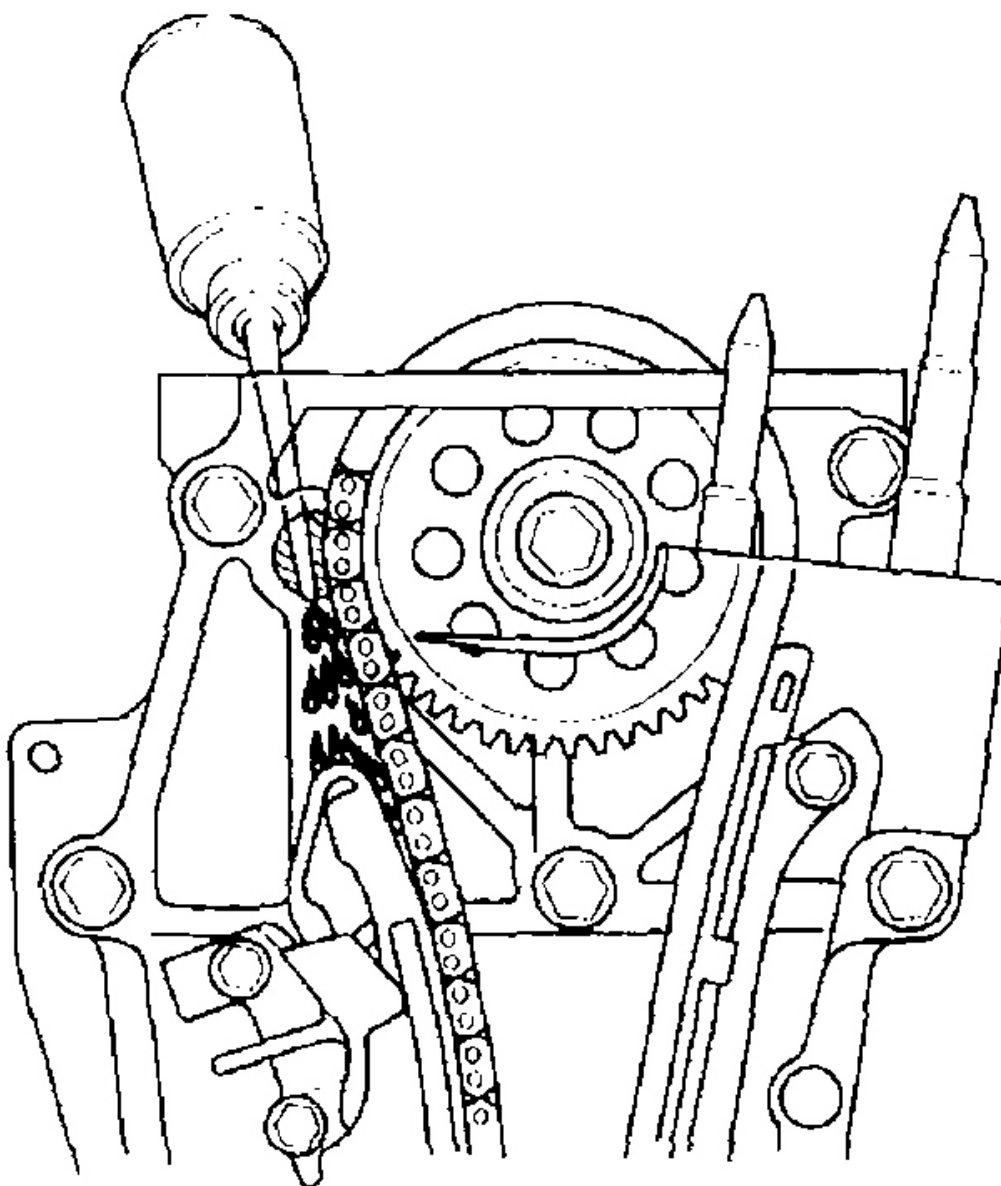
1. Remove the cylinder head cover (see Cylinder Head Cover Removal).
2. Make a reference mark (A) across the camshaft sprocket and cam chain.



G01431470

Fig. 99: Marking Reference Across Camshaft Sprocket & Cam Chain
Courtesy of AMERICAN HONDA MOTOR CO., INC.

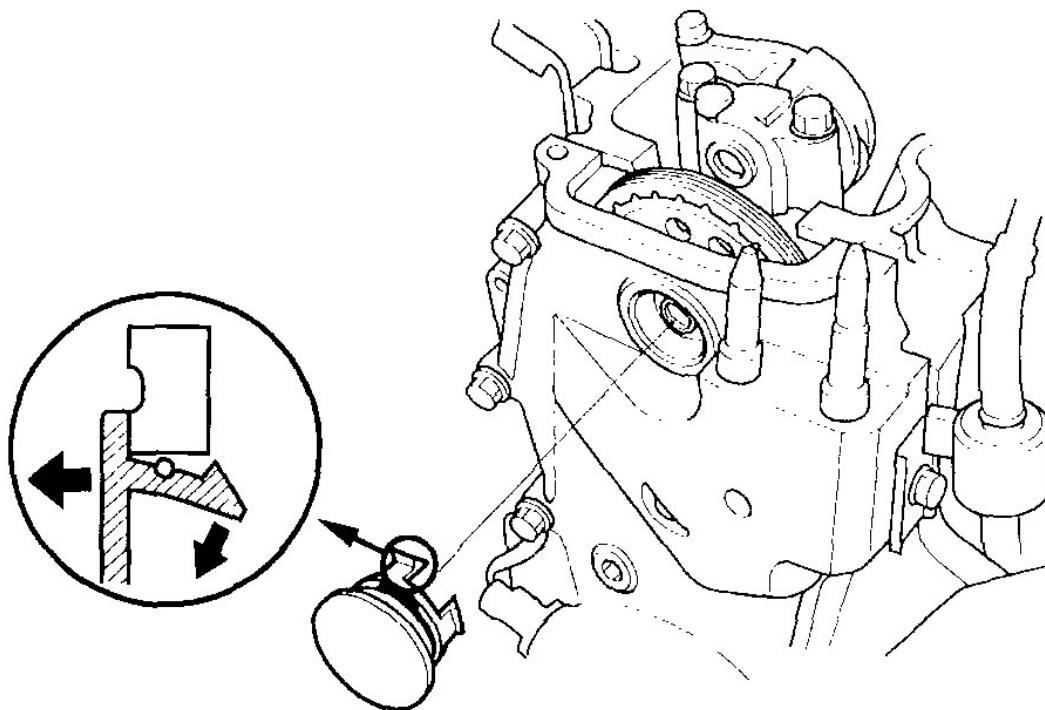
3. Apply new engine oil to the sliding surface of the cam chain tensioner through the oil return hole in the cylinder head.



G01431471

Fig. 100: Applying New Engine Oil To Sliding Surface Of Cam Chain Tensioner
Courtesy of AMERICAN HONDA MOTOR CO., INC.

4. Remove the cylinder head plug.

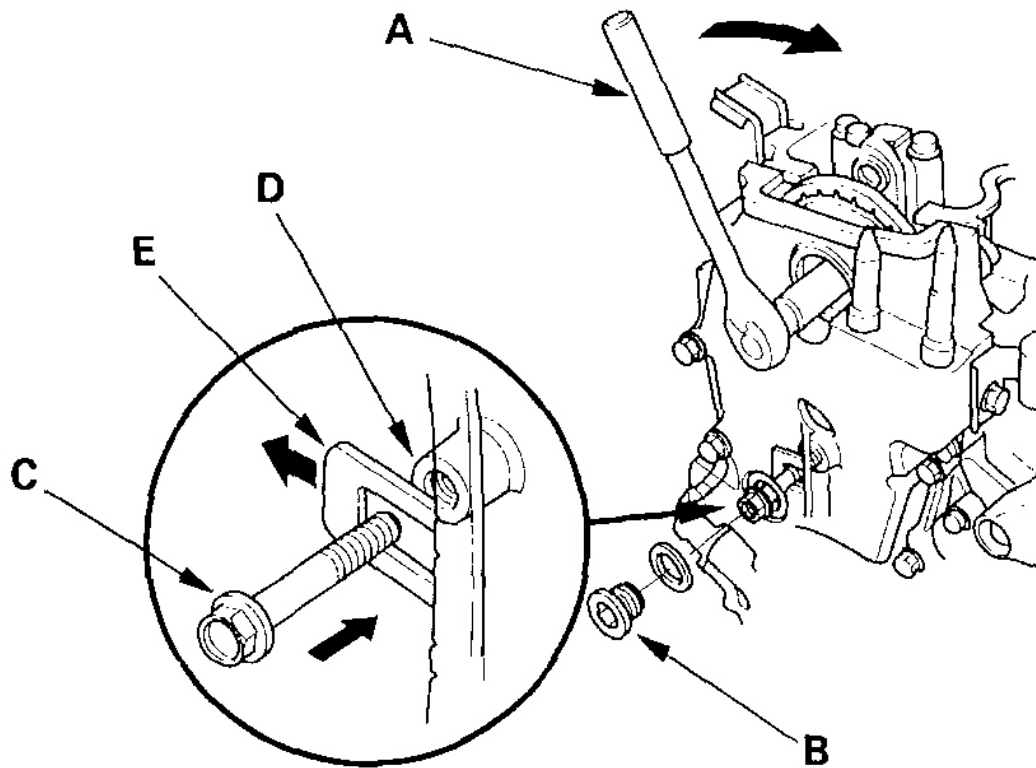


G01431472

Fig. 101: Removing Cylinder Head Plug

Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. Hold the crankshaft pulley and set the socket wrench (A) on the camshaft sprocket bolt.



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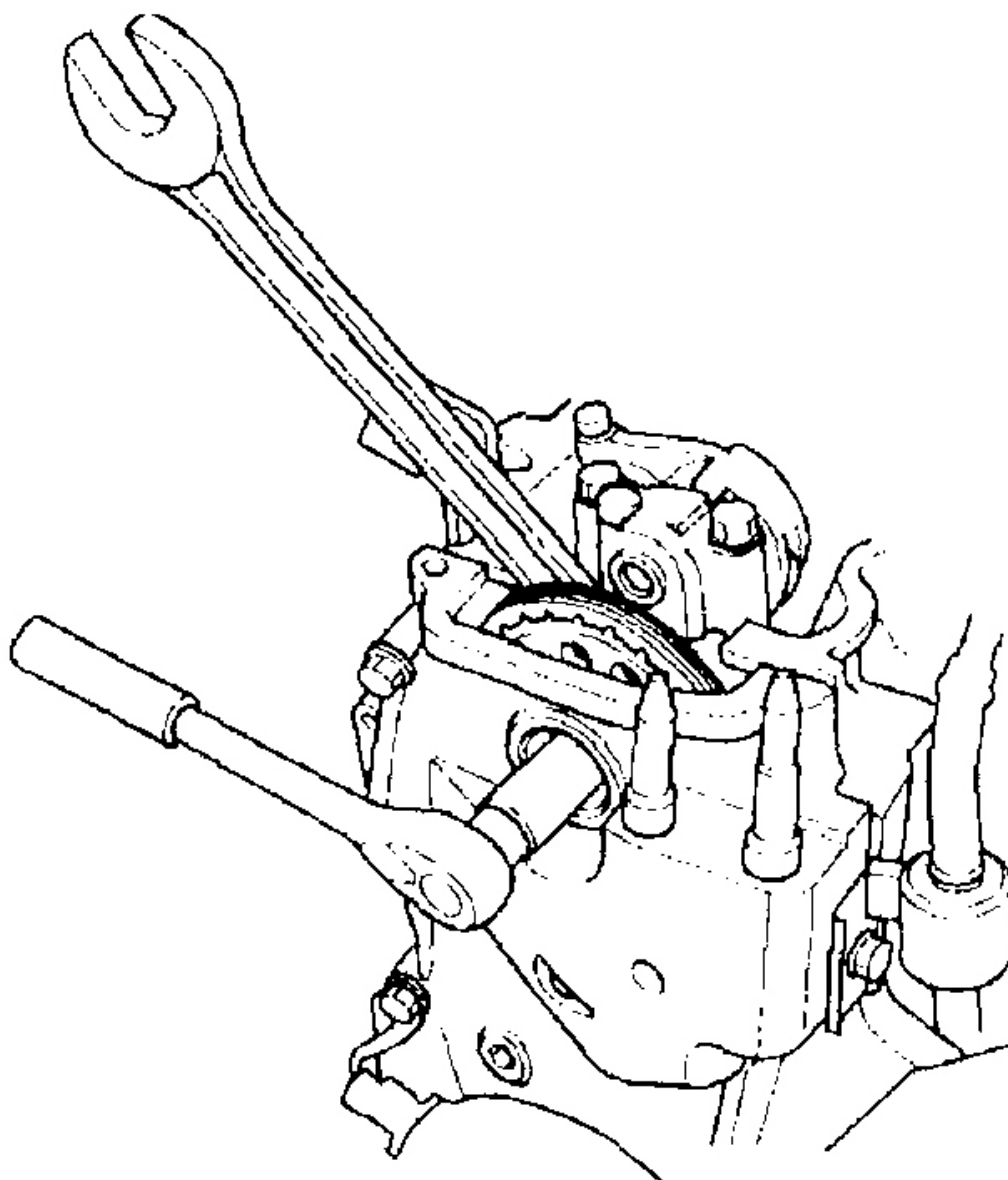
Fig. 102: Holding Crankshaft Pulley & Setting Socket Wrench On Camshaft Sprocket Bolt
Courtesy of AMERICAN HONDA MOTOR CO., INC.

6. Remove the maintenance bolt (B), and turn the camshaft clockwise to compress the cam chain tensioner rail, then install the 6 x 1.0 mm bolt (C) in the bolt hole (D) in the cylinder block through the maintenance hole and cam chain tensioner rail (E).

NOTE:

- Turning torque should not exceed 44 N.m (4.5 kgf.m, 33 lbf.ft), when turning the camshaft.
- Do not turn the camshaft counterclockwise.

7. Hold the camshaft with an open-end wrench, then loosen the camshaft sprocket bolt.

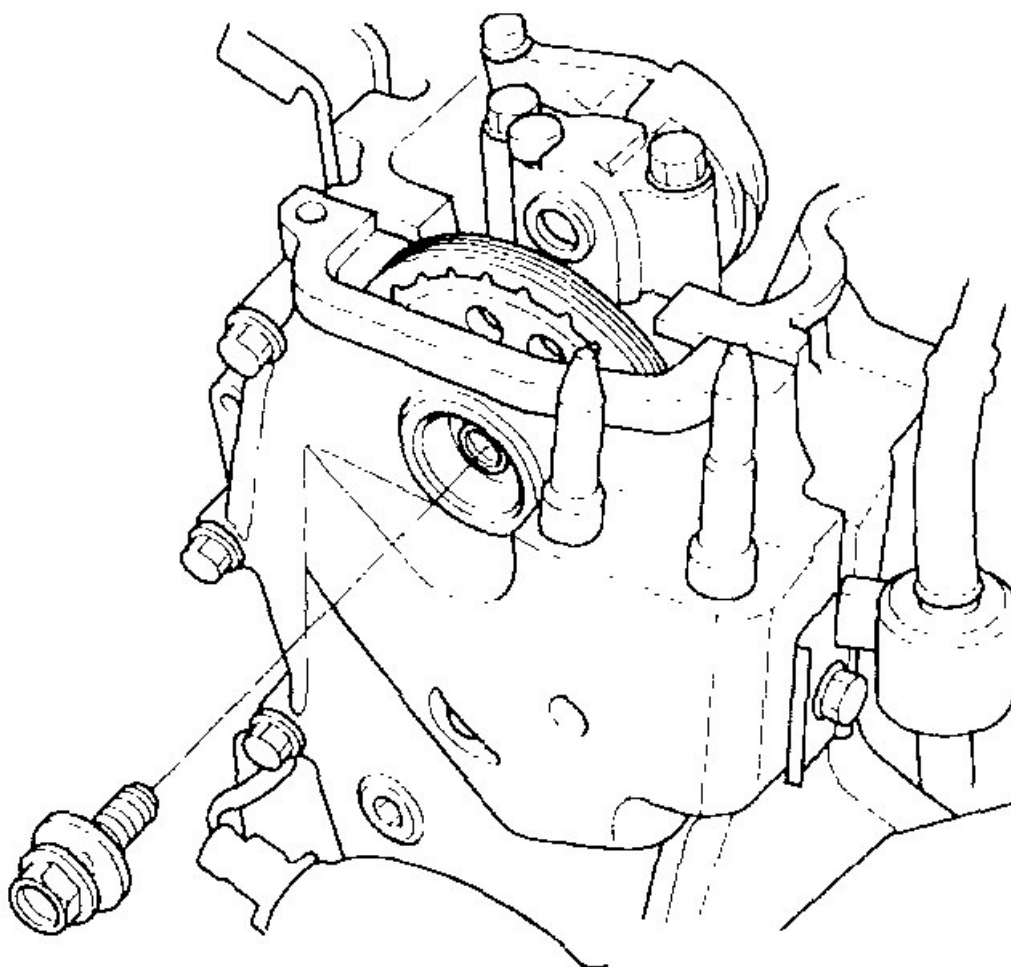


G01431474

Fig. 103: Loosening Camshaft Sprocket Bolt
Courtesy of AMERICAN HONDA MOTOR CO., INC.

8. Remove the camshaft sprocket bolt, then remove the camshaft sprocket.

NOTE: **Hang the cam chain with a wire.**



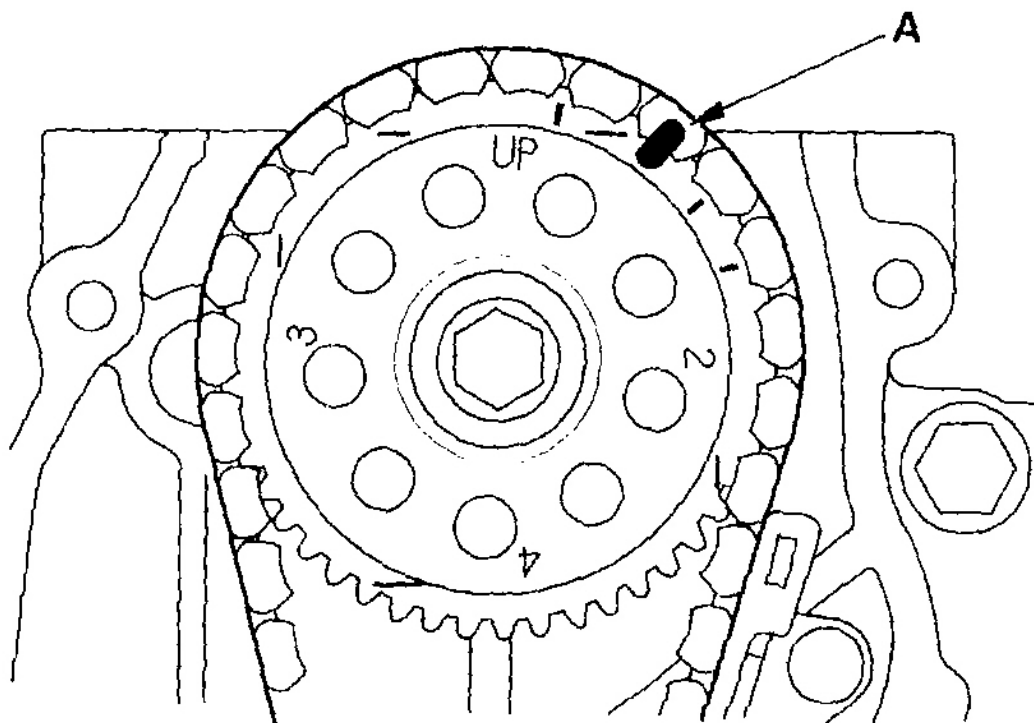
G01431475

Fig. 104: Removing Camshaft Sprocket Bolt
Courtesy of AMERICAN HONDA MOTOR CO., INC.

CAMSHAFT SPROCKET INSTALLATION

NOTE: **Keep the cam chain away from magnetic fields.**

1. Install the cam chain around the camshaft sprocket aligned with the reference mark (A), then install the camshaft sprocket on the camshaft.



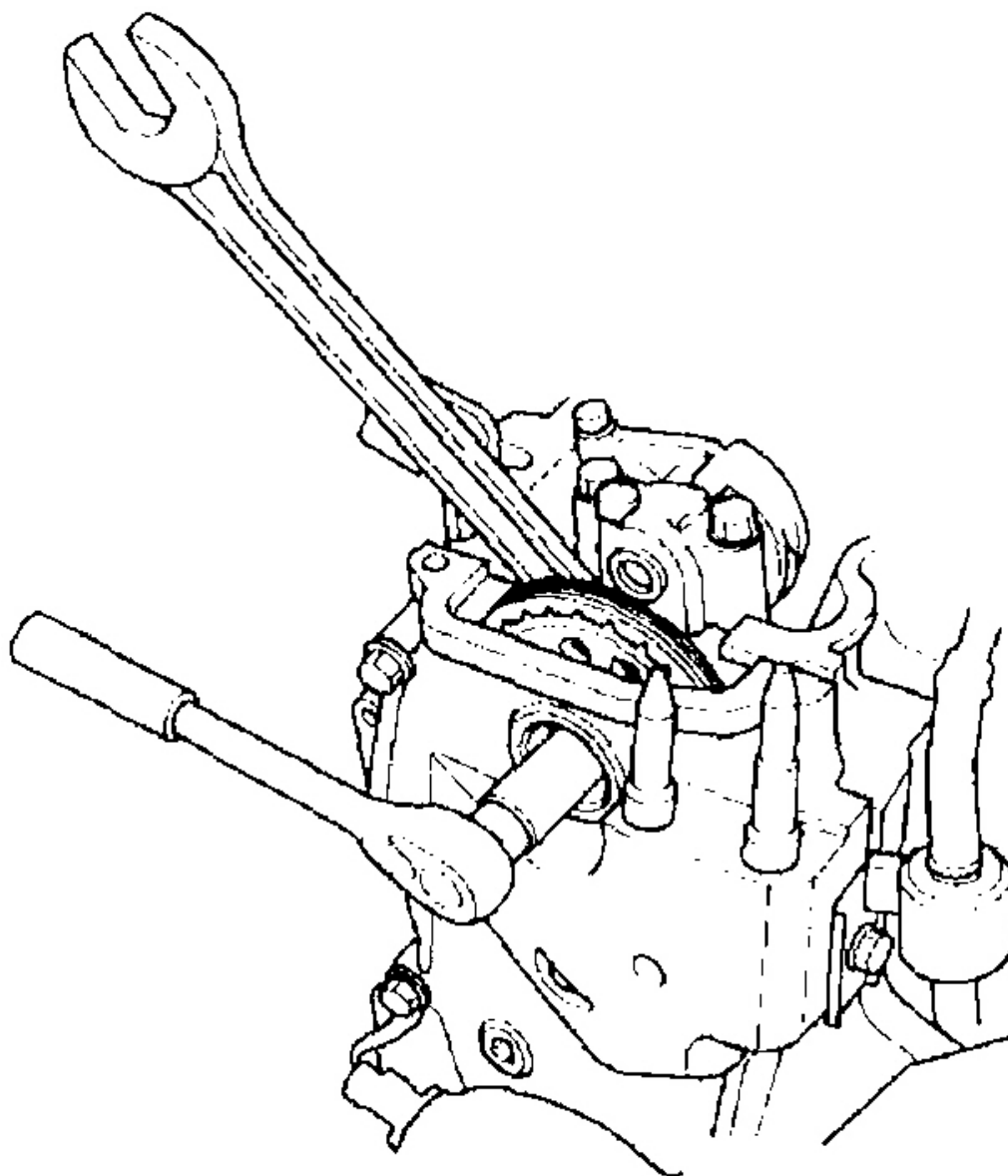
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Fig. 105: Installing Cam Chain Around Camshaft Sprocket Aligned With Reference Mark
Courtesy of AMERICAN HONDA MOTOR CO., INC.

2. Hold the camshaft with an open-end wrench, then tighten the bolt.

NOTE: Apply new engine oil to the bolt threads and flange.

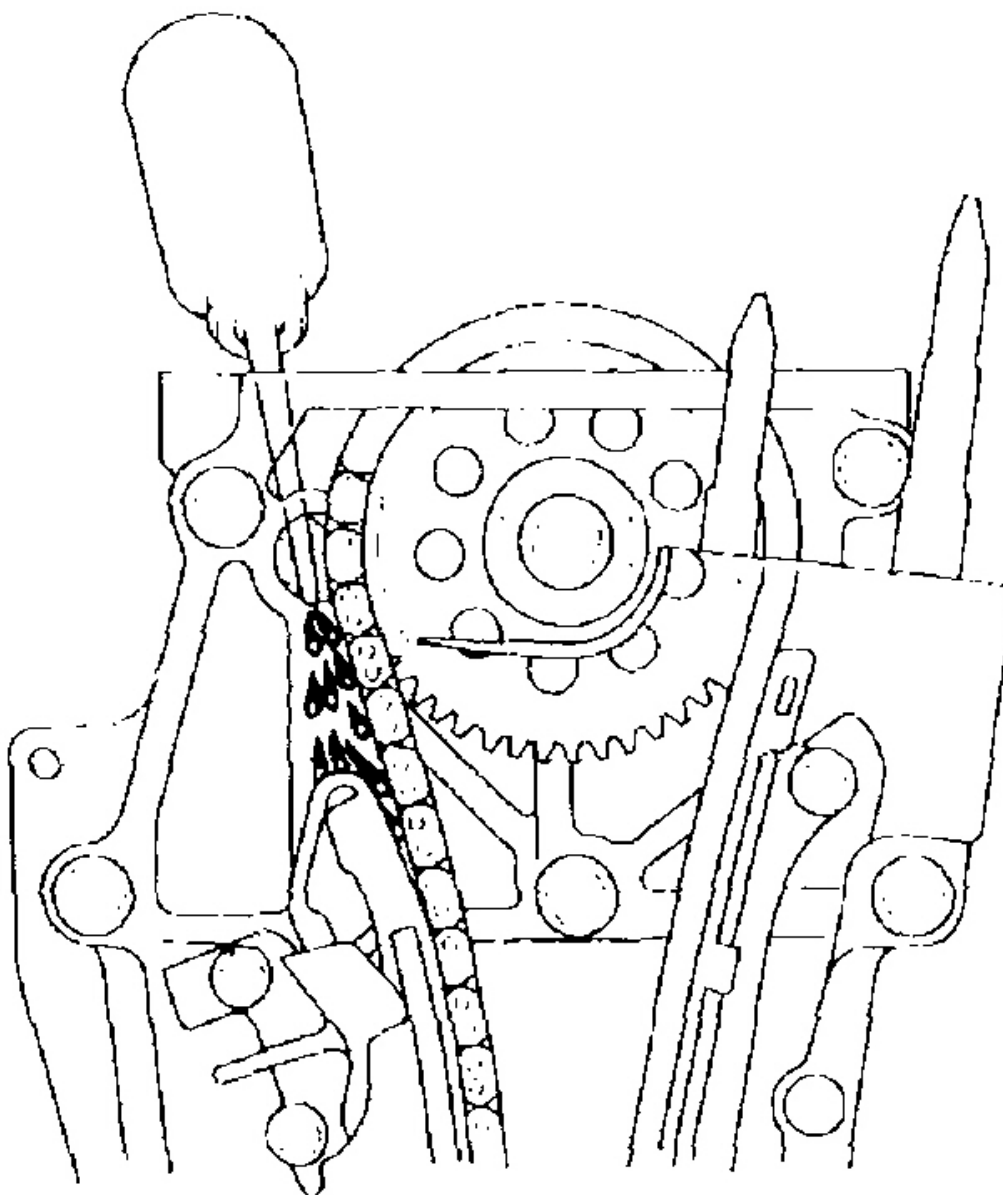
- i. Specified torque: 56 N.m (5.7 kgf.m, 41 lbf.ft)



G01431477

Fig. 106: Holding Camshaft With An Open-End Wrench
Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. Apply new engine oil to the sliding surface of the cam chain tensioner through the oil return hole in the cylinder head.

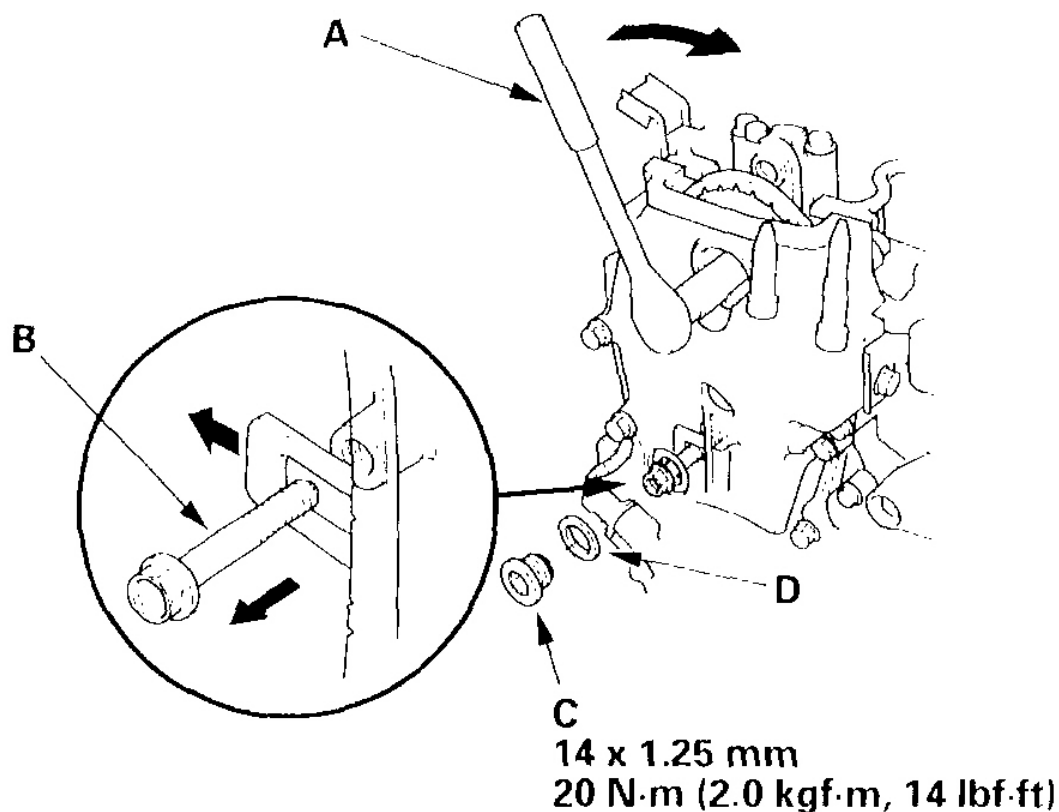


G01431478

Fig. 107: Applying New Engine Oil To Sliding Surface Of Cam Chain Tensioner Through Oil Return Hole In Cylinder Head

Courtesy of AMERICAN HONDA MOTOR CO., INC.

4. Hold the crankshaft pulley and set the socket wrench (A) on the camshaft sprocket bolt.



G01431479

Fig. 108: Holding Crankshaft Pulley & Setting Socket Wrench On Camshaft Sprocket Bolt
Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. Turn the camshaft clockwise to compress the cam chain tensioner rail, then remove the 6 x 1.0 mm bolt (B).

NOTE:

- Turning torque should not exceed 44 N·m (4.5 kgf·m, 33 lbf·ft), when turning the camshaft.
- Do not turn the camshaft counterclockwise.

6. Install the maintenance bolt (C) with a new washer (D).
7. Install the new cylinder head plug.

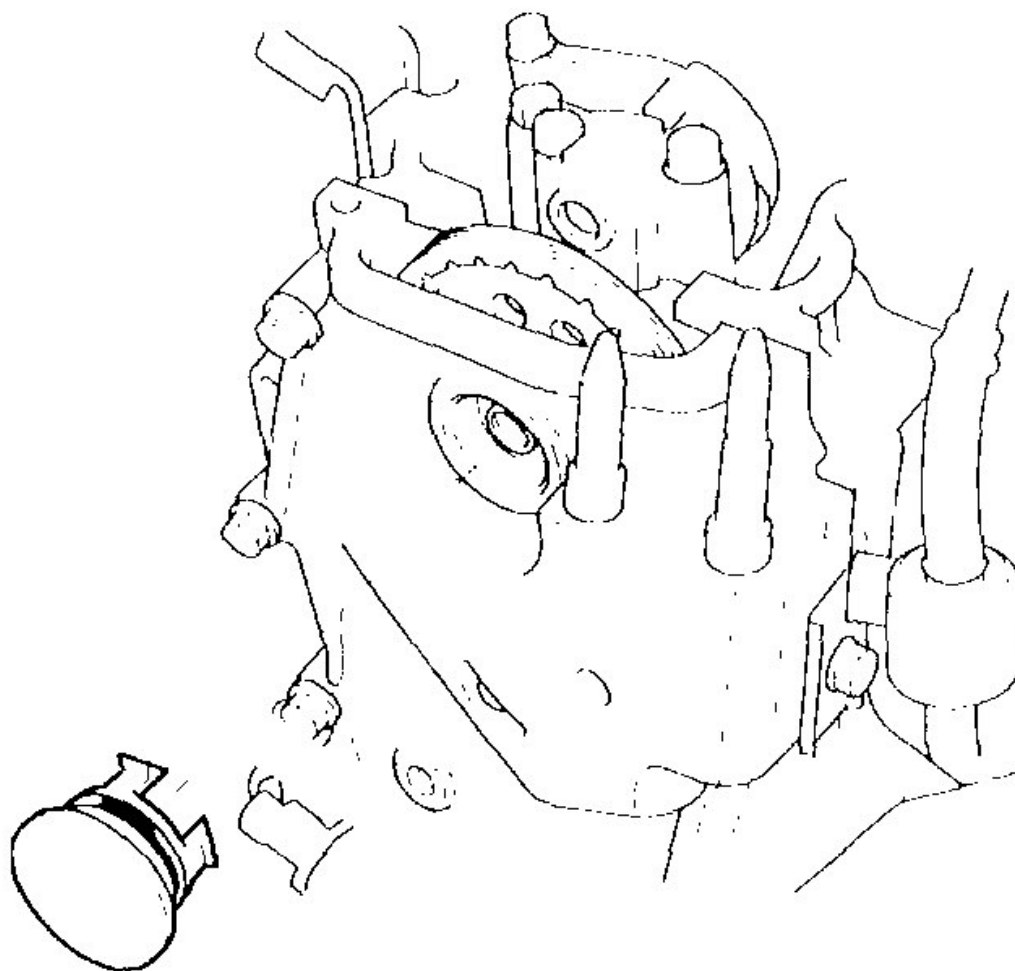
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Fig. 109: Installing New Cylinder Head Plug
Courtesy of AMERICAN HONDA MOTOR CO., INC.

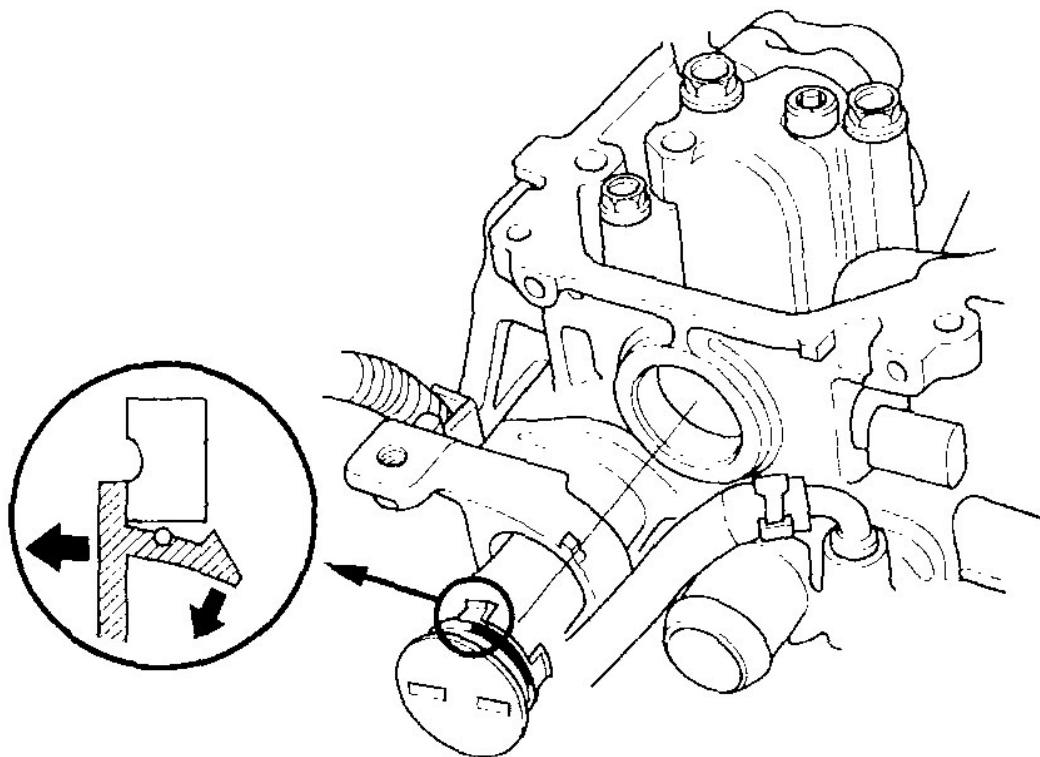
8. Install the cylinder head cover (see **Cylinder Head Cover Installation**).

CMP PULSE PLATE REPLACEMENT

Removal

1. Remove the air cleaner housing (see **AIR CLEANER REMOVAL/INSTALLATION**).
2. Remove the cylinder head cover (see **Cylinder Head Cover Removal**).

3. Remove the cylinder head plug.

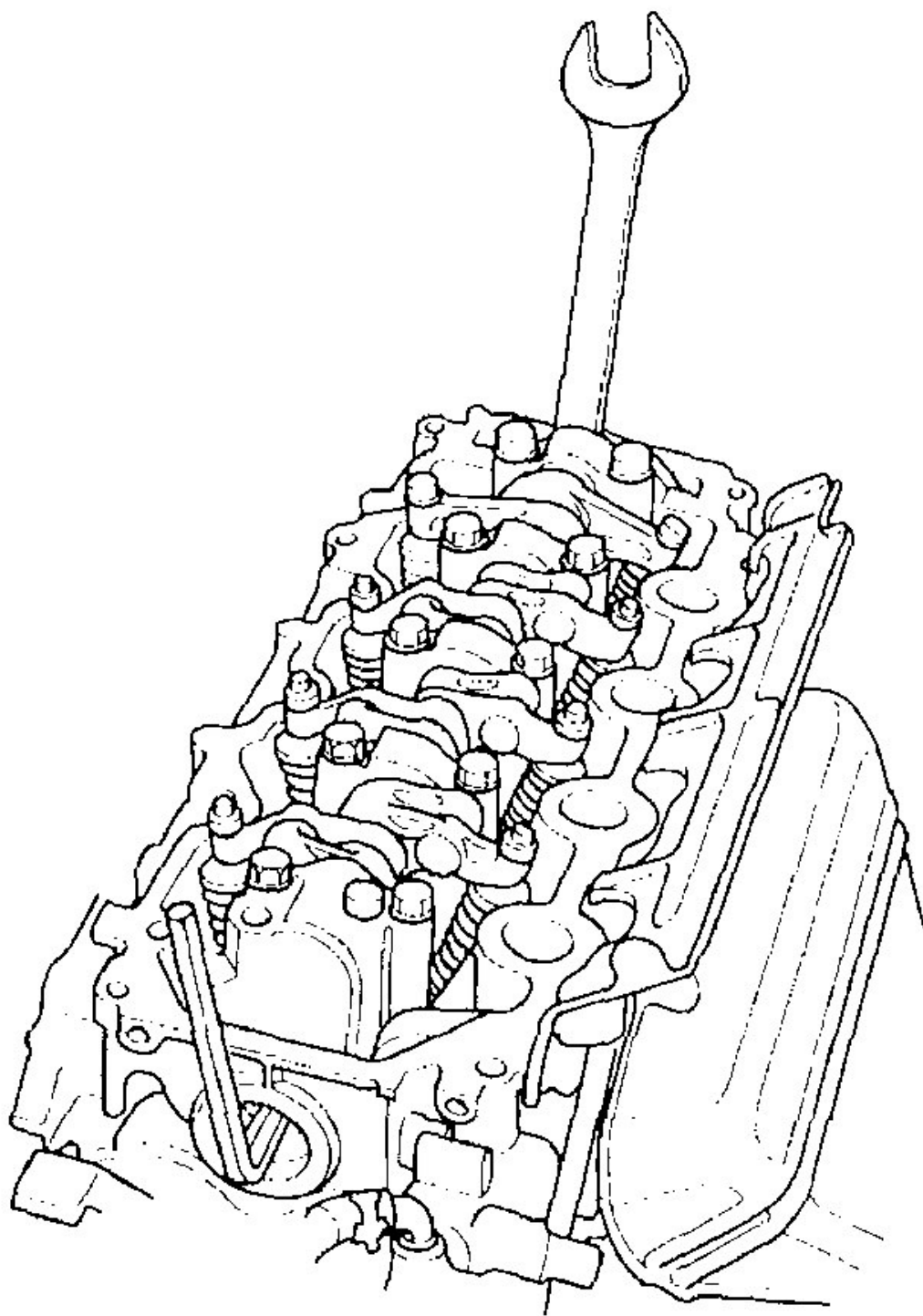


G01431481

Fig. 110: Removing Cylinder Head Plug

Courtesy of AMERICAN HONDA MOTOR CO., INC.

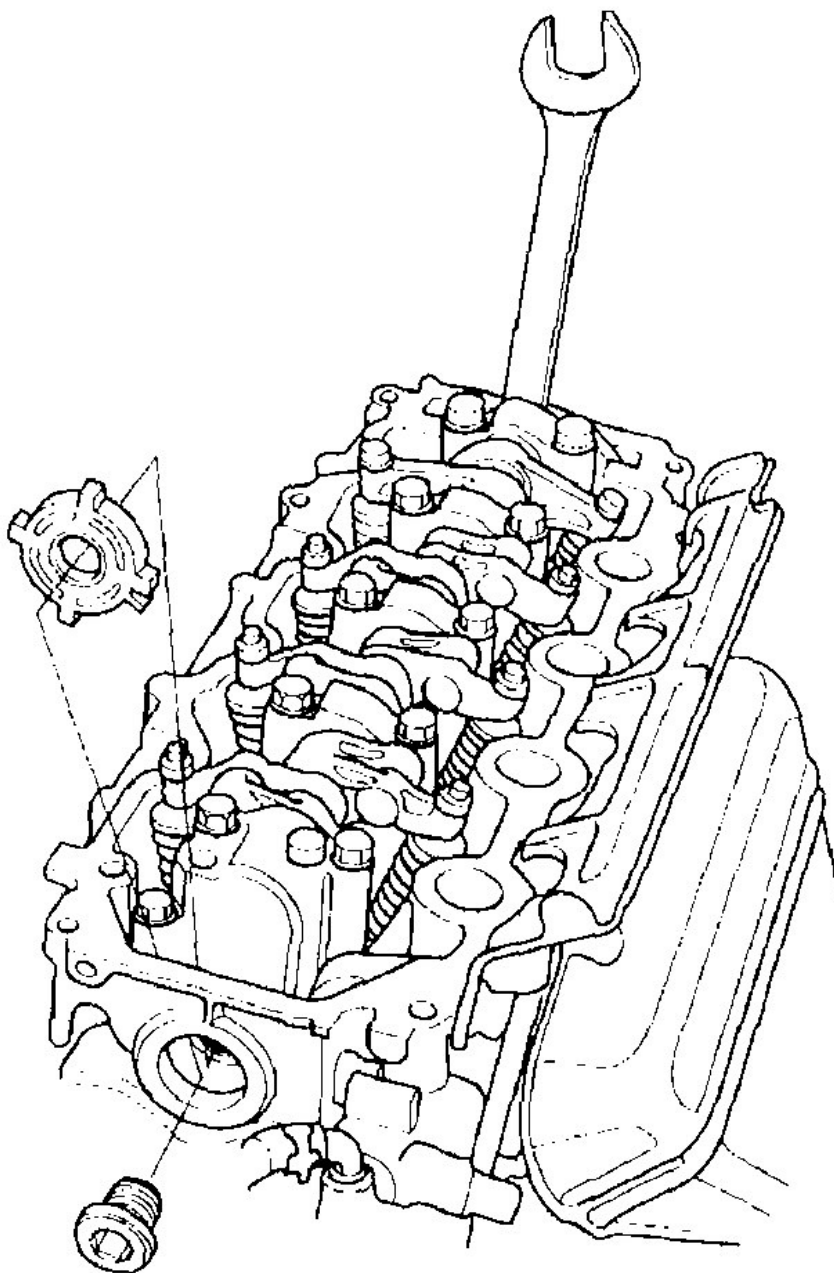
4. Hold the camshaft with an open-end wrench, then loosen the bolt.



G01431482

Fig. 111: Holding Camshaft With An Open-End Wrench
Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. Remove the camshaft position (CMP) pulse plate.



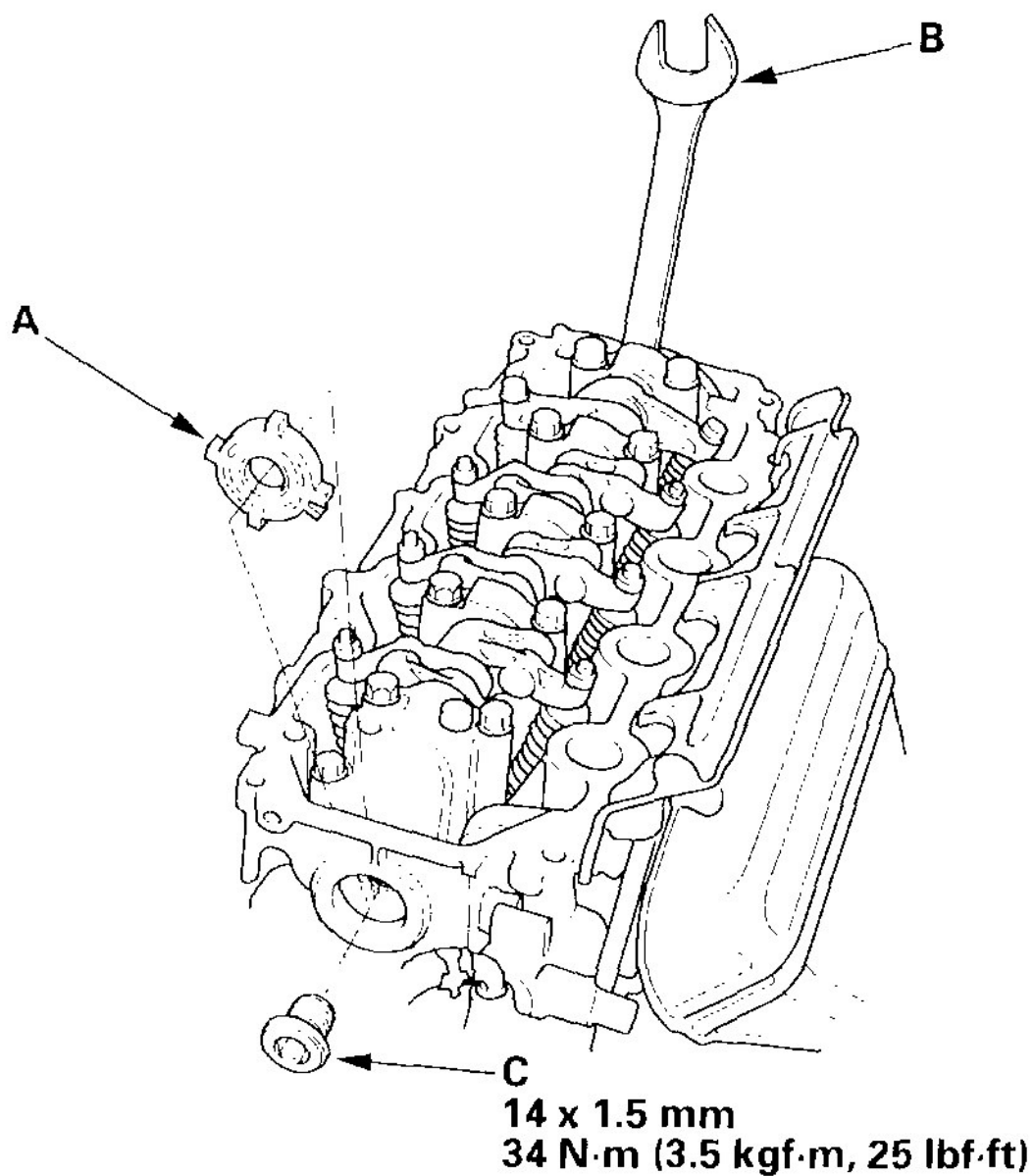
G01431483

Fig. 112: Removing CMP Pulse Plate

Courtesy of AMERICAN HONDA MOTOR CO., INC.

Installation

1. Install the CMP pulse plate (A). Hold the camshaft with an open-end wrench (B), then tighten the bolt (C).

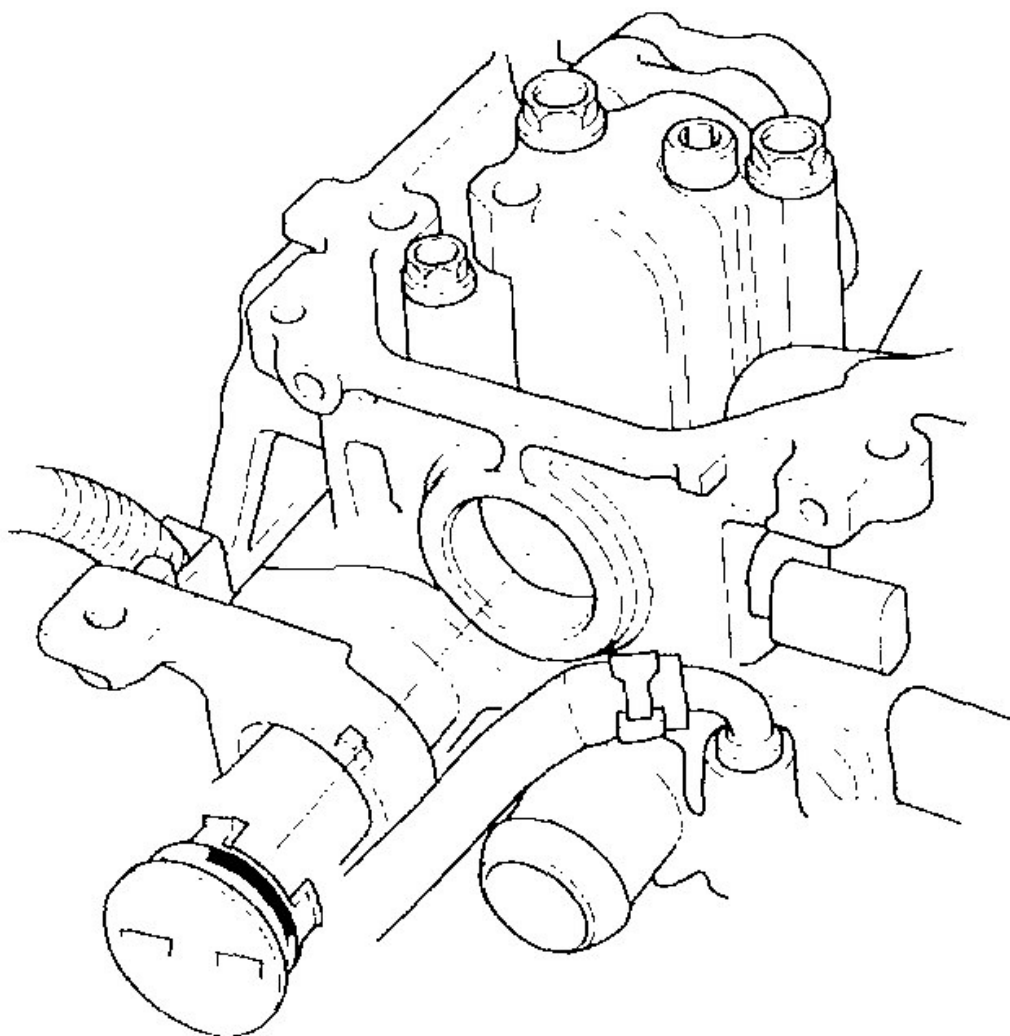


G01431484

Fig. 113: Installing CMP Pulse Plate

Courtesy of AMERICAN HONDA MOTOR CO., INC.

2. Install the new cylinder head plug.



G01431485

Fig. 114: Installing New Cylinder Head Plug

Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. Install the cylinder head cover (see **Cylinder Head Cover Installation**).
4. Install the air cleaner housing (see **AIR CLEANER REMOVAL/INSTALLATION**).

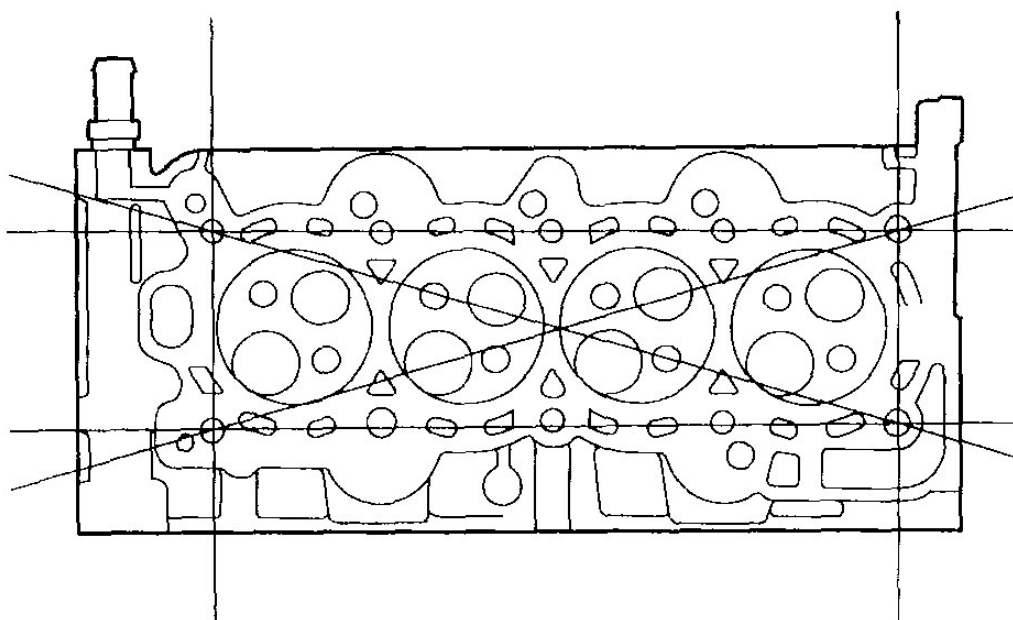
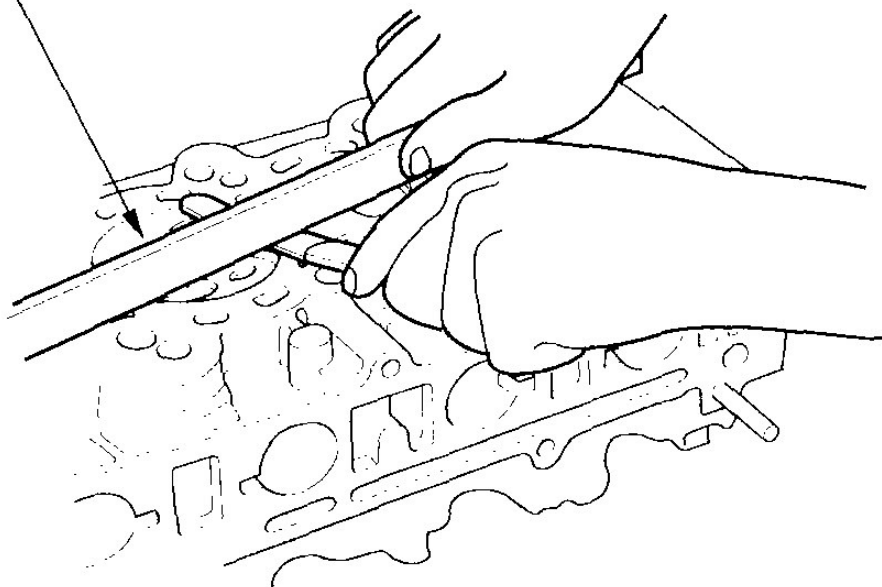
CYLINDER HEAD INSPECTION FOR WARPAGE

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 0.08 mm (0.003 in.) cylinder head resurfacing is not required.
 - If warpage is between 0.08 mm (0.003 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 120 mm (4.72 in.).

Cylinder Head Height

Standard (New): 119.9-120.1 mm (4.720-4.728 in.)

PRECISION STRAIGHT EDGE

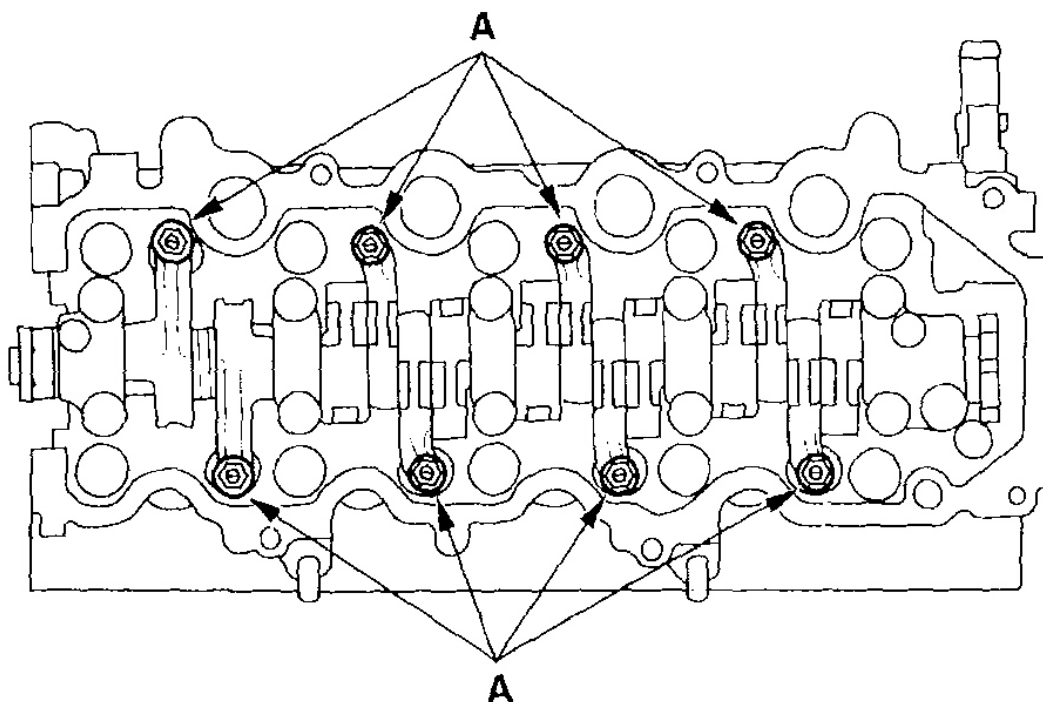


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Fig. 115: Checking Cylinder Head For Warpage
Courtesy of AMERICAN HONDA MOTOR CO., INC.

ROCKER ARM ASSEMBLY AND CAMSHAFT REMOVAL

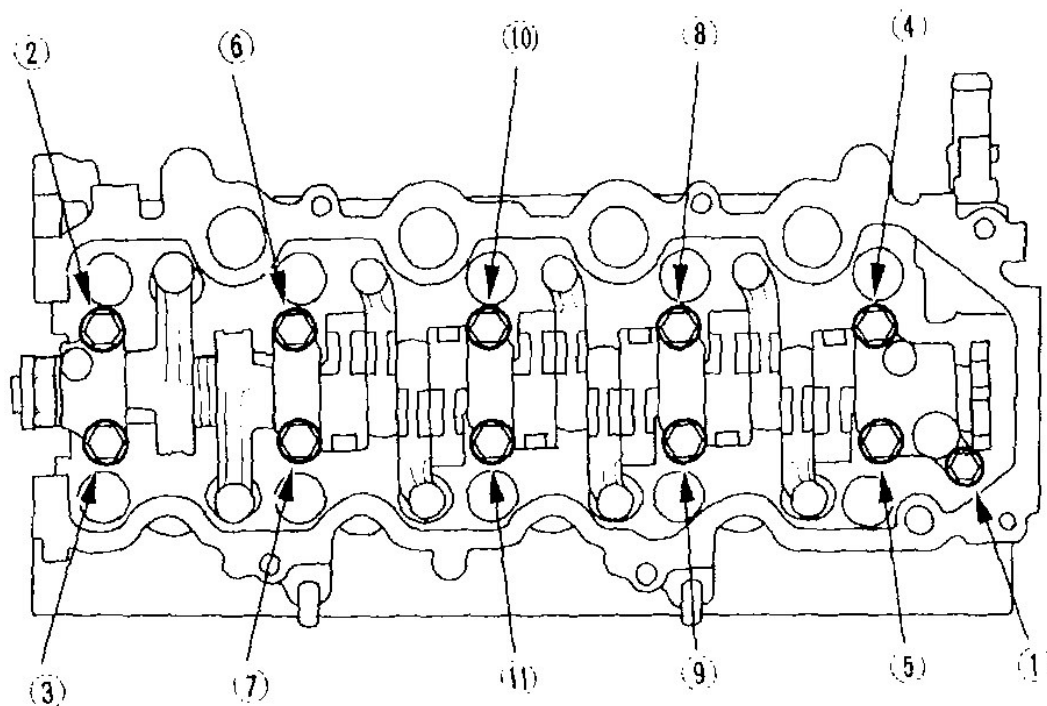
1. Remove the camshaft sprocket (see **Camshaft Sprocket Removal**).
2. Loosen the rocker arm adjusting screws (A).



