

Construction and Function

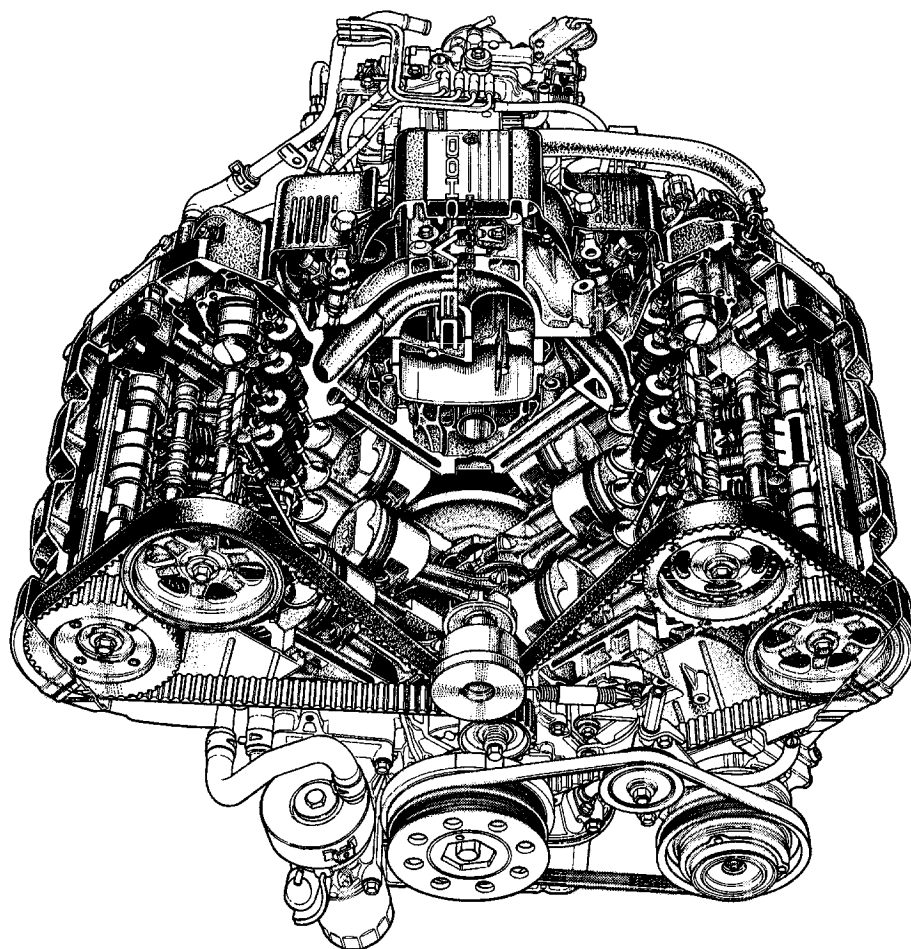
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Outline

Description

This engine is a 2,977 cc DOHC mid-ship unit having 6 cylinders of 90° -V configuration; it is water cooled and equipped with a center plug type pent roof combustion chamber. It is specified for unleaded fuel and uses a PGM-FI (Multi-point injection) system. This engine incorporates a new mechanism called Honda Variable Valve Timing and Lift Electronic Control System (VTEC). This mechanism, the world's first, allows the timing and lift of the intake and exhaust valves to be changed simultaneously. The engine also includes a new electronically controlled intake manifold system that can change the volume of the intake chamber.





This engine has the following new features.

- VTEC; High output and a broad power band is achieved through control of low-speed and high-speed valve operation by the PGM-FI ECU.
(Two knock sensors are used to detect octane level of the fuel.)
- Titanium connecting rods; Accommodate high rotation speed and high output. Titanium material of light weight and high strength is used for the connecting rods.
(Strength is at the same level as iron.)
(Weight is about 30% lighter than iron.)
- New mechanism to the intake system; Increased low and middle speed torque and higher output can both be achieved by switching the chamber volume of the intake manifold according to engine speed. This is electronically controlled.
- Cooling system for the mid-ship engine:
 - Radiator located in front compartment (An aluminum alloy radiator and pipes made of aluminum alloy)
 - Engine room cooling fan
 - Expansion tank
- The cylinder block is highly rigid with deep water jackets.
- In order to achieve lighter weight, **magnesium** is used for the following parts:
 - . Cylinder head cover
 - . Intake manifold cover
 - . Intake manifold chamber

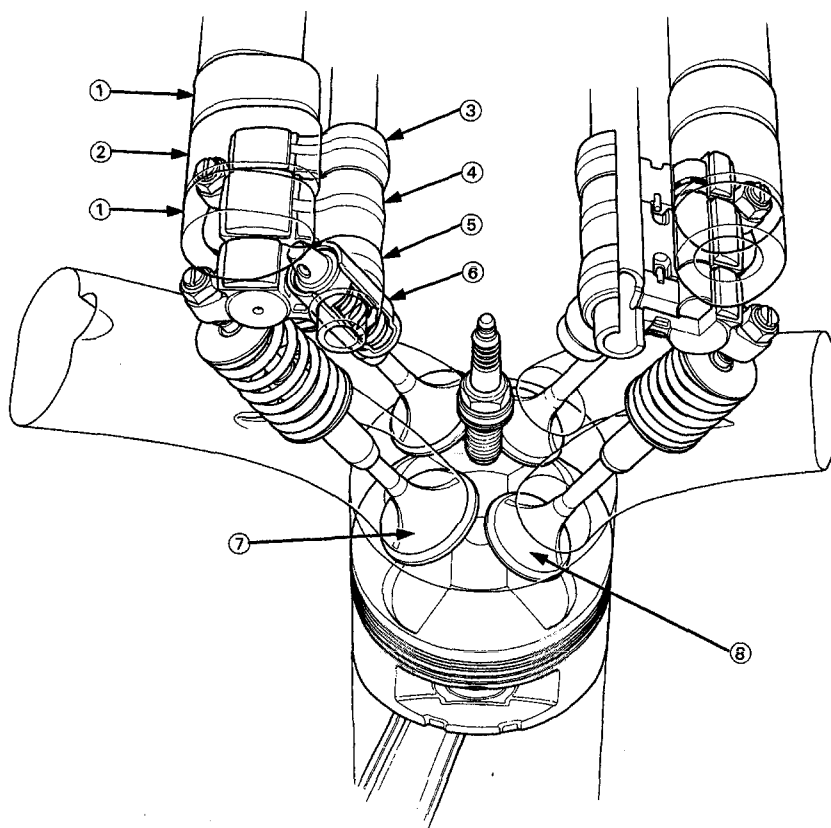
Major Specifications

Type	Water-cooled V6—90° Cross Flow
Displacement	2,977 cm ³ (181.6 cu.in)
Bore x Stroke	90 x 78 mm (3.54 x 3.07 in)
Compression Ratio	10.2
Cam, Valve Mechanism	DOHC (4-camshafts), VTEC
Valve Train	Belt Driven
Fuel Supply System	PGM-FI {Multi-Point Injection}

Variable Valve Timing and Lift Electronic Control System (VTEC)

Outline

The engine is equipped with multiple cam lobes per cylinder, providing one valve timing and lift profile at low speed and a different profile at high speed. Switch-over from one profile to the other is controlled electronically, and is selected by monitoring current engine speed and load.

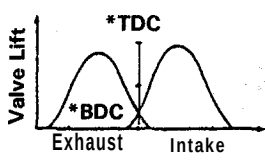
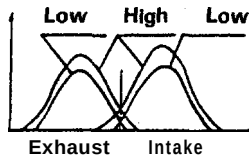
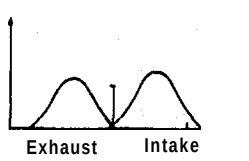


- ① CAM LOBES FOR LOW RPM
- ② CAM LOBES FOR HIGH RPM
- ③ PRIMARY ROCKER ARM
- ④ MID ROCKER ARM
- ⑤ SECONDARY ROCKER ARM
- ⑥ LOST MOTION ASSEMBLY
- ⑦ INTAKE VALVE
- ⑧ EXHAUST VALVE



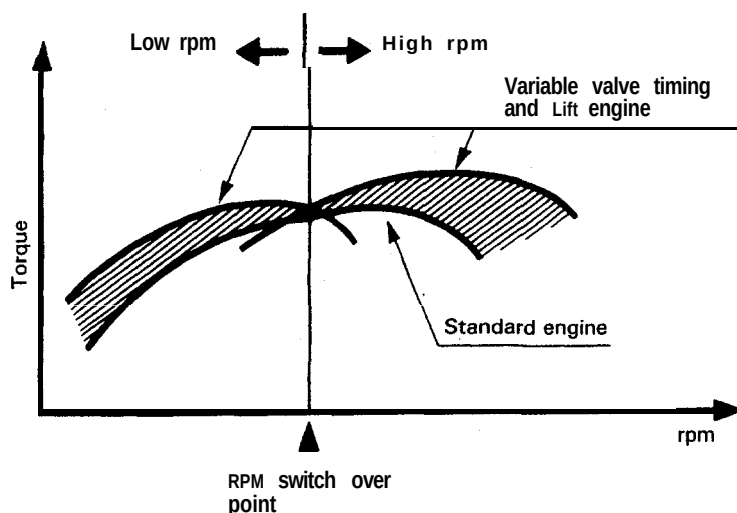
In general, it would be ideal if the high rpm performance of a racing engine and the low rpm performance of a standard passenger car engine could be combined in a single engine. This would result in a maximum performance engine with a wide power band. Two of the major differences between racing engines and standard engines are the timing of the intake/exhaust valves and the degree of valve lift. Racing engines have longer intake/exhaust timing and a higher valve lift than standard engines. The Honda Variable Valve Timing and Lift Electronic Control System takes this into account. When valve actuation is adjusted for low rpm timing and lift, low rpm torque is better than in a standard engine. When valve actuation is then adjusted for high rpm timing and lift, output improves to the level that a racing engine can offer. Until now, few variable valve timing systems have been commercialized. In those that have, only the time that both valves are open (intake/exhaust overlap) could be changed. Honda's system is the first in the world in which both the valve timing and the degree of valve lift can be changed as needed, making it the most advanced valve train mechanism available.

Comparison of Valve Lift of Racing Engines vs. Mass Produced Engines

	Racing Engine	Variable Timing & Lift Engine	Standard Engine
Valve Timing (exhaust/intake) Valve Lift			
Max. Power	0	0	0
Low rpm Torque		0	0
idling Stability		0	0

*TDC = Top Dead Center *BDC = Bottom Dead Center
0 = Optimum Characteristic

The engine is equipped with two valve timing and lift settings which change according to driving conditions.



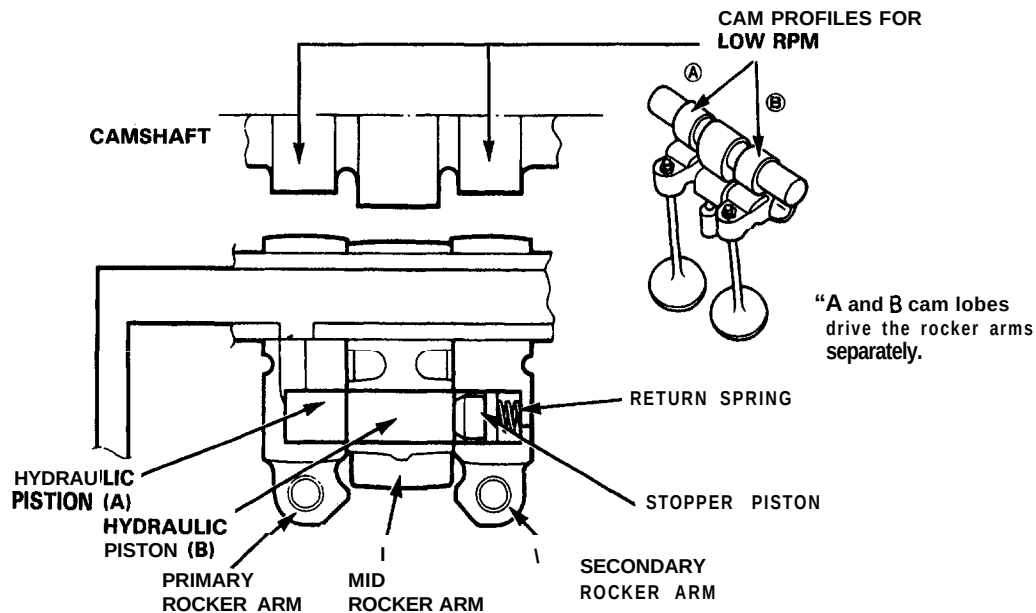
Variable Valve Timing and Lift Electronic Control System (VTEC)

Mechanism

At Low rpm:

As shown, the primary and secondary rocker arms located on both sides are not connected to the mid rocker arm but are driven separately by cam lobes A and B at different timing and lift. Although the mid rocker arm is following the center cam lobe with the lost-motion assembly, it has no effect on the opening and closing of the valves in the low rpm range.

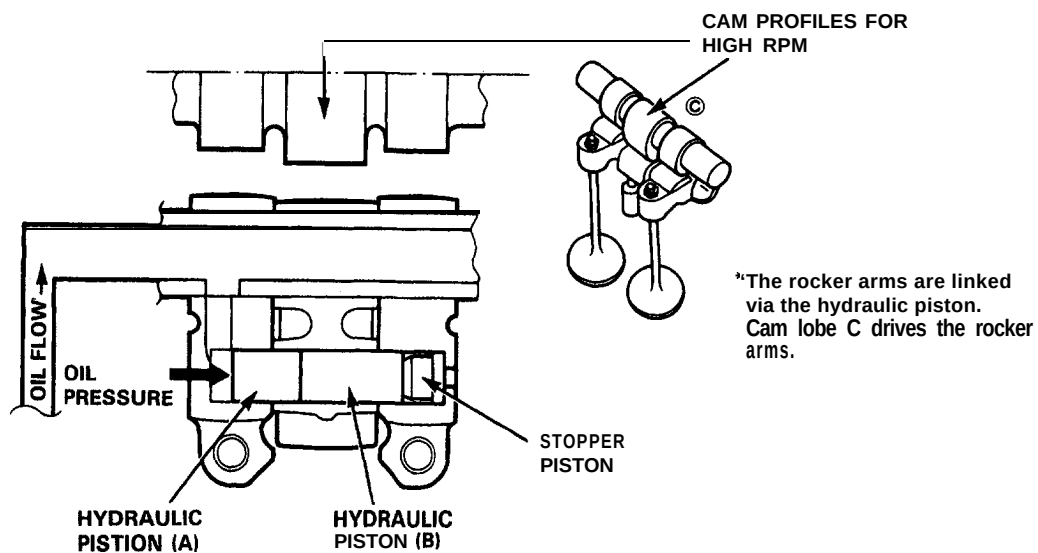
At Low rpm:



At High rpm:

When driving at high rpm, the built-in piston moves in the direction shown by the arrow in the figure below. As a result, the primary, secondary, and mid rocker arms are linked by 2 hydraulic pistons (like a skewer) and the 3 rocker arms move as a single unit. In this state, all the rocker arms are driven by cam lobe C opening and closing the valves at the valve timing and lift set for high operation.

At High rpm:





Control System

The control system for this mechanism, as shown below, constantly monitors the changes in engine status such as load, rpm and vehicle speed. This information is transmitted to the Control Unit.

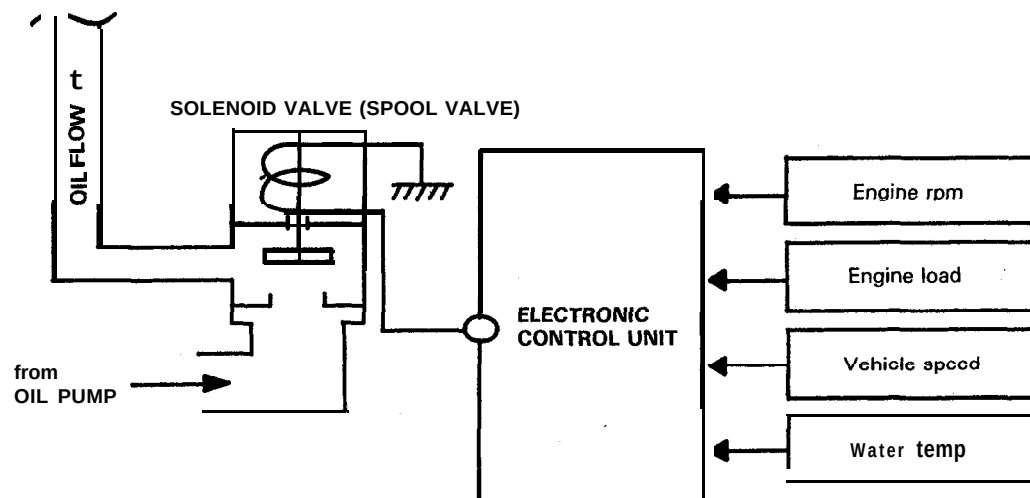
Valve Timing Change Conditions

Engine RPM: 5,800–6,000 rpm

Vehicle Speed: 5 km/h (3 MPH) or faster

Water Temperature: 60°C (140°F) or higher

Control System



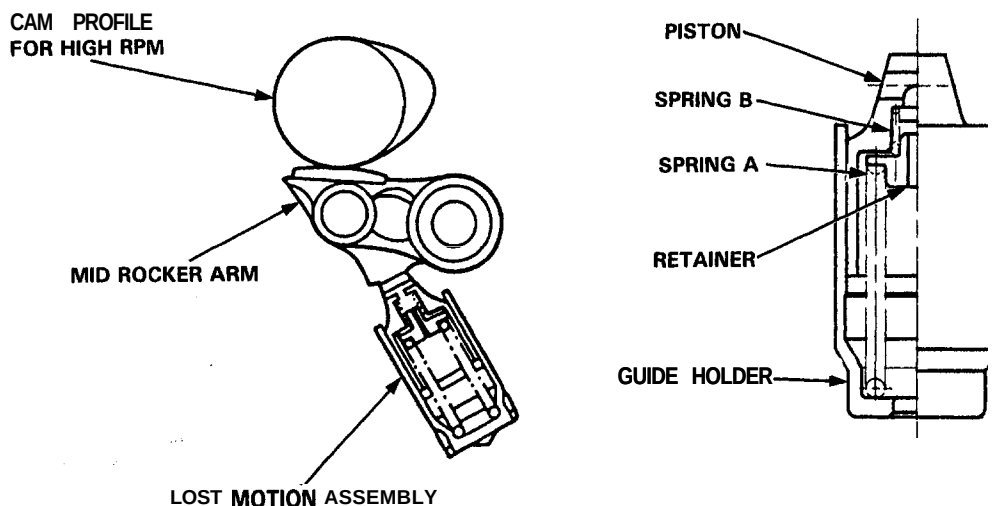
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Variable Valve Timing and Lift Electronic Control System (VTEC)

Control System

Lost Motion Mechanism

The mid rocker arm is always driven by the high-speed cam lobe, even at low speeds. At low speeds, the lost motion mechanism keeps the mid rocker arm in contact with the high-speed cam lobe. At high speeds, the lost motion mechanism acts as part of the valve spring load.

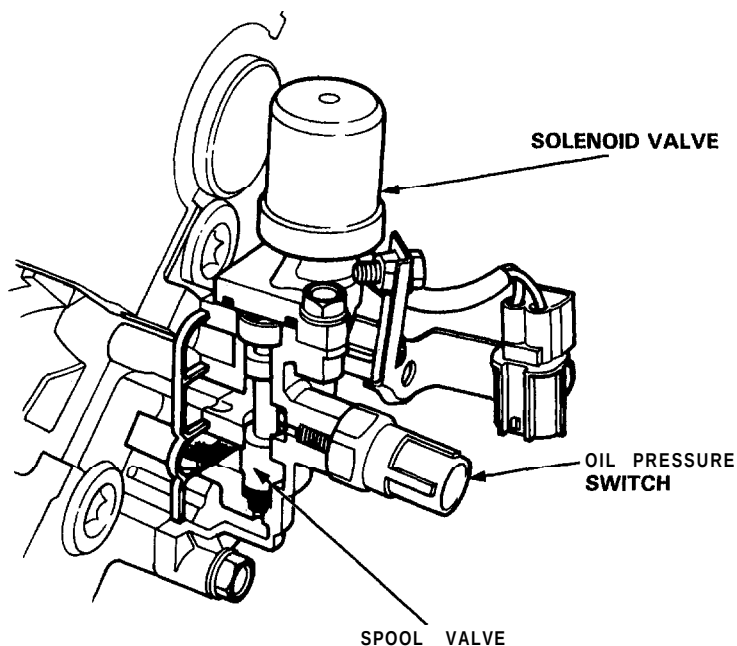


Hydraulic Pressure Control Mechanism

Spool valve/hydraulic pressure switch

The solenoid valve, in response to a signal from the PGM-FI ECU, closes the oil passage to the rocker arm at low speed. This cuts oil pressure to the hydraulic pistons in the rocker arms so the arms operate independently. At high speed, the ECU opens the solenoid valve. The increased oil pressure causes the hydraulic pistons to lock the primary, secondary, and mid rocker arms together.

The oil pressure switch serves as a sensor to determine if the switch-over has taken place in response to the ECU signal.



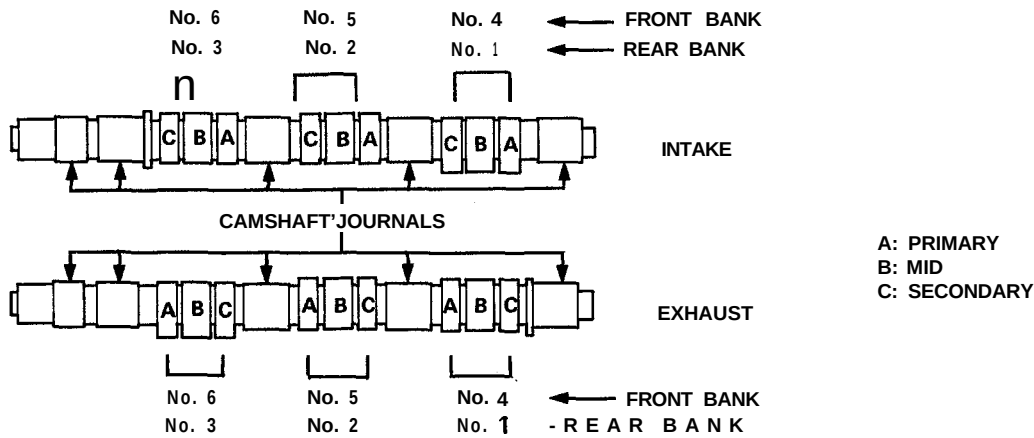
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Cylinder Head

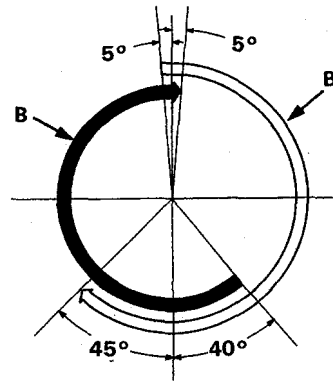
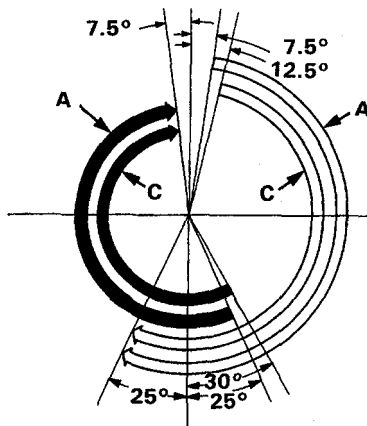
Camshaft

The camshaft is a cast piece. By improving dimensional accuracy, it became possible to achieve minimum space between cams, thus allowing a more compact cylinder head. Each camshaft is supported on four bearing journals with forced lubrication. On the right end of each camshaft is a driven pulley. The exhaust and intake cycles require a total of 36 cam lobes to open and close the valves.

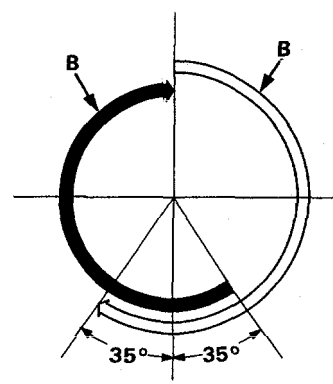
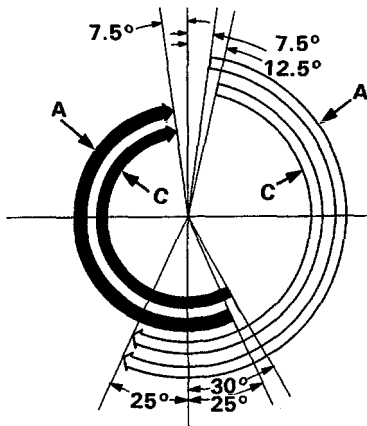


Manual Transmission

↖ : Intake valve open
↙ : Exhaust valve open



Automatic Transmission



Low-speed valve timing

High-speed valve timing

Valves

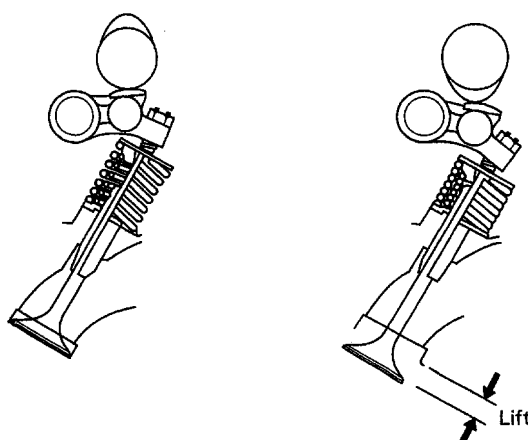
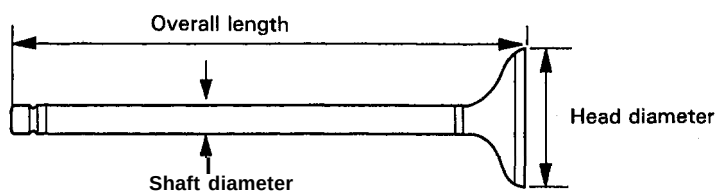
The valves are opened and closed by rocker arms driven by the camshaft. The rocker arm lever ratio is set to the optimum value, keeping cam lift to the minimum while increasing valve lift, thus improving intake/exhaust efficiency.

Valve specifications

Unit: mm (in)

VALVE		INTAKE	EXHAUST
ITEM			
HEAD DIAMETER		35 (1.38)	30 (1.18)
SHAFT DIAMETER		5.5 (0.22)	5.5 (0.22)
OVERALL LENGTH		112.45 (4.43)	111.55 (4.39)
VALVE LIFT	MIT	A: 8.7 B: 10.2" C: 8.3	A: 7.7 8: 9.0* c: 7.4
	A/T	A: 9.0 B: 9.5" c: 8.6	A: 7.7 B: 9.0" c: 7.4

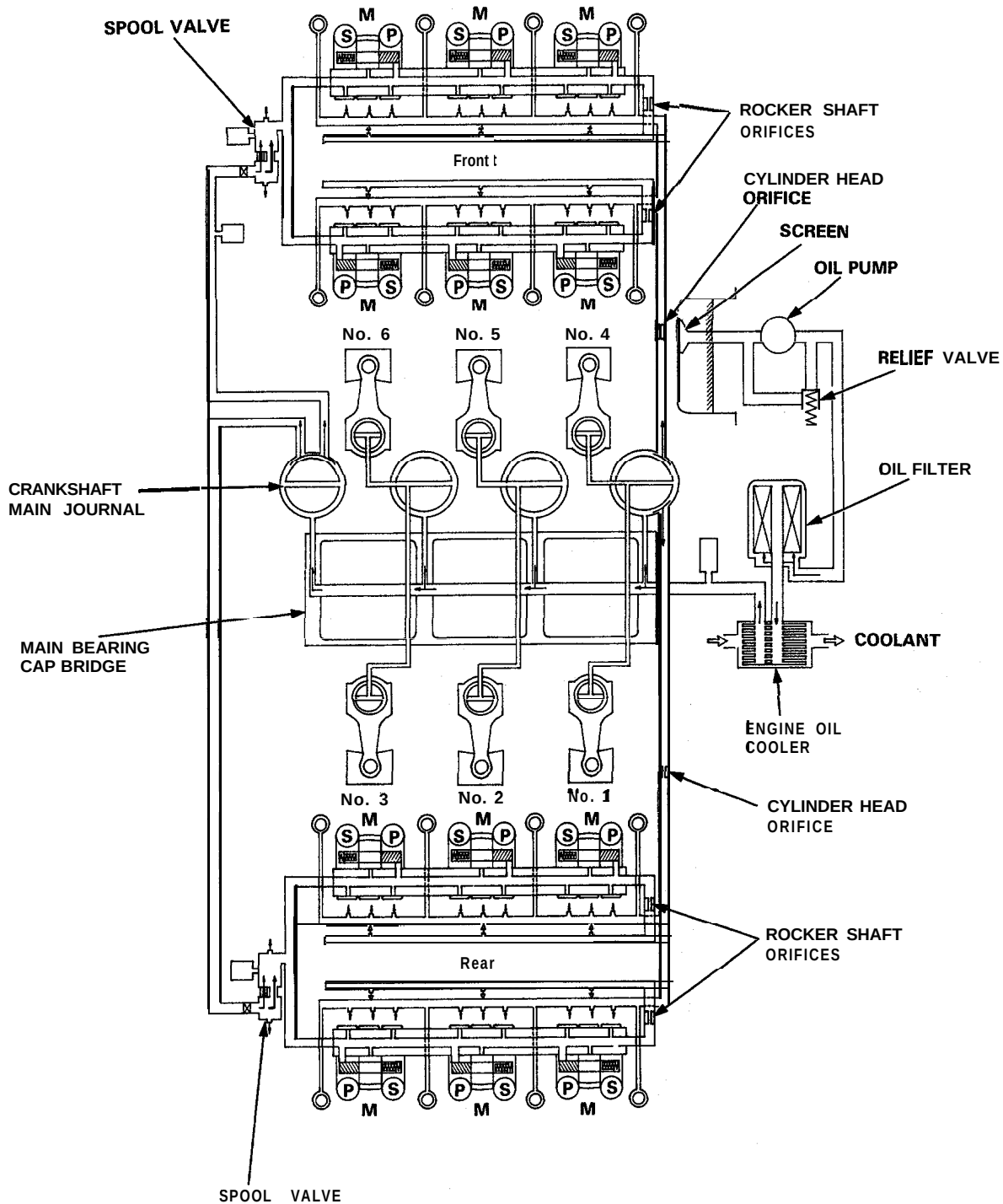
* Indicates high-speed valves



Lubrication System

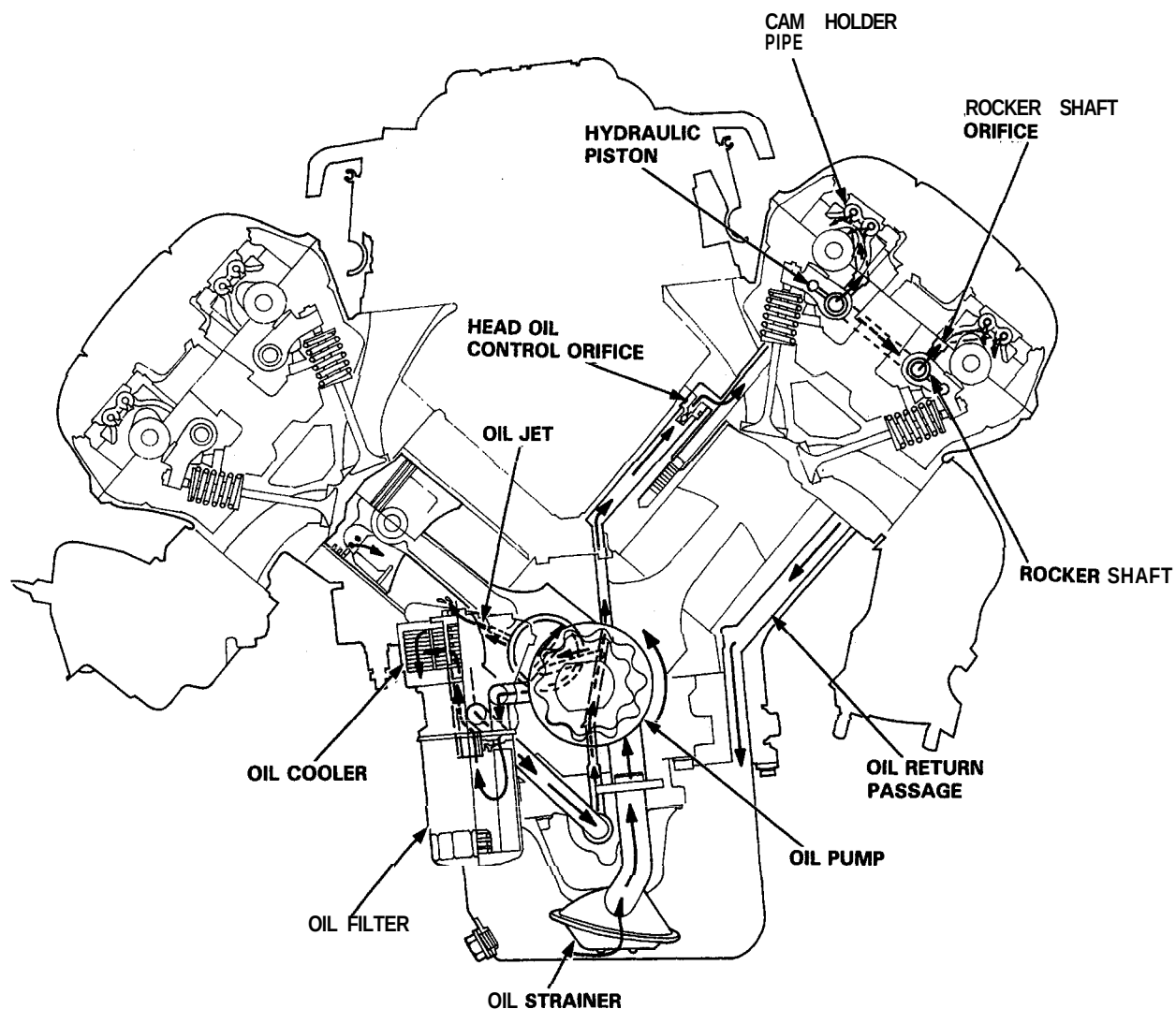


Lubrication Flow



Oil Passage

The lubrication system is a full filtration circulation type. The oil pump is directly linked to the crankshaft; oil to the oil pump is pulled through the oil strainer, after which pressure is regulated by the pump relief valve. It is then filtered through the oil filter and pumped to the cylinder block and cylinder head. A baffle plate is provided inside the oil pan; the baffle plate helps minimize the changes in oil level produced inside the pan while driving will affect the amount of oil going to the pump.



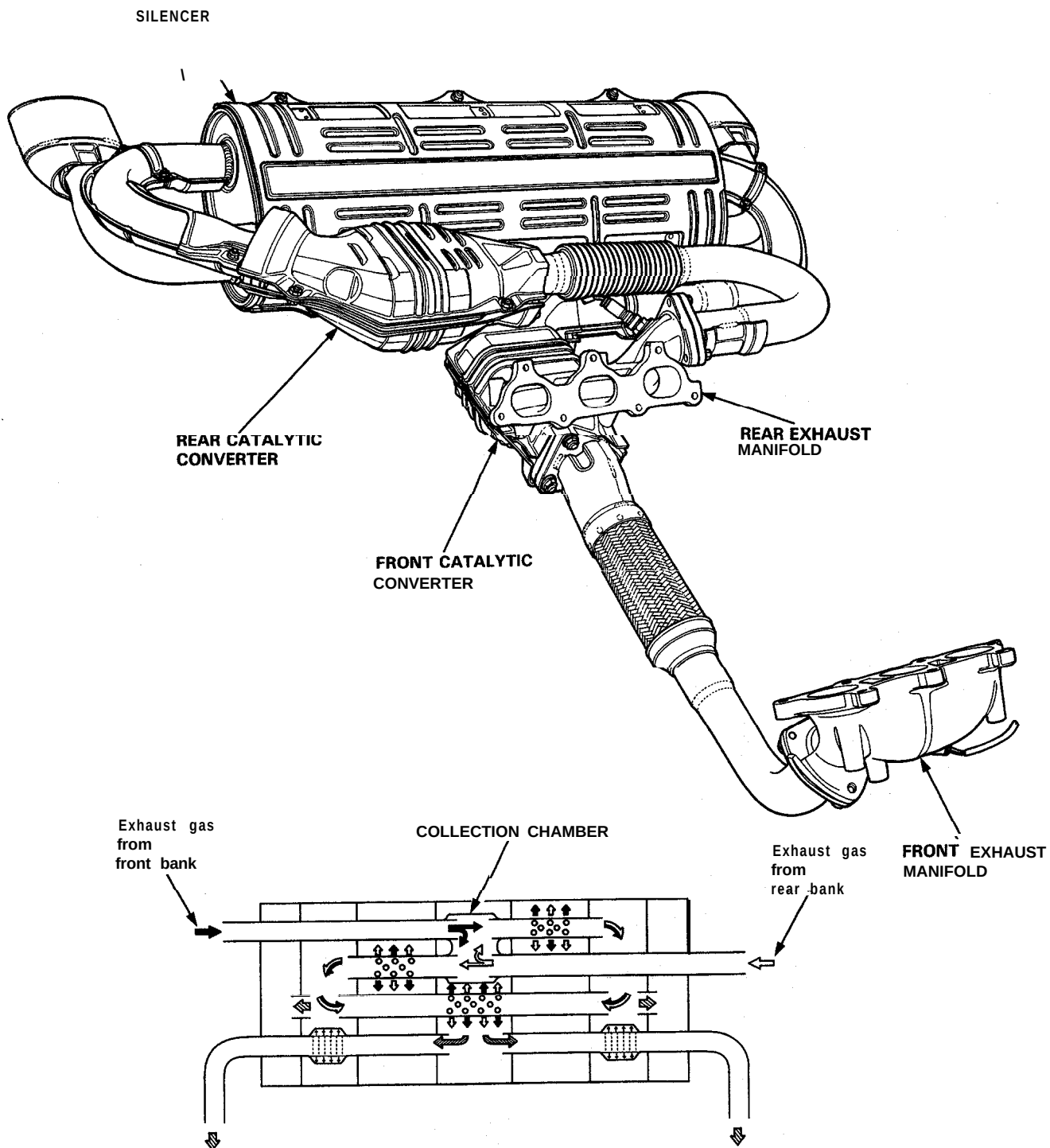
Exhaust System



Dual Exhaust System

Features

- A compact dual exhaust system is used to provide low back pressure.
- Sound tuning has been optimized to give a sporty exhaust sound note suitable to this type of car. This is done by a collection chamber in Exhaust Pipe B.

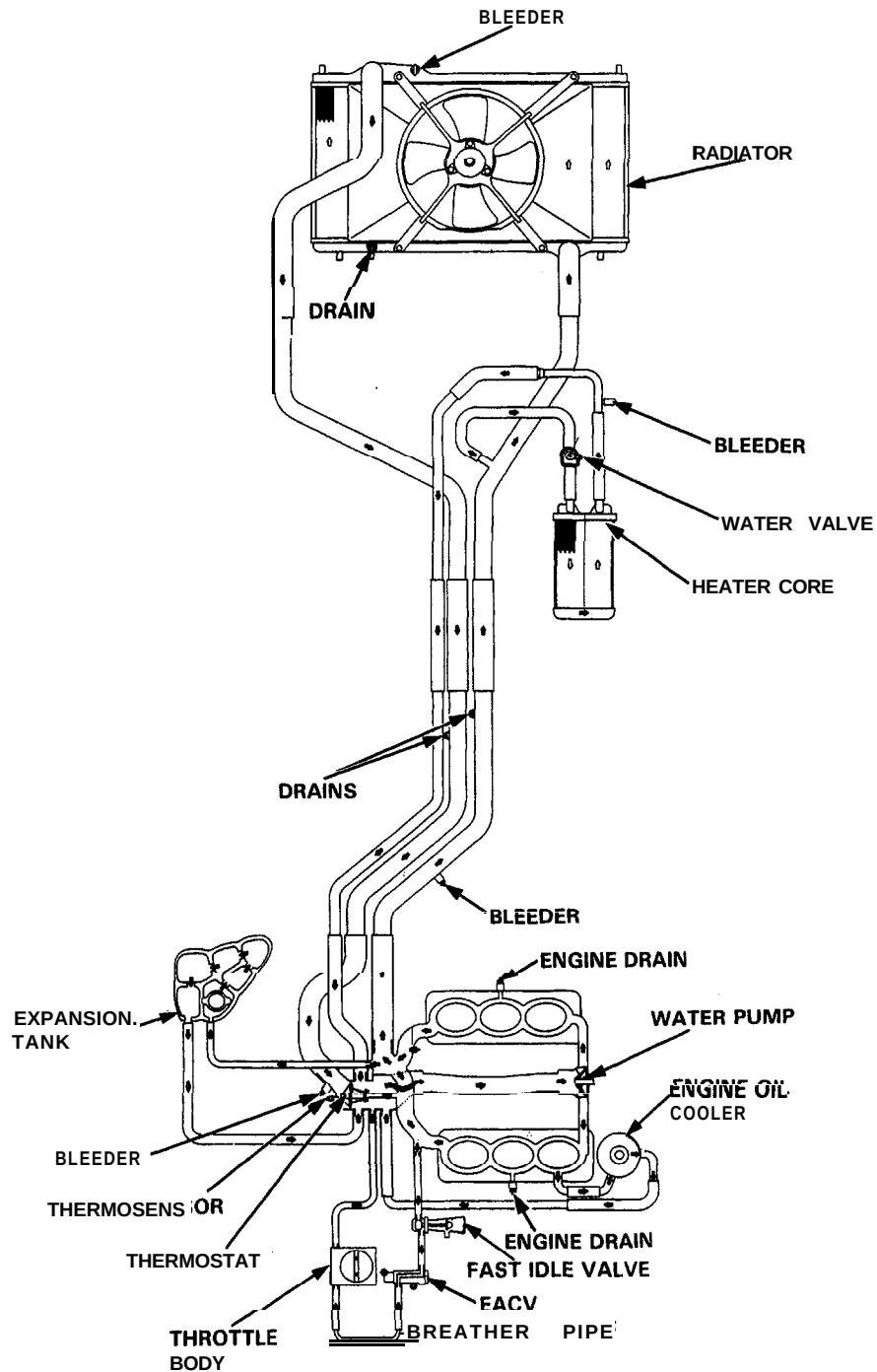


Cooling System

Two cooling systems are employed:

An antifreeze/water system with the radiator mounted in the front of the vehicle.

An air-cooling system driven by fan mounted in the engine compartment.





Radiator

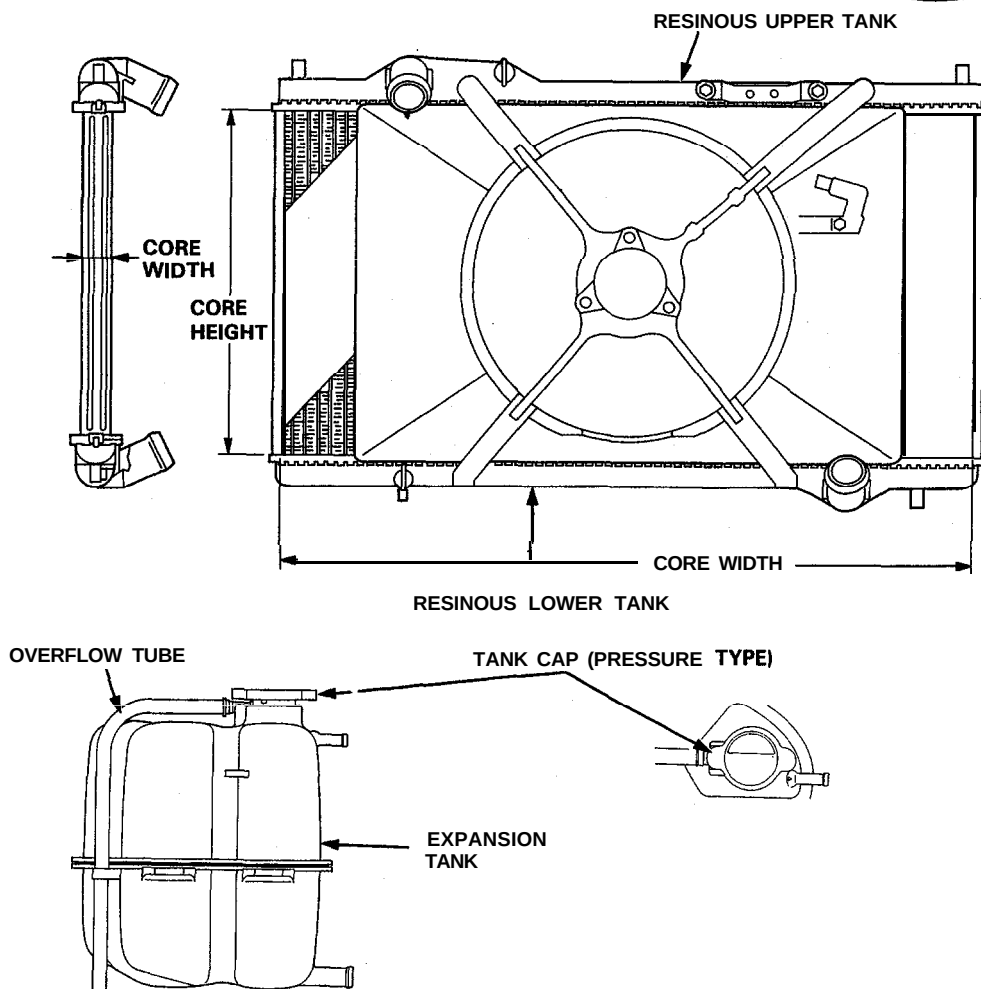
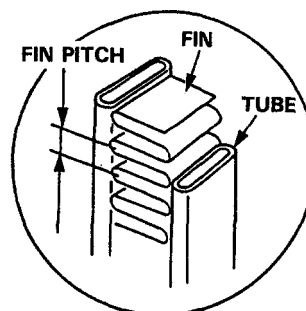
The radiator, made of aluminum alloy, is mounted in the front of the vehicle to gain maximum cooling efficiency from air passage. It is a corrugated-fin type, double row aluminum core radiator with electric cooling fan. Since the tubes are in a line, the volume of the cooling water in the radiator is reduced for less weight. The upper and lower tanks are made of resinous material for reduced weight and increased corrosion protection.

The engine compartment cooling fan is mounted on the right side. It operates in conjunction with the radiator's electric cooling fan in high mode.

The expansion tank is used to separate air out of the coolant circulating through the system.

Radiator Specifications

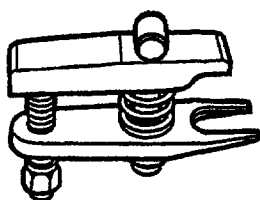
Radiator volume (kcal/h)		46,000
Core size	Height (mm)	340
	Width (mm)	688.1
	Thickness (mm)	32
Fin pitch (mm)		2.5



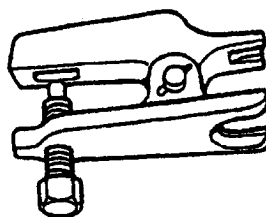
Engine Removal/Installation



Ref. No.	Tool Number	Description	Q'ty	Page	Reference
①	07MAC—SL00100	Ball Joint Remover	1	5-24	
②	07941-6920003	Ball Joint Remover	1	5-24	



①



②



⚠ WARNING

- Make sure jacks and safety stands are placed properly and hoist brackets are attached to the correct positions on the engine (See Section 1).
- Make sure the car will not roll off stands and fail while you are working under it.

CAUTION:

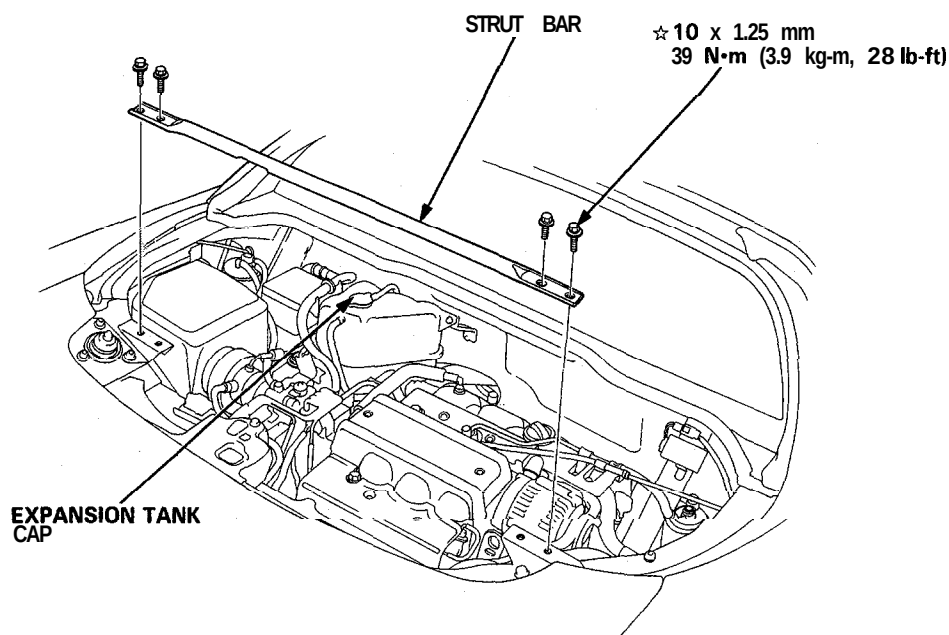
- Use front and rear fender covers to avoid damaging painted surfaces.
 - Unspecified items are common for the M/T cars, A/T cars, and the A/C equipped cars.
 - Unplug the wiring connectors carefully while holding the coupler and the connector portion to avoid damage.
 - Mark all wiring and hoses to avoid mis-connection. Also, be sure that they do not contact other wiring or hoses or interference with other parts.
 - If the ground clearance should be retained, use a scissors jack and install the rubber spacers to the coil springs (page I-6).
 - Put rubber pads under the jacking points when using jacks or safety stands to avoid damaging body (page I-7, I-81).
1. Move the seat bottoms and backs as far forward as they will go.
 2. Disconnect the battery negative terminal first, then the positive terminal.

3. Remove the expansion tank cap to speed draining.

⚠ WARNING

Use care when removing the expansion tank cap to avoid scalding by hot coolant or steam.

4. Raise the hoist to full height.
5. Drain the coolant (See Section 10).
 - Loosen the drain plug from the radiator lower tank.
 - Remove two drain bolts from the water pipes. Reinstall the drain bolts with new washers.
 - Loosen the front and rear engine drain bolts to drain coolant from cylinder heads. Connect rubber hoses to the drain bolts for easy operation.
6. Drain transmission oil/fluid. Use a 3/8" drive socket wrench to remove the drain plug. Reinstall the drain plug using a new washer.
7. Drain the engine oil. Reinstall the drain plug using a new washer.
8. Lower the hoist.
9. Remove the rear hatch (See Section 20).
10. Remove the engine cover (See Section 20).
11. Remove the rear hatch scoop (See Section 20).
12. Remove the strut bar.



