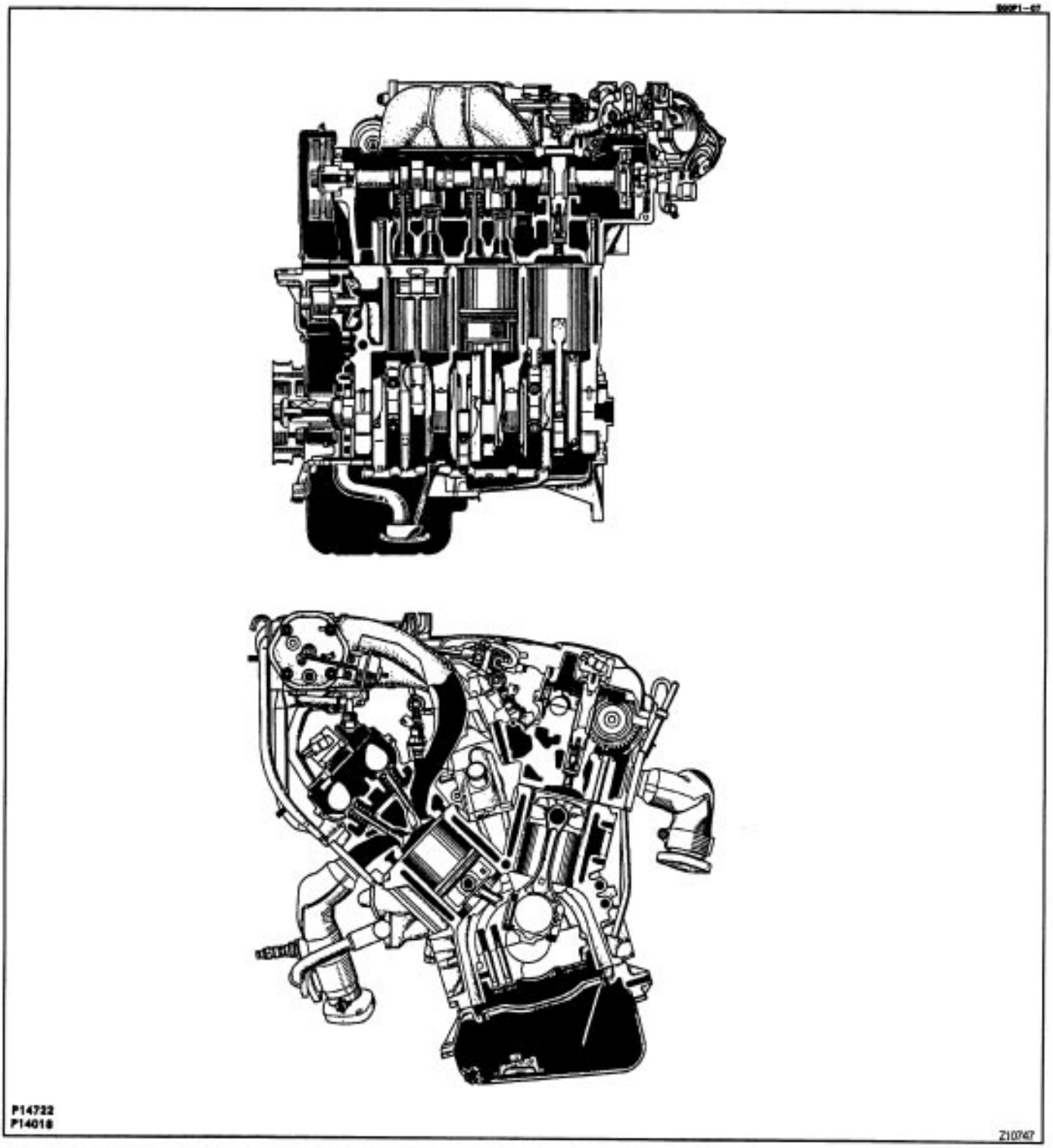
# 1MZ–FE ENGINE

# ENGINE MECHANICAL

## DESCRIPTION

The 1 MZ–FE engine is a V–6, 3.0 liter 24 valve DOHC engine.

## OPERATION



The 1 MZ–FE engine has 6 cylinders in a V arrangement at a bank angle of $60_2$. From the front of the RH bank cylinders are numbered 1–3–5, and from the front of the LH bank cylinders are numbered 2–4–6. The crankshaft is supported by 4 bearings inside the crankcase. These bearings are made of copper and lead alloy.

The crankshaft is integrated with 9 semi counterweights for balance. Oil holes are placed in the center of the crankshaft for supply oil to the connecting rods, bearings, pistons and other components.

This engine's firing order is 1–2–3–4–5–6. The cylinder head is made of aluminum alloy, with a cross flow type intake and exhaust layout and with pent–roof type combustion chambers. The spark plugs are located in the center of the combustion chambers.

At the front and rear of the intake manifold, a water passage has been provided which connects the RH and LH cylinder heads.

Exhaust and intake valves are equipped with irregular pitch springs made of special valve spring carbon steel which are capable of following the cam profile at all engine speeds.

The RH and LH exhaust camshafts are driven by a single timing belt, and a gear on the exhaust camshaft engages with a gear on the intake camshaft to drive it. The camshaft journal is supported at 5 places between the valve lifters of each cylinder and on the front end of the cylinder head. Lubrication of the cam journals and gears is accomplished by oil being supplied through the oiler port in the center of the camshaft.

Adjustment of the valve clearance is done by means of an outer shim type system, in which valve adjusting shims are located above the valve lifters. This permits replacement of the shims without removal of the camshafts.

The timing belt covers consist of the resin type No.2 and No.1 above and below the engine RH mounting bracket.

Pistons are made of high temperature–resistant aluminum alloy, and a depression is built into the piston head to prevent interference with the valves.

Piston pins are the full–floating type, with the pins fastened to neither the piston boss nor the connecting rods. Instead, snap rings are fitted on both ends of the pins, preventing the pins from falling out.

The No.1 compression ring is made of steel and the No.2 compression ring is made of cast iron. The oil ring also is made of a combination of steel and stainless steel. The outer diameter of each piston ring is slightly larger than the diameter of the piston and the flexibility of the rings allows them to hug the cylinder walls when they are mounted on the piston. Compression rings No. 1 and No.2 work to prevent gas leakage from the cylinder and the oil ring works to clear oil off the cylinder walls to prevent it from entering the combustion chambers.

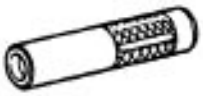
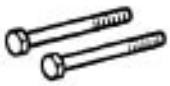
The cylinder block is made of aluminum alloy with a bank angle of $60_2$. It has 6 cylinders which are approximately 1.6 times the length of the piston stroke. The top of the cylinders is closed off by the cylinder heads and the lower end of the cylinders becomes the crankcase, in which the crankshaft is installed. In addition, the cylinder block contains a water jacket, through which coolant is pumped to cool the cylinders.

The No. 1 and No.2 oil pans are bolted onto the bottom of the cylinder block. The No. 1 oil pan is made of aluminum alloy. The No.2 oil pan is an oil reservoir made of pressed sheet steel. An oil pan baffle plate keeps sufficient oil in the bottom of the No.2 oil pan even when the vehicle is tilted. This dividing plate also prevents the oil from sloshing when the vehicle is stopped suddenly and the oil shifts away from the oil pump suction pipe.

Plastic region tightening bolts are used for the cylinder head, main bearing caps and connecting rods.

# PREPARATION

## SST (SPECIAL SERVICE TOOLS)

| | | |
|---|---|---|
|  | 09201–01055 Valve Guide Bushing Remover & Replacer 5.5 | |
|  | 09201–41020 Valve Stem Oil Seal Replacer | |
|  | 09202–70010 Valve Spring Compressor | |
|  | 09213–54015 Crankshaft Pulley Holding Tool | |
|  | 09213–60017 Crankshaft Pulley & Gear Puller Set | |
|  | (09213–00020) Body With Bolt | |
|  | (09213–00030) Handle | |
|  | (09213–00050) Bolt set | Crankshaft timing pulley |
|  | (09213–00060) Bolt set | Crankshaft pulley |
|  | 08223–00010 Cover & Seal Replacer | Crankshaft front oil seal |
|  | 09223–15030 Oil Seal & Bearing Replacer | Crankshaft rear oil seal |
|  | 09223–46011 Crankshaft Front Oil Seal Replacer | Crankshaft timing pulley |
|  | 09248–55040 Valve Clearance Adjust Tool set | |

| | | |
|---|---|---|
|  | (09248 –05410) Valve Lifter Press | |
|  | (09248–05420) Valve Lifter Stopper | |
|  | 09249–63010 Torque Wrench Adaptor | RH camshaft timing pulley |
|  | 09330–00021 Companion Flange Holding Tool | Crankshaft pulley |
|  | 09608–20012 Front Hub & Drive Pinion Bearing Tool Set | |
|  | (09608–03020) Handle | Crankshaft rear oil seal<br>Valve guide bushing |
|  | (09608–03070) Replacer | Spark plug tube gasket |
|  | 09631–22020 Power Steering Hose Nut 14 x 17 mm Wrench Set | |
|  | 09816–30010 Oil Pressure Switch Socket | Knock sensor<br>Oil pressure switch |
|  | 09843–18020 Diagnosis Check Wire | |
|  | 09960–10010 Variable Pin Wrench Set | |
|  | (09962–01000) Variable Pin Wrench Arm Assy | Camshaft timing pulley |

# RECOMMENDED TOOLS

| | | |
|---|---|---|
|  | 09040–00010 Hexagon Wrench Set | |
|  | 09090–04010 Engine Sling Device | For suspending engine |
|  | 09200–00010 Engine Adjust Kit | |
|  | 09258–00030 Hose Plug set | Plug for the vacuum hose, fuel hose etc. |
|  | 09904–00010 Expander Set | |

# EQUIPMENT

| | |
|---|---|
| Battery specific gravity gauge | |
| Caliper gauge | |
| CO/HC meter | |
| Connecting rod aligner | |
| Cylinder gauge | |
| Dial indicator | |
| Dye penetrant | |
| Engine tune–up tester | |
| Heater | |
| Micrometer | |
| Piston ring compressor | |
| Piston ring expander | |
| Plastigage | |
| Precision straight edge | |
| Magnetic finger | |

| | |
|---|---|
| Soft brush | |
| Spring tester | Valve spring |
| Steel square | Valve spring |
| Thermometer | |
| Torque wrench | |
| Valve seat cutter | |
| Vernier calipers | |

## COOLANT

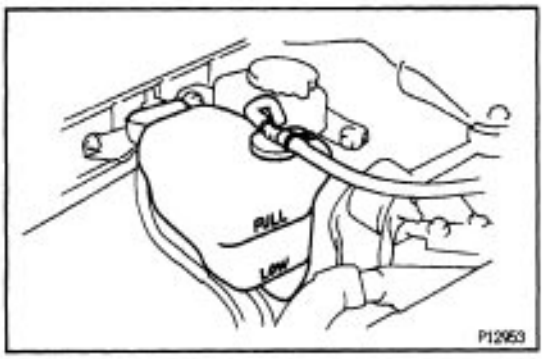
| Item | Capacity | Classification |
|---|---|---|
| Engine coolant | 8.7 liters (9.2 US qts, 7.7 Imp. qts) | Ethylene–glycol base |

## LUBRICANT

| Item | Capacity | Classification |
|---|---|---|
| Engine oil<br>Dry fill<br>Drain and refill<br>w/ Oil filter change<br>w/o Oil filter change | <br><br>5.5 liters (5.8 US qts, 4.8 Imp. qts)<br><br>4.7 liters (5.0 US qts, 4.1 Imp. qts)<br>4.5 liters (4.8 US qts, 4.0 Imp. qts) | API grade SG or SH, Energy–Conserving II or ILSC multigrade and recommended viscosity oil with SAE 5W–30 being the preferred engine oil |

## SSM (SERVICE SPECIAL MATERIALS)

| | |
|---|---|
| 08826–00080 Seal packing or equivalent | Camshaft bearing cap<br>Semi–circular plug<br>Spark plug tube<br>Cylinder head cover |
| 08826–00080 Seal packing or equivalent | Intake air control valve<br>Rear oil seal retainer<br>No. 1 oil pan<br>No.2 oil pan |
| 08826–00100 Seal Packing 1282B,<br>THREE BOND 1282B or equivalent | Engine coolant drain cock<br>Water seal plate<br>Water inlet housing |
| 08833–00070 Adhesive 1311,<br>THREE BOND 1311 or equivalent | Drive plate bolt<br>TVV |
| 08833–00080 Adhesive 1344,<br>THREE BOND 1344,<br>LOCTITE 242 or equivalent | Oil pressure switch |

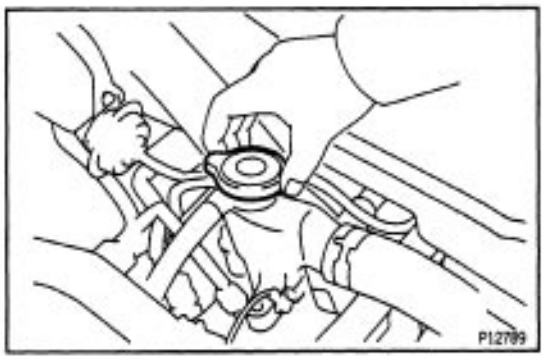



# TUNE–UP

## ENGINE COOLANT INSPECTION

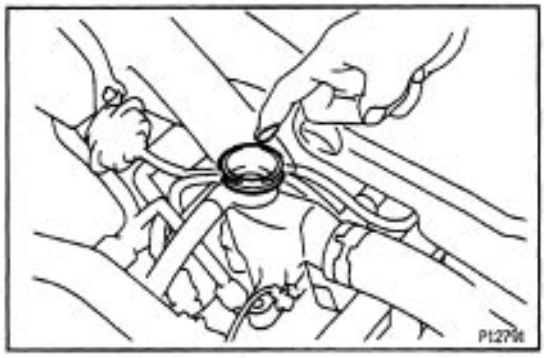
**1. CHECK ENGINE COOLANT LEVEL AT RESERVOIR TANK**

The engine coolant level should be between the ”LOW” and ”FULL” lines.
If low, check for leaks and add engine coolant up to the ”FULL” line.




**2. CHECK ENGINE COOLANT QUALITY**

(a) Remove the radiator cap from the water outlet.
**CAUTION: To avoid the danger of being burned, do not remove the radiator cap while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.**




(b) There should not be any excessive deposits of rust or scale around the radiator cap or water outlet filler hole, and the coolant should be free from oil.
If excessively dirty, clean the coolant passages and replace the coolant.

**Capacity:**

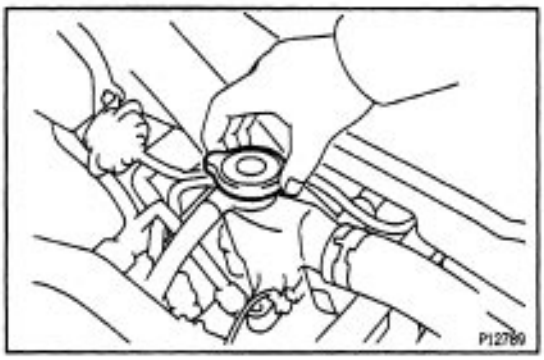
**8.7 liters (9.2 US qts, 7.7 Imp. qts)**

HINT:

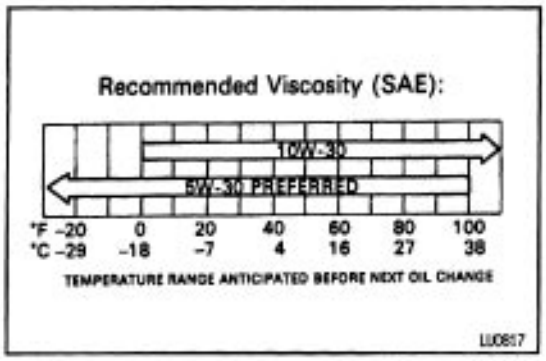
- Use a good brand of ethylene–glycol base coolant and mix it according to the manufacturer’s directions.
- Using coolant which includes more than 50 % ethylene–glycol (but not more than 70 %) is recommended.

**NOTICE:**

- **Do not use an alcohol type coolant.**
- **The coolant should be mixed with demineralized water or distilled water.**




(c) Reinstall the radiator cap.




# ENGINE OIL INSPECTION

**1. CHECK OIL QUALITY**

Check the oil for deterioration, entry of water, dis–coloring or thinning.

If oil quality is visibly poor, replace the oil.

**Oil grade:**

**API grade SG or SH, Energy – Conserving H or ILSAC multigrade engine oil. Recommended viscosi–ty is as shown in the illustration, with SAE 5W–30 being the preferred engine oil.**

**Drain and refill capacity:**

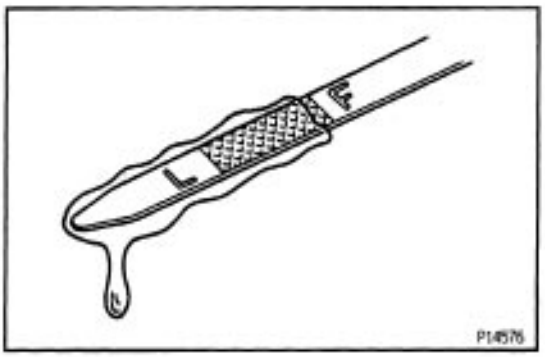
**w/ Oil filter change**

**4.7 liters (5.0 US qts, 4.1 Imp, qts)**

**w/o Oil filter change**

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





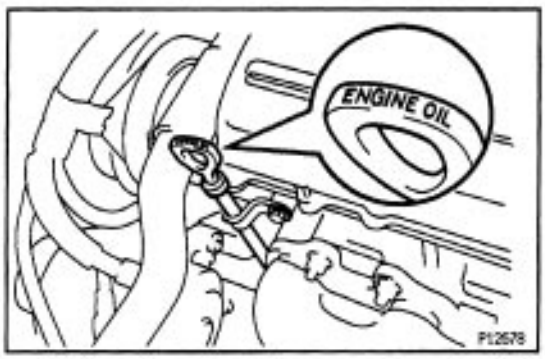

**2. CHECK ENGINE OIL LEVEL**

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

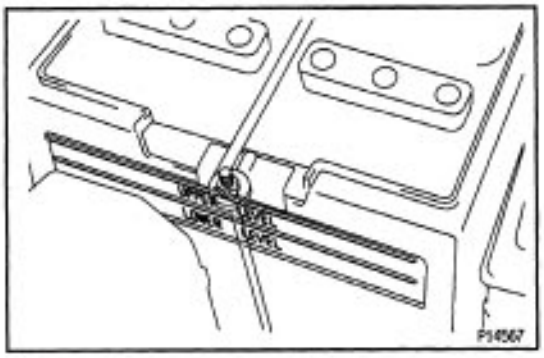
If low, check for leakage and add oil up to the ”F” mark.

**NOTICE:**

- **Do not fill with engine oil above the ’F’ mark.**




- **Install the oil dipstick facing the direction shown in the illustration.**




# BATTERY INSPECTION

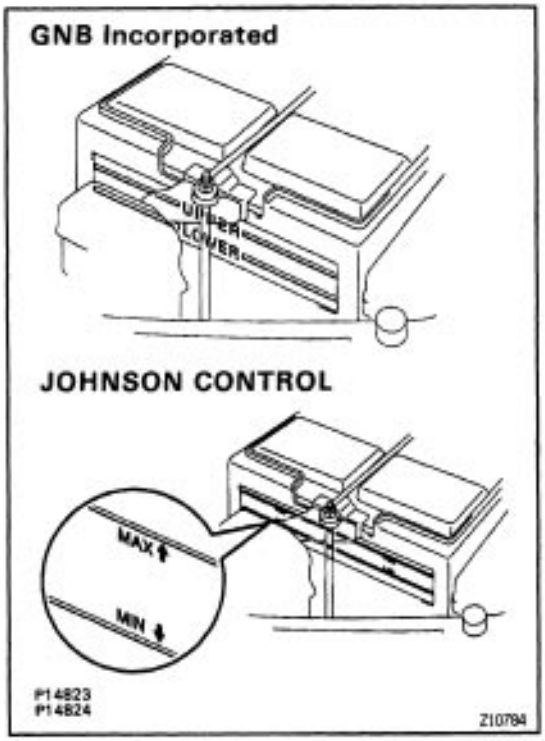
**1. Except Delco Battery:**

**CHECK BATTERY ELECTROLYTE LEVEL**

Check the electrolyte quantity of each cell.

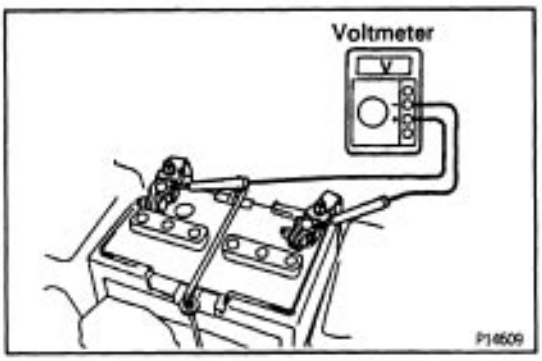
**A. Maintenance Free Battery**

If under the lower level, replace the battery (or add distilled water if possible). Check the charging system.




**B. Except Maintenance Free Battery**

If under the ”LOWER” or ”MIN’ line, add distilled water.




**2. Except Delco Battery:**

**CHECK BATTERY VOLTAGE AND SPECIFIC GRAVITY**

**A. Maintenance Free Battery**

Measure the battery voltage between the terminals negative (–) and positive (+) of the battery.

**Standard voltage:**

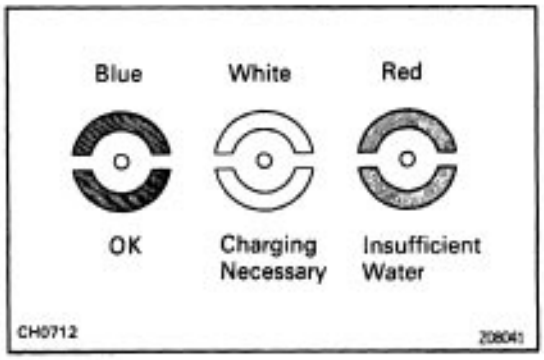
**12.7 – 12.9 V at 20˚C (68˚F)**

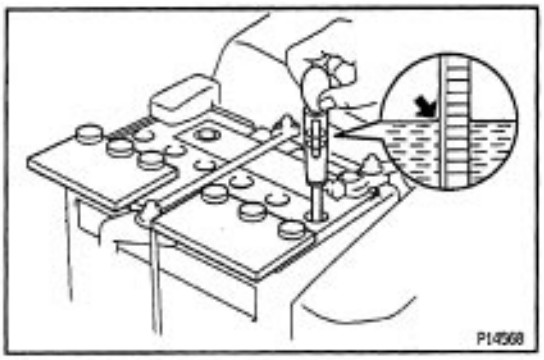
HINT:

- Before measuring the voltage, turn the ignition switch to LOCK and turn off the electrical sys–tems (headlight, blower motor, rear defogger etc.; for 60 seconds to remove the surface charge.
- If the vehicle has been running, wait 5 minutes or more after the vehicle stops before measuring the battery voltage.

If the voltage is less than specification, charge the battery.

HINT: Check the indicator as shown in the illustration.






**B. Except Maintenance Free Battery**

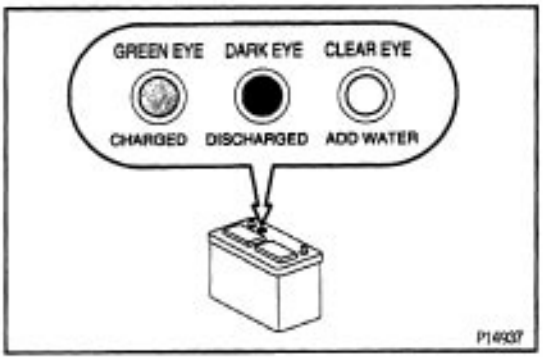
Check the specific gravity of each cell.

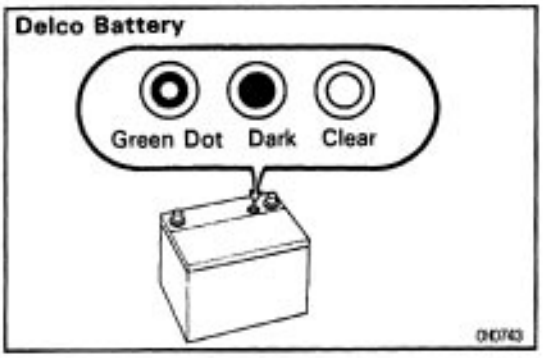
**Standard specific gravity:**

**55D23L battery for GNB Incorporated**
**1.25 – 1.27 at 20˚C (60˚F)**
**5513231– battery for JOHNSON CONTROLS**
**1.26 – 1.28 at 27˚C (81˚F)**
**80D26L battery for GNB Incorporated**
**1.27 – 1.29 at 20˚C (68˚F)**
**80D26L battery for JOHNSON CONTROLS**
**1.28 – 1.30 at 27˚C (80˚F)**

If the gravity is less than specification, charge the battery.

HINT: Check the indicator as shown in the illustration.




**3. Delco Battery:**

**CHECK HYDROMETER**

**Green Dot visible:**

**Battery is adequately charged**

**Dark (Green Dot not visible):**

**Battery must be charged**

**Clear or Light Yellow:**

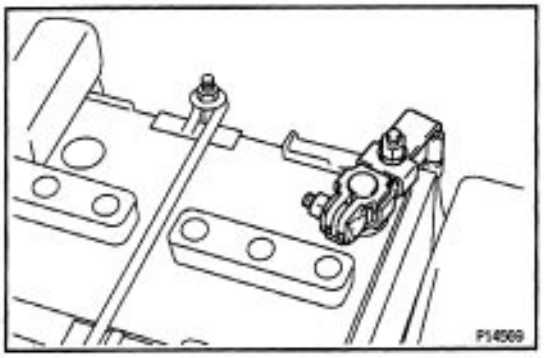
**Replace battery**

HINT: There is no need to add water during the entire service life of the battery.

**4. CHECK BATTERY TERMINALS, FUSIBLE LINK AND FUSES**

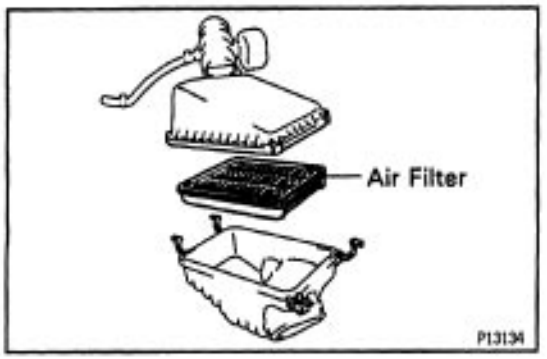
(a) Check that the battery terminals are not loose or corroded.

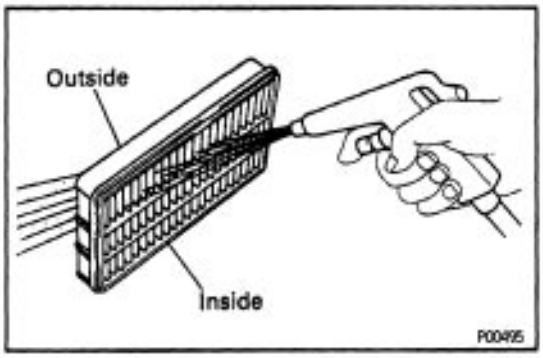
(b) Check the fusible link and fuses for continuity.




## AIR FILTER INSPECTION AND CLEANING

**1. REMOVE AIR FILTER**






**2. INSPECT AND CLEAN AIR FILTER**

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

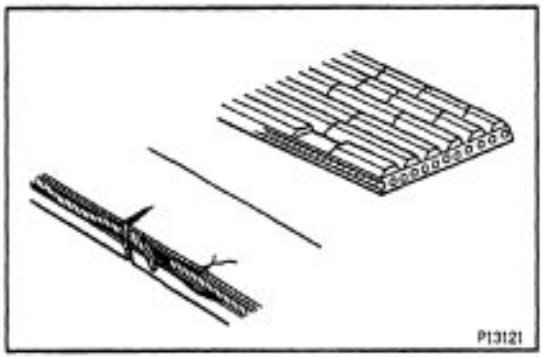
If necessary, replace the air filter.

(b) Clean the air filter with compressed air.

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

**3. REINSTALL AIR FILTER**

# GENERATOR DRIVE BELT INSPECTION



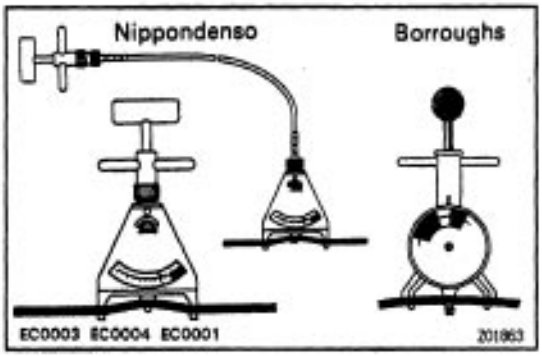

**INSPECT DRIVE BELT**

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

If necessary, replace the drive belt.

HINT: Cracks on the rib side of a belt are considered acceptable. If the belt has chunks missing from the ribs, it should be replaced.

(b) Using a belt tension gauge, measure the drive belt tension.




**Belt tension gauge:**

**Nippondenso BTG – 20 (95506–00020)**

**Borroughs No. BT–33–73F**

**Drive belt tension:**

**New belt**

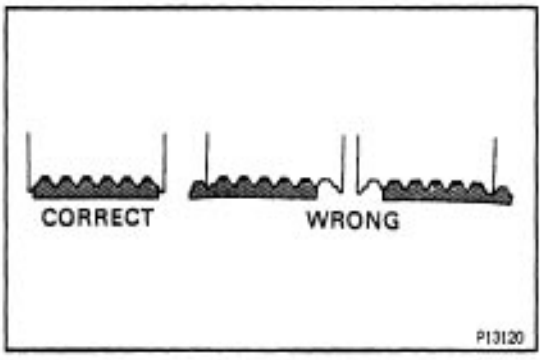
**175 ± 5 lbf**

**Used belt**

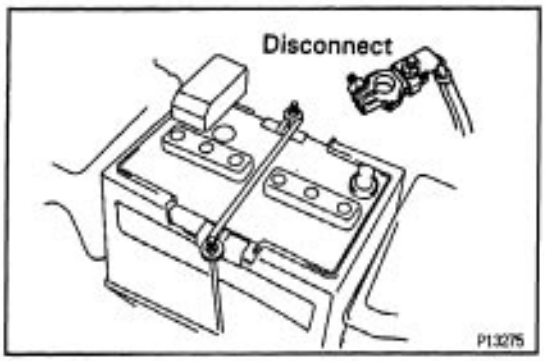
**115 ±20 lbf**

If the belt tension is not as specified, adjust it.

HINT:




- ”New belt” refers to a belt which has been used less than 5 minutes on a running engine.
- ”Used belt” refers to a belt which has been used on a running engine for 5 minutes or more.
- After installing the belt, check that it fits properly in the ribbed grooves.
- Check by hand to confirm that the belt has not slipped out of the groove on the bottom of the pulley.
- After installing a new belt, run the engine for about 5 minutes and recheck the belt tension.




# VALVE CLEARANCE INSPECTION AND ADJUSTMENT

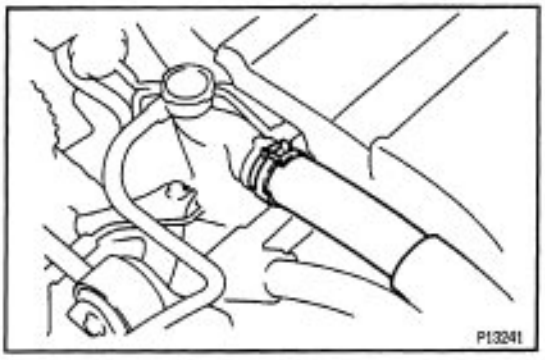
HINT: Inspect and adjust the valve clearance when the engine is cold.

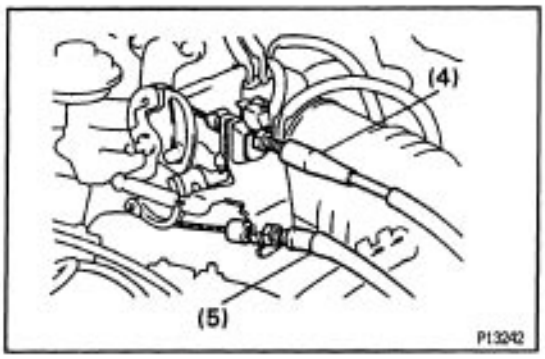
**1. DISCONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY**

**CAUTION: Work must be started after 90 seconds from the time the ignition switch is turned to the "LOCK" position and the negative (–) terminal cable is disconnected from the battery.**

**2. DRAIN ENGINE COOLANT**

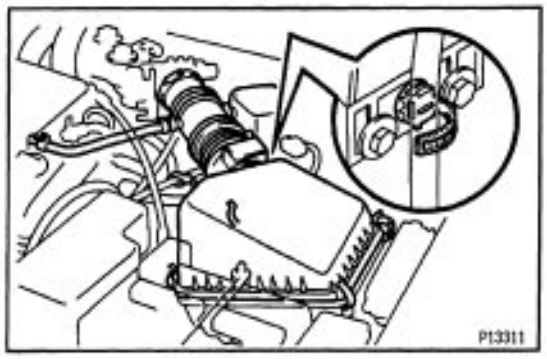
**3. DISCONNECT RADIATOR INLET HOSE**




**4. DISCONNECT ACCELERATOR CABLE**

**5. DISCONNECT THROTTLE CABLE**

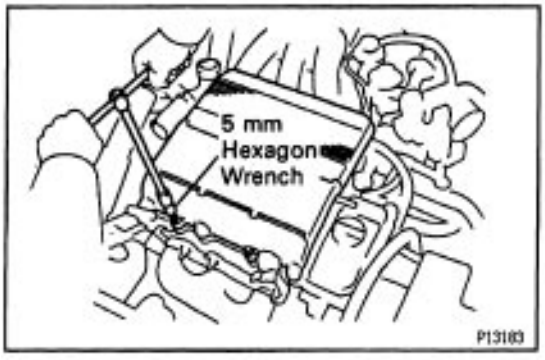


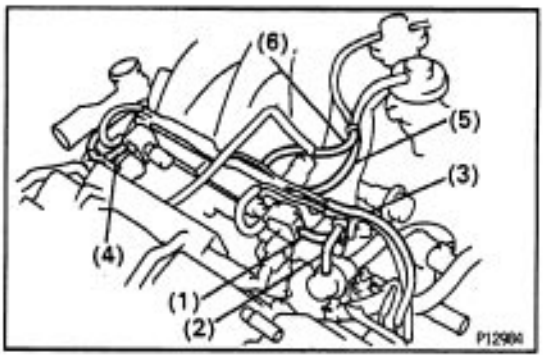

**6. REMOVE AIR CLEANER CAP, VOLUME AIR FLOW METER AND AIR CLEANER HOSE**

(a) Disconnect the volume air flow meter connector and wire clamp.
(b) Disconnect the accelerator cable clamp.
(c) Disconnect the PCV hose.
(d) Loosen the air cleaner hose clamp bolt.
(e) Disconnect the 4 air cleaner cap clips.
(f) Remove the air cleaner cap and volume air flow meter together with the air cleaner hose.

**7. REMOVE V–BANK COVER**

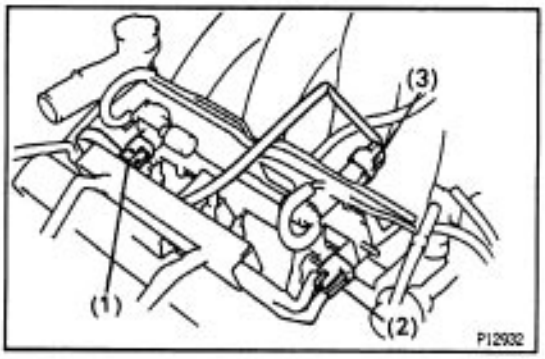
Using a 5 mm hexagon wrench, remove the 2 nuts and V–bank cover.



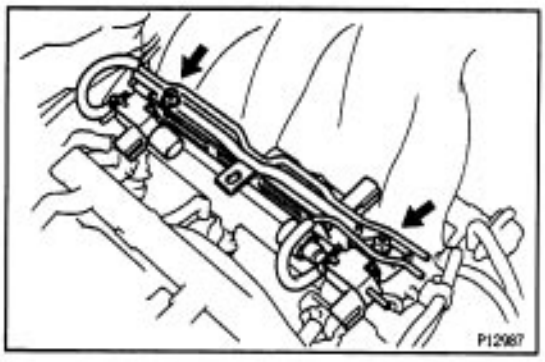



**8. REMOVE EMISSION CONTROL VALVE SET**

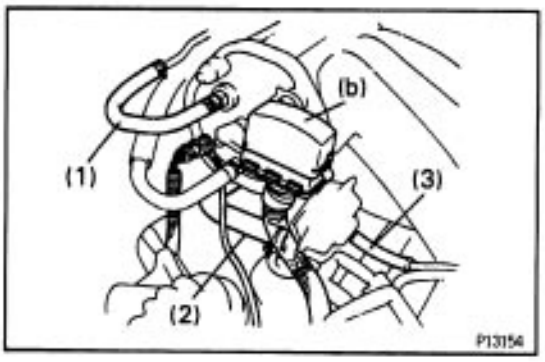
(a) Disconnect the following vacuum hoses:
- (1) Vacuum hose from fuel pressure control VSV
- (2) Vacuum hose from fuel pressure regulator
- (3) Vacuum hose from cylinder head rear plate
- (4) Vacuum hose from intake air control valve VSV
- (5) Vacuum hose from EGR vacuum modulator
- (6) Vacuum hose from EGR valve




(b) Disconnect the following connectors:
- (1) Intake air control valve connector
- (2) Fuel pressure connector
- (3) EGR VSV connector




(c) Remove the 2 nuts and emission control valve set.

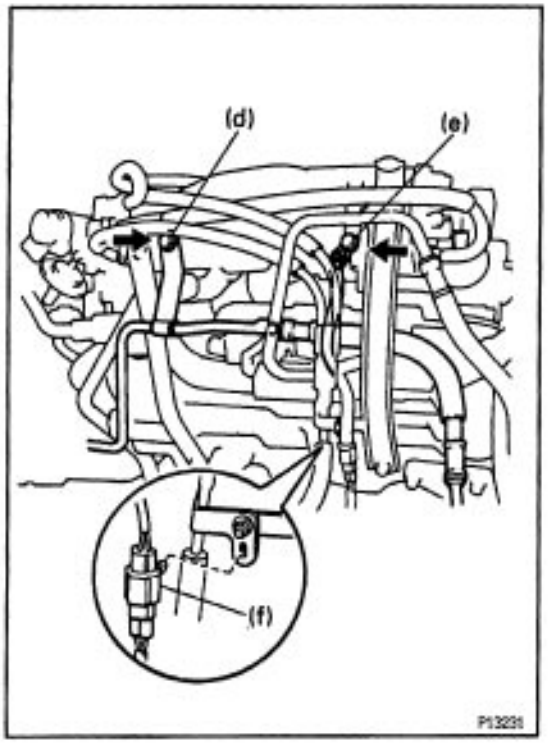



**9. REMOVE AIR INTAKE CHAMBER**

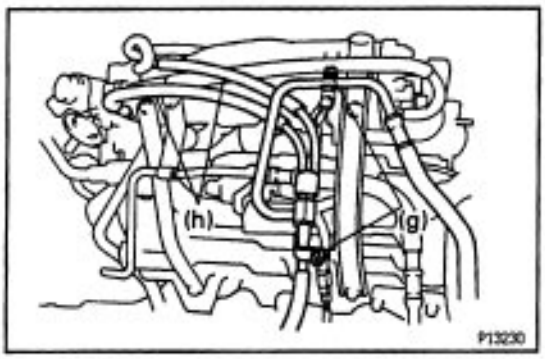
(a) Disconnect the following hoses:
- (1) Brake booster vacuum hose
- (2) PCV hose
- (3) Intake air control valve vacuum hose

(b) Disconnect the data link connector 1.

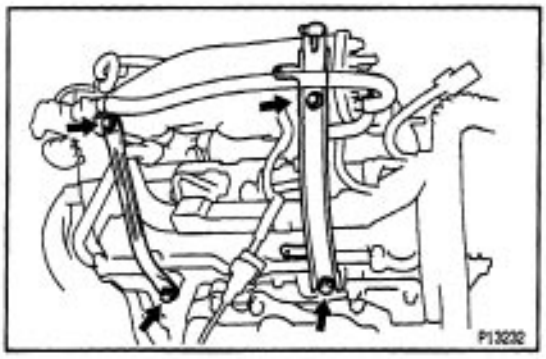
(c) Remove the nut and disconnect the 2 ground straps.




(d) Remove the bolt and disconnect the hydraulic motor pressure hose from the air intake chamber.
(e) Remove the bolt, and disconnect the ground strap.
(f) Disconnect the RH oxygen sensor connector clamp from the PS pressure tube.

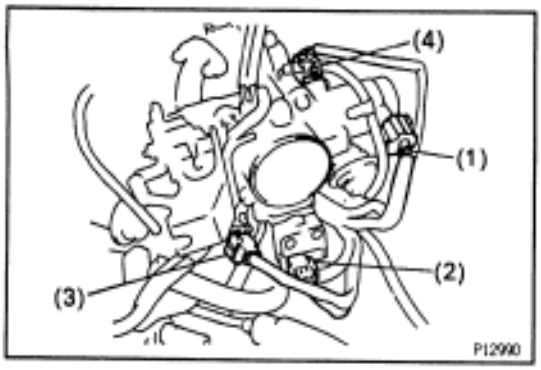



(g) Remove the 2 nuts, and disconnect the PS pressure tube.
(h) Disconnect the 2 PS air hoses.

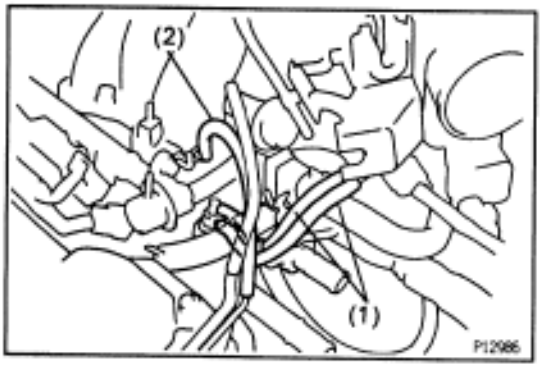



(i) Remove the 2 bolts and No.1 engine hanger.
(j) Remove the 2 bolts and air intake chamber stay.

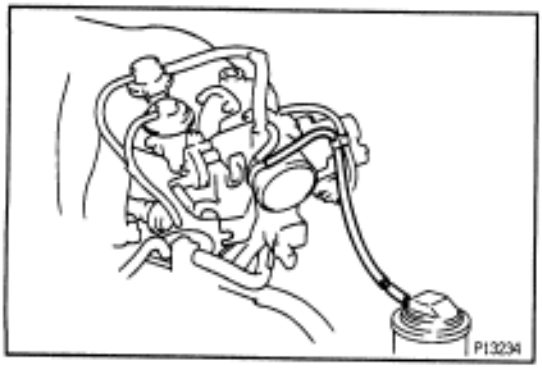

(k) Remove the 4 nuts, EGR pipe and 2 gaskets.



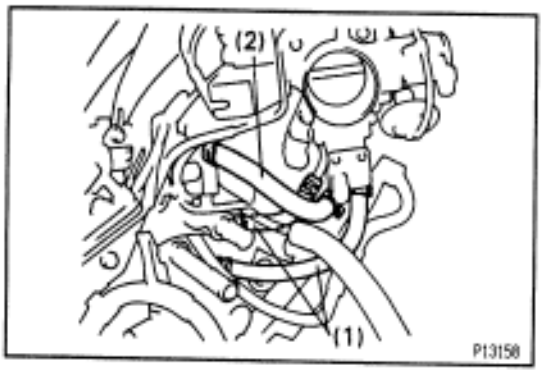

(l) Disconnect the following connectors:
(1) Throttle position sensor connector
(2) IAC valve connector
(3) EGR gas temperature sensor connector
(4) A/C idle–up connector



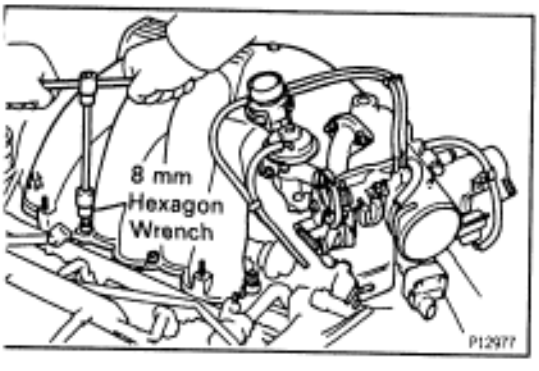

(m) Disconnect the following vacuum hoses:
(1) 2 vacuum hoses from TVV
(2) Vacuum hose from cylinder head rear plate



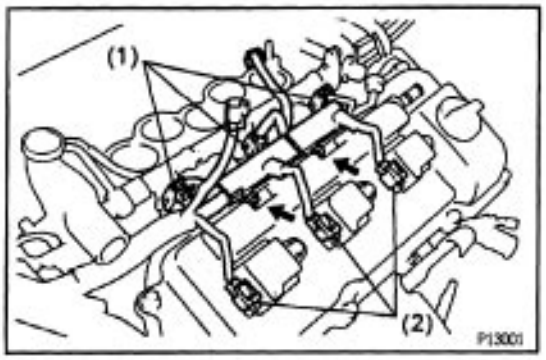

(3) Vacuum hose from charcoal canister




(n) Disconnect the following hoses:
(1) 2 water bypass hoses
(2) Air assist hose

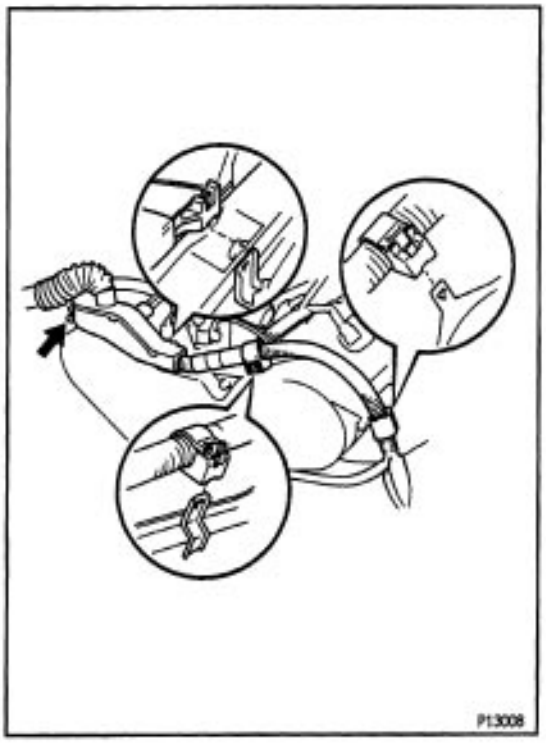



(o) Using an 8 mm hexagon wrench, remove the 2 bolts, 2 nuts, air intake chamber and gasket.



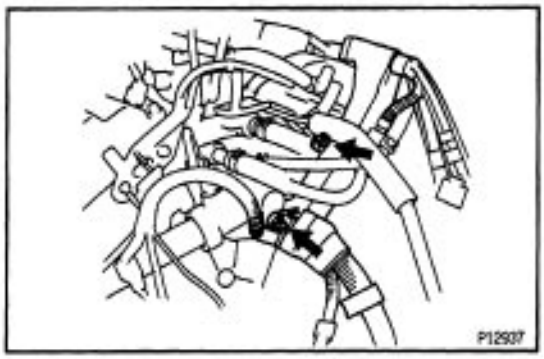

**10. DISCONNECT ENGINE WIRE FROM ENGINE LH SIDE**

(a) Disconnect the following connectors:
(1) 3 injector connectors
(2) 3 ignition coil connectors
(b) Remove the 2 nuts, and disconnect the engine wire.



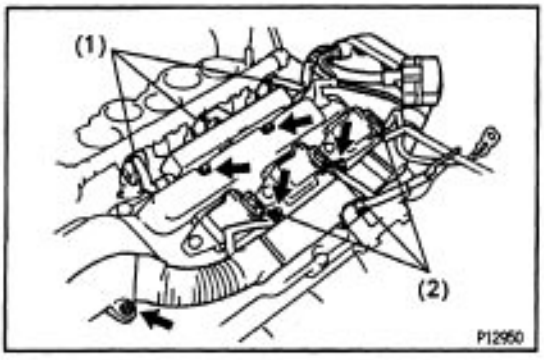

**11. DISCONNECT ENGINE WIRE FROM NO.3 TIMING BELT COVER**

Remove the bolt and 3 clamps, and disconnect the engine wire.



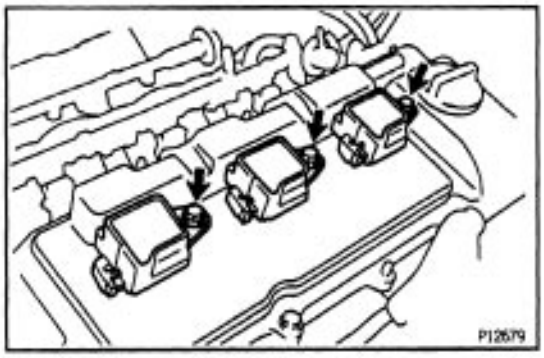

**12. DISCONNECT ENGINE WIRE FROM ENGINE REAR SIDE**

Remove the 2 nuts, and disconnect the engine wire.



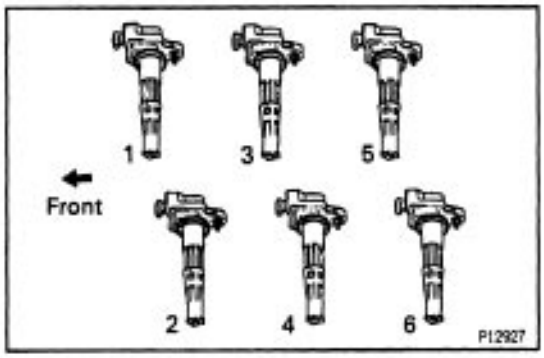

**13. DISCONNECT ENGINE WIRE FROM ENGINE RH SIDE**

(a) Disconnect the following connectors:
(1) 3 injector connectors
(2) 3 ignition coil connectors
(b) Remove the 5 nuts, and disconnect the engine wire.




**14. REMOVE IGNITION COILS**

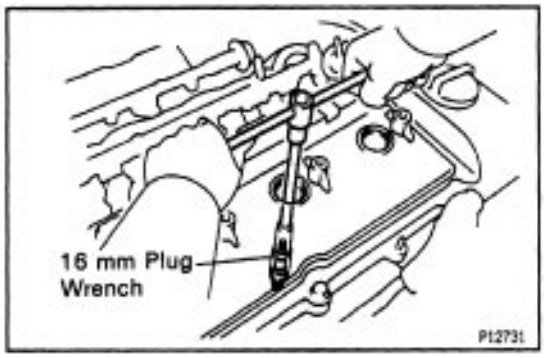
Remove the 6 bolts and 6 ignition coils from the RH and LH cylinder heads.




HINT: Arrange the ignition coils in the correct order.

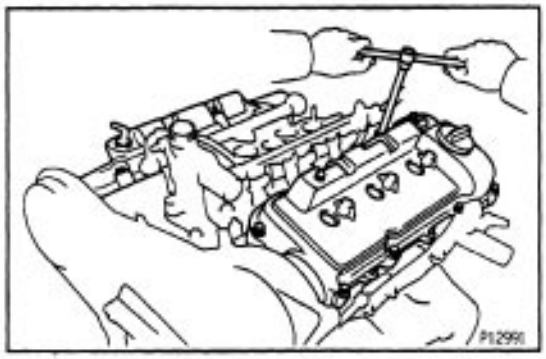
**15. REMOVE SPARK PLUGS**

Using a 16 mm plug wrench, remove the 6 spark plugs from the RH and LH cylinder heads.



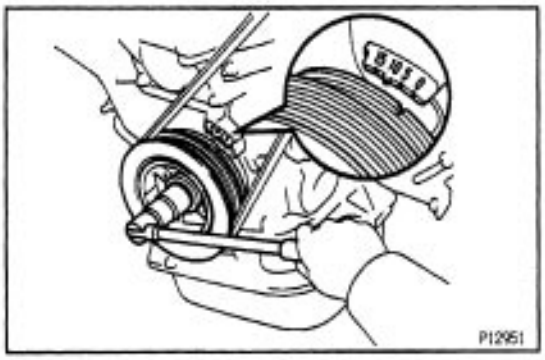

**16. REMOVE CYLINDER HEAD COVERS**

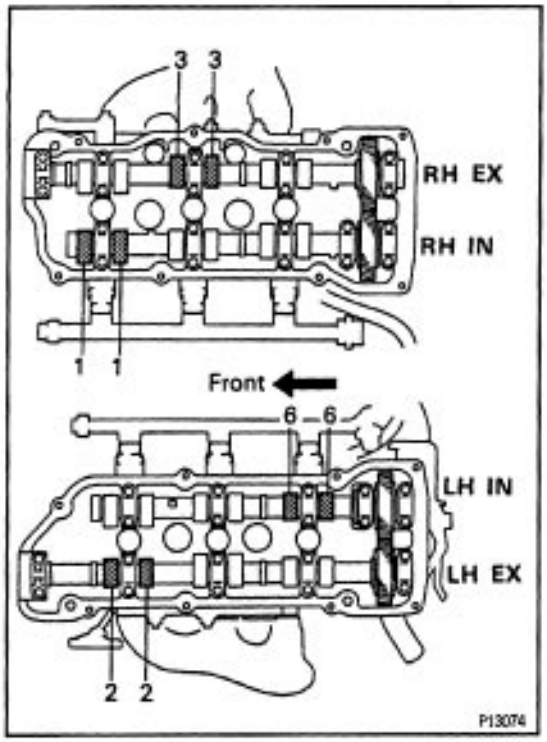
Remove the 8 bolts, cylinder head cover and gasket.
Remove the 2 cylinder head covers.




**17. SET NO.1 CYLINDER TO TDC/COMPRESSION**

(a) Turn the crankshaft pulley, and align its groove with the timing mark ”0” of the No.1 timing belt cover.
(b) Check that the valve lifters on the No.1 (IN) are loose and valve lifters on the No.1 (EX) are tight.
If not, turn the crankshaft 1 revolution (360˚) and align the mark as above.






**18. INSPECT VALVE CLEARANCE**

(a) Check only those valves indicated in the illustration.

- Using a feeler gauge, measure the clearance between the valve lifter and camshaft.
- Record out of specification valve clearance measurements. They will be used later to determine the required replacement adjusting shim.

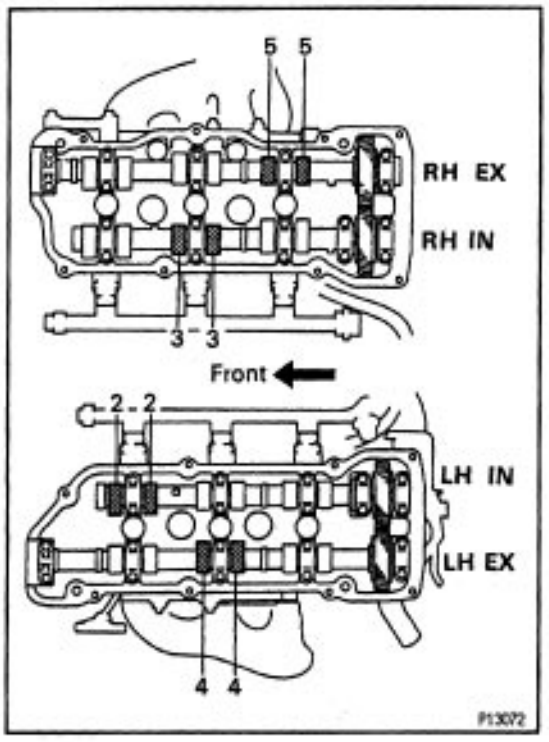
**Valve clearance (Cold):**

**Intake**

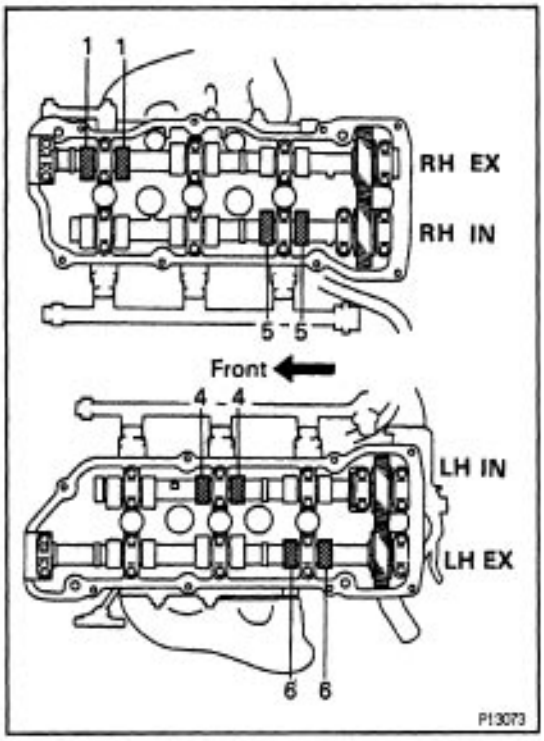
**0.15 – 0.25 mm (0.006 – 0.010 in.)**

**Exhaust**

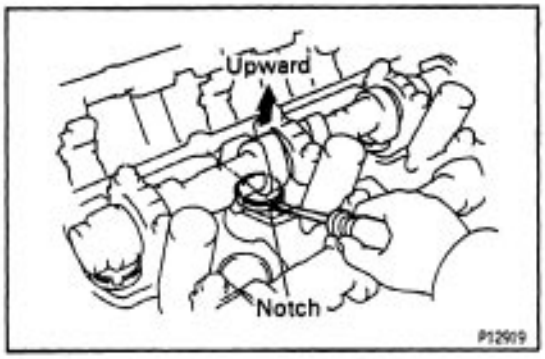
**0.25 – 0.35 mm (0.010 – 0.014 in.)**




(b) Turn the crankshaft 2/3 of a revolution ($240_2$), and check only. the valves indicated in the illustration. Measure the valve clearance.
(See procedure step (a))



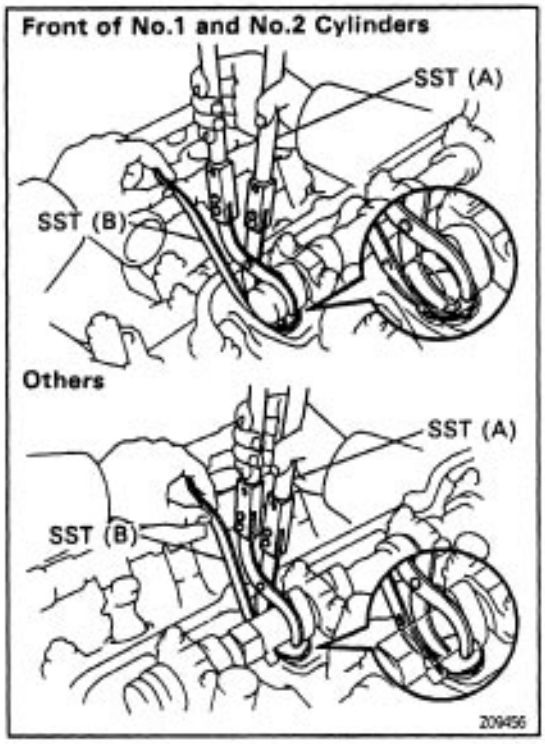

(c) Turn the crankshaft a further 2/3 of a revolution ($240_2$), and check only the valves indicated in the illustration.
Measure the valve clearance.
(See procedure step (a))




**19. ADJUST VALVE CLEARANCE**

(a) Remove the adjusting shim.

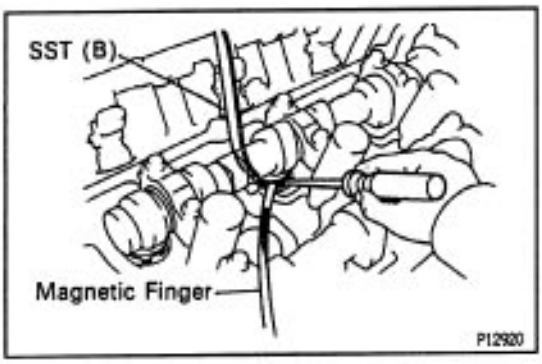
- Turn the camshaft so that the cam lobe for the valve to be adjusted faces up.
- Turn the valve lifter with a screwdriver so that the notches would be perpendicular to the cam–shaft.



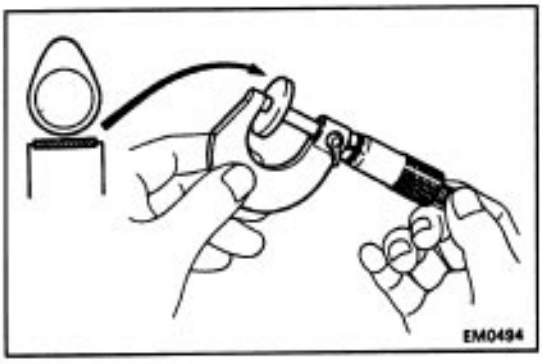

- Using SST (A), press down the valve lifter and place SST (B) between the camshaft and valve lifter. Remove SST (A).

SST 09248–55040 (09248–05410, 09248–05420)
HINT:

- Apply SST (B) at a slight angle on the side marked with ”9” or ”7”, at the position shown in the illustration.
- When SST (B) is inserted too deeply, it will get pinched by the shim. To prevent it from being stuck, insert it gently from the intake side, at a slight angle.




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




(b) Determine the replacement adjusting shim size according to the following Formula or Charts on the next 2 pages:

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

T ..... Thickness of used shim
A ..... Measured valve clearance
N ..... Thickness of new shim

**Intake**

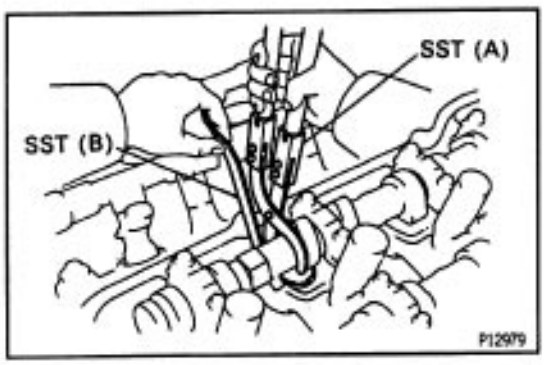
**N = T + (A – 0.20 mm (0.008 in.))**

**Exhaust**

**N = T + (A – 0.30 mm (0.012 in.))**

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

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

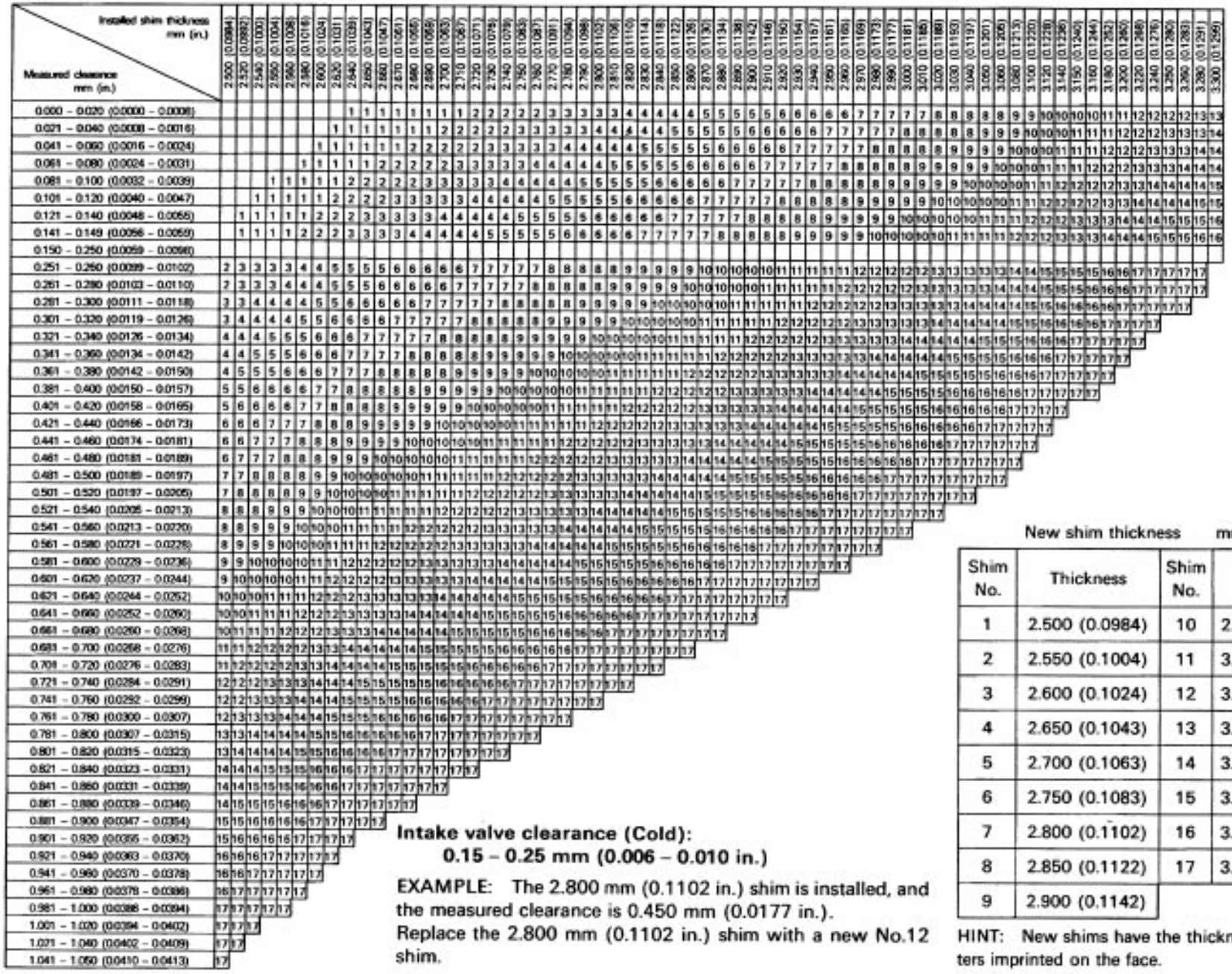



(c) Install a new adjusting shim.

- Place a new adjusting shim on the valve lifter, with imprinted numbers facing down.
- Press down the valve lifter with SST (A), and remove SST (B).
  SST 09248–55040 (09248–05410, 09248–05420)

(d) Recheck the valve clearance.

## Adjusting Shim Selection Chart (Intake)




**Intake valve clearance (Cold):**
**0.15 – 0.25 mm (0.006 – 0.010 in.)**

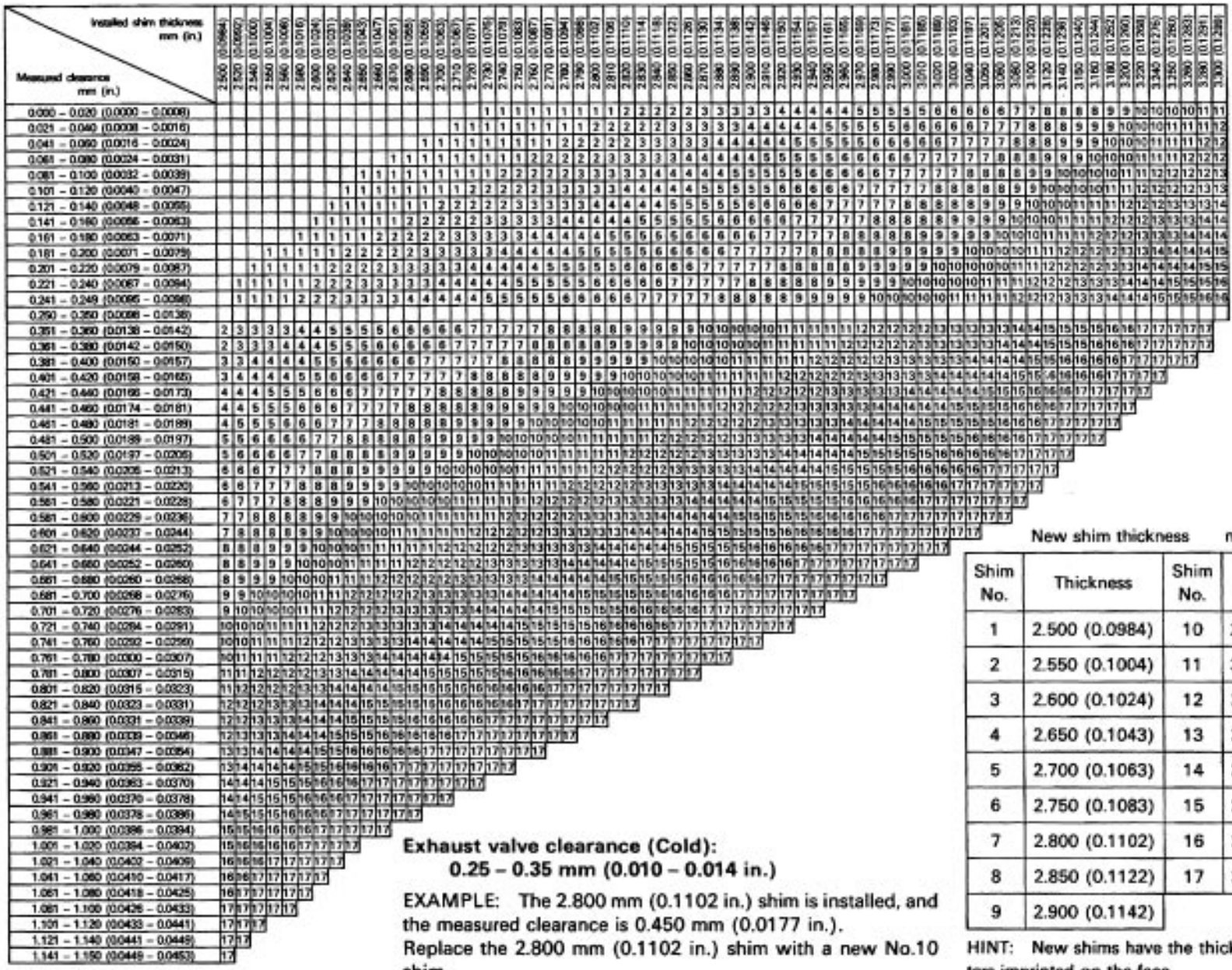
EXAMPLE: The 2.800 mm (0.1102 in.) shim is installed, and the measured clearance is 0.450 mm (0.0177 in.). Replace the 2.800 mm (0.1102 in.) shim with a new No.12 shim.

New shim thickness mm (in.)

| Shim No. | Thickness | Shim No. | Thickness |
|---|---|---|---|
| 1 | 2.500 (0.0984) | 10 | 2.950 (0.1161) |
| 2 | 2.550 (0.1004) | 11 | 3.000 (0.1181) |
| 3 | 2.600 (0.1024) | 12 | 3.050 (0.1201) |
| 4 | 2.650 (0.1043) | 13 | 3.100 (0.1220) |
| 5 | 2.700 (0.1063) | 14 | 3.150 (0.1240) |
| 6 | 2.750 (0.1083) | 15 | 3.200 (0.1260) |
| 7 | 2.800 (0.1102) | 16 | 3.250 (0.1280) |
| 8 | 2.850 (0.1122) | 17 | 3.300 (0.1299) |
| 9 | 2.900 (0.1142) | | |

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

## Adjusting Shim Selection Chart (Exhaust)



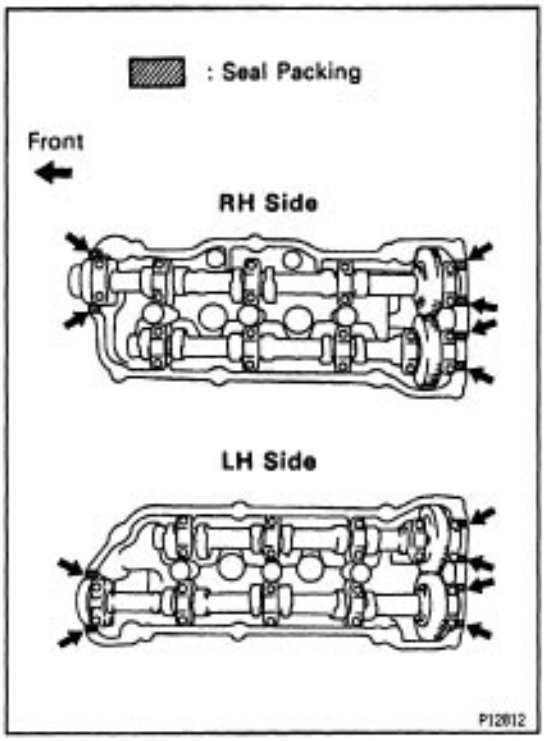

**Exhaust valve clearance (Cold):**
**0.25 – 0.35 mm (0.010 – 0.014 in.)**

EXAMPLE: The 2.800 mm (0.1102 in.) shim is installed, and the measured clearance is 0.450 mm (0.0177 in.).
Replace the 2.800 mm (0.1102 in.) shim with a new No.10 shim.

New shim thickness mm (in.)

| Shim No. | Thickness | Shim No. | Thickness |
|---|---|---|---|
| 1 | 2.500 (0.0984) | 10 | 2.950 (0.1161) |
| 2 | 2.550 (0.1004) | 11 | 3.000 (0.1181) |
| 3 | 2.600 (0.1024) | 12 | 3.050 (0.1201) |
| 4 | 2.650 (0.1043) | 13 | 3.100 (0.1220) |
| 5 | 2.700 (0.1063) | 14 | 3.150 (0.1240) |
| 6 | 2.750 (0.1083) | 15 | 3.200 (0.1260) |
| 7 | 2.800 (0.1102) | 16 | 3.250 (0.1280) |
| 8 | 2.850 (0.1122) | 17 | 3.300 (0.1299) |
| 9 | 2.900 (0.1142) | | |

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

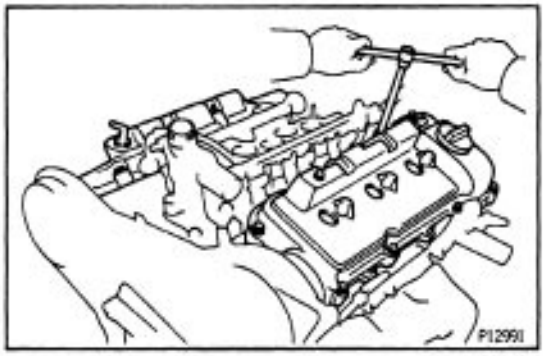



**20. REINSTALL CYLINDER HEAD COVERS**

(a) Apply seal packing to the cylinder heads as shown in the illustration.

**Seal packing:**

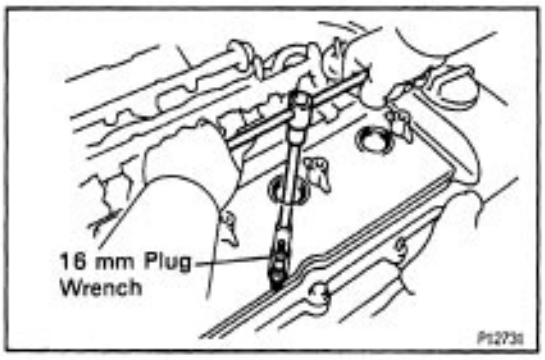
**Part No. 08826–00080 or equivalent**




(b) Install the gasket to the cylinder head cover.

(c) Install the cylinder head cover with the 8 bolts. Uniformly tighten the bolts in several passes. Install the 2 cylinder head covers.

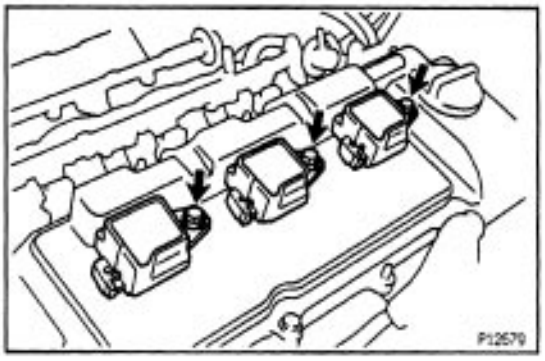
**Torque: 8 N–m (80 kgf–cm, 69 in.–lbf)**




**21. REINSTALL SPARK PLUGS**

Using a 16 mm plug wrench, install the 6 spark plugs to the RH and LH cylinder heads.

