

CO (w/o TWC) INSPECTION

HINT:

This check is used only to determine whether or not the idle CO complies with regulations.

1. INITIAL CONDITIONS

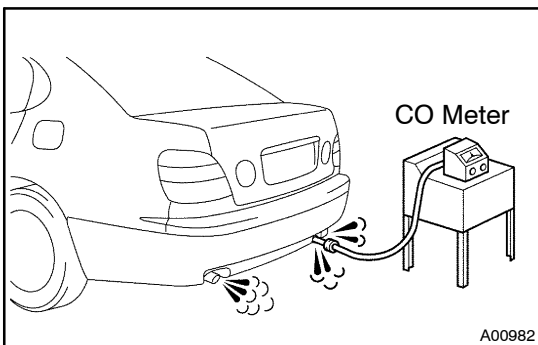
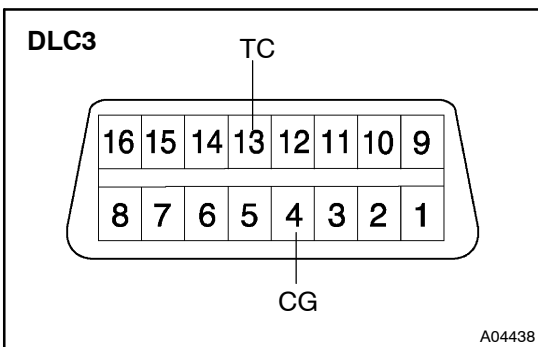
- (a) Engine at normal operating temperature
- (b) Air cleaner installed
- (c) All pipes and hoses of air induction system connected
- (d) All accessories switched OFF
- (e) All vacuum lines properly connected
- (f) EFI system wiring connectors fully plugged
- (g) Ignition timing checked correctly
- (h) Transmission in neutral position
- (i) Air conditioning switched OFF
- (j) Tachometer and CO meter calibrated by hand

2. CHECK AND ADJUST CO CONCENTRATION AT IDLE NOTICE:

Always use a CO meter when adjusting the idle mixture. It is not necessary to adjust with the idle mixture screw in most vehicles if they are in good condition. If a CO meter is not available, DO NOT ATTEMPT TO ADJUST IDLE MIXTURE.

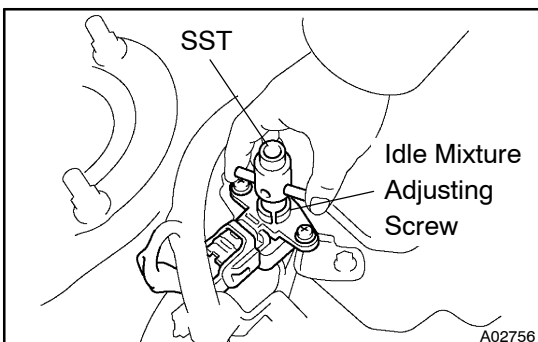
- (a) Using SST, connect terminals 13 (TC) and 4 (CG) of the DLC3.

SST 09843-18040



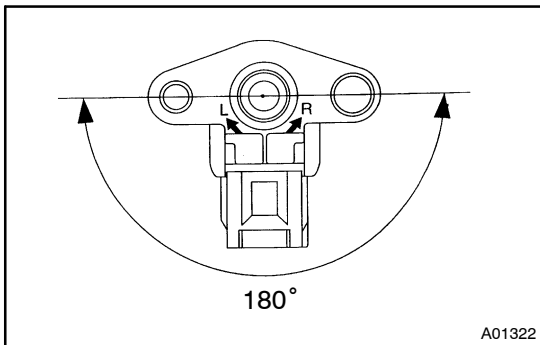
- (b) Race the engine at 2,500 rpm for approx. 180 seconds.
- (c) Insert a tester probe at least 40 cm (1.3 ft) into the tailpipe.
- (d) Wait at least 1 minute before measuring to allow the concentration to stabilize. Complete the measuring within 3 minutes.

Idle CO concentration: 1.0 – 2.0 %



If the CO concentration does not conform to regulations, adjust by turning the IDLE MIXTURE ADJUSTING SCREW in the variable resistor with SST.

SST 09243-00020

**HINT:**

The idle mixture adjusting screw can be tightened through on angle of 180°.

- If the CO concentration is within specification, this adjustment is complete.
- If the CO concentration cannot be corrected by idle mixture adjustment, see the table on [page EM-3](#) for other possible causes.

(e) Remove the SST.

SST 09843-18040

CO/HC (w/ TWC) INSPECTION

HINT:

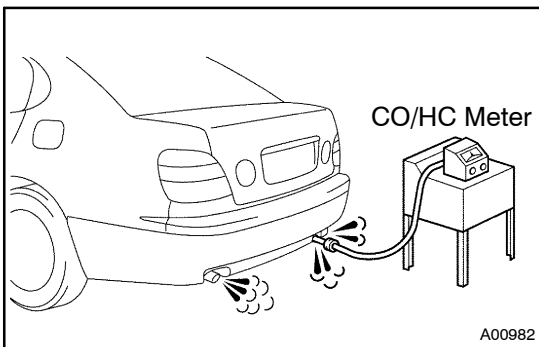
This check is used only to determine whether or not the idle CO/HC complies with specifications.

1. INITIAL CONDITIONS

- (a) Engine at normal operating temperature
- (b) Air cleaner installed
- (c) All pipes and hoses of air induction system connected
- (d) All accessories switched OFF
- (e) All vacuum lines properly connected
- (f) EFI system wiring connectors fully plugged
- (g) Ignition timing check correctly
- (h) Transmission in neutral position
- (i) Tachometer and CO/HC meter calibrated by hand

2. START ENGINE

3. RACE ENGINE AT 2,500 RPM FOR APPROX. 180 SECONDS



- 4. INSERT CO/HC METER TESTING PROBE INTO TAILPIPE AT LEAST 40 cm (1.3 ft) DURING IDLING
- 5. CHECK CO/HC CONCENTRATION AT IDLE

Idle CO concentration: 0 – 0.5 %

Idle HC concentration: Applicable local regulation

If the CO/HC concentration does not conform to specifications, perform troubleshooting in the order given below.

- (a) Check oxygen sensor operation.
- (b) See the table next page for possible causes, and then inspect and correct the applicable causes if necessary.

HC	CO	Problems	Causes
Normal	High	Rough idle	1. Faulty ignition: • Incorrect timing • Fouled, shorted or improperly gapped plugs • Open or crossed high-tension cords 2. Incorrect valve clearance 3. Leaky intake and exhaust valves 4. Leaky cylinders
Low	High	Rough idle (Fluctuating HC reading)	1. Vacuum leaks: • PCV hoses • Intake manifold • Air intake chamber • Throttle body 2. Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	1. Restricted air filter 2. Plugged PCV valve 3. Faulty EFI systems: • Faulty pressure regulator • Defective water temp. sensor • Faulty engine ECU • Faulty injectors • Faulty throttle position sensor • Faulty air flow meter

COMPRESSION INSPECTION

HINT:

If there is lack of power, excessive oil consumption or poor fuel economy, measure the compression pressure.

1. WARM UP AND STOP ENGINE

Allow the engine to warm up to normal operating temperature.

2. DISCONNECT IGNITION COILS AND HIGH-TENSION CORD SET ASSEMBLY (See page G-7)

3. REMOVE SPARK PLUGS

4. w/TWC:

DISCONNECT INJECTOR CONNECTORS

5. CHECK CYLINDER COMPRESSION

- Insert a compression tester into the spark plug hole.
- While cranking the engine, measure the compression pressure.

HINT:

Always use a fully charged battery to obtain engine revolutions of 250 rpm or more.

- Repeat steps (a) through (b) for each cylinder.

NOTICE:

This measurement must be done in as short a time as possible.

Compression:

1,324 kPa (13.5 kgf/cm² 192 psi) or more

Minimum pressure:

1,079 kPa (11.0 kgf/cm² 156 psi)

Difference between each cylinder:

98 kPa (1.0 kgf/cm² 14 psi) or less

- If the cylinder compression in 1 or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps (a) through (b) for the cylinder with low compression.

- If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore are probably worn or damaged.
- If pressure stays low, a valve may be sticking or seating improper, or there may be leakage past the gasket.

6. w/TWC:

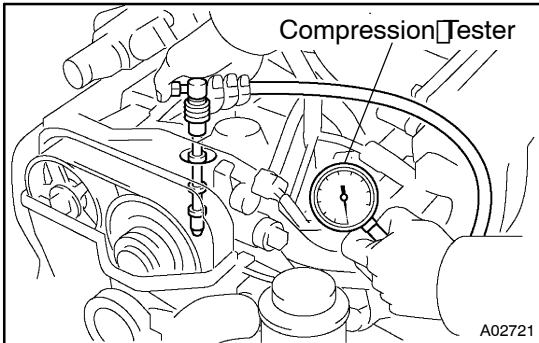
RECONNECT INJECTOR CONNECTORS

HINT:

The Nos. 1, 3, 5 injector connectors and dark gray, and the Nos. 2, 4, 6 injector connectors are brown.

7. REINSTALL SPARK PLUGS

8. RECONNECT IGNITION COILS AND HIGH-TENSION CORD SET ASSEMBLY (See page G-9)

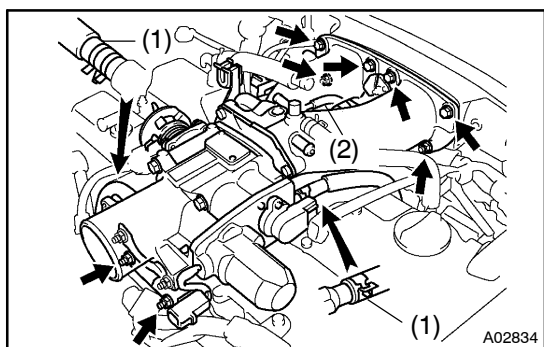
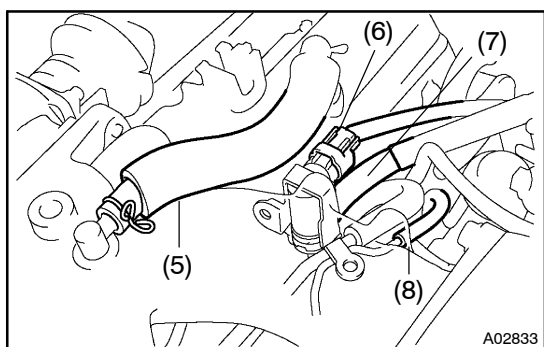
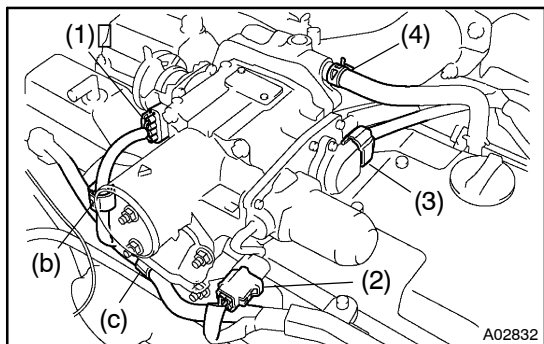


VALVE CLEARANCE ADJUSTMENT

HINT:

Inspect and adjust the valve clearance when the engine is cold.

1. **DRAIN ENGINE COOLANT**
2. **REMOVE INTAKE AIR RESONATOR**
3. **REMOVE THROTTLE BODY AND INTAKE AIR CONNECTOR ASSEMBLY**



- (a) Disconnect the accelerator cable from the throttle body.
- (b) Disconnect the engine wire clamp from the clamp bracket of the throttle body.
- (c) Disconnect the engine wire from the clamp on the throttle body bracket.
- (d) Disconnect these connectors and hoses:
 - (1) Accelerator pedal position sensor connector
 - (2) Throttle control motor connector
 - (3) Throttle position sensor connector
 - (4) Air assist hose from intake air connector
 - (5) PCV hose from intake air connector
 - (6) VSV connector for EVAP
 - (7) EVAP hose (from charcoal canister) from VSV for EVAP
 - (8) Vacuum hose (from No.2 vacuum pipe) from No.1 vacuum pipe
- (e) Remove the 2 nuts holding the throttle body bracket to the cylinder head.
- (f) Remove the 4 bolts and 2 nuts holding the intake air connector to the air intake chamber.
- (g) Disconnect these hoses, and remove the throttle body with the intake air connector and gasket:
 - (1) 2 water bypass hoses from throttle body
 - (2) Vacuum hose (from actuator for ACIS) from No.1 vacuum pipe.

4. REMOVE NO.3 TIMING BELT COVER

Using a 5 mm hexagon wrench, remove the 4 bolts, oil filler cap, timing belt cover and gasket.

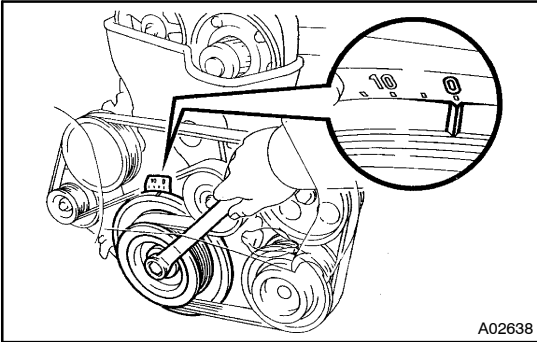
5. REMOVE IGNITION COILS AND HIGH-TENSION CORD SET ASSEMBLY (See page IG-7)

6. REMOVE SPARK PLUGS

7. DISCONNECT ENGINE WIRE FROM CYLINDER HEAD COVERS

8. REMOVE CYLINDER HEAD COVERS

(See page EM-33)

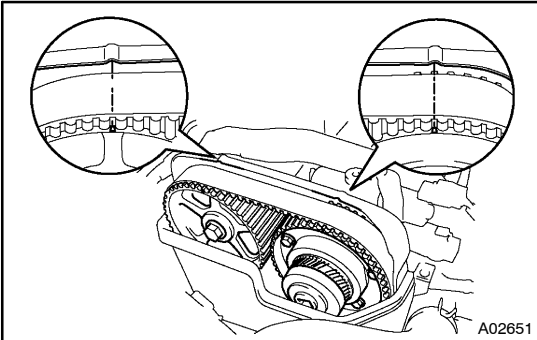


9. SET NO.1 CYLINDER TO TDC/COMPRESSION

- (a) Turn the crankshaft pulley and align its groove with the timing mark "0" of the No.1 timing belt cover.

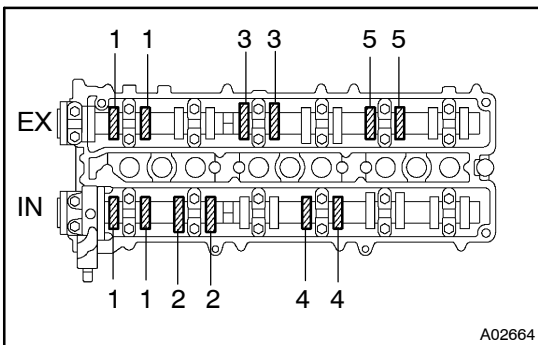
NOTICE:

Always turn the crankshaft clockwise.



- (b) Check that the timing marks of the camshaft timing pulleys are aligned with the timing marks of the No.4 timing belt cover.

If not, turn the crankshaft 1 revolution (360°).



10. INSPECT VALVE CLEARANCE

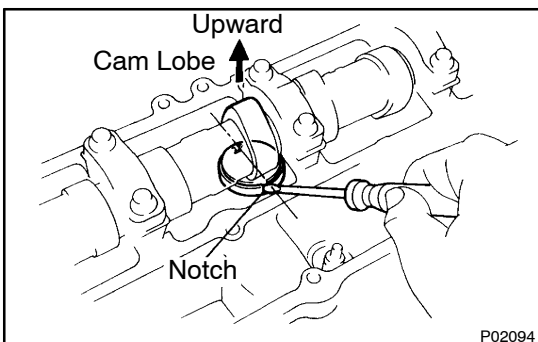
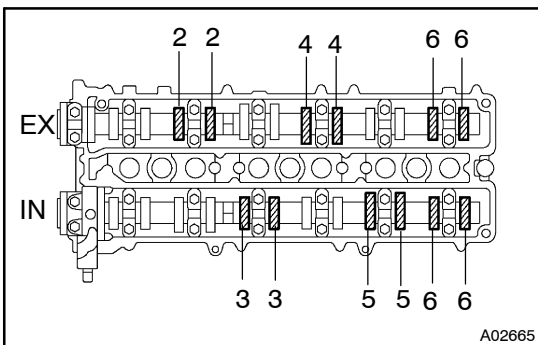
- (a) Check only those valves indicated in the illustration.
- Using a feeler gauge, measure the clearance between the valve lifter and camshaft.
 - Record the valve clearance measurements of those that are out of specification. They will be used later to determine the required replacement adjusting shim.

Valve clearance (Cold):

Intake 0.15 – 0.25 mm (0.006 – 0.010 in.)

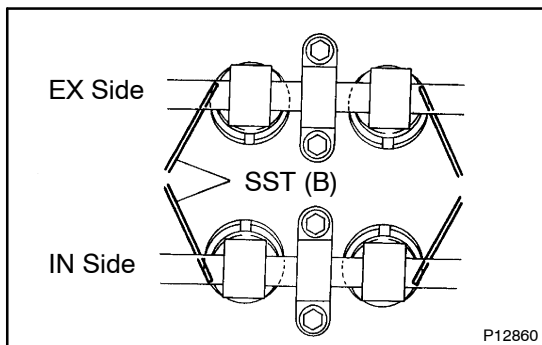
Exhaust 0.25 – 0.35 mm (0.010 – 0.014 in.)

- (b) Turn the crankshaft pulley 1 revolution (360°), and align the groove with the timing mark "0" of the No.1 timing belt cover.
- (c) Check only the valves indicated as shown. Measure the valve clearance. (See procedure in step (a))

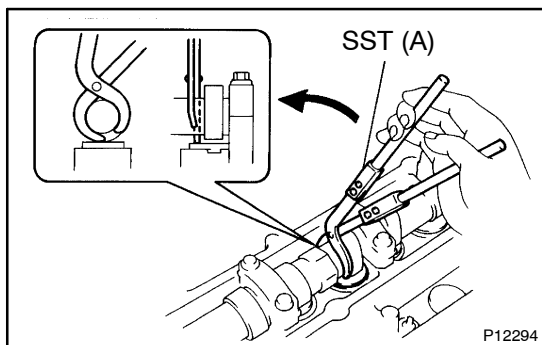


11. ADJUST VALVE CLEARANCE

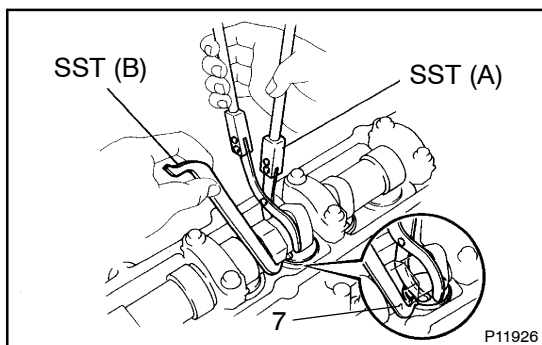
- (a) Remove the adjusting shim.
- Turn the camshaft so that the cam lobe for the valve to be adjusted faces up.
 - Turn the valve lifter with a screwdriver so that the notches are perpendicular to the camshaft.



- Insert SST (B) gently from the inside as shown in the illustration.



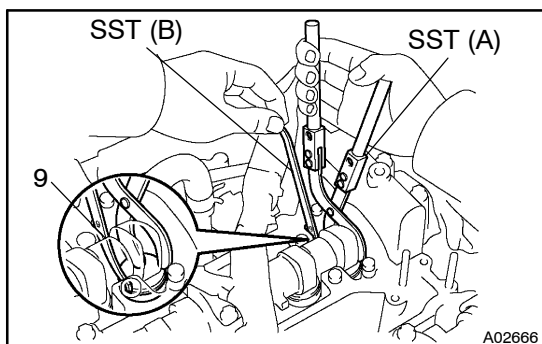
- Using SST (A), hold the camshaft as shown in the illustration.
- SST 09248-55040 (09248-05410)



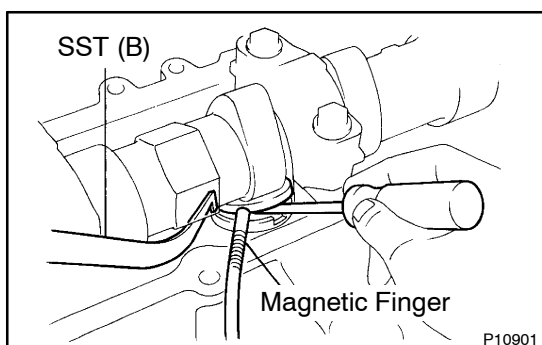
- Using SST (A), press down the valve lifter and place SST (B) between the camshaft and valve lifter. Remove SST (A).
- SST 09248-55040 (09248-05410, 09248-05420)

HINT:

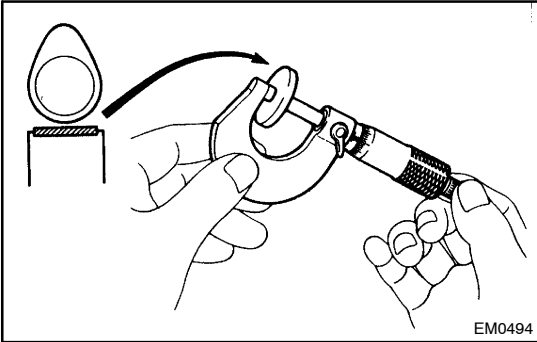
- Apply SST (B) at slight angle on the side marked with "7" or "9", at the position shown in the illustration.



- When the adjusting shim of the No.1 intake side replace, remove the No.2 or No.3 camshaft bearing cap, and insert SST as shown in the illustration.



- Using a small screwdriver and a magnetic finger, remove the adjusting shim.



(b) Determine the replacement adjusting shim size according to the following formula or Charts:

- Using a micrometer, measure the thickness of the removed shim.
- Calculate the thickness of a new shim so the valve clearance comes within specified value.

T..... Thickness of used shim

A..... Measured valve clearance

N..... Thickness of new shim

Intake

$$N = T + (A - 0.20 \text{ mm} (0.008 \text{ in.}))$$

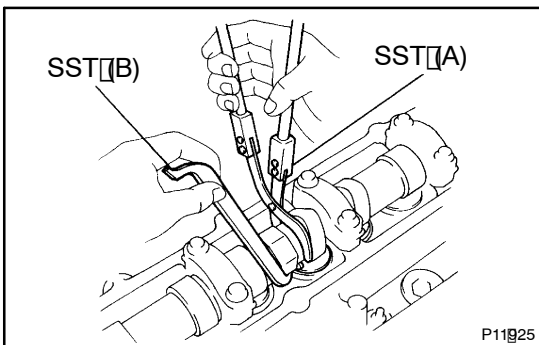
Exhaust

$$N = T + (A - 0.30 \text{ mm} (0.012 \text{ in.}))$$

- Select a new shim with a thickness as close as possible to the calculated values.

HINT:

Shims are available in 17 sizes in increments of 0.050 mm (0.0020 in.), from 2.500 mm (0.0984 in.) to 3.300 mm (0.1299 in.).



(c) Install a new adjusting shim.

- Place a new adjusting shim on the valve lifter, with imprinted numbers facing down.
- Press down the valve lifter with SST (A), and remove SST (B).

SST 09248-55040

12. REINSTALL CYLINDER HEAD COVERS

(See page EM-51)

13. RECONNECT ENGINE WIRE TO CYLINDER HEAD COVERS

14. REINSTALL SPARK PLUGS

15. REINSTALL IGNITION COILS AND HIGH-TENSION CORD SET ASSEMBLY (See page G-9)

16. REINSTALL NO.3 TIMING BELT COVER

(a) Install the gasket to the timing belt cover.

(b) Using a 5 mm hexagon wrench, install the timing belt cover with the 4 bolts.

Torque: 8.0 N·m (80 kgf·cm, 71 in.·lbf)

(c) Install the oil filler cap.

17. REINSTALL THROTTLE BODY AND INTAKE AIR CONNECTOR ASSEMBLY

(a) Install a new gasket to the air intake chamber.

(b) Place the throttle body with the intake air connector on the cylinder head.

(c) Connect these hoses:

- Vacuum hose (from actuator for ACIS) to No.1 vacuum pipe
- 2 water bypass hoses to throttle body

- (d) Install the 4 bolts and 2 nuts holding the intake air connector to the air intake chamber.

Torque: 28 N·m (280 kgf·cm, 21 ft·lbf)

- (e) Install the 2 nuts holding the throttle body bracket to the cylinder head.

Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)

- (f) Connect these hoses and connectors:

- Air assist hose to intake air connector
- PCV hose to intake air connector
- EVAP hose (from charcoal canister) to VSV for EVAP
- Vacuum hose (from No.2 vacuum pipe) to No.1 vacuum pipe
- Throttle position sensor connector
- Accelerator pedal position sensor connector
- Throttle control motor connector
- VSV connector for EVAP

- (g) Secure the engine wire with the clamp on the throttle body bracket.

- (h) Install the engine wire clamp with the clamp bracket of the throttle body.

- (i) Connect the accelerator cable to the throttle body.

18. REINSTALL INTAKE AIR RESONATOR

19. REFILL WITH ENGINE COOLANT

20. START ENGINE AND CHECK FOR LEAKS

Installed Shim Thickness mm (in.)	Measured Clearance mm (in.)	0.000 - 0.020 (0.0000 - 0.0008)	0.021 - 0.040 (0.0008 - 0.0016)	0.041 - 0.060 (0.0016 - 0.0024)	0.061 - 0.080 (0.0024 - 0.0031)	0.081 - 0.100 (0.0032 - 0.0039)	0.101 - 0.120 (0.0040 - 0.0047)	0.121 - 0.140 (0.0048 - 0.0055)	0.141 - 0.160 (0.0056 - 0.0063)	0.161 - 0.180 (0.0064 - 0.0071)	0.181 - 0.200 (0.0072 - 0.0079)	0.201 - 0.220 (0.0080 - 0.0087)	0.221 - 0.240 (0.0088 - 0.0095)	0.241 - 0.260 (0.0096 - 0.0103)	0.261 - 0.280 (0.0104 - 0.0111)	0.281 - 0.300 (0.0112 - 0.0119)	0.301 - 0.320 (0.0120 - 0.0127)	0.321 - 0.340 (0.0128 - 0.0135)	0.341 - 0.360 (0.0136 - 0.0143)	0.361 - 0.380 (0.0144 - 0.0151)	0.381 - 0.400 (0.0152 - 0.0159)	0.401 - 0.420 (0.0160 - 0.0167)	0.421 - 0.440 (0.0168 - 0.0175)	0.441 - 0.460 (0.0176 - 0.0183)	0.461 - 0.480 (0.0184 - 0.0191)	0.481 - 0.500 (0.0192 - 0.0199)	0.501 - 0.520 (0.0200 - 0.0207)	0.521 - 0.540 (0.0208 - 0.0215)	0.541 - 0.560 (0.0216 - 0.0223)	0.561 - 0.580 (0.0224 - 0.0231)	0.581 - 0.600 (0.0232 - 0.0239)	0.601 - 0.620 (0.0240 - 0.0247)	0.621 - 0.640 (0.0248 - 0.0255)	0.641 - 0.660 (0.0256 - 0.0263)	0.661 - 0.680 (0.0264 - 0.0271)	0.681 - 0.700 (0.0272 - 0.0279)	0.701 - 0.720 (0.0280 - 0.0287)	0.721 - 0.740 (0.0288 - 0.0295)	0.741 - 0.760 (0.0296 - 0.0303)	0.761 - 0.780 (0.0304 - 0.0311)	0.781 - 0.800 (0.0312 - 0.0319)	0.801 - 0.820 (0.0320 - 0.0327)	0.821 - 0.840 (0.0328 - 0.0335)	0.841 - 0.860 (0.0336 - 0.0343)	0.861 - 0.880 (0.0344 - 0.0351)	0.881 - 0.900 (0.0352 - 0.0359)	0.901 - 0.920 (0.0360 - 0.0367)	0.921 - 0.940 (0.0368 - 0.0375)	0.941 - 0.960 (0.0376 - 0.0383)	0.961 - 0.980 (0.0384 - 0.0391)	0.981 - 1.000 (0.0392 - 0.0399)	1.001 - 1.020 (0.0400 - 0.0407)	1.021 - 1.040 (0.0408 - 0.0415)	1.041 - 1.060 (0.0416 - 0.0423)	1.061 - 1.080 (0.0424 - 0.0431)	1.081 - 1.100 (0.0432 - 0.0439)	1.101 - 1.120 (0.0440 - 0.0447)	1.121 - 1.140 (0.0448 - 0.0455)	1.141 - 1.160 (0.0456 - 0.0463)	1.161 - 1.180 (0.0464 - 0.0471)	1.181 - 1.200 (0.0472 - 0.0479)	1.201 - 1.220 (0.0480 - 0.0487)	1.221 - 1.240 (0.0488 - 0.0495)	1.241 - 1.260 (0.0496 - 0.0503)	1.261 - 1.280 (0.0504 - 0.0511)	1.281 - 1.300 (0.0512 - 0.0519)	1.301 - 1.320 (0.0520 - 0.0527)	1.321 - 1.340 (0.0528 - 0.0535)	1.341 - 1.360 (0.0536 - 0.0543)	1.361 - 1.380 (0.0544 - 0.0551)	1.381 - 1.400 (0.0552 - 0.0559)	1.401 - 1.420 (0.0560 - 0.0567)	1.421 - 1.440 (0.0568 - 0.0575)	1.441 - 1.460 (0.0576 - 0.0583)	1.461 - 1.480 (0.0584 - 0.0591)	1.481 - 1.500 (0.0592 - 0.0599)	1.501 - 1.520 (0.0600 - 0.0607)	1.521 - 1.540 (0.0608 - 0.0615)	1.541 - 1.560 (0.0616 - 0.0623)	1.561 - 1.580 (0.0624 - 0.0631)	1.581 - 1.600 (0.0632 - 0.0639)	1.601 - 1.620 (0.0640 - 0.0647)	1.621 - 1.640 (0.0648 - 0.0655)	1.641 - 1.660 (0.0656 - 0.0663)	1.661 - 1.680 (0.0664 - 0.0671)	1.681 - 1.700 (0.0672 - 0.0679)	1.701 - 1.720 (0.0680 - 0.0687)	1.721 - 1.740 (0.0688 - 0.0695)	1.741 - 1.760 (0.0696 - 0.0703)	1.761 - 1.780 (0.0704 - 0.0711)	1.781 - 1.800 (0.0712 - 0.0719)	1.801 - 1.820 (0.0720 - 0.0727)	1.821 - 1.840 (0.0728 - 0.0735)	1.841 - 1.860 (0.0736 - 0.0743)	1.861 - 1.880 (0.0744 - 0.0751)	1.881 - 1.900 (0.0752 - 0.0759)	1.901 - 1.920 (0.0760 - 0.0767)	1.921 - 1.940 (0.0768 - 0.0775)	1.941 - 1.960 (0.0776 - 0.0783)	1.961 - 1.980 (0.0784 - 0.0791)	1.981 - 2.000 (0.0792 - 0.0799)	2.001 - 2.020 (0.0800 - 0.0807)	2.021 - 2.040 (0.0808 - 0.0815)	2.041 - 2.060 (0.0816 - 0.0823)	2.061 - 2.080 (0.0824 - 0.0831)	2.081 - 2.100 (0.0832 - 0.0839)	2.101 - 2.120 (0.0840 - 0.0847)	2.121 - 2.140 (0.0848 - 0.0855)	2.141 - 2.160 (0.0856 - 0.0863)	2.161 - 2.180 (0.0864 - 0.0871)	2.181 - 2.200 (0.0872 - 0.0879)	2.201 - 2.220 (0.0880 - 0.0887)	2.221 - 2.240 (0.0888 - 0.0895)	2.241 - 2.260 (0.0896 - 0.0903)	2.261 - 2.280 (0.0904 - 0.0911)	2.281 - 2.300 (0.0912 - 0.0919)	2.301 - 2.320 (0.0920 - 0.0927)	2.321 - 2.340 (0.0928 - 0.0935)	2.341 - 2.360 (0.0936 - 0.0943)	2.361 - 2.380 (0.0944 - 0.0951)	2.381 - 2.400 (0.0952 - 0.0959)	2.401 - 2.420 (0.0960 - 0.0967)	2.421 - 2.440 (0.0968 - 0.0975)	2.441 - 2.460 (0.0976 - 0.0983)	2.461 - 2.480 (0.0984 - 0.0991)	2.481 - 2.500 (0.0992 - 0.0999)	2.501 - 2.520 (0.1000 - 0.1007)	2.521 - 2.540 (0.1008 - 0.
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HINT: New shims have the thickness in millimeters imprinted on the face.

Intake valve clearance (Cold):

0.15 – 0.25 mm (0.006 – 0.010 in.)

EXAMPLE: The 2.800 mm (0.1102 in.) shim is installed, and the measured clearance is 0.450 mm (0.0177 in.).

Replace the 2.800 mm (0.1102 in.) shim with a new No.12 shim.

V00719

Adjusting Shim Selection Chart (Exhaust)

Installed Shim Thickness
mm (in.)

Measured Clearance
mm (in.)

0.000 - 0.020 (0.0000 - 0.0008)

0.021 - 0.040 (0.0008 - 0.0016)

0.041 - 0.060 (0.0016 - 0.0024)

0.061 - 0.080 (0.0024 - 0.0031)

0.081 - 0.100 (0.0032 - 0.0039)

0.101 - 0.120 (0.0040 - 0.0047)

0.121 - 0.140 (0.0048 - 0.0055)

0.141 - 0.160 (0.0056 - 0.0063)

0.161 - 0.180 (0.0063 - 0.0071)

0.181 - 0.200 (0.0071 - 0.0079)

0.201 - 0.220 (0.0079 - 0.0087)

0.221 - 0.240 (0.0087 - 0.0094)

0.241 - 0.249 (0.0095 - 0.0098)

0.250 - 0.350 (0.0098 - 0.0138)

0.351 - 0.380 (0.0138 - 0.0142)

0.381 - 0.400 (0.0142 - 0.0150)

0.401 - 0.420 (0.0150 - 0.0157)

0.421 - 0.440 (0.0157 - 0.0165)

0.441 - 0.460 (0.0165 - 0.0173)

0.461 - 0.480 (0.0173 - 0.0181)

0.481 - 0.500 (0.0181 - 0.0189)

0.501 - 0.520 (0.0189 - 0.0197)

0.521 - 0.540 (0.0197 - 0.0205)

0.541 - 0.560 (0.0205 - 0.0213)

0.561 - 0.580 (0.0213 - 0.0220)

0.581 - 0.600 (0.0220 - 0.0228)

0.601 - 0.620 (0.0228 - 0.0236)

0.621 - 0.640 (0.0236 - 0.0244)

0.641 - 0.660 (0.0244 - 0.0252)

0.661 - 0.680 (0.0252 - 0.0260)

0.681 - 0.700 (0.0260 - 0.0268)

0.701 - 0.720 (0.0268 - 0.0276)

0.721 - 0.740 (0.0276 - 0.0284)

0.741 - 0.760 (0.0284 - 0.0291)

0.761 - 0.780 (0.0291 - 0.0299)

0.781 - 0.800 (0.0299 - 0.0307)

0.801 - 0.820 (0.0307 - 0.0315)

0.821 - 0.840 (0.0315 - 0.0323)

0.841 - 0.860 (0.0323 - 0.0331)

0.861 - 0.880 (0.0331 - 0.0339)

0.881 - 0.900 (0.0339 - 0.0346)

0.901 - 0.920 (0.0346 - 0.0354)

0.921 - 0.940 (0.0354 - 0.0362)

0.941 - 0.960 (0.0362 - 0.0370)

0.961 - 0.980 (0.0370 - 0.0378)

0.981 - 1.000 (0.0378 - 0.0386)

1.001 - 1.020 (0.0386 - 0.0394)

1.021 - 1.040 (0.0394 - 0.0402)

1.041 - 1.060 (0.0402 - 0.0410)

1.061 - 1.080 (0.0410 - 0.0418)

1.081 - 1.100 (0.0418 - 0.0425)

1.101 - 1.120 (0.0425 - 0.0433)

1.121 - 1.140 (0.0433 - 0.0441)

1.141 - 1.160 (0.0441 - 0.0449)

1.161 - 1.180 (0.0449 - 0.0457)

3.300 (0.1299)

3.280 (0.1291)

3.260 (0.1283)

3.240 (0.1276)

3.220 (0.1268)

3.200 (0.1260)

3.180 (0.1252)

3.160 (0.1244)

3.150 (0.1240)

3.140 (0.1236)

3.130 (0.1232)

3.120 (0.1228)

3.110 (0.1224)

3.100 (0.1220)

3.090 (0.1216)

3.080 (0.1213)

3.070 (0.1209)

3.060 (0.1205)

3.050 (0.1201)

3.040 (0.1197)

3.030 (0.1193)

3.020 (0.1189)

3.010 (0.1185)

3.000 (0.1181)

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2.980 (0.1173)

2.970 (0.1169)

2.960 (0.1165)

2.950 (0.1161)

2.940 (0.1157)

2.930 (0.1154)

2.920 (0.1150)

2.910 (0.1146)

2.900 (0.1142)

2.890 (0.1138)

2.880 (0.1134)

2.870 (0.1130)

2.860 (0.1126)

2.850 (0.1122)

2.840 (0.1118)

2.830 (0.1114)

2.820 (0.1110)

2.810 (0.1106)

2.800 (0.1102)

2.790 (0.1098)

2.780 (0.1094)

2.770 (0.1091)

2.760 (0.1087)

2.750 (0.1083)

2.740 (0.1079)

2.730 (0.1075)

2.720 (0.1071)

2.710 (0.1067)

2.700 (0.1063)

2.690 (0.1059)

2.680 (0.1055)

2.670 (0.1051)

2.660 (0.1047)

2.650 (0.1043)

2.640 (0.1039)

2.630 (0.1031)

2.620 (0.1024)

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2.600 (0.1008)

2.590 (0.1004)

2.580 (0.1000)

2.570 (0.9992)

2.560 (0.9984)

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3.180 (0.1252)

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3.150 (0.1240)

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3.120 (0.1228)

3.110 (0.1224)

3.100 (0.1220)

3.090 (0.1216)

3.080 (0.1213)

3.070 (0.1209)

3.060 (0.1205)

3.050 (0.1201)

3.040 (0.1197)

3.030 (0.1193)

3.020 (0.1189)

3.010 (0.1185)

3.000 (0.1181)

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2.960 (0.1165)

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2.940 (0.1157)

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2.920 (0.1150)

2.910 (0.1146)

2.900 (0.1142)

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2.860 (0.1126)

2.850 (0.1122)

2.840 (0.1118)

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2.820 (0.1110)

2.810 (0.1106)

2.800 (0.1102)

2.790 (0.1098)

2.780 (0.1094)

2.770 (0.1091)

2.760 (0.1087)

2.750 (0.1083)

2.740 (0.1079)

2.730 (0.1075)

2.720 (0.1071)

2.710 (0.1067)

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2.670 (0.1051)

2.660 (0.1047)

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2.640 (0.1039)

2.630 (0.1031)

2.620 (0.1024)

2.610 (0.1016)

2.600 (0.1008)

2.590 (0.1004)

2.580 (0.1000)

2.570 (0.9992)

2.560 (0.9984)

Shim
No.

Thickness

1

2.500 (0.0984)

2

2.550 (0.1004)

3

2.600 (0.1024)

4

2.650 (0.1043)

5

2.700 (0.1063)

6

2.750 (0.1083)

7

2.800 (0.1102)

8

2.850 (0.1122)

9

2.900 (0.1142)

Shim
No.

Thickness

10

2.950 (0.1161)

11

3.000 (0.1181)

12

3.050 (0.1201)

13

3.100 (0.1220)

14

3.150 (0.1240)

15

3.200 (0.1260)

16

3.250 (0.1280)

17

3.300 (0.1299)

Shim
No.

Thickness

18

3.350 (0.1319)

19

3.400 (0.1339)

20

3.450 (0.1359)

21

3.500 (0.1379)

22

3.550 (0.1399)

23

3.600 (0.1419)

24

3.650 (0.1439)

25

3.700 (0.1459)

26

3.750 (0.1479)

27

3.800 (0.1499)

28

3.850 (0.1519)

29

3.900 (0.1539)

30

3.950 (0.1559)

31

4.000 (0.1579)

32

4.050 (0.1599)

33

4.100 (0.1619)

34

4.150 (0.1639)

35

4.200 (0.1659)

36

4.250 (0.1679)

37

4.300 (0.1699)

38

4.350 (0.1719)

39

4.400 (0.1739)

40

4.450 (0.1759)

41

4.500 (0.1779)

42

4.550 (0.1799)

43

4.600 (0.1819)

44

4.650 (0.1839)

45

4.700 (0.1859)

46

4.750 (0.1879)

47

4.800 (0.1899)

48

4.850 (0.1919)

49

4.900 (0.1939)

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4.950 (0.1959)

51

5.000 (0.1979)

52

5.050 (0.1999)

53

5.100 (0.2019)

54

5.150 (0.2039)

55

5.200 (0.2059)

56

5.250 (0.2079)

57

5.300 (0.2099)

58

5.350 (0.2119)

59

5.400 (0.2139)

60

5.450 (0.2159)

61

5.500 (0.2179)

62

5.550 (0.2199)

63

5.600 (0.2219)

64

5.650 (0.2239)

65

5.700 (0.2259)

66

5.750 (0.2279)

67

5.800 (0.2299)

68

5.850 (0.2319)

69

5.900 (0.2339)

70

5.950 (0.2359)

71

6.000 (0.2379)

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6.050 (0.2399)

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6.150 (0.2439)

75

6.200 (0.2459)

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6.300 (0.2499)

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6.350 (0.2519)

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6.400 (0.2539)

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6.450 (0.2559)

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6.500 (0.2579)

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6.600 (0.2619)

84

6.650 (0.2639)

85

6.700 (0.2659)

86

6.750 (0.2679)

87

6.800 (0.2699)

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6.850 (0.2719)

89

6.900 (0.2739)

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6.950 (0.2759)

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7.050 (0.2799)

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8.750 (0.3479)

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8.800 (0.3499)

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8.850 (0.3519)

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8.950 (0.3559)

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9.000 (0.3579)

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10.850 (0.4319)

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10.950 (0.4359)

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11.000 (0.4379)

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11.050 (0.4399)

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11.100 (0.4419)

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201

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15.950 (0.6359)

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16.000 (0.6379)

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280

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281

16.500 (0.6579)

282

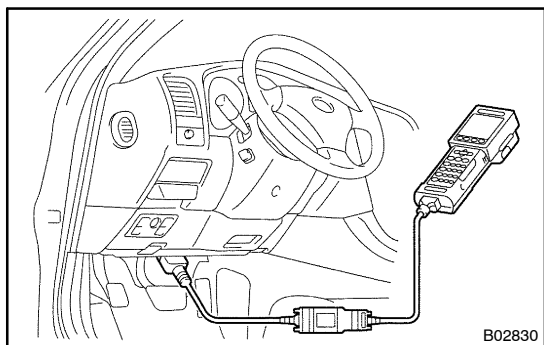
16.550 (

HINT: New shims have the thickness in millimeters imprinted on the face.

