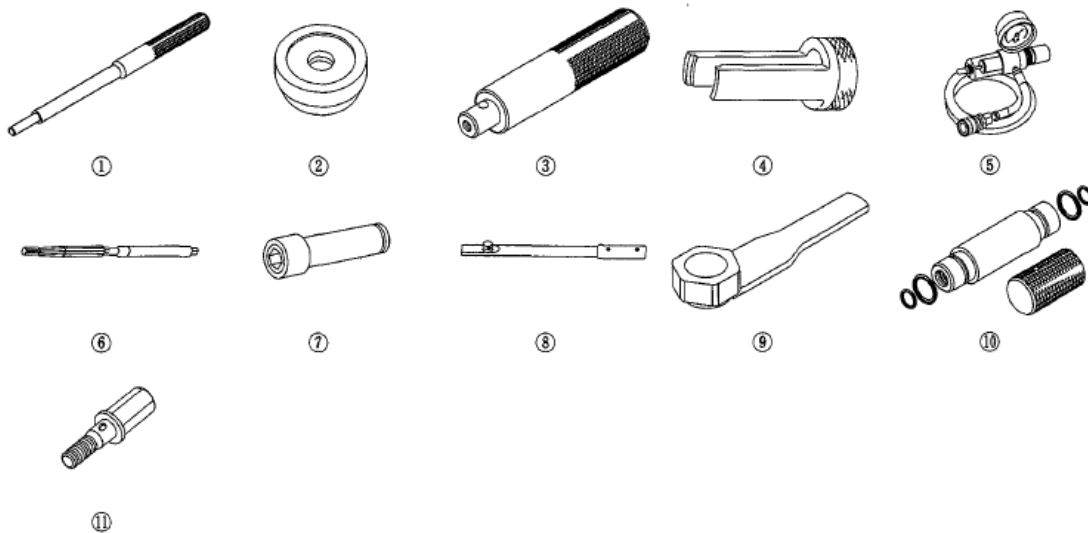


## 2010-11 ENGINE

### Cylinder Head - Insight

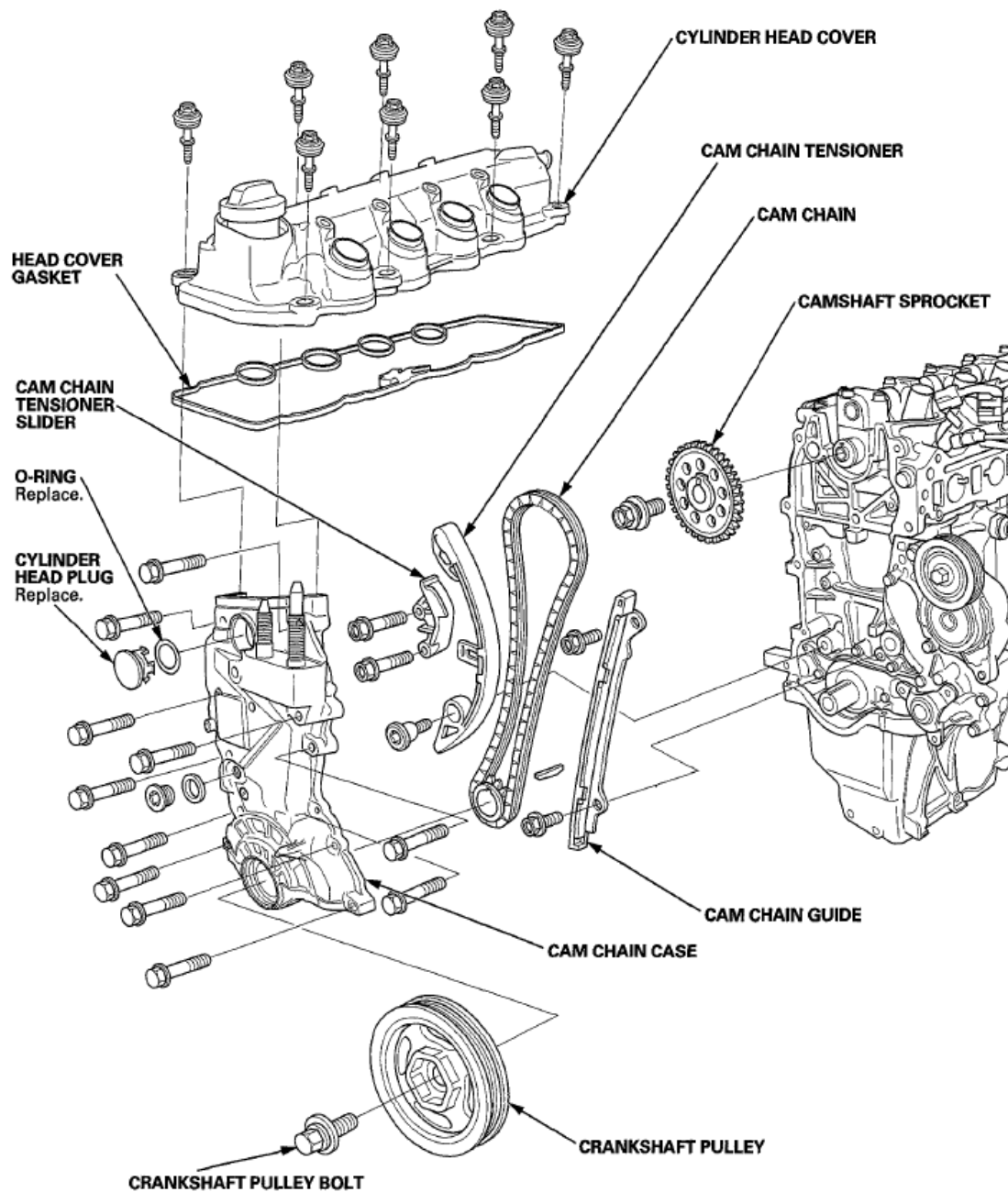
## SPECIAL TOOLS

Ref.No.	Tool Number	Description	Qty
①	07742-0010100	Valve Guide Driver, 5.35 x 9.7	1
②	07746-0010400	Attachment, 52 x 55 mm	1
③	07749-0010000	Driver Handle, 15 x 135L	1
④	07757-PJ1010A	Valve Spring Compressor Attachment	1
⑤	07AAJ-PNAA101	Air Pressure Regulator	1
⑥	07HAH-PJ7A100	Valve Guide Reamer, 5.5 mm	1
⑦	07JAA-001020A	Socket, 19 mm	1
⑧	07JAB-001020A	Holder Handle	1
⑨	07NAB-001040A	Holder Attachment, 50 mm	1
⑩	07PAD-0010000	Stem Seal Driver, 30	1
⑪	07VAJ-P8A010A	VTEC Air Adapter	1

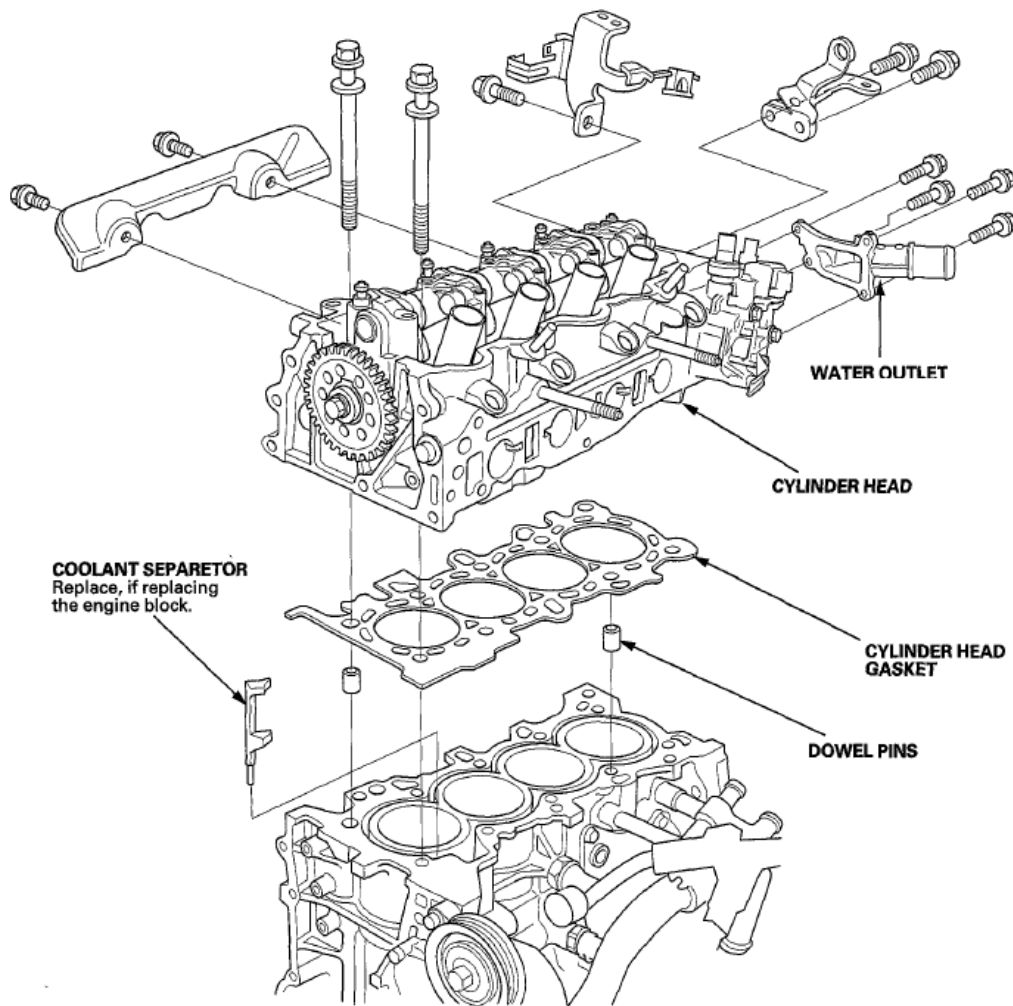


**Fig. 1: Identifying Special Tools**

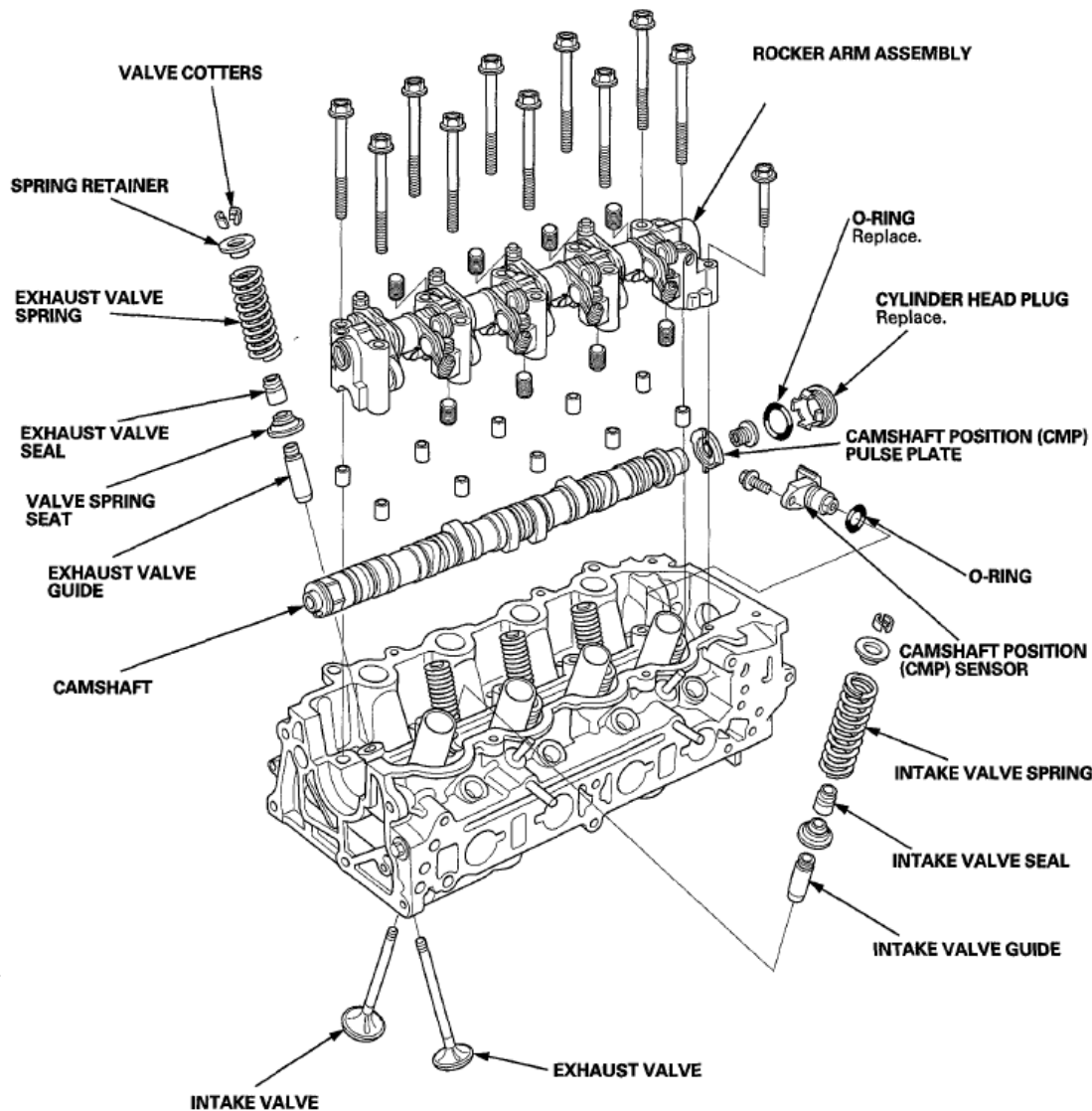
## COMPONENT LOCATION INDEX



**Fig. 2: Identifying Cylinder Head Component Location (1 Of 3)**



**Fig. 3: Identifying Cylinder Head Component Location (2 Of 3)**



**Fig. 4: Identifying Cylinder Head Component Location (3 Of 3)**

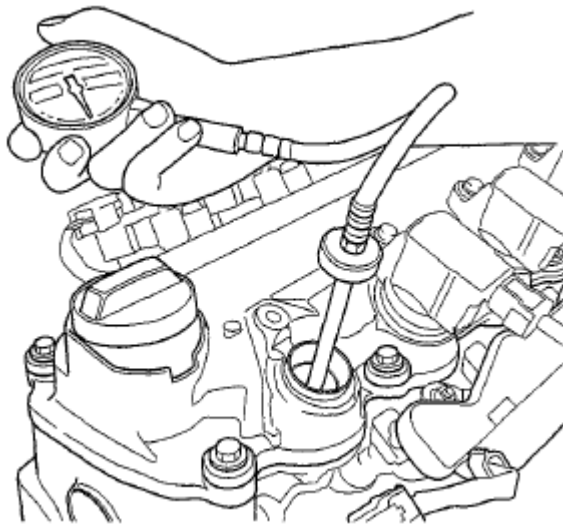
## ENGINE COMPRESSION INSPECTION

**NOTE:** After this inspection, you must reset the powertrain control module (PCM). Otherwise the PCM will continue to stop the injectors from functioning. Select PCM reset using the Honda Diagnostic System (HDS) (see HDS CLEAR COMMAND ).

1. Warm up the engine to normal operating temperature (cooling fan comes on).
2. Turn the ignition switch to LOCK (0).
3. Connect the HDS to the data link connector (DLC) (see step 2 HOW TO USE THE HDS (HONDA DIAGNOSTIC SYSTEM) ).
4. Turn the ignition switch to ON (II).

5. Make sure the HDS communicates with the vehicle and the PCM. If it does not, troubleshoot the DLC circuit (see **DLC CIRCUIT TROUBLESHOOTING** ).
6. Select PGM-FI, INSPECTION, then ALL INJECTORS STOP function on the HDS.
7. Remove the four intake side ignition coils (see **IGNITION COIL REPLACEMENT** ).
8. Remove the four intake side spark plugs.
9. Attach the compression gauge to a 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).



**Fig. 5: Attaching Compression Gauge To Spark Plug Hole**

10. Turn the battery module switch OFF (see **DISCONNECTING THE MOTOR POWER CABLE CONNECTOR FROM THE MOTOR STATOR** ).
11. Step on the accelerator pedal to open the throttle fully, then crank the engine with the starter motor and measure the compression.

### **Compression Pressure**

#### **Service Limit:**

**980 kPa (10.0 kgf/cm<sup>2</sup> , 142 psi)**

12. Measure the compression on the remaining cylinders.

#### **Maximum Variation:**

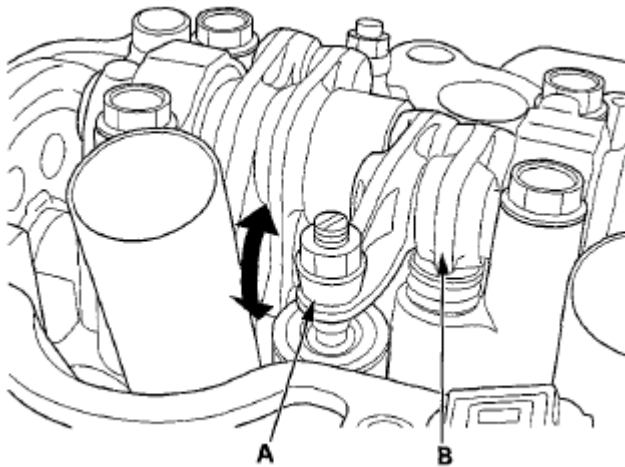
**Within 200 kPa (2.0 kgf/cm<sup>2</sup> , 29 psi)**

13. If the compression is not within specifications, check the following items, then remeasure the compression.
  - Incorrect valve clearance
  - Valve deposits
  - Confirmation of cam timing
  - Damaged or worn cam lobes
  - Looseness of exhaust side spark plug
  - Damaged or worn valves and seats
  - Damaged cylinder head gasket
  - Damaged or worn piston rings
  - Damaged or worn piston and cylinder bore
14. Remove the compression gauge from the spark plug hole.
15. Install the four intake side spark plugs (see **IGNITION COIL REPLACEMENT** ).
16. Install the four intake side ignition coils (see **IGNITION COIL REPLACEMENT** ).
17. Select PCM reset (see **HDS CLEAR COMMAND** ) to cancel the ALL INJECTORS OFF function on the HDS.
18. Turn the battery module switch ON (see **DISCONNECTING THE MOTOR POWER CABLE CONNECTOR FROM THE MOTOR STATOR** ).

## **VTEC ROCKER ARM TEST**

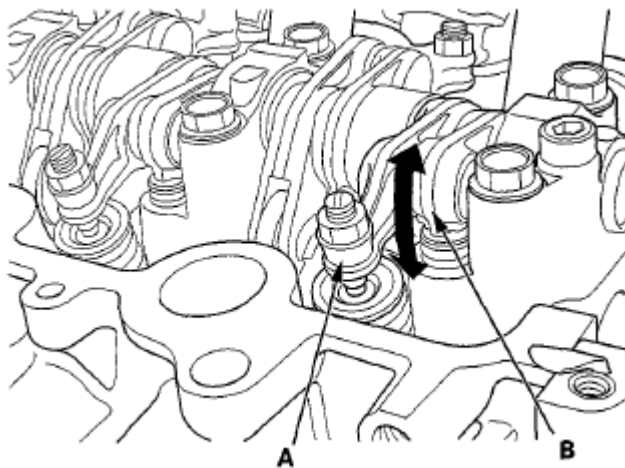
### **Special Tools Required**

- Air Pressure Regulator 07AAJ-PNAA101
  - VTEC Air Adapter 07VAJ-P8A010A
1. Start the engine, and let it run for 5 minutes, then turn the ignition switch to LOCK (0).
  2. Remove the cylinder head cover (see **CAM CHAIN CASE OIL SEAL INSTALLATION** ).
  3. Set the No. 1 piston at top dead center (TDC) (see step 2 ).
  4. Push on the intake primary rocker arm (A) for the No. 1 cylinder. Make sure that the intake primary rocker arm and the intake secondary rocker arm (B) are mechanically connected by the rocker arm pistons and that the intake secondary rocker arm does not move when pushed manually.
    - If the intake secondary rocker arm does not move independently, go to step 5.
    - If the intake secondary rocker arm moves independently, remove and disassemble the rocker arm assembly, and check that the rocker arm pistons between the intake primary and secondary rocker arms move smoothly. If any rocker arm or rocker arm piston needs replacing, replace the rocker arms for the cylinder as assembly, then retest.



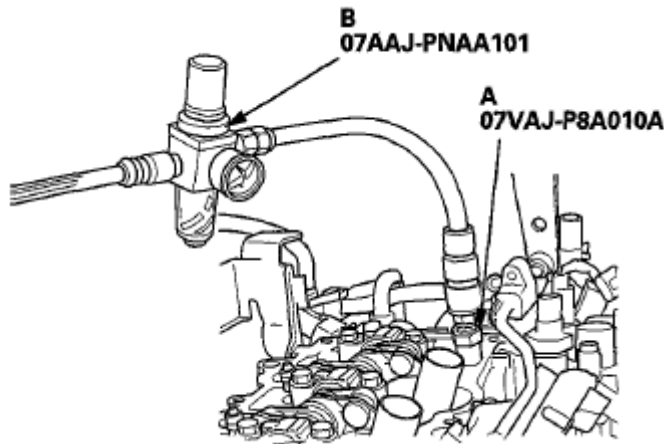
**Fig. 6: Pushing Intake Primary Rocker Arm For No. 1 Cylinder**

5. Push on the exhaust primary rocker arm (A) for the No. 1 cylinder. Make sure that the exhaust primary rocker arm and the exhaust secondary rocker arm (B) are mechanically connected by the rocker arm pistons and that the exhaust secondary rocker arm does not move when pushed manually.
  - If the exhaust secondary rocker arm does not move independently, go to step 6.
  - If the exhaust secondary rocker arm moves independently, remove and disassemble the rocker arm assembly, and check that the rocker arm pistons between the exhaust primary and secondary rocker arms move smoothly. If any rocker arm or rocker arm piston needs replacing, replace the rocker arms for the cylinder as an assembly, then retest.



**Fig. 7: Pushing Exhaust Primary Rocker Arm**

6. Check that the air pressure on the shop air compressor gauge indicates over 340 kPa (3.5 kgf/cm<sup>2</sup> , 50 psi).
7. Inspect the valve clearance after the engine is cool (see **VALVE CLEARANCE ADJUSTMENT** ).
8. Install the VTEC air adapter (A) to the inspection hole, then connect the air pressure regulator (B).



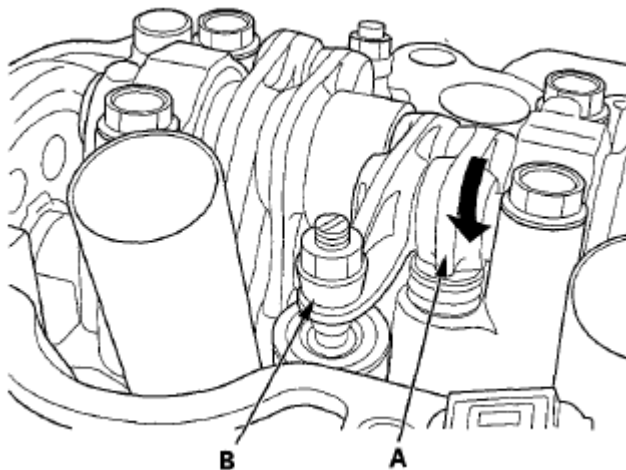
**Fig. 8: Installing VTEC Air Adapter To Inspection Hole**

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

**Specified Air Pressure:**

**200 kPa (2.0 kgf/cm<sup>2</sup> , 28 psi)**

10. Move the intake secondary rocker arm (A) for the No. 1 cylinder. The intake secondary rocker arm should move independently of the intake primary rocker arm (B).
  - If the intake secondary rocker arm moves independently, go to step 11.
  - If the intake secondary rocker arm does not move independently, remove and disassemble the rocker arm assembly, and check that the rocker arm pistons between the intake primary and secondary rocker arms move smoothly. If any rocker arm or rocker arm piston needs replacing, replace the rocker arms for the cylinder as an assembly, then retest.



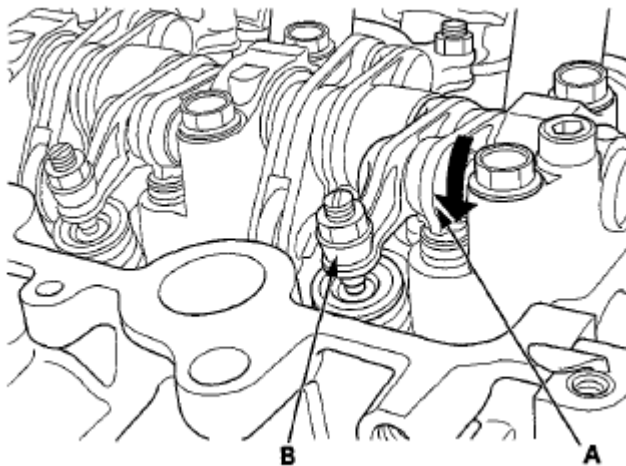
**Fig. 9: Moving Intake Secondary Rocker Arm For No. 1 Cylinder**

11. Move the exhaust secondary rocker arm (A) for the No. 1 cylinder. The exhaust secondary rocker arm



should move independently of the exhaust primary rocker arm (B).

- If the exhaust secondary rocker arm moves independently, go to step 12.
- If the exhaust secondary rocker arm does not move independently, remove and disassemble the rocker arm assembly, and check that the rocker arm pistons between the exhaust primary and secondary rocker arms move smoothly. If any rocker arm or rocker arm piston needs replacing, replace the rocker arms for the cylinder as an assembly, then retest.



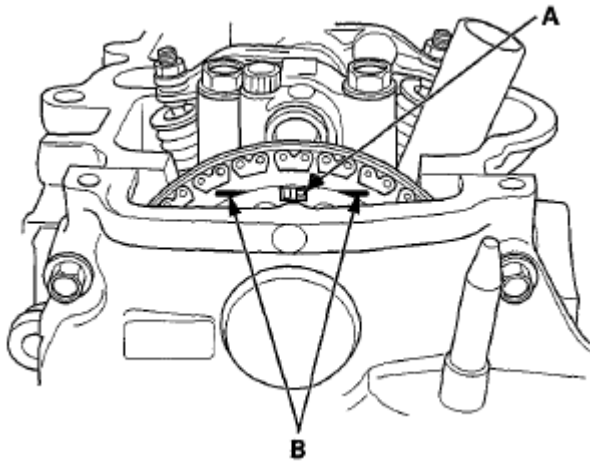
**Fig. 10: Moving Intake Secondary Rocker Arm For No. 1 Cylinder**

12. Tighten the valve on the air pressure regulator, then remove the VTEC air adapter.
13. Repeat steps 4 to 12 on the remaining cylinder's rocker arms with each piston at TDC. When all the rocker arms pass the test, go to step 14.
14. Install the cylinder head cover (see CYLINDER HEAD COVER INSTALLATION ).

## VALVE CLEARANCE ADJUSTMENT

**NOTE:** Adjust the valves only when the cylinder head temperature is less than 100 °F (38 °C). Check the engine coolant temperature with the HDS if you are not sure.

1. Remove the cylinder head cover (see CAM CHAIN CASE OIL SEAL INSTALLATION ).
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 cam chain case.



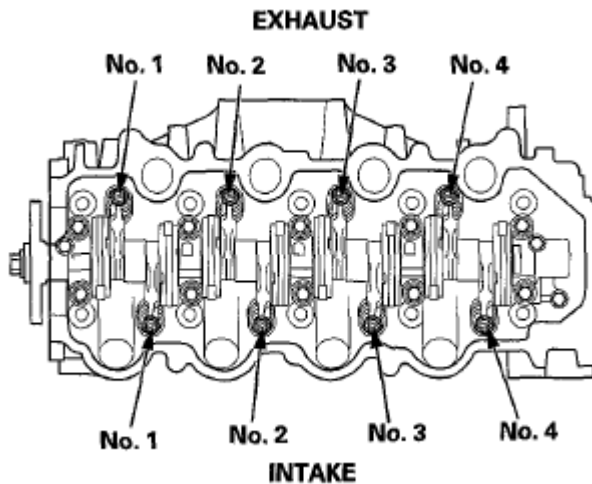
**Fig. 11: Identifying Mark On Camshaft Sprocket**

3. Select the correct feeler gauge for the valves you are going to check.

**Valve Clearance**

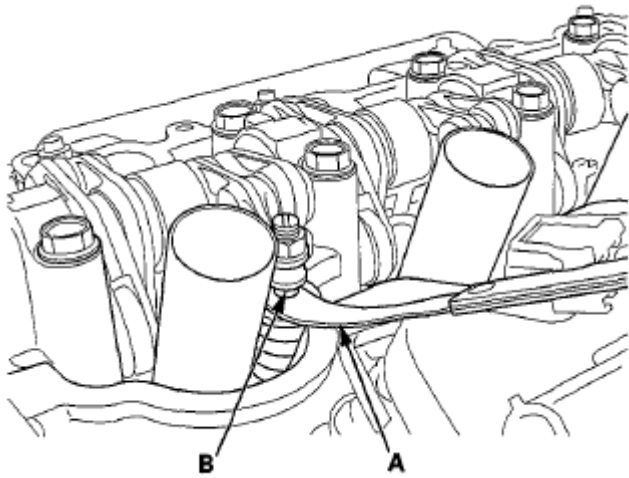
**Intake: 0.15-0.19 mm (0.006-0.007 in)**

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



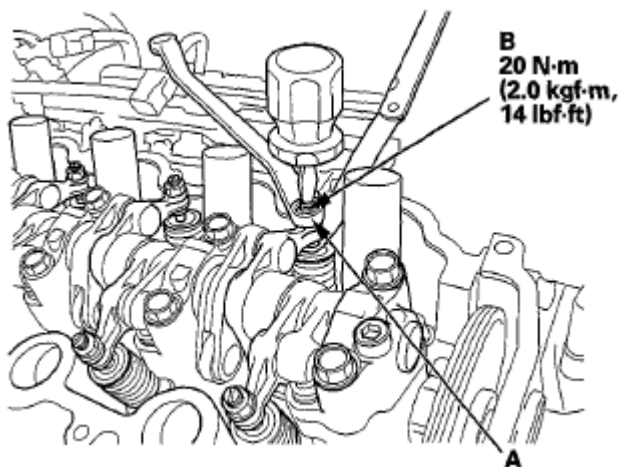
**Fig. 12: Identifying Intake And Exhaust Valve Clearance**

4. Insert the feeler gauge (A) between the adjusting screw (B) and the end of the valve stem on No. 1 cylinder and slide it back and forth; you should feel a slight amount of drag.



**Fig. 13: Checking Valve Clearance**

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



**Fig. 14: Adjusting Valve Clearance And Locknut With Torque Specifications**

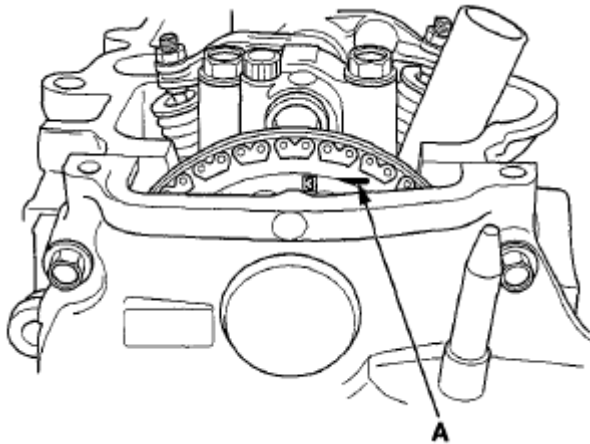
6. While holding the adjusting screw with the screw driver, tighten the locknut, and recheck the clearance. Repeat the adjustment if necessary.