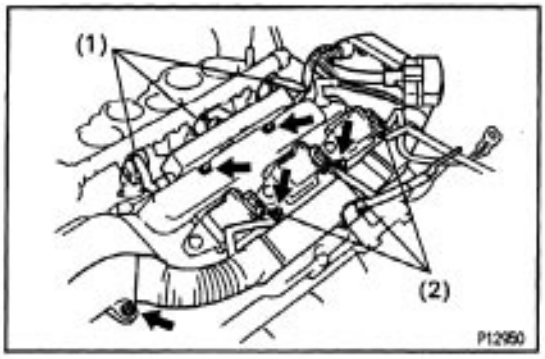
**Torque: 18 N–m (180 kgf–cm, 13 ft–lbf)**




**22. REINSTALL IGNITION COILS**

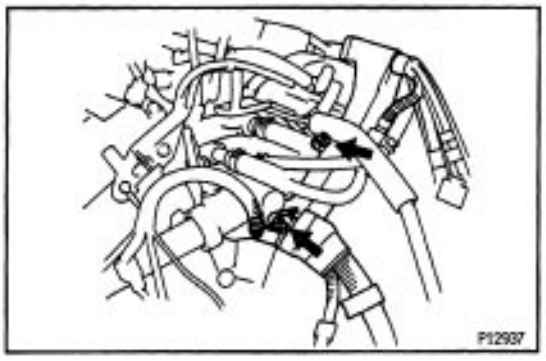
Install the6 ignition coils to the RH and LH cylinder heads.

**Torque: 8 N–m (80 kgf–cm, 69 in.–lbf)**



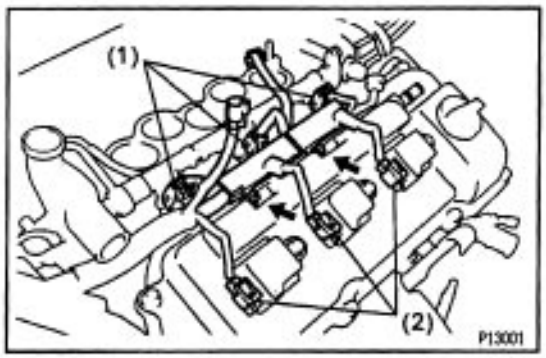

**23. RECONNECT ENGINE WIRE TO ENGINE RH SIDE**

(a) Connect the engine wire with the 5 nuts.
(b) Connect the following connectors:
    (1) 3 injector connectors
    (2) 3 ignition coil connectors



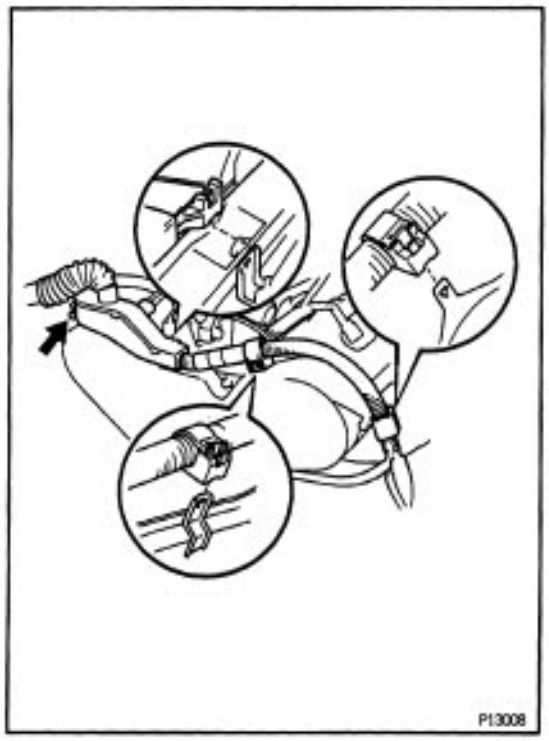

**24. RECONNECT ENGINE WIRE TO ENGINE REAR SIDE**

Connect the engine wire with the 2 nuts.



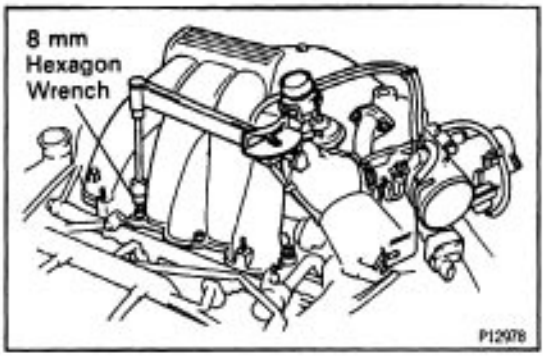

**25. RECONNECT ENGINE WIRE TO ENGINE LH SIDE**

(a) Connect the engine wire with the 2 nuts.
(b) Connect the following connectors:
    (1) 3 injector connectors
    (2) 3 ignition coil connectors



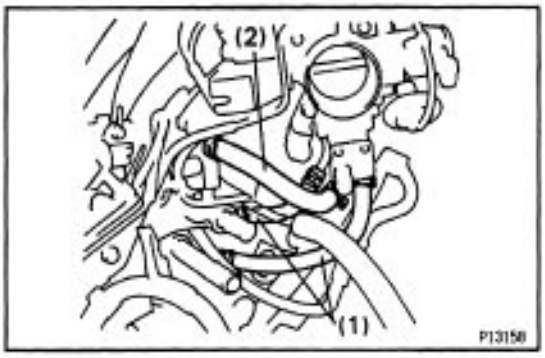

**26. RECONNECT ENGINE WIRE TO NO.3 TIMING BELT COVER**

(a) Connect the 3 clamps.
(b) Connect the engine wire with the bolt.

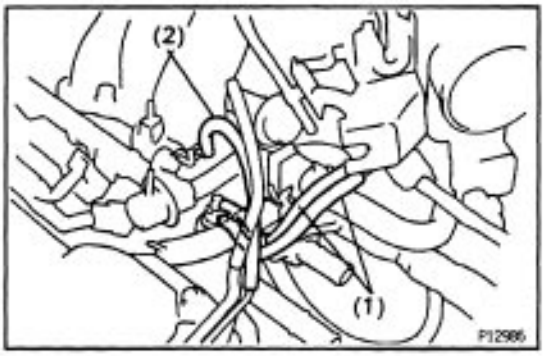



**27. REINSTALL AIR INTAKE CHAMBER**

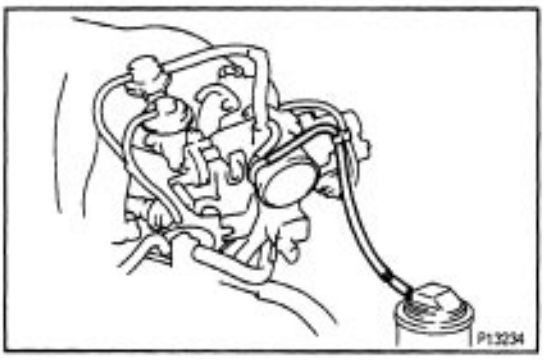
(a) Using an 8 mm hexagon wrench, install a new gasket and the air intake chamber with the 2 bolts and 2 nuts.
**Torque: 43 N–m (440 kgf–cm, 32 ft–lbf)**



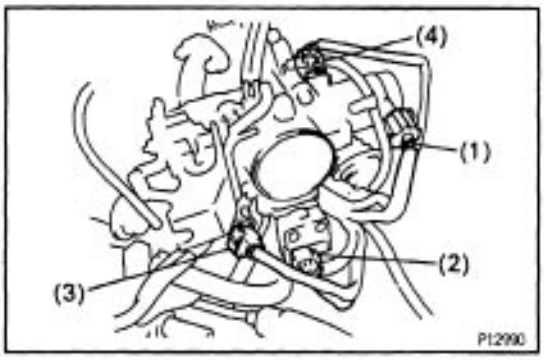

(b) Connect the following hoses:
(1) 2 water bypass hoses
(2) Air assist hose




(c) Connect the following vacuum hoses:
(1) 2 vacuum hoses to TVV
(2) Vacuum hose to cylinder head rear plate

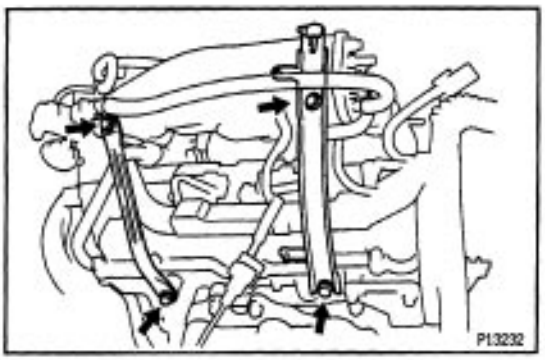



(3) Vacuum hose to charcoal canister

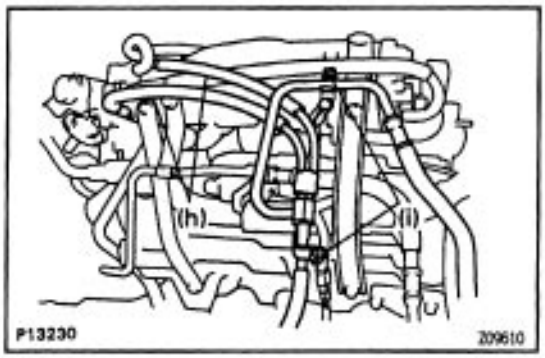



(d) Connect the following connectors:
(1) Throttle position sensor connector
(2) IACV valve connector
(3) EGR gas temperature sensor connector
(4) A/C idle–up connector

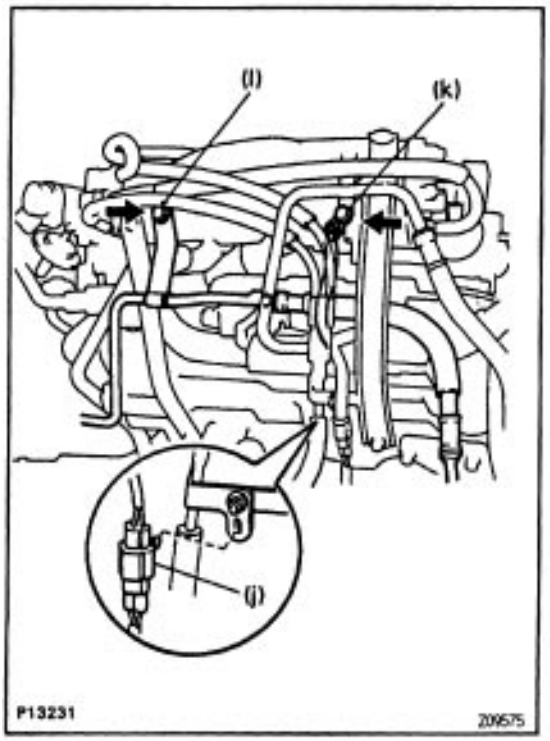

(e) Install 2 new gaskets and EGR pipe with the 4 nuts.
**Torque: 12 N–m (120 kgf–cm. 9 ft–lbf)**



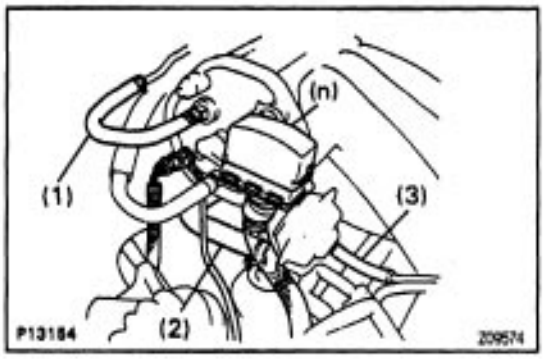

(f) install the No. 1 engine hanger with the 2 bolts.
**Torque: 39 N–m (400 kgf–cm, 19 ft–lbf)**
(g) Install the air intake chamber stay with the 2 bolts.
**Torque: 19.5 N–m (200 kgf–cm, 14 ft–lbf)**



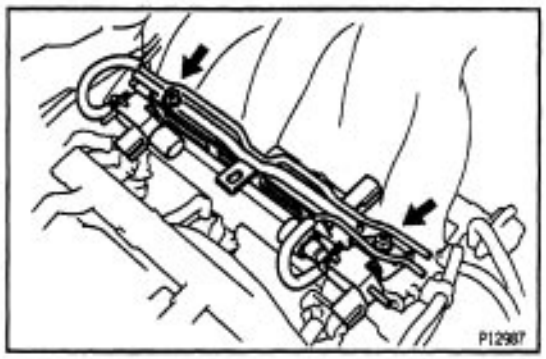

(h) Connect the 2 PS air hoses.
(i) Connect the PS pressure tube with the 2 nuts.



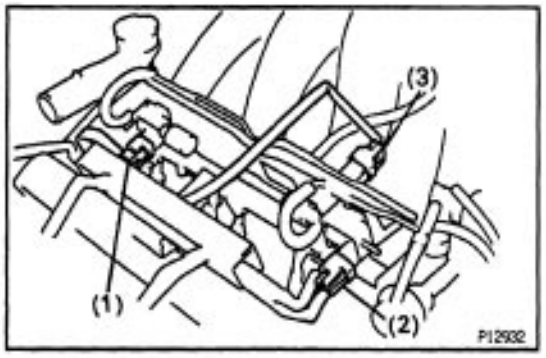

(j) Connect the RH oxygen sensor connector clamp to the PS pressure tube.
(k) Connect the ground strap with the bolt.
(1) Connect the hydraulic pressure pipe to the air intake chamber with the bolt.



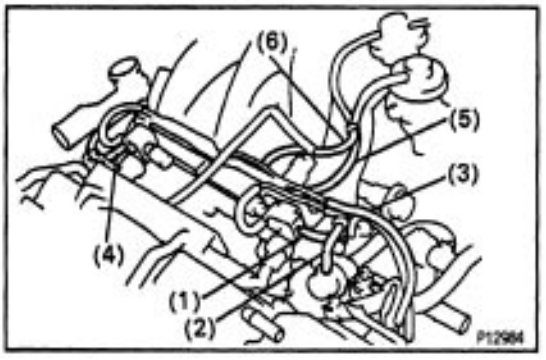

(m) Connect the following hoses:
(1) Brake booster vacuum hose
(2) PCV hose
(3) Intake air control valve vacuum hose
(n) Connect the data link connector 1.
(o) Connect the 2 ground straps with the nut.



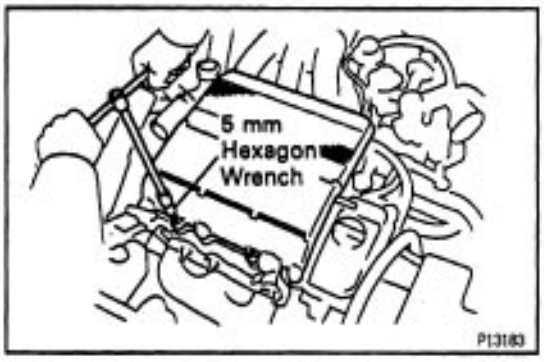

**28. REINSTALL EMISSION CONTROL VALVE SET**
(a) Install the emission control valve set with the 2 bolts.
**Torque: 8 N–m (80 kgf–cm, 69 in.–lbf)**



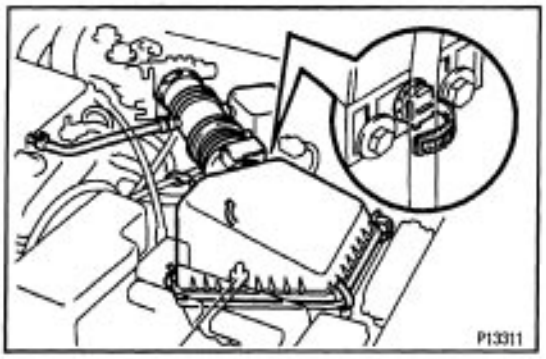

(b) Connect the following connectors:
(1) Intake control valve connector
(2) Fuel pressure connector
(3) EGR VSV connector




(c) Connect the following vacuum hoses:
(1) Vacuum hose to fuel pressure control VSV
(2) Vacuum hose to fuel pressure regulator
(3) Vacuum hose to cylinder head rear plate
(4) Vacuum hose to intake air control valve
(5) Vacuum hose to EGR vacuum modulator
(6) Vacuum hose to EGR valve

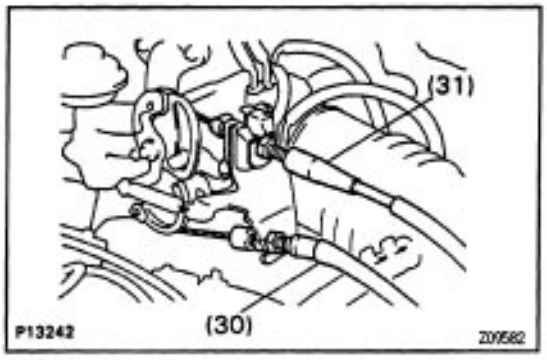



**28. REINSTALL V–BANK COVER**
Using a 5 mm hexagon wrench, install the V– bank cover with the 2 nuts.

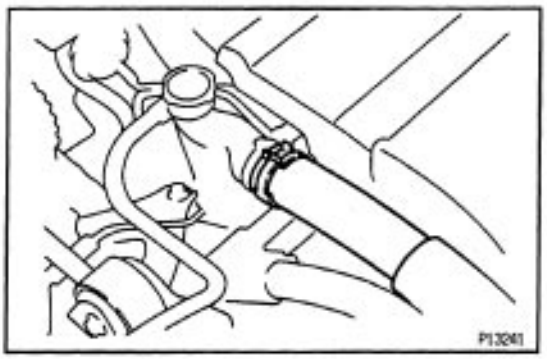



**29. REINSTALL AIR CLEANER CAP, VOLUME AIR FLOW METER AND AIR CLEANER HOSE**

(a) Connect the air cleaner hose, and install the air clean–er cap and volume air flow meter with the 4 clips.
(b) Tighten the air cleaner hose clamp bolt.
(c) Connect the PCV hose.
(d) Connect the accelerator cable clamp.
(e) Connect the volume air flow meter connector and wire clamp.




**30. RECONNECT THROTTLE CABLE**
**31. RECONNECT ACCELERATOR CABLE**



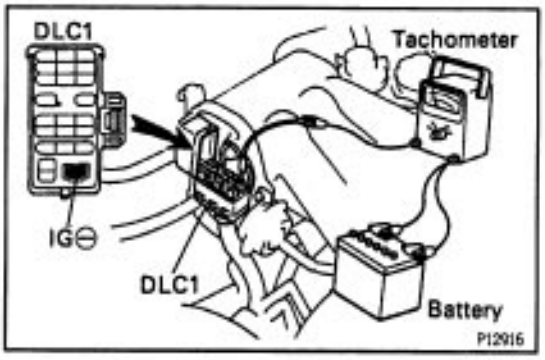

**32. RECONNECT RADIATOR INLET HOSE**

**33. FILL WITH ENGINE COOLANT**
**Capacity:**
**8.7 liters (9.2 US qts, 7.7 Imp. qts)**
**34. RECONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY**

# IGNITION TIMING INSPECTION

**1. WARM UP ENGINE**

Allow the engine to warm up to normal operating temperature.




**2. CONNECT TACHOMETER TO ENGINE**

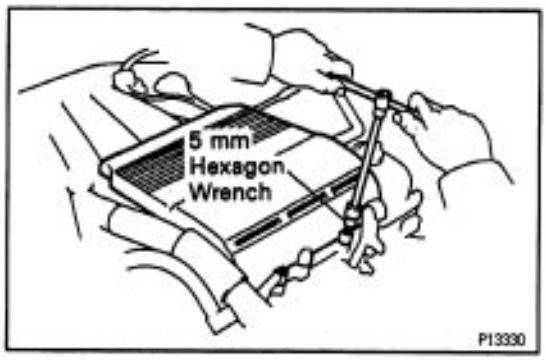
Connect the tester probe of a tachometer to terminal IG(–) of the data link connector 1.

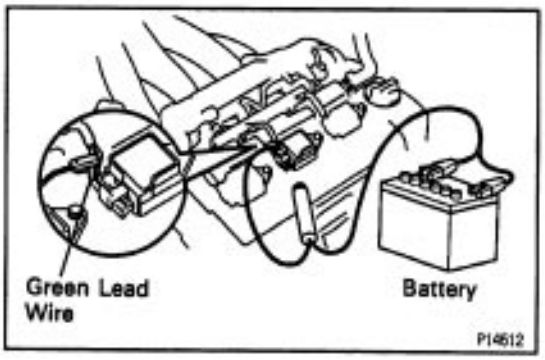
**NOTICE:**

- **Never allow the tachometer terminal to touch ground as it could result In damage to the igniter and/or ignition coil.**
- **As some tachometers are not compatible with this ignition system, we recommend that you confirm the compatibility of your unit before use.**

**3. CONNECT TIMING LIGHT TO ENGINE**

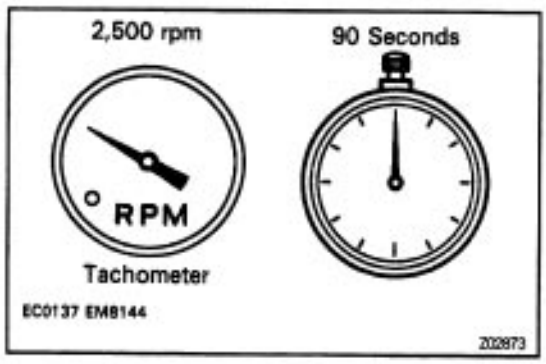
(a) Using a 5 mm hexagon wrench, remove the 2 cap nuts and V– bank cover.



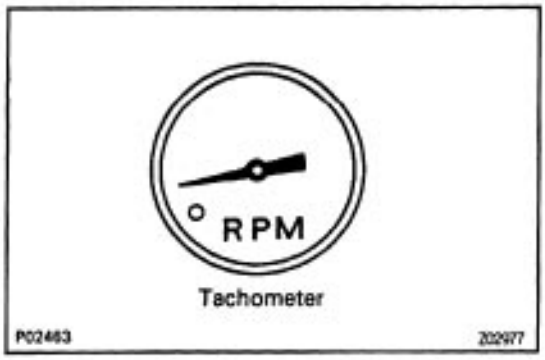

(b) Connect the timing light pickup clip to the the green lead wire for the No.4 ignition coil.

HINT: Use a timing light that can detect the primary signal.

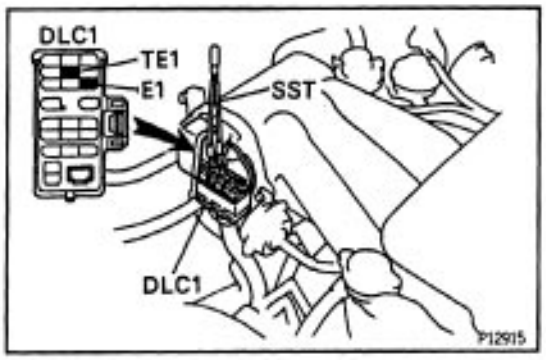



**4. CHECK IDLE SPEED**

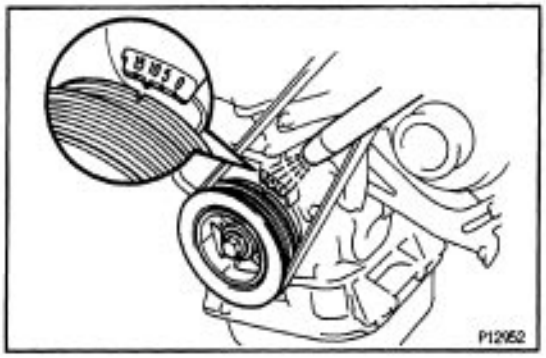
(a) Race the engine speed at 2,500 rpm for approx. 90 seconds.




(b) Check the idle speed.
**Idle speed:**
**700 ± 60 rpm**

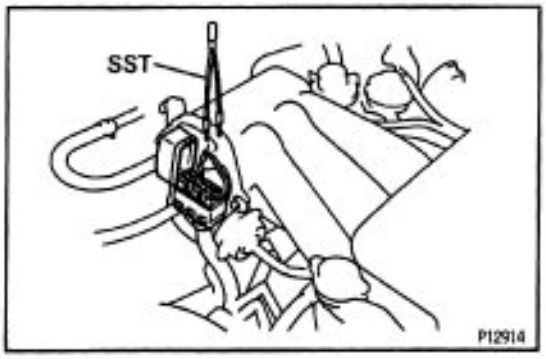


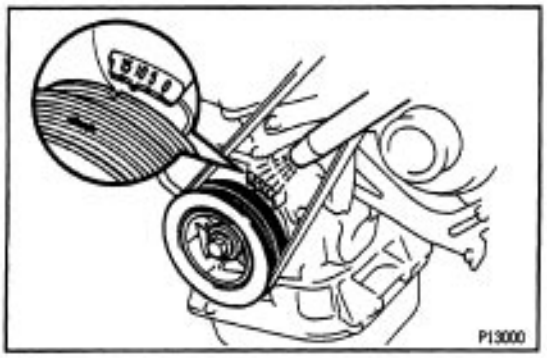

**5. INSPECT IGNITION TIMING**
(a) Using SST, connect terminals TE1 and E1 of the data link connector 1.
SST 09843–18020



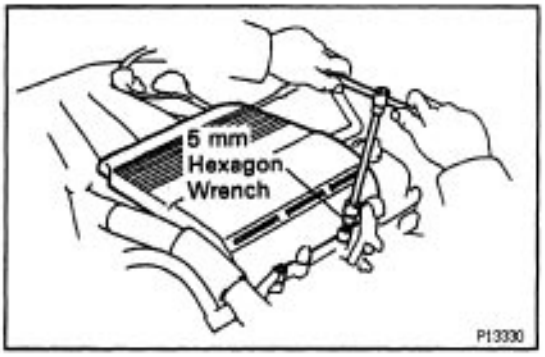

(b) Using a timing light, check the ignition timing.
**Ignition timing:**
**8 – 12$_2$ BTDC @ idle**
**(Transmission in neutral position)**
If the ignition timing is not as specified, check that following conditions are normal:
- Throttle valve fully closed
- Continuity between terminals IDL1 and E2 of the throttle position sensor.
- Valve timing

(c) Remove the SST from the data link connector 1.
SST 09843–18020




**6. FURTHER CHECK IGNITION TIMING**
**Ignition timing:**
**7 – 17$_2$ BTDC @ idle**
**(Transmission in neutral position)**
HINT: The timing mark moves in a range between 7$_2$ and 17$_2$.




**7. DISCONNECT TIMING LIGHT FROM ENGINE**

(a) Remove the timing light.

(b) Using a 5 mm hexagon wrench, install the V–bank cover with the 2 cap nuts.

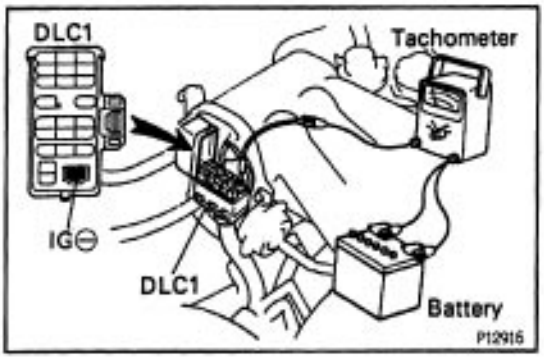
**8. DISCONNECT TACHOMETER FROM ENGINE**

# IDLE SPEED INSPECTION

**1. INITIAL CONDITIONS**

(a) Engine at normal operating temperature
(b) Air cleaner installed
(c) All pipes and hoses of air induction system connected
(d) All accessories switched OFF
(e) All vacuum lines properly connected
HINT: All vacuum hoses for EGR system, etc. should be properly connected.
(f) SFI system wiring connectors fully plugged
(g) Ignition timing set correctly
(h) Transmission, in neutral position






**2. CONNECT TACHOMETER**

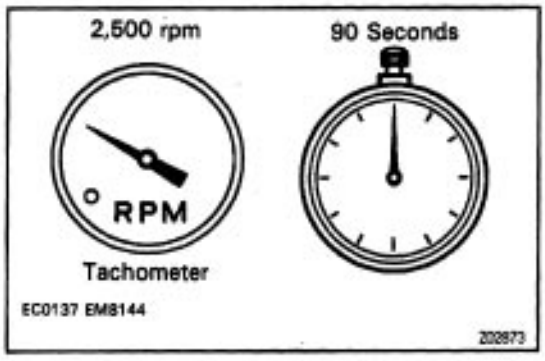
Connect the tester probe of a tachometer to terminal IG(–) of the data link connector 1.

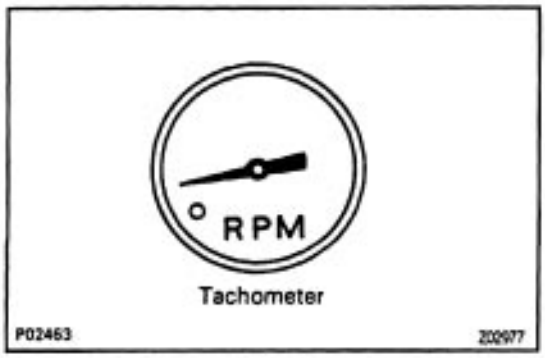
**NOTICE:**

- **Never allow the tachometer terminal to touch ground as it could result in damage to the igniter and/or ignition coil.**
- **As some tachometers are not compatible with this ignition system, we recommend that you confirm the compatibility of your unit before use.**

**3. INSPECT IDLE SPEED**

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




(b) Check the idle speed.

**Idle speed:**

**700 ± 50 rpm**

If the idle speed is not as specified, check the IAC valve and air intake system.

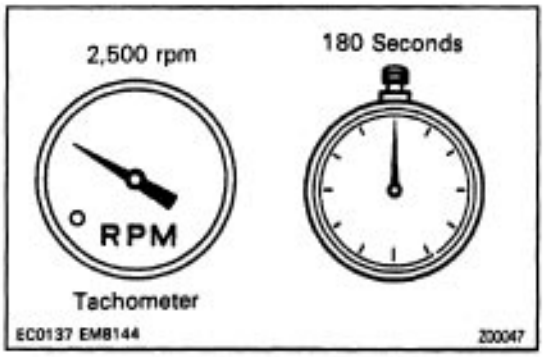
**4. DISCONNECT TACHOMETER**

# IDLE AND OR 2500 RPM CO HC CHECK

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

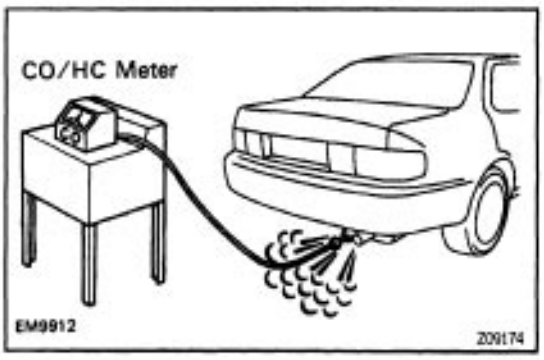
**1. INITIAL CONDITIONS**

(a) Engine at normal operating temperature
(b) Air cleaner installed
(c) All pipes and hoses of air induction system connected
(d) All accessories switched OFF
(e) All vacuum lines properly connected
HINT: All vacuum hoses for EGR systems, etc. should be properly connected.
(f) SFI system wiring connectors fully plugged
(g) Ignition timing set correctly
(h) Transmission in neutral position
(i) Tachometer and CO/HC meter calibrated by hand




**2. START ENGINE**

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




**4. INSERT CO/NC METER TESTING PROBE AT LEAST 40 cm (1.3 ft) INTO TAILPIPE DURING IDLING**

**5. IMMEDIATELY CHECK CO/HC CONCENTRATION AT IDLE AND/OR 2,500 RPM**

HINT: When performing the 2 mode (2,500 rpm and idle) test, follow the measurement order prescribed by the applicable local regulations.

## Troubleshooting

If the CO/HC concentration does not comply with regulations, perform troubleshooting in the order given below.

See the table below for possible causes, and then inspect and correct the applicable causes if neces–sary.

| CO | HC | Phenomenon | Causes |
|---|---|---|---|
| Normal | High | Rough idle | 1. Faulty ignitions:<br>• Incorrect timing<br>• Fouled, shorted or improperly gapped plugs<br>• Open or crossed high–tension cords<br>• Cracked distributor cap<br>2. Incorrect valve clearance<br>3. Leaky EGR valve<br>4. Leaky intake and exhaust valves<br>5. Leaky cylinder |
| Low | High | Rough idle<br>(Fluctuating HC reading) | 1. Vacuum leaks:<br>• PCV hose<br>• EGR valve<br>• Intake manifold<br>• Air intake chamber<br>• Throttle body<br>• IAC valve<br>• Brake booster line<br>2. Lean mixture causing misfire |
| High | High | Rough idle<br>(Black smoke from exhaust) | 1. Restricted air filter<br>2. Faulty SFI systems:<br>• Faulty fuel pressure regulator<br>• Clogged fuel return line<br>• Defective ECT switch<br>• Faulty ECM<br>• Faulty injector<br>• Faulty throttle position sensor<br>• Faulty volume air flow meter |

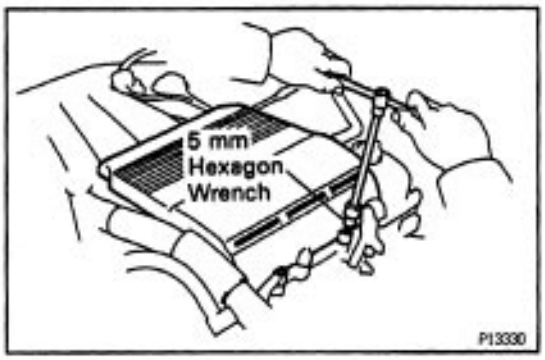
V02907

# COMPRESSION CHECK

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

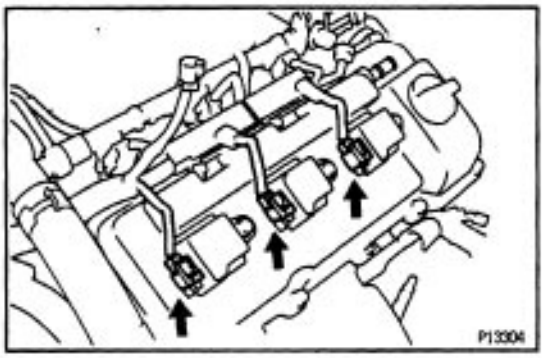
**1. WARM UP AND STOP ENGINE**

Allow the engine to warm up to normal operating temperature.



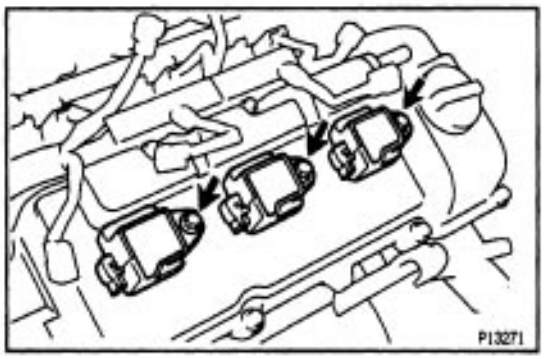

**2. REMOVE V–BANK COVER**

Using a 5 mm hexagon wrench, remove the 2 cap nuts and V– bank cover.

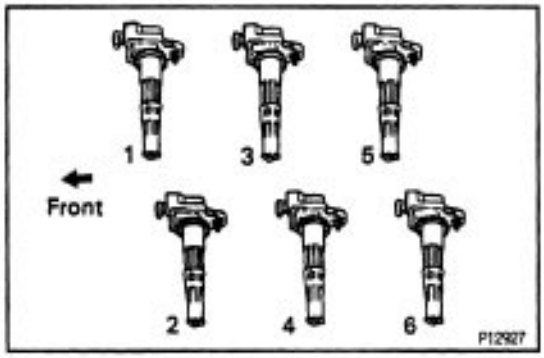



**3. REMOVE IGNITION COILS**

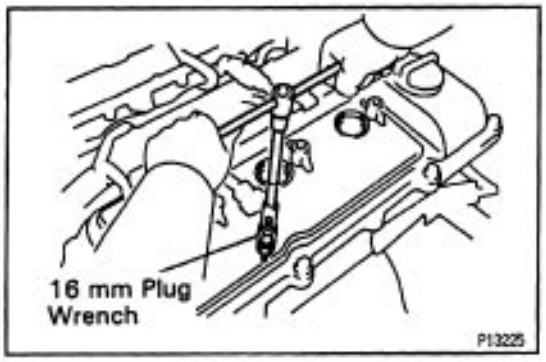
(a) Disconnect the 6 connectors from the RH and LH cylinder heads.




(b) Remove the 6 bolts and 6 ignition coils from the RH and LH cylinder heads.

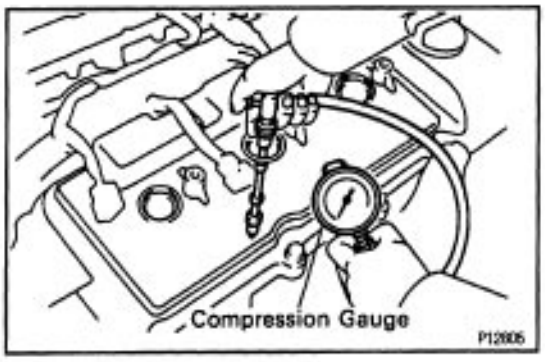



HINT: Arrange the ignition coils in the correct order.




**4. REMOVE SPARK PLUGS**

Using a 16 mm plug wrench, remove the 6 spark plugs from the RH and LH cylinder heads.




**5. CHECK CYLINDER COMPRESSION PRESSURE**

(a) Insert a compression gauge into the spark plug hole.
(b) Fully open the throttle.
(c) While cranking the engine, measure the compression pressure.
HINT: Always use a fully charged battery to obtain engine speed of 250 rpm or more.

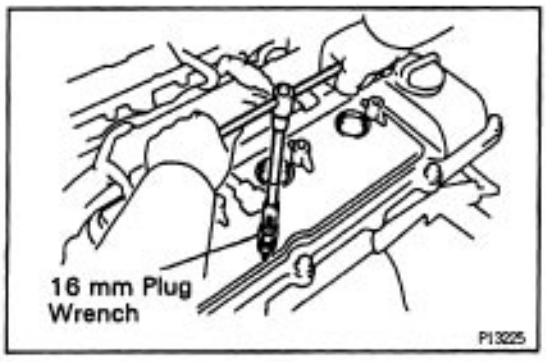
(d) Repeat steps
(a) through
(c) for each cylinder.

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

**Compression pressure:**
**1,226 kPa (12.5 kgf/cm$^2$, 178 psi) or more**
**Minimum pressure:**
**981 kPa (10.0 kgf/cm$^2$, 142 psi)**
**Difference between each cylinder:**
**98 kPa (1.0 kgf/cm$^2$, 14 psi) or less**

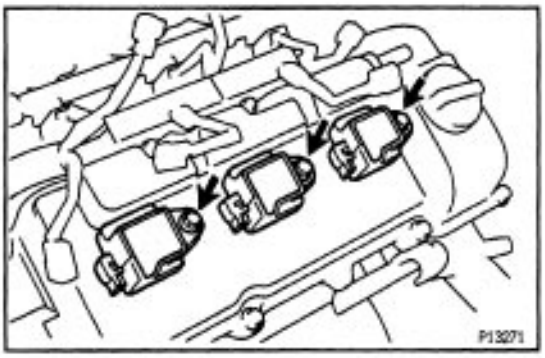
(e) If the cylinder compression in 1 or more cylinders is low, pour a small amount of engine oil into the cylin–der through the spark plug hole and repeat steps (a) through (c) for cylinders with low compression.

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




**6. REINSTALL SPARK PLUGS**

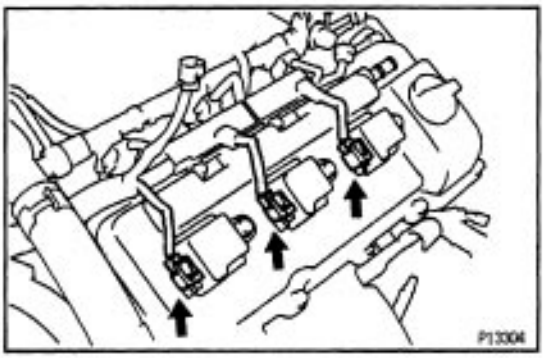
Using a 16 mm plug wrench, install the 6 spark plugs to the RH and LH cylinder heads.
**Torque: 18 N–m (180 kgf–cm, 13 ft–lbf)**



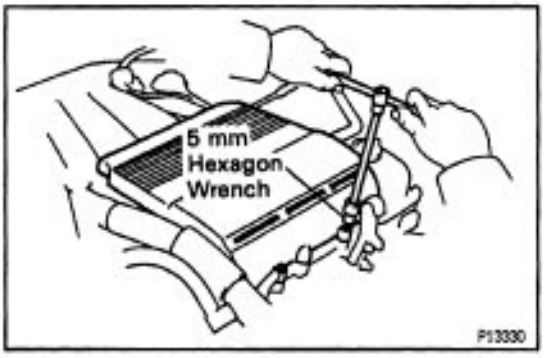

**7. INSTALL IGNITION COILS**

(a) Install the 6 ignition coil to the RH and LH cylinder heads with the 6 bolts.

**Torque: 8 N–m (80 kgf–cm, 69 in.–lbf)**




(b) Connect the 6 ignition coil connectors.

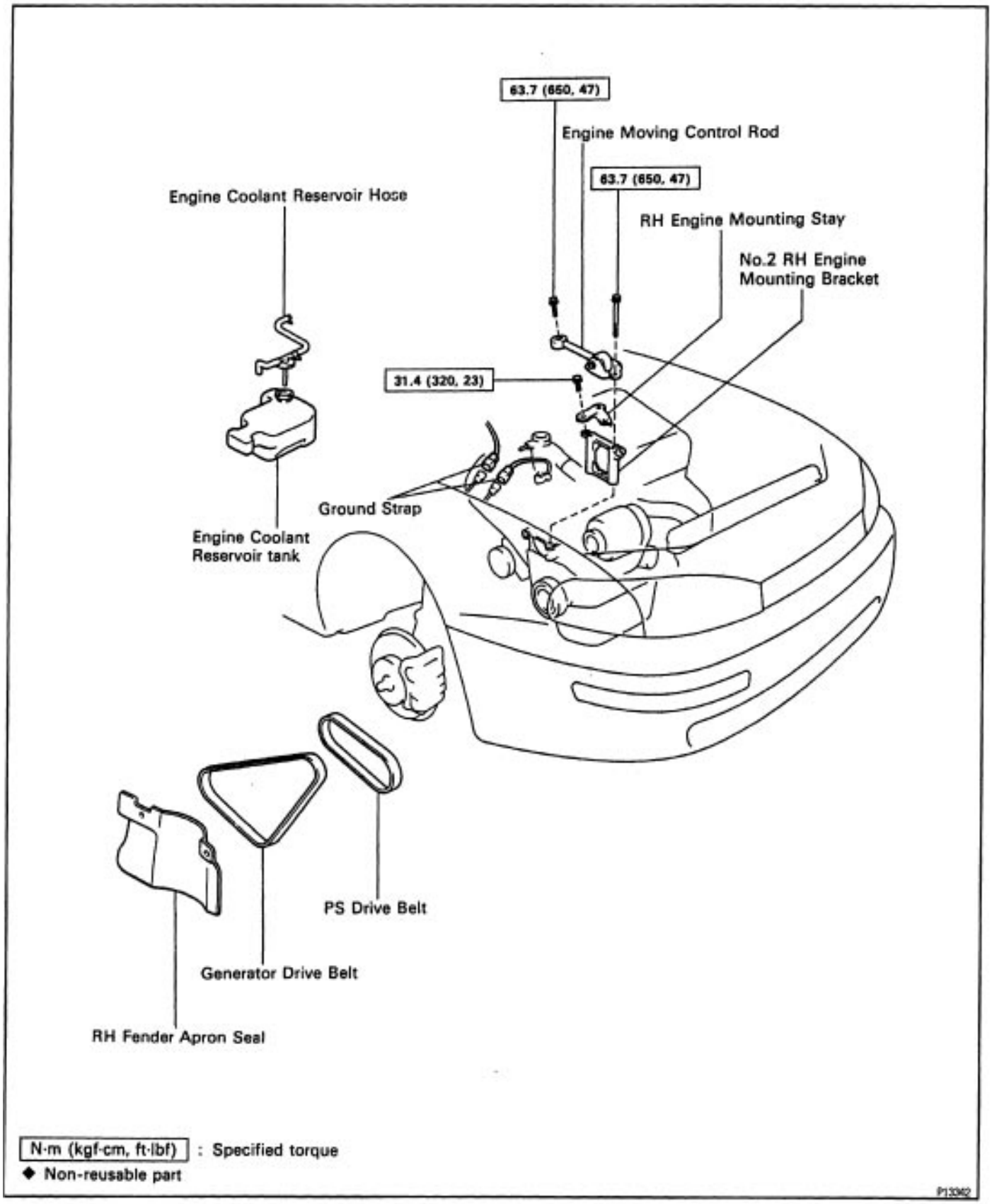


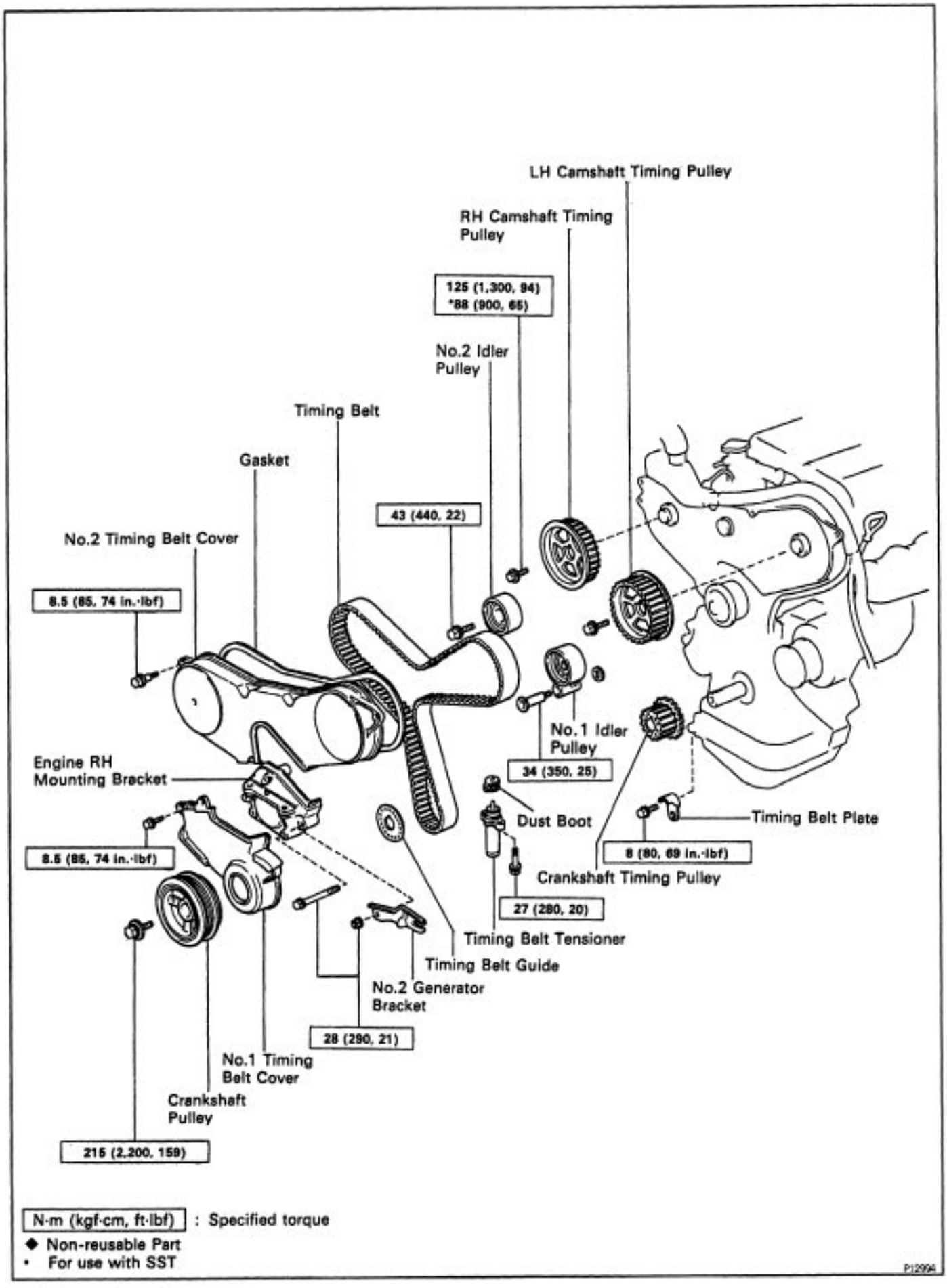

**8. REINSTALL V–BANK COVER**

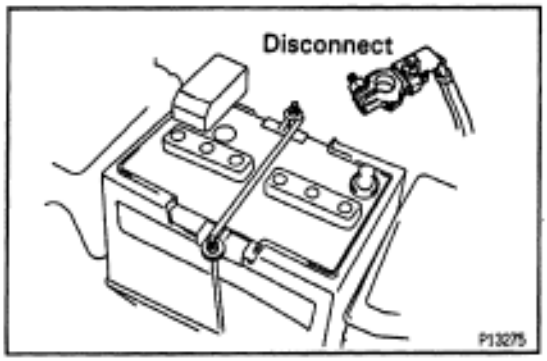
Using a 5 mm hexagon wrench, install the V –bank cover with the 2 cap nuts.

# TIMING BELT

## COMPONENTS FOR REMOVAL AND INSTALLATION








# TIMING BELT REMOVAL

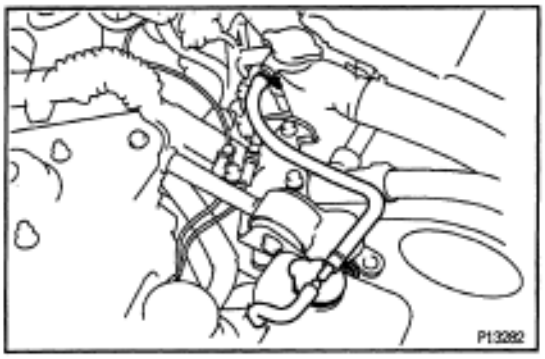
**(See Components for Removal and Installation)**

**1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY**

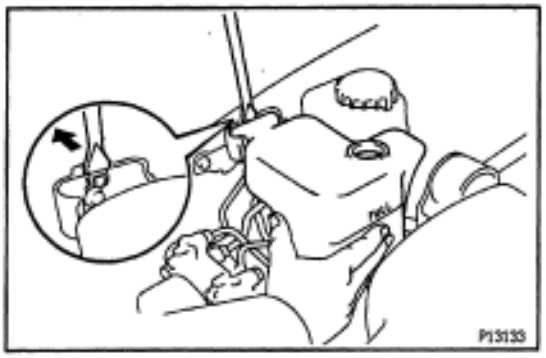
**CAUTION: Work must be started after 90 seconds from the time the ignition switch is turned to the 'LOCK' position and the negative (–) terminal cable is disconnected from the battery.**

**2. REMOVE ENGINE COOLANT RESERVOIR TANK**

(a) Disconnect the reservoir hose.

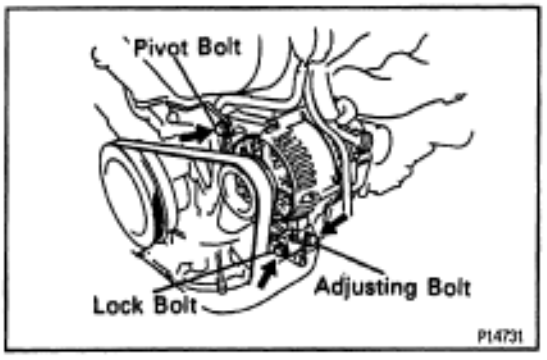



(b) Using a screwdriver, remove the reservoir tank.



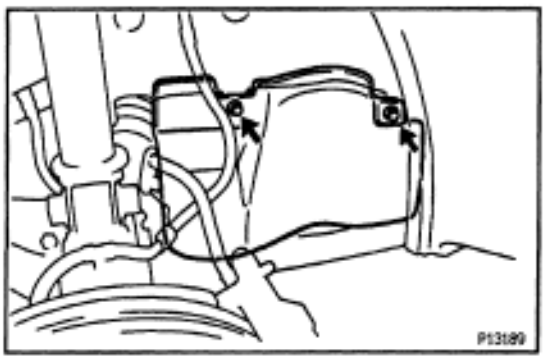

**3. REMOVE GENERATOR DRIVE BELT**

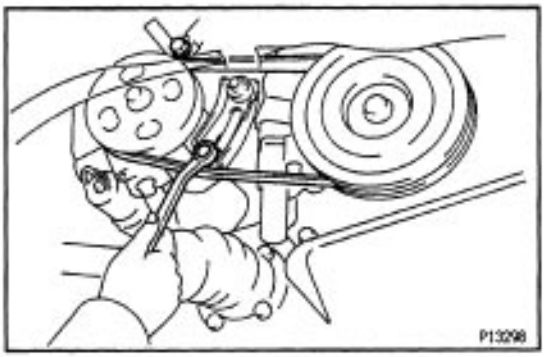
Loosen the pivot bolt and adjusting lock bolt, and remove the drive belt.




**4. REMOVE RH FRONT WHEEL**

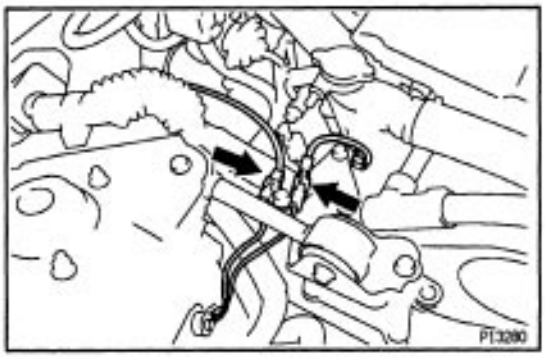
**5. REMOVE RH FENDER APRON SEAL**





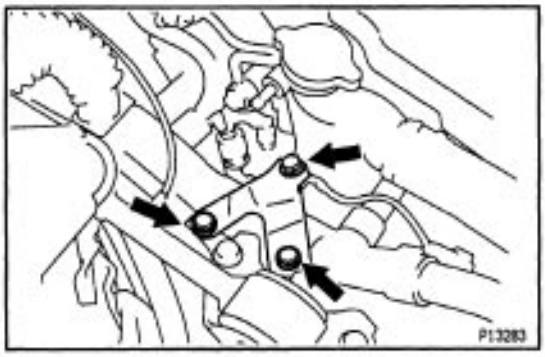

**6. REMOVE PS DRIVE BELT**

Loosen the 2 bolts, and remove the drive belt.



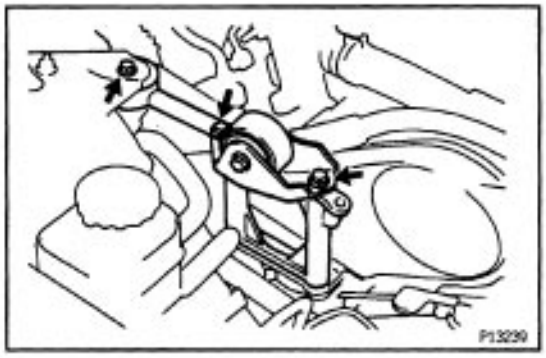

**7. DISCONNECT GROUND STRAPS**

Disconnect the 2 straps.



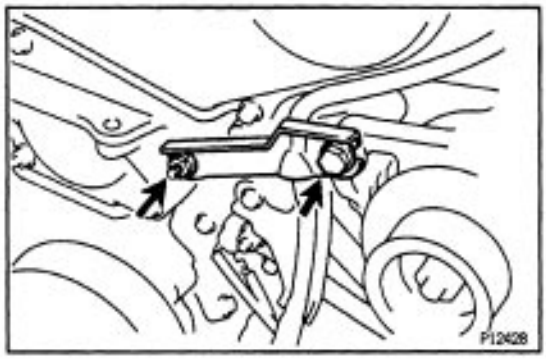

**8. REMOVE RH ENGINE MOUNTING STAY**

Remove the 3 bolts and RH engine mounting stay.



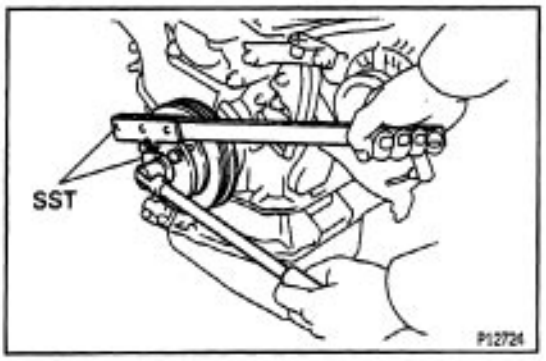

**9. REMOVE ENGINE MOVING CONTROL ROD AND NO.2 RH ENGINE MOUNTING BRACKET**

Remove the 3 bolts, control rod and mounting brack–et.



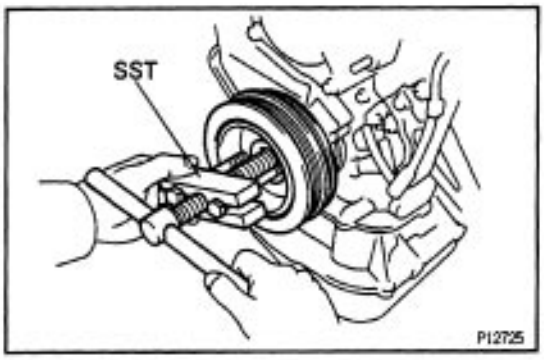

**10. REMOVE NO.2 GENERATOR BRACKET**

(a) Loosen the generator pivot bolt.
(b) Remove the nut and bracket.

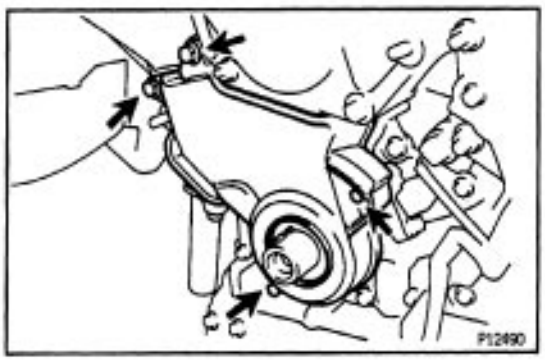



**11. REMOVE CRANKSHAFT PULLEY**

(a) Using SST, remove the pulley bolt.
SST 09213–54016, 09330–00021

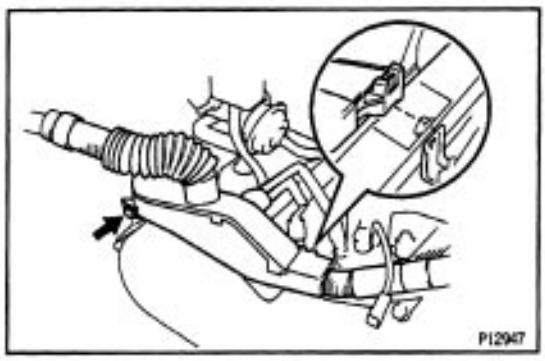



(b) Using SST, remove the pulley.
SST 09213–00060



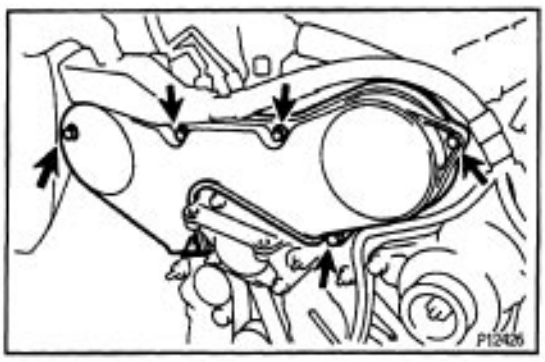

**12. REMOVE No.1 TIMING BELT COVER**

**Remove the 4 bolts and timing belt cover.**



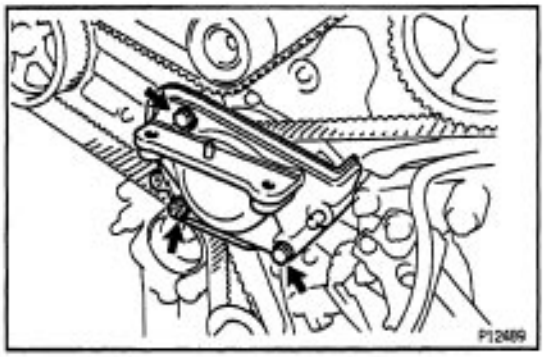

**13. DISCONNECT ENGINE WIRE**

(a) Remove the bolt holding the engine wire to the No.3 timing belt cover.
(b) Disconnect the engine wire from the clamp.

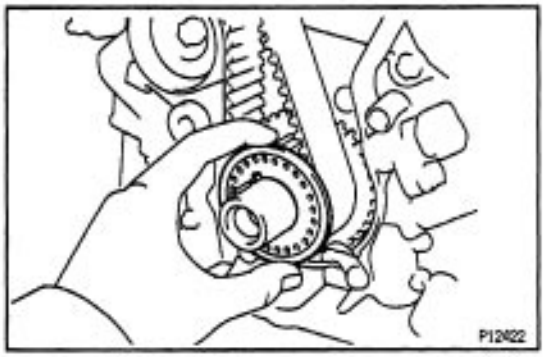



**14. REMOVE N0.2 TIMING BELT COVER**

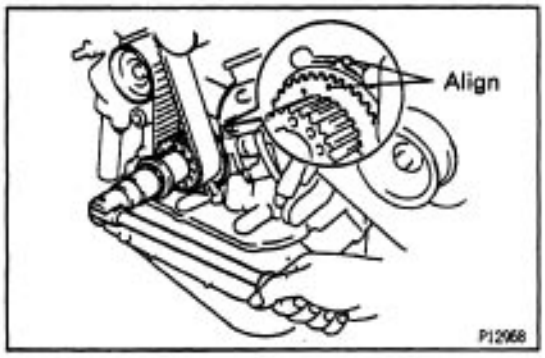
Remove the 5 bolts and timing belt cover.



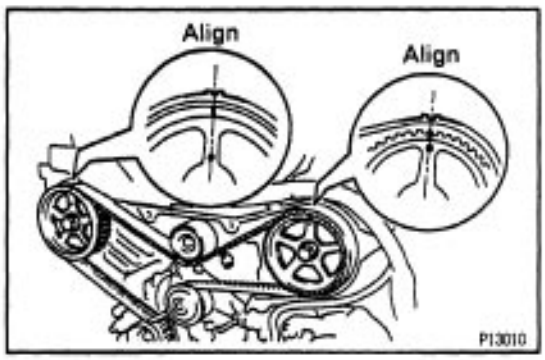

**15. REMOVE ENGINE RH MOUNTING BRACKET**
Remove the 2 bolts, nut and mounting bracket.



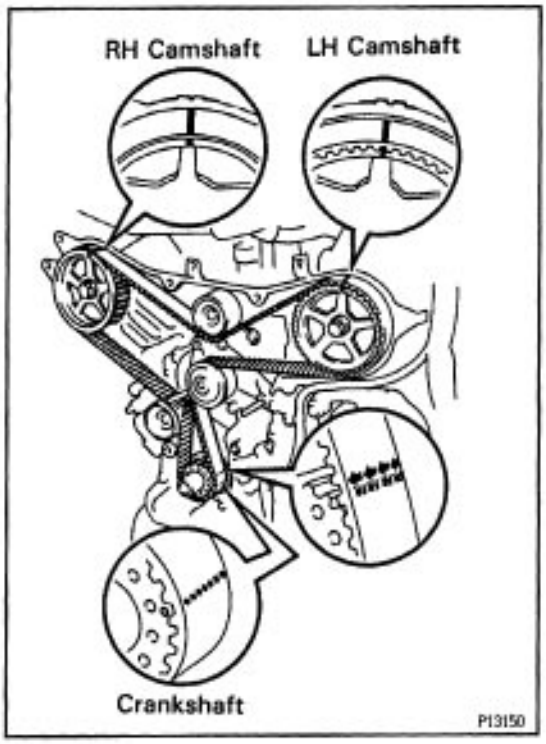

**16. REMOVE TIMING BELT GUIDE**




**17. SET NO.1 CYLINDER TO TDC/COMPRESSION**
(a) Temporarily install the crankshaft pulley bolt to the crankshaft.
(b) Turn the crankshaft and align the crankshaft timing pulley groove with the oil pump alignment mark.
**NOTICE: Always turn the crankshaft clockwise.**




(c) Check that timing marks of the camshaft timing pul–leys and No.3 timing belt cover are aligned.
If not, turn the crankshaft 1 revolution (360˚).
(d) Remove the crankshaft pulley bolt.

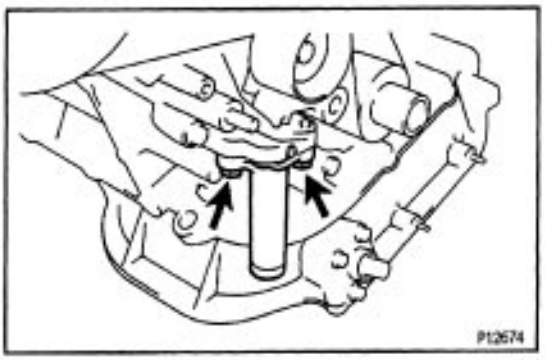



**18. IF REUSING TIMING BELT, CHECK INSTALLATION MARKS ON TIMING BELT**

Check that there are 3 installation marks and front mark on the timing belt.

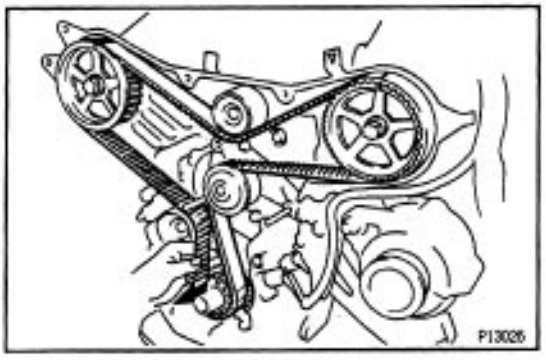
If the installation and front marks have disappeared, before removing the timing belt, place new installation and front marks on the timing belt to the following position:

- Timing mark of RH camshaft timing pulley
- Timing mark of LH camshaft timing pulley
- Dot mark of crankshaft timing pulley

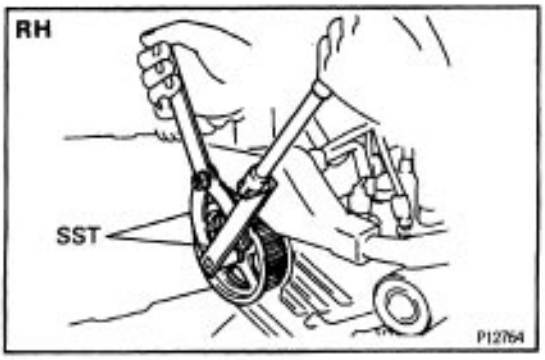



**19. REMOVE TIMING BELT TENSIONER**

Alternately loosen the 2 bolts, and remove them, the tensioner and dust boot.



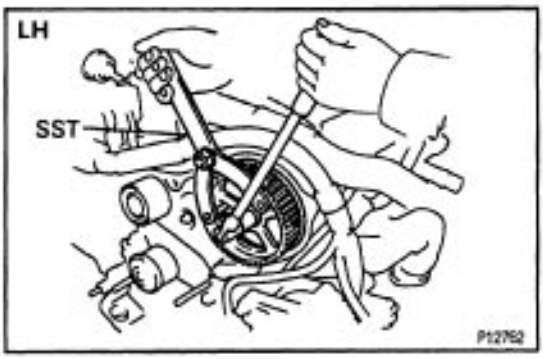

**20. REMOVE TIMING BELT**



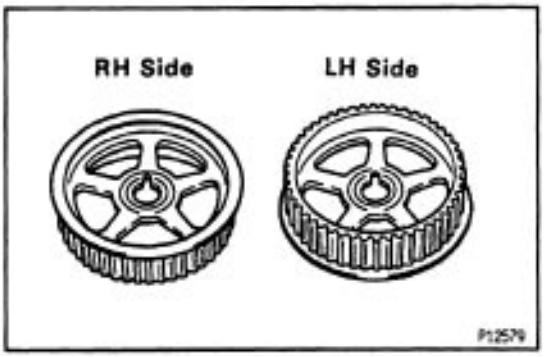

**21. REMOVE CAMSHAFT TIMING PULLEYS**

(a) Using SST, remove the bolt and RH timing pulley.

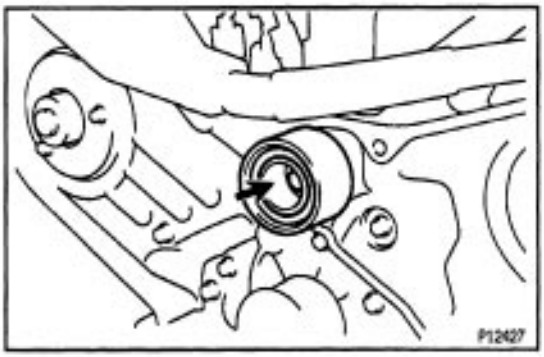
SST 09249 – 63010, 09960 –10010 (09962 – 01000)



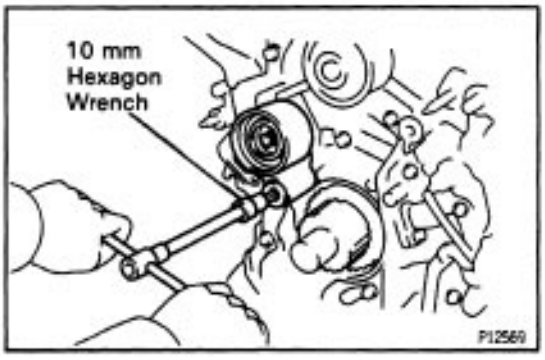

(b) Using SST, remove the LH timing pulley.
SST 09960–10010 (09962–01000)



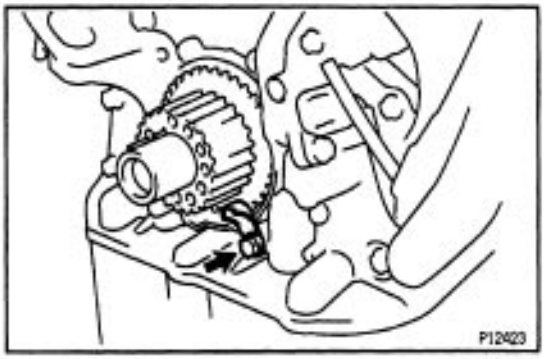

HINT: Arrange the camshaft timing pulleys (RH and LH sides).



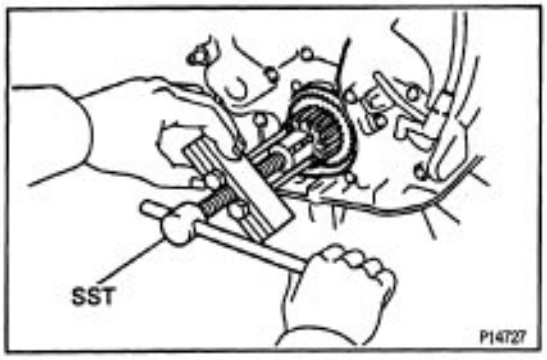

**22. REMOVE NO.2 IDLER PULLEY**
Remove the bolt and idler pulley.



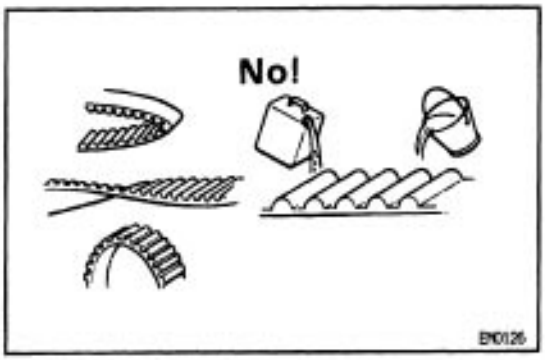

**23. REMOVE No.1 IDLER PULLEY**
Using a 10 mm hexagon wrench, remove the bolt, idler pulley and plate washer.




**24. REMOVE CRANKSHAFT TIMING PULLEY**
(a) Remove the bolt and timing belt plate.

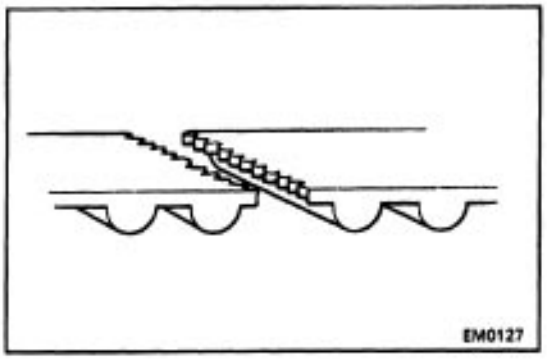



(b) Using SST, remove the crankshaft timing pulley.
SST 09213–60017 (09213–00020, 09213–00030, 09213–00050)
**NOTICE: Do not scratch the sensor part of the crankshaft timing pulley.**

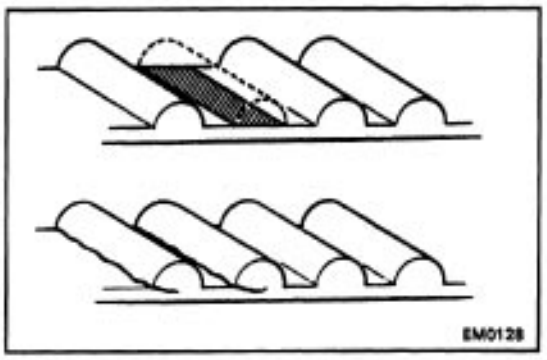



# TIMING BELT INSPECTION

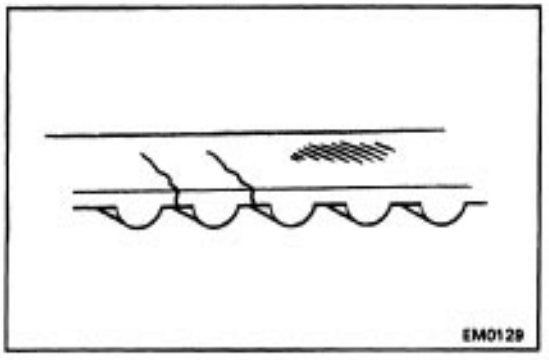
**1. INSPECT TIMING BELT**
**NOTICE:**
- **Do not bend, twist or turn the timing belt inside out.**
- **Do not allow the timing belt to come into contact with oil, water or steam.**
- **Do not utilize timing belt tension when installing or removing the mount bolt of the camshaft timing pulley.**



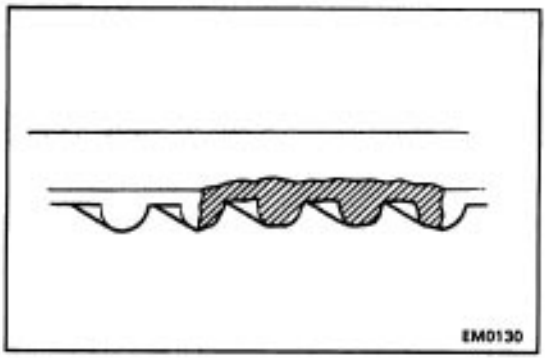

If there are any defects, as shown in the illustrations, check the following points:
(a) Premature parting
- Check for proper installation.
- Check the timing cover gasket for damage and proper installation.



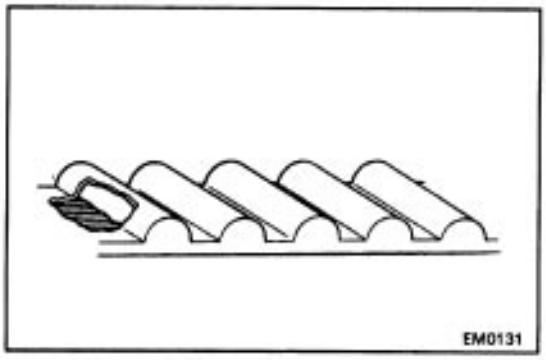

(b) If the belt teeth are cracked or damaged, check to see if either camshaft is locked.