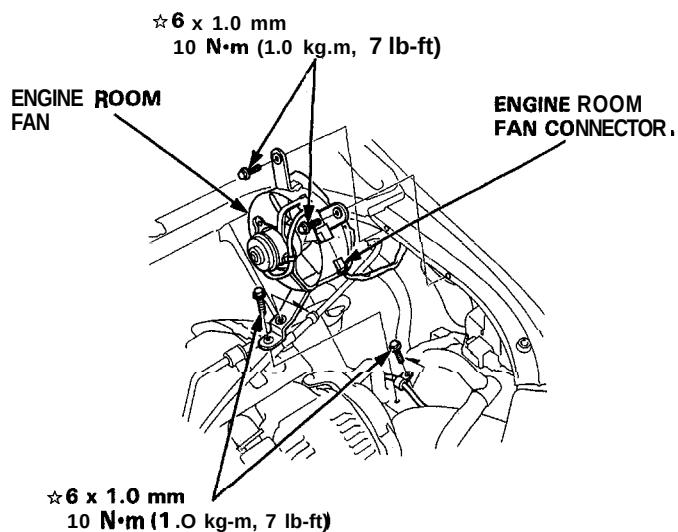
☆ : CORROSION RESISTANT BOLT

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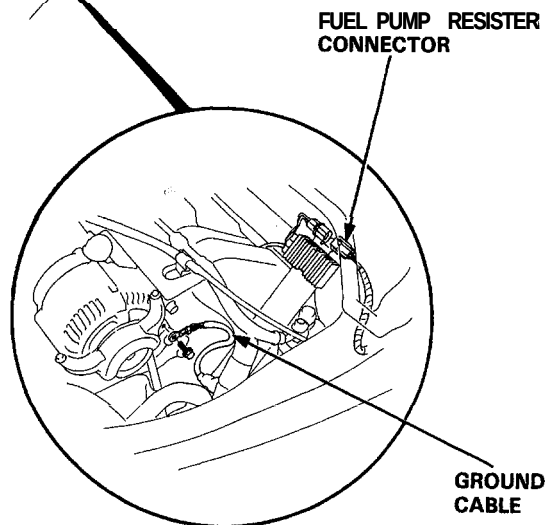
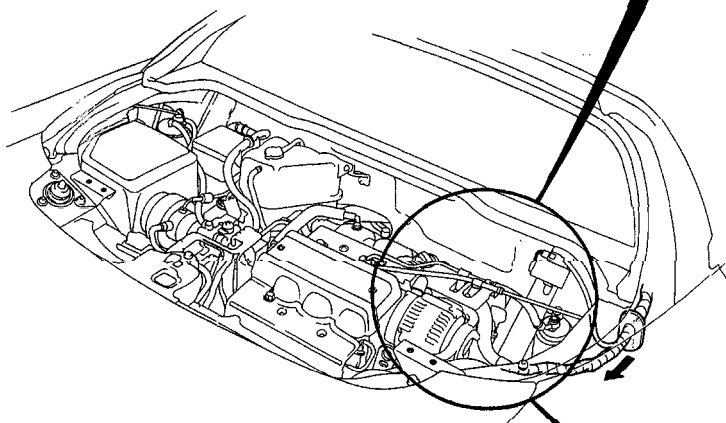
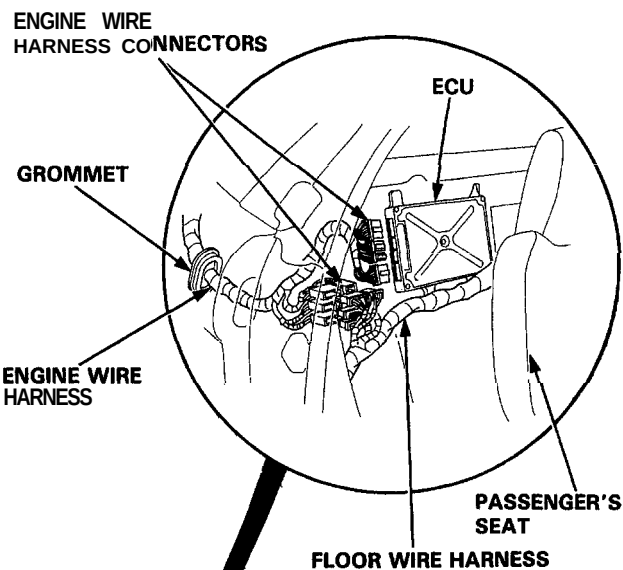
Engine Removal/Installation

- (cont'd)

13. Disconnect the resistor connector and fan motor connector, then remove the engine room fan assembly.



14. Remove the rear trim panels behind the passenger's seat, then disconnect four connectors from ECU and five connectors from floor wire harness.



☆ : CORROSION RESISTANT BOLT

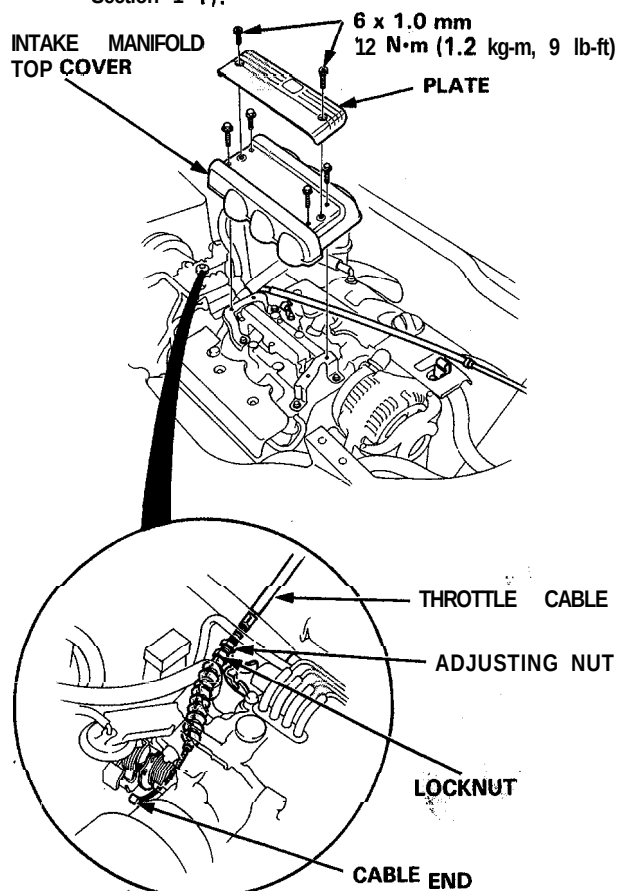


15. Remove the intake manifold plate and the top cover.

16. Remove the throttle cable by loosening the locknut, then slip the cable end out of the throttle bracket and accelerator linkage.

NOTE:

- Take care not to bend the cable when removing it. Always replace a kinked cable with a new one.
- Adjust the throttle cable when installing (See Section 11).



17. Relieve fuel pressure by slowly loosening the service bolt on the fuel filter about one turn (See Section 11).

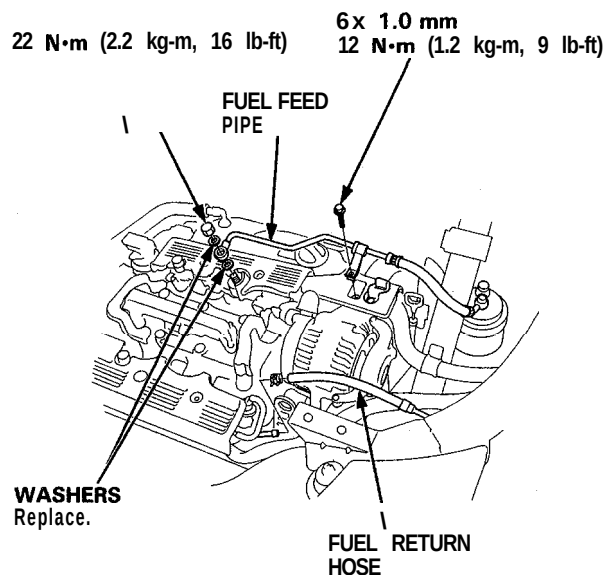
⚠ WARNING Do not smoke while working on the fuel system. Keep open flame away from work area. Drain fuel only into an approved container.

CAUTION:

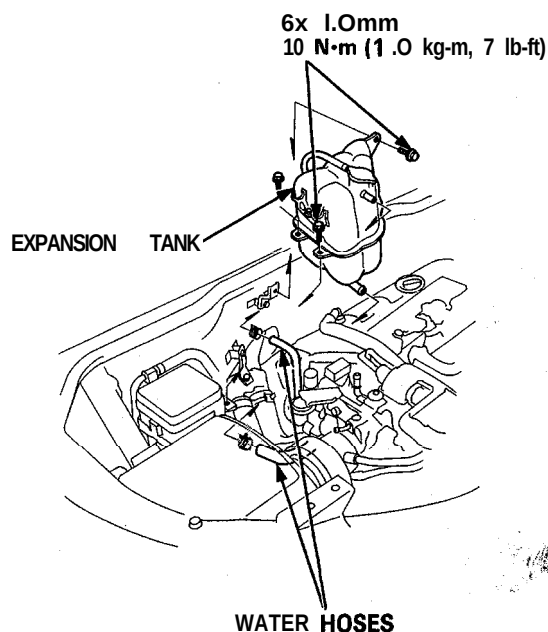
- Before disconnecting any fuel line, the fuel pressure should be relieved as described above.
- Place a shop towel over the fuel filter to prevent pressurized fuel from spraying over the engine.

18. Remove the fuel feed pipe.

19. Remove the fuel return hose from the pressure control valve.



20. Disconnect two hoses, then remove the expansion tank.



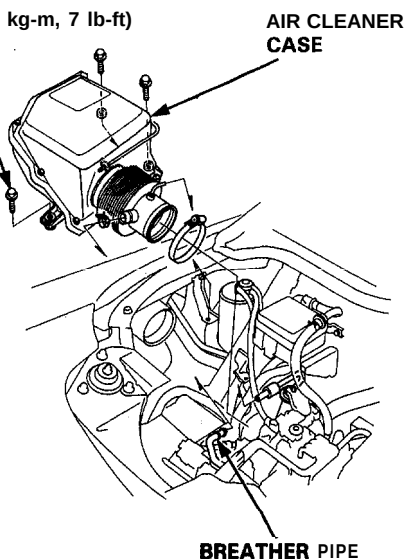
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Engine Removal/Installation

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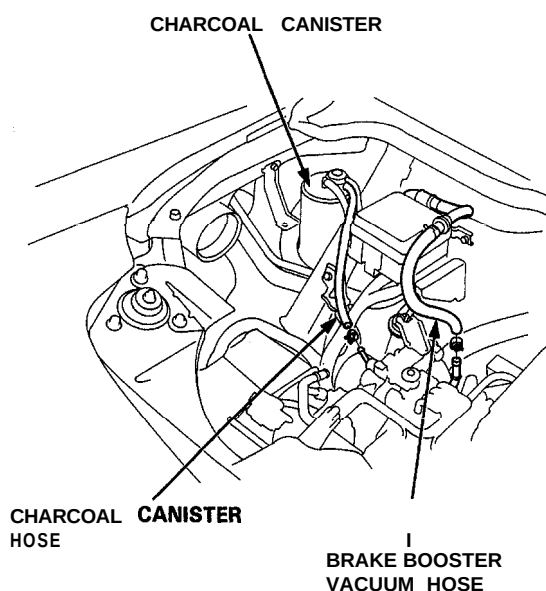
21. Remove the breather hose, then remove the air intake duct and the air cleaner case.

☆ 6 x 1.0 mm
10 N·m (1.0 kg-m, 7 lb-ft)



22. Disconnect the charcoal canister hose from throttle body.

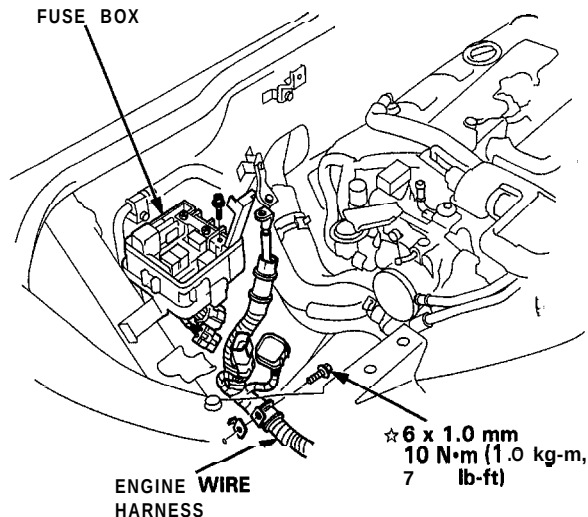
23. Disconnect the brake booster vacuum hose from the intake manifold.



24. Disconnect the two engine wire harness connectors from the side wire harness at left side of engine compartment, and remove the engine wire harness terminal and the starter cable terminal from the under hood relay box and clamps.

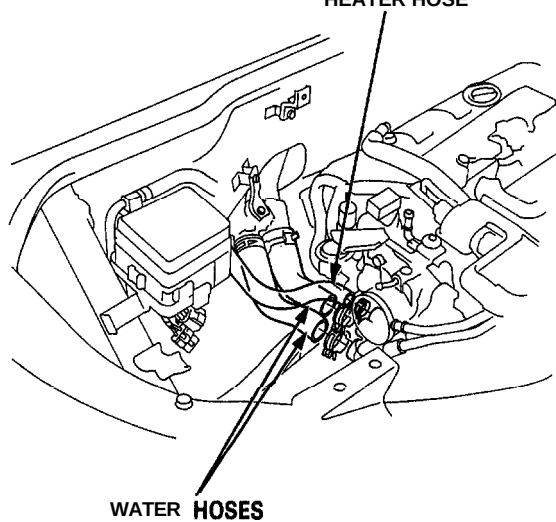
25. Remove the ground cable from the transmission.

FUSE BOX



26. Remove the water hoses and the heater hose from the water passage.

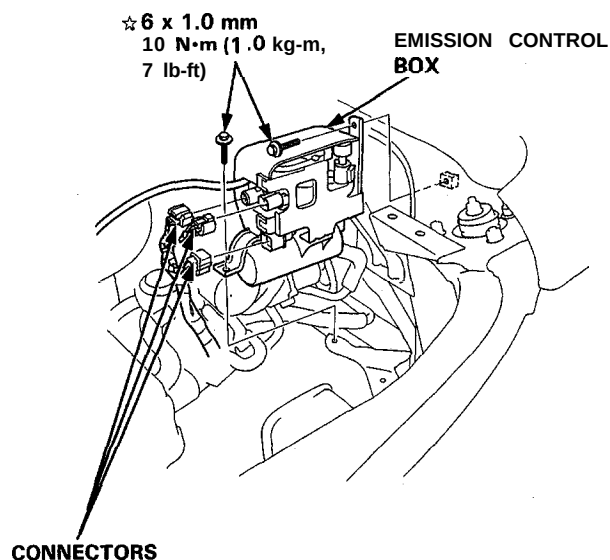
HEATER HOSE



☆ : CORROSION RESISTANT BOLT

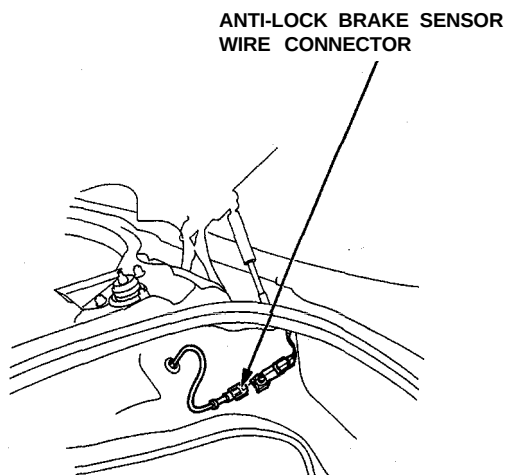


27. Disconnect the three connectors, then remove the emission control box. Fix it to the intake manifold.
- Do not disconnect the vacuum hoses.



28. Move the trunk carpet and disconnect the anti-lock brake right sensor connector. Push the wire and connector through the body hole into the engine compartment.

29. Remove the front engine mounting bolt (page 5-28).



30. Raise hoist to full height.

31. Remove the clutch slave cylinder from the transmission case (M/T, See Section 12)
- Do not disconnect the clutch hose.

32. Remove the lower cover, then remove the shift cable and select cable with cable bracket (M/T, See Section 13).

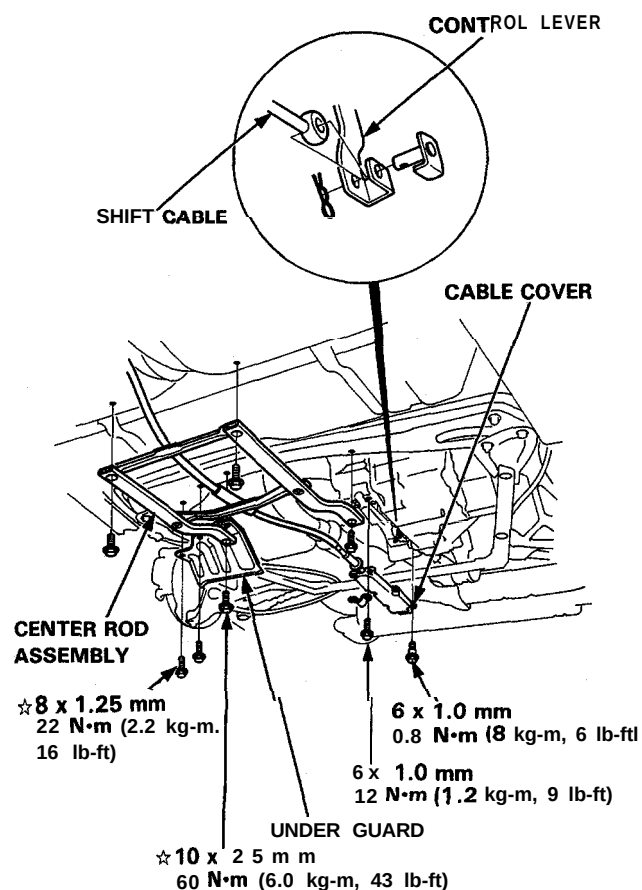
33. Remove the cover, then remove the shift cable (A/T See Section 14).

NOTE:

- Take care not to bend the cable when removing it. Always replace a kinked cable with a new one.
- Adjust the cables when installing.

34. Remove the engine under guard and the center rod assembly.

A/T:



☆ : CORROSION RESISTANT BOLT/NUT

(cont'd)

Engine Removal/Installation

• (cont'd)

35. Remove the rear beam rod assembly.

36. Remove the front beam. Remove the A/C compressor, then reinstall the front beam and retorque the two nuts to the front beam.

NOTE:

- Do not remove the compressor hoses.
- Hang the A/C compressor with wire or rope as shown. Do not let it hang from hoses.

37. Remove the left and right parking brake cables.

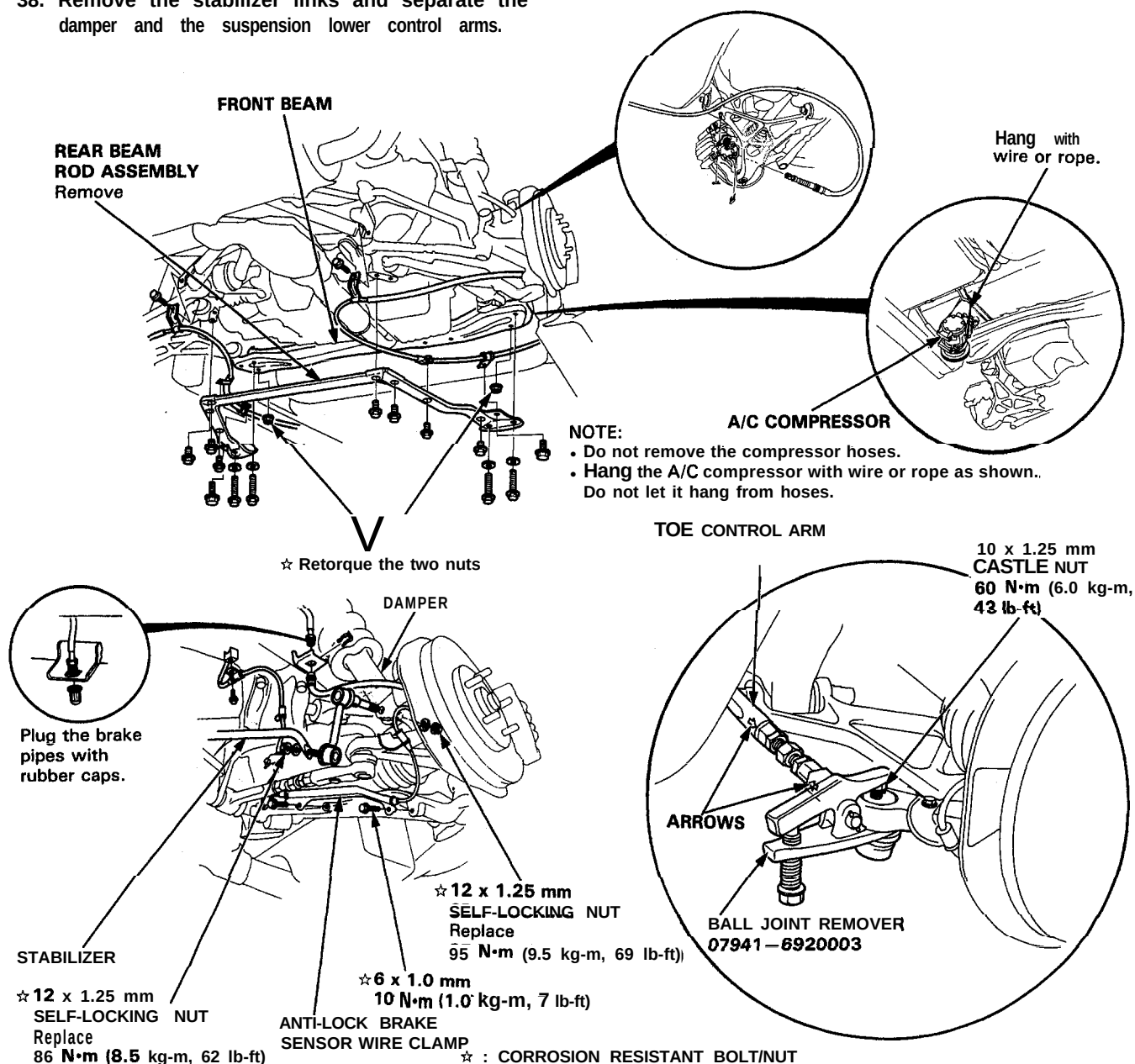
38. Remove the stabilizer links and separate the damper and the suspension lower control arms.

39. Remove the rear brake hoses. Plug the brake pipes with rubber caps.

40. Remove the anti-lock brake sensor wire clamps.

41. Remove the ball joints from the suspension lower control arms (use ball joint remover 07MAC-SL00100), and the toe control arms (use ball joint remover 07941-6920003).

CAUTION: Make sure that the reference marks on the control arm are aligned.





42. Remove the oxygen sensor connectors.

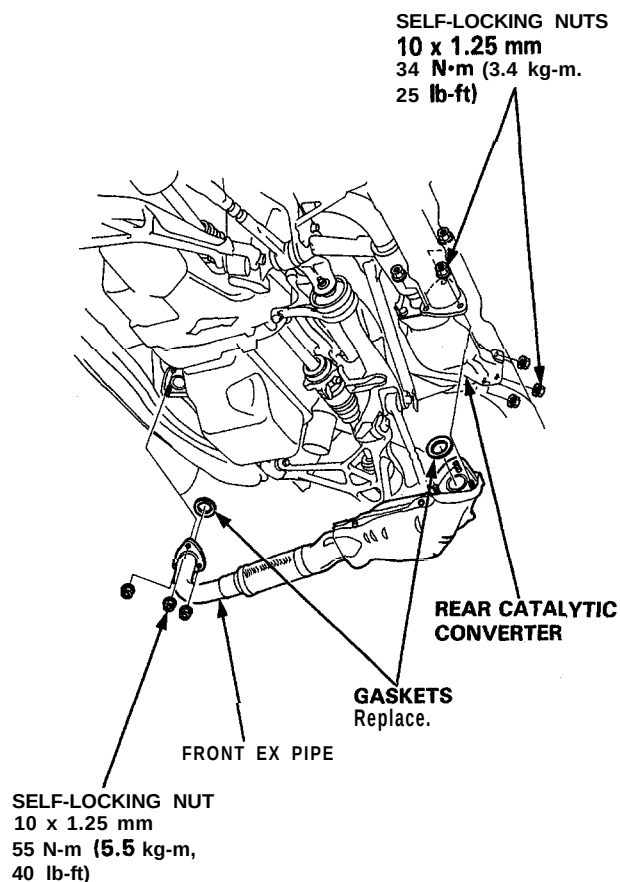
43. Remove the front exhaust pipe A and catalytic converter.

44. Remove the self-locking nuts, then separate the catalytic converter and exhaust silencer.

CAUTION:

- Do not use air wrench or hammer to remove exhaust pipes or catalytic converters if the oxygen sensors are not to be removed.
- Do not use air wrench for tightening self-locking nuts on exhaust pipes or catalytic converters if the oxygen sensors are not to be removed.

NOTE: Use new gaskets and self-locking nuts when reassembling.



45. Remove the half shaft heat cover

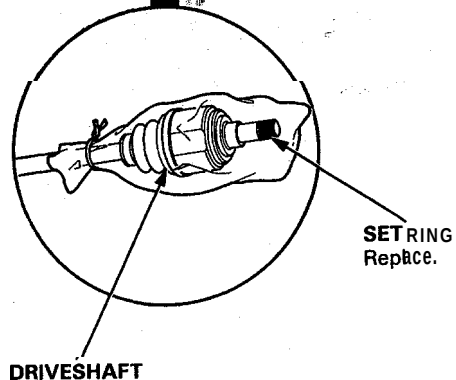
46. Remove the driveshafts.

NOTE:

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

**HALF SHAFT
HEAT COVER**

6 x 1.0 mm
10 N·m (1.0 kg-m, 7 lb-ft)



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Engine Removal/Installation

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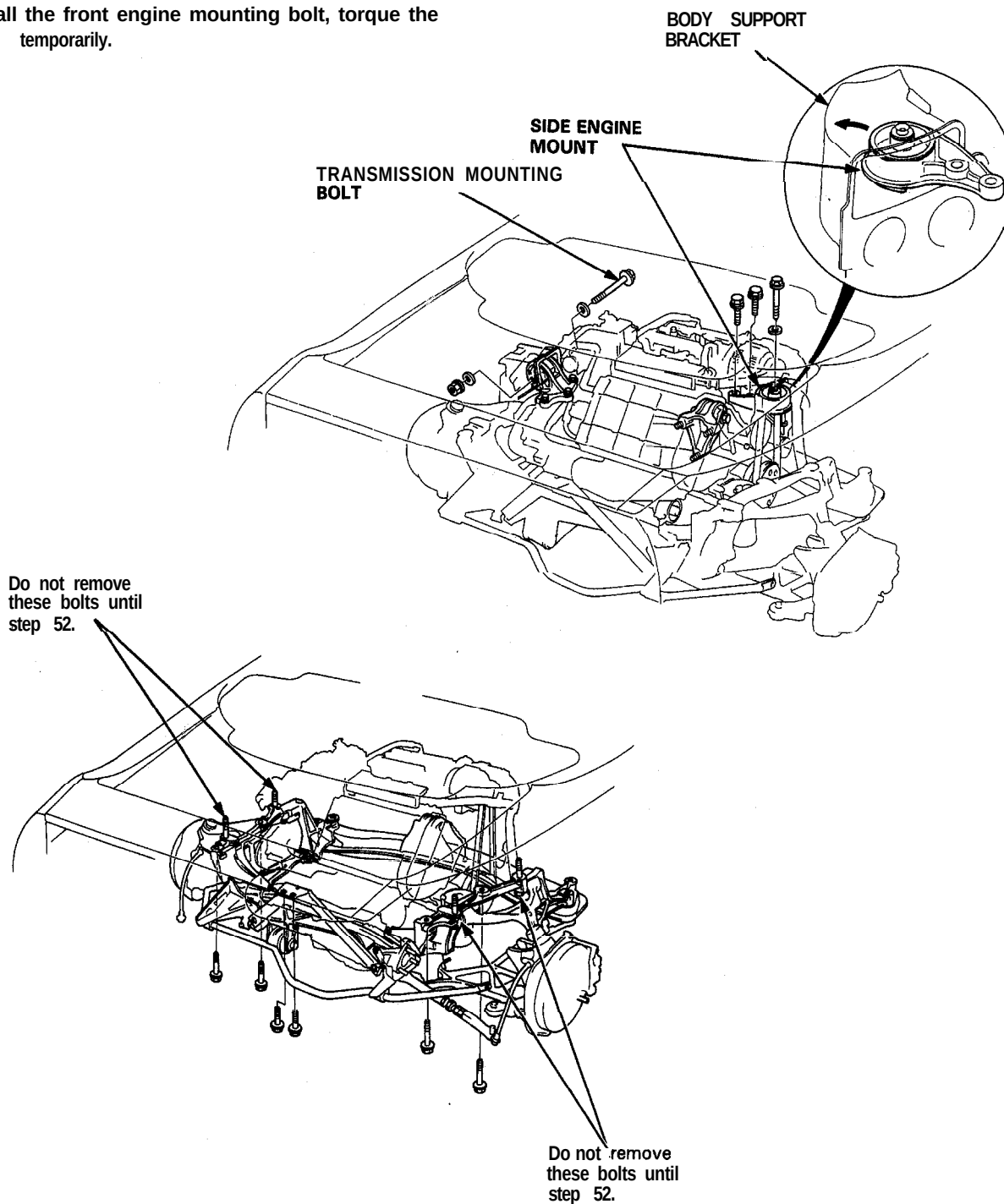
47. Loosen the rear beam side bracket mounting bolts one or two turns, then remove the mounting bolts except the four bolts shown.

48. Lower hoist, attach a chain hoist to the engine.

49. Install the front engine mounting bolt, torque the nut temporarily.

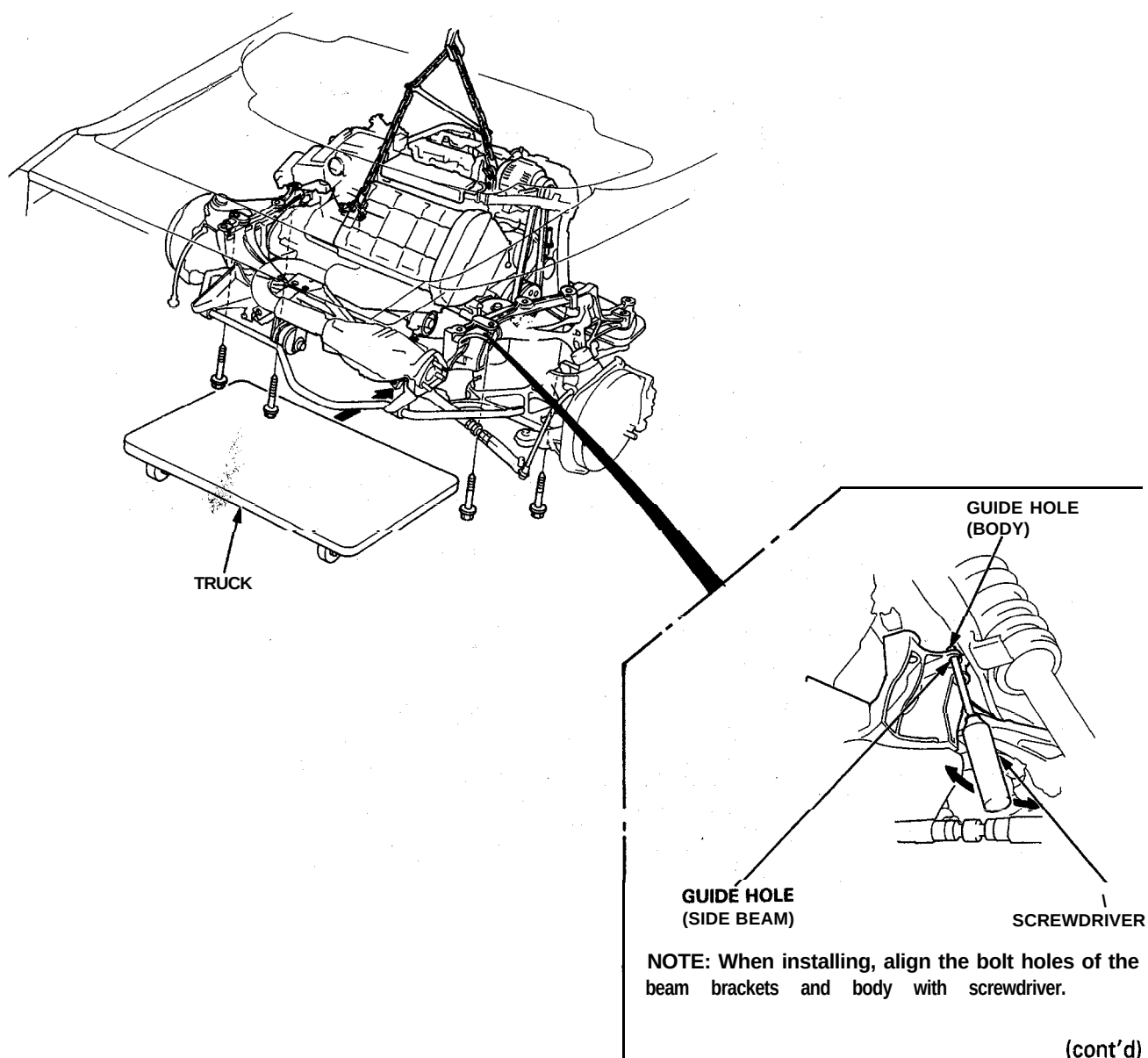
50. Remove the side engine mount and bolts, then push the side engine mounting bracket into the support bracket of the body.

51. Remove the transmission mounting bolt.





52. Remove the four mounting bolts from the rear beam side bracket.
53. Lower the engine, suspension and beam assembly a few inches with the chain hoist.
54. Check that wires and hoses are completely removed from the engine assembly.
55. Slowly lower the engine assembly on to a truck.
56. Remove the chain hoist from the engine.
57. Raise the body with the hoist. Roll the engine assembly from under the body.

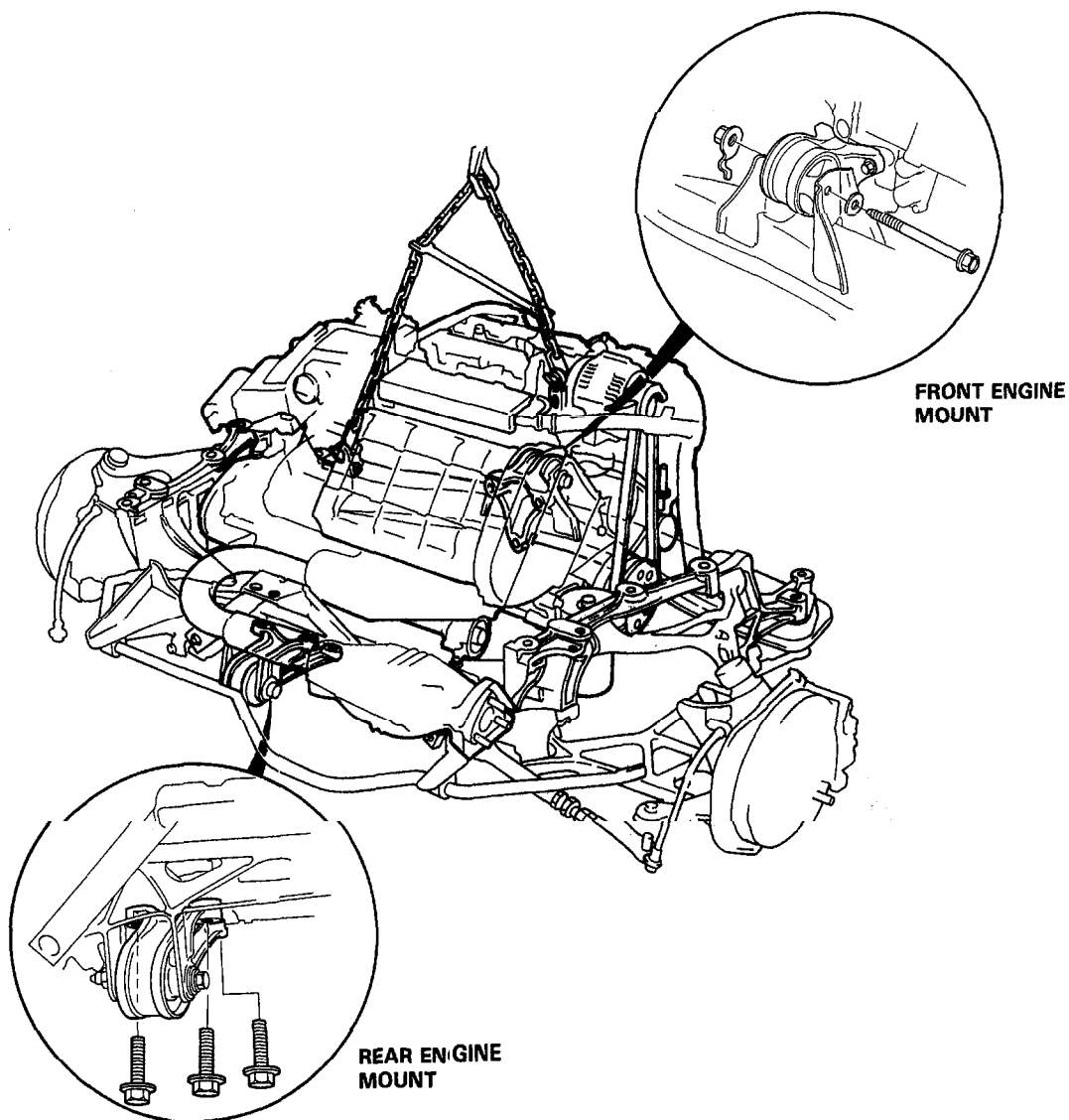


Engine Removal/Installation

(cont'd)

60. Attach a chain hoist to the engine. Remove the front and rear mounting bolts, then separate the engine from the suspension and the beam assembly.

CAUTION: Do not hit the engine oil cooler on the rear right beam bracket.



61. Install the engine in the reverse order of removal:

NOTE:

- Align the bolt holes of the beam brackets and body with screwdriver (page 5-27).
- Temporarily torque the two front beam nuts and front engine mounting bolt when installing the A/C compressor.

- Combine the front beam and the rear beam rod assembly, then torque the four mounting bolts.
- Check that the set ring on the end of each driveshaft clicks into place.

CAUTION: Use new set ring on installation.



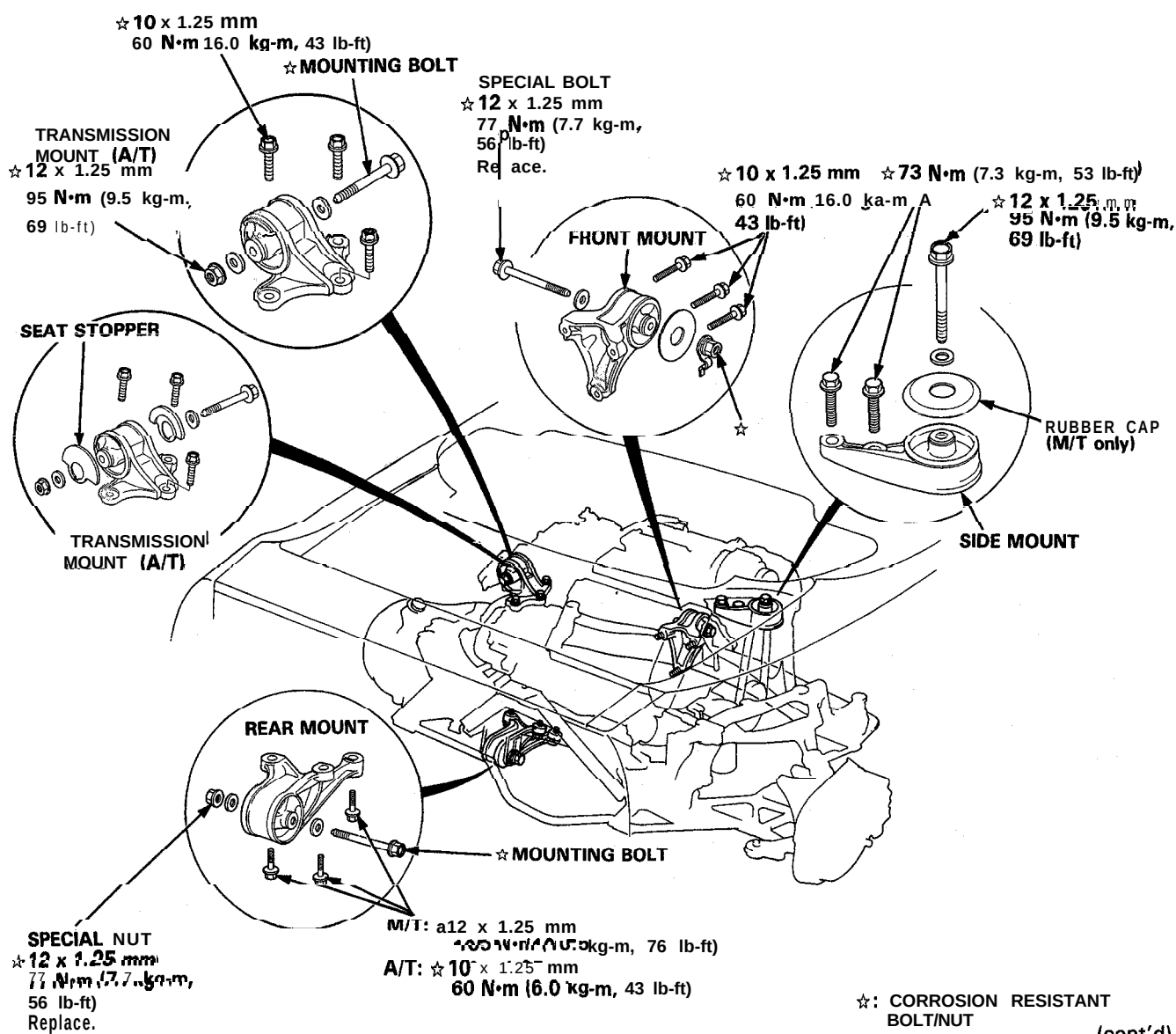
After the engine is in place:

- Torque the engine mounting bolts in sequence shown below.

CAUTION: Failure to tighten the bolts in the proper sequence can cause excessive noise and vibration and reduce bushing life; check that the bushings are not twisted or offset.

- Bleed air from the cooling system (See Section 10)
- Bleed air from the brake lines (See Section 19)
- Adjust the throttle cable tension.
- Check the clutch pedal free play.
- Adjust the clutch guide assemblies when disassembling clutch (See Section 12).

- Check that the transmission shifts into gear smoothly (M/T See Section 13, A/T See Section 14).
- Adjust the alternator belt (See Section 23).
- Adjust the A/C belt (See Section 22).
- Clean battery posts and cable terminals with sandpaper, assemble, then apply grease to prevent corrosion.
- Inspect for fuel leakage:
 - After assembling fuel line parts, turn on the ignition switch (do not operate the starter) so that the fuel pump is operated for approximately two seconds and the fuel is pressurized. Repeat this operation two or three times and check whether any fuel leakage has occurred at any point in the fuel line.

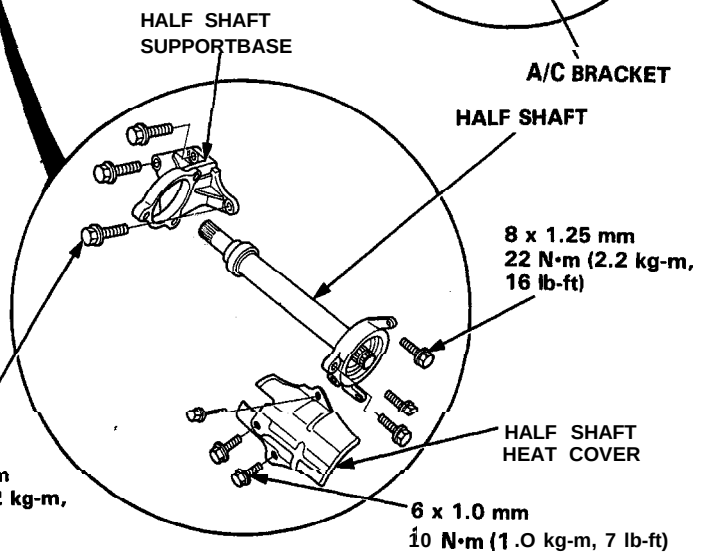
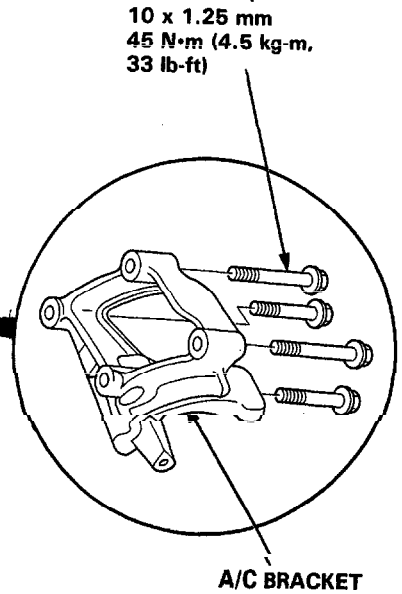
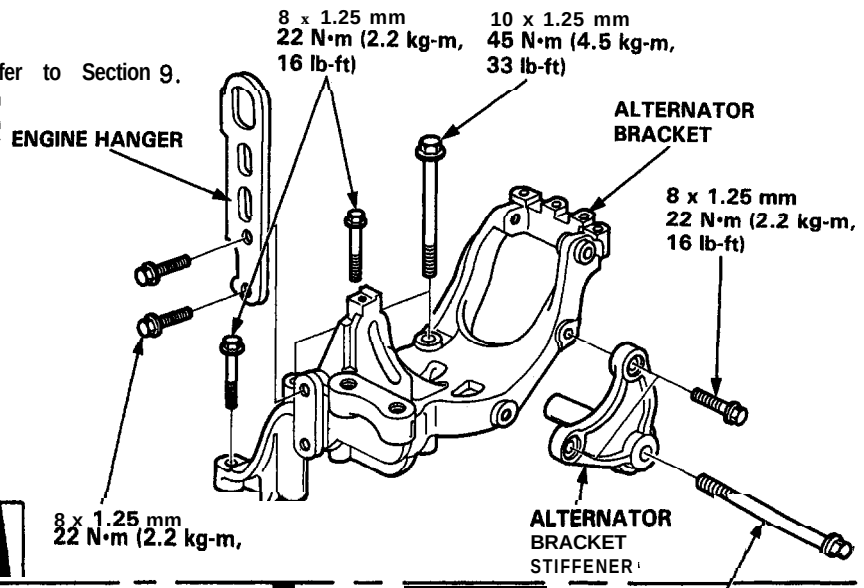
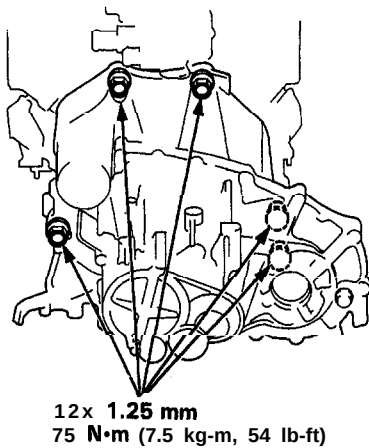
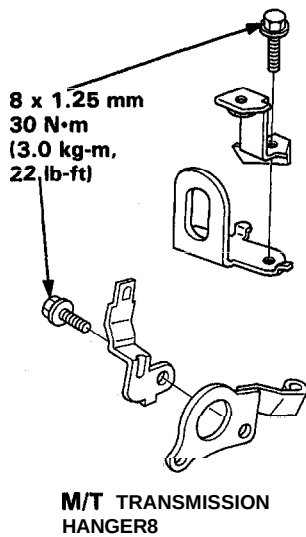
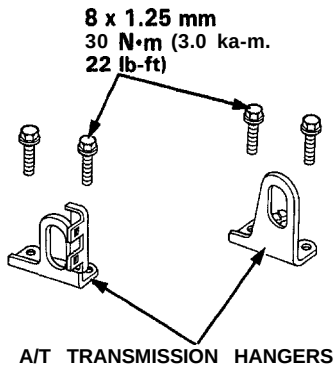


Engine Removal/Installation

(cont'd)

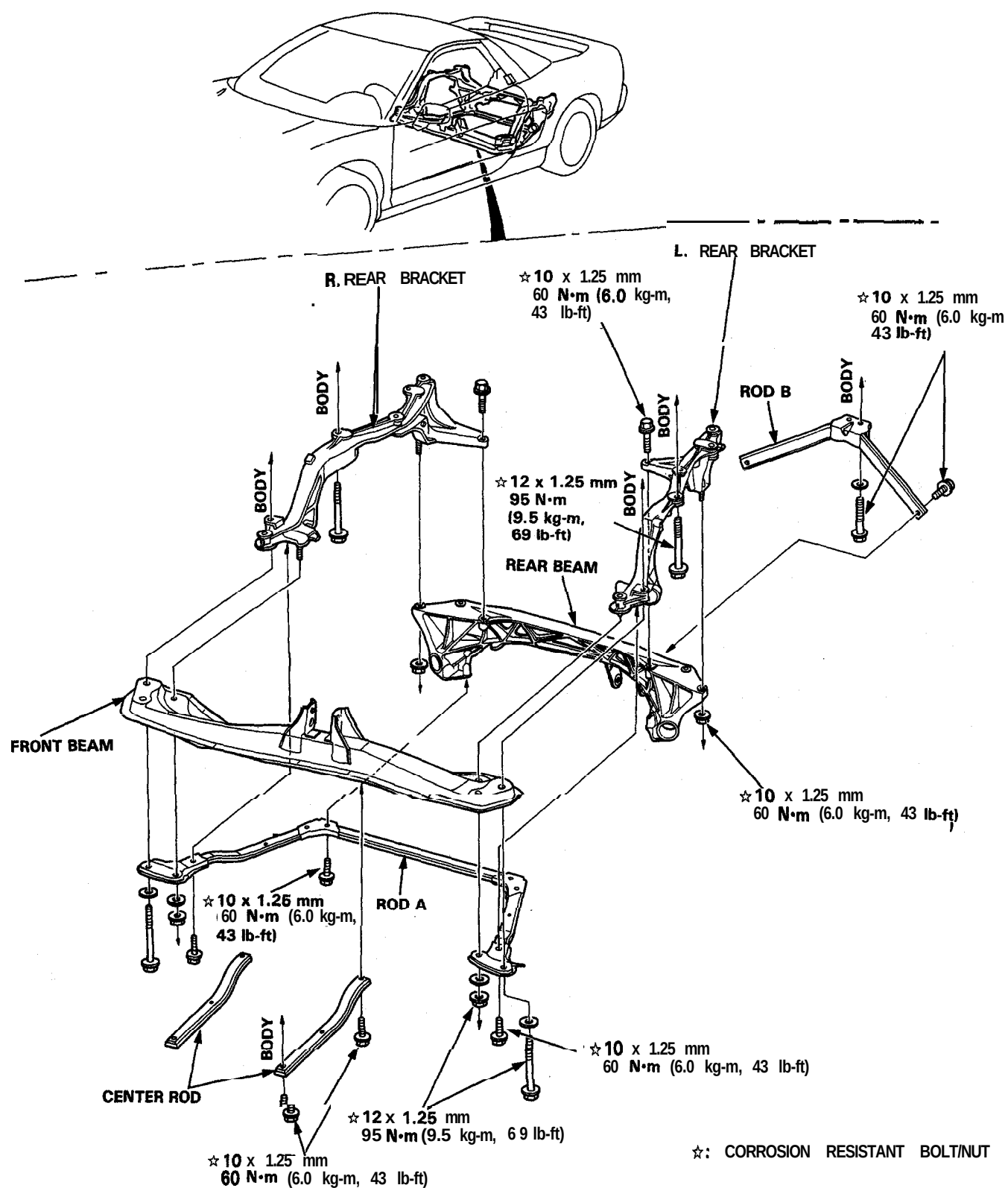
Additional Torque Valve Specifications:

NOTE: For manifold replacement, refer to Section 9.





