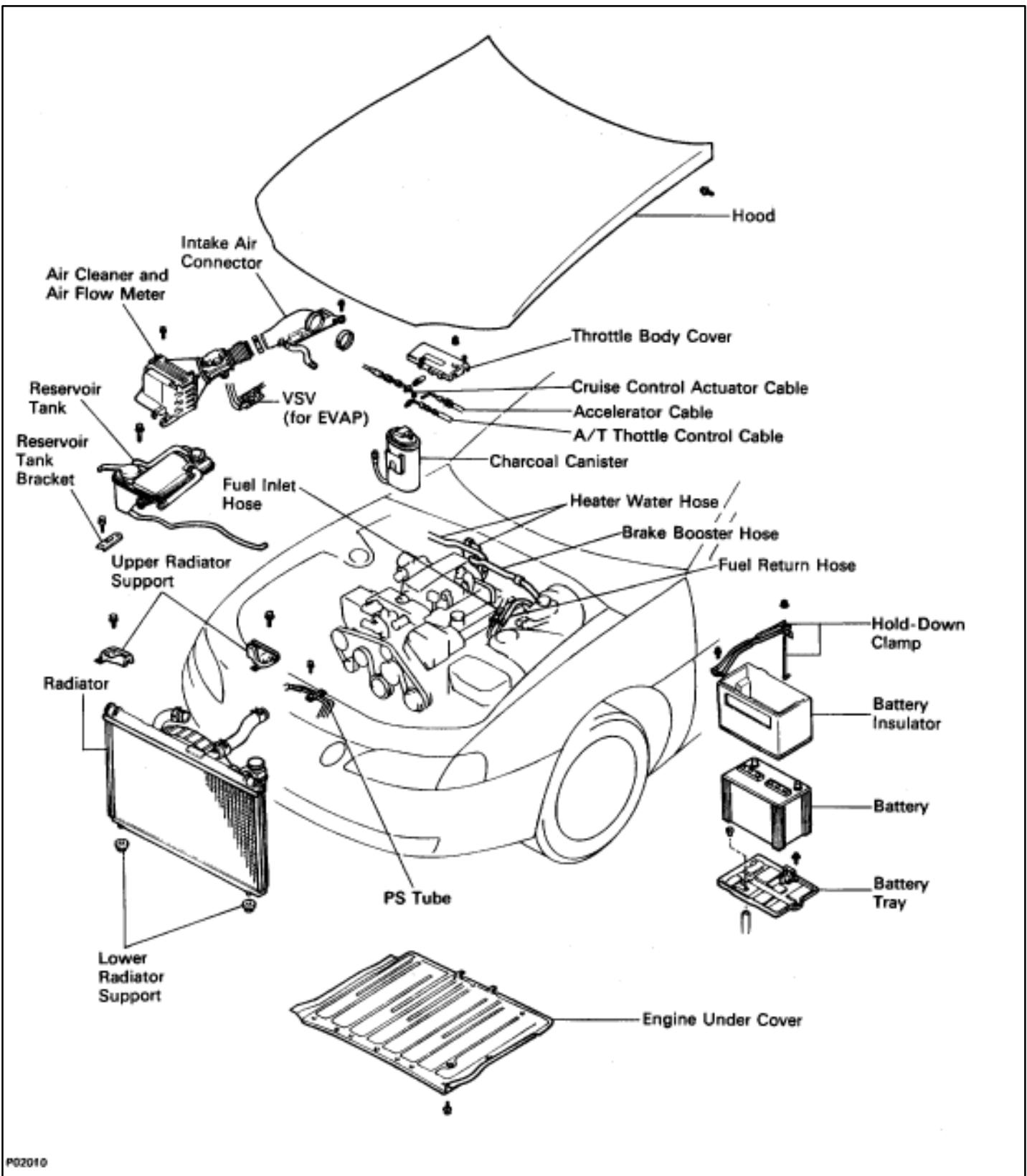
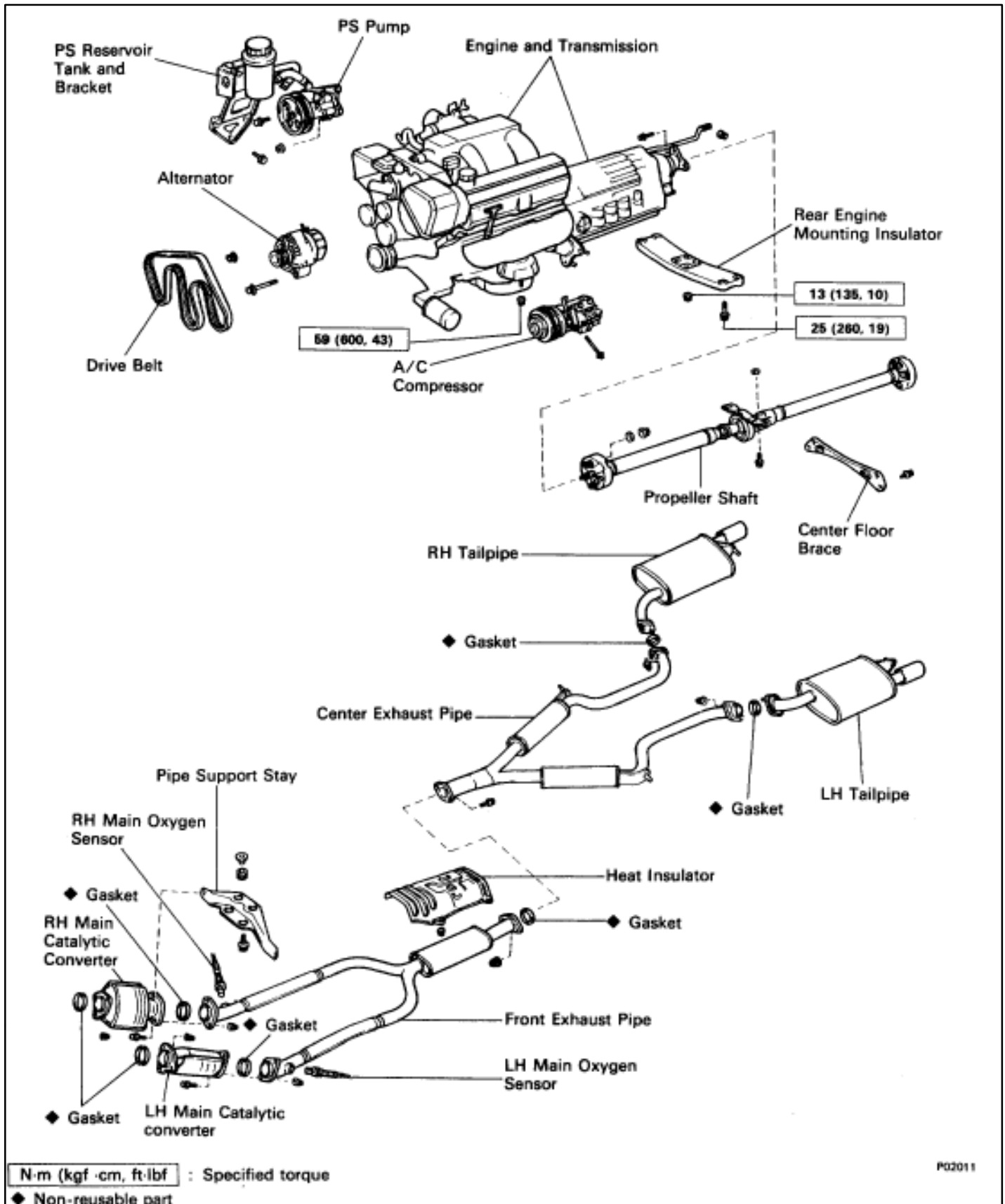


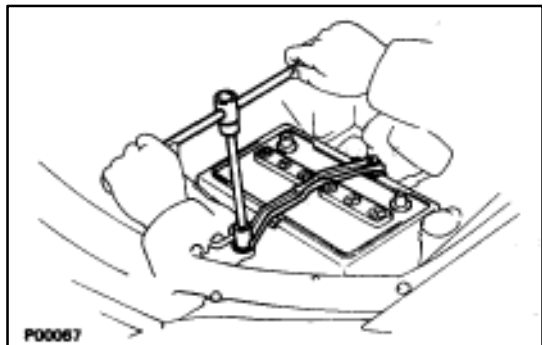
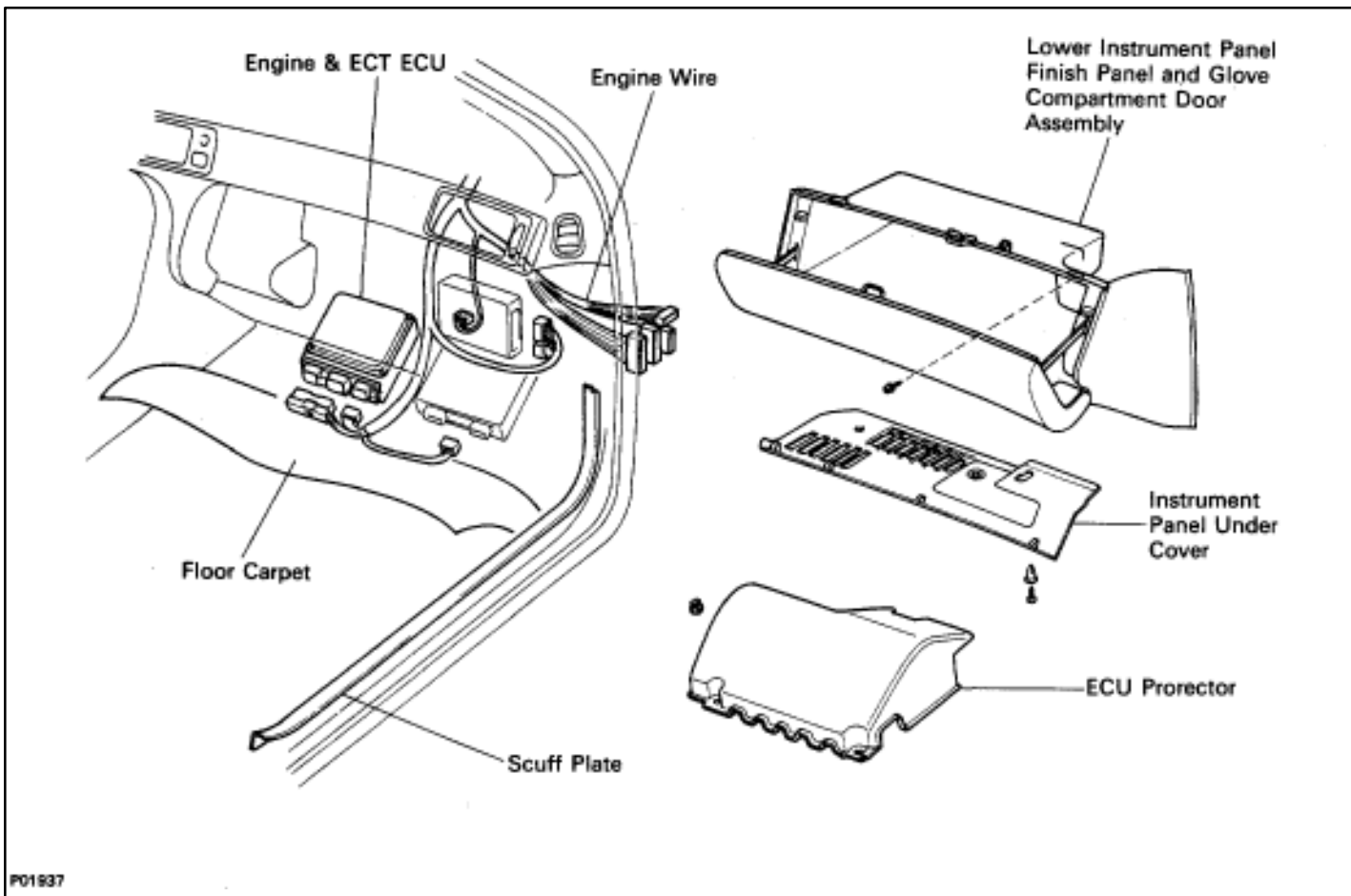
# **CYLINDER BLOCK COMPONENTS FOR REMOVAL AND INSTALLATION OF ENGINE WITH TRANSMISSION**



# 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](#))

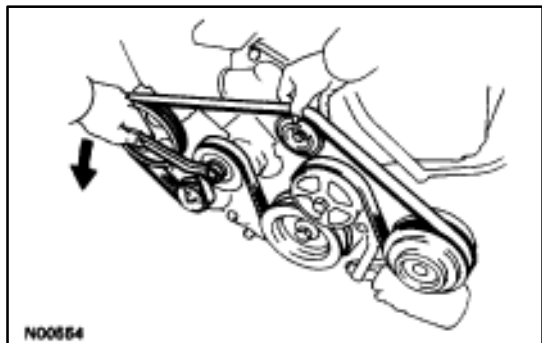
### 4. DRAIN ENGINE OIL

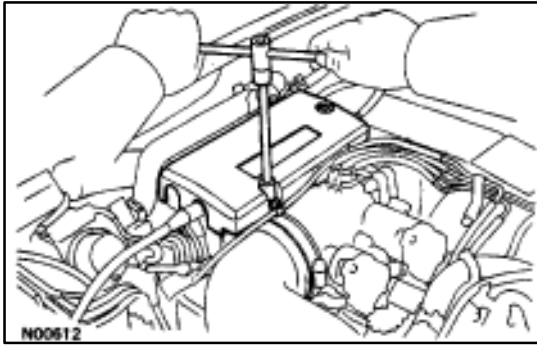
### 5. REMOVE HOOD

### 6. REMOVE DRIVE BELT

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

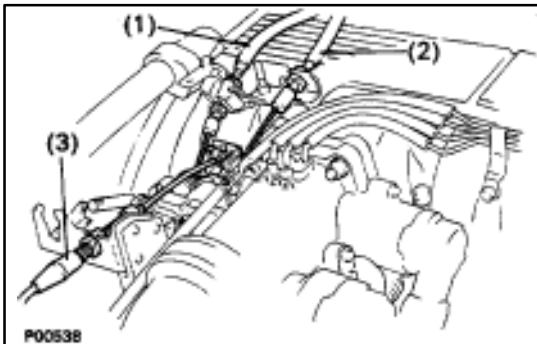
**HINT:** The pulley bolt for the belt tensioner has a left-hand thread.





## 7. REMOVE THROTTLE BODY COVER

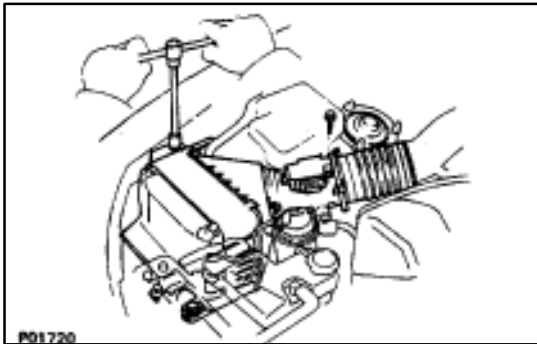
- (a) Remove the mounting cap nut.
- (b) Loosen the two bolts, and remove the throttle body cover.



## 8. DISCONNECT CONTROL CABLES FROM THROTTLE BODY

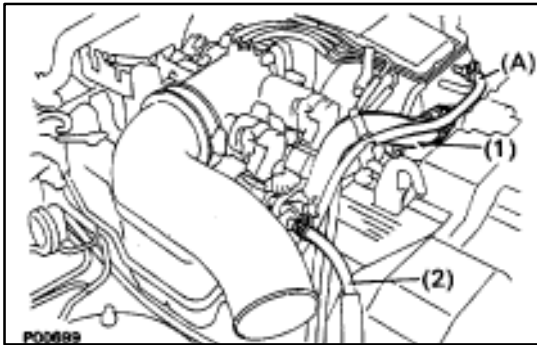
Disconnect the following cables:

- (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

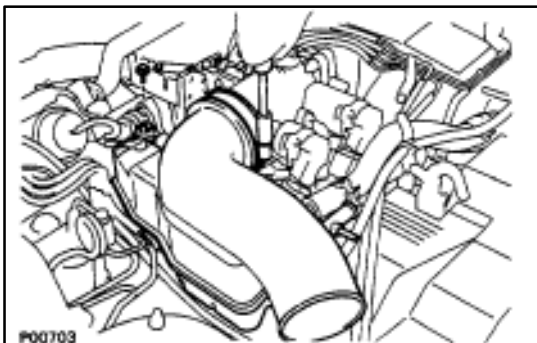
- (a) Disconnect the air flow meter connector.
- (b) Loosen the hose clamp holding the air cleaner hose to the intake air connector.
- (c) Remove the four mounting bolts.
- (d) Disconnect the air cleaner hose from the intake air connector.
- (e) Disconnect the air duct from the air cleaner case, and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



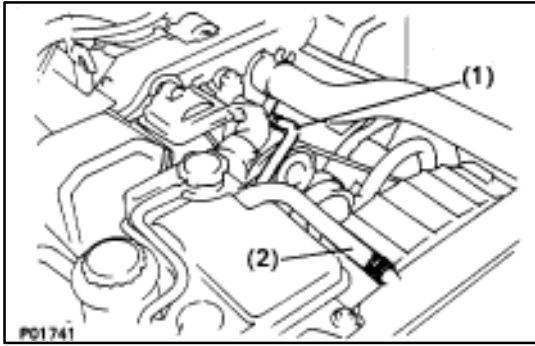
## 10. DISCONNECT VACUUM HOSE (A) (FROM PS AIR CONTROL VALVE) FROM AIR INTAKE CHAMBER

## 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

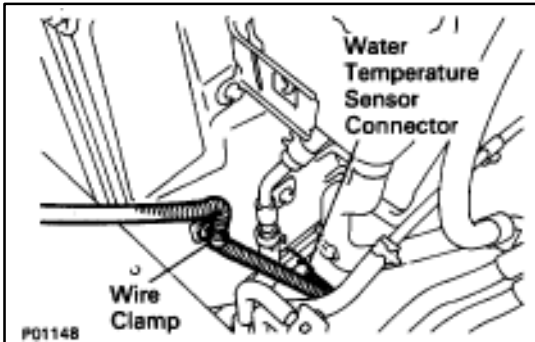
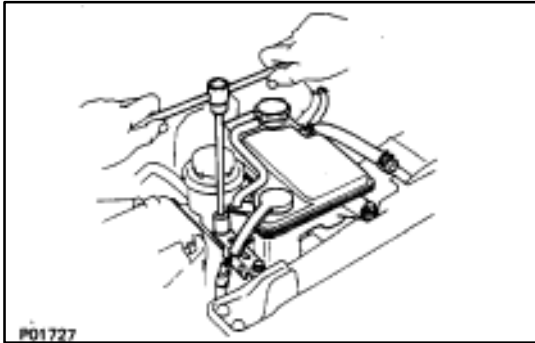


- (b) Remove the bolt holding the intake air connector to the cylinder head cover.
- (c) Loosen the hose clamp.
- (d) Disconnect the intake air connector from the throttle body, and remove the intake air connector.



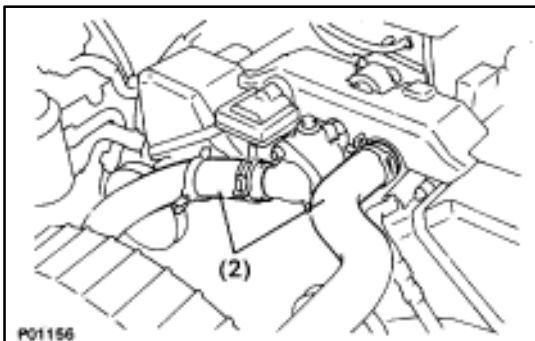
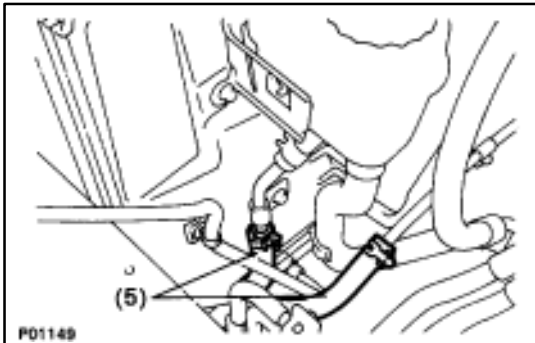
## 12. REMOVE RADIATOR RESERVOIR TANK

- (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.

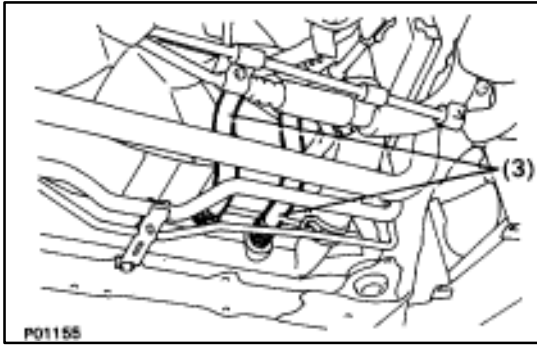


## 13. REMOVE RADIATOR

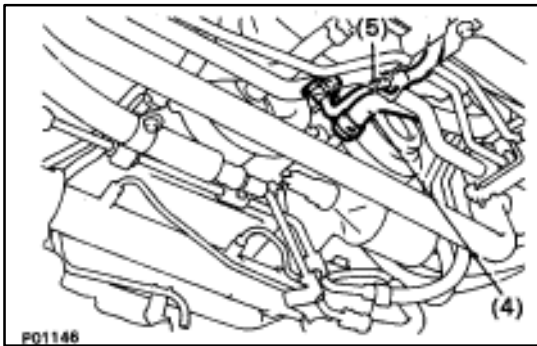
- (a) Disconnect the water temperature sensor connector.
- (b) Disconnect the wire clamp (for water temperature sensor) from the radiator fan shroud.
- (c) Disconnect the following hoses:
  - (1) Two oil cooler hoses (for cooling fan) from pipes



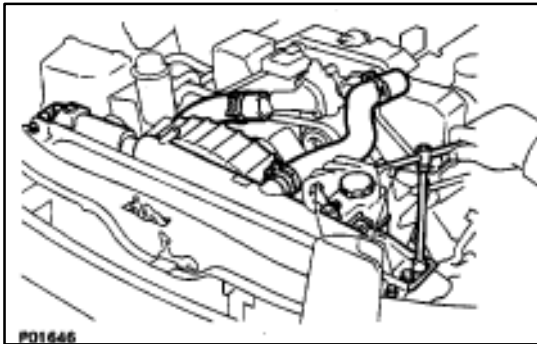
- (2) Two radiator hoses



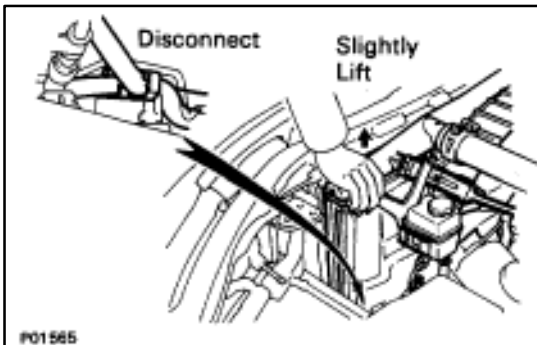
- (3) Two oil cooler hoses (for A/T) from radiator Plug the hose ends.



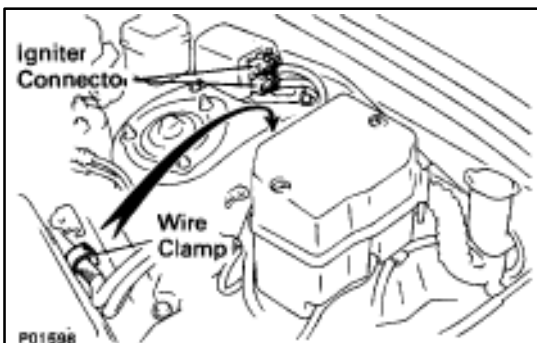
- (4) Suction hose from hydraulic pump  
(5) Pressure hose from hydraulic pump



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

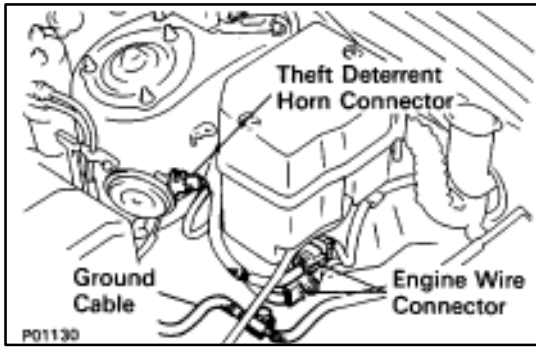


- (d) Slightly lift the radiator, and disconnect the two oil cooler hoses (for cooling fan) from the hose clamp on the radiator fan shroud.  
(e) Remove the radiator.



#### 14. DISCONNECT IGNITER CONNECTORS

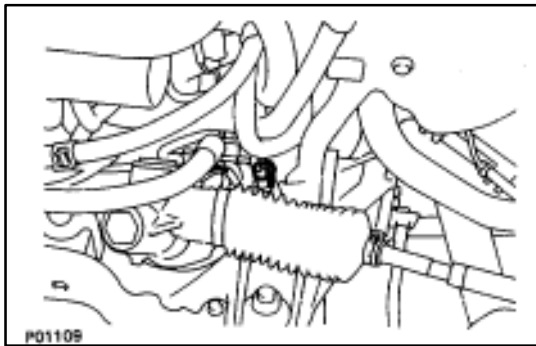
- (a) Disconnect the two igniter connectors.  
(b) Disconnect the wire clamp from the body.