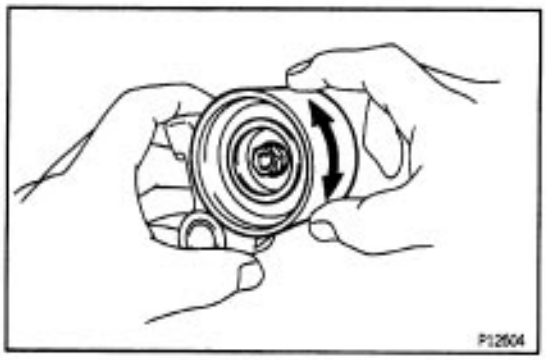

(c) If there is noticeable wear or cracks on the belt face, check to see if there are nicks on the side of the idler pulley lock and water pump.



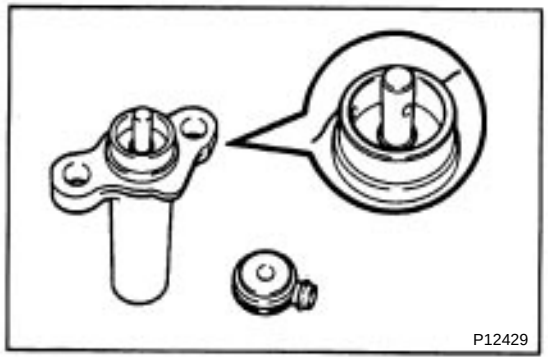

(d) If there is wear or damage on only one side of the belt, check the belt guide and the alignment of each pulley.



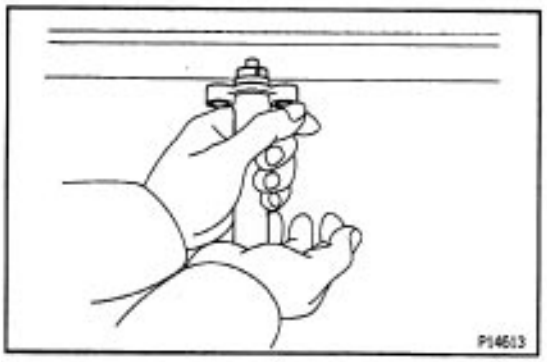

(e) If there is noticeable wear on the belt teeth, check timing cover for damage and check gasket has been installed correctly and for foreign material on the pulley teeth.
If necessary, replace the timing belt.



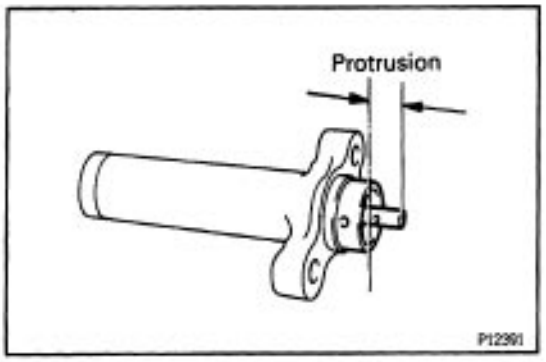

**2. INSPECT IDLER PULLEYS**
Check that the idler pulley turns smoothly.
If necessary, replace the idler pulley.



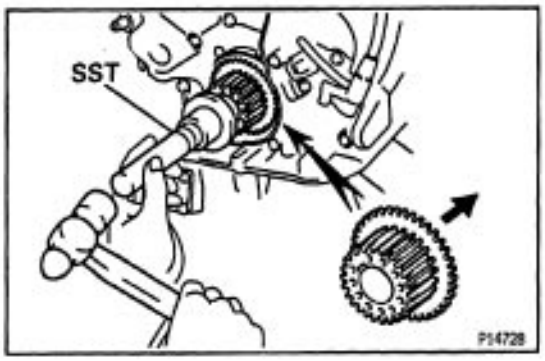

**3. INSPECT TIMING BELT TENSIONER**
(a) Visually check tensioner for oil leakage.
HINT: If there is only the faintest trace of oil on the seal on the push rod side, the tensioner is all right.
If leakage is found, replace the tensioner.




(b) Hold the tensioner with both hands and push the push rod strongly as shown to check that it doesn't move.
If the push rod moves, replace the tensioner.
**NOTICE: Never hold the tensioner push rod facing down–ward.**




(c) Measure the protrusion of the push rod from the housing end.
**Protrusion:**
**10.0 – 10.8 mm (0.394 – 0.425 In.)**
If the protrusion is not as specified, replace the tensioner.

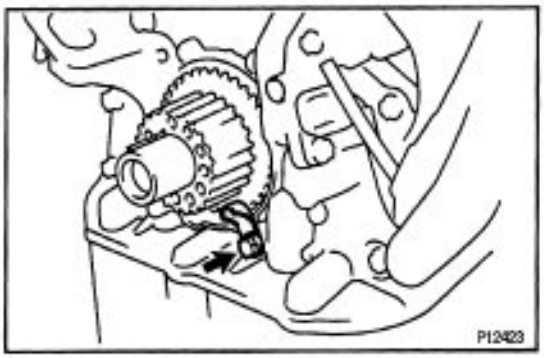



# TIMING BELT INSTALLATION

**(See Components for Removal and Installation)**

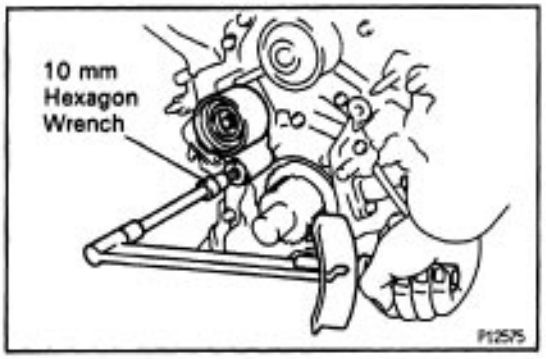
**1. INSTALL CRANKSHAFT TIMING PULLEY**

(a) Align the pulley set key with the key groove of the timing pulley and slide on the timing pulley.
(b) Using SST and a hammer, tap in the timing pulley, facing the sensor side rearward.
SST 09223–46011
**NOTICE: Do not scratch the sensor part of the crankshaft timing pulley.**

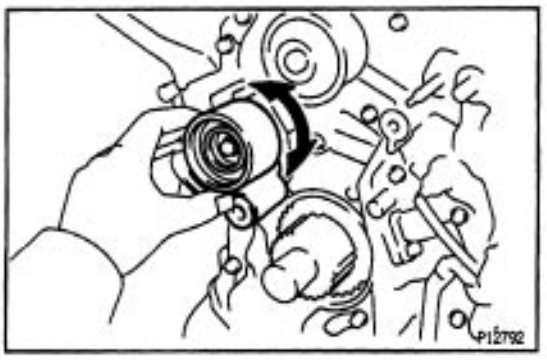



(c) Install the timing belt plate with the bolt.
**Torque: 8 N–m (80 kgf–cm, 69 in.–lbf)**

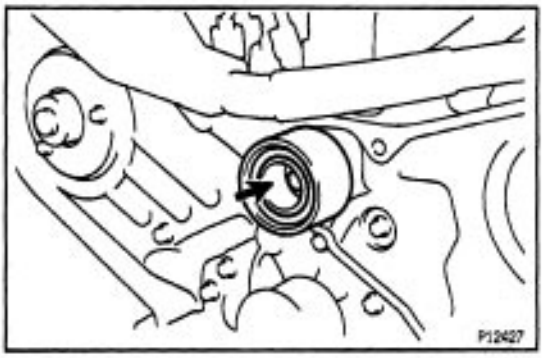
**2. INSTALL NO.1 IDLER PULLEY**




(a) Using a 10 mm hexagon wrench, install the idler pulley with the plate washer and bolt.
**Torque: 34 N–m (350 kgf–cm, 25 ft–lbf)**




(b) Check that the pulley bracket moves smoothly.

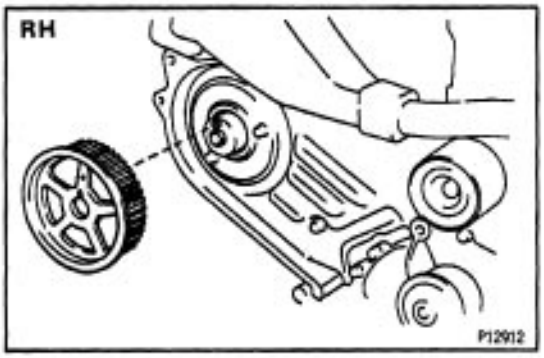



**3. INSTALL No.2 IDLER PULLEY**

(a) Install the idler pulley with the bolt.

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

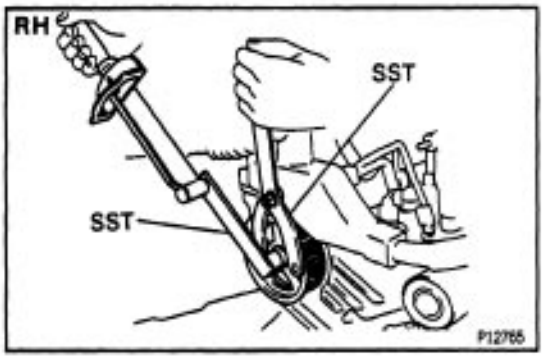
(b) Check that the idler pulley moves smoothly.




**4. INSTALL RH CAMSHAFT TIMING PULLEY**

(a) Install the timing pulley, facing the flange side outward.

(b) Align the knock pin hole of the camshaft with the knock pin groove of the timing pulley as shown.

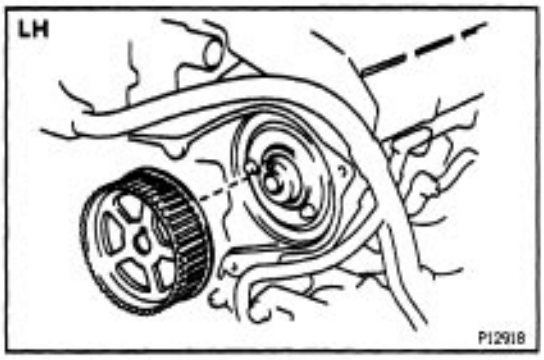



(c) Using SST, install and torque the bolt.

SST 09249–63010, 09960–10010 (09962–01000)

**Torque: 88 N–m (900 kgf–cm, 65 ft–lbf)**

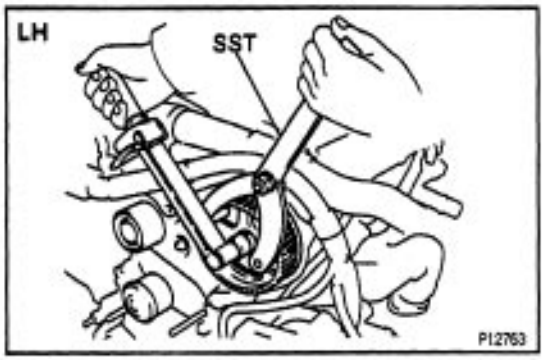
HINT: Use a torque wrench with a fulcrum length of 340 mm (113.39 in.)




**5. INSTALL LH CAMSHAFT TIMING PULLEY**

(a) Install the timing pulley, facing the flange side inward.

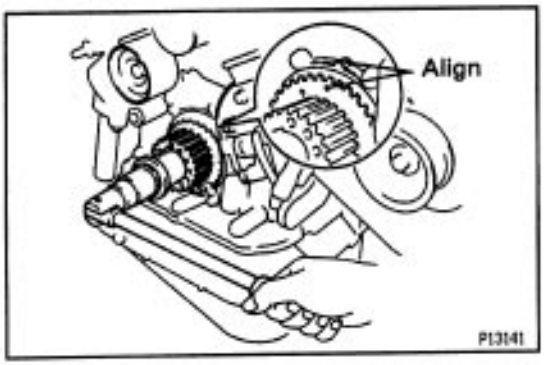
(b) Align the knock pin hole of the camshaft with the knock pin groove of the timing pulley as shown.




(d) Using SST, install and torque the bolt.

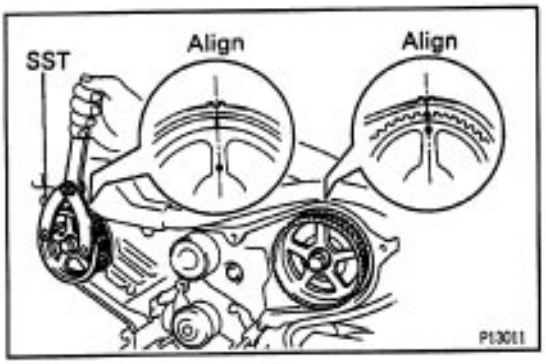
SST 09960–10010 (09962–01000)

**Torque: 126 N–m (1,300 kgf–cm, 94 ft–lbf)**



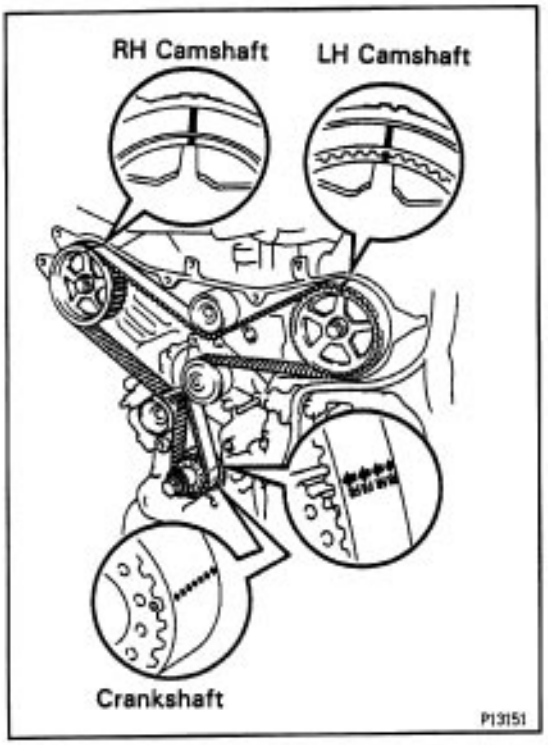

**6. SET NO.1 CYLINDER TO TDC/COMPRESSION**

(a) Crankshaft Timing Pulley Position:
Temporarily install the crankshaft pulley bolt to the crankshaft.
Turn the crankshaft and align the crankshaft timing pulley groove with the oil pump alignment mark.




(b) RH Camshaft Timing Pulley Position:
Using SST, turn the camshaft pulley, align the timing marks of the camshaft and the No.3 timing belt cover.
SST 09960–10010 (09962–01000)

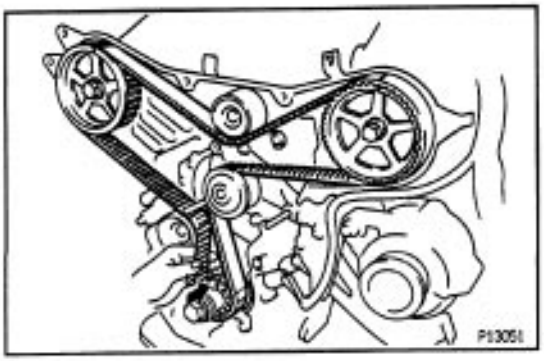
(c) LH Camshaft Timing Pulley Position:
Using SST, turn the camshaft pulley, align the timing marks of the camshaft and the No.3 timing belt cover.
SST 09960 –10010 (09962 – 01000)




**7. INSTALL TIMING BELT**

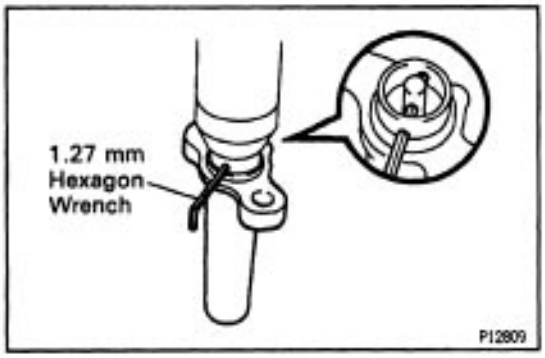
**NOTICE: The engine should be cold.**

(a) Remove any oil or water on the pulleys, and keep them clean.
(b) Check the timing belt front mark.
(c) Align the installation mark on the timing belt with the dot mark of the crankshaft timing pulley.
(d) Align the installation marks on the timing belt with the timing marks of the camshaft timing pulleys.




(e) Install the timing belt with the following order:

- Crankshaft timing pulley
- Water pump pulley
- LH camshaft timing pulley
- No.2 idler pulley
- RH camshaft timing pulley
- No.1 idler pulley

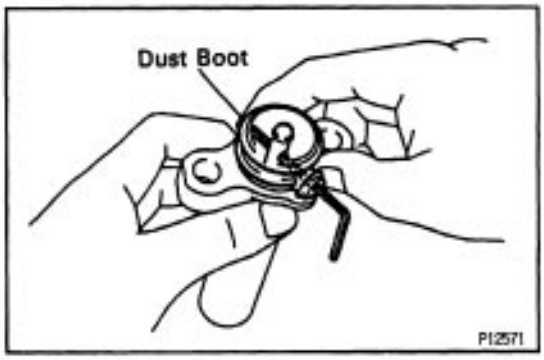



**8. SET TIMING BELT TENSIONER**

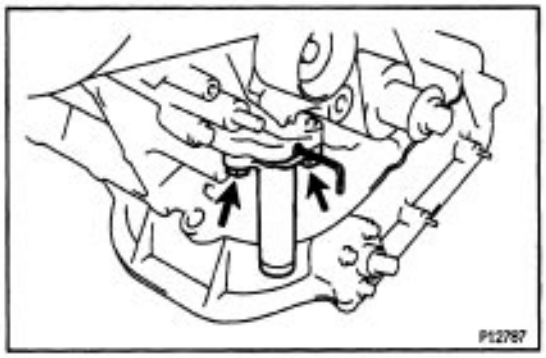
(a) Using a press, slowly press in the push rod using 981 –9,807 N (1100–1,000 kgf, 200–2,205 lbf) of pres– sure.

(b) Align the holes of the push rod and housing, pass a 1.27 mm hexagon wrench through the holes to keep the setting position of the push rod.

(c) Release the press.




(d) Install the dust boot to the tensioner.

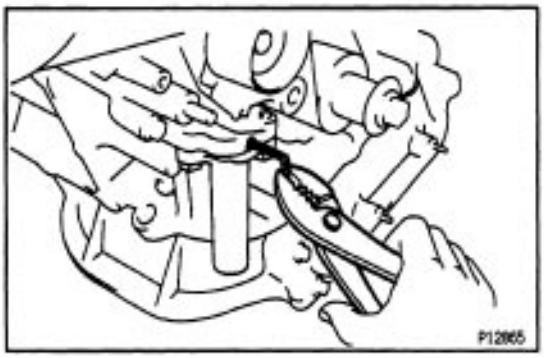



**9. INSTALL TIMING BELT TENSIONER**

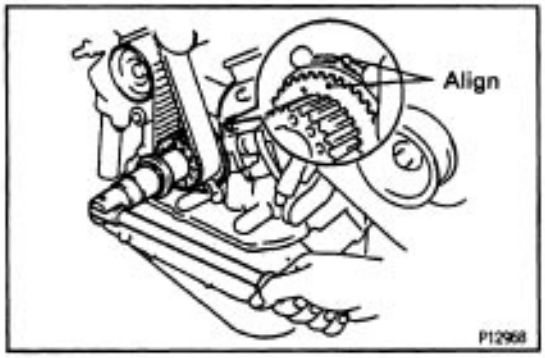
(a) Temporarily install the tensioner with the 2 bolts.

(b) Alternately tighten the 2 bolts.

**Torque: 27 N–m (280 kgf–cm, 20 ft–lbf)**



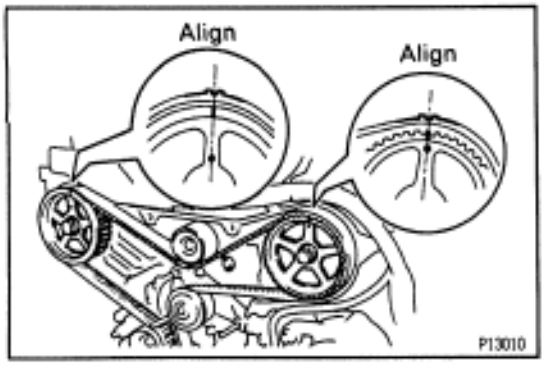

(c) Remove the 1.27 mm hexagon wrench from the tensi– oner.



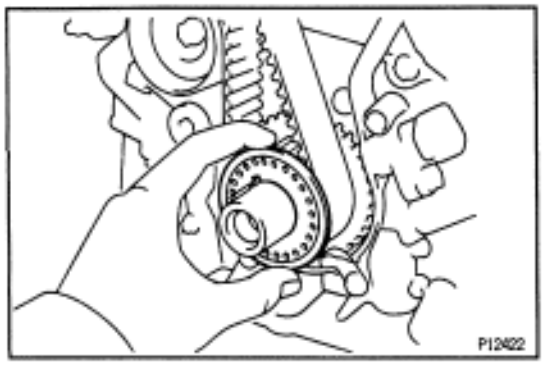

**10. CHECK VALVE TIMING**

(a) Turn the crankshaft, and align the crankshaft timing pulley groove with the oil pump alignment mark.

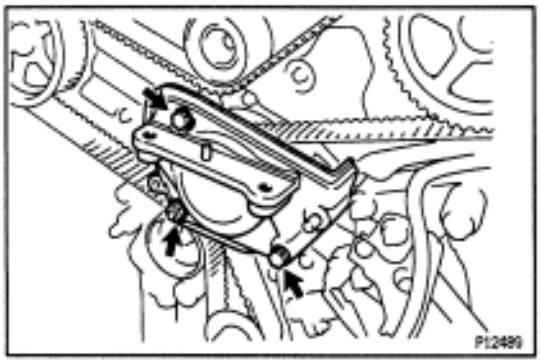
**NOTICE: Always turn the crankshaft clockwise.**



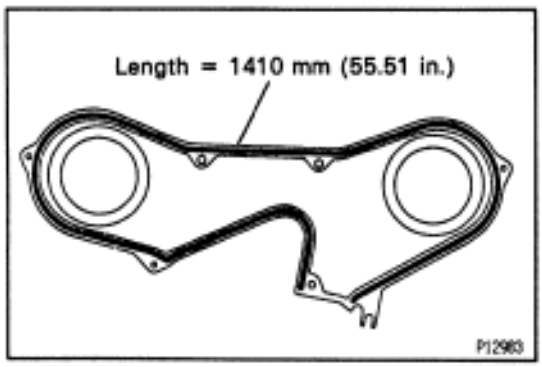

(b) Check that the timing marks of the RH and LH timing pulleys with the timing marks of the No.3 timing belt cover as shown in the illustration.
If the marks do not align, remove the timing belt and reinstall it.
(c) Remove the crankshaft pulley bolt.




**11. INSTALL TIMING BELT GUIDE**
Install the belt guide, facing the cup side outward.



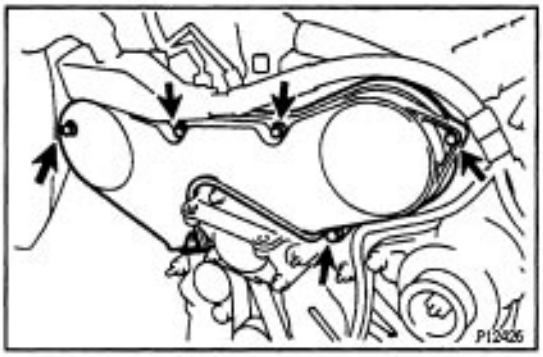

**12. INSTALL ENGINE RH MOUNTING BRACKET**
Install the mounting bracket with the 2 bolts and nut.
**Torque: 28 N–m (290 kgf–cm, 21 ft–lbf)**



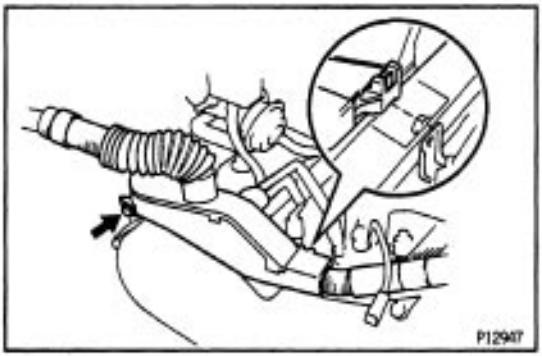

**13. INSTALL N0.2 TIMING BELT COVER**
(a) Check that the timing belt cover gasket has no cracks or peeling, etc.
If the gasket does have cracks or peeling, etc., replace it using following steps.

(1) Using a screwdriver and gasket scraper, remove all the old gasket material.
(2) Thoroughly clean all components to remove all the loose material.
(3) Remove the backing paper from a new gasket and install the gasket evenly to the part of the belt cover shaded black in the illustration.
(4) After installing the gasket, press down on it sc that the adhesive firmly sticks to the belt cover.

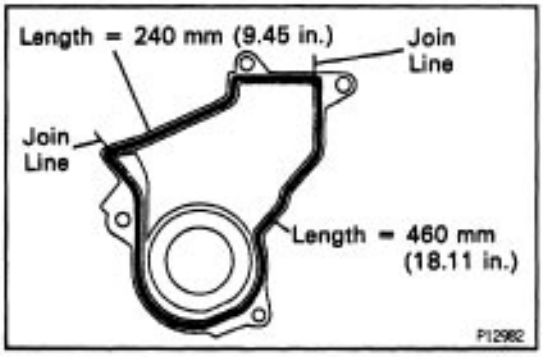
(b) Install new gasket to the No.2 belt cover.



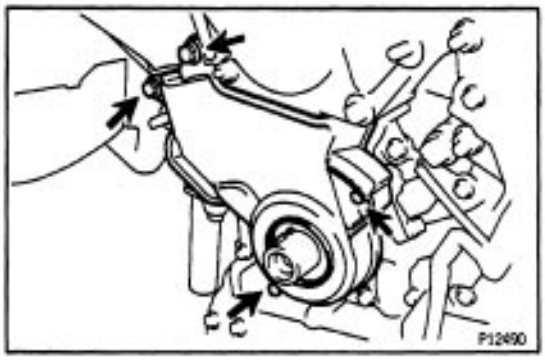

(c) Install the belt cover with the 5 bolts.
**Torque: 8.5 N–m (85 kgf–cm. 74 in.–lbf)**



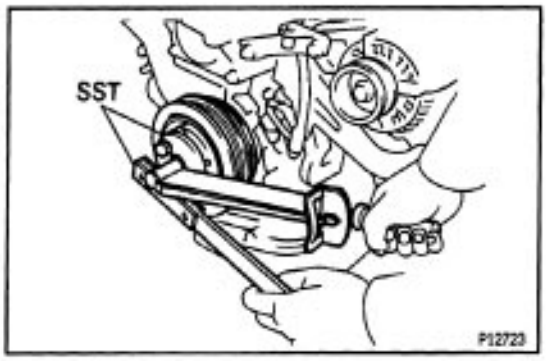

**14. CONNECT ENGINE WIRE**
(a) Connect the engine wire with the clamp.
(b) Install the bolt holding the engine wire to the No.3 timing belt cover.




**15. INSTALL NO.1 TIMING BELT COVER**
(a) Check that the timing belt cover gaskets have cracks or peeling, etc.
If the gasket does have cracks or peeling, etc., replace it using following steps, peeling, etc., replace them using following steps.
(1) Using a screwdriver and gasket scraper, remove all the old gasket material.
(2) Thoroughly clean all components to remove all the loose material.
(3) Remove the backing paper from a new gasket and install the gasket evenly to the part of the belt cover shaded back in the illustration.
**NOTICE: When joining 2 gaskets, do not leave a gap between them. Cut off any excess gasket.**
(4) After installing the gasket, press down on it so that the adhesive firmly sticks to the belt cover.
(b) Install new gaskets to the No.1 belt cover.




(c) Install the belt cover with the 4 bolts.
**Torque: 8.5 N–m (85 kgf–cm, 74 in.–lbf)**



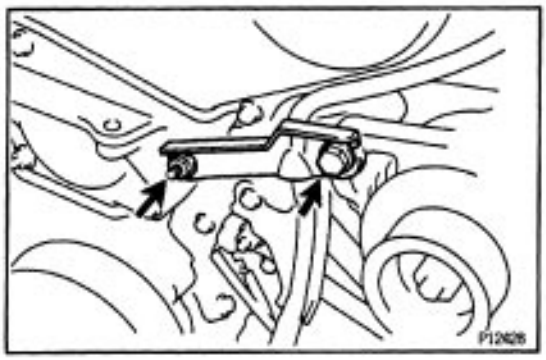

**16. INSTALL CRANKSHAFT PULLEY**

(a) Align the pulley set key with the key groove of the pulley, and slide the pulley.

(b) Using SST, install and torque the bolt.

SST 09213–54015, 09330–00021

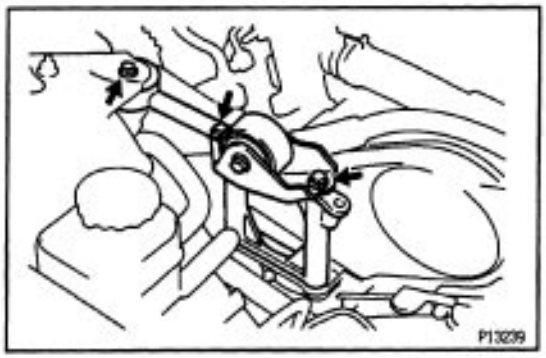
**Torque: 216 N–m (2,200 kgf–cm, 159 ft–lbf)**




**17. INSTALL NO.2 GENERATOR BRACKET**

Install the bracket with the pivot bolt and nut. Do not tighten the bolt yet.

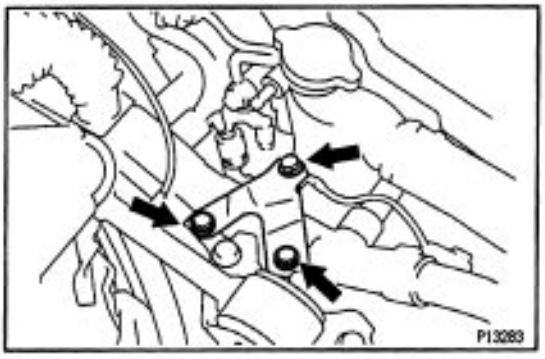
**Torque: 28 N–m (290 kgf–cm, 21 ft–lbf) for Nut**




**18. INSTALL NO.2 RH ENGINE MOUNTING BRACKET AND ENGINE MOVING CONTROL ROD**

Install the mounting bracket and control rod with the 3 bolts.

**Torque: 63.7 N–m (650 kgf–cm, 47 ft–lbf)**



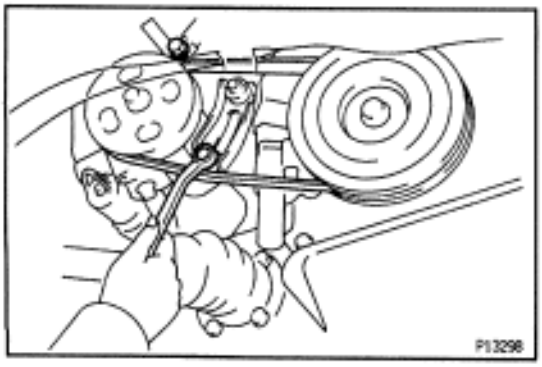

**19. INSTALL RH ENGINE MOUNTING STAY**

Install the mounting stay with the 3 bolts.

**Torque: 31.4 N–m (320 kgf–cm. 23 ft–lbf)**


**24. CONNECT GROUND STRAPS**

Connect the 2 straps.




**21. INSTALL AND ADJUST PS DRIVE BELT**

Install the drive belt with the pivot and adjusting bolts.

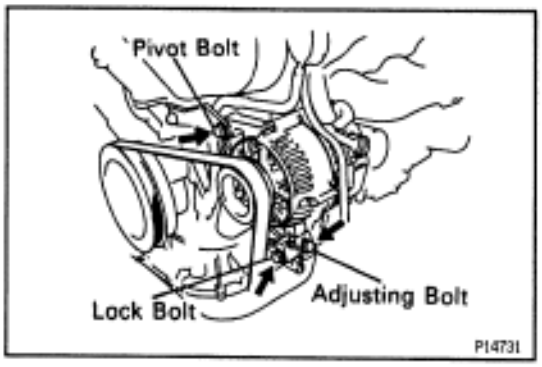
**Drive belt tension:**

**New belt**

**150 ± 185 l bf**

**Used belt**

**115 ± 20 lbf**




**22. INSTALL GENERATOR DRIVE BELT**

Adjust the drive belt. (See CH section)

**Drive belt tension:**

**New belt**

**175 ± 5 lbf**

**Used belt**

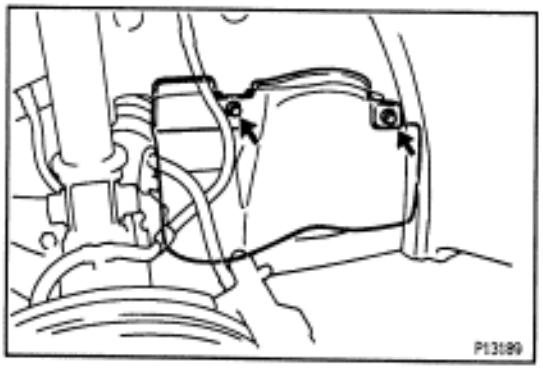
**115 ± 20 lbf**

**23. INSTALL COOLANT RESERVOIR TANK**

**24. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY**

**25. START ENGINE, AND CHECK FOR ABNORMAL NOISE AND SMOOTH OPERATION**



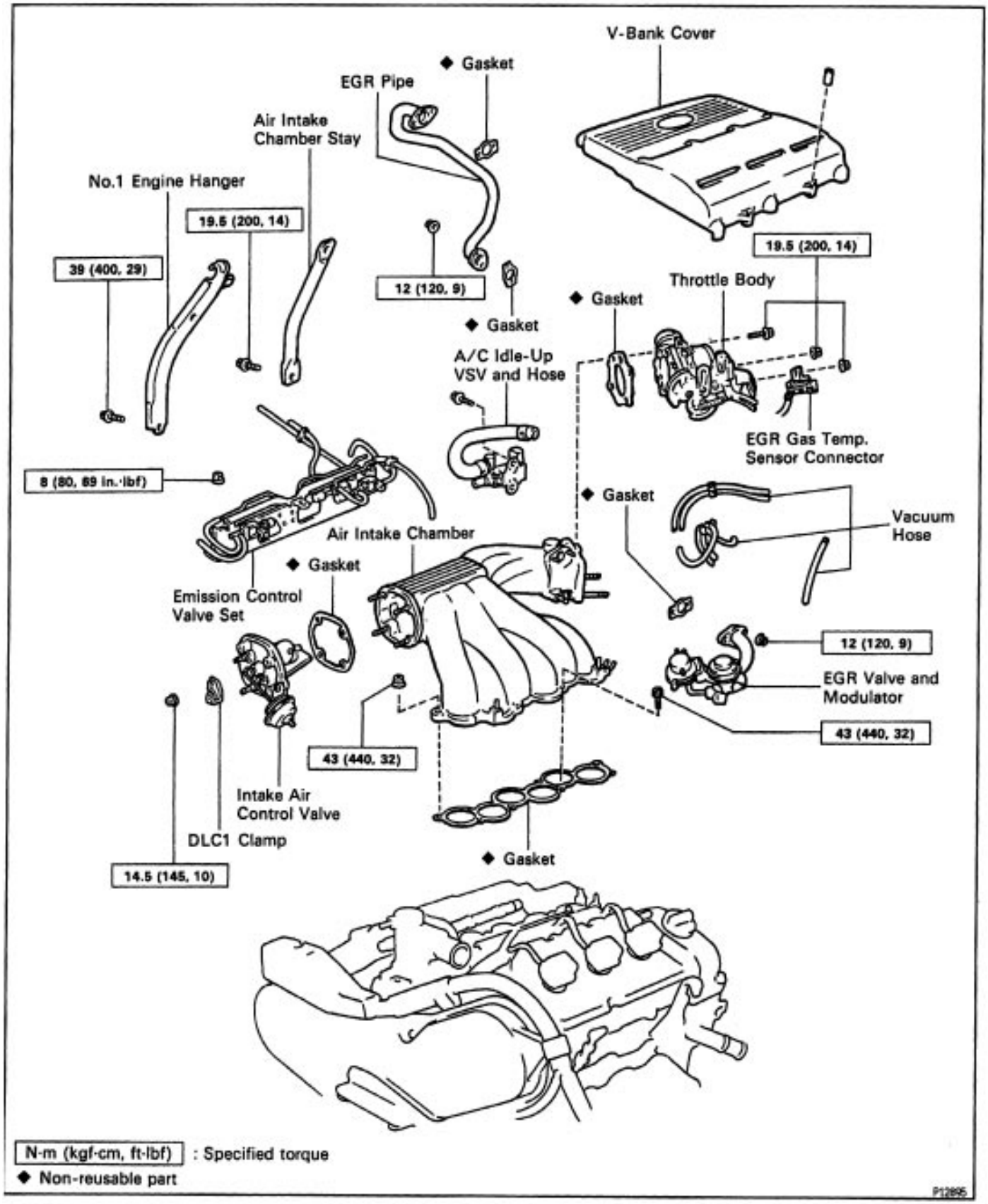


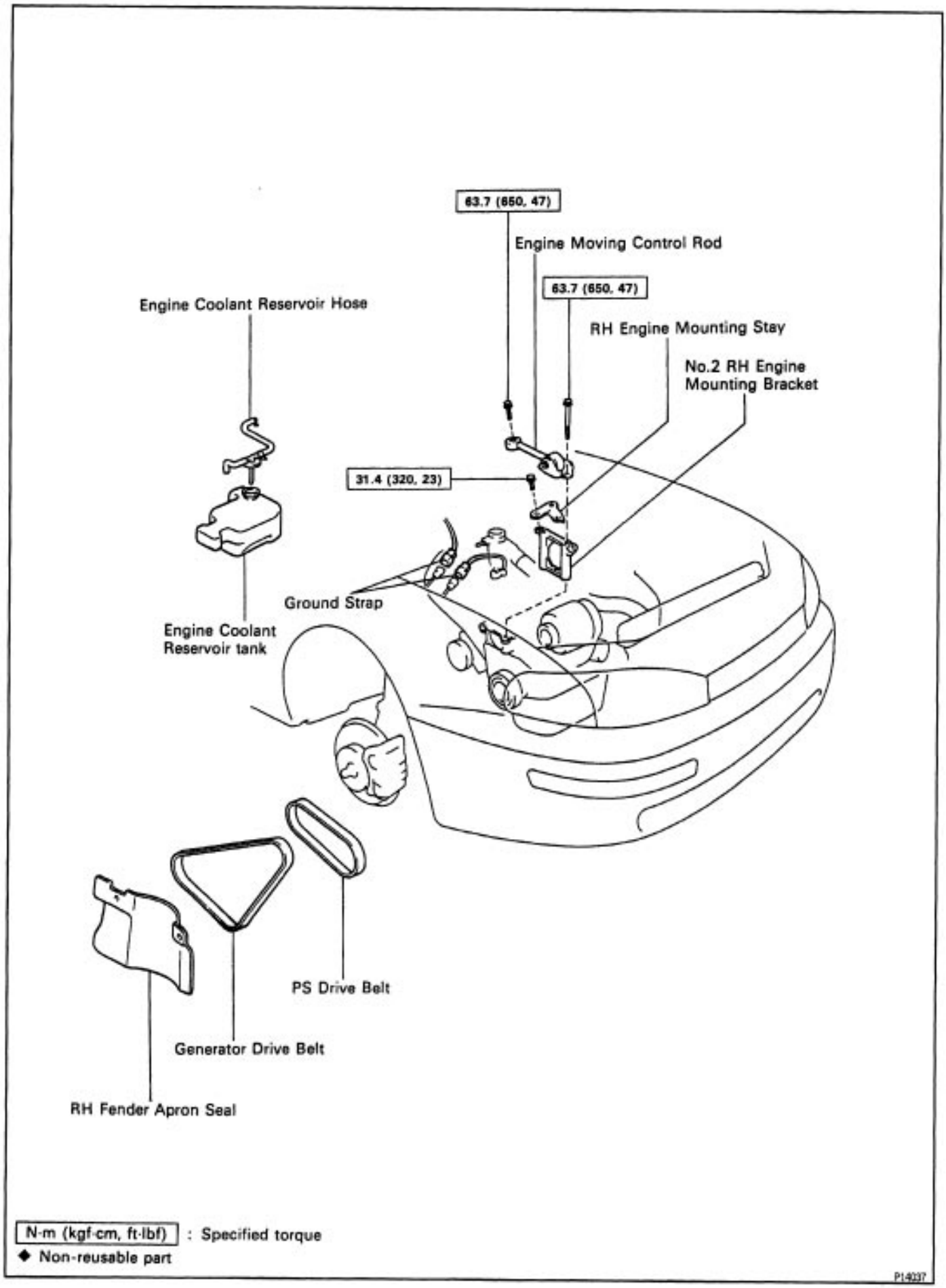

**26. INSTALL RH FENDER APRON SEAL**

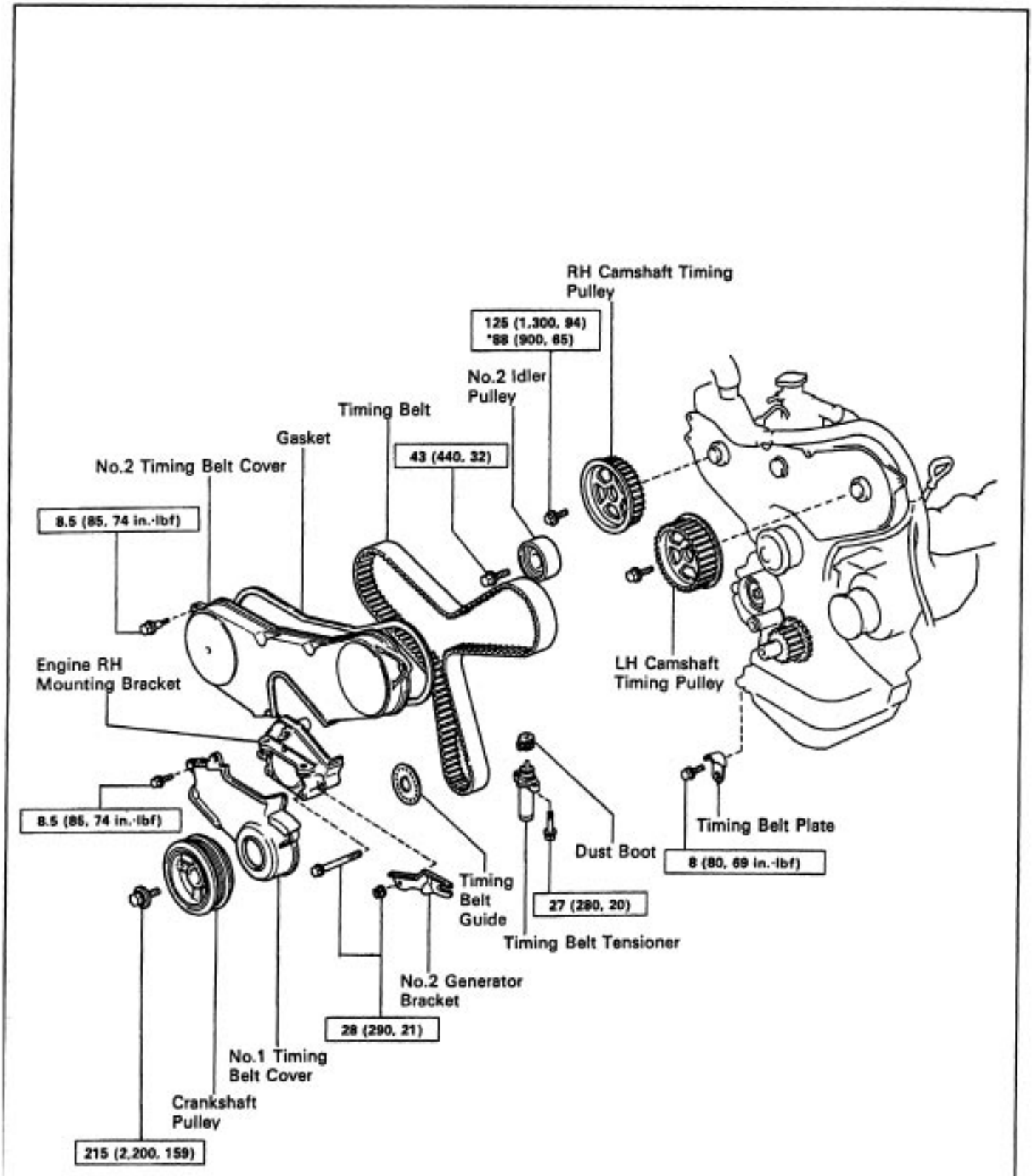
**27. INSTALL RH FRONT WHEEL**

# CYLINDER HEAD

## COMPONENTS FOR REMOVAL AND INSTALLATION

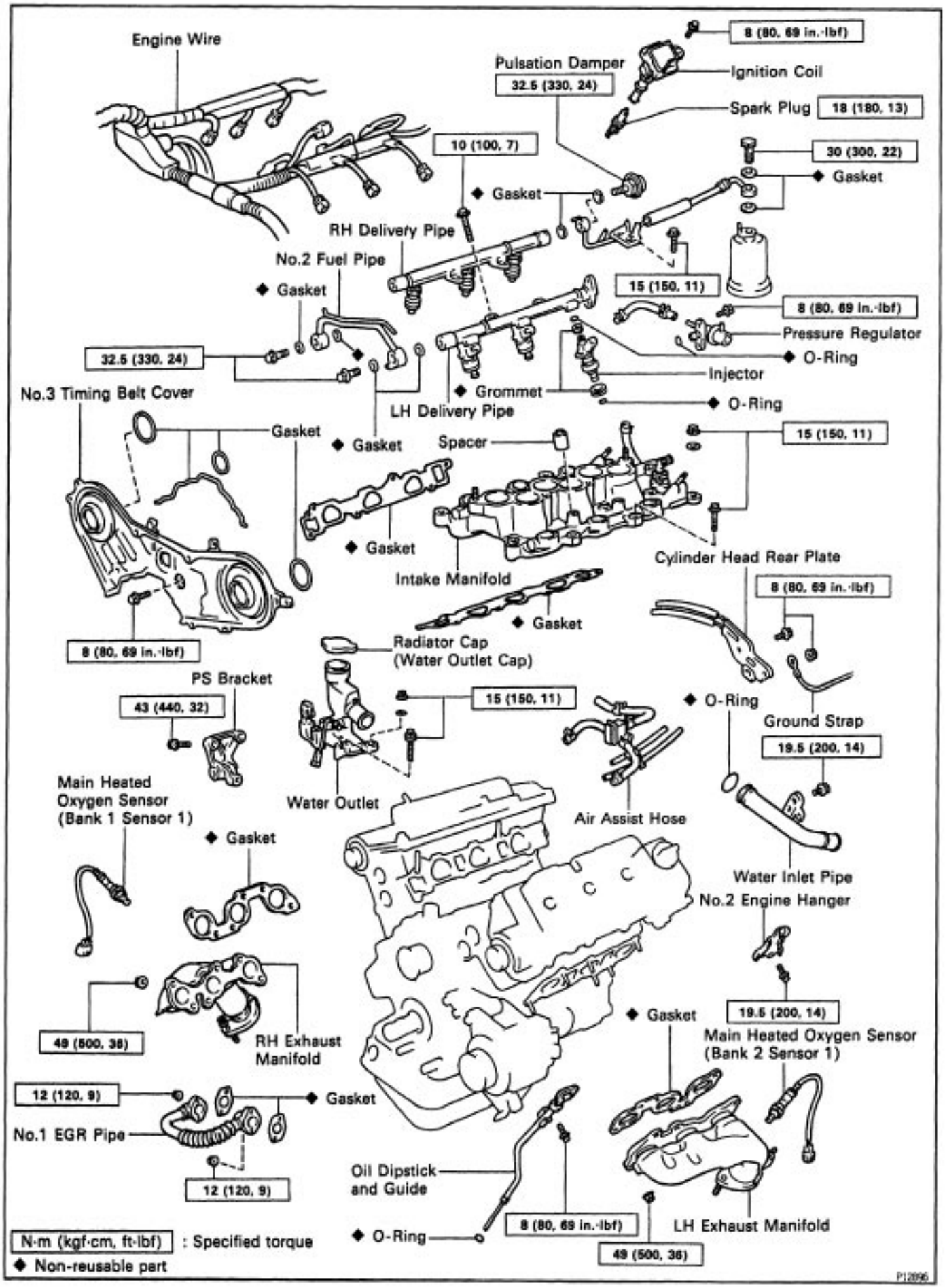


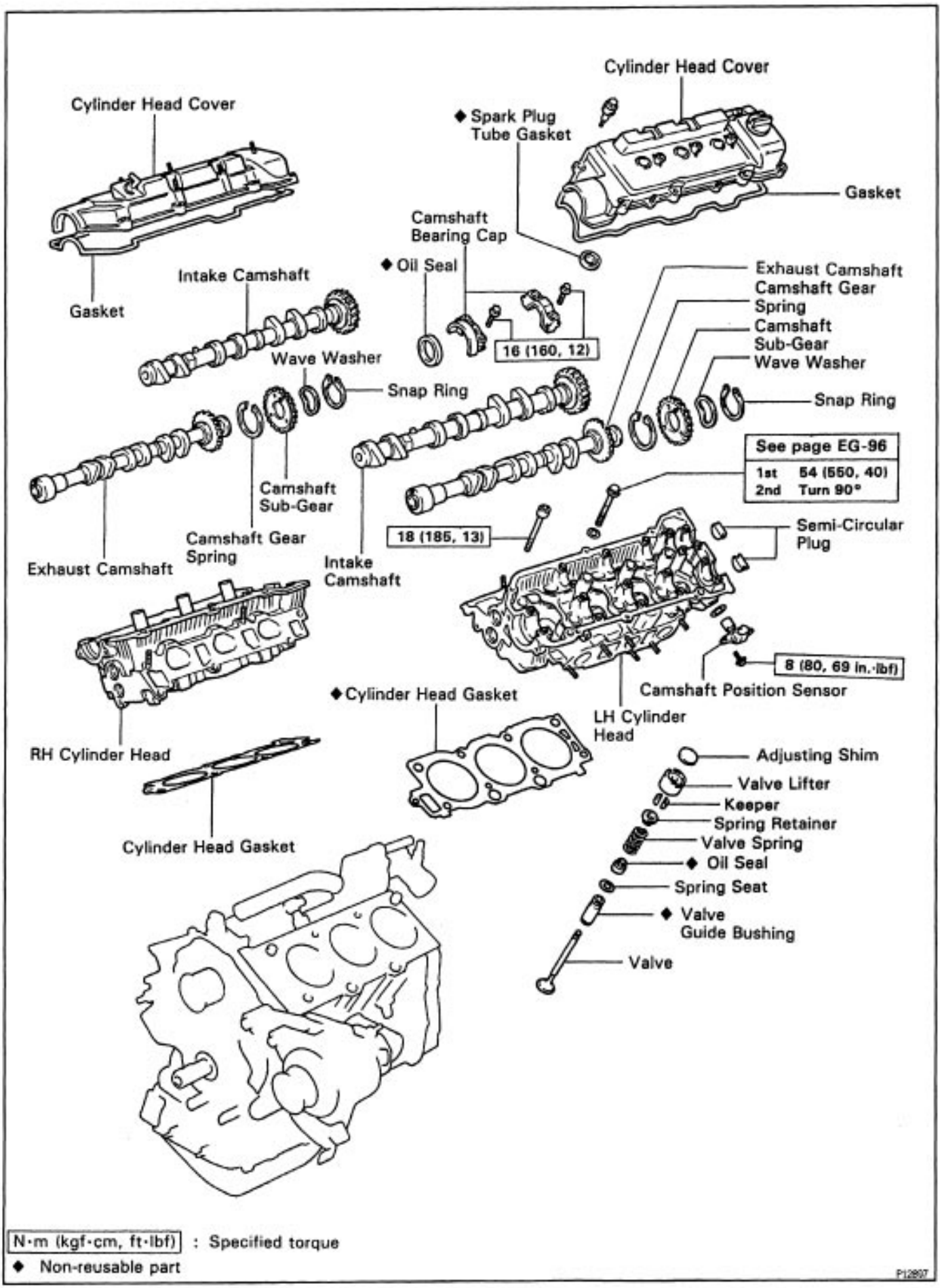


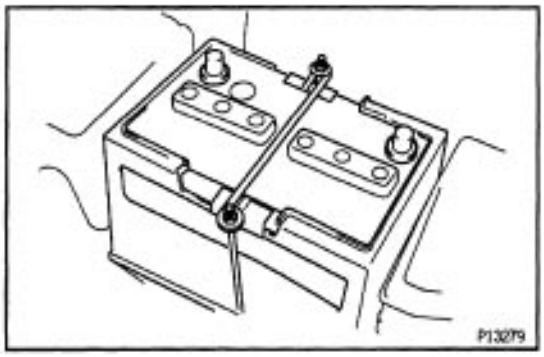



N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
* For use with SST

P13400








# CYLINDER HEADS REMOVAL

**(See Components for Removal and Installation)**

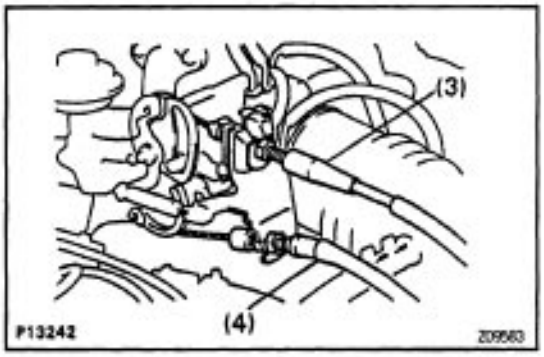
**1. REMOVE BATTERY AND TRAY**

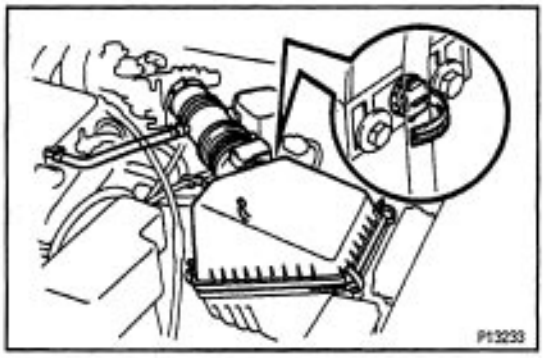
**CAUTION: Work must be started after 90 seconds from the time the ignition switch is turned to the 'LOCK' position and the negative (–) terminal cable is disconnected from the battery.**

**2. DRAIN ENGINE COOLANT**

**3. DISCONNECT ACCELERATOR CABLE**

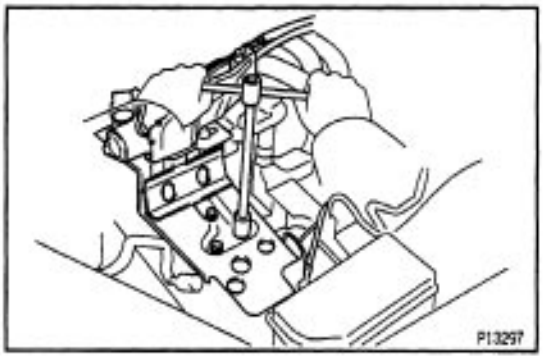
**4. DISCONNECT THROTTLE CABLE**



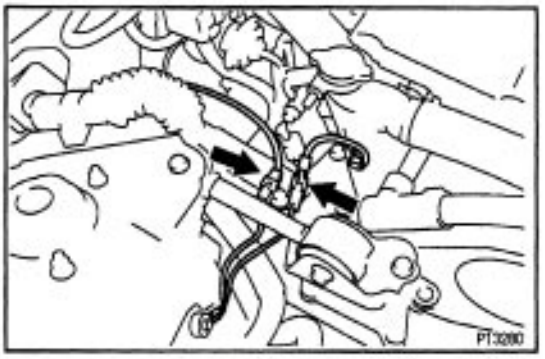

**5. REMOVE AIR CLEANER CAP, VOLUME AIR FLOW METER AND AIR CLEANER HOSE**

(a) Disconnect the volume air flow meter connector and wire clamp.
(b) Disconnect the accelerator cable clamp.
(c) Disconnect the PCV hose.
(d) Loosen the air cleaner hose clamp bolt.
(e) Disconnect the 4 air cleaner cap clips.
(f) Remove the air cleaner cap and volume air flow meter together with the air cleaner hose.



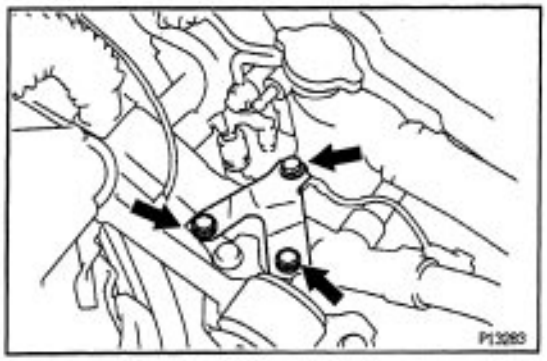

**6. w/ CRUISE CONTROL SYSTEM:**
**REMOVE CRUISE CONTROL ACTUATOR**

(a) Remove the bolt, clip and actuator cover.
(b) Disconnect the actuator connector and clamp.
(c) Remove the 3 bolts, and disconnect the actuator with the bracket.

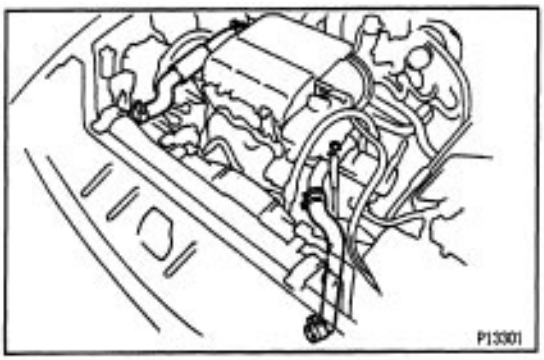



**7. DISCONNECT GROUND STRAPS**

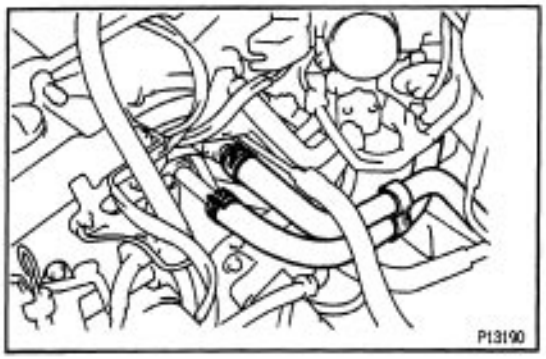
Disconnect the 2 straps.



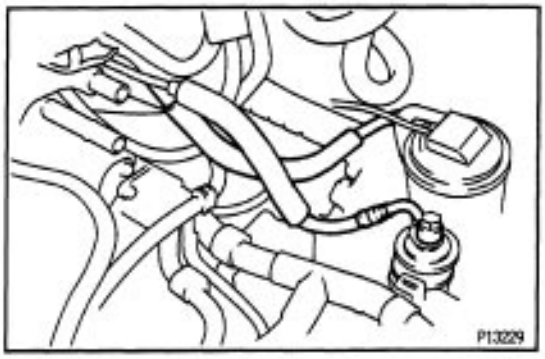

**8. REMOVE RH ENGINE MOUNTING STAY**
Remove the 3 bolts and RH engine mounting stay.




**9. DISCONNECT RADIATOR HOSES**

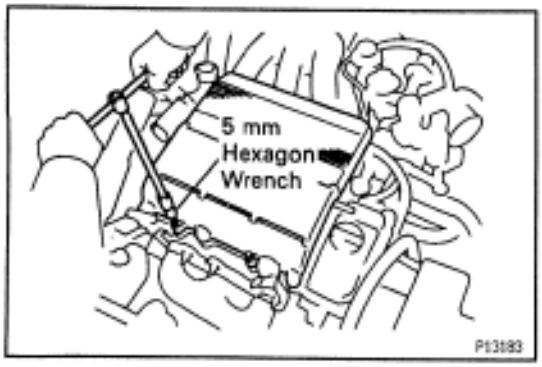



**10. DISCONNECT HEATER HOSES**
Disconnect the 2 hoses.



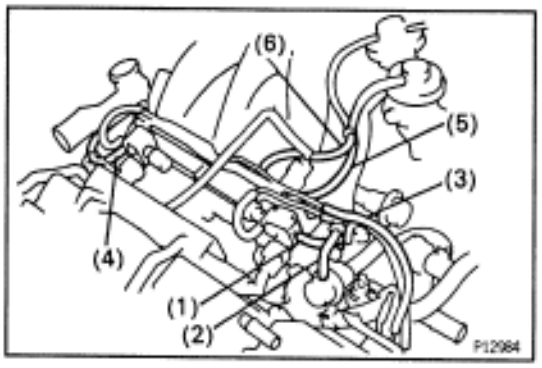

**11. DISCONNECT FUEL HOSES**
Disconnect the fuel inlet and return hoses.
**CAUTION: Catch leaking fuel in a container.**


**12. DISCONNECT PRESSURE HOSE OF HYDRAULIC MOTOR**
Remove the bolt, and disconnect the pressure hose from the water inlet.



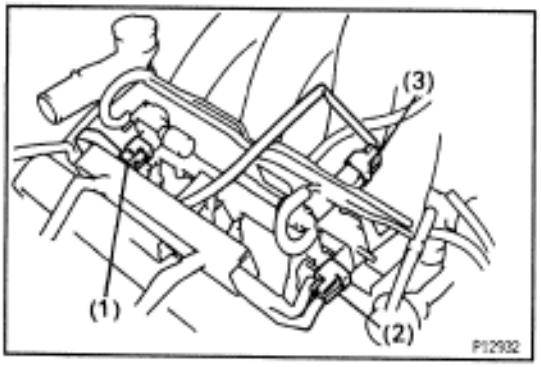

**13. REMOVE V – BANK COVER**

Using a 5 mm hexagon wrench, remove the 2 nuts and V–bank cover.

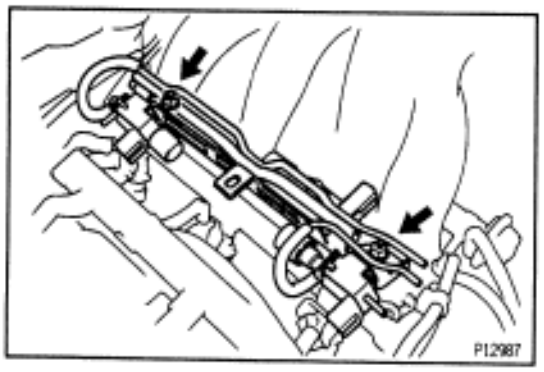



**14. REMOVE EMISSION CONTROL VALVE SET**

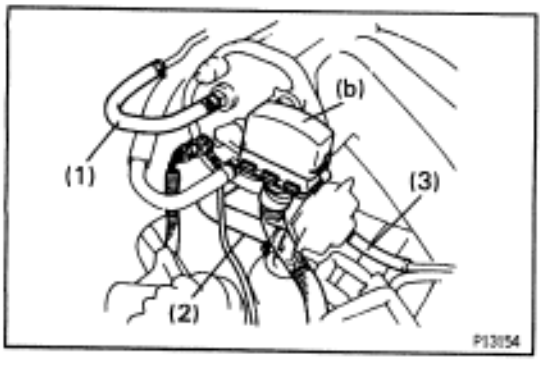
(a) Disconnect the following vacuum hoses:
- (1) Vacuum hose from fuel pressure control VSV
- (2) Vacuum hose from fuel pressure regulator
- (3) Vacuum hose from cylinder head rear plate
- (4) Vacuum hose from intake air control valve VSV
- (5) Vacuum hose from EGR vacuum modulator
- (6) Vacuum hose from EGR valve




(b) Disconnect the following connectors:
- (1) Intake air control valve connector
- (2) Fuel pressure connector
- (3) EGR VSV connector




(c) Remove the 2 nuts and emission control valve set.

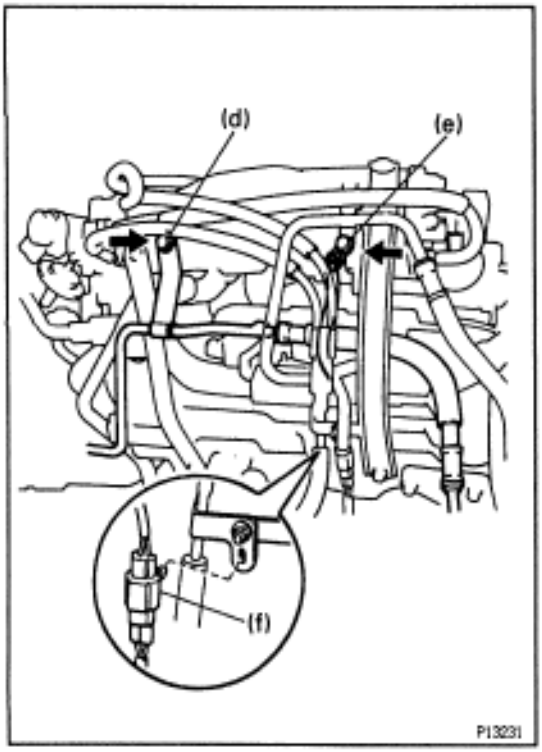



**15. REMOVE AIR INTAKE CHAMBER**

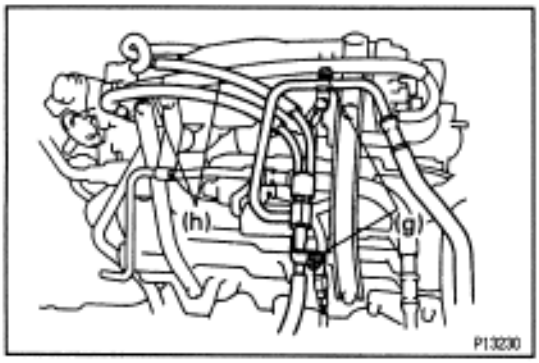
(a) Disconnect the following hoses:
- (1) Brake booster vacuum hose
- (2) PCV hose
- (3) Intake air control valve vacuum hose

(b) Disconnect the data link connector 1.

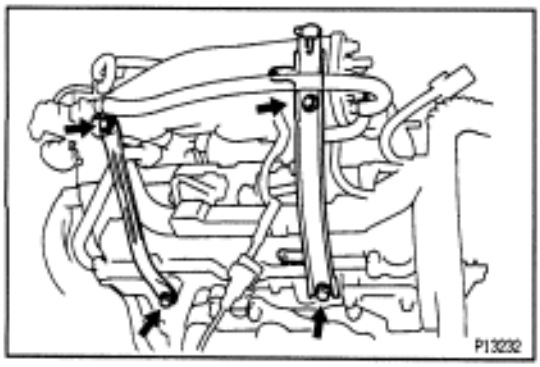
(c) Remove the nut and disconnect the 2 ground straps.




(d) Remove the bolt and disconnect the hydraulic motor pressure hose from the air intake chamber.
(e) Remove the bolt, and disconnect the ground strap.
(f) Disconnect the RH oxygen sensor connector clamp from the PS pressure tube.

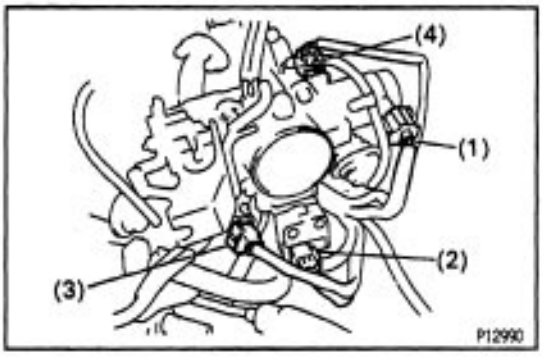



(g) Remove the 2 nuts, and disconnect the PS pressure tube.
(h) Disconnect the 2 PS air hoses.

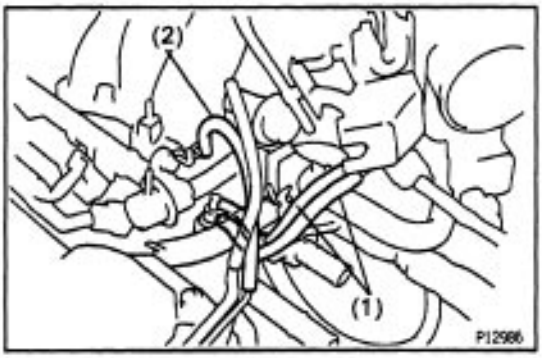



(i) Remove the 2 bolts and No.1 engine hanger.
(j) Remove the 2 bolts and air intake chamber stay.

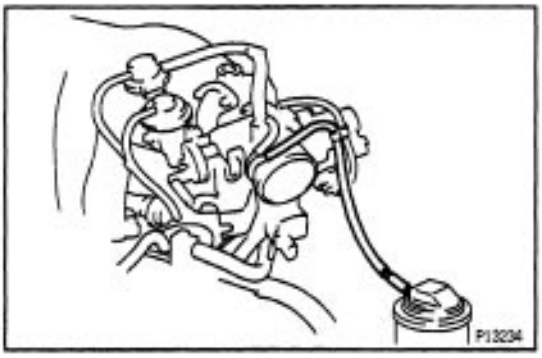

(k) Remove the 4 nuts, EGR pipe and 2 gaskets.



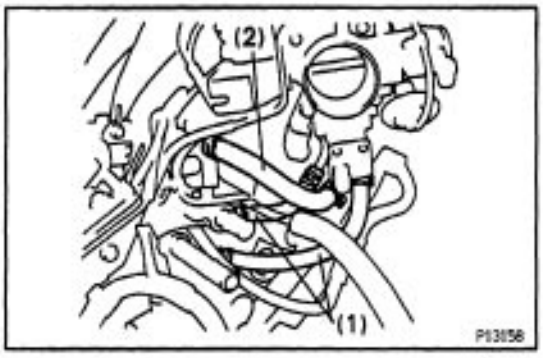

(l) Disconnect the following connectors:
(1) Throttle position sensor connector
(2) IAC valve connector
(3) EGR gas temperature sensor connector
(4) A/C idle–up connector



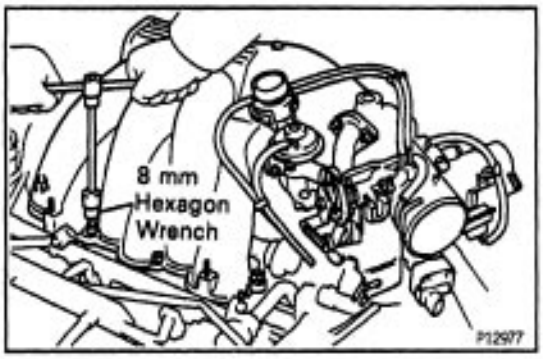

(m) Disconnect the following vacuum hoses:
(1) 2 vacuum hoses from TVV
(2) Vacuum hose from cylinder head rear plate



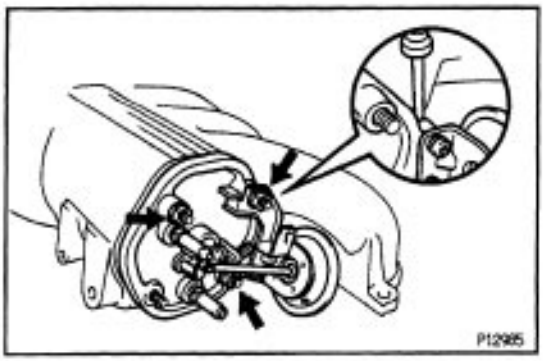

(3) Vacuum hose from charcoal canister




(n) Disconnect the following hoses:
(1) 2 water bypass hoses
(2) Air assist hose

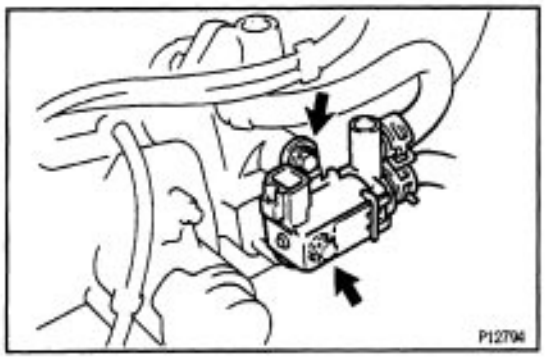



(o) Using an 8 mm hexagon wrench, remove the 2 bolts, 2 nuts, air intake chamber and gasket.



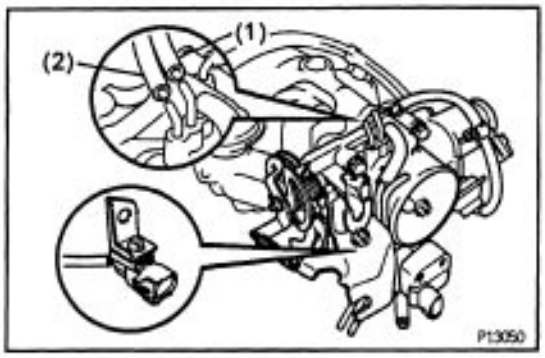

**16. REMOVE INTAKE AIR CONTROL VALVE FROM AIR INTAKE CHAMBER**

(a) Disconnect the A/C air hose.
(b) Remove the 3 nuts and data link connector 1 clamp.
(c) Remove the intake air control valve by prying a screw–driver between the intake air control valve and air intake chamber.
(d) Remove the gasket.



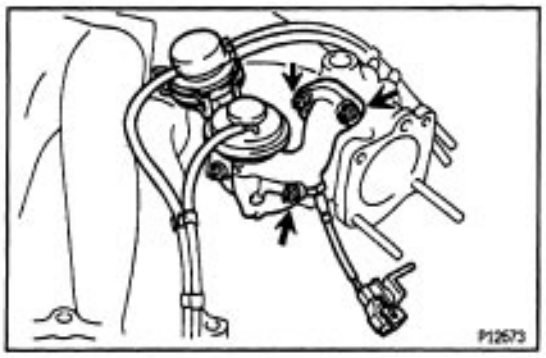

**17. REMOVE A/C IDLE–UP VSV FROM AIR INTAKE CHAMBER**

(a) Disconnect the air hose.
(b) Remove the 2 bolts and A/C idle–up VSV.



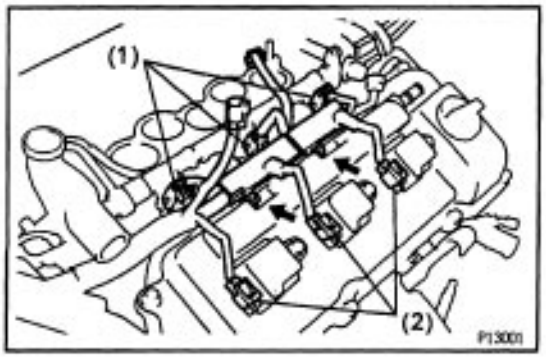

**18. REMOVE THROTTLE BODY FROM AIR INTAKE CHAMBER**

(a) Disconnect the following vacuum hoes:
(1) Vacuum hose from P port of EGR vacuum modu–lator
(2) Vacuum hose from R port of EGR vacuum modu–lator
(b) Remove the 2 bolts, 2 nuts, throttle body and gasket.



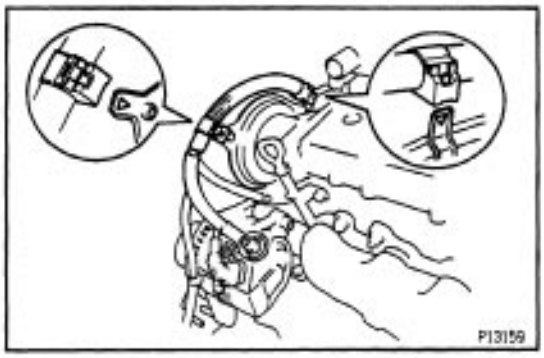

**19. REMOVE EGR VALVE AND VACUUM MODULATOR FROM AIR INTAKE CHAMBER**

Remove the 3 nuts, EGR valve, vacuum modulator and gasket.



