
ENGINE MECHANICAL

NOTE: The specification descriptions "**USA Spec.**" and "**Exc. USA Spec.**" used in this section indicate the following specifications.

USA Spec.: USA (50 States) Specifications.

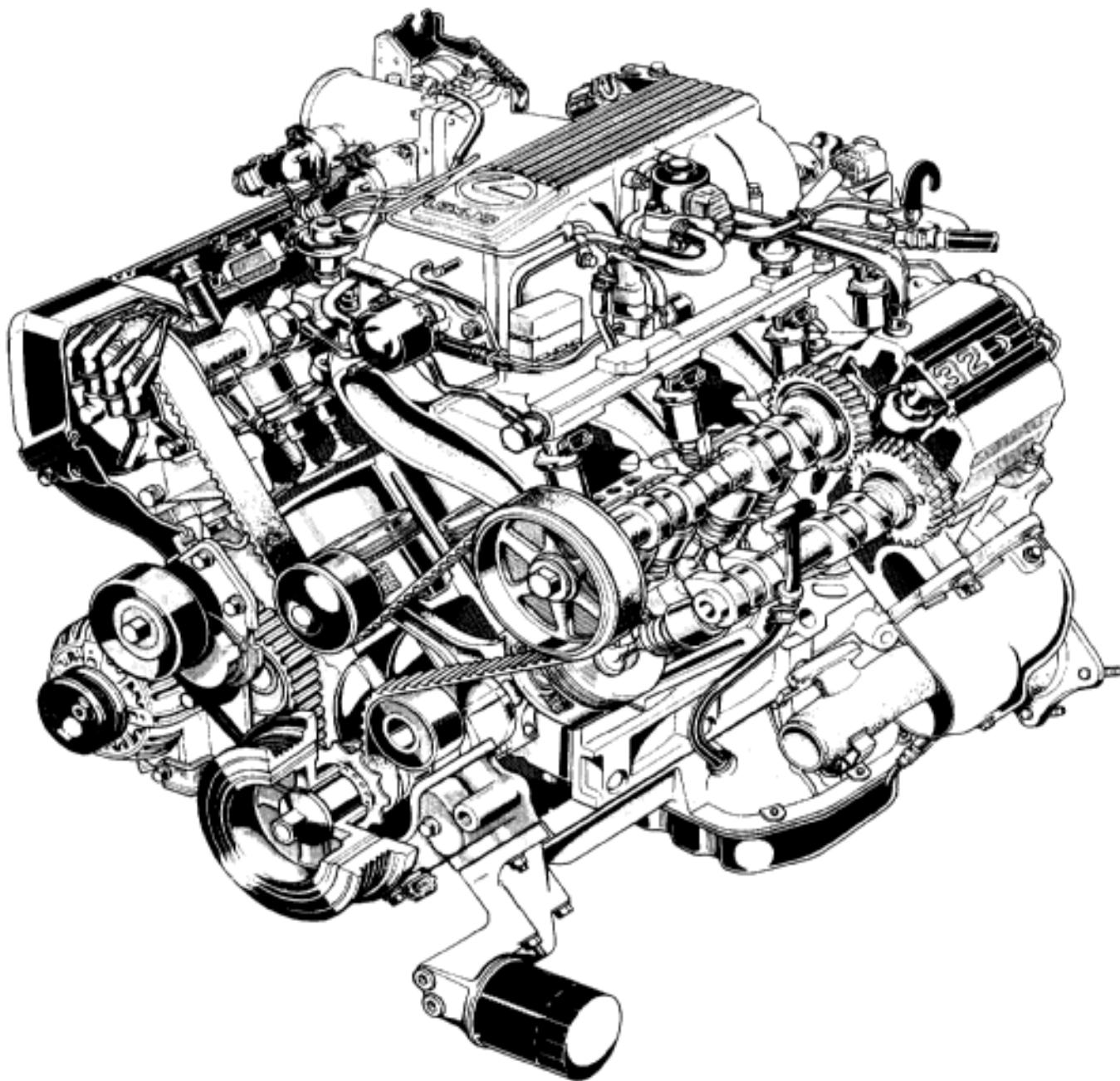
Exc. USA Spec.: USA (except California) and Canadian Specifications.

DESCRIPTION

The 1UZ-FE engine is an V-8 4.0 liter DOHC 32 valve engine.

OPERATION

USA Spec.



COMPRESSION CHECK

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

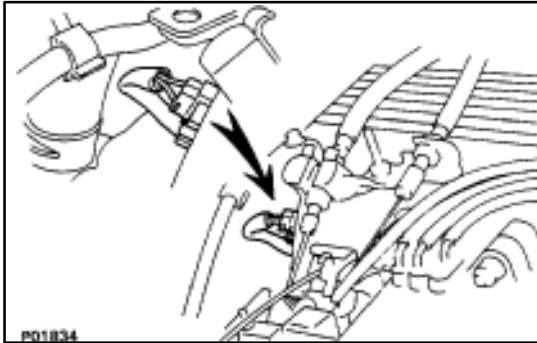
1. WARM UP AND STOP ENGINE

Allow the engine to warm up to normal operating temperature.

2. REMOVE NO.3 TIMING BELT COVERS

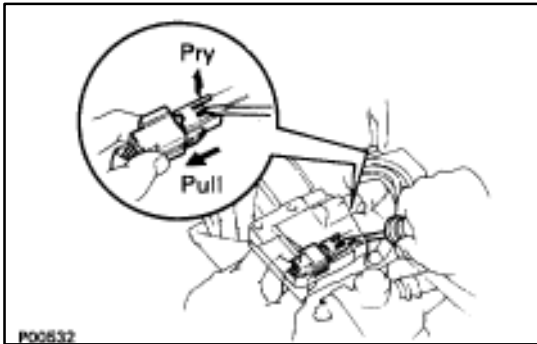
(See steps 1, 5 to 10 and 14 on pages [EM-11](#) to 13)

3. DISCONNECT COLD START INJECTOR CONNECTOR

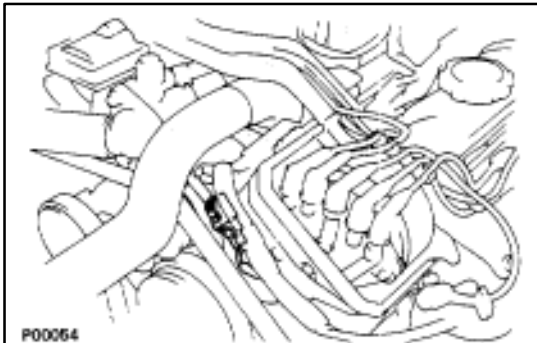


4. DISCONNECT RH CAM POSITION SENSOR CONNECTOR

- (a) Disconnect the connector from the ignition coil bracket.
- (b) Disconnect the sensor connector.



5. DISCONNECT LH CAM POSITION SENSOR CONNECTOR

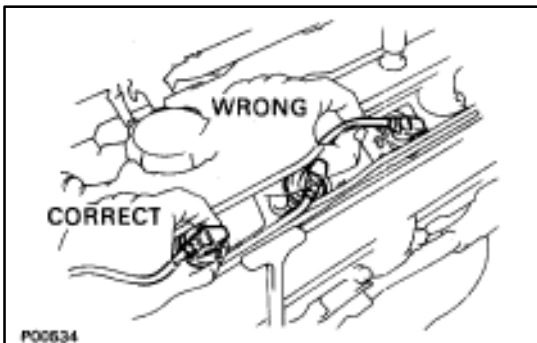


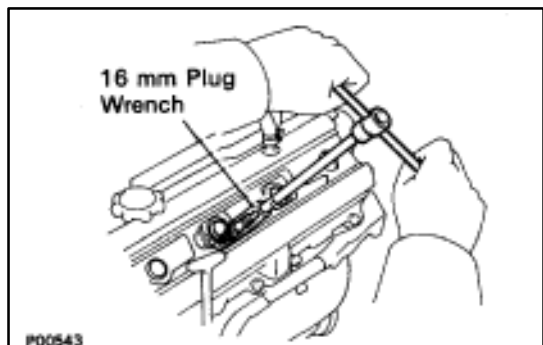
6. REMOVE SPARK PLUGS

- (a) Disconnect the eight high-tension cords from the spark plugs.

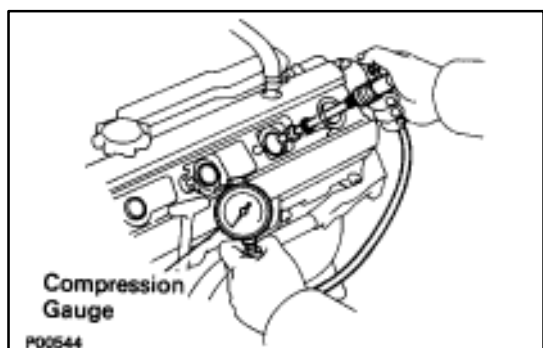
Disconnect the high-tension cords at rubber boot. Do not pull on the cords.

NOTICE: Pulling on or bending the cords may damage the conductor inside.





- (b) Using a 16 mm spark plug wrench, remove the eight spark plugs.



7. CHECK CYLINDER COMPRESSION PRESSURE

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

HINT: Always use a fully charged battery to obtain engine revolution of 250 rpm or more.

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

NOTICE: This measurement must be done in as short time as possible.

Compression pressure:

1,226 kPa (12.5 kgf/cm, 178 psi) or more

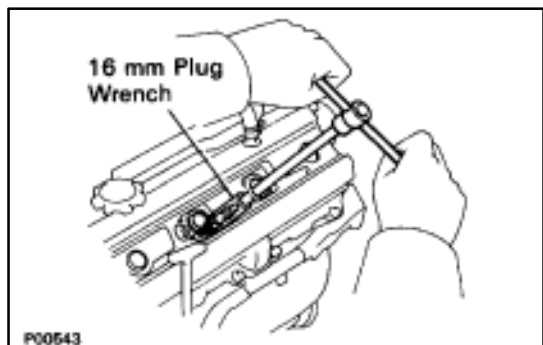
Minimum pressure:

981 kPa (10.0 kgf/cm, 142 psi)

Difference between each cylinder:

98 kPa (1.0 kgf/cm, 14 psi) or less

- If the cylinder compression in one 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 (c) for the cylinder with low compression.
 - If adding oil helps the compression 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.

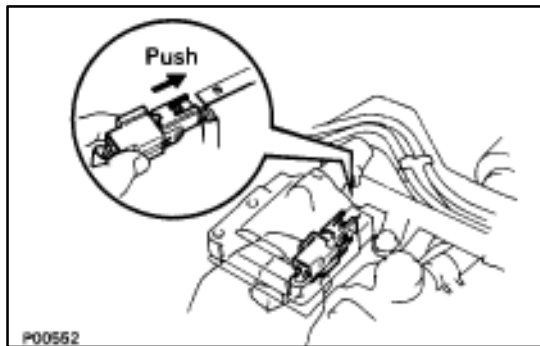


8. REINSTALL SPARK PLUGS

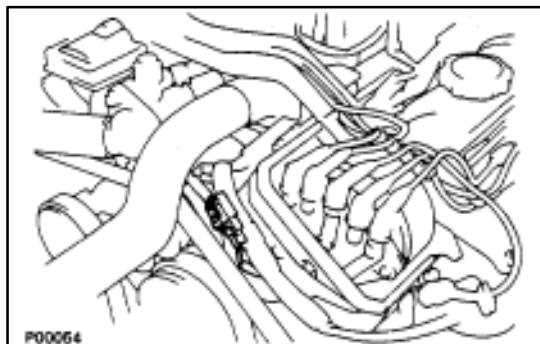
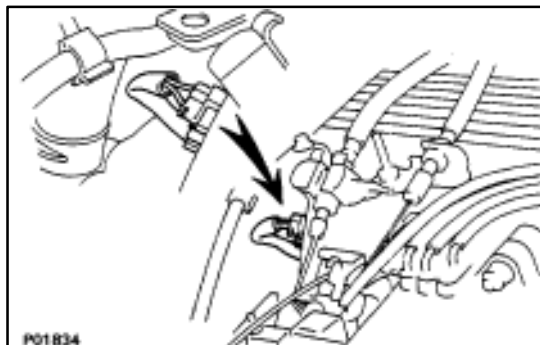
- Using a 16 mm plug wrench, install the eight spark plugs.

Torque: 18 N·m (180 kgf·cm, 13 ft·lbf)

- Connect the eight high-tension cords to the spark plugs.
- Fit the high-tension cords to the cord clamps.
(See page [IG-16](#))

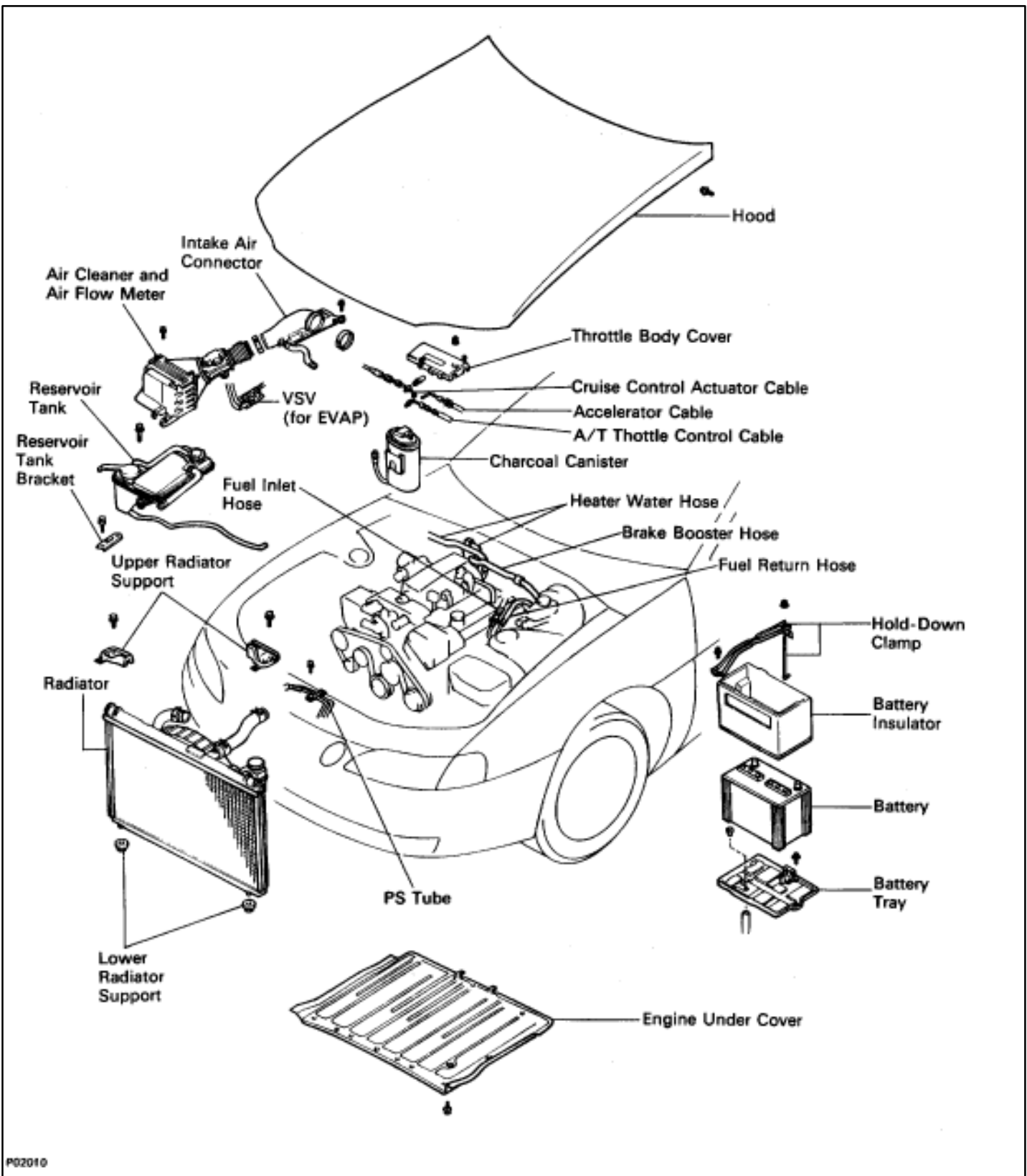
**9. RECONNECT RH CAM POSITION SENSOR CONNECTOR**

- (a) Connect the sensor connector.
- (b) Connect the connector to the ignition coil bracket.

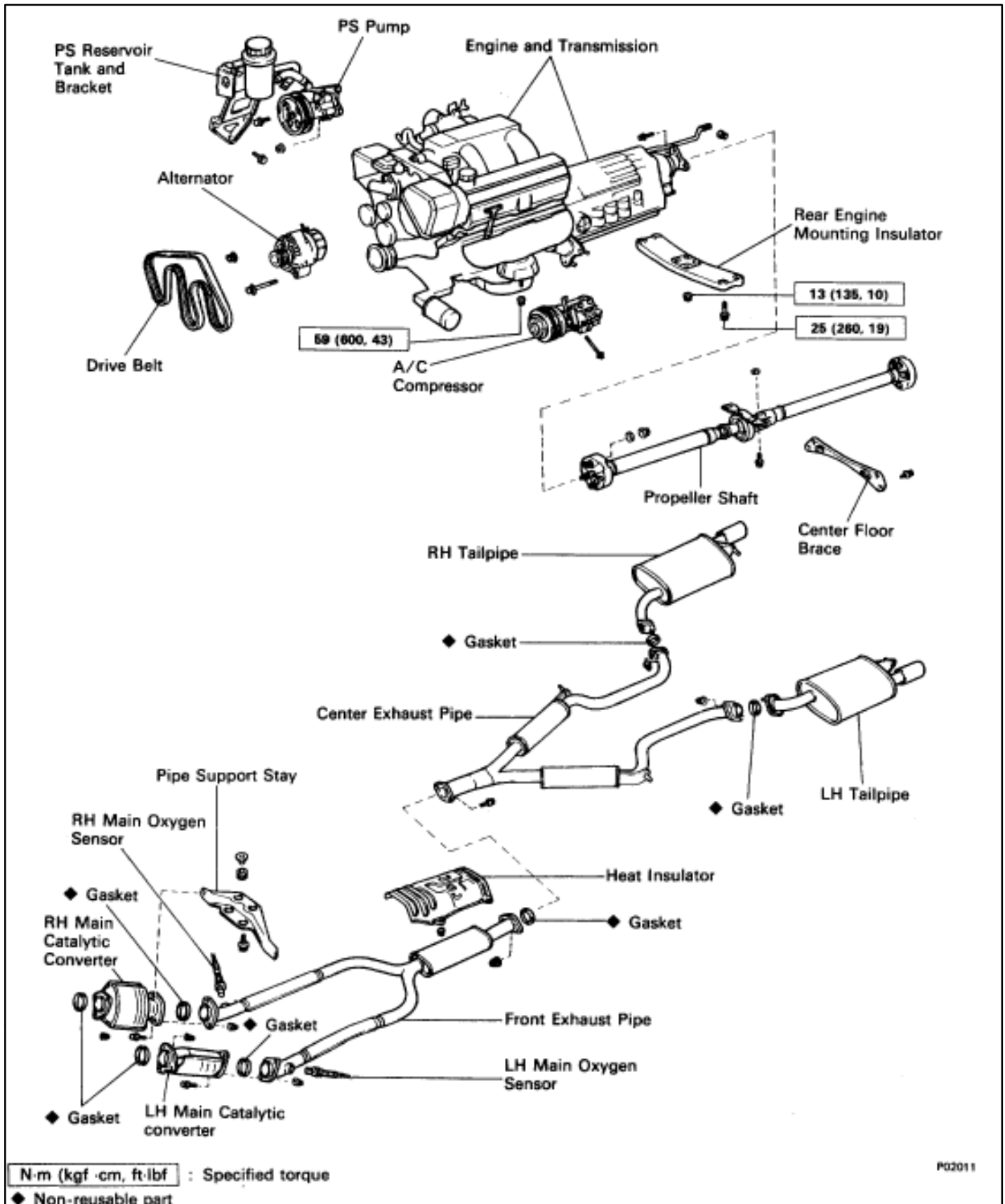
**10. RECONNECT LH CAM POSITION SENSOR CONNECTOR****11. RECONNECT COLD START INJECTOR CONNECTOR****12. REINSTALL NO.3 TIMING BELT COVERS**

(See steps 28 to 30, 34 to 37, 40 and 41 on pages [EM-25](#) to 27)

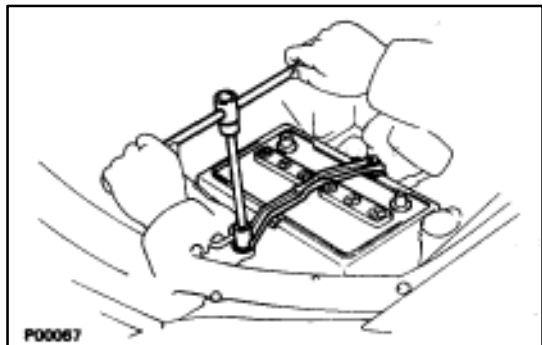
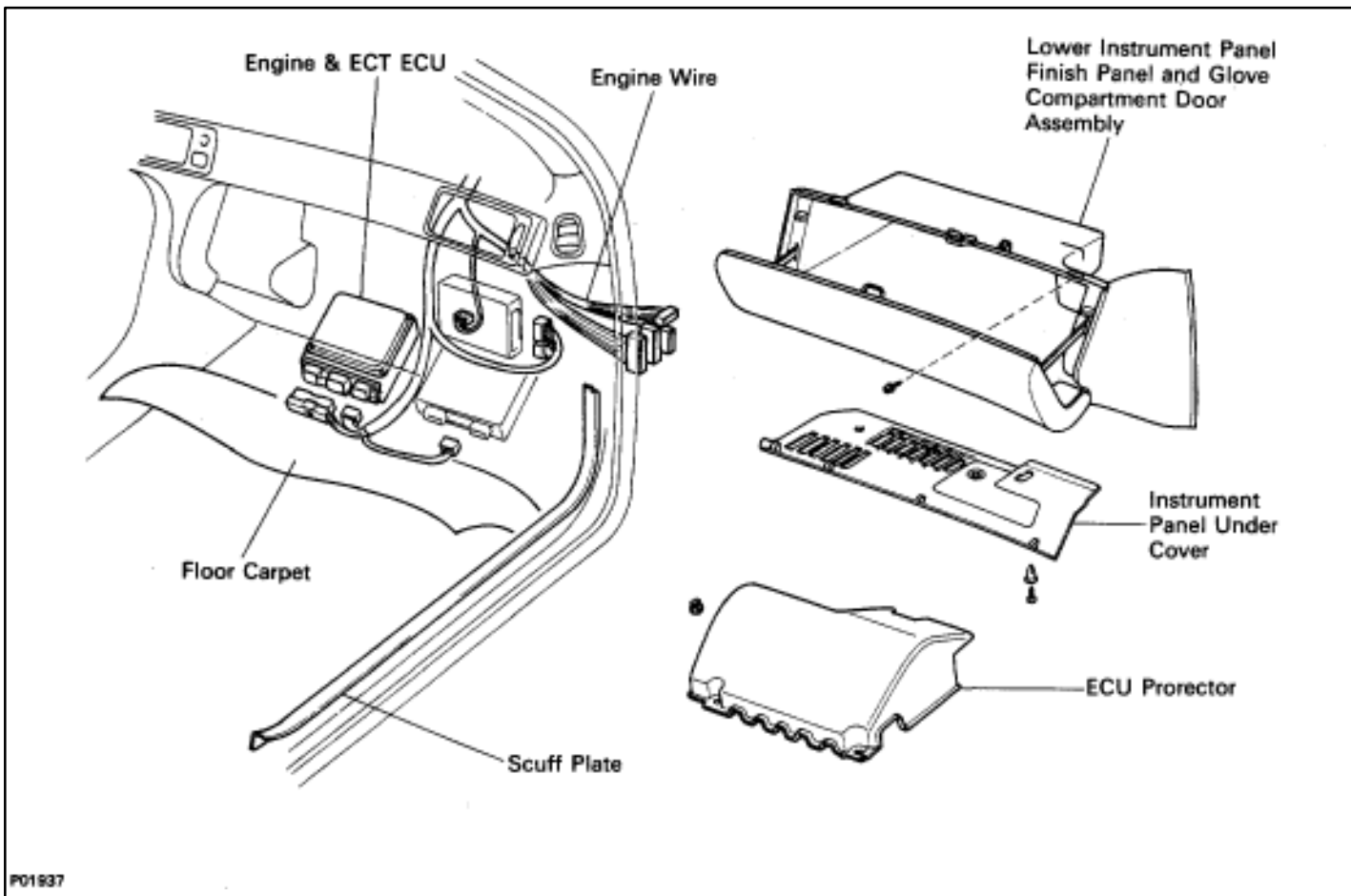
CYLINDER BLOCK COMPONENTS FOR REMOVAL AND INSTALLATION OF ENGINE WITH TRANSMISSION



COMPONENTS FOR REMOVAL AND INSTALLATION OF ENGINE WITH TRANSMISSION (Cont'd)



COMPONENTS FOR REMOVAL AND INSTALLATION OF ENGINE WITH TRANSMISSION (Cont'd)



REMOVAL OF ENGINE WITH TRANSMISSION

1. REMOVE BATTERY

CAUTION: Work must be started after approx. 20 seconds or longer from the time the ignition switch is turned to the "LOCK" position and the negative (-) terminal cable is disconnected from the battery.

2. REMOVE ENGINE UNDER COVER

3. DRAIN ENGINE COOLANT (See page [CO-6](#))

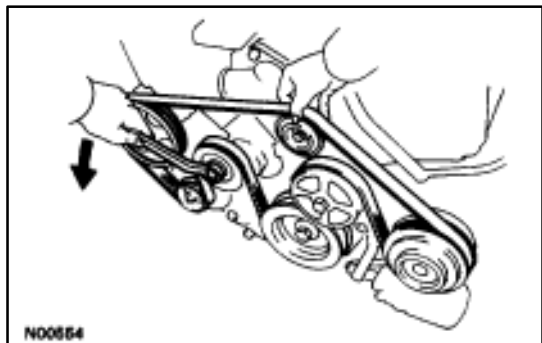
4. DRAIN ENGINE OIL

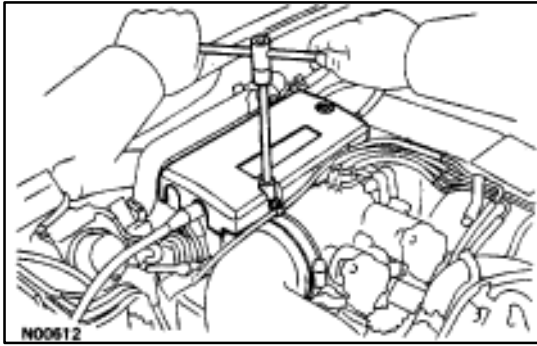
5. REMOVE HOOD

6. REMOVE DRIVE BELT

Loosen the drive belt tension by turning the drive belt tensioner counterclockwise, and remove the drive belt.

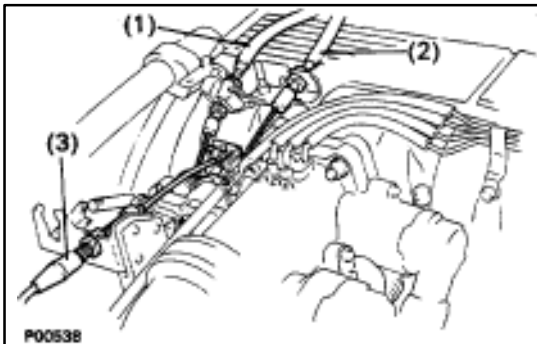
HINT: The pulley bolt for the belt tensioner has a left-hand thread.





7. REMOVE THROTTLE BODY COVER

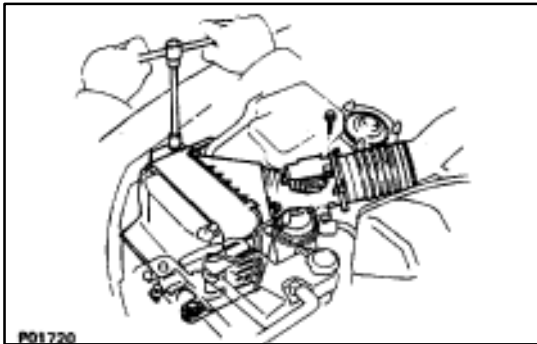
- (a) Remove the mounting cap nut.
- (b) Loosen the two bolts, and remove the throttle body cover.



8. DISCONNECT CONTROL CABLES FROM THROTTLE BODY

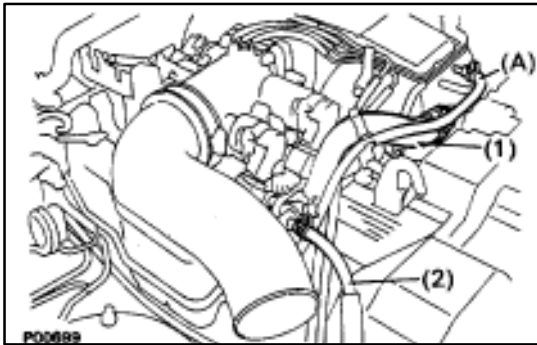
Disconnect the following cables:

- (1) Accelerator cable
- (2) A/T throttle cable
- (3) (w/ Cruise Control System)
Cruise control actuator cable



9. REMOVE AIR CLEANER AND AIR FLOW METER

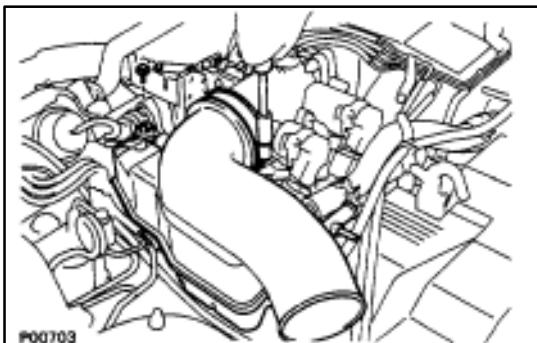
- (a) Disconnect the air flow meter connector.
- (b) Loosen the hose clamp holding the air cleaner hose to the intake air connector.
- (c) Remove the four mounting bolts.
- (d) Disconnect the air cleaner hose from the intake air connector.
- (e) Disconnect the air duct from the air cleaner case, and remove the air cleaner and air flow meter assembly.



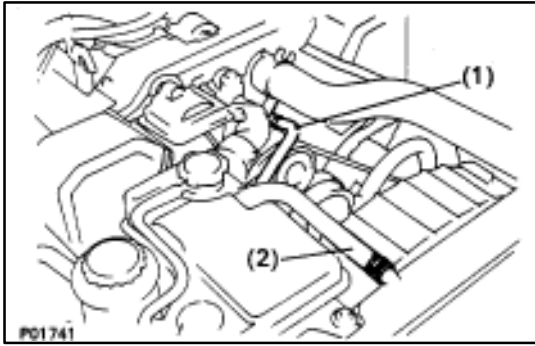
10. DISCONNECT VACUUM HOSE (A) (FROM PS AIR CONTROL VALVE) FROM AIR INTAKE CHAMBER

11. REMOVE INTAKE AIR CONNECTOR

- (a) Disconnect the following hose:
 - (1) Air hose from ISC valve
 - (2) Air hose (from PS air control valve) from intake air connector

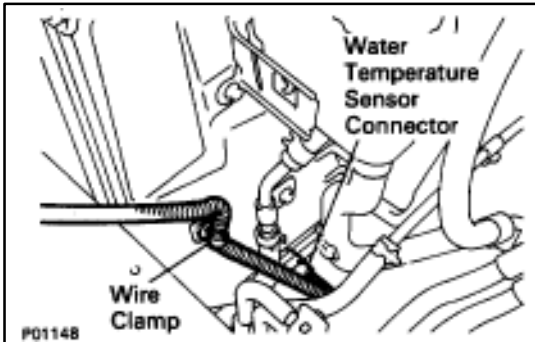
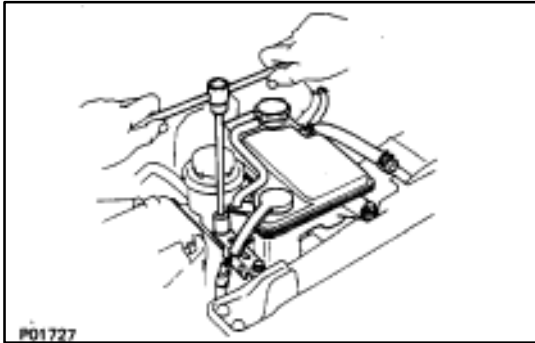


- (b) Remove the bolt holding the intake air connector to the cylinder head cover.
- (c) Loosen the hose clamp.
- (d) Disconnect the intake air connector from the throttle body, and remove the intake air connector.



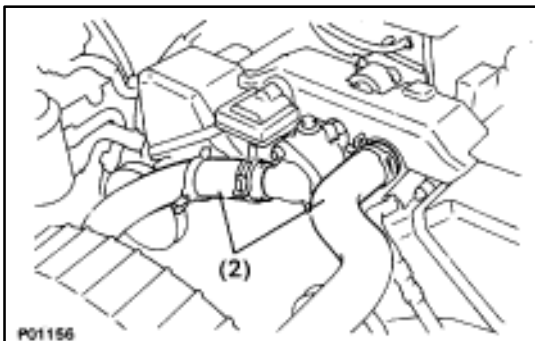
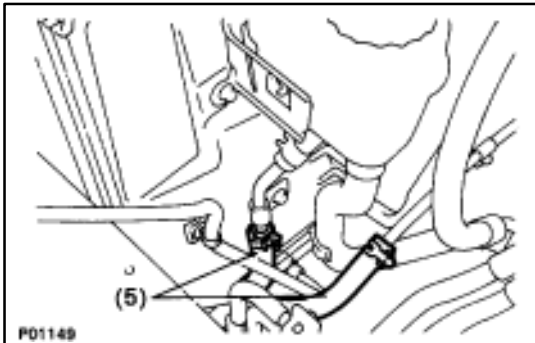
12. REMOVE RADIATOR RESERVOIR TANK

- (a) Disconnect the coolant level sensor connector.
- (b) Disconnect the following hoses:
 - (1) Reservoir hose to water inlet housing
 - (2) Reservoir hose to radiator
- (c) Remove the two bolts and reservoir tank bracket.
- (d) Disconnect the reservoir tank from the reservoir tank bracket, and remove the reservoir tank.

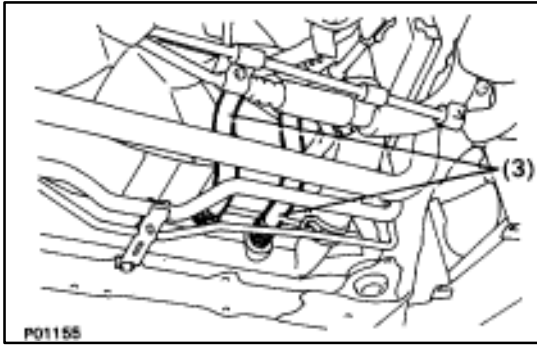


13. REMOVE RADIATOR

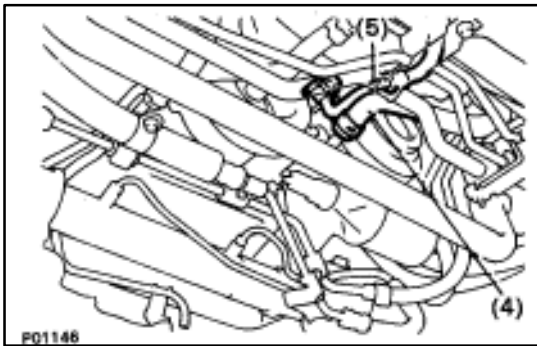
- (a) Disconnect the water temperature sensor connector.
- (b) Disconnect the wire clamp (for water temperature sensor) from the radiator fan shroud.
- (c) Disconnect the following hoses:
 - (1) Two oil cooler hoses (for cooling fan) from pipes



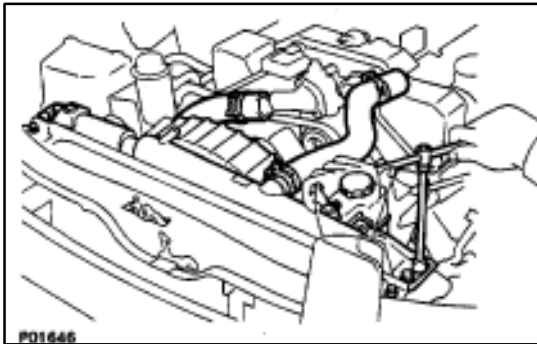
- (2) Two radiator hoses



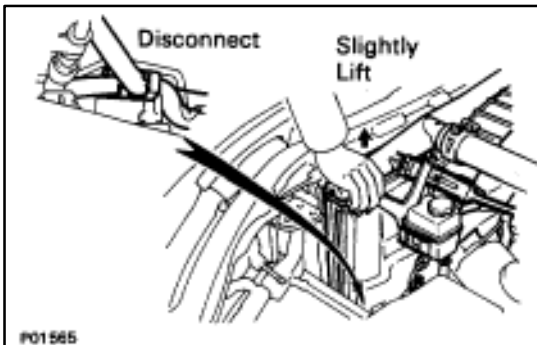
- (3) Two oil cooler hoses (for A/T) from radiator Plug the hose ends.



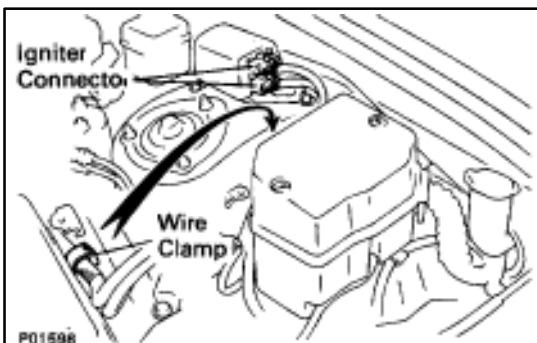
- (4) Suction hose from hydraulic pump
(5) Pressure hose from hydraulic pump



- (c) Remove the two bolts, screw and upper radiator support. Remove the two upper radiator supports.

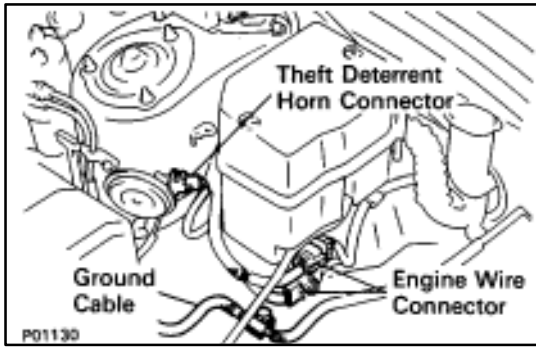


- (d) Slightly lift the radiator, and disconnect the two oil cooler hoses (for cooling fan) from the hose clamp on the radiator fan shroud.
(e) Remove the radiator.



14. DISCONNECT IGNITER CONNECTORS

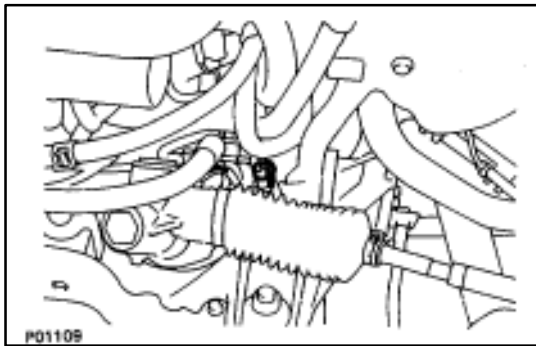
- (a) Disconnect the two igniter connectors.
(b) Disconnect the wire clamp from the body.



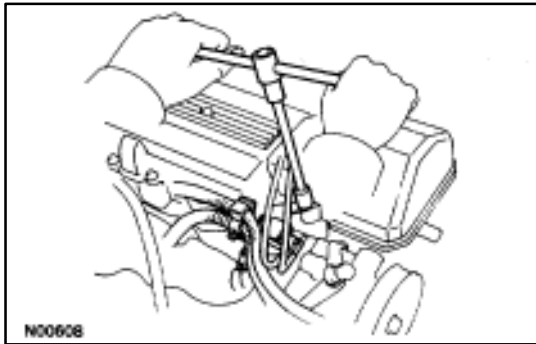
15. DISCONNECT ENGINE WIRE CONNECTORS

16. DISCONNECT THEFT DETERRENT HORN CONNECTOR

17. DISCONNECT GROUND CABLE FROM BODY

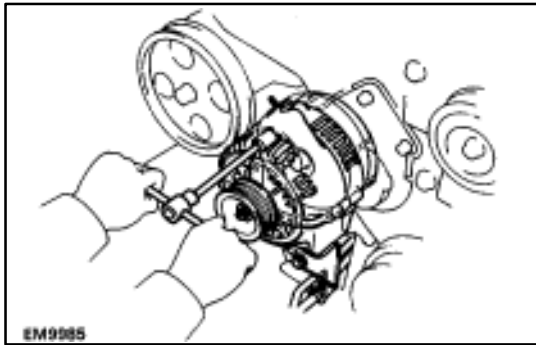


18. DISCONNECT PS SOLENOID VALVE CONNECTOR



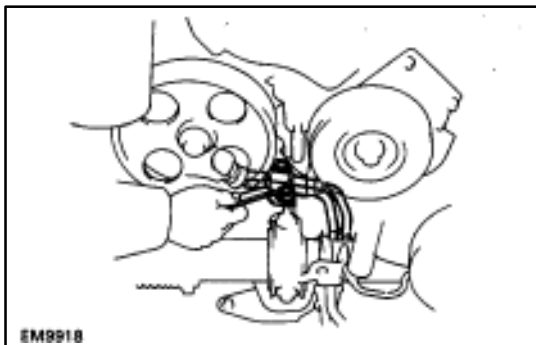
19. DISCONNECT WIRE CLAMP (FOR ALTERNATOR) FROM VSV (FOR EVAP SYSTEM)

- (a) Remove the two bolts, and disconnect the VSV from the RH cylinder head.
- (b) Disconnect the wire clamp from the VSV bracket.



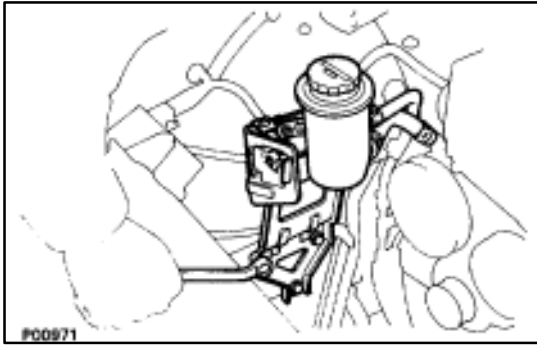
20. REMOVE ALTERNATOR

- (a) Disconnect the alternator connector.
- (b) Remove the cap and nut, and disconnect the alternator wire.
- (c) Remove the mounting bolt and nut.
- (d) Disconnect the A/T oil cooler pipe bracket.
- (e) Remove the alternator.



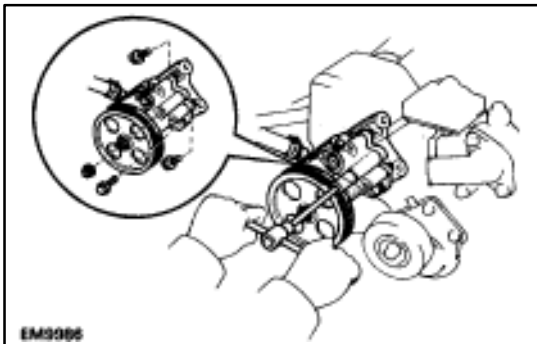
21. DISCONNECT PS TUBES FROM SUSPENSION CROSSMEMBER

Remove the clamp bolt, and disconnect the PS tubes.



22. DISCONNECT PS RESERVOIR TANK AND BRACKET FROM BODY

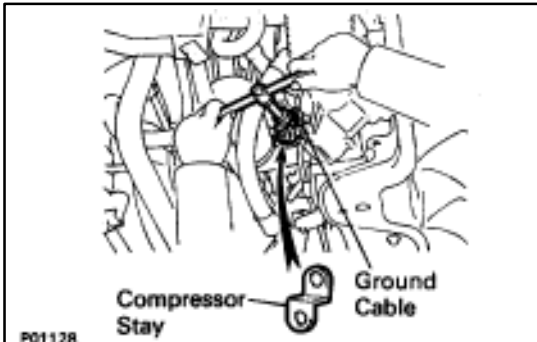
Remove the three bolts, and disconnect the reservoir tank and bracket assembly.



23. DISCONNECT PS PUMP FROM ENGINE

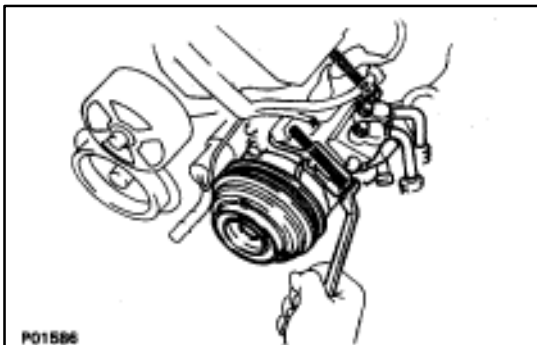
Remove the three pump bolts and nut, and disconnect the PS pump.

HINT: Put aside the PS pump, and suspend it.



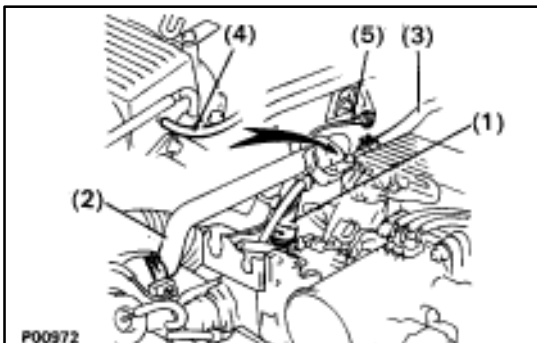
24. DISCONNECT A/C COMPRESSOR

- Disconnect the compressor connector.
- Remove the mounting nut, and disconnect the ground cable.
- Remove the mounting bolt and compressor stay.



- Remove the two mounting bolts, and disconnect the compressor from the engine.

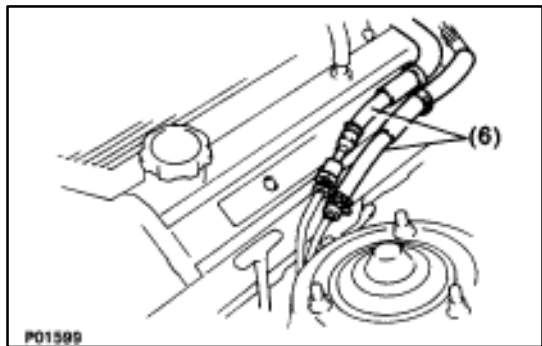
HINT: Put aside the compressor, and suspend it.



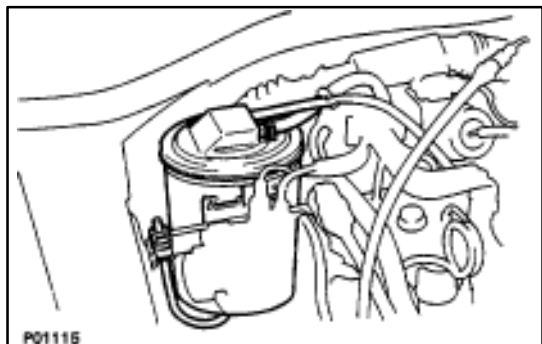
25. DISCONNECT HOSES AND GROUND STRAP

Disconnect the following hose and ground strap:

- Heater water hose from water by-pass pipe
- Heater water hose from heater water valve
- Vacuum hose from brake booster union on air intake chamber
- Vacuum hose (from VSV for heater water valve) from air intake chamber
- Ground strap from bracket on body

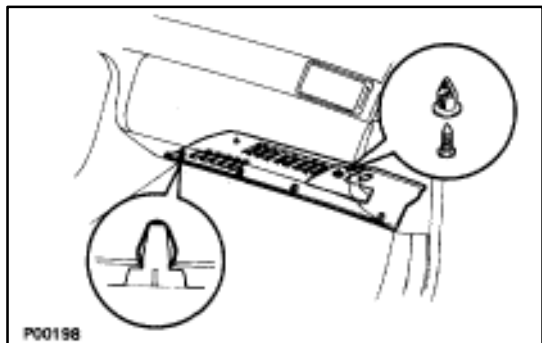


- (6) Two fuel hoses from fuel tubes.
Plug the hose end.



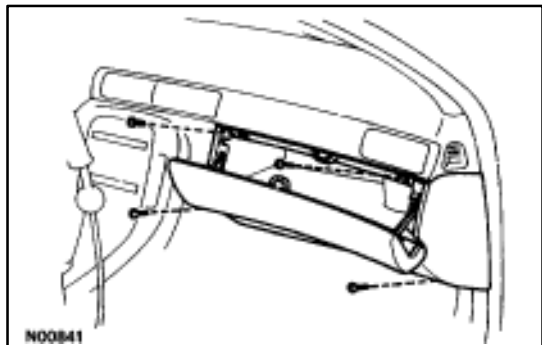
26. REMOVE CHARCOAL CANISTER

- (a) Disconnect the vacuum hose and air hose from the charcoal canister.
- (b) Remove the charcoal canister.

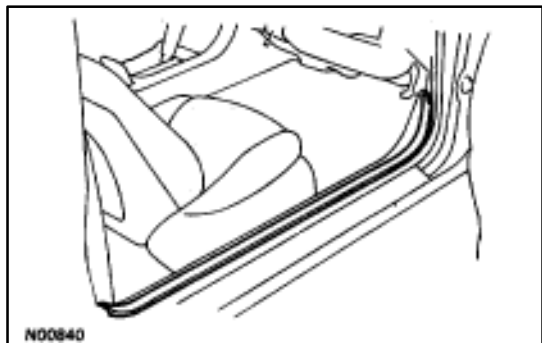


27. DISCONNECT ENGINE WIRE FROM CABIN

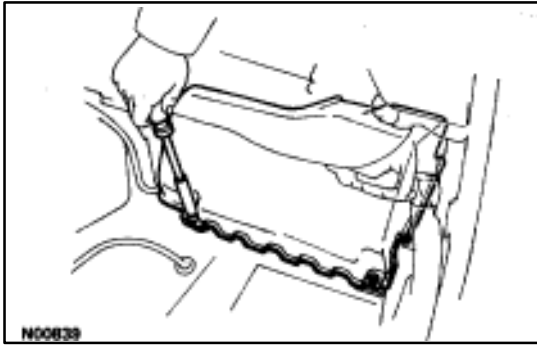
- (a) Remove the two clips, and pull out the instrument panel under cover.



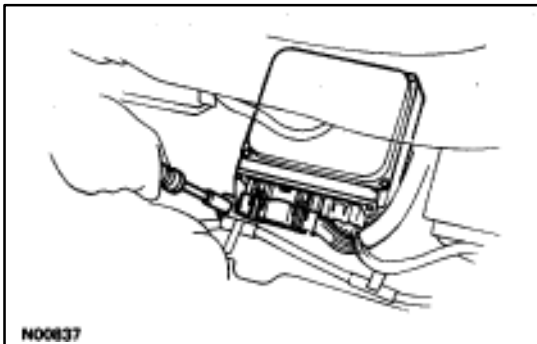
- (b) Remove the four mounting screws.
- (c) Disconnect the connectors, and remove the lower instrument panel finish panel and glove compartment door assembly.



- (d) Pull out the scuff plate.

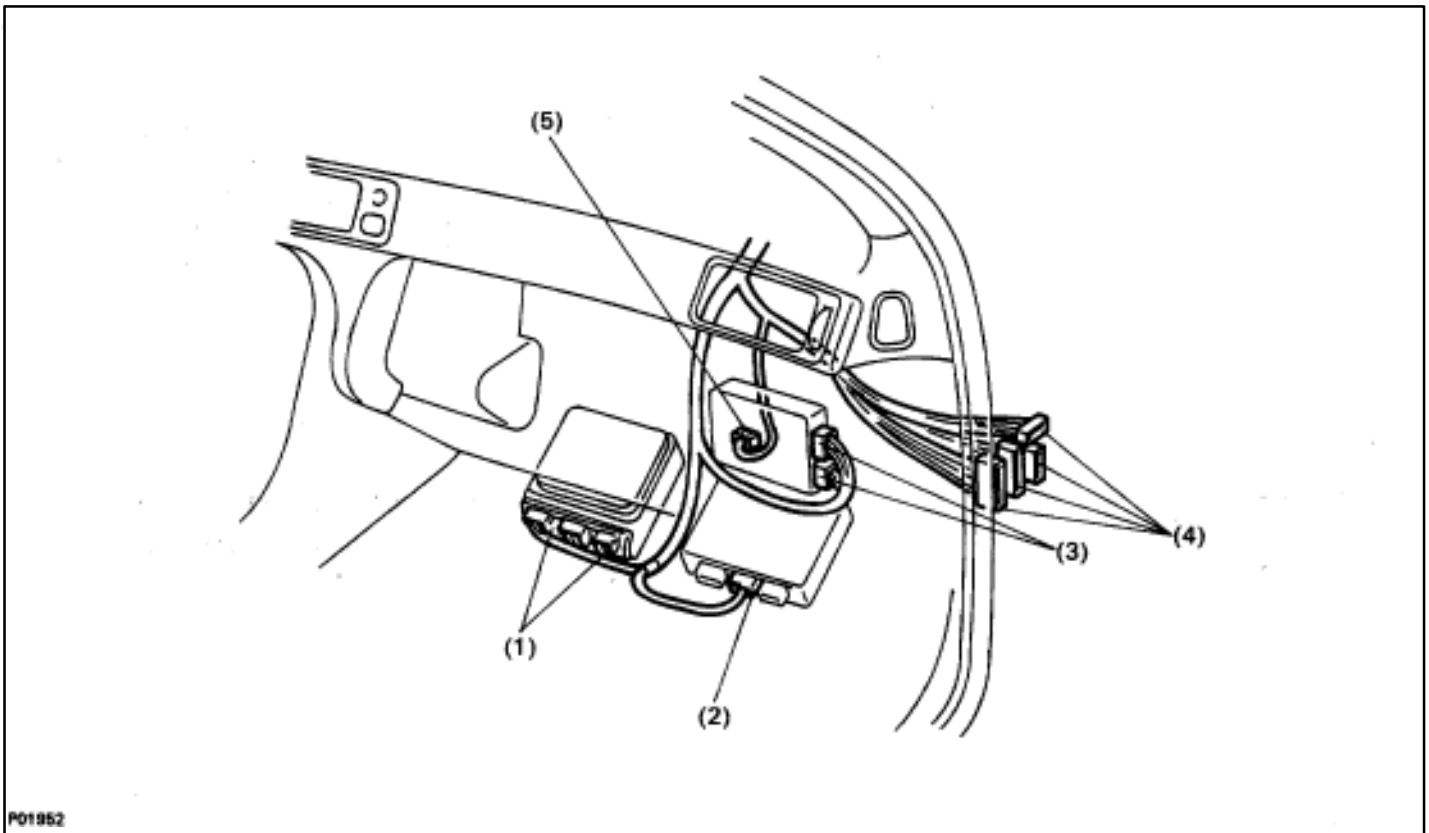


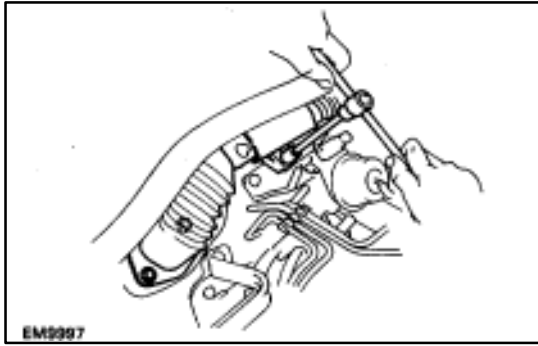
- (e) Take out the front side of the floor carpet.
- (f) Remove the two nuts and ECU protector.



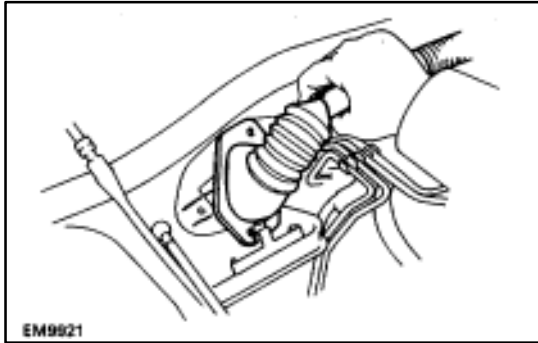
- (g) Remove the nut, and disconnect the engine & ECT ECU from the floor panel.

- (h) Disconnect the following connectors:
 - (1) Two connectors from engine & ECT ECU
 - (2) Connector from ABS & TRAC ECU
 - (3) Two connectors from TRAC ECU
 - (4) Four connectors from connector cassette
 - (5) Connector from A/C control assembly

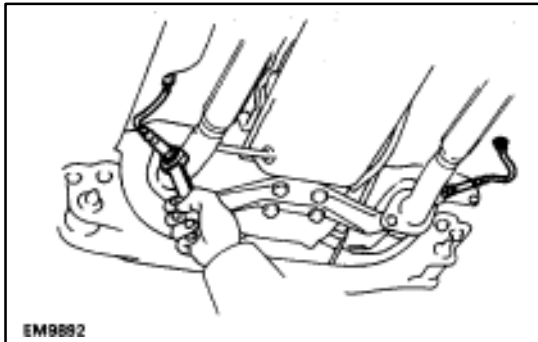




- (i) Remove the bolt holding the engine wire clamp to the heater water valve bracket.
- (j) Remove the two bolts holding the engine wire clamp to the body.

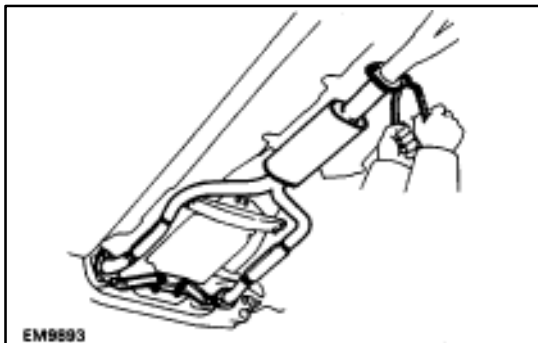


- (k) Pull out the engine wire from the cabin.

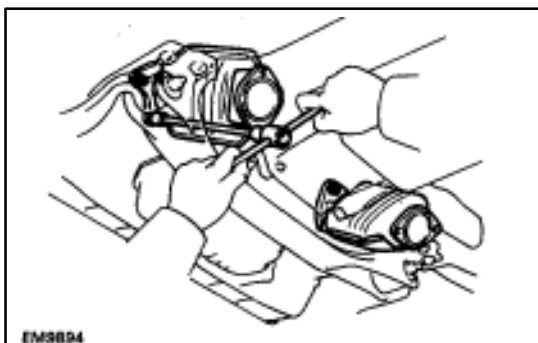


28. REMOVE FRONT EXHAUST PIPE

- (a) Disconnect the grommet from the floor, and disconnect the sub-oxygen sensor from the exhaust pipe. Disconnect the two sub-oxygen sensors.
- (b) Remove the four bolts holding the front exhaust pipe to the transmission.

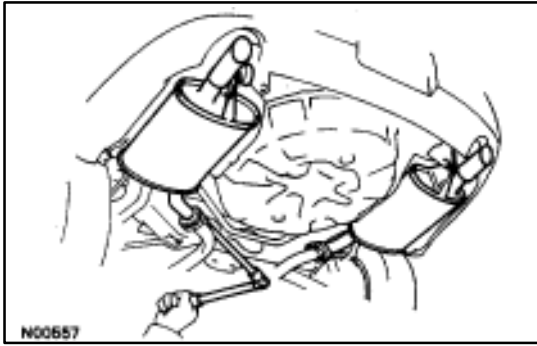


- (c) Remove the two bolts and nuts holding the front exhaust pipe to the center exhaust pipe.
- (d) Remove the four bolts and nuts holding the front exhaust pipe to the catalytic converter. Remove the pipe support stay, front exhaust pipe and three gaskets.

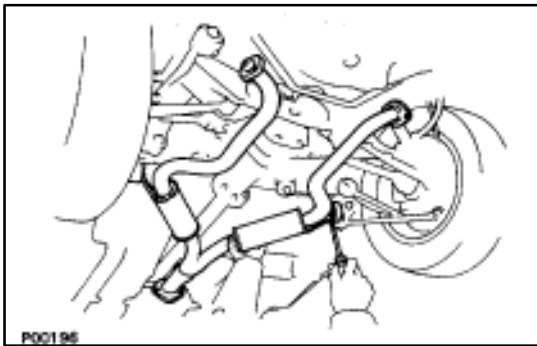


29. REMOVE CATALYTIC CONVERTERS (MAIN)

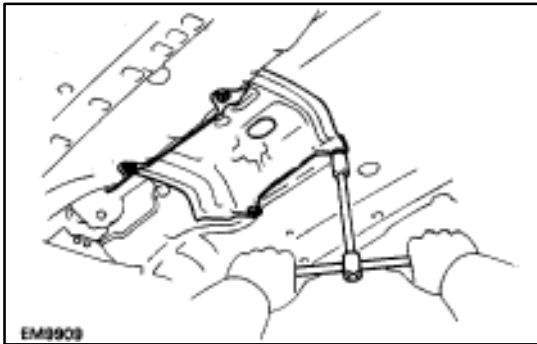
Remove the three nuts, catalytic converter and gasket. Remove the two catalytic converters.

**30. REMOVE TAILPIPES**

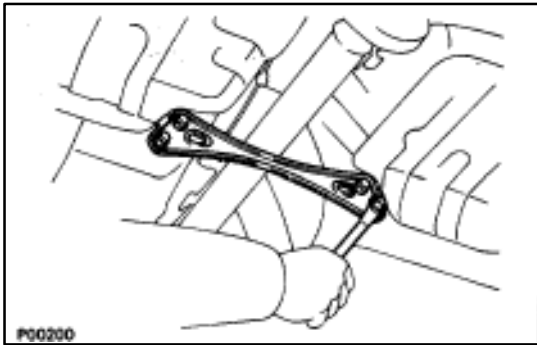
- (a) Remove the four bolts holding the tailpipes to the center exhaust pipe.
- (b) Disconnect the tailpipe hook from the ring on tailpipe bracket, and remove the tailpipe and gasket. Remove the two tailpipes.

**31. REMOVE CENTER EXHAUST PIPE**

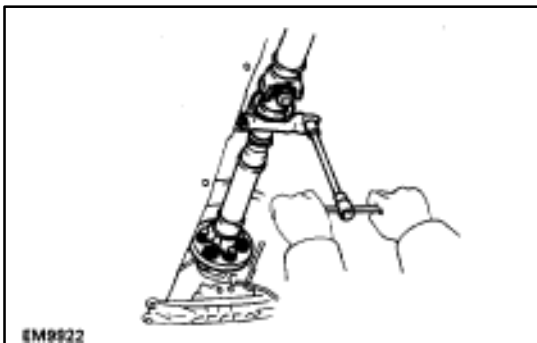
Disconnect the two hooks of the exhaust pipe from the rings on exhaust pipe brackets, and remove the center exhaust pipe.

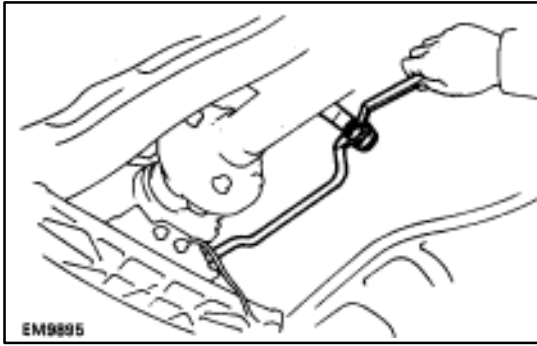
**32. REMOVE EXHAUST PIPE HEAT INSULATOR**

Remove the four nuts and heat insulator.

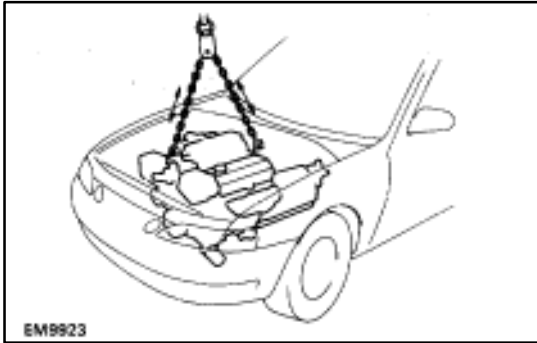
**33. REMOVE CENTER FLOOR BRACE**

Remove the four bolts and brace.

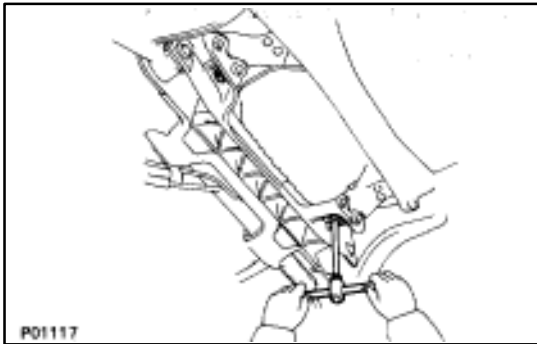
**34. REMOVE PROPELLER SHAFT (See PR section)**

**35. DISCONNECT TRANSMISSION CONTROL ROD**

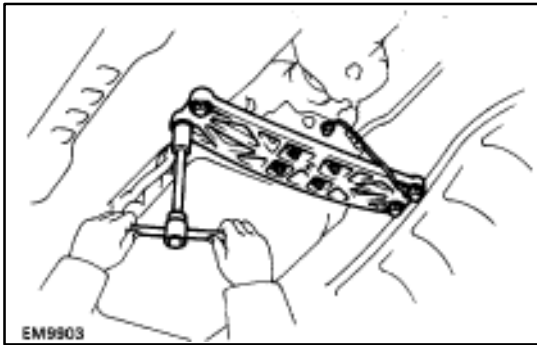
Remove the nut, and disconnect the control rod from the shift lever.

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

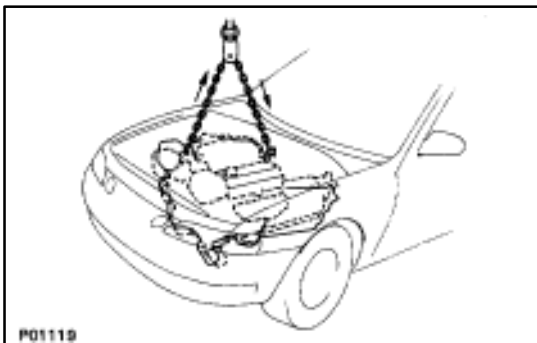
(a) Attach the engine hoist chain to the engine hangers.



(b) Remove the two nuts holding the engine mounting insulators to the front suspension crossmember.



(c) Remove the four bolts, four nuts and rear engine mounting member. Disconnect the ground strap.

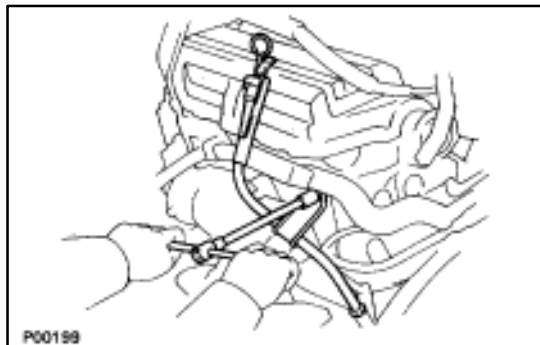
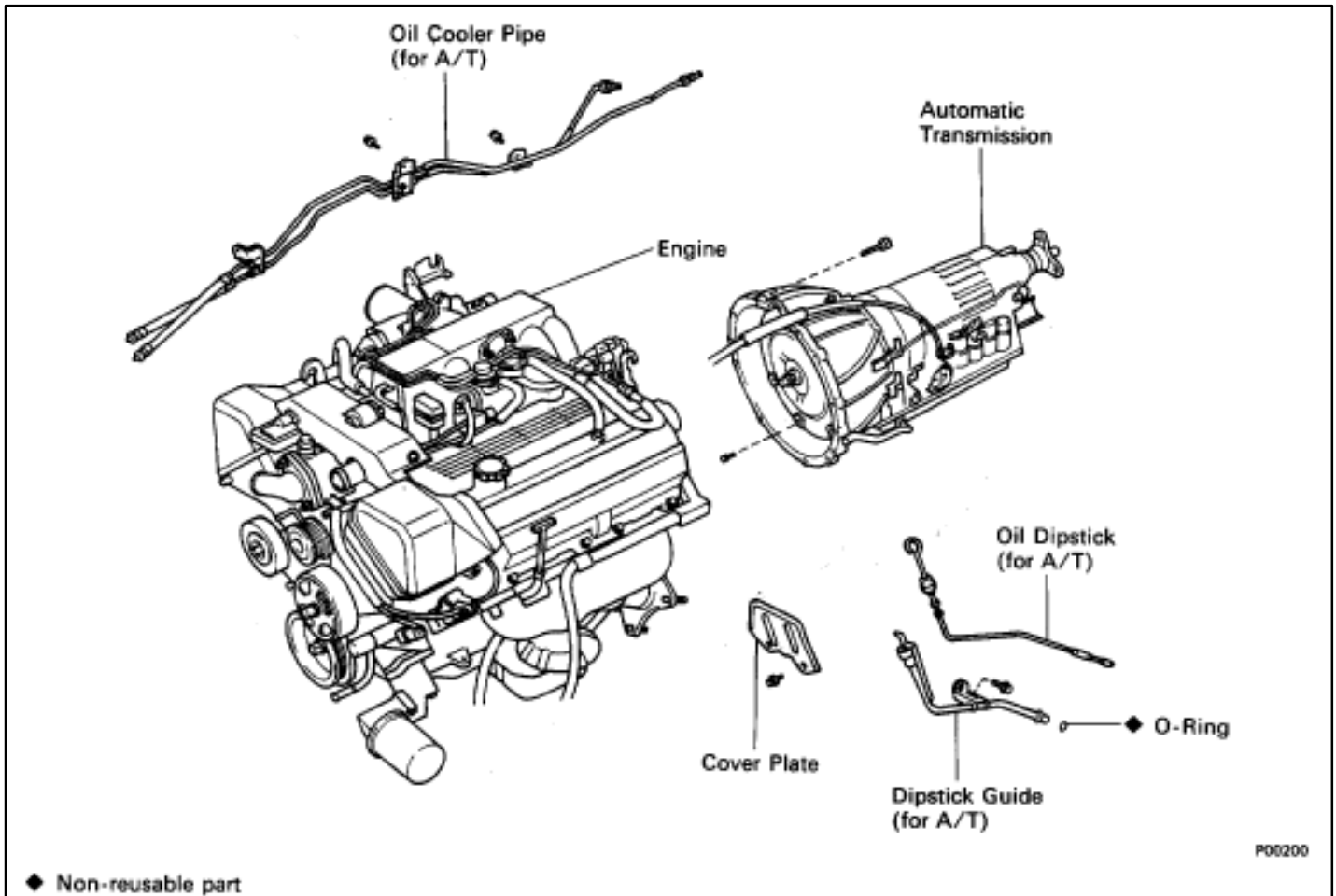


(d) Lift the engine out of the vehicle slowly and carefully.
NOTICE: Be careful not to hit the PS gear housing, neutral start switch and ABS actuator.

(e) Make sure the engine is clear of all wiring, hoses and cables.

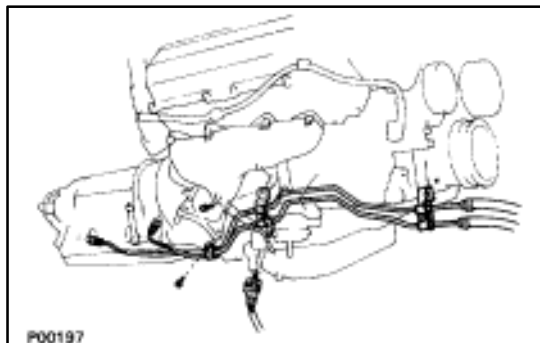
(f) Place the engine and transmission assembly onto the stand.

COMPONENTS FOR SEPARATION AND ASSEMBLY OF ENGINE AND TRANSMISSION



SEPARATION OF ENGINE AND TRANSMISSION

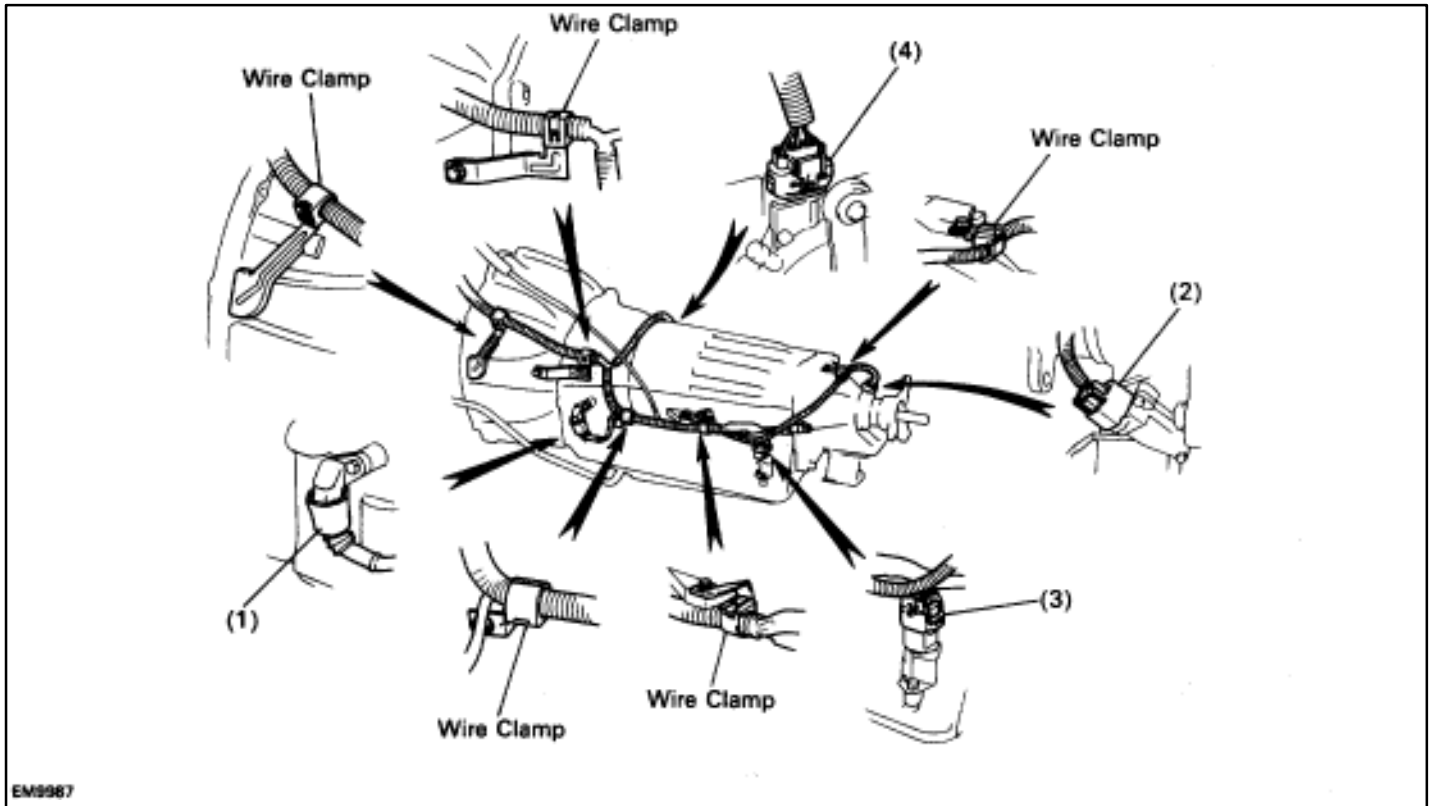
1. REMOVE OIL DIPSTICK GUIDE FOR TRANSMISSION
 - (a) Remove the mounting bolt.
 - (b) Pull out the dipstick guide and dipstick from the transmission.
 - (c) Remove the O-ring from the dipstick guide.



2. REMOVE OIL COOLER PIPES FOR TRANSMISSION
 - (a) Remove the two mounting bolts.
 - (b) Loosen the two union nuts, and remove the oil cooler pipes.

3. DISCONNECT ENGINE WIRE FROM TRANSMISSION

- (a) Disconnect the following connectors:
- (1) O/D direct clutch speed sensor connector
 - (2) No.1 speed sensor connector
 - (3) No.2 speed sensor connector
 - (4) Neutral start switch connector
- (b) Disconnect the five wire clamps from the brackets on the transmission.

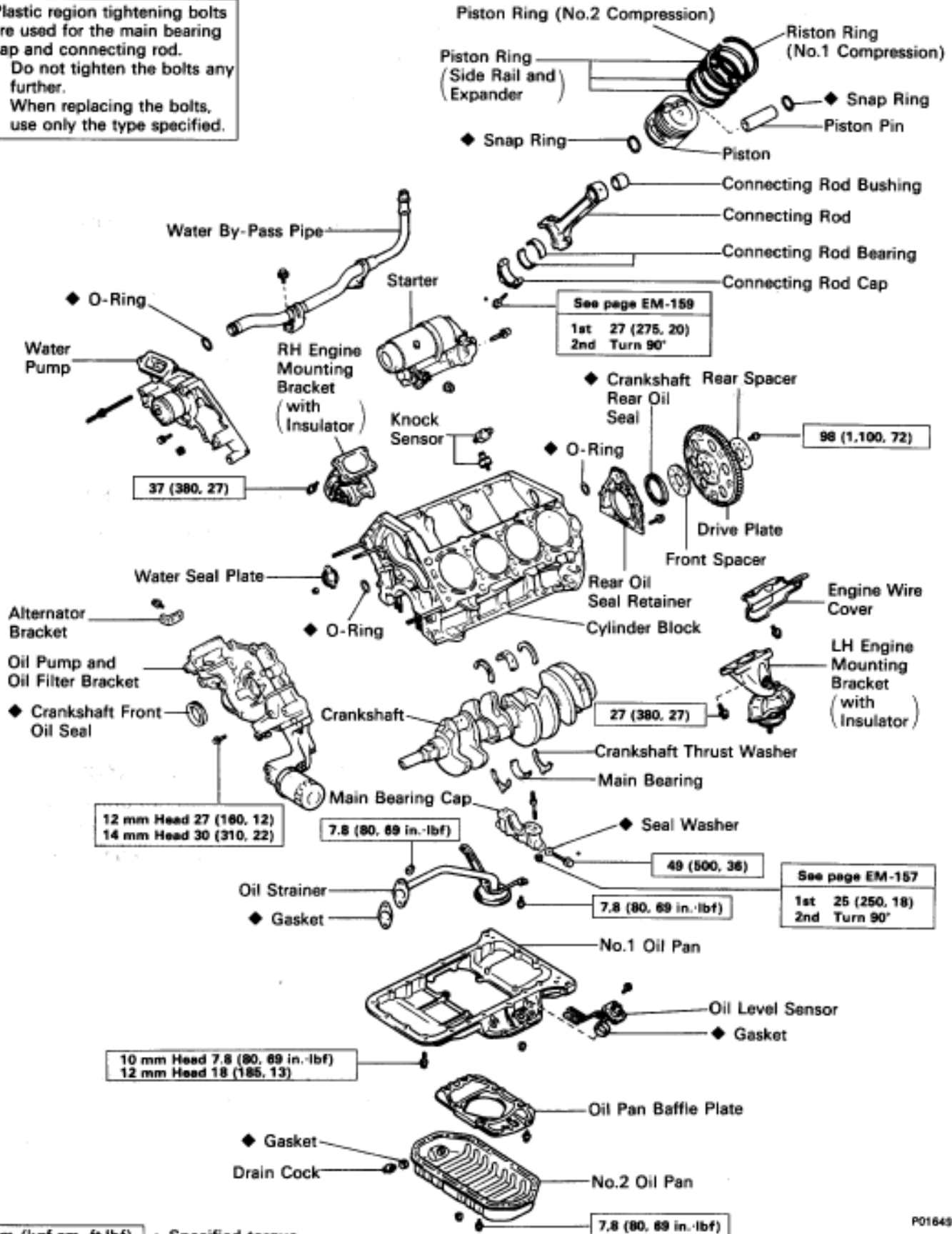


EM9987

4. SEPARATE ENGINE AND TRANSMISSION
(See AT section)

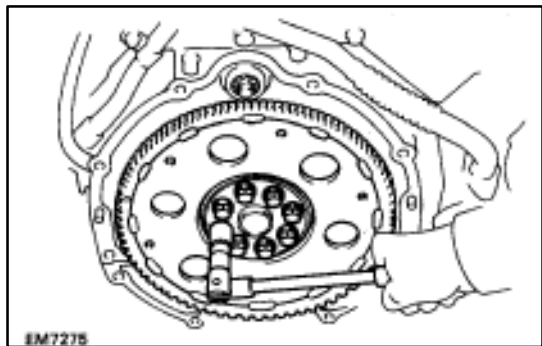
COMPONENTS FOR DISASSEMBLY AND ASSEMBLY OF CYLINDER BLOCK

- *Plastic region tightening bolts are used for the main bearing cap and connecting rod.
- Do not tighten the bolts any further.
 - When replacing the bolts, use only the type specified.



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

◆ Non-reusable part



PREPARATION FOR DISASSEMBLY

(See Components on page EM-131)

1. REMOVE DRIVE PLATE

Remove the eight bolts, two spacers and drive plate.

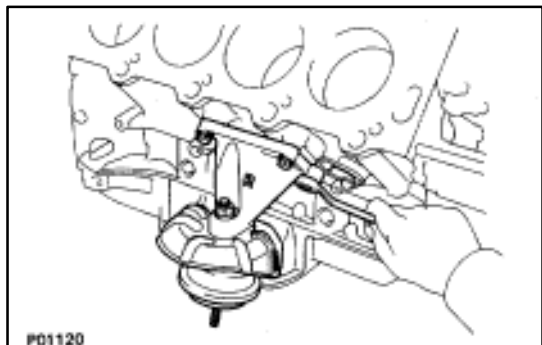
2. INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY

3. REMOVE TIMING BELT AND PULLEYS

(See pages EM-36 to 44)

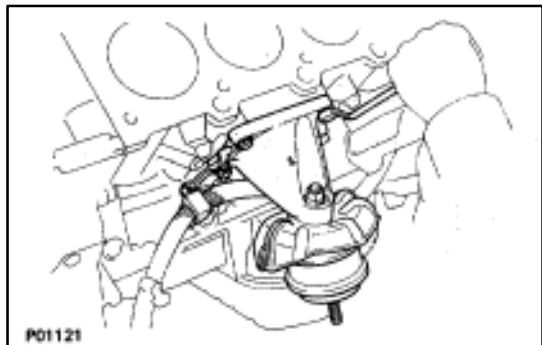
4. REMOVE Cylinder Block

(See pages EM-61 to 75)



5. REMOVE RH ENGINE MOUNTING BRACKET

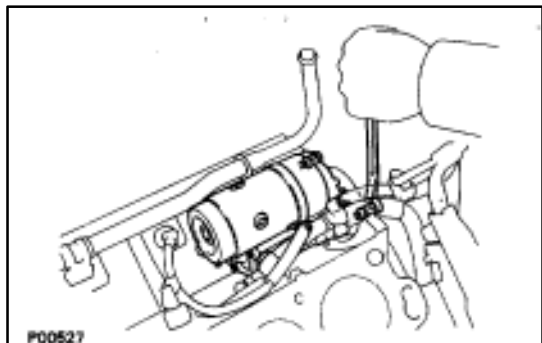
Remove the four bolts and mounting bracket.



6. REMOVE LH ENGINE MOUNTING BRACKET

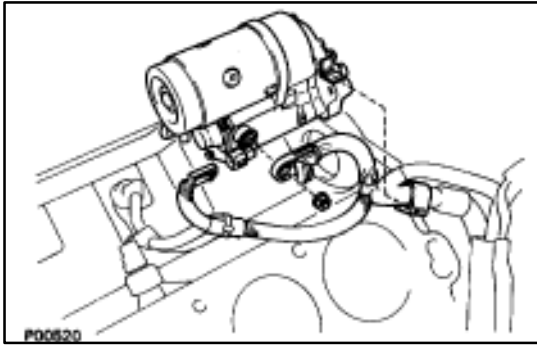
(a) Remove the clamp bolt, and disconnect the engine wire from the engine mounting bracket.

(b) Remove the four bolts and mounting bracket.

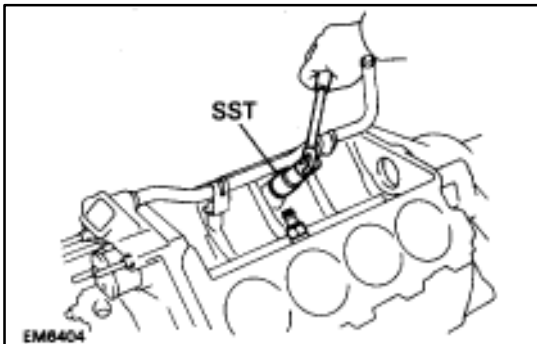


7. REMOVE STARTER

(a) Remove the two bolts, and disconnect the starter from the cylinder block.