G01431487

Fig. 116: Loosening Rocker Arm Adjusting Screws
Courtesy of AMERICAN HONDA MOTOR CO., INC.

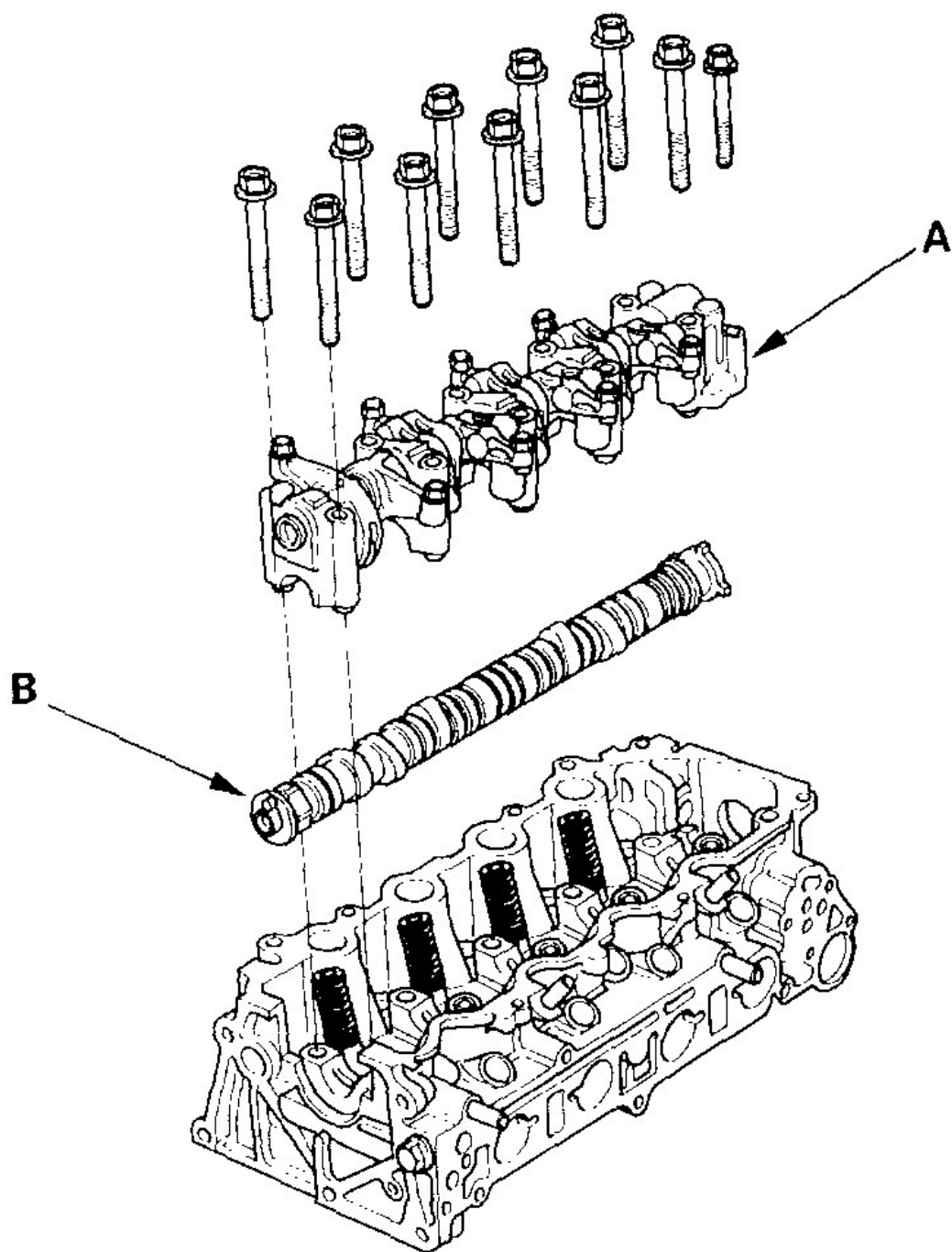
3. Unscrew the camshaft holder bolts. To prevent damaging the camshaft, unscrew the bolts two turns at a time, in a crisscross pattern.



G01431488

Fig. 117: Unscrewing Camshaft Holder Bolt
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

4. Remove the rocker arm assembly (A) and the camshaft (B).



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Fig. 118: Removing Rocker Arm Assembly & Camshaft
Courtesy of AMERICAN HONDA MOTOR CO., INC.

ROCKER ARM AND SHAFT DISASSEMBLY/REASSEMBLY

NOTE:

- Identify parts as they are removed to ensure reinstallation in original location.
- Remove the rocker shaft bolts before disassembling the rocker arms.
- Inspect the rocker shaft and rocker arms (see Rocker Arm and Shaft Inspection).
- The rocker arms must be installed in the same positions if reused.
- Prior to reassembling, clean all the parts in solvent, dry them, and apply new engine oil to any contact points.
- Apply new engine oil to the threads of the rocker shaft bolts when installing them.

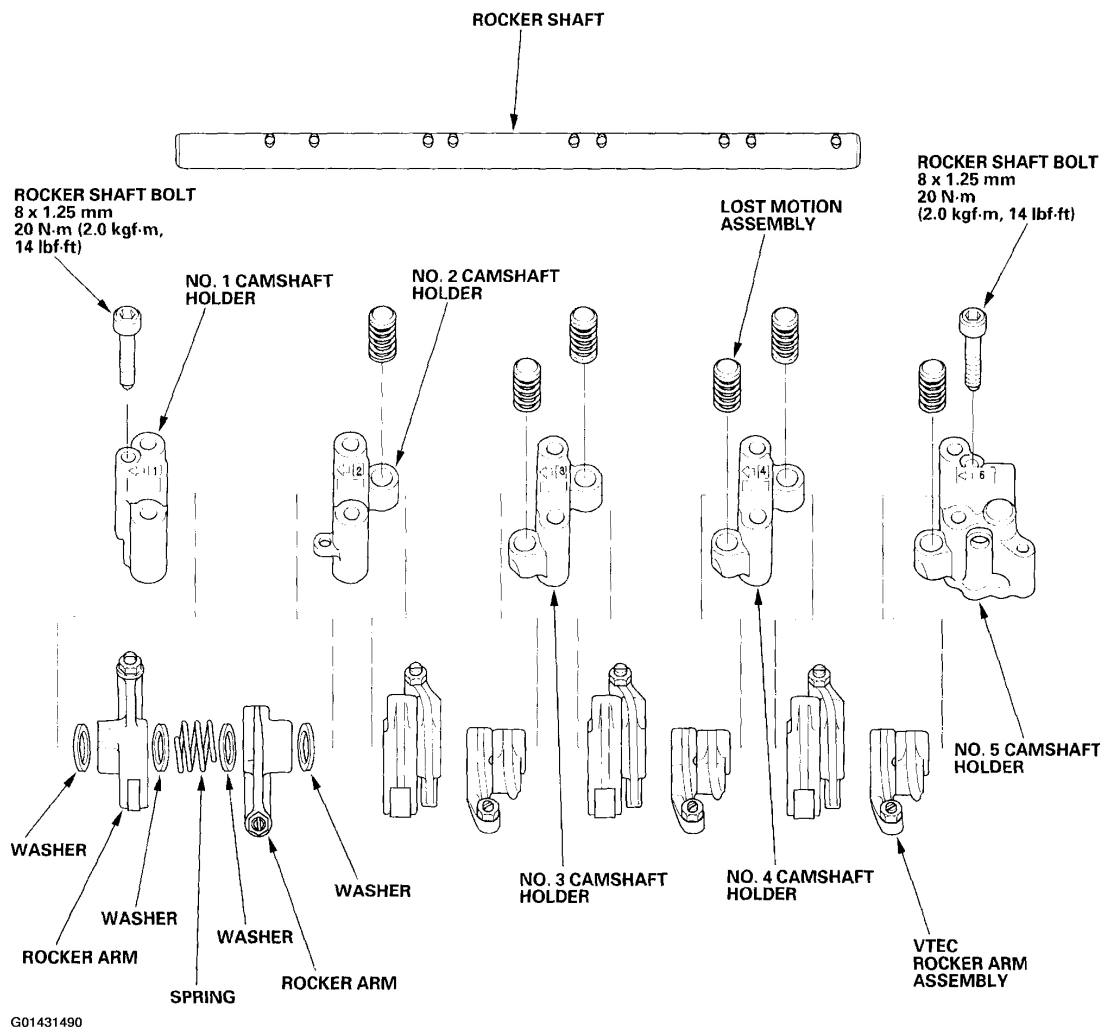


Fig. 119: Rocker Arm & Shaft Disassembly/Reassembly
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

ROCKER ARM AND SHAFT INSPECTION

1. Remove the rocker arm assembly (see **Rocker Arm Assembly and Camshaft Removal**).
2. Measure the diameter of the shaft at the first rocker location.

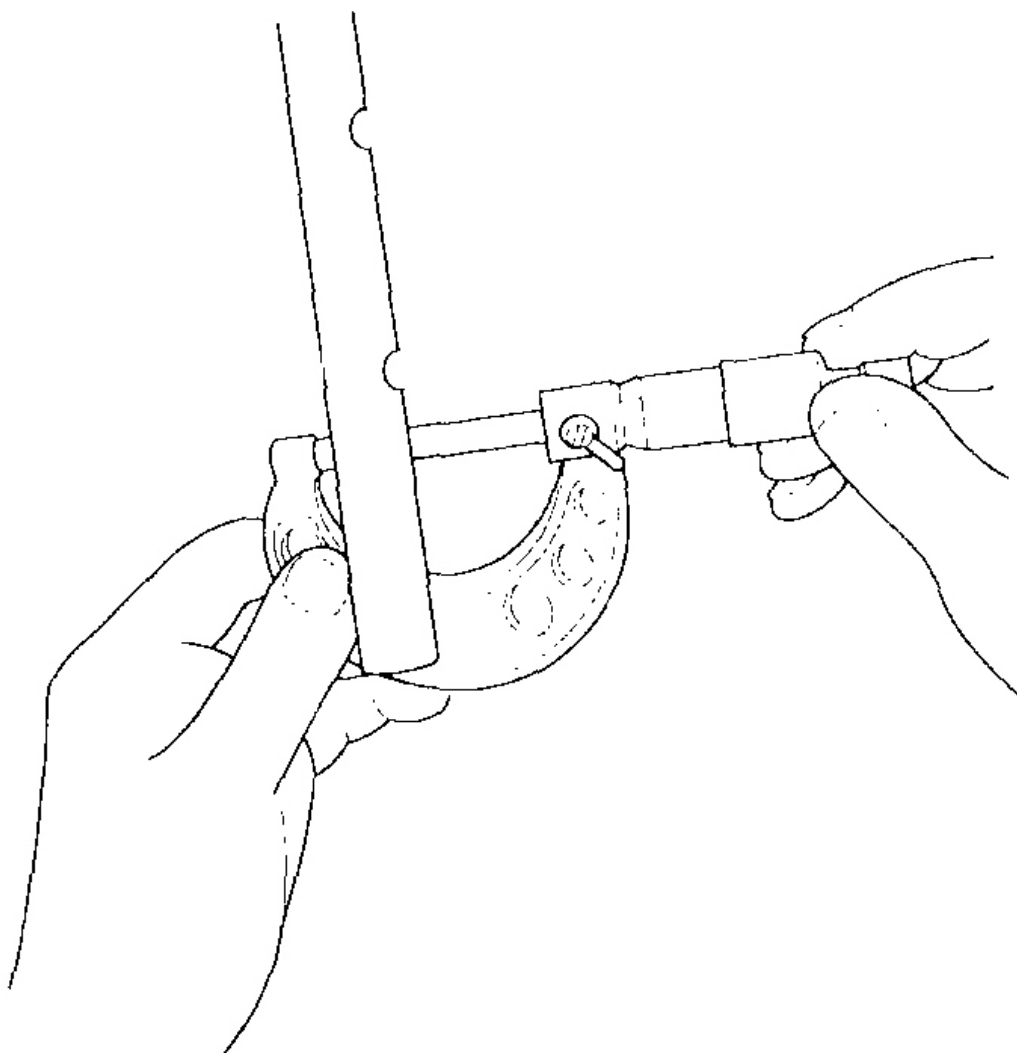
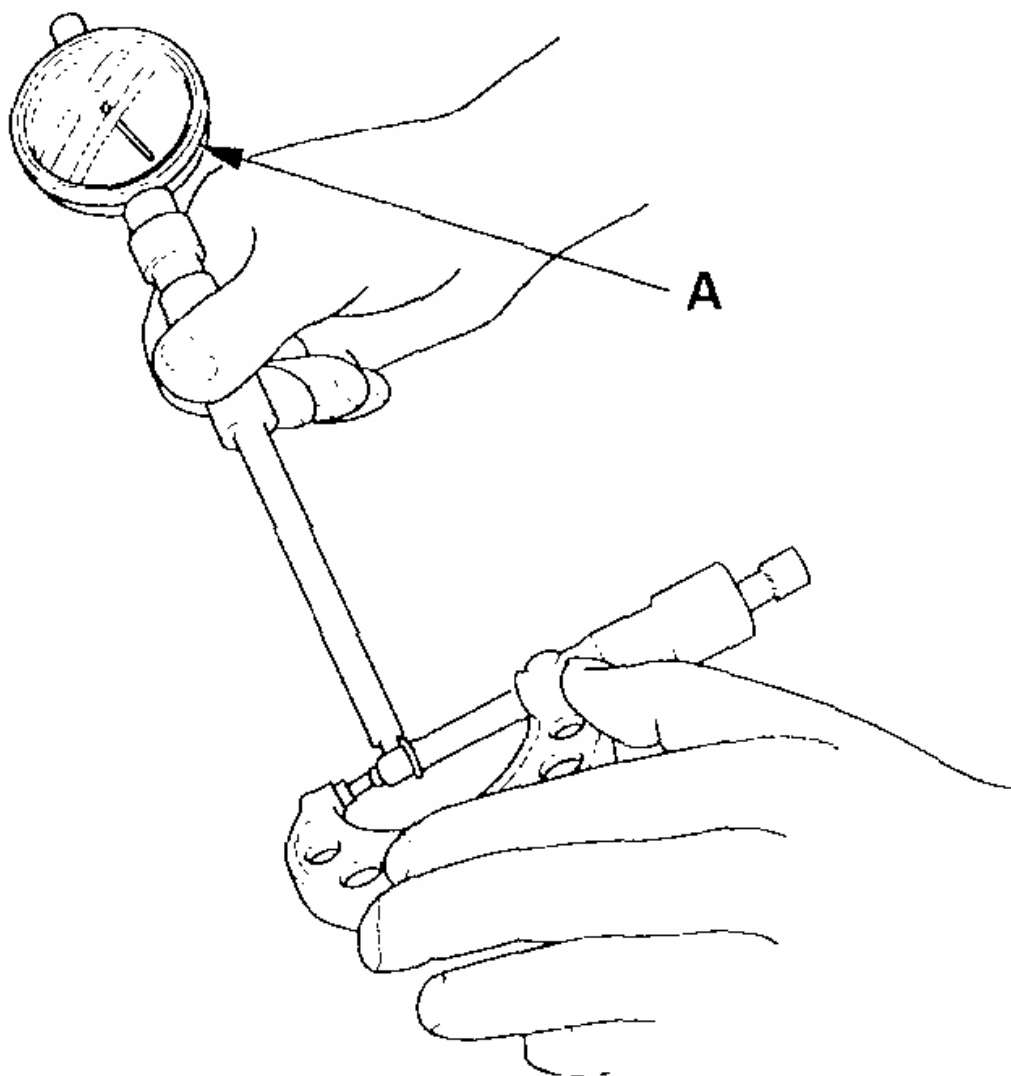
**G01431491**

Fig. 120: Measuring Diameter Of Shaft At First Rocker Location
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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



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Fig. 121: Zeroing Gauge To Shaft Diameter
Courtesy of AMERICAN HONDA MOTOR CO., INC.

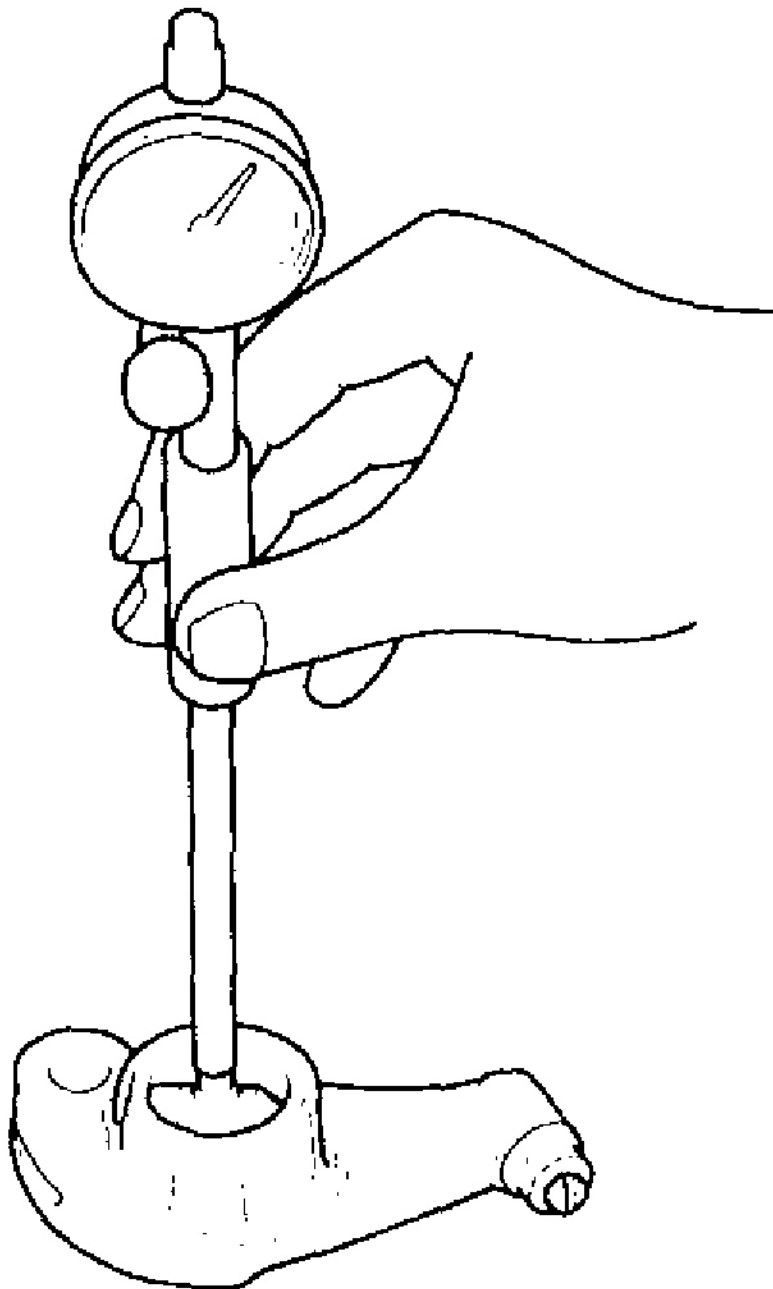
4. Measure the inside diameter of the rocker arm, and check it for an out-of-round condition.

Rocker Arm-to-Shaft Clearance

Standard (New): No. 1 rocker arms: 0.019-0.050 mm (0.0007-0.0020 in.)

No. 2,3, 4 rocker arms: 0.017-0.045 mm (0.0007-0.0018 in.)

Service Limit: 0.08 mm (0.003 in.)



G01431493

Fig. 122: Checking For Out-Of-Round Condition

Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. Repeat for all rocker arms and shaft. If the clearance is over the limit, replace the rocker shaft and all over tolerance rocker arms. If any VTEC rocker arm needs replacement, replace the rocker arms (primary (A) and secondary (B)) as a set.

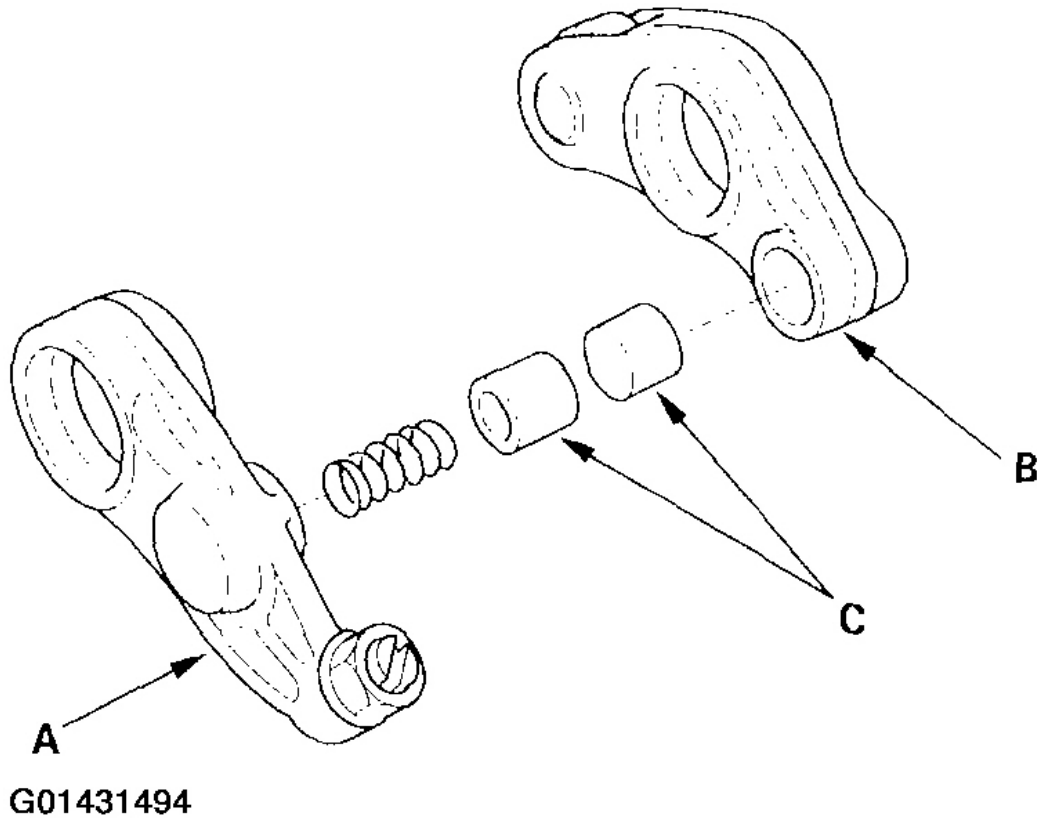


Fig. 123: Replacing Rocker Arms (Primary & Secondary) As A Set
Courtesy of AMERICAN HONDA MOTOR CO., INC.

6. Inspect the rocker arm pistons (C). Push each piston manually.

If it does not move smoothly, replace the rocker arm set.

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

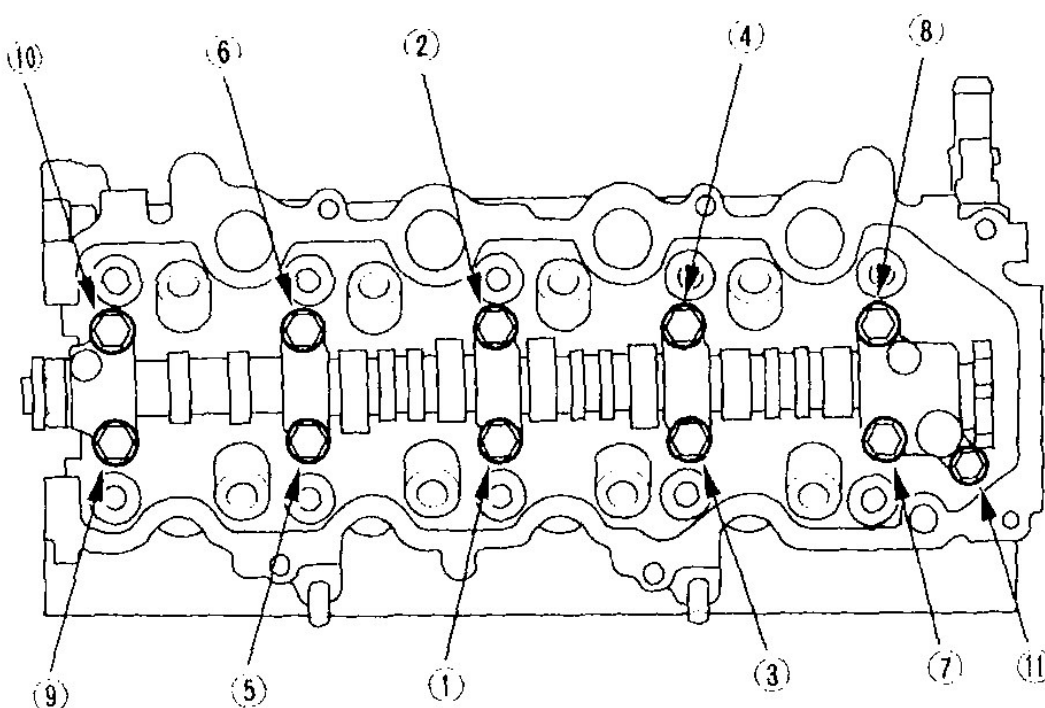
CAMSHAFT INSPECTION

NOTE: Do not rotate the camshaft during inspection.

1. Remove the rocker arm assembly (see **Rocker Arm Assembly and Camshaft Removal**).
2. Put the camshaft and camshaft holders on the cylinder head, then tighten the bolts to the specified torque.

Specified torque

- i. **8 mm bolts:** 22 N.m (2.2 kgf.m, 16 lbf.ft)
- ii. **Apply new engine oil to the bolt threads and flange 6 mm bolt:** 12 N.m (1.2 kgf.m, 8.7 lbf.ft)
- iii. **Apply new engine oil to the bolt threads and flange 6 mm bolt:** (11)



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Fig. 124: Tightening Cylinder Head Bolts

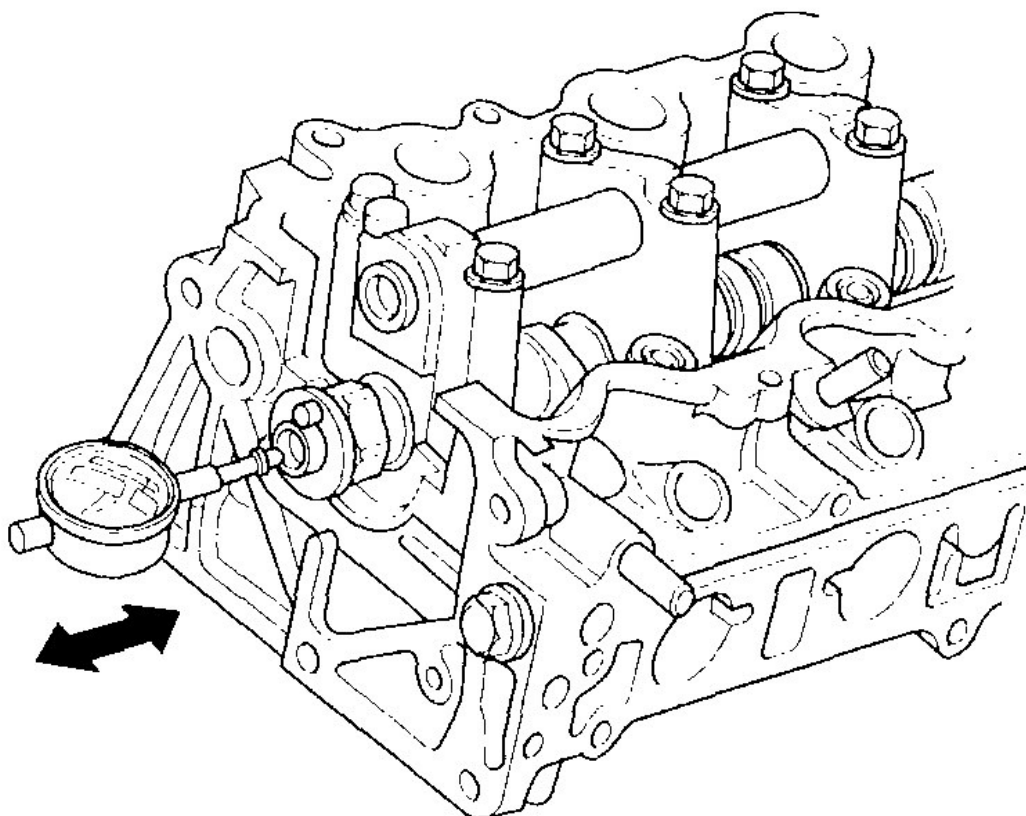
Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. Seat the camshaft by pushing it away from the camshaft pulley 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): 0.05-0.15 mm (0.002-0.006 in.)

Service Limit: 0.3 mm (0.01 in.)



G01431496

Fig. 125: Replacing Camshaft

Courtesy of AMERICAN HONDA MOTOR CO., INC.

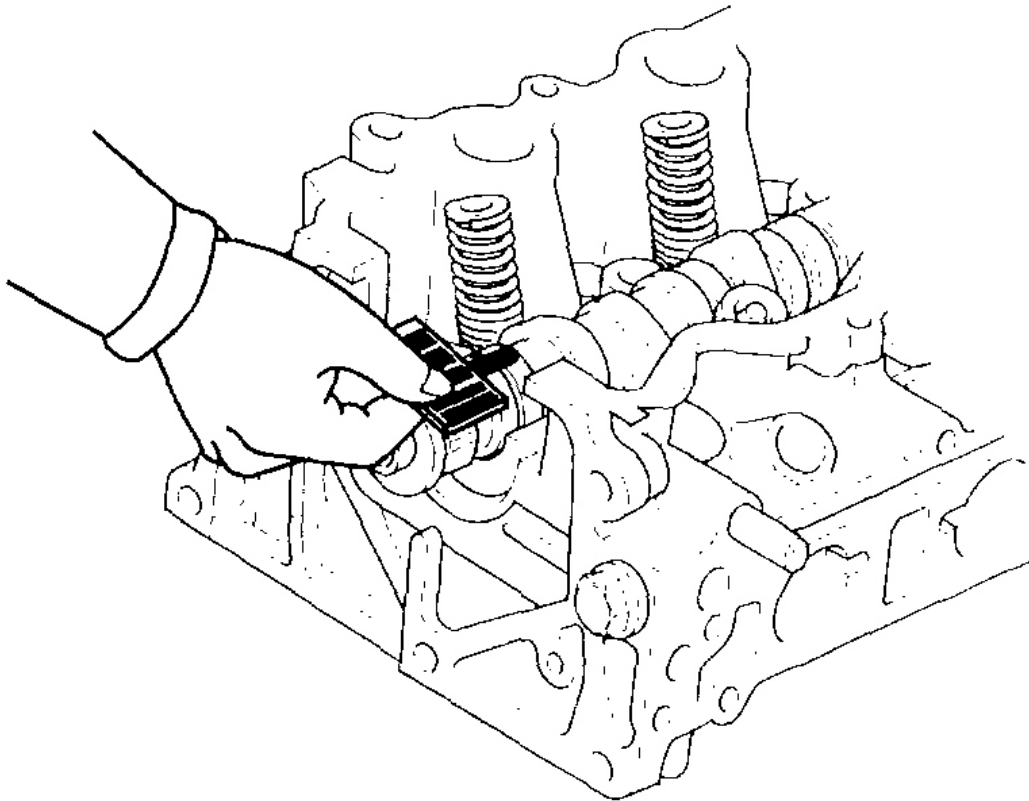
5. Unscrew the camshaft holder bolts two turns at a time, in a crisscross pattern. Then remove the camshaft holders from the cylinder head.
6. Lift the camshaft out of the cylinder head, wipe it clean, then inspect the lift ramps. Replace the camshaft if any lobes are pitted, scored, or excessively worn.
7. Clean the camshaft journal surfaces in the cylinder head, then set the camshaft 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 portion 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): 0.050-0.089 mm (0.0020-0.0035 in.)

Service Limit: 0.15 mm (0.006 in.)



G01431497

Fig. 126: Measuring Widest Portion Of Plastigage On Each 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.)

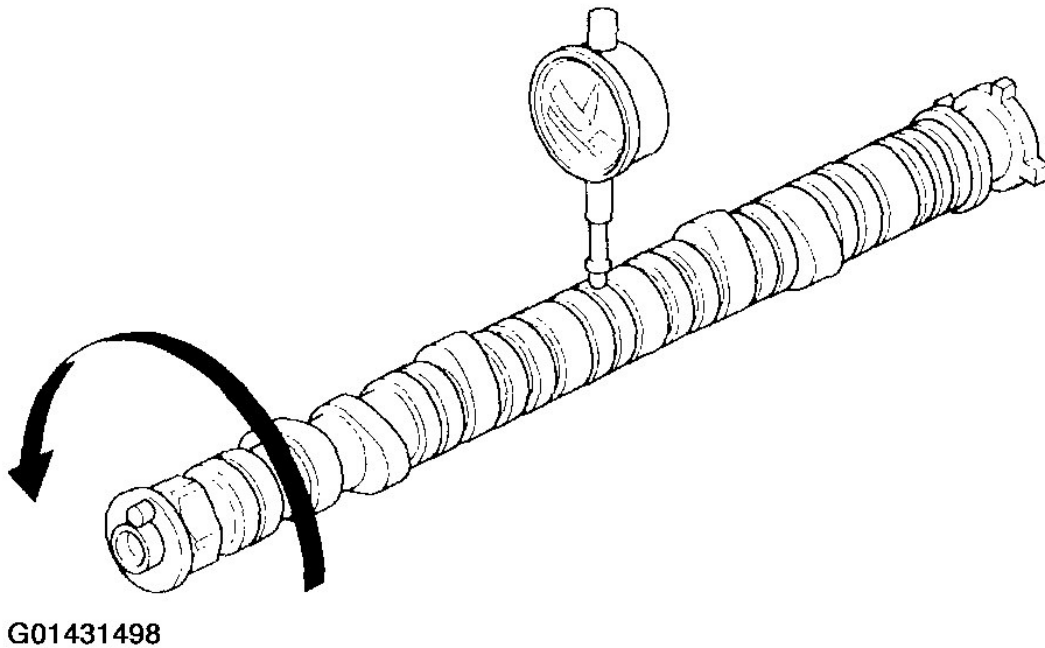


Fig. 127: Checking Total Runout With Camshaft Supported On V-Blocks
Courtesy of AMERICAN HONDA MOTOR CO., INC.

11. Measure cam lobe height.

NOTE: When measuring the No. 2, 3, 4 cylinder's cam lobe height, measure the secondary cam lobe.

Cam Lobe Height Standard (New)

Intake: 35.471 mm (1.3965 in.)

Exhaust: 35.604 mm (1.4017 in.)

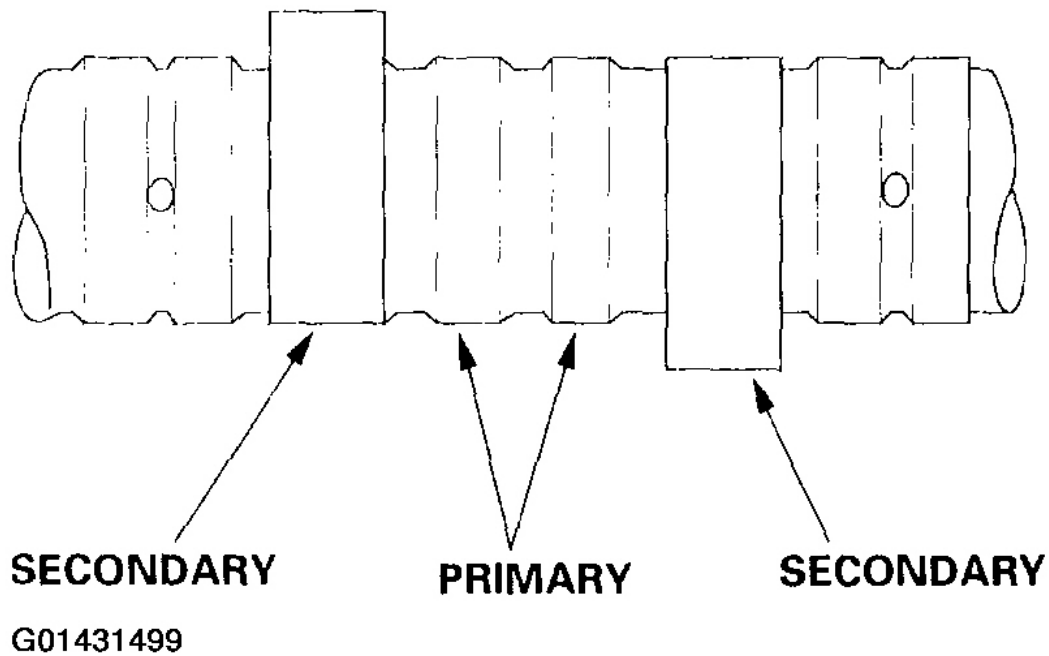


Fig. 128: Measuring Cam Lob Height (No. 2, 3, 4 Cylinder's Cam Lobe)
Courtesy of AMERICAN HONDA MOTOR CO., INC.

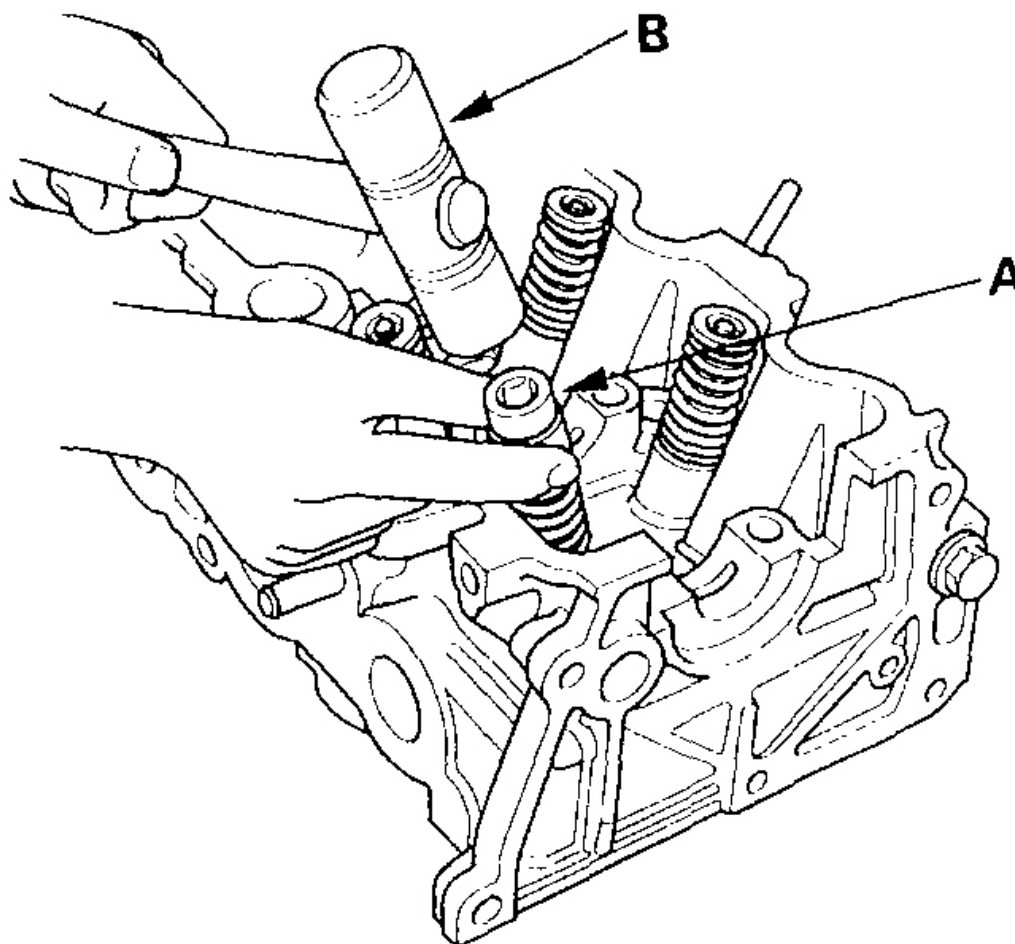
VALVE, SPRING, AND VALVE SEAL REMOVAL

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.

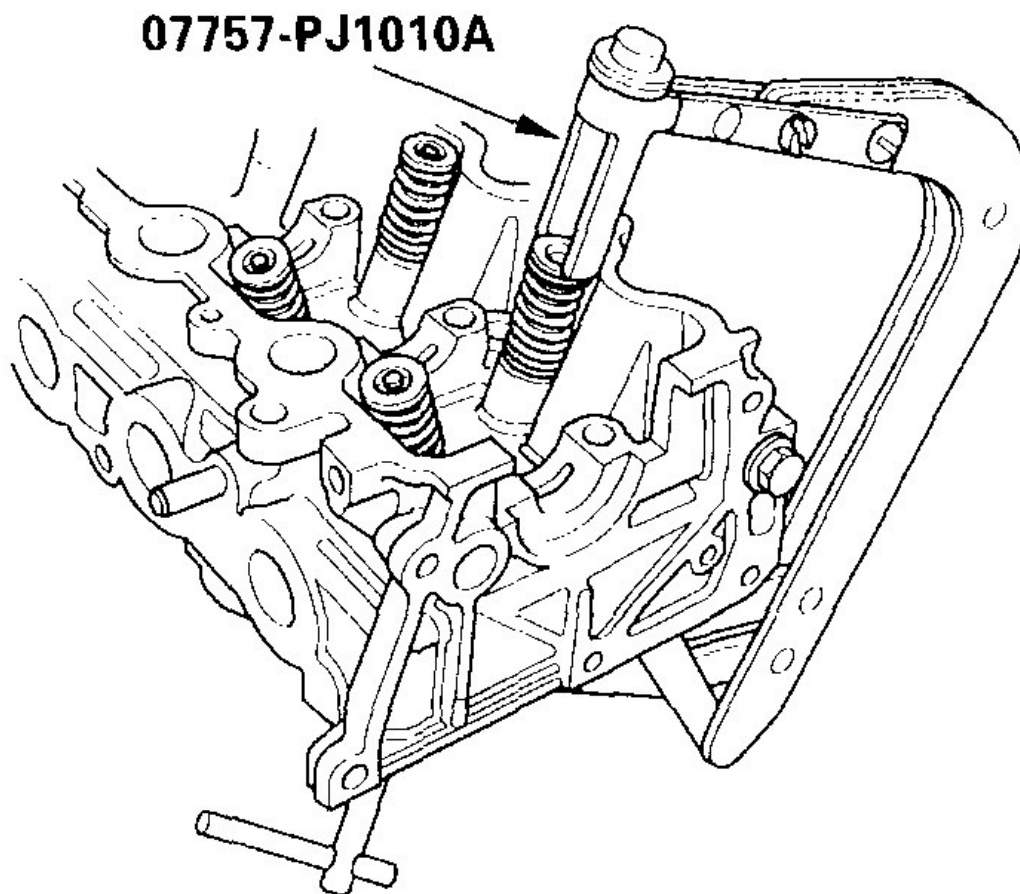
1. Remove the cylinder head (see **Cylinder Head Removal**).
2. Using an appropriate-sized socket (A) and plastic mallet (B), lightly tap the valve retainer to loosen the valve keepers.



G01431500

Fig. 129: Using Appropriate-Sized Socket & Plastic Mallet
Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. Install the spring compressor. Compress the spring, and remove the valve keepers.

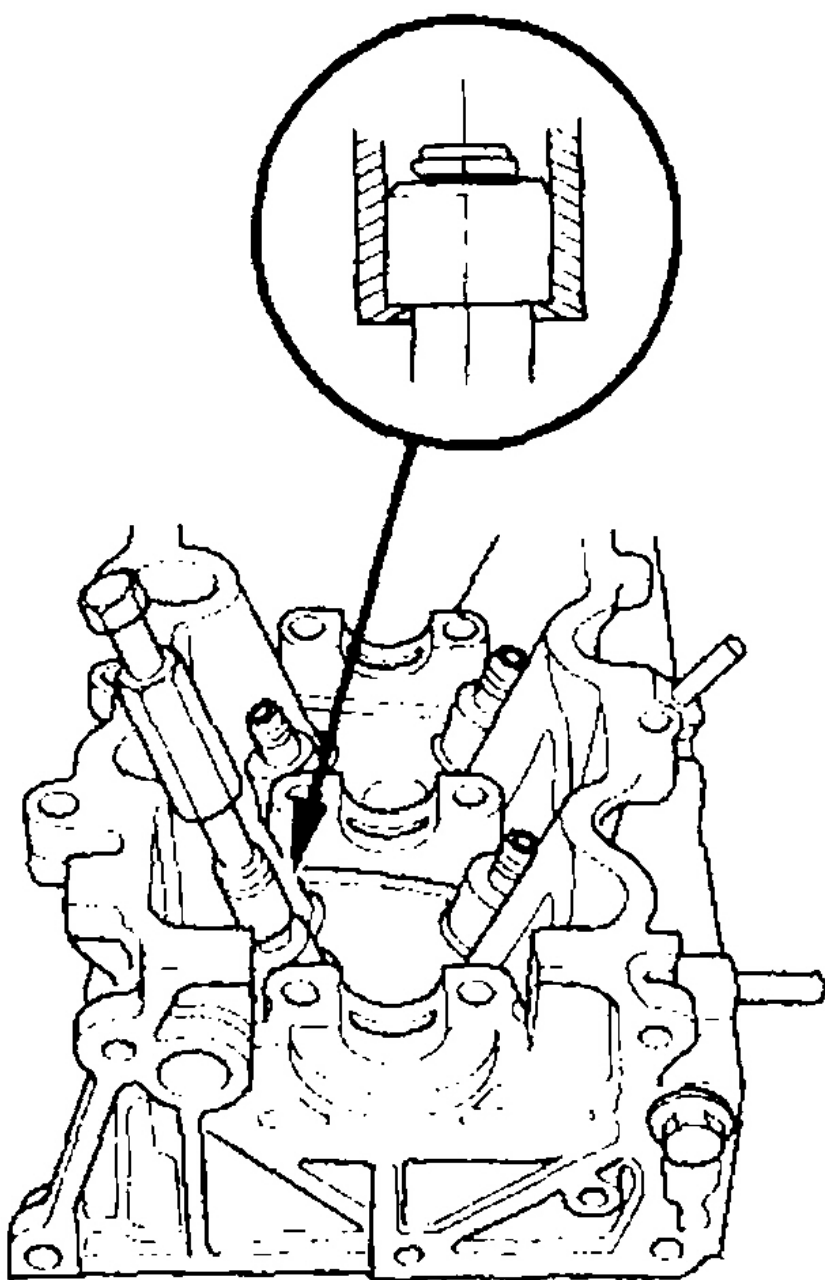


G01431501

Fig. 130: Installing Spring Compressor

Courtesy of AMERICAN HONDA MOTOR CO., INC.

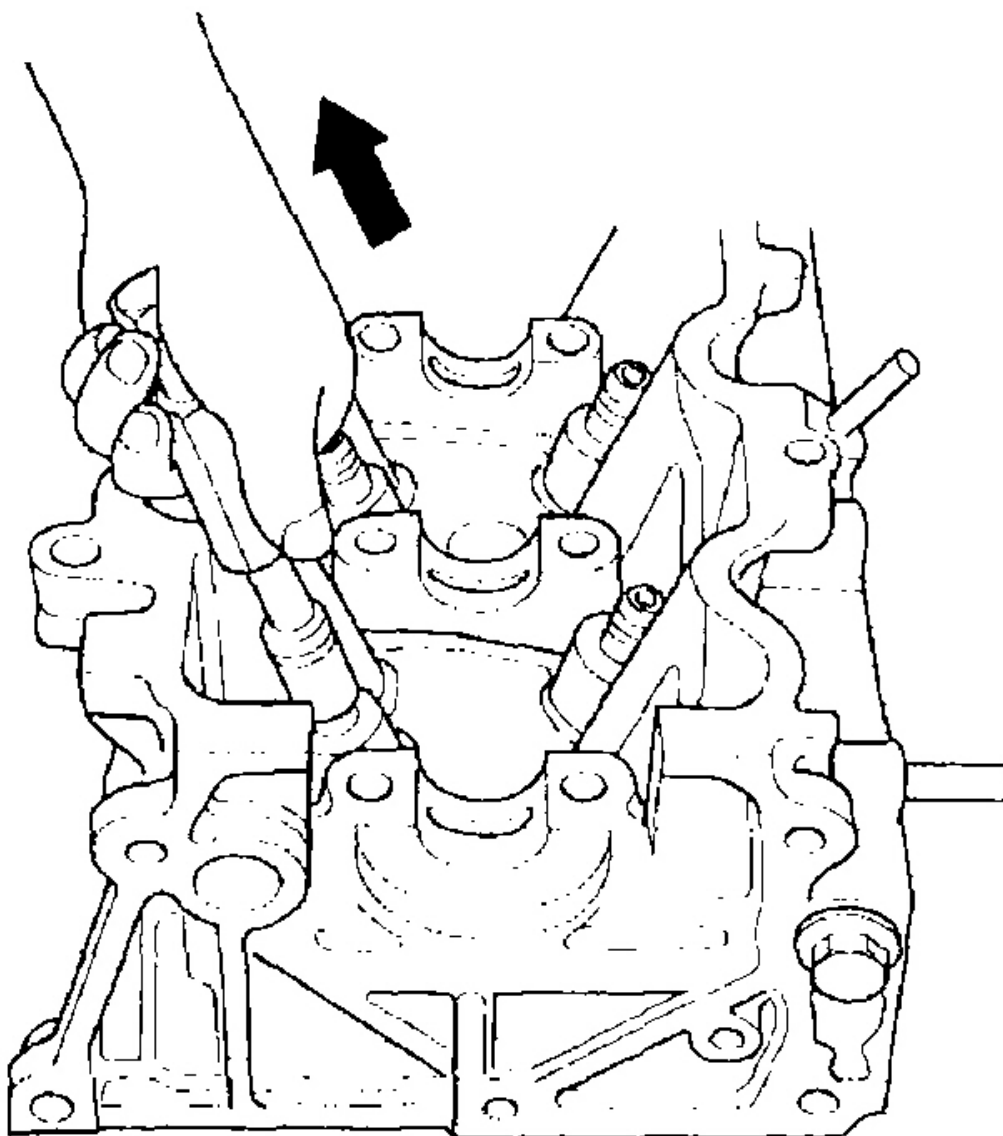
4. Remove the valve springs, valve retainer, and valve spring compressor.



G01431502

Fig. 131: Removing Valve Springs, Valve Retainer & Valve Spring Compressor
Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. Install the valve guide seal remover.
6. Remove the valve seal and valve.



G01431503

Fig. 132: Removing Valve Seal & Valve
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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): 31.85-32.15 mm (1.254-1.266 in.)

B Standard (New): 118.05-118.65 mm (4.648-4.671 in.)

C Standard (New): 5.48-5.49 mm (0.2157-0.2161 in.)

C Service Limit: 5.45 mm (0.215 in.)

Exhaust Valve Dimensions

A Standard (New): 27.85-28.15 mm (1.096-1.108 in.)

B Standard (New): 117.76-118.36 mm (4.636-4.660 in.)

C Standard (New): 5.45-5.46 mm (0.2146-0.2150 in.)

C Service Limit: 5.42 mm (0.213 in.)

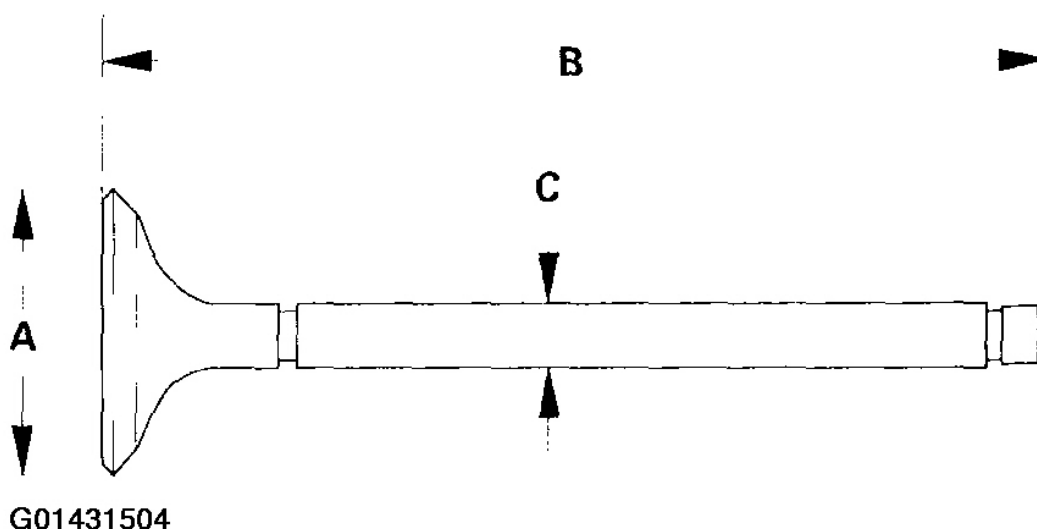


Fig. 133: Measuring Valves

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, 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

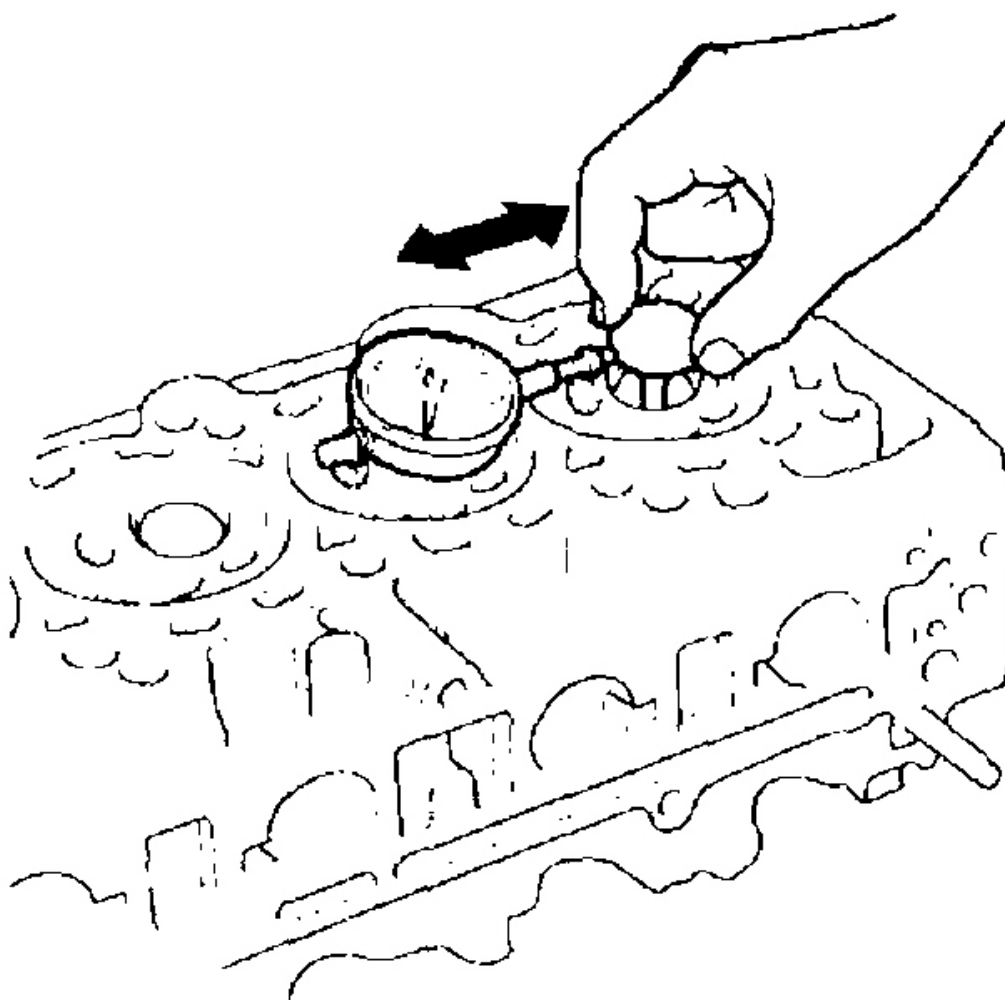
Standard (New): 0.04-0.10 mm (0.002-0.004 in.)

Service Limit: 0.16 mm (0.006 in.)

Exhaust Valve Stem-to-Guide Clearance

Standard (New): 0.10-0.16 mm (0.004-0.006 in.)

Service Limit: 0.22 mm (0.009 in.)



G01431505

Fig. 134: Measuring Valve Areas**Courtesy of AMERICAN HONDA MOTOR CO., INC.**

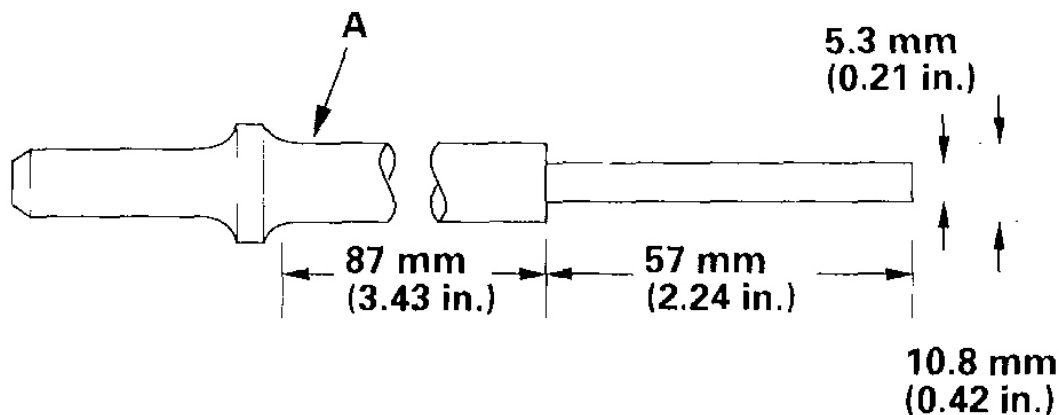
3. Subtract the O.D. of the valve stem, measured with a micrometer, from the I.D. of the valve guide, measured with an inside micrometer or ball gauge. Take the measurements in three places along the valve stem and three places inside the valve guide. The difference between the largest guide measurement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

Intake Valve Stem-to-Guide Clearance

- i. **Standard (New):** 0.020-0.050 mm (0.0008-0.0020 in.)
- ii. **Service Limit:** 0.08 mm (0.003 in.)

Exhaust Valve Stem-to-Guide Clearance**Standard (New):** 0.050-0.080 mm (0.0020-0.0031 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 Stem-to-Guide Clearance 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.



G01431506

Fig. 135: Using Commercially Available Air-Impact Valve Guide Driver Modified To Fit Diameter Of Valve Guides

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.