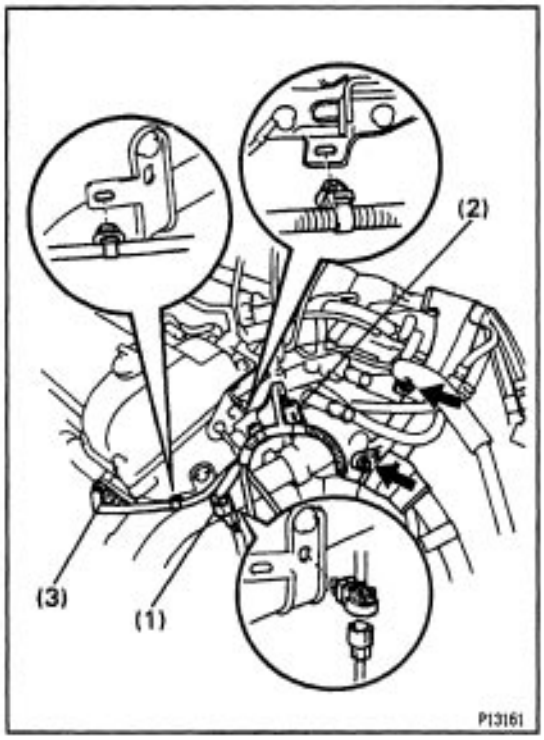

**20. DISCONNECT ENGINE WIRE FROM ENGINE LH SIDE**

(a) Disconnect the following connectors:
(1) 3 injector connectors
(2) 3 ignition coil connectors
(b) Remove the 2 nuts, and disconnect the engine wire.




**21. DISCONNECT ENGINE WIRE FROM NO.3 TIMING BELT COVER**

Disconnect the 2 clamps and engine wire.

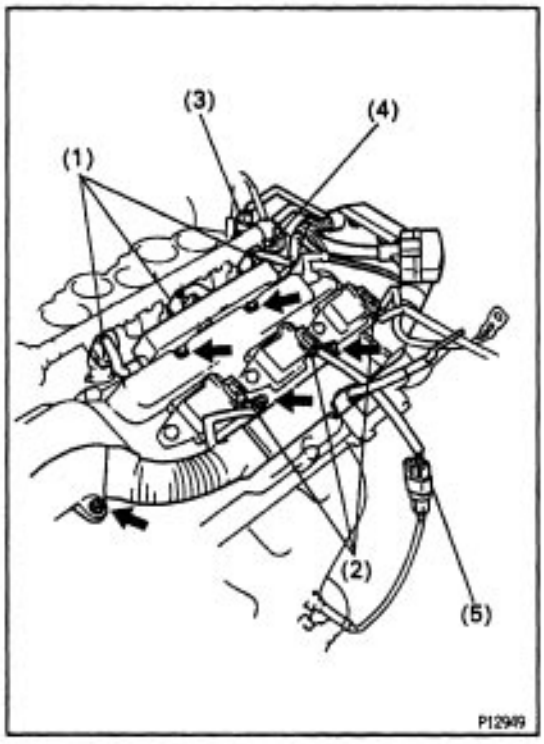



**22. DISCONNECT ENGINE WIRE FROM ENGINE REAR SIDE**

(a) Disconnect the following connectors:
- (1) LH oxygen sensor
- (2) Engine coolant temperature sensor
- (3) Camshaft position sensor

(b) Disconnect the 3 clamps.

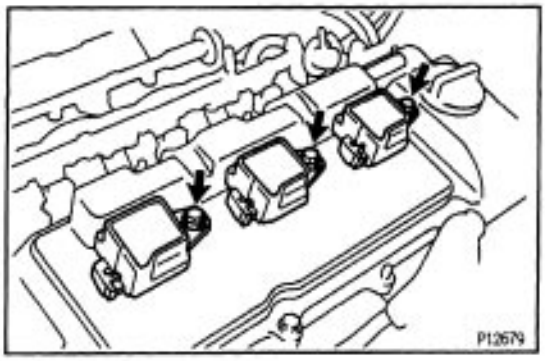
(c) Remove the 2 nuts, and disconnect the engine wire.




**23. DISCONNECT ENGINE WIRE FROM ENGINE RH SIDE**

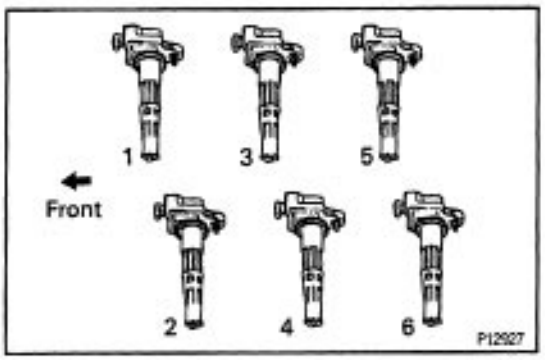
(a) Disconnect the following connectors:
- (1) 3 injector connectors
- (2) 3 ignition coil connectors
- (3) Water temperature sender gauge connector
- (4) Water temperature sensor connector
- (5) RH oxygens sensor connector

(b) Remove the 5 nuts, and disconnect the engine wire.

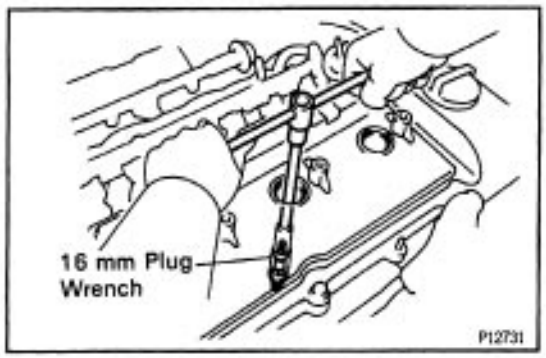



**24. REMOVE IGNITION COILS**

Remove the6 bolts and6 ignition coils from the RH and LH cylinder heads.

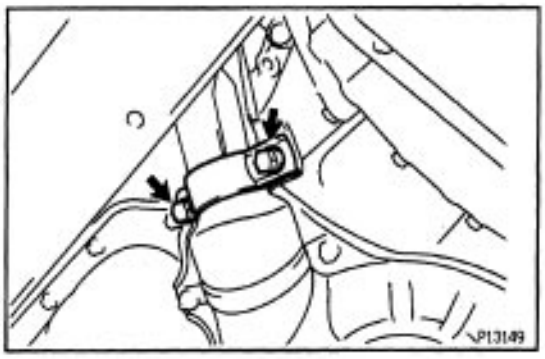



HINT: Arrange the ignition coils in the correct order.



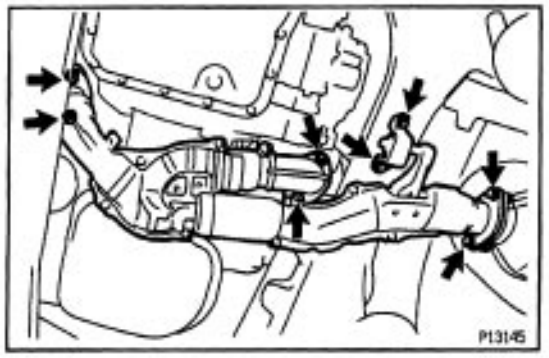

**25. REMOVE SPARK PLUGS**

Using a 16 mm plug wrench, remove the6 spark plugs from the RH and LH cylinder heads.



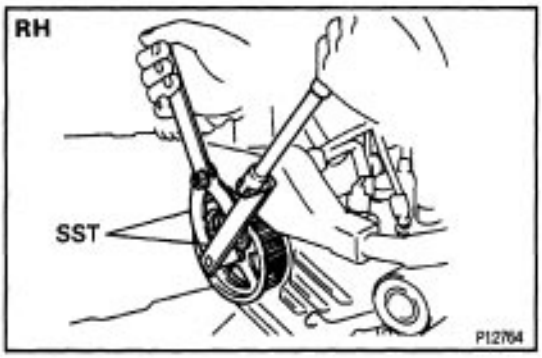

**26. REMOVE FRONT EXHAUST PIPE**

(a) Remove the 2 bolts and front exhaust pipe clamp.

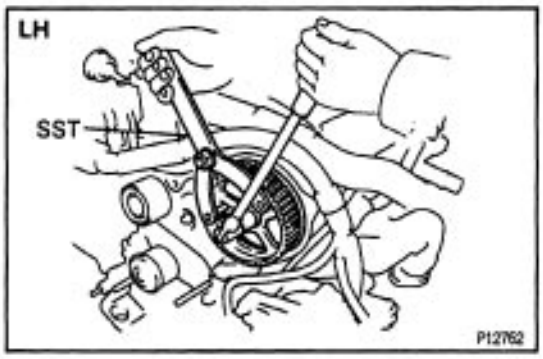



(b) Remove the 2 bolts, and disconnect the bracket.
(c) Remove the 2 bolts and 2 nuts holding the front exhaust pipe to the three–way catalytic converter.
(d) Remove the 4 nuts holding the front exhaust pipe to the exhaust manifolds.
(e) Remove the front exhaust pipe and gaskets.

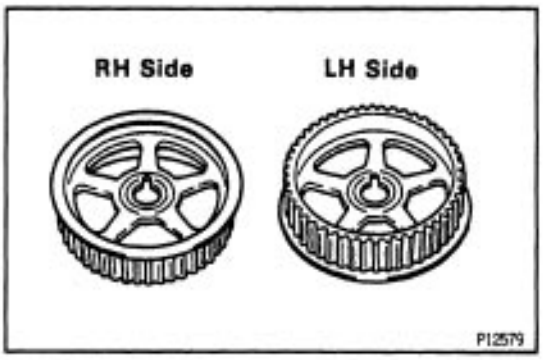
**27. REMOVE TIMING BELT**
**(See steps 2 to 20 on pages EG2–41 to 45)**



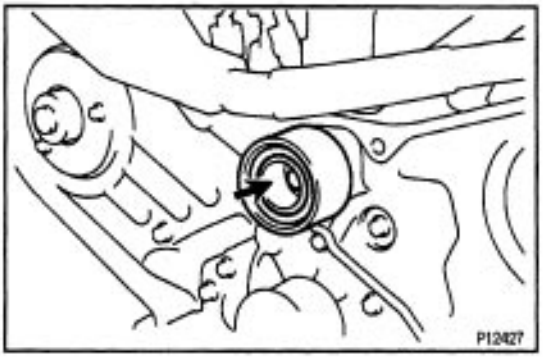

**28. REMOVE CAMSHAFT TIMING PULLEYS**
(a) Using SST, remove the bolt and RH timing pulley.
SST 09249–63010, 09960–10010 (09862–01000)



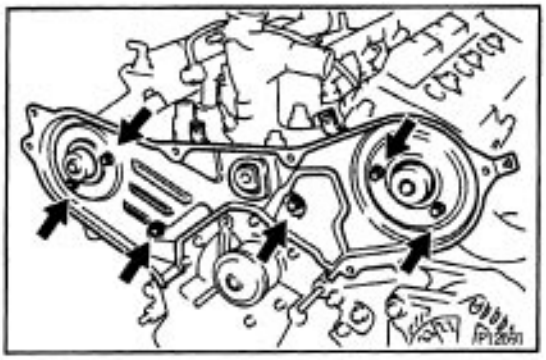

(b) Using SST, remove the LH timing pulley.
SST 09960–10010 (09962–01000)




HINT: Arrange the camshaft timing pulleys (RH and LH sides).

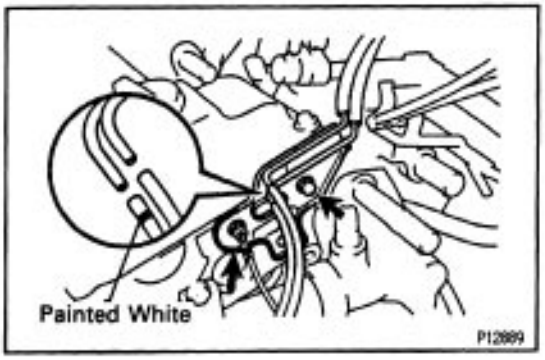



**29. REMOVE NO.2 IDLER PULLEY**
Remove the bolt and idler pulley.



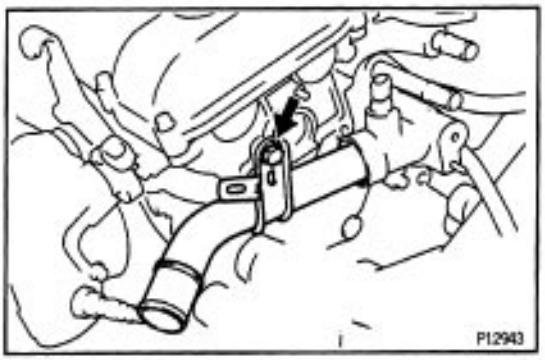
**30. REMOVE NO.3 TIMING BELT COVER**

Remove the 6 bolts and belt cover.



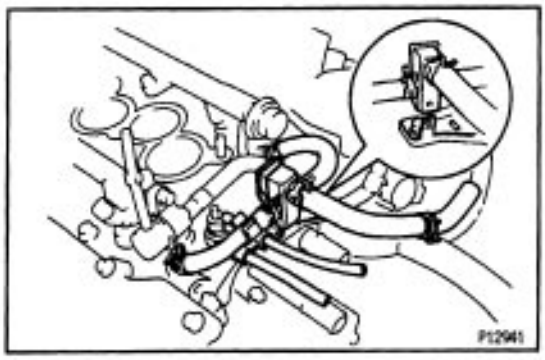

**31. REMOVE CYLINDER HEAD REAR PLATE**

(a) Disconnect the vacuum hose from the vacuum tank.
(b) Remove the nut, and disconnect the ground strap.
(c) Remove the bolt and rear plate.

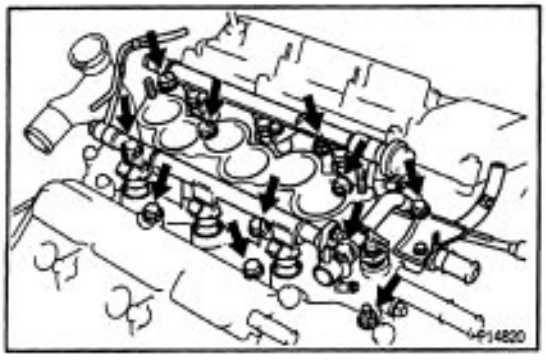



**32. REMOVE WATER INLET PIPE**

(a) Remove the bolt and inlet pipe.
(b) Remove the O–ring.

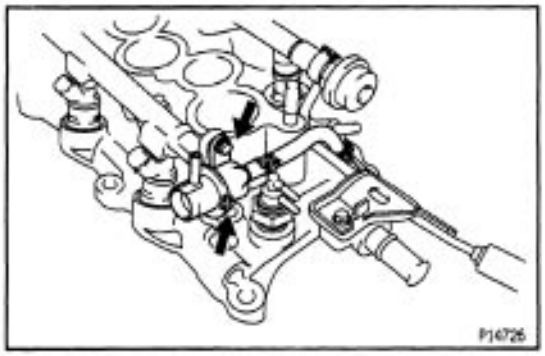



**33. REMOVE AIR ASSIST HOSE AND VACUUM HOSE**




**34. REMOVE INTAKE MANIFOLD, DELIVERY PIPES AND INJECTORS**

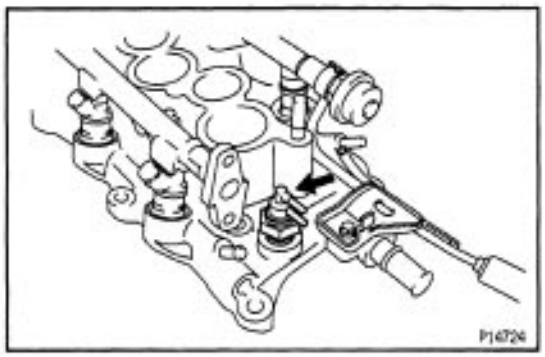
Remove the 9 bolts, 2 nuts, 2 plate washers and intake manifold together with the delivery pipes, and injectors.



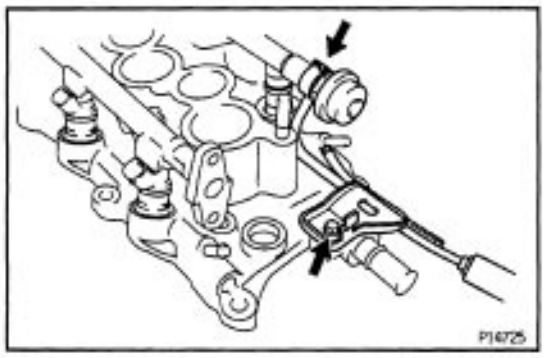

**35. REMOVE FUEL PRESSURE REGULATOR FROM LH DELIVERY PIPE**

(a) Remove the 2 bolts, and pull out the pressure regula–tor.

(b) Remove the 0–ring from the pressure regulator.

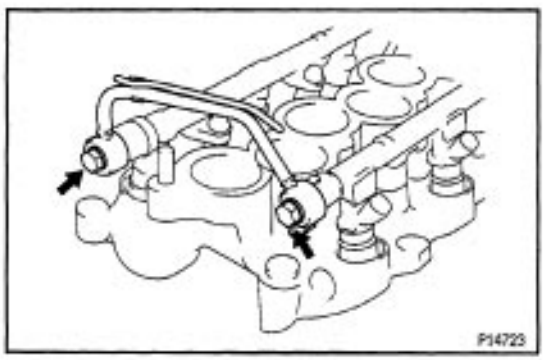



**36. REMOVE TVV FROM INTAKE MANIFOLD**



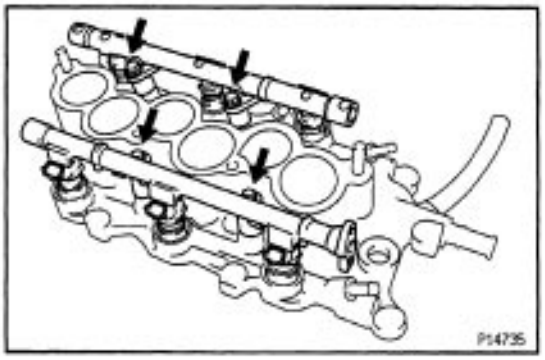

**37. REMOVE FUEL PULSATION DAMPER AND No.1 FUEL PIPE**

Remove the bolt, pulsation damper, No. 1 fuel pipe and 2 gaskets.




**38. REMOVE No.2 FUEL PIPE**

Remove the 2 union bolts, No.2 fuel pipe and 4 gas–kets.

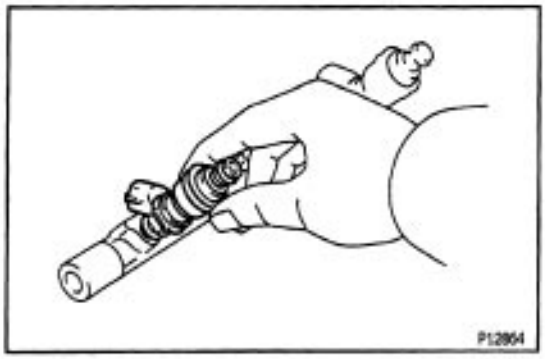



**39. REMOVE DELIVERY PIPES AND INJECTORS**

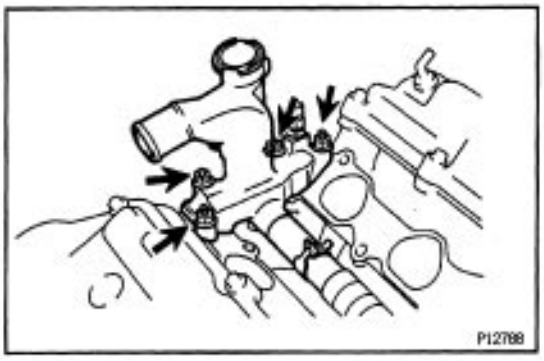
(a) Remove the 4 bolts, delivery pipes together with the 6 injectors.

**NOTICE: Be careful not to drop the injectors when rem–oving the delivery pipes.**

(b) Remove the 4 spacers from the intake manifold.

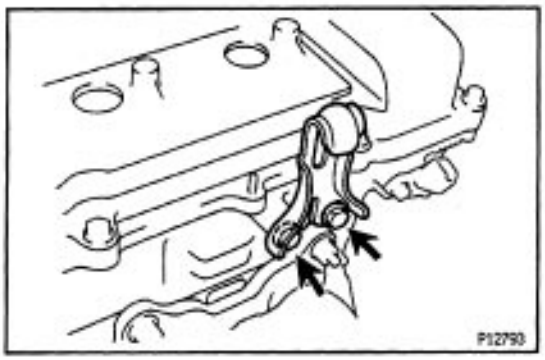



(c) Pull out the 6 injectors from the delivery pipes.
Remove the 0–ring and grommet from each injector.



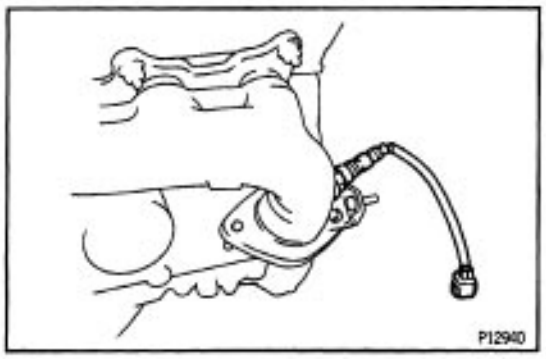

**40. REMOVE WATER OUTLET**

(a) Remove the 2 bolts, 2 nuts and 2 plate washers.
(b) Disconnect the water bypass hose and remove the water outlet.
(c) Remove the 2 intake manifold gaskets.



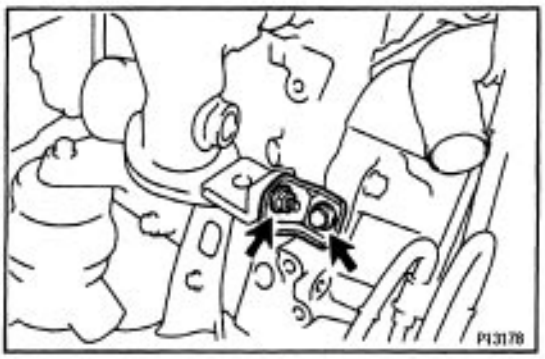

**41. REMOVE No.2 ENGINE HANGER**

Remove the 2 bolts and engine hanger.

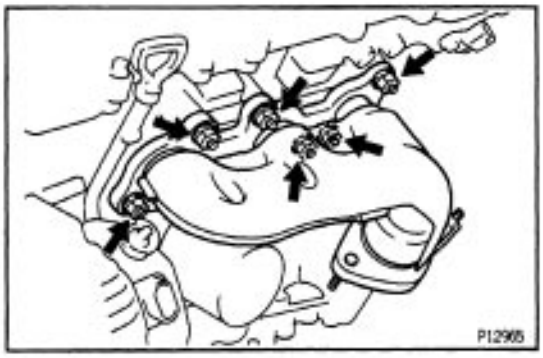



**42. REMOVE LH EXHAUST MANIFOLD**

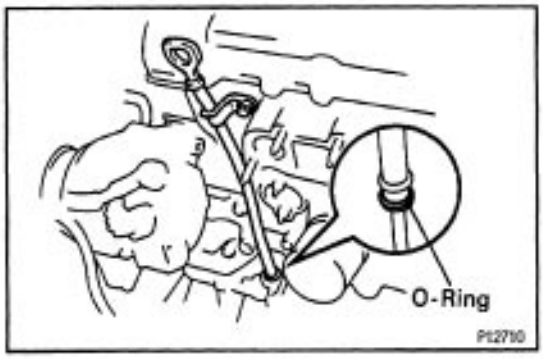
(a) Remove the main heated oxygen sensor (Bank 2 Sensor 1).




(b) Remove the bolt, nut and exhaust manifold stay.

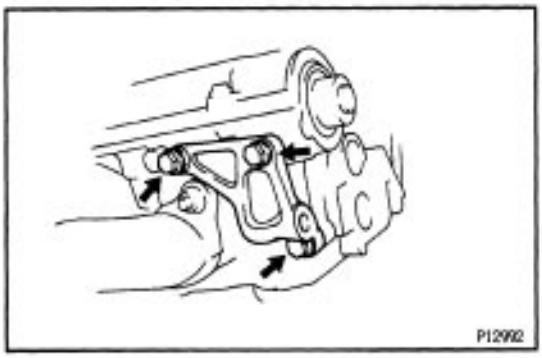



(c) Remove the 6 nuts, exhaust manifold and gasket.



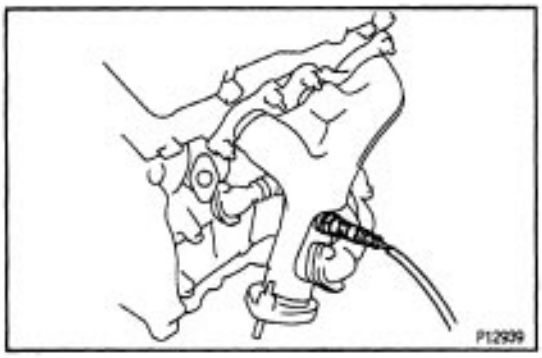

**43. REMOVE OIL DIPSTICK AND GUIDE**

(a) Remove the bolt holding the dipstick guide to the LH cylinder head.
(b) Pull out the dipstick guide together with the dipstick from the No.1 oil pan.
(c) Remove 0–ring from the dipstick guide.



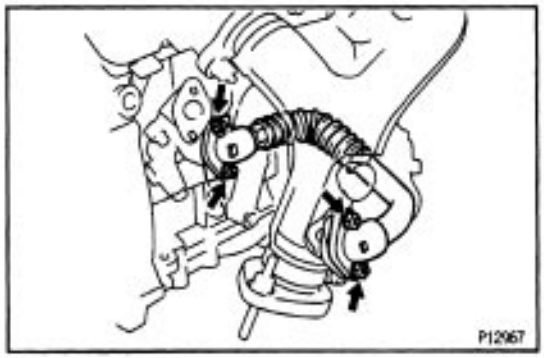

**44. REMOVE PS BRACKET**

Remove the 3 bolts and PS bracket.

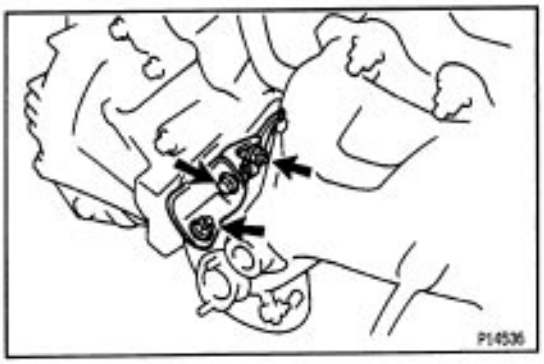



**45. REMOVE RH EXHAUST MANIFOLD**

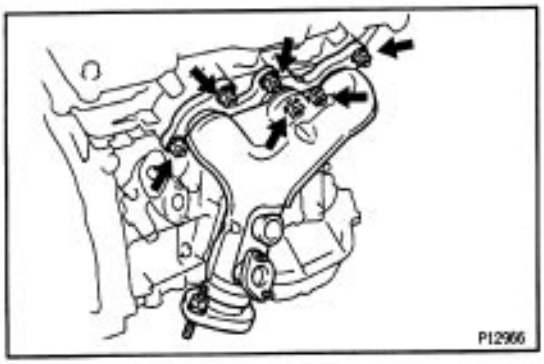
(a) Remove the main heated oxygen sensor (Bank 1 Sensor 1).



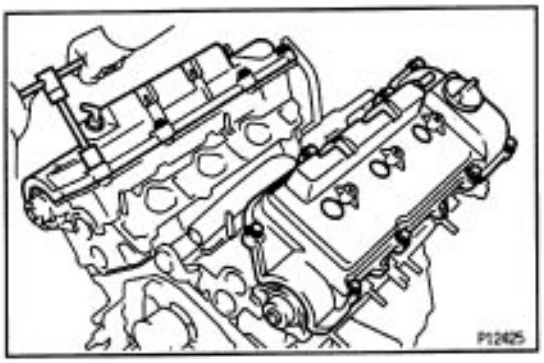

(b) Remove the 4 nuts, EGR pipe and 2 gaskets.




(c) Remove the bolts, 2 nuts, exhaust manifold stay and exhaust manifold plate.

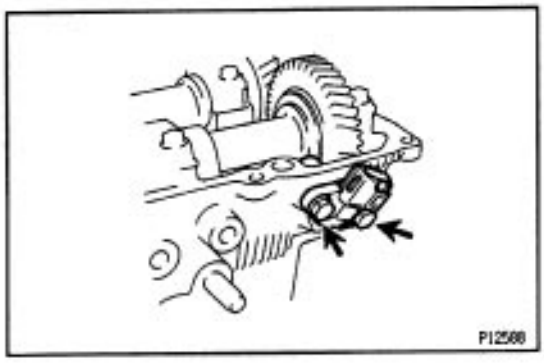



(d) Remove the 6 nuts, exhaust manifold and gasket.




**46. REMOVE CYLINDER HEAD COVERS**

Remove the 8 bolts, cylinder head cover and gasket.
Remove the 2 cylinder head covers.

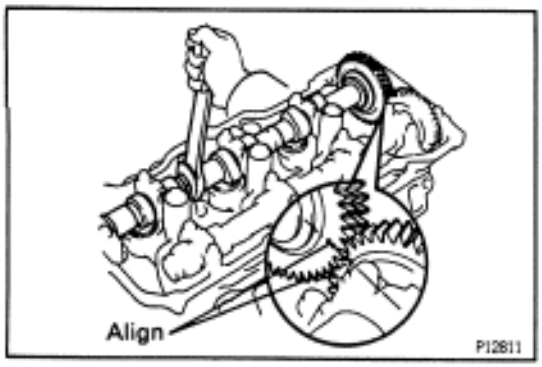



**47. REMOVE CAMSHAFT POSITION SENSOR**

(a) Remove the bolt and position sensor.
(b) Remove the gasket from the position sensor.

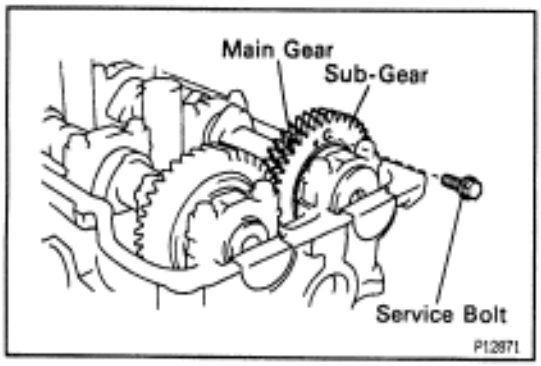
**48. REMOVE CAMSHAFTS**

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




**A. Remove intake camshaft of RH cylinder head**

(a) Align the timing marks (2 dot marks) of the camshaft drive and driven gears by turning the camshaft with a wrench.

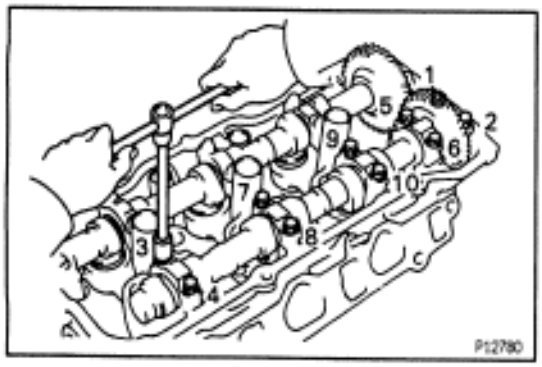



(b) Secure the exhaust camshaft sub–gear to the main gear with a service bolt.

**Recommended service bolt:**

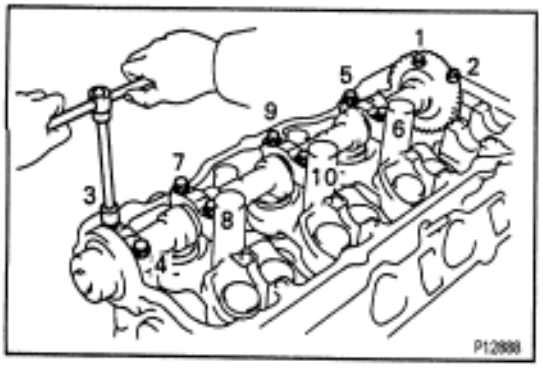
**Thread diameter 6 mm**
**Thread pitch 1.0 mm**
**Bolt length 16–20 mm**

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




(c) Uniformly loosen and remove the 10 bearing cap bolts, in several passes, in the sequence shown.

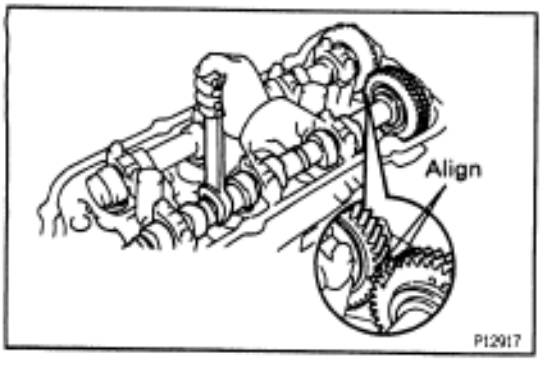
(d) Remove the 5 bearing caps and intake camshaft.




**B. Remove exhaust camshaft of RH cylinder head**

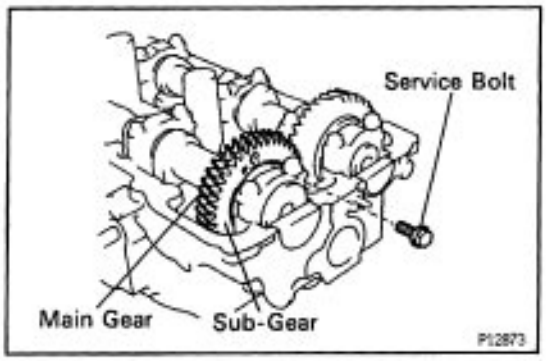
(a) Uniformly loosen and remove the 10 bearing cap bolts, in several passes, in the sequence shown.

(b) Remove the 5 bearing caps, oil seal and exhaust cam–shaft.




**C. Remove intake camshaft of LH cylinder head**

(a) Align the timing marks (11 dot mark) of the camshaft drive and driven gears by turning the camshaft with a wrench.

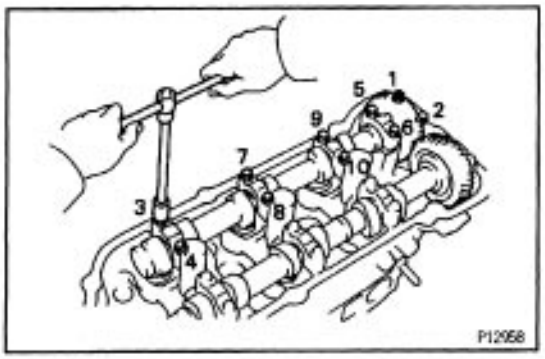



(b) Secure the exhaust camshaft sub–gear to the main gear with a service bolt.

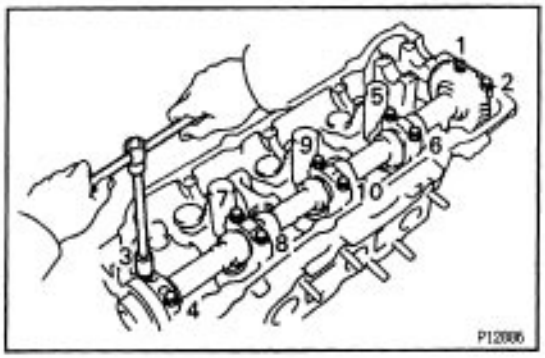
**Recommended service bolt:**

**Thread diameter 6 mm**
**Thread pitch 1.0 mm**
**Bolt length 16–20 mm**

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

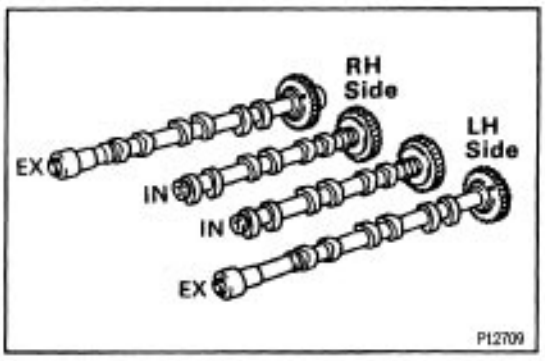



(c) Uniformly loosen and remove the 10 bearing cap bolts, in several passes, in the sequence shown.
(d) Remove the 5 bearing caps and intake camshaft.



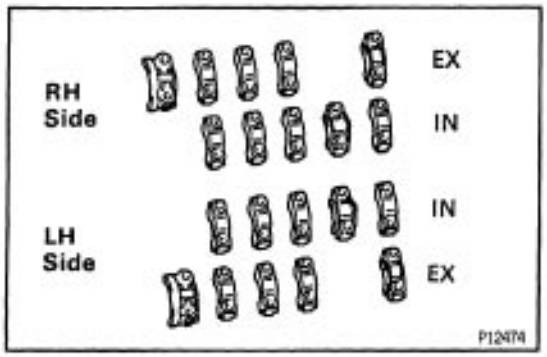

**D. Remove exhaust camshaft of LH cylinder head**

(a) Uniformly loosen and remove the 10 bearing cap bolts, in several passes, in the sequence shown.
(b) Remove the 5 bearing caps, oil seal and exhaust cam–shaft.

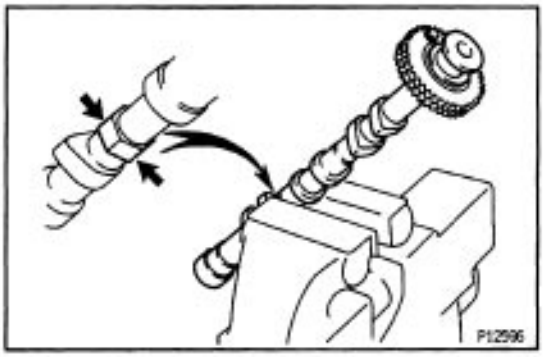



HINT:

- Arrange the camshafts in the correct order.



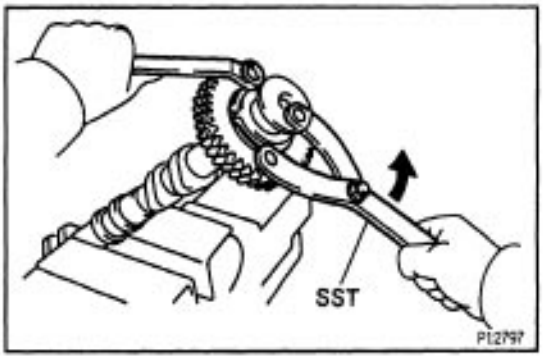

- Arrange the bearing caps in the correct order.




**49. DISASSEMBLE EXHAUST CAMSHAFTS**

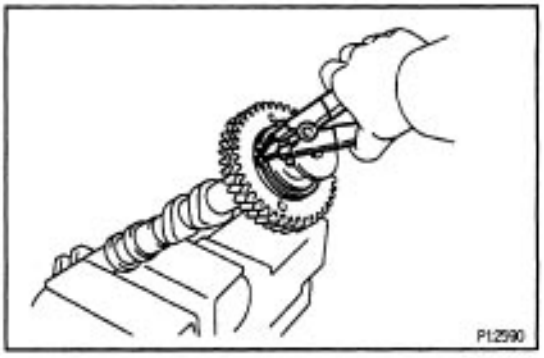
(a) Mount the hexagonal wrench head portion of the camshaft in a vise.

**NOTICE: Be careful not to damage the camshaft.**

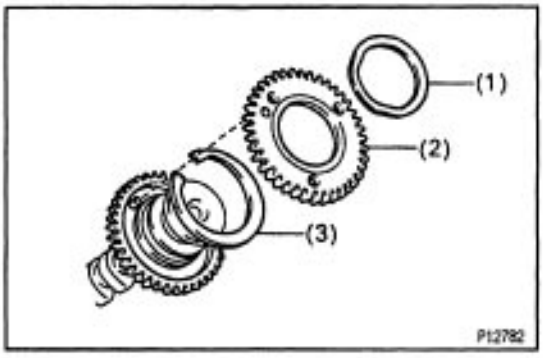



(b) Using SST, turn the sub–gear counterclockwise, and remove the service bolt.

SST 09960–10010 (09962–0100)

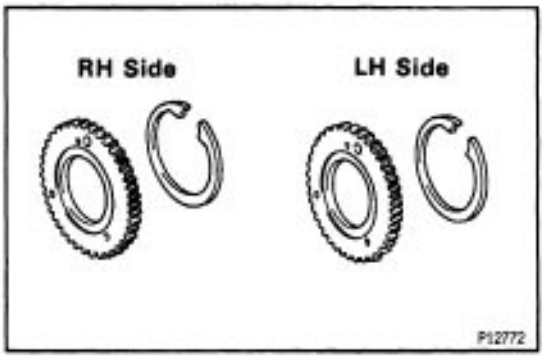



(c) Using snap ring pliers, remove the snap ring.

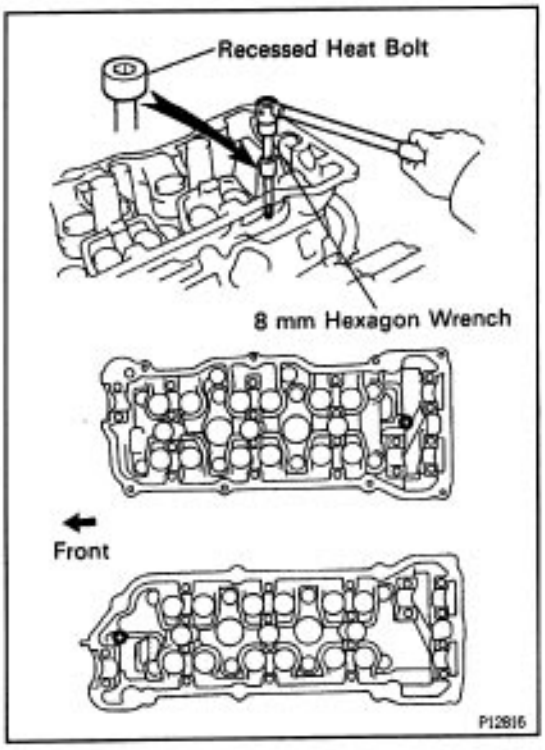



(d) Remove the following parts:

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

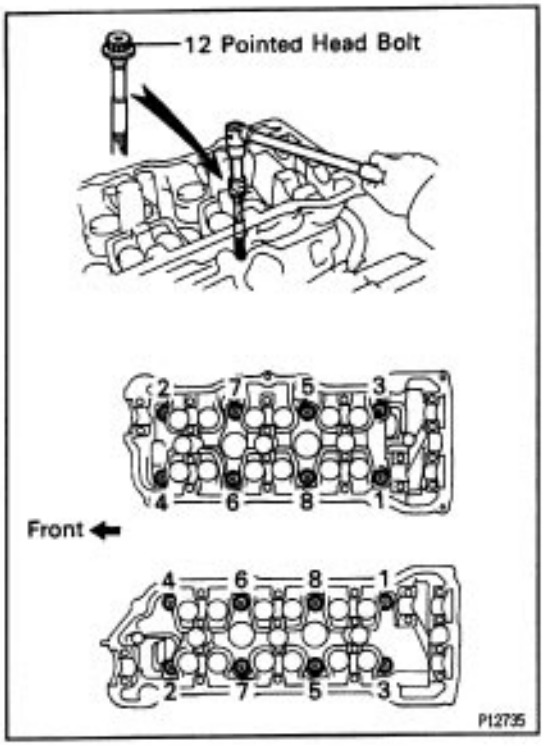



HINT: Arrange the camshaft sub–gears and gear springs (RH and LH sides).




**50. REMOVE CYLINDER HEADS**

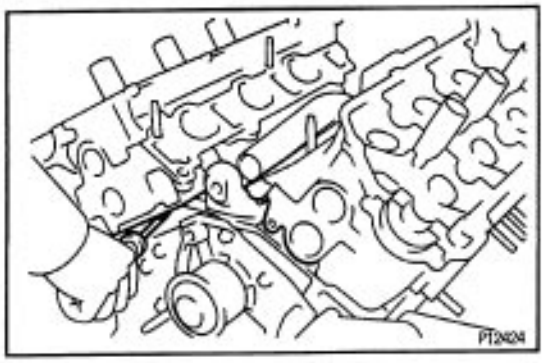
(a) Using a 8 mm hexagon wrench, remove the cylinder head (recessed head) bolt on each cylinder head, then repeat for the other side, as shown.




(b) Uniformly loosen and remove the 8 cylinder head (12 pointed head) bolts on each cylinder head, in several passes, in the sequence shown, then repeat for the other side, as shown.

Remove the 16 cylinder head bolts and plate washers.

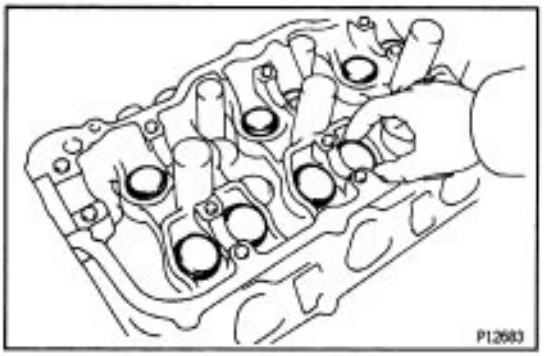
**NOTICE: Head warpage or cracking could result from removing bolts in an incorrect order.**




(c) Lift the cylinder head from the dowels on the cylinder block and place the 2 cylinder heads on wooden blocks on a bench.

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

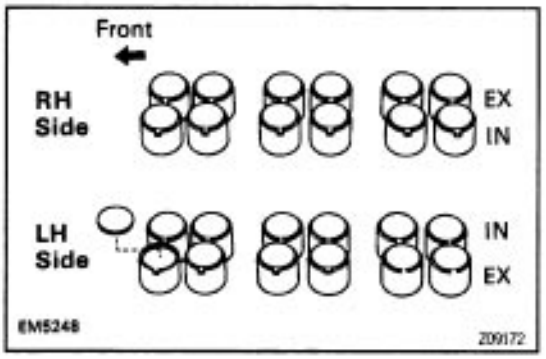
**NOTICE: Be careful not to damage the contact surfaces of the cylinder head and cylinder block.**



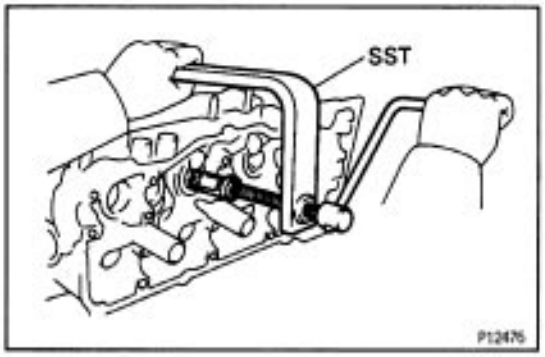

# CYLINDER HEAD DISASSEMBLY

**(See Components for Removal and Installation)**

**1. REMOVE VALVE LIFTERS AND SHIMS**

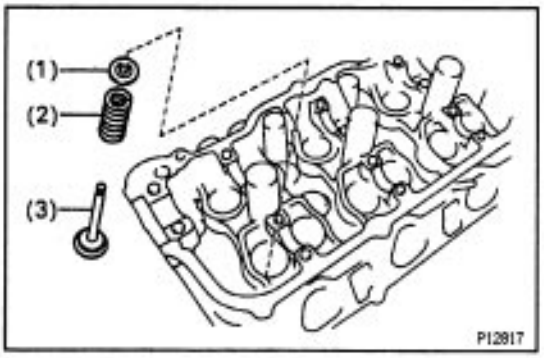



HINT: Arrange the valve lifters and shims in the cor–rect order.

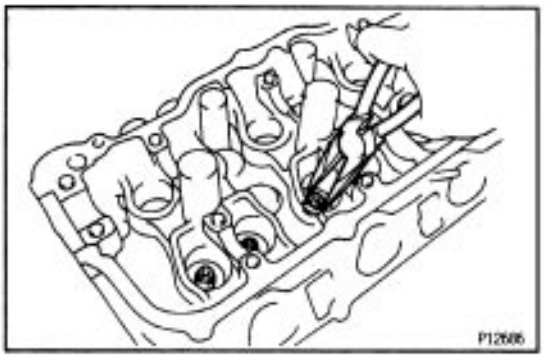



**2. REMOVE VALVES**

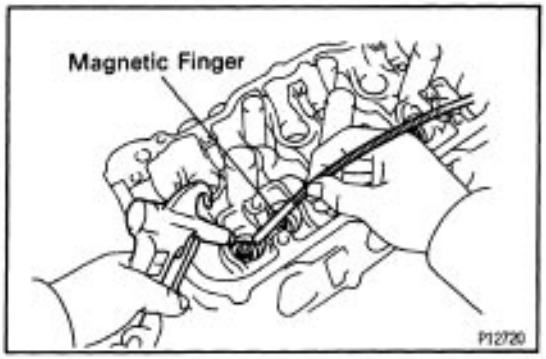
(a) Using SST, compress the valve spring and remove the 2 keepers.
SST 09202 – 70010



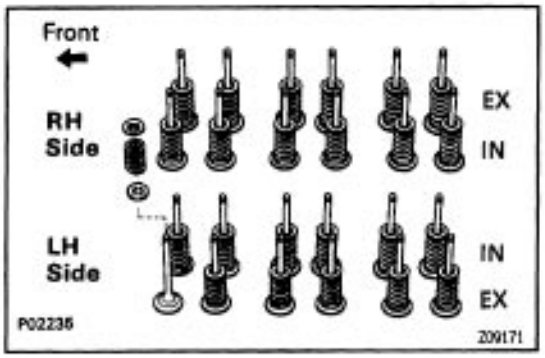

(b) Remove the following parts:
(1) Spring retainer
(2) Valve spring
(3) Valve



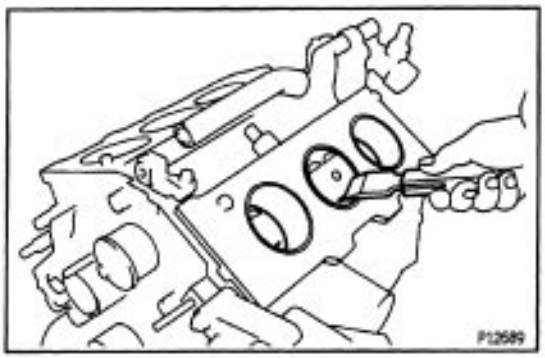

(c) Using needle–nose pliers, remove the oil seal.




(d) Using compressed air and a magnetic finger, remove the spring seat by blowing air.



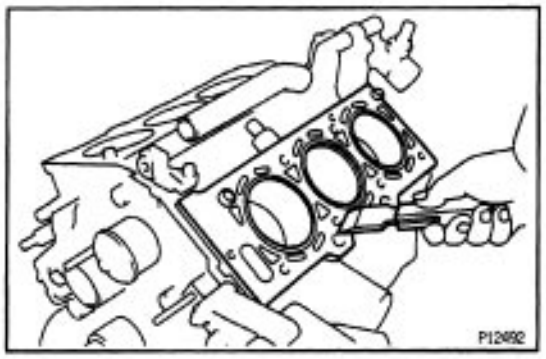

HINT: Arrange the valves, valve springs, spring seats and spring retainers in the correct order.




## CYLINDER HEAD COMPONENTS INSPECTION AND REPAIR

### 1. CLEAN TOP SURFACES OF PISTONS AND CYLINDER BLOCK

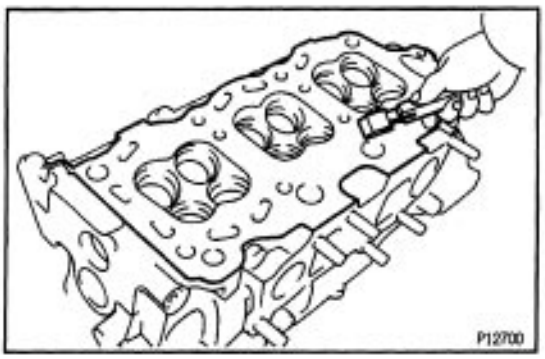
(a) Turn the crankshaft, and bring each piston to top dead center (TDC). Using a gasket scraper, remove all the carbon from the piston top surface.




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

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

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

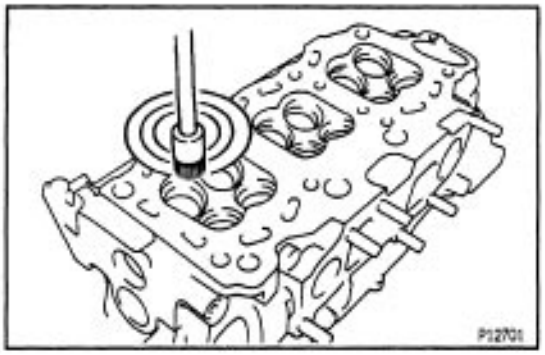



### 2. CLEAN CYLINDER HEAD

**A. Remove gasket material**

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

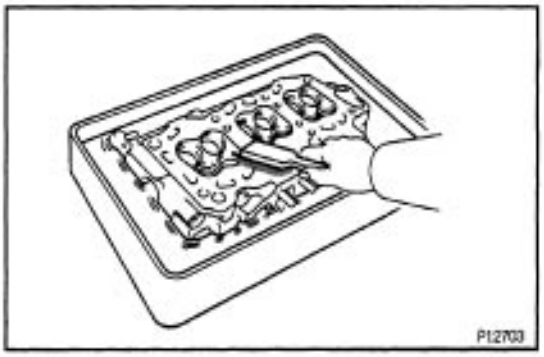
**NOTICE: Be careful not to scratch the cylinder block contact surface.**




**B. Clean combustion chambers**

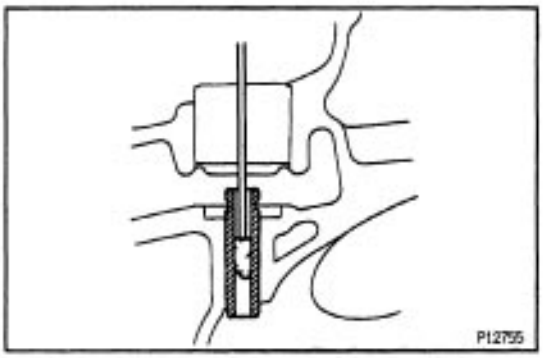
Using a wire brush, remove all the carbon from the combustion chambers.

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



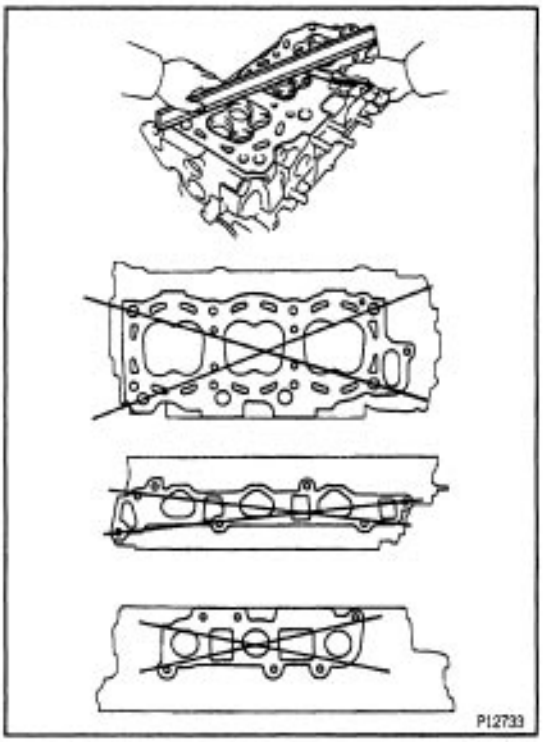

**C. Clean cylinder head**

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




**D. Clean valve guide bushings**

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




**3. INSPECT CYLINDER HEAD**

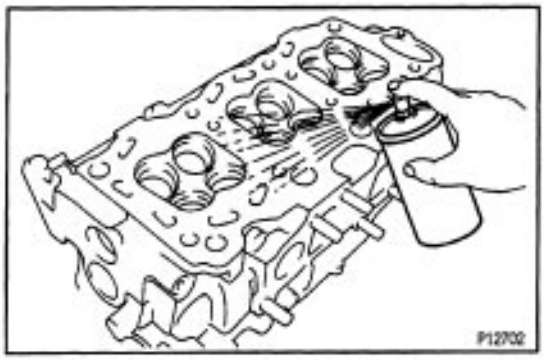
**A. Inspect for flatness**

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

**Maximum warpage:**

**0.10 mm (0.0039 in.)**

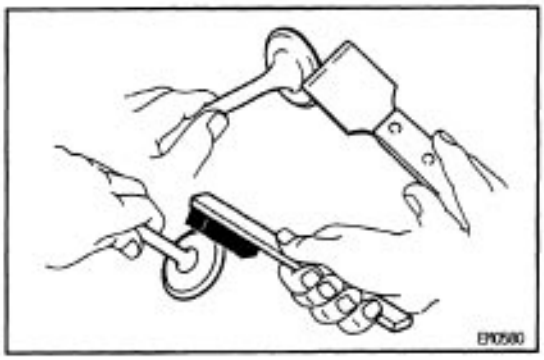
If warpage is greater than maximum, replace the cylinder head.




**B. Inspect for cracks**

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

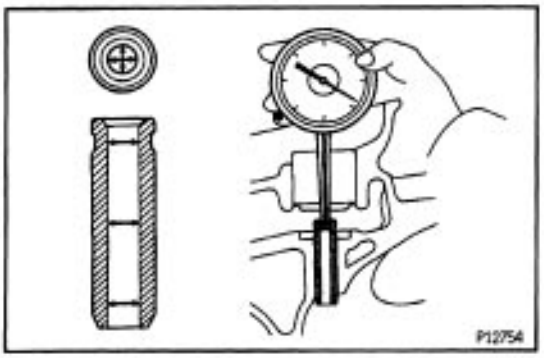
If cracked, replace the cylinder head.




**4. CLEAN VALVES**

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

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

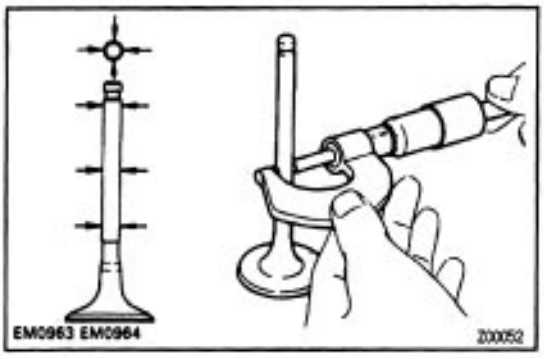



**5. INSPECT VALVE STEMS AND GUIDE BUSHINGS**

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

**Bushing inside diameter:**

**5.510 – 5.530 mm (0.2169 – 0.2177 in.)**




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

**Valve stem diameter:**

**Intake**

**5.470 – 5.485 mm (0.2154 – 0.2159 in.)**

**Exhaust**

**5.465 – 5.480 mm (0.2152 – 0.2157 in.)**

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

Standard oil clearance:

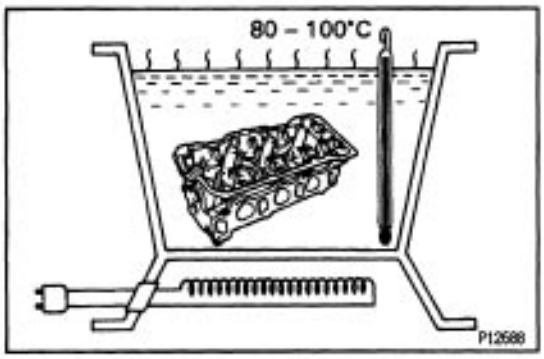
**Intake**

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

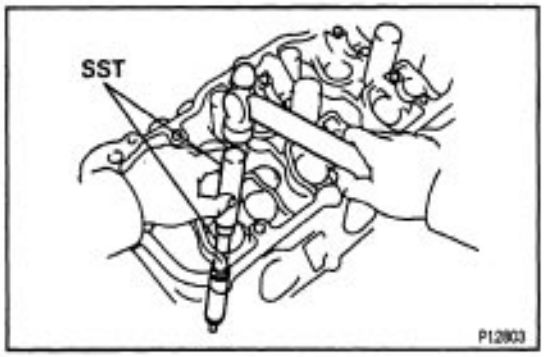
**Exhaust**

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

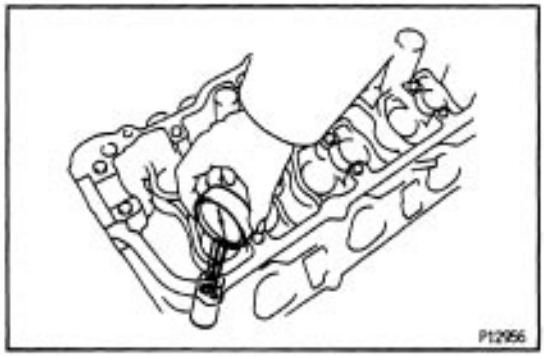
**Maximum oil clearance:**
**Intake**
**0.08 mm (0.0031 in.)**
**Exhaust**
**0.10 mm (0.0039 in.)**
If the clearance is greater than maximum, replace the valve and guide bushing.




**6. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS**
(a) Gradually heat the cylinder head to 80 – $100_2$ C (176 – $212_2$ F).




(b) Using SST and a hammer, tap out the guide bushing.
SST 09201– 01055, 09608–20012 (09608–03020)



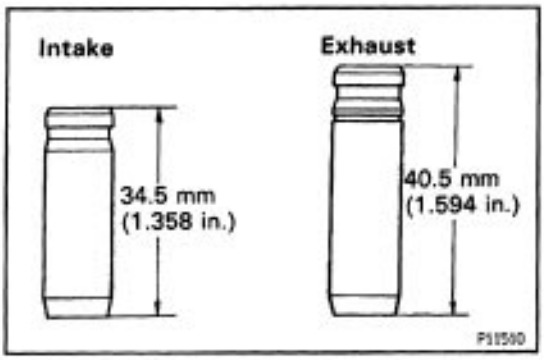

(c) Using a caliper gauge, measure the bushing bore di–ameter of the cylinder head.

Both intake and exhaust

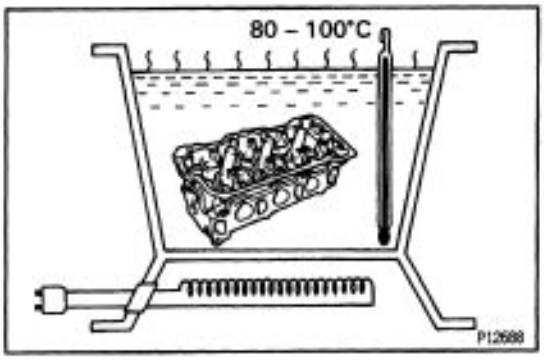
| Bushing bore diameter mm (in.) | Bushing size |
|---|---|
| 10.295 –10.313 (0.4053 – 0.4060) | Use STD |
| 10.345 – 10.363 (0.4073 – 0.4080) | Use O/S 0.05 |

V04650

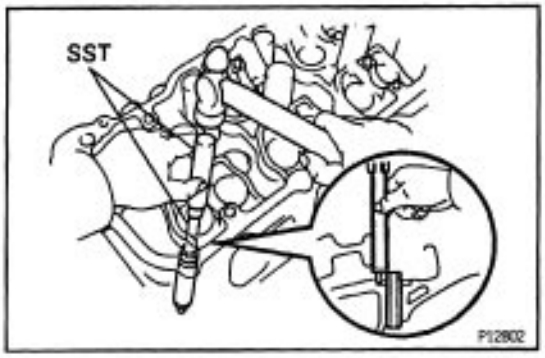
(d) Select a new guide bushing (STD or O/S 0.05).
If the bushing bore diameter of the cylinder head is greater than 10.313 mm (0.4060 in.), machine the bushing bore to the following dimension:
**10.345 – 10.363 mm (0.4073 – 0.4080 in.)**
If the bushing bore diameter of the cylinder head is greater than 10.363 mm (0.4080 in.), replace the cylinder head.



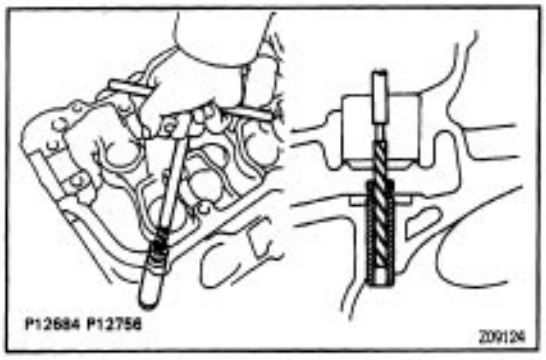

HINT: Different bushings are used for the intake and exhaust.



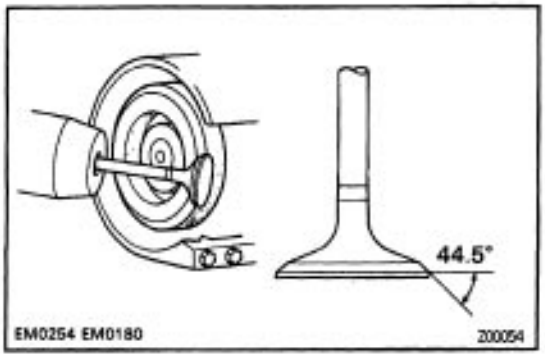

(e) Gradually heat the cylinder head to 80 – $100_2$C (176 – $212_2$F).



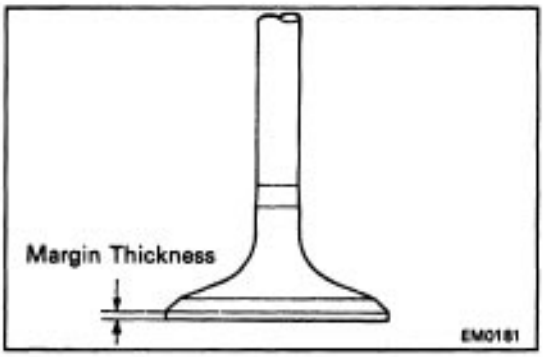

(f) Using SST and a hammer, tap in a new guide bushing to the specified protrusion height.
SST 09201– 01055, 09608–20012 (09608–03020)
**Protrusion height:**
**Intake**
**11.1 – 11.3 mm (0.437 – 0.445 in.)**
**Exhaust**
**8.9 – 9.3 mm (0.350 – 0.366 in.)**



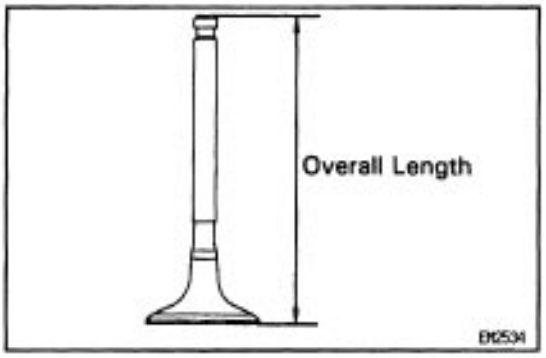

(h) Using a sharp 5.5 mm reamer, ream the guide bushing to obtain the standard specified clearance (See step 5 above) between the guide bushing and valve stem.




**7. INSPECT AND GRIND VALVES**
(a) Grind the valve enough to remove pits and carbon.
(b) Check that the valve is ground to the correct valve face angle.
**Valve face angle:**
**$44.5_2$**

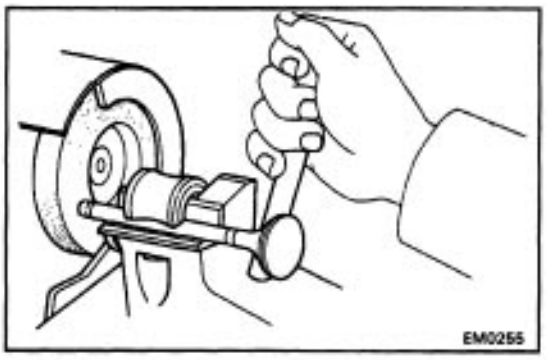



(c) Check the valve head margin thickness.
**Standard margin thickness:**
**1.0 mm (0.039 in.)**
**Minimum margin thickness:**
**0.5 mm (0.020 in.)**
If the margin thickness is less than minimum, replace the valve.

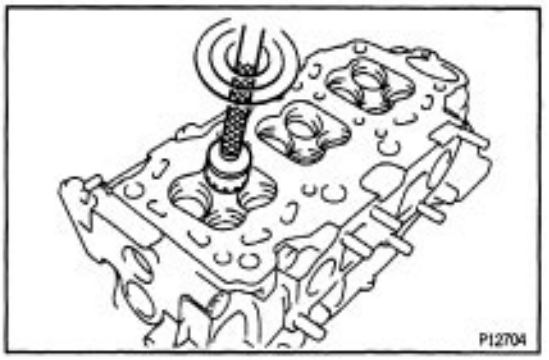



(d) Check the valve overall length.
**Standard overall length:**
**Intake**
**95.45 mm (3.5779 in.)**
**Exhaust**
**95.40 mm (3.7559 in.)**
**Minimum overall length:**
**Intake**
**94.95 mm (3.7382 in.)**
**Exhaust**
**94.90 mm (3.7362 in.)**
If the overall length is less than minimum, replace the valve.

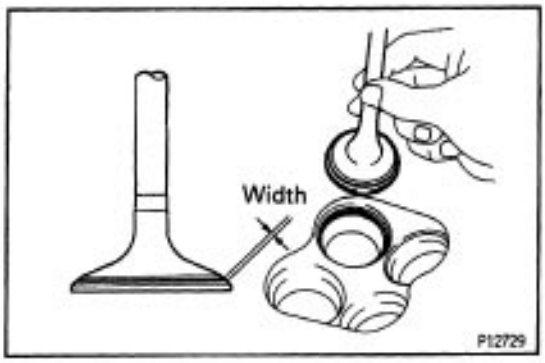





(e) Check the surface of the valve stem tip for wear.
If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.
**NOTICE: Do not grind off more than minimum.**




**8. INSPECT AND CLEAN VALVE SEATS**
(a) Using a $45_2$ carbide cutter, resurface the valve seats. Remove only enough metal to clean the seats.

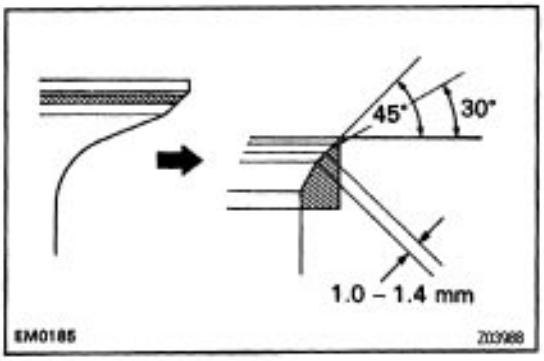



(b) Check the valve seating position.
Apply a light coat of prussian blue (or white lead) to the valve face. Lightly press the valve against the seat. Do not rotate valve.
(c) Check the valve face and seat for the following:

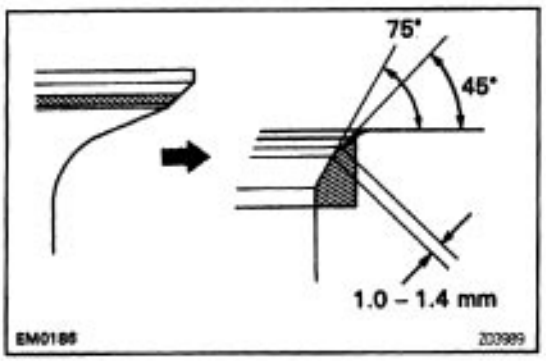
- If blue appears $360_2$ around the face, the valve is concentric. If not, replace the valve.
- If blue appears $360_2$ around the valve seat, the guide and face are concentric. If not, resurface the seat.
- Check that the seat contact is in the middle of the valve face with the following width:
  **1.0 – 1.4 mm (0.039 – 0.055 In.)**

If not, correct the valve seats as follows:

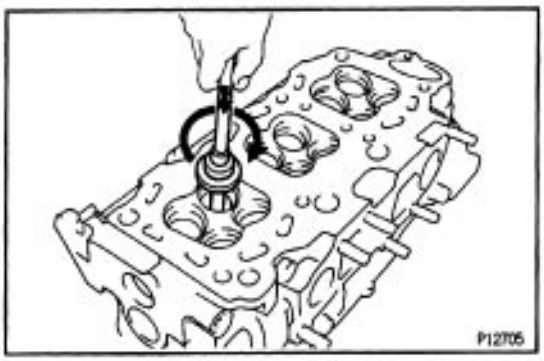
(1) If the seating is too high on the valve face, use $30_2$ and $45_2$ cutters to correct the seat.



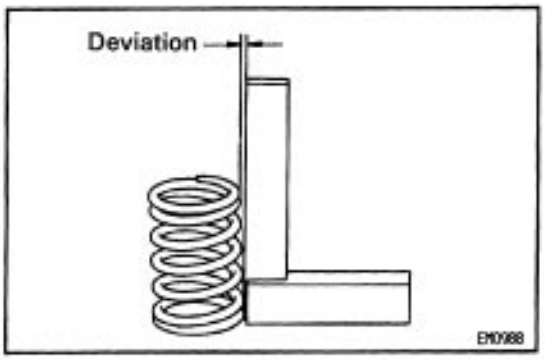

(2) If the seating is too low on the valve face, use $75_2$ and $45_2$ cutters to correct the seat.

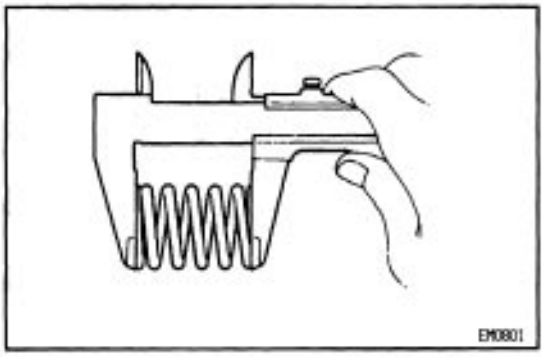



(d) Hand–lap the valve and valve seat with an abrasive compound.
(e) After hand–lapping, clean the valve and valve seat.




**9. INSPECT VALVE SPRINGS**
(a) Using a steel square, measure the deviation of the valve spring.
**Maximum deviation:**
**2.0 mm (0.079 in.)**
If the deviation is greater than maximum, replace the valve spring.



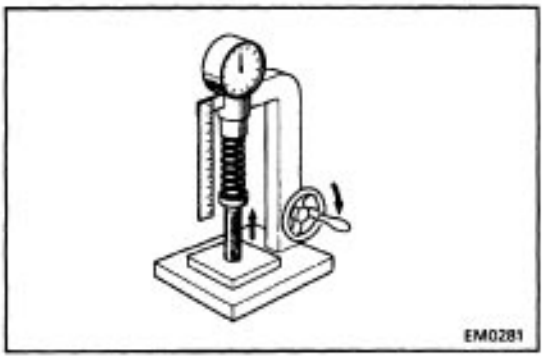



(b) Using a vernier caliper, measure the free length of the valve spring.

**Free length:**

**45.50 mm (1.7913 in.)**

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

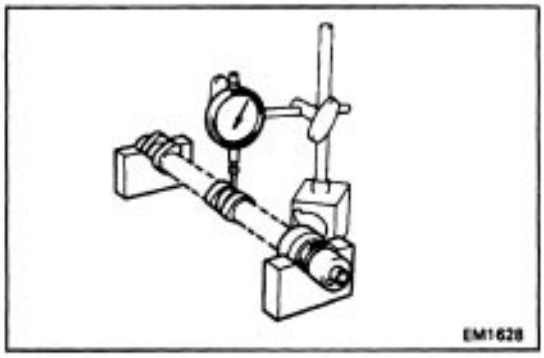



(c) Using a spring tester, measure the tension of the valve spring at the specified installed length.

**Installed tension:**

**186 – 206 N (19.0 – 21.0 kgf, 41.9 – 46.3 lbf)**
**at 33.8 mm (1.331 in.)**

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




**10. INSPECT CAMSHAFTS AND BEARINGS**

**A. Inspect camshaft for runout**

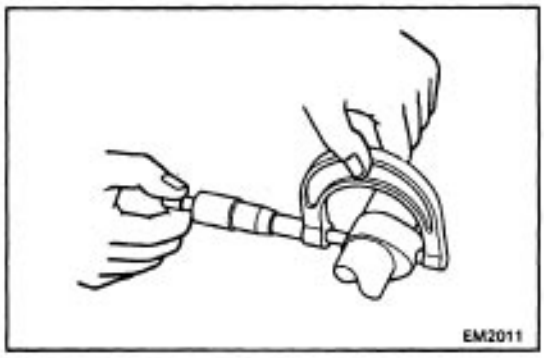
(a) Place the camshaft on V – blocks.