EXAMPLE: The 2.800 mm (0.1102 in.) shim is installed, and the measured clearance is 0.450 mm (0.0177 in.).

Replace the 2.800 mm (0.1102 in.) shim with a new No.10 shim.

Exhaust valve clearance (Cold):
0.25 – 0.35 mm (0.010 – 0.014



IGNITION TIMING INSPECTION

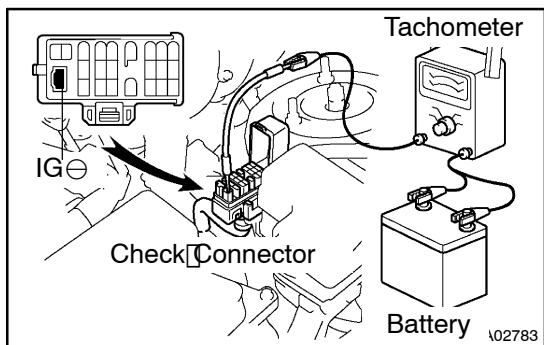
EMOEN-01

1. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.

2. CONNECT HAND-HELD TESTER

- Connect the hand-held tester to the DLC3.
- Please refer to the hand-held tester operator's manual for further details.

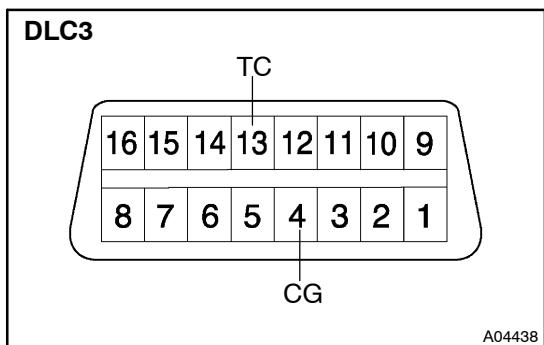


If you have no hand-held tester, connect tachometer test probe to terminal IG- of the check connector.

3. CONNECT TIMING LIGHT TO ENGINE

4. CHECK IDLE SPEED (See page EM-14)

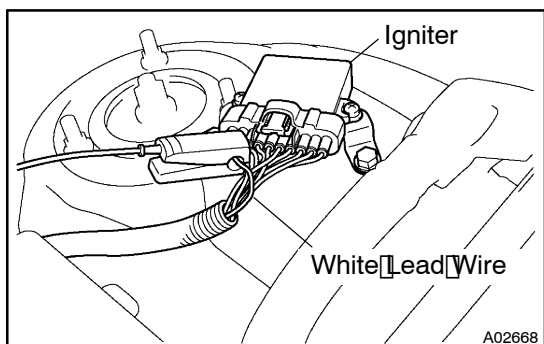
5. DISCONNECT HAND-HELD TESTER



6. INSPECT IGNITION TIMING

- Using SST, connect terminals 13 (TC) and 4 (CG) of the DLC3.

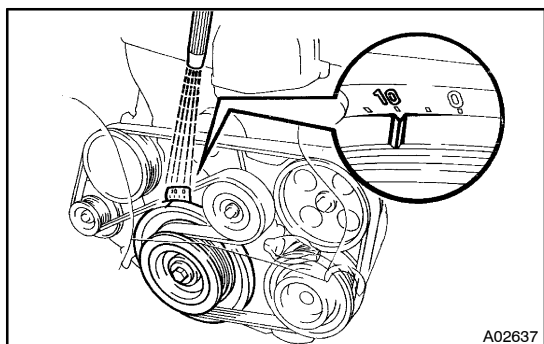
SST 09843-18040



- Connect the timing light clip to the white lead wire.

NOTICE:

Use a timing light that can detect the primary signal.



- Using a timing light, check the ignition timing.

Ignition timing: $10 \pm 2^\circ$ BTDC @ idle
(Transmission in neutral position)

- Remove the SST from the DLC3.

7. FURTHER CHECK IGNITION TIMING

Ignition timing: $6 - 16^\circ$ BTDC @ idle
(Transmission in neutral position)

HINT:

The timing mark moves in a range between 6° and 16° .

8. DISCONNECT TIMING LIGHT FROM ENGINE

IDLE SPEED

EM004-02

INSPECTION

1. INITIAL CONDITIONS

- (a) Engine at normal operating temperature
- (b) Air cleaner installed
- (c) All pipes and hoses of air induction system connected
- (d) All accessories switched OFF
- (e) All vacuum lines properly connected
- (f) EFI system wiring connectors fully plugged
- (g) Ignition timing checked correctly
- (h) Transmission in neutral position

2. CONNECT HAND-HELD TESTER (See page EM-13)

3. INSPECT IDLE SPEED

- (a) Race the engine speed at 2,500 rpm for approx. 90 seconds.
- (b) Check the idle speed.

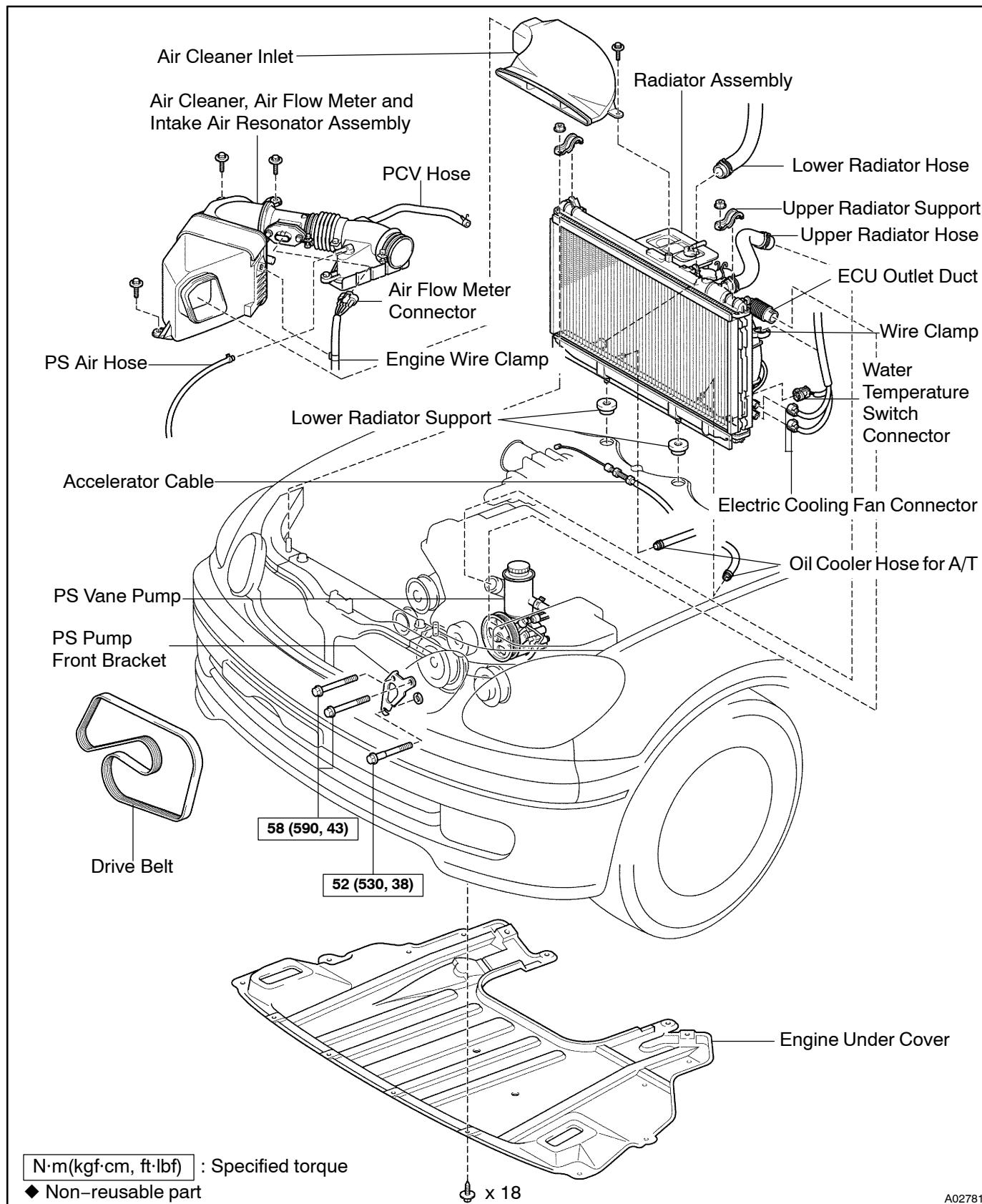
Idle speed: 700 ± 50 rpm

If the idle speed is not as specified, check the throttle body.

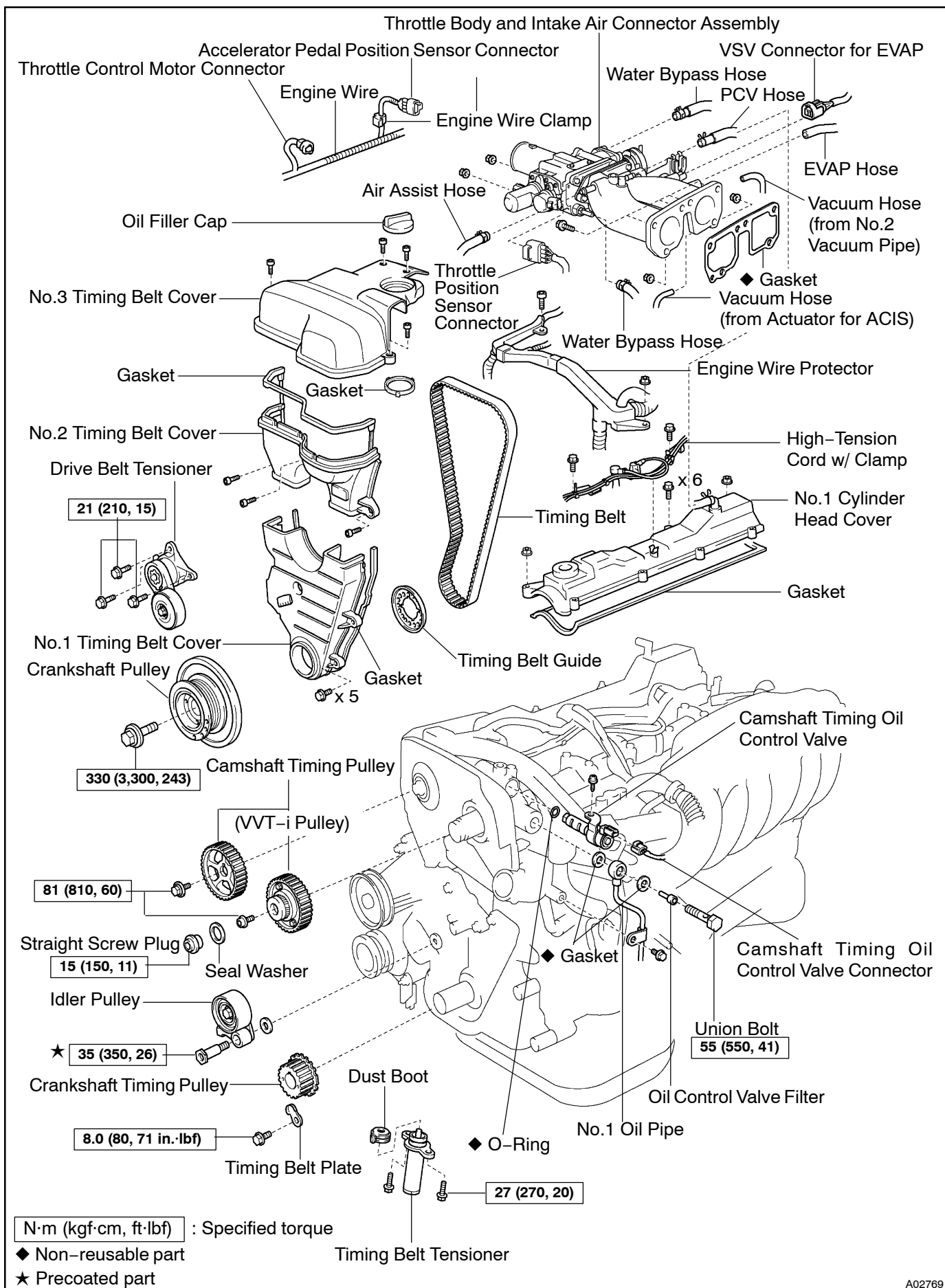
4. DISCONNECT HAND-HELD TESTER

TIMING BELT COMPONENTS

EM005-02

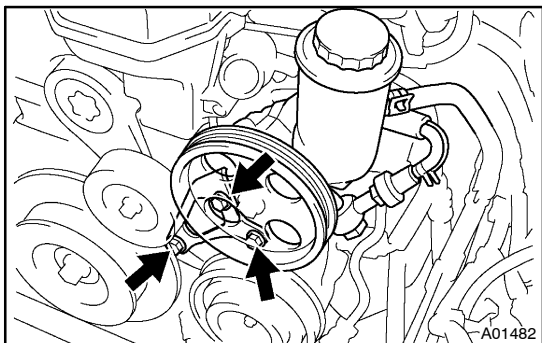


A02781



REMOVAL

1. REMOVE ENGINE UNDER COVER
2. DRAIN ENGINE COOLANT
3. REMOVE RADIATOR ASSEMBLY (See page CO-15)
4. REMOVE DRIVE BELT (See page CH-6)

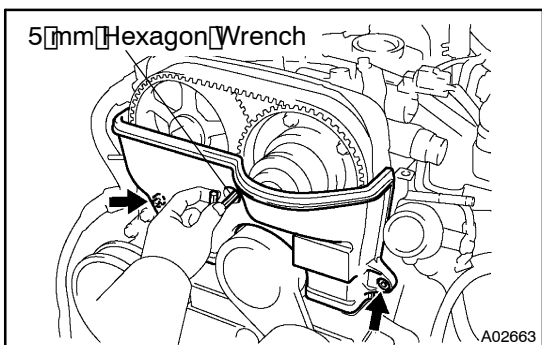


5. REMOVE PS PUMP AND FRONT BRACKET

- (a) Remove the 3 bolts, plate washer and pump front bracket.
- (b) Disconnect the vane pump from the bracket.

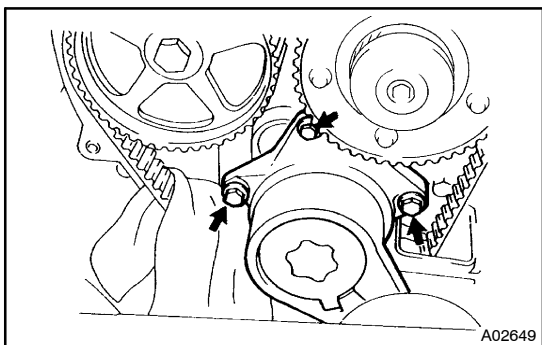
6. REMOVE NO.3 TIMING BELT COVER

Using a 5 mm hexagon wrench, remove the 4 bolts, oil filler cap, timing belt cover and gasket.



7. REMOVE NO.2 TIMING BELT COVER

Using a 5 mm hexagon wrench, remove the 3 bolts, timing belt cover and gasket.

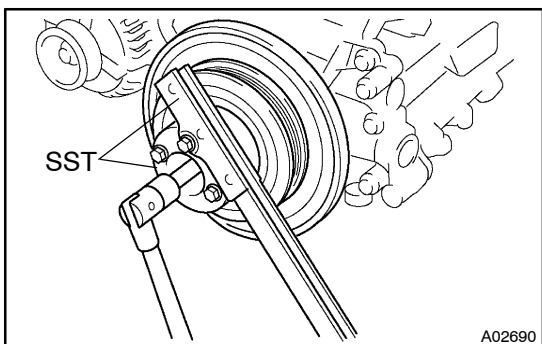


8. REMOVE DRIVE BELT TENSIONER

Remove the 3 bolts and tensioner.

NOTICE:

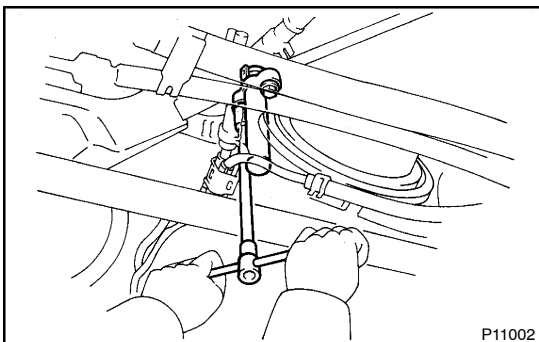
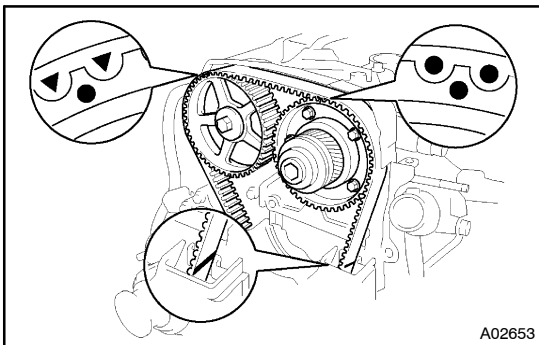
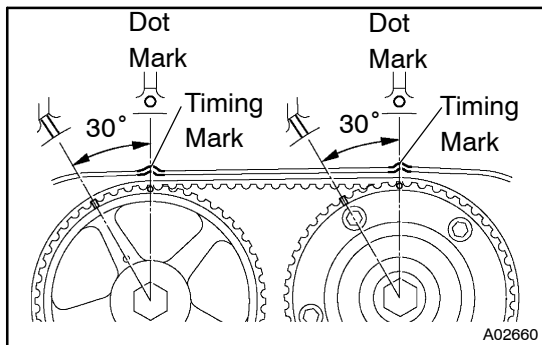
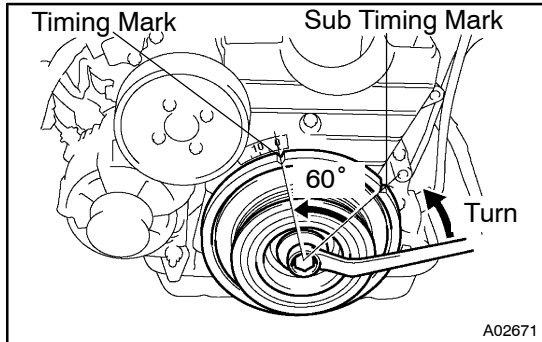
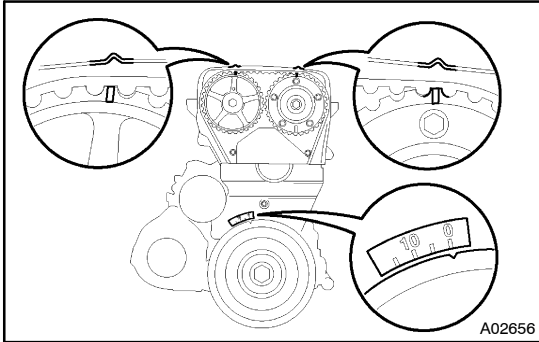
Be careful not to drop the bolts inside the timing belt cover.



9. LOOSEN CRANKSHAFT PULLEY BOLT

Using SST, loosen the pulley bolt.

SST 09213 – 70010, 09330 – 00021



10. SET NO.1 CYLINDER TO APPROX. 60° / BTDC COMPRESSION

- Turn the crankshaft pulley, and align its groove with timing mark "0" of the No.1 timing belt cover.

NOTICE:

Always turn the crankshaft clockwise.

- Check that the timing marks (TDC mark) of the camshaft timing pulleys are aligned with the timing marks of the No.4 timing belt cover.

If not, turn the crankshaft 1 revolution (360°).

- Turn the crankshaft pulley 60° counterclockwise to place the sub timing mark (60° mark BTDC) on the crankshaft pulley at the timing mark "0" position of the No.1 timing belt cover.

NOTICE:

If the timing belt is disengaged, having the crankshaft pulley at the wrong angle can cause the piston head and valve head to come into contact with each other when you remove the camshaft timing pulleys (steps 11 to 17), thus resulting damage. So, always set the crankshaft pulley at the correct angle.

- Check that the dot marks (60° mark BTDC) of the camshaft timing pulleys are aligned with the timing marks of the No.4 timing belt cover.

- Remove the crankshaft pulley bolt.

NOTICE:

Do not turn the crankshaft pulley.

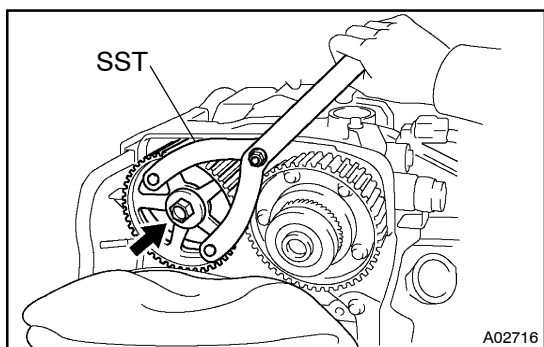
11. REMOVE TIMING BELT FROM CAMSHAFT TIMING PULLEYS

HINT:

(Re-using timing belt):

Place matchmarks on the timing belt and camshaft timing pulleys as shown in the illustration.

- Alternately loosen the 2 bolts, and remove them, the tensioner and dust boot.
- Disconnect the timing belt from the camshaft timing pulleys.

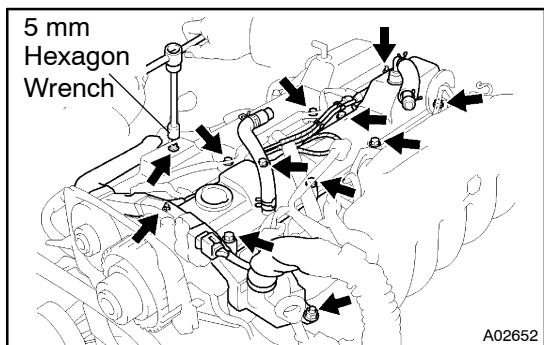


12. REMOVE EXHAUST CAMSHAFT TIMING PULLEY

Using SST, remove the bolt and timing pulley.

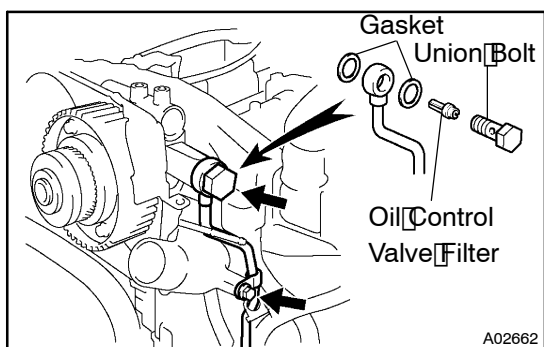
SST 09960-10010 (09962-01000, 09963-01000)

13. REMOVE THROTTLE BODY AND INTAKE AIR CONNECTOR ASSEMBLY (See page EM-6)



14. REMOVE NO. 1 CYLINDER HEAD COVER

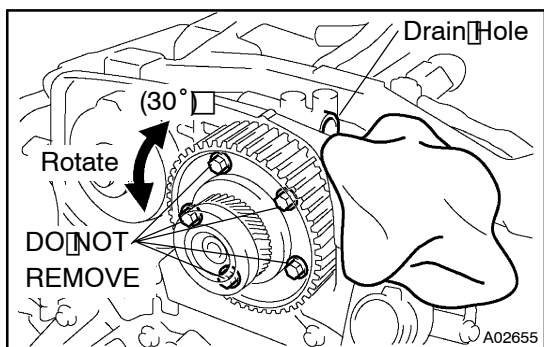
- Using a 5 mm hexagon wrench, remove the bolts, and disconnect the engine wire protector from the No. 2 cylinder head cover.
- Remove the nut, and disconnect the engine wire protector from the intake manifold.
- Remove the 2 bolts, and disconnect the high-tension cords with the clamp from the No. 2 cylinder head.
- Remove the 6 bolts, 2 nuts, No. 1 cylinder head cover and gasket.



15. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE (See page FI-42)

16. DISCONNECT NO. 1 OIL PIPE

Remove the bolt, union bolt, oil control valve filter and 2 gaskets, and disconnect the No. 1 oil pipe from the No. 3 camshaft bearing cap.



17. REMOVE VVT-i (INTAKE CAMSHAFT TIMING) PULLEY

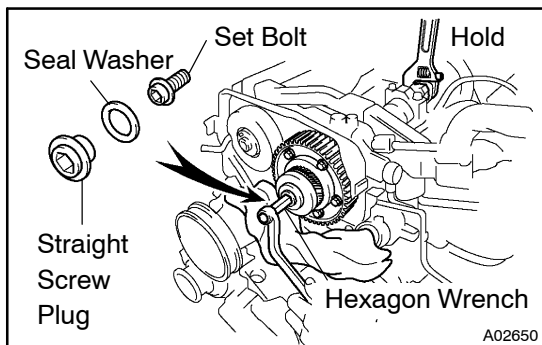
NOTICE:

- The 5 bolts shown in the illustration determine the backlash of the gear in the timing pulley, so do not remove them. If any of the 5 bolts are removed, install a new camshaft timing pulley assembly.
- When removing the straight screw plug, follow the prescribed procedure in order to avoid spilling oil on the timing system parts.

- Rotate the VVT-i pulley from left to right 2 to 3 times within its range of movement (30°) and use a waste cloth to collect the oil from the camshaft timing oil control valve installation hole.

NOTICE:

Approximately 20 cc (1.2 cu in.) of oil will be ejected, so take care not to spill it.

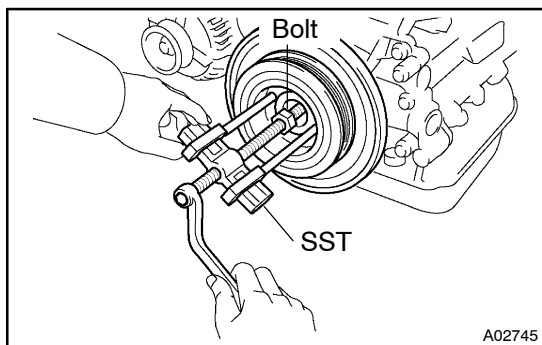


- (b) Holding the hexagon portion of camshaft with a wrench.
- (c) Using a 14 mm hexagon wrench, remove the straight screw plug and seal washer.

NOTICE:

Some oil may spill, so put a waster cloth below the plug while doing the operation.

- (d) Using a 10 mm hexagon wrench, and remove the set bolt and VVT-i pulley.
- (e) Remove the wrench.

**18. REMOVE CRANKSHAFT PULLEY**

Using SST and bolt (diameter: 8 mm, pitch: 1.5 mm), remove the crankshaft pulley.

SST 09950-50010 (09951-05010, 09552-05010, 09553-05020, 09554-05030)

Bolt: Part No. 90119-18001

NOTICE:

Do not turn the crankshaft pulley.

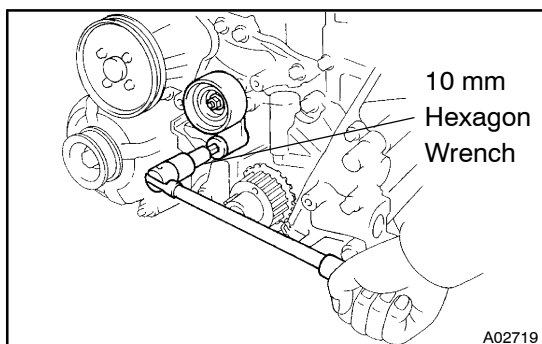
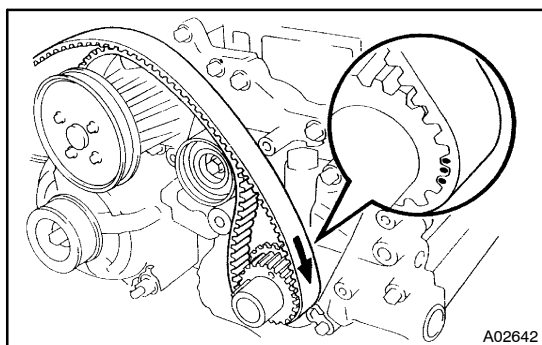
19. REMOVE NO.1 TIMING BELT COVER

Remove the 5 bolts, timing belt cover and gasket.

20. REMOVE TIMING BELT GUIDE**21. REMOVE TIMING BELT****HINT:**

(When re-using timing belt):

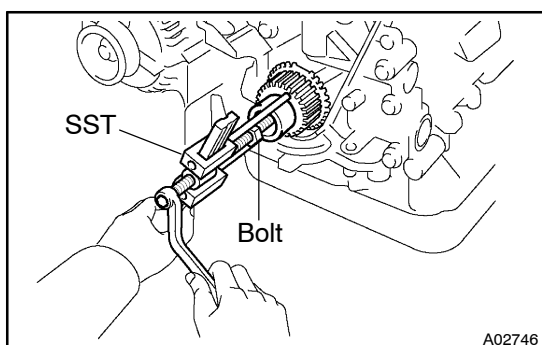
Draw an arrow on the timing belt in the direction of engine revolution, and place matchmarks on the timing belt and crankshaft timing pulley.

**22. REMOVE IDLER PULLEY**

Using a 10 mm hexagon wrench, remove the pivot bolt, plate washer and idler pulley.

23. REMOVE CRANKSHAFT TIMING PULLEY

- (a) Remove the bolt and timing belt plate.



- (b) Remove the crankshaft timing pulley.

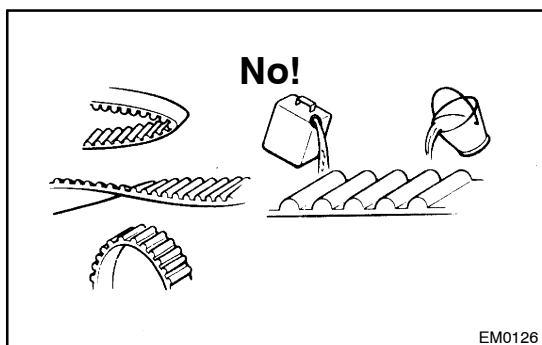
If the pulley cannot be removed by hand, use SST and bolt (diameter: 8 mm, pitch: 1.5 mm) to remove the crankshaft timing pulley.

SST 09950-50010 (09951-05010, 09952-05010, 09953-05020, 09954-05010)

Bolt: Part No. 90119-18001

NOTICE:

- **Do not scratch the sensor part the crankshaft timing pulley.**
- **Do not turn the timing pulley.**



INSPECTION

1. INSPECT TIMING BELT

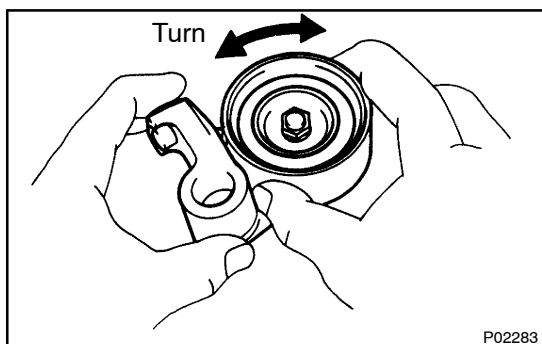
NOTICE:

- Do not bend, twist or turn the timing belt inside out. Do not allow the timing belt to come into contact with oil, water or steam.
- Do not utilize timing belt tension when installing or removing the mount bolt of the camshaft timing pulley.

If there are any defects, as shown in the illustrations, check the following points.

- Premature parting
 - Check for proper installation.
 - Check the timing cover gasket for damage and proper installation.
- If the belt teeth are cracked or damaged, check to see if either camshaft is locked.
- If there is noticeable wear or cracks on the belt face, check to see if there are nicks on the side of the idler pulley lock.
- If there is wear or damage on only one side of the belt, check the belt guide and the alignment of each pulley.
- If there is noticeable wear on the belt teeth, check timing cover for damage and check gasket has been installed correctly and for foreign material on the pulley teeth.

If necessary, replace the timing belt.



2. INSPECT IDLER PULLEY

- Visually check the seal portion of the idler pulley for oil leakage.

If leakage is found, replace the idler pulley.

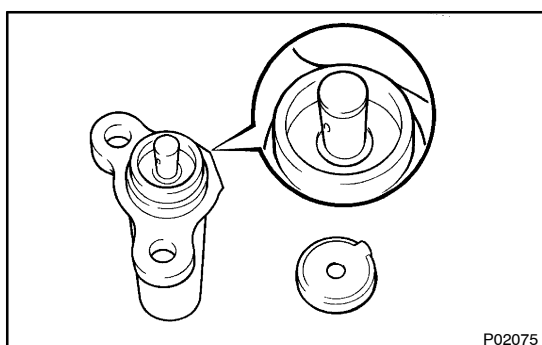
- Check the turning smoothness of the idler pulley.

If necessary, replace the idler pulley.

3. INSPECT DRIVE BELT TENSIONER

Check the turning smoothness of the tensioner.

If necessary, replace the tensioner.



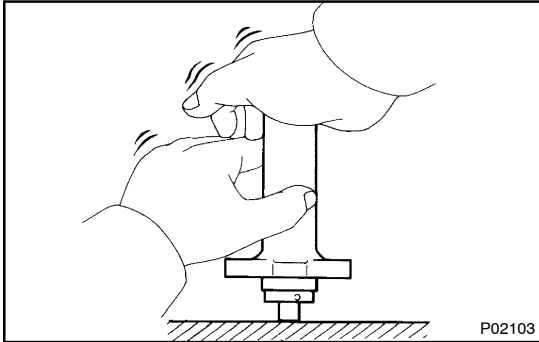
4. INSPECT TIMING BELT TENSIONER

- Visually check tensioner for oil leakage.

HINT:

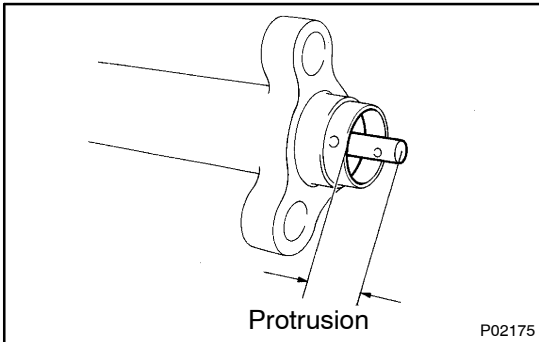
If there is only the faintest trace of oil on the seal on the push rod side, the tensioner is all right.

If leakage is found, replace tensioner.



- (b) Hold the tensioner with both hands and push the push rod strongly against the floor or wall to check that it doesn't move.

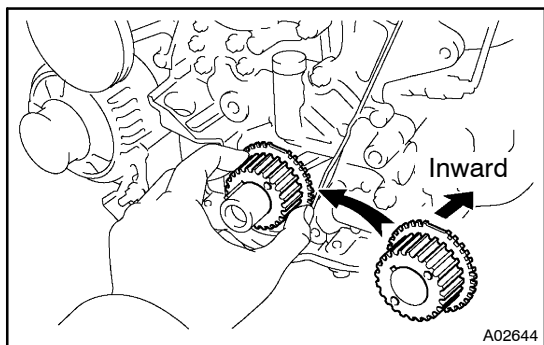
If the push rod moves, replace the tensioner.



- (c) Measure the protrusion of the push rod from the housing end.

Protrusion: 8.0 – 8.8 mm (0.315 – 0.346 in.)

If the protrusion is not as specified, replace the tensioner.



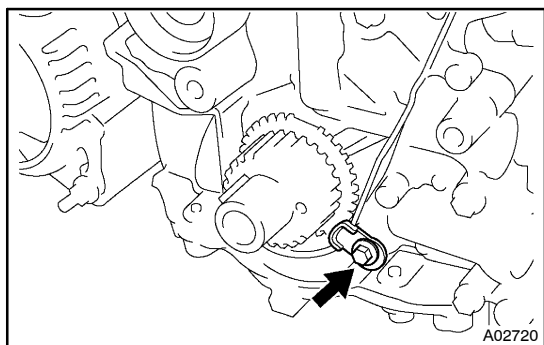
INSTALLATION

1. INSTALL CRANKSHAFT TIMING PULLEY

- Align the pulley set key with the key groove of the pulley.
- Slide on the timing pulley facing the flange side inward.

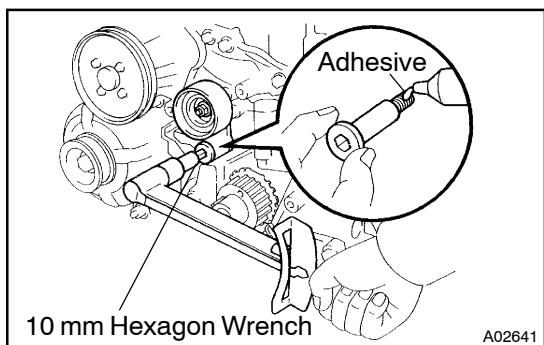
NOTICE:

Do not scratch the sensor part of the crankshaft timing pulley.



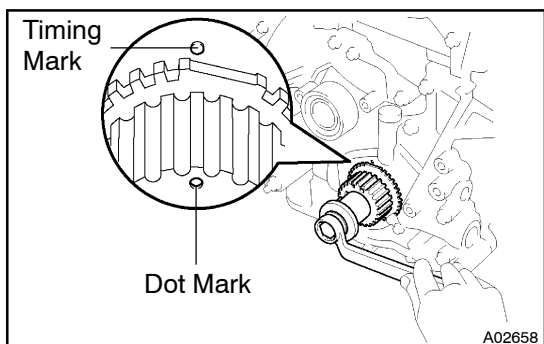
- Install the timing belt plate with the bolt.

Torque: 8.0 N·m (80 kgf·cm, 71 in·lbf)



2. INSTALL IDLER PULLEY

- Apply adhesive to 2 or 3 threads of the pivot bolt.
Adhesive: Part No. 08833-00080, THREE BOND 1344, LOCTITE 242 or equivalent
- Using a 10 mm hexagon wrench, install the plate washer and pulley with the pivot bolt.
Torque: 35 N·m (350 kgf·cm, 26 ft·lbf)
- Check that the pulley bracket moves smoothly.

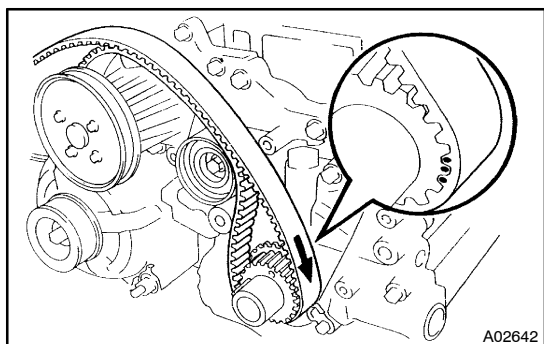


3. TEMPORARILY INSTALL TIMING BELT

NOTICE:

The engine should be cold.

- Use the crankshaft pulley bolt to turn the crankshaft, and align the dot mark on the crankshaft timing pulley and the timing mark on the oil pump body.
- Remove any oil or water on the crankshaft timing pulley and idler pulley, and keep them clean.

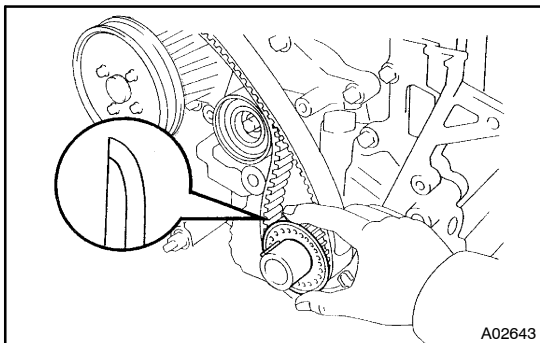


- Install the timing belt on the crankshaft timing pulley and idler pulley.

HINT:

(When re-using timing belt):

Align the matchmarks of the crankshaft timing pulley and timing belt, and install the belt with the arrow pointing in the direction of engine revolution.



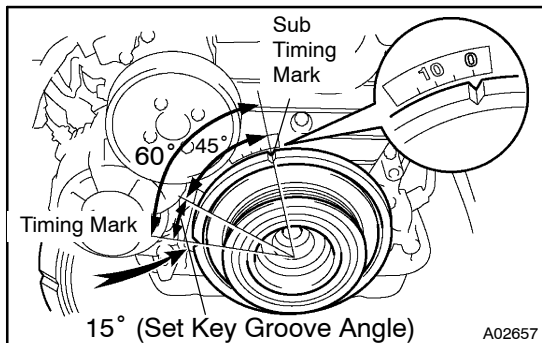
4. INSTALL TIMING BELT GUIDE

Install the guide, facing the cup side outward.

5. INSTALL NO.1 TIMING BELT COVER

- Install the gasket to the timing belt cover.
- Install the timing belt cover with the 5 bolts.

Torque: 8.0 N·m (80 kgf·cm, 71 in·lbf)

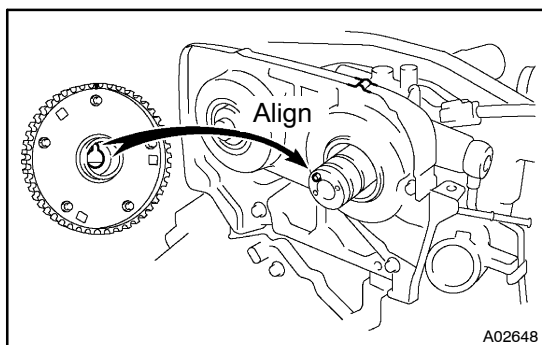


6. INSTALL CRANKSHAFT PULLEY

- Align the pulley set key with the key groove of the pulley, and slide on the pulley.
- Check that the sub timing mark (60° mark BTDC) of the crankshaft pulley is aligned with the timing mark "0" of the No.1 timing belt cover.