#### **Specified Torque**

**20 N·m (2.0 kgf·m, 14 lbf·ft)**

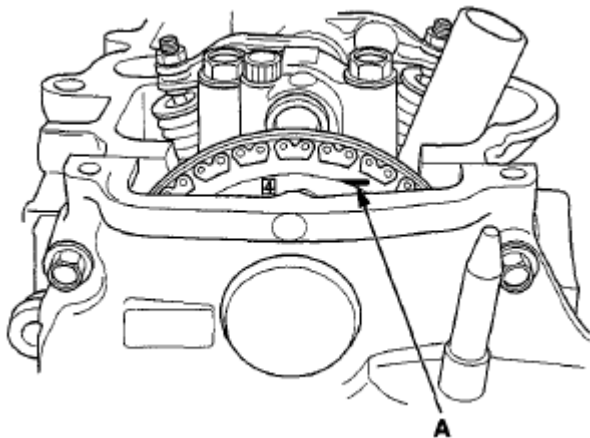
**Apply new engine oil to the nut threads.**

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



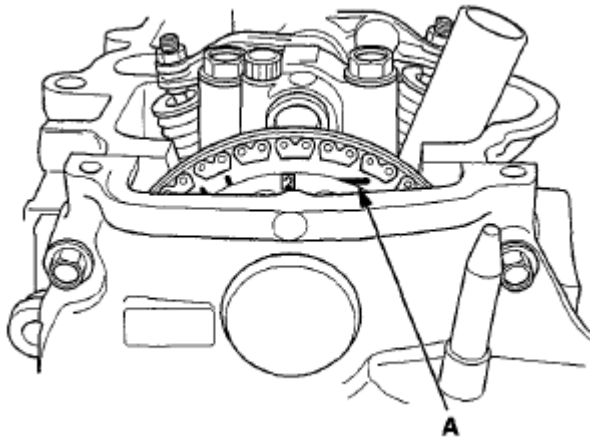
**Fig. 15: Aligning No. 3 Piston TDC Groove On Camshaft Sprocket With Top Edge Of Cam Chain Case**

8. Check and, if necessary, adjust the valve clearance on the 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 cam chain case.



**Fig. 16: Aligning No. 4 Piston TDC Groove On Camshaft Sprocket With Top Edge Of Cam Chain Case**

10. Check and, if necessary, adjust the valve clearance on the 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 cam chain case.



**Fig. 17: Aligning No. 2 Piston TDC Groove On Camshaft Sprocket With Top Edge Of Cam Chain Case**

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

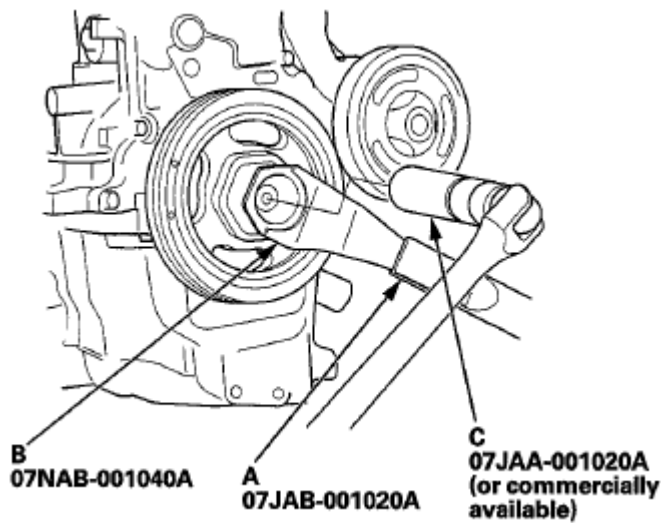
## CRANKSHAFT PULLEY REMOVAL AND INSTALLATION

### Special Tools Required

- Holder Handle 07JAB-001020A
- Holder Attachment, 50 mm 07NAB-001040A
- Socket, 19 mm 07JAA-001020A or equivalent

### REMOVAL

1. Remove the front wheels.
2. Remove the right front wheel.
3. Remove the splash shields (see step 22 **ENGINE REMOVAL** ).
4. Remove the drive belt (see **DRIVE BELT INSPECTION** ).
5. Hold the pulley with the holder handle (A) and the pulley holder attachment (B).



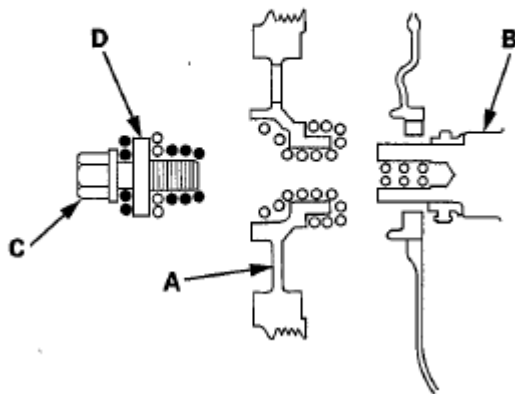
**Fig. 18: Holding Pulley With Holder Handle**

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

## INSTALLATION

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

- : Clean
- : Lubricate with new engine oil

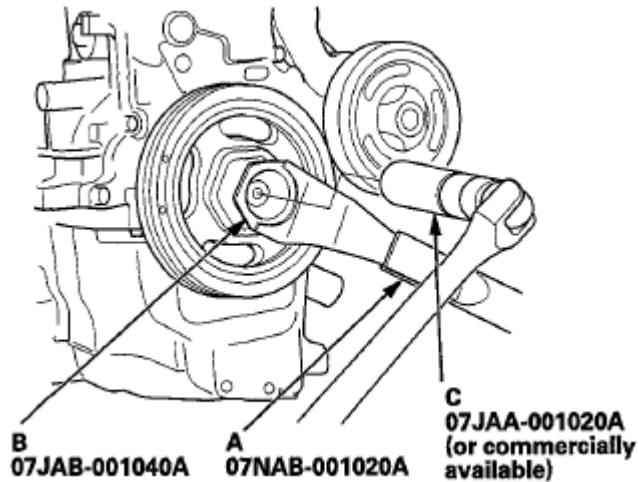


**Fig. 19: Identifying Engine Oil Cleaning Area**

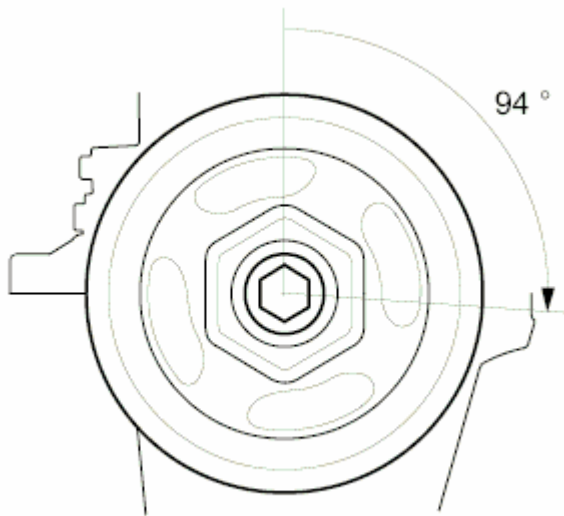
2. Install the crankshaft pulley.
3. Tighten the crankshaft pulley bolt. Do not use an impact wrench.
  1. Hold the pulley with the holder handle (A) and the pulley holder attachment (B), then tighten the bolt to 37 N.m (3.8 kgf.m, 27 lbf.ft) with a torque wrench and heavy duty 19 mm socket wrench (C). If the pulley bolt or crankshaft is 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).

2. Mark the bolt head (D) and the crankshaft pulley (E) as shown, then tighten the bolt an additional 90 ° (The mark on the bolt head lines up with the mark on the crankshaft pulley).

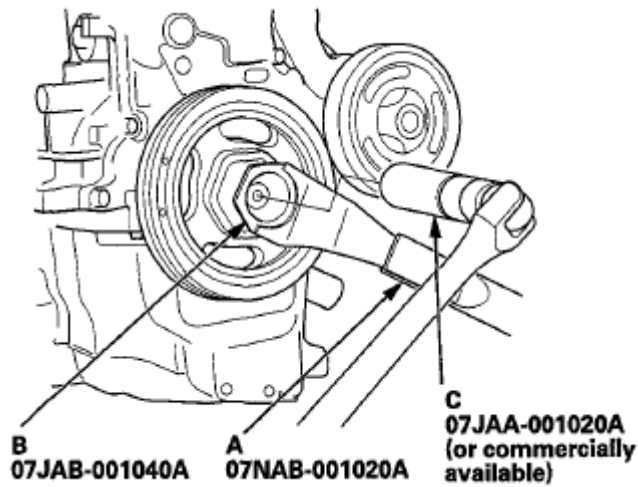


**Fig. 20: Holding Pulley With Holder Handle**

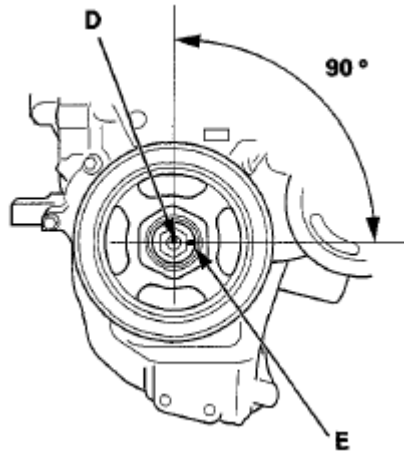


**Fig. 21: Identifying Crankshaft Pulley Bolts Tightening Angle**

4. When the crankshaft or the pulley bolt is reused: Tighten the crankshaft pulley bolt. Do not use an impact wrench.
  1. Hold the pulley with the holder handle (A) and crankshaft pulley holder (B), then torque the bolt to 37 N.m (3.8 kgf.m, 27 lbf.ft) with a torque wrench and a socket (C).
  2. Tighten the bolt an additional 90 °.



**Fig. 22: Holding Pulley With Holder Handle**



**Fig. 23: Identifying Crankshaft Pulley Bolts Tightening Angle**

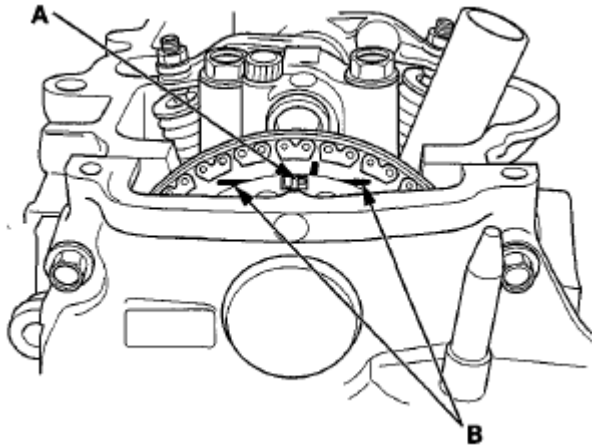
5. Install the drive belt (see **DRIVE BELT INSPECTION** ).
6. Install the splash shields (see step 29 **ENGINE INSTALLATION** ).
7. Install the front wheels.

## CAM CHAIN REMOVAL

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

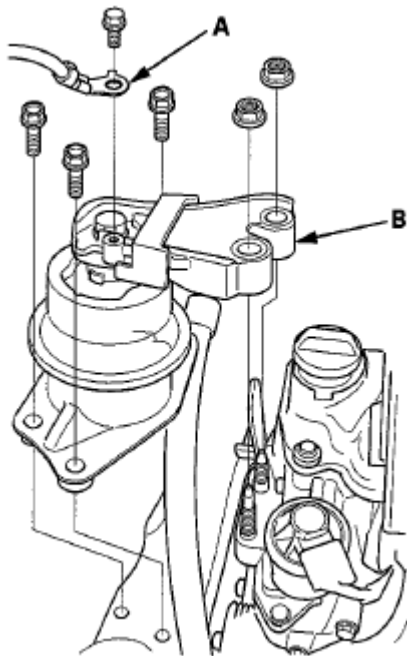
1. Remove the cylinder head cover (see **CAM CHAIN CASE OIL SEAL INSTALLATION** ).
2. Set the No. 1 piston at top dead center (TDC). The UP mark (A) on the camshaft sprocket should be at the top, and the TDC grooves (B) on the camshaft sprocket should lineup with the top edge of the head.





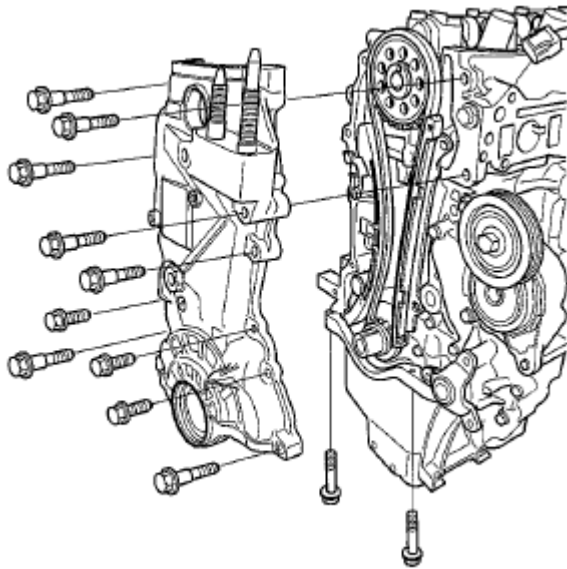
**Fig. 24: Identifying Mark On Camshaft Sprocket**

3. Remove the front wheels.
4. Remove the splash shields (see step 22 **ENGINE REMOVAL** ).
5. Loosen the water pump pulley mounting bolts.
6. Remove the drive belt (see **DRIVE BELT INSPECTION** ).
7. Remove the water pump pulley (see step 6 **WATER PUMP REPLACEMENT** ).
8. Remove the crankshaft pulley (see **CRANKSHAFT PULLEY REMOVAL AND INSTALLATION** ).
9. Support the engine with a jack and a wood block under the oil pan.
10. Disconnect the ground cable (A), then remove the side engine mount/bracket assembly (B).



**Fig. 25: Identifying Ground Cable And Engine Mount/Bracket Assembly**

11. Remove the cam chain case.

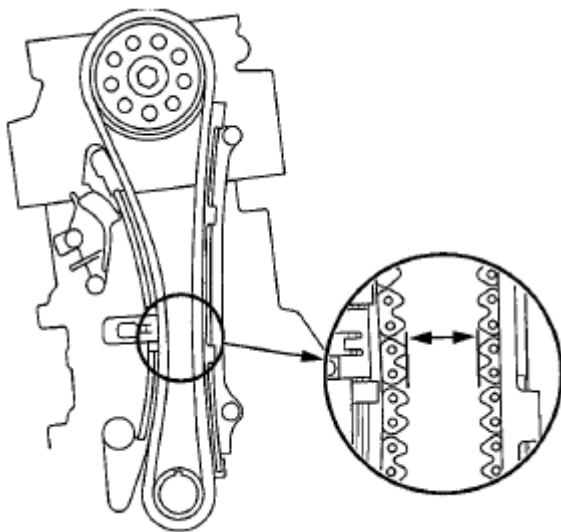


**Fig. 26: Identifying Cam Chain Case With Bolts**

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

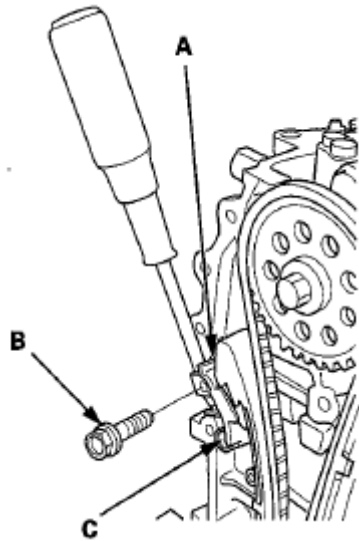
**Standard Distance: 19 mm (0.75 in)**

**Service Limit: 15 mm (0.59 in)**



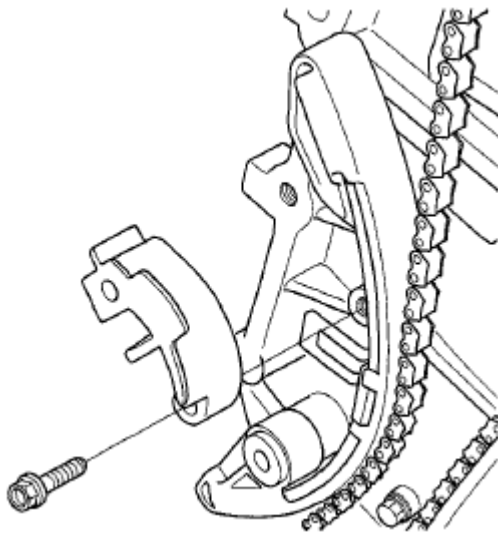
**Fig. 27: Identifying Cam Chain Distance**

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



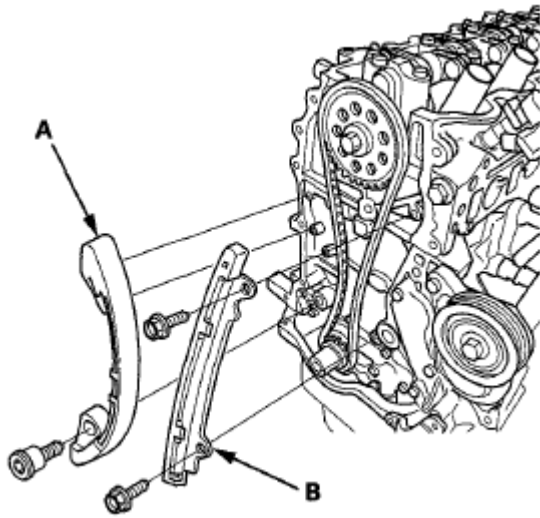
**Fig. 28: Sliding Surface Of Cam Chain Tensioner Slider**

14. Hold the cam chain tensioner slider with a screwdriver, then remove the upper bolt (B), and loosen the lower bolt (C).
15. Remove the cam chain tensioner slider.



**Fig. 29: Identifying Cam Chain Tensioner Slider**

16. Remove the cam chain tensioner (A) and the cam chain guide (B). Inspect the tensioner and the guide, and replace them if needed.



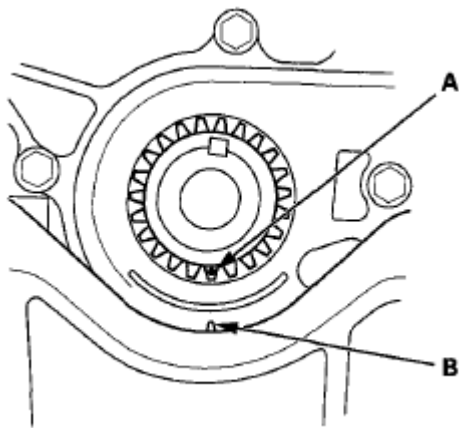
**Fig. 30: Identifying Cam Chain Tensioner And Cam Chain Guide**

17. Remove the cam chain.

## CAM CHAIN INSTALLATION

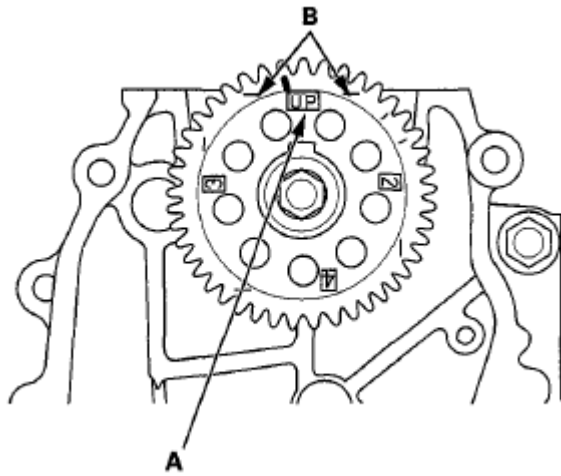
**NOTE:** Keep the cam chain away from magnetic fields.

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.



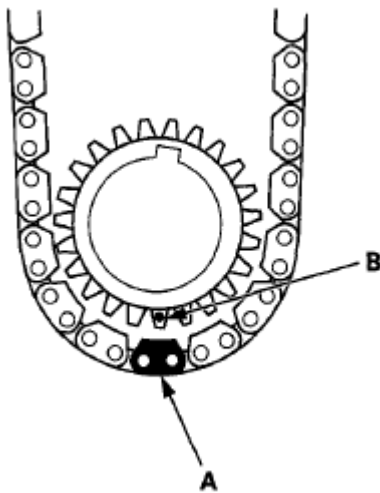
**Fig. 31: Aligning TDC Mark On Crankshaft Sprocket With Pointer On Oil Pump**

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 cylinder head.



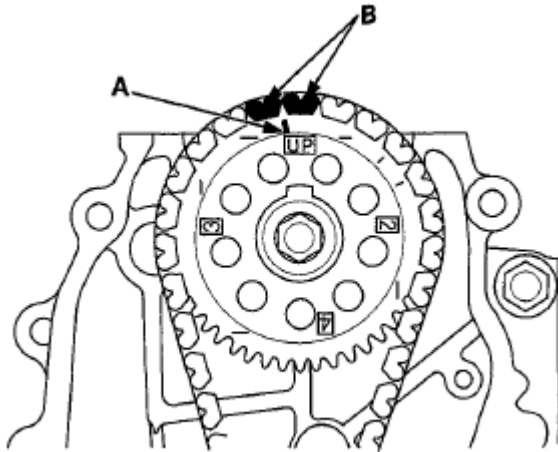
**Fig. 32: Identifying Camshaft Sprocket Mark Location**

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



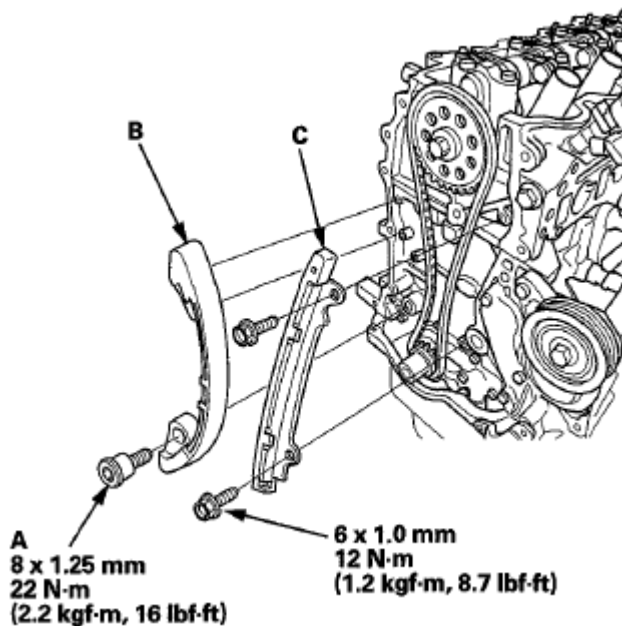
**Fig. 33: Aligning Mark Cam Chain And Crankshaft Sprocket**

4. Install the cam chain on the camshaft sprocket with the pointer (A) centered between the two colored pieces (B).



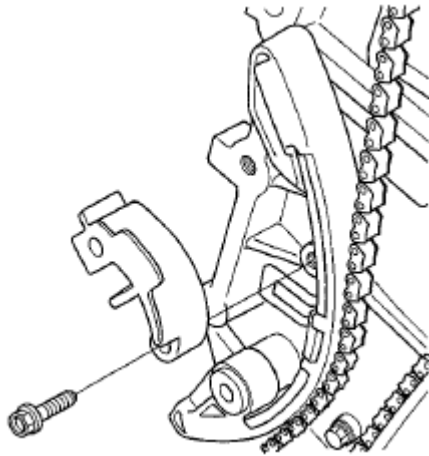
**Fig. 34: Identifying Cam Chain On Camshaft Sprocket With Pointer**

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



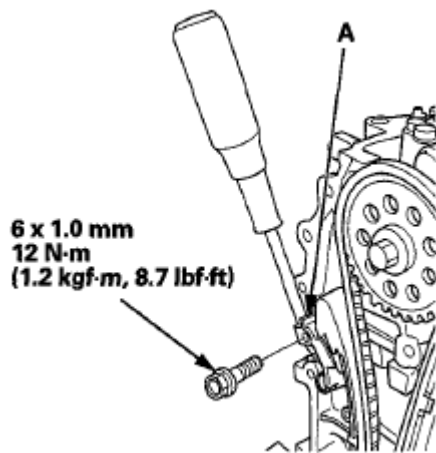
**Fig. 35: Identifying Cam Chain Tensioner With Torque Specifications And Cam Chain Guide**

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



**Fig. 36: Identifying Cam Chain Tensioner Slider**

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



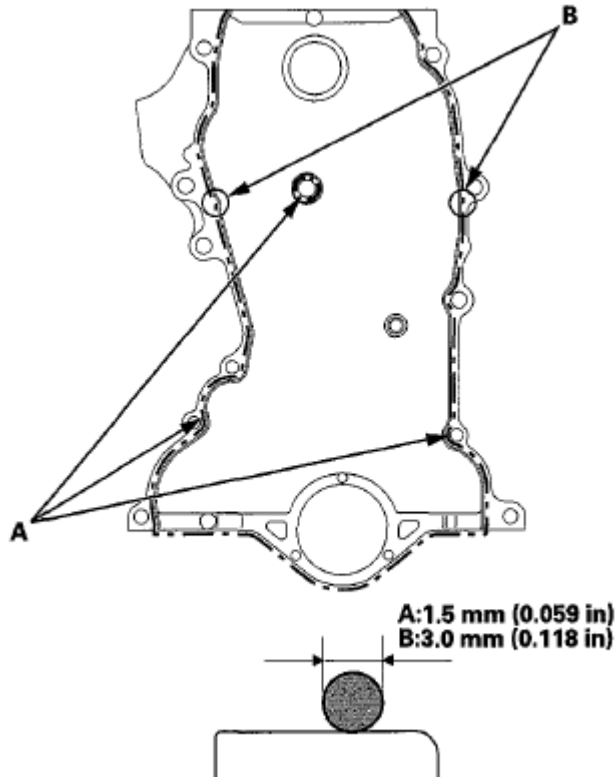
**Fig. 37: Sliding Surface Of Cam Chain Tensioner Slider And Bolts With Torque Specifications**

9. Rotate the cam chain tensioner slider clockwise to compress the cam chain tensioner, and install the remaining bolt, then tighten the two bolts.
10. Check the cam chain case oil seal for damage. If the oil seal is damaged, replace the cam chain case oil seal (see **CAM CHAIN CASE OIL SEAL INSTALLATION** ).
11. Remove all of the old liquid gasket from the cam chain case mating surfaces, the bolts, and the bolt holes.
12. Clean and dry the cam chain case mating surfaces.
13. Apply liquid gasket (P/N 08717-0004, 08718-0003, or 08718-0009) to the cylinder head and the engine block mating surfaces of the cam chain case and to the inside edge of the bolt holes. Install the component within 5 minutes of applying the liquid gasket.

**NOTE:**

- Apply a 1.5 mm (0.059 in) diameter bead of liquid gasket along the broken line (A).

- Apply a 3.0 mm (0.118 in) diameter bead of liquid gasket to the upper surface contact areas of the engine block (B).
- If you apply liquid gasket P/N 08718-0012, the component must be installed within 4 minutes.
- If too much time has passed after applying the liquid gasket, remove the old liquid gasket and residue, then reapply new liquid gasket.



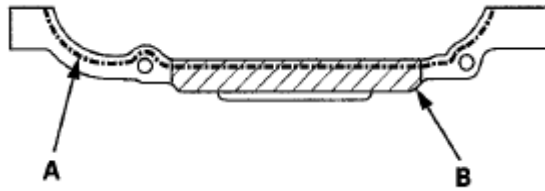
**Fig. 38: Identifying Liquid Gasket Applying Area**

14. Apply liquid gasket (P/N 08717-0004, 08718-0003, or 08718-0009) to the oil pan mating surface of the cam chain case and to the inside edge of the bolt holes. Install the component within 5 minutes of applying the liquid gasket.

**NOTE:**

- Apply a 2.5 mm (0.098 in) diameter bead of liquid gasket along the broken line (A).
- Apply a 5.0 mm (0.20 in) diameter bead of liquid gasket to the shaded area (B).
- If you apply liquid gasket P/N 08718-0012, the component must be installed within 4 minutes.
- If too much time has passed after applying the liquid gasket, remove the old liquid gasket and residue, then reapply new liquid gasket.



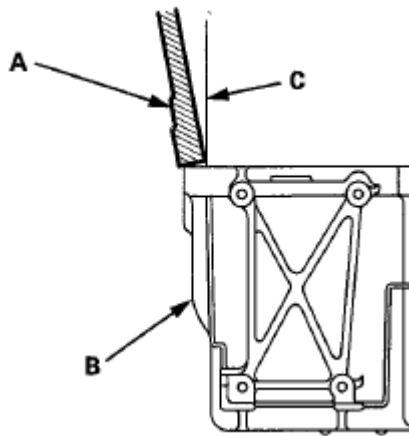


**Fig. 39: Identifying Liquid Gasket Applying Area**

15. Set the edge of the cam chain case (A) on the edge of the oil pan (B), then install the cam chain case on the engine block (C).

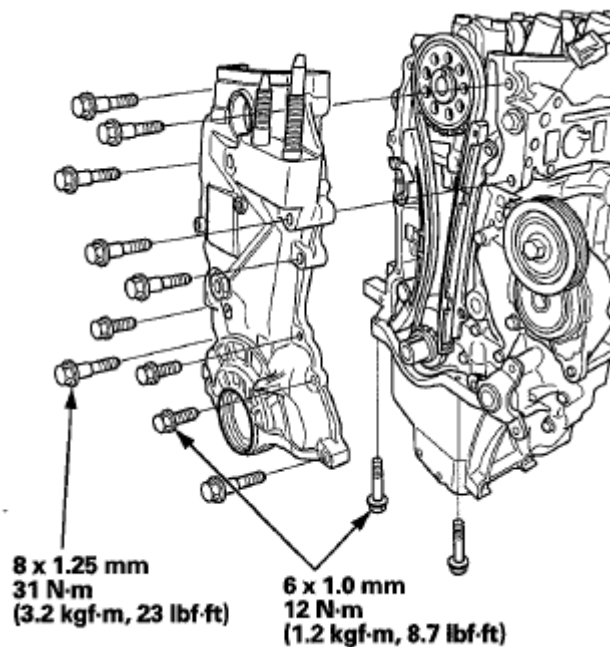
**NOTE:**

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



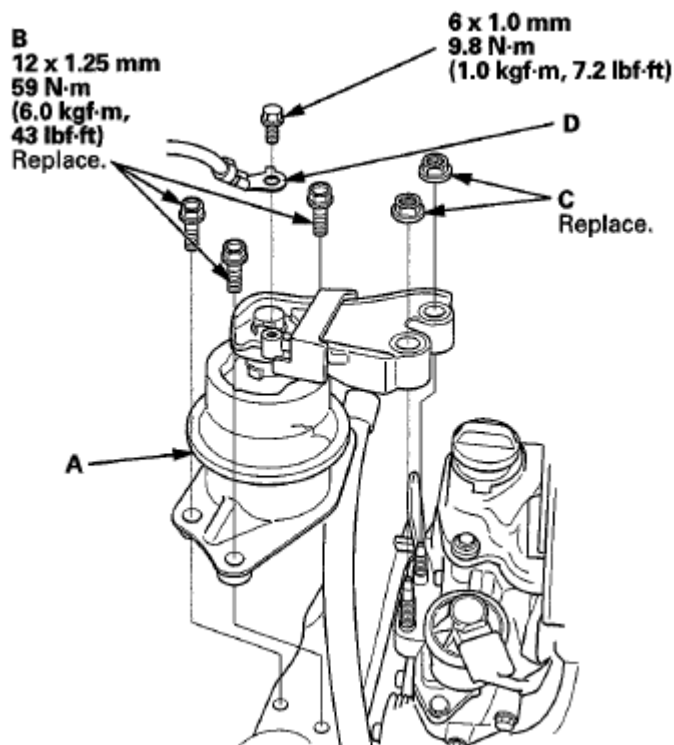
**Fig. 40: Identifying Cam Chain Case On Engine Block**

16. Tighten the cam chain case mounting bolts. Wipe off the excess liquid gasket from the oil pan and the cam chain case mating area.



**Fig. 41: Identifying Cam Chain Case Mounting Bolts With Torque Specifications**

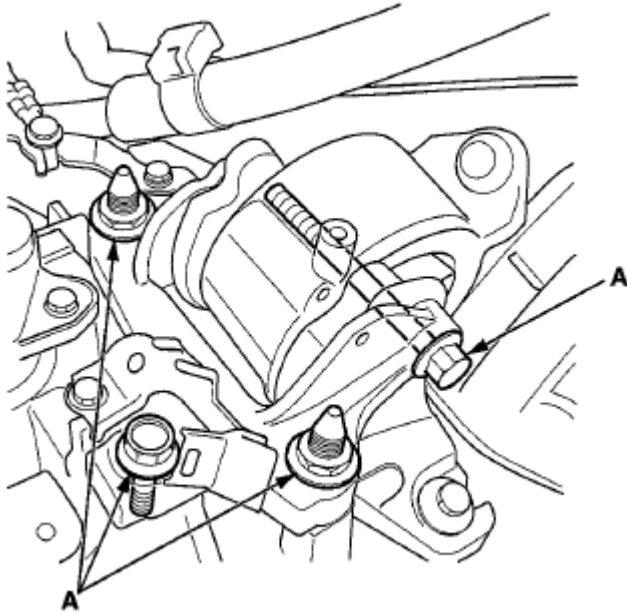
17. Install the cylinder head cover (see **CYLINDER HEAD COVER INSTALLATION**.)
18. Install the side engine mount/bracket assembly (A), then tighten the new side engine mount/bracket assembly mounting bolts (B).