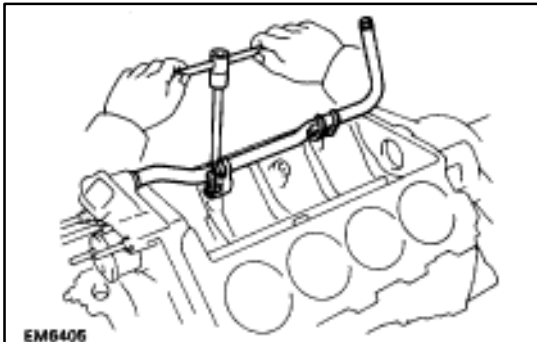


- (b) Disconnect the wire clamp from the bracket on the starter.
- (c) Remove the nut, and disconnect the wire.
- (d) Disconnect the connector, and remove the starter.



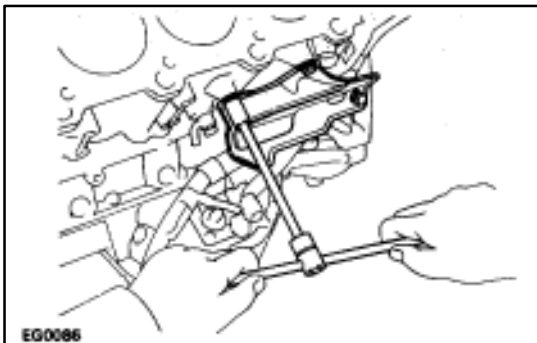
8. REMOVE KNOCK SENSORS

- (a) Disconnect the two knock sensor connectors.
- (b) Using SST, remove the two knock sensors.
SST 09816-30010



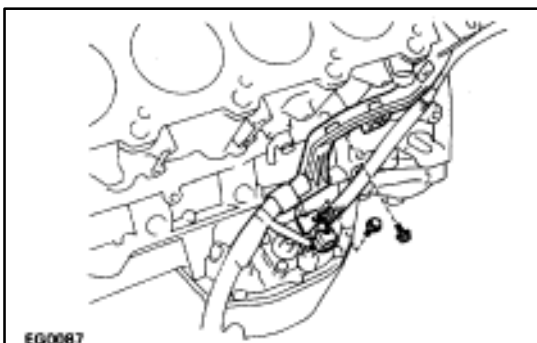
9. REMOVE WATER BY-PASS PIPE

- (a) Remove the two bolts.
- (b) Pull out the by-pass pipe from the water pump.
- (c) Remove the O-ring from the by-pass pipe.

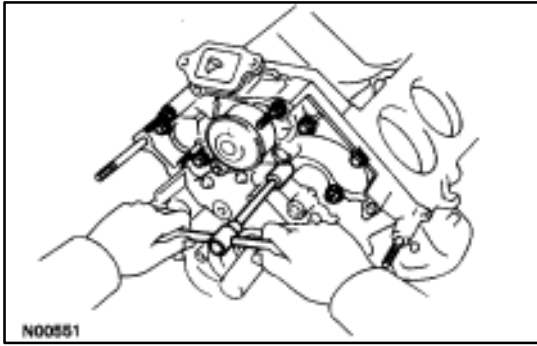


10. REMOVE ENGINE WIRE

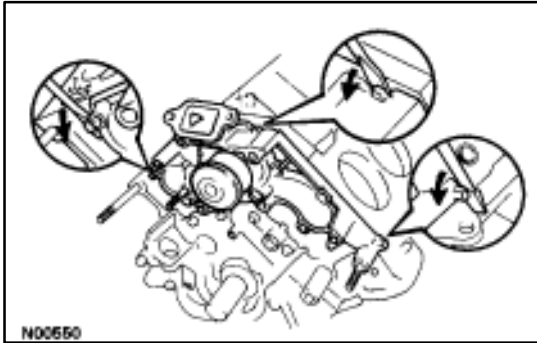
- (a) Disconnect the following connectors:
 - (1) Oil level sensor connector
 - (2) Oil pressure switch connector
- (b) Remove the three bolts and wire cover from the LH side of the cylinder block.



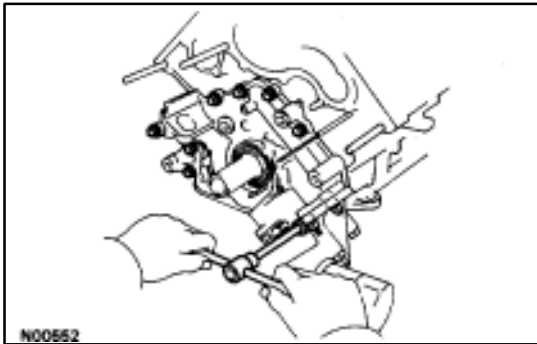
- (c) Remove the two bolts and engine wire.

**11. REMOVE WATER PUMP**

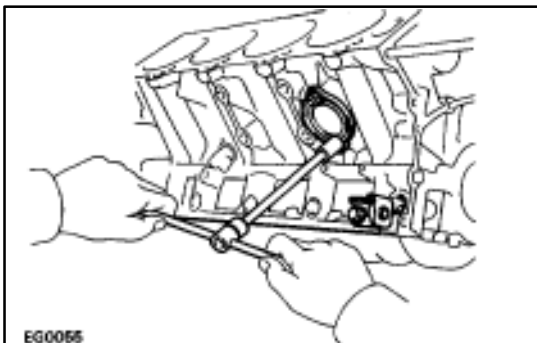
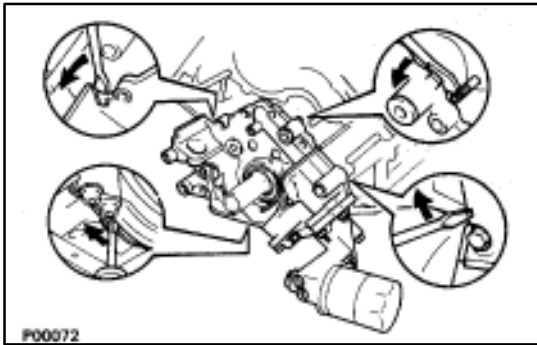
- (a) Remove the five mounting bolt, two mounting stud bolts and mounting nut.
- (b) Remove the water pump by prying the portions between the water pump and cylinder block with a screwdriver.

**12. REMOVE NO.2 AND NO.1 OIL PANS**

(See steps 7 to 12 on pages [LU-9](#) to 11)

**13. REMOVE OIL PUMP**

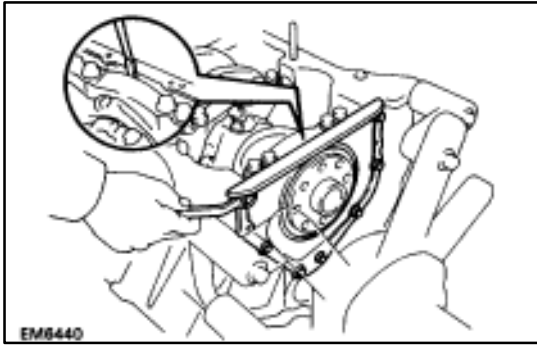
- (a) Remove the eight mounting bolts.
- (b) Remove the oil pump by prying the portions between the oil pump and cylinder block with a screwdriver.
- (c) Remove the O-ring from the cylinder block.

**14. REMOVE ALTERNATOR BRACKET**

Remove the bolt and bracket.

15. REMOVE WATER SEAL PLATE

Remove the two nuts and seal plate.

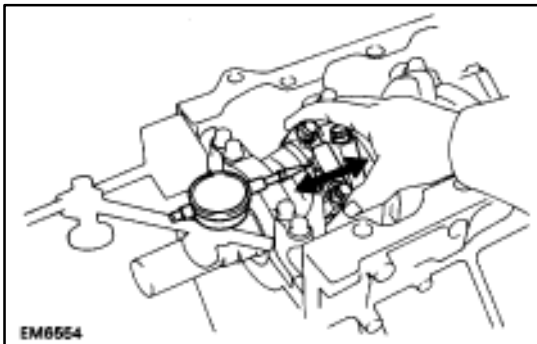


DISASSEMBLY OF CYLINDER BLOCK

(See Components on page [EM-131](#))

1. REMOVE REAR OIL SEAL RETAINER

- (a) Remove the seven bolts.
- (b) Remove the oil seal retainer by prying the portions between the oil seal retainer and main bearing cap with a screwdriver.
- (c) Remove the O-ring.



2. CHECK CONNECTING ROD THRUST CLEARANCE

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

Standard thrust clearance: 0.160–0.290 mm

(0.0063–0.0114 in.)

Maximum thrust clearance: 0.35 mm (0.0138 in.)

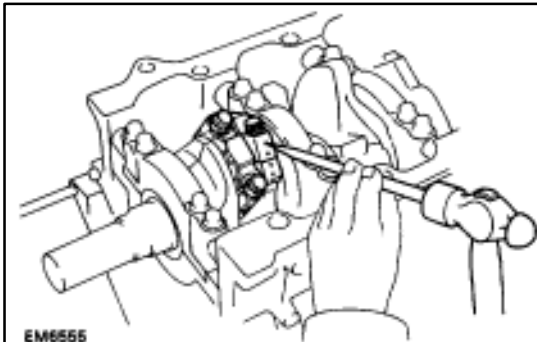
If the thrust clearance is greater than maximum, replace the connecting rod assembly(s). If necessary, replace the crankshaft.

Connecting rod thickness: 22.880–22.920 mm

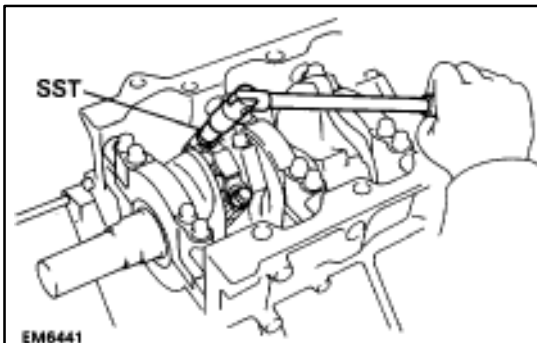
(0.9008–0.9024 in.)

3. REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE

- (a) Using a punch or numbering stamp, place the matchmarks on the connecting rod and cap to ensure correct reassembly.

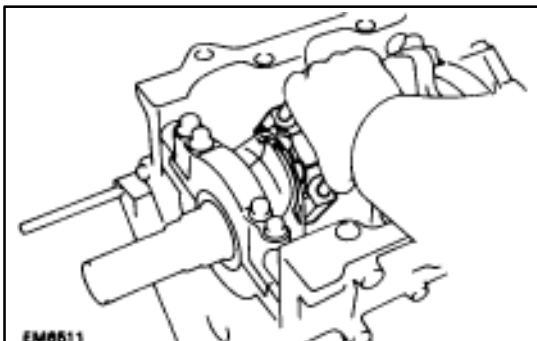


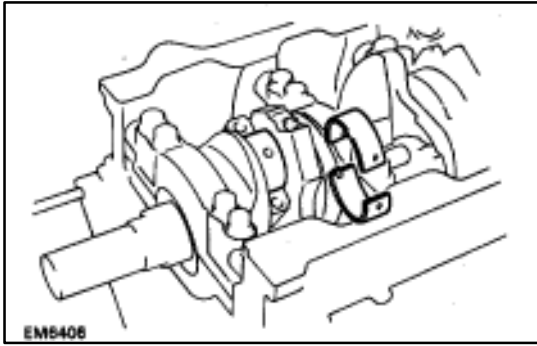
- (b) Using SST, remove the two connecting rod bolts.
SST 09011–38121



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

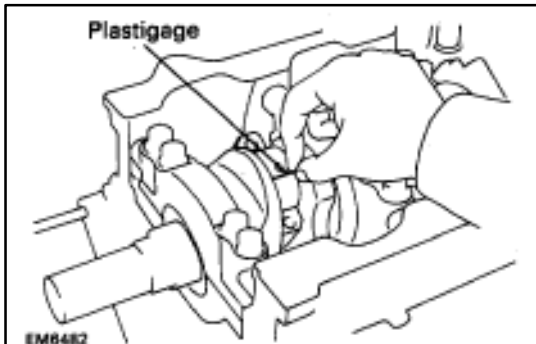
HINT: Keep the lower bearing inserted with the connecting rod cap.



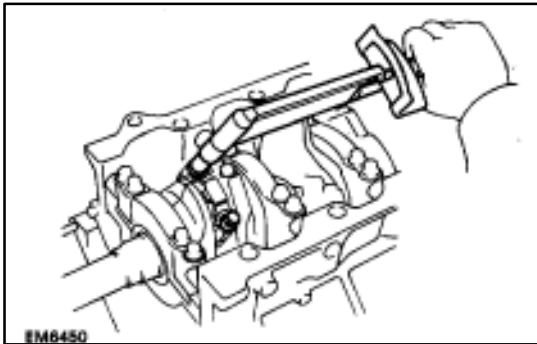


- (d) Clean the crank pin and bearings.
- (e) Check the crank pin and bearing for pitting and scratches.

If the crank pin or bearing are damaged, replace the bearings. If necessary, replace the crankshaft.



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

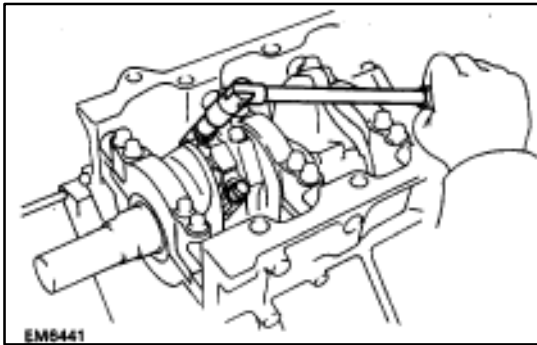


- (g) Install the connecting rod cap with the two bolts.
(See step 6 on pages [EM-159](#) and 160)

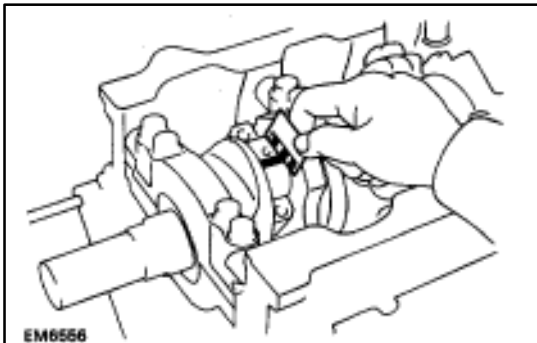
Torque: 1st 25 N·m (250 kgf·cm, 18 ft·lbf)

2nd Turn 90°

NOTICE: Do not turn the crankshaft.



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



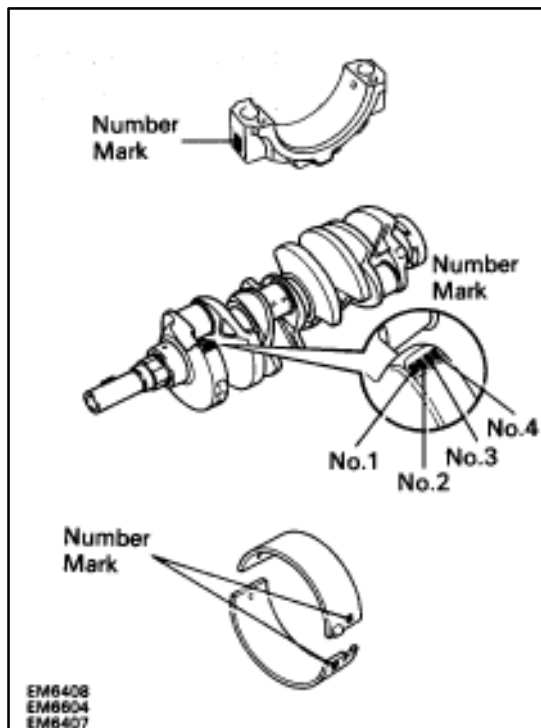
- (i) Measure the Plastigage at widest point.

Standard oil clearance: 0.027–0.053 mm

(0.0011–0.0021 in.)

Maximum oil clearance: 0.065 mm (0.0026 in.)

If the oil clearance is greater than maximum, replace the bearings. If necessary, 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 six sizes of standard bearings, marked "2", "3", "4", "5", "6" and "7" accordingly.

	Number mark											
Connecting rod cap	1	1	2	1	2	3	2	3	4	3	4	4
Crankshaft	1	2	1	3	2	1	3	2	1	3	2	3
Use bearing	2	3		4			5		6	7		

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

(Reference)

Connecting rod big end inside diameter:

Mark "1" 55.000–55.006 mm
(2.1654–2.1656 in.)

Mark "2" 55.006–55.012 mm
(2.1656–2.1658 in.)

Mark "3" 55.012–55.018 mm
(2.1658–2.1661 in.)

Mark "4" 55.018–55.024 mm
(2.1661–2.1663 in.)

Crankshaft crank pin diameter:

Mark "1" 51.994–52.000 mm
(2.0470–2.0472 in.)

Mark "2" 51.988–51.994 mm
(2.0468–2.0470 in.)

Mark "3" 51.982–51.988 mm
(2.0465–2.0468 in.)

Standard sized bearing center wall thickness:

Mark "2" 1.484–1.487 mm
(0.0584–0.0585 in.)

Mark "3" 1.487–1.490 mm
(0.0585–0.0587 in.)

Mark "4" 1.490–1.493 mm
(0.0587–0.0588 in.)

Mark "5" 1.493–1.496 mm
(0.0588–0.0589 in.)

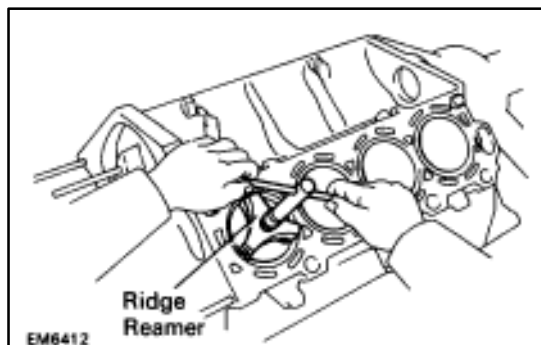
Mark "6" 1.496–1.499 mm
(0.0589–0.0590 in.)

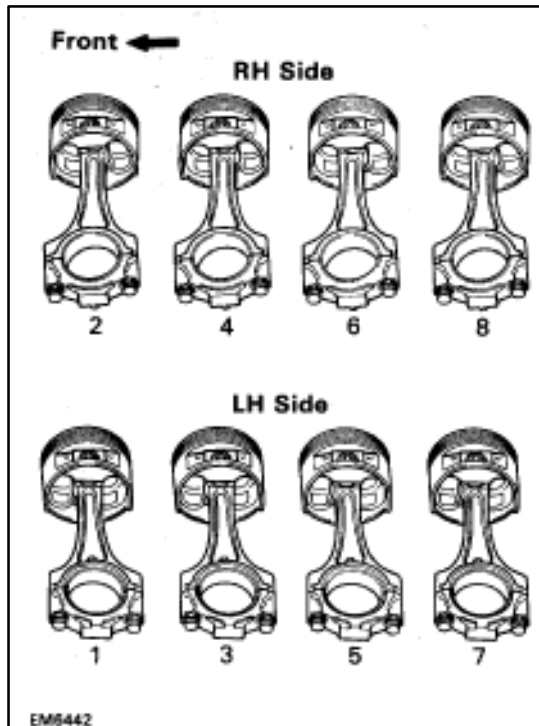
Mark "7" 1.499–1.502 mm
(0.0590–0.0591 in.)

(j) Completely remove the Plastigage.

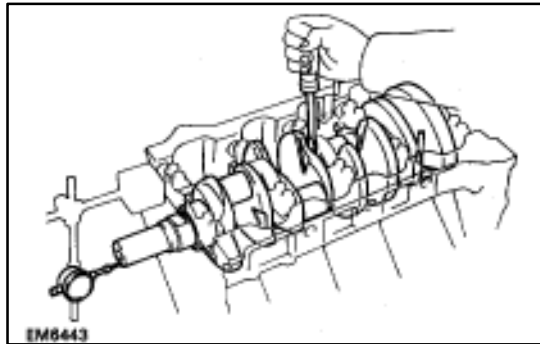
4. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

- Using a ridge reamer, remove all the carbon from the top of the cylinder.
- Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.



**HINT:**

- Keep the bearings, connecting rod and cap together.
- Arrange the piston and connecting rod assemblies in correct order.

**5. 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

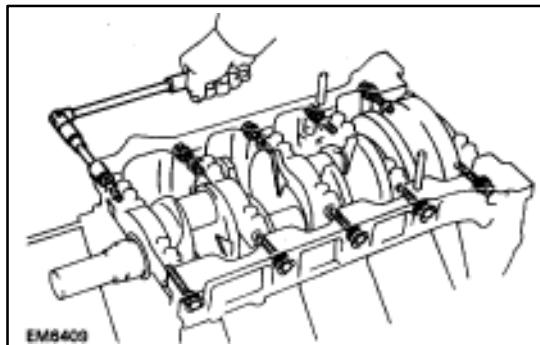
(0.0008–0.0087 in.)

Maximum thrust clearance: 0.30 mm (0.0118 in.)

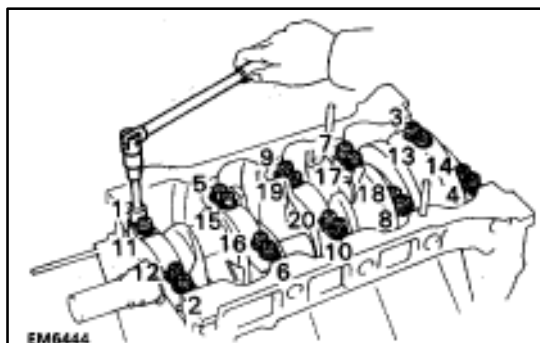
If the thrust clearance is greater than maximum, replace the thrust washers as a set.

Thrust washer thickness: 2.440–2.490 mm

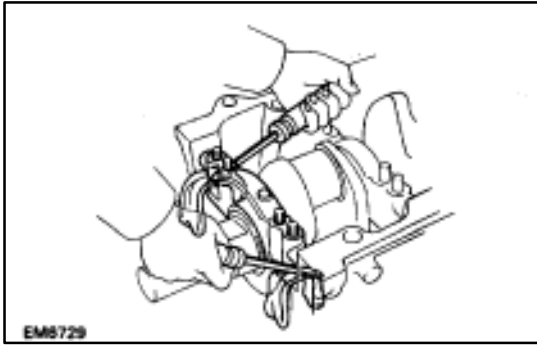
(0.0961–0.0980 in.)

**6. REMOVE MAIN BEARING CAP AND CHECK OIL CLEARANCE**

(a) Remove the ten main bearing cap bolts.



(b) Uniformly loosen and remove the twenty main bearing cap nuts in several passes in the sequence shown.



- (c) Using two screwdrivers, pry out the main bearing cap, and remove the five main bearing cap, lower main bearings and two lower thrust washers (No.3 main bearing cap only).

NOTICE: Be careful not to damage the cylinder block.

HINT:

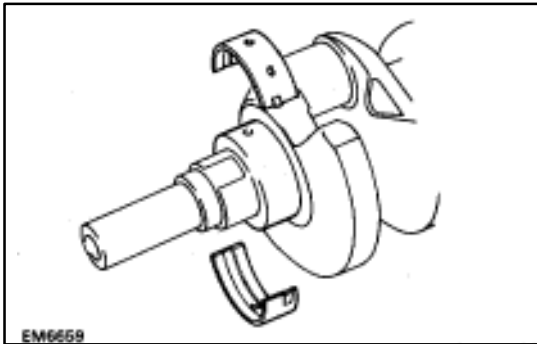
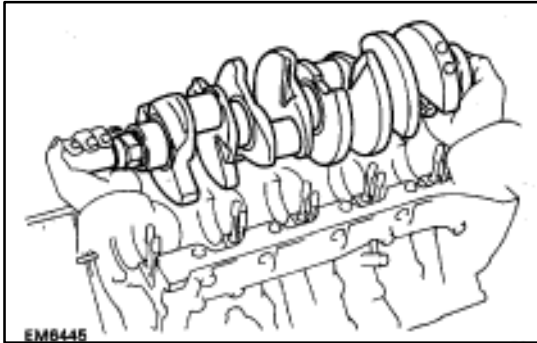
- Keep the lower main bearing and main bearing cap together.
- Arrange the main bearing caps and lower thrust washers in correct order.

- (d) Lift out the crankshaft.

- (e) Remove the two upper thrust washers.

HINT:

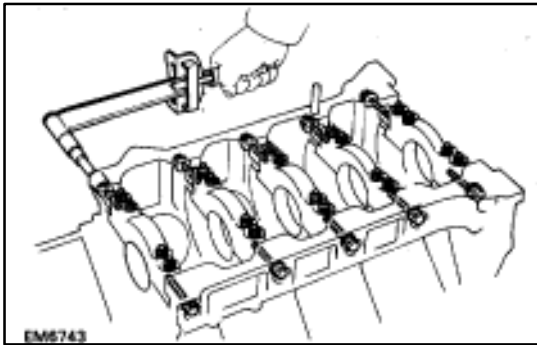
- Arrange the upper thrust washers in correct order.
- Keep the upper main bearings together with the cylinder block.



- (f) Clean each main journal and bearing.

- (g) Check each main journal and bearing for pitting and scratches.

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



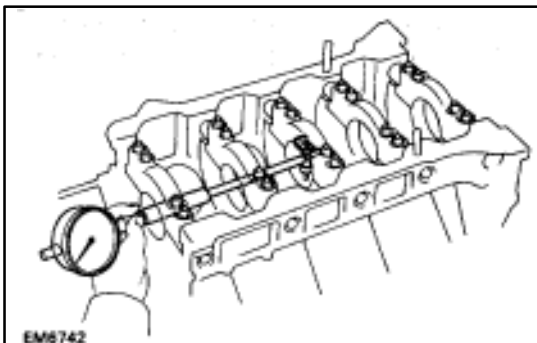
- (h) Install the five main bearing caps with the twenty nuts and ten bolts. Do not install the crankshaft. (See step 4 on pages [EM-157](#) and 158)

Torque:

Nut 1st 27 N·m (275 kgf·cm, 20 ft·lbf)

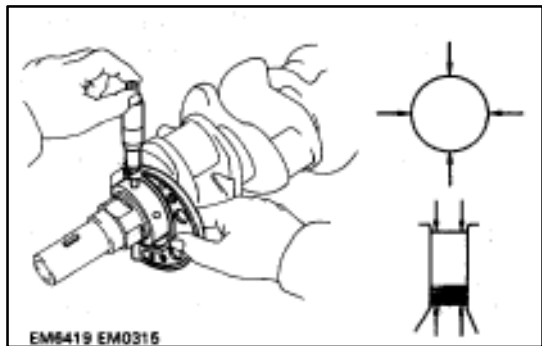
2nd Turn 90°

Bolt 49 N·m (500 kgf·cm, 36 ft·lbf)



- (i) Using a cylinder gauge, measure the inside diameter of the main bearing.

Bearing inside diameter: 67.026–67.033 mm
(2.6388–2.6391 in.)



- (j) Using a micrometer, measure the diameter of the main journal.

**Main journal diameter: 66.988–67.000 mm
(2.6373–2.6378 in.)**

- (k) Subtract the main journal diameter measurement from the main bearing inside diameter measurement.

**Standard oil clearance: 0.026–0.045 mm
(0.0010–0.0018 in.)**

Maximum clearance: 0.055 mm (0.0022 in.)

If the oil clearance is greater than maximum, replace the bearings. If necessary, 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 five sizes of standard bearings, marked "1", "2", "3", "4" and "5" accordingly.

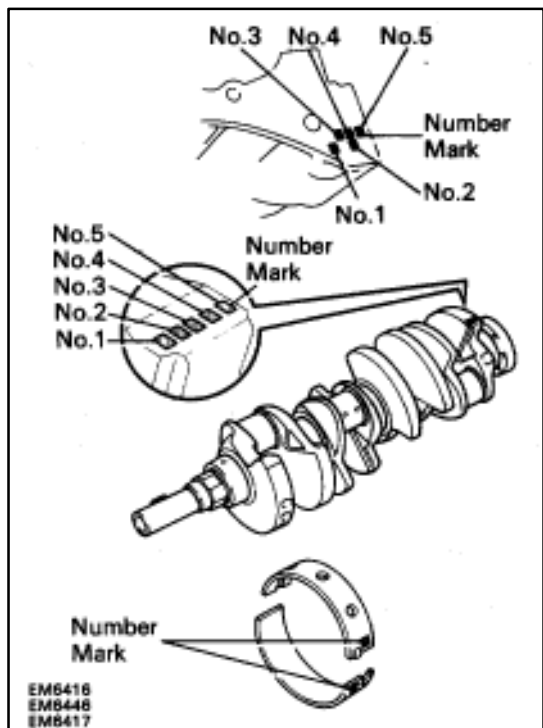
	Total number " ": Number mark				
Cylinder block (A) + Crankshaft (B) =	0–5	6–11	12–17	18–23	24–28
Use bearing	"1"	"2"	"3"	"4"	"5"

EXAMPLE: Cylinder block "06" (A)
+ Crankshaft "08" (B)
= Total number 14 (Use bearing "3")

(Reference)

Cylinder block main journal bore diameter (A):

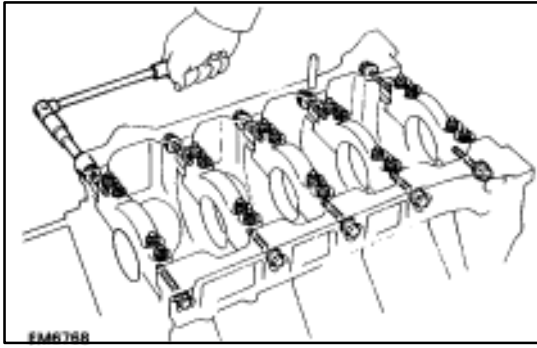
Mark "00" 72.000 mm (2.8346 in.)
 Mark "01" 72.001 mm (2.8347 in.)
 Mark "02" 72.002 mm (2.8347 in.)
 Mark "03" 72.003 mm (2.8348 in.)
 Mark "04" 72.004 mm (2.8348 in.)
 Mark "05" 72.005 mm (2.8348 in.)
 Mark "06" 72.006 mm (2.8349 in.)
 Mark "07" 72.007 mm (2.8349 in.)
 Mark "08" 72.008 mm (2.8350 in.)
 Mark "09" 72.009 mm (2.8350 in.)
 Mark "10" 72.010 mm (2.8350 in.)
 Mark "11" 72.011 mm (2.8351 in.)
 Mark "12" 72.012 mm (2.8351 in.)
 Mark "13" 72.013 mm (2.8352 in.)
 Mark "14" 72.014 mm (2.8352 in.)
 Mark "15" 72.015 mm (2.8352 in.)
 Mark "16" 72.016 mm (2.8353 in.)



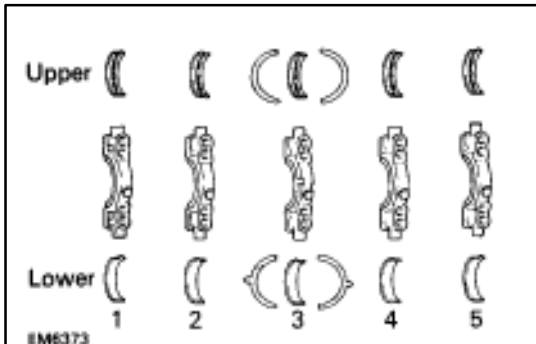
Crankshaft main journal diameter (B):**Mark "00" 67.000 mm (2.6378 in.)****Mark "01" 66.999 mm (2.6378 in.)****Mark "02" 66.998 mm (2.6377 in.)****Mark "03" 66.997 mm (2.6377 in.)****Mark "04" 66.996 mm (2.6376 in.)****Mark "05" 66.995 mm (2.6376 in.)****Mark "06" 66.994 mm (2.6376 in.)****Mark "07" 66.993 mm (2.6375 in.)****Mark "08" 66.992 mm (2.6375 in.)****Mark "09" 66.991 mm (2.6374 in.)****Mark "10" 66.990 mm (2.6374 in.)****Mark "11" 66.989 mm (2.6374 in.)****Mark "12" 66.988 mm (2.6373 in.)****Standard sized bearing center wall thickness:****Mark "1" 2.486–2.489 mm****(0.0979–0.0980 in.)****Mark "2" 2.489–2.492 mm****(0.0980–0.0981 in.)****Mark "3" 2.492–2.495 mm****(0.0981–0.0982 in.)****Mark "4" 2.495–2.498 mm****(0.0982–0.0983 in.)****Mark "5" 2.498–2.501 mm****(0.0983–0.0985 in.)****Standard sized Bearing Selection Chart**

Crankshaft number mark	Cylinder block number mark																
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
00	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3
01	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3
02	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3	4
03	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3	4	4
04	1	1	2	2	2	2	2	2	3	3	3	3	3	3	4	4	4
05	1	2	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4
06	2	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	4
07	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	4	4
08	2	2	2	2	3	3	3	3	3	3	4	4	4	4	4	4	5
09	2	2	2	3	3	3	3	3	3	4	4	4	4	4	4	5	5
10	2	2	3	3	3	3	3	3	4	4	4	4	4	4	5	5	5
11	2	3	3	3	3	3	3	4	4	4	4	4	4	5	5	5	5
12	3	3	3	3	3	3	4	4	4	4	4	4	5	5	5	5	5

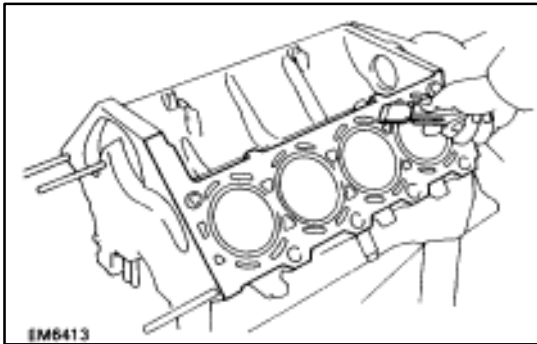
EXAMPLE: Cylinder block "06", Crankshaft "08" = Use bearing "3"



- (k) Remove the ten bolts, twenty nuts and five main bearing caps. (See procedure (a) to (c) above)
- (l) Remove the five upper main bearings from the cylinder block.



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



INSPECTION AND REPAIR OF CYLINDER BLOCK

1. CLEAN CYLINDER BLOCK

A. Remove gasket material

Using a gasket scraper, remove all the gasket material from the top surfaces of the cylinder block.

B. Clean cylinder block

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

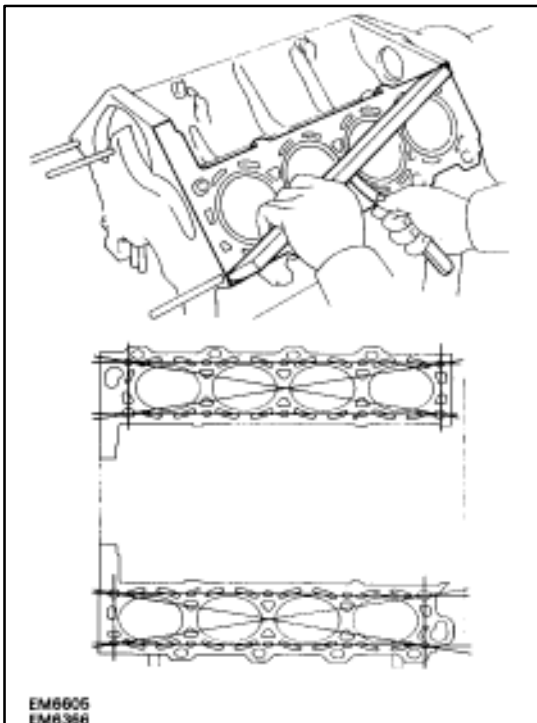
NOTICE: If the cylinder is washed at high temperatures, the cylinder liner sticks out beyond the cylinder block, so always wash the cylinder block at temperature of 45° or less.

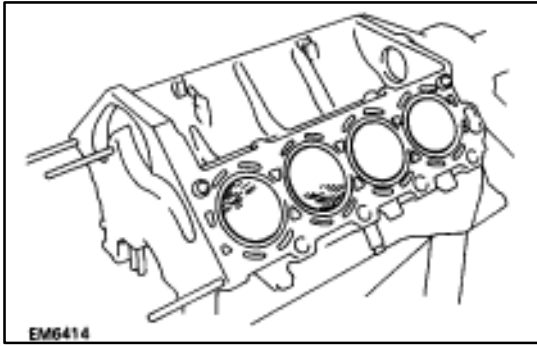
2. INSPECT TOP SURFACES OF CYLINDER BLOCK FOR FLATNESS

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.

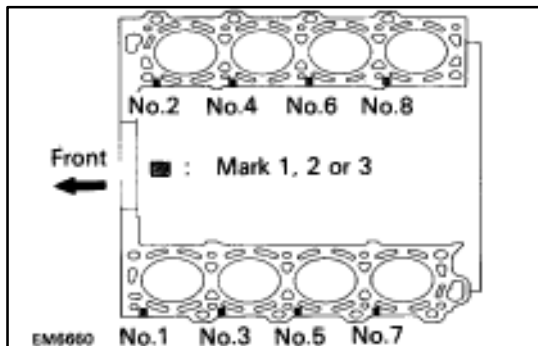




3. INSPECT CYLINDER FOR VERTICAL SCRATCHES

Visually check the cylinder for vertical scratches.

If deep scratches are present, replace the cylinder block.



4. INSPECT CYLINDER BORE DIAMETER

HINT: There are three sizes of the standard cylinder bore diameter, marked "1", "2" and "3" accordingly. The marked is stamped on the top of the cylinder block.

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

Standard diameter:

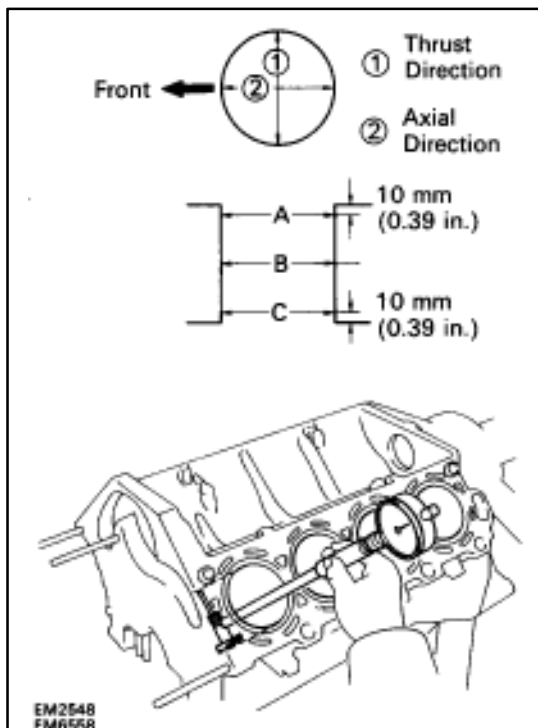
Mark "1" 87.500–87.510 mm
(3.4449–3.4453 in.)

Mark "2" 87.510–87.520 mm
(3.4453–3.4457 in.)

Mark "3" 87.520–87.530 mm
(3.4457–3.4461 in.)

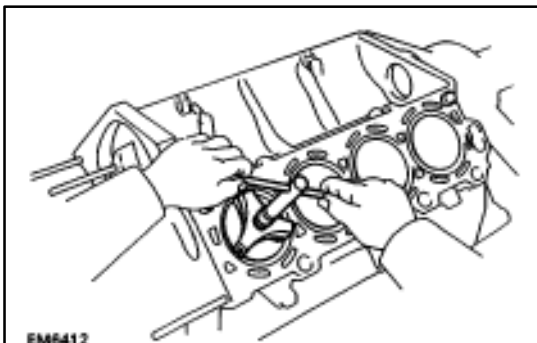
Maximum diameter: 87.73 mm (3.4539 in.)

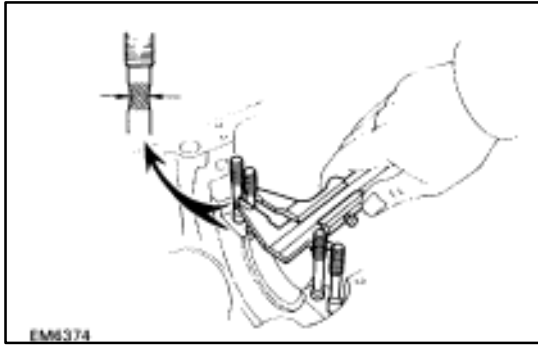
If the diameter is greater than maximum, replace the cylinder block.



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 STUD BOLTS

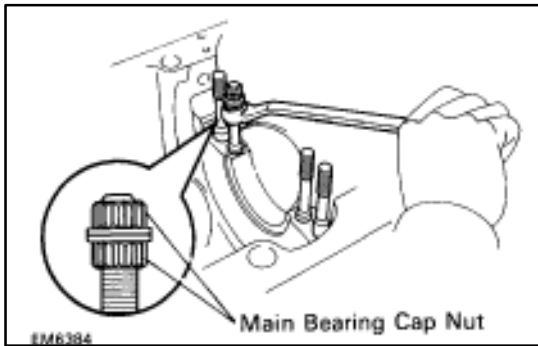
Using a vernier caliper, measure the tension portion diameter of the stud bolt.

Standard diameter: 7.500–7.600 mm

(0.2953–0.2992 in.)

Minimum diameter: 7.40 mm (0.2913 in.)

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



7. IF NECESSARY, REPLACE MAIN BEARING CAP STUD BOLTS

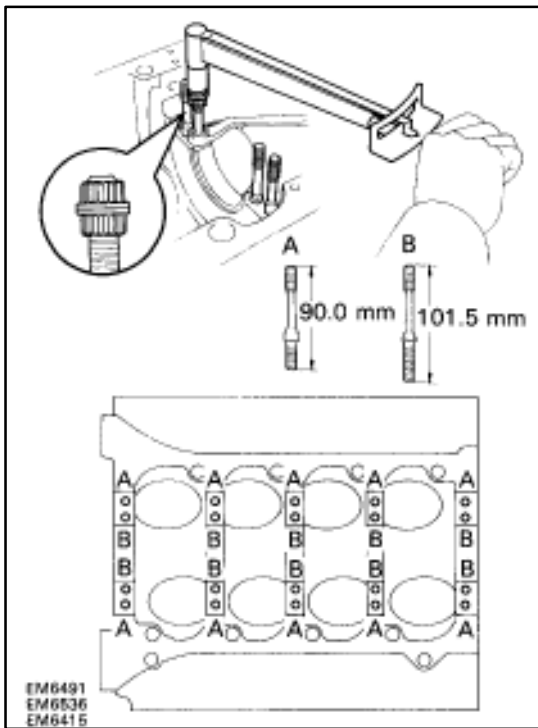
(a) Using the two main bearing cap nuts, remove the stud bolt.

(b) Apply a light coat of engine oil on the threads and under the flange of the stud bolt.

(c) Using the two main bearing cap nuts, install and torque the stud bolt.

Torque: 10 N·m (100 kgf·cm, 7 ft·lbf)

HINT: Stud bolts come in lengths of 90.0 mm (3.543 in.) and 101.5 mm (3.996 in.). Install the 101.5 mm (3.996 in.) bolts in inside positions. Install the 90.0 mm (3.543 in.) bolts in out-side positions.

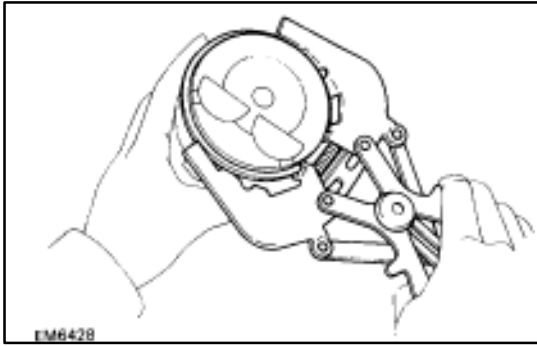


DISASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLIES

1. 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.

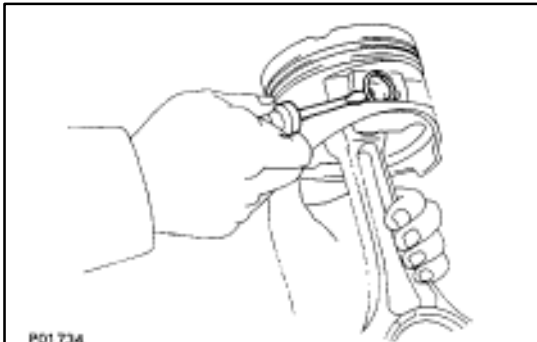


2. REMOVE PISTON RINGS

- (a) Using a piston ring expander, remove the two compression rings.

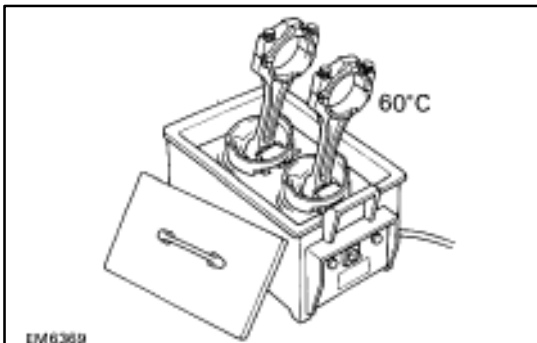


- (b) Remove the two side rails and oil ring expander by hand.
HINT: Arrange the piston rings in correct order only.

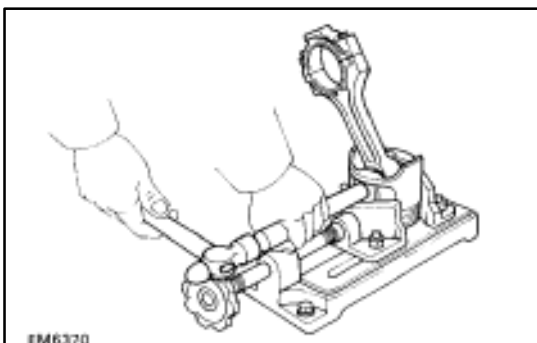


3. DISCONNECT CONNECTING ROD FROM PISTON

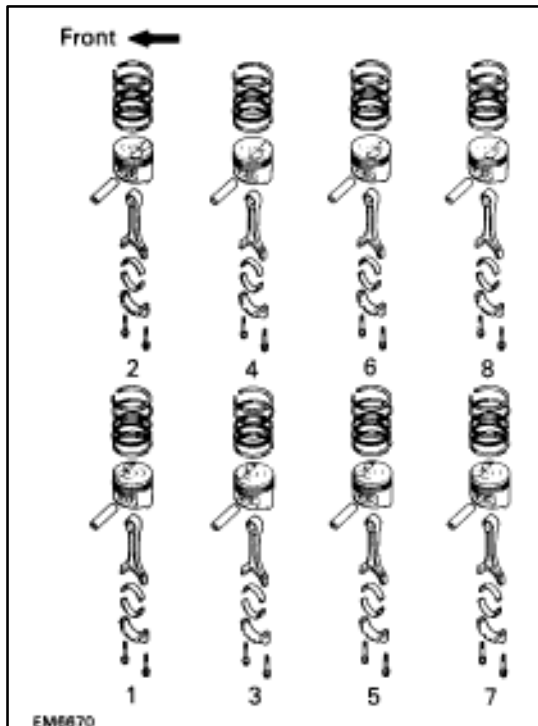
- (a) Using a small screwdriver, pry out the two snap rings.



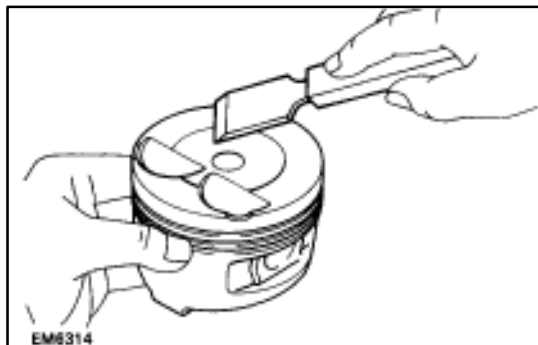
- (b) Gradually heat the piston to approx. 60°C (140°F).



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

**HINT:**

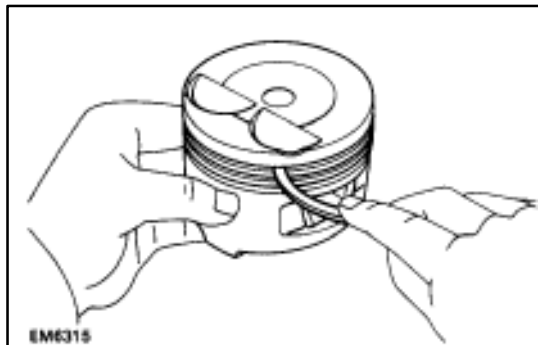
- The piston and pin are a matched set.
- Arrange the pistons, pins, rings, connecting rods and bearings in correct order.



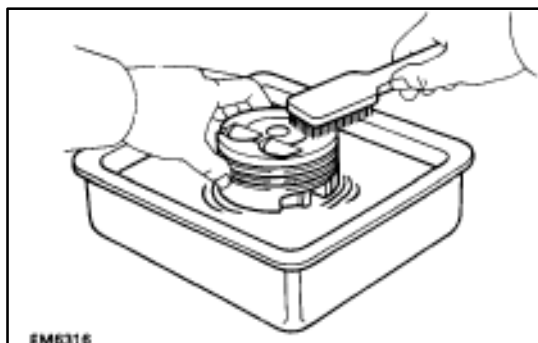
INSPECTION OF PISTON AND CONNECTING ROD ASSEMBLIES

1. CLEAN PISTON

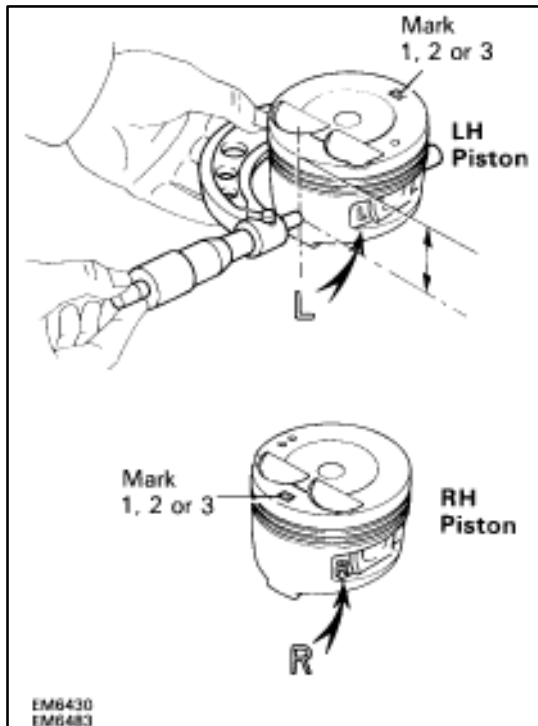
- Using a gasket scraper, remove the carbon from the piston top.



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



- Using solvent and a brush, thoroughly clean the piston.
NOTICE: Do not use a wire brush.



2. INSPECT PISTON

A. Inspect piston oil clearance

HINT: There are three sizes of the standard piston, marked "1", "2" and "3" accordingly. The mark is stamped on the top of the piston.

- (a) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 49 mm (1.93 in.) from the piston head.

Piston diameter:

Mark "1" 87.470–87.480 mm

(3.4437–3.4441 in.)

Mark "2" 87.480–87.490 mm

(3.4441–3.4445 in.)

Mark "3" 87.490–87.500 mm

(3.4445–3.4449 in.)

- (b) Measure the cylinder bore diameter in the thrust directions. (See step 4 on page [EM-143](#))
- (c) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Standard oil clearance: 0.020–0.040 mm

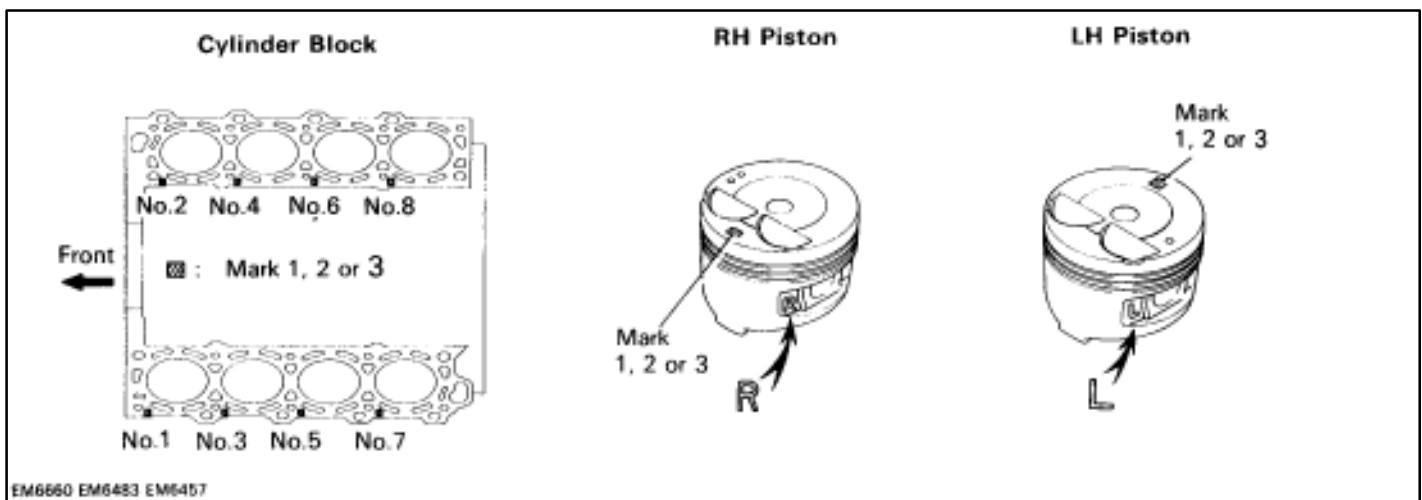
(0.0008–0.0016 in.)

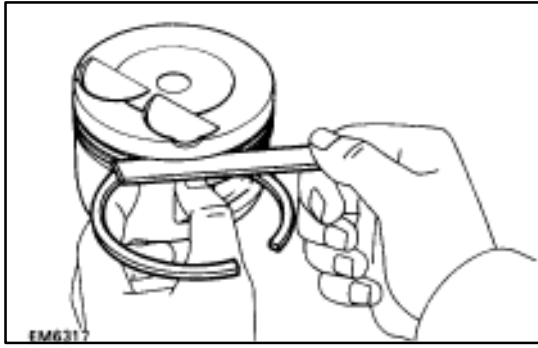
Maximum oil clearance: 0.06 mm (0.0024 in.)

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

HINT (Use new cylinder block):

- Use a piston with the same size mark as the cylinder bore diameter size mark on the cylinder block.
- The shape of the piston varies for the RH and LH banks. The RH piston is marked with "R", the LH piston with "L".





B. Inspect piston ring groove clearance

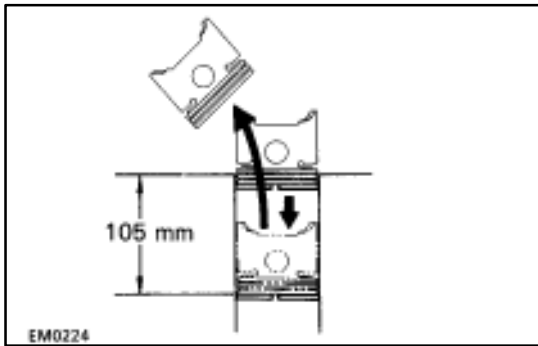
Using a feeler gauge, measure the clearance between new piston ring and the wall of the piston ring groove.

Ring groove clearance:

No.1 0.020–0.060 mm (0.0008–0.0024 in.)

No.2 0.015–0.055 mm (0.0006–0.0022 in.)

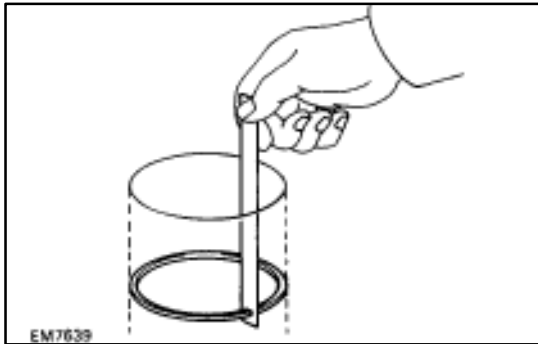
If the clearance is greater than maximum, replace the piston.



C. 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.



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

Standard ring end gap:

No.1 0.250–0.450 mm

(0.0098–0.0177 in.)

No.2 0.350–0.600 mm

(0.0138–0.0236 in.)

Oil (Side rail) 0.150–0.500 mm

(0.0059–0.0197 in.)

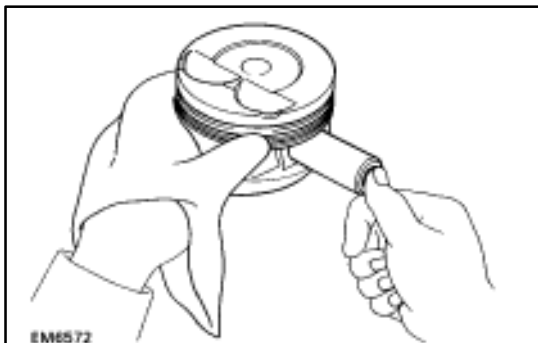
Maximum ring end gap:

No.1 1.05 mm (0.0413 in.)

No.2 1.20 mm (0.0472 in.)

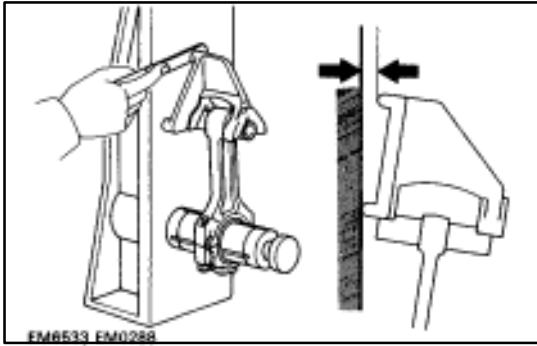
Oil (Side rail) 1.10 mm (0.0433 in.)

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.



D. Inspect piston pin fit

At 60°C (140°F), you should be able to push the piston pin into the piston pin hole with your thumb.



3. INSPECT CONNECTING ROD

A. Inspect connecting rod alignment

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

- Check for bending.

Maximum bending:

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

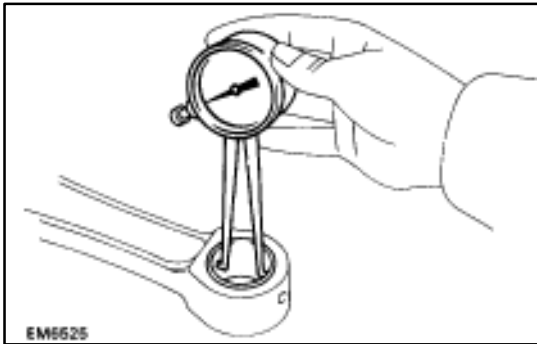
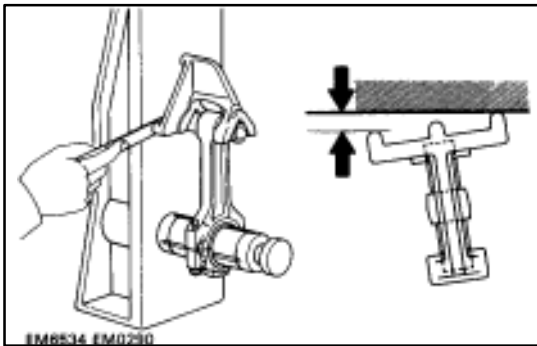
If bent is greater than maximum, replace the connecting rod assembly.

- Check for twist.

Maximum twist:

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

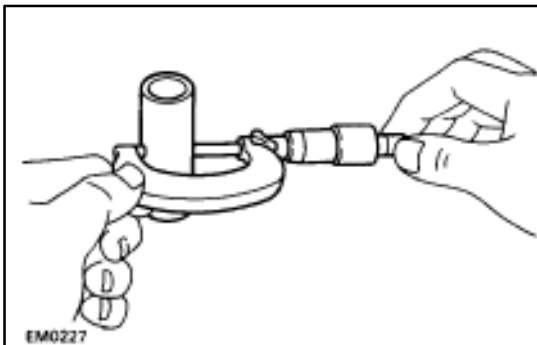
If twist is greater than maximum, replace the connecting rod assembly.



B. Inspect connecting rod bushings

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

**Bushing inside diameter: 22.005–22.017 mm
(0.8663–0.8668 in.)**



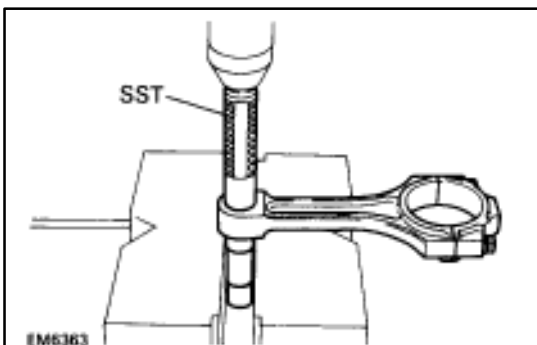
- Using a micrometer, measure the piston pin diameter.

**Piston pin diameter: 21.997–22.009 mm
(0.8660–0.8665 in.)**

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

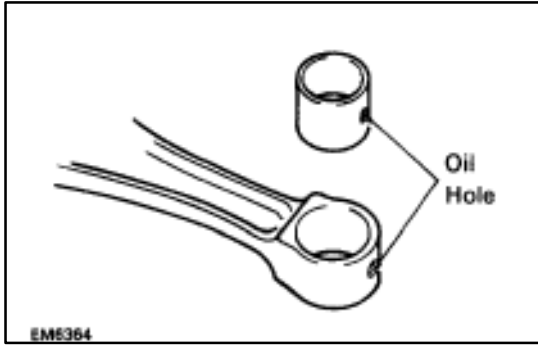
**Standard oil clearance: 0.005–0.011 mm
(0.0002–0.0004 in.)**

Maximum oil clearance: 0.05 mm (0.0020 in.)

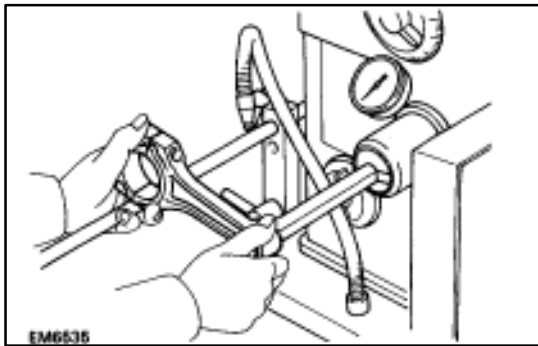


C. If necessary, replace connecting rod bushings

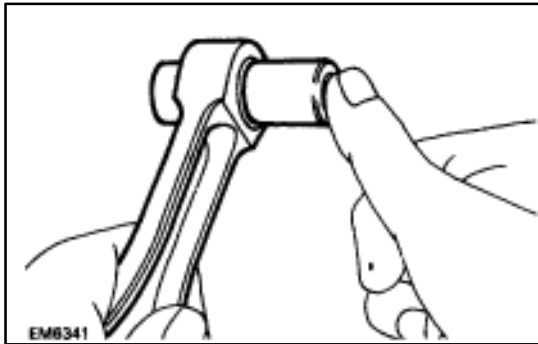
- Using SST and a press, press out the bushing.
SST 09222–30010



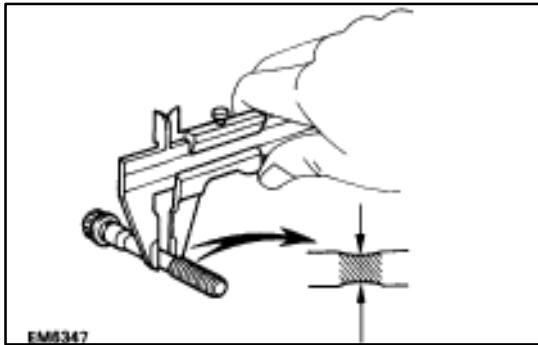
- (b) Align the oil holes of the connecting rod and a new bushing.
- (c) Using SST and a press, press in the bushing.
SST 09222-30010



- (d) Using a pin hole grinder, hone the bushing to obtain the standard specified clearance (see step B above) between the bushing and piston pin.



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



D. Inspect connecting rod bolts

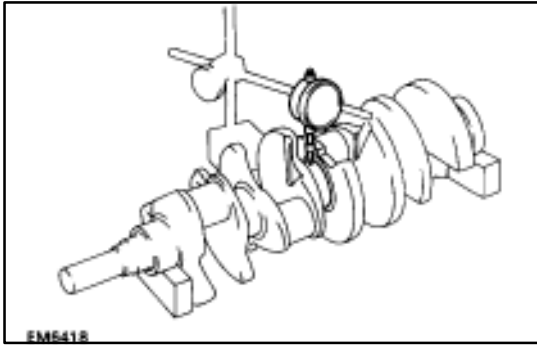
Using a vernier caliper, measure the tension portion diameter of the bolt.

Standard diameter: 7.200–7.300 mm

(0.2835–0.2874 in.)

Minimum diameter: 7.00 mm (0.2756 in.)

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



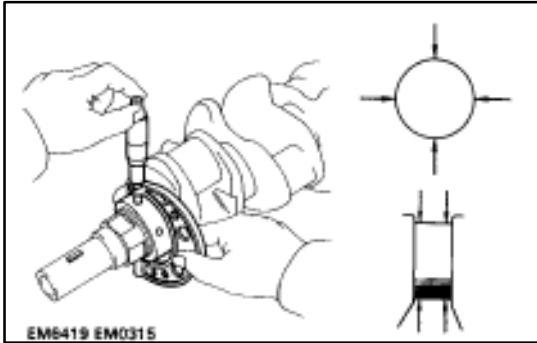
INSPECTION OF CRANKSHAFT

1. 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: 0.08 mm (0.0031 in.)

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



2. INSPECT MAIN JOURNALS AND CRANK PINS

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

Main journal diameter: 66.988–67.000 mm

(2.6373–2.6378 in.)

Crank pin diameter: 51.982–52.000 mm

(2.0465–2.0472 in.)

If the diameter is not as specified, check the oil clearance (See page [EM-136](#) or 139).

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

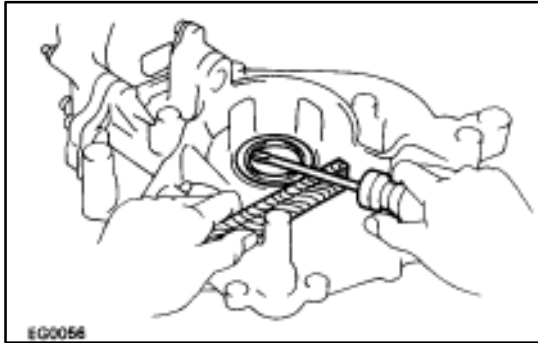
Maximum taper and out-of-round: 0.02 mm

(0.0008 in.)

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

REPLACEMENT OF CRANKSHAFT OIL SEALS

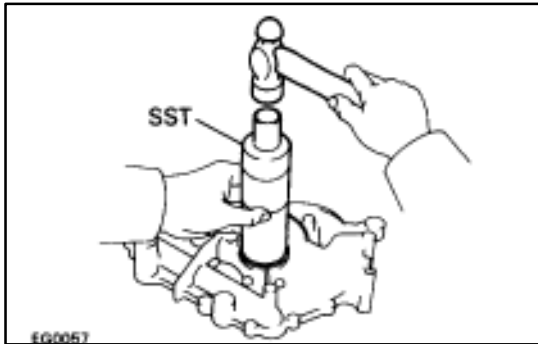
HINT: There are two methods (A and B) to replace the oil seal which are as follows:



1. REPLACE CRANKSHAFT FRONT OIL SEAL

A. If oil pump is removed from cylinder block:

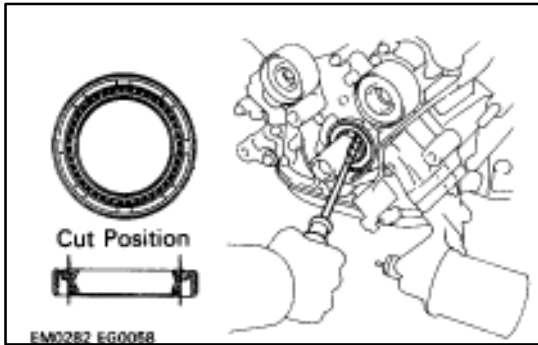
- (a) Using a screwdriver, pry out the oil seal.



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

SST 09316-60010 (09316-00010)

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

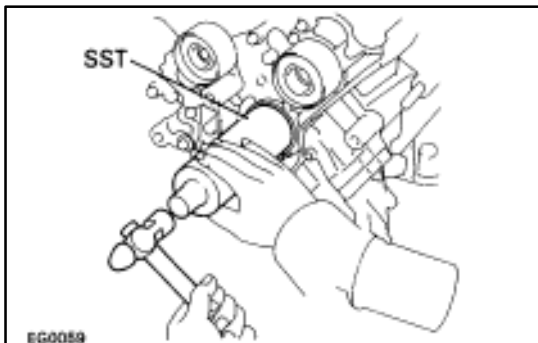


B. If oil pump is installed to the cylinder block:

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

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

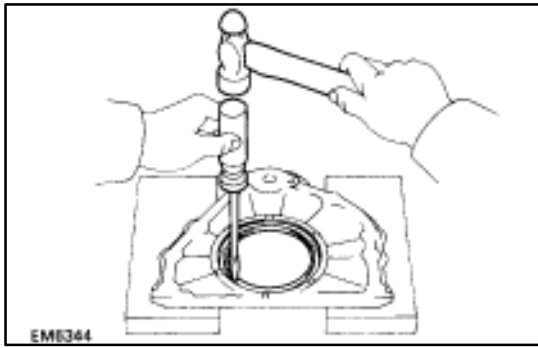
NOTICE: Be careful not to damage the crankshaft. Tape the screwdriver tip.



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

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

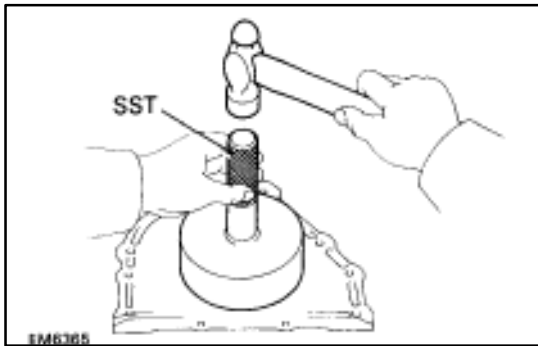
SST 09316-60010 (09316-00010)



2. REPLACE CRANKSHAFT REAR OIL SEAL

A. If rear oil seal retainer is removed from cylinder block:

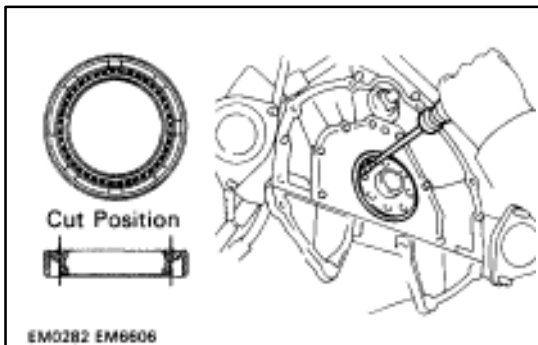
- (a) Using a screwdriver and hammer, tap out the oil seal.



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

SST 09223-56010

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



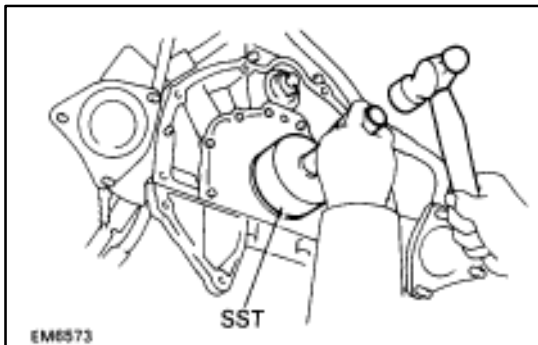
B. If rear oil seal retainer is installed to cylinder block:

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

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

NOTICE: Be careful not to damage the crankshaft.

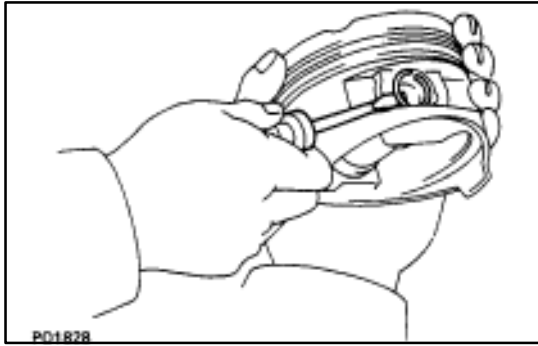
Tap the screwdriver tip.



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

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

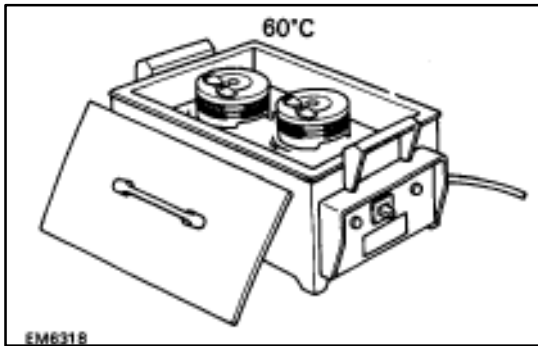
SST 09223-56010



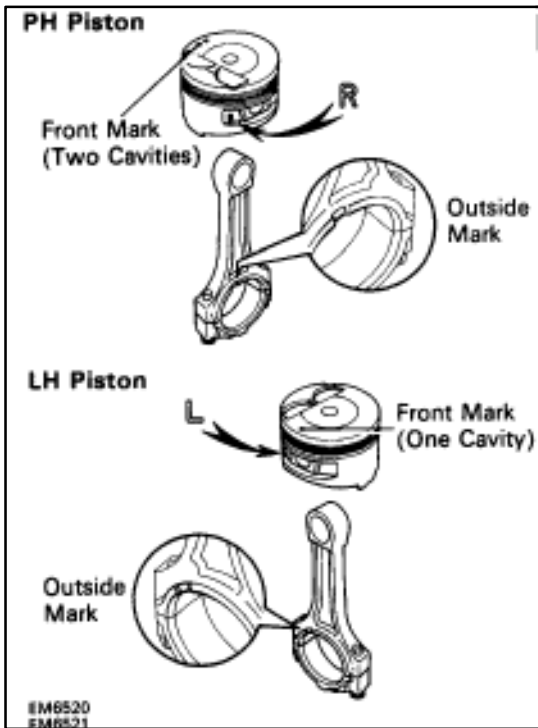
ASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLIES

1. ASSEMBLE PISTON AND CONNECTING ROD

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



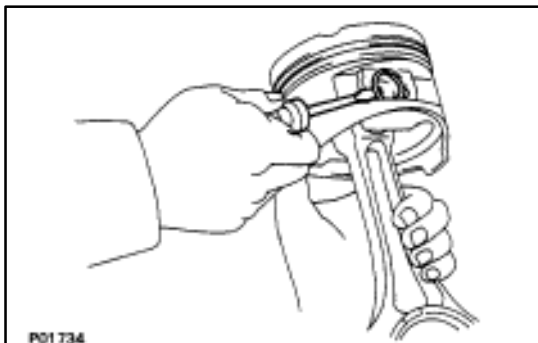
- (b) Gradually heat the piston to about 60°C (140°F).



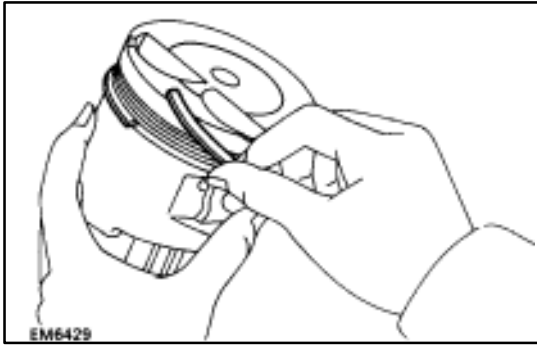
- (c) Position the piston front mark with respect to the outside mark on the connecting rod as shown in the diagram.

NOTICE: The installation direction of the piston and connecting rod are different for the RH and LH banks. The RH piston is marked with "R", the LH piston with "L".

- (d) Align the piston pin holes of the piston and connecting rod, and push in the piston pin with your thumb.

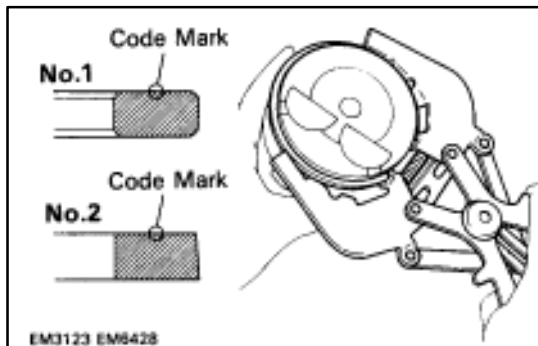


- (e) Using a small screwdriver, install a new snap ring on the other side of the piston pin hole.



2. INSTALL PISTON RINGS

- (a) Install the oil ring expander and two side rails by hand.



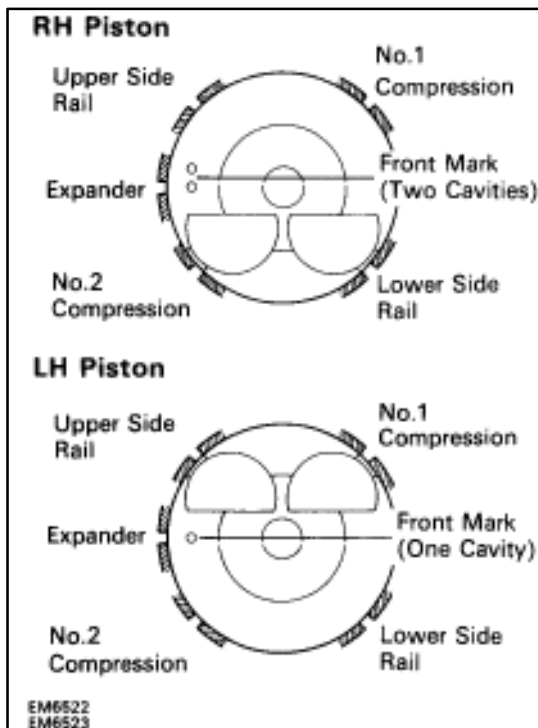
- (b) Using a piston ring expander, install the two compression rings with the code mark facing upward.

Code mark: No.1 1R or T

No.2 2R or 2T

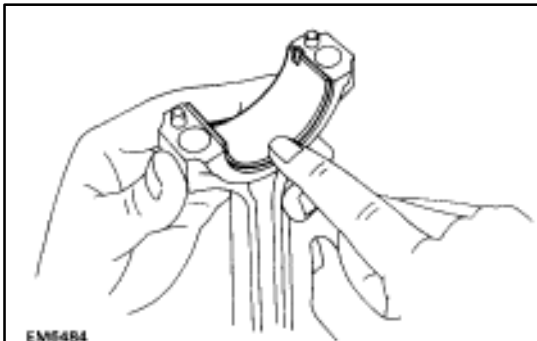
- (c) Position the piston rings so that the ring ends are as shown.

NOTICE: Do not align the piston ring ends.



3. INSTALL BEARINGS

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

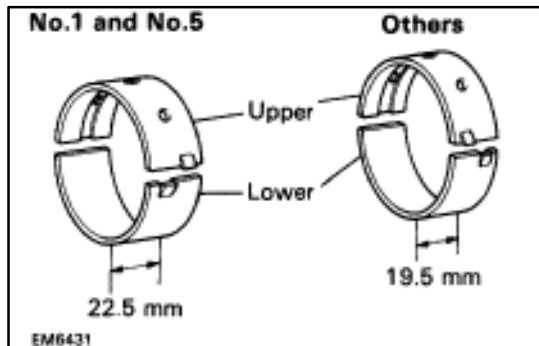


ASSEMBLY OF CYLINDER BLOCK

(See Components on page [EM-131](#))

HINT:

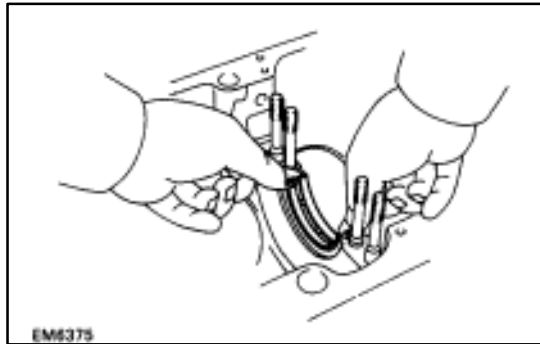
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with new parts.



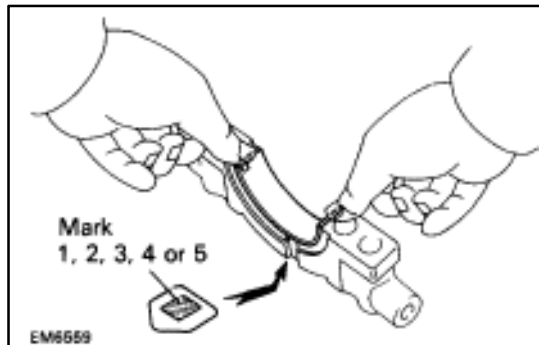
1. INSTALL MAIN BEARINGS

HINT:

- Main bearings come in widths of 19.5 mm (0.768 in.) and 22.5 mm (0.886 in.). Install the 22.5 mm (0.886 in.) bearings in the No.1 and No.5 cylinder block journal positions with the main bearing caps. Install the 19.5 mm (0.768 in.) bearings in the other positions.
- Upper bearings have an oil groove and oil holes; lower bearings do not.

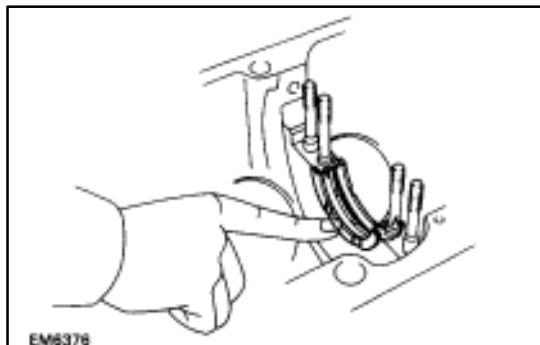


- (a) Align the bearing claw with the claw groove of the cylinder block, and push in the five upper bearings.



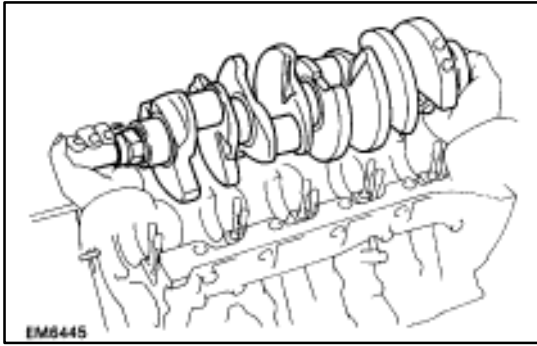
- (b) Align the bearing claw with the claw groove of the main bearing cap, and push in the five lower bearings.

HINT: A number is marked on each main bearing cap indicating the installation position.

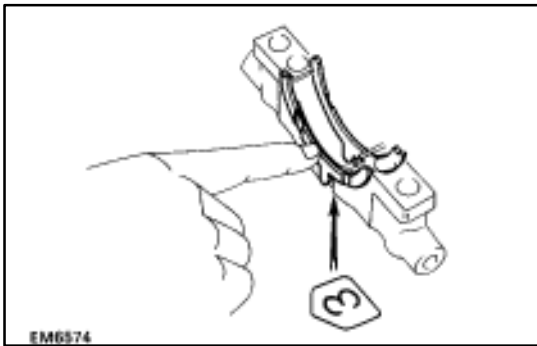


2. INSTALL UPPER THRUST WASHERS

Install the two thrust washers under the No.3 journal position of the block with the oil grooves facing outward.



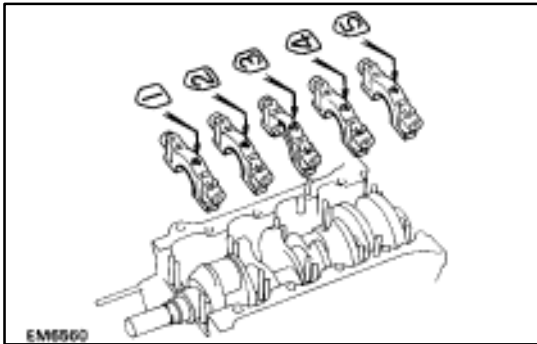
3. PLACE CRANKSHAFT ON CYLINDER BLOCK



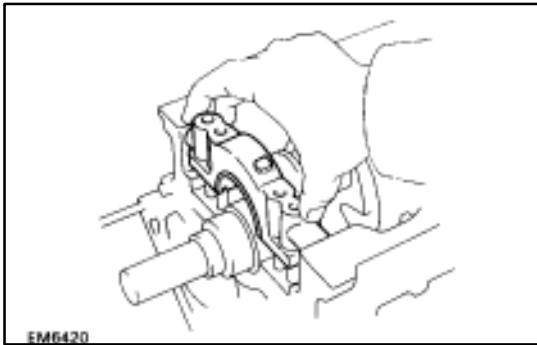
4. INSTALL MAIN BEARING CAP AND LOWER THRUST WASHERS

A. Place main bearing cap and lower thrust washers on cylinder block

- (a) Install the two thrust washers on the No.3 main bearing cap with the grooves facing outward.



- (b) Install the main bearing caps in their proper location.



