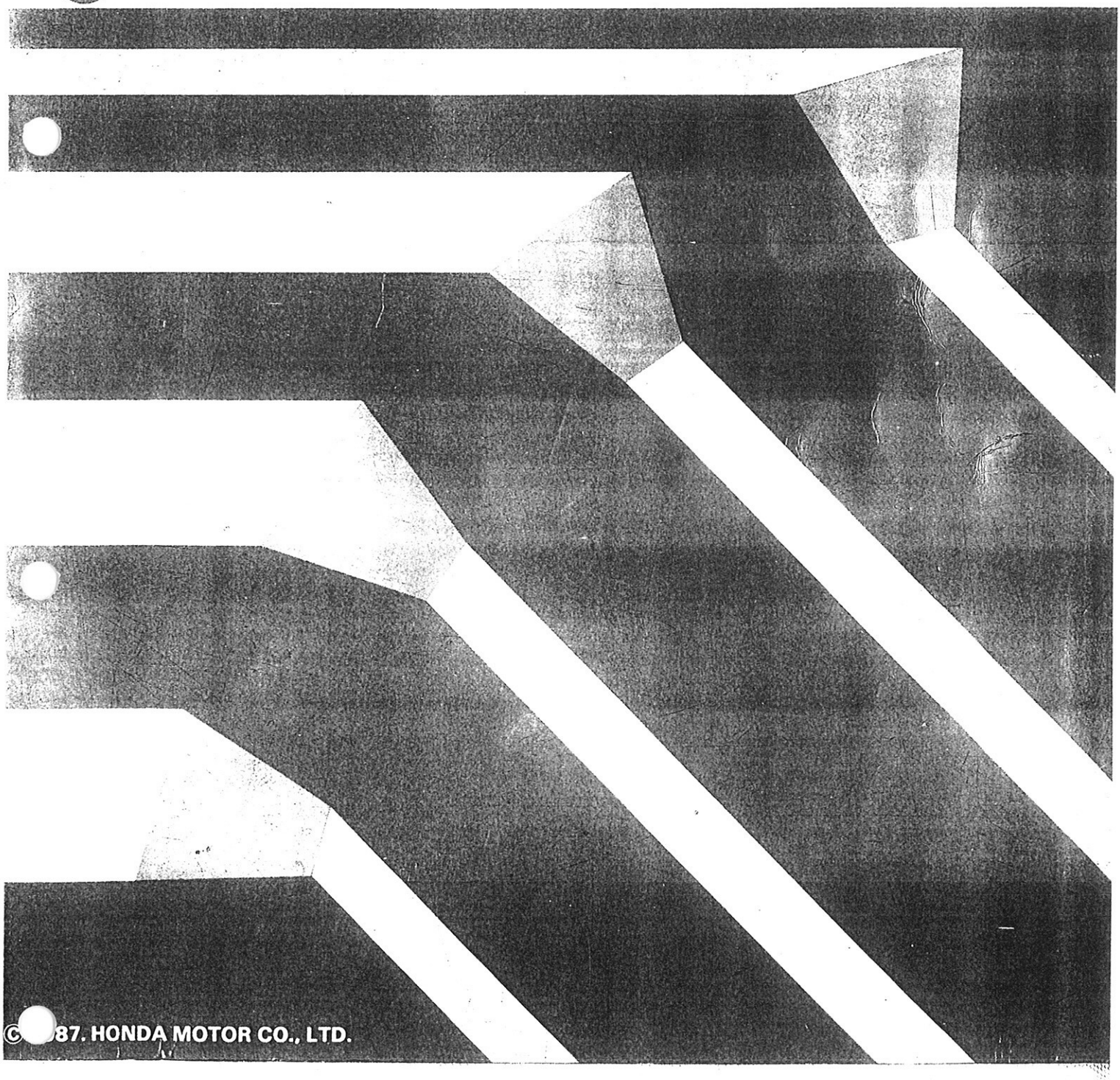
SHOP MANUAL

HONDA

D12B/D13B/D14A/D15B/D16A

ENGINE MAINTENANCE AND REPAIR



INTRODUCTION

How to Use This Manual

This manual contains information regarding repair procedures for the D12B, D13B, D14A, D15B, D16A types of Engine. For information regarding installation and removal of the engine, and engine electrical, fuel supply system, and emission control system, please consult the Chassis maintenance and repair manual for the vehicle concerned.
This manual is divided into 6 sections. The first page of each section is numbered with a black tab that lines up with one of the thumb index tabs on this pages. You can quickly find the first page of each section without looking through a full table of contents.

Each section includes:

1. A table of contents, or an exploded view index showing:
   - Parts disassembly sequence.
   - Bolt torques and thread sizes.
   - Page references to descriptions in text.
2. Disassembly/assembly procedures and tools.
3. Inspection.
4. Repair.
5. Adjustments.

Special Information

WARNING **Indicates a strong possibility of severe personal injury or loss of life if instructions are not followed.**

CAUTION: Indicates a possibility of personal injury or equipment damage if instructions are not followed.

NOTE: Gives helpful information.

CAUTION: Detailed descriptions of *standard* workshop procedures, safety principles and service operations are not included. Please note that this manual does contain warnings and cautions against some specific service methods which could cause PERSONAL INJURY, or could damage a vehicle or make it unsafe. Please understand that these warnings cannot cover all conceivable ways in which service, whether or not recommended by Honda Motor, might be done, or of the possible hazardous consequences of each conceivable way, nor could Honda Motor investigate all such ways. Anyone using service procedures or tools, whether or not recommended by Honda Motor, *must satisfy himself thoroughly* that neither personal safety nor vehicle safety will be jeopardized.

HONDA MOTOR CO., LTD.
Service Publication Office

First Edition 11/87 104pages

Chart of Engine Types

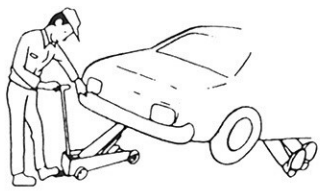
D12B1 : 1.2 ℓ SOHC 1-Carbureted Engine
D13B1 : 1.3 ℓ SOHC 1-Carbureted Engine
D14A1 : 1.4 ℓ SOHC 2-Carbureted Engine
D15B1 : 1.5 ℓ SOHC PGM-FI Engine with CATA (Austria only)
D15B2 : 1.5 ℓ SOHC PGM-FI Engine with CATA
D15B3 : 1.5 ℓ SOHC 1-Carbureted Engine without CATA
D15B4 : 1.5 ℓ SOHC 2-Carbureted Engine with CATA
D16A6 : 1.6 ℓ SOHC PGM-FI Engine with CATA
D16A7 : 1.6 ℓ SOHC PGM-FI Engine without CATA
D16A8 : 1.6 ℓ DOHC PGM-FI Engine with CATA
D16A9 : 1.6 ℓ DOHC PGM-FI Engine without CATA

General Information

Preparation of Work

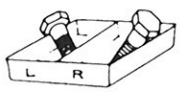
CAUTION: Observe all safety precautions and notes while working.

1. Work safely and give your work your undivided attention. When either the front or rear wheels are to be raised, block the remaining wheels securely. Communicate as frequently as possible when a work involves two or more workers. Do not run the engine unless the shop or working area is well ventilated.

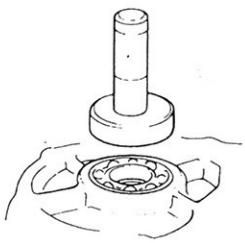


2. Prior to removing or disassembling parts, they must be inspected carefully to isolate the cause for which service is necessary. Observe all safety notes and precautions and follow the proper procedures as described in this manual.

3. Mark or place all removed parts in order in a parts rack so they can be reassembled in their original places.

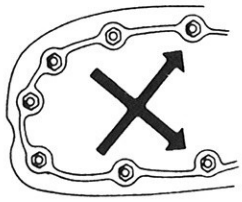


4. Use the special tool when use of such a tool is specified.

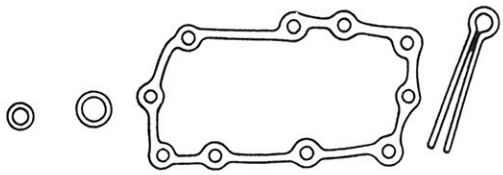


5. Parts must be assembled with the proper torque according to the maintenance standards established.

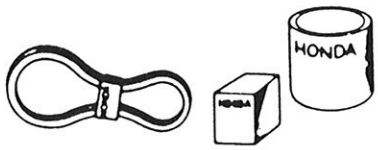
6. When tightening a series of bolts or nuts, begin with the center or large diameter bolts and tighten them in crisscross pattern in two or more steps.



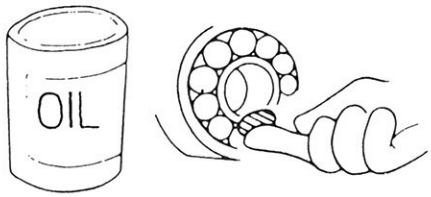
7. Use new packings, gaskets, O-rings and cotter pins whenever reassembling.



8. Use genuine HONDA parts and lubricants or those equivalent. When parts are to be reused, they must be inspected carefully to make sure they are not damaged or deteriorated and are in good usable condition.



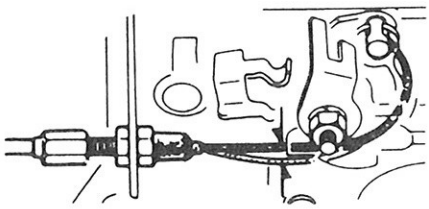
9. Coat or fill parts with specified grease as specified. Clean all removed parts in or with solvent upon disassembly.



10. Apply liquid gasket to the transmission, oil pump cover, right side cover and water outlet. Use HONDA PARTS NO. 08740–99969 as a liquid gasket.
    - Check that the mating surfaces are clean and dry before applying liquid gasket. Degrease the mating surfaces if necessary.
    - Apply liquid gasket evenly, being careful to cover all the mating surface.
    - To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.
    - Do not allow liquid gasket to stand for more than 20 minutes before assembly.
    - Fill the case with clean engine oil or coolant 30 minutes after assembly.

11. Avoid oil or grease getting on rubber parts and tubes, unless specified.

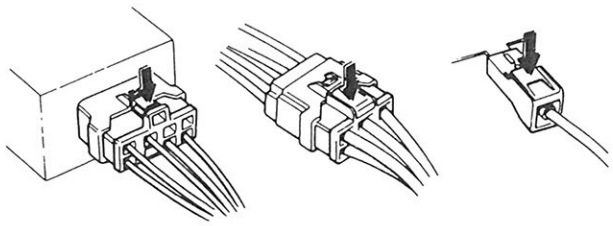
12. Upon assembling, check every possible part for proper installation and movement or operation.

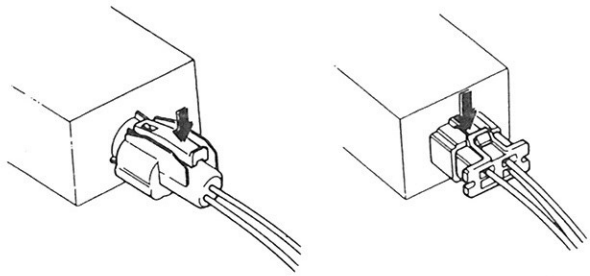


Electrical

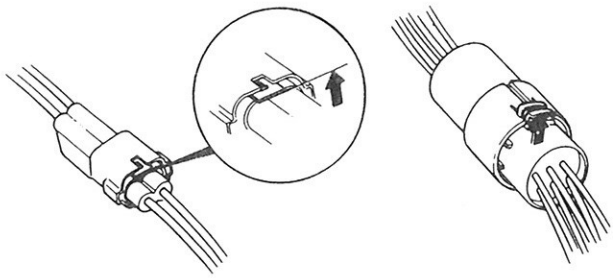
- When removing locking couplers, be sure to disconnect the lock before performing work.
- Couplers may be of two types, those in which the lock is pressed to remove, and those in which the lock is pulled up to remove. Be sure to ascertain the type of locking device before beginning work. The following is a depiction of the means of disconnecting various typical couplers.

Press to disengage :

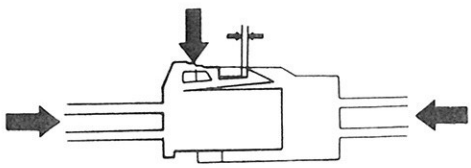




Pull up to disengage :



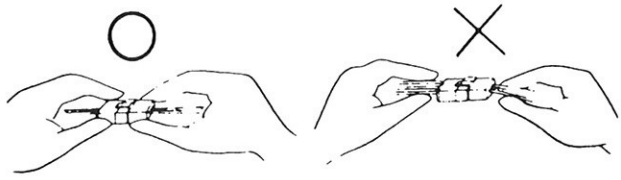
When disconnecting locks, first press in the coupler tightly (to provide clearance to the locking device), then operate the tab fully and remove the coupler in the designated manner.



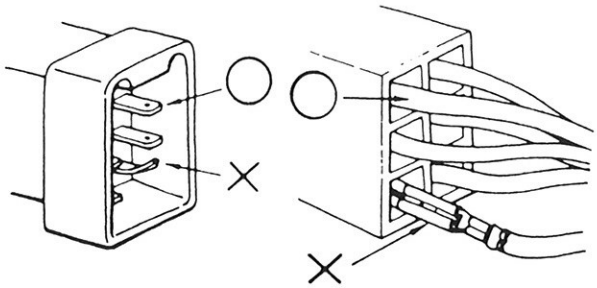
(cont'd)

Electrical (cont'd)

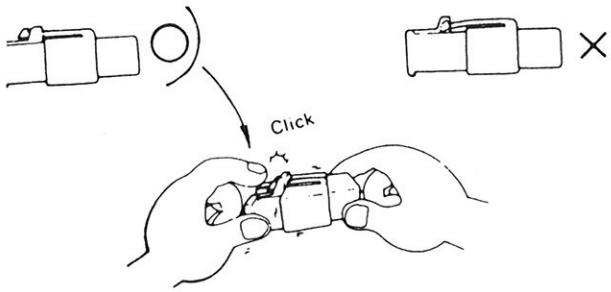
- When disconnecting a coupler, pull it off from the mating coupler by holding on both couplers.
- Never try to disconnect couplers by pulling on their wires.



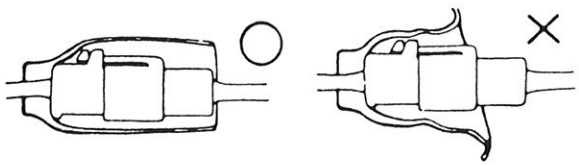
- Before connecting couplers, check to see that the terminals are in place and are not bent or distorted.



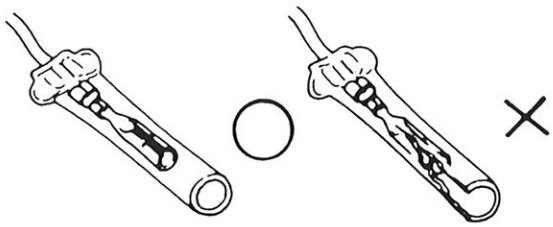
- Insert couplers fully until they will no longer go.
- Some couplers have locking tabs that must be aligned and engaged securely.
- Don't use wire harnesses with a loose wire or coupler.



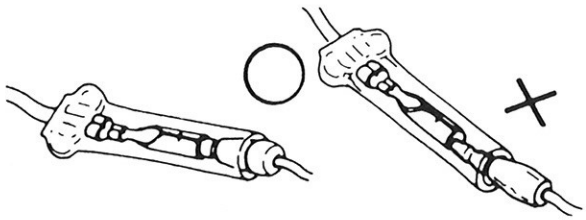
Place the plastic cover over the mating coupler after reconnecting. Also check that the cover is not distorted.



- Before connecting, check each connector cover for damage. Also make sure that the female connector is tight and not loosened from the previous use.



- Insert male connectors into the female connectors fully until they will no longer go.
- Be sure that plastic cover is placed over the connection.
- Position the wires so that the open end of the cover is not facing upward.
- Do not drop parts.



- Do not throw or let parts fall.

- Rust is the enemy of all finished surfaces. Before connecting connectors and couplers, check the terminals and remove, if any, rust using a fine sand paper or emery cloth.

Symbol Marks

The following symbols stand for:

:Apply engine oil.

:Apply brake fluid.

:Apply grease.

:Apply DEXRON®II Automatic Transmission Fluid.

:Apply Power Steering Fluid.

①, ②, ③, ...
❶, ❷, ❸, ... : Sequence for Removal

Abbreviations

A/C	Air Conditioner
A/T	Automatic Transmission
ATF	DEXRON®II Automatic Transmission Fluid
CATA	Catalytic Converter
CYL	Cylinder
DOHC	Double Over Head Camshafts
EACV	Electronic Air Control Valve
EGR	Exhaust Gas Recirculation
Ex.	Except
L.	Left Side
M/T	Manual Transmission
PCV VALVE	Positive Crankcase Ventilation Valve
PGM-CARB	Programmed Carburetor
PGM-FI	Programmed Fuel-Injection
P/S	Power Steering
R.	Right Side
SOHC	Single Over Head Camshaft
TA	Intake Air Temperature
TDC	Top Dead Center
TW	Coolant Temperature

Chart of Engine Types

D12B1	1.2 ℓ SOHC 1-Carbureted
D13B1	1.3 ℓ SOHC 1-Carbureted
D14A1	1.4 ℓ SOHC 2-Carbureted
D15B1	1.5 ℓ SOHC PGM-FI with CATA (Austria only)
D15B2	1.5 ℓ SOHC PGM-FI with CATA
D15B3	1.5 ℓ SOHC 1-Carbureted without CATA
D15B4	1.5 ℓ SOHC 2-Carbureted with CATA
D16A6	1.6 ℓ SOHC PGM-FI with CATA
D16A7	1.6 ℓ SOHC PGM-FI without CATA
D16A8	1.6 ℓ DOHC PGM-FI with CATA
D16A9	1.6 DOHC PGM-FI without CATA

Timing Belt

Timing Belt

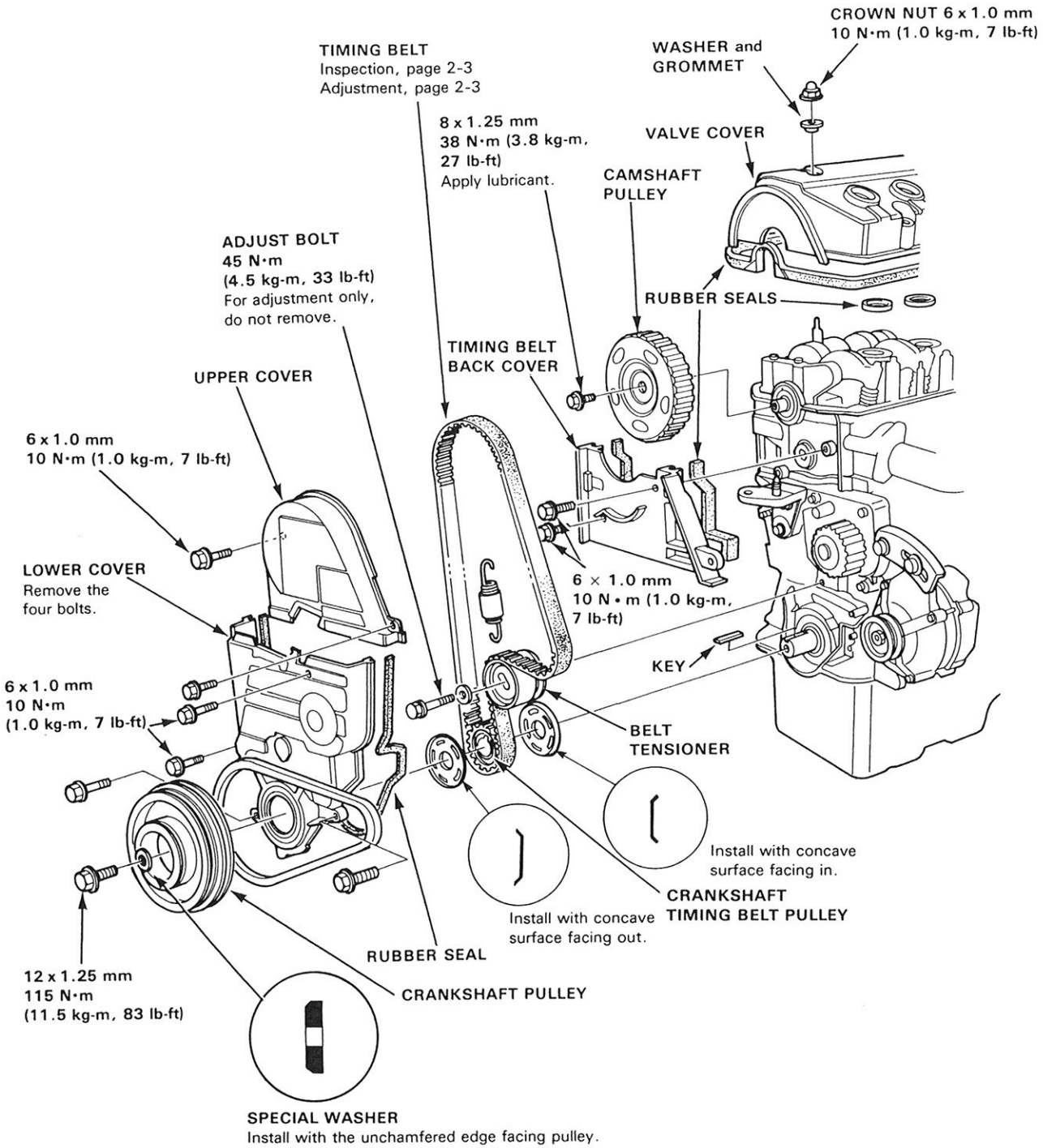
〈SOHC〉

Timing Belt

Illustrated Index

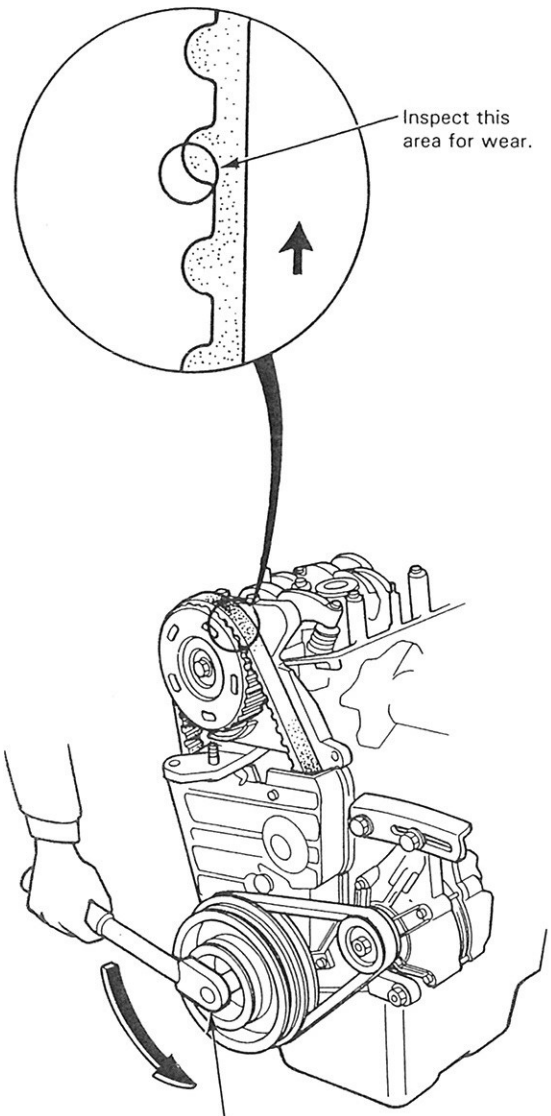
NOTE:

- Refer to page 2-6, for positioning crank and pulley before installing belt.
- Refer to page 3-44, for alternator belt adjustment.
- Refer to page 3-45, for P/S pump belt adjustment.
- Refer to page 3-45, for A/C compressor belt adjustment.
- Mark direction of rotation before removing.



Inspection

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



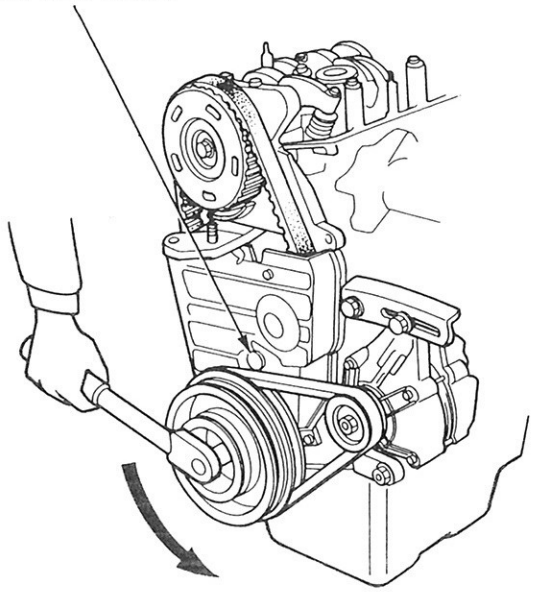
Tension Adjustment

CAUTION: Always adjust timing belt tension with the engine cold.

NOTE: Tensioner is spring-loaded to apply proper tension to the belt automatically after making the following adjustment:

1. Set the No. 1 piston at TDC.
2. Loosen adjust bolt.

ADJUST BOLT
45 N·m
(4.5 kg-m, 33 lb-ft)



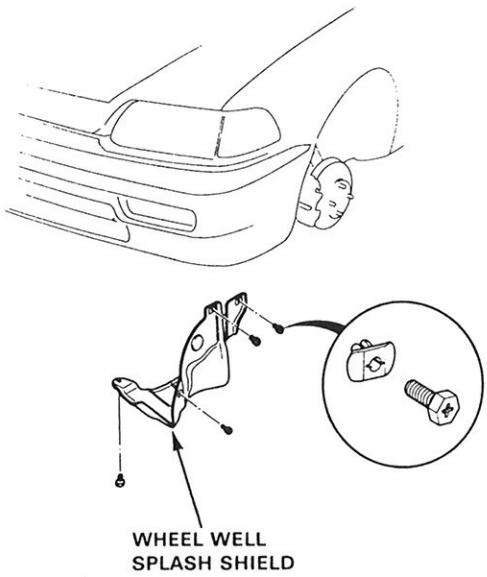
3. Rotate crankshaft counterclockwise 3-teeth on camshaft pulley to create tension on timing belt.
4. Tighten adjust bolt.
5. If pulley bolt broke loose while turning crank, retorque it to 115 N·m (11.5 kg-m, 83 lb-ft).

NOTE: Put transmission in gear and set parking brake before retorquing pulley bolt.

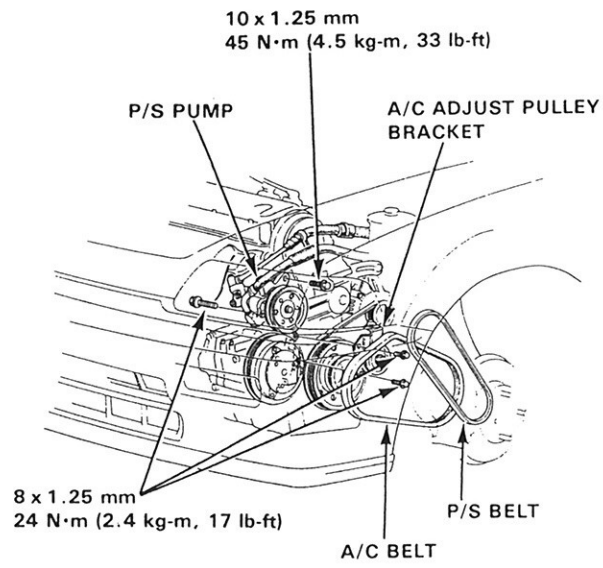
Timing Belt

Replacement

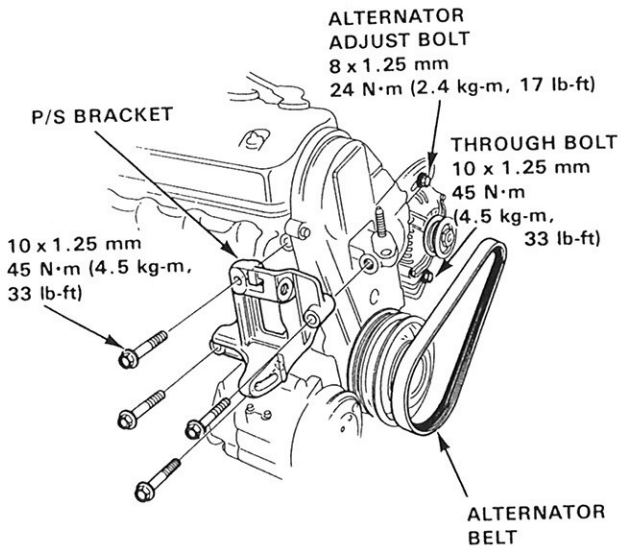
1. Remove the wheel well splash shield.



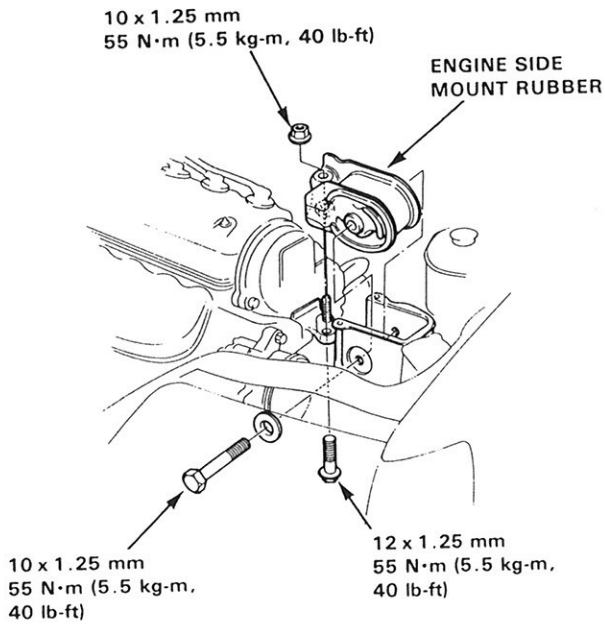
2. Remove the power steering pump (with P/S).
3. Remove the A/C compressor adjust pulley with bracket and the belt (with A/C).



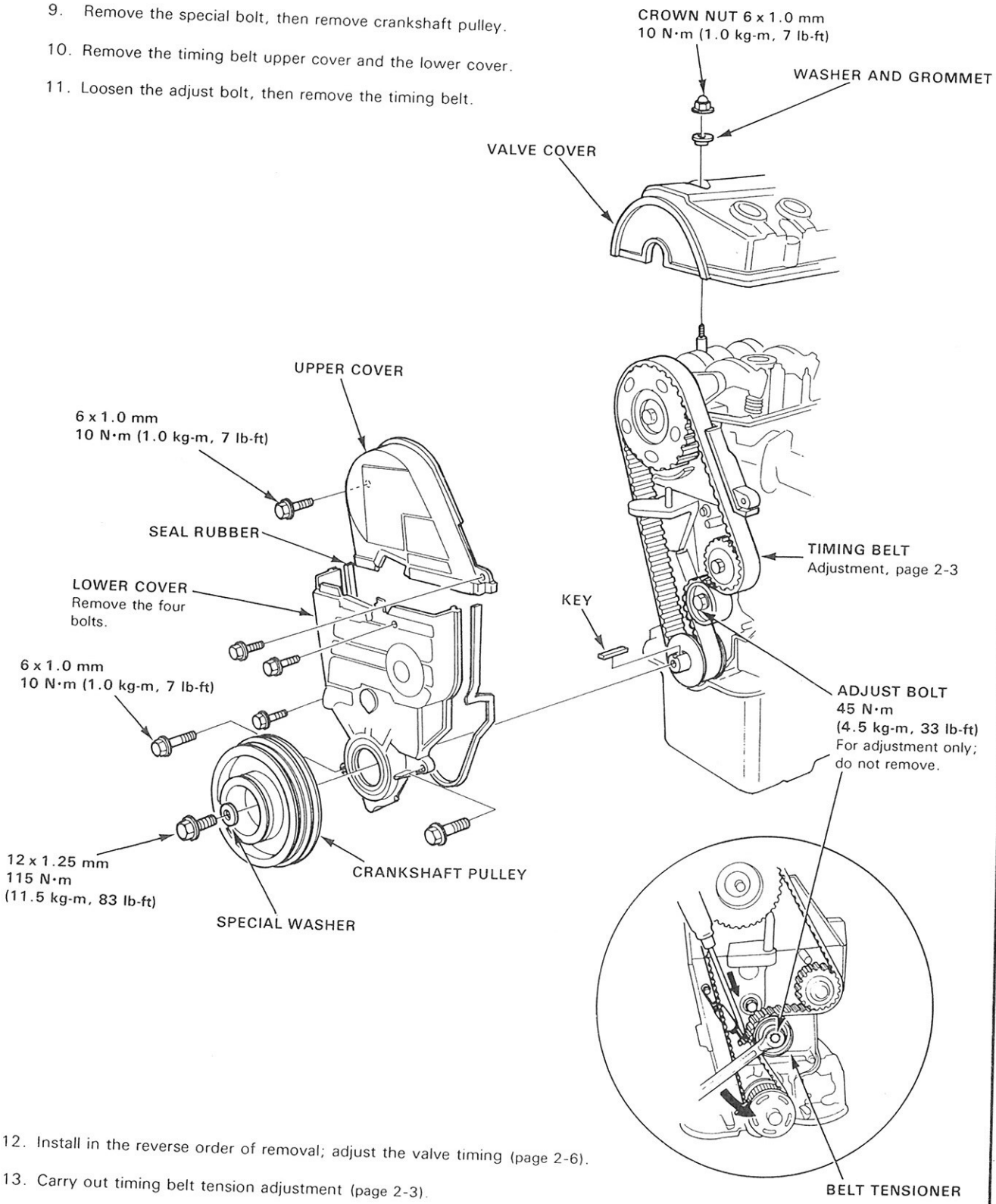
4. Remove the P/S bracket.
5. Loosen the alternator adjust bolt and through bolt, then remove the belt.



6. After installation, adjust the tension of each belt.
   See Section 3-44 for alternator belt tension adjustment.
   See Section 3-45 for A/C compressor belt tension ajustment.
   See Section 3-45 for P/S pump belt tension adjustment.
7. Remove the engine support bolts and nut, then remove the side mount rubber.



8. Remove the valve cover.
9. Remove the special bolt, then remove crankshaft pulley.
10. Remove the timing belt upper cover and the lower cover.
11. Loosen the adjust bolt, then remove the timing belt.

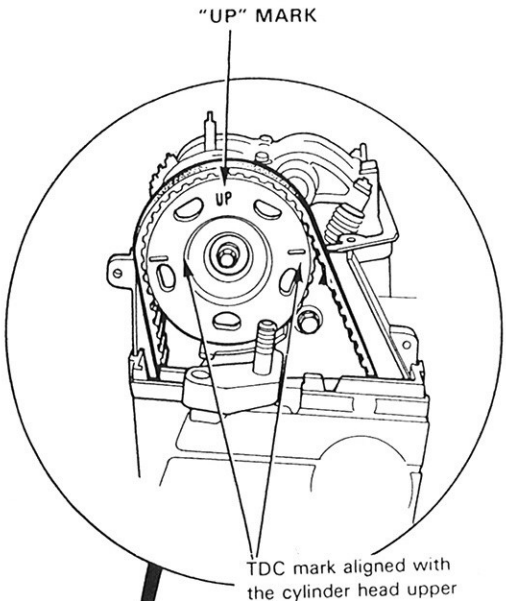


12. Install in the reverse order of removal; adjust the valve timing (page 2-6).
13. Carry out timing belt tension adjustment (page 2-3).

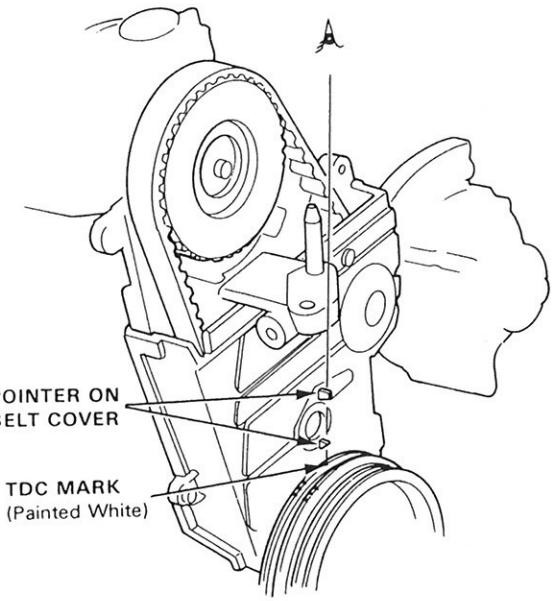
Timing Belt

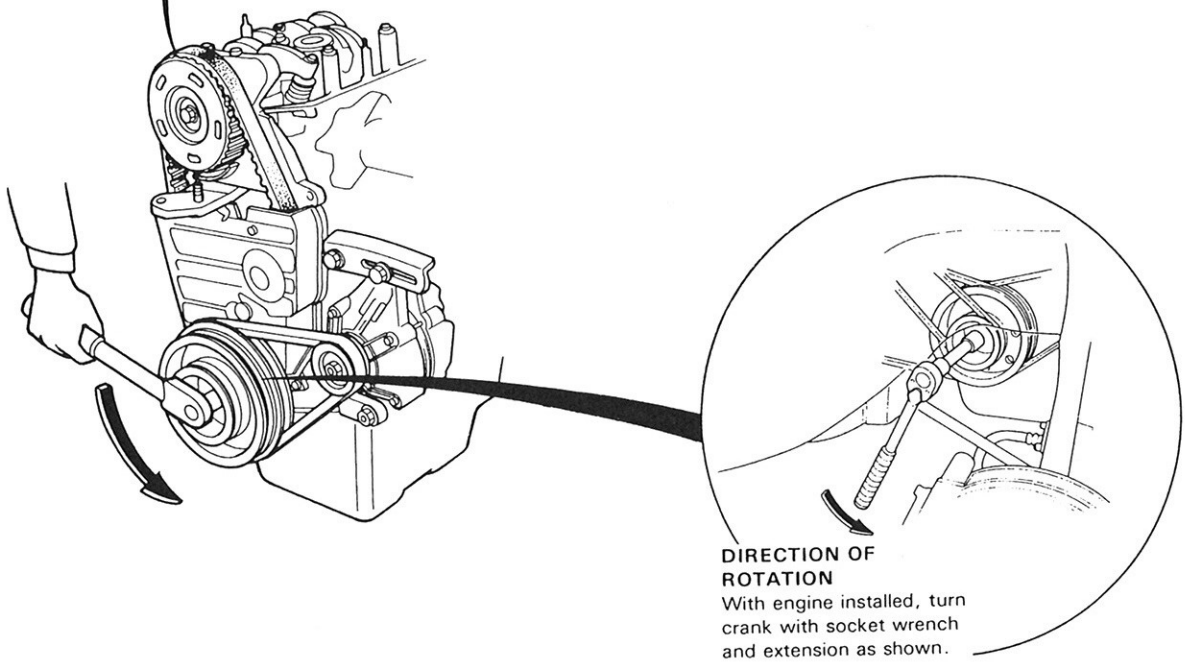
Positioning Crankshaft Before Installing Timing Belt

NOTE: Install the timing belt with the No. 1 piston at TDC (Top Dead Center) of the compression stroke.



TDC mark aligned with the cylinder head upper surface.





DIRECTION OF ROTATION
With engine installed, turn crank with socket wrench and extension as shown.