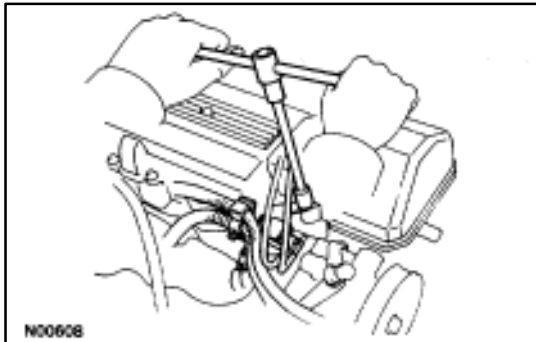
**15. DISCONNECT ENGINE WIRE CONNECTORS**

**16. DISCONNECT THEFT DETERRENT HORN CONNECTOR**

**17. DISCONNECT GROUND CABLE FROM BODY**

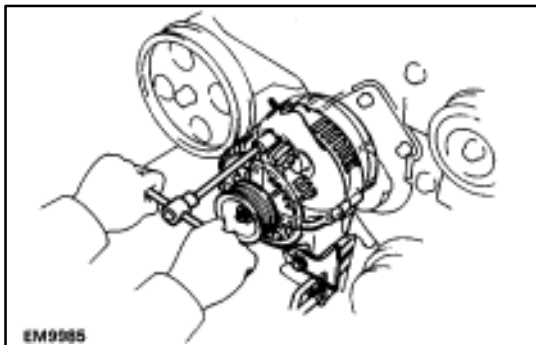


**18. DISCONNECT PS SOLENOID VALVE CONNECTOR**



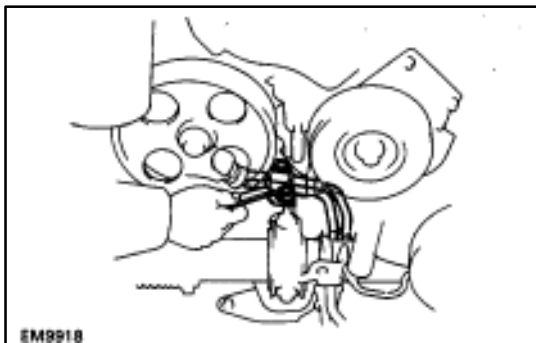
**19. DISCONNECT WIRE CLAMP (FOR ALTERNATOR) FROM VSV (FOR EVAP SYSTEM)**

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



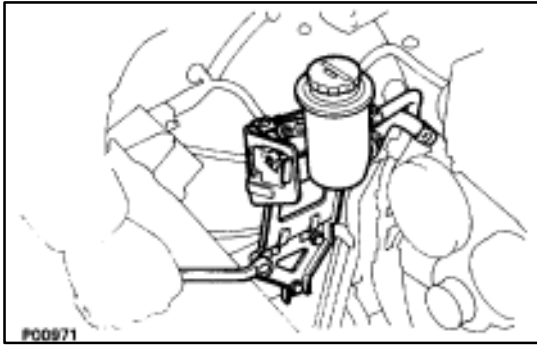
**20. REMOVE ALTERNATOR**

- (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.



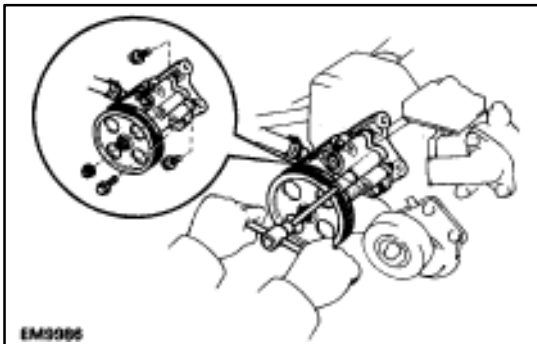
**21. DISCONNECT PS TUBES FROM SUSPENSION CROSSMEMBER**

Remove the clamp bolt, and disconnect the PS tubes.



## 22. DISCONNECT PS RESERVOIR TANK AND BRACKET FROM BODY

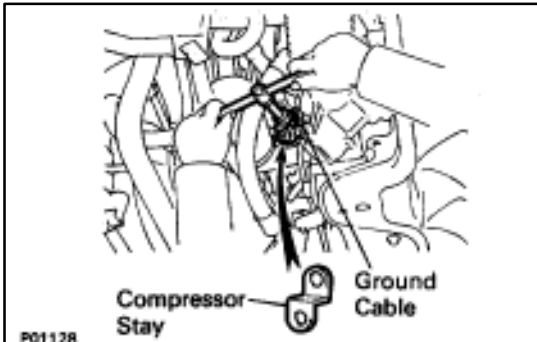
Remove the three bolts, and disconnect the reservoir tank and bracket assembly.



## 23. DISCONNECT PS PUMP FROM ENGINE

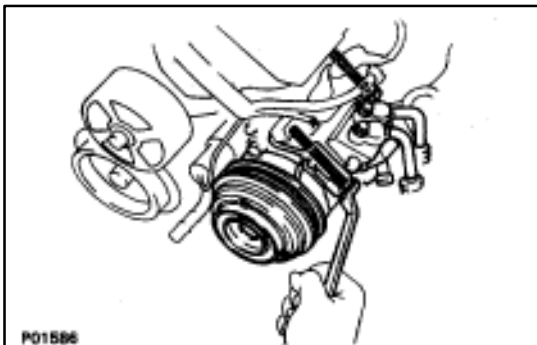
Remove the three pump bolts and nut, and disconnect the PS pump.

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



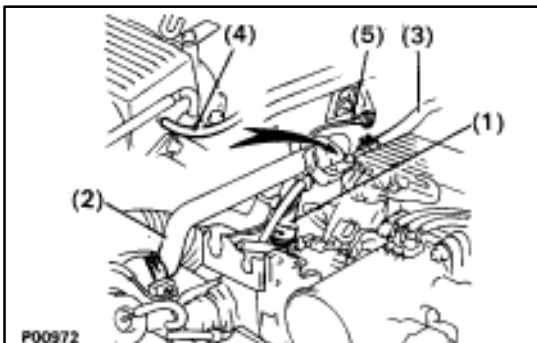
## 24. DISCONNECT A/C COMPRESSOR

- (a) Disconnect the compressor connector.
- (b) Remove the mounting nut, and disconnect the ground cable.
- (c) Remove the mounting bolt and compressor stay.



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

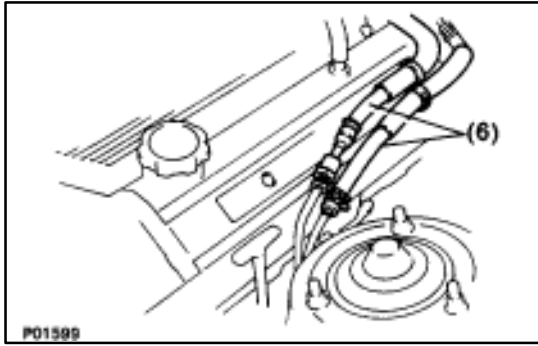
HINT: Put aside the compressor, and suspend it.



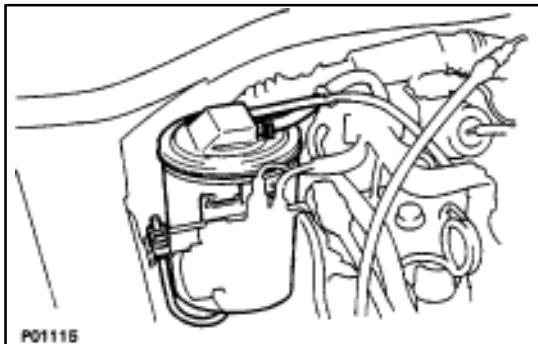
## 25. DISCONNECT HOSES AND GROUND STRAP

Disconnect the following hose and ground strap:

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

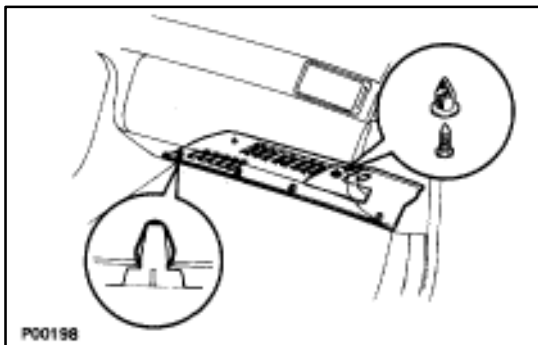


- (6) Two fuel hoses from fuel tubes.  
Plug the hose end.



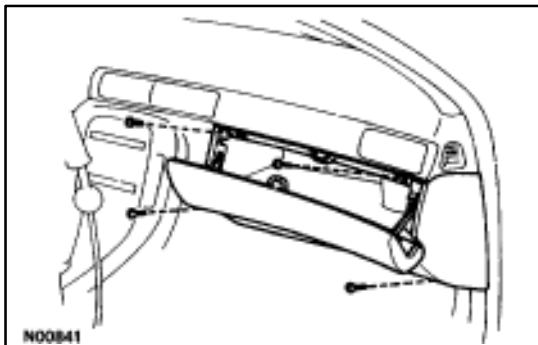
## 26. REMOVE CHARCOAL CANISTER

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

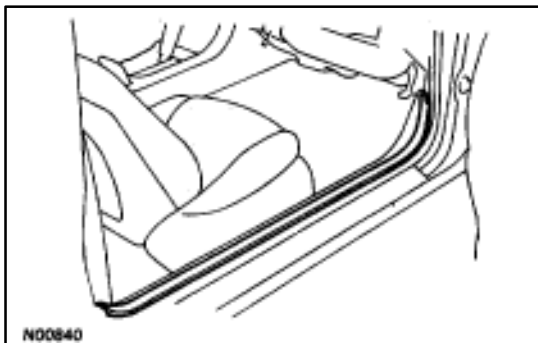


## 27. DISCONNECT ENGINE WIRE FROM CABIN

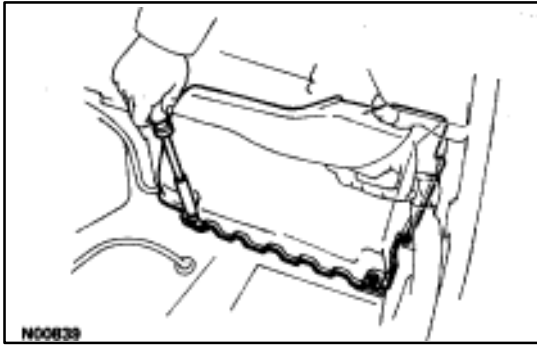
- (a) Remove the two clips, and pull out the instrument panel under cover.



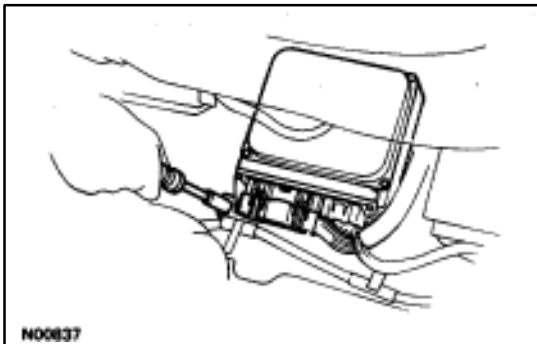
- (b) Remove the four mounting screws.
- (c) Disconnect the connectors, and remove the lower instrument panel finish panel and glove compartment door assembly.



- (d) Pull out the scuff plate.

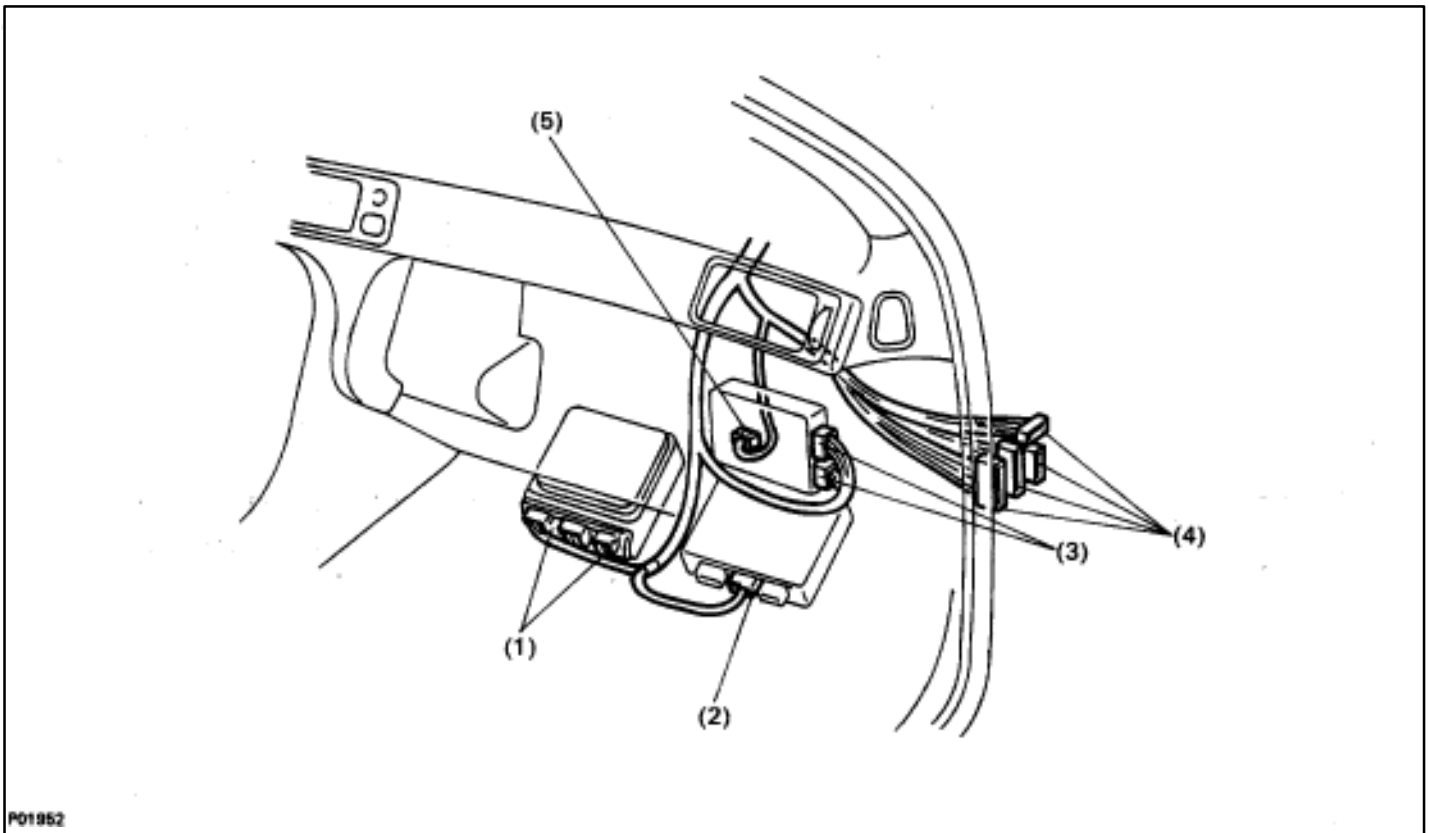


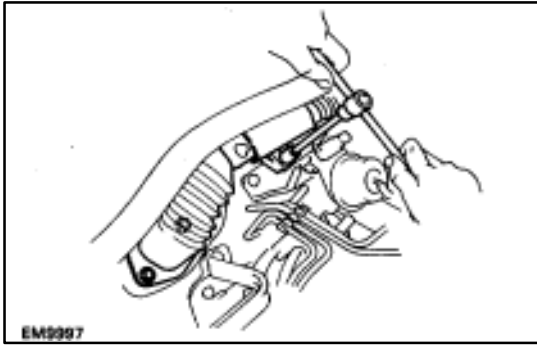
- (e) Take out the front side of the floor carpet.
- (f) Remove the two nuts and ECU protector.



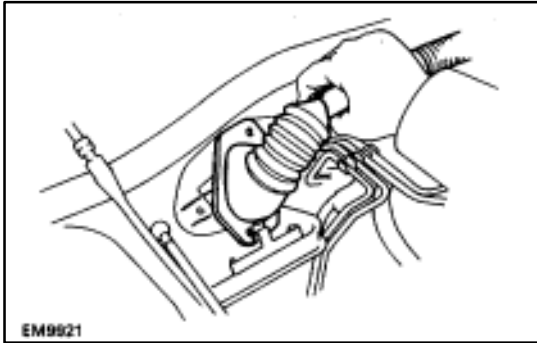
- (g) Remove the nut, and disconnect the engine & ECT ECU from the floor panel.

- (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

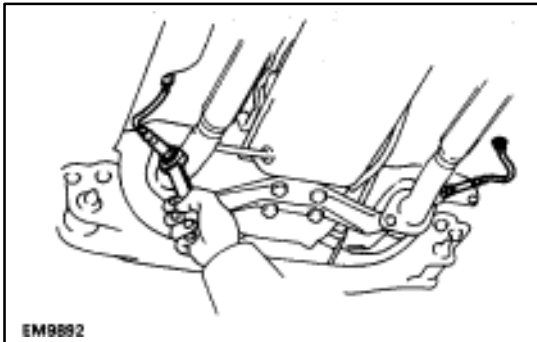




- (i) Remove the bolt holding the engine wire clamp to the heater water valve bracket.
- (j) Remove the two bolts holding the engine wire clamp to the body.

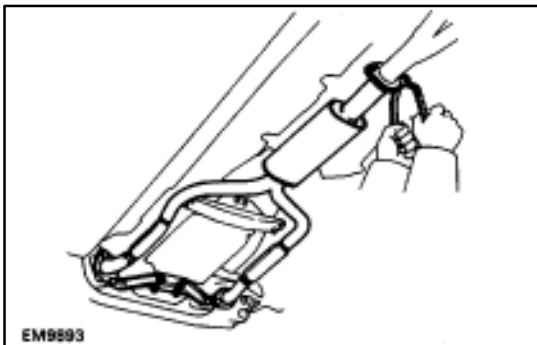


- (k) Pull out the engine wire from the cabin.

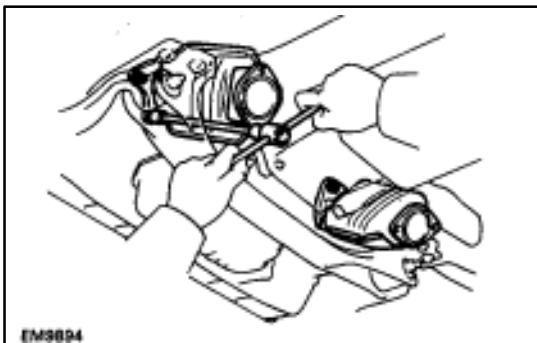


## 28. REMOVE FRONT EXHAUST PIPE

- (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.

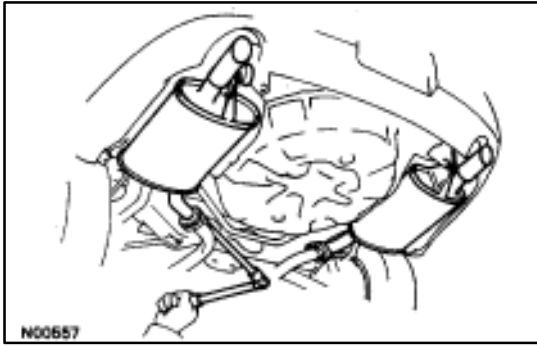


- (c) Remove the two bolts and nuts holding the front exhaust pipe to the center exhaust pipe.
- (d) Remove the four bolts and nuts holding the front exhaust pipe to the catalytic converter. Remove the pipe support stay, front exhaust pipe and three gaskets.

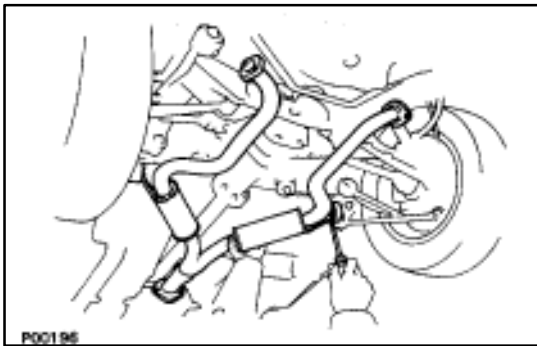


## 29. REMOVE CATALYTIC CONVERTERS (MAIN)

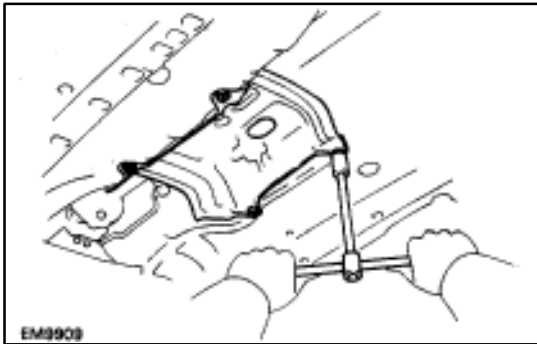
Remove the three nuts, catalytic converter and gasket. Remove the two catalytic converters.

**30. REMOVE TAILPIPES**

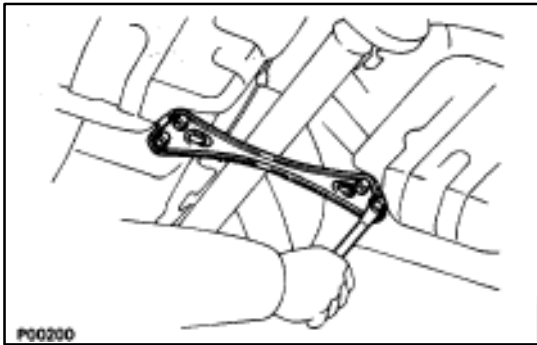
- (a) Remove the four bolts holding the tailpipes to the center exhaust pipe.
- (b) Disconnect the tailpipe hook from the ring on tailpipe bracket, and remove the tailpipe and gasket. Remove the two tailpipes.

**31. REMOVE CENTER EXHAUST PIPE**

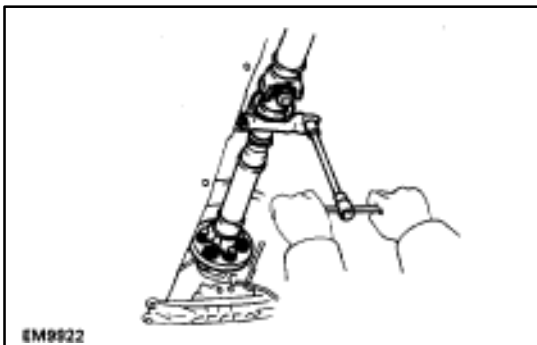
Disconnect the two hooks of the exhaust pipe from the rings on exhaust pipe brackets, and remove the center exhaust pipe.

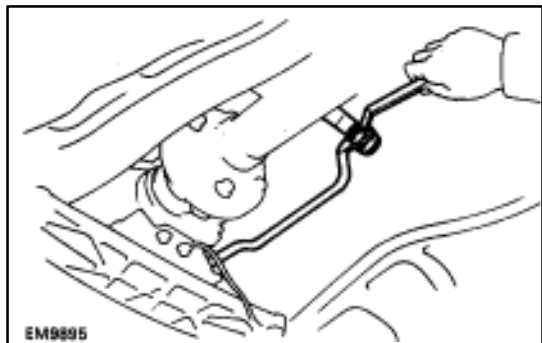
**32. REMOVE EXHAUST PIPE HEAT INSULATOR**

Remove the four nuts and heat insulator.

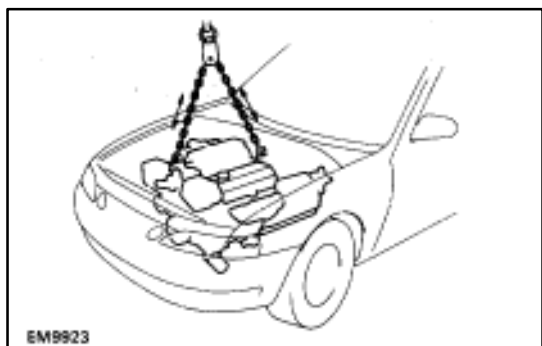
**33. REMOVE CENTER FLOOR BRACE**

Remove the four bolts and brace.

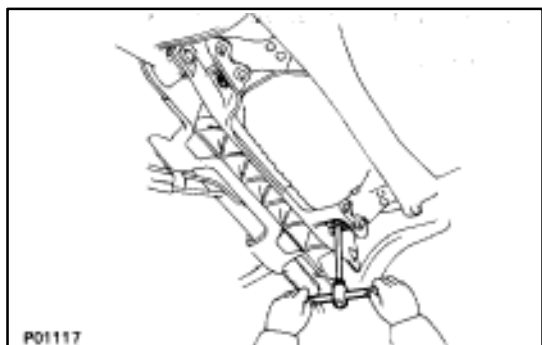
**34. REMOVE PROPELLER SHAFT (See PR section)**

**35. DISCONNECT TRANSMISSION CONTROL ROD**

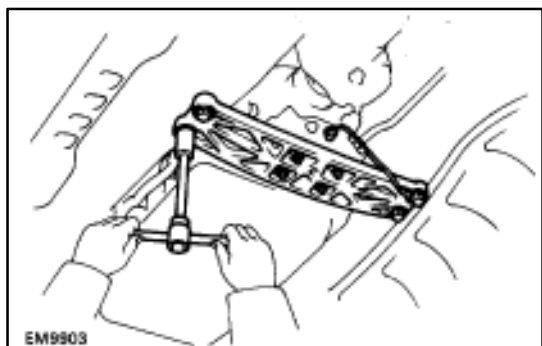
Remove the nut, and disconnect the control rod from the shift lever.

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

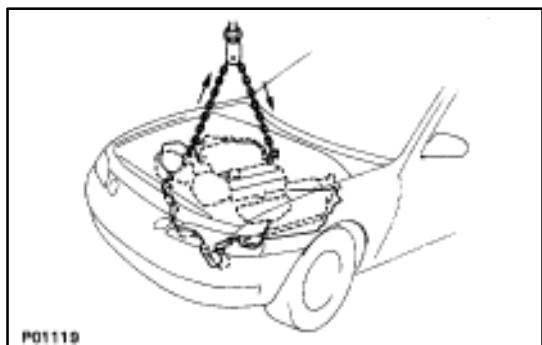
(a) Attach the engine hoist chain to the engine hangers.



(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.