Sub-frame Torque Value Specifications:



Cylinder Head/Valve Train

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Cylinder Head Removal *	6-28
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Rocker Arms and Shafts

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Special Tools

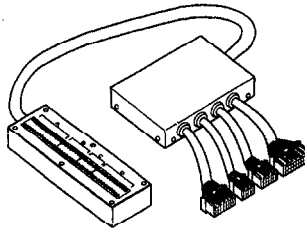
Ref. No.	Tool Number	Description	Q'ty	Page Reference
①	07HAH-PJ701 0A	Valve Guide Reamer, 5.5 mm	1	6-45
②	07LAJ-PT301 0A	Test Harness	1	6-11
③	07MAA-PR70110	Tappet Adjuster	1	6-55
④	07MAA-PR70120	Tappet Locknut Wrench	1	6-55
⑤	07MAJ-PR70100	Test Harness	1	6-1 1
⑥	07MAJ-PR70200	VTEC Plug	1	6-52, 53
⑦	07757-PJ1010A	Valve Spring Compressor Attachment	1	6-40
⑧	07742-0010100	Valve Guide Driver, 5.5 mm	1	6-44, 45



①



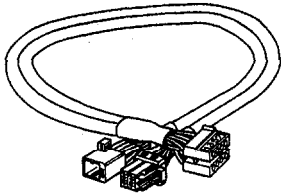
②



③



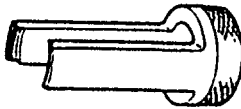
④



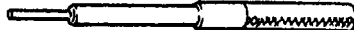
⑤



⑥



⑦



⑧



Cylinder Head/Valve Train

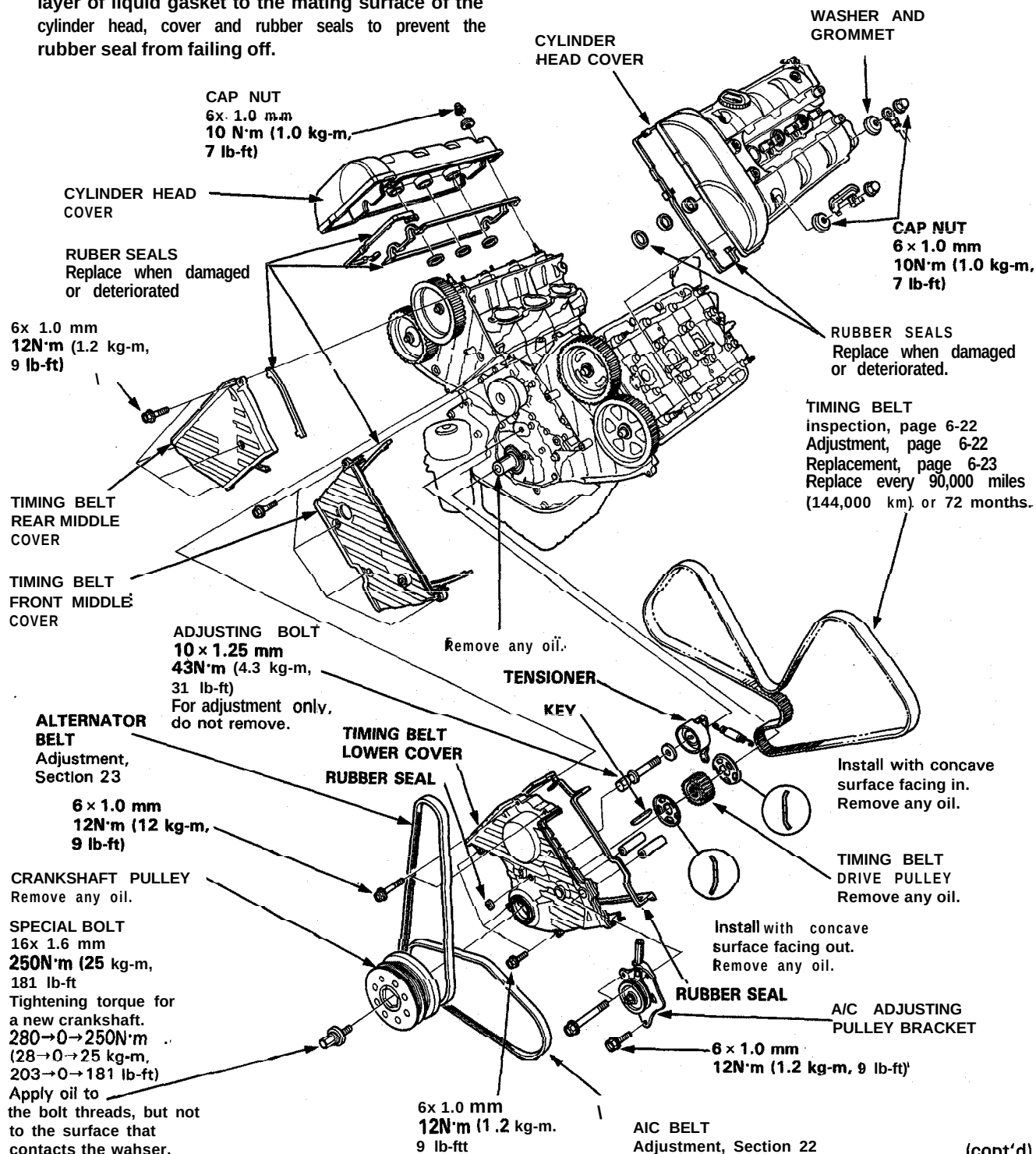
Illustrated Index

CAUTION: To avoid damaging the cylinder head, wait until the coolant temperature drops below **38°C (100°F)** before removing it.

NOTE:

- Use new O-rings and gaskets when reassembling.
- Replace rubber seals, if damaged or deteriorated.
- Prior to installing the cylinder head cover, apply a thin layer of liquid gasket to the mating surface of the cylinder head, cover and rubber seals to prevent the rubber seal from failing off.

- After installation, fill the engine with oil up to the specified level, run the engine for more than 3 minutes, then check for oil leakage.
- When installing the new crankshaft; ① tighten the crankshaft pulley bolt to 280 N·m (28 kg-m, 203 lb-ft), ② loosen it bolt, ③ retighten it to 250 N·m (25 kg-m, 181 lb-ft).



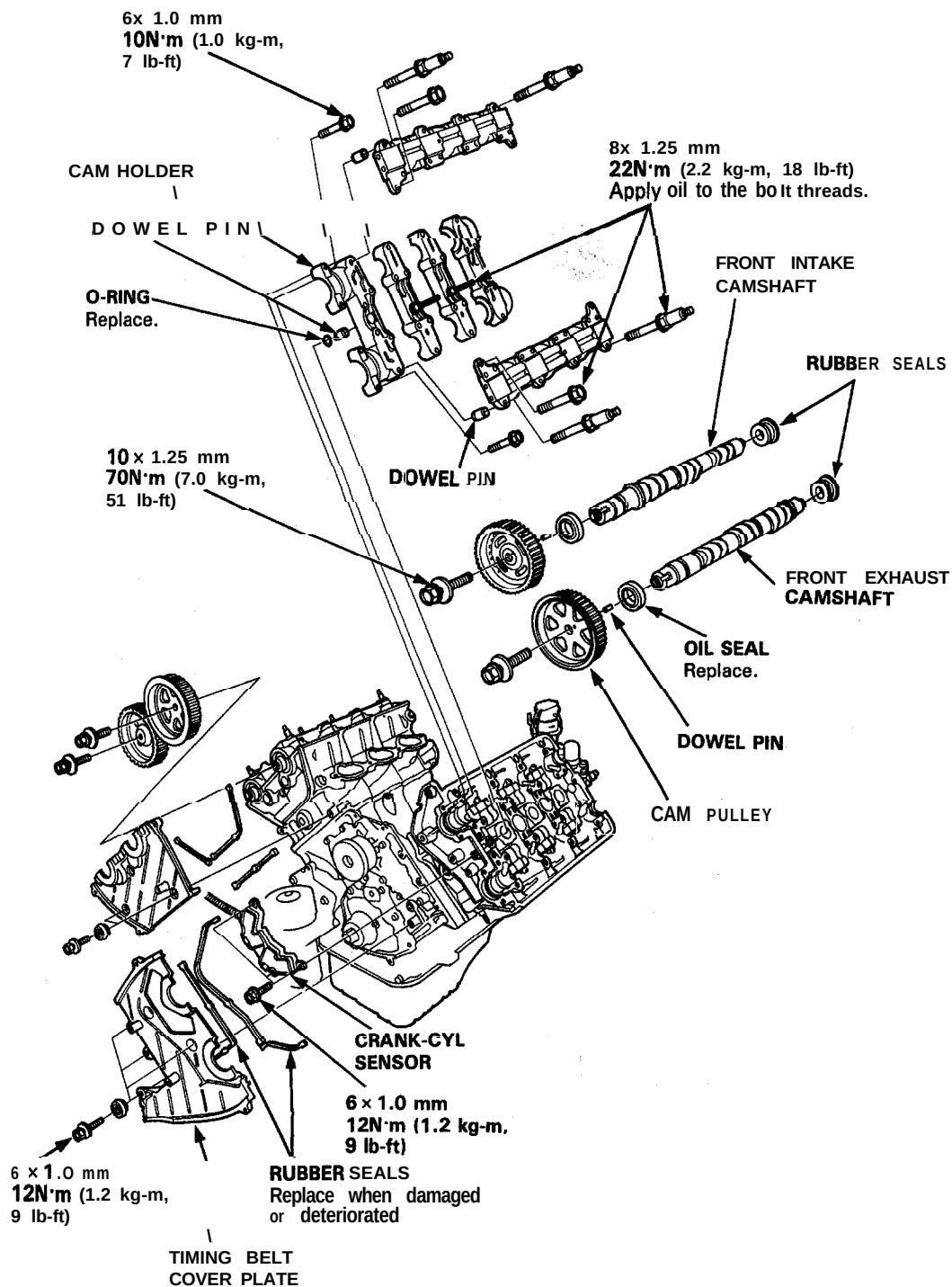
(cont'd)

Cylinder Head/Valve Train

Illustrated Index (cont'd)

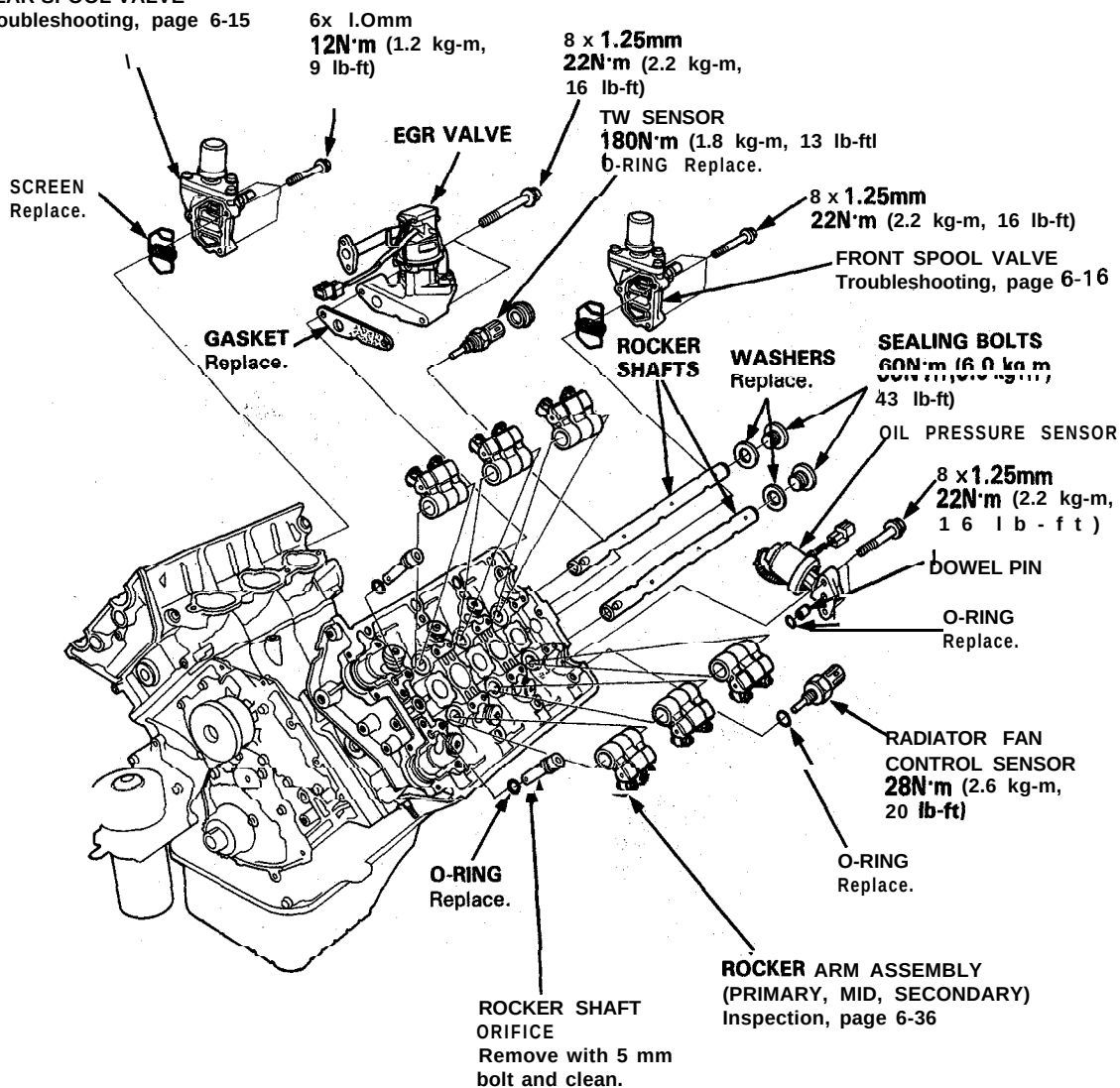
NOTE:

- Use new O-rings and gaskets when reassembling.
- Replace rubber seals, if damaged or deteriorated.





REAR SPOOL VALVE
Troubleshooting, page 6-15



(cont'd)

Cylinder Head/Valve Train

Illustrated Index (cont'd)

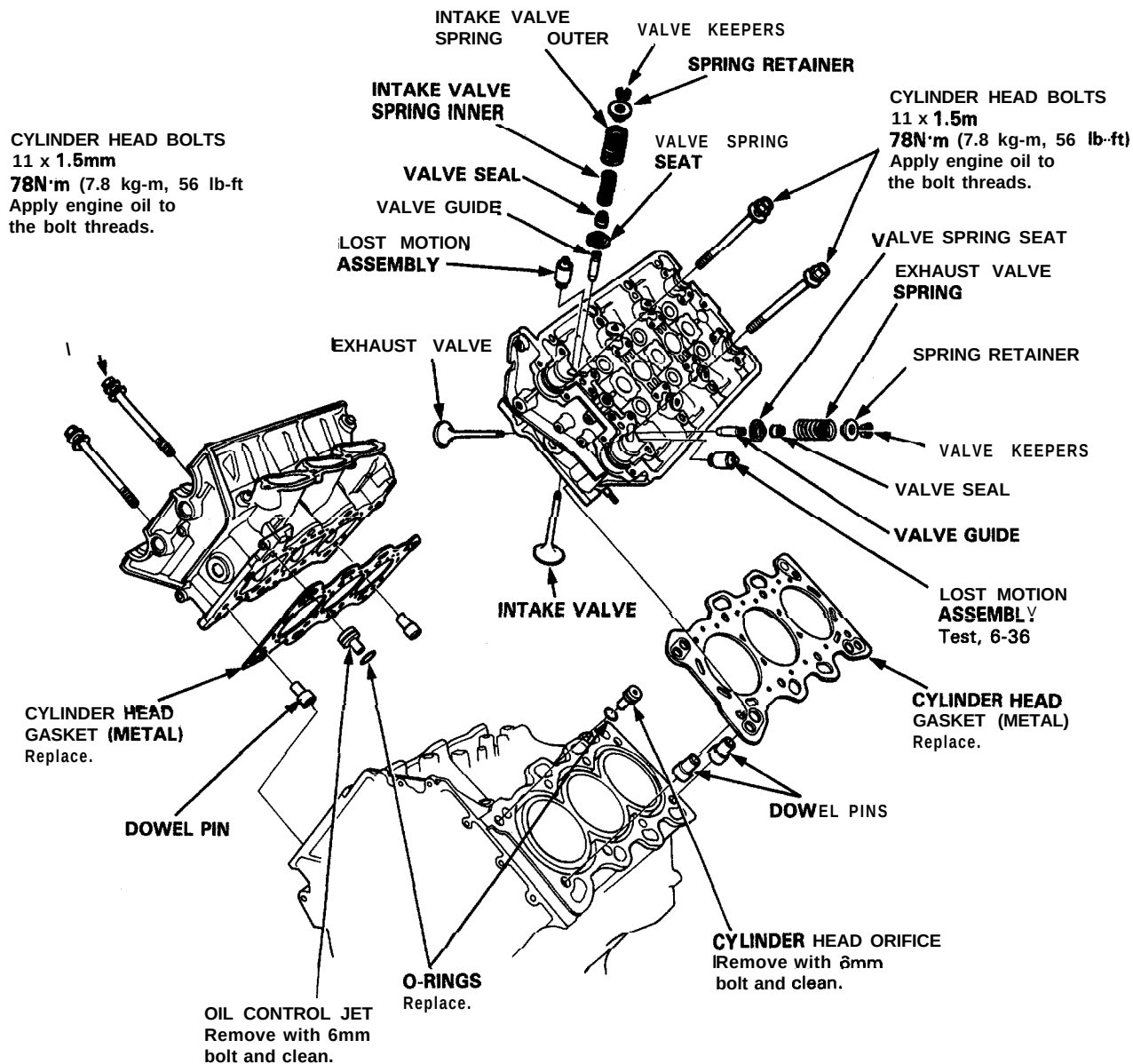
CAUTION:

- To avoid damaging the cylinder head, wait until the coolant temperature drops below 38°C (100°F) before removing it.
- In handling a metal gasket, care should be taken not to fold it or damage the contact surface of the gasket.

NOTE: Use new O-rings and gaskets when reassembling.



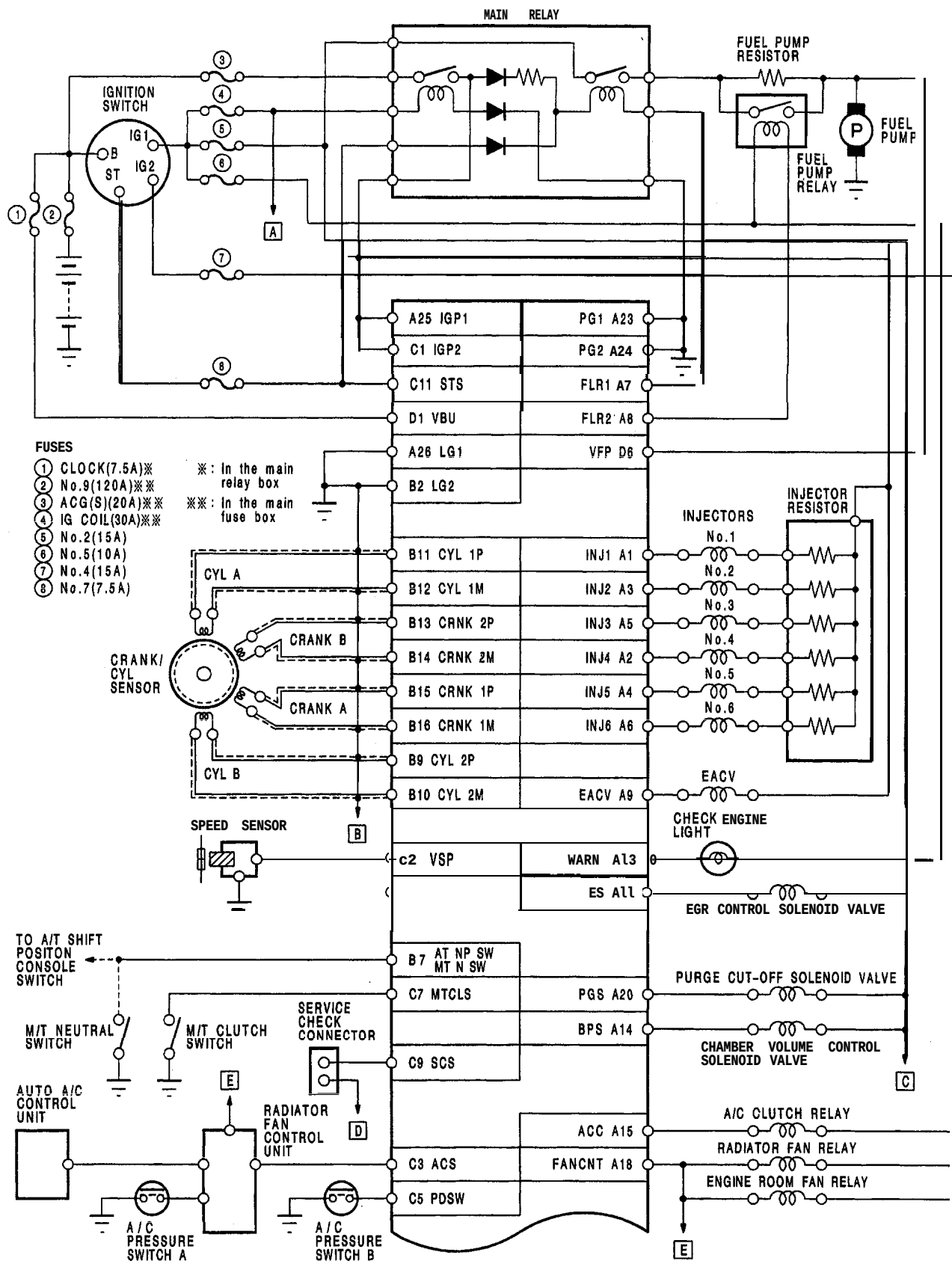
Prior to reassembling, clean all the parts in solvent, dry them, and apply lubricant to any contact parts.

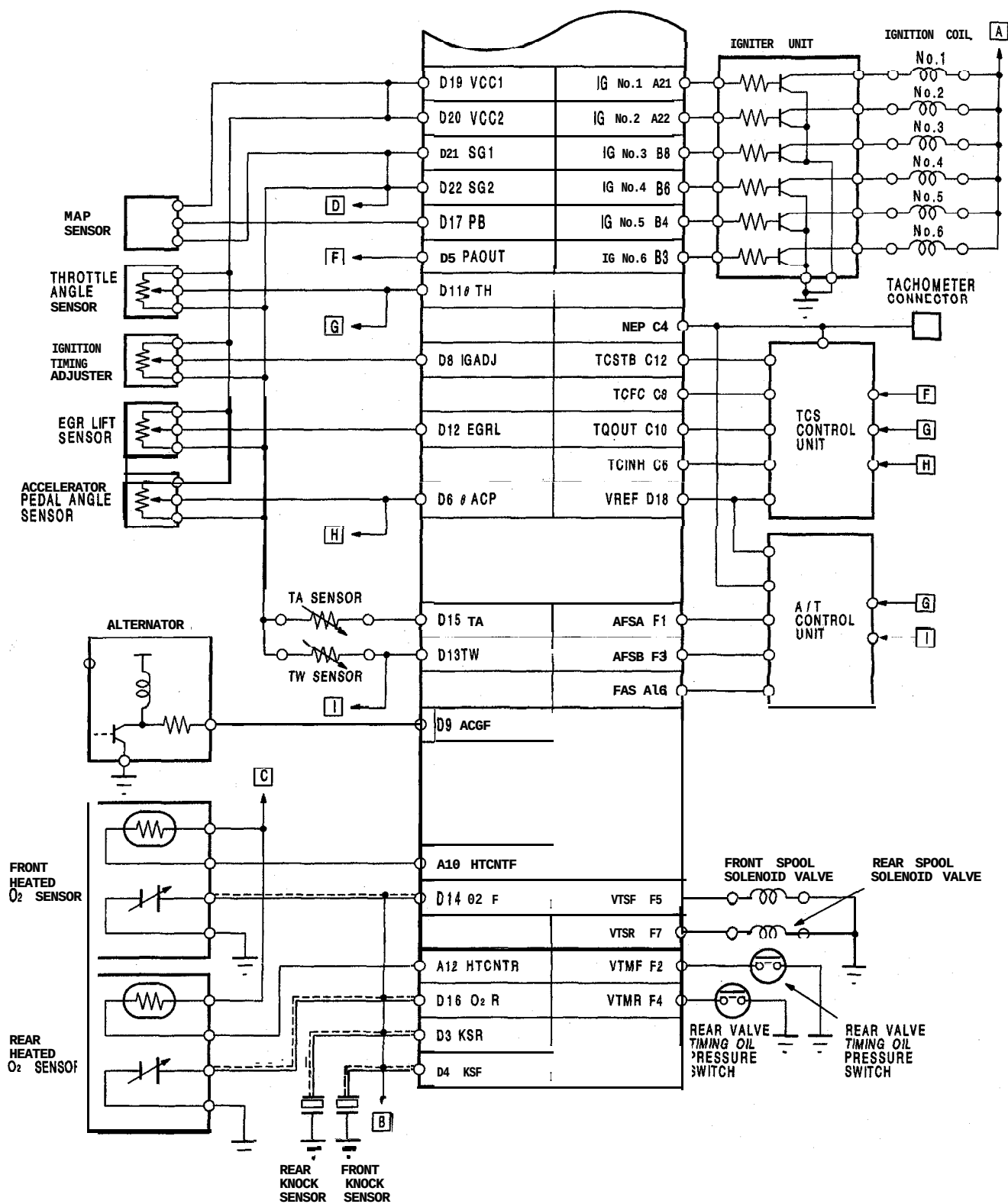




VTEC

Electrical Connections





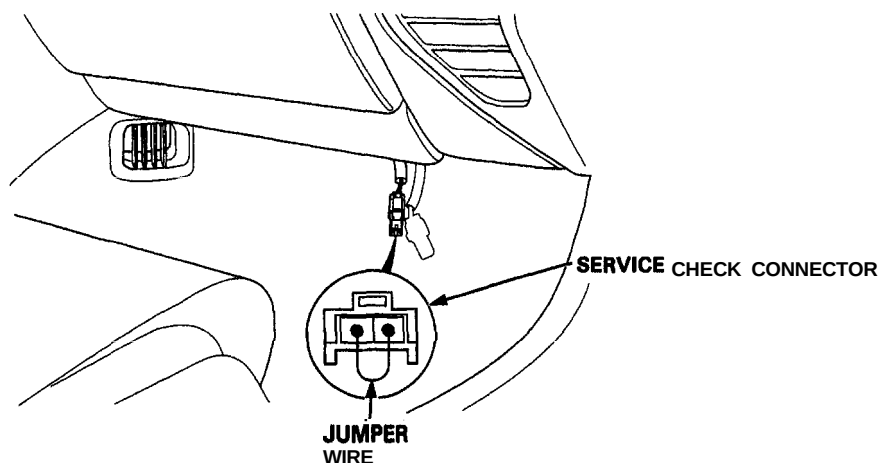
A1	A3	A5	A7	A9	A11	A13	A15	A17	A19	A21	A23	A25	B1	B3	B5	B7	B9	B11	B13	B15	C1	C3	C5	C7	C9	C11	D1	D3	D5	D7	D9	D11	D13	D15	D17	D19	D21	F1	F3	F5	F7			
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
A2	A4	A6	A8	A10	A12	A14	A16	A18	A20	A22	A24	A26	B2	B4	B6	B8	B10	B12	B14	B16	C2	C4	C6	C8	C10	C12	D2	D4	D6	D8	D10	D12	D14	D16	D18	D20	D22	F2	F4	F6	F8			
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

TERMINAL LOCATION

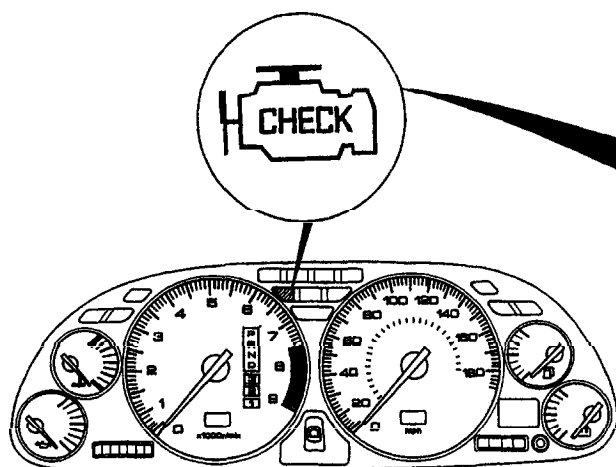
VTEC

Troubleshooting -Self-diagnostic Procedures

1. Connect the Service Check Connector terminals with a jumper wire as shown (the Service Check Connector is located under the dash on the passenger side of the car).



2. Note the CODE: the Check Engine light indicates a failure code by blinking frequency. The Check Engine light can indicate any number of simultaneous component problems by blinking separate codes, one after another. Problem codes 1 through 9 are indicated by a individual short blinks. Problem codes 10 through 59 are indicated by a series of long and short blinks. The number of long blinks equals the first digit, the number of short blinks equals the second digit.



Separate Problems:

Short

See Problem CODE 1
= See Problem CODE 3
= See Problem CODE 13

Long short

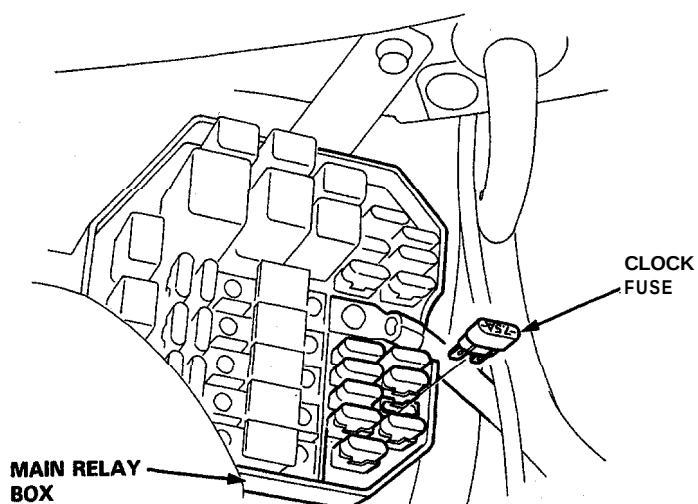
Simultaneous Problems:

= See Problem CODE 1 and 3
= See Problem CODE 3 and 4
= See Problem CODE 3 and 14



2. Remove the **CLOCK** fuse (7.5 A) from the main relay box for 10 seconds to reset ECU.

NOTE: Disconnecting the **CLOCK** fuse also cancels the radio preset stations and the clock setting. Make note of the radio presets before removing the fuse so you can reset them.



III. Final Procedure (this procedure must be done after any troubleshooting)

(cont'd)

VTEC

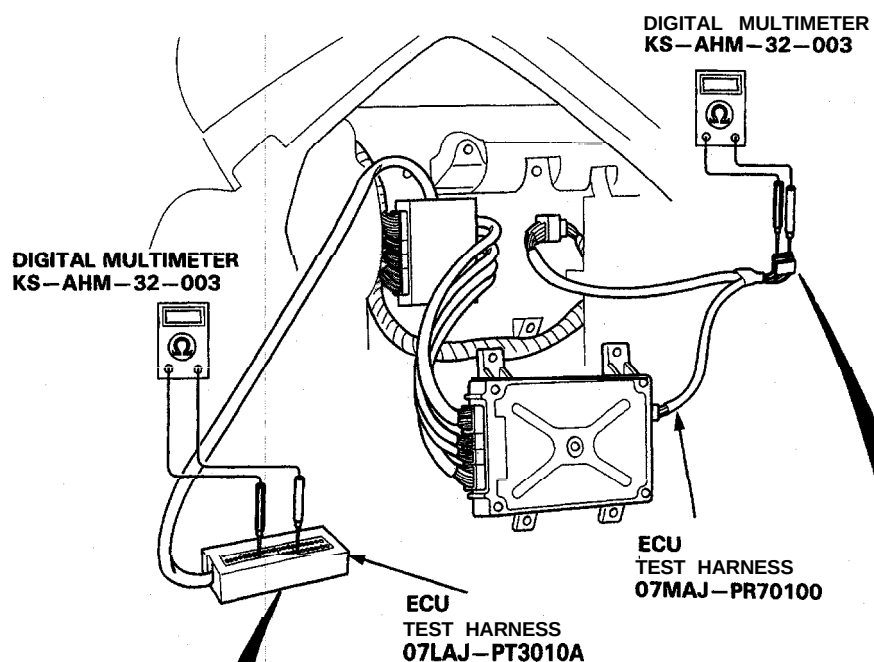
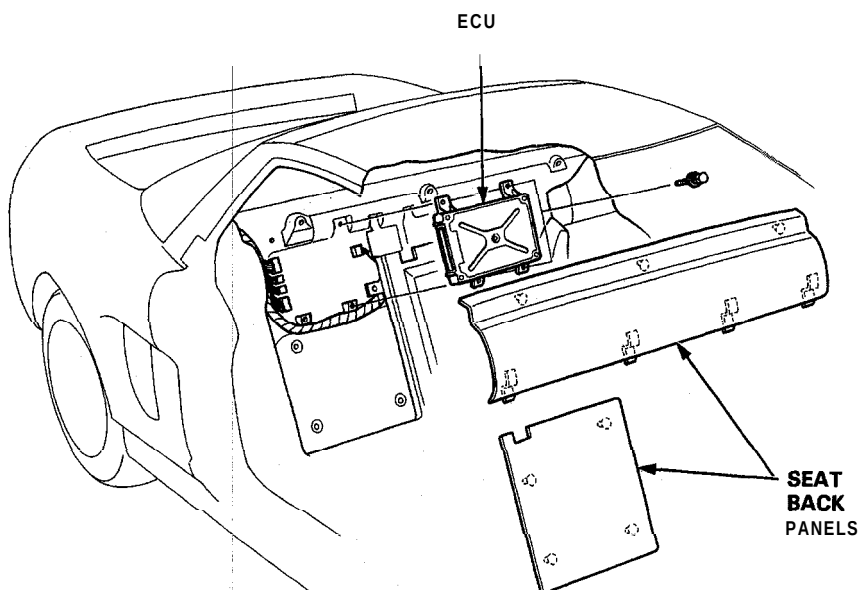
• Troubleshooting -Self-diagnostic Procedures (cont'd)

SELF-DIAGNOSIS INDICATOR BLINKS	SYSTEM INDICATED	PAGE
0	ECU	11-26
1	FRONT OXYGEN SENSOR	11-30
2	REAR OXYGEN SENSOR	11-30
3	MANIFOLD ABSOLUTE PRESSURE (MAP SENSOR)	11-40
5		
4	CRANK ANGLE A	11-46
6	COOLANT TEMPERATURE (TW SENSOR)	11-48
7	THROTTLE ANGLE	11-50
9	No. 1 CYLINDER POSITION A (CYL SENSOR)	11-46
10	INTAKE AIR TEMPERATURE (TA SENSOR)	11-52
12	EXHAUST GAS RECIRCULATION SYSTEM (EGR)	11-128
13	ATMOSPHERIC PRESSURE (PA SENSOR)	11-54
14	ELECTRONIC AIR CONTROL (EACV)	11-70
15	IGNITION OUTPUT SIGNAL	11-56
16	FUEL INJECTOR	11-89
17	VEHICLE SPEED SENSOR	11-58
18	IGNITION TIMING ADJUSTMENT	11-60
21	FRONT SPOOL SOLENOID VALVE	6-15
22	FRONT VALVE TIMING OIL PRESSURE SWITCH	6-17
23	FRONT KNOCK SENSOR	11-62
30	A/T FI SIGNAL A	11-64
31	A/T FI SIGNAL B	11-64
35	TC STB SIGNAL	19-100
36	TCFC SIGNAL	19-102
41	FRONT OXYGEN SENSOR HEATER	11-32
42	REAR OXYGEN SENSOR HEATER	11-32
43	FRONT FUEL SUPPLY SYSTEM	11-36
44	REAR FUEL SUPPLY SYSTEM	11-36
45	FRONT FUEL METERING	11-38
46	REAR FUEL METERING	11-38
47	FUEL PUMP	11-99
	REAR SPOOL SOLENOID VALVE	6-15
52	REAR VALVE TIMING OIL PRESSURE SWITCH	6-17
53	REAR KNOCK SENSOR	11-62
54	CRANK ANGLE B	11-46
59	No. 1 CYLINDER POSITION B (CYL SENSOR)	11-46

- If codes other than those listed above are indicated, verify the code. If the code indicated is not listed above, replace the ECU.
- The Check Engine light may come on, indicating a system problem, when, in fact, there is a poor or intermittent electrical connection. First, check the electrical connections, clean or repair connections if necessary.
- The Check Engine light and D indicator light may come on simultaneously when the self-diagnosis indicator blinks 6, 7 and 17. Check the PGM-FI system according to the PGM-FI control system troubleshooting, then recheck the D indicator light. If it comes on, see page 14-52.
- The Check Engine light and TCS indicator light may come on simultaneously when the self-diagnosis indicator blinks 3, 5, 6, 13, 15, 16, 17, 35 and 36. Check the PGM-FI system according to the PGM-FI control system troubleshooting, then recheck the TCS indicator light. If it comes on, see page 1 S-84.
- The Check Engine light does not come on when there is a malfunction in the A/T FI signal. However, when the two terminals of the service check connector are connected with a jumper wire and, the Check Engine light will indicate the codes.



If the inspection for a particular failure code requires the ECU test harness, remove the seat back panels. Unbolt the ECU bracket. Connect the ECU test harness. Then check the system according to the procedure described for the appropriate code(s) listed on the following pages.



A1	A3	A5	A7	A9	A11	A13	A15	A17	A19	A21	A23	A25	B1	B3	B5	B7	B9	B11	B13	B15	C1	C3	C5	C7	C9	C11	D1	D3	D5	D7	D9	D11	D13	D15	D17	D19	D21	F1	F3	F5	F7				
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
A2	A4	A6	A8	A10	A12	A14	A16	A18	A20	A22	A24	A26	B2	B4	B6	B8	B10	B12	B14	B16	C2	C4	C6	C8	C10	C12	D2	D4	D6	D8	D10	D12	D14	D16	D18	D20	D22	F2	F4	F6	F8				
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

TERMINAL LOCATION

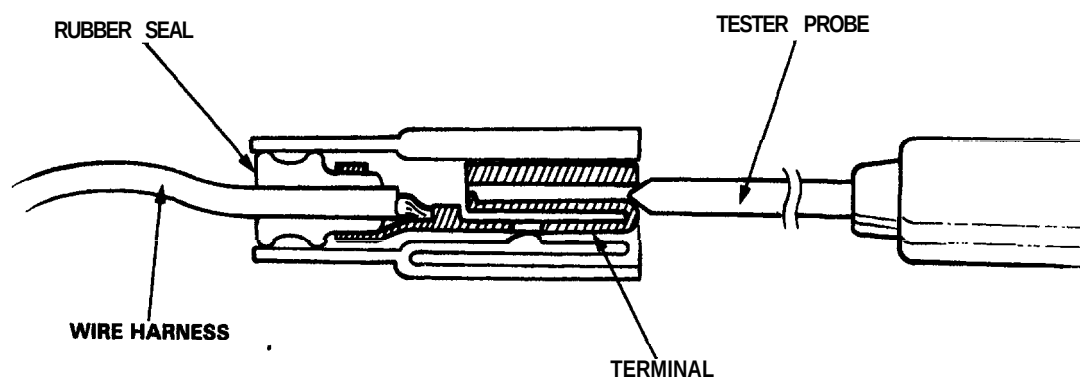
(cont'd)

VTEC

• Troubleshooting — Self-diagnostic Procedures (cont'd)

CAUTION:

- Puncturing the insulation on a wire can cause poor or intermittent electrical connections.
- For testing at connectors other than the ECU test harness, bring the tester probe into contact with the terminal from the connector side of wire harness connectors in the engine compartment. For female connectors, just touch lightly with the tester probe and do not insert the probe.



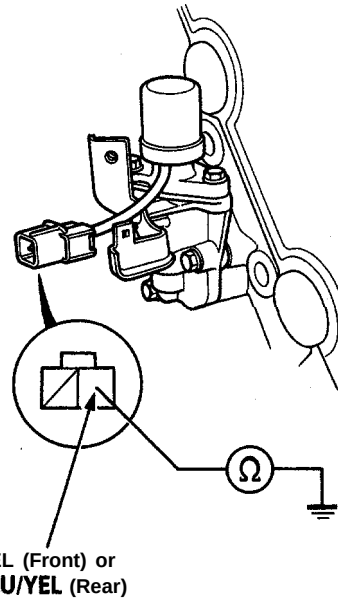


- Troubleshooting Flowchart — Spool Valve

21 (Front) or 51 (Rear) Check Engine indicates code 21 (Front) or 51 (Rear): A problem in the Spool Valve circuit.

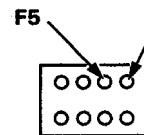
Disconnect the 2P connector from the spool valve.

Check for continuity between YEL (Front) or BLU/YEL (Rear) terminal and body ground.

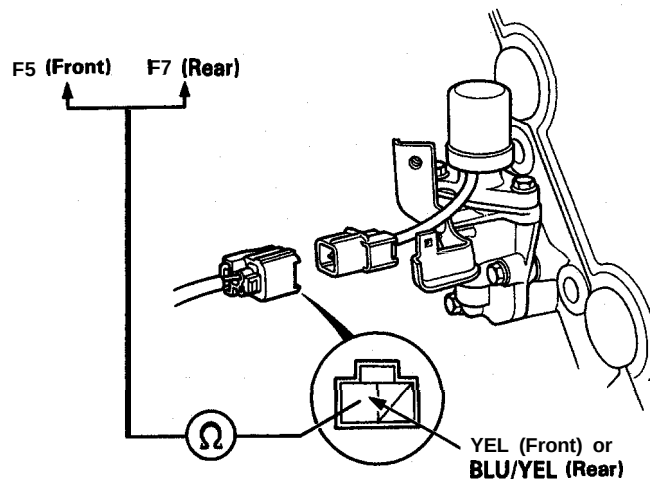


Is there 14–30 Ω ?
 NO → Replace the spool valve.
 YES →

Connect the ECU test harness.



Check for continuity between YEL (Front) or BLU/YEL (Rear) terminal and F5 (Front) or F7 (Rear) terminal.



Does continuity exist?
 NO → Repair open in YEL (Front) or BLU/YEL (Rear) wire between ECU and spool valve connector.
 YES →

(To page 6-16)

(cont'd)

VTEC

-Troubleshooting Flowchart — Spool Valve (cont'd)

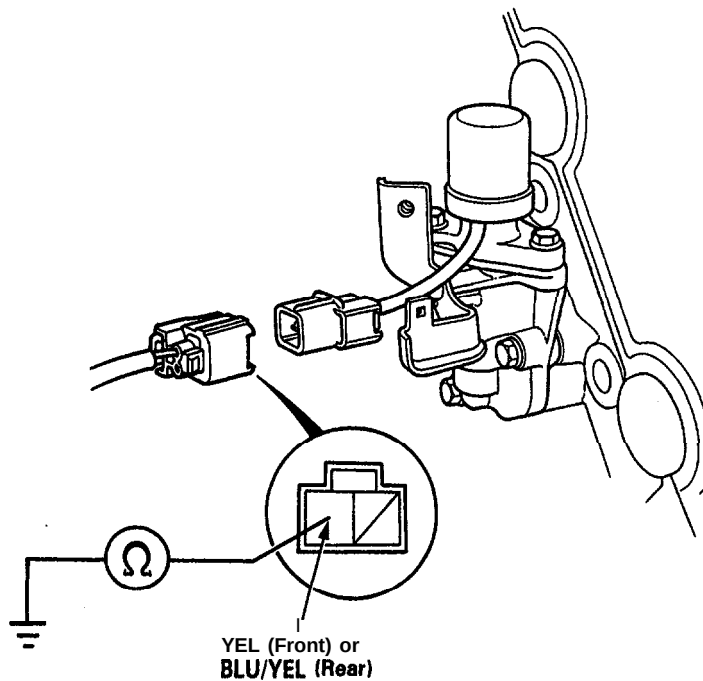
(From page 6-15)

Check for continuity between YEL (Front) or BLU/YEL (Rear) terminal (harness side) and body ground.

Does continuity exist ?

YES

NO



Repair short in YEL (Front) or BLU/YEL (Rear) wire between ECU and spool valve connector.

Substitute a known-good ECU and recheck. If symptom/indication goes away replace the original ECU.



-Troubleshooting Flowchart ---Oil Pressure Switch

22 (Front) or 52 (Rear) Check Engine indicates code. 22 (Front), 52 (Rear): A problem in the Oil Pressure Switch circuit.

Disconnect the 2P connector from the oil pressure switch.

Check for continuity between BLU (Front) or BLU/BLK (Rear) terminal and body ground.

OIL PRESSURE SWITCH

GRN/WHT (Front and Rear)

BLU (Front) or BLU/BLK (Rear)



Does continuity exist ?

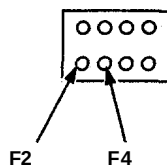
NO

Repair open in BLU (Front) or BLU/BLK (Rear) wire between 2P connector and body ground.

YES

Connect the ECU test harness.

Check for continuity between BLU (Front) or BLU/BLK (Rear) terminal and F2 (Front) or F4 (Rear) terminal.



Does continuity exist ?

NO

Repair open in BLU (Front) or BLU/BLK (Rear) wire between ECU and 2P connector.

YES

(To page 6-18)

(cont'd)

Troubleshooting Flowchart – Oil Pressure Switch (cont'd)

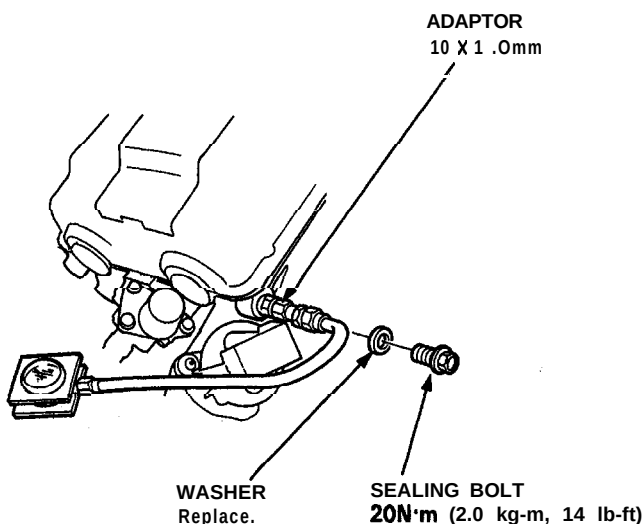
(From page 6-17)

Remove 10 mm sealing bolt and connect oil pressure gauge (for VTEC oil pressure test).

Connect a tachometer.

Start the engine and warm it up to normal operating temperature

Check oil pressure at 1,000 rpm, 3,000 rpm and 5,000 rpm.



NOTE: Keep measuring time as short as possible because engine is running with no load (within one minute).

Is pressure below 49 kPa (0.5 kg/cm² 7 psi) ?

NO

Inspect the spool valve.

YES

Turn off the engine.
Check for continuity between the, 2 terminals on the oil pressure switch.

Does continuity exist ?

NO

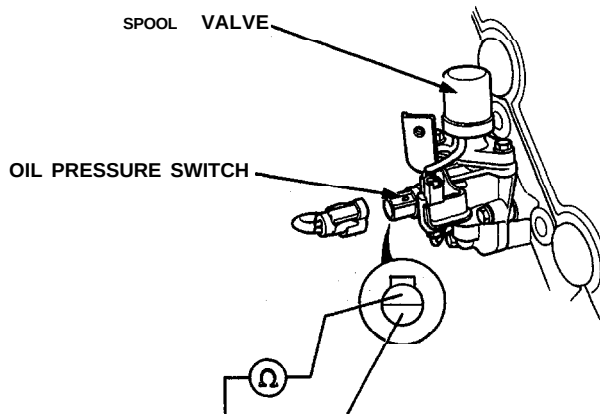
Replace oil pressure switch.

YES

Disconnect the 2P connector from the spool valve.

Attach the battery positive terminal to the YEL (Front) or BLU/YEL (Rear) terminal.

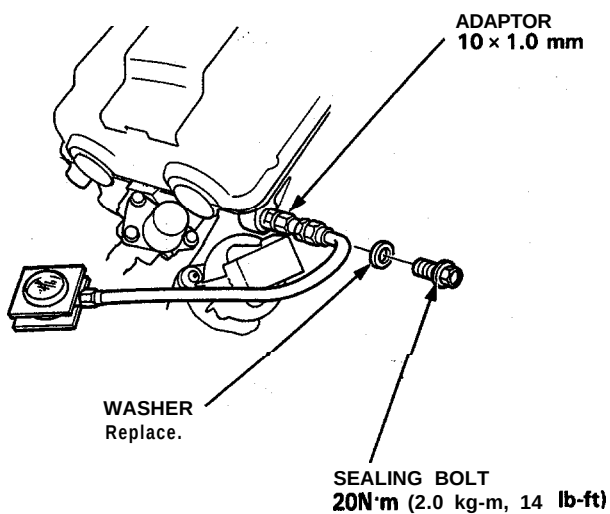
(To page 6-19)





(From page 6-18)

Start the engine and check oil pressure at 5,000 rpm.



Note: Keep measuring time as short as possible because engine is running with no load (within one minute).

Is pressure above 392 kPa (4 kg/cm², 57 psi) ?

NO

Inspect the spool valve.

YES

Check for continuity between the 2 terminals on the oil pressure switch under above condition.

Does continuity exist ?

YES

Replace oil pressure switch.

NO

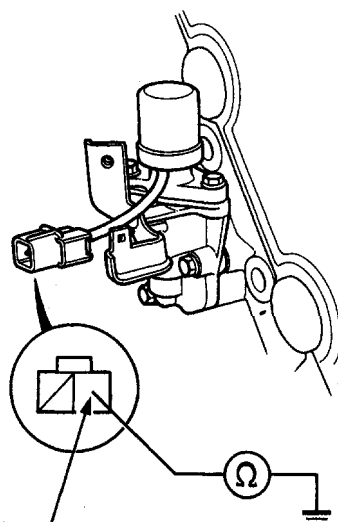
Substitute a known-good ECU and recheck. If **symptom/indication** goes away replace the **original** ECU.