HINT:

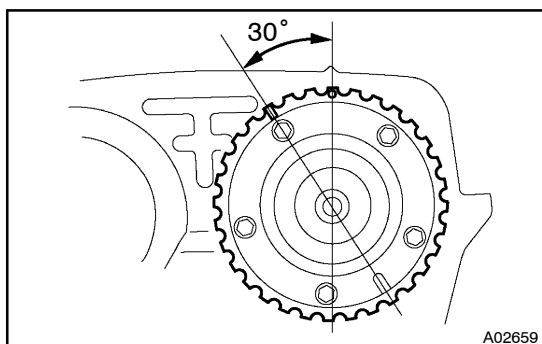
At this time, the crankshaft pulley set key groove and the timing mark (TDC mark) of the crankshaft pulley are as shown the illustration.



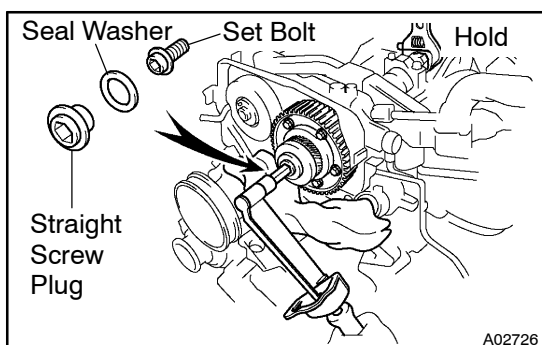
- Temporarily install the pulley bolt.

7. INSTALL VVT-i (INTAKE CAMSHAFT TIMING) PULLEY

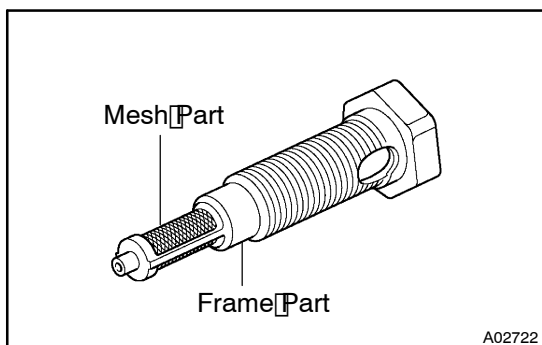
- Align the camshaft knock pin with the VVT-i pulley, and push the VVT-i pulley by hand until you feel it touch the bottom.



- Check that the outer circumference of the VVT-i pulley easily rotates through 30°.



- Holding the hexagon portion of the camshaft with a wrench.
- Using a 10 mm hexagon wrench, and the set bolt.
Torque: 81 N·m (810 kgf·cm, 60 ft·lbf)
- Using a 14 mm hexagon wrench, install the straight screw plug with the seal washer to the set bolt.
Torque: 15 N·m (150 kgf·cm, 11 ft·lbf)
- Align the dot mark on the camshaft timing pulley with the timing mark of the No.4 timing belt cover.
- Remove the wrench.



8. CONNECT NO.1 OIL PIPE

- (a) Install the union bolt to the oil control valve filter.

NOTICE:

In case of touching the filter, avoid holding the mesh part and holding the frame part.

- (b) Install the oil pipe with 2 new gasket and the union bolt to the No.3 camshaft bearing cap.

Torque: 55 N·m (550 kgf·cm, 41 ft·lbf)

9. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE (See page FI-42)

10. INSTALL NO.1 CYLINDER HEAD COVER

- (a) Install the cylinder head and gasket with the 6 bolts and 2 nuts.

Torque: 8.5 N·m (85 kgf·cm, 75 in·lbf)

- (b) Install the high-tension cords and clamps with the 2 bolts.

Torque: 8.0 N·m (80 kgf·cm, 71 in·lbf)

- (c) Using a 5 mm hexagon wrench, install the engine wire protector with the bolt and nut.

11. INSTALL THROTTLE BODY AND INTAKE AIR CONNECTOR ASSEMBLY (See page EM-6)

12. INSTALL EXHAUST CAMSHAFT TIMING PULLEY

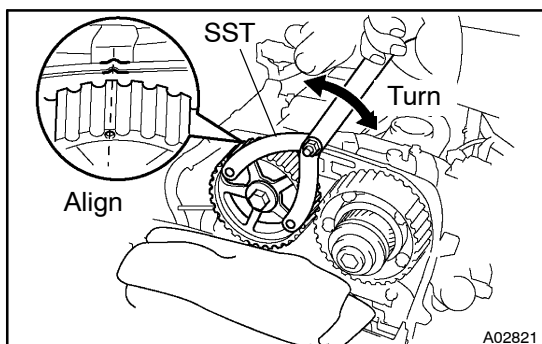
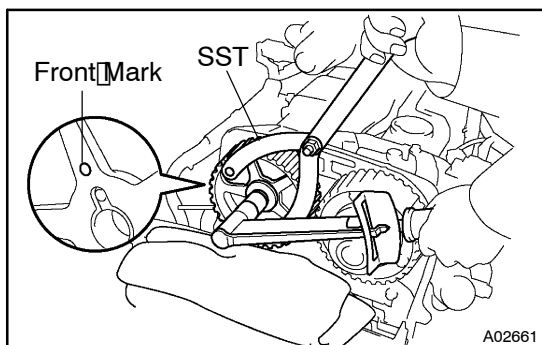
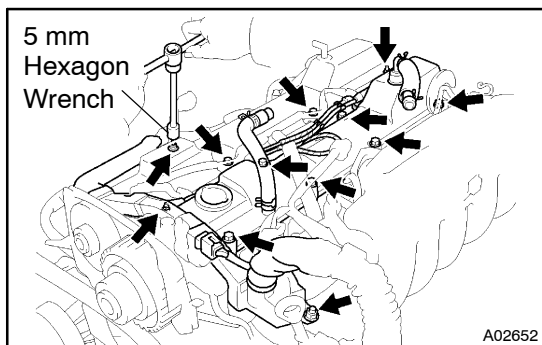
- (a) Align the camshaft knock pin with the groove on the pulley, and slide on the timing pulley.

- (b) Slide the timing pulley on the camshaft, facing the front mark forward.

- (c) Using SST, install the pulley bolt.

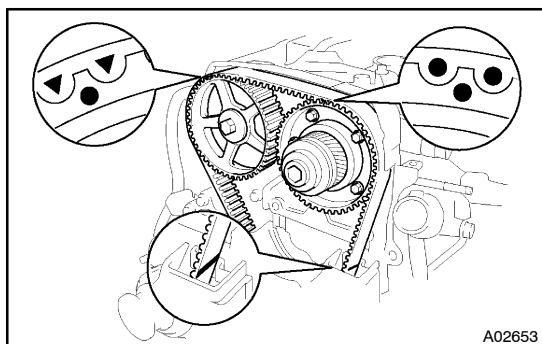
SST 09960-10010 (09962-01000, 09963-01000)

Torque: 81 N·m (810 kgf·cm, 60 ft·lbf)



- (d) Using SST, align the dot mark on the camshaft timing pulley with the timing mark of the No.4 timing belt cover.

SST 09960-10010 (09962-01000, 09963-01000)



13. CONNECT TIMING BELT TO CAMSHAFT TIMING PULLEYS

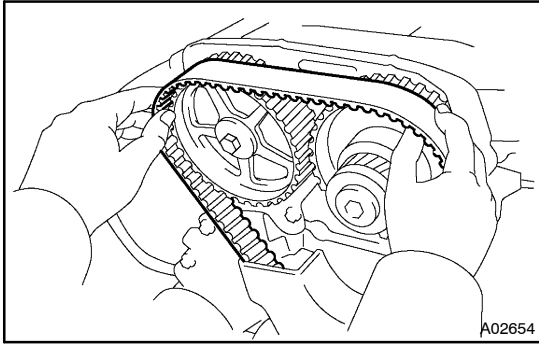
HINT:

(When re-using timing belt):

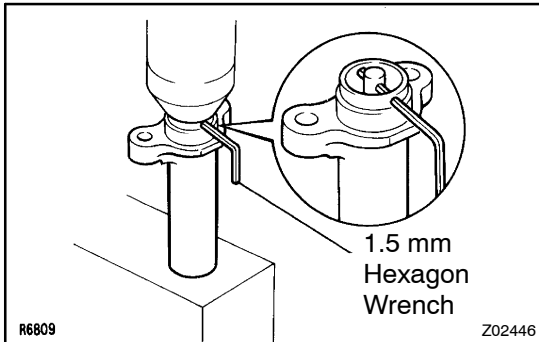
- Check that the matchmark on the timing belt matches the end of the No.1 timing belt cover.

If the matchmark does not align, shift the meshing of the timing belt and crankshaft timing pulley until they align.

- Align the matchmarks of the timing belt and camshaft timing pulleys.

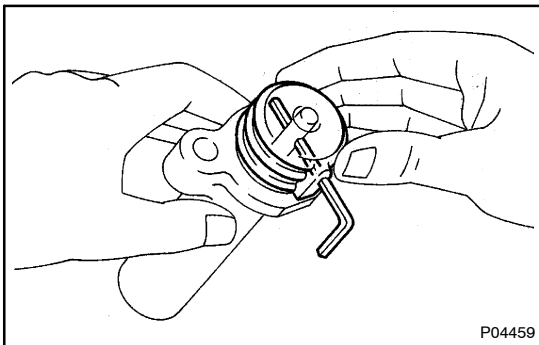


- (a) Remove any oil or water on the camshaft timing pulley, and keep it clean.
- (b) Install the timing belt, checking the tension between the crankshaft timing pulley and intake camshaft timing pulley.

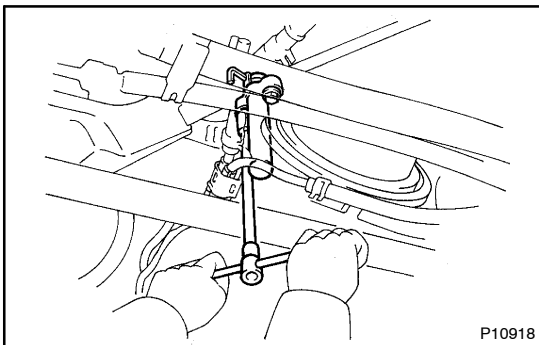


14. SET TIMING BELT TENSIONER

- (a) Using a press, slowly press in the push rod using 981 – 9,807 N (100 – 1,000 kgf, 220 – 2,205 lbf) of force.
- (b) Align the holes of the push rod and housing, pass a 1.5 mm hexagon wrench through the holes to keep the push rod retracted.
- (c) Release the press.



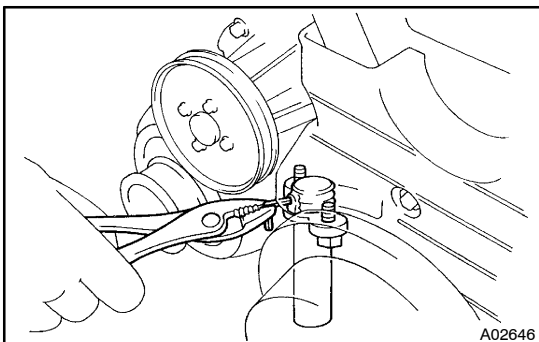
- (d) Install the dust boot onto the tensioner.



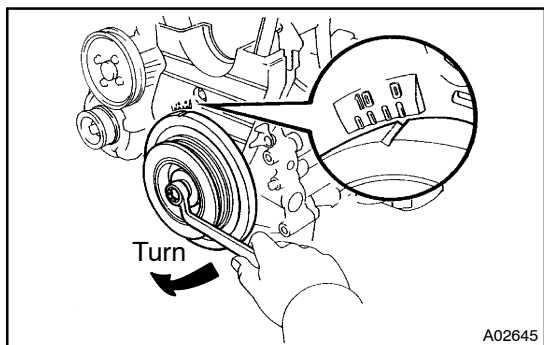
15. INSTALL TIMING BELT TENSIONER

- (a) Temporarily install the tensioner with the 2 bolts.
- (b) Alternately tighten the 2 bolts.

Torque: 27 N·m (270 kgf·cm, 20 ft·lbf)



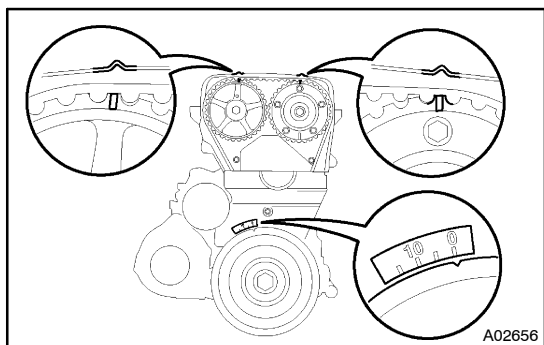
- (c) Remove the 1.5 mm hexagon wrench from the tensioner with pliers.

**16. CHECK VALVE TIMING**

- (a) Slowly turn the crankshaft pulley 2 revolutions from TDC to TDC.

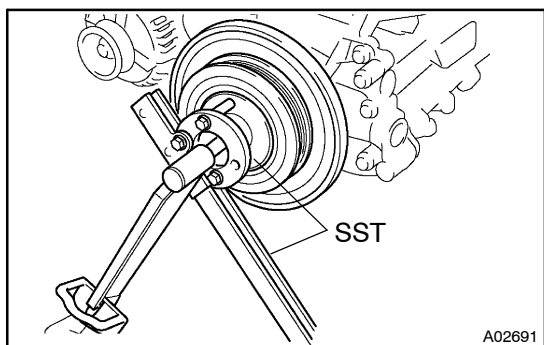
NOTICE:

Always turn the crankshaft clockwise.



- (b) Check that each pulley aligns with the timing marks as shown in the illustration.

If the marks do not align, remove the timing belt and reinstall it.

**17. TIGHTEN CRANKSHAFT PULLEY BOLT**

Using SST, install the pulley bolt.

SST 09213-70010, 09330-00021

Torque: 330 N·m (3,300 kgf·cm, 243 ft·lbf)

18. INSTALL DRIVE BELT TENSIONER

Install the tensioner with the 3 bolts.

Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)

NOTICE:

Be careful not to drop the bolts inside the timing belt cover.

19. INSTALL NO.2 TIMING BELT COVER

- (a) Install the gasket on the timing belt cover.
 (b) Using a 5 mm hexagon wrench, install the timing belt cover with the 3 bolts.

Torque: 8.0 N·m (80 kgf·cm, 71 in·lbf)

20. INSTALL NO.3 TIMING BELT COVER

- (a) Install the gasket on the timing belt cover.
 (b) Using a 5 mm hexagon wrench, install the timing belt cover with the 4 bolts.

Torque: 8.0 N·m (80 kgf·cm, 71 in·lbf)

- (c) Install the oil filler cap.

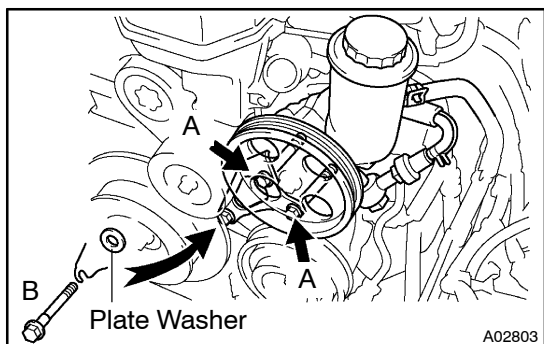
21. INSTALL PS PUMP AND FRONT BRACKET

- (a) Temporarily install the vane pump to the bracket.
 (b) Install the plate washer and front bracket with the 3 bolts.

Torque:

A bolt: 58 N·m (590 kgf·cm, 43 ft·lbf)

B bolt: 52 N·m (530 kgf·cm, 38 ft·lbf)



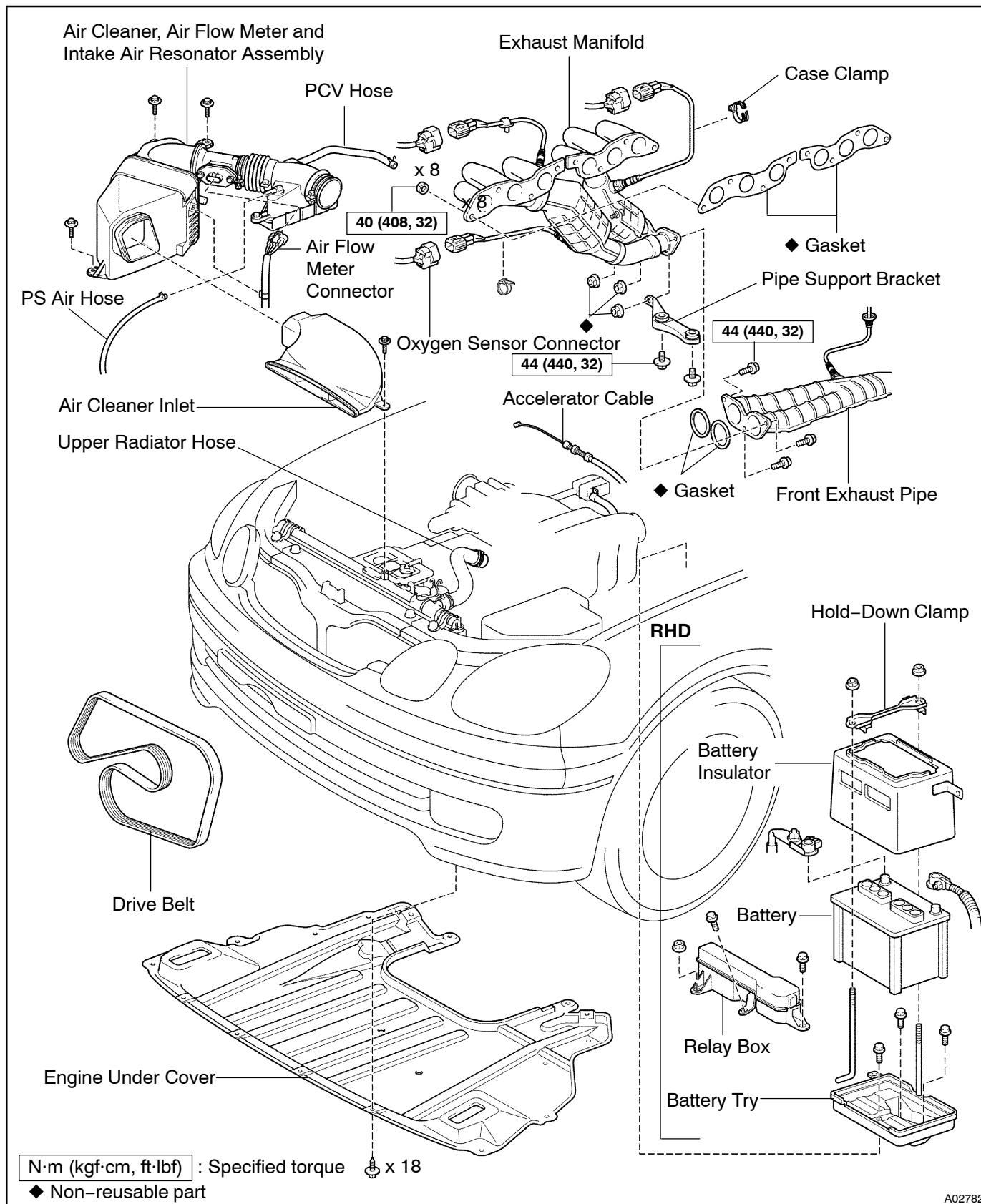
- 22. **INSTALL DRIVE BELT** ([See page CH-16](#))
- 23. **INSTALL RADIATOR ASSEMBLY** ([See page CO-21](#))
- 24. **FILL ENGINE WITH COOLANT**
- 25. **START ENGINE CHECK FOR LEAKS**
- 26. **INSTALL ENGINE UNDER COVER**
- 27. **ROAD TEST**

Check for abnormal noise, shock, slippage, correct shift points and smooth operation.

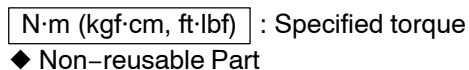
- 28. **RECHECK ENGINE COOLANT LEVEL**

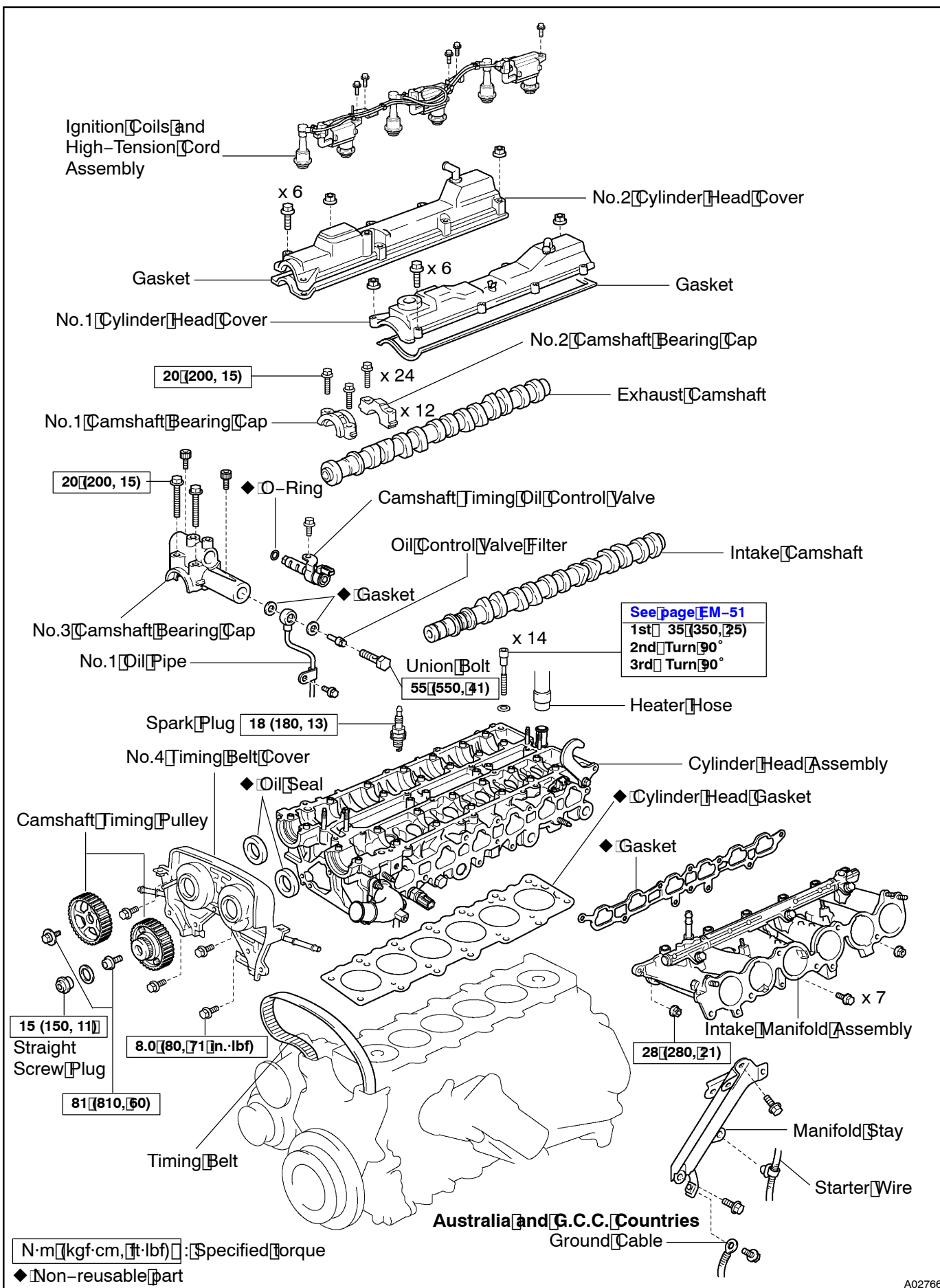
CYLINDER HEAD COMPONENTS

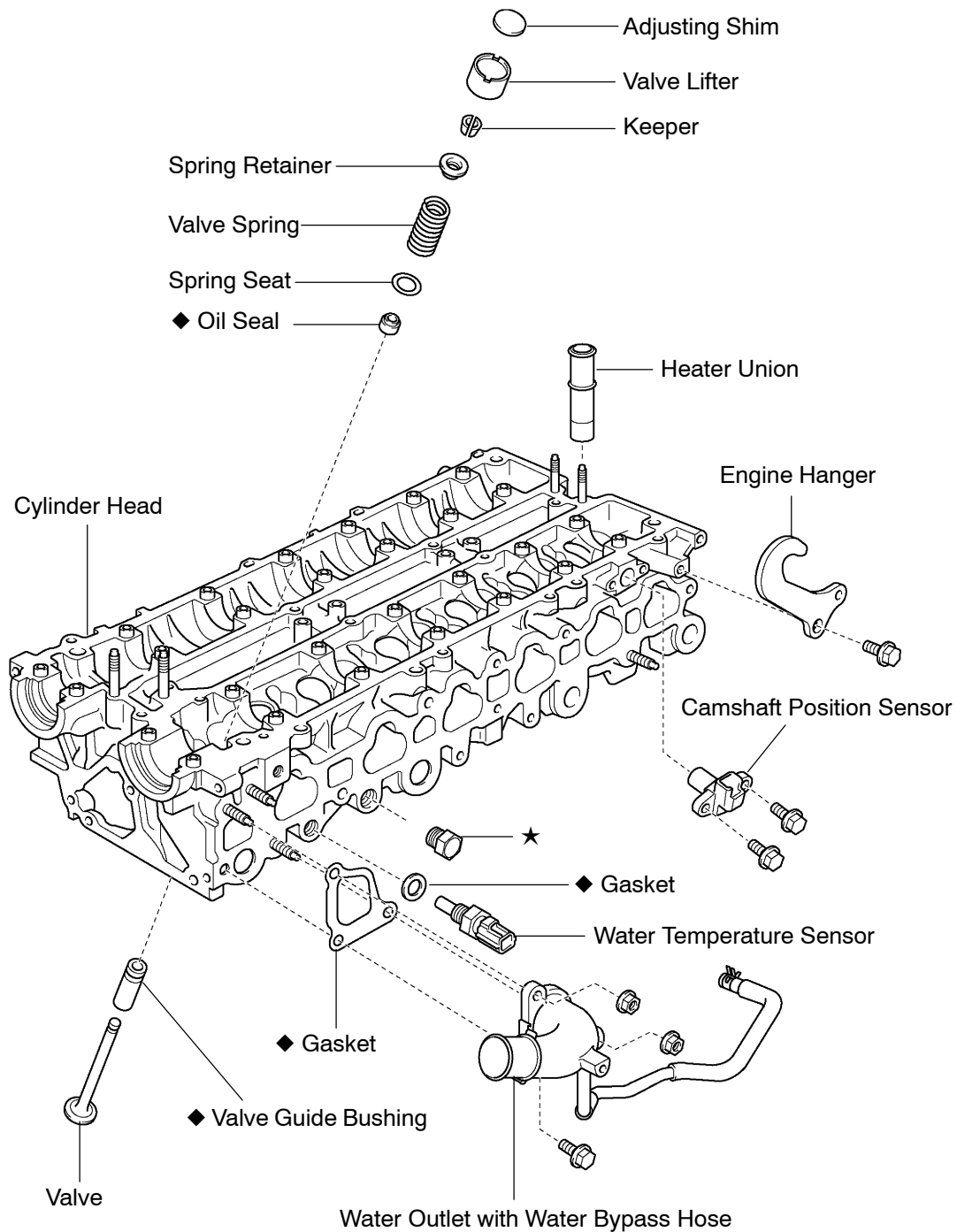
EMOD9-02



A02782







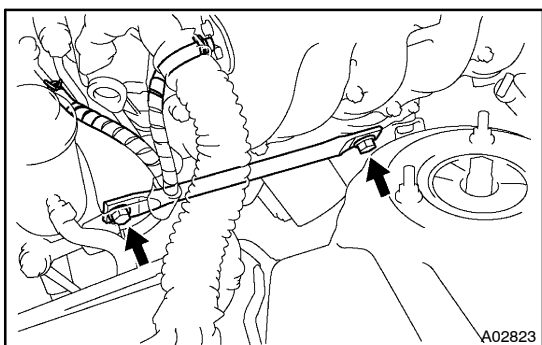
◆ Non-reusable part

★ Precoated part

A02822

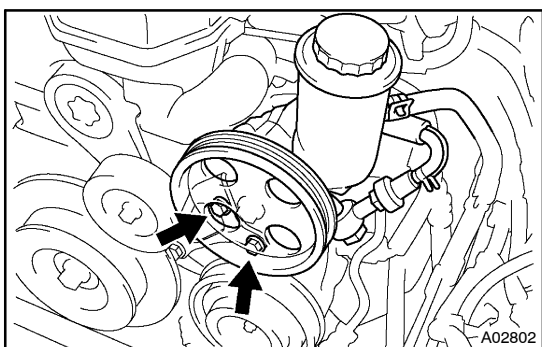
REMOVAL

1. REMOVE ENGINE UNDER COVER
2. DRAIN ENGINE COOLANT
3. DISCONNECT UPPER RADIATOR HOSE FROM WATER OUTLET
4. REMOVE AIR CLEANER INLET
5. REMOVE AIR CLEANER, AIR FLOW METER AND INTAKE AIR RESONATOR ASSEMBLY (See page EM-61)
6. REMOVE DRIVE BELT (See page CH-6)



7. DISCONNECT PS PUMP WITHOUT DISCONNECTING HOSES

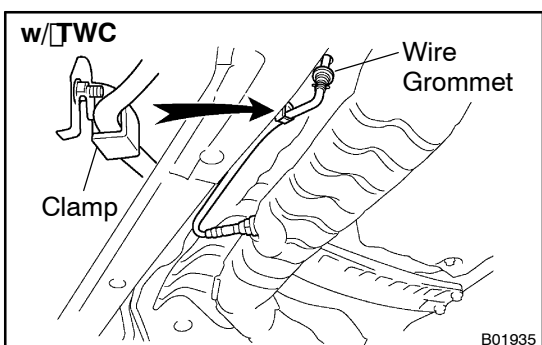
- (a) Disconnect these hoses:
 - PS air hose from No.4 timing belt cover
 - PS air hose from air intake chamber
- (b) Remove the 2 bolts and pump rear stay.



- (c) Remove the 2 bolts, and disconnect the vane pump from the pump bracket.

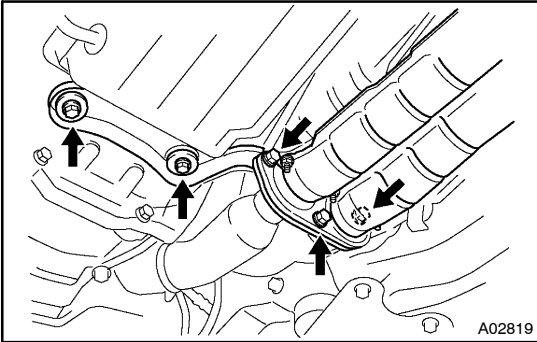
HINT:

Put aside the vane pump, and suspend it.

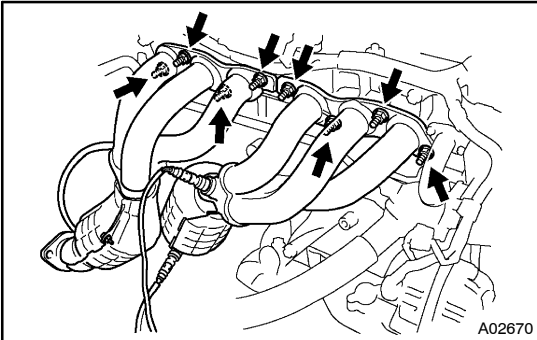


8. DISCONNECT FRONT EXHAUST PIPE FROM EXHAUST MANIFOLD

- (a) w/ TWC: Disconnect the wire grommet and sensor wire of the oxygen sensor (bank 2 sensor 2) from the hole and clamp on the floor.



- (b) Remove the 3 bolts and nuts holding the front exhaust pipe to the exhaust manifold.
- (c) Remove the 2 bolts and pipe support bracket.
- (d) Disconnect the front exhaust pipe from the exhaust manifold, and remove the 2 gaskets.



9. REMOVE EXHAUST MANIFOLD

- (a) w/ TWC:
Disconnect the 3 oxygen sensor connectors and clamp.
- (b) w/ TWC:
Remove the clamp and case clamp.
- (c) Using a 14 mm deep socket wrench, remove the 3 nuts, exhaust manifold and 2 gaskets.

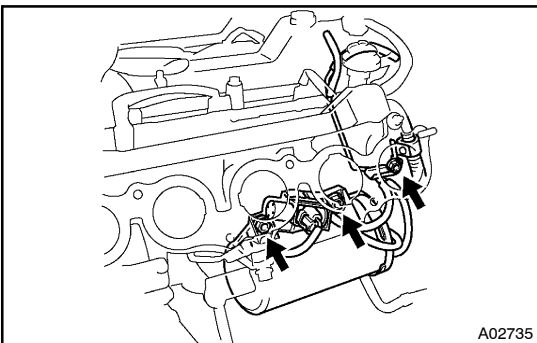
10. REMOVE WATER BYPASS OUTLET AND NO.1 WATER BYPASS PIPE (See page CO-5)

11. REMOVE THROTTLE BODY AND INTAKE AIR CONNECTOR ASSEMBLY (See page EM-6)

12. REMOVE OIL DIPSTICK AND GUIDE FOR ENGINE (See page LU-6)

13. REMOVE OIL DIPSTICK AND GUIDE FOR A/T (See page EM-61)

14. REMOVE AIR INTAKE CHAMBER (See page FI-45)



15. REMOVE VACUUM CONTROL VALVE SET AND NO.2 VACUUM PIPE

- (a) Disconnect the VSV connector for the ACIS.
- (b) Remove the 3 nuts, vacuum control valve set and No.2 vacuum pipe.
- (c) Disconnect the engine wire clamp from the clamp bracket of the No.2 vacuum pipe.

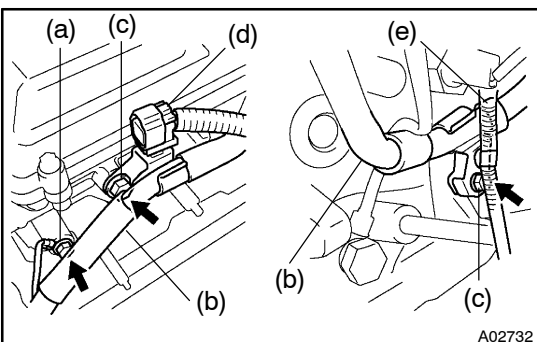
16. REMOVE NO.3 TIMING BELT COVER

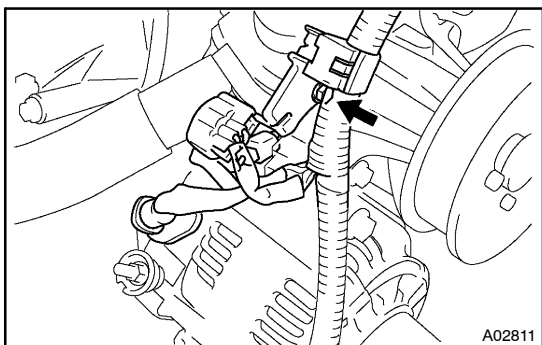
17. REMOVE IGNITION COILS AND HIGH-TENSION CORD SET ASSEMBLY (See page IG-7)

18. REMOVE SPARK PLUGS

19. DISCONNECT ENGINE WIRE FROM CYLINDER HEAD

- (a) Disconnect the ground strap from the cylinder head.
- (b) Disconnect the 2 water bypass hoses from the hose clamps on the cylinder head and oil filter bracket.
- (c) Remove the 2 bolts and hose clamps.
- (d) w/ TWC:
Disconnect the oxygen sensor (bank 2 sensor 1) connector from the hose clamp.
- (e) Disconnect the engine wire clamp from the hose clamp.

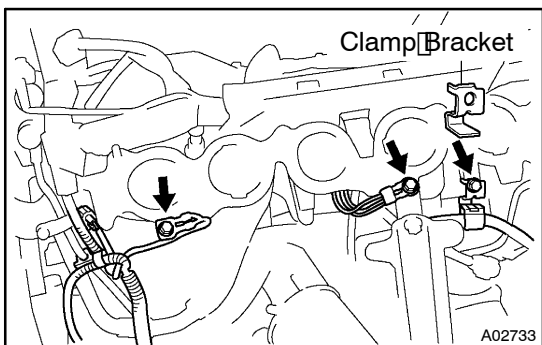




(f) Disconnect these connectors:

- w/TWC:
Oxygen sensor (bank 1 sensor 1) connector
- Crankshaft position sensor connector
- Alternator connector

(g) Remove the bolt and clamp bracket, and disconnect the engine wire from the water pump.



(h) Disconnect the 2 ground terminals from the intake manifold.

(i) Disconnect the 2 engine wire clamps from the No. 1 oil pipe and clamp bracket on the intake manifold.

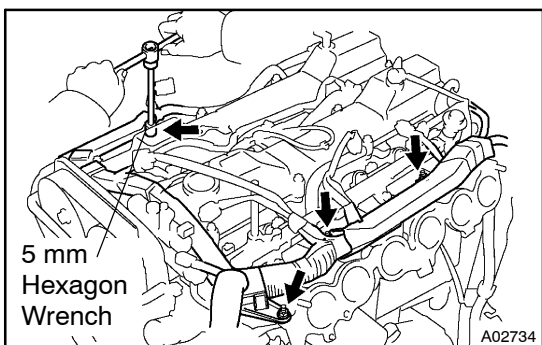
(j) Remove the bolt and clamp bracket.

(k) Disconnect these connectors:

- Water temperature sensor connector
- 2 knock sensor connectors
- Oil pressure switch connector
- Oil level sensor connector
- Starter connector
- 6 injector connectors
- Camshaft timing oil control valve connector
- Camshaft position sensor connector

(l) Using a 5 mm hexagon wrench, remove the bolt holding the engine wire protector to the No. 2 cylinder head cover.

(m) Remove the 3 nuts, and disconnect the engine wire protector from the intake manifold.



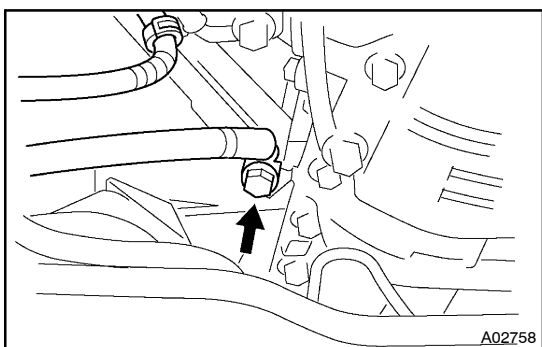
20. REMOVE FUEL PRESSURE PULSATION DAMPER (See page FI-26)

21. REMOVE INTAKE MANIFOLD ASSEMBLY

(a) Disconnect the starter wire from the manifold stay.

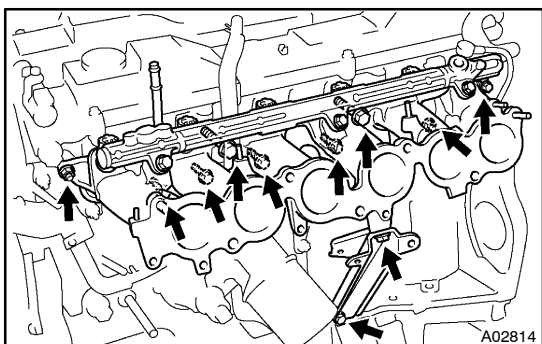
(b) Australia and G.C.C. Countries:

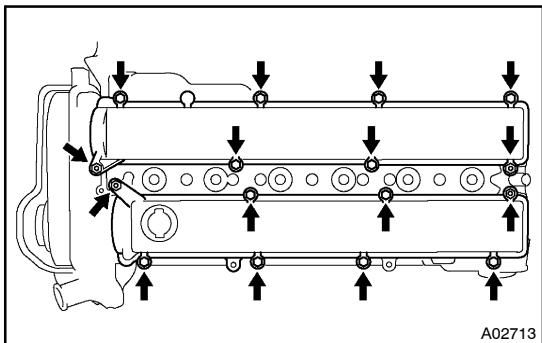
Disconnect the ground cable from the manifold stay.



(c) Remove the 2 bolts and manifold stay.

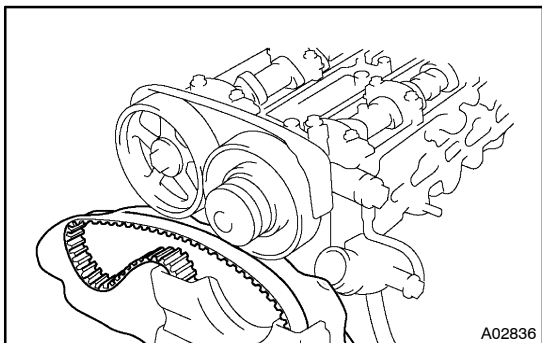
(d) Remove the 7 bolts, 2 nuts, intake manifold and delivery pipe assembly and gasket.





22. REMOVE NO.1 AND NO.2 CYLINDER HEAD COVERS

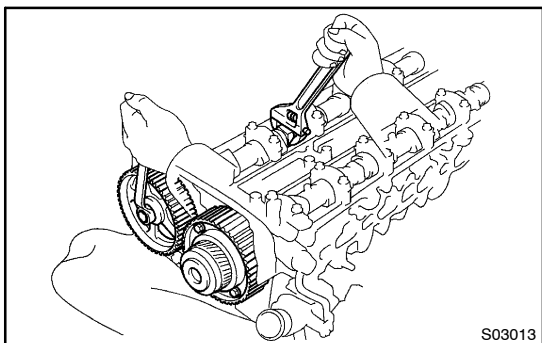
- Remove the 12 bolts and 4 nuts.
- Remove the cylinder head covers and gaskets.