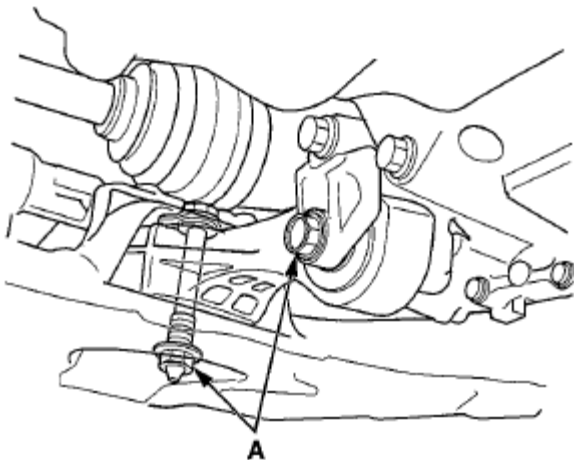
**Fig. 42: Identifying Engine Mount/Bracket, Assembly Mounting Bolts With Torque Specifications**

**And Ground Cable**

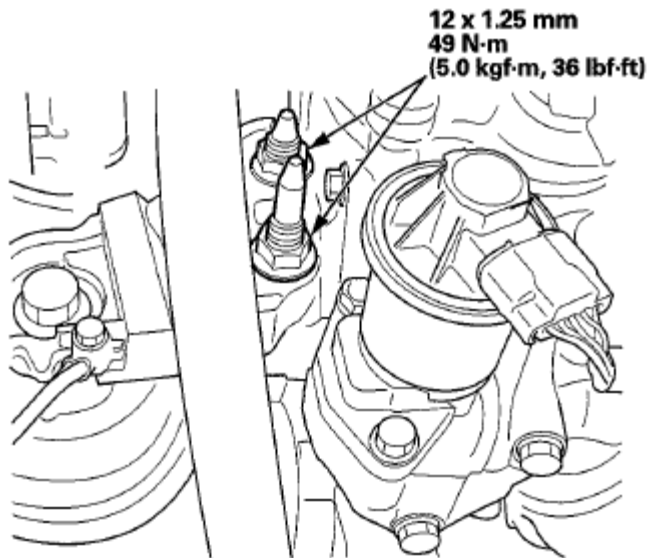
19. Loosely tighten the new side engine mount/bracket assembly mounting nuts (C).
20. Connect the ground cable (D).
21. Remove the jack and the wood block.
22. Remove the air cleaner (see **AIR CLEANER REMOVAL/INSTALLATION** ).
23. Loosen the transmission mount bracket mounting bolts and nuts (A).

**Fig. 43: Identifying Transmission Mount Bracket Mounting Bolts And Nuts**

24. Raise the vehicle on the lift to full height.
25. Loosen the torque rod mounting bolt and nut (A).

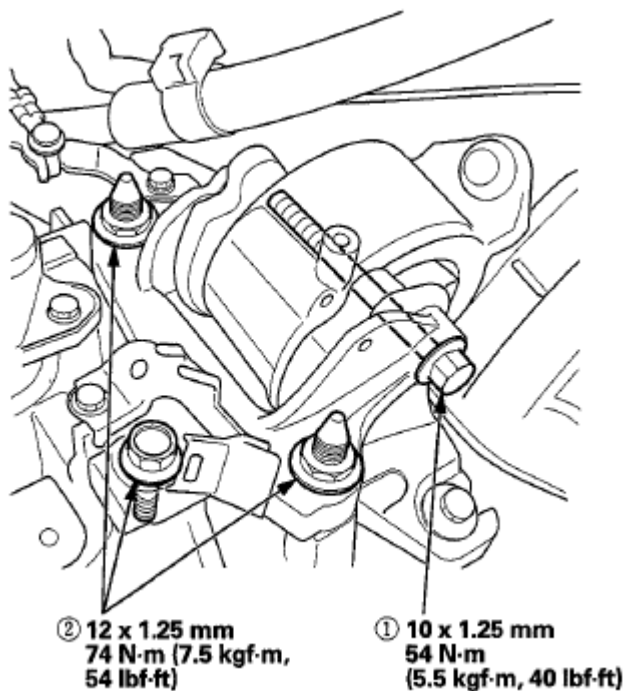
**Fig. 44: Identifying Torque Rod Mounting Bolt And Nut**

26. Lower the vehicle on the lift.
27. Tighten the side engine mount/bracket assembly mounting nuts.



**Fig. 45: Identifying Engine Mount/Bracket Assembly Mounting Nuts With Torque Specifications**

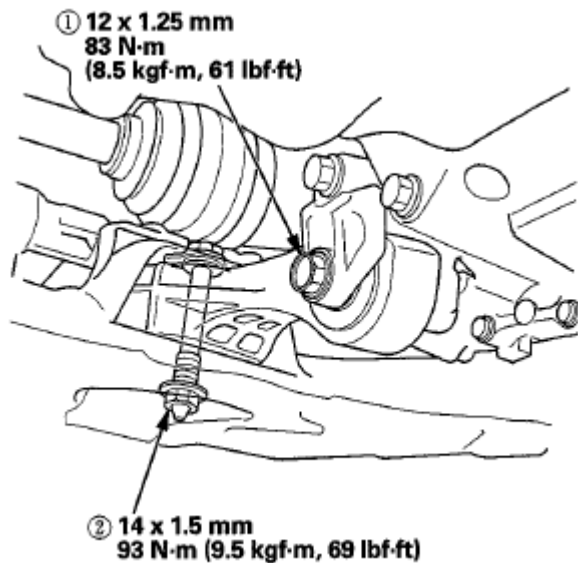
28. Tighten the transmission mount mounting bolts and nuts in the numbered sequence shown.



**Fig. 46: Identifying Transmission Mount Mounting Bolts And Nuts With Torque Specifications**

29. Raise the vehicle on the lift to full height.

30. Tighten the torque rod mounting bolt and nut in the numbered sequence shown.



**Fig. 47: Identifying Torque Rod Mounting Bolt And Nut With Torque Specifications**

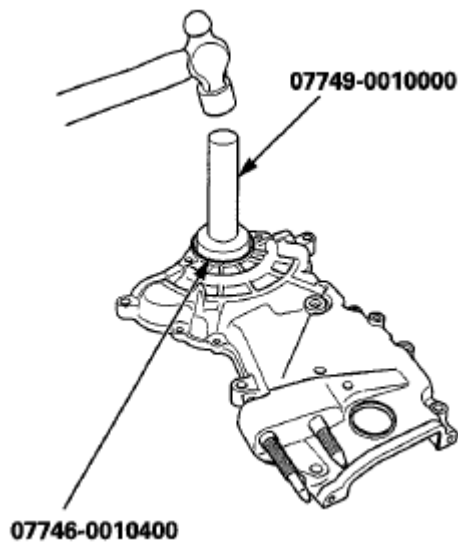
31. Lower the vehicle on the lift.
32. Install the air cleaner (see [AIR CLEANER REMOVAL/INSTALLATION](#) ).
33. Install the crankshaft pulley (see [CRANKSHAFT PULLEY REMOVAL AND INSTALLATION](#) ).
34. Install the water pump pulley (see step 11 [WATER PUMP REPLACEMENT](#) ).
35. Install the drive belt (see [DRIVE BELT INSPECTION](#) ).
36. Tighten water pump pulley mounting bolts (see [WATER PUMP REPLACEMENT](#) ).
37. Install the splash shields (see step 29 [ENGINE INSTALLATION](#) ).
38. Install the front wheel.
39. Do the crankshaft position (CKP) pattern clear/CKP pattern learn procedure (see [CKP PATTERN CLEAR/CKP PATTERN LEARN](#) ).

## CAM CHAIN CASE OIL SEAL INSTALLATION

### Special Tools Required

- Driver Handle, 15 x 135L 07749-0010000
- Attachment, 52 x 55 mm 07746-0010400

1. Clean and dry the cam chain case oil seal housing.
2. Apply a light coat of new engine oil to the lip of the cam chain case oil seal.
3. Use the driver handle and the bearing driver attachment to drive a new oil seal squarely into the cam chain case to the specified installed height.

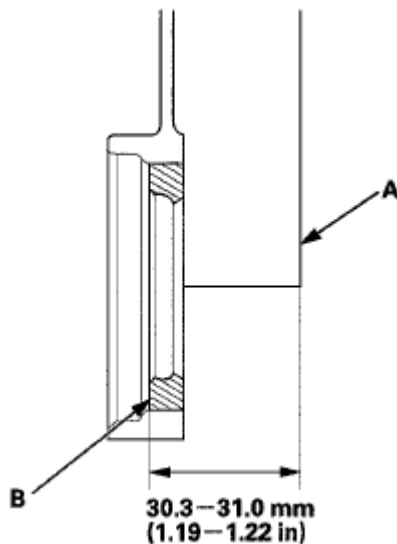


**Fig. 48: Tapping Oil Seal Into Cam Chain Case**

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

**Oil Seal Installed Height:**

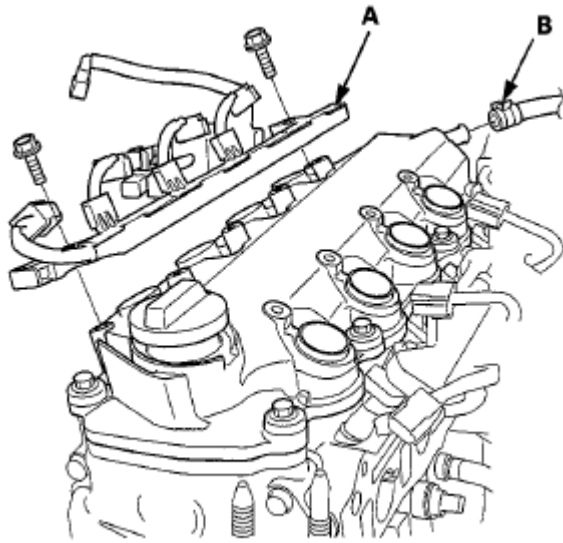
**30.3-31.0 mm (1.19-1.22 in)**



**Fig. 49: Measuring Distance Between Cam Chain Case Surface And Oil Seal**

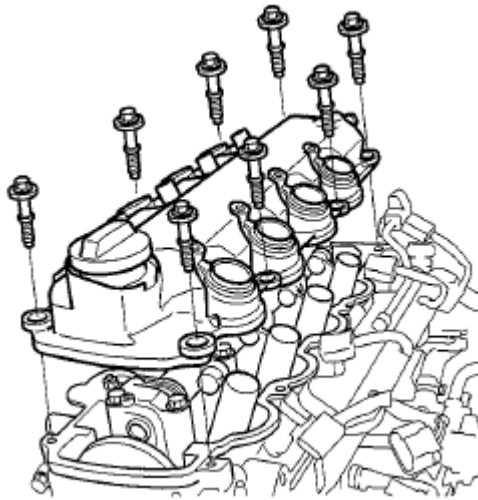
## CYLINDER HEAD COVER REMOVAL

1. Remove the intake manifold (see **REMOVAL** ).
2. Remove the eight ignition coils (see **IGNITION COIL REPLACEMENT** ).
3. Remove the harness holder (A), and disconnect the breather hose (B).



**Fig. 50: Identifying Harness Holder And Breather Hose**

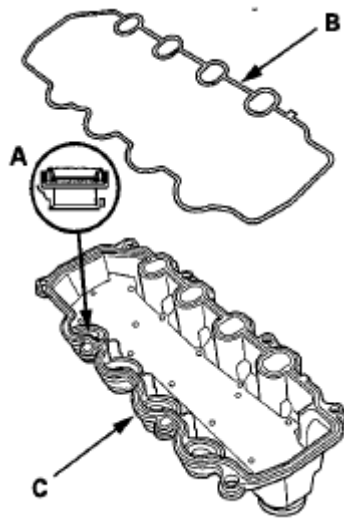
4. Remove the cylinder head cover.



**Fig. 51: Identifying Cylinder Head Cover**

## **CYLINDER HEAD COVER INSTALLATION**

1. Check the spark plug seals (A) for damage. If the seal is damaged, replace the spark plug seals.



**Fig. 52: Identifying Spark Plug Seals And Head Cover Gasket**

2. Thoroughly clean the head cover gasket (B) and the groove.

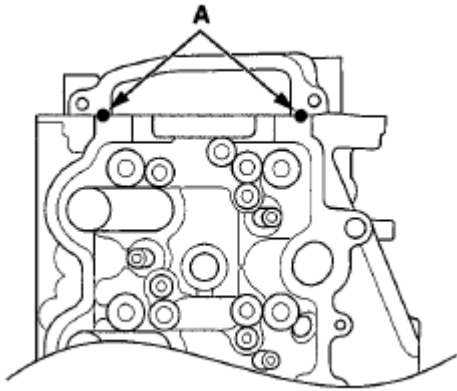
**NOTE:** Check and if necessary, replace head cover gasket.

3. Install the head cover gasket in the groove of the cylinder head cover (C). Make sure the gasket is evenly seated securely.
4. Remove all of the old liquid gasket from the chain case.
5. Clean the head cover contacting surfaces with a shop towel.
6. Apply liquid gasket (P/N 08717-0004, 08718-0003, or 08718-0009) to the cam chain case contact areas (A). Install the component within 5 minutes of applying the liquid gasket.

**NOTE:**

- Apply a 3.0 mm (0.118 in) diameter bead of liquid gasket to the chain case contact areas.
- If you apply liquid gasket P/N 08718-0012, the component must be installed within 4 minutes.
- If too much time has passed after applying the liquid gasket, remove the old liquid gasket and residue, then reapply new liquid gasket.



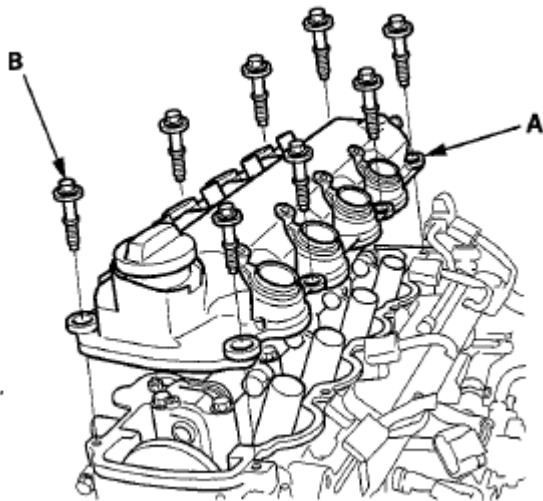


**Fig. 53: Identifying Liquid Gasket Applying Area**

7. Place the cylinder head cover (A) on the cylinder head, then slide the cover slightly back and forth to seat the head cover gasket.

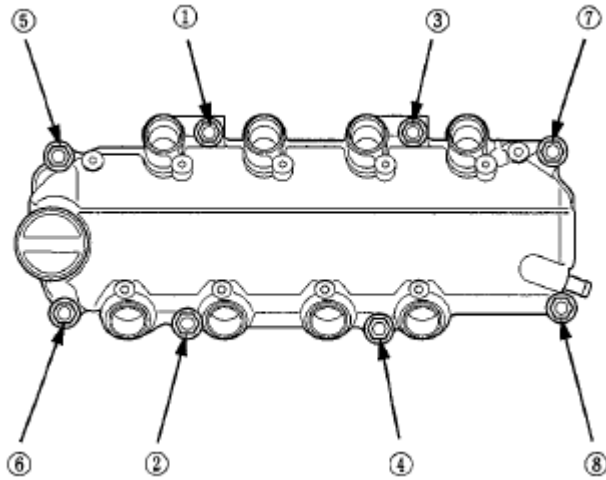
**NOTE:**

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



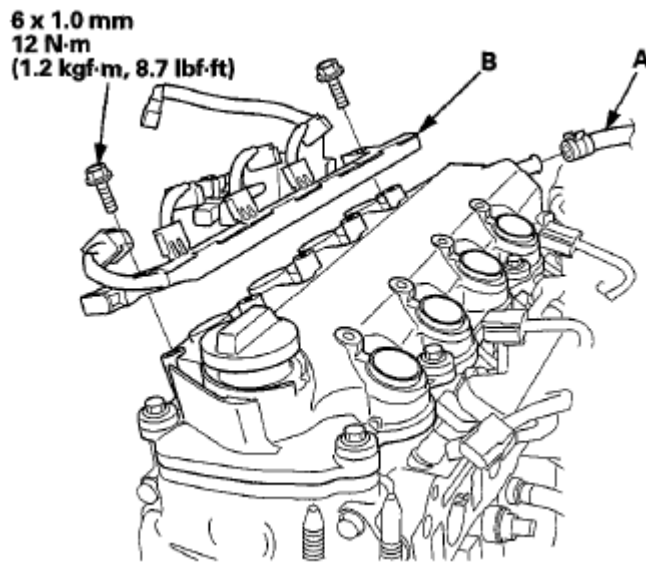
**Fig. 54: Identifying Cylinder Head Cover And Cover Washer**

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



**Fig. 55: Identifying Bolts Tightening Sequence**

10. Connect the breather hose (A), and install the harness holder (B).



**Fig. 56: Identifying Breather Hose, Harness Holder And Bolts With Torque Specifications**

11. Install the eight ignition coils (see IGNITION COIL REPLACEMENT).
12. Install the intake manifold (see INSTALLATION).

## CYLINDER HEAD REMOVAL

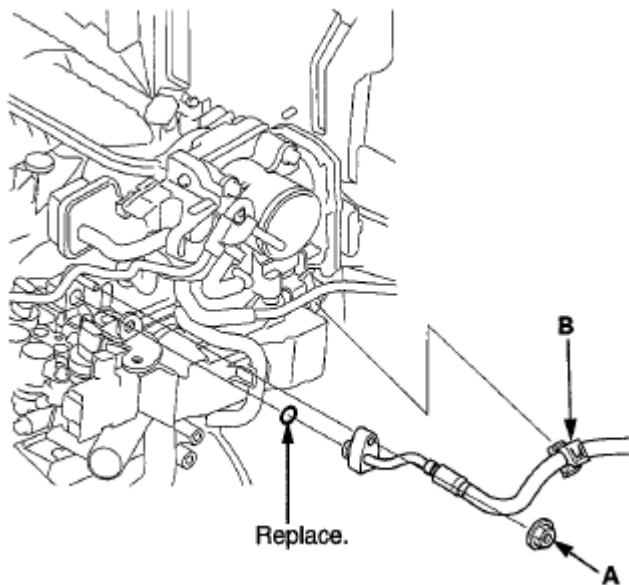
### NOTE:

- 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.

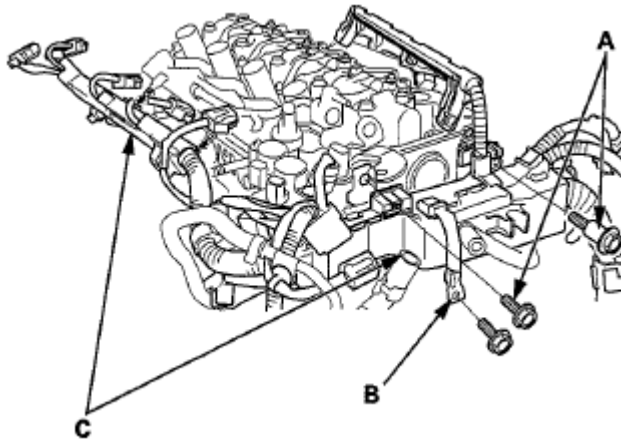
- Mark all wiring and hoses to avoid misconnection. Also, be sure that they do not contact other wiring or hoses, or interfere with other parts.
- Keep the cam chain away from magnetic fields.

1. Relieve the fuel pressure (see **FUEL PRESSURE RELIEVING** ).
2. Drain the engine coolant (see **COOLANT CHECK** ).
3. Do the 12 volt battery removal procedure (see **12 VOLT BATTERY REMOVAL AND INSTALLATION** ).
4. Remove the air cleaner (see **AIR CLEANER REMOVAL/INSTALLATION** ).
5. Remove the intake manifold (see **REMOVAL** ).
6. Remove the eight ignition coils (see **IGNITION COIL REPLACEMENT** ).
7. Remove the following engine wire harness connectors and wire harness clamps from the cylinder head:
  - Four injector connectors
  - Engine coolant temperature (ECT) sensor 1 connector
  - Camshaft position (CMP) sensor connector
  - Secondary heated oxygen sensor (secondary HOS2) connector
  - Rocker arm oil control solenoid connector
8. Remove the harness holder, and disconnect the breather hose (see step 3 on ).
9. Remove the fuel pipe bolt (A) and the fuel pipe clamp (B).



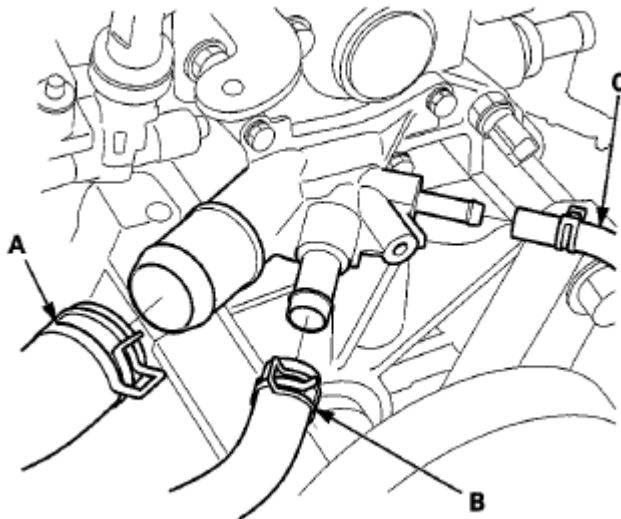
**Fig. 57: Identifying Fuel Pipe Bolt And Fuel Pipe Clamp**

10. Remove the harness holder mounting bolt (A) and the ground cable (B), then remove the harness holder (C).



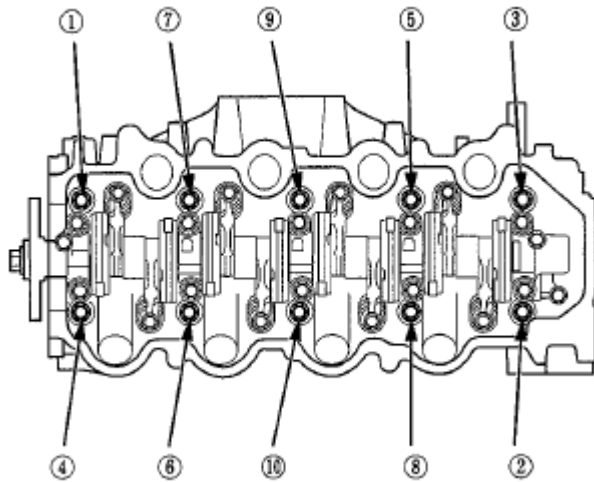
**Fig. 58: Identifying Harness Holder Mounting Bolt And Ground Cable With Heater Hose**

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



**Fig. 59: Identifying Upper Radiator Hose, Water Bypass Hose And Heater Hose**

12. Remove the drive belt (see **DRIVE BELT INSPECTION** ).
13. Remove the water pump (see **WATER PUMP REPLACEMENT** ).
14. Remove the cylinder head cover (see **CAM CHAIN CASE OIL SEAL INSTALLATION** ).
15. Remove the warm-up three way catalytic converter (WU-TWC) (see **WARM UP TWC REMOVAL/INSTALLATION** ).
16. Remove the cam chain (see **CAM CHAIN REMOVAL** ).
17. Remove the cylinder head bolts. To prevent warpage, loosen the bolts in sequence 1/3 turn at a time; repeat the sequence until all bolts are loosened.



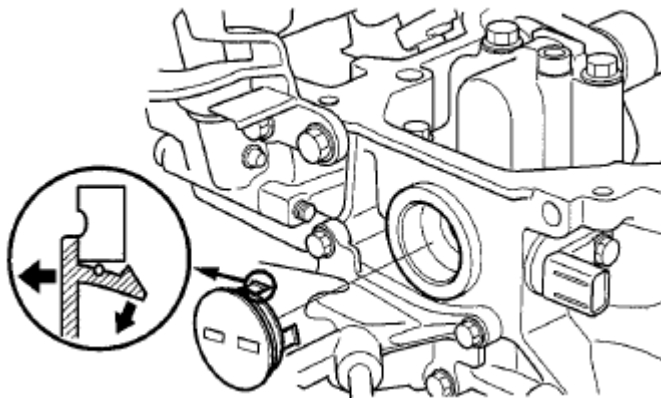
**Fig. 60: Identifying Cylinder Head Bolts Removing Sequence**

18. Remove the cylinder head.

## CMP PULSE PLATE REMOVAL AND INSTALLATION

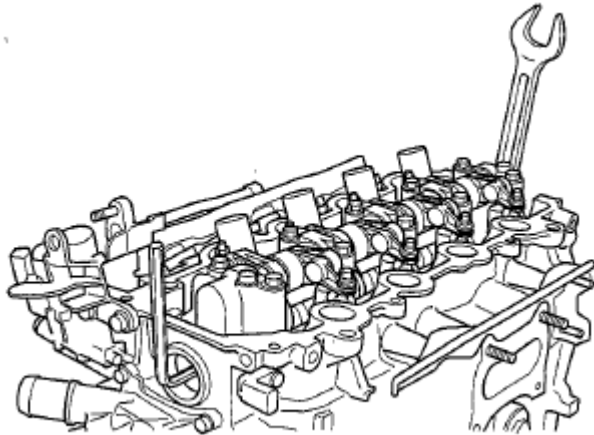
### REMOVAL

1. Remove the air cleaner (see [AIR CLEANER REMOVAL/INSTALLATION](#) ).
2. Remove the cylinder head cover (see [CAM CHAIN CASE OIL SEAL INSTALLATION](#) ).
3. Remove the harness holder mounting bolt and the ground cable, then remove the harness holder (see step 10 ).
4. Remove the cylinder head plug.



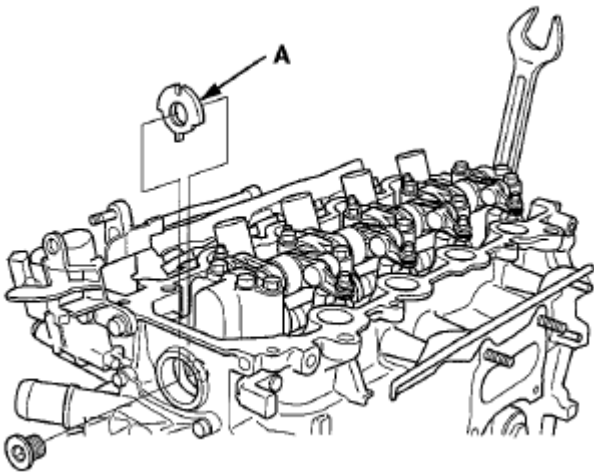
**Fig. 61: Identifying Cylinder Head Plug**

5. Hold the camshaft with a 27 mm open-end wrench, then loosen the bolt.



**Fig. 62: Holding Camshaft**

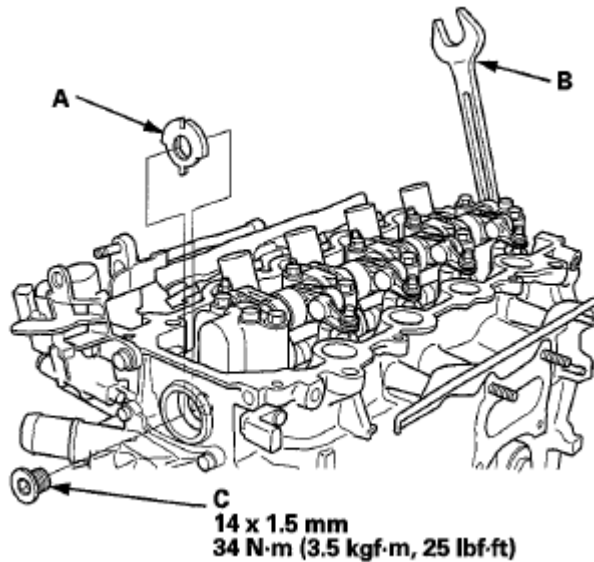
6. Remove the camshaft position (CMP) pulse plate (A).



**Fig. 63: Removing Camshaft Position (CMP) Pulse Plate**

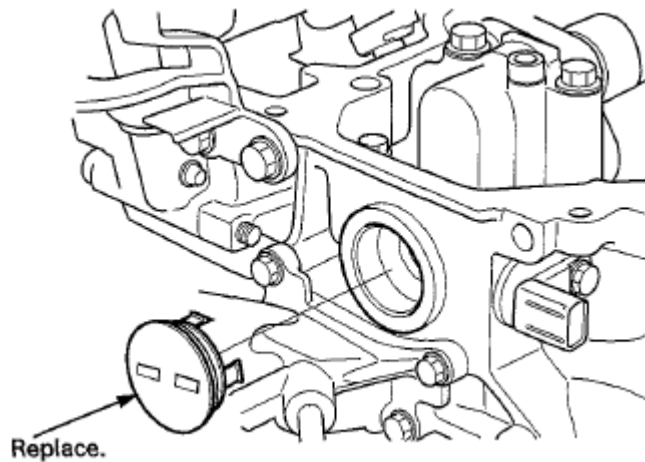
## INSTALLATION

1. Install the CMP pulse plate (A).



**Fig. 64: Installing CMP Pulse Plate And Tightening Bolt With Torque Specifications**

2. Hold the camshaft with a 27 mm open-end wrench (B), then tighten the bolt (C).
3. Install the new cylinder head plug.



**Fig. 65: Identifying Cylinder Head Plug**

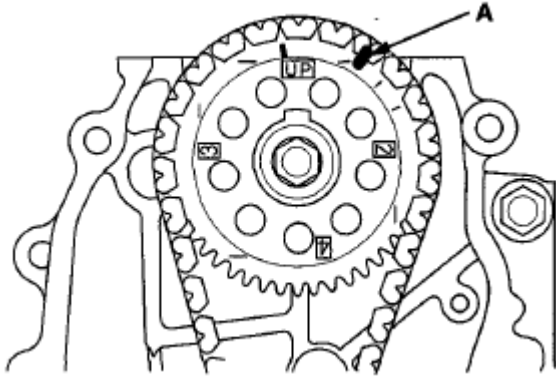
4. Install the harness holder and the ground cable (see step 16 ).
5. Install the cylinder head cover (see **CYLINDER HEAD COVER INSTALLATION** ).
6. Install the air cleaner (see **AIR CLEANER REMOVAL/INSTALLATION** ).

## CAMSHAFT SPROCKET REMOVAL

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

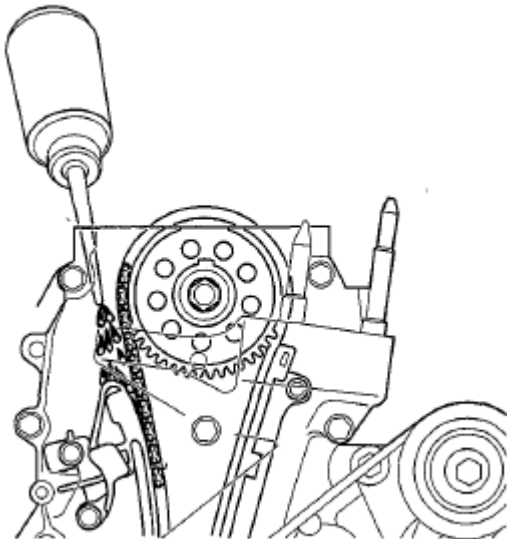
1. Remove the cylinder head cover (see **CAM CHAIN CASE OIL SEAL INSTALLATION** ).

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



**Fig. 66: Aligning Mark Across Camshaft Sprocket And Cam Chain**

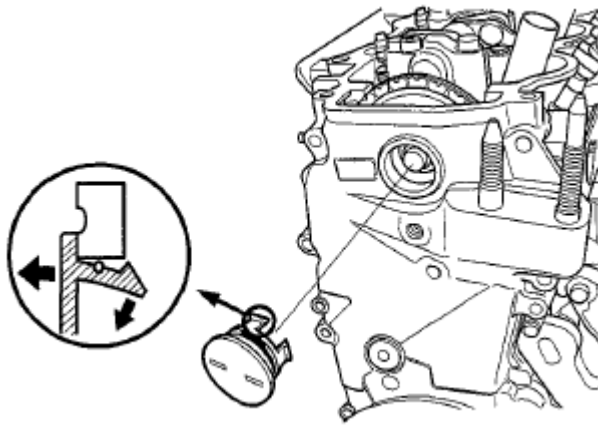
3. Apply new engine oil to the slider surface of the cam chain tensioner slider through the oil return hole in the cylinder head.