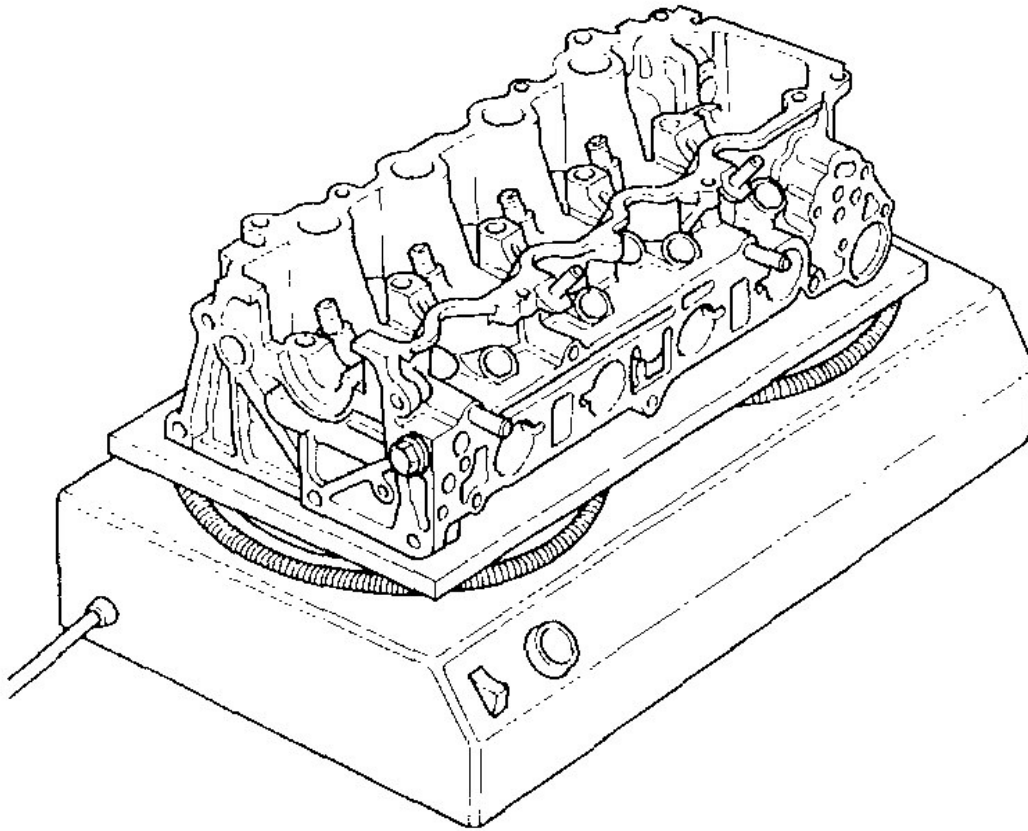
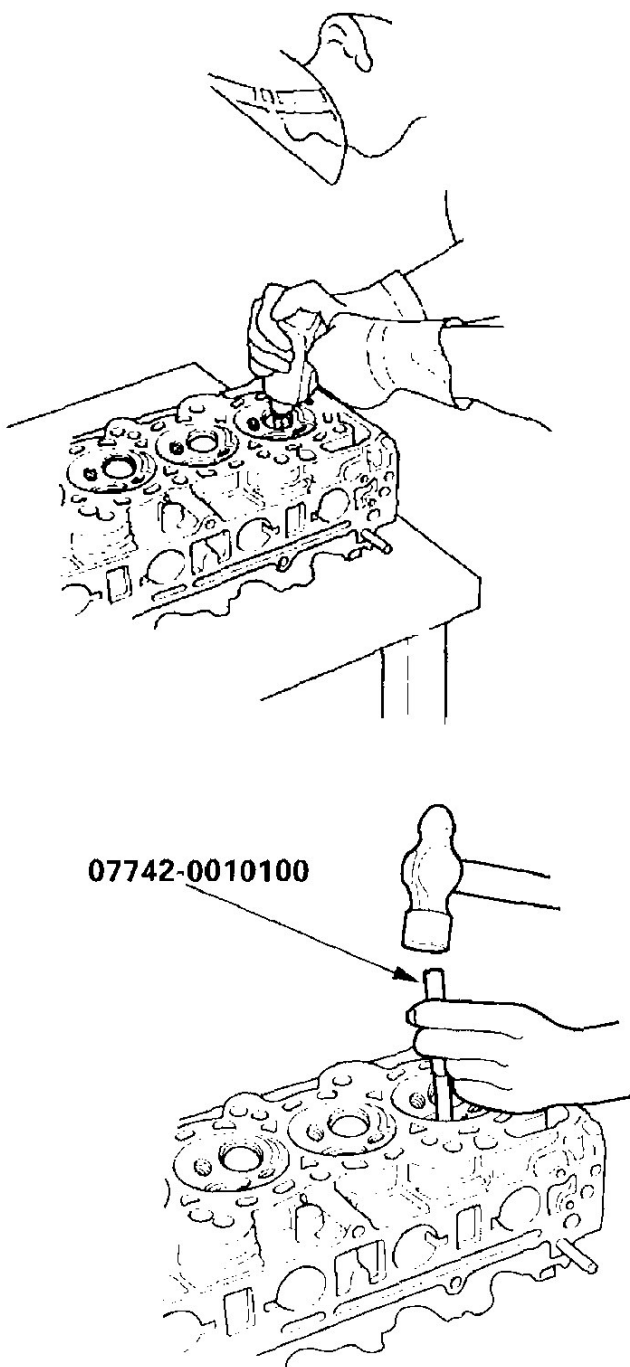
**G01431507**

Fig. 136: Selecting Proper Replacement Guides
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.
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.
6. Turn the head over, and drive the guide out toward the camshaft side of the head.



G01431508

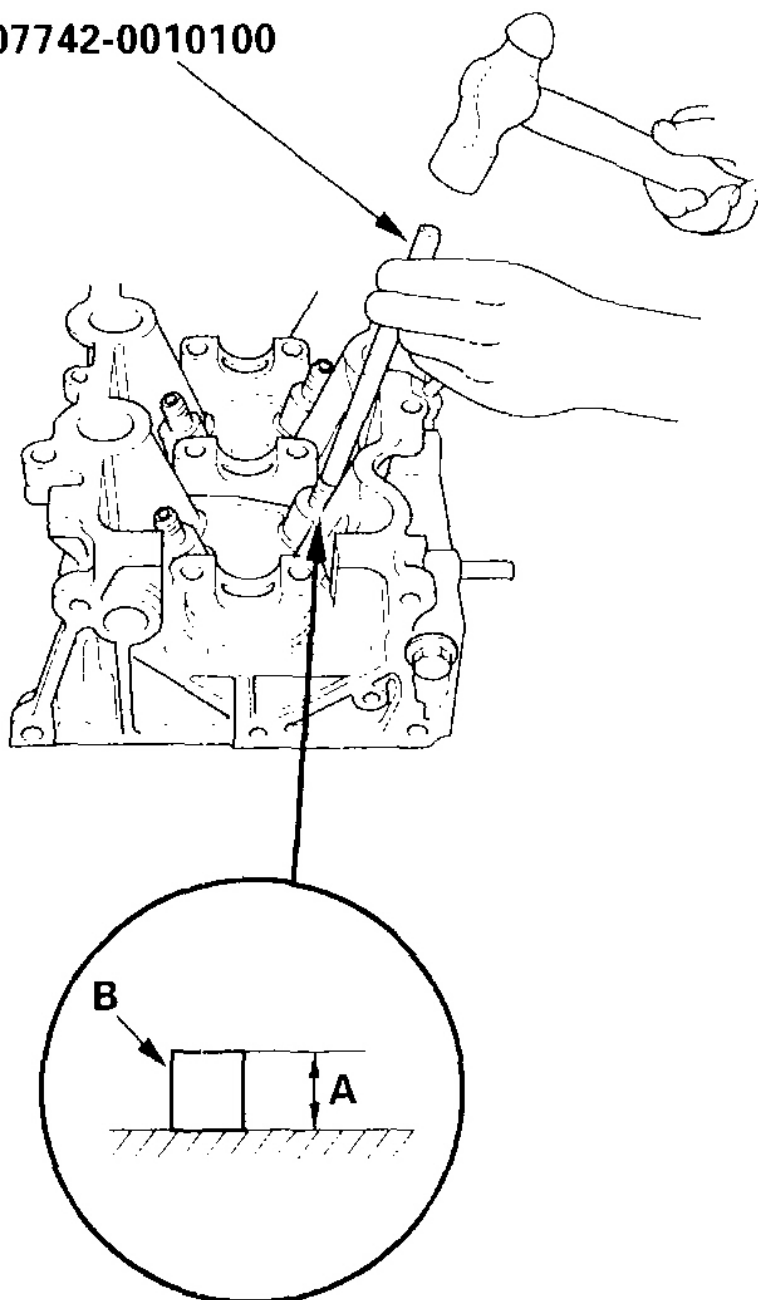
Fig. 137: Driving Guide Out Toward Camshaft Side Of Head
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

8. Remove the new guide(s) from the freezer, one at a time, as you need them.
9. Apply a thin coat of clean 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 eight guides to do, you may have to reheat the head.

Valve Guide Installed Height: 15.85-16.35 mm (0.624-0.644 in.)

07742-0010100



G01431509

Fig. 138: Using Special Tool To Drive Guide Into Specified Installed Height Of 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.
12. Continue to rotate the reamer clockwise while removing it from the bore.

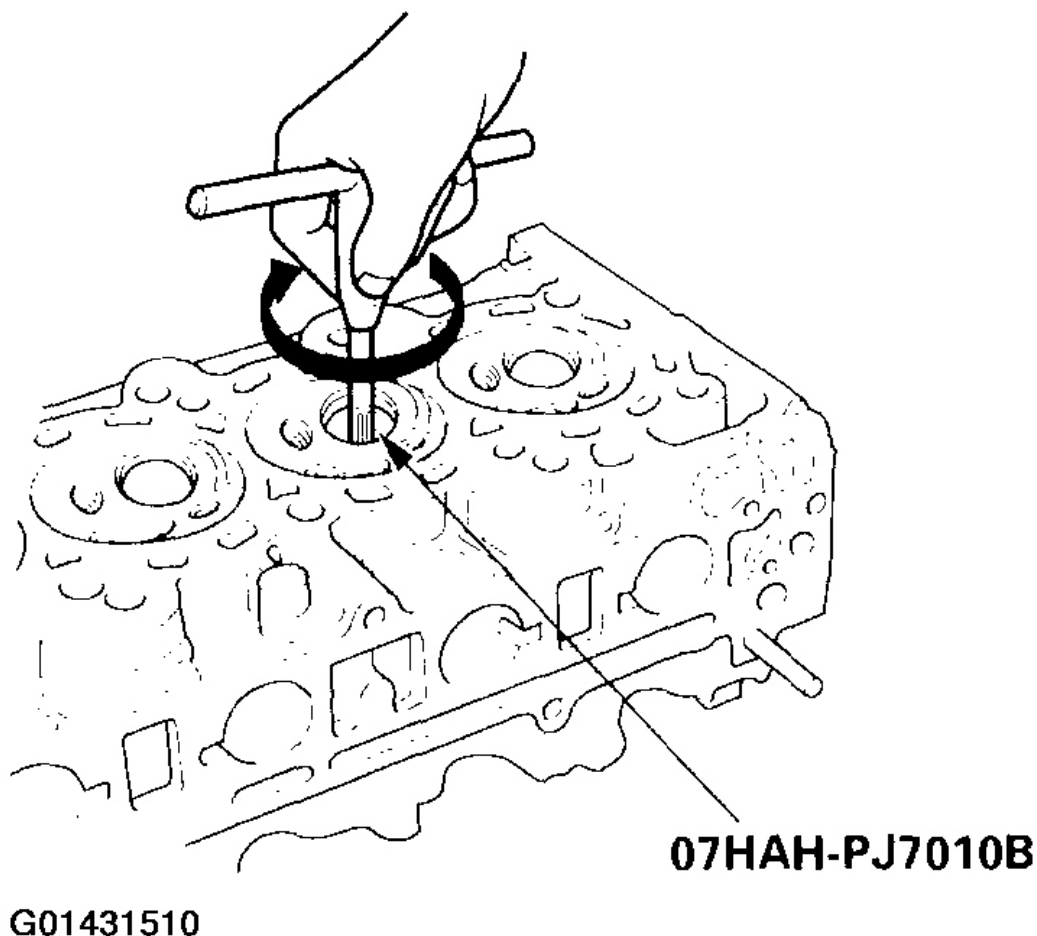
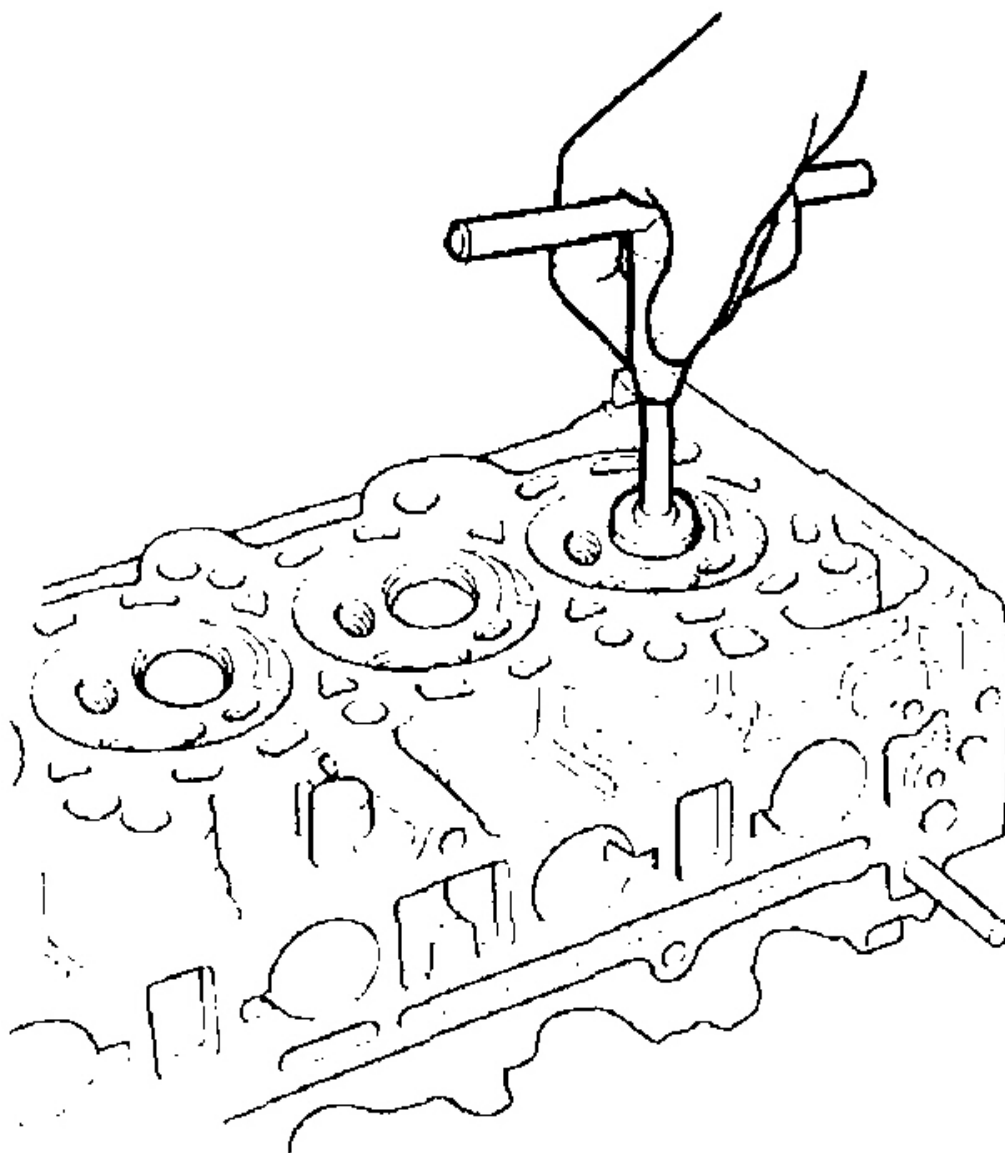


Fig. 139: Continuing To Rotate Reamer Clockwise While Removing From Bore
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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 exerting pressure.

VALVE SEAT RECONDITIONING

1. Inspect valve stem-to-guide clearance (see **Valve Stem-to-Guide Clearance 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.

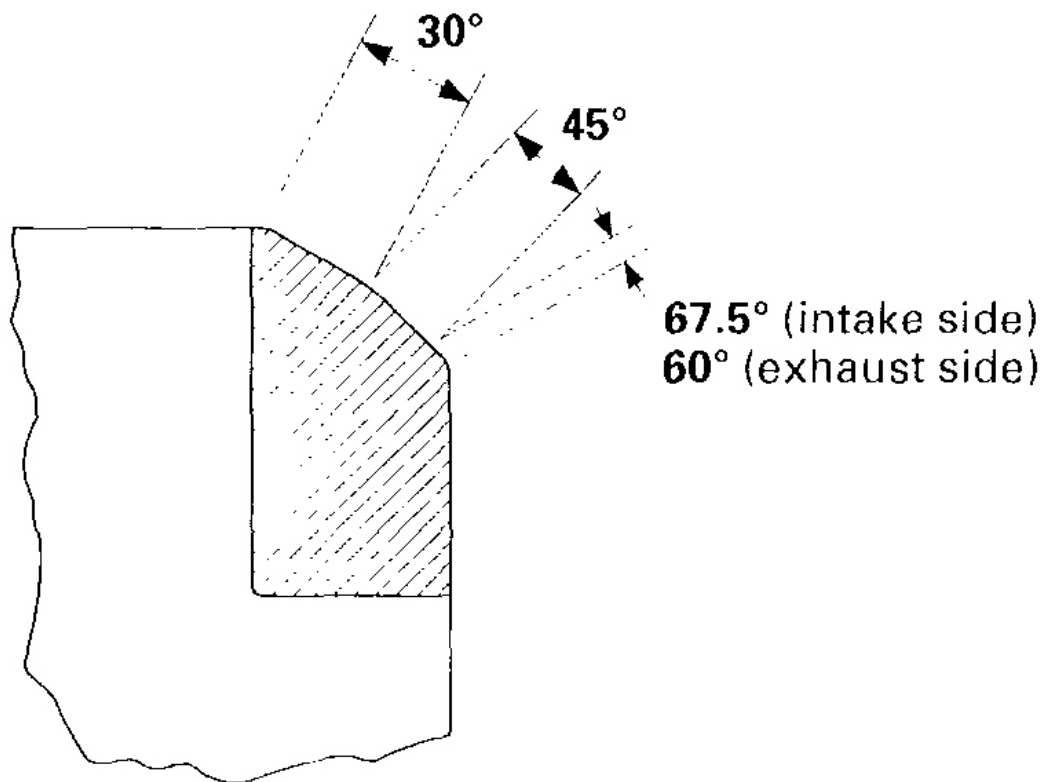


G01431511

Fig. 140: Renewing Valve Seats In Cylinder Head Using Valve Seat Cutter
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.



G01431512

Fig. 141: Beveling Upper & Lower Edges At Angles
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

Intake

Standard (New): 0.850-1.150 mm (0.0335-0.0453 in.)

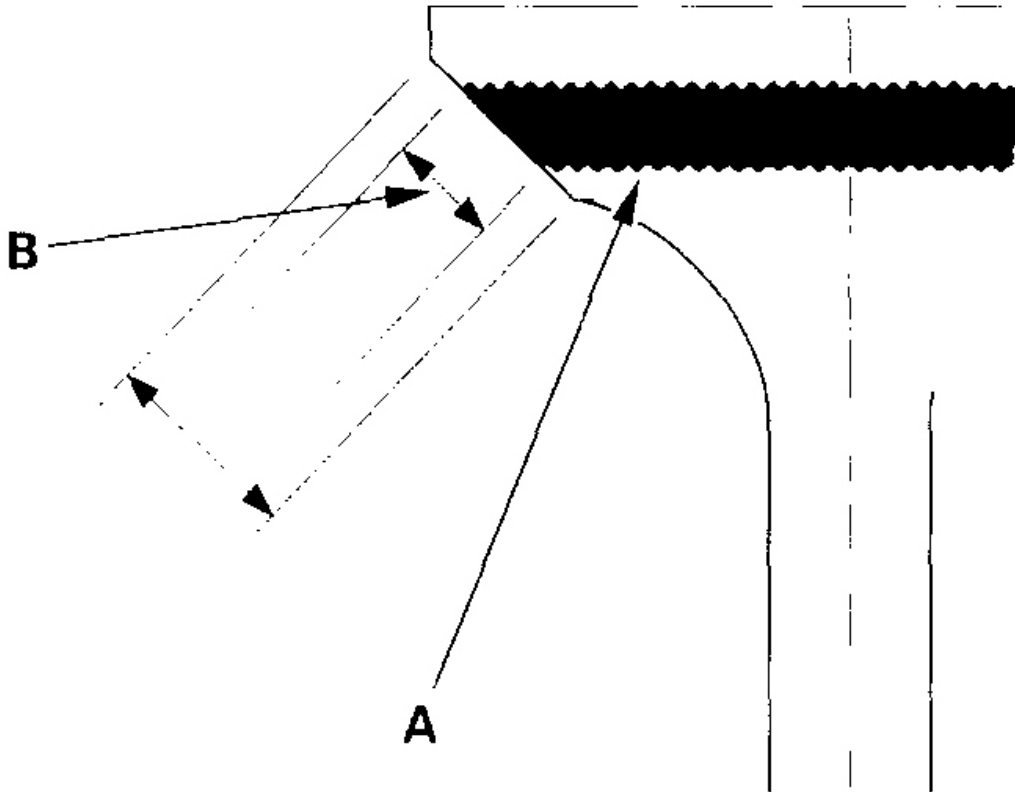
Service Limit: 1.60 mm (0.063 in.)

Exhaust

Standard (New): 1.250-1.550 mm (0.0492-0.0610 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.



G01431513

Fig. 142: Applying Prussian Blue Compound To Valve Face
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 (intake) or 60° cutter (exhaust) 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 30° cutter 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

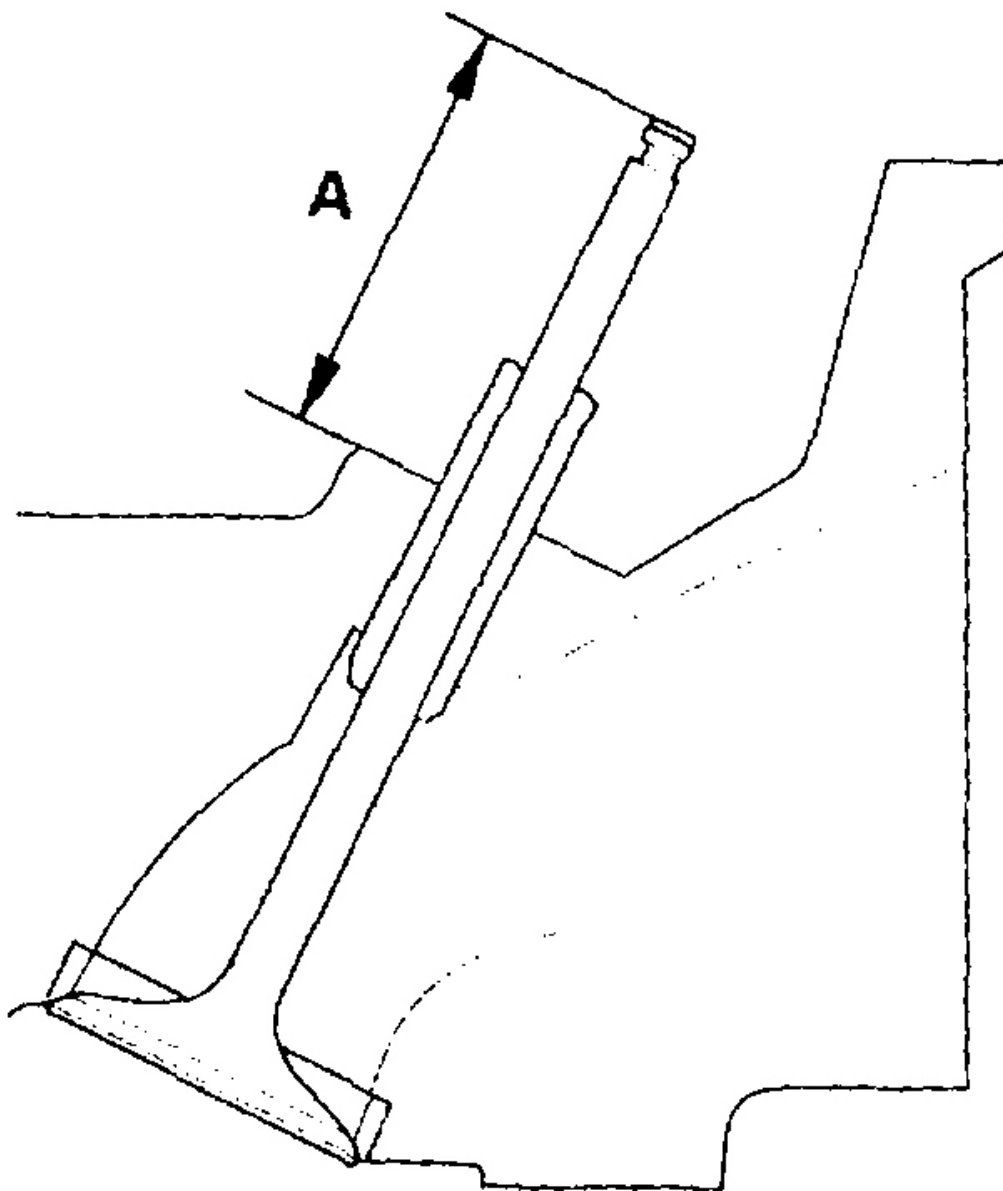
Standard (New): 46.1-46.5 mm (1.815-1.831 in.)

Service Limit: 46.8 mm (1.843 in.)

Exhaust Valve Stem Installed Height

Standard (New): 46.2-46.6 mm 1.819-1.835 in.)

Service Limit: 46.9mm (1.846 in.)



G01431514

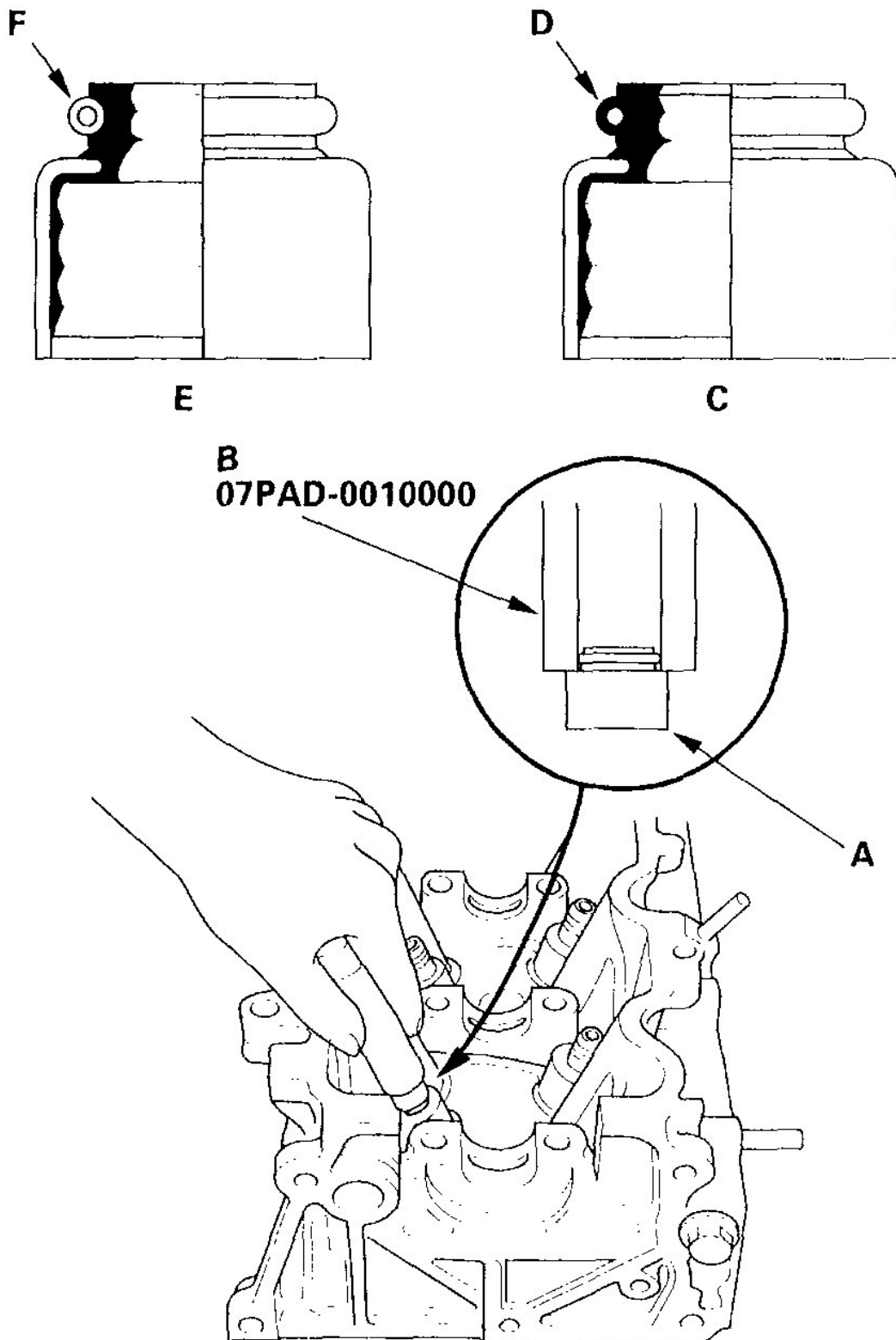
Fig. 143: Measuring Valve Stem Installed Height
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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.**



G01431515

Fig. 144: Installing New Valves Seals Using Stem Seal Driver
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 keepers.

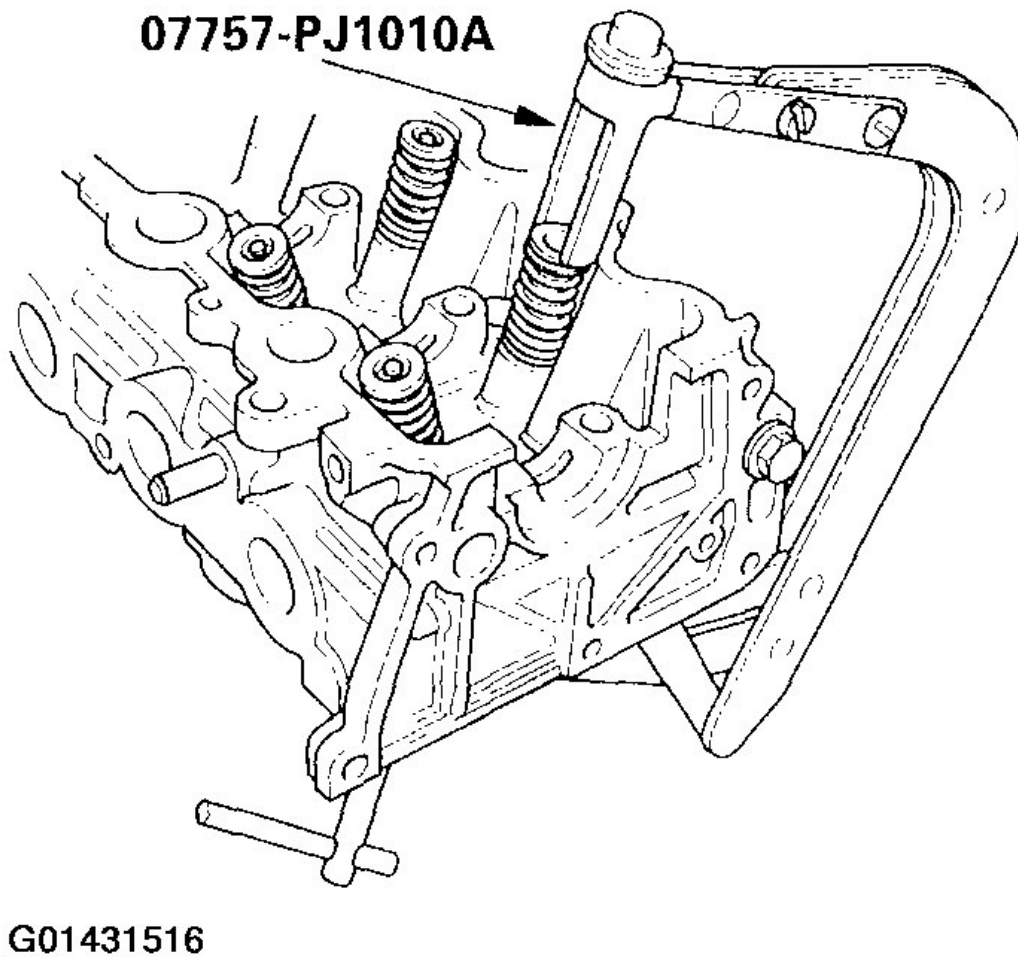
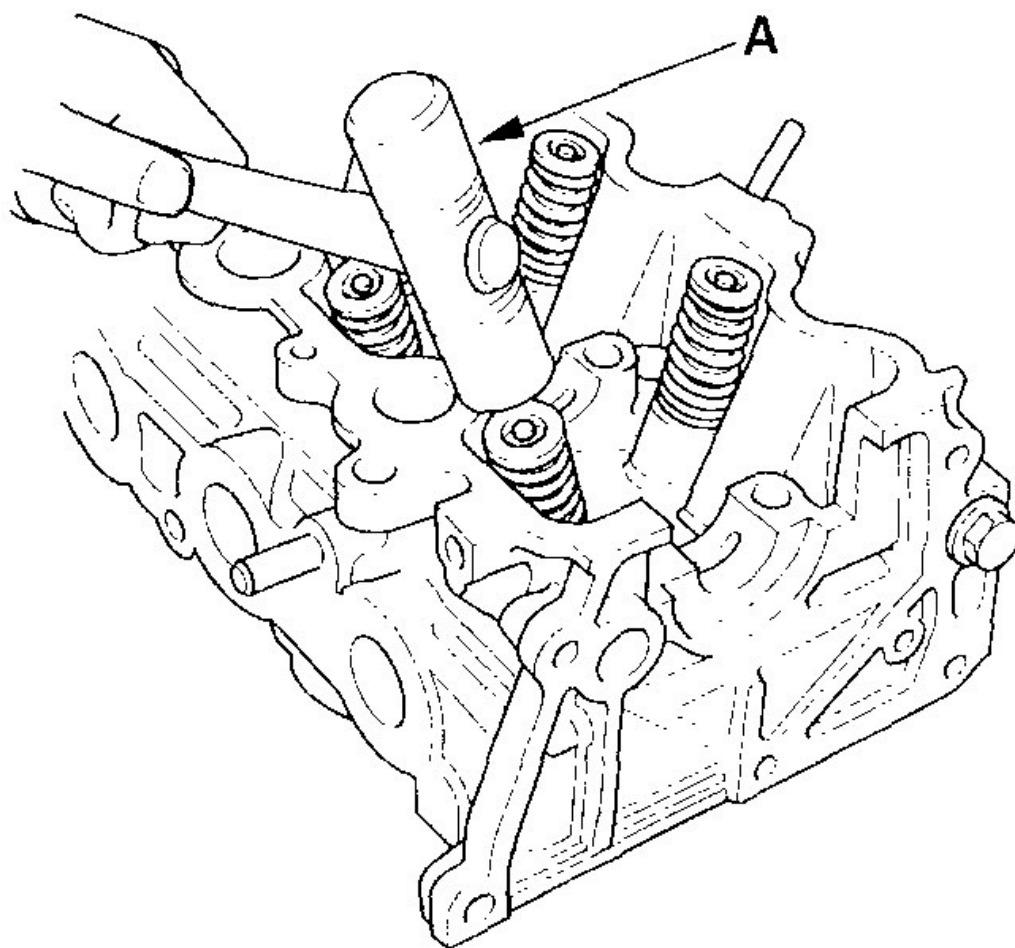


Fig. 145: Installing Valve Spring Compressor
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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 keepers. Tap the valve stem only along its axis so you do not bend the stem.

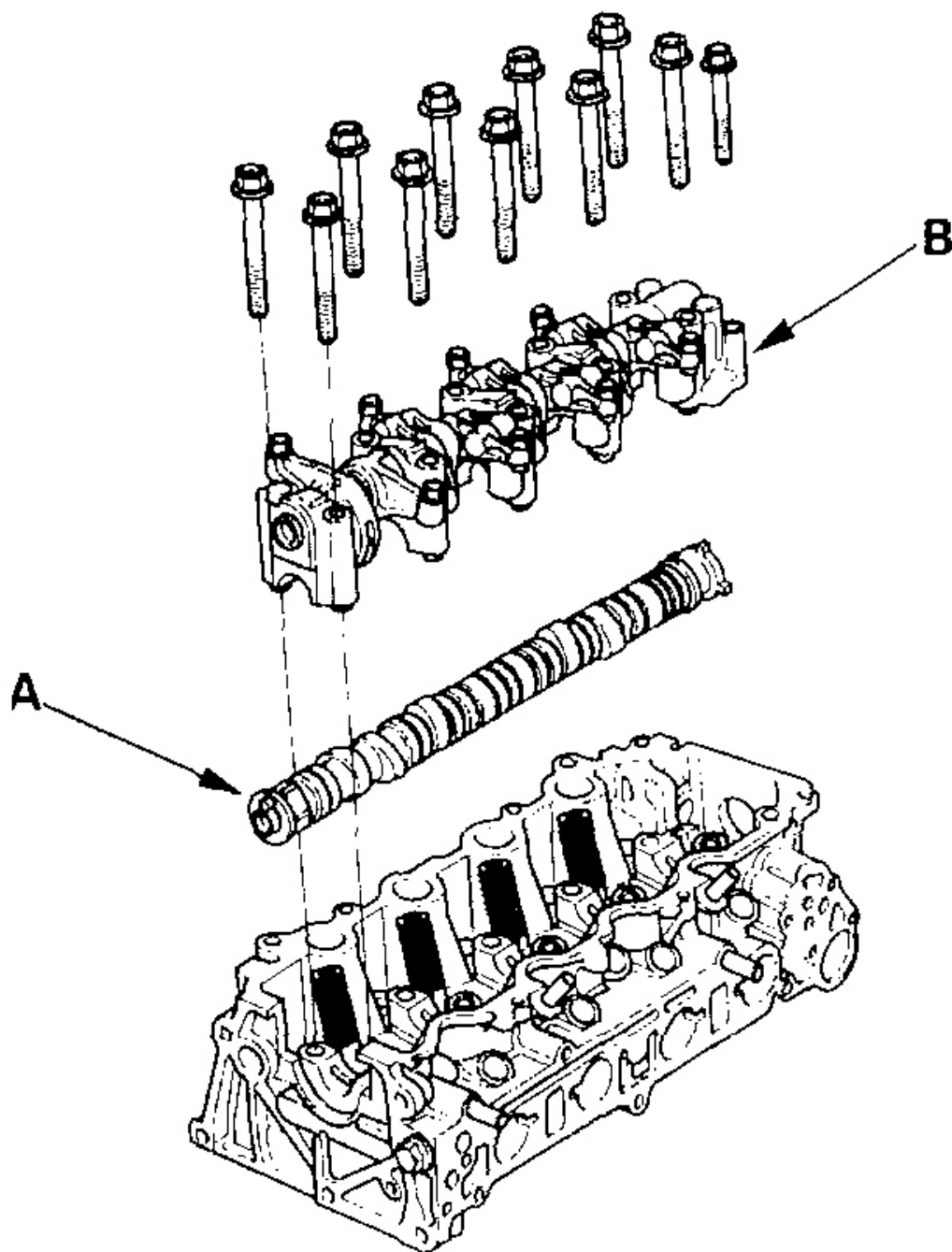


G01431517

Fig. 146: Lightly Tapping End Of Each Valve Stem With Plastic Mallet
Courtesy of AMERICAN HONDA MOTOR CO., INC.

ROCKER ARM ASSEMBLY AND CAMSHAFT INSTALLATION

1. Reassemble the rocker arm assembly (see **Rocker Arm and Shaft Disassembly/Reassembly**).
2. Install the camshaft (A) and rocker arm assembly (B). Apply new engine oil to the camshaft lobes and journals.



G01431518

Fig. 147: Installing Camshaft & Rocker Arm Assembly

Courtesy of AMERICAN HONDA MOTOR CO., INC.

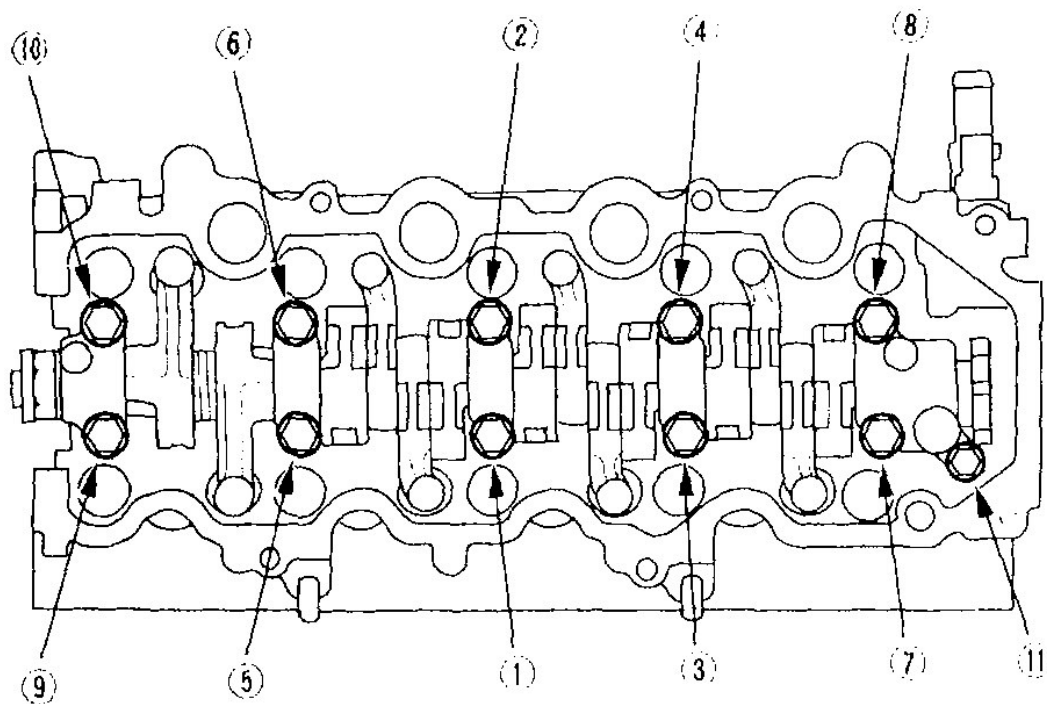
3. Apply new engine oil to the bolt threads and flange. Tighten each bolt two turns at a time in sequence.

Specified torque

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

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

6 mm bolt: (11)



G01431519

Fig. 148: Tightening Each Bolt Two Turns At A Time In Sequence
Courtesy of AMERICAN HONDA MOTOR CO., INC.

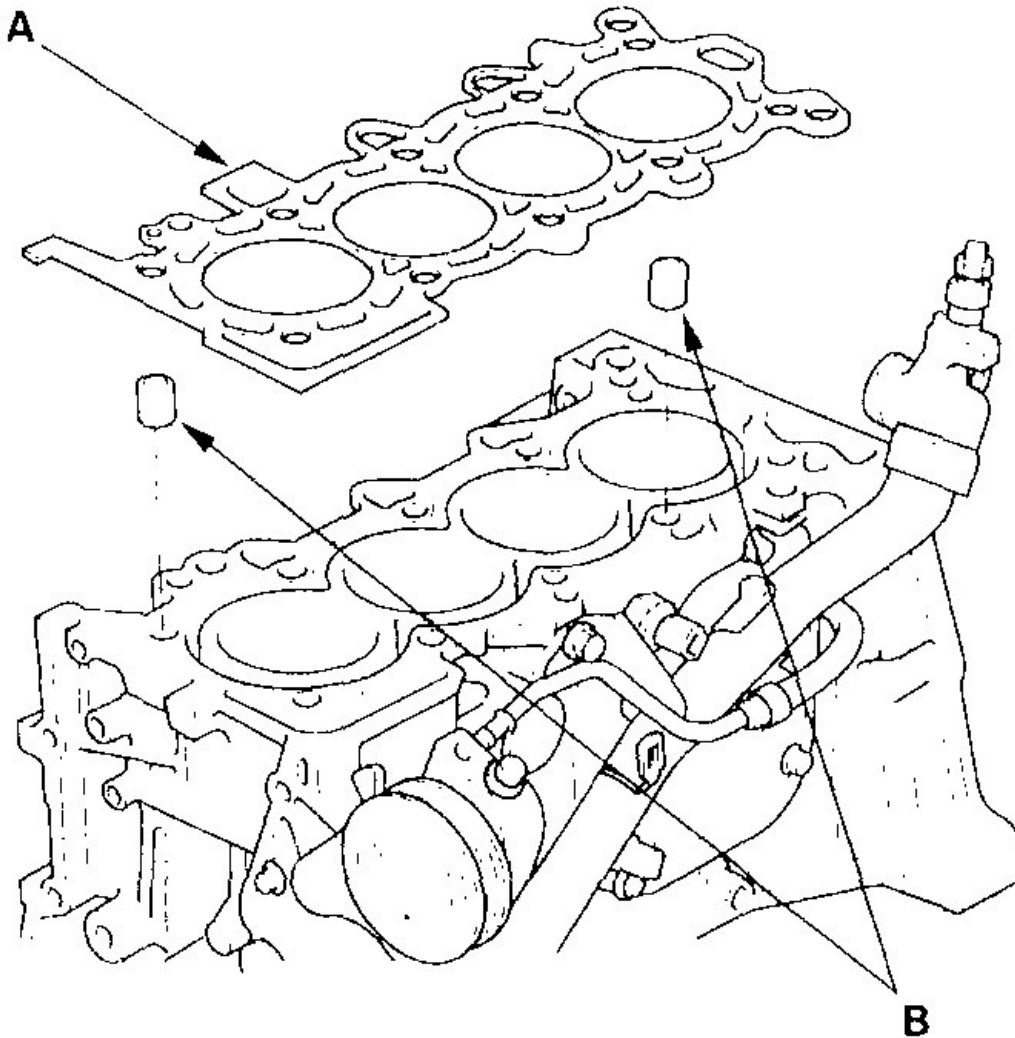
4. Install the camshaft sprocket (see [Camshaft Sprocket Removal](#)), then adjust the valve clearance (see [Valve Clearance Adjustment](#)).

CYLINDER HEAD INSTALLATION

Install the cylinder head in the reverse order of removal:

1. Clean the cylinder head and block surface.

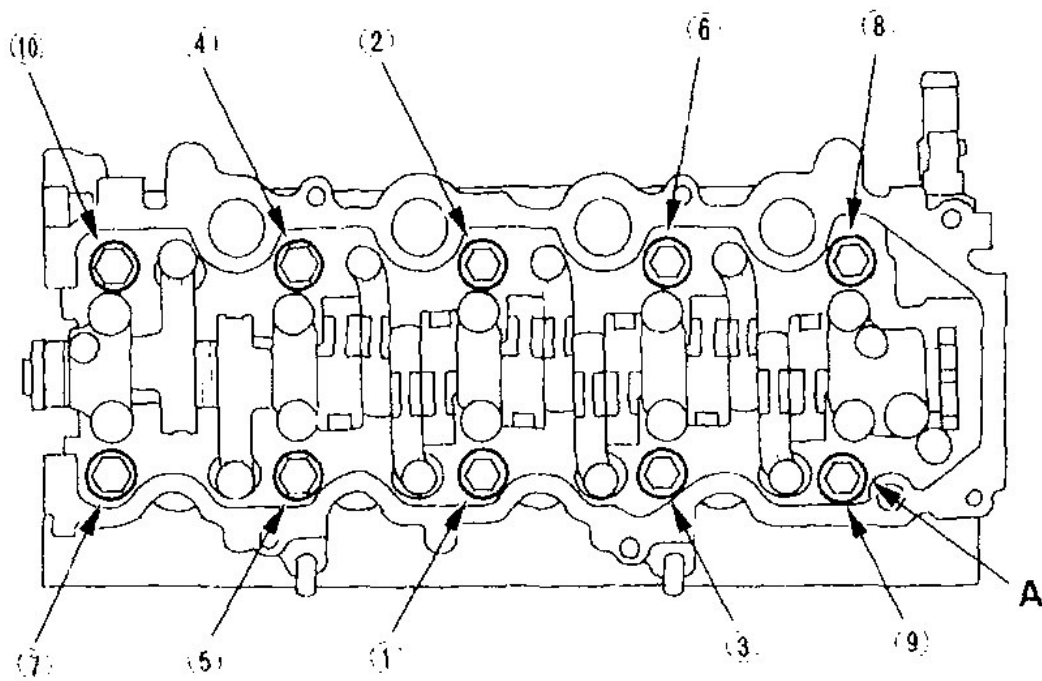
2. Install the new cylinder head gasket (A) and dowel pins (B) on the cylinder block. Always use a new cylinder head gasket.



G01431520

Fig. 149: Installing New Cylinder Head Gasket
Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. Check that the crankshaft keyway is facing up.
4. Install the cylinder head on the block.
5. Apply new engine oil to the threads and under the bolt heads of all cylinder head bolts. Be sure to install the 165 mm long head bolt (A) in the location shown.



G01431521

Fig. 150: Installing 165 mm Long Head Bolt
Courtesy of AMERICAN HONDA MOTOR CO., INC.

6. Tighten the cylinder head bolts in sequence to 29 N.m (3.0 kgf.m, 22 lbf.ft), use 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.
7. Tighten all cylinder head bolts an additional 130°.
8. Install the cam chain guide mounting bolt.

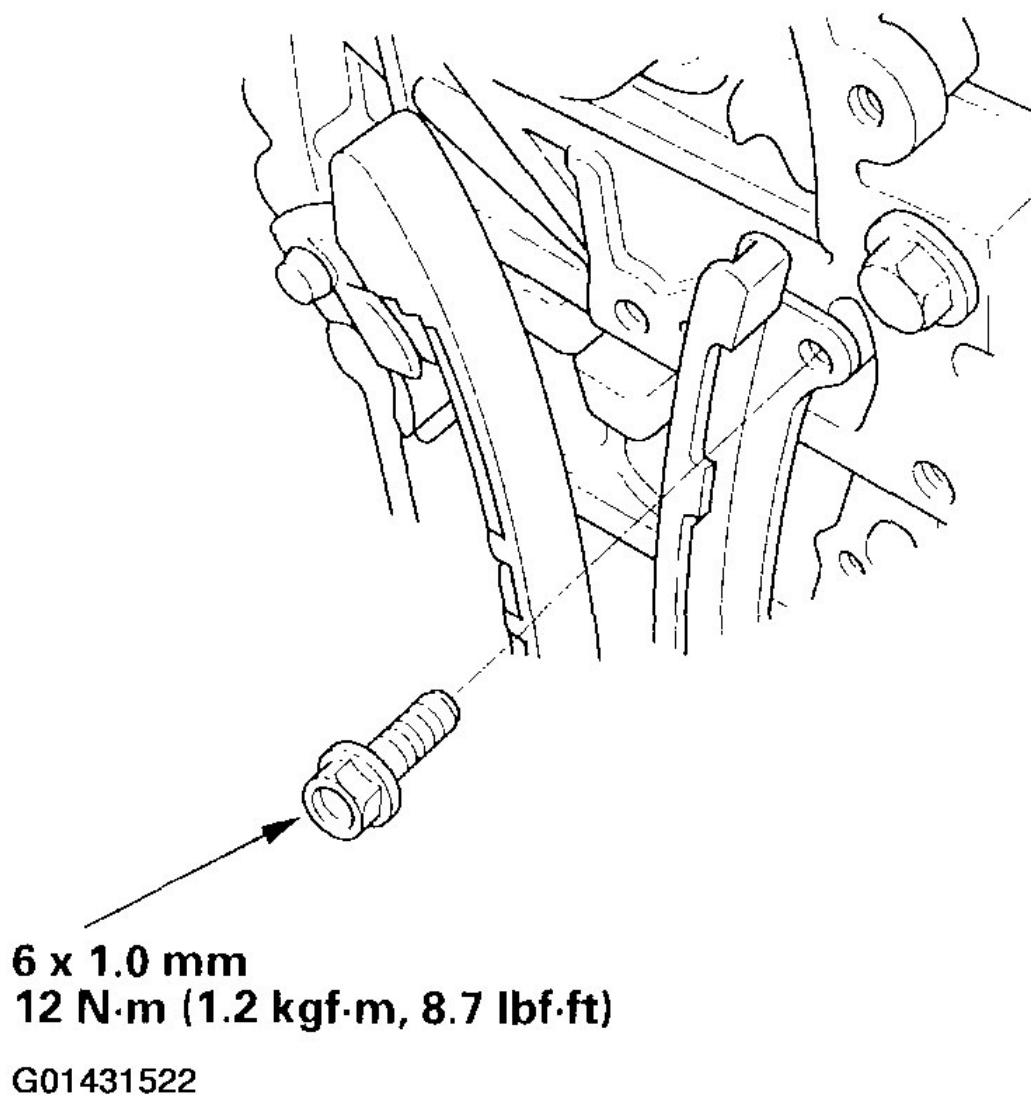
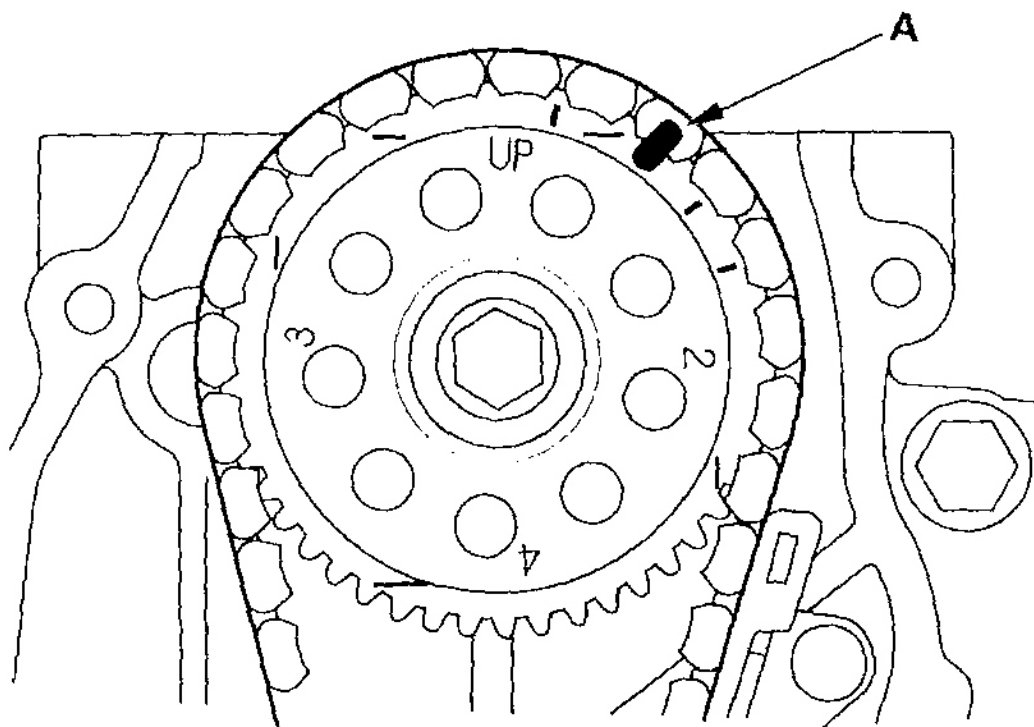


Fig. 151: Installing Cam Chain Guide Mounting Bolt
Courtesy of AMERICAN HONDA MOTOR CO., INC.

9. Install the cam chain around the camshaft sprocket aligned with the reference mark (A), then install the camshaft sprocket on the camshaft.



G01431523

Fig. 152: Installing Cam Chain Around Camshaft Sprocket Aligned With Reference Mark
Courtesy of AMERICAN HONDA MOTOR CO., INC.

10. Hold the camshaft with an open-end wrench, then tighten the bolt.
Specified torque: 56 N.m (5.7 kgf.m, 41 lbf.ft)

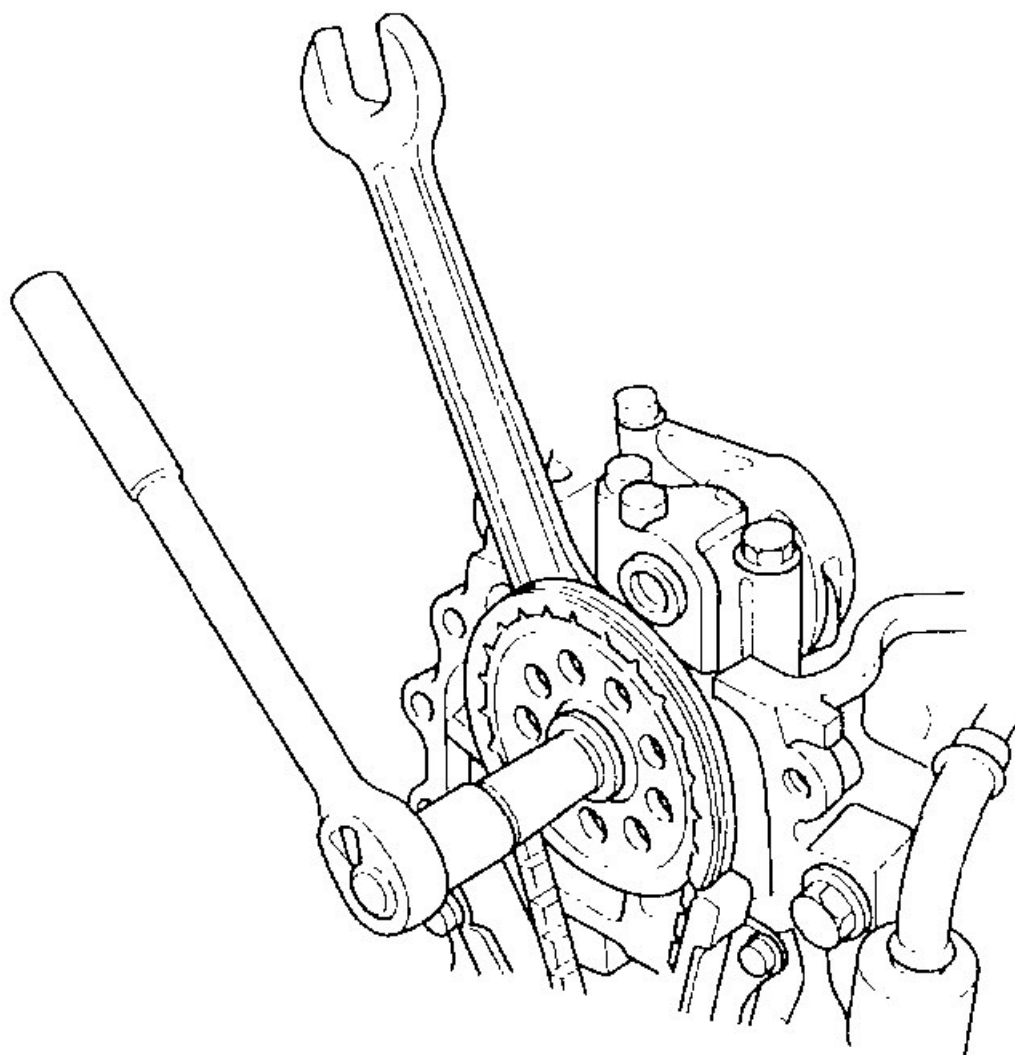
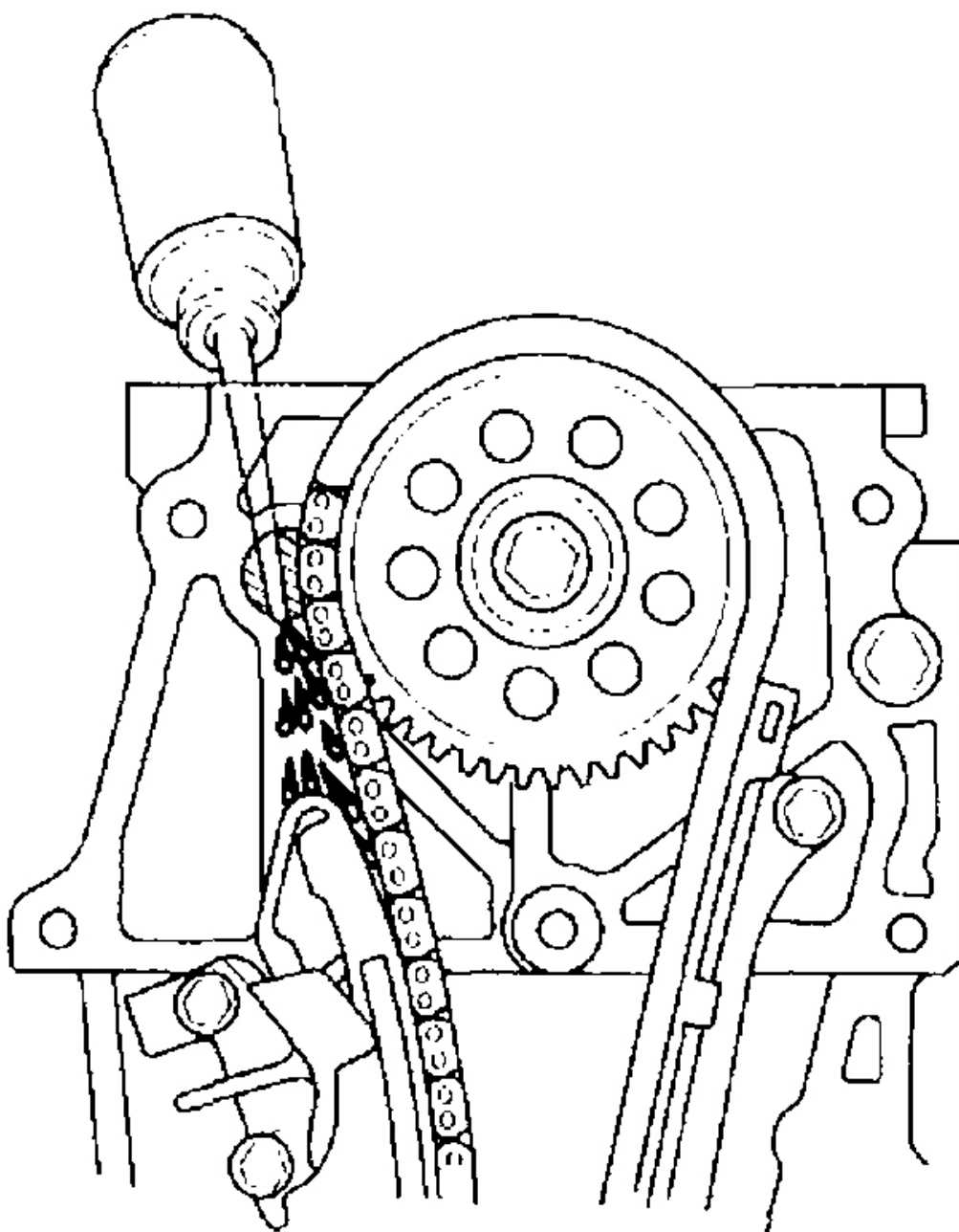
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Fig. 153: Holding Camshaft With An Open-End Wrench
Courtesy of AMERICAN HONDA MOTOR CO., INC.