(b) Using a dial indicator, measure the circle runout at the center journal.

**Maximum circle runout:**

**0.06 mm (0.0024 in.)**

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




**B. Inspect cam lobes**

Using a micrometer, measure the cam lobe height.

**Standard cam lobe height:**

**Intake**

**42.11 – 42.21 mm (1.6579 – 1.6618 in.)**

**Exhaust**

**41.96 – 42.06 mm (1.6520 – 1.6559 in.)**

**Minimum cam lobe height:**

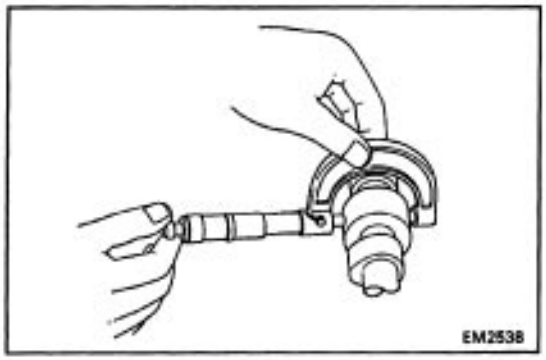
**Intake**

**41.96 mm (1.6520 in.)**

**Exhaust**

**41.81 mm (1.6461 in.)**

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



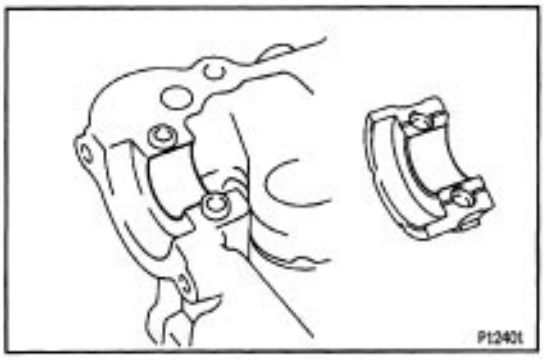

**C. Inspect camshaft journals**

Using a micrometer, measure the journal diameter.

**Journal diameter:**

**26.949 – 26.965 mm (1.0610 – 1.061 6 in.)**

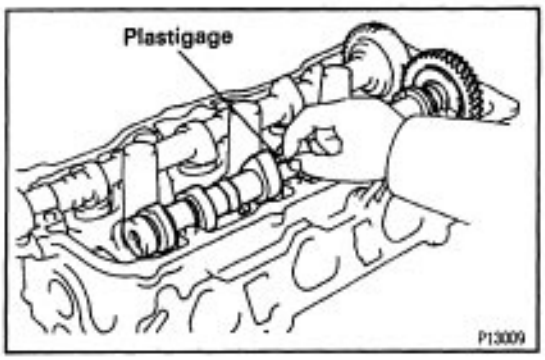
If the journal diameter is not as specified, check the oil clearance.




**D. Inspect camshaft bearings**

Check that bearings for flaking and scoring.

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

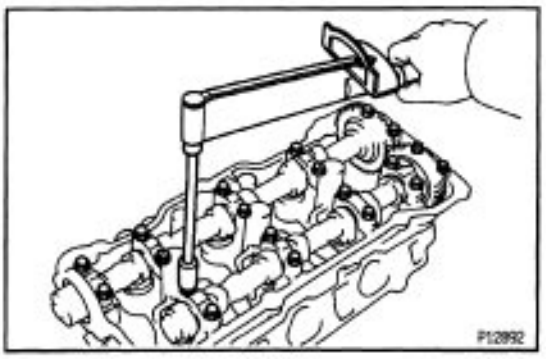



**E. Inspect camshaft journal oil clearance**

(a) Clean the bearing caps and camshaft journals.

(b) Place the camshafts on the cylinder head.

(c) Lay a strip of Plastigage across each of the camshaft journals.

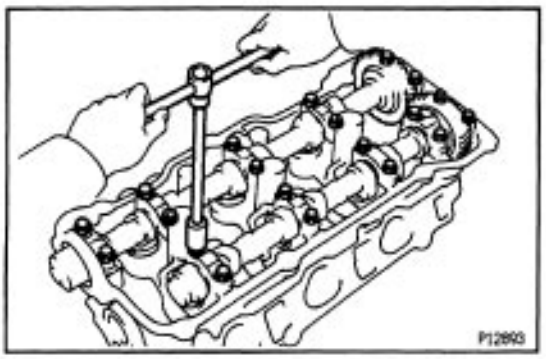



(d) Install the bearing caps.

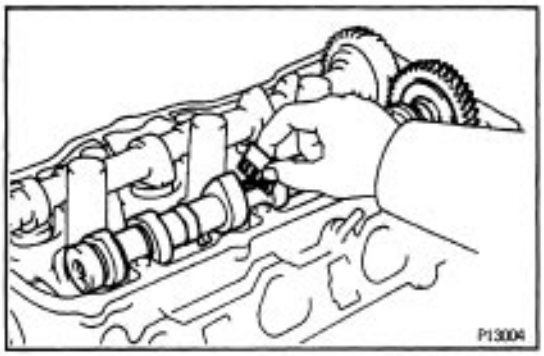
(See step 3 on pages EG2–98 to 102)

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

**NOTICE: Do not turn the camshaft.**




(e) Remove the bearing caps.




(f) Measure the Plastigage at its widest point.

**Standard oil clearance:**

**0.035 – 0.072 mm (0.0014 – 0.0028 in.)**

**Maximum oil clearance:**

**0.10 mm (0.0039 fn.)**

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

(g) Completely remove the Plastigage.

(h) Remove the camshafts.

**F. Inspect camshaft thrust clearance**

(a) Install the camshafts.

(See step 3 on pages EG2–98 to 102)

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

**Standard thrust clearance:**

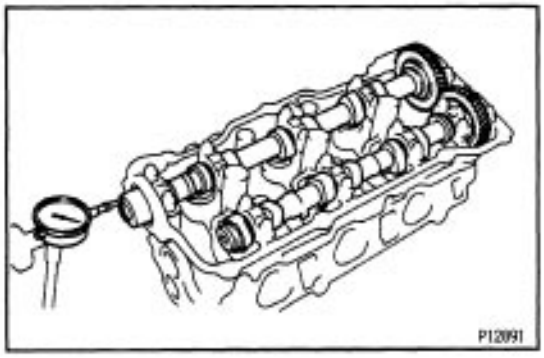
**0.040 – 0.090 mm (0.0016 – 0.0035 in.)**

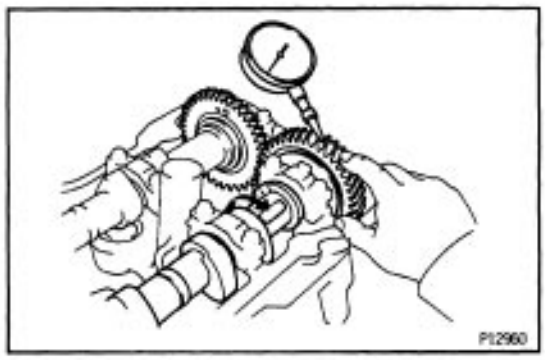
**Maximum thrust clearance:**

**0.12 mm (0.0047 in.)**

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

(c) Remove the camshafts.




**G. Inspect camshaft gear backlash**

(a) Install the camshafts without installing the exhaust cam sub–gear.

(See step 3 on pages EG2–98 to 102)

(b) Using a dial indicator, measure the backlash.

**Standard backlash:**

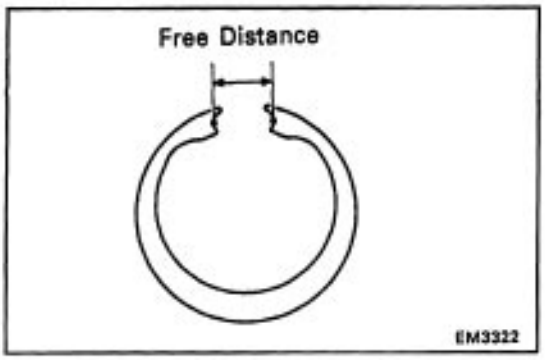
**0.020 – 0.200 mm (0.0008 – 0.0079 In.)**

**Maximum backlash:**

**0.30 mm (0.0188 in.)**

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

(c) Remove the camshafts.



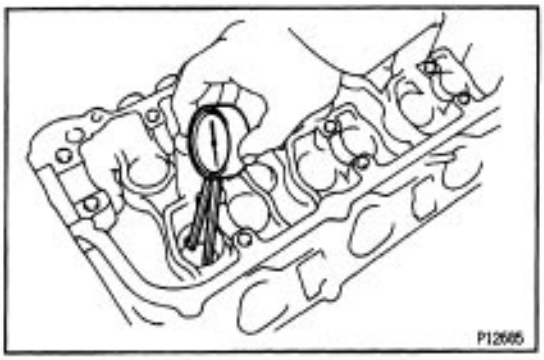

**H. Inspect camshaft gear spring**

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

**Free distance:**

**18.2 – 18.8 mm (0.712 – 0.740 in.)**

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

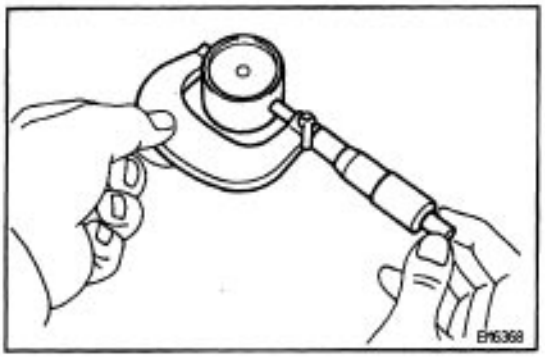



**11. INSPECT VALVE LIFTERS AND LIFTER BORES**

(a) Using a caliper gauge, measure the lifter bore diame–ter of the cylinder head.

**Lifter bore diameter:**

**31.000 – 31.018 mm (1.2205 – 1.2212 in.)**




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

**Lifter diameter:**

**30.966 – 30.976 mm (1.2191 – 1.2196 in.)**

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

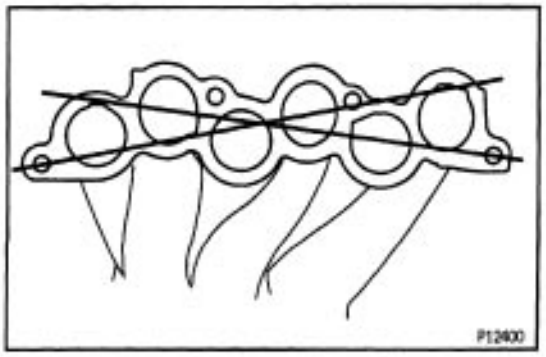
**Standard oil clearance:**

**0.024 – 0.050 mm (0.0009 – 0.0020 in.)**

**Maximum oil clearance:**

**0.07 mm (0.0028 In.)**

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



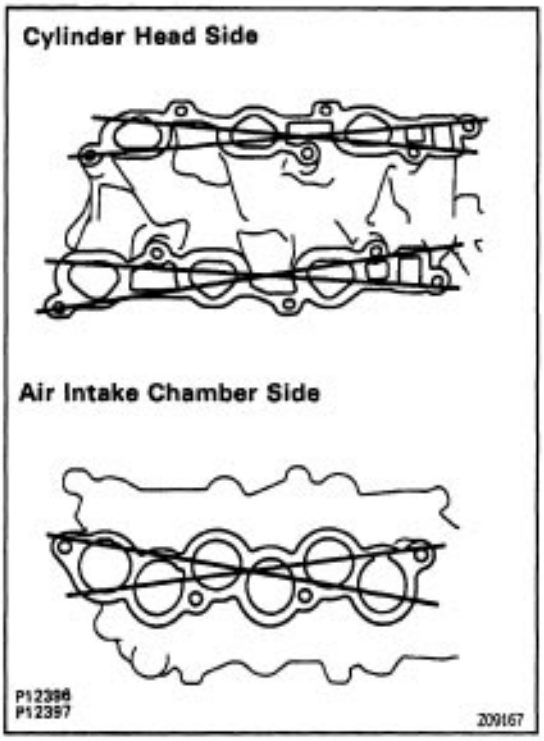

**12. INSPECT AIR INTAKE CHAMBER**

Using a precision straight edge and feeler gauge, mea–sure the surface contacting the intake manifold for warpage.

**Maximum warpage:**

**0.10 mm (0.0039 in.)**

If warpage is greater than maximum, replace the cha–mber.




**13. INSPECT INTAKE MANIFOLD**

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

**Maximum warpage:**

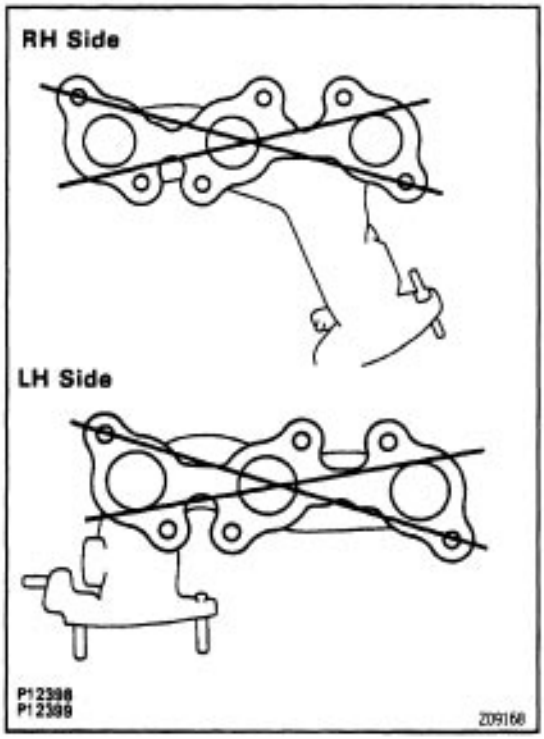
**Air Intake Chamber Side**

**0.15 mm (0.0059 in.)**

**Cylinder Head Side**

**0.08 mm (0.0031 in.)**

If warpage is greater than maximum, replace the manifold.



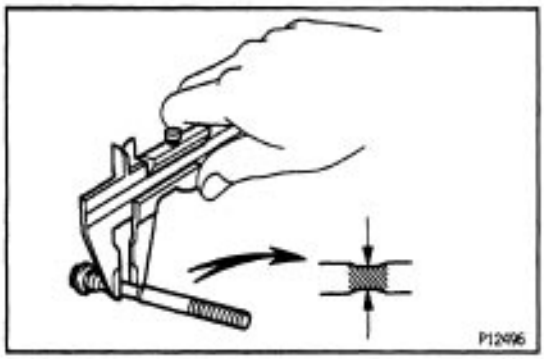

**14. INSPECT EXHAUST MANIFOLD**

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

**Maximum warpage:**

**0.50 mm (0.0196 in.)**

If warpage is greater than maximum, replace the manifold.




**15. INSPECT CYLINDER HEAD BOLTS**

(for 12 Pointed Head Bolts)

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

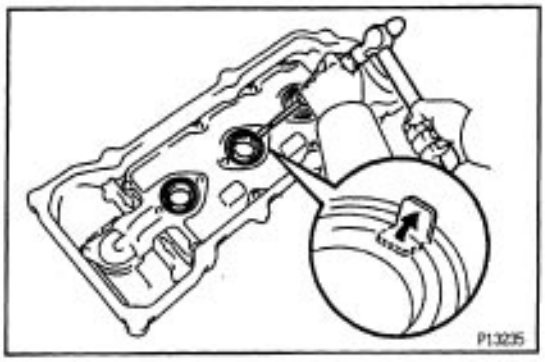
**Standard outside diameter:**

**8.95 – 9.05 mm (0.3524 – 0.3563 in.)**

**Minimum outside diameter:**

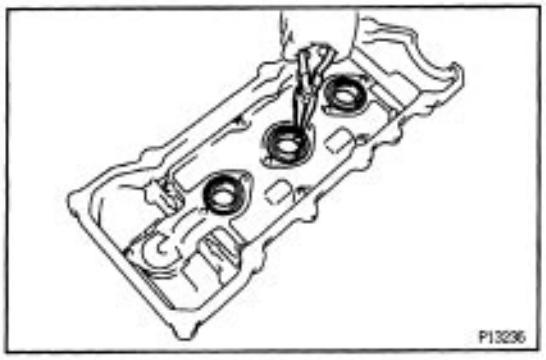
**8.75 mm (0.3445 in.)**

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

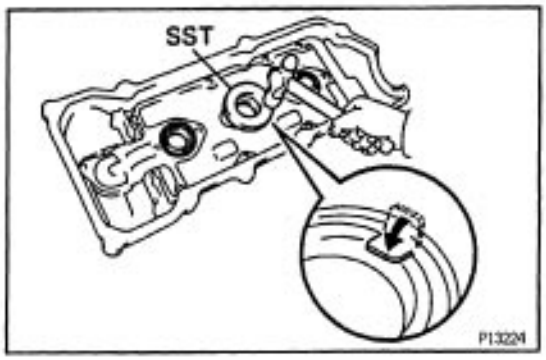



**16. IF NECESSARY, REPLACE SPARK PLUG TUBE GASKETS**

(a) Bend up the tab on the ventilation baffle plate which prevents the gasket from the slipping out.
(b) Using a screwdriver and hammer, tap out the gasket.




(c) Using needle–nose pliers, ply out the gasket.



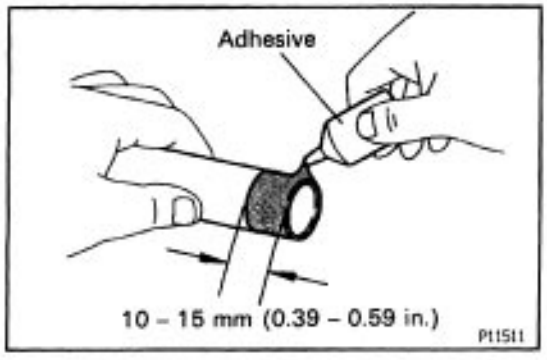

(d) Using SST and a hammer, tap in a new gasket until its surface is flush with the upper edge of the cylinder head cover.
SST 09608–20012 (09608–03070)
(e) Apply a light coat of MP grease to the gasket lip.
(f) Return the ventilation plate tab to its original position.

# CYLINDER HEAD ASSEMBLY

**(See Components for Removal and Installation)**

HINT:

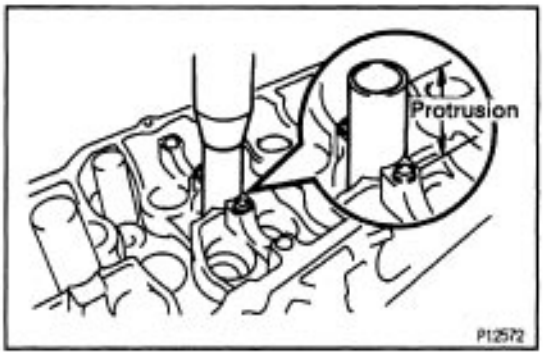
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets and oil seals with new ones.




**1. INSTALL SPARK PLUG TUBES**

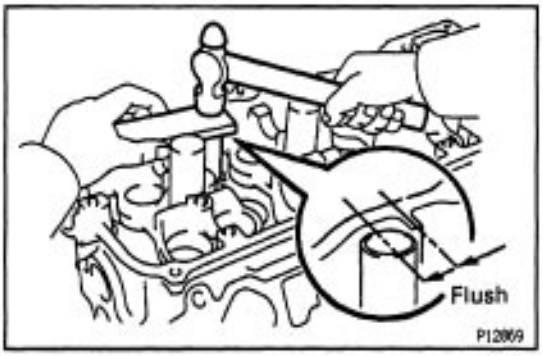
HINT: When using a new cylinder head, spark plug tubes must be installed.
(a) Apply adhesive to the end of the spark plug tube.
**Adhesive:**

**Part No. 08833–00070, THREE BOND 1324 or equivalent**




(b) Using a press, press in a new spark plug tube until there is 42.4 – 43.4 mm (1.669 – 1.749) protruding from the camshaft bearing cap installation surface of the cylinder head.

**NOTICE: Avoid pressing a new spark plug tube In too far by measuring the amount of the protrusion while press–ing.**

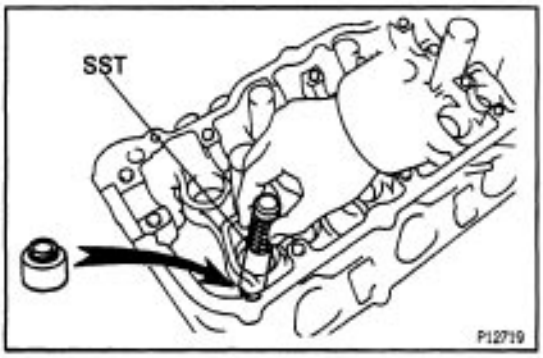



**2. INSTALL PCV PIPES**

HINT: When using a new cylinder head, PCV pipe must be installed.

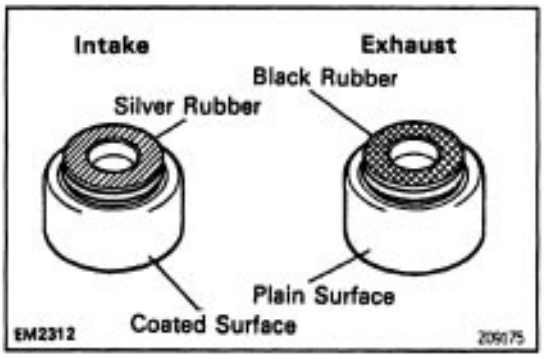
Using a wooden block and hammer, tap in a new spark tube until its top side is flush with the cylinder head edge.

**NOTICE: Be careful not to damage the cylinder head edge.**

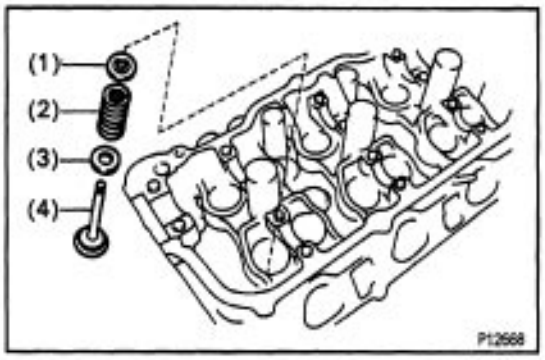



# 3. INSTALL VALVES

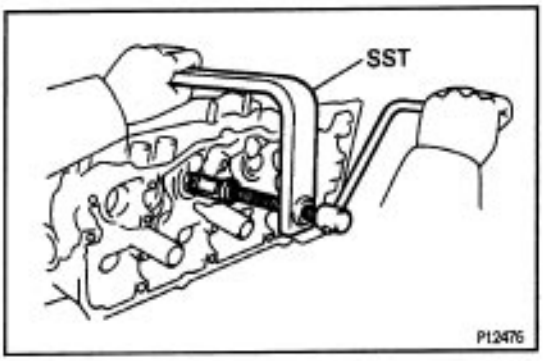
(a) Using SST, push in a new oil seal.
SST 09201 –41020



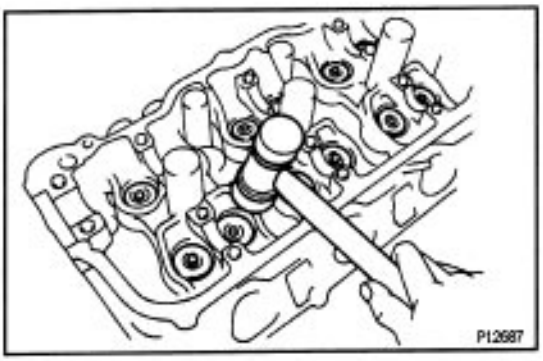

HINT: The intake valve oil seal is silver and the ex–haust valve oil seal is black.



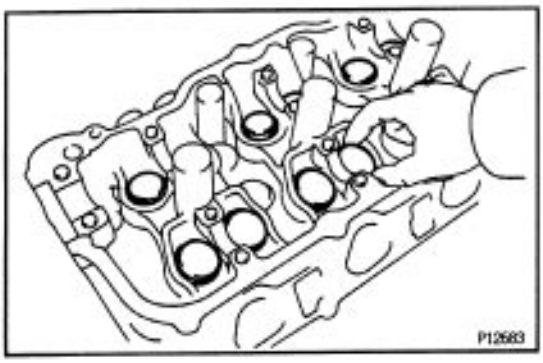

(b) Install the following parts:
(1) Valve
(2) Spring seat
(3) Valve spring
(4) Spring retainer




(c) Using SST, compress the valve spring and place the 2 keepers around the valve stem.
SST 09202 – 70010

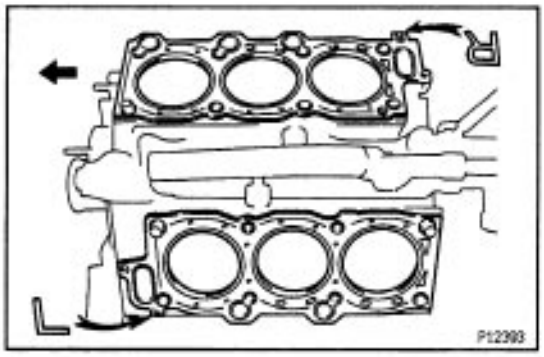



(d) Using a plastic–faced hammer, lightly tap the valve stem tip to ensure a proper fit.




**4. INSTALL VALVE LIFTERS AND SHIMS**

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




# CYLINDER HEAD INSTALLATION

**(See Components for Removal and Installation)**

**1. INSTALL CYLINDER HEADS**

**A. Place cylinder head on cylinder block**

(a) Place 2 new cylinder head gaskets in position on the cylinder block.

**NOTICE: Be careful of the installation direction.**

(b) Place the 2 cylinder heads in position on the cylinder head gaskets.

**B. Install cylinder head (12 pointed head) bolts**

HINT:

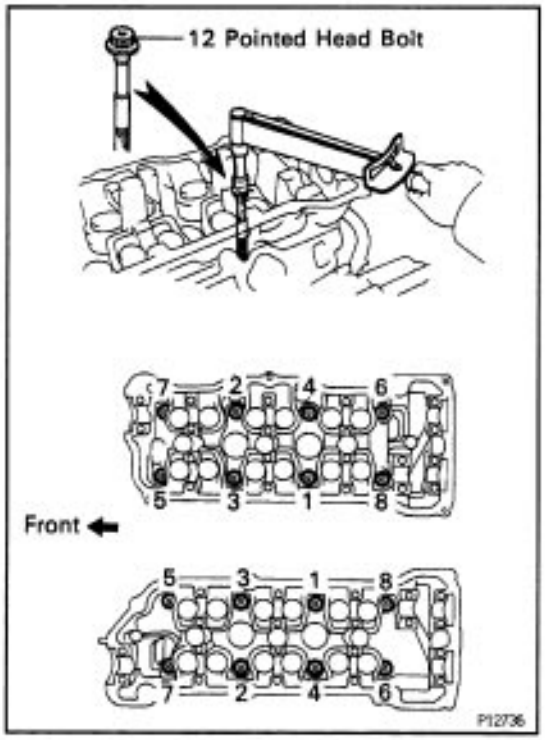
- The cylinder head bolts are tightened in 2 pro–gressive steps (steps (b) and (d)).
- If any bolt is broken or deformed, replace it.

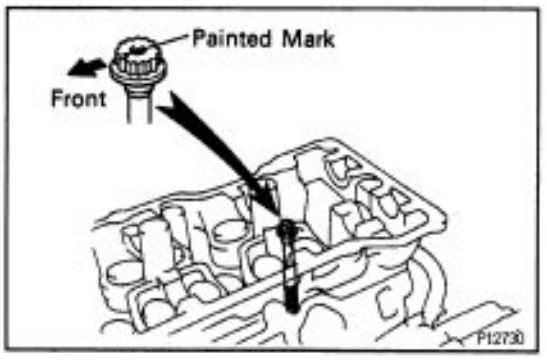
(a) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.

(b) Install and uniformly tighten the . cylinder head bolts on each cylinder head, in several passes, in the se–quence shown, then repeat for the other side, as shown.

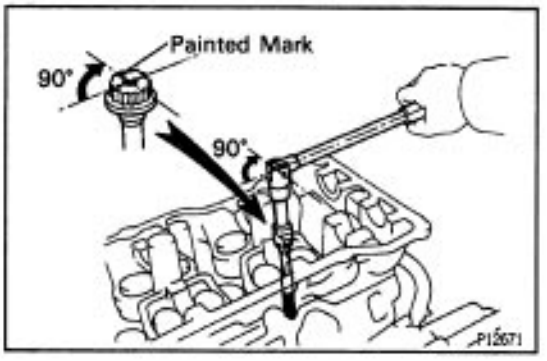
**Torque: 64 N–m (550 kgf–cm, 40 ft–lbf)**

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



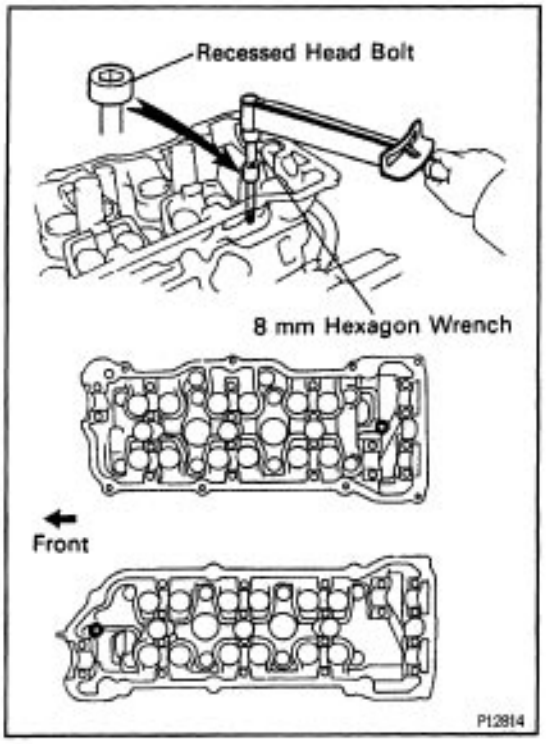




(c) Mark the front of the cylinder head bolt head with paint.




(d) Retighten the cylinder head bolts by $90_2$ in the numer–ical order shown.

(e) Check that the painted mark is now at a $90_2$ angle to the front.

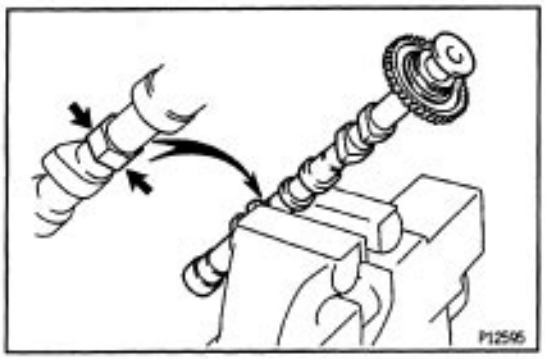



**C. Install cylinder head (recessed head) bolts**

(a) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.

(b) Using a 8 mm hexagon wrench, install the cylinder head bolt on each cylinder head, then repeat for the other side, as shown.

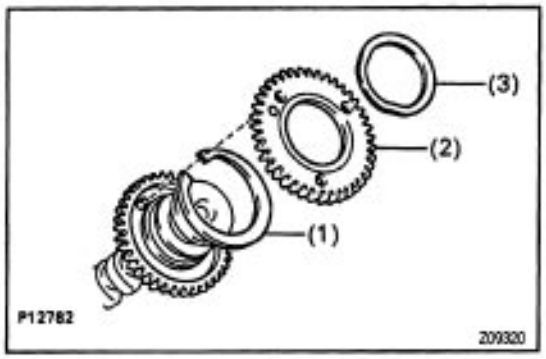
**Torque: 18.5 N–m (185 kgf–cm, 13 ft–lbf)**




**2. ASSEMBLY EXHAUST CAMSHAFTS**

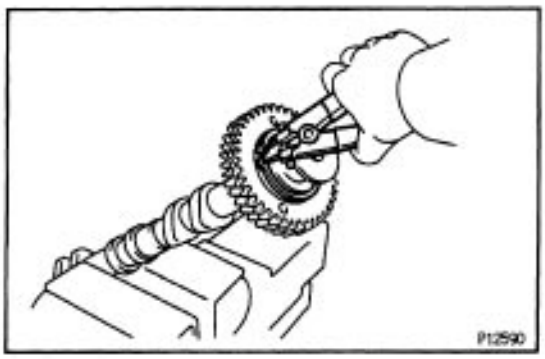
(a) Mount the hexagonal wrench head portion of the camshaft in a vise.

**NOTICE: Be careful not to damage the camshaft.**

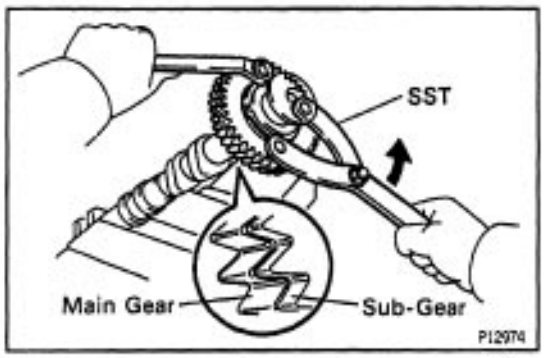



(b) Install the following parts:

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



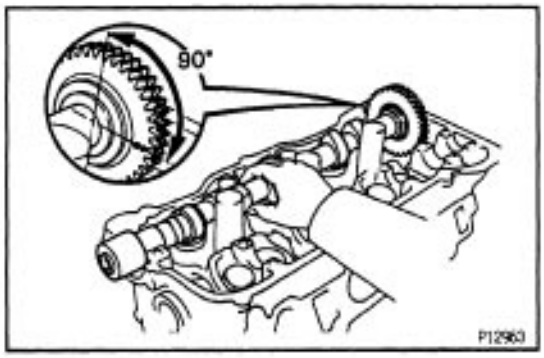

(c) Using snap ring pliers, install the snap ring.



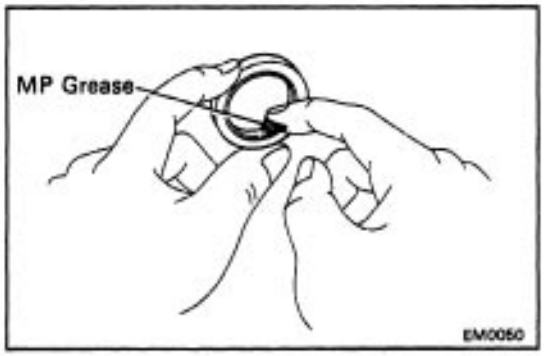

(d) Using SST, align the holes of the camshaft main gear and sub–gear by turning camshaft sub–gear coun–terclockwise, and install a service bolt.
SST 09960–10010 (09962–0100)
HINT: Align the pins on the gears with the gear spring ends.

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

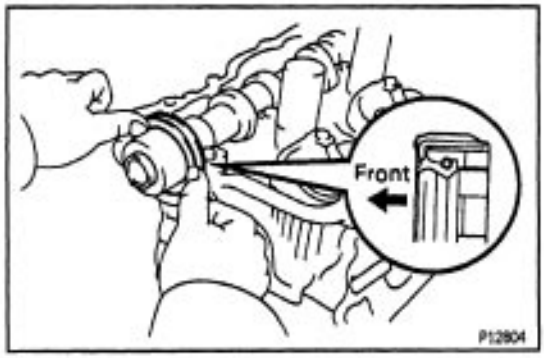




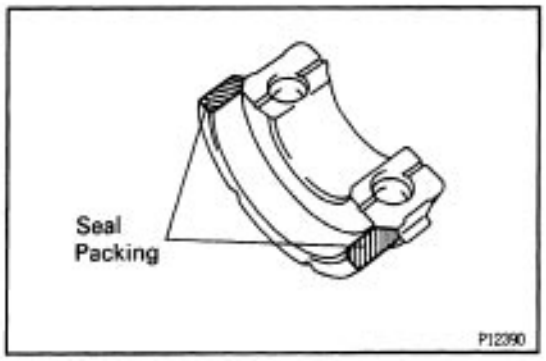

**A. Install exhaust camshaft of RH cylinder head**
(a) Apply new engine oil to the thrust portion and journal of the camshaft.
(b) Place the exhaust camshaft at $90_2$ angle of timing mark (2 dot marks) on the cylinder head.



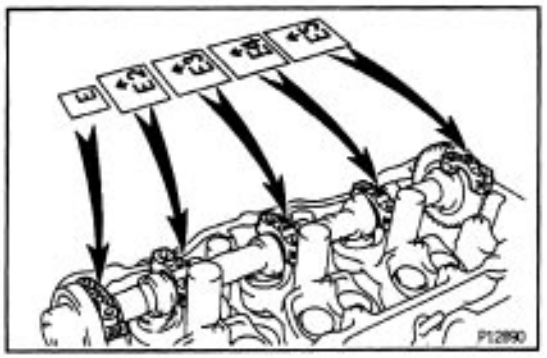

(c) Apply MP grease to a new oil seal lip.



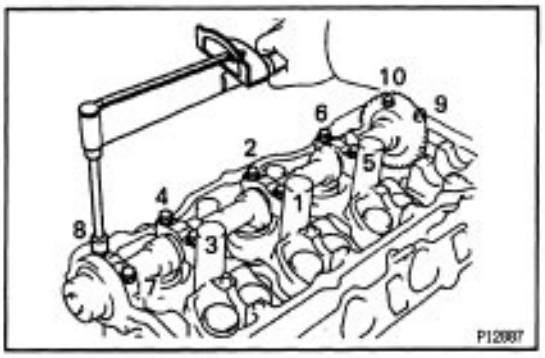

(d) Install the oil seal to the camshaft.



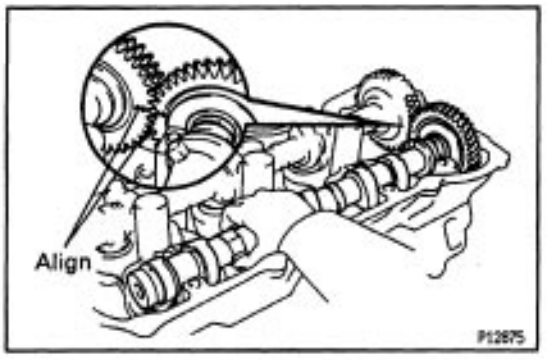

(e) Remove any old packing (FIPG) material.
(f) Apply seal packing to the No. 1 bearing cap as shown.
**Seal packing:**
**Part No. 08826–00080 or equivalent**



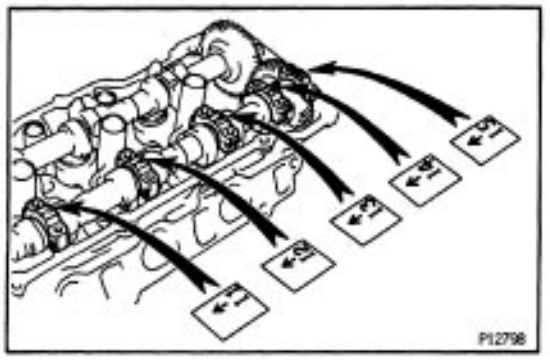

(g) Install the 5 bearing caps in their proper locations.



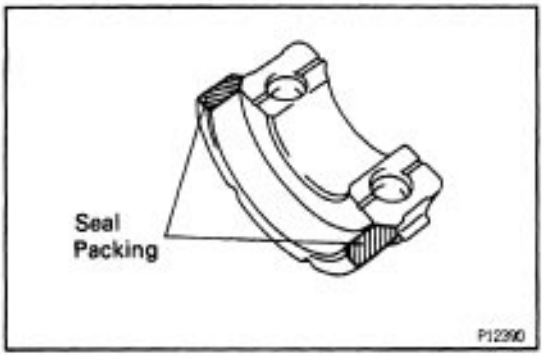

(h) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.
(i) Install and uniformly tighten the 10 bearing cap bolts, in several passes, in the sequence shown.
**Torque: 16 N–m (160 kgf–cm, 12 ft–lbf)**



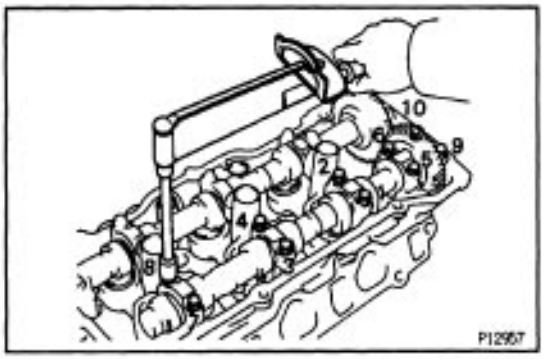

**B. Install intake camshaft of RH cylinder head**
(a) Apply new engine oil to the thrust portion and journal of the camshaft.
(b) Align the timing marks (2 dot marks) of the camshaft drive and driven gears.
(c) Place the intake camshaft on the cylinder head.



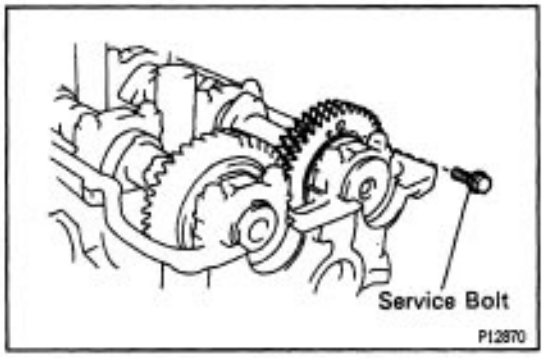

(d) Install the 5 bearing caps in their proper locations.




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

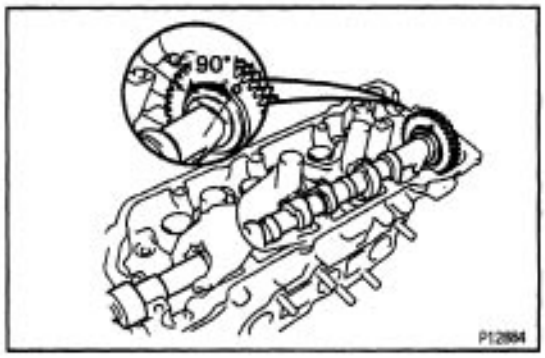



(f) Install and uniformly tighten the 10 bearing cap bolts, in several passes, in the sequence shown.
**Torque: 16 N–m (160 kgf–cm, 12 ft–lbf)**

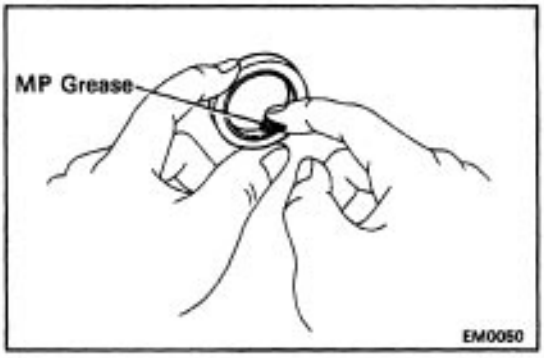



(g) Remove the service bolt

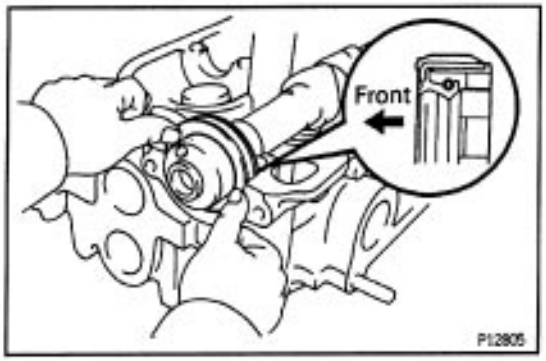
**C. Install exhaust camshaft of LH cylinder head**



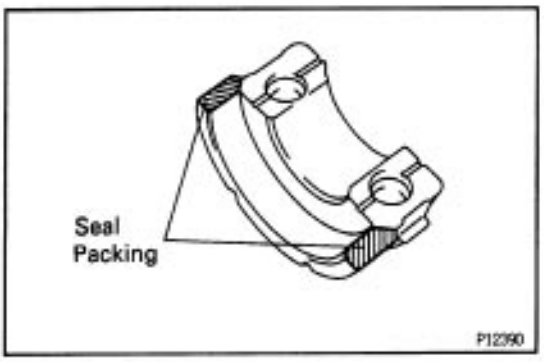

(a) Apply MP grease to the thrust portion of the cam–shaft.
(b) Place the intake camshaft at $90_2$ angle of timing mark (1 dot mark) on the cylinder head.



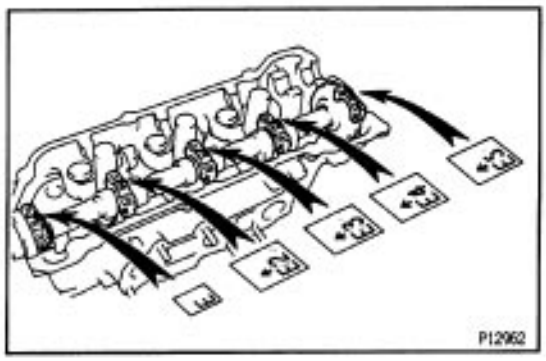

(c) Apply MP grease to a new oil seal lip.



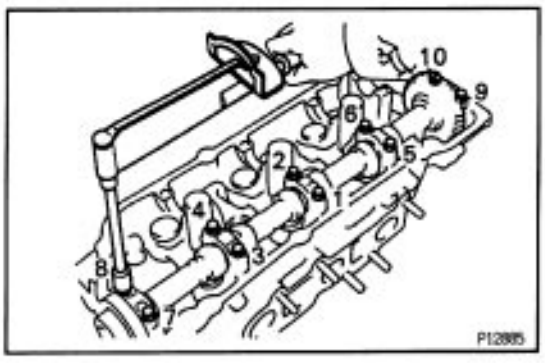

(d) Install the oil seal to the camshaft.



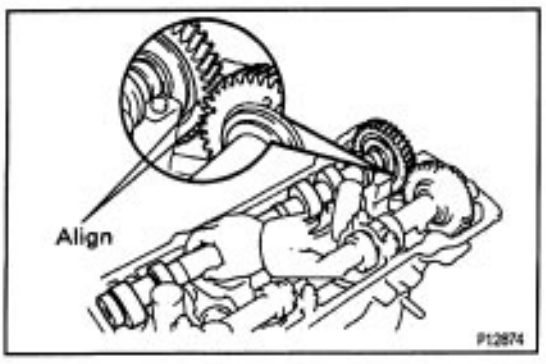

(e) Remove any old packing (FIPG) material.
(f) Apply seal packing to the No. 1 bearing cap as shown.
**Seal packing:**
**Part No. 08826–00080 or equivalent**



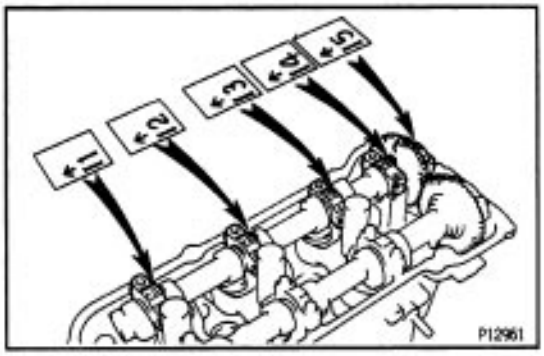

(g) Install the 5 bearing caps in their proper locations.



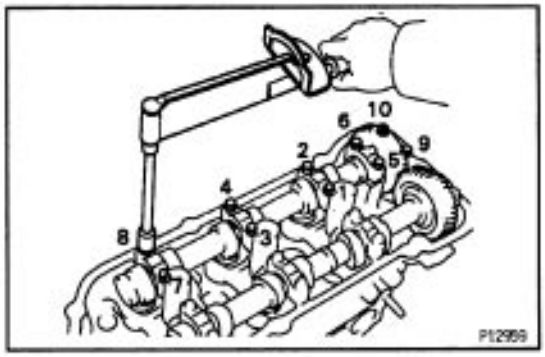

(h) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.
(i) Install and uniformly tighten the 10 bearing cap bolts, in several passes, in the sequence shown.
**Torque: 16 N–m (160 kgf–cm, 12 ft–lbf)**



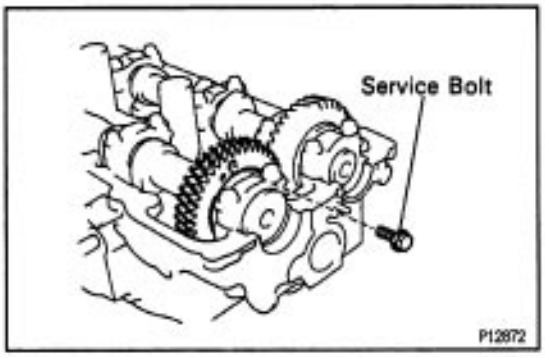

**D. Install intake camshaft of LH cylinder head**
(a) Apply MP grease to the thrust portion of the cam–shaft.
(b) Align the timing marks (1 dot mark) of the camshaft drive and driven gears.
(c) Place the intake camshaft on the cylinder head.




(d) Install the 5 bearing caps in their proper locations.

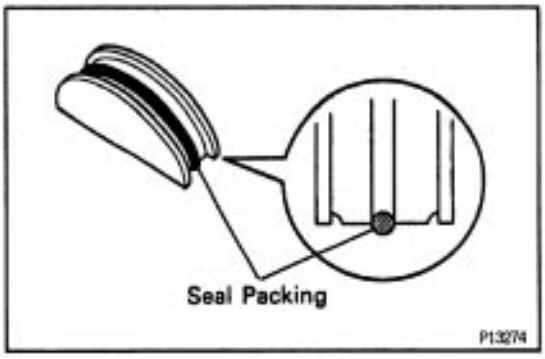



(e) Apply a light coat of engine oil on the threads and under the heads of bearing cap bolts.
(f) Install and uniformly tighten the 10 bearing cap bolts, in several passes, in the sequence shown.
**Torque: 16 N–m (160 kgf–cm, 12 ft–lbf)**

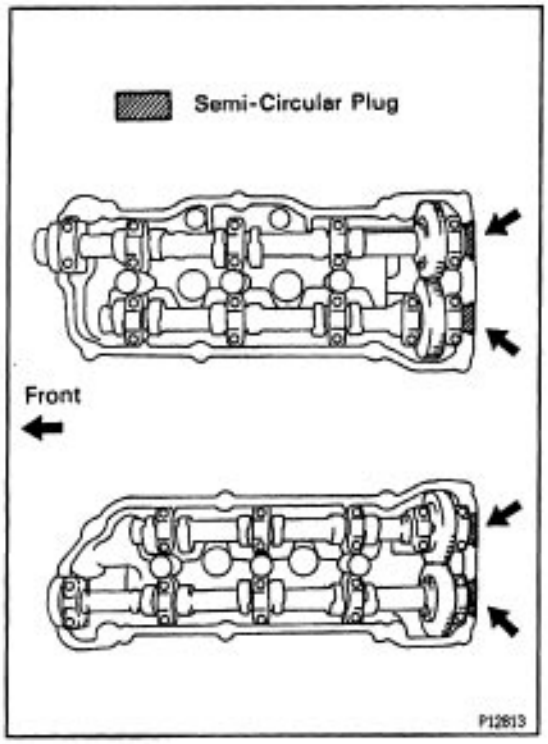



(g) Remove the service bolt.

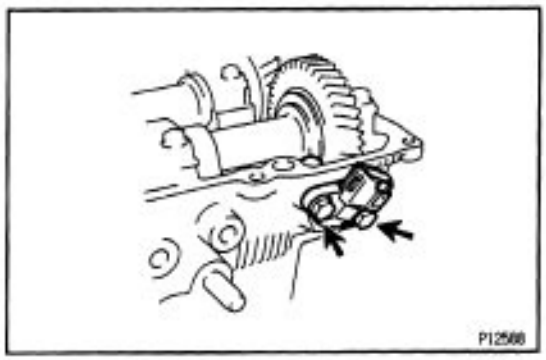
**4. CHECK AND ADJUST VALVE CLEARANCE**
**(See steps 17 to 19 on pages** EG2–18 **to 23)**
Turn the camshaft and position the cam lobe upward, and check and adjust the valve clearance.
**Valve clearance (Cold):**
**Intake**
**0.15 – 0.25 mm (0.006 – 0.010 in.)**
**Exhaust**
**0.25–0.35mm(0.010–0.014in.)**




**6. INSTALL SEMI–CIRCULAR PLUGS**
(a) Remove any old packing (FIPG) material.
(b) Apply seal packing to the semi–circular plug grooves,
**Seal packing:**
**Part No. 08826–00080 or equivalent**




(c) Install the 4 semi–circular plugs to the cylinder heads.

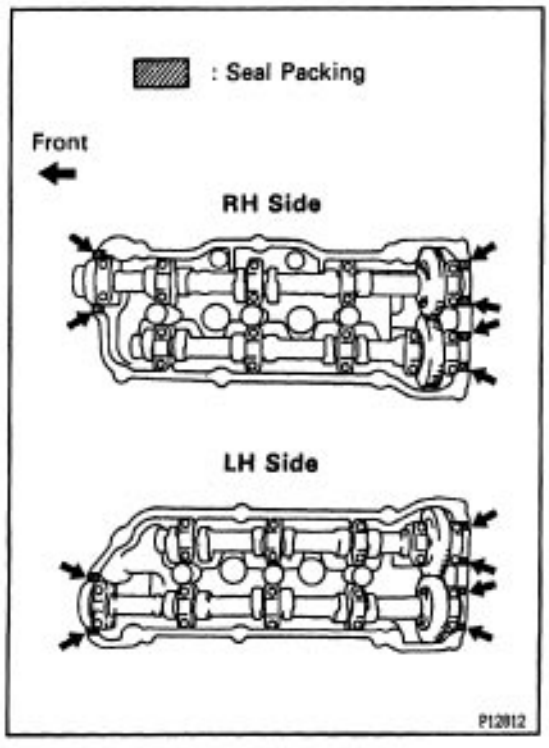



**6. INSTALL CAMSHAFT POSITION SENSOR**

(a) Install a new gasket to the position sensor.

(b) Install the positron sensor with the bolt.

**Torque: 8 N–m (80 kgf–cm, 69 in.–lbf)**

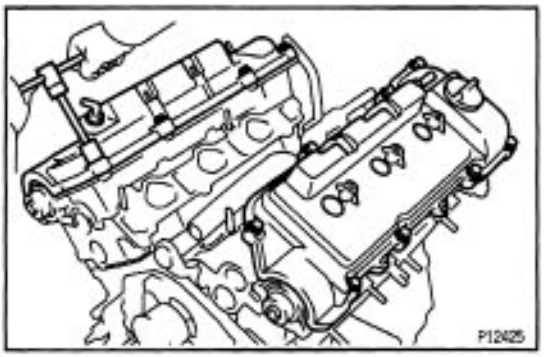



**7. INSTALL CYLINDER HEAD COVERS**

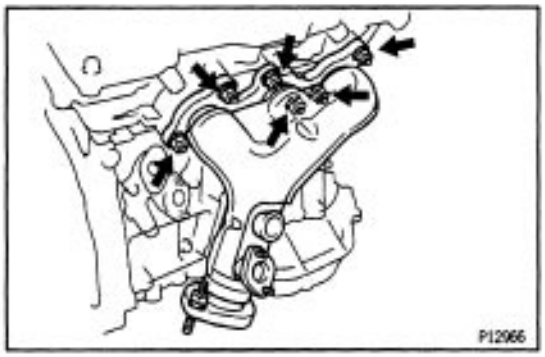
(a) Apply seal packing to the cylinder heads as shown in the illustration.

**Seal packing:**

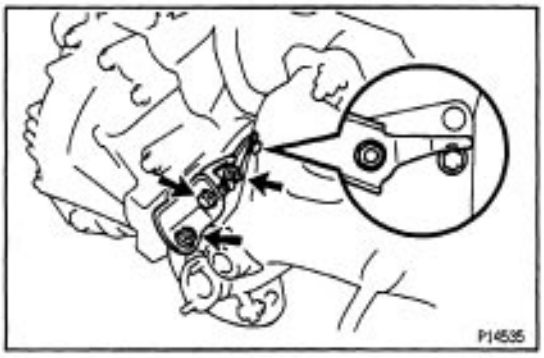
**Part No. 08826–00080 or equivalent**



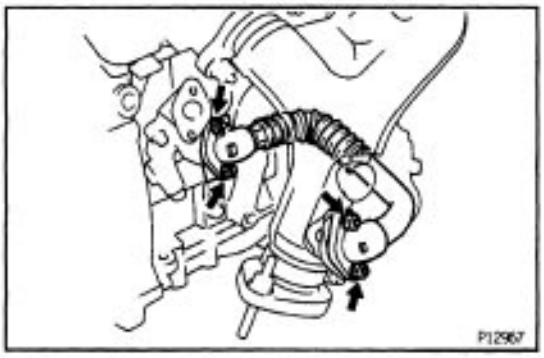

(b) Install the gasket to the cylinder head cover.
(c) Install the cylinder head cover with the 8 bolts. Uniformly tighten the bolts in several passes. Install the 2 cylinder head covers.
**Torque: 8 N–m (80 kgf–cm, 69 in.–lbf)**



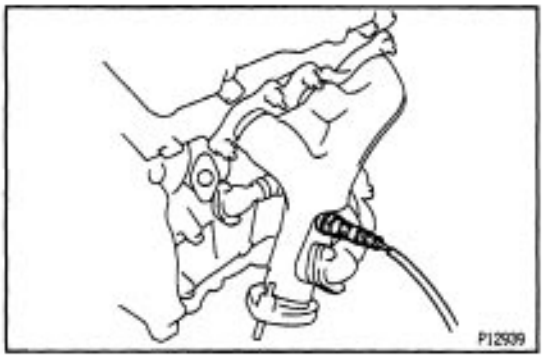

**8. INSTALL RH EXHAUST MANIFOLD**
(a) Install a new gasket and the exhaust manifold with the 6 nuts.
**Torque: 49 N–m (500 kgf–cm, 36 ft–lbf)**



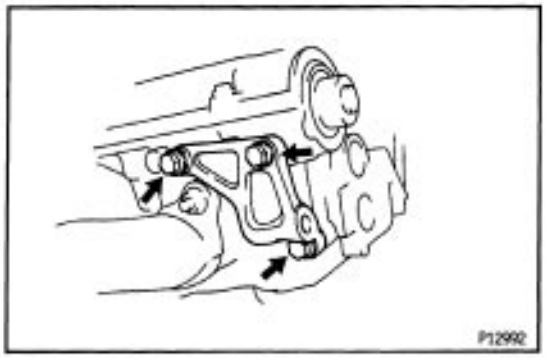

(b) Install the exhaust manifold stay and plate with the bolt and 2 nuts.
**Torque: 19.5 N–m (200 kgf–cm, 14 ft–lbf)**
HINT: Install the manifold stay so that the tip of the stay touches the head of the differential retainer installation bolt as shown in the illustration.




(c) Install 2 new gaskets and the EGR pipe with the 4 nuts.
**Torque: 12 N–m (120 kgf–cm, 9 ft–lbf)**



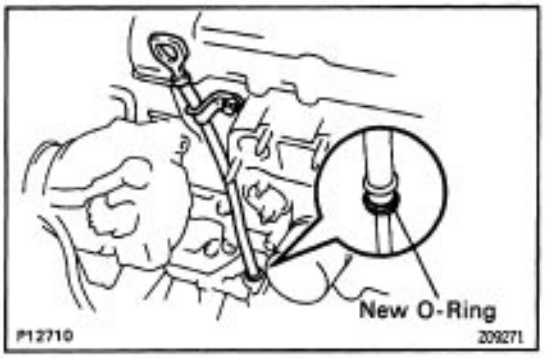

(d) Install the main heated oxygen sensor (Bank 1 Sensor 1).
**Torque: 44 N–m (450 kgf–cm, 33 ft–lbf)**




**9. INSTALL PS BRACKET**

Install the PS bracket with the 3 bolts.

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

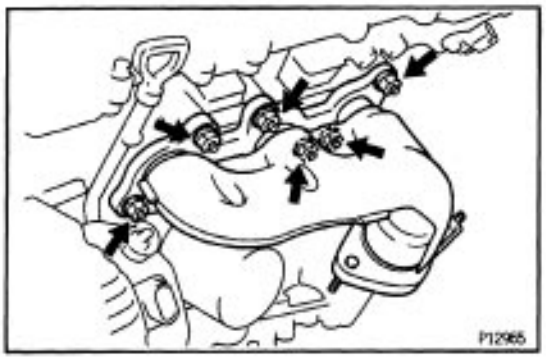



**10. INSTALL OIL DIPSTICK AND GUIDE**

(a) Install a new O–ring to the dipstick guide.
(b) Apply soapy water to the 0– ring.
(c) Push in the dipstick guide end into the guide hole of the No. 1 oil pan.
(d) Install the dipstick guide with the bolt.

**Torque: 8 N–m (80 kgf–cm, 69 in.–lbf)**

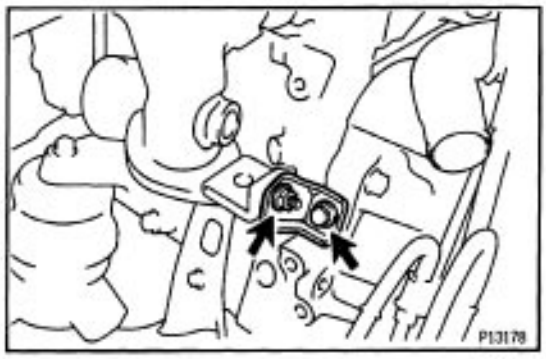
(e) Install the dipstick.




**11. INSTALL LH EXHAUST MANIFOLD**

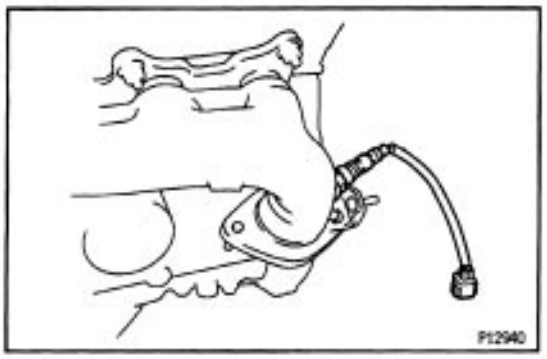
(a) Install a new gasket and the exhaust manifold with the 6 nuts.

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



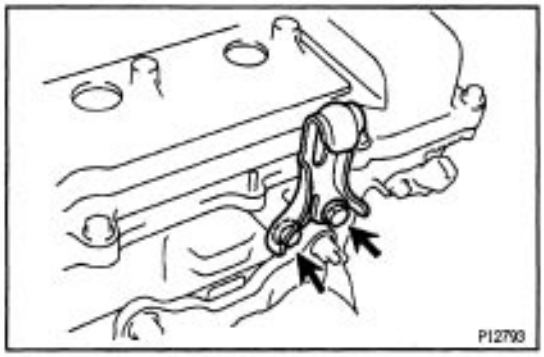

(b) Install the exhaust main manifold stay with the bolt and nut.

**Torque: 19.5 N–m (200 kgf–cm, 14 ft–lbf)**

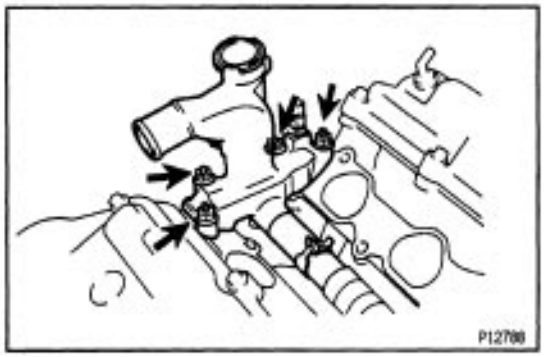



(c) Install the main heated oxygen sensor (Bank 2 Sensor 1).

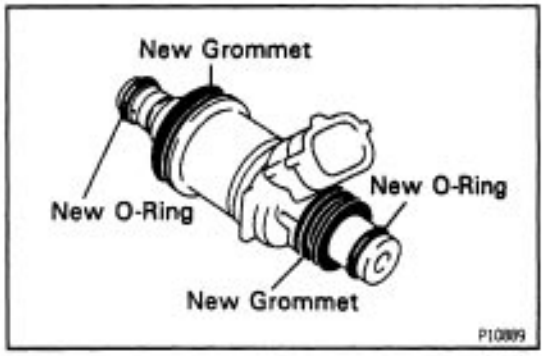
**Torque: 44 N–m (450 kgf–cm, 33 ft–lbf)**



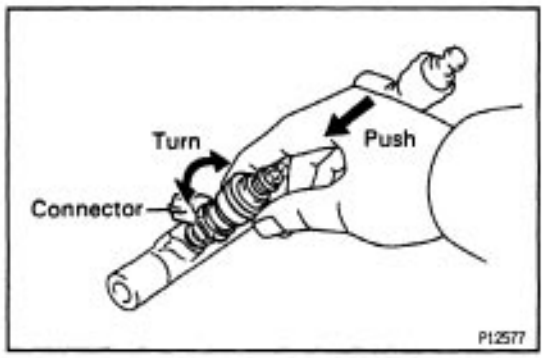

**12. INSTALL No.2 ENGINE HANGER**
Install the engine hanger with the 2 bolts.
**Torque: 19.5 N–m (200 kgf–cm, 14 ft–lbf)**



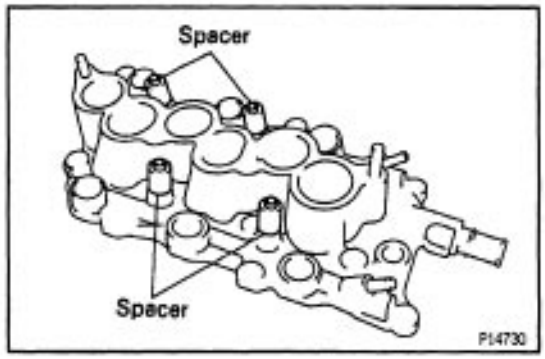

**13. INSTALL WATER OUTLET**
(a) Connect the water outlet to the bypass hose.
(b) Install 2 new gaskets and the water outlet with the 2 bolts, 2 nuts and 2 plate washers.
**Torque: 15 N–m (150 kgf–cm, 11 ft–lbf)**
**NOTICE: Do not scratch the seal surface of the water outlet with the stud bolt.**



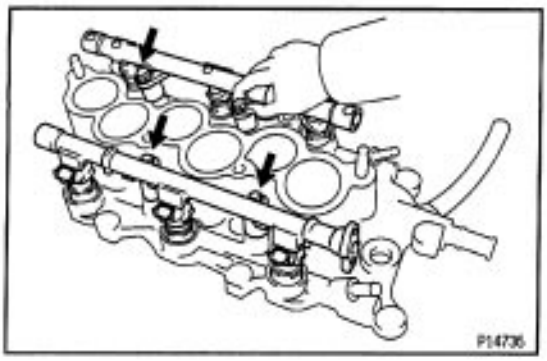

**14. INSTALL INJECTORS AND DELIVERY PIPES**
(a) Install 2 new grommets to each injector.
(b) Apply a light coat of gasoline to 2 new 0–rings and install them to each injector.



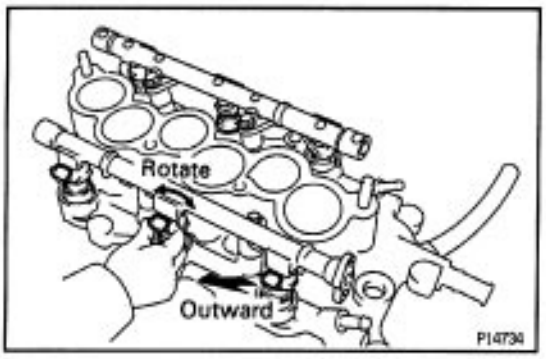

(c) While turning the injector clockwise and counter–clockwise, push it to the delivery pipes. Install the 6 injectors.
(d) Position the injector connector outward.



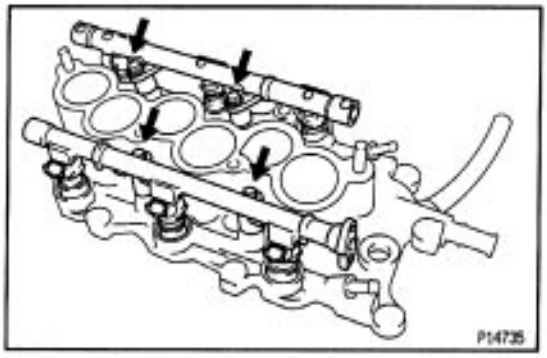

(e) Place the 4 spacers in position on the intake manifold.



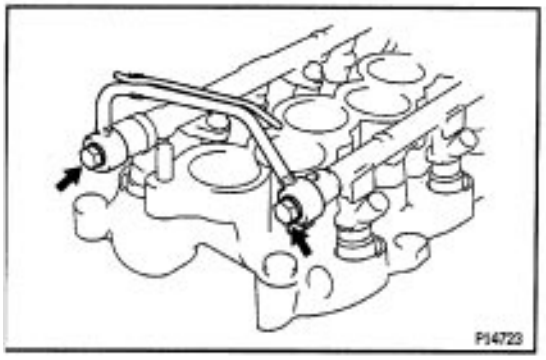

(f) Place the delivery pipes together with the 6 injectors in position on the intake manifold.
(g) Temporarily install the 4 bolts holding the delivery pipes to the intake manifold.



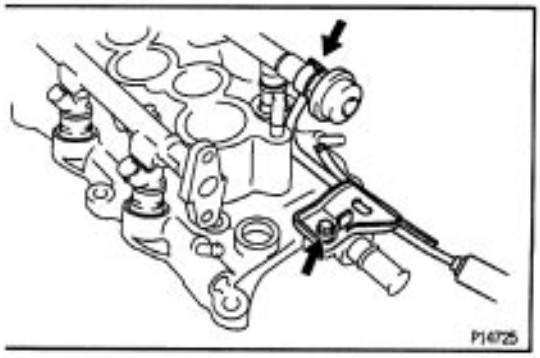

(h) Check that the injectors rotate smoothly.
HINT: If injectors do not rotate smoothly, the probable cause is incorrect installation of O–rings. Replace the O–rings.
(i) Position the injector connector outward.



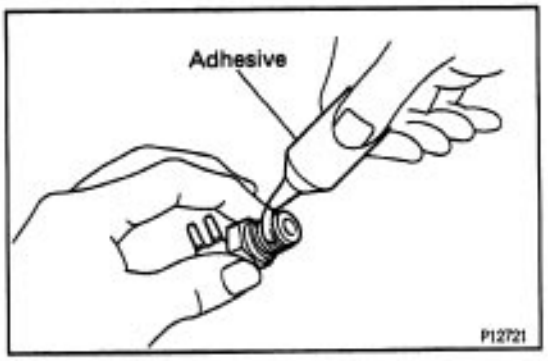

(j) Tighten the 4 bolts holding the delivery pipes to the intake manifold.
**Torque: 10 N–m (100 kgf–cm, 7 ft–lbf)**




**15. INSTALL No.2 FUEL PIPE**
**Install the No.2 fuel pipe with the 2 union bolts and 4 gaskets.**
**Torque: 32.5 N–m (330 kgf–cm, 24 ft–lbf)**




**16. INSTALL NO.1 FUEL PIPE AND PULSATION DAMPER**
Install the No.1 fuel pipe with the pulsation damper, 4 new gaskets and bolt.
**Torque: 32.5 N–m (330 kgf–cm, 24 ft–lbf) for Pulsation damper**
**Torque: 15 N–m (150 kgf–cm, 11 ft–lbf) for Bolt**

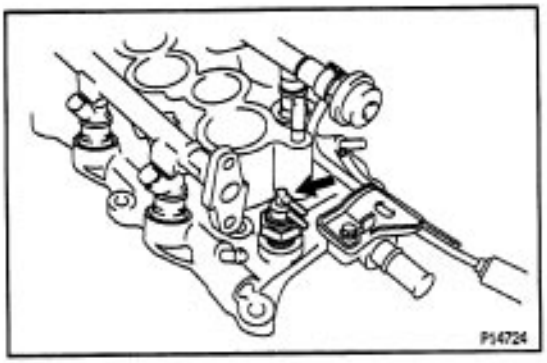



**17. INSTALL TVV**

(a) Apply adhesive to 2 or 3 threads.

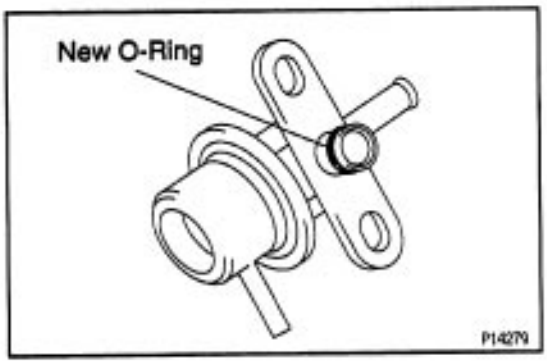
**Adhesive:**

**Part No. 08833–00070, THREE BOND 1324 or equivalent**




(b) Install the TVV.

**Torque: 30 N–m (305 kgf–cm, 22 ft–lbf)**



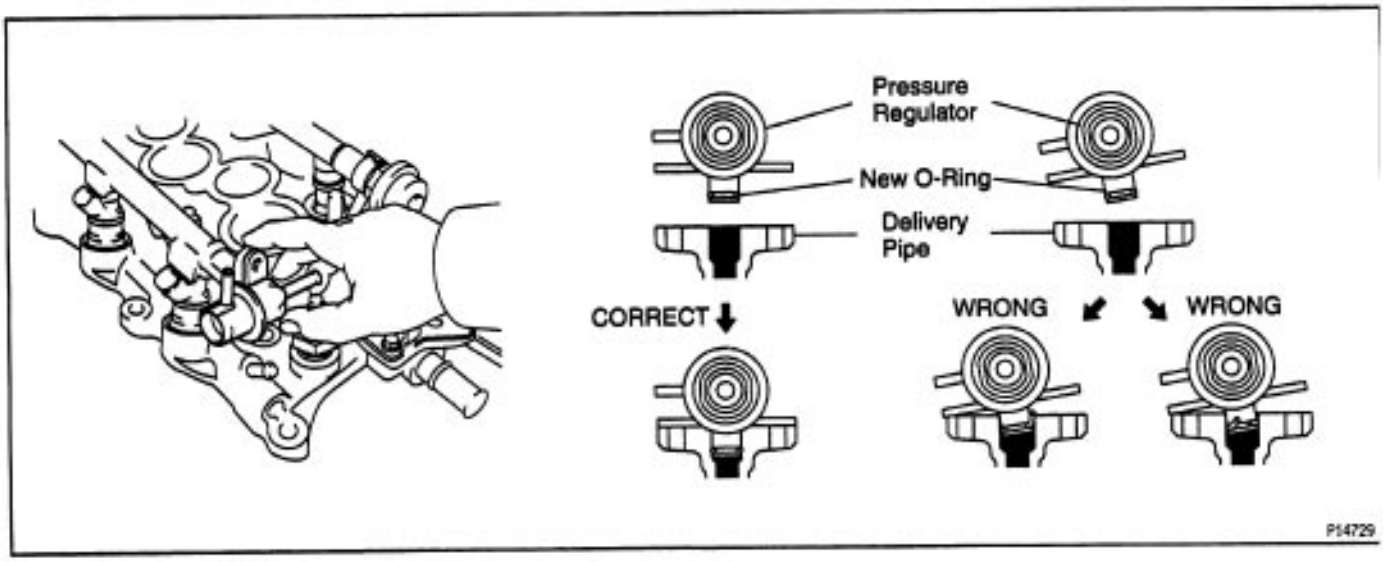

**18. INSTALL FUEL PRESSURE REGULATOR**

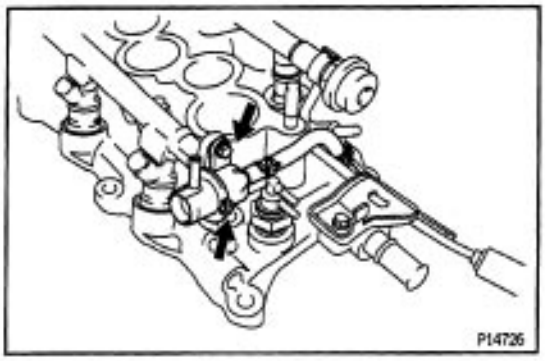
(a) Apply a light coat of gasoline to a new 0–ring, and install it to the pressure regulator.