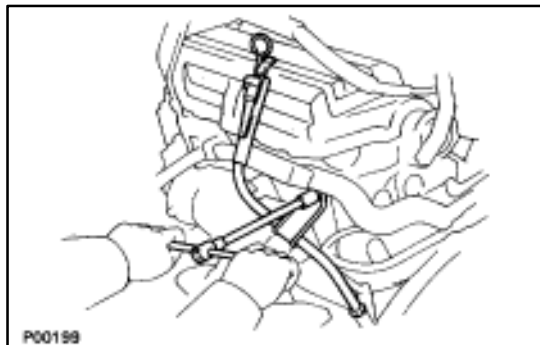
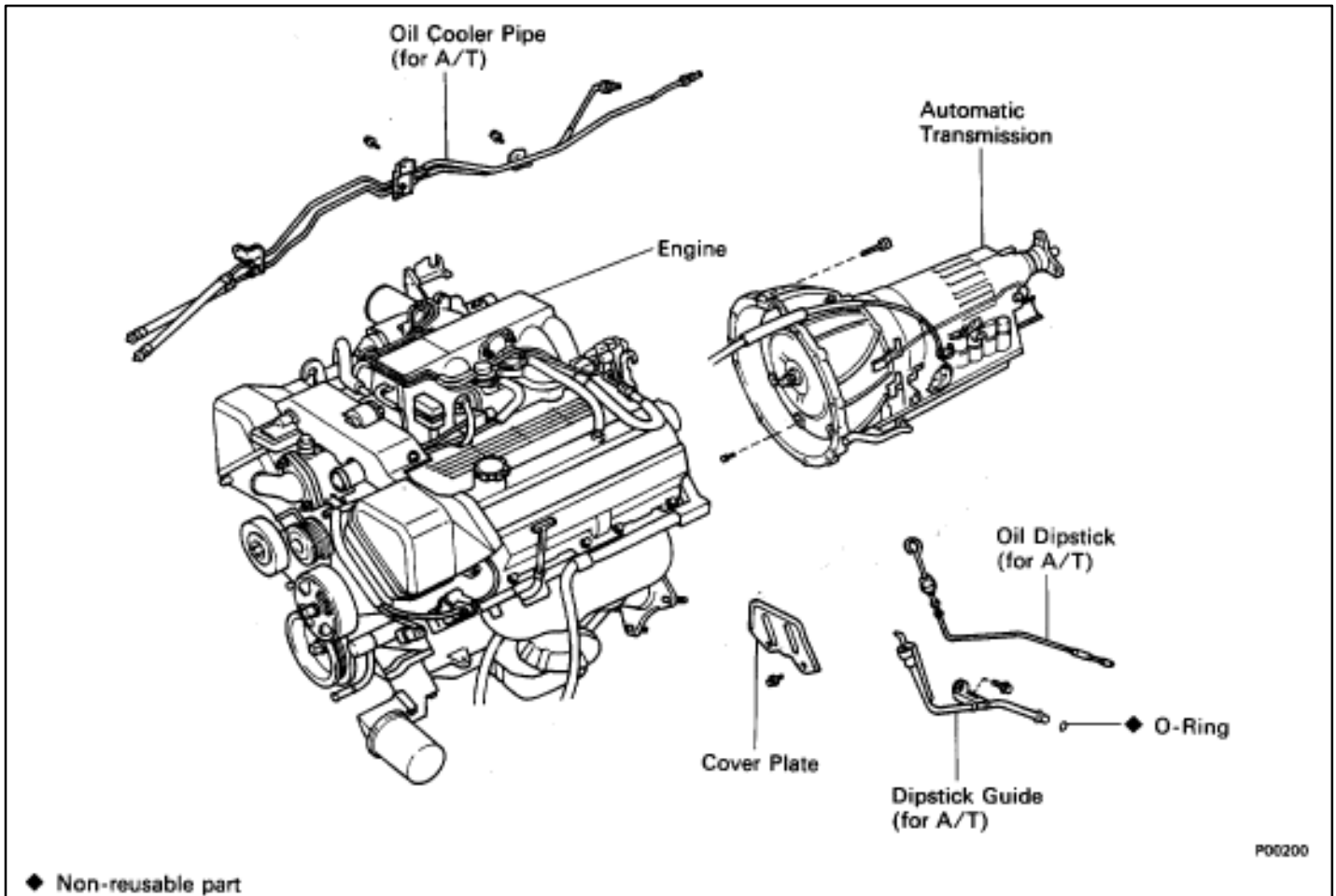


(d) Lift the engine out of the vehicle slowly and carefully.  
**NOTICE: Be careful not to hit the PS gear housing, neutral start switch and ABS actuator.**

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

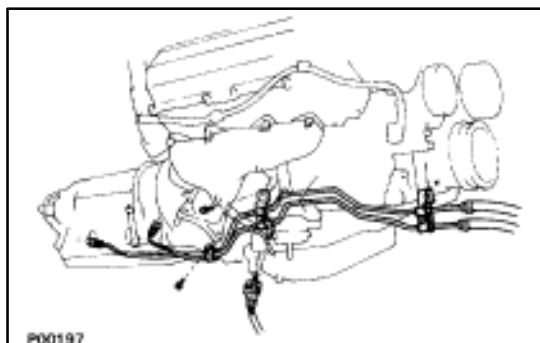
(f) Place the engine and transmission assembly onto the stand.

## COMPONENTS FOR SEPARATION AND ASSEMBLY OF ENGINE AND TRANSMISSION



### SEPARATION OF ENGINE AND TRANSMISSION

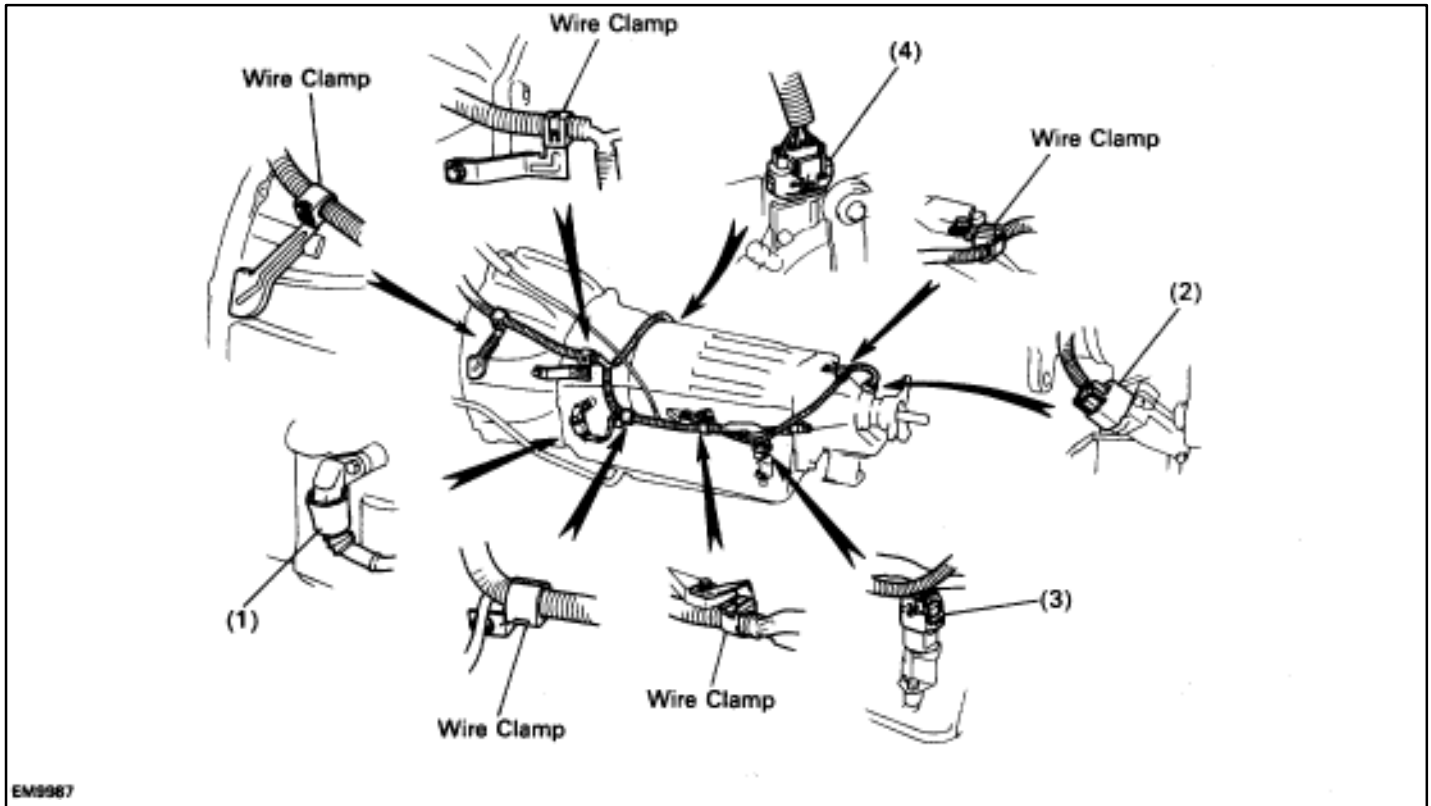
1. REMOVE OIL DIPSTICK GUIDE FOR TRANSMISSION
  - (a) Remove the mounting bolt.
  - (b) Pull out the dipstick guide and dipstick from the transmission.
  - (c) Remove the O-ring from the dipstick guide.



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.

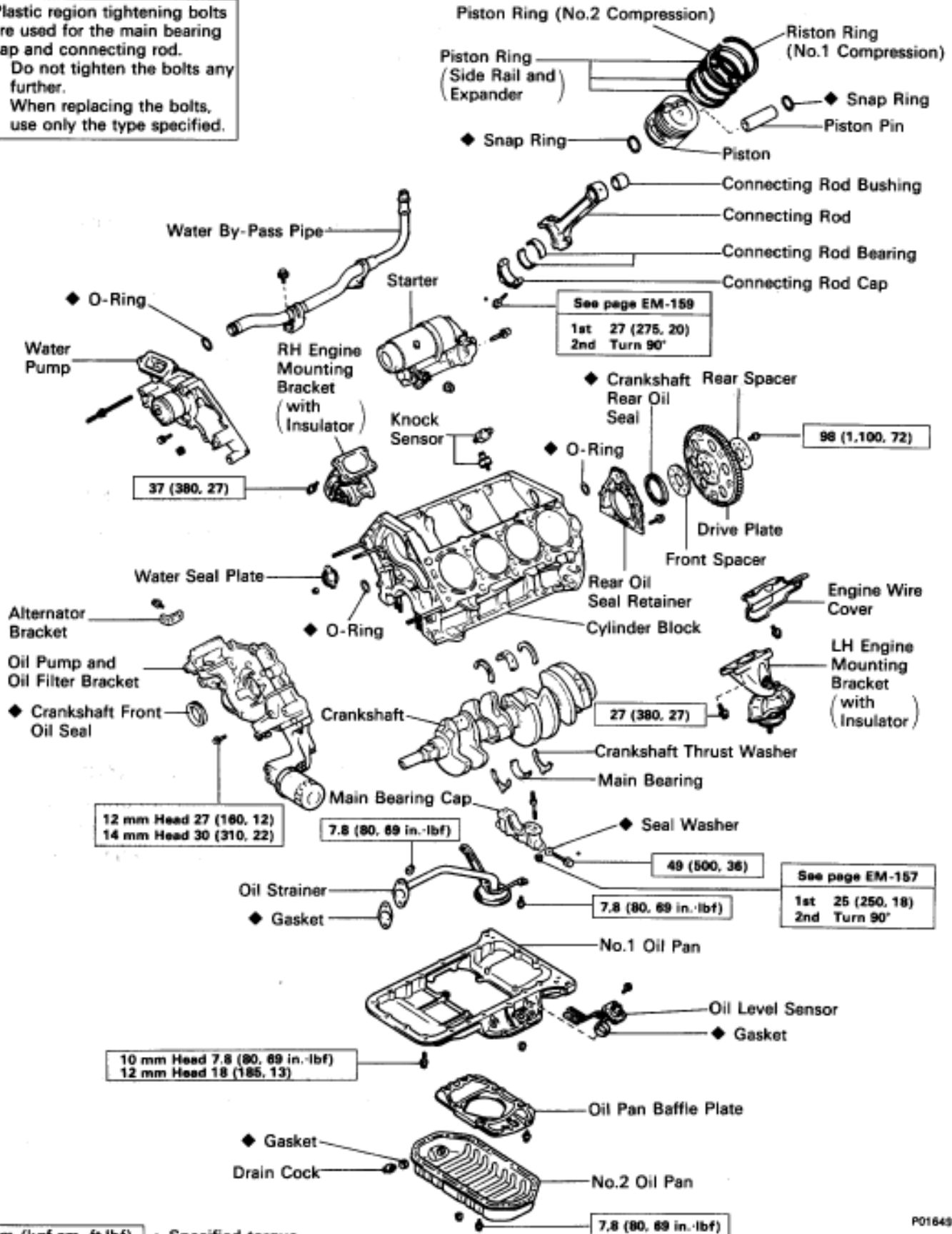


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**4. SEPARATE ENGINE AND TRANSMISSION**  
(See AT section)

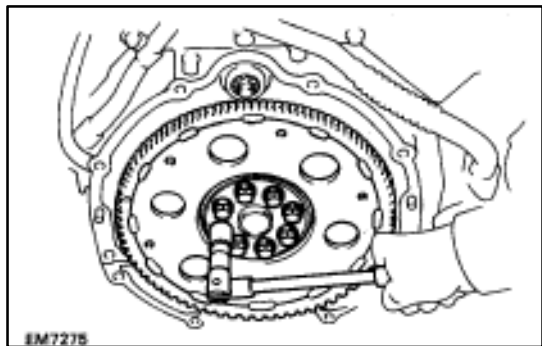
## COMPONENTS FOR DISASSEMBLY AND ASSEMBLY OF CYLINDER BLOCK

- \*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.

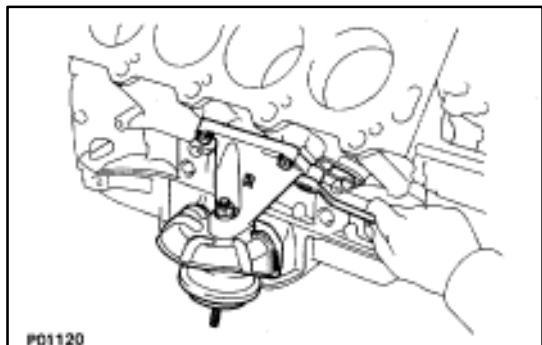
### 2. INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY

### 3. REMOVE TIMING BELT AND PULLEYS

(See pages EM-36 to 44)

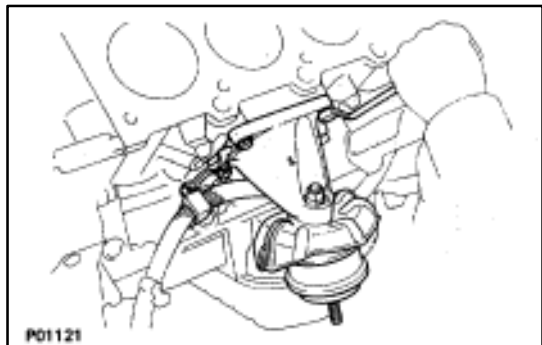
### 4. REMOVE Cylinder Block

(See pages EM-61 to 75)



### 5. REMOVE RH ENGINE MOUNTING BRACKET

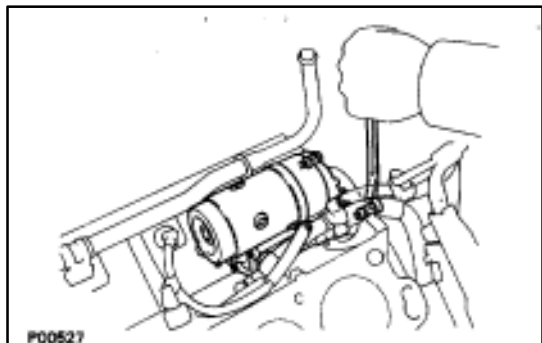
Remove the four bolts and mounting bracket.



### 6. REMOVE LH ENGINE MOUNTING BRACKET

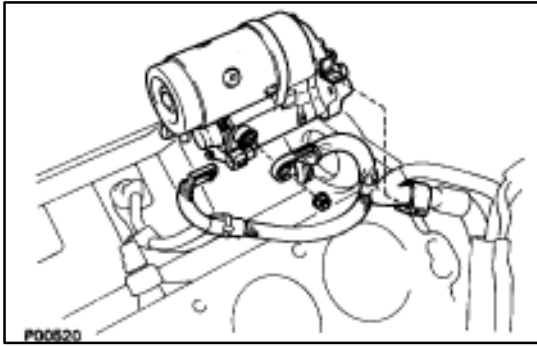
(a) Remove the clamp bolt, and disconnect the engine wire from the engine mounting bracket.

(b) Remove the four bolts and mounting bracket.

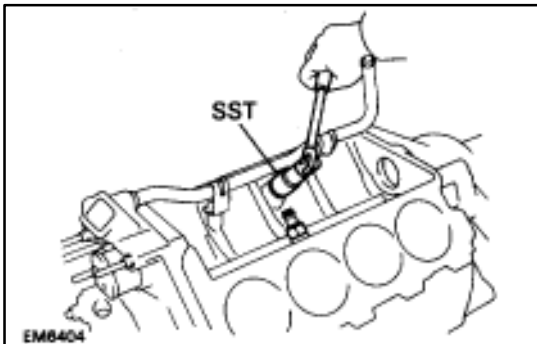


### 7. REMOVE STARTER

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

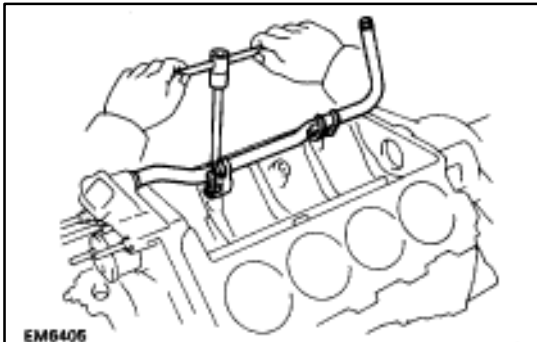


- (b) Disconnect the wire clamp from the bracket on the starter.
- (c) Remove the nut, and disconnect the wire.
- (d) Disconnect the connector, and remove the starter.



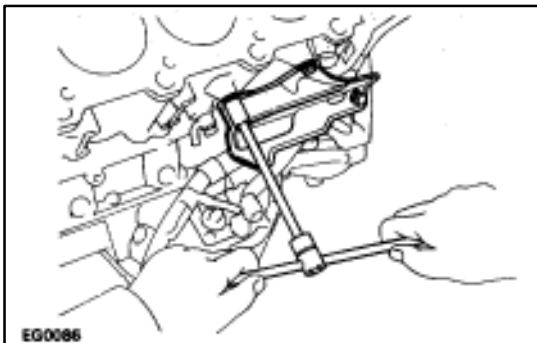
#### 8. REMOVE KNOCK SENSORS

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



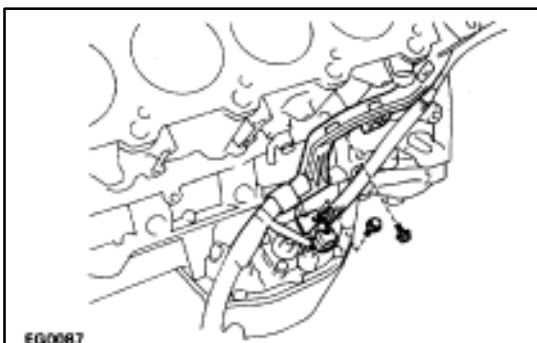
#### 9. REMOVE WATER BY-PASS PIPE

- (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.

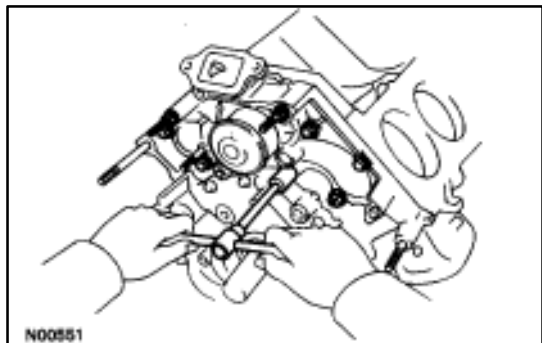


#### 10. REMOVE ENGINE WIRE

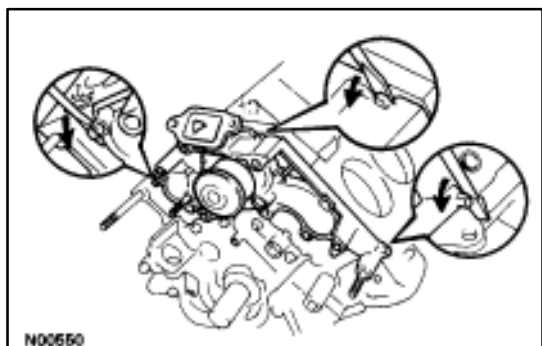
- (a) Disconnect the following connectors:
  - (1) Oil level sensor connector
  - (2) Oil pressure switch connector
- (b) Remove the three bolts and wire cover from the LH side of the cylinder block.



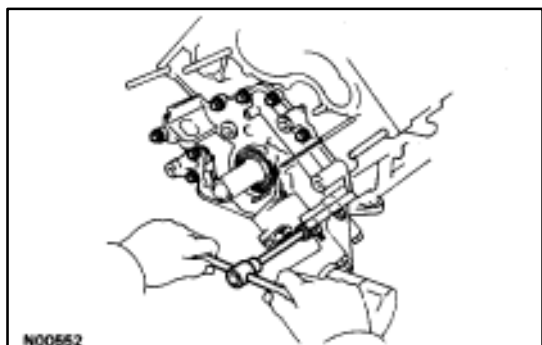
- (c) Remove the two bolts and engine wire.

**11. REMOVE WATER PUMP**

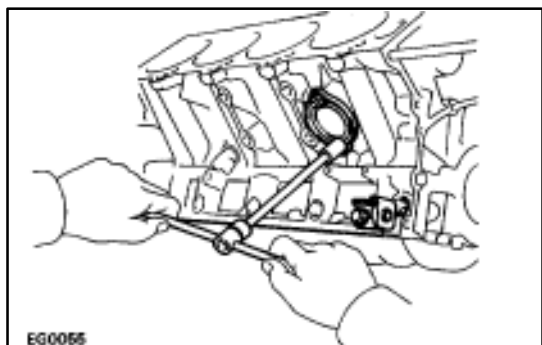
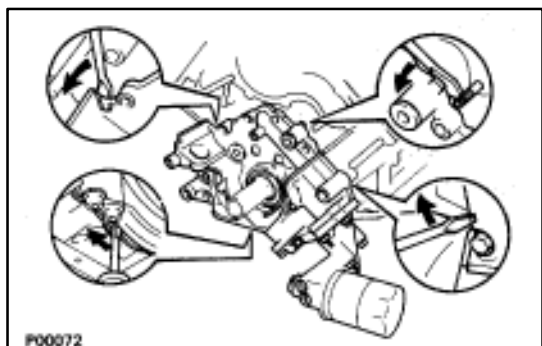
- (a) Remove the five mounting bolt, two mounting stud bolts and mounting nut.
- (b) Remove the water pump by prying the portions between the water pump and cylinder block with a screwdriver.

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

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

**13. REMOVE OIL PUMP**

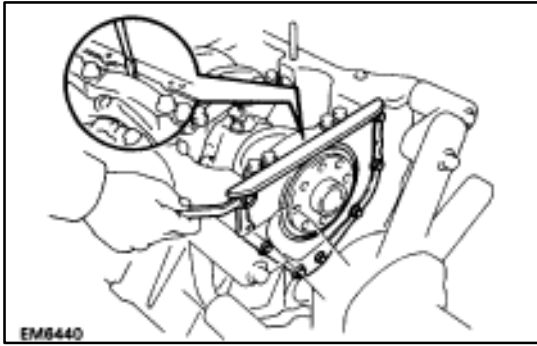
- (a) Remove the eight mounting bolts.
- (b) Remove the oil pump by prying the portions between the oil pump and cylinder block with a screwdriver.
- (c) Remove the O-ring from the cylinder block.

**14. REMOVE ALTERNATOR BRACKET**

Remove the bolt and bracket.

**15. REMOVE WATER SEAL PLATE**

Remove the two nuts and seal plate.

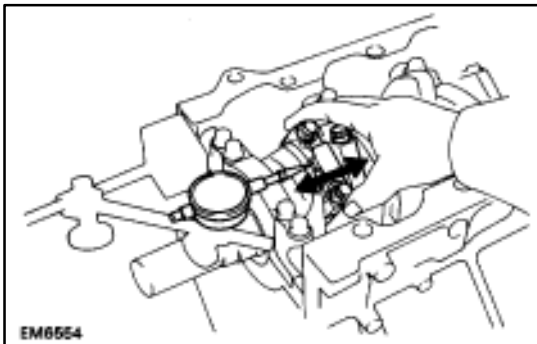


## DISASSEMBLY OF CYLINDER BLOCK

(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.)**

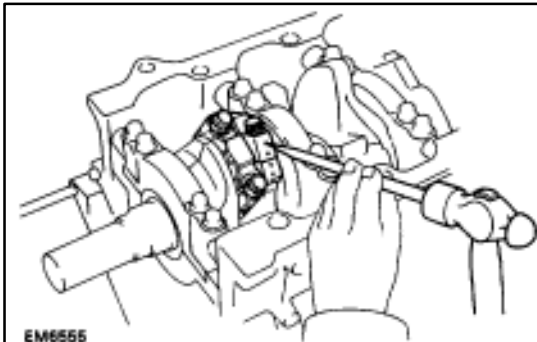
If the thrust clearance is greater than maximum, replace the connecting rod assembly(s). If necessary, replace the crankshaft.

**Connecting rod thickness: 22.880–22.920 mm**

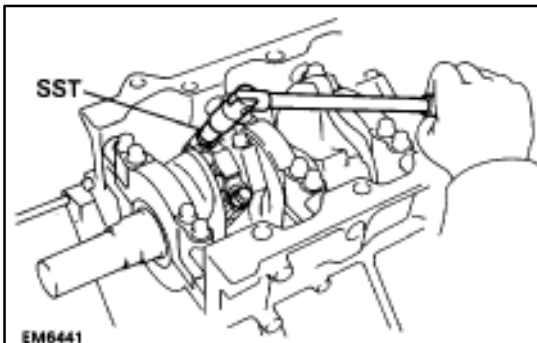
**(0.9008–0.9024 in.)**

### 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.

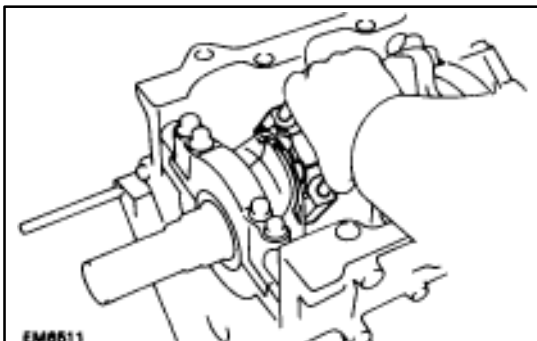


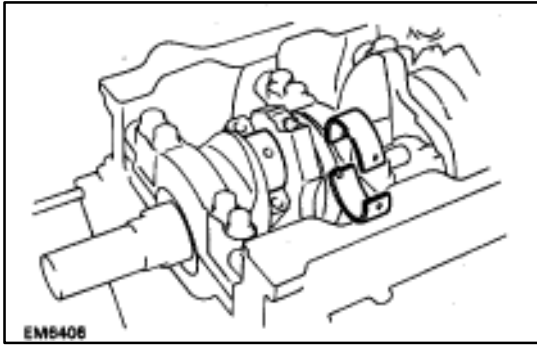
- (b) Using SST, remove the two connecting rod bolts.  
SST 09011–38121



- (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.