- (c) Place the five bearing caps in position on cylinder block.
HINT: Place the bearing caps level and let them return to their original position by their own weight.

NOTICE: Do not install the main bearing cap by tapping it.

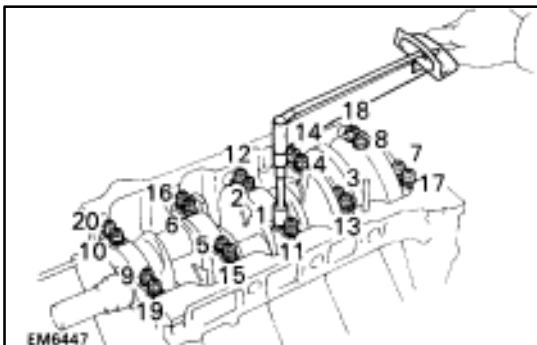
B. Install main bearing cap nuts

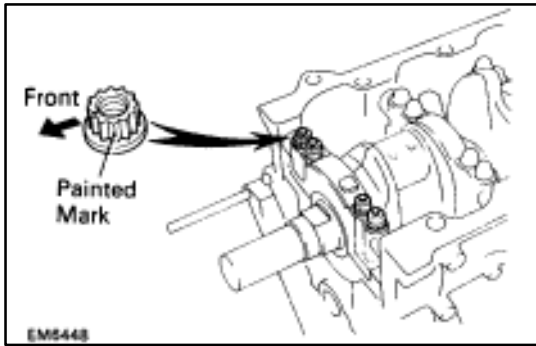
HINT:

- The main bearing cap nuts are tightened in two progressive steps (steps (b) and (d)).
 - If any one of the main bearing cap stud bolts is broken or deformed, replace it.
- (a) Apply a light coat of engine oil on the threads and under the nuts of the main bearing caps.
 - (b) Install and uniformly tighten the twenty main bearing cap nuts in several passes in the sequence shown.

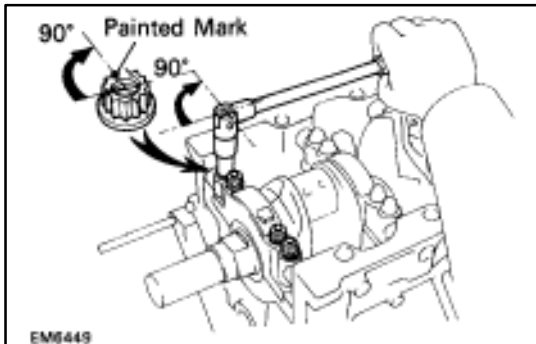
Torque: 27 N·m (275 kgf·cm, 20 ft·lbf)

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





(c) Mark the front of the main bearing cap nut with paint.



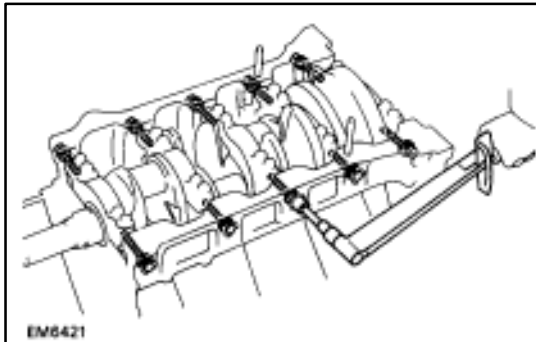
(d) Retighten the main bearing cap nuts 905 in the numerical order shown.

(e) Check that the painted mark is now at a 905 angle to the front.

(f) Check that the crankshaft turns smoothly.

(g) Check the crankshaft thrust clearance.

(See step 5 on page [EM-138](#))

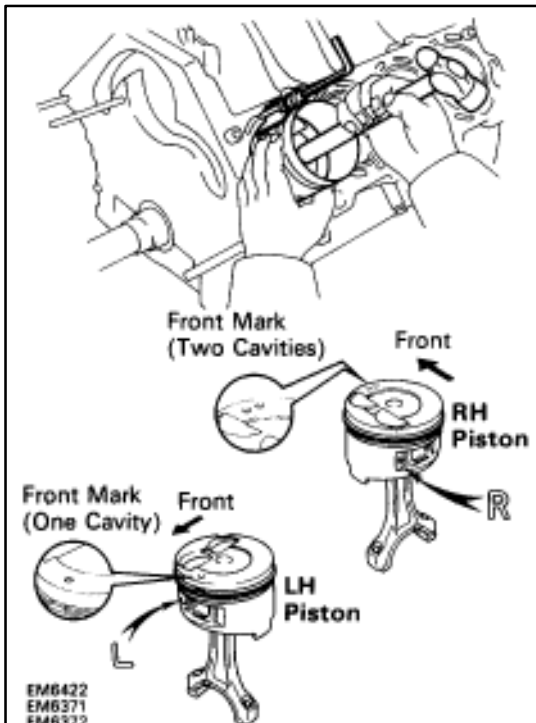


C. Install main bearing cap bolts

(a) Install a new seal washer to the main bearing cap bolt.

(b) Install the ten main bearing cap bolts.

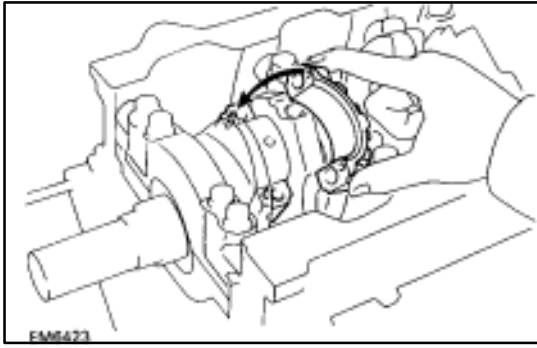
Torque: 49 N·m (500 kgf·cm, 36 ft·lbf)



5. 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.

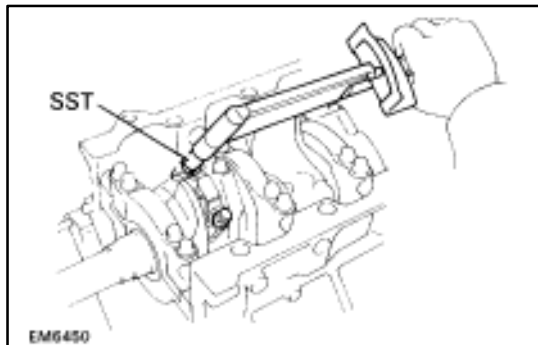
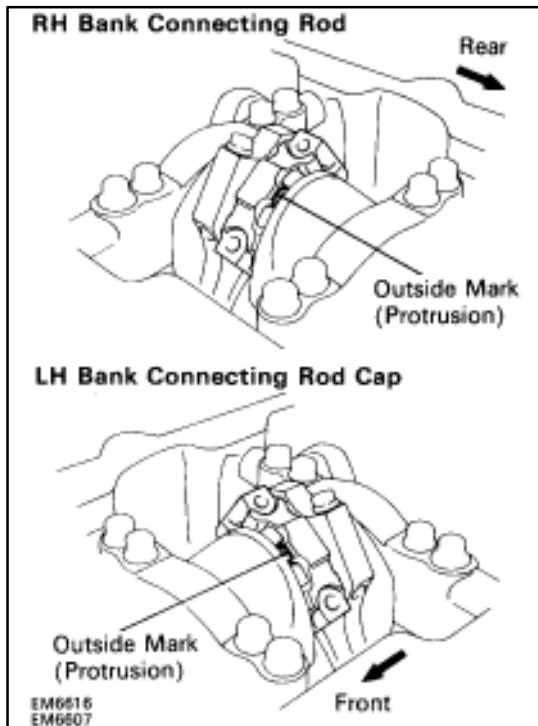
NOTICE: The shape of the piston varies for the RH and LH banks. The RH piston is marked with "R", the LH piston with "L".



6. INSTALL CONNECTING ROD CAPS

A. Place connecting rod cap on connecting rod

- (a) Match the numbered connecting rod cap with the connecting rod.
- (b) Align the pin groove of the connecting rod cap with the pins of the connecting rod, and install the connecting rod cap.
- (c) Check that the outside mark on the connecting rod cap is facing in correct direction.



B. Install connecting rod cap bolts

HINT:

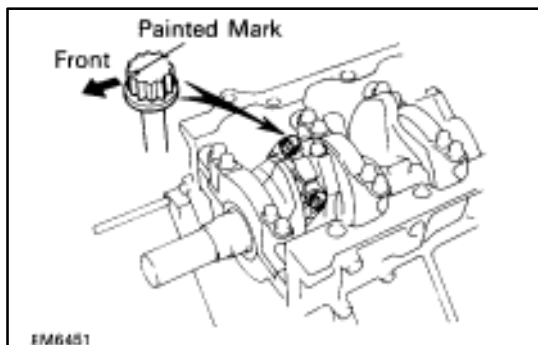
- The connecting rod cap bolts are tightened in two progressive steps (steps (b) and (d)).
 - If any one of the connecting rod bolts is broken or deformed, replace it.
- (a) Apply a light of engine oil on the threads and under the heads of the connecting rod cap bolts.
 - (b) Using SST, install and alternately tighten the two connecting rod cap bolts in several passes.

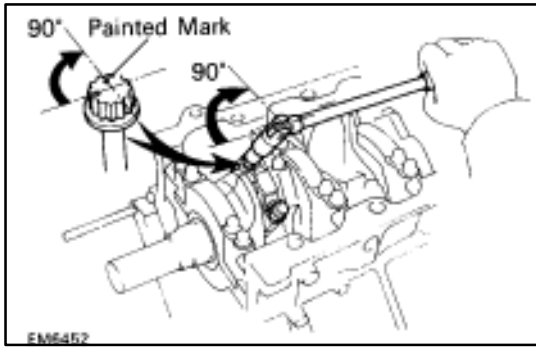
SST 09011-38121

Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)

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

- (c) Mark the front of the connecting rod cap bolt with paint.





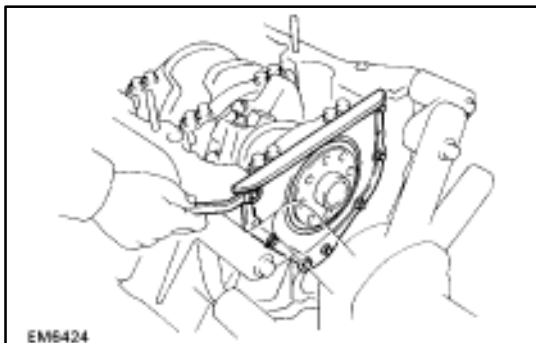
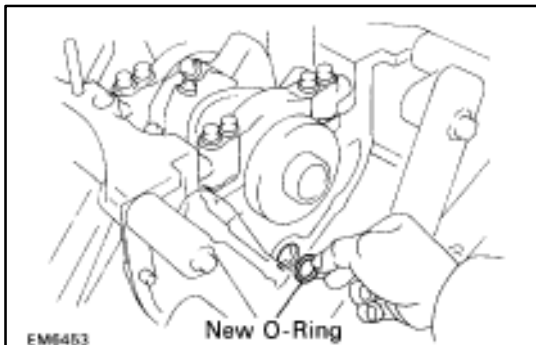
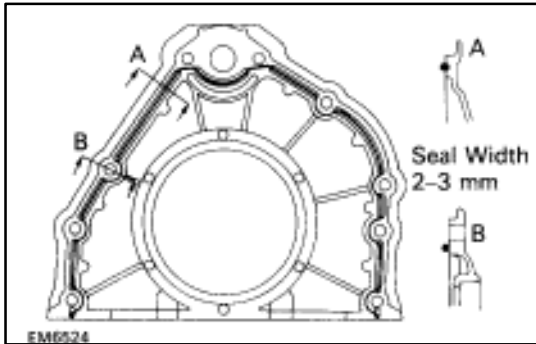
- (d) Retighten the connecting rod cap bolts 905 in the numerical order shown.
- (e) Check that the painted mark is now at a 905 angle to the front.
- (f) Check that the crankshaft turns smoothly.
- (g) Check the connecting rod thrust clearance.
(See step 2 on page [EM-135](#))

7. INSTALL REAR OIL SEAL RETAINER

- (a) 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 the loose material.
 - 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) Place a new O-ring in position on the cylinder block.



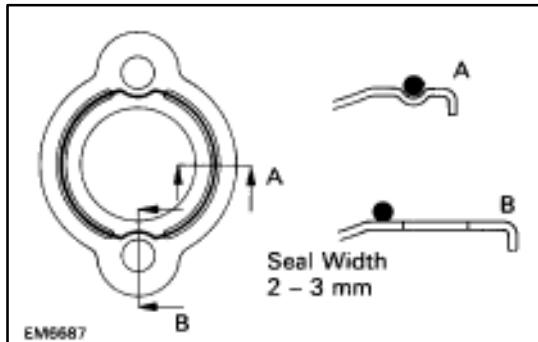
- (d) Install the retainer with the seven bolts.
Torque: 7.8 N·m (80 kgf·cm, 69 in.·lbf)

POST ASSEMBLY

(See Components on page [EM-131](#))

1. INSTALL WATER SEAL PLATE

- (a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the seal plate 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 the loose material.
 - Using a non-residue solvent, clean both sealing surfaces.
- (b) Apply seal packing to the seal plate as shown in the illustration.



Seal packing: Part No.08826-00100 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 5 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.

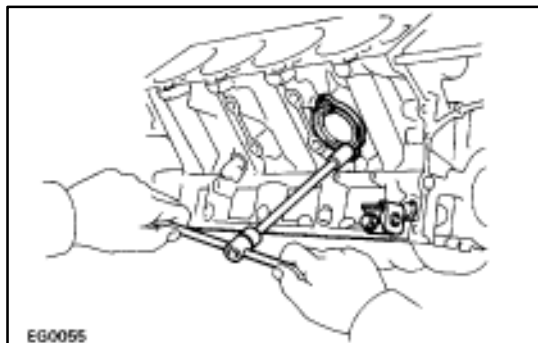
- (c) Install the seal plate with the two nuts.

Torque: 14 N·m (145 kgf·cm, 10 ft·lbf)

2. INSTALL ALTERNATOR BRACKET

Install the bracket with the bolt.

Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)

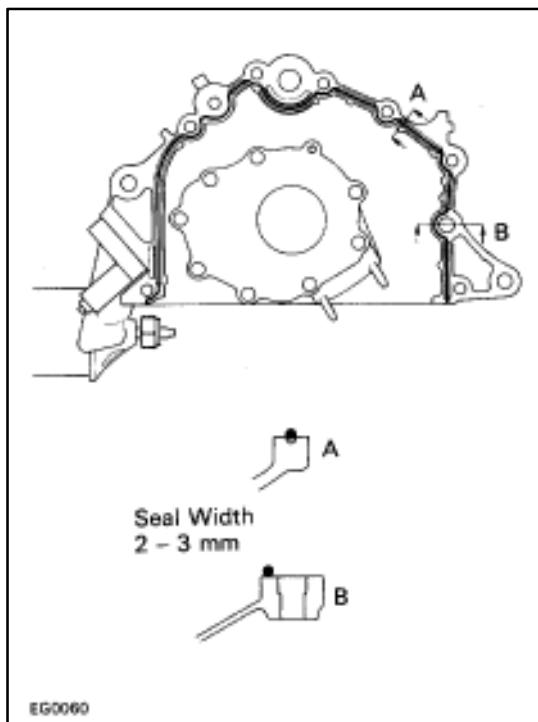


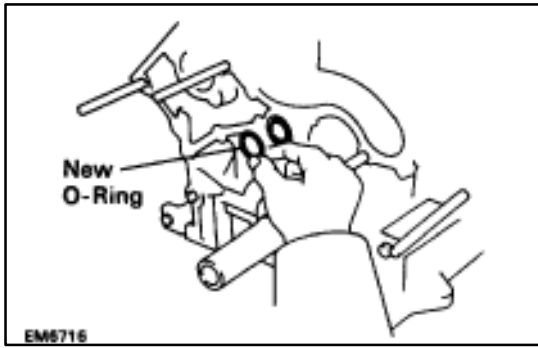
3. INSTALL OIL PUMP

- (a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the oil pump 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 the loose material.
 - Using a non-residue solvent, clean both sealing surfaces.
- (b) Apply seal packing to the oil pump as shown in the illustration.

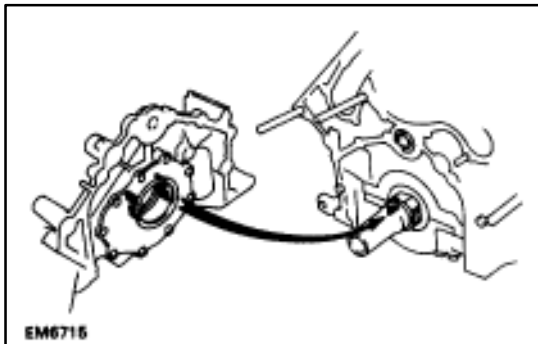
Seal packing: Part No.08826-00080 or equivalent

- 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.

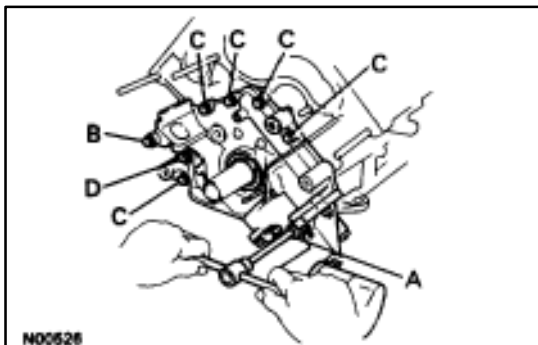




- (c) Place a new O-ring in position on the cylinder block.



- (d) Engage the spline teeth of the oil pump drive gear with the large teeth of the crankshaft, and slide the oil pump.



- (e) Install the oil pump with the eight bolts.

Torque:

12 mm head 16 N·m (160 kgf·cm, 12 ft·lbf)

14 mm head 30 N·m (310 kgf·cm, 22 ft·lbf)

HINT: Each bolt length is indicated in the illustration.

Bolt length:

A 50 mm (1.97 in.) for 12 mm head

B 106 mm (4.17 in.) for 12 mm head

C 30 mm (1.18 in.) for 12 mm head

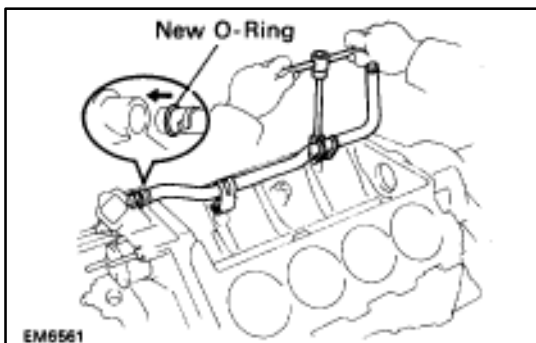
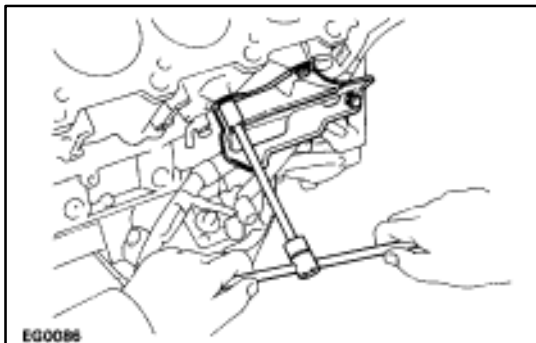
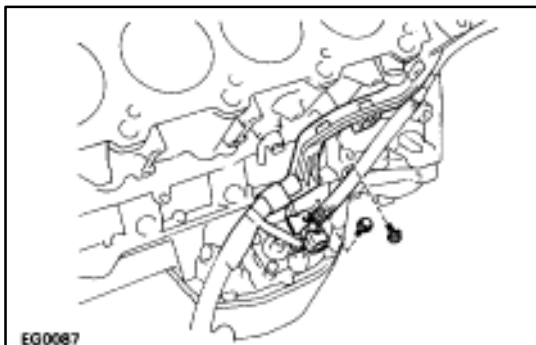
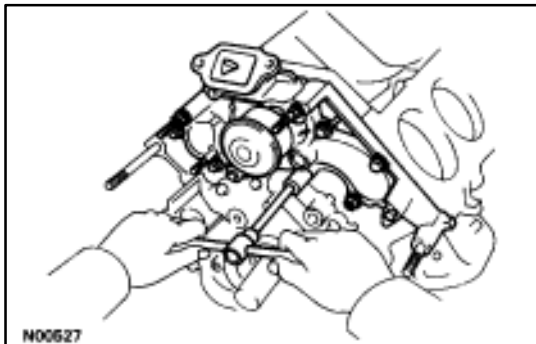
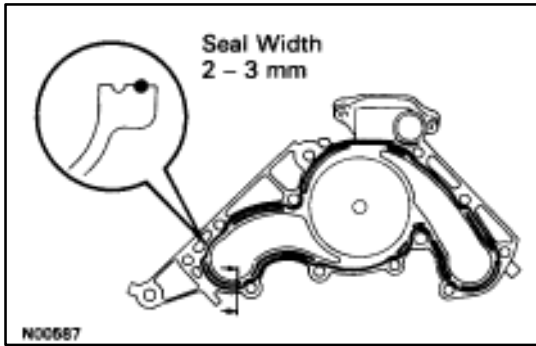
D 40 mm (1.57 in.) for 14 mm head

4. INSTALL NO. 1 OIL PAN AND NO. 2 OIL PANS

(See steps 4 to 9 on pages [LU-16](#) to 19)

5. INSTALL WATER PUMP

- (a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the water pump 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 the loose material.
 - Using a non-residue solvent, clean both sealing surfaces.



- (b) Apply seal packing to the sealing groove of the water pump as shown in the illustration.

Seal packing: Part No.08826-00100 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 5 minutes of application. Otherwise the material must be removed and reapplied.
 - Immediately remove nozzle from the tube and reinstall cap.
- (c) Install the water pump with the five bolts, two stud bolts and nut.

Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)

HINT: Use bolts 30 mm (1.18 in.) in length.

6. INSTALL ENGINE WIRE

- (a) Install the engine wire to the LH side of the cylinder block with the two bolts.

- (b) Install the wire cover with the three bolts.

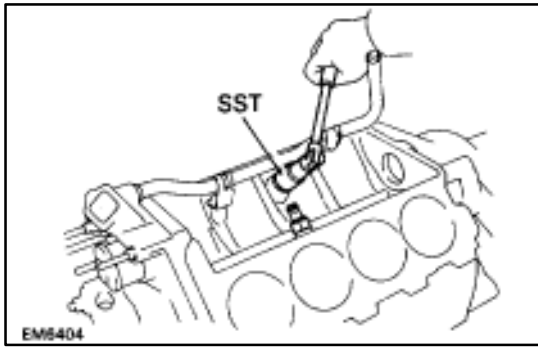
- (c) Connect the following connectors:

- (1) Oil level sensor connector
- (2) Oil pressure switch connector

7. INSTALL WATER BY-PASS PIPE

- (a) Install a new O-ring to the by-pass pipe.
- (b) Apply soapy water to the O-ring.
- (c) Pull in the by-pass pipe end into the pipe hole of the water pump.
- (d) Install the water by-pass pipe with the two bolts.

Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)



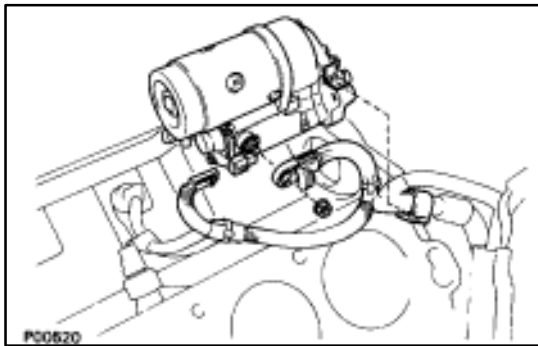
8. INSTALL KNOCK SENSORS

(a) Using SST, install the two knock sensors.

SST 09816-30010

Torque: 44 N·m (450 kgf·cm, 33 ft·lbf)

(b) Connect the two knock sensor connectors.

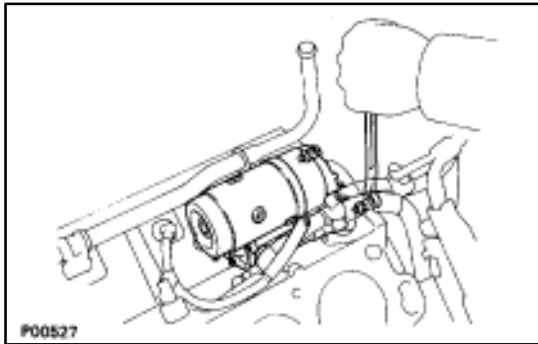


9. INSTALL STARTER

(a) Install the wire clamp to the bracket on the starter.

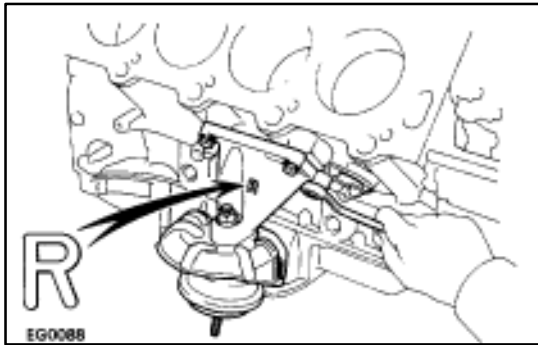
(b) Connect the wire to the starter with the nut.

(c) Connect the connector to the starter.



(d) Install the starter with the two bolts.

Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)



10. INSTALL RH ENGINE MOUNTING BRACKET

Install the mounting bracket with the four bolts.

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

HINT: The RH mounting bracket is marked with "R".



11. INSTALL LH ENGINE MOUNTING BRACKET

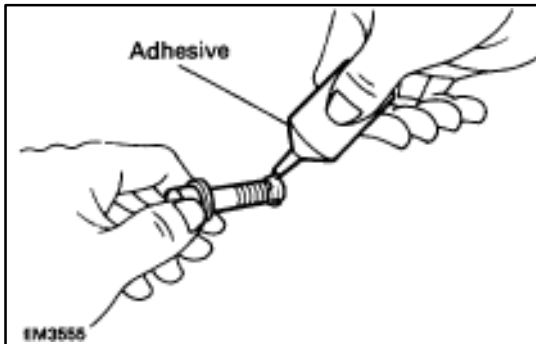
(a) Install the mounting bracket with the four bolts.

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

HINT: The LH mounting bracket is marked with "L".

(b) Install the engine wire to the mounting bracket with the bolt.

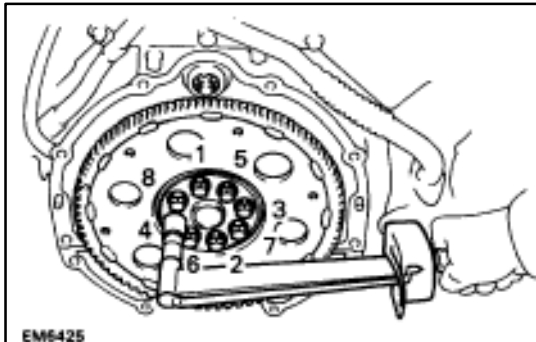
12. **INSTALL CYLINDER HEADS**
(See pages [EM-92](#) to 115)
13. **INSTALL TIMING PULLEYS AND BELT**
(See pages [EM-48](#) to 57)
14. **REMOVE ENGINE STAND FROM ENGINE**



15. **INSTALL DRIVE PLATE**

- (a) Apply adhesive to two or three threads of the mounting bolt end.

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



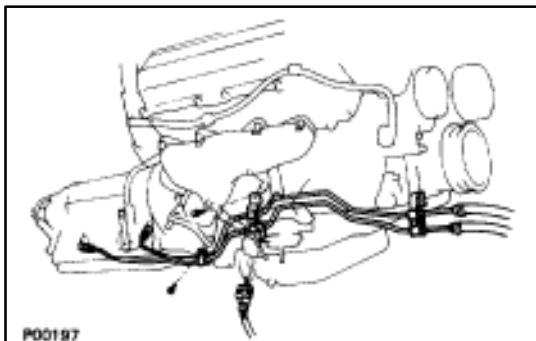
- (b) Install the front spacer, drive plate and rear spacer on the crankshaft.
- (c) Install and uniformly tighten the eight mounting bolts in several passes in the sequence shown.

Torque: 98 N·m (1,000 kgf·cm, 72 ft·lbf)

ASSEMBLY OF ENGINE AND TRANSMISSION

(See Components on page [EM-129](#))

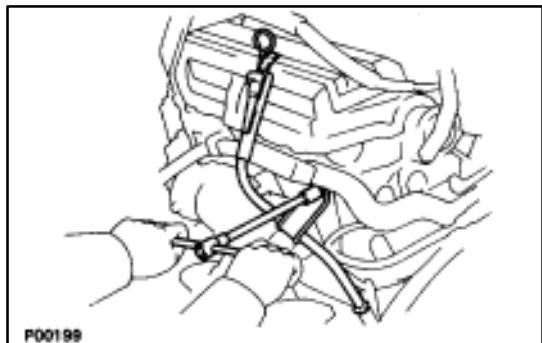
1. **ASSEMBLE ENGINE AND TRANSMISSION**
(See AT section)



2. **INSTALL OIL COOLER PIPE**

- (a) Temporarily install the two mounting bolts.
- (b) Connect the two oil cooler pipes to the unions on the transmission. Tighten the union nuts.

Torque: 34 N·m (350 kgf·cm, 25 ft·lbf)

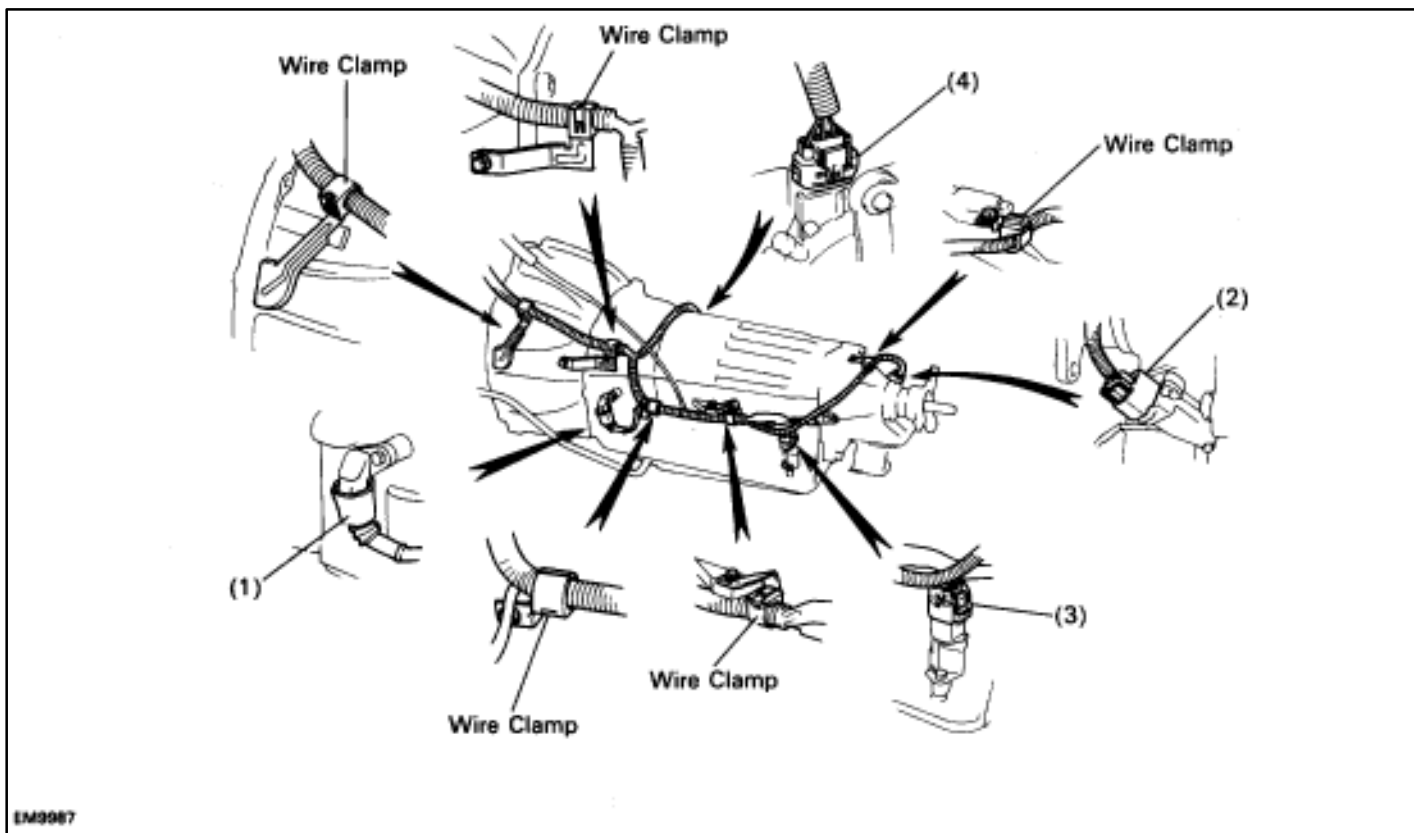


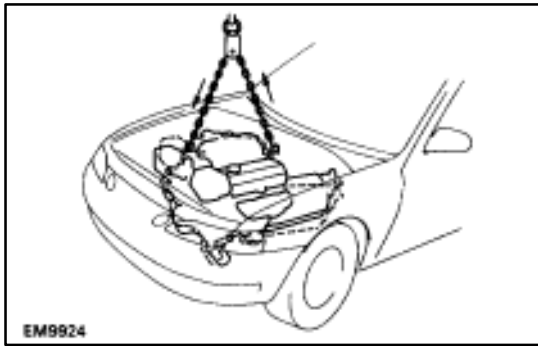
3. INSTALL DIPSTICK GUIDE FOR TRANSMISSION

- (a) Install a new O-ring to the dipstick guide.
- (b) Apply soapy water to the O-ring.
- (c) Connect the dipstick guide end to the tube of the oil pan, and install the dipstick guide with the bolt.
- (d) Install the dipstick.

4. CONNECT ENGINE WIRE TO TRANSMISSION

- (a) Connect the following connectors:
 - (1) O/D direct clutch speed sensor connector
 - (2) No.1 speed sensor connector
 - (3) No.2 speed sensor connector
 - (4) Neutral start switch connector
- (b) Install the five wire clamps to the brackets on the transmission.





INSTALLATION OF ENGINE

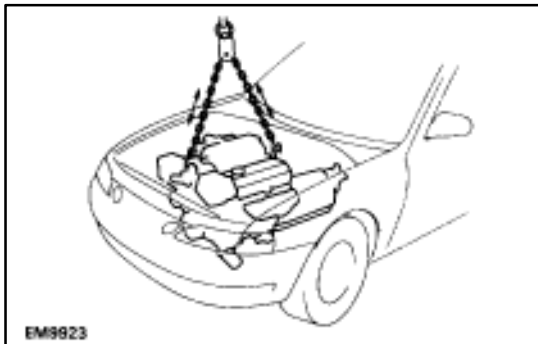
(See Components on pages [EM-116](#) to 118)

1. INSTALL ENGINE AND TRANSMISSION ASSEMBLY IN VEHICLE

- (a) Attach the engine hoist chain to the engine hangers.
- (b) Lower the engine and transmission assembly into the engine compartment.

CAUTION: Be careful not to hit the PS gear housing or neutral start switch.

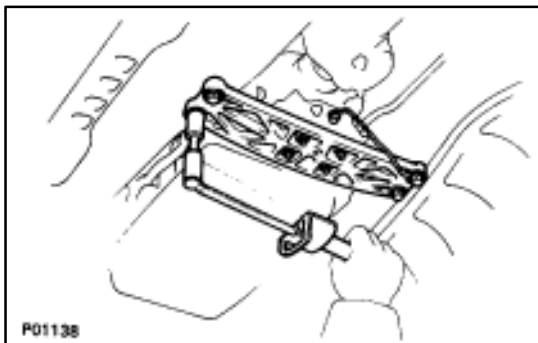
- (c) Insert the stud bolts of the front engine mounting brackets into the stud bolt holes of the front suspension crossmember.
- (d) Keep the engine level.



- (e) Install the rear engine mounting member with the four bolts and four nuts with the front mark facing forward. Install the ground strap.

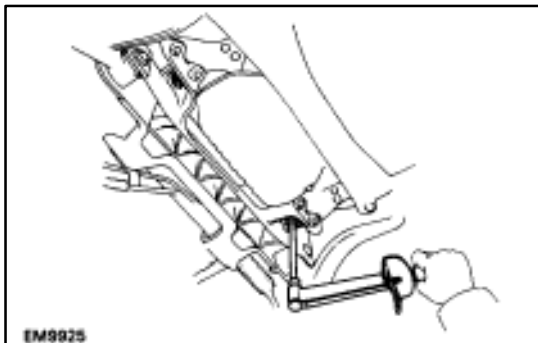
Torque: Nut 13 N·m (135 kgf·cm, 10 ft·lbf)

Bolt 25 N·m (260 kgf·cm, 19 ft·lbf)



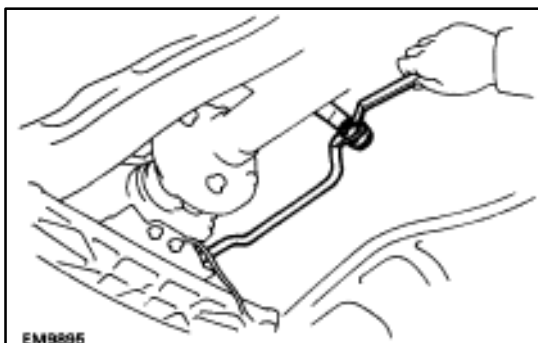
- (f) Install the two nuts holding the engine mounting brackets to the front suspension crossmember.

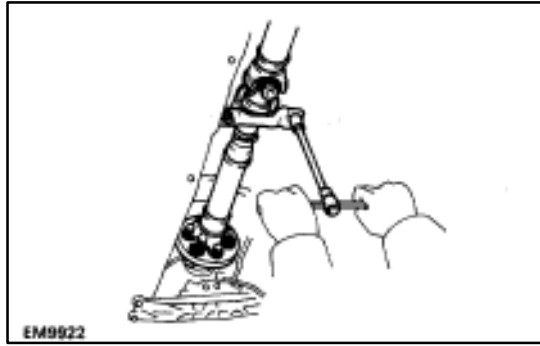
Torque: 59 N·m (600 kgf·cm, 43 ft·lbf)



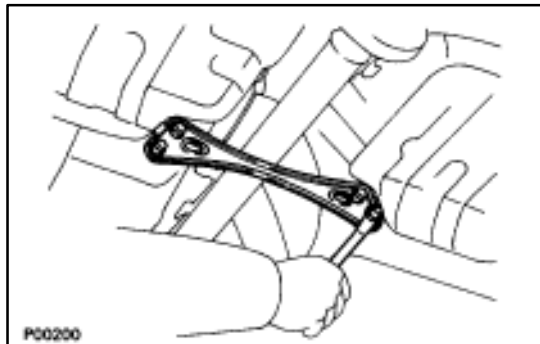
3. CONNECT TRANSMISSION CONTROL ROD

Connect the control rod to the shift lever with the nut.

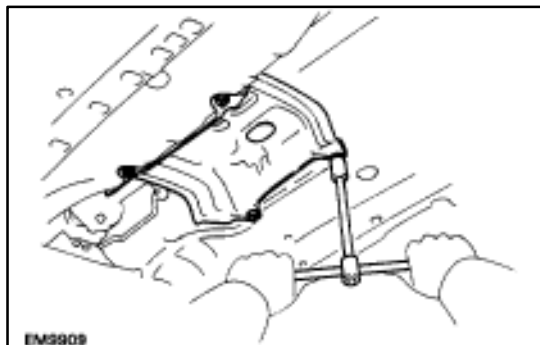




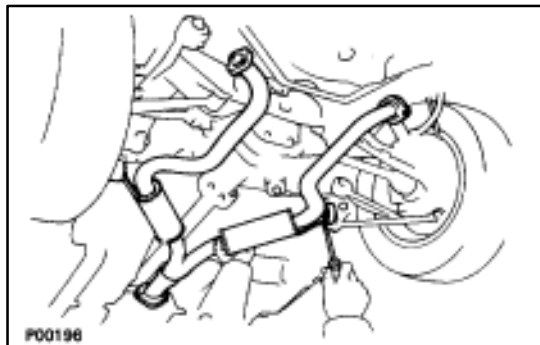
4. INSTALL PROPELLER SHAFT
(See PR section)



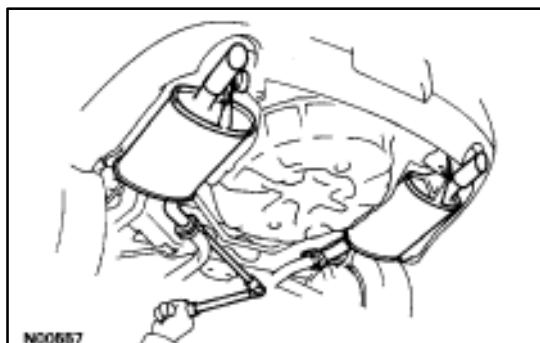
5. INSTALL CENTER FLOOR BRACE
Install the brace with the four nuts.
Torque: 13 N·m (130 kgf·cm, 9 ft·lbf)



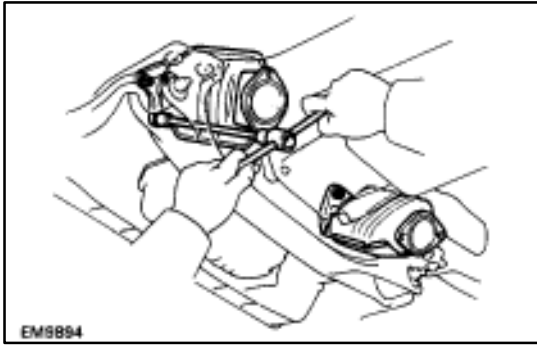
6. INSTALL EXHAUST PIPE HEAT INSULATOR
Install the heat insulator with the four nuts.



7. INSTALL CENTER EXHAUST PIPE
Install the two hooks of the exhaust pipe to the rings on the exhaust pipe brackets.



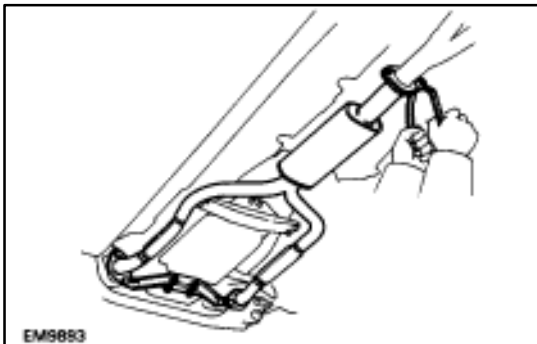
8. INSTALL TAILPIPE
(a) Install the tailpipe hook to the ring on the tailpipe brackets.
(b) Install a new gasket and the tailpipe to the center exhaust pipe with the two bolts. Install the two tailpipe.
Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)



9. INSTALL CATALYTIC CONVERTERS (MAIN)

Install a new gasket and the catalytic converter with three new nuts. Install the two catalytic converters.

Torque: 62 N·m (630 kgf·cm, 46 ft·lbf)



10. INSTALL FRONT EXHAUST PIPE

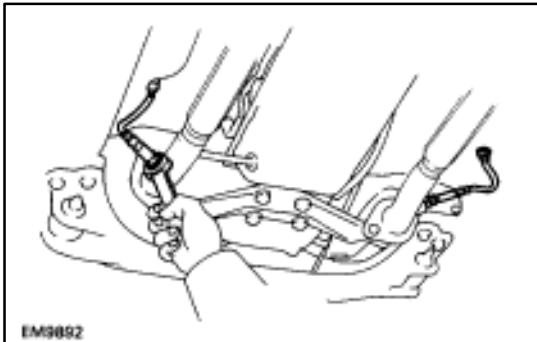
(a) Temporarily install the pipe support stay with the four bolts.

(b) Install three new gaskets, the exhaust pipe and pipe support stay with the six bolts and nuts.

Torque: 43 N·m (440 kgf·cm, 32 ft·lbf)

(c) Tighten the four bolts holding the pipe support bracket to the transmission.

Torque: 43 N·m (440 kgf·cm, 32 ft·lbf)

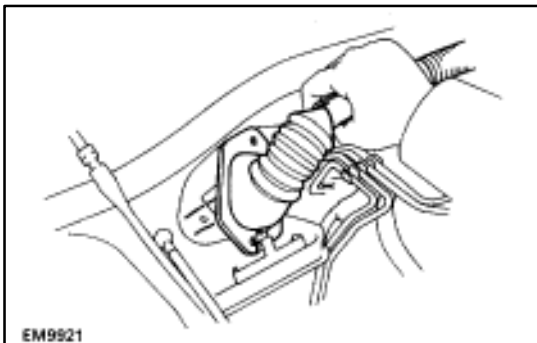


(d) Install the two sub-oxygen sensors to the exhaust pipe.

Torque: 44 N·m (450 kgf·cm, 33 ft·lbf)

HINT:

- Before installing the sub-oxygen sensor, twist the sensor wire counterclockwise 3 1/2 turns.
 - After installing the sub-oxygen sensor, check that the sensor wire is not twisted. If it is twisted, remove the sub-oxygen sensor and reinstall it.
- (e) Install the wire grommets to the floor.



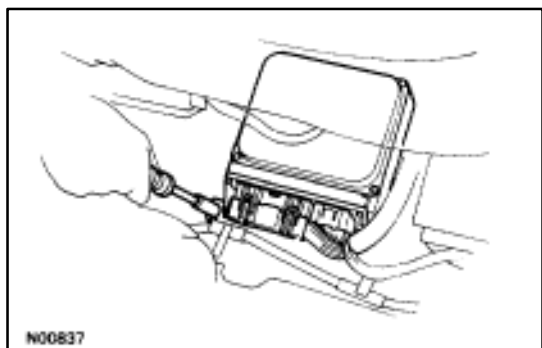
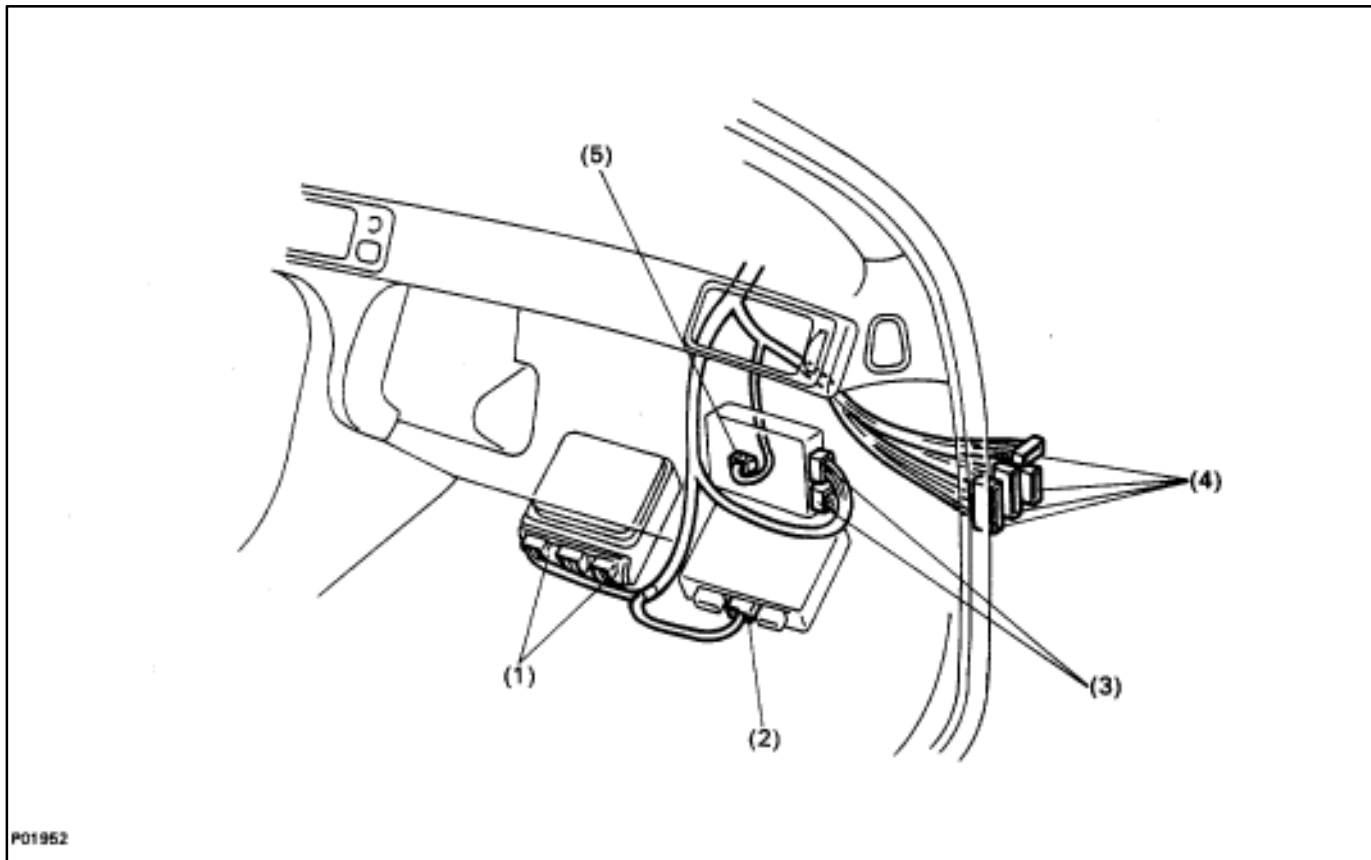
11. CONNECT ENGINE WIRE TO CABIN

(a) Push in the engine wire through the cowl panel.

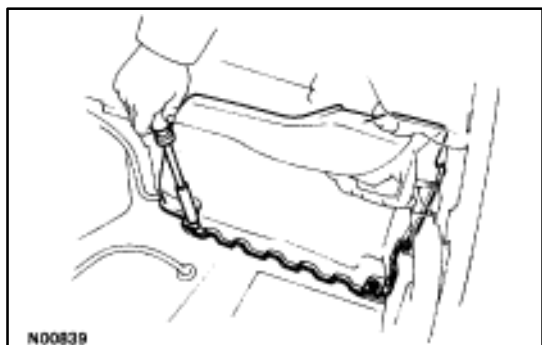


(b) Install the engine wire clamp with the three bolts.

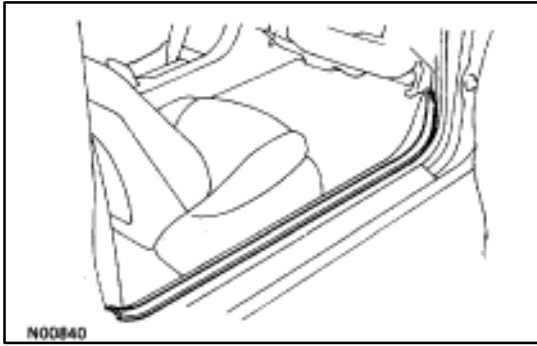
- (c) Connect the following connectors:
- (1) Two connectors to engine & ECT ECU
 - (2) Connectors to ABS & TRAC ECU
 - (3) Two connectors to TRAC ECU
 - (4) Four connectors to connector cassette
 - (5) Connector to A/C control assembly



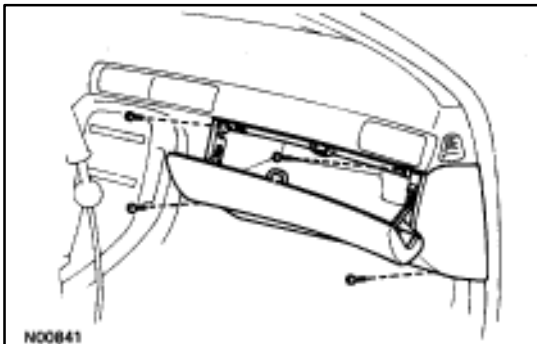
- (d) Install the engine & ECT ECU with the nut.



- (e) Install the ECU protector with the two nuts.
(f) Install the floor carpet.

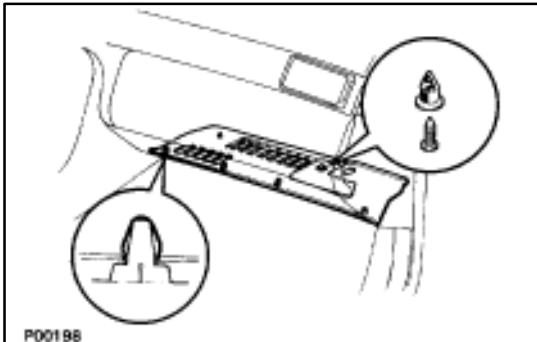


(g) Install the scuff plate.

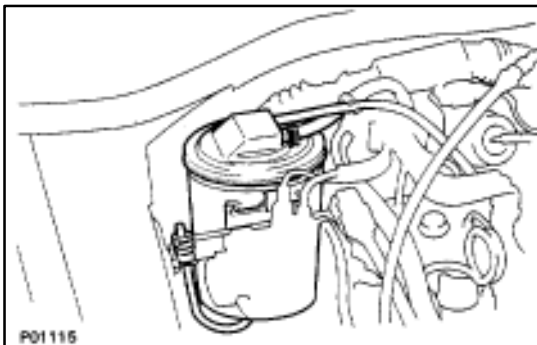


(h) Connect the connectors.

(i) Install the lower instrument panel finish panel and glove compartment door assembly with the four screws.



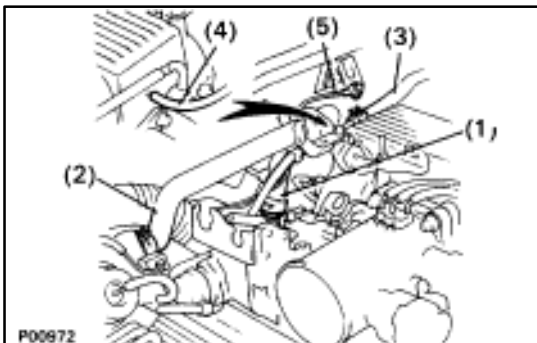
(j) Install the instrument panel under cover with the two clips.



12. INSTALL CHARCOAL CANISTER

(a) Install the charcoal canister.

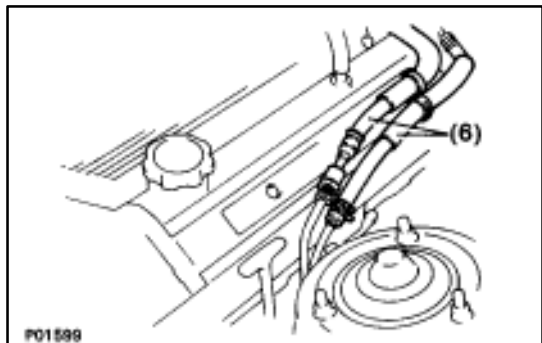
(b) Connect the vacuum hose and air hose to the charcoal canister.



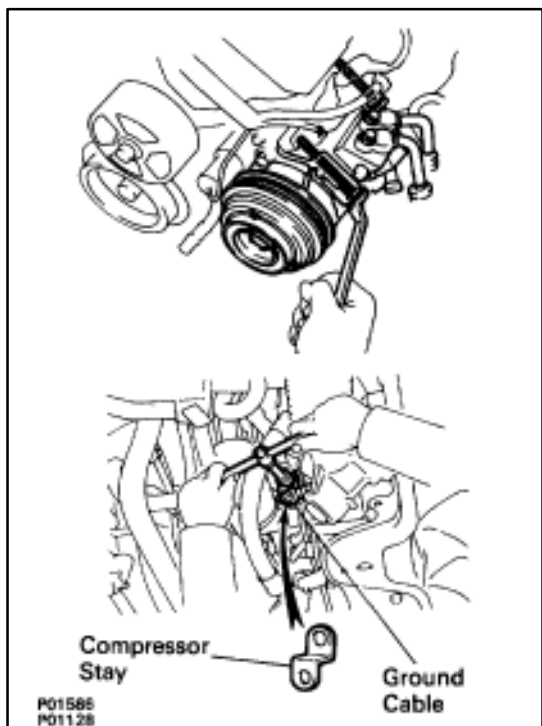
13. CONNECT HOSES

Connect the following hose and ground strap:

- (1) Heater water hose to water by-pass pipe
- (2) Heater water hose to heater water valve
- (3) Vacuum hose to brake booster union on air intake chamber
- (4) Vacuum hose (from VSV for heater water valve) to air intake chamber
- (5) Ground strap to bracket on body



(6) Two fuel hoses to fuel tubes



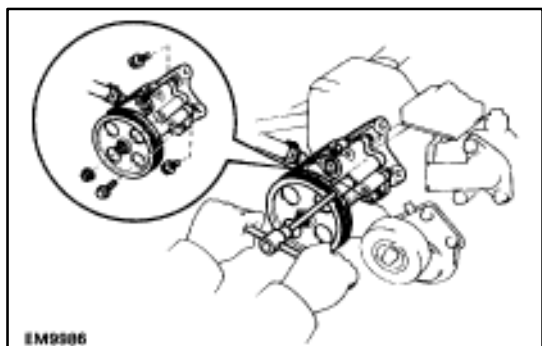
14. INSTALL A/C COMPRESSOR

- (a) Install the A/C compressor, compressor stay and ground cable with the nut and three bolts.

Torque: Bolt 49 N·m (500 kgf·cm, 36 ft·lbf)

Nut 29 N·m (300 kgf·cm, 22 ft·lbf)

- (b) Connect the A/C compressor connector.

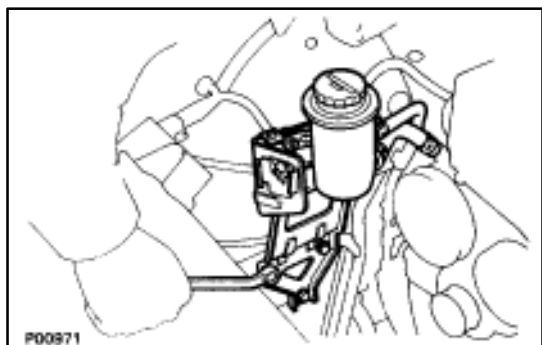


15. INSTALL PS PUMP

Install the PS pump with the three bolts and nut. Alternately tighten the bolts and nut.

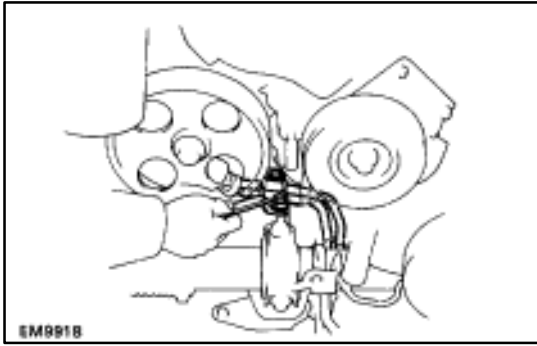
Torque: Bolt 39 N·m (400 kgf·cm, 29 ft·lbf)

Nut 43 N·m (440 kgf·cm, 32 ft·lbf)



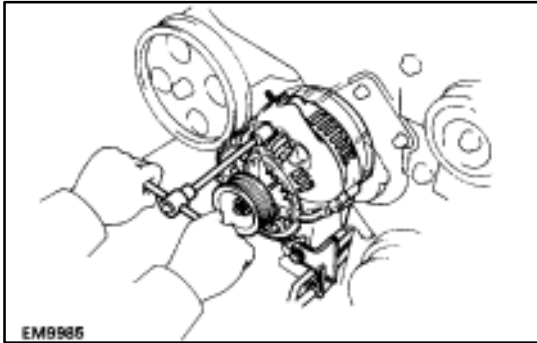
16. INSTALL PS RESERVOIR TANK AND BRACKET

Install the reservoir tank and bracket assembly with the three bolts.



17. INSTALL PS TUBES

Install the PS tube clamp with the bolt.

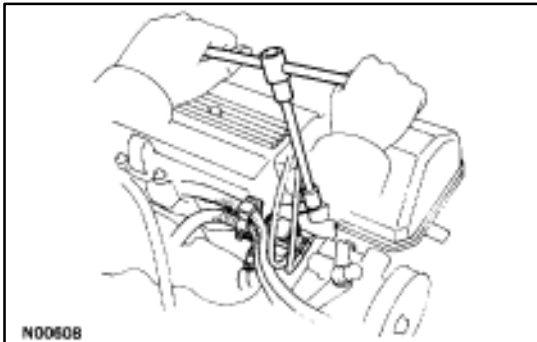


18. INSTALL ALTERNATOR

- (a) Install the alternator and A/T oil cooler pipe bracket with the bolt and nut.

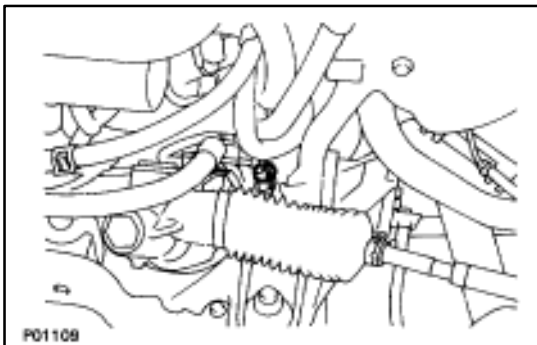
Torque: 37 N·m (380 kgf·cm, 27 ft·lbf)

- (b) Connect the alternator connector.
- (c) Connect the alternator wire with the nut and cap.

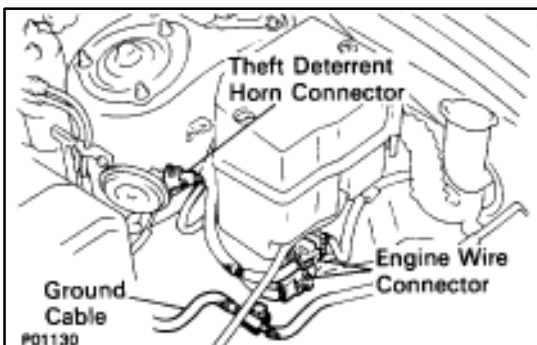


19. INSTALL WIRE CLAMP (FOR ALTERNATOR) AND VSV (FOR EVAP SYSTEM)

- (a) Install the wire clamp to the VSV bracket.
- (b) Install the VSV with the two bolts.



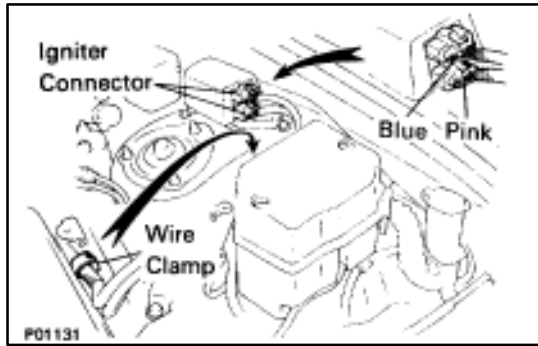
20. CONNECT PS SOLENOID VALVE CONNECTOR



21. CONNECT ENGINE WIRE CONNECTORS

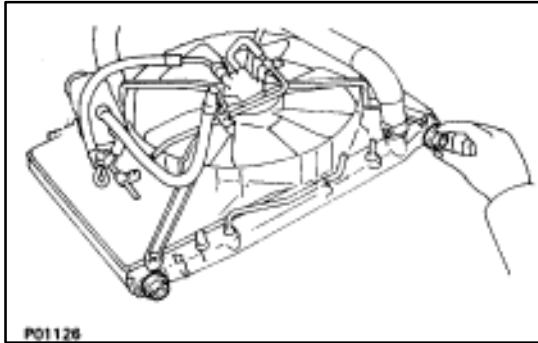
22. CONNECT THEFT DETERRENT HORN CONNECTOR

23. INSTALL GROUND CABLE TO BODY



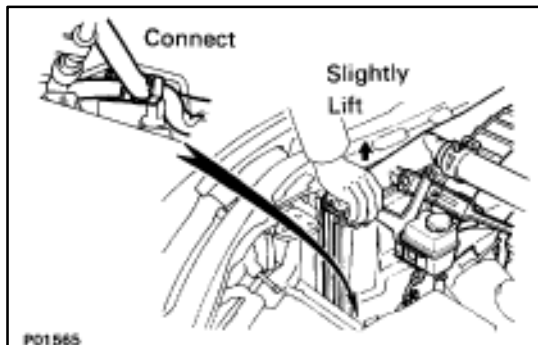
24. CONNECT IGNITER CONNECTOR

- (a) Connect the two igniter connectors.
- (b) Install the wire clamp.

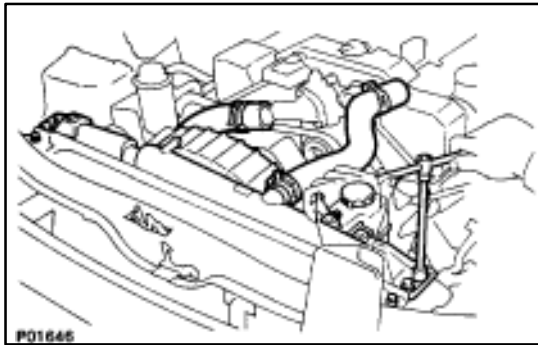


25. INSTALL RADIATOR

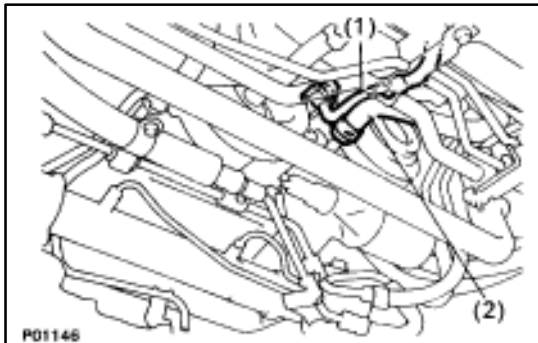
- (a) Install the two lower radiator supports to the radiator.



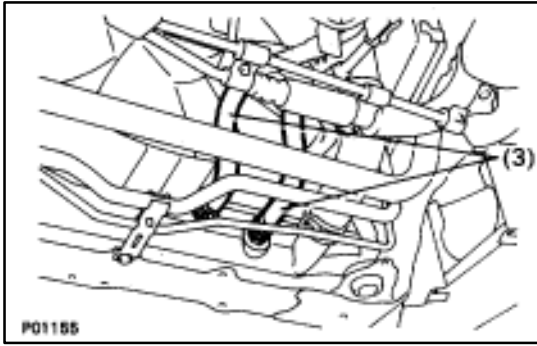
- (b) Place the radiator on the body bracket.
- (c) Slightly lift the radiator, and connect the two cooler hose (for cooling fan) to the hose clamp on the radiator fan shroud.



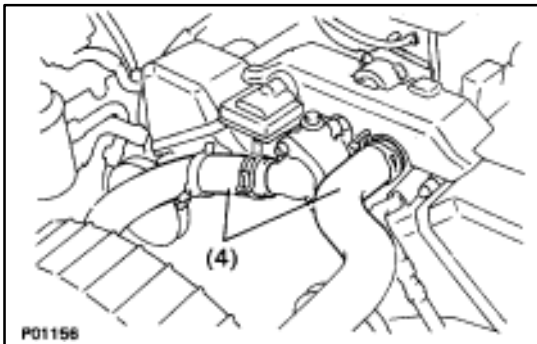
- (d) Install the upper radiator support with the two bolts and screw. Install the two upper radiator supports.



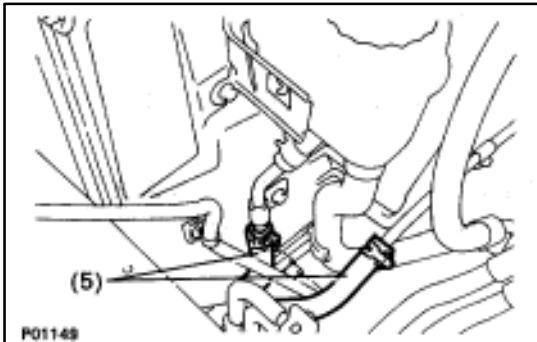
- (e) Connect the following hoses:
 - (1) Pressure hose to hydraulic pump
 - (2) Suction hose to hydraulic pump



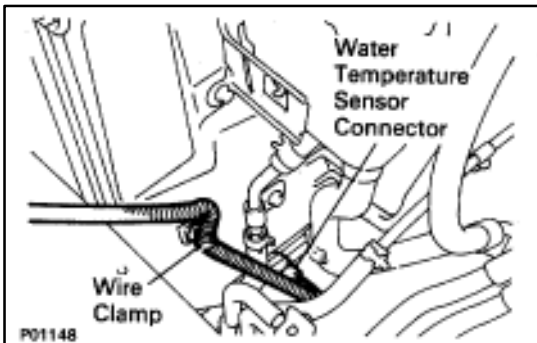
(3) Two oil cooler hoses (for A/T) to radiator



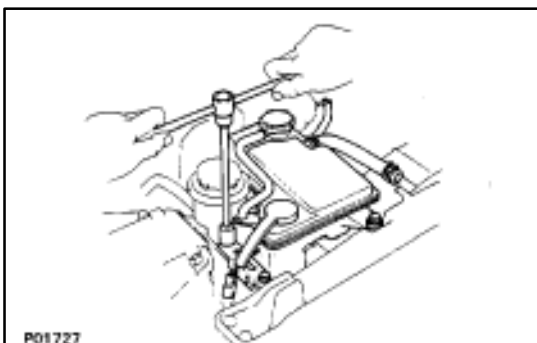
(4) Two radiator hoses



(5) Two oil cooler hoses (for cooling fan) to pipes

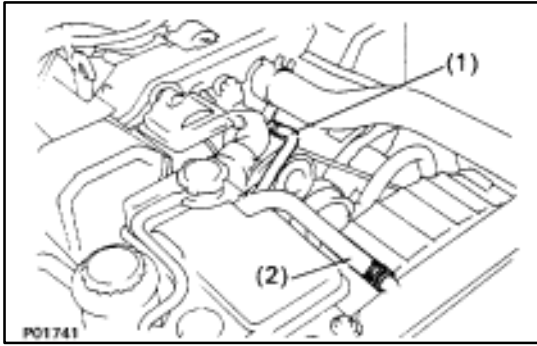


- (f) Connect the water temperature sensor connector.
- (g) Install the wire clamp (for water temperature sensor) to the radiator fan shroud.



26. INSTALL RADIATOR RESERVOIR TANK

- (a) Install the reservoir tank to the reservoir tank bracket.
- (b) Install the reservoir tank bracket with the two bolts.

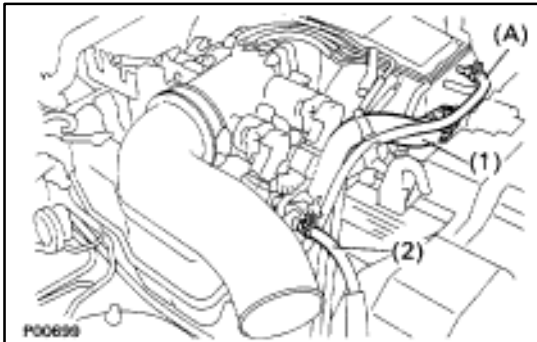


- (c) Connect the following hoses:
 - (1) Reservoir hose to water inlet housing
 - (2) Reservoir hose to radiator
- (d) Connect the coolant level sensor connector.



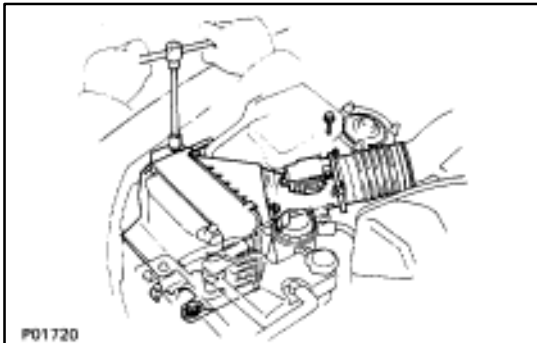
27. INSTALL INTAKE AIR CONNECTOR

- (a) Connect the intake air connector to the throttle body.
- (b) Install the hose clamp and mounting bolt.



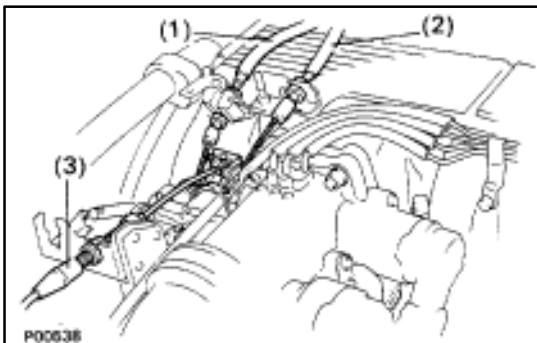
- (c) Connect the following hoses:
 - (1) Air hose to ISC valve
 - (2) Air hose (from PS air control valve) to air intake chamber

28. CONNECT VACUUM HOSE (A) (FROM PS AIR CONTROL VALVE) TO AIR INTAKE CHAMBER



29. INSTALL AIR CLEANER AND AIR FLOW METER

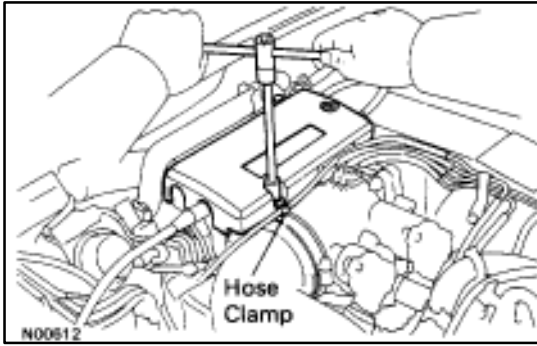
- (a) Connect the air cleaner case to the air duct.
- (b) Connect the air cleaner hose to the intake air connector.
- (c) Install the four mounting bolts and hose clamp.
- (d) Connect the air flow meter connector.



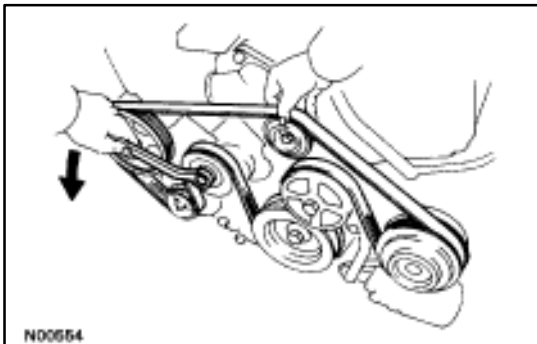
30. CONNECT CONTROL CABLES TO THROTTLE BODY

Connect the following cables:

- (1) Accelerator cable
- (2) A/T throttle cable
- (3) (w/ Cruise Control System)
Cruise control actuator cable

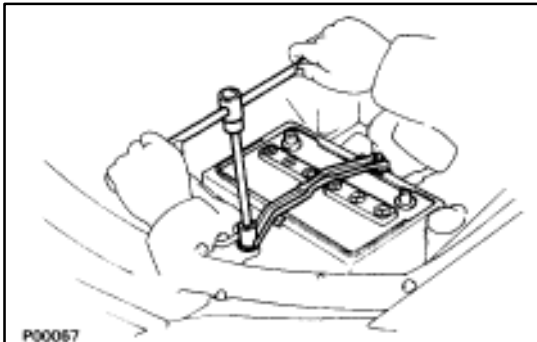
**31. INSTALL THROTTLE BODY COVER**

Install the throttle body cover and hose clamp with the two bolts and cap nut.

**32. INSTALL DRIVE BELT**

Install the drive belt by turning the drive belt tensioner counterclockwise.

HINT: The pulley bolt for the belt tensioner has a left-hand thread.

**33. INSTALL BATTERY****34. FILL WITH ENGINE COOLANT (See page [CO-7](#))****35. FILL COOLING FAN RESERVOIR TANK WITH FLUID (See page [CO-23](#))****36. FILL WITH ENGINE OIL (See page [LU-7](#))**

Capacity:

Drain and refill

w/Oil filter change

4.8 liters (5.1 US qts, 4.2 Imp. qts)

w/o Oil filter change

4.5 liters (4.8 US qts, 4.0 Imp. qts)

Dry fill 6.0 liters (6.3 US qts, 5.3 Imp. qts)

37. START ENGINE AND CHECK FOR LEAKS**38. CHECK AUTOMATIC TRANSMISSION FLUID LEVEL****39. CHECK IGNITION TIMING (See page [IG-28](#))**

Ignition timing:

8–12° BTDC @ idle

(w/ Terminals TE1 and E1 connected)

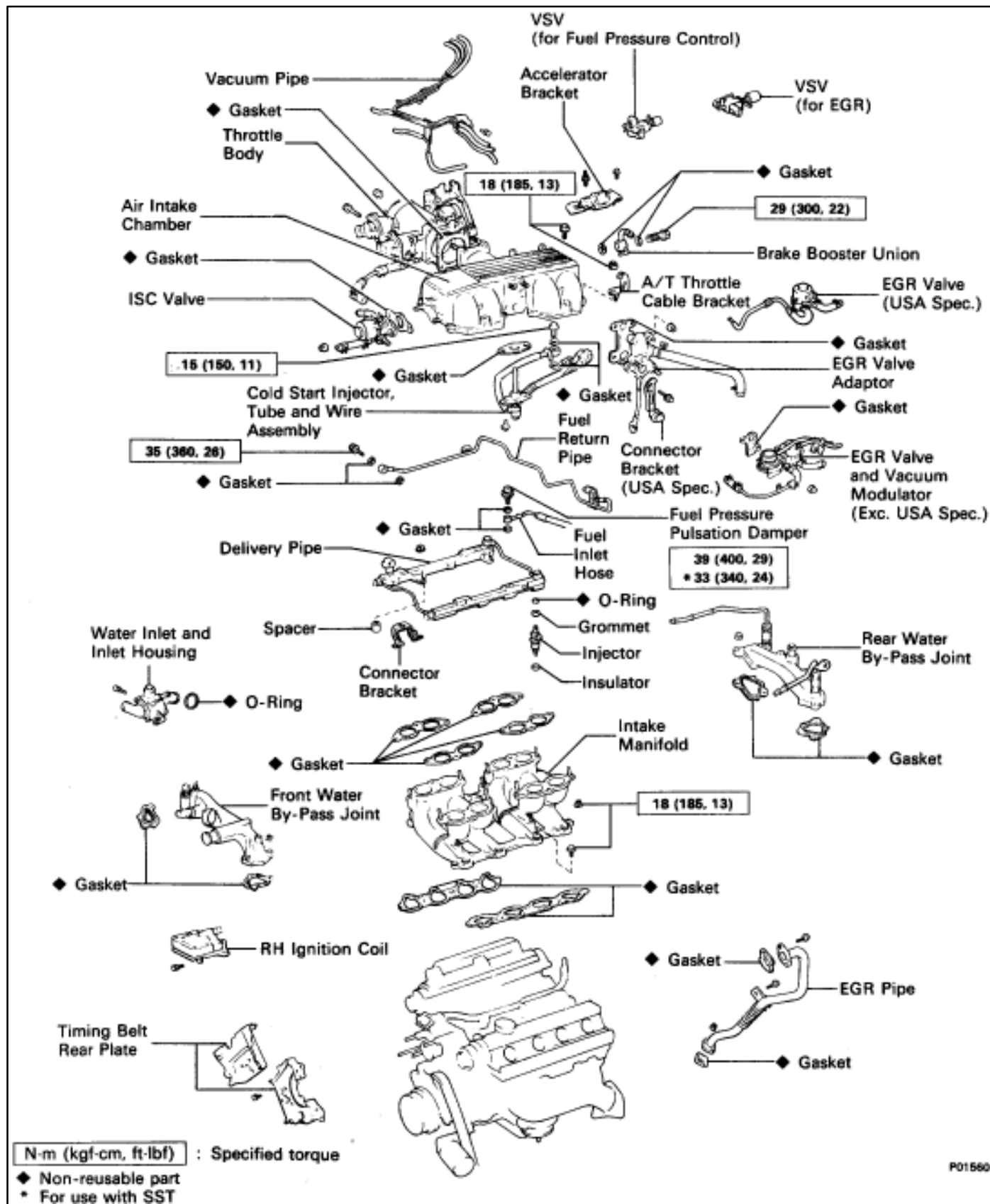
40. INSTALL ENGINE UNDER COVER**41. INSTALL HOOD****42. PERFORM ROAD TEST**

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

32. RECHECK ENGINE COOLANT AND ENGINE OIL LEVELS

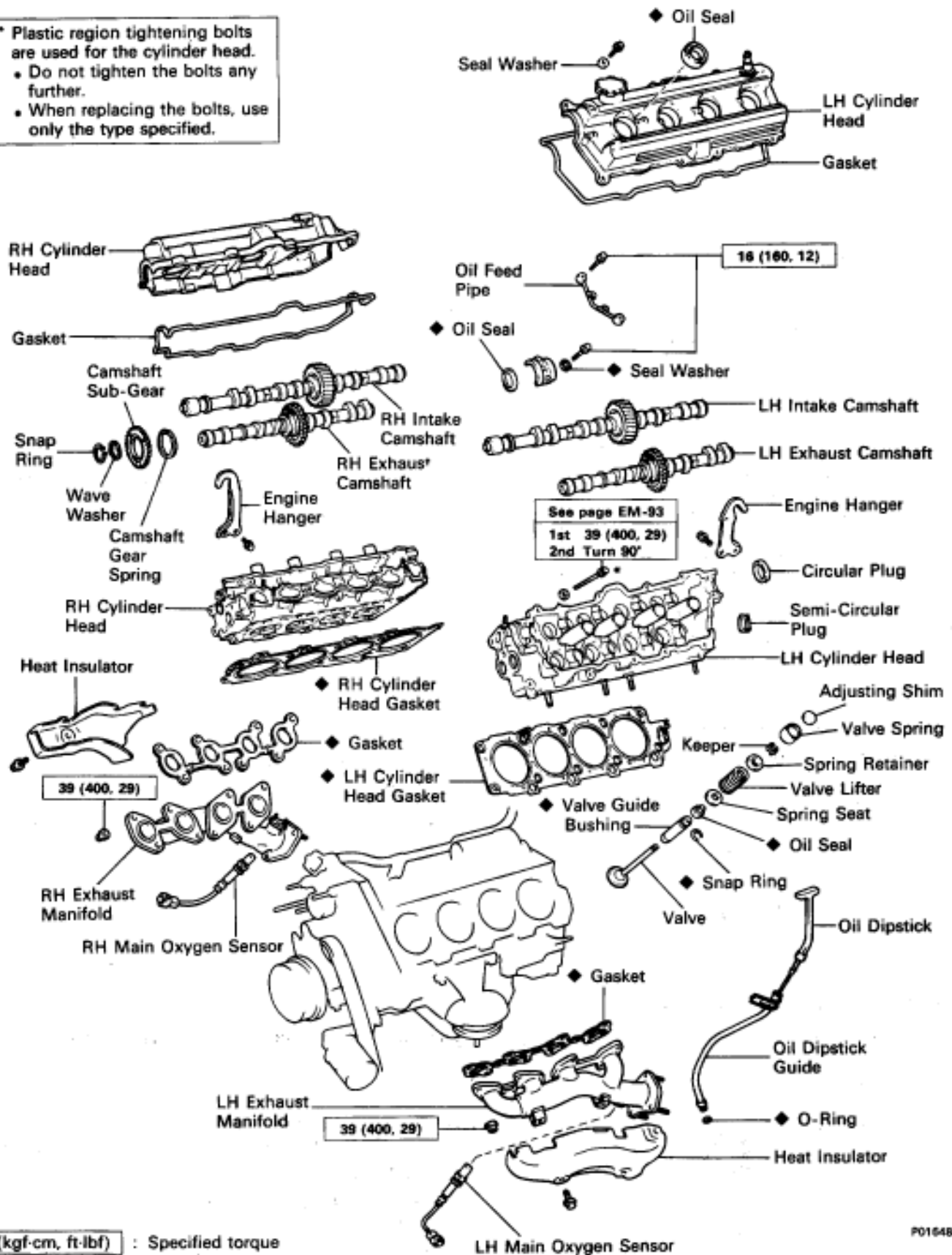
CYLINDER HEADS

COMPONENTS FOR REMOVAL AND INSTALLATION



COMPONENTS FOR REMOVAL AND INSTALLATION (Cont'd)

- Plastic region tightening bolts are used for the cylinder head.
- Do not tighten the bolts any further.
- When replacing the bolts, use only the type specified.



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

◆ Non-reusable part

P01648

REMOVAL OF CYLINDER HEADS

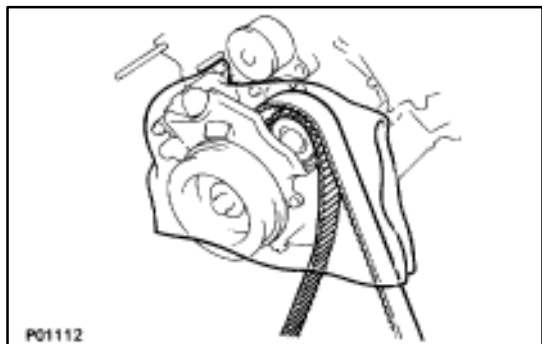
(See Components on pages EM-58 and 59)

1. DISCONNECT TIMING BELT FROM CAMSHAFT TIMING PULLEYS

(See steps 1 to 28 on pages EM-35 to 42)

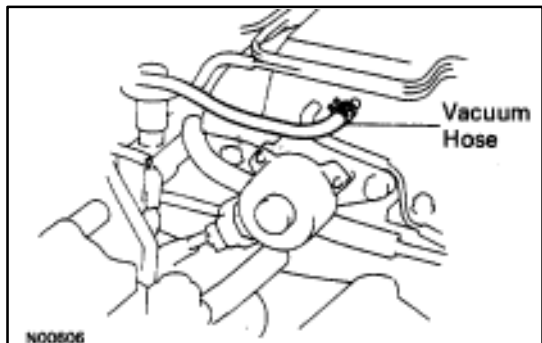
2. REMOVE CAMSHAFT TIMING PULLEYS AND HYDRAULIC PUMP

(See steps 29 and 31 on pages EM-42 and 43)



HINT:

- 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.