Timing Belt

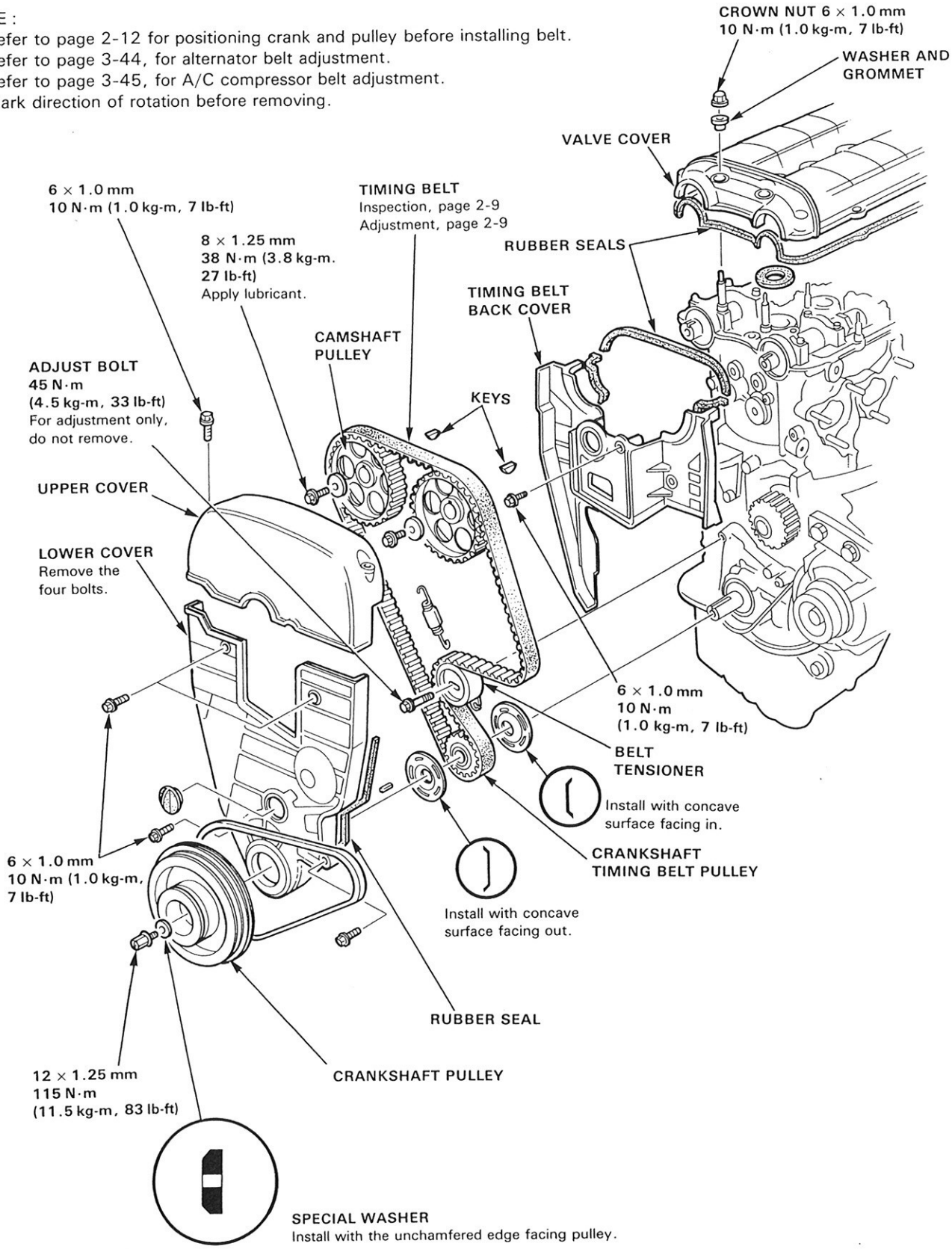
〈DOHC〉

Timing Belt

Illustrated Index

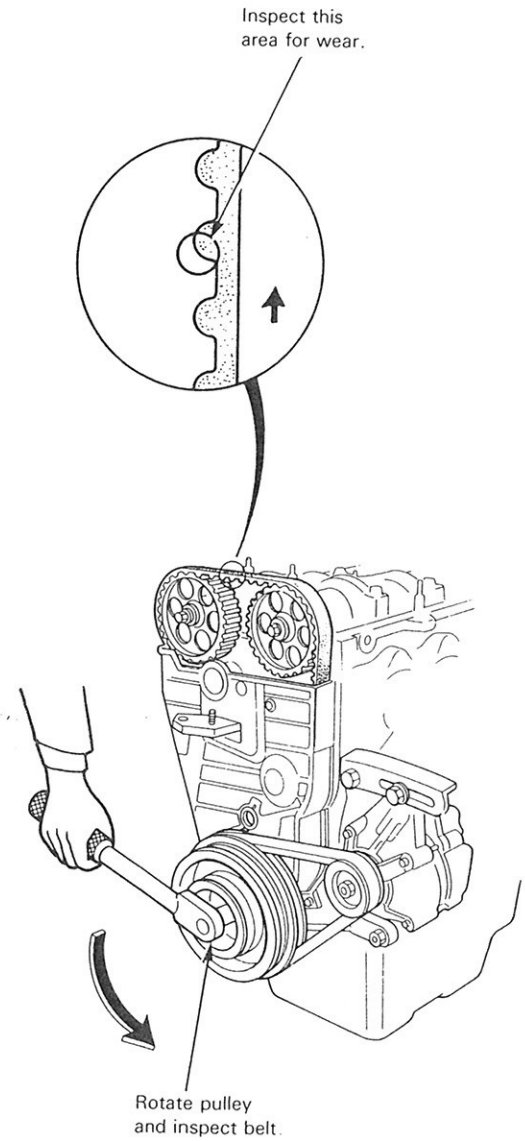
NOTE :

- Refer to page 2-12 for positioning crank and pulley before installing belt.
- Refer to page 3-44, for alternator belt adjustment.
- Refer to page 3-45, for A/C compressor belt adjustment.
- Mark direction of rotation before removing.



Inspection

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

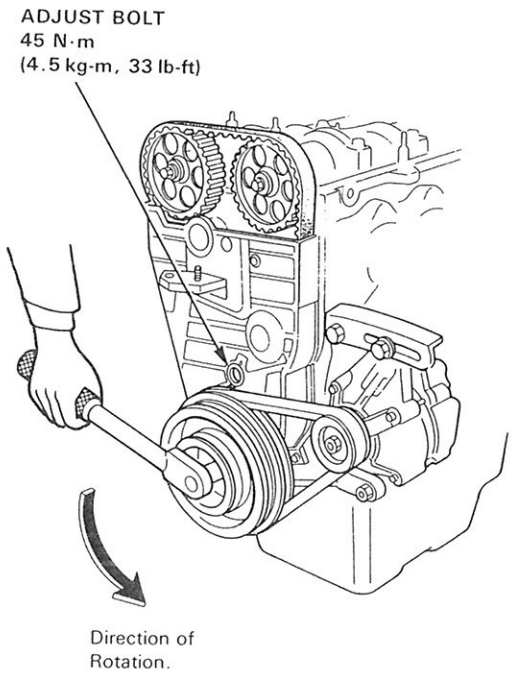


Tension Adjustment

CAUTION : Always adjust timing belt tension with the engine cold.

NOTE : Tensioner is spring-loaded to apply proper tension to the belt automatically after making the following adjustment :

1. Set the No. 1 piston at TDC.
2. Loosen adjust bolt.



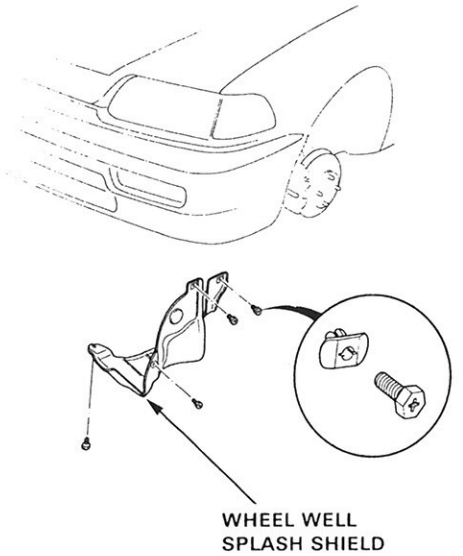
3. Rotate crankshaft counterclockwise 3-teeth on camshaft pulley to create tension on timing belt.
4. Tighten adjust bolt.
5. If pulley bolt broke loose while turning crank, retorque it to 115 N·m (11.5 kg-m, 83 lb-ft).

NOTE : Put transmission in gear and set parking brake before retorquing pulley bolt.

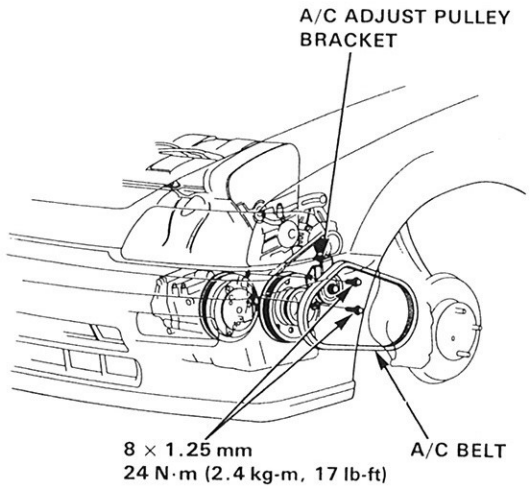
Timing Belt

Replacement

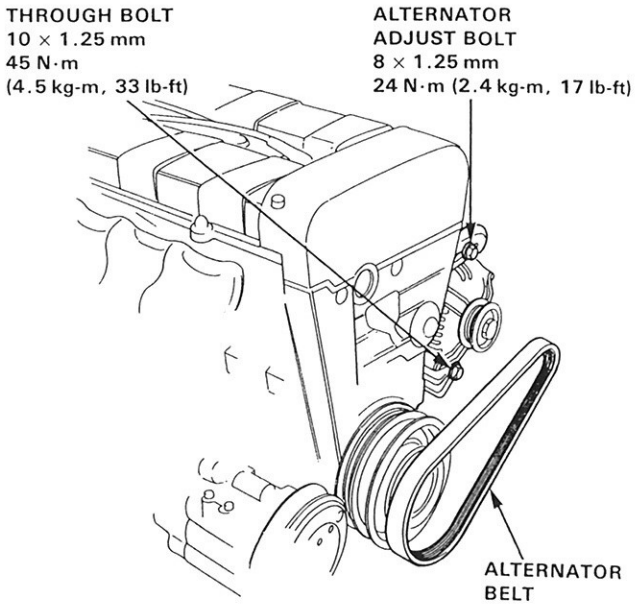
1. Remove the wheel well splash shield.



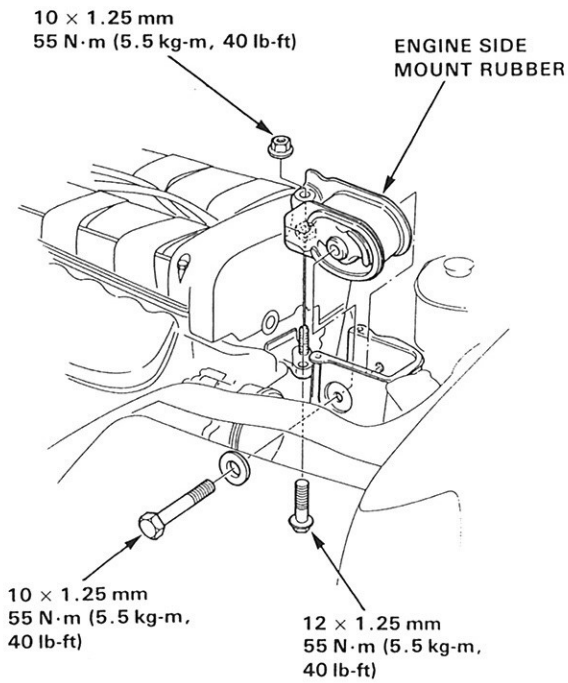
2. Remove the A/C compressor adjust pulley with bracket and the belt (with A/C).



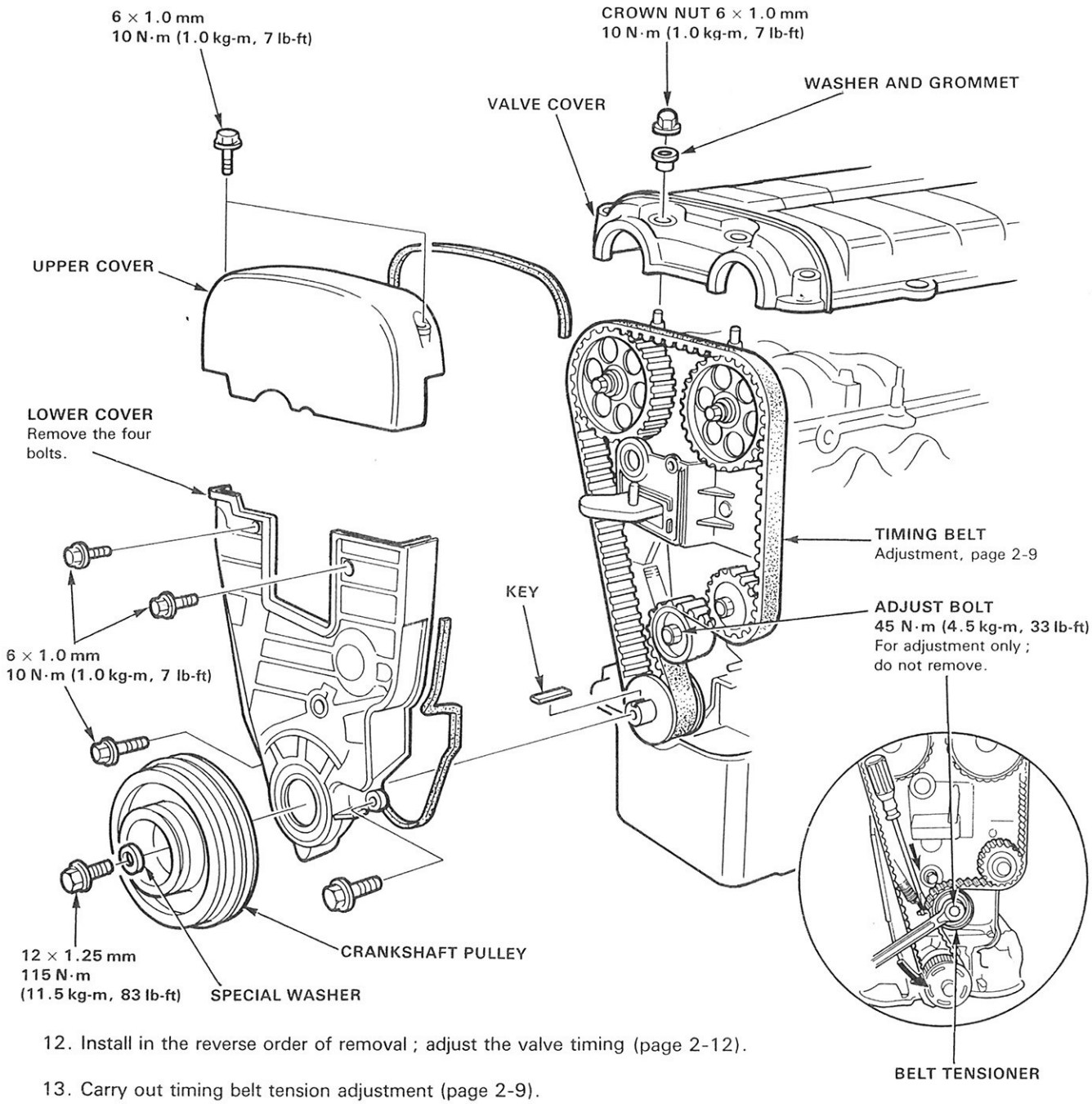
3. Loosen the alternator adjust bolt and through bolt.
4. Remove the alternator belt.



5. After installation, adjust the tension of each belt.
   See Section 3-44 for alternator belt tension adjustment.
   See Section 3-45 for A/C compressor belt tension adjustment.
6. Remove the engine support bolts and nut, then remove the side mount rubber.



7. Remove the timing belt upper cover.
8. Remove the valve cover.
9. Remove the special bolt, then remove crankshaft pulley.
10. Remove the timing belt lower cover.
11. Loosen the adjust bolt, then remove the timing belt.

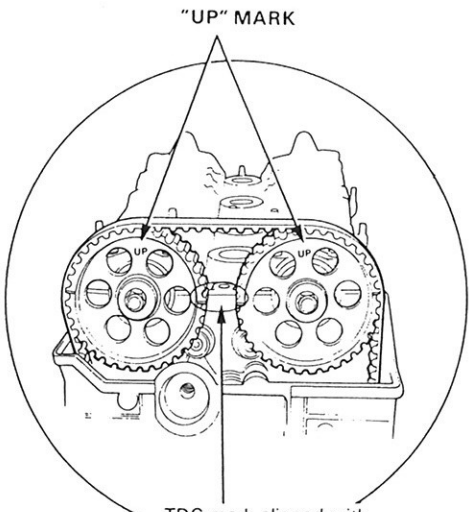


12. Install in the reverse order of removal ; adjust the valve timing (page 2-12).
13. Carry out timing belt tension adjustment (page 2-9).

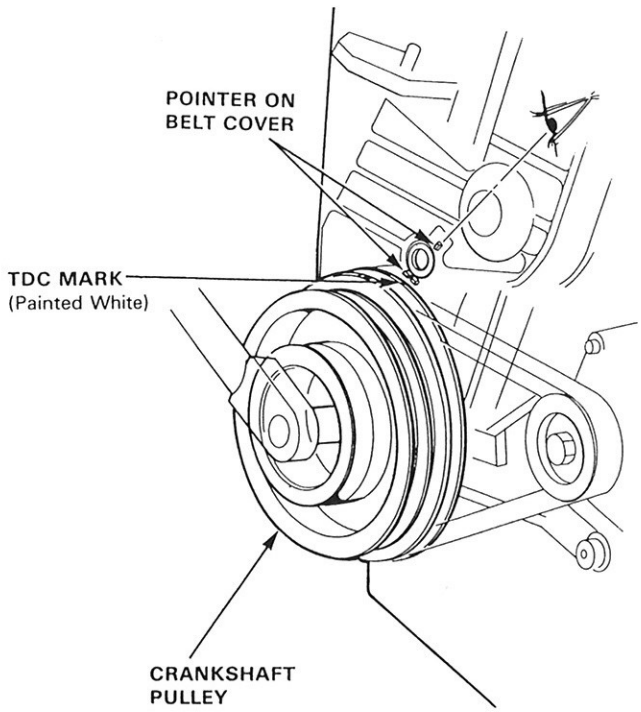
Timing Belt

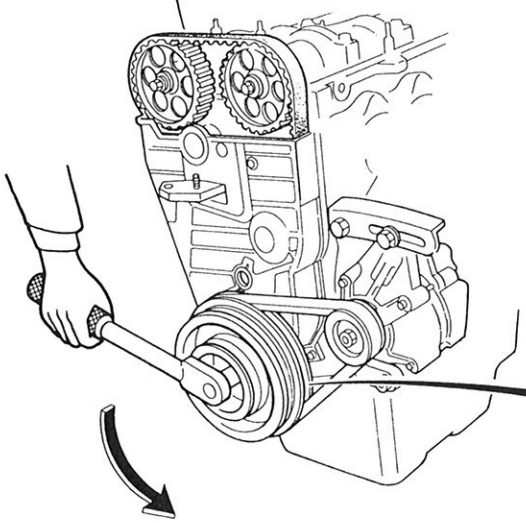
Positioning Crankshaft Before Installing Timing Belt

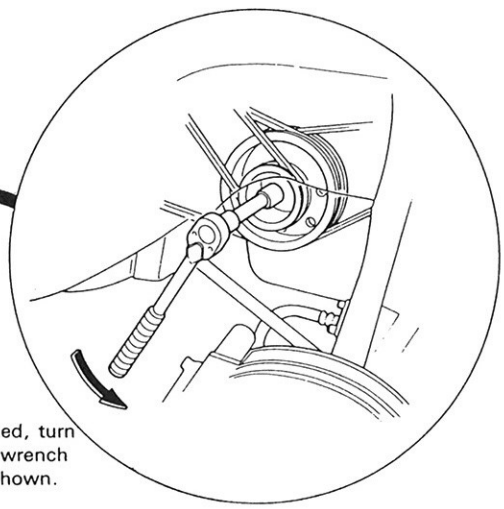
NOTE : Install the timing belt with the No. 1 piston at TDC (Top Dead Center) of the compression stroke.



TDC mark aligned with the cylinder head upper surface.







DIRECTION OF ROTATION
With engine installed, turn crank with socket wrench and extension as shown.

Cylinder Head/Valve Train

Cylinder Head/Valve Train

〈SOHC〉

Standards and Service Limits (SOHC)

Unit : mm (in,

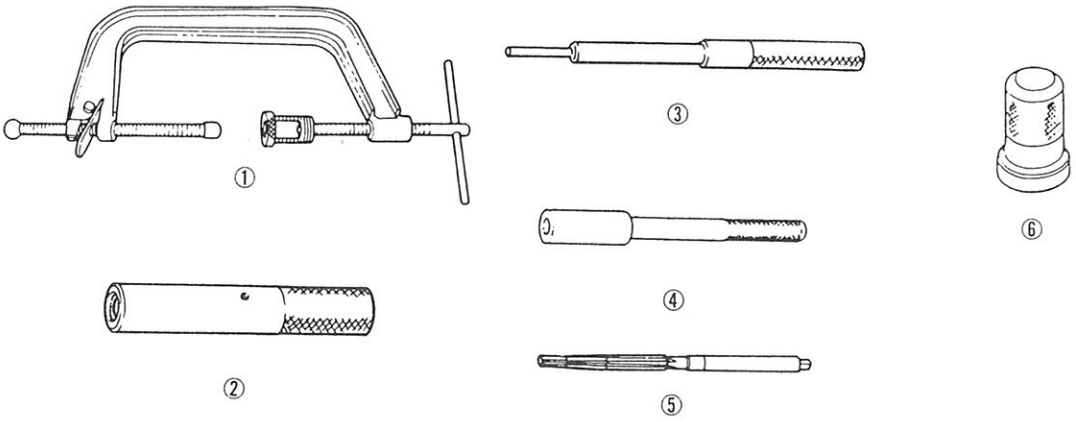
	MEASUREMENT		STANDARD (NEW)	SERVICE LIMIT
Compression	250 rpm and wide-open throttle		Nominal Minimum Maximum variation	1,275 kPa (13.0 kg/cm², 185 psi) 932kPa (9.5kg/cm², 135psi) 196 kPa (2 kg/cm², 28 psi)
Cylinder head	Warpage Height		— 94.95–95.05	0.05 (0.002) —
Camshaft	End play Oil clearance Runout Cam lobe height IN 1.2 ℓ, 1.3 ℓ (Ex. KG A/T) 1.3 ℓ (KG A/T) 1.4 ℓ, 1.5 ℓ (2-Carbureted) 1.5 ℓ (PGM-FI Ex.KW*) 1.6 ℓ (Ex. KB, KW) 1.5 ℓ (1-Carbureted) 1.5 ℓ (PGM-FI KW*) 1.6 ℓ (KB, KW) EX 1.2 ℓ, 1.3 ℓ 1.4 ℓ (M/T) 1.5 ℓ (2-Carbureted A/T) 1.5 ℓ (PGM-FI AT/ Ex. KW*) 1.4 ℓ (A/T) 1.5 ℓ (2-Carbureted M/T) 1.5 ℓ (PGM-FI M/T Ex.KW*) 1.6 ℓ (Ex. KB, KW) 1.5 ℓ (1-Carbureted) 1.5 ℓ (PGM-FI KW*) 1.6 ℓ (KB,KW)		0.05–0.15 (0.002–0.006) 0.050–0.089 (0.002–0.004) 0–0.03 (0–0.001) max. 35.672 (1.4044) 35.472 (1.3965) 36.603 (1.4411) 36.057 (1.4196) 34.868 (1.3728) 36.957 (1.4515) 35.693 (1.4052) 36.750 (1.4468) 36.747 (1.4467) 36.198 (1.4251) 36.435 (1.4344) 36.996 (1.4565)	0.5 (0.02) 0.15 (0.006) 0.03 (0.001) — — — — — — — — — — — —
Valve	Valve clearance	IN EX	0.17–0.22 (0.007–0.009) 0.22–0.27 (0.009–0.011)	— —
	Valve stem O.D.	IN EX	5.48–5.49 (0.2157–0.2161) 5.45–5.46 (0.2147–0.2150)	5.45 (0.2147) 5.42 (0.2134)
	Stem-to-guide clearance	IN EX	0.02–0.05 (0.001–0.002) 0.05–0.08 (0.002–0.003)	0.08 (0.003) 0.12 (0.005)
	Stem installed height	IN EX	46.985–47.455 (1.898–1.8683) 48.965–49.435 (1.9278–1.9263)	47.705 (1.8781) 49.685 (1.9561)
Valve seat	Width	IN EX	0.85–1.15 (0.033–0.045) 1.25–1.55 (0.049–0.061)	1.6 (0.06) 2.0 (0.08)
Valve spring	Free length IN 1.2 ℓ, 1.3 ℓ Ex. 1.2 ℓ, 1.3 ℓ EX Ex. 1.4 ℓ, 1.5 ℓ (KQ) 1.4 ℓ, 1.5 ℓ (KQ)		47.66 (1.8764) 48.58 (1.9126) 49.19 (1.9366) 48.49 (1.9091)	46.78 (1.8417) 47.64 (1.8756) 48.32 (1.9024) 47.68 (1.8772)
	Squareness IN 1.2 ℓ, 1.3 ℓ Ex. 1.2 ℓ, 1.3 ℓ EX Ex. 1.4 ℓ, 1.5 ℓ (KQ) 1.4 ℓ, 1.5 ℓ (KQ)		— — — —	1.66 (0.065) 1.70 (0.067) 1.72 (0.068) 1.69 (0.067)
Valve guide	I.D.	IN and EX	5.51–5.53 (0.2169–0.2177)	5.55 (0.2185)
Rocker arm	Arm-to-shaft clearance	IN EX	0.017–0.05 (0.0007–0.0020) 0.018–0.054 (0.0007–0.0021)	0.08 (0.003) 0.08 (0.003)

KW* : for Austria

Special Tools

Special Tools (Common with Other Models)

Ref. No.	Tool Number	Description	Q'ty	Remarks
①	07757–0010000	Valve Spring Compressor	1	07957–3290001 may be also used
②	07HAD–PJ70200	Valve Stem Seal Installer	1	
③	07742–0010100	Valve Guide Driver, 5.5 mm	1	
④	07743–0020000	Adjustable Valve Guide Driver	1	
⑤	07HAH–PJ70100	Valve Guide Reamer, 5.5 mm	1	
⑥	07947–SB00100	Oil Seal Driver	1	Camshaft

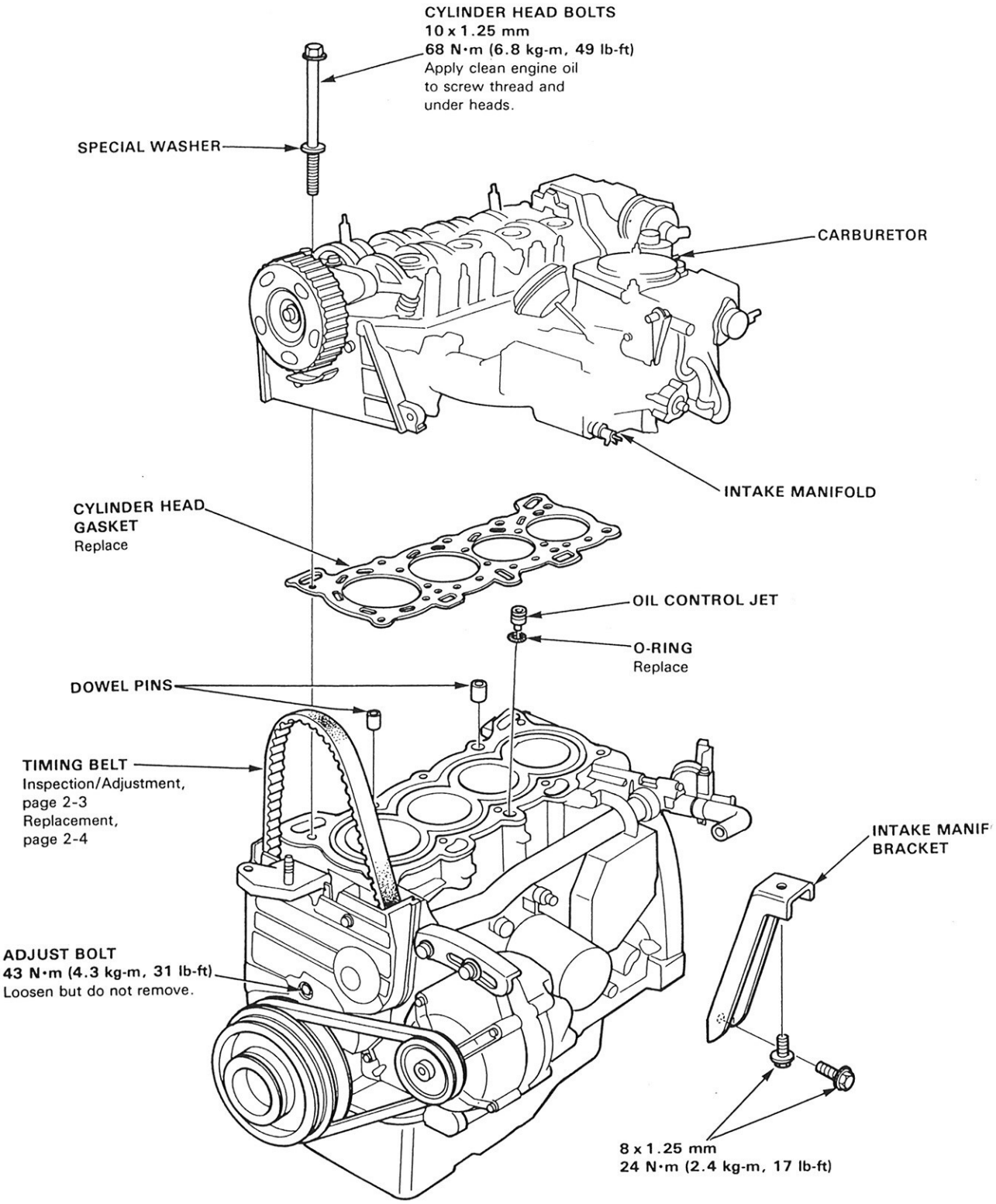


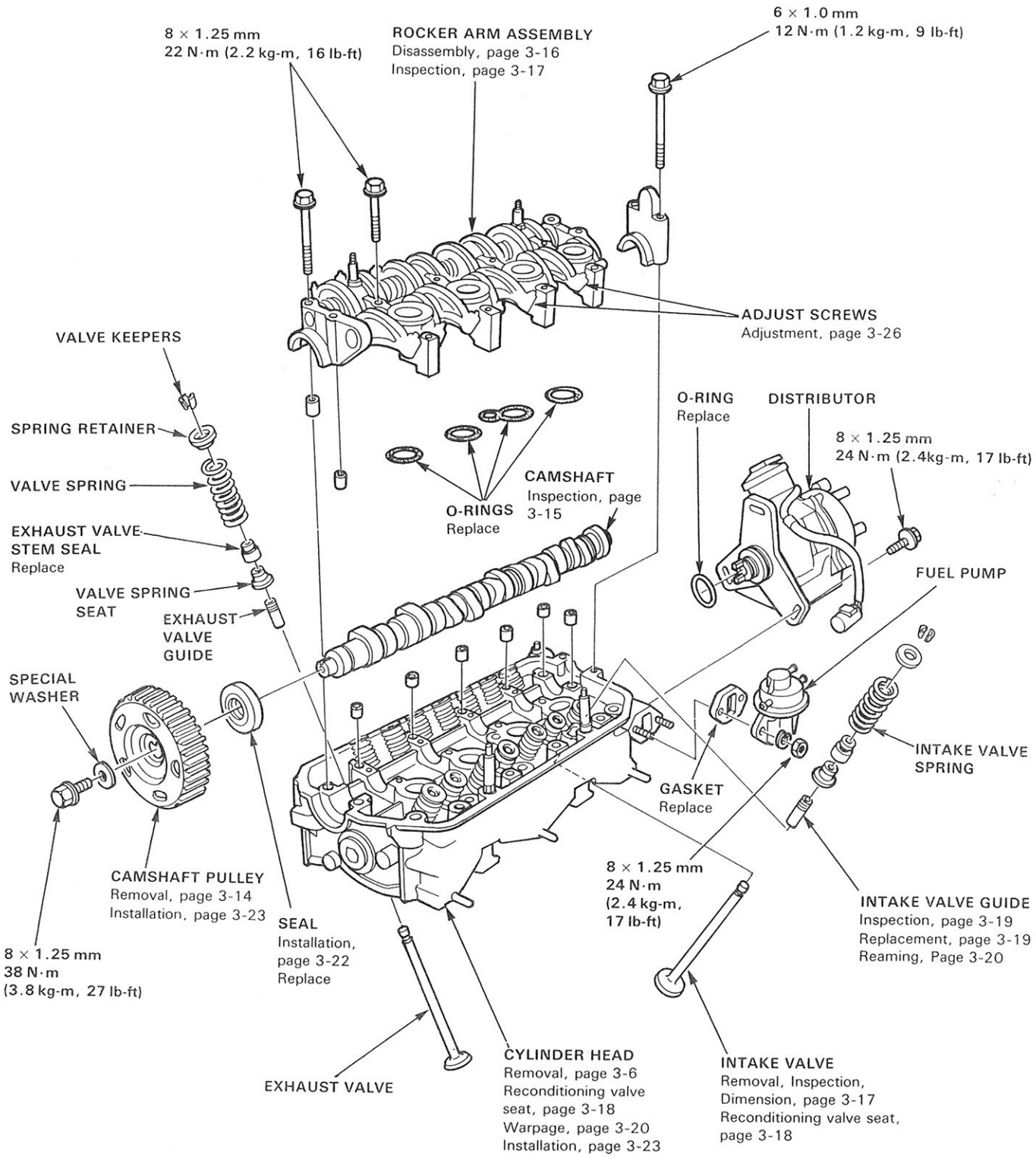
Cylinder Head/Valve Train

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 whenever reassembling.



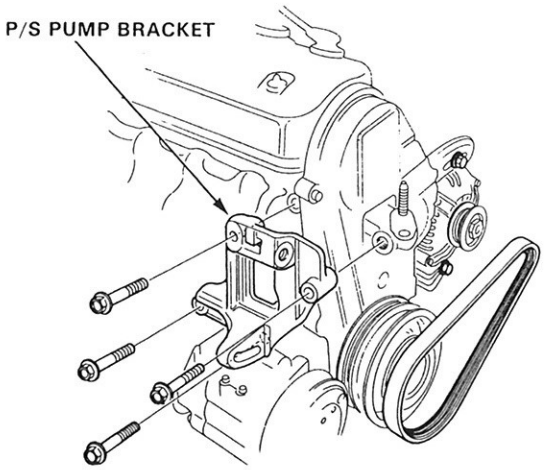


Cylinder Head

Removal

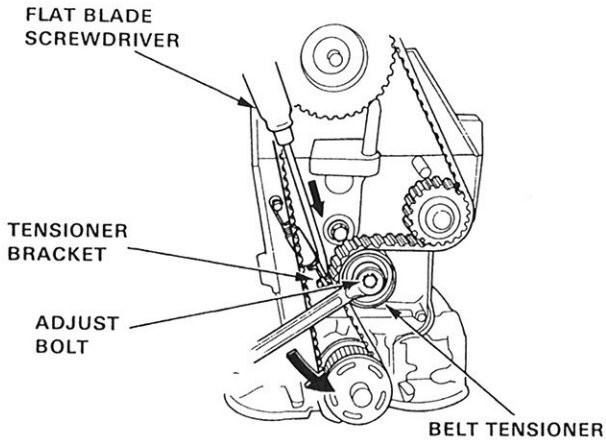
NOTE :
- Inspect the timing belt before removing the cylinder head.
- Turn the crankshaft pulley so that the No. 1 cylinder is at top-dead-center (page 2-6).
- Mark all emissions hoses before disconnecting them.

1. Disconnect the spark plug wire.
2. Remove the distributor from the cylinder head.
3. Remove the power steering (P/S) pump, belt and the alternator belt.
4. Remove the P/S pump bracket.

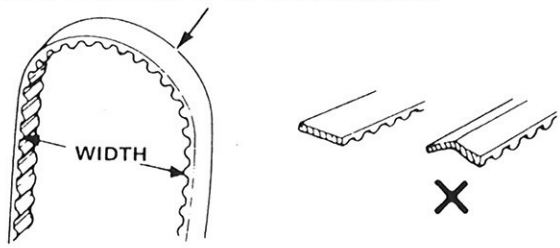


5. Disconnect the engine wire connectors form the cylinder head and the intake manifold.
   - Ignition coil connector (from distributor)
   - EACV connector
   - Ground wire terminals
   - Thermo sensor connector
   - Coolant temperature sending unit connector
   - Oxygen sensor connector (with CATA)
   - Carburetor solenoid valve, automatic choke connector (1-Carbureted Engine)
   - Carburetor solenoid valve, inner vent solenoid valve connector (2-Carbureted Engine)
   - Slow air leak solenoid valve connector (2-Carbureted Engine)
   - L. carburetor solenoid valve connector (2-Carbureted Engine)
   - Intake air temperrature sensor connector (PGM-FI)
   - Throttle angle sensor connector (PGM-FI)
   - Injector connector (PGM-FI)
   - TDC/CRANK sensor connector (PGM-FI from distributor)
6. Remove the exhaust manifold from the cylinder head.
7. Disconnect the vacuum hoses and the water bypass hoses from the intake manifold.
8. Remove the PCV hose from the intake manifold and valve cover
9. Remove the intake masifold from the cylinder head.
10. Remove the valve cover and the timing belt upper cover.
11. Loosen the timing belt adjust bolt, then remove the timing belt from the camshaft pulley.

NOTE :
- Push the tensioner bracket with a flat blade screwdriver to loosening belt tension.
- Do not push on the belt.



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



12. Remove the cylinder head.

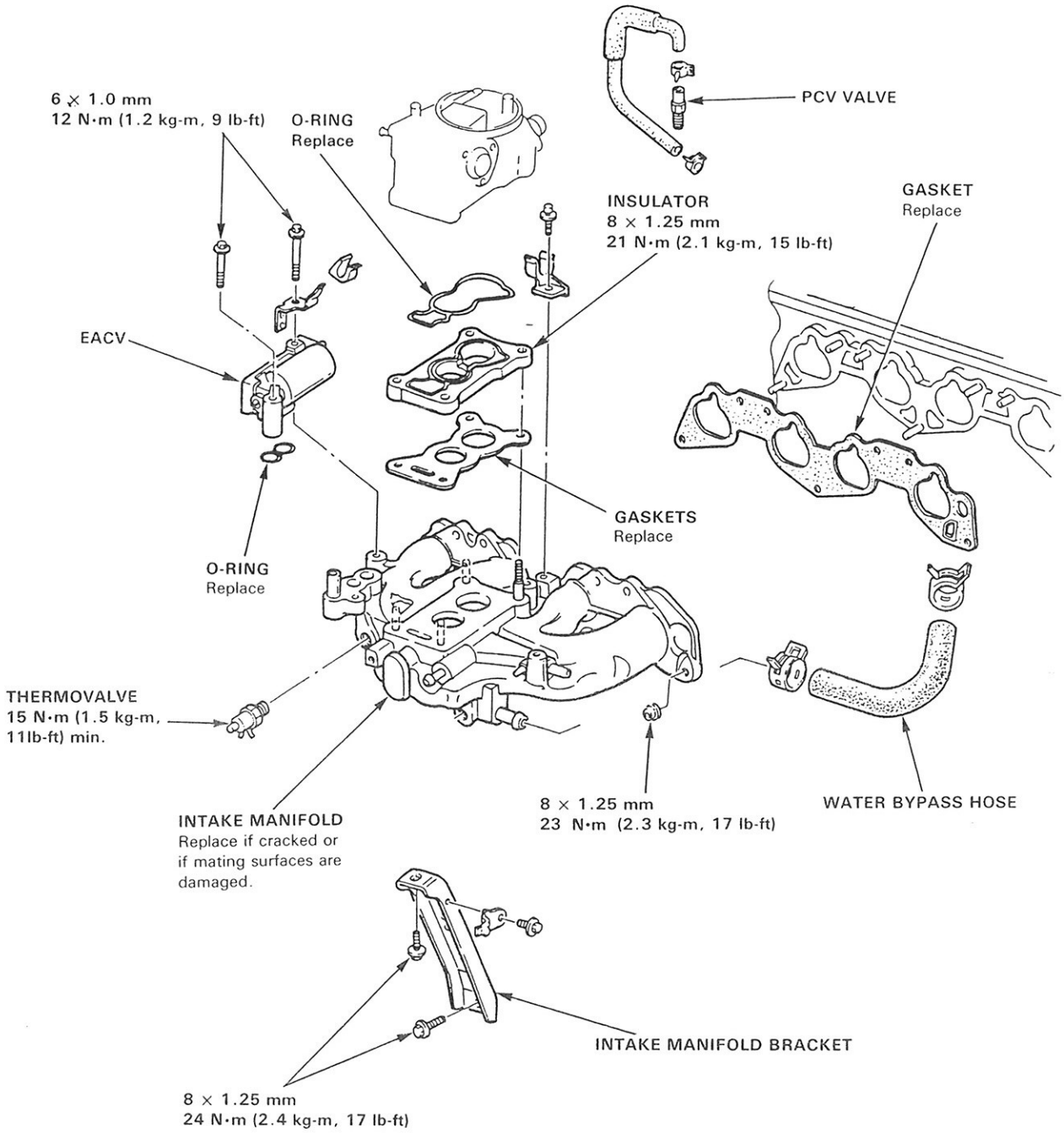
CAUTION : To prevent warpage, unscrew bolts 1/3 turn each time and repeat sequence until loose.