VTEC

-Spool Valve Inspection

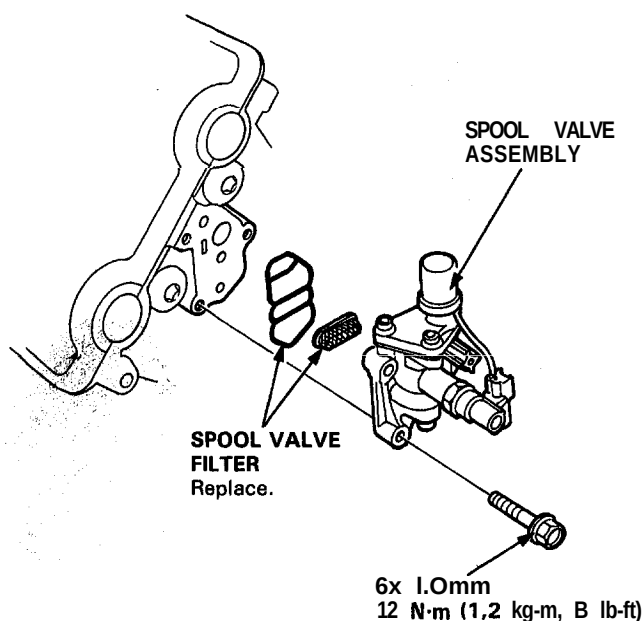
1. Disconnect the 2P connector from the spool valve.
2. Measure resistance between the YEL (Front) or BLU/YEL (Rear) terminal and body ground.

Resistance: approx 14-30 ohms

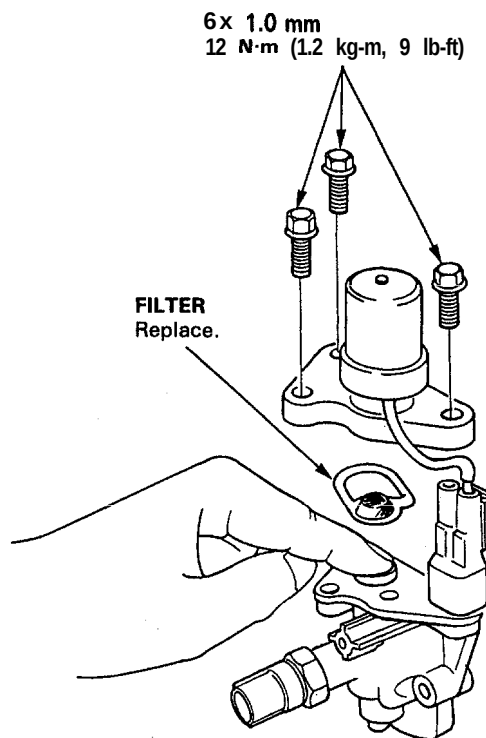


YEL (Front) or
BLU/YEL (Rear)

3. If the resistance is within specifications, remove the spool valve assembly from the cylinder head, and check the spool valve filter for clogging.
 - If there is clogging, replace the engine oil filter and the engine oil.

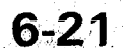


4. If filters are normal, push the spool valve with the finger and check its movement.
 - If spool valve is normal, check the engine oil pressure.



NOTE:

- 4



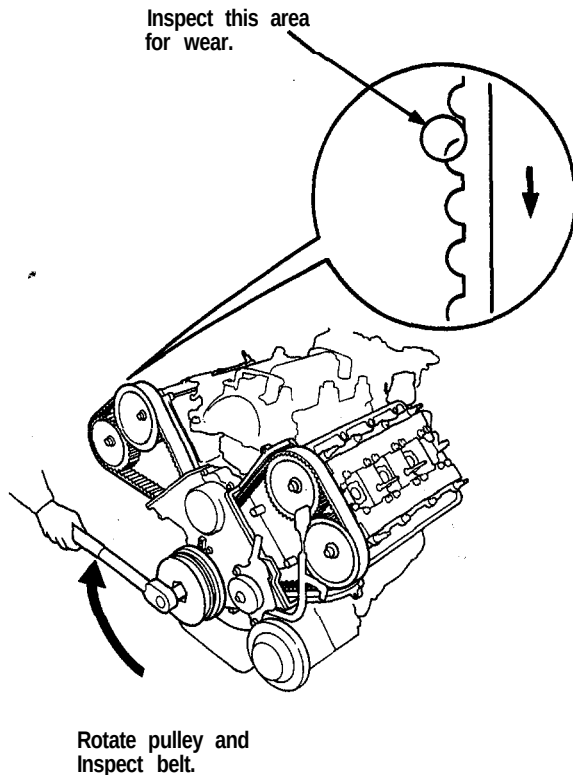
Timing Belt

Inspection

1. Remove the ignition coil covers and harness clamps.
 2. Disconnect the connectors, then remove the ignition coils.
- NOTE:**
3. Remove the cylinder head covers.
 4. Inspect the timing belt for cracks and oil soaking.

NOTE:

- Replace the belt if oil soaked.
- Remove any oil or solvent that gets on the belt.



Tension Adjustment

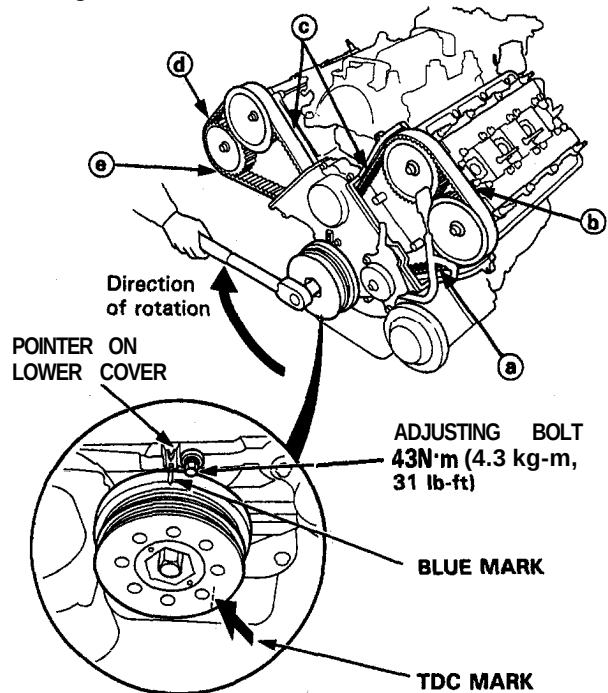
CAUTION:

- Always adjust timing belt tension with the engine cold.
- Do not rotate the crankshaft when adjusting belt is loose (the timing belt will skid over the teeth of the rear intake cam pulley).
- Never adjust the belt tension on any other occasion than when the belt is removed for belt or parts replacement.

NOTE:

- Tensioner is spring-loaded to apply proper tension to the belt automatically after making the following adjustment.
- Inspect the timing belt before adjusting the belt tension.
- Always rotate the crankshaft clockwise. Rotating it counterclockwise may result in improper adjustment of the belt tension.

1. Install the timing belt with the No. 1 piston at TDC (page 6-25, 26).
2. Fix the crankshaft, remove the slack in the sequence of ①, ②, ③, and ④ by turning each cam pulley.
3. Loosen the timing belt adjusting bolt 80° (the slack at ⑤ should be eliminated). Then, tighten the timing belt adjusting bolt.
4. Set the No. 1 piston at TDC (page 6-26)
5. Rotate the crankshaft clockwise 9-teeth on camshaft pulley (The blue mark on crankshaft pulleys should be line up with the pointer on lower cover).
6. Loosen the timing belt adjusting bolt.
7. Retighten the adjusting bolt torque to 43 N·m (4.3 kg-m, 31 lb-ft).





Timing Belt

Removal

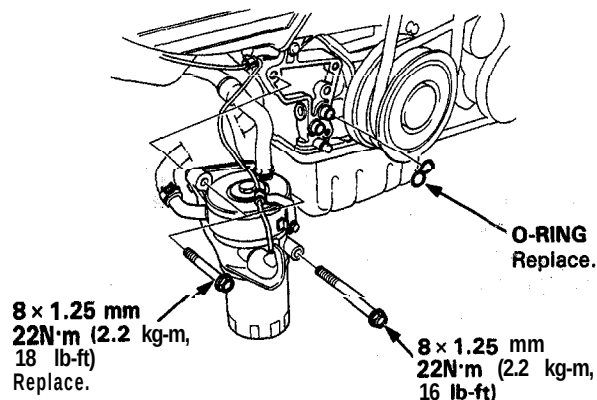
CAUTION: Inspect the water pump when replacing the timing belt (page IO- 11).

NOTE:

- Turn the crankshaft so that the No. 1 piston is at top-dead-center (page 6-25, 26).
- Before removing the timing belt, mark direction of rotation if it is to be reused.

1. Disconnect the negative terminal from the battery.
2. Raise the car.
3. Remove the right rear wheel/tire.
4. Remove the engine oil cooler base assembly.

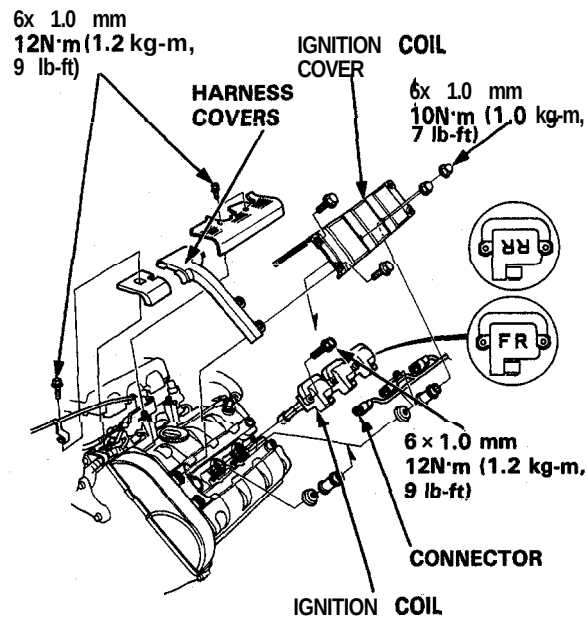
- Do not disconnect the hoses.



5. Lower the car.
6. Remove the strut bar (page 5-19).
7. Remove the intake manifold plate.
8. Remove the top cover (page 5-21).
9. Remove the ignition coil covers.
10. Remove the injector cover and the wire harness covers.
11. Remove the ignition coils and the connectors.

NOTE:

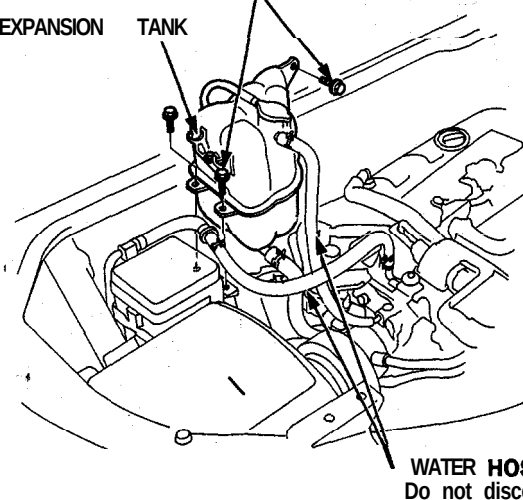
- There are front and rear ignition coils and covers. They can be identified by the mark FF (front) or RR (rear) printed on them.
- When installing front and rear ignition coil covers, attach a rubber seal to the intake side.



12. Remove the expansion tank.
- NOTE:** Do not disconnect water hoses.

6 x 1.0 mm
10N·m (1.0 kg-m, 7 lb-ft)

EXPANSION TANK

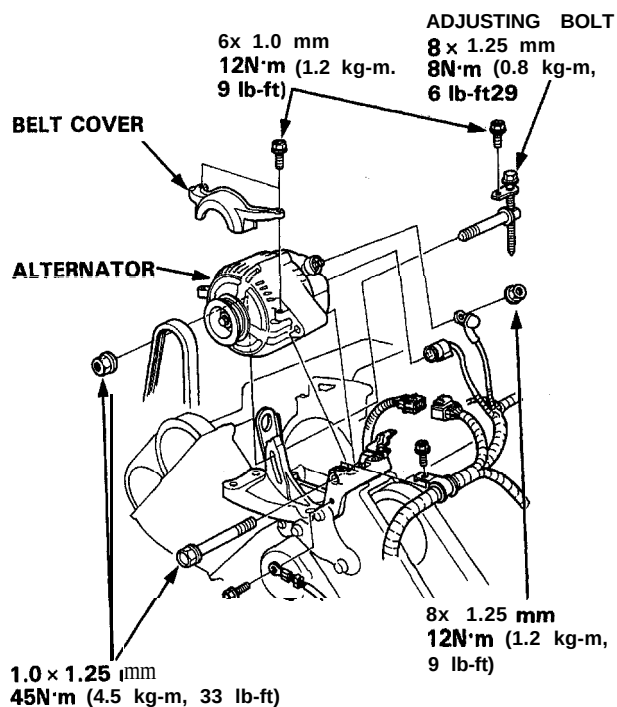


13. Remove the breather hose, and the air cleaner case (page 5-22).

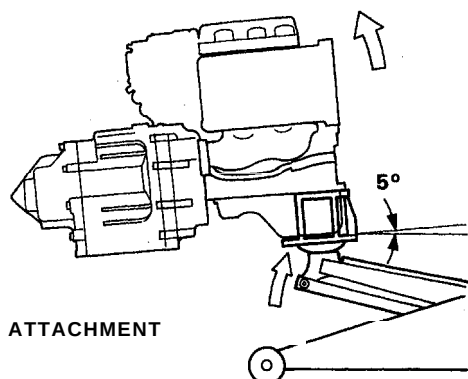
(cont'd)

Timing Belt

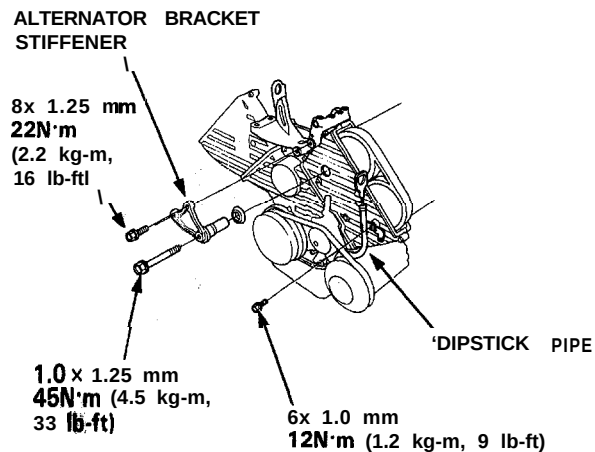
-Removal (cont'd)-



14. Remove the connector, the terminal and the alternator.
15. Remove the side engine mount, then push into the side mounting bracket housing of the body (page 5-26).
16. Remove the transmission mount.
17. Remove the cylinder head covers.
18. Turn the crankshaft so that the No. 1 piston is at top-dead-center (page 6-25, 26).
19. Install the attachment under the engine, then tilt the engine approximately 5° using a jack.

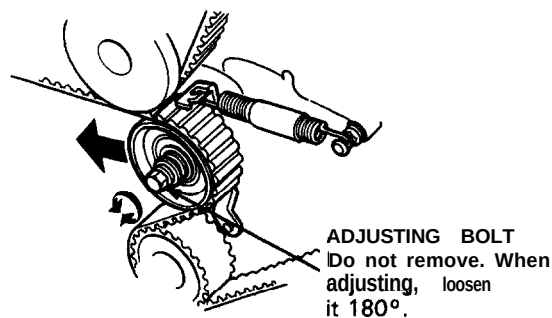


20. Remove the alternator bracket stiffener.



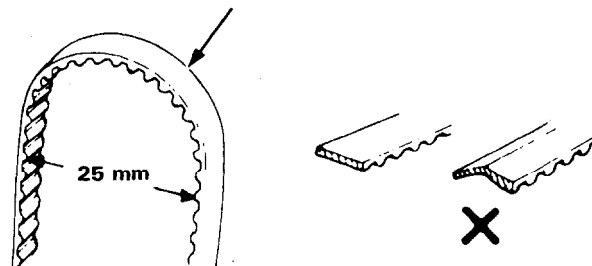
21. Remove the A/C adjusting pulley and belt.
22. Remove the dipstick pipe mounting bolt, then remove the front and rear timing belt middle covers.
23. Remove the crankshaft pulley, then remove the timing belt lower cover.
24. Loosen the timing belt adjusting bolt 180° and release the belt tension.

NOTE: Push the tensioner to release tension from the belt, then retighten the adjusting bolt.



25. Remove the timing belt from the pulleys.

CAUTION: Do not crimp or bend the timing belt more than 90° or less than 25 mm (1 in.) in diameter.





Installation

CAUTION: Do not rotate the crankshaft or camshaft without installing the belt. The piston could hit a valve and damage may result.

1. Install the timing belt in the reverse order of removal; Only keypoints are described here.
2. Remove all spark plugs.
3. Position the crankshaft and the cam pulleys as shown before installing the timing belt.

A Set the crankshaft so that the No.1 piston is at top-dead-center (TDC).
NOTE: Turn the crankshaft until its keyway is facing up.

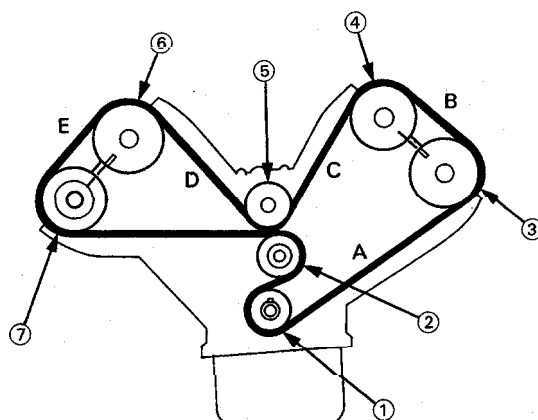
B Align the TDC mark on the front exhaust cam pulley and front intake cam pulley to the pointer on the front timing belt cover plate.

C Align the TDC mark on the rear intake cam pulley to the pointer on the rear timing belt cover plate.

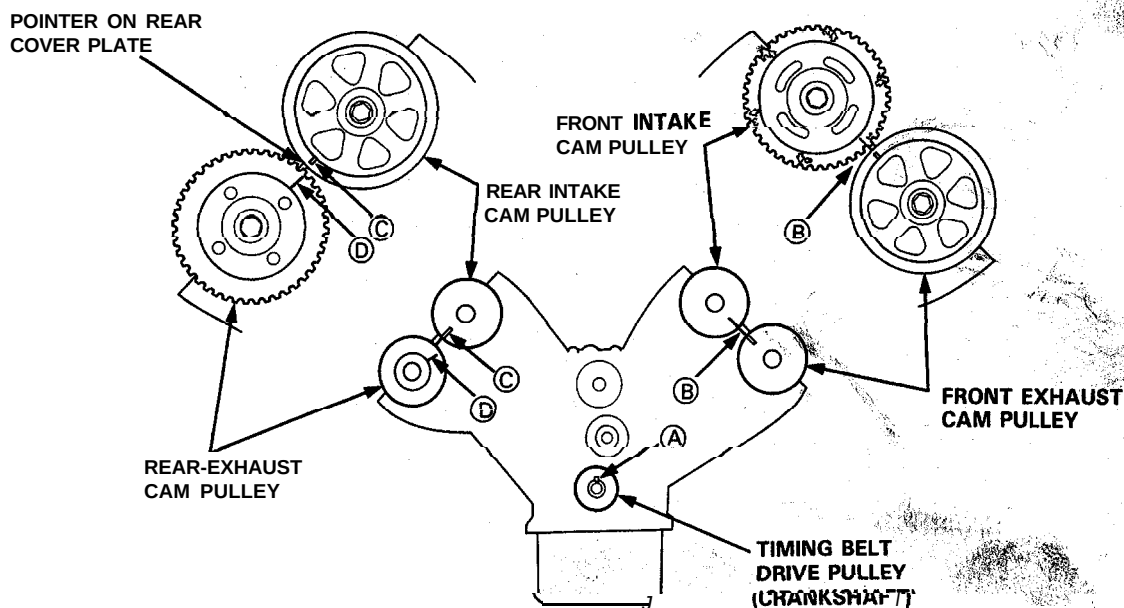
D Advance the rear exhaust cam pulley to one half tooth from TDC.

4. Install the timing belt in the sequence shown.

@Timing belt drive pulley (crankshaft) → **2** Adjusting pulley → **3** Front exhaust cam pulley → **4** Front intake cam pulley → @Water pump pulley → **6** Rear intake cam pulley → **7** Rear exhaust cam pulley.



5. Tension the timing belt between the pulleys in the sequence A to E as shown above.
 - Refer to page 6-22 for timing belt tension adjustment.

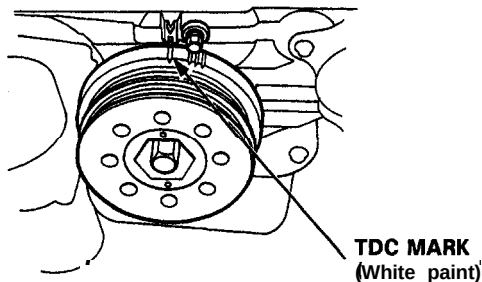


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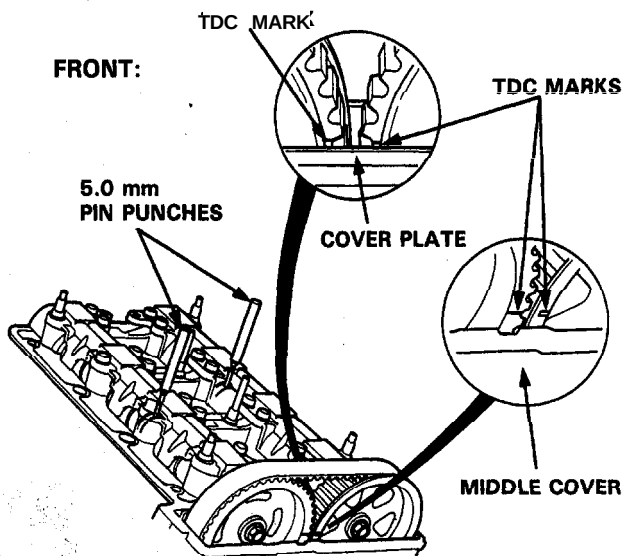
Timing Belt

Installation (cont'd)

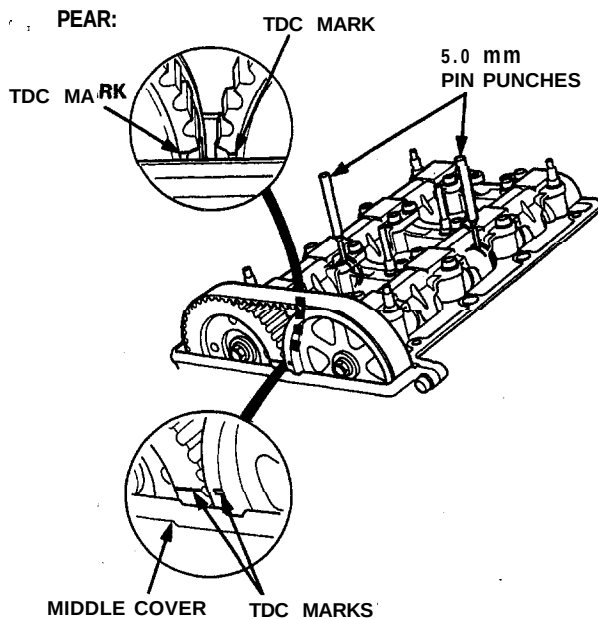
6. Check the crankshaft pulley and the cam pulleys at TDC.



FRONT:



REAR:

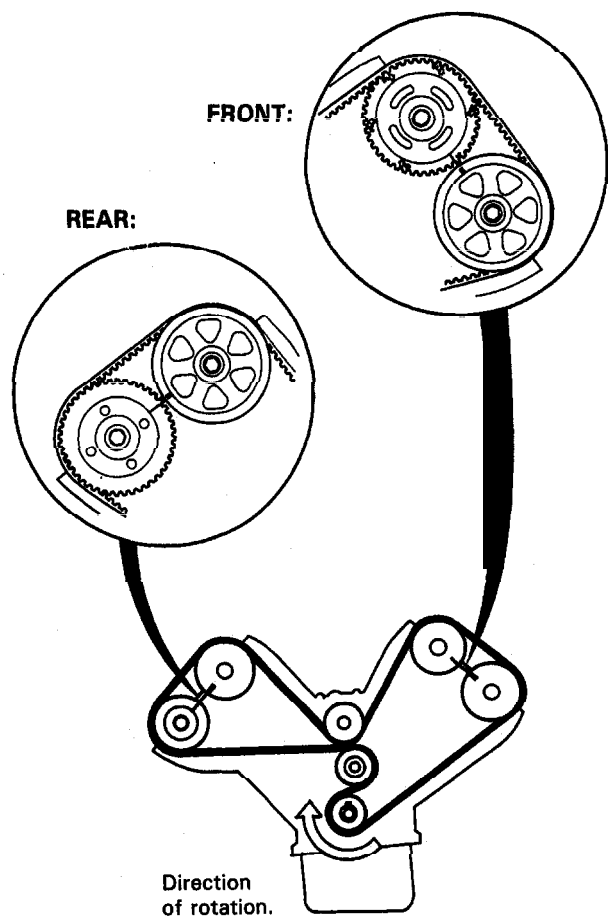


7. If the cam pulleys are not positioned at TDC, remove the timing belt and adjust the positioning following procedure, then reinstall the timing belt.

NOTE:

- Refer to page 6-23 for timing belt removal.
- Bring the "UP" mark of the cam pulleys to the top, and align the TDC marks on the pulleys.
- Align the holes on the camshaft holder pipes to the camshaft holes, insert 5.0 mm pin punches and fix them at TDC.
- Remove the pin punches after the timing belt has been reinstalled.

FRONT:



NOTE:

- Prior to installing the cylinder head cover, apply a thin layer of liquid gasket to the mating surface of the cylinder head cover and rubber seals to prevent the rubber seal from falling off.
- After installation, fill the engine with oil up to the specified level, run the engine for more than 3 minutes, then check for oil leakage.

CRANK/CYL Sensor

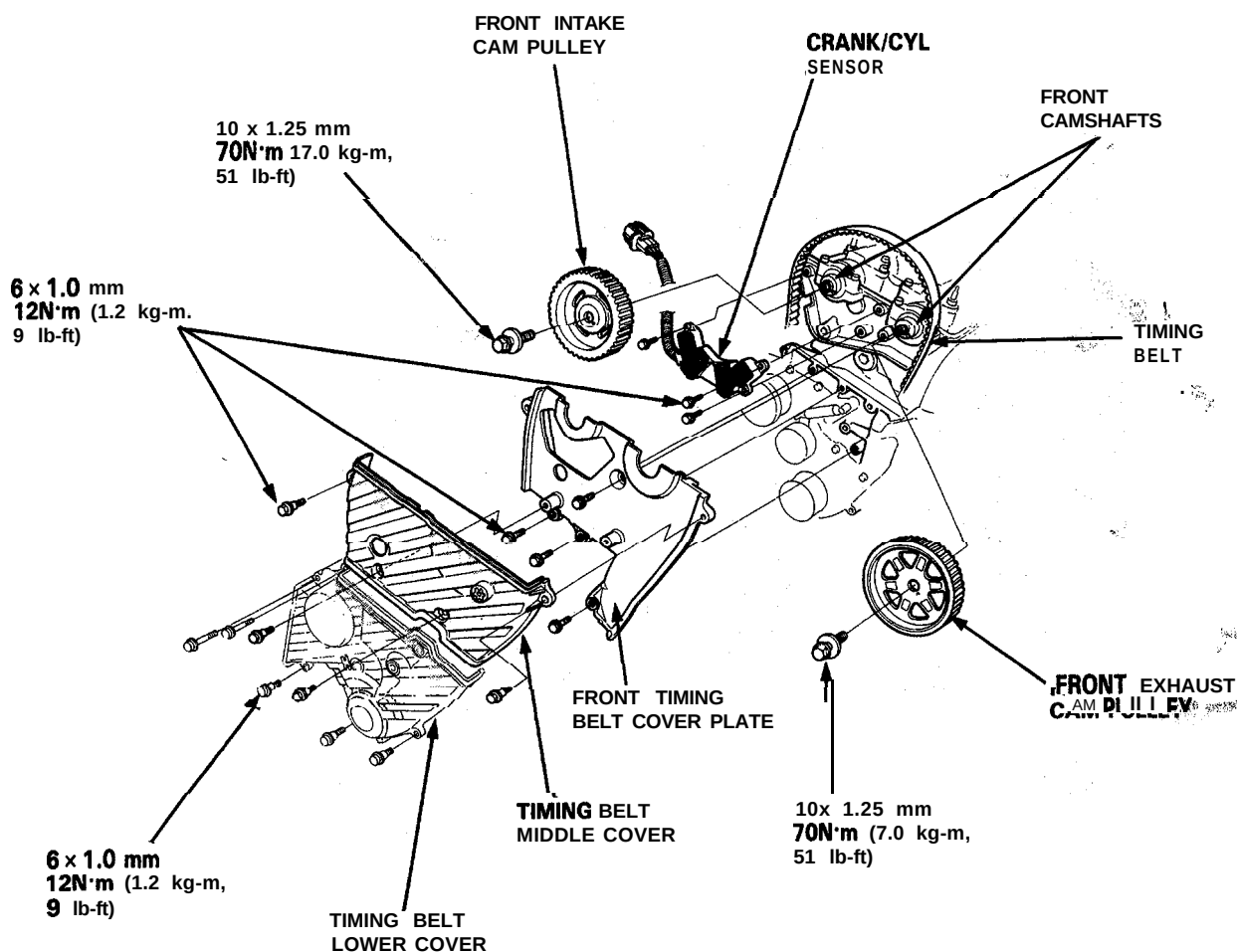


• Replacement

NOTE: Turn the crankshaft so that the No.1 piston is at top-dead-center (page 6-26).

1. Remove the timing belt (page 6-23 and 24).
2. Remove the front intake and exhaust cam pulleys.
3. Remove the front timing belt cover plate.
4. Remove the CRANK/CYL sensor from the front cylinder head.

5. Install the CRANK/CYL sensor in the reverse order of removal;
 - Refer to page 6-25 and 26, when installing the timing belt.



Cylinder Heads

Removal

NOTE: Engine removal is not required in this procedure.

CAUTION: To avoid damaging the cylinder heads, wait until the coolant temperature drops below **38°C (100°F)** before loosening the retaining bolts.

NOTE:

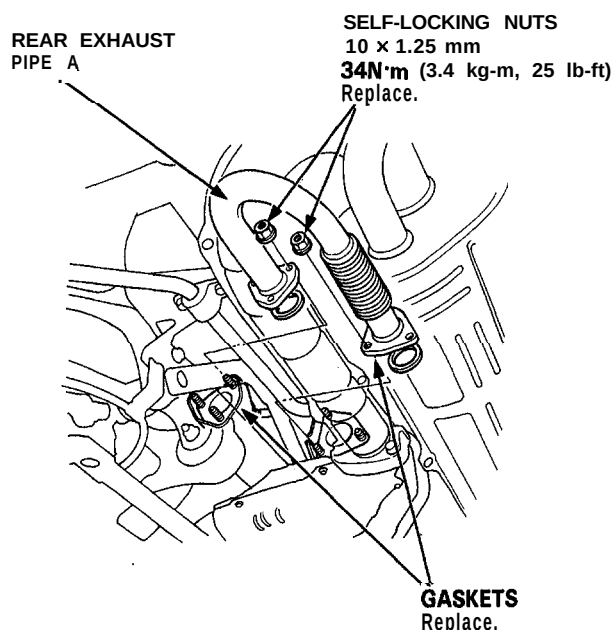
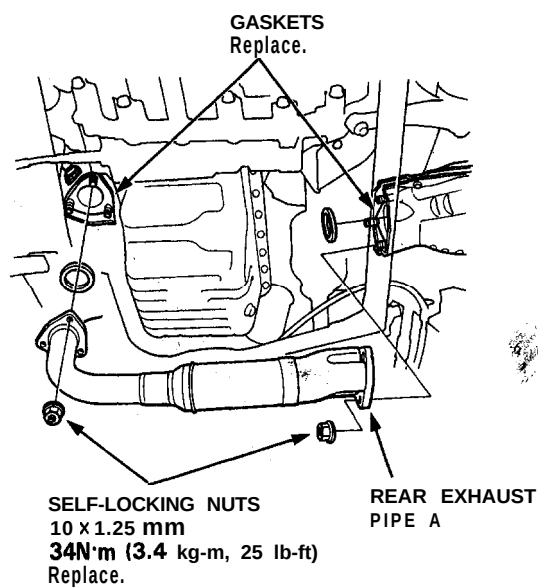
- Inspect the timing belt before removing the cylinder heads.
- Turn the crankshaft so that the No. 1 piston is at top-dead-center (page 6-25, 261).
- Mark all emission hoses before disconnecting them.

1. Disconnect the negative terminal from the battery.
2. Remove the expansion tank cap.

WARNING Use care when removing the expansion tank cap to avoid scalding by coolant or steam.

3. Raise the car.
4. Remove the right rear wheel/tire.
5. Remove the engine under guard, then remove the front exhaust pipe A.
6. Remove the exhaust pipe A.

CAUTION: Do not use air wrench or hammer for removing the exhaust pipe A and the catalytic converter if the oxygen sensors are not to be removed.



7. Remove the under cover, then remove the water pipe drain bolts and drain the coolant.
8. Attach the hoses to front and rear engine drain bolts, then loosen the bolts and drain the coolant.
 - Bleed air from the cooling system when installing the cylinder heads (page 10-5).
9. Remove the engine oil cooler base assembly (page 6-23).
10. Lower the car.
11. Remove the strut bar (Page 5-19).
12. Remove the intake manifold plate and top cover (page 5-21).
13. Remove the throttle cable by loosening the locknut, then slip the cable and nut off the throttle bracket and throttle link (page 5-21).

NOTE:

- Take care not to bend the cable when removing it. Always replace a kinked cable with new one.
- Adjust throttle cable when installing (See Section 11).



14. Relieve fuel pressure (See Section 11).

⚠ WARNING Do not smoke while working on fuel system; keep open flame or spark away from work area. Drain fuel only into an approved container.

15. Disconnect the fuel feed hose and the return hose (page 5-21).

16. Remove the ignition coil covers, the wire harness covers, the ignition coils and the connectors (page 6-23).

17. Remove the water hoses, then remove the expansion tank (page 5-21).

18. Remove the breather hose, and the air cleaner case (page 5-22).

19. Remove the brake booster hose, the charcoal canister hose and other hoses from the intake manifold and throttle body (page 5-22).

20. Remove the emission control box (page 5-23).

- Do not disconnect emission hoses.
- Disconnect the three connectors before removing.

21. Remove the connector, the terminal and the alternator.

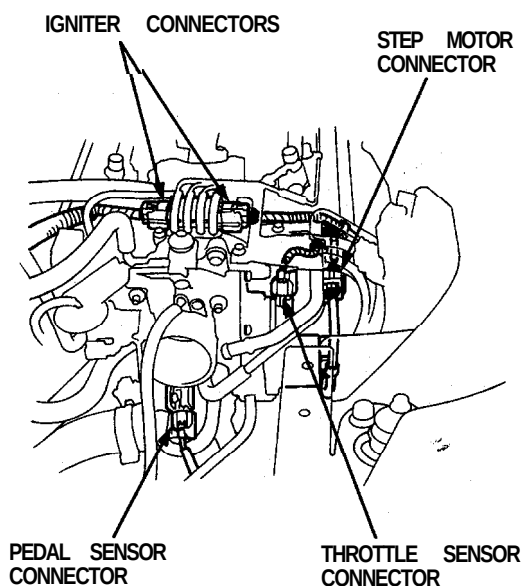
22. Disconnect the engine wire harness connectors, then remove the harness clamps from the cylinder head and the intake manifold.

Front cylinder head:

- CRANK/CYL sensor connector
- A/C compressor magnetic clutch connector
- Oxygen sensor connector
- Ground cable terminal
- Ground terminal
- Three injector connectors (cylinders No.4, 5, and 6)
- TA sensor connector
- Igniter connector
- Condenser connector
- Oil pressure sensor connector (oil pressure gauge)
- Spool valve connector
- Oil pressure switch connector (VTEC)
- TW sensor connector (for emission)
- Temperature sender unit connector
- Pedal sensor connector (throttle body)
- TW sensor connector (for radiator fan)

Rear cylinder head:

- Oil pressure switch connector (oil cooler base)
- Oxygen sensor connector
- Three injector connectors (cylinders No. 1, 2, and 3)
- EACV connector
- Knock sensor connector
- Step motor connector (throttle body)
- Throttle sensor connector
- Spool valve connector
- Oil pressure switch connector (VTEC)
- Igniter connector
- Ground terminal

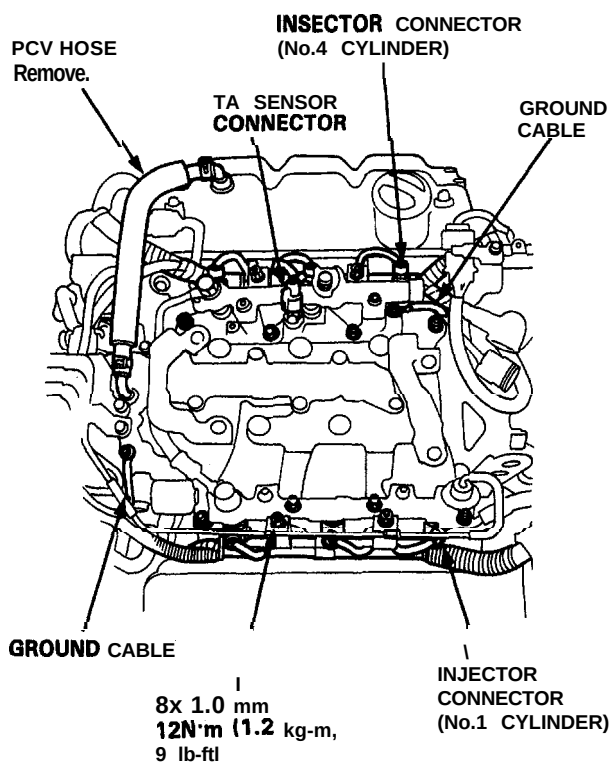
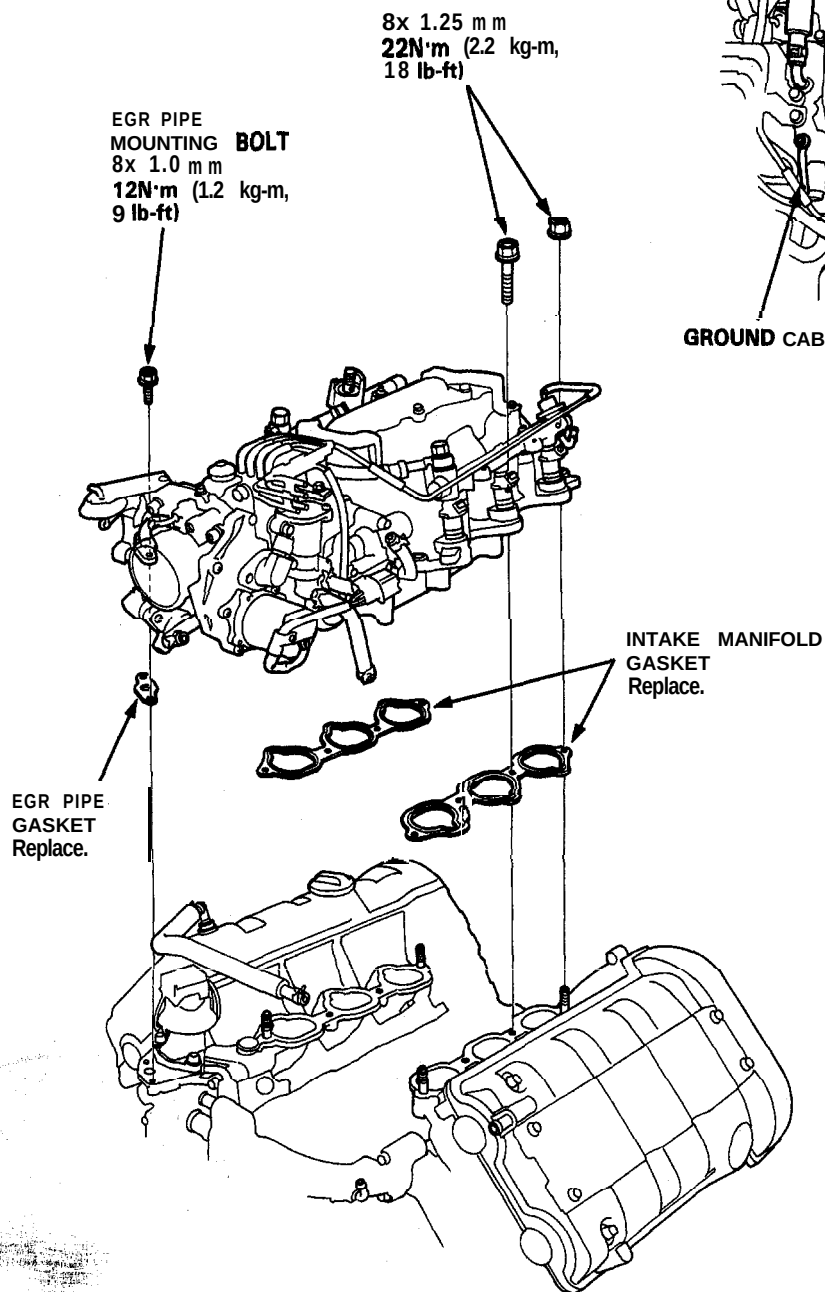


(cont'd)

-Removal (cont'd)

23. Remove the EGR pipe and the intake manifold assembly.

NOTE: Fill the cylinder head intake ports with clean shop towels to prevent foreign materials from getting into the cylinders.



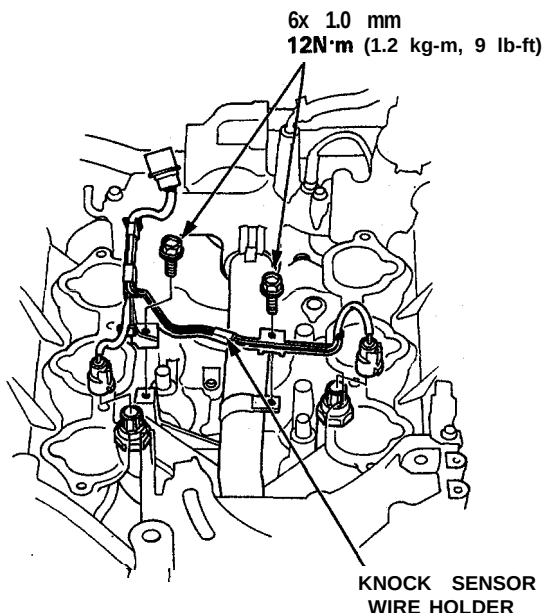


24. Remove the side engine mount, then push it into the side mounting bracket housing of the body (page 5-26).

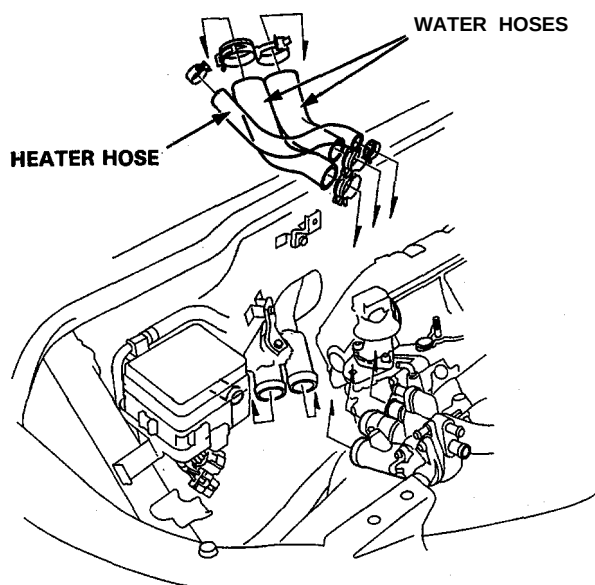
25. Remove the transmission mount.

26. Remove the alternator bracket stiffener (page 6-24).

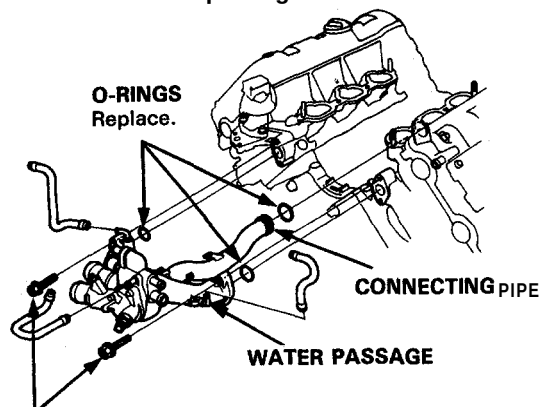
27. Disconnect the knock sensor connectors, then remove the wire holder.



28. Remove the heater hose and the water hoses.



29. Remove the water passage.



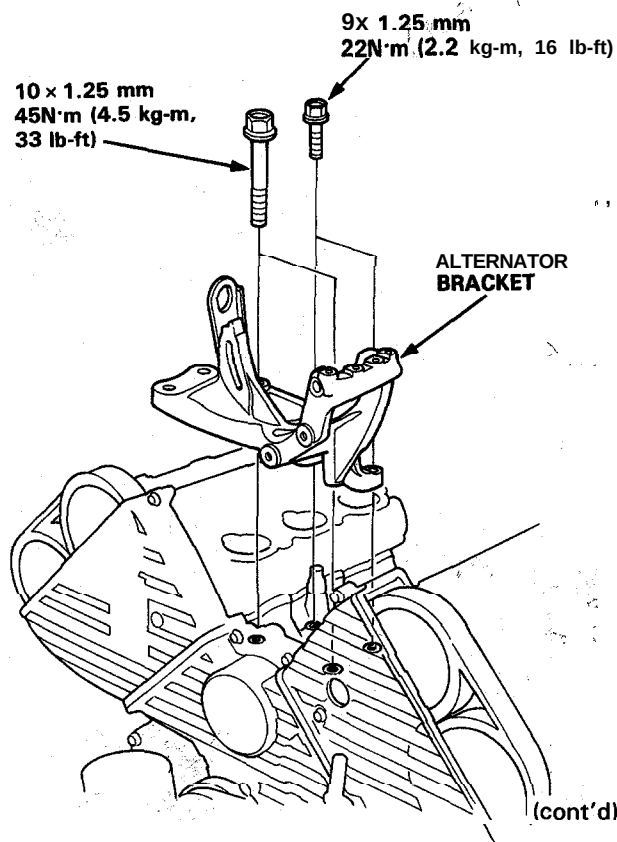
8 x 1.25 mm
22N·m (2.2 kg-m, 16 lb-ft)

30. Remove the cylinder head covers.

31. Turn the crankshaft so that the No. 1 piston is at top-dead-center (page 6-25, 26).

32. Install the attachment under the engine, then tilt the engine approximately 5° using a jack (page 6-24)

33. Remove the alternator bracket.



Cylinder Head

Removal (cont'd)

NOTE: Removal of the following items is not necessary if only the rear cylinder head is going to be removed.

- A/C adjusting pulley and A/C belt
- Timing belt lower cover
- Crankshaft pulley

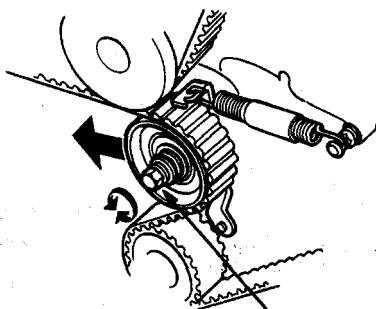
34. Remove the A/C adjusting pulley and belt.

33. Remove the dipstick pipe mounting bolt, then remove the front and rear timing belt middle covers.

35. Remove the crankshaft pulley, then remove the timing belt lower cover.

36. Loosen the timing belt adjusting bolt 180° and release the belt tension.

NOTE: Push the tensioner to release tension from the belt, then retighten the adjusting bolt.

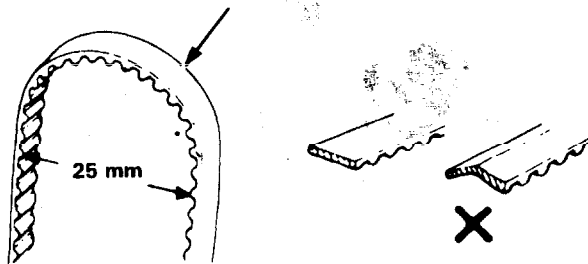


ADJUSTING BOLT
Do not remove.
Loosen it 180° .

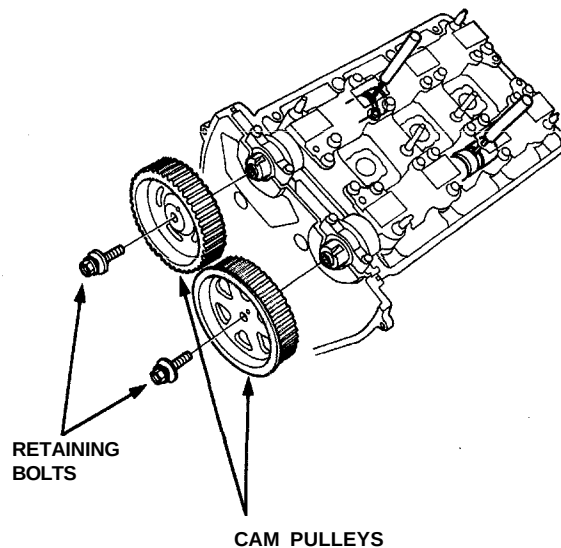
37. Remove the timing belt from the pulleys.

CAUTION: Do not crimp or bend the timing belt more than 90° or less than 25 mm (1 in) in diameter.

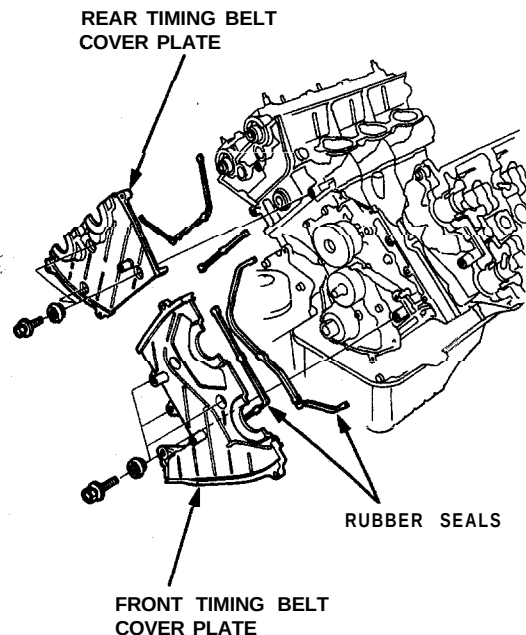
CAUTION: Do not crimp or bend the timing belt more than 90° or less than 25 mm (1 in) in diameter.