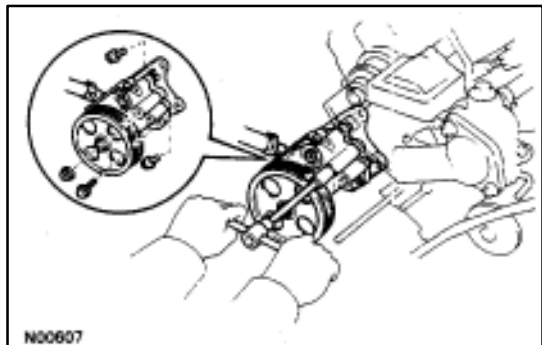


3. DISCONNECT PS PUMP FROM LH CYLINDER HEAD

- (a) Disconnect the vacuum hose from the air intake chamber.

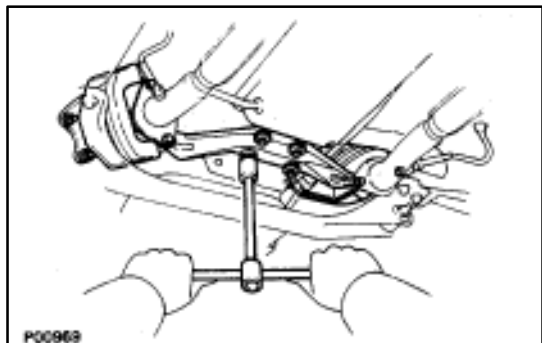
- (b) Remove the three bolts and nut, and disconnect the PS pump.

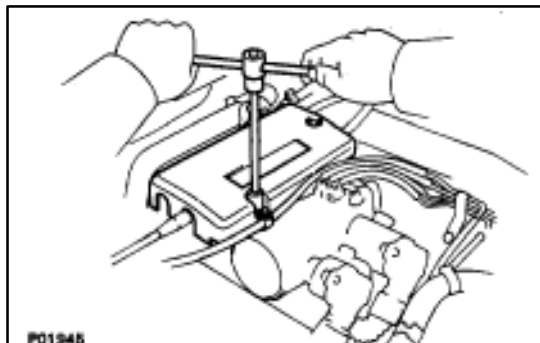
HINT: Put aside the PS pump, and suspend it.



4. REMOVE CATALYTIC CONVERTERS (MAIN)

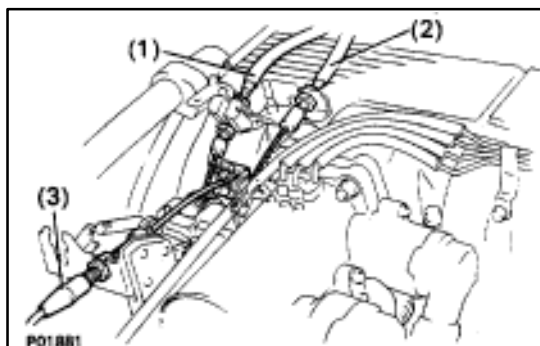
- (a) Remove the four bolts holding the pipe support bracket to the transmission.
- (b) Remove the four bolts and nuts holding the catalytic converters to the front exhaust pipe. Remove the pipe support bracket.
- (c) Disconnect the front exhaust pipe from the catalytic converter, and remove the two gaskets.
- (d) Remove the three nuts, catalytic converter and gasket. Remove the two catalytic converters.





5. REMOVE THROTTLE BODY COVER

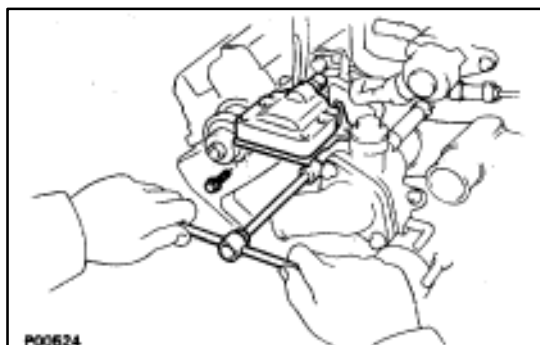
- (a) Remove the mounting cap nut.
- (b) Loosen the two bolts, and remove the throttle body cover.



6. DISCONNECT CONTROL CABLES FROM THROTTLE BODY

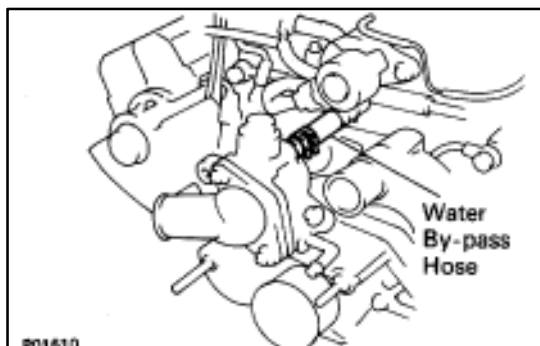
Disconnect the following cables:

- (1) Accelerator cable
- (2) A/T throttle control cable
- (3) (w/ Cruise Control System)
Cruise control actuator cable



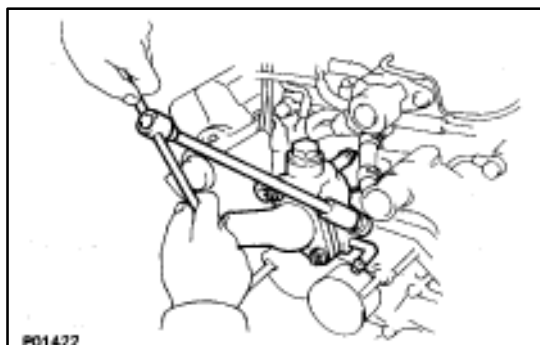
7. REMOVE RH IGNITION COIL

Remove the two bolts and ignition coil.

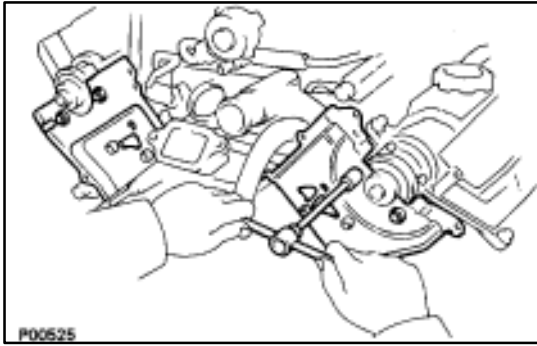


8. REMOVE WATER INLET AND INLET HOUSING

- (a) Disconnect the water by-pass hose from the ISC valve.

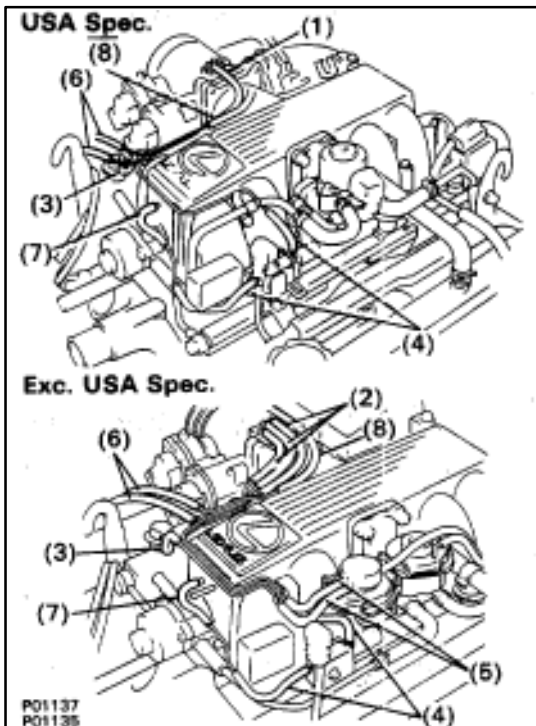


- (b) Remove the two bolts holding the water inlet housing to the water pump.
- (c) Pull out the water inlet and inlet housing assembly.
- (d) Remove the O-ring from the water inlet housing.



9. REMOVE TIMING BELT REAR PLATES

Remove the two bolts and rear plate. Remove the two rear plates.

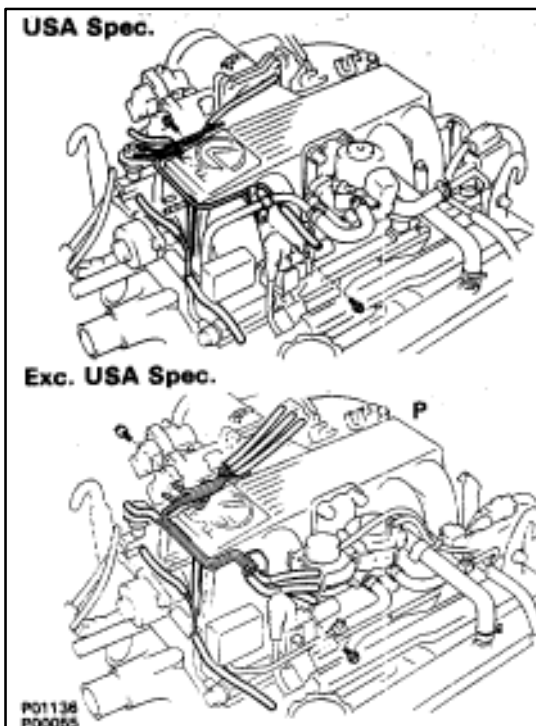


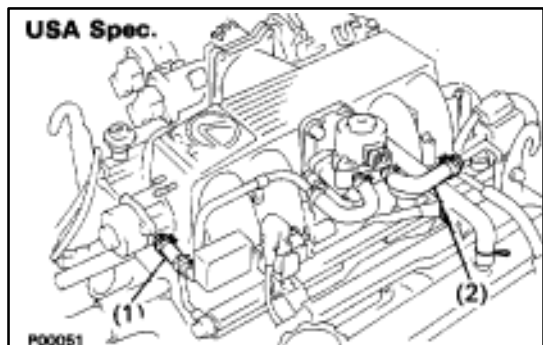
10. REMOVE VACUUM PIPE

(a) Disconnect the following hoses:

- (1) (USA Spec.)
Vacuum hose from throttle body
- (2) (Exc. USA Spec.)
Three vacuum hoses from throttle body
- (3) Vacuum hose from fuel pressure regulator
- (4) Two vacuum hoses from VSV for fuel pressure control system
- (5) (Exc. USA Spec.)
Two vacuum hoses from EGR vacuum modulator
- (6) Two vacuum hoses (from VSV for EVAP system) from vacuum pipe
- (7) Vacuum hose (from VSV for fuel pressure control system) from air intake chamber
- (8) Vacuum hose (from charcoal canister) from vacuum pipe.

(b) Remove the two bolts, the vacuum pipe and vacuum hoses assembly.

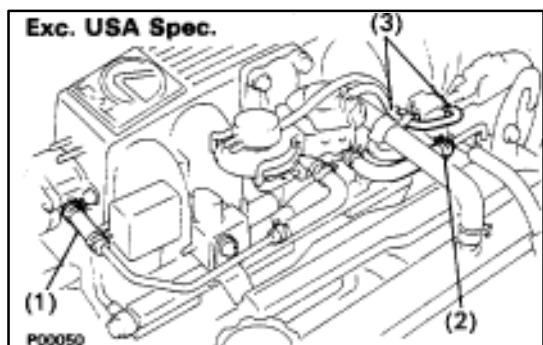
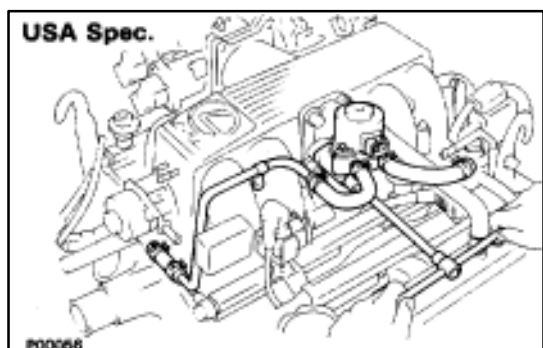




11. (USA Spec.)

REMOVE EGR VALVE

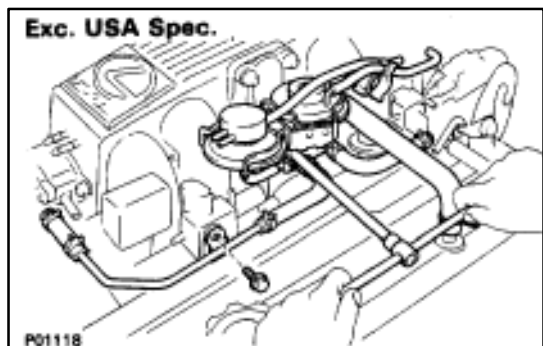
- (a) Disconnect the EGR valve connector.
- (b) Disconnect the following hoses:
 - (1) Water by-pass pipe hose from ISC valve
 - (2) Water by-pass hose from water by-pass pipe (from rear water by-pass joint)
- (c) Remove the two nuts, EGR valve and gasket.



12. (Exc. USA Spec.)

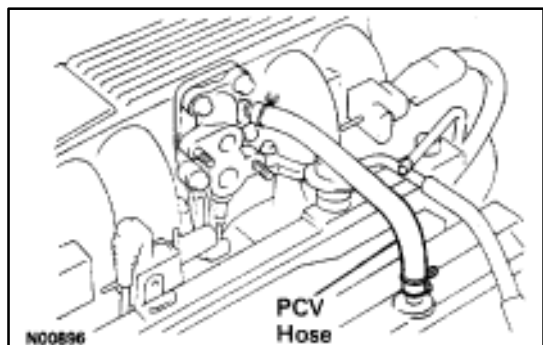
REMOVE EGR VALVE AND VACUUM MODULATOR

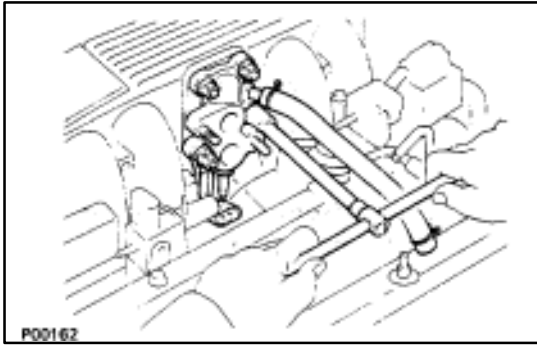
- (a) Disconnect the hose clamp (A) from the PCV hose.
- (b) Disconnect the following hoses:
 - (1) Water by-pass pipe hose from ISC valve
 - (2) Water by-pass hose from water by-pass pipe (from rear water by-pass joint)
 - (3) Two vacuum hoses from VSV for EGR system
- (c) Remove the bolt, two nuts, the EGR valve, vacuum modulator assembly and gasket.



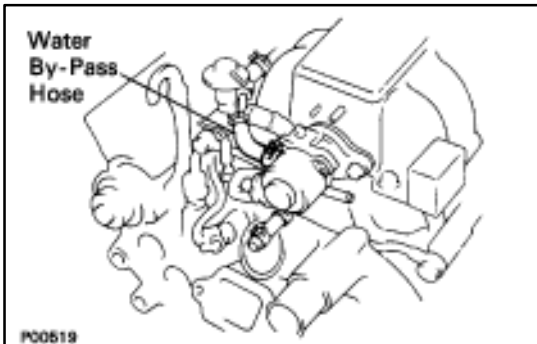
13. REMOVE EGR VALVE ADAPTOR

- (a) Disconnect the PCV hose from the cylinder head.



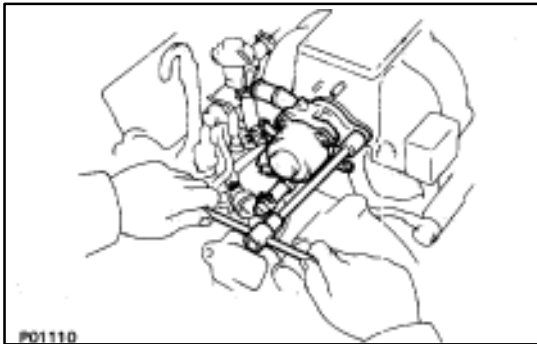


- (b) Remove the two bolts, two nuts, adaptor and gasket.
- (c) (USA Spec. only)
Disconnect the EGR gas temperature sensor connector.

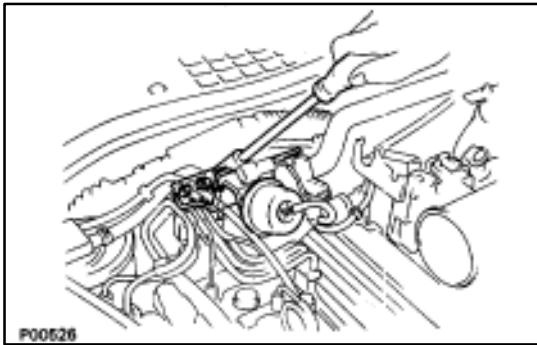


14. REMOVE ISC VALVE

- (a) Disconnect the ISC valve connector.
- (b) Disconnect the water by-pass hose from the ISC valve.

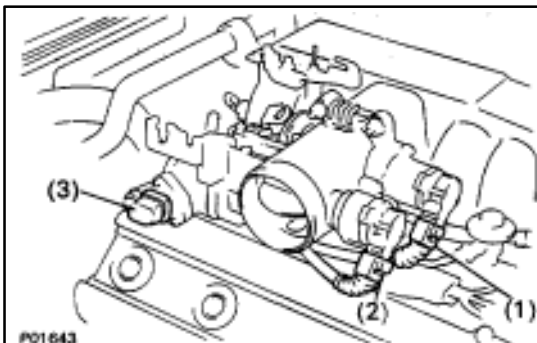


- (c) Remove the two nuts, ISC valve and gasket.



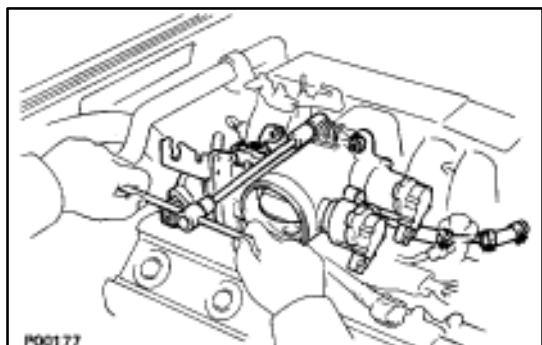
15. DISCONNECT HEATER WATER VALVE FROM BODY

- (a) Disconnect the VSV connector.
- (b) Remove the bolt holding the engine wire clamp to the water valve bracket.
- (c) Remove the two bolts, and disconnect the water valve and bracket assembly.

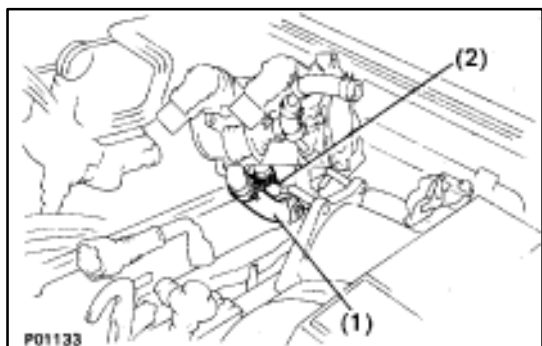


16. REMOVE THROTTLE BODY

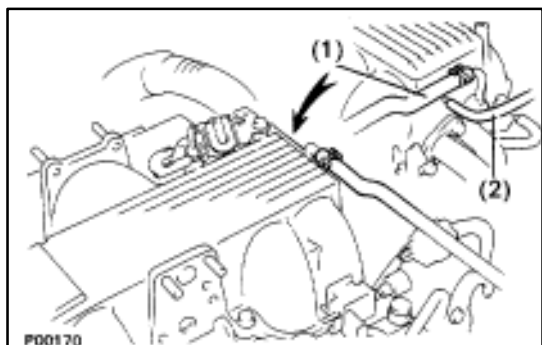
- (a) Disconnect the following connectors:
 - (1) Throttle position sensor connector
 - (2) (w/ TRAC)
Sub-throttle position sensor connector
 - (3) (w/ TRAC)
Sub-throttle actuator connector



- (b) Remove the two mounting bolts and two mounting nuts, and disconnect the throttle body from the air intake chamber.



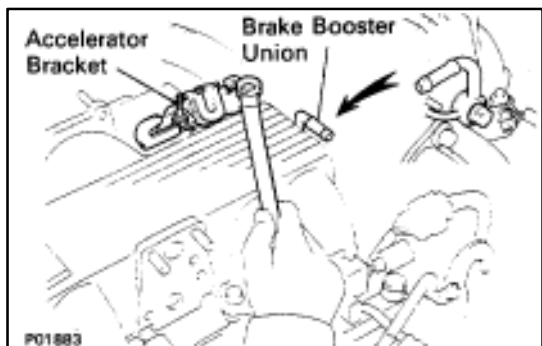
- (c) Disconnect the following hoses, and remove the throttle body:
- (1) PCV hose from throttle body
 - (2) Water by-pass hose from throttle body
- (d) Remove the throttle body gasket.



17. DISCONNECT VACUUM HOSES

Disconnect the following hoses:

- (1) Vacuum hose from brake booster union
- (2) Vacuum hose (from VSV for heater water valve) from air intake chamber

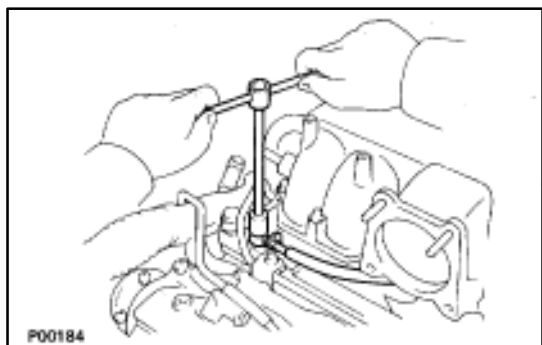


18. REMOVE ACCELERATOR BRACKET

Remove the bolt, stud bolt and bracket.

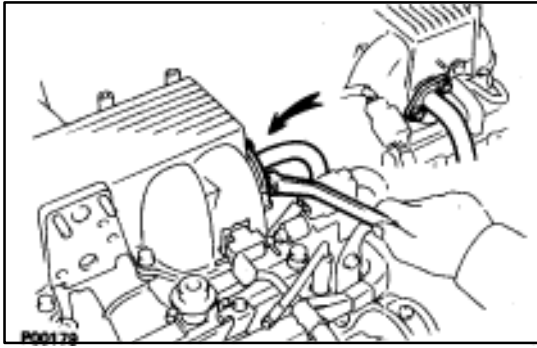
19. REMOVE BRAKE BOOSTER UNION

Remove the union bolt, union and two gaskets.

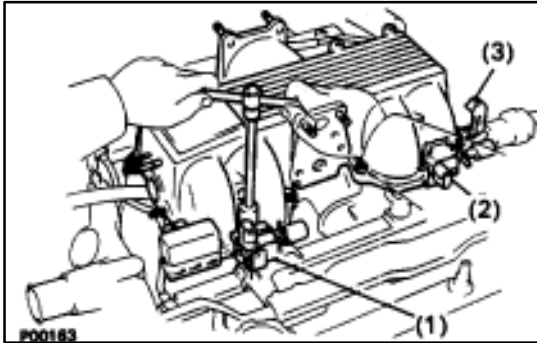


20. REMOVE AIR INTAKE CHAMBER

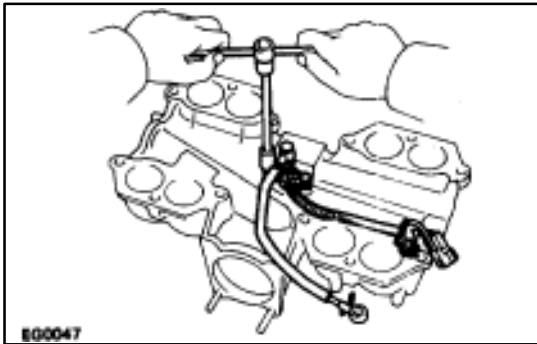
- (a) Disconnect the following connectors:
- Cold start injector connector
 - VSV connector for fuel pressure control system
 - (Exc. USA Spec.) VSV connector for EGR system
- (b) Remove the union bolt and two gaskets, and disconnect the cold start injector tube from the RH delivery pipe.



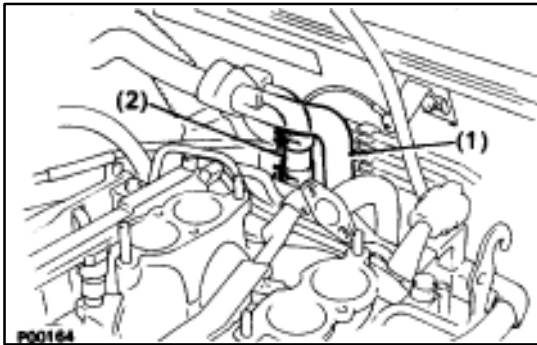
- (c) Remove the two bolts and gaskets, and disconnect the EGR pipe from the air intake chamber.



- (d) Remove the four mounting bolts, eight mounting nuts and following parts:
- (1) VSV for fuel pressure control system
 - (2) (Exc. USA Spec.)
VSV for EGR system
 - (3) A/T throttle cable bracket
- (e) Disconnect the check ("DIAGNOSIS") connector from the intake chamber.
- (f) Remove the air intake chamber and four gaskets.



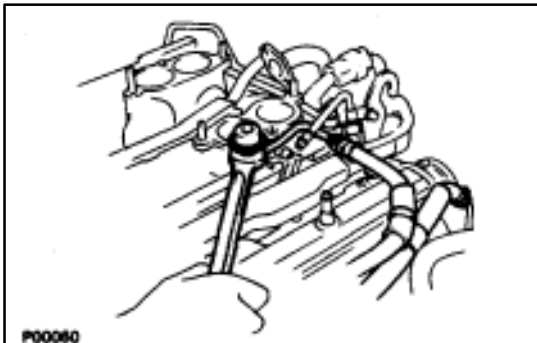
- (g) Remove the three bolts, the cold start injector, tube, lead wire assembly and gasket.



21. DISCONNECT HEATER WATER HOSES

Disconnect the following hoses:

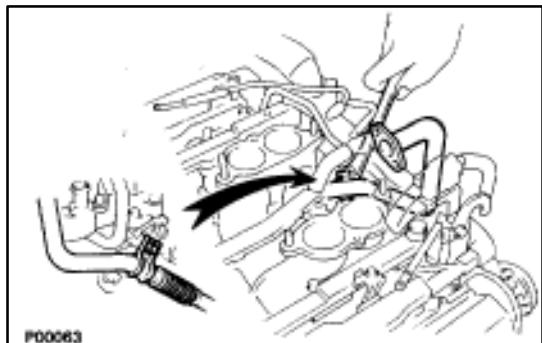
- (1) Water hose from water by-pass pipe
- (2) Water hose from rear water by-pass joint



22. DISCONNECT FUEL INLET HOSE FROM LH DELIVERY PIPE

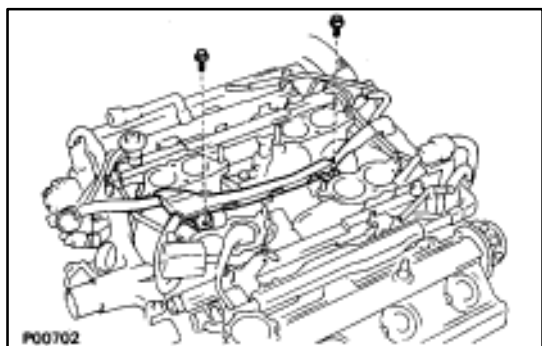
Remove the pulsation damper and two gaskets, and disconnect the inlet hose.

23. DISCONNECT FUEL RETURN HOSE FROM FUEL RETURN PIPE



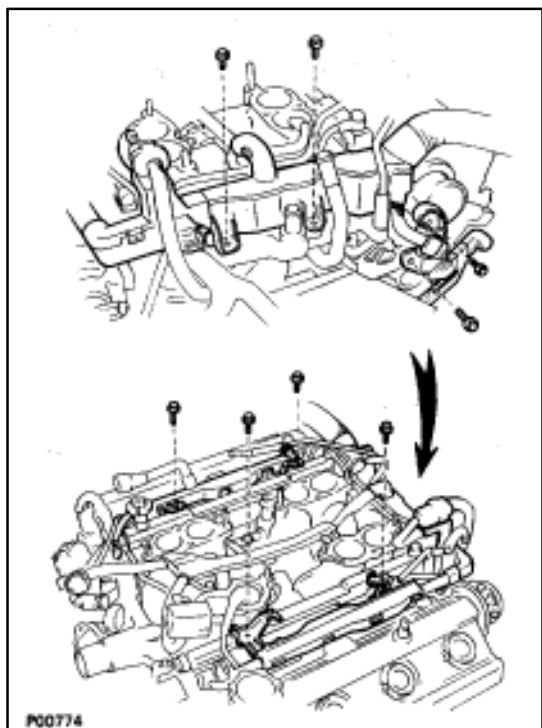
24. DISCONNECT EGR PIPE FROM RH CYLINDER HEAD

Remove the bolt holding the EGR pipe to the RH cylinder head, and disconnect the EGR pipe.



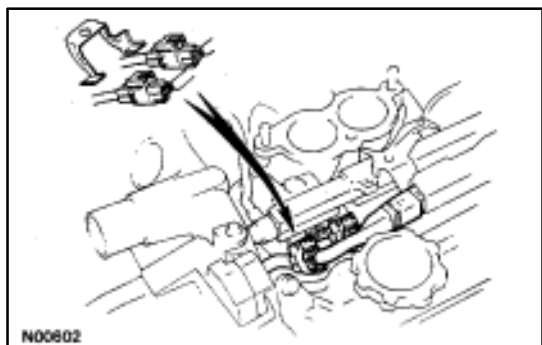
25. DISCONNECT ENGINE WIRE FROM INTAKE MANIFOLD

Remove the two bolts, and disconnect the engine wire.

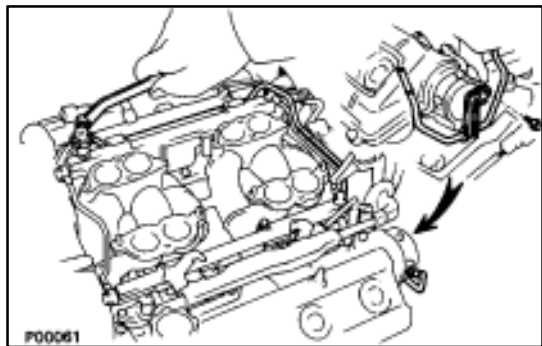


26. DISCONNECT ENGINE WIRE FROM DELIVERY PIPES, REAR WATER BY-PASS JOINT AND RH CYLINDER HEAD

- (a) Remove the four bolts holding the engine wire to the delivery pipes, and disconnect the engine wire from the delivery pipes.
- (b) Remove the two bolts holding the engine wire to the rear water by-pass joint, and disconnect the engine wire from the rear water by-pass joint.
- (c) Remove the two bolts holding the engine wire to the rear side of the RH cylinder head, and disconnect the engine wire from the engine wire RH cylinder head.

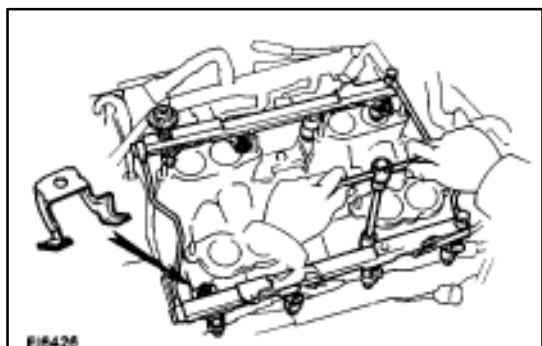


- (d) Disconnect the two engine wire connectors from the connector bracket on the front side of the LH delivery pipe.
- (e) Disconnect the eight injector connectors.



27. REMOVE FUEL RETURN PIPE

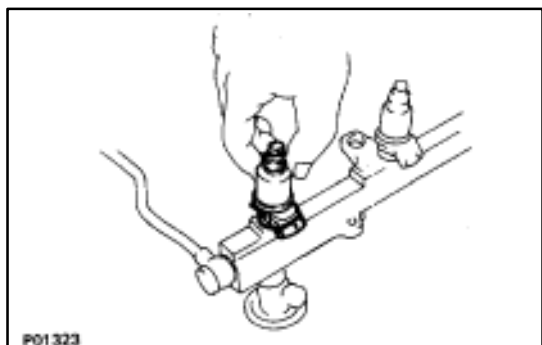
- (a) Remove the bolt holding the fuel return pipe to the rear side of the LH cylinder head.
- (b) Remove the union bolt, two gaskets and return pipe.



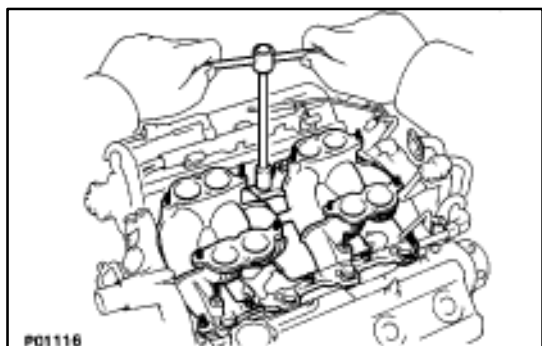
28. REMOVE DELIVERY PIPES AND INJECTORS

- (a) Remove the four nuts holding the delivery pipe to the intake manifold.
- (b) Remove the connector bracket, the two delivery pipes, eight injectors assembly, four spacers and eight insulators.

NOTICE: Be careful not to drop the injectors.

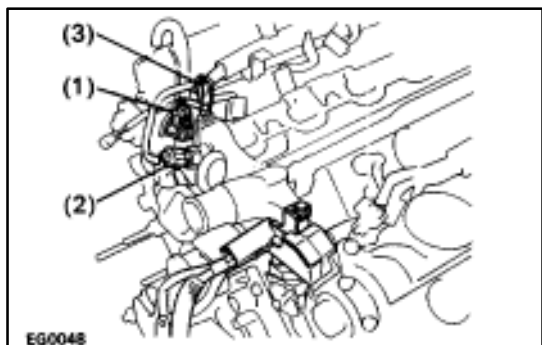


- (c) Remove the eight injectors from the delivery pipes.
- (d) Remove the O-ring and grommet from each injector.



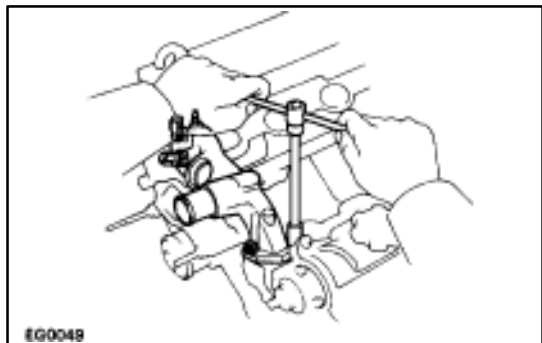
29. REMOVE INTAKE MANIFOLD

Remove the six bolts, four nuts, intake manifold and two gaskets.

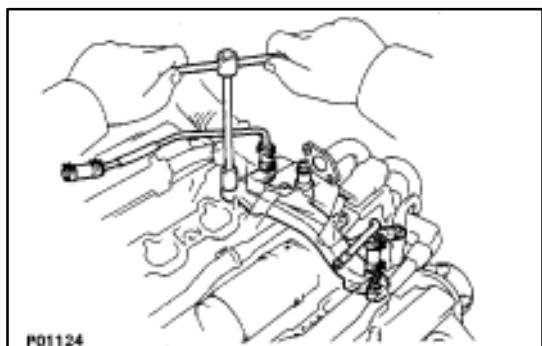


30. REMOVE FRONT WATER BY-PASS JOINT

- (a) Disconnect the following connectors:
 - (1) Water temperature sensor connector
 - (2) Cold start injector time switch connector
 - (3) Water temperature sender gauge connector
- (b) Remove the bolt, and disconnect the engine wire clamp from the water by-pass joint.

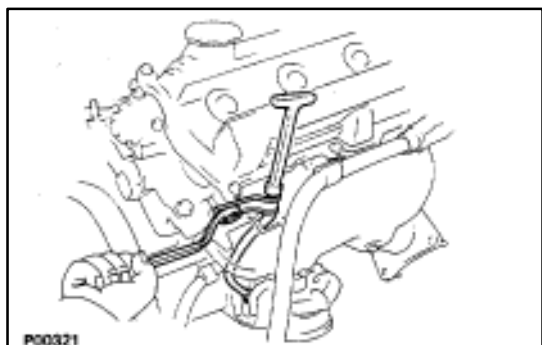


- (c) Remove the four nuts, water by-pass joint and two gaskets.



31. REMOVE REAR WATER BY-PASS JOINT

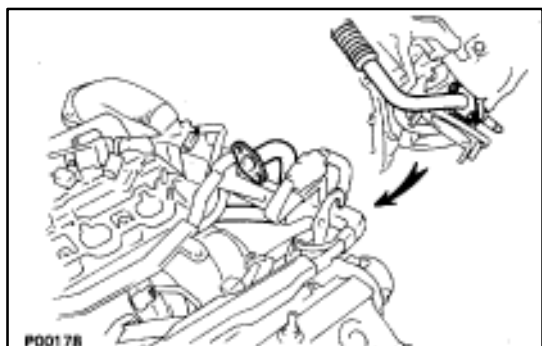
- (a) Remove the bolt holding the water by-pass pipe to the engine hanger.
 (b) Remove the four nuts, water by-pass joint and two gaskets.



32. REMOVE OIL DIPSTICK AND GUIDE FOR ENGINE

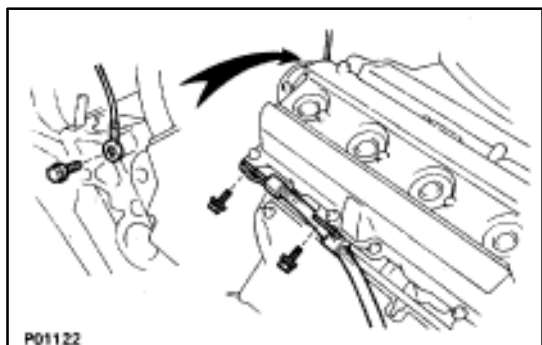
- (a) Remove the mounting bolt.
 (b) Pull out the dipstick guide together with the dipstick.
 (c) Remove the O-ring from the dipstick guide.

33. REMOVE OIL DIPSTICK AND GUIDE FOR A/T



34. REMOVE EGR PIPE

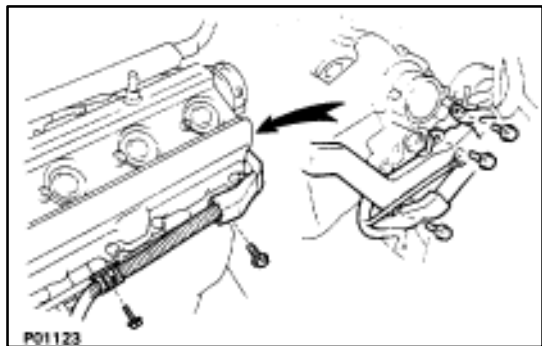
- (a) Remove the two nuts holding the EGR pipe to the RH exhaust pipe.
 (b) Remove the EGR pipe and gasket.



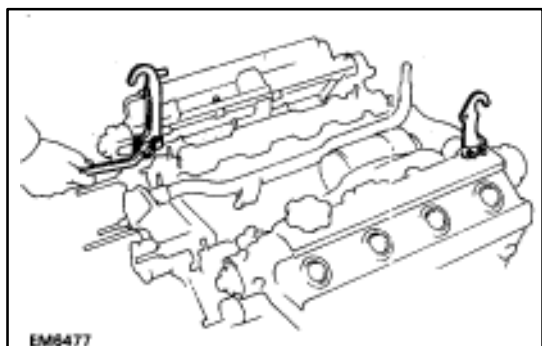
35. DISCONNECT GROUND STRAP FROM RH CYLINDER HEAD

36. DISCONNECT ENGINE WIRE FROM RH CYLINDER HEAD

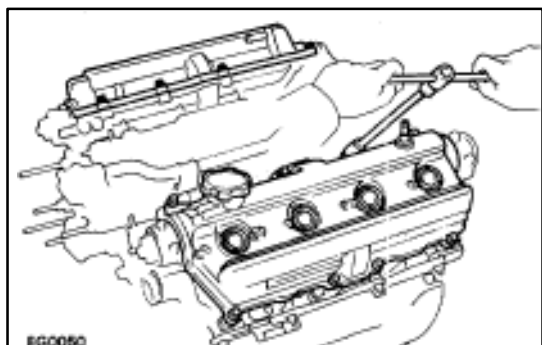
Remove the two bolts, and disconnect the engine wire.

**37. DISCONNECT ENGINE WIRE FROM LH CYLINDER HEAD**

Remove the five bolts, and disconnect the engine wire.

**38. REMOVE ENGINE HANGERS**

Remove the two bolts and engine hanger. Remove the two engine hangers.

**39. REMOVE CYLINDER HEAD COVERS**

Remove the eight bolts, seal washers, cylinder head cover and gasket. Remove the two cylinder head covers.

40. IF NECESSARY, REMOVE SEMI-CIRCULAR PLUGS**41. REMOVE CAMSHAFTS**

NOTICE: Since the thrust clearance of the camshaft is small, the camshaft must be held level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing due the camshaft to seize or break. To avoid this, the following steps should be carried out.

A. Remove exhaust camshaft from RH cylinder head

- (a) Bring the service bolt hole of the driven sub-gear upward by turning the hexagon wrench head portion of the exhaust camshaft with a wrench.
- (b) Secure the exhaust camshaft sub-gear to the driven gear with a service bolt.

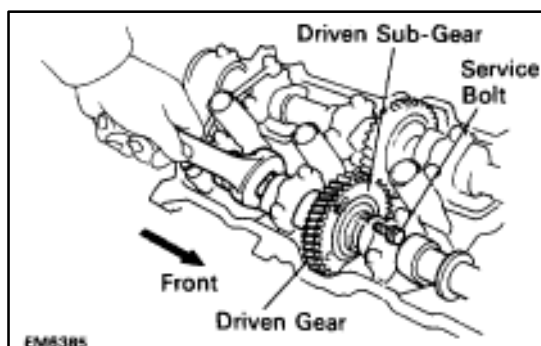
Recommended service bolt:

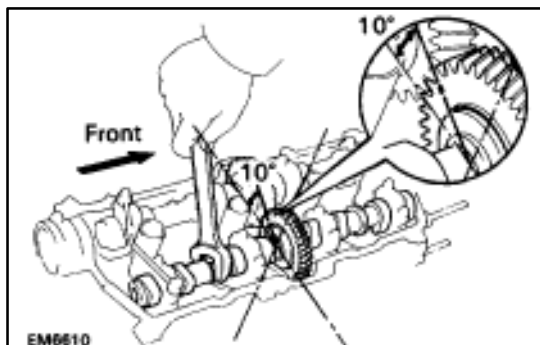
Thread diameter 6 mm

Thread pitch 1.0 mm

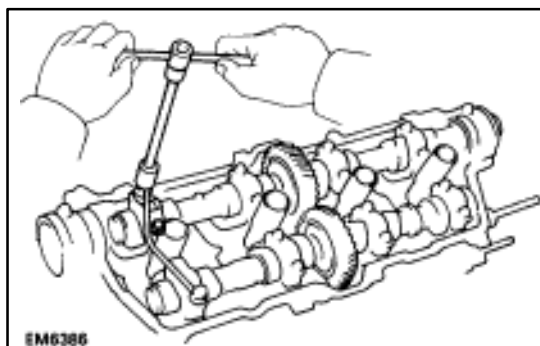
Bolt length 16–20 mm (0.63–0.79 in.)

HINT: When removing the camshaft, make certain that the torsional spring force of the sub-gear has been eliminated by the above operation.

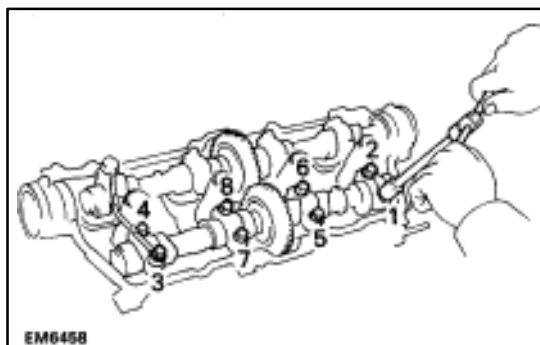




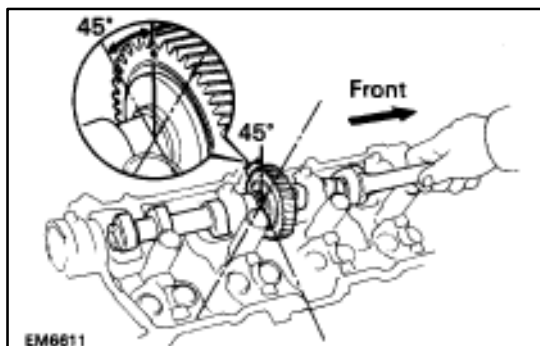
- (c) Set the timing mark (one dot mark) of the camshaft driven gear at approx. 105 angle by turning the hexagon wrench head portion of the exhaust camshaft with a wrench.



- (d) Alternately loosen and remove the two bearing cap bolts holding the intake camshaft side of the oil feed pipe to the cylinder head.

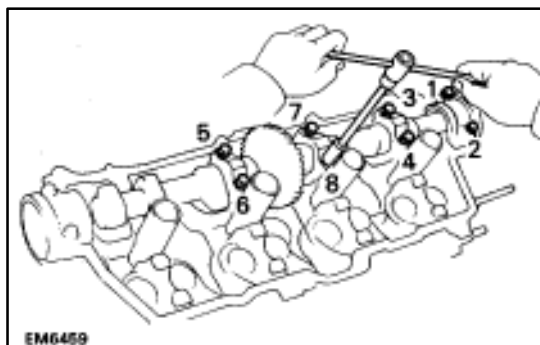


- (e) Uniformly loosen and remove the eight bearing cap bolts in several passes in the sequence shown.
 (f) Remove the oil feed pipe, four bearing caps and exhaust camshaft.

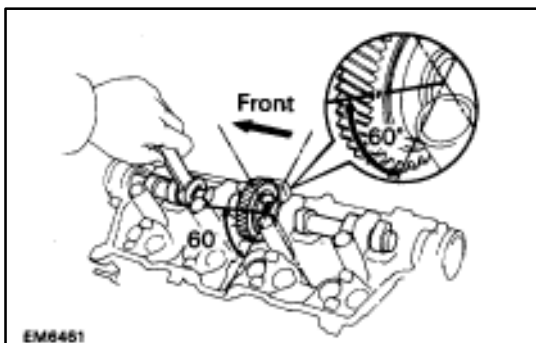
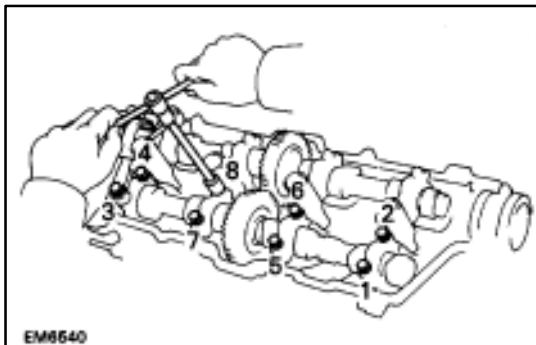
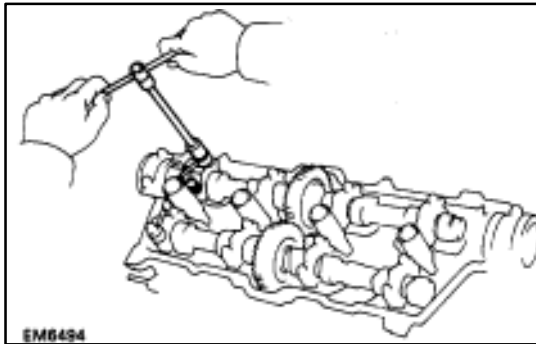
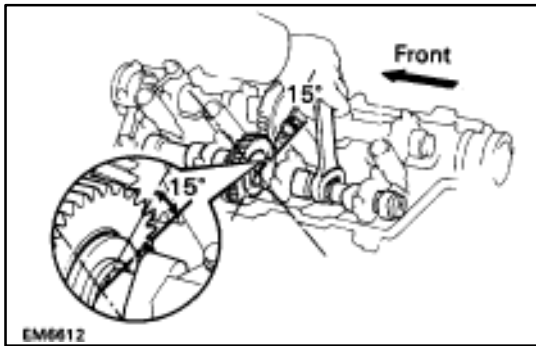
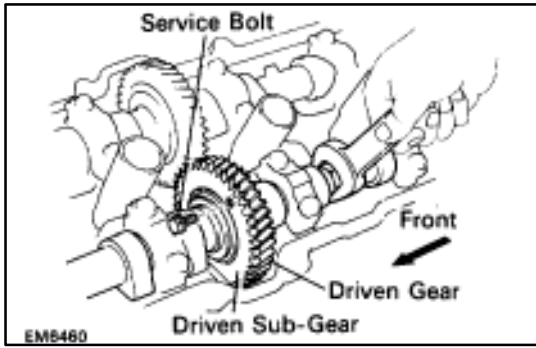


B. Remove intake camshaft from RH cylinder head

- (a) Remove the rear bearing cap.
 (b) Set the timing mark (one dot mark) of the camshaft drive gear at approx. 455 angle by turning the hexagon wrench head portion of the intake camshaft with a wrench.



- (c) Uniformly loosen and remove the eight bearing cap bolts in several passes in the sequence shown.
 (d) Remove the four bearing caps, oil seal and intake camshaft.



C. Remove exhaust camshaft from LH cylinder head

- Bring the service bolt hole of the driven sub-gear upward by turning the hexagon wrench head portion of the exhaust camshaft with a wrench.
- Secure the exhaust camshaft sub-gear to the driven gear with a service bolt.

Recommended service bolt:

Thread diameter 6 mm

Thread pitch 1.0 mm

Bolt length 16–20 mm (0.63–0.79 in.)

HINT: When removing the camshaft, make certain that the torsional spring force of the sub-gear has been eliminated by the above operation.

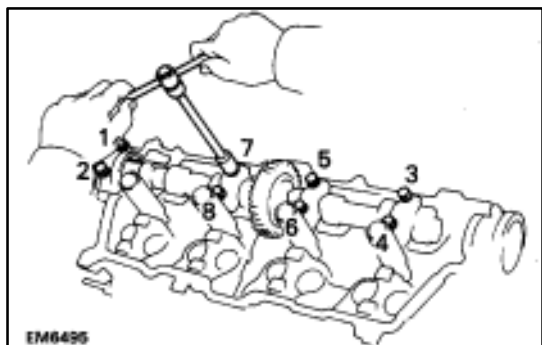
- Set the timing mark (two dot marks) of the camshaft driven gear at approx. 155 angle by turning the hexagon wrench head portion of the exhaust camshaft with a wrench.

- Alternately loosen and remove the two bearing cap bolts holding the intake camshaft side of the oil feed pipe to the cylinder head.

- Uniformly loosen and remove the eight bearing cap bolts in several passes in the sequence shown.
- Remove the oil feed pipe, four bearing caps and exhaust camshaft.

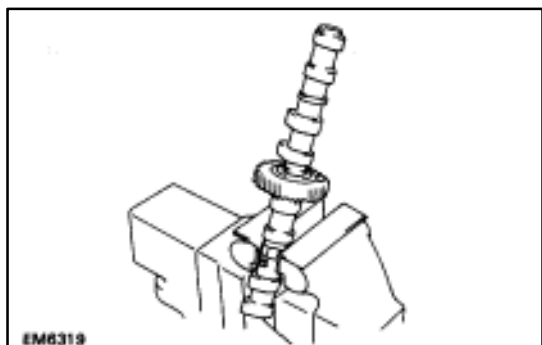
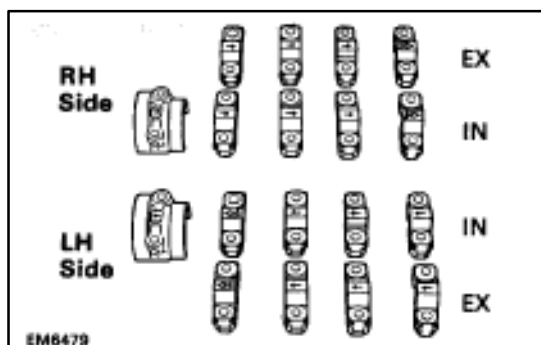
D. Remove intake camshaft from LH cylinder head

- Remove the front bearing cap.
- Set the timing mark (one dot mark) of the camshaft drive gear at approx. 60° angle by turning the hexagon wrench head portion of the intake camshaft with a wrench.



- (c) Uniformly loosen and remove the eight bearing cap bolts in several passes in the sequence shown.
- (d) Remove the four bearing caps, oil seal and intake camshaft.

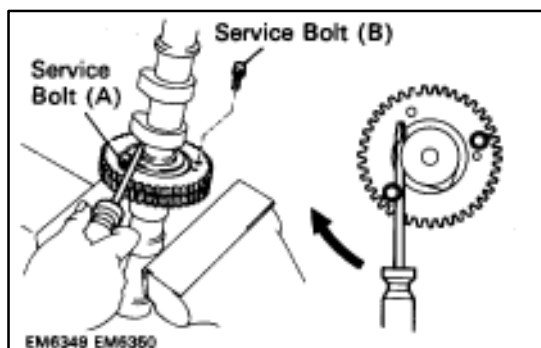
HINT: Arrange the bearing caps in correct order.



42. DISASSEMBLE EXHAUST CAMSHAFTS

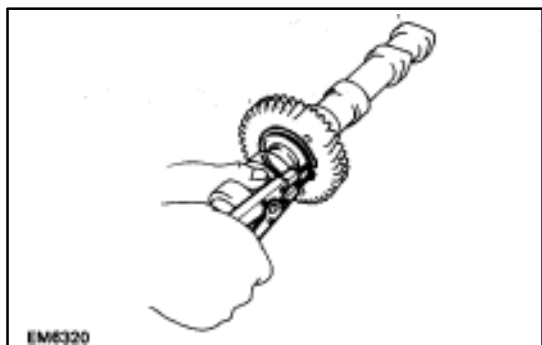
- (a) Mount the hexagon wrench head portion of the camshaft in a vise.

NOTICE: Be careful not to damage the camshaft.

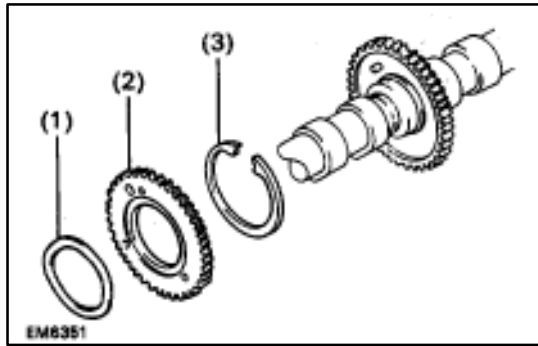


- (b) Insert a service bolt (A) into the service hole of the camshaft sub-gear.
- (c) Using a screwdriver, turn the sub-gear clockwise, and remove the service bolt (B).

NOTICE: Be careful not to damage the camshaft.



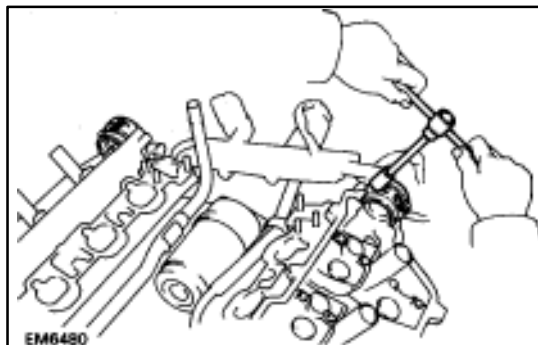
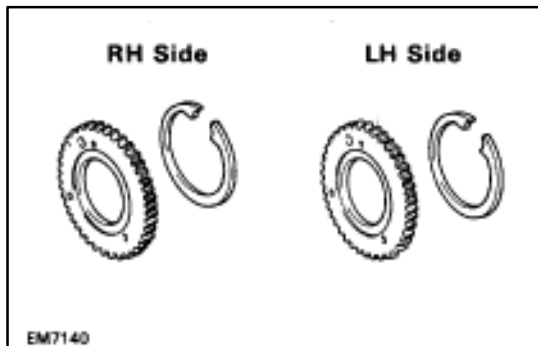
- (d) Using snap ring pliers, remove the snap ring.



(e) Remove the following parts:

- (1) Wave washer
- (2) Camshaft sub-gear
- (3) Camshaft gear spring

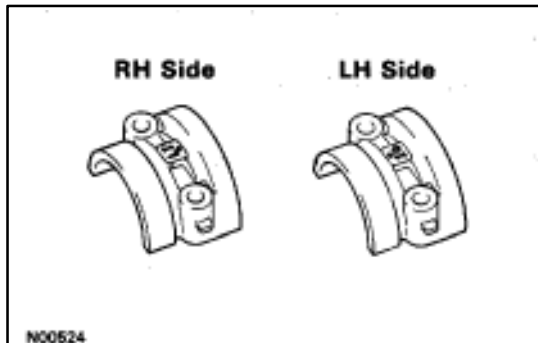
HINT: Arrange the camshaft sub-gears and gear springs (RH side and LH side).



43. REMOVE CIRCULAR PLUGS

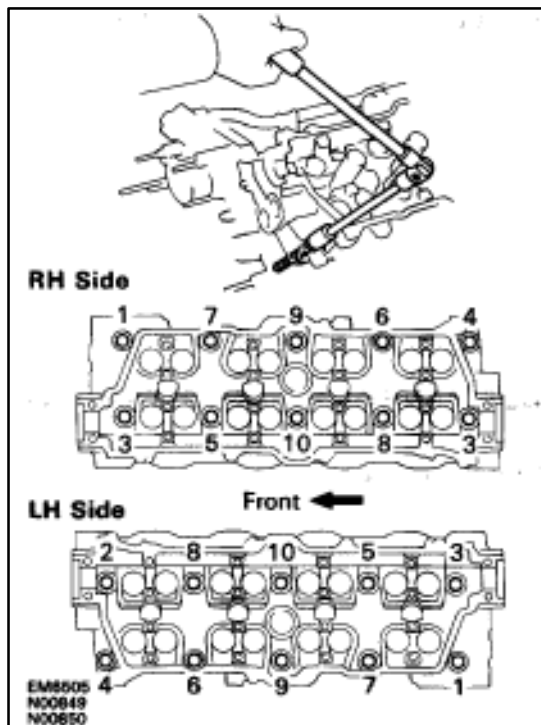
Remove the two bolts, seal washers, bearing cap and circular plug. Remove the two circular plugs.

HINT: Arrange the bearing caps (RH side and LH side).



44. DISCONNECT MAIN OXYGEN SENSOR CONNECTORS

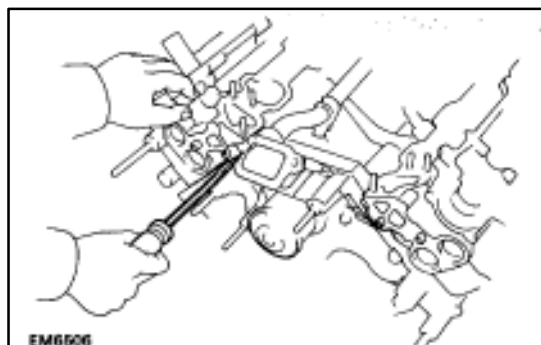
Disconnect the RH and LH oxygen sensor connector.



45. REMOVE CYLINDER HEADS

- (a) Uniformly loosen the ten cylinder head bolts on one side of each cylinder head in several passes in the sequence shown, then do the other side as shown. Remove the twenty cylinder head bolts and plate washers.

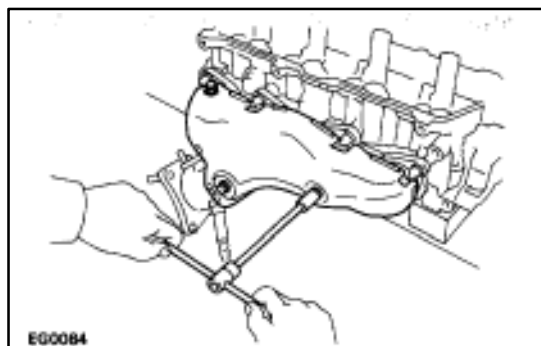
NOTICE: Head warpage or cracking could result from removing bolts in an incorrect order.



- (b) Lift the cylinder heads from the dowels on the cylinder block, and place the two cylinder heads on wooden blocks on a bench.

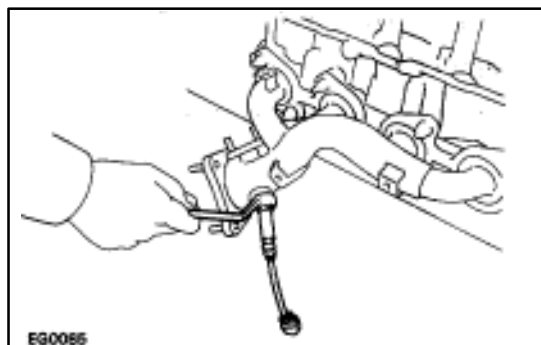
HINT: If the cylinder head is difficult to lift off, pry between the cylinder head and cylinder block with a screwdriver.

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

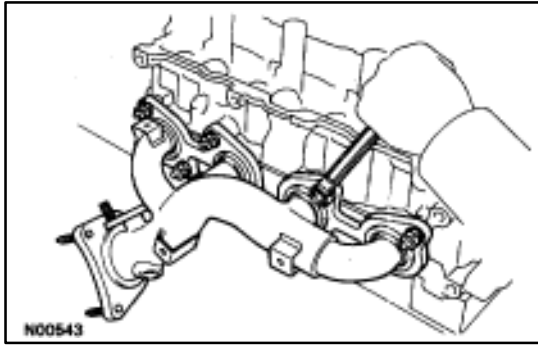


46. REMOVE EXHAUST MANIFOLD FROM RH CYLINDER HEAD

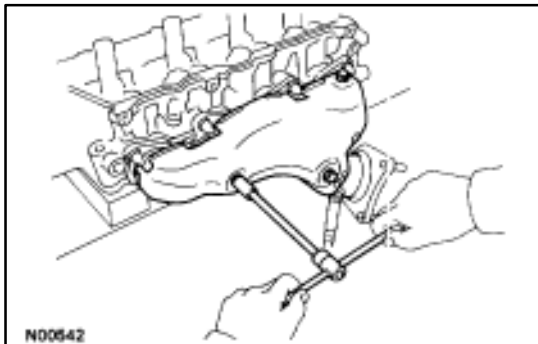
- (a) Remove the three bolts and heat insulator.



- (b) Remove the main oxygen sensor.

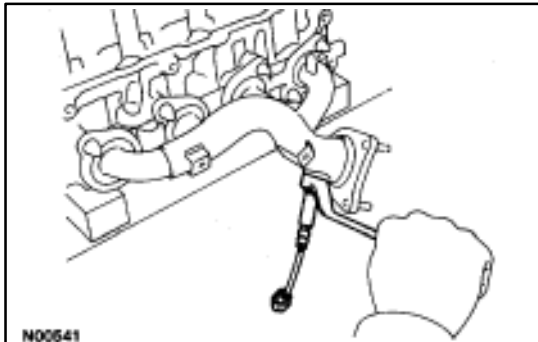


(c) Remove the eight nuts, exhaust manifold and gasket.

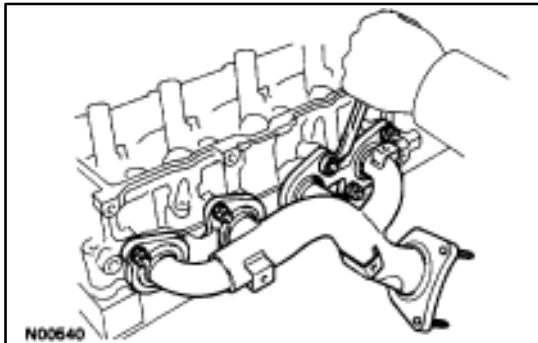


47. REMOVE EXHAUST MANIFOLD FROM LH CYLINDER HEAD

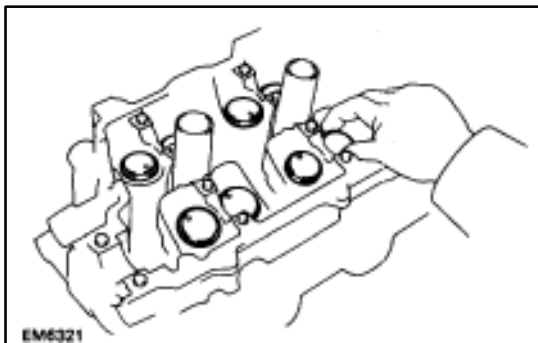
(a) Remove the three bolts and heat insulator.



(b) Remove the main oxygen sensor.



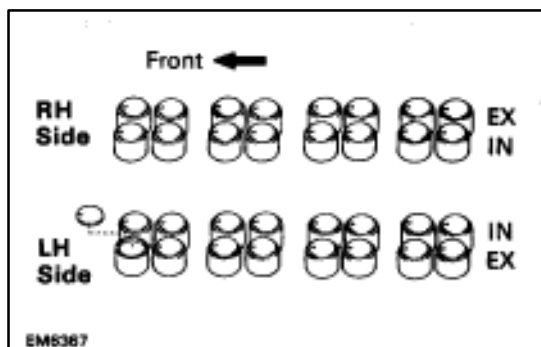
(c) Remove the eight nuts, exhaust manifold and gasket.



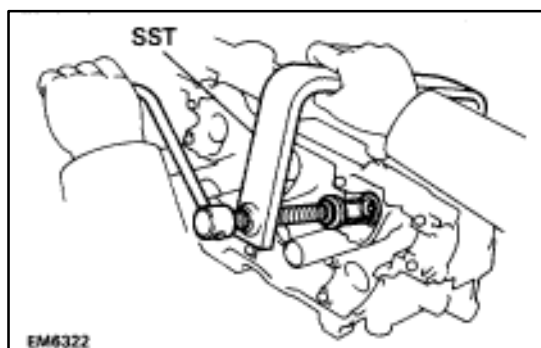
DISASSEMBLY OF CYLINDER HEADS

(See Components on page [EM-59](#))

1. REMOVE VALVE LIFTERS AND ADJUSTING SHIMS



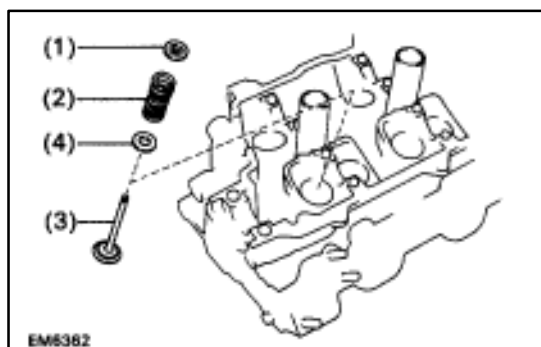
HINT: Arrange the valve lifters and adjusting shims in correct order.



2. REMOVE VALVES

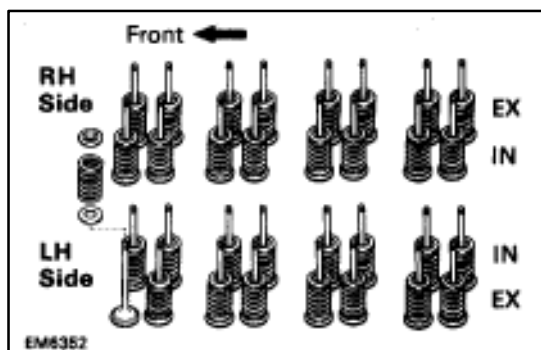
(a) Using SST, compress the valve spring and remove the two keepers.

SST 09202-70010

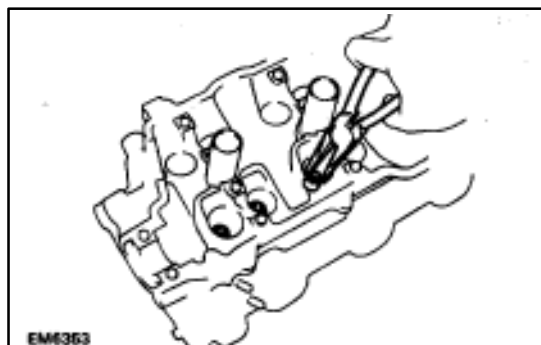


(b) Remove the following parts:

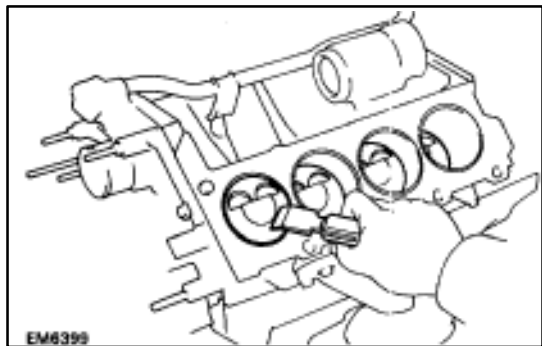
- (1) Spring retainer
- (2) Valve spring
- (3) Valve
- (4) Spring seat



HINT: Arrange the valves, valve springs, spring seats and spring retainers in correct order.



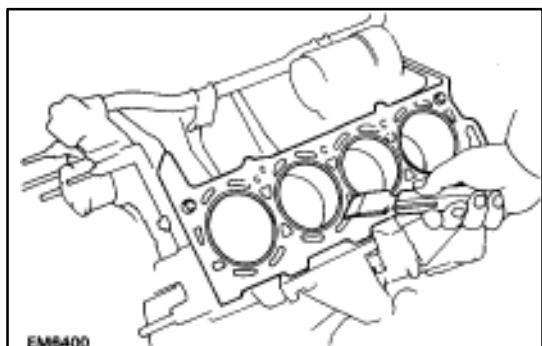
(c) Using needle-nose pliers, remove the oil seal.



INSPECTION, CLEANING AND REPAIR OF CYLINDER HEAD COMPONENTS

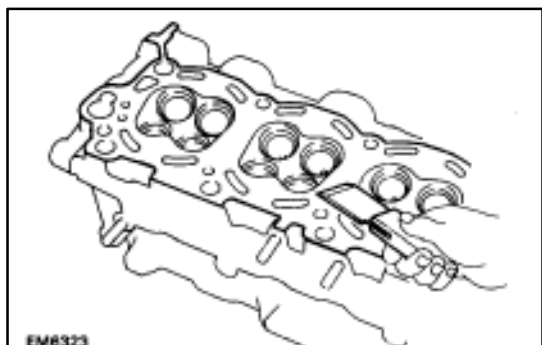
1. CLEAN TOP SURFACES OF PISTONS AND CYLINDER BLOCK

- (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 surfaces.



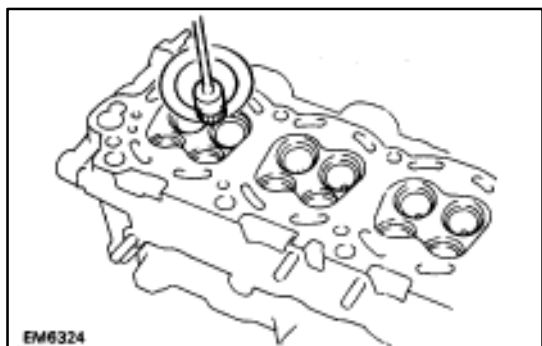
- (b) Using a gasket scraper, remove all the gasket material from the top surfaces of the cylinder block.
- (c) Using compressed air, blow carbon and oil from the bolt holes.

CAUTION: Protect your eyes when using high-pressure compressed air.



2. CLEAN CYLINDER HEADS

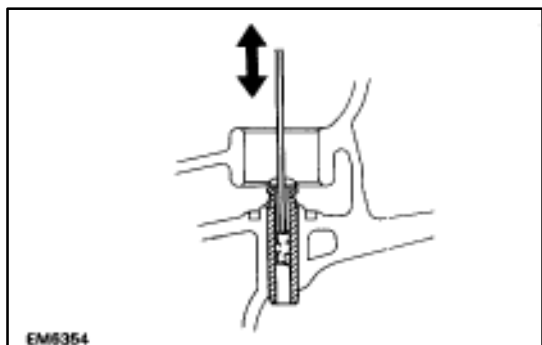
- A. Remove gasket material** Using a gasket scraper, remove all the gasket material from the cylinder block surface. **NOTICE:** Be careful not to scratch the cylinder block contact surface.



B. Clean combustion chambers

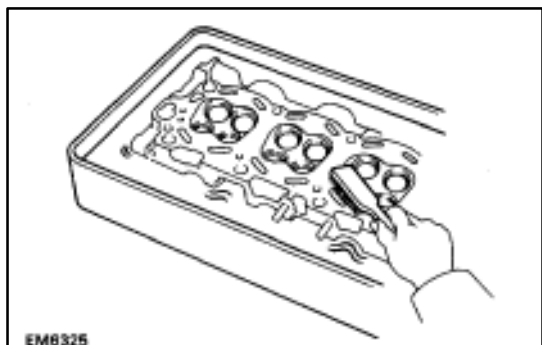
Using a wire brush, remove all the carbon from the combustion chambers.

NOTICE: Be careful not to scratch the cylinder block contact surface.



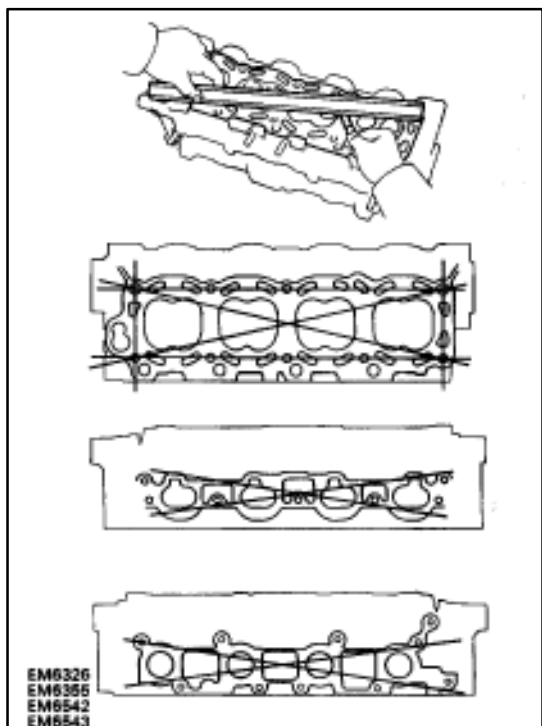
C. Clean valve guide bushings

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



D. Clean cylinder heads

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



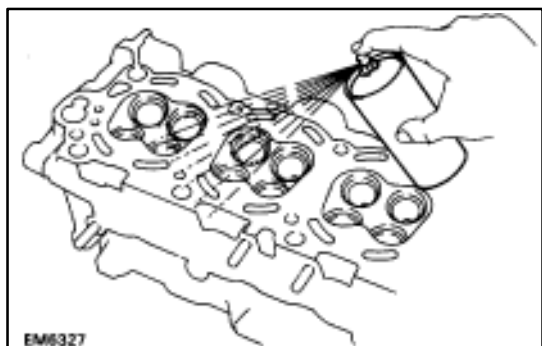
3. INSPECT CYLINDER HEADS

A. Inspect for flatness

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

Maximum warpage: 0.10 mm (0.0039 in.)

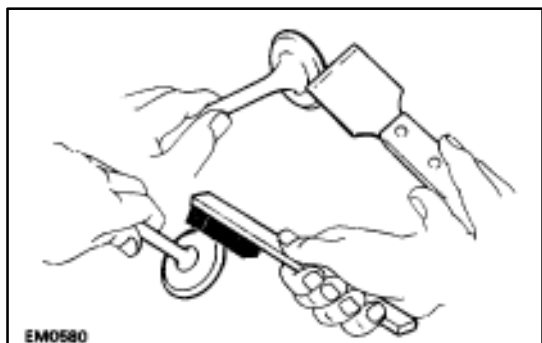
If warpage is greater than maximum, replace the cylinder head.



B. Inspect for cracks

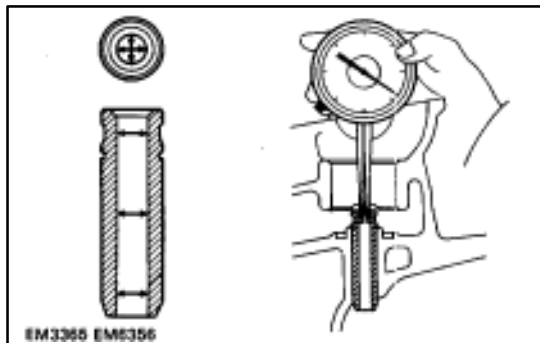
Using a dye penetrant, check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks.

If cracked, replace the cylinder head.



4. CLEAN VALVES

- (a) Using a gasket scraper, chip any carbon from the valve head.
- (b) Using a wire brush, thoroughly clean the valve.

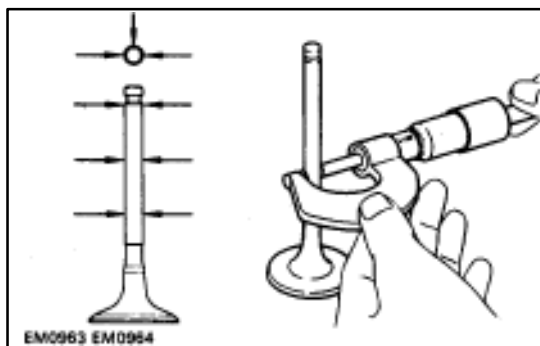


5. INSPECT VALVE STEMS AND GUIDE BUSHINGS

- (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 diameter measurement of the valve stem from the inside diameter measurement of the guide bushing.

Standard oil clearance:

Intake 0.025–0.060 mm

(0.0010–0.0024 in.)

Exhaust 0.030–0.065 mm

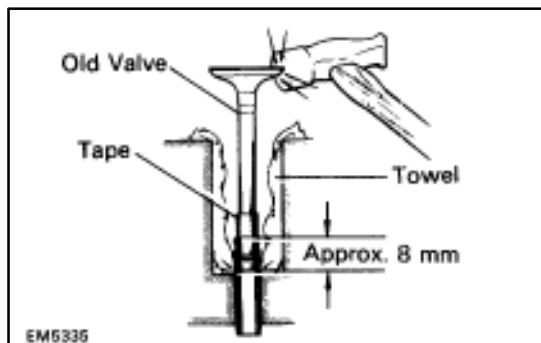
(0.0012–0.0026 in.)

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.

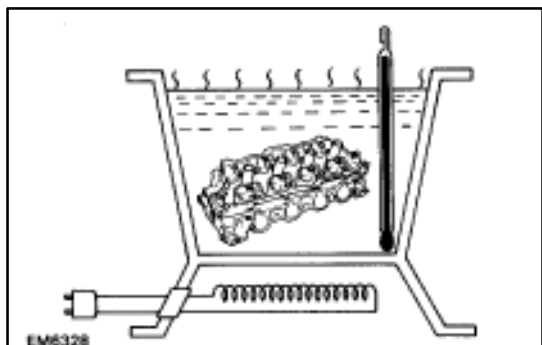


6. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS

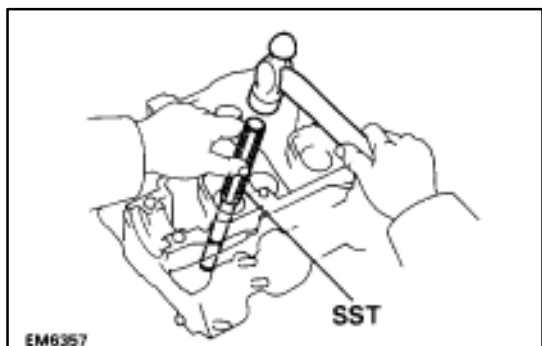
- (a) Insert an old valve wrapped with tape into the valve guide bushing, and break off the valve guide bushing by hitting it with a hammer. Remove the snap ring.

HINT: Wrap the tape approx. 8 mm (0.31 in.) from the stem end.

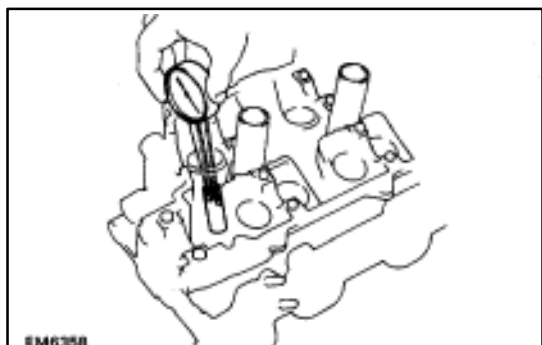
NOTICE: Be careful not to damage the valve lifter hole.



- (b) Gradually heat the cylinder head to 80–100°C (176–212°F).



- (c) Using SST and a hammer, tap out the guide bushing.
SST 09201–70010



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

Both intake and exhaust

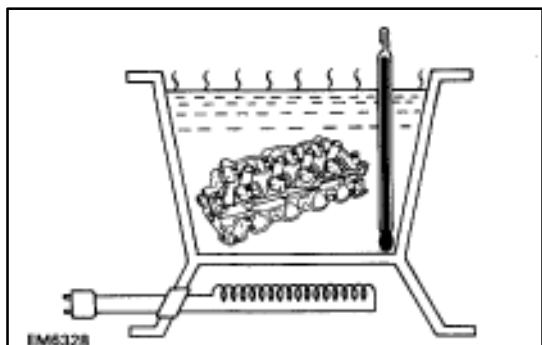
Bushing bore diameter mm (in.)	Bushing size
11.000–11.027 (0.4331–0.4342)	Use STD
11.050–11.077 (0.4350–0.4361)	Use O/S 0.05

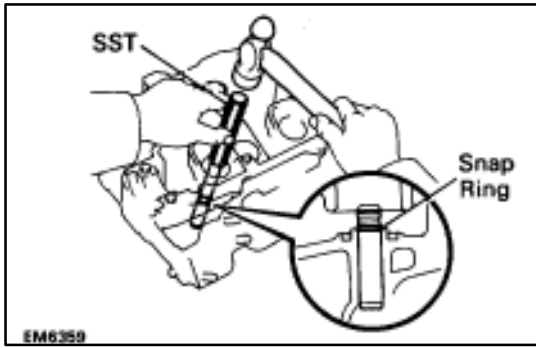
- (e) Select a new guide bushing (STD size or O/S 0.05).
If the bushing bore diameter of the cylinder head is greater than 11.027 mm (0.4341 in.), grind the bushing bore to the following dimension:

11.050–11.077 mm (0.4350–0.4361 in.)

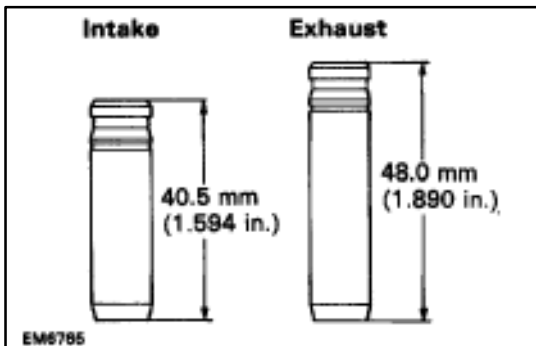
If the bushing bore diameter of the cylinder head is greater than 11.077 mm (0.4361 in.), replace the cylinder head.

- (f) Gradually heat the cylinder head to 80–100°C (176–212°F).

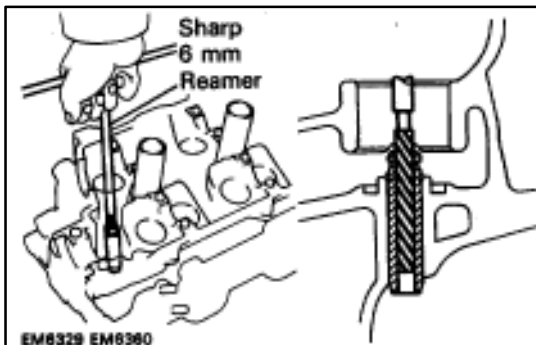




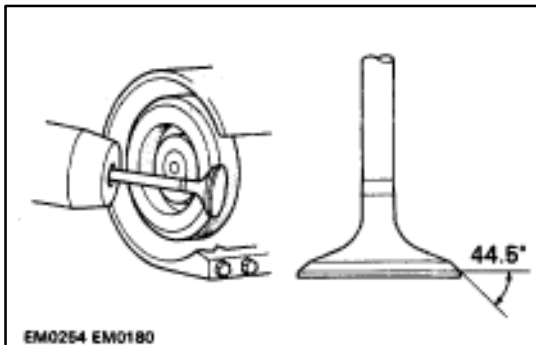
- (g) Using SST and a hammer, tap in a new guide bushing until the snap ring makes contact with the cylinder head.
SST 09201-70010



HINT: Different the bushings are used for the intake and exhaust.