Intake Manifold

Replacement

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

1-Carbureted Engine :



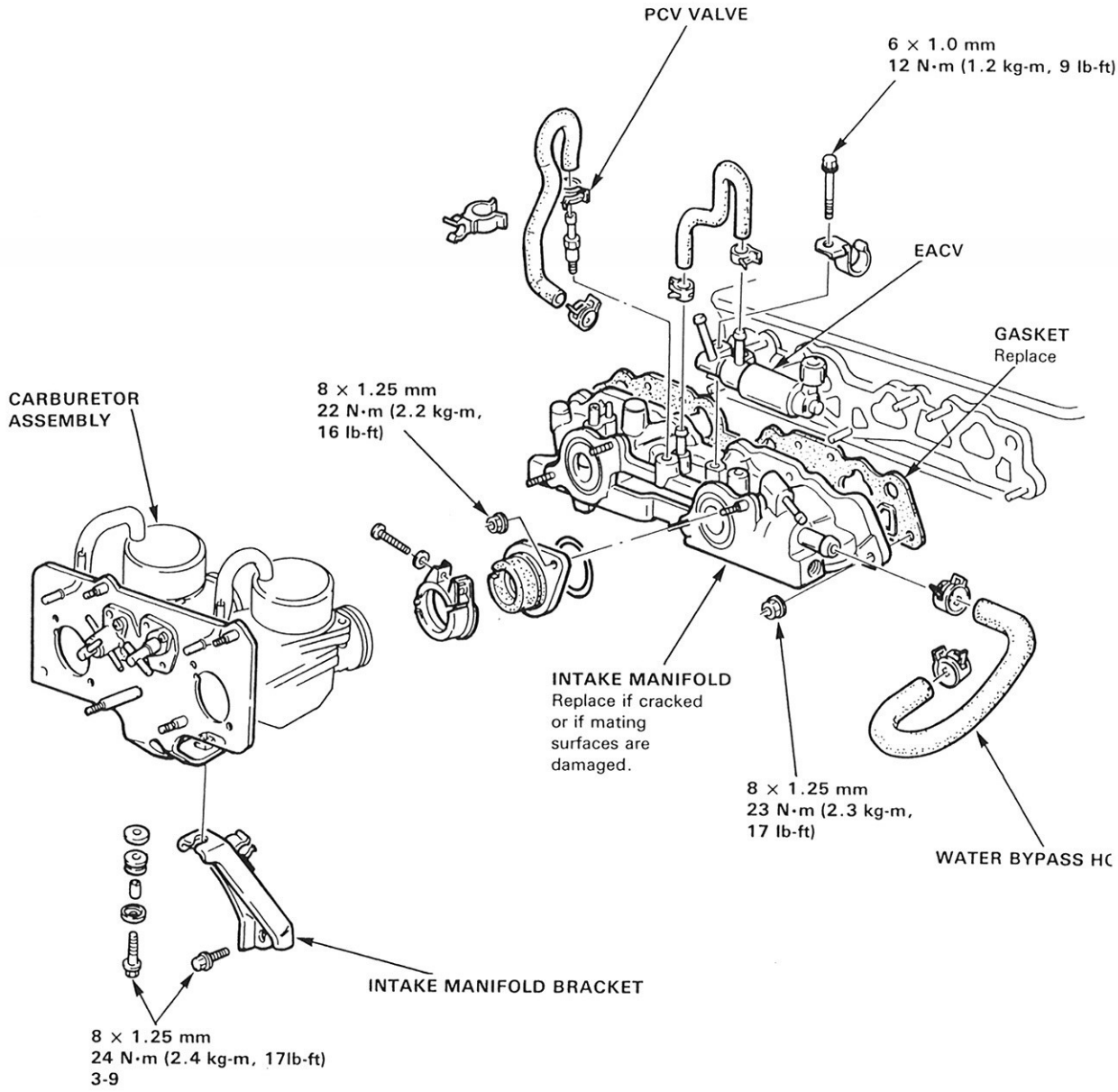
(cont'd)

Intake Manifold

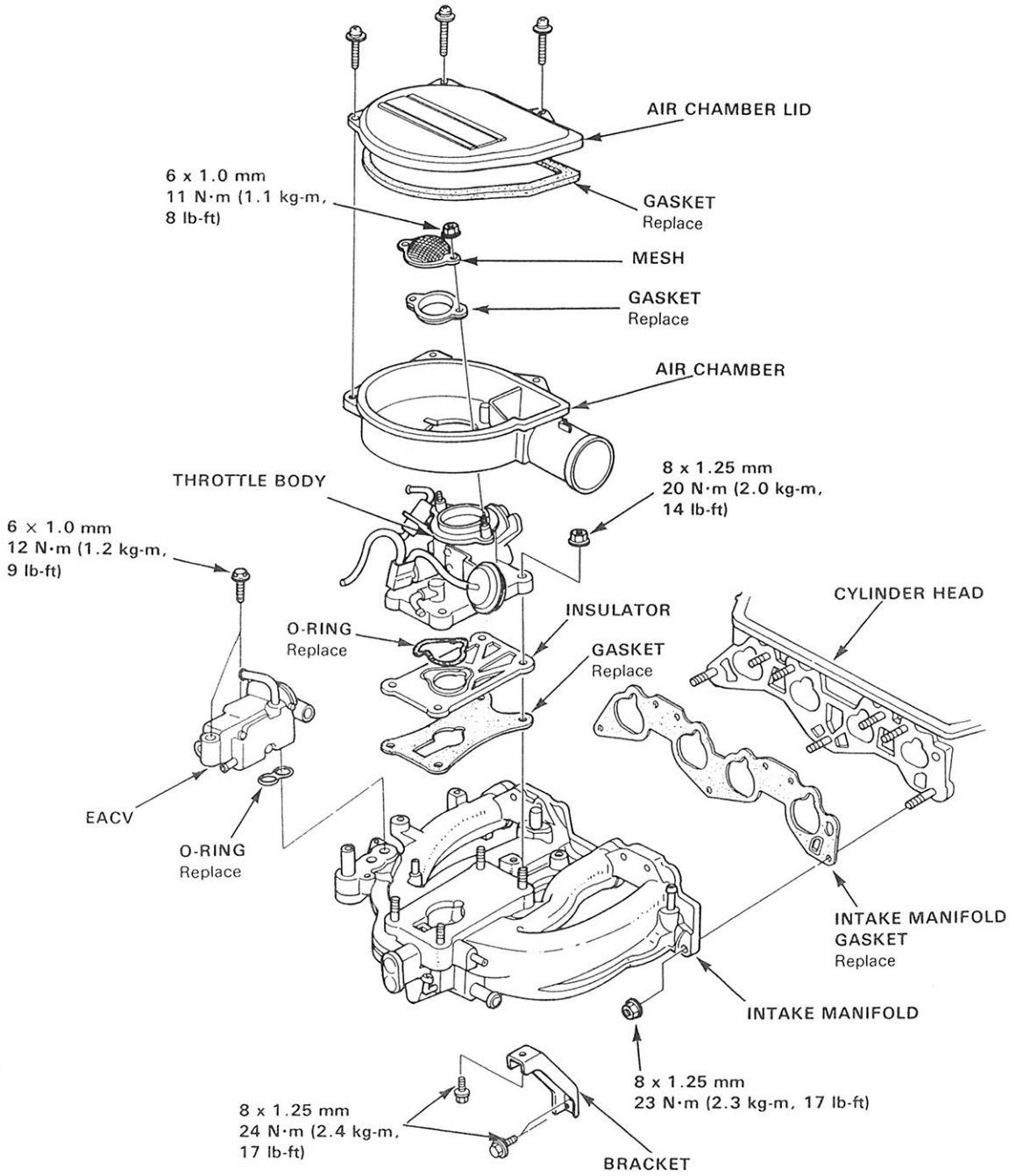
Replacement (cont'd)

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

2-Carbureted Engine :



1.5 ℓ PGM-FI Engine :



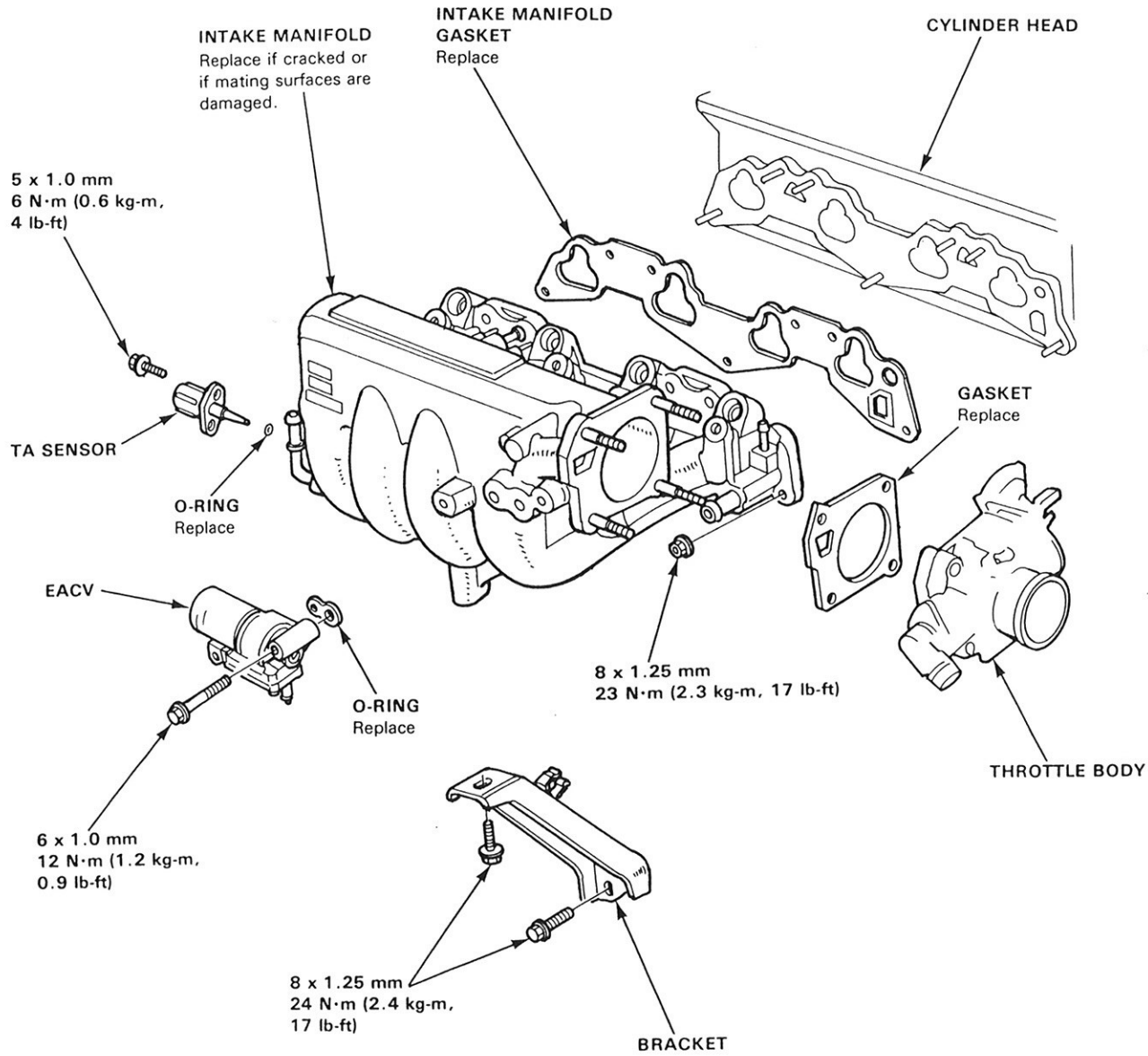
(cont'd)

Intake Mainfold

Replacement (cont'd)

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

1.6 ℓ PGM-FI Engine :

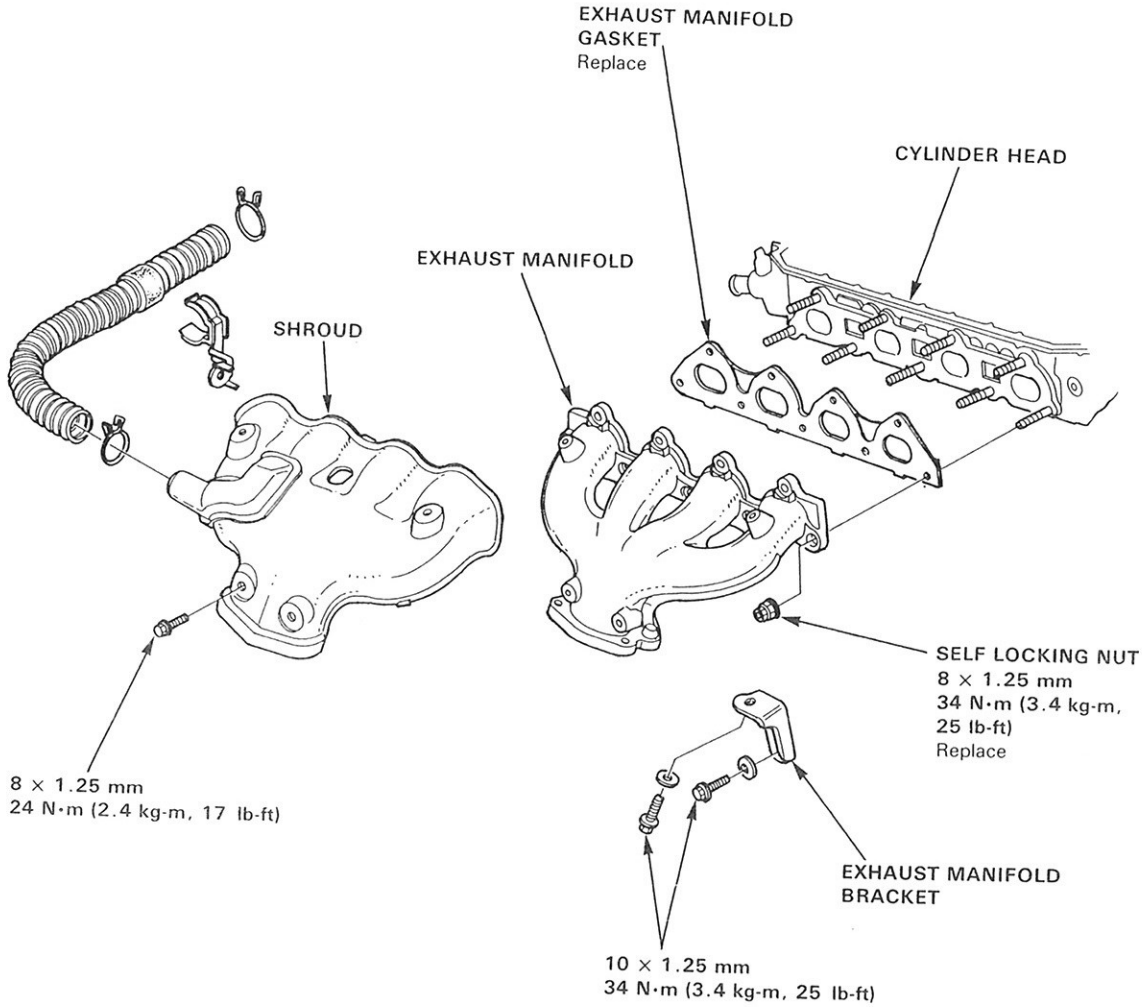


Exhaust Manifold

Replacement

NOTE : Use new gaskets whenever reassembling.

1-Carbureted Engine (Ex. 1.5 ℓ) :

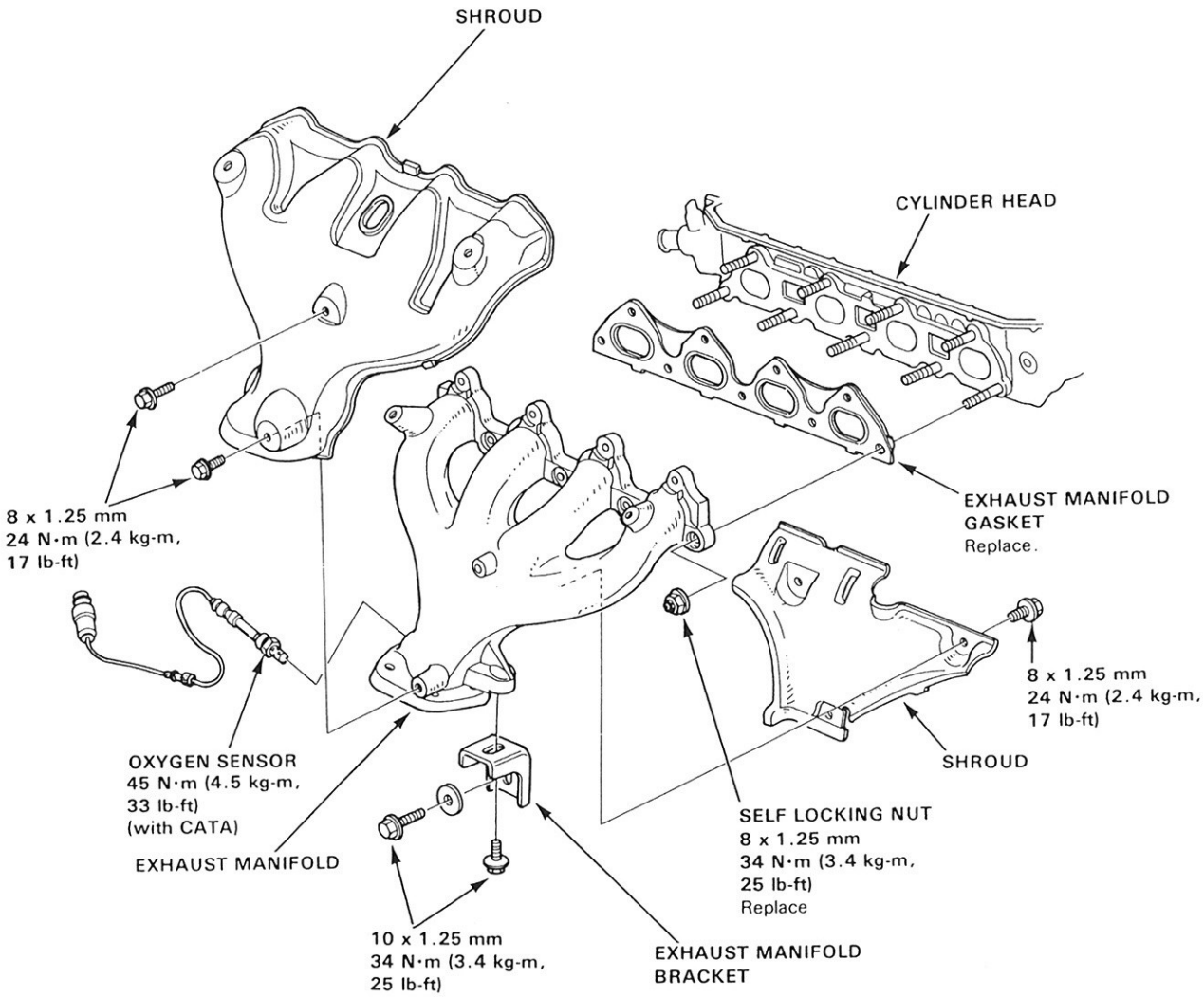


Exhaust Manifold

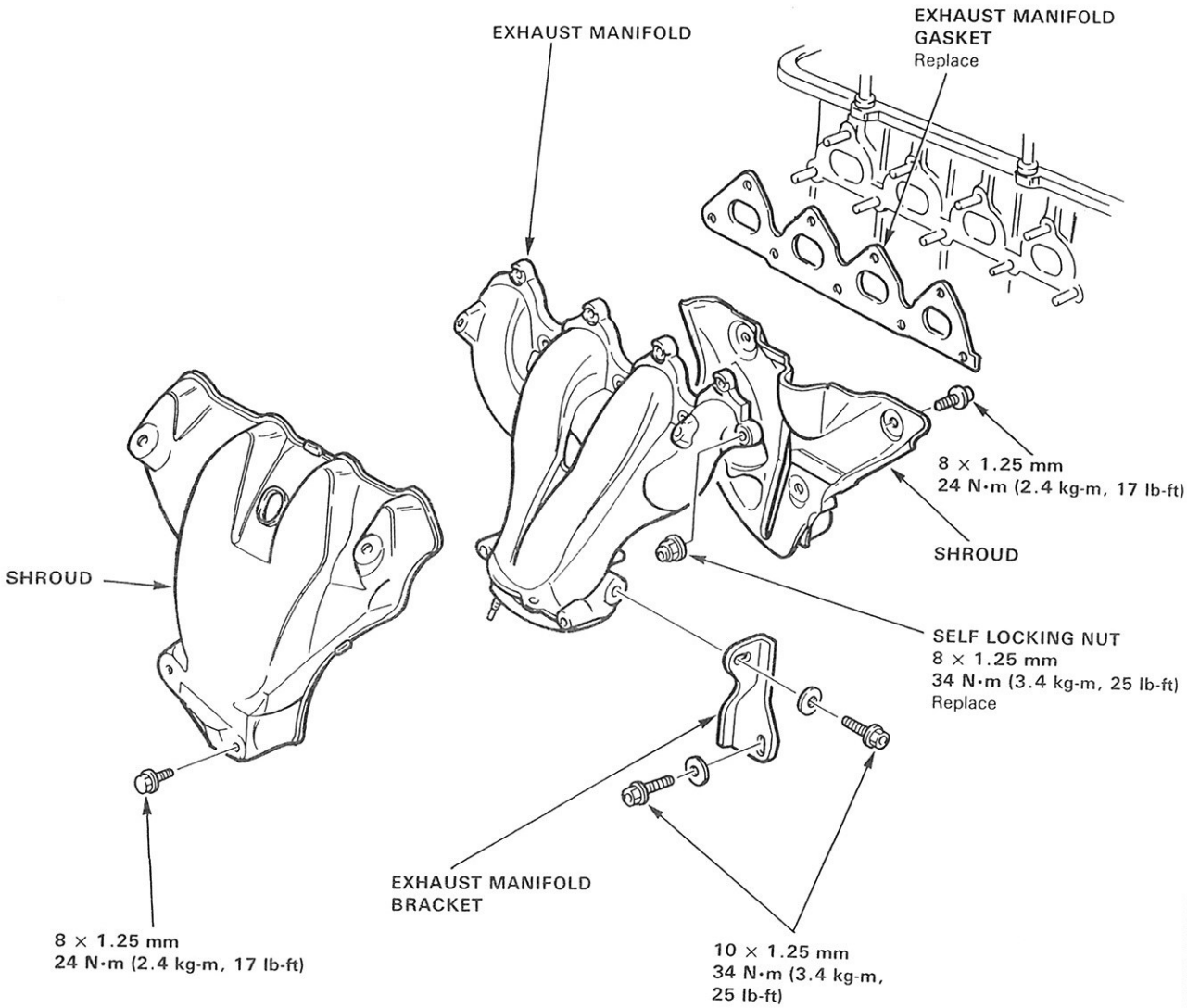
Replacement

NOTE : Use new gaskets whenever reassembling.

1.5 ℓ (Ex. 1-Carbureted Engine), 2-Carbureted, PGM-FI (Ex. KB, KW) :



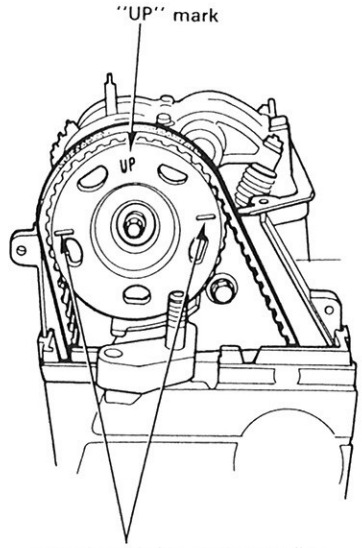
1.6 ℓ (KB, KW) :



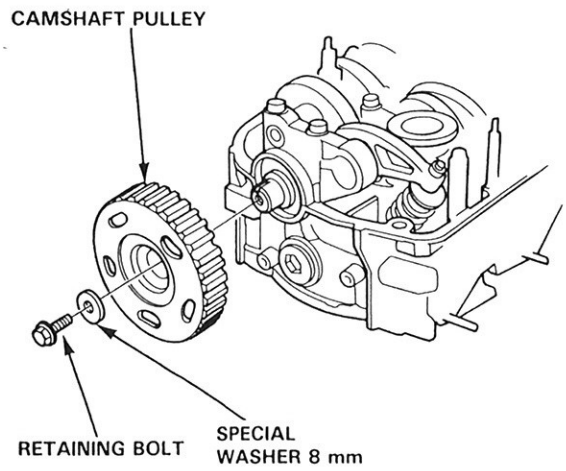
Camshaft Pulley

Removal

1. To ease reassembly, turn the pulley until the "UP" mark faces up, and the front timing mark is aligned with the valve cover surface.



2. Remove the pulley retaining bolt and washer, then remove the pulley.



NOTE: Before removing rocker arm assembly, check camshaft end play.

Camshaft

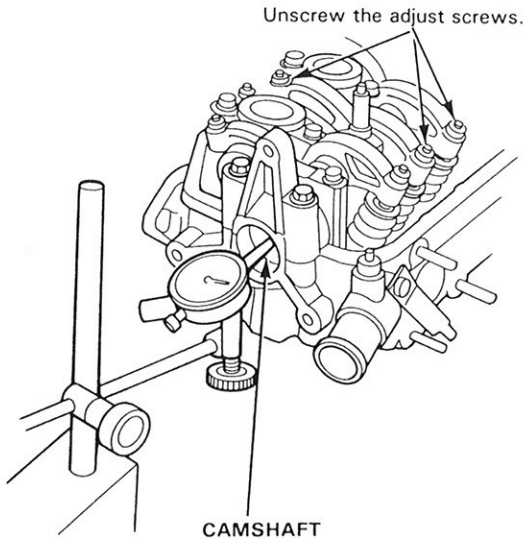
Inspection

NOTE: Do not rotate camshaft during inspection; loosen the adjust screws before starting.

1. Seat camshaft by pushing it toward distributor end of cylinder head.

2. Zero dial indicator against end of distributor drive, then push 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.)



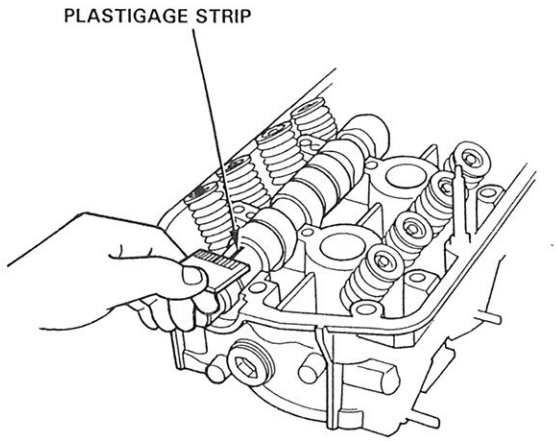
3. Remove the rocker arm bolts, then remove the rocker assembly from the cylinder head.

NOTE: Unscrew the rocker arm bolts, two turns at a time, in a criss-cross pattern, to prevent damaging valves or rocker assembly.

- 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.
- Install the rocker arm assembly and torque bolts to values and in sequence shown on page 3-23 then remove the bolts and the rocker arm assembly.

4. Measure widest portion of plastigage on each journal.

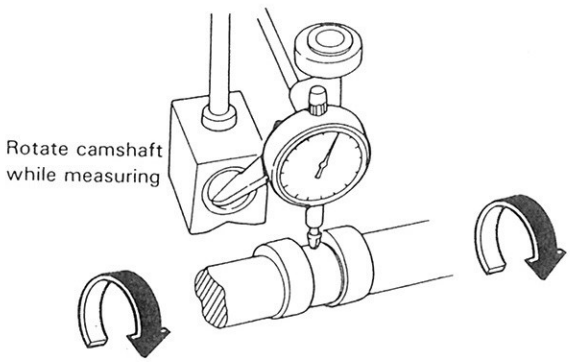
Camshaft Bearing Radial Clearance:
Standard (New): 0.050—0.089 mm (0.002—0.004 in.)
Service Limit: 0.15 mm (0.006 in.)



5. 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): 0.03 mm (0.001 in.)
Service Limit: 0.06 mm (0.002 in.)



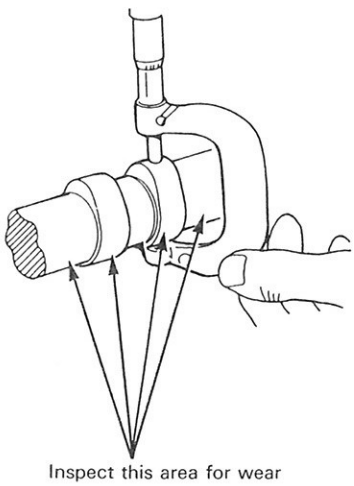
— If the total runout of the camshaft is within tolerance, replace the cylinder head.

— 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.

6. Measure Camshaft height.

Intake Standard :
1.2 ℓ , 1.3 ℓ (Ex. KG A/T) : 35.672 mm (1.4044 in.)
1.3 ℓ (KG A/T) : 35.472 mm (1.3965 in.)
1.4 ℓ , 1.5 ℓ (2-Carbureted) :
1.5 ℓ (PGM-FI Ex. KW*) :
1.6 ℓ (Ex. KB, KW) :
} 36.603 mm (1.4411 in.)
1.5 ℓ (1-Carbureted) : 36.057 mm (1.4196 in.)
1.5 ℓ (PGM-FI KW*) : 34.868 mm (1.3728 in.)
1.6 ℓ (KG, KW) : 36.957 mm (1.4515 in.)

Exhaust Standard :
1.2 ℓ , 1.3 ℓ : 35.693 mm (1.4052 in.)
1.4 ℓ (M/T) :
1.5 ℓ (2-Carbureted A/T) :
1.5 ℓ (PGM-FI A/T Ex. KW*):
} 36.750 mm (1.4468 in.)
1.4 ℓ (A/T) :
1.5 ℓ (2-Carbureted M/T) :
1.5 ℓ (PGM-FI M/T Ex. KW*):
1.6 ℓ (Ex. KB, KW) :
} 36.747 mm (1.4467 in.)
1.5 ℓ (1-Carbureted) : 36.198 mm (1.4251 in.)
1.5 ℓ (2-Carbureted, PGM-FI KW*) : 36. 435 mm (1.4344 in.)
1.6 ℓ (KB, KW) : 36.996 mm (1.4565 in.)
KW* : for Austria

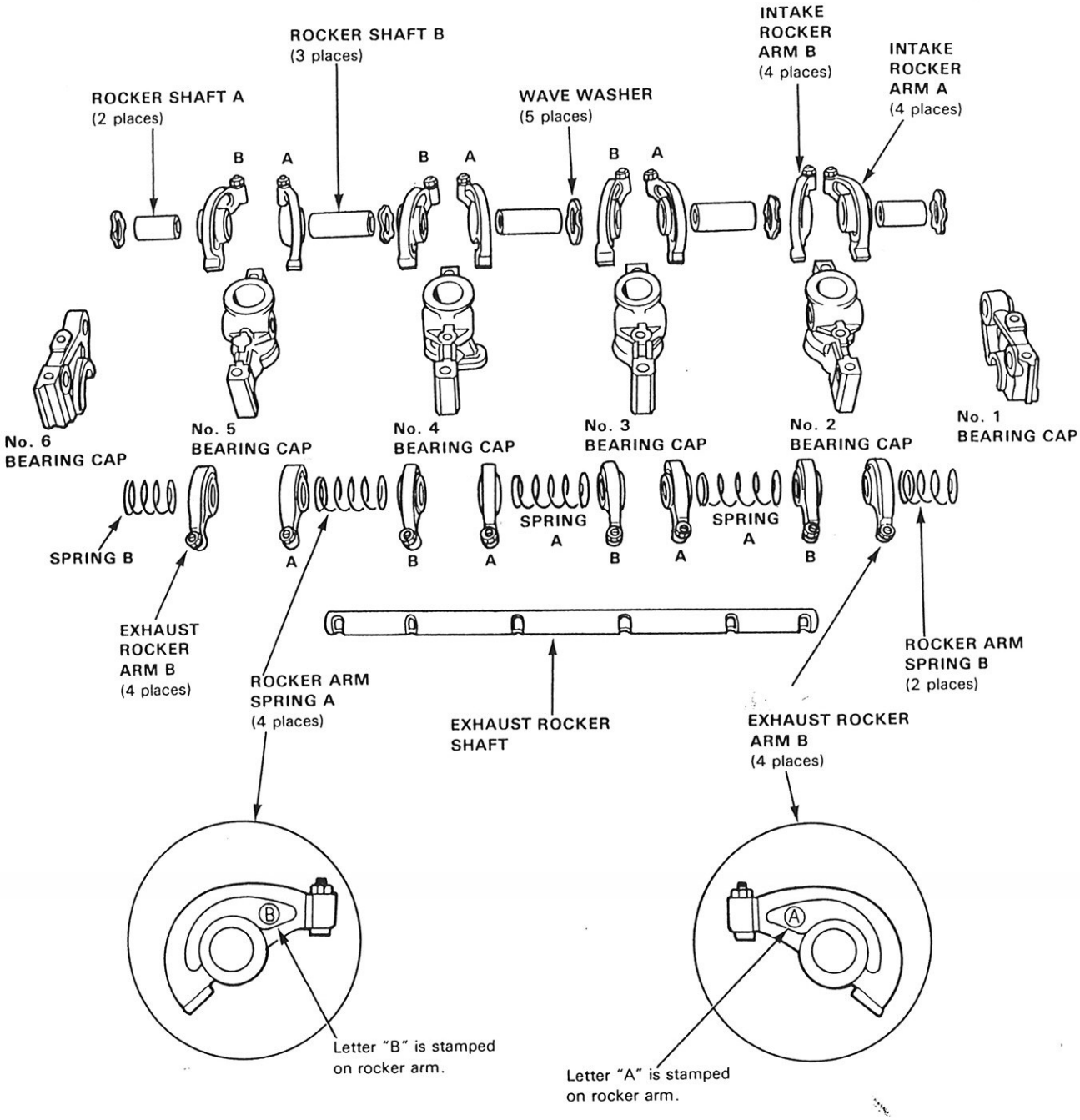


Rocker Arms

Overhaul

NOTE:

- Identify parts as they are removed to ensure reinstallation in original locations.
- Inspect rocker shafts and rocker arms (page 3-17).
- Rocker arms must be installed in the same position if reused.
- When removing or installing rocker arm assembly, do not remove bearing cap bolts. The bolts will keep the holders, springs and rocker arms on the shaft.
- Install a exhaust rocker shaft with its oil holes downwards.

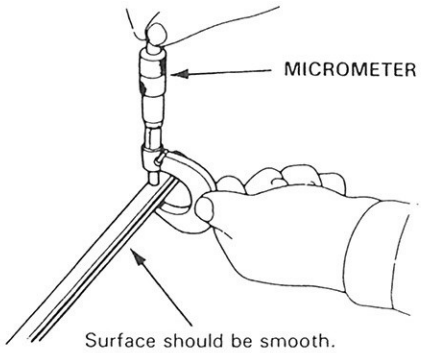


Valves

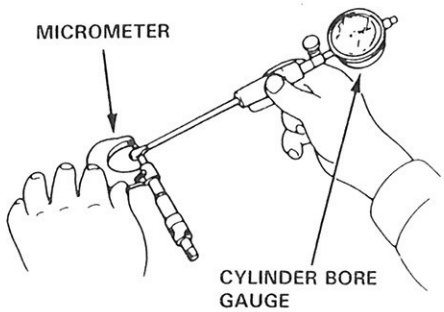
Clearance

Measure both the intake rocker shaft and exhaust rocker shaft.

1. Measure diameter of shaft at first rocker location.

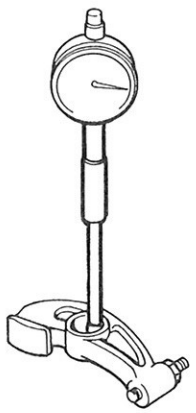


2. Zero gauge to shaft diameter.



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.)



Inspect rocker arm face for wear.

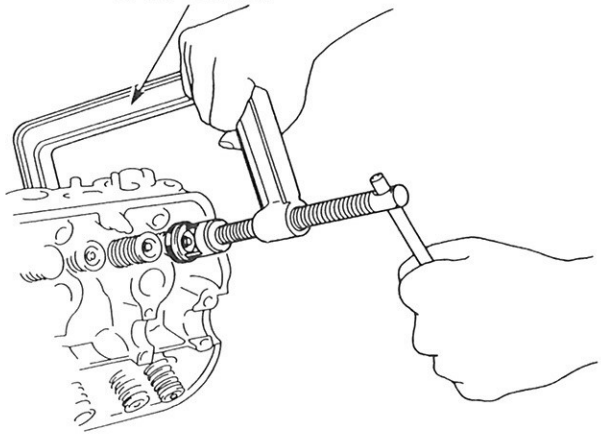
Repeat for all rockers. If over limit, replace rocker shaft and all over-tolerance rocker arms.

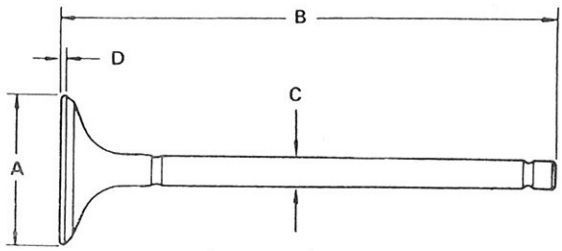
Replacement

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

1. Tap each valve stem with a plastic mallet to loosen valve keepers before installing spring compressor.
2. Install spring compressor. Compress spring and remove valve keeper.

VALVE SPRING COMPRESSOR
07757-0010000





Intake Valve Dimensions
A Standard (New): 28.9—29.1 mm (1.138—1.146 in.)
B Standard (New): 114.82—115.12 mm (4.521—4.532 in.)
C Standard (New): 5.48—5.49 mm (0.2157—0.2161 in.)
C Service Limit: 5.45 mm (0.215 in.)
D Standard (New): 0.85—1.15 mm (0.033—0.045 in.)
D Service Limit: 0.65 mm (0.026 in.)

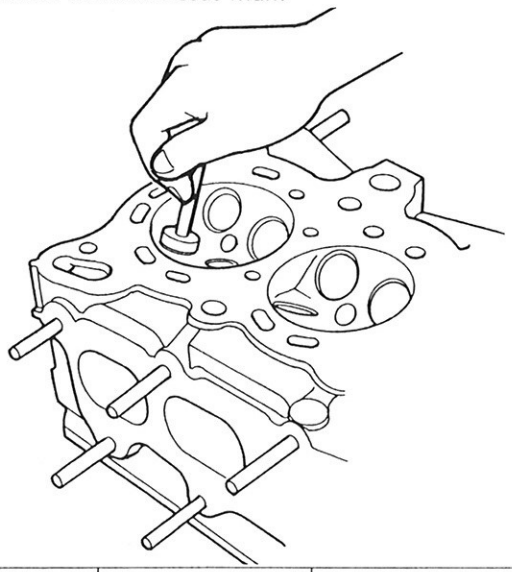
Exhaust Valve Dimensions
A Standard (New): 24.9—25.1 mm (0.980—0.988 in.)
B Standard (New): 118.60—118.90 mm (4.669—4.681 in.)
C Standard (New): 5.45—5.46 mm (0.2146—0.2150 in.)
C Service Limit: 5.42 mm (0.213 in.)
D Standard (New): 1.05—1.35 mm (0.041—0.053 in.)
D Service Limit: 0.95 mm (0.037 in.)

Valve Seats

Reconditioning

1. Renew the valve seats in the cylinder head using valve seat cutters.

   NOTE : If guides are worn, replace them (page 3-19) before cutting valve seats.
   cutter to restore seat widh.



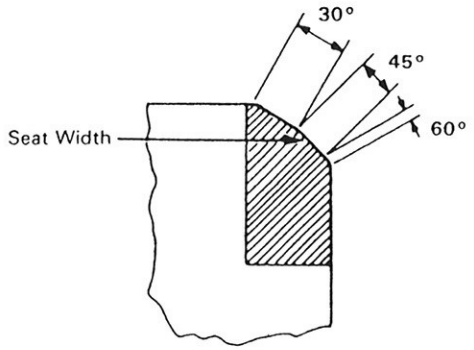
CUTTER	INTAKE	EXHAUST
45°	07780–0010300	07780–0010200
30°	07780–0012200	07780–0012100
60°	07780–0014000	07780–0014000
HOLDER	07781–0010100 or 07781–0010101	

2. Carefully cut a 45° seat, removing only enough material to ensure a smooth and concentric seat.

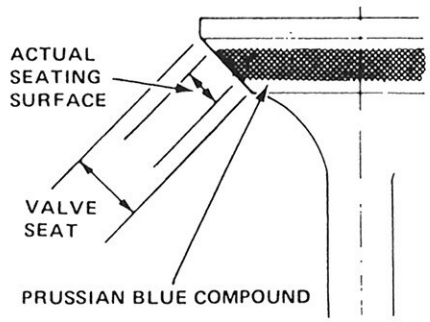
3. Bevel the upper edge of seat with the 30° cutter and the lower edge of seat with the 60° cutter. Check width of seat and adjust accordingly.

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

   Valve Seat Width:
   Standard: 1.25–1.55 mm (0.049–0.061 in.)
   Service Limit: 2.0 mm (0.08 in.)



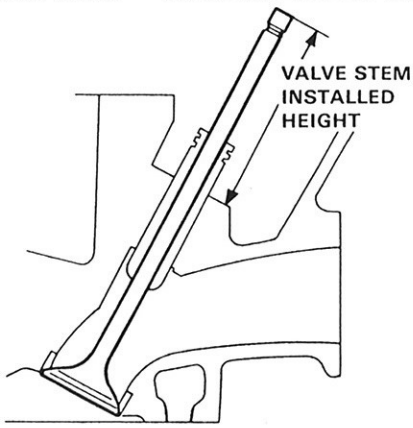
5. After resurfacing seat, inspect for even valve seating: Apply Prussian Blue compound to valve face, and insert valve in original location in head, then lift it and snap it closed against seat several times.