(b) Attach the pressure regulator to the delivery pipe.

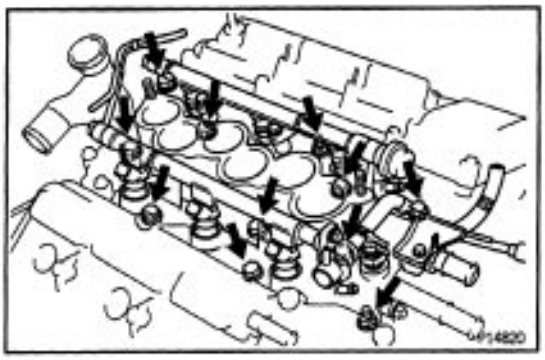
(c) Check that the pressure regulator rotates smoothly.

**NOTICE: If it does not rotate smoothly, the O–ring may be pinched, so remove the pressure regulator and repeat steps (b) and (e) above.**

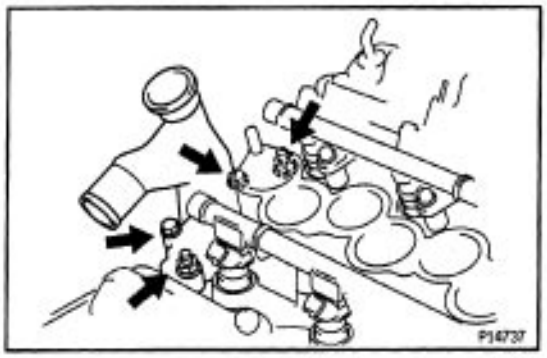




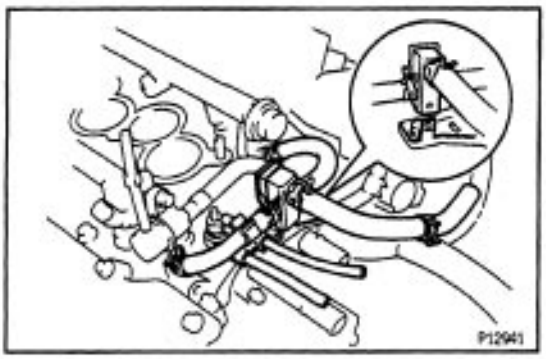

(d) Install the pressure regulator with the 2 bolts.
**Torque: 8 N–m (80 kgf–cm, 69 in.–lbf)**



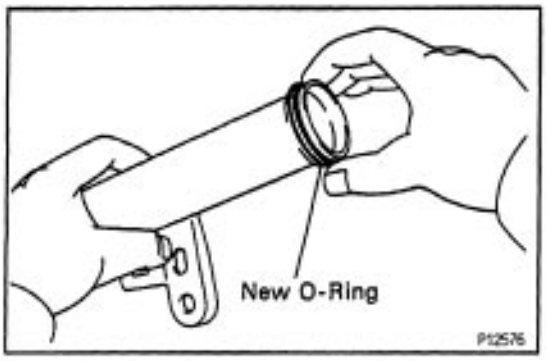
**19. INSTALL INTAKE MANIFOLD**
Install the intake manifold with the 9 bolts, 2 nuts and 2 plate washers.
**Torque: 15 N–m (150 kgf–cm, 11 ft–lbf)**



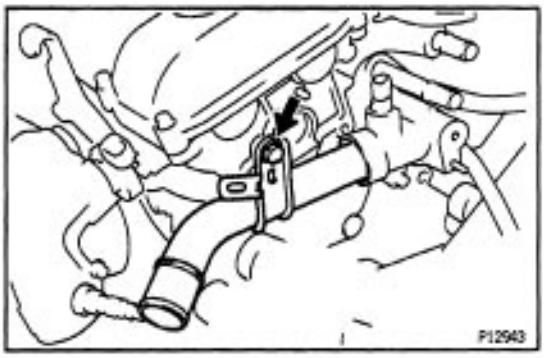

**20. RETIGHTEN WATER OUTLET MOUNTING BOLTS AND NUTS**
**Torque: 15 N–m (150 kgf–cm, 11 ft–lbf)**



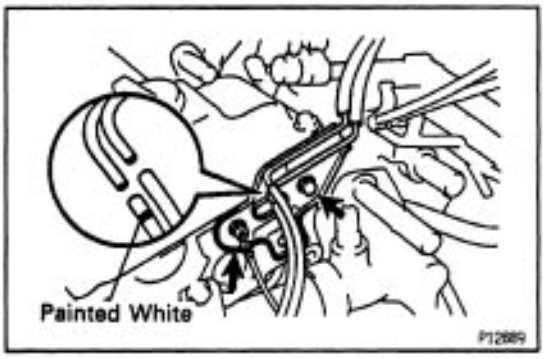

**21. INSTALL AIR ASSIST HOSE**



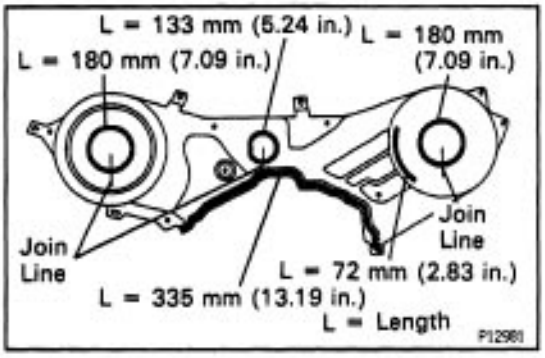

**22. INSTALL WATER INLET PIPE**
(a) Install a new O–ring to the water inlet pipe.
(b) Apply soapy water to the O–ring.



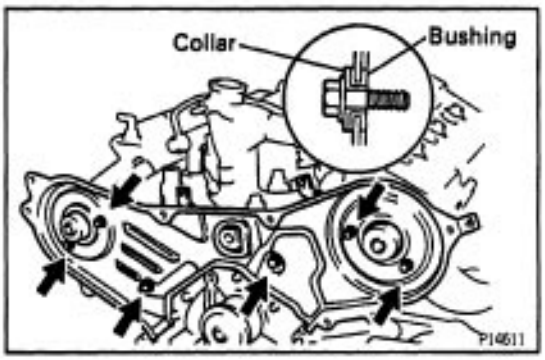

(c) Connect the water inlet pipe to the water inlet.
(d) Install the bolt holding the water inlet pipe to the cylinder head.
**Torque: 19.5 N–m (200 kgf–cm, 14 ft–lbf)**



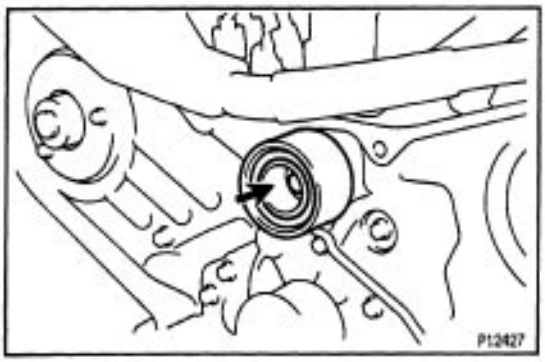

**23. INSTALL CYLINDER HEAD REAR PLATE**
(a) Install the rear plate and grand strap with the bolt and nut.
**Torque: 8 N–m (80 kgf–cm, 69 in.–lbf)**
(b) Connect the vacuum hose to the air intake chamber.
(c) Connect the 2 vacuum hoses to the vacuum tank.




**24. INSTALL NO–3 TIMING BELT COVER**
(a) Check that the timing belt cover gaskets have no cracks or peeling, etc.
If the gaskets do have cracks or peeling etc., replace them using following steps.
(1) Using a screwdriver and gasket scraper, remove all the old gasket material.
(2) Thoroughly clean all components to remove all the loose material.
(3) Remove the backing paper from a new gasket and install the gasket evenly to the part of the belt cover shaded black in the illustration.
**NOTICE: When joining gaskets, do not leave a gap between them. Cut off any excess gasket.**
(4) After installing the gasket, press down on it so that the adhesive firmly sticks to the belt cover.
(b) Install new gaskets to the No.3 belt cover.




(c) Install the belt cover with the 6 bolts.
**Torque: 8.5 N–m (85 kgf–cm, 74 in–lbf)**

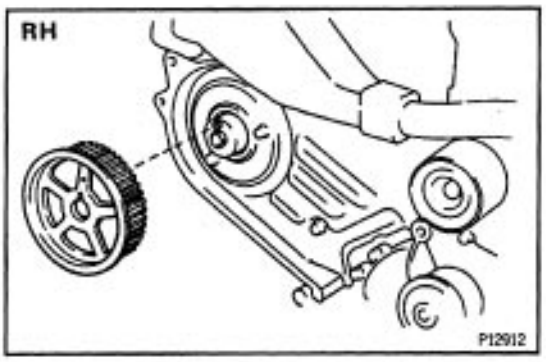



**25. INSTALL NO.2 IDLER PULLEY**

(a) Install the idler pulley with the bolt.

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

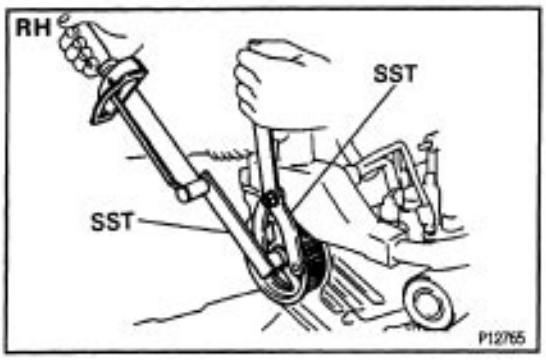
(b) Check that the idler pulley moves smoothly.




**26. INSTALL RH CAMSHAFT TIMING PULLEY**

(a) Install the timing pulley, facing the flange side outward.

(b) Align the knock pin hole of the camshaft with the knock pin groove of the timing pulley as shown.

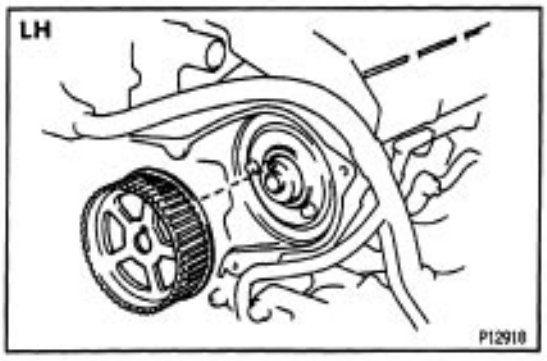



(c) Using SST, install and torque the bolt.

SST 09249–63010, 09960–10010 (09962–01000)

**Torque: 88 N–m (900 kgf–cm, 65 ft–lbf)**

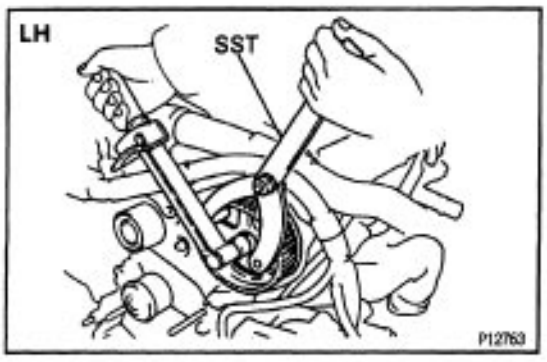
HINT: Use a torque wrench with a fulcrum length of 340 mm (13.39 in.)




**27. INSTALL LH CAMSHAFT TIMING PULLEY**

(a) Install the timing pulley, facing the flange side inward.

(b) Align the knock pin hole of the camshaft with the knock pin groove of the timing pulley as shown.

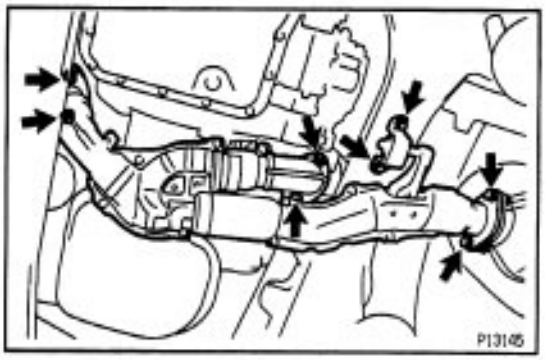



(d) Using SST, install and torque the bolt.

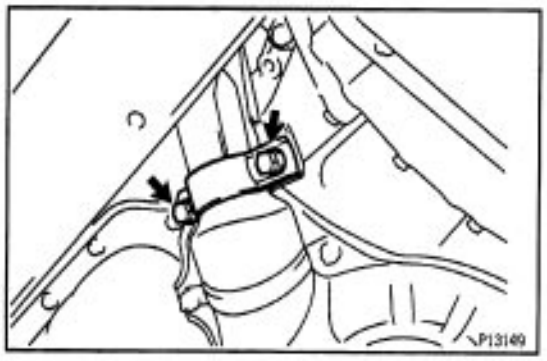
SST 09960–10010 (09962–01000)

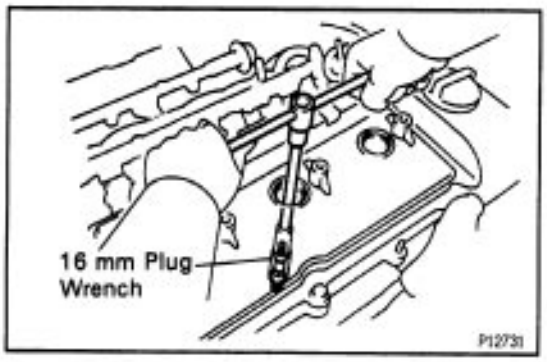
**Torque: 125 N–m (1,300 kgf–cm, 94 ft–lbf)**

**28. INSTALL TIMING BELT**
**(See steps 6 to 27 on pages EG2–51 to 66)**

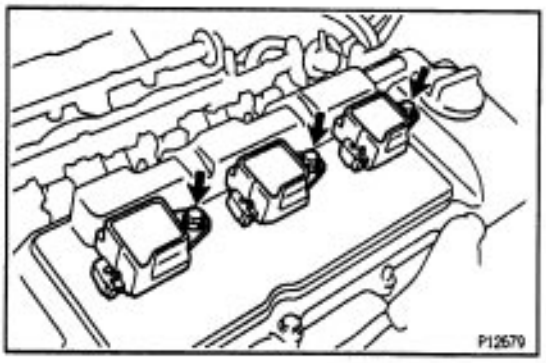



**29. INSTALL FRONT EXHAUST PIPE**
(a) Temporarily install 3 new gaskets and the front ex–haust pipe with the 2 bolts and 6 nuts.
(b) Tighten the 4 nuts holding the exhaust manifolds to the front exhaust pipe.
**Torque: 62 N–m (630 kgf–cm, 46 ft–lbf)**
(c) Tighten the 2 bolts and 2 nuts holding the three–way catalytic converter to the front exhaust pipe.
**Torque: 56 N–m (570 kgf–cm, 41 ft–lbf)**
(d) Connect the bracket with the 2 bolts.
**Torque: 19 N–m (195 kgf–cm, 14 ft–lbf)**
(e) Connect the front exhaust pipe clamp with the 2 bolts.
**Torque: 29 N–m (300 kgf–cm, 22 ft–lbf)**

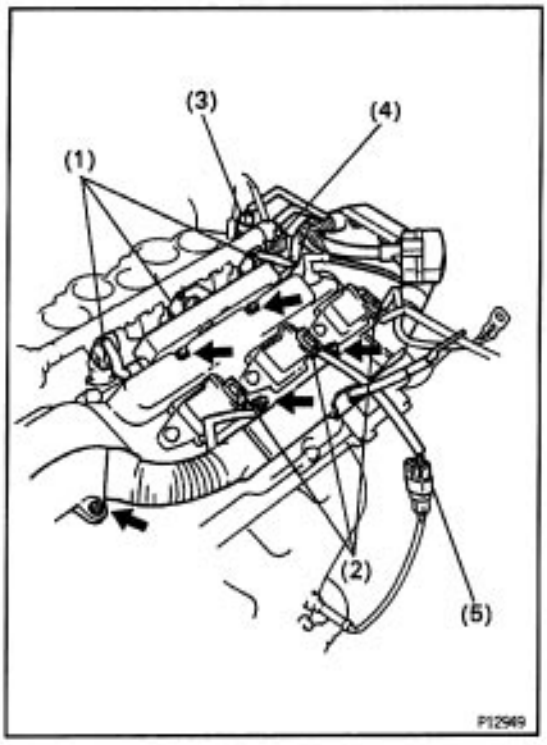



**30. INSTALL SPARK PLUGS**
Using a 16 mm plug wrench, install the6 spark plugs to the RH and LH cylinder heads.



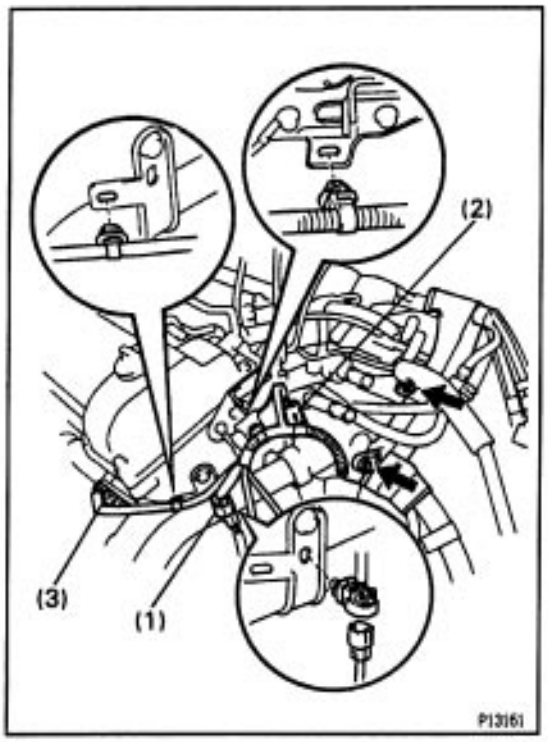

**31. INSTALL IGNITION COILS**
Install the6 ignition coils to the RH and LH cylinder heads.
**Torque: 8 N–m (80 kgf–cm, 69 in.–lbf)**




**32. CONNECT ENGINE WIRE TO ENGINE RH SIDE**

(a) Connect the following connectors:
- (1) 3 injector connectors
- (2) 3 ignition coil connectors
- (3) Water temperature sender gauge connector
- (4) Water temperature sensor connector
- (5) RH oxygens sensor connector

(b) Connect the engine wire with the 5 nuts.

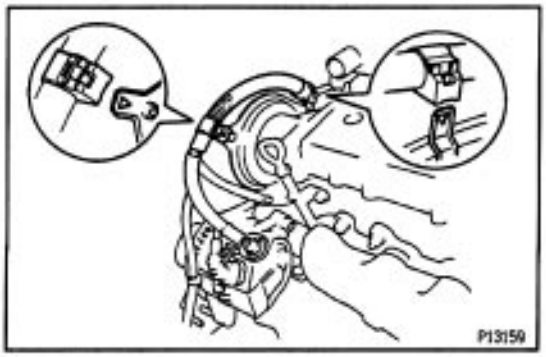



**33. CONNECT ENGINE WIRE TO ENGINE REAR SIDE**

(a) Connect the following connectors:
- (1) LH oxygen sensor
- (2) Engine coolant temperature sensor
- (3) Camshaft position sensor

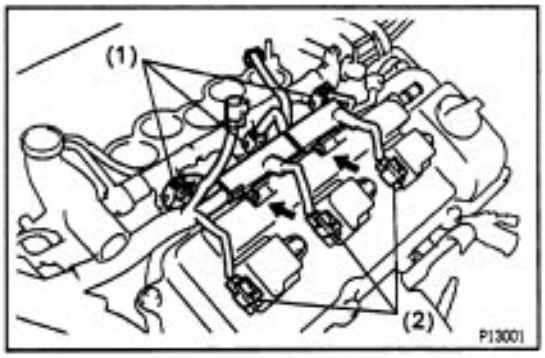
(b) Connect the 3 clamps.

(c) Connect the engine wire with the 2 nuts.




**34. CONNECT ENGINE WIRE TO N0.3 TIMING BELT COVER**

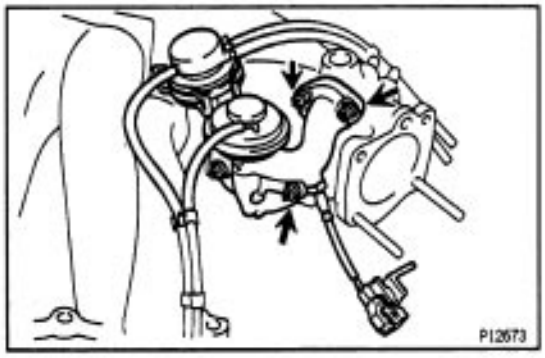
Connect the engine wire with the 2 clamps.




**35. CONNECT ENGINE WIRE TO ENGINE LH SIDE**

(a) Connect the following connectors:
- (1) 3 injector connectors
- (2) 3 ignition coil connectors

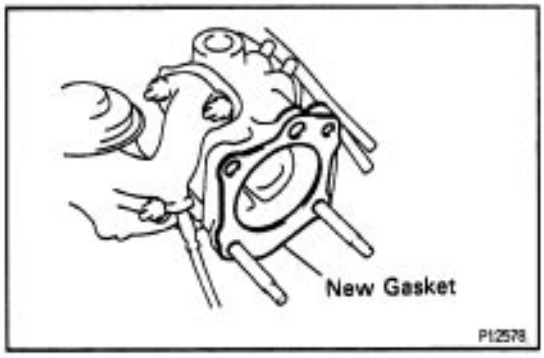
(b) Connect the engine wire with the 2 nuts.




**36. INSTALL EGR VALVE AND VACUUM MODULATOR TO AIR INTAKE CHAMBER**

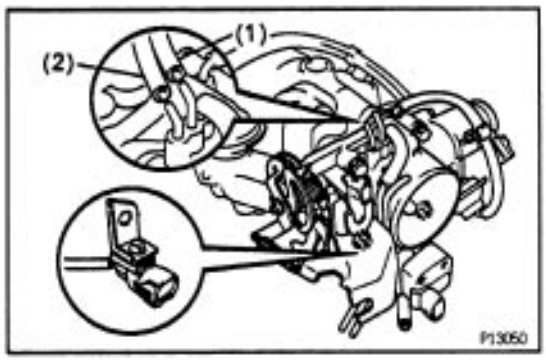
Install a new gasket, the EGR valve and vacuum mod–ulator with the 3 nuts.

**Torque: 12 N–m (120 kgf–cm, 9 ft–lbf)**




**37. INSTALL THROTTLE BODY TO AIR INTAKE CHAMBER**

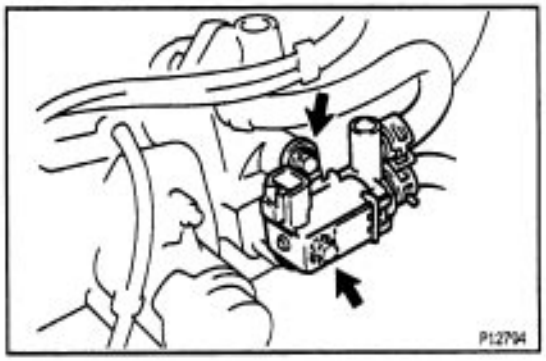
(a) Place a new gasket on the air intake chamber.




(b) Install the throttle body with the 2 bolts and 2 nuts.

**Torque: 19.5 N–m (200 kgf–cm. 14 ft–lbf)**

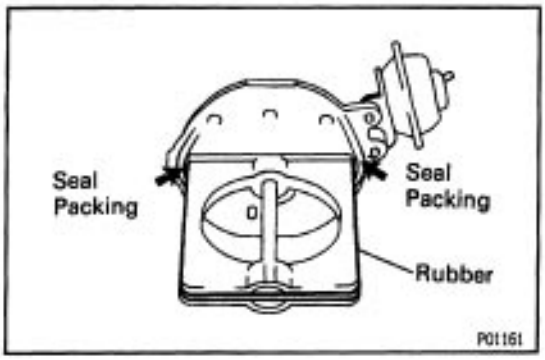
(c) Connect the following vacuum hoses:
- (1) Vacuum hose to P port of EGR vacuum modula–tor
- (2) Vacuum hose to R port of EGR vacuum modula–tor




**38. INSTALL A/C IDLE–UP VSV TO AIR INTAKE CHAMBER**

(a) Install the A/C idle–up VSV with the 2 bolts.

(b) Connect the air hose.




**39. INSTALL INTAKE AIR CONTROL VALVE TO AIR INTAKE CHAMBER**

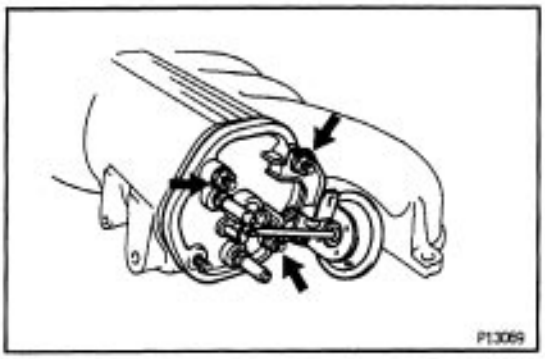
(a) Install a new gasket to the air intake chamber.

(b) Apply a light coat of engine oil to the rubber portions.

(c) Apply seal packing to the positions of the intake air control valve as shown in the illustration.

**Seal packing:**

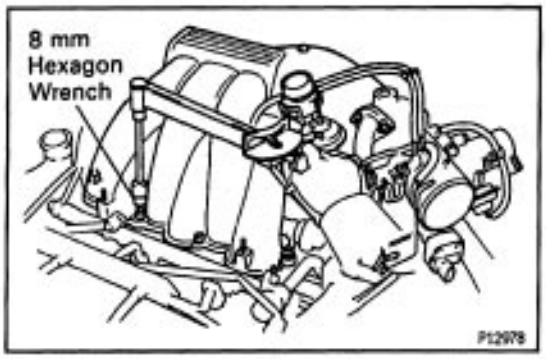
**Part No. 08826–00080 or equivalent**




(d) Install the intake air control valve and data link connector 1 clamp with the 3 nuts.

**Torque: 14.5 N–m (145 kgf–cm, 10 ft–lbf)**

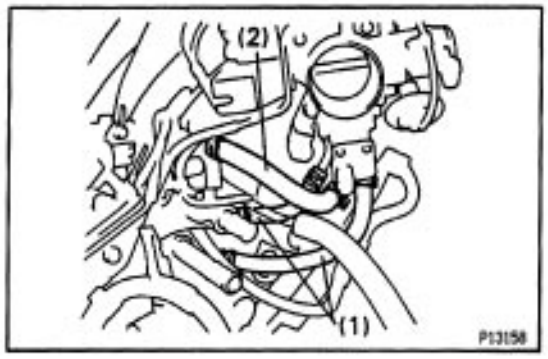
(d) Connect the A/C air hose.




**40. INSTALL AIR INTAKE CHAMBER**

(a) Using an 8 mm hexagon wrench, install a new gasket and the air intake chamber with the 2 bolts and 2 nuts.

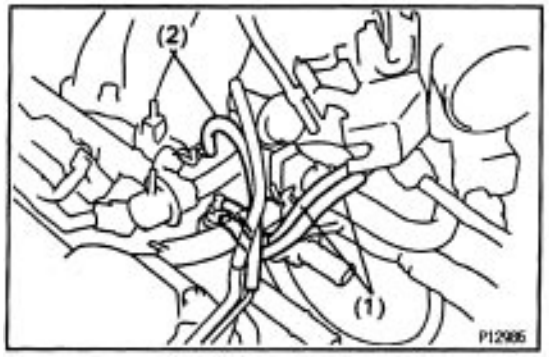
**Torque: 43 N–m (440 kgf–cm, 32 ft–lbf)**




(b) Connect the following hoses:

(1) 2 water bypass hoses

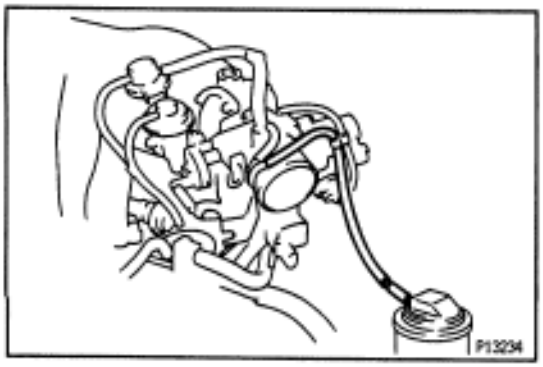
(2) Air assist hose



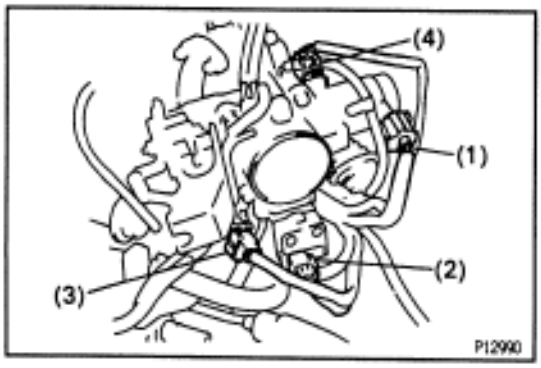

(c) Connect the following vacuum hoses:

(1) 2 vacuum hoses to TVV

(2) Vacuum hose to cylinder head rear plate

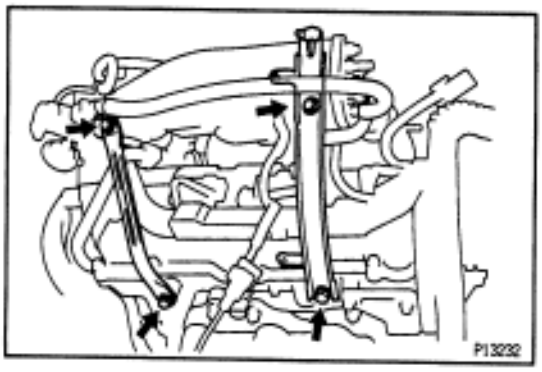



(3) Vacuum hose to charcoal canister

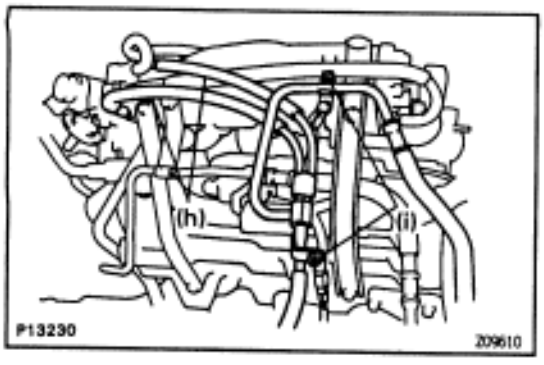



(d) Connect the following connectors:
(1) Throttle position sensor connector
(2) IAC valve connector
(3) EGR gas temperature sensor connector
(4) A/C idle–up connector

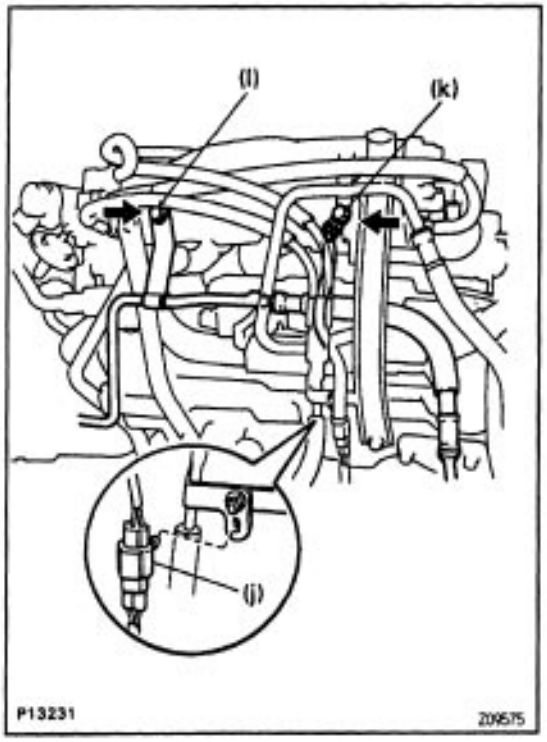

(e) Install 2 new gaskets and EGR pipe with the 4 nuts.
**Torque: 12 N–m (120 kgf–cm, 9 ft–lbf)**



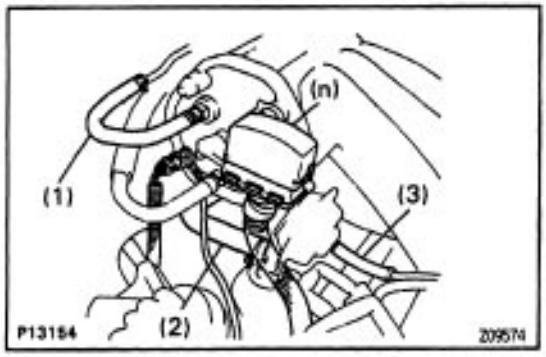

(f) Install the No.1 engine hanger with the 2 bolts.
**Torque: 39 N–m (400 kgf–cm, 19 ft–lbf)**
(g) Install the air intake chamber stay with the 2 bolts.
**Torque: 19.5 N–m (200 kgf–cm, 14 ft–lbf)**



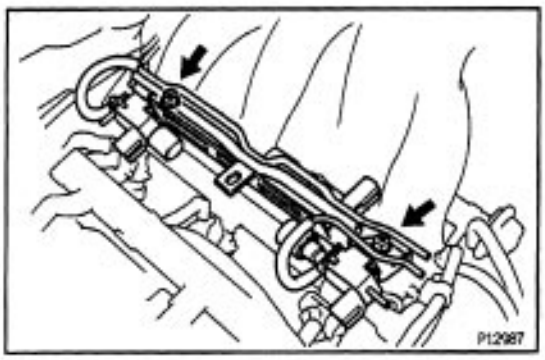

(h) Connect the 2 PS air hoses.
(i) Connect the PS pressure tube with the 2 nuts.



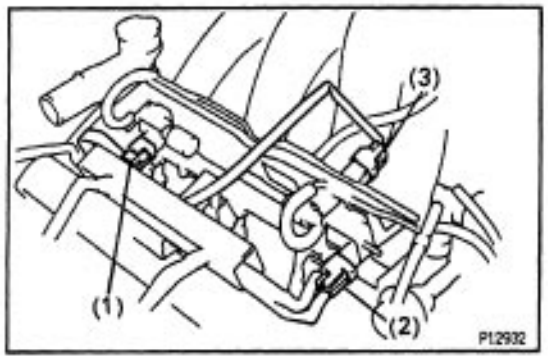

(j) Connect the RH oxygen sensor connector clamp to the PS pressure tube.
(k) Connect the ground strap with the bolt.
(l) Connect the hydraulic pressure pipe to the air intake chamber with the bolt.



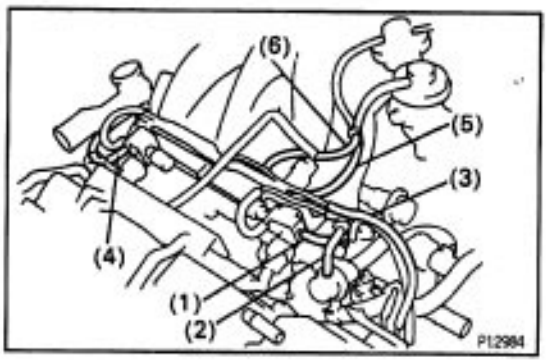

(m) Connect the following hoses:
(1) Brake booster vacuum hose
(2) PCV hose
(3) Intake air control valve vacuum hose
(n) Connect the data link connector 1.
(o) Connect the 2 ground straps with the nut.
**Torque: 14.5 N–m (145 kgf–cm, 10 ft–lbf)**



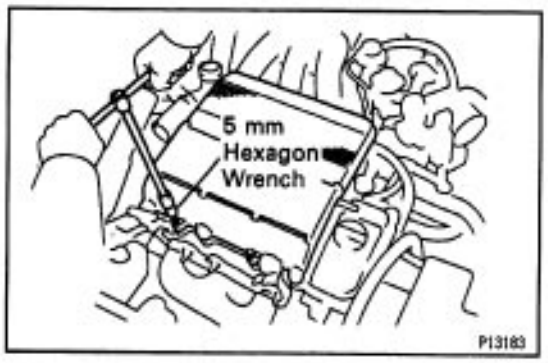

**41. INSTALL EMISSION CONTROL VALVE SET**
(a) Install the emission control valve set with the 2 bolts.
**Torque: 8 N–m (80 kgf–cm, 69 in.–lbf)**




(b) Connect the following connectors:
(1) Intake air control connector
(2) Fuel pressure connector
(3) EGR VSV connector

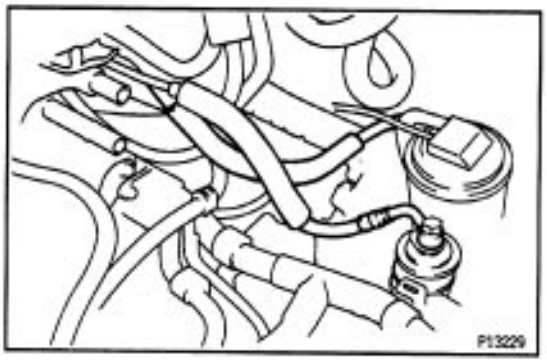



(c) Connect the following vacuum hoses:
(1) Vacuum hose to fuel pressure control VSV
(2) Vacuum hose to fuel pressure regulator
(3) Vacuum hose to cylinder head rear plate
(4) Vacuum hose to intake air control valve VSV
(5) Vacuum hose to EGR vacuum modulator
(6) Vacuum hose to EGR valve

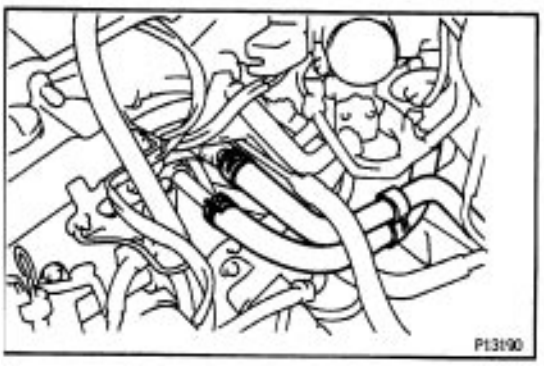



**42. INSTALL V–BANK COVER**
Using a 5 mm hexagon wrench, install the V–bank cover with the 2 nuts.

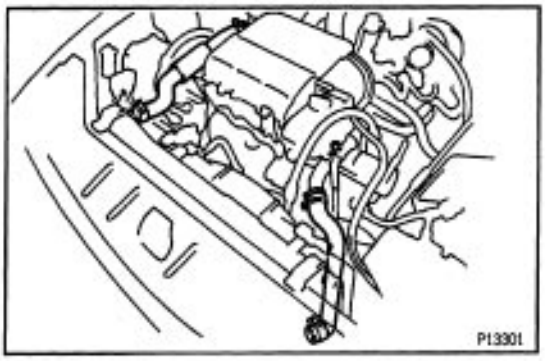

**43. CONNECT PRESSURE HOSE TO HYDRAULIC MOTOR**
Connect the pressure hose to the water inlet.



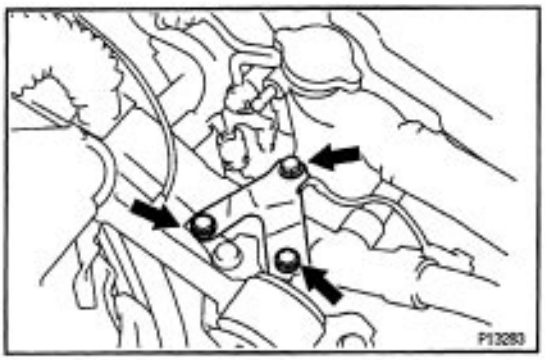

**44. CONNECT FUEL HOSES**
(a) Connect the fuel return hose to the fuel pipe.
(b) Connect the fuel inlet hose to the fuel filter.
**Torque: 30 N–m (300 kgf–cm, 22 ft–lbf)**



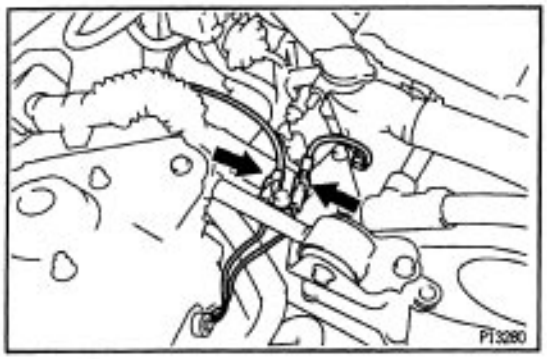

**45. CONNECT HEATER HOSES**
Connect the 2 hoses.



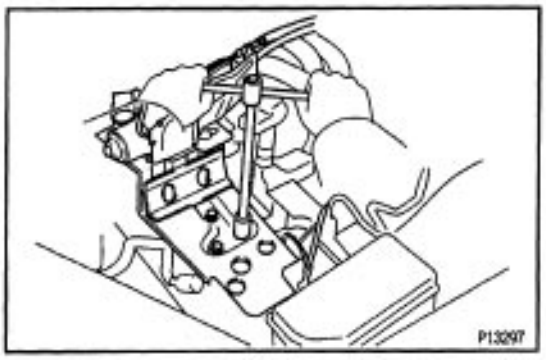

**46. CONNECT RADIATOR HOSES**
Connect the 2 hoses.



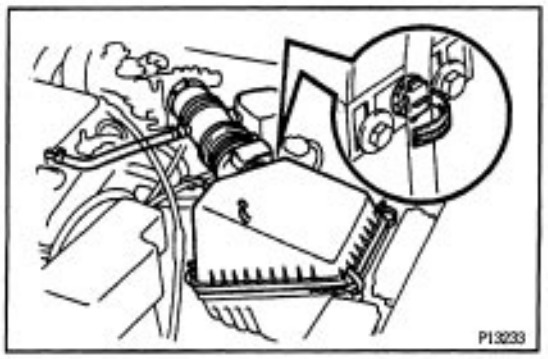

**47. INSTALL RH ENGINE MOUNTING STAY**
Install the mounting stay with the 3 bolts.
**Torque: 31.4 N–m (320 kgf–cm, 23 ft–lbf)**



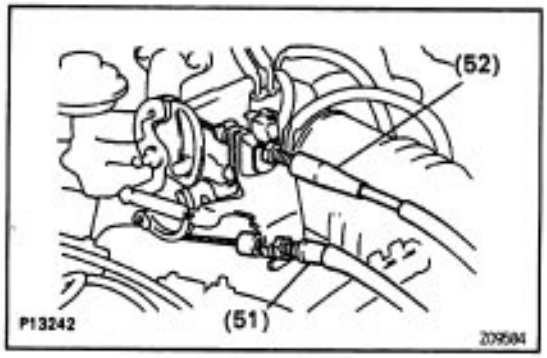

**48. CONNECT GROUND STRAPS**
Connect the 2 straps.




**49. w/ CRUISE CONTROL SYSTEM:**
**INSTALL CRUISE CONTROL ACTUATOR**
(a) Connect the actuator and bracket with the 3 bolts.
(b) Connect the actuator connector and clamp.
(c) Install the actuator cover with the bolt and clip.

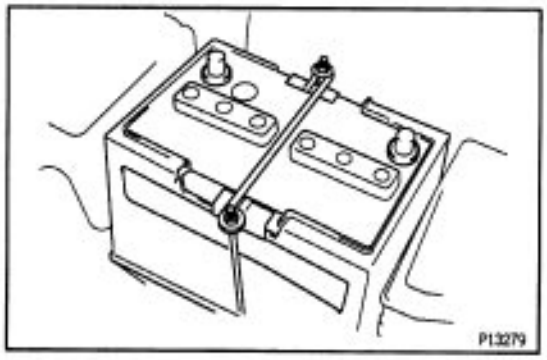



**50. INSTALL AIR CLEANER CAP, VOLUME AIR FLOW METER AND AIR CLEANER HOSE**
(a) Connect the air cleaner hose, and install the air clean–er cap and volume air flow meter with the 4 clips.
(b) Tighten the air cleaner hose clamp bolt.
(c) Connect the PCV hose.
(d) Connect the accelerator cable clamp.
(e) Connect the volume air flow meter connector and wire clamp.




**51. CONNECT THROTTLE CABLE**
**52. CONNECT ACCELERATOR CABLE**

**53. FILL WITH ENGINE COOLANT**
**Capacity:**
**8.7 liters (9.2 US qts, 7.7 Imp. qts)**

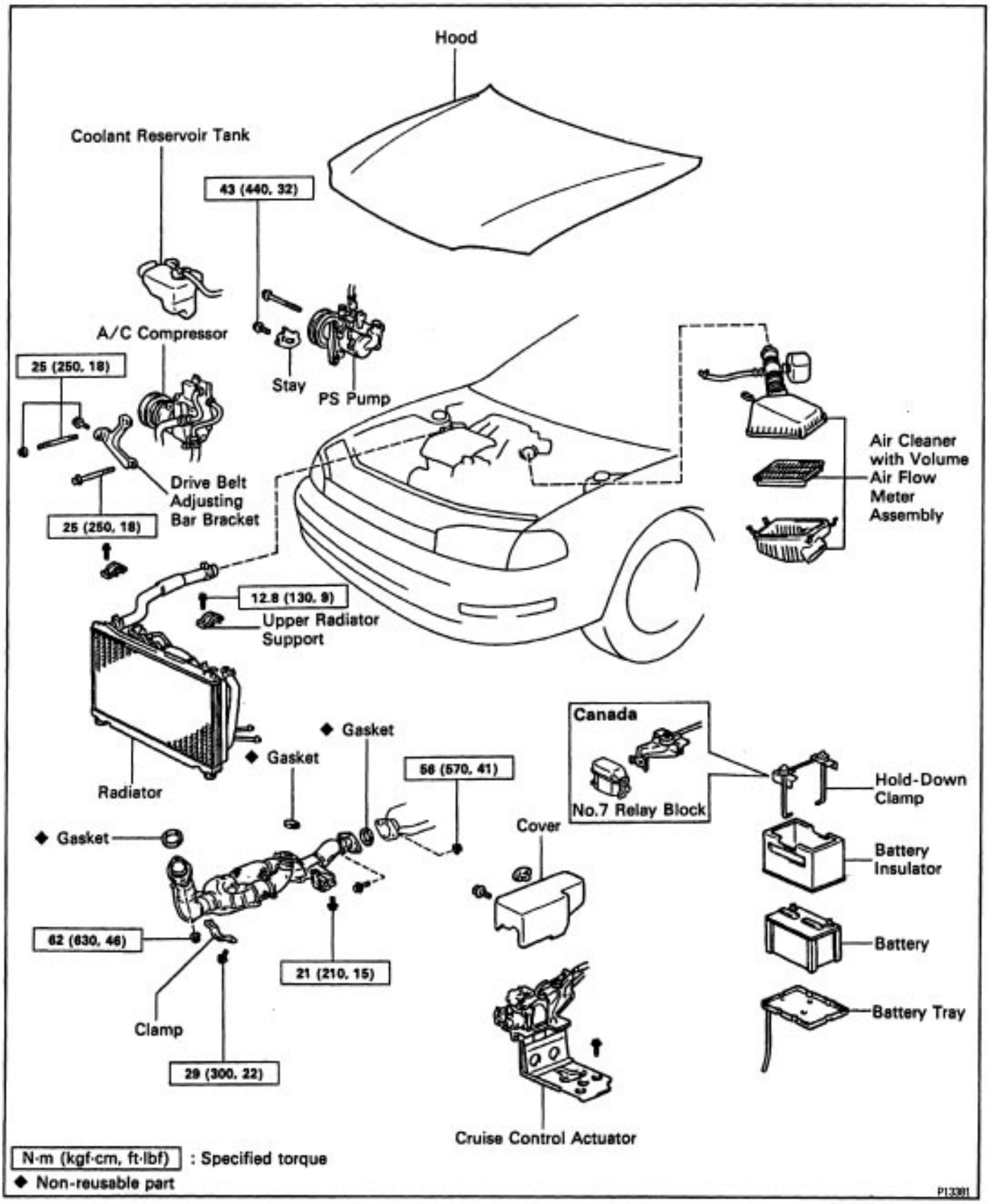


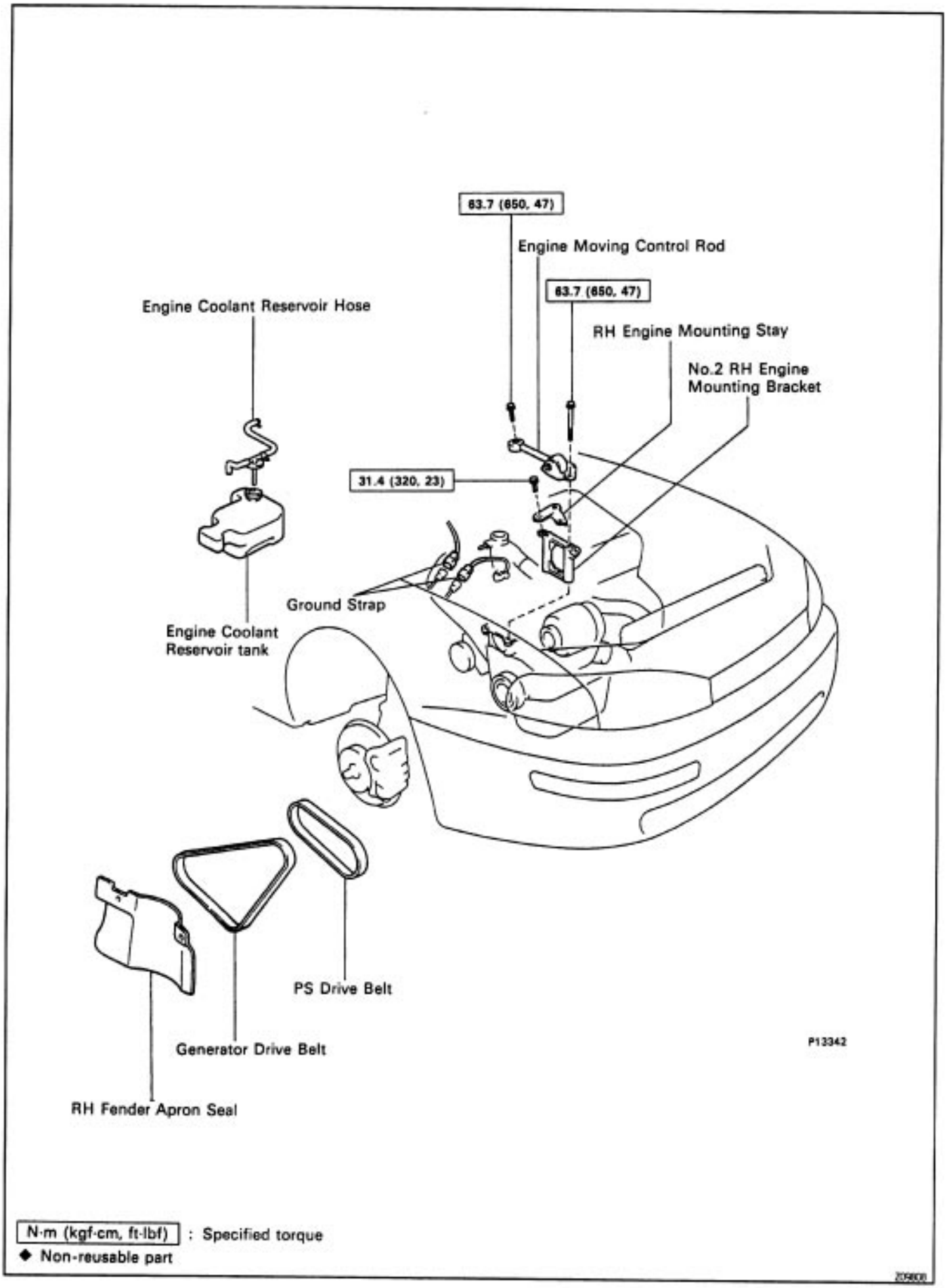

**54. INSTALL BATTERY TRAY AND BATTERY**

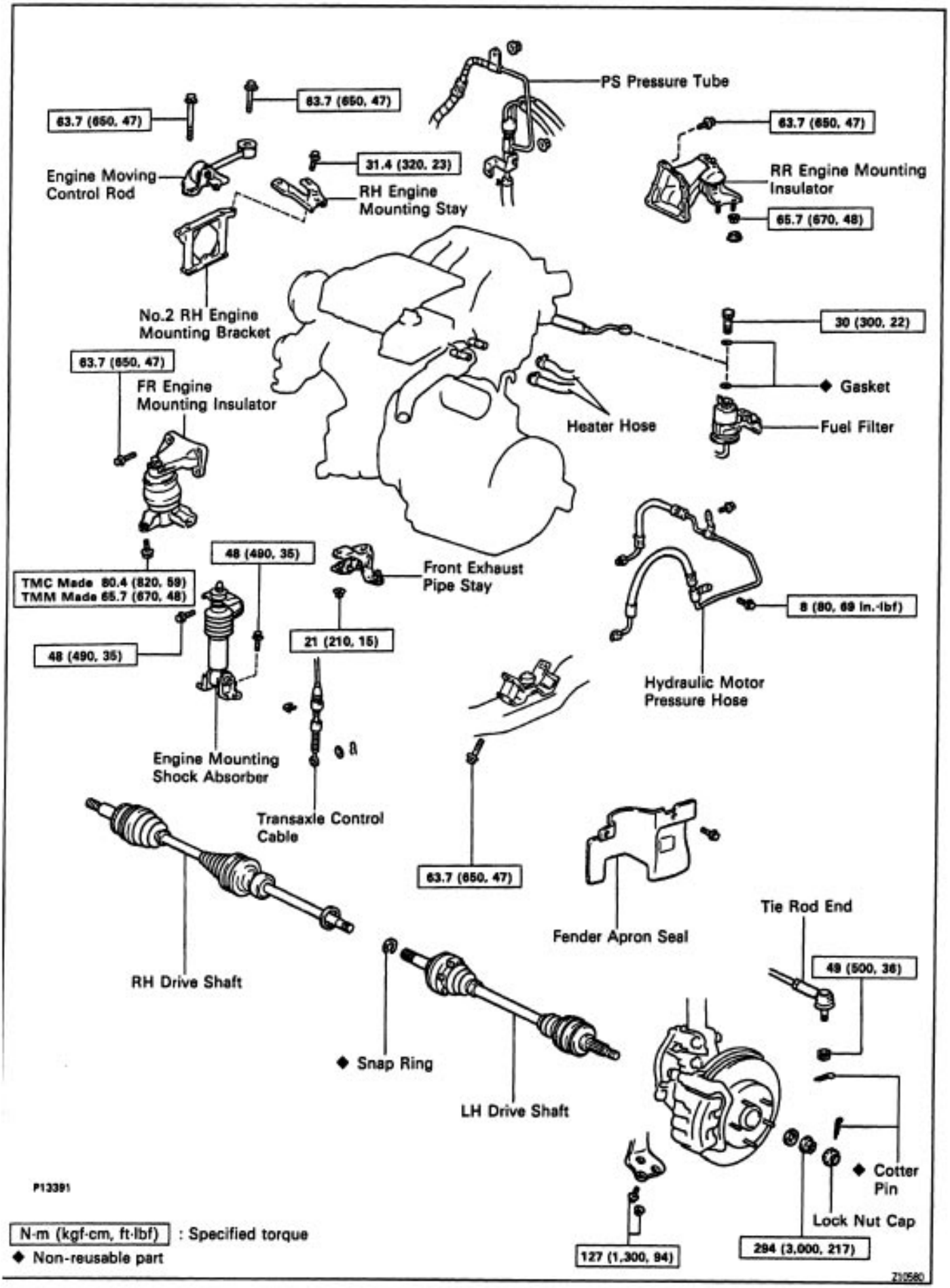
**55. START ENGINE AND CHECK FOR LEAKS**
**56. PERFORM ROAD TEST**
Check for abnormal noise, shock, slippage, correct shift points and smooth operation.
**57. RECHECK ENGINE COOLANT LEVEL**

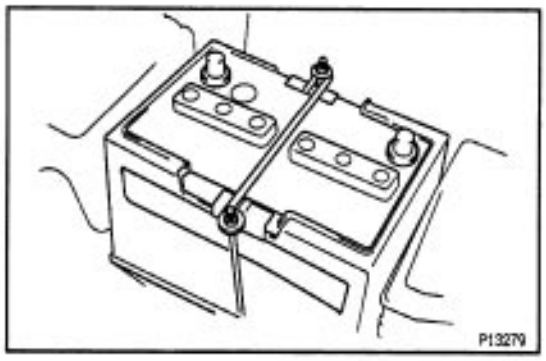
# CYLINDER BLOCK

## COMPONENTS FOR ENGINE REMOVAL AND INSTALLATION










# ENGINE REMOVAL

**(See Components for Engine Removal and Installation)**

**1. REMOVE BATTERY AND TRAY**

**CAUTION: Work must be started after 90 seconds from the time the ignition switch is turned to the "LOCK" position and the negative (–) terminal cable is disconnected from the battery.**

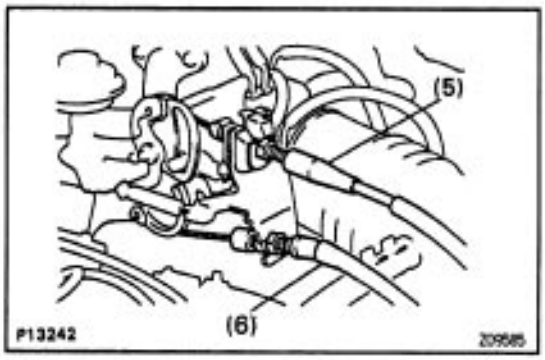
**2. REMOVE HOOD**

**3. DRAIN ENGINE COOLANT**

**4. DRAIN ENGINE OIL**

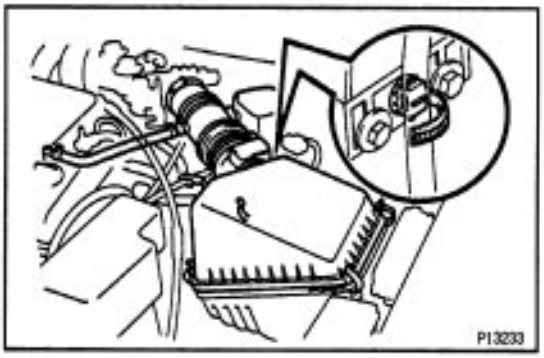
**5. DISCONNECT ACCELERATOR CABLE**

**6. DISCONNECT THROTTLE CABLE**



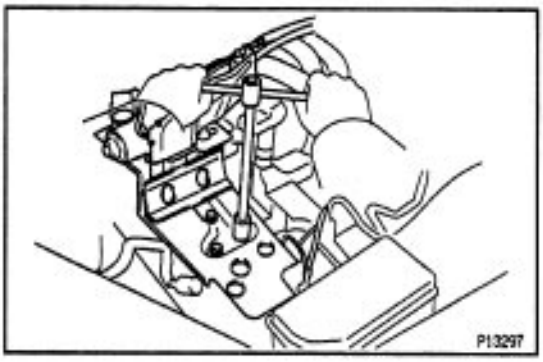

**7. REMOVE AIR CLEANER CAP, VOLUME AIR FLOW METER AND AIR CLEANER HOSE**

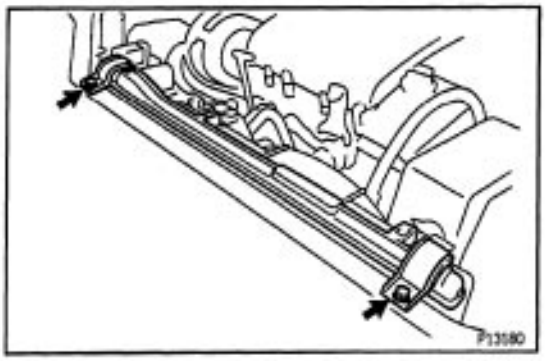
(a) Disconnect the volume air flow meter connector and wire clamp.
(b) Disconnect the accelerator cable clamp.
(c) Disconnect the PCV hose.
(d) Loosen the air cleaner hose clamp bolt.
(e) Disconnect the 4 air cleaner cap clips.
(f) Remove the air cleaner cap and volume air flow meter together with the air cleaner hose.
(g) Remove the element.
(h) Remove the 3 bolts and air cleaner case.




**8. w/ CRUISE CONTROL SYSTEM:**
**REMOVE CRUISE CONTROL ACTUATOR**

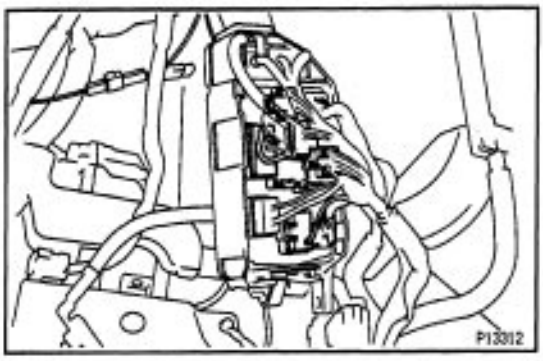
(a) Remove the bolt, clip and actuator cover.
(b) Disconnect the actuator connector and clamp.
(c) Remove the 3 bolts, and disconnect the actuator with the bracket.






**9. REMOVE RADIATOR**

(See page EG2–336)

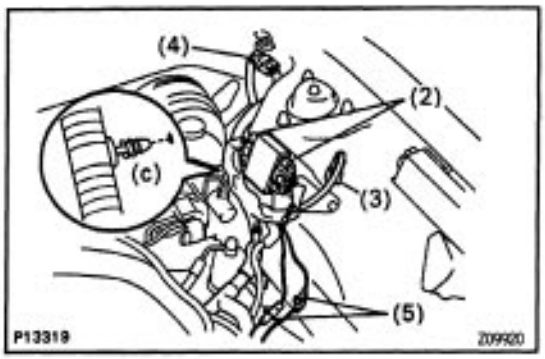



**10. DISCONNECT ENGINE WIRE**

(a) Remove the 2 bolts and disconnect the engine relay box.

(b) Disconnect the following wires and connectors:

(1) 5 connectors from relay box



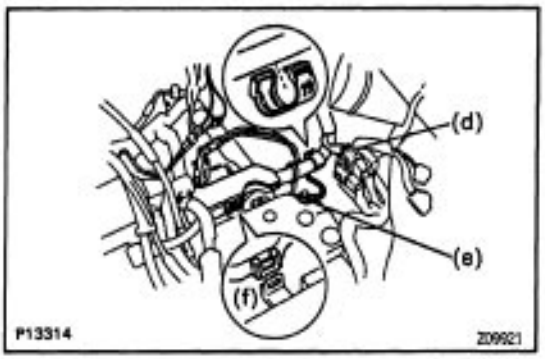

(2) 2 igniter connectors

(3) Noise filter connector

(4) Connector from LH fender apron

(5) 2 ground straps

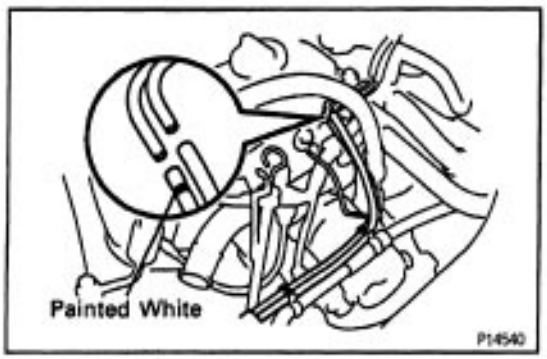
(c) Disconnect the wire clamp.




(d) Disconnect the connector from the LH fender apron.

(e) Remove the bolt and disconnect the ground strap.

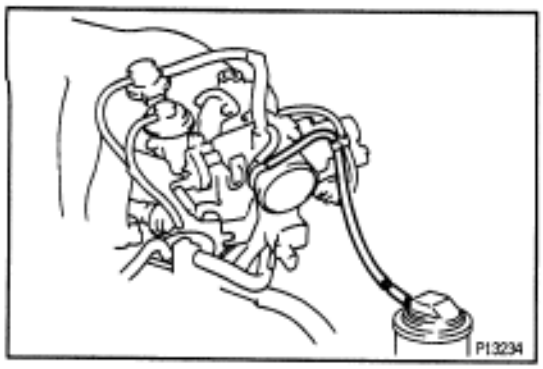
(f) Disconnect the wire clamp.




**11. DISCONNECT VACUUM HOSES**

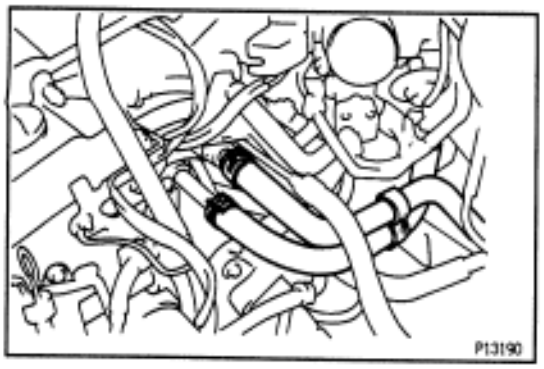
Disconnect the following vacuum hoses:

(1) Vacuum hoses from vacuum tank for intake air control valve

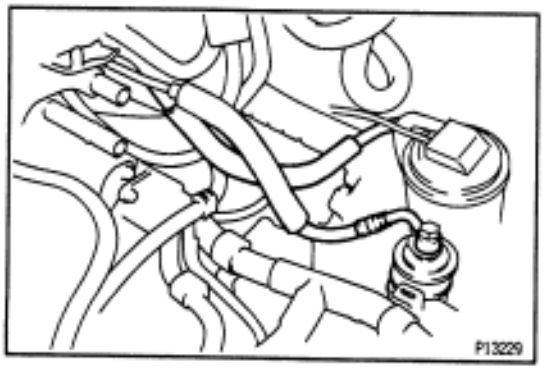



(2) Vacuum hose from charcoal canister

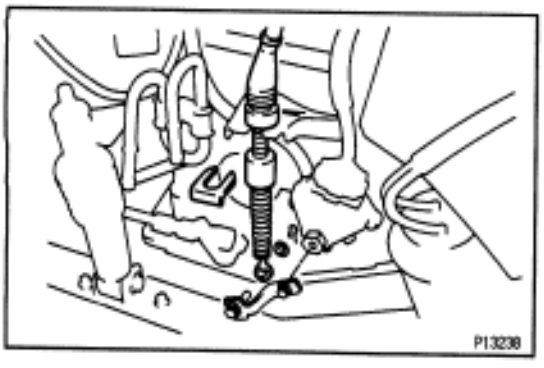

(3) Brake booster vacuum hose from air intake cha–mber




**12. DISCONNECT HEATER HOSES**
Disconnect the 2 hoses.




**13. DISCONNECT FUEL HOSES**
Disconnect the fuel inlet and return hoses.
**CAUTION: Catch leaking fuel in a container.**

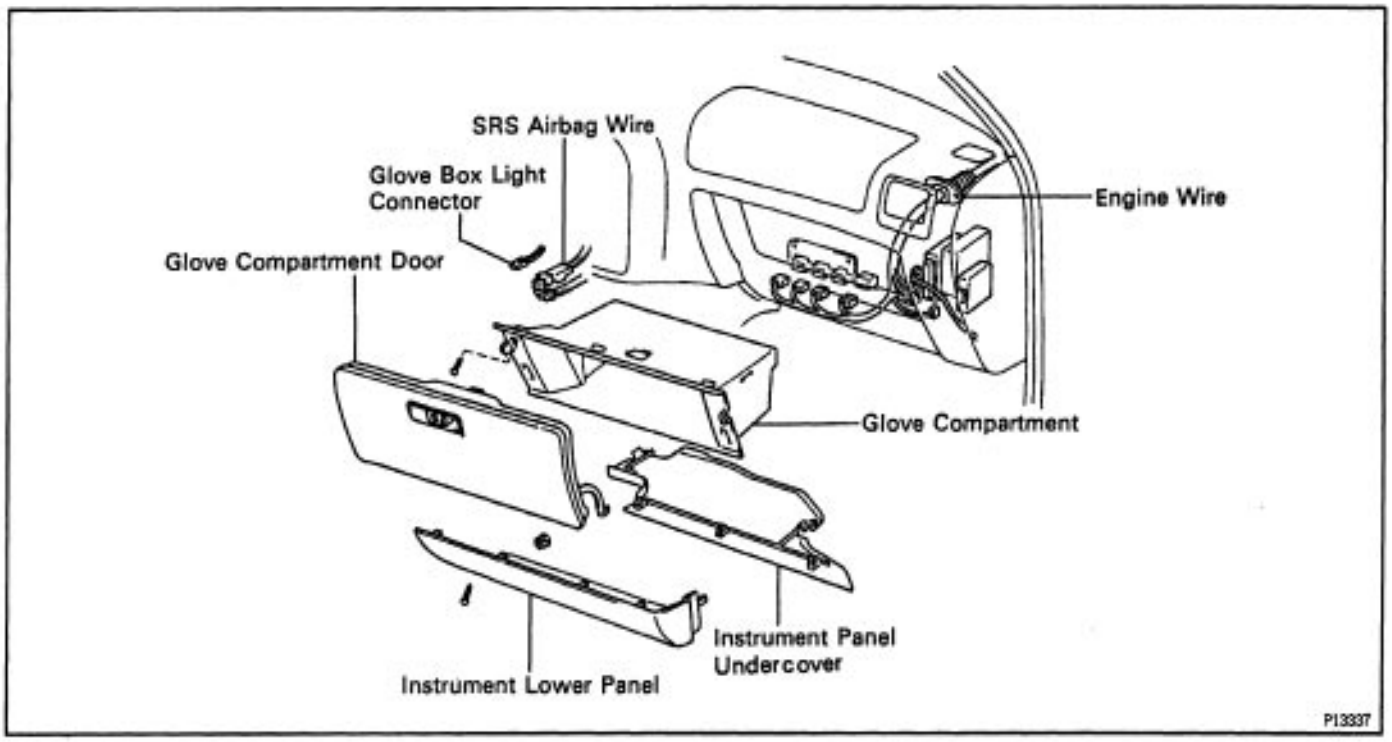


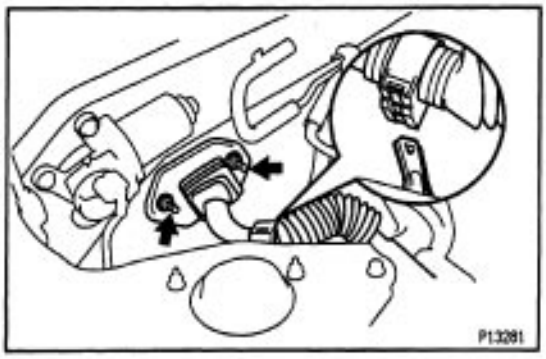

**14. DISCONNECT TRANSAXLE CONTROL CABLE FROM TRANSAXLE**

**15. DISCONNECT ENGINE WIRE FROM CABIN**

(a) Remove the following parts:
- (1) Under cover
- (2) Lower instrument panel
- (3) Glove compartment door
- (4) Glove compartment

(b) Disconnect the following connectors:
- (1) 3 ECM connectors
- (2) 5 cowl wire connectors
- (3) Cooling fan ECU connector

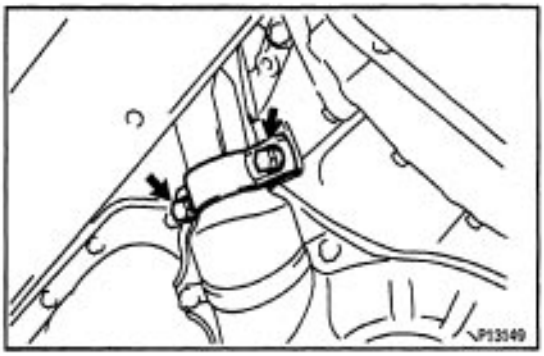



(c) Disconnect the wire clamp.
(d) Remove the 2 nuts, and pull out the engine wire from the cowl panel.

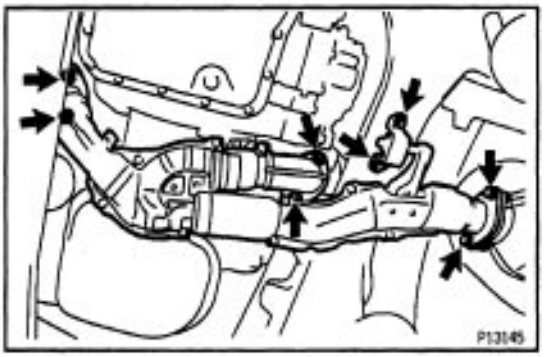

**16. REMOVE A/C COMPRESSOR WITHOUT DISCONNECTING HOSES**

(a) Disconnect the A/C compressor connector.
(b) Remove the drive belt.
(c) Remove the 5 bolts and drive belt adjusting bar brack–et and, disconnect the A/C compressor.
HINT: Move the compressor aside and suspend it.



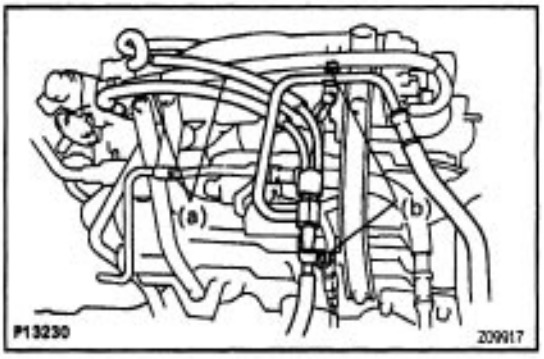

**17. REMOVE FRONT EXHAUST PIPE**

(a) Remove the 2 bolts and exhaust pipe clamp.



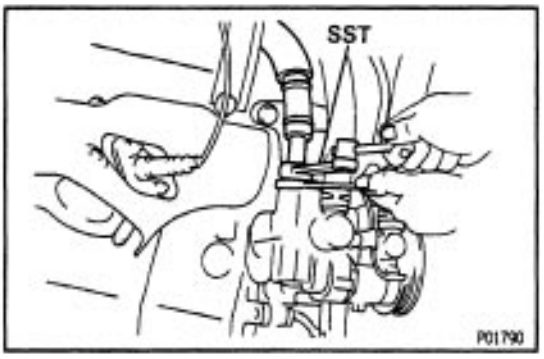

(b) Remove the 2 bolts, and disconnect the bracket.
(c) Remove the 2 bolts and 2 nuts holding the front exhaust pipe to the three–way catalytic converter.
(d) Remove the 4 nuts holding the front exhaust pipe to the exhaust manifolds.
(e) Remove the front exhaust pipe and 3 gaskets.

**18. REMOVE DRIVE SHAFTS**
**(See SA section)**



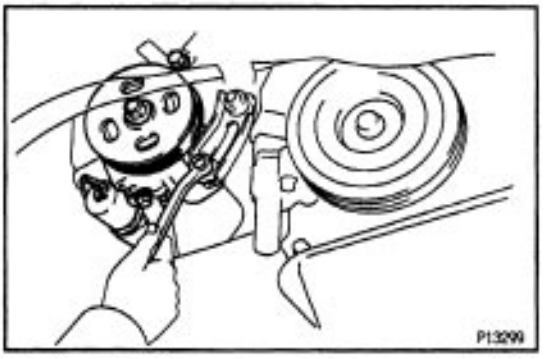

**19. DISCONNECT PS PRESSURE TUBE**

(a) Disconnect the 2 PS air hoses.
(b) Remove the 2 nuts and disconnect the PS pressure tube.