38. Remove the cam pulleys.



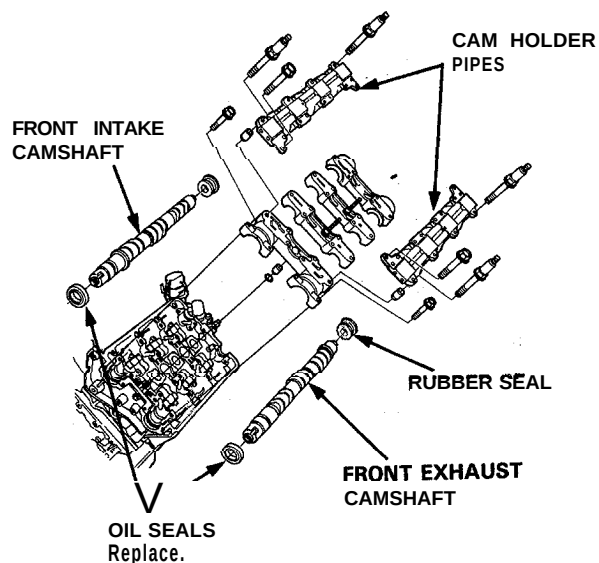
39. Remove the front and rear timing belt cover plates.



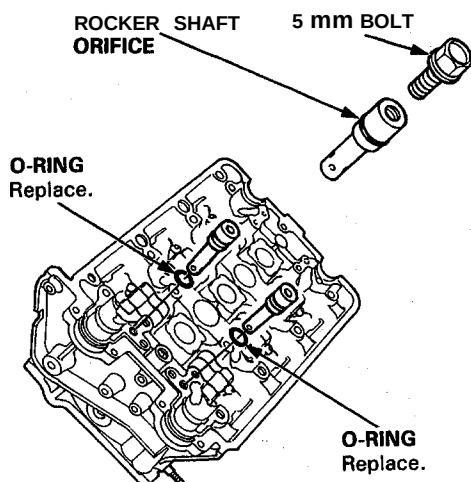


40. Loosen the valve locknuts, backed off the adjusting screw.

41. Remove the cam holder pipes, the cam holders and the camshafts.

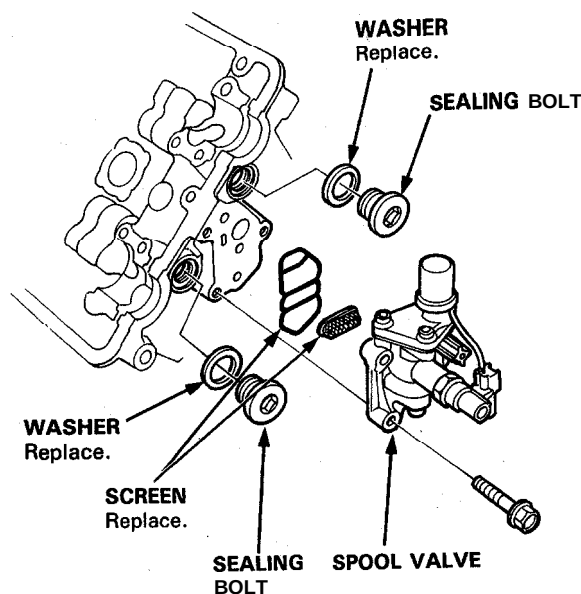


42. Screw a 5 mm bolt into each rocker shaft orifice, then pull out the rocker shaft orifices.



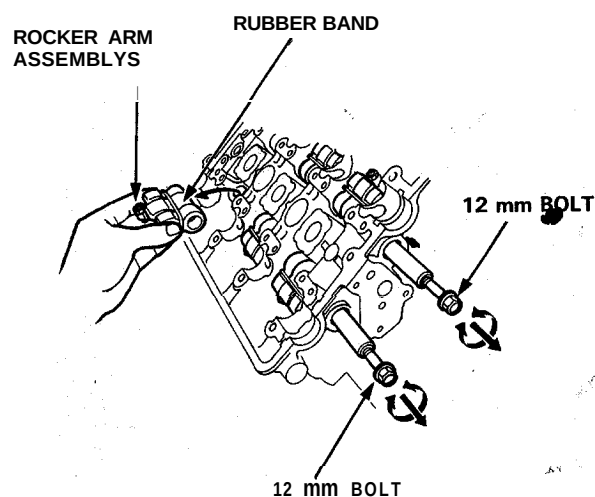
43. Remove the spool valve assemblies.

44. Remove the sealing bolts.



45. Bundle the rocker arms with a rubber band to prevent them from separating.

46. Screw a 12 x 1.25 mm bolt into each rocker shaft. Remove the rocker arms while slowly pulling the rocker shafts out of the cylinder heads toward the transmission.



(cont'd)

Cylinder Heads

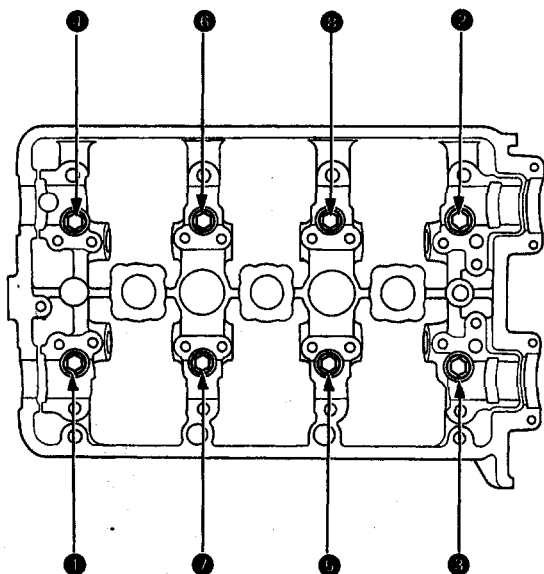
- Removal (cont'd)

47. Disconnect the connectors and remove the engine wire harness.

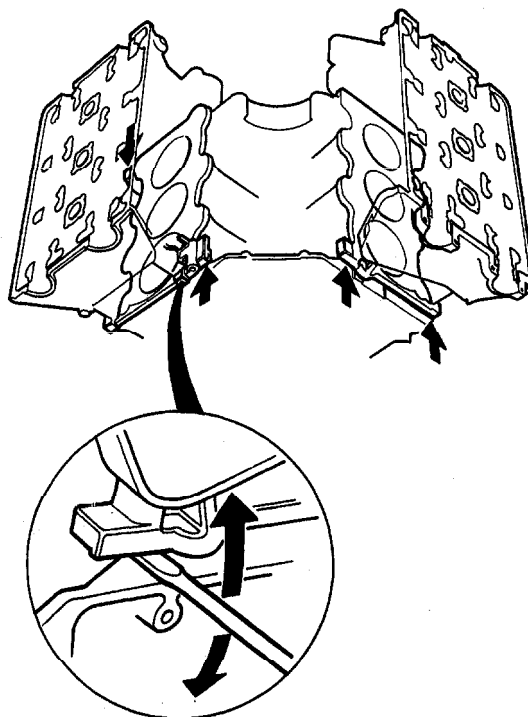
48. Remove the cylinder head bolts, then remove the cylinder heads.

CAUTION: To prevent **warpage**, unscrew the bolts in sequence **1/3** turn at a time; repeat the sequence until all bolts are loosened.

CYLINDER HEAD BOLTS LOOSENING SEQUENCE



NOTE: Separate the cylinder head from the block with a flat blade screwdriver as shown.



49. Remove the front and rear exhaust manifold covers, then remove the front and rear exhaust manifolds.

CAUTION:

- Remove the oxygen sensors before removing the exhaust manifolds.
- Do not use air wrench or hammer for removing the exhaust manifolds if the oxygen sensors are not to be removed.



Rocker Arms and Shafts

Locations

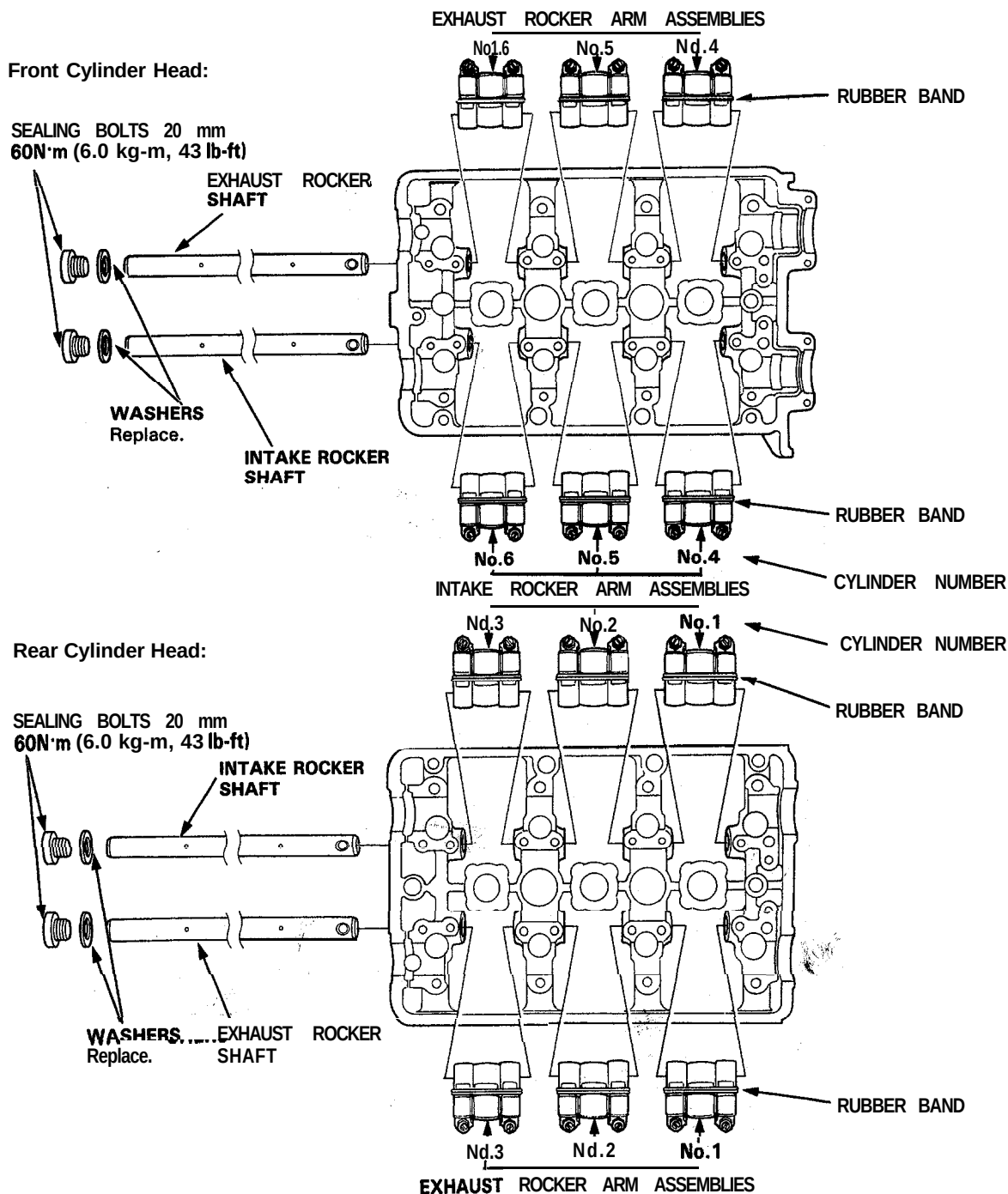
CAUTION: After installing the locker shaft orifice, try to turn the locker shaft to make sure that the orifice has been inserted in the hole of lockershaft correctly. If the orifice is in place, it should not turn.

NOTE:

- Identify parts as they are removed to ensure reinstallation in original locations.
- Inspect rocker shafts and rocker arms (pages 6-13 and 141).
- Rocker arms must be installed in the same position if reused.
- Install the rocker arms after torquing the cylinder head bolts.



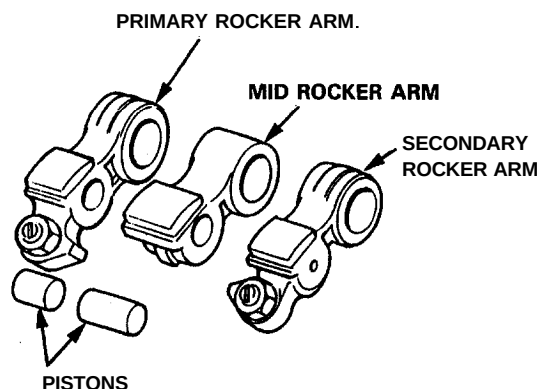
Prior to reinstalling, clean all the parts in solvent, dry them and apply lubricant to any contact surfaces.



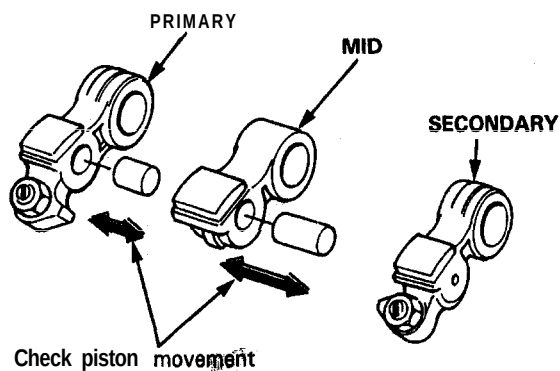
Rocker Arms and Lost Motion Assemblies

Inspection

NOTE: When reassembling the primary rocker arm, carefully apply air pressure to the oil passage of the rocker arm.



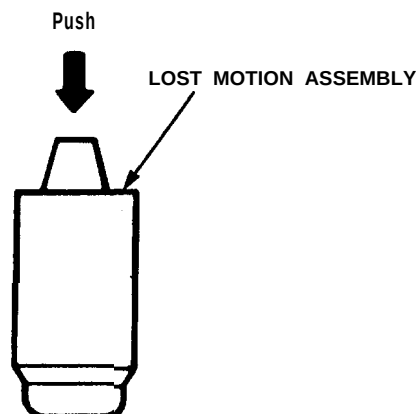
1. inspect the rocker arm piston. Push it manually.
 - If it does not move smoothly, replace the rocker arm assembly.



NOTE:

- Apply oil to the pistons when reassembling.
- Bundle the rocker arms with a rubber band to prevent them from separating.

2. Remove the lost motion assembly from the cylinder head and inspect it. Pushing it gently with the finger will cause it to sink slightly. Increasing the force on it will cause it to sink deeper.
 - If the lost motion assembly does not move smoothly, replace it.



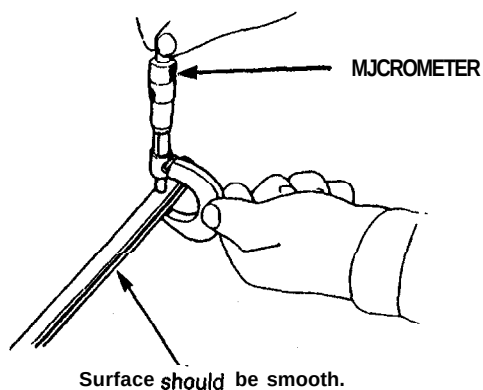
Rocker Arms and Shafts



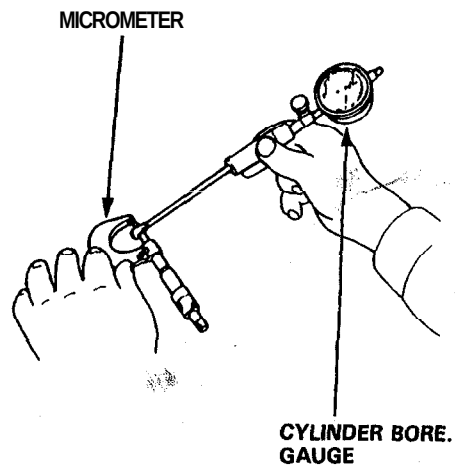
- Clearance

Measure both the intake rocker shafts and exhaust rocker shafts.

1. Measure diameter of shaft at first rocker location.

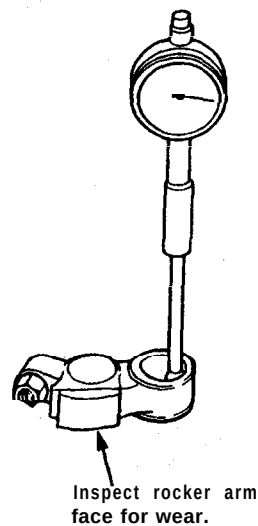


2. Zero gauge to shaft diameter.



3. Measure inside diameter of rocker arm and check for out-of-round condition.

Rocker Arm Radial Clearance:
Service Limit: 0.08 mm (0.003 in.)



Repeat for all rockers.

- If over limit, replace rocker shaft and all over-tolerance rocker arms.

NOTE: If any rocker arm needs replacement, replace all three rocker arms in that set (primary, mid, and secondary).

Camshafts

Inspection

NOTE:

- Do not rotate the camshaft during inspection.
 - Remove the rocker arms and rocker shafts.
1. Put the camshafts, the cam holders the holder pipes on the cylinder head, and then tighten the bolts to the specified torque.

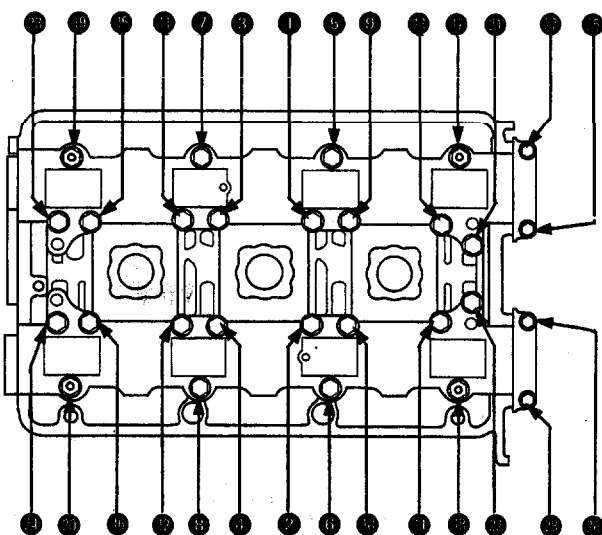
NOTE: Apply clean engine oil to 8 mm bolt threads.
Specified torque:

① - ②④ **8 mm × 1.25 mm bolts:**
22N·m (2.2 kg-m, 16 lb-ft)

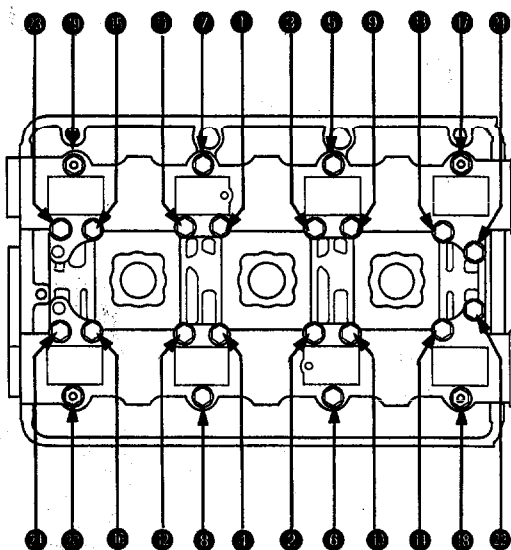
②⑤ - ②⑧ **6 mm × 1.0 mm bolts:**
10N·m (1.0 kg-m, 7 lb-ft)

CAM HOLDER BOLTS TORQUE SEQUENCE

FRONT:



REAR:

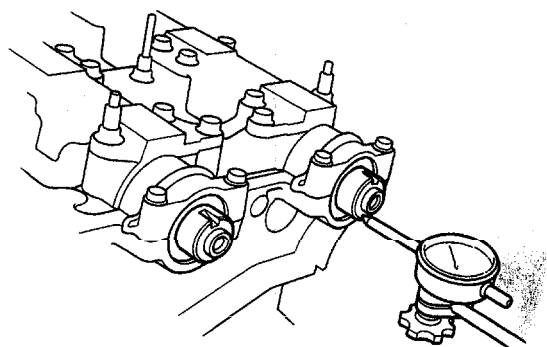


2. Seat the camshaft by pushing it toward left end of cylinder head.
3. Zero the dial indicator against the left end, then push the camshaft back and forth, and read the end play.

Camshaft End Play:

Standard (New): 0.05-0.15 mm
(0.002-0.006 in.)

Service limit: 0.5 mm (0.02 in.)



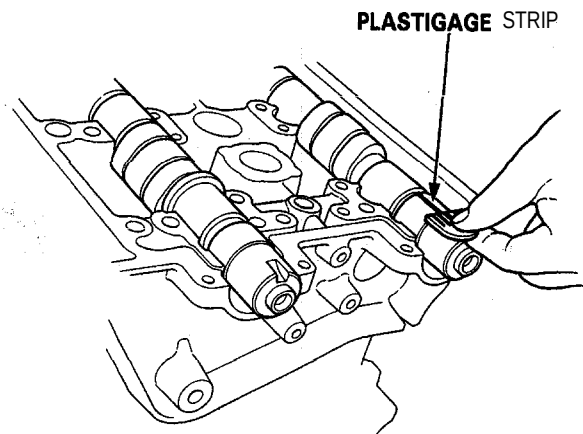
4. Remove the bolts, then remove the cam holders from the cylinder head.
 - Lift camshaft out of cylinder head, wipe clean, then inspect lift ramps. Replace camshaft if lobes are pitted, scored, or excessively worn.
 - Clean the camshaft bearing surfaces in the cylinder head, then set camshaft back in place.
 - **Insert** plastigage strip across each journal.
5. **Install the** cam holders, and then tighten the bolts to the specified torque, as shown in the left column on this page.

6. Remove the cam holders and measure widest portion of plastigage on each journal.

Camshaft Bearing Radial Clearance:

Standard (New): 0.050-0.089 mm
(0.002-0.004 in.)

Service Limit: 0.15 mm (0.006 in.)





e

7. If camshaft bearing radial clearance is out of tolerance:

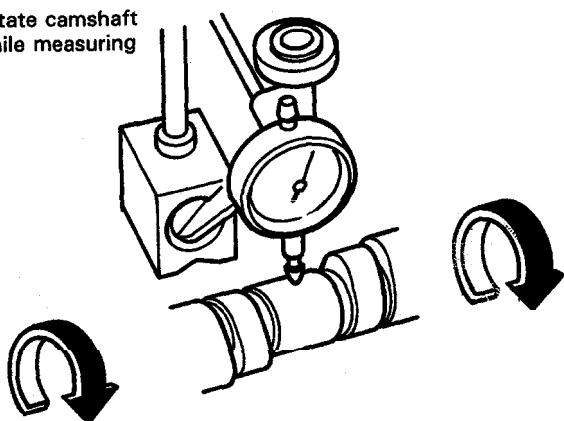
- And camshaft has already been replaced, you must replace the cylinder head.
- If camshaft has not been replaced, first check total runout with the camshaft supported on V-blocks.

Camshaft Total Runout:

Standard (New): 0.015 mm (0.0005 in)

Service Limit: 0.030 mm (0.0012 in)

Rotate camshaft while measuring



- If the total runout of the camshaft is within tolerance, replace the cylinder head.
- If the total runout is out of tolerance, replace the camshaft and recheck. If the bearing clearance is still out of tolerance, replace the cylinder head.

8. Check cam lobe height wear.

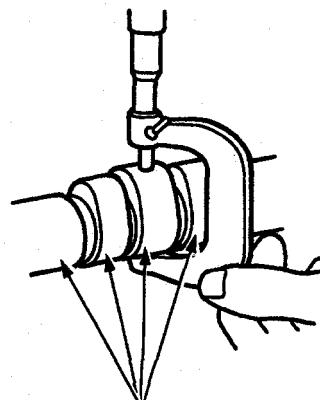
Cam lobe height standard (New):

M/T

	INTAKE	EXHAUST
PRIMARY	37.086 mm (1.4601 in)	36.559 mm (1.4393 in)
MID	38.037 mm (1.4975 in)	37.398 mm (1.4724 in)
SECONDARY	37.326 mm (1.4695 in)	36.741 mm (1.4465 in)

A/T

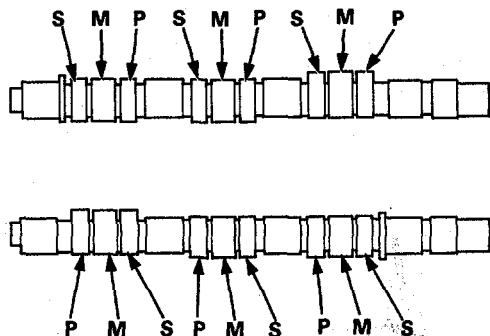
	INTAKE	EXHAUST
PRIMARY	37.266 mm (1.4672 in)	36.559 mm (1.4393 in)
MID	37.655 mm (1.4825 in)	37.398 mm (1.4724 in)
SECONDARY	37.504 mm (1.4765 in)	36.741 mm (1.4465 in)



Check this area for wear.

Cam position

P : Primary M : Mid S : Secondary

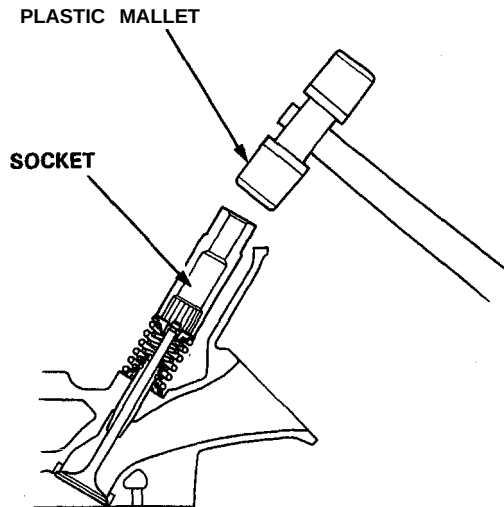


Valves and Valve Seals

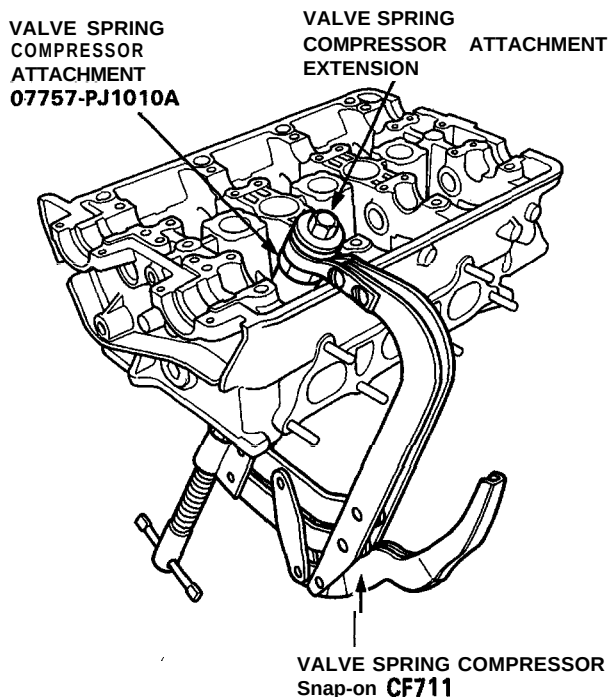
- Replacement

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

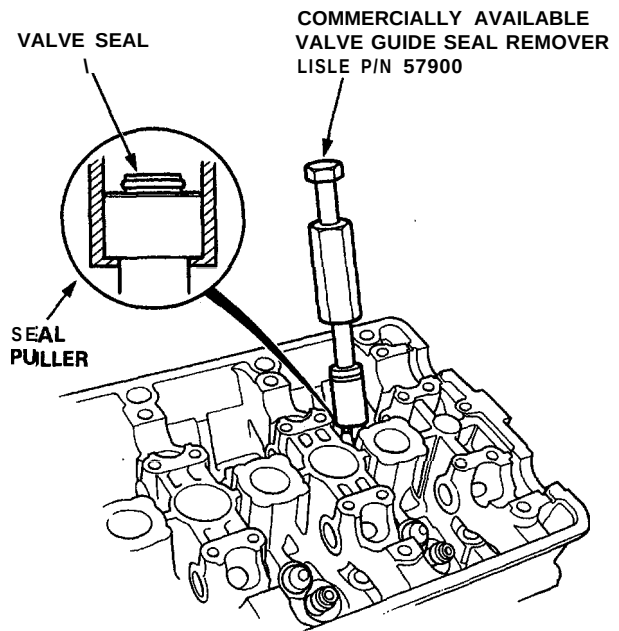
1. Using an appropriate-sized socket and plastic mallet, lightly tap the valve retainer to loosen the valve keepers before installing the valve spring compressor.



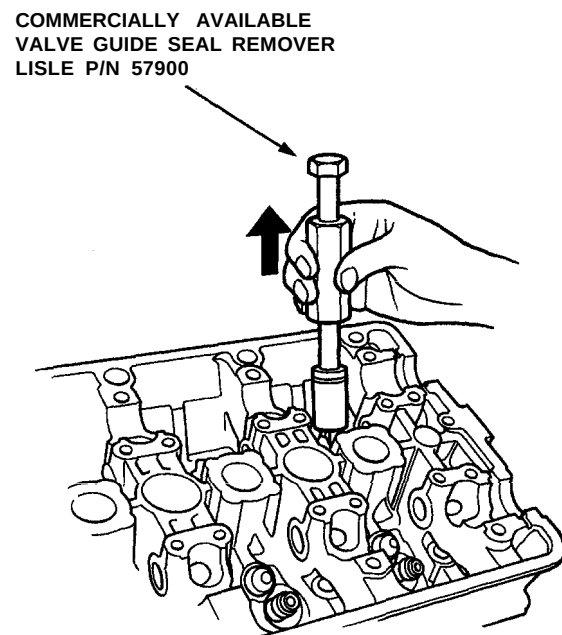
2. Install spring compressor. Compress spring and remove valve keeper.



3. Install the special tool as shown.



4. Remove the valve guide seal.



Cylinder Heads



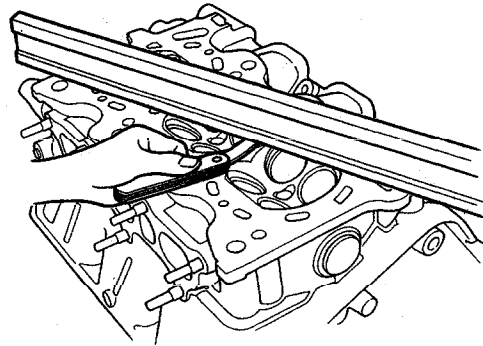
Warpage

NOTE: If camshaft bearing clearances (page 6-38) are not within specification, the head cannot be resurfaced.

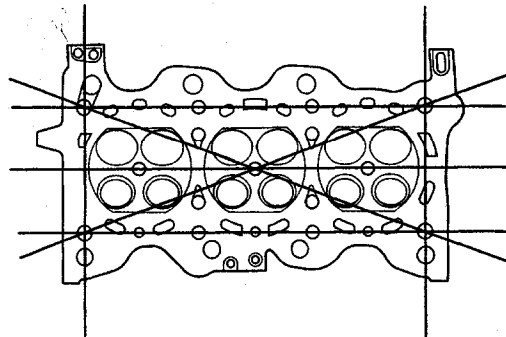
If camshaft bearing radial clearances are within specifications, check the head for warpage.

- If warpage is less than 0.05 mm (0.002 in.) cylinder head resurfacing is not required.
- If warpage is between 0.05 mm (0.002 in.) and 0.2 mm (0.008 in.), resurface cylinder head.
- Maximum resurface limit is 0.2 mm (0.008 in.) based on a height of 151 mm (5.945 in).

PRECISION STRAIGHT EDGE



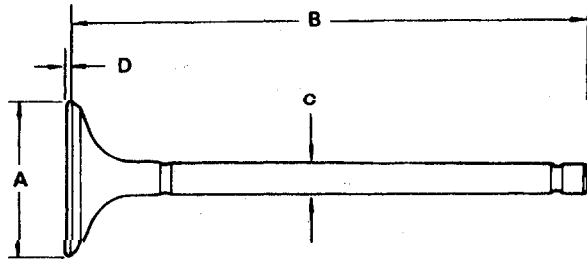
Measure along edges, and 3 ways across center.



Cylinder Head Height:

Standard (New): 150.95– 151.05
(5.943-5.947 in)

Service Limit: 150.8 mm (5.937 in)



Intake Valve Dimensions

- A Standard (New): 34.9-35.1 mm
(1.374– 1.382 in)
- 8 Standard (New): 111.05-111.40 mm
(4.372-4.388 in)
- C Standard (New): 5.475-5.485 mm
(0.2158-0.2159 in)
- C Service Limit: 5.445 mm (0.2144 in)
- D Standard (New): 1.05-1.35 mm
(0.041-0.053 in)
- D Service Limit: 0.85 mm (0.033 in)

Exhaust Valve Dimensions

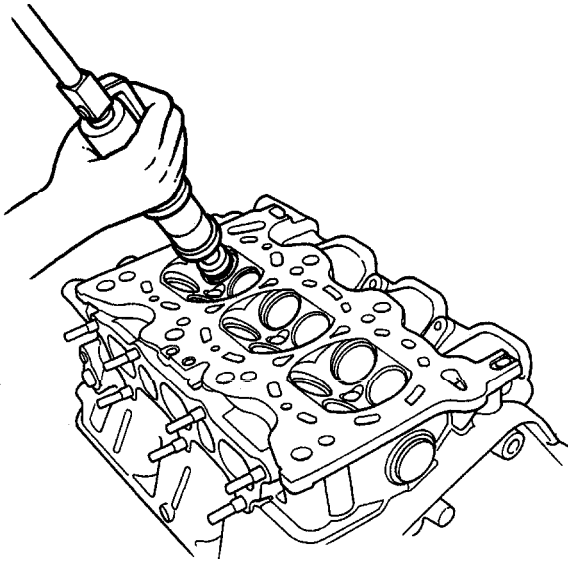
- A Standard (New): 29.9-30.1 mm
(1.177-1.185 in)
- 8 Standard (New): 109.60– 109.90 mm
(4.315-4.327 in)
- C Standard (New): 5.45-5.46 mm
(0.2146– 0.2150 in)
- C Service Limit: 5.42 mm (0.2134 in)
- D Standard (New): 1.65– 1.95 mm
(0.065-0.077 in)
- D Service Limit: 1.45 mm (0.057 in)

Valve Seats

Reconditioning

1. Renew the valve seats in the cylinder head using a valve seat grinder.

NOTE: If guides are worn (page 6-43), replace them (page 6-44) before grinding the valve seats.

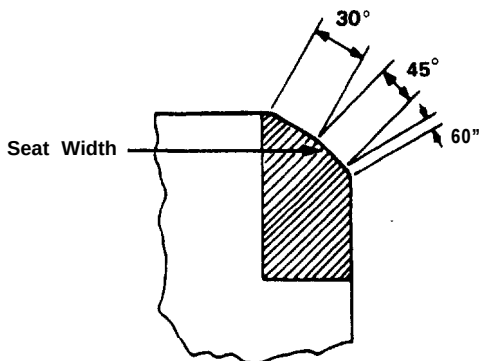


2. Carefully grind a 45° seat, removing only enough material to ensure a smooth and concentric seat.
3. Bevel the upper edge of the seat with the 30° stone and the lower edge of the seat with the 60° stone. Check width of seat and adjust accordingly.
4. Make one more very light pass with the 45° stone to remove any possible burrs caused by the other stones.

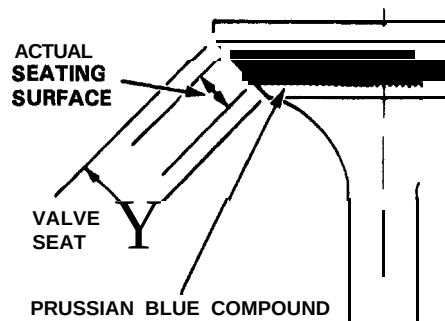
Valve seat Width:

Standard: IN 0.80–1.00 mm (0.031-0.039 in)
EX 1.25-1.55 mm (0.049-0.061 in.)

Service Limit: IN 1.5 mm (0.059 in)
EX 2.0 mm (0.079 in)

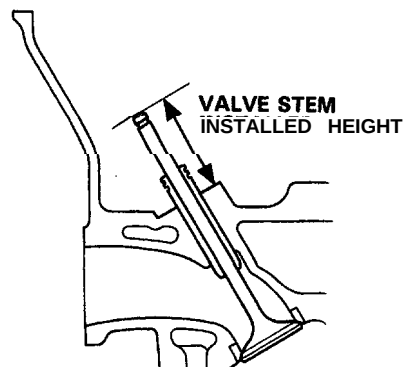


5. After resurfacing the seat, inspect for even valve seating: Apply Prussian Blue compound to the valve face, and insert valve in original location in the head, then lift it and snap it closed against the seat several times.



6. The actual valve seating surface, 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° stone to move it down, then one more cut with the 45° stone to restore seat width.
 - If it is too low (closer to the valve edge), you must make a second cut with the 30° stone to move it up, then one more cut with the 45° stone to restore seat width.NOTE: The final cut should always be made with the 45° stone.

7. Insert intake and exhaust valves in the head and measure valve stem installed height.
Valve Stem Installed Height (IN and EX):
Standard (New): 41.55-42.35 mm
(1.6358–1.6673 in)
Service Limit: 42.435 mm (1.6707 in)



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



Valves

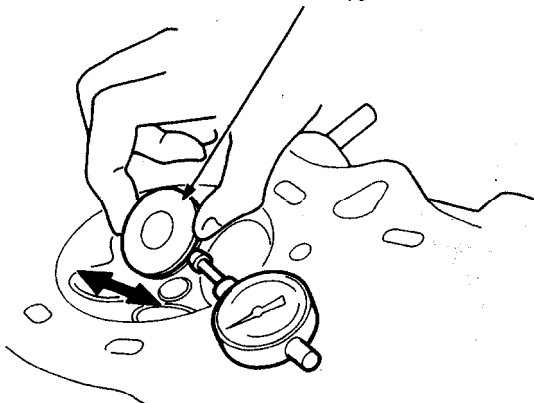
. Valve Movement

Measure the guide-to-stem clearance with a dial indicator while rocking the stem in the direction of normal thrust (wobble method).

Intake Valve Stem-to-Guide Clearance:
Standard (New): 0.0125-0.0275 mm
(0.0005-0.0011 in)
Service Limit: 0.08 mm (0.003 in)

Exhaust Valve Stem-to-Guide Clearance:
Standard (New): 0.025-0.04 mm
(0.001-0.0016 in)
Service Limit: 0.055 in (0.0022 in)

Valve extended 10 mm out from seat.



- If measurement exceeds the service limit, recheck using a new valve.
- If measurement is now within the service limit, reassemble using a new valve.
- If measurement still exceeds limit, recheck using alternate method below, then replace valve and guide, if necessary.

NOTE: An alternate method of checking guide to stem clearance is to 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

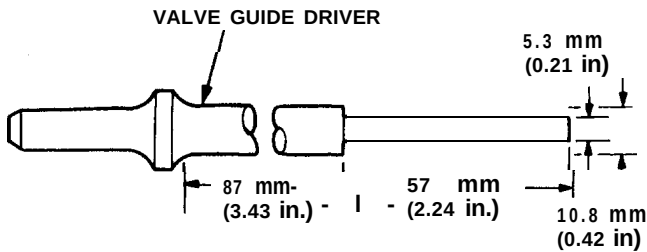
Intake Valve Stem-to-Guide Clearance:
Standard (New): 0.025-0.055 mm
(0.001-0.002 in)
Service Limit: 0.08 mm (0.003 in)

Exhaust Valve Stem-to-Guide Clearance:
Standard (New): 0.05-0.08 mm
(0.002-0.003 in)
Service Limit: 0.11 mm (0.004 in)

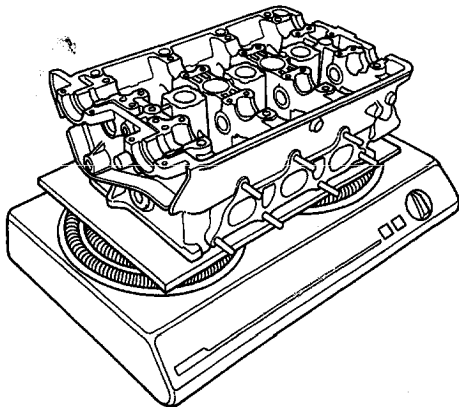
Valve Guides

Replacement

1. As illustrated, in the removal steps of this procedure use a commercially-available air-impact driver attachment which may need to be modified to fit the diameter of the valve guides. In most cases, the same procedure can be done using Valve Guide Drivers and a conventional hammer. Tool numbers are at the end of this procedure.



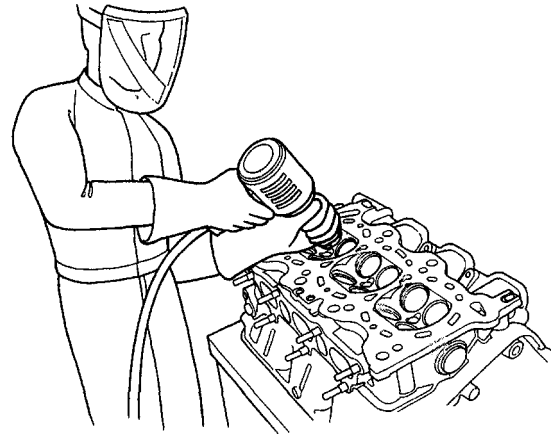
2. Select the proper replacement guides and chill them in the freezer section of a refrigerator for about an hour.
3. Use a hot plate or oven to evenly heat the cylinder head to 150°C (300°F). Monitor the temperature with a cooking thermometer.



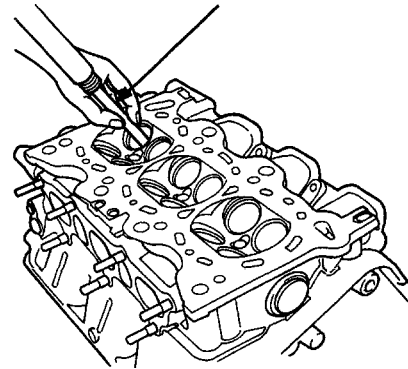
CAUTION:

- Do not use a torch; it may warp the head.
- Do not get the head hotter than 150°C (300°F); excessive heat may loosen the valve seats.
- To avoid burns, use heavy gloves when handling the heated cylinder head.

4. Use the driver and an air hammer working from the camshaft side to drive the guide about 2 mm towards the combustion chamber. This will knock off some of the carbon and make removal easier.



VALVE GUIDE DRIVER
07742-0010100



CAUTION:

- Always wear safety goggles or a face shield when using the air hammer.
- Hold the air hammer directly in line with the valve guide to prevent damaging the driver.

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

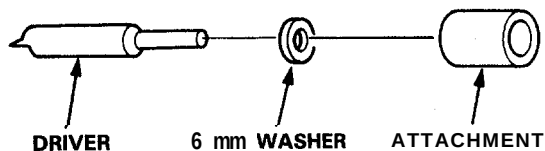
If a valve guide still won't move, drill it out with a 5/16 inch bit, then try again.

CAUTION: Drill guides only in extreme cases: you could damage the cylinder head if the guide breaks.

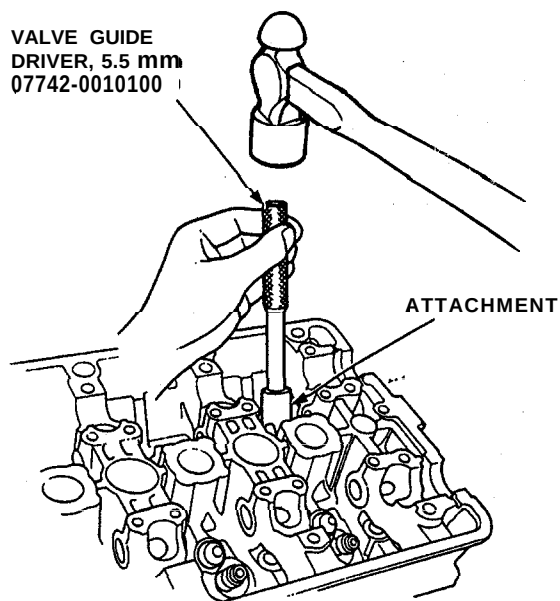
6. Remove the new guide(s) from the refrigerator, one at a time, as you need them.



- Slip a 6 mm steel washer and the correct driver attachment over the end of the driver (The washer will absorb some of the impact and extend the life of the driver).



- Install the new guide(s) from the camshaft side of the head; drive each one in until the attachment bottoms on the head. If you have all twelve guides to do, you may have to reheat the head one or two more times.



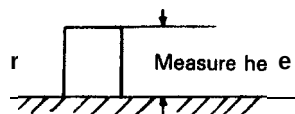
NOTE: Valve guide replacement can be performed with this special tool.

Removal and Installation
VALVE GUIDE DRIVER
07742-0010100

Valve Guide Installed Height:

Intake: 13.75-14.25 mm (0.541-0.561 in)

Exhaust: 13.75-14.25 mm (0.541-0.561 in)



-Valve Guide Reaming

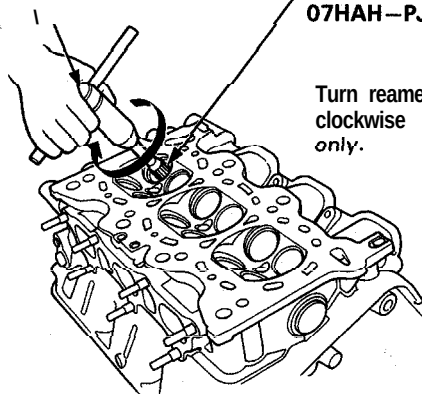
NOTE: For new valve guides only.

- Coat both reamer and valve guide with cutting oil.
- Rotate the reamer clockwise the full length of the valve guide bore.
- Continue to rotate the reamer clockwise while removing it from the bore.
- Thoroughly wash the guide in detergent and water to remove any cutting residue.
- Check clearance with a valve (page 6-43).
— Verify that the valve slides in the IN, EX valve guides without exerting pressure.

REAMER HANDLE

VALVE GUIDE
REAMER, 5.5 mm
07HAH-PJ7010A

Turn reamer in
clockwise direction
only.

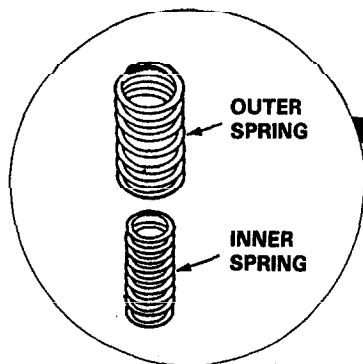


Valve Springs and Valves

-Valve Spring and Valve Seal Installation Sequence

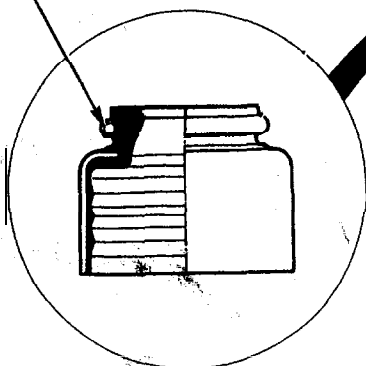
NOTE: Exhaust and intake valve seals are NOT interchangeable.

INTAKE VALVE SPRING (M/T only)

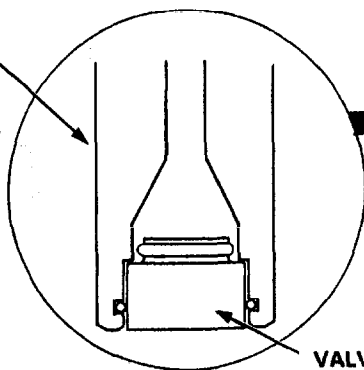


NOTE: Place the end of valve spring with closely wound coils toward the cylinder head.

INTAKE VALVE SEAL
(WHITE SPRING)
Replace.



VALVE SEAL INSTALLER
KD-2899



VALVE SEAL
Replace.

VALVE KEEPERS

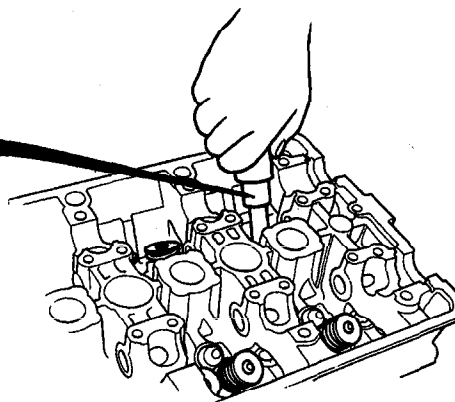
VALVE SPRING
RETAINER

VALVE SPRING

EXHAUST VALVE SEAL
(BLACK SPRING)
Replace.

SPRING SEAT

NOTE: Install the valve spring seats
before installing the valve seals.

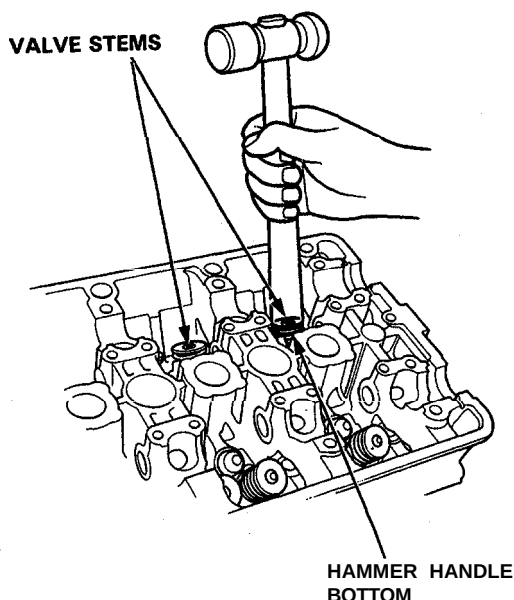




Cylinder Heads

Valve Installation

- When installing valves in cylinder head, coat valve stems with oil before inserting into valve guides, and make sure valves move up and down smoothly.
- When valves and springs are in place, lightly tap the end of each valve stem two or three times to ensure proper seating of valve and valve keepers (use hammer handle bottom).



Installation

Install the cylinder heads in the reverse order of removal:

- Always use new head gaskets.
- Cylinder heads and engine block surface must be clean.
- Turn the crankshaft so that No. 1 piston is at TDC (page 6-26).

1. Install the front and rear exhaust manifolds to each cylinder head, then tighten the self-locking nuts in a criss-cross pattern in two or three steps, beginning with the inner nut.

- Apply oil to the self-locking nut threads.

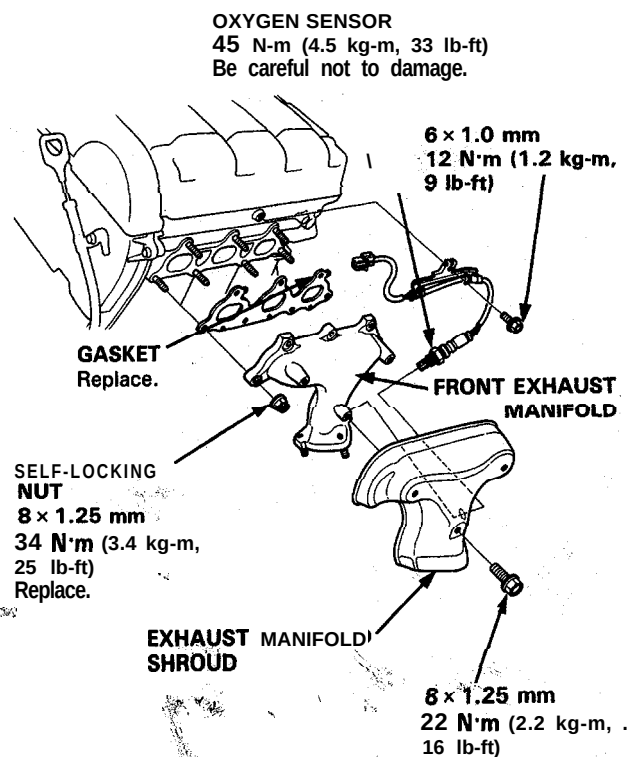
- Always use new exhaust manifold gaskets.