6. The actual valve seating surface, as shown by the blueing compound, should be centered on the seat.
   - If it is too high (closer to the valve stem), you must make a second cut with the 60° cutter to move it down, then one more cut with the 45° cutter to restore seat width.
   - If it is too low (closer to valve edge), you must make a second cut with the 30° cutter to move it up, then one more cut with the 45° cutter to restore seat width.
     NOTE: The final cut should always be made with the 45° cutter.

7. Insert intake and exhaust valves in head and measure valve stem installed height.

   Intake Value Stem Installed Height :
   Standard (New) : 46.985–47.455 mm (1.8498–1.8880 in.)
   Service Limit : 47.705 mm (1.8863 in.)
   Exhaust Valve Stem Installed Height :
   Standard (New) : 48.965–49.435 mm (1.9278–1.9463 in.)
   Service Limit : 49.685 mm (1.9561 in.)



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

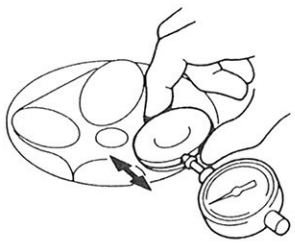
Valve Guides

Valve Movement

1. Measure the valve movement with a dial indicator, while rocking the stem in the direction of normal thrust (Wobble Method).

Intake Valve Movement
Standard (New): 0.04–0.10 mm (0.0016–0.004 in.)
Service Limit: 0.16 mm (0.006 in.)
Exhaust Valve Movement
Standard (New): 0.10–0.16 mm (0.004–0.006 in.)
Service Limit: 0.24 mm (0.009 in.)

Valve extended 10 mm out from seat.



- If measurement exceeds the service limit, recheck using new valve.
- If measurement is now within service limit, reassemble using 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.

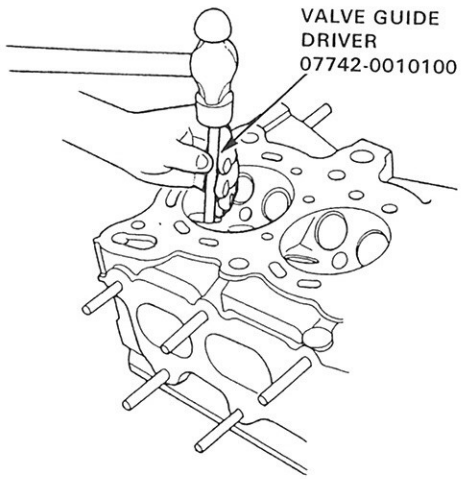
Intake Valve Stem-to-Guide Clearance
Standard (New): 0.02–0.05 mm (0.001–0.002 in.)
Service Limit: 0.08 mm (0.003 in.)
Exhaust Valve Stem-to-Guide Clearance
Standard (New): 0.05–0.08 mm (0.002–0.003 in.)
Service Limit: 0.12 mm (0.005 in.)

Replacement

NOTE :
- For best results, heat cylinder head to 150°C (300°F) before removing or installing guides.
- It may be necessary to use an air hammer to remove some valve guides.

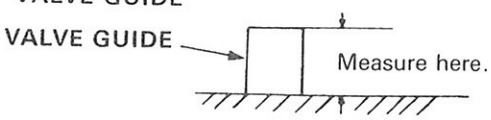
CAUTION : To avoid burns, use heavy gloves when handling heated cylinder head.

1. Drive the valve guide out from the bottom of the cylinder head.

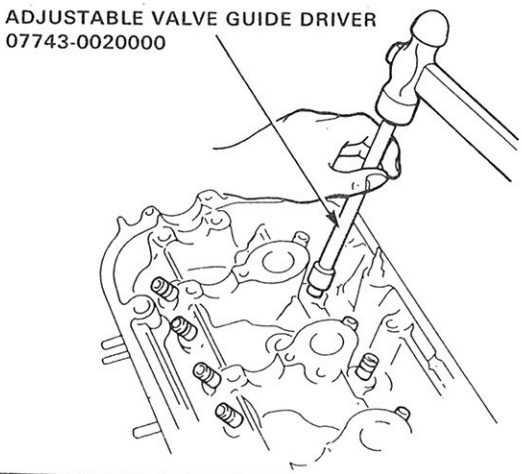


2. Drive in a new valve guide to the specified depth.

Intake : 16.2 mm (0.64 in.)
Exhaust : 16.2 mm (0.64 in.)



NOTE : If using adjustable valve guide driver 07743-0020000, adjust the collar depth to correspond with the measurements given above.



Cylinder Head

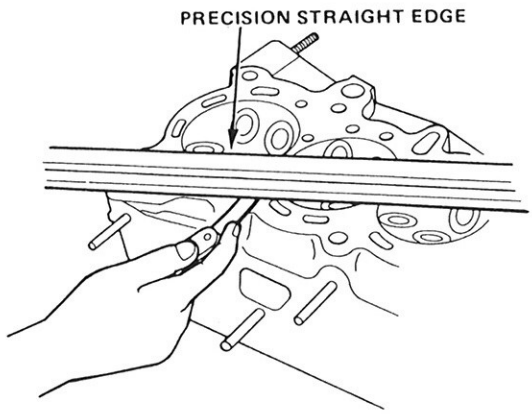
Warpage

NOTE: If camshaft bearing clearances are not within specification, the head cannot be resurfaced (page 3-14).

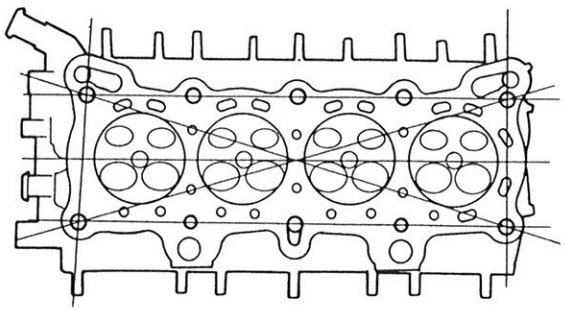
- Check cam bearing clearances before resurfacing a head.

If camshaft bearing radial clearances are within specifications, check 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 new cylinder head height of 95 mm (3.74 in.).



Measure along edges, and 3 ways across center.



Cylinder Head Height:
Standard (New): 94.95—95.05 mm (3.7382—3.7421 in.)
Service Limit: 94. 8 mm (3.73 in.)

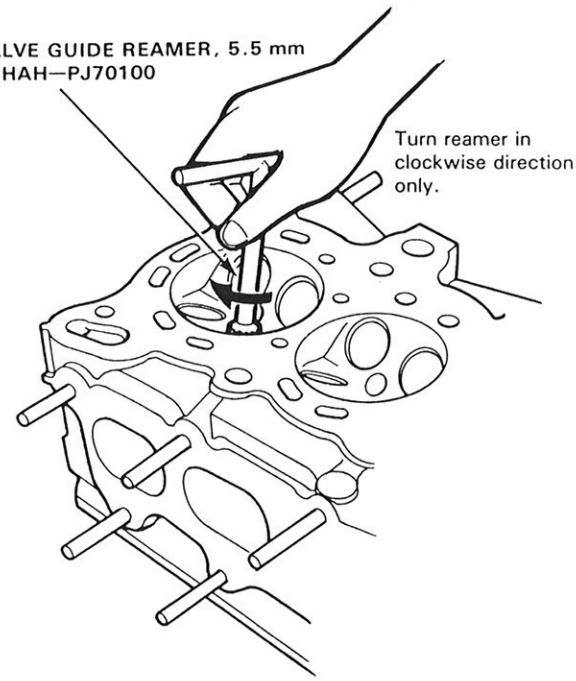
Valve Guides

Reaming

NOTE: For new valve guides only.

1. Coat reamer and valve guide with cutting oil.
2. Rotate reamer clockwise the full length of the valve guide bore.

VALVE GUIDE REAMER, 5.5 mm
07HAH—PJ70100

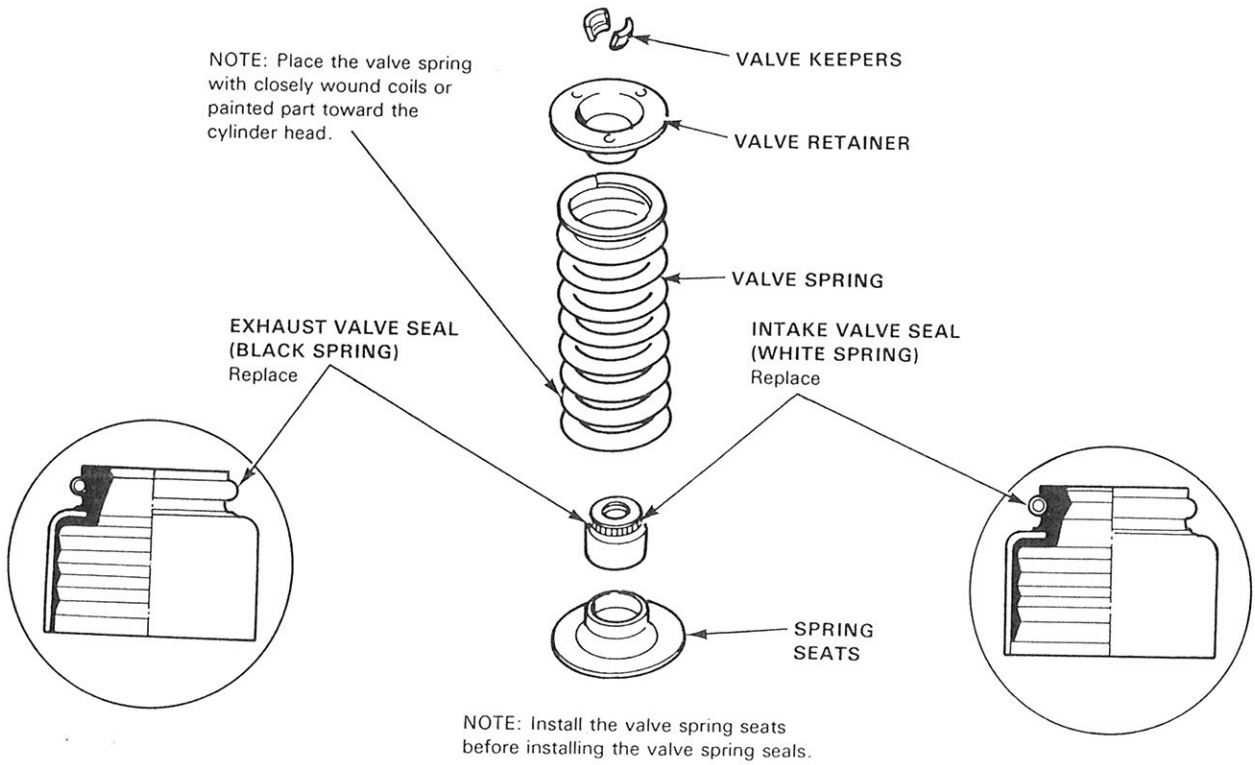


3. Continue to rotate reamer clockwise while removing.
4. Thoroughly wash the guide in detergent and water to remove any cutting residue.
5. Check clearance with valve (page 3-19).

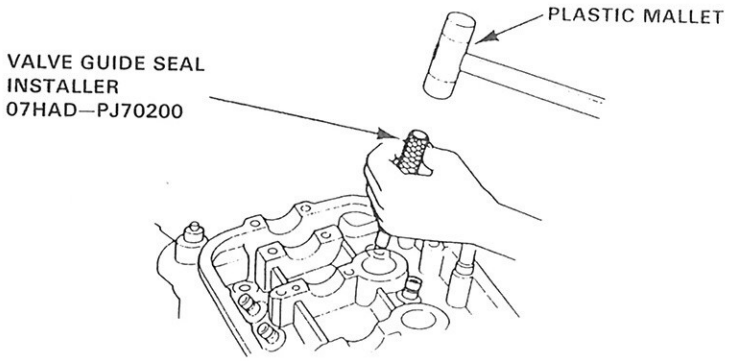
Valve Spring and Valve Seals

Installation Sequence

NOTE: Exhaust and intake valve seals are NOT interchangeable.



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

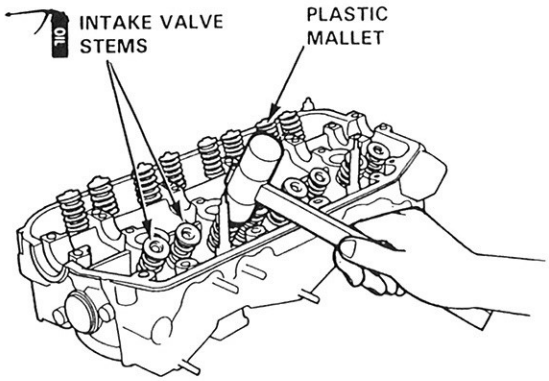


Valve Springs and Valve Seals

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 with a plastic mallet to ensure proper seating of valve and valve keepers.



Camshaft/Rocker Arms and Camshaft Seals/Pulley

Installation

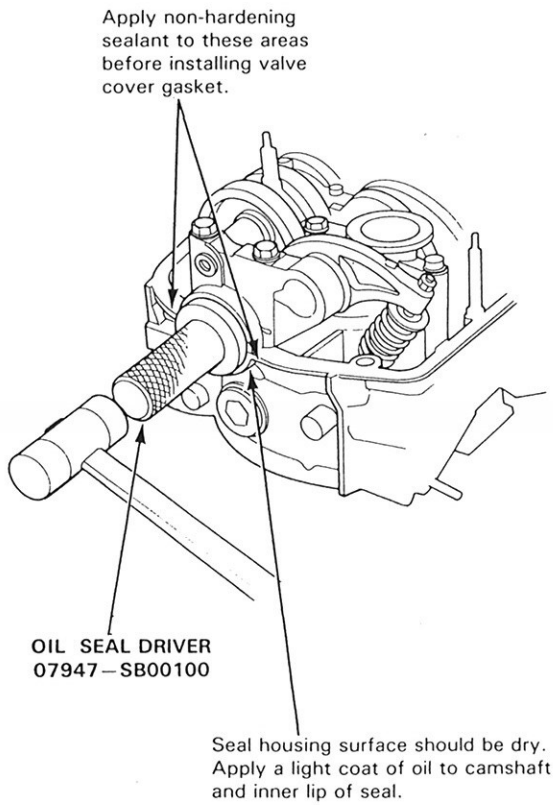
CAUTION:

- **Make sure that all rockers are in alignment with valves with torquing rocker assembly bolts.**
- **Valve locknuts should be loosened and adjust screws backed off before installation.**
- **To prevent rocker arm assembly from coming apart, leave bearing cap holding bolts in the holes.**

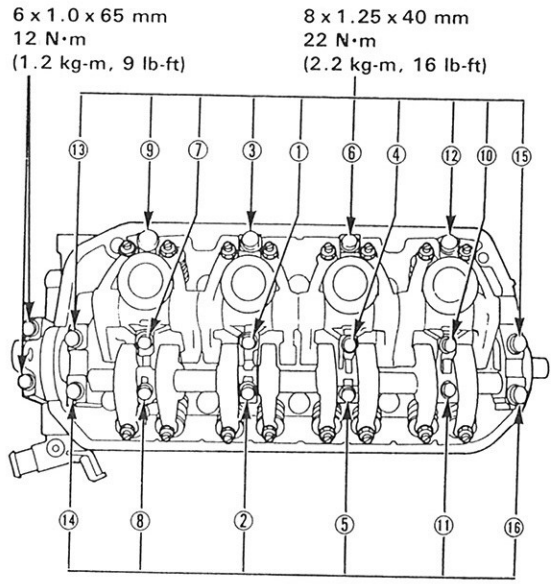
1. After wiping down cam and journals in cylinder head, lubricate both surfaces and install camshaft.
2. Turn camshaft until its keyway is facing up. (No. 1 cylinder TDC).
3. Install the camshaft seal with the open side (spring) facing in.

OIL Lubricate cam lobes after reassembly.

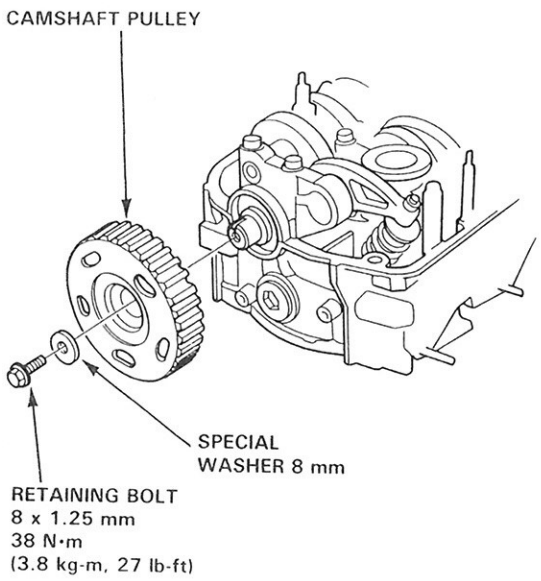
4. Set rocker arm assembly in place and loosely install the bolts.
5. Drive in the camshaft oil seal securely with the special tool.



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

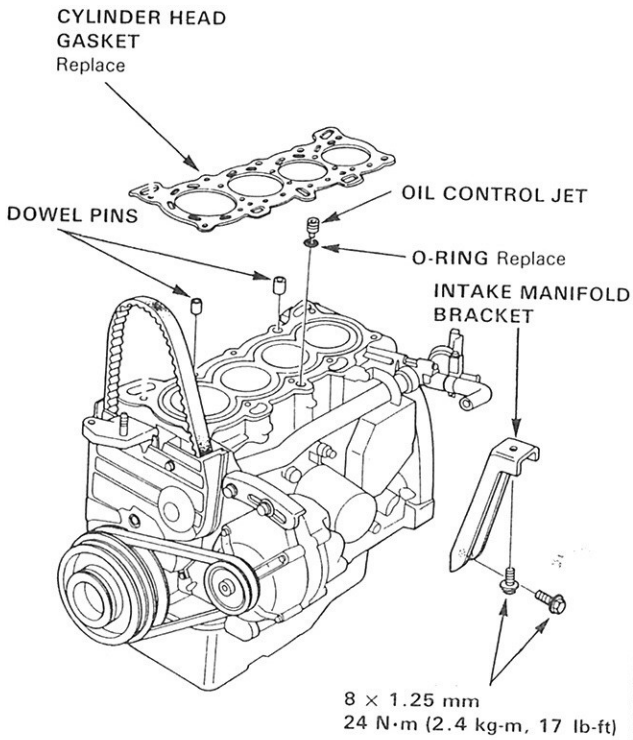


7. Push camshaft pulley onto camshaft, then tighten retaining bolt to torque shown.



Installation

1. Install the cylinder head in reverse order of removal :
   - Always use a new head gasket.
   - Cylinder head and engine block surface must be clean.
   - "UP" mark on timing belt pulley should be at the top.
2. Cylinder head dowel pins and oil control jet must be aligned.

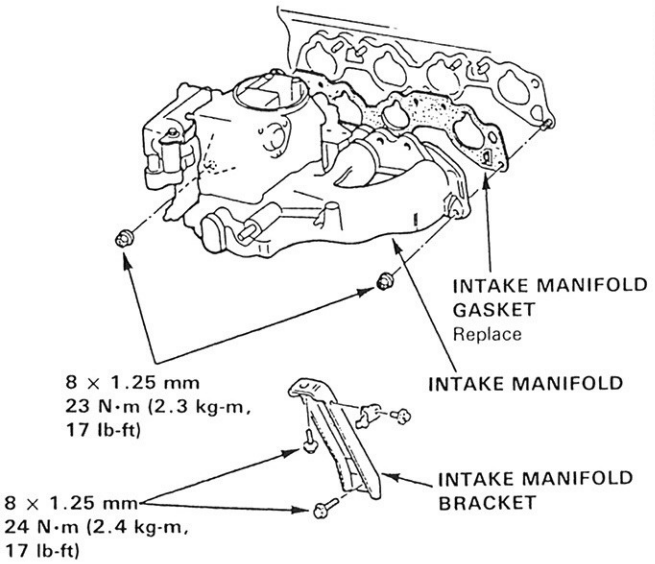


(cont'd)

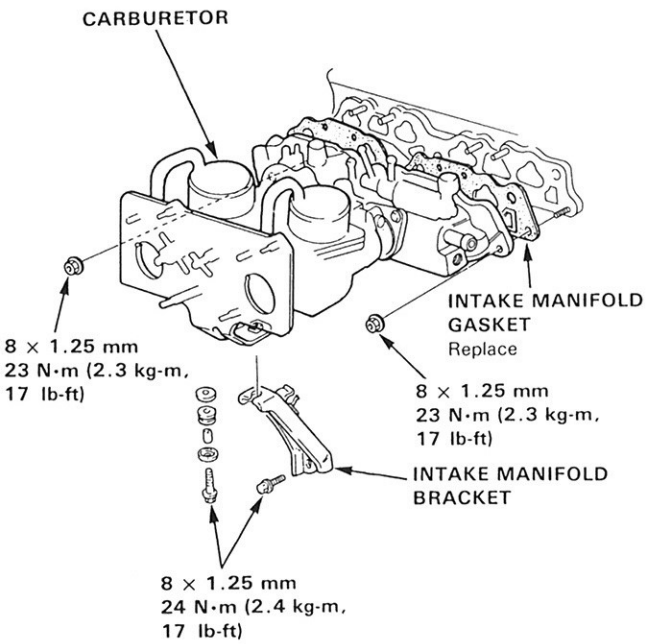
Installation (cont'd)

3. Install the intake manifold and tighten the nuts in a criss-cross pattern, beginning with the inner nuts.

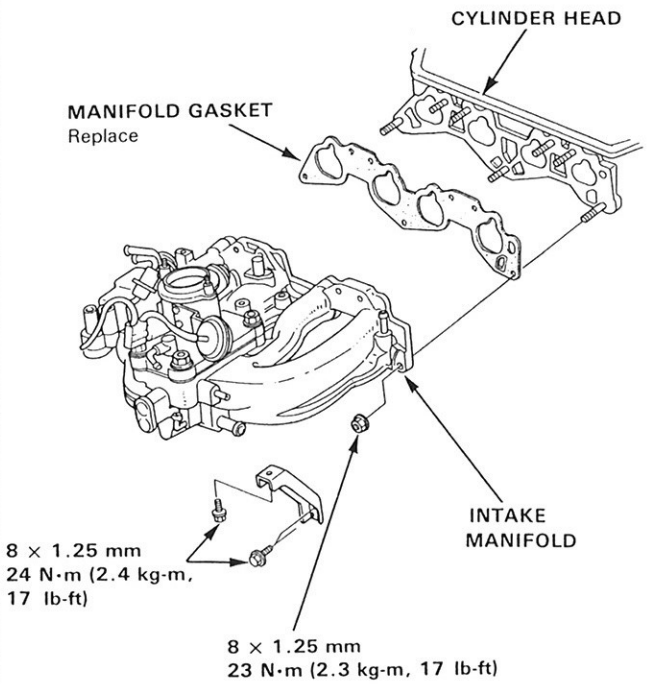
1-carbureted Engine :



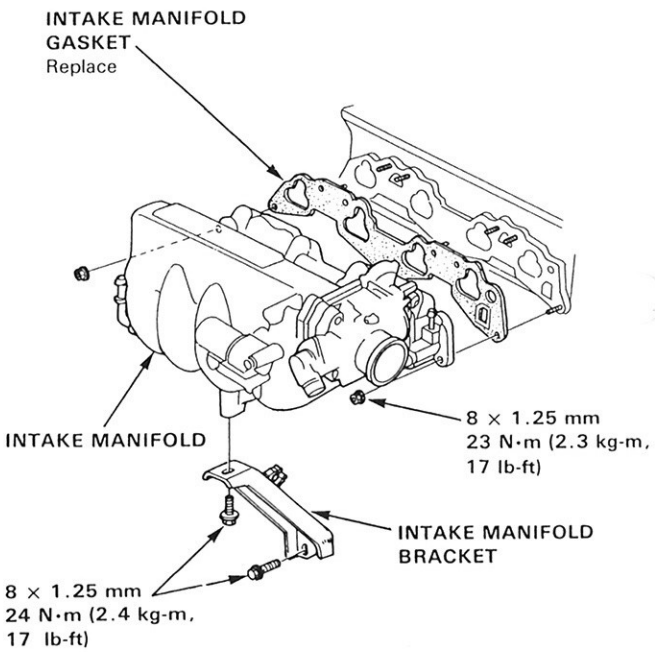
2-Carbureted Engine :



1.5 ℓ (PGM-FI) :



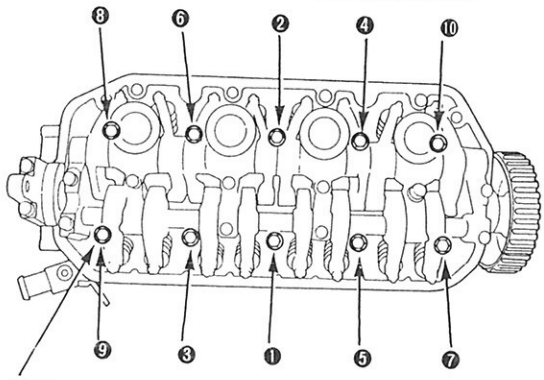
1.6 ℓ (PGM-FI) :



4. Tighten cylinder head bolts in two steps.
In the first step tighten all bolts and nuts, in sequence, to about 30 N·m (3.0 kg-m, 22lb-ft) ; in the final step tighten, in same sequence, to 68 N·m (6.8 kg-m, 49lb-ft).

NOTE : Apply engine oil to the cylinder head bolts and the washers.

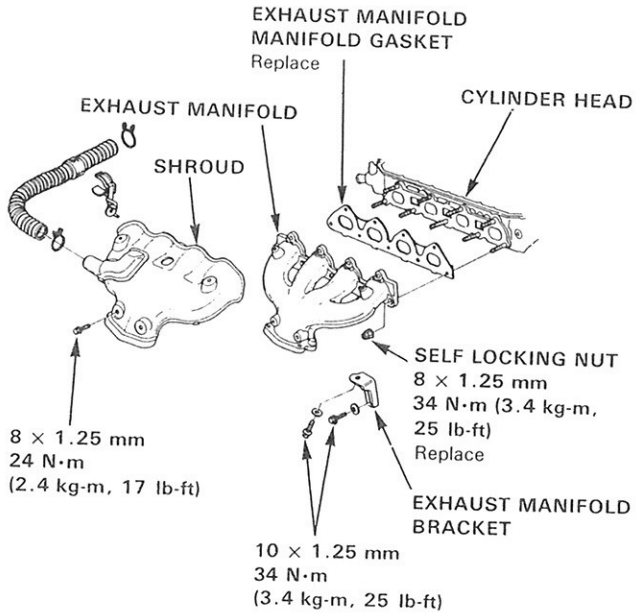
CYLINDER HEAD TORQUE SEQUENCE



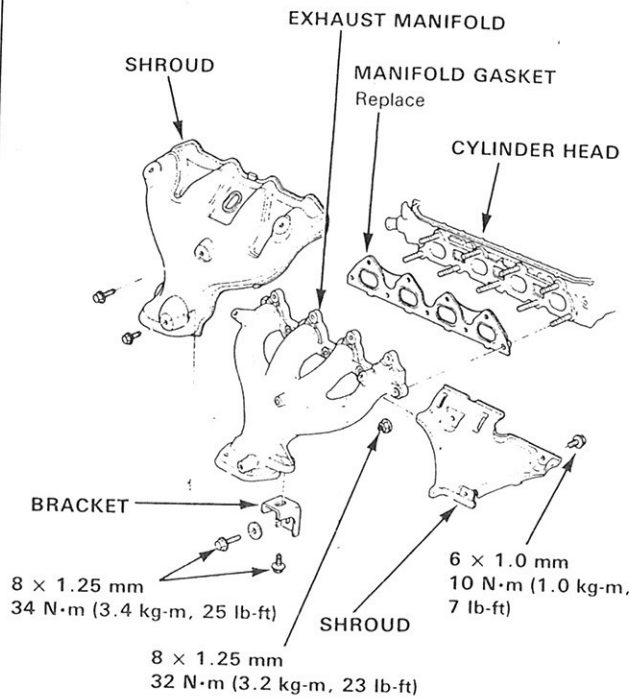
CYLINDER HEAD BOLT
10 × 1.25 mm
68 N·m (6.8 kg-m, 49 lb-ft)

5. Adjust the valve timing.
6. Install the exhaust manifold and bracket.

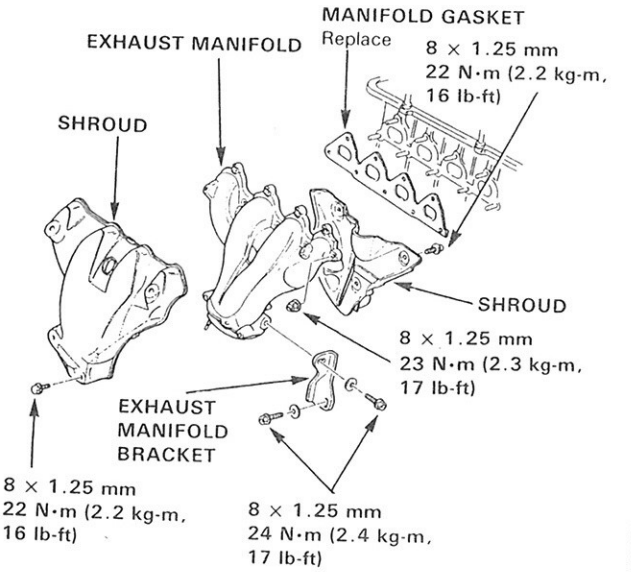
1-Carbureted Engine (Ex. 1.5 ℓ):



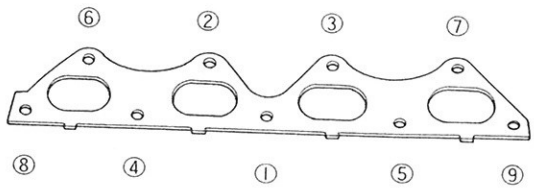
1.5 ℓ (1-Carbureted), PGM-FI (Ex. KB, KW) and 2-Carbureted Engine :



1.6 ℓ (KB, KW) Engine :



EXHAUST MANIFOLD TORQUE SEQUENCE

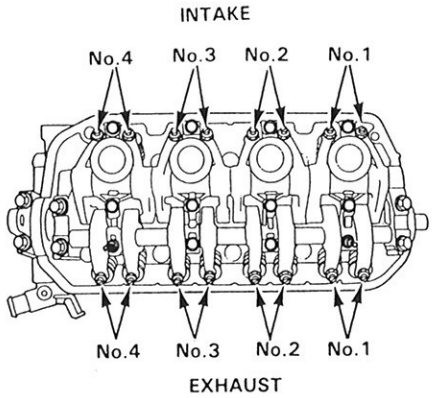


Valve Clearance

Adjustment

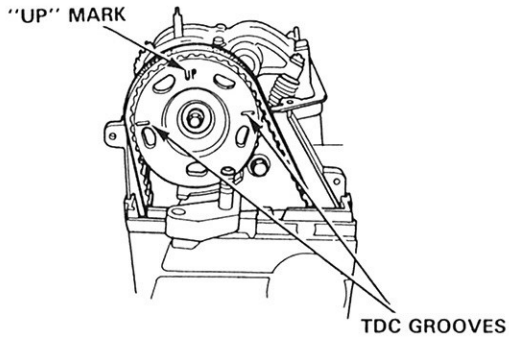
NOTE: Valves should be adjusted cold when the cylinder head temperature is less than 38°C (100°F). Adjustment is the same for intake and exhaust valves.

1. Remove valve cover.

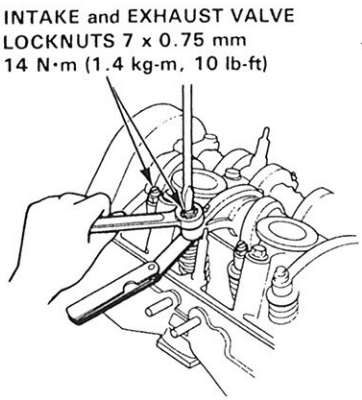


2. Set No. 1 piston at TDC. "UP" mark on the pulley should be at top, and TDC grooves on the pulley should align with cylinder head surface. The distributor rotor must be pointing towards No. 1 plug wire.

Number 1 piston at TDC

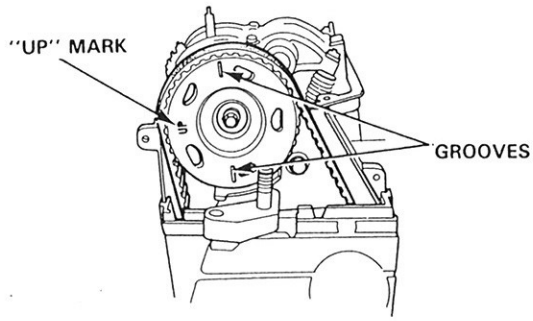


3. Adjust valves on No.1 cylinder.
   Intake: 0.17—0.22 mm (0.007—0.009 in.)
   Exhaust: 0.22—0.27 mm (0.009—0.011 in.)
4. Loosen locknut and turn adjustment screw until feeler gauge slides back and forth with slight amount of drag.



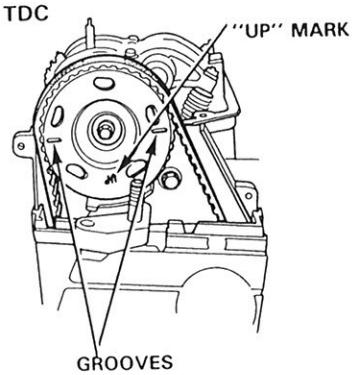
5. Tighten locknut and check clearance again. Repeat adjustment if necessary.
6. Rotate crankshaft 180° counterclockwise (cam pulley turns 90°). The "UP" mark should be at exhaust side. Distributor rotor should point to No. 3 plug wire. Adjust valves on No. 3 cylinder.

Number 3 piston at TDC



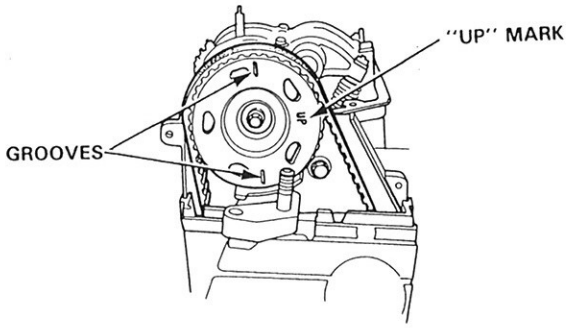
7. Rotate crankshaft 180° counterclockwise to bring No. 4 piston to TDC. Both TDC grooves are once again visible and distributor rotor points to No.4 plug wire. Adjust valves on No.4 cylinder.

Number 4 piston at TDC



8. Rotate crankshaft 180° counterclockwise to bring No. 2 piston to TDC. The "UP" mark should be at intake side. Distributor rotor should point to No. 2 plug wire. Adjust valves on No. 2 cylinder.

Number 2 piston at TDC



Cylinder Head/Valve Train

〈DOHC〉

Standards and Service Limits, Special Tools

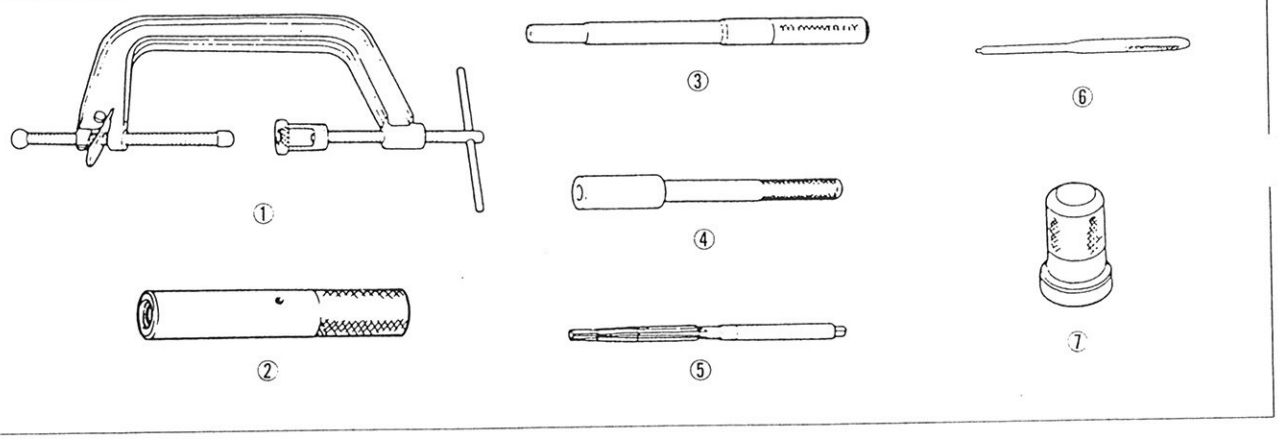
Standards and Service Limits (DOHC)

Unit : mm (in)

	MEASUREMENT		STANDARD (NEW)	SERVICE LIMIT
Compression	250 rpm and wide-open throttle		Nominal Minimum Maximum variation	1,324kPa (13.5kg/cm², 192psi) 932kPa (9.5kg cm², 135psi) 196kPa (2kg/cm², 28psi)
Cylinder head	Warpage Height		— 131.95–132.05	0.05 (0.002) —
Camshaft	End play Oil clearance Runout Cam lobe height	 IN EX	0.05–0.15 (0.002–0.006) 0.050–0.089 (0.002–0.004) 0–0.03 (0–0.001) max. 33.021 (1.3000) 32.382 (1.2749)	0.5 (0.02) 0.15 (0.006) 0.03 (0.001) — —
Valve	Valve clearance	IN EX	0.13–0.17 (0.005–0.007) 0.15–0.19 (0.006–0.008)	— —
	Valve stem O.D.	IN EX	6.58–6.59 (0.2591–0.2595) 6.55–6.56 (0.2579–0.2583)	6.55 (0.2579) 6.52 (0.2567)
	Stem-to-guide clearance	IN EX	0.02–0.05 (0.001–0.002) 0.05–0.08 (0.002–0.003)	0.08 (0.003) 0.12 (0.005)
	Stum installed height	IN EX	45.545–46.015 (1.7931–1.8116) 44.735–45.205 (1.7612–1.7797)	46.265 (1.8215) 45.455 (1.7896)
Valve seat	Width	IN and EX	1.25–1.55 (0.049–0.061)	2.0 (0.08)
Valve spring	Free length	IN EX	47.49 (1.8697) 46.89 (1.8461)	46.46 (1.8291) 45.93 (1.8083)
	Squareness	IN and EX	—	1.66/1.64 (0.065/0.065)
Valve guide	I.D.	IN and EX	6.61–6.63 (0.2602–0.2610)	6.55 (0.2579)

Special Tools (Common with Other Models)

Ref. No.	Tool Number	Description	Q'ty	Remarks
①	07757–0010000	Valve Spring Compressor	1	
②	07GMD–PH70100	Valve Stem Seal Installer	1	
③	07942–6570100	Valve Guide Driver, 6.6 mm	1	07942–6110000 may be also used
④	07743–0020000	Adjustable Valve Guide Driver	1	
⑤	07984–6570101	Valve Guide Reamer, 6.6 mm	1	
⑥	07944–6110100	Pin Driver 5.0 mm	2	07744–0010400 may be also used
⑦	07947–SB00100	Oil Seal Driver	1	Camshaft seal

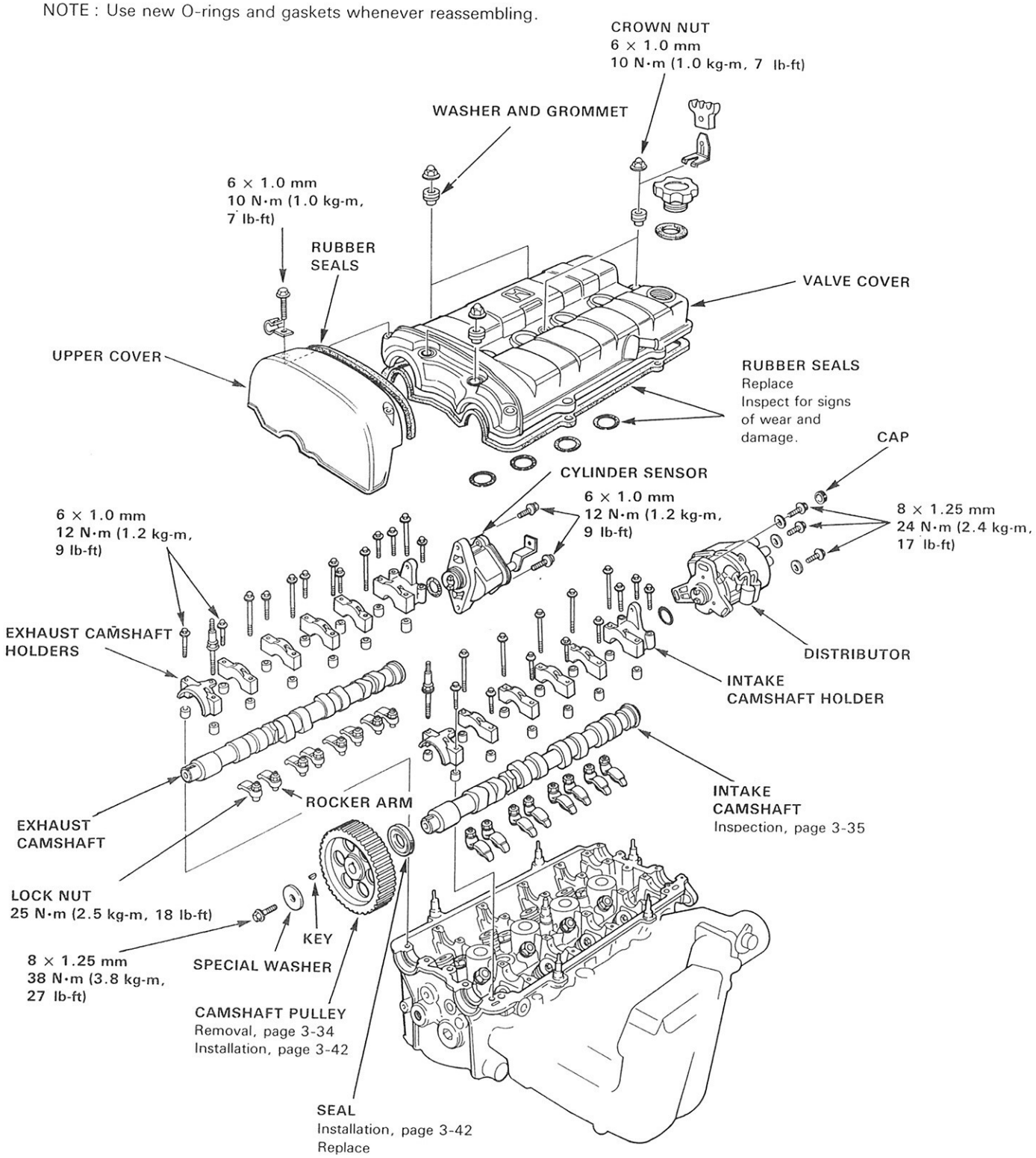


Cylinder Head/Valve Train

Illustrated Index

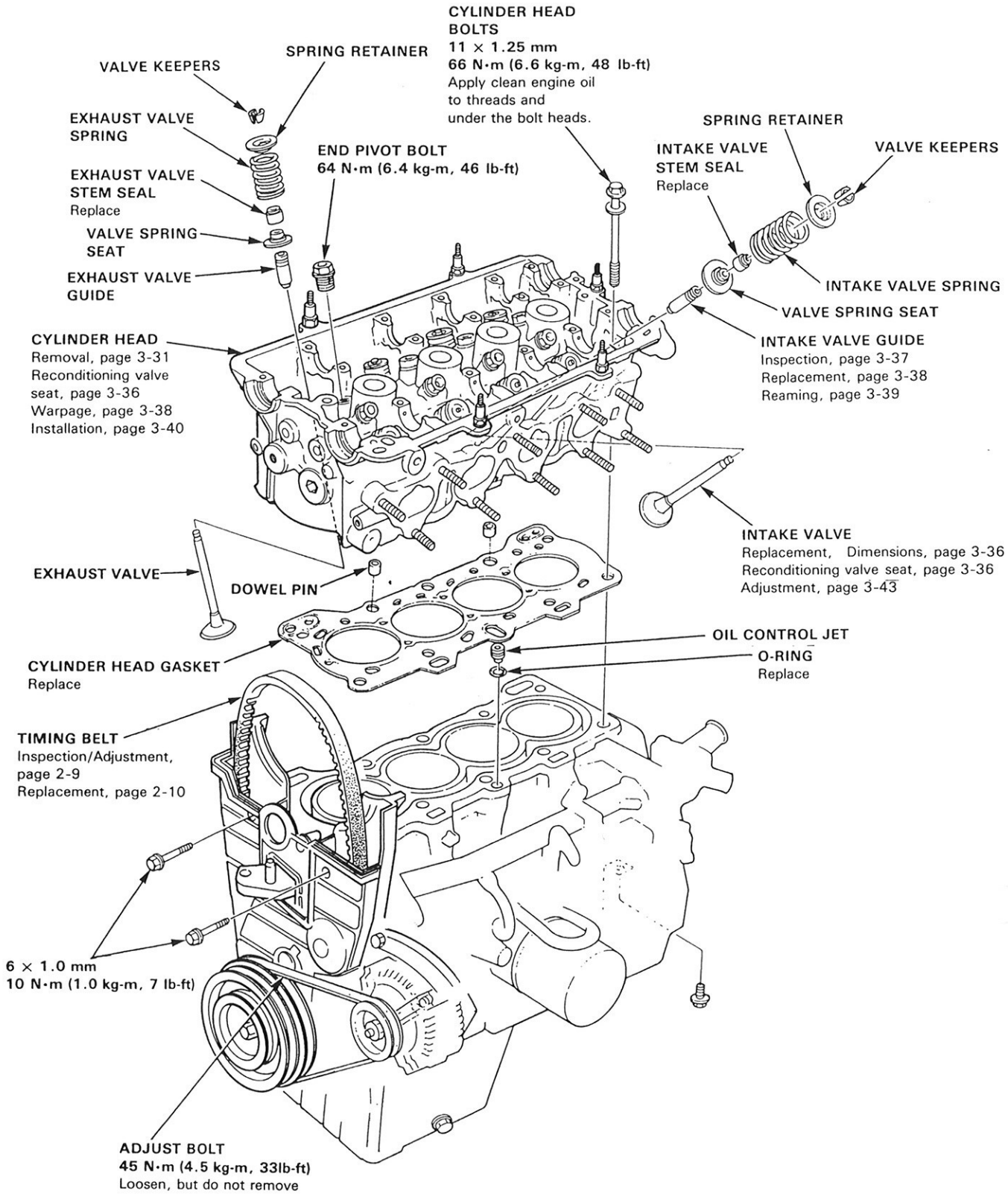
CAUTION : To avoid damaging the cylinder head, wait until the coolant temperature drops below 38°C (100°F) before removing it.