**Fig. 67: Applying Engine Oil To Slider Surface Of Cam Chain Tensioner**

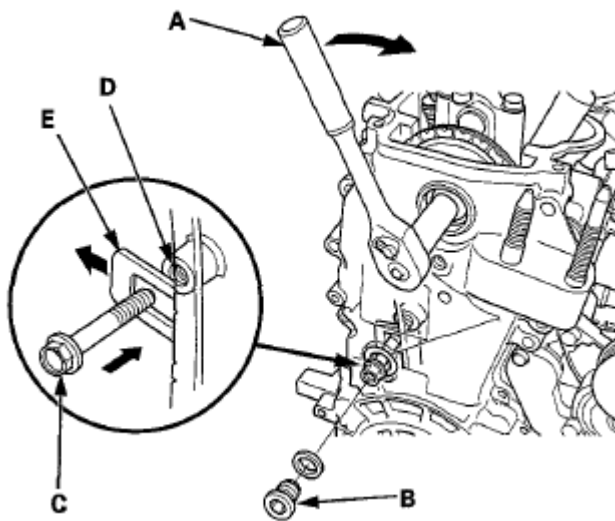
4. Remove the cylinder head plug.





**Fig. 68: Removing Cylinder Head Plug**

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



**Fig. 69: Holding Crankshaft Pulley**

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

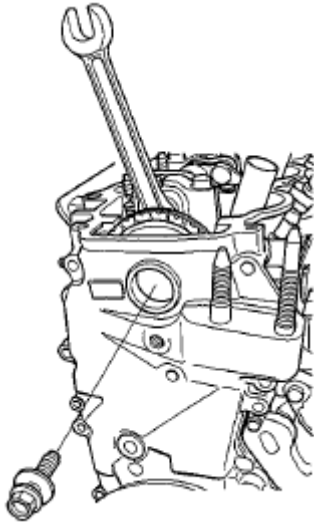
**NOTE:**

- 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 a 27 mm open-end wrench, then remove the camshaft sprocket.

**NOTE:**

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

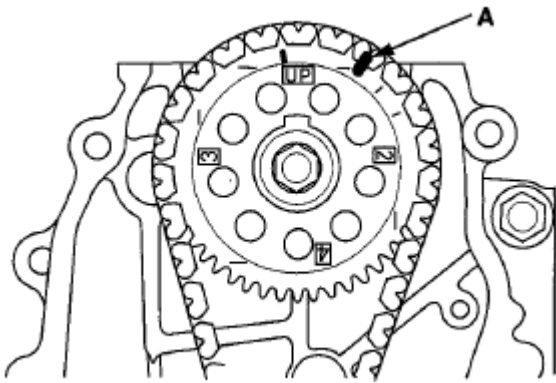


**Fig. 70: Holding Camshaft**

## CAMSHAFT SPROCKET INSTALLATION

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

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

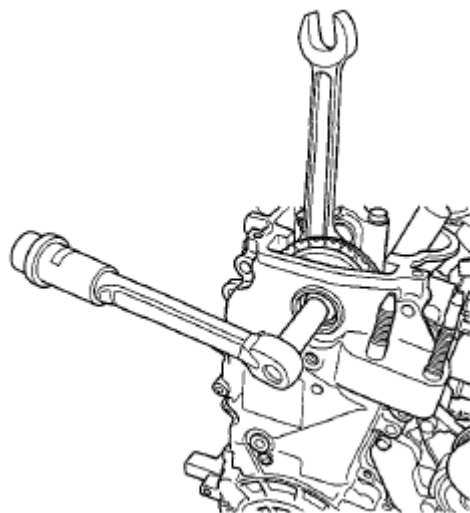


**Fig. 71: Aligning Mark Camshaft Sprocket And Cam Chain**

2. Hold the camshaft with a 27 mm open-end wrench, then tighten the bolt.

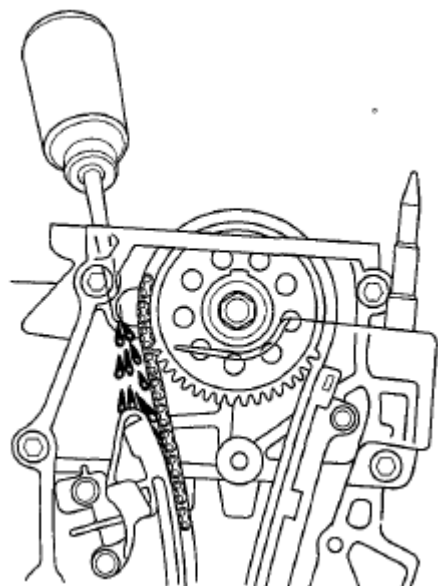
**NOTE:** Apply new engine oil to the bolt threads and flange.

**Specified Torque: 56 N.m (5.7 kgf.m, 41 lbf.ft)**



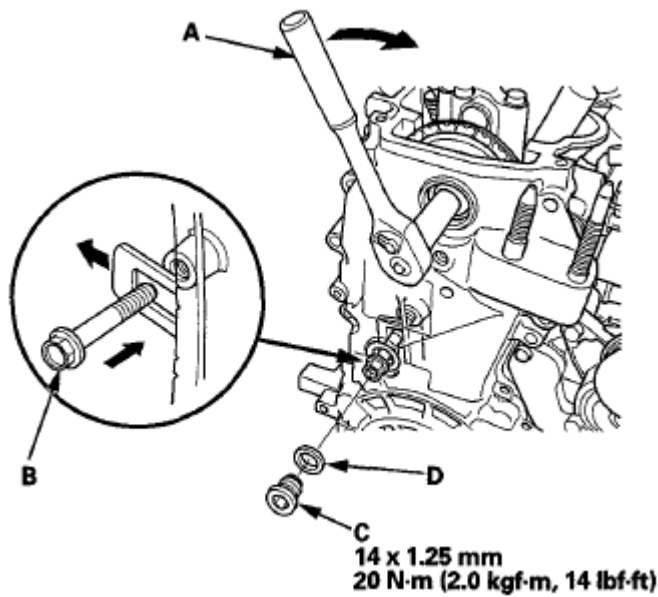
**Fig. 72: Holding Camshaft**

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



**Fig. 73: Applying Engine Oil To Slider Surface Of Cam Chain Tensioner**

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



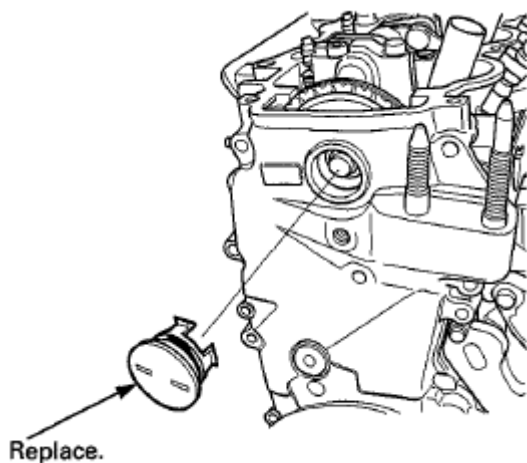
**Fig. 74: Holding Crankshaft Pulley And Identifying Maintenance Bolt With Torque Specifications**

5. Turn the camshaft clockwise to compress the cam chain tensioner, 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.



**Fig. 75: Identifying Cylinder Head Plug**

8. Install the cylinder head cover (see **CYLINDER HEAD COVER 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.

### Warpage

**Standard (New): 0.07 mm (0.0028 in)**

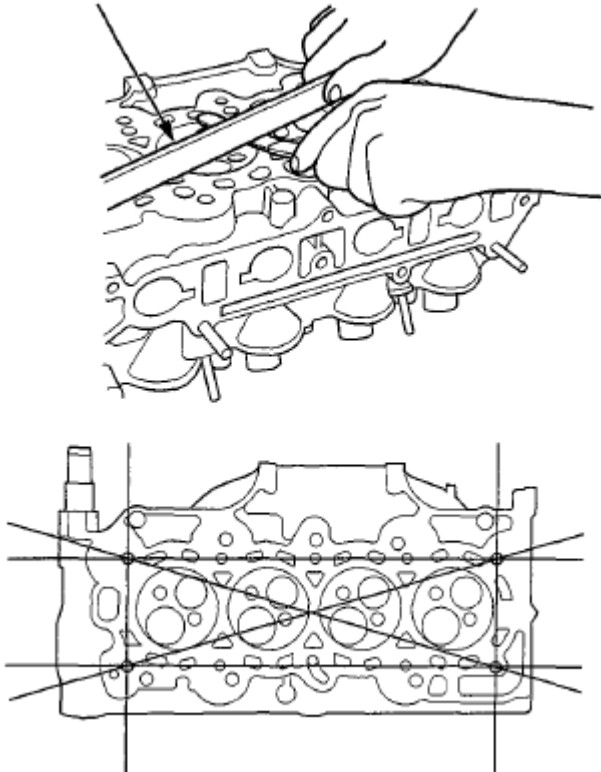
**Service Limit: 0.08 mm (0.0031 in)**

- If warpage is less than 0.08 mm (0.0031 in) cylinder head resurfacing is not required.
- If warpage is between 0.08 mm (0.0031 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)**

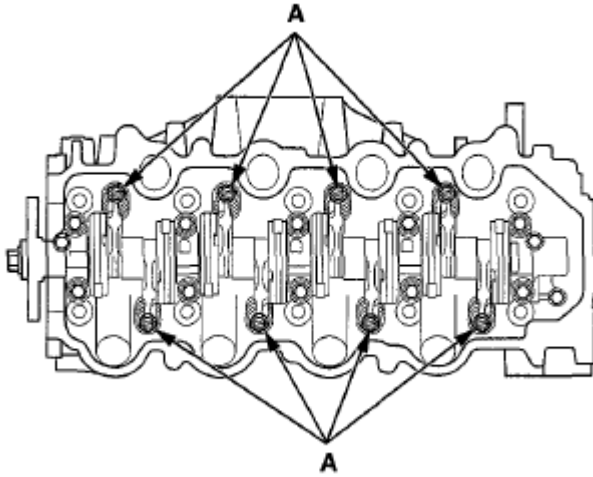
**PRECISION STRAIGHT EDGE**



**Fig. 76: Measuring Cylinder Head Height**

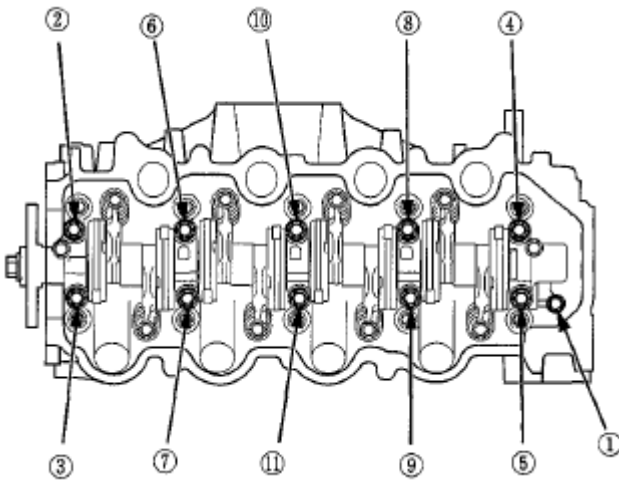
## ROCKER ARM ASSEMBLY REMOVAL

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



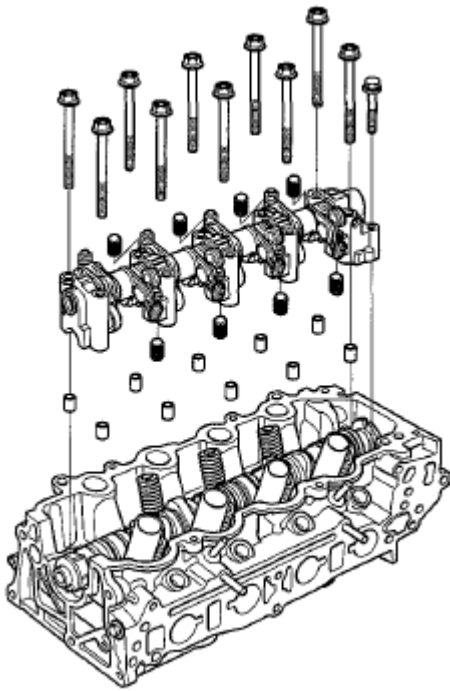
**Fig. 77: Identifying Rocker Arm Adjusting Screws**

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



**Fig. 78: Identifying Camshaft Holder Bolts Removing Sequence**

4. Remove the rocker arm assembly.

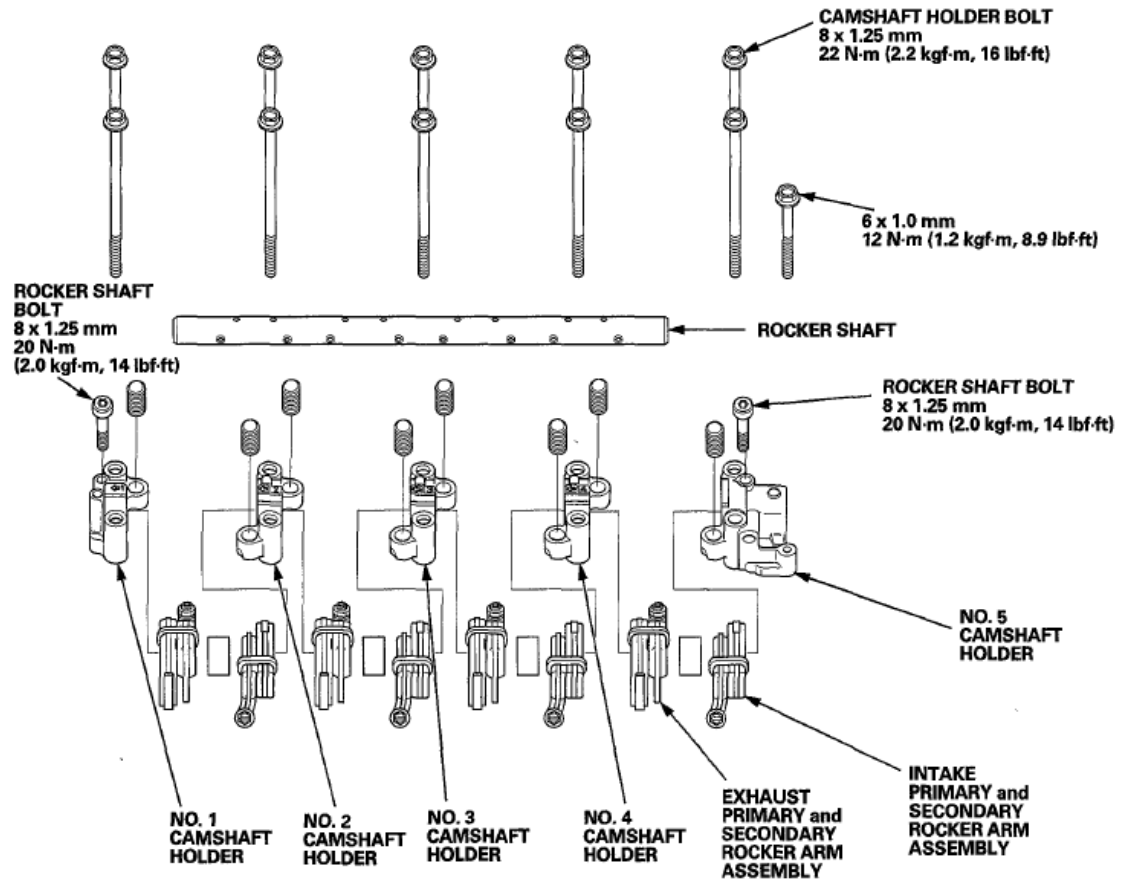


**Fig. 79: Identifying Rocker Arm Assembly With Bolts**

## ROCKER ARM AND SHAFT DISASSEMBLY/REASSEMBLY

**NOTE:**

- Identify each part as it is removed so that each item can be reinstalled in their 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 ).
- If reused, the rocker arms must be installed in their original location.
- Bundle the rocker arms with rubber bands to keep them together as a set, and remove the bands after the rocker arms have been installed.
- 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.
- When replacing the rocker arm assembly, remove the fastening hardware from the new rocker arm assembly.

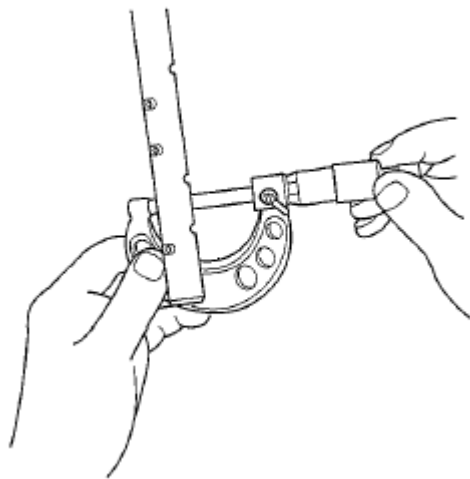


**Fig. 80: Disassembling View Of Rocker Arm , Shaft And Bolts With Torque Specifications**

## ROCKER ARM AND SHAFT INSPECTION

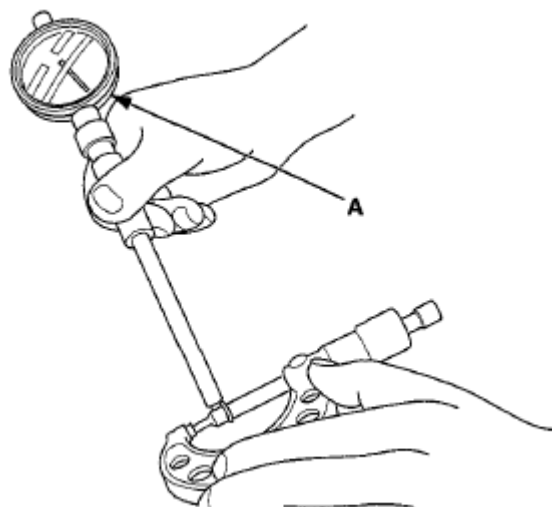
1. Remove the rocker arm assembly (see **ROCKER ARM ASSEMBLY REMOVAL** ).
2. Disassemble the rocker arm assembly (see **ROCKER ARM AND SHAFT DISASSEMBLY/REASSEMBLY** ).
3. Measure the diameter of the shaft at the first rocker location.





**Fig. 81: Measuring Diameter Of Shaft**

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



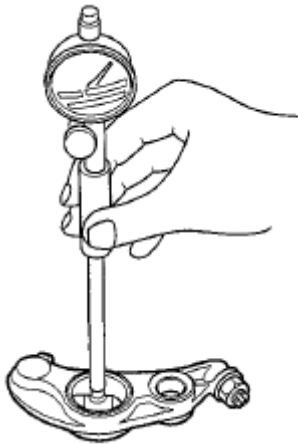
**Fig. 82: Measuring Shaft Diameter**

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

**Rocker Arm-to-Shaft Clearance**

**Standard (New): 0.017-0.045 mm (0.0007-0.0018 in)**

**Service Limit: 0.08 mm (0.003 in)**



**Fig. 83: Measuring Inside Diameter Of Rocker Arm**

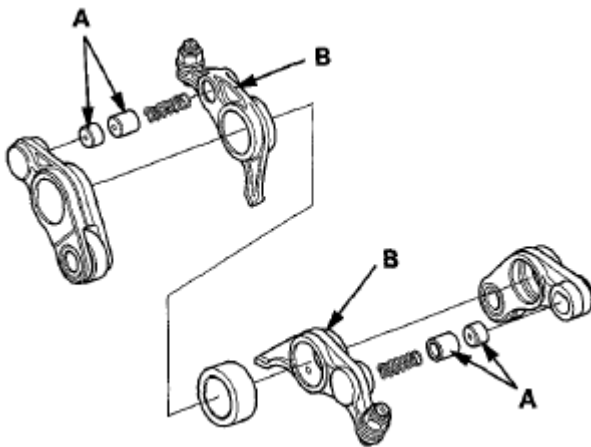
6. Repeat for all the rockers and both shafts. If the clearance is beyond the service limit, replace the rocker shaft and all out of service limit rocker arms. If any intake rocker arm needs replacement, replace all four rocker arms in that set (intake primary and secondary, exhaust primary and secondary).

### Rocker Arms

7. Inspect the rocker arm pistons (A). Slide them manually. If they do not move smoothly, replace the rocker arm set.

#### NOTE:

- Apply new engine oil to the rocker arm pistons when reassembling.
- When reassembling the intake primary and exhaust primary rocker arms (B), carefully apply air pressure to the oil passage of the rocker arm.



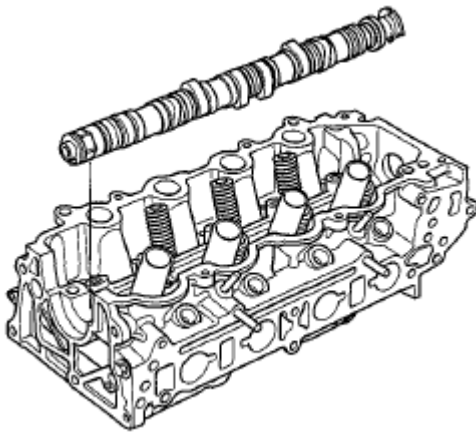
**Fig. 84: Identifying Rocker Arm Pistons And Rocker Arm**

8. Reassemble the rocker arm assembly (see **ROCKER ARM AND SHAFT DISASSEMBLY/REASSEMBLY**).

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

## **CAMSHAFT REMOVAL**

1. Remove the air cleaner (see **AIR CLEANER REMOVAL/INSTALLATION** ).
2. Remove the intake manifold (see **REMOVAL** ).
3. Remove the cylinder head cover (see **CAM CHAIN CASE OIL SEAL INSTALLATION** ).
4. Remove the camshaft sprocket (see **INSTALLATION** ).
5. Remove the rocker arm assembly (see **ROCKER ARM ASSEMBLY REMOVAL** ).
6. Remove the camshaft.



**Fig. 85: Identifying Camshaft**

## **CAMSHAFT INSPECTION**

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

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

### **Specified Torque**

#### **8 mm Bolts:**

**22 N.m (2.2 kgf.m, 16 lbf.ft)**

**Apply new engine oil to the bolt threads and flange.**

**8 mm Bolts: (11), (13)**

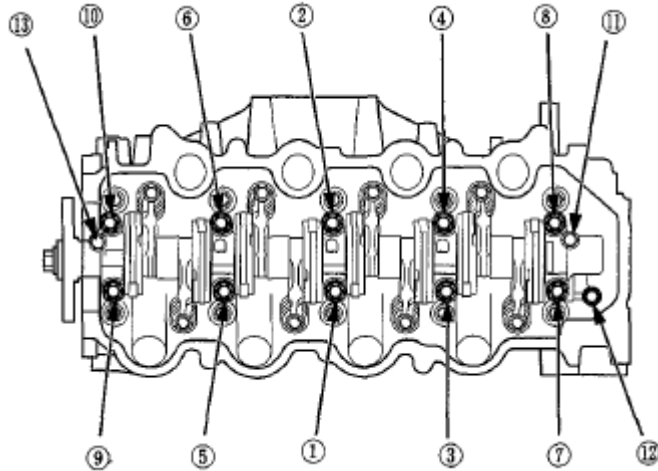
**20 N.m (2.0 kgf.m, 14 lbf.ft)**

Apply new engine oil to the bolt threads and flange.

**6 mm Bolt: (12)**

**12 N.m (1.2 kgf.m, 8.7 lbf.ft)**

Apply new engine oil to the bolt threads and flange.



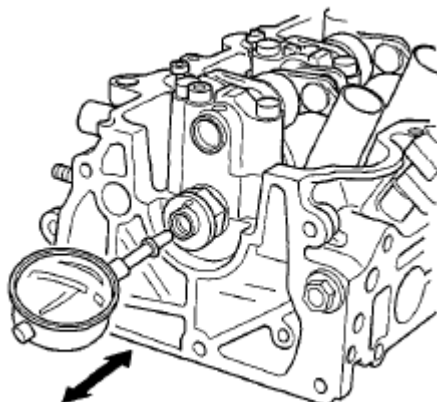
**Fig. 86: Identifying Camshaft Holders Bolts Tightening Sequence**

3. Seat the camshaft by pushing it toward the rear 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)**



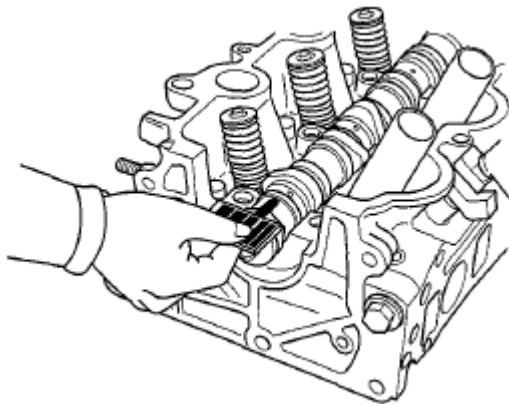
**Fig. 87: Checking Camshaft End Play**

5. Loosen 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 part of plastigage on each journal.
  - If the camshaft-to-holder clearance is within limits, go to step 11.
  - If the camshaft-to-holder clearance is beyond the service limit and the camshaft has been replaced, replace the cylinder head.
  - If the camshaft-to-holder clearance is beyond the service limit and the camshaft has not been replaced, go to step 10.

**Camshaft-to-Holder Oil Clearance**

**Standard (New): 0.050-0.089 mm (0.0020-0.0035 in)**

**Service Limit: 0.10 mm (0.004 in)**

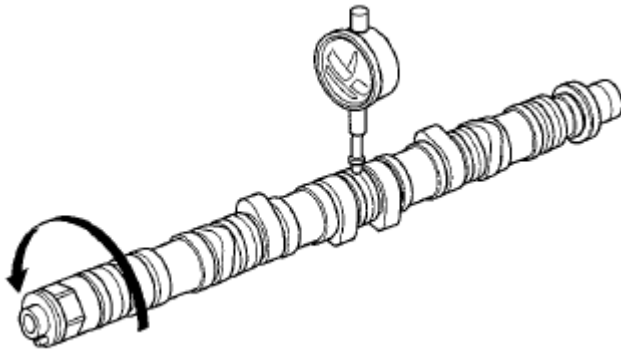
**Fig. 88: Measuring Widest Part Of Plastigage On Each Journal**

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 out of tolerance, 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. 89: Checking Total Runout With Camshaft Supported On V-Blocks**

11. Measure the cam lobe height.

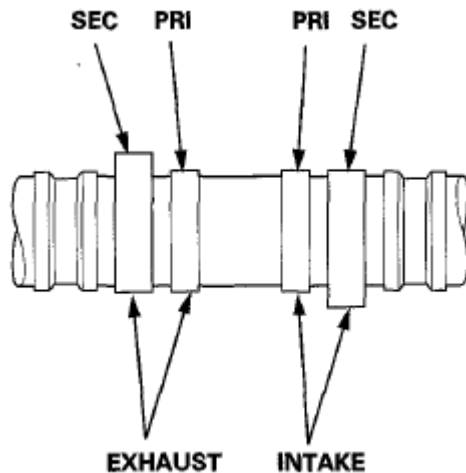
**Cam Lobe Height Standard (New):**

**CAM LOBE HEIGHT SPECIFICATION**

	INTAKE	EXHAUST
SEC	35.854 mm (1.4116 in)	35.470 mm (1.3965 in)
PRI	29.700 mm (1.1693 in)	29.900 mm (1.1772 in)

PRI: Primary

SEC: Secondary



**Fig. 90: Measuring Cam Lobe Height**

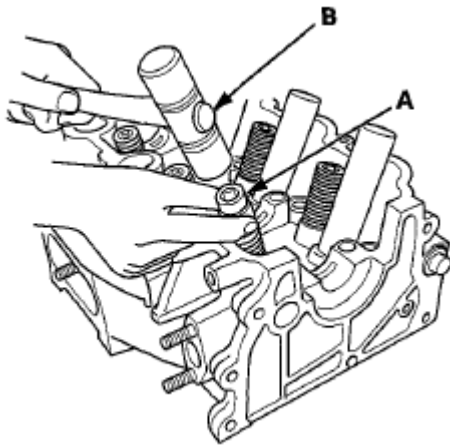
## VALVE, SPRING, AND VALVE SEAL REMOVAL

### Special Tools Required

Valve Spring Compressor Attachment 07757-PJ1010A

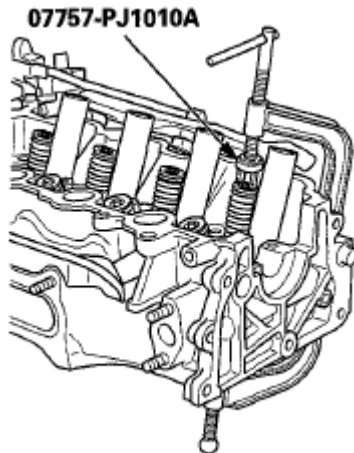
Identify the valves and valve springs as they are removed so that each item can be reinstalled in its original position.

1. Remove the cylinder head (see **CYLINDER HEAD REMOVAL** ).
2. Remove the rocker arm assembly (see **ROCKER ARM ASSEMBLY REMOVAL** ).
3. Remove the camshaft (see **CAMSHAFT REMOVAL** ).
4. Using an appropriate-sized socket (A), and a plastic mallet (B), lightly tap the valve retainer to loosen the valve cotters.



**Fig. 91: Tapping Valve Retainer**

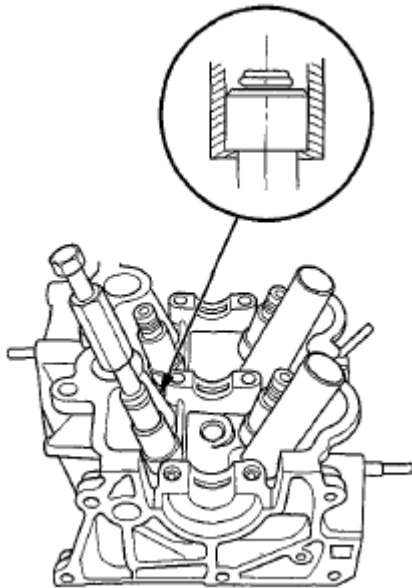
5. Install the valve spring compressor and attachment. Compress the valve spring, and remove the valve cotters.



**Fig. 92: Compressing Valve Spring**

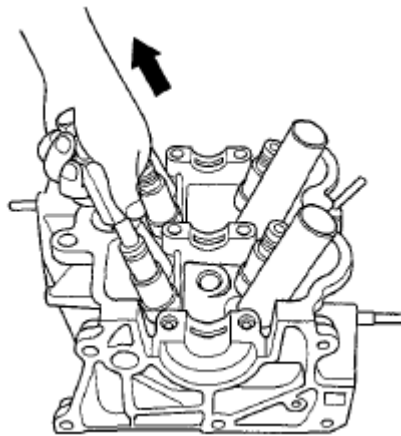
6. Remove the valve spring compressor and the attachment, then remove the spring retainer, the valve spring and the valve.

7. Install the valve guide seal remover.



**Fig. 93: Identifying Valve Guide Seal Remover**

8. Remove the valve seal.



**Fig. 94: Removing Valve Seal**

9. Remove the valve spring seat.

## VALVE INSPECTION

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

### intake Valve Dimensions



**A Standard (New): 34.85-35.15 mm (1.372-1.383 in)**

**B Standard (New): 117.60-118.40 mm (4.630-4.661 in)**

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

**C Service Limit: 5.45 mm (0.215 in)**

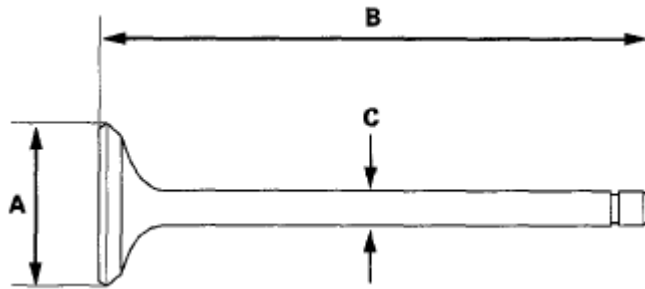
#### Exhaust Valve Dimensions

**A Standard (New): 29.85-30.15 mm (1.175-1.187 in)**

**B Standard (New): 117.50-118.30 mm (4.626-4.657 in)**

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

**C Service Limit: 5.42 mm (0.213 in)**



**Fig. 95: Identifying Valve Dimensions**

## VALVE STEM-TO-GUIDE CLEARANCE INSPECTION

1. Remove the valves (see VALVE, SPRING, AND VALVE SEAL REMOVAL ).
2. Subtract the O.D. of the valve stem, measured with a micrometer, from the I.D. of the valve guide, measured with an inside micrometer or ball gauge.

Take the measurements in three places along the valve stem and three places inside the valve guide.

The difference between the largest guide measurement and the smallest stem measurement should not exceed the service limit.