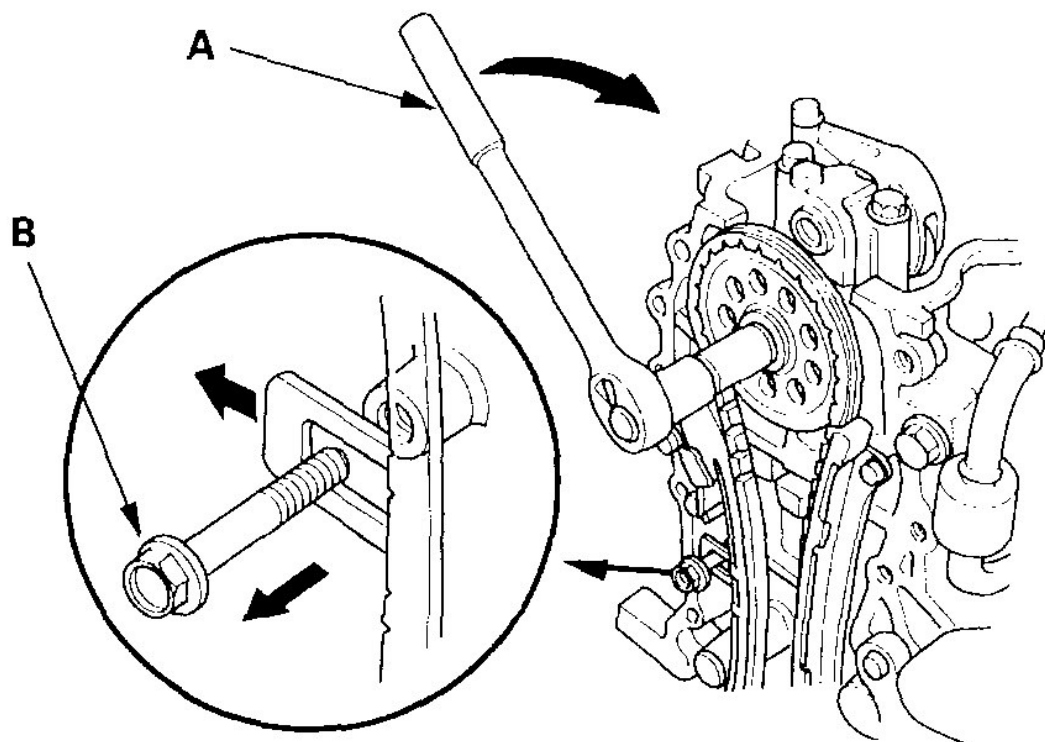
11. Loosely install the crankshaft pulley.
12. Apply new engine oil to the sliding surface of the cam chain tensioner through the oil return hole in the cylinder head.



G01431525

Fig. 154: Applying New Engine Oil To Sliding Surface Of Cam Chain Tensioner Through Oil Return In Cylinder Head
Courtesy of AMERICAN HONDA MOTOR CO., INC.

13. Hold the crankshaft pulley and set the socket wrench (A) on the camshaft sprocket bolt.



G01431526

Fig. 155: Holding Crankshaft Pulley & Setting Socket Wrench On Camshaft Sprocket Bolt
Courtesy of AMERICAN HONDA MOTOR CO., INC.

14. Turn the camshaft clockwise to compress the cam chain tensioner rail, then remove the 6 x 1.0 mm bolt (B).

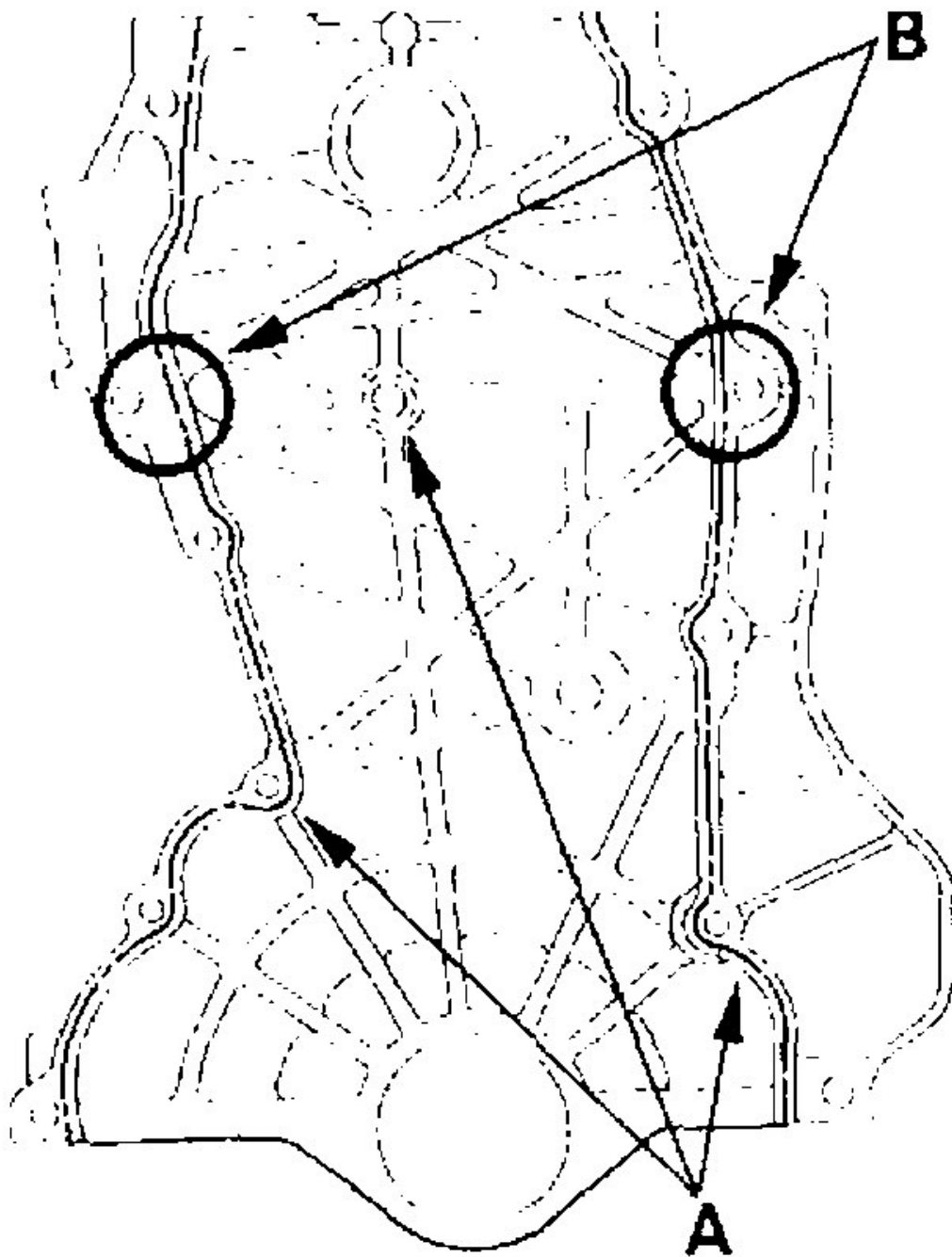
NOTE:

- Turning torque should not exceed 44 N.m (4.5 kgf.m, 33 lbf.Ft), when turning the camshaft.
- Do not turn the camshaft counterclockwise.

15. 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**).
16. Remove any old liquid gasket from the chain case mating surfaces, bolts, and bolt holes.
17. Clean and dry the chain case mating surfaces.
18. Apply liquid gasket, P/N 08718-0009, to the cylinder block mating surface of the chain case and the inner threads of the holes.

NOTE:

- Apply a 1.5 mm wide bead of liquid gasket along the broken line (A).
- Apply a 3.0 mm wide bead of liquid gasket to the cylinder block upper surface contact areas (B) on the chain case.



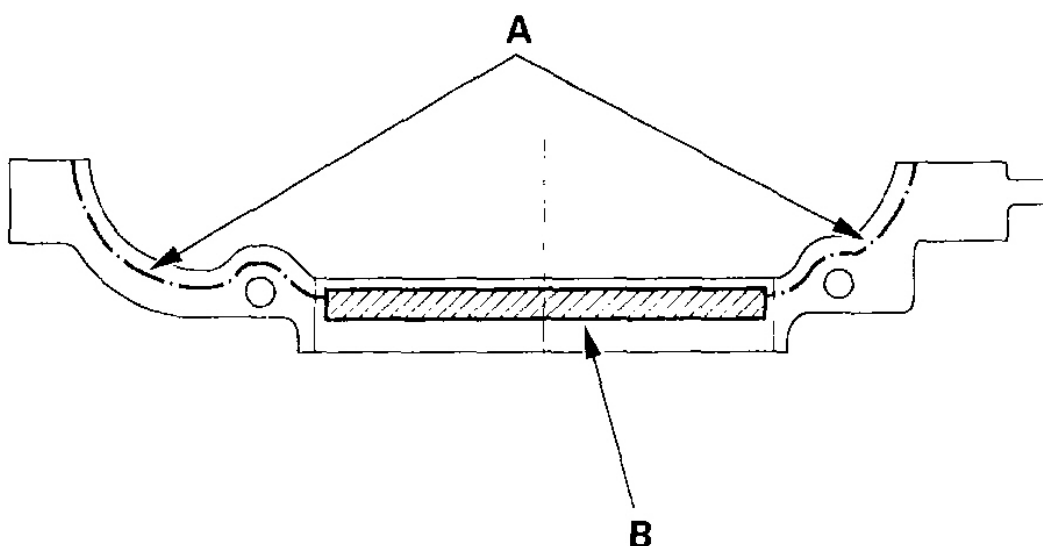
G01431527

Fig. 156: Applying Liquid Gasket To Cylinder Block Mating Surface
Courtesy of AMERICAN HONDA MOTOR CO., INC.

19. Apply liquid gasket, P/N 08718-0009 to the oil pan mating surface of the chain case and the inner threads of the holes.

NOTE:

- Apply a 1.5 mm wide bead of liquid gasket along the broken line (A).
- Apply a 5.0 mm wide bead of liquid gasket to the shaded area (B).
- Do not install the parts if 4 minutes or more have elapsed since applying liquid gasket. Instead, reapply liquid gasket after removing the old residue.



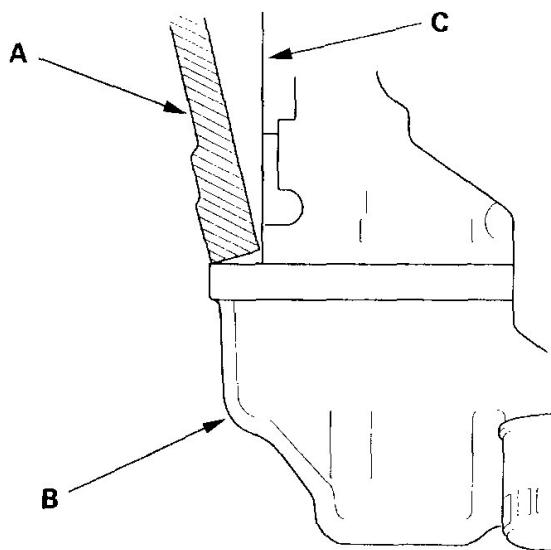
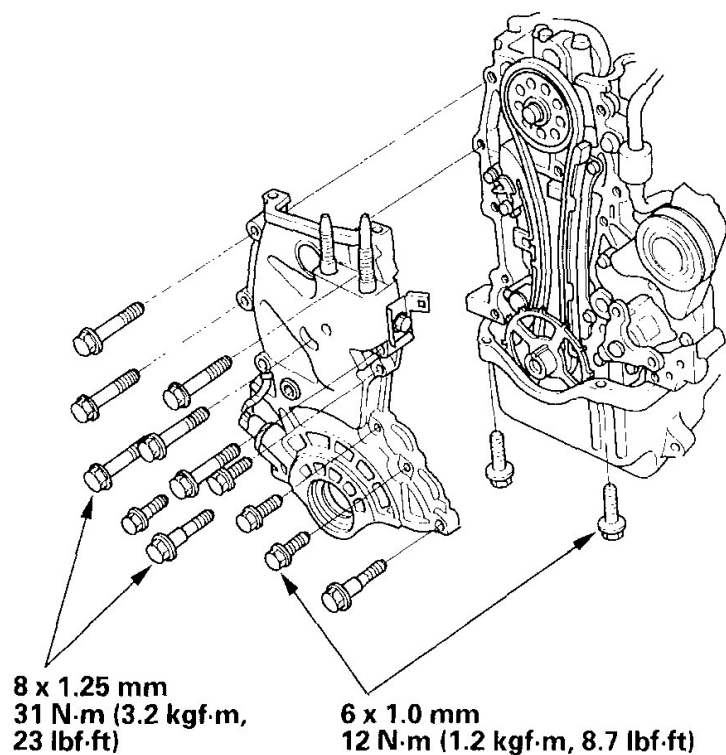
G01431528

Fig. 157: Applying Liquid Gasket To Oil Pan Mating Surface
Courtesy of AMERICAN HONDA MOTOR CO., INC.

20. Set the edge of the chain case (A) to the edge of the oil pan (B), then install the chain case on the cylinder block (C).

NOTE:

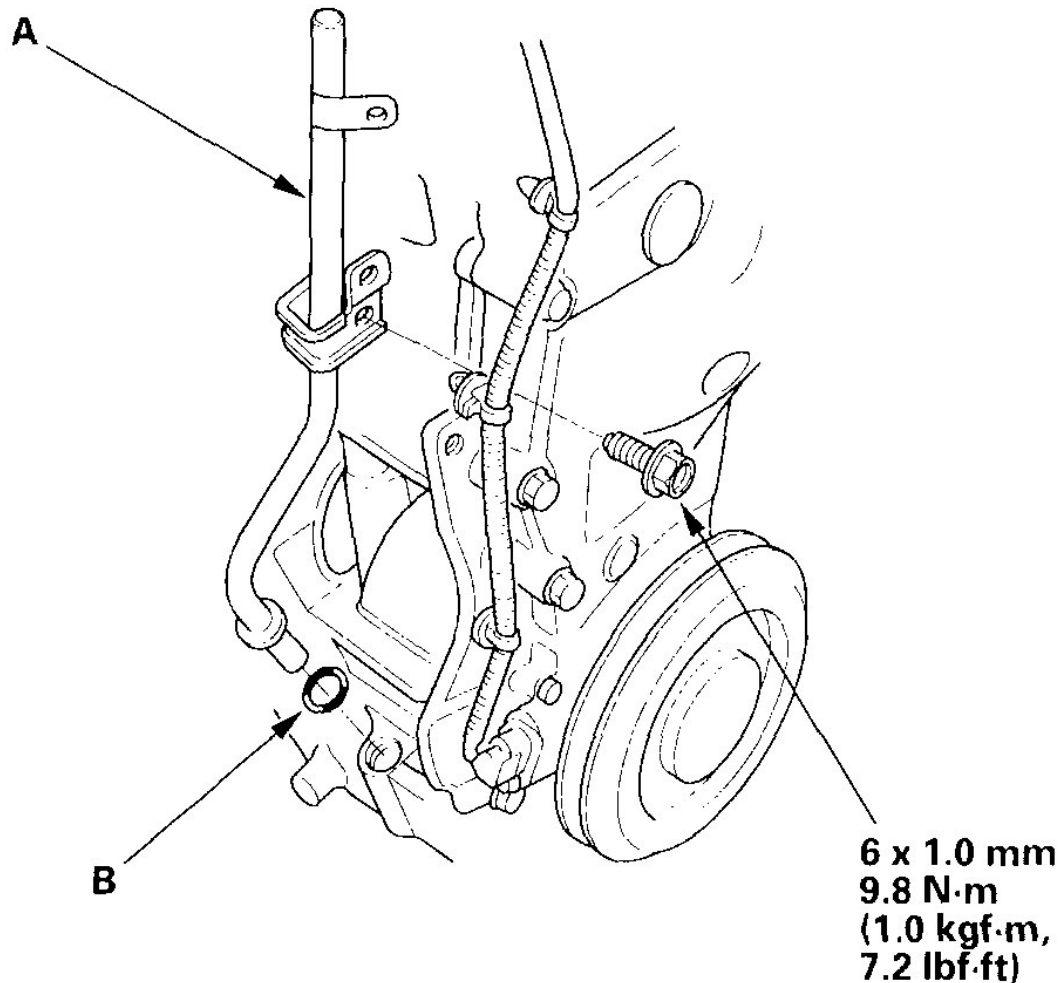
When installing the chain case, do not slide the bottom surface on the oil pan mounting surface.



G01431529

Fig. 158: Setting Edge Of Chain Case to Edge Of Oil Pan
Courtesy of AMERICAN HONDA MOTOR CO., INC.

21. Install the dipstick tube (A), using a new O-ring (B).

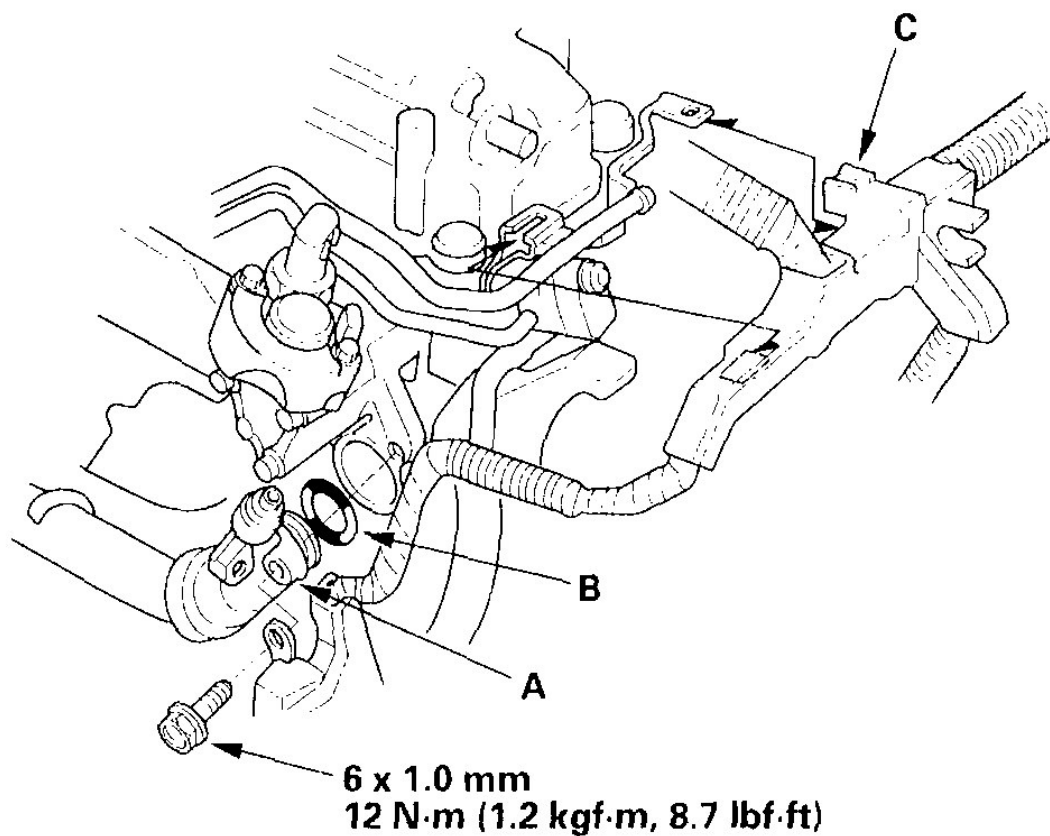


G01431530

Fig. 159: Installing Dipstick Tube

Courtesy of AMERICAN HONDA MOTOR CO., INC.

22. Install the upper bracket, then tighten the mounting nuts in the numbered sequence shown (see step 15 on **Cam Chain Installation**).
23. Install the ground cable (see step 16 on **Cam Chain Installation**).
24. Install the crankshaft pulley (see **Crankshaft Pulley Removal and Installation**).
25. Install the cylinder head cover (see **Cylinder Head Cover Installation**).
26. Install the water pump pulley (see step 4 on **WATER PUMP REPLACEMENT**).
27. Install the drive belt and adjust it (see **DRIVE BELT INSPECTION AND ADJUSTMENT**).
28. Install the connecting pipe (A), using a new O-ring (B).

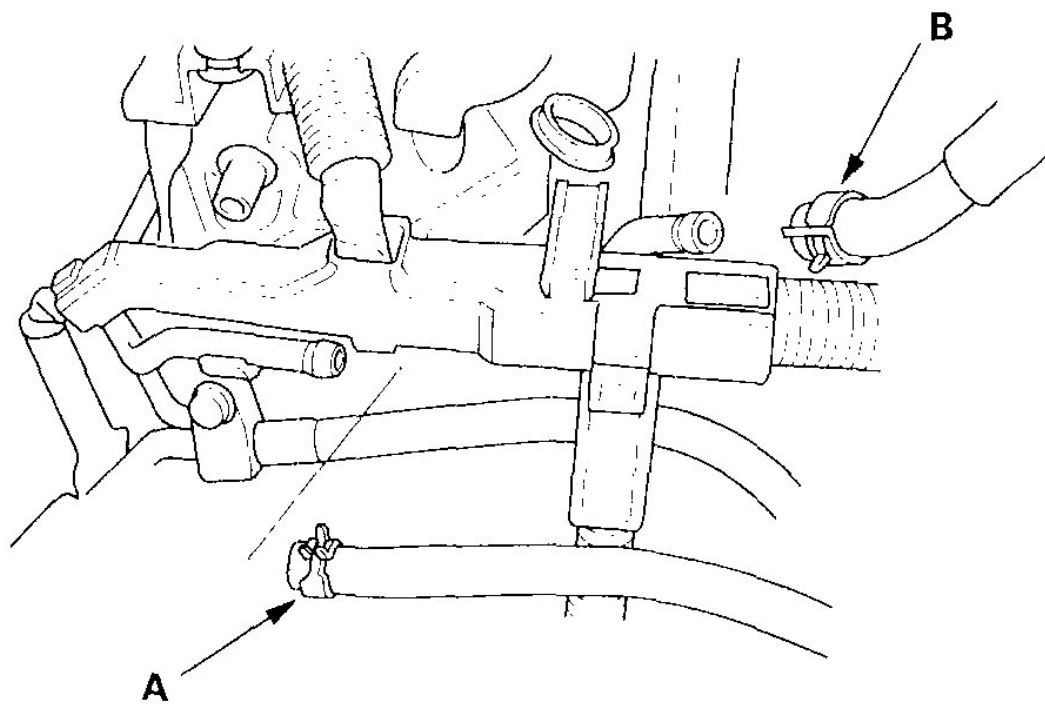


G01431531

Fig. 160: Installing Connecting Pipe

Courtesy of AMERICAN HONDA MOTOR CO., INC.

29. Install the harness holder (C) to the brackets.
30. Install the evaporative emission (EVAP) canister hose (A) and brake booster vacuum hose (B).

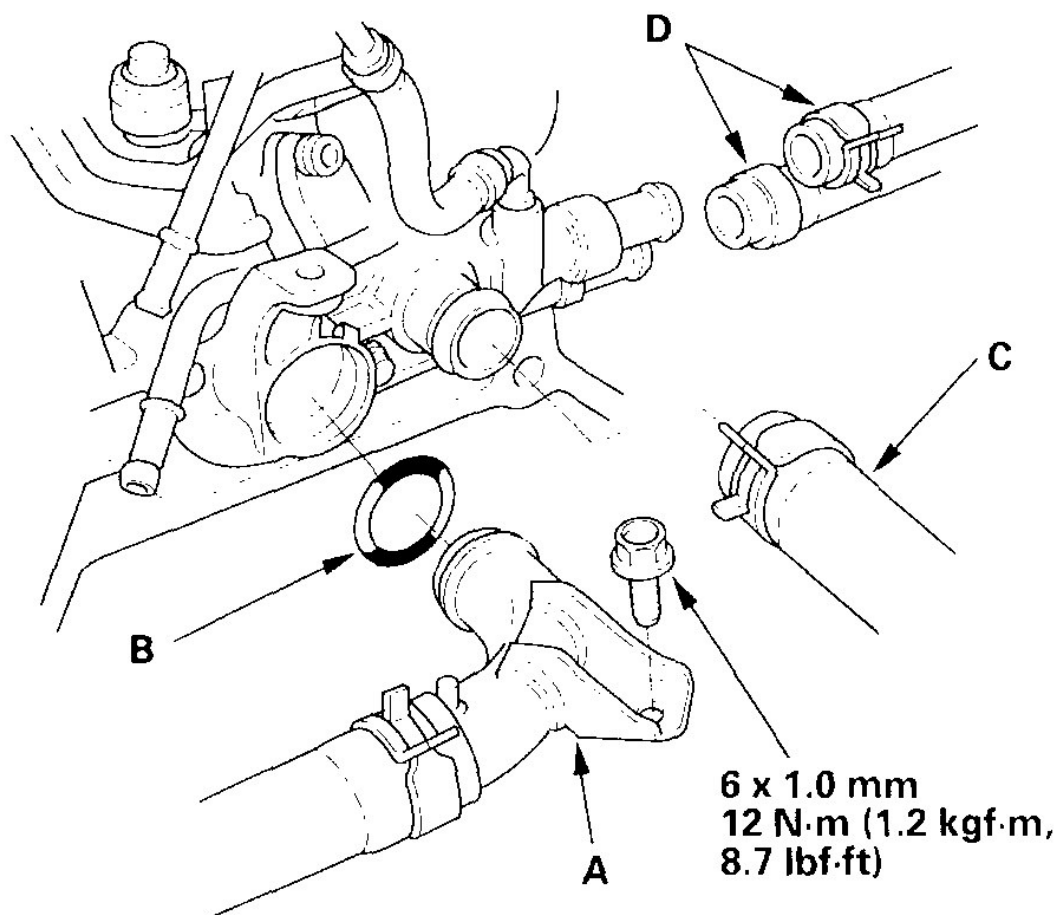


G01431532

Fig. 161: Installing EVAP Canister Hose

Courtesy of AMERICAN HONDA MOTOR CO., INC.

31. Install the lower radiator hose joint (A) with a new O-ring (B).



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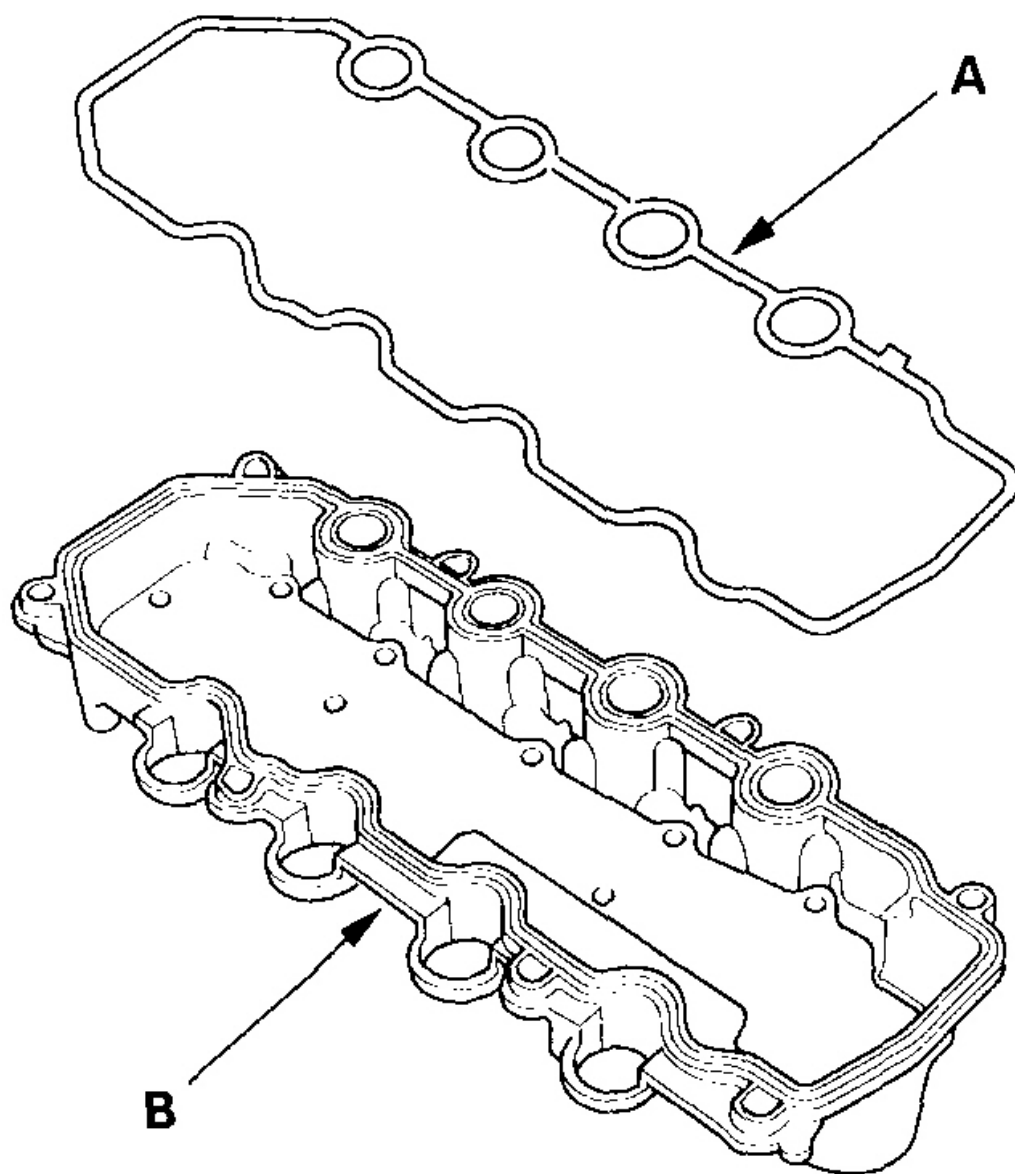
Fig. 162: Installing Lower Radiator Hose Joint With New O-Ring
Courtesy of AMERICAN HONDA MOTOR CO., INC.

32. Install the upper radiator hose (C) and heater hoses (D).
33. Install the exhaust manifold (see **Exhaust Manifold Removal and Installation**).
34. Install the intake manifold (see **Intake Manifold Removal and Installation**).
35. Install the fuel feed hose (see **FUEL LINE/QUICK-CONNECT FITTING INSTALLATION**).
36. Install the air cleaner housing (see **AIR CLEANER REMOVAL/INSTALLATION**).
37. After installation, check that all tubes, hoses and connectors are installed correctly.
38. 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.
39. Refill the radiator with engine coolant, and bleed the air from the cooling system with the heater valve open (see step 8 on **COOLANT REPLACEMENT**).

40. Inspect and adjust the idle speed (see **IDLE SPEED ADJUSTMENT**).
41. Inspect the ignition timing (see **IGNITION TIMING INSPECTION**).

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).

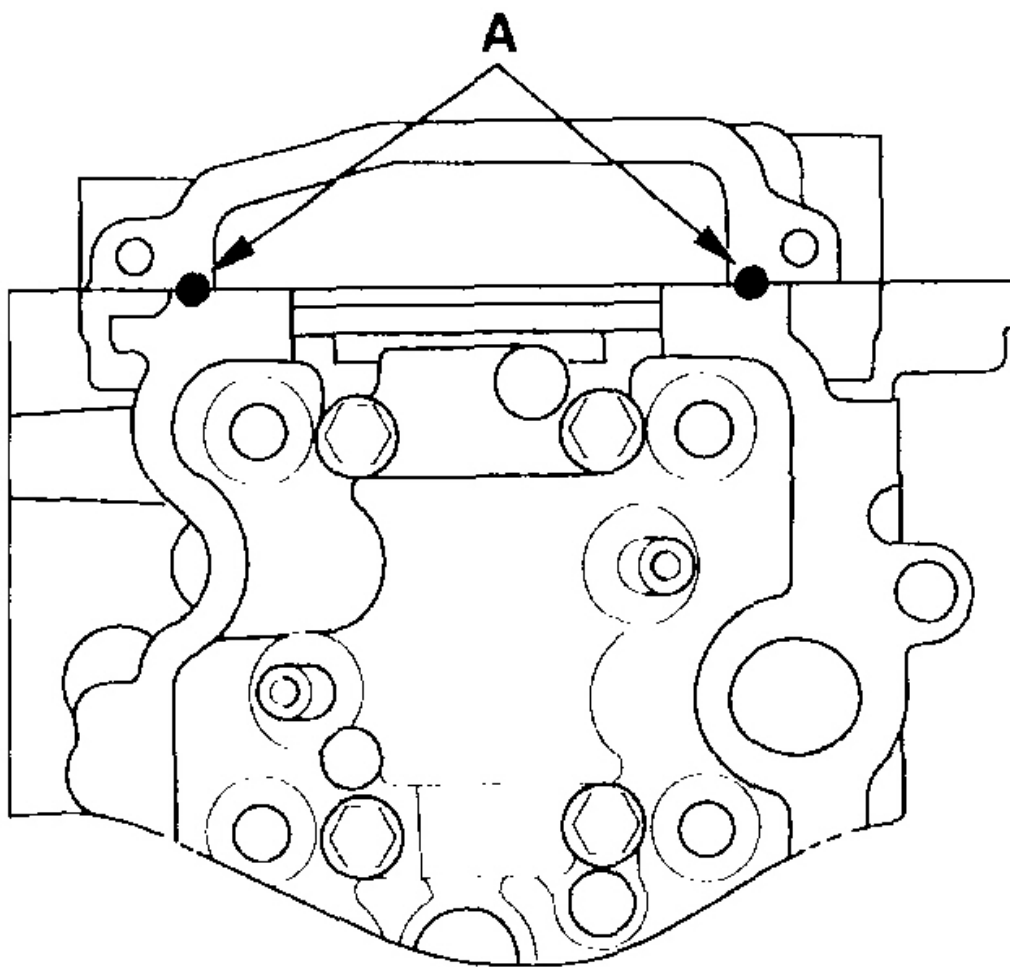


G01431534

Fig. 163: Installing Head Cover Gasket In Groove Of Cylinder Head Cover
Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. Check that the mating surfaces are clean and dry.
4. Apply a 3.0 mm wide bead of the liquid gasket, P/N 08718-0009, on the chain case mating areas (A).

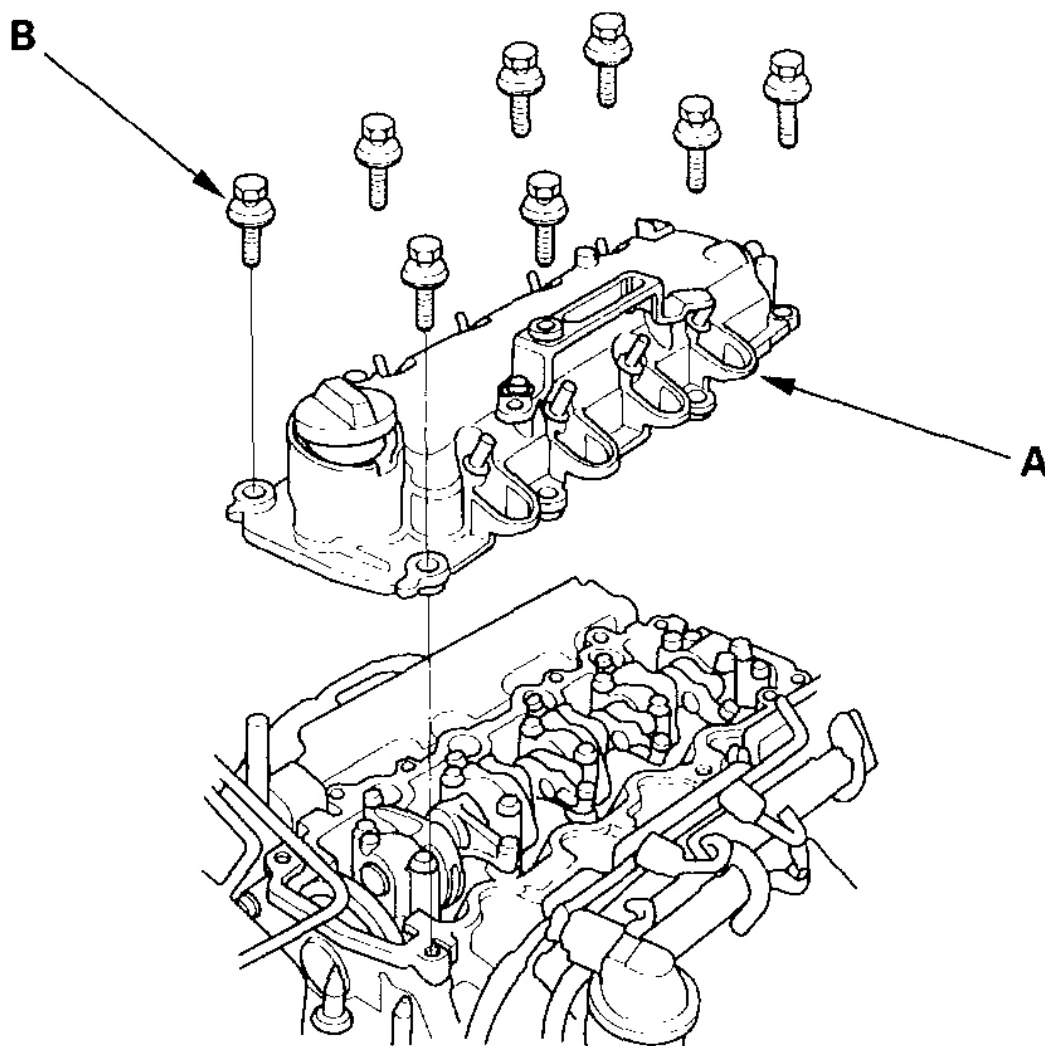
NOTE: Do not install the parts if 4 minutes or more have elapsed since applying liquid gasket. Instead, reapply liquid gasket after removing the old residue.



G01431535

Fig. 164: Applying Liquid Gasket On Chain Case Mating Areas
Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. Once the cylinder head cover (A) is on the cylinder head, slide the cover slightly back and forth to seat the head cover gasket.

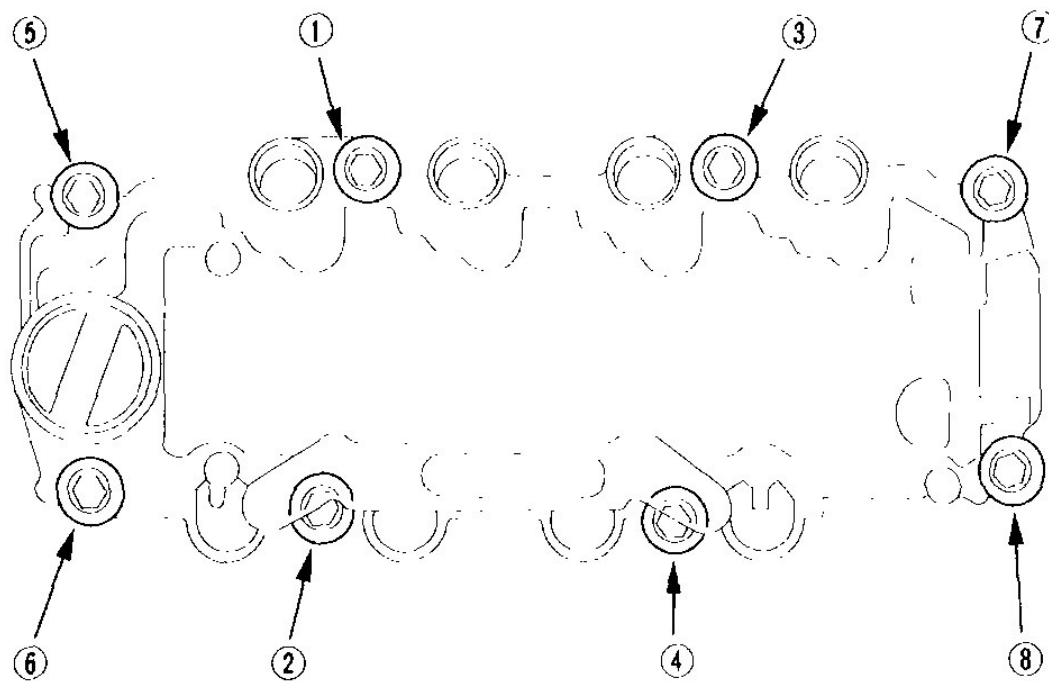


G01431536

Fig. 165: Sliding Cover Slightly Back & Forth to Seat Head Cover Gasket When Cylinder Head Cover Is On Cylinder Head

Courtesy of AMERICAN HONDA MOTOR CO., INC.

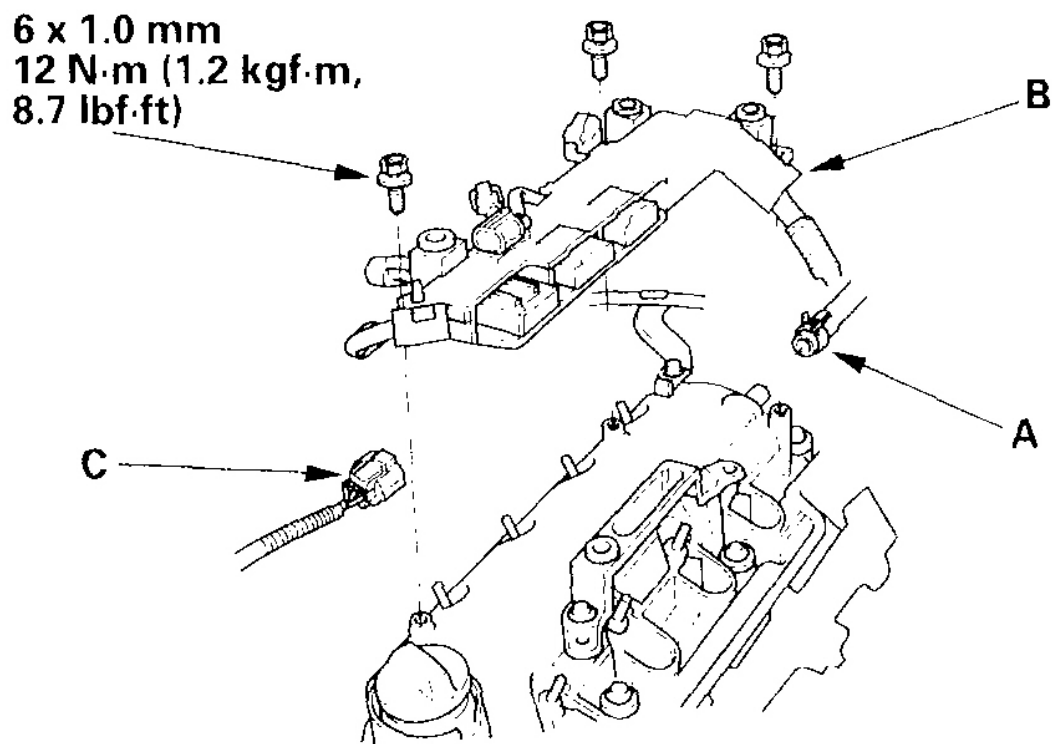
6. Inspect the cover washer (B). Replace any washer that is damaged or deteriorated.
7. Tighten the bolts in two or three steps. In the final step, tighten all bolts in sequence 12 N.m (1.2 kgf.m, 8.7 lbf.ft).



G01431537

Fig. 166: Tightening Bolt In Two Or Three Steps
Courtesy of AMERICAN HONDA MOTOR CO., INC.

8. Install the breather hose (A) and harness holder (B), then connect the subharness connector (C).



G01431538

Fig. 167: Installing Breather hose & Harness Holder
Courtesy of AMERICAN HONDA MOTOR CO., INC.

9. Install the eight ignition coils (see **IGNITION COIL REMOVAL/INSTALLATION**).
10. After assembly, wait at least 30 minutes before filling the engine with oil.

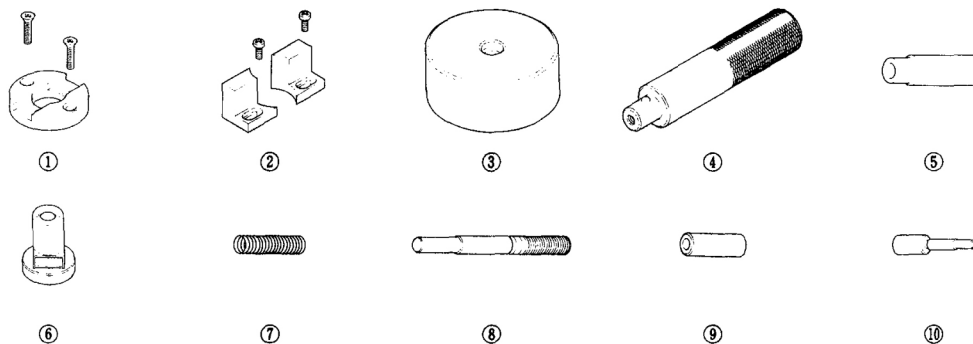
CYLINDER BLOCK

SPECIAL TOOLS

2003 Honda Civic Si

2003-05 ENGINES Overhaul - 1.3L 4-Cylinder (Hybrid)

Ref.No.	Tool Number	Description	Qty
①	07PAF-0010400	Piston Base Head	1
②	07PAF-0010500	Piston Base Head Insert (2)	1
③	07ZAD-PNA0100	Oil Seal Driver Attachment	1
④	07749-0010000	Driver	1
⑤	07973-6570201	Adjustable Piston Pin Driver Head	1
⑥	07973-6570500	Piston Base	1
⑦	07973-6570800	Piston Base Spring	1
⑧	07973-6890200	Adjustable Piston Pin Driver Shaft	1
⑨	07973-6890300	Pilot Collar	1
⑩	07973-6890400	Piston Pin Base Insert	1

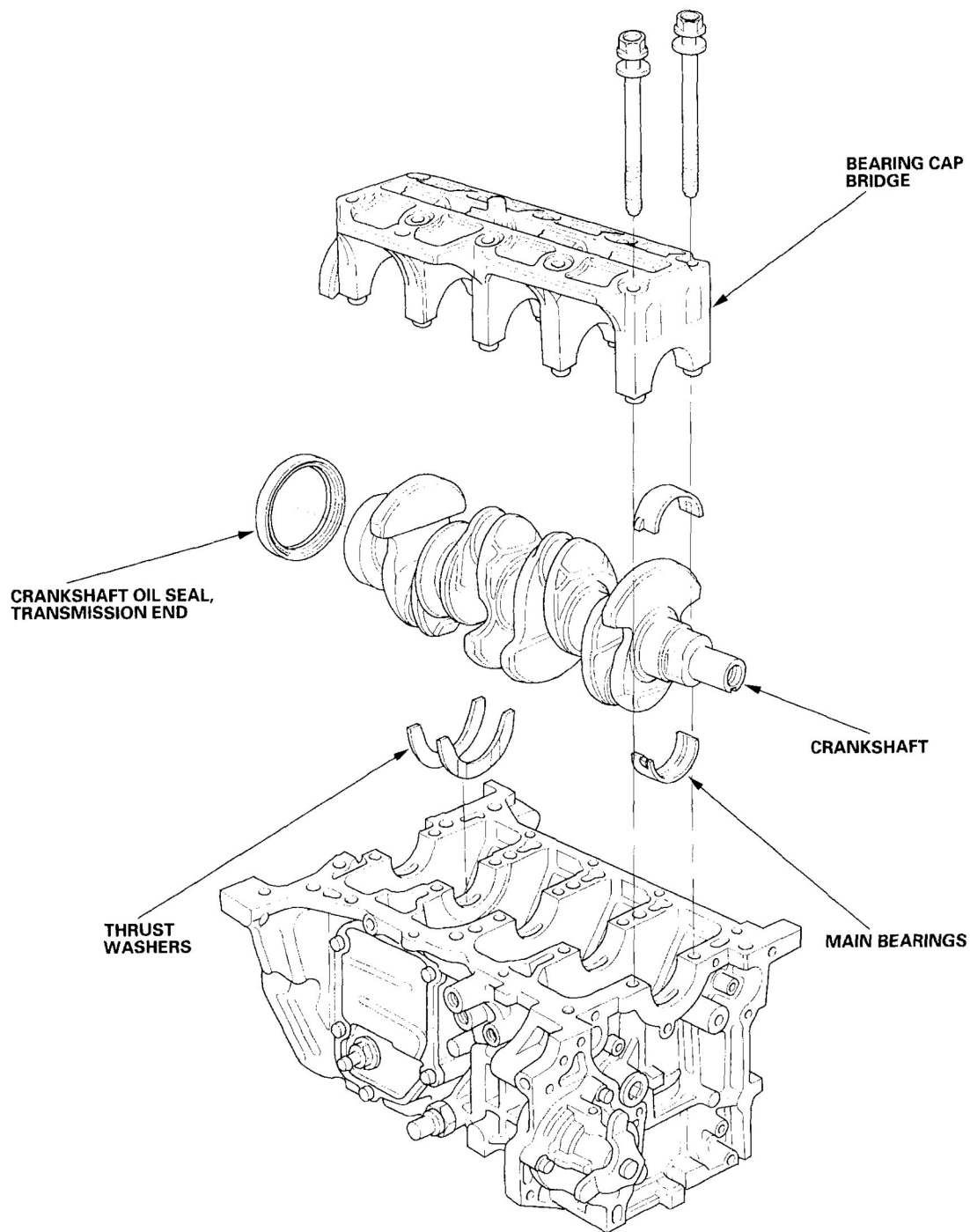


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Fig. 168: Identifying Special Tools

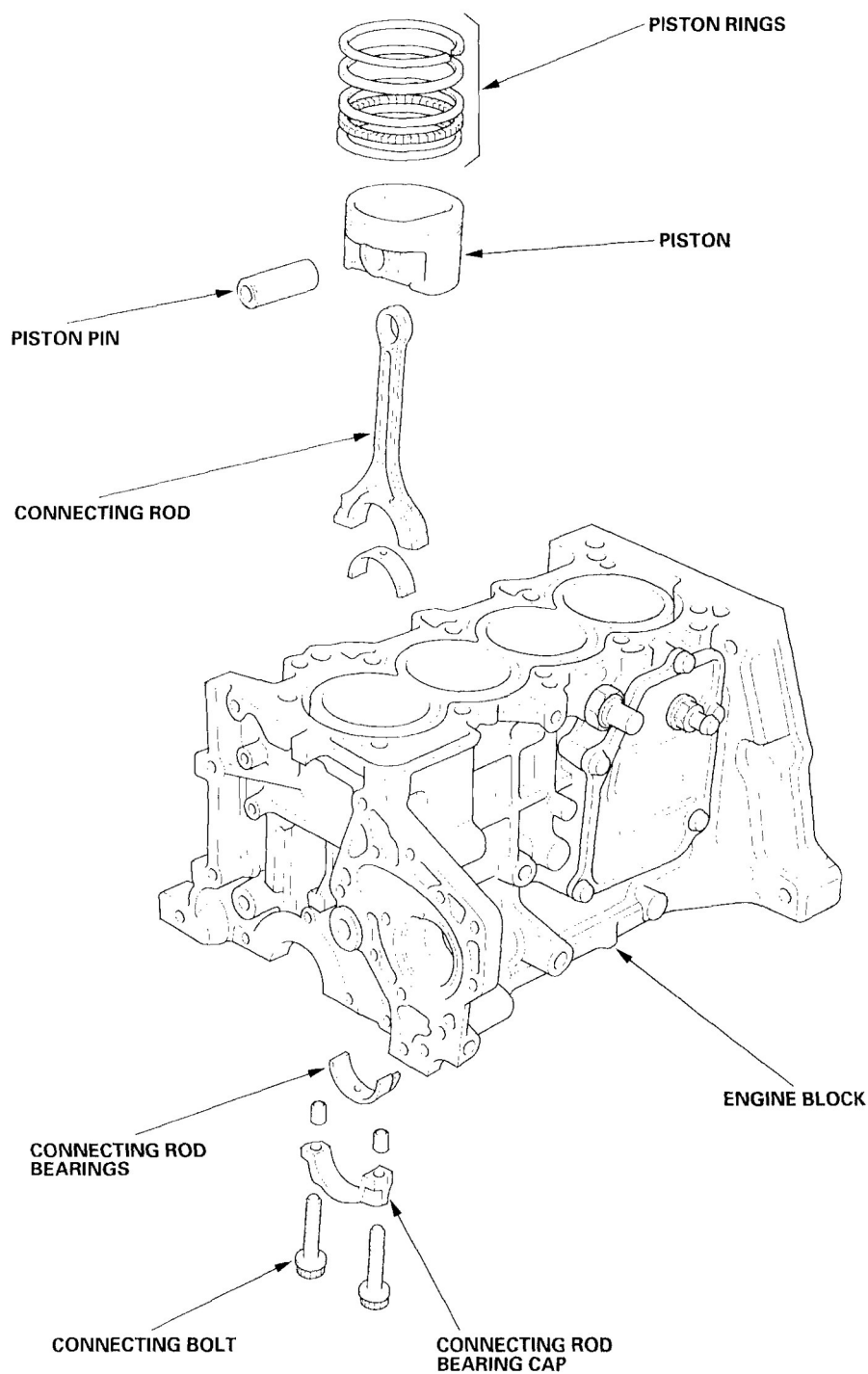
Courtesy of AMERICAN HONDA MOTOR CO., INC.

COMPONENT LOCATION INDEX



G01431540

Fig. 169: Identifying Cylinder Block Components (1 Of 2)
Courtesy of AMERICAN HONDA MOTOR CO., INC.



G01431541

Fig. 170: Identifying Cylinder Block Components (2 Of 2)
Courtesy of AMERICAN HONDA MOTOR CO., INC.

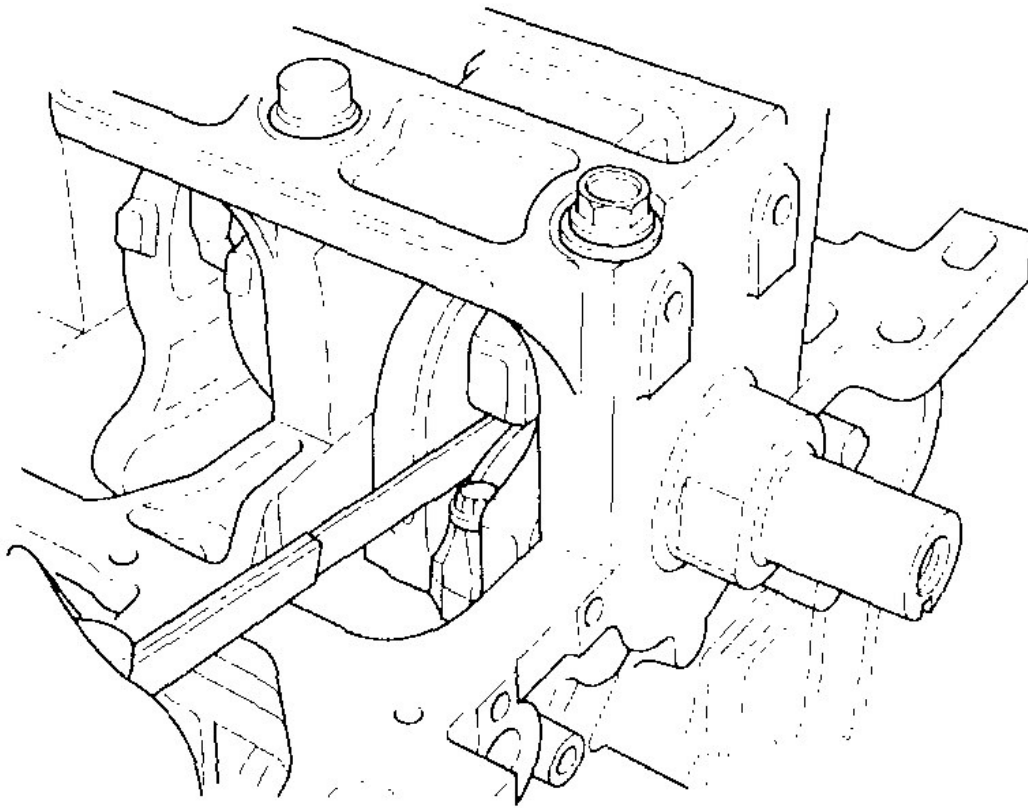
CONNECTING ROD AND CRANKSHAFT END PLAY INSPECTION

1. Remove the oil pump (see **OIL PUMP OVERHAUL**).
2. Measure the connecting rod end play with a feeler gauge between the connecting rod and crankshaft.

Connecting Rod End Play

Standard (New): 0.15-0.30 mm (0.006-0.012 in.)

Service Limit: 0.40 mm (0.016 in.)



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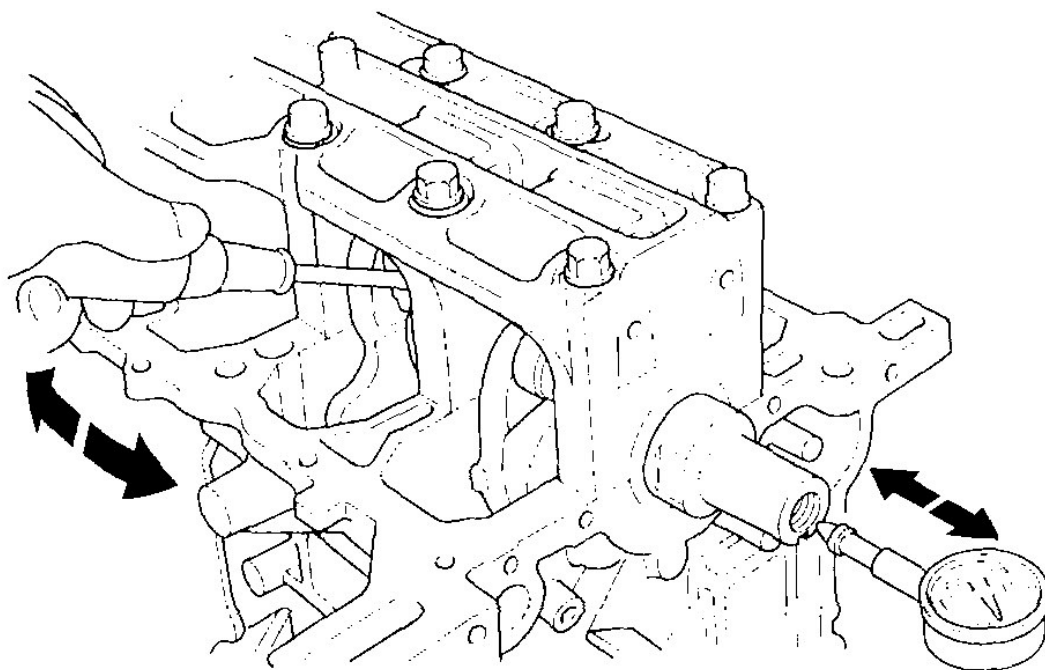
Fig. 171: Measuring Connecting Rod End Play With Feeler Gauge
Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. If the connecting rod end play is out-of-tolerance, install a new connecting rod, and recheck. If it is still out-of-tolerance; replace the crankshaft (see **Crankshaft and Piston Removal**).
4. Push the crankshaft firmly away from the dial indicator, and zero the dial against the end of the crankshaft. Then pull the crankshaft firmly back toward the indicator; the dial reading should not exceed the service limit.

Crankshaft End Play

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

Service Limit: 0.45 mm (0.018 in.)



G01431543

Fig. 172: Pushing Crankshaft Firmly Away From Dial Indicator
Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. If the end play is out-of-tolerance, replace the thrust washers and recheck, if it is still out-of-tolerance, replace the crankshaft (see **Crankshaft and Piston Removal**).

CRANKSHAFT MAIN BEARING REPLACEMENT

Main Bearing Clearance Inspection

1. Remove the bearing cap bridge and bearing halves (see **Crankshaft and Piston Removal**).
2. Clean each main journal and bearing half with a clean shop towel.
3. Place one strip of plastigage across each main journal.
4. Reinstall the bearings and bearing cap bridge, then torque the bolts to 25 N.m (2.5 kgf.m, 18 lbf.ft) I 40°.

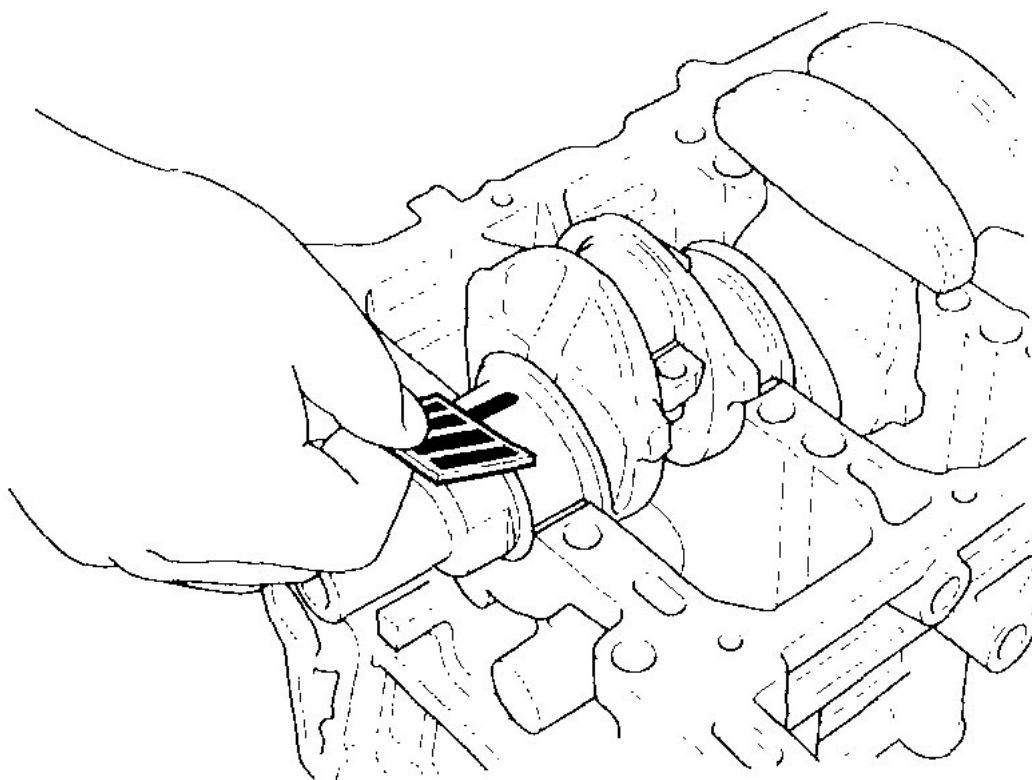
NOTE: Do not rotate the crankshaft during inspection.