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



Cylinder Head/Valve Train

Illustrated Index



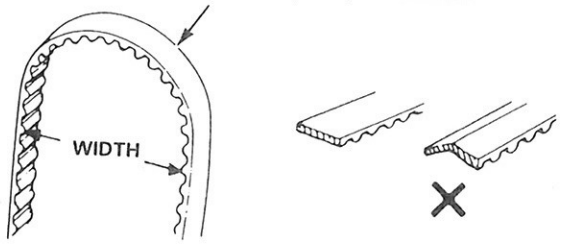
Cylinder Head

Removal

NOTE :
- Inspect the timing belt before removing the cylinder head.
- Turn the crankshaft pulley so that the No. 1 cylinder is at top-dead-center (pages 2-12, 3-42)
- Mark all emissions hoses before disconnecting them.

1. Disconnect the spark plug wire, then remove the distributor assembly from the cylinder head.
2. Remove the cylinder sensor from the cylinder head.
3. Remove the valve cover and the upper cover.
4. Disconnect the engine wire connectors from the cylinder head and the intake manifold.
   - Ignition coil connector (from distributor)
   - EACV connector
   - Ground wire terminal at the fuel pipe
   - Thermosensor connector
   - Coolant temperature sensor connector
   - CYL sensor cnnector
   - Injector connectors
   - TDC/CRANK sensor connector (from distributor)
5. Disconnect the vacuum hoses and the water by-pass hoses from the intake manifold.
6. Remove the exhaust manifold from the cylinder head.
7. Remove the intake manifold from the cylinder head.
8. Loosen the timing belt adjust bolt, then remove the timing belt from the camshaft pulley.

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



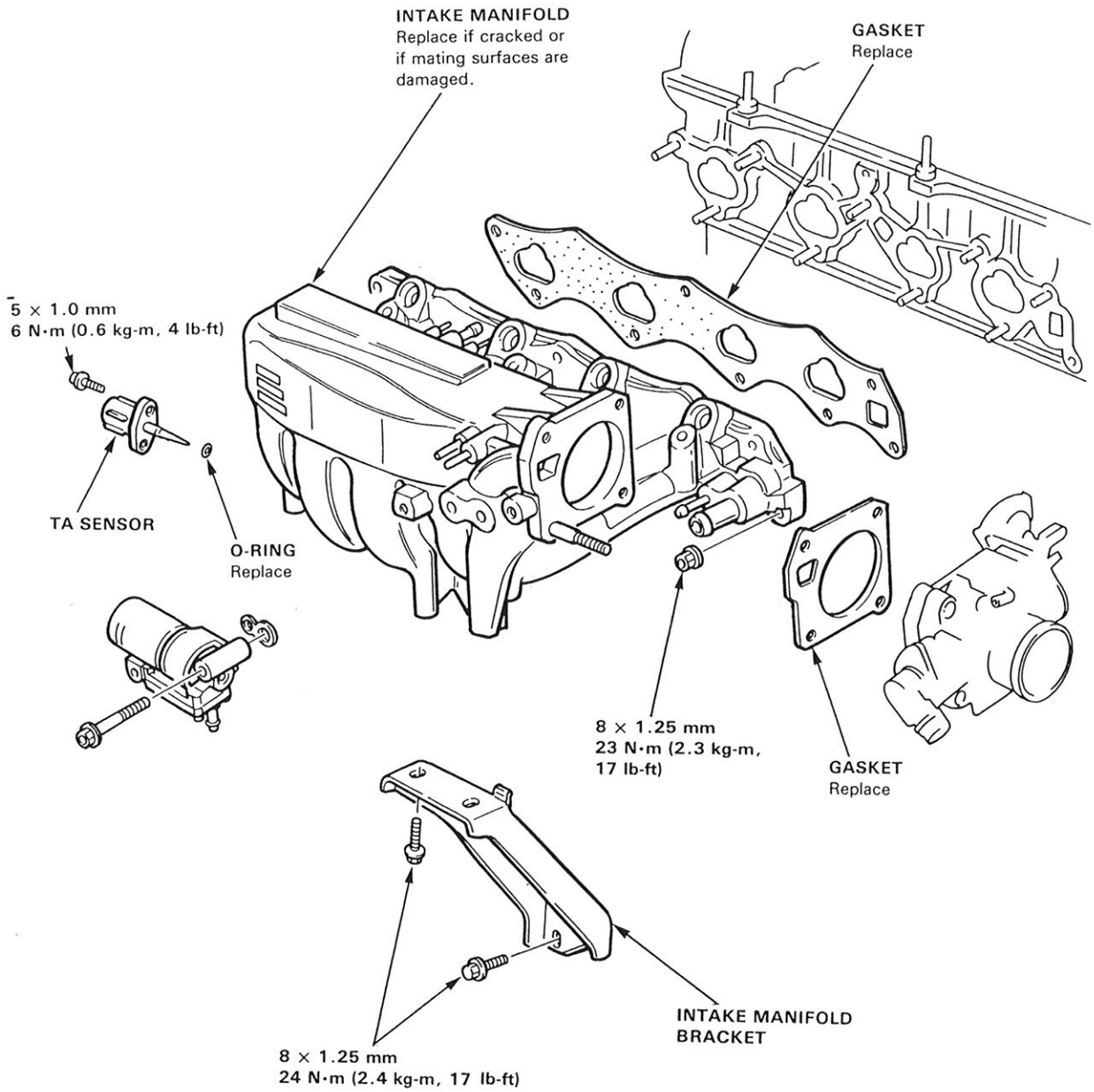
9. Remove the camshaft holders, camshafts and rocker arms.
10. Remove the cylinder head.

CAUTION : To prevent warpage, unscrew bolts 1/3 turn each time and repeat sequence until loose.

Intake Manifold

Replacement

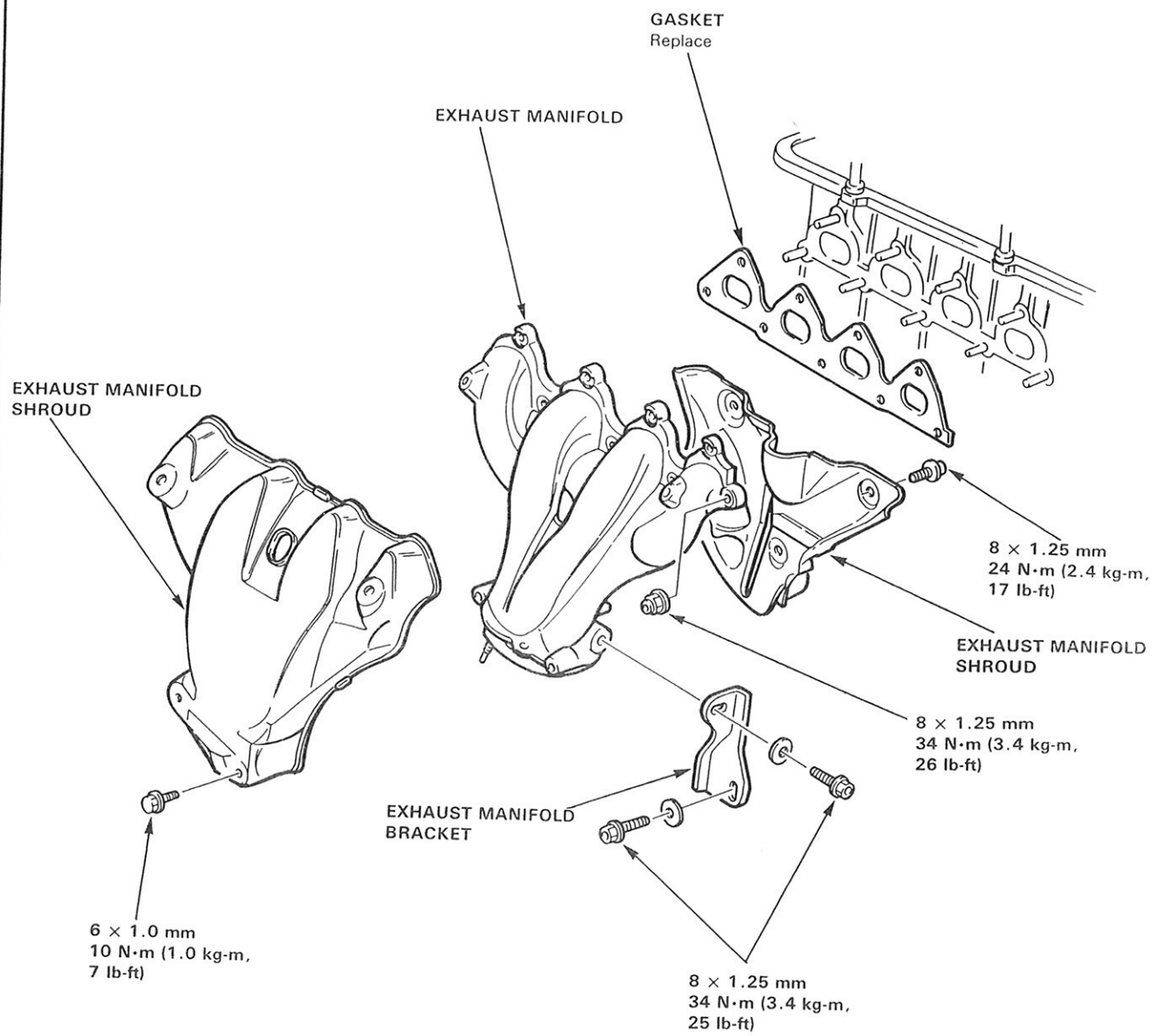
NOTE : Use new O-ring and gaskets whenever reassembling



Exhaust Manifold

Replacement

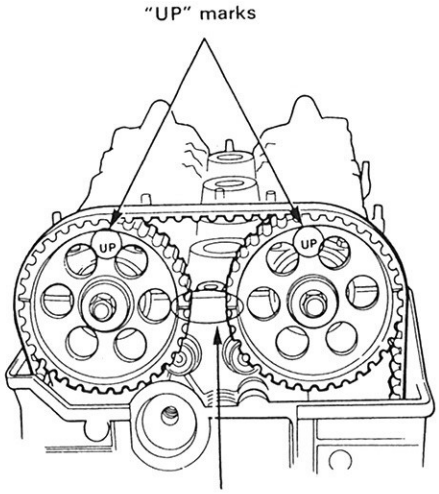
NOTE : Use new gaskets whenever reassembling.



Camshaft Pulleys

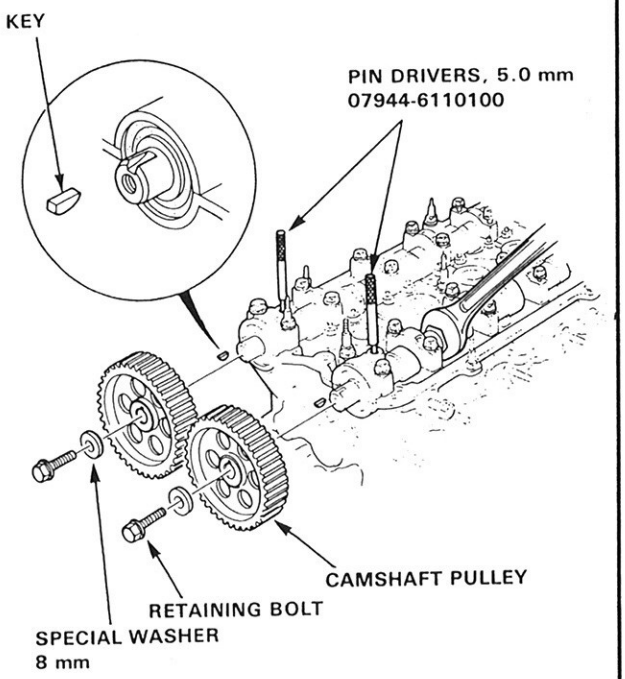
Removal

1. To ease reassembly, turn the pulley until the "UP" marks faces up, and the front timing marks are aligned with the both mark on the pulleys.



Align the marks on the pulleys.

2. Remove the pulley retaining bolts and washers, then remove the pulleys.



NOTE: Before removing camshafts assembly, check camshaft end play.

Camshafts

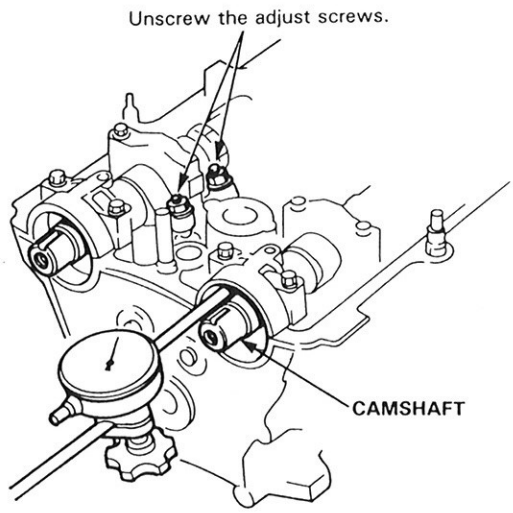
Inspection

NOTE: Do not rotate camshaft during inspection; loosen the adjust screws before starting.

1. Seat camshafts by pushing them toward distributor end of cylinder head.

2. Zero dial indicator against end of distributor drive, then push camshafts 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.)



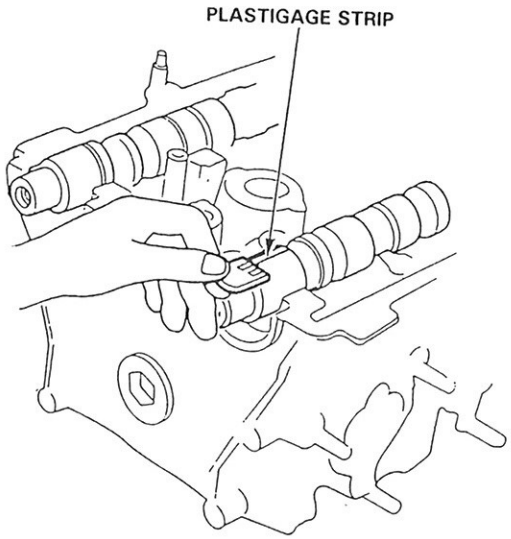
3. Remove the camshaft holder bolts from the cylinder head.

NOTE: Unscrew the camshaft holder bolts, two turns at a time, in a crisscross pattern, to prevent damaging valves or rocker arms.

- 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.
- Install the camshaft holders and torque bolts to values and in sequence shown on page 3-42.

4. Measure widest portion of plastigage on each journal.

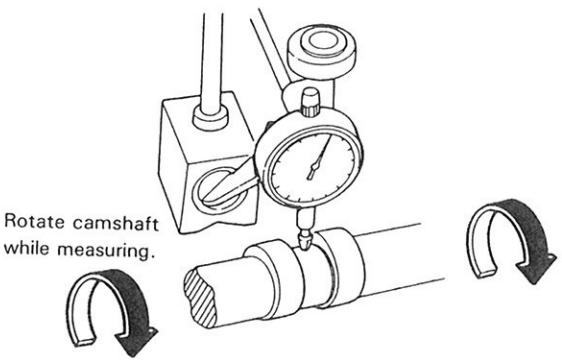
Camshaft Bearing Radial Clearance:
Standard (New): 0.050—0.089 mm (0.002—0.004 in.)
Service Limit: 0.15 mm (0.006 in.)



5. 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) : 0.003 mm (0.001 in.)
Service Limit : 0.06 mm (0.002 in.)

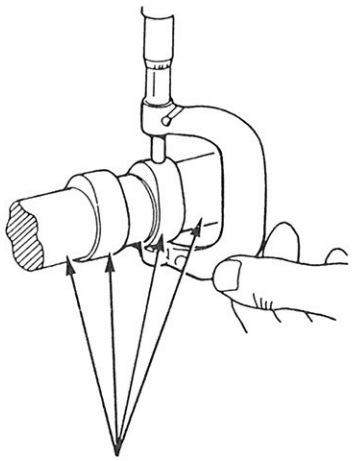


— If the total runout of the camshaft is within tolerance, replace the cylinder head.

— 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.

6. Measure camshaft height.

Intake Standard : 33.021 mm (1.3000 in.)
Exhaust Standard : 32.382 mm (1.2749 in.)



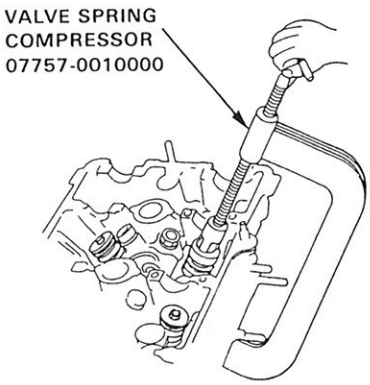
Inspect this area for wear.

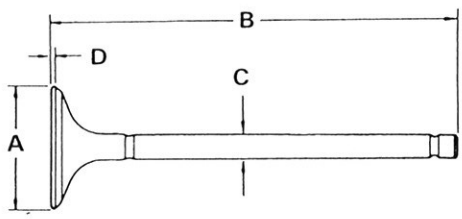
Valves

Replacement

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

1. Tap each valve stem with a plastic mallet to loosen valve keepers before installing spring compressor.
2. Install spring compressor. Compress spring and remove valve keeper.





Intake Valve Dimensions
A Standard (New): 29.9–30.1 mm (1.177–1.185 in.)
B Standard (New): 105.18–105.48 mm (4.141–4.153 in.)
C Standard (New): 6.58–6.59 mm (0.2591–0.2594 in.)
C Service Limit: 6.55 mm (0.258 in.)
D Standard (New): 1.05–1.35 mm (0.041–0.053 in.)
D Service Limit: 1.00 mm (0.039 in.)

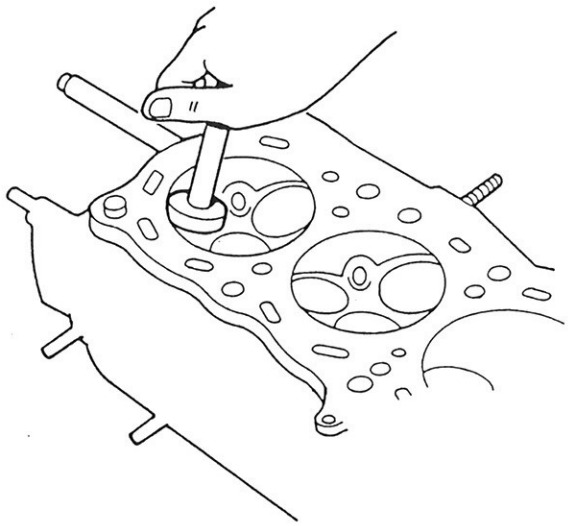
Exhaust Valve Dimensions
A Standard (New): 26.9–27.1 mm (1.059–1.067 in.)
B Standard (New): 104.47–104.77 mm (4.113–4.125 in.)
C Standard (New): 6.55–6.56 mm (0.2579–0.2583 in.)
C Service Limit: 6.52 mm (0.257 in.)
D Standard (New): 1.65–1.95 mm (0.065–0.077 in.)
D Service Limit: 1.45 mm (0.057 in.)

Valve Seats

Reconditioning

1. Renew the valve seats in the cylinder head using valve seat cutters.

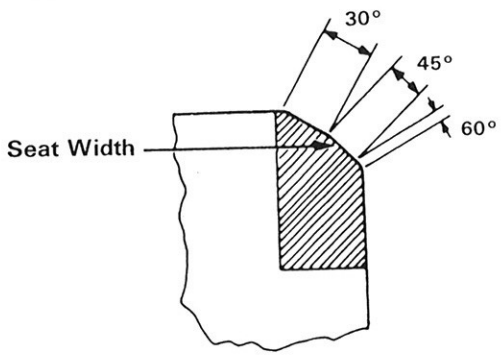
   NOTE: If guides are worn, replace them (page 3-38) before cutting valve seats.



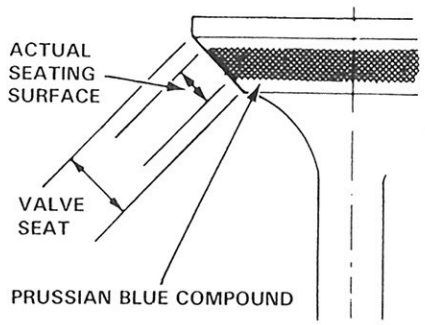
CUTTER	INTAKE	EXHAUST
45°	07780–0010800	07780–0010300
30°	07780–0012900	07780–0012200
60°	07780–0014000	07780–0014000
HOLDER	07781–0010201 and 07781–0010301	

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

Valve Seat Width:
Standard: 1.25–1.55 mm (0.049–0.061 in.)
Service Limit: 2.0 mm (0.08 in.)



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

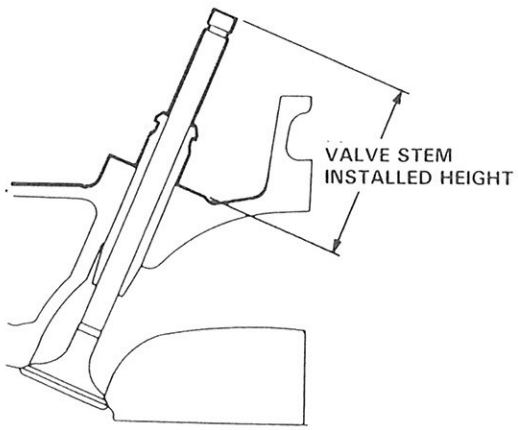


6. The actual valve seating surface, as shown by the blue compound, should be centered on the seat.
   - If it is too high (closer to the valve stem), you must make a second cut with the 60° cutter to move it down, then one more cut with the 45° cutter to restore seat width.
   - If it is too low (closer to valve edge), you must make a second cut with the 30° cutter to move it up, then one more cut with the 45° cutter to restore seat width.

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

7. Insert intake and exhaust valves in head and measure valve stem installed height.

   Intake Valve Stem Installed Height :
   Standard (New) : 45.780 mm (1.802 in.)
   Service Limit : 46.265 mm (1.822 in.)
   Exhaust Valve Stem Installed Height :
   Standard (New) : 44.970 mm (1.771 in.)
   Service Limit : 45.455 mm (1.790 in.)



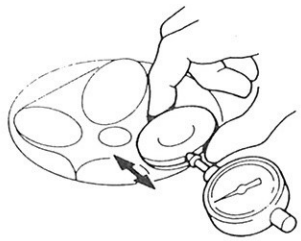
8. If valve stem installed height is over service limit, replace valve and recheck. If still over service limit, replace cylinder head; the valve seat in the head is too deep.

Valve Movement

1. Measure the valve movement with a dial indicator, while rocking the stem in the direction of normal thrust (Wobble Method).

   Intake Valve Movement
   Standard (New): 0.04—0.10 mm
   (0.0016—0.004 in.)
   Service Limit: 0.16 mm (0.006 in.)
   Exhaust Valve Movement
   Standard (New): 0.10—0.16 mm
   (0.004—0.006 in.)
   Service Limit: 0.22 mm (0.009 in.)

Valve extended 10 mm out from seat



- If measurement exceeds the service limit, recheck using new valve.
- If measurement is now within service limit, reassemble using 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): 0.02—0.05 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.)

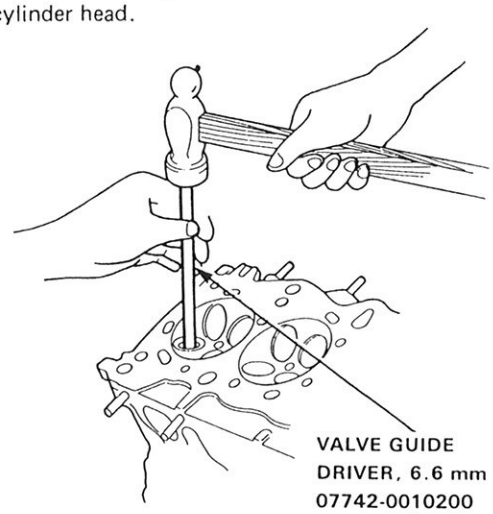
Valve Guides

Replacement

NOTE:
- For best results, heat cylinder head to 150°C (300°F) before removing or installing guides.
- It may be necessary to use an air hammer to remove some valve guides.

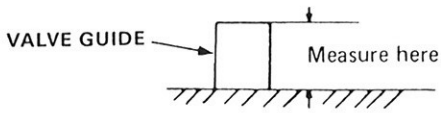
CAUTION: To avoid burns, use heavy gloves when handling heated cylinder head.

1. Drive the valve guide out from the bottom of the cylinder head.

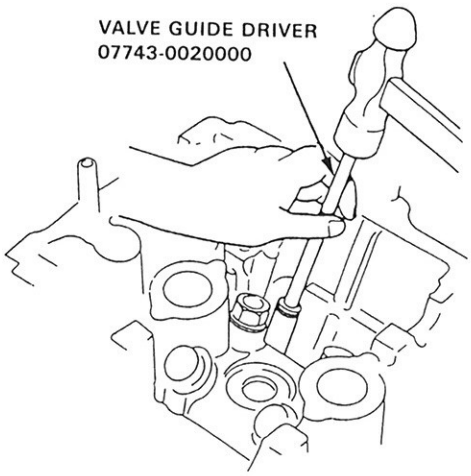


2. Drive in a new valve guide to the specified depth.

Intake : 19.4 mm (0.76 in.)
Exhaust : 19.0 mm (0.75 in.)



NOTE: If using adjustable valve guide driver 07743–0020000, adjust the collar depth to correspond with the measurements given above.



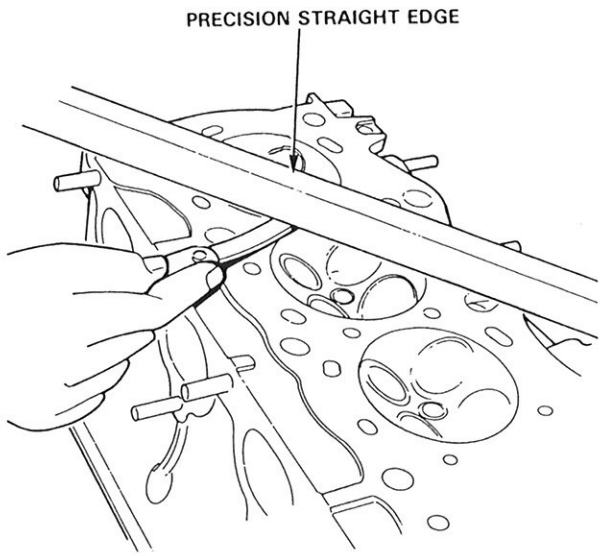
Cylinder Head

Warpage

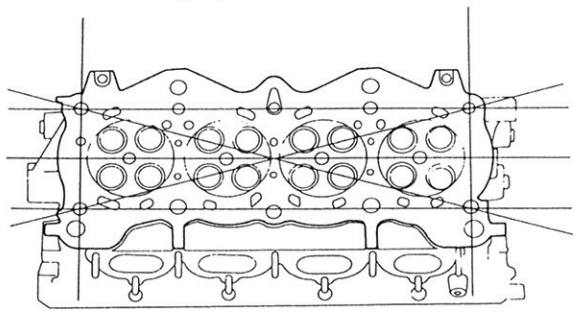
NOTE: If camshaft bearing clearances are not within specification, the head can not be resurfaced (page 3-34).

If camshaft bearing radial clearances are within specifications, check 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 height of 131.8 mm (5.19 in.).



Measure along edges, and 3 ways across center.



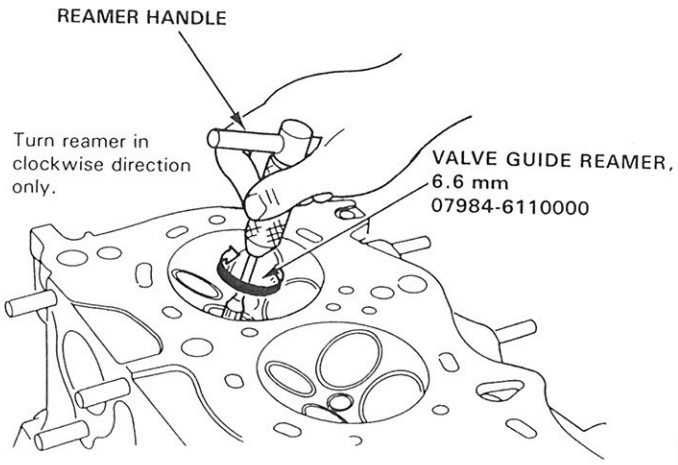
Cylinder Head Height:
Standard New: 132.0 mm (5.20 in.)
Standard New: 132.0 mm (5.20 in.)

Valve Guides and Valve Springs/Valve Seals

Valve Guides Reaming

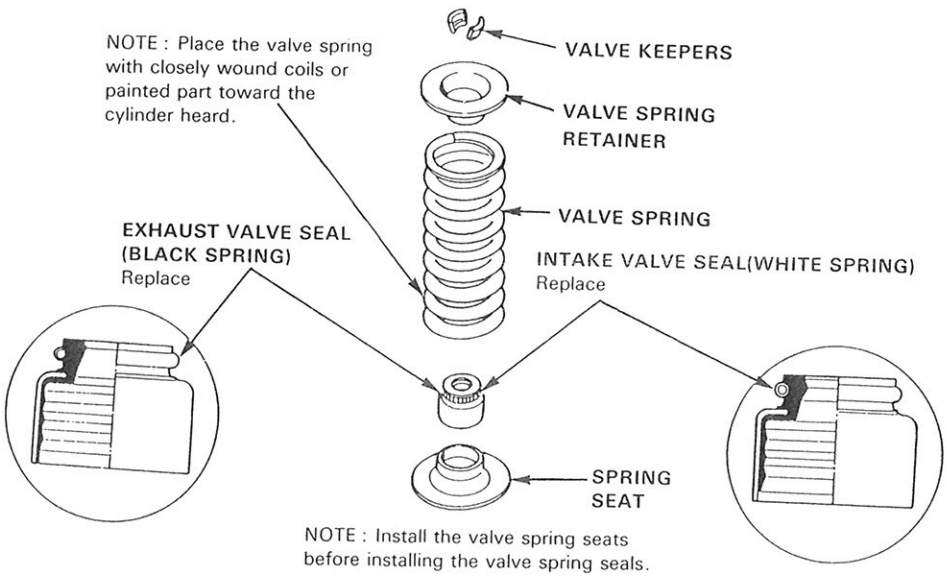
NOTE: For new valve guides only.

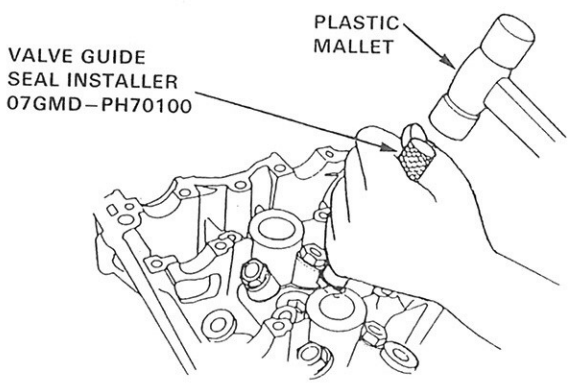
1. Coat reamer and valve guide with cutting oil.
2. Rotate reamer clockwise the full length of the valve guide bore.
3. Continue to rotate reamer clockwise while removing.
4. Throughly wash the guide in detergent and water to remove any cutting residue.
5. Check clearance with valve (page 3-43).



Valve Springs/Valve Seals Installation Sequence

NOTE : Exhaust and intake valve seals are NOT interchangeable.



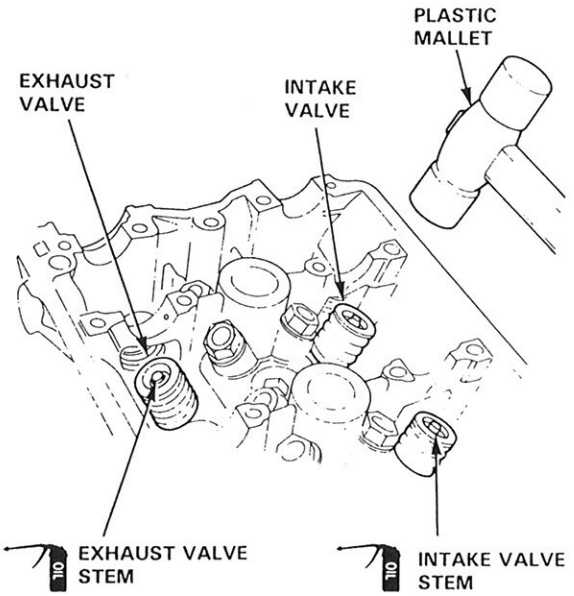


Valves

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 plastic mallet).



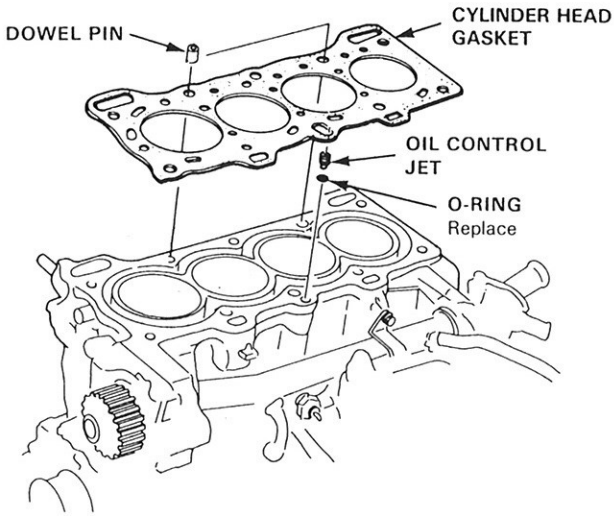
Cylinder Head

Installation

1. Install the cylinder head in reverse order of removal:

   - Always use a new head gasket.
   - Cylinder head and engine block surface must be clean.
   - "UP" mark on timing belt pulley should be at the top.

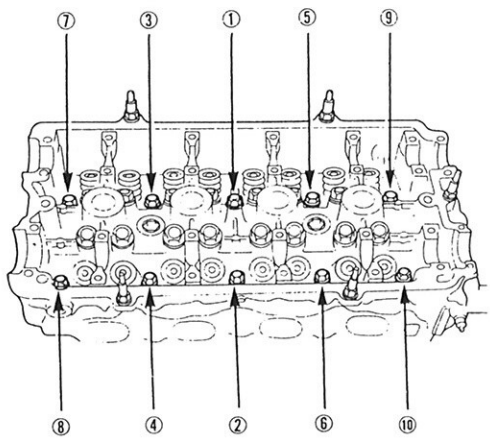
   NOTE: Cylinder head dowel pins and oil control jet must be aligned.



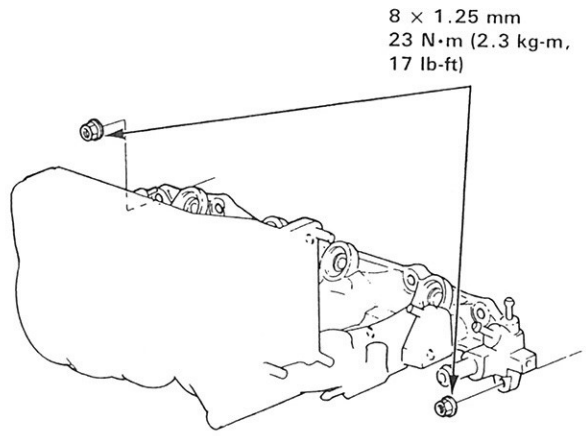
2. Tighten cylinder head bolts in two steps. In the first step tighten all bolts, in sequence, to about 30 N·m (3.0 kg-m, 22 lb-ft); in the final step tighten, in same sequence, to 66 N·m (6.6 kg-m, 47 lb-ft)

   NOTE:
   - Apply engine oil to the cylinder head bolts and the washers.
   - Use the longer bolts at the position No. 1 and No. 2 as shown.