**20. DISCONNECT HYDRAULIC COOLING FAN PRESSURE HOSE**

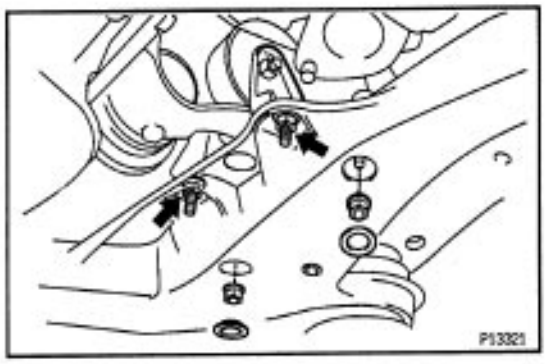
Using SST, disconnect the pressure hose.
SST 09631– 22020



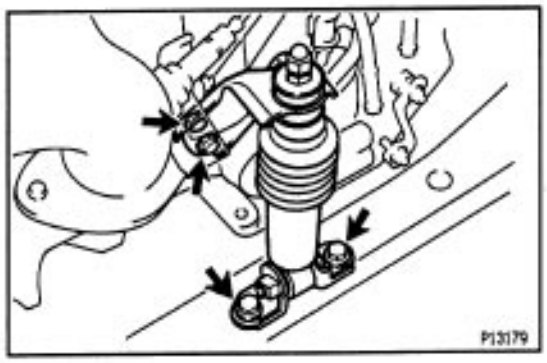

**21. REMOVE PS PUMP WITHOUT DISCONNECTING HOSES**

(a) Remove the PS drive belt.
(b) Remove the 2 bolts, and disconnect the PS pump from the engine.
HINT: Move the PS pump aside and suspend it.

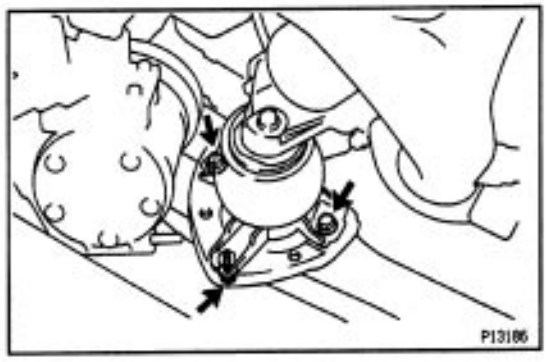

**22. DISCONNECT LH ENGINE MOUNTING INSULATOR**
Remove the 4 bolts, and disconnect the mounting insulator.



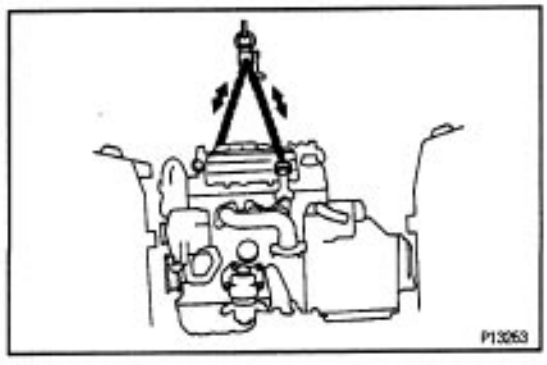

**23. DISCONNECT RR ENGINE MOUNTING INSULATOR**
(a) Remove the 2 hole plugs.
(b) Remove the 4 nuts, and disconnect the mounting insulator.



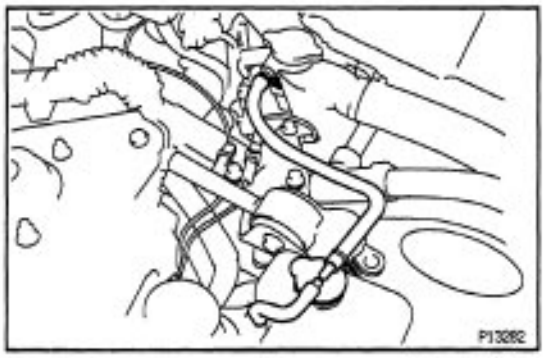

**24. REMOVE ENGINE MOUNTING SHOCK ABSORBER**
Remove the 4 bolts and engine mounting shock absorber.




**25. DISCONNECT FR ENGINE MOUNTING INSULATOR**
Remove the 3 bolts, and disconnect the mounting insulator.

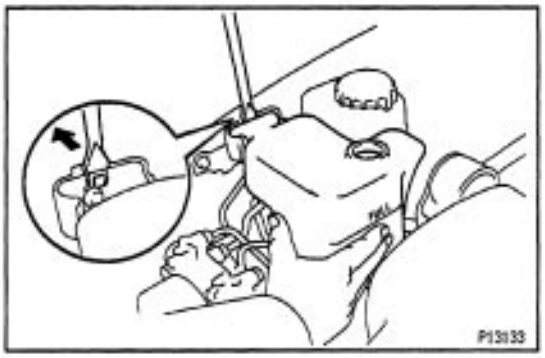



**26. ATTACH ENGINE SLING DEVICE TO ENGINE HANGERS**

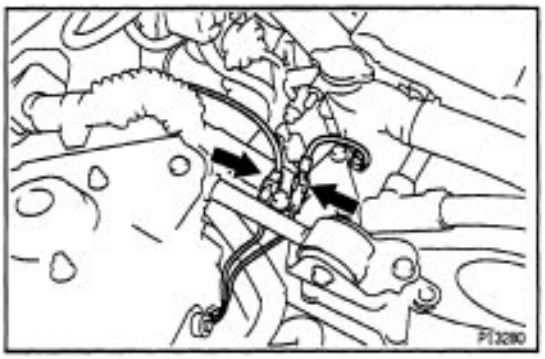



**27. REMOVE COOLANT RESERVOIR TANK**

(a) Disconnect the reservoir hose.

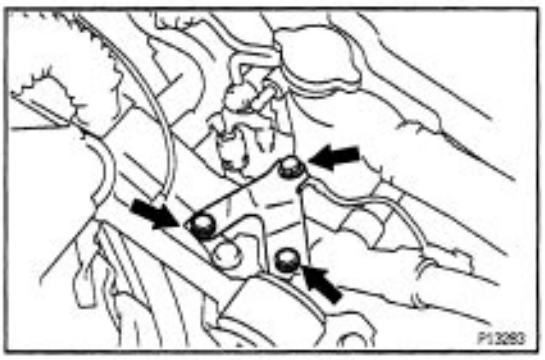



(b) Using a screwdriver, remove the reservoir tank.



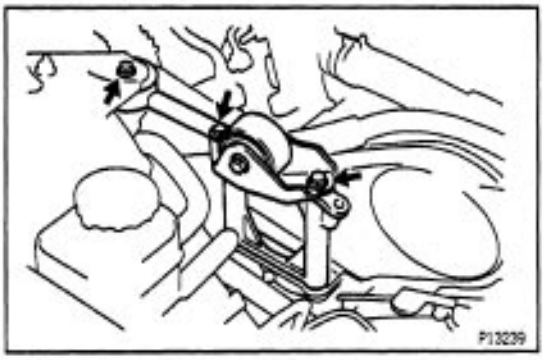

**28. DISCONNECT GROUND STRAPS**

Disconnect the 2 straps.



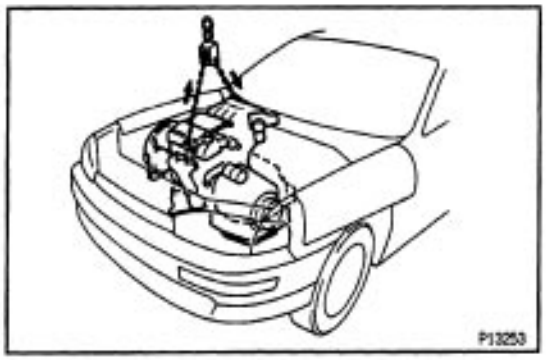

**29. REMOVE RH ENGINE MOUNTING STAY**

Remove the 3 bolts and RH engine mounting stay.




**30. REMOVE ENGINE MOVING CONTROL ROD AND NO.2 RH ENGINE MOUNTING BRACKET**

Remove the 3 bolts, control rod and mounting brack–et.



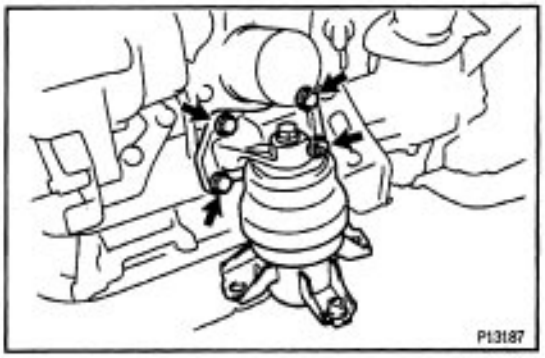

**31. REMOVE ENGINE AND TRANSAXLE ASSEMBLY PROM VEHICLE**

(a) Lift the engine out of the vehicle slowly and carefully.

**NOTICE: Be careful not to hit the PS gear housing or park/neutral position switch.**

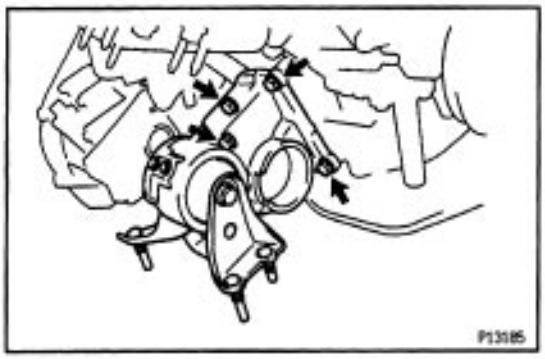
(b) Make sure the engine is clear of all wiring, hoses and cables.

(c) Place the engine and transaxle assembly onto the stand.




**32. REMOVE FR ENGINE MOUNTING INSULATOR**

Remove the 4 bolts and mounting insulator.



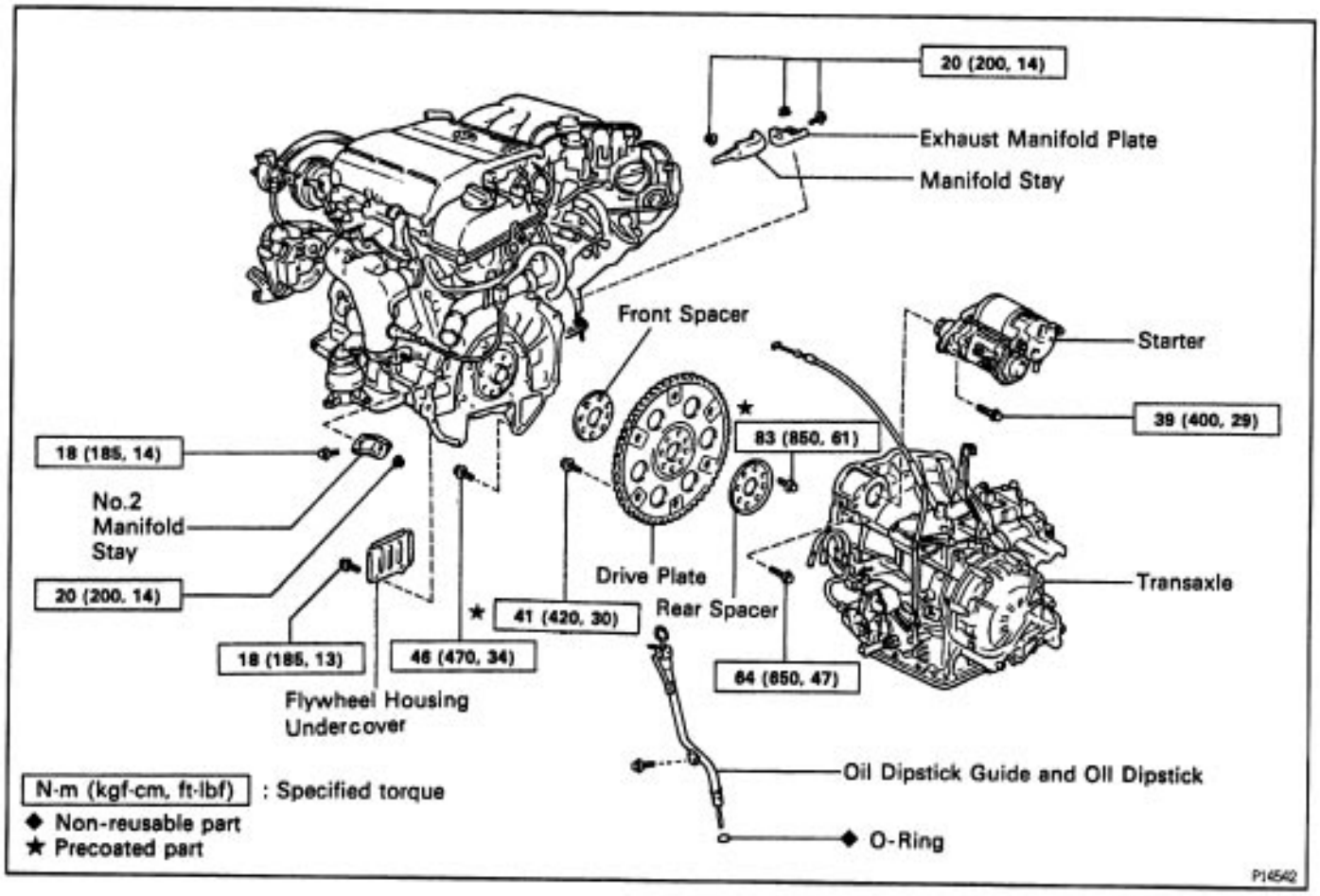

**33. REMOVE RR ENGINE MOUNTING INSULATOR**

Remove the 4 bolts and mounting insulator.

**34. REMOVE FRONT EXHAUST PIPE STAY**

Remove the 2 bolts and pipe stay.

# COMPONENTS FOR ENGINE & TRANSAXLE SEPARATION AND ASSEMBLY



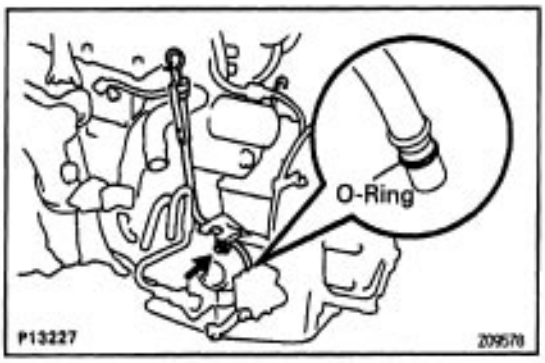

## ENGINE & TRANSAXLE SEPARATION

**(See Components for Engine & Transaxle Separation and Assembly)**

**1. DISCONNECT ENGINE WIRE**

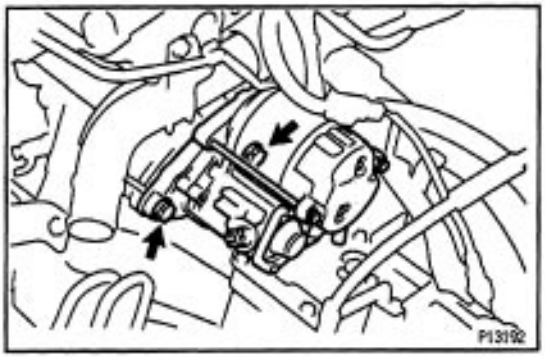
(a) Disconnect the following connector:
- (1) O/D solenoid connector
- (2) PNP switch speedometer
- (3) Starter 50 terminal
- (4) Starter B terminal
- (5) Speed sensor connector

(b) Disconnect the 2 wire clamps from the transaxle.



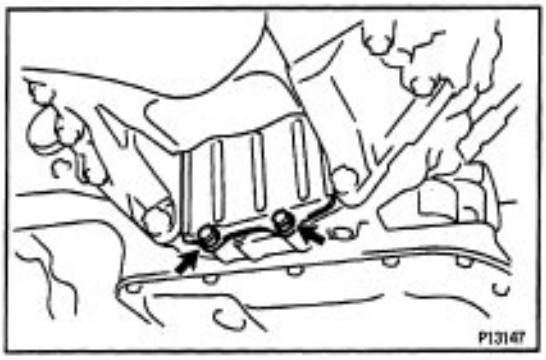

**2. REMOVE OIL DIPSTICK GUIDE AND DIPSTICK FOR TRANSAXLE**

(a) Remove the mounting bolt.
(b) Pull out the dipstick guide and dipstick from the port of transaxle.
(c) Remove the 0–ring from the dipstick guide.




**3. REMOVE STARTER**

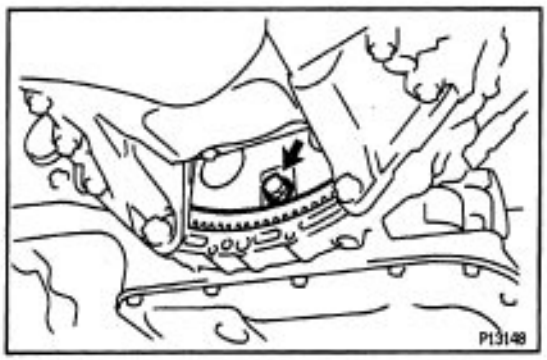
Remove the 2 bolts and starter.



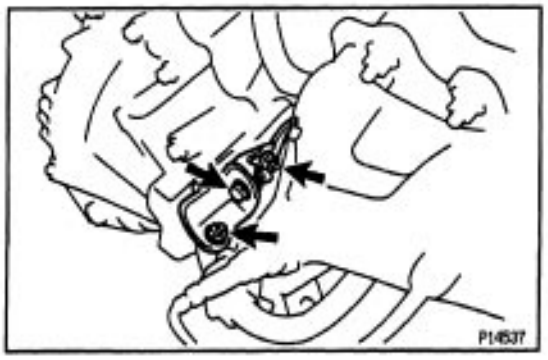

**4. REMOVE TRANSAXLE**

**A. Remove torque converter clutch mounting bolts**

(a) Remove the 2 bolts and flywheel housing undercover.

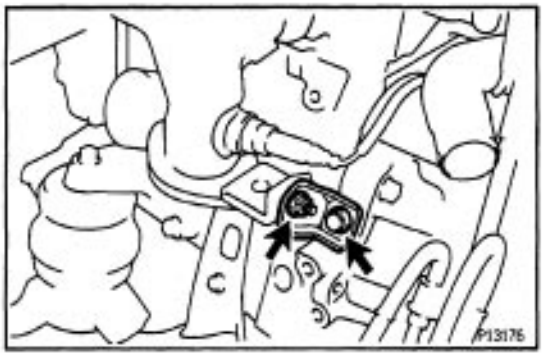



(b) Turn the crankshaft pulley bolt to gain access to each bolt.
(c) Hold the crankshaft pulley bolt with a wrench, and remove the 6 bolts.

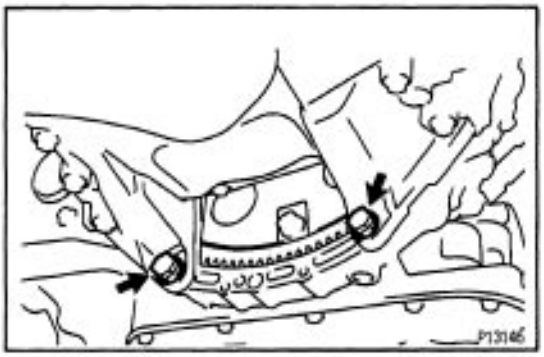



**6. Remove transaxle**

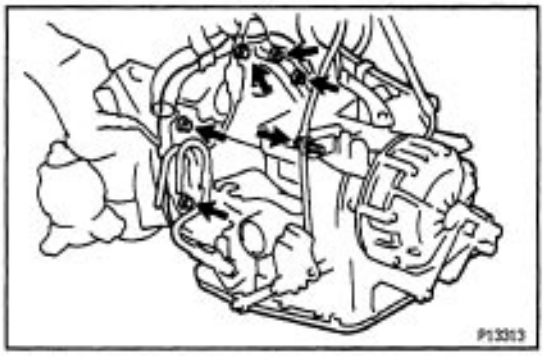
(a) Remove the bolt, 2 nuts, manifold stay and exhaust manifold plate.



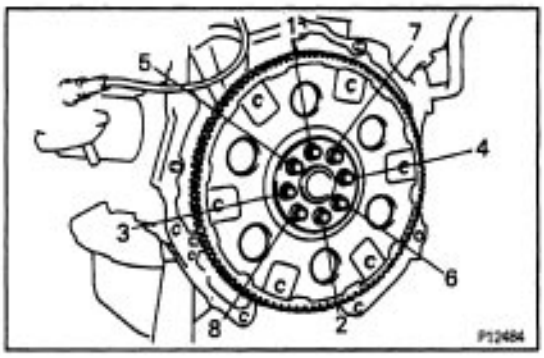

(b) Remove the bolt, nut and No.2 manifold stay.




(c) Remove the 2 bolts holding the No.2 oil pan to the transaxle.

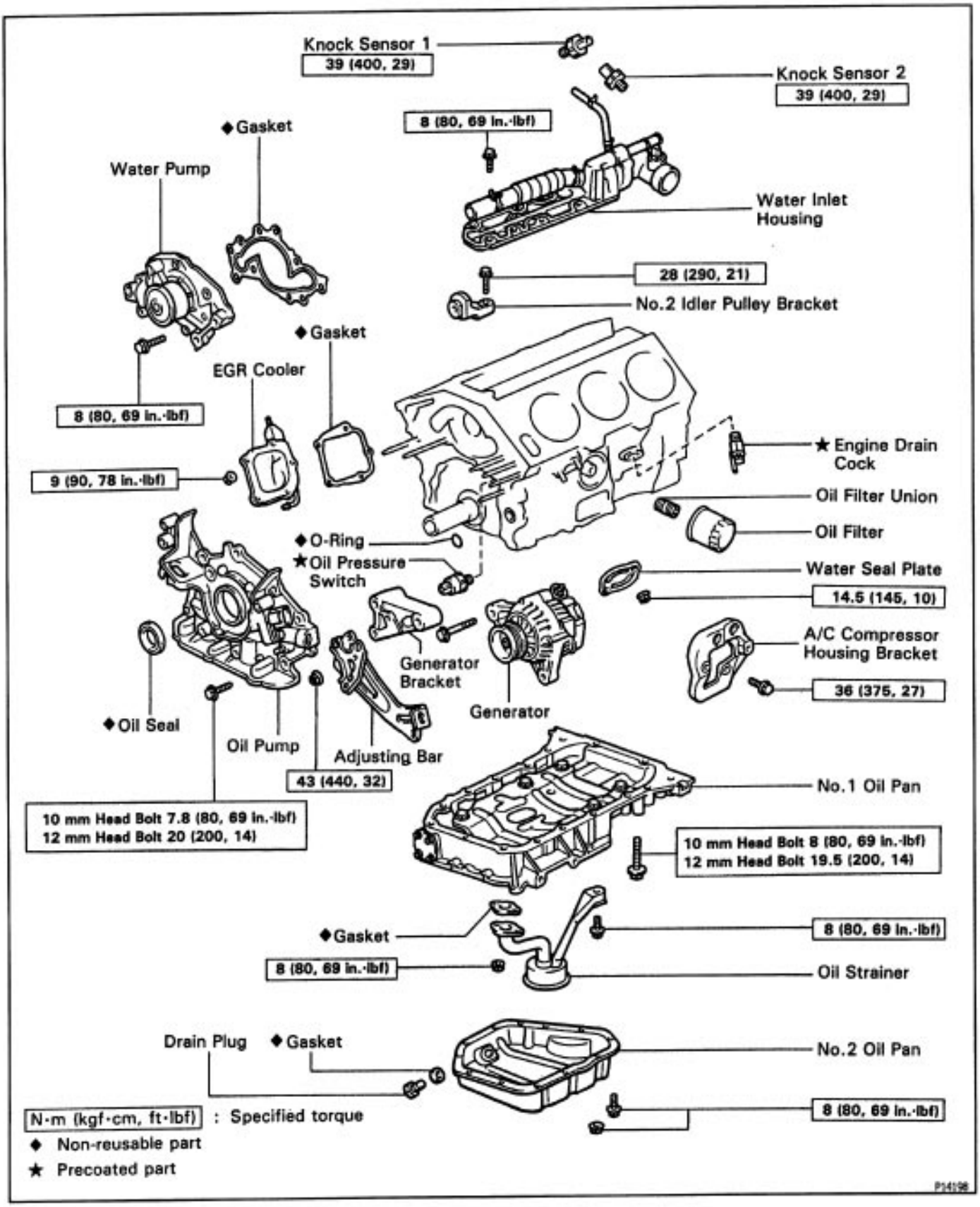



(d) Remove the 6 bolts holding the engine to the trans–axle.
(e) Remove the transaxle together with the torque con–verter clutch from the engine.




**5. REMOVE DRIVE PLATE**
Uniformly loosen and remove the drive plate bolts, in several passes, in the sequence shown.

# COMPONENTS FOR PREPARATION AND AFTER ASSEMBLY



# PREPARATION FOR DISASSEMBLY

**(See Components for Cylinder Block Preparation of Disassembly and After Assembly)**

**1. INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY**

**2. REMOVE TIMING BELT AND PULLEYS**

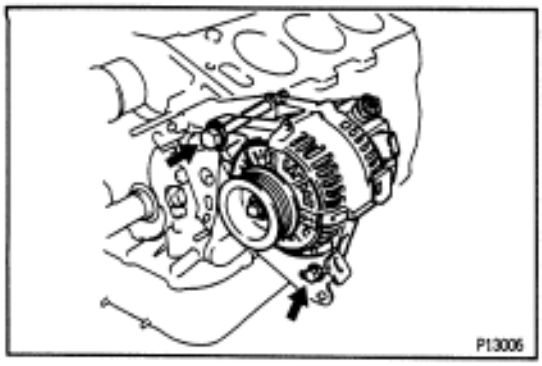
**(See pages EG2–42 to 47)**

**3. REMOVE CYLINDER HEAD**

**(See pages EG2–64 to 79)**

**4. REMOVE GENERATOR**

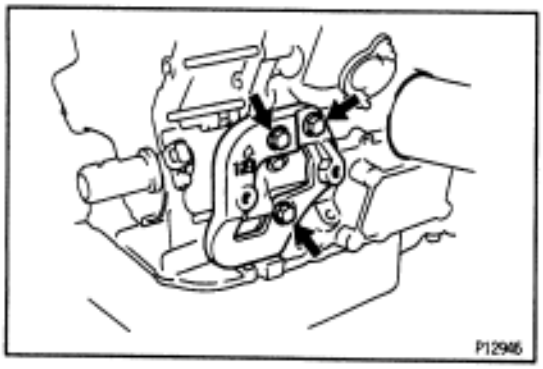
Remove the 2 bolts and generator.





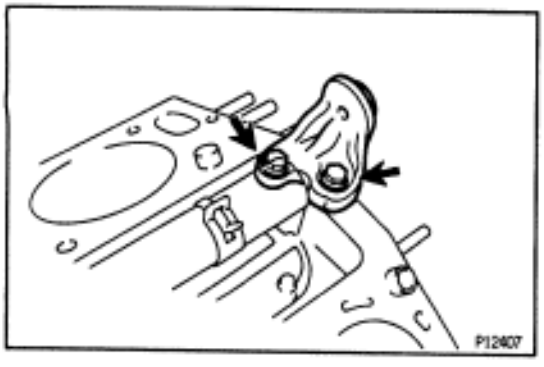
**5. REMOVE GENERATOR ADJUSTING BAR AND BRACKET**

Remove the 3 nuts, generator adjusting bar and bra–cket.



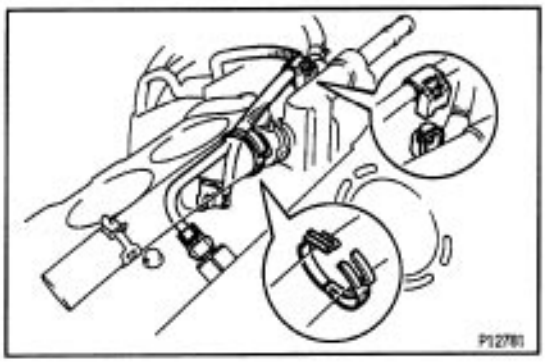

**6. REMOVE A/C COMPRESSOR HOUSING BRACKET**

Remove the 3 bolts and compressor housing bracket.



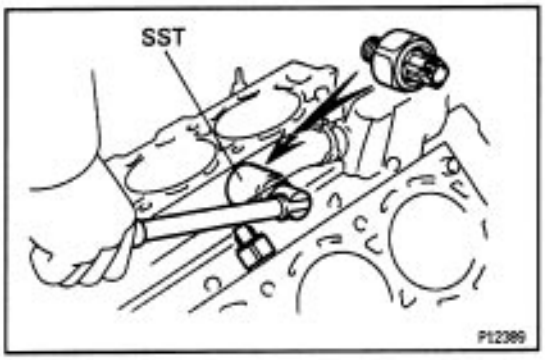

**7. REMOVE No.2 IDLER PULLEY BRACKET**

Remove the 2 bolts and idler pulley bracket.

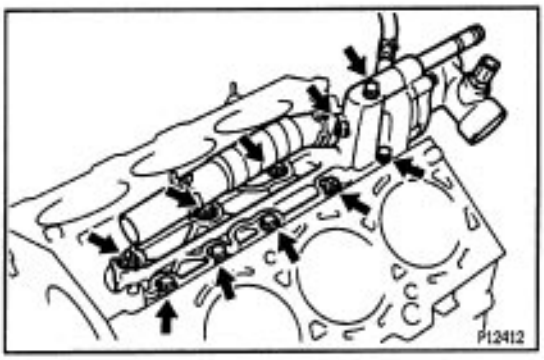



**8. REMOVE KNOCK SENSORS**

(a) Disconnect the 2 knock sensor connectors.
(b) Remove the wire band.
(c) Disconnect the engine wire clamp.

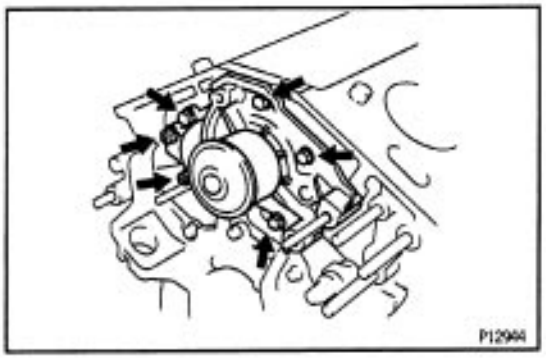



(d) Using SST, remove the 2 knock sensors.
SST 09816 – 30010



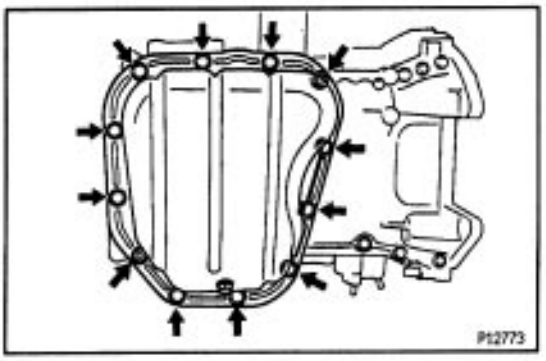

**9. REMOVE WATER INLET HOUSING**

Remove the 8 bolts, 2 nuts and water inlet housing.



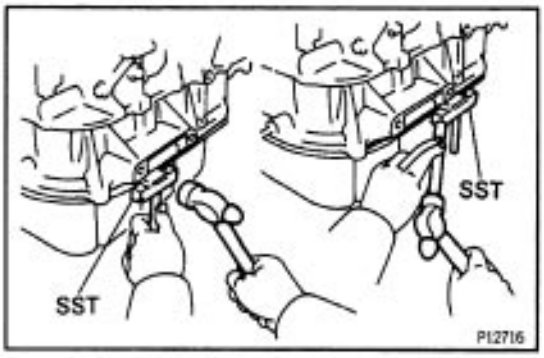

**10. REMOVE WATER PUMP**

Remove the 4 bolts, 2 nuts, water pump and gasket.



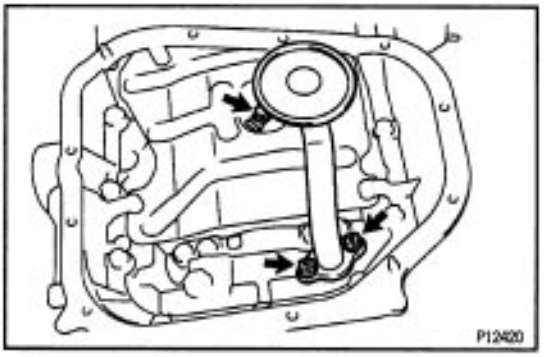

**11. REMOVE NO.2 OIL PAN**

(a) Remove the 10 bolts and 2 nuts.

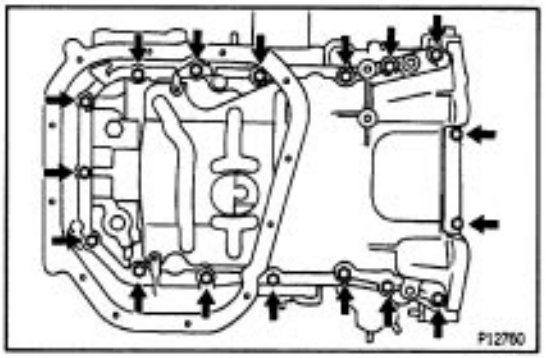



(b) Insert the blade of SST between the No. 1 and No.2 oil pans, and cut off applied sealer and remove the No. 1 oil pan.
SST 09032 – 00100
**NOTICE:**

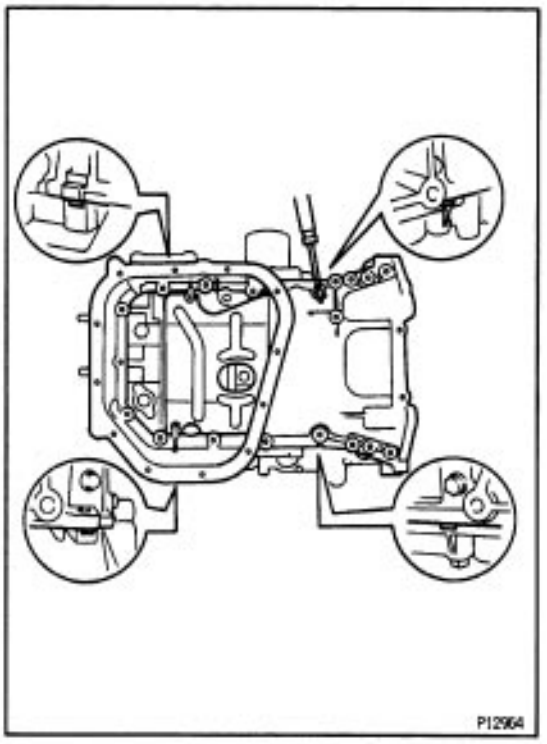
- **Be careful not to the damage the No.2 oil pan con–tact surface of the No.1 oil pan.**
- **Be careful not to damage the No.2 oil pan flange.**



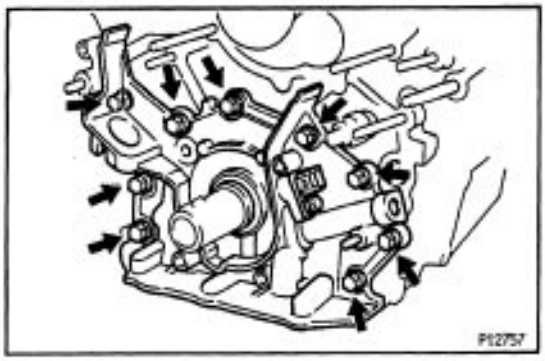

**12. REMOVE OIL STRAINER**
Remove the bolt, 2 nuts, oil strainer and gasket.




**13. REMOVE NO.1 OIL PAN**
(a) Remove the 17 bolts.

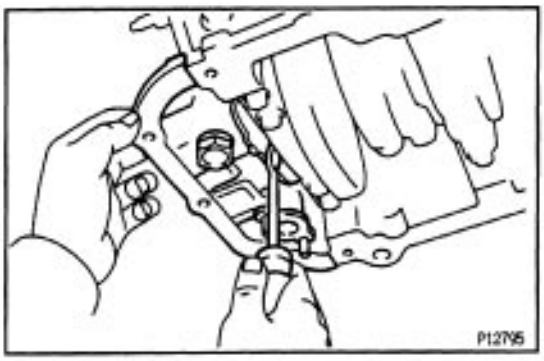



(b) Using a screwdriver, remove the No. 1 oil pan by prying the portions between the cylinder block and No.1 oil pan.
**NOTICE: Be careful not to damage the contact surfaces of the cylinder block and No.1 oil pan.**

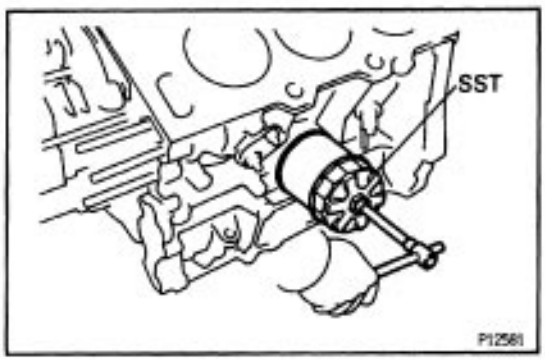



**14. REMOVE OIL PUMP**

(a) Remove the 9 bolts.

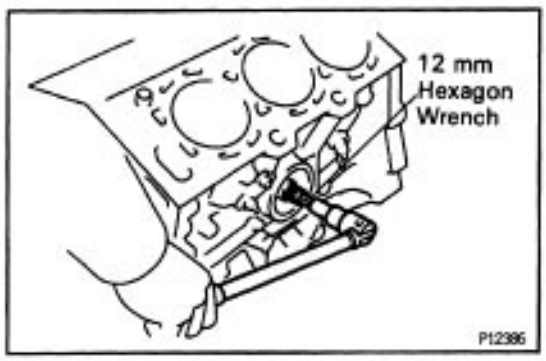



(b) Remove the oil pump by prying a screwdriver between the oil pump and main bearing cap.
(c) Remove the 0–ring.



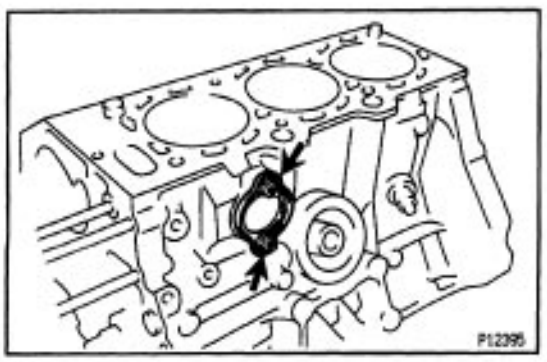

**15. REMOVE OIL FILTER**

Using SST, remove the oil filter.
SST 09816 – 30010



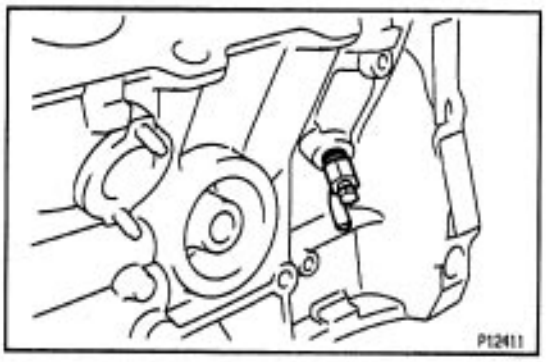

**16. REMOVE OIL FILTER UNION**

Using a 12 mm hexagon wrench, remove the oil filter union.

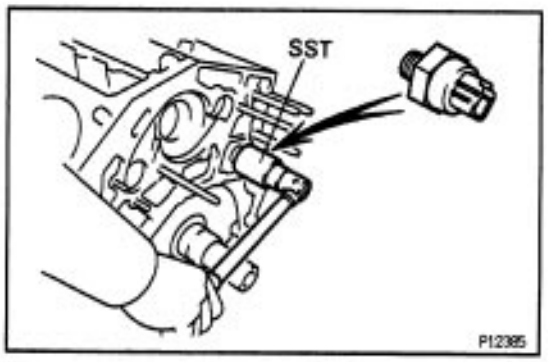



**17. REMOVE WATER SEAL PLATE**

Remove the 2 nuts and seal plate.

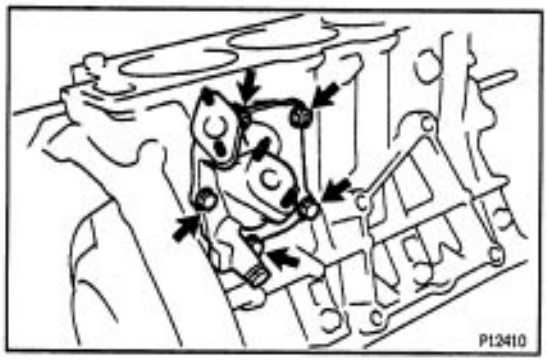



**18. REMOVE ENGINE COOLANT DRAIN COCK**




**19. REMOVE OIL PRESSURE SWITCH**

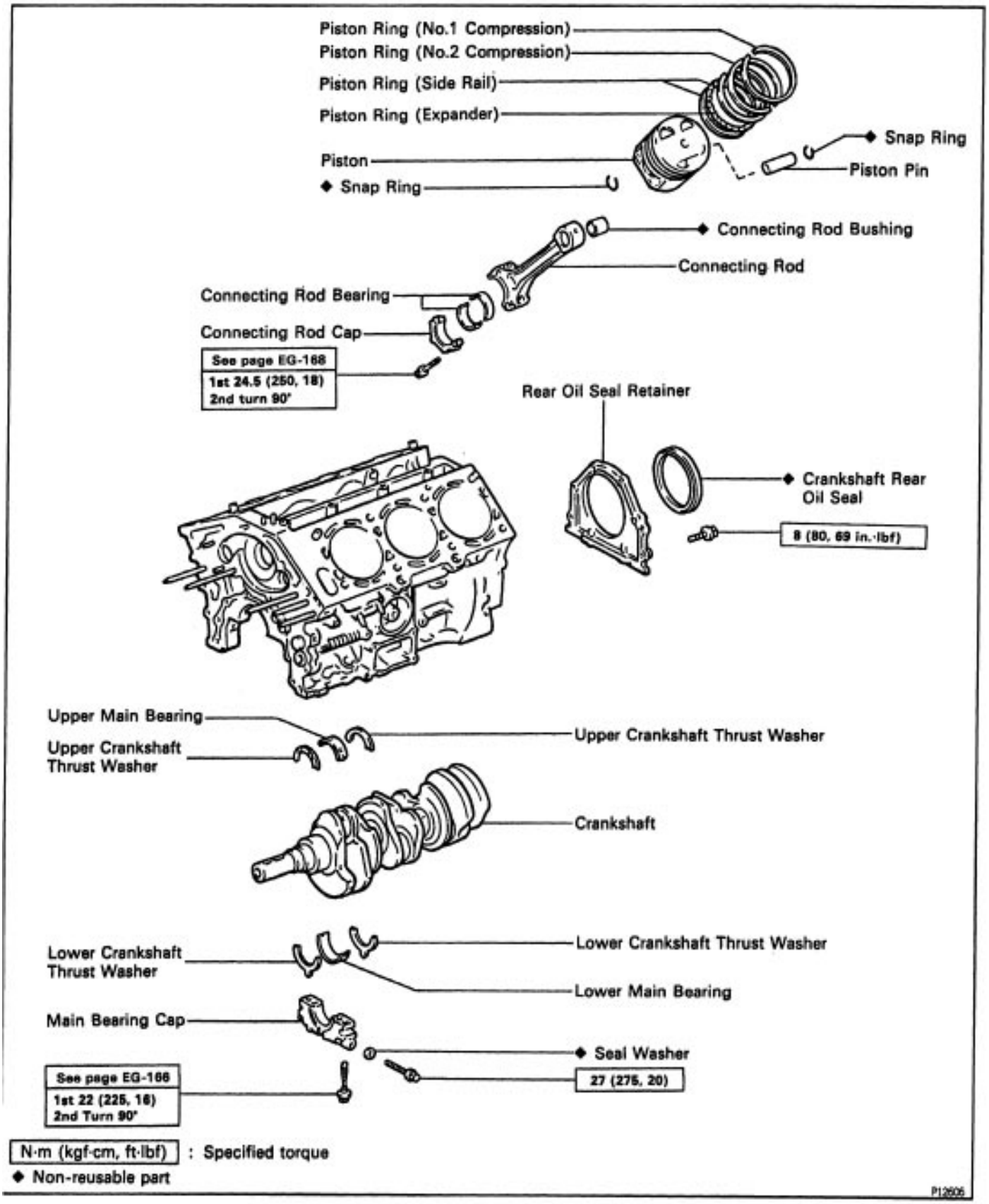
Using SST, remove the oil pressure switch.
SST 09816 – 30010

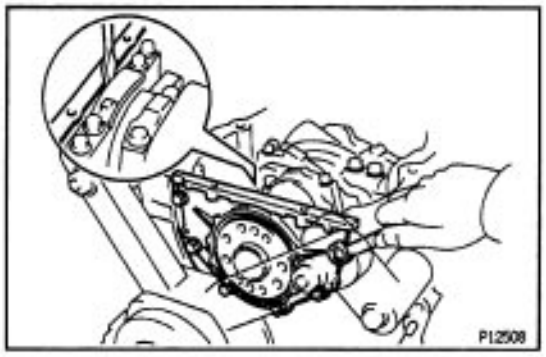



**20. REMOVE EGR COOLER**

Remove the 3 bolts, 2 nuts, EGR cooler and gasket.

# COMPONENTS FOR CYLINDER BLOCK DISASSEMBLY AND ASSEMBLY





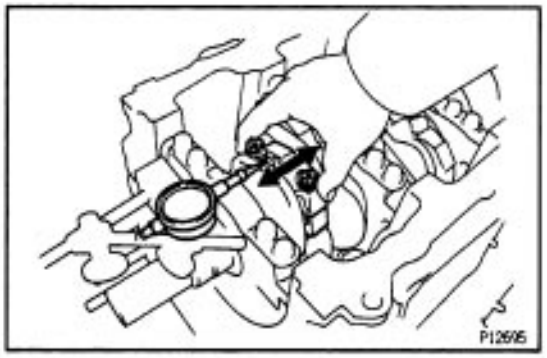

# CYLINDER BLOCK DISASSEMBLY

**(See Components for Disassembly and Assembly)**

**1. REMOVE REAR OIL SEAL RETAINER**

(a) Remove the 6 bolts.

(b) Using a screwdriver, remove the oil seal retainer by prying the portions between the oil seal retainer and main bearing cap.




**2. CHECK CONNECTING ROD THRUST CLEARANCE**

Using a dial indicator, measure the thrust clearance while moving the connecting rod back an forth.

**Standard thrust clearance:**

**0.15 – 0.30 mm (0.0059 – 0.0118 in.)**

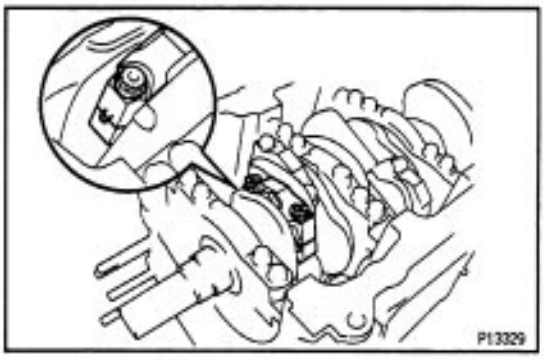
**Maximum thrust clearance:**

**0.35 mm (0.0138 in.)**

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

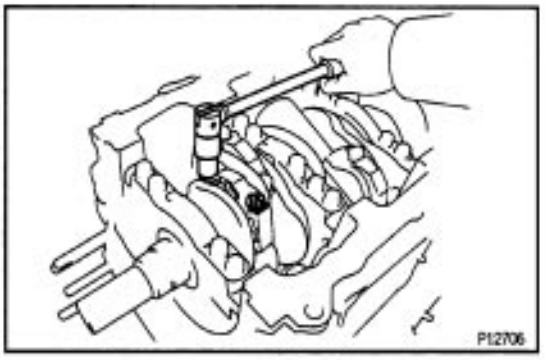
**Connecting rod thickness:**

**20.80 – 20.85 mm (0.8189 – 0.8209 in.)**

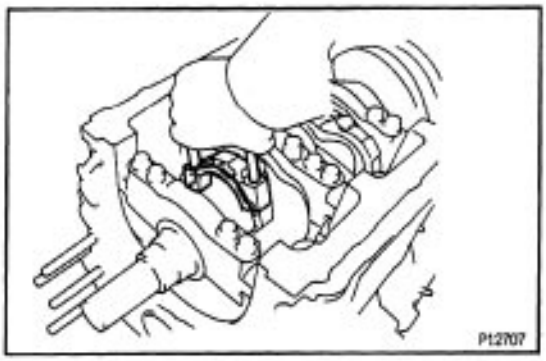



**3. REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE**

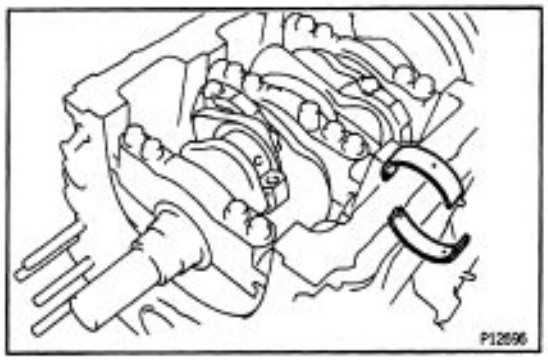
(a) Check the matchmarks on the connecting rod and cap to ensure correct reassembly.



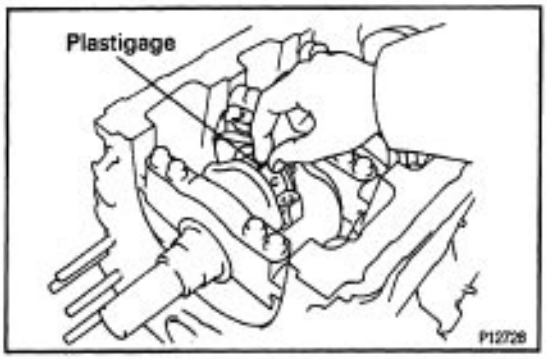

(b) Remove the 2 connecting rod cap bolts.



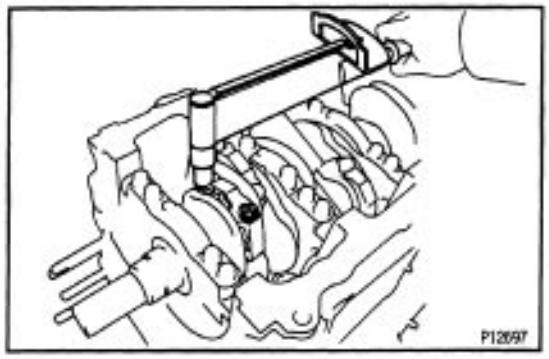

(c) Using the 2 removed connecting rod cap bolts, remove the connecting rod cap and lower bearing by wiggling the connecting rod cap right and left.
HINT: Keep the lower bearing inserted with the con–necting rod cap.



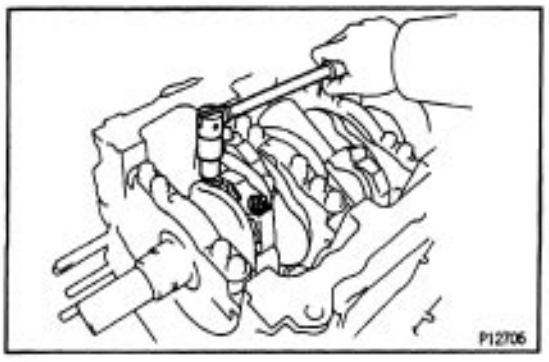

(d) Clean the crank pin and bearing.
(e) Check the crank pin and bearing for pitting and scrat–ches.
If the crank pin or bearing is damaged, replace the bearings. If necessary, replace the crankshaft.



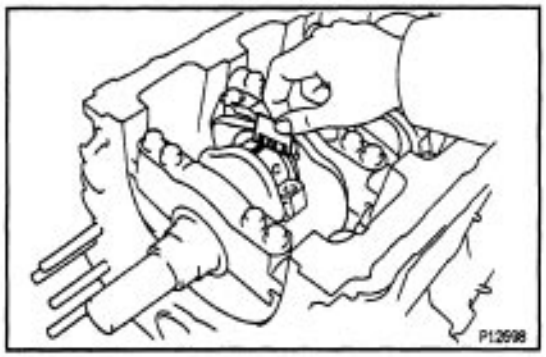

(f) Lay a strip of Plastigage across the crank pin.



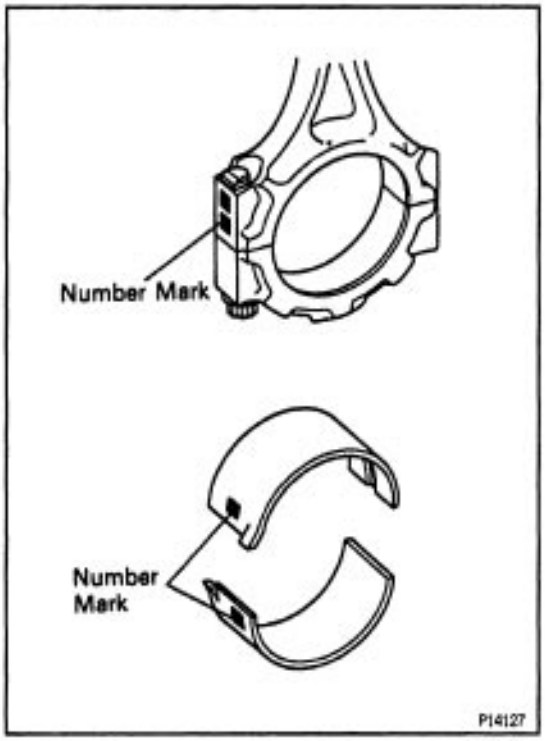

(g) Install the connecting rod cap with the 2 bolts.
(See step 7 on page EG2–167)
**Torque:**
**1st 24.5 N–m (250 kgf–cm. 18 ft–lbf)**
**2nd Turn extra 90°**
**NOTICE: Do not turn the crankshaft.**



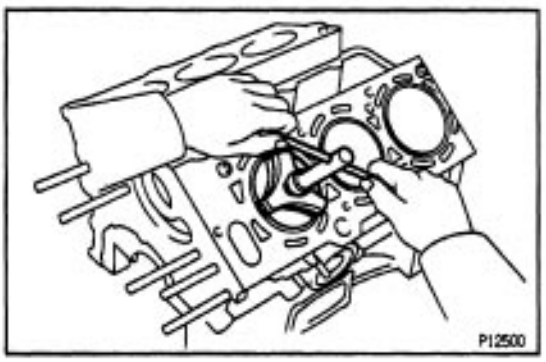

(h) Remove the 2 bolts, connecting rod cap and lower bearing. (See procedure (b) and (c) above)



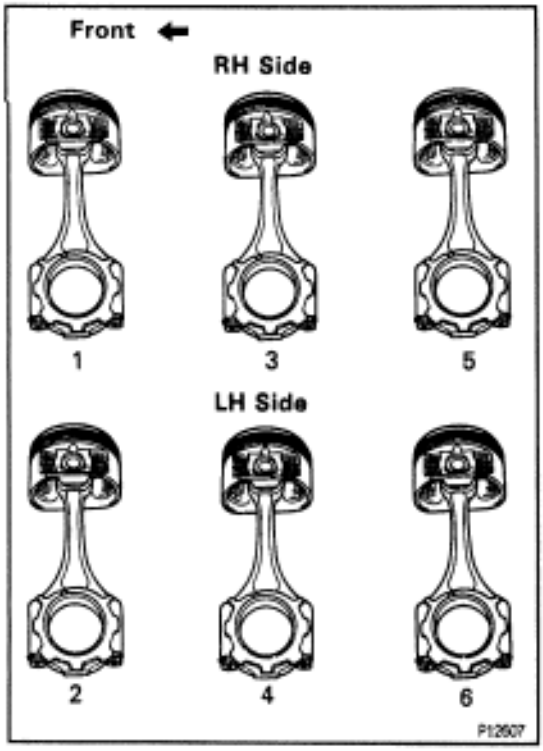

Measure the Plastigage at its widest point.
**Standard oil clearance:**
**0.038 – 0.064 mm (0.0015 – 0.0025 in.)**
**Maximum oil clearance:**
**0.08 mm (0.0031 in.)**
If the oil clearance is greater than maximum, replace the bearings. If necessary, grind or replace the crank–shaft.




HINT: If replacing a bearing, replace it with 1 having the same number as marked on the connecting rod. There are 4 sizes of standard bearings, marked ”I”, ”2”, ”3” and ”4” accordingly.
**Reference:**
**Connecting rod big end inside diameter:**
**Mark ’1”**
**518.000 – 56.006 mm (2.2047 – 2.2050 in.)**
**Mark ’2’**
**56.006 – 56.012 mm (2.2050 – 2.2052 in.)**
**Mark ’3’**
**56.012 – 56.018 mm (2.2052 – 2.2054 in.)**
**Mark ”4’**
**56.018 – 56.024 mm (2.2054 – 2.2057 in.)**
**Crankshaft crank pin diameter:**
**52.994 – 53.000 mm (2.0864 – 2.0868 in.)**
**Standard sized bearing center wall thickness:**
**Mark ’1’**
**1.484 – 1.487 mm (0.0584 – 0.0585 in.)**
**Mark ’2’**
**1.487 – 1.490 mm (0.0585 – 0.0587 in.)**
**Mark ’3’**
**1.490 – 1.493 mm (0.0587 – 0.0588 in.)**
**Mark W**
**1.493 – 1.496 mm (0.0588 – 0.0589 in.)**
(j) Completely remove the Plastigage.

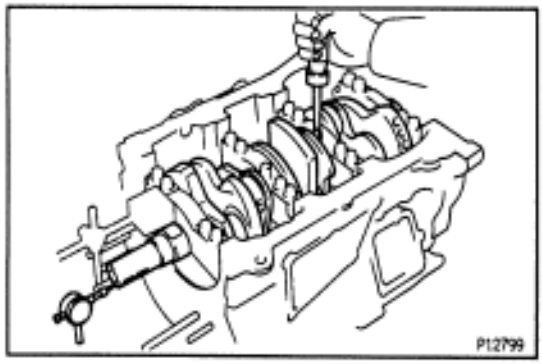



**4. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES**
(a) Using a ridge reamer, remove all the carbon from the top of the cylinder.
(b) Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.




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:**

**0.04 – 0.24 mm (0.0016 – 0.0095 In.)**

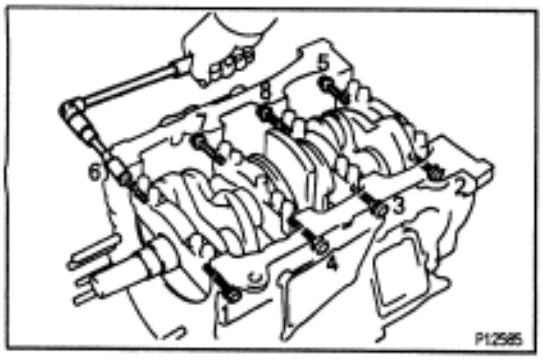
**Maximum thrust clearance:**

**0.30 mm (0.0118 in.)**

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

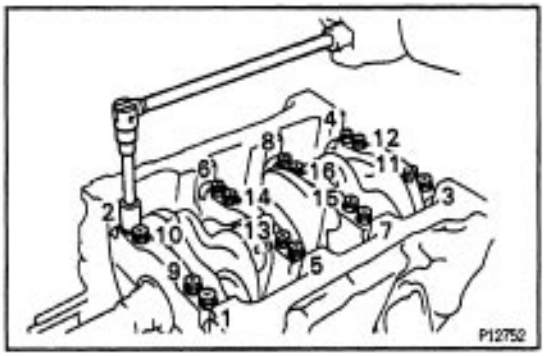
**Thrust washer thickness:**

**1.930 – 1.980 mm (0.0760 – 0.0780 In.)**

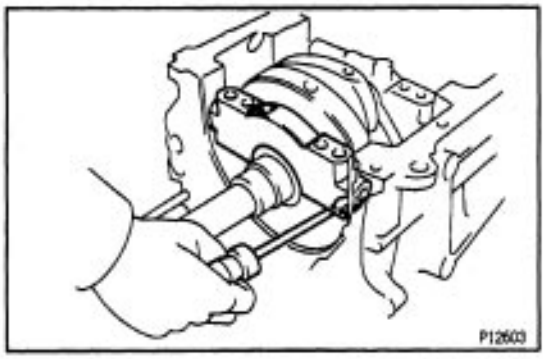



**6. REMOVE MAIN BEARING CAPS AND CHECK OIL CLEARANCE**

(a) Uniformly loosen and remove the 8 main bearing cap bolts and seal washers, in several passes, in the sequence shown.

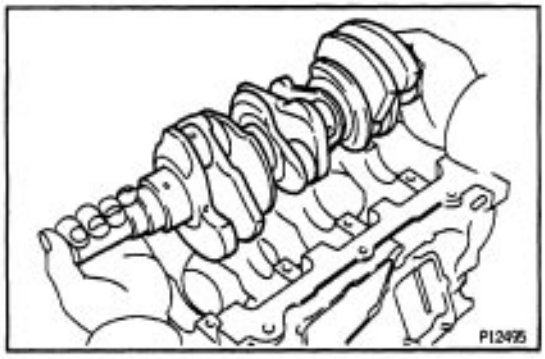



(b) Uniformly loosen and remove the 16 main bearing cap bolts, in several passes, in the sequence shown.

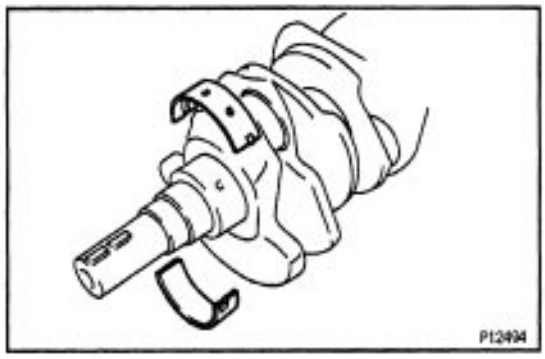



(c) Using a screwdriver, pry out main bearing caps, remove the 4 main bearing caps, lower bearings and (No.2 main bearing cap only) 2 lower thrust washers.
HINT:

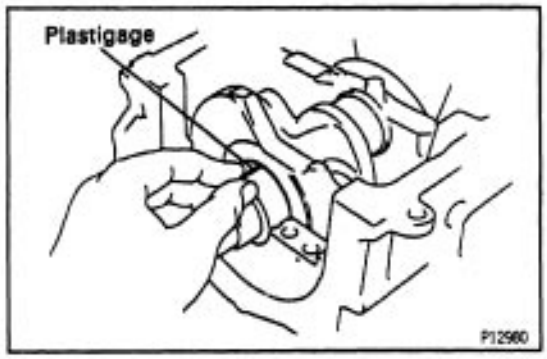
- Keep the lower bearing and main bearing cap together.
- Arrange the main bearing caps and lower thrust washers in correct order.



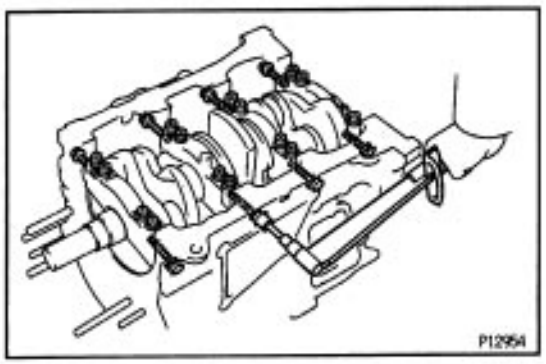

(d) Lift out the crankshaft.
HINT: Keep the upper bearings together with the cyl–inder block.



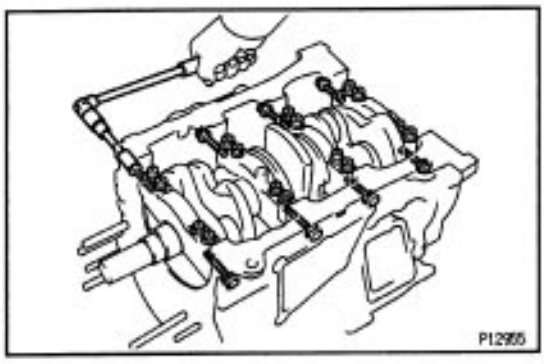

(e) Clean each main journal and bearing.
(f) Check each main journal and bearing for pitting and scratches.
If the journal or bearing is damaged, replace the bear–ings. If necessary, replace the crankshaft.



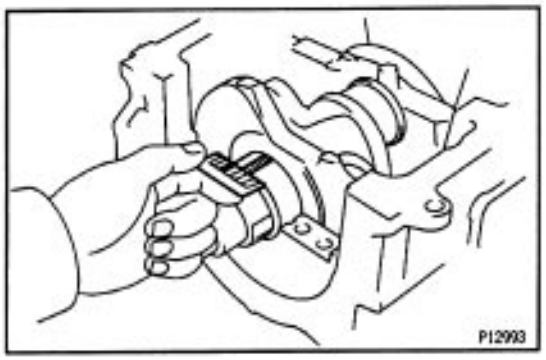

(g) Place the crankshaft on the cylinder block.
(h) Lay a strip of Plastigage across each journal.



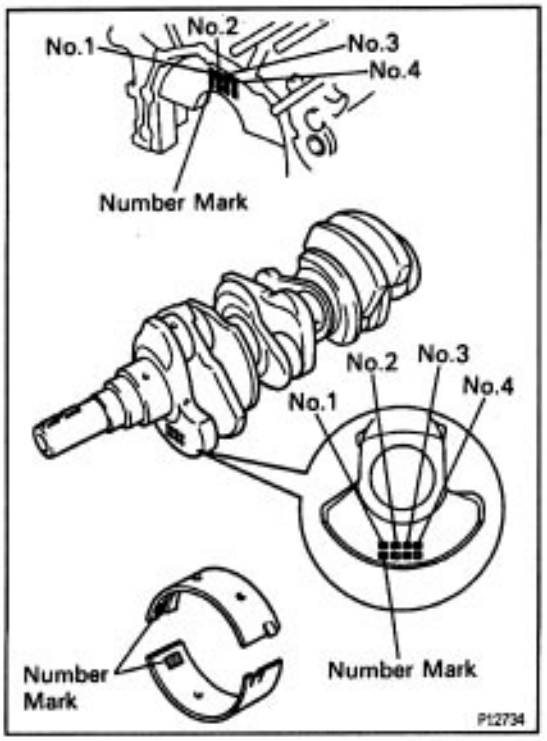

(i) Install the 4 main bearing caps.
(See step 4 on pages EG2–165)
**12 Pointed Head Bolts:**
**Torque:**
**1 st 22 N–m (225 kgf–cm, 16 ft–lbf)**
**2nd Turn extra 90$_2$**
**Hexagon Head Bolts:**
**Torque: 27 N–m (275 kgf–cm, 20 ft–lbf)**
**NOTICE: Do not turn the crankshaft.**




(j) Remove the main bearing caps.
(See procedures (a) to (c) above)




(k) Measure the Plastigage at its widest point.
**Standard oil clearance:**
**0.026 – 0.046 mm (0.0010 – 0.0018 in.)**
**Maximum clearance:**
**0.06 mm (0.0024 in.)**
If the oil clearance is greater than maximum, replace the bearings. If necessary, replace the crankshaft.
HINT: If using a bearing, replace it with one having the same number. If the number of the bearing cannot be determined, select the correct bearing by adding together the numbers imprinted on the cylinder block and crankshaft, then refer to the table below for the appropriate bearing number. There are 5 standard bearing sizes, 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”)

V01565

**Reference:**
**Cylinder block main journal bore diameter (A):**
**Mark ”00’**
**66.000 mm (2.5984 in.)**
**Mark ’01’**
**66.001 mm (2.5985 in.)**
**Mark ”02”**
**66.002 mm (2.5985 in.)**
**Mark ’03’**
**66.003 mm (2.5985 in.)**
**Mark ”04’**
**66.004 mm (2.5986 in.)**
**Mark ’05’**
**66.005 mm (2.5986 In.)**
**Mark ’06’**
**66.006 mm (2.5987 in.)**
**Mark ’07’**
**66.007 mm (2.5987 in.)**
**Mark ’08’**
**66.008 mm (2.5987 in.)**
**Mark ’09’**
**66.009 mm (2.5988 in.)**
**Mark ”10’**
**66.010 mm (2.5988 in.)**
**Mark ’11 ”**
**66.011 mm (2.5989 in.)**
**Mark ’12’**
**66.012 mm (2.5989 in.)**
**Mark ’13’**
**66.013 mm (2.5989 in.)**
**Mark ”14’**
**66.014 mm (2.5990 in.)**
**Mark ’15’**
**66.015 mm (2.5990 in.)**
**Mark ”16’**
**66.01 6 mm (2.5990 in.)**

**Crankshaft main journal diameter (B):**
**Mark ’00”**
**61.000 mm (2.401 6 in.)**
**Mark ”01’**
**60.999 mm (2.4015 in.)**
**Mark ’02’**
**60.998 mm (2.4015 in.)**
**Mark ”03”**
**60.997 mm (2.4015 in.)**
**Mark ’04’**
**60.996 mm (2.4014 in.)**
**Mark ’05’**
**60.995 mm (2.4014 in.)**
**Mark ’06”**
**60.994 mm (2.4013 in.)**
**Mark ’07’**
**60.993 mm (2.4012 in.)**
**Mark ’08’**
**60.992 mm (2.4012 In.)**
**Mark ’09”**
**60.991 mm (2.4012 In.)**
**Mark ”10’**
**60.990 mm (2.4012 in.)**
**Mark ’11’**
**60.989 mm (2.4011 in.)**
**Mark ”12”**
**60.988 mm (2.4011 in.)**
**Standard sized bearing center wall thickness:**
**Mark ”1’**
**2.488 – 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.)**

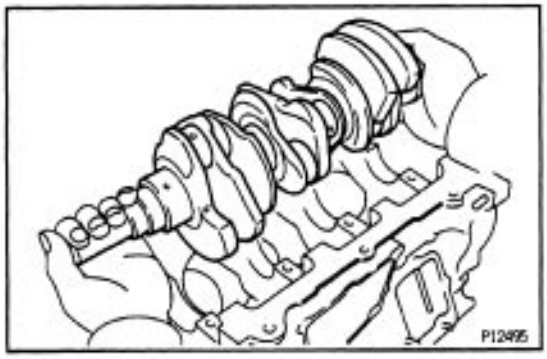
**Standard sized Bearing Selection Chart**

| 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”

W03574

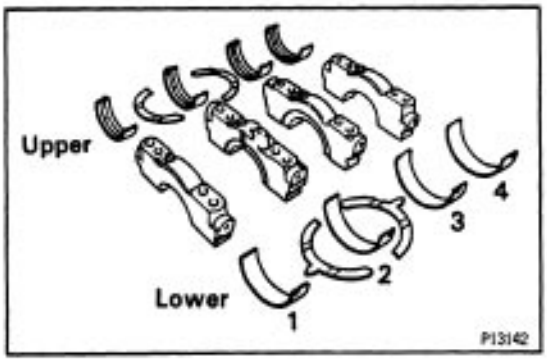
(l) Completely remove the Plastigage.



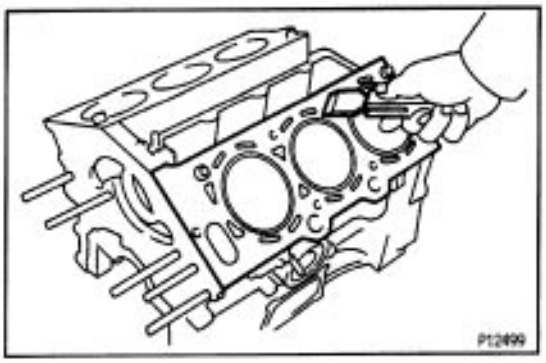

**7. REMOVE CRANKSHAFT**

(a) Lift out the crankshaft.

(b) Remove the 4 upper main bearings and 2 upper thrust washers from the cylinder block.




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




# CYLINDER BLOCK INSPECTION AND REPAIR

**1. CLEAN CYLINDER BLOCK**

**A. Remove gasket material**

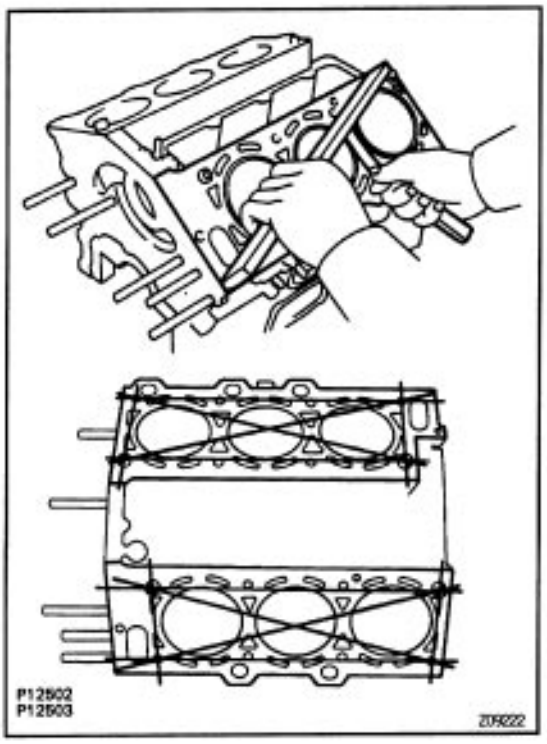
Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.

**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 a temperature of 45°C (113°F) or less.**





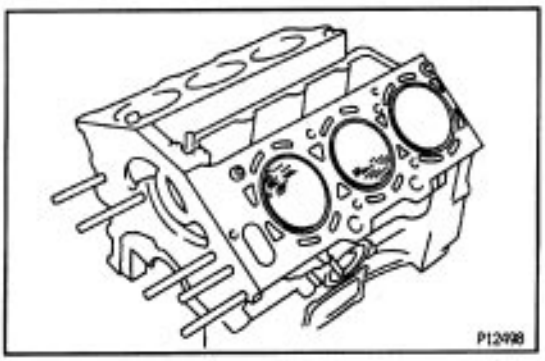

**2. INSPECT TOP SURFACE OF CYLINDER BLOCK FOR FLATNESS**

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

**Maximum warpage:**

**0.07 mm (0.0028 In.)**

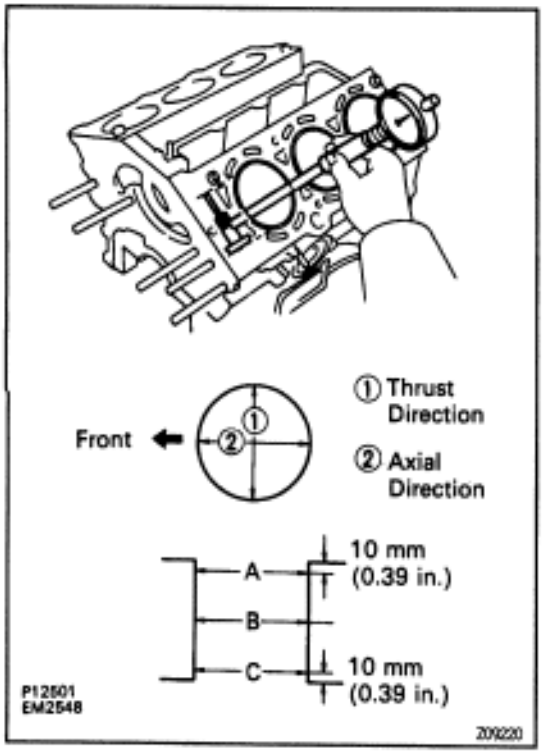
If warpage is greater than maximum, replace the cylinder block.




**3. INSPECT CYLINDER FOR VERTICAL SCRATCHES**

Visually check the cylinder for vertical scratches.

If deep scratches are present, replace the cylinder block.