#### Intake Valve Stem-to-Guide Clearance

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

**Service Limit: 0.08 mm (0.003 in)**

#### Exhaust Valve Stem-to-Guide Clearance

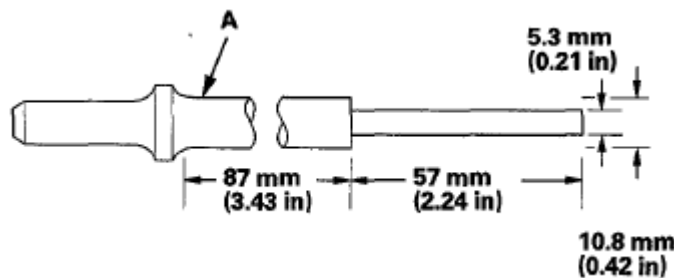
**Standard (New): 0.050-0.080 mm (0.0020-0.0031 in)**

**Service Limit: 0.11 mm (0.004 in)**

## VALVE GUIDE REPLACEMENT

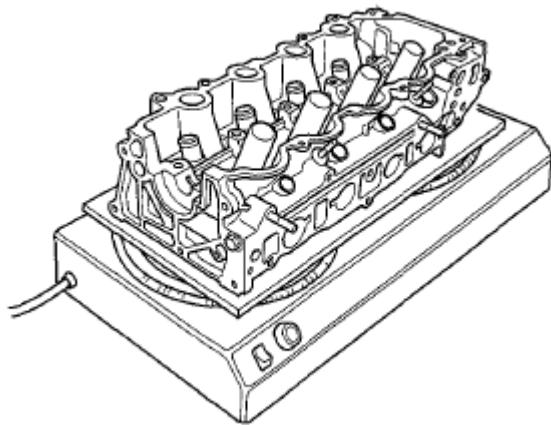
### Special Tools Required

- Valve Guide Driver, 5.35 x 9.7 07742-0010100
  - Valve Guide Reamer, 5.5 mm 07HAH-PJ7A100
1. Inspect valve stem-to-guide clearance (see **VALVE INSPECTION** ).
  2. As illustrated below, 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 valve guide driver and a conventional hammer.



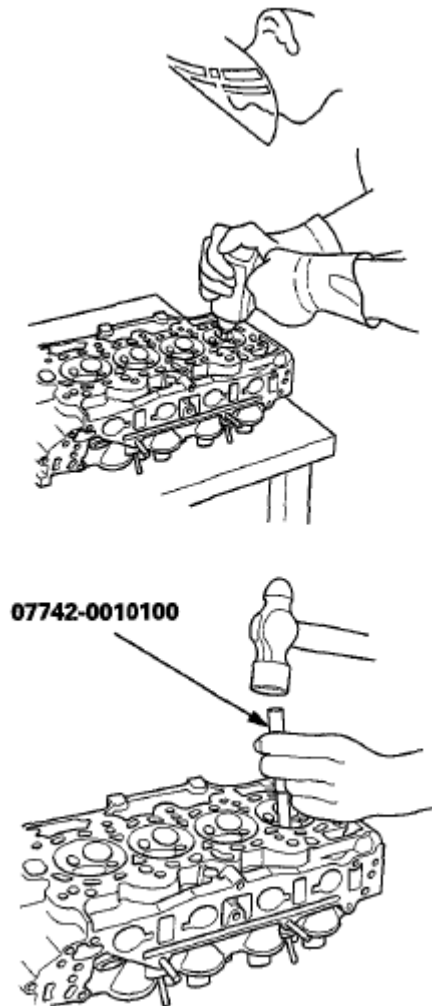
**Fig. 96: Identifying Valve Stem-To-Guide Clearance**

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



**Fig. 97: Heating Cylinder Head**

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

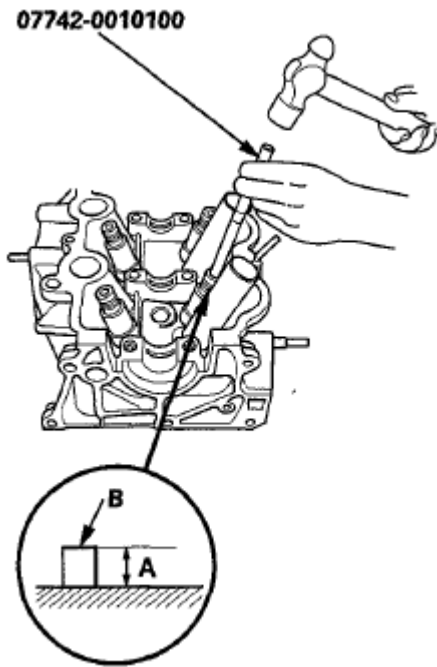


**Fig. 98: Tapping Valve Guide**

7. If a valve guide will not move, drill it out with a 8 mm (5/16 in) bit, then try again. Drill guides only in extreme cases; you could damage the cylinder head if the guide breaks.
8. Remove the new guide(s) from the freezer, one at a time, as you need them.
9. Apply a thin coat of new engine oil to the outside of the new valve guide. Install the guide from the camshaft side of the head; use the valve guide driver to drive the guide in to the specified installed height (A) of the guide (B). If you have all eight guides to do, you may have to reheat the head.

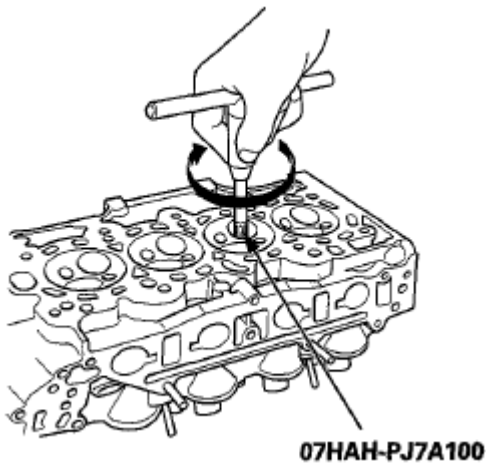
**Valve Guide Installed Height:**

**16.25-16.75 mm (0.640-0.659 in)**



**Fig. 99: Identifying Valve Guide Installation Height**

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

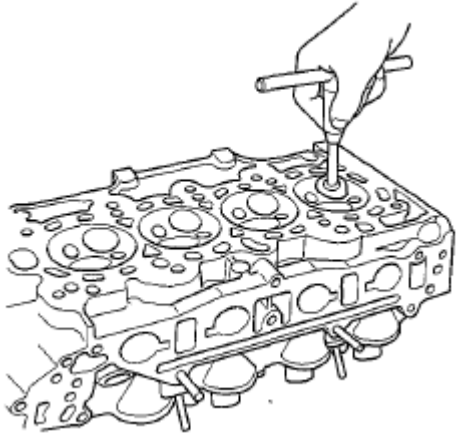


**Fig. 100: Rotating Reamer**

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

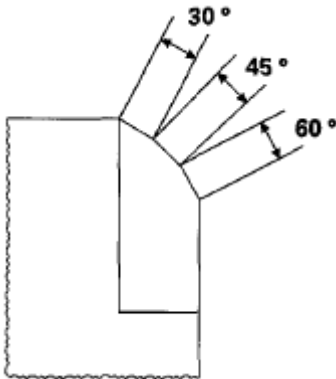
## VALVE SEAT RECONDITIONING

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



**Fig. 101: Cutting Valve Seats In Cylinder Head Using Valve Seat Cutter**

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 the illustration. Check the width of the seat and adjust accordingly.



**Fig. 102: Identifying Valve Seats Angle**

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)**

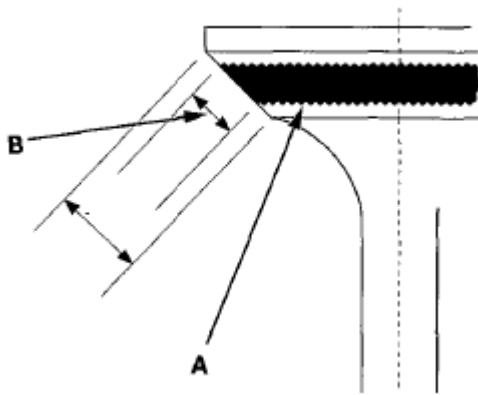
**Service Limit: 1.80 mm (0.071 in)**

**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.



**Fig. 103: Identifying Valve Seating Surface**

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 60 ° cutter to move it down, then one more cut with the 45 ° cutter to restore seat width.
  - If it is too low (close to the valve edge), you must make a second cut with the 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**

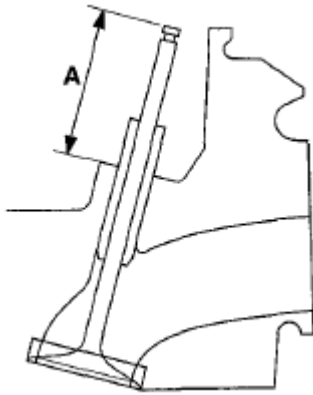
**Standard (New): 47.4-47.8 mm (1.866-1.882 in)**

**Service Limit: 48.1 mm (1.894 in)**

**Exhaust Valve Stem Installed Height**

**Standard (New): 47.3-47.7 mm (1.862-1.878 in)**

**Service Limit: 48.0 mm (1.890 in)**



**Fig. 104: Measuring Valve Stem Installed Height**

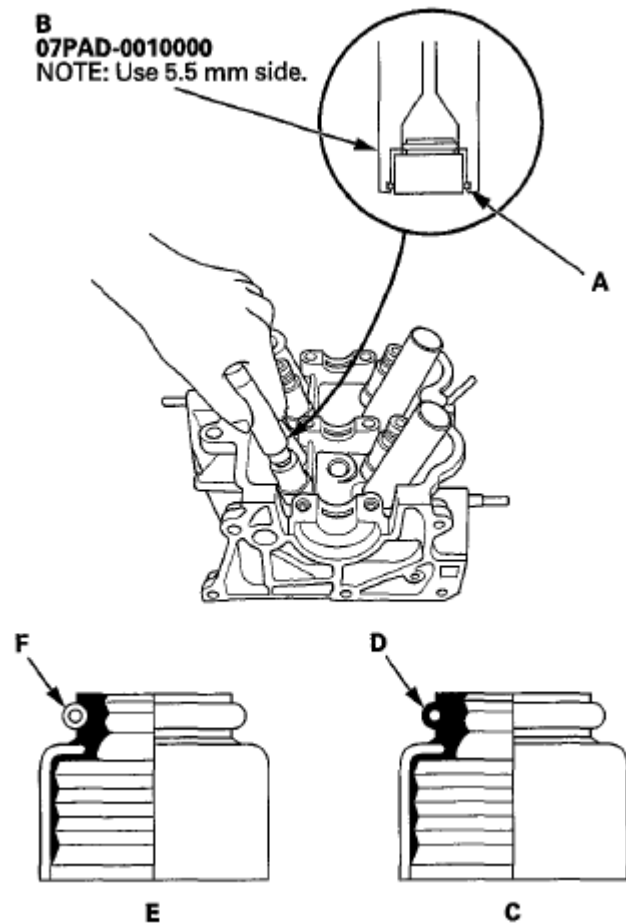
9. If valve stem installed height is over the service limit, replace the valve and recheck. If it is still over the service limit, replace the cylinder head; the valve seat in the head is too deep.

## VALVE, SPRING, AND VALVE SEAL INSTALLATION

### Special Tools Required

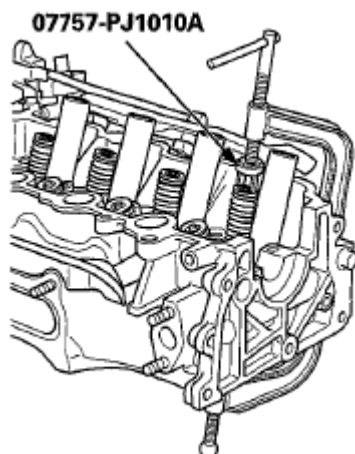
- Stem Seal Driver, 30 07PAD-0010000
  - Valve Spring Compressor Attachment 07757-PJ1010A
1. Coat the valve stems with new engine oil. Install the valves in the valve guides.
  2. Check that the valves move up and down smoothly.
  3. Install the spring seats on the cylinder head.
  4. Install the new valve seals (A) using the 5.5 mm side of the stem seal driver (B).

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



**Fig. 105: Identifying Exhaust And Intake Valve Seal**

5. Install the valve spring. Place the end of the valve spring with closely wound coils toward the cylinder head.
6. Install the spring retainer.
7. Install the valve spring compressor and the attachment. Compress the spring, and install the valve cotters.

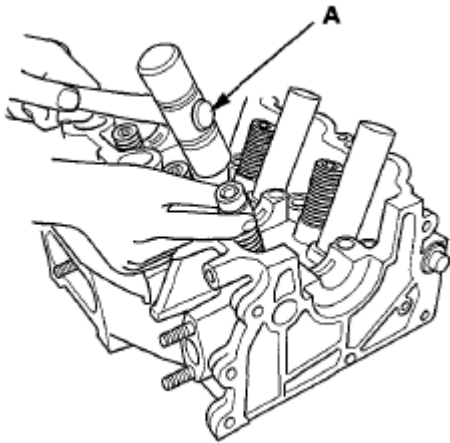




**Fig. 106: Compressing Valve Spring**

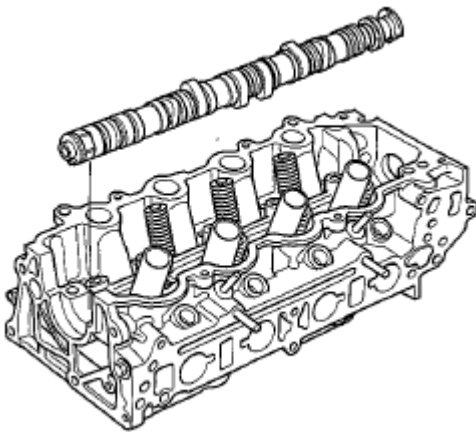
8. Remove the valve spring compressor and the attachment.
9. Lightly tap the end of each valve stem two or three times with a plastic mallet (A) to ensure proper seating of the valve and the valve cotters. Tap the valve stem only along its axis so you do not bend the stem.

**NOTE:** Be sure to raise the head off the work bench so the valve is not possibly damaged.

**Fig. 107: Tapping Valve Stem**

## CAMSHAFT INSTALLATION

1. Install the camshaft.

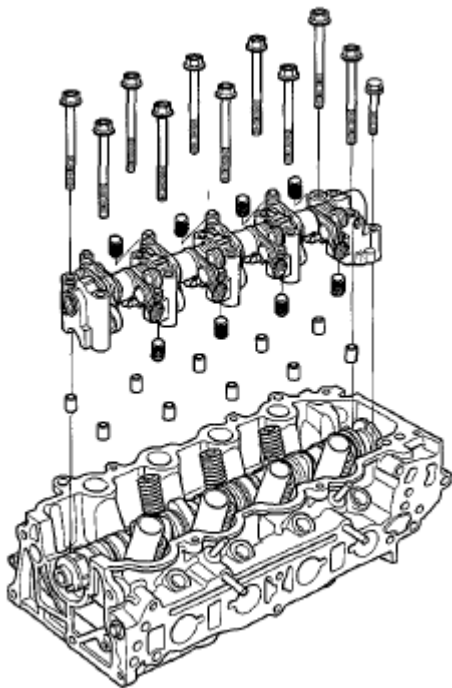
**Fig. 108: Identifying Camshaft**

2. Install the rocker arm assembly (see **ROCKER ARM ASSEMBLY INSTALLATION** ).
3. Install the camshaft sprocket (see **CAMSHAFT SPROCKET INSTALLATION** ).

4. Install the cylinder head cover (see CYLINDER HEAD COVER INSTALLATION ).
5. Install the intake manifold (see INSTALLATION ).
6. Install the air cleaner (see AIR CLEANER REMOVAL/INSTALLATION ).

## ROCKER ARM ASSEMBLY INSTALLATION

1. Reassemble the rocker arm assembly (see ROCKER ARM AND SHAFT DISASSEMBLY/REASSEMBLY ).
2. Apply new engine oil to the camshaft lobes and journals.
3. Install the rocker arm assembly.



**Fig. 109: Identifying Rocker Arm Assembly**

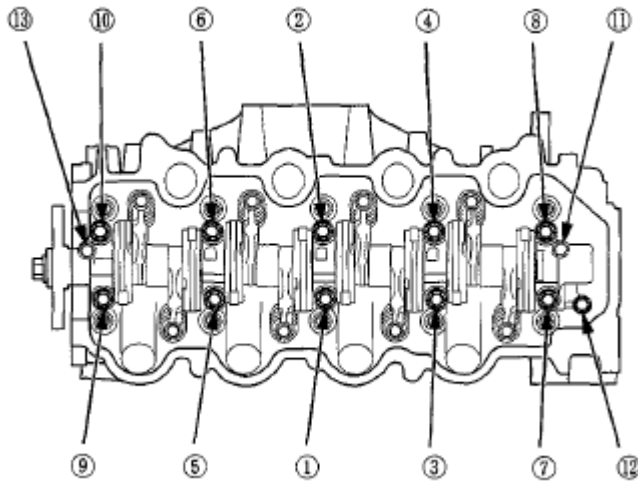
4. Apply new engine oil to the bolt threads and flange. Tighten each bolt two turns at a time in sequence.

### **Specified Torque**

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

**8 mm Bolts: (11), (13) 20 N.m (2.0 kgf.m, 14 lbf.ft)**

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

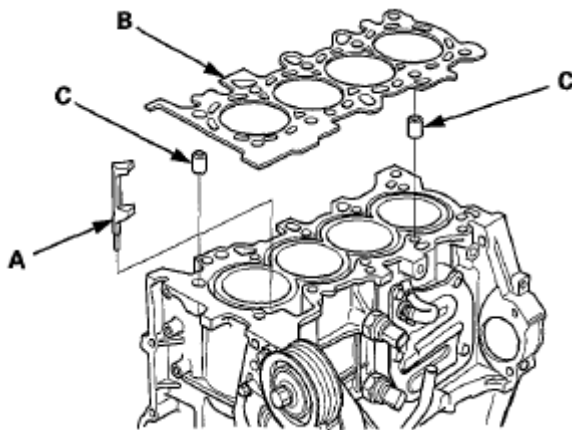


**Fig. 110: Identifying Bolts Tightening Sequence**

5. Install the camshaft sprocket (see [CAMSHAFT SPROCKET INSTALLATION](#) ).
6. Adjust the valve clearance (see [VALVE CLEARANCE ADJUSTMENT](#) ).

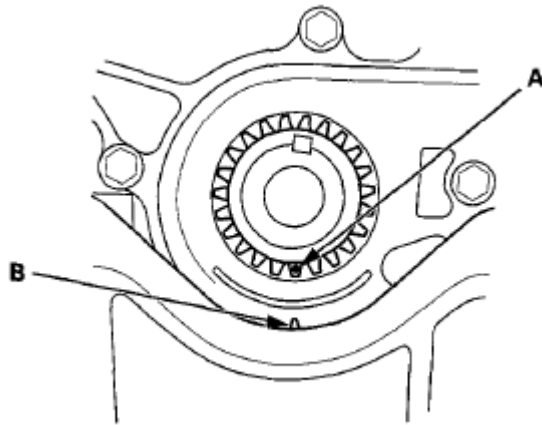
## CYLINDER HEAD INSTALLATION

1. Clean the cylinder head and the engine block surface.
2. Install a new coolant separator (A) in the engine block whenever the engine block is replaced.



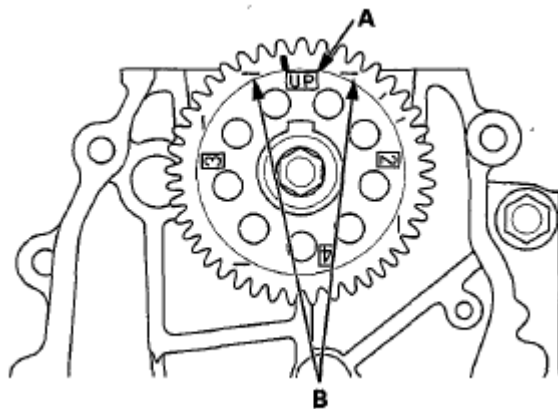
**Fig. 111: Identifying Coolant Separator And Cylinder Head Gasket**

3. Install the new cylinder head gasket (B) and the dowel pins (C) on the engine block. Always use a new cylinder head gasket.
4. 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.



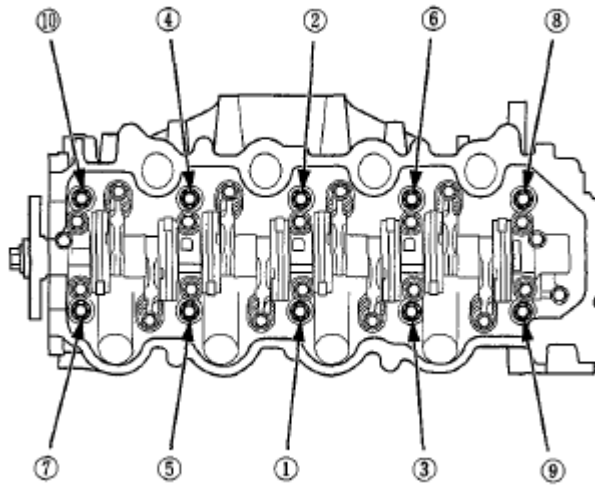
**Fig. 112: Aligning TDC Mark On Crankshaft Sprocket With Pointer On Oil Pump**

5. Set the camshaft 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.



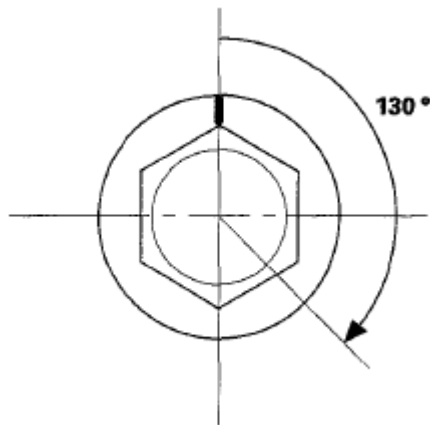
**Fig. 113: Identifying Camshaft Sprocket Mark Location**

6. Install the cylinder head on the engine block.
7. Apply new engine oil to the threads and flange of all cylinder head bolts.
8. 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-click-type torque wrench, be sure to tighten slowly and do not overtighten. If a bolt makes any noise while you are torquing it, loosen the bolt and retighten it from the first step.



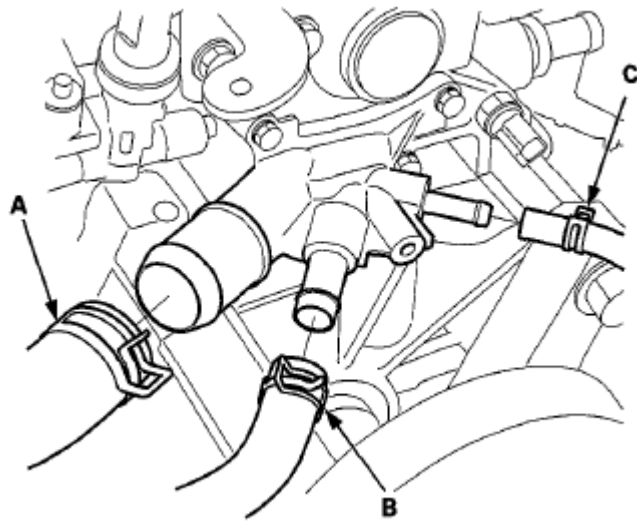
**Fig. 114: Identifying Cylinder Head Tightening Bolts Sequence**

9. Tighten all cylinder head bolts an additional 130°.



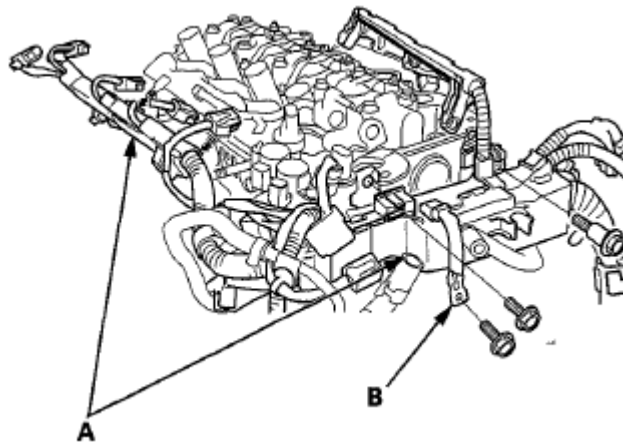
**Fig. 115: Identifying Cylinder Head Bolts Tightening Angle**

10. Install the cam chain (see **CAM CHAIN INSTALLATION** ).
11. Install the warm-up three way catalytic converter (WU-TWC) (see **WARM UP TWC REMOVAL/INSTALLATION** ).
12. Install the cylinder head cover (see **CYLINDER HEAD COVER INSTALLATION** ).
13. Install the water pump (see **WATER PUMP REPLACEMENT** ).
14. Install the drive belt (see **DRIVE BELT INSPECTION** ).
15. Install the upper radiator hose (A), the water bypass hose (B), and the heater hose (C).



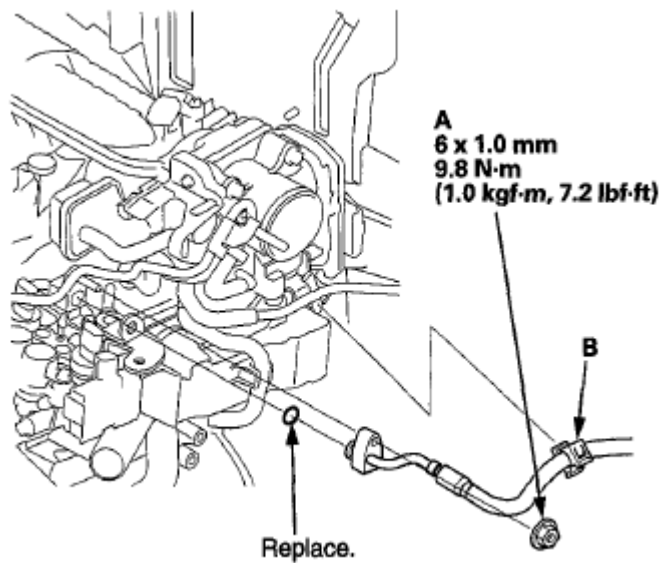
**Fig. 116: Identifying Upper Radiator Hose, Water Bypass Hose And Heater Hose**

16. Install the harness holder (A) and the ground cable (B).



**Fig. 117: Identifying Harness Holder And Ground Cable**

17. Install the fuel pipe bolt (A) and the fuel pipe clamp (B).



**Fig. 118: Identifying Fuel Pipe Bolt With Torque Specifications And Fuel Pipe Clamp**

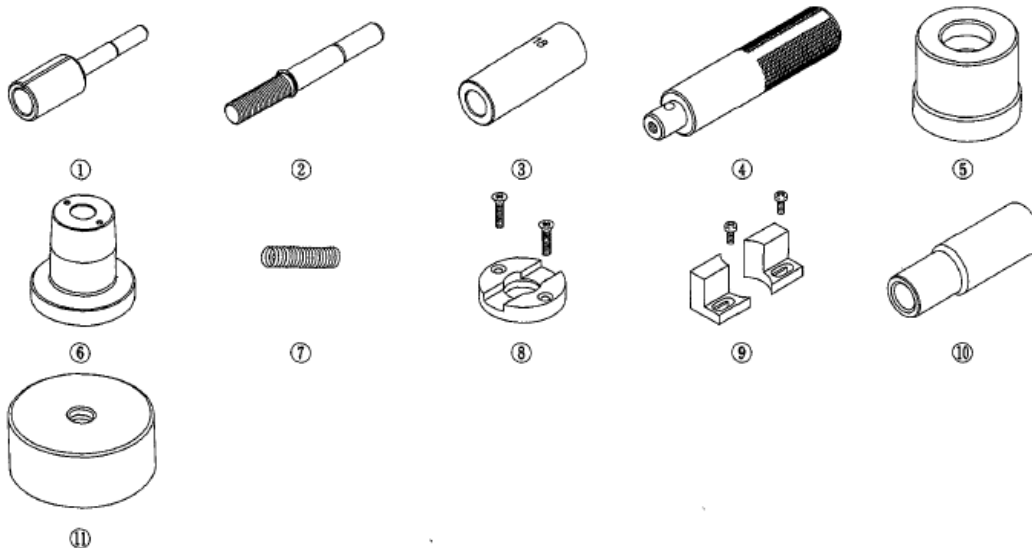
18. Install the breather hose and the harness holder (see step 10).
19. Connect the engine wire harness connectors, and install the wire harness clamps to cylinder head.
  - Four injector connectors
  - Engine coolant temperature (ECT) sensor 1 connector
  - Camshaft position (CMP) sensor connector
  - Secondary heated oxygen sensor (secondary HO2S) connector
  - Rocker arm oil control solenoid connector
20. Install the eight ignition coils (see **IGNITION COIL REPLACEMENT** ).
21. Install the intake manifold (see **INSTALLATION** ).
22. install the air cleaner (see **AIR CLEANER REMOVAL/INSTALLATION** ).
23. After installation, check that all tubes, hoses, and connectors are installed correctly.
24. Do the 12 volt battery installation procedure (see **12 VOLT BATTERY REMOVAL AND INSTALLATION** ).
25. Inspect for fuel leaks. Turn the ignition switch to ON (II) (do not operate the starter) so the fuel pump runs for about 2 seconds and pressurizes the fuel line. Repeat this operation three times, then check for fuel leakage at any point in the fuel line.
26. Refill the radiator with engine coolant, and bleed the air from the cooling system with the heater valve open (see step 9 **COOLANT REPLACEMENT** ).
27. Do the crankshaft position (CKP) pattern clear/CKP pattern learn procedure (see **CKP PATTERN CLEAR/CKP PATTERN LEARN** ).
28. Inspect the idle speed (see **IDLE SPEED INSPECTION** ).
29. Inspect the ignition timing (see **IGNITION TIMING INSPECTION** ).