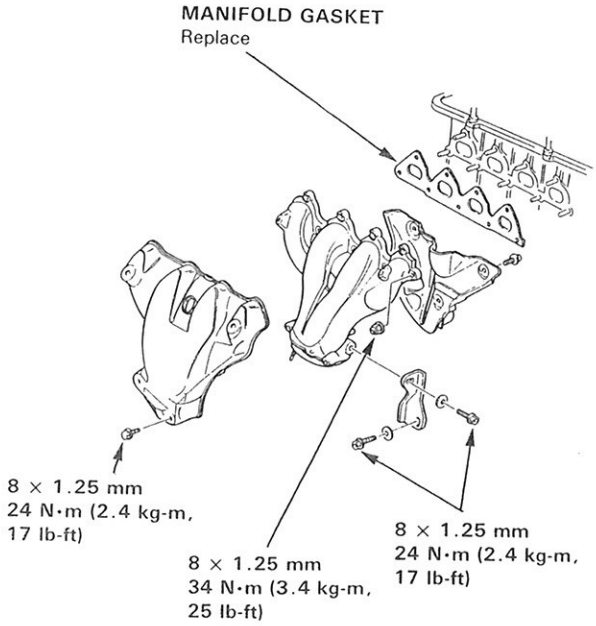
CYLINDER HEAD BOLTS TORQUE SEQUENCE



3. Install the intake manifold and tighten the nuts in a crisscross pattern in 2 or 3 steps, beginning with the inner nuts.



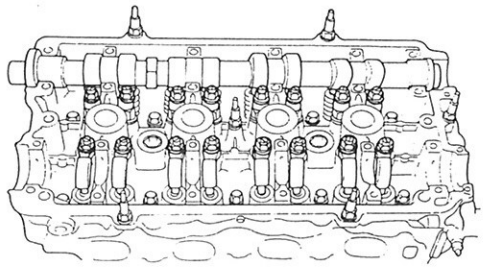
4. Install the exhaust manifold and bracket.



Installation

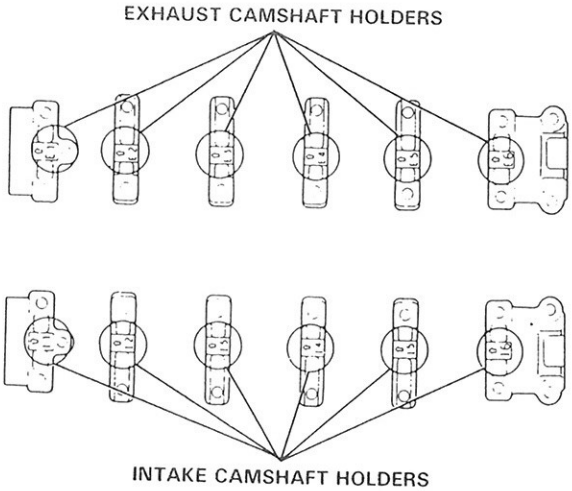
CAUTION:
- Make sure that the keyways on the camshafts are facing up. (NO. 1 cylinder TDC).
- Valve locknuts should be loosened and adjust screws backed off before installation.
- Replace the rocker arms in these original positions.

1. Place the rocker arms on the pivot bolts and the valve stems.



2. Install the camshafts and the camshaft seals with the open side (spring) facing in.

NOTE:
- "I" or "E" marks are stamped on the camshaft holders.
- Do not apply oil to the holder mating surface of camshaft seals.



(cont'd)

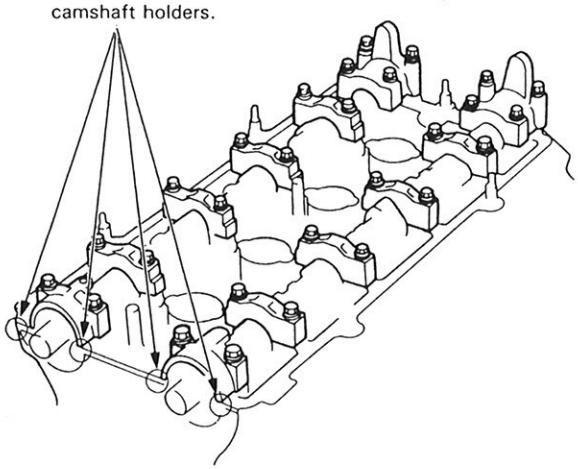
Cam/Rocker Arm and Camshaft Seal/Pulley

Installation (cont'd)

3. Apply liquid gasket to the head mating surfaces of the No. 1 and No. 6 camshaft holders, then install them, along with the No. 2. 3. 4 and 5.

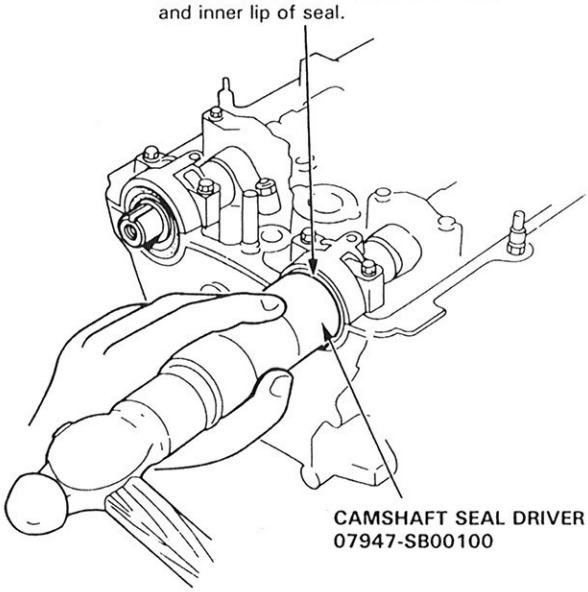
4. Tighten the camshaft holders temporarily.
   - Make sure that the rocker arms are properly positioned on the valve stems.

Apply non-hardening sealant to these areas (also opposite sides) before installing camshaft holders.

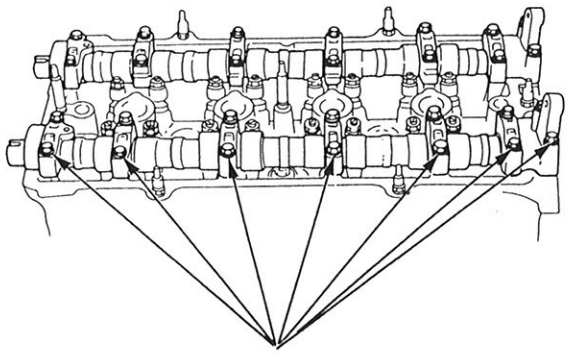


5. Press in the camshaft oil seal securely with the special tool.

Seal housing surface should be dry. Apply a light coat of oil to camshaft and inner lip of seal.

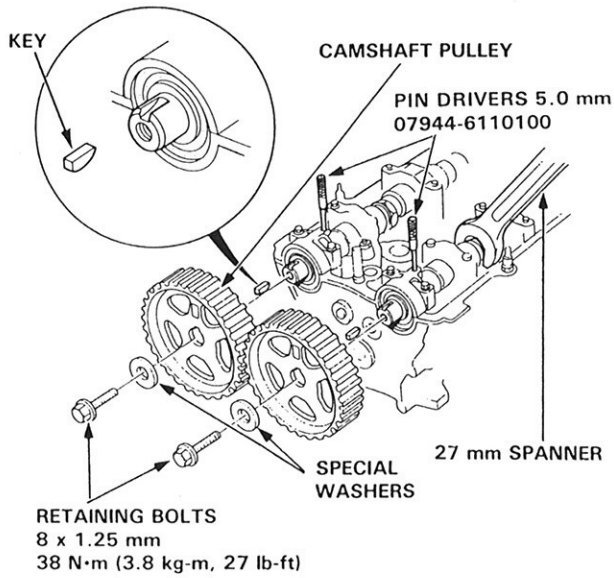


6. Tighten each bolt two turns at a time in the sequence shown below to insure that the rockers do not bind on the valves.



7. Install keys into grooves in camshafts.

NOTE: To set the No.1 piston at TDC, align the hole on the camshaft with the hole in the No.1 camshaft holders and drive 5.0 mm pin punches into the holes.



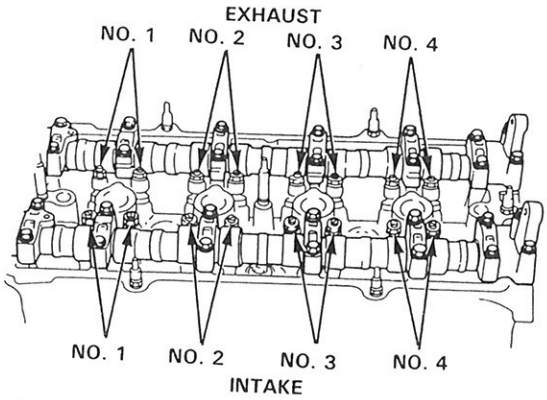
8. Push camshaft pulleys onto camshafts, then tighten retaining bolts to torque shown.
9. Adjust the valve timing (page 2-12).
10. After installation, check that all hoses and connectors are installed correctly.

Valve Clearance

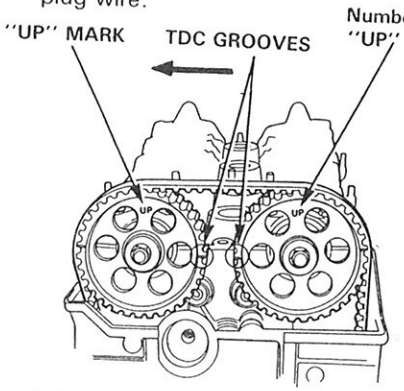
Adjustment

NOTE: Valves should be adjusted cold when the cylinder head temperature is less than 38°C (110°F). Adjustment is the same for intake and exhaust valves.

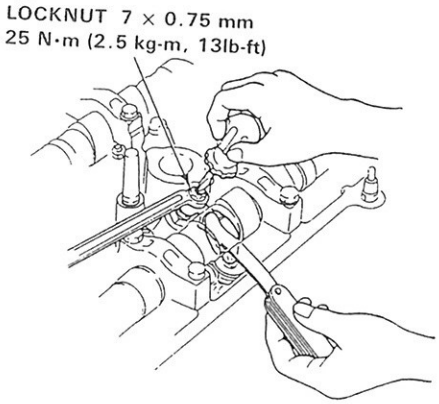
1. Remove the valve cover.



2. Set the No. 1 piston at TDC. "UP" marks in the pulleys should be at top, and the TDC grooves on pulley should align with cylinder head surface. The distributor rotor must be pointing towards. No. 1 plug wire.

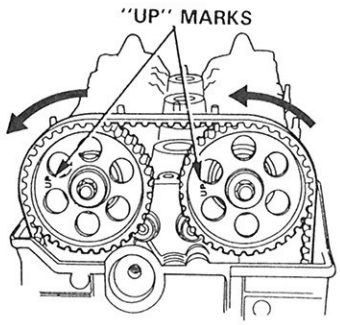


3. Adjust valves on No. 1 cylinder.
   Intake : 0.13—0.17 mm (0.005—0.007 in.)
   Exhaust : 0.15—0.19 mm (0.006—0.007 in.)
4. Loosen locknut and turn adjust screw until feeler gauge slides back and forth with slight amount of drag.



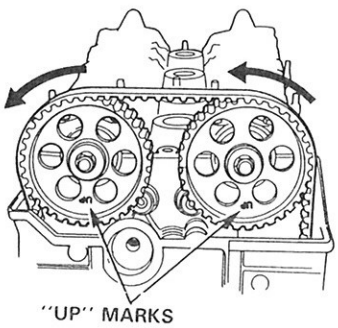
5. Tighten locknut and check clearance again. Repeat adjustment if necessary.
6. Rotate crankshaft 180° counterclockwise (cam pulley turns 90°). The "UP" marks should be at exhaust side. Distributor rotor should point to No. 3 plug wire. Adjust valves on No. 3 cylinder.

Number 3 piston at TDC



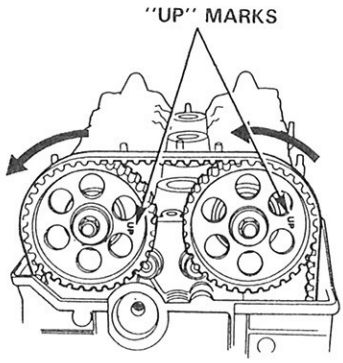
7. Rotate crankshaft 180° counterclockwise to bring No. 4 piston to TDC. Both "UP" marks should be at bottom and distributor rotor points to No. 4 plug wire. Adjust valves on No. 4 cylinder.

Number 4 piston at TDC



8. Rotate crankshaft 180° counterclockwise to bring No. 2 piston to TDC. "UP" marks should be at intake side. Distributor rotor should point to No. 2 plug wire. Adjust valves on No. 2 cylinder.

Number 2 piston at TDC

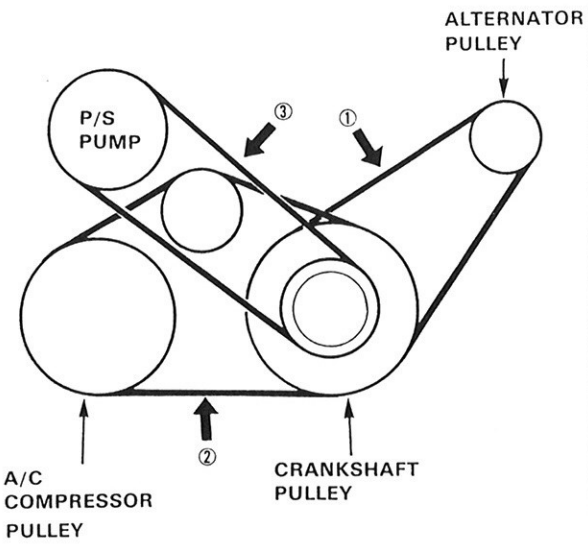


Drive Belts

Drive Belt Inspection

Drive Belts Deflection
(When applying a force of 9.8 N (10 kg, 22 lbs)

	Used Belt	New Belt
① Alternator Belt	9-11 mm (0.35–0.43in)	7–9 mm (0.28–0.35in)
② A/C Compressor Belt	9–12 mm (0.35–0.47in)	7–10 mm (0.28–0.39in)
③ P/S Belt	9–11 mm (0.35–0.43in)	7–9 mm (0.28–0.35in)

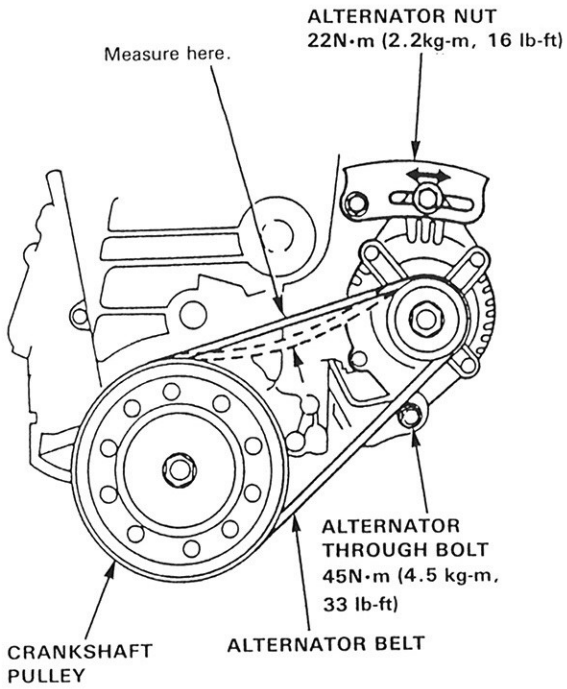


Alternator Belt Adjustment

1. Apply a force of 98 N (10 kg, 22 lb) and measure the deflection between the alternator pulley and the crankshaft pulley.

   Deflection : 9–11 mm (0.35–0.43)

   NOTE : On a brand-new belt, the deflection should be 7–9 mm (0.28–0.35 in.) when first measured.

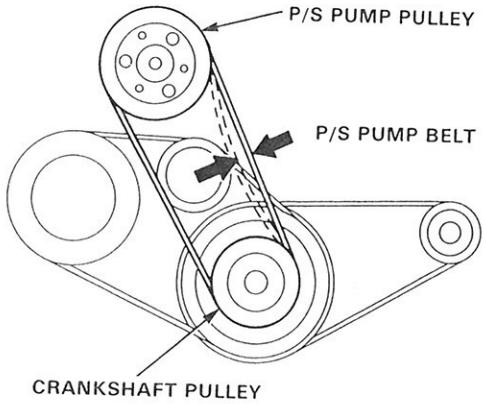


2. Loosen the alternator nut and through bolt.
3. Move the alternator by turning the adjust nut to obtain the proper belt tension, then retighten the bolt and nut.
4. Recheck the deflection of the belt.

P/S Pump Belt Adjustment

1. Apply a force of 98 N (10 kg, 22 lb) and measure the deflection, between the P/S pump pulley and the crankeshaft pulley.

   Deflection : 9–12mm (0.36–0.47 in.)
   NOTE : On a brand-new belt, the deflection should be 7–10mm (0.28–0.39 in.) when first measured.



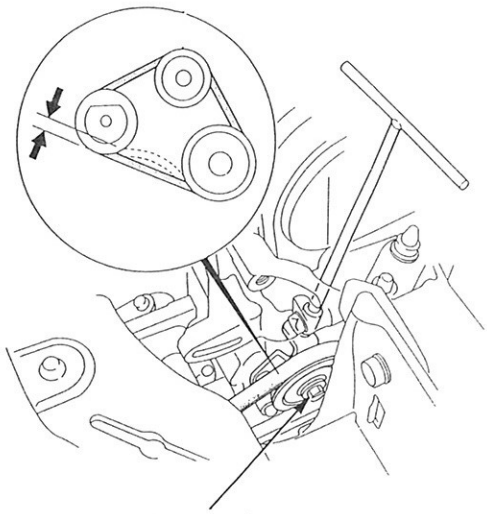
2. Loosen the P/S adjust pulley bolt.
3. Turn the adjust nut to get the proper belt tension, then retighten the bolt and nut.
4. Recheck the deflection of the belt.

A/C Compressor Belt Adjustment

1. Apply a force of 98 N (10 kg, 22 lb) and measure the deflection, between the A/C compressor adjusting pulley and the crankshaft pulley.

   Deflection : 9—11 mm (0.35—0.43 in.)

   NOTE : On a brand-new belt, the deflection should be 7—9 mm (0.28—0.35 in.) when first measured.



2. Loosen the adjust pulley nut.
3. Turn the adjust bolt to get the proper belt tension, then retighten the bolt and nut.
4. Recheck the deflection of the belt.

Engine Block

Standards and Service Limits, Special Tools

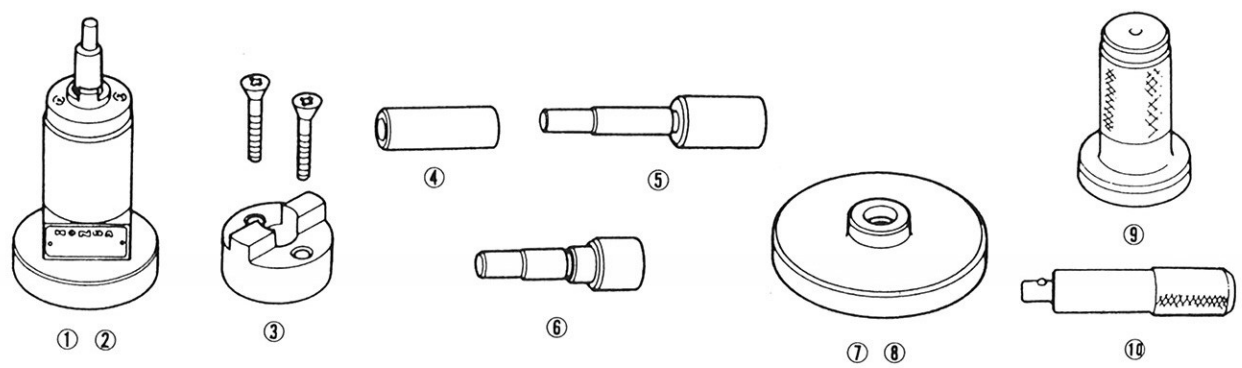
Standards and Service Limits

Unit : mm (in)

	MEASUREMENT		STANDARD (NEW)	SERVICE LIMIT
Cylinder	Warpage of deck surface		0.07 (0.0028) max.	0.10 (0.004)
	Bore diameter		75.00—75.02 (2.9526—2.9535)	75.07 (2.9555)
	Bore taper		—	0.05 (0.002)
	Reboring limit		—	0.5 (0.02)
Piston	Skirt O.D. At 16 mm (0.63 in) from bottom of skirt		74.98—74.99 (2.9520—2.9524)	74.97 (2.9517)
	Clearance in cylinder		0.01—0.04 (0.0004—0.0016)	0.05 (0.002)
	Piston-to-ring clearance	Top	0.03—0.06 (0.0012—0.0024)	0.13 (0.005)
		2nd	0.030—0.055 (0.0012—0.0022)	0.13 (0.005)
Piston ring	Ring end gap	Top	0.15—0.35 (0.006—0.014)	0.6 (0.02)
		2nd	0.15—0.35 (0.006—0.014)	0.6 (0.02)
		Oil	0.20—0.60 (0.008—0.024)	0.7 (0.03)
Connecting rod	Pin-to-Rod interference		0.014—0.040 (0.0006—0.0016)	—
	Large end bore diameter		Nominal 45.0 (1.77)	—
	End play installed on crankshaft		0.15—0.30 (0.006—0.012)	0.40 (0.016)
Crankshaft	Main journal diameter		44.976—45.000 (1.7707—1.7718)	—
	Taper/out-of-round, main jounal		0.005 (0.0002) max.	0.010 (0.0004)
	Rod journal diameter	1.2 ℓ, 1.3 ℓ, 1.4 ℓ	39.976—40000 (1.5739—1.5748)	—
		1.5 ℓ	41.976—42.000 (1.6526—1.6535)	—
		1.6 ℓ	44.976—45.000 (1.7707—1.7765)	—
	Taper/out-of-round, rod journal		0.0025 (0.0001) max.	0.010 (0.0004)
	End play		0.10—0.35 (0.004—0.014)	0.45 (0.018)
	Runout		0.015 (0.0006) max.	0.03 (0.002)
Bearings	Main bearing-to-journal oil clearance			
	Ex. 1.6 ℓ		0.024—0.042 (0.0010—0.0017)	0.5 (0.02)
	1.6 ℓ No. 1,2,4 and 5 journals		0.024—0.042 (0.0010—0.0017)	0.5 (0.02)
	1.6 ℓ No.3 journal		0.030—0.048 (0.0012—0.0019)	0.5 (0.02)
	Rod bearing-to-journal oil clearance		0.020—0.038 (0.0008—0.0015)	0.05 (0.002)

Special Tools (Common with Other Models)

Ref. No.	Tool Number	Description	Q'ty	Remarks
①	07973—6570002	Piston Pin Dis/Assembly Tool Set	1	
②	07973—6570500	Piston Base	1	
③	07973—SB00100	Piston Base Head	1	
④	07973—PE00200	Pilot Collar	1	
⑤	07973—PE00400	Piston Pin Base Insert	1	
⑥	07973—PE00301	Adjustable Piston Pin Driver	1	
⑦	07948—SB00101	Driver Attachment	1	for SOHC
⑧	07948—SB00800	Driver Attachment	1	for DOHC
⑨	07HAD—PJ70100	Driver	1	
⑩	07749—0010000	Driver	1	

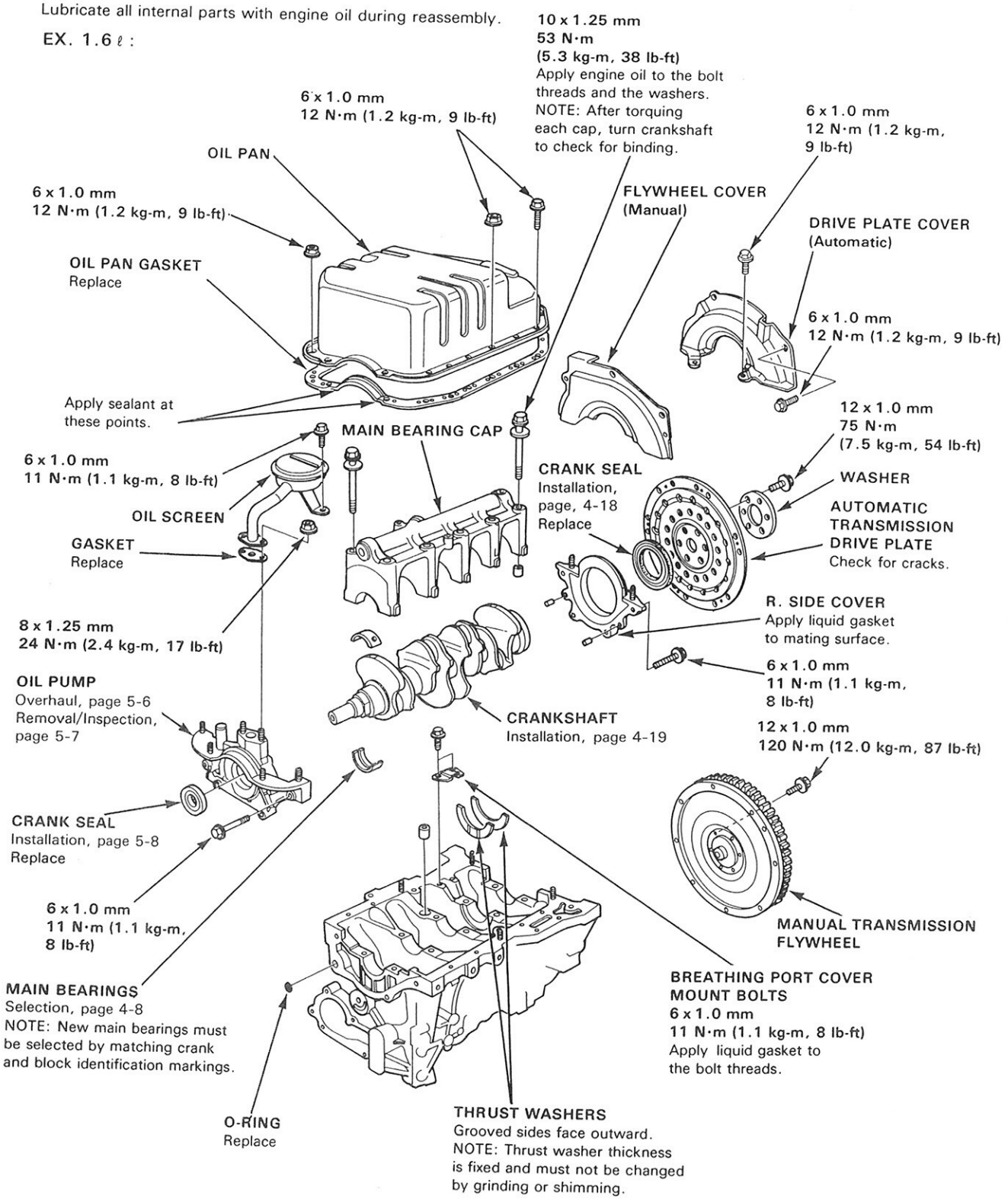


Engine Block

Illustrated Index

Lubricate all internal parts with engine oil during reassembly.

EX. 1.6 ℓ :



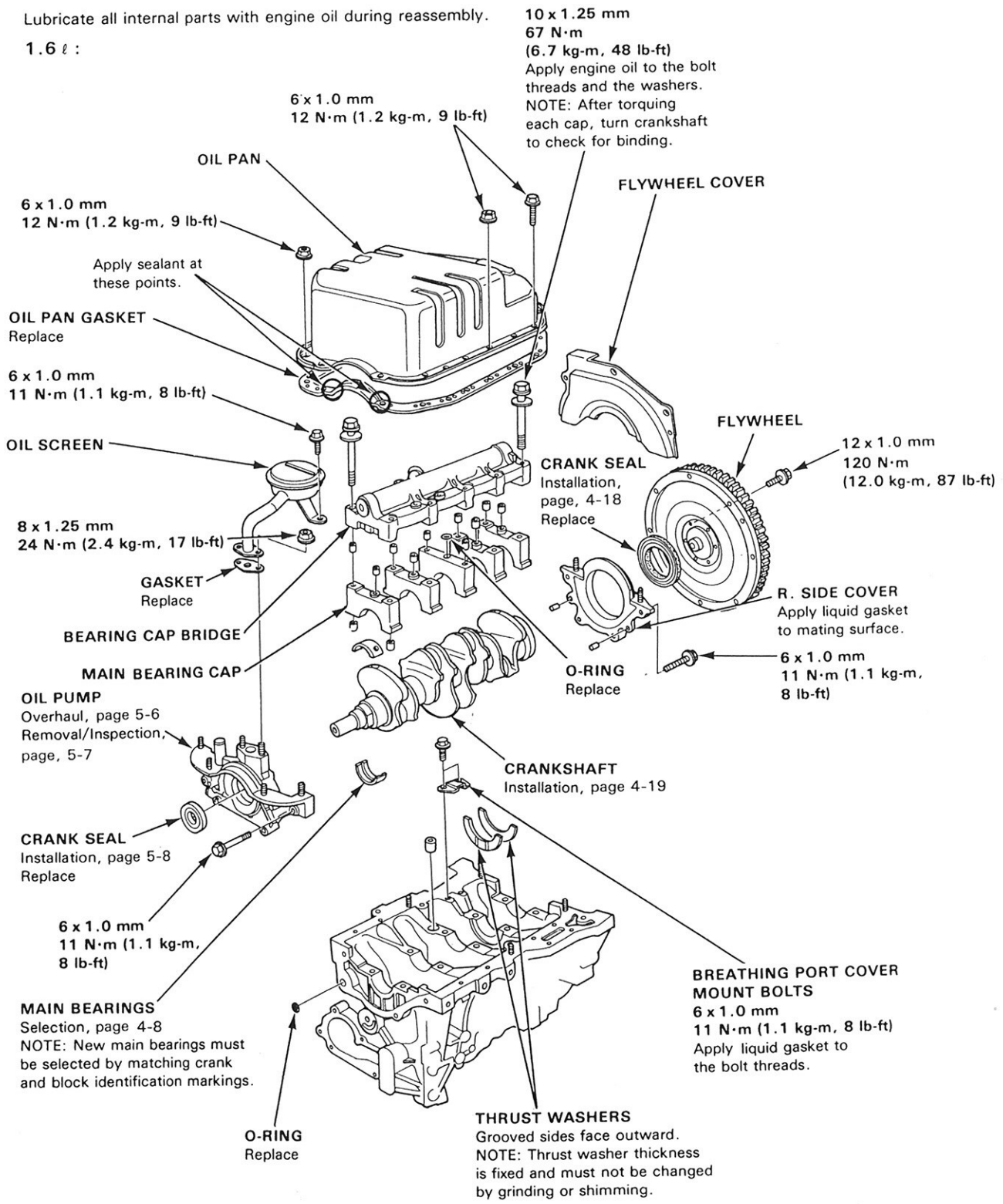
(cont'd)

Engine Block

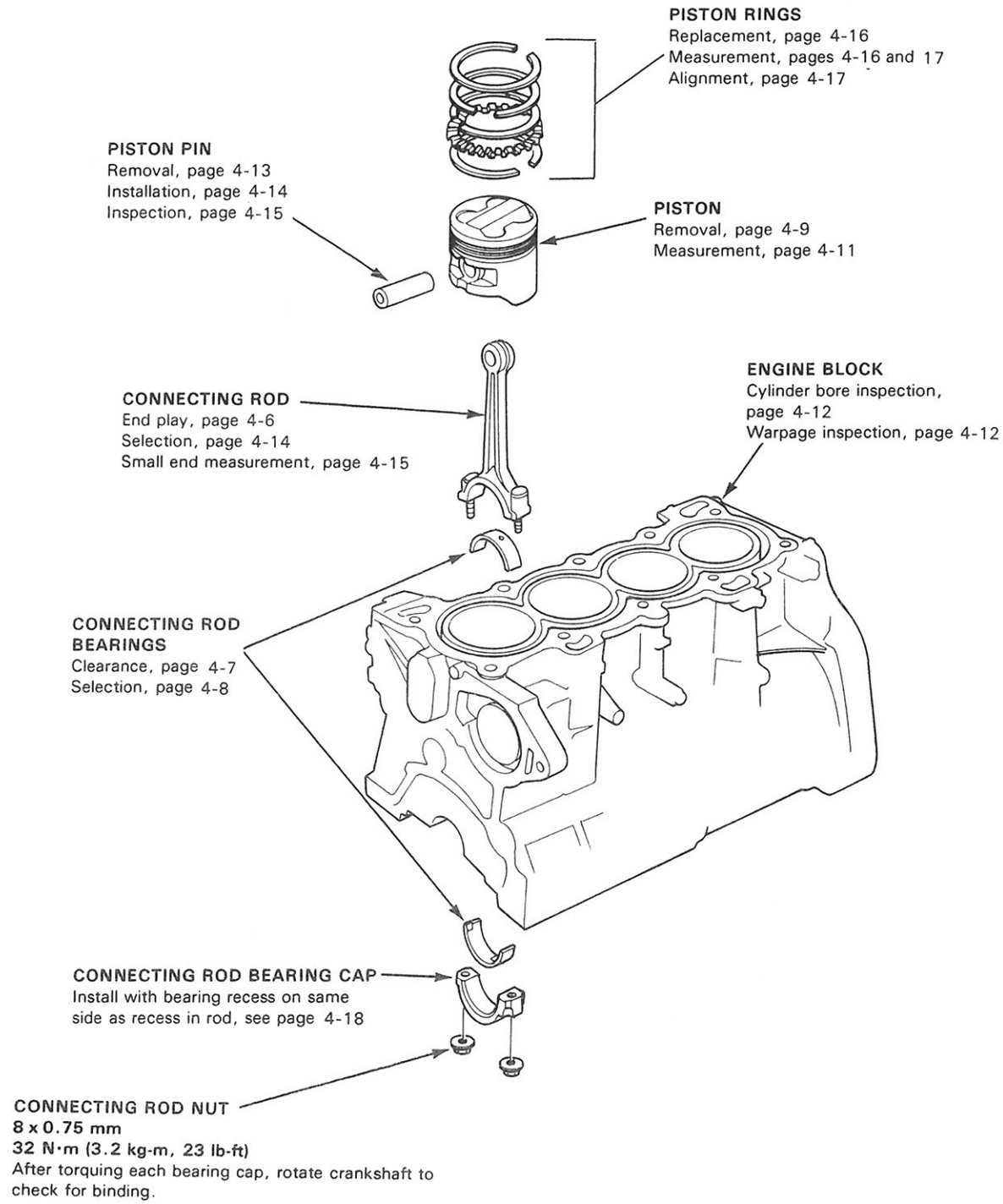
Illustrated Index (cont'd)

Lubricate all internal parts with engine oil during reassembly.

1.6 ℓ :



NOTE: New rod bearings must be selected by matching connecting rod and crankshaft identification markings (page 4-8).

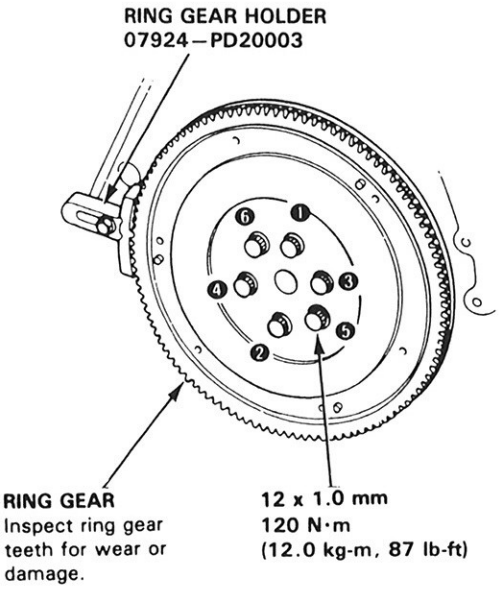


Flywheel and Drive Plate

Replacement

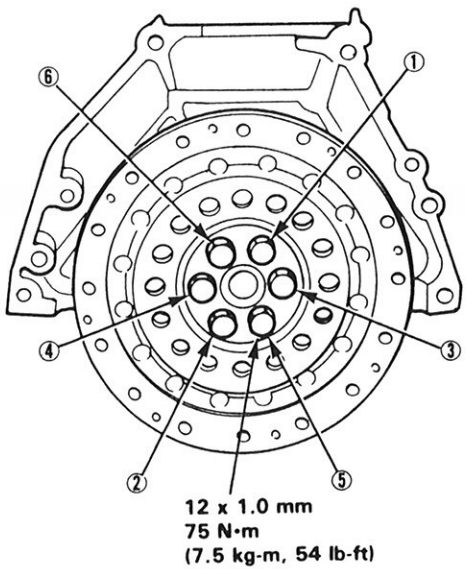
Manual Transmission:

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



Automatic Transmission:

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



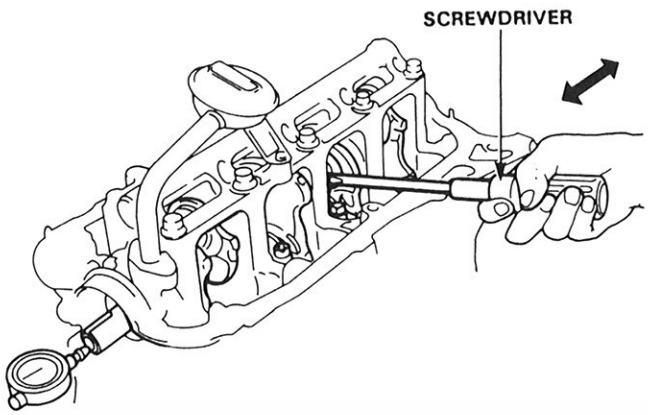
Connecting Rod and Crankshaft

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 new connecting rod.
- If still out-of-tolerance, replace crankshaft (pages 4-9 and 4-19).

Push crank firmly away from dial indicator, and zero dial against end of crank. Pull crank firmly back toward 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: 0.45 mm (0.018 in.)

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

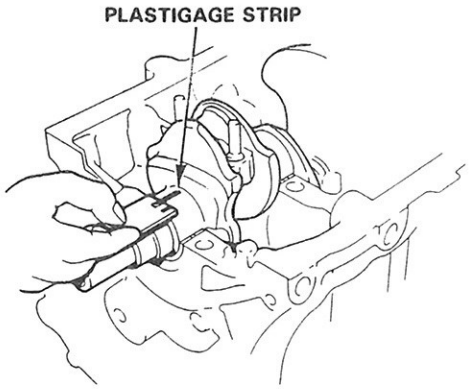
NOTE: Thrust washer thickness is fixed and must not be changed either by grinding or shimming. Thrust washers are installed with grooved sides outward.

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 and caps, then torque the bolts.
   Ex. 1.6 ℓ : 53 N·m (5.3 kg-m, 38 lb-ft)
   1.6 ℓ : 67 N·m (6.7 kg-m, 48 lb-ft)
5. Remove the caps and bearings again, and measure the widest part of the plastigage.

Main Bearing Clearance:
Ex. 1.6 ℓ : 0.024—0.042mm
(0.0010—0.0017 in.)
1.6 ℓ : (No. 1, 2, 4, 5 Journals:
0.024—0.042 mm (0.0010—0.0017 in.)
(No. 3 Journal):
0.030—0.048 mm (0.0012—0.0019 in.)
Service Limit: 0.05 mm (0.002 in.)



6. If the plastigage measures too wide or too narrow, loosen the main caps and spin the top half of the bearing out of the block, then install a new, complete bearing with the same color code (select the color as shown on the next page), and recheck the clearance.
   CAUTION: Do not file, shim, or scrape the bearings or the caps to adjust clearance.

7. If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing (the color listed above or below that one), and check again.
   NOTE: If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crank and start over.

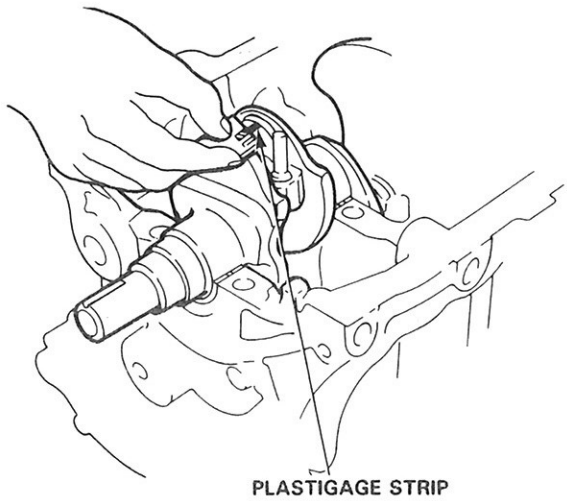
Rod Bearings

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.
   32 N·m (3.2 kg-m, 23 lb-ft)

   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): 0.020—0.038 mm
(0.0008—0.0015 in.)
Service Limit: 0.05 mm (0.002 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.