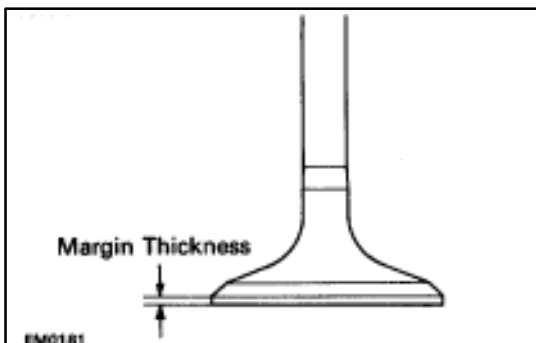
- (h) Using a sharp 6 mm reamer, ream the guide bushing to obtain the standard specified clearance (See page [EM-80](#)) between the guide bushing and valve stem.



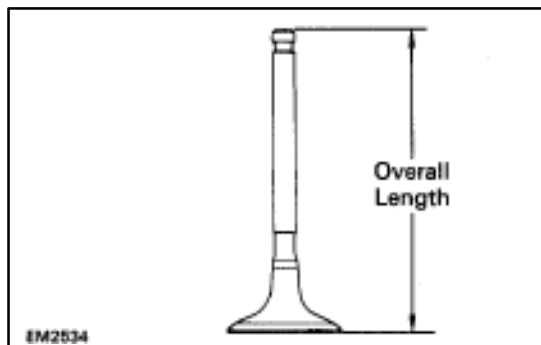
7. INSPECT AND GRIND VALVES

- (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: 1.0 mm (0.039 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 94.95 mm (3.7382 in.)

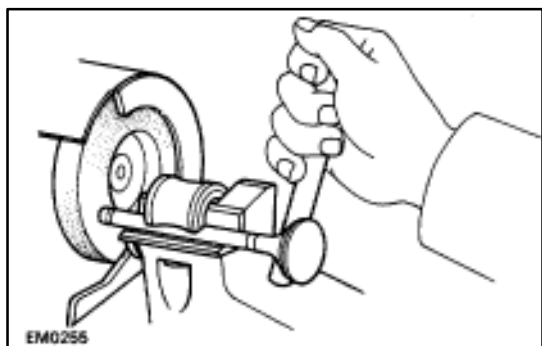
Exhaust 96.90 mm (3.8150 in.)

Minimum overall length:

Intake 94.45 mm (3.7185 in.)

Exhaust 96.40 mm (3.7953 in.)

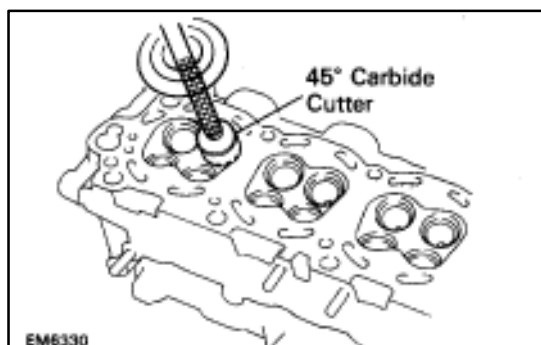
If the overall length is less than minimum, replace the valve.



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

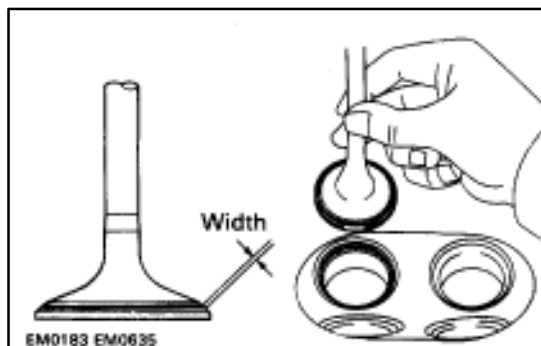
If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.

NOTICE: Do not grind off more than the minimum overall length.



8. INSPECT AND CLEAN VALVE SEATS

(a) Using a 455 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.

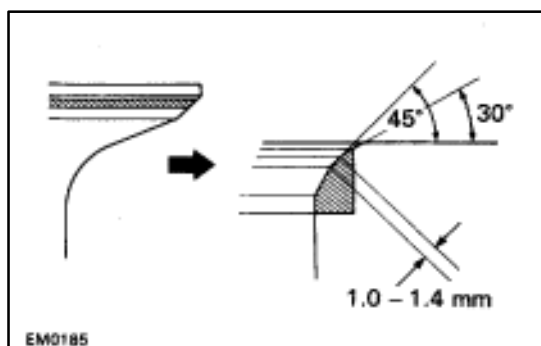
(c) Check the valve face and seat for the following:

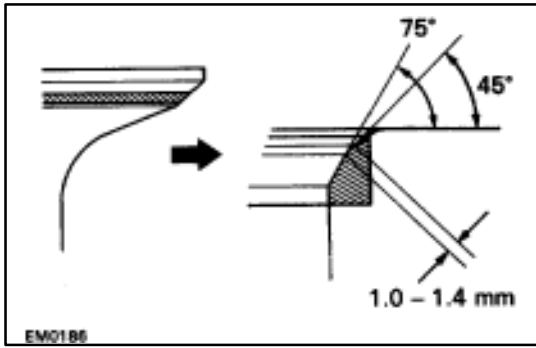
- If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
- If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
- Check that the seat contact is on the middle of the valve face with the following width:

1.0–1.4 mm (0.039–0.055 in.)

If not, correct the valve seats as follows:

- (1) If the seating is too high on the valve face, use 30° and 45° cutters to correct the seat.

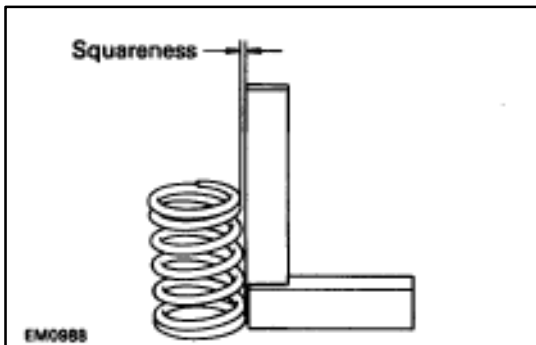




- (2) If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.



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

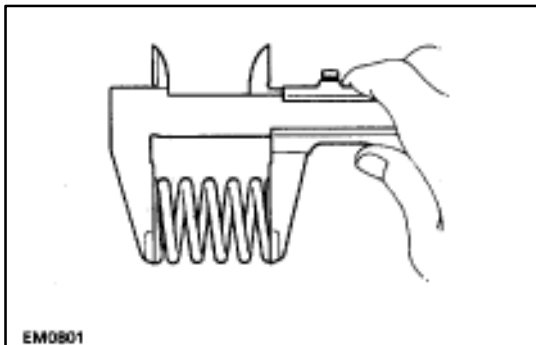


9. INSPECT VALVE SPRINGS

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

Maximum squareness: 2.0 mm (0.079 in.)

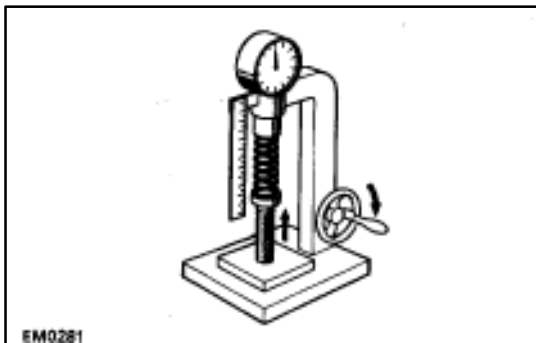
If squareness is greater than maximum, replace the valve spring.



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

Free length: 43.6 mm (1.717 in.)

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

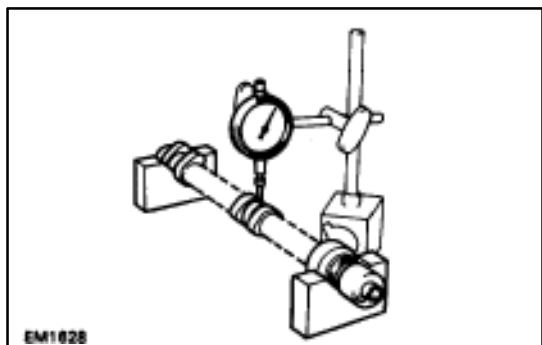


- (c) Using a spring tester, measure the tension of the valve spring at the specified installed length.

Installed tension (at 32.9 mm (1.295 in.):

186–206 N (19.0–21.0 kgf, 41.9–46.3 lbf)

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



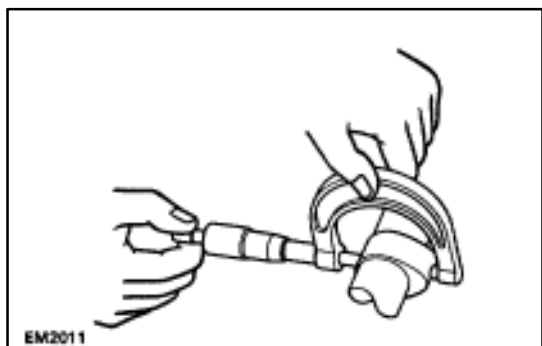
10. INSPECT CAMSHAFTS AND BEARINGS

A. Inspect camshaft for 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.



B. Inspect cam lobes

Using a micrometer, measure the cam lobe height.

Standard cam lobe height:

Intake 41.710–41.810 mm

(1.6421–1.6461 in.)

Exhaust 41.910–42.010 mm

(1.6500–1.6539 in.)

Minimum cam lobe height:

Intake 41.56 mm (1.6362 in.)

Exhaust 41.76 mm (1.6441 in.)

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

C. Inspect camshaft journals

Using a micrometer, measure the journal diameter.

Journal diameter:

Exhaust camshaft thrust portion (A)

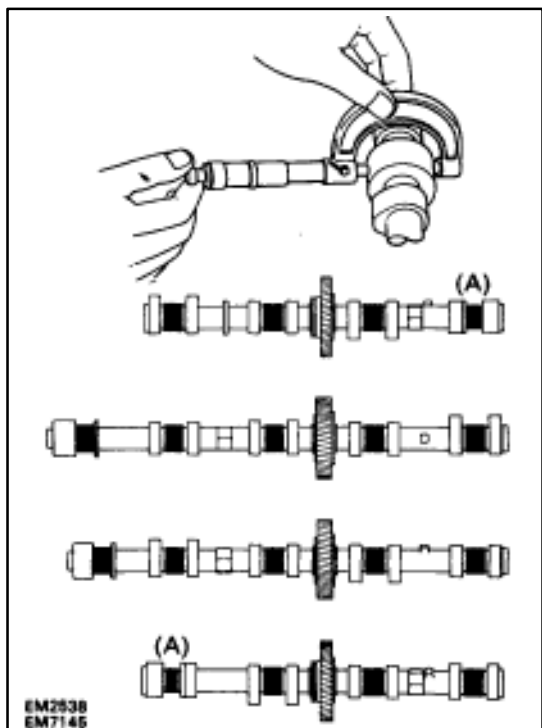
23.959–23.975 mm

(0.9433–0.9439 in.)

Others 26.954–26.970 mm

(1.0612–1.0618 in.)

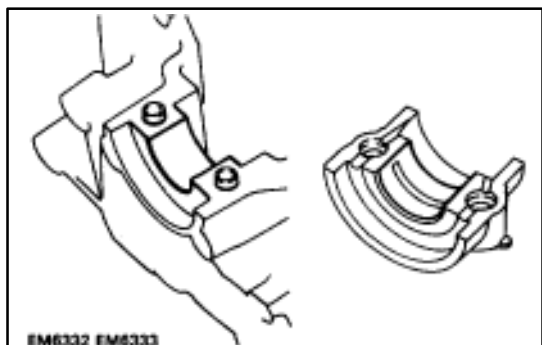
If the journal diameter is not as specified, check the oil clearance.

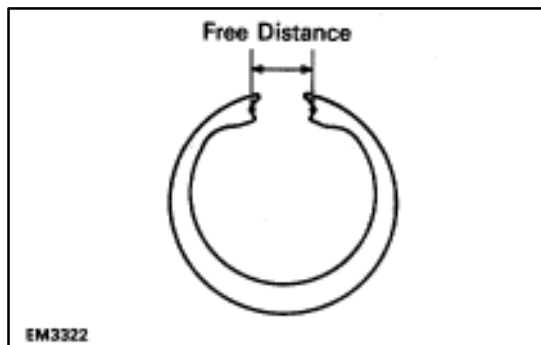


D. Inspect camshaft bearings

Check the bearings for flaking and scoring.

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



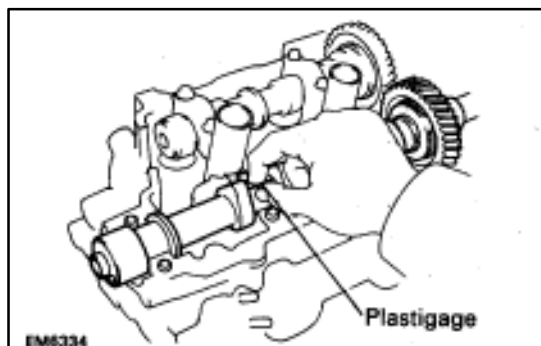


E. Inspect camshaft gear spring

Using a vernier caliper, measure the free distance between the spring ends.

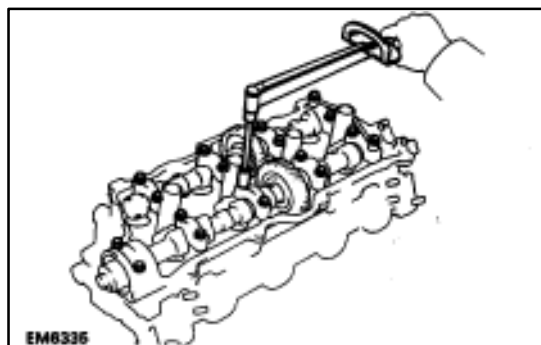
Free distance: 18.2–18.8 mm (0.712–0.740 in.)

If the free distance is not as specified, replace the gear spring.



F. 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.

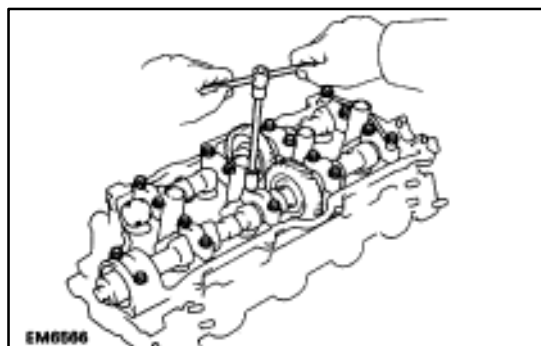


- (d) Install the bearing caps.

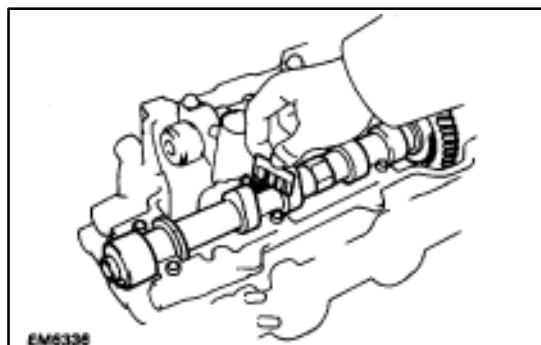
(See step 7 on pages [EM-95](#) to 101)

Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)

NOTICE: Do not turn the camshaft.



- (e) Remove the bearing caps.



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

Standard oil clearance:

Exhaust camshaft thrust portion

0.025–0.061 mm

(0.0010–0.0024 in.)

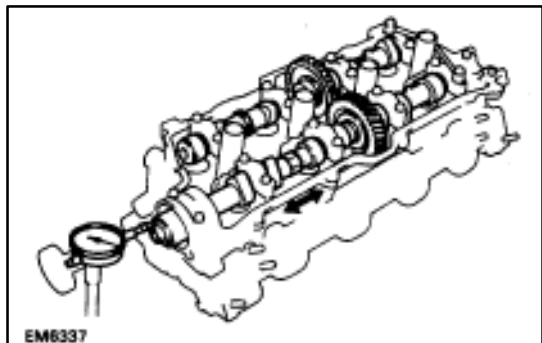
Others 0.030–0.067 mm

(0.0012–0.0026 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.



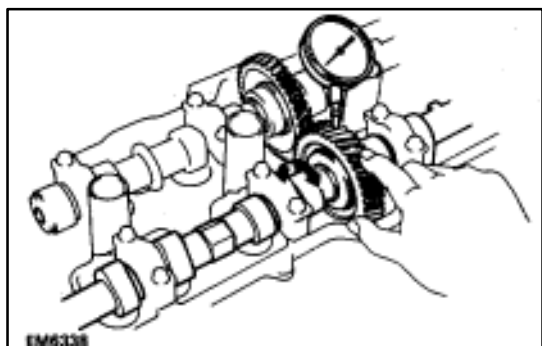
G. Inspect camshaft thrust clearance

- (a) Install the camshafts.
(See step 7 on pages [EM-95](#) to 101)
- (b) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

Standard thrust clearance: 0.040–0.090 mm
(0.0016–0.0035 in.)

Maximum thrust clearance: 0.12 mm (0.0047 in.)

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



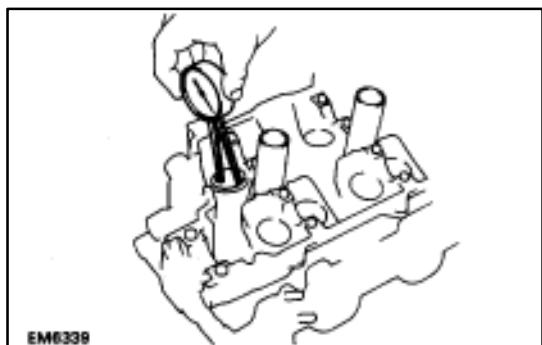
H. Inspect camshaft gear backlash

- (a) Install the camshafts without installing the exhaust camshaft sub-gear.
(See step 7 on pages [EM-95](#) to 101)
- (b) Using a dial indicator, measure the backlash.

Standard backlash: 0.020–0.200 mm
(0.0008–0.0079 in.)

Maximum backlash: 0.30 mm (0.0188 in.)

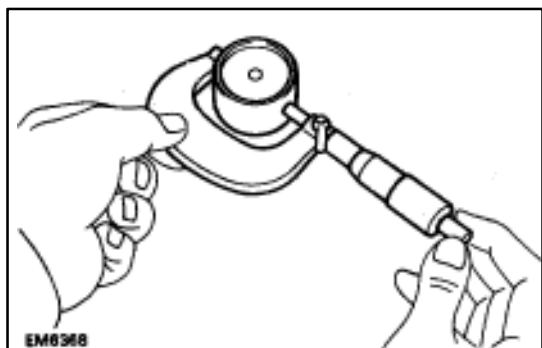
If the backlash is greater than maximum, replace the camshafts.



11. 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.

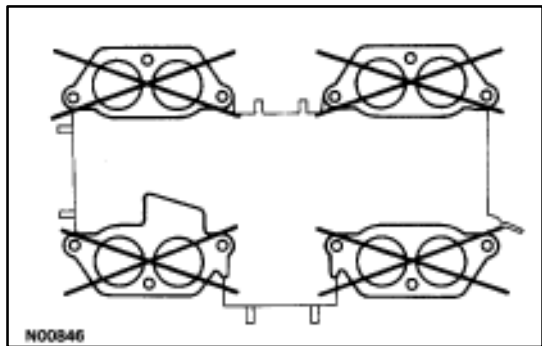
Lifter diameter: 30.966–30.976 mm
(1.2191–1.2195 in.)

- (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.

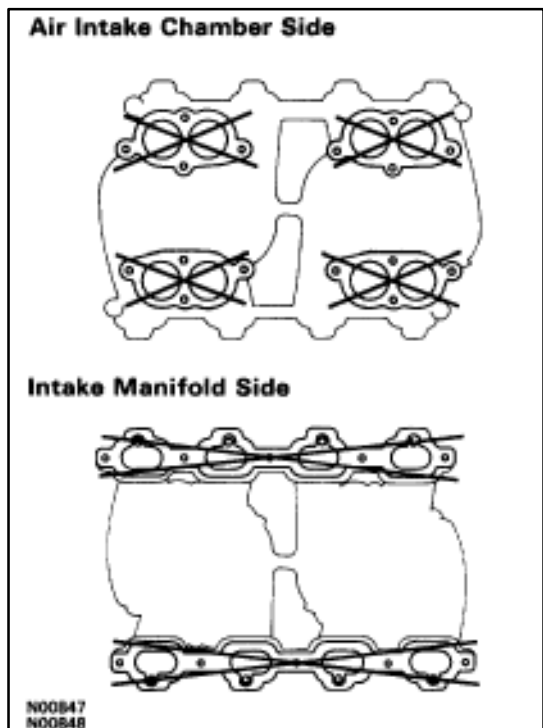


12. INSPECT AIR INTAKE CHAMBER

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.

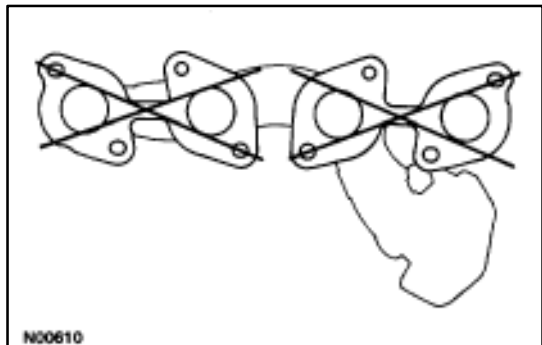


13. INSPECT INTAKE MANIFOLD

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.

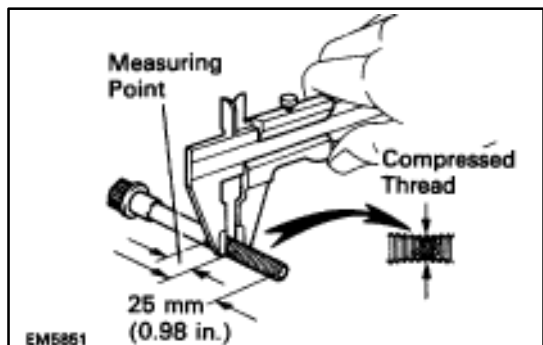


14. INSPECT EXHAUST MANIFOLD

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

Maximum warpage: 1.00 mm (0.0394 in.)

If warpage is greater than maximum, replace the manifold.



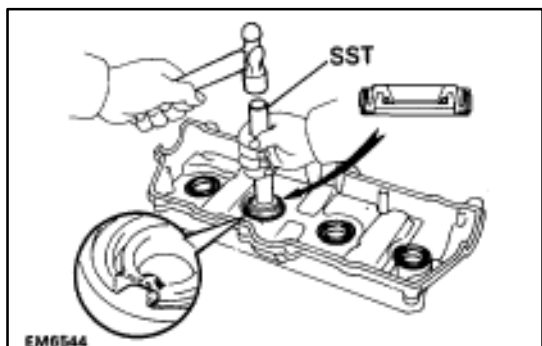
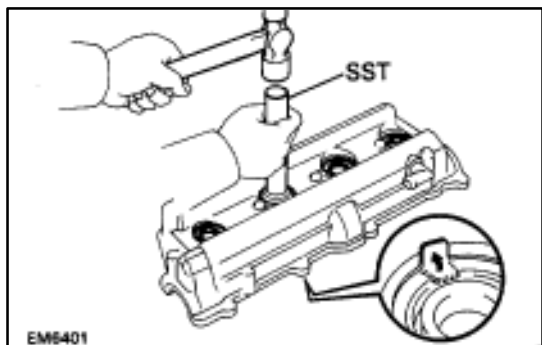
15. INSPECT CYLINDER HEAD BOLTS

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

**Standard outside diameter: 9.770–9.960 mm
(0.3846–0.3921 in.)**

Minimum outside diameter: 9.60 mm (0.3780 in.)

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



16. IF NECESSARY, REPLACE SPARK PLUG TUBE GASKETS

- Bend the ventilation case claw installed on the cylinder head cover to an angle of 90° or more.
- Using SST and a hammer, tap out the gasket.
SST 09550-10012 (09552-10010, 09560-10010)

- Using SST and a hammer, tap in a new gasket until its surface is flush with the upper edge of the cylinder head cover.

SST 09550-10012 (09552-10010, 09560-10010)

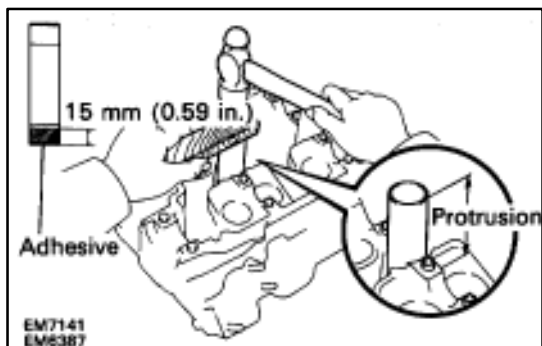
- Apply a light coat of MP grease to the gasket lip.
- Return the ventilation case claw to its original position.

ASSEMBLY OF CYLINDER HEADS

(See Components on page [EM-59](#))

HINT:

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



1. INSTALL SPARK PLUG TUBES

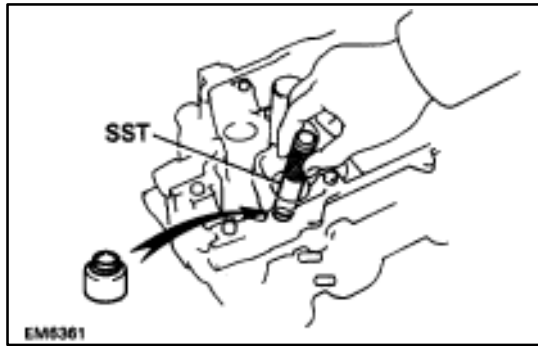
HINT: When using a new cylinder head, spark plug tubes must be installed.

- Apply adhesive to the end of the spark plug tube.

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

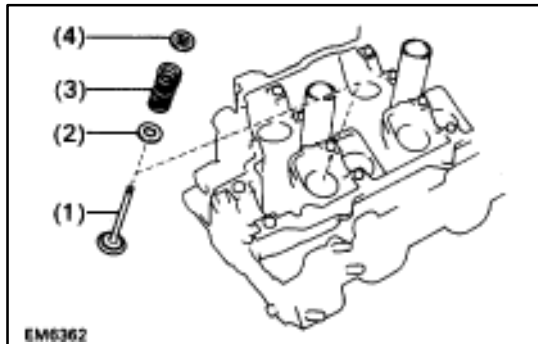
- Using a wooden block and hammer, tap in a new spark plug tube until there is 48.7–49.3 mm (1.917 –1.941 in.) protruding from the camshaft bearing cap installation surface of the cylinder head.

NOTICE: Avoid tapping a new spark plug tube in too far by measuring the amount of protrusion while tapping.

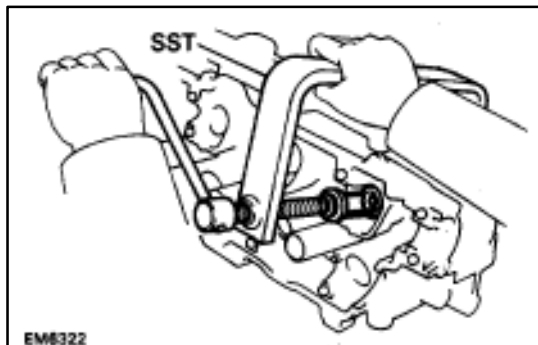


2. INSTALL VALVES

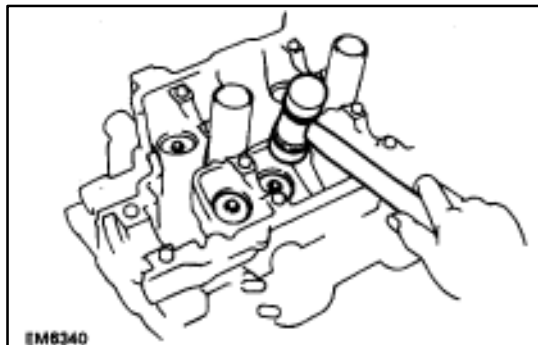
- (a) Using SST, push in a new oil seal.
SST 09201-41020



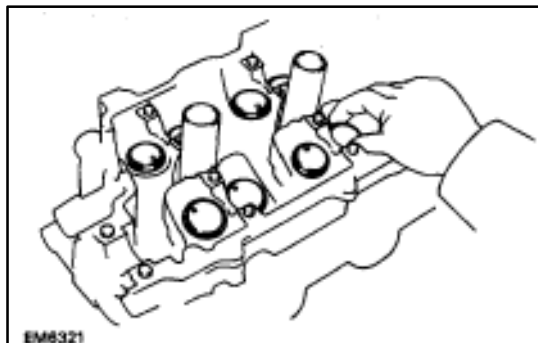
- (b) Install the following parts:
- (1) Valve
 - (2) Spring seat
 - (3) Valve spring
 - (4) Spring retainer



- (c) Using SST, compress the valve spring and place the two keepers around the valve stem.
SST 09202-70010

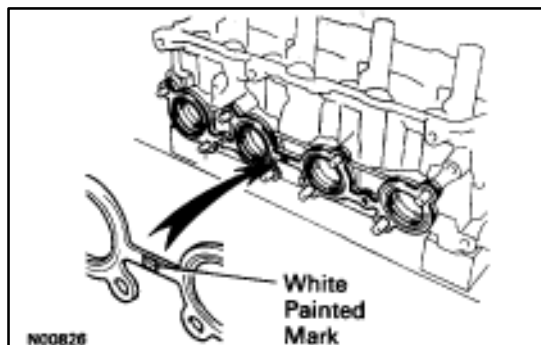


- (d) Using a plastic-faced hammer, lightly tap the valve stem tip to assure proper fit.



3. INSTALL VALVE LIFTERS AND SHIMS

Check the valve lifter rotates smoothly by hand.



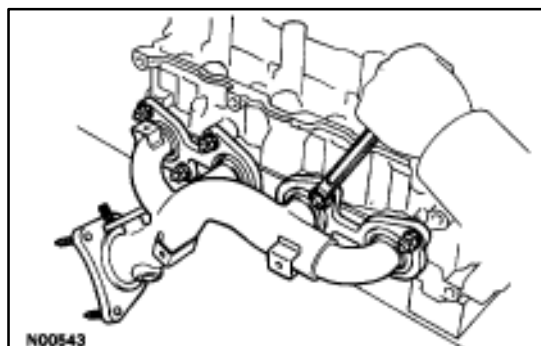
INSTALLATION OF CYLINDER HEADS

(See Components on pages [EM-58](#) and [59](#))

1. INSTALL RH EXHAUST MANIFOLD TO RH CYLINDER HEAD

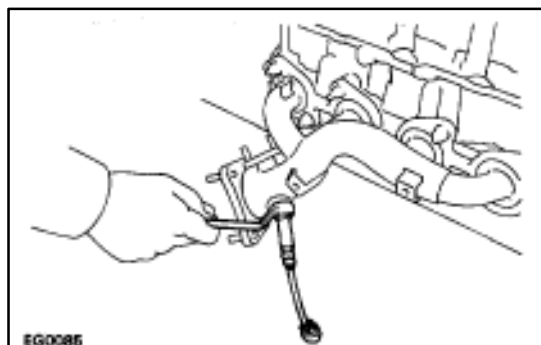
- (a) Place a new gasket on the cylinder head with the white painted marks facing the manifold side.

NOTICE: Be careful of the installation direction.



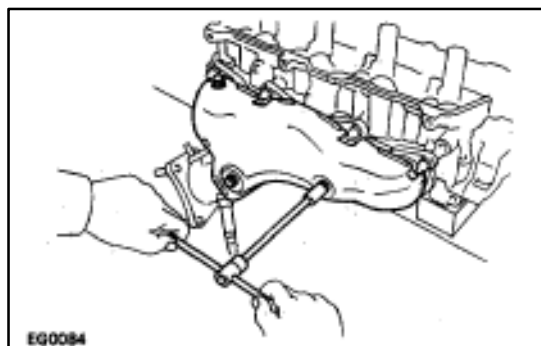
- (b) Install the exhaust manifold with the eight new nuts. Uniformly tighten the nuts in several passes.

Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

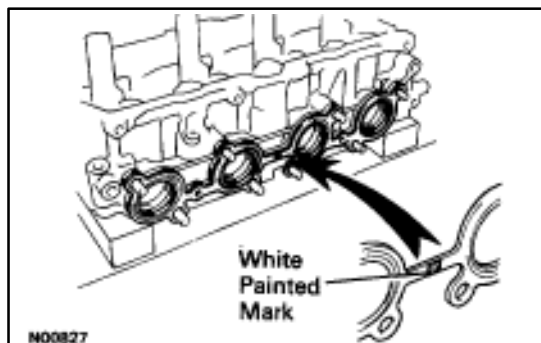


- (c) Install the main oxygen sensor.

Torque: 44 N·m (450 kgf·cm, 33 ft·lbf)



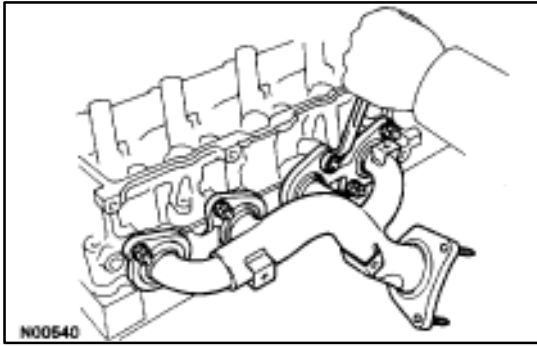
- (d) Install the heat insulator with the three bolts.



2. INSTALL LH EXHAUST MANIFOLD TO LH CYLINDER HEAD

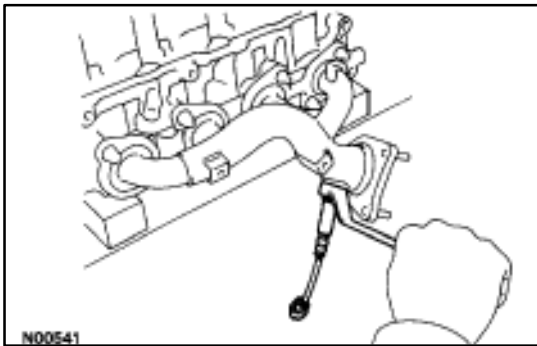
- (a) Place a new gasket on the cylinder head with the white painted marks facing the manifold side.

NOTICE: Be careful of the installation direction.



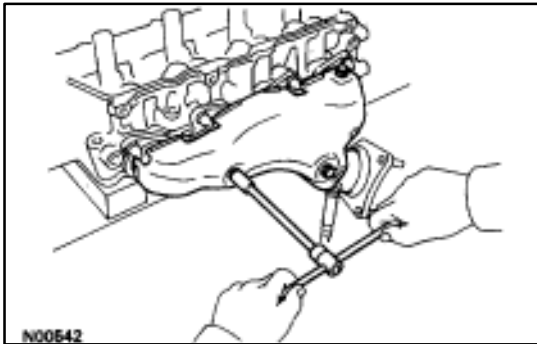
- (b) Install the exhaust manifold with the eight new nuts. Uniformly tighten the nuts in several passes.

Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

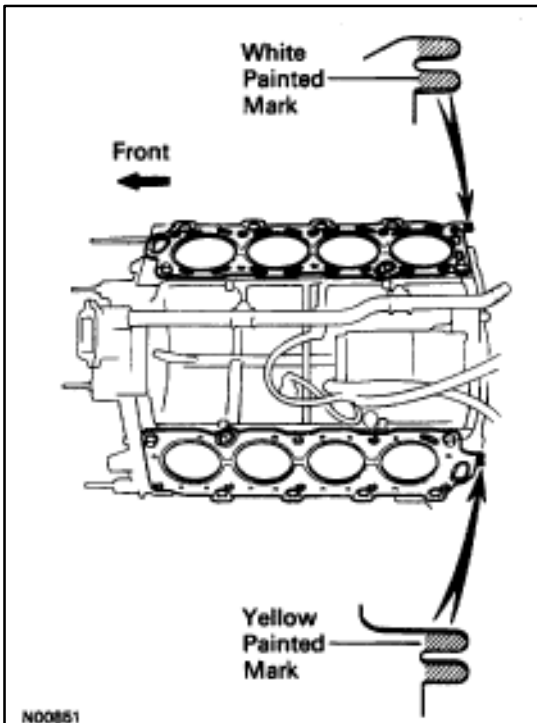


- (c) Install the main oxygen sensor.

Torque: 44 N·m (450 kgf·cm, 33 ft·lbf)



- (d) Install the heat insulator with the three bolts.



3. INSTALL CYLINDER HEADS

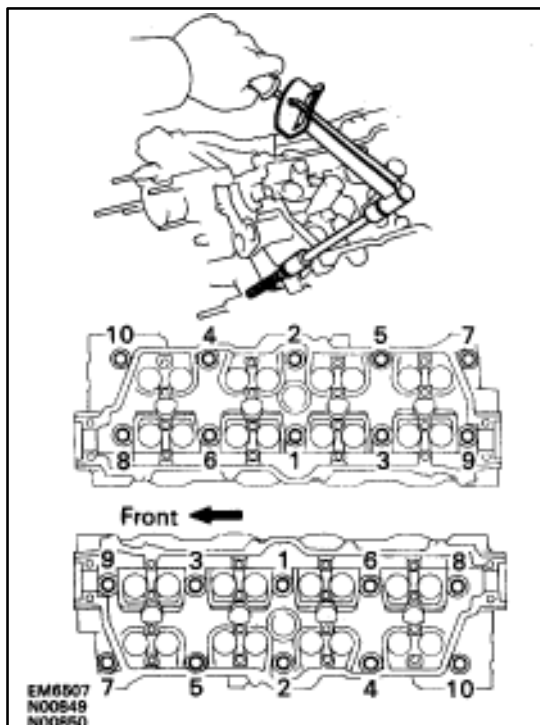
A. Place cylinder heads on cylinder block

- (a) Place two new cylinder head gaskets in position on the cylinder block.

HINT: On the rear side of the cylinder head gasket are painted marks to distinguish the LH and RH banks, a white painted mark for the RH bank and a yellow painted mark for the LH bank.

NOTICE: Be careful of the installation direction.

- (b) Place the two cylinder heads in position on the cylinder head gaskets.



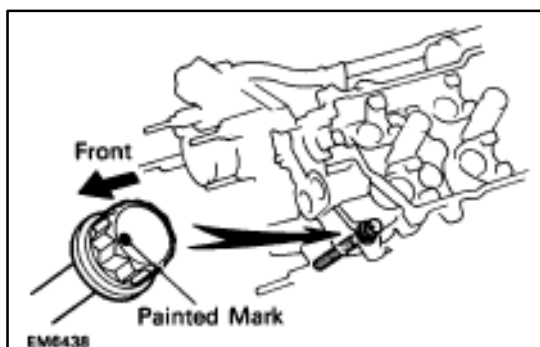
B. Install cylinder head bolts

HINT:

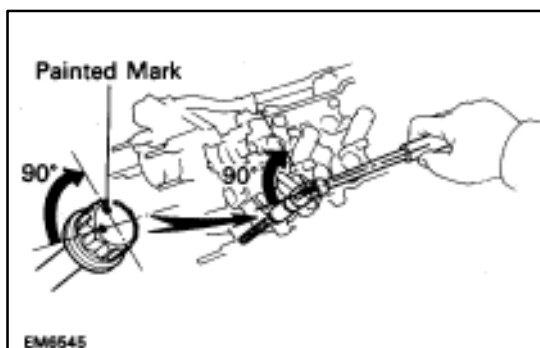
- The cylinder head bolts are tighten in two progressive steps (steps (c) and (e)).
 - If any one of the cylinder head bolts broken or deformed, replace it.
- (a) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.
 - (b) Temporarily install the twenty plate washers and cylinder head bolts.
 - (c) Uniformly tighten the ten cylinder head bolts on one side of the cylinder head in several passes in the sequence shown, then do the other side as shown.

Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

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



- (d) Mark the front of the cylinder head bolt head with paint.



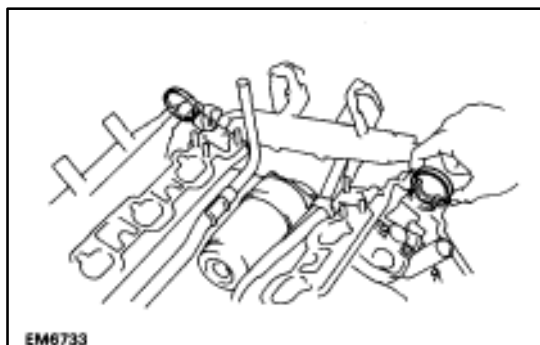
- (e) Retighten the cylinder head bolts 90° in the numerical order shown.
- (f) Check that the painted mark is now at a 90° angle to front.

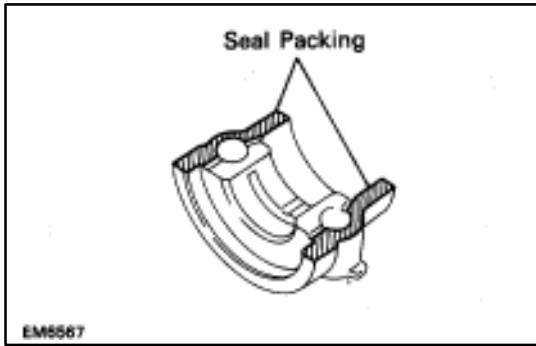
4. CONNECT MAIN OXYGEN SENSOR CONNECTORS

Connect the RH and LH oxygen sensor connector.

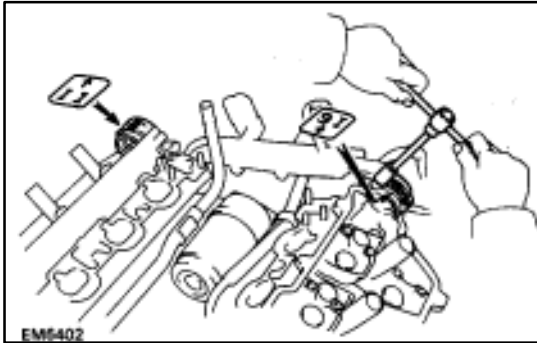
5. INSTALL CIRCULAR PLUGS

- (a) Place two new circular plugs in position on the cylinder heads, facing the cup side forward.

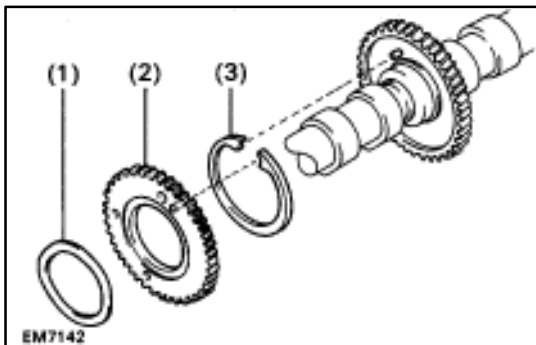




- (b) Remove any old packing (FIPG) material.
- (c) Apply seal packing to the bearing caps as shown.
Seal packing: Part No. 08826-00080 or equivalent

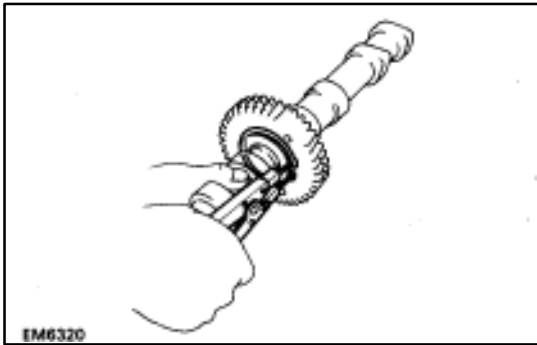


- (d) (RH Cylinder Head)
Install the bearing cap (mark "11") in position with the arrow mark facing rearward.
- (e) (LH Cylinder Head)
Install the bearing cap (mark "16") in position with the arrow mark facing forward.
- (f) Install a new seal washer to the bearing cap bolt.
- (g) Apply a light of engine oil on the threads of the bearing cap bolt.
- (h) Install the four bearing cap bolts.
Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)
HINT: Use silver colored bolts 38 mm (1.50 in.) in length.

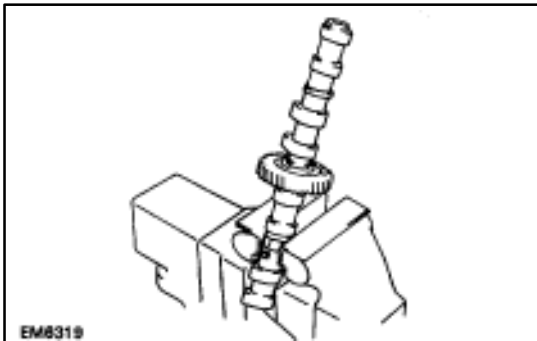


6. ASSEMBLE EXHAUST CAMSHAFTS

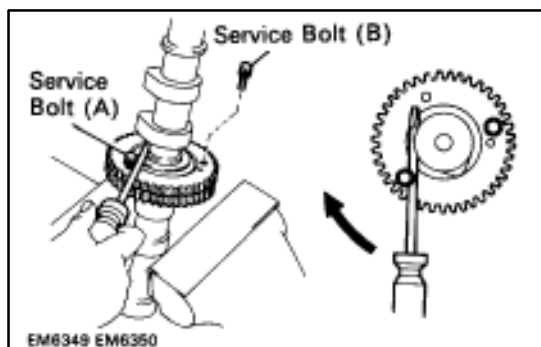
- (a) Install the following parts:
 - (1) Camshaft gear spring
 - (2) Camshaft sub-gear
 - (3) Wave washer



- (b) Using snap ring pliers, install the snap ring.



- (c) Mount the hexagon wrench head portion of the camshaft in a vice.



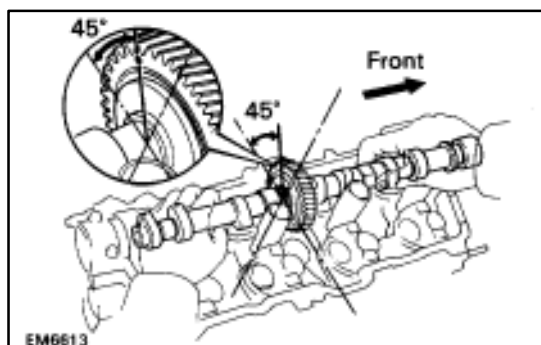
- (d) Insert a service bolt (A) into the service hole of the camshaft sub-gear.
- (e) Using a screwdriver, align the service holes and teeth of the camshaft driven gear and sub-gear by turning camshaft sub-gear clockwise, and install a service bolt (B).

NOTICE: Be careful not to damage the camshaft.

- (f) Remove the service bolt (A).

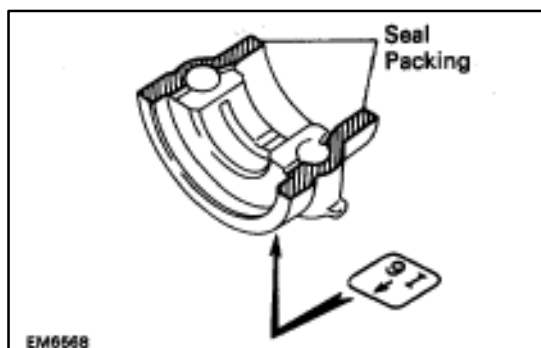
7. INSTALL CAMSHAFTS

NOTICE: Since the thrust clearance of the camshaft is small, the camshaft must be held level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged causing the camshaft to seize or break. To avoid this, the following steps should be carried out.



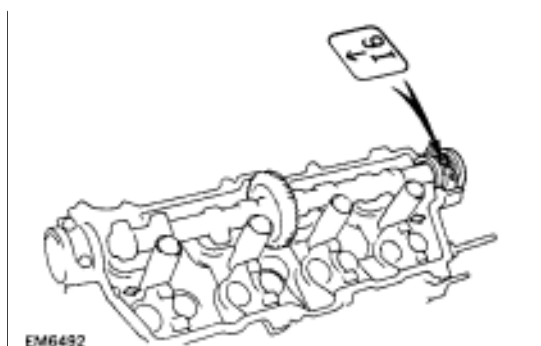
A. Install intake camshaft to RH cylinder head

- (a) Apply MP grease to the thrust portion of the camshaft.
- (b) Place the intake camshaft at 45° angle of the timing mark (one dot mark) on the cylinder head.



- (c) Remove any old packing (FIPG) material.
- (d) Apply seal packing to the bearing cap (mark "16") as shown.

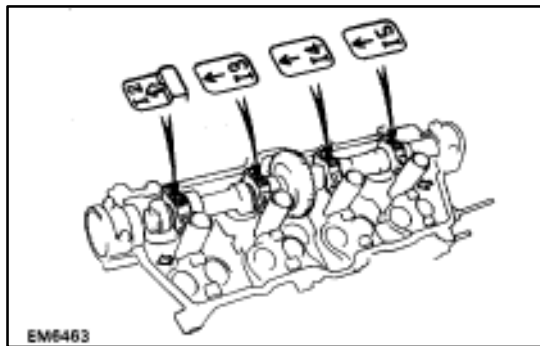
Seal packing: Part No. 08826-00080 or equivalent



- (e) Install the front bearing cap (mark "16") with the arrow mark facing rearward.

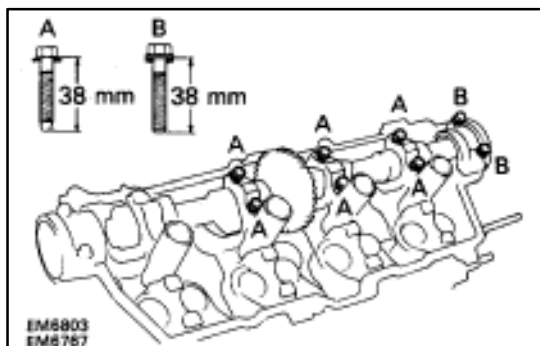
HINT:

- Installing the front bearing cap will determine the thrust position of the camshaft.
- Align the arrow marks at front and rear of the cylinder head with the mark on the bearing cap.



- (f) Install the other bearing caps in the sequence shown with the arrow mark facing rearward.

HINT: Align the arrow marks at front and rear of the cylinder head with the mark on the bearing cap.



- (g) Apply a light coat of engine oil on the threads and under the heads (A only) of the bearing cap bolts.

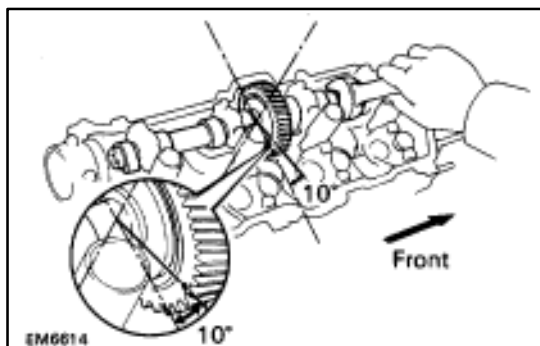
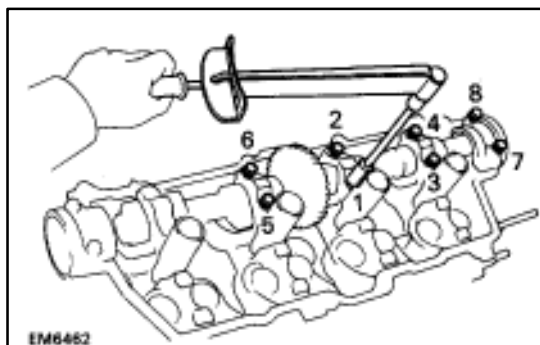
HINT: Do not apply engine oil under the heads of the bearing cap bolts (B).

- (h) Install a new seal washer to the bearing cap bolt (B). Install the eight bearing cap bolts as shown.

HINT:

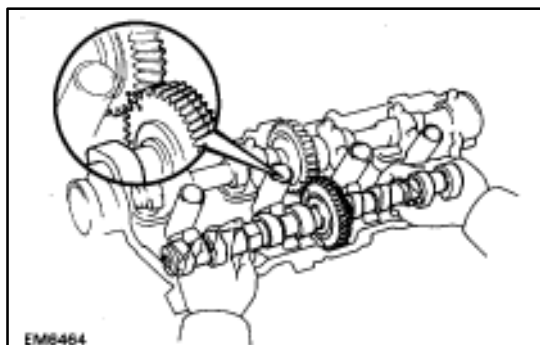
- Use bearing cap bolts 38 mm (1.50 in.) in length. The bolts are black (A) or silver (B) in color. Install the two silver bolts to the front bearing cap. Install the six black bolts to the other positions.
 - After installing the oil feed pipe, install the two bolts to the rear bearing cap as directed in step B (i).
- (i) Uniformly tighten the eight bearing cap bolts in several passes in the sequence shown.

Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)

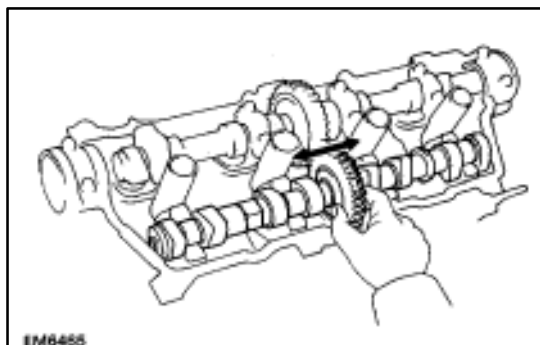


B. Install exhaust camshaft to RH cylinder head

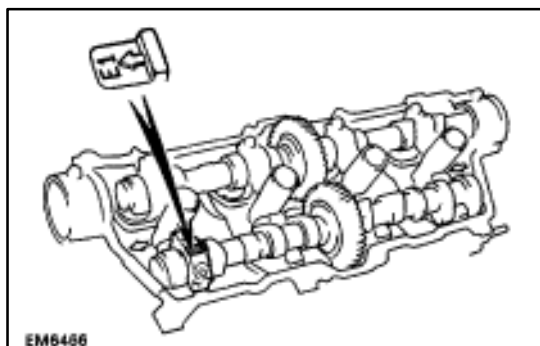
- (a) Set the timing mark (one dot mark) of the camshaft drive gear at 105 angle by turning the hexagon wrench head portion of the intake camshaft with a wrench.



- (b) Apply MP grease to the thrust portion of the exhaust camshaft.
- (c) Align the timing marks (one dot mark) of the camshaft drive and driven gears.
- (d) Place the exhaust camshaft on the cylinder head.



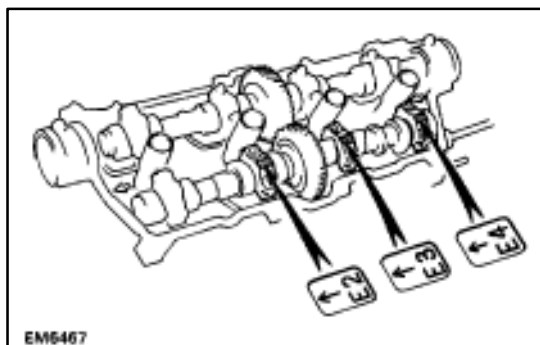
- (e) Check that the exhaust camshaft moves smoothly in the thrust direction.



- (f) Install the rear bearing cap with the arrow mark facing rearward.

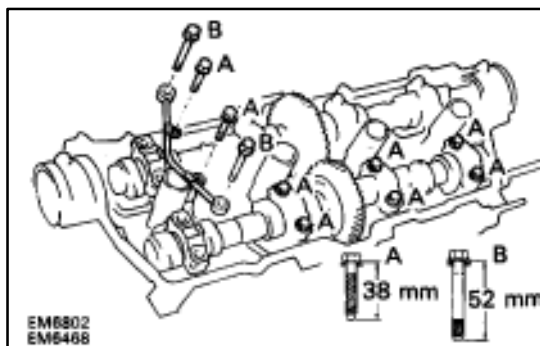
HINT:

- Installing the rear bearing cap will determine the thrust position of the camshaft.
- Align the arrow marks at front and rear of the cylinder head with the mark on the bearing cap.



- (g) Install the other bearing caps in the sequence shown with the arrow mark facing rearward.

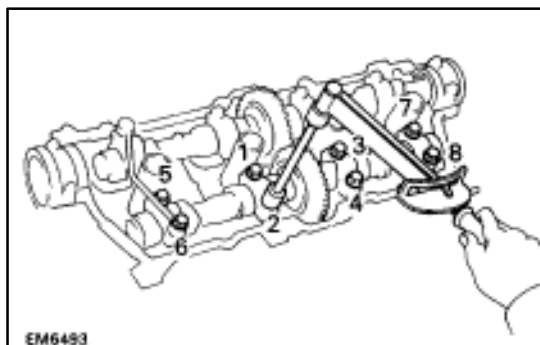
HINT: Align the arrow marks at front and rear of the cylinder head with the mark on the bearing cap.



- (h) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

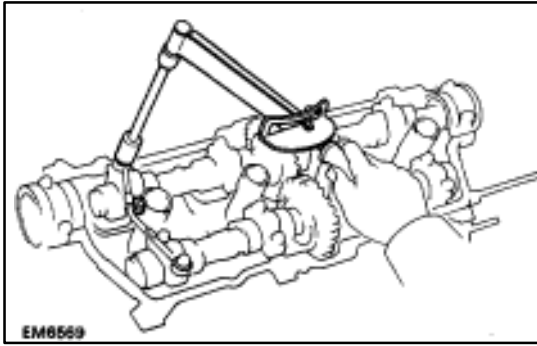
- (i) Install the oil feed pipe and ten bolts.

HINT: Use bearing cap bolts 38 mm (1.50 in.) and 52 mm (2.05 in.) in length. Use black colored 38 mm (1.50 in.) bolts. Install the two 52 mm (2.05 in.) bolts in outside positions of the oil pipe. Install the eight 38 mm (1.50 in.) bolts in the other positions.

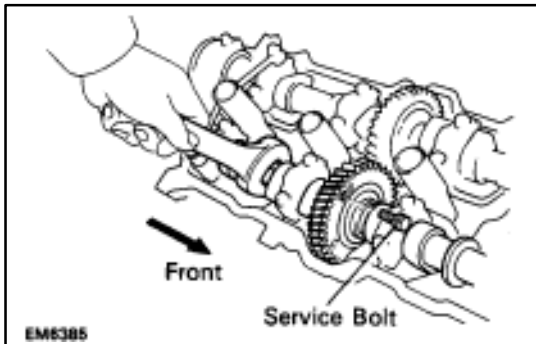


- (j) Uniformly tighten the eight bearing cap bolts on the bearing caps of the exhaust camshaft in several passes in the sequence shown.

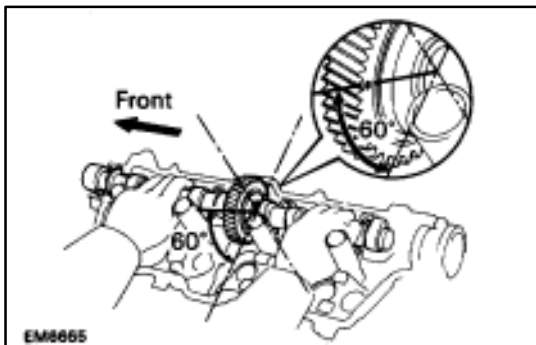
Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)



- (k) Alternately tighten the two bearing cap bolts on the rear bearing cap of the intake camshaft in several passes.
Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)

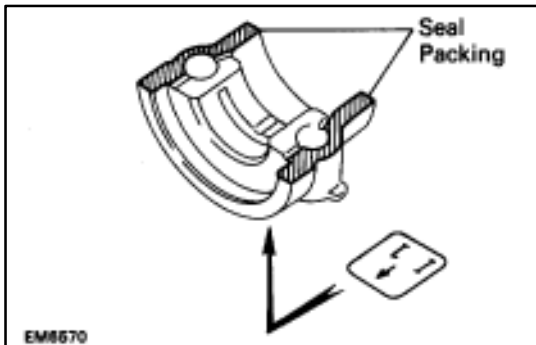


- (l) Bring the service bolt installed in the driven subgear upward by turning the hexagon wrench head portion of the camshaft with a wrench.
 (m) Remove the service bolt.



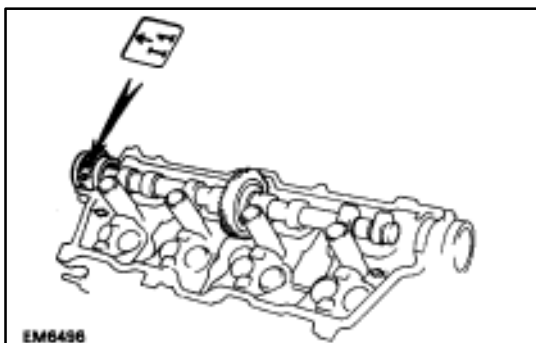
C. Install intake camshaft to LH cylinder head

- (a) Apply MP grease to the thrust portion of the camshaft.
 (b) Place the intake camshaft at 60° angle of the timing mark (one dot mark) on the cylinder head.



- (c) Remove any old packing (FIPG) material.
 (d) Apply seal packing to the bearing cap (mark "I1") as shown.

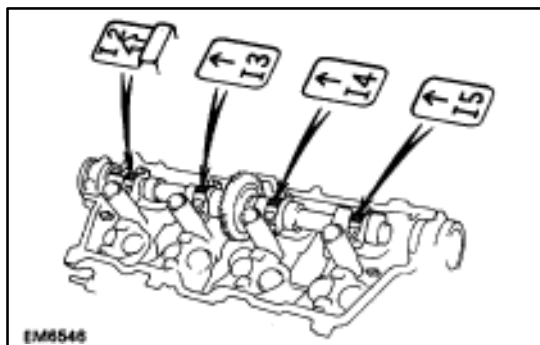
Seal packing: Part No. 08826-00080 or equivalent



- (e) Install the front bearing cap (mark "I1") with the arrow mark facing forward.

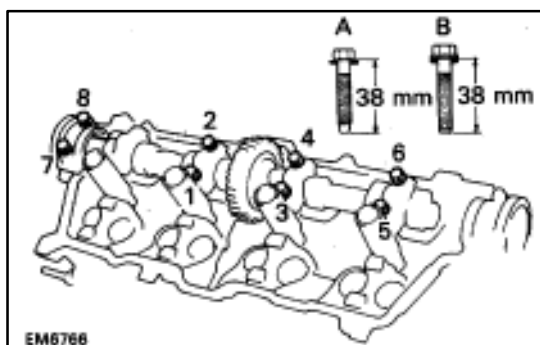
HINT:

- Installing the front bearing cap will determine the thrust position of the camshaft.
- Align the arrow marks at front and rear of the cylinder head with the mark on the bearing cap.



- (f) Install the other bearing caps in the sequence shown with the arrow mark facing forward.

HINT: Align the arrow marks at front and rear of the cylinder head with the mark on the bearing cap.



- (g) Apply a light coat of engine oil on the threads and under the heads (A only) of the bearing cap bolts.

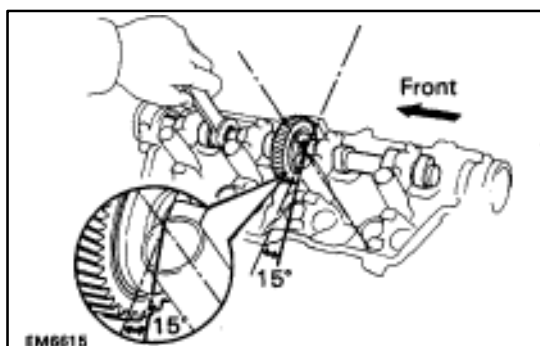
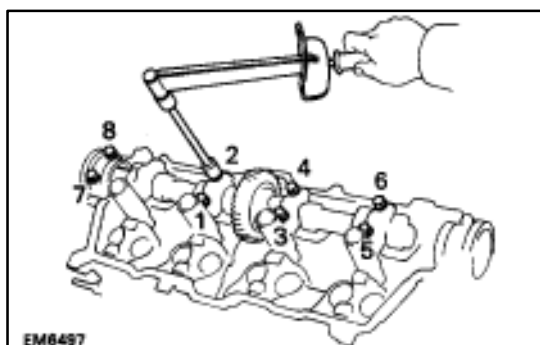
HINT: Do not apply engine oil under the heads of the bearing cap bolts (B).

- (h) Install a new seal washer to the bearing cap bolt (B). Install the eight bearing cap bolts as shown.

HINT:

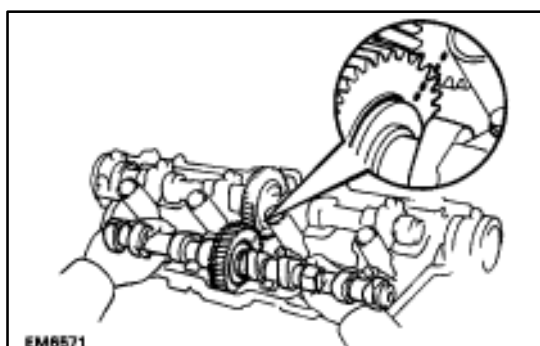
- Use bearing cap bolts 38 mm (1.50 in.) in length. The bolts are black (A) or silver (B) in color. Install the two silver bolts to the front bearing cap. Install the six black bolts to the other positions.
 - After installing the oil feed pipe, install the two bolts to the bearing cap second from the front as directed in step D (i).
- (i) Uniformly tighten the eight bearing cap bolts in several passes in the sequence shown.

Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)

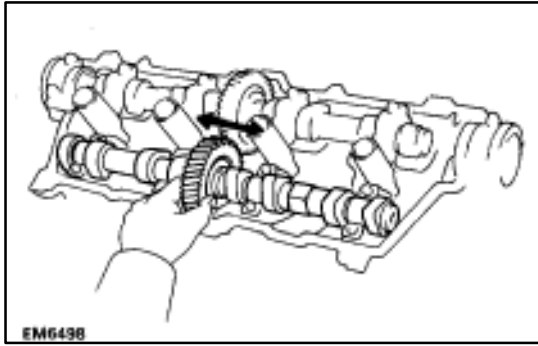


D. Install exhaust camshaft to LH cylinder head

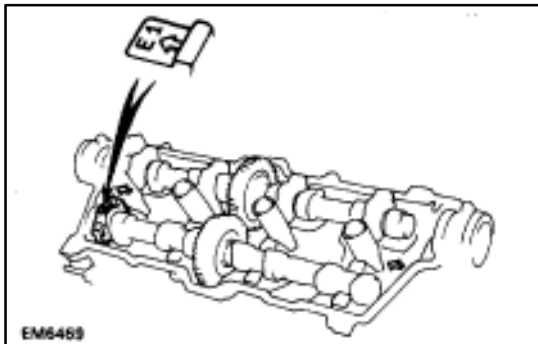
- (a) Set the timing mark (two dot marks) of the camshaft drive gear at 15° angle by turning the hexagon wrench head portion of the intake camshaft with a wrench.



- (b) Apply MP grease to the thrust portion of the exhaust camshaft.
- (c) Align the timing marks (two dot marks) of the camshaft drive and driven gears.
- (d) Place the exhaust camshaft on the cylinder head.



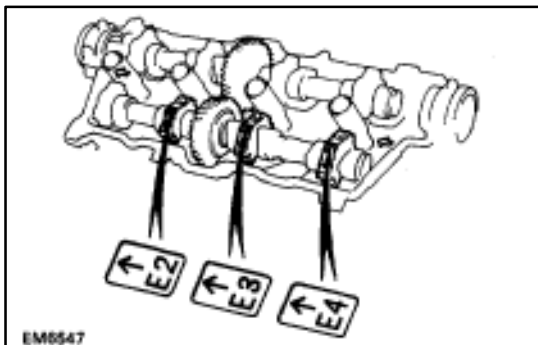
- (e) Check that the exhaust camshaft moves smoothly in the thrust direction.



- (f) Install the front bearing cap with the arrow mark facing forward.

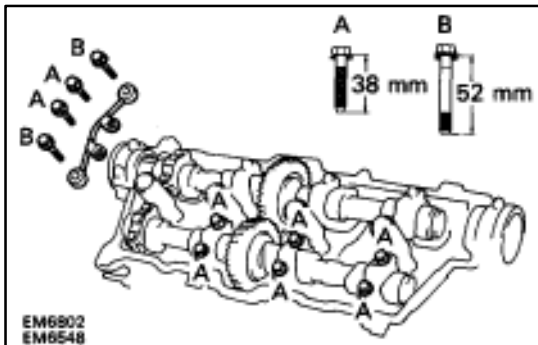
HINT:

- Installing the front bearing cap will determine the thrust position of the camshaft.
- Align the arrow marks at front and rear of the cylinder head with the mark on the bearing cap.



- (g) Install the other bearing caps in the sequence shown with the arrow mark facing forward.

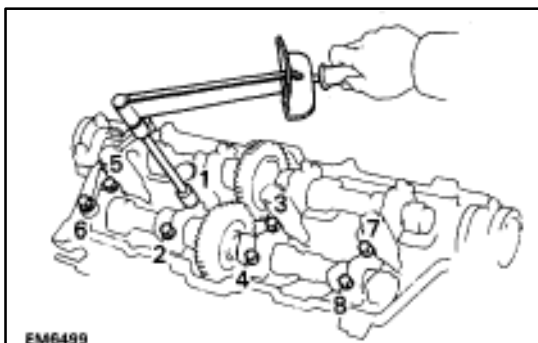
HINT: Align the arrow marks at front and rear of the cylinder head with the mark on the bearing cap.



- (h) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

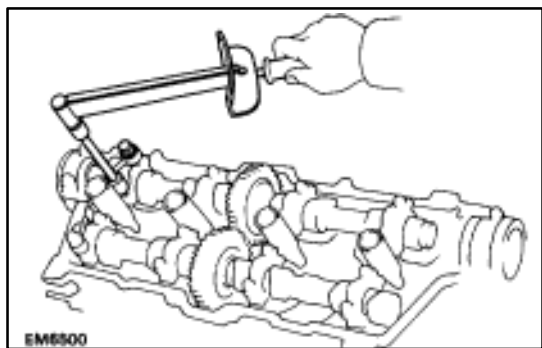
- (i) Install the oil feed pipe and ten bolts.

HINT: Use bearing cap bolts 38 mm (1.50 in.) and 52 mm (2.05 in.) in length. Use black colored 38 mm (1.50 in.) bolts. Install the two 52 mm (2.05 in.) bolts in outside positions of the oil pipe. Install the eight 38 mm (1.50 in.) bolts in the other positions.



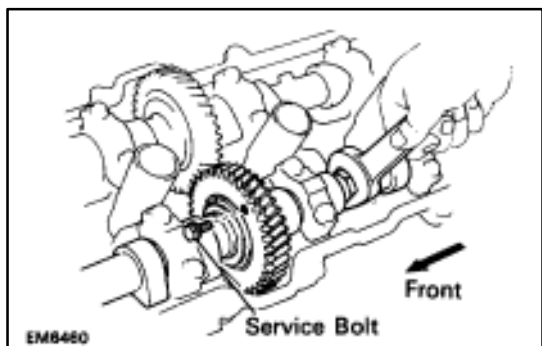
- (j) Uniformly tighten the eight bearing cap bolts on the bearing caps of the exhaust camshaft in several passes in the sequence shown.

Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)



- (k) Alternately tighten the two bearing cap bolts on the bearing cap of the intake camshaft second from the front in several passes.

Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)



- (l) Bring the service bolt installed in the driven subgear upward by turning the hexagon wrench head portion of the camshaft with a wrench.

- (m) Remove the service bolt.

8. CHECK AND ADJUST VALVE CLEARANCE

(See steps 19 to 23 on pages [EM-15](#) to 22)

Turn the camshaft, and position the cam lobe upward, check and adjust the valve clearance.

Valve clearance:

Intake 0.15–0.25 mm (0.006–0.010 in.)

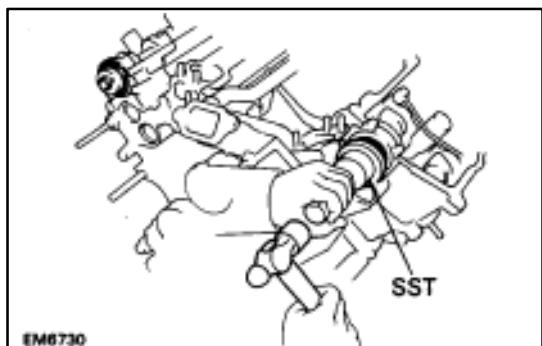
Exhaust 0.25–0.35 mm (0.010–0.014 in.)

9. INSTALL CAMSHAFT OIL SEALS

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



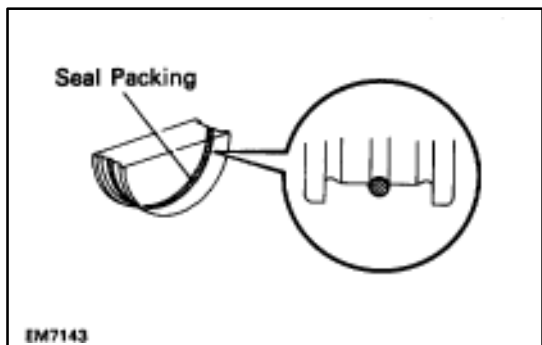
- (b) Using SST and a hammer, tap in the two oil seals.
SST 09223-46011

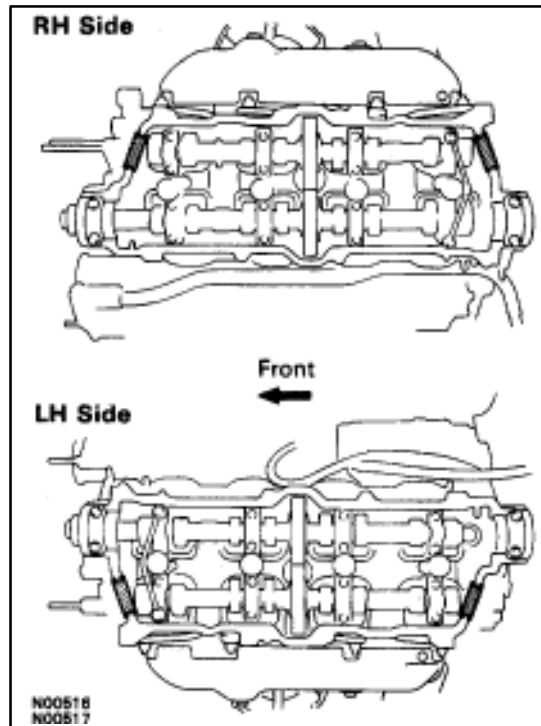


10. INSTALL SEMI-CIRCULAR PLUGS

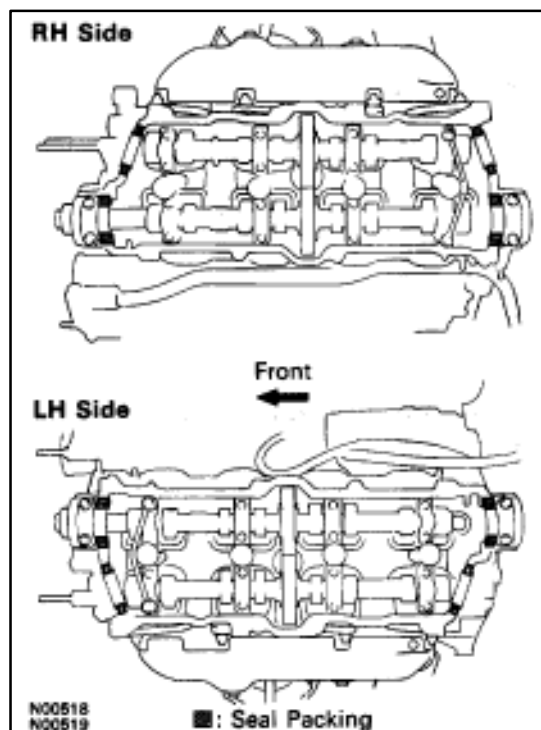
- (a) Remove any oil packing (FIPG) material.
(b) Apply seal packing to the semi-circular plug groove.

Seal packing: Part No. 08826-00080 or equivalent





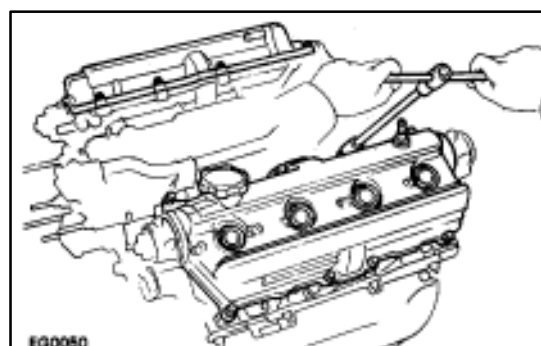
- (c) Install the four semi-circular plugs.



11. INSTALL CYLINDER HEAD COVERS

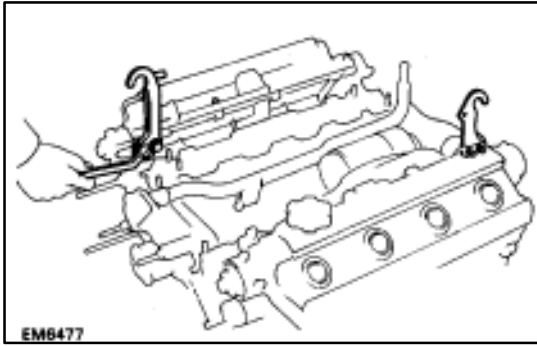
- (a) Remove any oil packing (FIPG) material.
 (b) Apply seal packing to the cylinder heads as shown in the figure.

Seal packing: Part No.08826-00080 or equivalent



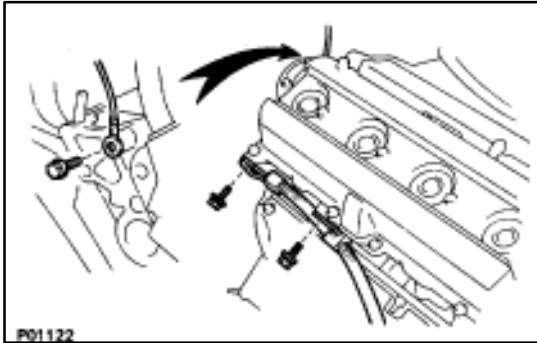
- (c) Install the gasket to the cylinder head cover.
 (d) Install the seal washer to the bolt. Install the cylinder head cover with the eight bolts. Uniformly tighten the bolts. Install the two cylinder head covers

Torque: 5.9 N·m (60 kgf·cm, 52 in·lbf)

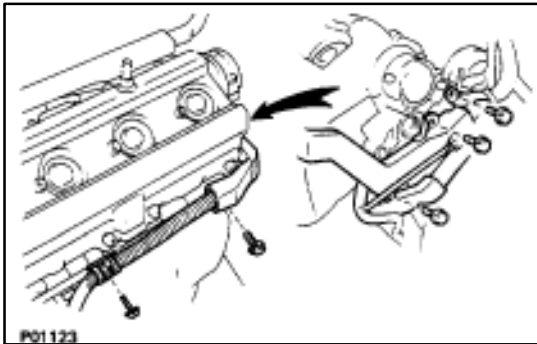
**12. INSTALL ENGINE HANGERS**

Install the engine hanger with the two bolts.
Install the two engine hangers.

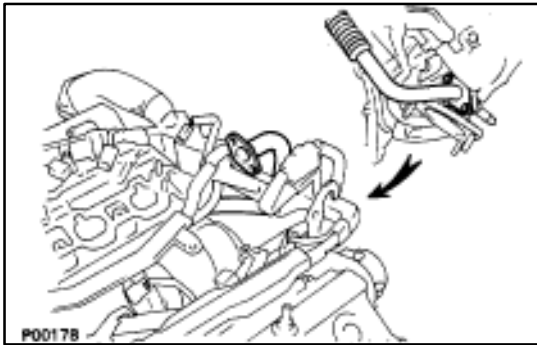
Torque: 37 N·m (380 kgf·cm, 27 ft·lbf)

**13. CONNECT GROUND STRAP TO RH CYLINDER HEAD****14. INSTALL ENGINE WIRE TO RH CYLINDER HEAD**

Install the engine wire with the two bolts.

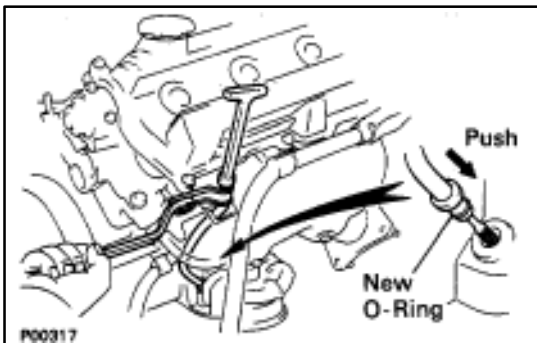
**15. INSTALL ENGINE WIRE TO LH CYLINDER HEAD**

Install the engine wire with the five bolts.

**16. INSTALL EGR PIPE TO RH EXHAUST MANIFOLD**

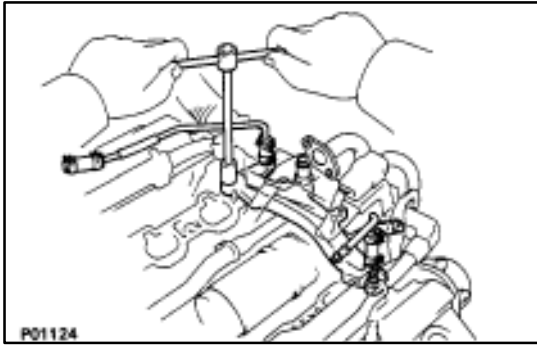
Install a new gasket and the EGR pipe with the two new nuts.

Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)

**17. INSTALL OIL DIPSTICK AND GUIDE FOR ENGINE**

- (a) Install a new O-ring to the dipstick guide.
- (b) Apply a light of engine oil on the O-ring.
- (c) Push in the dipstick guide into the guide hole of the No.1 oil pan.
- (d) Install the dipstick guide with the bolt.
- (e) Install the oil dipstick.

18. INSTALL OIL DIPSTICK AND GUIDE FOR A/T

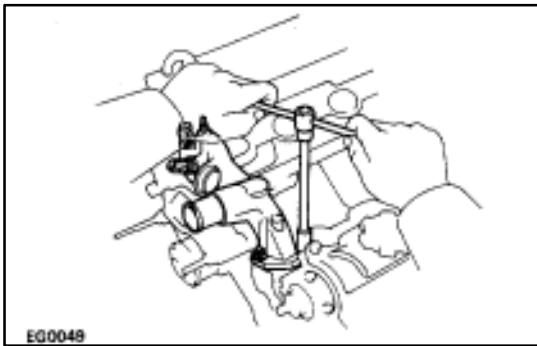


19. INSTALL REAR WATER BY-PASS JOINT

- (a) Install two new gaskets and the water by-pass joint with the four nuts. Alternately tighten the nuts.

Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)

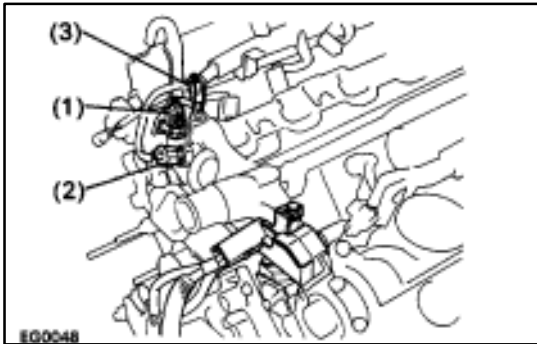
- (b) Install the bolt holding the water by-pass pipe to the engine hanger.



20. INSTALL FRONT WATER BY-PASS JOINT

- (a) Install two new gaskets and the water by-pass joint with the four nuts. Alternately tighten the nuts.

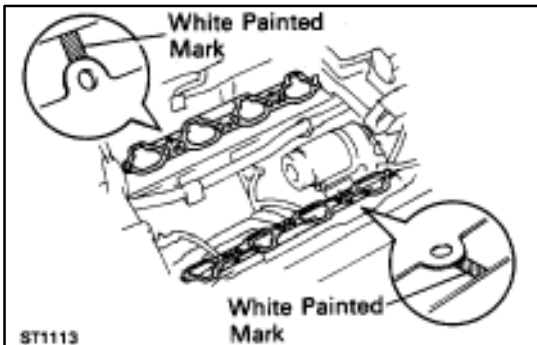
Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)



- (b) Install the engine wire clamp with the bolt.

- (c) Connect the following connectors:

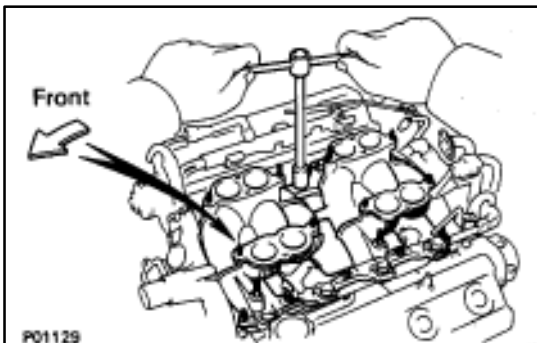
- (1) Water temperature sensor connector
- (2) Cold start injector time switch connector
- (3) Water temperature sender gauge connector



21. INSTALL INTAKE MANIFOLD

- (a) Place two new gaskets on the cylinder heads with the white painted mark facing upward.

NOTICE: Align the port holes of the gasket and cylinder head. Be careful of the installation direction.



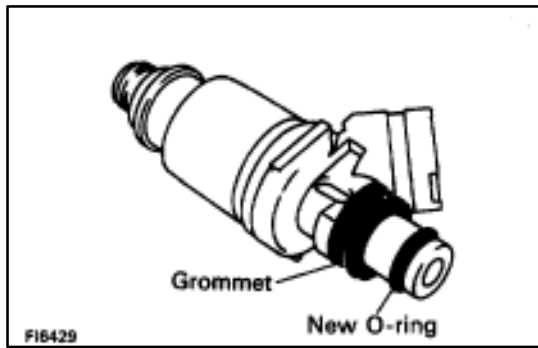
- (b) Place the intake manifold in position on the cylinder head with the arrow mark facing forward.