23. DISCONNECT TIMING BELT FROM CAMSHAFT TIMING PULLEYS (See page EM-17)

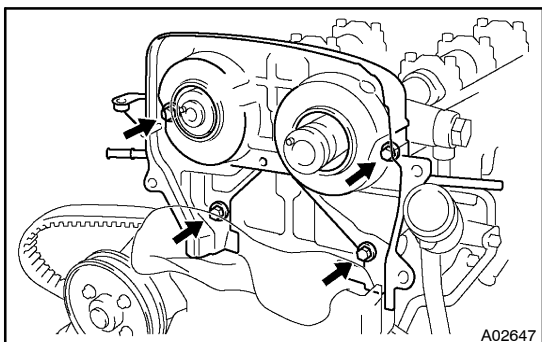
NOTICE:

- Support the timing belt, so that the measuring of the crankshaft timing pulley and timing belt does not shift.
- Be careful not to drop anything inside the timing belt cover.
- Do not allow the timing belt to come into contact with oil, water or dust.



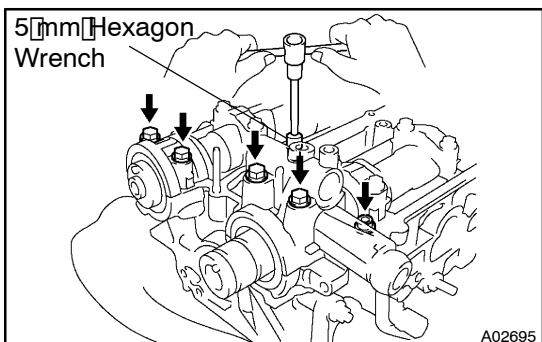
24. REMOVE CAMSHAFT TIMING PULLEYS

- Remove the exhaust camshaft timing pulley. Hold the hexagon portion of the camshaft with a wrench, and remove the pulley bolt and camshaft pulley.
- Remove the VVT-i (intake camshaft timing) pulley. (See page EM-17)



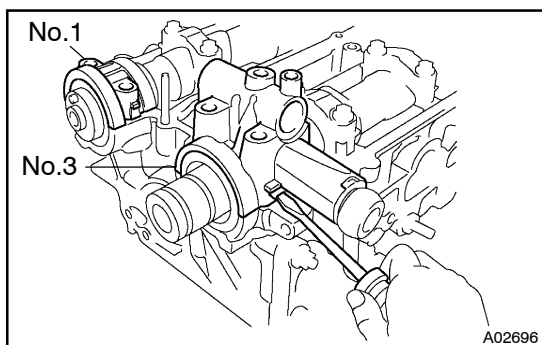
25. REMOVE NO.4 TIMING BELT COVER

Remove the 4 bolts and timing belt cover.



26. REMOVE CAMSHAFTS

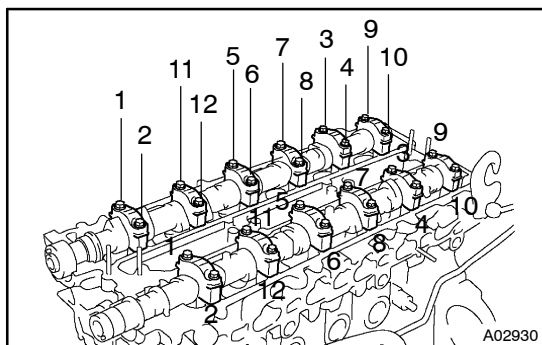
- Using a 5 mm hexagon wrench, the 2 No.3 camshaft bearing cap bolts.
- Uniformly loosen and remove the 4 camshaft bearing cap bolts.



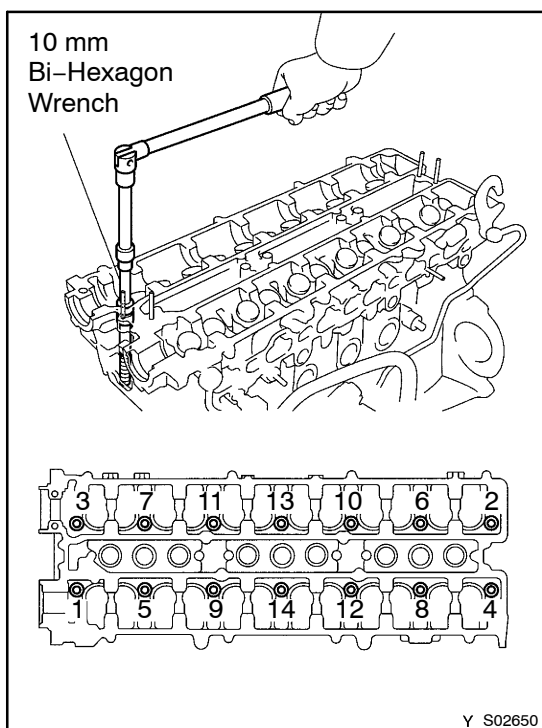
- (c) Using a screwdriver, pry out the Nos. 1, 3 camshaft bearing caps and oil seals.

NOTICE:

Be careful not to damage the cap. Tape the screwdriver tip.



- (d) Uniformly loosen and remove the 12 camshaft bearing cap bolts, in several passes, in the sequence shown.
- (e) Remove the 6 No. 2 camshaft bearing caps and camshaft. Remove the intake and exhaust camshafts.

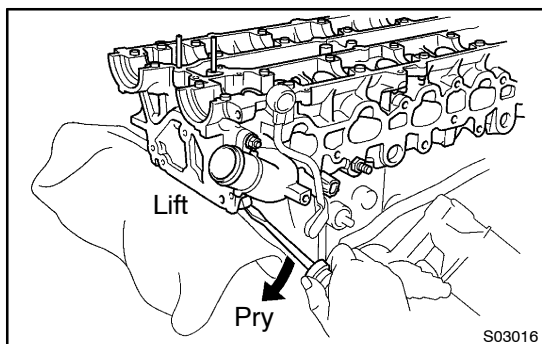
**27. REMOVE CYLINDER HEAD ASSEMBLY**

- (a) Using a 10 mm bi-hexagon wrench, uniformly loosen and remove the 14 cylinder head bolts, in several passes, in the sequence shown.

NOTICE:

Cylinder head warpage or cranking could result from removing in incorrect order.

- (b) Remove the 14 plate washers.



- (c) Lift the cylinder head from the dowels on the cylinder block.
- (d) Disconnect the heater hose from the heater union.
- (e) Place the head on wooden blocks on a bench.

If the cylinder head is difficult to lift off, pry with a screwdriver between the cylinder head and block projection.

NOTICE:

Be careful not to damage the contact surfaces of the cylinder head and cylinder block.

DISASSEMBLY

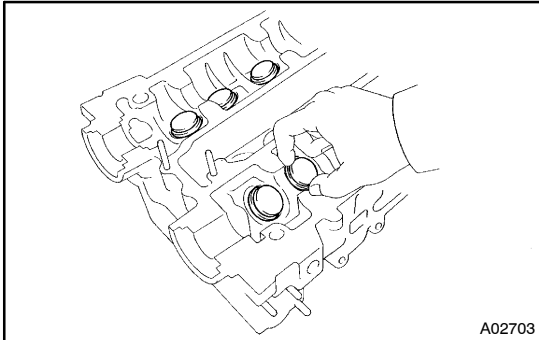
1. REMOVE WATER OUTLET WITH WATER BYPASS HOSE

Remove the 2 nuts, bolt, water outlet and gasket.

2. REMOVE ENGINE HANGER

3. REMOVE CAMSHAFT POSITION SENSOR

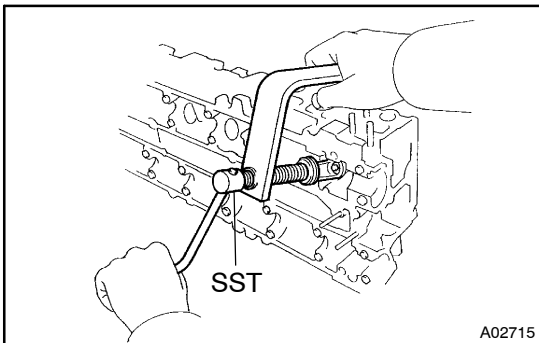
4. REMOVE WATER TEMPERATURE SENSOR



5. REMOVE VALVE LIFTERS AND SHIMS

HINT:

Store the valve lifters and shims in correct order.



6. REMOVE VALVES

- (a) Using SST, compress the valve spring and remove the 2 keepers.

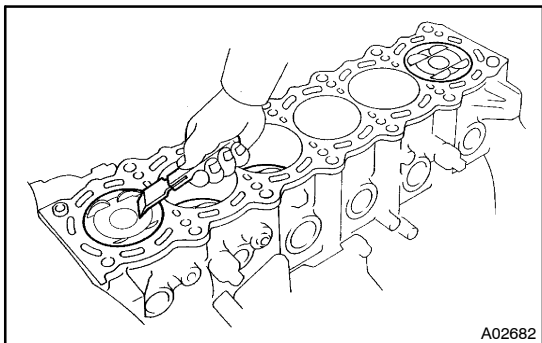
SST 09202-70020 (09202-00010)

- (b) Remove the spring retainer, valve spring, valve and spring seat.

HINT:

Store the valves, valve springs, spring seats and spring retainers in correct order.

- (c) Using needle-nose pliers, remove the oil seal.

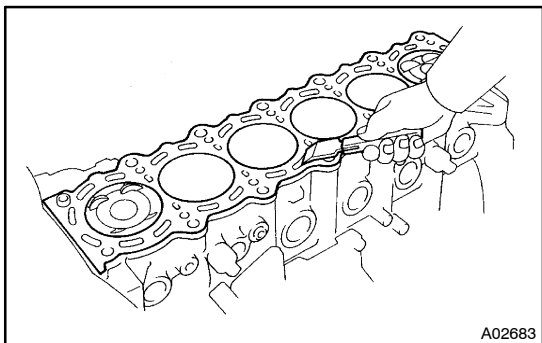


A02682

INSPECTION

1. CLEAN TOP SURFACES OF PISTONS AND CYLINDER BLOCK

- (a) Turn the crankshaft, and bring each piston to top dead center (TDC). Using a gasket scraper, remove all the carbon from the piston top surface.



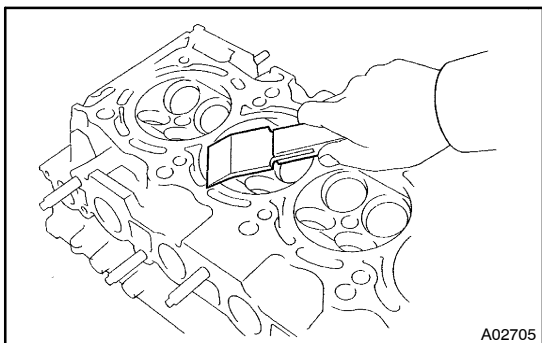
A02683

- (b) Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.

- (c) Using compressed air, blow carbon and oil from the bolt holes.

CAUTION:

Protect your eyes when using high – pressure compressed air.



A02705

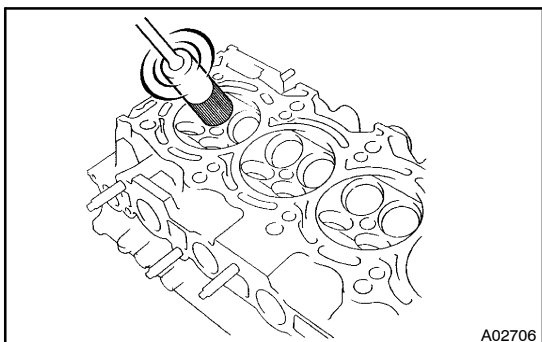
2. CLEAN CYLINDER HEAD

- (a) Remove gasket material

Using a gasket scraper, remove all the gasket material from the cylinder block surface.

NOTICE:

Be careful not to scratch the cylinder block contact surface.



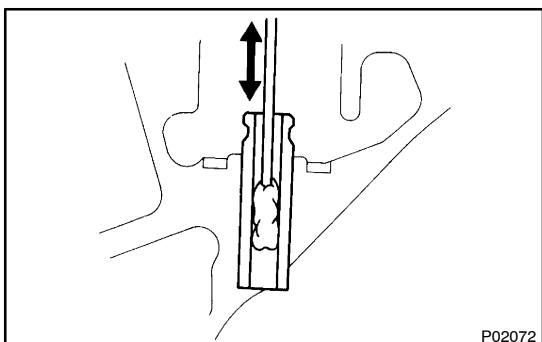
A02706

- (b) Clean combustion chambers

Using a wire brush, remove all the carbon from the combustion chambers.

NOTICE:

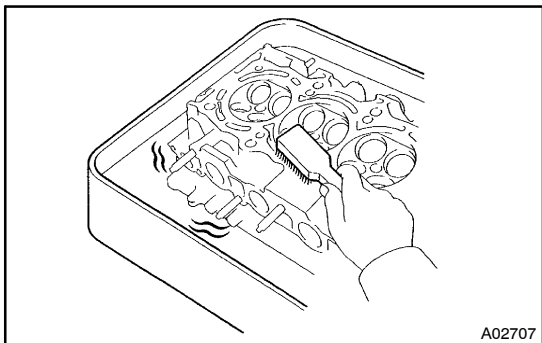
Be careful not to scratch the cylinder block contact surface.



P02072

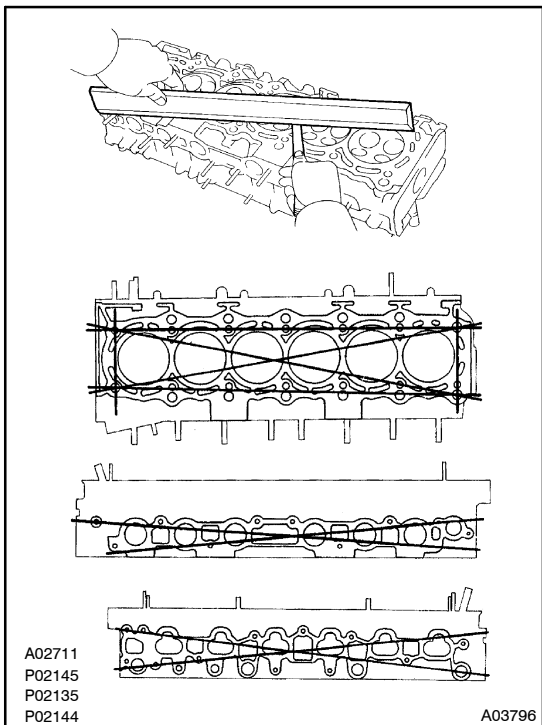
- (c) Clean valve guide bushings

Using a valve guide bushing brush and solvent, clean all the guide bushings.



(d) Clean cylinder head

Using a soft brush and solvent, thoroughly clean the cylinder head.



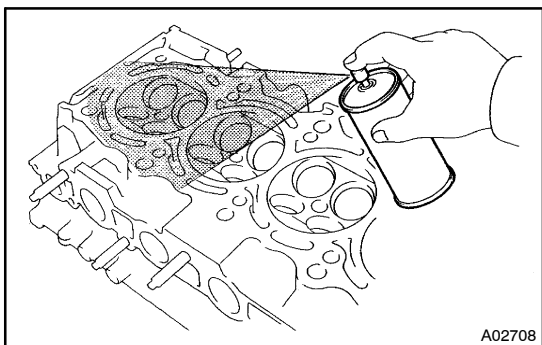
3. INSPECT CYLINDER HEAD

(a) Inspect for flatness

Using precision straight edge and feeler gauge, measure the surfaces contacting the cylinder block, intake and exhaust manifolds for warpage.

Maximum warpage: 0.10 mm (0.0039 in.)

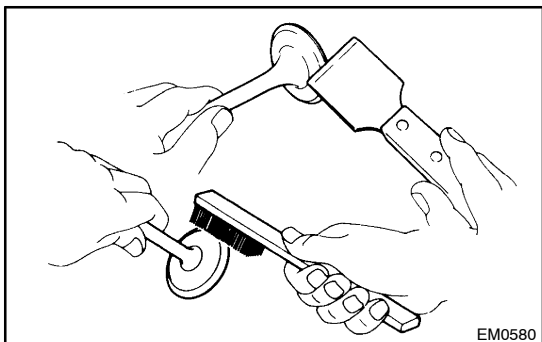
If warpage is greater than maximum, replace the cylinder head.



(b) Inspect for cracks

Using a dye penetrant, check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks.

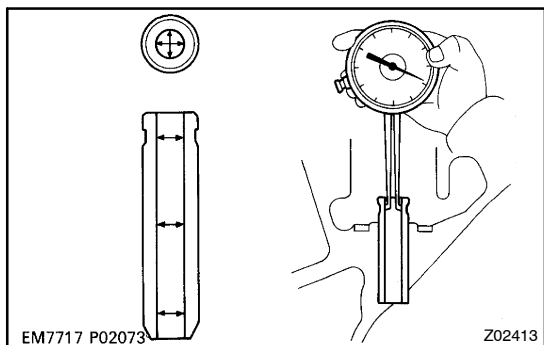
If cracked, replace the cylinder head.



4. CLEAN VALVES

(a) Using a gasket scraper, chip off any carbon from the valve head.

(b) Using a wire brush, thoroughly clean the valve.

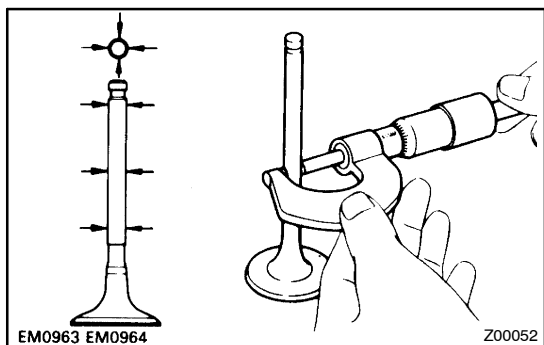


5. INSPECT VALVE STEMS AND GUIDE BUSHINGS

- (a) Using a caliper gauge, measure the inside diameter of the guide bushing.

Bushing inside diameter:

6.010 – 6.030 mm (0.2366 – 0.2374 in.)



- (b) Using a micrometer, measure the diameter of the valve stem.

Valve stem diameter:

Intake 5.970 – 5.985 mm (0.2350 – 0.2356 in.)

Exhaust 5.965 – 5.980 mm (0.2348 – 0.2354 in.)

- (c) Subtract the valve stem diameter measurement from the guide bushing inside diameter measurement.

Standard oil clearance:

Intake 0.025 – 0.060 mm (0.0010 – 0.0024 in.)

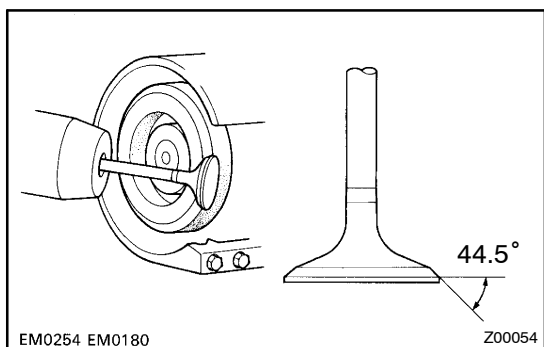
Exhaust 0.030 – 0.065 mm (0.0012 – 0.0026 in.)

Maximum oil clearance:

Intake 0.08 mm (0.0031 in.)

Exhaust 0.10 mm (0.0039 in.)

If the clearance is greater than maximum, replace the valve and guide bushing. (See page EM-47)

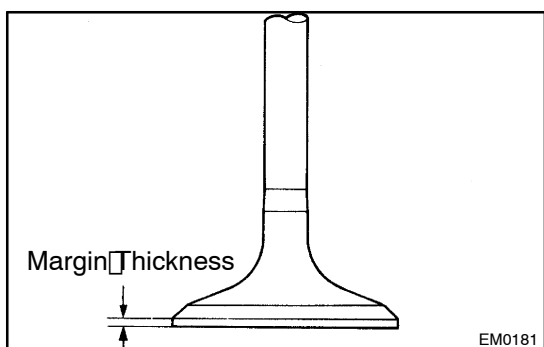


6. INSPECT AND GRIND VALVES

- (a) Grind the valve enough to remove pits and carbon.

- (b) Check that the valve is ground to the correct valve face angle.

Valve face angle: 44.5°



- (c) Check the valve head margin thickness.

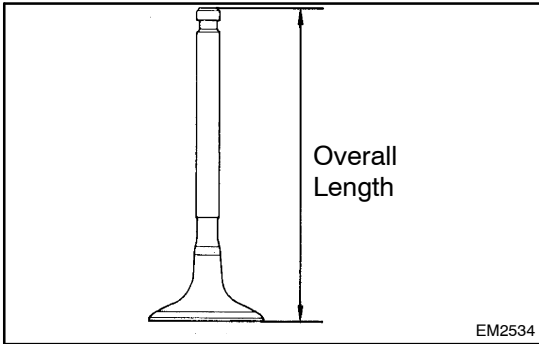
Standard margin thickness:

0.8 – 1.2 mm (0.031 – 0.047 in.)

Minimum margin thickness:

0.5 mm (0.020 in.)

If the margin thickness is less than minimum, replace the valve.



- (d) Check the valve overall length.

Standard overall length:

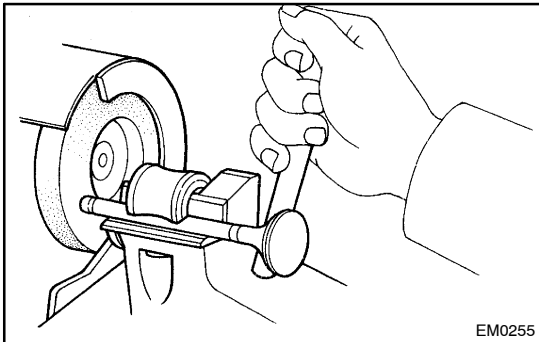
Intake 98.29 – 98.79 mm (3.8697 – 3.8894 in.)

Exhaust 98.84 – 99.34 mm (3.8913 – 3.9110 in.)

Minimum overall length:

Intake 98.19 mm (3.8657 in.)

Exhaust 98.74 mm (3.8874 in.)



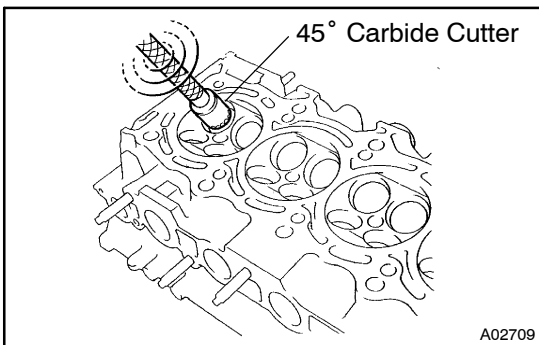
If the overall length is less than minimum, replace the valve.

- (e) Check the surface of the valve stem tip for wear.

If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.

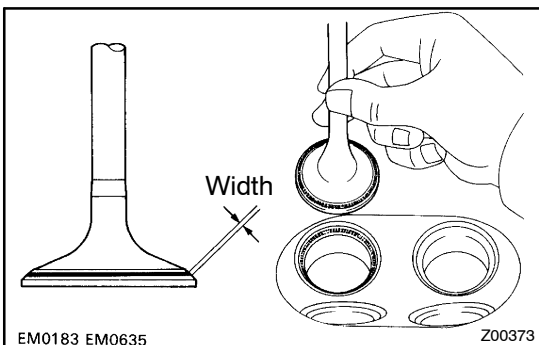
NOTICE:

Do not grind off more than the minimum overall length.



7. INSPECT AND CLEAN VALVE SEATS

- (a) Using a 45° carbide cutter, resurface the valve seats. Remove only enough metal to clean the seats.



- (b) Check the valve seating position.

Apply a thin coat of prussian blue (or white lead) to the valve face. Lightly press the valve against the seat. Do not rotate the valve.

- (c) Check the valve face and seat for the following:

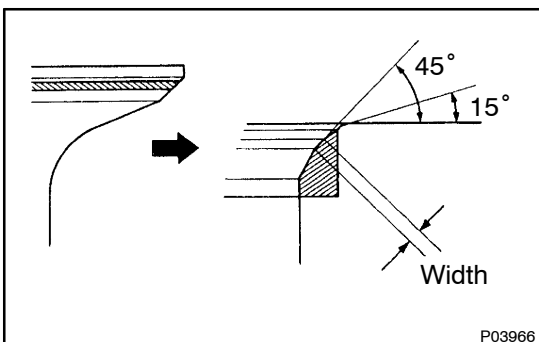
- If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
- If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
- Check that the seat contact is in the middle of the valve face with the following width:

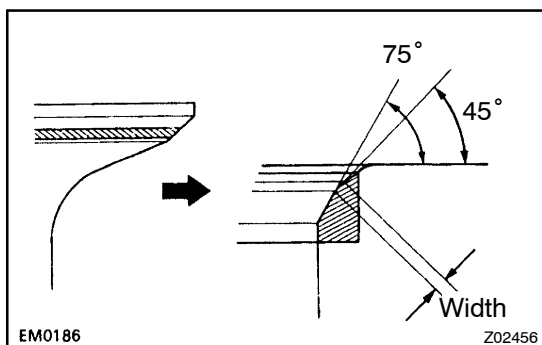
Intake 1.0 – 1.4 mm (0.039 – 0.055 in.)

Exhaust 1.2 – 1.6 mm (0.047 – 0.063 in.)

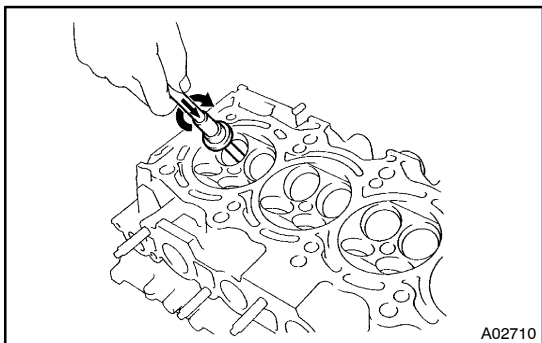
If not, correct the valve seats as follows:

- (1) If the seating is too high on the valve face, use 15° and 45° cutters to correct the seat.

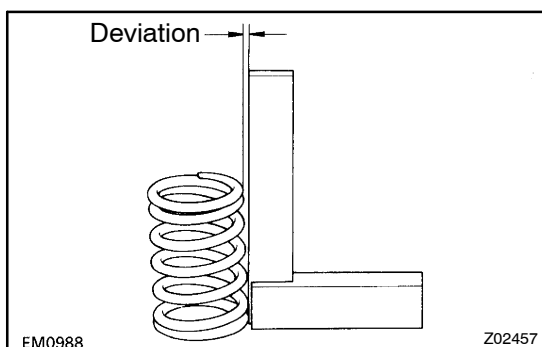




- (2) If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.



- (d) Hand-lap the valve and valve seat with an abrasive compound.
(e) After hand-lapping, clean the valve and valve seat.

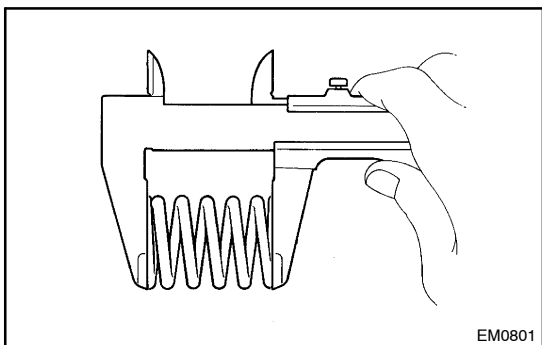


8. INSPECT VALVE SPRINGS

- (a) Using a steel square, measure the deviation of the valve spring.

Maximum deviation: 2.0 mm (0.079 in.)

If deviation is greater than maximum, replace the valve spring.

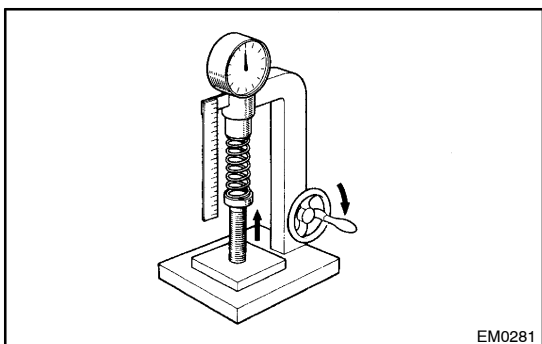


- (b) Using vernier calipers, measure the free length of the valve spring.

Free length:

Pink painted mark	43.71 mm (1.7209 in.)
Yellow painted mark	44.10 mm (1.7362 in.)

If the free length is not as specified, replace the valve spring.



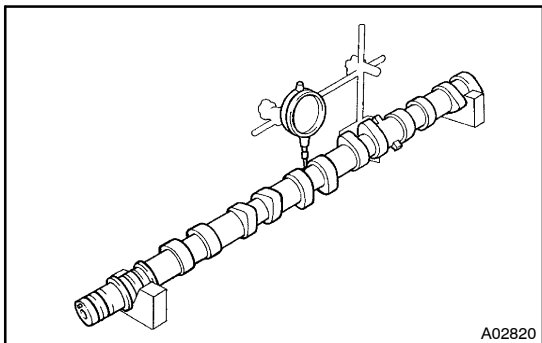
- (c) Using a spring tester, measure the tension of the valve spring at the specified installed length.

Installed tension:

186.2 – 205.8 N (19.0 – 21.0 kgf, 41.9 – 46.3 lbf)

at 34.5 mm (1.358 in.)

If the installed tension is not as specified, replace the valve spring.

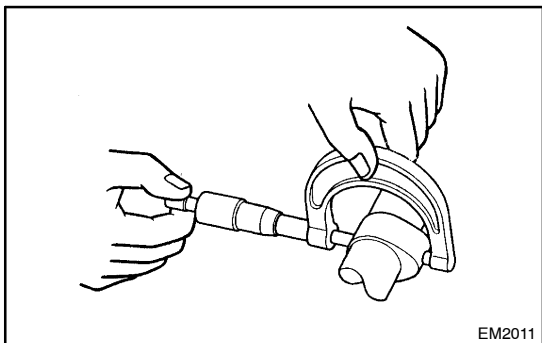


9. INSPECT CAMSHAFT RUNOUT

- (a) Place the camshaft on V-blocks.
- (b) Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout: 0.08 mm (0.0031 in.)

If the circle runout is greater than maximum, replace the camshaft.



10. INSPECT CAM LOBES

Using a micrometer, measure the cam lobe height.

Standard cam lobe height:

Intake 44.310 – 44.360 mm (1.7445 – 1.7465 in.)

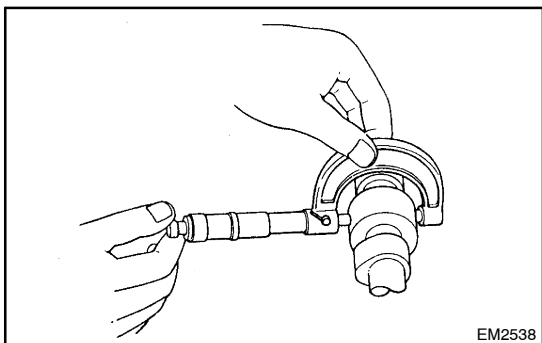
Exhaust 44.250 – 44.350 mm (1.7421 – 1.7461 in.)

Minimum cam lobe height:

Intake 44.16 mm (1.7386 in.)

Exhaust 44.10 mm (1.7362 in.)

If the cam lobe height is less than minimum, replace the camshaft.



11. INSPECT CAMSHAFT JOURNALS

Using a micrometer, measure the journal diameter.

Journal diameter:

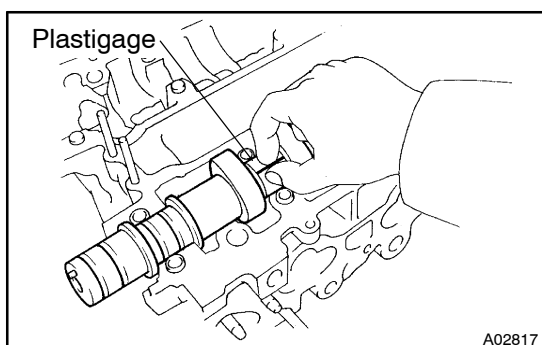
28.949 – 28.965 mm (1.1397 – 1.1404 in.)

If the journal diameter is not as specified, check the oil clearance.

12. INSPECT CAMSHAFT BEARINGS

Check the bearings for flaking and scoring.

If the bearings are damaged, replace the bearing caps and cylinder head as a set.



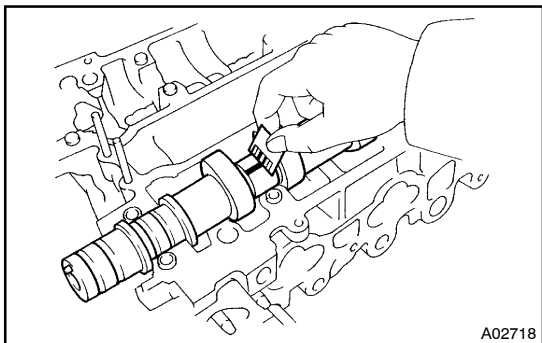
13. INSPECT CAMSHAFT JOURNAL OIL CLEARANCE

- (a) Clean the bearing caps and camshaft journals.
 - (b) Place the camshafts on the cylinder head.
 - (c) Lay a strip of Plastigage across each of the camshaft journals.
 - (d) Install the bearing caps. (See page EM-51)
- Torque: 20 N·m (200 kgf·cm, 14 ft·lbf)**

NOTICE:

Do not turn the camshaft.

- (e) Remove the bearing caps.



- (f) Measure the Plastigage at its widest point.

Standard oil clearance:

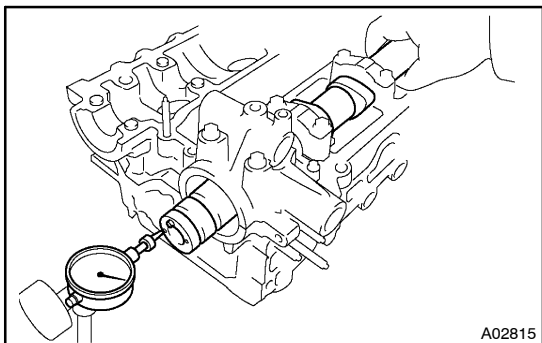
0.035 – 0.072 mm (0.0014 – 0.0028 in.)

Maximum oil clearance:

0.10 mm (0.0039 in.)

If the oil clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

- (g) Completely remove the Plastigage.



14. INSPECT CAMSHAFT THRUST CLEARANCE

- (a) Install the camshafts. (See page EM-51)

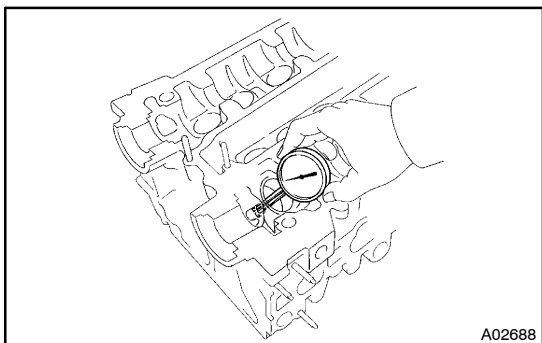
- (b) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

Standard thrust clearance:

0.080 – 0.190 mm (0.0031 – 0.0075 in.)

Maximum thrust clearance: 0.30 mm (0.0118 in.)

If the thrust clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.



15. INSPECT VALVE LIFTERS AND LIFTER BORES

- (a) Using a caliper gauge, measure the lifter bore diameter of the cylinder head.

Lifter bore diameter:

31.000 – 31.016 mm (1.2205 – 1.2211 in.)

- (b) Using a micrometer, measure the lifter diameter.

Lifter diameter:

30.966 – 30.976 mm (1.2191 – 1.2195 in.)

- (c) Subtract the lifter diameter measurement from the lifter bore diameter measurement.

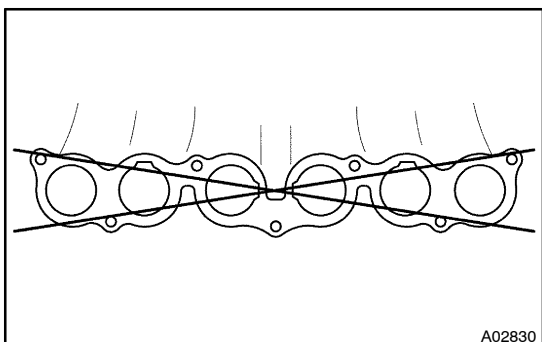
Standard oil clearance:

0.024 – 0.050 mm (0.0009 – 0.0020 in.)

Maximum oil clearance:

0.07 mm (0.0028 in.)

If the oil clearance is greater than maximum, replace the lifter. If necessary, replace the cylinder head.

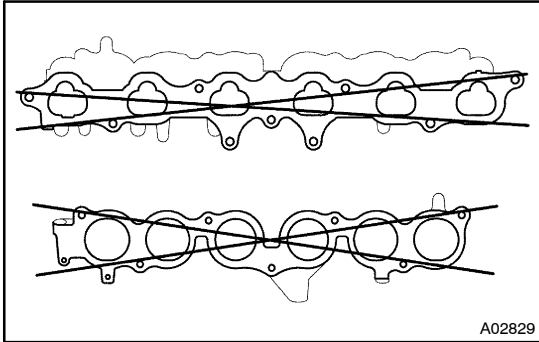


16. INSPECT AIR INTAKE CHAMBER

Using a precision straight edge and feeler gauge, measure the surfaces contacting the intake manifold for warpage.

Maximum warpage: 0.15 mm (0.0059 in.)

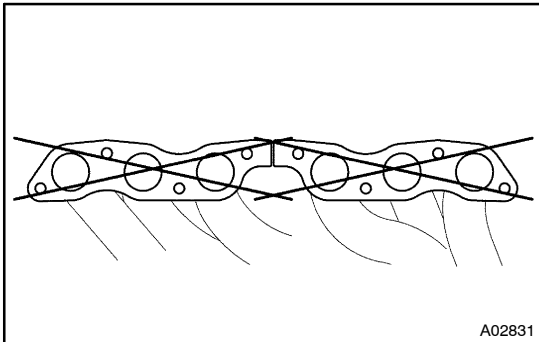
If warpage is greater than maximum, replace the chamber.

**17. INSPECT INTAKE MANIFOLD**

Using a precision straight edge and feeler gauge, measure the surfaces contacting the cylinder head and air intake chamber for warpage.

Maximum warpage: 0.15 mm (0.0059 in.)

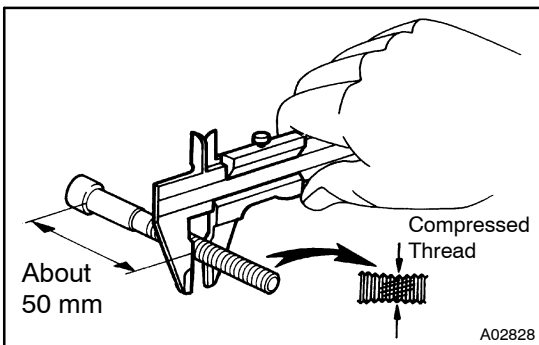
If warpage is greater than maximum, replace the manifold.

**18. INSPECT EXHAUST MANIFOLD**

Using a precision straight edge and feeler gauge, measure the surfaces contacting the cylinder head for warpage.

Maximum warpage: 0.50 mm (0.0196 in.)

If warpage is greater than maximum, replace the manifold.

**19. INSPECT CYLINDER HEAD BOLTS**

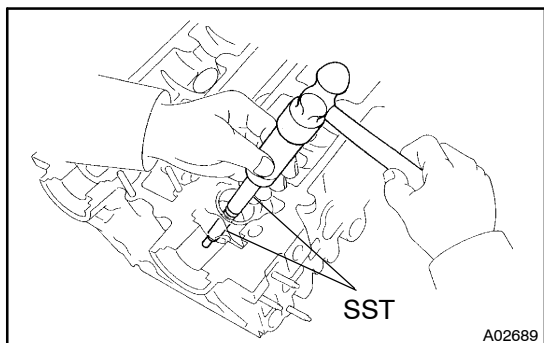
Using a vernier caliper, measure the thread outside diameter of the bolt.

Standard outside diameter:

10.8 – 11.0 mm (0.425 – 0.433 in.)

Minimum outside diameter: 10.7 mm (0.421 in.)

If the diameter is less than minimum, replace the bolt.



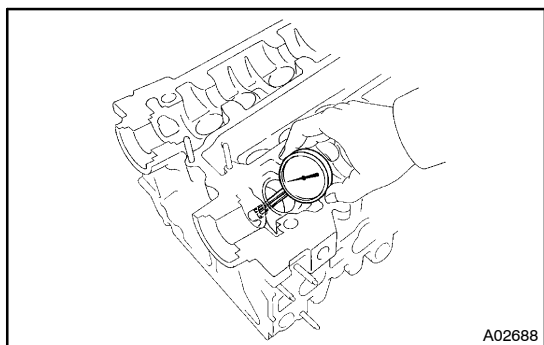
A02689

REPLACEMENT

REPLACE VALVE GUIDE BUSHINGS

- (a) Using SST and a hammer, tap out the guide bushing.

SST 09201-10000 (09201-01060),
09950-70010 (09951-07100)



A02688

- (b) Using a caliper gauge, measure the bushing bore diameter of the cylinder head.

Both intake and exhaust

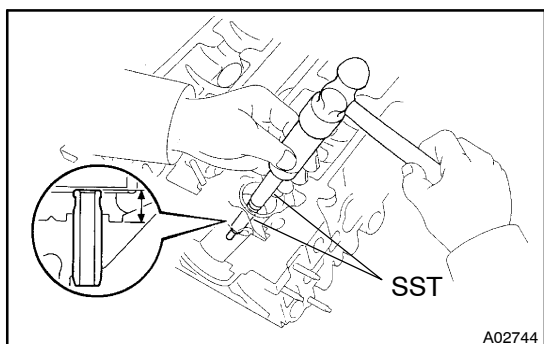
Bushing bore diameter mm (in.)	Bushing size
10.985 – 11.006 mm (0.4325 – 0.4333 in.)	Use STD
11.035 – 11.056 mm (0.4344 – 0.4353 in.)	Use O/S 0.05

- (c) Select a new guide bushing (STD or O/S 0.05).

If the bushing bore diameter of the cylinder head is greater than 11.006 mm (0.4333 in.), machine the bushing bore to the following dimension:

11.035 – 11.056 mm (0.4344 – 0.4353 in.)

If the bushing bore diameter of the cylinder head is greater than 11.056 mm (0.4353 in.), replace the cylinder head.