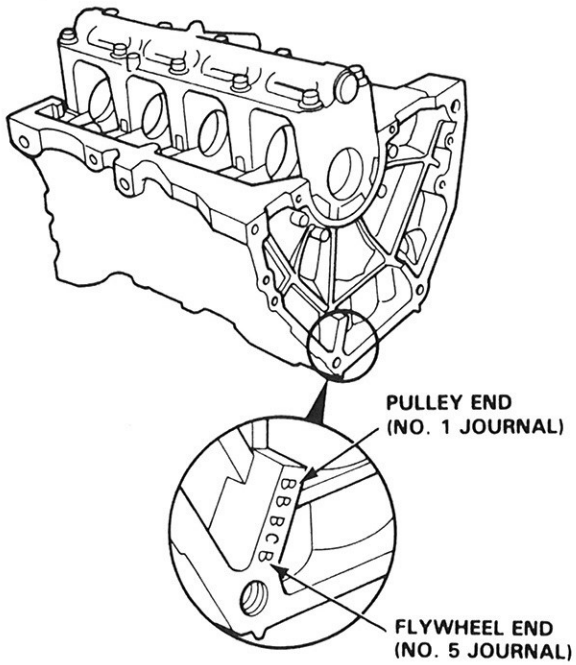
   NOTE: If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crank and start over.

Main Bearings

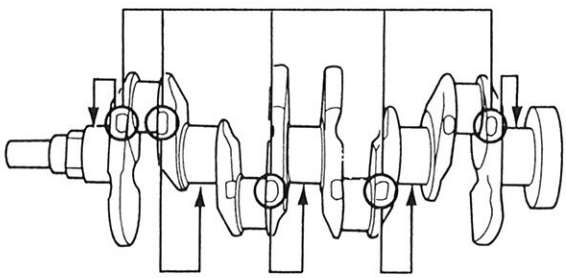
Selection

Crank Bore Code Location (Marks)

Marks have been stamped on the end of the block as a code for the size of each of the 5 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 → Larger crank bore

A	B	C	D

→ Smaller bearing (thicker)

1	Red	Pink	Yellow	Green
2	Pink	Yellow	Green	Brown
3	Yellow	Green	Brown	Black
4	Green	Brown	Black	Blue

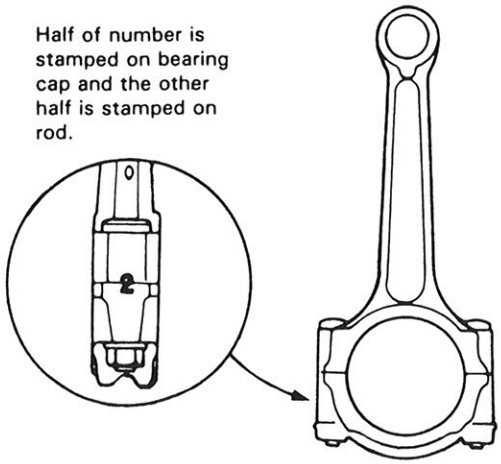
Smaller main journal ↓ | Smaller bearing (thicker) ↓

Rod Bearings

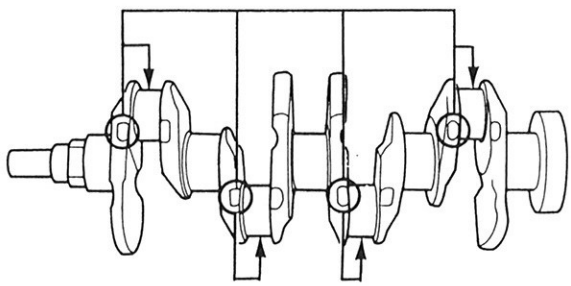
Selection

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.



Rod Journal Code Locations (Letters)



Bearing Identification

Color code is on the edge of the bearing → Larger big end bore

1	2	3	4

→ Smaller bearing (thicker)

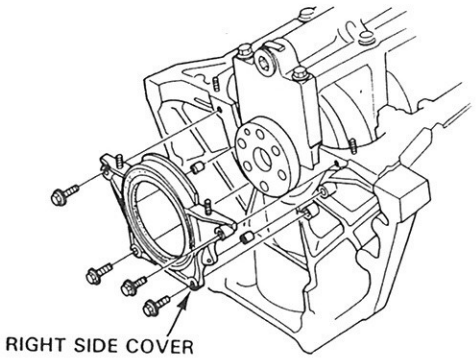
A	Red	Pink	Yellow	Green
B	Pink	Yellow	Green	Brown
C	Yellow	Green	Brown	Black
D	Green	Brown	Black	Blue

Smaller rod journal ↓ | Smaller bearing (thicker) ↓

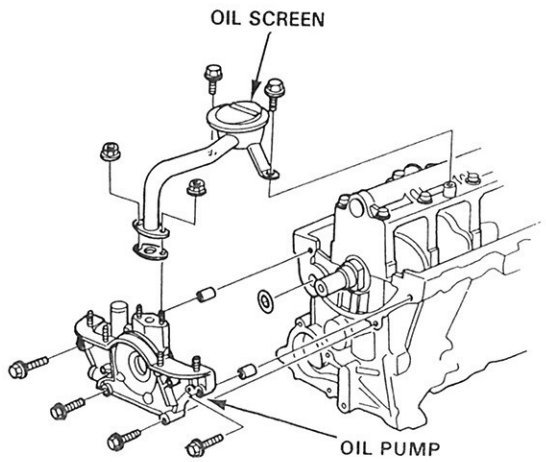
Crankshaft and Pistons

Removal

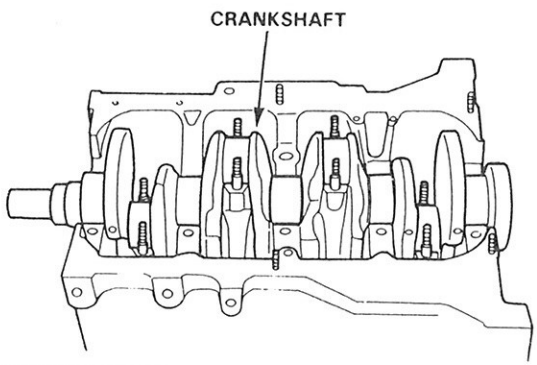
1. Remove the right side cover.



2. Remove the oil screen.

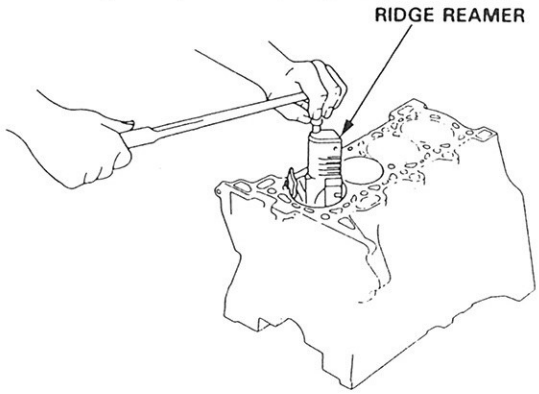


3. Remove the oil pump.
4. Turn the crankshaft so No. 2 and 3 crankpins are at the bottom.
5. Remove the bearing cap bridge (1.6 ℓ).
6. Remove the rod caps/bearings and main caps/bearings. Keep all caps/bearings in order.
7. Lift the crankshaft out of engine, being careful not to damage journals.

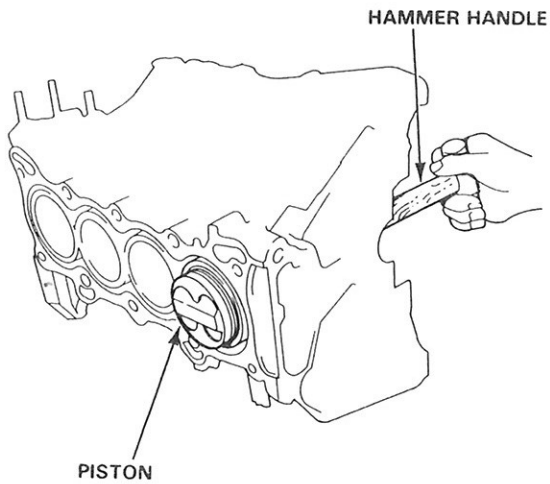


8. Remove upper bearing halves from connecting rods and set aside with their respective caps.
9. Reinstall main cap and bearings on engine in proper order.
10. If you can feel a ridge of metal or hard carbon around the top of each cylinder, remove it with a ridge reamer. Follow reamer manufacturer's instructions.

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



11. Use the wooden handle of a hammer to drive out pistons.



12. Reinstall the rod bearings and caps after removing each piston/connecting rod assembly.
13. 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.

Crankshaft

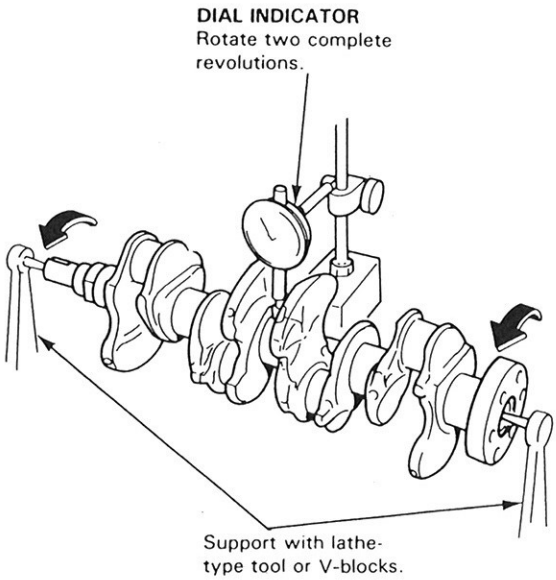
Inspection

- 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.

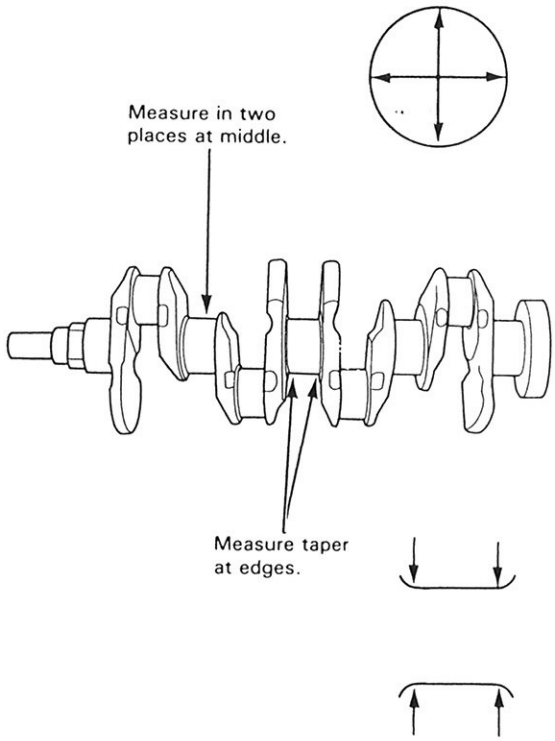
Crankshaft Total Indicate Runout:
Standard (New): 0.03 mm (0.0012 in.)
Service Limit: 0.06 mm (0.0024 in.)



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.

Journal Out-of-Round:
Standard (New): 0.0025 mm (0.0001 in.)
Service Limit: 0.010 mm (0.0004 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.

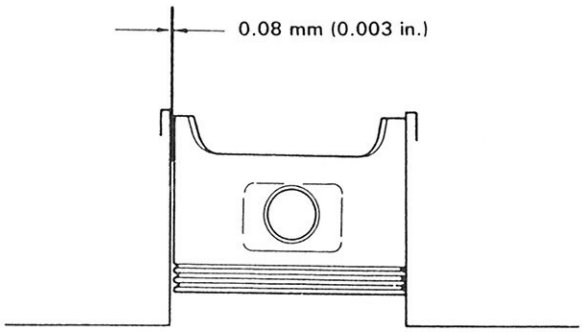
Journal Taper:
Standard (New): 0.0025 mm (0.0001 in.)
Service Limit: 0.010 mm (0.0004 in.)

Cylinder Block

Piston-to-Block Clearance

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

   Service Limit: 0.08 mm (0.003 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 4-12 and piston diameter.

   Piston-to-Cylinder Clearance:
   Standard (New): 0.01—0.04 mm
   (0.0004—0.0016 in.)
   Service Limit: 0.05 mm (0.002 in.)

Piston

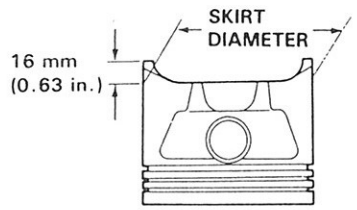
Inspection

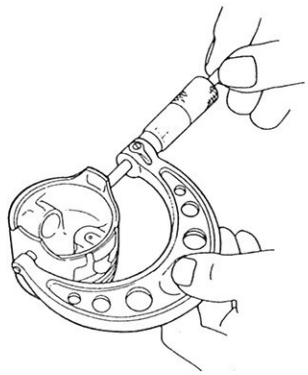
1. Check the piston for distortion or cracks.

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

2. Measure piston diameter at a point 16 mm (0.63 in.) from bottom of skirt.

   Piston Diameter:
   Standard (New): 74.98—74.99 mm
   (2.9520—2.9524 in.)
   Service Limit: 74.97 mm (2.9516 in.)





   Oversize Piston Diameter
   0.25: 75.23—75.24 mm
   (2.9618—2.9622 in.)
   0.50: 75.48—75.49 mm
   (2.9716—2.9720 in.)

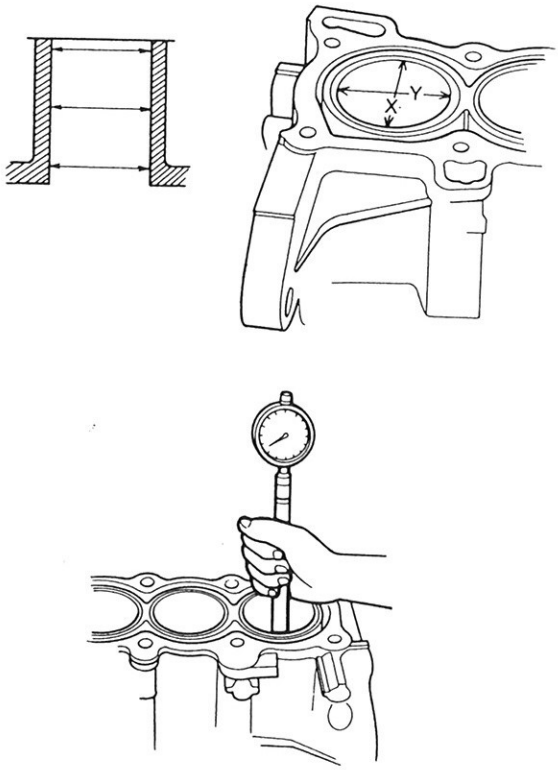
3. Check the piston pin-to-piston clearance. Coat the piston pin with engine oil.
   It should then be possible to push the piston pin into the piston hole with thumb pressure.

   Piston Pin-to-Piston Clearance:
   Service Limit : 0.010—0.022 mm
   (0.0004—0.0009 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): 75.00—75.02 mm (2.9528—2.9535 in.)
Service Limit: 75.07 mm (2.9555 in.)

Oversize
0.25: 75.25—75.27 mm (2.9626—2.9634 in.)
0.50: 75.50—75. 52 mm (2.9724—2.9732 in.)

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

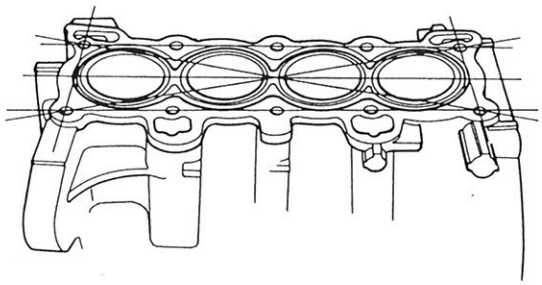
- If measurements in any cylinder are beyond Oversize Bore Service Limit, replace the block.
- If block is to be rebored, refer to Piston Clearance Inspection (page 4-11) after reboring.

NOTE: Scored or scratched cylinder bores must be honed.

Out-of-Round
Service Limit: 0.05 mm (0.002 in.)

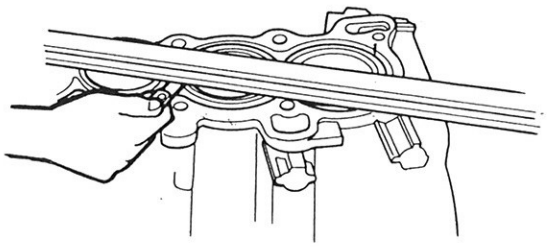
2. Check the top of the block for warpage. Measure along the edges and across the center as shown.

SURFACES TO BE MEASURED



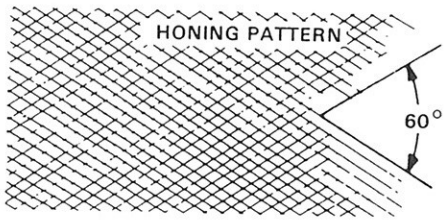
Engine Block Warpage:
Standard (New): 0.07 mm (0.0028 in.)
Service Limit: 0.10 mm (0.004 in.)

PRECISION STRAIGHT EDGE



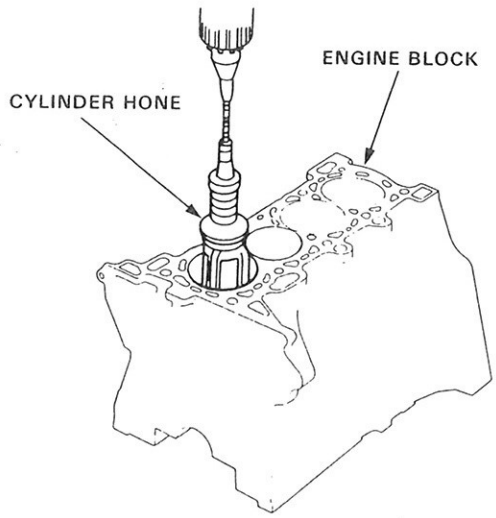
Bore Honing

1. Measure cylinder bores as shown on page 4-12. If the block is to be re-used, 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.



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

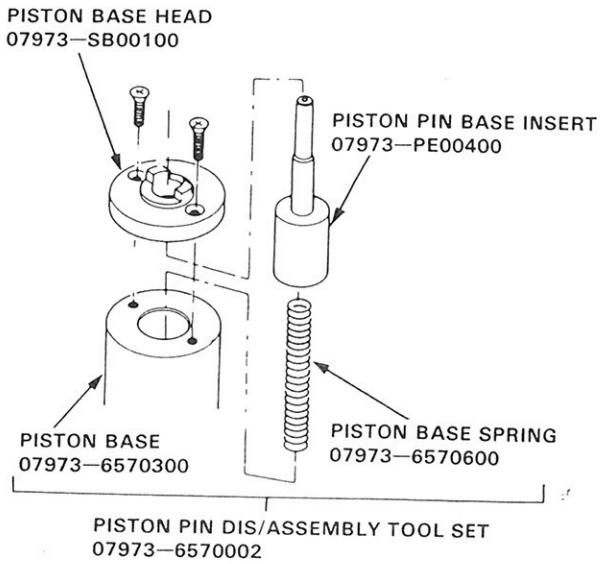
   NOTE: Some light vertical scoring and scratching is acceptable if it is not deep enough to catch your fingernail and does not run the full length of the bore.



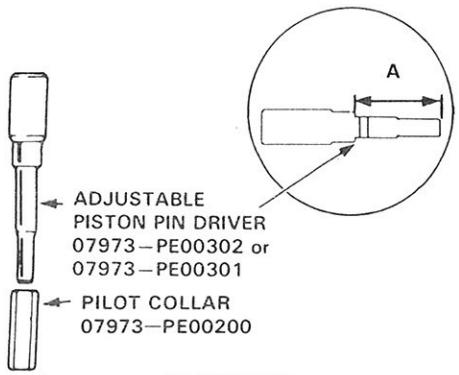
Piston Pins

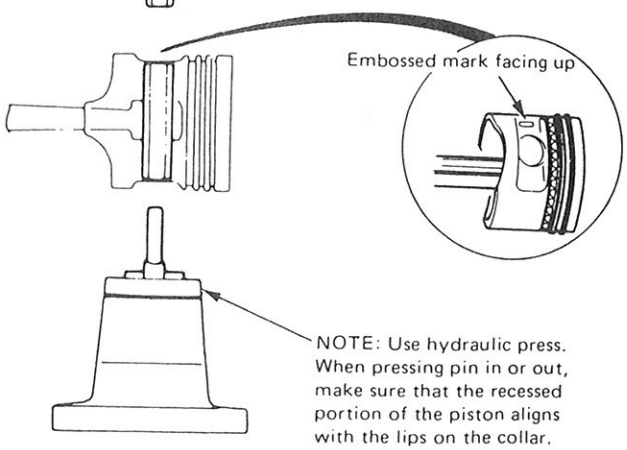
Removal

1. Assemble the Piston Pin Dis/assembly Tool as shown.



2. Adjust the length A of piston pin driver.
   A : 53.0 mm (2.09 in.)





3. Place the piston on the piston base and press the pin out with a hydraulic press.

Connecting Rods

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 it's 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.

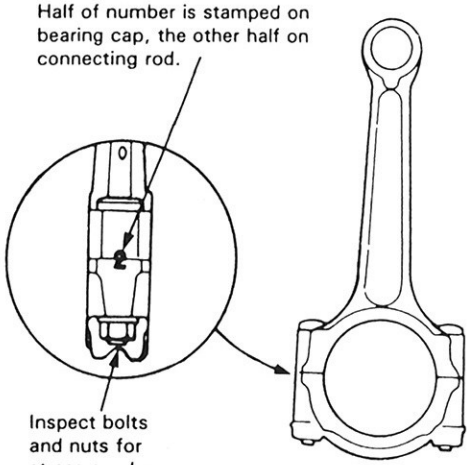
Normal Bore Size:

1.2 ℓ, 1.3 ℓ, 1.4 ℓ: 43mm (1.6929 in.)
1.5 ℓ: 45 mm (1.7717 in.)
1.6 ℓ: 48 mm (1.8898 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.

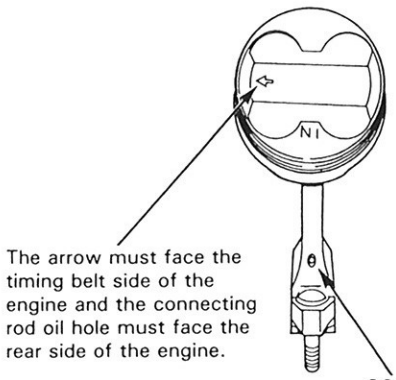


Inspect bolts and nuts for stress cracks.

Piston Pins

Installation

1. Use a hydraulic press for installation.
   - When pressing pin in or out, be sure you position the recessed flat on the piston against the lugs on the base attachment.

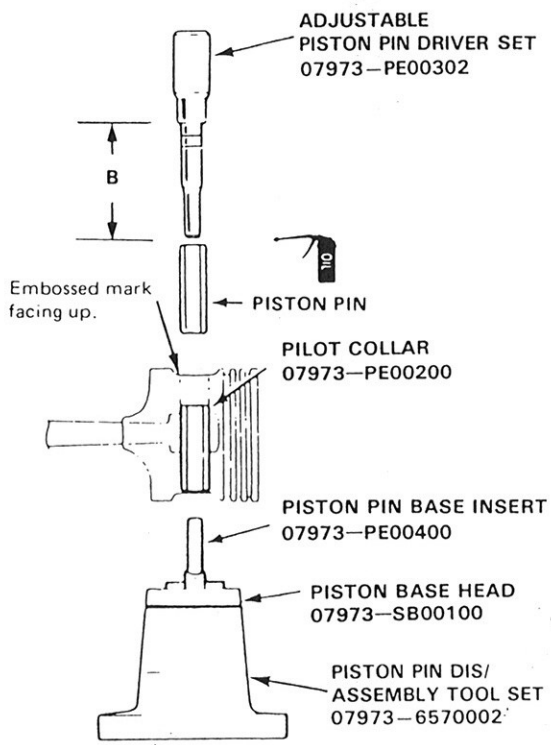


The arrow must face the timing belt side of the engine and the connecting rod oil hole must face the rear side of the engine.

CONNECTING ROD OIL HOLE

2. Adjust the length B of piston pin driver.
   53.0 mm (2.09 in.)

B: • When pressing the center-narrowed piston pin into the piston using a piston pin driver, the piston pin may not be in the center of the piston.
In that case, if necessary, re-adjust the piston pin until it seats in the center of the piston.



NOTE: Install the assembled piston and rod with the oil hole facing the rear of the engine.

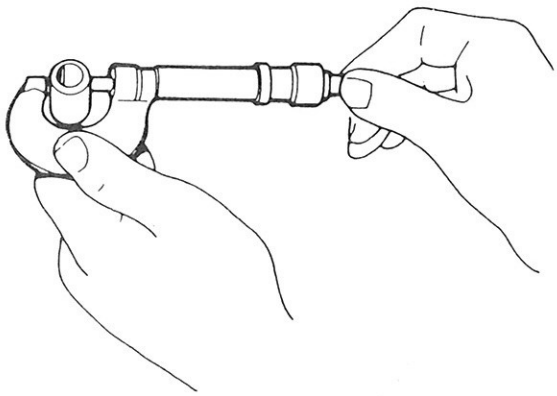
Inspection

1. Measure the diameter of the piston pin.

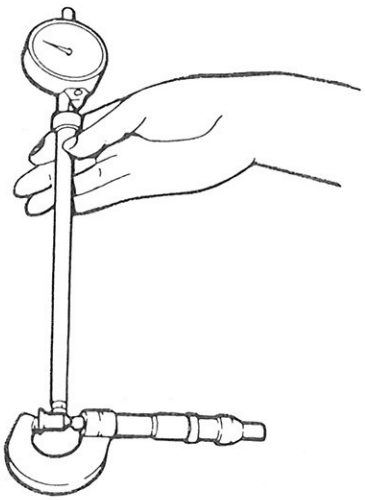
   Piston Pin Diameter:
   Standard (New): 18.994—19.000 mm
   (0.7478—0.7480 in.)

   Overasize: 18.997—19.003 mm
   (0.7479—0.7481 in.)

   NOTE: All replacement piston pins are oversize.



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

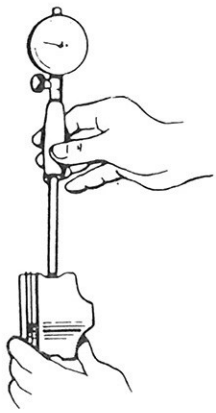


3. Measure the piston pin-to-piston clearance.

   NOTE: Check the piston for distortion or cracks.

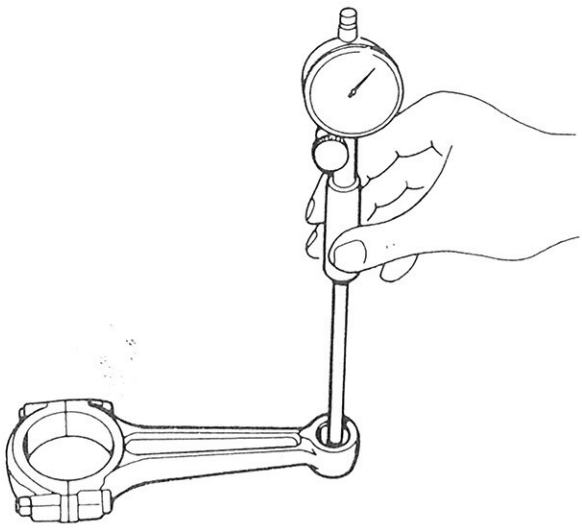
   If the piston pin clearance is greater than 0.022 mm (0.0009 in.), re-measure using an oversize piston pin.

   Piston Pin-to-Piston Clearance:
   Service Limit: 0.010—0.022 mm
   (0.0004—0.0009 in.)



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

   Pinston Pin-to-Connecting Rod Interference:
   Standard (New): 0.014—0.040 mm
   (0.0006—0.0016 in.)



Piston Rings

End Gap

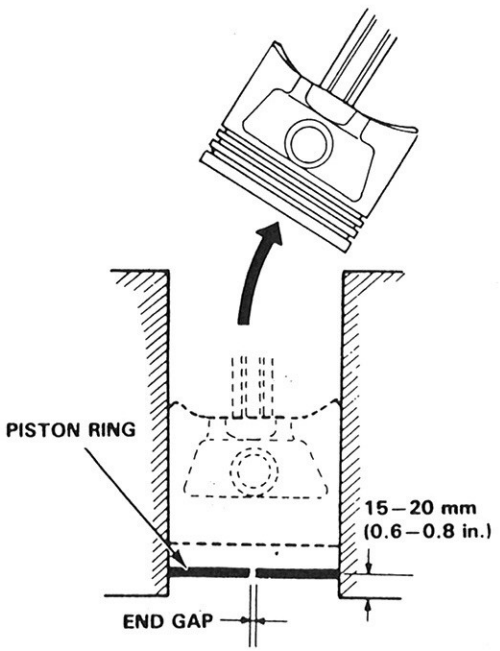
1. Using a piston, push a new ring into the cylinder bore 15—20 mm (0.6—0.8 in.) from the bottom.
2. Measure the piston ring end-gap with a feeler gauge:
   - If the gap is too small, check to see if you have the proper rings for your engine.
   - If the gap is too large, re-check the cylinder bore diameter against the wear limits on page 4-11. If the bore is over limit, the engine block must be rebored.

Piston Ring End-Gap:

Top Ring
Standard (New): 0.015—0.35 mm (0.006—0.014 in.)
Service Limit: 0.6 mm (0.02 in.)

Second Ring
Standard (New): 0.15—0.35 mm (0.006—0.014 in.)
Service Limit: 0.6 mm (0.02 in.)

Oil Ring
Standard (New): 0.2—0.6 mm (0.008—0.024 in.)
Service Limit: 0.8 mm (0.03 in.)



Replacement

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

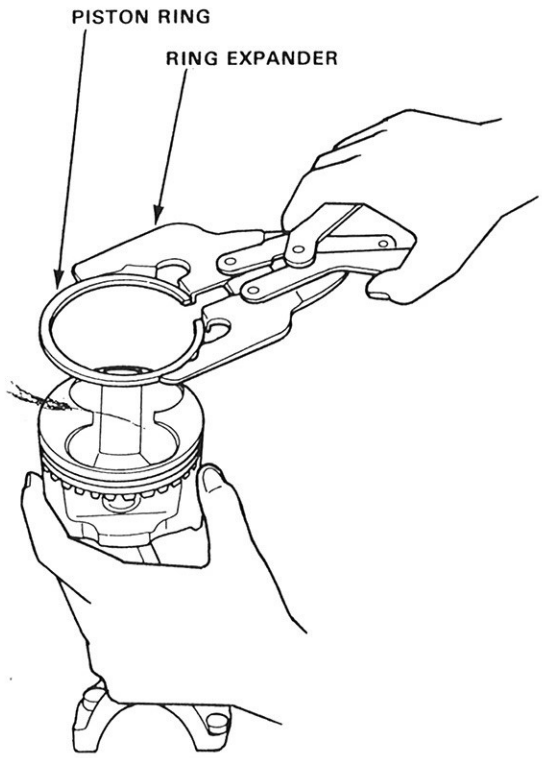
   NOTE : Use squared-off broken ring, or file down blade on ring grove cleaner to fit (top ring is 1.2 mm wide ; second ring is 1.5 mm wide ; oil ring is 2.8 mm wide).

   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 4-17).

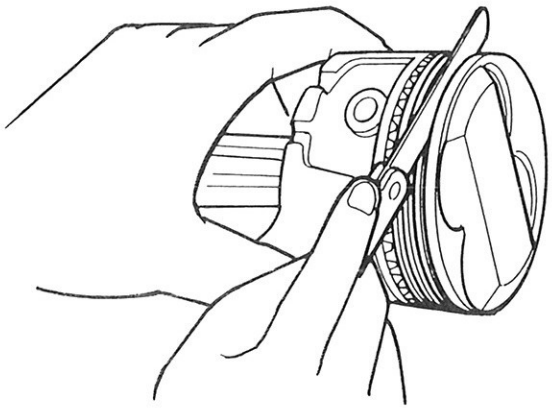
   NOTE: Do not re-use old piston rings.



Land Clearances

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

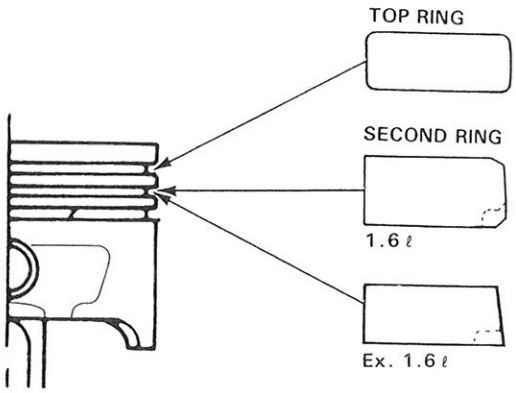
Top Ring Clearance:
Standard (New): 0.03—0.06 mm (0.0012—0.0024 in.)
Service Limit: 0.13 mm (0.005 in.)
Second Ring Clearance:
Standard (New): 0.03—0.055 mm (0.0012—0.0022 in.)
Service Limit: 0.13 mm (0.005 in.)



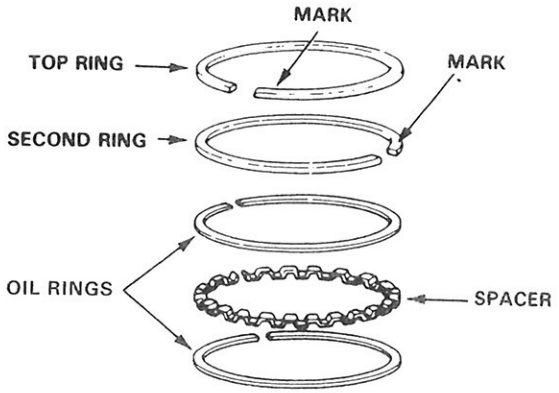
Alignment

1. Install the rings as shown on page 4-16.

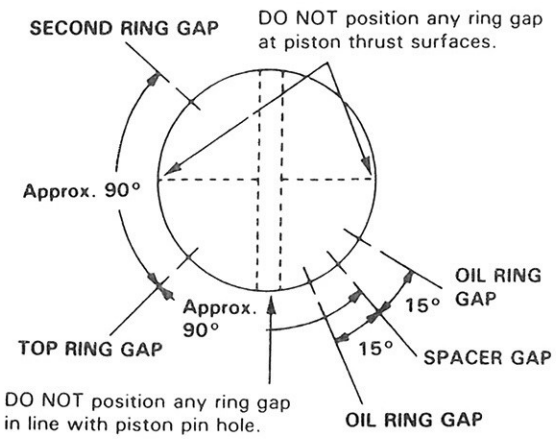
   Identify top and second rings by the chamfer on the edge, and make sure they are in proper grooves on piston.



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:



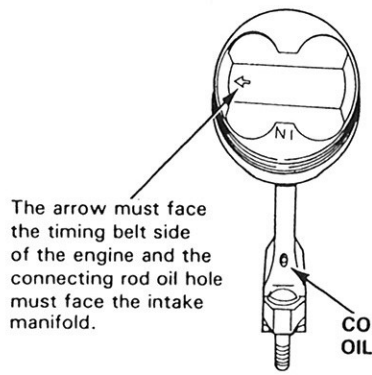
Pistons

Installation

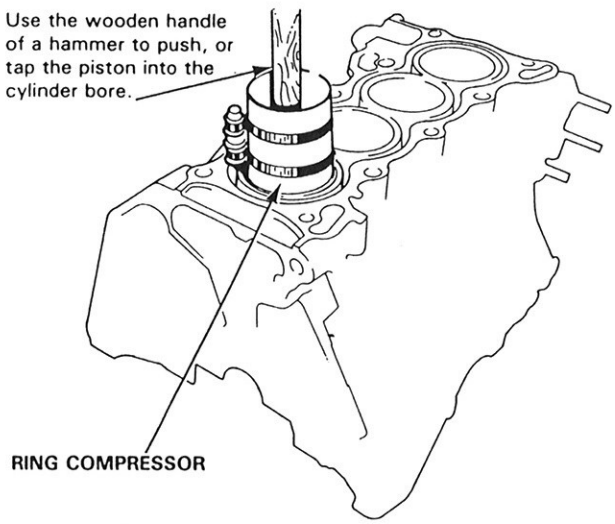
Before installing the piston, apply a coat of engine oil to the ring grooves and cylinder bores.

1. If the crankshaft is already installed:
   - 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.
     32 N·m (3.2 kg-m, 23 lb-ft)

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.
   - Position all pistons at top dead center.



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



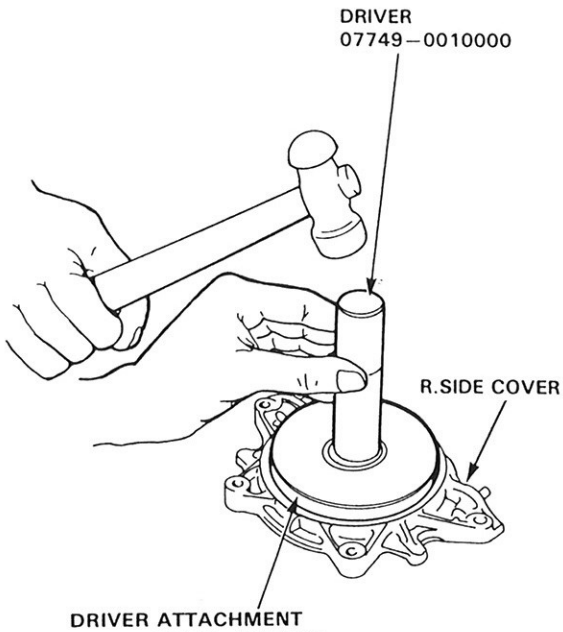
Oil Seal

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 against R. side cover.

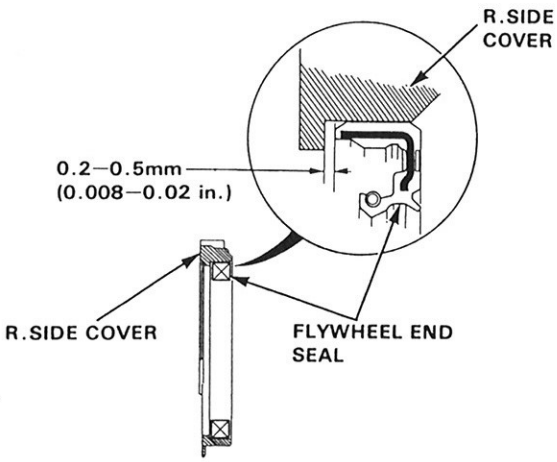
   NOTE: Drive in flywheel end seal squarely.



Install seal with the part number side facing out.

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

   Clearance: 0.2–0.5 mm (0.008–0.02 in.)



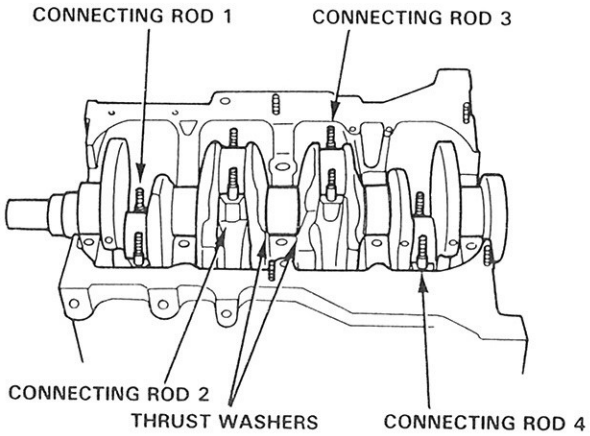
NOTE: Refer to page 5-8 for steps on the oil pump side oil seal.

Crankshaft

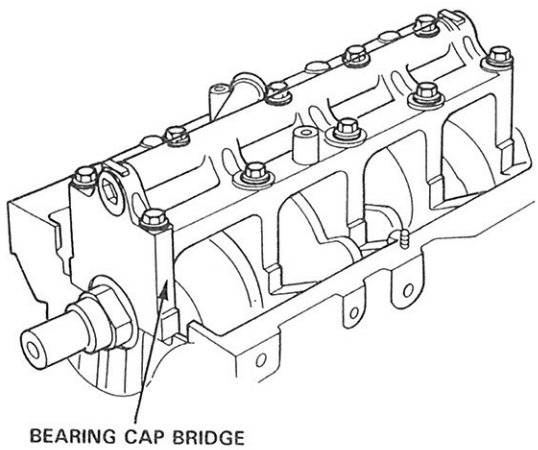
Installation

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 rod.
2. Hold the crankshaft so rod journals for cylinder No. 2 and No.3 are straight down.
3. Lower the crankshaft into the block, seating the rod journals into connecting rods No. 2 and No. 3 and install rod caps and nuts finger tight.



4. Rotate the crankshaft clockwise, seat journals into connecting rods No. 1 and No. 4, and install the rod caps and nuts finger tight.
5. Install the thrust washers, main bearing halves caps and cap bridge, check clearance with plastigage (page 4-7), then torque the bolts.
   Ex. 1.6 ℓ : 53 N·m (5.3 kg-m, 38 lb-ft)
   1.6 ℓ : 67 N·m (6.7 kg-m, 48 lb-f)
   Oil thrust washer surfaces.