5. Remove the bearing cap bridge and bearings again, and measure the widest part of the plastigage.

Main Bearing-to-Journal Oil Clearance

Standard (New): 0.018-0.036 mm (0.0007-0.0014 in.)

Service Limit: 0.050 mm (0.0020 in.)



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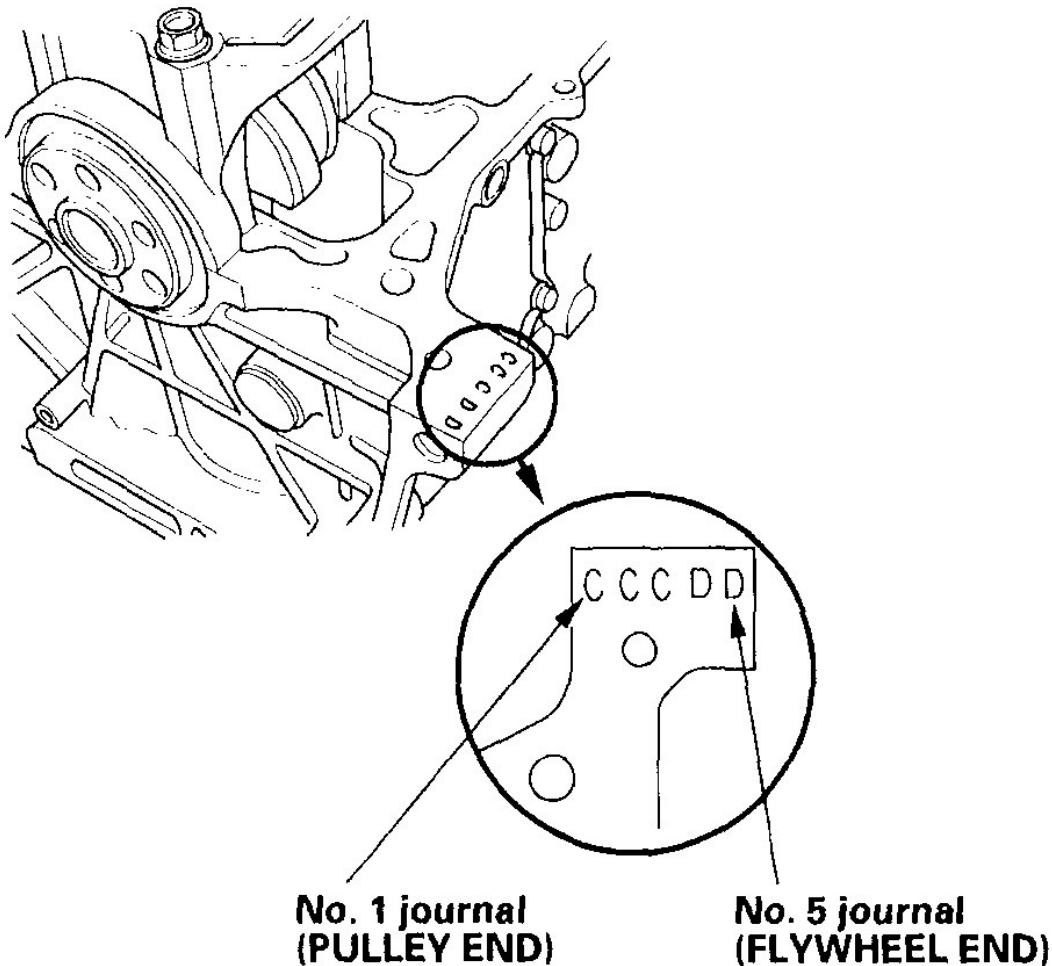
Fig. 173: Measuring Widest Part Of Plastigage

Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

Main Bearing Selection**Crankshaft Bore Code Location**

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

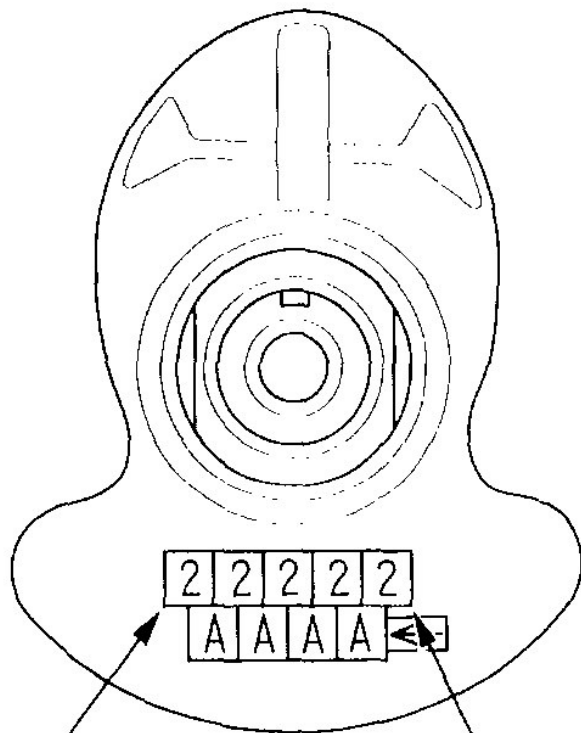
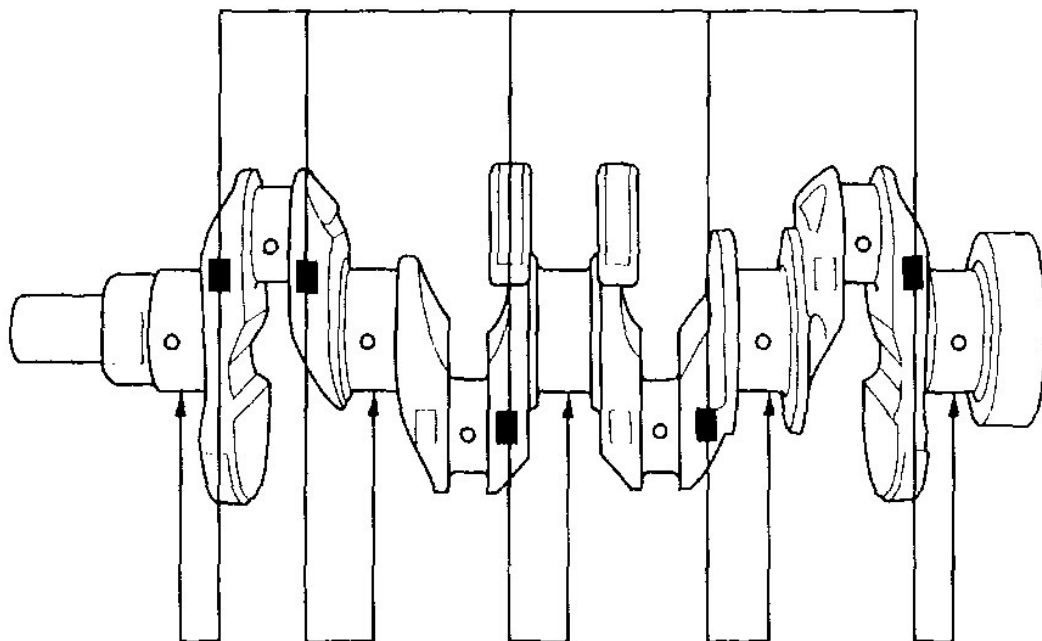


G01431545

Fig. 174: Letters Have Been Stamped On End Of Block
Courtesy of AMERICAN HONDA MOTOR CO., INC.

i. Main Journal Code Location

2. The main journal codes are stamped on the crankshaft.



2	2	2	2	2
A	A	A	A	←

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No.1 JOURNAL

G01431546

Fig. 175: Main Journal Codes Are Stamped On Crankshaft
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

NOTE: Color code is on the edge of the bearing.

		Crank bore code			
		→ Larger crank bore			
		A	B	C	D
		→ Smaller bearing (Thicker)			
Main journal code	1	Red	Pink	Yellow	Green
	2	Pink	Yellow	Green	Brown
	3	Yellow	Green	Brown	Black
	4	Green	Brown	Black	Blue
↓ Smaller main journal ↓		↓ Smaller bearing (Thicker) ↓			

G01431547

Fig. 176: Selecting Appropriate Replacement Bearings Table
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

CONNECTING ROD BEARING REPLACEMENT

Rod Bearing Clearance Inspection

- To check rod bearing-to-journal oil clearance, remove the bearing cap bridge (see Crankshaft and Piston Removal).
- Remove the connecting rod cap and bearing half.
- Clean the crankshaft rod journal and bearing half with a clean shop towel.

4. Place plastigage across the rod journal.
5. Reinstall the bearing half and cap, and torque the bolts.

Tightening torque: 9.8 N.m (1.0 kgf.m, 7.2 lbf.ft) +90°

NOTE: Do not rotate the crankshaft during inspection.

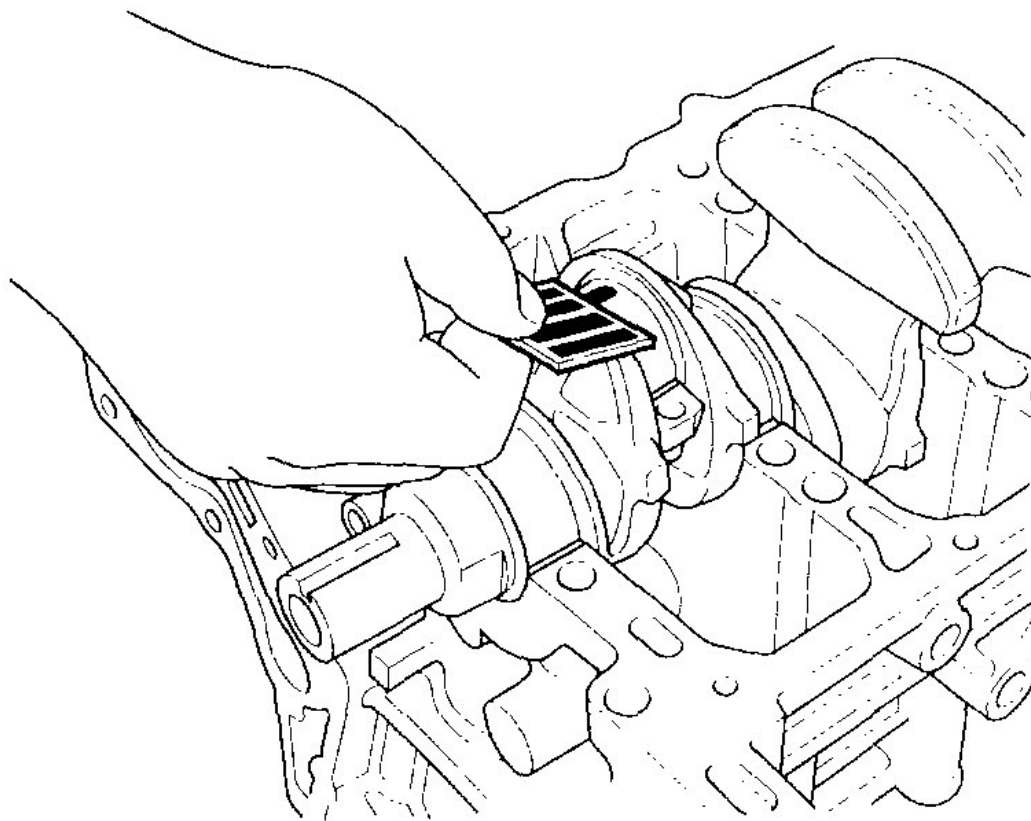
6. Remove the rod cap and bearing half, and measure the widest part of the plastigage.

Connecting Rod Bearing-to-Journal Oil

Clearance

Standard (New): 0.020-0.038 mm (0.0008-0.0015 in.)

Service Limit: 0.050 mm (0.0020 in.)



G01431548

Fig. 177: Measuring Widest Part Of Plastigage

Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

Rod Bearing Selection

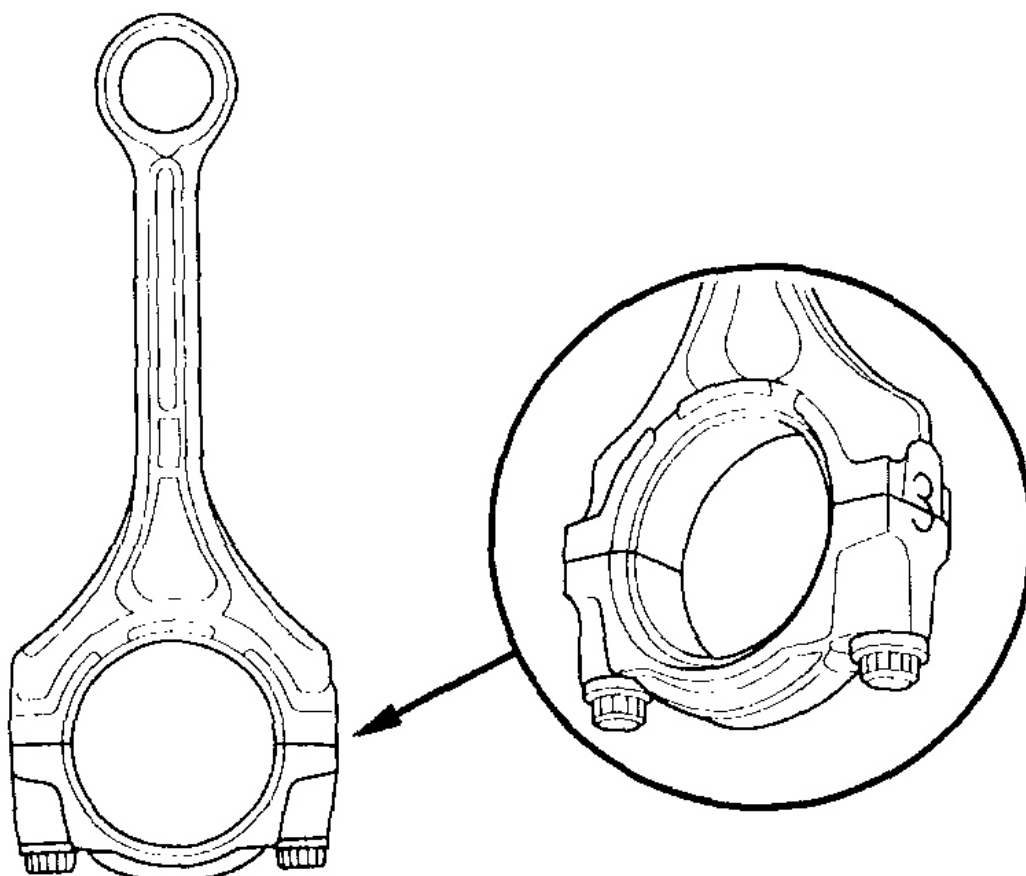
1. Inspect each connecting rod for cracks and heat damage.

Connecting Rod Big End Bore Code Locations

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

If you can't read the code because of an accumulation of oil and varnish, do not scrub it with a wire brush or scraper. Clean it only with solvent or detergent.

Normal Bore Size: 43.0mm (1.69 in.)



G01431549

Fig. 178: Identifying Bearing Cap Marking
Courtesy of AMERICAN HONDA MOTOR CO., INC.

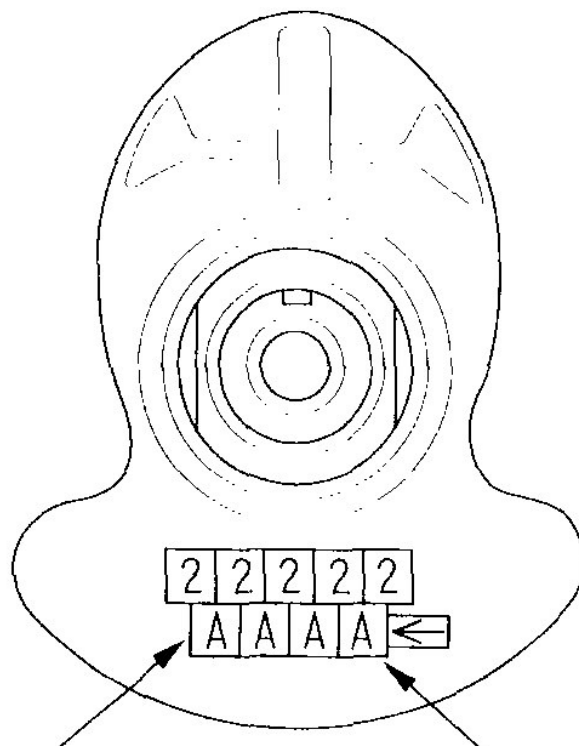
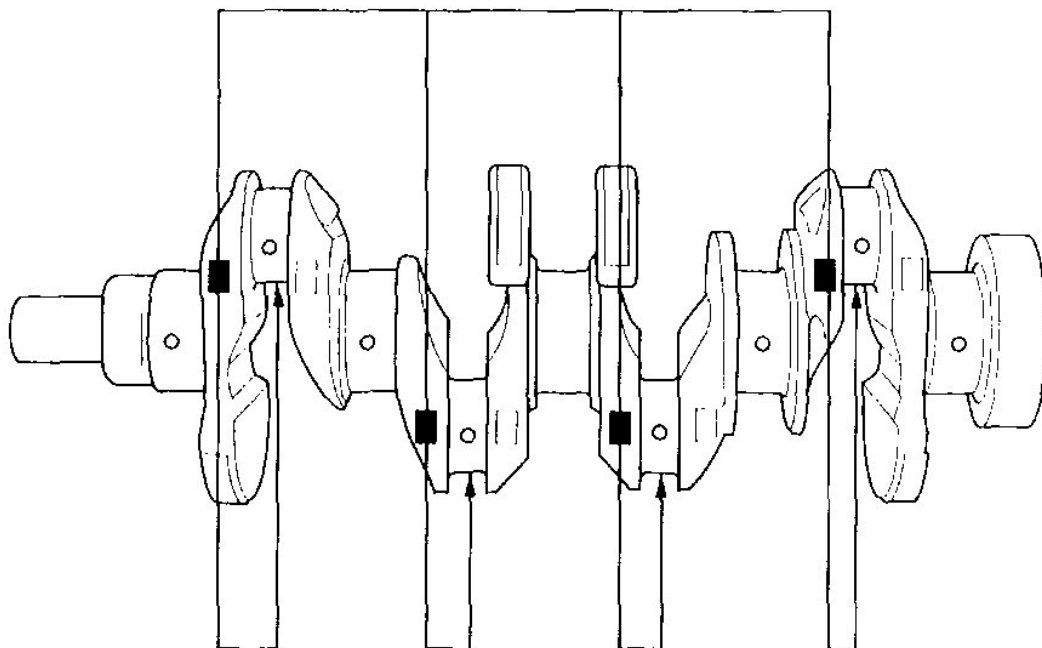
Connecting Rod Journal Code Location

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

Connecting Rod Journal Code Location (Letters)

2003 Honda Civic Si

2003-05 ENGINES Overhaul - 1.3L 4-Cylinder (Hybrid)



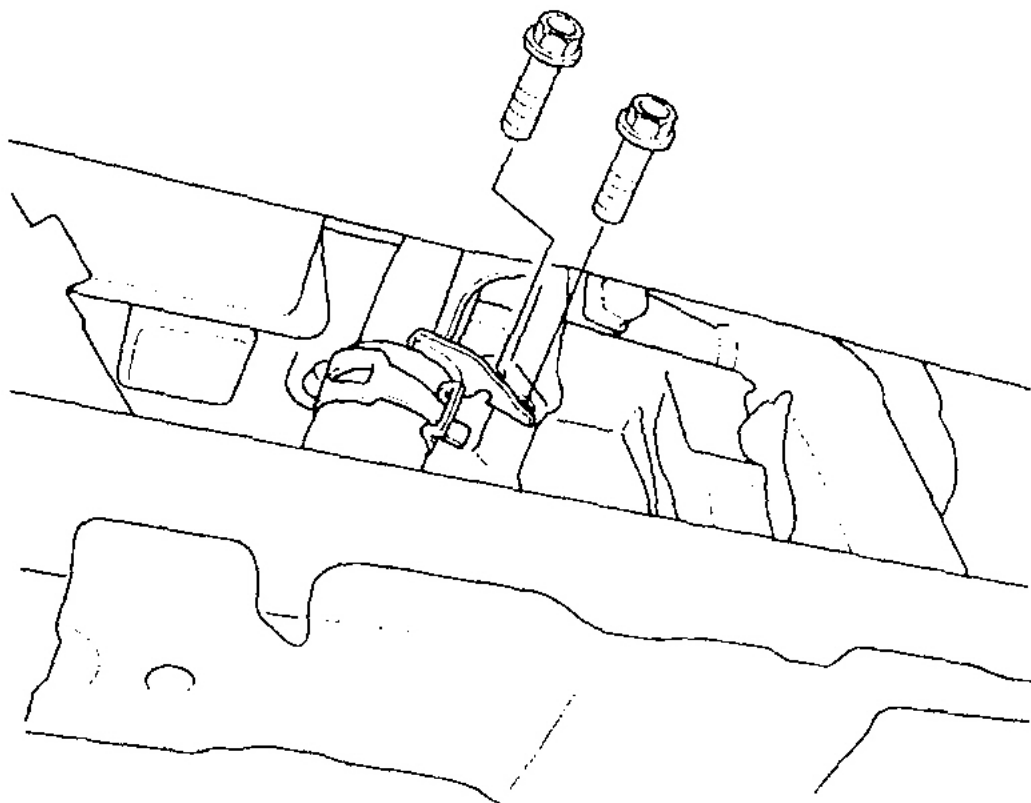
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Engine Removal).

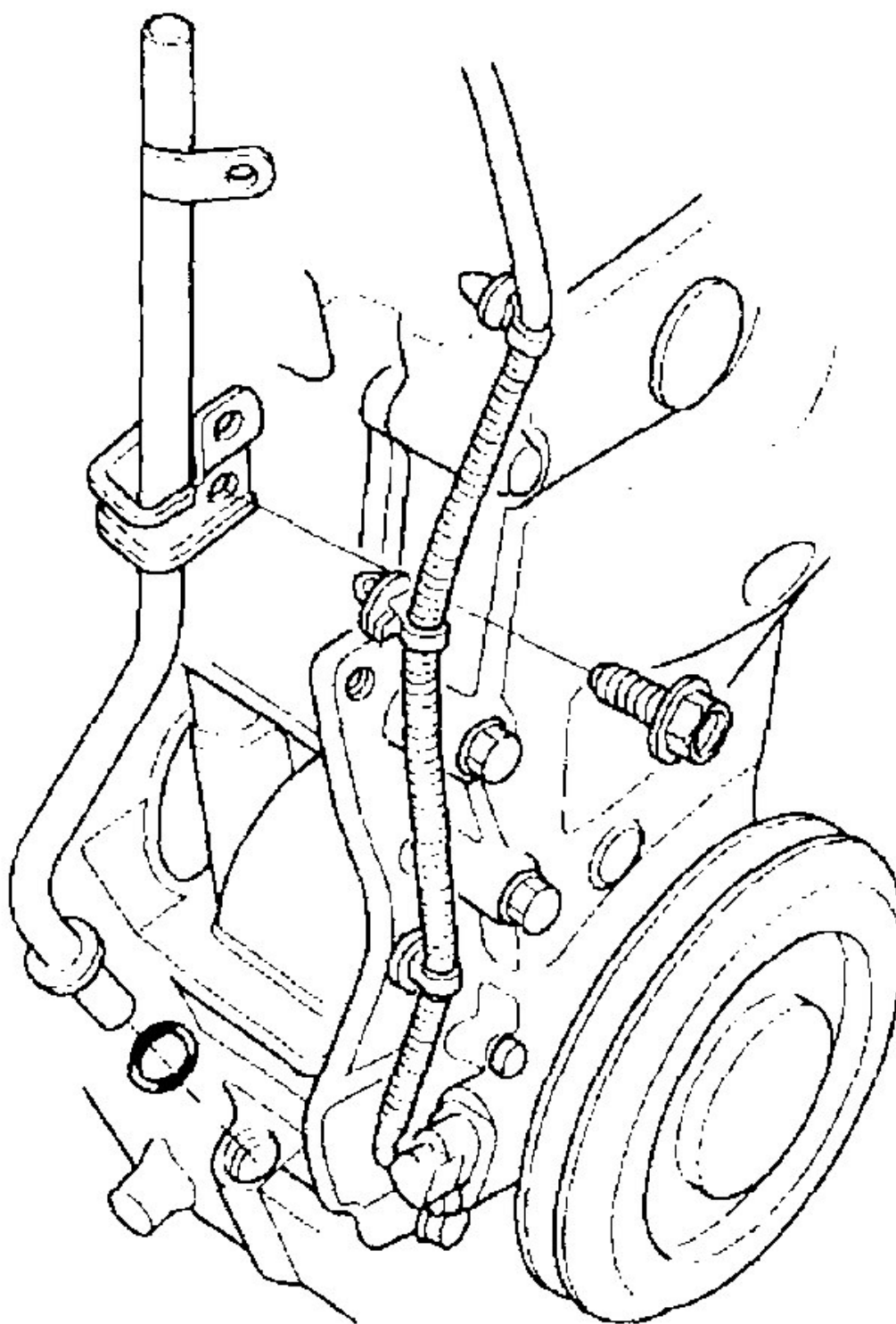
- **4** SULEV model: Disconnect the secondary heated oxygen sensor (secondary HO2S) connector, then remove the three way catalytic converter (TWC) (see step 28 on **Engine Removal**).
 - **5** Disconnect the suspension lower arm ball joints (see **LOWER ARM**).
 - **6** Remove the automatic transmission fluid (ATF) cooler hoses, then plug the hoses and the lines (CVT) (see step 33 on **Engine Removal**).
 - **7** Remove the front mount mounting bolt (see step 42 on **Engine Removal**).
 - **8** Remove the rear mount mounting bolts (see step 43 on **Engine Removal**).
 - **9** Use a marker to make alignment marks on the reference lines that align with the centers of the rear subframe mounting bolts. Remove the front subframe (see step 44 on **Engine Removal**).
3. If the engine is still in the vehicle, remove the A/C compressor without disconnecting the A/C hoses (see step 25 on **Engine Removal**).
4. If the engine is still in the vehicle, remove the lower radiator hose joint pipe from the oil pan.



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Fig. 181: Removing Lower Radiator Hose Joint Pipe From Oil Pan
Courtesy of AMERICAN HONDA MOTOR CO., INC.

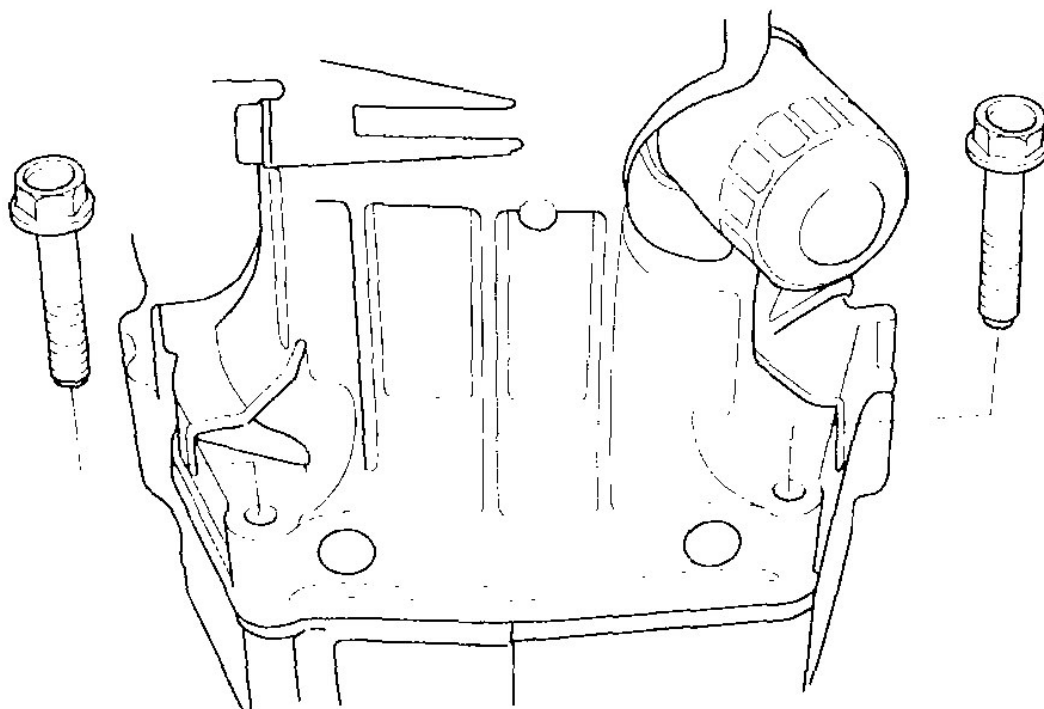
5. Remove the intermediate shaft bracket (see **INTERMEDIATE SHAFT**).
6. Remove the dipstick tube.



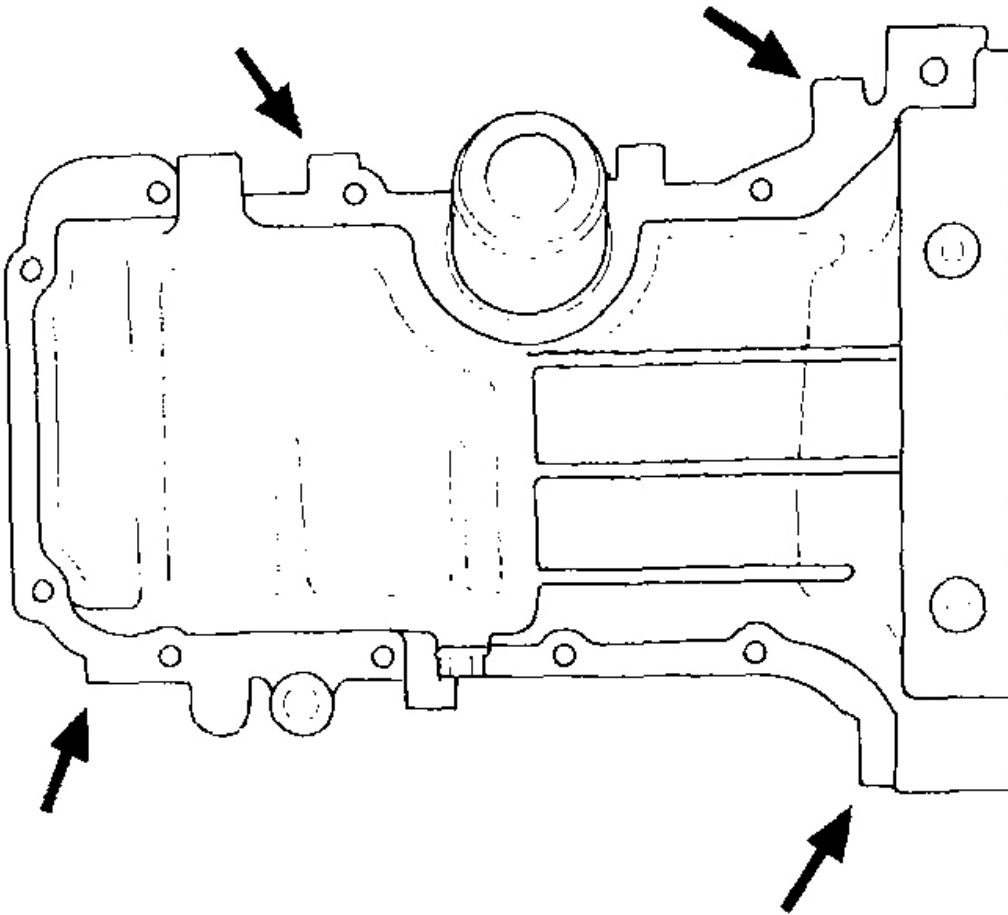
G01431553

Fig. 182: Removing Dipstick Tube**Courtesy of AMERICAN HONDA MOTOR CO., INC.**

7. Remove the two bolts securing the transmission.

**G01431554****Fig. 183: Removing Bolts Securing Transmission****Courtesy of AMERICAN HONDA MOTOR CO., INC.**

8. Remove the bolts/nuts securing the oil pan.
9. Insert a flat blade screwdriver where shown, and separate the oil pan from the engine block.
10. Remove the oil pan.



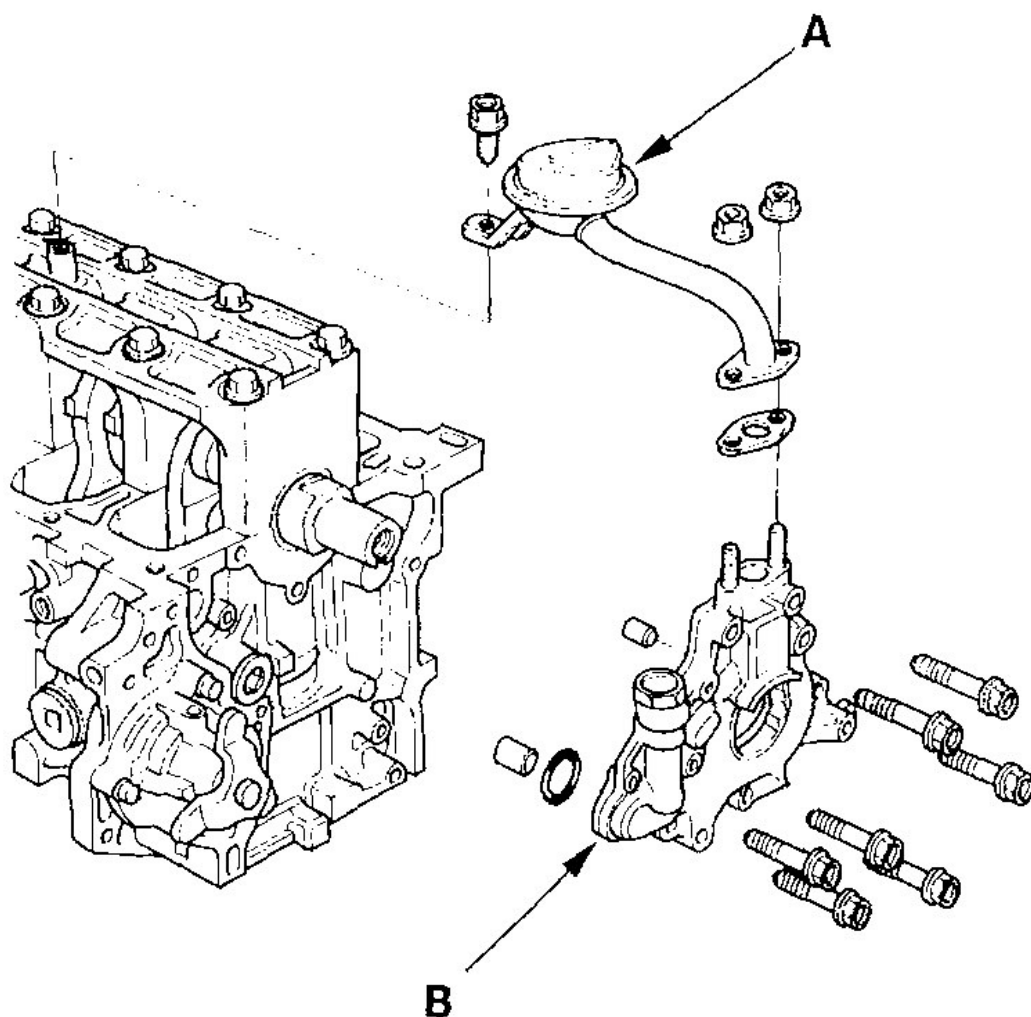
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Fig. 184: Removing Oil Pan

Courtesy of AMERICAN HONDA MOTOR CO., INC.

CRANKSHAFT AND PISTON REMOVAL

1. Remove the engine assembly (see **Engine Removal**).
2. Remove the IMA motor (see **IMA MOTOR REMOVAL/INSTALLATION**).
3. Remove the cam chain (see **Cam Chain Removal**).
4. Remove the cylinder head (see **Cylinder Head Removal**).
5. Remove the oil screen (A), then remove the oil pump (B).

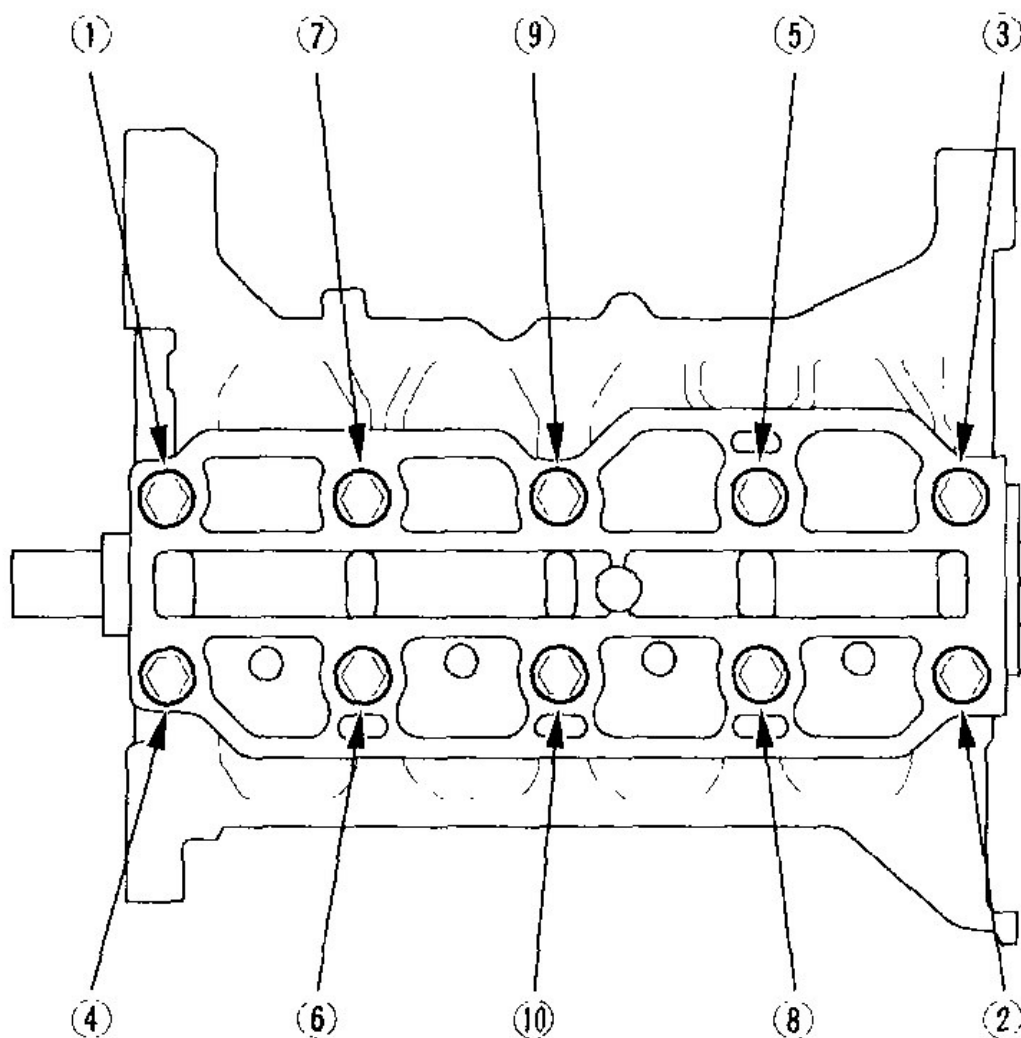


G01431556

Fig. 185: Removing Oil Screen

Courtesy of AMERICAN HONDA MOTOR CO., INC.

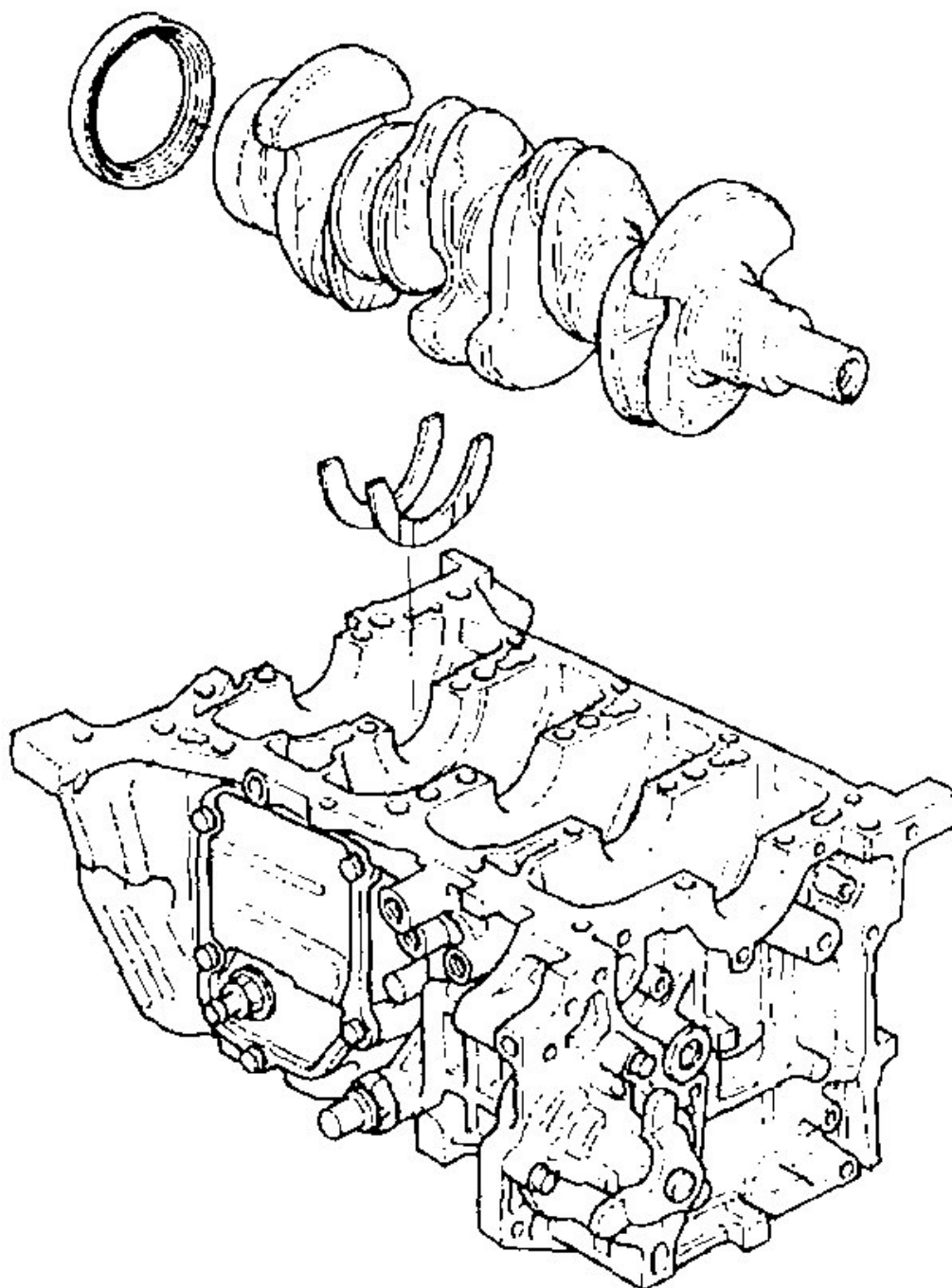
6. Remove the bearing cap bridge bolts. To prevent warpage, unscrew the bolts in sequence 1/3 turn at a time; repeat the sequence until all bolts are loosened.



G01431557

Fig. 186: Removing Bearing Cap Bridge Bolts
Courtesy of AMERICAN HONDA MOTOR CO., INC.

7. Remove the bearing cap bridge.
8. Remove the connecting rod caps/bearings. Keep all caps/bearings in order.
9. Lift the crankshaft out of the engine block, being careful not to damage the journals.

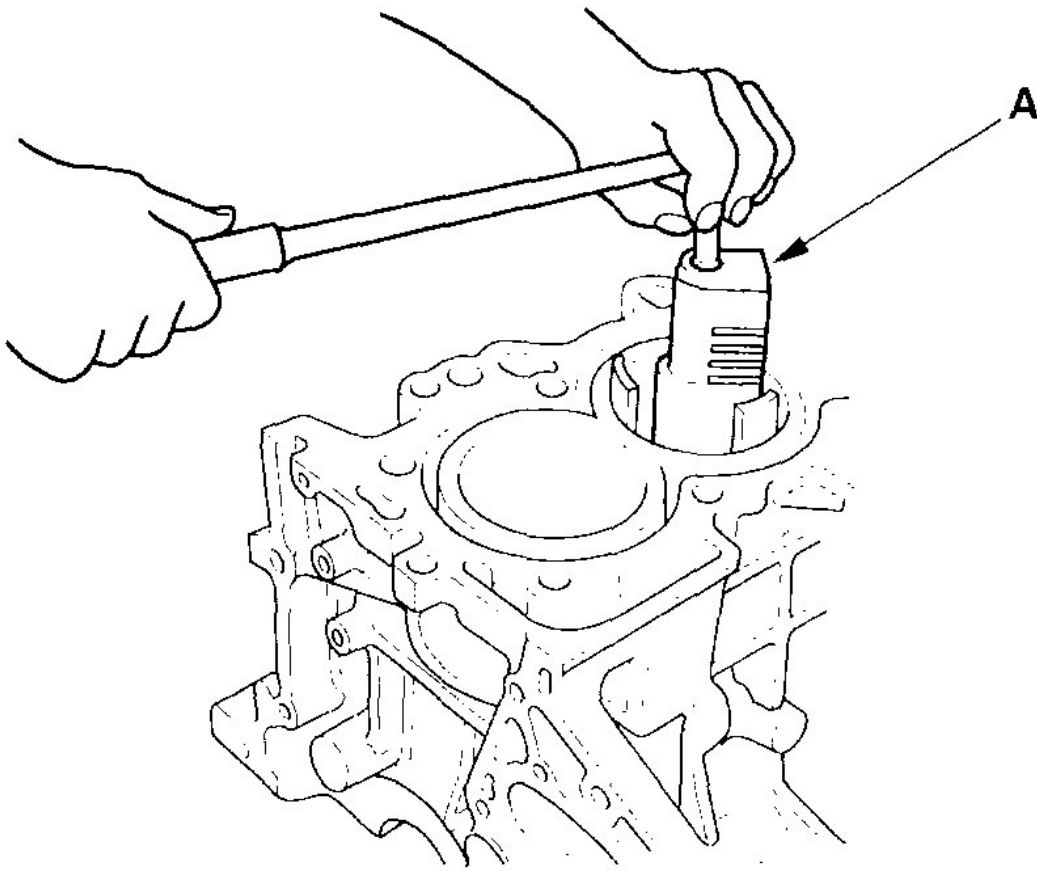


G01431558

Fig. 187: Lifting Crankshaft Out Of Engine Block

Courtesy of AMERICAN HONDA MOTOR CO., INC.

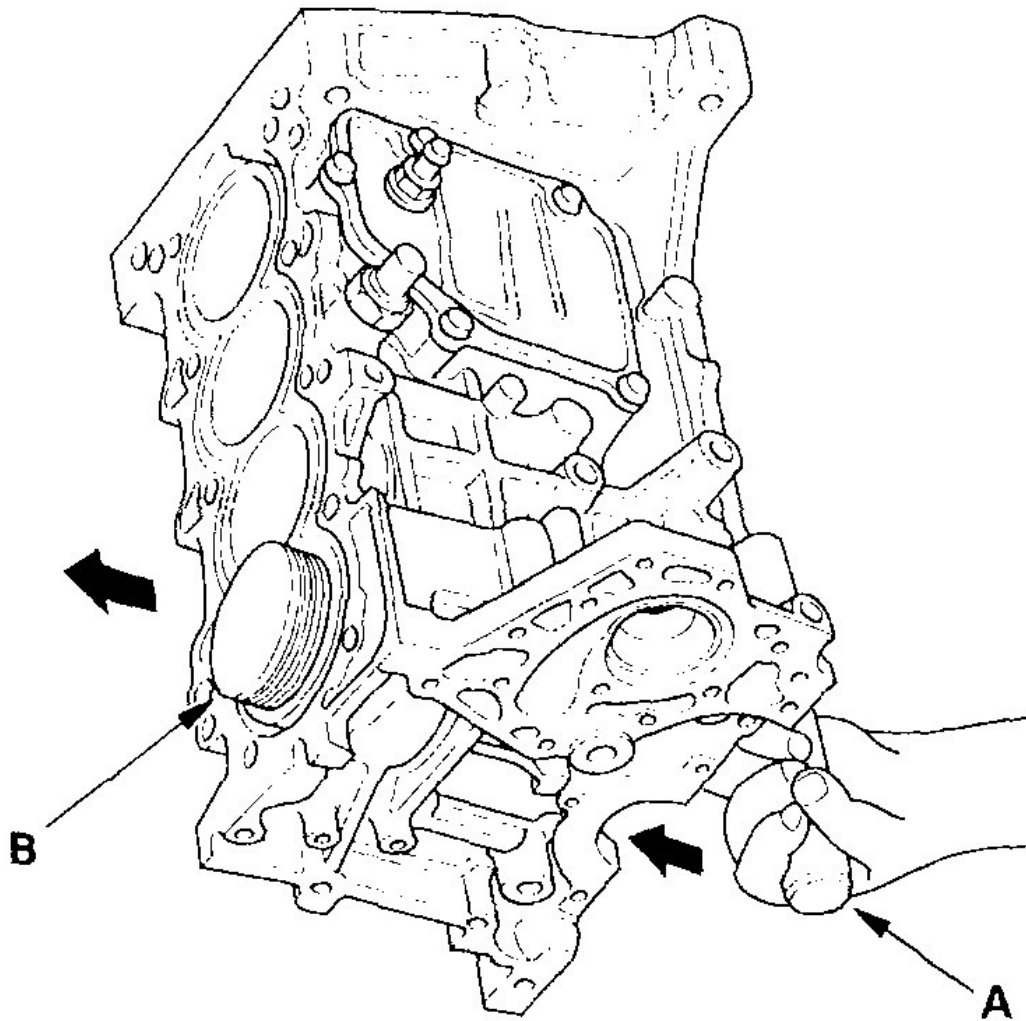
10. Remove the upper bearing halves from the connecting rods, and set them aside with their respective caps.
11. If you can feel a ridge of metal or hard carbon around the top of each cylinder, remove it with a ridge reamer (A). Follow the reamer manufacturer's instructions. If the ridge is not removed, it may damage the pistons as they are pushed out.



G01431559

Fig. 188: Removing With A Ridge Reamer If You Can Feel A Ridge Of Metal
Courtesy of AMERICAN HONDA MOTOR CO., INC.

12. Use the wooden handle of a hammer (A) to drive out the pistons (B).



G01431560

Fig. 189: Using Wooden Handle Of Hammer To Drive Out Pistons
Courtesy of AMERICAN HONDA MOTOR CO., INC.

13. Reinstall the bearing cap bridge and bearings on the engine block.
14. Reinstall the connecting rod bearings and caps after removing each piston/connecting rod assembly.
15. To avoid mix-up on reassembly, mark each piston/ connecting rod assembly with its cylinder number.

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

CRANKSHAFT INSPECTION

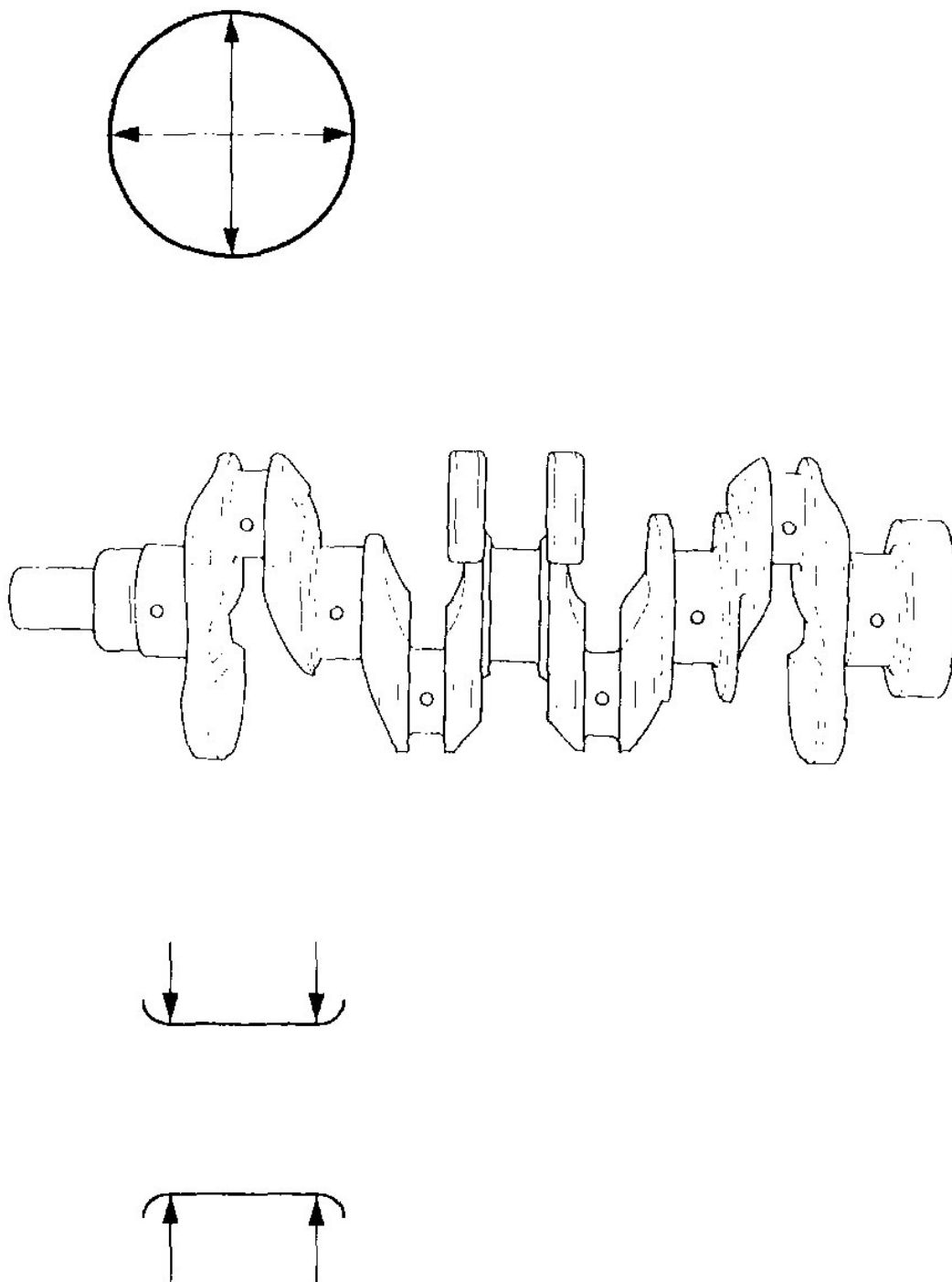
Out-of-Round and Taper

1. Remove the crankshaft from the engine block (see **Crankshaft and Piston Removal**).
2. Clean the crankshaft oil passages with pipe cleaners or a suitable brush.
3. Clean the keyway and threads.
4. Measure out-of round at the middle of each rod and main journal in two places. The difference between measurements on each journal must not be more than the service limit.

Journal Out-of-Round

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

Service Limit: 0.010 mm (0.0004 in.)



G01431561

Fig. 190: Measuring Out-Of-Round At Middle Of Each Rod & Main Journal In Two Places
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

Journal Taper

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

Service Limit: 0.010 mm (0.0004 in.)

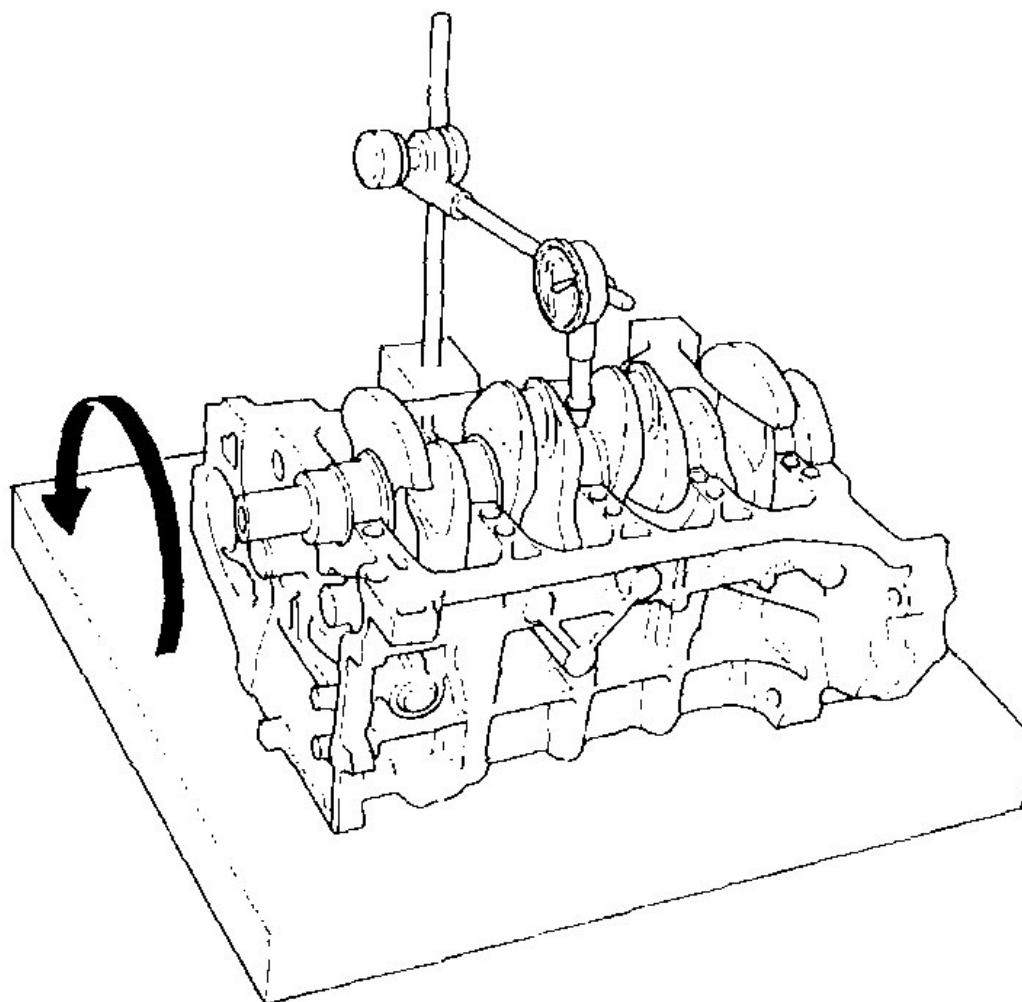
Straightness

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

Crankshaft Total Runout

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

Service Limit: 0.04 mm (0.0016 in.)



G01431562

Fig. 191: Measuring Runout On all Of Main Journals
Courtesy of AMERICAN HONDA MOTOR CO., INC.

BLOCK AND PISTON INSPECTION

1. Remove the crankshaft and pistons (see **Crankshaft and Piston Removal**).
2. Check the piston for distortion or cracks.
3. Measure the piston diameter (A) at a point 13 mm (0.5 in.) from the bottom of the skirt.