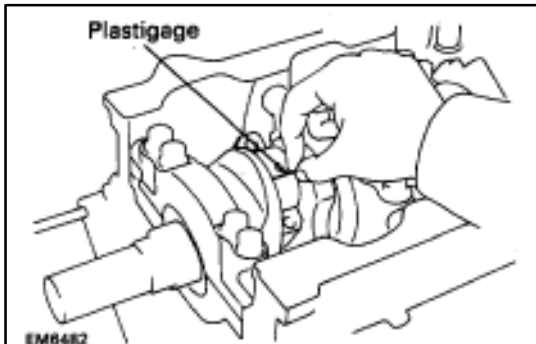
**HINT:** Keep the lower bearing inserted with the connecting rod cap.



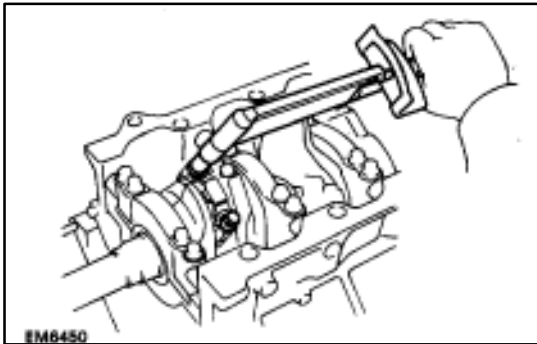


- (d) Clean the crank pin and bearings.
- (e) Check the crank pin and bearing for pitting and scratches.

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.

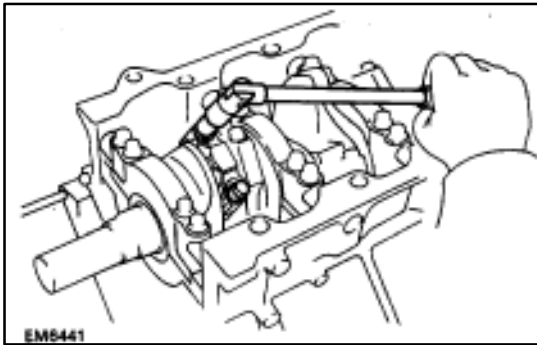


- (g) Install the connecting rod cap with the two bolts.  
(See step 6 on pages [EM-159](#) and 160)

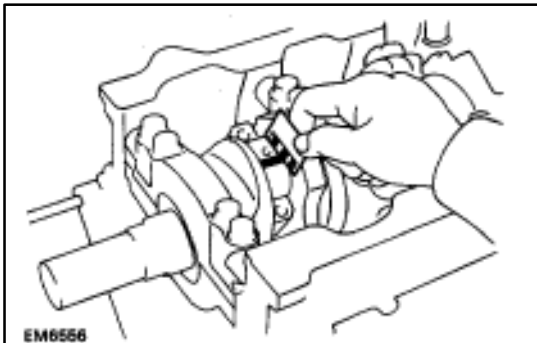
**Torque: 1st 25 N·m (250 kgf·cm, 18 ft·lbf)**

**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)



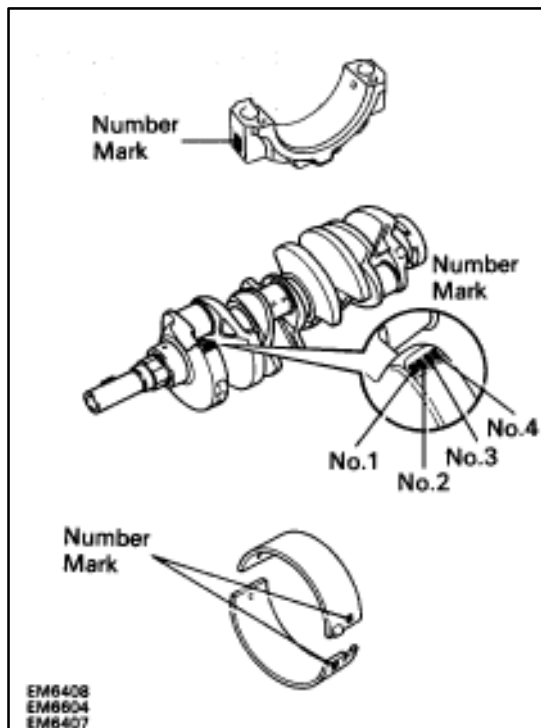
- (i) Measure the Plastigage at widest point.

**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.)

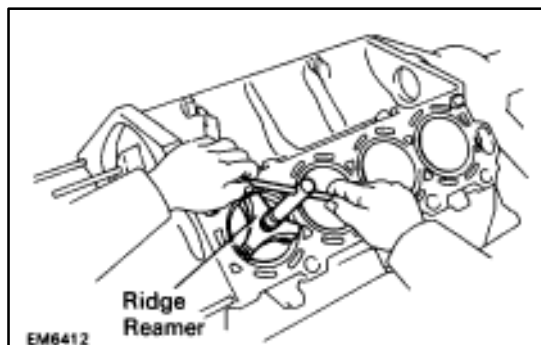
Mark "6" 1.496–1.499 mm  
(0.0589–0.0590 in.)

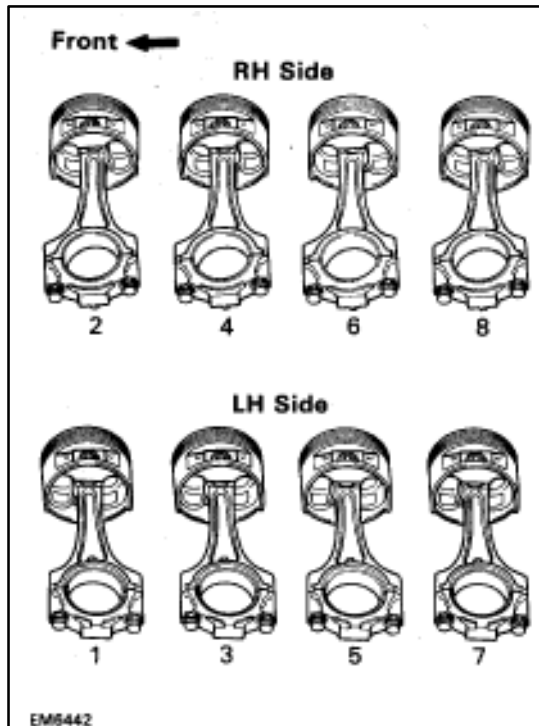
Mark "7" 1.499–1.502 mm  
(0.0590–0.0591 in.)

(j) Completely remove the Plastigage.

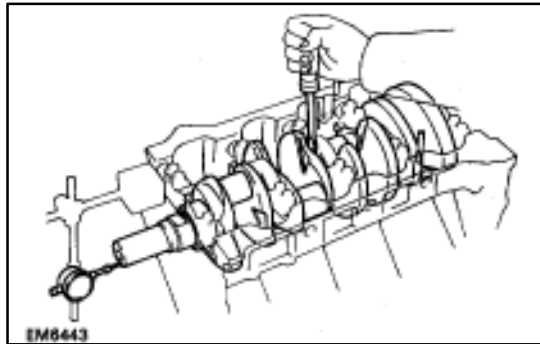
#### 4. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

- 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**

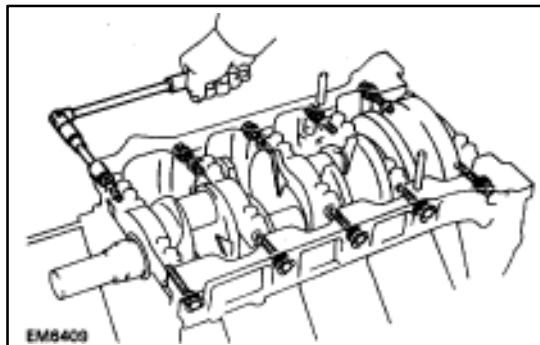
**(0.0008–0.0087 in.)**

**Maximum thrust clearance: 0.30 mm (0.0118 in.)**

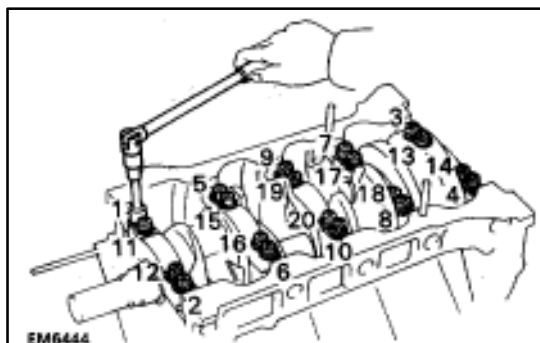
If the thrust clearance is greater than maximum, replace the thrust washers as a set.

**Thrust washer thickness: 2.440–2.490 mm**

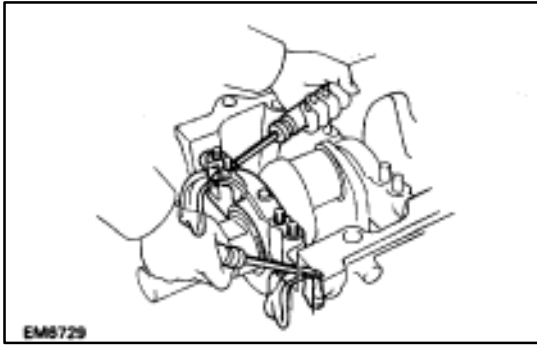
**(0.0961–0.0980 in.)**

**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:**

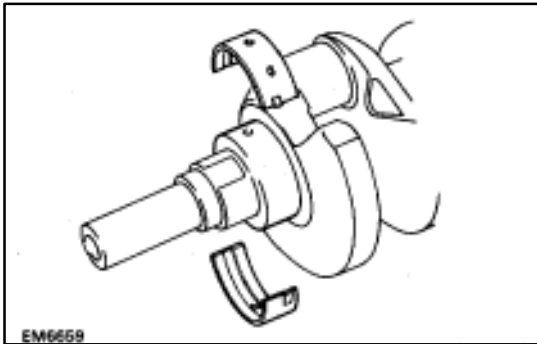
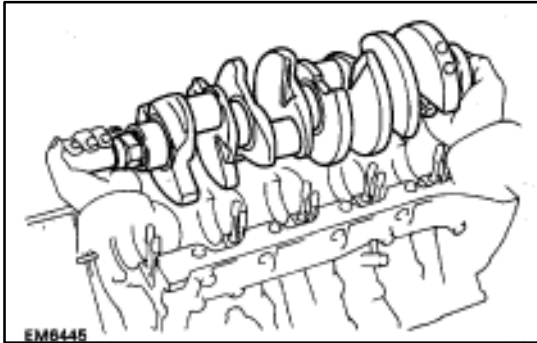
- Keep the lower main bearing and main bearing cap together.
- Arrange the main bearing caps and lower thrust washers in correct order.

- (d) Lift out the crankshaft.

- (e) Remove the two upper thrust washers.

**HINT:**

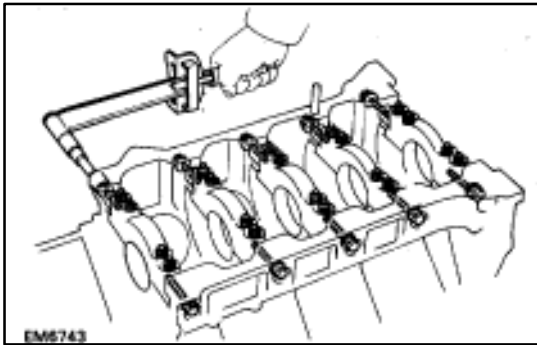
- Arrange the upper thrust washers in correct order.
- Keep the upper main bearings together with the cylinder block.



- (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.



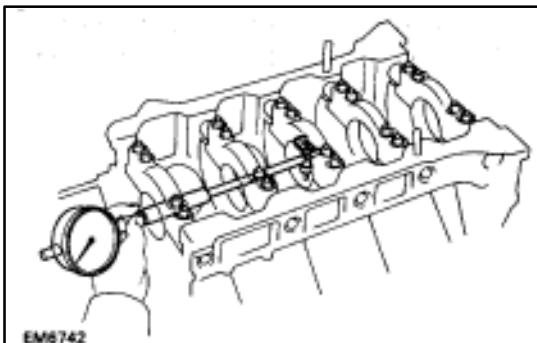
- (h) Install the five main bearing caps with the twenty nuts and ten bolts. Do not install the crankshaft. (See step 4 on pages [EM-157](#) and 158)

**Torque:**

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

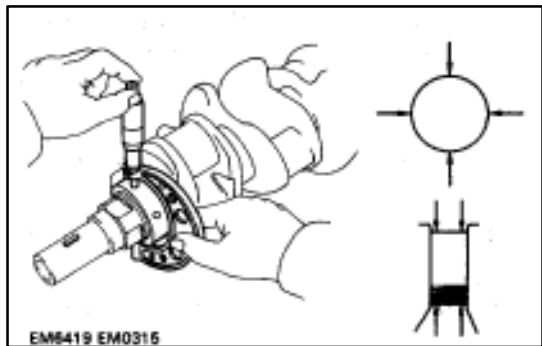
**2nd Turn 90°**

**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.

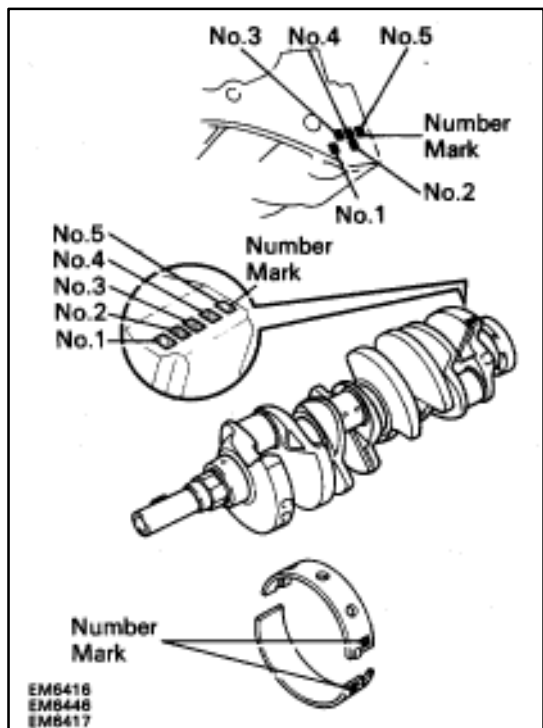
	Total number " ": Number mark				
Cylinder block (A) + Crankshaft (B) =	0–5	6–11	12–17	18–23	24–28
Use bearing	"1"	"2"	"3"	"4"	"5"

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

#### (Reference)

##### Cylinder block main journal bore diameter (A):

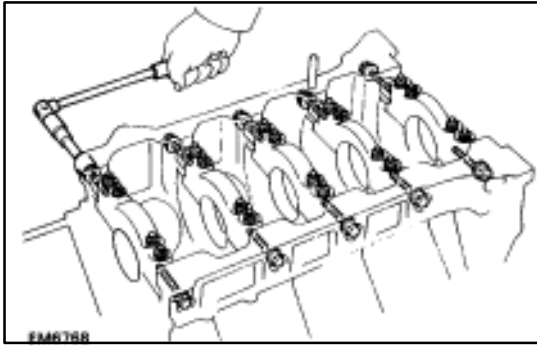
Mark "00" 72.000 mm (2.8346 in.)  
 Mark "01" 72.001 mm (2.8347 in.)  
 Mark "02" 72.002 mm (2.8347 in.)  
 Mark "03" 72.003 mm (2.8348 in.)  
 Mark "04" 72.004 mm (2.8348 in.)  
 Mark "05" 72.005 mm (2.8348 in.)  
 Mark "06" 72.006 mm (2.8349 in.)  
 Mark "07" 72.007 mm (2.8349 in.)  
 Mark "08" 72.008 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.)



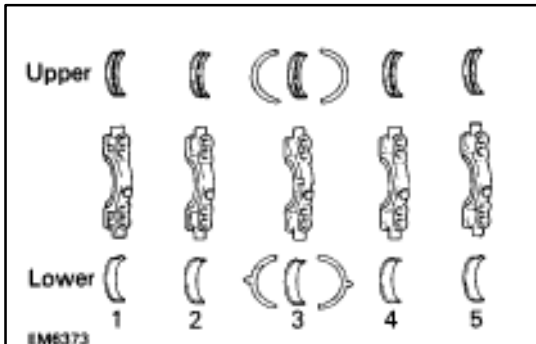
**Crankshaft main journal diameter (B):****Mark "00" 67.000 mm (2.6378 in.)****Mark "01" 66.999 mm (2.6378 in.)****Mark "02" 66.998 mm (2.6377 in.)****Mark "03" 66.997 mm (2.6377 in.)****Mark "04" 66.996 mm (2.6376 in.)****Mark "05" 66.995 mm (2.6376 in.)****Mark "06" 66.994 mm (2.6376 in.)****Mark "07" 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

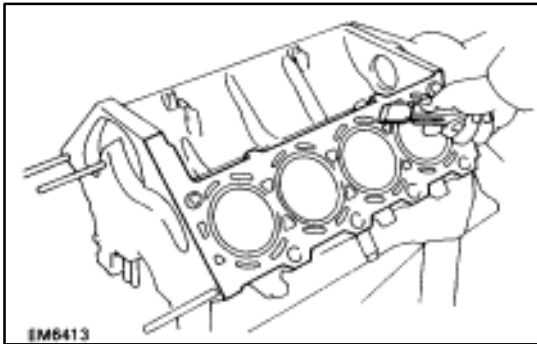
**EXAMPLE: Cylinder block "06", Crankshaft "08" = Use bearing "3"**



- (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.

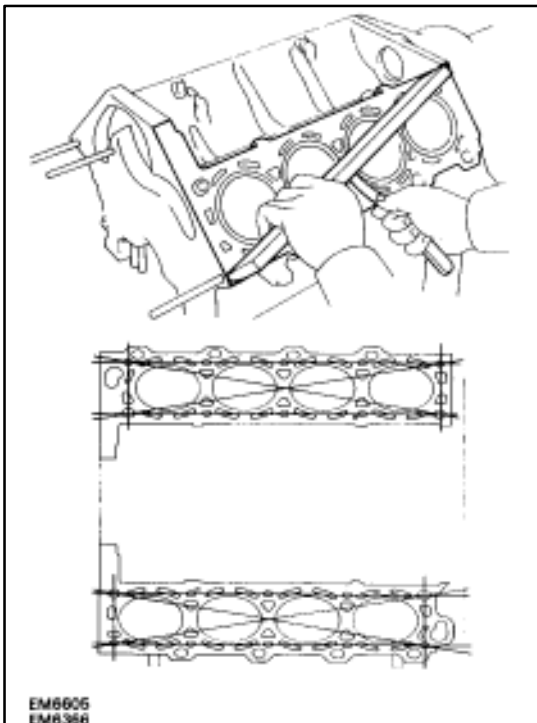
**NOTICE:** If the cylinder is washed at high temperatures, the cylinder liner sticks out beyond the cylinder block, so always wash the cylinder block at temperature of 45° or less.

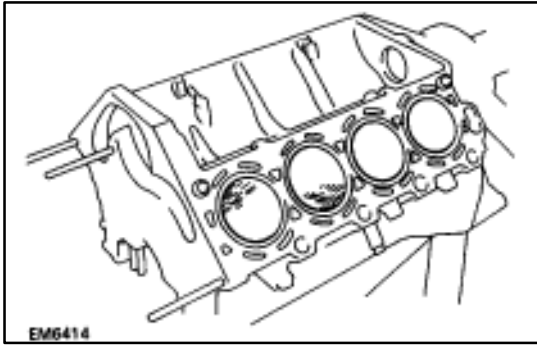
### 2. INSPECT TOP SURFACES OF CYLINDER BLOCK FOR FLATNESS

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.

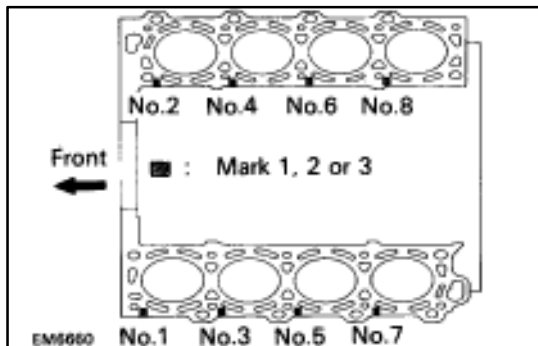




### 3. INSPECT CYLINDER FOR VERTICAL SCRATCHES

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:**

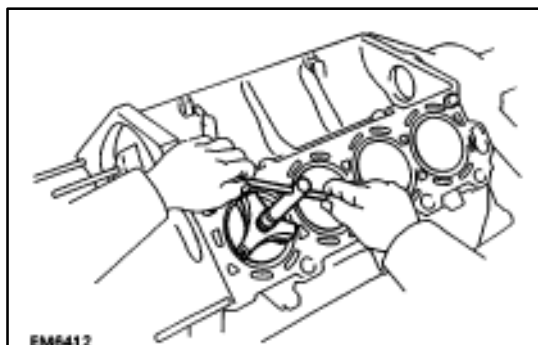
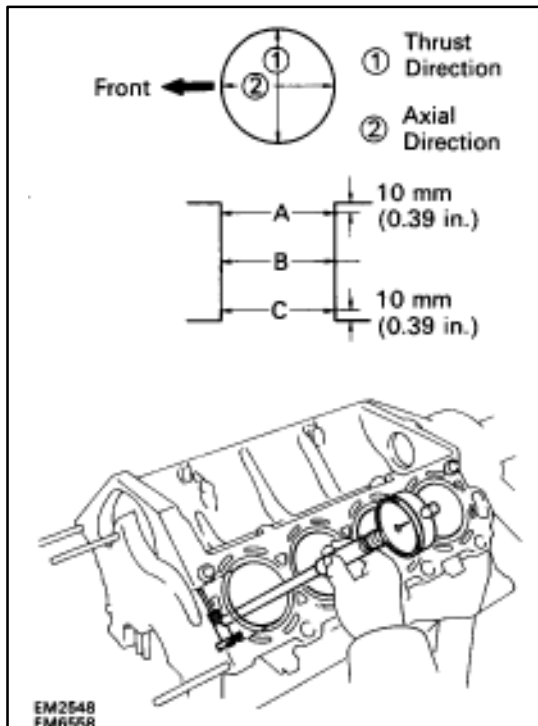
**Mark "1"** 87.500–87.510 mm  
(3.4449–3.4453 in.)

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

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

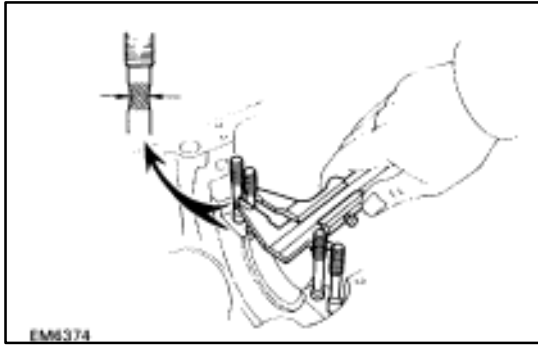
**Maximum diameter:** 87.73 mm (3.4539 in.)

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

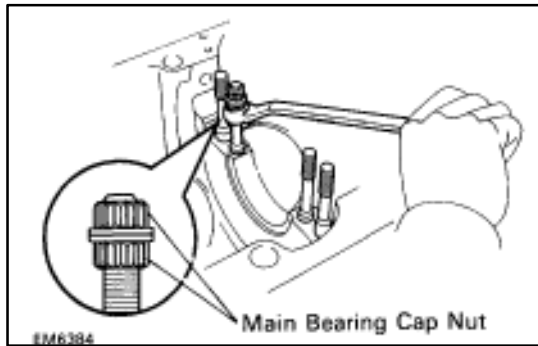
Using a vernier caliper, measure the tension portion diameter of the stud bolt.

**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

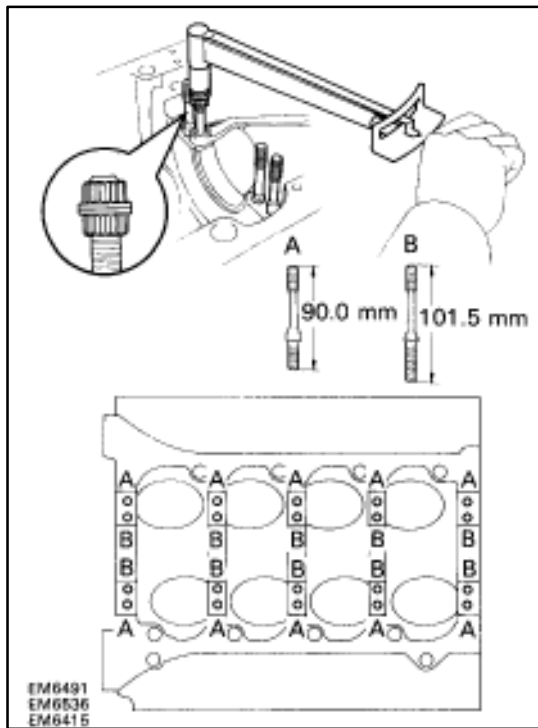
- (a) Using the two main bearing cap nuts, remove the stud bolt.

- (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.