CAUTION:

- Install the oxygen sensors after installing the exhaust manifolds.
- Do not use air wrench for tightening the self-locking nuts if the oxygen sensors are not to be removed.

2. install the exhaust manifold covers.

Front:



(cont'd)

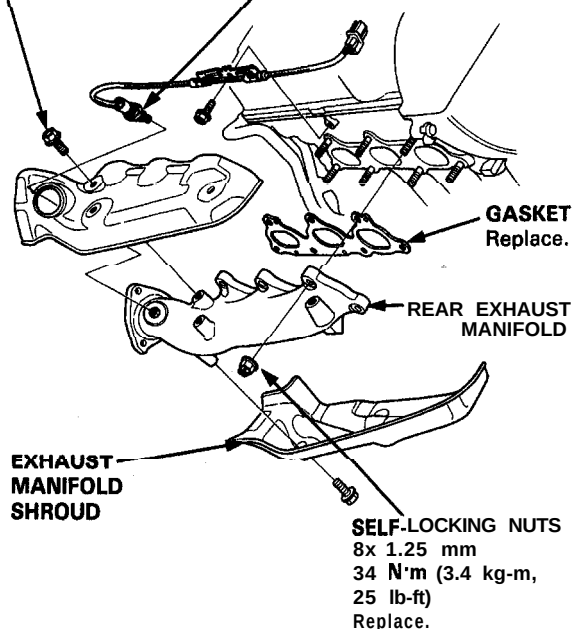
Cylinder Heads

Installation (cont'd)

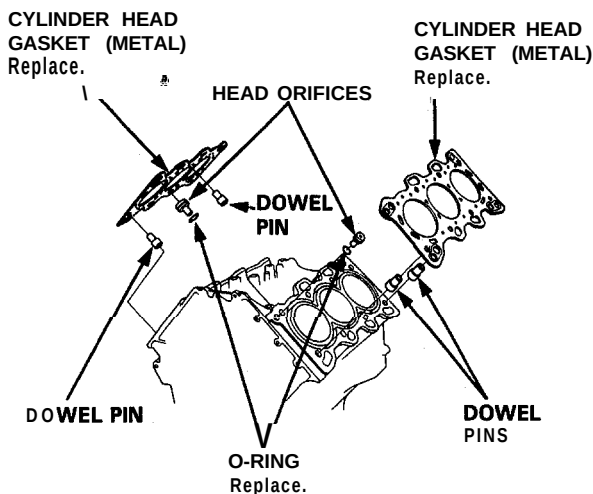
Rear:

8x 1.25 mm
22 N·m (2.2 kg-m,
16 lb-ft)

OXYGEN SENSOR
45 N·m (4.5 kg-m,
33 lb-ft)
Be careful not to damage.



3. Install the cylinder heads on the engine block.
The cylinder head dowel pins and the head oil control orifice must be aligned.
 - Always new cylinder head gasket.



4. Tighten the cylinder head bolts sequentially in two or three steps.
 - Apply clean engine oil to the bolt threads and washer contact surfaces.

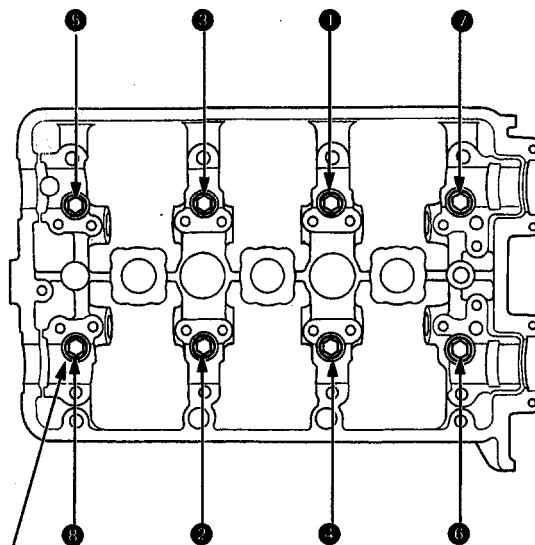
Specified Torque

11 x 1.5 mm

78 N·m (7.8 kg-m, 56 lb-ft)

NOTE: We recommend using a beam-type torque wrench. When using a preset-type torque wrench, be sure to tighten slowly and not to over-tighten.

CYLINDER HEAD BOLTS TORQUE SEQUENCE



CYLINDER HEAD BOLTS

11 x 1.5 mm

78 N·m (7.8 kg-m, 56 lb-ft)

Apply clean engine oil to the bolt threads and washer contact surfaces.

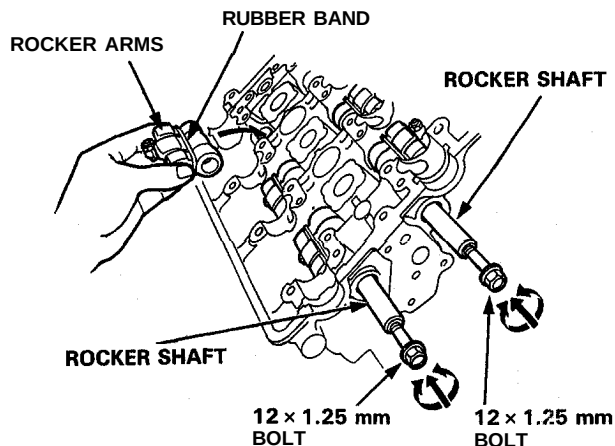
Rocker Arms

Installation

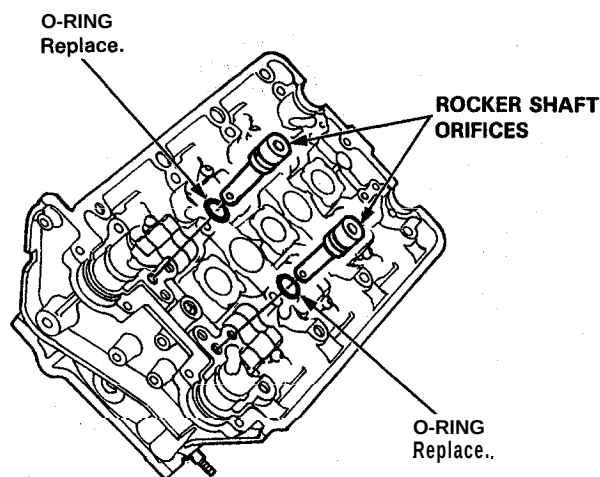
Install the rocker arms in the reverse order of removal:

- Valve adjusting locknuts should be loosened and adjusting screws backed off before installation.
- The component parts must be installed in the original locations.

1. Install the lost motion assemblies.
2. Install the rocker arms while passing the rocker arm shaft through the cylinder head.



3. Install the orifices. If the holes in the rocker arm shafts and the cylinder head are not in line with each other, mount a 12 x 1.25 mm bolt on the rocker arm shaft and rotate the shaft.



CAUTION:

- After installing the rocker shaft orifice, try to turn the rocker shaft to make sure that the orifice has been inserted in the hole of rocker shaft correctly. If the orifice is in place, it should not turn.
- Remove the rubber bands after installing the rocker arms.

Camshafts

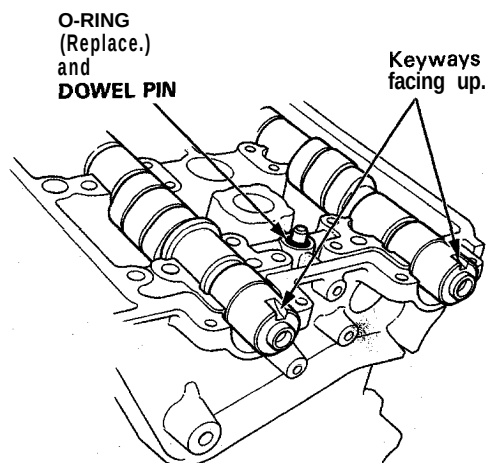
Installation

CAUTION: Valve locknuts should be loosened and adjusting screws backed off before installation.

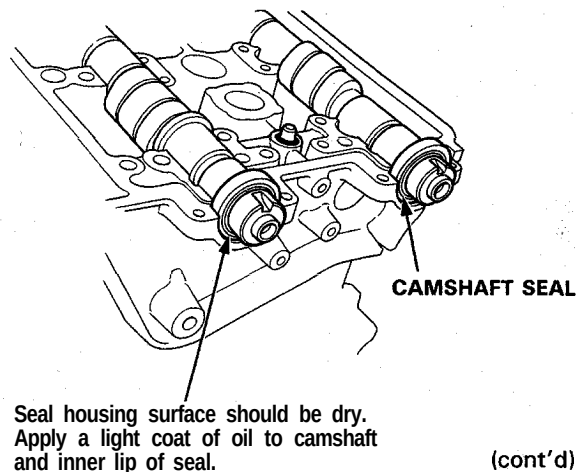
1. After wiping down the cam and journals in cylinder head, lubricate both surfaces and install camshaft.
2. Turn the camshaft until its keyway is facing up. (No. 1 cylinder TDC).
3. Install the camshaft seal with the open side (spring) facing in.

 Lubricate cam lobes after reassembly.

4. Set a new O-ring and a dowel pin in the oil passage of the No.1 cam holder.



5. Set the camshaft seal as shown below.



(cont'd)

Camshafts

Installation (cont'd)

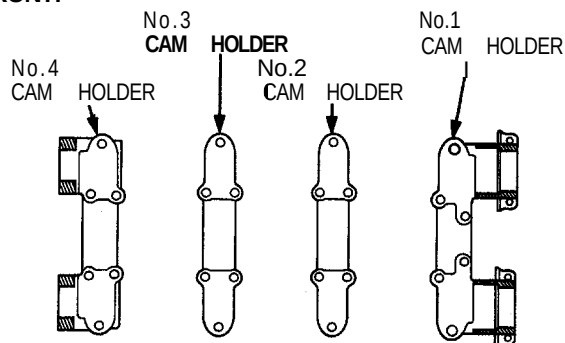
6. Apply liquid gasket to the head mating surfaces of the No. 1 and the No. 4 cam holders.
 → Apply liquid gasket to the shaded areas.

7. Place the cam holders.

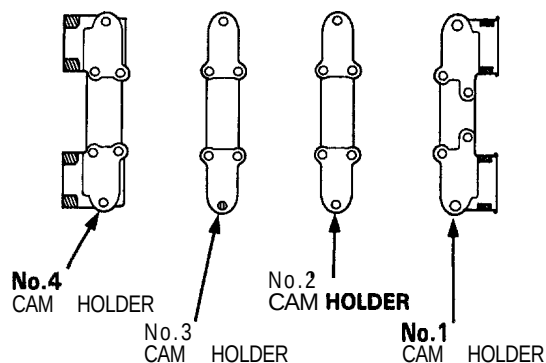
NOTE:

- "F" or "R" marks are stamped on the cam holders.
- The arrows must be pointing to the timing belt side.
- Set two dowel pins in each cam holder.

FRONT:



REAR:



8. Place the cam holder pipes.

9. Tighten each bolt two turns at a time in the sequence shown below to insure that the rockers do not bind on the valves.

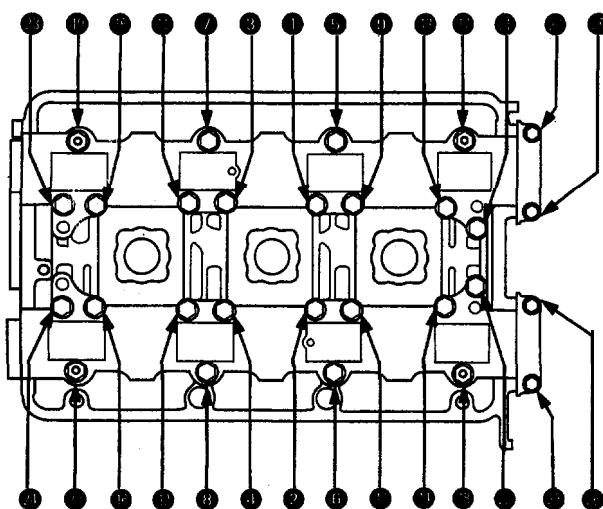
NOTE: Apply clean engine oil to 8 mm bolt threads.

Specified torque:

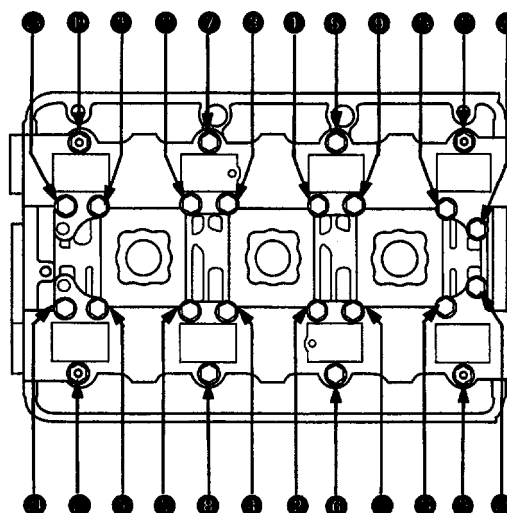
- ①-②④ 8 mm x 1.25 mm bolts:
22 N-m (2.2 kg-m, 16 lb-ft)
- ②⑤-②⑧ 6 mm x 1.0 mm bolts:
10 N-m (1.0 kg-m, 7 lb-ft)

CAM HOLDER BOLT TORQUE SEQUENCE

FRONT:

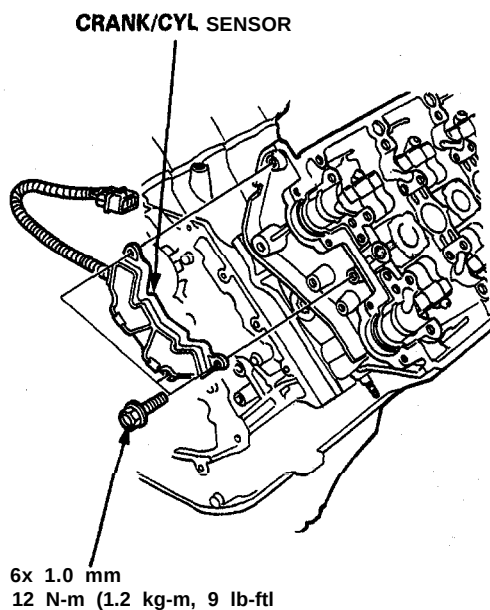


REAR:

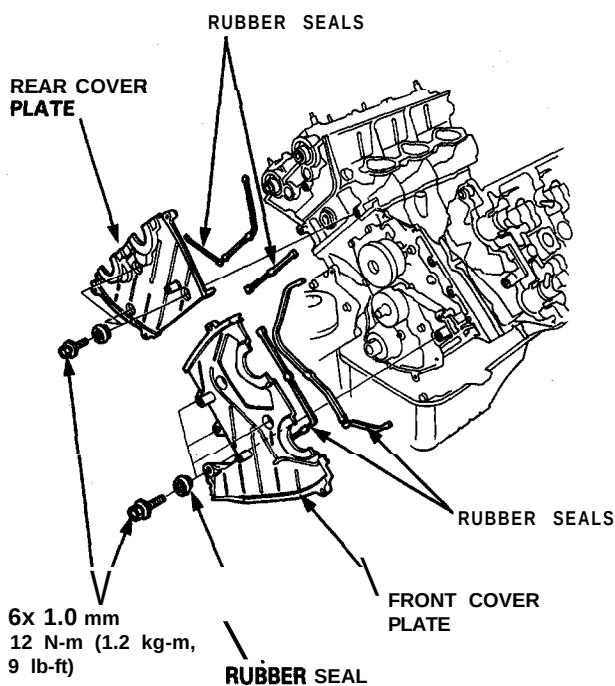




10. Install the **CRANK/CYL** sensor on the front cylinder head.



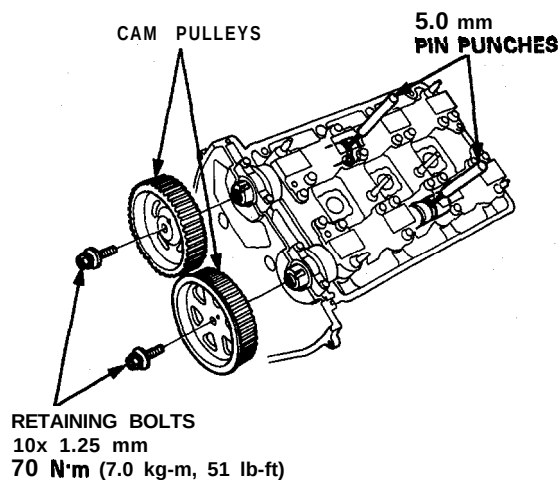
11. install the front and rear timing cover plates.



12. Insert the dowel pins in the camshaft pulleys.

13. Install the cam pulleys then tighten the retaining bolts to the torque specified.

NOTE: To set the camshafts at TDC, align the camshaft holes with the camholder pipe holes and insert 5.0 mm pin punches as shown.



14. install the timing belt (page 6-25).

15. Adjust the valve clearance (6-54).

16. Inspect the rocker arms (pages 6-36, and 6-52 thru 6-54).

17. After installation, check that hoses and connectors are installed correctly.

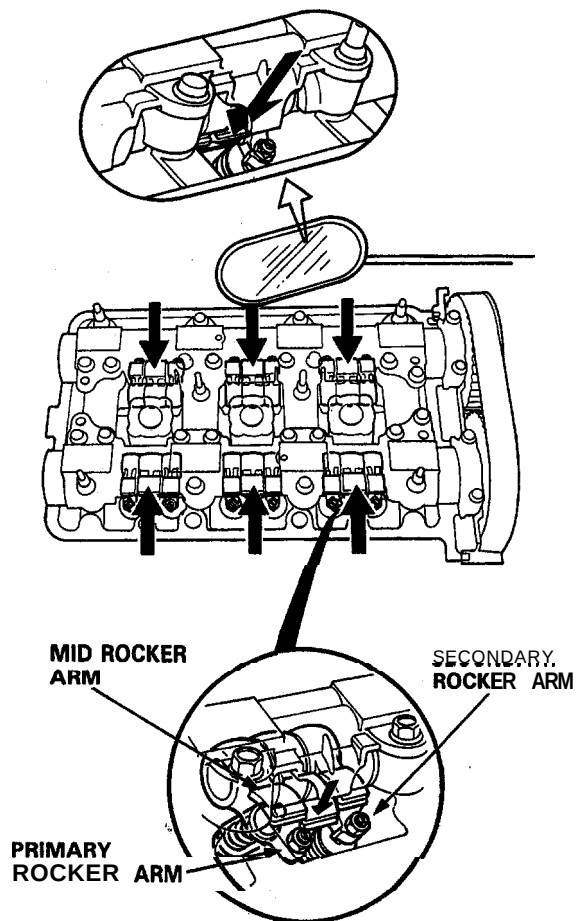
NOTE:

- Prior to installing the cylinder head cover, apply a thin layer of liquid gasket to the mating surface of the cylinder head cover and rubber seals to prevent the rubber seal from falling off.
- After installation, fill the engine with oil up to the specified level, run the engine for more than 3 minutes, then check for oil leakage.

Rocker Arms

Manual Inspection

1. Remove the ignition coil covers (page 6-23).
2. Remove the ignition coils (page 6-23).
3. Remove the cylinder head covers (page 6-3).
4. Set the No.1 piston at TDC (page 6-26).
5. Push the mid rocker arm on the No.1 cylinder manually.
6. Check that the mid rocker arm moves independently of the primary and secondary rocker arms.



NOTE:

Check the mid rocker arm of each cylinder at TDC.

- If the mid rocker arm does not move, remove the mid, primary and secondary rocker arms as an assembly and check that the pistons in the mid and primary rocker arms move smoothly.
- Replace the rocker arms as an assembly if there is any abnormality.

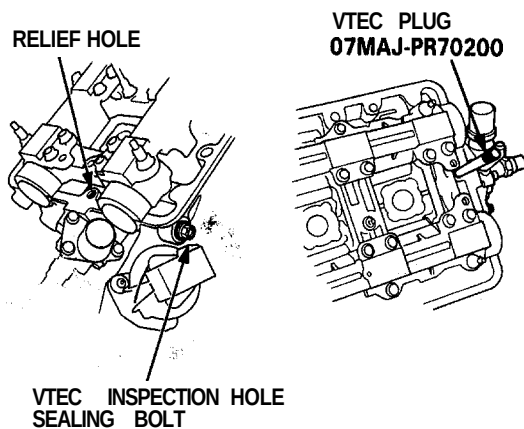
Inspection Using Special Tools

CAUTION:

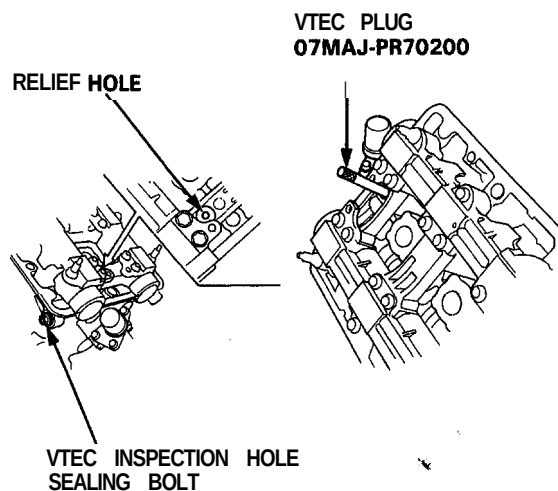
- Before using the special tool (Valve Inspection Set), make sure that the air pressure gauge on the air compressor indicates over 245 kPa (2.5 kg/cm², 36 psi).
- Inspect the valve clearance before rocker arm inspection.
- Cover the timing belt with shop towel to prevent the belt.
- Check the mid rocker arm of each cylinder at TDC.

1. Plug the relief hole with the special tool as shown.

Front cylinder head:

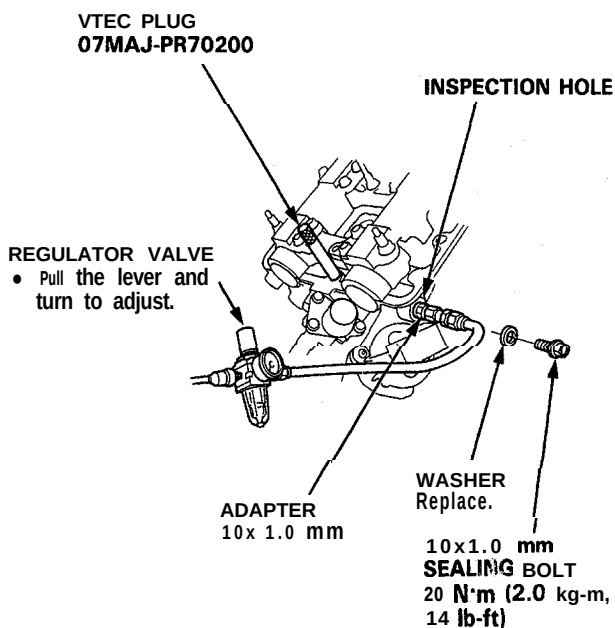


Rear cylinder head:





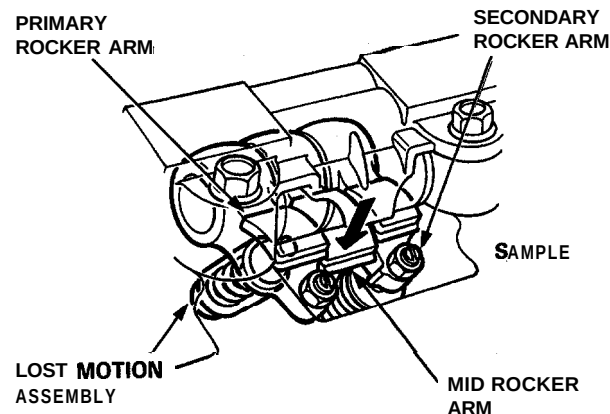
2. Remove the 10 mm sealing bolt and washer from the inspection hole and connect the special tool.



3. Apply specified air pressure to the rocker arm pistons after loosening the regulator valve on the VTEC inspection attachment

Specified Air Pressure:
245 kPa (2.5 kg/cm², 36 psi)
-490 kPa (5.0 kg/cm², 71 psi)

4. Make sure that the primary and secondary rocker arms are mechanically connected by pistons and that the mid rocker arms do not move when pushed manually.



- If the mid rocker arms move independently of the primary and secondary rocker arms, replace the rocker arms as a set.

5. Remove the special tools.

6. Check for smooth operation of the lost motion assembly. It is compressed slightly when the mid rocker arm is lightly pushed and compressed deeply when the mid rocker arm is strongly pushed.

- Replace the lost motion assembly if it does not move smoothly.

After inspection, check that the ECU does not show an error code.

Valve Clearance

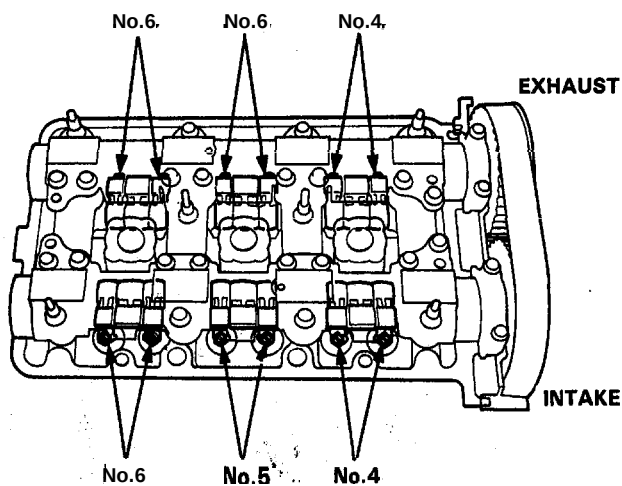
Adjustment

NOTE:

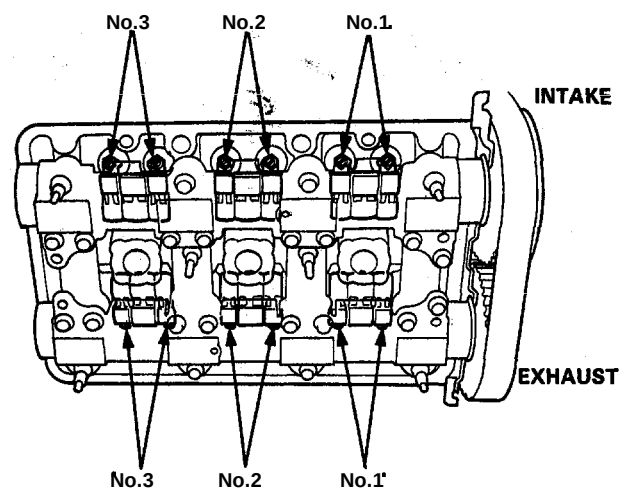
- Valves should be adjusted cold when the cylinder head temperature is less than **38°C (100°F)**.
- Adjustment is the same for both intake and exhaust valves.
- Adjust valve clearance at TDC of each cylinder.

1. Remove the cylinder head covers.

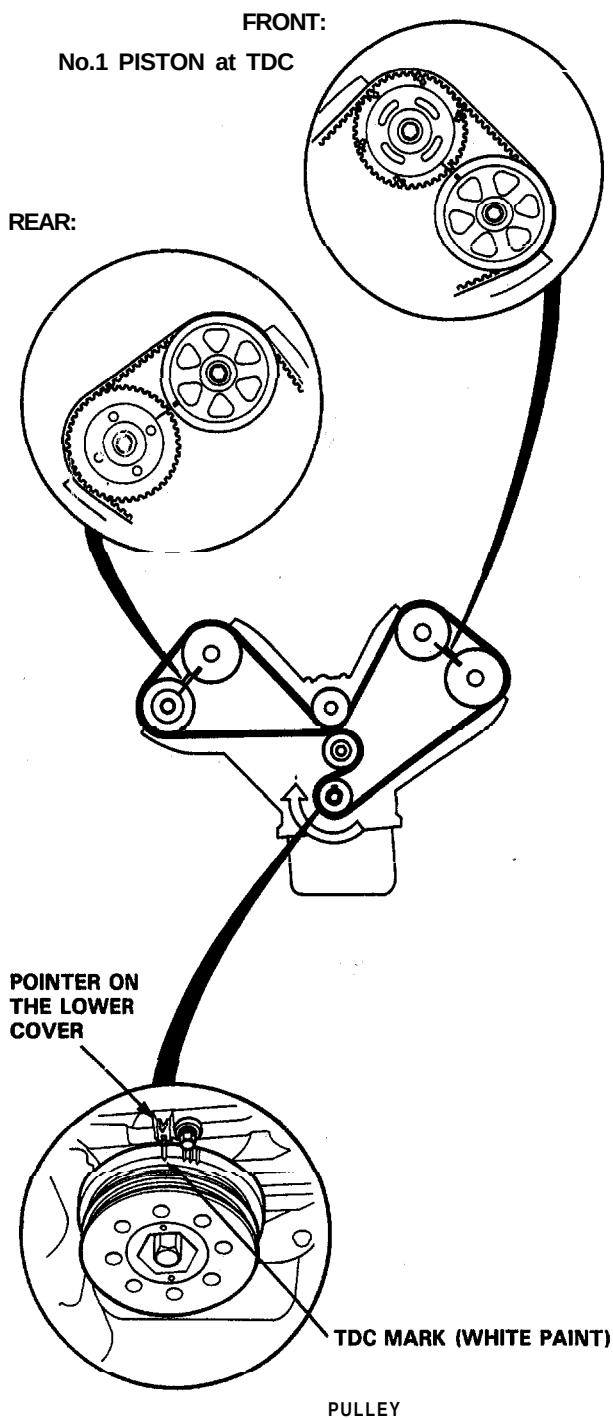
FRONT:



REAR:



2. Rotate crankshaft and set No.1 piston at TDC.
 - TDC mark (white paint) on the crank pulley should align with pointer on the timing lower cover, and TDC grooves on the camshaft pulleys should align with timing belt cover plates.





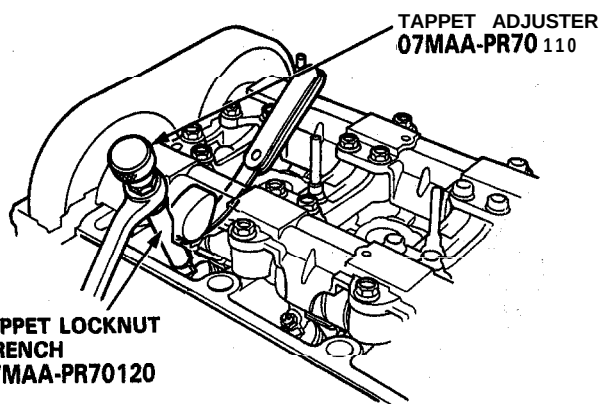
3. Manually inspect the rocker arms for independent operation (page 6-52).
4. Adjust valves on No.1 cylinder.
 - Adjusting screws **are on** primary and secondary rocker arms.

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

Exhaust: 0.17-0.21 mm (0.007-0.008 in)

5. Loosen locknut and turn adjustment screw until feeler gauge slides back and forth with slight amount of drag.

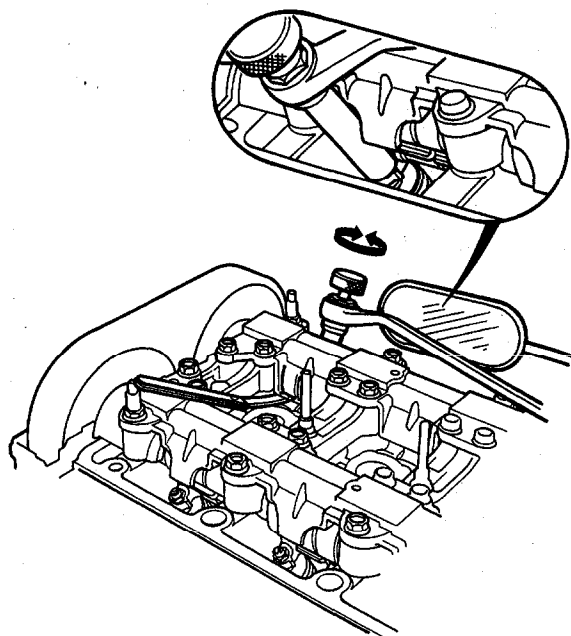
INTAKE:



TAPPET LOCKNUT
WRENCH
07MAA-PR70120

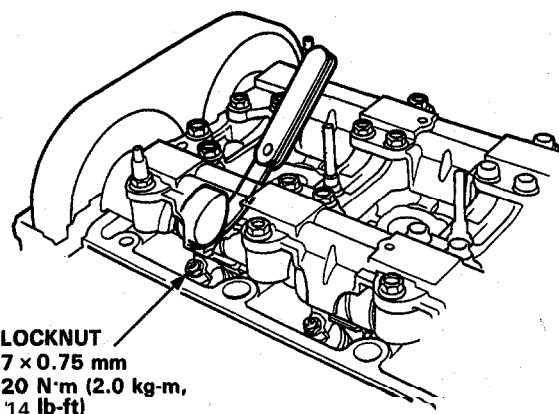
EXHAUST:

NOTE: Use a mirror to check if the special tool is positioned on the locknut correctly.

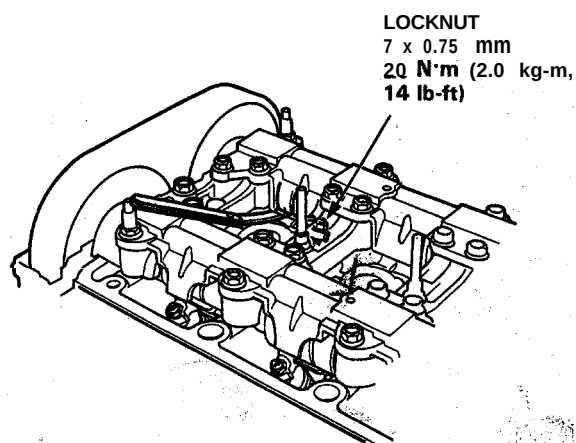


6. Tighten locknut **and check** clearance again. Repeat adjustment if necessary.

INTAKE:



EXHAUST:

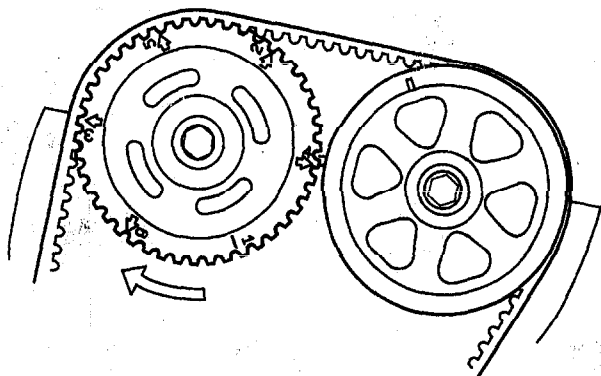


(cont'd)

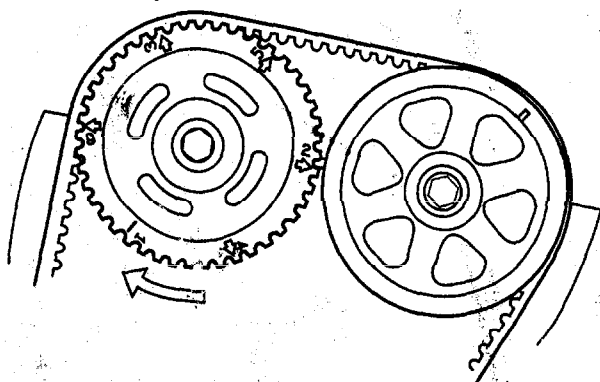
Valve Clearance

<Adjustment (cont'd)

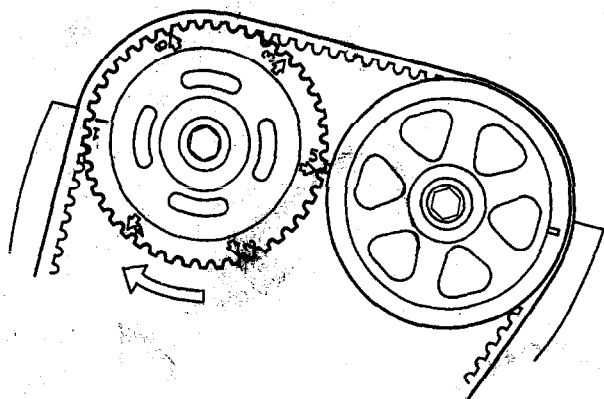
7. Rotate the crankshaft 120° clockwise (cam pulley turns 60°). Check that the front intake cam pulley is positioned as shown.
Repeat step 3 to step 6
Number 4 piston at TDC:



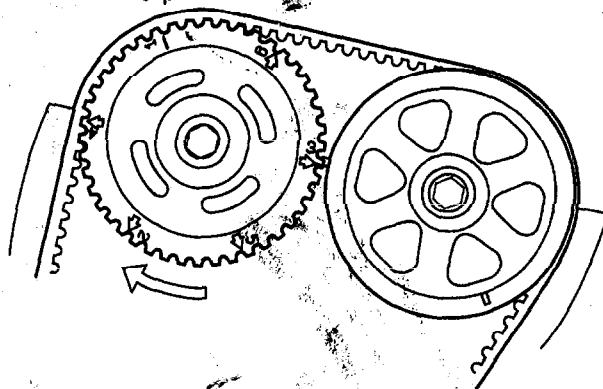
8. Rotate the crankshaft 120° clockwise (cam pulley turns 60°). Check that the front intake cam pulley is positioned as shown.
Repeat step 3 to step 6.
Number 2 piston at TDC:



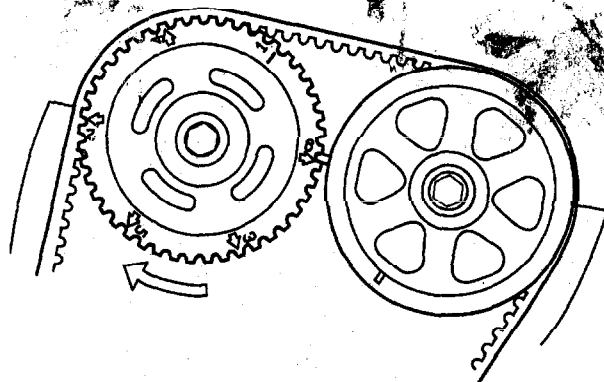
9. Rotate the crankshaft 120° clockwise (cam pulley turns 60°). Check that the front intake cam pulley is positioned as shown.
Repeat step 3 to step 6.
Number 5 piston at TDC:



10. Rotate the crankshaft 120° clockwise (cam pulley turns 60°). Check that the front intake cam pulley is positioned as shown.
Repeat step 3 to step 6.
Number 3 piston at TDC:



11. Rotate the crankshaft 120° clockwise (cam pulley turns 60°). Check that the front intake cam pulley is positioned as shown.
Repeat step 3 to step 6.
Number 6 piston at TDC:



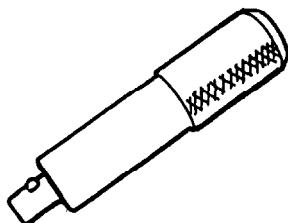
Engine Block

Special Tools	7-2
Illustrated Index	7-3
Flywheel and Drive Plate	7-6
Rod and Main Bearings	7-6
Piston/Connecting Rod Assembly and Crankshaft Removal	7-9
Crankshaft	7-11
Cylinder Block	7-12
Pistons/Connecting Rod Assembly ...	7-12
Piston Rings	7-15
Oil Seal	7-18
Crankshaft Installation	7-18

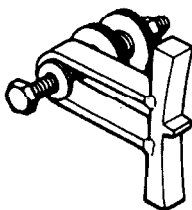


Special Tools

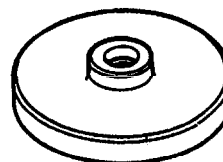
Ref. No.	Tool Number	Description	Q'ty	Page Reference
①	07746-0010000	Driver	1	7-18
②	07924-PD20003	Ring Gear Holder	1	7-6
③	07948-SB00101	Driver Attachment	1	7-18



①



②



③

Engine Block

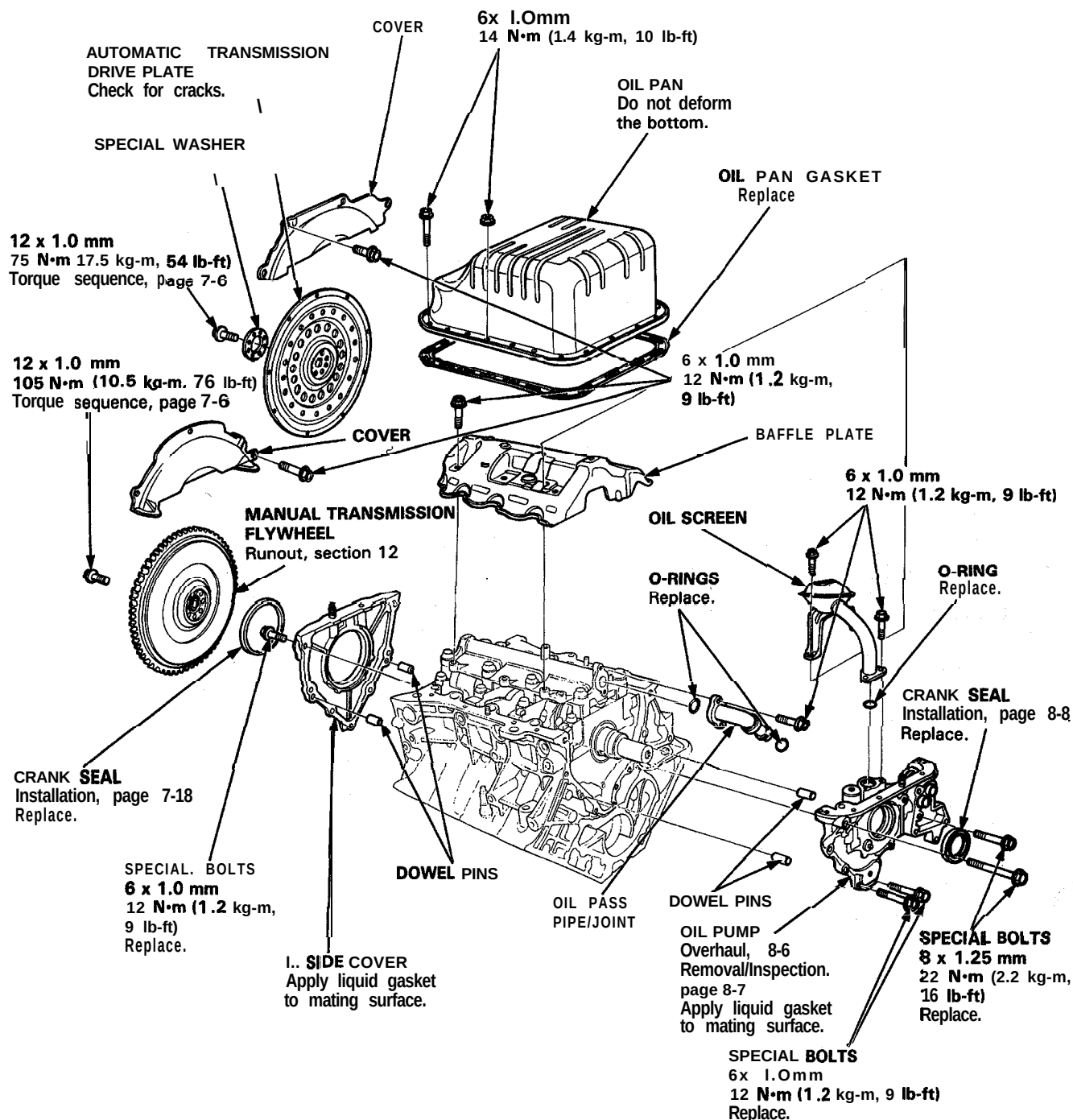
Illustrated Index



Lubricate all internal parts with engine oil during reassembly.

NOTE:

- Apply liquid gasket to the mating surfaces of the left side cover and oil pump case before installing them.
- Use liquid gasket, part No. 08718-550000 OE.
- If the bottom of the oil pan is deformed, it should be repaired or the oil pan should be replaced with new one so as to retain a proper clearance between the screen and the bottom.



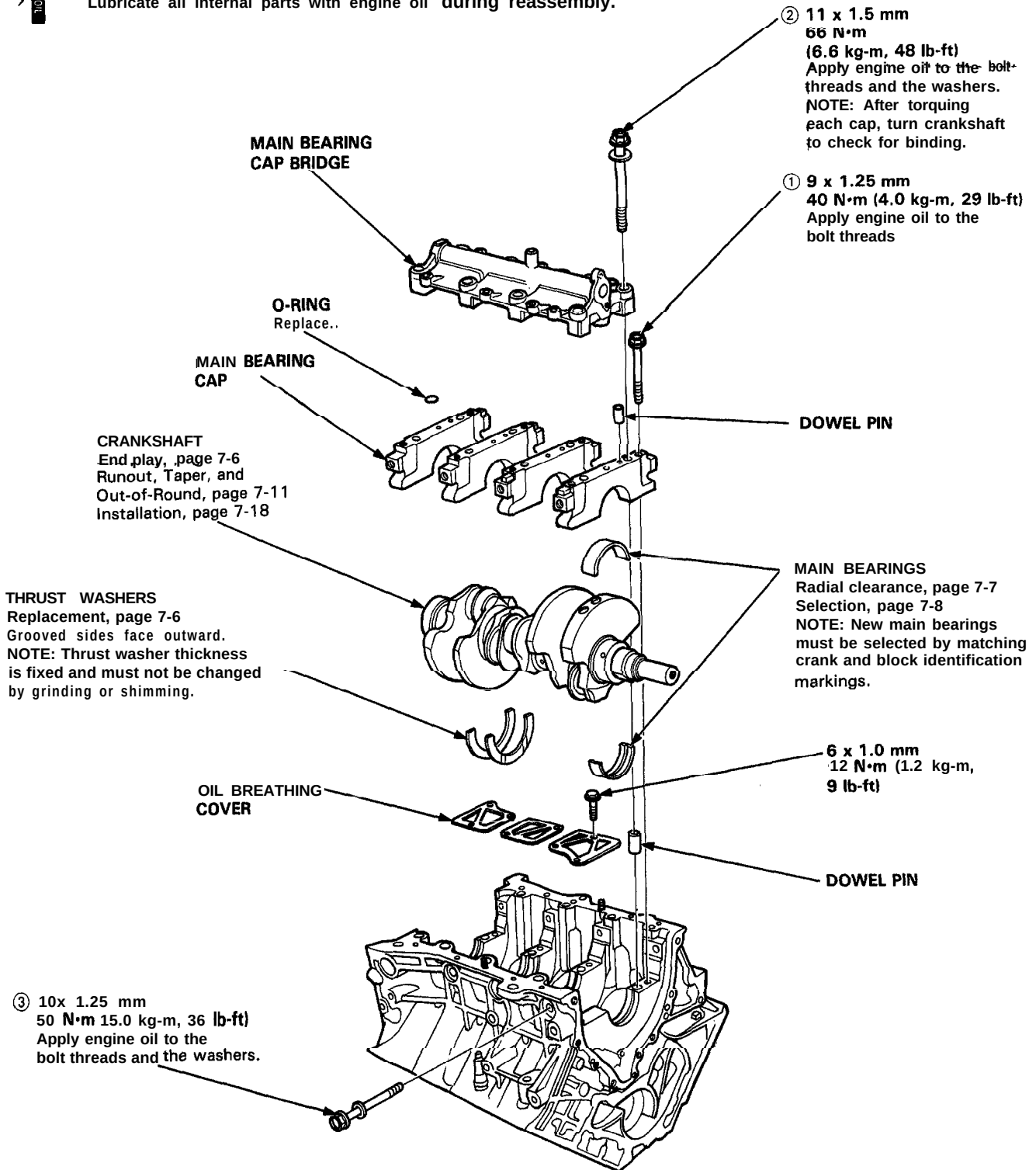
(cont'd)

Engine Block

Illustrated Index (cont'd)

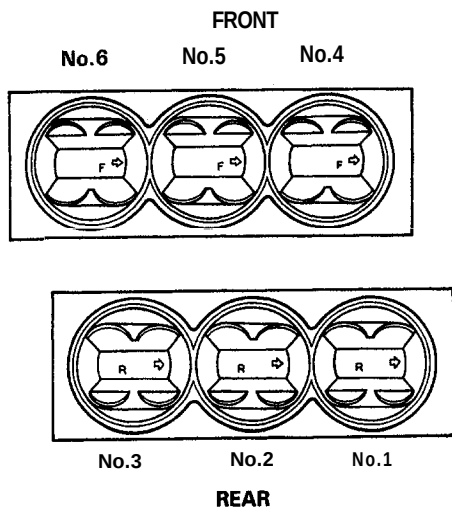


Lubricate all internal parts with engine oil during reassembly.





NOTE: New rod bearings must be selected by matching connecting rod assembly and crankshaft identification markings (page 7-7).



CAUTION:

- The piston skirt is coated with molybdenum; handle the piston carefully to prevent any damage.
- The connecting rods are made of titanium. Attempting to remove the piston pin with conventional shop equipment will damage the connecting rod.
- If the piston, connecting rod, or piston pin require replacement, all three must be replaced as an assembly.

PISTON

Inspection, page 7-1 2

NOTE:

- Before removing piston, inspect the top of the cylinder bore for carbon build-up or ridge. Remove ridge if necessary, page 7-9.
- To maintain proper piston clearance, match the letter on the piston top (No letter denotes A.) with the letter for each cylinder stamped on the block.

CONNECTING ROD ASSEMBLY

End play, page 7-6

Selection, oaae 7-1 4

CONNECTING ROD BEARINGS

Clearance, page 7-7
Selection, page 7-8

PISTON RINGS

Replacement, page 7-1 5
Measurement, pages 7-1 5 and 16
Alignment, page 7-1 6

CONNECTING ROD BOLT

Inspect top of each cylinder bore for carbon build-up or ridge before removing piston.
Remove ridge if necessary, page 7-9

ENGINE BLOCK

Cylinder bore inspection, page 7-13
Warpage inspection, page 7-13
Cylinder bore honing, oaae 7-14

CONNECTING ROD WASHER

CONNECTING ROD CAP NUT

8 x 0.75 mm
20 N·m (2.0 kg-m, 14 lb-ft)
then turn 95°

After torquing each bearing cap, rotate crankshaft to check for binding.

CONNECTING ROD BEARING CAP

Installation, page 7-18

NOTE: Install caps so the bearing recess is on the same side as the recess in the rod.

CYLINDER BORE SIZES

NOTE: To maintain proper piston clearance, match these letters with the letters on the pistons. The letters on the block read from left to right, No. 1 through No. 3 cylinders on the first line and No. 4 through No. 6 cylinders on the second line.