NOTICE: Be careful of the installation direction.

- (c) Install and uniformly tighten the six mounting bolts and four mounting nuts.

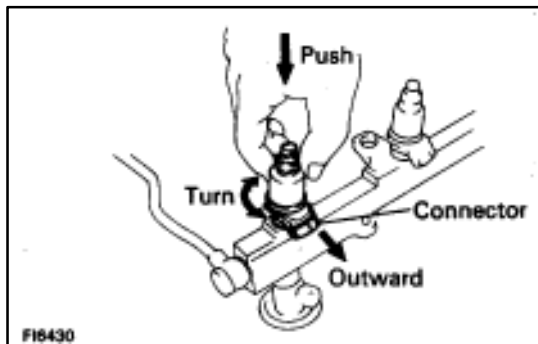
Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)

HINT: Use bolts 30 mm (1.18 in.) in length.



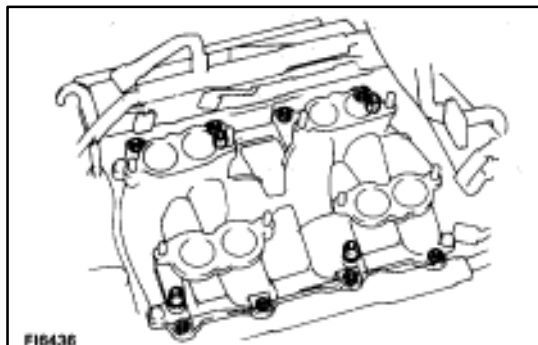
22. INSTALL DELIVERY PIPES AND INJECTORS

- (a) Install the grommet and a new O-ring to each injector.

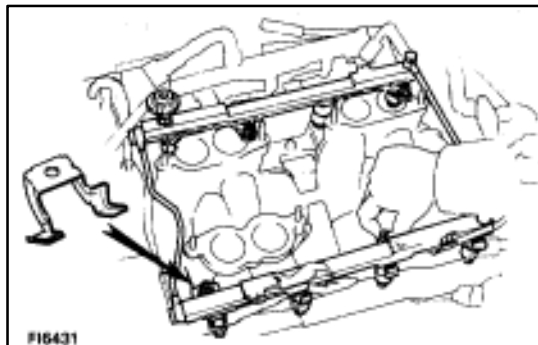


- (b) While turning the Injector clockwise and counterclockwise, push it to delivery pipe. Install the eight injectors.

- (c) Position the injector connector outward.

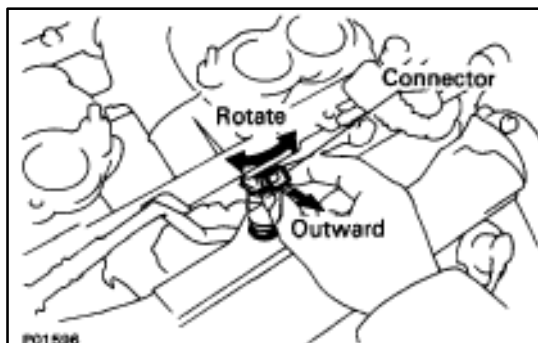


- (d) Place the eight insulators and four spacers in positions on the intake manifold.



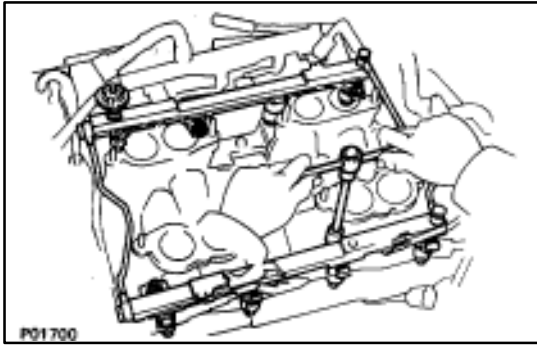
- (e) Place the eight injectors and two delivery pipes assembly in position on the intake manifold.

- (f) Temporarily install the connector bracket and four mounting nuts.



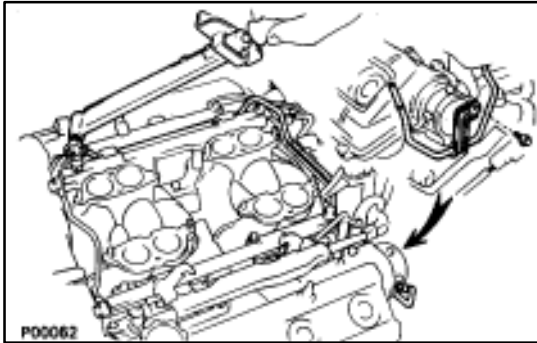
- (g) Check that the injectors rotates smoothly.

- (h) Position the injector connectors outward.



(i) Tighten the four mounting nuts.

Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)



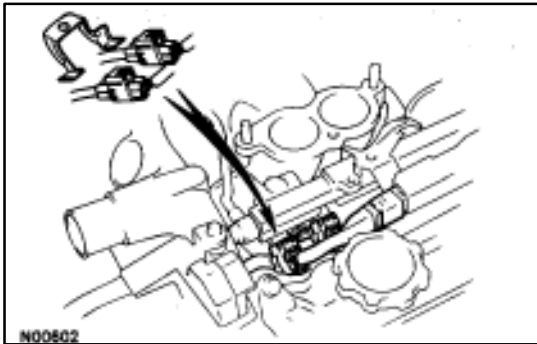
23. INSTALL FUEL RETURN PIPE

(a) Temporarily install the return pipe with the bolt, two new gaskets and union bolt.

(b) Tighten the union bolt holding the return pipe to the fuel pressure regulator.

Torque: 35 N·m (360 kgf·cm, 26 ft·lbf)

(c) Tighten the bolt holding the return pipe to the LH cylinder head.



24. INSTALL ENGINE WIRE TO DELIVERY PIPES, REAR WATER BY-PASS JOINT AND RH CYLINDER HEAD

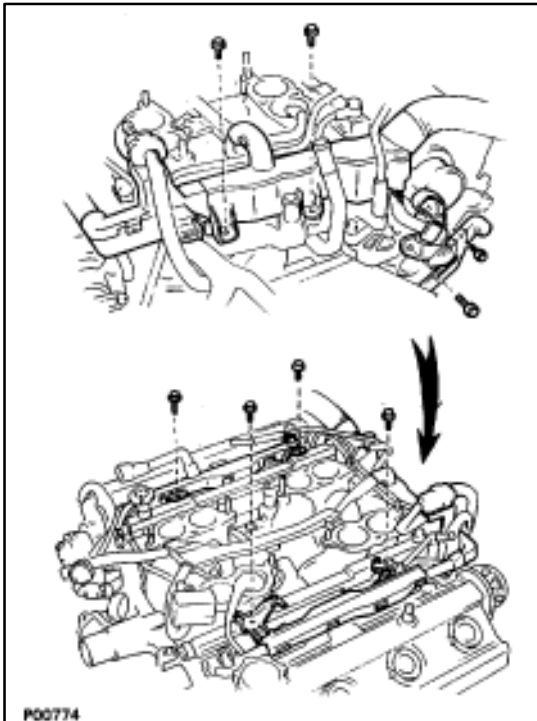
(a) Connect the eight injector connectors.

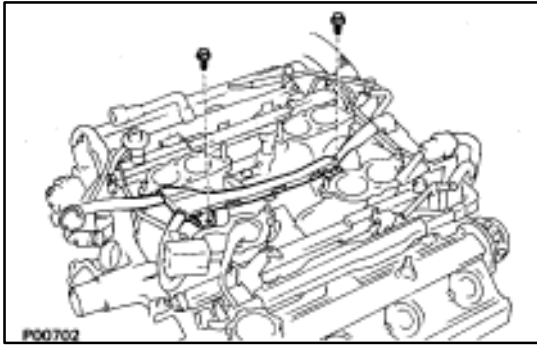
(b) Install the two engine wire connectors to connectors bracket on the LH delivery pipe.

(c) Install the engine wire to the RH cylinder head with the two bolts.

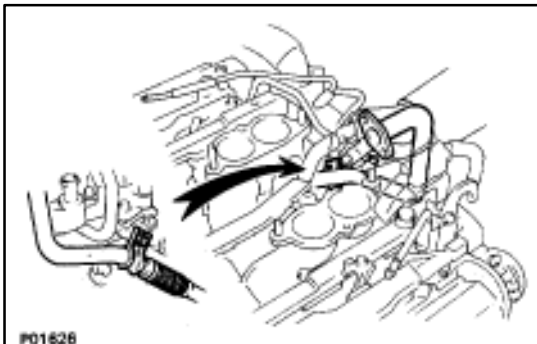
(d) Install the engine wire to the rear water by-pass joint with the two bolts.

(e) Install the engine wire to the delivery pipes with the four bolts.



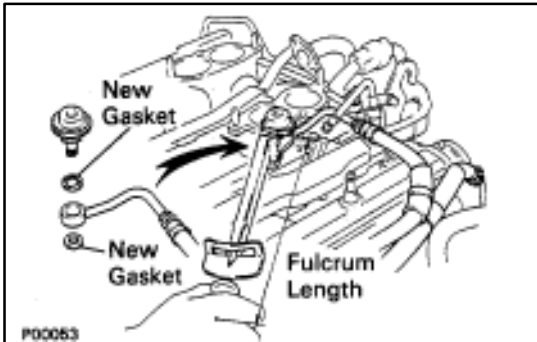
**25. INSTALL ENGINE WIRE TO INTAKE MANIFOLD**

Install the engine wire with the two bolts.

**26. TEMPORARILY INSTALL EGR PIPE TO RH CYLINDER HEAD**

Temporarily install a new gasket and the EGR pipe with the two bolts.

HINT: Use bolt 25 mm (0.98 in.) in length.

**27. CONNECT FUEL RETURN HOSE TO FUEL RETURN PIPE****28. CONNECT FUEL INLET HOSE TO LH DELIVERY PIPE**

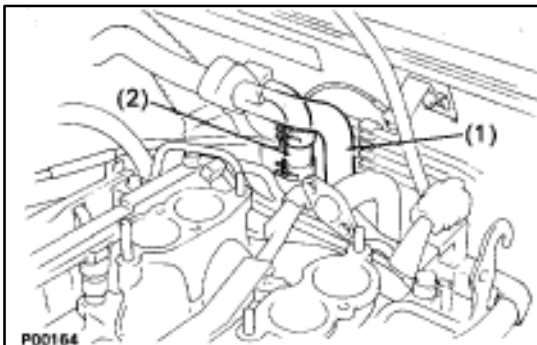
Connect the inlet hose with two new gaskets and the pulsation damper.

SST 09612-24012 (09617-24011)

Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

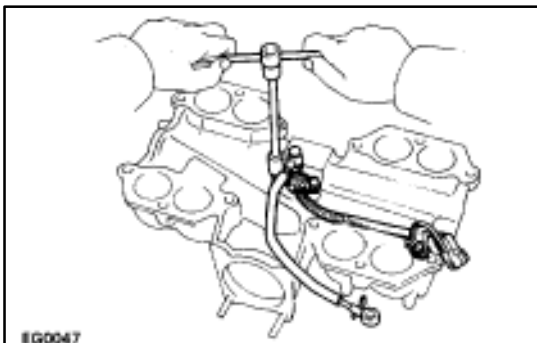
33 N·m (340 kgf·cm, 24 ft·lbf) for SST

HINT: Use a torque wrench with a fulcrum length of 30 cm (11.81 in.).

**29. CONNECT HEATER WATER HOSES**

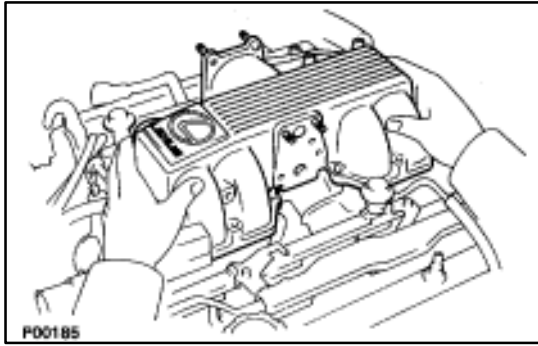
Connect the following hoses:

- (1) Water hose to water by-pass pipe
- (2) Water hose to rear water by-pass joint

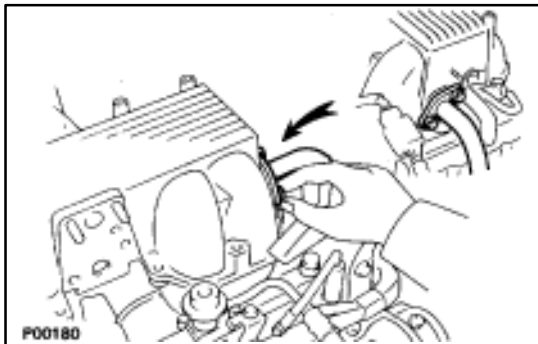
**30. INSTALL AIR INTAKE CHAMBER**

- (a) Install the cold start injector, tube and wire assembly with the three bolts.

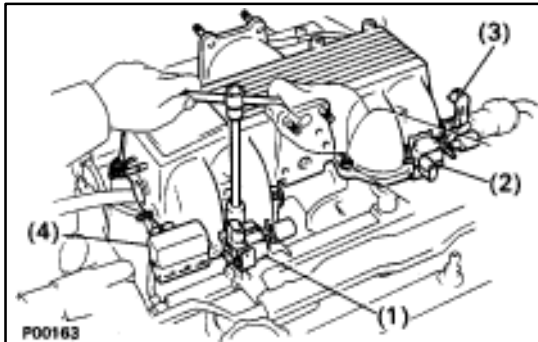
Torque: 7.8 N·m (80 kgf·cm, 69 in·lbf)



- (b) Place four new gaskets on the intake manifold.
 HINT: Gaskets can only be used twice before being replaced.
 (c) Place the air intake chamber on the intake manifold.



- (d) Temporarily connect the EGR pipe to the air intake chamber with a new gasket and the two bolts.
 HINT: Use bolts 20 mm (0.79 in.) in length.



- (e) Temporarily install the air intake chamber and following parts with the four bolts and eight nuts:
 (1) VSV for fuel pressure control system
 (2) (Exc. USA Spec.)
 VSV for EGR system
 (3) A/T throttle cable bracket
 (4) Check connector ("DIAGNOSIS") connector
 (f) Uniformly tighten the bolts and nuts in several passes.

Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)

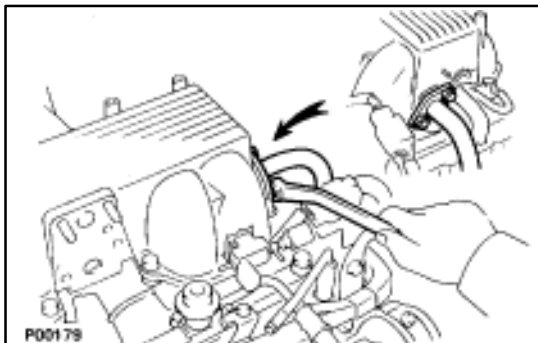
HINT: Use bolts 40 mm (1.57 in.) in length.

- (g) Tighten the two bolts holding the EGR pipe to the air intake chamber.

Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)

- (h) Tighten the two bolts holding the EGR pipe to the RH cylinder head.

Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)

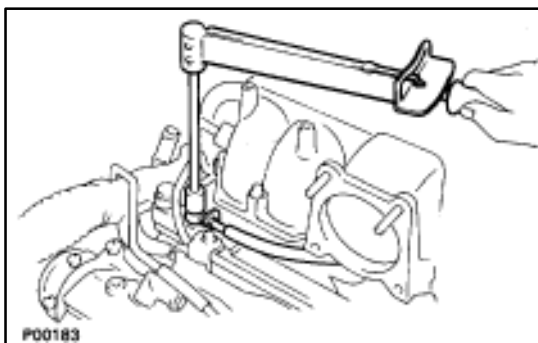


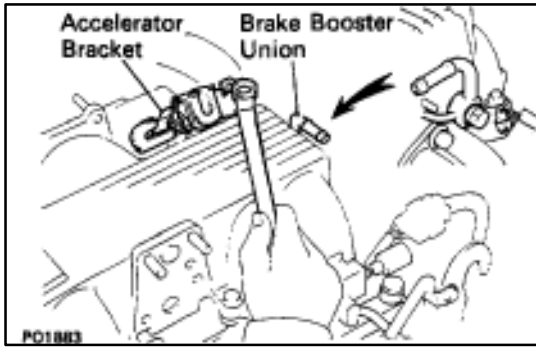
- (i) Connect the cold start injector tube to the RH delivery pipe with the two new gaskets and the union bolt.

Torque: 15 N·m (150 kgf·cm, 11 ft·lbf)

- (j) Connect the following connectors:

- Cold start injector connector
- SV connector for fuel pressure control system
- (Exc. USA Spec.)
 VSV connector for EGR system



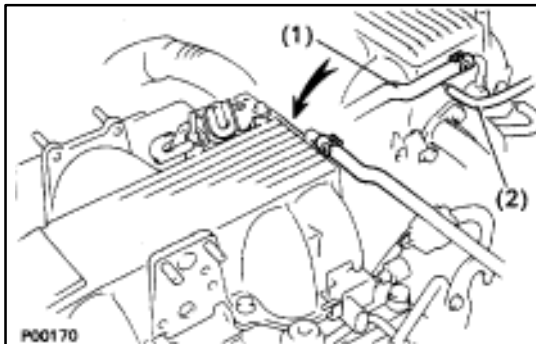
**31. INSTALL ACCELERATOR BRACKET**

Install the bracket with the bolt and stud bolt.

32. INSTALL BRAKE BOOSTER UNION

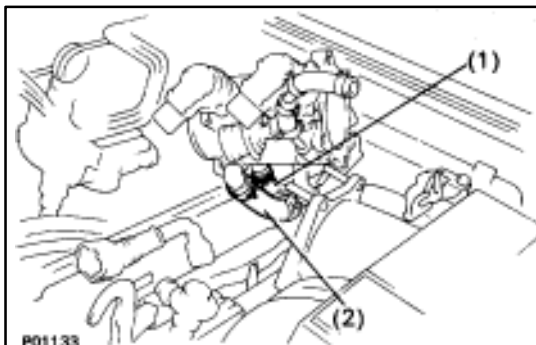
Install the union with two new gaskets and the union bolt.

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

**33. CONNECT VACUUM HOSES**

Connect the following hoses:

- (1) Vacuum hose to brake booster union
- (2) Vacuum hose (from VSV for heater water valve) to air intake chamber

**34. INSTALL THROTTLE BODY**

(a) Connect the following hoses:

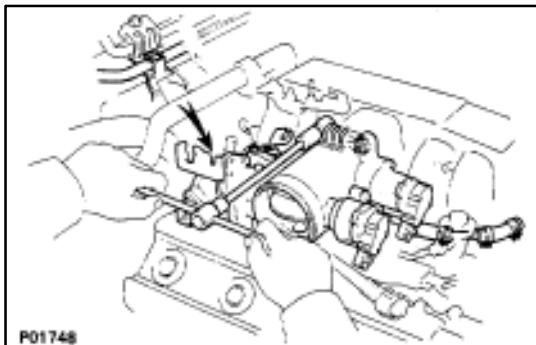
- (1) Water by-pass hose to throttle body
- (2) PCV hose to throttle body

(b) Install a new gasket and throttle body with the two bolts and two nuts.

Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)

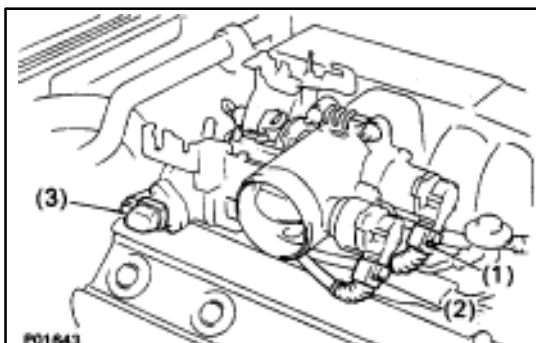
HINT: Use bolts 40 mm (1.57 in.) in length.

(c) Install the water by-pass pipe (from rear water bypass joint) to the clamp on the engine wire cover.



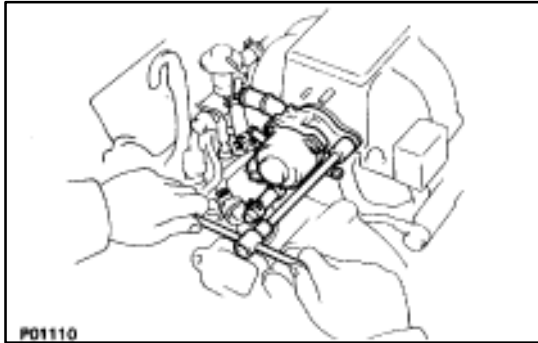
(d) Connect the following connectors:

- (1) Throttle position sensor connector
- (2) (w/ TRAC)
Sub-throttle position sensor connector
- (3) (w/ TRAC)
Sub-throttle actuator connector

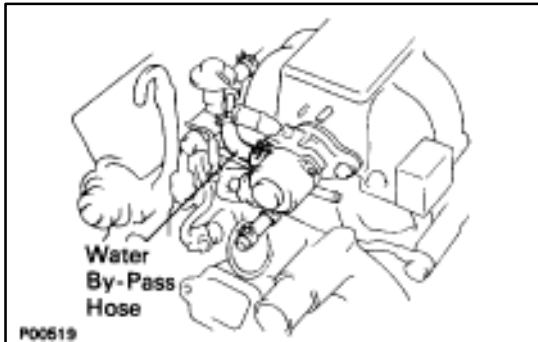


**35. INSTALL HEATER WATER VALVE**

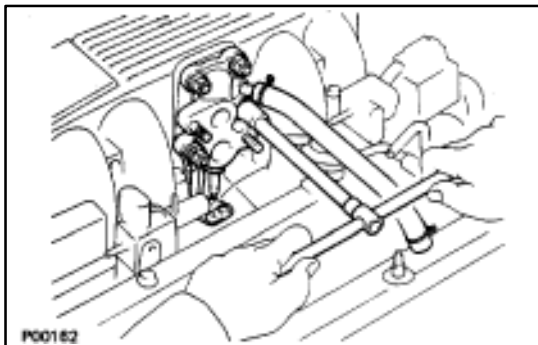
- (a) Install the water valve and bracket assembly with the two bolts.
- (b) Install the engine wire clamp with the bolt.
- (c) Connect the VSV connector.

**36. INSTALL ISC VALVE**

- (a) Install a new gasket and the ISC valve with the two nuts.
Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)



- (b) Connect the water by-pass hose (from throttle body) to the ISC valve.
- (c) Connect the ISC valve connector.

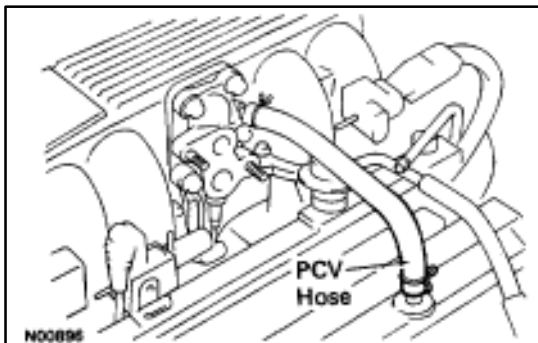
**37. INSTALL EGR VALVE ADAPTOR**

- (a) Install a new gasket, the adaptor and connector bracket (USA spec. only) with the two bolts and two nuts.

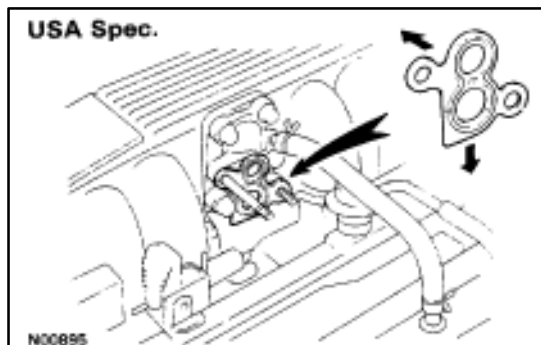
Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)

HINT: Use bolts 20 mm (1.79 in.) in length.

NOTICE: Do not touch the air intake chamber and adaptor surfaces of the gasket with your hand.



- (b) Connect the PCV hose to cylinder head.
- (c) (USA Spec. only)
Connect the EGR gas temperature sensor connector.

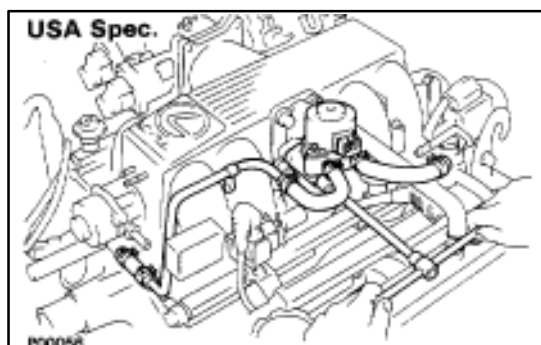


38. (USA Spec.) INSTALL EGR VALVE

- (a) Place a new gasket on the EGR valve adaptor.

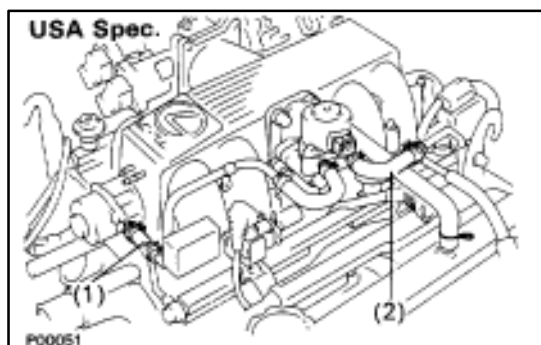
NOTICE:

- Do not touch the adapter and EGR valve surfaces of the gasket with your hand.
- Align the port holes of the gasket and adaptor. Be careful of the installation direction.

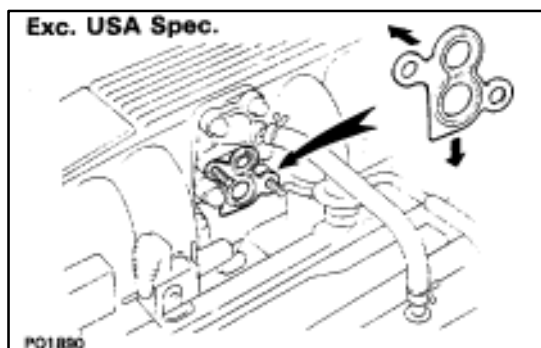


- (b) Install the EGR valve with the two nuts.

Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)



- (c) Connect the following hoses:
- (1) Water by-pass pipe hose to ISC valve
 - (2) Water by-pass pipe hose to water by-pass pipe (from rear water by-pass joint)
- (d) Connect the EGR valve connector.

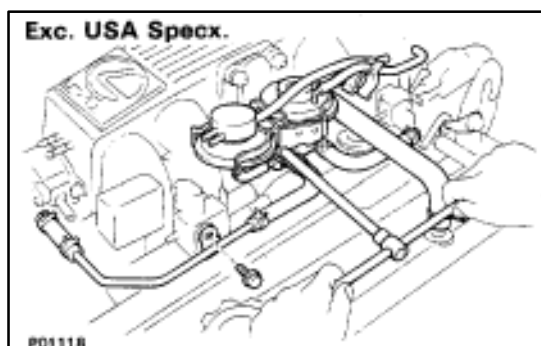


39. (Exc. USA Spec.) INSTALL EGR VALVE AND VACUUM MODULATOR

- (a) Place a new gasket on the EGR valve adaptor.

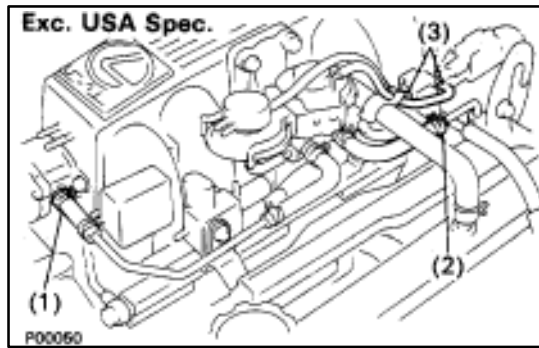
NOTICE:

- Do not touch the adapter and EGR valve surfaces of the gasket with your hand.
- Align the port holes of the gasket and adaptor. Be careful of the installation direction.

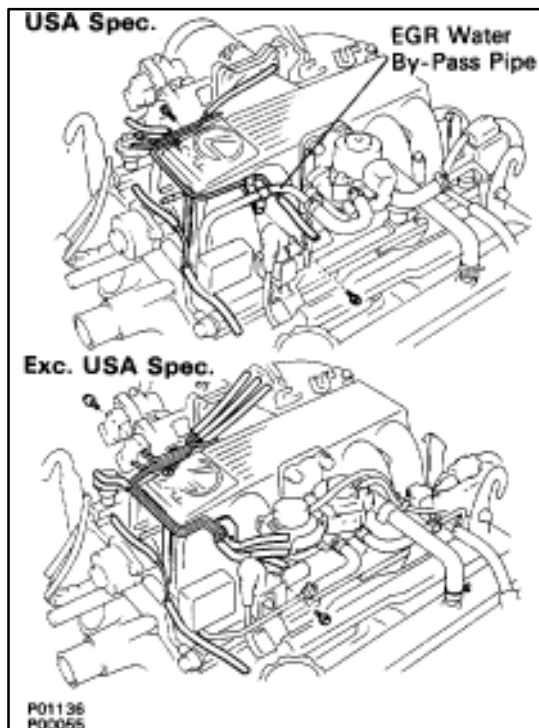


- (b) Install the EGR valve and vacuum and modulator assembly with the two nuts and bolt.

Torque (Nut): 18 N·m (185 kgf·cm, 13 ft·lbf)

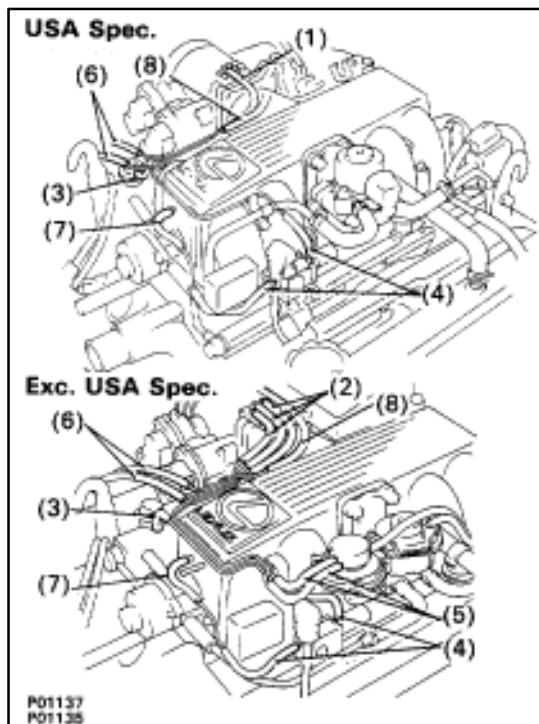


- (c) Connect the following hoses:
- (1) Water by-pass pipe hose to ISC valve
 - (2) Water by-pass pipe hose to water by-pass pipe (from rear water by-pass joint)
 - (3) Two vacuum hoses to VSV for EGR system

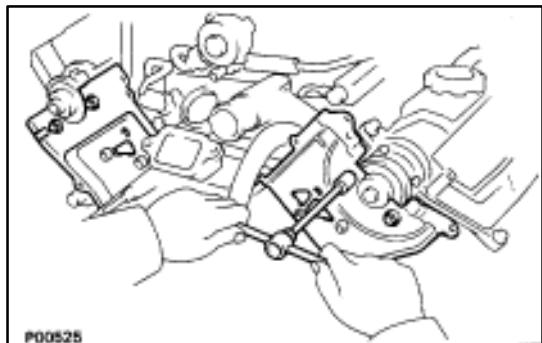


40. INSTALL VACUUM PIPE

- (a) Install the vacuum pipe, vacuum hoses assembly and EGR water by-pass pipe (USA spec. only) with the two bolts.



- (b) Connect the following hoses:
- (1) (USA Spec.)
Vacuum hose to throttle body
 - (2) (Exc. USA Spec.)
Three vacuum hoses to throttle body
 - (3) Vacuum hose to fuel pressure regulator
 - (4) Two vacuum hoses to VSV for fuel pressure control system
 - (5) (Exc. USA Spec.)
Two vacuum hoses to EGR vacuum modulator
 - (6) Two vacuum hoses (from VSV for EVAP system) to vacuum pipe
 - (7) Vacuum hose (from VSV for fuel pressure control system) to air intake chamber
 - (8) Vacuum hose (from charcoal canister) to vacuum pipe



41. INSTALL TIMING BELT REAR PLATES

Install the rear plate with the two bolts. Install the two rear plates.

Torque: 7.8 N·m (80 kgf·cm, 69 in·lbf)

42. INSTALL WATER INLET AND INLET HOUSING

- (a) Remove any old packing (FIPG) material.
 - Using a razor blade and gasket scraper, remove all the old packing (FIPG) materials from the gasket surfaces and sealing groove.
 - Thoroughly clean all components to remove all the loose materials.
 - Using a non-residue solvent, clean both sealing surfaces.
- (b) Apply seal packing to the sealing groove of the water inlet housing as shown in the illustration.

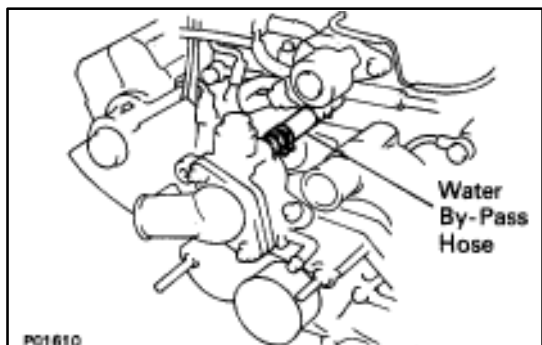
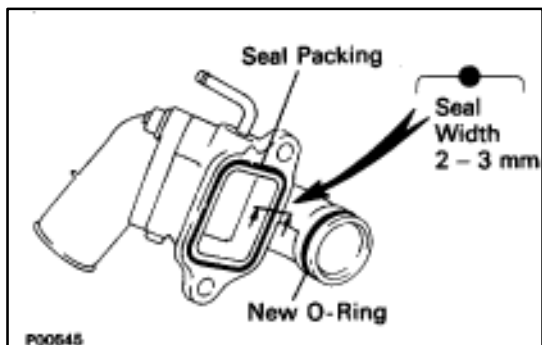
Seal packing: Part No.08826-00100 or equivalent

- Install a nozzle that has been cut to a 2–3 mm (0.08–0.12 in.) opening.
- Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.

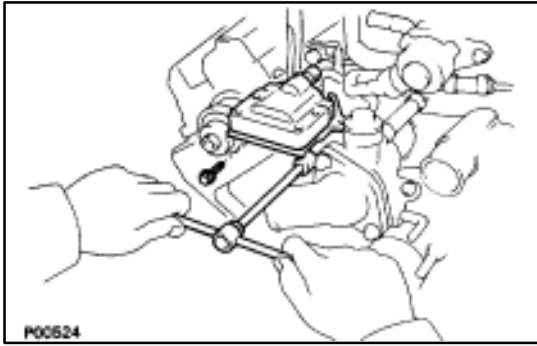
- (c) Install a new O-ring to the water inlet housing.
- (d) Apply soapy water to the O-ring.
- (e) Push the water inlet housing end into the water pump hole.
- (f) Install the water inlet and housing assembly with the two bolts. Alternately tighten the bolts.

Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)

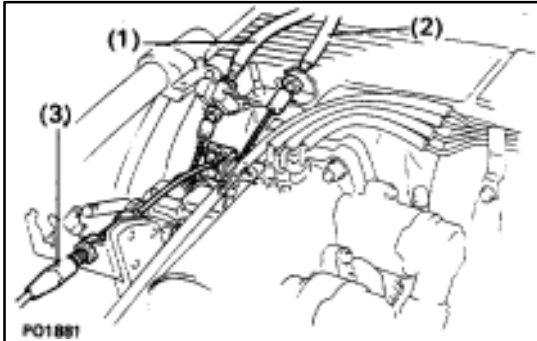
HINT: Use bolts 25 mm (0.98 in.) in length.



- (g) Connect the water by-pass hose to the ISC valve.

**43. INSTALL RH IGNITION COIL**

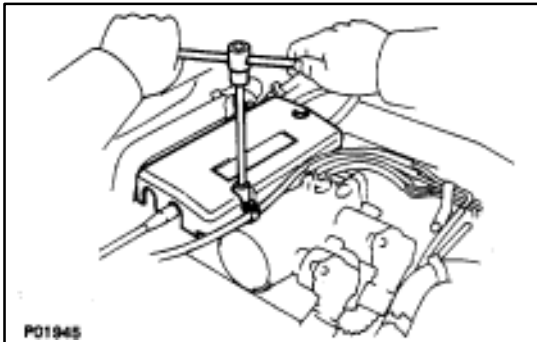
Install the ignition coil with the two bolts.

**44. CONNECT CONTROL CABLES TO THROTTLE BODY**

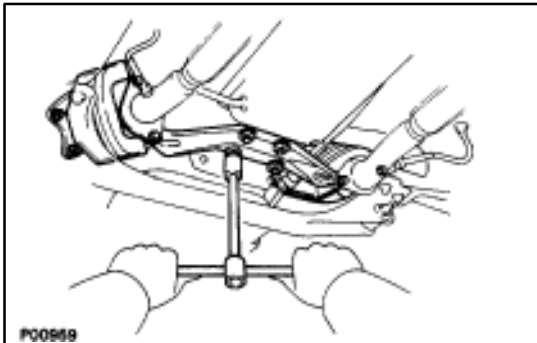
Connect the following cables:

- (1) Accelerator cable
- (2) A/T throttle cable
- (3) (w/ Cruise Control System)

Cruise control actuator cable

**45. INSTALL THROTTLE BODY COVER**

Install the throttle body cover and hose clamp with the two bolts and cap nut.

**46. INSTALL CATALYTIC CONVERTERS (MAIN)**

- (a) Install a new gasket and the catalytic converter to the exhaust manifold with the three new bolts. Install the two catalytic converters.

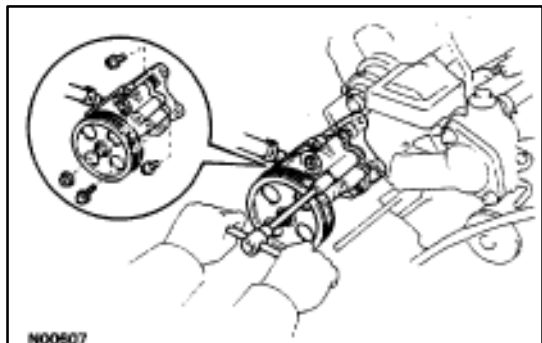
Torque: 62 N·m (630 kgf·cm, 46 ft·lbf)

- (b) Install a new gasket to each front end of the front exhaust pipe.
- (c) Connect the front exhaust pipe to the catalytic converters.
- (d) Temporarily install the four bolts holding the pipe support bracket to the transmission.
- (e) Install the four bolts and nuts holding the catalytic converters to the front exhaust pipe.

Torque: 43 N·m (440 kgf·cm, 32 ft·lbf)

- (f) Tighten the four bolts holding the pipe support bracket to the transmission.

Torque: 43 N·m (440 kgf·cm, 32 ft·lbf)

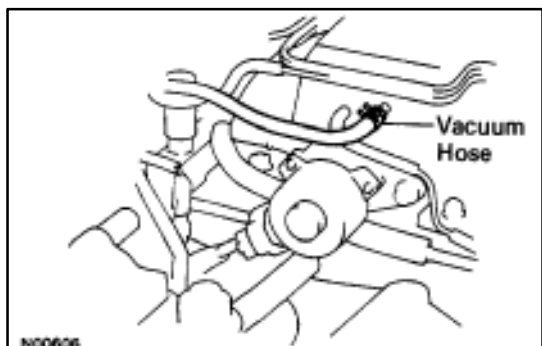
**47. INSTALL PS PUMP**

- (a) Install the PS pump with the three bolts and nut. Alternately tighten the bolts and nut.

Torque:

Bolt 39 N·m (400 kgf·cm, 29 ft·lbf)

Nut 43 N·m (440 kgf·cm, 32 ft·lbf)



- (b) Connect the vacuum hose to the vacuum pipe.

48. INSTALL HYDRAULIC PUMP AND CAMSHAFT TIMING PULLEYS

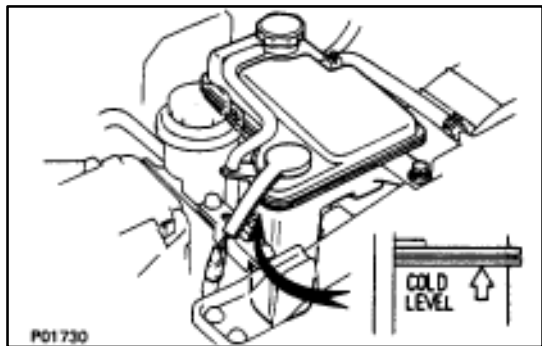
(See steps 8, 10 and 11 on pages [EM-48](#) to 49)

49. INSTALL HYDRAULIC PUMP AND CAMSHAFT TIMING PULLEYS

(See steps 12 to 43 on pages [EM-49](#) to 57)

50. PERFORM ROAD TEST

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



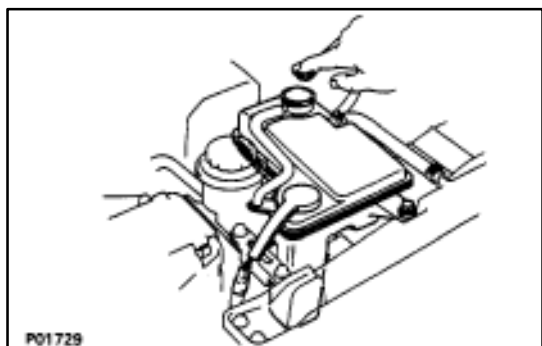
ENGINE TUNE-UP

INSPECTION OF ENGINE COOLANT

1. INSPECT ENGINE COOLANT LEVEL AT RESERVOIR TANK

The coolant level should be above the "COLD LEVEL" at normal temperature (20°C (68°F)).

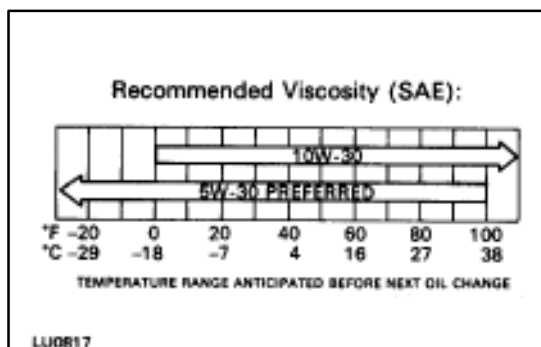
If low, check for leaks and add coolant up to the "COLD LEVEL".



2. INSPECT ENGINE COOLANT QUALITY

There should be any excessive deposits of rust or scales around the radiator cap or reservoir tank filler hole, and the coolant should be free from oil.

If excessively dirty, clean the coolant passages and replace the coolant.



INSPECTION OF ENGINE OIL

1. INSPECT ENGINE OIL QUALITY

Check the oil for deterioration, entry of water, discoloring or thinning.

If the quality is poor, replace the oil.

Oil grade: API grade SG, Energy-Conserving II multigrade.

Recommended viscosity is as shown, with SAE 5W-30 being the preferred engine oil.

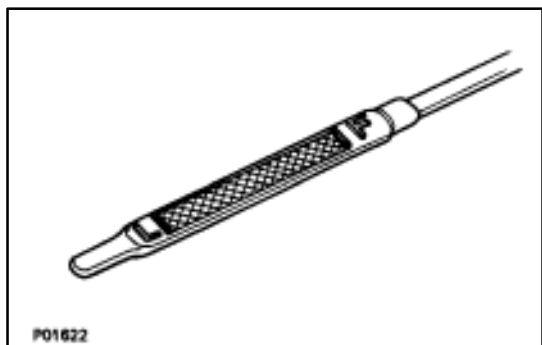
Drain and refill oil capacity:

w/ oil filter change

4.8 liter (5.1 US qts, 4.2 Imp. qts)

w/o oil filter change

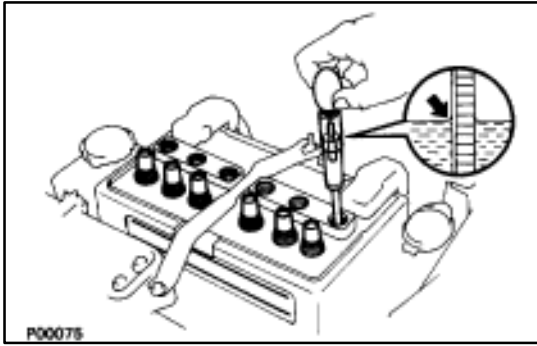
4.5 liter (4.8 US qts, 4.0 Imp. qts)



2. INSPECT ENGINE OIL LEVEL

The oil level should be between the "L" and "F" marks on the dipstick.

If low, check for leakage and add oil up to "F" mark.



INSPECTION OF BATTERY

1. INSPECT BATTERY SPECIFIC GRAVITY AND ELECTROLYTE LEVEL

(a) Check the specific gravity of each cell.

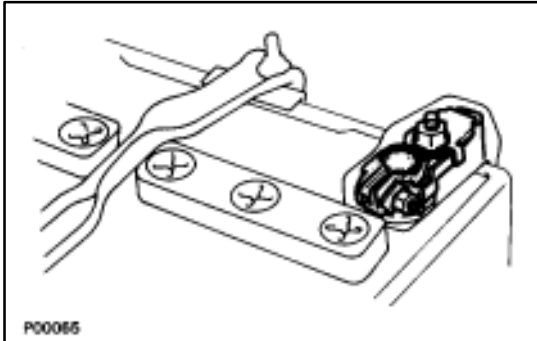
Standard specific gravity:

1.27–1.29 when fully charged at 20°C(68°F)

If not within specification, charge the battery.

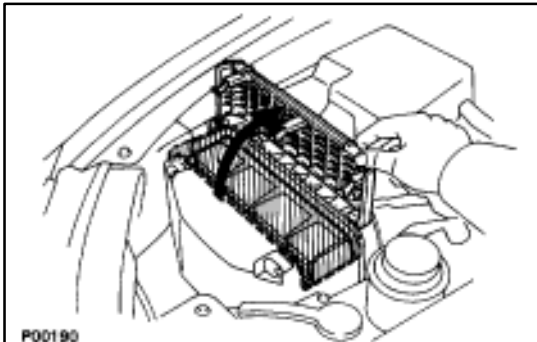
(b) Check the electrolyte quantity of each cell.

If insufficient, refill with distilled (or purified) water.



2. CHECK BATTERY TERMINALS

Check that the battery terminals are not loose or corroded.

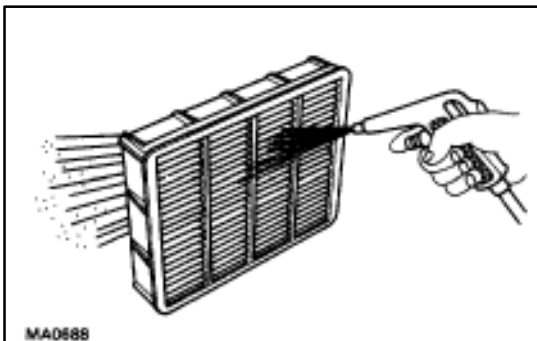
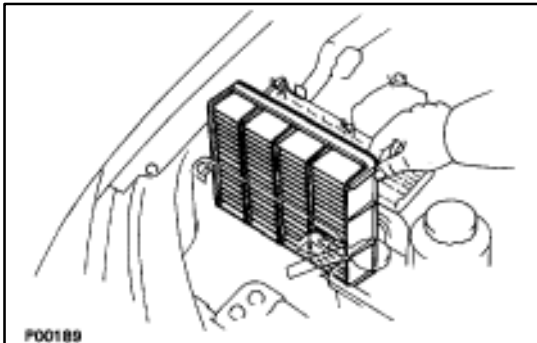


INSPECTION AND CLEANING OF AIR FILTER

1. REMOVE AIR FILTER

(a) Open the air cleaner cap.

(b) Remove the air filter.



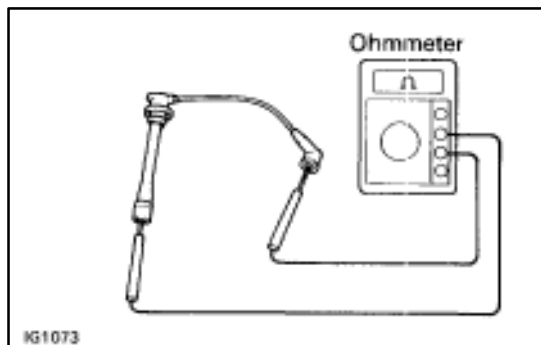
2. INSPECT AIR FILTER

(a) Visually check that the air filter is not excessively damaged or oily.

(b) Clean the air filter with compressed air.

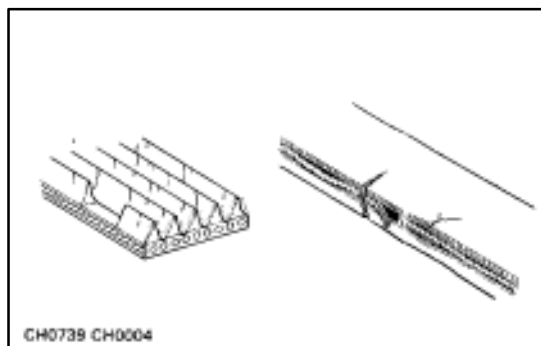
First blow from the inside thoroughly, then blow off the outside of the air filter.

3. REINSTALL AIR FILTER



INSPECTION OF HIGH-TENSION CORDS

1. **REMOVE HIGH-TENSION CORDS** (See page [IG-11](#))
2. **INSPECT HIGH-TENSION CORDS**
 - (b) Using an ohmmeter, measure the resistance.
Maximum resistance: 25 kΩ per cord
If the resistance is greater than maximum, replace the cord.
3. **REINSTALL HIGH-TENSION CORDS** (See page [IG-16](#))



INSPECTION OF DRIVE BELT

INSPECT DRIVE BELT

HINT: A belt tensioner is used, so checking the belt tension is not necessary.

- (a) Visually check the drive belt for excessive wear, frayed cords etc.

If necessary, replace the drive belt.

HINT:

- Cracks on rib side of a drive belt are considered acceptable. If the drive belt has chunks missing from the ribs, it should be replaced.
- The drive belt tension can be released by turning the belt tensioner counterclockwise. The pulley bolt for the belt tensioner has a left-hand thread.
- (b) Check the belt tensioner operation.
 - Check that the belt tensioner moves downward when the drive belt is pressed down at the points indicated in the illustration with approx. 98 N (10 kgf, 22.0 lbf) of force.
 - Check the alignment of the belt tensioner pulley to make sure the drive belt has not slipped off the pulley.

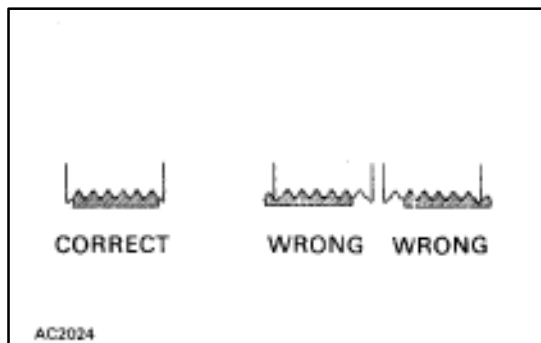
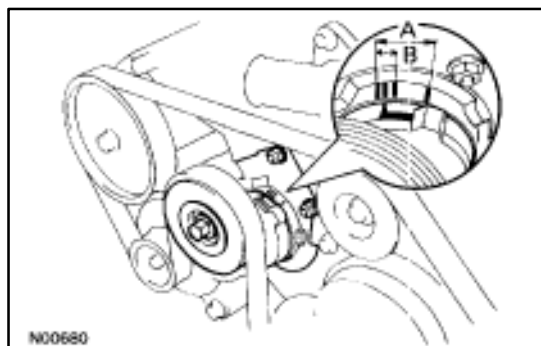
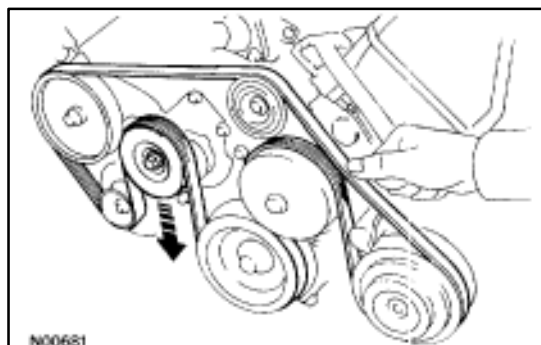
If necessary, replace the belt tensioner.

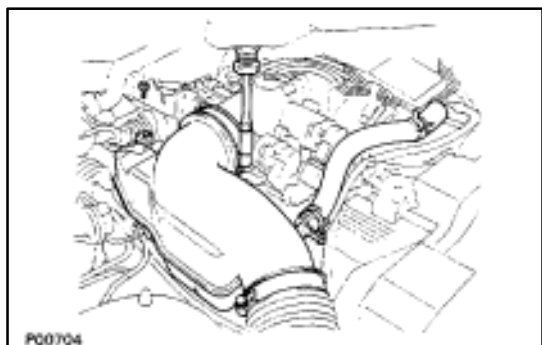
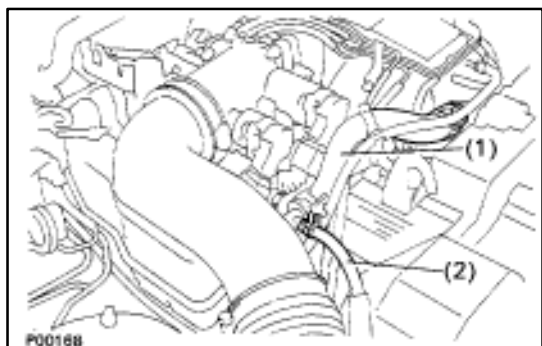
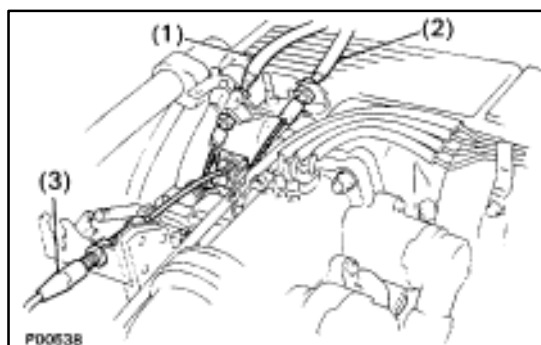
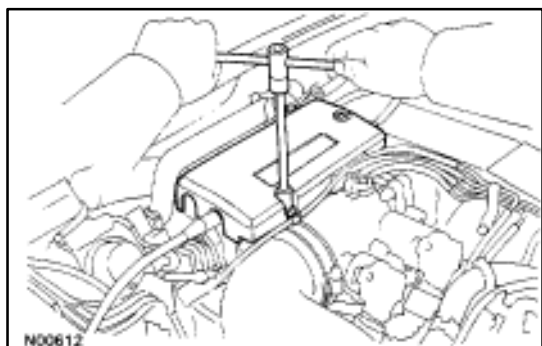
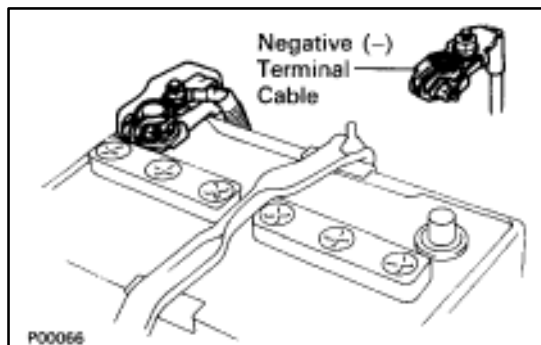
- Check that the arrow mark on the belt tensioner falls within area A of the scale.

If it is outside area A, replace the drive belt.

HINT:

- When a new belt is installed, it should lie within area B. If not, the drive belt is not correct.
- After installing a belt, check that it fits properly in the ribbed grooves.
- Check by hand to confirm that the belt has not slipped out of the groove on the bottom of the pulley.





INSPECTION AND ADJUSTMENT OF VALVE CLEARANCE

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

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY

CAUTION: Work must be started after approx. 20 seconds or longer from the time the ignition switch is turned to the "LOCK" position and the negative (-) terminal cable is disconnected from the battery.

2. DRAIN ENGINE COOLANT (See page [CO-6](#))

3. REMOVE THROTTLE BODY COVER

- Remove the mounting cap nut.
- Loosen the two bolts, and remove the throttle body cover.

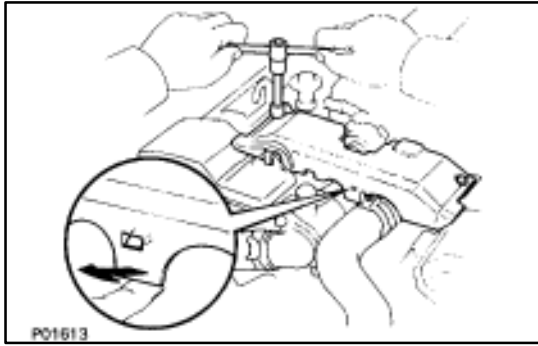
4. DISCONNECT CONTROL CABLES FROM THROTTLE BODY

Disconnect the following cables:

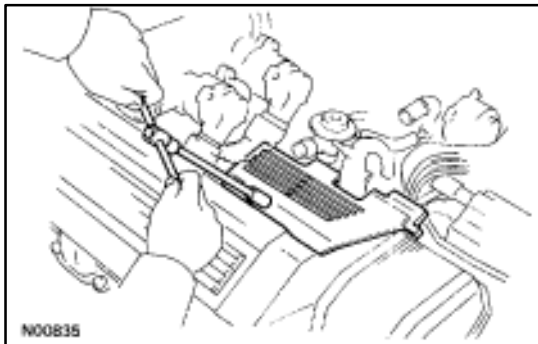
- Accelerator cable
- A/T throttle control cable
- (w/ Cruise Control System)
Cruise control actuator cable

5. REMOVE INTAKE AIR CONNECTOR

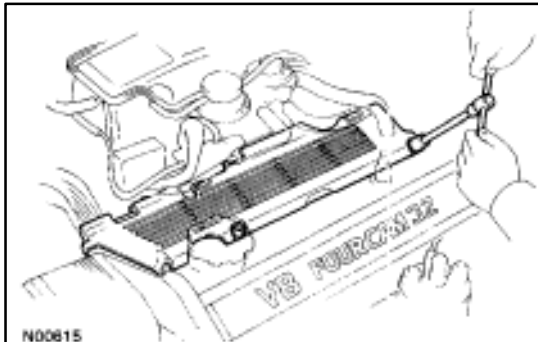
- Disconnect the following hoses:
 - Air hose from ISC valve
 - Air hose (from PS air control valve) from intake air connector
- Remove the bolt holding the intake air connector to the cylinder head cover.
- Loosen the two hose clamps.
- Disconnect the intake air connector from the throttle body and air cleaner hose, and remove the throttle body.

**6. REMOVE UPPER HIGH-TENSION CORD COVER**

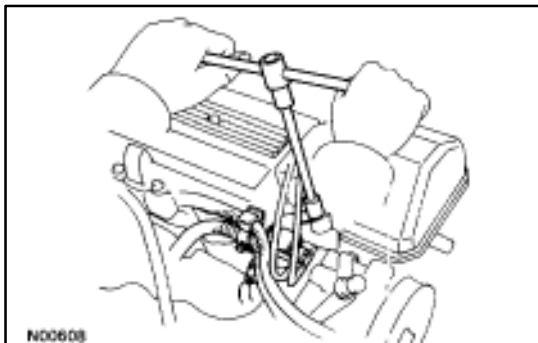
- (a) Remove the two mounting bolts.
- (b) Disconnect the front side claw groove of the cord cover from the claw of the lower cover, and remove the cord cover.

**7. REMOVE RH ENGINE WIRE COVER**

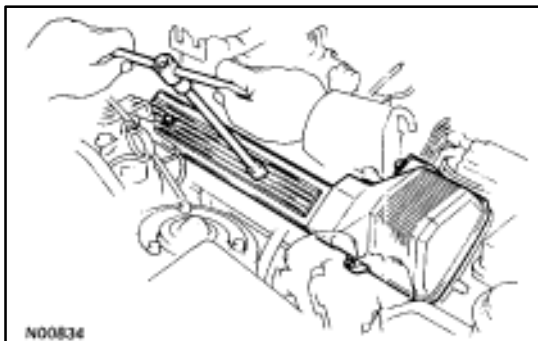
Remove the bolt and engine wire cover.

**8. REMOVE LH ENGINE WIRE COVER**

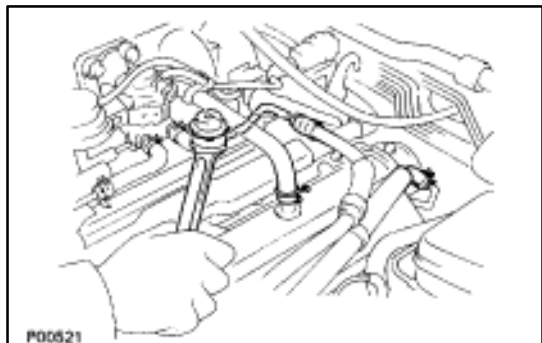
Remove the two bolts and engine wire cover.

**9. REMOVE VSV FOR EVAP SYSTEM**

Remove the two bolts, and disconnect the VSV from cylinder head and timing belt cover.

**10. REMOVE RH NO.3 TIMING BELT COVER**

Remove the three bolts and timing belt cover.

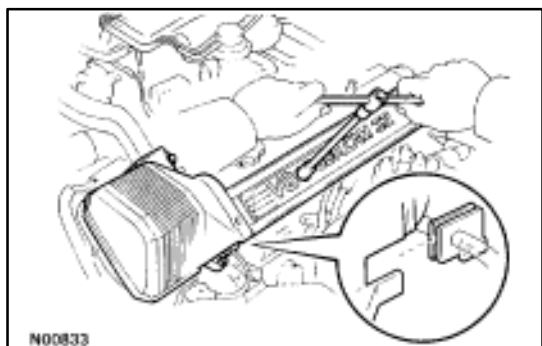


11. DISCONNECT FUEL INLET HOSE FROM LH DELIVERY PIPE

Remove the pulsation damper and two gaskets, and disconnect the inlet hose.

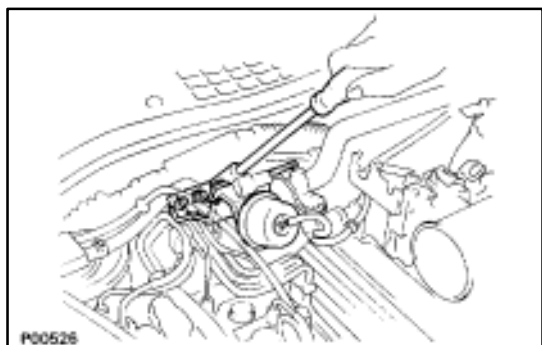
12. DISCONNECT FUEL RETURN HOSE FROM FUEL RETURN PIPE

13. DISCONNECT PCV HOSE FROM LH CYLINDER HEAD



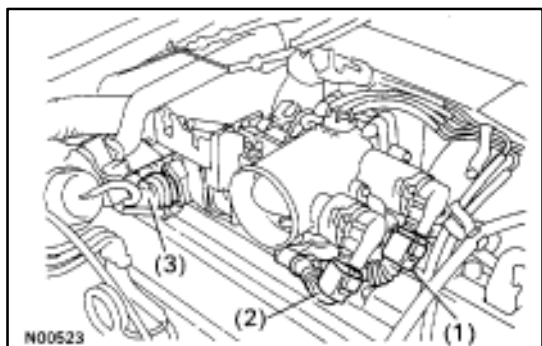
14. REMOVE LH NO.3 TIMING BELT COVER

- (a) Remove the four mounting bolts.
- (b) Disconnect the cord grommet from the timing belt cover, and remove the timing belt cover.
- (c) Remove the cord grommet from the high-tension cord.



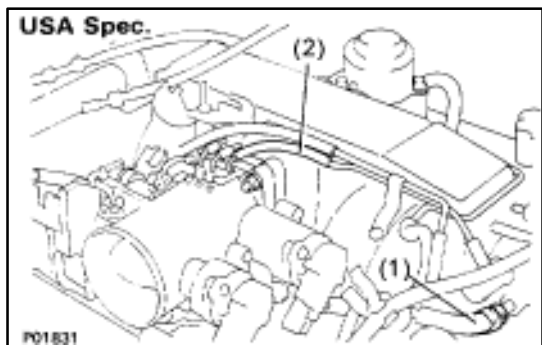
15. DISCONNECT HEATER WATER VALVE FROM BODY

- (a) Disconnect the VSV connector.
- (b) Remove the bolt holding the engine wire clamp to the water valve bracket.
- (c) Remove the two bolts, and disconnect the water valve and bracket assembly.

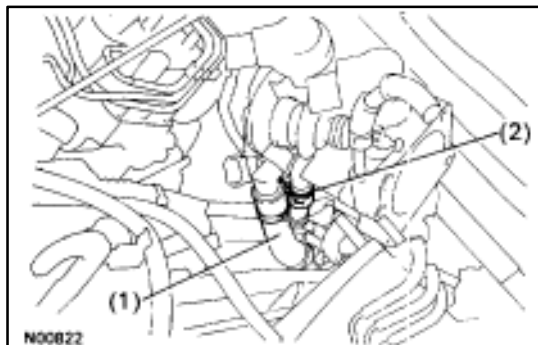
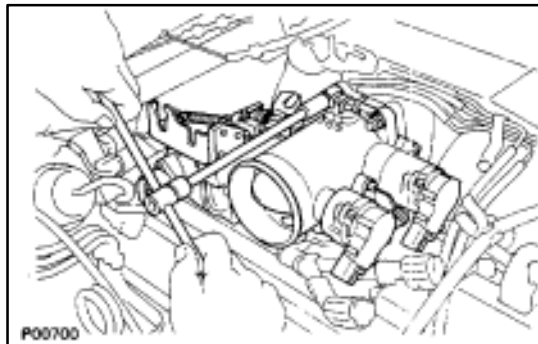
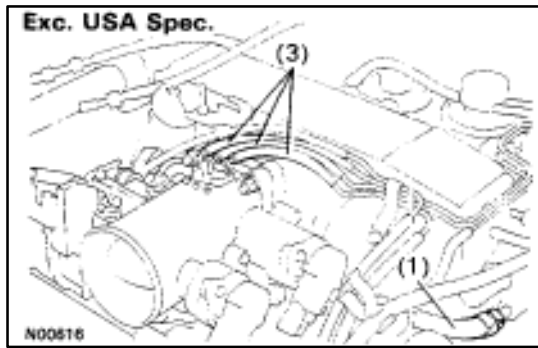


16. REMOVE THROTTLE BODY

- (a) Disconnect the following connectors:
 - (1) Throttle position sensor connector
 - (2) (w/ TRAC)
Sub-throttle position sensor connector
 - (3) (w/ TRAC)
Sub-throttle actuator connector



- (b) Disconnect the following hoses:
 - (1) Water by-pass hose from ISC valve
 - (2) (USA Spec.)
Vacuum hose from throttle body
 - (3) (Exc. USA Spec.)
Three vacuum hoses from throttle body

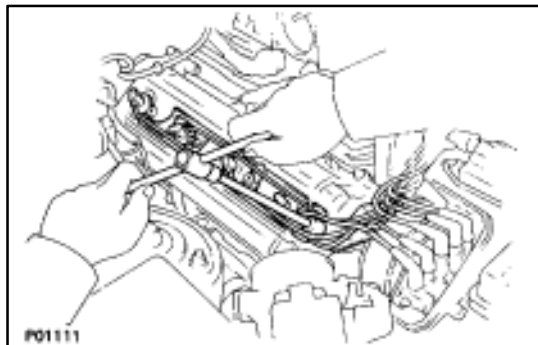


- (c) Remove the two bolts and two nuts, disconnect the throttle body from the air intake chamber.

- (d) Disconnect the following hoses, and remove the throttle body:

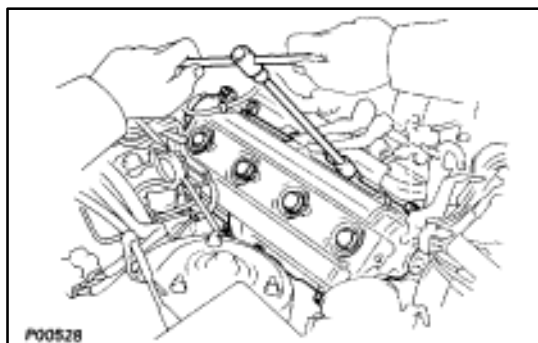
- (1) PCV hose from throttle body
- (2) Water by-pass hose from throttle body

- (e) Remove the throttle body gasket.

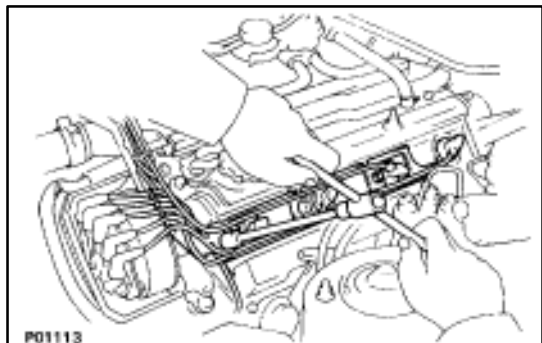


17. REMOVE RH CYLINDER HEAD COVER

- (a) Remove the two bolts holding the cord clamp to the cylinder head.
- (b) Disconnect the high-tension cords from the spark plugs.
- (c) Disconnect the high-tension cords from the front high-tension cord clamp.

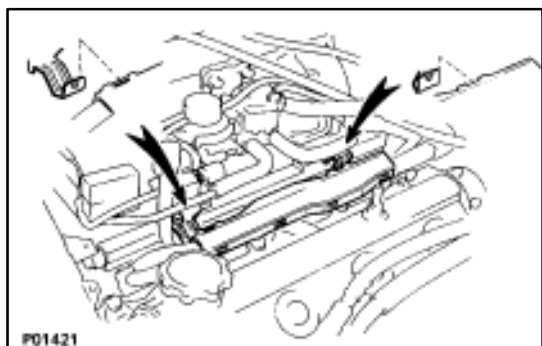


- (d) Remove the eight bolts, seal washers, cylinder head cover and gasket.

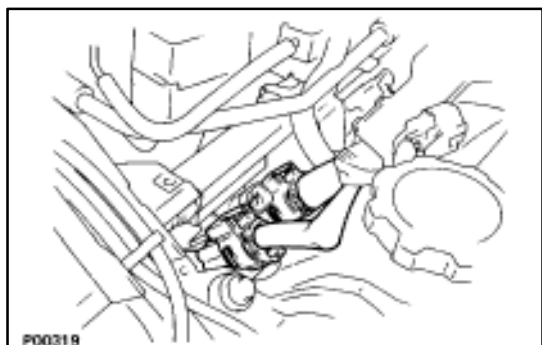


16. REMOVE LH CYLINDER HEAD COVER

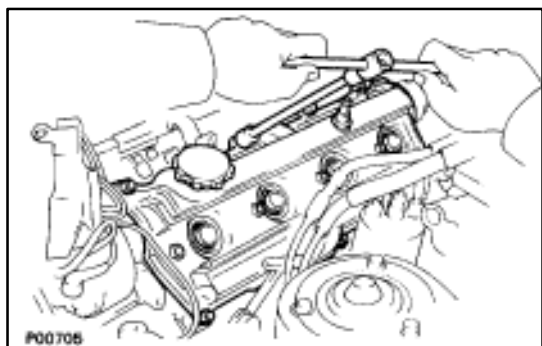
- (a) Remove the two bolts holding the high-tension cord clamp to the cylinder head.
- (b) Disconnect the high-tension cords from the spark plugs.
- (c) Disconnect the high-tension cords from the front high-tension cord clamp.



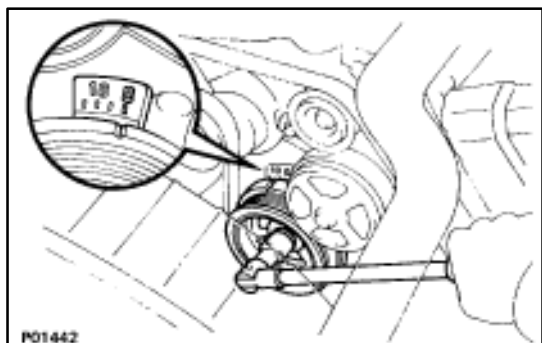
- (d) Disconnect the engine wire from the two wire clamps on the LH delivery pipe.
- (e) Disconnect the four injector connectors.



- (f) Disconnect the two engine wire connectors.

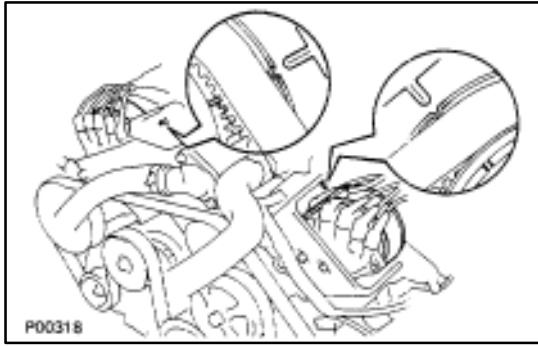


- (g) Remove the eight bolts, seal washers, cylinder head cover and gasket.

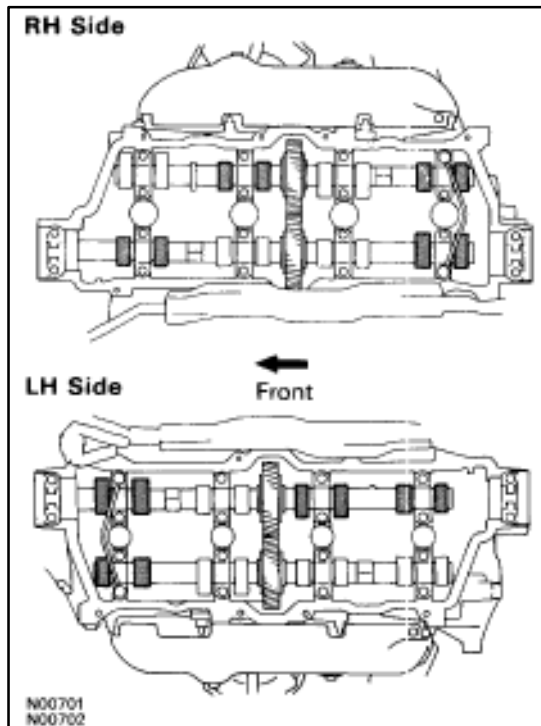


19. SET NO.1 CYLINDER TO TDC/COMPRESSION

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



- (b) Check that the timing marks of the camshaft timing pulleys and timing belt rear plates aligned.
If not, turn the crankshaft one revolution (360°) and align the mark as above.



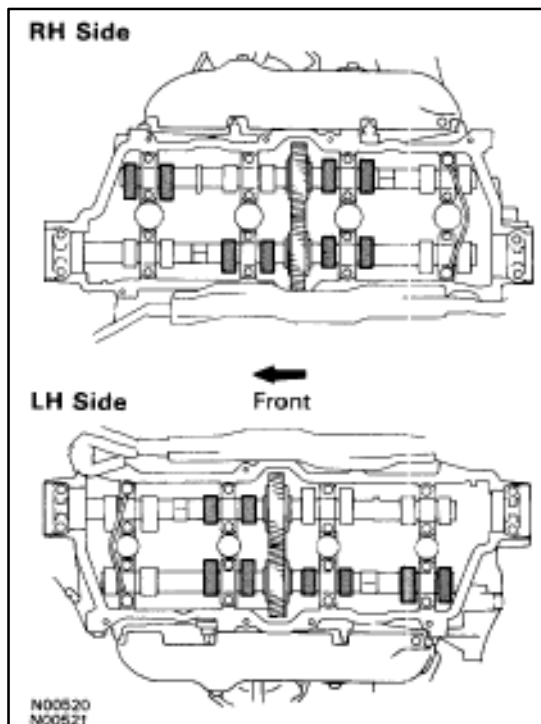
20. INSPECT VALVE CLEARANCE

- (a) Check only those valves indicated.
- Using a feeler gauge, measure the clearance between the valve lifter and camshaft.
 - Record the out-of-specification valve clearance measurements. 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.)



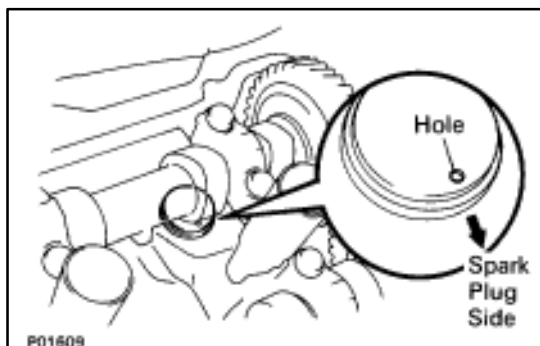
- (b) Turn the crankshaft one revolution (360°), and align the mark as above. (See procedure step in 19 (a))
- (c) Check only the valves indicated as shown. Measure the valve clearance.
(See procedure in step (a))



21. REMOVE THEFT DETERRENT HORN

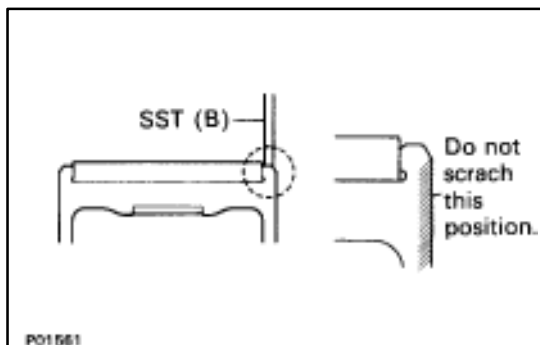
- (a) Disconnect the connector.
- (b) Remove the bolt and theft deterrent horn.

HINT: Remove the deterrent horn when the valve clearance is adjusted for the front portion of the exhaust camshaft on the LH cylinder head.



22. ADJUST VALVE CLEARANCE

- (a) Remove the adjusting shim.
 - Turn the crankshaft, and position the cam lobe of the camshaft on the adjusting valve upward.
 - Position the hole of the adjusting shim toward the spark plug side.



- Press down the valve lifter with SST (A), and place SST (B) between the camshaft and valve lifter flange. Remove SST (A).

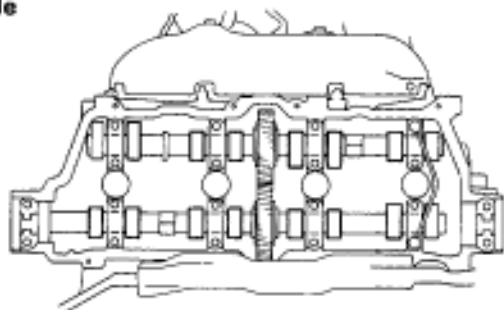
SST 09248-55011

(09248-05011 (A), 09248-05021 (B))

NOTICE: The valve lifter is made of aluminum, which is easily scratched. So when setting SST (B), take care not to scratch the face of the valve lifter.

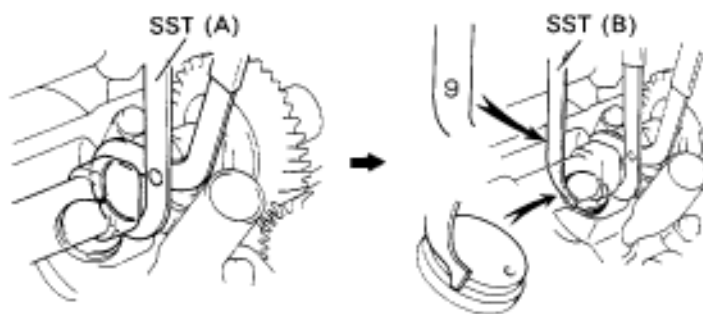
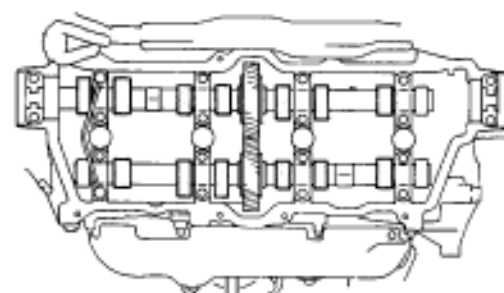
Setting Method for SST for Except Camshaft End Portions

RH Side



LH Side

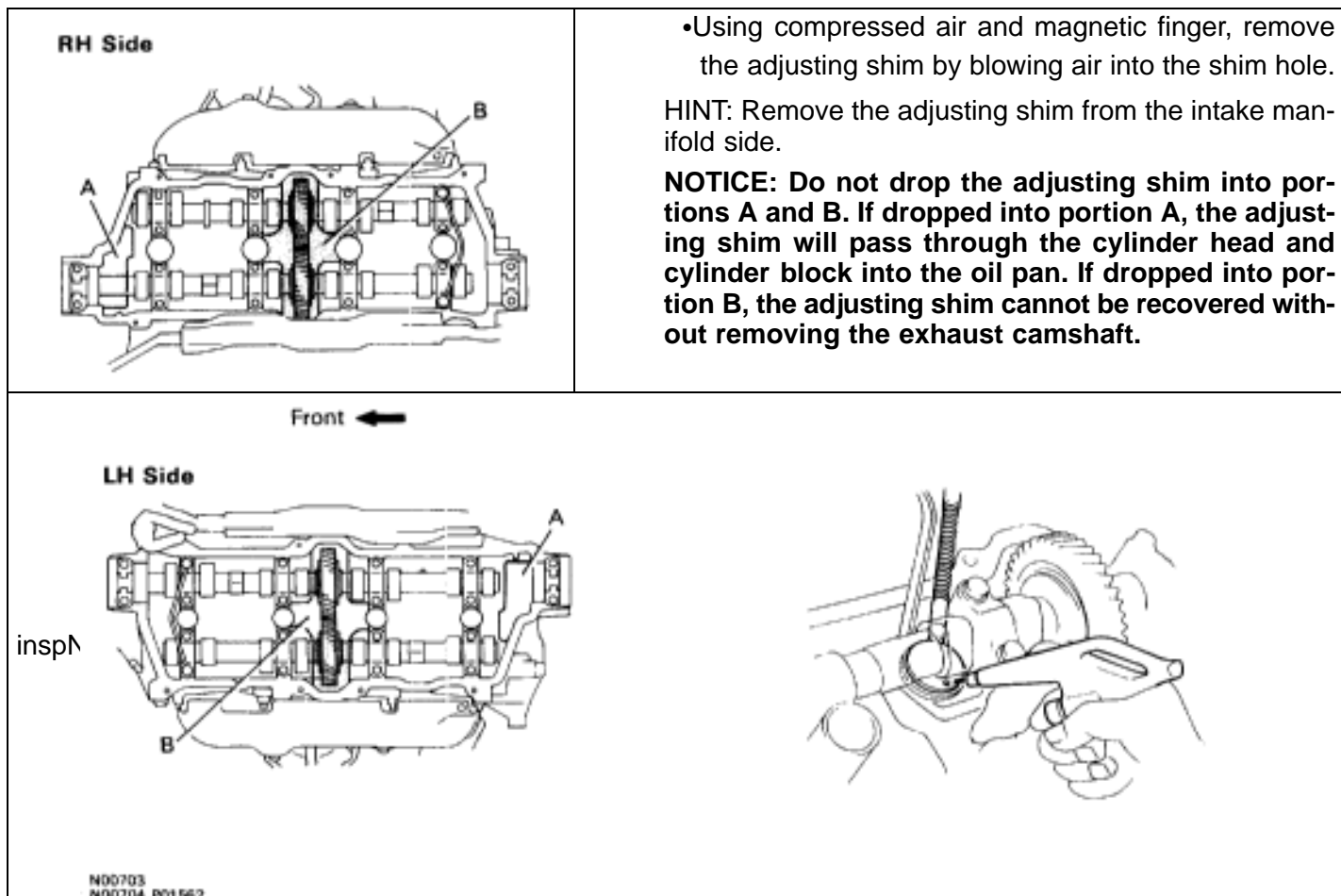
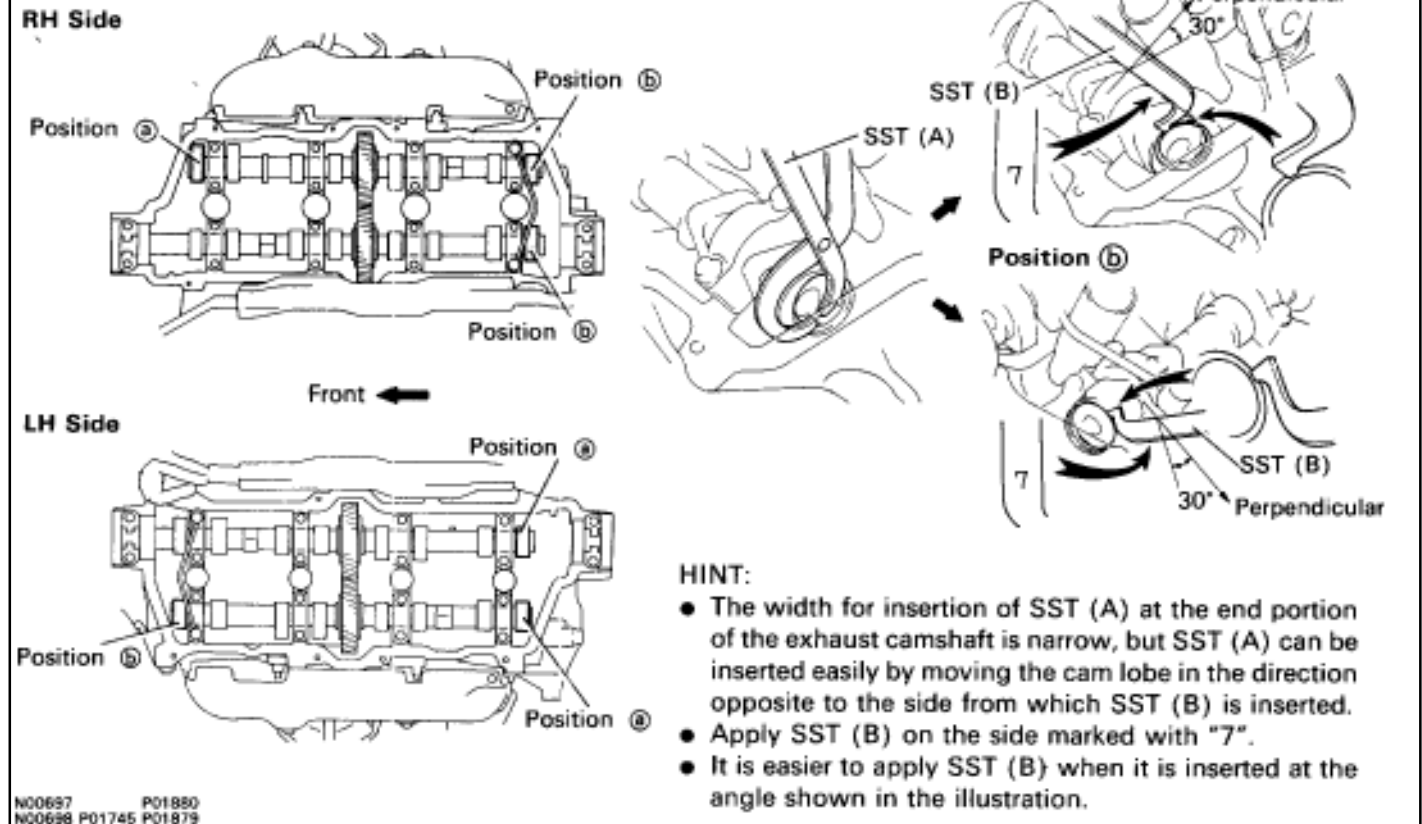
Front ←

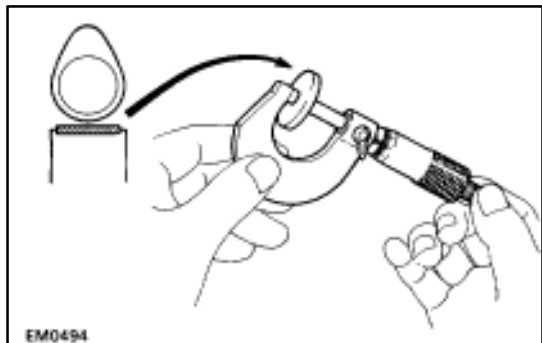


HINT: Apply SST (B) on the side marked with "9".