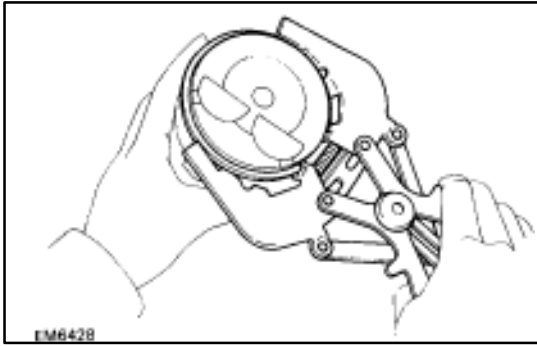
## DISASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLIES

### 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.



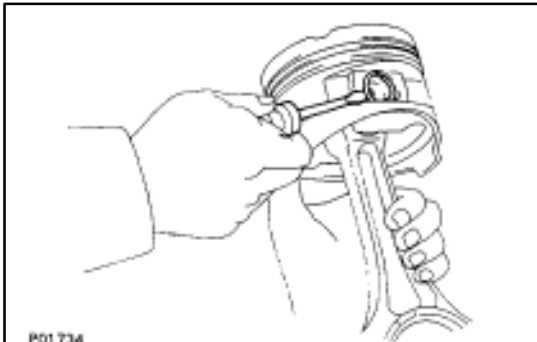


## 2. REMOVE PISTON RINGS

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

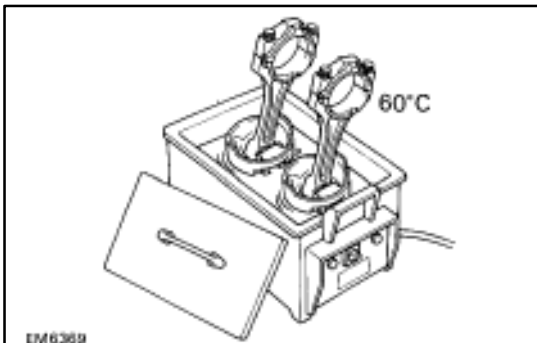


- (b) Remove the two side rails and oil ring expander by hand.  
HINT: Arrange the piston rings in correct order only.

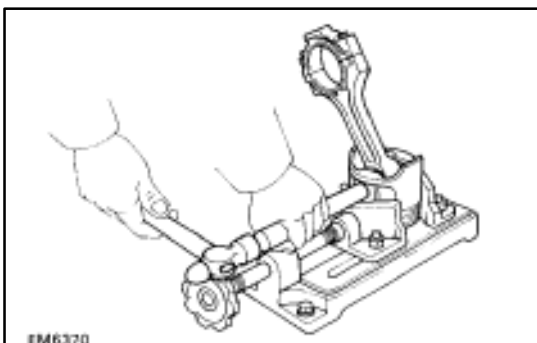


## 3. DISCONNECT CONNECTING ROD FROM PISTON

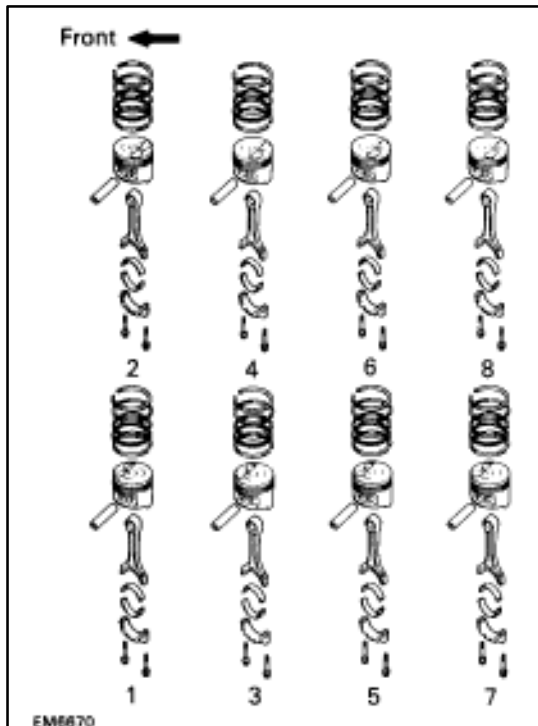
- (a) Using a small screwdriver, pry out the two snap rings.



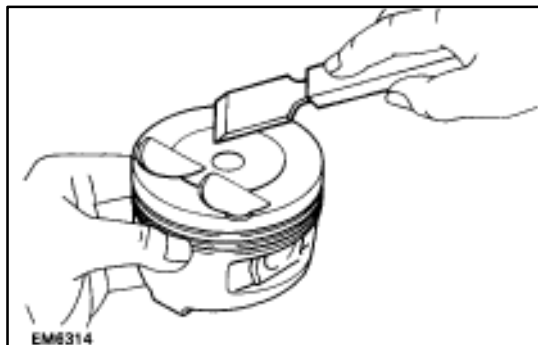
- (b) Gradually heat the piston to approx. 60°C (140°F).



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

**HINT:**

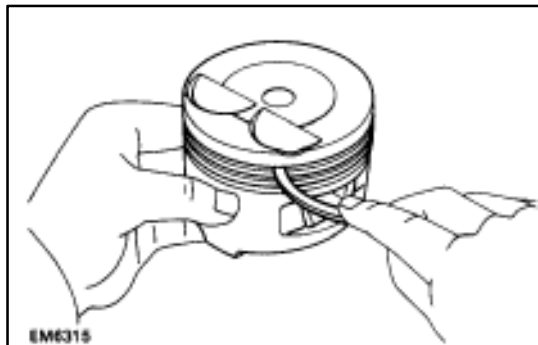
- The piston and pin are a matched set.
- Arrange the pistons, pins, rings, connecting rods and bearings in correct order.



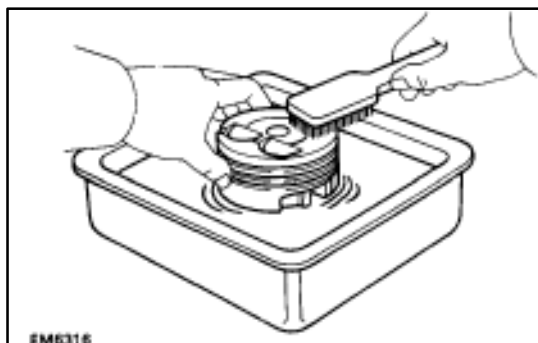
## INSPECTION OF PISTON AND CONNECTING ROD ASSEMBLIES

### 1. CLEAN PISTON

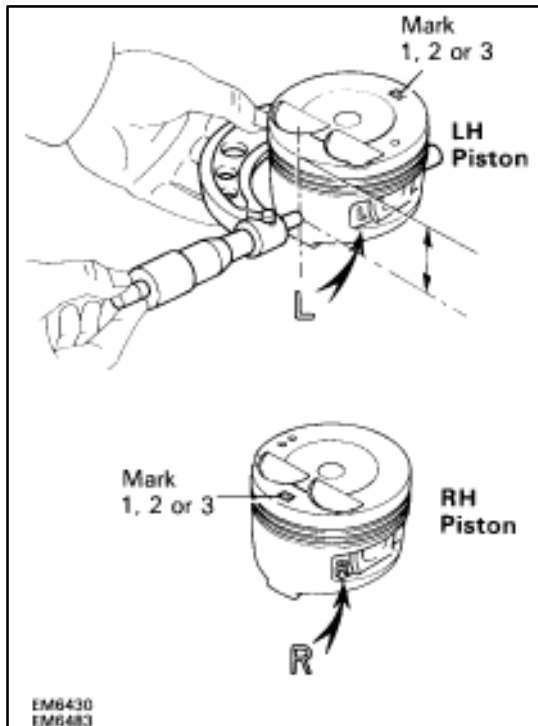
- Using a gasket scraper, remove the carbon from the piston top.



- 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**

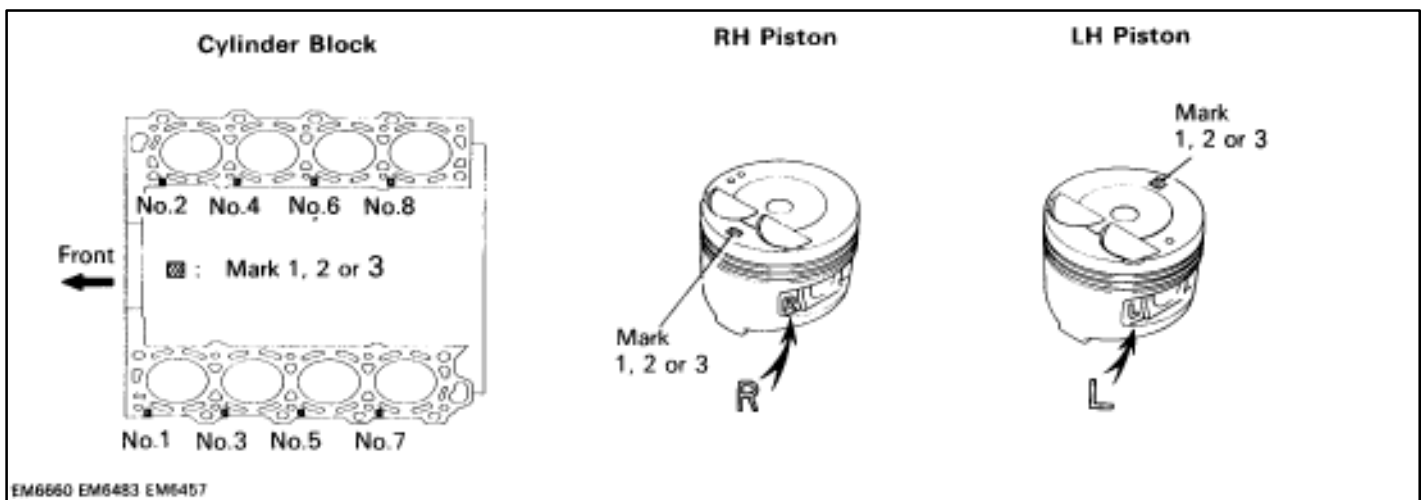
(0.0008–0.0016 in.)

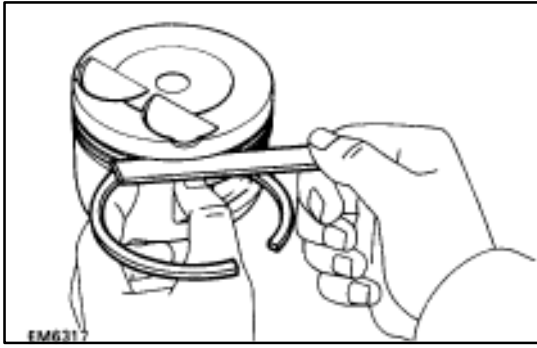
**Maximum oil clearance: 0.06 mm (0.0024 in.)**

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

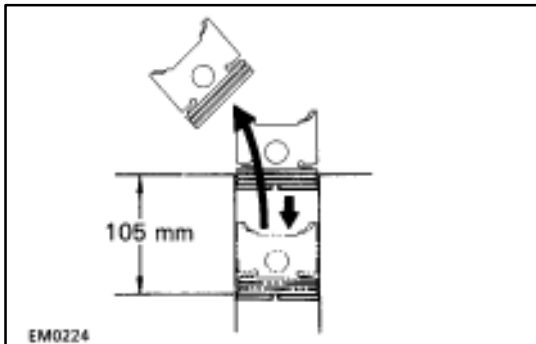
Using a feeler gauge, measure the clearance between new piston ring and the wall of the piston ring groove.

**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.)**

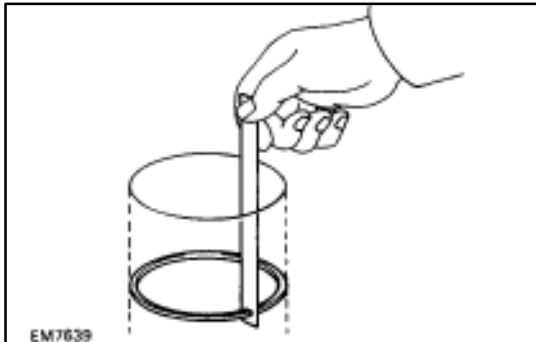
If the clearance is greater than maximum, replace the piston.



### 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.)**

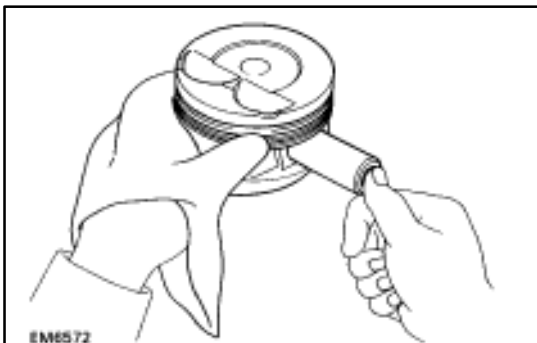
**Maximum ring end gap:**

**No.1 1.05 mm (0.0413 in.)**

**No.2 1.20 mm (0.0472 in.)**

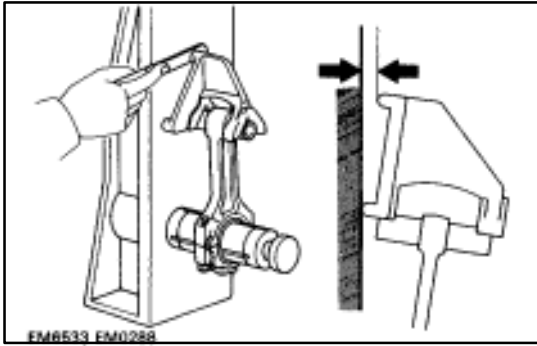
**Oil (Side rail) 1.10 mm (0.0433 in.)**

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.)**

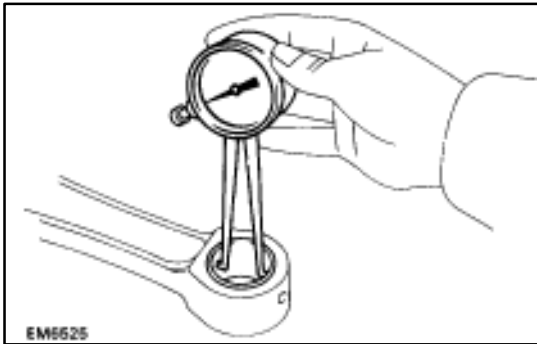
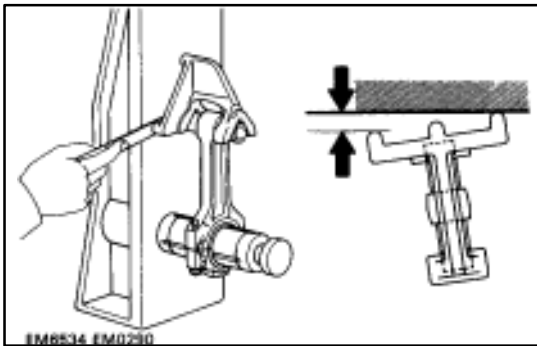
If bent is greater than maximum, replace the connecting rod assembly.

- 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.

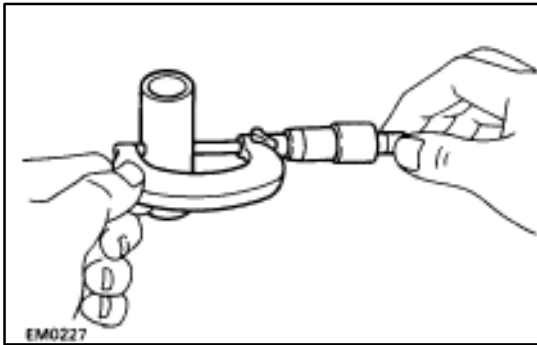


#### B. Inspect connecting rod bushings

- 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**

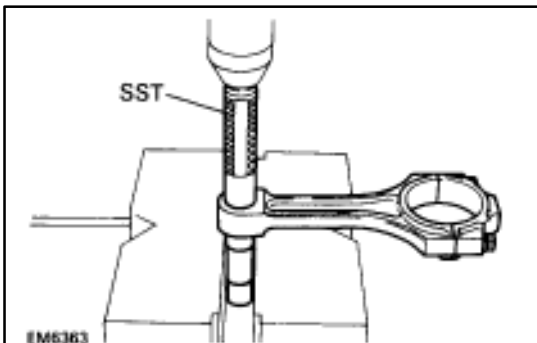
**(0.8660–0.8665 in.)**

- 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.)**

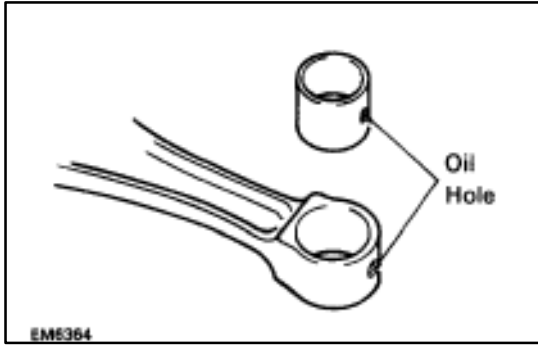
**Maximum oil clearance: 0.05 mm (0.0020 in.)**



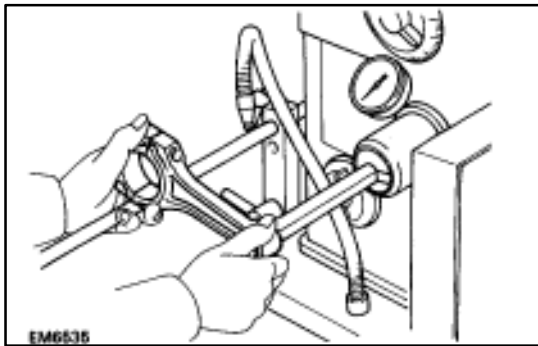
#### C. If necessary, replace connecting rod bushings

- Using SST and a press, press out the bushing.

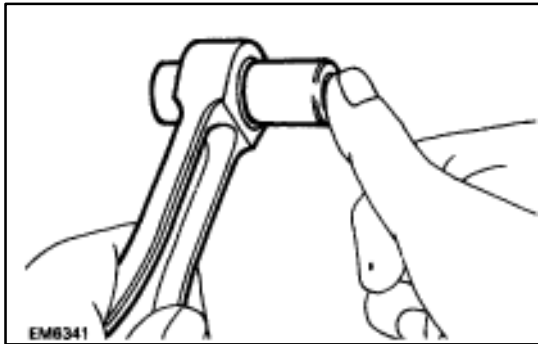
**SST 09222–30010**



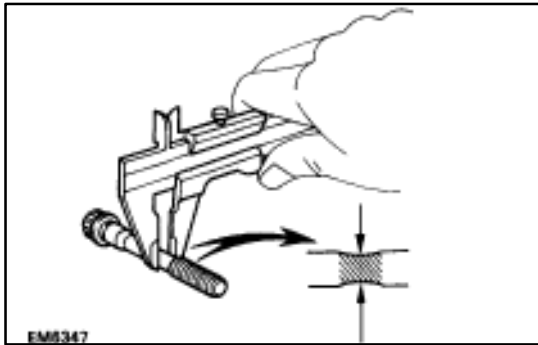
- (b) Align the oil holes of the connecting rod and a new bushing.
- (c) Using SST and a press, press in the bushing.  
SST 09222-30010



- (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

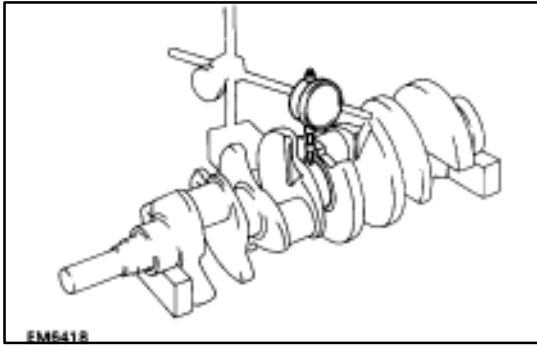
Using a vernier caliper, measure the tension portion diameter of the bolt.

**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.



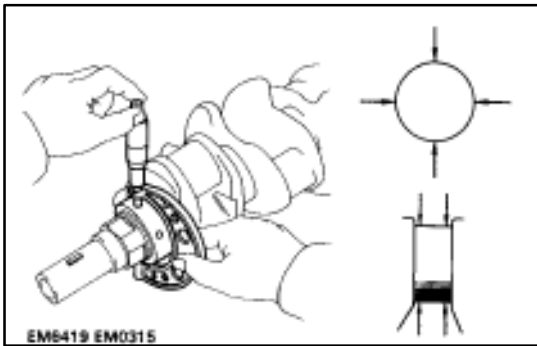
## INSPECTION OF CRANKSHAFT

### 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).

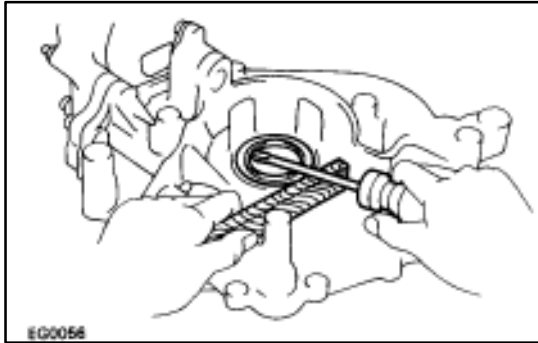
- (b) Check each main journal and crank pin for taper and out-of-round as shown.

**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

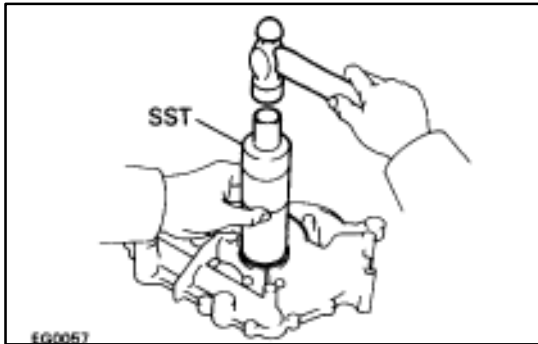
HINT: There are two methods (A and B) to replace the oil seal which are as follows:



### 1. REPLACE CRANKSHAFT FRONT OIL SEAL

#### A. If oil pump is removed from cylinder block:

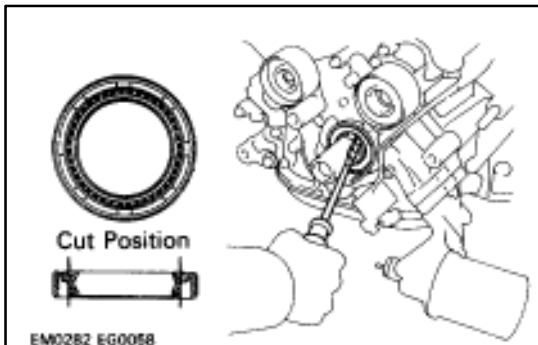
- (a) Using a screwdriver, pry out the oil seal.



- (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.

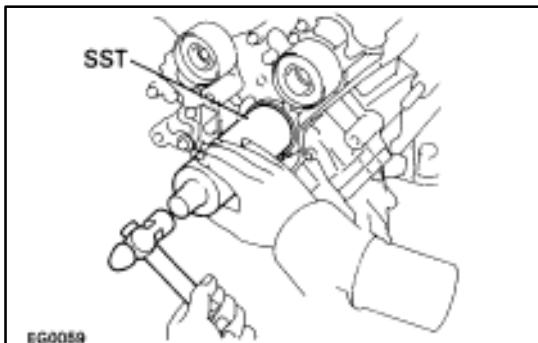


#### B. If oil pump is installed to the cylinder block:

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

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

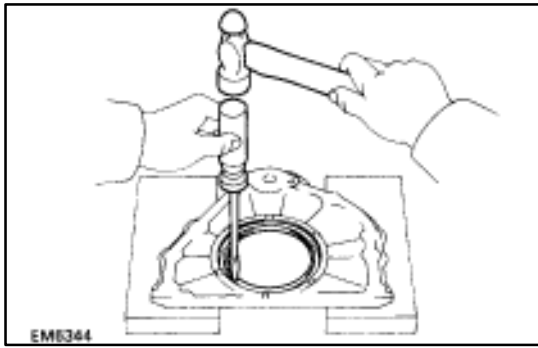
**NOTICE: Be careful not to damage the crankshaft. Tape the screwdriver tip.**



- (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.

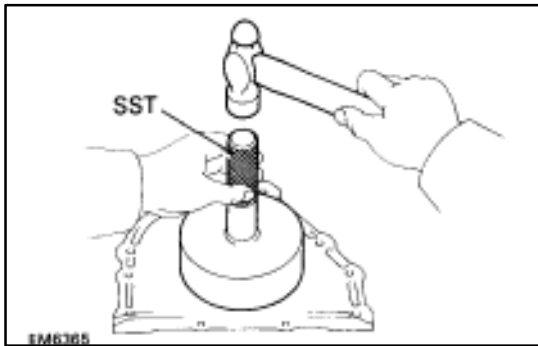
SST 09316-60010 (09316-00010)



## 2. REPLACE CRANKSHAFT REAR OIL SEAL

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

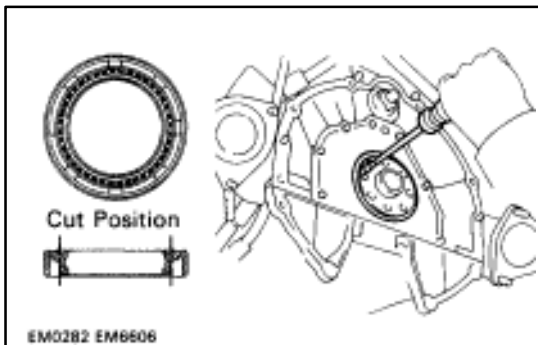
- (a) Using a screwdriver and hammer, tap out the oil seal.



- (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.



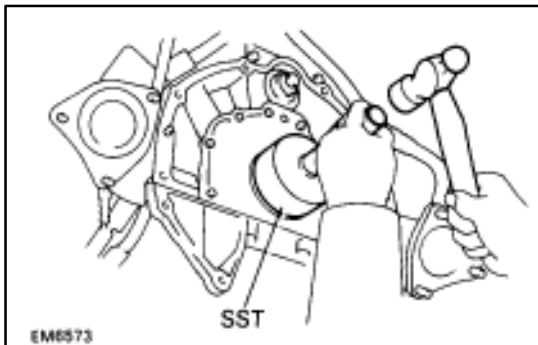
### B. If rear oil seal retainer is installed to cylinder block:

- (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.**

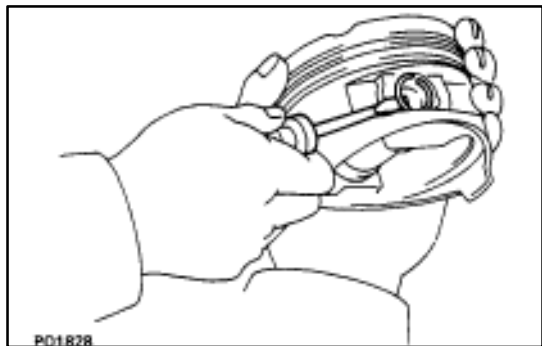
Tap the screwdriver tip.



- (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.