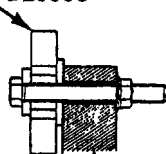
Flywheel and Drive Plate

- Replacement

Manual Transmission:

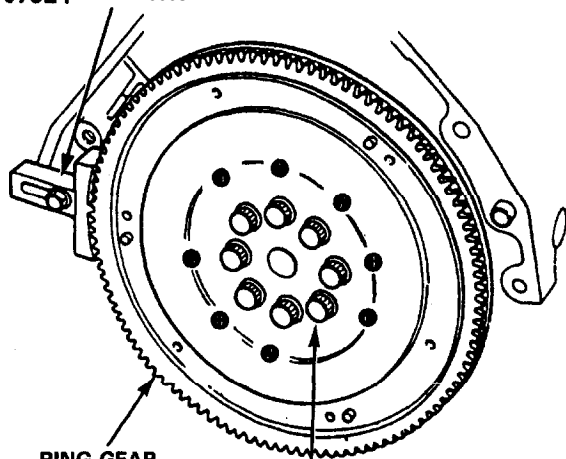
Remove the eight flywheel bolts, then separate the flywheel from the crankshaft flange. After installation, tighten the bolts in the sequence shown.

RING GEAR HOLDER
07924-PD20003



ENGINE
BLOCK

RING GEAR HOLDER
07924-PD20003

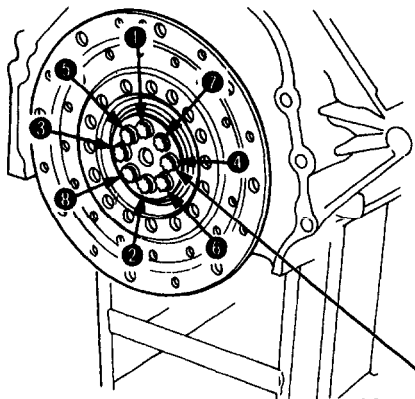


RING GEAR
Inspect ring gear
teeth for wear or
damage.

12x 1.0mm
105 N·m
(10.5 kg-m, 76 lb-ft)

Automatic Transmission:

Remove the eight drive plate bolts, then separate the drive plate from the crankshaft flange. After installation, tighten the bolts in the sequence shown.



12 x 1.0 mm
75 N·m
(7.5 kg-m, 54 lb-ft)

Connecting Rod and Crankshaft

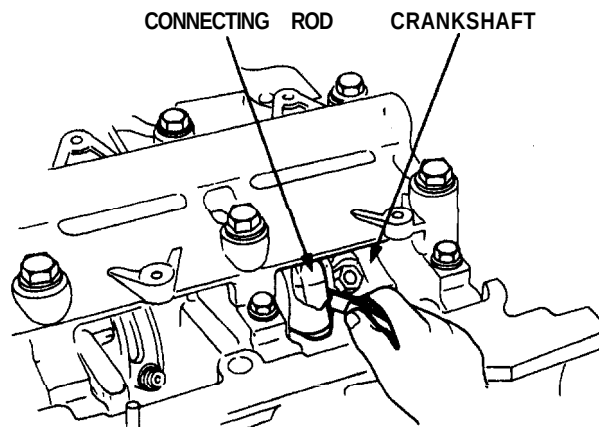
- End Play

Connecting Rod End Play:

Standard (New): 0.15-0.30 mm

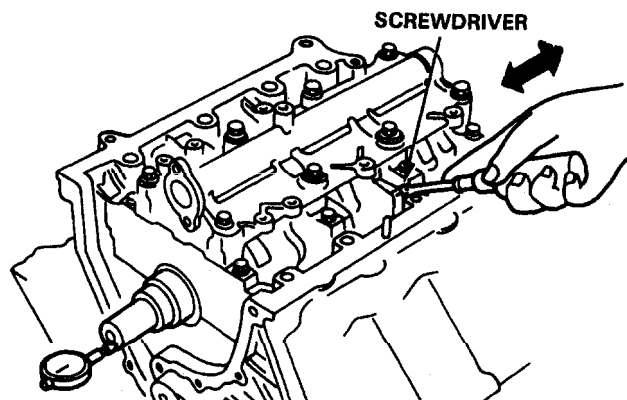
(0.006-0.012 in)

Service Limit: 0.40 mm (0.016 in)



- if out-of-tolerance, install a new connecting rod.
- if still out-of-tolerance, replace the crankshaft (pages 7-9, 10 and 7-1 8).

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



Crankshaft End Play:

Standard (New): 0.10-0.35 mm

(0.004-0.014 in)

Service Limit: 0.46 mm (0.018 in)

- if end play is excessive, inspect the thrust washers and thrust surface on the crankshaft. Replace parts as necessary.

NOTE: Thrust washer thickness is fixed and must not be changed either by grinding or shimming. Thrust washers are installed with grooved side facing outward.



Main Bearings

Clearance

1. To check main bearing clearance, remove the main caps and bearing halves.
2. Clean each main journal and bearing half with a clean shop rag.
3. Place one strip of plastigage across each main journal.

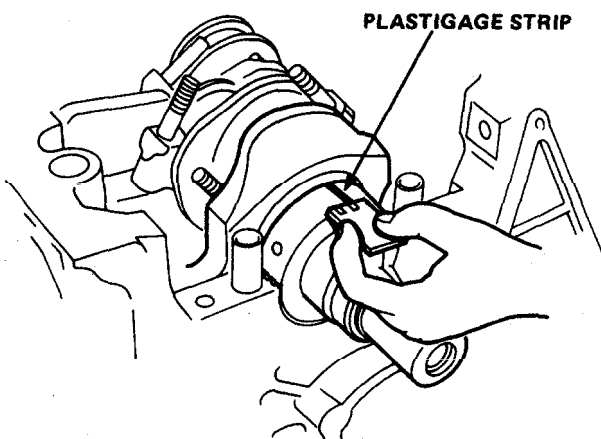
NOTE: If the engine is still in the car when you bolt the main cap down to check clearance, the weight of the crank and flywheel will flatten the plastigage further than just the torque on the cap bolts, and give you an incorrect reading. For an accurate reading, support the crank with a jack under the counterweights and check only one bearing at a time.

4. Reinstall the bearings, caps and cap bridge, then torque the 9 mm bridge bolts to 40 N·m (14.0 kg-m, 29 lb-ft). Torque the 11 mm cap bolts to 66 N·m (6.6 kg-m, 48 lb-ft).
5. Torque the side bolts to 50 N·m (5.0 kg-m, 36 lb-ft).
6. Remove the bridge, caps and bearings, and measure the widest part of the plastigage.

Main Bearing Clearance:

Standard (New): 0.024-0.048 mm
(0.0009-0.0019 in)

Service Limit: 0.05 mm (0.002 in)



If the plastigage measures too wide or too narrow, (remove the engine if it's still in the car), remove the crank, remove the upper half of the bearing, then install a new, complete bearing with the same color code (select the color as shown on next page), and recheck the clearance.

CAUTION: Do not file, shim, or scrape the bearings or the caps to adjust clearance.

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.

NOTE: If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crank and start over.

Rod Bearings

Clearance

1. Remove the connecting rod cap and bearing half.
2. Clean the crankshaft rod journal and bearing half with a clean shop rag.
3. Place plastigage across the rod journal.
4. Reinstall the bearing half and cap, and torque the nuts to 20 N·m (2.0 kg-m, 14 lb-ft), then turn 95° (page 7-19).

NOTE: Do not rotate the crank during inspection.

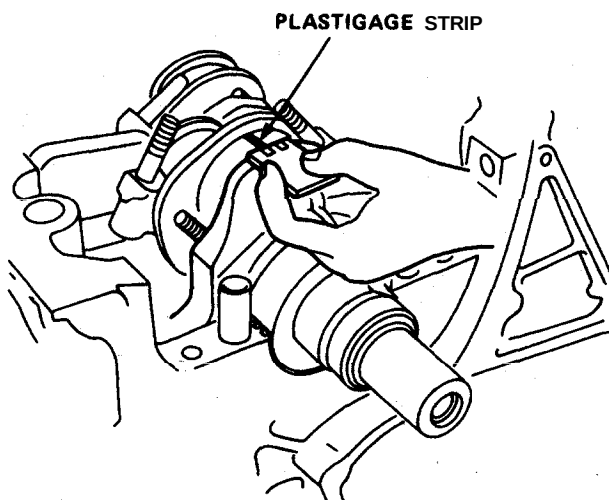
5. Remove the rod cap and bearing half and measure the widest part of the plastigage.

Connecting Rod Bearing Clearance:

Standard (New): 0.04-0.06 mm

10.0016-0.0024 in

Service Limit: 0.06 mm (0.0024 in)



6. 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 (select color as shown on next page), and recheck the clearance.

CAUTION: Do not file, shim, or scrape the bearing or the caps to adjust clearance.

7. If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing (the color listed above or below that one), and check clearance again.

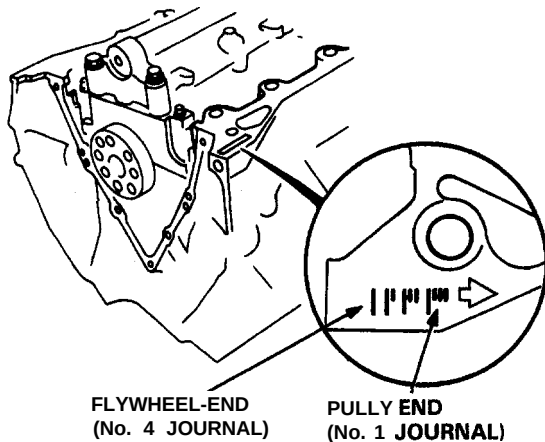
NOTE: If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crank and start over.

Main Bearings

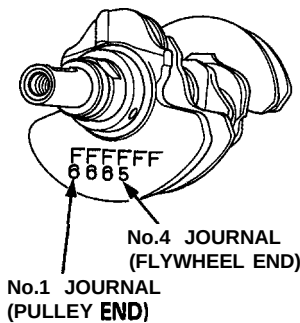
Selection

Crank Bore Code Locations (Letters)

Letters have been stamped on the end of the block as a code for the size of each of the 4 main journal bores. Use them, and the numbers stamped on the crank (codes for main journal size), to choose the correct bearings.



Main Journal Code Locations (Numbers)



Bearing Identification
Color code is on the edge of the bearing

1 or I	Smaller main journal
2 or II	
3 or III	Smaller bearing (thinner)
4 or IV	
5 or V	
6 or VI	

-Larger crank bore
A or I B or II C or III D or IV
-Small bearing (thicker)

Pink	Pink	Yellow	Yellow
Pink	Yellow	Yellow	Green
Yellow	Yellow	Green	Green
Yellow	Yellow	Green	Green
Yellow	Green	Green	Brown
Yellow	Green	Green	Brown
Green	Green	Brown	Brown
Green	Green	Brown	Black
Green	Brown	Black	Black
Brown	Brown	Black	Black

NOTE: When the different color bearing in top and bottom are mated, the color is irrespective of top or bottom.

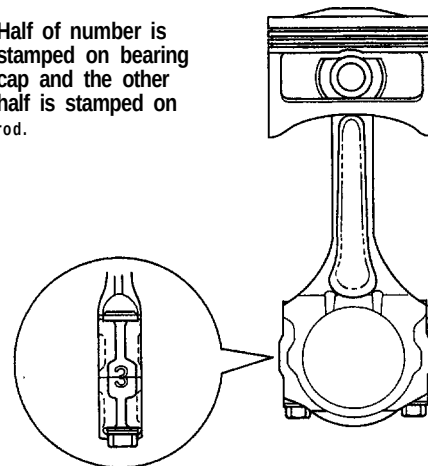
Rod Bearings

Selection

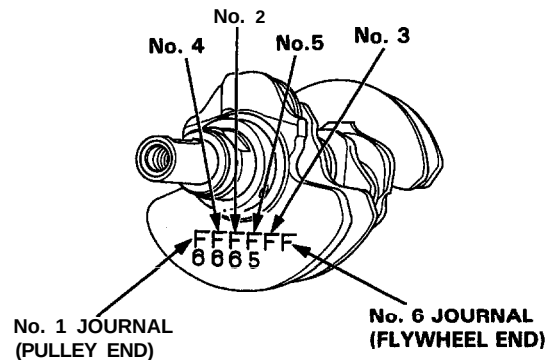
Rod Code Location (Numbers)

Numbers have been stamped on the side of each connecting rod as a code for the size of the big end. Use them, and the letters stamped on the crank (codes for rod journal size), to choose the correct bearings.

Half of number is stamped on bearing cap and the other half is stamped on rod.



Rod Journal Code Locations (Letters)



Bearing Identification

Color code is on the edge of the bearing

A or I	Smaller rod journal
B or II	
C or III	Smaller bearing (thinner)
D or IV	
E or V	
F or VI	

-Larger big end bore
1 2 3 4
-Small bearing (thicker)

Red	Red	Pink	Yellow
Red	Pink	Yellow	Yellow
Red	Pink	Yellow	Green
Pink	Yellow	Yellow	Green
Yellow	Yellow	Green	Brown
Yellow	Yellow	Green	Brown
Yellow	Green	Green	Brown
Yellow	Green	Brown	Brown
Yellow	Green	Brown	Black
Green	Brown	Brown	Black
Green	Brown	Black	Black

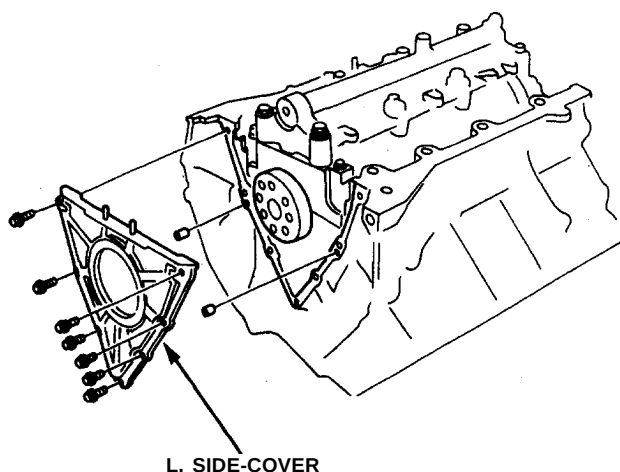
NOTE: When the different color bearing in top and bottom are mated, the color is irrespective of top or bottom.

Piston/Connecting Rod Assemblies and Crankshaft

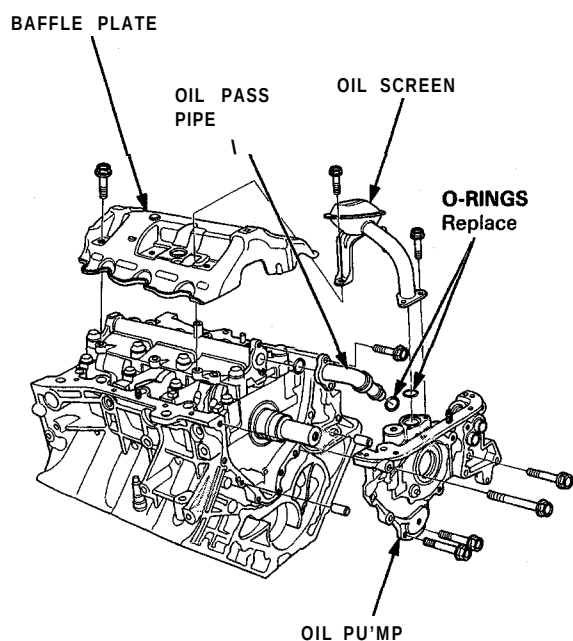


Removal

1. Remove the L. side cover.



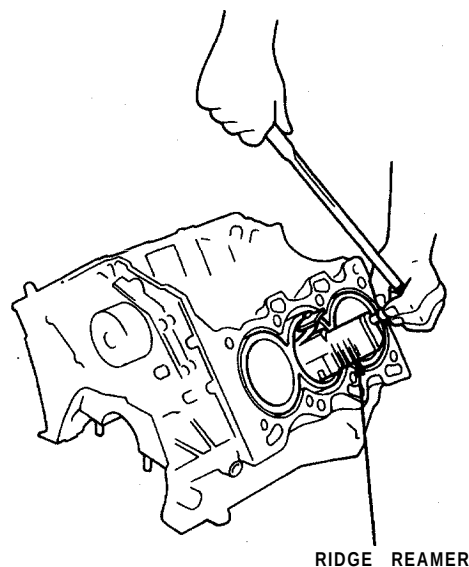
2. Remove the oil screen.



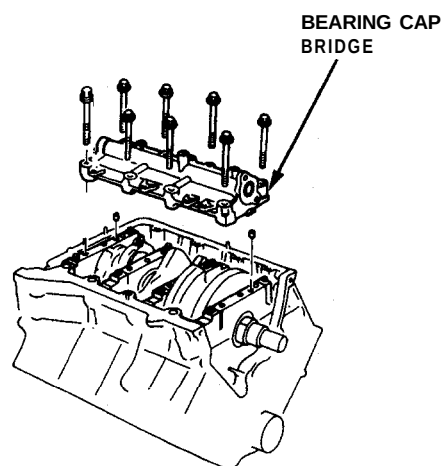
3. Remove the baffle plate.
4. Remove the oil pass pipe and joint.
5. Remove the oil pump.

6. If you can feel a ridge of metal or hard carbon around the top of any cylinder, remove it with a ridge reamer. Follow reamer manufacturer's instructions.

CAUTION: If the ridge is not removed, it may damage the pistons as they are pushed out.



7. Remove the bearing cap bridge.



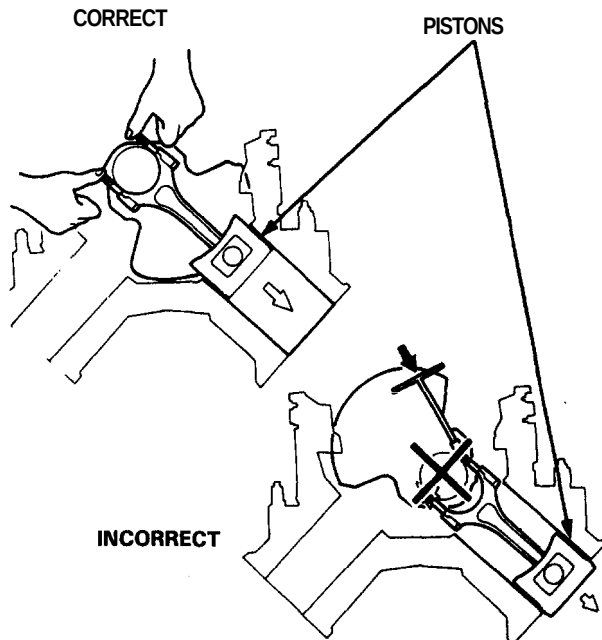
(cont'd)

Piston/Connecting Rod Assemblies and Crankshaft

Removal (cont'd)

- Remove the connecting rod caps after setting the crank pin at the BDC for each cylinder. Remove the piston assembly by pushing on the connecting rod.

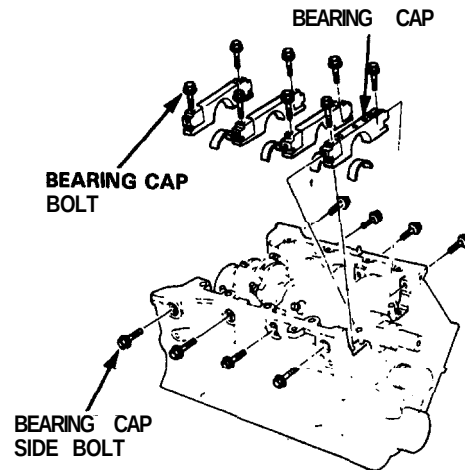
CAUTION: Take care not to damage the crank pin or cylinder with the connecting rod.



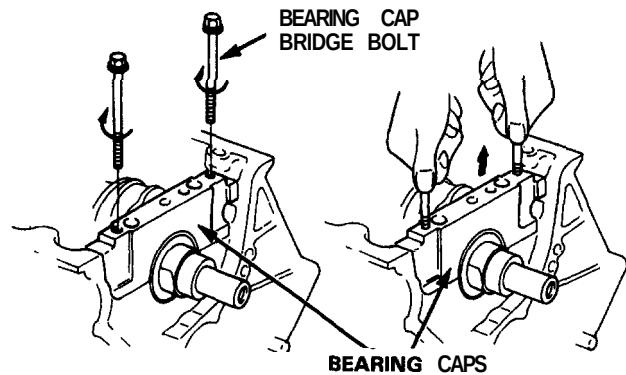
8. Remove the bearing from the cap. Keep all caps/bearings in order.
9. Remove upper bearing halves from connecting rods and set aside with their respective caps.
10. Reinstall the cap on the rod after removing each piston/connecting rod assembly.
11. Mark piston/connecting rod assemblies with cylinder numbers to avoid mixup on reassembly.

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

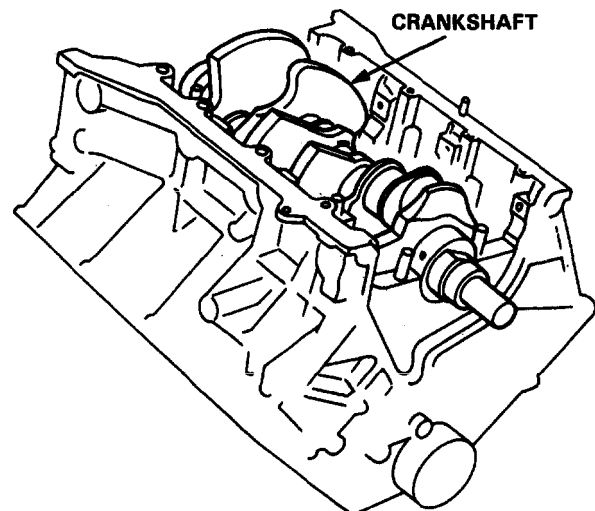
12. Remove the bearing cap bolts and bearing cap side bolts, then remove the bearing caps.



- To help with removal of the caps install the bearing cap bolts in the bearing cap bridge bolt holes.



13. Lift the crankshaft out of engine, being careful not to damage journals.



14. Reinstall main caps and bearings on engine in proper order.



Crankshaft

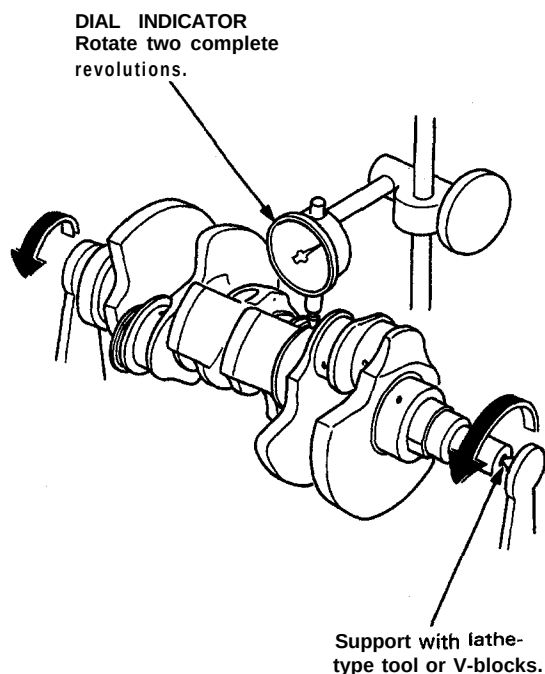
- Inspection

- Clean the crankshaft oil passages with pipe cleaners or a suitable brush.
- Check the keyway and threads.

Alignment

- Measure runout on all main journals to make sure the crank is not bent.
- The difference between measurements on each journal must not be more than the service limit.

Crankshaft Total Indicated Runout:
Standard (New): 0.015 mm (0.0005 in) min.
Service limit: 0.03 mm (0.0012 in)



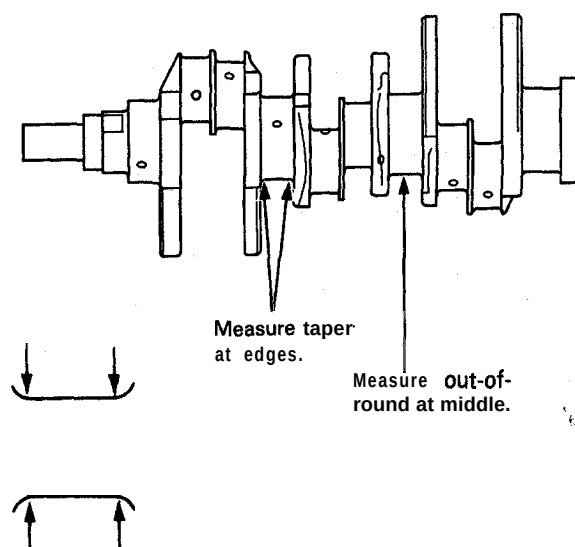
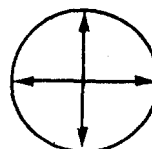
Out-of-Round and Taper

- Measure out-of-round at the middle of each rod and main journal in two places.
- The difference between measurements on each journal must not be more than the service limit.

Jouinal Out-of-Round:

Standard (New): 0.004 mm (0.00016 in) min.

Service Limit: 0.006 mm (0.00024 in)



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

Journal Taper:

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

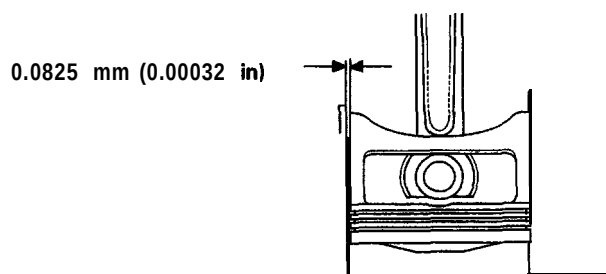
Service Limit: 0.010 mm (0.0004 in)

Cylinder Block

Piston-to-Block Clearance

1. Make a preliminary piston-to-block clearance check with a feeler gauge:

Service Limit: 0.0825 mm (0.0032 in)



If the clearance is near or exceeds the service limit, inspect the piston and cylinder block for excessive wear.

To confirm the feeler gauge check, further measurement with a micrometer will be necessary.

2. Calculate difference between cylinder bore diameter on page 7-13 and piston diameter.

Piston-to-Cylinder Clearance:

Service Limit: 0.0825 mm (0.0032 in)

Pistons

Inspection

1. Check the piston for distortion or cracks.

NOTE: If cylinder is bored, an oversized piston must be used.

2. Measure piston diameter at a point 17 mm (0.67 in.) from bottom of skirt.

NOTE: There are two standard-size pistons (A and B). The letter is stamped on the top of the piston. These letters are also stamped on the block as cylinder bore sizes.

Piston A Diameter

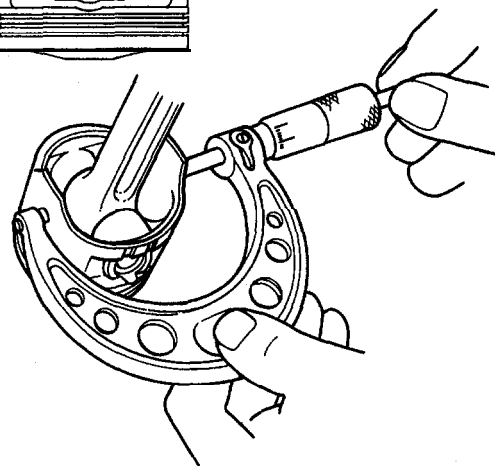
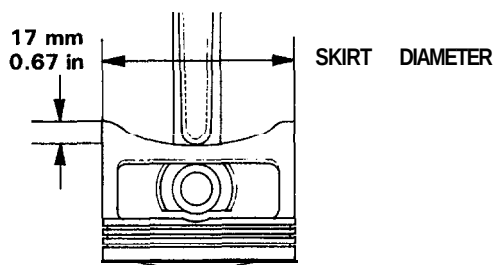
Standard (New): 89.986-90.004 mm
(3.5427-3.5434 in)

Service Limit: 89.97 mm (3.5421 in)

Piston B Diameter

Standard (New): 89.976-89.994 mm
(3.5424-3.5431 in)

Service Limit: 89.96 mm (3.5417 in)



Override Piston Diameter

0.25: 90.226-90.244 mm (3.5522-3.5530 in)

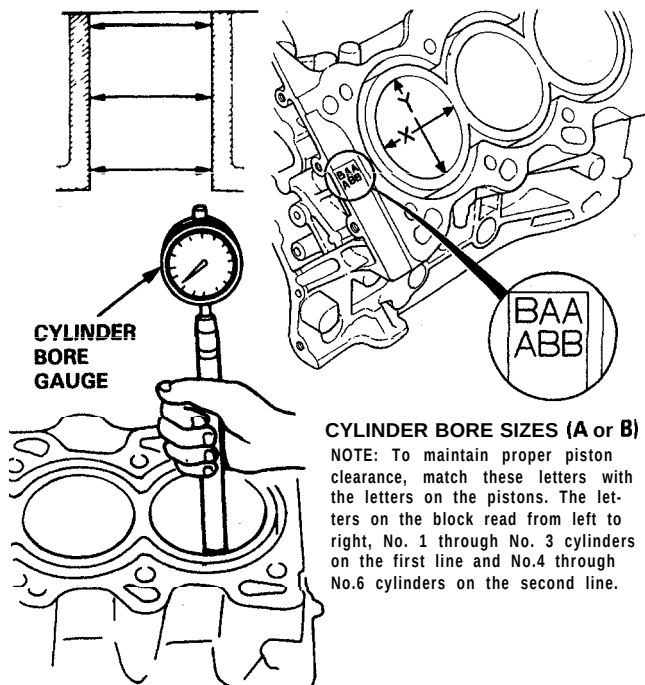
0.50: 90.476-90.494 mm (3.5620-3.5627 in)



Cylinder Block

Inspection

1. Measure wear and taper in directions X and Y at three levels in each cylinder as shown.



Cylinder Bore Size
Standard (New): 90.00—90.02 mm
(3.543-3.544 in)
Service Limit: 90.07 mm (3.546 in)

Oversize
0.25: 90.25-90.27 mm (3.553-3.554 in)
0.50: 90.50-90.52 mm (3.563-3.564 in)

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

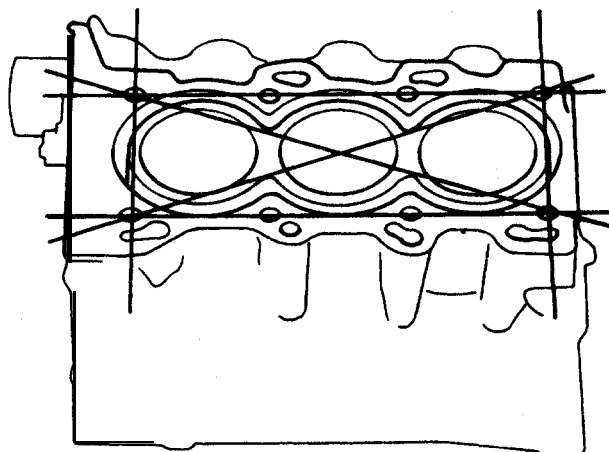
- If measurements in any cylinder are beyond Oversize Bore Service Limit, replace the block.
- If block is to be rebored, refer to Piston Clearance Inspection (page 7-1 2) after reboring.

NOTE: Scored or scratched cylinder bores must be honed.

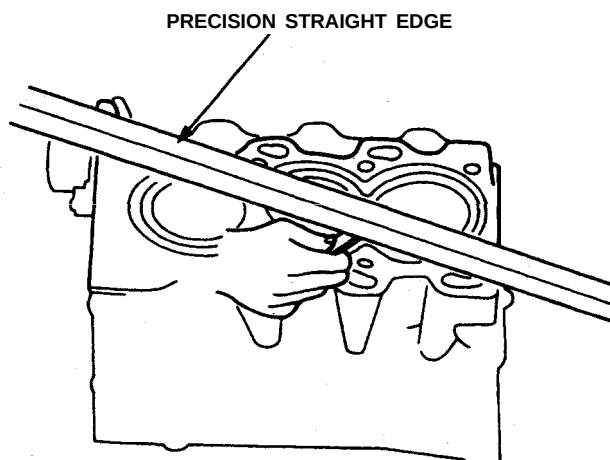
Reboring Limit: 0.50 mm (0.020 in)

2. Check the top of the block for warpage. Measure along the edges and across the center as shown.

SURFACES TO BE MEASURED



Engine Block Warpage:
Standard (New): 0.07 mm (0.003 in)
Service Limit: 0.10 mm (0.004 in)



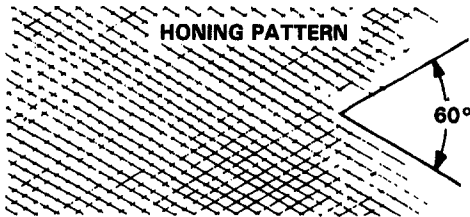
Cylinder Block

• Bore Honing

1. Measure cylinder bores as shown on page 7-13. If the block is to be reused, hone the cylinders and remeasure the bores.
2. Hone cylinder bores with honing oil and a fine (400 grit) stone in a 60 degree cross-hatch pattern.

NOTE:

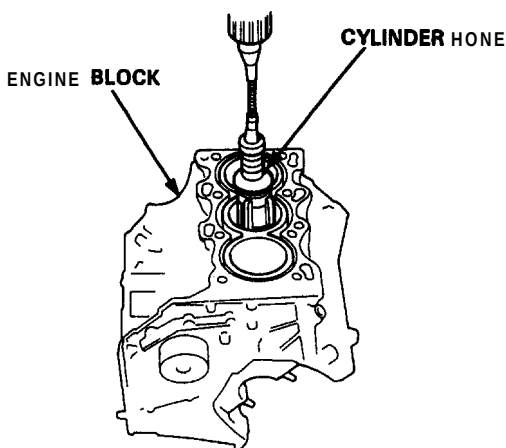
- Use only a rigid hone with 400 grit or finer stone such as Sunnen, Ammco, or equivalent.
- Do not use stones that are worn or broken.



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 the cylinder walls immediately.

NOTE: Never use solvent, it will only redistribute the grit.

4. If scoring or scratches are still present in cylinder bores after honing to service limit, rebore the engine block.



NOTE:

- After honing, clean the cylinder thoroughly with soapy water.
- Only scored or scratched cylinder bores must be honed.

Piston/Connecting Rod Assemblies

• Selection

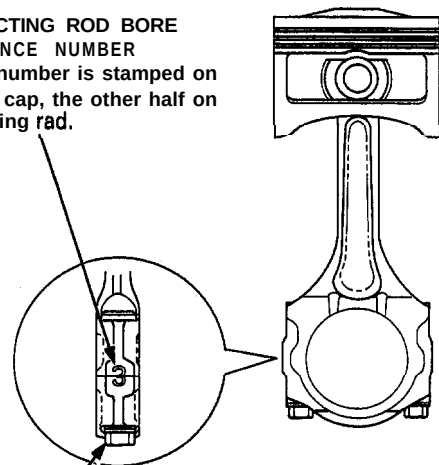
Each rod is sorted into one of four tolerance ranges (from 0 to 0.024 mm, in 0.006 mm increments) depending on the size of its big end bore. It's then stamped with a number (1, 2, 3 or 4) indicating that tolerance. You may find any combination of 1, 2, 3 or 4 in any engine.

Normal Bore Size: 53 mm (2.09 in)

NOTE:

- Reference numbers are for big end bore size and do NOT indicate the position of rod in engine.
- Inspect connecting rod for cracks and heat damage.

**CONNECTING ROD BORE
REFERENCE NUMBER**
Half of number is stamped on
bearing cap, the other half on
connecting rod.



Inspect bolts
and nuts for
stress cracks.



Piston Rings

End Gap

1. Using a piston, push a new ring into the cylinder bore 15–20 mm (0.6–0.8 in.) from the bottom.
2. Measure the piston ring end-gap 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 on page 7-13. If the bore is over limit, the engine block must be rebored.

Piston Ring End-Gap:

Top Ring

Standard (New): 0.25-0.40 mm
(0.010-0.016 in)

Service Limit: 0.60 mm (0.024 in)

Second Ring

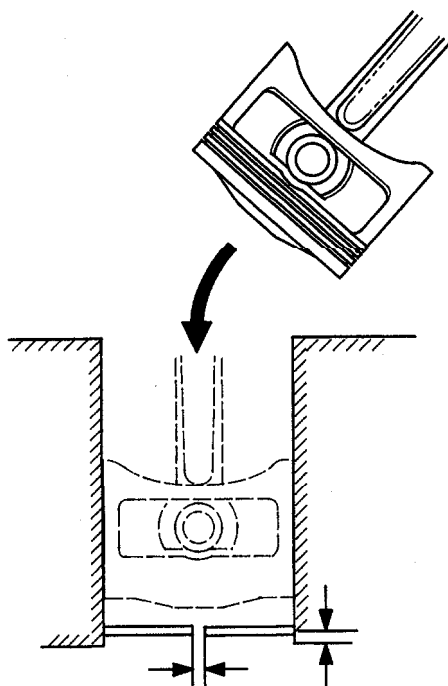
Standard (New): 0.35–0.50 mm
(0.014-0.020 in)

Service Limit 0.75 mm (0.03 in)

Oil Ring

Standard (New): 0.2-0.7 mm (0.008-0.028 in)

Service Limit: 0.8 mm (0.03 in)



Replacement

1. Using ring expander, remove old piston rings.
2. Clean all ring grooves thoroughly.

NOTE:

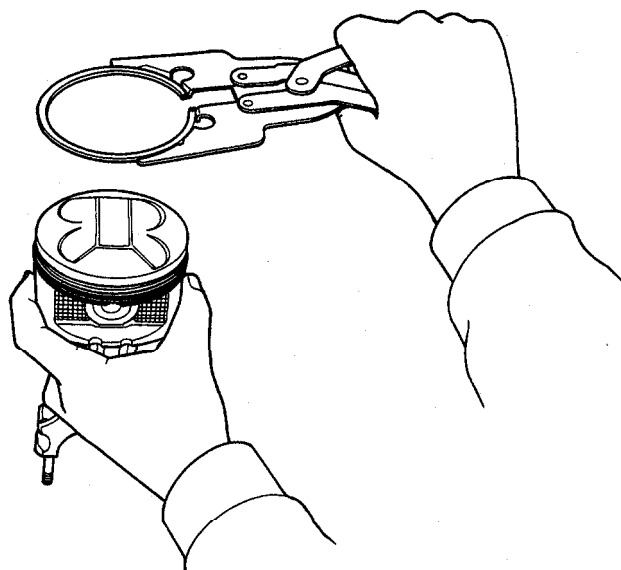
- Use a squared-off broken ring or ring groove cleaner with blade to fit piston grooves.
- Compression ring grooves are 1.2 mm wide and oil ring groove is 2.8 mm wide.
- File down blade if necessary.

CAUTION: Do not use a wire brush to clean ring lands, or cut ring lands deeper with cleaning tool.

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

3. Install new rings in proper sequence and position (page 7-1 6).

NOTE: Do not reuse old piston rings.

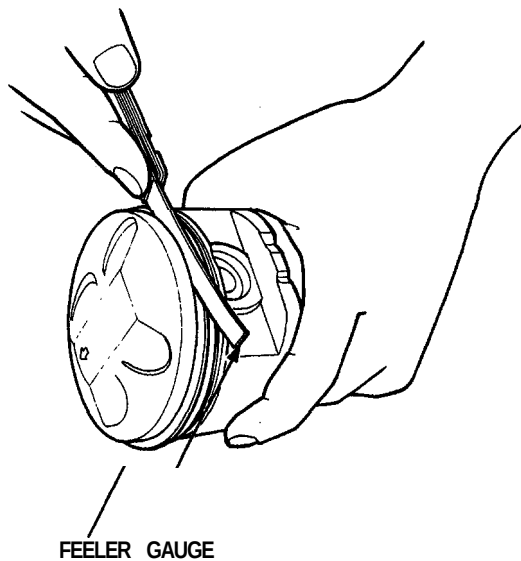


Piston Rings

Land Clearances

After installing a new set of rings, measure ring-to-land clearances:

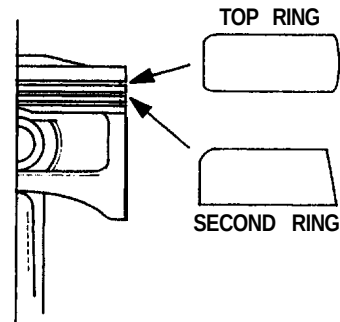
Top and Second Rings Clearance
 Standard (New): 0.030-0.055 mm
 (0.001-0.002 in)
 Service Limit: 0.13 mm (0.005 in)



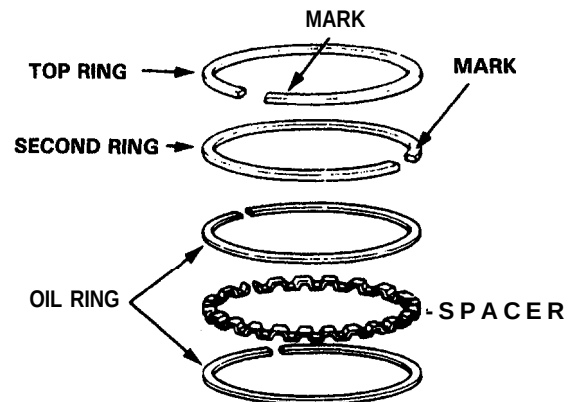
Alignment

1. Install the rings as shown on page 7-I 5.

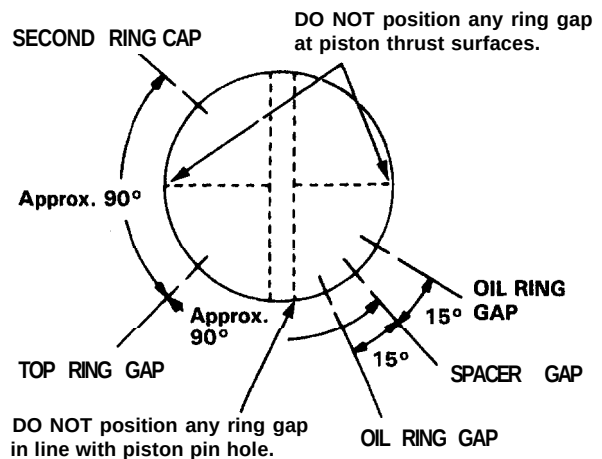
identify top and second rings by the chamfer on the edge, and make sure they are in proper grooves on piston.



2. Rotate the rings in grooves to make sure they do not bind.
3. The manufacturing marks must be facing upward.



4. position the ring end gaps as shown:





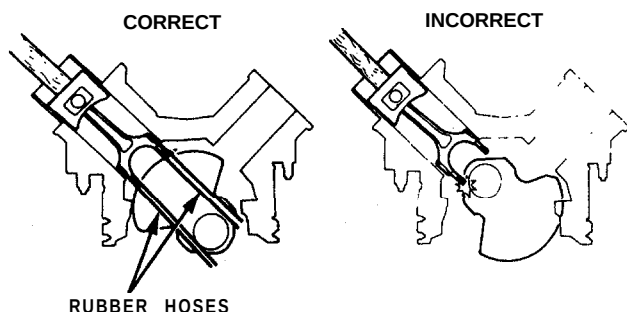
Piston/Connecting Rod Assemblies

Installation

-  Before installing the piston, apply a coat of engine oil to the ring grooves and cylinder bores.

NOTE:

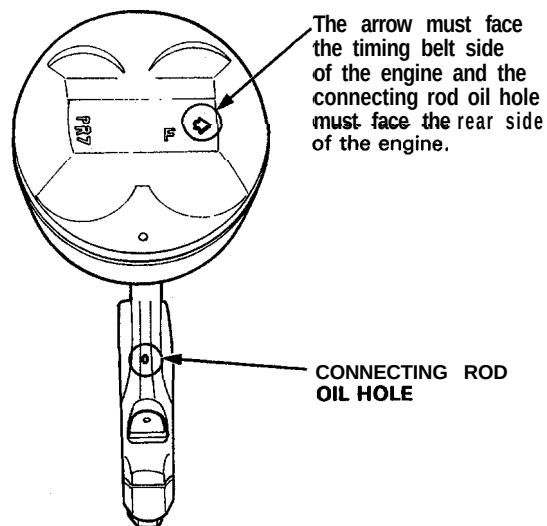
- Guide the piston carefully to prevent damage.
- Fit long rubber hoses (about 30 cm long) to connecting rod bolts to protect the crankshaft.
- Install the pistons after setting the crankshaft to BDC for each cylinder.



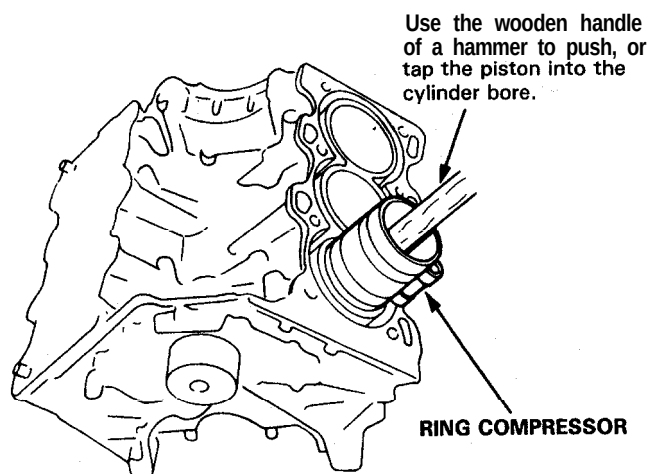
1. If the crankshaft is already installed:
 - Install the piston assemblies in No. 1 and No. 4 cylinders, No. 2 and No. 5 cylinders, and No. 3 and No. 6 cylinder.
 - Remove the connecting rod caps, then slip short sections of rubber hose over the threaded ends of the connecting rod bolts.
 - Install the ring compressor, check that the bearing is securely in place; then position the piston in the cylinder and drive it in using the wooden handle of a hammer.
 - Stop after the ring compressor pops free and check the connecting rod-to-crank journal alignment before driving rod into place.
 - Install the rod caps with bearings, and torque the nuts to 20 N·m (2.0 kg-m, 14 lb-ft), then turn the nut 95 degrees (page 7-19).

2. If the crankshaft is not installed:

- Remove the rod caps and bearings, install the ring compressor, then position the piston in the cylinder and drive it in using the wooden handle of a hammer.



NOTE: Maintain downward force on ring compressor to prevent rings from expanding before entering the cylinder bore.

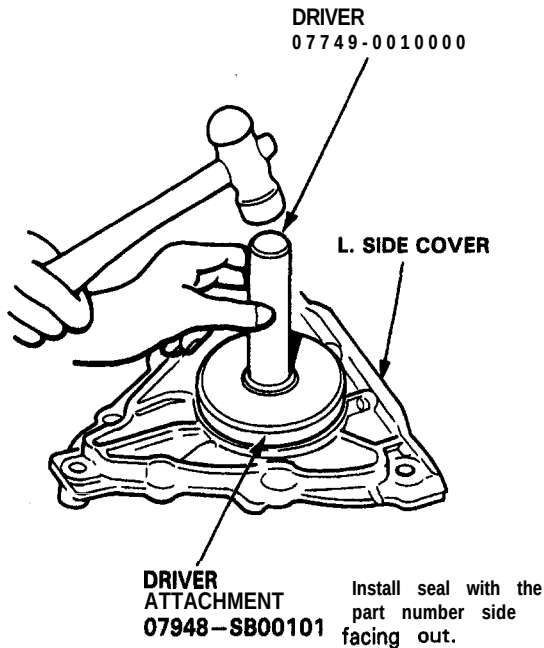


Oil Seal

Installation

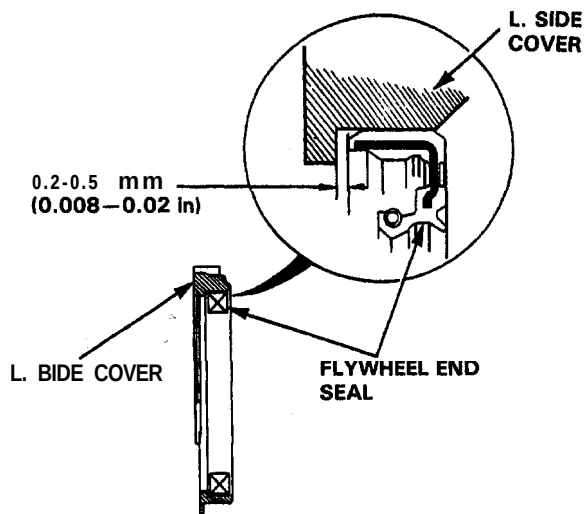
-  The seal surface on the block should be dry. Apply a light coat of oil to the crankshaft and to the lip of seal.

1. Drive in flywheel-end seal until to bottoms against L. side cover.



2. Confirm clearance is equal all the way around, with a feeler gauge.

Clearance: 0.2-0.5 mm (0.008-0.02 in)



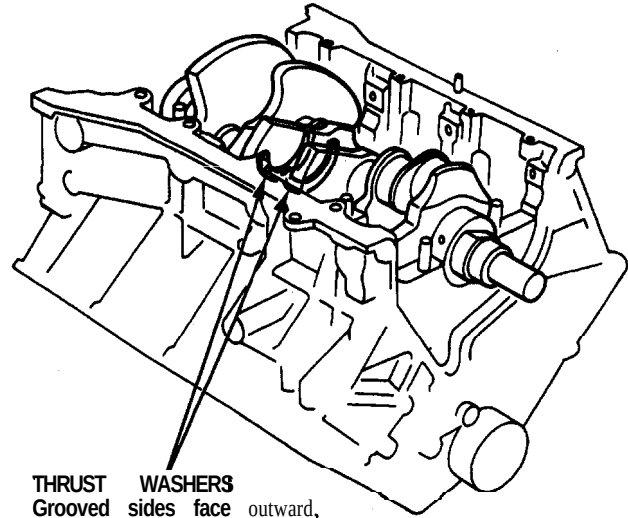
NOTE: Refer to page 8-8 for installation of the oil pump side oil seal.

Crankshaft

Installation

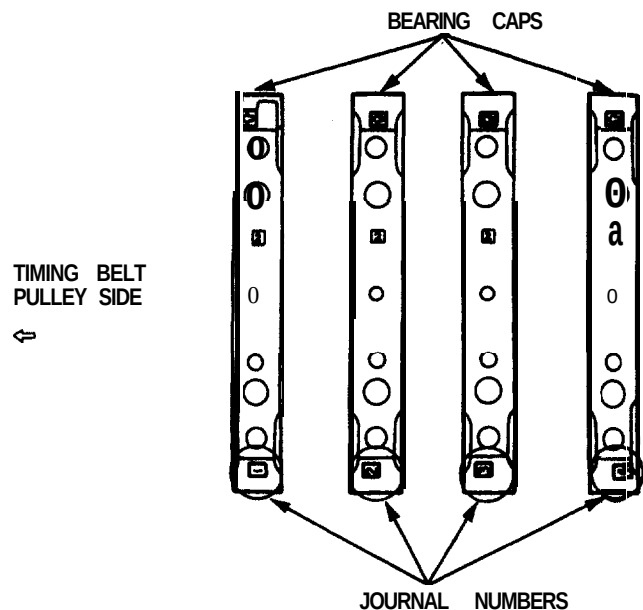
-  Before installing the crankshaft, apply a coat of engine oil to the main bearings and rod bearings.