A02744

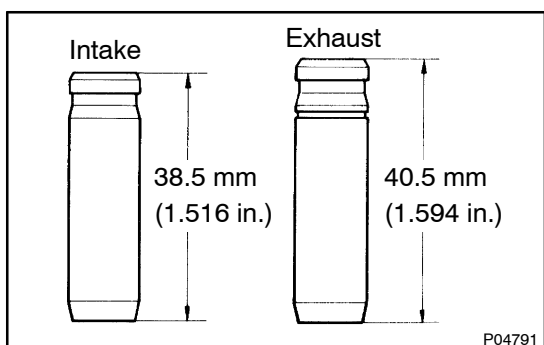
- (d) Using SST and a hammer, tap in a new guide bushing to the specified protrusion height.

SST 09201-10000 (09201-01060),
09950-70010 (09951-07100)

Protrusion height:

Intake 12.3 – 12.7 mm (0.484 – 0.500 in.)

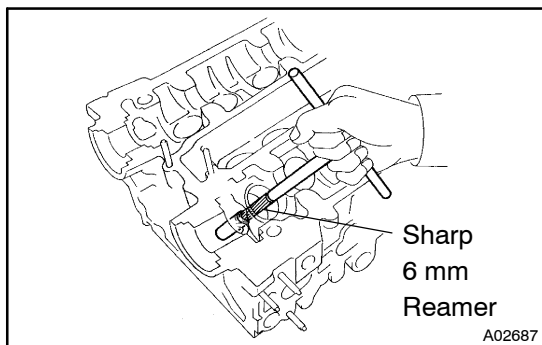
Exhaust 11.4 – 11.8 mm (0.449 – 0.465 in.)



P04791

HINT:

Different bushings are used for the intake and exhaust.

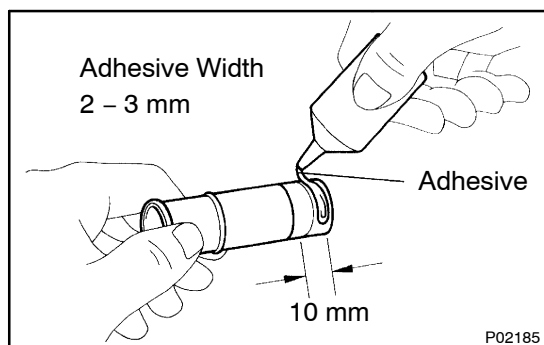


- (e) Using a sharp 6 mm reamer, ream the guide bushing to obtain the standard specified clearance (see page EM-39) between the guide bushing and valve stem.

REASSEMBLY

HINT:

- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.
- Replace all gaskets and oil seals with new ones.



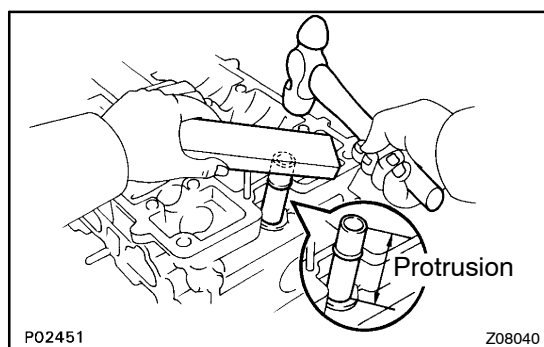
1. INSTALL HEATER UNION

HINT:

When using a new cylinder head, a new heater union must be installed.

- (a) Apply adhesive to the end of the heater union as shown in the illustration.

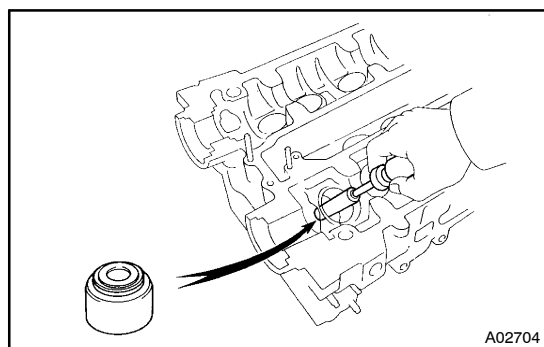
Adhesive: Part No.08833-00070, THREE BOND 1324 or equivalent



- (b) Using a wooden block and hammer, tap in a new heater union, leaving 48 mm (1.89 in.) protruding from the cylinder head.

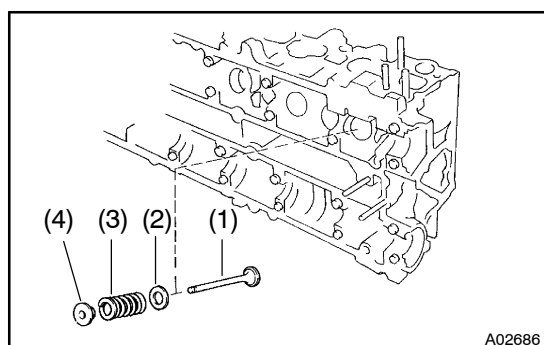
NOTICE:

Do not tap it in too far.

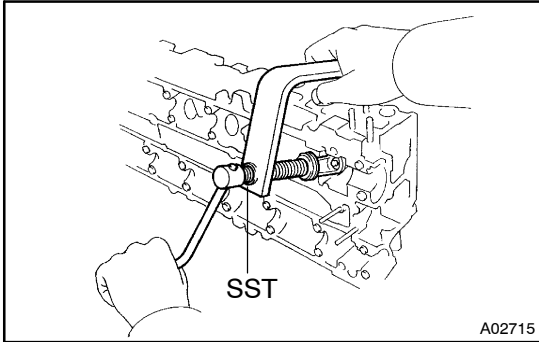


2. INSTALL VALVES

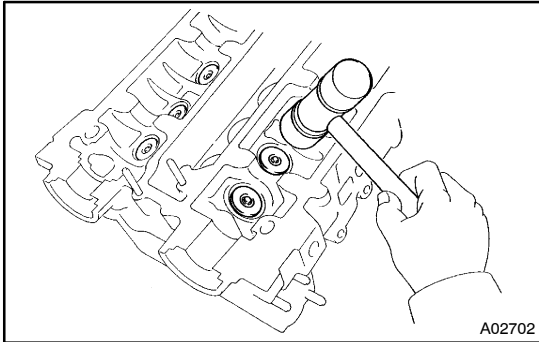
- (a) Install a new oil seal on the valve guide bushing.



- (b) Install these parts:
- (1) Valve
 - (2) Spring seat
 - (3) Valve spring
 - (4) Spring retainer



- (c) Using SST, compress the valve spring and place the 2 keepers around the valve stem.
SST 09202-70020 (09202-00010)



- (d) Using a plastic-faced hammer, lightly tap the valve stem tip to assure proper fit.

3. INSTALL VALVE LIFTERS AND SHIMS

- (a) Install the valve lifter and shim.
(b) Check that the valve lifter rotates smoothly by hand.

4. INSTALL WATER TEMPERATURE SENSOR

Torque: 19.6 N·m (200 kgf·cm, 14 ft·lbf)

5. INSTALL CAMSHAFT POSITION SENSOR

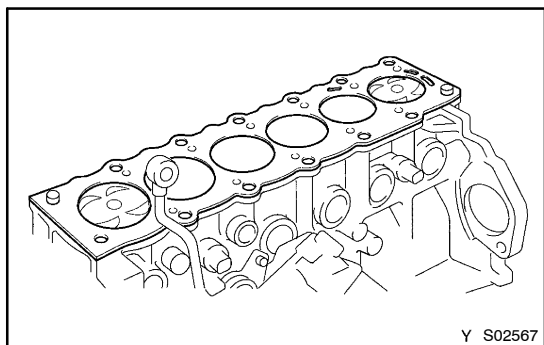
6. INSTALL ENGINE HANGER

Torque: 40 N·m (400 kgf·cm, 30 ft·lbf)

7. INSTALL WATER OUTLET WITH WATER BYPASS HOSE

Install a new gasket and the water outlet with the bolt and 2 nuts.

Torque: 28 N·m (280 kgf·cm, 21 ft·lbf)



INSTALLATION

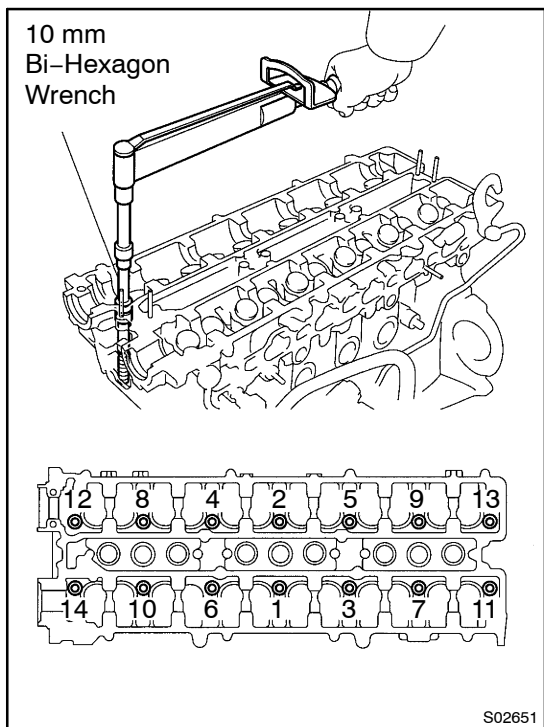
1. PLACE CYLINDER HEAD ON CYLINDER BLOCK

- Place a new cylinder head gasket in position on the cylinder block.

NOTICE:

Be sure to install it correctly.

- Place the cylinder head in position on the cylinder head gasket.



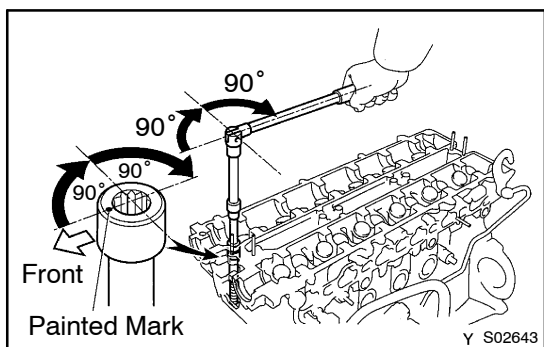
2. INSTALL CYLINDER HEAD BOLTS

HINT:

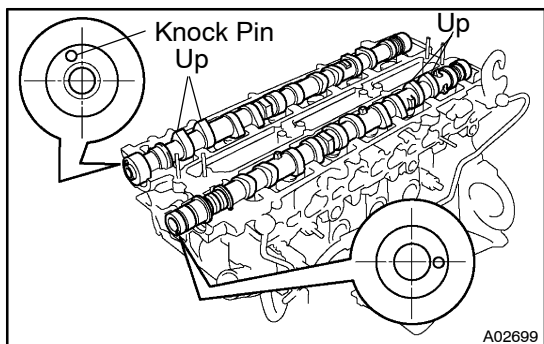
- The cylinder head bolts are tightened in 2 progressive steps (steps (c) and (f)).
 - If any of bolts break or deform, replace them.
- Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.
 - Install the 14 plate washers to each cylinder head bolt.
 - Using a 10 mm bi-hexagon wrench, uniformly tighten the cylinder head bolts, in several passes, in the sequence shown.

Torque: 35 N·m (350 kgf·cm, 26 ft·lbf)

If any of the bolts do not meet the torque specification, replace the bolt.

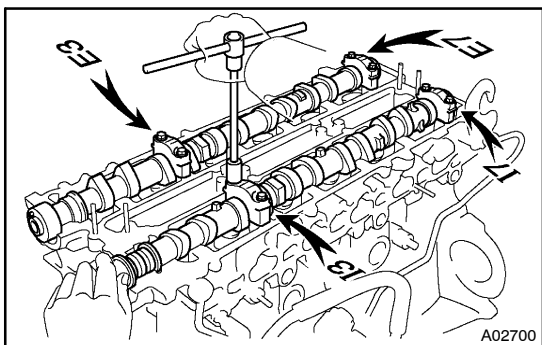


- Mark the front of the cylinder head bolt head with paint.
- Retighten the cylinder head bolts 90° in the numerical order shown.
- Retighten cylinder head bolts by an additional 90° shown.
- Check that the painted mark is now turned to the rear.

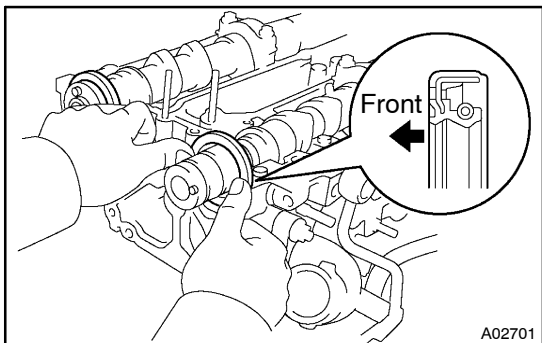


3. INSTALL CAMSHAFTS

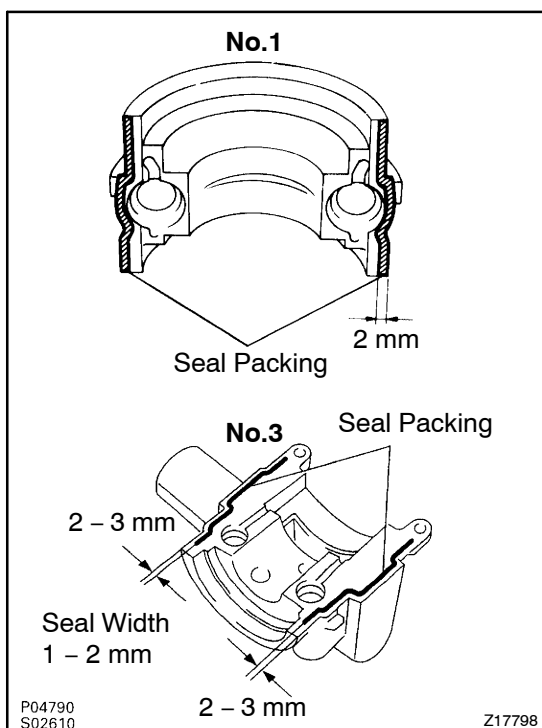
- Apply engine oil to the thrust portion of the camshaft.
- Place the camshaft on the cylinder head with the cam lobe facing up as shown.



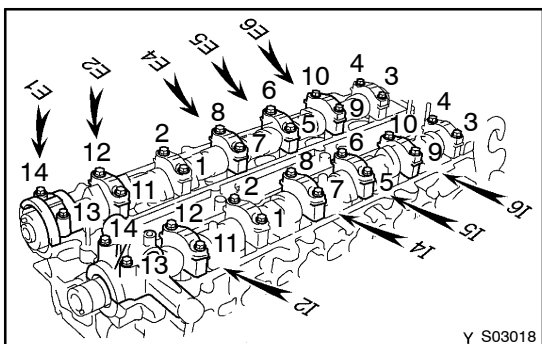
- (c) Place the (Nos. 3, 7 journal) camshaft bearing caps in their proper location.
- (d) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.
- (e) Temporarily tighten these bearing cap bolts uniformly and alternately, in several passes, until the bearing caps are snug with the cylinder head.



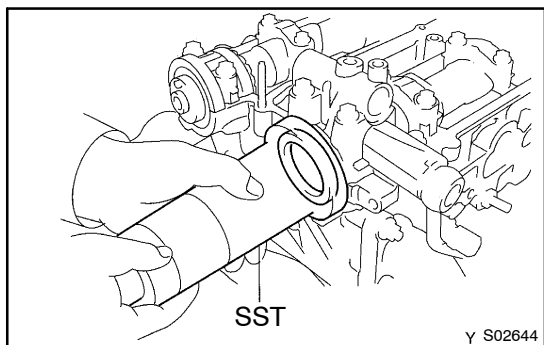
- (f) Apply MP grease to a new camshaft oil seal lip.
- (g) Install the 2 oil seals to the camshafts.



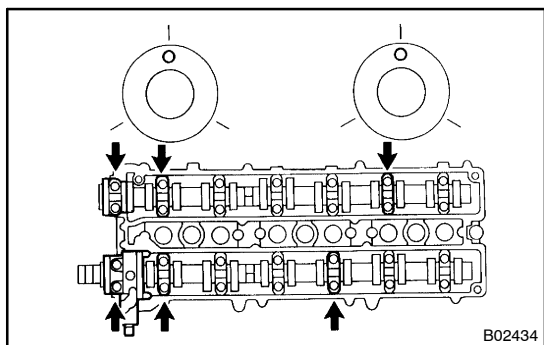
- (h) Clean the installed surfaces of the Nos.1, 3 camshaft bearing cap and cylinder head with cleaner.
- (i) Apply seal packing to the bearing caps as shown.
Seal packing: Part No. 08826-00080 or equivalent



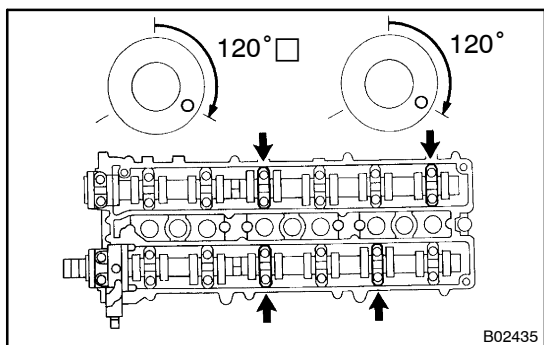
- (j) Install the other bearing caps in their proper locations.
- (k) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.
- (l) Install and uniformly tighten the 14 bearing cap bolts on one side, in several passes, in the sequence shown.
Torque: 20 N·m (200 kgf·cm, 15 ft·lbf)
- (m) Using a 5 mm hexagon wrench, the 2 No.3 camshaft bearing cap bolts.
Torque: 5.0 N·m (50 kgf·cm, 44 in·lbf)



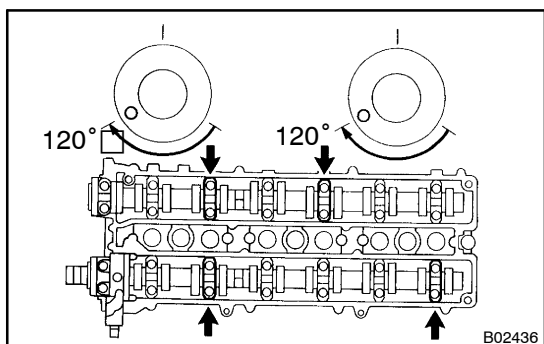
- (n) Using SST, push the 2 oil seals in as far as they can go.
SST 09316-60011 (09316-00011, 09316-00051)



- (o) Rotate the camshaft with a wrench at the hexagon position, bring the forward straight pin up.
(p) Loosen the 12 bearing cap bolts as shown, until they can be turned by hand; retighten in several passes.
Torque: 20 N·m (200 kgf·cm, 15 ft·lbf)



- (q) Turn the camshaft 1/3 of a revolution.
(r) Loosen the 8 bearing cap bolts as shown, until they can be turned by hand; retighten in several passes.
Torque: 20 N·m (200 kgf·cm, 15 ft·lbf)



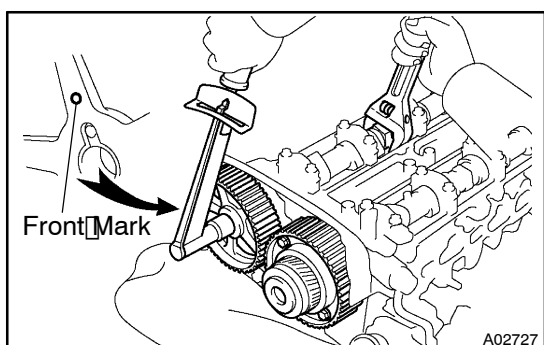
- (s) Turn the camshaft a further 1/3 of a revolution.
(t) Loosen the 8 bearing cap bolts as shown, until they can be turned by hand; retighten in several passes.
Torque: 20 N·m (200 kgf·cm, 15 ft·lbf)

4. CHECK AND ADJUST VALVE CLEARANCE (See page EM-6)

5. INSTALL NO.4 TIMING BELT COVER

Install the timing belt cover with 4 bolts.

Torque: 8.0 N·m (80 kgf·cm, 71 in·lbf)



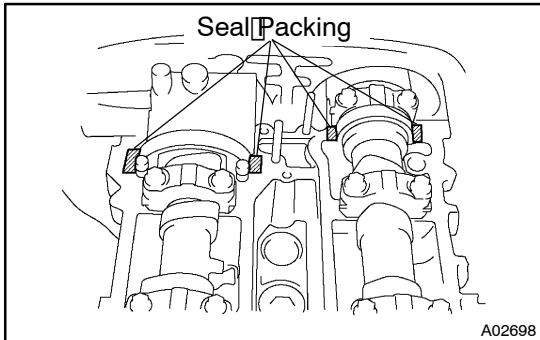
6. INSTALL CAMSHAFT TIMING PULLEYS

- (a) Install the exhaust camshaft timing pulley.
- (1) Align the camshaft knock pin with the groove in the pulley, and slide on the pulley.
 - (2) Slide the timing pulley on the camshaft, facing the front mark forward.
 - (3) Hold the hexagon portion of the camshaft with a wrench, and tighten the timing pulley bolt.

Torque: 81 N·m (810 kgf·cm, 60 ft·lbf)

- (b) Install the VV-i intake camshaft timing pulley.
(See page EM-17)

7. CONNECT TIMING BELT TO CAMSHAFT TIMING PULLEYS (See page EM-23)



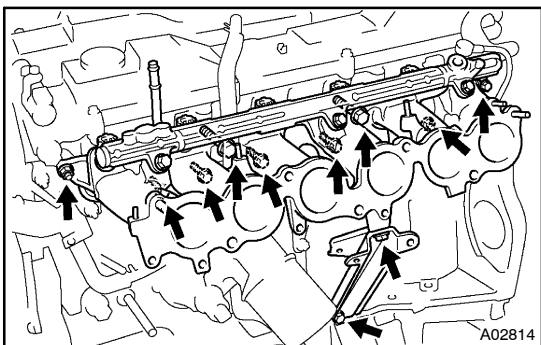
8. INSTALL NO.1 AND NO.2 CYLINDER HEAD COVERS

- (a) Remove the any old packing (FIPG) material.
(b) Apply seal packing to the cylinder head as shown in the illustration.

Seal packing: Part No. 08826-00080 or equivalent

- (c) Install the gaskets to the cylinder head covers.
(d) Install the cylinder head covers with the 12 bolts and 4 nuts.

Torque: 8.5 N·m (85 kgf·cm, 75 in·lbf)



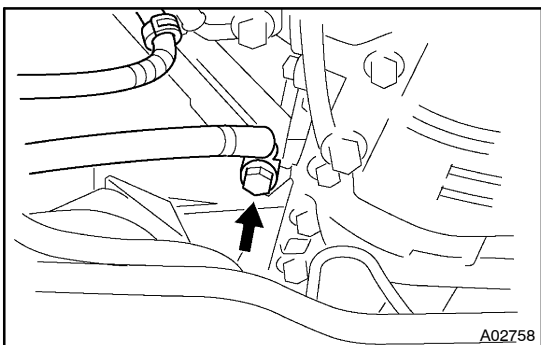
9. INSTALL INTAKE MANIFOLD ASSEMBLY

- (a) Install a new gasket and the intake manifold and delivery pipe assembly with the 7 bolts and 2 nuts.

Torque: 28 N·m (280 kgf·cm, 21 ft·lbf)

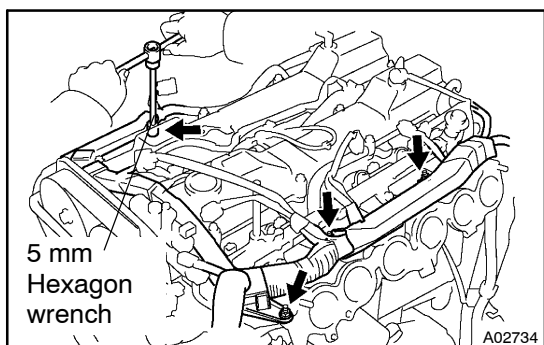
- (b) Pass the water bypass hose between the No.2, No.3 intake ports of the manifold and delivery pipe.
(c) Install the manifold stay with the 2 bolts.

Torque: 40 N·m (400 kgf·cm, 30 ft·lbf)



- (d) Australia and G.C.C. Countries:
Connect the ground cable to the manifold stay.
(e) Install the starter wire to the manifold stay.

10. INSTALL FUEL PRESSURE PULSATION DAMPER (See page FI-27)

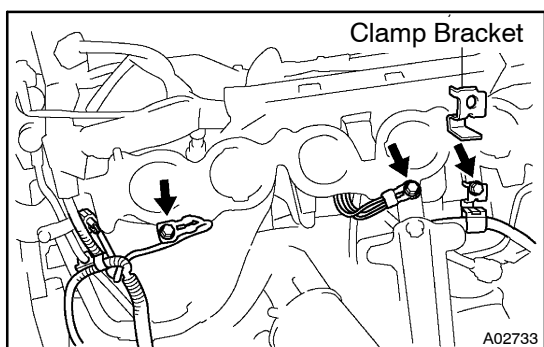
**11. CONNECT ENGINE WIRE TO CYLINDER HEAD**

- (a) Install the engine wire protector with the 3 nuts.
- (b) Using a 5 mm hexagon wrench, install the bolt holding the engine wire protector to the No.2 cylinder head cover.
- (c) Connect these connectors:
 - 6 injector connectors

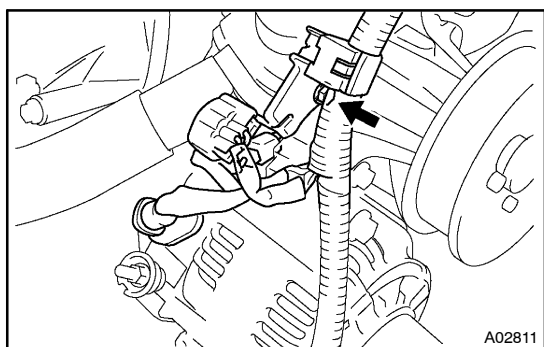
HINT:

The Nos.1, 3, 5 injector connectors and dark gray, and the Nos.2, 4, 6 injector connectors are brown.

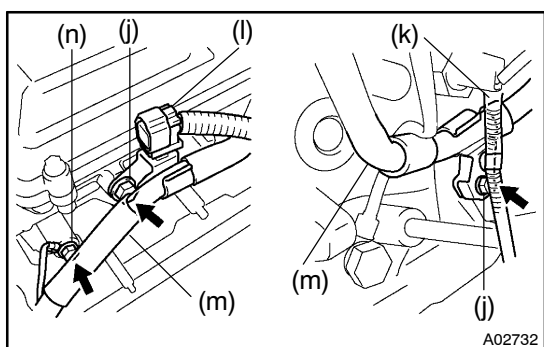
- Camshaft timing oil control valve connector
- Camshaft position sensor connector
- Water temperature sensor connector
- 2 knock sensor connectors
- Starter connector
- Oil pressure switch connector
- Oil level sensor connector



- (d) Install the clamp bracket to the intake manifold.
- (e) Connect the 2 wire clamps to the No.1 oil pipe and clamp bracket on the intake manifold.
- (f) Install the 2 ground terminals to the intake manifold. Tighten so that each calking part should face inside.

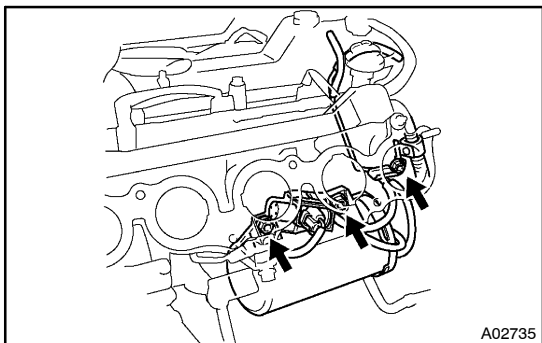


- (g) Install the clamp bracket to the water pump.
- (h) Connect these connectors:
 - Alternator connector
 - Crankshaft position sensor connector
 - w/ TWC:
 - Oxygen sensor (bank 1 sensor 1) connector
- (i) Secure the engine wire with the clamp.



- (j) Install the 2 hose clamps to the cylinder head and oil filter bracket.
- (k) Install the engine wire clamp to the hose clamp.
- (l) w/ TWC:
 - Install the oxygen sensor (bank 2 sensor 1) connector to the hose clamp.
- (m) Install the 2 water bypass hoses to the hose clamps on the cylinder head and oil filter bracket.
- (n) Install the ground strap to the cylinder head.

12. INSTALL SPARK PLUGS
13. INSTALL IGNITION COILS AND HIGH-TENSION CORD SET ASSEMBLY (See page G-9)
14. INSTALL NO.3 TIMING BELT COVER
Torque: 8.0 N·m (80 kgf·cm, 71 in·lbf)



15. INSTALL VACUUM CONTROL VALVE SET AND NO.2 VACUUM PIPE

- (a) Install the vacuum control valve set and No.2 vacuum pipe with the 3 nuts.

Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)

- (b) Install the engine wire clamp to the clamp bracket of the No.2 vacuum pipe.
- (c) Connect the VSV connector for the ACIS.

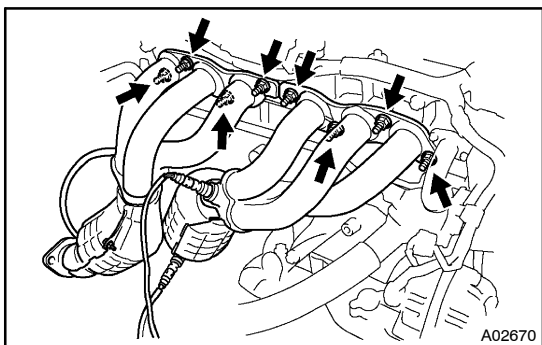
16. INSTALL AIR INTAKE CHAMBER (See page FI-48)

17. INSTALL OIL DIPSTICK AND GUIDE FOR A/T (See page EM-66)

18. INSTALL OIL DIPSTICK AND GUIDE FOR ENGINE (See page LU-12)

19. INSTALL THROTTLE BODY AND INTAKE AIR CONNECTOR ASSEMBLY (See page EM-6)

20. INSTALL WATER BYPASS OUTLET AND NO.1 WATER BYPASS PIPE (See page CO-7)

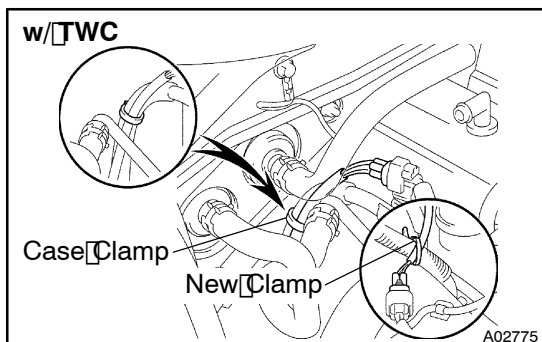


21. INSTALL EXHAUST MANIFOLD

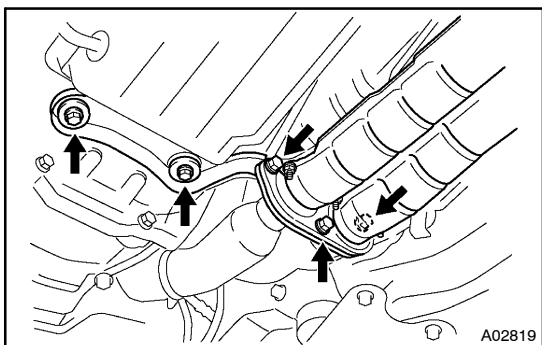
- (a) Install 2 new gaskets to the cylinder head.
- (b) Using a 14 mm deep socket wrench, install the exhaust manifold with the 8 nuts. Uniformly tighten the nuts in several passes.

Torque: 40 N·m (408 kgf·cm, 30 ft·lbf)

- (c) w/ TWC:
Connect the 3 oxygen sensor connectors and clamp.



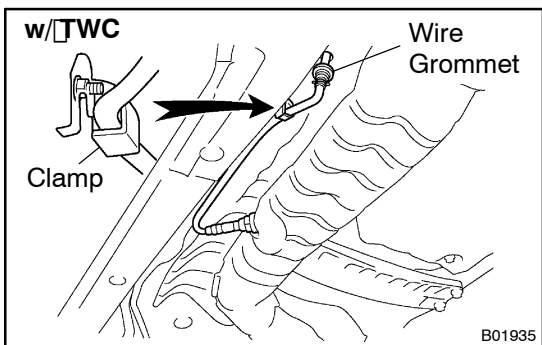
- (d) w/ TWC:
Install a new clamp and the case clamp as shown in the illustration.



22. CONNECT FRONT EXHAUST PIPE TO EXHAUST MANIFOLD

- Temporarily install the pipe support bracket to the transmission with the 2 bolts.
- Install 2 new gaskets to front end of the front exhaust pipe, and connect the front exhaust pipe to the exhaust manifold with the 3 bolts and new nuts.

Torque: 44 N·m (440 kgf·cm, 32 ft·lbf)

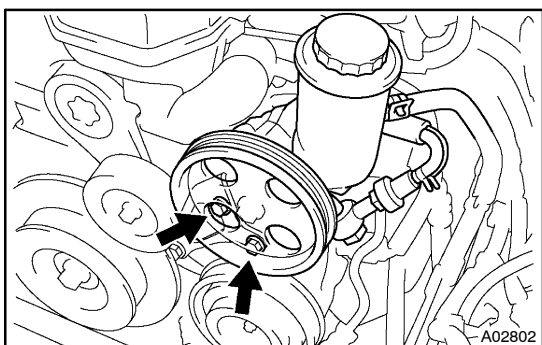


- Tighten the 2 bolts holding the pipe support bracket to the transmission.

Torque: 44 N·m (440 kgf·cm, 32 ft·lbf)

- w/TWC:

Connect the wire grommet and sensor wire of the oxygen sensor (bank 2 sensor 2) to the hole and clamp on the floor.



23. INSTALL PS PUMP

- Install the vane pump with the 2 bolts.
Torque: 58 N·m (590 kgf·cm, 43 ft·lbf)
- Install the pump rear stay with the 2 bolts.
Torque: 39.2 N·m (400 kgf·cm, 29 ft·lbf)
- Connect these hoses:
 - PS air hose to the No. 4 timing belt cover
 - PS air hose to the air intake chamber

24. INSTALL DRIVE BELT (See page CH-16)

25. INSTALL AIR CLEANER, AIR FLOW METER AND INTAKE AIR RESONATOR ASSEMBLY (See page EM-66)

26. INSTALL AIR CLEANER INLET

27. CONNECT UPPER RADIATOR HOSE TO WATER OUTLET

28. FILL WITH ENGINE COOLANT

29. START ENGINE AND CHECK FOR LEAKS

30. INSTALL ENGINE UNDER COVER

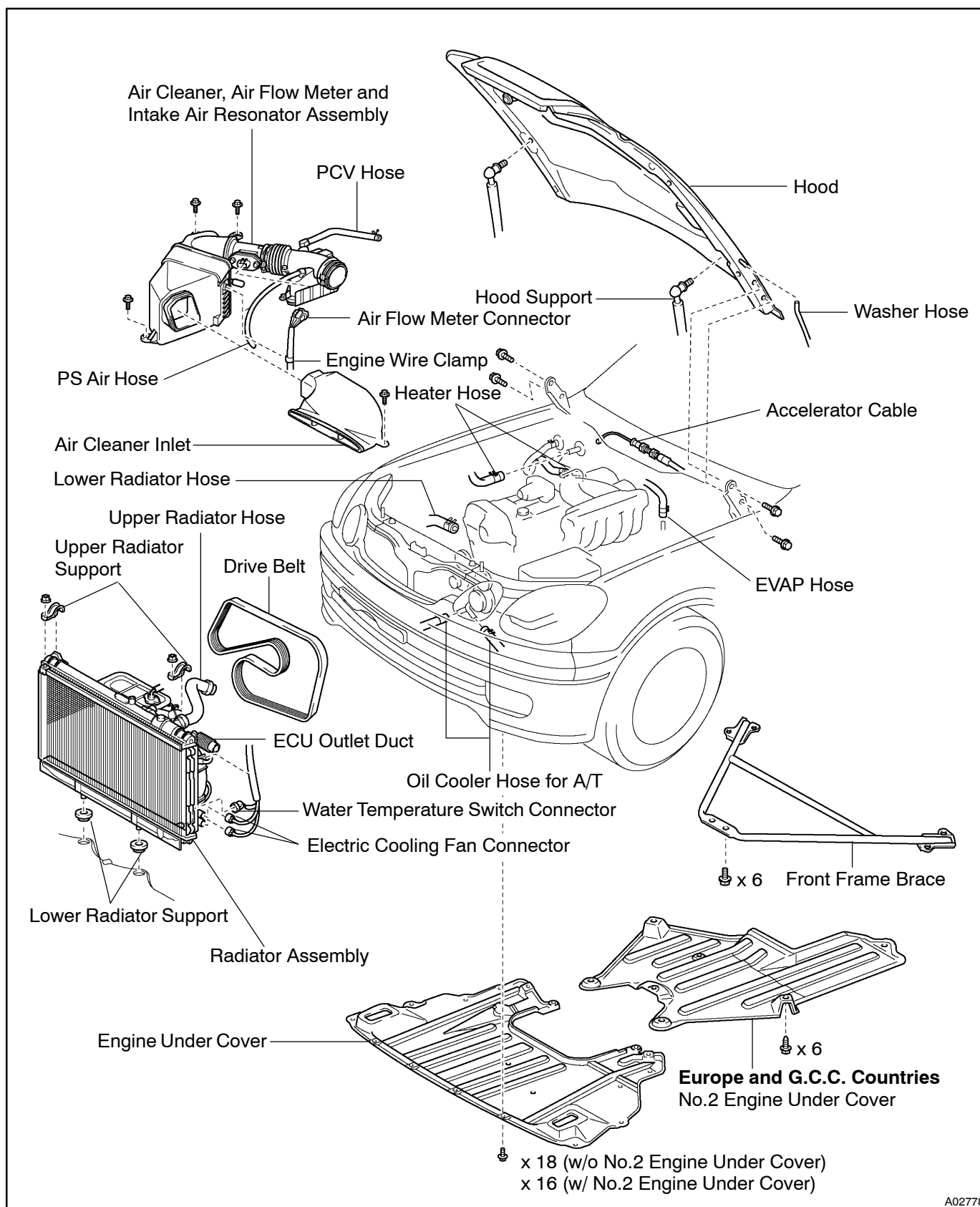
31. ROAD TEST

Check for abnormal noise, shock, slippage, correct shift points and smooth operation.

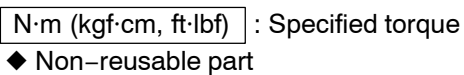
32. RECHECK ENGINE COOLANT LEVEL

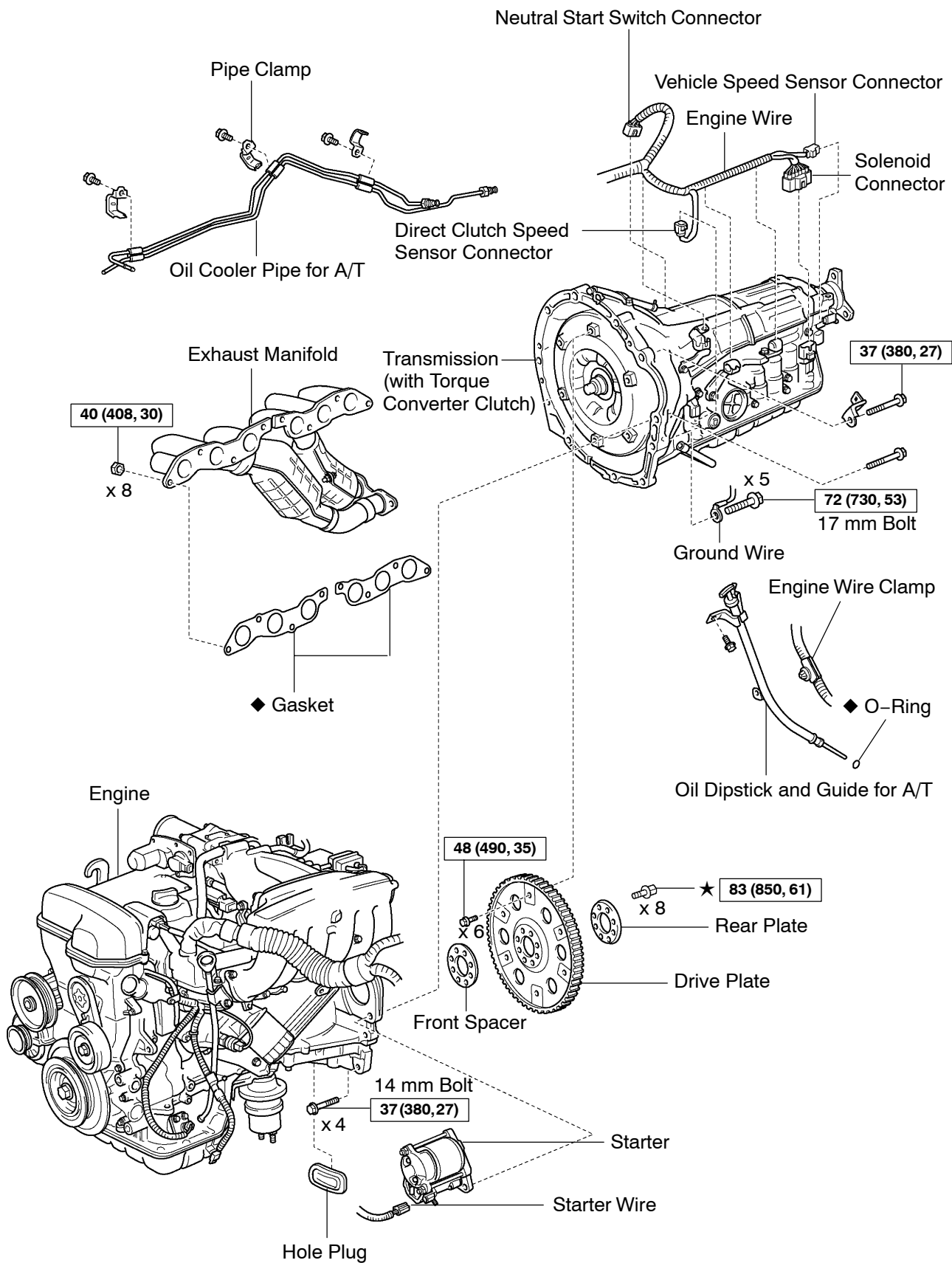
ENGINE UNIT COMPONENTS

EM0DG-02



A02778





N·m (kgf·cm, ft·lbf) : Specified torque

◆ Non-reusable part

A02767

REMOVAL

1. REMOVE HOOD

NOTICE:

Be careful not to damage the body or glass with the hood end.