N00699
N00700 P01746 P01747

Setting Method for SST for Camshaft End Portions





(b) Determine the replacement adjusting shim size 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 $N = T + (A - 0.20 \text{ mm (0.008 in.)})$

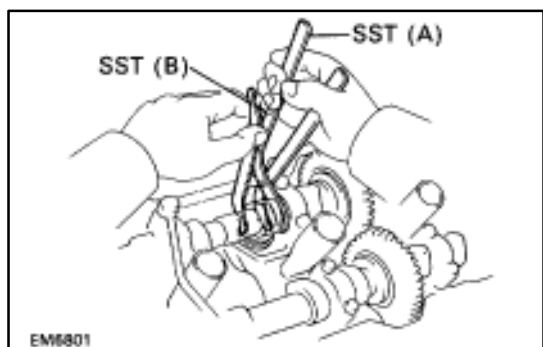
Exhaust $N = T + (A - 0.30 \text{ mm (0.012 in.)})$

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

HINT: Shims are available in thirty-three sizes in increments of 0.025 mm (0.0010 in.), from 2.50 mm (0.0984 in.) to 3.30 mm (0.1299 in.).

(c) Install a new adjusting shim.

- Place a new adjusting shim on the valve lifter.



- Press down the valve lifter with SST (A), and remove SST (B).

SST 09248-55011

(d) Recheck the valve clearance.

Adjusting Shim Selection Chart (Intake)

[illegible]

New shin thickness					
		mm (in.)			
Shin No.	Thickness	Shin No.	Thickness	Shin No.	Thickness
01	2.500 (0.0984)	19	2.775 (0.1093)	48	3.050 (0.1201)
62	2.525 (0.0994)	23	2.800 (0.1102)	75	3.075 (0.1211)
63	2.550 (0.1004)	70	2.825 (0.1112)	81	3.100 (0.1220)
64	2.575 (0.1014)	28	2.850 (0.1122)	76	5 (0.1230)
66	2.600 (0.1024)	71	2.875 (0.1132)	77	3.150 (0.1240)
65	2.625 (0.1033)	33	2.900 (0.1142)	78	3.175 (0.1250)
68	2.650 (0.1043)	72	2.925 (0.1152)	56	3.200 (0.1260)
67	2.675 (0.1053)	38	2.950 (0.1161)	79	3.225 (0.1270)
13	2.700 (0.1063)	73	2.975 (0.1171)	80	3.250 (0.1280)
68	2.725 (0.1073)	43	3.000 (0.1181)	81	3.275 (0.1289)
18	2.750 (0.1083)	74	3.025 (0.1191)	61	3.300 (0.1299)

Adjusting Shim Selection Chart (Exhaust)

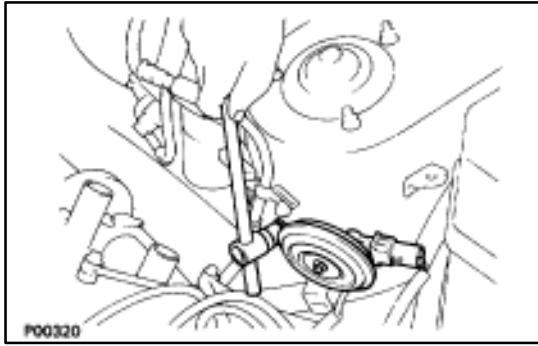
Measured clearance mm (in.)	Installed shim thickness mm (in.)		New shim thickness mm (in.)	
	mm (in.)	mm (in.)	Shim No.	Thickness
0.000 - 0.030 (0.0000 - 0.0012)	0.000 (0.0000)	0.000 (0.0000)	01	2.500 (0.0984)
0.031 - 0.050 (0.0012 - 0.0020)	0.031 (0.0012)	0.031 (0.0012)	02	2.525 (0.0994)
0.051 - 0.070 (0.0020 - 0.0028)	0.051 (0.0020)	0.051 (0.0020)	03	2.550 (0.1004)
0.071 - 0.090 (0.0028 - 0.0035)	0.071 (0.0028)	0.071 (0.0028)	04	2.575 (0.1014)
0.091 - 0.110 (0.0035 - 0.0043)	0.091 (0.0035)	0.091 (0.0035)	05	2.600 (0.1024)
0.111 - 0.130 (0.0043 - 0.0051)	0.111 (0.0043)	0.111 (0.0043)	06	2.625 (0.1033)
0.131 - 0.150 (0.0051 - 0.0059)	0.131 (0.0051)	0.131 (0.0051)	07	2.650 (0.1043)
0.151 - 0.170 (0.0059 - 0.0067)	0.151 (0.0059)	0.151 (0.0059)	08	2.675 (0.1053)
0.171 - 0.190 (0.0067 - 0.0075)	0.171 (0.0067)	0.171 (0.0067)	09	2.700 (0.1063)
0.191 - 0.210 (0.0075 - 0.0083)	0.191 (0.0075)	0.191 (0.0075)	10	2.725 (0.1073)
0.211 - 0.230 (0.0083 - 0.0091)	0.211 (0.0083)	0.211 (0.0083)	11	2.750 (0.1083)
0.231 - 0.249 (0.0091 - 0.0098)	0.231 (0.0091)	0.231 (0.0091)	12	2.775 (0.1093)
0.250 - 0.269 (0.0098 - 0.0106)	0.250 (0.0098)	0.250 (0.0098)	13	2.800 (0.1102)
0.270 - 0.289 (0.0106 - 0.0114)	0.270 (0.0106)	0.270 (0.0106)	14	2.825 (0.1112)
0.290 - 0.309 (0.0114 - 0.0122)	0.290 (0.0114)	0.290 (0.0114)	15	2.850 (0.1122)
0.310 - 0.329 (0.0122 - 0.0130)	0.310 (0.0122)	0.310 (0.0122)	16	2.875 (0.1132)
0.330 - 0.349 (0.0130 - 0.0138)	0.330 (0.0130)	0.330 (0.0130)	17	2.900 (0.1142)
0.350 - 0.369 (0.0138 - 0.0146)	0.350 (0.0138)	0.350 (0.0138)	18	2.925 (0.1152)
0.370 - 0.389 (0.0146 - 0.0154)	0.370 (0.0146)	0.370 (0.0146)	19	2.950 (0.1162)
0.390 - 0.410 (0.0154 - 0.0161)	0.390 (0.0154)	0.390 (0.0154)	20	2.975 (0.1172)
0.411 - 0.430 (0.0161 - 0.0169)	0.411 (0.0161)	0.411 (0.0161)	21	3.000 (0.1182)
0.431 - 0.450 (0.0169 - 0.0177)	0.431 (0.0169)	0.431 (0.0169)	22	3.025 (0.1192)
0.451 - 0.470 (0.0177 - 0.0185)	0.451 (0.0177)	0.451 (0.0177)	23	3.050 (0.1201)
0.471 - 0.490 (0.0185 - 0.0193)	0.471 (0.0185)	0.471 (0.0185)	24	3.075 (0.1211)
0.491 - 0.510 (0.0193 - 0.0201)	0.491 (0.0193)	0.491 (0.0193)	25	3.100 (0.1220)
0.511 - 0.530 (0.0201 - 0.0209)	0.511 (0.0201)	0.511 (0.0201)	26	3.125 (0.1230)
0.531 - 0.550 (0.0209 - 0.0217)	0.531 (0.0209)	0.531 (0.0209)	27	3.150 (0.1240)
0.551 - 0.570 (0.0217 - 0.0225)	0.551 (0.0217)	0.551 (0.0217)	28	3.175 (0.1250)
0.571 - 0.590 (0.0225 - 0.0233)	0.571 (0.0225)	0.571 (0.0225)	29	3.200 (0.1260)
0.591 - 0.610 (0.0233 - 0.0240)	0.591 (0.0233)	0.591 (0.0233)	30	3.225 (0.1270)
0.611 - 0.630 (0.0240 - 0.0248)	0.611 (0.0240)	0.611 (0.0240)	31	3.250 (0.1280)
0.631 - 0.650 (0.0248 - 0.0256)	0.631 (0.0248)	0.631 (0.0248)	32	3.275 (0.1289)
0.651 - 0.670 (0.0256 - 0.0264)	0.651 (0.0256)	0.651 (0.0256)	33	3.300 (0.1299)
0.671 - 0.690 (0.0264 - 0.0272)	0.671 (0.0264)	0.671 (0.0264)	34	3.325 (0.1309)
0.691 - 0.710 (0.0272 - 0.0280)	0.691 (0.0272)	0.691 (0.0272)	35	3.350 (0.1319)
0.711 - 0.730 (0.0280 - 0.0287)	0.711 (0.0280)	0.711 (0.0280)	36	3.375 (0.1329)
0.731 - 0.750 (0.0287 - 0.0295)	0.731 (0.0287)	0.731 (0.0287)	37	3.400 (0.1339)
0.751 - 0.770 (0.0295 - 0.0303)	0.751 (0.0295)	0.751 (0.0295)	38	3.425 (0.1349)
0.771 - 0.790 (0.0303 - 0.0311)	0.771 (0.0303)	0.771 (0.0303)	39	3.450 (0.1359)
0.791 - 0.810 (0.0311 - 0.0319)	0.791 (0.0311)	0.791 (0.0311)	40	3.475 (0.1369)
0.811 - 0.830 (0.0319 - 0.0327)	0.811 (0.0319)	0.811 (0.0319)	41	3.500 (0.1379)
0.831 - 0.850 (0.0327 - 0.0335)	0.831 (0.0327)	0.831 (0.0327)	42	3.525 (0.1389)
0.851 - 0.870 (0.0335 - 0.0343)	0.851 (0.0335)	0.851 (0.0335)	43	3.550 (0.1399)
0.871 - 0.890 (0.0343 - 0.0351)	0.871 (0.0343)	0.871 (0.0343)	44	3.575 (0.1409)
0.891 - 0.910 (0.0351 - 0.0359)	0.891 (0.0351)	0.891 (0.0351)	45	3.600 (0.1419)
0.911 - 0.930 (0.0359 - 0.0367)	0.911 (0.0359)	0.911 (0.0359)	46	3.625 (0.1429)
0.931 - 0.950 (0.0367 - 0.0375)	0.931 (0.0367)	0.931 (0.0367)	47	3.650 (0.1439)
0.951 - 0.970 (0.0375 - 0.0383)	0.951 (0.0375)	0.951 (0.0375)	48	3.675 (0.1449)
0.971 - 0.990 (0.0383 - 0.0391)	0.971 (0.0383)	0.971 (0.0383)	49	3.700 (0.1459)
0.991 - 1.010 (0.0391 - 0.0399)	0.991 (0.0391)	0.991 (0.0391)	50	3.725 (0.1469)
1.011 - 1.030 (0.0399 - 0.0406)	1.011 (0.0399)	1.011 (0.0399)	51	3.750 (0.1479)
1.031 - 1.050 (0.0406 - 0.0413)	1.031 (0.0406)	1.031 (0.0406)	52	3.775 (0.1489)
1.051 - 1.070 (0.0413 - 0.0421)	1.051 (0.0413)	1.051 (0.0413)	53	3.800 (0.1499)
1.071 - 1.090 (0.0421 - 0.0429)	1.071 (0.0421)	1.071 (0.0421)	54	3.825 (0.1509)
1.091 - 1.110 (0.0429 - 0.0437)	1.091 (0.0429)	1.091 (0.0429)	55	3.850 (0.1519)
1.111 - 1.130 (0.0437 - 0.0445)	1.111 (0.0437)	1.111 (0.0437)	56	3.875 (0.1529)
1.131 - 1.150 (0.0445 - 0.0453)	1.131 (0.0445)	1.131 (0.0445)	57	3.900 (0.1539)

Exhaust valve clearance (Cold):

0.25 - 0.35 mm (0.010 - 0.014 in.)

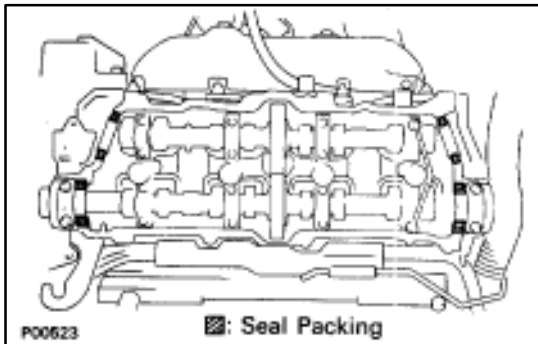
EXAMPLE: The 2.800 mm (0.1102 in.) shim is installed, and the measured clearance is 0.440 mm (0.0173 in.). Replace the 2.800 mm (0.1102 in.) shim with a No.38 shim.

Shim No.	Thickness	Shim No.	Thickness	Shim No.	Thickness
01	2.500 (0.0984)	19	2.775 (0.1093)	48	3.050 (0.1201)
02	2.525 (0.0994)	23	2.800 (0.1102)	51	3.075 (0.1211)
03	2.550 (0.1004)	28	2.825 (0.1112)	55	3.100 (0.1220)
04	2.575 (0.1014)	33	2.850 (0.1122)	56	3.125 (0.1230)
05	2.600 (0.1024)	38	2.875 (0.1132)	57	3.150 (0.1240)
06	2.625 (0.1033)	42	2.900 (0.1142)	58	3.175 (0.1250)
07	2.650 (0.1043)	47	2.925 (0.1152)	59	3.200 (0.1260)
08	2.675 (0.1053)	51	2.950 (0.1161)	60	3.225 (0.1270)
13	2.700 (0.1063)	56	2.975 (0.1171)	61	3.250 (0.1280)
18	2.725 (0.1073)	61	3.000 (0.1181)	62	3.275 (0.1289)
19	2.750 (0.1083)	66	3.025 (0.1191)	63	3.300 (0.1299)



23. REINSTALL THEFT DETERRENT HORN

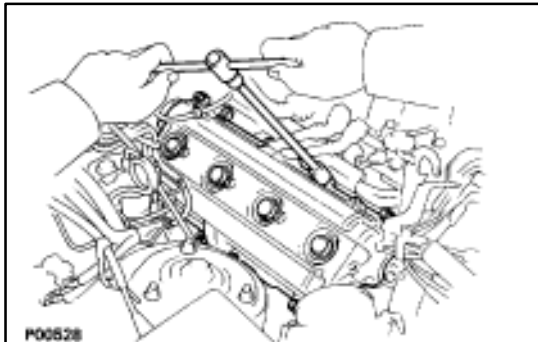
- (a) Install the theft deterrent horn with the bolt.
- (b) Connect the connector.



24. REINSTALL RH CYLINDER HEAD COVER

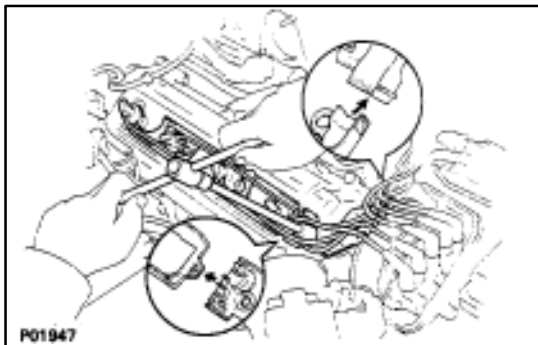
- (a) Remove any oil packing (FIPG) material.
- (b) Apply seal packing to the cylinder head as shown in the illustration.

Seal packing: Part No. 08826-00080 or equivalent



- (c) Install the gasket to the cylinder head cover.
- (d) Install the seal washer to the mounting bolt.
- (e) Install the cylinder head cover with the eight bolts.

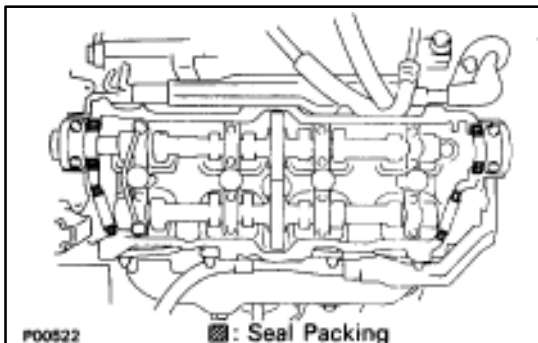
Torque: 5.9 N·m (60 kgf·cm, 52 in·lbf)



- (g) Connect the four high-tension cords to the spark plugs.
- (h) Install the rear and front high-tension cord clamps with the two bolts.

HINT: Place the front and rear ends of the front high-tension cord clamp on the rear high-tension cord clamp and lower high-tension cord cover.

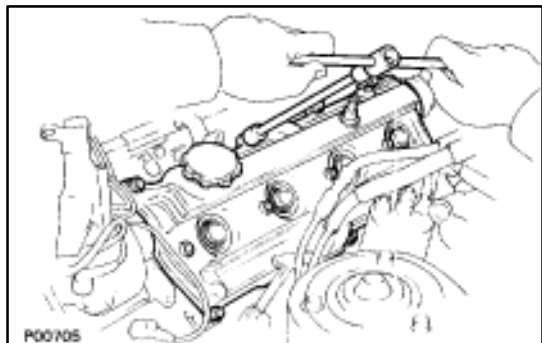
- (i) Fit the high-tension cords to the high-tension cord clamps. (See page [IG-16](#))



25. REINSTALL LH CYLINDER HEAD COVER

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

Seal packing: Part No. 08826-00080 or equivalent

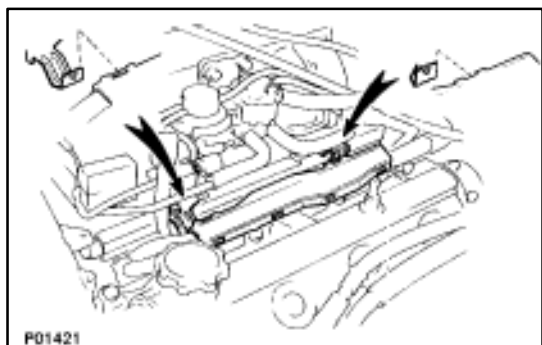


- (c) Install the gasket to the cylinder head cover.
- (d) Install the seal washer to the mounting bolt.
- (e) Install the cylinder head cover with the eight bolts.

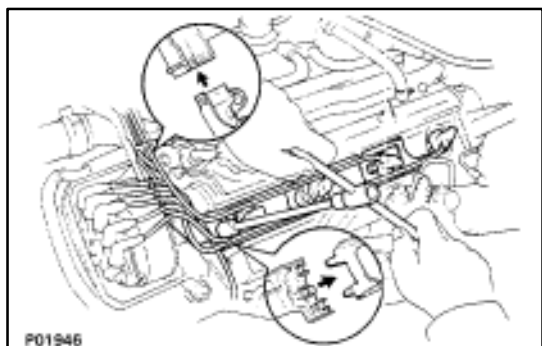
Torque: 5.9 N·m (60 kgf·cm, 52 in.·lbf)



- (f) Connect the two engine wire connectors.
- (g) Connect the four injector connectors.



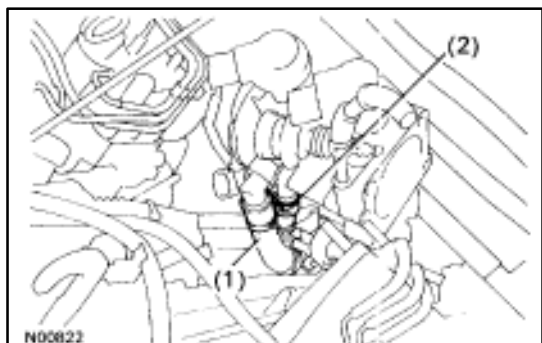
- (h) Install the engine wire to the two wire clamps on the delivery pipe.



- (i) Connect the four high-tension cords to the spark plugs.
- (j) Install the rear and front high-tension cord clamps with the two bolts.

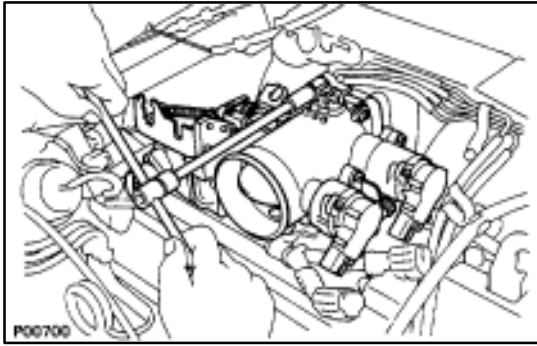
HINT: Place the front and rear ends of the front high-tension cord clamp on the rear high-tension cord clamp and lower high-tension cord cover.

- (k) Fit the high-tension cords to the high-tension cord clamps. (See page [IG-16](#))



26. REINSTALL THROTTLE BODY

- (a) Connect the following hoses:
 - (1) PCV hose from throttle body
 - (2) Water by-pass hose from throttle body

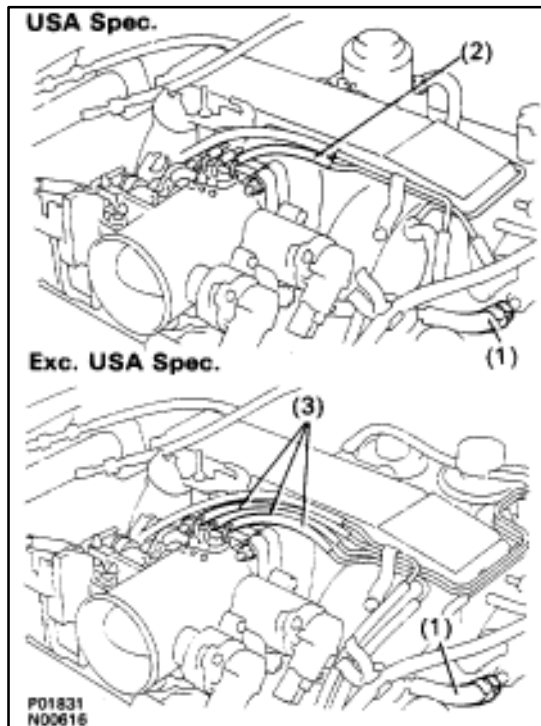


- (b) Install a new gasket and throttle body with the two bolts and two nuts.

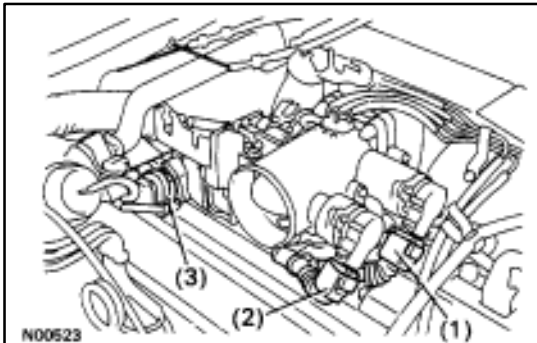
Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)

HINT: Use bolts 40 mm (1.57 in.) in length.

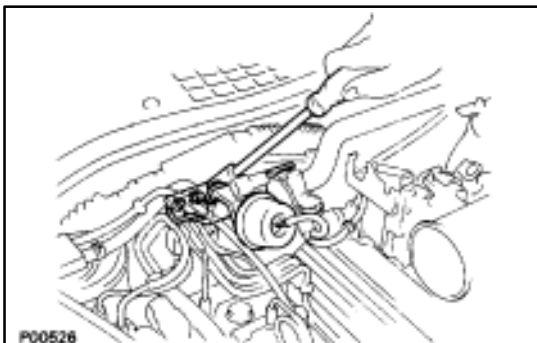
- (c) Install the water by-pass pipe (from rear water by-pass joint) to the clamp on the engine wire cover.



- (d) Connect the following hoses:
- (1) Water by-pass hose to the ISC valve
 - (2) (USA Spec.)
Vacuum hose to throttle body
 - (3) (Exc. USA Spec.)
Three vacuum hoses to throttle body

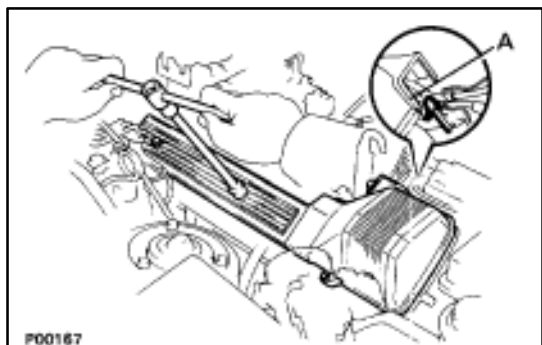


- (e) Connect the following connectors:
- (1) Throttle position sensor connector
 - (2) (w/ TRAC)
Sub-throttle position sensor connector
 - (3) (w/ TRAC)
Sub-throttle actuator

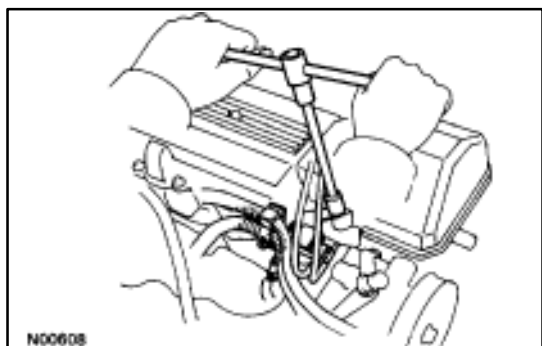


27. REINSTALL HEATER WATER VALVE

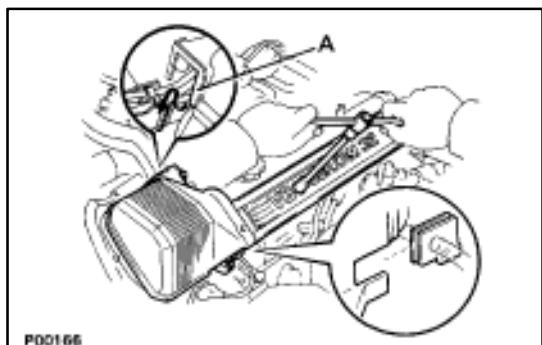
- (a) Install the water valve and bracket assembly with the two bolts.
- (b) Install the engine wire clamp with the bolt.
- (c) Connect the VSV connector.

**28. REINSTALL RH NO.3 TIMING BELT COVER**

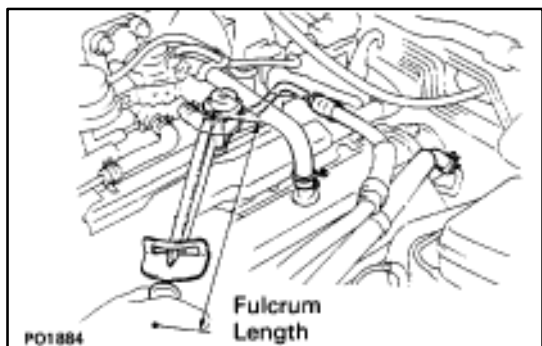
- (a) Install the three gaskets to the timing belt cover.
- (b) Fit portion A of the timing belt cover, matching it with the lower high-tension cord cover.
- (c) Install the timing belt cover with the three bolts.

**29. REINSTALL VSV FOR EVAP SYSTEM**

Install the VSV with the two bolts.

**30. REINSTALL LH NO.3 TIMING BELT COVER**

- (a) Install the three gaskets to the timing belt cover.
- (b) Install the cord grommet to the high-tension cord.
- (c) Install the cord grommet to the timing belt cover.
- (d) Fit portion A of the timing belt cover, matching it with the lower high-tension cord cover.
- (e) Install the timing belt cover with the three bolts.

**31. RECONNECT PCV HOSE TO LH CYLINDER HEAD****32. RECONNECT FUEL RETURN HOSE TO FUEL RETURN PIPE****33. RECONNECT FUEL INLET HOSE TO LH DELIVERY PIPE**

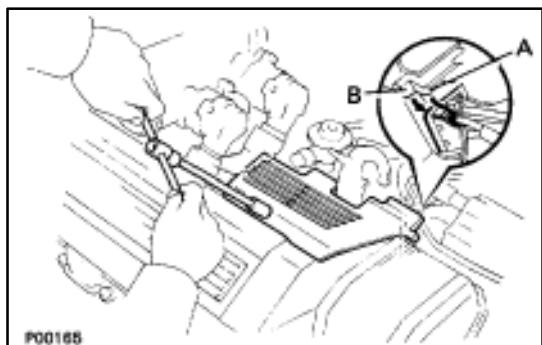
Connect the inlet hose with two new gaskets and the pulsation damper.

SST 09612-24014 (09617-24011)

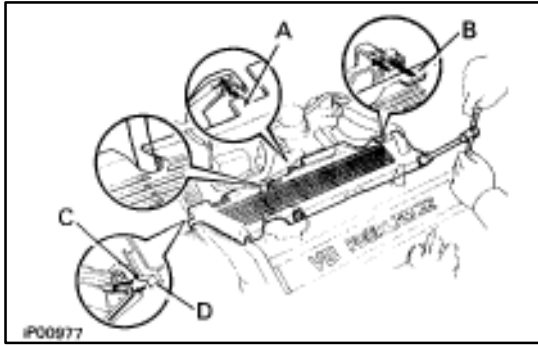
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

33 N·m (340 kgf·cm, 24 ft·lbf) for SST

HINT: Use a torque wrench with a fulcrum length of 30 cm (11.81 in.)

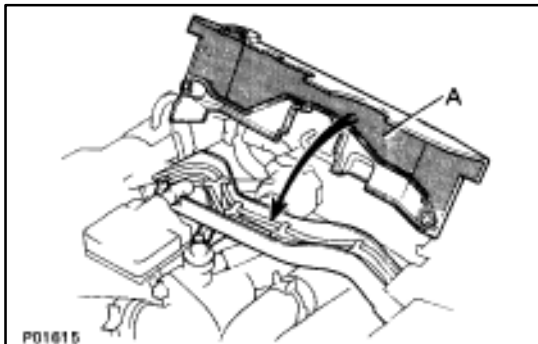
**34. REINSTALL RH ENGINE WIRE COVER**

- (a) Fit portions A and B of the engine wire cover, matching them with the lower high-tension cord cover and No.3 timing belt cover.
- (b) Install the engine wire cover with the bolt.



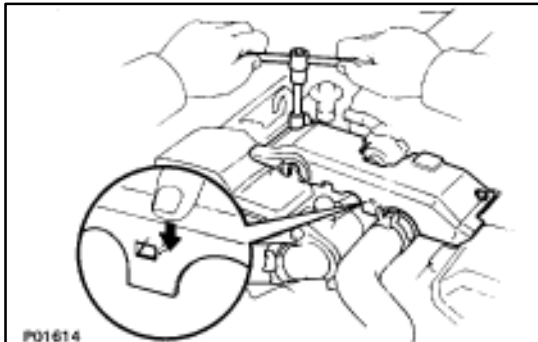
35. REINSTALL LH ENGINE WIRE COVER

- (a) Connect portions A and B engine wire cover to the wire brackets.
- (b) Set the VSV (for fuel pressure control system) wire in original position.
- (c) Fit portions C and D of the engine wire cover, matching them with the lower high-tension cord cover and No.3 timing belt cover.
- (d) Install the engine wire cover with the two bolts.

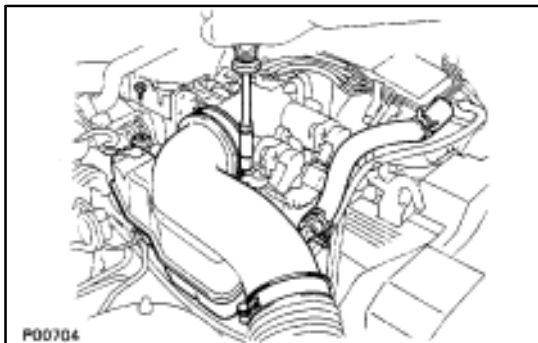


36. REINSTALL UPPER HIGH-TENSION CORD COVER

- (a) Fit portion A of the upper high-tension cover, matching the top of the lower high-tension cord cover.

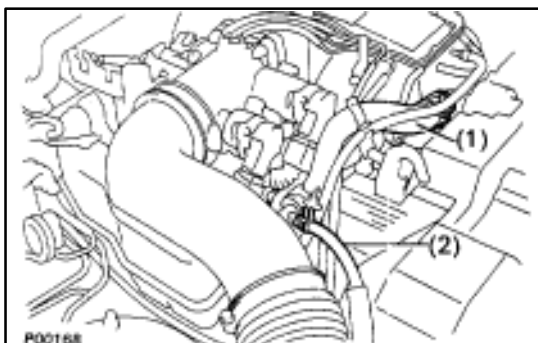


- (b) Push the front side of the upper high-tension cord cover, and connect the front side claw groove of the upper high-tension cord cover to the claw of the lower high-tension cord cover.
- (c) Install the upper high-tension cord cover with the two bolts.

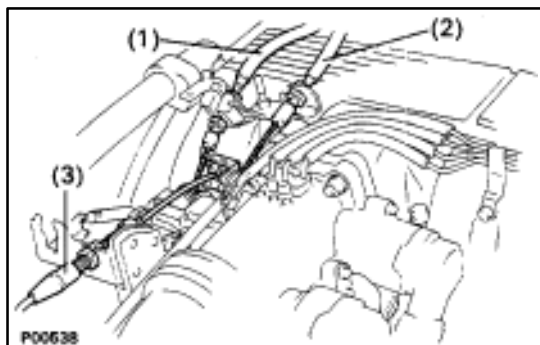


37. REINSTALL INTAKE AIR CONNECTOR

- (a) Connect the end portions of the intake air connector to the throttle body and air cleaner hose.
- (b) Tighten the two hose clamps.
- (c) Install the bolt holding the intake air connector to the cylinder head cover.



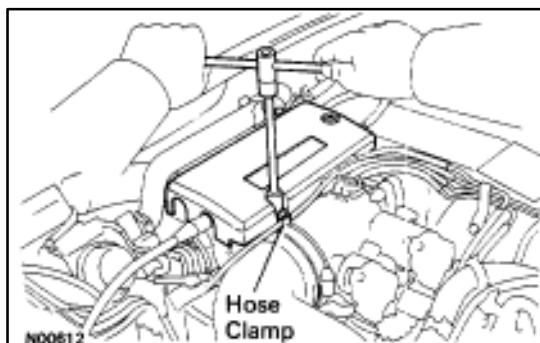
- (d) Connect the following hoses:
 - (1) Air hose to ISC to ISC valve
 - (2) Air hose (from PS air control valve) to intake air connector



38. RECONNECT CONTROL CABLES TO THROTTLE BODY

Connect the following hoses:

- (1) Accelerator cable
- (2) A/T throttle control cable
- (3) (w/ Cruise Control System)
Cruise control actuator cable

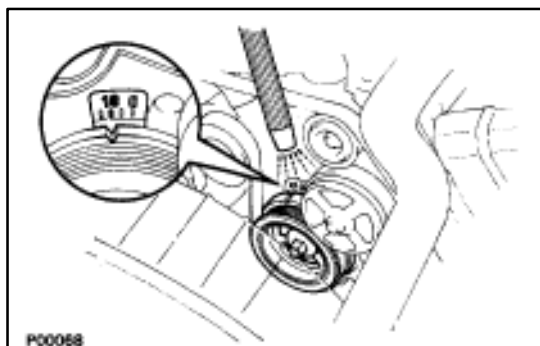


39. REINSTALL THROTTLE BODY COVER

Install the throttle body cover and hose clamp with the two bolts and cap nut.

40. RECONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

41. FILL WITH ENGINE COOLANT (See page [CO-7](#))



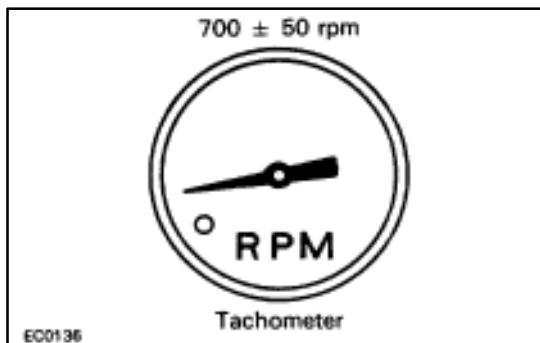
INSPECTION OF IGNITION TIMING

(See page [IG-28](#))

Ignition timing:

8–12° BTDC @ idle

(w/ Terminals TE1 and E1 connected)



INSPECTION OF IDLE SPEED

HINT:

- Initial conditions (See step 1 on page [EM-28](#))
- Set the tachometer to the 4-cylinder range.

Idle speed: 700 ± 50 rpm

IDLE AND/OR 2,500 RPM HC/CO CONCENTRATION CHECK METHOD

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

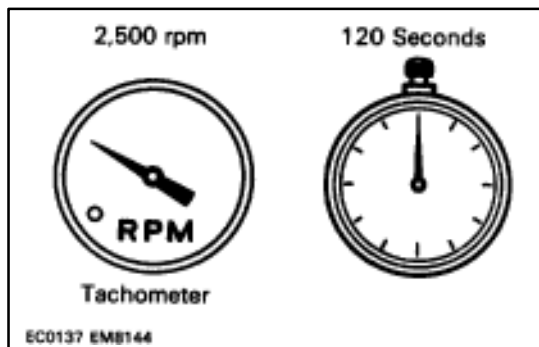
1. INTIAL CONDITIONS

- (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.

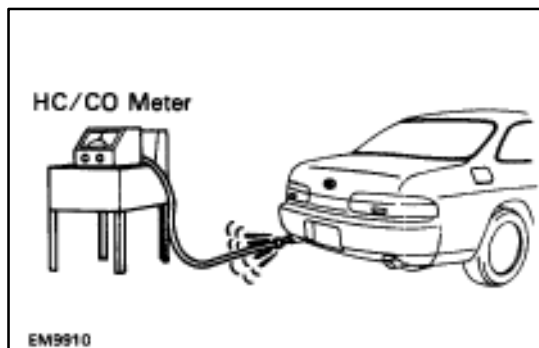
HINT: All vacuum hoses for EGR systems, etc. should be properly connected.

- (f) EFI system wiring connectors fully plugged.
- (g) Transmission in neutral range.
- (h) Tachometer and HC/CO meter calibrated at hand.

2. START ENGINE



3. RACE ENGINE AT 2,500 PRM FOR APPROX. 120 SECONDS



4. INSERT HC/CO METER TESTING PROBE INTO TAILPIPE AT LEAST 40 cm (1.3 ft)

5. CHECK HC/CO CONCENTRATION AT IDLE AND/OR 2,500 PRM

Complete the measuring within three times.

HINT: When performing the 2 mode (2,500 rpm and idle) test, follow the measurement order prescribed by the regulations.

If the HC/CO concentration at 2,500 rpm does not comply with regulations, try the following procedure.

Race the engine again at 2,500 rpm for approx. 1 minute and quickly repeat steps 4 and 5 above.

This may correct the problem.

Troubleshooting

If the HC/CO concentration does not comply with regulations, perform troubleshooting in the order given below.

(a) Check oxygen sensor operation.

(See page [FI-113](#))

(b) See the table below for possible cause, and then inspect and correct the applicable causes if necessary.

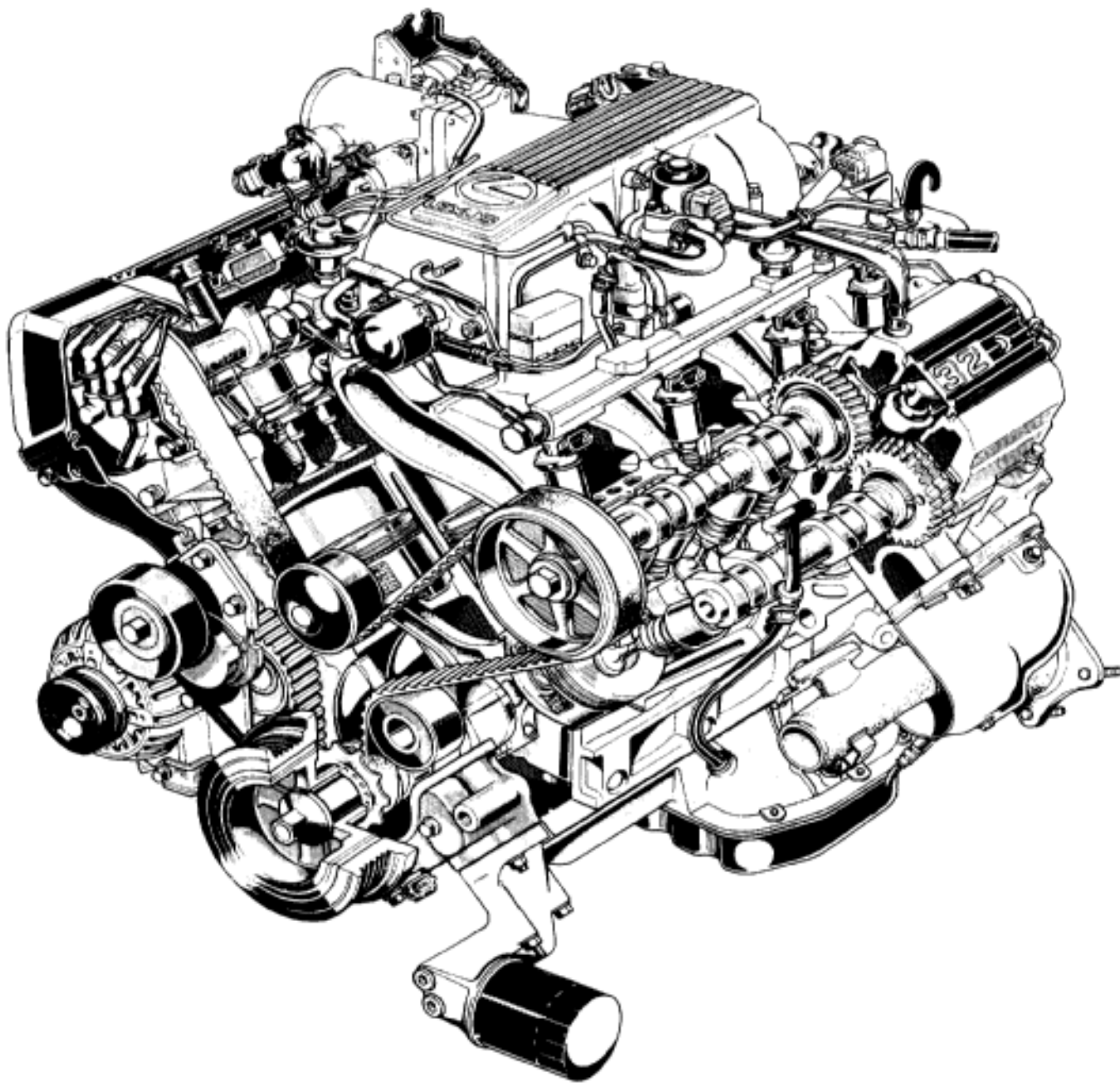
HC	CO	Symptoms	Cause
High	Normal	Rough idle	1. Faulty ignitions: <ul style="list-style-type: none"> • Incorrect timing • Fouled, shorted or improperly gapped plugs • Open or crossed high-tension cords • Cracked distributor cap 2. Incorrect valve clearance 3. Leaky EGR valve 4. Leaky intake and exhaust valves 5. Leaky cylinders
High	Low	Rough idle (Fluctuating HC reading)	1. Vacuum leaks: <ul style="list-style-type: none"> • PCV hoses • EGR valve • Intake manifold • Air intake chamber • Throttle body • ISC valve • Brake booster line 2. Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	1. Clogged air filter 2. Faulty EFI systems: <ul style="list-style-type: none"> • Faulty pressure regulator • Clogged fuel return line • Defective water temp. sensor • Defective air temp. sensor • Faulty ECU • Faulty injectors • Faulty cold start injector • Faulty throttle position sensor • Faulty air flow meter

DESCRIPTION

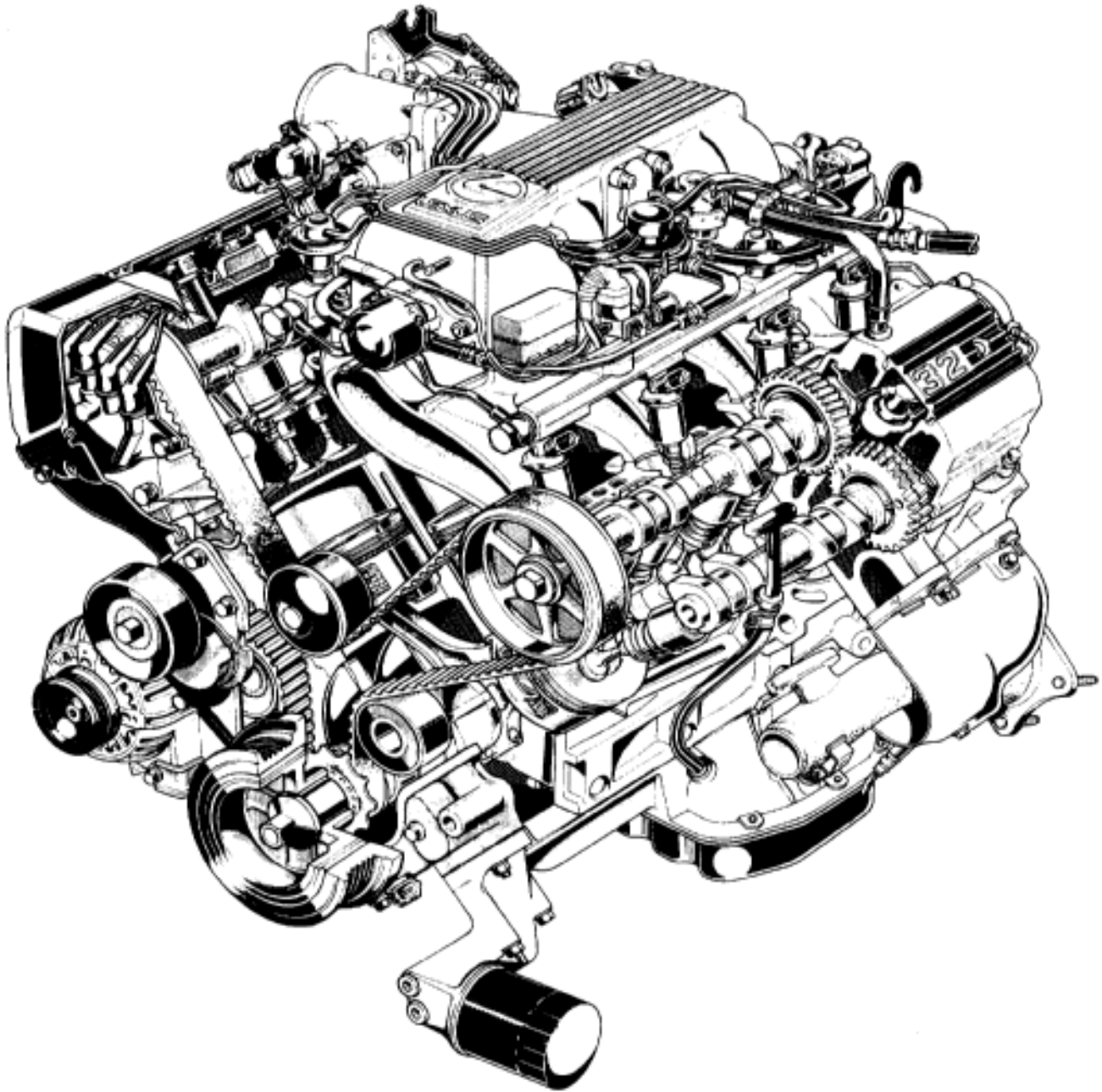
The 1UZ-FE engine is an V-8 4.0 liter DOHC 32 valve engine.

OPERATION

USA Spec.



Exc. USA Spec.



The 1 UZ-FE engine has 8-cylinders in a V-arrangement at a bank angle of 90°. From the front of the RH bank cylinders are numbered 2-4-6-8, and from the front of the LH bank cylinders are numbered 1 -3-5-7. The crankshaft is supported by 5 bearings specified by the inside of the crankcase. These bearings are made of a copper and lead alloy.

The crankshaft is integrated with 8 weights which are cast along with it for balancing. Oil holes are built into the center of the crankshaft for supplying oil to the connecting rods, pistons and other components.

The ignition order is 1-8-4-3-6-5-7-2. The cylinder head is made of aluminum alloy, with a cross flow type intake and exhaust layout and with pent-roof type combustion chambers. The spark plugs are located in the center of the combustion chambers.

At the front and rear of the intake manifold, a water passage has been provided which connects the RH and LH cylinder heads.

Exhaust and intake valves are equipped with irregular pitch springs made of special valve spring carbon steel which are capable of following no matter what the engine speed.

The RH and LH intake camshafts are driven by a single timing belt, and a gear on the intake camshaft engages with a gear on the exhaust camshaft to drive it. The camshaft journal is supported at 5 (intake) or 4 (exhaust) places between the valve lifters of each cylinder and on the front end of the cylinder head. Lubrication of the cam journal gear is accomplished by oil being supplied through the oiler port in the center of the camshaft.

Adjustment of the valve clearance is done by means of an outer shim type system, in which valve adjusting shims are located above the valve lifters. This permits replacement of the shims without removal of the camshafts.

Pistons are made of high temperature-resistant aluminum alloy, and a depression is built into the piston head to prevent interference with valves.

Piston pins are the full-floating type, with the pins fastened to neither the piston boss nor the connecting rods. Instead, snap rings are fitted on both ends of the pins, preventing the pins from falling out.

The No.1 compression ring is made of steel and the No.2 compression ring is made of cast iron. The oil ring is made of a combination of steel and stainless steel. The outer diameter of each piston ring is slightly larger than the diameter of the piston and the flexibility of the rings allows them to hug the cylinder walls when they are mounted on the piston. Compression rings No.1 and No.2 work to prevent the leakage of gas from the cylinder and the oil ring works to scrape oil off the cylinder walls to prevent it from entering the combustion chamber.
















The cylinder block is made of aluminum alloy with a bank angle of 90°. Cast iron cylinders are installed inside the cylinder block. It has 8 cylinders which are approximately twice the length of the piston stroke. The top of each cylinder is closed off by the cylinder heads and the lower end of the cylinders becomes the crankcase, in which the crankshaft is installed. In addition, the cylinder block contains a water jacket, through which coolant is pumped to cool the cylinders.

The No.1 and No.2 oil pans are bolted onto the bottom of the cylinder block. The No.1 oil pan is made of aluminum alloy. The No.2 oil pan is an oil reservoir made of pressed steel sheet. An oil level sensor is installed in the No.1 oil pan (If the oil level drops below a set level, a warning light lights up.). A oil pan baffle plate keeps sufficient oil in the bottom of the No.2 oil pan even when the vehicle is tilted. This dividing plate also prevents the oil from making waves when the vehicle is stopped suddenly and the oil shifts away from the oil pump suction pipe.










Plastic region tightening bolts are used for the cylinder head, main bearing cap and connecting rod.

PREPARATION





SST (SPECIAL SERVICE TOOLS)

Illustration	Part No.	Part Name	Note
	09011-38121	12 mm Socket Wrench for 12 Pointed Head	Connecting rod bolt
	09201-41020	Valve Stem Oil Seal Replacer	
	09201-70010	Valve Guide Bushing Remover & Replacer	
	09202-70010	Valve Spring Compressor	
	09213-31021	Crankshaft Pulley Puller	
	09213-60017	Crankshaft Pulley & Gear Puller Set	
	(09213-00050)	(Bolt Set)	
	09213-70010	Crankshaft Pulley Holding Tool	
	09222-30010	Connecting Rod Bushing Remover & Replacer	
	09223-46011	Crankshaft Front Oil Seal Replacer	Crankshaft timing pulley Crankshaft pulley Camshaft oil seal
	09223-56010	Crankshaft Rear Oil Seal Replacer	
	09248-55011	Valve Clearance Adjust Tool Set	
	(09248-05011)	(Valve Lifter Press)	
	(09248-05021)	(Valve Lifter Stopper)	
	09278-54012	Drive Shaft Holding Tool	Camshaft timing pulley

SST (SPECIAL SERVICE TOOLS) (Cont'd)

Illustration	Part No.	Part Name	Note
	09316-60010	Transmission & Transfer Bearing Replacer	
	(09316-00010)	(Replacer Pipe)	Crankshaft front oil seal
	09330-00021	Companion Flange Holding Tool	Crankshaft pulley
	09550-10012	Replacer Set "B"	
	(09552-10010)	(No. 2 Replacer Handle)	Spark plug tube gasket
	(09560-10010)	(Knuckle Outer Bearing Replacer)	Spark plug tube gasket
	09612-24014	Steering Gear Housing Overhaul Tool Set	
	(09617-24011)	(Steering Rack Wrench)	Fuel inlet hose
	09816-30010	Oil Pressure Switch Socket	Knock sensor

RECOMMENDED TOOLS

Illustration	Part No.	Part Name	Note
	09090-04010	Engine Sling Device	For suspending engine
	09200-00010	Engine Adjust Kit	
	09258-00030	Hose Plug Set	Plug for vacuum hose, fuel hose etc.
	09904-00010	Expander Set	

EQUIPMENT

Part Name	Note
Caliper gauge	
HC/CO meter	
Compression gauge	Cylinder compression pressure
Connecting rod aligner	
Cylinder gauge	
Dial indicator	
Engine turn-up tester	
Feeler gauge	
Micrometer	
Precision straight edge	
Spring tester	Valve spring
Steel square	Valve spring
Torque wrench	
Vernier caliper	

SSM (SPECIAL SERVICE MATERIALS)

Part Name	Part No.	Use etc.
Seal packing or equivalent	08826-00080	Camshaft bearing can Cylinder head semi-circular plug Cylinder head cover Rear oil seal retainer Oil pump
Seal packing 1282B, Three bond 1282B or equivalent	08826-00100	Water inlet housing Water seal plate Water pump
Adhesive 1324, Three bond 1324 or equivalent	08833-00070	Drive plate mounting bolt
Adhesive 1344, Three bond 1344, Loctite 242 or equivalent	08833-00080	No.1 idler pulley mounting bolt

SERVICE SPECIFICATIONS

SERVICE DATA

Engine tune-up	Battery specific gravity			1.27–1.29 (when fully charged at 20°C (68°F))	
	High-tension cord resistance			25 kΩ per cord	
	Valve clearance			Intake	0.15 – 0.25 mm 0.006 – 0.010 in.
				Exhaust	0.25 – 0.35 mm 0.010 – 0.014 in.
	Ignition timing			8–12° BTDC @ idle (w/ Terminals TE1 and E1 connected)	
	Idle speed			700 ± 50 rpm	
Intake manifold vacuum	at Idle speed			60 kPa 450 mmHg 17.7 in.Hg	
Compression pressure	at 250 rpm			STD	1,226 kPa (12.5 kgf/cm, 178 psi) or more
				Limit	981 kPa 10.0 kgf/cm 142 psi
	Difference of pressure between each cylinder				98 kPa (1.0 kgf/cm, 14 psi) or less
Timing belt tensioner	Protrusion from housing end			10.5 – 11.5 mm 0.413 – 0.453 in.	
Cylinder head	Warpage	Cylinder block side	Limit	0.10 mm	0.0039 in.
		Manifold side	Limit	0.10 mm	0.0039 in.
	Valve seat	Refacing angle		30°, 45°, 75°	
		Contacting angle		45°	
		Contacting width		1.0 – 1.4 mm	0.039 – 0.055 in.
	Cylinder head bolt thread outside diameter			STD	9.770 – 9.960 mm 0.3846 – 0.3921 in.
				Limit	9.60 mm 0.3780 in.
Valve guide bushing	Inside diameter			6.010 – 6.030 mm	0.2366 – 0.2374 in.
	Outside diameter (for repair part)			STD	11.048 – 11.059 mm 0.4350 – 0.4354 in.
				O/S 0.05	11.098 – 11.109 mm 0.4369 – 0.4374 in.
Valve	Valve overall length	STD	Intake	94.95 mm	3.7382 in.
			Exhaust	96.90 mm	3.8150 in.
		Limit	Intake	94.45 mm	3.7185 in.
			Exhaust	96.40 mm	3.7953 in.
	Valve face angle			44.5°	
	Stem diameter		Intake	5.970 – 5.985 mm	0.2350 – 0.2356 in.
			Exhaust	5.965 – 5.980 mm	0.2356 – 0.2354 in.
	Stem oil clearance	STD	Intake	0.025 – 0.060 mm	0.0010 – 0.0024 in.
			Exhaust	0.030 – 0.065 mm	0.0012 – 0.0026 in.
		Limit	Intake	0.08 mm	0.0031 in.
			Exhaust	0.10 mm	0.0039 in.
	Margin thickness	STD		1.0 mm	0.039 in.
		Limit		0.5 mm	0.020 in.
Valve spring	Squareness			2.0 mm	0.079 in.
	Free length			43.6 mm	1.717 in.
	Installed tension at 32.9 mm (1.295 in.)			186–206 N (19.0 – 21.0 kgf, 41.9 – 46.3 lbf)	
Valve lifter	Lifter diameter			30.966–30.976 mm	1.2191–1.2195 in.
	Lifter bore diameter			31.000–31.016 mm	1.2205–1.2211 in.
	Oil clearance	STD		0.024–0.050 mm	0.0009–0.0020 in.
		Limit		0.07 mm	0.0028 in.

SERVICE DATA (Cont'd)

Camshaft	Thrust clearance		STD	0.040–0.090 mm	0.0016–0.0035 in.
			Limit	0.12 mm	0.0047 in.
	Journal oil clearance				
	STD Exhaust camshaft thrust portion			0.025–0.061 mm	0.0010–0.0024 in.
	Others			0.030–0.067 mm	0.0012–0.0026 in.
	Limit			0.10 mm	0.0039 in.
	Journal diameter				
	Exhaust camshaft thrust portion			23.959–23.975 mm	0.9433–0.9439 in.
	Others			26.954–26.970 mm	1.0612–1.0618 in.
	Circle runout		Limit	0.08 mm	0.0031 in.
	Cam lobe height	STD	Intake	41.710–41.810 mm	1.6421–1.6461 in.
			Exhaust	41.910–42.010 mm	1.6500–1.6539 in.
		Limit	Intake	41.56 mm	1.6362 in.
Exhaust			41.76 mm	1.6441 in.	
Camshaft gear backlash	STD		0.020–0.200 mm	0.0008–0.0079 in.	
	Limit		0.30 mm	0.0188 in.	
	Camshaft gear spring end free distance			18.2–18.8 mm	0.712–0.740 in.
Manifold	Warpage	Limit	Intake	0.15 mm	0.0059 in.
			Exhaust	1.00 mm	0.0394 in.
Air intake chamber	Warpage	Limit		0.15 mm	0.0059 in.
Cylinder block	Cylinder head surface warpage		Limit	0.07 mm	0.0028 in.
	Cylinder bore diameter	STD	Mark 1	87.500–87.510 mm	3.4449–3.4453 in.
			Mark 2	87.510–87.520 mm	3.4453–3.4457 in.
			Mark 3	87.520–87.530 mm	3.4457–3.4461 in.
				87.73 mm	3.4539 in.
	Main bearing cap stud bolt tension portion diameter	STD		7.500–7.600 mm	0.2953–0.2992 in.
			Limit	7.40 mm	0.2913 in.
Piston and piston ring	Piston diameter		Mark 1	87.470–87.480 mm	3.4437–3.4441 in.
			Mark 2	87.480–87.490 mm	3.4441–3.4445 in.
			Mark 3	87.490–87.500 mm	3.4445–3.4449 in.
	Piston oil clearance		STD	0.020–0.040 mm	0.0008–0.0016 in.
			Limit	0.06 mm	0.0024 in.
	Piston ring groove clearance		No.1	0.020–0.060 mm	0.0008–0.0024 in.
			No.2	0.015–0.055 mm	0.0006–0.0022 in.
	Piston ring end gap	STD	No.1	0.250–0.450 mm	0.0098–0.0177 in.
			No.2	0.350–0.600 mm	0.0138–0.0236 in.
			Oil	0.150–0.500 mm	0.0059–0.0197 in.
		Limit	No.1	1.05 mm	0.0413 in.
			No.2	1.20 mm	0.0472 in.
			Oil	1.10 mm	0.0433 in.

SERVICE DATA (Cont'd)

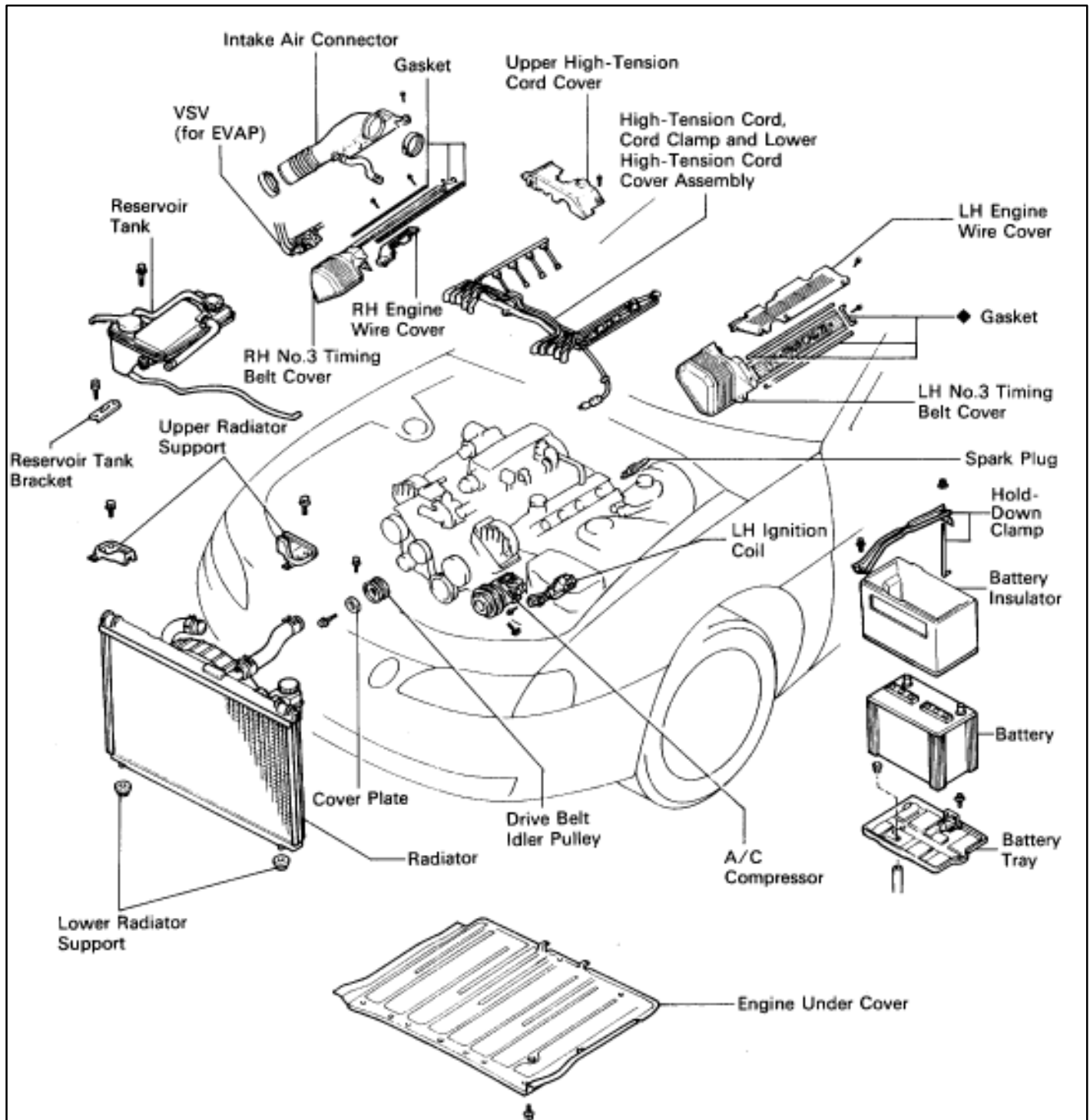
Connecting rod	Thrust clearance	STD	0.160–0.330 mm	0.0063–0.0114 in.
		Limit	0.35 mm	0.138 in.
	Connecting rod thickness		22.880–22.920 mm	0.9008–0.9024 in.
	Connecting rod bearing center wall thickness			
		Mark 2	1.484–1.487 mm	0.0584–0.0585 in.
		Mark 3	1.487–1.490 mm	0.0585–0.0587 in.
		Mark 4	1.490–1.493 mm	0.0587–0.0588 in.
		Mark 5	1.493–1.496 mm	0.0588–0.0589 in.
		Mark 6	1.496–1.499 mm	0.0589–0.0590 in.
		Mark 7	1.499–1.502 mm	0.0590–0.0591 in.
	Connecting rod oil clearance	STD	0.027–0.053 mm	0.0011–0.0021 in.
		Limit	0.065 mm	0.0026 in.
	Rod bending Limit per 100 mm (3.94 in.)		0.05 mm	0.0020 in.
	Rod twist Limit per 100 mm (3.94 in.)		0.15 mm	0.0059 in.
	Connecting rod bushing inside diameter		22.005–22.017 mm	0.8663–0.8668 in.
	Piston pin diameter		21.997–22.009 mm	0.8660–0.8665 in.
	Connecting rod bushing oil clearance	STD	0.005–0.011 mm	0.0002–0.0004 in.
		Limit	0.05 mm	0.0020 in.
Crankshaft	Connecting rod tension portion diameter			
		STD	7.200–7.300 mm	0.2835–0.2874 in.
		Limit	7.00 mm	0.2756 in.
	Thrust clearance	STD	0.020–0.220 mm	0.0008–0.0087 in.
		Limit	0.30 mm	0.0118 in.
	Thrust washer thickness	STD	2.440–2.490 mm	0.0961–0.0980 in.
	Main journal bore diameter on cylinder block (with main bearing)		67.026–67.033 mm	2.6388–2.6391 in.
	Main journal oil clearance	STD	0.026–0.045 mm	0.0010–0.0018 in.
		Limit	0.055 mm	0.0022 in.
	Main journal diameter		66.988–67.000 mm	2.6373–2.6378 in.
	Main bearing center wall thickness	Mark 1	2.486–2.489 mm	0.0979–0.0980 in.
		Mark 2	2.489–2.492 mm	0.0980–0.0981 in.
		Mark 3	2.492–2.495 mm	0.0981–0.0982 in.
		Mark 4	2.495–2.498 mm	0.0982–0.0983 in.
		Mark 5	2.498–2.501 mm	0.0983–0.0985 in.
	Crank pin diameter		51.982–52.000 mm	2.0465–2.0472 in.
	Circle runout	Limit	0.08 mm	0.0031 in.
	Main journal taper and out-of-round	Limit	0.02 mm	0.0008 in.
	Crank pin taper and out-of-round	Limit	0.02 mm	0.0008 in.

TORQUE SPECIFICATIONS

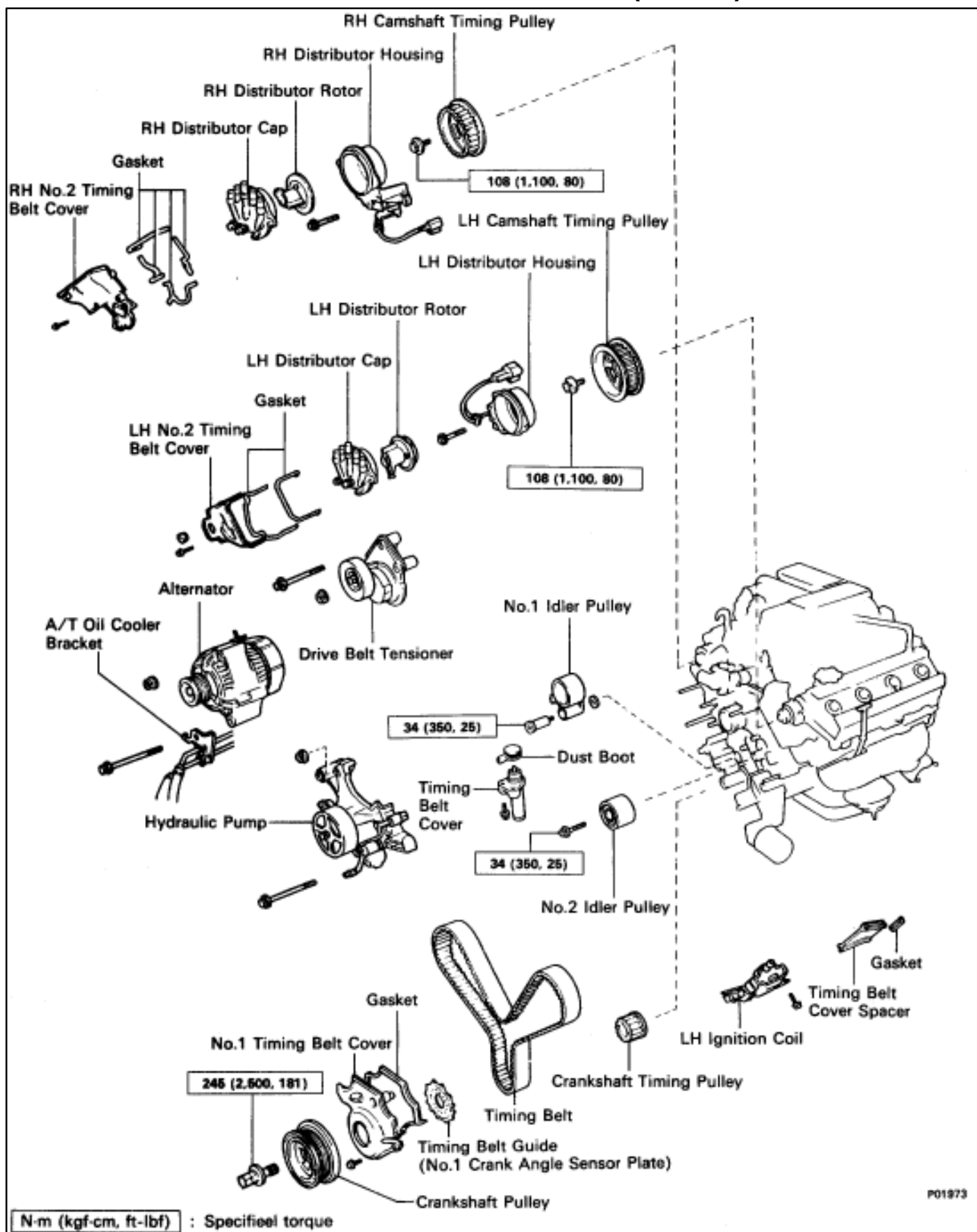
Part tightened		N-m	kgf-cm	ft-lbf
No.1 idler pulley X Cylinder block		34	350	25
No.2 idler pulley X Cylinder block		34	350	25
Hydraulic pump X Cylinder block	12 mm head	16	160	12
	14 mm head	30	310	22
Crankshaft pulley X Crankshaft		245	2,500	181
Camshaft timing pulley X Camshaft		108	1,100	80
Timing belt tensioner X Oil pump		26	270	20
Spark plug X Cylinder head		18	180	13
Drive belt tensioner X Cylinder block		16	160	12
Alternator X Alternator bracket		37	380	27
Alternator X Cylinder block		37	380	27
Distributor housing X Cylinder head		18	185	13
Distributor rotor X Distributor housing		3.8	39	34 in.-lbf
Distributor cap X Camshaft timing pulley		3.8	39	34 in.-lbf
RH No.2 timing belt cover X Cylinder block (for 12 mm head)		16	160	12
Drive belt idler pulley X Hydraulic pump		37	380	27
A/C compressor X Hydraulic pump		49	500	36
A/C compressor X Cylinder block	49	500	36	
A/C compressor stay X Oil filter bracket		29	300	22
Exhaust manifold X Cylinder head		39	400	29
Main oxygen sensor X Exhaust manifold		44	450	33
Cylinder head X Cylinder block	1st	39	400	29
	2nd	Turn 90°		
Camshaft bearing cap X Cylinder head		16	160	12
Cylinder head cover X Cylinder head		5.9	60	52 in.-lbf
Engine hanger X Cylinder head		37	380	27
EGR pipe X Exhaust manifold		18	185	13
Rear water by-pass joint X Cylinder head		18	185	13
Front water by-pass joint X Cylinder head		18	185	13
Intake manifold X Cylinder head		18	185	13
Delivery pipe X Intake manifold		18	185	13
Fuel return pipe X RH delivery pipe(for union bolt)		35	360	26
Fuel inlet hose X LH delivery pipe		39	400	29
	for SST	33	340	24
Cold start injector X Air intake chamber		7.8	80	69 in.-lbf
Air intake chamber X Intake manifold		18	185	13
EGR pipe X Air intake chamber		18	185	13
EGR pipe X RH cylinder head		18	185	13
Cold start injector tube X RH delivery pipe		15	150	11
Brake booster union X Air intake chamber		29	300	22
Throttle body X Air intake chamber		18	185	13
ISC valve X Air intake chamber		18	185	13
EGR valve adapter X Air intake chamber		18	185	13
EGR valve X EGR valve adapter		18	185	13
Timing belt rear plate X Cylinder head		7.8	80	69 in.-lbf
Water inlet housing X Water pump		18	185	13
Catalytic converter (main) X Exhaust manifold		62	630	46
Catalytic converter (main) X Front exhaust pipe		43	440	32
Front exhaust pipe support bracket X Transmission		43	440	32
PS pump X RH cylinder head	Bolt	39	400	29
	Nut	43	440	32
Main bearing cap X Cylinder block	Nut 1st	27	275	20
	2nd	Turn 90°		
	Bolt	49	500	36

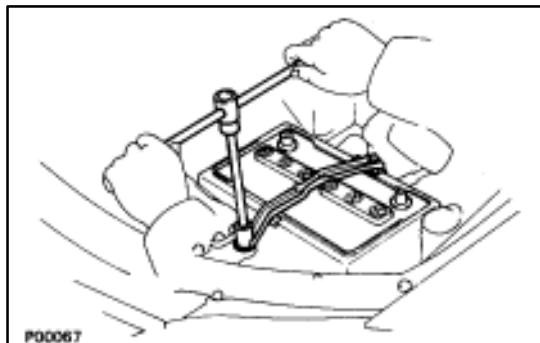
TORQUE SPECIFICATIONS (Cont'd)

Part tightened			N·m	kgf·cm	ft·lbf
Connecting rod cap X Connecting rod	1st		25	250	18
	2nd		Turn 90°		
Rear oil seal retainer X Cylinder block			7.8	80	69 in.·lbf
Water seal plate X Cylinder block			14	145	10
Alternator bracket X Cylinder block			18	185	13
Oil pump X Cylinder block	12 mm head		16	160	12
	14 mm head		30	310	22
Water pump X Cylinder block			18	185	13
Water by-pass pipe X Cylinder block			18	185	13
Knock sensor X Cylinder block			44	450	33
Starter X Cylinder block			39	400	29
Engine mounting bracket X Cylinder block			37	380	27
Drive plate X Crankshaft			98	1,000	72
A/T oil cooler pipe X Transmission			34	350	25
Rear engine mounting member X Body			25	260	19
Rear engine mounting member X Engine mounting insulator			13	135	10
Front engine mounting insulator X Suspension crossmember			59	600	43
Center floor brace X Body			13	130	9
Tailpipe X Center exhaust pipe			43	440	32
Front exhaust pipe X Center exhaust pipe			43	440	32
Sub-oxygen sensor X Front exhaust pipe			44	450	33



COMPONENTS FOR REMOVAL AND INSTALLATION (Cont'd)





REMOVAL OF TIMING BELT

(See Components on pages [EM-33](#) and 34)

1. REMOVE BATTERY

CAUTION: Work must be started after approx. 20 seconds or longer from the time the ignition switch is turned to the "LOCK" position and the negative (-) terminal cable is disconnected from the battery.

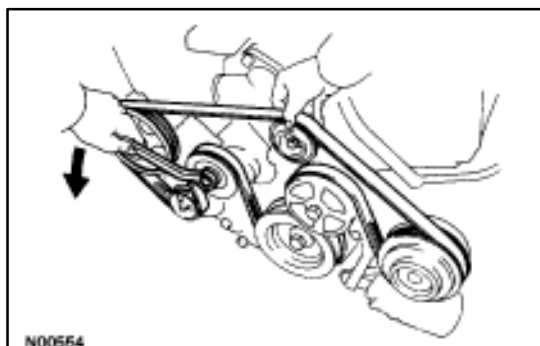
2. REMOVE ENGINE UNDER COVER

3. DRAIN ENGINE COOLANT (See page [CO-6](#))

4. REMOVE DRIVE BELT

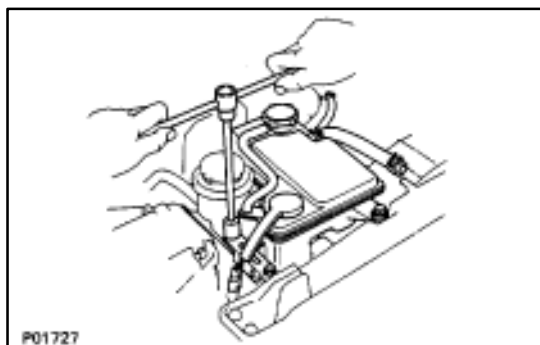
Loosen the drive belt tension by turning the drive belt tensioner counterclockwise, and remove the drive belt.

HINT: The pulley bolt for the belt tensioner has a left-hand thread.



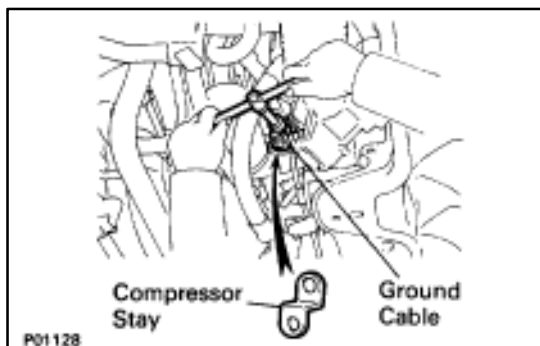
5. REMOVE RESERVOIR TANK RADIATOR

(See steps 12 and 13 on pages [EM-120](#) and 121)



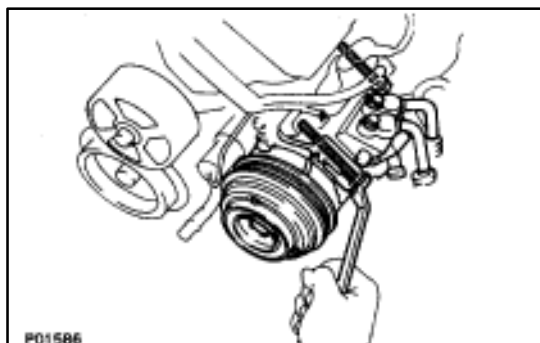
6. REMOVE A/C COMPRESSOR WITHOUT DISCONNECTING HOSES

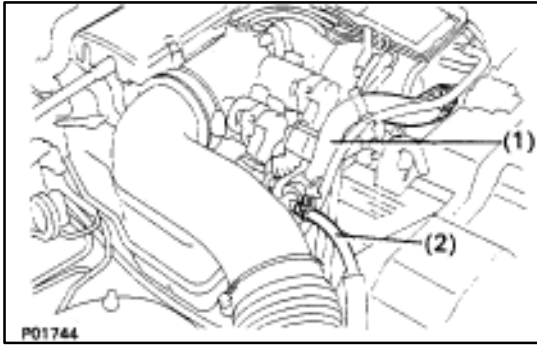
- Disconnect the compressor connector.
- Remove the mounting nut, and disconnect the ground cable.
- Remove the mounting bolt and compressor stay.



- Remove the two bolts, and disconnect the A/C compressor from the engine.

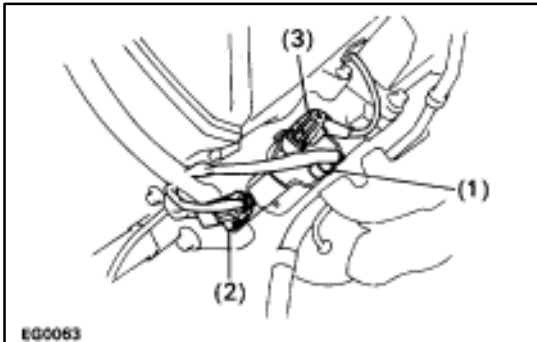
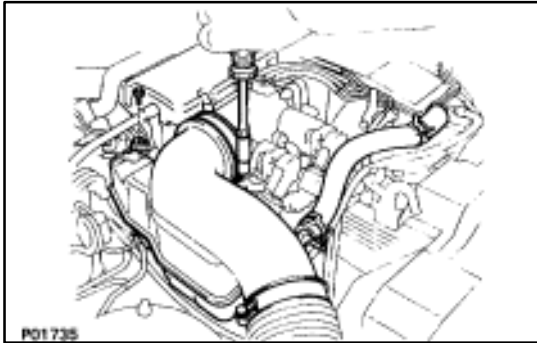
HINT: Put aside the compressor, and suspend it.





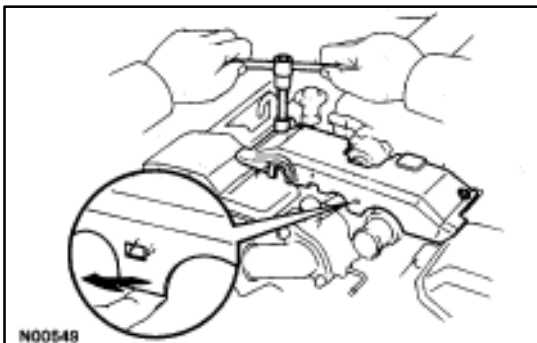
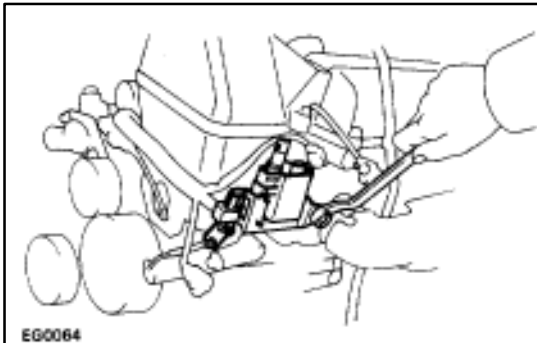
7. REMOVE INTAKE AIR CONNECTOR

- (a) Disconnect the following hoses:
 - (1) Air hose from ISC valve
 - (2) Air hose (from PS air control valve) from intake air connector
- (b) Remove the bolt holding the intake air connector to the cylinder head cover.
- (c) Loosen the two hose clamps.
- (d) Disconnect the intake air connector from the throttle body and air cleaner hose, and remove the throttle body.