6. Check the rod bearing clearance with plastigage (page 4-7), then torque the nuts.

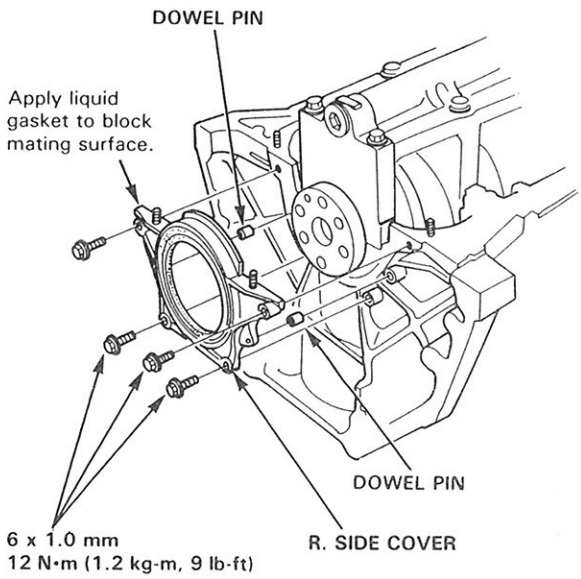
   32 N·m (3.2 kg-m, 23 lb-ft)

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

   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.

7. Install the baffle plate.
8. Apply non-hardening liquid gasket to the block mating surface of the right side cover and oil pump case, and install them on the engine block.

R.SIDE COVER SIDE;

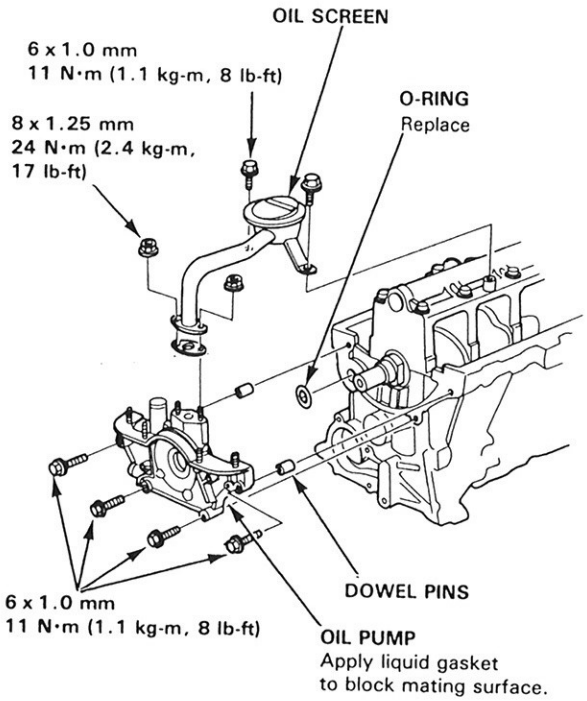


(cont'd)

Crankshaft

Installation (cont'd)

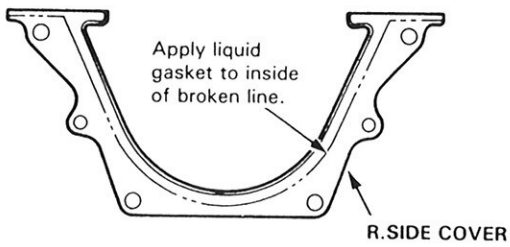
OIL PUMP SIDE:



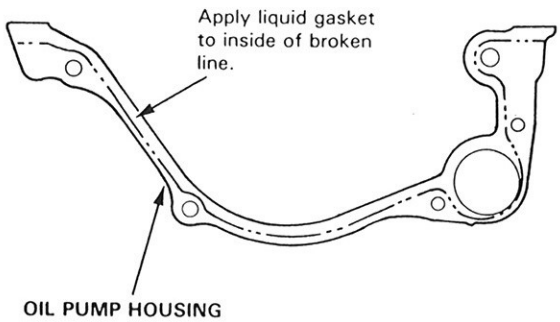
NOTE:

- Use **PART NO. 08740-99968** for the liquid gasket.
- Check that the mating surfaces are clean and dry before applying liquid gasket.
- Apply liquid gasket by starting with an even bend, centered between edges of the mating surface.
- To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.

R.SIDE COVER SIDE:



OIL PUMP SIDE:



- Do not allow the sealant to dry before assembly.
- Wait at least 30 minutes after assembly before filling the engine with oil.

9. Install the oil screen.
10. Install the oil pan.

Engine Lubrication

Standards and Service Limits, Special Tools

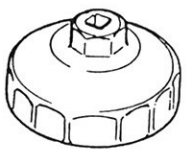
Standards and Service Limits

Unit : mm (in.

	MEASUREMENT			STANDARD (NEW)	SERVICE LIMIT
Engine oil	Capacity ℓ (U.S.qt., Imp. qt)		SOHC	4.0 (4.2, 3.5) After engine disassembly 3.5 (3.7, 3.1) After oil change, including oil filter 3.0 (3.2, 2.6) After oil change, excluding oil filter	
			DOHC	4.3 (4.5, 3.8) After engine disassembly 3.8 (4.0, 3.3) After oil change, including oil filter 3.3 (3.5, 2.9) After oil change, excluding oil filter	
Oil pump	Displacement		SOHC	44 ℓ (11.6 U.S. gal., 9.7 Imp, gal.) 6,250 min^{-1}(rpm)	
			DOHC	67 ℓ (17.7 U.S. gal., 14.7 Imp.gal.) 6,750 min^{-1}(rpm)	
	Inner-to-outer rotor radial clearance			0.14 (0.006)	0.2 (0.008)
	Pump body-to-rotor radial clearance			0.10–0.175 (0.004–0.007)	0.2 (0.008)
	Pump body-to-rotor side clearance			0.03–0.08 (0.001–0.003)	0.15 (0.006)
Relief valve	Pressure setting 80°C(176°F)	Idle	SOHC	167 kPa (1.7 kg/cm², 24 psi) min.	
			DOHC	137 kPa (1.4 kg/cm², 20psi) min.	
		3,000min^{-1} (rpm)			
			SOHC	451 kPa (4.6 kg/cm², 65 psi)	
			DOHC	470 kPa (4.8 kg/cm², 68 psi)	

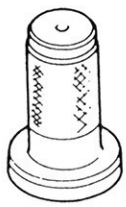
Special Tools (Common with Other Models)

Ref. No.	Tool Number	Description	Q'ty	Remarks
①	07912–6110001	Oil Filter Socket Wrench	1	
②	07406–0030000	Oil Pressure Gauge Adaptor	1	
③	07HAD–PJ70100	Oil Seal Driver	1	Crankshaft Oil Seal (Oil Pump)



①

②

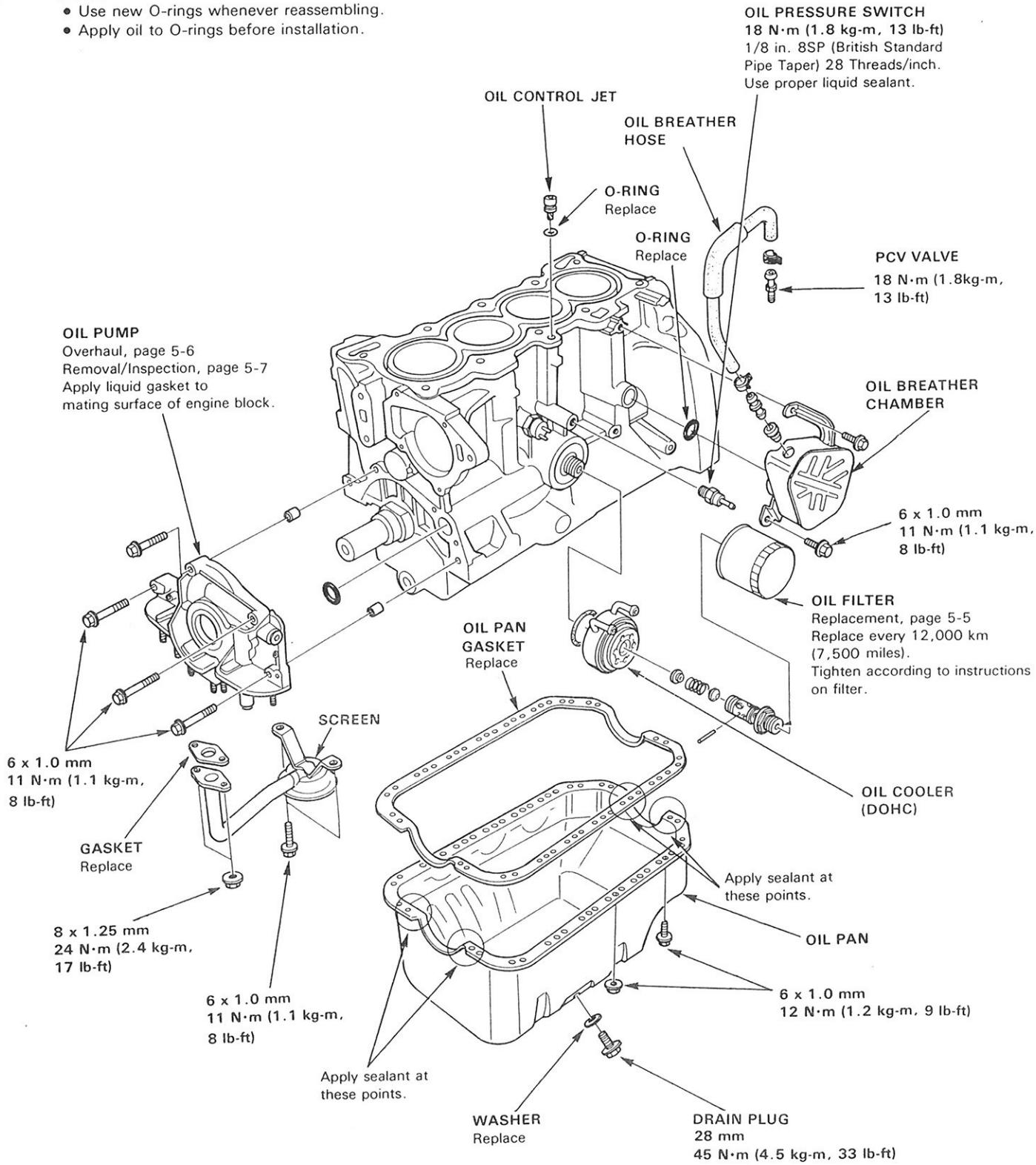


③

Engine Lubrication

Illustrated Index

NOTE:
- Use new O-rings whenever reassembling.
- Apply oil to O-rings before installation.

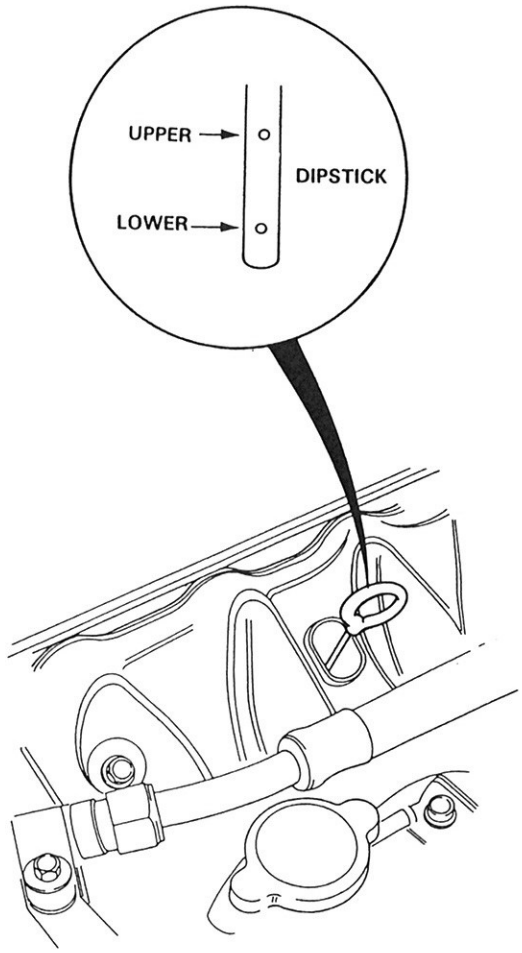


Oil Level

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.

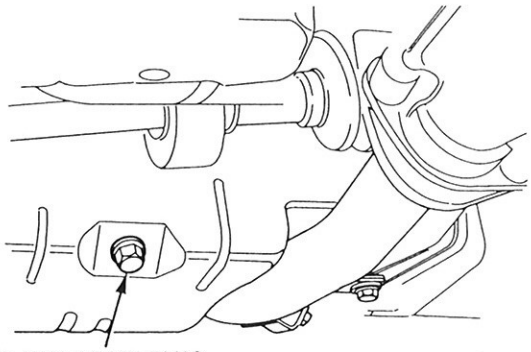


Engine Oil

Replacement

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

   NOTE: Remove the filler cap to speed draining.

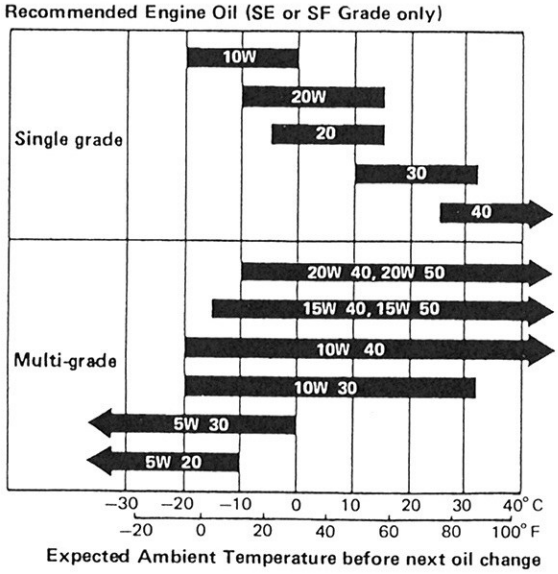


OIL PAN DRAIN PLUG
45 N·m (4.5 kg-m, 33 lb-ft)

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

Capacity	SOHC : 3.0lit (3.2US qt, 2.7Imp.qt) DOHC : 3.3lit (3.5US qt, 2.9Imp.qt) excluding oil filter SOHC : 3.5lit (3.7US qt, 3.1Imp.qt) DOHC : 3.8lit (4.0US qt, 3.4Imp.qt) at change, including filter SOHC : 4.0lit (4.2US qt, 3.5Imp.qt) DOHC : 4.3lit (4.6US qt, 3.8Imp.qt)
Change	Every 10,000km (6,000miles) or 6months

Recommended Engine Oil (SE or SF Grade only)



Expected Ambient Temperature before next oil change

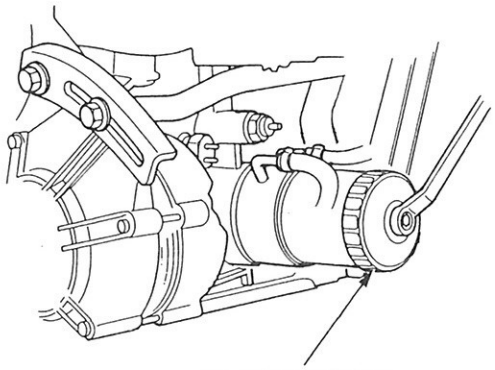
NOTE : Oil filter should be replaced at each oil change.

Oil Filter

Replacement

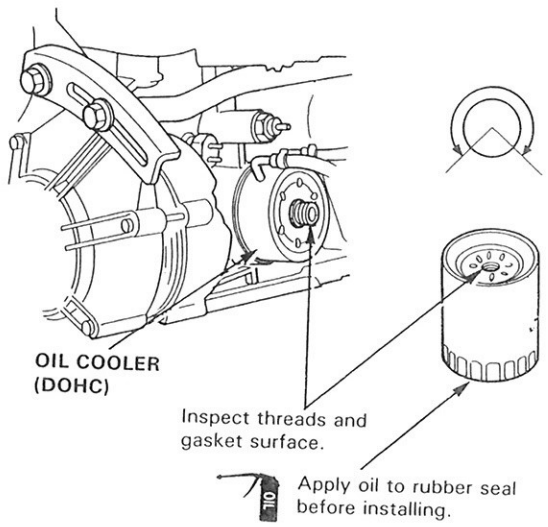
CAUTION: After the engine has been run, the exhaust pipes will be hot; be careful when working around the exhaust manifold.

1. Remove the oil filter with the special oil filter socket.



OIL FILTER SOCKET
07912–6110001
22 N·m (2.2 kg-m, 16 lb-ft)

2. Inspect the threads and gasket on the new filter. Wipe off seat on engine block, then apply a light coat of oil to the gasket, and install filter. Tighten according to instructions on, or with, the filter.



Oil Pressure

Test

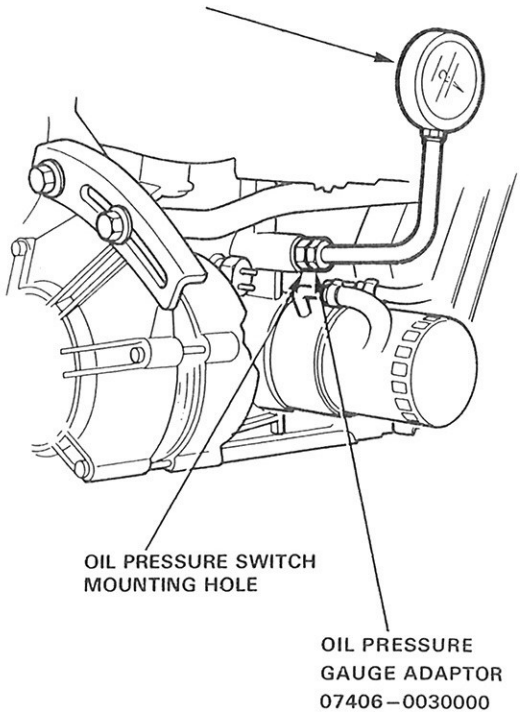
If the oil pressure warning light stays on with the engine running, check the engine oil level. If the oil level is correct:

1. Remove the oil pressure switch 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 :
SOHC : 167 kPa (1.7 kg/cm², 24 psi)min.
DOHC : 137 kPa (1.4 kg/cm², 20 psi) min.
At 3,000 min⁻¹(rpm) :
SOHC : 451 kPa (4.6 kg/cm², 65 psi)
DOHC : 470 kPa (4.8 kg/cm², 68 psi)

- If oil pressure is within specifications, replace oil pressure sender and recheck.
- If oil pressure is NOT within specifications, inspec the oil pump (page 5-7).

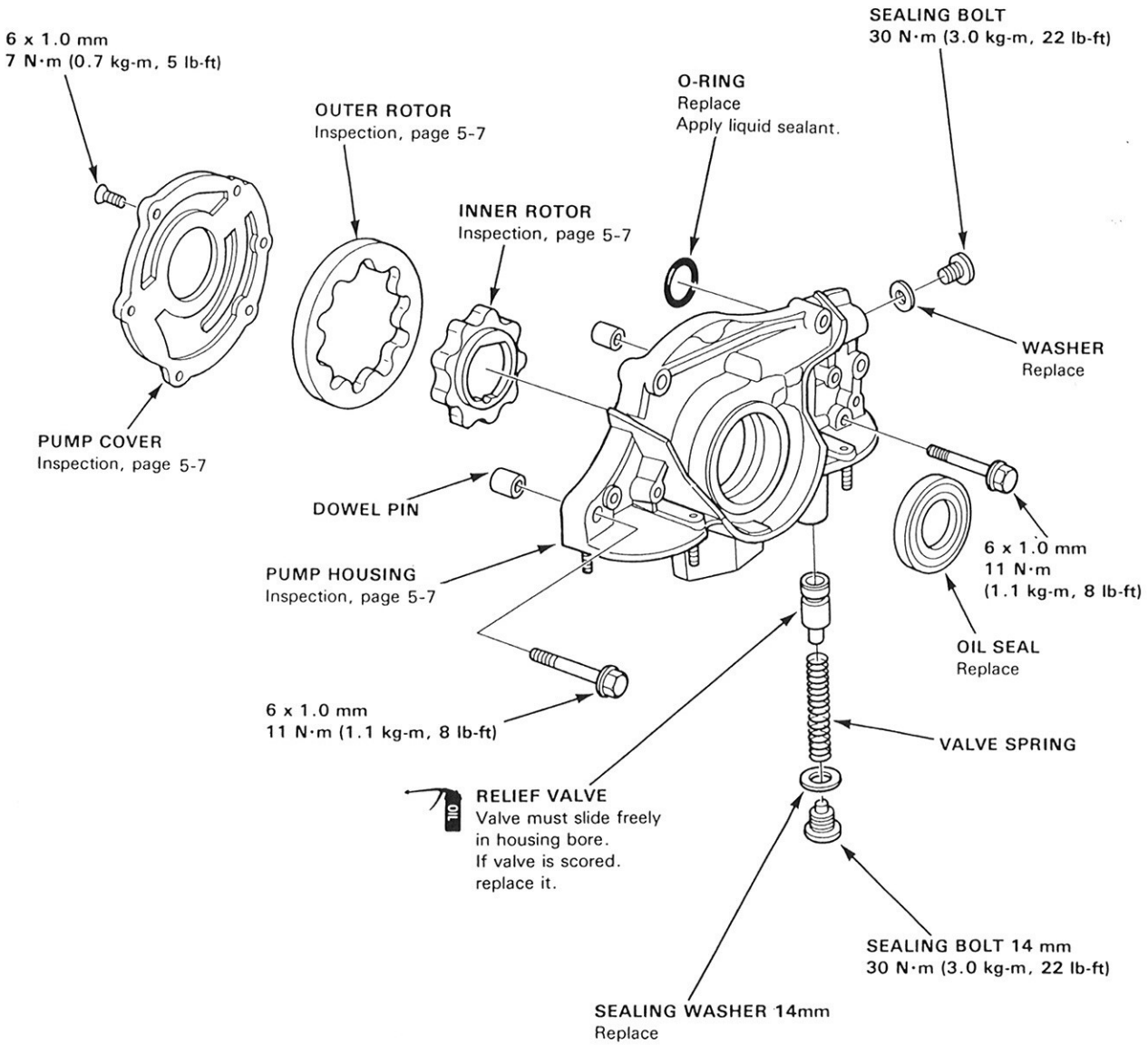
OIL PRESSURE GAUGE



Oil Pump

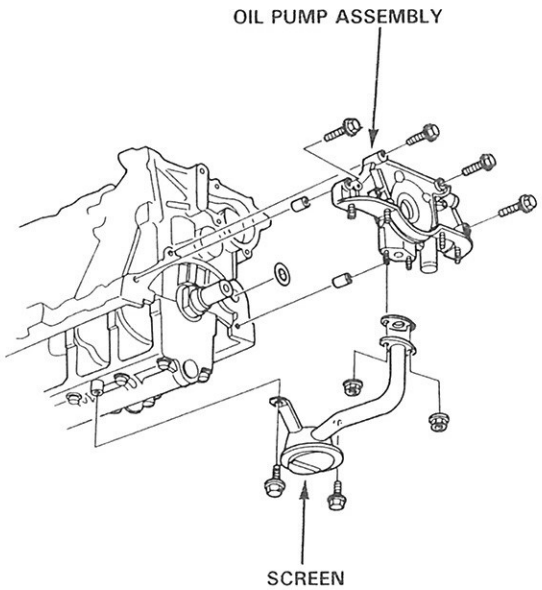
Overhaul

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



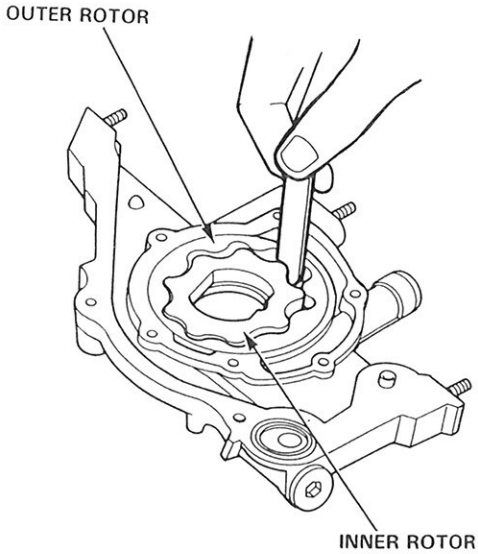
Removal/Inspection

1. Drain the engine oil.
2. Turn the crankshaft and align the white groove on the crankshaft pulley with the point on the timing belt cover.
3. Remove the valve cover and timing belt upper cover.
4. Remove the power steering pump belt and the alternator belt.
5. Remove the crankshaft pulley and remove the timing belt lower cover.
6. Remove the timing belt and drive pulley.
7. Remove the oil pan.
8. Remove the oil screen.
9. Remove the mount bolts and the oil pump assembly.



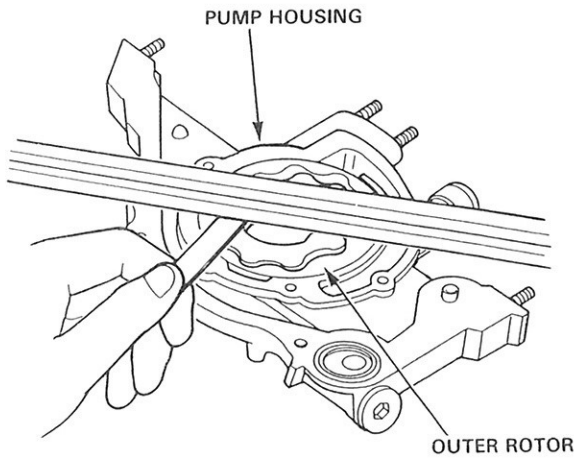
10. Remove the screws from the pump housing, then separate the housing and cover.
11. Check the radial clearance on the pump rotor.

Inner Rotor-to-Outer Rotor Radial Clearance
Standard (New): 0.04—0.14 mm
0.02—0.06 mm
Service Limit: 0.2 mm (0.008 in.)



12. Check the axial clearance on the pump rotor.

Housing-to-Rotor Axial Clearance
Standard (New): 0.03—0.08 mm
(0.001—0.003 in.)
Service Limit: 0.15 mm (0.006 in.)



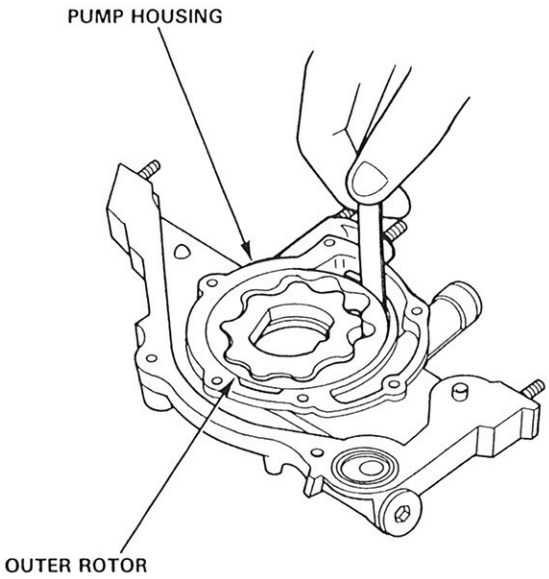
(cont'd)

Oil Pump

Removal/Inspection (cont'd)

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

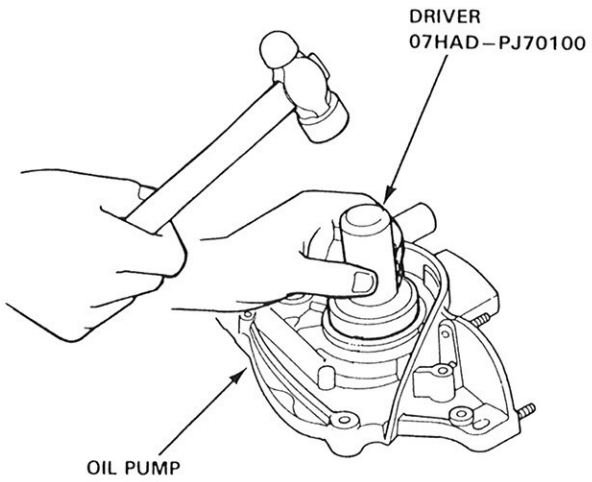
    Housing-to-Rotor Radial Clearance
    Standard (New): 0.10—0.175 mm (0.004—0.007 in.)
    Service Limit: 0.20 mm (0.008 in.)



14. Inspect both rotors and pump housing for scoring or other damage. Replace parts as necessary.

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

16. Gently tap in the new oil seal until the tool bottoms on the pump.



17. Reassemble the oil pump, applying locking fluid to the pump housing screws.

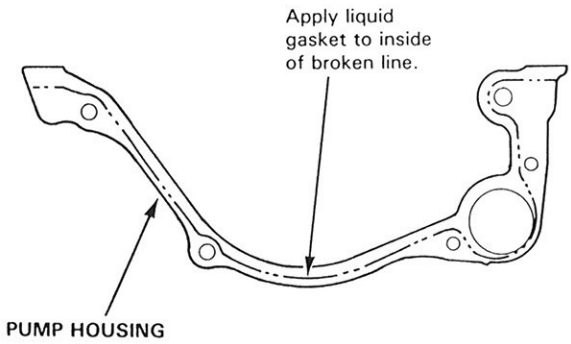
18. Check that the oil pump turns freely.

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 PART NO. 08740—99968 for the liquid gasket.
    - 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 sealant to the in ner threads of the bolt holes.

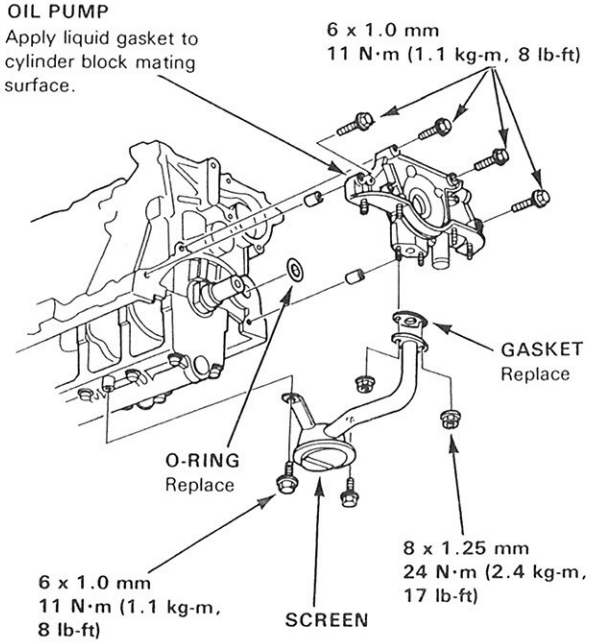


- Do not allow the sealant to dry before assembly.
- Wait at least 30 minutes after assembly before filling the engine with oil.

22. Install the oil pump on the cylinder block.

23. Install the oil screen.

24. Install the oil pan.



Cooling

Standards and Service Limits

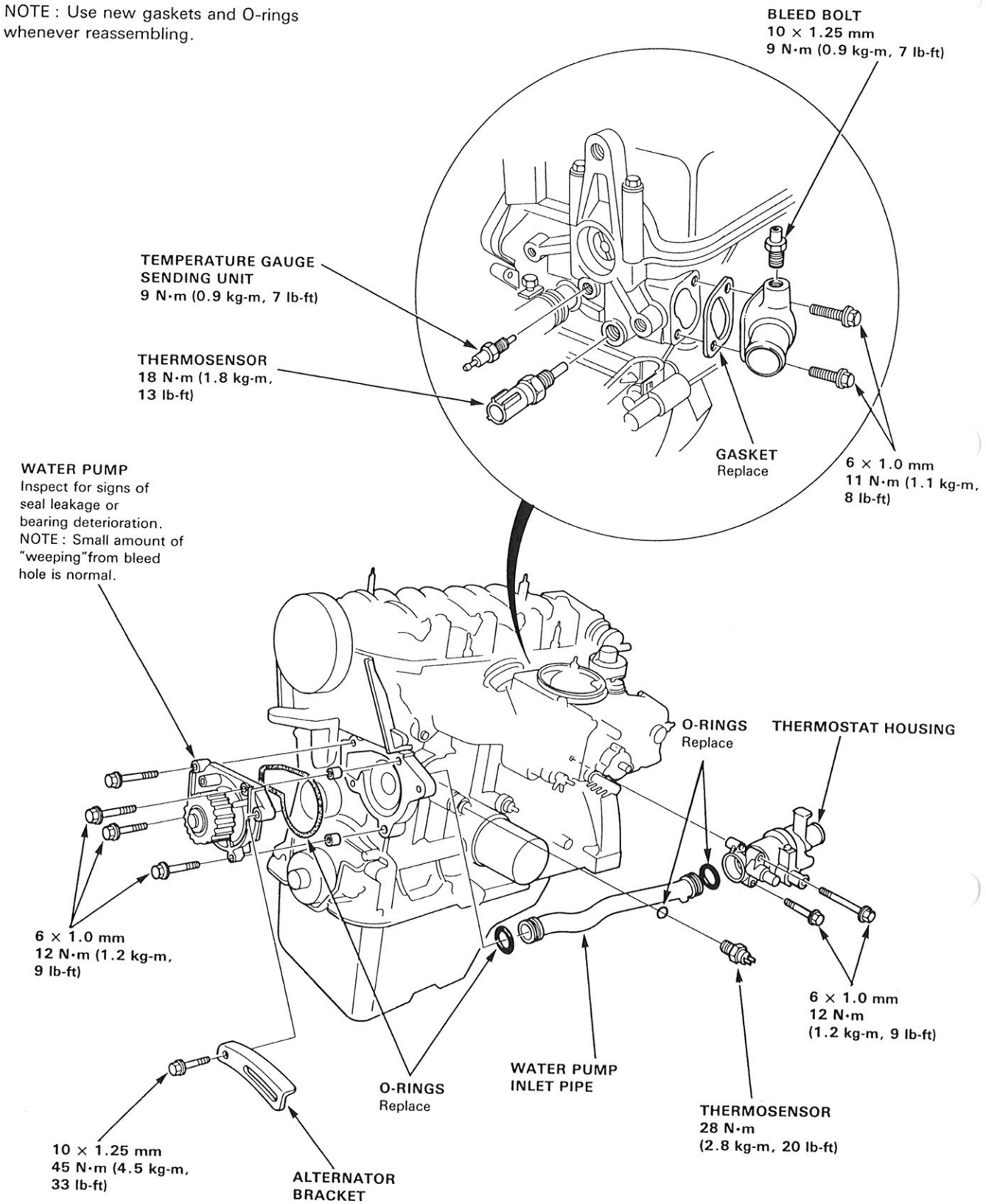
Unit : mm (in.)

	MEASUREMENT	STANDARD (NEW)
Thermostat	Starts to open Full open Valve lift at full open	78°C±2 (172±3) 90°C (194°F) 8 (0.31) min.
Water pump	Pulley ratio (crankshaft) Capacity : ℓ per min/at rpm	1 : 1 108 (27 U.S. gal., 23 Imp. gal.) /5,000 min^{-1} (rpm)

Cooling

Illustrated Index

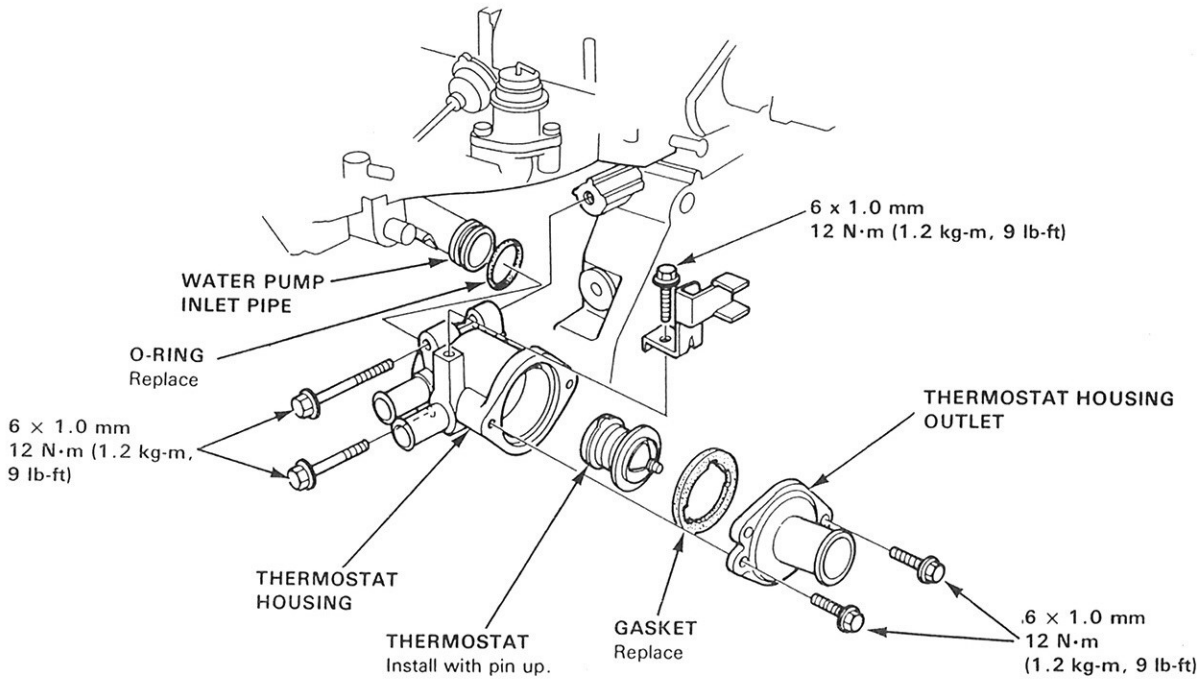
NOTE : Use new gaskets and O-rings whenever reassembling.



Thermostat

Replacement

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



Testing

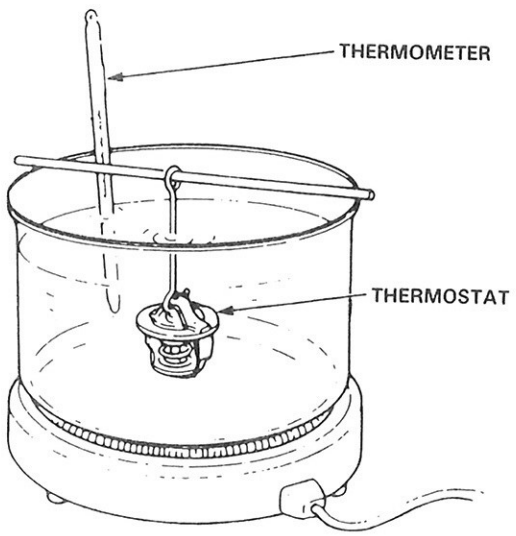
Replace thermostat if it is open at room temperature.

To test a closed thermostat:

1. Suspend the thermostat in a container of water as shown.
2. Heat the water and check the temperature with a thermometer. Check the temperature at which the thermostat first opens and at full lift.

   CAUTION: Do not let thermometer touch bottom of hot container.
3. Measure lift height of thermostat when fully open.

STANDARD THERMOSTAT
Lift height: 8 mm (0.31 in.)
Starts opening: 78°C ± 2°C (172°F ± 3°F)
Fully open: 90°C (194°F)



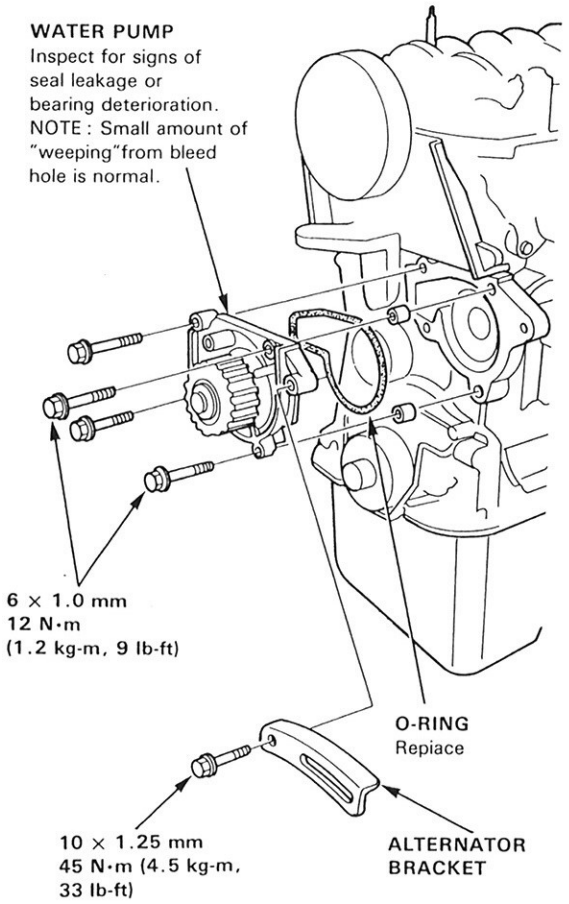
Water Pump

Replacement

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

1. Remove the timing belt (pages 2-4 and 2-10).

2. Remove the mounting bolts and remove the water pump.



3. Install the water pump in the reverse order of removal.

HONDA

HONDA MOTOR CO., LTD. TOKYO, JAPAN

62PM100

㊊Ⓗ A10008711J
PRINTED IN JAPAN