1. Insert bearing halves in the engine block and connecting rods.
2. Lower the crankshaft into the block.



3. Install the thrust washers on the No. 3 journal. Oil thrust washer surfaces.
4. Install the bearings and caps. Tighten 9 x 1.25 mm cap bolts to the specified torque.

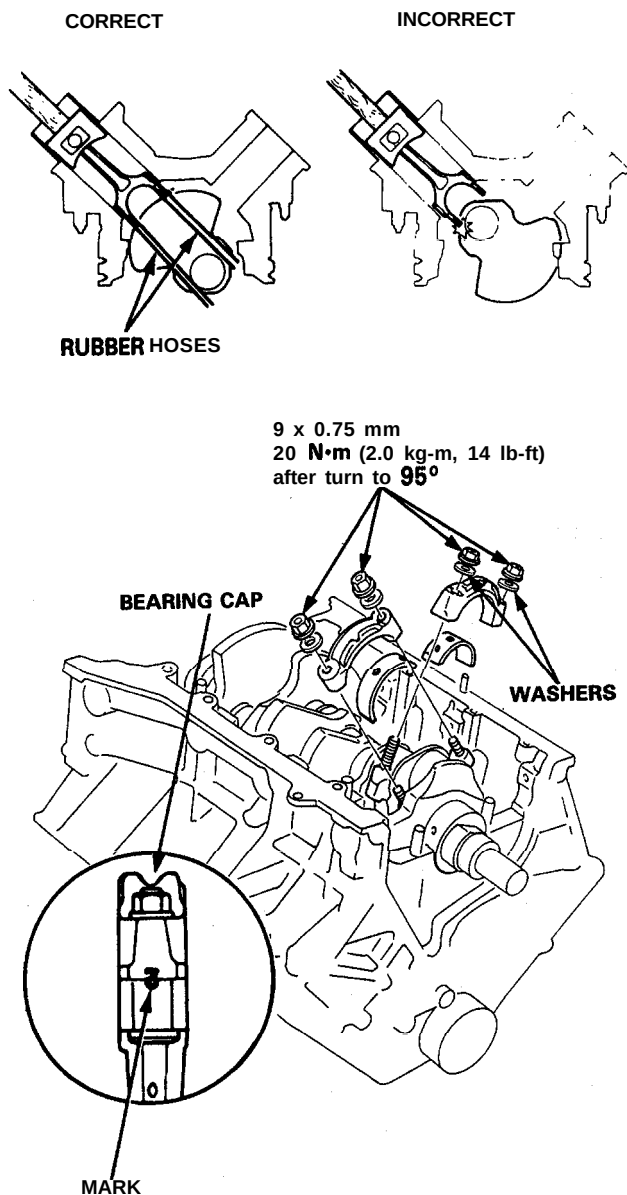
Torque: 40 N·m (4.0 kg-m, 29 lb-ft)





NOTE:

- Guide the piston carefully to prevent damage.
- Fit long rubber noses (about 30 cm long) to connecting rod bolts to protect the crankshaft.
- Install the pistons after setting the crankshaft to BDC for each cylinder.



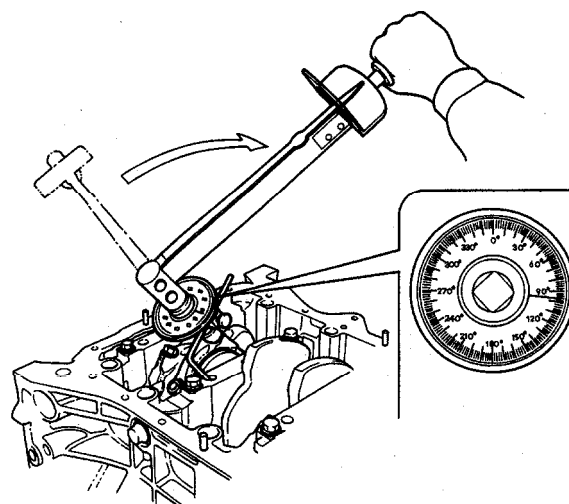
- Line up the marks when installing connecting rod cap.

5. Check the rod bearing clearance with plastigage (page 7-7), then torque the connecting rod cap nuts.

NOTE: Reference numbers on connecting rods are for big-end bore tolerance and do NOT indicate the position of piston in engine.

CONNECTING ROD CAP NUT TORQUING METHOD

- 1) Torque the connecting rod cap nut to 20 N·m (2.0 kg-m, 14 lb-ft) with a beam-type torque wrench.
- 2) Install a torque degree gauge to the cap nut, then turn the cap nut 95 degrees.

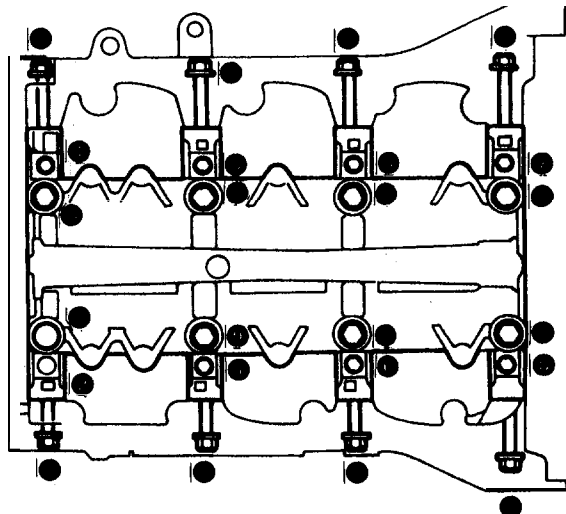


(cont'd)

Crankshaft

Installation (cont'd)

BEARING CAP BOLTS TORQUE SEQUENCE



6. Install the bearing cap bridge, and tighten 11 x 1.5 mm bolts to the specified torque diagonally outward from the center.

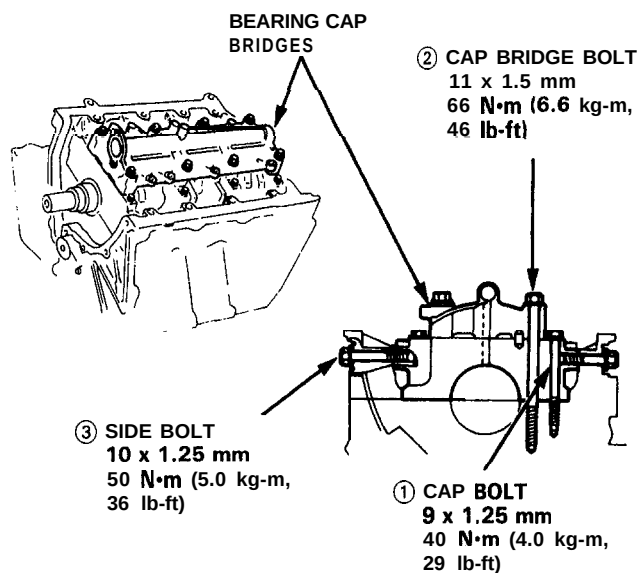
Torque 66 N·m (6.6 kg-m, 48 lb-ft)

7. Tighten cap side bolts (10 x 1.25 mm) to the specified torque.

Torque: 50 N·m (5.0 kg-m, 36 lb-ft)

- Coat the bolt thread and seat surface with engine oil.

NOTE: The shorter side bolts are for the front side.

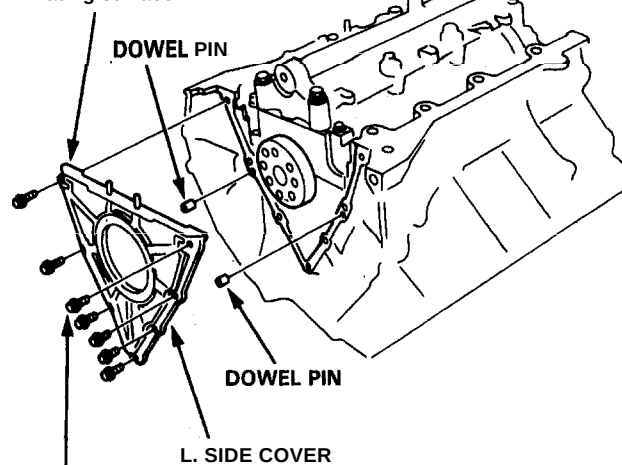


8. Apply liquid gasket to the block mating surface of the left side cover and oil pump case, and install them on the engine block.

NOTE: The seal surface on the block should be dry. Apply a light coat of oil to the crankshaft and to the lip of seal.

LEFT SIDE:

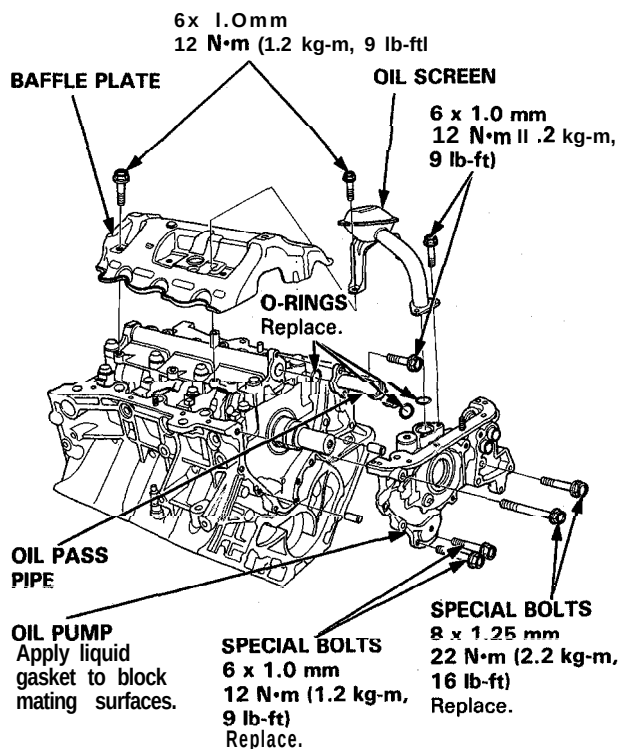
Apply liquid gasket to block mating surface.



SPECIAL BOLTS
6 x 1.0 mm
12 N·m (1.2 kg-m,
9 lb-ft)
Replace.

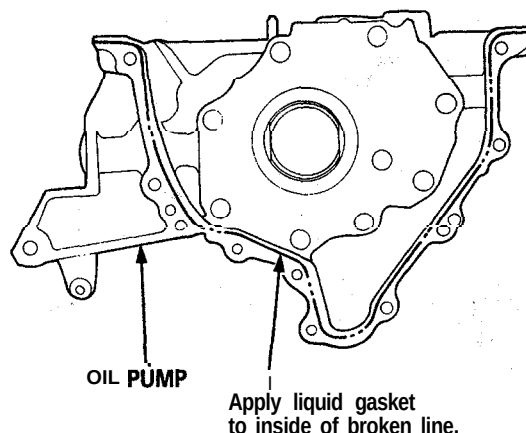
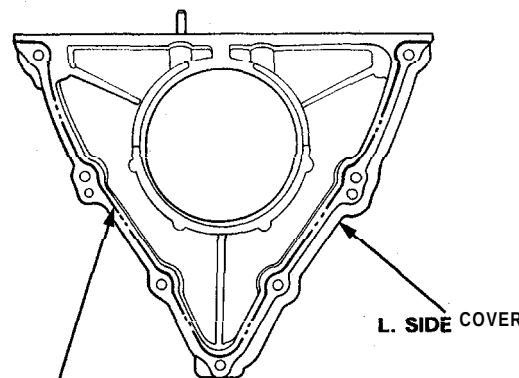


OIL PUMP SIDE:



NOTE:

- Use liquid gasket, Part No. 087 18— 550000 OE.
- Check that the mating surfaces are clean and dry before applying liquid gasket.
- Apply liquid gasket by starting with an even band, centered between edges of the mating surface.
- To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.



- Do not install the parts if 20 minutes or more have elapsed since applying liquid gasket. Instead reapply liquid gasket after removing old residue.
- After assembly, wait at least 30 minutes before filling the engine with oil.

11. Install the oil pass pipe and joint.
12. Install the baffle plate.
13. Install the oil screen.
14. Install the oil pan (page 8-9).

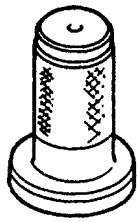
CAUTION: Whenever any crankshaft or connecting rod bearing is replaced, after reassembly, run the engine at idling speed until it reaches normal operating temperature, then continue to run for approximately 15 minutes.

Engine Lubrication

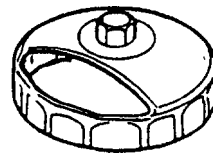
Special Tools	8-2
Illustration Index	8-3
Oil Level Inspection	8-4
Oil Replacement	8-4
Oil Filter Replacement	8-5
Oil Pressure Test	8-5
Oil Pump Illustrated Index	8-6
Oil Pump Removal/Inspection	8-7
Oil Cooler, Oil Filter Base	8-10



Ref. No.	Tool Number	Description	Q'ty	Page Reference
①	07GAD-PH70200	Seal Driver	1	8-8
②	07912-6110001	Oil Filter Socket	1	8-5



①



②

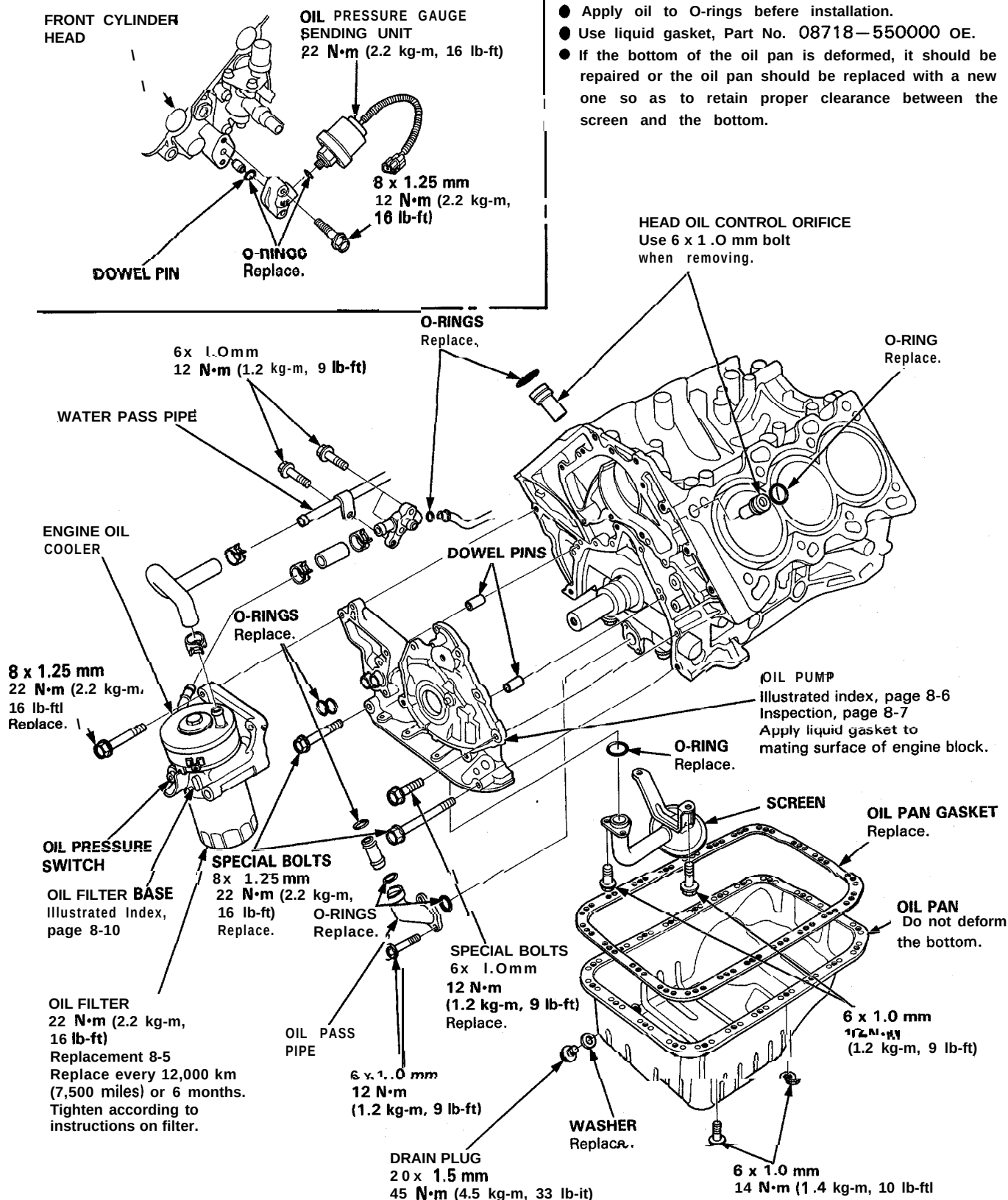


Engine Lubrication

Illustrated Index

NOTE:

- Use new O-rings when reassembling.
- Apply oil to O-rings before installation.
- Use liquid gasket, Part No. 08718—550000 OE.
- If the bottom of the oil pan is deformed, it should be repaired or the oil pan should be replaced with a new one so as to retain proper clearance between the screen and the bottom.

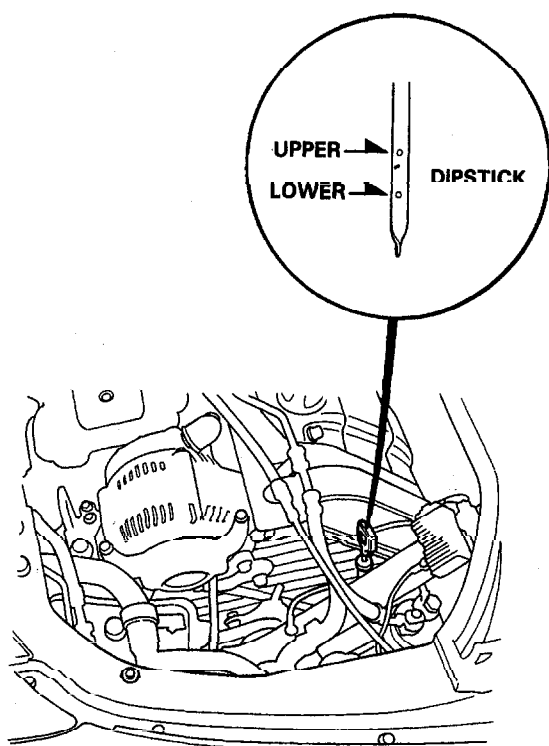


Oil Level

Inspection

1. Check engine oil with the engine off and the car parked on level ground.
2. Make certain that the oil level indicated on the dipstick is between the upper and lower marks.
3. If the level has dropped close to the lower mark, add oil until it reaches the upper mark.

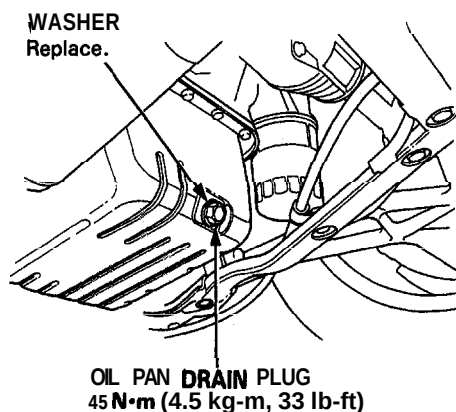
CAUTION: Insert the dipstick carefully to avoid bending it.



Engine Oil

Replacement

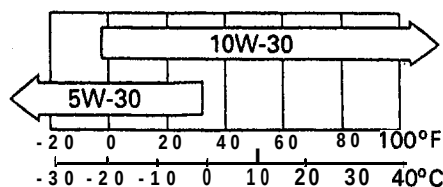
1. Warm up the engine.
2. Drain the engine oil.



3. Reinstall the drain plug with a new washer, and refill with the recommended oil.

Requirement	API Service Grade: SG SAE viscosity: 10 W-30 recommended Fuel Efficient oil: Identified by the words, "Energy Conserving II"
Capacity	5.0 l (5.3 US qt, 4.4 Imp qt) for change, including filter. 6.3 l (6.7 US qt, 5.5 Imp qt) for engine overhaul.
Change	Every 12,000 km (7,500 miles)

Engine Oil Viscosity for Outside Temperature Ranges.



NOTE: Oil filter should be replaced at each oil change.

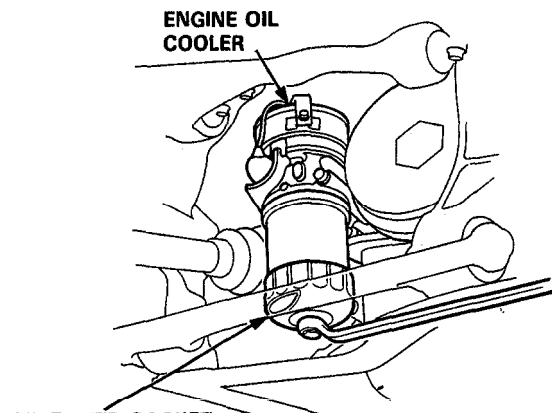


Oil Filter

• Replacement

CAUTION: Loosen the oil filter carefully 'while the engine is hot, the hot oil may cause scalding.

1. Remove the oil filter with the special tool as shown.



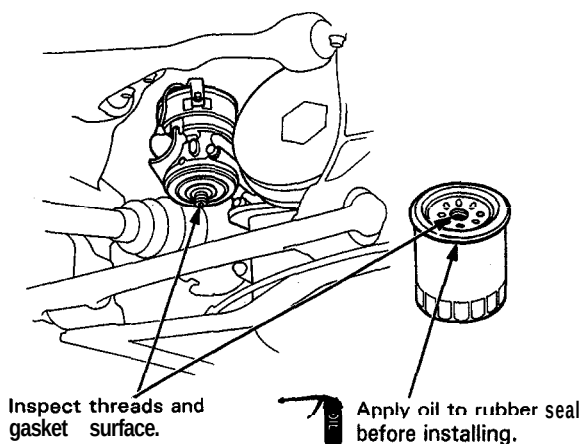
OIL FILTER SOCKET
07912-6110001

Torque: One turn
(22 N·m (2.2 kg-m, 16 lb-ft))

2. Inspect the threads and rubber seal on the new filter. Wipe off seat on oil filter base, then apply a light coat of oil to the rubber seal, and install filter.

3. After rubber seal is seated, tighten the oil filter by turning approximately one turn:

Torque: One turn (22 N·m (2.2 kg-m, 16 lb-ft)).



4. Start the engine and check the filter for oil leakage.

Oil Pressure

• Test

If the oil pressure warning light stays on with the engine running, check the engine oil level. If the oil level is correct:

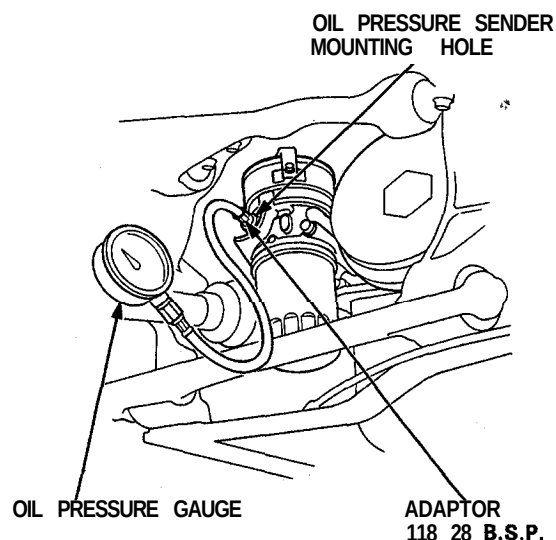
1. Remove the oil pressure sender and install an oil pressure gauge.
2. Start the engine and allow to reach operating temperature (fan comes on at least twice).
3. Pressure should be:

Engine Oil Pressure:

At Idle: 69 kPa (0.7 kg/cm², 10 psi)
minimum

At 3,000 rpm: 343 kPa (3.5 kg/cm², 50 psi)
minimum

- If oil pressure is within specifications, replace oil pressure sender and recheck.
- If oil pressure is NOT within specifications, inspect oil pump (page 8-7).



Oil Pump

Overhaul

NOTE:

- Use new O-rings when reassembling.
- Apply oil to O-rings before installation.

6x 1.0mm
6 N·m (0.6 kg-m, 4 lb-ft)

PUMP COVER
Inspection, page 8-7

PUMP HOUSING
Inspection, page 8-7

OUTER ROTOR
Inspection, page 8-7

INNER ROTOR
Inspection, page 8-7

OIL SEAL
Replace.

SEALING BOLT 16 mm
50 N·m (5.0 kg-m, 36 lb-ft)

WASHER
Replace.

VALVE SPRING

RELIEF VALVE
Valve must slide freely
in housing bore.
If valve is scored,
replace it.

O-RING
Replace.

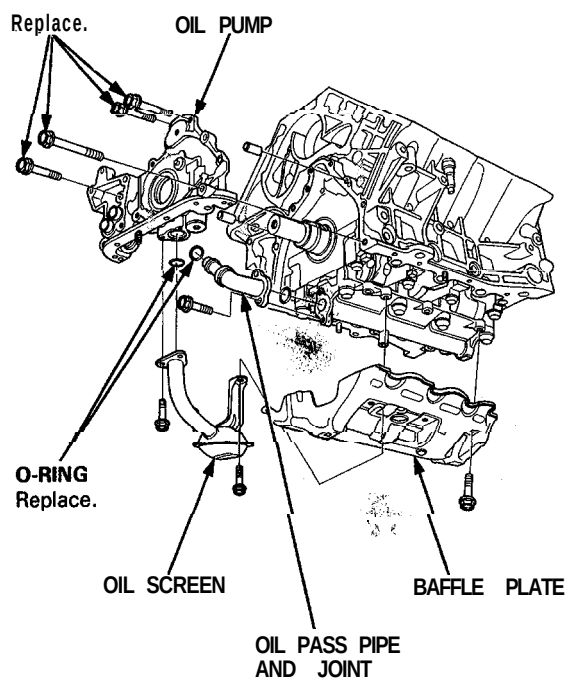
SEALING BOLT 20 mm
40 N·m (4.0 kg-m, 29 lb-ft)



Oil Pump

Removal/Inspection

1. Drain the engine oil.
2. Remove the timing belt (page 6-19).
3. Remove the dipstick and the pipe.
4. Remove the oil filter assembly.
5. Remove the oil pan.
6. Remove the oil screen.
7. Remove the baffle plate.
8. Remove the oil pass pipe and the joint.
9. Remove the mounting bolts and the oil pump assembly.



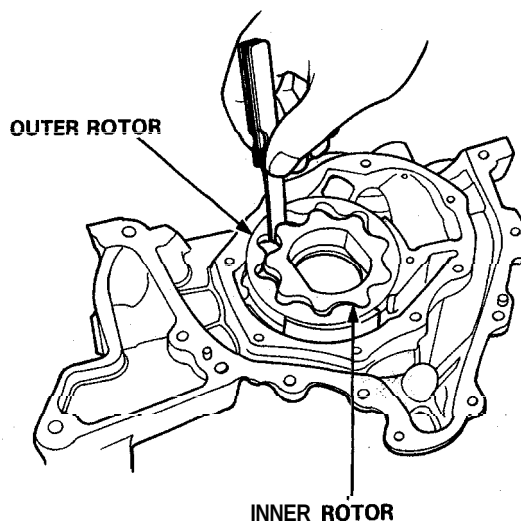
10. Remove the nine screws from the pump housing, then separate the housing and cover.

11. Check the radial clearance on the pump rotor.

Rotor Radial Clearance

Standard (New): 0.02-0.18 mm
(0.0008-0.0071 in)

Service Limit: 0.2 mm (0.008 in)

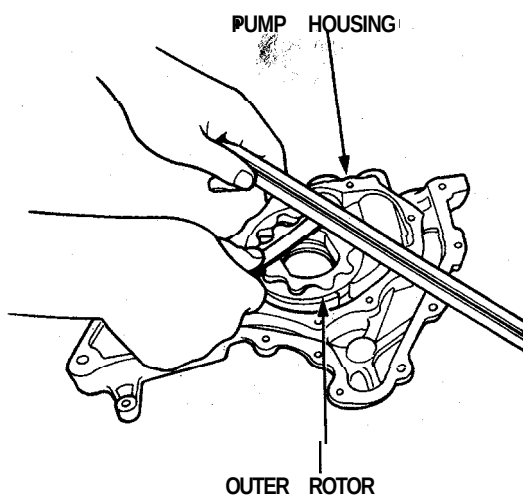


12. Check the axial clearance on the outer pump rotor.

Housing-to-Rotor Axial Clearance

Standard (New): 0.02-0.07 mm
(0.0008-0.0028 in)

Service Limit: 0.12 mm (0.005 in)



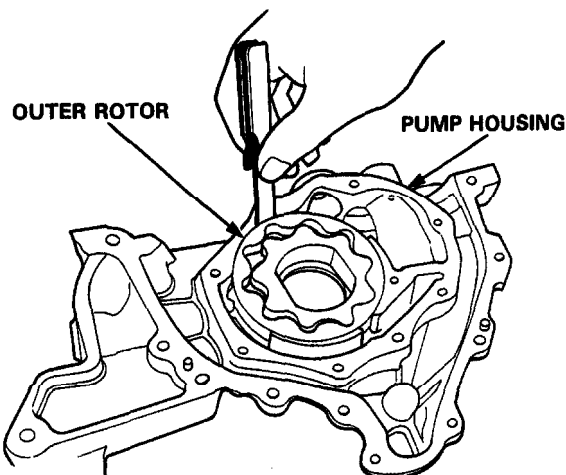
(cont'd)

Oil Pump

Removal/Inspection (cont'd)

13. Check the radial clearance between the housing and the outer rotor.

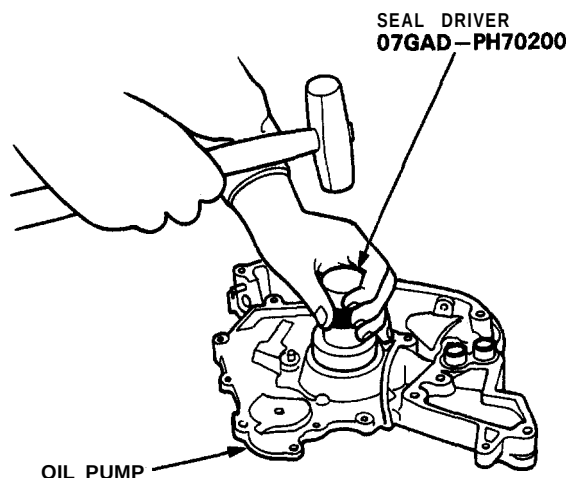
Housing-to-Rotor	Radial	Clearance
Standard (New):	0.10-0.19 mm	
	(0.0008-0.0075 in)	
Service Limit:	0.2 mm (0.008 in)	



14. Inspect both rotors and pump housing for scoring or other damage. Replace oil pump assembly if necessary.

15. Remove the old oil seal from the oil pump.

16. Using special tool, gently tap in the new oil seal until the tool bottoms on the pump.



17. Reassemble the oil pump, applying liquid thread-lock to the pump housing screws.

18. Check that the oil pump turns freely.

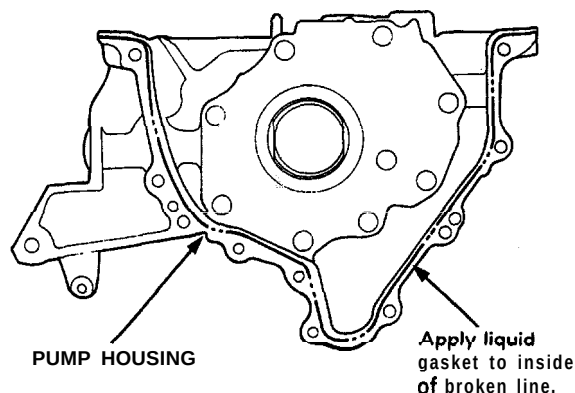
19. Apply a light coat of oil to the seal lip.

20. Install the two dowel pins and new O-ring on the cylinder block.

21. Apply liquid gasket to the cylinder block mating surface of the oil pump.

NOTE:

- Use liquid gasket, Part No. 08718-550000 OE.
- Check that the mating surfaces are clean and dry before applying liquid gasket.
- Apply liquid gasket evenly, in a narrow bead centered on the mating surface.
- To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.



- Do not install the parts if 20 minutes or more have elapsed since applying liquid gasket. Instead reapply liquid gasket after removing old residue.
- After assembly, wait at least 30 minutes before filling the engine with oil.

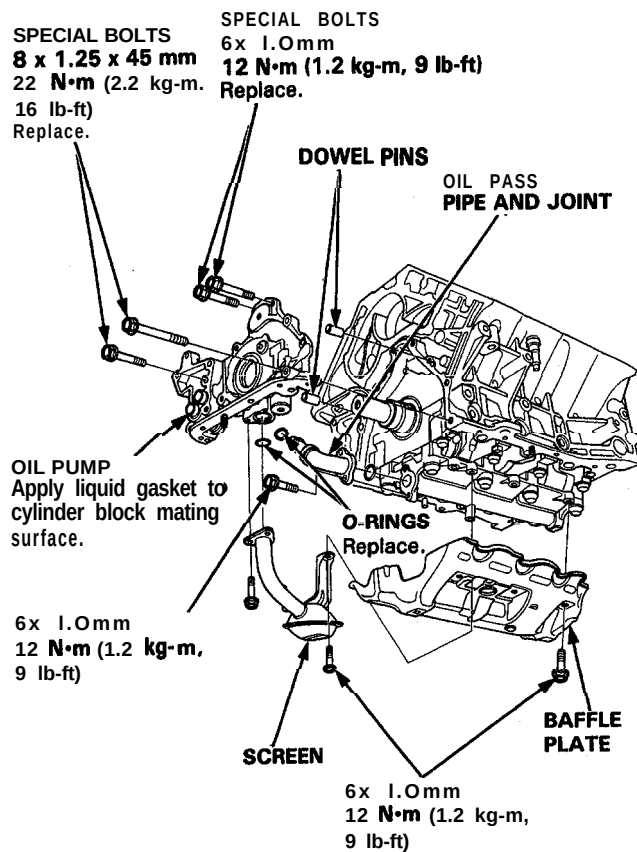


22. Install the oil pump on the cylinder block.

23. Install the oil pass pipe and the joint.

24. Install the baffle plate.

25. Install the oil screen.

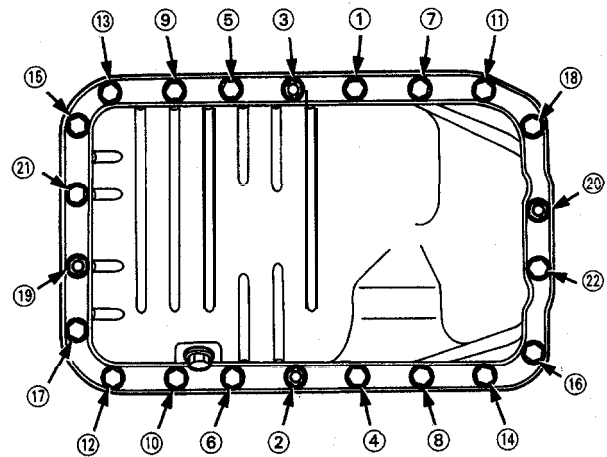


26. Install the oil pan and gasket.

NOTE:

- Use the new gasket.
- If the bottom of the oil pan is deformed, it should be repaired or the oil pan should be replaced with a new one so as to retain proper clearance between the screen and the bottom.

OIL PAN BOLTS and NUTS TORQUE SEQUENCE

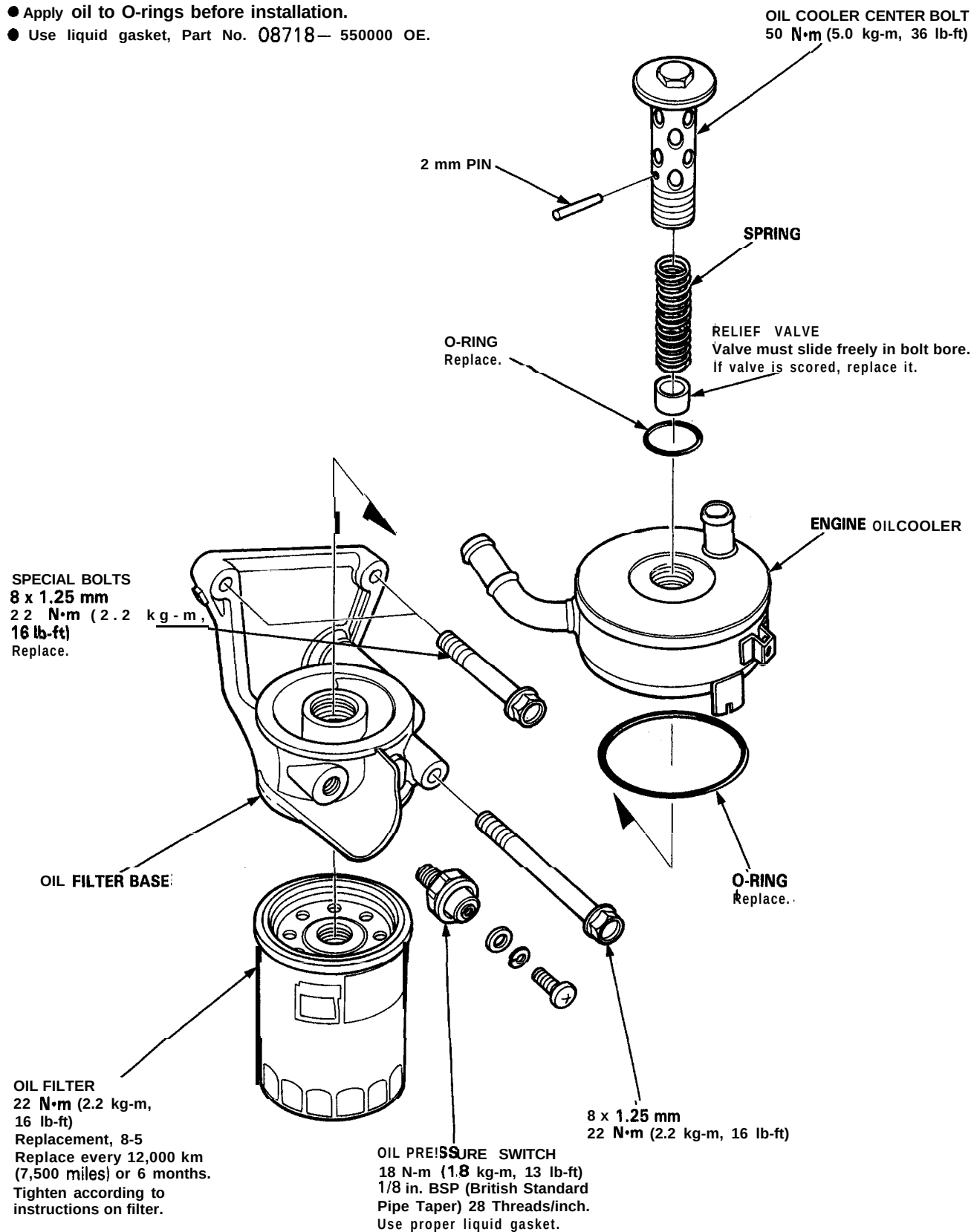


Oil Cooler, Oil Filter Base

Illustrated Index

NOTE:

- Use new O-rings when reassembling.
- Apply oil to O-rings before installation.
- Use liquid gasket, Part No. 08718— 550000 OE.



Intake Manifold/Exhaust System

Intake Manifold 9-2

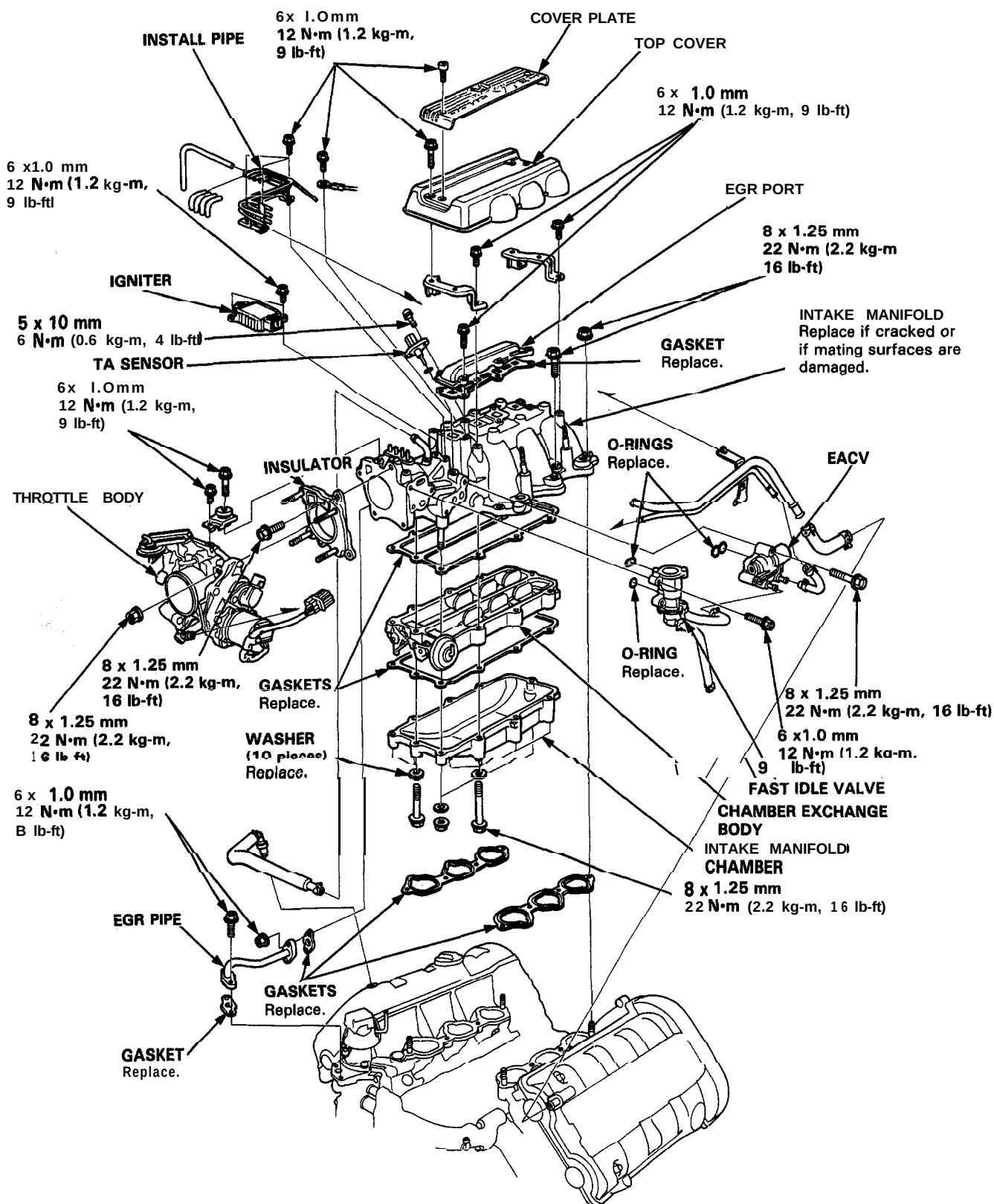
Exhaust Manifold 9-3

Exhaust Pipe and Muffler 9-4



Intake Manifold

Illustrated Index



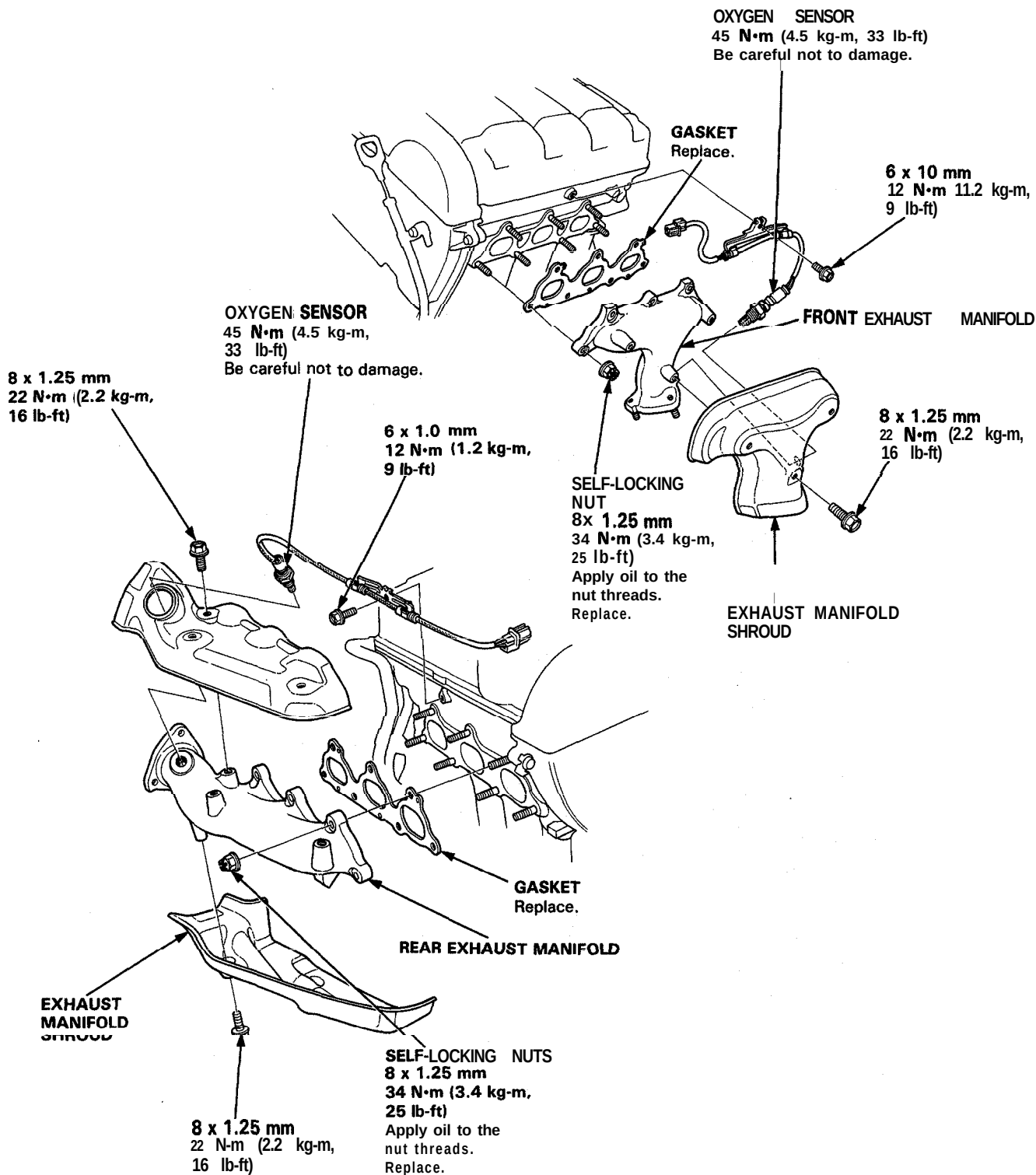
Exhaust Manifold



Illustrated Index

CAUTION:

- Remove the oxygen sensors before removing the exhaust manifolds.
- Do not use air wrench or hammer to **remove** or install the exhaust manifolds if the oxygen sensors are not to be removed.
- Install the oxygen sensors after installing the exhaust manifolds.

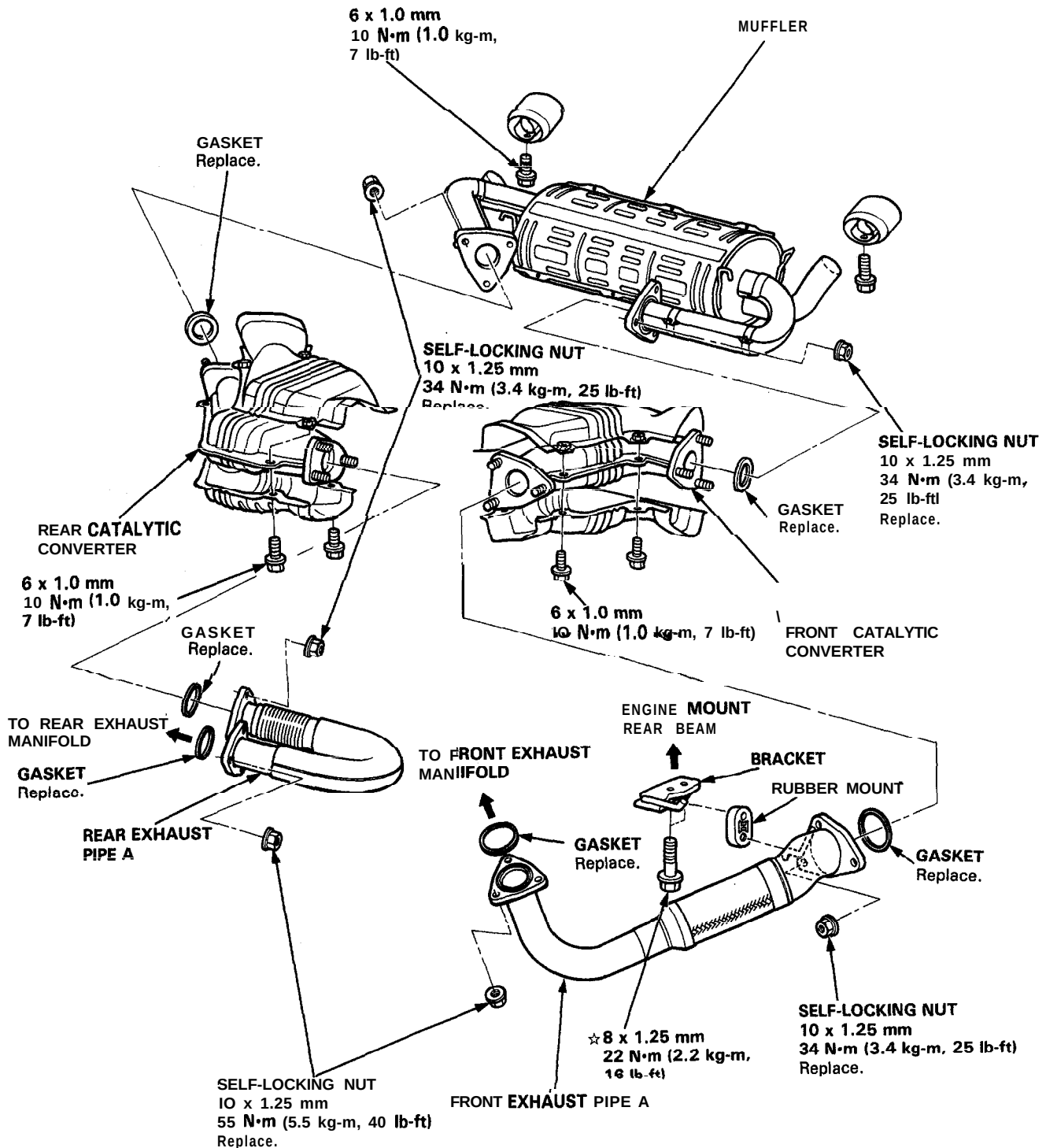


Exhaust Pipe and Muffler

Illustrated Index

CAUTION:

- Remove the oxygen sensors before removing the exhaust pipes.
- Do not use air wrench or hammer to disconnect or connect the exhaust manifolds and the exhaust pipes if the oxygen sensors are not to be removed.
- Install the oxygen sensors after installing the exhaust pipes.



☆ : CORROSION RESISTANT BOLT