## 2010-11 ENGINE

## Engine Block - Insight

## SPECIAL TOOLS

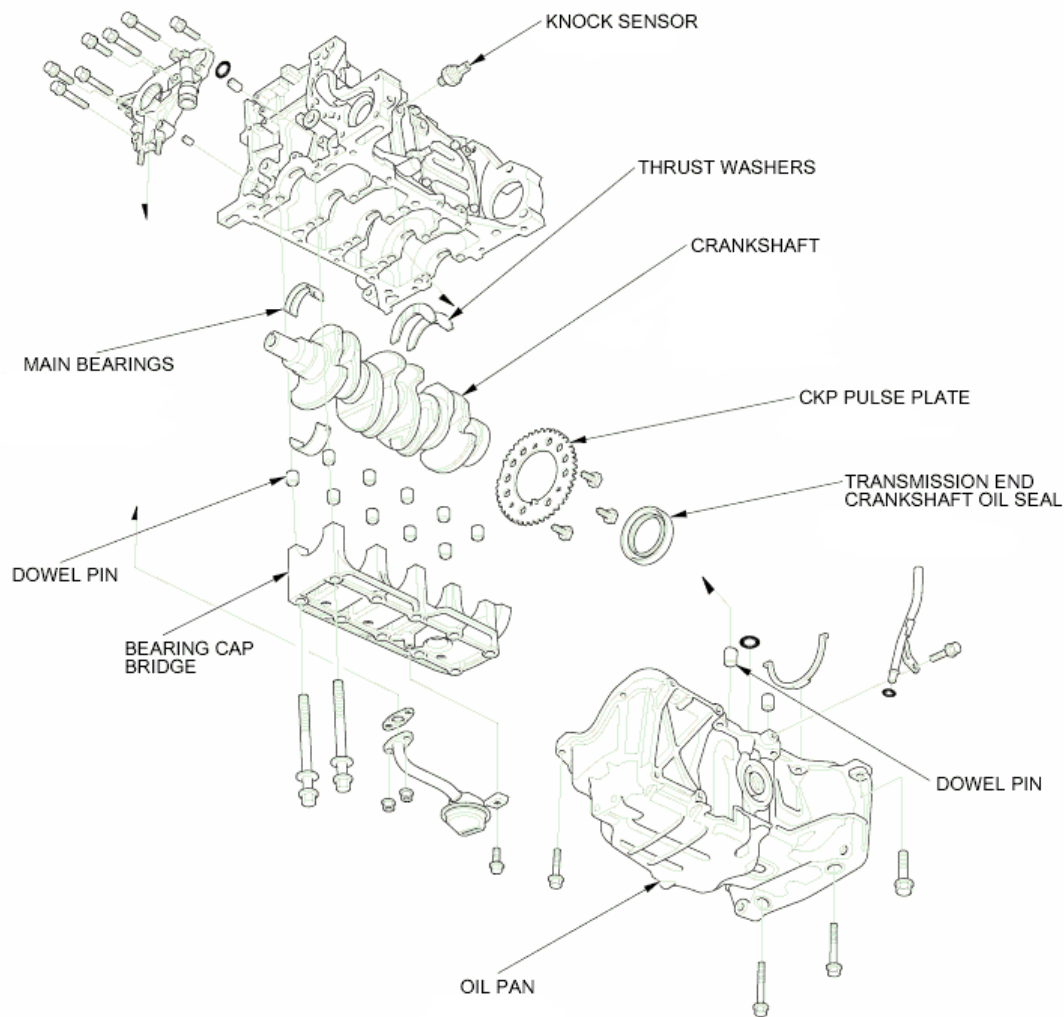
Ref.No.	Tool Number	Description	Qty
①	070AF-PWC0110	Pilot Pin	1
②	070AF-PWC0120	Insert Adjust	1
③	070AF-PWC0130	Pilot Collar, O.D. 18 mm	1
④	07749-0010000	Driver Handle, 15 x 135L	1
⑤	07946-1870100	Bearing Driver Attachment, 28 x 30	1
⑥	07973-6570500	Piston Base	1
⑦	07973-6570600	Piston Base Spring	1
⑧	07PAF-0010400	Piston Base Head	1
⑨	07PAF-0010500	Piston Base Head Insert	2
⑩	07PAF-0010700	Insert Pin	1
⑪	07ZAD-PNAA100	Oil Seal Driver Attachment, 96 mm	1

**Fig. 1: Identifying Special Tools**

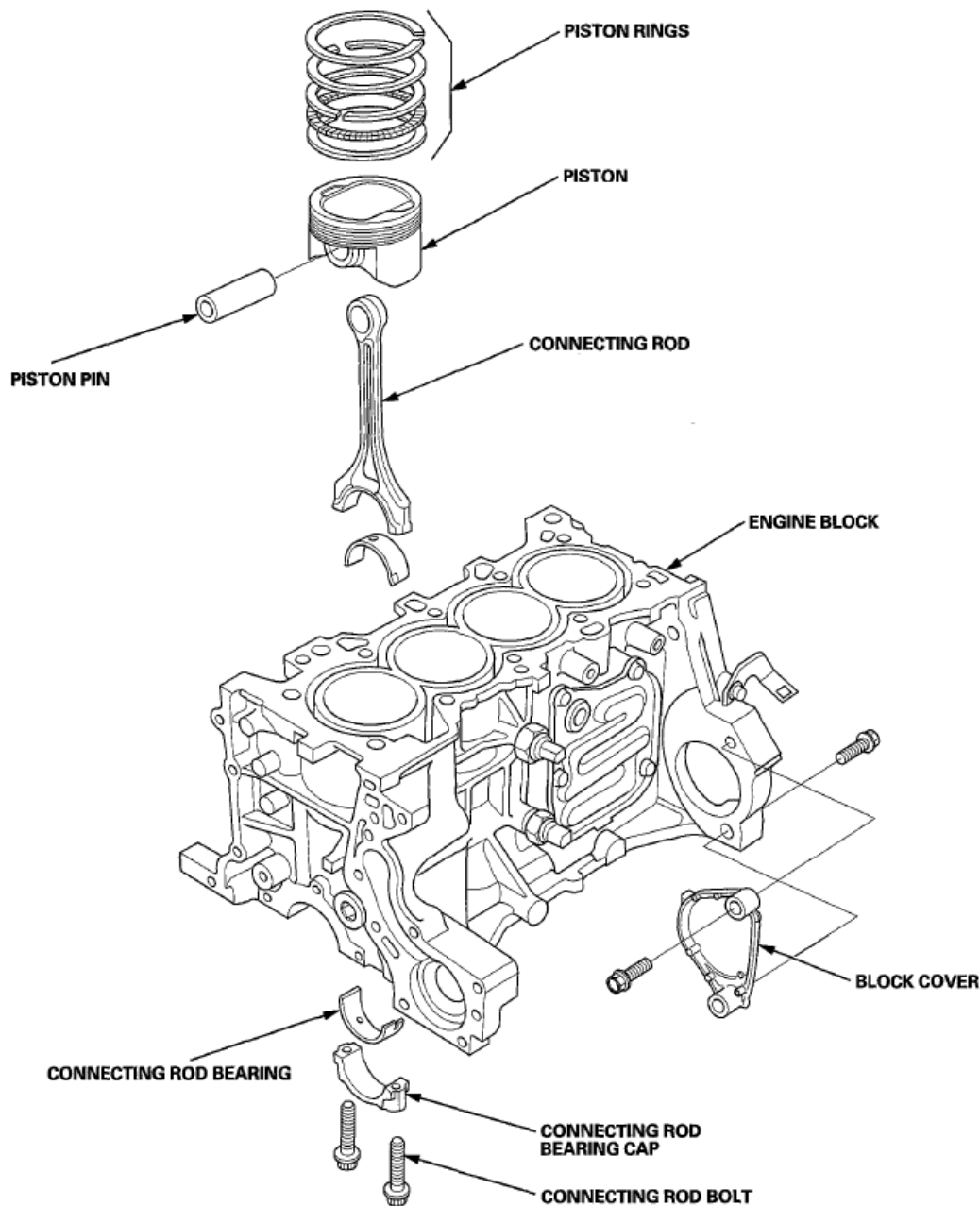
Courtesy of AMERICAN HONDA MOTOR CO., INC.

## COMPONENT LOCATION INDEX





**Fig. 2: Identifying Engine Block Component Location (1 Of 2)**  
Courtesy of AMERICAN HONDA MOTOR CO., INC.



**Fig. 3: Identifying Engine Block Component Location (2 Of 2)**  
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

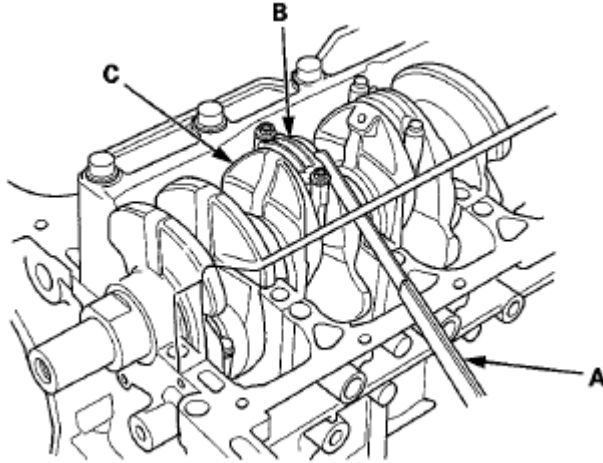
## CONNECTING ROD AND CRANKSHAFT END PLAY INSPECTION

1. Remove the oil pump (see [REMOVAL](#) ).
2. Measure the connecting rod end play with a feeler gauge (A) between the connecting rod (B) and the crankshaft (C).

### Connecting Rod End Play

**Standard (New): 0.15-0.35 mm (0.006-0.014 in)**

**Service Limit: 0.40 mm (0.016 in)**



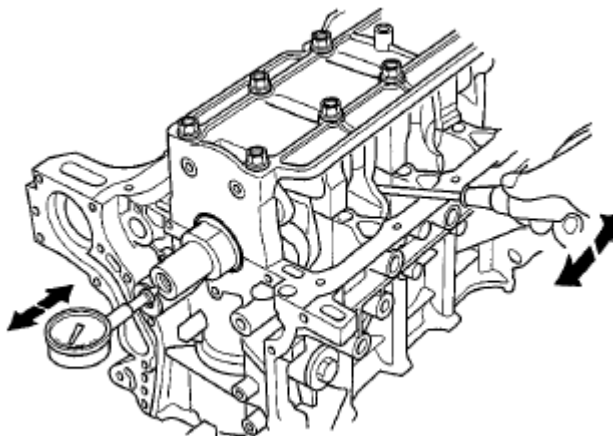
**Fig. 4: Measuring Connecting Rod End Play With Feeler Gauge**  
Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. If the connecting rod end play is beyond the service limit, install a new connecting rod, and recheck. If it is still beyond the service limit, replace the crankshaft (see **CRANKSHAFT AND PISTON REMOVAL** ).
4. To check crankshaft end play, 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)**



**Fig. 5: Checking Crankshaft End Play**

Courtesy of AMERICAN HONDA MOTOR CO., INC.

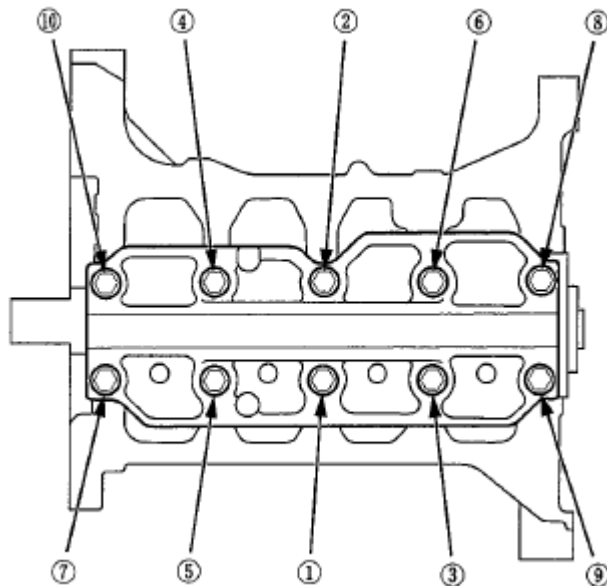
5. If the end play is beyond the service limit, replace the thrust washers, and recheck. If it is still beyond the service limit, replace the crankshaft (see CRANKSHAFT AND PISTON REMOVAL ).

**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 tighten the bearing cap bolts to 25 N.m (2.5 kgf.m, 18 lbf.ft) in the proper sequence.

**NOTE:**

- Apply new engine oil to the bolt threads and flanges.
- Do not rotate the crankshaft during inspection.

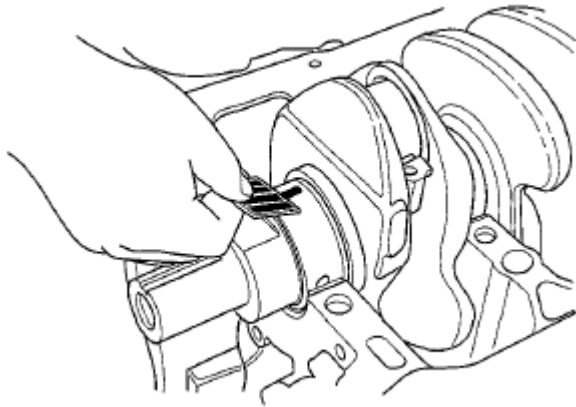
**Fig. 6: Identifying Bearing Cap Bolts Tightening Sequence**

Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. Tighten the bearing cap bolts an additional 40 °.
6. 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)**



**Fig. 7: Measuring Widest Part Of Plastigage**  
**Courtesy of AMERICAN HONDA MOTOR CO., INC.**

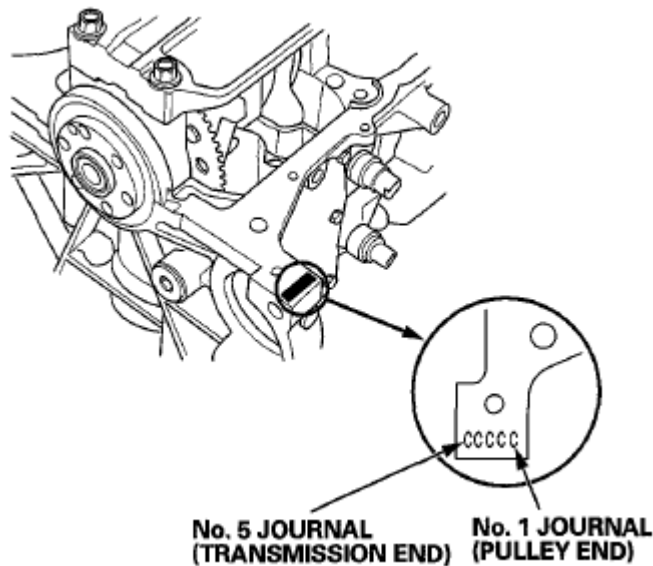
7. If the plastigage measures too wide or too narrow, remove the crankshaft, and remove the upper half of the bearing. Install a new, complete bearing with the same color code(s), and recheck the clearance. Do not file, shim, or scrape the bearings or the caps to adjust clearance.
8. If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing (the color listed above or below that one), and check 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 engine block as a code for the size of each of the five main journal bores. Write down the crank bore codes.

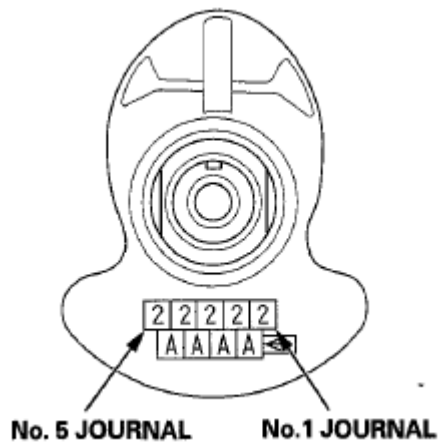
If you can't read the codes because of accumulated dirt and oil, do not scrub them with a wire brush or scraper. Clean them only with solvent or detergent.



**Fig. 8: Identifying Crankshaft Bore Code Location**  
Courtesy of AMERICAN HONDA MOTOR CO., INC.

#### Main Journal Code Location

- The main journal codes are stamped on the crankshaft.



**Fig. 9: Identifying Main Journal Code Location**  
Courtesy of AMERICAN HONDA MOTOR CO., INC.

- Use the crank bore codes and the 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
Main Journal code ↓	1	→ Smaller bearing (Thicker)			
	2	Red	Pink	Yellow	Green
	3	Pink	Yellow	Green	Brown
	4	Yellow	Green	Brown	Black
Smaller main journal ↓		Green	Brown	Black	Blue
	Smaller bearing (Thicker) ↓				

Fig. 10: Crank Bore Codes Chart

Courtesy of AMERICAN HONDA MOTOR CO., INC.

## CONNECTING ROD BEARING REPLACEMENT

### ROD BEARING CLEARANCE INSPECTION

1. To check rod bearing-to-journal oil clearance, remove the bearing cap bridge (see CRANKSHAFT AND PISTON REMOVAL ).
2. Remove the connecting rod cap and the bearing half.
3. Clean the crankshaft rod journal and the bearing half with a clean shop towel.
4. Place plastigage across the rod journal.
5. Reinstall the bearing half and connecting rod cap, and torque the bolts to 9.8 N.m (1.0 kgf.m, 7.2 lbf.ft) +90 °.

#### NOTE:

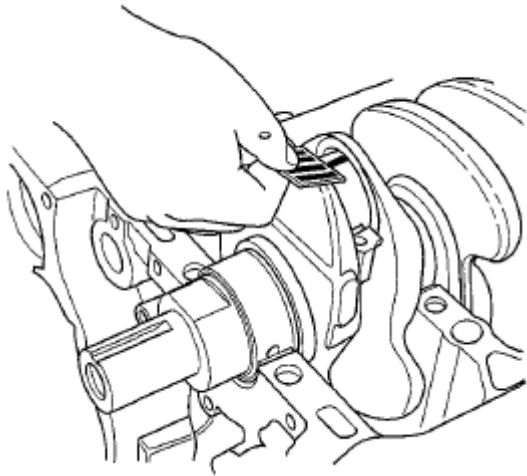
- Apply new engine oil to the bolt threads and flanges.
- Do not rotate the crankshaft during inspection.

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

#### Connecting Rod Bearing-to-Journal Oil Clearance

**Standard (New): 0.026-0.044 mm (0.0010-0.0017 in)**

**Service Limit: 0.050 mm (0.0020 in)**



**Fig. 11: 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.

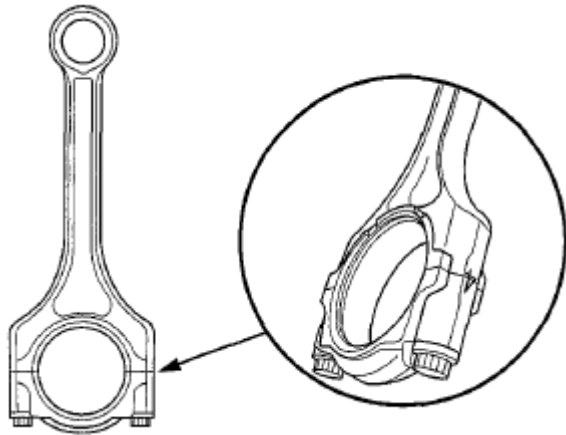
### Connecting Rod Big End Bore Code Locations

2. Each connecting rod falls into one of four tolerance ranges (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 or bar (1, 2, 3, or 4) indicating the range. You may find any combination of 1, 2, 3, or 4 in any engine.

If the codes are indecipherable because of an accumulation of dirt and dust, do not scrub them with a wire brush or scraper. Clean them only with solvent or detergent.

**Normal Bore Size: 43.0 mm (1.69 in)**

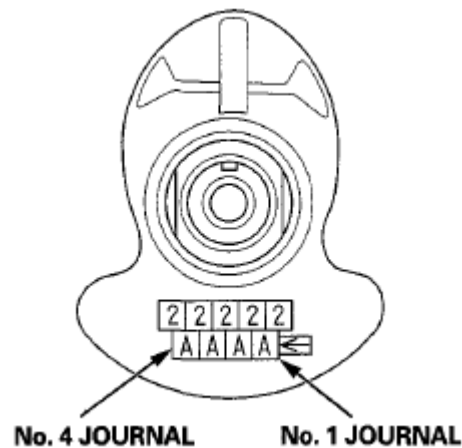




**Fig. 12: Identifying Connecting Rod Big End Bore Code Locations**  
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

### Connecting Rod Journal Code Location

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



**Fig. 13: Identifying Connecting Rod Journal Code Location**  
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

4. Use the big end bore codes and the rod journal codes to select appropriate replacement bearings from the following table.

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

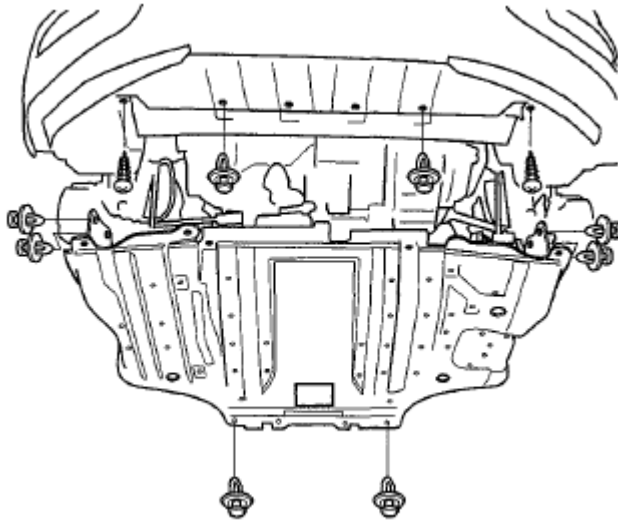
		Big end bore code → Larger big rod bore			
		1	2	3	4
Rod Journal code ↓	A	→ Smaller bearing (Thicker)			
	B	White	Red	Pink	Yellow
	C	Red	Pink	Yellow	Green
	D	Pink	Yellow	Green	Brown
Smaller rod journal	Smaller bearing (Thicker)	Yellow	Green	Brown	Black

**Fig. 14: Bore Codes Chart**

Courtesy of AMERICAN HONDA MOTOR CO., INC.

## OIL PAN REMOVAL

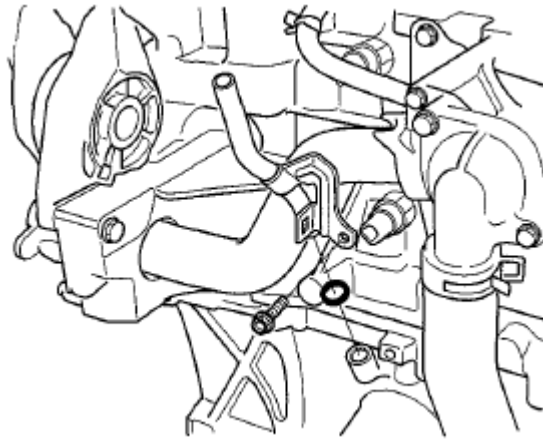
1. If the engine is already out of the vehicle, go to step 7.
2. Remove the splash shields (see **ENGINE REMOVAL** ).



**Fig. 15: Identifying Splash Shields**

Courtesy of AMERICAN HONDA MOTOR CO., INC.

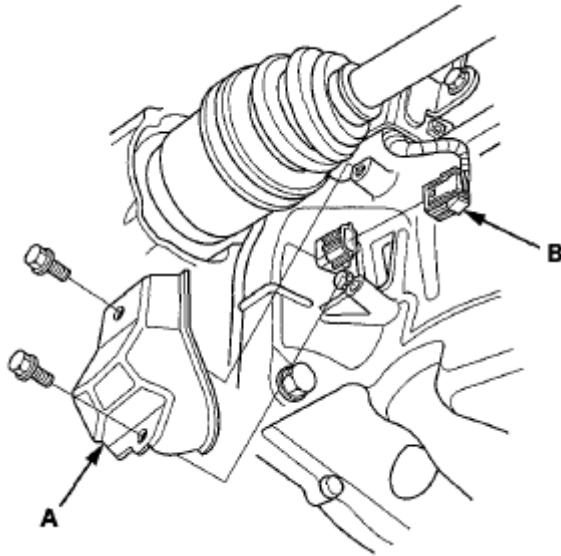
3. Drain the engine oil (see **ENGINE OIL REPLACEMENT** ).
4. Remove the drive belt (see **DRIVE BELT INSPECTION** ).
5. Remove the driveshaft heat shield (see step 32 **ENGINE REMOVAL** ).
6. Remove the A/C compressor without disconnecting the A/C hoses (see step 34 **ENGINE REMOVAL** ).
7. Remove the dipstick, then remove the dipstick tube.



**Fig. 16: Identifying Dipstick Tube**

Courtesy of AMERICAN HONDA MOTOR CO., INC.

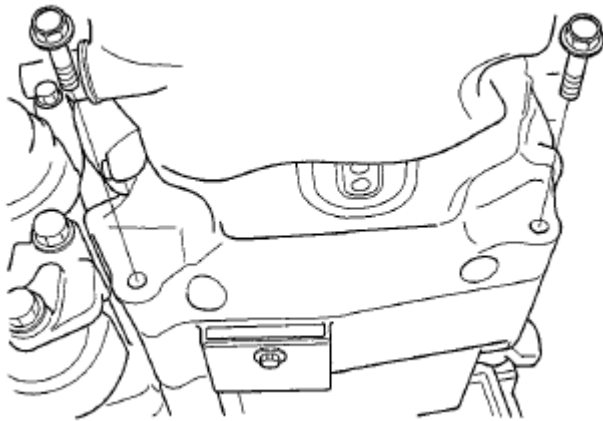
8. Remove the crankshaft position (CKP) sensor cover (A), then disconnect the CKP sensor connector (B).



**Fig. 17: Identifying Crankshaft Position (CKP) Sensor Cover And CKP Sensor Connector**

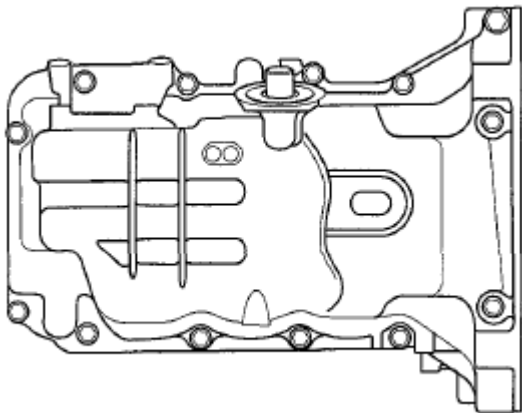
Courtesy of AMERICAN HONDA MOTOR CO., INC.

9. Remove the transmission mounting bolts.



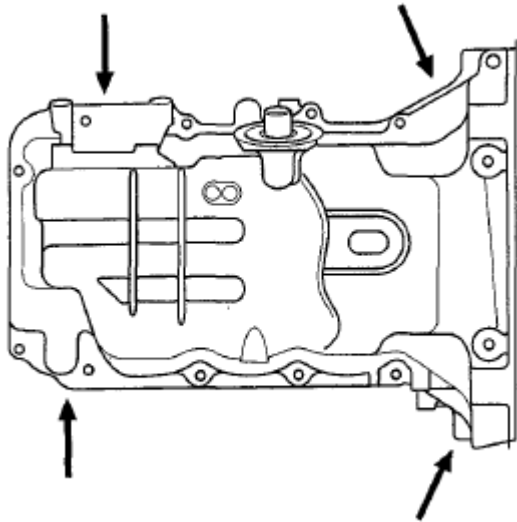
**Fig. 18: Identifying Transmission Mounting Bolts**  
Courtesy of AMERICAN HONDA MOTOR CO., INC.

10. Remove the oil pan bolts. Note the bolt locations by their size.



**Fig. 19: Identifying Oil Pan Bolts**  
Courtesy of AMERICAN HONDA MOTOR CO., INC.

11. Insert a flat blade screwdriver where shown, and separate the oil pan from the engine block.



**Fig. 20: Locating Oil Pan**

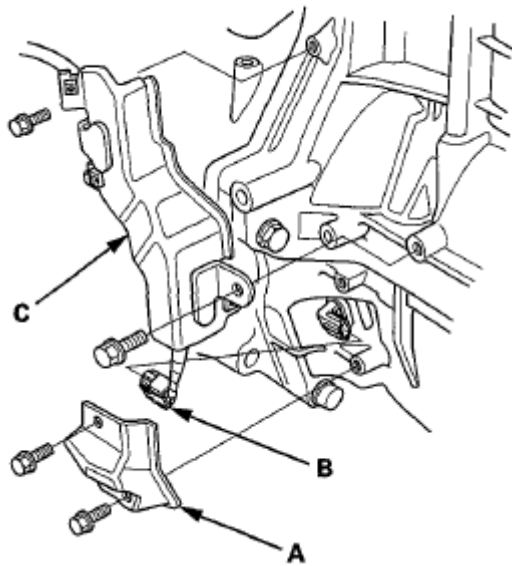
Courtesy of AMERICAN HONDA MOTOR CO., INC.

12. Remove the oil pan.

**NOTE:** Lower the oil pan carefully not to damage the IMA motor rotor position sensor.

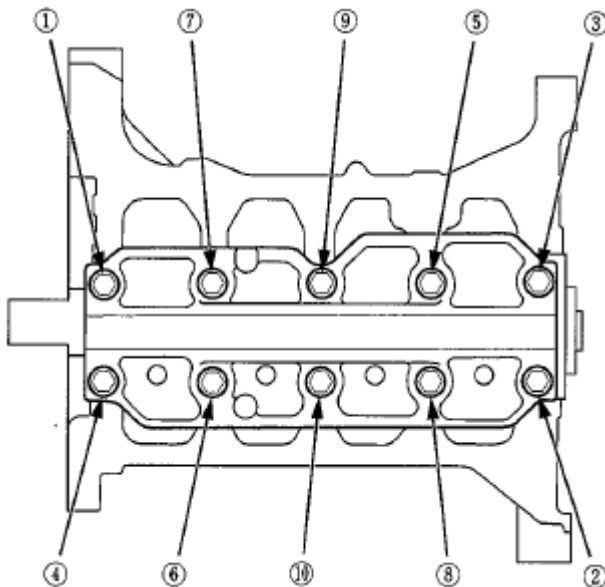
## CRANKSHAFT AND PISTON REMOVAL

1. Remove the engine/IMA motor/transmission assembly (see ENGINE REMOVAL ).
2. Remove the transmission (see TRANSMISSION REMOVAL ).
3. Remove the IMA motor housing (see DRAIN COVER REMOVAL/INSTALLATION ).
4. Remove the crankshaft position (CKP) sensor cover (A), then disconnect the CKP sensor connector (B).



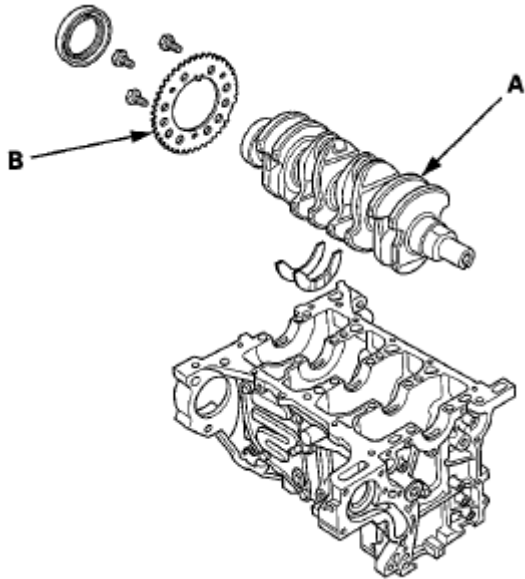
**Fig. 21: Identifying Crankshaft Position (CKP) Sensor Cover And CKP Sensor Connector**  
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. Remove the harness cover (C).
6. Remove the oil pan (see **OIL PAN REMOVAL** ).
7. Remove the oil pump (see **REMOVAL** ).
8. Remove the cylinder head (see **CYLINDER HEAD REMOVAL** ).
9. Remove the bearing cap bolts. To prevent warpage, loosen the bolts in sequence 1/3 turn at a time; repeat the sequence until all bolts are loosened.



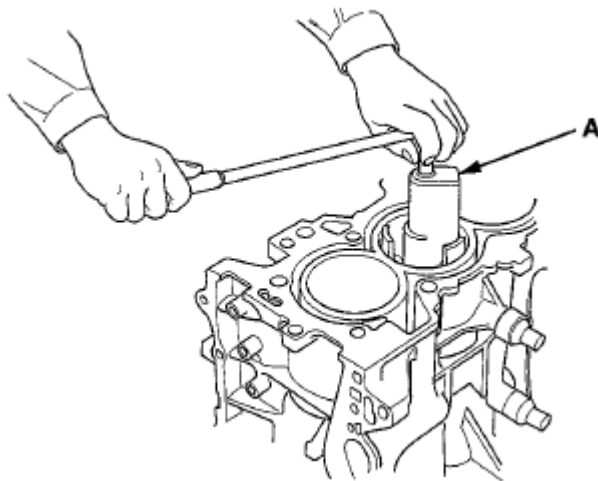
**Fig. 22: Identifying Bearing Cap Bolts Tightening Sequence**  
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

10. Remove the bearing cap bridge.
11. Remove the connecting rod caps/bearings. Keep all caps/bearings in order.
12. Lift crankshaft (A) out of the engine block, being careful not to damage the journals and the CKP pulse plate (B).



**Fig. 23: Identifying Crankshaft And CKP Pulse Plate**  
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

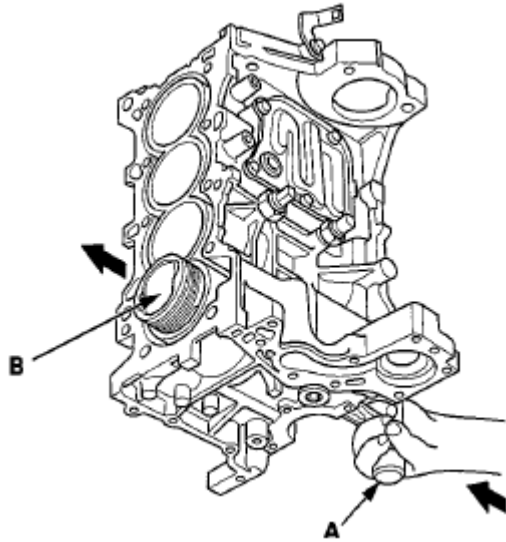
13. Remove the CKP pulse plate.
14. Remove the upper bearing halves from the connecting rods, and set them aside with their respective caps.
15. If you can feel a ridge of metal or hard carbon around the top of each cylinder, remove it with a ridge reamer (A). Follow the reamer manufacturer's instructions.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



**Fig. 24: Removing Hard Carbon**

Courtesy of AMERICAN HONDA MOTOR CO., INC.

16. Use the wooden handle of a hammer (A) to drive out the piston/connecting rod assembly (B). Take care not to damage the cylinder with the connecting rod.



**Fig. 25: Removing Piston/Connecting Rod Assembly**  
Courtesy of AMERICAN HONDA MOTOR CO., INC.

17. Reinstall the bearing cap bridge and bearings on the engine block.
18. Reinstall the connecting rod bearings and caps after removing each piston/connecting rod assembly.
19. Mark each piston/connecting rod assembly with its cylinder number to make sure they are reused in original order.