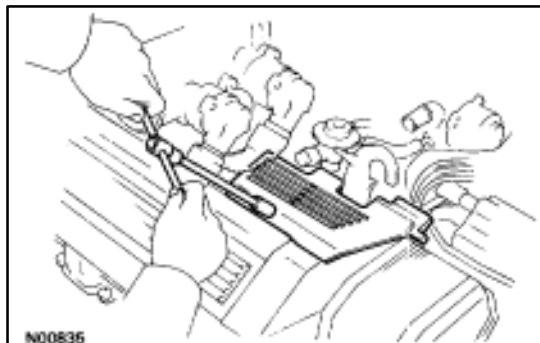
8. REMOVE LH IGNITION COIL

- (a) Disconnect the following connectors and cord:
 - (1) Ignition coil connector
 - (2) Noise filter connector
 - (3) High-tension cord
- (b) Remove the two bolts and ignition coil.

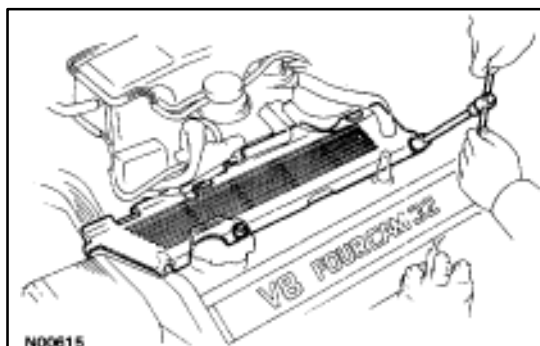


9. REMOVE UPPER HIGH-TENSION CORD COVER

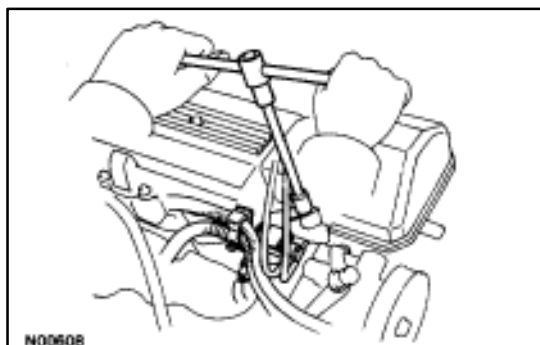
- (a) Remove the two mounting bolts.
- (b) Disconnect the front side claw groove of the cord cover from the claw of the lower cover, and remove the cord cover.

**10. REMOVE RH ENGINE WIRE COVER**

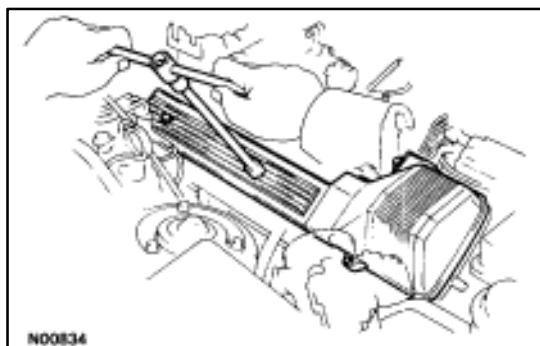
Remove the bolt and engine wire cover.

**11. REMOVE LH ENGINE WIRE COVER**

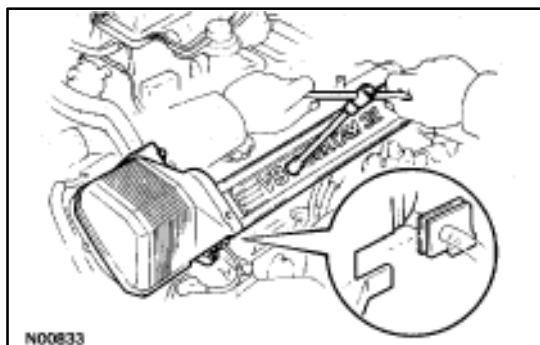
Remove the two bolts and engine wire cover.

**12. REMOVE VSV FOR EVAP SYSTEM**

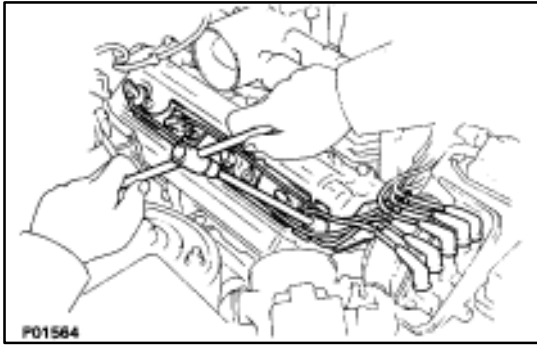
Remove the two bolts, and disconnect the VSV from cylinder head and timing belt cover.

**13. REMOVE NO.3 TIMING BELT COVER**

Remove the three bolts and timing belt cover.

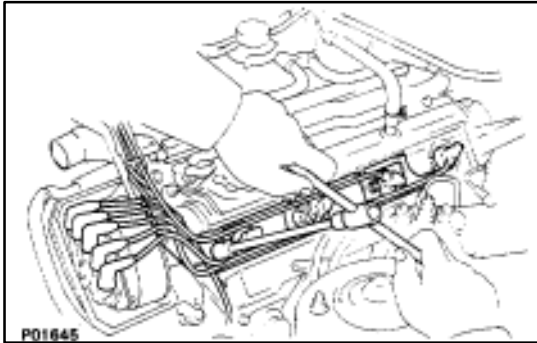
**14. REMOVE LH NO.3 TIMING BELT COVER**

- (a) Remove the four mounting bolts.
- (b) Disconnect the cord grommet from the timing belt cover, and remove the timing belt cover.
- (c) Remove the cord grommet from the high-tension cord.

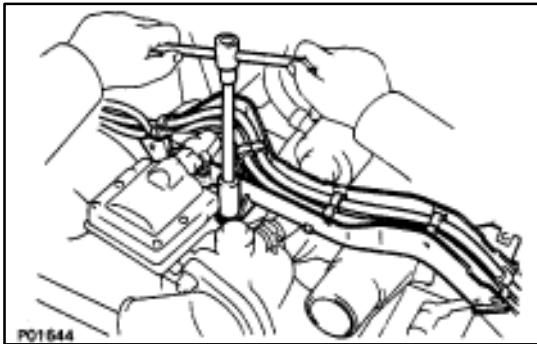


15. REMOVE HIGH-TENSION CORDS, HIGH-TENSION CORD CLAMPS AND LOWER HIGH-TENSION CORD COVER ASSEMBLY

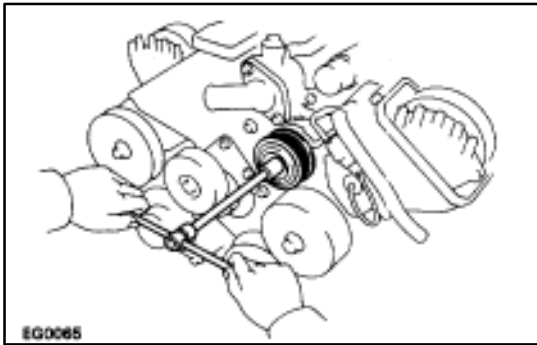
- (a) Remove the two bolts holding the RH rear high-tension cord clamp to the cylinder head.
- (b) Disconnect the high-tension cords from the RH spark plugs and distributor cap.



- (c) Remove the two bolts holding the LH rear high-tension cord clamp to the cylinder head.
- (d) Disconnect the high-tension cords from the LH spark plugs, distributor cap and LH ignition coil.

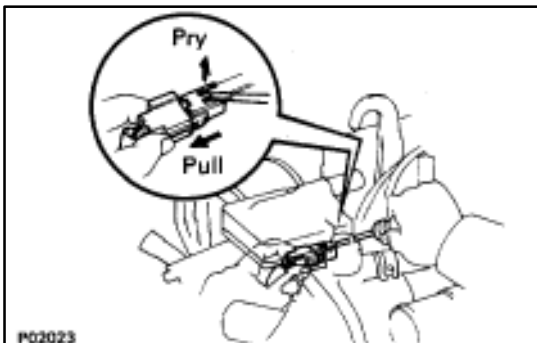


- (e) Remove the bolt holding the lower high-tension cord cover to the water inlet housing.
- (f) Disconnect the high-tension cord from the RH ignition coil, and remove the high-tension cords, clamps and cover assembly.



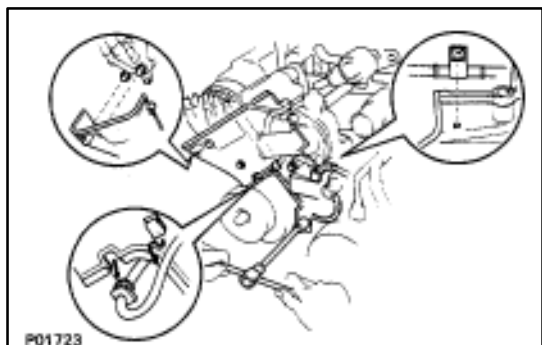
16. REMOVE DRIVE BELT IDLER PULLEY

Remove the pulley bolt, cover plate and idler pulley.

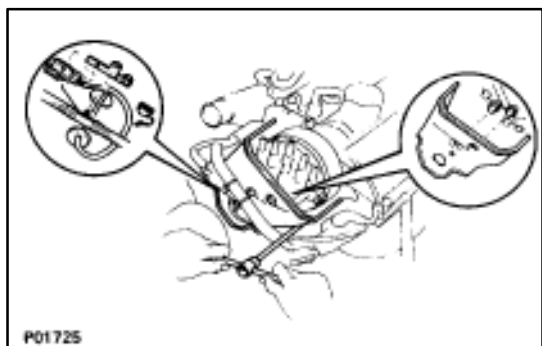


17. REMOVE RH NO.2 TIMING BELT COVER

- (a) Disconnect the cam position sensor connector from the ignition coil bracket.

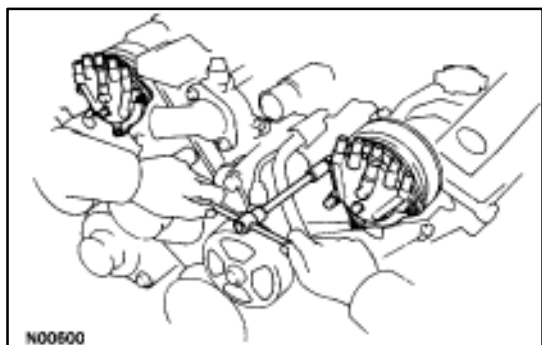


- (b) Disconnect the cam position sensor wire from the clamp on the timing belt cover.
- (c) Remove the five mounting bolts.
- (d) Disconnect the connector grommet from the timing belt cover.
- (e) Disconnect the wire clamp from the timing belt cover, and remove the timing belt cover and four gaskets.



18. REMOVE LH NO.2 TIMING BELT COVER

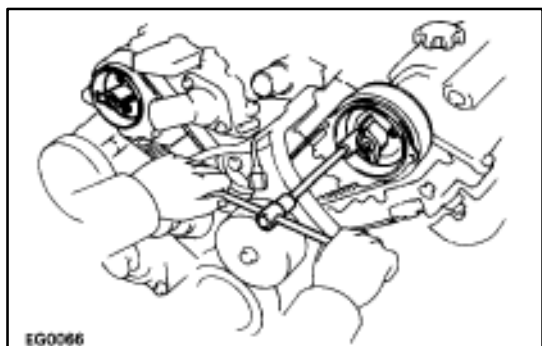
- (a) Disconnect the cam position sensor wire from the clamp on the timing belt cover.
- (b) Disconnect the cam position sensor connector.
- (c) Remove the three mounting bolts.
- (d) Disconnect the connector grommet from the timing belt cover, and remove the timing belt cover and two gaskets.



19. REMOVE DISTRIBUTOR CAPS

Loosen the three bolts, and remove the distributor cap. Remove the two distributor caps.

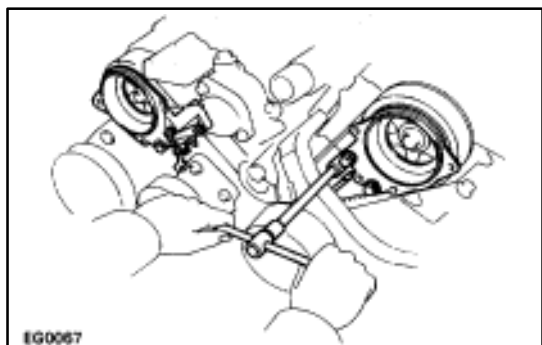
HINT: Arrange the distributor caps (RH side and LH side).



20. REMOVE DISTRIBUTOR ROTORS

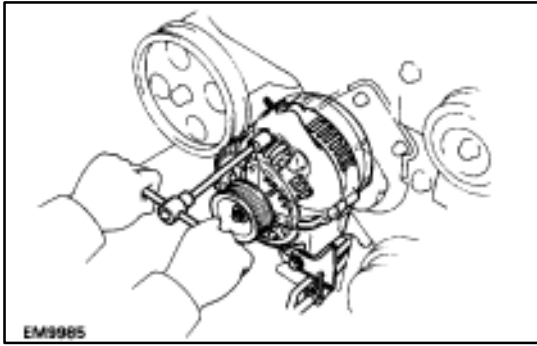
Loosen the two bolts, and remove the distributor rotor. Remove the two distributor rotors.

HINT: Arrange the distributor rotors (RH side and LH side).

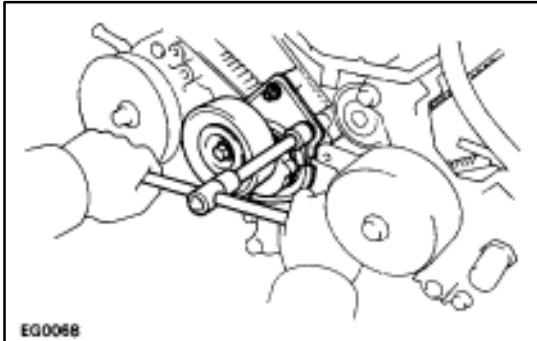


21. REMOVE DISTRIBUTOR HOUSINGS

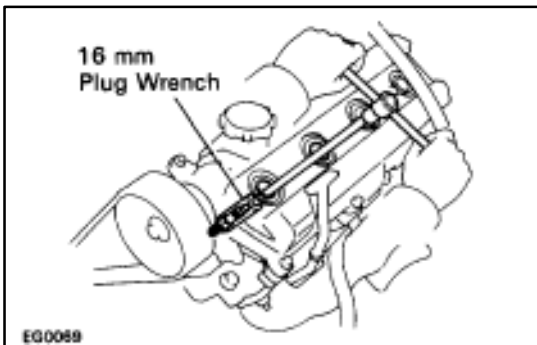
- (a) (RH Distributor Housing)
Disconnect the cam position sensor connector.
- (b) Remove the three bolts and distributor housing. Remove the two distributor housings.

**22. REMOVE ALTERNATOR**

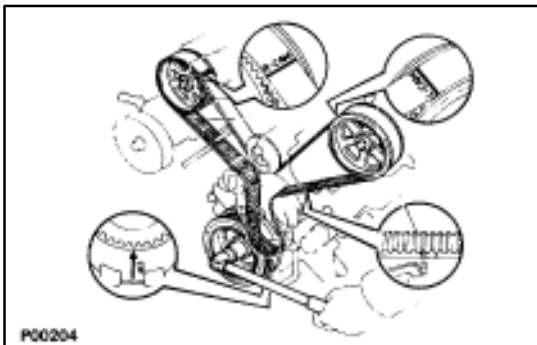
- (a) Disconnect the alternator connector.
- (b) Remove the cap and nut, and disconnect the alternator wire.
- (c) Remove the bolt, and disconnect the A/T oil cooler pipe bracket.
- (d) Remove the nut and alternator.

**23. REMOVE DRIVE BELT TENSIONER**

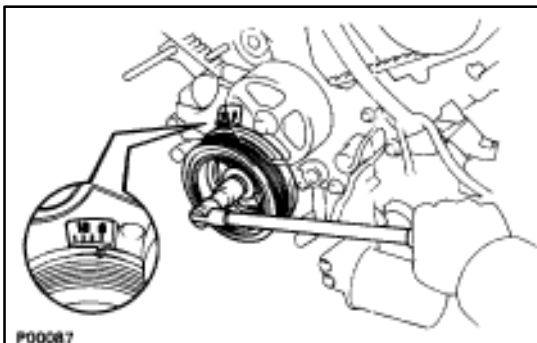
Remove the bolt, two nuts and tensioner.

**24. REMOVE SPARK PLUGS**

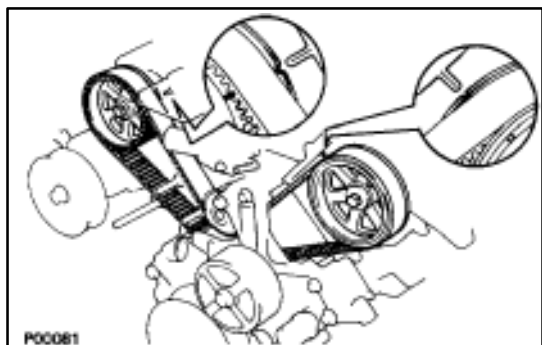
Using a 16 mm plug wrench, remove the eight spark plugs.

**25. IF RE-USING TIMING BELT, CHECK INSTALLATION MARKS ON TIMING BELT**

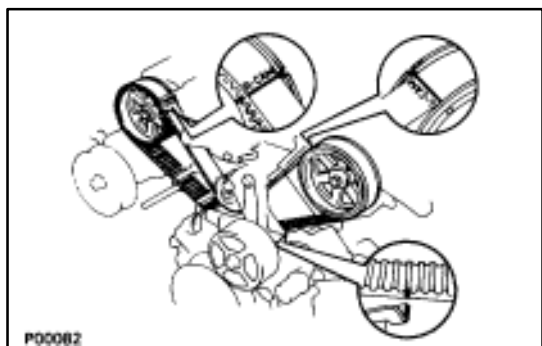
Check that there are four installation marks on the timing belt by turning the crankshaft pulley as shown in the illustration. If the installation marks have disappeared, place a new installation mark on the timing belt before removing each part.

**26. SET NO.1 CYLINDER TO TDC/COMPRESSION**

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



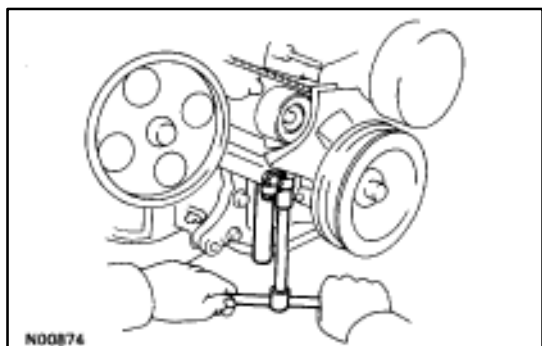
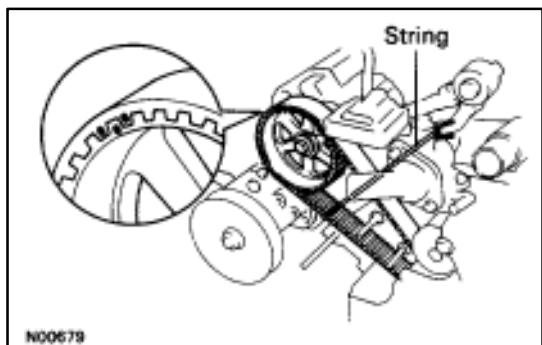
- (b) Check that the timing marks of the camshaft timing pulleys and timing belt rear plates aligned.
If not, turn the crankshaft one revolution (360°).



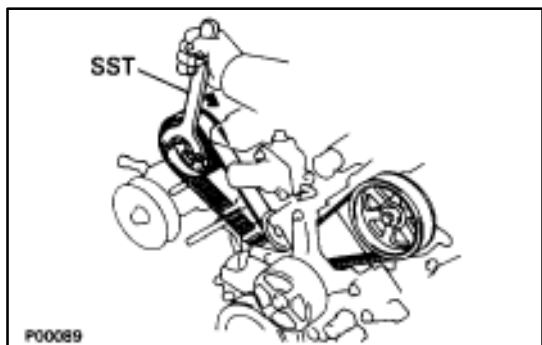
27. REMOVE TIMING BELT TENSIONER

HINT:

- (Re-using timing belt)
If the installation marks have disappeared, before removing the timing belt, place new installation marks on the timing belt to match the timing marks of the camshaft timing pulleys, and place a new installation mark on the timing belt to match the end of the hydraulic pump.
- (When replacing timing belt tensioner only)
To avoid meshing of the timing pulley and timing belt, secure one of them with string. And place matchmarks on the timing belt and RH camshaft timing pulley.



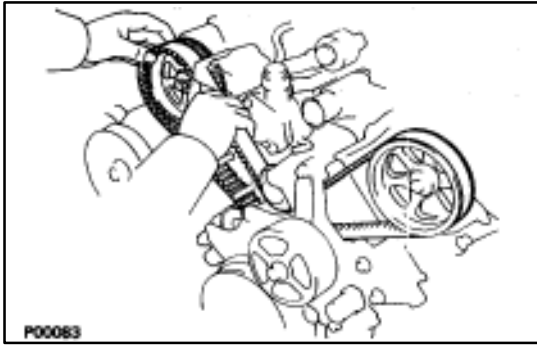
Alternately loosen the two bolts, and remove them, the tensioner and dust boot.



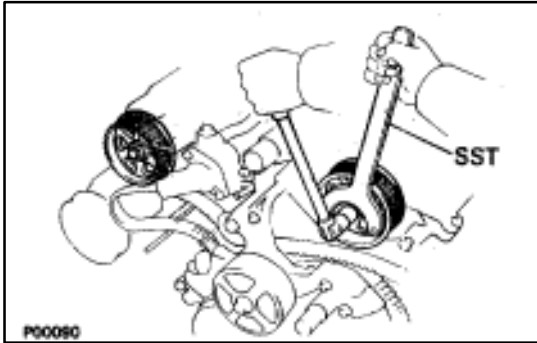
28. DISCONNECT TIMING BELT FROM CAMSHAFT TIMING PULLEYS

- (a) Using SST, loosen the tension between the LH and RH camshaft timing pulleys by slightly turning the LH camshaft timing pulley clockwise.

SST 09278-54012



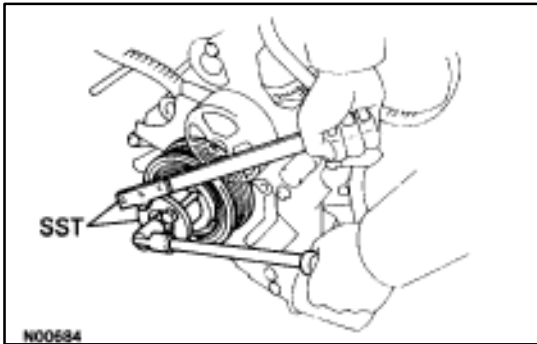
- (b) Disconnect the timing belt from the camshaft timing pulleys.



29. REMOVE CAMSHAFT TIMING PULLEYS

Using SST, remove the bolt, timing pulley. Remove the two timing pulleys.

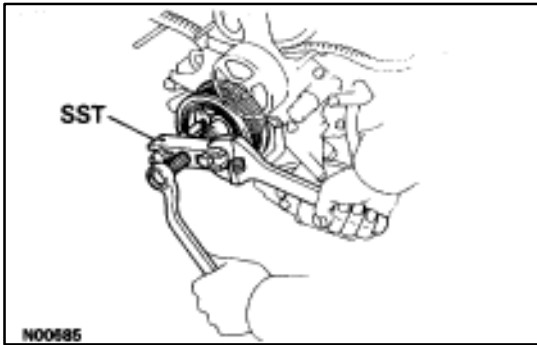
SST 09278-54012



30. REMOVE CRANKSHAFT PULLEY

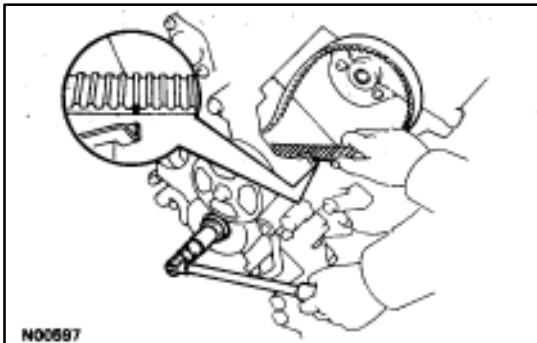
- (a) Using SST, remove the pulley bolt.

SST 90213-70010 and 09330-00021



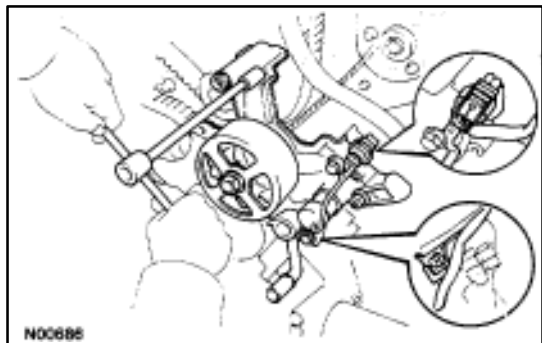
- (b) Using SST, remove the pulley.

SST 09213-31021

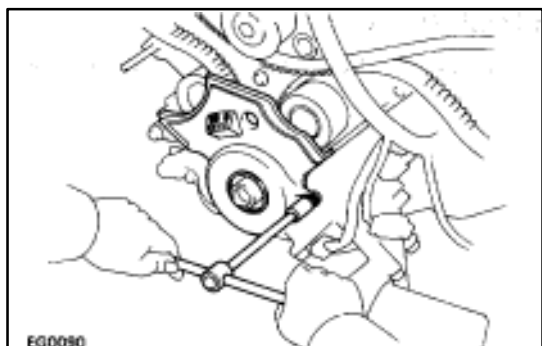


31. REMOVE HYDRAULIC PUMP

HINT (Re-using timing belt): Before removing the hydraulic pump, using the crankshaft pulley bolt, turn the crankshaft pulley and align the installation mark of the timing belt with the end of the hydraulic pump.

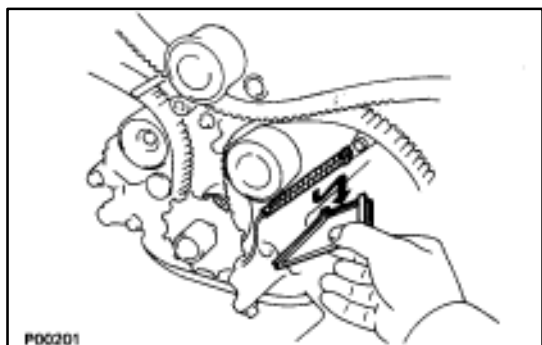


- (a) Disconnect the solenoid valve connector.
- (b) Remove the two mounting bolts and two mounting nuts.
- (c) Disconnect the engine speed sensor wire clamp.
- (d) Remove the hydraulic pump.



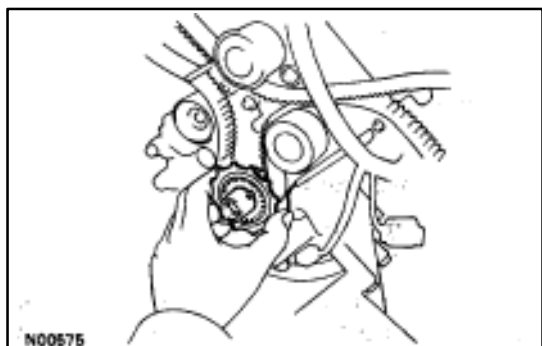
32. REMOVE NO.1 TIMING BELT COVER

Remove the four bolts, timing belt cover and gasket.

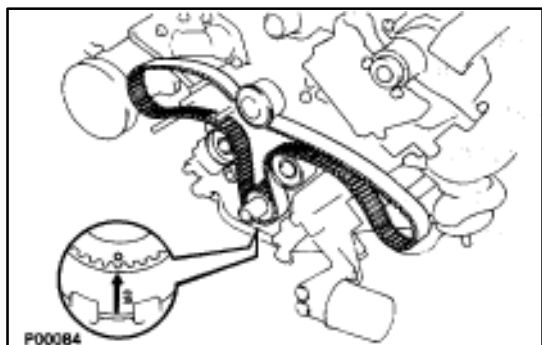


33. REMOVE TIMING BELT COVER SPACER

Remove the cover spacer and gasket.

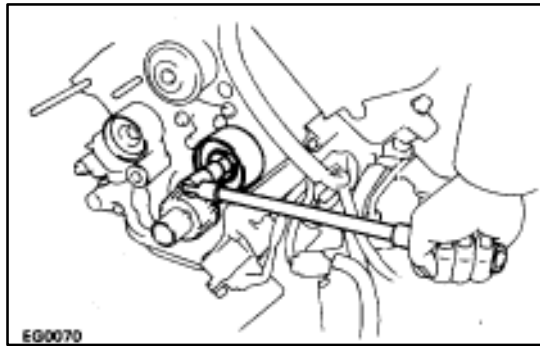


34. REMOVE TIMING BELT GUIDE (NO.1 CRANK ANGLE SENSOR PLATE)



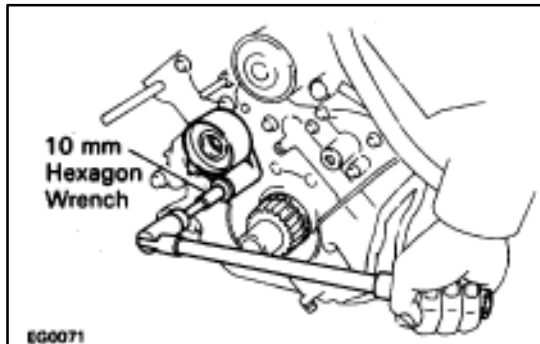
35. REMOVE TIMING BELT

HINT (Re-using timing belt): If the installation marks have disappeared, place a new installation mark on the timing belt to match the dot mark of the crankshaft timing pulley.



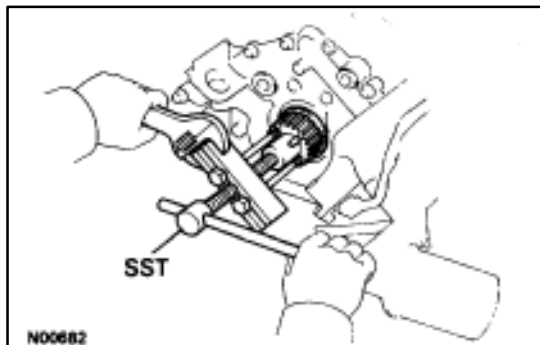
36. REMOVE NO.2 IDLER PULLEY

Remove the pulley bolt and idler pulley.



37. REMOVE NO.1 IDLER PULLEY

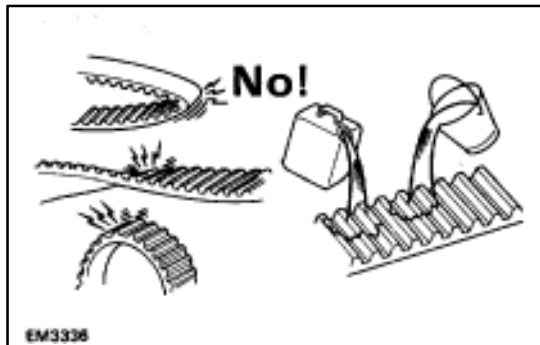
Using a 10 mm hexagon wrench, remove the bolt, idler pulley and plate washer.



38. REMOVE CRANKSHAFT TIMING PULLEY

Using SST, remove the timing pulley.

SST 09213-60017 (09213-00050)



INSPECTION OF TIMING BELT COMPONENTS

1. INSPECT TIMING BELT

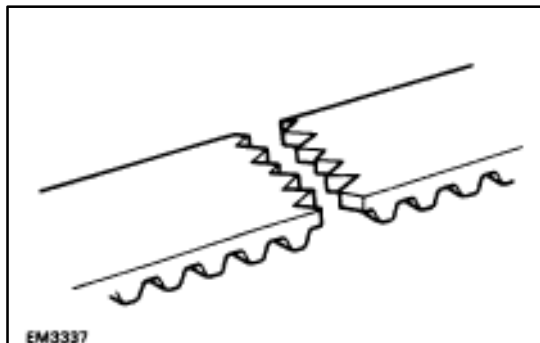
NOTICE:

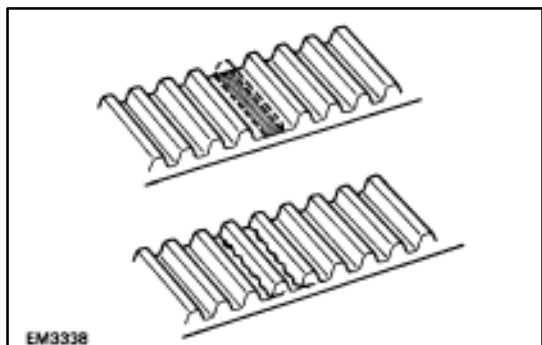
- Do not bend, twist or turn the timing belt inside out.
- Do not allow the timing belt to come into contact with oil, water or steam.
- Do not utilize timing belt tension when installing or removing the mounting bolt of the camshaft timing pulley.

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

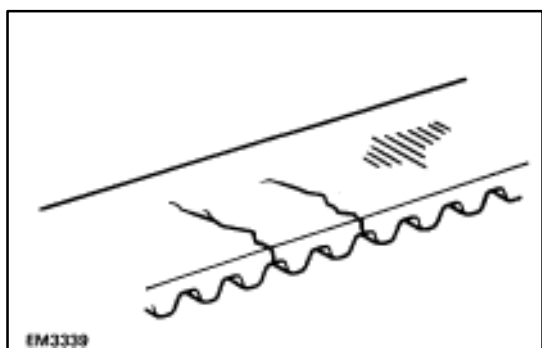
(a) Premature parting

- Check for proper installation.
- Check the timing cover gasket for damage and proper installation.

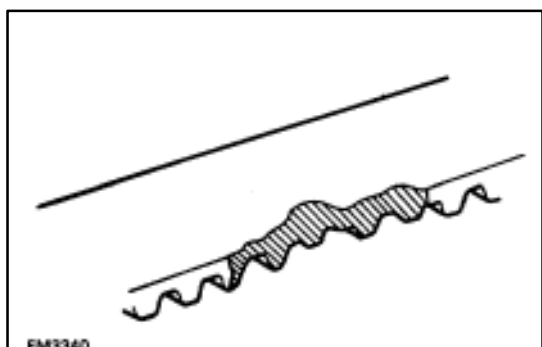




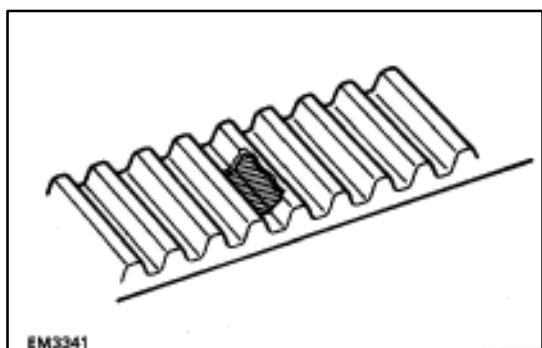
- (b) If the belt teeth are cracked or damaged, check to see if either the camshaft is locked.



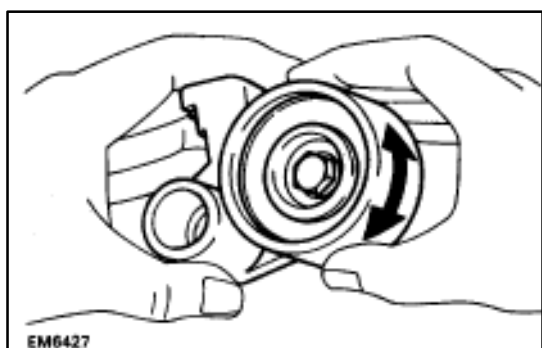
- (c) If there is noticeable wear or cracks on the belt face, check to see if there are nicks on the side of the idler pulley lock and water pump.



- (d) If there is wear or damage on only one side of the belt, check the belt guide and the alignment of the each pulley.

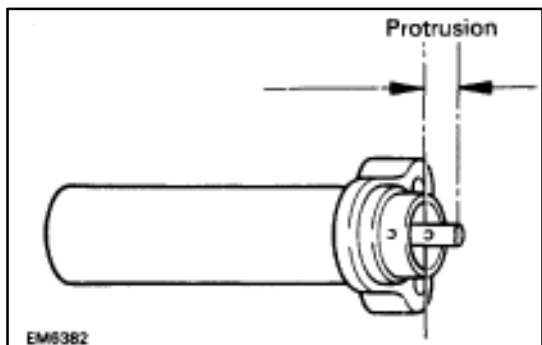
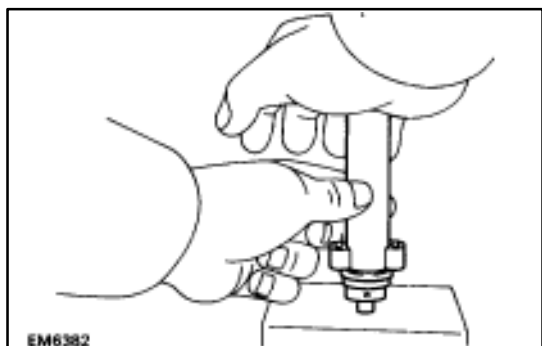
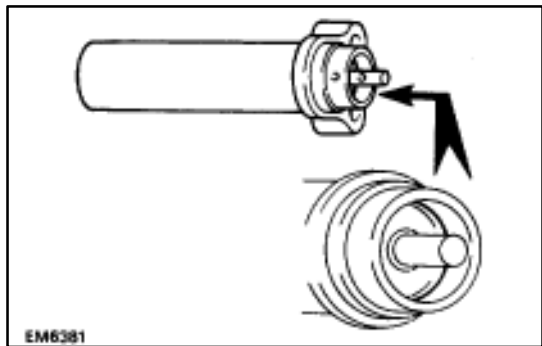


- (e) If there is noticeable wear on the belt teeth, check timing belt cover for damage, correct gasket installation. and the foreign material on the pulley teeth.
If necessary, replace the timing belt.



2. INSPECT IDLER PULLEYS

Check the turning smoothness of the idler pulley.
If necessary, replace the idler pulley.



3. INSPECT TIMING BELT TENSIONER

(a) 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 the tensioner.

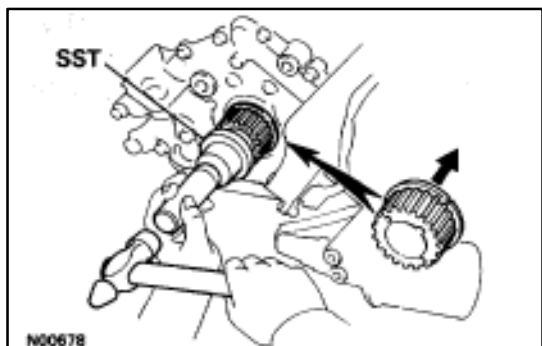
(b) Hold the tensioner in both hands and push the push rod strongly against the floor or wall to check that it doesn't move.

If the push rod moves, replace the tensioner.

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

Protrusion: 10.5–11.5 mm (0.413–0.453 in.)

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



INSTALLATION OF TIMING BELT

(See Components pages [EM-33](#) and [34](#))

1. INSTALL CRANKSHAFT TIMING PULLEY

(a) Align the pulley set key on the crankshaft with the key groove of the timing pulley.

(b) Using SST and a hammer, tap in the timing pulley, facing the flange side rearward.

SST 09223-46011

2. INSTALL NO. 1 IDLER PULLEY

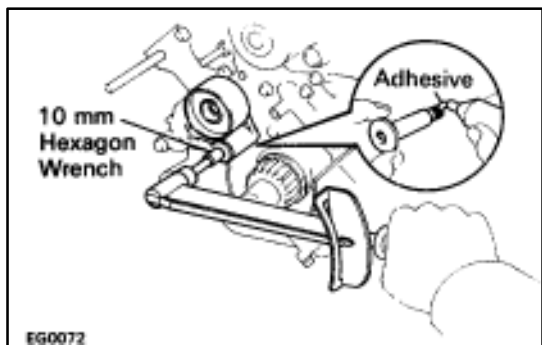
(a) Apply adhesive to two or three threads of the pulley bolt end.

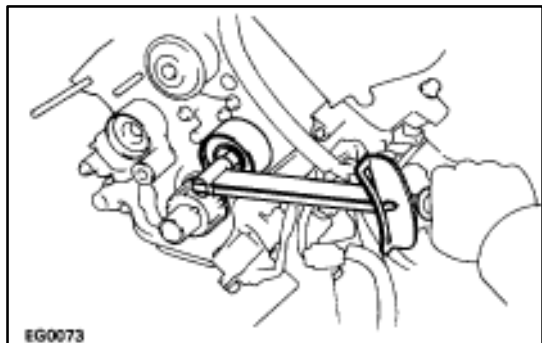
Adhesive: Part No. 08833-00080, THREE BOND 1344, LOCTITE 242 OR equivalent

(b) Using a 10 mm hexagon wrench, install the plate washer and idler pulley with the pulley bolt. Torque the pulley bolt.

Torque: 34 N·m (350 kgf·cm, 25 ft·lbf)

(c) Check that the pulley bracket moves smoothly.



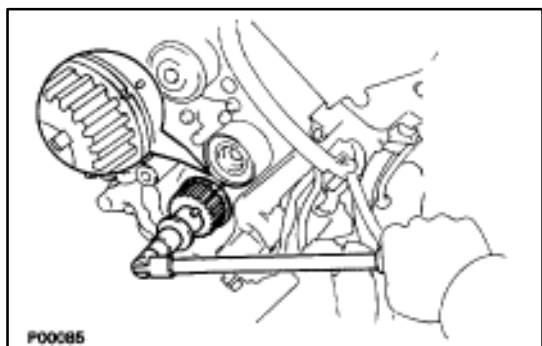


3. INSTALL NO. 2 IDLER PULLEY

- (a) Install the idler pulley with the pulley bolt. Torque the pulley bolt.

Torque: 34 N·m (350 kgf·cm, 25 ft·lbf)

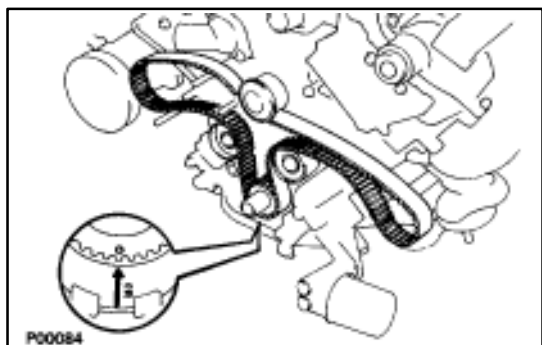
- (b) Check that the idler pulley moves smoothly.



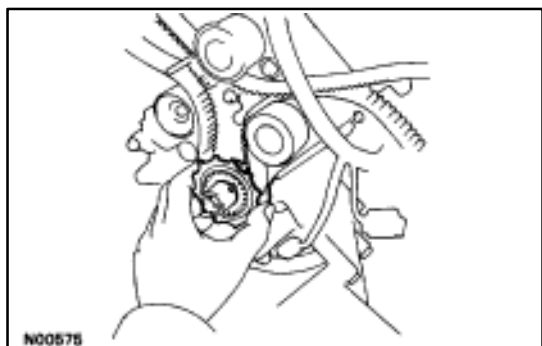
4. TEMPORARILY INSTALL TIMING BELT

NOTICE: The engine should be cold.

- (a) Using the crankshaft pulley bolt, turn the crankshaft and align the timing marks of the crankshaft timing pulley and oil pump body.
- (b) Remove any oil or water on the crankshaft timing pulley, No. 1 idler pulley and No. 2 idler pulley, and keep them clean.

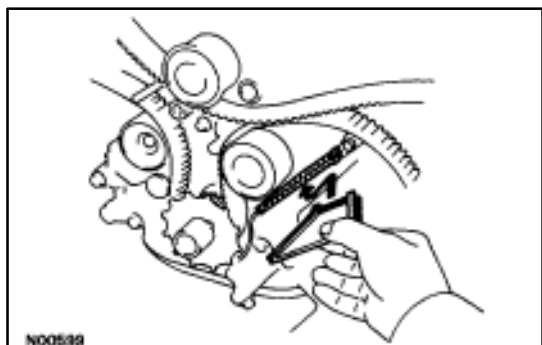


- (c) Align the installation mark on the timing belt with the dot mark of the crankshaft timing pulley.
- (d) Install the timing belt on the crankshaft timing pulley, No. 1 idler pulley and No. 2 idler pulley.



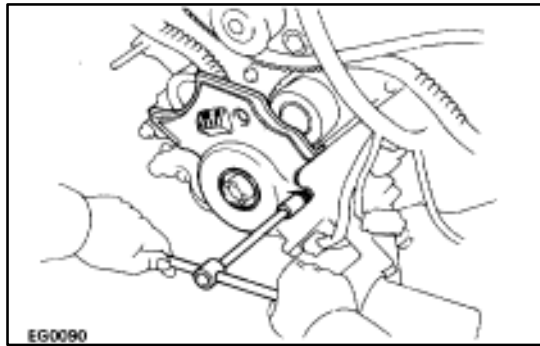
5. INSTALL TIMING BELT GUIDE (NO. 1 CRANK ANGLE SENSOR PLATE)

Install the belt guide, facing the cup side forward.



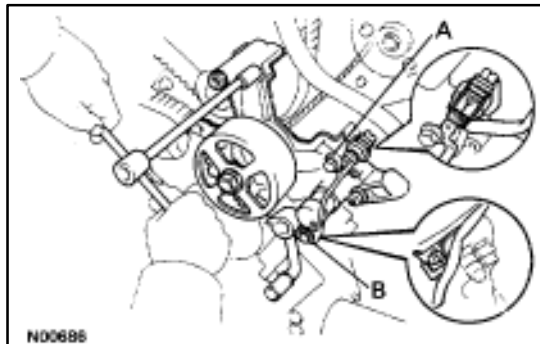
6. INSTALL TIMING BELT COVER SPACER

- (a) Install the gasket to the spacer.
- (b) Install the spacer.



7. INSTALL NO.1 TIMING BELT COVER

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



8. INSTALL HYDRAULIC PUMP

- Install the hydraulic pump and solenoid valve connector clamp and engine speed sensor wire clamp with the two bolts and two nuts.

Torque:

12 mm heads 16 N·m (160 kgf·cm, 12 ft·lbf)

Others 30 N·m (310 kgf·cm, 22 ft·lbf)

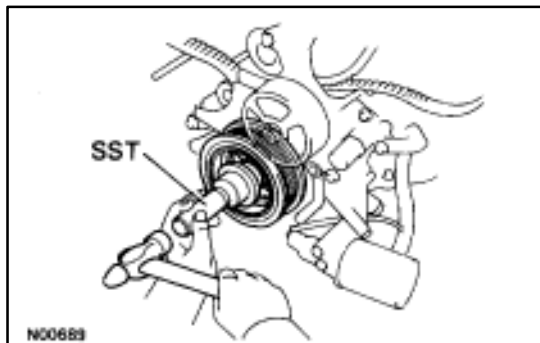
HINT: Each bolt length is indicated in the illustration.

Bolt length:

A 106 mm (4.17 in.) for 12 mm head

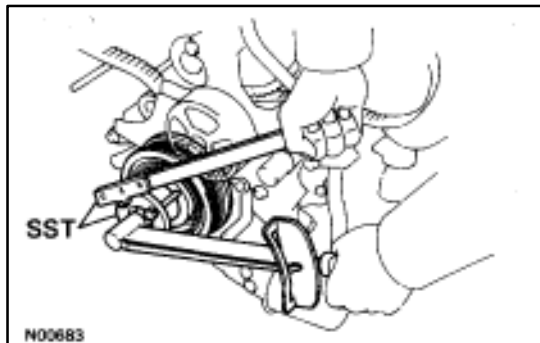
B 114 mm (4.49 in.) for 14 mm head

- Connect the solenoid valve connector.



9. INSTALL CRANKSHAFT PULLEY

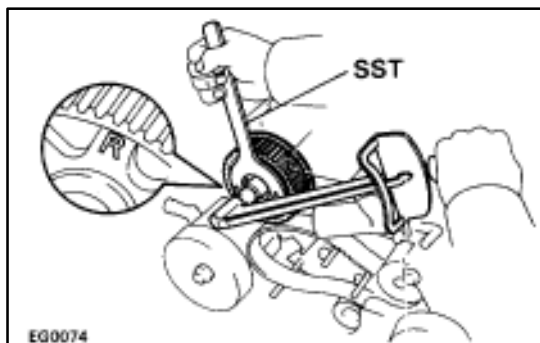
- Align the pulley set key on the crankshaft with the key groove of the pulley.
- Using SST and a hammer, tap in the pulley.
SST 09223-46011



- Using SST, install and torque the pulley bolt.

SST 09213-70010 and 09330-00021

Torque: 245 N·m (2,500 kgf·cm, 181 ft·lbf)

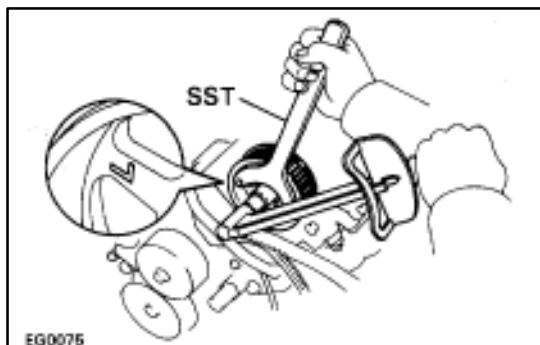


10. INSTALL RH CAMSHAFT TIMING PULLEY

- Align the knock pin on the camshaft with the knock pin groove of the timing pulley.
- Slide the timing pulley, facing the "R" mark forward.
- Using SST, install and torque the pulley bolt.

SST 09278-54012

Torque: 108 N·m (1,100 kgf·cm, 80 ft·lbf)

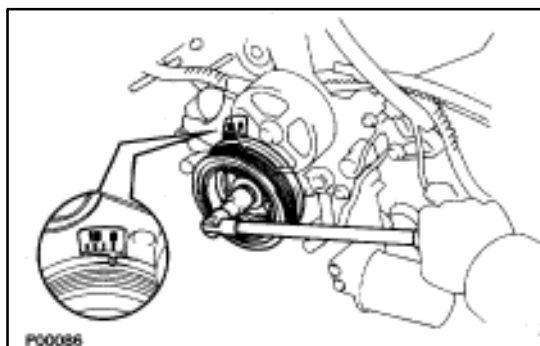


11. INSTALL LH CAMSHAFT TIMING PULLEY

- (a) Align the knock pin on the camshaft with the knock pin groove of the timing pulley.
- (b) Slide the timing pulley, facing the "L" mark forward.
- (c) Using SST, install and torque the pulley bolt.

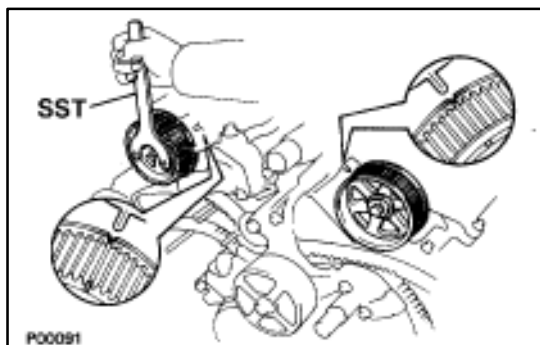
SST 09278-54012

Torque: 108 N·m (1,100 kgf·cm, 80 ft·lbf)



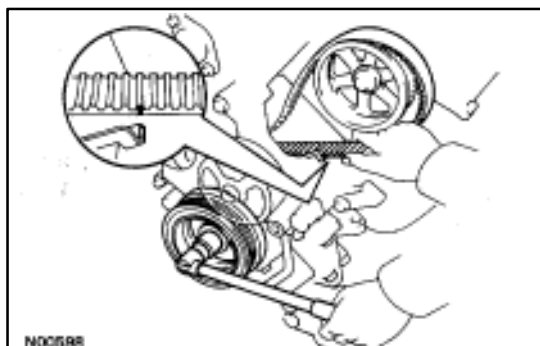
12. SET NO.1 CYLINDER TO TDC/COMPRESSION

- (a) (Crankshaft Pulley Position)
Turn the crankshaft pulley, and align its groove with the "O" timing mark of the No.1 timing belt cover.



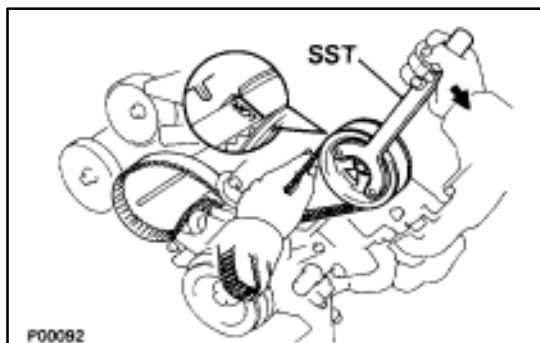
- (b) (Camshaft Timing Pulley Position)
Using SST, turn the camshaft timing pulley, and align the timing marks of the camshaft timing pulley and timing belt rear plate.

SST 09278-54012



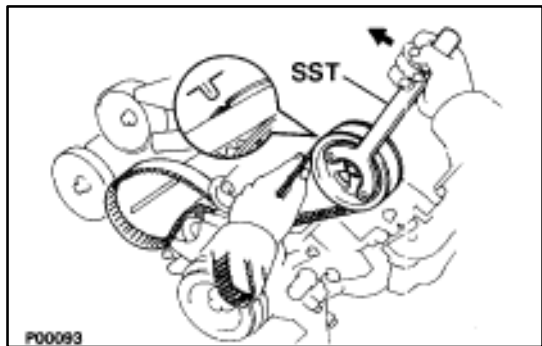
13. INSTALL TIMING BELT TO LH CAMSHAFT TIMING PULLEY

- (a) Align the installation mark on the timing belt with the end of the hydraulic pump.



- (b) Remove any oil or water on the LH camshaft timing pulley, and keep it clean.
- (c) Using SST, slightly turn the LH camshaft timing pulley clockwise. Align the installation mark on the timing belt with the timing mark of the camshaft timing pulley, and hang the timing belt on the LH camshaft timing pulley.

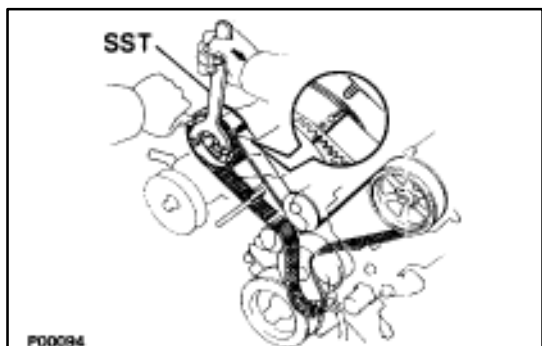
SST 09278-54012



- (d) Using SST, align the timing marks of the LH camshaft pulley and timing belt rear plate.

SST 09278-54012

- (e) Check that the timing belt has tension between the crankshaft timing pulley and LH camshaft timing pulley.

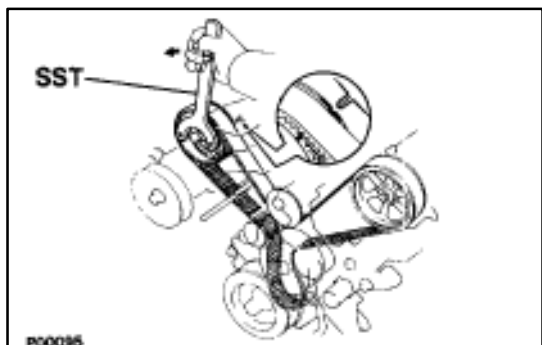


14. INSTALL TIMING BELT TO RH CAMSHAFT TIMING PULLEY

- (a) Remove any oil or water on the RH camshaft timing and water pump pulley, and keep them clean.

- (b) Using SST, slightly turn the RH camshaft timing pulley clockwise. Align the installation mark on the timing belt with the timing mark of the camshaft timing pulley, and hang the timing belt on the RH camshaft timing pulley.

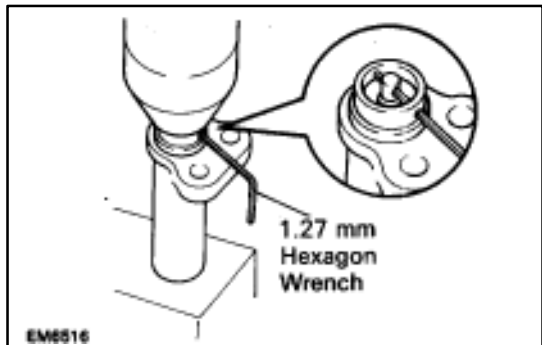
SST 09278-54012



- (c) Using SST, align the timing marks of the RH camshaft pulley and timing belt rear plate.

SST 09278-54012

- (d) Check that the timing belt has tension between the RH camshaft timing pulley and LH camshaft timing pulley.

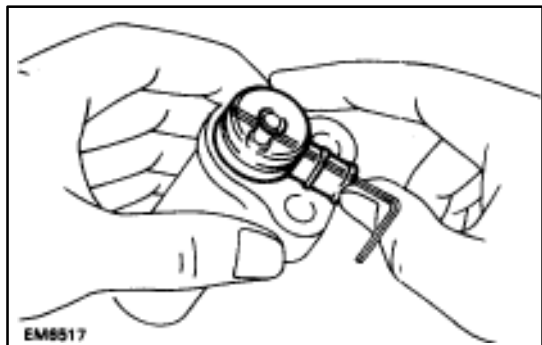


15. SET TIMING BELT TENSIONER

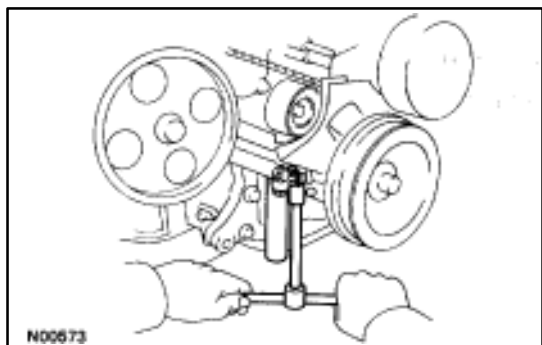
- (a) Using a press, slowly press in the push rod using 981-9,807 N (100-1,000 kgf, 220-2,205 lbf) of pressure.

- (b) Align the holes of the push rod and housing, pass a 1.27 mm hexagon wrench through the holes to keep the setting position of the push rod.

- (c) Release the press.



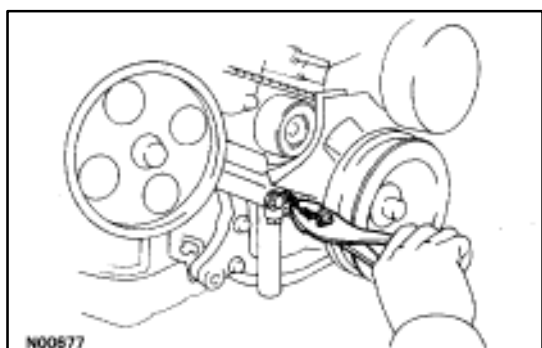
- (d) Install the dust boot to the tensioner.



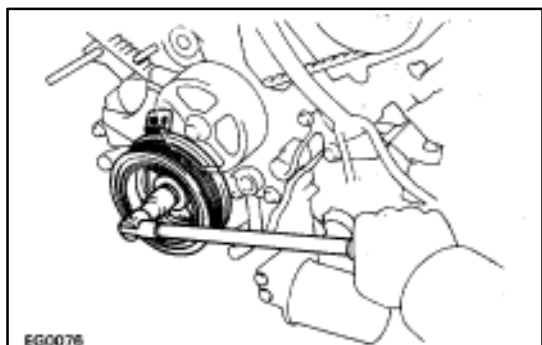
16. INSTALL TIMING BELT TENSIONER

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

Torque: 26 N·m (270 kgf·cm, 20 ft·lbf)



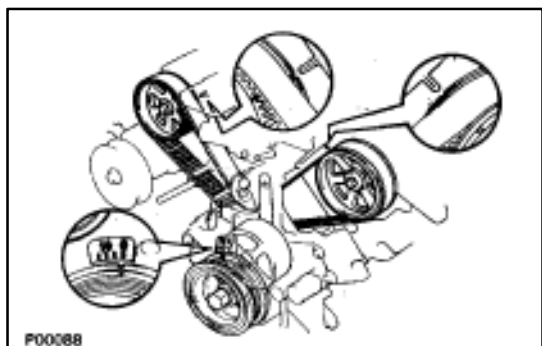
- (c) Using pliers, remove the 1.27 mm hexagon wrench from the tensioner.



17. CHECK VALVE TIMING

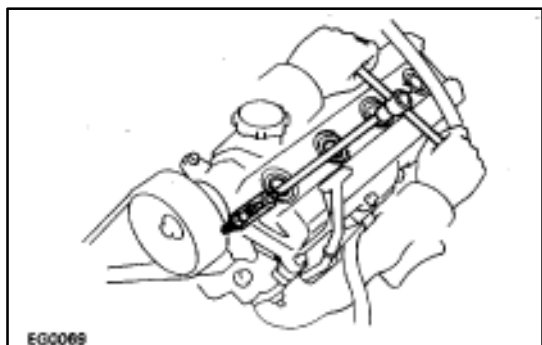
- (a) Turn the crankshaft pulley two revolutions from TDC to TDC.

NOTICE: Always turn the crankshaft clockwise.



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

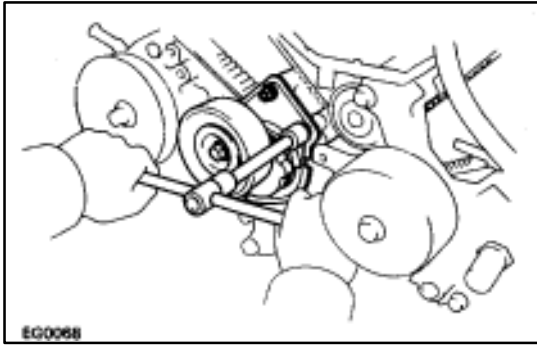
If the marks do not align, remove the timing belt and reinstall it.



18. INSTALL SPARK PLUGS

Using a 16 mm plug wrench, install the eight spark plugs.

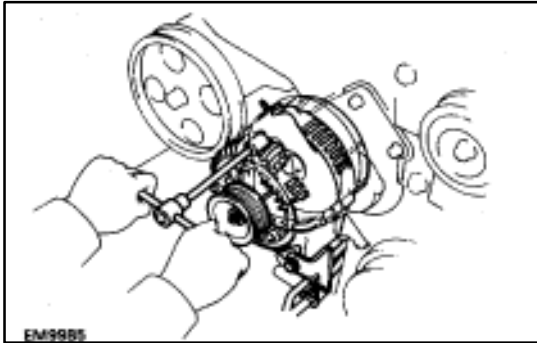
Torque: 18 N·m (180 kgf·cm, 13 ft·lbf)

**19. INSTALL DRIVE BELT TENSIONER**

Install the tensioner with the bolt and two nuts.

Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)

HINT: Use bolt 106 mm (4.17 in.) in length.

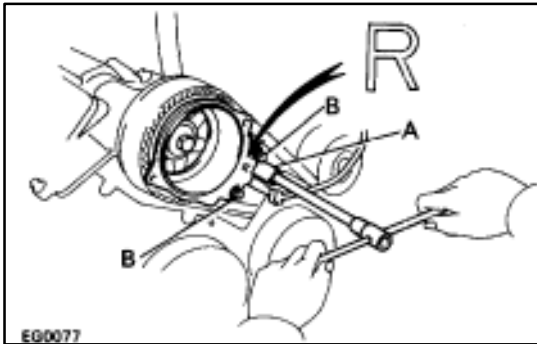
**20. INSTALL ALTERNATOR**

(a) Install the alternator and A/T oil cooler pipe bracket with the bolt and nut.

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

(b) Connect the alternator connector.

(c) Connect the alternator wire with the nut and cap.

**21. INSTALL RH DISTRIBUTOR HOUSING**

(a) Install the distributor housing with the three bolts.

Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)

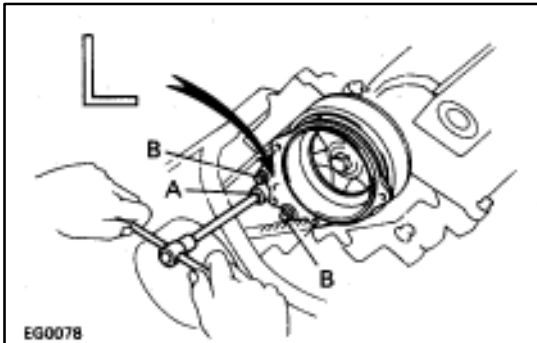
HINT:

- The RH distributor housing is marked with "R".
- Each bolt length is indicated in the illustration.

Bolt length: A 38 mm (1.50 in.)

B 96 mm (3.78 in.)

(b) Connect the cam position sensor connector.

**22. INSTALL LH DISTRIBUTOR HOUSING**

(a) Install the distributor housing with the three bolts.

Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)

HINT:

- The LH distributor housing is marked with "L".
- Each bolt length is indicated in the illustration.

Bolt length: A 38 mm (1.50 in.)

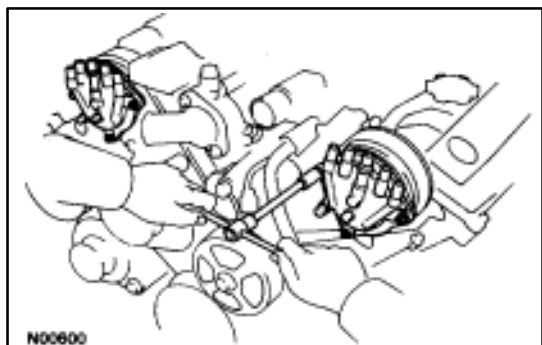
B 80 mm (3.15 in.)

**23. INSTALL DISTRIBUTOR ROTORS**

(a) Align the protrusion of the distributor rotor with the groove of the camshaft timing pulley.

(b) Install the distributor rotor with the two bolts. Install the two distributor rotors.

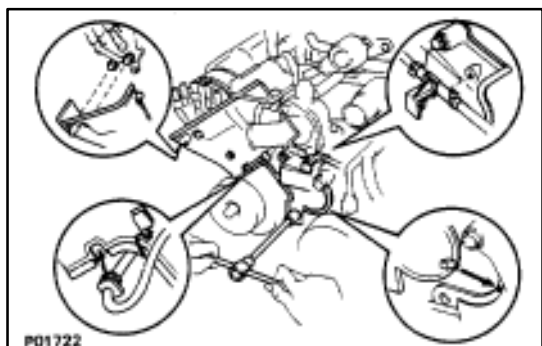
Torque: 3.8 N·m (39 kgf·cm, 34 in·lbf)



24. INSTALL DISTRIBUTOR CAPS

Install the distributor cap with the three bolts. Install the two distributor caps.

Torque: 3.8 N·m (39 kgf·cm, 34 in.-lbf)



25. INSTALL RH NO.2 TIMING BELT COVER

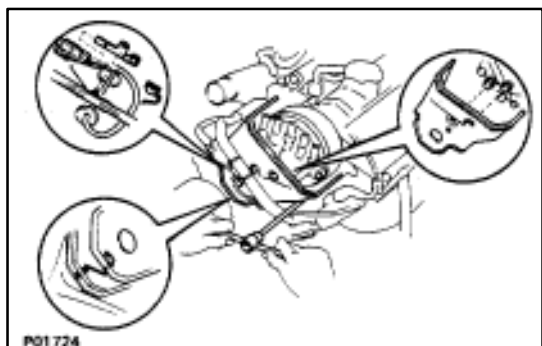
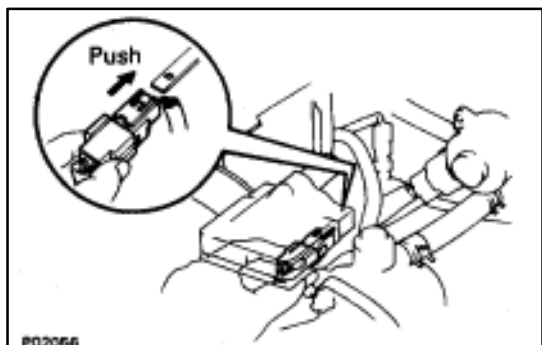
- Install the four gaskets to the timing belt cover.
- Install the connector grommet to the timing belt cover.
- Install the timing belt cover with the five bolts.

Torque (12 mm head bolt):

16 N·m (160 kgf·cm, 12 ft-lbf)

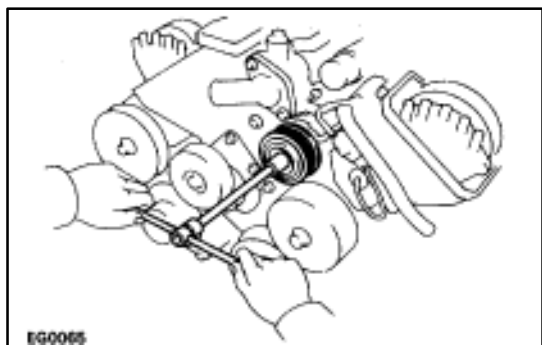
HINT (12 mm head bolt): Use bolts 106 mm (4.17 in.) in length.

- Install the wire clamp to the timing belt cover.
- Install the cam position sensor connector to the ignition coil bracket.



26. INSTALL LH NO.2 TIMING BELT COVER

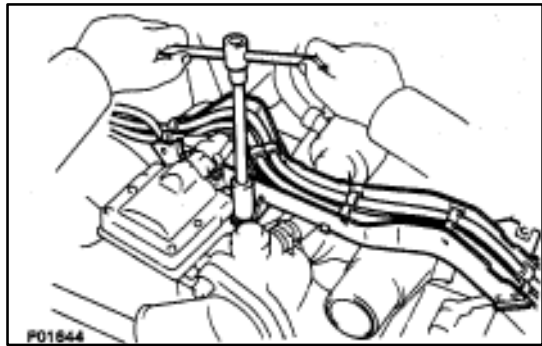
- Install the two gaskets to the timing belt cover.
- Run the cam position sensor wire through the timing belt cover hole.
- Install the timing belt cover and connector bracket with the three bolts.
- Connect the cam position sensor connector.
- Install cam position sensor connector to connector bracket.
- Install the connector grommet to the timing belt cover hole.



27. INSTALL DRIVE BELT IDLER PULLEY

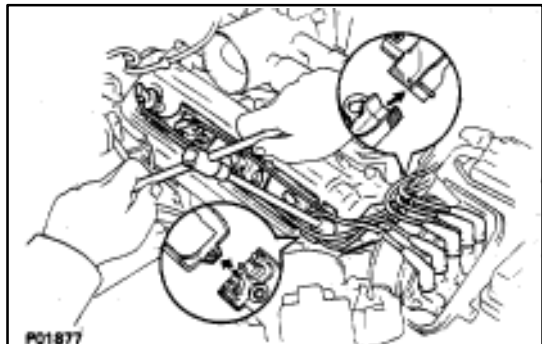
Install the idler pulley and cover plate with the pulley bolt.

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



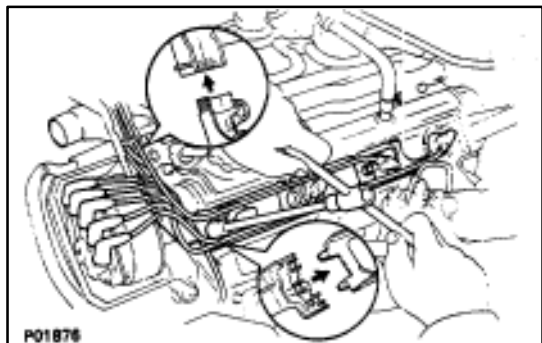
28. INSTALL HIGH-TENSION CORDS, HIGH-TENSION CORD CLAMP AND LOWER HIGH-TENSION CORD COVER ASSEMBLY

- (a) Install the lower high-tension cord cover with the bolt.
- (b) Connect the high-tension cord to RH ignition coil.



- (c) Connect the four high-tension cord to the RH spark plugs.
- (d) Install the RH rear and front high-tension cord clamps with the two bolts.

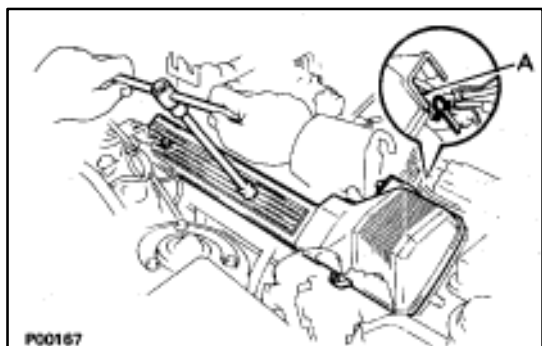
HINT: Place the front and rear ends of the front high-tension cord clamp on the rear high-tension cord clamp and lower high-tension cord cover.



- (e) Connect the four high-tension cord to the LH spark plugs.
- (f) Install the LH rear and front high-tension cord clamps with the two bolts.

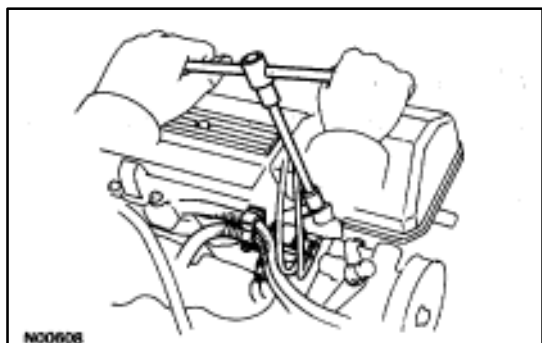
HINT: Place the front and rear ends of the front high-tension cord clamp on the rear high-tension cord clamp and lower high-tension cord cover.

- (g) Fit the high-tension cords to the high-tension cord clamp. (See page [IG-16](#))



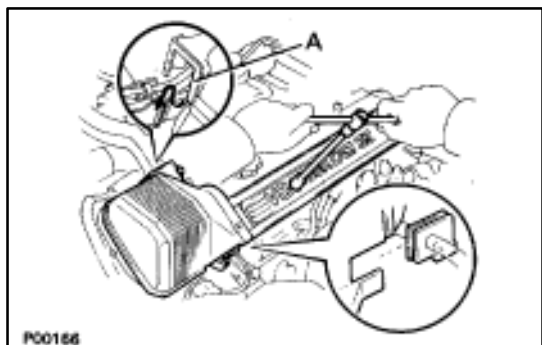
29. INSTALL RH NO.3 TIMING BELT COVER

- (a) Install the three gaskets to the timing belt cover.
- (b) Fit portion A of the timing belt cover, matching it with the lower high-tension cord cover.
- (c) Install the timing belt cover with the three bolts.

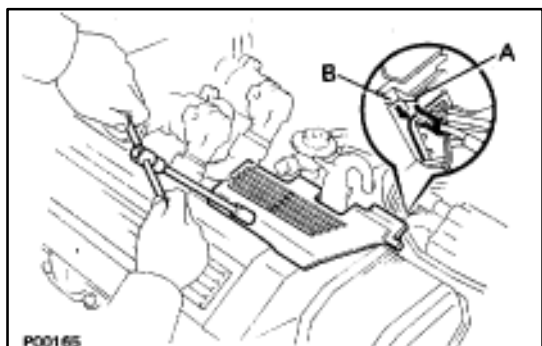


30. INSTALL VSV FOR EVAP SYSTEM

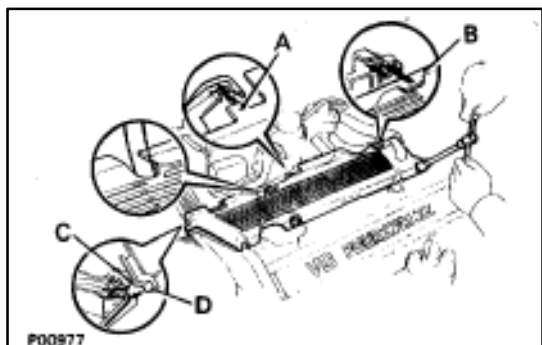
Install the VSV with the two bolts.

**31. INSTALL LH NO.3 TIMING BELT COVER**

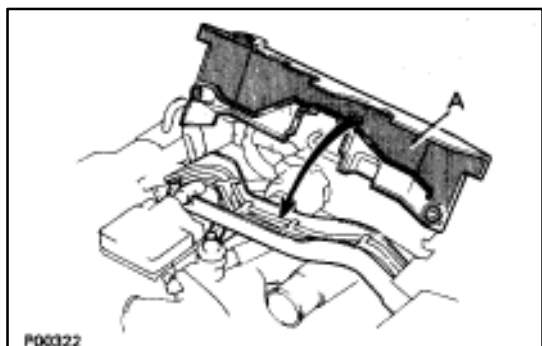
- (a) Install the three gaskets to the timing belt cover.
- (b) Install the cord grommet to the high-tension cord.
- (c) Install the cord grommet to the timing belt cover.
- (d) Fit portion A of the timing belt cover, matching it with the lower high-tension cord cover.
- (e) Install the timing belt cover with the four bolts.

**32. INSTALL RH ENGINE WIRE COVER**

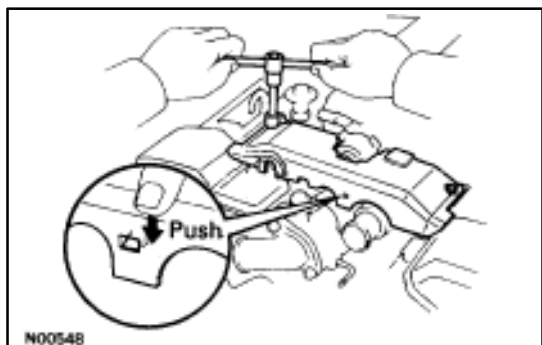
- (a) Fit portions A and B of the engine wire cover, matching them with the lower high-tension cord cover and No. 3 timing belt cover.
- (b) Install the engine wire cover with the bolt.

**33. INSTALL LH ENGINE WIRE COVER**

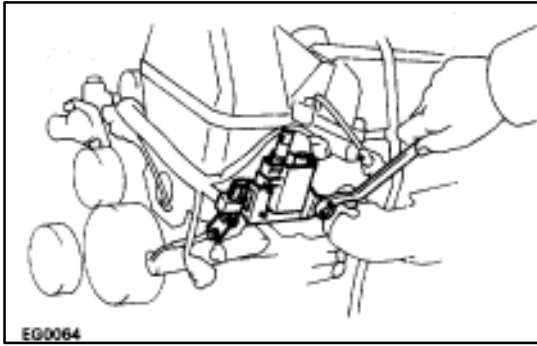
- (a) Connect portions A and B of the engine wire cover to the wire cover brackets.
- (b) Set the VSV (for Fuel pressure control system) wire in original position.
- (c) Fit portions C and D of the engine wire cover, matching them with the lower high-tension cord cover and No.3 timing belt cover.
- (b) Install the engine wire cover with the two bolts.

**34. INSTALL UPPER HIGH-TENSION CORD COVER**

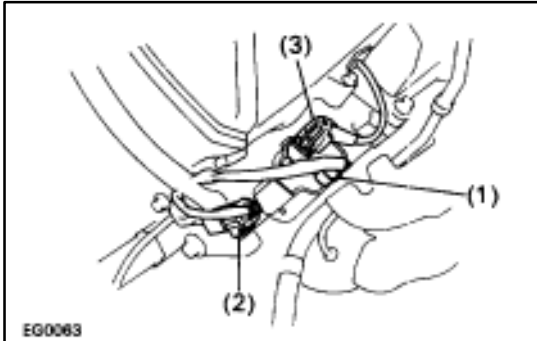
- (a) Fit portion A of the upper high-tension cover, matching it with the top of the lower high-tension cord cover.



- (b) Push the front side of the high-tension cord cover, and connect the front side claw groove of the upper high-tension cord cover to the claw of the lower high-tension cord cover.
- (c) Install the upper high-tension cord cover with the two bolts.

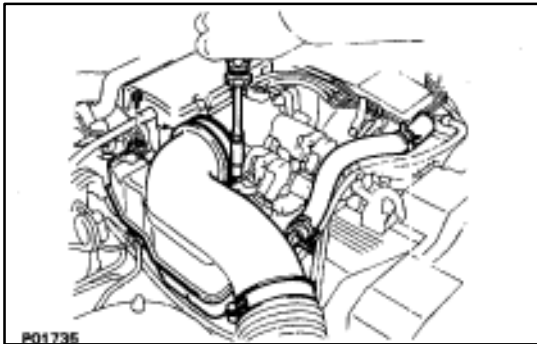
**35. INSTALL LH IGNITION COIL**

- (a) Install the ignition coil with the two bolts.

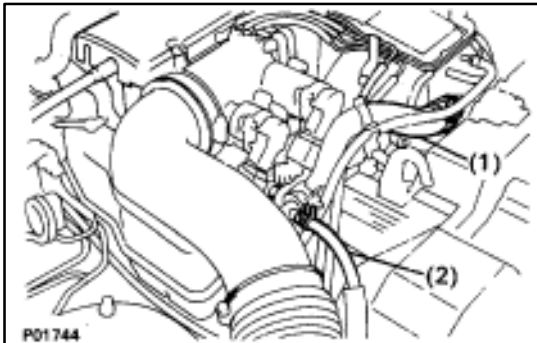


- (b) Connect the following connectors and cord:

- (1) Ignition coil connector
- (2) Noise filter connector
- (3) High-tension cord

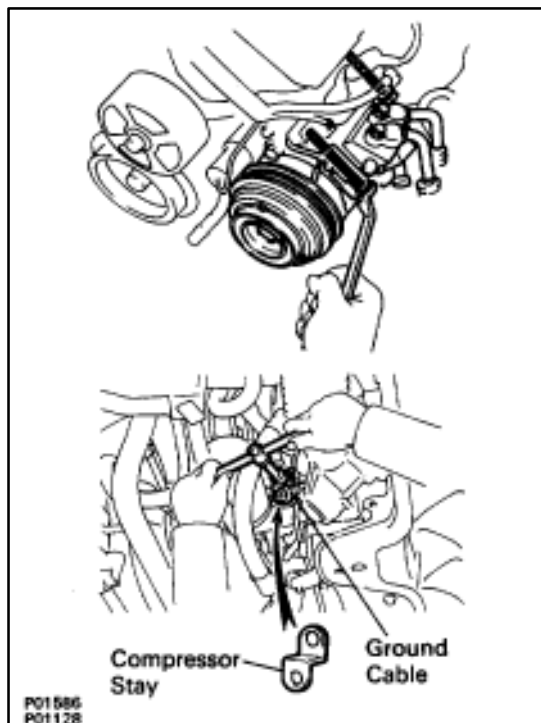
**36. INSTALL INTAKE AIR CONNECTOR**

- (a) Connect the end portions of the intake air connector to the throttle body and air cleaner hose.
- (b) Tighten the two hose clamps.
- (c) Install the bolt holding the intake air connector to the cylinder head cover.



- (d) Connect the following hoses:

- (1) Air hose to ISC valve
- (2) Air hose (from PS air control valve) to intake air connector

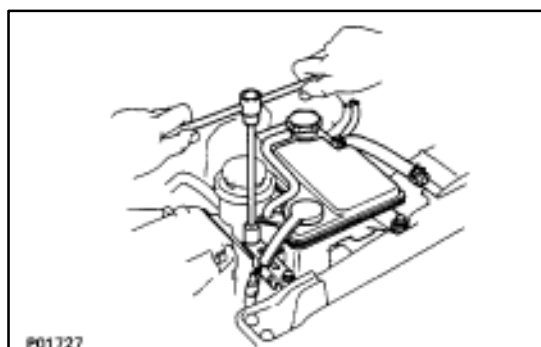
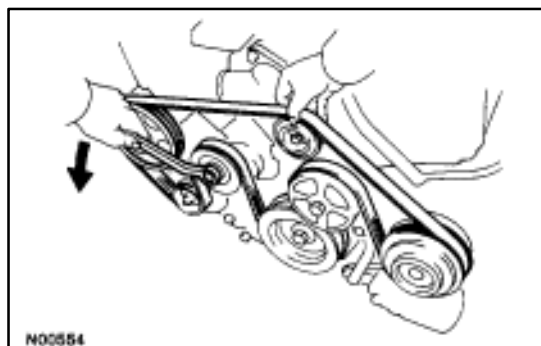
**37. INSTALL A/C COMPRESSOR**

- (a) Install the A/C compressor, compressor stay and ground cable with the three bolts and nut.

Torque: Bolt 49 N·m (500 kgf·cm, 36 ft·lbf)

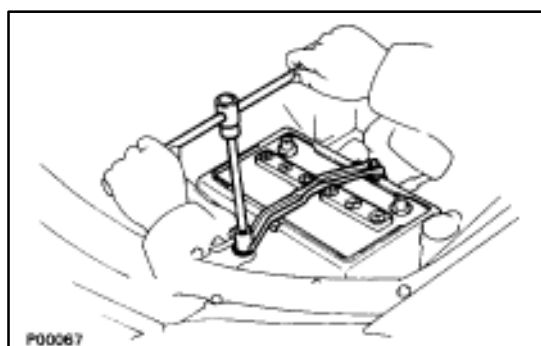
Nut 29 N·m (300 kgf·cm, 22 ft·lbf)

- (b) Connect the A/C compressor connector.

**38. INSTALL RADIATOR AND RESERVOIR TANK**
(See steps 25 and 26 on pages [EM-174](#) to 175)**39. INSTALL DRIVE BELT**

Install the drive belt by turning the drive belt tensioner counterclockwise.

HINT: The pulley bolt for the belt tensioner has a lefthand thread.

**40. INSTALL BATTERY****41. FILL WITH ENGINE COOLANT** (See page [CO-7](#))**42. CHECK IGNITION TIMING** (See page [IG-28](#))

Ignition timing:

8–12° BTDC @ idle

(w/ Terminals TE1 and E1 connected)

43. INSTALL ENGINE UNDER COVER