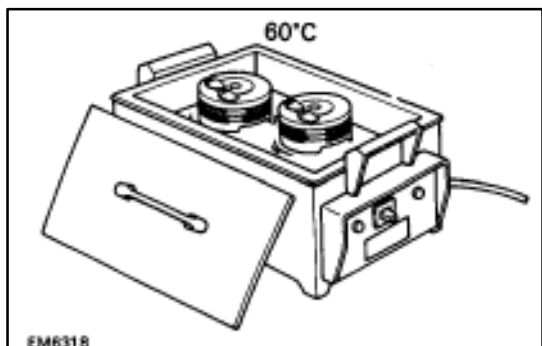
SST 09223-56010



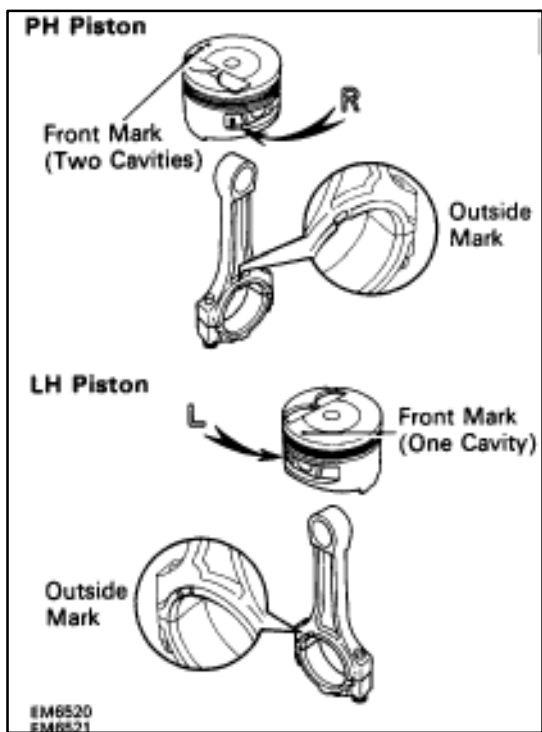
## ASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLIES

### 1. ASSEMBLE PISTON AND CONNECTING ROD

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



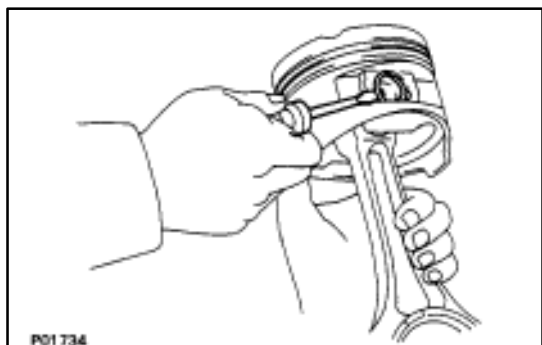
- (b) Gradually heat the piston to about 60°C (140°F).



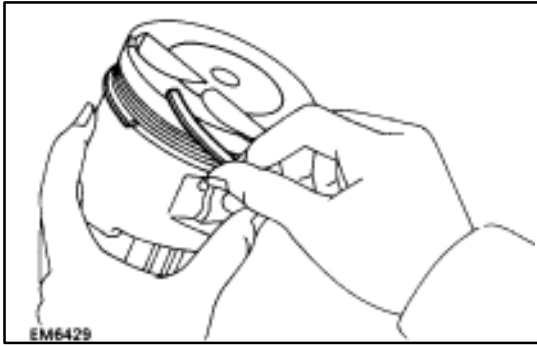
- (c) Position the piston front mark with respect to the outside mark on the connecting rod as shown in the diagram.

**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.

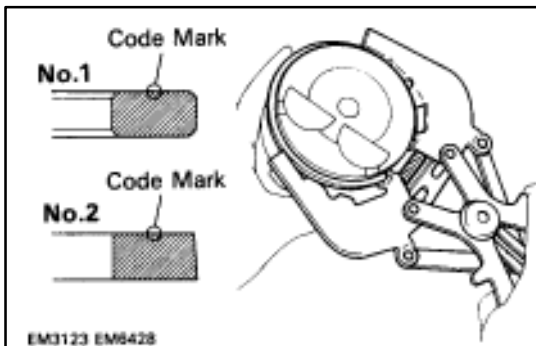


- (e) Using a small screwdriver, install a new snap ring on the other side of the piston pin hole.



## 2. INSTALL PISTON RINGS

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



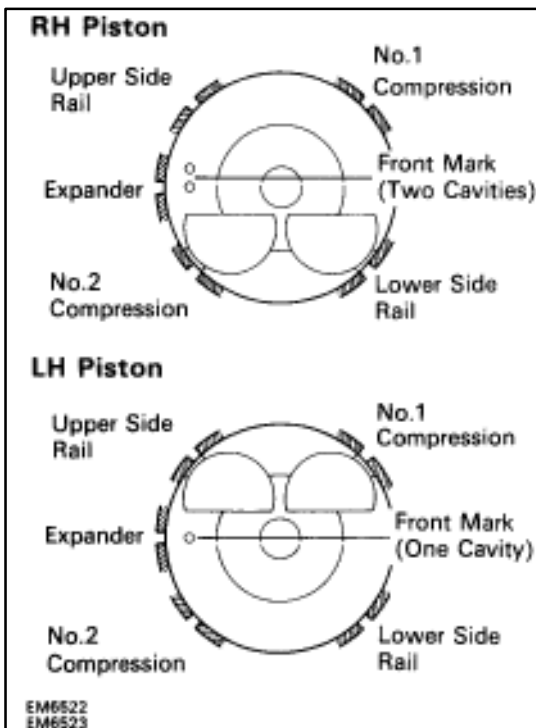
- (b) Using a piston ring expander, install the two compression rings with the code mark facing upward.

**Code mark: No.1 1R or T**

**No.2 2R or 2T**

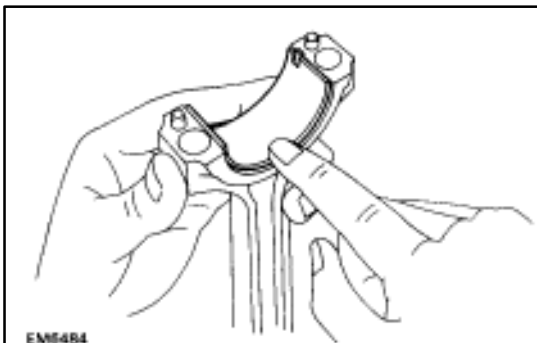
- (c) Position the piston rings so that the ring ends are as shown.

**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.

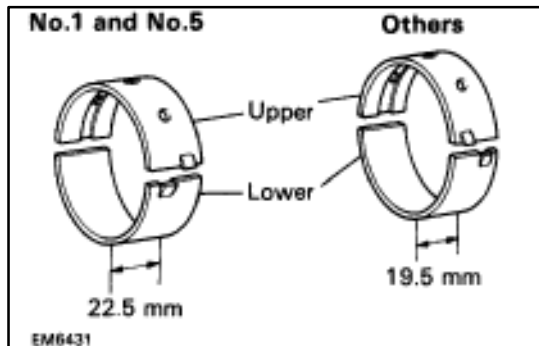


## ASSEMBLY OF CYLINDER BLOCK

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

HINT:

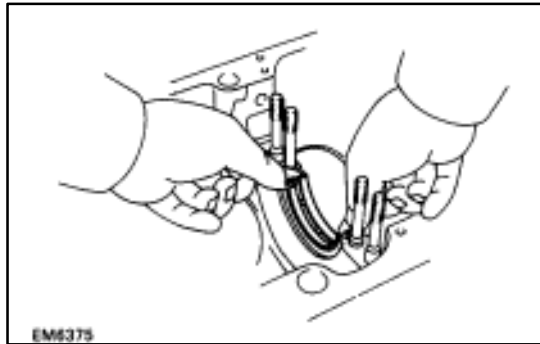
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with new parts.



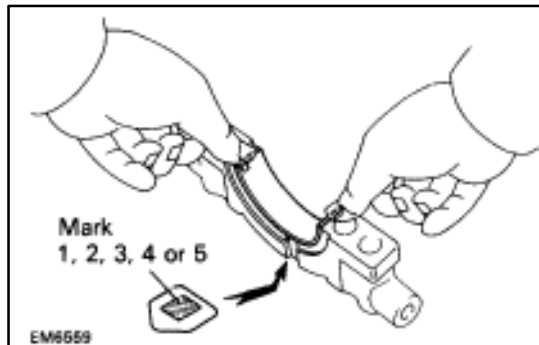
### 1. INSTALL MAIN BEARINGS

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.

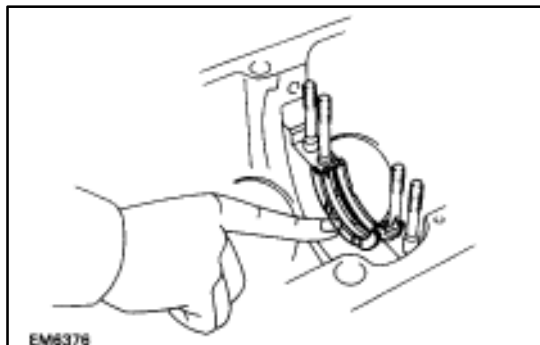


- (a) Align the bearing claw with the claw groove of the cylinder block, and push in the five upper bearings.



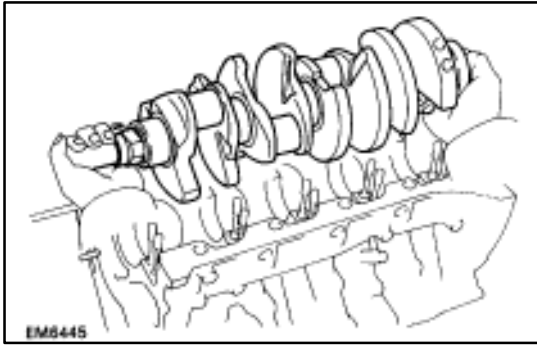
- (b) Align the bearing claw with the claw groove of the main bearing cap, and push in the five lower bearings.

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

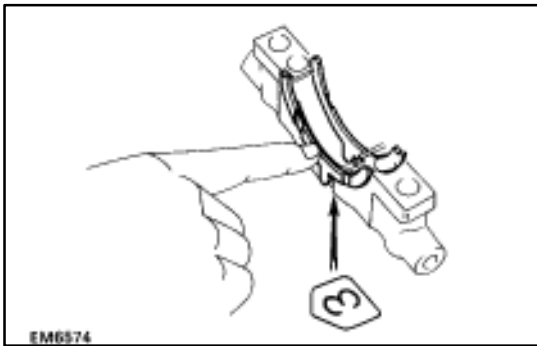


### 2. INSTALL UPPER THRUST WASHERS

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



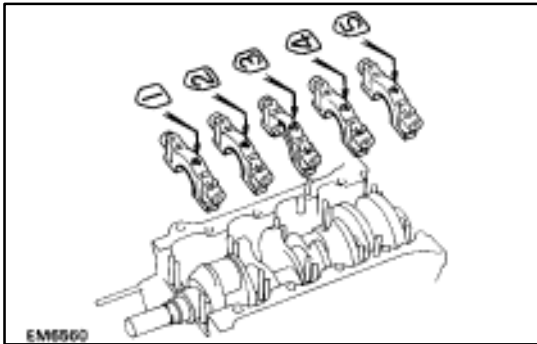
### 3. PLACE CRANKSHAFT ON CYLINDER BLOCK



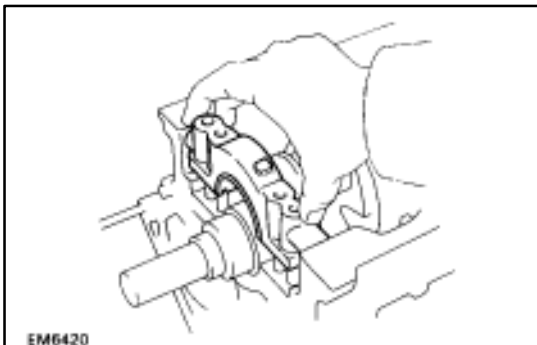
### 4. INSTALL MAIN BEARING CAP AND LOWER THRUST WASHERS

#### 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.

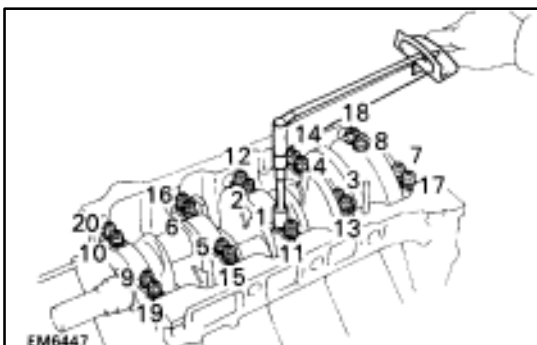
#### B. Install main bearing cap nuts

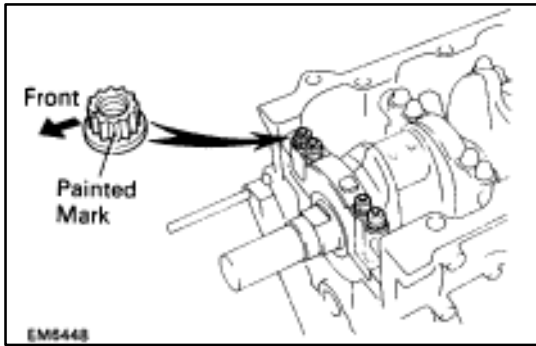
##### HINT:

- 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.

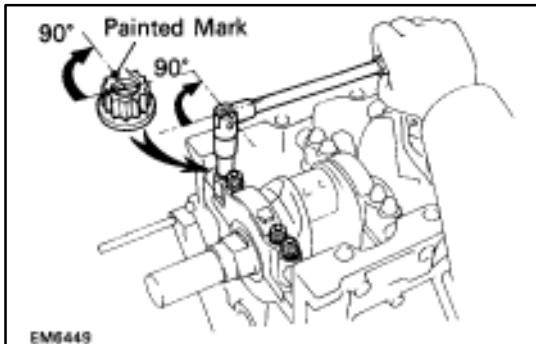
**Torque: 27 N·m (275 kgf·cm, 20 ft·lbf)**

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.



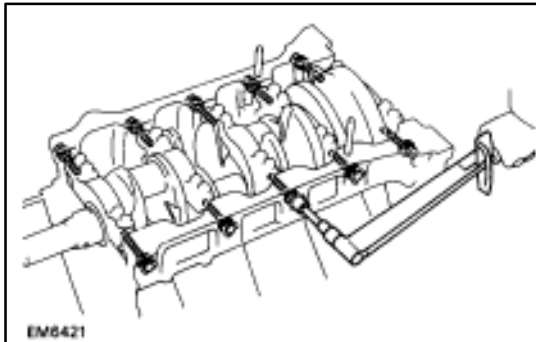
(d) Retighten the main bearing cap nuts 905 in the numerical order shown.

(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](#))

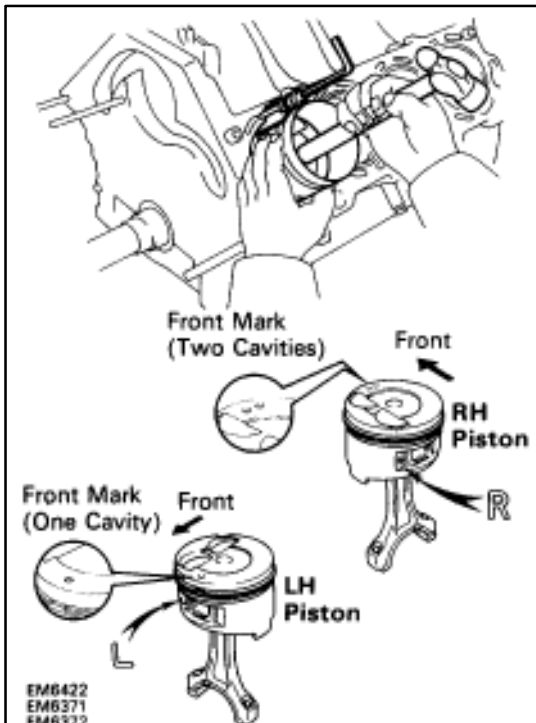


### C. Install main bearing cap bolts

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

(b) Install the ten main bearing cap bolts.

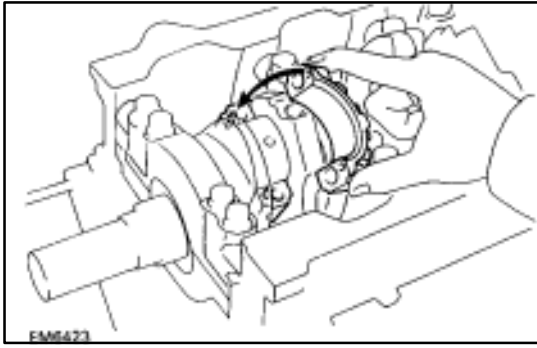
**Torque: 49 N·m (500 kgf·cm, 36 ft·lbf)**



### 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.

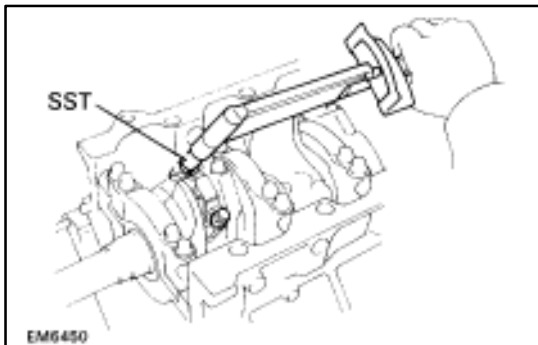
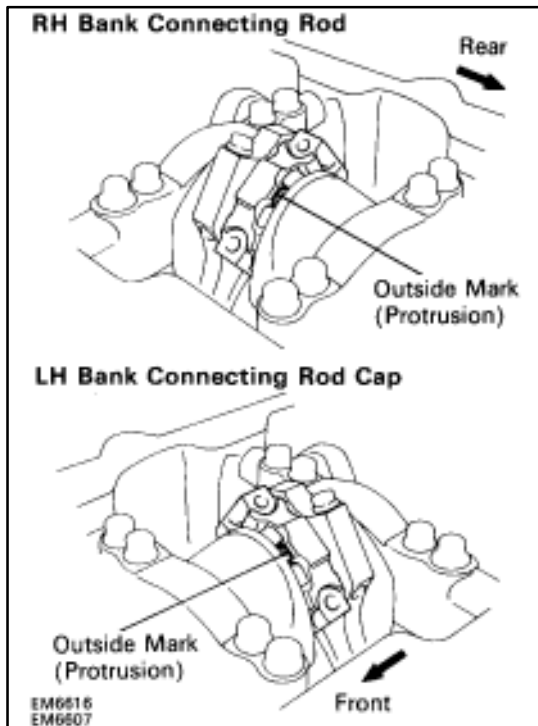
**NOTICE:** The shape of the piston varies for the RH and LH banks. The RH piston is marked with "R", the LH piston with "L".



## 6. INSTALL CONNECTING ROD CAPS

### A. Place connecting rod cap on connecting rod

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



### B. Install connecting rod cap bolts

#### HINT:

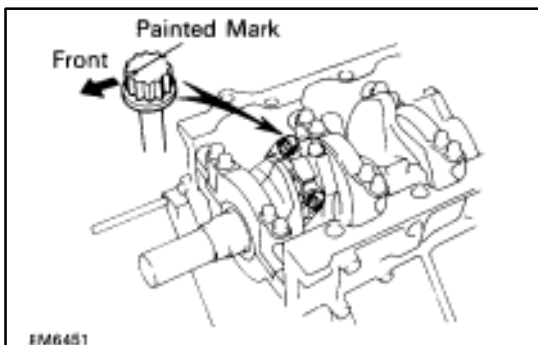
- The connecting rod cap bolts are tightened in two progressive steps (steps (b) and (d)).
  - If any one of the connecting rod bolts is broken or deformed, replace it.
- Apply a light of engine oil on the threads and under the heads of the connecting rod cap bolts.
  - Using SST, install and alternately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

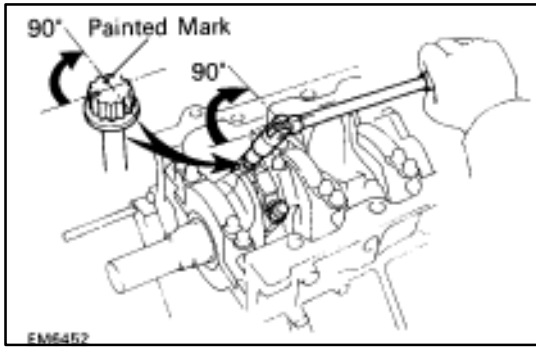
SST 09011-38121

**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.

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





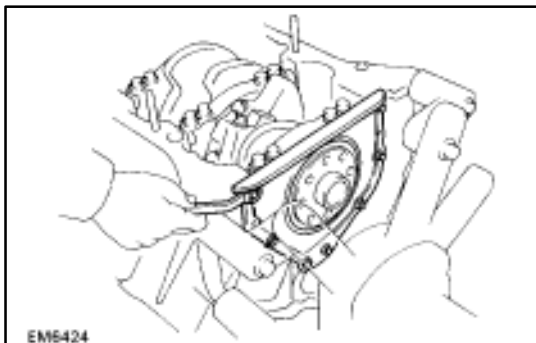
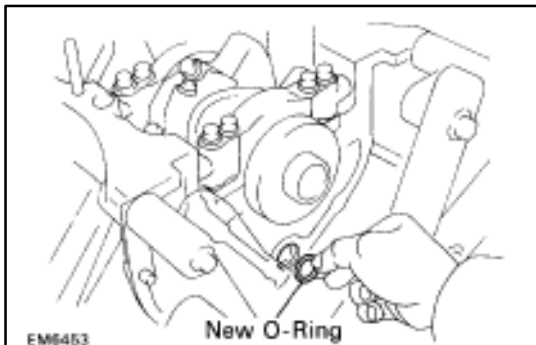
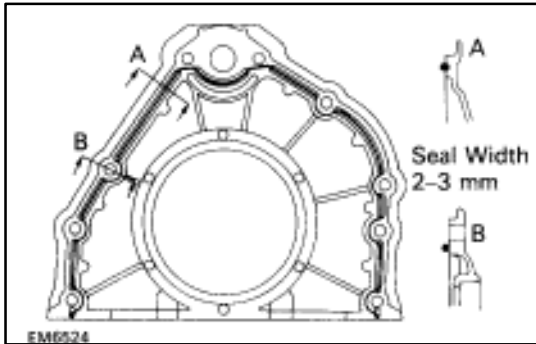
- (d) Retighten the connecting rod cap bolts 905 in the numerical order shown.
- (e) Check that the painted mark is now at a 905 angle to the front.
- (f) Check that the crankshaft turns smoothly.
- (g) Check the connecting rod thrust clearance.  
(See step 2 on page [EM-135](#))

## 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.



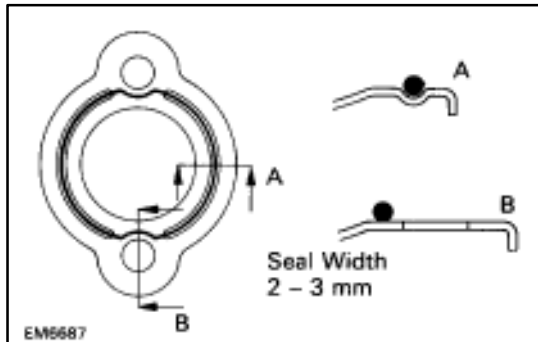
- (d) Install the retainer with the seven bolts.  
**Torque: 7.8 N·m (80 kgf·cm, 69 in.·lbf)**

## 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.

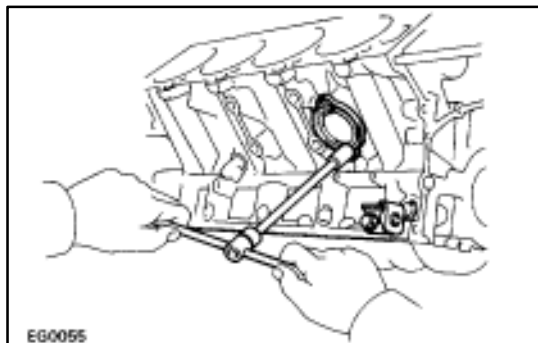
- (c) Install the seal plate with the two nuts.

**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)**

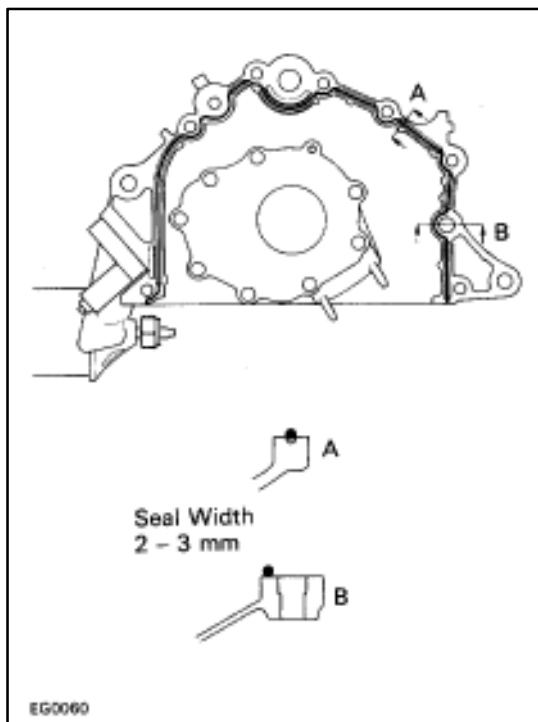


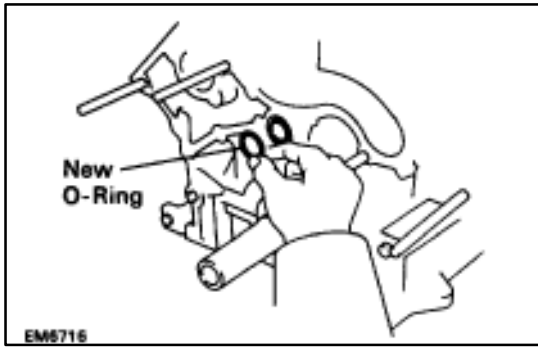
### 3. INSTALL OIL PUMP

- (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.