2. Europe and G.C.C. Countries:

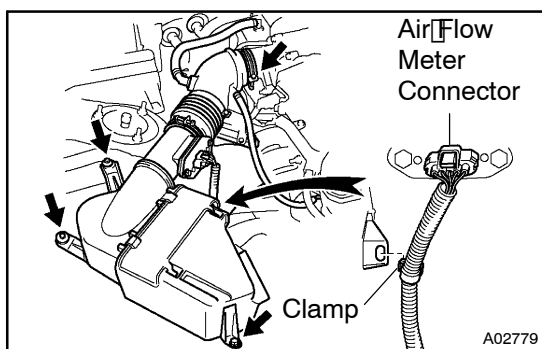
REMOVE NO.2 ENGINE UNDER COVER

3. REMOVE ENGINE UNDER COVER

4. DRAIN ENGINE COOLANT

5. DRAIN ENGINE OIL

6. REMOVE AIR CLEANER INLET

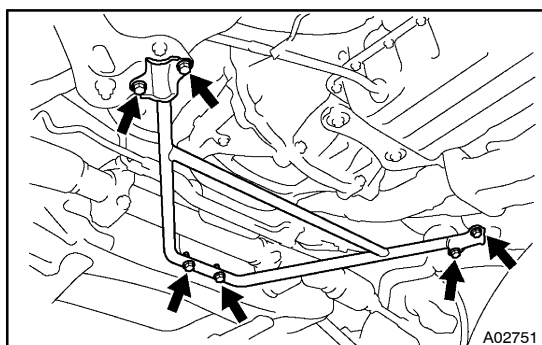


7. REMOVE AIR CLEANER, AIR FLOW METER AND INTAKE AIR RESONATOR ASSEMBLY

(a) Disconnect these connector, clamp and hoses:

- Air flow meter connector
- Engine wire clamp from air cleaner case
- PS air hose from No.4 timing belt cover
- PCV hose from No.2 cylinder head cover

(b) Loosen the hose clamp bolt holding the intake air resonator to the throttle body.



(c) Remove the 3 bolts, the air cleaner, air flow meter and intake air resonator assembly.

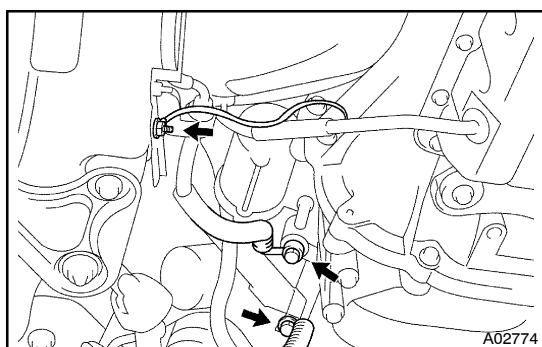
8. DISCONNECT ACCELERATOR CABLE FROM ENGINE

9. REMOVE RADIATOR ASSEMBLY (See page CO-15)

10. REMOVE DRIVE BELT (See page CH-15)

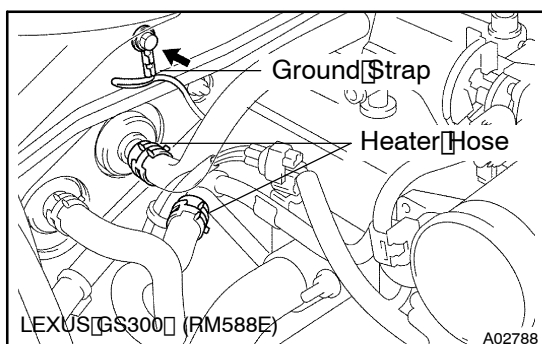
11. REMOVE FRONT FRAME BRACE

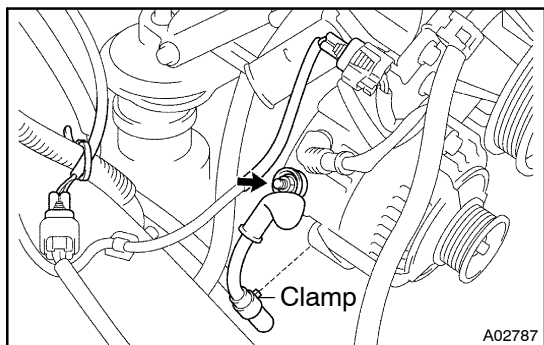
Remove the 6 bolts and brace.



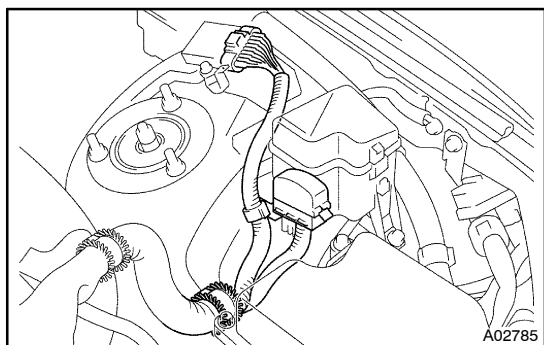
12. DISCONNECT WIRES, CABLE, STRAP, CONNECTORS, HOSES AND CLAMPS

- Ground wire from body
- Starter wire from terminal B and manifold stay
- Fuel inlet hose from fuel pipe support
- Australia and G.C.C. Countries:
Ground cable from manifold stay
- Ground strap from dash panel
- Heater hose from heater pipe
- Heater hose from water bypass pipe
- EVAP hose from pipe (from charcoal canister)

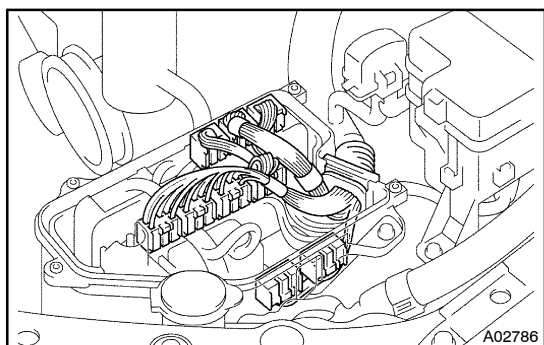




- w/ TWC:
Oxygen sensor (bank 1 sensor 1) connector
- w/ TWC:
Oxygen sensor (bank 1 sensor 2) connector
- Alternator wire
- Engine wire clamp from wire clip of alternator
- LHD:
Ground cable from bracket on cylinder block

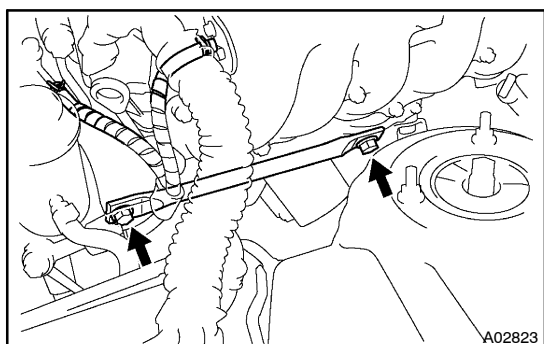


- Igniter connector
- Check connector
- 2 engine wire clamps from clamp brackets



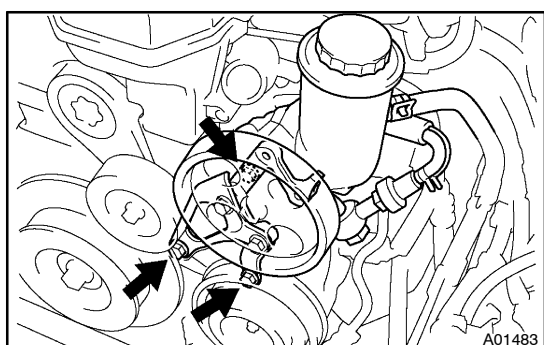
13. DISCONNECT ENGINE WIRE FROM ECU BOX

- Remove these parts:
 - ECU hood
 - ECU cover
- Disconnect these connectors:
 - 3 ECU connectors
 - 4 wire harness connectors
 - 2 junction connectors
- Disconnect the grommet and engine wire from the ECU box.

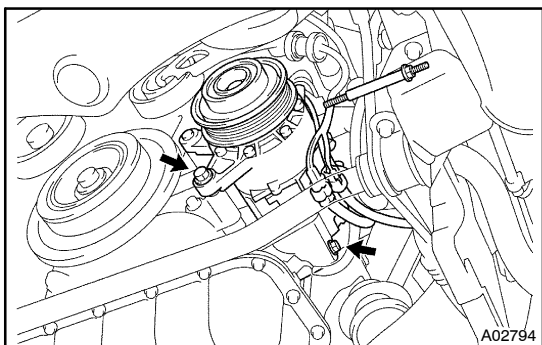


14. DISCONNECT PS PUMP AND A/C COMPRESSOR WITHOUT DISCONNECTING HOSES

- Disconnect these hoses:
 - PS air hose from No.4 timing belt cover
 - PS air hose from air intake chamber
- Remove the 2 bolts and pump rear stay.



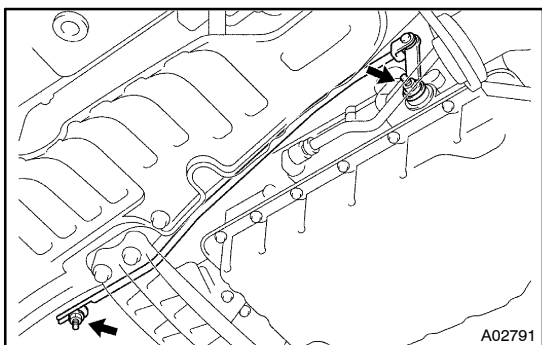
- Remove the 3 bolts and plate washer, and disconnect the vane pump assembly from the engine.



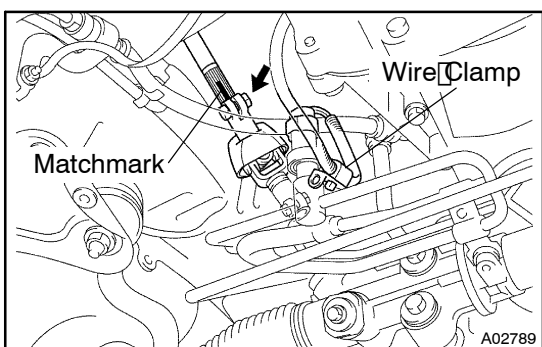
- (d) Loosen the nut.
- (e) Using a Torx socket (E10), remove the stud bolt and nut.
- (f) Disconnect the PPS solenoid valve connector.
- (g) Disconnect the A/C compressor connector.
- (h) Remove the 2 bolts, and disconnect the compressor from the engine.

HINT:

Put aside the vane pump and compressor, and suspend it securely.

**15. REMOVE PROPELLER SHAFT (See page PR-4)****16. REMOVE TRANSMISSION CONTROL ROD**

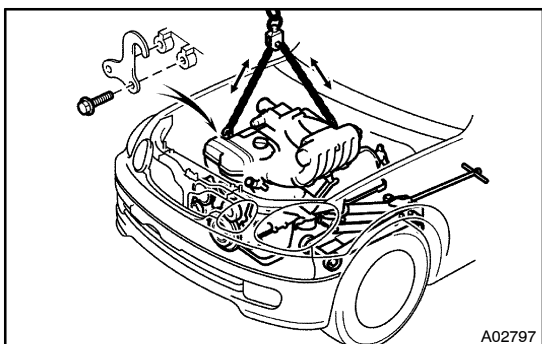
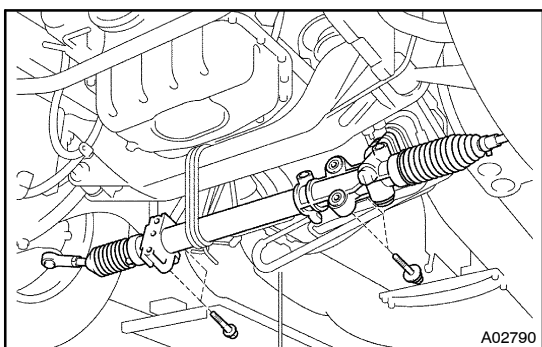
Remove the 2 nuts and control rod.

**17. DISCONNECT PS GEAR HOUSING**

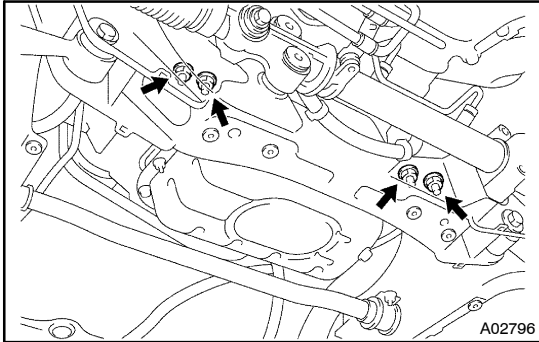
- (a) Check the steering wheel at the straight-ahead position, and place matchmarks on the sliding yoke and intermediate shaft.
- (b) Remove the bolt holding the sliding yoke to the steering intermediate shaft.
- (c) Disconnect the PS pressure switch connector and wire clamp.
- (d) Remove the bolt, and disconnect the 2 PS oil tubes from the front frame.
- (e) Remove the 4 bolts, and disconnect the PS housing from the front frame.
- (f) Disconnect the sliding yoke from the intermediate shaft.

HINT:

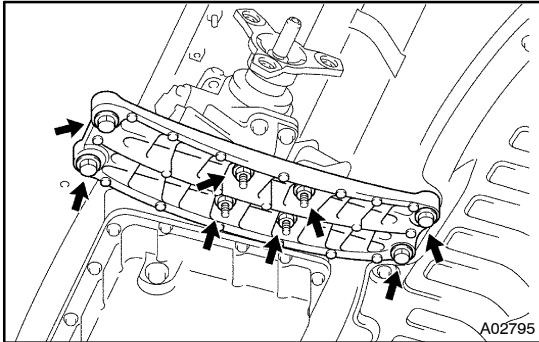
Suspend the PS gear housing securely.

**18. REMOVE ENGINE AND TRANSMISSION ASSEMBLY FROM VEHICLE**

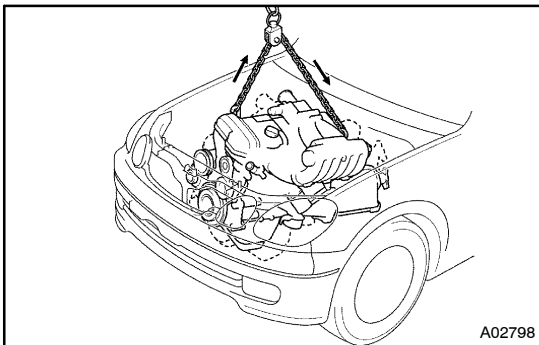
- (a) Install a No.1 engine hanger in the correct direction.
Part No.:
No.1 engine hanger 12281-46050
Bolt 90105-10345
Torque: 40 N·m (400 kgf·cm, 30 ft·lbf)
- (b) Attach the engine chain hoist to the engine hangers.



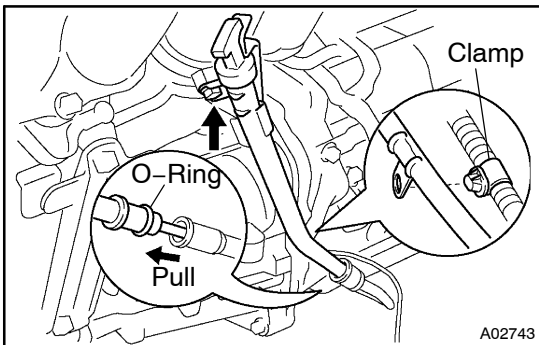
- (c) Remove the 2 hole plugs.
- (d) Remove the 4 nuts holding the engine mounting insulators to the front suspension crossmember.



- (e) Remove the 4 bolts, 4 nuts and rear engine mounting member.

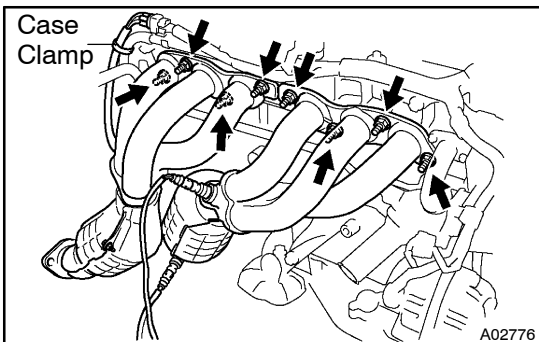


- (f) Lift the engine out of the vehicle slowly and carefully.
- HINT:**
Make sure the engine is clear of all wiring, hoses and cables.
- (g) Place the engine and transmission assembly onto the stand.



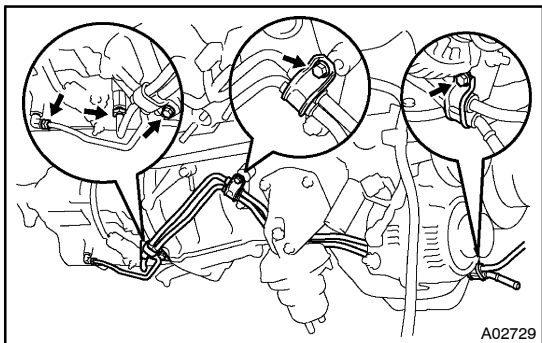
19. REMOVE OIL DIPSTICK AND GUIDE FOR A/T

- (a) Disconnect the engine wire clamp from the dipstick guide.
- (b) Remove the bolt.
- (c) Pull out the dipstick guide and dipstick from the dipstick tube.
- (d) Remove the O-ring from the dipstick guide.

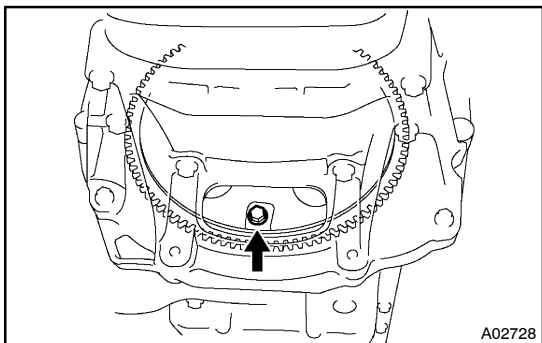


20. REMOVE EXHAUST MANIFOLD

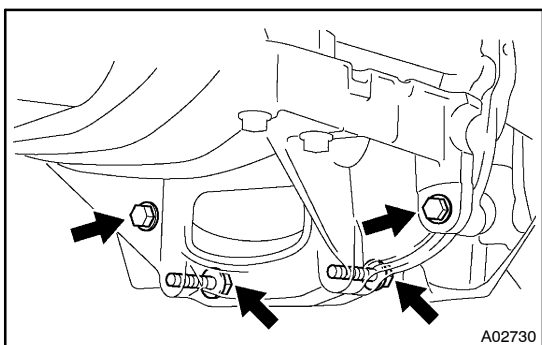
- (a) w/ TWC:
Remove the case clamp.
- (b) w/ TWC:
Disconnect the oxygen sensor (bank 2 sensor 1) connector.
- (c) Remove the 8 nuts, exhaust manifold and 2 gaskets.

**21. REMOVE OIL COOLER PIPES FOR A/T**

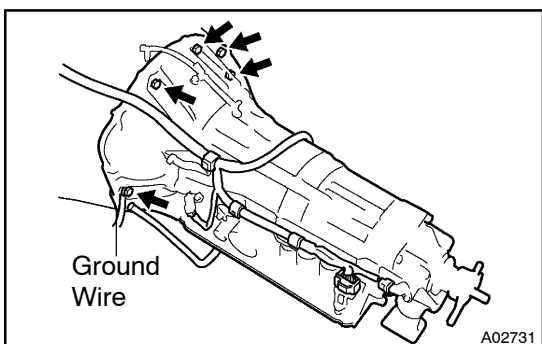
- (a) Remove the 3 bolts and pipe clamps.
- (b) Loosen the 2 union nuts, and remove the 2 oil cooler pipes.

**22. REMOVE TORQUE CONVERTER CLUTCH BOLTS**

- (a) Remove the hole plug.
- (b) Turn the crankshaft pulley bolt to gain access to each bolt.
- (c) Hold the crankshaft pulley bolt with a wrench, and remove the 6 bolts.

**23. REMOVE 4 BOLTS HOLDING NO.1 OIL PAN TO TRANSMISSION****24. REMOVE STARTER**

- (a) Disconnect the starter connector.
- (b) Remove the 2 bolts, clamp bracket and starter.

**25. DISCONNECT ENGINE WIRE FROM TRANSMISSION**

Disconnect these connectors and wire:

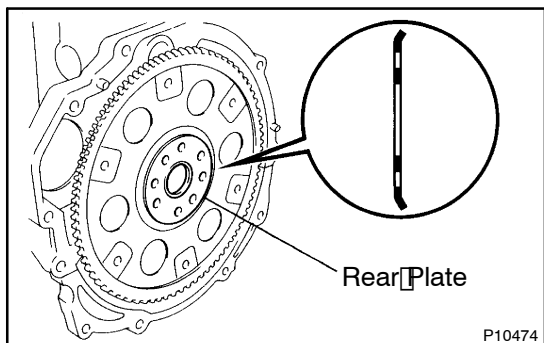
- Vehicle speed sensor connector
- Neutral switch connector
- Solenoid connector
- Direct clutch speed sensor connector
- Engine wire from 3 wire clamps

26. REMOVE TRANSMISSION FROM ENGINE

- (a) Remove the 5 bolts and ground wire.
- (b) Remove the transmission together with the torque converter clutch from the engine.

27. REMOVE DRIVE PLATE

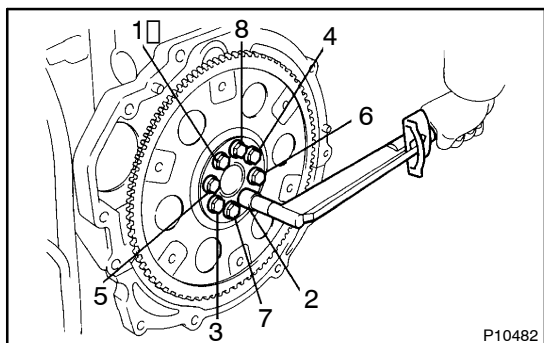
Remove the 8 bolts, rear plate, drive plate and front spacer.



INSTALLATION

1. INSTALL DRIVE PLATE

- (a) Install the front spacer, drive plate and rear plate on the crankshaft.



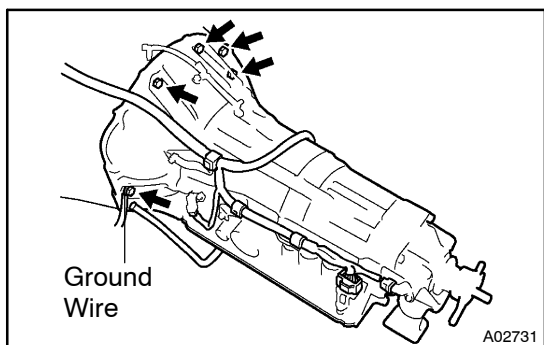
- (b) Apply adhesive to 2 or 3 threads of the mounting bolt end.

Adhesive:

Part No. 08833-00070, THREE BOND 1324 or equivalent

- (c) Install the uniformly tighten the 8 mounting bolts, in several passes, in the sequence shown.

Torque: 83 N·m (850 kgf·cm, 61 ft·lbf)



2. INSTALL TRANSMISSION TO ENGINE

- (a) Check the torque converter clutch installation.
(See page AT-34)

- (b) Attach the transmission to the engine.

- (c) Install the ground wire and 5 bolts.

Torque: 72 N·m (730 kgf·cm, 53 ft·lbf)

3. CONNECT ENGINE WIRE TO TRANSMISSION

Connect these connectors and wire:

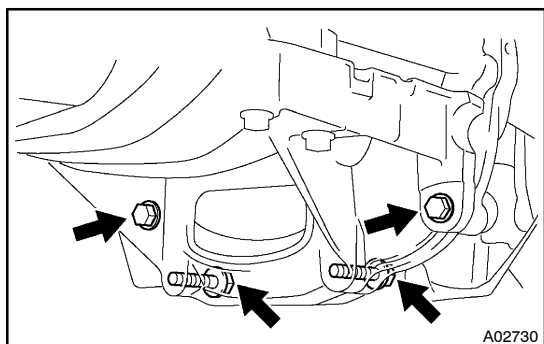
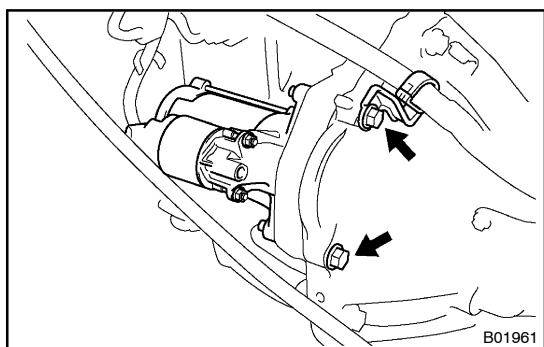
- Vehicle speed sensor connector
- Neutral start switch connector
- Solenoid connector
- Direct clutch speed sensor connector
- Engine wire to 3 wire clamps

4. INSTALL STARTER

- (a) Install the starter and clamp bracket with the 2 bolts.

Torque: 37 N·m (380 kgf·cm, 27 ft·lbf)

- (b) Connect the starter connector.



5. INSTALL 4 BOLTS HOLDING NO. 1 OIL PAN TO TRANSMISSION

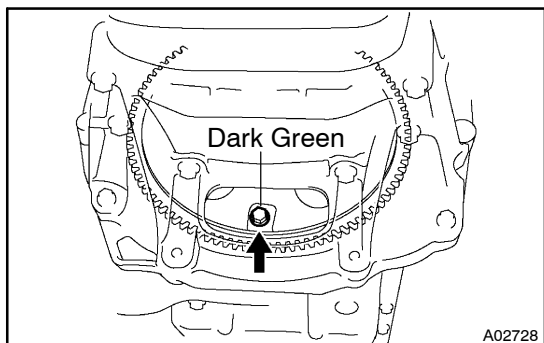
Torque: 37 N·m (380 kgf·cm, 27 ft·lbf)

6. INSTALL TORQUE CONVERTER CLUTCH BOLTS

- (a) Apply adhesive to 2 or 3 threads of the bolt end.

Adhesive:

Part No. 08833-00070, THREE BOND 1324 or equivalent



- (b) Hold the crankshaft pulley bolt with a wrench, and install the 6 bolts evenly.

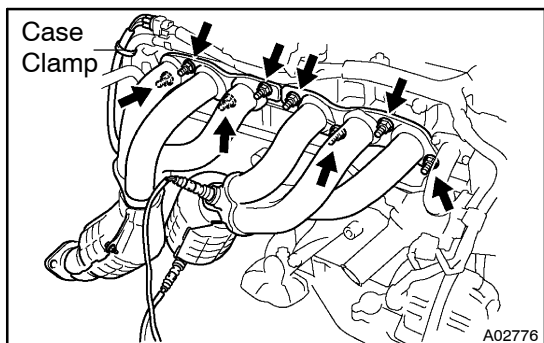
Torque: 48 N·m (490 kgf·cm, 35 ft·lbf)

HINT:

First install the dark green colored bolt, install the other bolts.

- (c) Install the hole plug.

7. INSTALL OIL COOLER PIPE FOR A/T



8. INSTALL EXHAUST MANIFOLD

- (a) Install 2 new gaskets to the cylinder head.

- (b) Using a 14 mm deep socket wrench, install the exhaust manifold with the 8 nuts. Uniformly tighten the nuts in several passes.

Torque: 40 N·m (408 kgf·cm, 30 ft·lbf)

- (c) w/ TWC:

Connect the oxygen sensor (bank 2 sensor 1) connector.

- (d) w/ TWC:

Install the case clamp.

9. INSTALL OIL DIPSTICK GUIDE AND DIPSTICK FOR A/T

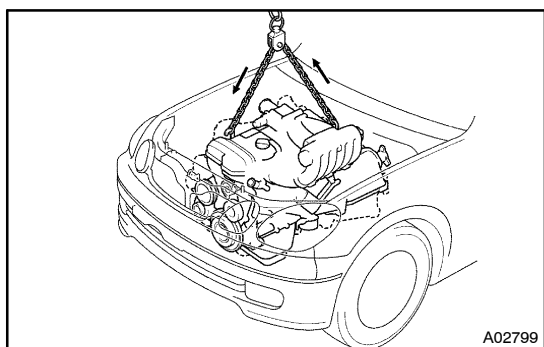
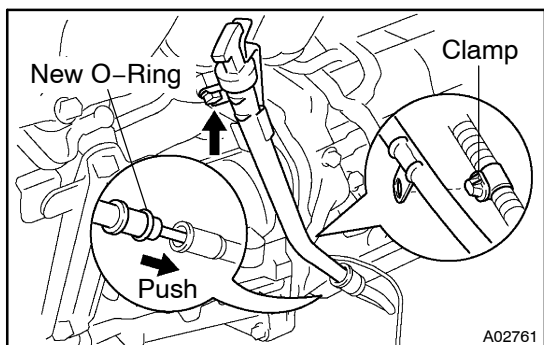
- (a) Install a new O-ring to the dipstick guide.

- (b) Push in the dipstick guide end to the dipstick tube of the oil pan.

- (c) Install the dipstick guide with the bolt.

- (d) Connect the engine wire clamp to the dipstick guide.

- (e) Install the dipstick.



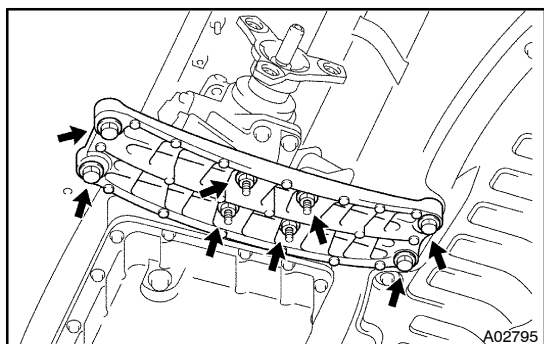
10. INSTALL ENGINE AND TRANSMISSION ASSEMBLY IN VEHICLE

- (a) Attach the engine chain hoist to the engine hangers.

- (b) Slowly lower the engine and transmission assembly into the engine compartment.

- (c) Insert the stud bolts of the front engine mounting brackets into the stud bolt holes of the front suspension crossmember.

- (d) Keep the engine level.



- (e) Install the rear engine mounting member with the 4 bolts and 4 nuts.

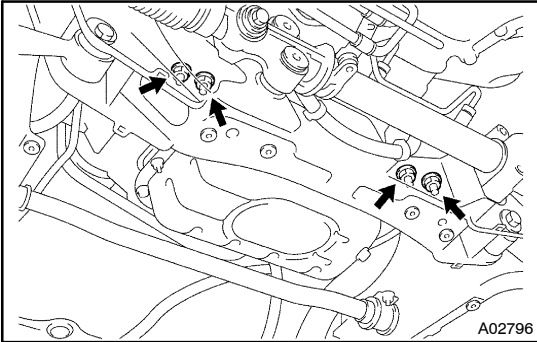
Torque:

25.5 N·m (260 kgf·cm, 19 ft·lbf) for bolts

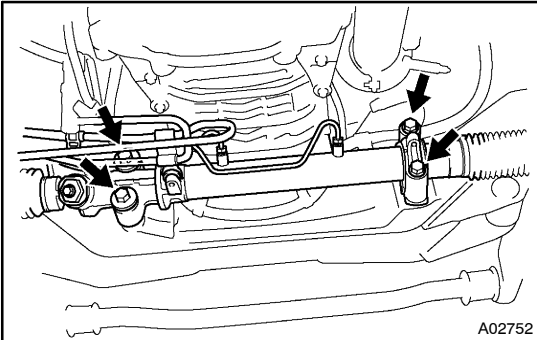
13.5 N·m (135 kgf·cm 10 ft·lbf) for nuts

NOTICE:

Be careful of installation direction.

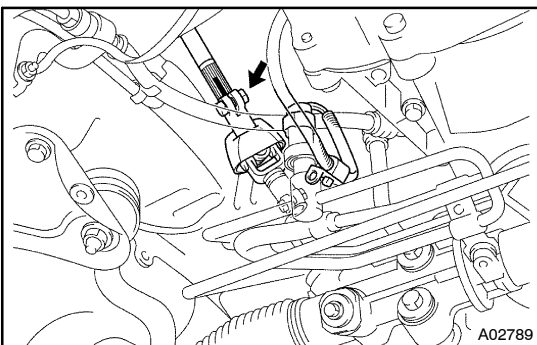


- (f) Install the 4 nuts holding the engine mounting brackets to the front suspension crossmember.
Torque: 70 N·m (714 kgf·cm, 52 ft·lbf)
- (g) Install the 2 hole plugs.
- (h) Remove the engine chain hoist.
- (i) Remove the bolt and No.1 engine hanger.

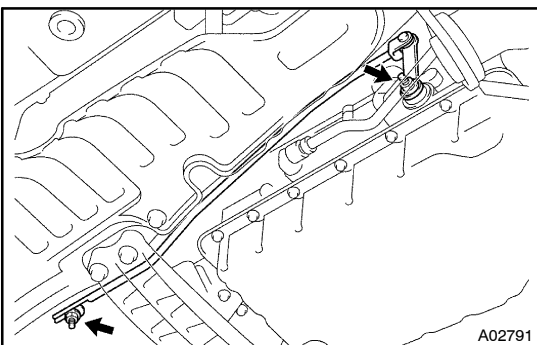


11. INSTALL PS GEAR HOUSING

- (a) Align the matchmarks and connect the sliding yoke to the steering intermediate shaft.
- (b) Install the PS gear housing with the 4 bolts.
Torque: 65 N·m (660 kgf·cm, 48 ft·lbf)
- (c) Install the 2 PS oil tube with the bolt.



- (d) Install the bolt holding the sliding yoke to the steering intermediate shaft.
Torque: 35 N·m (360 kgf·cm, 26 ft·lbf)
- (e) Connect the PS pressure switch and wire clamp.



12. INSTALL TRANSMISSION CONTROL ROD

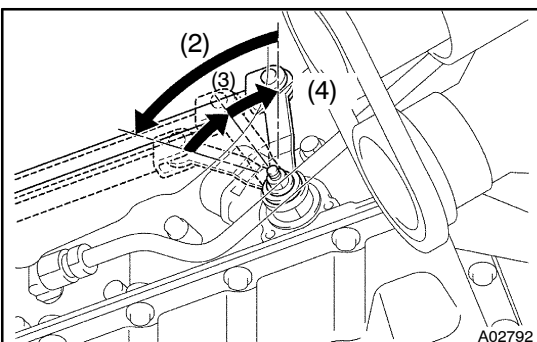
Install the control rod with the 2 nuts.

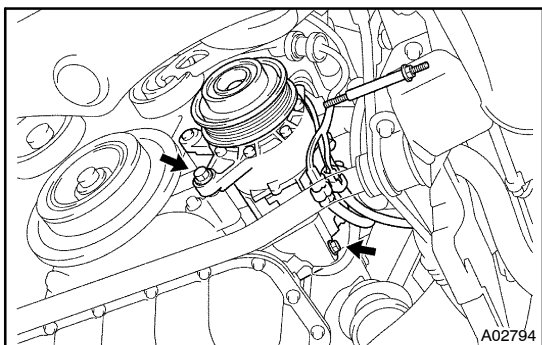
Torque: 13 N·m (130 kgf·cm, 9 ft·lbf)

If the indicator is not aligned with the correct position, carry out the following adjustment procedures.

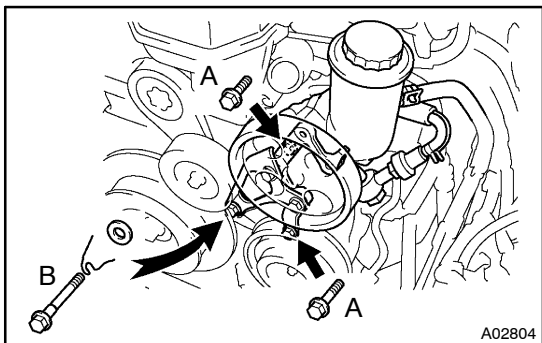
- (1) Loosen the nut on the shift lever.
- (2) Push the control shaft lever fully rearward.
- (3) Return the control shaft lever 2 notches to the N position.
- (4) Set the shift lever to the N position.
- (5) While holding the shift lever lightly toward the R position side, tighten the nut.

Torque: 13 N·m (130 kgf·cm, 9 ft·lbf)

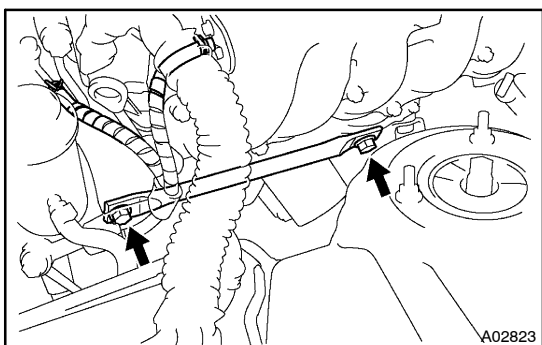


**13. INSTALL A/C COMPRESSOR AND PS PUMP**

- (a) Temporarily install the compressor with the 2 bolts.
- (b) Using a torx socket (E10), install the stud bolt.
Torque: 26 N·m (265 kgf·cm, 19 ft·lbf)
- (c) Tighten the nut and 2 bolts.
Torque: 52 N·m (530 kgf·cm, 38 ft·lbf)
- (d) Connect the compressor connector.
- (e) Connect the PPS solenoid valve connector.



- (f) Install the vane pump assembly with the 3 bolts and plate washer.

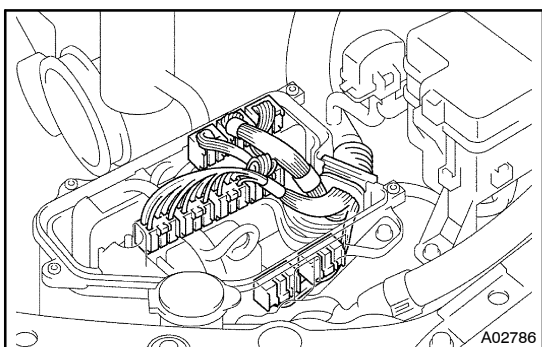
Torque:**57.9 N·m (590 kgf·cm, 43 ft·lbf) for A bolts****52 N·m (530 kgf·cm, 38 ft·lbf) for B bolt**

- (g) Install the pump rear stay with the 2 bolts.

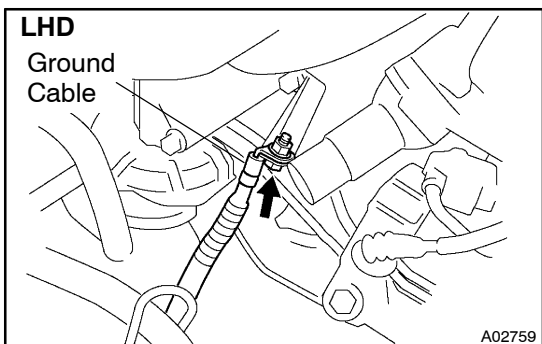
Torque: 39.2 N·m (400 kgf·cm, 29 ft·lbf)

- (h) Connect these hoses:

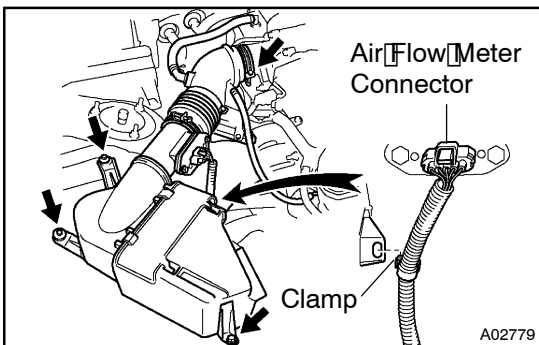
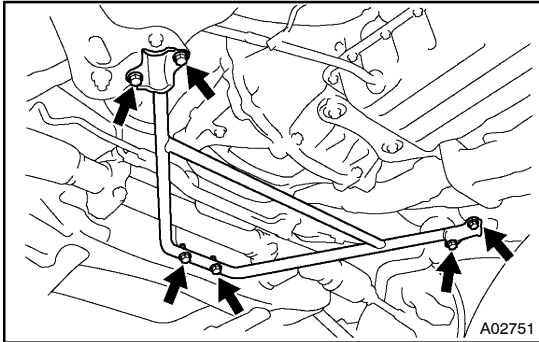
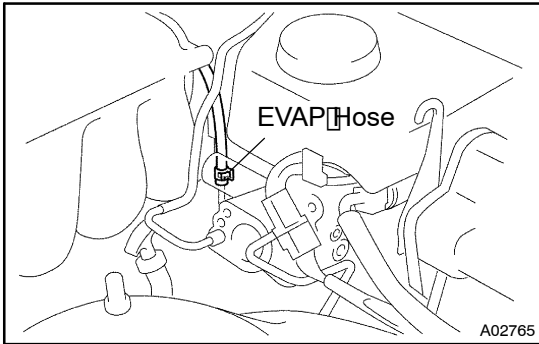
- PS air hose to No.4 timing belt cover
- PS air hose to air intake chamber

**14. CONNECT ENGINE WIRE TO ECU BOX**

- (a) Install the engine wire grommet to the ECU box.
- (b) Connect these connectors:
 - 3 ECU connectors
 - 4 wire harness connectors
 - 2 junction connectors
- (c) Install these parts:
 - ECU cover
 - ECU hood

**15. CONNECT CLAMPS, WIRES, CONNECTORS, HOSES, CABLE AND STRAP**

- 2 engine wire clamps to clamp brackets
- Check connector
- Igniter connector
- LHD:
 - Ground cable to bracket on cylinder block
- Engine wire clamp to wire clip of alternator
- Alternator wire



- w/TWC:
Oxygen sensor (bank 1 sensor 1) connector
- w/TWC:
Oxygen sensor (bank 1 sensor 2) connector
- EVAP hose to pipe (from charcoal canister)
- Heater hose to heater pipe
- Heater hose to water bypass pipe
- Ground strap to dash panel
- Australia and G.C.C. Countries:
Ground cable to manifold stay
- Fuel inlet hose to fuel pipe support

Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)

- Starter wire to terminal B and manifold stay
- Ground wire to body

16. INSTALL FRONT FRAME BRACE

Install the brace with the 6 bolts.