Piston Diameter

2003 Honda Civic Si

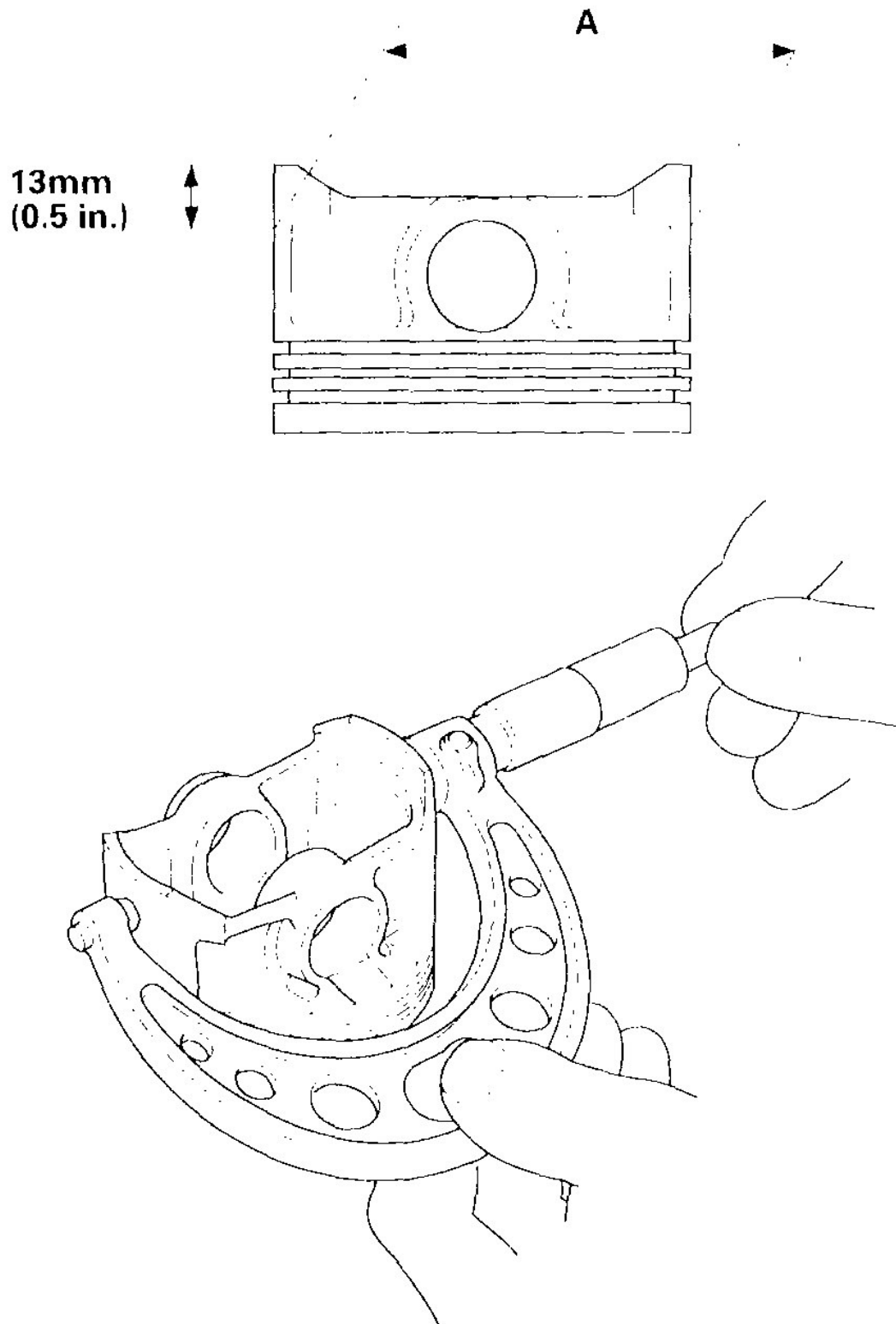
2003-05 ENGINES Overhaul - 1.3L 4-Cylinder (Hybrid)

Standard (New): 72.98-72.99 mm (2.8732-2.8736 in.)

Service Limit: 72.97 mm (2.8728 in.)

Oversize Piston Diameter

0.25: 73.23-73.24 mm (2.8831-2.8835 in.)



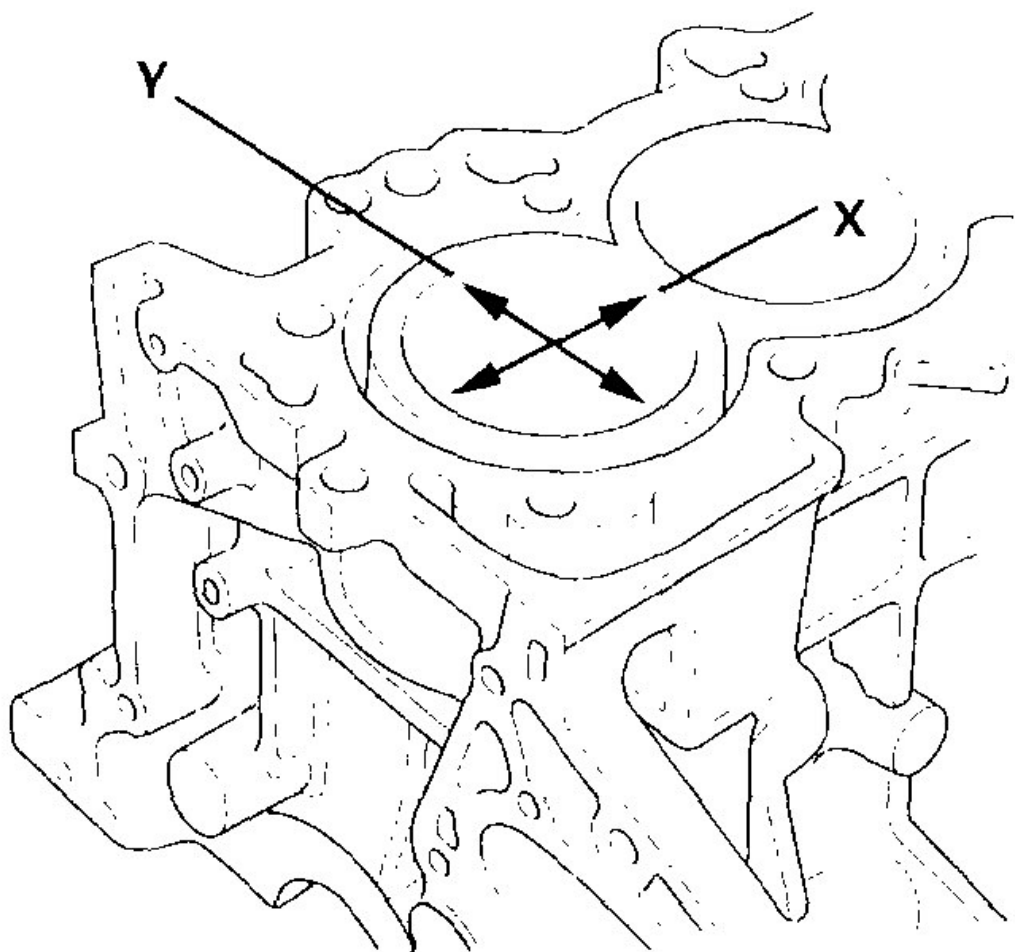
G01431563

Fig. 192: Measuring Piston Diameter**Courtesy of AMERICAN HONDA MOTOR CO., INC.**

4. Measure wear and taper in direction X and Y at three levels in each cylinder as shown. If measurements in any cylinder are beyond the Oversize Bore Service Limit, replace the engine block. If the engine block is to be rebored, refer to step 7 after reboring.

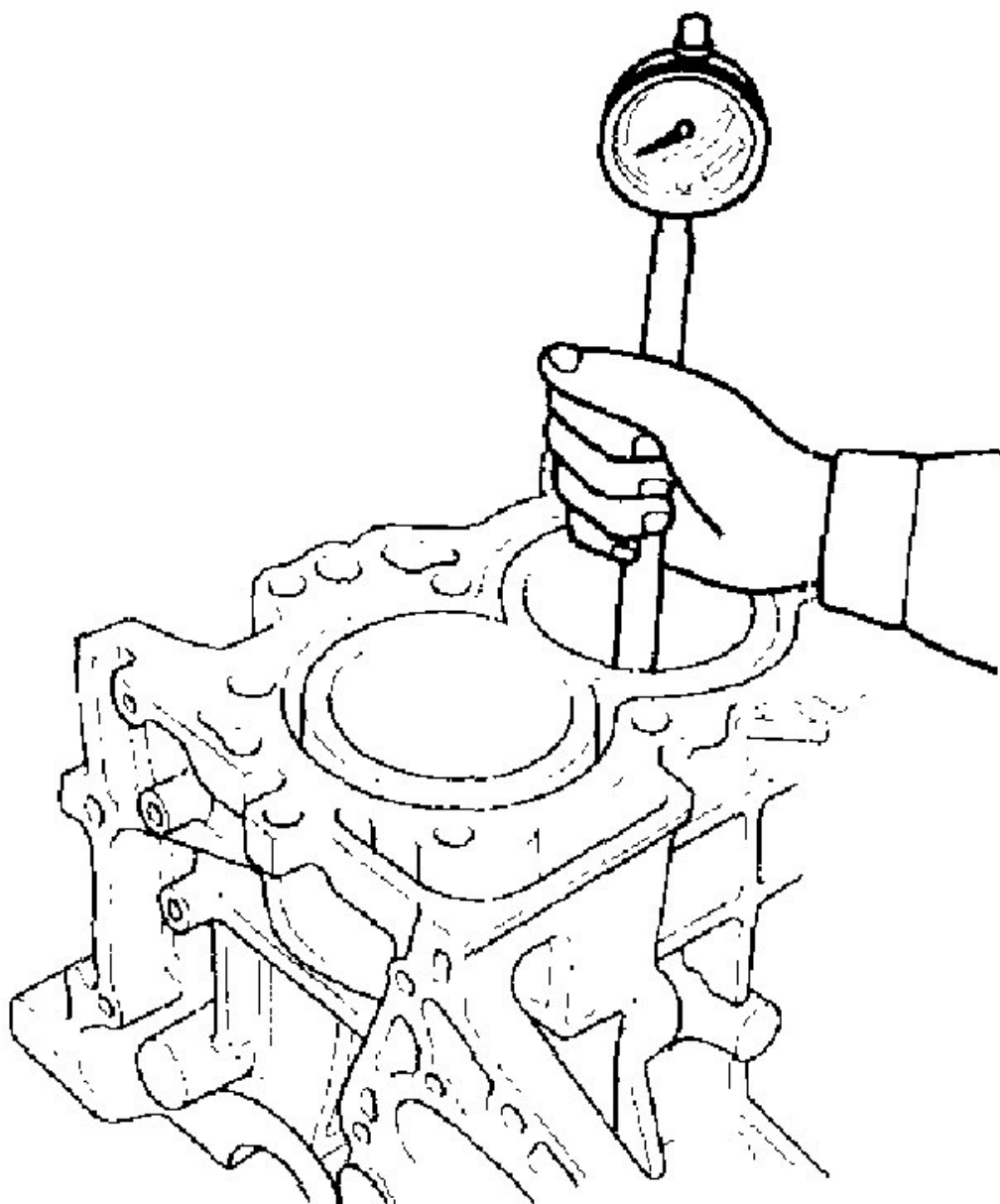
Cylinder Bore Size**Standard (New):** 73.00-73.02 mm (2.8740-2.8748 in.)**Service Limit:** 73.07 mm (2.8767 in.)**Oversize:****0.25:** 73.25-73.27 mm (2.8839-2.8846 in.)**Reboring limit:** 0.25 mm (0.01 in.) max.**Bore Taper**

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



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Fig. 193: Measuring Wear & Taper In Direction X & Y At Three Levels In Each Cylinder (1 Of 2)
Courtesy of AMERICAN HONDA MOTOR CO., INC.



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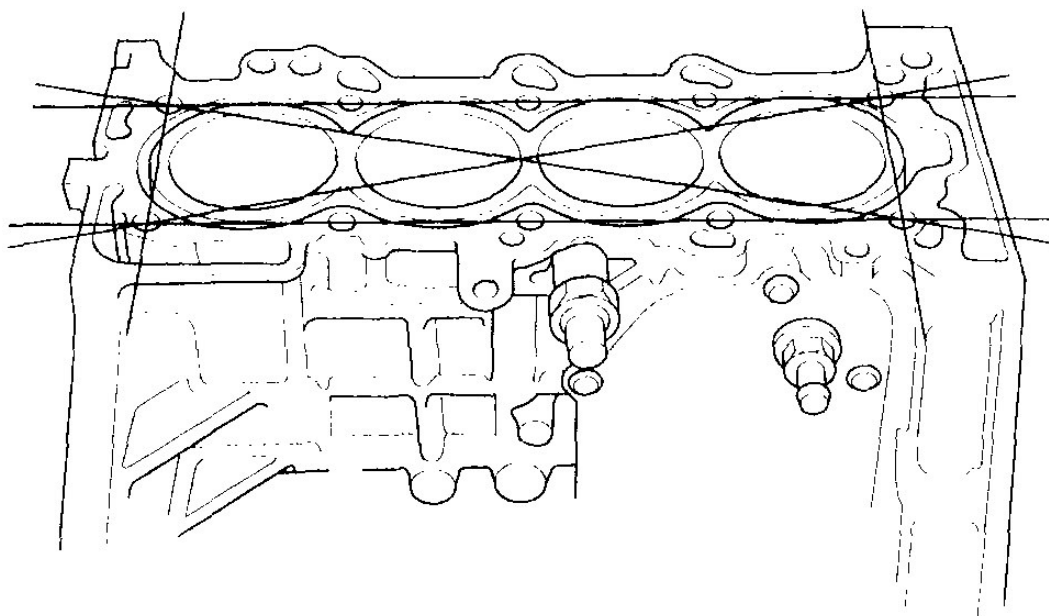
Fig. 194: Measuring Wear & Taper In Direction X & Y At Three Levels In Each Cylinder (2 Of 2)
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

Engine Block Warpage

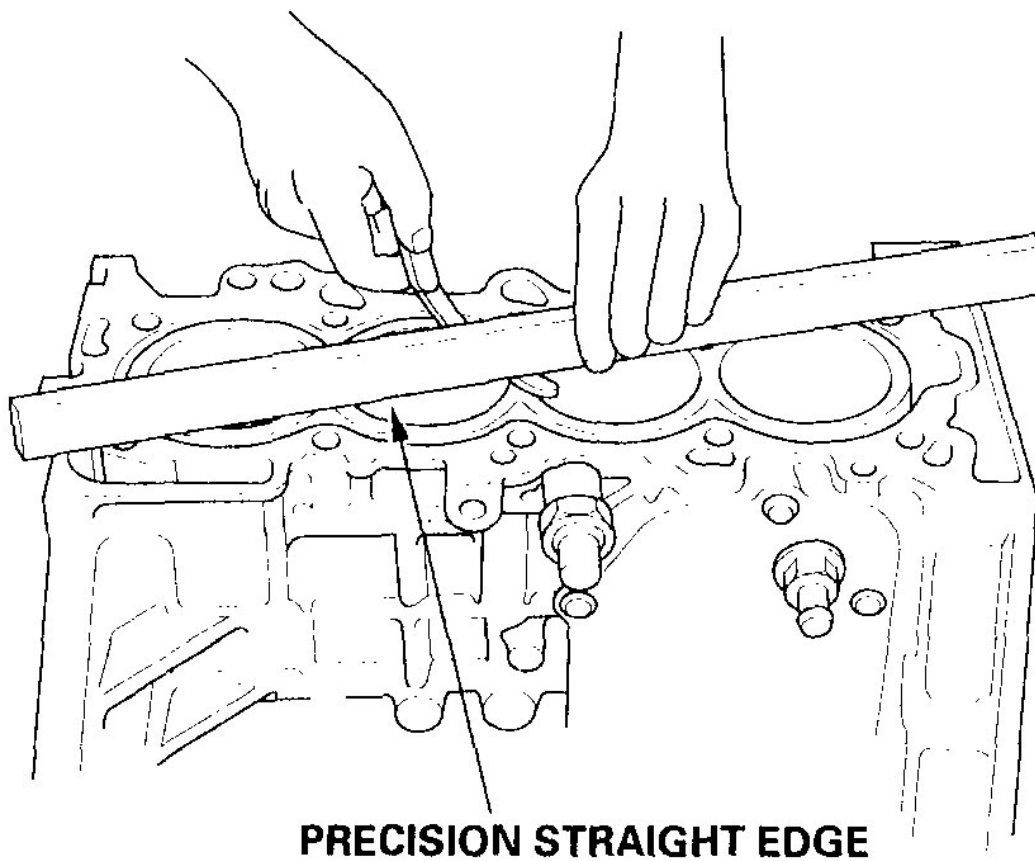
Standard (New): 0.07 mm (0.003 in.) max.

Service Limit: 0.10 mm (0.004 in.)



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Fig. 195: Measuring Along Edges & Across Center Of Engine Block (1 Of 2)
Courtesy of AMERICAN HONDA MOTOR CO., INC.



G01431567

Fig. 196: Measuring Along Edges & Across Center Of Engine Block (2 Of 2)

Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

Piston-to-Cylinder Clearance**Standard (New):** 0.010-0.040 mm (0.0004-0.0016 in.)**Service Limit:** 0.05 mm (0.002 in.)

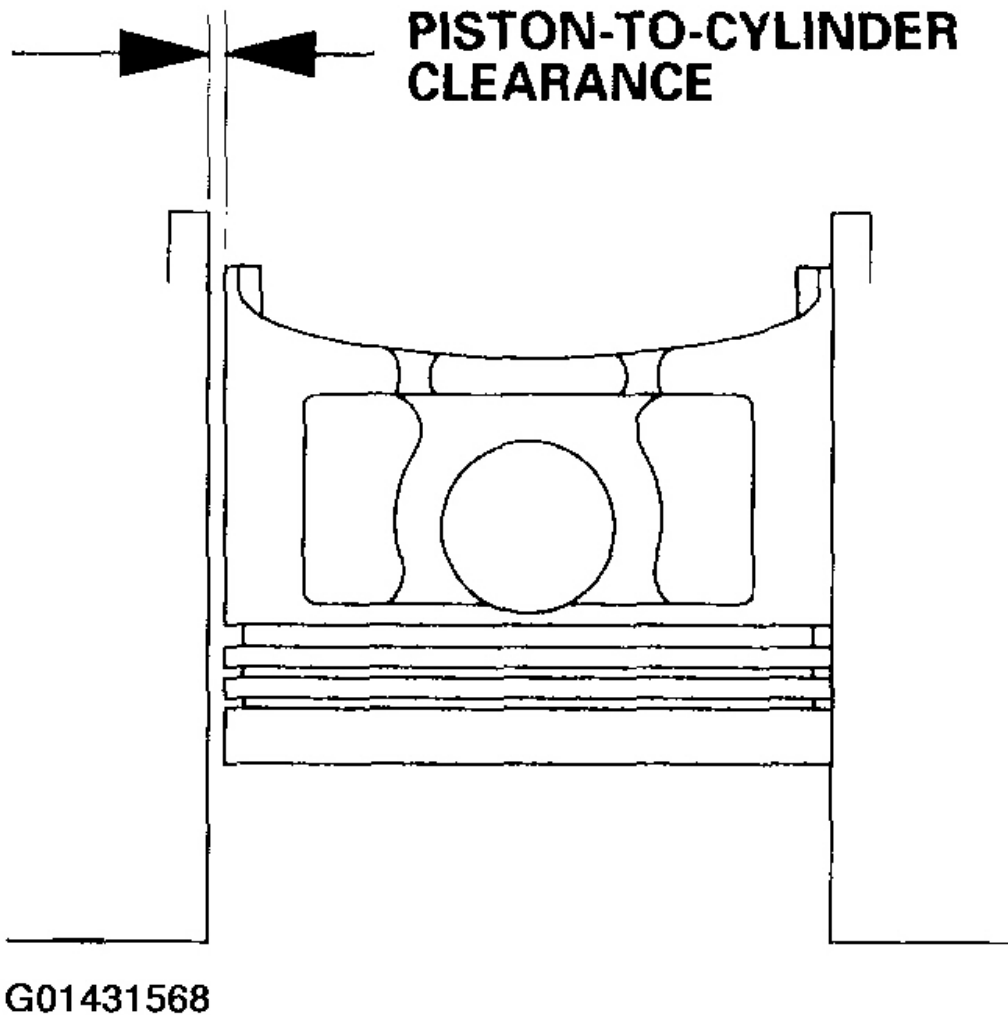


Fig. 197: Calculating Difference Between Cylinder Bore Diameter & Piston Diameter
Courtesy of AMERICAN HONDA MOTOR CO., INC.

CYLINDER HONING

Only a scored or scratched cylinder bore must be honed.

1. Measure the cylinder bores (see **Block and Piston Inspection**).

If the block is to be reused, hone the cylinders and remeasure the bores.

2. Hone the cylinder bores with honing oil and a fine (400 grit) stone in a 60 degree cross-hatch pattern (A). Use only a rigid hone with 400 grit or finer stone such as Sunnen, Ammco, or equivalent. Do not use

stones that are worn or broken.

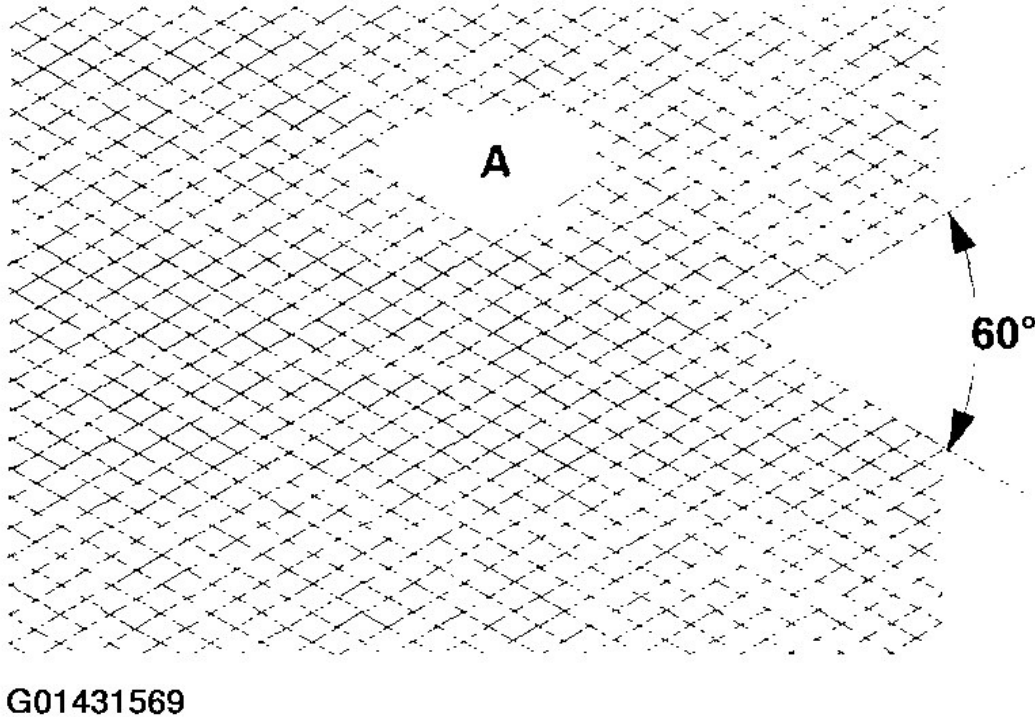


Fig. 198: Honing Cylinder Bores With Honing Oil & Fine Stone In Cross-Hatch Pattern
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

PISTON, PIN, AND CONNECTING ROD REPLACEMENT

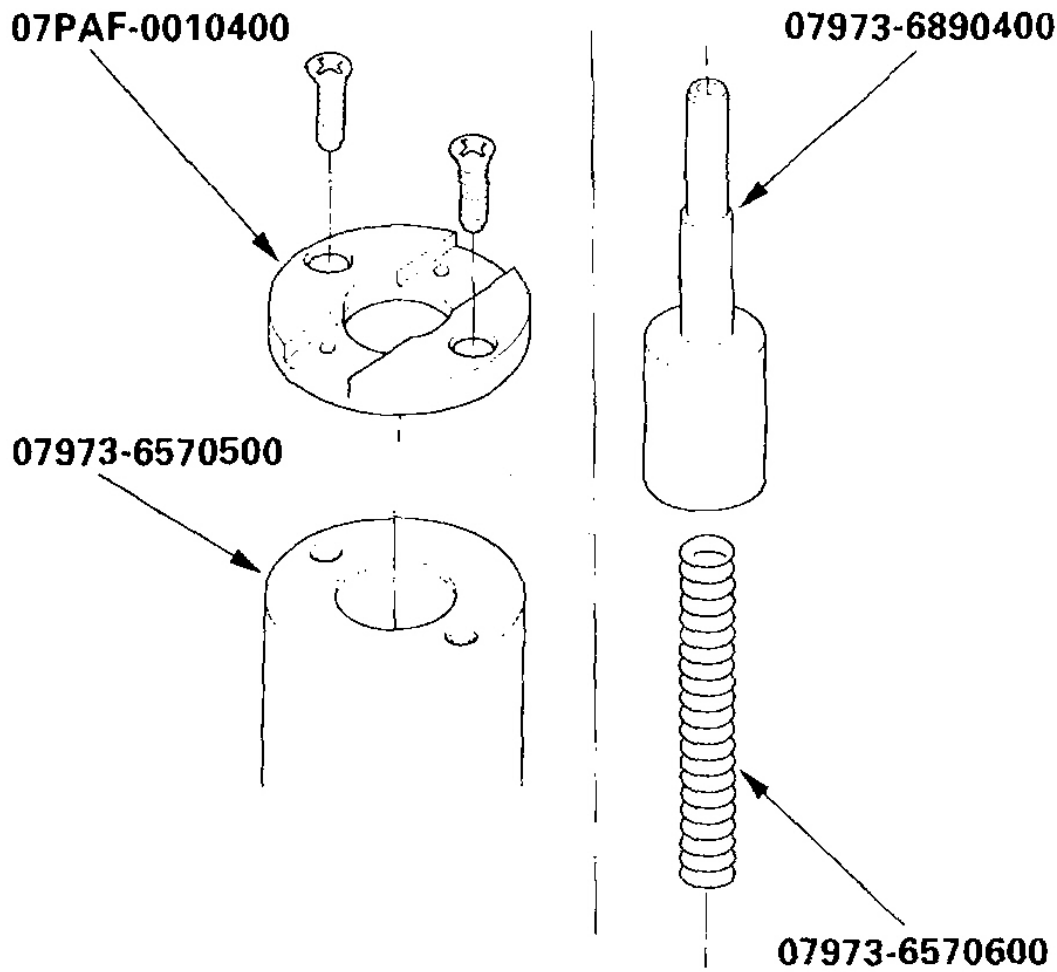
Special Tools Required

- Piston Base 07973-6570500
- Piston Base Spring 07973-6570600
- Piston Pin Base Insert 07973-6890400
- Piston Base Head 07PAF-0010400
- Pilot Collar 07973-6890300

- Adjustable Piston Pin Driver Shaft 07973-6890200
- Adjustable Piston Pin Driver Head 07973-6570201
- Piston Base Head Insert (2) 07PAF-0010500

Disassembly

1. Assemble the special tool as shown.



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Fig. 199: Assembling Special Tool

Courtesy of AMERICAN HONDA MOTOR CO., INC.

2. Temporarily install the pilot collar over the piston pin base insert (A), and adjust the piston base head inserts as shown, then tighten the screws (B). Remove the pilot collar.

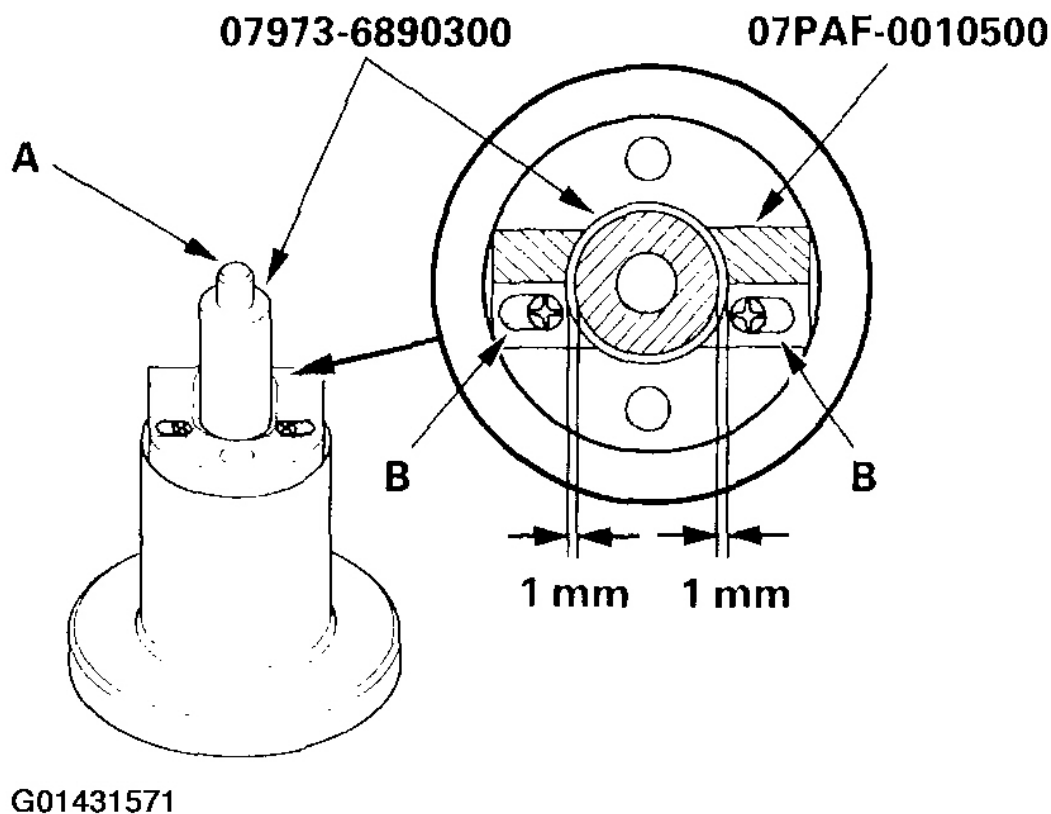


Fig. 200: Installing Pilot Collar Over Piston Pin Base Insert
Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. Assemble and adjust the length of the piston pin driver head and shaft to 57 mm (2.2 in.).

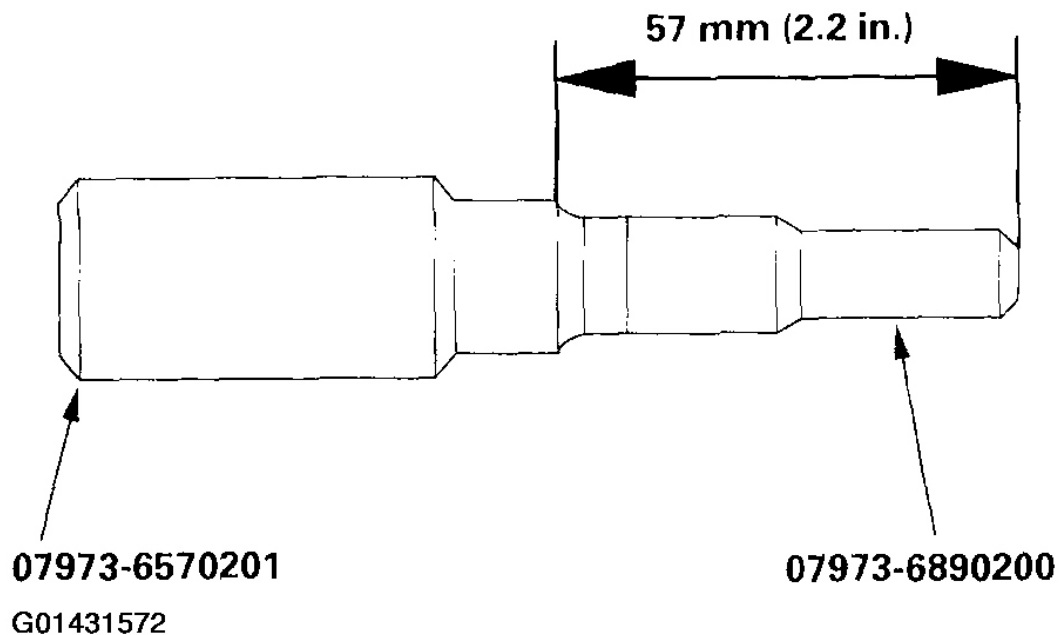
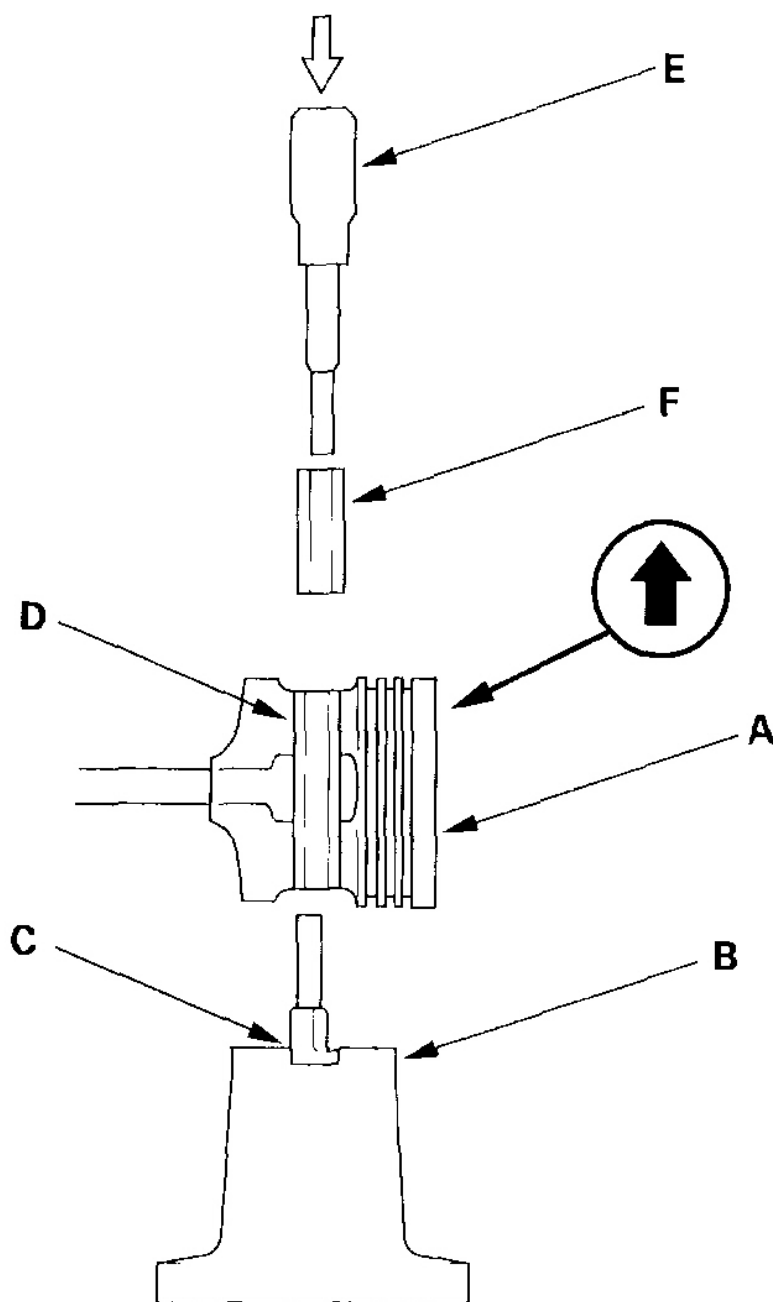


Fig. 201: Assembling & Adjusting Length Of Piston Pin Driver Head & Shaft
Courtesy of AMERICAN HONDA MOTOR CO., INC.

4. With the arrow on top of the piston pointing up, place the piston assembly (A) on the special tool (B). Be sure you position the recessed flat area of the piston against the piston base head inserts (C) as shown.



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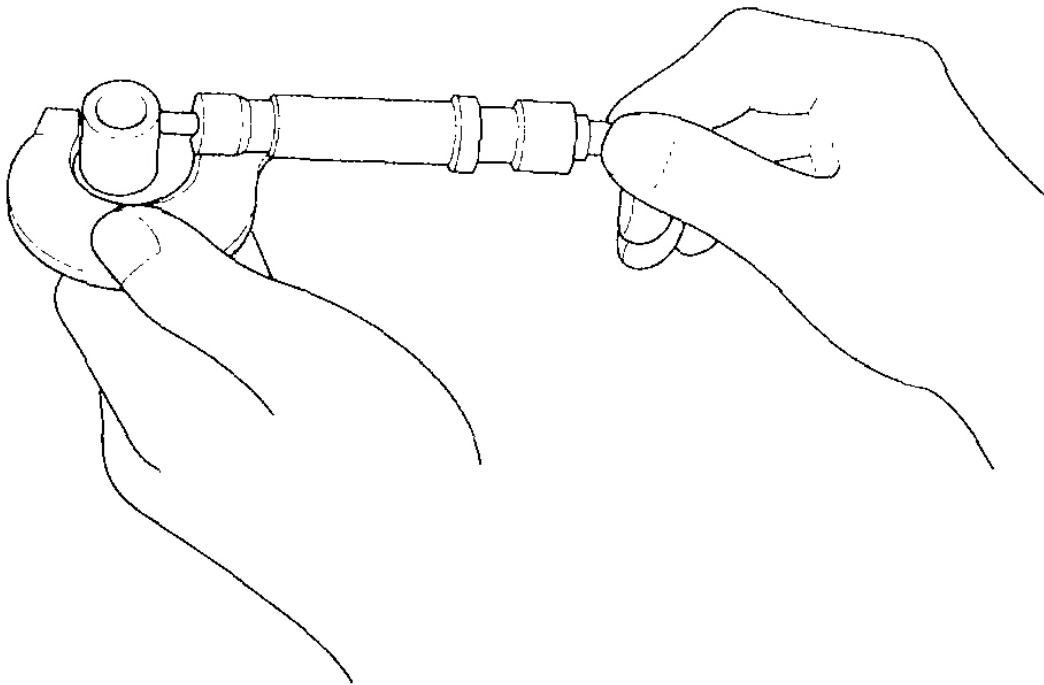
Fig. 202: Placing Piston Assembly On Special Tool With Arrow On Top Of Piston Pointing Up
Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. Press the pin (D) out with the pin driver (E), pilot collar (F) and a hydraulic press.

Inspection

1. Measure the diameter of the piston pin.

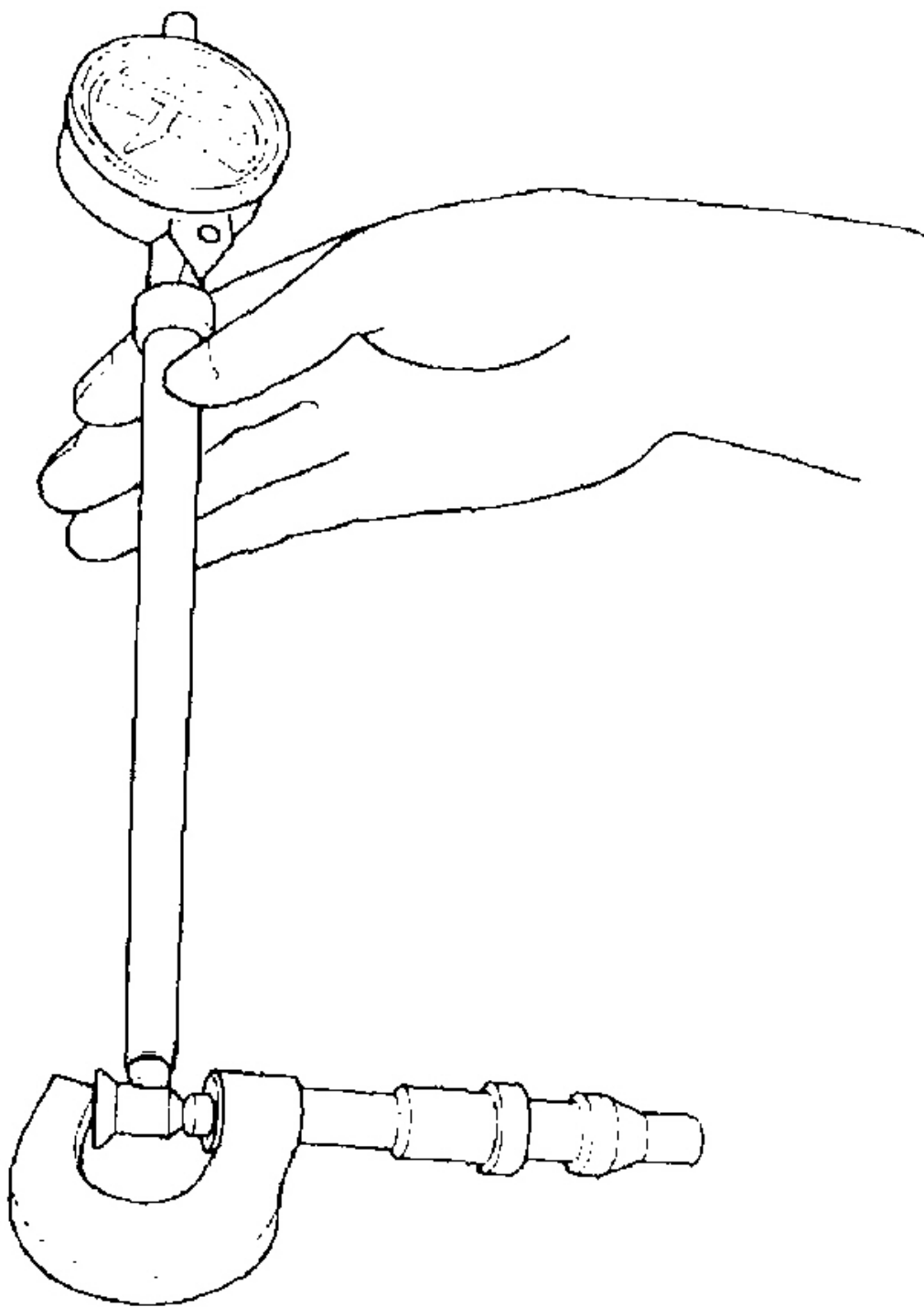
Piston Pin Diameter Standard (New): 17.996-18.000 mm (0.7085-0.7087 in.)



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Fig. 203: Measuring Diameter Of Piston Pin
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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



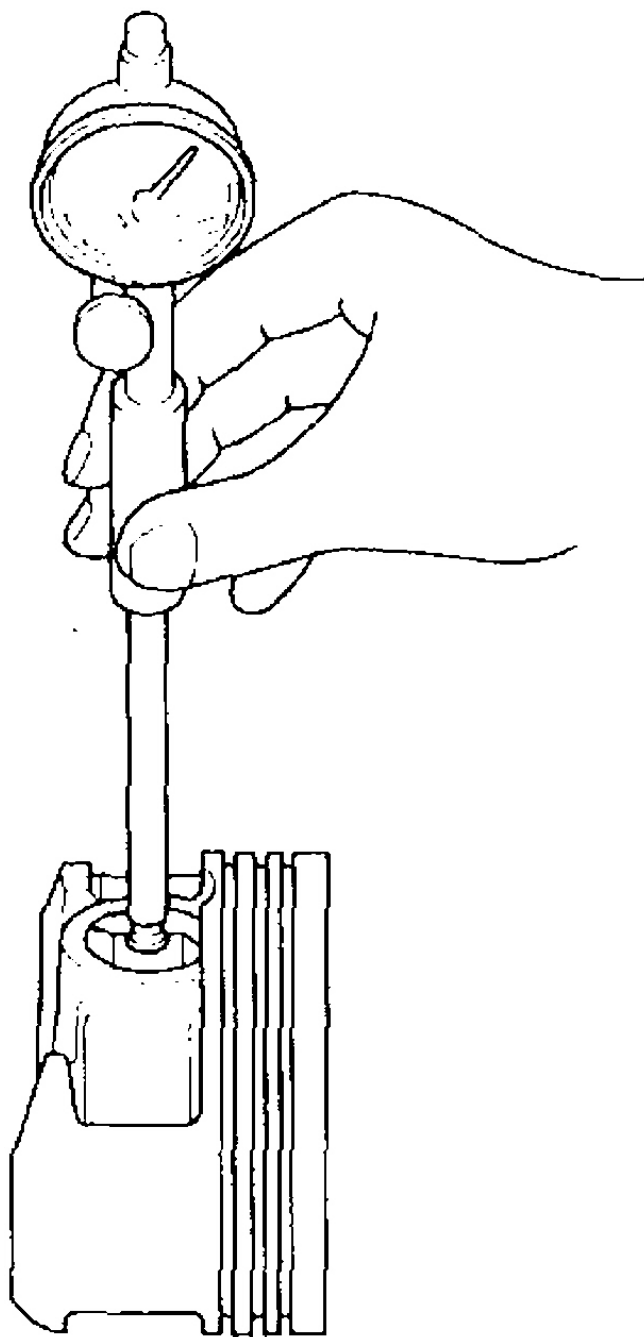
G01431575

Fig. 204: Zeroing Dial Indicator To Piston Pin Diameter
Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. Measure the piston pin-to-piston clearance.

Piston Pin-to-Piston Clearance

Standard (New): 0.010-0.017 mm (0.0004-0.0007 in.)



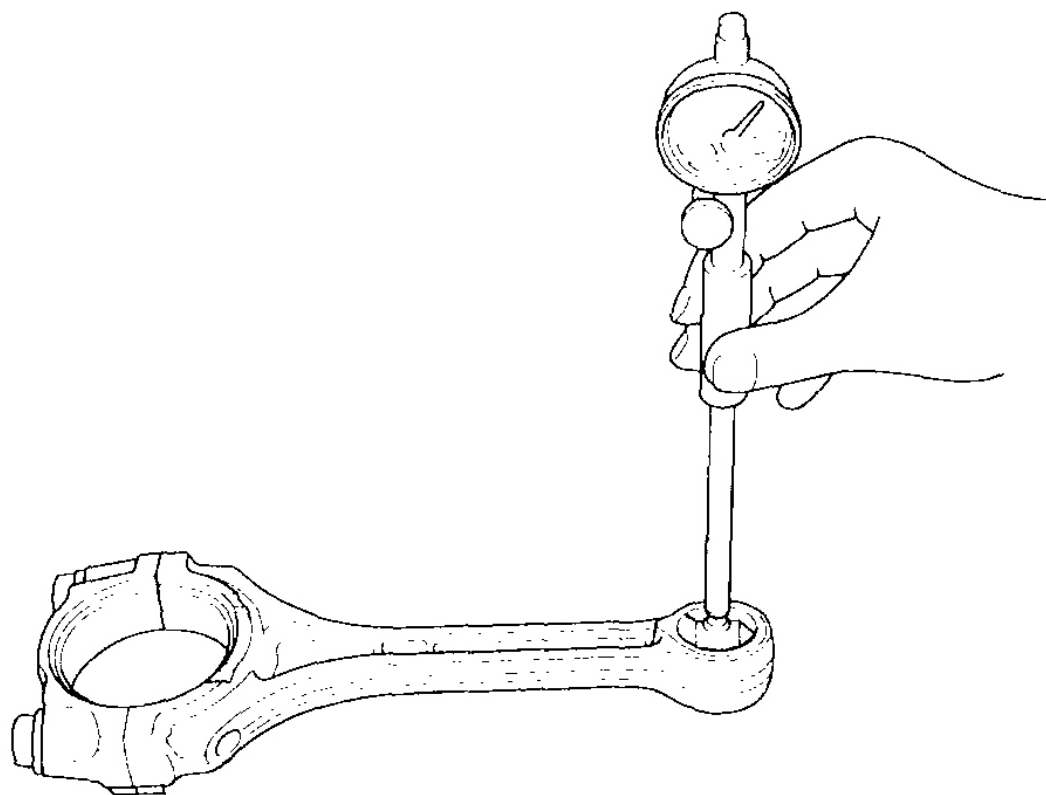
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Fig. 205: Measuring Piston Pin-To-Piston Clearance
Courtesy of AMERICAN HONDA MOTOR CO., INC.

4. Check the difference between the piston pin diameter and connecting rod small end diameter.

Piston Pin-to-Connecting Rod Interference

Standard (New): 0.020-0.036 mm (0.0008-0.0014 in.)

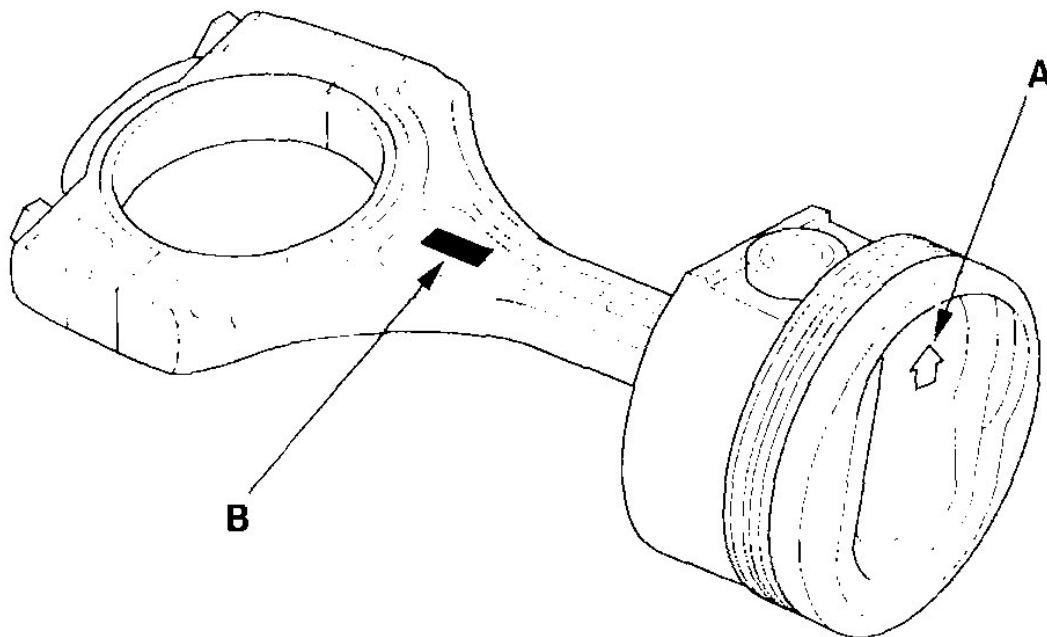


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Fig. 206: Checking Difference Between Piston Pin Diameter & Connecting Rod Smaller End Diameter
Courtesy of AMERICAN HONDA MOTOR CO., INC.

Reassembly

1. Assemble the piston with the arrow (A) pointing up and connecting rod with the embossed marks (B) on the same side.

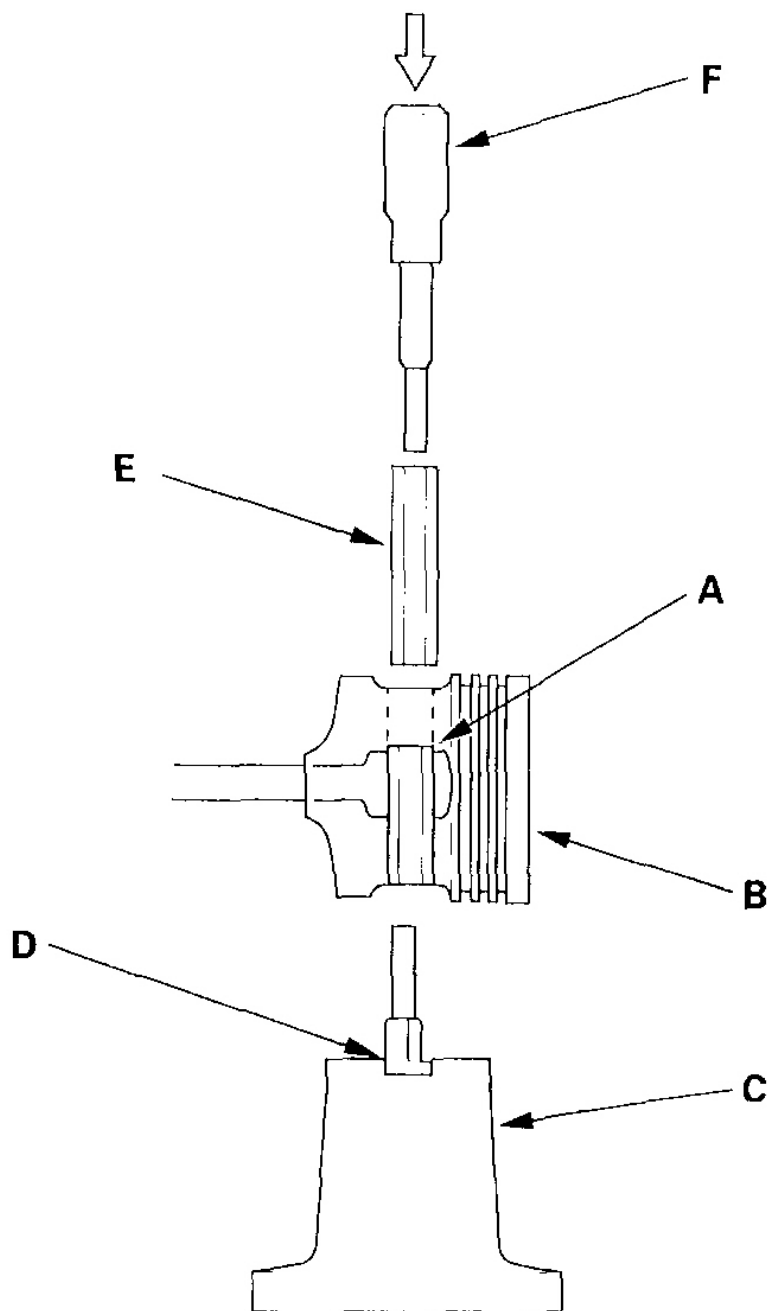


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Fig. 207: Assembling Piston With Arrow Pointing Up & Connecting Rod With Embossed Marks On Same Side

Courtesy of AMERICAN HONDA MOTOR CO., INC.

2. Insert the pilot collar (A) into the piston and connecting rod.



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Fig. 208: Inserting Pilot Collar Into Piston & Connecting Rod
Courtesy of AMERICAN HONDA MOTOR CO., INC.

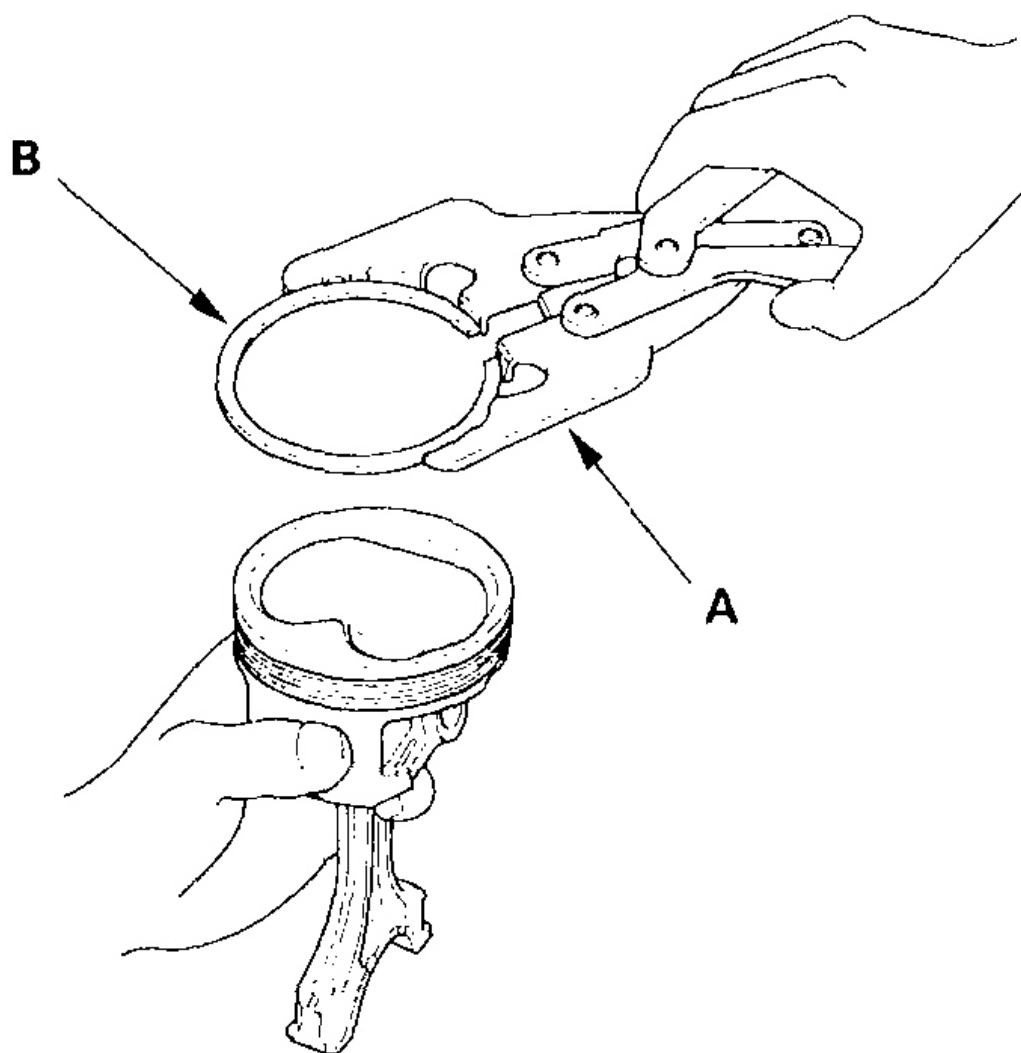
3. With the arrow on top of the piston and the embossed mark on the connecting rod facing up, place the piston assembly (B) on the special tool (C). Be sure you position the recessed flat area of the piston

against the piston base head inserts (D) as shown.

4. Press the pin (E) in with the pin driver (F) and a hydraulic press.

PISTON RING REPLACEMENT

1. Remove the piston from the engine block (see **Crankshaft and Piston Removal**).
2. Using a ring expander (A), remove the old piston rings (B).



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Fig. 209: Removing Old Piston Rings With Ring Expander
Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. Clean all ring grooves thoroughly with a squared-off broken ring or ring groove cleaner with a blade to fit the piston grooves.
 - The top ring groove is 1.0 mm (0.04 in.) wide.
 - The second ring groove is 1.2 mm (0.05 in.) wide.
 - The oil ring groove is 2.0 mm (0.08 in.) wide. File down a blade if necessary.

Do not use a wire brush to clean the ring grooves, or cut the ring grooves deeper with the cleaning tools.

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

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

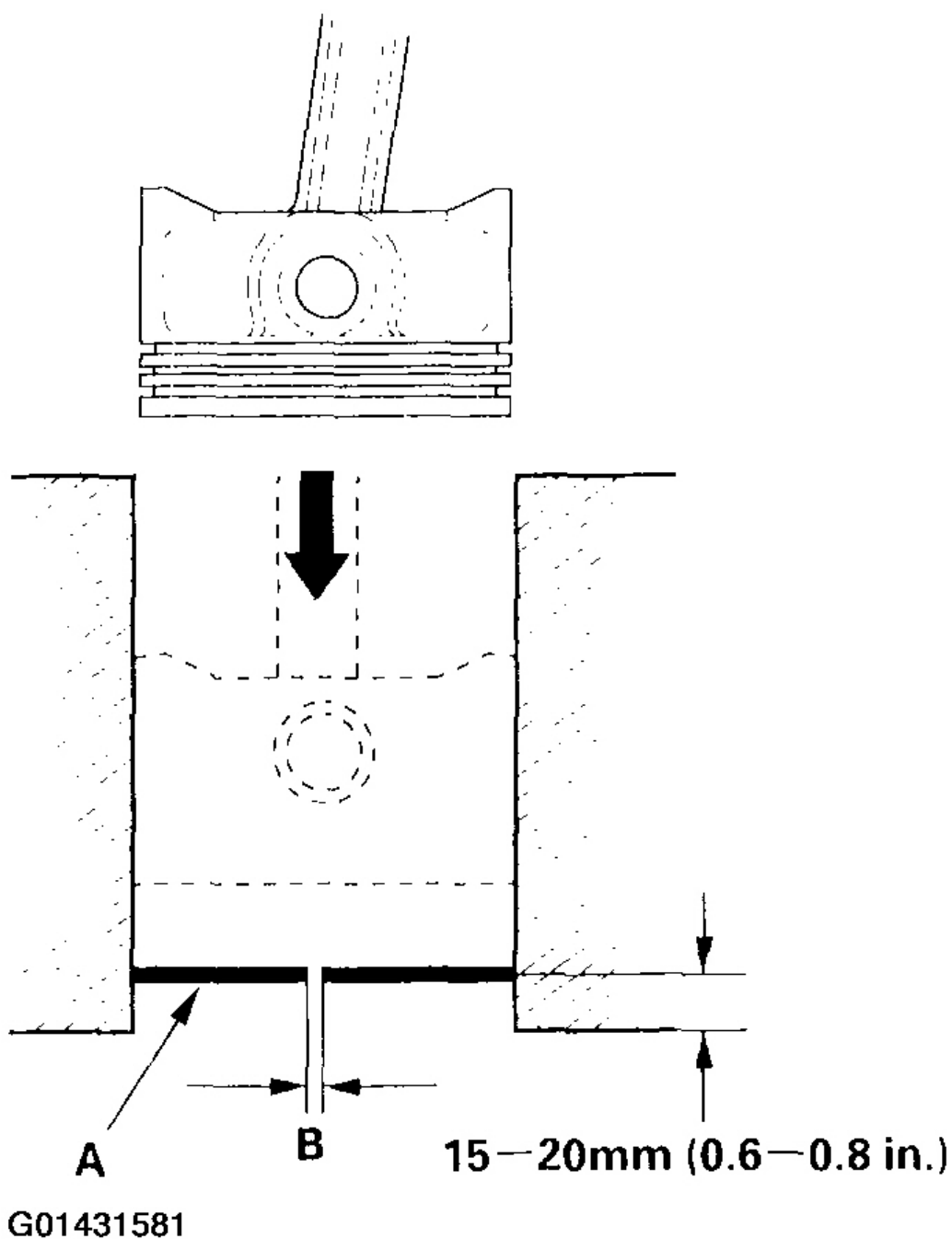


Fig. 210: Pushing New Ring Into Cylinder Bore Using Piston
Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. Measure the piston ring end-gap (B) with a feeler gauge:

- If the gap is too small, check to see if you have the proper rings for your engine.
- If the gap is too large, recheck the cylinder bore diameter against the wear limits (see **Block and Piston Inspection**). If the bore is over the service limit, the engine block must be rebored.