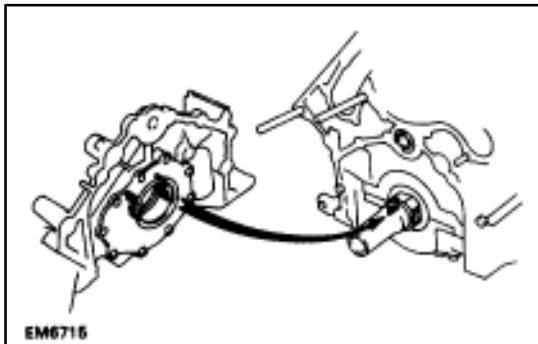
**Seal packing: Part No.08826-00080 or equivalent**

- 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.

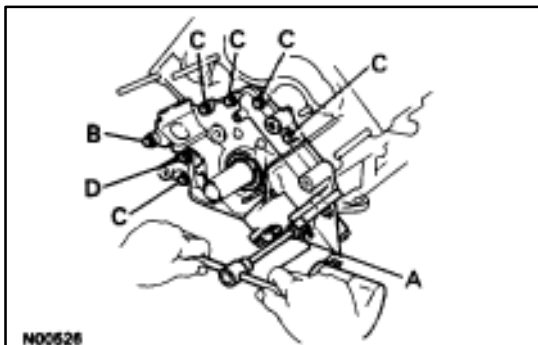




- (c) Place a new O-ring in position on the cylinder block.



- (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

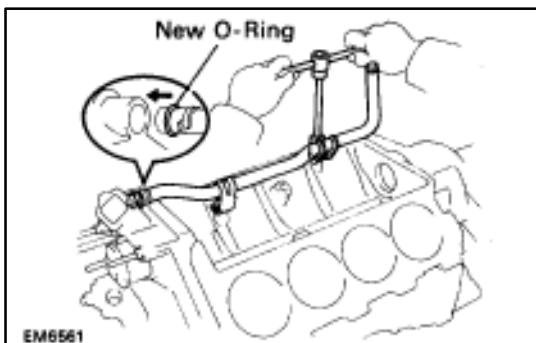
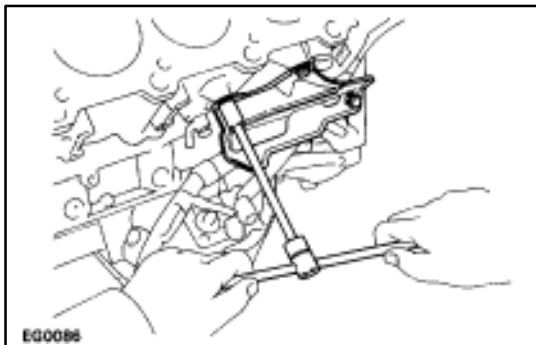
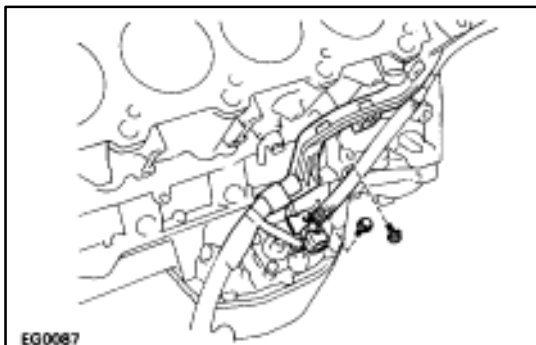
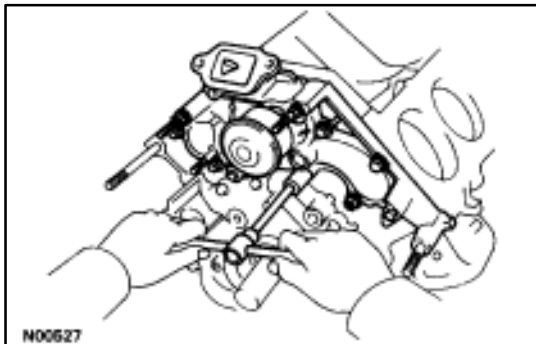
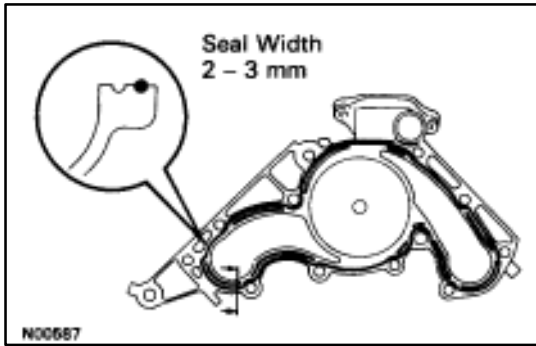
D 40 mm (1.57 in.) for 14 mm head

**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.

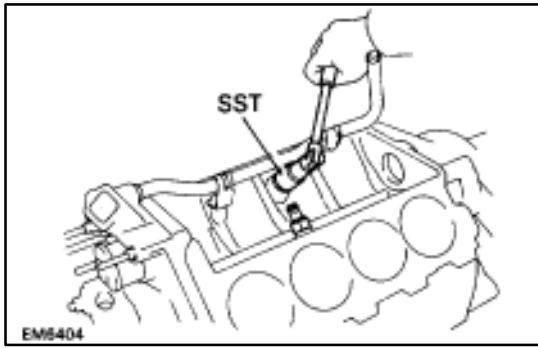
- (c) Connect the following connectors:

- (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)**



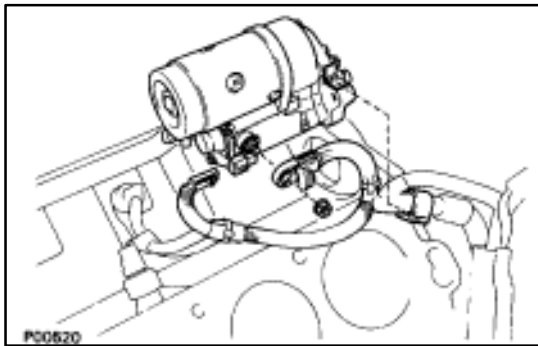
## 8. INSTALL KNOCK SENSORS

(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.

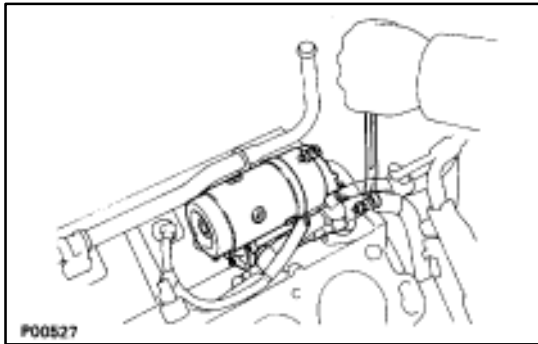


## 9. INSTALL STARTER

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

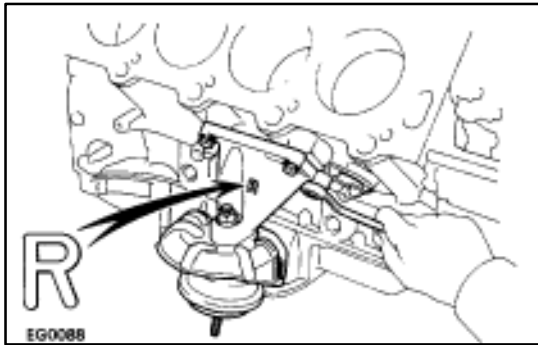
(b) Connect the wire to the starter with the nut.

(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

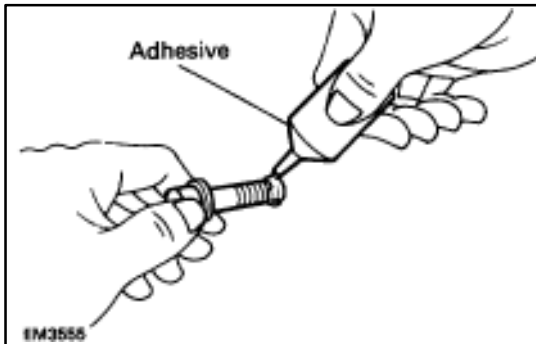
(a) Install the mounting bracket with the four bolts.

**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.

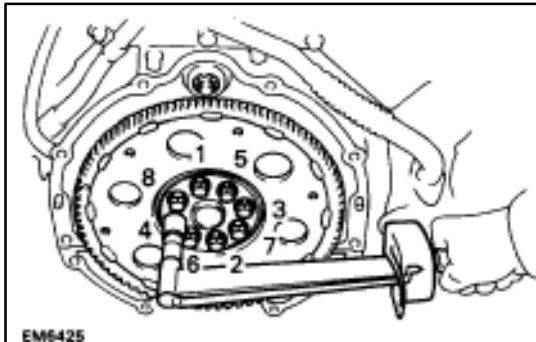
12. **INSTALL CYLINDER HEADS**  
(See pages [EM-92](#) to 115)
13. **INSTALL TIMING PULLEYS AND BELT**  
(See pages [EM-48](#) to 57)
14. **REMOVE ENGINE STAND FROM ENGINE**



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



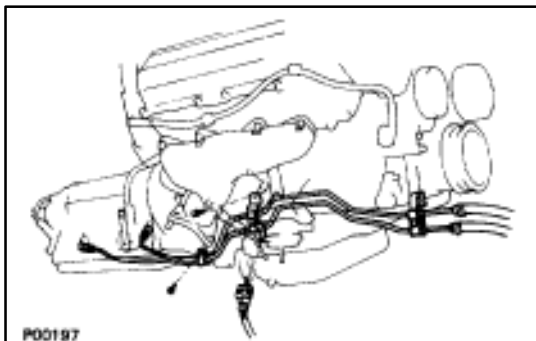
- (b) Install the front spacer, drive plate and rear spacer on the crankshaft.
- (c) Install and uniformly tighten the eight mounting bolts in several passes in the sequence shown.

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

## ASSEMBLY OF ENGINE AND TRANSMISSION

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

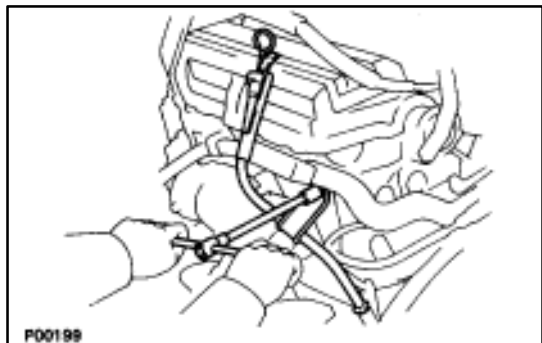
1. **ASSEMBLE ENGINE AND TRANSMISSION**  
(See AT section)



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)

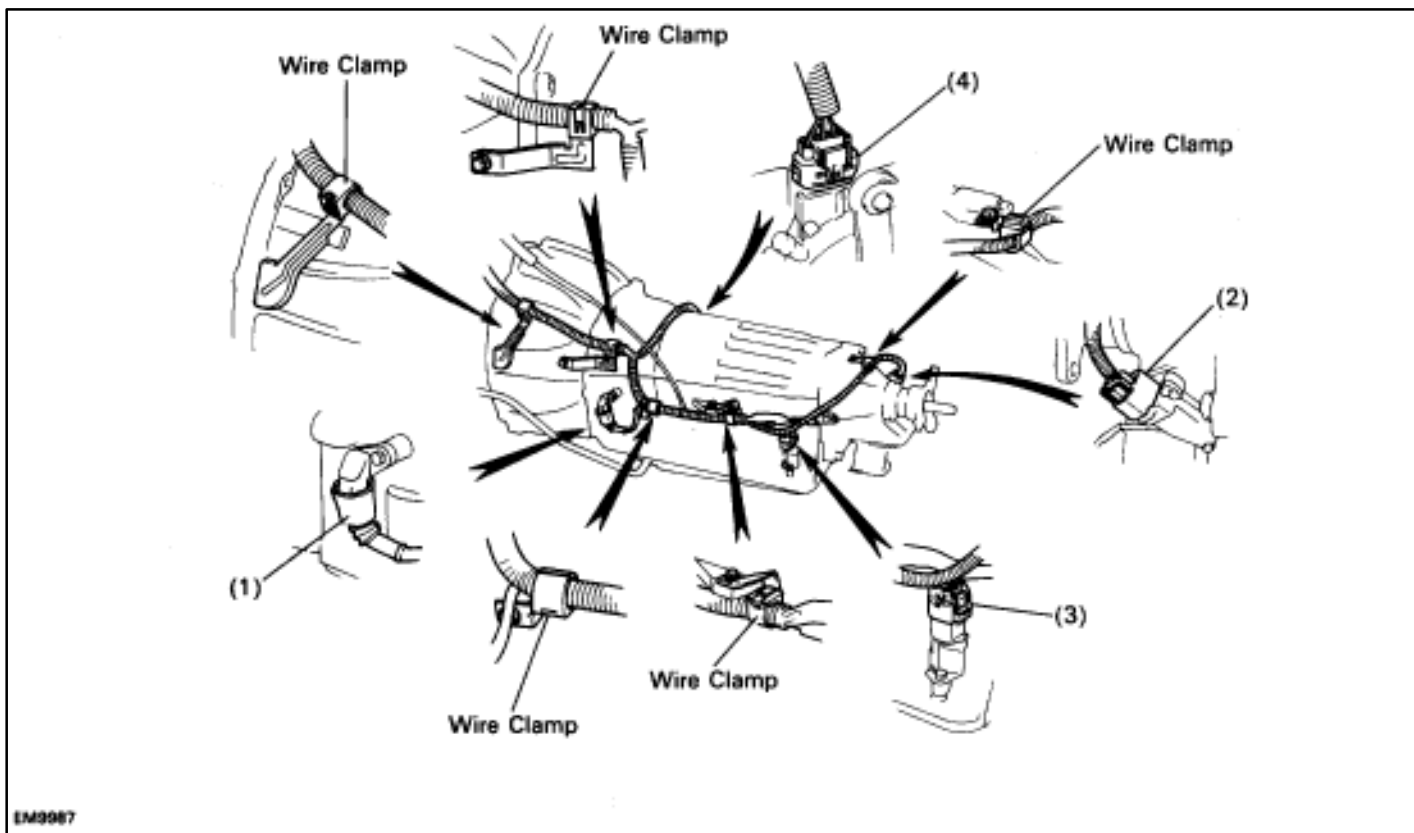


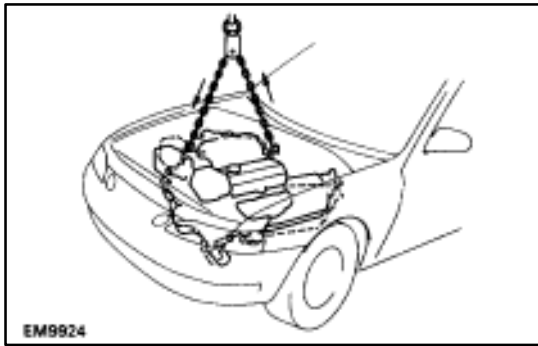
### 3. INSTALL DIPSTICK GUIDE FOR TRANSMISSION

- (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

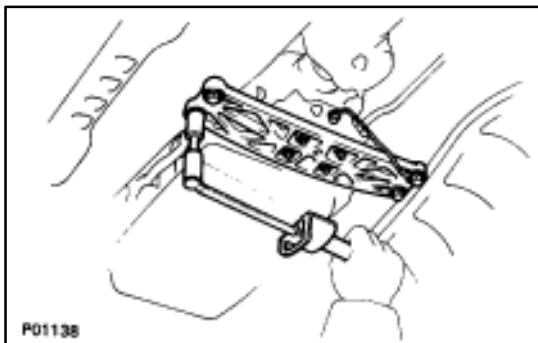
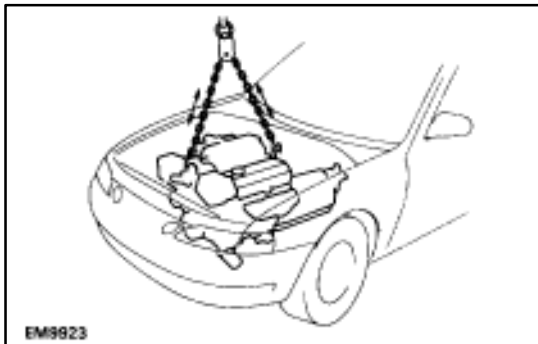
(See Components on pages [EM-116](#) to 118)

### 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.**

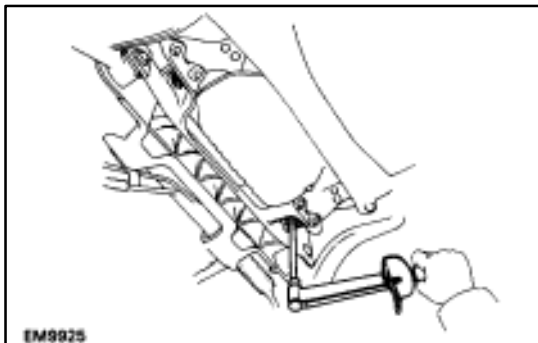
- (c) Insert the stud bolts of the front engine mounting brackets into the stud bolt holes of the front suspension crossmember.
- (d) Keep the engine level.



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

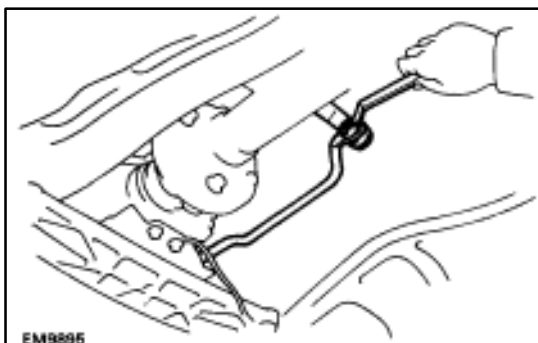
**Torque: Nut 13 N·m (135 kgf·cm, 10 ft·lbf)**

**Bolt 25 N·m (260 kgf·cm, 19 ft·lbf)**



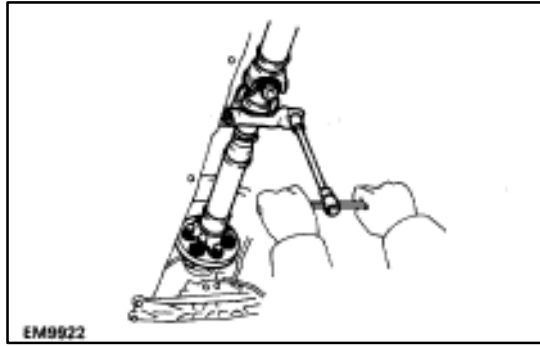
- (f) Install the two nuts holding the engine mounting brackets to the front suspension crossmember.

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

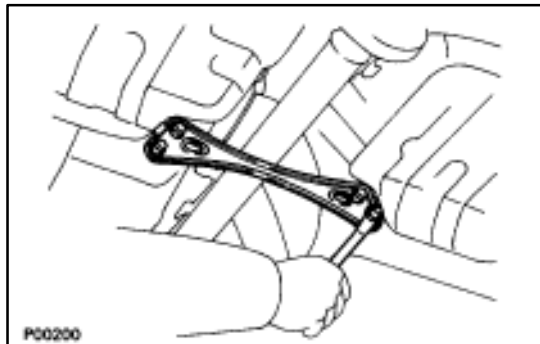


### 3. CONNECT TRANSMISSION CONTROL ROD

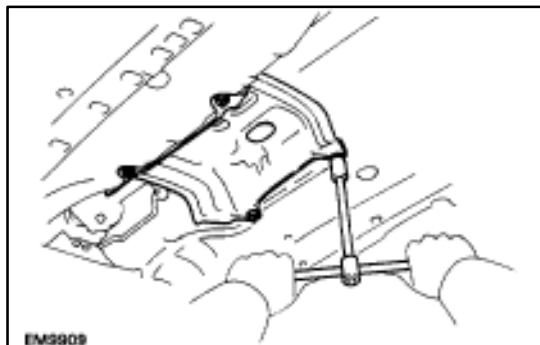
Connect the control rod to the shift lever with the nut.



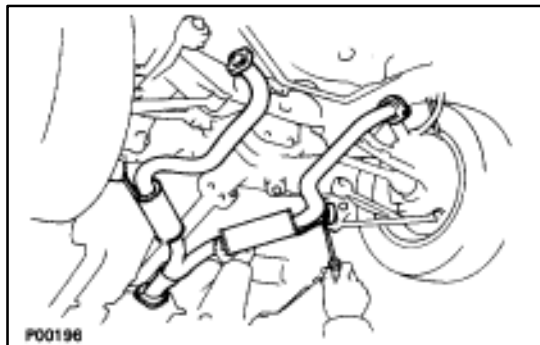
**4. INSTALL PROPELLER SHAFT**  
(See PR section)



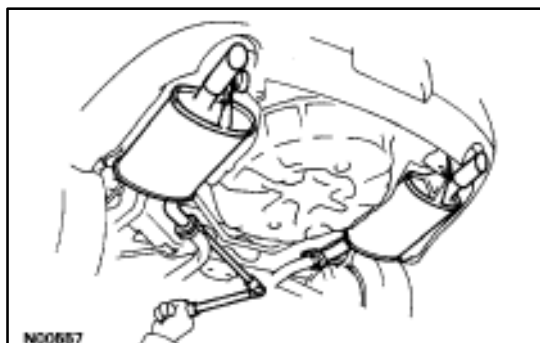
**5. INSTALL CENTER FLOOR BRACE**  
Install the brace with the four nuts.  
Torque: 13 N·m (130 kgf·cm, 9 ft·lbf)



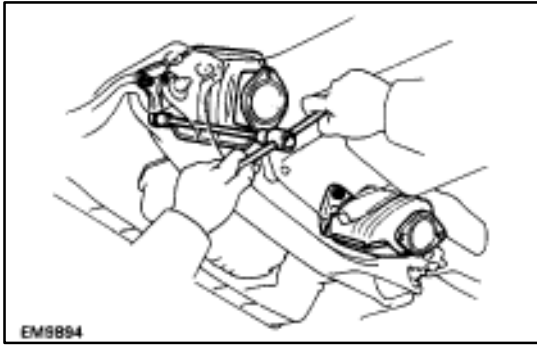
**6. INSTALL EXHAUST PIPE HEAT INSULATOR**  
Install the heat insulator with the four nuts.



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



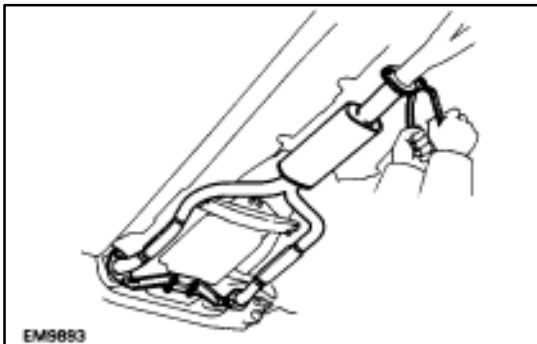
**8. INSTALL TAILPIPE**  
(a) Install the tailpipe hook to the ring on the tailpipe brackets.  
(b) Install a new gasket and the tailpipe to the center exhaust pipe with the two bolts. Install the two tailpipe.  
Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)



### 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

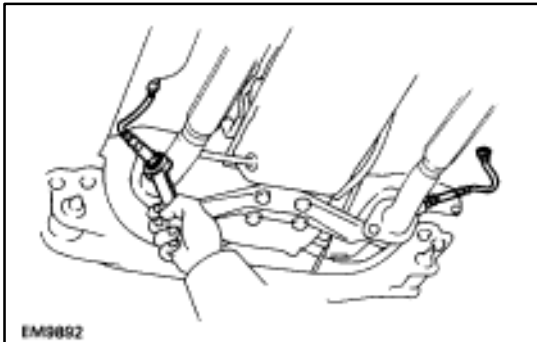
(a) Temporarily install the pipe support stay with the four bolts.

(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)**

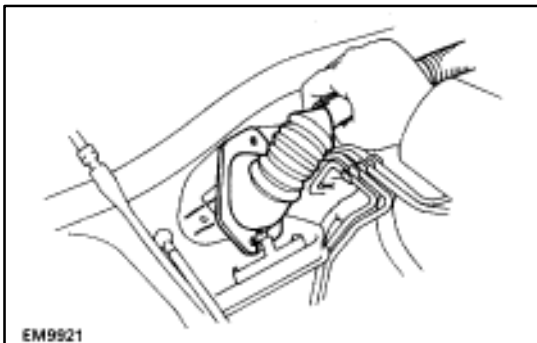


(d) Install the two sub-oxygen sensors to the exhaust pipe.