Torque: 58 N·m (590 kgf·cm, 43 ft·lbf)

17. INSTALL DRIVE BELT (See page CH-16)

18. INSTALL RADIATOR ASSEMBLY (See page CO-21)

19. CONNECT ACCELERATOR CABLE TO ENGINE

20. INSTALL AIR CLEANER, AIR FLOW METER AND INTAKE AIR RESONATOR ASSEMBLY

- (a) Connect the intake air resonator to the throttle body.
- (b) Install the air cleaner case with the 3 bolts.
- (c) Tighten the hose clamp bolt holding the intake air resonator to the throttle body.
- (d) Connect the connector, clamp and hoses:
 - Air flow meter connector
 - Engine wire clamp to air cleaner case
 - PS air hose to No.4 timing belt cover
 - PCV hose to No.2 cylinder head cover

21. INSTALL AIR CLEANER INLET

22. FILL WITH ENGINE COOLANT

23. FILL WITH ENGINE OIL

24. START ENGINE AND CHECK FOR LEAKS

25. INSTALL ENGINE UNDER COVER

26. Europe and G.C.C. Countries: INSTALL NO.2 ENGINE UNDER COVER

27. INSTALL HOOD

NOTICE:

Be careful not to damage the body or glass with the hood end.

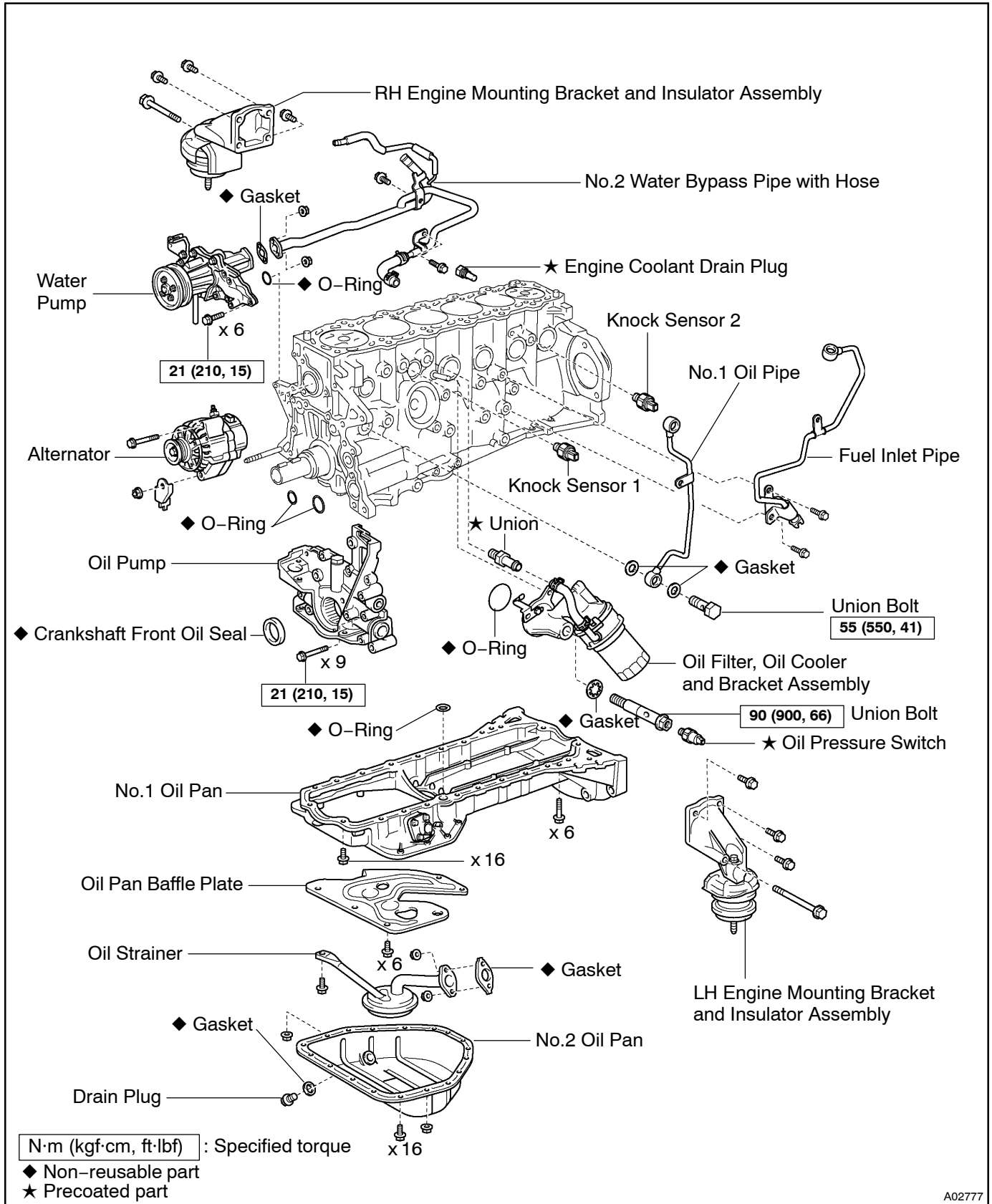
28. PERFORM ROAD TEST

Check for abnormal noise, shock, slippage, correct shift points and smooth operation.

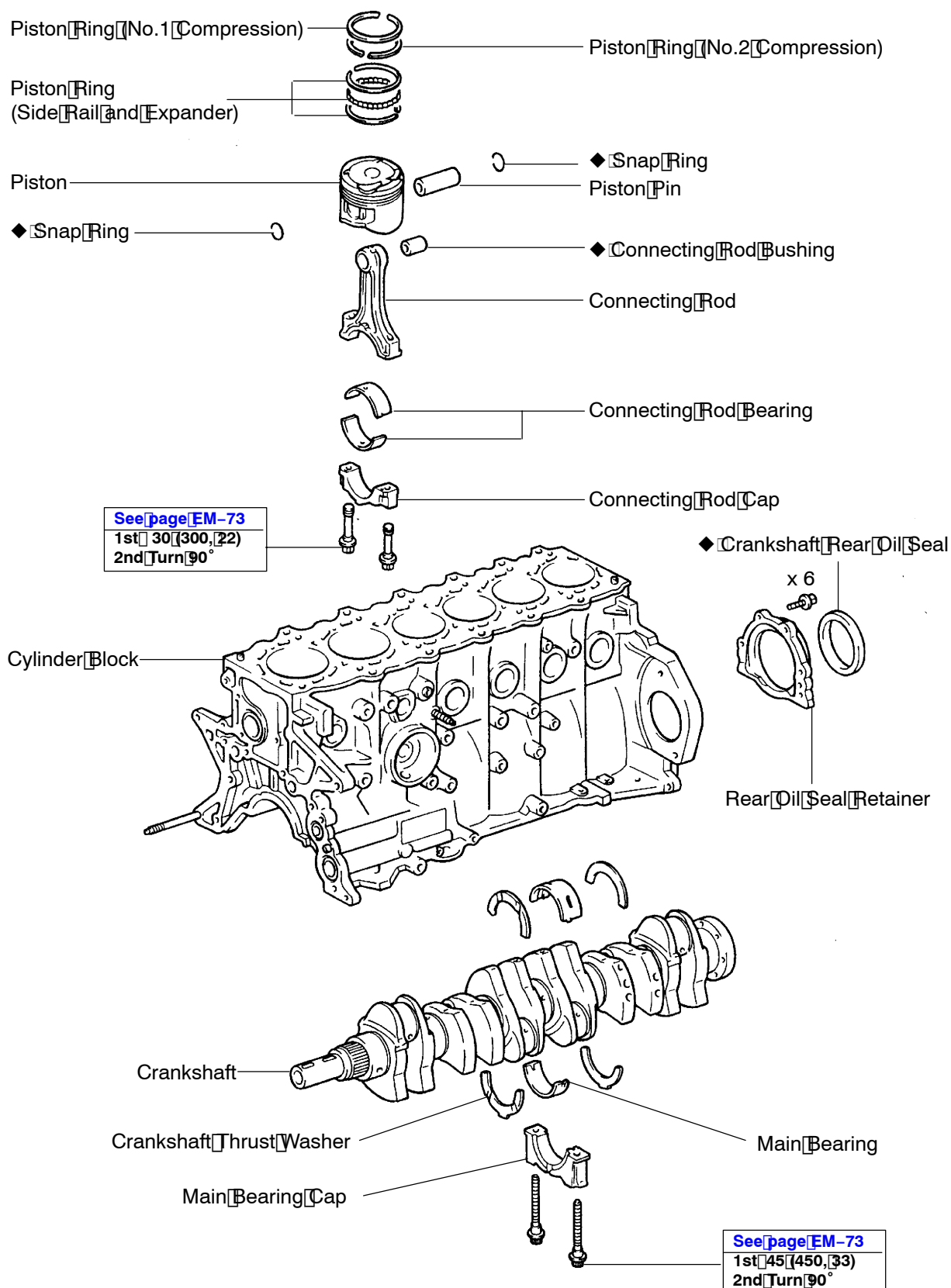
29. RECHECK ENGINE COOLANT AND OIL LEVELS

CYLINDER BLOCK COMPONENTS

EM0DJ-02



A02777



N·m (kgf·cm, ft·lbf) : Specified Torque

◆ Non-reusable part

DISASSEMBLY

1. INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY

2. REMOVE ALTERNATOR

Remove the bolt, nut, pipe bracket and alternator.

3. REMOVE TIMING BELT AND PULLEYS

(See page EM-17)

4. REMOVE NO.2 WATER BYPASS PIPE WITH HOSE

(a) Disconnect the water bypass hose from the oil cooler.

(b) Remove the 2 bolts, 2 nuts, No.2 water bypass pipe and gasket.

5. REMOVE WATER PUMP

Remove the 6 bolts, water pump and O-ring.

6. REMOVE CYLINDER HEAD (See page EM-33)

7. REMOVE OIL PRESSURE SWITCH AND KNOCK SENSORS

Using SST, remove the switch and sensors.

SST 09816-30010

8. REMOVE OIL FILTER, OIL COOLER AND BRACKET ASSEMBLY

(a) Disconnect the water bypass hose from the union.

(b) Remove the union bolt and oil filter bracket.

(c) Remove the gasket from the union bolt.

(d) Remove the O-ring from the oil filter bracket.

9. REMOVE NO.1 OIL PIPE

Remove the union bolt, No.1 oil pipe and 2 gaskets.

10. REMOVE FUEL INLET PIPE

Remove the 2 bolts and fuel inlet pipe.

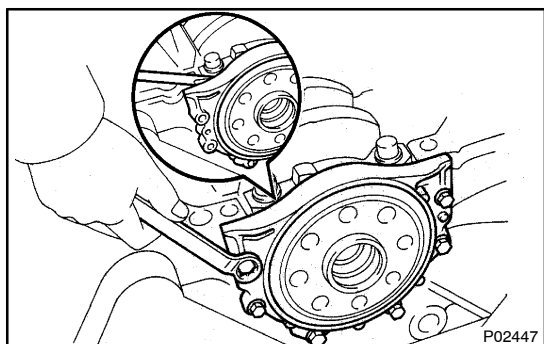
11. REMOVE LH ENGINE MOUNTING BRACKET AND INSULATOR ASSEMBLY

Remove the 4 bolts and mounting bracket.

12. REMOVE RH ENGINE MOUNTING BRACKET AND INSULATOR ASSEMBLY

Remove the 4 bolts and mounting bracket.

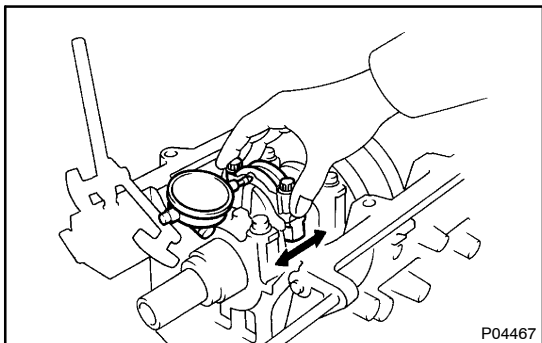
13. REMOVE OIL PUMP (See page LU-6)



14. REMOVE REAR OIL SEAL RETAINER

(a) Remove the 6 bolts of the retainer.

(b) Remove the oil seal retainer by prying the area between the oil seal retainer and main bearing cap with a screwdriver.



15. CHECK CONNECTING ROD THRUST CLEARANCE

Using a dial indicator, measure the thrust clearance while moving the connecting rods back and forth.

Standard thrust clearance:

0.250 – 0.402 mm (0.0098 – 0.0158 in.)

Maximum thrust clearance:

0.50 mm (0.0197 in.)

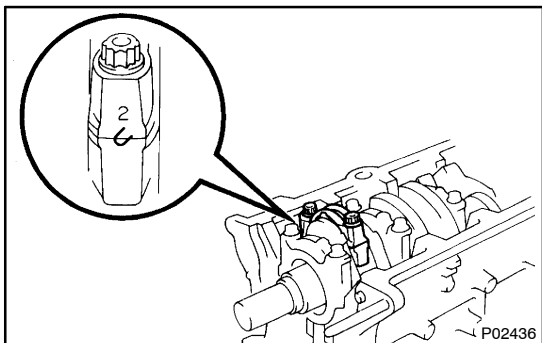
If the thrust clearance is greater than maximum, replace the connecting rod assembly(s). If necessary, replace the crankshaft.

Connecting rod thickness:

25.898 – 25.950 mm (1.0196 – 1.0217 in.)

16. REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE

- (a) Check the matchmarks on the connecting rod and cap to ensure correct reassembly.
- (b) Remove the connecting rod cap bolts.

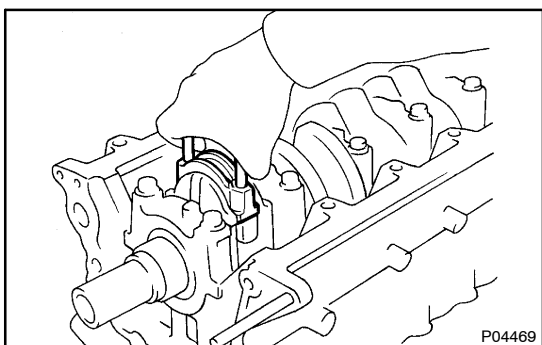


- (c) Using the 2 removed connecting rod bolts, remove the connecting rod cap and lower bearing by wiggling the connecting rod cap right and left.

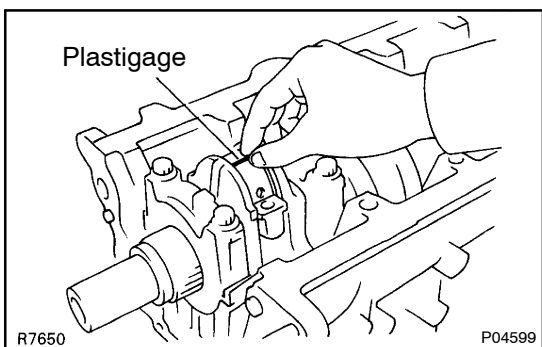
HINT:

Keep the lower bearing inserted with the connecting rod cap.

- (d) Clean the crank pin and bearings.
- (e) Check the crank pin and bearing for pitting and scratches. If the crank pin or bearing is damaged, replace the bearings. If necessary, replace the crankshaft.



- (f) Lay a strip of Plastigage across the crank pin.



- (g) Install the connecting rod cap with the 2 bolts. (See page EM-88)

Torque:

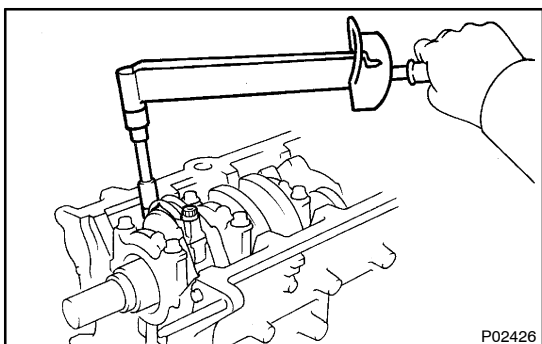
1st 30 N·m (300 kgf·cm, 22 ft·lbf)

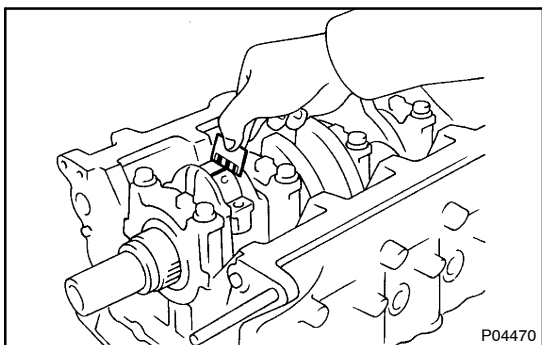
2nd Turn extra 90°

NOTICE:

Do not turn the crankshaft.

- (h) Remove the 2 bolts, connecting rod cap and lower bearing. (See procedure (b) and (c) above)





- (i) Measure the Plastigage at its widest point.
Standard oil clearance:
STD 0.023 – 0.041 mm (0.0009 – 0.0016 in.)
U/S 0.25 0.028 – 0.066 mm (0.0011 – 0.0026 in.)
Maximum oil clearance.
STD 0.07 mm (0.0027 in.)
U/S 0.25 0.08 mm (0.0031 in.)

If the oil clearance is greater than maximum, replace the bearings. If necessary, grind or replace the crankshaft

HINT:

If using a standard bearing, replace with one having the same number. If the number of the bearing cannot be determined, select the correct bearing by adding together the numbers imprinted on the connecting rod cap and crankshaft, then selecting the bearing with the same number as the total. There are 5 sizes of standard bearings, marked "1", "2", "3", "4" and "5" accordingly.

	Number mark								
	1			2			3		
Connecting rod cap									
Crankshaft	0	1	2	0	1	2	0	1	2
Use bearing	1	2	3	2	3	4	3	4	5

EXAMPLE: Connecting rod cap "3" + Crankshaft "1"
 = Total number 4 (Use bearing "4")

Reference

Connecting rod big end inside diameter:

Mark "1"	55.025 – 55.031 mm (2.1663 – 2.1666 in.)
Mark "2"	55.031 – 55.037 mm (2.1666 – 2.1668 in.)
Mark "3"	55.037 – 55.043 mm (2.1668 – 2.1670 in.)

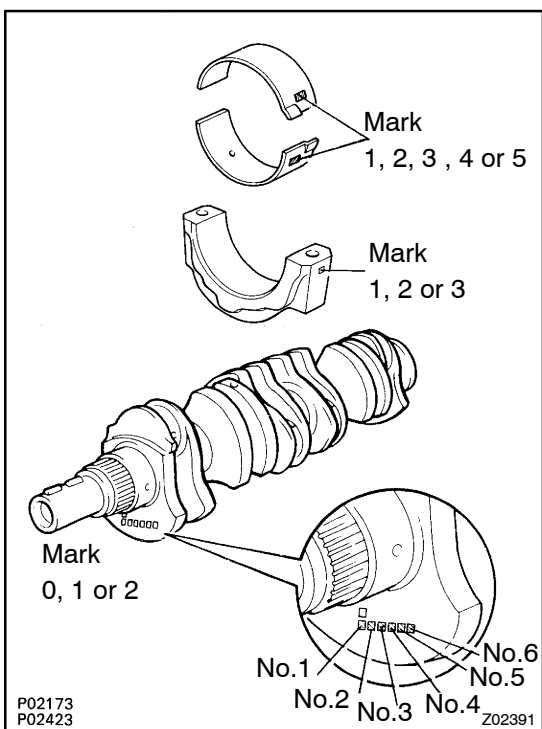
Crankshaft crank pin diameter:

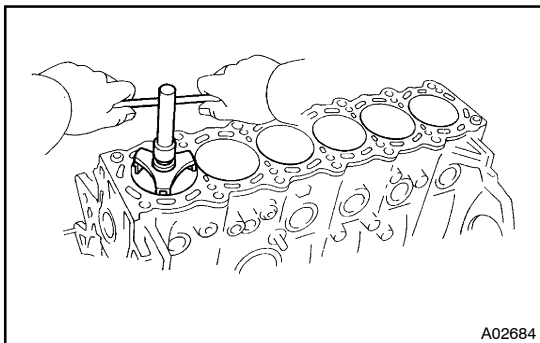
Mark "0"	51.994 – 52.000 mm (2.0470 – 2.0472 in.)
Mark "1"	51.988 – 51.994 mm (2.0468 – 2.0470 in.)
Mark "2"	51.982 – 51.988 mm (2.0465 – 2.0468 in.)

Standard sized bearing center wall thickness:

Mark "1"	1.498 – 1.501 mm (0.0590 – 0.0591 in.)
Mark "2"	1.501 – 1.504 mm (0.0591 – 0.0592 in.)
Mark "3"	1.504 – 1.507 mm (0.0592 – 0.0593 in.)
Mark "4"	1.507 – 1.510 mm (0.0593 – 0.0594 in.)
Mark "5"	1.510 – 1.513 mm (0.0594 – 0.0596 in.)

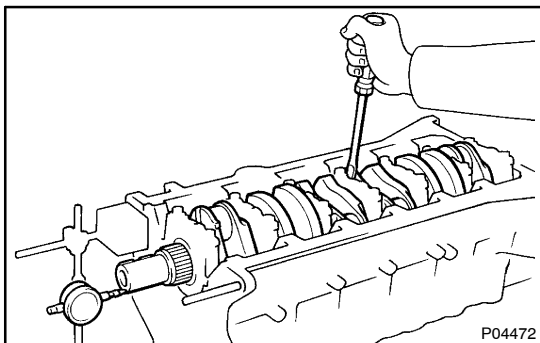
- (j) Completely remove the Plastigage.





17. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

- (a) Using a ridge reamer, remove all the carbon from the top of the cylinder.
- (b) Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.
 - Keep the bearings, connecting rod and cap together.
 - Arrange the piston and connecting rod assemblies in correct order.



18. CHECK CRANKSHAFT THRUST CLEARANCE

Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

Standard thrust clearance:

0.020 – 0.220 mm (0.0008 – 0.0087 in.)

Maximum thrust clearance:

0.30 mm (0.0118 in.)

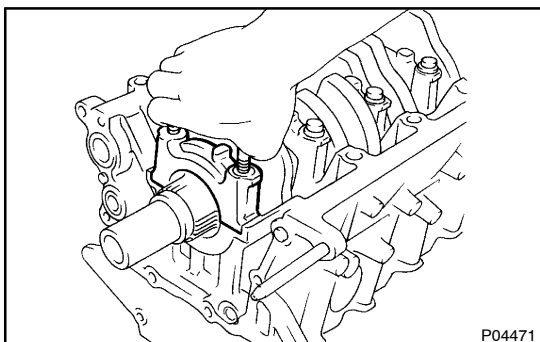
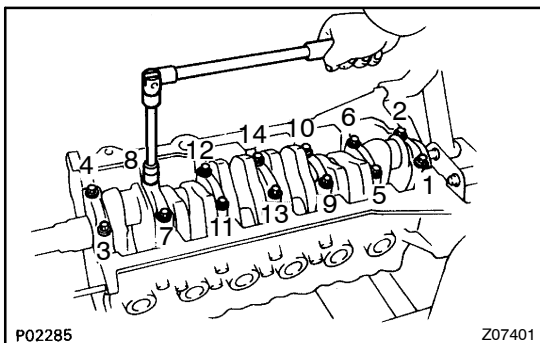
If the thrust clearance is greater than maximum, replace the thrust washers as a set.

Thrust washer thickness:

1.940 – 1.990 mm (0.0764 – 0.0783 in.)

19. REMOVE MAIN BEARING CAPS AND CHECK OIL CLEARANCE

- (a) Uniformly loosen and remove the 14 main bearing cap bolts, in several passes, in the sequence shown.



- (b) Using the removed main bearing cap bolts, pry the main bearing cap back and forth, and remove the main bearing caps, lower bearings and lower thrust washers (No.4 main bearing cap only).

HINT:

- Keep the lower bearing and main bearing cap together.
- Arrange the main bearing caps and lower thrust washers in correct order.

- (c) Lift out the crankshaft.

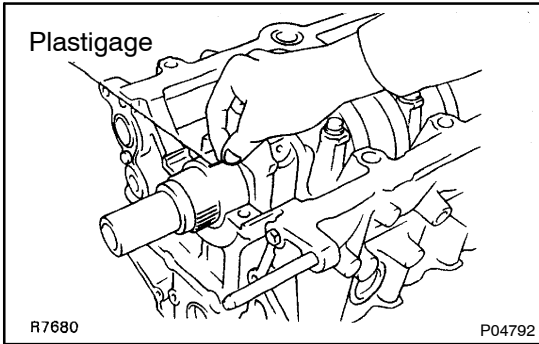
HINT:

Keep the upper bearing and upper thrust washers together with the cylinder block.

- (d) Clean each main journal and bearing.
- (e) Check each main journal and bearing for pitting and scratches.

If the journal or bearing is damaged, replace the bearings. If necessary, grind or replace the crankshaft.

- (f) Place the crankshaft on the cylinder block.



- (g) Lay a strip of Plastigage across each journal.
 (h) Install the main bearing caps. (See page EM-88)

Torque:

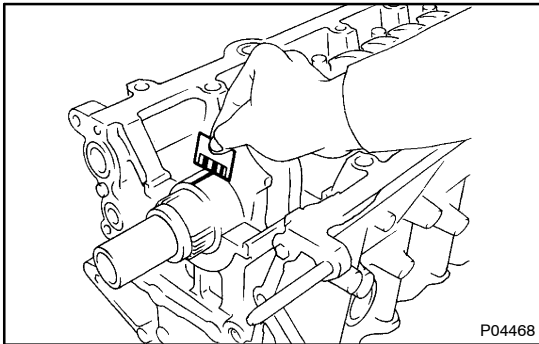
1st 45 N·m (450 kgf·cm, 33 ft·lbf)

2nd Turn extra 90°

NOTICE:

Do not turn the crankshaft.

- (i) Remove the main bearing caps.
 (See procedures (a) and (b) above)



- (j) Measure the Plastigage at its widest point.

Standard clearance:

STD 0.026 - 0.040 mm (0.0010 - 0.0016 in.)

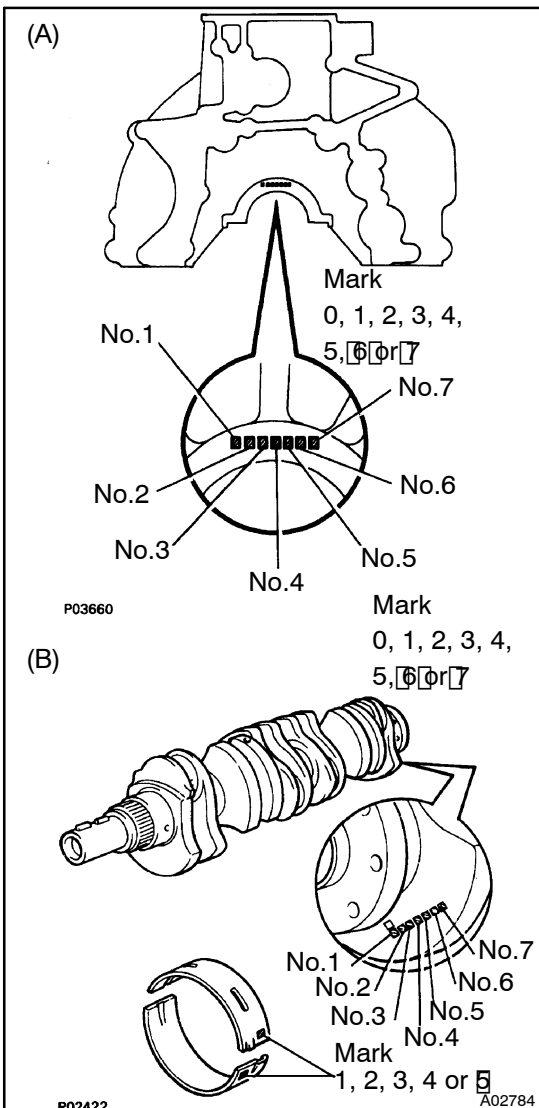
U/S 0.25 0.025 - 0.061 mm (0.0010 - 0.0024 in.)

Maximum clearance:

STD 0.06 mm (0.0024 in.)

U/S 0.25 0.08 mm (0.0031 in.)

If the oil clearance is greater than maximum, replace the bearings. If necessary, grind or replace the crankshaft.



HINT:

If using a standard bearing, replace with one having the same number. If the number of the bearing cannot be determined, select the correct bearing by adding together the numbers imprinted on the cylinder block and crankshaft, then refer to the table below for the appropriate bearing number. There are 5 sizes of standard bearings, marked "1", "2", "3", "4" and "5" accordingly.

	Total Number " " Number mark				
Cylinder block (A) + Crankshaft (B)	0-2	3-5	6-8	9-11	12-14
Use bearing	"1"	"2"	"3"	"4"	"5"

EXAMPLE: Cylinder block "3" (A)

+ Crankshaft "4" (B)

= Total number 7 (Use bearing "3")

Standard sized bearing selection chart

Crankshaft number mark	Cylinder block number mark							
	0	1	2	3	4	5	6	7
0	1	1	1	2	2	2	3	3
1	1	1	2	2	2	3	3	3
2	1	2	2	2	3	3	3	4
3	2	2	2	3	3	3	4	4
4	2	2	3	3	3	4	4	4
5	2	3	3	3	4	4	4	4
6	3	3	3	4	4	5	5	5
7	3	3	4	4	5	5	5	5

EXAMPLE: Cylinder block "3" Crankshaft "4"
= Use bearing "3"

Reference**Cylinder block main journal bore diameter (A):**

Mark "0"	66.020 – 66.022 mm (2.59922 – 2.59929 in.)
Mark "1"	66.022 – 66.024 mm (2.59929 – 2.59936 in.)
Mark "2"	66.024 – 66.026 mm (2.59936 – 2.59944 in.)
Mark "3"	66.026 – 66.028 mm (2.59944 – 2.59952 in.)
Mark "4"	66.028 – 66.030 mm (2.59952 – 2.59960 in.)
Mark "5"	66.030 – 66.032 mm (2.59960 – 2.59968 in.)
Mark "6"	66.032 – 66.034 mm (2.59968 – 2.59976 in.)
Mark "7"	66.034 – 66.036 mm (2.59976 – 2.59984 in.)

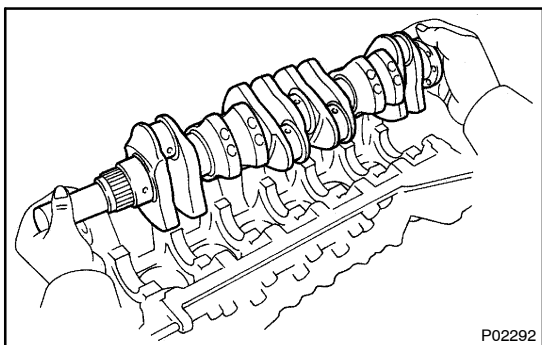
Crankshaft main journal diameter (B):

Mark "0"	61.998 – 62.000 mm (2.44086 – 2.44094 in.)
Mark "1"	61.996 – 61.998 mm (2.44078 – 2.44086 in.)
Mark "2"	61.994 – 61.996 mm (2.44070 – 2.44078 in.)
Mark "3"	61.992 – 61.994 mm (2.44063 – 2.44070 in.)
Mark "4"	61.990 – 61.992 mm (2.44055 – 2.44063 in.)
Mark "5"	61.988 – 61.990 mm (2.44047 – 2.44055 in.)
Mark "6"	61.986 – 61.988 mm (2.44039 – 2.44047 in.)
Mark "7"	61.984 – 61.986 mm (2.44031 – 2.44039 in.)

Standard bearing center wall thickness:

Mark "1"	1.994 – 1.997 mm (0.0785 – 0.0786 in.)
Mark "2"	1.997 – 2.000 mm (0.0786 – 0.0787 in.)
Mark "3"	2.000 – 2.003 mm (0.0787 – 0.0789 in.)
Mark "4"	2.003 – 2.006 mm (0.0789 – 0.0790 in.)
Mark "5"	2.006 – 2.009 mm (0.0790 – 0.0791 in.)

(k) Completely remove the Plastigage.

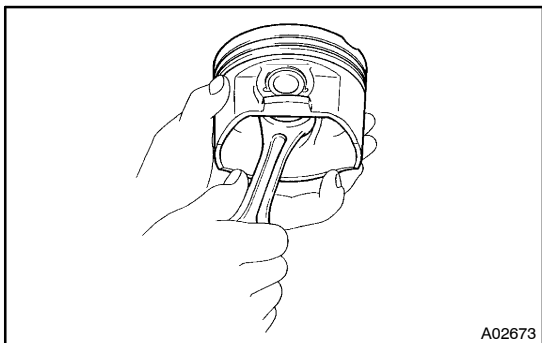


20. REMOVE CRANKSHAFT

- (a) Lift out the crankshaft
- (b) Remove the upper bearings and upper thrust washers from the cylinder block.

HINT:

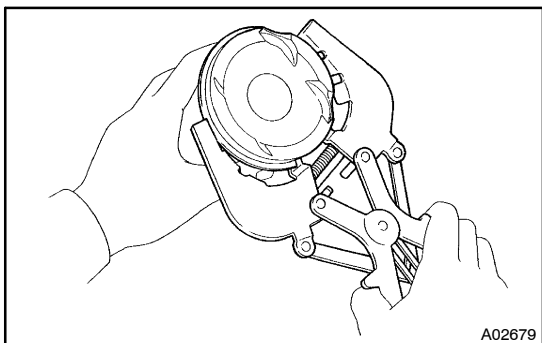
Arrange the main bearing caps, bearings and thrust washers in the correct order.



21. CHECK FIT BETWEEN PISTON AND PISTON PIN

Try to move the piston back and forth on the piston pin.

If any movement is felt, replace the piston and pin as a set.

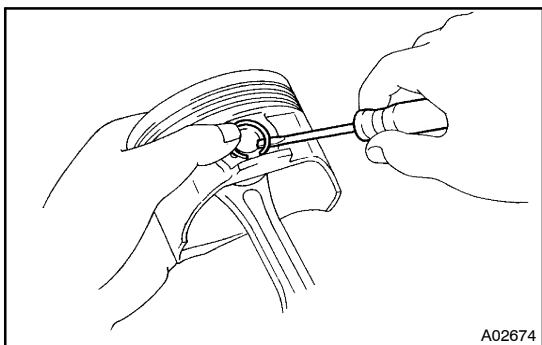


22. REMOVE PISTON RINGS

- (a) Using a piston ring expander, remove the 2 compression rings.
- (b) Remove the 2 side rails and oil ring expander by hand.

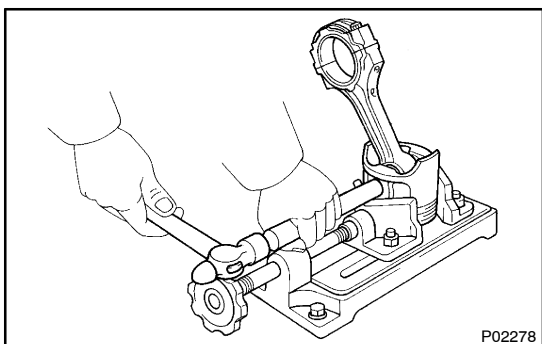
HINT:

Arrange the piston rings in correct order only.



23. DISCONNECT CONNECTING ROD FROM PISTON

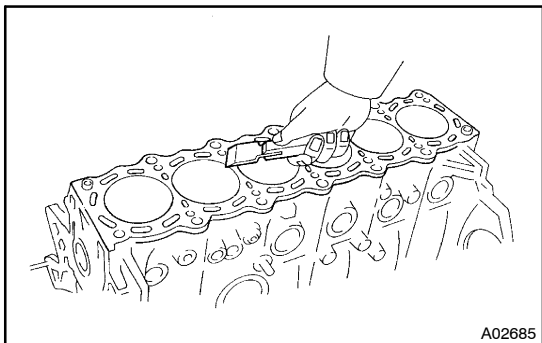
- (a) Using a small screwdriver, remove the 2 snap rings.
- (b) Gradually heat the piston to about 80°C (176°F).



- (c) Using a plastic-faced hammer and brass bar, lightly tap out the piston pin and remove the connecting rod.

HINT:

- The piston and pin are a matched set.
- Arrange the pistons, pins, rings, connecting rods and bearings in the correct order.



INSPECTION

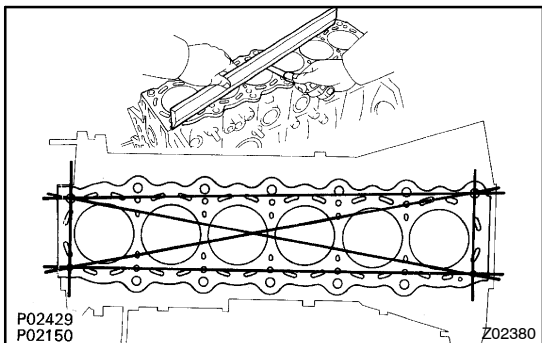
1. CLEAN CYLINDER BLOCK

- (a) Remove gasket material

Using a gasket scraper, remove all the gasket material from the cylinder block surface.

- (b) Clean cylinder block

Using a soft brush and solvent, thoroughly clean the cylinder block.

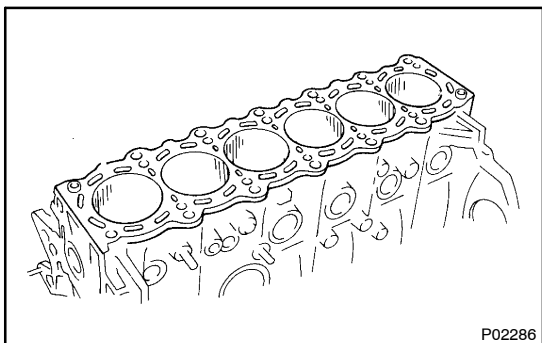


2. INSPECT CYLINDER BLOCK SURFACE FOR FLATNESS

Using precision straight edge and feeler gauge, measure the top surfaces of the cylinder block for warpage.

Maximum warpage: 0.07 mm (0.0028 in.)

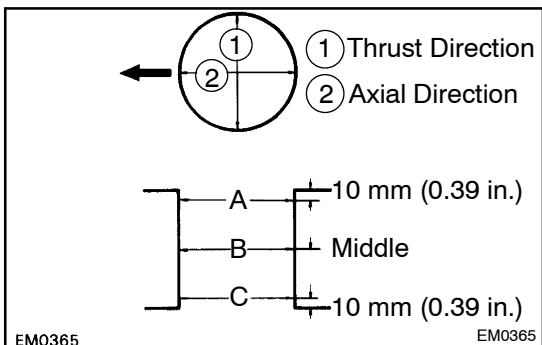
If warpage is greater than maximum, replace the cylinder block.



3. INSPECT CYLINDER FOR VERTICAL SCRATCHES

Visually check the cylinder for vertical scratches.

If deep scratches are present, replace the cylinder block.



4. INSPECT CYLINDER BORE DIAMETER

Using a cylinder gauge, measure the cylinder bore diameter at positions A, B and C in the thrust and axial directions.

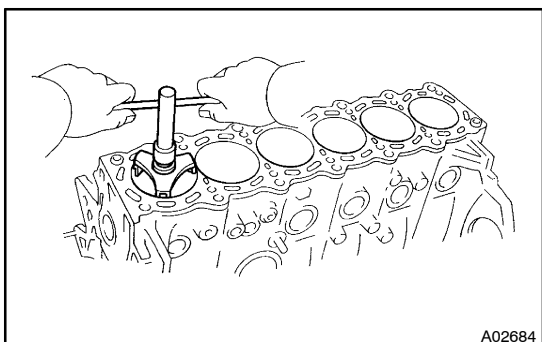
Standard diameter:

86.000 – 86.013 mm (3.3858 – 3.3863 in.)

Maximum diameter:

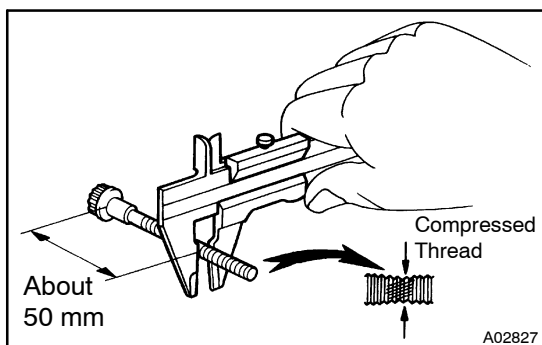
86.02 mm (3.3866 in.)

If the diameter is greater than maximum, replace the cylinder block.



5. REMOVE CYLINDER RIDGE

If the wear is less than 0.2 mm (0.008 in.), using a ridge reamer, grind the top of the cylinder.



6. INSPECT MAIN BEARING CAP BOLTS

Using vernier calipers, measure the minimum diameter of the compressed thread at the measuring point.

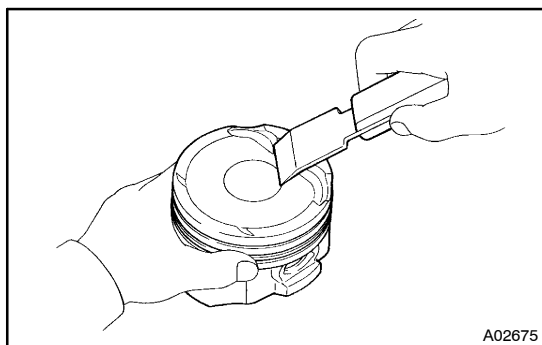
Standard diameter:

9.96 – 9.97 mm (0.3921 – 0.3925 in.)

Minimum diameter:

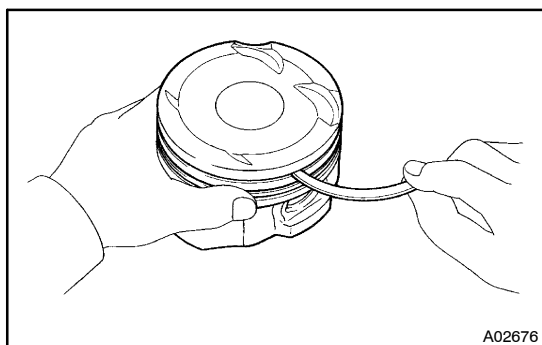
9.7 mm (0.382 in.)