Piston Ring End-Gap**Top Ring**

Standard (New): 0.15-0.30 mm (0.006-0.012 in.)

Service Limit: 0.60 mm (0.024 in.)

Second Ring

Standard (New): 0.35-0.50 mm (0.014-0.020 in.)

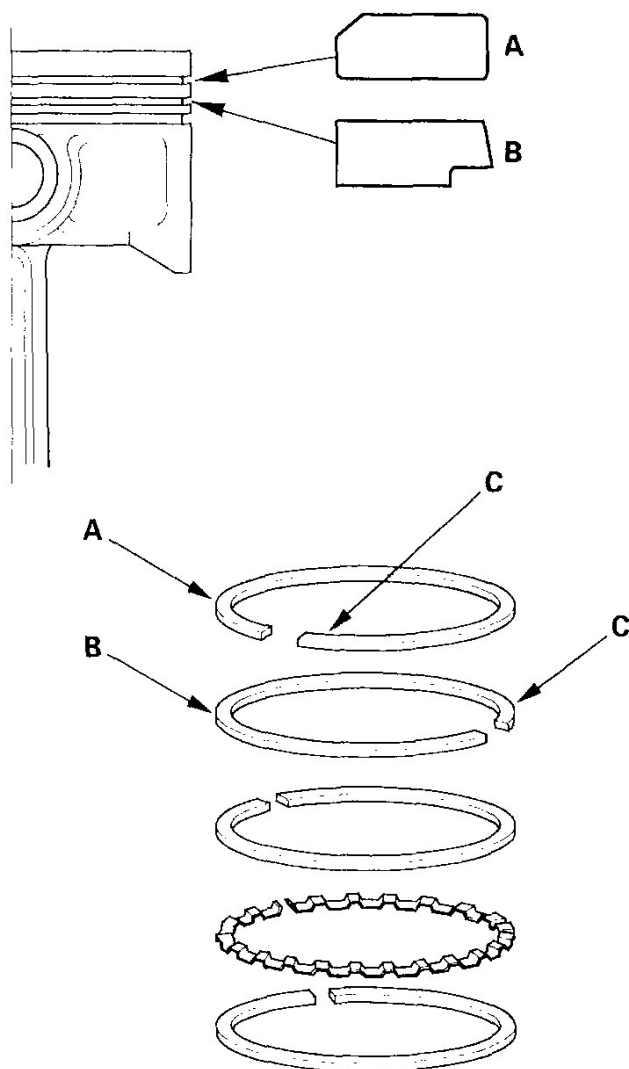
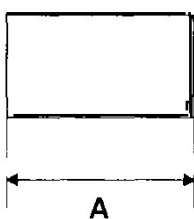
Service Limit: 0.65 mm (0.026 in.)

Oil Ring

Standard (New): 0.20-0.70 mm (0.008-0.028 in.)

Service Limit: 0.80 mm (0.031 in.)

6. Install the top ring and second ring as shown. The top ring (A) has a R1 mark and the second ring (B) has a R mark. The manufacturing marks (C) must be facing upward.

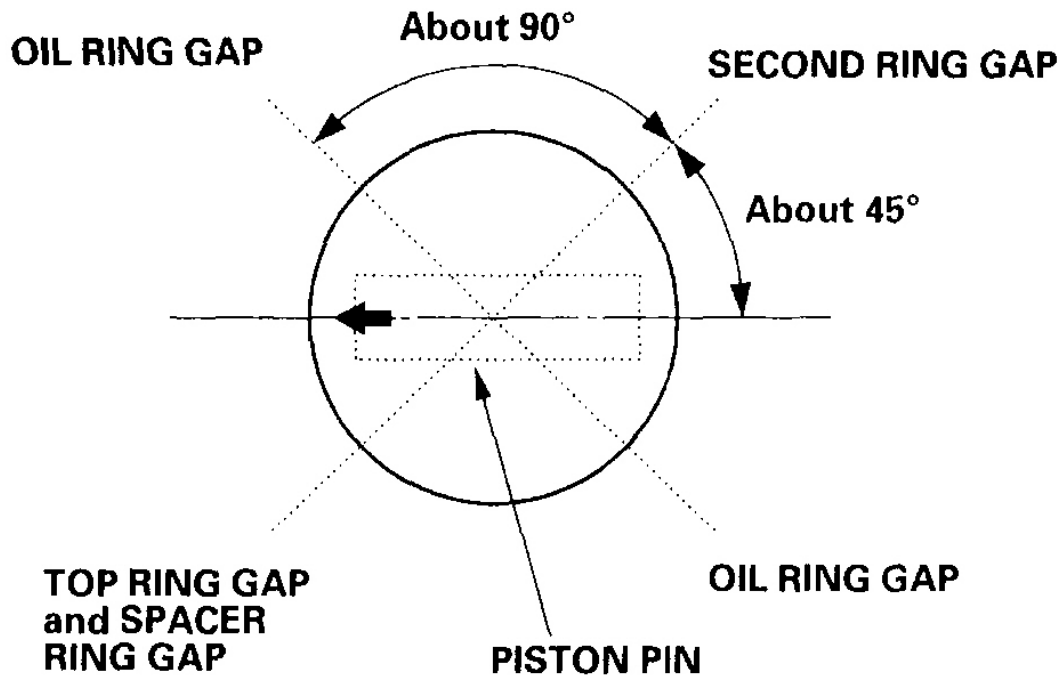
**Piston Ring Dimensions:**

G01431582

Top Ring (Standard)**A:** 2.3 mm (0.09 in.)**B:** 1.0 mm (0.04 in.)**Second Ring (Standard)****A:** 3.0 mm (1.2 in.)**B:** 1.2 mm (0.05 in.)

Fig. 211: Installing Top Ring & Second Ring
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

7. Rotate the rings in their grooves to make sure they do not bind.
8. Position the ring end gaps as shown:



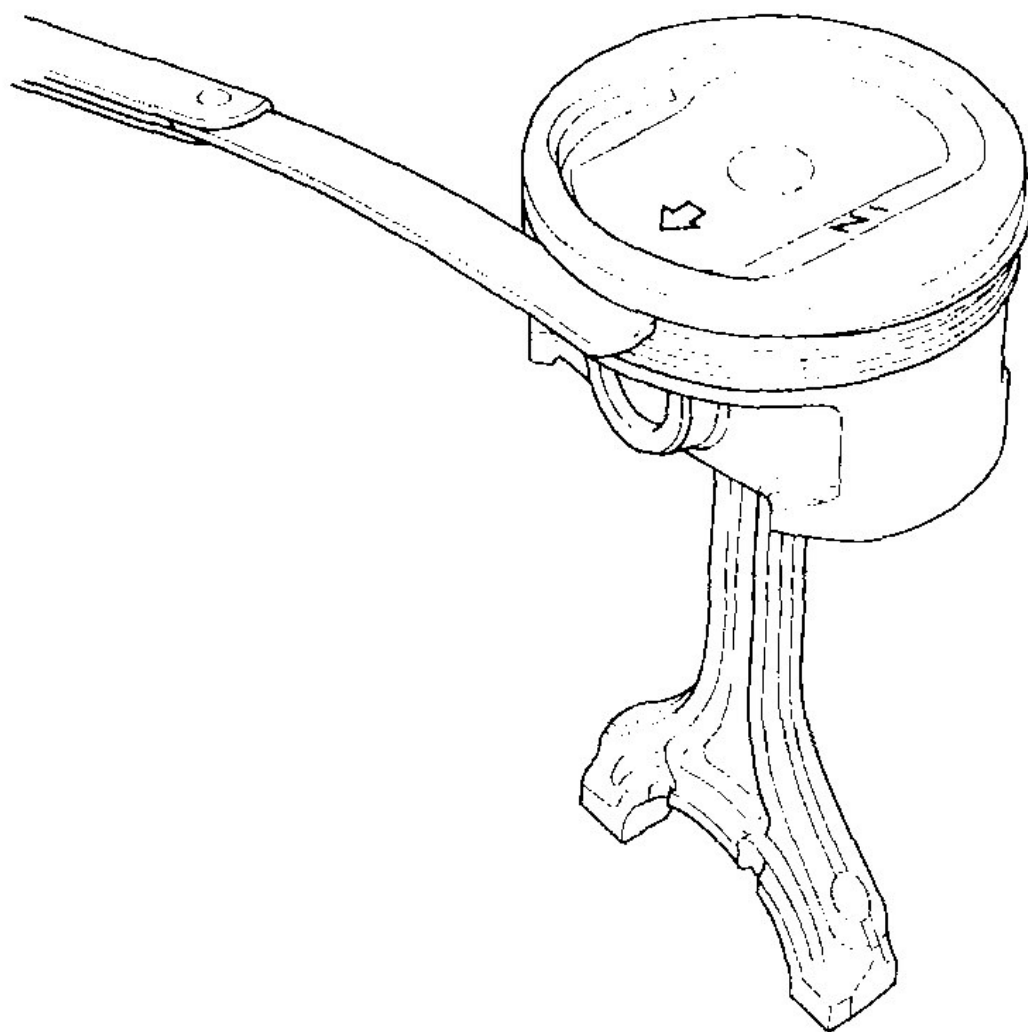
G01431583

Fig. 212: Positioning Ring End Gaps

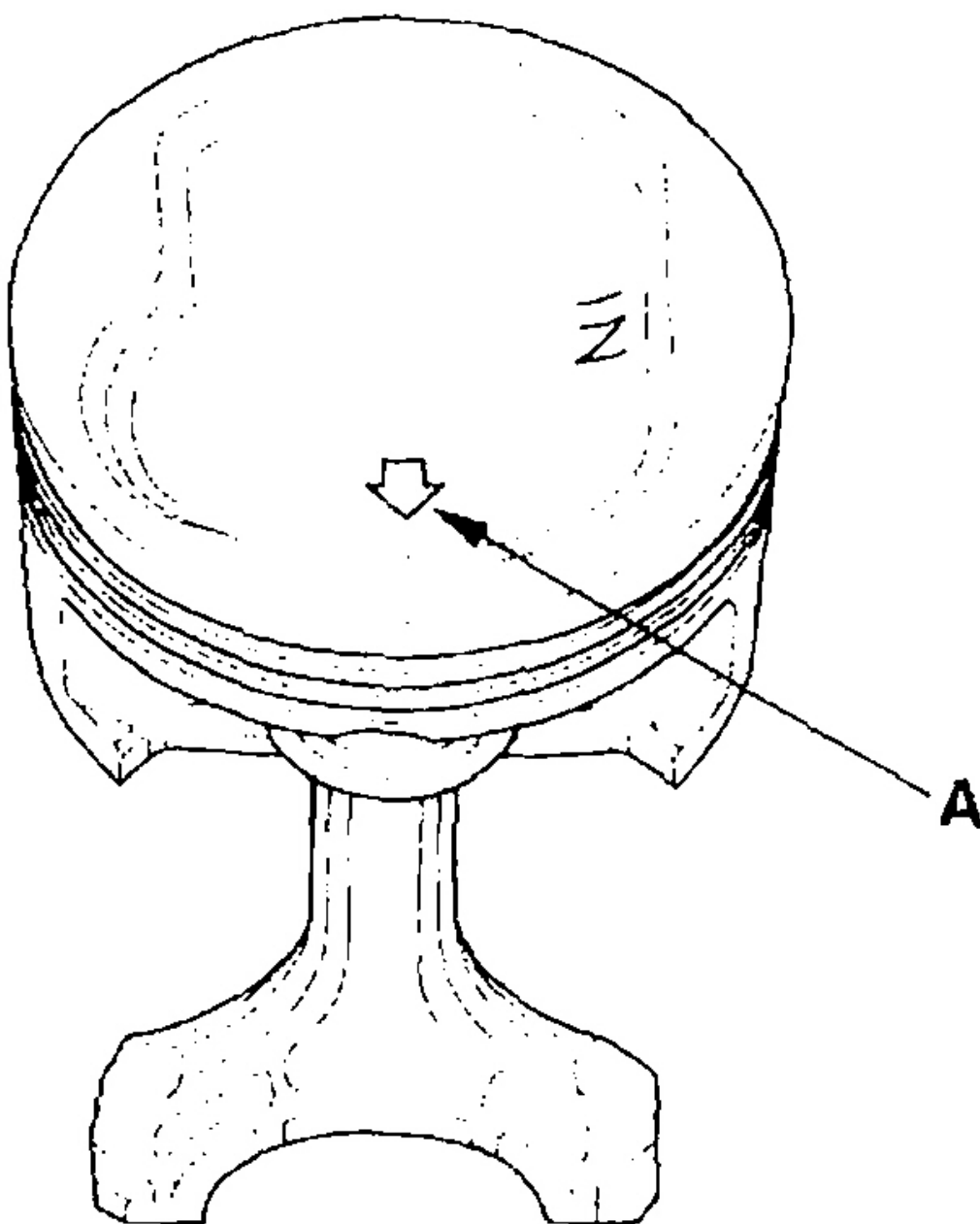
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

Top Ring Clearance**Standard (New):** 0.055-0.080 mm (0.0022-0.0031 in.)**Service Limit:** 0.15 mm (0.006 in.)**Second Ring Clearance****Standard (New):** 0.030-0.055 mm (0.0012-0.0022 in.)**Service Limit:** 0.13 mm (0.005 in.)

**G01431584****Fig. 213: Measuring Ring-To-Groove****Courtesy of AMERICAN HONDA MOTOR CO., INC.****PISTON INSTALLATION****If the crankshaft is already installed**

1. Set the crankshaft to BDC for each cylinder.
2. Remove the connecting rod caps, then install the ring compressor, and check that the bearing is securely in place.
3. Position the arrow (A) facing the timing chain side of the engine.

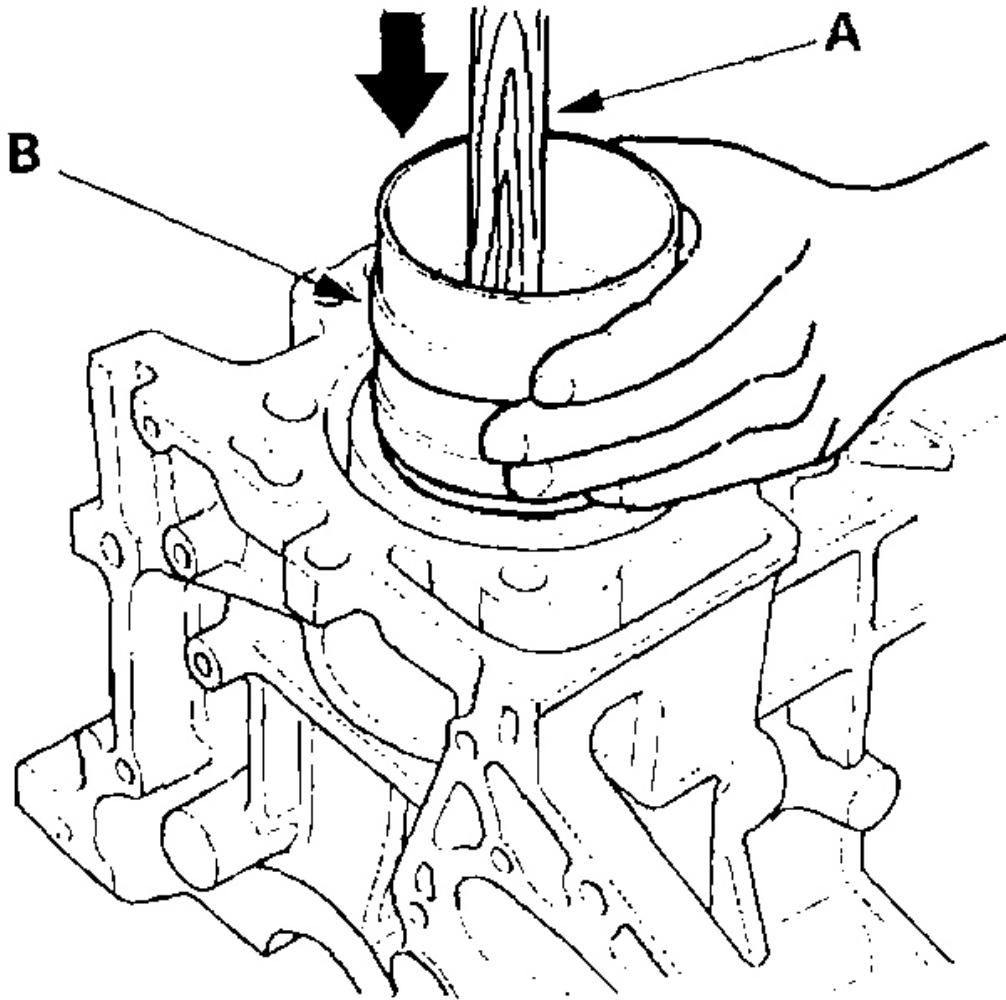


G01431585

Fig. 214: Positioning Arrow Facing Timing Chain Side Of Engine
Courtesy of AMERICAN HONDA MOTOR CO., INC.

4. Position the piston in the cylinder, and tap it in using the wooden handle of a hammer (A). Maintain

downward force on the ring compressor (B) to prevent the rings from expanding before entering the cylinder bore.



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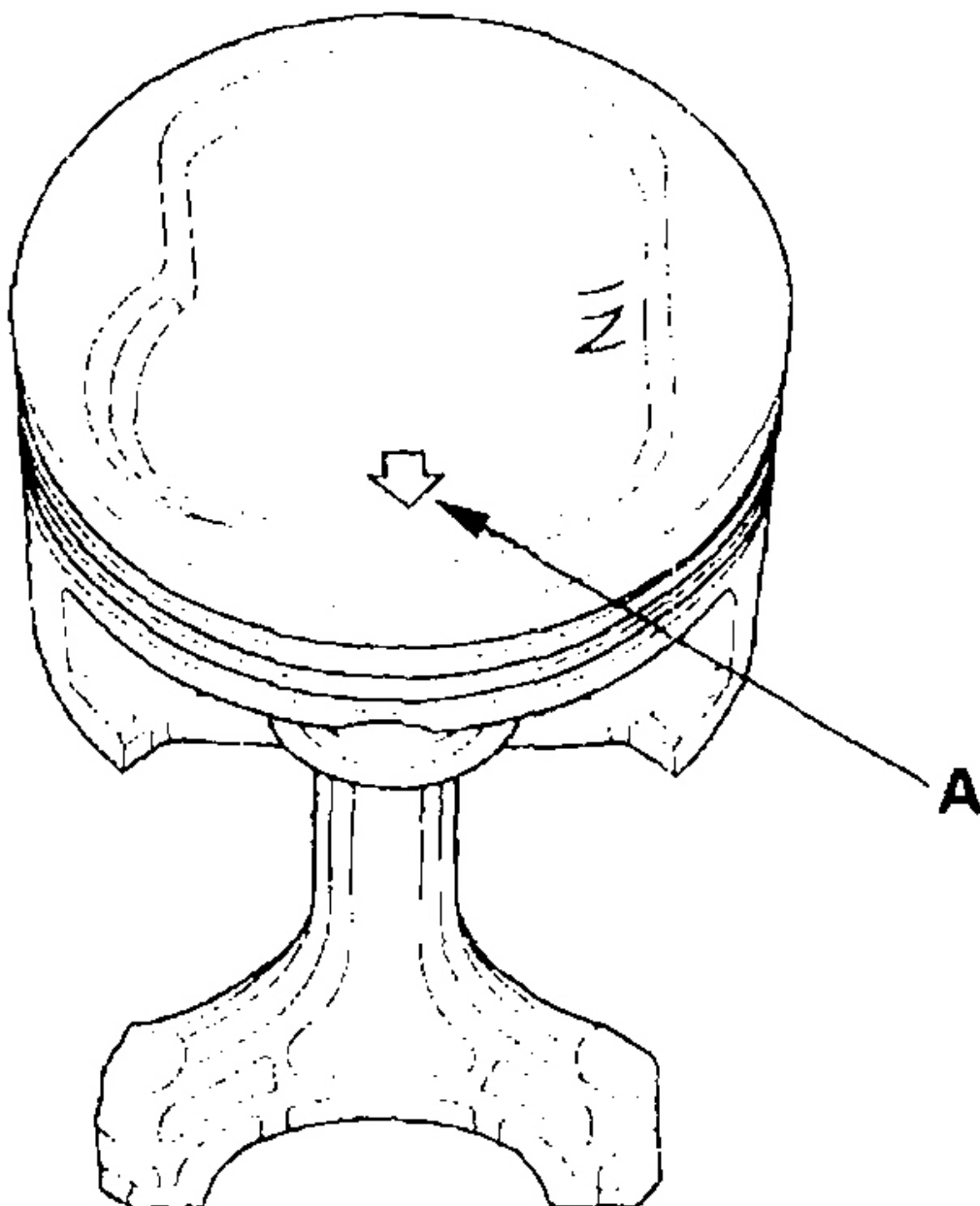
Fig. 215: Positioning Piston In Cylinder & Tapping It Using Wooden Handle Of Hammer
Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. Stop after the ring compressor pops free, and check the connecting rod-to-crank journal alignment before pushing the piston into place.
6. Check the connecting rod bearing clearance with plastigage (see **Connecting Rod Bearing Replacement**).

7. Inspect the connecting rod bolts (see **Connecting Rod Bolt Inspection**).
8. Apply new engine oil to the bolt threads, then install the rod caps with bearings. Torque the bolts to 9.8 N.m (1.0 kgf.m, 7.2 lbf.ft) +90°.

If the crankshaft is not installed

1. Remove the connecting rod caps, then install the ring compressor, and check that the bearing is securely in place.
2. Position the arrow (A) facing the timing chain side of the engine.

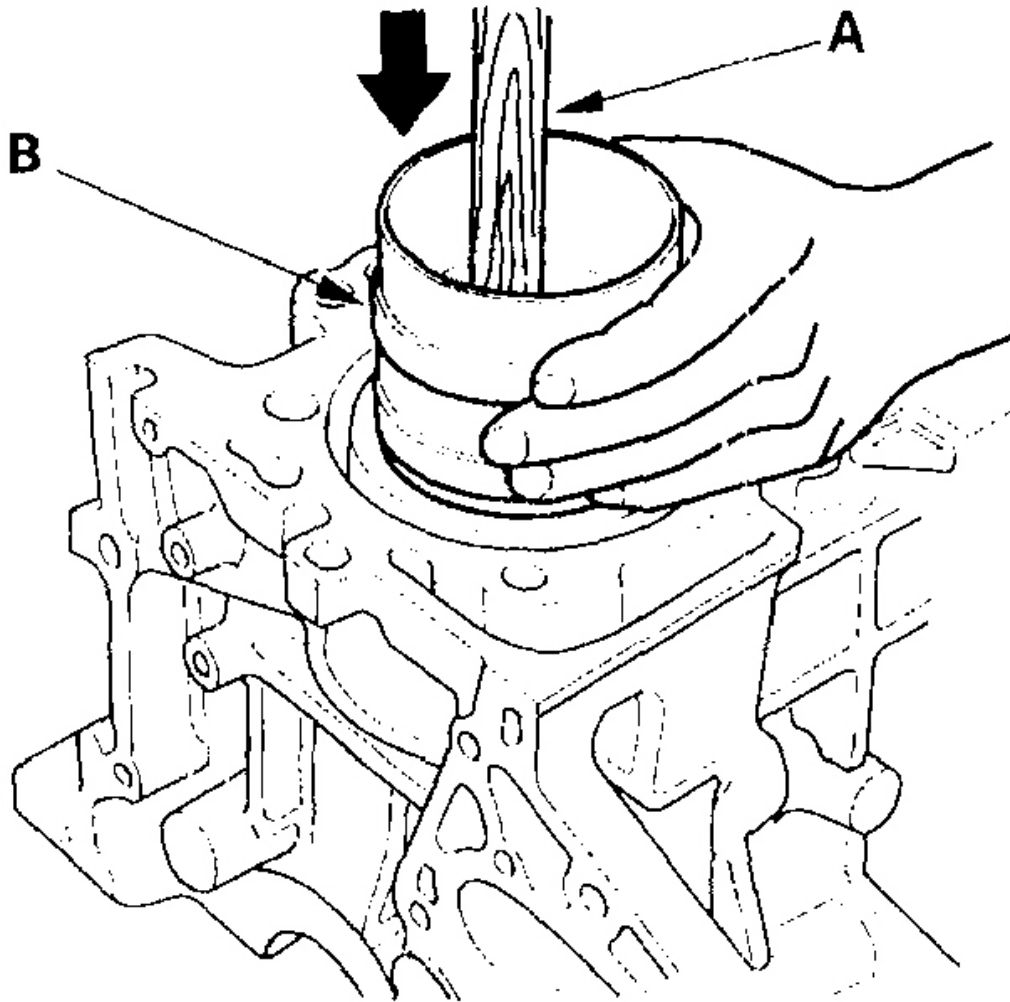


G01431587

Fig. 216: Positioning Arrow Facing Timing Chain Side Of Engine
Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. Position the piston in the cylinder, and tap it in using the wooden handle of a hammer (A). Maintain

downward force on the ring compressor (B) to prevent the rings from expanding before entering the cylinder bore.



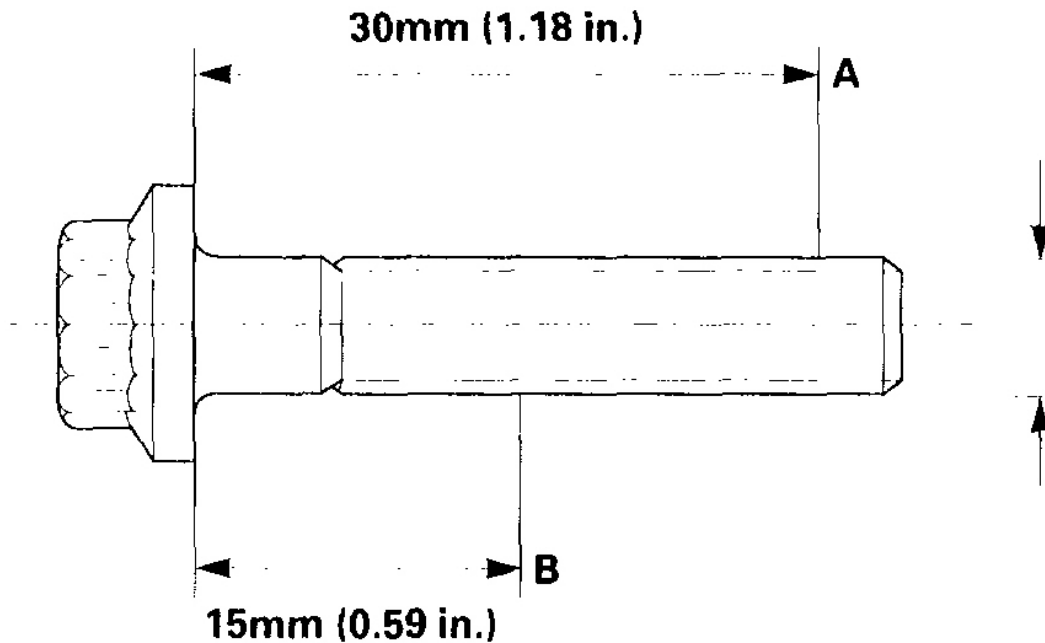
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Fig. 217: Positioning Piston In Cylinder & Tapping It Using Wooden Handle Of Hammer
Courtesy of AMERICAN HONDA MOTOR CO., INC.

4. Position all pistons at top dead center.

CONNECTING ROD BOLT INSPECTION

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



G01431589

Fig. 218: Measuring Diameter of Each Connecting Rod Bolt At Point A & Point B With Micrometer

Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

Point A - Point B = Difference in Diameter

Difference in Diameter

Specification: 0-0.05 mm (0-0.002 in.)

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

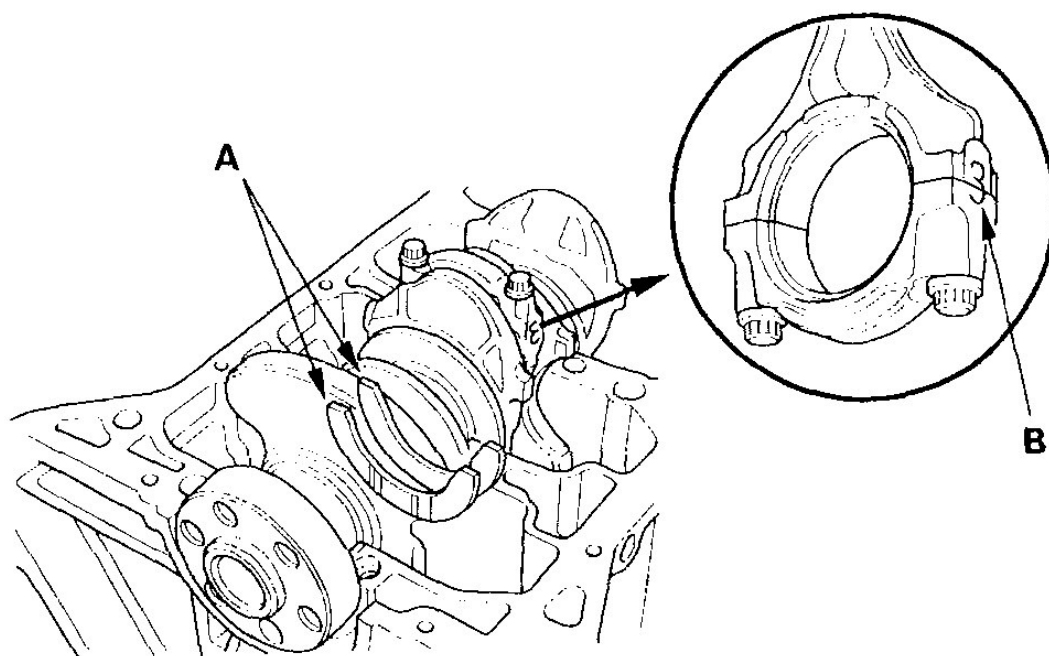
CRANKSHAFT INSTALLATION

Special Tools Required

- Driver 07749-0010000
- Oil seal driver attachment 96 07ZAD-PNA0100

1. Check the connecting rod bearing clearance with plastigage (see **Connecting Rod Bearing Replacement**).

2. Check the main bearing clearance with plastigage (see **Crankshaft Main Bearing Replacement**).
3. Inspect the connecting rod bolts (see **Connecting Rod Bolt Inspection**).
4. Install the bearing halves in the engine block and connecting rods.
5. Apply a coat of new engine oil to the main bearings and rod bearings.
6. Hold the crankshaft so rod journal No. 2 and rod journal No. 3 are straight up, and lower the crankshaft into the block.
7. Install the thrust washers (A) in the No. 4 journal of the cylinder block.



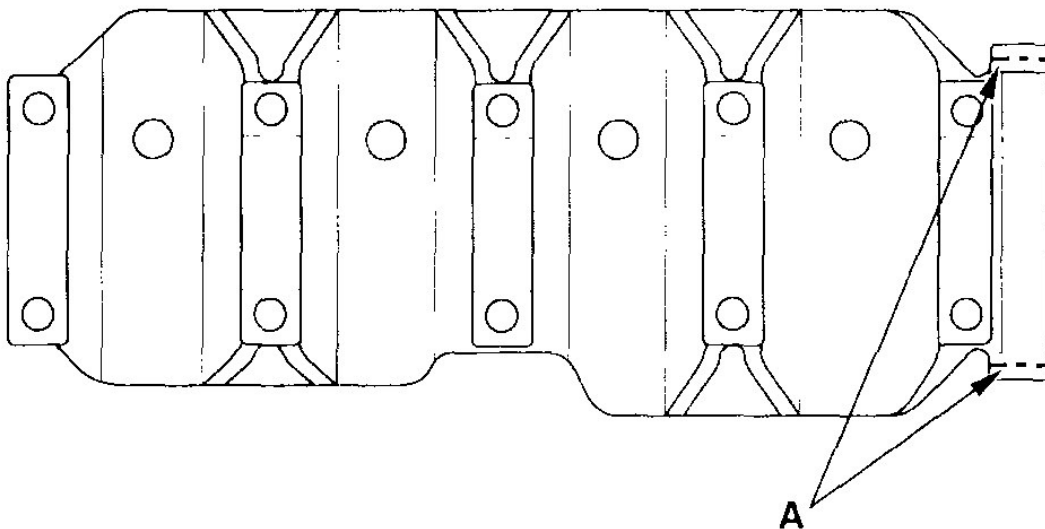
G01431590

Fig. 219: Installing Thrust Washers In No. 4 Journal Of Cylinder Block
Courtesy of AMERICAN HONDA MOTOR CO., INC.

8. Apply new engine oil to the threads and flange of the connecting rod bolts.
9. Seat the rod journals into connecting rod No. 1 and connecting rod No. 4. Line up the mark (B) on the connecting rod and cap, then install the caps and bolts finger-tight.
10. Rotate the crankshaft clockwise, and seat the journals into connecting rod No. 2 and connecting rod No. 3. Line up the mark on the connecting rod and cap, then install the caps and bolts finger-tight.
11. Tighten the connecting rod bolts to 9.8 N.m (1.0 kgf.m, 7.2 lbf.ft).
12. Tighten the connecting rod bolts an additional 90°.
13. Remove any old liquid gasket from the bearing cap bridge mating surfaces.
14. Clean and dry the bearing cap bridge mating surfaces.

15. Apply a 1.5 mm wide bead of the liquid gasket, P/N 08718-0009, along the broken lines (A).

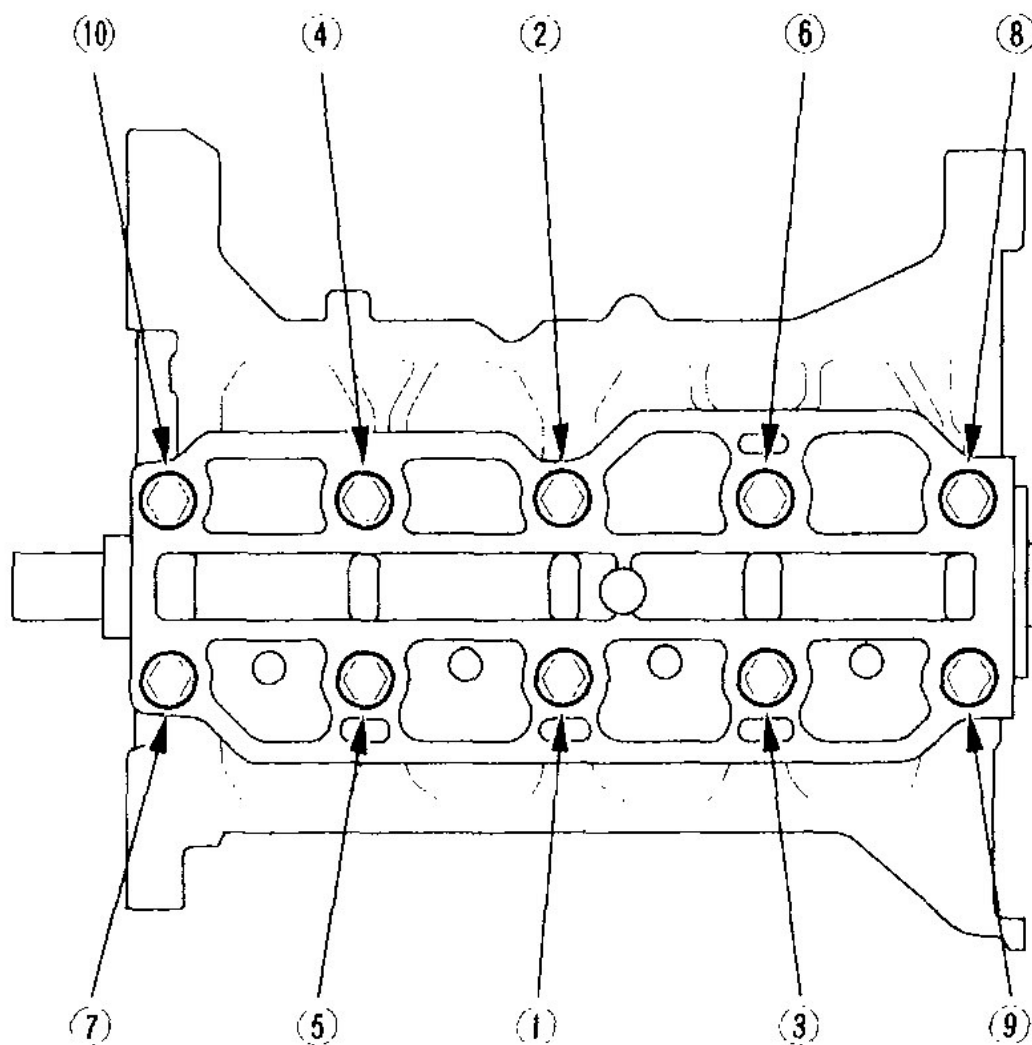
NOTE: Do not install the parts if 4 minutes or more have elapsed since applying liquid gasket. Instead, reapply liquid gasket after removing the old residue.



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Fig. 220: Applying Wide Bead Of Liquid Gasket Along Broken Lines
Courtesy of AMERICAN HONDA MOTOR CO., INC.

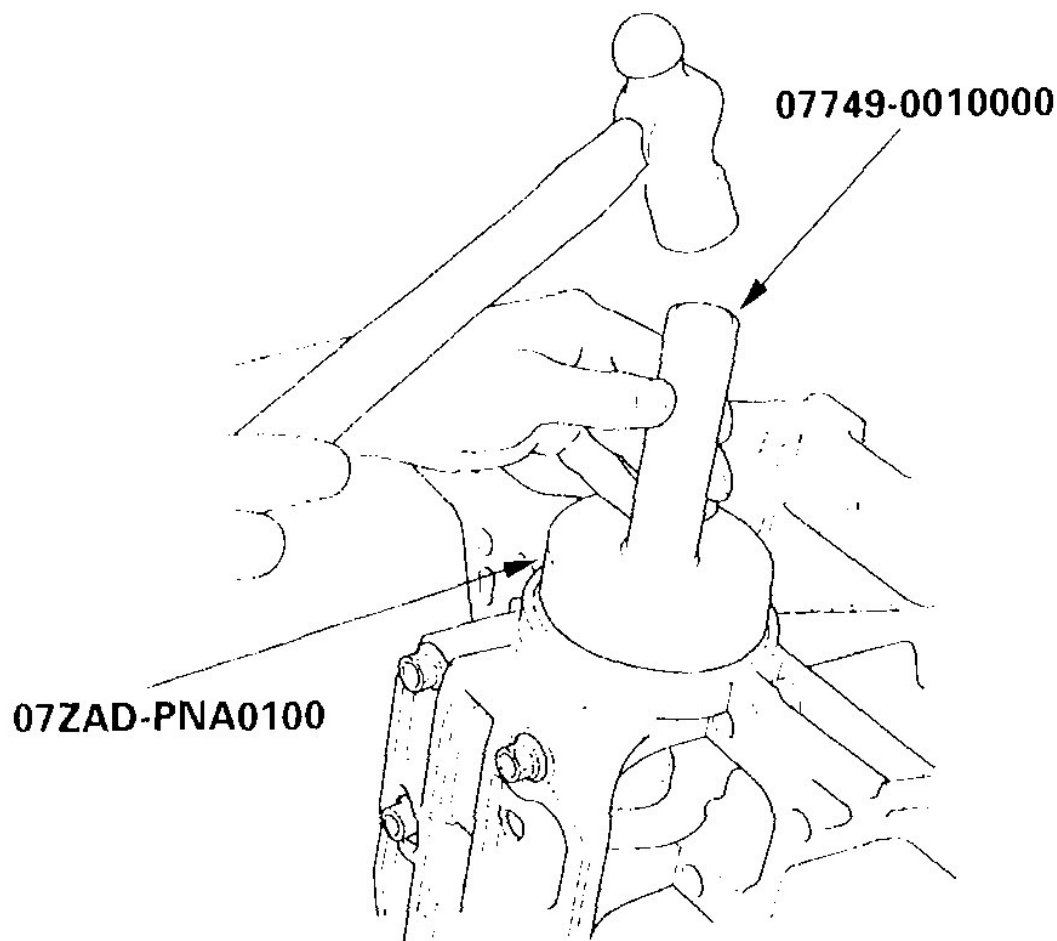
16. Put the bearing cap bridge on the engine block.
17. Apply new engine oil to the threads and flanges of the bearing cap bridge bolts.
18. Tighten the bearing cap bridge bolts in sequence to 25 N.m (2.5 kgf.m, 18 lbf.ft).



G01431592

Fig. 221: Tightening Bearing Cap Bridge Bolts In Sequence
Courtesy of AMERICAN HONDA MOTOR CO., INC.

19. Tighten the bearing cap bolts an additional 40°.
20. Clean the excess liquid gasket off the engine block.
21. Use the special tools to drive a new oil seal squarely into the block to the specified installed height.

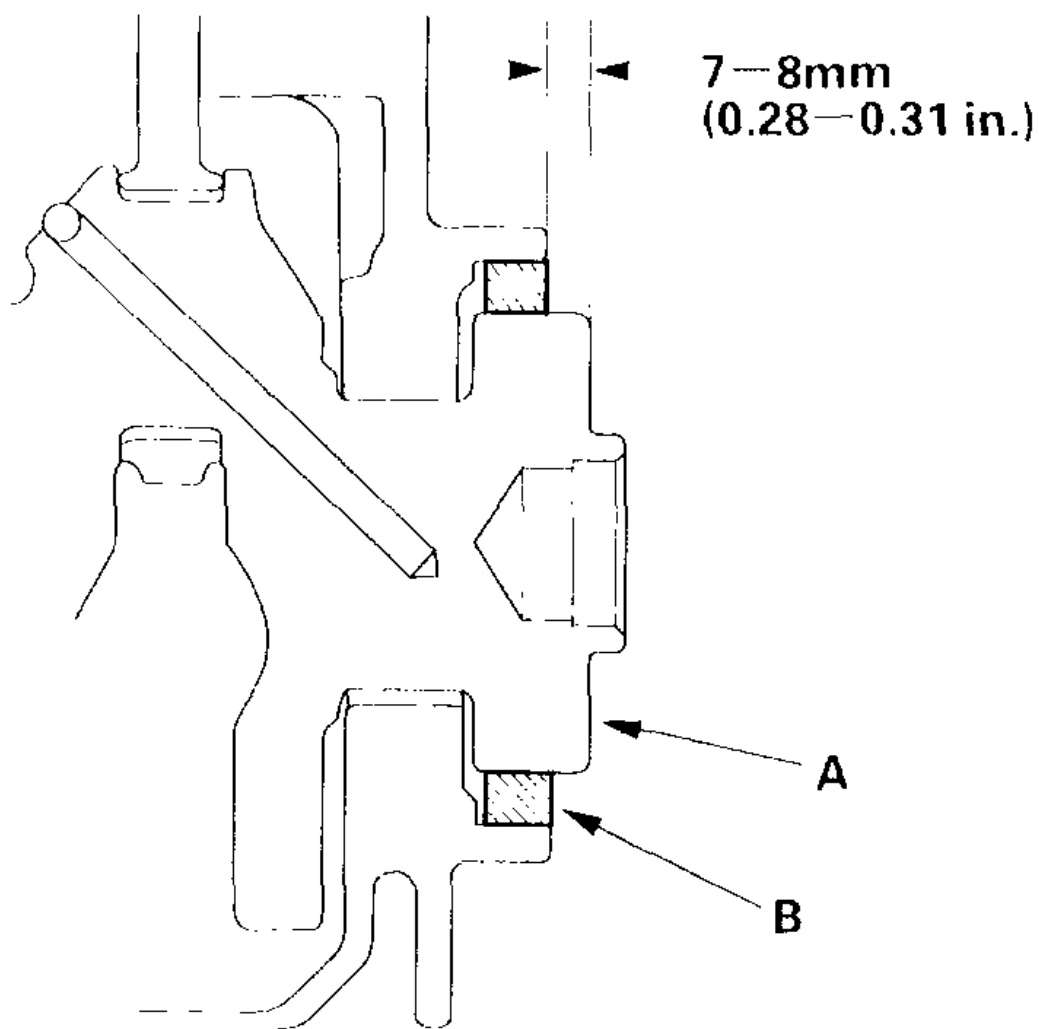


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Fig. 222: Using Special Tools To Drive New Oil Seal Squarely Into Block
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

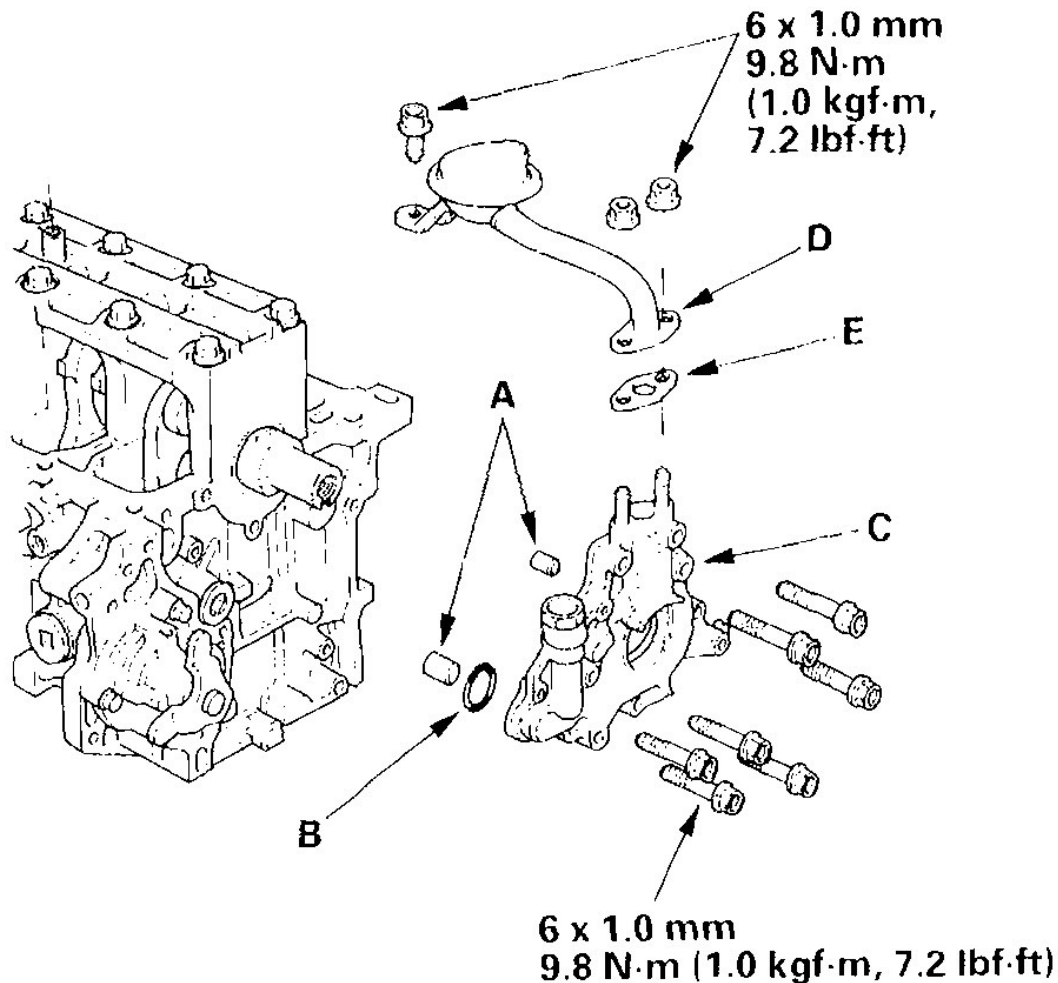
Oil Seal Installed Height: 7-8 mm (0.28-0.31 in.)



G01431594

Fig. 223: Measuring Distance Between Crankshaft & Oil Seal
Courtesy of AMERICAN HONDA MOTOR CO., INC.

23. Install the dowel pins (A) and new O-ring (B) on the oil pump (C), then align the inner rotor with the crankshaft, and install the oil pump.



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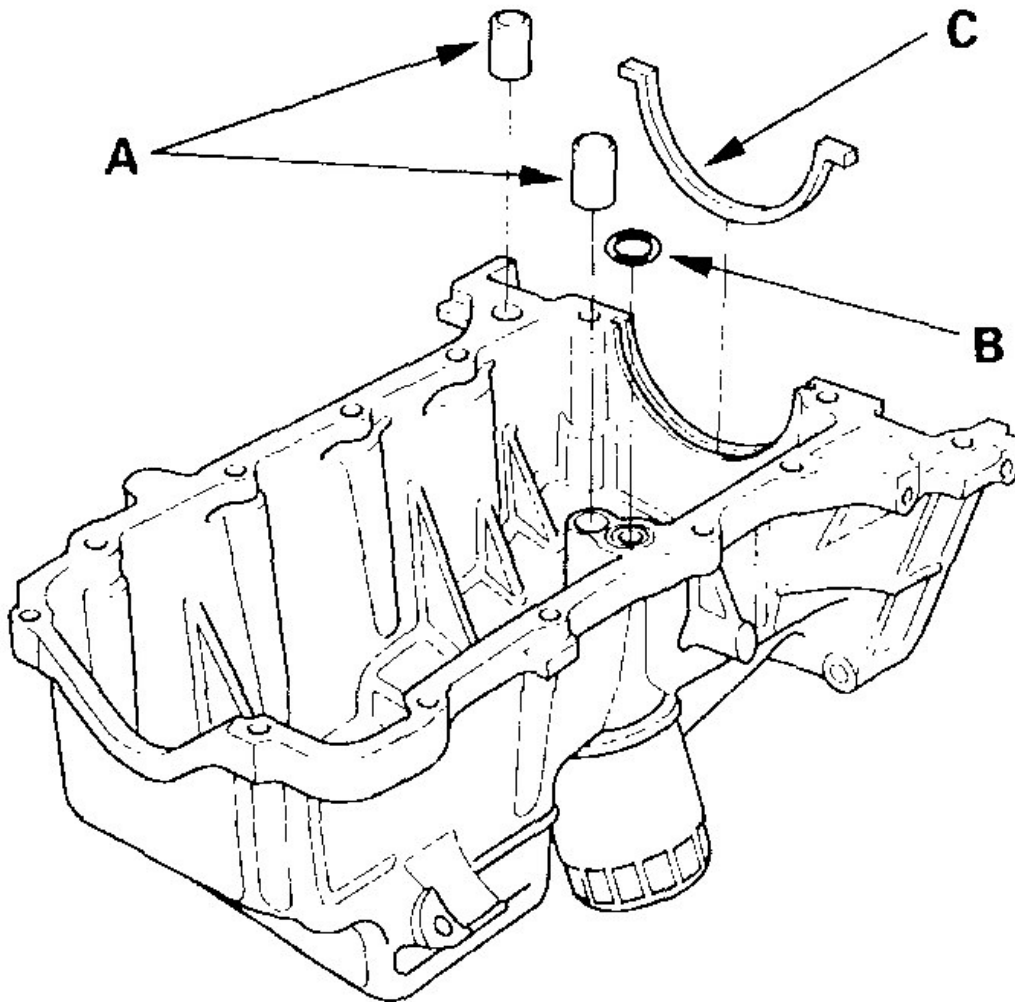
Fig. 224: Installing Dowel Pins

Courtesy of AMERICAN HONDA MOTOR CO., INC.

24. Install the oil screen (D) with new gasket (E).
25. Install the cylinder head (see **Cylinder Head Installation**).
26. Install the cam chain (see **Cam Chain Installation**).
27. Install the IMA motor (see **IMA MOTOR REMOVAL/INSTALLATION**).
28. Install the transmission
 - Manual transmission (see **TRANSMISSION INSTALLATION**).
 - CVT (see **TRANSMISSION INSTALLATION**).
29. Install the engine assembly (see **Engine Installation**).

OIL PAN INSTALLATION

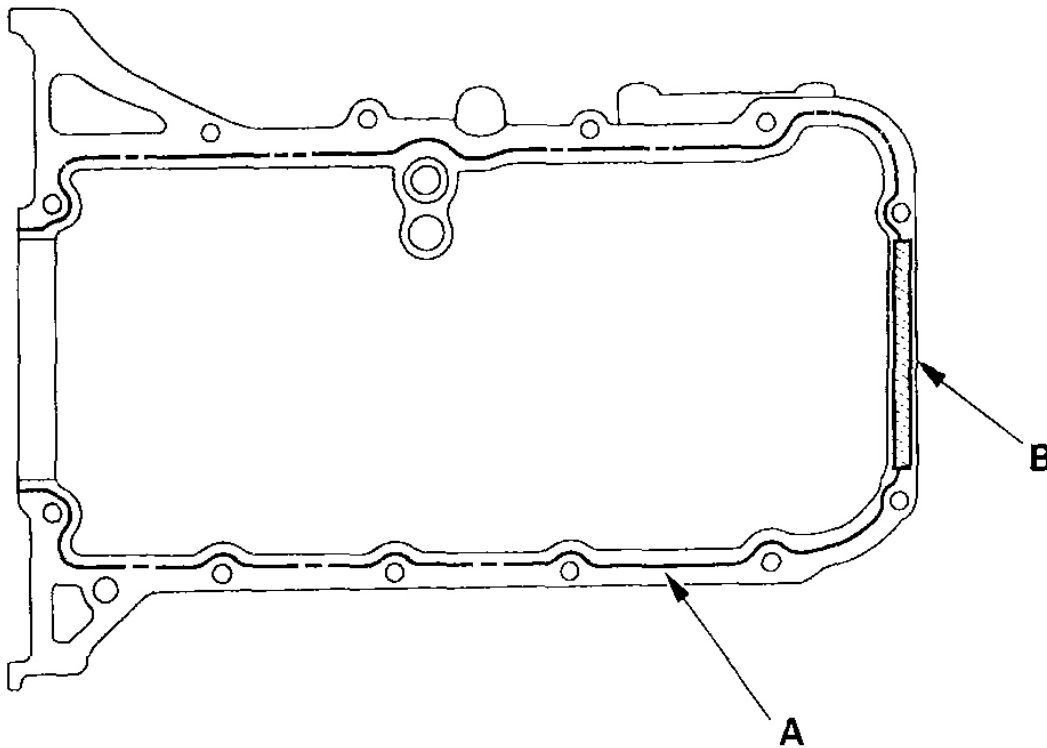
1. Remove any old liquid gasket from the oil pan mating surfaces, bolts, and bolt holes.
2. Clean and dry the oil pan mating surfaces and O-ring groove.
3. Install the dowel pins (A), and install the new O-ring (B) and oil pan gasket (C) on the oil pan.

**G01431596****Fig. 225: Installing Dowel Pins****Courtesy of AMERICAN HONDA MOTOR CO., INC.**

4. Apply liquid gasket, P/N 08718-0009, to the cylinder block mating surface of the oil pan and the inner threads of the holes.

NOTE:

- Apply a 1.5 mm wide bead of the liquid gasket along the broken line (A).
- Apply a 5.0 mm wide bead of the liquid gasket to the shaded area (B).
- Do not install the parts if 4 minutes or more have elapsed since applying liquid gasket. Instead, reapply liquid gasket after removing the old residue.



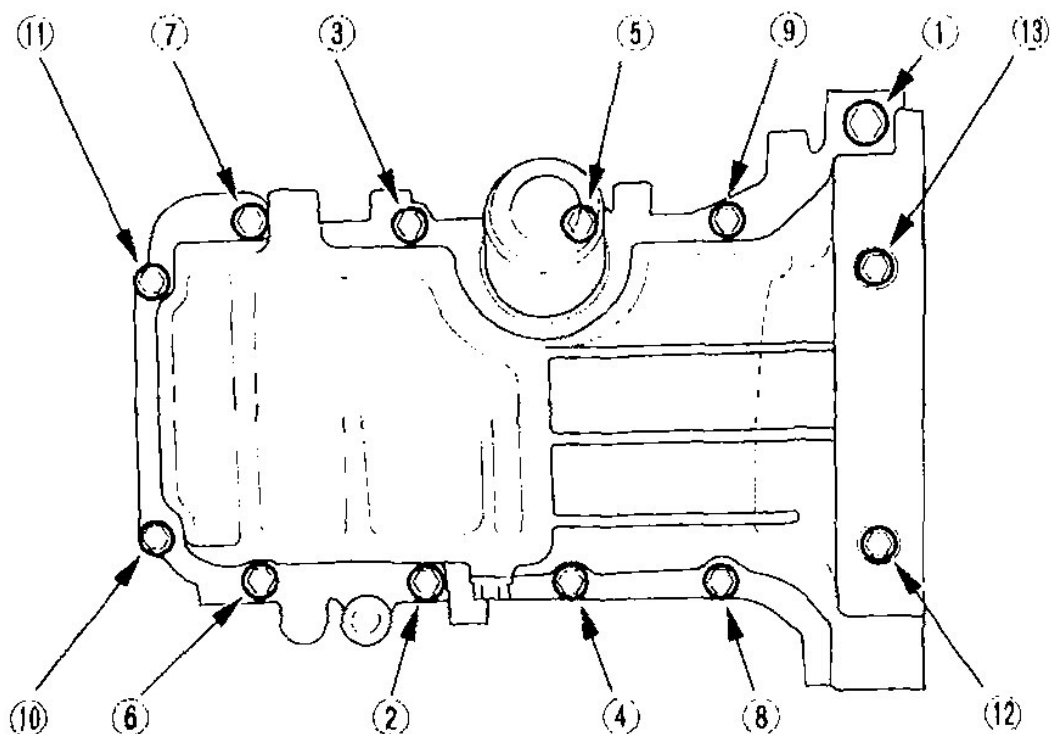
G01431597

Fig. 226: Applying Liquid Gasket To Cylinder Block Mating Surface Of Oil Pan
Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. Install the oil pan.
6. Tighten the bolts in two or three steps.

Specified torque

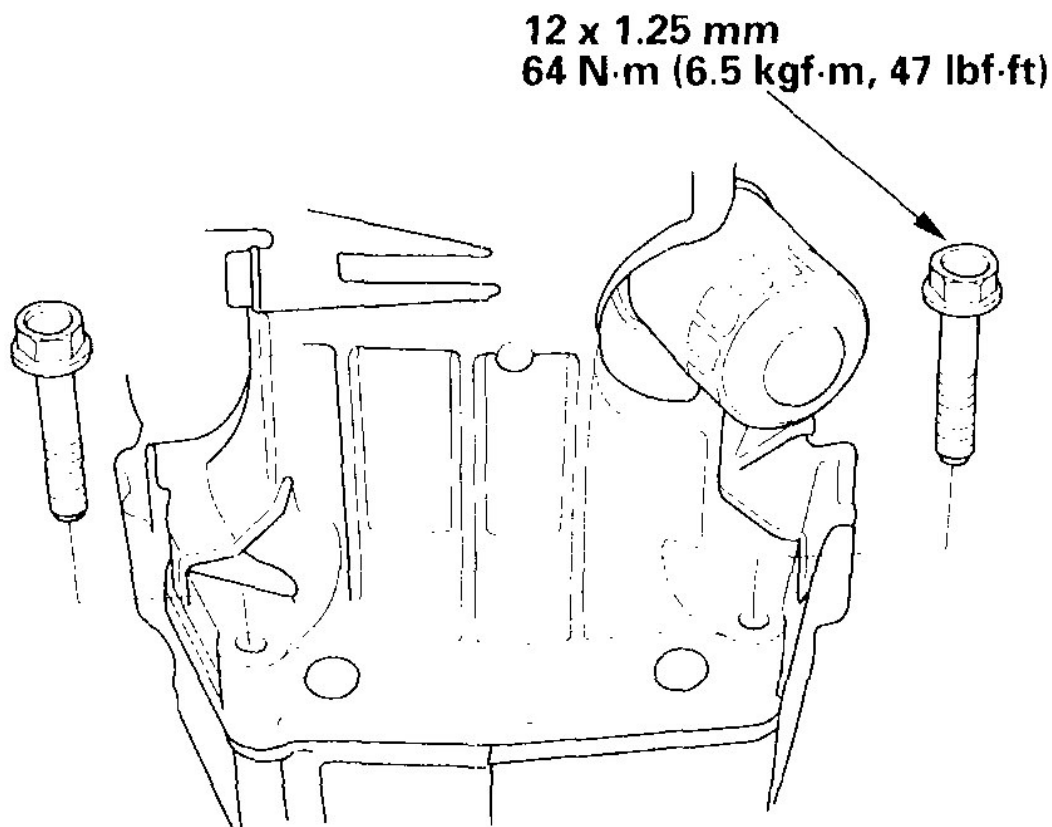
- i. 24 N.m (2.4 kgf.m, 17 lbf.ft)
- ii. 12 N.m (1.2 kgf.m, 8.7 lbf.ft)



G01431598

Fig. 227: Tightening Bolts In Two Or Three Steps
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

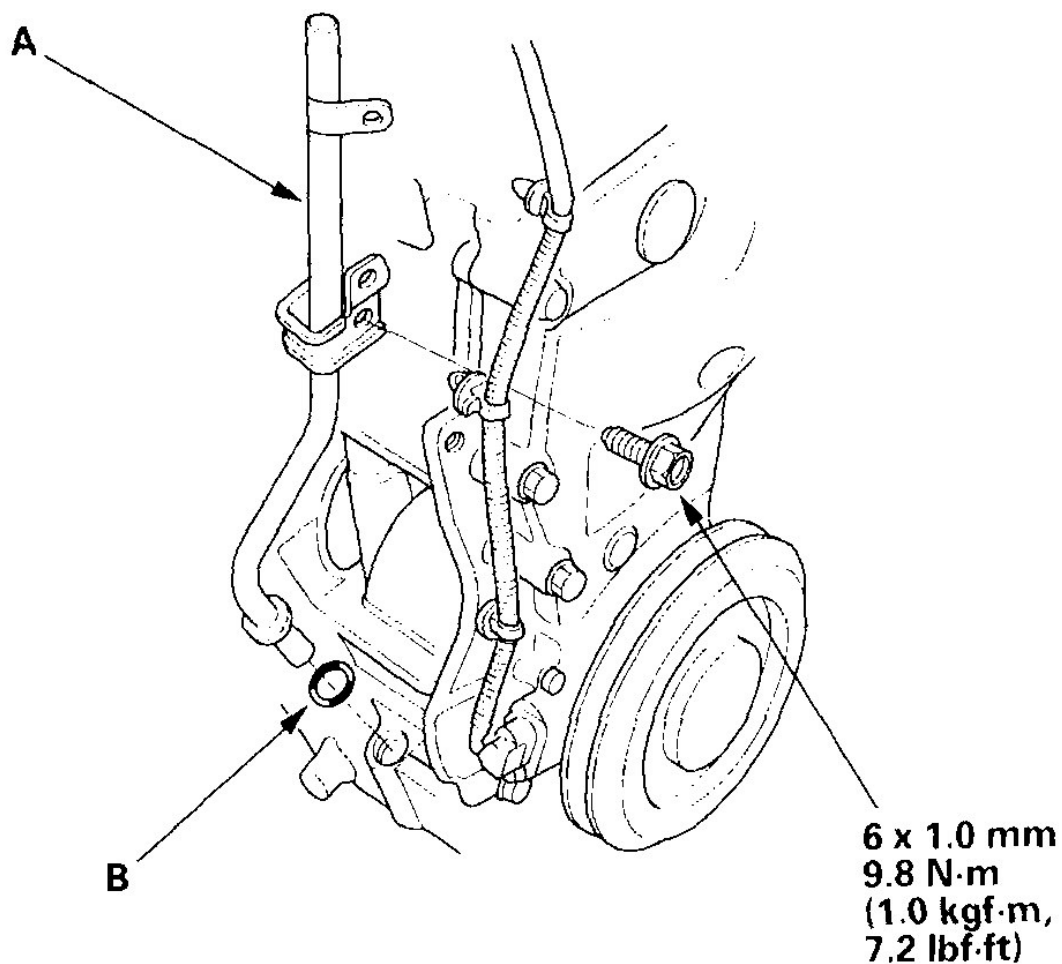
7. Tighten the two bolts securing the transmission.