**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.



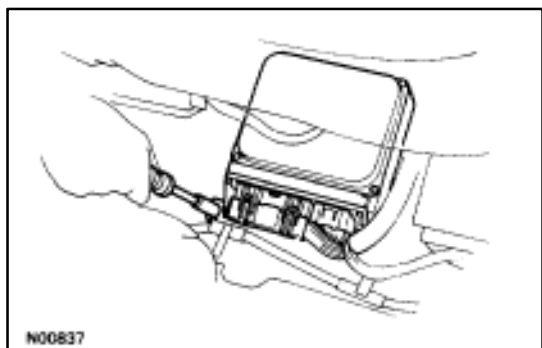
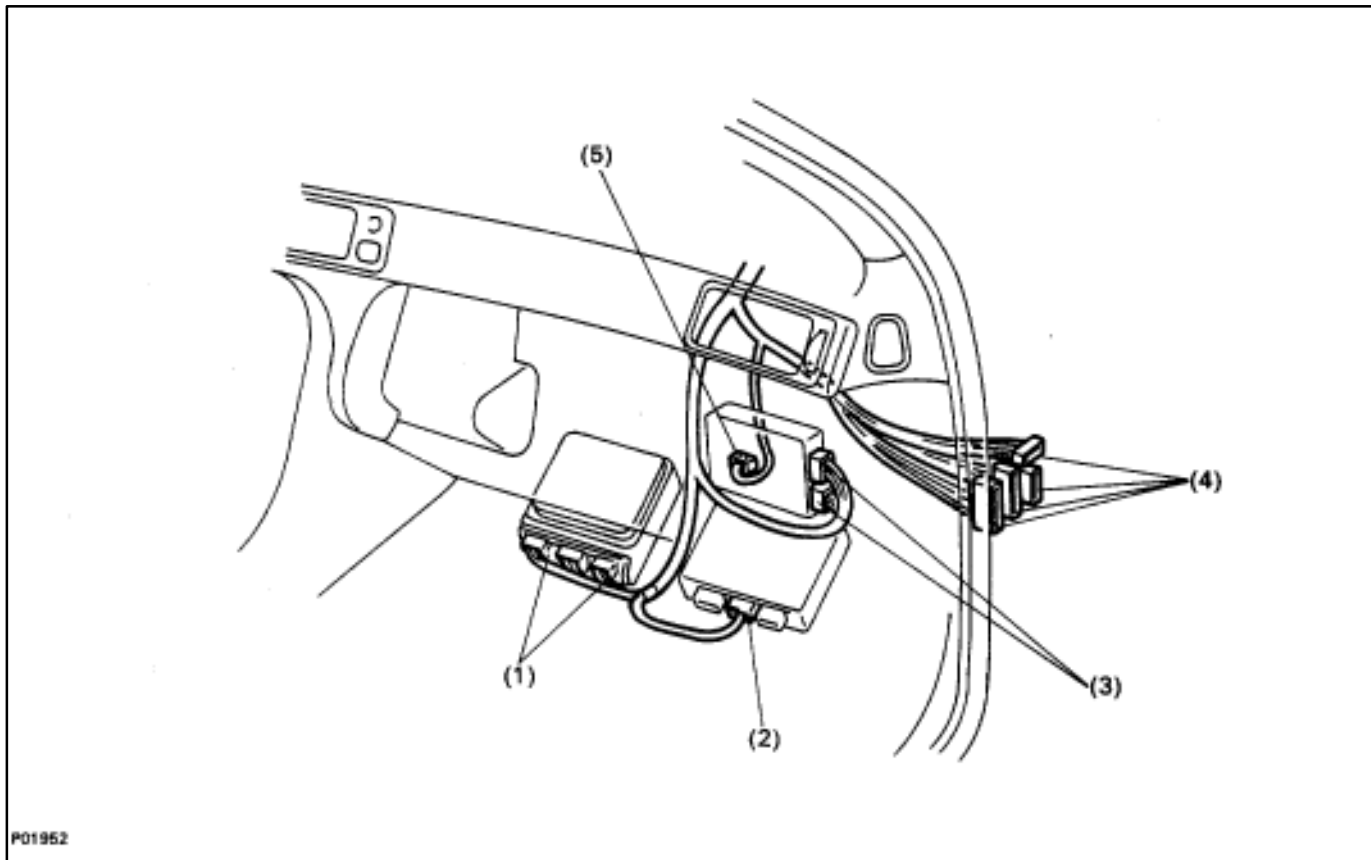
### 11. CONNECT ENGINE WIRE TO CABIN

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

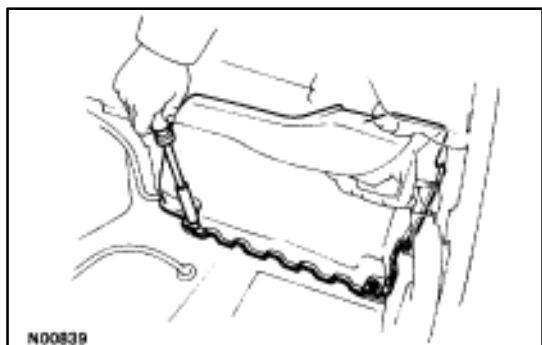


(b) Install the engine wire clamp with the three bolts.

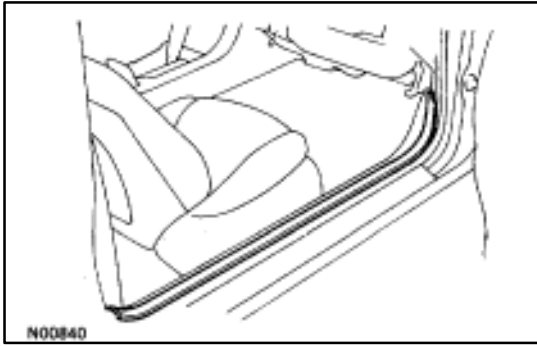
- (c) Connect the following connectors:
- (1) Two connectors to engine & ECT ECU
  - (2) Connectors to ABS & TRAC ECU
  - (3) Two connectors to TRAC ECU
  - (4) Four connectors to connector cassette
  - (5) Connector to A/C control assembly



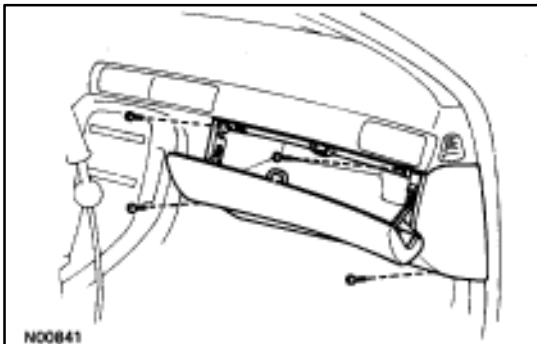
- (d) Install the engine & ECT ECU with the nut.



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

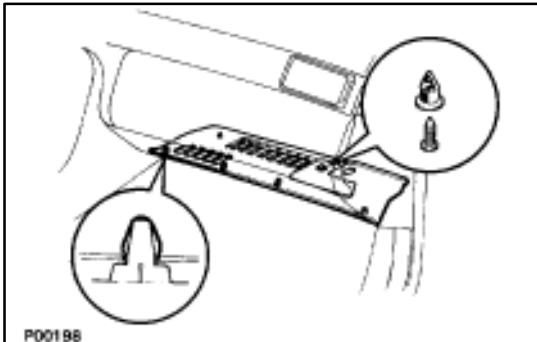


(g) Install the scuff plate.

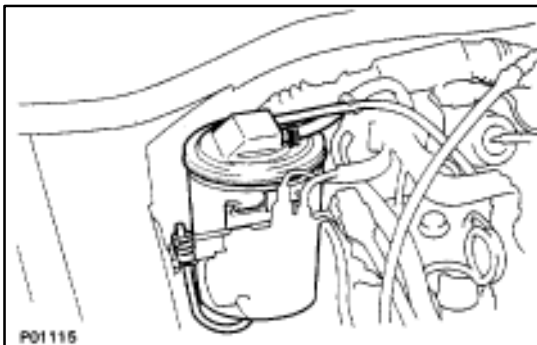


(h) Connect the connectors.

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



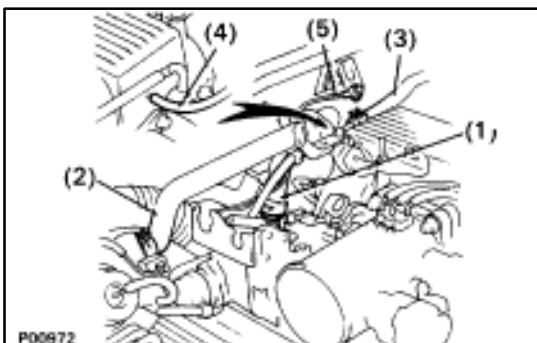
(j) Install the instrument panel under cover with the two clips.



## 12. INSTALL CHARCOAL CANISTER

(a) Install the charcoal canister.

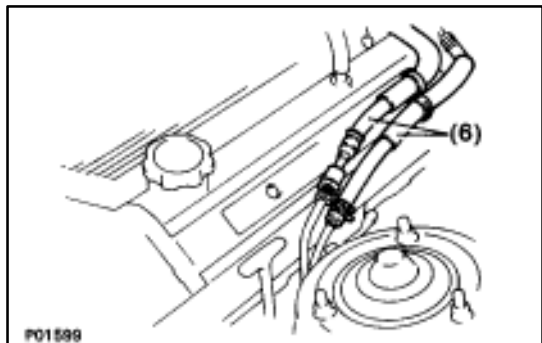
(b) Connect the vacuum hose and air hose to the charcoal canister.



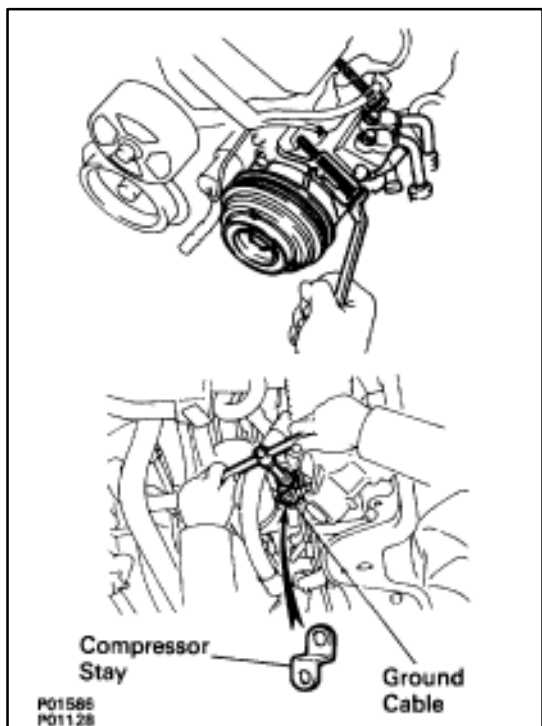
## 13. CONNECT HOSES

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



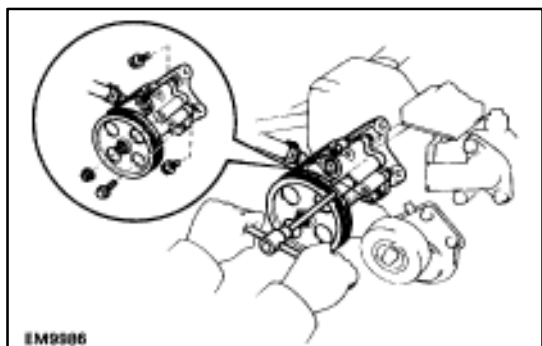
#### 14. INSTALL A/C COMPRESSOR

- (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.

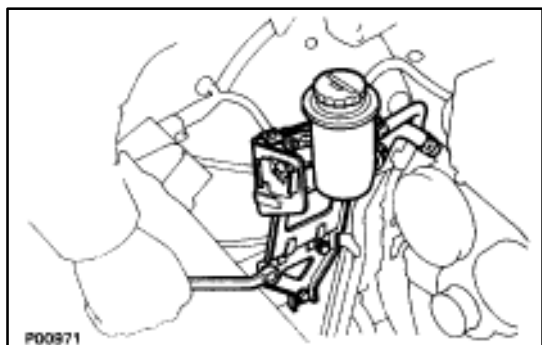


#### 15. INSTALL PS PUMP

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

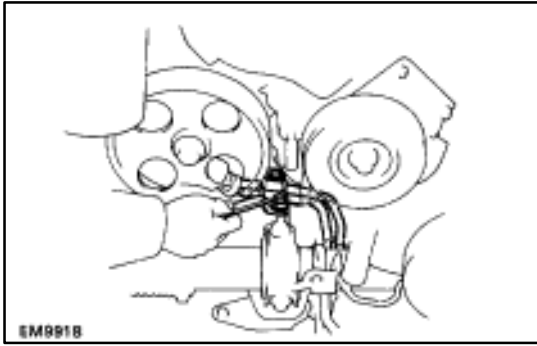
**Torque: Bolt 39 N·m (400 kgf·cm, 29 ft·lbf)**

**Nut 43 N·m (440 kgf·cm, 32 ft·lbf)**



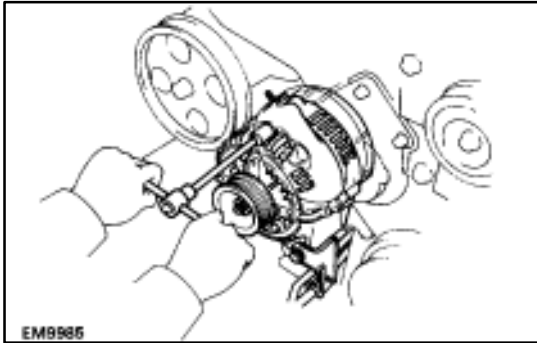
#### 16. INSTALL PS RESERVOIR TANK AND BRACKET

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



### 17. INSTALL PS TUBES

Install the PS tube clamp with the bolt.

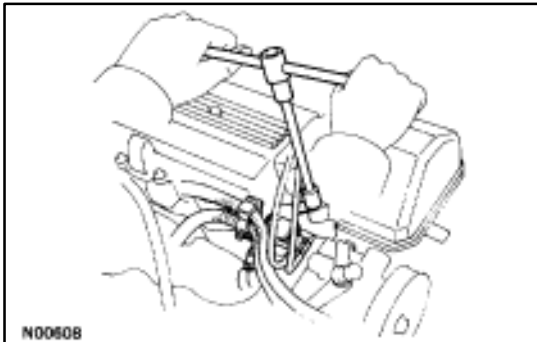


### 18. INSTALL ALTERNATOR

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

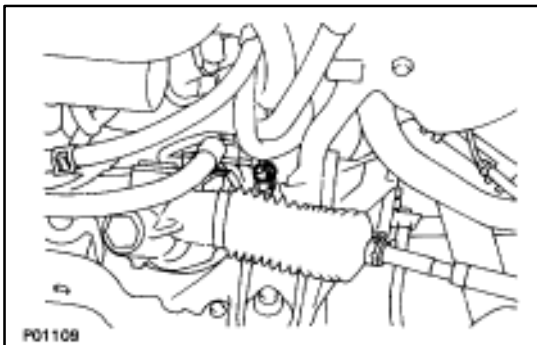
**Torque: 37 N·m (380 kgf·cm, 27 ft·lbf)**

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

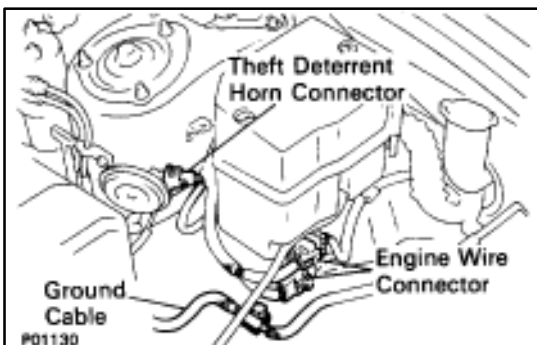


### 19. INSTALL WIRE CLAMP (FOR ALTERNATOR) AND VSV (FOR EVAP SYSTEM)

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



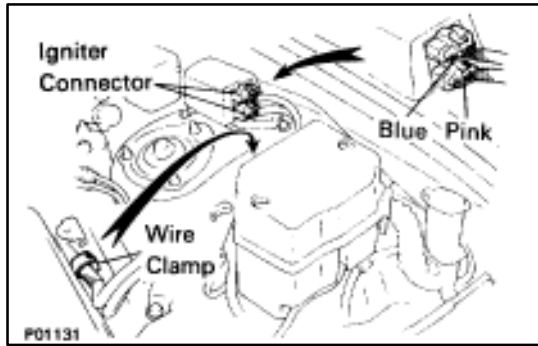
### 20. CONNECT PS SOLENOID VALVE CONNECTOR



### 21. CONNECT ENGINE WIRE CONNECTORS

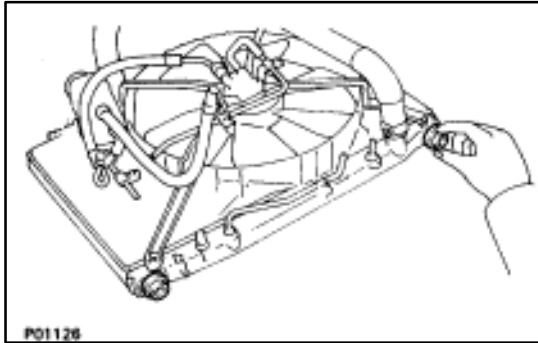
### 22. CONNECT THEFT DETERRENT HORN CONNECTOR

### 23. INSTALL GROUND CABLE TO BODY



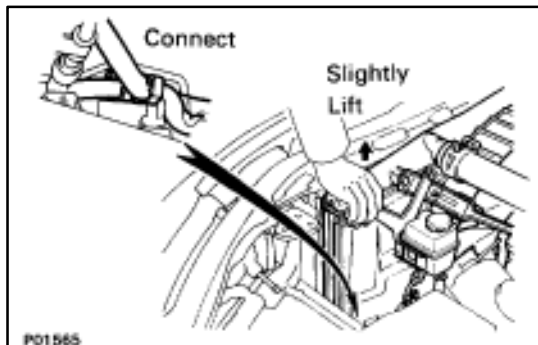
## 24. CONNECT IGNITER CONNECTOR

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

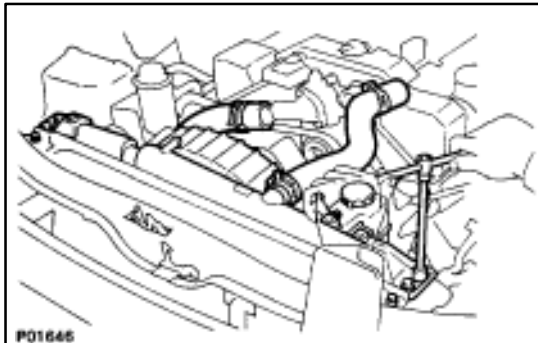


## 25. INSTALL RADIATOR

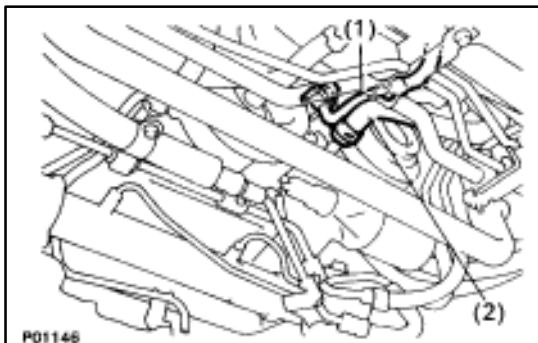
- (a) Install the two lower radiator supports to the radiator.



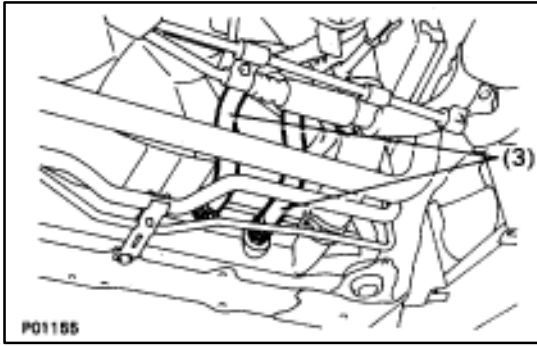
- (b) Place the radiator on the body bracket.
- (c) Slightly lift the radiator, and connect the two cooler hose (for cooling fan) to the hose clamp on the radiator fan shroud.



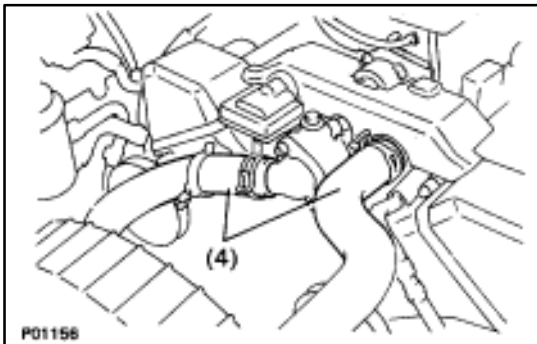
- (d) Install the upper radiator support with the two bolts and screw. Install the two upper radiator supports.



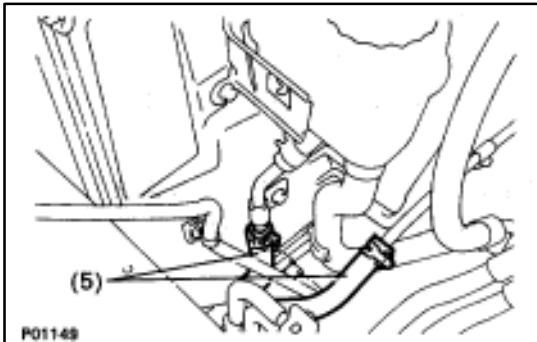
- (e) Connect the following hoses:
  - (1) Pressure hose to hydraulic pump
  - (2) Suction hose to hydraulic pump



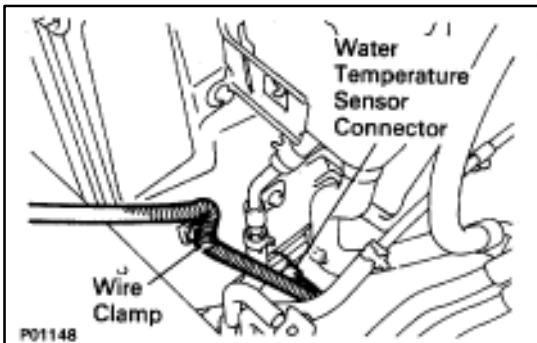
(3) Two oil cooler hoses (for A/T) to radiator



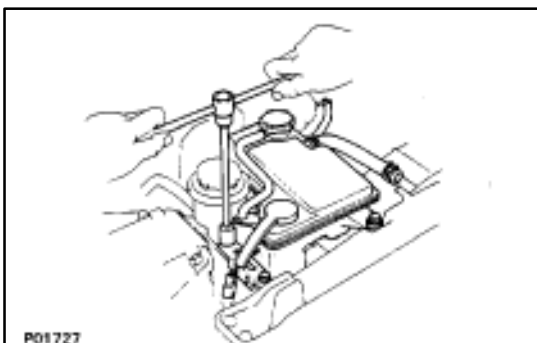
(4) Two radiator hoses



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

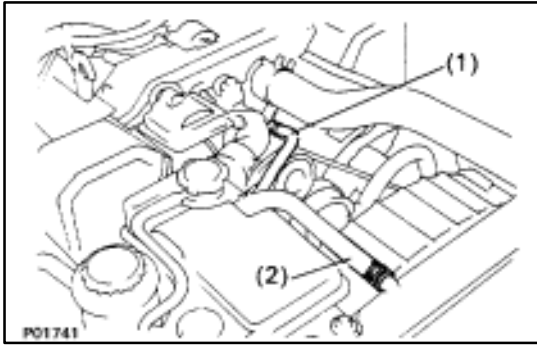


- (f) Connect the water temperature sensor connector.
- (g) Install the wire clamp (for water temperature sensor) to the radiator fan shroud.



## 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.

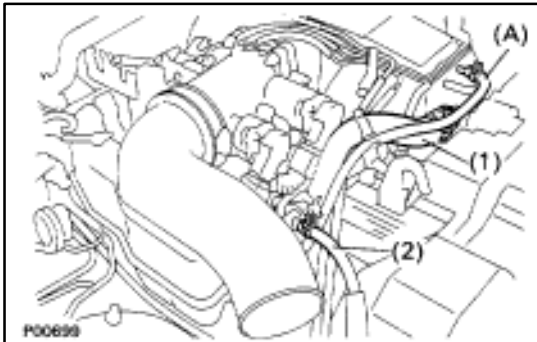


- (c) Connect the following hoses:
  - (1) Reservoir hose to water inlet housing
  - (2) Reservoir hose to radiator
- (d) Connect the coolant level sensor connector.



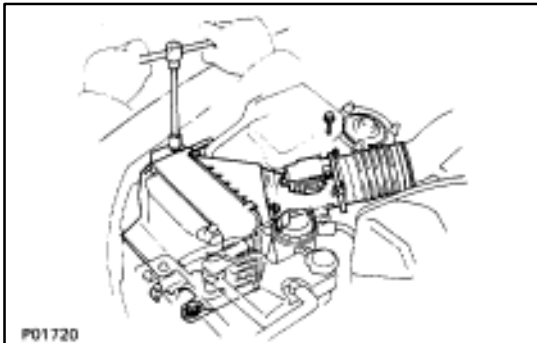
## 27. INSTALL INTAKE AIR CONNECTOR

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



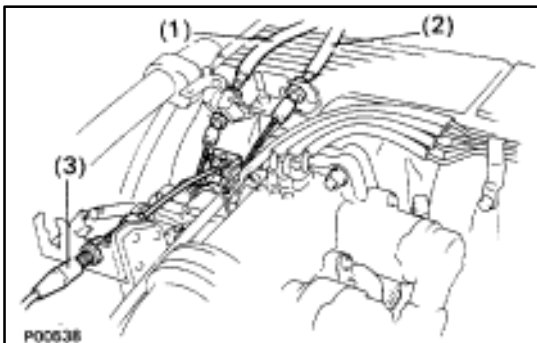
- (c) Connect the following hoses:
  - (1) Air hose to ISC valve
  - (2) Air hose (from PS air control valve) to air intake chamber

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



## 29. INSTALL AIR CLEANER AND AIR FLOW METER

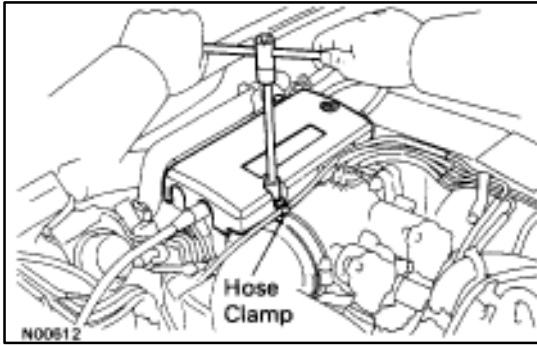
- (a) Connect the air cleaner case to the air duct.
- (b) Connect the air cleaner hose to the intake air connector.
- (c) Install the four mounting bolts and hose clamp.
- (d) Connect the air flow meter connector.



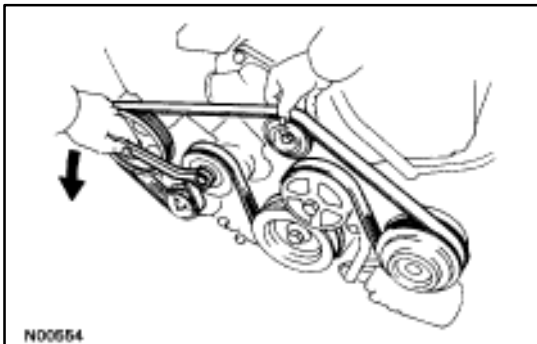
## 30. CONNECT CONTROL CABLES TO THROTTLE BODY

Connect the following cables:

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

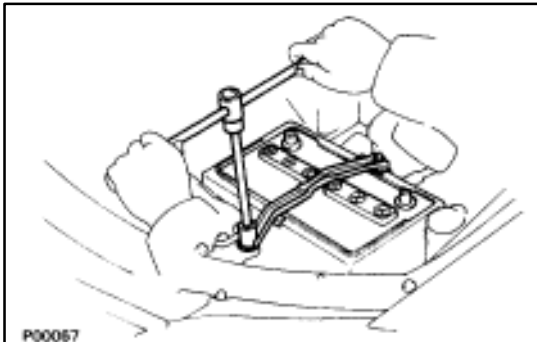
**31. INSTALL THROTTLE BODY COVER**

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**