If the diameter is less than minimum, replace the bolt.



7. CLEAN PISTON

- (a) Using a gasket scraper, remove the carbon from the piston top.

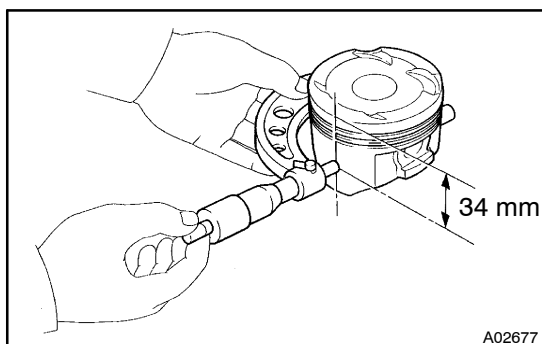


- (b) Using a groove cleaning tool or broken ring, clean the piston ring grooves.

- (c) Using solvent and a brush, thoroughly clean the piston.

NOTICE:

Do not use a wire brush.



8. INSPECT PISTON OIL CLEARANCE

- (a) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 34 mm (1.34 in.) from the piston head.

Piston diameter:

85.945 – 85.965 mm (3.3837 – 3.3844 in.)

- (b) Measure the cylinder bore diameter in the thrust directions. (See step 4)

- (c) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

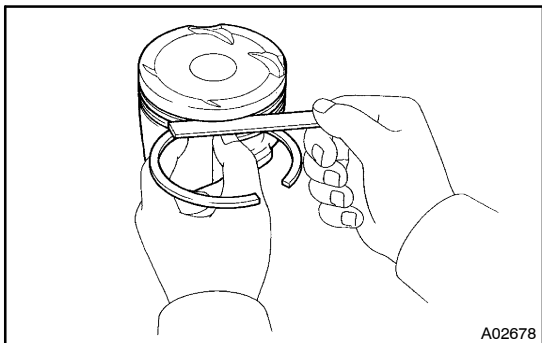
Standard oil clearance:

0.035 – 0.068 mm (0.0014 – 0.0027 in.)

Maximum oil clearance:

0.10 mm (0.0039 in.)

If the oil clearance is greater than maximum, replace all the 6 pistons. If necessary, replace the cylinder block.



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9. INSPECT PISTON RING GROOVE CLEARANCE

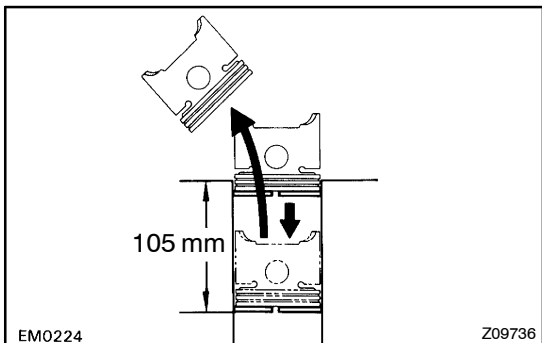
Using a feeler gauge, measure the clearance between new piston ring and the wall of the piston ring groove.

Ring groove clearance:

No.1 0.040 – 0.080 mm (0.0016 – 0.0031 in.)

No.2 0.030 – 0.070 mm (0.0012 – 0.0028 in.)

If the clearance is not as specified, replace the piston.

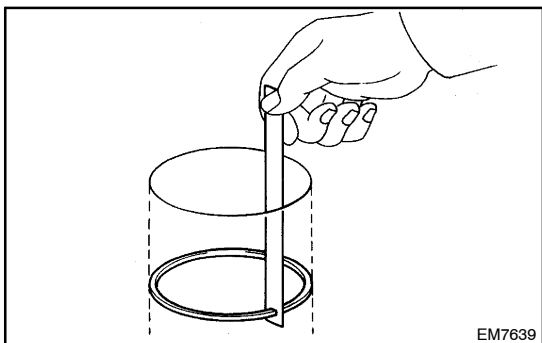


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10. INSPECT PISTON RING END GAP

- (a) Insert the piston ring into the cylinder bore.
- (b) Using a piston, push the piston ring a little beyond the bottom of the ring travel, 105 mm (4.13 in.) from the top of the cylinder block.



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- (c) Using a feeler gauge, measure the ring end gap.

Standard ring end gap:

No.1 0.300 – 0.470 mm (0.0118 – 0.0185 in.)

No.2 0.350 – 0.520 mm (0.0138 – 0.0205 in.)

Oil (Side rail)

0.130 – 0.450 mm (0.0051 – 0.0177 in.)

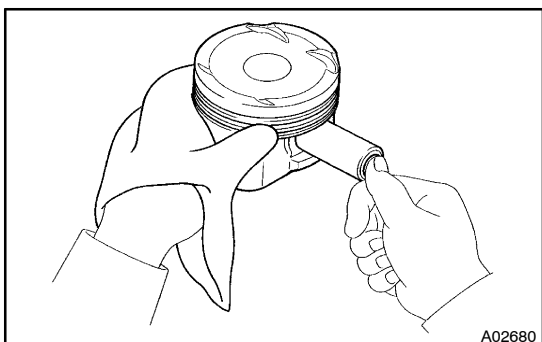
Maximum ring end gap:

No.1 1.07 mm (0.0421 in.)

No.2 1.12 mm (0.0441 in.)

Oil (Side rail) 1.05 mm (0.0413 in.)

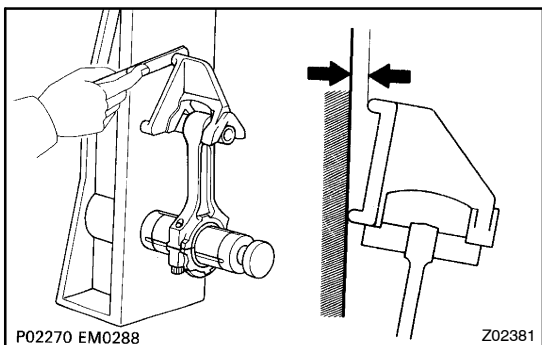
If the end gap is greater than maximum, replace the piston ring.
If the end gap is greater than maximum, even with a new piston ring, replace the cylinder block.



A02680

11. INSPECT PISTON PIN FIT

At 80°C (176°F), you should be able to push the piston pin into the piston pin hole with your thumb.



12. INSPECT CONNECTING ROD ALIGNMENT

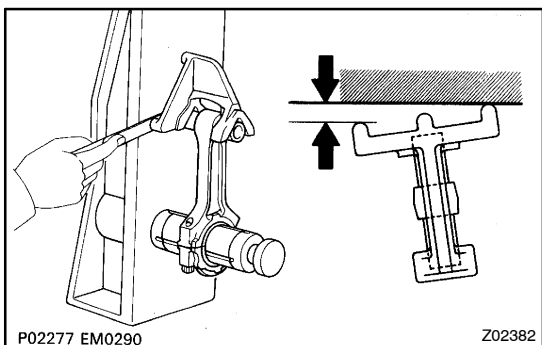
Using a feeler gauge and rod aligner, check the connecting rod alignment.

- Check for out-of-alignment

Maximum out-of-alignment:

0.05 mm (0.0020 in.) per 100 mm (3.94 in.)

If out-of-alignment is greater than maximum, replace the connecting rod assembly.

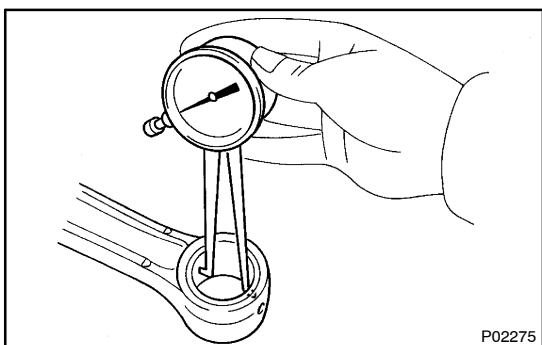


- Check for twist

Maximum twist:

0.15 mm (0.0059 in.) per 100 mm (3.94 in.)

If twist is greater than maximum, replace the connecting rod assembly.

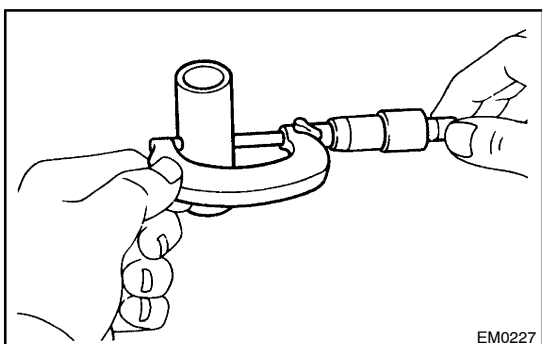


13. INSPECT PISTON PIN OIL CLEARANCE

- Using a caliper gauge, measure the inside diameter of the connecting rod bushing.

Bushing inside diameter:

22.005 – 22.014 mm (0.8663 – 0.8667 in.)



- Using a micrometer, measure the piston pin diameter.

Piston pin diameter:

21.997 – 22.006 mm (0.8660 – 0.8664 in.)

- Subtract the piston pin diameter measurement from the bushing inside diameter measurement.

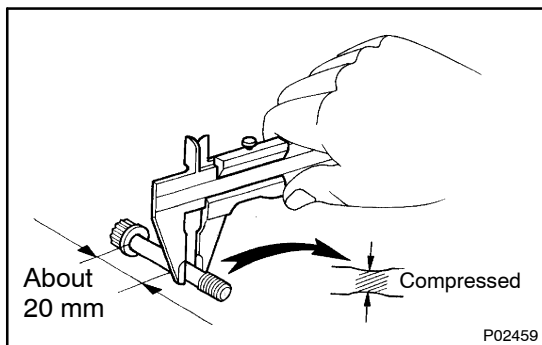
Standard oil clearance:

0.005 – 0.011 mm (0.0002 – 0.0004 in.)

Maximum oil clearance:

0.05 mm (0.0020 in.)

If the oil clearance is greater than maximum, replace the bushing. If necessary, replace the piston and piston pin as a set.

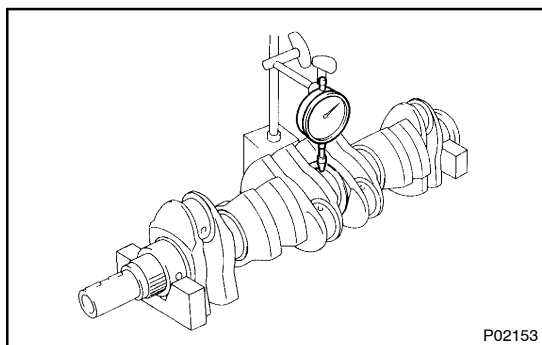
**14. INSPECT CONNECTING ROD BOLTS**

Using vernier calipers, measure the minimum diameter of the compressed bolt at the measuring point.

Standard diameter: 8.1 – 8.3 mm (0.319 – 0.327 in.)

Minimum diameter: 8.0 mm (0.315 in.)

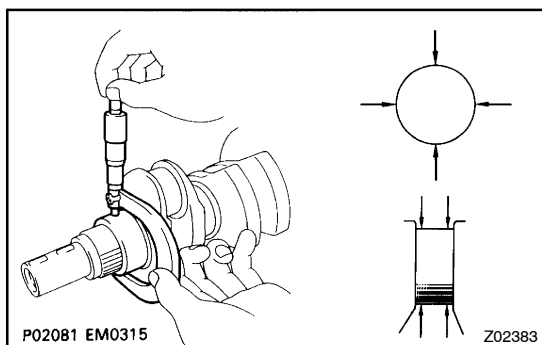
If the diameter is less than minimum, replace the connecting rod bolt.

**15. INSPECT CRANKSHAFT FOR RUNOUT**

- (a) Place the crankshaft on V-blocks.
- (b) Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout: 0.06 mm (0.0024 in.)

If the circle runout is greater than maximum, replace the crankshaft.

**16. INSPECT MAIN JOURNALS AND CRANK PINS**

- (a) Using a micrometer, measure the diameter of each main journal and crank pin.

Main journal diameter:

STD 61.984 – 62.000 mm (2.4403 – 2.4409 in.)

U/S 0.25 61.745 – 61.755 mm (2.4309 – 2.4313 in.)

Crank pin diameter:

STD 51.982 – 52.000 mm (2.0465 – 2.0472 in.)

U/S 0.25 51.745 – 51.755 mm (2.0372 – 2.0376 in.)

If the diameter is not as specified, check the oil clearance.

(See [page EM-73](#))

- (b) Check each main journal and crank pin for taper and out-of-round as shown.

Maximum taper and out-of-round:

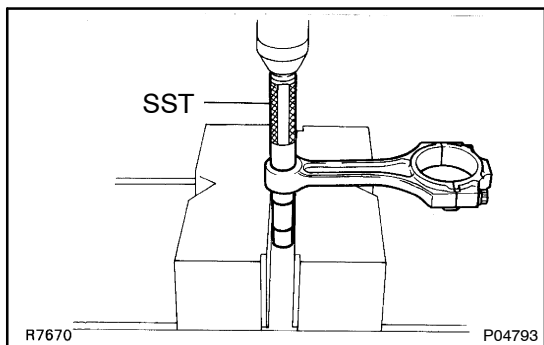
0.02 mm (0.0008 in.)

If the taper or out-of-round is greater than maximum, grind or replace the crankshaft.

17. IF NECESSARY, GRIND AND HONE MAIN JOURNALS AND/OR CRANK PINS

Grind and hone the main journals and/or crank pins to the finished undersized diameter. (See procedure step 16)

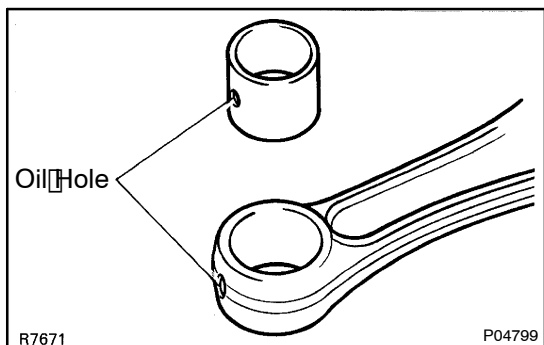
Install new main journal and/or crank pin undersized bearings.



REPLACEMENT

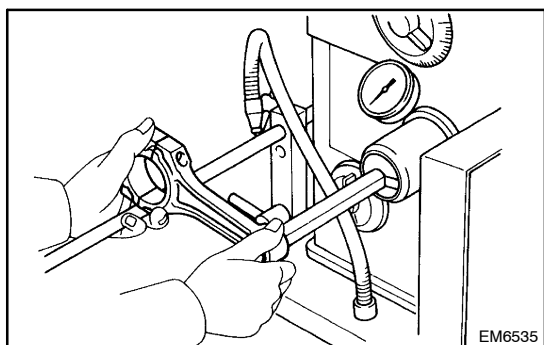
1. REPLACE CONNECTING ROD BUSHING

- (a) Using SST and a press, press out the bushing.
SST 09222-30010

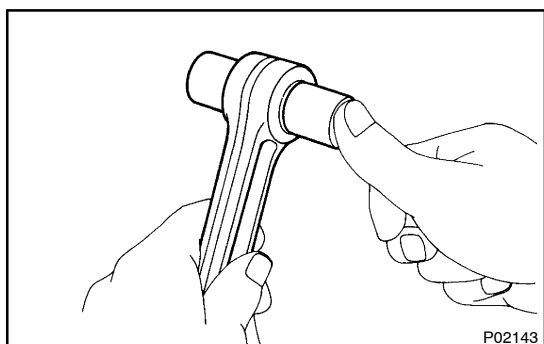


- (b) Align the oil holes of a new bushing and the connecting rod.

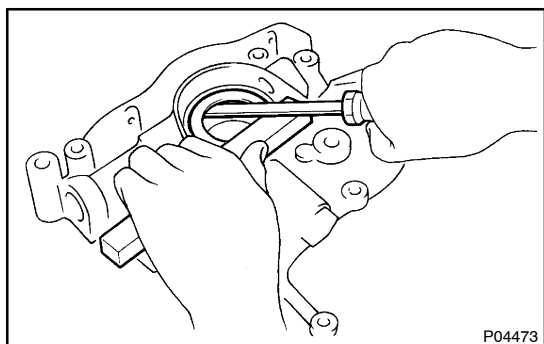
- (c) Using SST and a press, press in the bushing.
SST 09222-30010



- (d) Using a pin hole grinder, bore the bushing to obtain the standard specified clearance (see page EM-80) between the bushing and piston pin.



- (e) Check the piston pin fit at room temperature. Coat the piston pin with engine oil and push it into the connecting rod with your thumb.

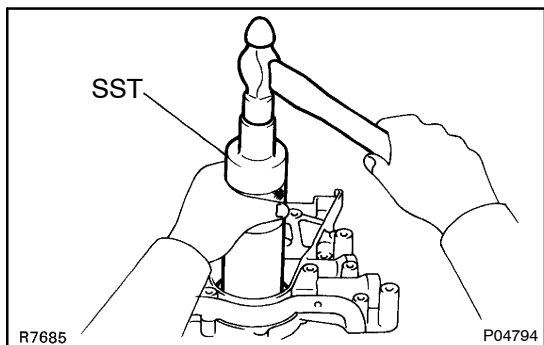


2. REPLACE CRANKSHAFT FRONT OIL SEAL

HINT:

There are 2 methods (a) and (b) to replace the oil seal as follows:

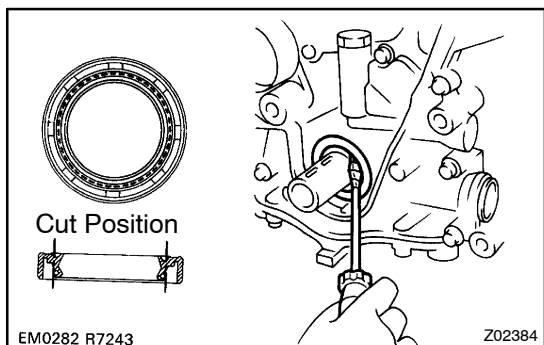
- (a) If the oil pump is removed from the cylinder block.
(1) Using a screwdriver, pry out the oil seal.



- (2) Using SST and a hammer, tap in a new oil seal until its surface is flush with the oil pump body edge.

SST 09316-60011 (09316-00011)

- (3) Apply MP grease to the oil seal lip.



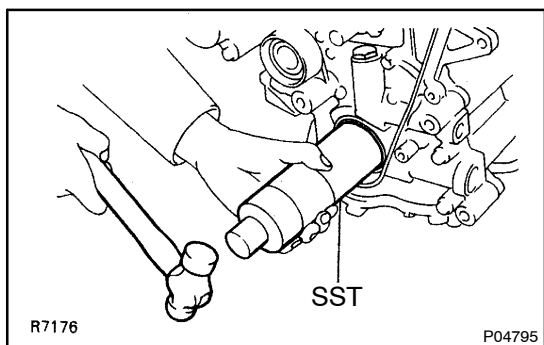
- (b) If the pump is installed on the cylinder block.

- (1) Using a knife, cut off the oil seal lip.

- (2) Using a screwdriver, pry out the oil seal.

NOTICE:

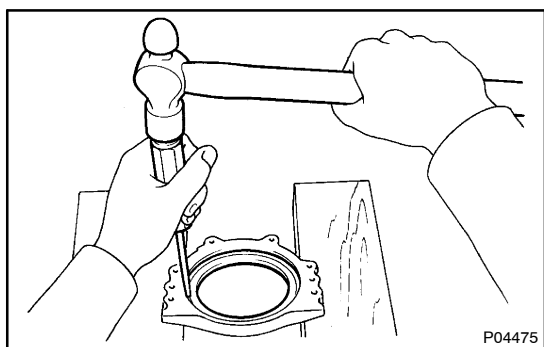
Be careful not to damage the crankshaft. Tape the screwdriver tip.



- (3) Apply MP grease to a new oil seal lip.

- (4) Using SST and a hammer, tap in the oil seal until its surface is flush with the oil pump body edge.

SST 09316-60011 (09316-00011)



3. REPLACE CRANKSHAFT REAR OIL SEAL

HINT:

There are 2 methods (a) and (b) to replace the oil seal as follows:

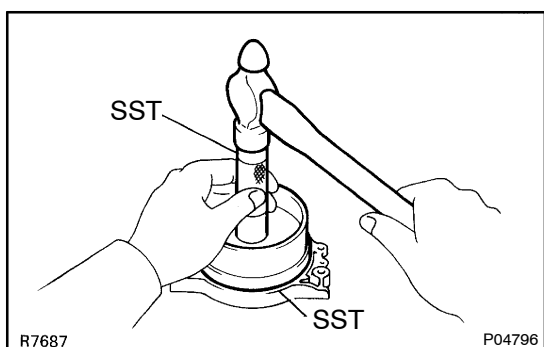
- (a) If the rear oil seal retainer is removed from the cylinder block.

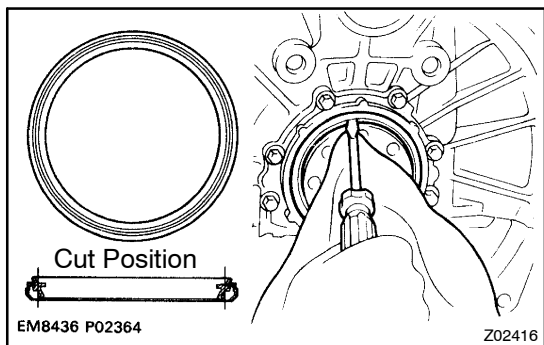
- (1) Using a screwdriver and hammer, tap out the oil seal.

- (2) Using SST and a hammer, tap in a new oil seal until its surface is flush with the rear oil seal retainer edge.

SST 09223-15030, 09950-70010 (09951-07100)

- (3) Apply MP grease to the oil seal lip.

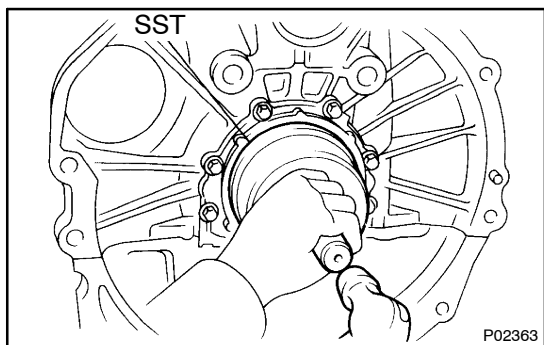




- (b) If the rear seal retainer is installed on the cylinder block.
- (1) Using a knife, cut off the oil seal lip.
 - (2) Using a screwdriver, pry out the oil seal.

NOTICE:

Be careful not to damage the crankshaft. Tape the screwdriver tip.



- (3) Apply MP grease to a new oil seal lip.
- (4) Using SST and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.

SST 09223-15030, 09950-70010 (09951-07100)

REASSEMBLY

HINT:

- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with new parts.

NOTICE:

Apply a generous amount of oil on the sliding surface of the bearing, and not on the back of it or on the surface to which it is installed.

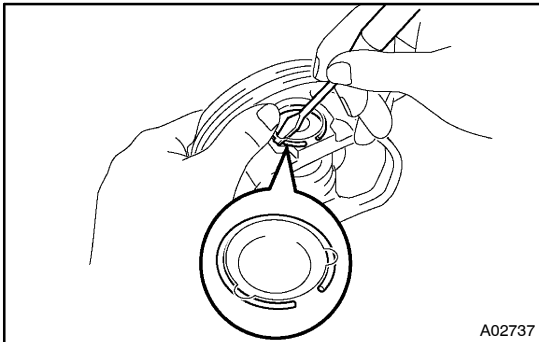
1. ASSEMBLE PISTON AND CONNECTING ROD

- (a) Using a small screwdriver, install a new snap ring on one side of the piston pin hole.

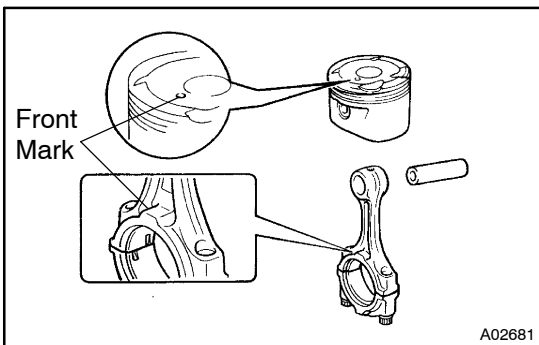
HINT:

Be sure that end gap of the snap ring is not aligned with the pin hole cutout portion of the piston.

- (b) Gradually heat the piston to about 80°C (176°F).



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- (c) Coat the piston pin with engine oil.
 (d) Align the front marks of the piston and connecting rod, and push in the piston pin with your thumb.
 (e) Install a new snap ring at the other end of the piston pin hole.

HINT:

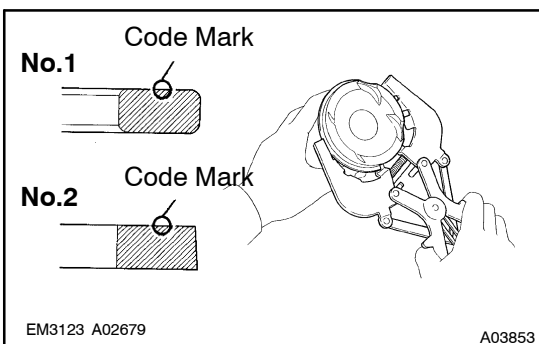
Be sure that end gap of the snap ring is not aligned with the pin hole cutout portion of the piston.

2. INSTALL PISTON RINGS

- (a) Install the oil ring expander and 2 side rails by hand.
 (b) Using a piston ring expander, install the 2 compression rings with the code mark facing up.

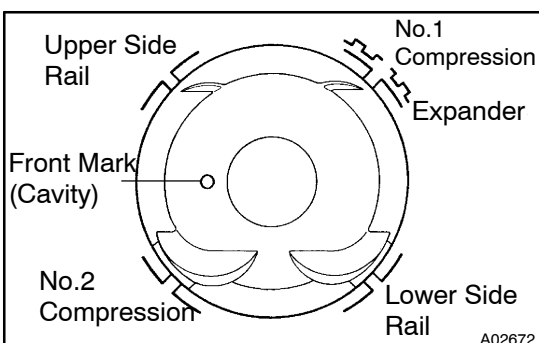
Code mark:

No.1	1N
No.2	2N



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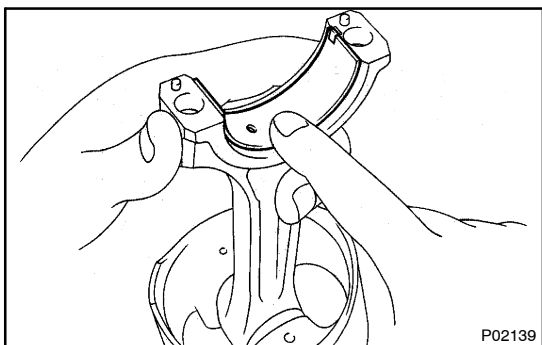


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- (c) Position the piston rings so that the ring ends are as shown.

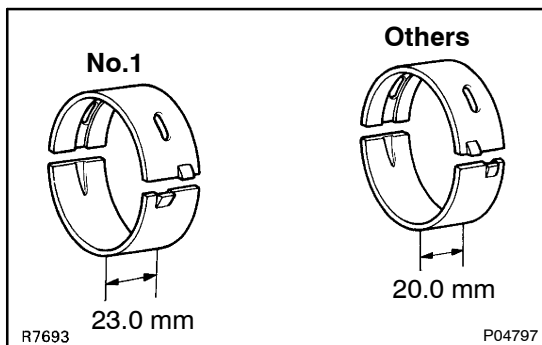
NOTICE:

Do not align the piston ring ends.



3. INSTALL BEARINGS

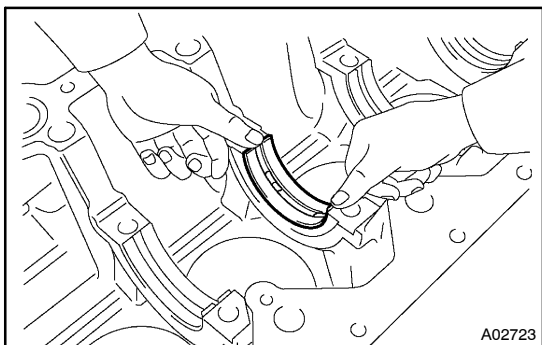
- (a) Align the bearing claw with the groove of the connecting rod and connecting cap.
- (b) Install the bearings in the connecting rod and connecting rod cap.



4. INSTALL MAIN BEARINGS

HINT:

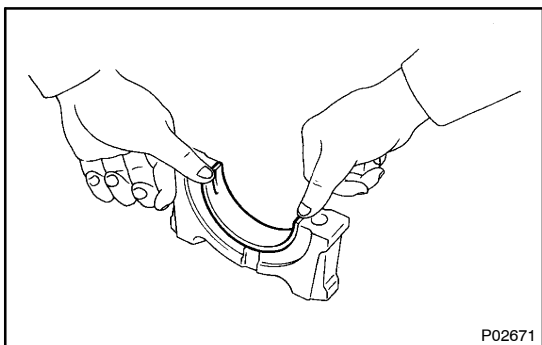
- Main bearings come in widths of 20.0 mm (0.787 in.) and 23.0 mm (0.906 in.). Install the 23.0 mm bearings in the No.1 cylinder block journal position with the main bearing cap. Install the 20.0 mm bearings in the other positions.
- Upper bearings have an oil groove and oil holes; lower bearings do not.



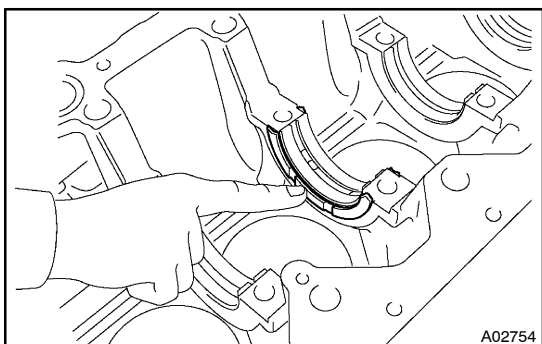
- (a) Align the bearing claw with the claw groove of the main bearing cap or cylinder block.

NOTICE:

Install the bearing with the oil hole in the cylinder block.



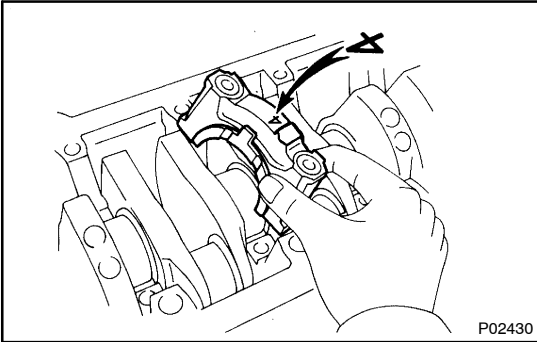
- (b) Install the bearings in the cylinder block and main bearing caps.



5. INSTALL UPPER THRUST WASHERS

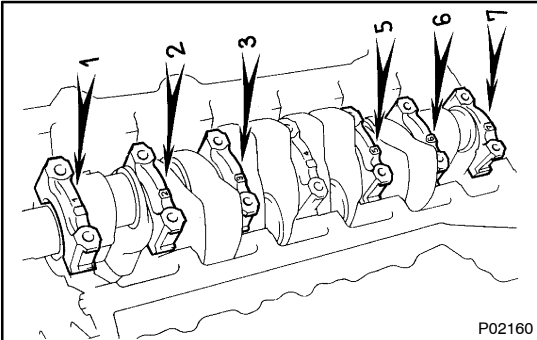
Install the 2 thrust washers under the No.4 main journal position of the cylinder block with the oil grooves facing outward.

6. PLACE CRANKSHAFT ON CYLINDER BLOCK



7. PLACE MAIN BEARING CAP AND LOWER THRUST WASHERS ON CYLINDER BLOCK

- (a) Install the lower thrust washers on the No.4 main bearing with the grooves facing outward.

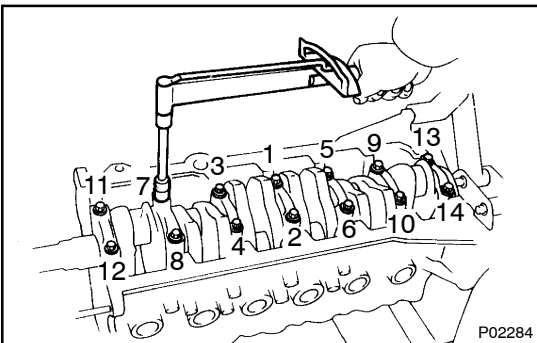


- (b) Install the main bearing caps in numerical order with the arrows facing forward.

8. INSTALL MAIN BEARING CAP BOLTS

HINT:

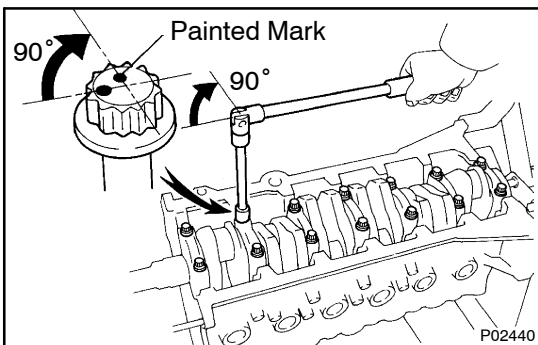
- The main bearing cap bolts are tightened in 2 progressive steps (steps (b) and (d)).
- If any of the main bearing bolts break or deform, replace them.



- (a) Apply a light coat of engine oil on the threads and under the heads of the main bearing cap bolts.
- (b) Install and uniformly tighten the 14 main bearing cap bolts, in several passes, in the sequence shown.

Torque: 45 N·m (450 kgf·cm, 33 ft·lbf)

If any one of the main bearing cap bolts does not meet the torque specification, replace the main bearing cap bolt.



- (c) Mark the front of the main bearing cap bolt head with paint.
- (d) Retighten the main bearing cap bolts 90° in the numerical order shown above.
- (e) Check that the painted mark is now at a 90° angle to the front.
- (f) Check that the crankshaft turns smoothly.

9. CHECK CRANKSHAFT THRUST CLEARANCE

Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

Standard thrust clearance:

0.020 – 0.220 mm (0.0008 – 0.0087 in.)

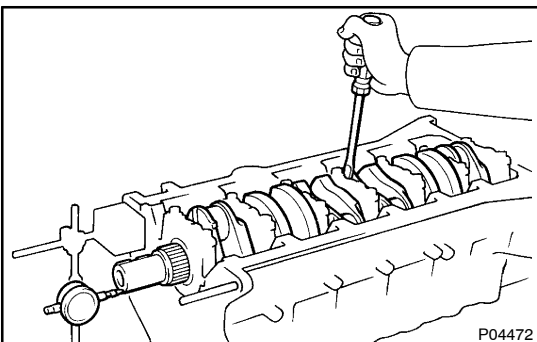
Maximum thrust clearance:

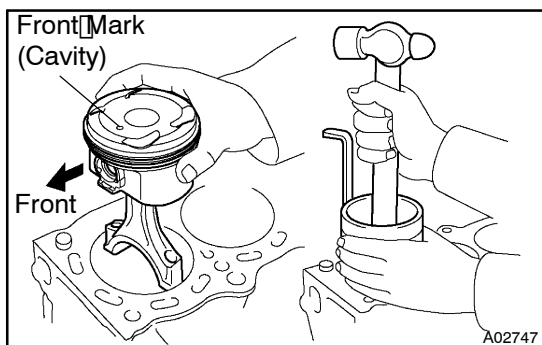
0.30 mm (0.0118 in.)

If the thrust clearance is greater than maximum, replace the thrust washers as a set.

Thrust washer thickness:

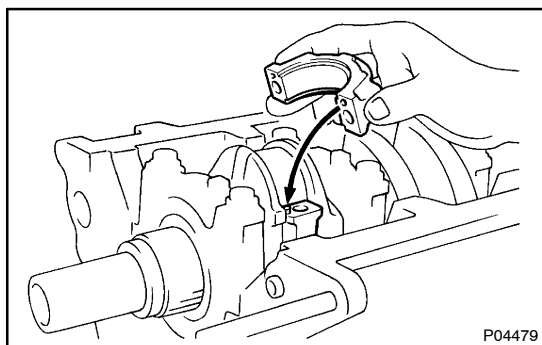
1.940 – 1.990 mm (0.0764 – 0.0783 in.)





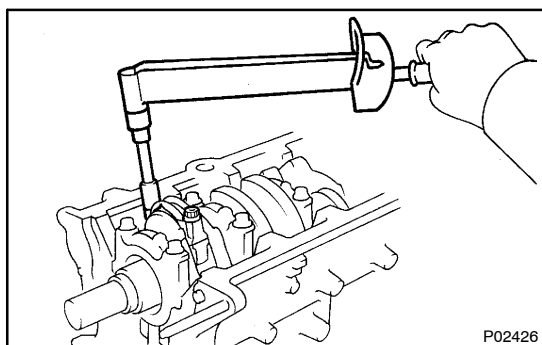
10. INSTALL PISTON AND CONNECTING ROD ASSEMBLIES

Using a piston ring compressor, push the correctly numbered piston and connecting rod assemblies into each cylinder with the front mark of the piston facing forward.



11. PLACE CONNECTING ROD CAP ON CONNECTING ROD

- Match the numbered connecting rod cap with the connecting rod.
- Install the connecting rod cap with by aligning the dowel pin to the corresponding hole.



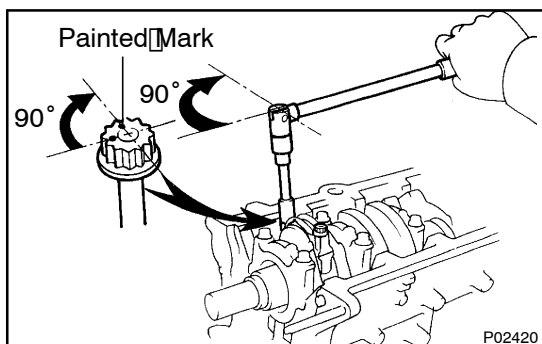
12. INSTALL CONNECTING ROD CAP BOLTS

HINT:

- The connecting rod cap bolts are tightened in 2 progressive steps (steps (b) and (d)).
 - If any of the connecting rod bolts break or deform, replace them.
- Apply a light coat of engine oil on the threads and under the heads of the connecting rod cap bolts.
 - Install and alternately tighten the bolts of the connecting rod cap in several passes.

Torque: 30 N·m (300 kgf·cm, 22 ft·lbf)

If any one of the connecting rod cap bolts does not meet the torque specification, replace the cap bolt.

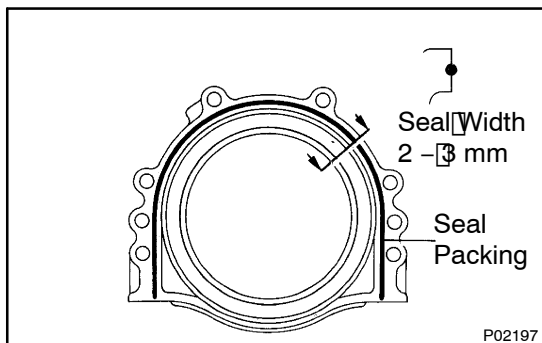


- Mark the front of the connecting rod cap bolt with paint.
- Retighten the connecting rod cap bolts 90° in the numerical order shown.
- Check that the painted mark is now at a 90° angle to the front.
- Check that the crankshaft turns smoothly.

13. CHECK CONNECTING ROD THRUST CLEARANCE (See page EM-73)

14. INSTALL REAR OIL SEAL RETAINER

- Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the retainer and cylinder block.
 - Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing groove.
 - Thoroughly clean all components to remove all debris.



- Using a non-residue solvent, clean both sealing surfaces.
- (b) Apply seal packing to the retainer as shown in the illustration.

Seal packing: Part No.08826-00080 or equivalent

- Install a nozzle that has been cut to a 2 - 3 mm (0.08 - 0.12 in.) opening.
 - Parts must be assembled within 3 minutes of application. Otherwise the material must be removed and reapplied.
 - Immediately remove nozzle from the tube and reinstall cap.
- (c) Install the retainer with the 6 bolts.
Torque: 6.0 N·m (60 kgf·cm, 53 in·lbf)
- 15. INSTALL OIL PUMP (See page LU-12)**
- 16. INSTALL RH ENGINE MOUNTING BRACKET AND INSULATOR ASSEMBLY**
 Install the mounting bracket with the 4 bolts.
Torque: 59 N·m (590 kgf·cm, 44 ft·lbf)
- 17. INSTALL LH ENGINE MOUNTING BRACKET AND INSULATOR ASSEMBLY**
 Install the mounting bracket with the 4 bolts.
Torque: 59 N·m (590 kgf·cm, 44 ft·lbf)
- 18. INSTALL FUEL INLET PIPE**
 Install the fuel inlet pipe with the 2 bolts.
Torque: 29 N·m (290 kgf·cm, 21 ft·lbf)
- 19. INSTALL NO.1 OIL PIPE**
 Install the No.1 oil pipe with 2 new gaskets and the union bolt.
Torque: 55 N·m (550 kgf·cm, 41 ft·lbf)
- 20. INSTALL OIL FILTER, OIL COOLER AND BRACKET ASSEMBLY**
- (a) Install a new O-ring to the oil filter bracket.
 - (b) Install a new gasket to the union bolt.
 - (c) Install the oil filter bracket with the union bolt.
Torque: 90 N·m (900 kgf·cm, 65 ft·lbf)
 - (d) Connect the water bypass hose to the union.
- 21. INSTALL OIL PRESSURE SWITCH AND KNOCK SENSORS (See pages LU-1 and FI-59)**
- 22. INSTALL CYLINDER HEAD (See page EM-51)**
- 23. INSTALL WATER PUMP (See page CO-7)**
- 24. INSTALL NO.2 WATER BYPASS PIPE WITH HOSE**
- (a) Install the water bypass pipe with the bolt and 2 nuts.
Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)
 - (b) Connect the water bypass hose to the oil cooler.
 - (c) Connect the water bypass hose to the hose clamp.
- 25. INSTALL TIMING PULLEYS AND BELT (See page EM-23)**
- 26. INSTALL ALTERNATOR**
Torque: 40 N·m (400 kgf·cm, 30 ft·lbf)
- 27. REMOVE ENGINE STAND FROM ENGINE**