G01431599

Fig. 228: Tightening Bolts Securing Transmission
Courtesy of AMERICAN HONDA MOTOR CO., INC.

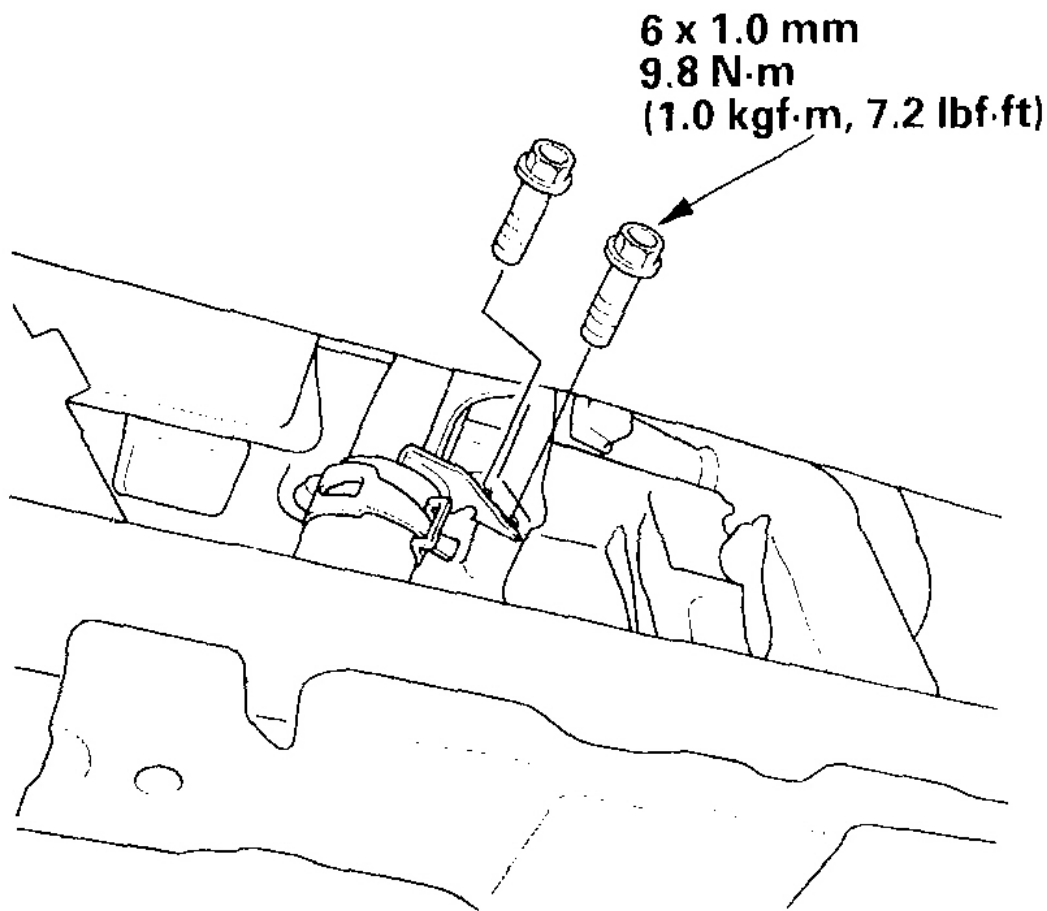
8. Install the dipstick tube (A) with new O-ring (B).



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Fig. 229: Installing Dipstick Tube With New O-Ring
Courtesy of AMERICAN HONDA MOTOR CO., INC.

9. Install the intermediate shaft bracket (see **INTERMEDIATE SHAFT**).
10. With the engine in the vehicle, install the lower radiator hose joint pipe to the oil pan.



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Fig. 230: Installing Lower Radiator Hose Joint Pipe To Oil Pan
Courtesy of AMERICAN HONDA MOTOR CO., INC.

11. With the engine in the vehicle, install the A/C compressor (see step 23 on **Engine Installation**).
12. With the engine in the vehicle, install the subframe.
 - 1 Install the subframe. Align the reference lines on the subframe with the bolt head center, then tighten the bolts (see step 5 on **Engine Installation**).
 - 2 Tighten the rear mount mounting bolts (see step 7 on **Engine Installation**).
 - 3 Tighten the front mount mounting bolt (see step 8 on **Engine Installation**).
 - 4 Install the automatic transmission fluid (ATF) cooler hoses (CVT) (see step 26 on **Engine Installation**).
 - 5 Connect the suspension lower arm ball joints (see **LOWER ARM**).
 - Except SULEV model: Install the NOx adsorptive three way catalytic converter (NOx adsorptive TWC); use new gaskets and new self locking nuts (see step 19 on **Engine Installation**).

- Except SULEV model: Connect the third heated oxygen sensor (third HO2S) connector (see step 20 on **Engine Installation**).
- **SULEV model:** Install the three way catalytic converter (TWC); use new gaskets and new self locking nuts (see step 21 on **Engine Installation**).
- **SULEV model:** Connect the secondary heated oxygen sensor (secondary HO2S) connector (see step 22 on **Engine Installation**).
- Install the splash shield and under cover (see step 27 on **Engine Installation**).

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

TRANSMISSION END CRANKSHAFT SEAL INSTALLATION-IN CAR

Special Tools Required

- Driver 07749-0010000
- Oil seal driver attachment 07ZAD-PNA0100

1. Clean and dry the crankshaft oil seal housing.
2. Use the special tools to drive a new oil seal squarely into the block to the specified installed height.

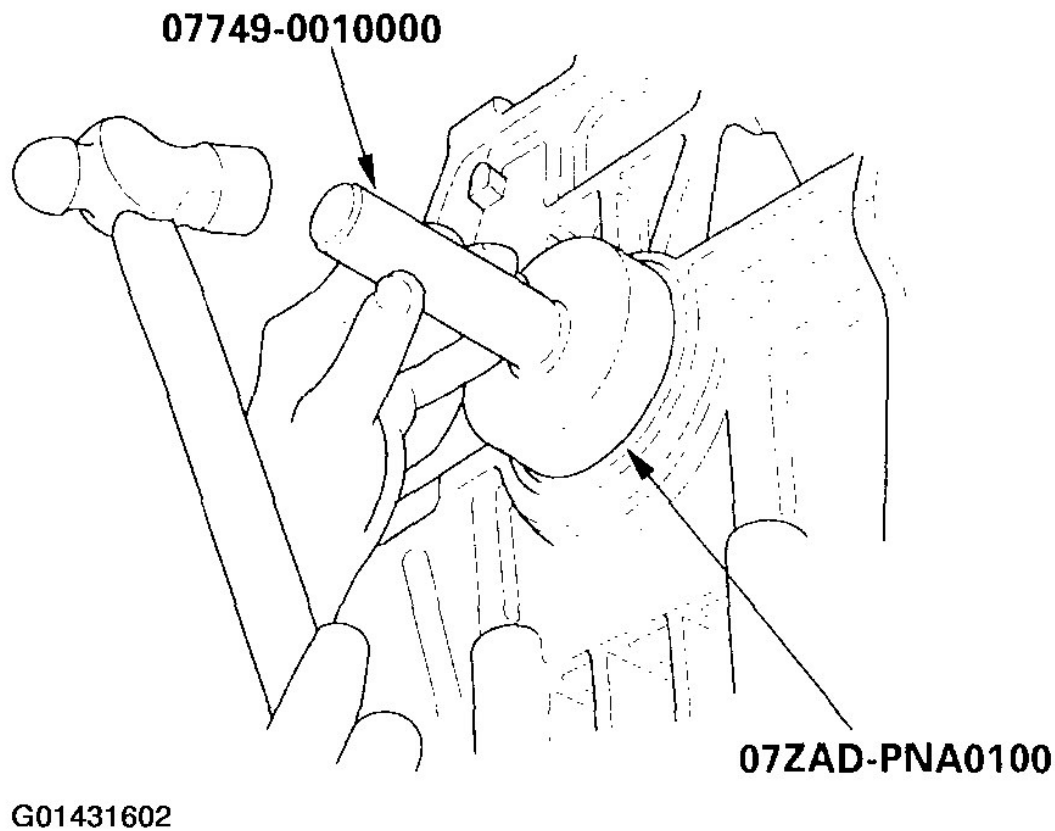
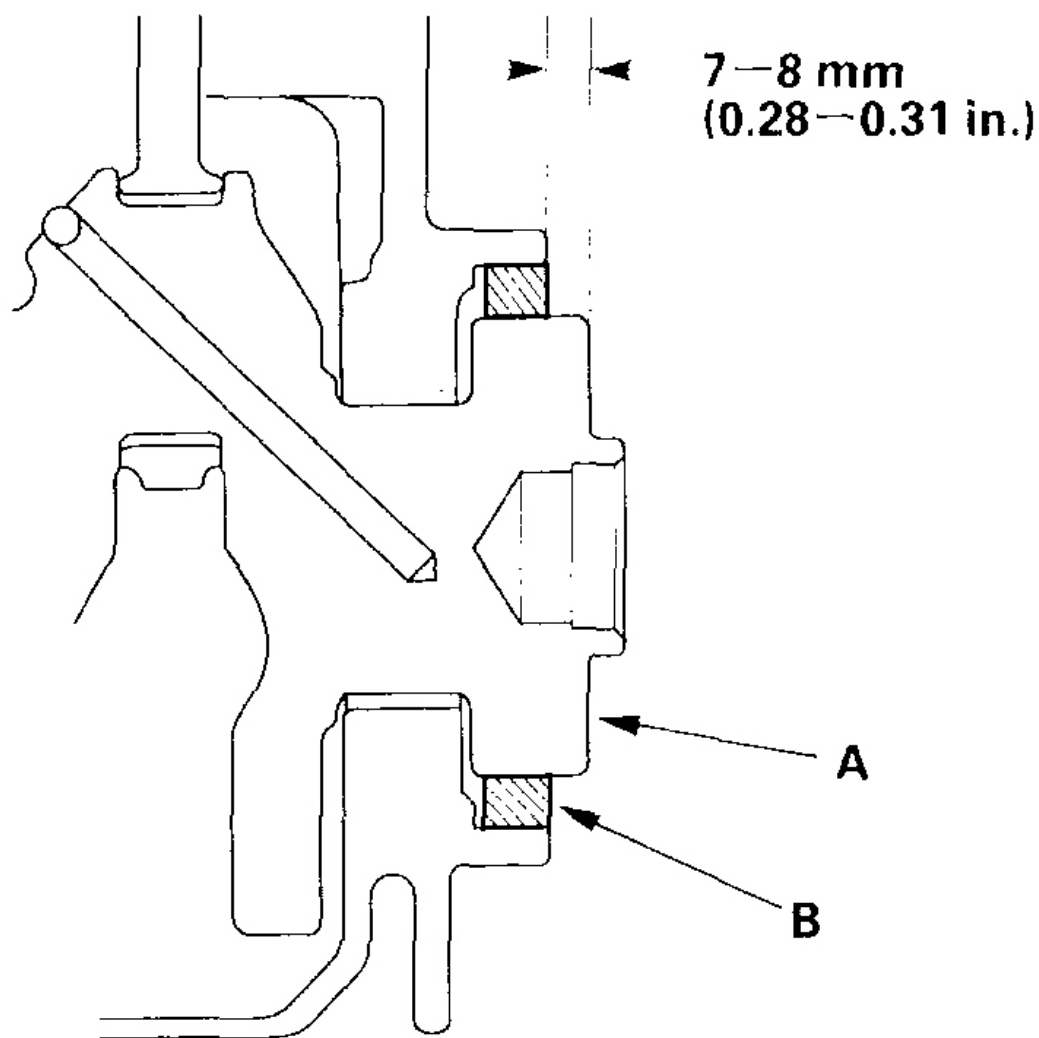


Fig. 231: Using Special Tools To Drive New Oil Seal Squarely Into Block
Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. Measure the distance between the crankshaft (A) and oil seal (B).

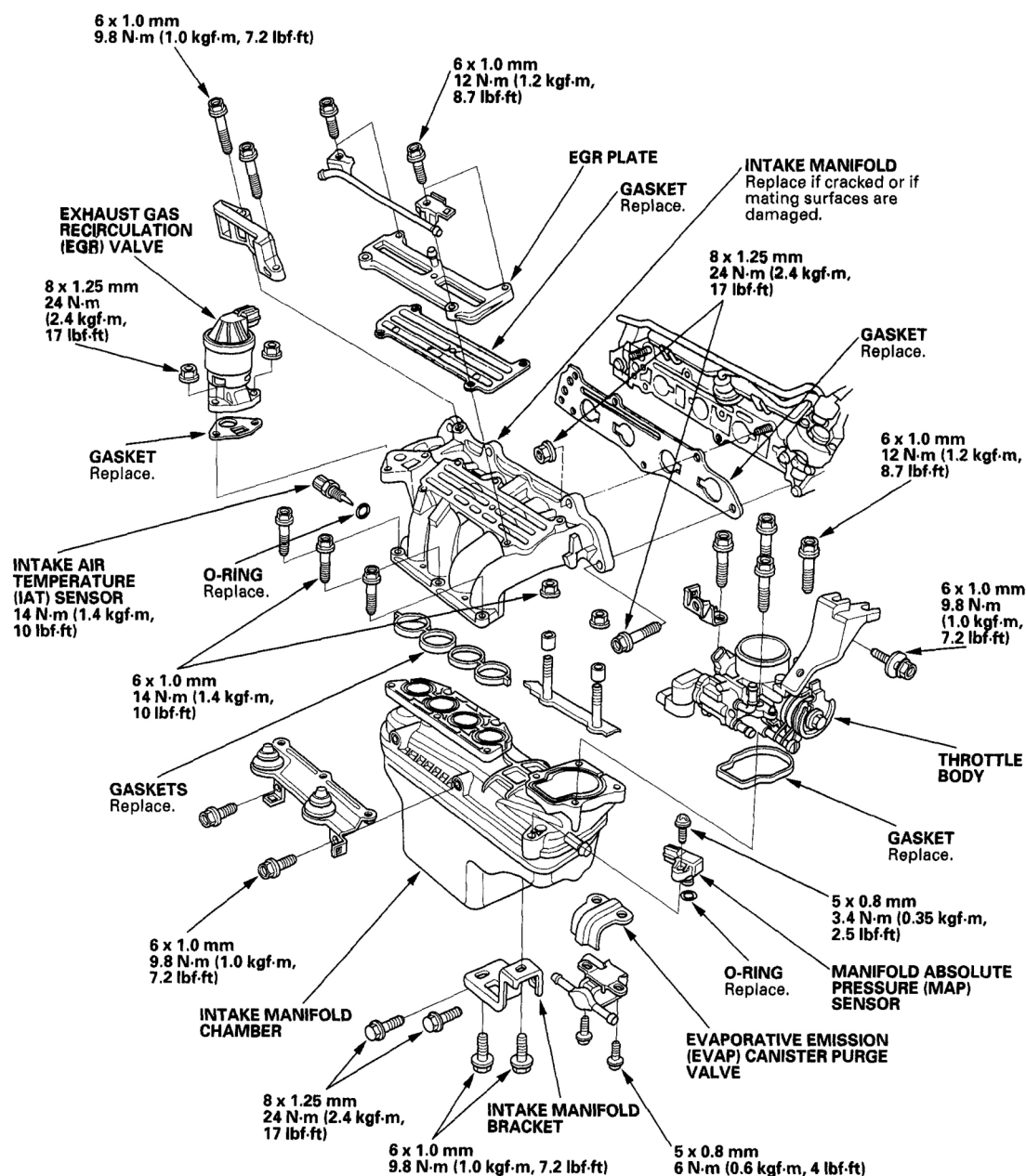
Oil Seal Installed Height: 7-8 mm (0.28-0.31 in.)



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Fig. 232: Measuring Distance Between Crankshaft & Oil Seal
Courtesy of AMERICAN HONDA MOTOR CO., INC.

INTAKE MANIFOLD REMOVAL AND INSTALLATION



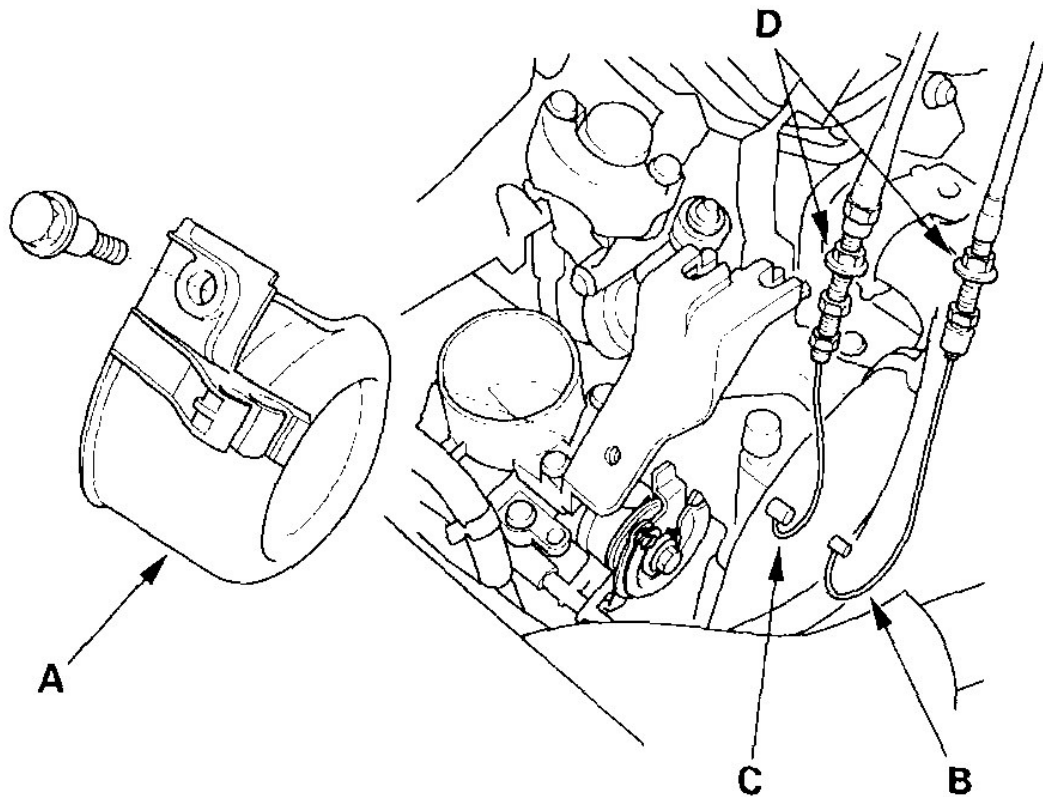
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Fig. 233: Exploded View Of Intake Manifold
Courtesy of AMERICAN HONDA MOTOR CO., INC.

REMOVAL

1. Remove the engine cover, then remove the resonator (see **RESONATOR REPLACEMENT**).
2. Remove the air cleaner housing (see **AIR CLEANER REMOVAL/INSTALLATION**).
3. Remove the throttle cover (A). Fully open the throttle link and cruise control link by hand, then remove the throttle cable (B) and cruise control actuator cable (C) from the links. Loosen the locknuts (D), and

remove the cables from the bracket.

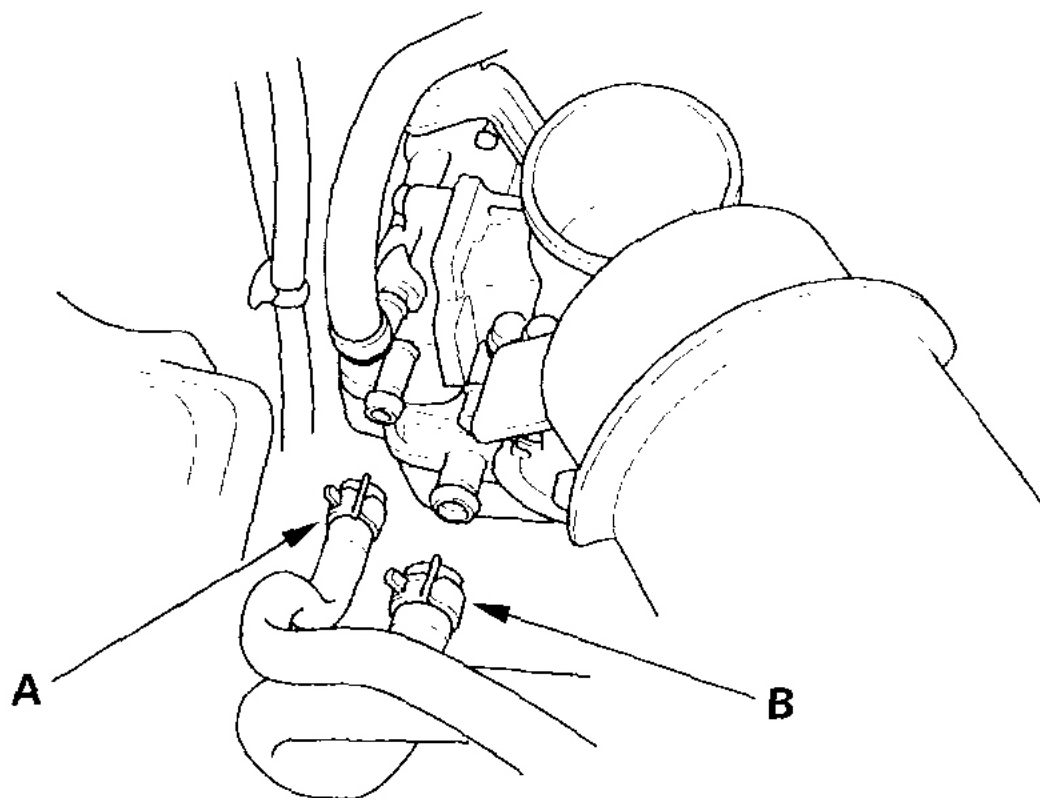


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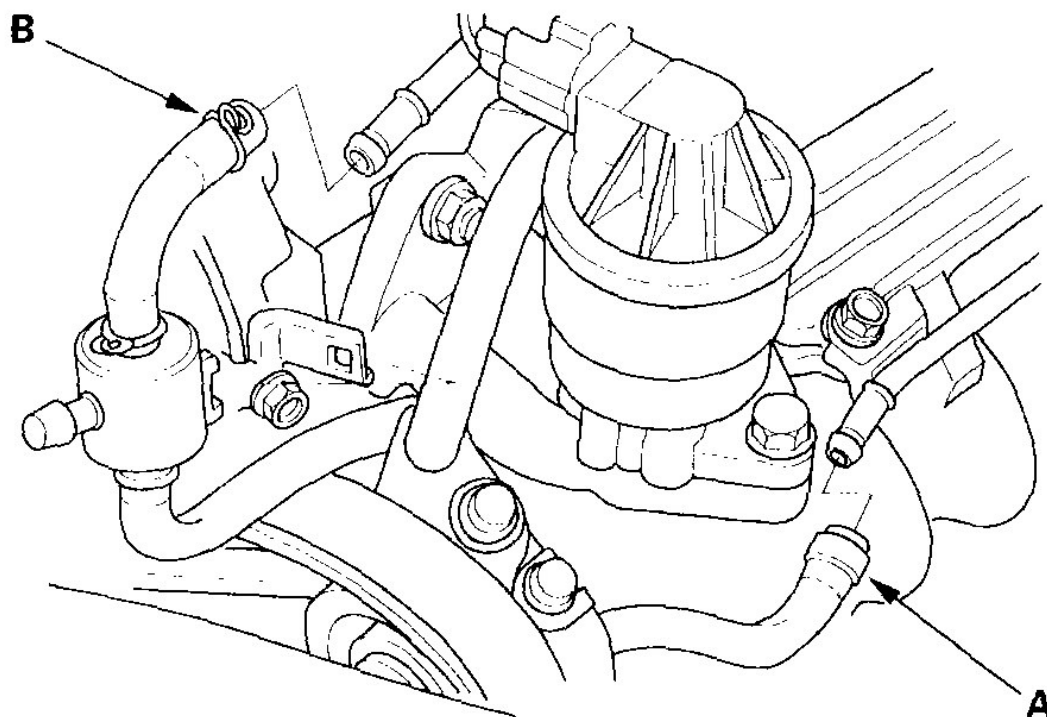
Fig. 234: Removing Throttle Cover

Courtesy of AMERICAN HONDA MOTOR CO., INC.

4. Remove the water bypass hose (A), then plug the water bypass hose.

**G01459954****Fig. 235: Removing Water Bypass Hose****Courtesy of AMERICAN HONDA MOTOR CO., INC.**

5. Remove the brake booster vacuum hose (B).
6. Remove the water bypass hose (A), then plug the water bypass hose.



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Fig. 236: Removing Water Bypass Hose & Plugging Water Bypass Hose
Courtesy of AMERICAN HONDA MOTOR CO., INC.

7. Remove the evaporative emission (EVAP) canister hose (B).
8. Disconnect the intake manifold subharness connector (A), and remove the positive crankcase ventilation (PCV) hose (B) and ground cable (C).

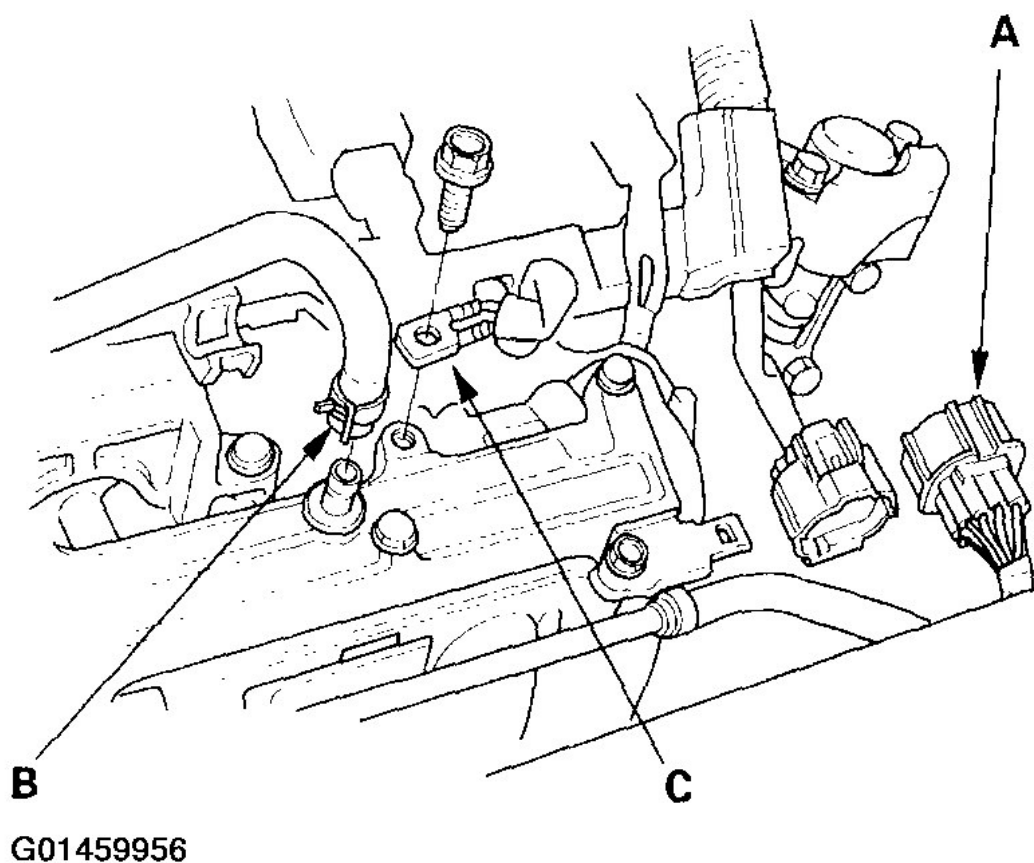
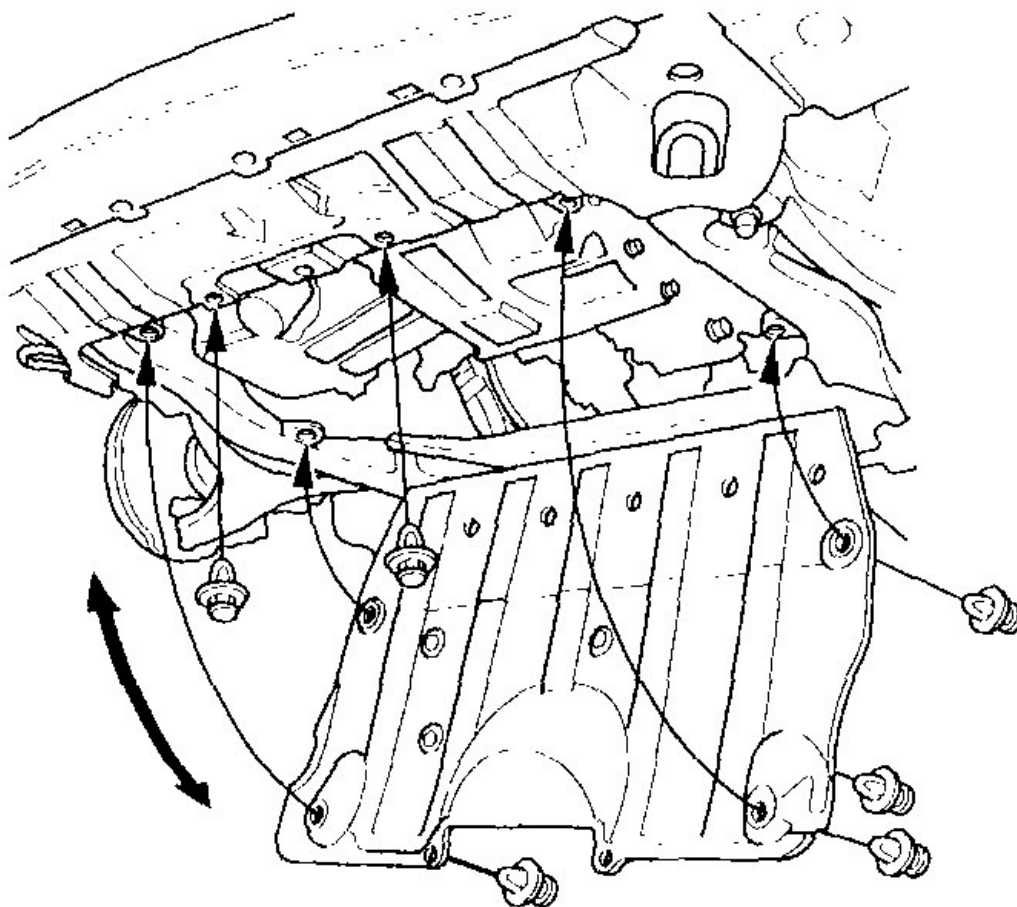


Fig. 237: Disconnecting Intake Manifold Subharness Connector
Courtesy of AMERICAN HONDA MOTOR CO., INC.

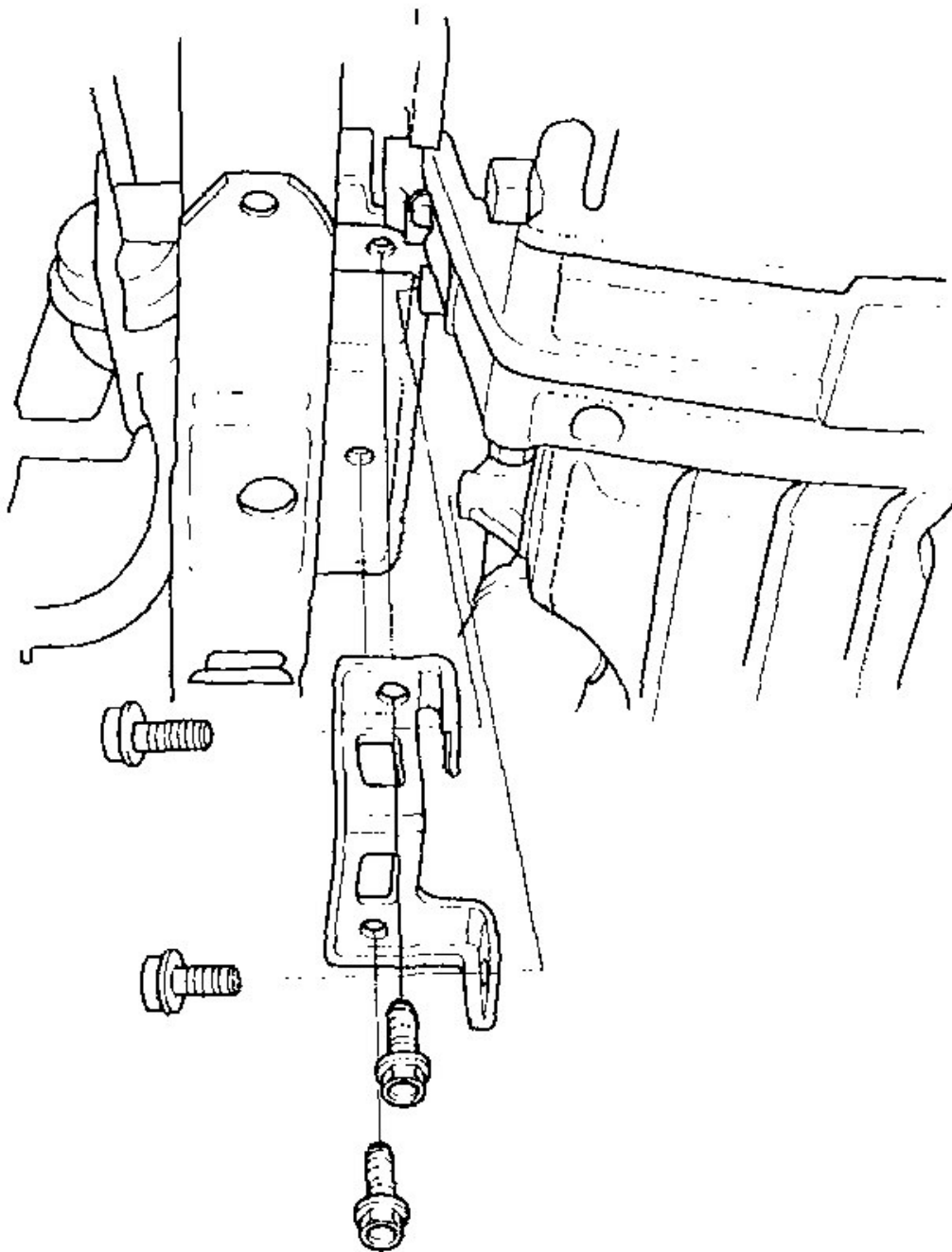
9. Disconnect the exhaust gas recirculation (EGR) valve connector.
10. Remove the six clips securing the under-cover, then open the under-cover.



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Fig. 238: Removing Clips Securing Under-Cover
Courtesy of AMERICAN HONDA MOTOR CO., INC.

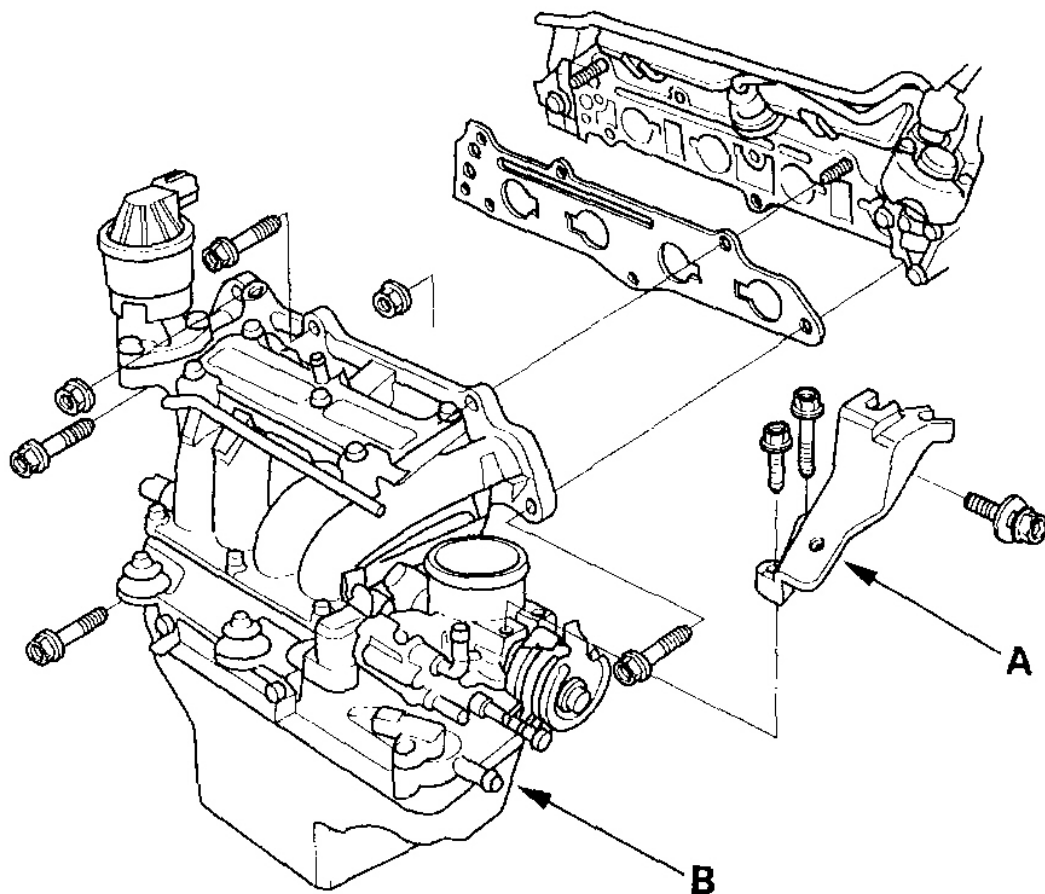
11. Remove the intake manifold bracket.



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Fig. 239: Removing Intake Manifold Bracket
Courtesy of AMERICAN HONDA MOTOR CO., INC.

12. Remove the throttle cable bracket (A), then remove the intake manifold (B).

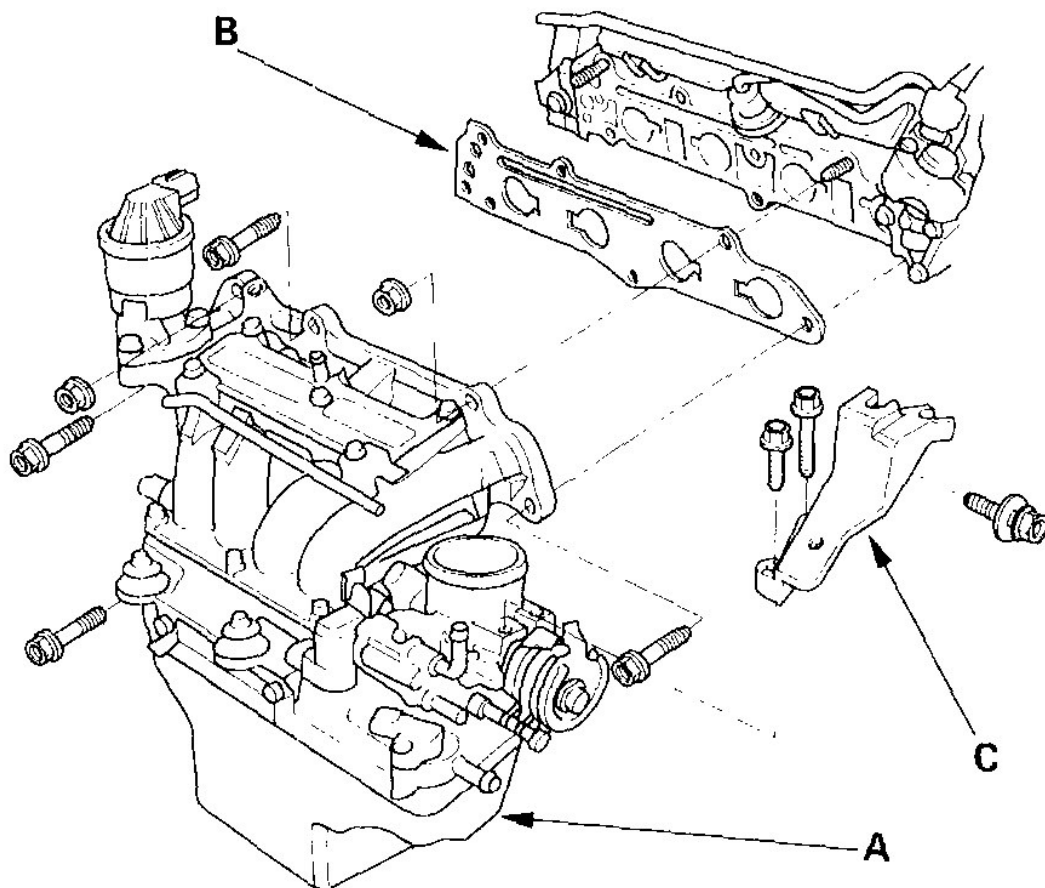


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Fig. 240: Removing Throttle Cable Bracket
Courtesy of AMERICAN HONDA MOTOR CO., INC.

INSTALLATION

1. Install the intake manifold (A) and tighten the bolts/ nuts in a crisscross pattern in two or three steps, beginning with the inner bolt. Use a new gasket (B).

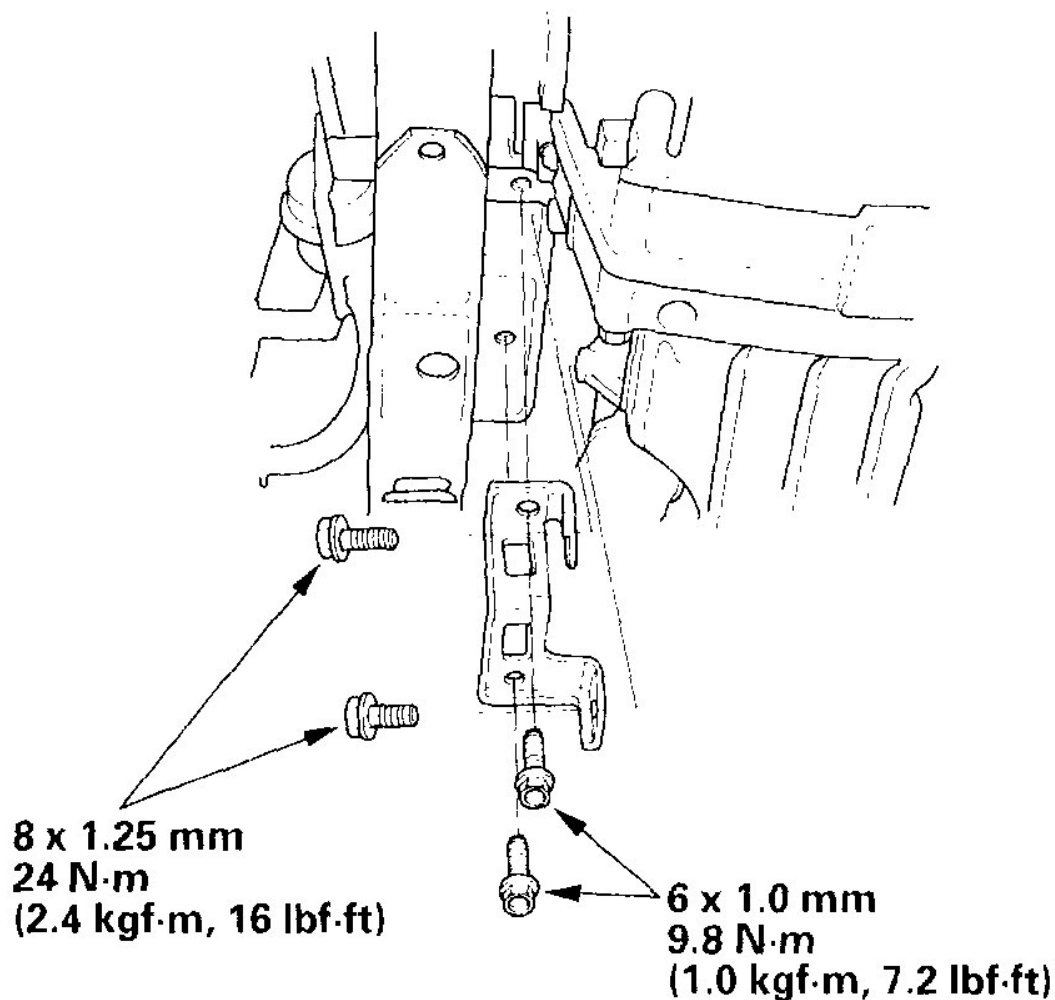


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Fig. 241: Installing Intake Manifold

Courtesy of AMERICAN HONDA MOTOR CO., INC.

2. Install the throttle cable bracket (C).
3. Install the intake manifold bracket.

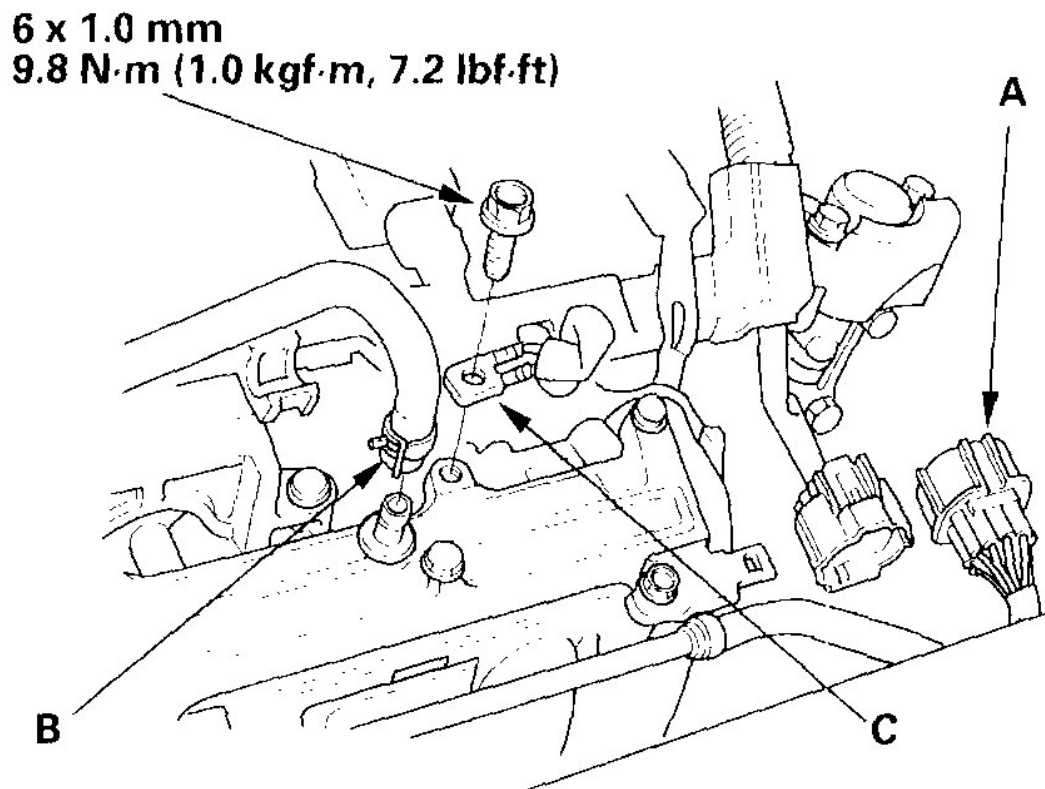


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Fig. 242: Installing Intake Manifold Bracket

Courtesy of AMERICAN HONDA MOTOR CO., INC.

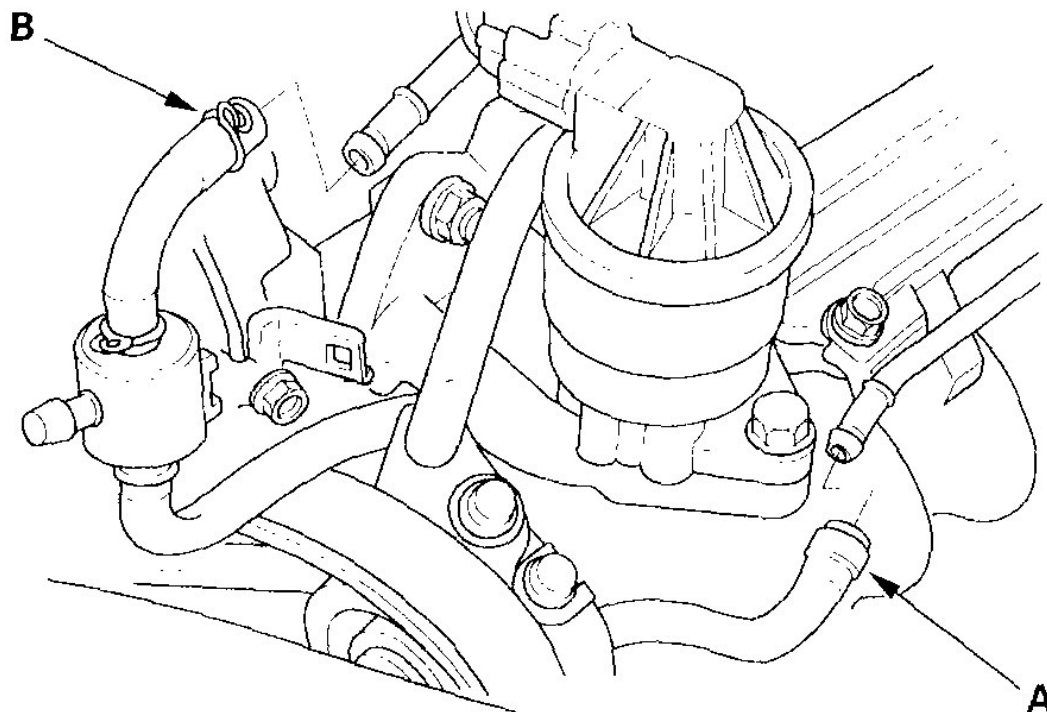
4. Install the under-cover.
5. Connect the intake manifold subharness connector (A), and install the positive crankcase ventilation (PCV) hose (B) and ground cable (C).



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Fig. 243: Connecting Intake Manifold Subharness Connector
Courtesy of AMERICAN HONDA MOTOR CO., INC.

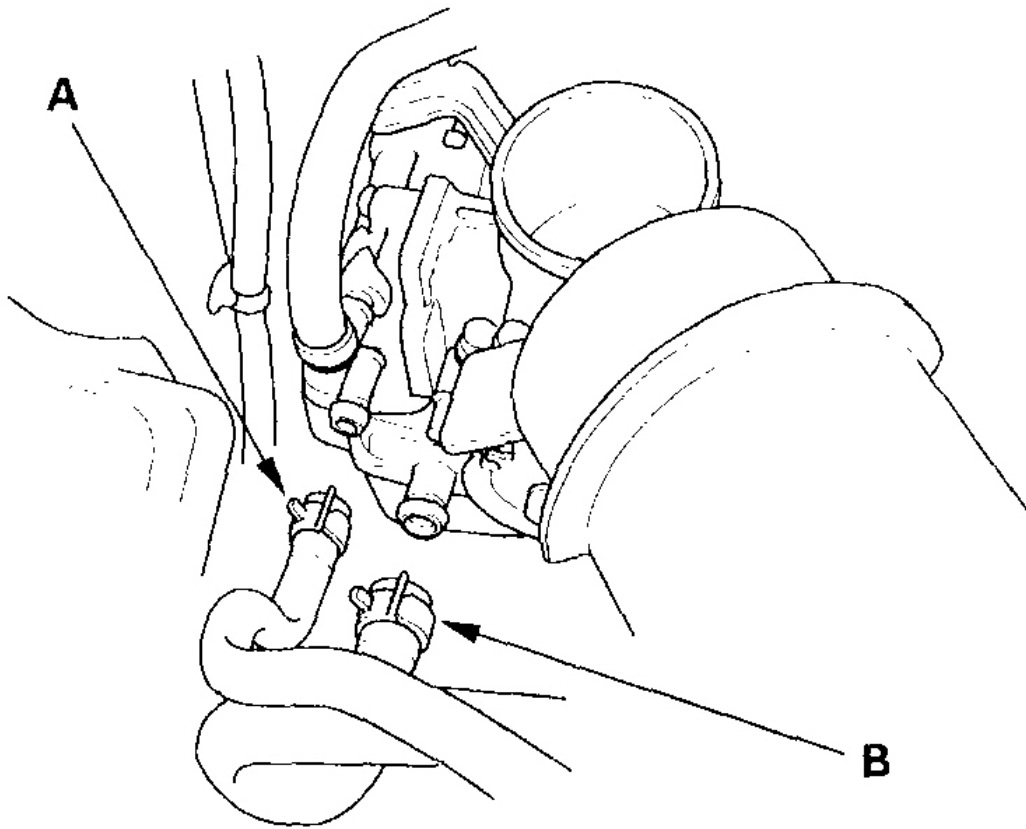
6. Connect the exhaust gas recirculation (EGR) valve connector.
7. Install the water bypass hose (A) and evaporative emission (EVAP) canister hose (B).



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Fig. 244: Installing Water Bypass Hose & EVAP Canister Hose
Courtesy of AMERICAN HONDA MOTOR CO., INC.

8. Install the water bypass hose (A) and brake booster vacuum hose (B).



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Fig. 245: Installing Water Bypass Hose & Brake Booster Vacuum Hose
Courtesy of AMERICAN HONDA MOTOR CO., INC.

9. Install the throttle cable (see **THROTTLE CABLE REMOVAL/INSTALLATION**), then adjust the cable (see **THROTTLE CABLE ADJUSTMENT**).
10. Install the cruise control actuator cable (see **CRUISE CONTROL ACTUATOR/CABLE REPLACEMENT**), then adjust the cable (see **CRUISE CONTROL ACTUATOR CABLE ADJUSTMENT**).
11. Install the air cleaner housing (see **AIR CLEANER REMOVAL/INSTALLATION**).
12. Install the resonator, then install the engine cover (see **RESONATOR REPLACEMENT**).
13. After installation, check that all tubes, hoses and connectors are installed correctly.
14. If the engine coolant was drained, refill the radiator with engine coolant, and bleed air from the cooling system with the heater valve open (see **COOLANT REPLACEMENT**).

EXHAUST MANIFOLD REMOVAL AND INSTALLATION

1. **Except SULEV model:** Disconnect the air/fuel ratio (A/F) sensor connector and secondary heated oxygen sensor (secondary HO2S) connector.
2. **SULEV model:** Disconnect the air/fuel ratio (A/F) sensor connector.
3. Remove the cover and exhaust manifold bracket, then remove the exhaust manifold/three way catalytic converter (TWC) assembly.

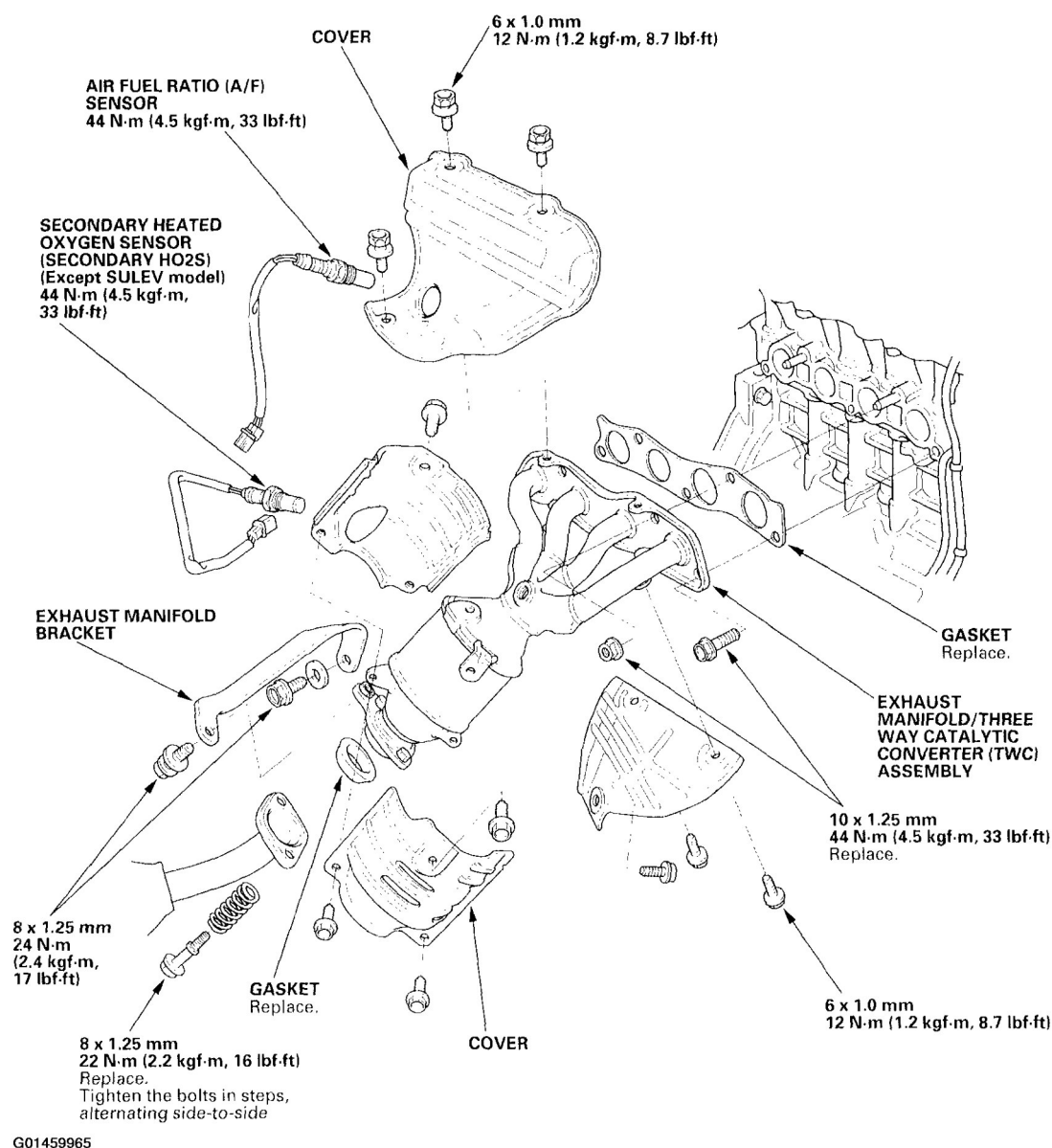


Fig. 246: Removing Cover & Exhaust Manifold Bracket
Courtesy of AMERICAN HONDA MOTOR CO., INC.

4. Install the exhaust manifold/TWC assembly and tighten the bolts/nuts in a crisscross pattern in two or three steps, beginning with the inner bolt

5. Install the other parts in the reverse order of removal.