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

## CRANKSHAFT INSPECTION

### Out-of-Round and Taper

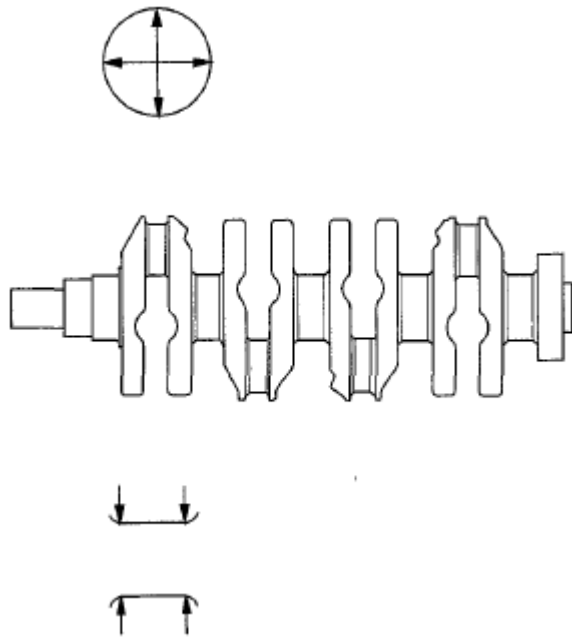
1. Remove the crankshaft from the engine block (see CRANKSHAFT AND PISTON REMOVAL ).
2. Clean the crankshaft oil passages with pipe cleaners or a suitable brush.
3. Clean the keyway slot and threaded holes for damage.
4. Measure the out-of-round at the middle of each rod and the main journal in two places. 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)**



**Fig. 26: Measuring Out-Of-Round Middle Of Rod And Main Journal In Two Places**  
Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. Measure the taper at the edges of each rod and the 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)**

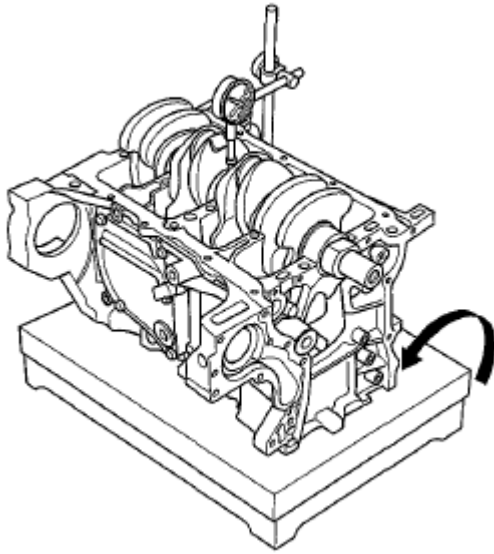
#### **Straightness**

6. Place the engine block on a flat surface, crankshaft side up.
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: 0.040 mm (0.0016 in)**



**Fig. 27: Measuring Runout Of Main Journals**  
Courtesy of AMERICAN HONDA MOTOR CO., INC.

## **BLOCK AND PISTON INSPECTION**

1. Remove the crankshaft and the pistons (see **CRANKSHAFT AND PISTON REMOVAL** ).
2. Check the piston for distortion or cracks.
3. Measure the piston skirt diameter (A) at a point 16 mm (0.6 in) from the bottom of the skirt.

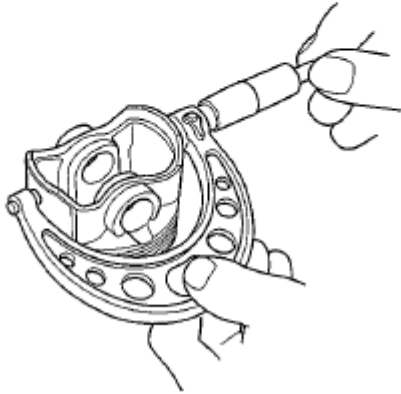
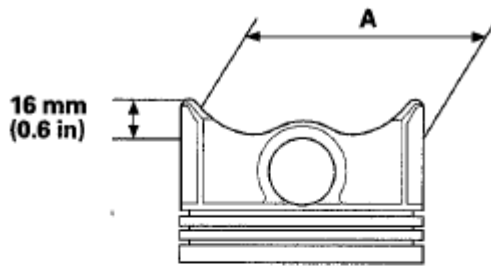
### **Piston Diameter**

**Standard (New):** 72.969-72.979 mm (2.8728-2.8732 in)

**Service Limit:** 72.967 mm (2.8727 in)

### **Oversize Piston Diameter**

**0.25:** 73.219-73.229 mm (2.8826-2.8830 in)



**Fig. 28: Measuring Piston Skirt Diameter**

Courtesy of AMERICAN HONDA MOTOR CO., INC.

4. Measure wear and taper in direction 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): 73.000-73.015 mm (2.8740-2.8746 in)**

**Service Limit: 73.065 mm (2.8766 in)**

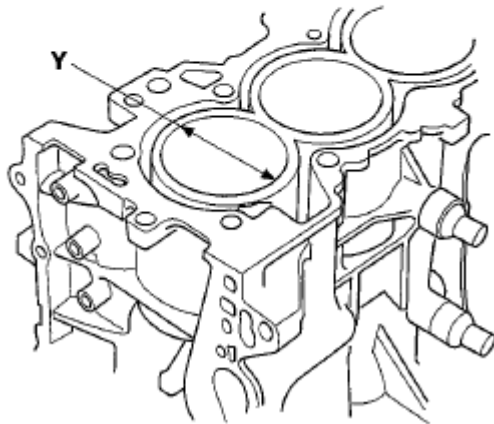
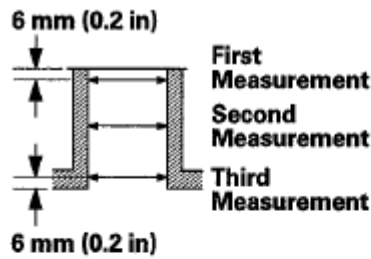
#### Oversize

**0.25: 73.250-73.265 mm (2.8839-2.8844 in)**

**Reboring limit: 0.25 mm (0.010 in) max.**

#### Bore Taper

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



**Fig. 29: Measuring Cylinder Bore Size**

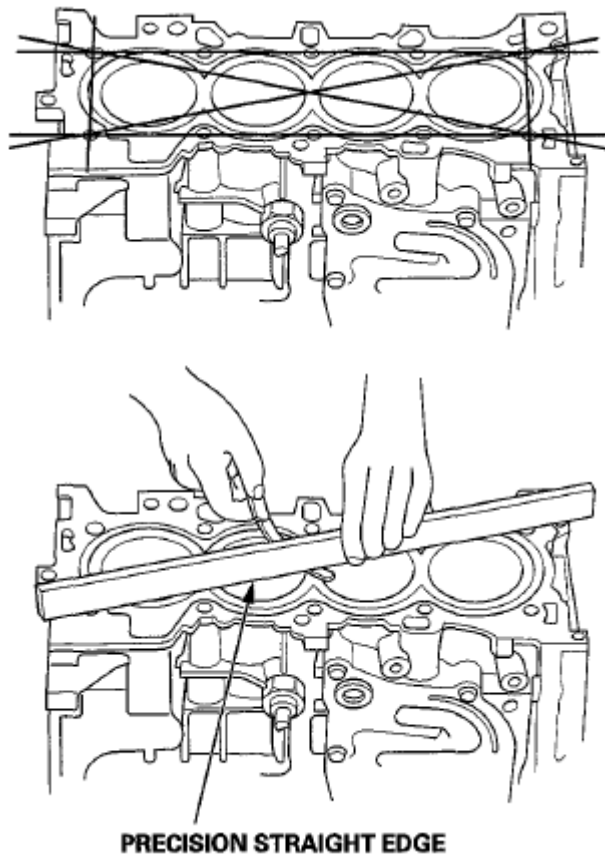
Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. Hone any scored or scratched cylinder bores.
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)**



**Fig. 30: Checking Engine Block Warpage**

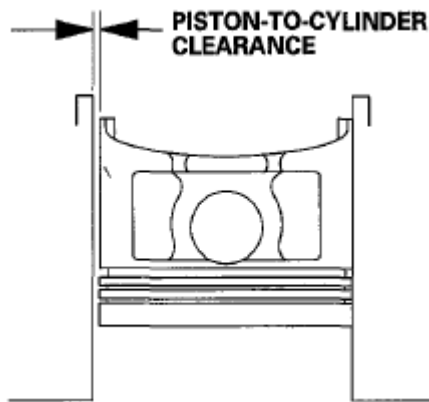
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

**Piston-to-Cylinder Clearance**

**Standard (New): 0.021-0.046 mm (0.0008-0.0018 in)**

**Service Limit: 0.05 mm (0.002 in)**



**Fig. 31: Identifying Piston-To-Cylinder Clearance**  
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

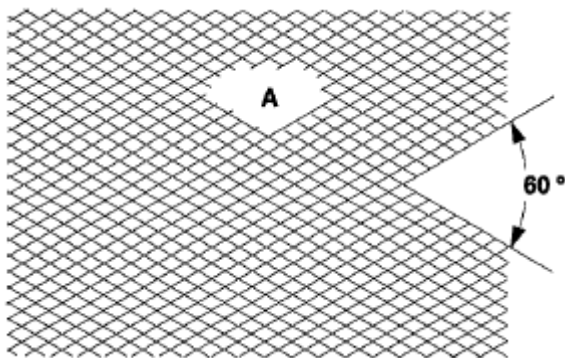
## CYLINDER BORE HONING

Only a scored or scratched cylinder bore must be honed.

1. Measure the cylinder bores (see **BLOCK AND PISTON INSPECTION** ).

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

2. Hone the cylinder bores with honing oil and a fine (400 grit) stone in a 60 degree cross-hatch pattern (A). 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. 32: Identifying Cylinder Bores - 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.

**NOTE:**        **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 the engine block to the service

limit, rebore the engine block. Some light vertical scoring and scratching is acceptable if it is not deep enough to catch your fingernail and does not run the full length of the bore.

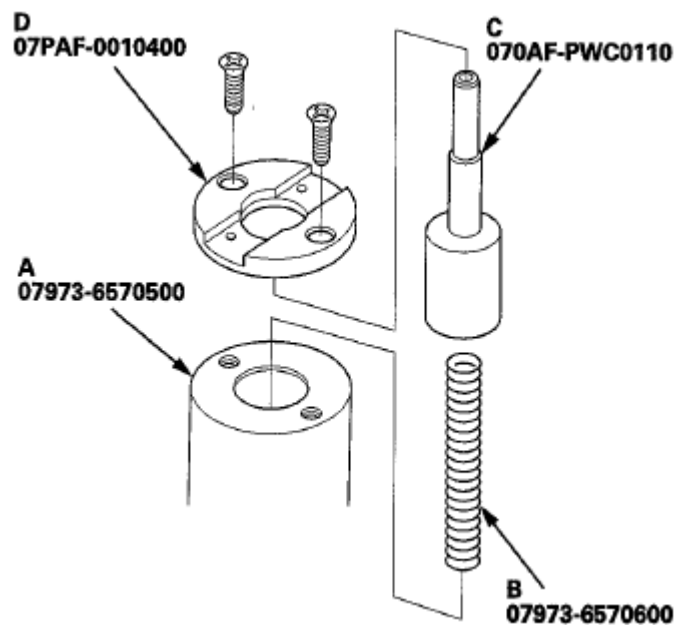
## PISTON, PIN, AND CONNECTING ROD REPLACEMENT

### Special Tools Required

- Piston Base Head 07PAF-0010400
- Piston Base Head Insert 07PAF-0010500
- Insert Pin 07PAF-0010700
- Pilot Pin 070AF-PWC0110
- Insert Adjust 070AF-PWC0120
- Pilot Collar, O.D. 18 mm 070AF-PWC0130
- Piston Base 07973-6570500
- Piston Base Spring 07973-6570600

### DISASSEMBLY

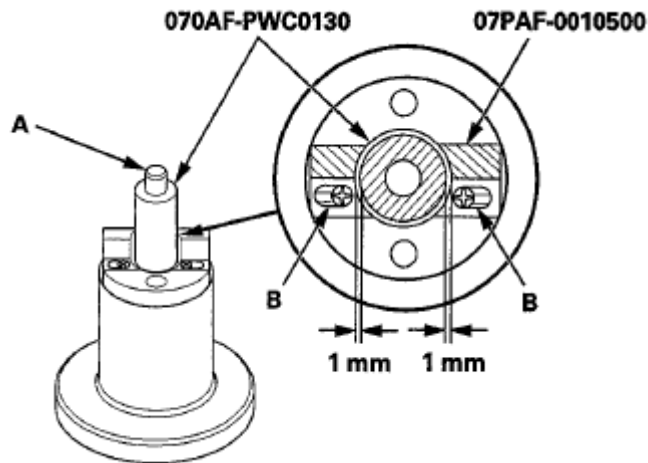
1. Assemble the piston base (A), piston base spring (B), pilot pin (C), and piston base head (D) as shown.



**Fig. 33: Identifying Special Tools**

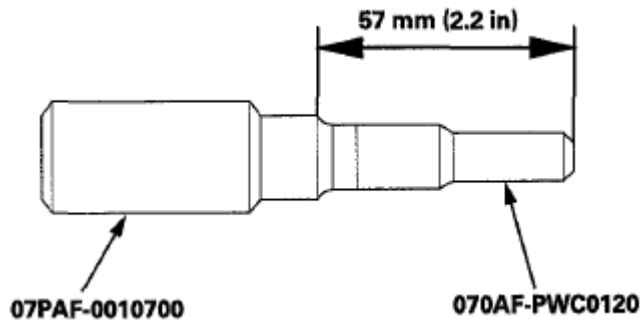
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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



**Fig. 34: Installing Pilot Collar Over Pilot Pin And Adjust Piston Base Head**  
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

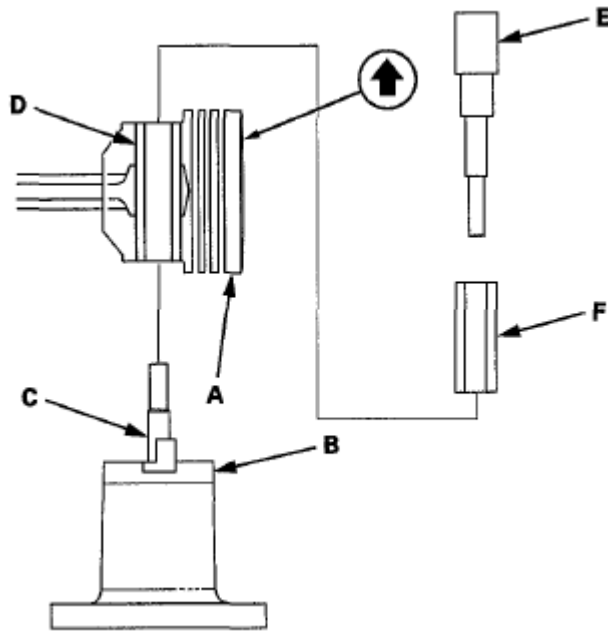
3. Assemble and adjust the length of the piston pin driver head and shaft to 57 mm (2.2 in).



**Fig. 35: Assembling And Adjust Length Of Piston Pin Driver Head And 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 piston base (B).  
 Be sure you position the recessed flat area of the piston against the piston base head inserts (C) as shown.





**Fig. 36: Pressing Pin Out With Piston Pin Driver And Pilot Collar**  
Courtesy of AMERICAN HONDA MOTOR CO., INC.

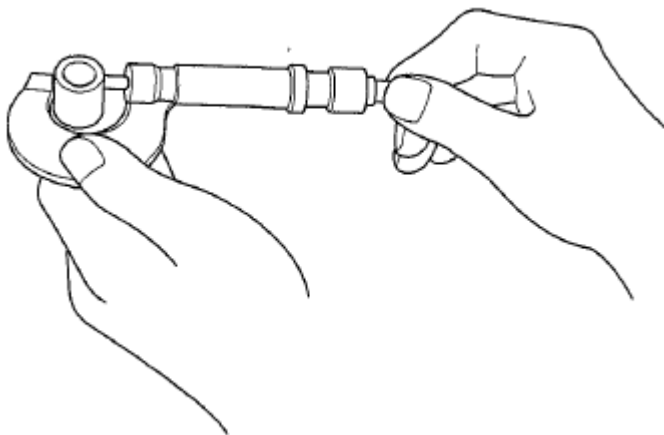
5. Press the pin (D) out with the piston pin driver (E), the pilot collar (F), and a hydraulic press.

## INSPECTION

1. Measure the diameter of the piston pin.

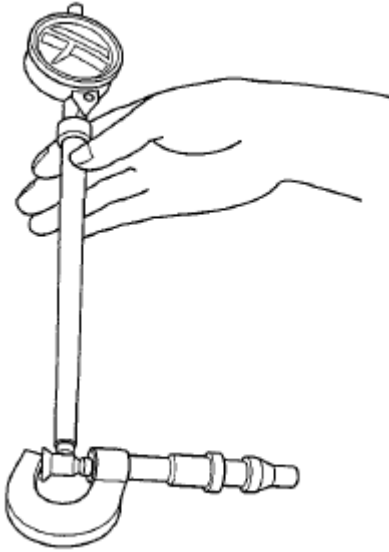
### Piston Pin Diameter

**Standard (New): 17.996-18.000 mm (0.7085-0.7087 in)**



**Fig. 37: Measuring Diameter Of Piston Pin**  
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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



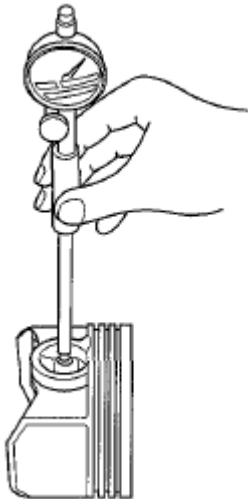
**Fig. 38: Checking Piston Pin Diameter**

Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

#### **Piston Pin-to-Piston Clearance**

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



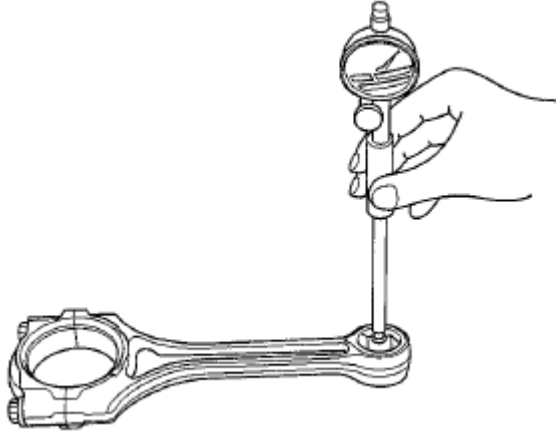
**Fig. 39: Checking Difference Piston Pin Diameter And Piston Pin Hole Diameter In Piston**

Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

**Piston Pin-to-Connecting Rod Interference**

**Standard (New): 0.019-0.036 mm (0.0007-0.0014 in)**

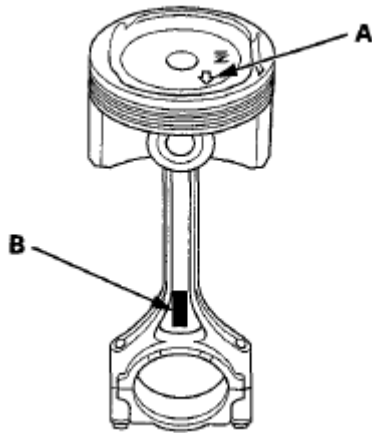


**Fig. 40: Checking Difference Between Piston Pin Diameter And Connecting Rod Small End Diameter**

Courtesy of AMERICAN HONDA MOTOR CO., INC.

**REASSEMBLY**

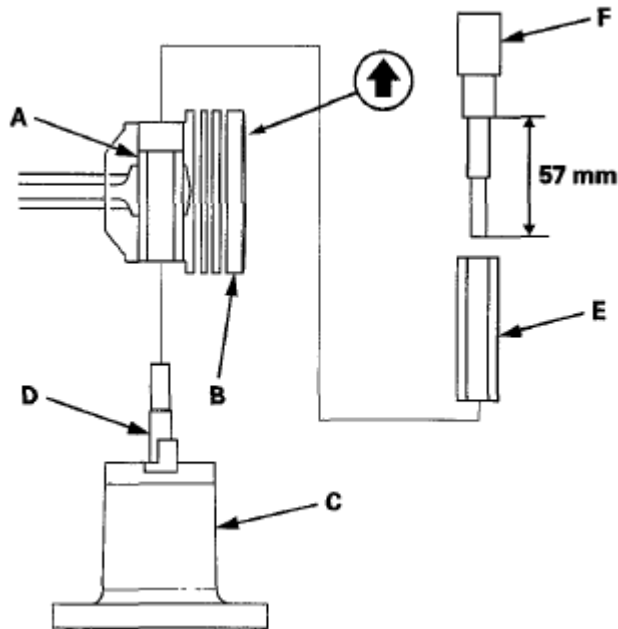
1. Assemble the piston with the arrow (A) pointing up and the connecting rod with the embossed mark (B) on the same side.



**Fig. 41: Identifying Piston And Connecting Rod Installation Position**

Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

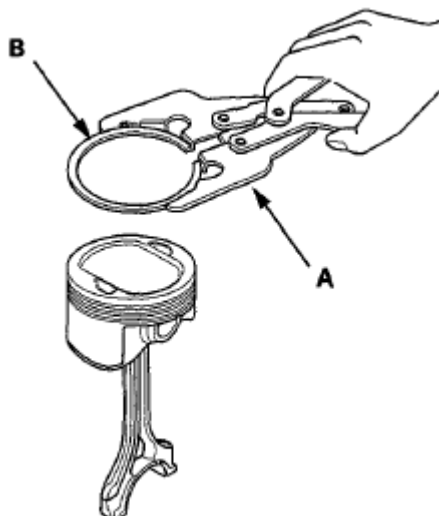


**Fig. 42: Inserting Pilot Collar Into Piston And Connecting Rod**  
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

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 piston base (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 piston 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).



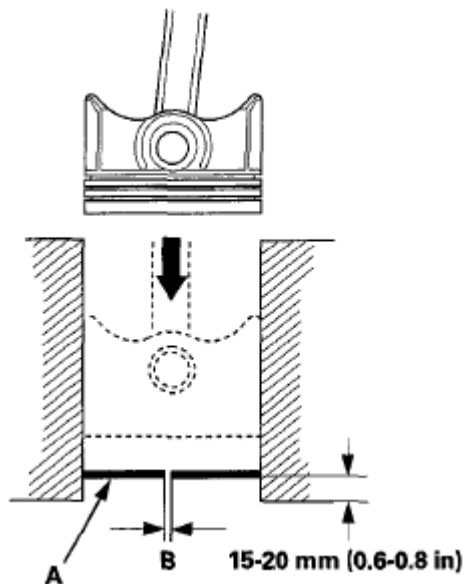
**Fig. 43: Removing Old Piston Rings**

Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. Clean all the ring grooves thoroughly with a squared-off broken ring, or a ring groove cleaner with a blade to fit the piston grooves. File down the blade, if necessary. The top and second ring grooves are 1.0 mm (0.04 in) wide, and the oil ring groove is 2.0 mm (0.08 in) wide. Do not use a wire brush to clean the ring grooves, or cut the ring grooves deeper with the cleaning tool.

**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. 44: Measuring Piston Ring End-Gap**

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): 0.30-0.42 mm (0.012-0.017 in)**

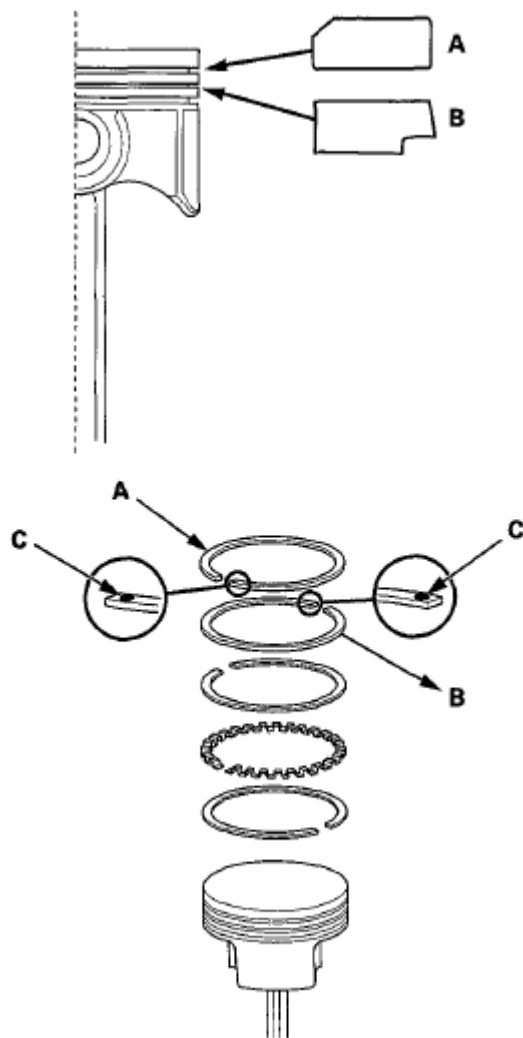
**Service Limit: 0.65 mm (0.026 in)**

**Oil Ring:**

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

**Service Limit: 0.80 mm (0.031 in)**

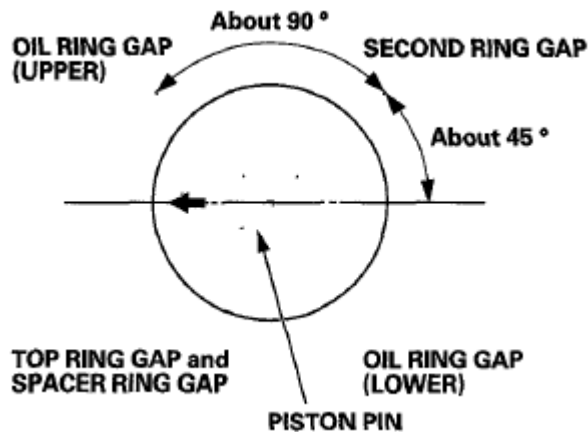
6. Install the rings as shown. The top ring (A) has a R mark, and the second ring (B) has a 2R mark. The manufacturing marks (C) must face upward.



**Fig. 45: Identifying Position Ring Installation Position**

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:



**Fig. 46: 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**

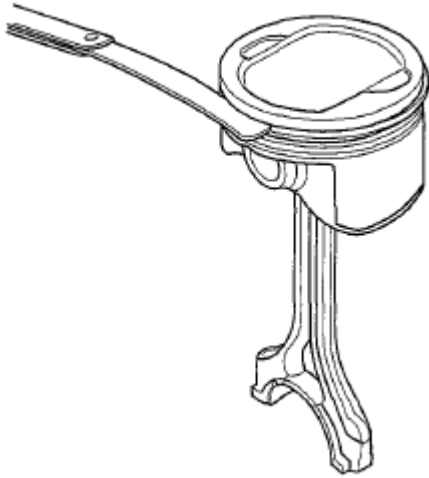
**Standard (New): 0.065-0.090 mm (0.0026-0.0035 in)**

**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: 0.12 mm (0.005 in)**

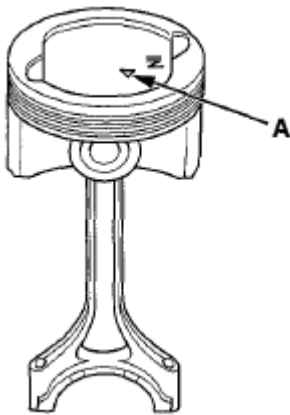


**Fig. 47: Measuring Ring-To-Groove Clearances**  
Courtesy of AMERICAN HONDA MOTOR CO., INC.

## PISTON INSTALLATION

### IF THE CRANKSHAFT IS ALREADY INSTALLED

1. Set the crankshaft to bottom dead center (BDC) for each cylinder.
2. Apply new engine oil to the piston, inside of the ring compressor, and the cylinder bore.
3. Remove the connecting rod caps, then install the ring compressor, and check that the bearing is securely in place.
4. Position the piston/connecting rod assembly with the arrow (A) facing the cam chain side of the engine.



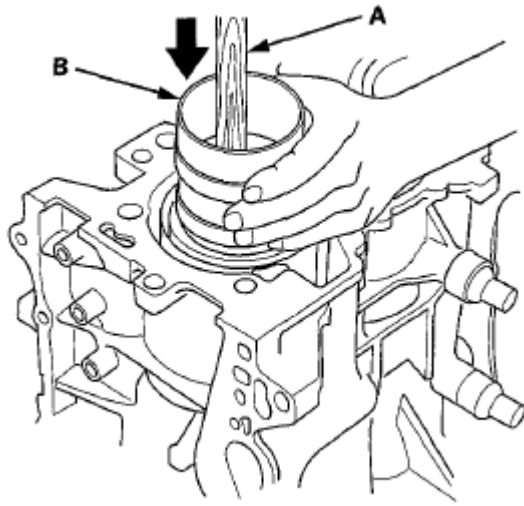
**Fig. 48: Identifying Piston/Connecting Rod Assembly Installation Position**  
Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. Position the piston/connecting rod assembly in the cylinder, and tap it in using the wooden handle of a hammer (A).

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



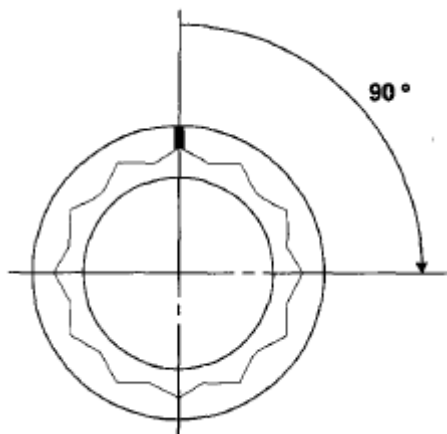
the cylinder bore.



**Fig. 49: Positioning Piston/Connecting Rod Assembly In Cylinder**  
Courtesy of AMERICAN HONDA MOTOR CO., INC.

6. Stop after the ring compressor pops free, and check the connecting rod-to-crank journal alignment before pushing the piston into place.
7. Check the connecting rod bearing clearance with plastigage (see **CONNECTING ROD BEARING REPLACEMENT** ).
8. Inspect the connecting rod bolts (see **IF THE CRANKSHAFT IS NOT INSTALLED** ).
9. Apply new engine oil to the bolt threads, then install the rod caps with bearings. Torque the bolts to 9.8 N.m (1.0 kgf.m, 7.2 lbf.ft).
10. Tighten the connecting rod bolts an additional 90 °.

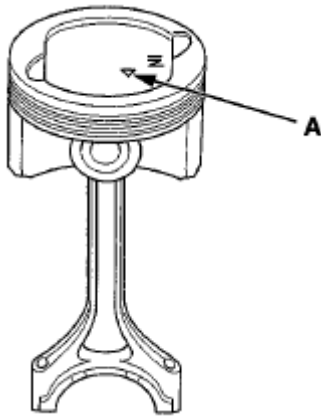
**NOTE:** Remove the connecting rod bolt if you tightened it beyond the specified angle, and go back to step 8 of the procedure. Do not loosen it back to the specified angle.



**Fig. 50: Identifying Connecting Rod Bolt Tightening Angle**  
Courtesy of AMERICAN HONDA MOTOR CO., INC.

#### IF THE CRANKSHAFT IS NOT INSTALLED

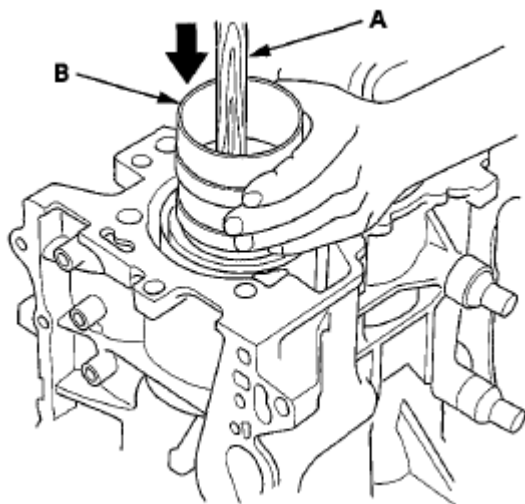
1. Apply new engine oil to the piston, inside of the ring compressor, and the cylinder bore.
2. Remove the connecting rod caps, then install the ring compressor, and check that the bearing is securely in place.
3. Position the piston/connecting rod assembly with the arrow (A) facing the cam chain side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



**Fig. 51: Identifying Piston/Connecting Rod Assembly Incorrect Installation Position**  
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

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

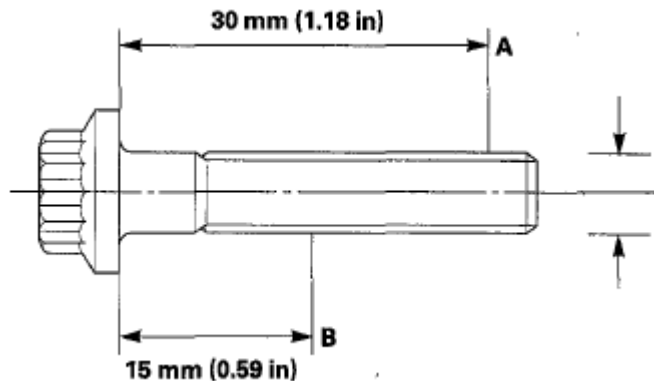


**Fig. 52: Positioning Piston/Connecting Rod Assembly In Cylinder**  
Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

## CONNECTING ROD BOLT INSPECTION

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



**Fig. 53: Measuring Diameter Of Connecting Rod Bolt**  
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)**

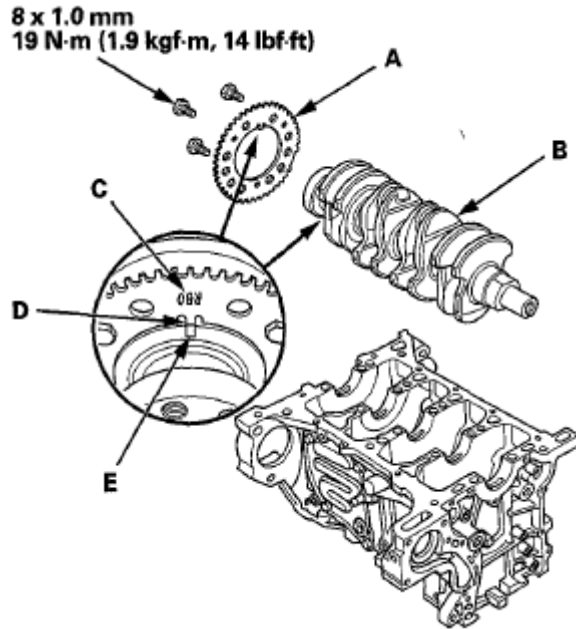
3. If the difference in diameter is out of tolerance, replace the connecting rod bolt.

## CRANKSHAFT INSTALLATION

### Special Tools Required

- Driver Handle, 15 x 135L 07749-0010000
  - Oil Seal Driver Attachment, 96 mm 07ZAD-PNAA100
1. Check the connecting rod bearing clearance with plastigage (see **CONNECTING ROD BEARING REPLACEMENT** ).
  2. Check the main bearing clearance with plastigage (see **CONNECTING ROD AND CRANKSHAFT END PLAY INSPECTION** ).
  3. Install the bearing halves in the engine block and the connecting rods.

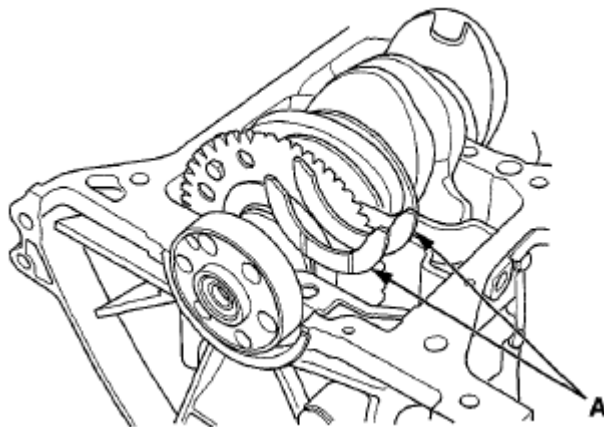
4. Apply new engine oil to the main bearings and the rod bearings.
5. Install the crankshaft position (CKP) pulse plate (A) on the crankshaft (B); face the marked side (C) opposite the crankshaft, and align the tab (D) on the CKP pulse plate with the groove (E) on the crankshaft.



**Fig. 54: Aligning Tab On CKP Pulse Plate With Groove On Crankshaft With Torque Specifications**

Courtesy of AMERICAN HONDA MOTOR CO., INC.

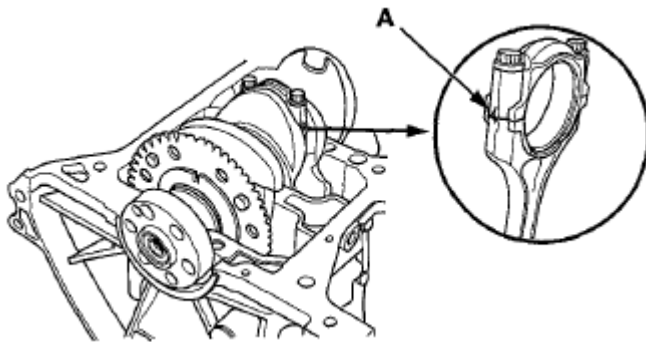
6. Hold the crankshaft so rod journal No. 2 and rod journal No. 3 are straight up, and lower the crankshaft into the engine block.
7. Apply new engine oil to the thrust washer surfaces. Install the thrust washers (A) in the No. 4 journal of the engine block.



**Fig. 55: Identifying Thrust Washer**

Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

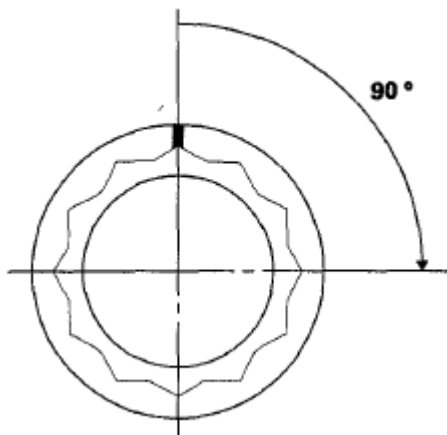


**Fig. 56: Aligning Mark Connecting Rod And Cap**

Courtesy of AMERICAN HONDA MOTOR CO., INC.

11. Rotate the crankshaft clockwise, and seat the rod journals into connecting rod No. 2 and connecting rod No. 3. Line up the mark on the connecting rod and the cap, then install the caps and the bolts finger-tight.
12. Tighten the connecting rod bolts to 9.8 N.m (1.0 kgf.m, 7.2 lbf.ft).
13. Tighten the connecting rod bolts an additional 90 °.

**NOTE:** Remove the connecting rod bolt if you tightened it beyond the specified angle, and go back to step 10 of the procedure. Do not loosen it back to the specified angle.



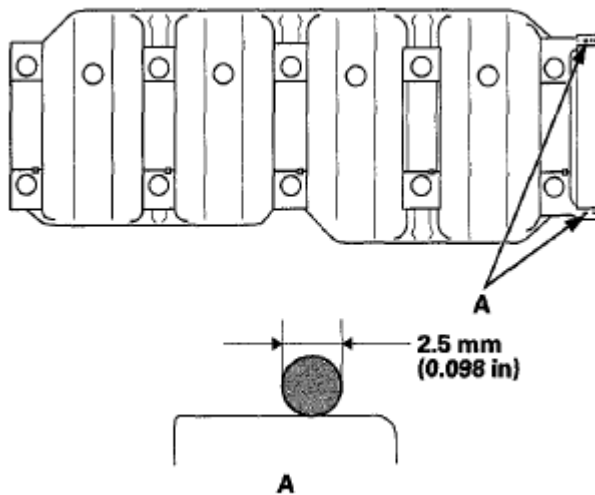
**Fig. 57: Identifying Connecting Rod Bolts Tightening Angle**

Courtesy of AMERICAN HONDA MOTOR CO., INC.

14. Remove all of the old liquid gasket from the bearing cap bridge mating surfaces.
15. Clean and dry the bearing cap bridge mating surfaces.
16. Apply liquid gasket (P/N 08717-0004, 08718-0003, or 08718-0009) to the engine block mating surface of the bearing cap bridge. Install the component within 5 minutes of applying the liquid gasket.

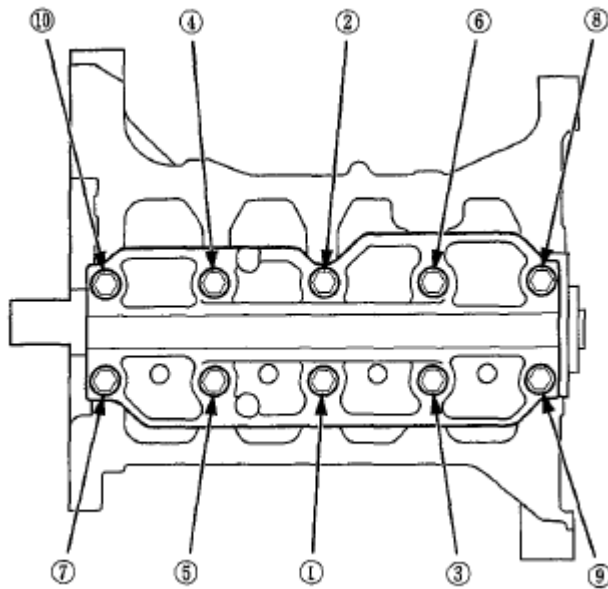
**NOTE:**

- Apply a 2.5 mm (0.098 in) diameter bead of liquid gasket along the broken line (A).
- If you apply liquid gasket P/N 08718-0012, the component must be installed within 4 minutes.
- If too much time has passed after applying the liquid gasket, remove the old liquid gasket and residue, then reapply new liquid gasket.



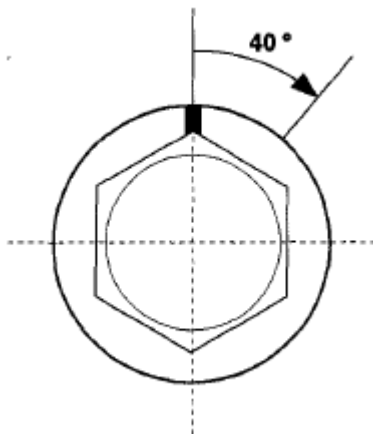
**Fig. 58: Identifying Liquid Gasket Applying Area**  
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

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



**Fig. 59: Identifying Bearing Cap Bolts Tightening Sequence**  
Courtesy of AMERICAN HONDA MOTOR CO., INC.

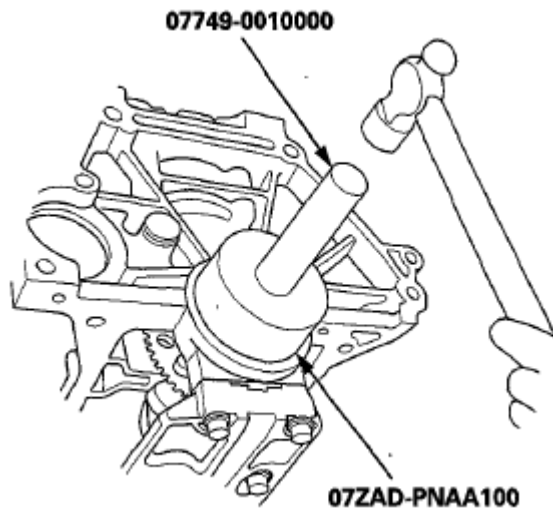
20. Tighten the bearing cap bolts an additional 40°.



**Fig. 60: Identifying Bearing Cap Bolts Tightening Angle**  
Courtesy of AMERICAN HONDA MOTOR CO., INC.

21. Clean the excess liquid gasket off the engine block.
22. Use the driver handle and oil seal driver attachment to drive a new crankshaft oil seal squarely into the block to the specified installed height.

**NOTE:** Lubricate the inner lips of the new crankshaft oil seal with new engine oil before installation, but never lubricate the outside diameter of the seal.



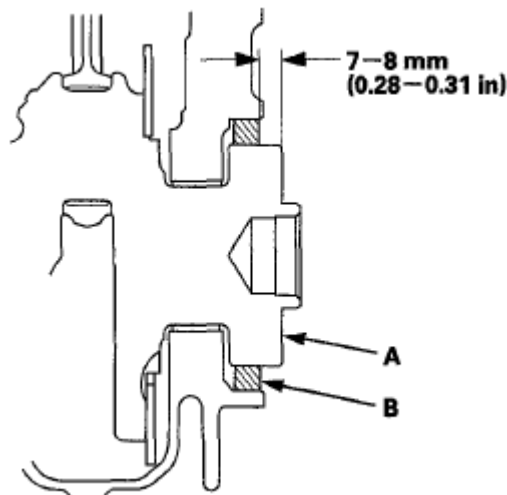
**Fig. 61: Tapping Oil Seal**

Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

**Oil Seal Installed Height:**

**7-8 mm (0.28-0.31 in)**

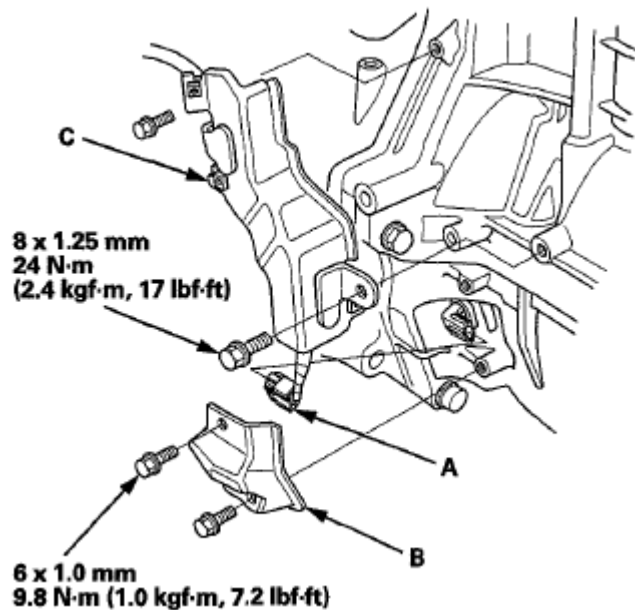


**Fig. 62: Measuring Distance Between Crankshaft And Oil Seal**

Courtesy of AMERICAN HONDA MOTOR CO., INC.

24. Install the cylinder head (see **ROCKER ARM ASSEMBLY INSTALLATION** ).
25. Install the oil pump (see **INSTALLATION** ).
26. Install the oil pan (see **CKP PULSE PLATE REPLACEMENT** ).
27. Install the cam chain (see **CAM CHAIN INSTALLATION** ).
28. Connect the CKP sensor connector (A), then install the CKP sensor cover (B).





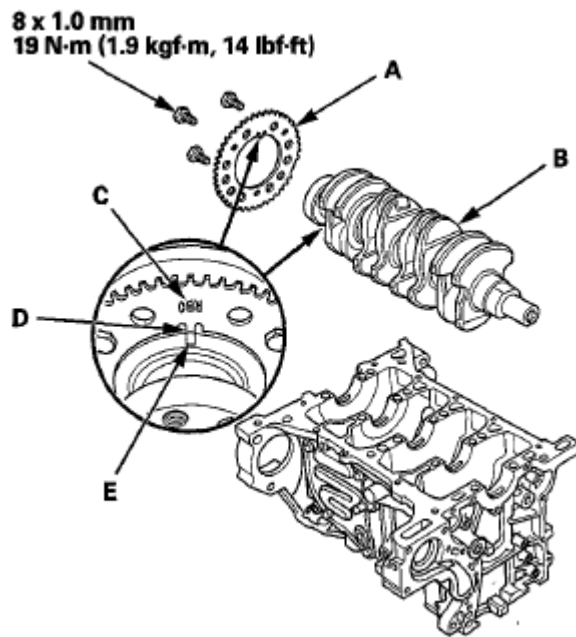
**Fig. 63: Identifying CKP Sensor Connector And CKP Sensor Cover With Torque Specifications**  
Courtesy of AMERICAN HONDA MOTOR CO., INC.

29. Install the harness cover (C).
30. Install the IMA motor housing (see [DRAIN COVER REMOVAL/INSTALLATION](#) ).
31. Install the transmission (see [TRANSMISSION INSTALLATION](#) ).
32. Install the engine/IMA motor/transmission assembly (see [ENGINE INSTALLATION](#) ).

**NOTE:** When any crankshaft or connecting rod bearing is replaced, run the engine at idle until it reaches normal operating temperature, then continue to running it for about 15 minutes.

## CKP PULSE PLATE REPLACEMENT

1. Remove the crankshaft (see [CRANKSHAFT AND PISTON REMOVAL](#) ).
2. Remove the crankshaft position (CKP) pulse plate (A).



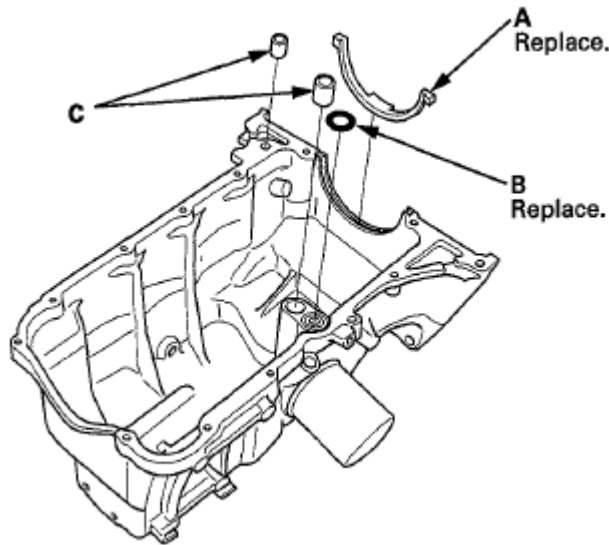
**Fig. 64: Aligning Tab On CKP Pulse Plate With Groove On Crankshaft With Torque Specifications**

Courtesy of AMERICAN HONDA MOTOR CO., INC.

3. Install the CKP pulse plate on the crankshaft (B); face the marked side (C) opposite the crankshaft, and align the tab (D) on the CKP pulse plate with the groove (E) on the crankshaft.
4. Install the crankshaft (see **CRANKSHAFT INSTALLATION** ).

## OIL PAN INSTALLATION

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

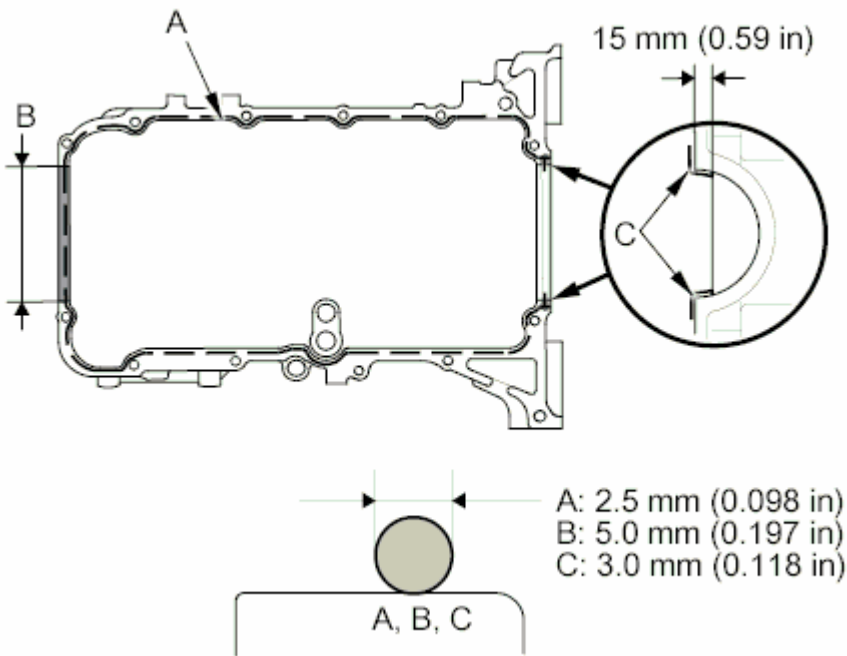


**Fig. 65: Identifying Oil Pan Gasket, O-Ring And Dowel Pins**  
Courtesy of AMERICAN HONDA MOTOR CO., INC.

4. Apply liquid gasket (P/N 08717-0004, 08718-0003, or 08718-0009) to the engine block mating surface of the oil pan and to the inside edge of the bolt holes. Install the component within 5 minutes of applying the liquid gasket.

**NOTE:**

- Apply a 2.5 mm (0.098 in) diameter bead of liquid gasket along the broken line (A).
- Apply a 5.0 mm (0.20 in) diameter bead of liquid gasket to the shaded area (B).
- Apply a 3.0 mm (0.118 in) diameter bead of liquid gasket along the broken line (C).
- If you apply liquid gasket P/N 08718-0012, the component must be installed within 4 minutes.
- If too much time has passed after applying the liquid gasket, remove the old liquid gasket and residue, then reapply new liquid gasket.

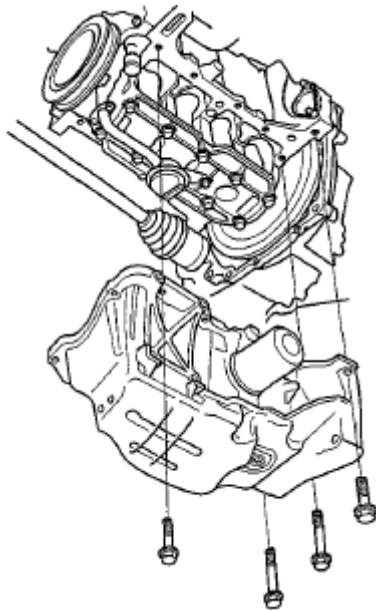


**Fig. 66: Identifying Liquid Gasket Applying Area**  
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

5. Install the oil pan.

**NOTE:**

- Raise the oil pan carefully not to damage IMA motor rotor position sensor.
- Wait at least 30 minutes before filling the engine with oil.
- Do not run the engine for at least 3 hours after installing the oil pan.
- Make sure to install the bolts in the correct locations according to size.



**Fig. 67: Identifying Oil Pan With Bolts**

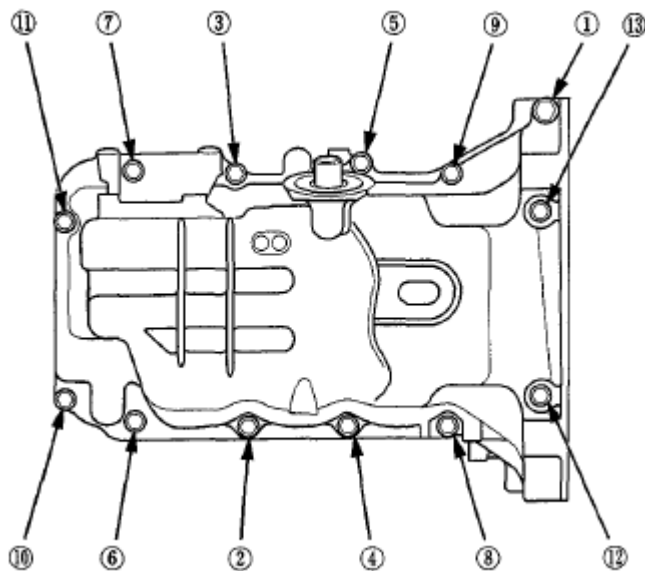
Courtesy of AMERICAN HONDA MOTOR CO., INC.

6. Tighten the bolts in three steps. Wipe off the excess liquid gasket on the each side of crankshaft pulley and the drive plate.

#### Specified torque

(1): 24 N.m (2.4 kgf.m, 17 lbf.ft)

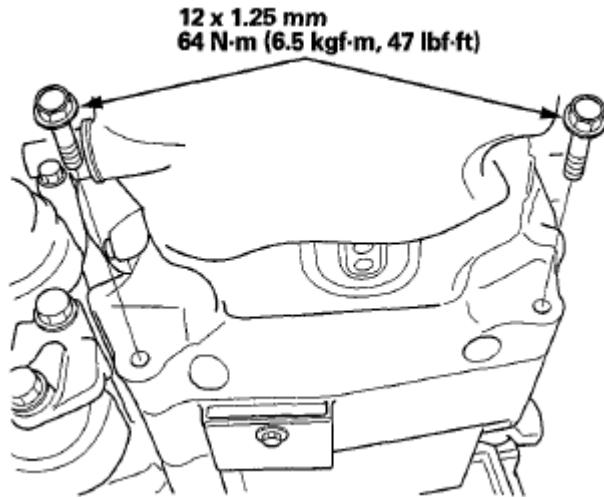
(2)-(13): 12 N.m (1.2 kgf.m, 8.8 lbf.ft)



**Fig. 68: Identifying Oil Pan Bolts Tightening Sequence**

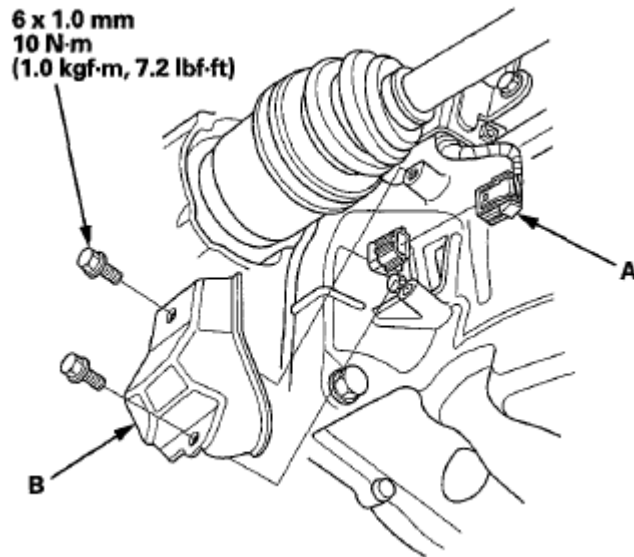
Courtesy of AMERICAN HONDA MOTOR CO., INC.

7. Install the transmission mounting bolts.



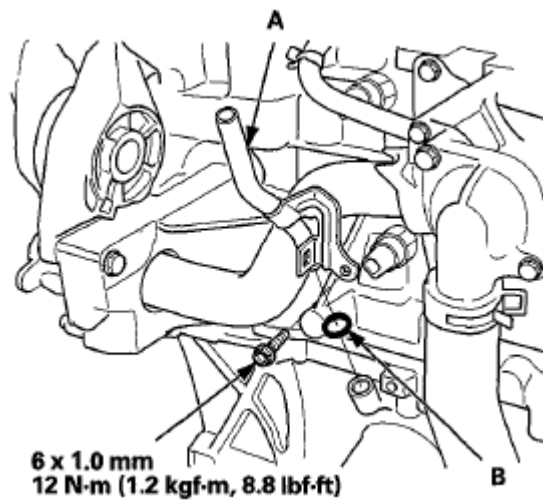
**Fig. 69: Identifying Transmission Mounting Bolts With Torque Specifications**  
Courtesy of AMERICAN HONDA MOTOR CO., INC.

8. Connect the CKP sensor connector (A), then install the CKP sensor cover (B).



**Fig. 70: Identifying CKP Sensor Connector And CKP Sensor Cover With Torque Specifications**  
Courtesy of AMERICAN HONDA MOTOR CO., INC.

9. Install the dipstick tube (A) with new O-ring (B), then install the dipstick.



**Fig. 71: Identifying Dipstick Tube With O-Ring And Bolt With Torque Specifications**  
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

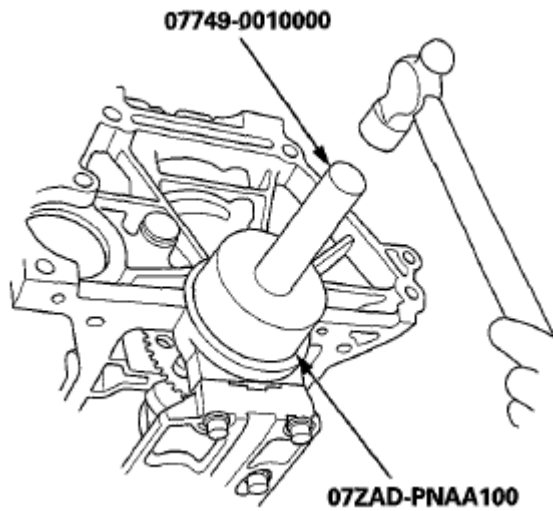
10. If the engine is still in the vehicle, do steps 11 through 15.
11. Install the A/C compressor (see step 27 under ENGINE INSTALLATION ).
12. Install the driveshaft heat shield (see step 22 under ENGINE INSTALLATION ).
13. Install the drive belt (see DRIVE BELT INSPECTION ).
14. Install the splash shields (see step 29 under ENGINE INSTALLATION ).
15. Refill the engine with engine oil (see step 6 under ENGINE OIL REPLACEMENT ).

## TRANSMISSION END CRANKSHAFT OIL SEAL INSTALLATION - IN CAR

### Special Tools Required

- Driver Handle, 15 x 135L 07749-0010000
- Oil Seal Driver Attachment, 96 mm 07ZAD-PNAA100

1. Remove the transmission (see TRANSMISSION REMOVAL ).
2. Remove the IMA motor housing (see DRAIN COVER REMOVAL/INSTALLATION ).
3. Clean and dry the crankshaft oil seal housing.
4. Use the driver handle and oil seal driver attachment to drive a new crankshaft oil seal squarely into the block to the specified installed height.



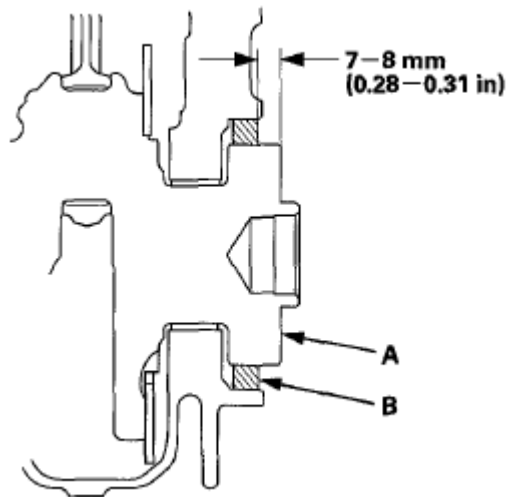
**Fig. 72: Tapping Crankshaft Oil Seal**

Courtesy of AMERICAN HONDA MOTOR CO., INC.

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

**Oil Seal Installed Height:**

**7-8 mm (0.28-0.31 in)**



**Fig. 73: Measuring Distance Between Crankshaft And Oil Seal**

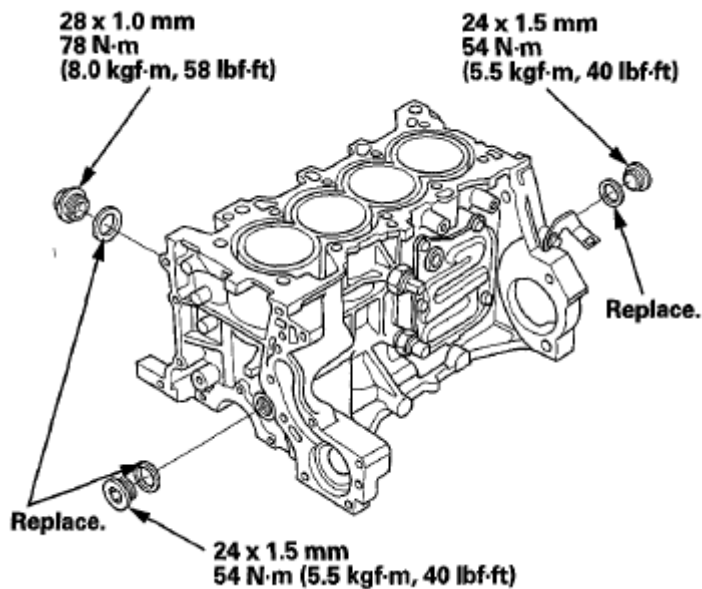
Courtesy of AMERICAN HONDA MOTOR CO., INC.

6. Install the IMA motor housing (see [DRAIN COVER REMOVAL/INSTALLATION](#) ).
7. Install the transmission (see [TRANSMISSION INSTALLATION](#) ).

## DRAIN BOLT/SEALING BOLT INSTALLATION



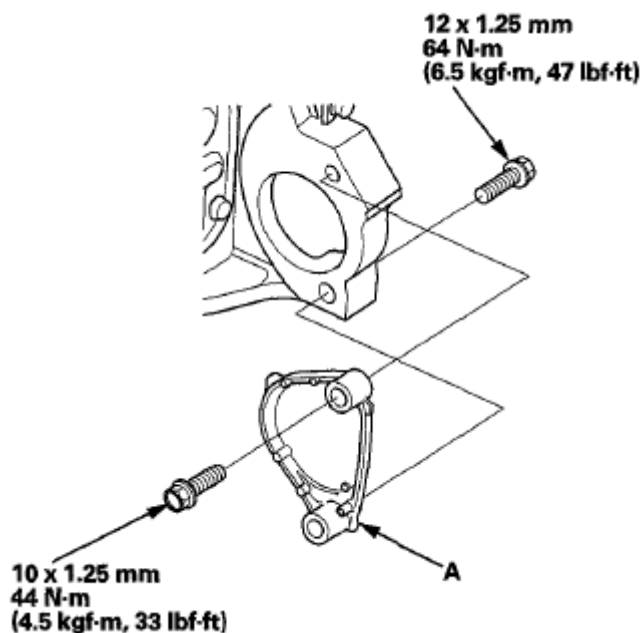
**NOTE:** When installing the drain bolt and/or sealing bolt, always use a new washer.



**Fig. 74: Identifying Drain and Sealing Bolt With Torque Specifications**  
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

## BLOCK COVER REMOVAL AND INSTALLATION

1. Remove the block cover (A).



**Fig. 75: Identifying Block Cover With Torque Specifications**  
 Courtesy of AMERICAN HONDA MOTOR CO., INC.

2. Install the block cover in the reverse order of removal.