**4. INSPECT CYLINDER BORE DIAMETER**

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

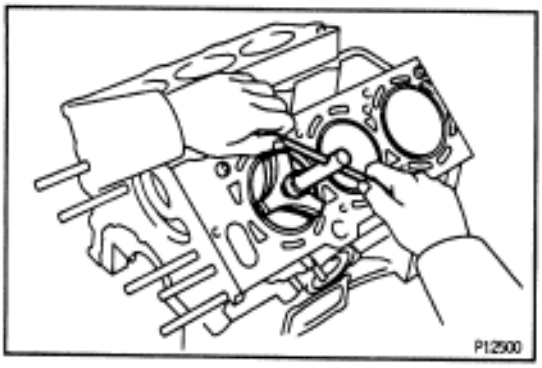
**Standard diameter:**

**87.500 – 87.512 mm (3.4449 – 3.4453 in.)**

**Maximum diameter:**

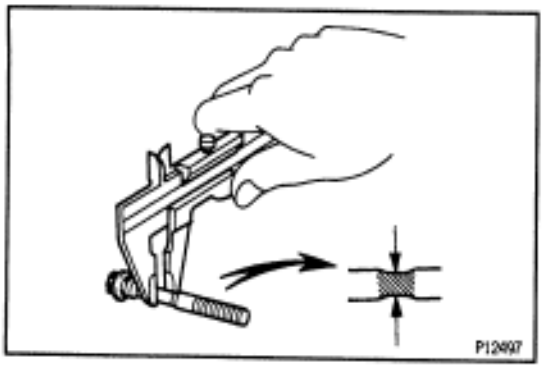
**87.52 mm (3.4457 in.)**

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




**5. REMOVE CYLINDER RIDGE**

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




**6. INSPECT MAIN BEARING CAP BOLTS**

(for 12 Pointed Head Bolts)

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

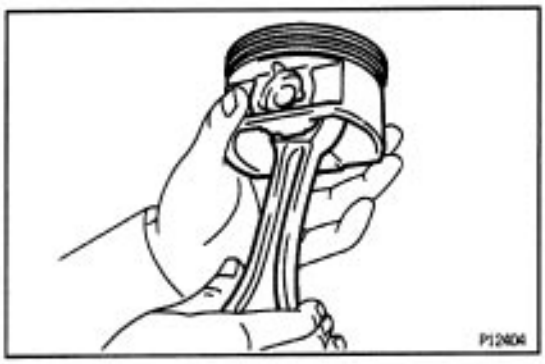
**Standard diameter:**

**7.500 – 7.600 mm (0.2953 – 0.2992 in.)**

**Minimum diameter:**

**7.20 mm (0.2835 In.)**

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

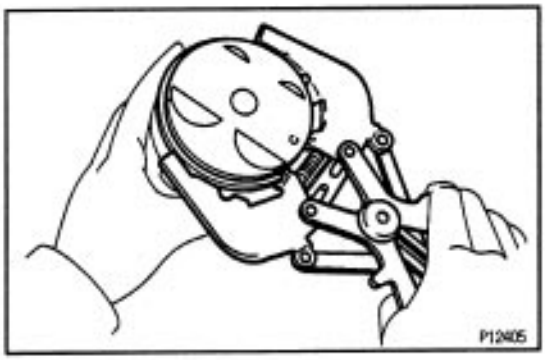



# PISTON AND CONNECTING ROD DISASSEMBLY

**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.

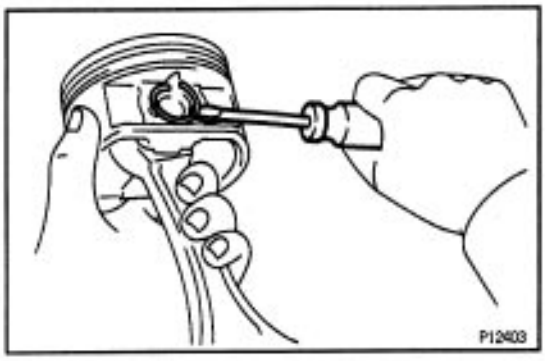



**2. REMOVE PISTON RINGS**

(a) Using a piston ring expander, remove the 2 compression rings.

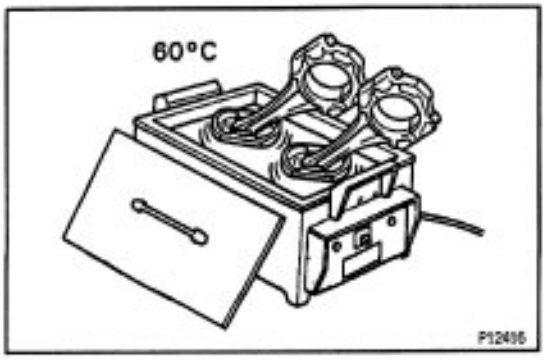

(b) Remove the 2 side rails and oil ring by hand.

HINT: Arrange the piston rings in correct order only.

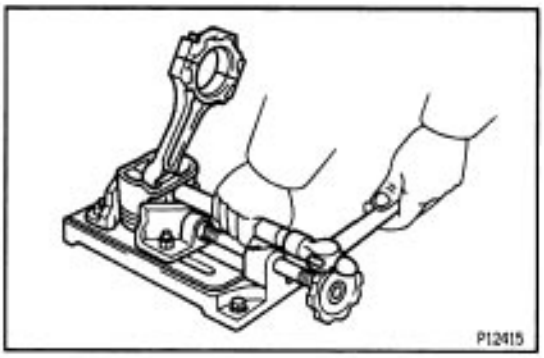



**3. DISCONNECT CONNECTING ROD FROM PISTON**

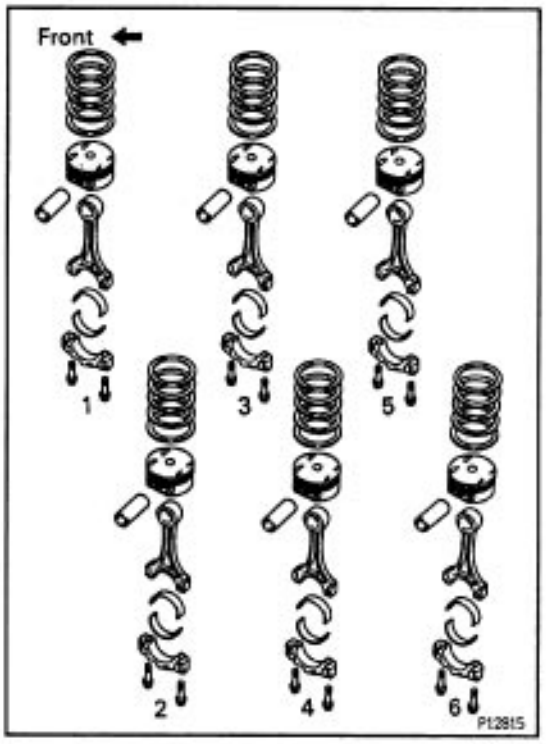
(a) Using a small screwdriver, pry out the 2 snap rings.



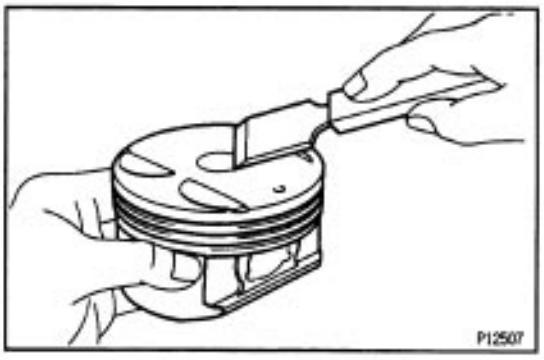

(b) Gradually heat the piston to approx. 60°C (140°F).




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



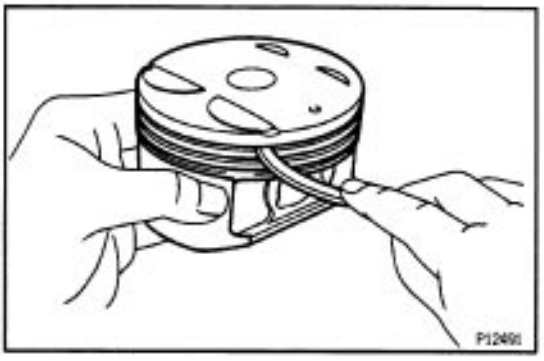

HINT:
- The piston and pin are a matched set.
- Arrange the pistons, pins, rings, connecting rods and bearings in correct order.



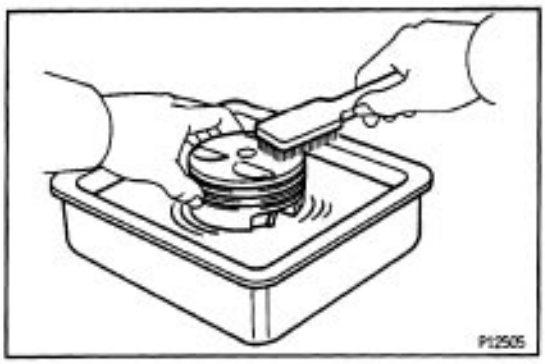

## PISTON AND CONNECTING ROD INSPECTION

**1. CLEAN PISTON**

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

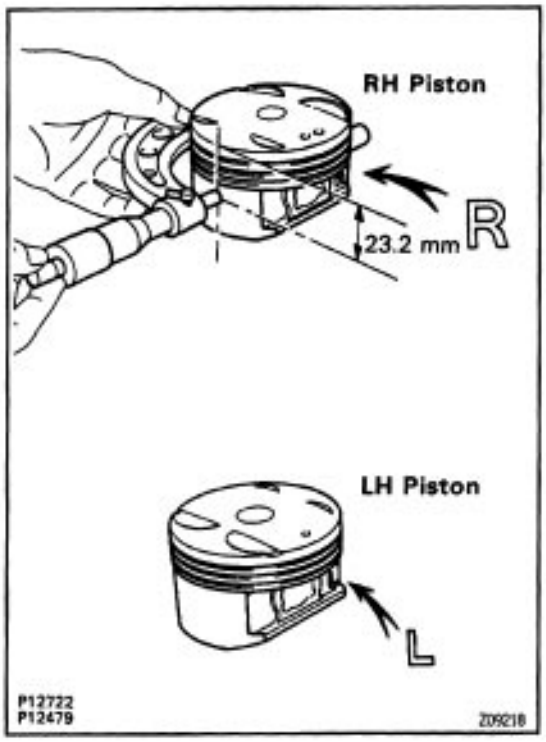



(b) Using a groove cleaning tool or broken ring, clean the piston ring grooves.




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

**NOTICE: Do not use a wire brush.**




**2. INSPECT PISTON**

**A. Inspect piston oil clearance**

(a) Using a micrometer, measure the piston diameter at ring angles to the piston pin center line, 23.2 mm (0.913 in.) from the piston head.

**Piston diameter:**

**87.406 – 87.416 mm (3.4412 – 3.4416 in.)**

(b) Measure the cylinder bore diameter in the thrust di–rections. (See step 4 on page EG2–152)

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

**Standard oil clearance:**

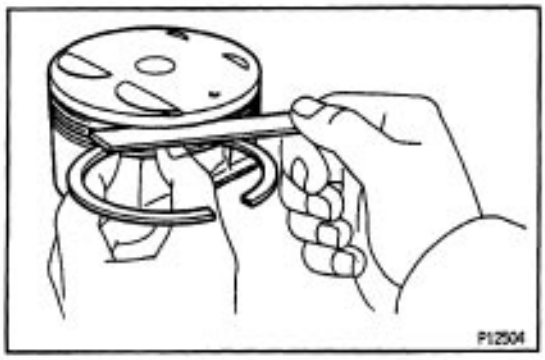
**0.084 – 0.106 mm (0.0033 – 0.0042 in.)**

**Maximum oil clearance:**

**0.13 mm (0.0051 in.)**

If the oil clearance is greater than maximum, replace all the6 pistons. If necessary, replace the cylinder block.

HINT: 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 ring groove.

**Ring groove clearance:**

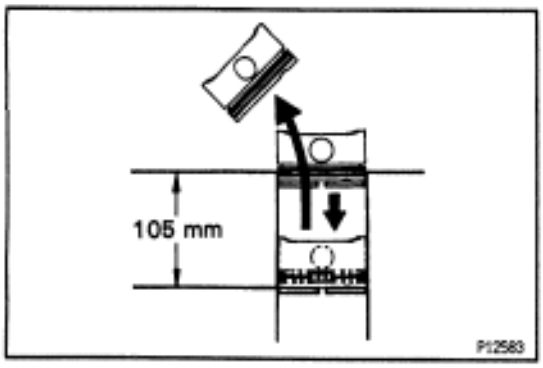
**No.1**

**0.020 – 0.070 mm (0.0008 – 0.0028 in.)**

**No.2**

**0.020 – 0.060 mm (0.0008 – 0.0024 In.)**

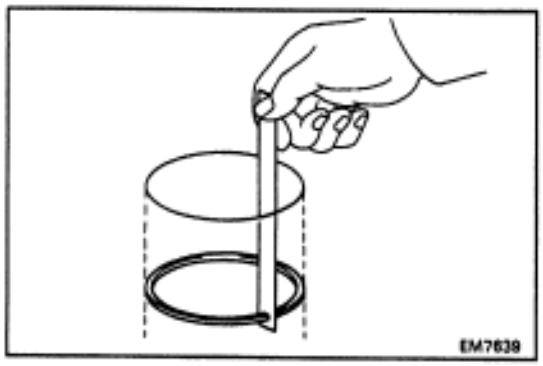
If the clearance is not as specified, replace the piston.




**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 end gap.

**Standard end gap:**

**No. 1**

**0.25 – 0.35 mm (0.0098 – 0.0138 in.)**

**No.2**

**0.35 – 0.45 mm (0.0138 – 0.0177 in.)**

**Oil (Side rail)**

**0.15 – 0.40 mm (0.0059 – 0.0157 in.)**

**Maximum end gap:**

**No.1**

**0.95 mm (0.0374 in.)**

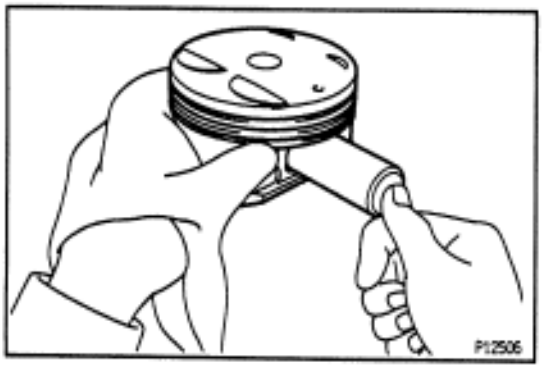
**No.2**

**1.05 mm (0.0413 in.)**

**Oil (Side rail)**

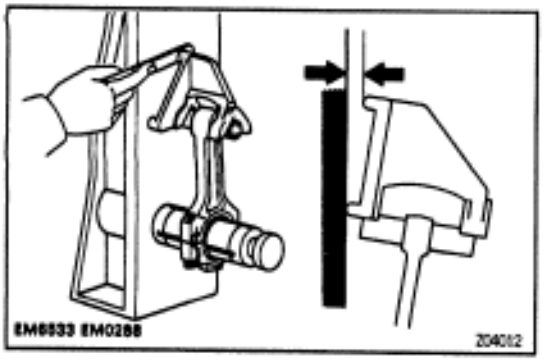
**1.00 mm (0.0394 in.)**

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 $60_2$C ($140_2$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**

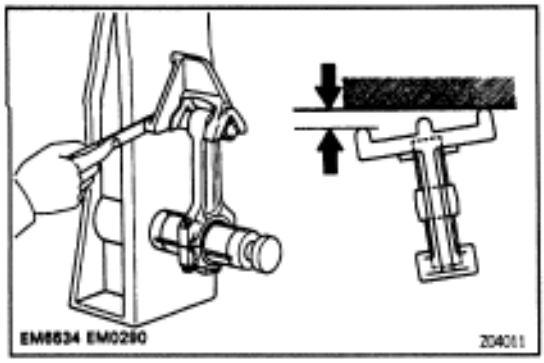
Using a rod aligner and feeler gauge, check the con–necting rod alignment.

- Check for out–of–alignment.

**Maximum out–of –alignment:**

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

If out–of–alignment is greater than maximum, re–place the connecting rod assembly.

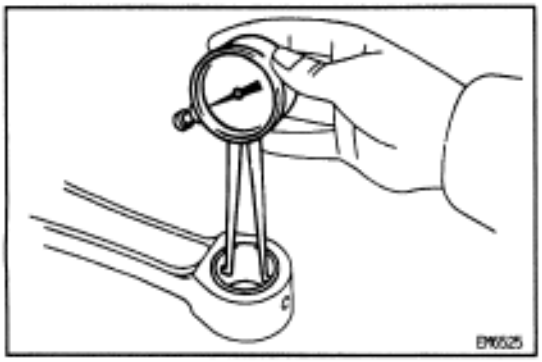



- Check for twist

**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.

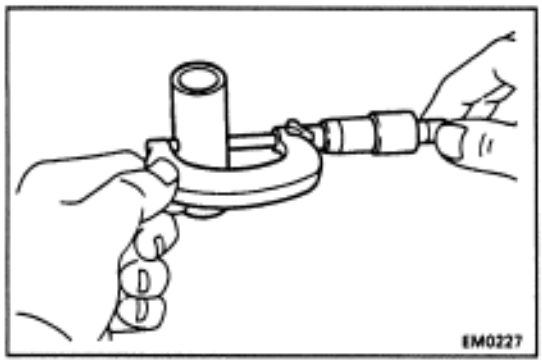



**B. Inspect piston pin oil clearance**

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

**Bushing inside diameter:**

**22.005 – 22.014 mm (0.8663 – 0.8667 in.)**




(b) Using a micrometer, measure the piston pin diameter.

**Piston pin diameter:**

**21.997 – 22.006 mm (0.8660 – 0.8664 in.)**

(c) Subtract the piston pin diameter measurement from the bushing inside diameter measurement.

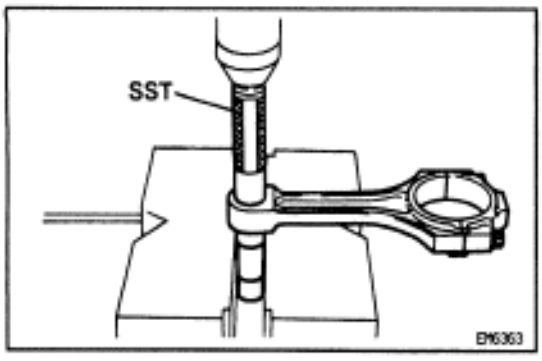
**Standard oil clearance:**

**0.005 – 0.011 mm (0.0002 – 0.0004 in.)**

**Maximum oil clearance:**

**0.05 mm (0.0020 in.)**

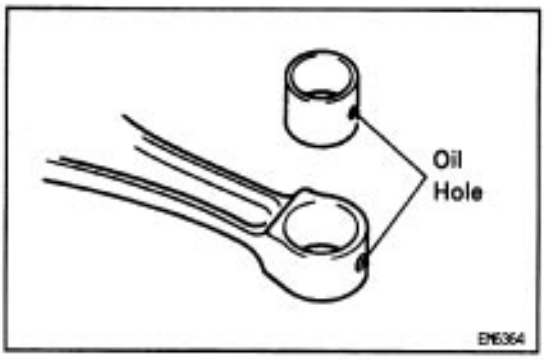
If the oil clearance is greater than maximum, replace the bushing. If necessary, replace the piston and piston pin as a set.



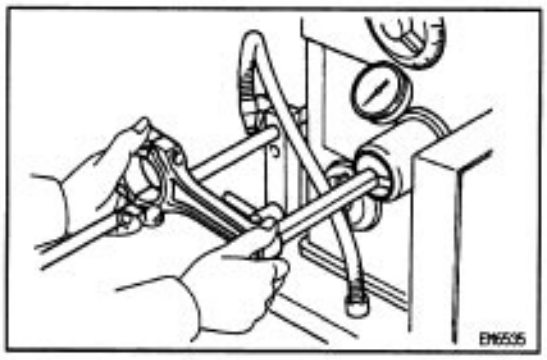

**C. If necessary, replace connecting rod bushing**

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

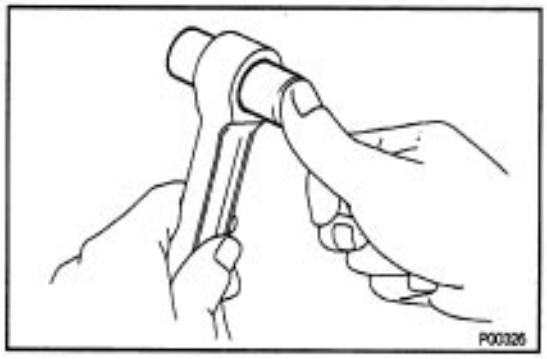
SST 09222 – 30010



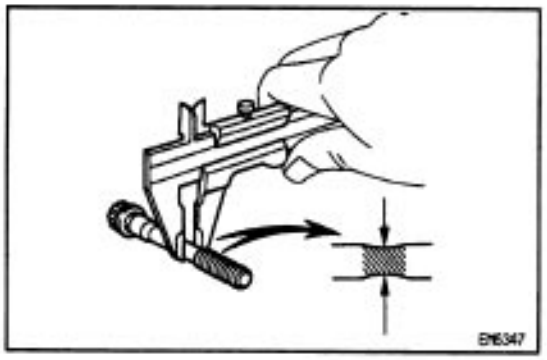

(b) Align the oil holes of a new bushing and the connecting rod.
(c) Using SST and a press, press in the bushing.
SST 09222–30010



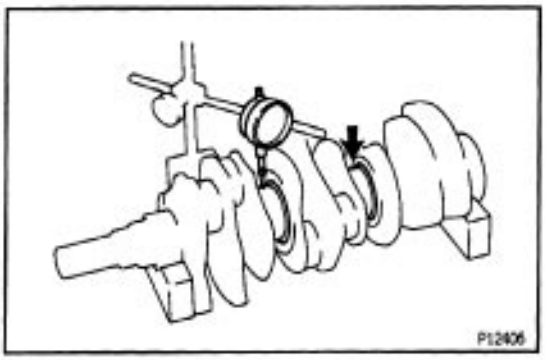

(d) Using a pin hole grinder, hone the bushing to obtain the standard specified clearance (see step B above) between the bushing and piston pin.

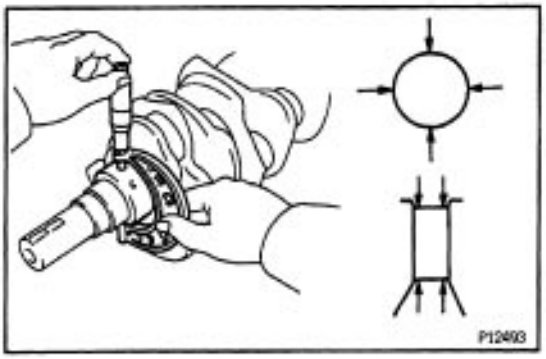



(e) Check the piston pin fit at normal room temperature. Coat the piston pin with engine oil, and push it into the connecting rod with your thumb.




**D. Inspect connecting rod bolts**
Using a vernier caliper, measure the tension portion of of the connecting rod bolt.
**Standard diameter:**
**7.2 – 7.3 mm (0.284 – 0.287 in.)**
**Minimum diameter:**
**7.0 mm (0.276 in.)**
HINT: If the tension portion diameter is less than minimum, replace the connecting rod bolt.




# CRANKSHAFT INSPECTION

**1. INSPECT CRANKSHAFT FOR CIRCLE RUNOUT**

(a) Place the crankshaft on V–blocks.

(b) Using a dial indicator, measure the circle runout, as shown in the illustration.

**Maximum circle runout:**

**0.06 mm (0.0024 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:**

**60.988 –61.000 mm (2.4011 – 2.4016 in.)**

**Crank pin diameter:**

**52.994 – 53.000 mm (2.0864 – 2.0866 in.)**

If the diameter is not as specified, check the oil clearance (See steps 3 or6 on page EG2–142 or 145). If necessary, replace the crankshaft.

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

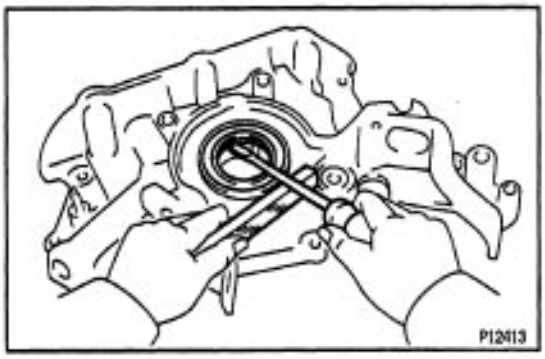
**Maximum taper and out–of–round:**

**0.02 mm (0.0008 in.)**

If the taper and out–of–round is greater than maximum, replace the crankshaft.

# CRANKSHAFT OIL SEALS REPLACEMENT

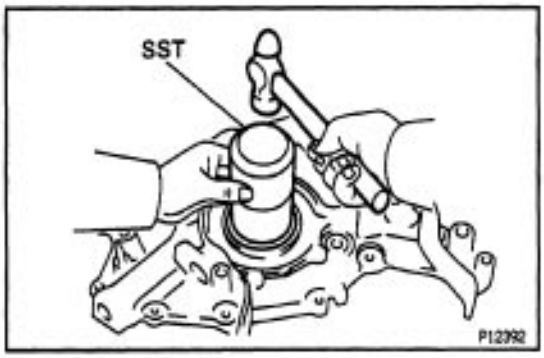
HINT: There are 2 methods (A and B) to replace the oil seal which are as follows:




**1. REPLACE CRANKSHAFT FRONT OIL SEAL**

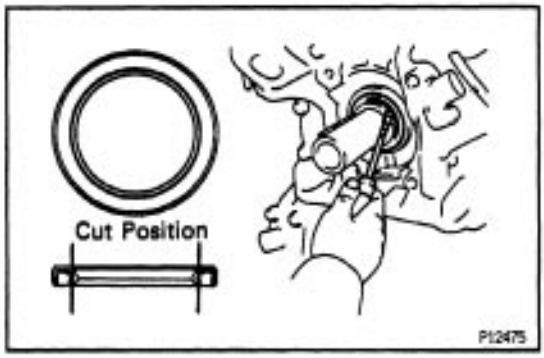
**A. If oil pump is removed from cylinder block:**

(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 09223 – 00010

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

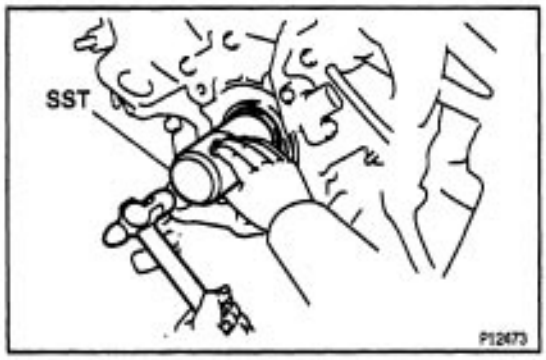



**B. If oil pump is installed to the cylinder block:**

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

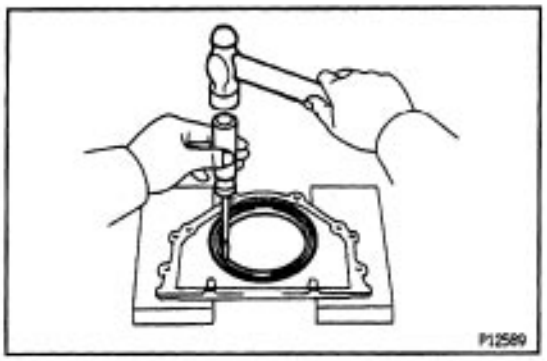
(b) Using a screwdriver, pry out the oil seal.

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




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

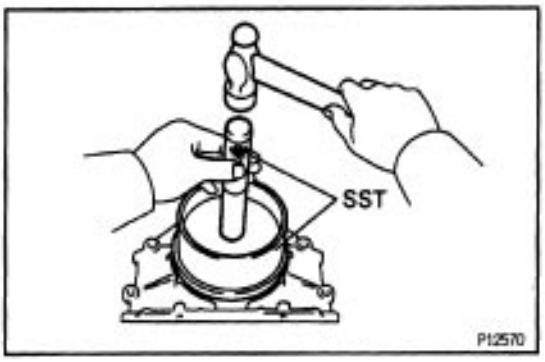
(d) Using SST and a hammer, tap in the oil seal until its surface is flush with the oil pump body edge.
SST 09223 – 00010



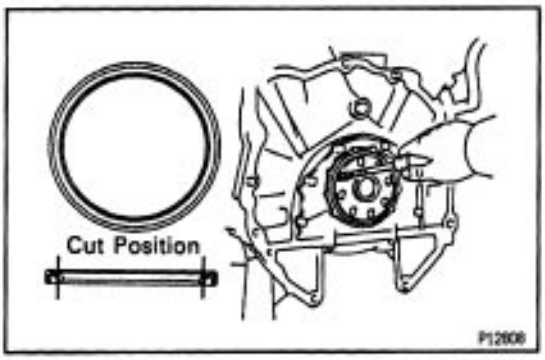

**2. REPLACE CRANKSHAFT REAR OIL SEAL**

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

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



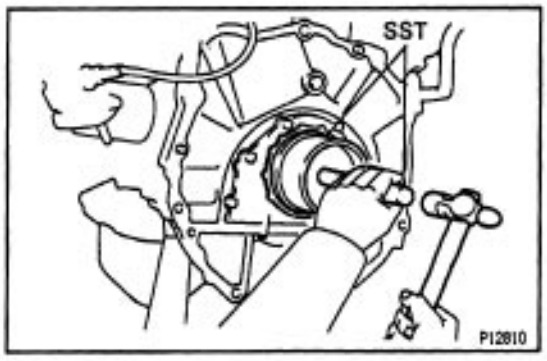

(b) Using SST and a hammer, tap in a new oil seal until its surface is flush with the rear oil seal retainer edge.
SST 09223 –15030, 09608 – 30022 (09608 – 05010)
(c) Apply MP grease to the oil seal lip.




**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.

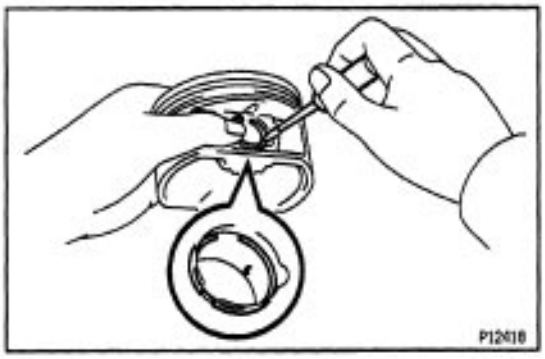
**NOTICE: Be careful not to damage the crankshaft. Tape the screwdriver tip.**



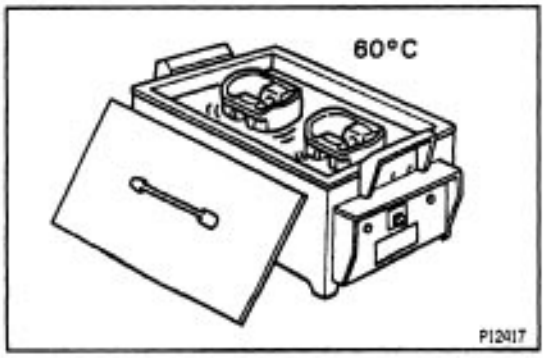

(c) Apply MP grease to a new oil seal lip.
(d) Using SST and a hammer, tap in the oil sea! until its surface is flush with the rear oil seal retainer edge.
SST 09223–15030, 09608–30022 (09608–05010)

# PISTON AND CONNECTING ROD ASSEMBLY

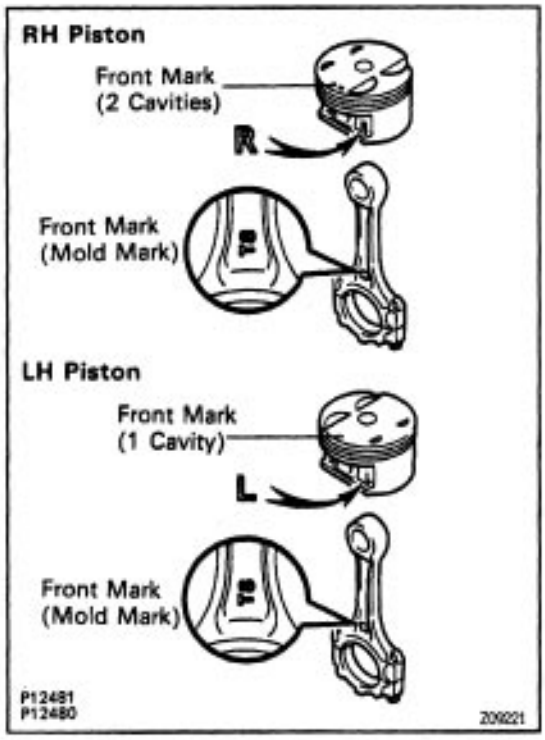
## 1. ASSEMBLE PISTON AND CONNECTING ROD



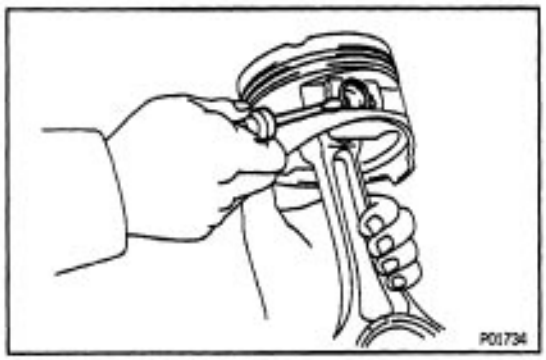

(a) Using a small screwdriver, install a new snap ring at one end of the piston pin hole.
HINT: Be sure that end gap of the snap ring is not aligned with the pin hole cutout portion of the piston.




(b) Gradually heat the piston to about $60_2$C ($140_2$F).



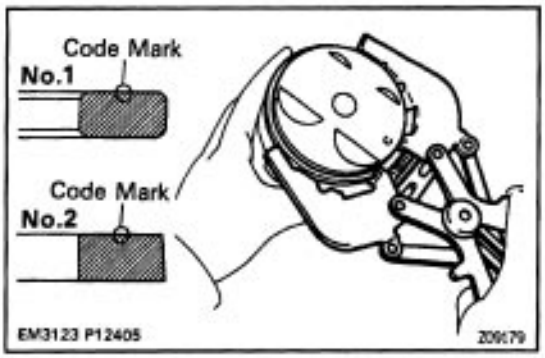

(c) Coat the piston pin with engine oil.
(d) Align the front marks of the piston and connecting rod, and push in the piston pin with your thumb.




(e) Using a small screwdriver, install a new snap ring on the other end of the piston pin hole.
HINT: Be sure that end gap of the snap ring is not aligned with the pin hole cutout portion of the piston.


**2. INSTALL PISTON RINGS**

(a) Install the oil ring expander and 2 side rails by hand.




(b) Using a piston ring expander, install the 2 compres–sion rings with the code mark facing upward.

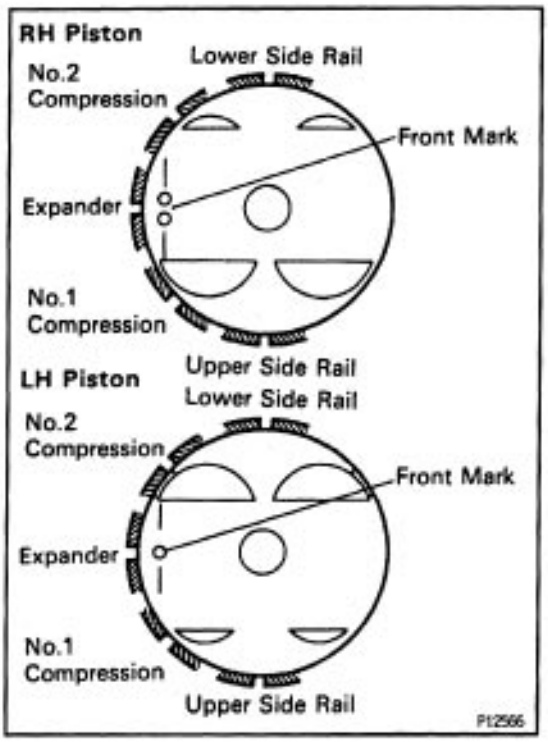
**Code mark:**

**No.1**

**1RorT**

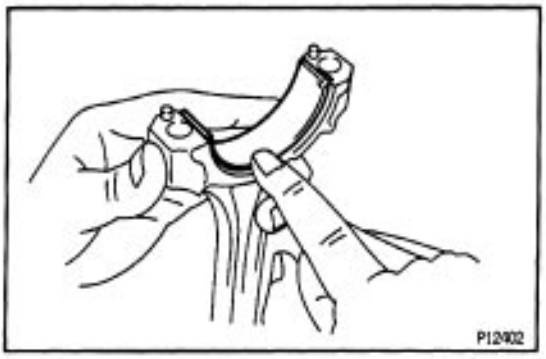
**No.2**

**2R or 2T**




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

**NOTICE: Do not align the ring ends.**




**3. INSTALL BEARINGS**

(a) Align the bearing claw with the groove of the connect–ing rod or connecting cap.

(b) Install the bearings in the connecting rod and con–necting rod cap.

# CYLINDER BLOCK ASSEMBLY

**(See Components for Disassembly and Assembly)**

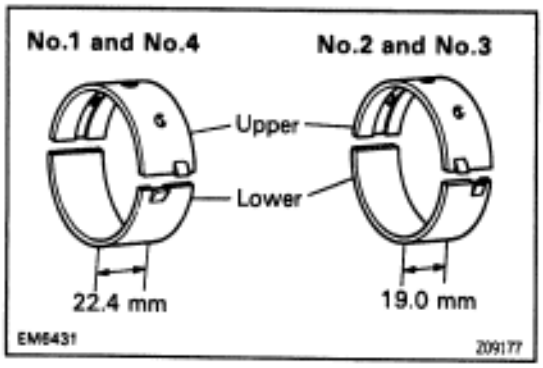
HINT:

- Thoroughly clean all parts to be assembled. Before installing the parts, apply new engine oil to all sliding and and rotating surfaces.
- Replace all gaskets, 0–rings and oil seals with new parts.

**1. INSTALL MAIN BEARINGS**

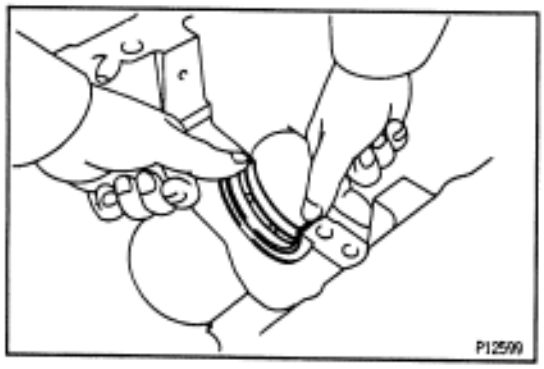
HINT:

- Main bearings come in widths of 19.0 mm (0.748 in.) and 22.4 mm (0.882 in.). Install the 22.4 mm (0.882 in.) bearings in the No. 1 and No.4 cylinder block journal positions with the main bearing cap.
- Install the 19.0 mm (0.748 in.) bearings in the No. 2 and No.3 positions.
- Upper bearings have an oil groove and oil holes; lower bearings do not.



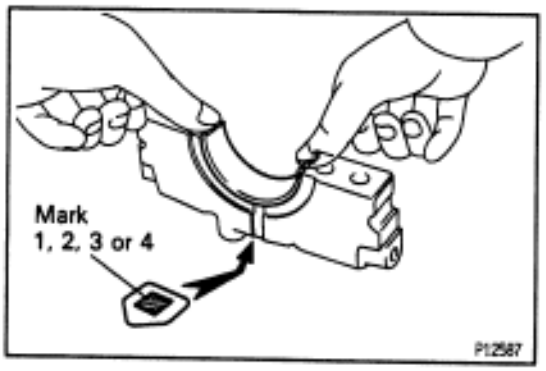

(a) Align the bearing claw with the claw groove of the cylinder block, and push in the 4 upper bearings.

**NOTICE: Install the bearing with the oil hole in the cylin–der block.**



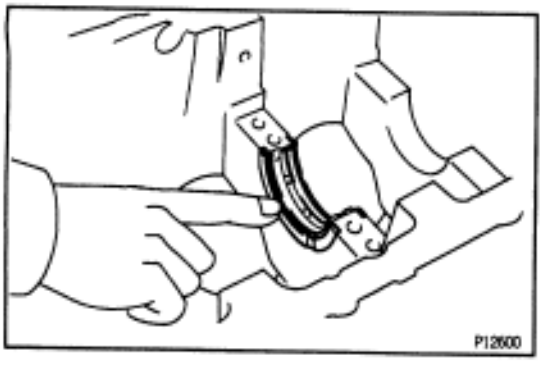

(b) Align the bearing claw with the claw groove of the main bearing cap, and push in the 4 lower bearings.

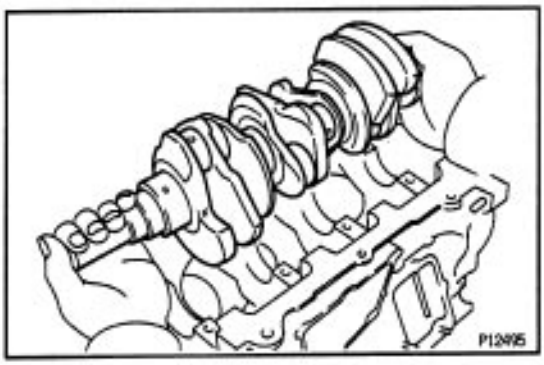
HINT: A number is marked on each main bearing cap to indicate the installation position.



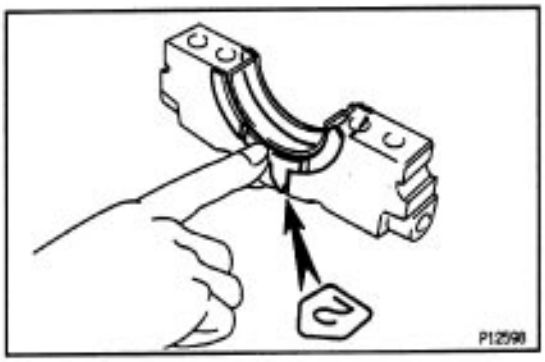

**2. INSTALL UPPER THRUST WASHERS**

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





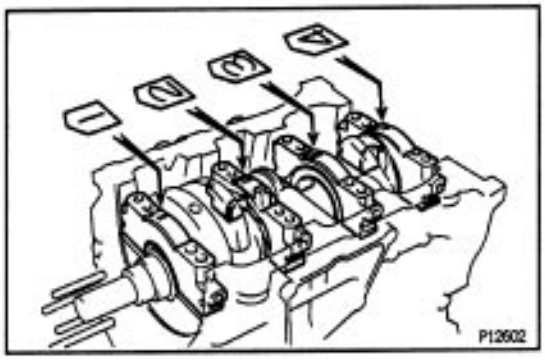

**3. PLACE CRANKSHAFT ON CYLINDER BLOCK**



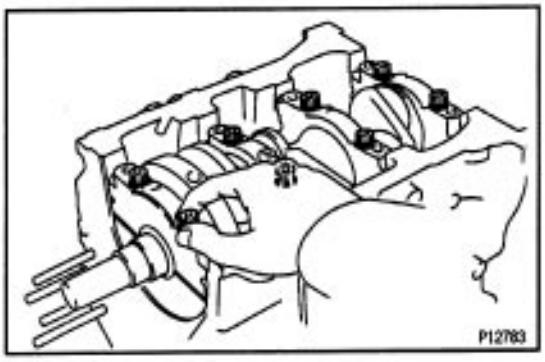

**4. INSTALL MAIN BEARING CAPS AND LOWER THRUST WASHERS**

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

(a) Install the 2 thrust washers on the No.2 bearing cap with the grooves facing outward.

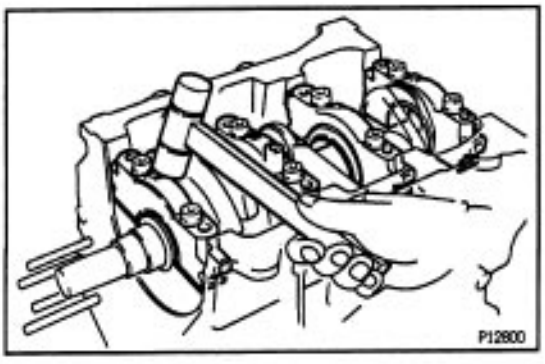



(b) Temporarily place the 4 main bearing caps level and let them in their proper locations.




(c) Apply a light coat of engine oil on the threads and under the main bearing cap bolts (12 Pointed Head Bolts).

(d) Temporarily install the 8 main bearing cap bolts.

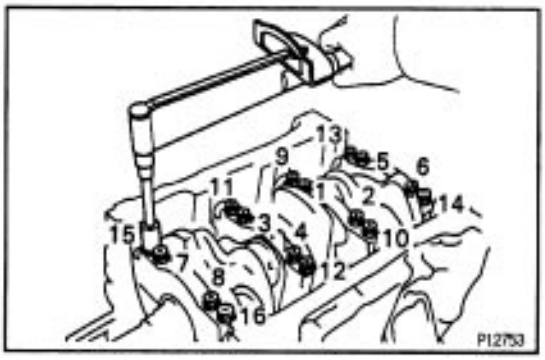



(e) Using a plastic–faced hammer, lightly tap the bearing cap to ensure a proper fit.

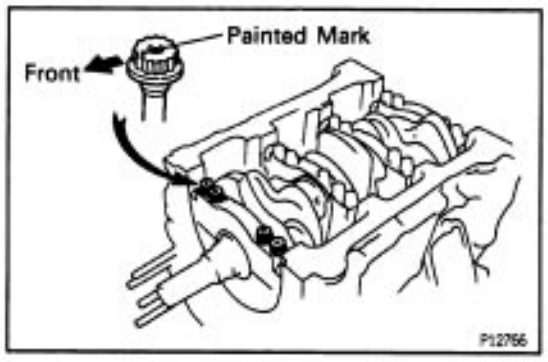
**B. Install main bearing cap bolts**
**(for 12 Pointed Head Bolts)**

HINT:

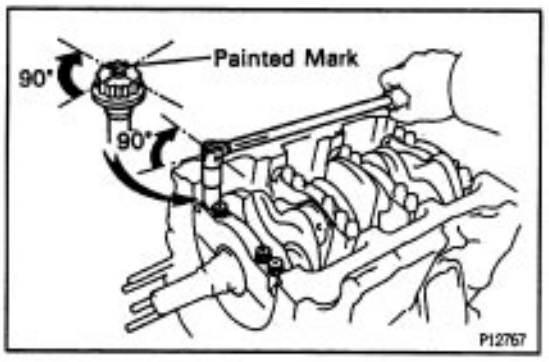
- The main bearing cap bolts are tightened in 2 progressive steps (steps (b) and (d)).
- If any of the main bearing cap bolts is broken or deformed, replace it.



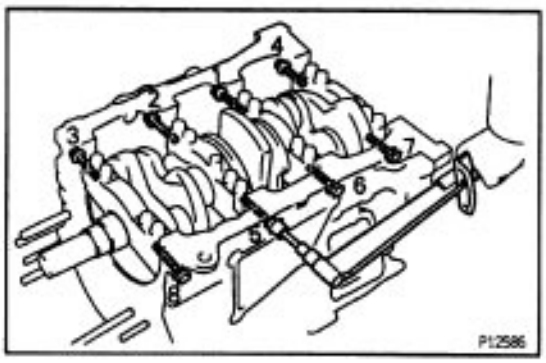

(a) Apply a light coat of engine oil on the threads and under the main bearing cap bolts.
(b) Install and uniformly tighten the 16 main bearing cap bolts, in several passes, in the sequence shown.
**Torque: 22 N–m (225 kgf–cm, 16 ft–lbf)**
If any of the main bearing cap bolts does not meet the torque specification, replace the main bearing cap bolt.




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

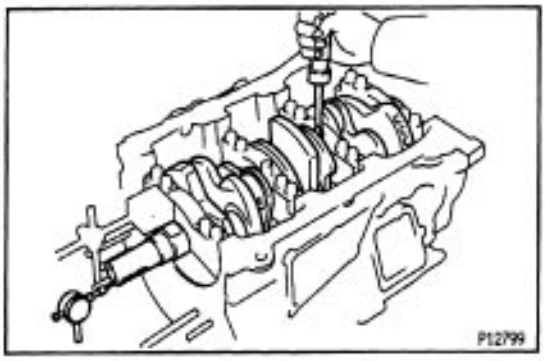



(d) Retighten the main bearing cap bolts by $90_2$ in the numerical order shown.
(e) Check that the painted mark is now at a $90_2$ angle to the front.




**C. Install main bearing cap bolts**
**(for Hexagon Head Bolts)**

(a) Install a new seal washer to the main bearing cap bolt.
(b) Install and uniformly tighten the 8 main bearing cap bolts, in several passes, in the sequence shown.
**Torque: 27 N–m (275 kgf–cm, 20 ft–lbf)**
(c) Check that the crankshaft turns smoothly.




**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:**

**0.04 – 0.24 mm (0.0016 – 0.0095 in.)**

**Maximum thrust clearance:**

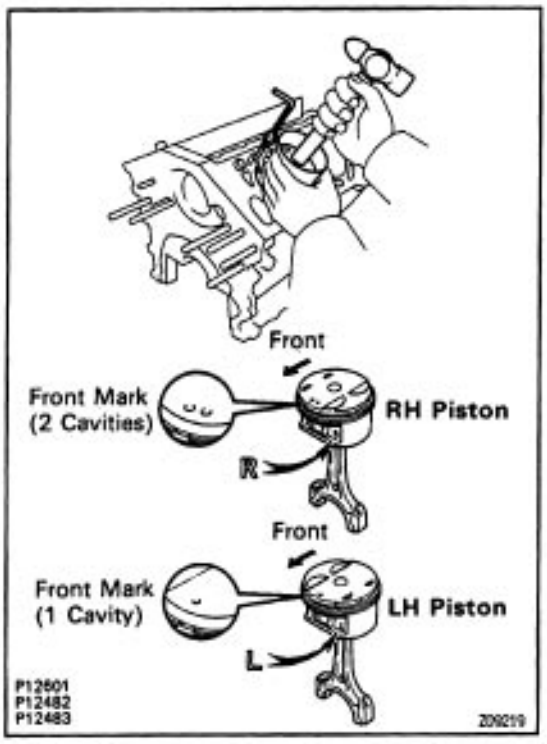
**0.30 mm (0.0118 in.)**

If the thrust clearance is greater than maximum, re–place the thrust washers as a set.

**Thrust washer thickness:**

**1.930 – 1.980 mm (0.0760 – 0.0780 in.)**

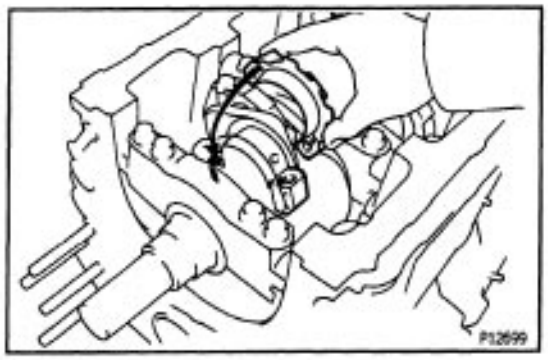





**6. INSTALL PISTON AND CONNECTING ROD ASSEMBLES**

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.

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

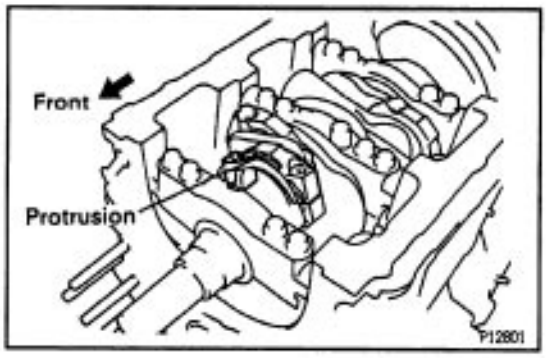



**7. INSTALL CONNECTING ROD CAPS**

**A. Place connecting rod cap on connecting rod**

(a) Match the numbered connecting rod cap with the connecting rod.

(b) Align the pin dowels of the connecting rod cap with the pins of the connecting rod, and install the con–necting rod.

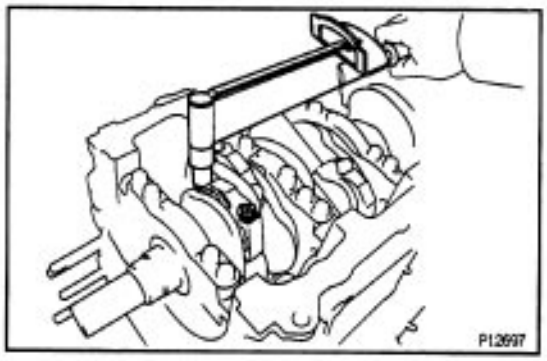



(c) Check that the protrusion of the connecting rod cap is facing in the correct direction.

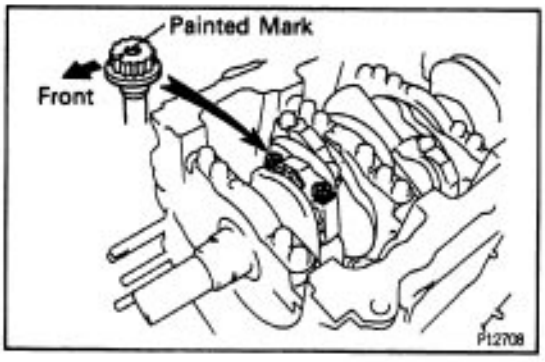
**B. Install connecting rod cap bolts**

HINT:

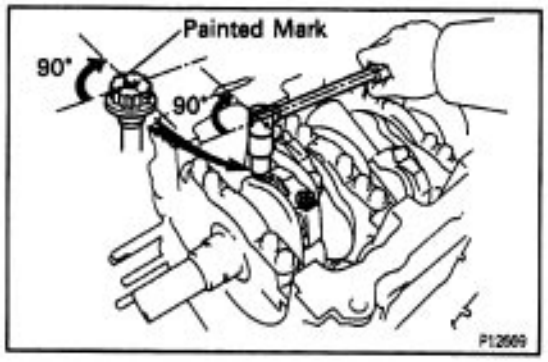
- The connecting rod cap bolts are tightened in 2 progressive steps (steps (b) and (d)).
- If any of the connecting rod cap bolts is broken or deformed, replace it.



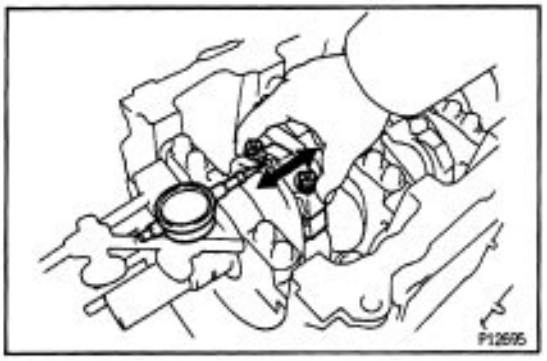

(a) Apply a light coat of engine oil on the threads and under the heads of the connecting rod cap bolts.
(b) Install and alternately tighten the 2 connecting rod cap bolts in several passes.
**Torque: 24.5 N–m (250 kgf–cm, 18 ft–lbf)**
If any of the connecting rod cap bolts does not meet the torque specification, replace the connecting rod cap bolts.




(c) Mark the front of the connecting cap bolts with paint.




(d) Retighten the cap bolts by $90_2$ as shown.
(e) Check that the painted mark is now at a $90_2$ angle to the front.
(f) Check that the crankshaft turns smoothly.




**8. CHECK CONNECTING ROD OIL CLEARANCE**

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

**Standard thrust clearance:**

**0.15 – 0.30 mm (0.0059 – 0.0118 in.)**

**Maximum thrust clearance:**

**0.35 mm (0.0138 in.)**

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

**Connecting rod thickness:**

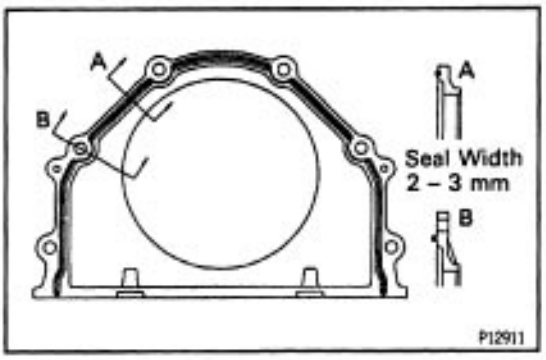
**20.80 – 20.85 mm (0.8189 – 0.8209 in.)**



**9. INSTALL REAR OIL SEAL RETAINER**

(a) Remove any old packing (FIPG) material and be care–ful not to drop any oil on the contact surfaces of the oil seal retainer and cylinder block.

- Using a razor blade and gasket scraper, remove all the oil packing (FIPG) material from the gasket surfaces and sealing grooves.
- Thoroughly clean all components to remove all the loose material.
- Using a non–residue solvent, clean both sealing surfaces.

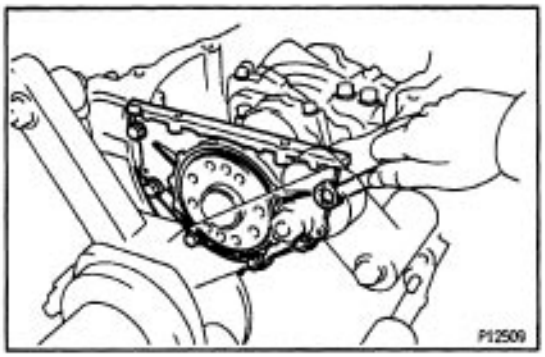



(b) Apply seal packing to the oil seal retainer as shown in the illustration.

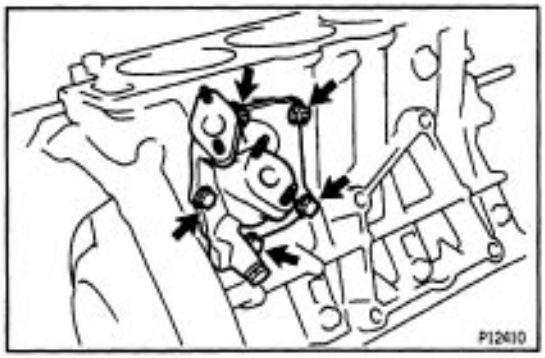
**Seal packing:**

**Part No. 08826–00080 or equivalent**

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



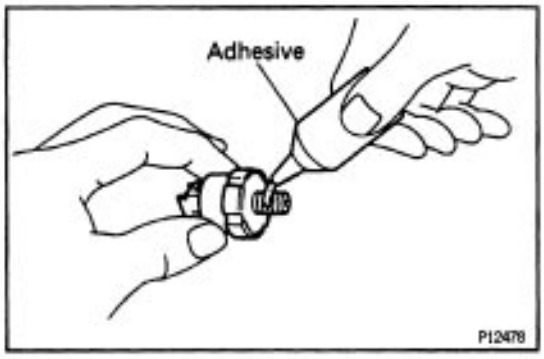

(c) Install the oil seal retainer with the 6 bolts.
**Torque: 8 N–m (80 kgf–cm, 69 in.–lbf)**



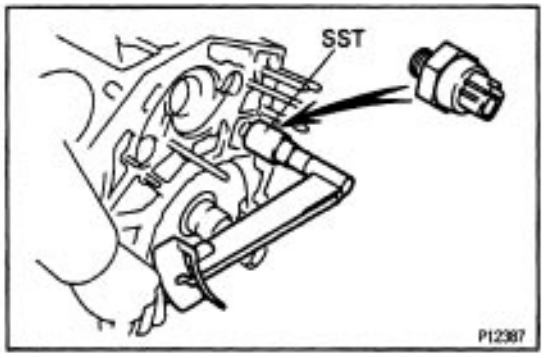

## AFTER ASSEMBLY

**(See Components for Cylinder Block Preparation of Disassembly and After Assembly)**

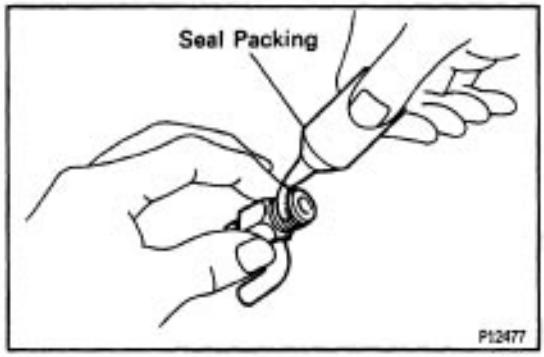
**1. INSTALL EGR COOLER**
Install a new gasket and the EGR cooler with the 3 bolts and 2 nuts.
**Torque: 9 N–m (90 kgf–cm, 78 in.–lbf)**



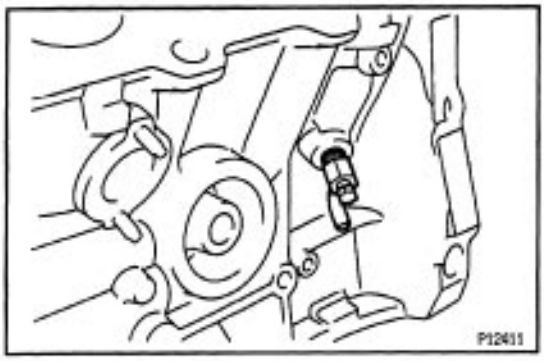

**2. INSTALL OIL PRESSURE SWITCH**
(a) Apply adhesive to 2 or 3 threads.
**Adhesive:**
**Part No. 08833–00080. THREE BOND 1344, LOCTITE 242 or equivalent**




(b) Using SST, install the oil pressure switch.
SST 09816 – 30010
**Torque: 13 N–m (130 kgf–cm, 9 ft–lbf)**

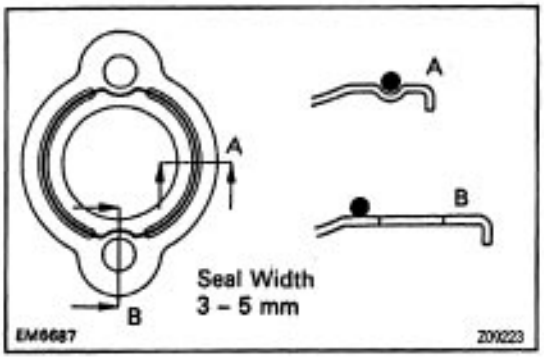



**3. INSTALL ENGINE COOLANT DRAIN COCK**
(a) Apply seal packing to 2 or 3 threads.
**Seal packing:**
**Part No. 08826–00100 or equivalent**

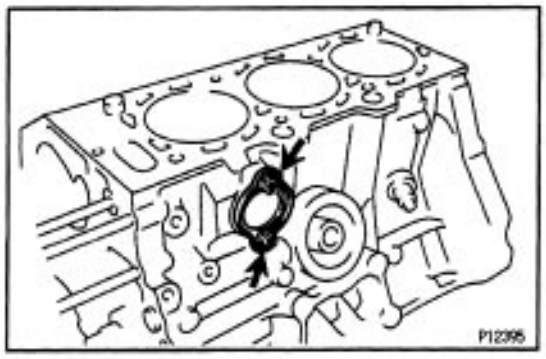



(b) Install the drain cock.
**Torque: 39 N–m (400 kgf–cm, 29 ft–lbf)**
HINT: After applying the specified torque, rotate the drain cock clockwise until it is in the position shown.

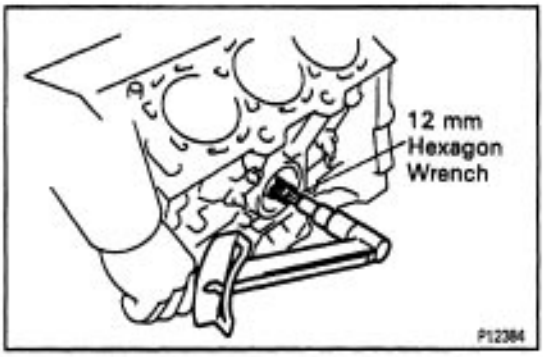
**4. INSTALL WATER SEAL PLATE**
(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the seal plate and cylinder block.
- Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing groove.
- 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 3–5 mm (0.12 – 0.20 in.) opening.
- Parts must be assembled within 3 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.



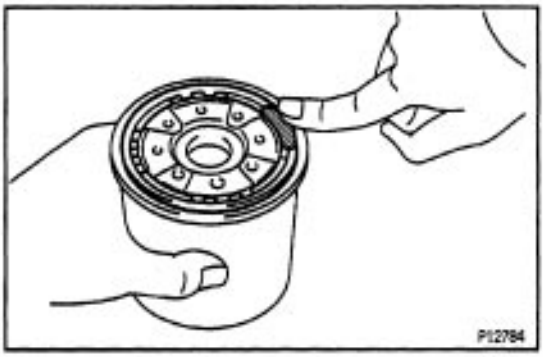

(c) Install the seal plate with the 2 nuts.
**Torque: 14.5 N–m (145 kgf–cm. 10 ft–lbf)**




**5. INSTALL OIL FILTER UNION**

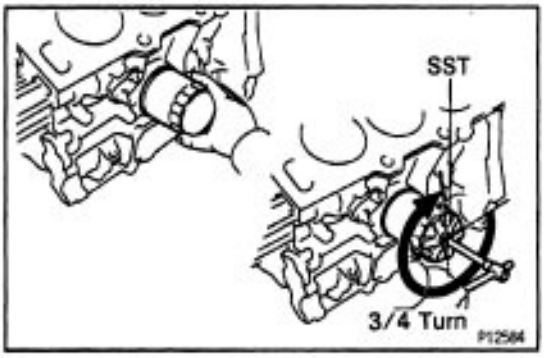
Using a 12 mm hexagon wrench, install the oil filter union.

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




**6. INSTALL OIL FILTER**

(a) Apply clean engine oil to the gasket of anew oil filter.

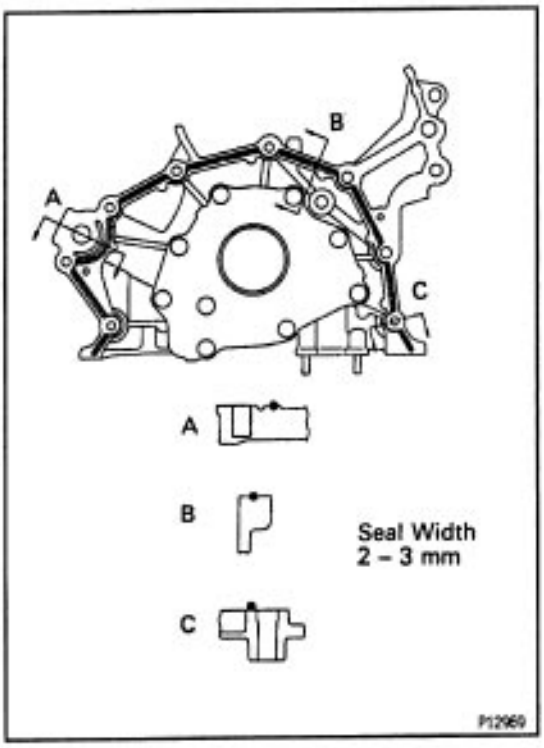



(b) Lightly screw the oil filter into place, and tighten it until the gasket contacts the seat.
(c) Using SST, tighten it an additional 3/4 turn.
SST 09228–07500

**7. 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 grooves.
- 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.

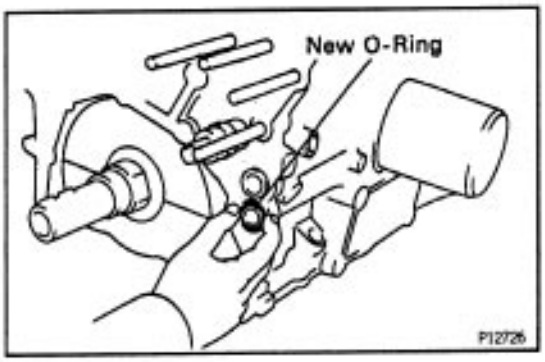
**Seal packing:**

**Part No. 08826–00080 or equivalent**

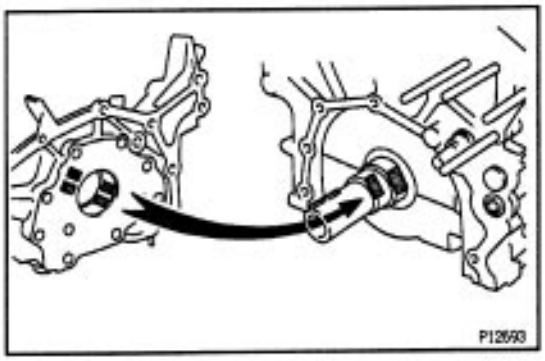
- Install a nozzle that has been cut to a 2–3 mm (0.08–0.12 in.) opening.

HINT: Avoid applying an excessive amount to the surface.

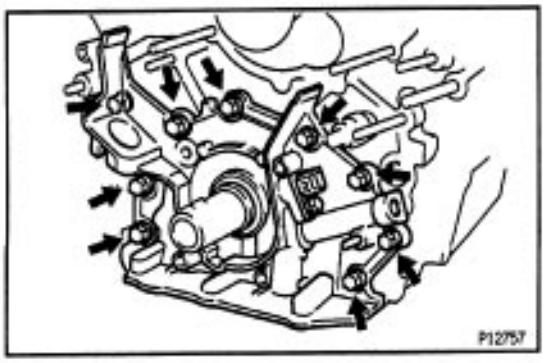
- Parts must be assembled within 3 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.




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



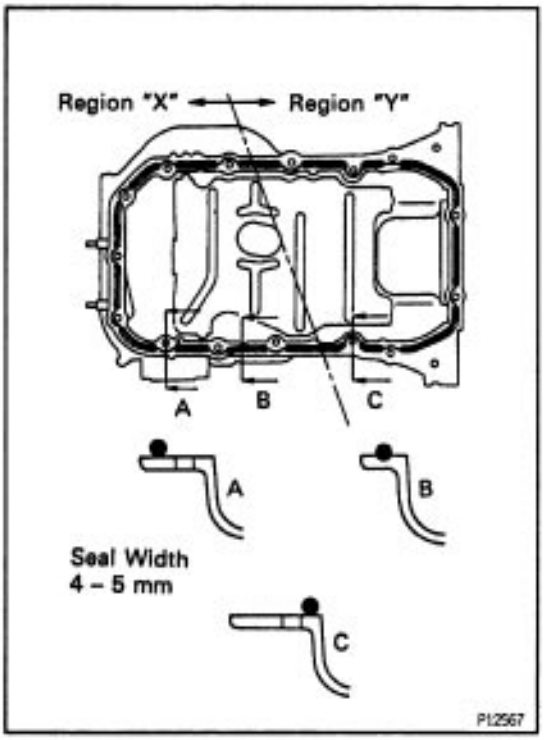

(d) Engage the spline teeth of the oil pump drive gear with the large teeth of the crankshaft, and slide the oil pump on the crankshaft.




(e) Install the oil pump with the 9 bolts.

**Torque:**

**8 N–m (80 kgf–cm, 69 in.–lbf) for 10 mm head bolt**
**19.5 N–m (200 kgf–cm,14 ft–lbf) for 12 mm head bolt**




**8. INSTALL N0.1 OIL PAN**

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surface of the No.1 oil pan and cylinder block.

- Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing grooves.
- Thoroughly clean all components to remove all the loose material.
- Using a non–residue solvent, clean both sealing surfaces.

**NOTICE: Do not use a solvent which will affect the painted surfaces.**

(b) Apply seal packing to the No.2 oil pan as shown in the illustration.

**Seal packing:**

**Part No. 08826–00080 or equivalent**

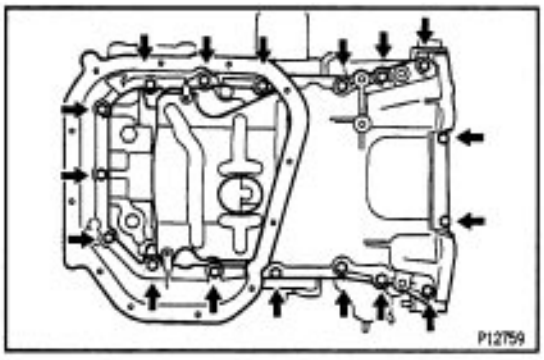
**Region "x" is at the outer side of the bolt hole.**

**Region "*" is at the inner side of the bolt hole.**

- Install a nozzle that has been cut to a 4–5 m m (0.16 – 0.20 in.) opening.

HINT: Avoid applying an excessive amount to the surface.

- Parts must be assembled within 3 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.

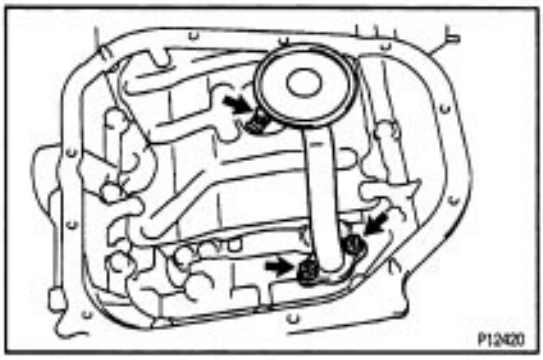



(c) Install the No.1 oil pan with the 17 bolts.

**Torque:**

**8 N–m (80 kgf–cm, 69 in.–lbf) for 10 mm head bolt**

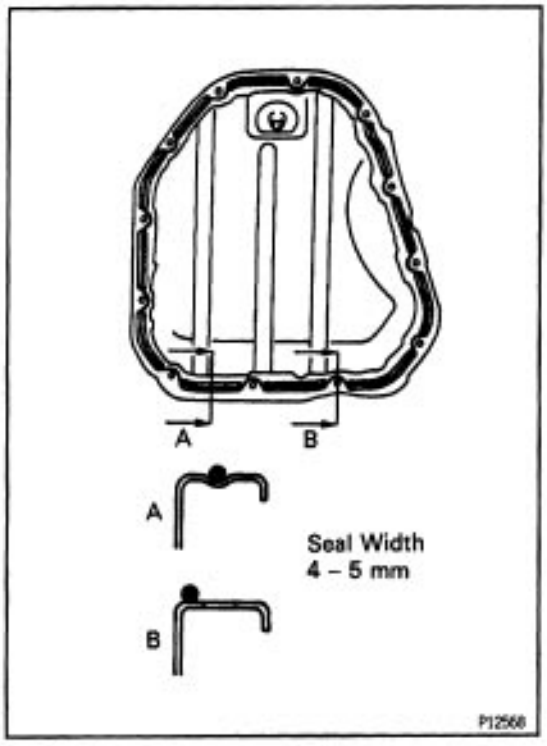
**19.5 N–m (200 kgf–cm, 14 ft–lbf) for 12 mm head bolt**




**9. INSTALL OIL STRAINER**

Install a new gasket and the oil strainer with the bolt and 2 nuts.

**Torque: 8 N–m (80 kgf–cm, 69 in–lbf)**




**10. INSTALL NO.2 OIL PAN**

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surface of the No.1 and No.2 oil pans.

- Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing grooves.
- Thoroughly clean all components to remove all the loose material.
- Using a non–residue solvent, clean both sealing surfaces.

**NOTICE: Do not use a solvent which will affect the painted surfaces.**

(b) Apply seal packing to the No.2 oil pan as shown in the illustration.

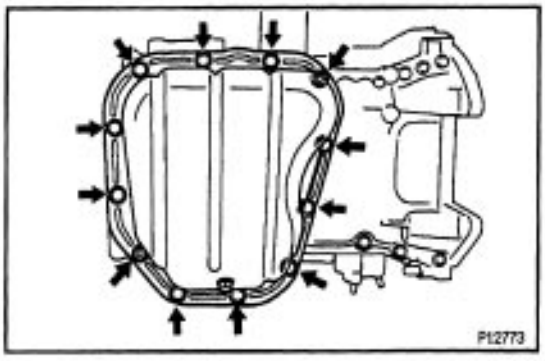
**Seal packing:**

**Part No. 08828–00080 or equivalent**

- Install a nozzle that–has been cut to a 4–5 mm (0.16 – 0.20 in.) opening.

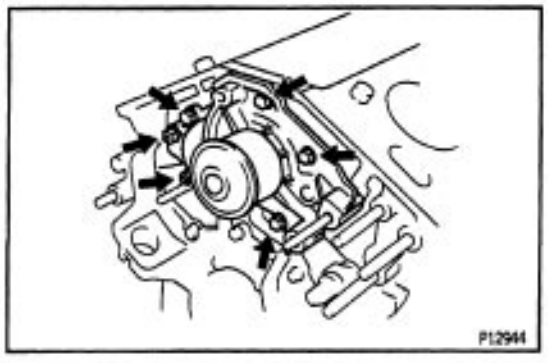
HINT: Avoid applying an excessive amount to the surface.

- Parts must be assembled within 3 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.




(c) Install the No.2 oil pan with the 10 bolts and 2 nuts.

**Torque: 8 N–m (80 kgf–cm, 69 in.–lbf)**




**11. INSTALL WATER PUMP**

Install a new gasket and the water pump with the 4 bolts and 2 nuts.

**Torque: 8 N–m (80 kgf–cm, 69 in.–lbf)**

**NOTICE: Do not got oil on the gasket.**

**12. INSTALL WATER INLET HOUSING**

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the water inlet housing and cylinder block.

- Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing grooves.
- 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 water inlet housing as shown in the illustration.

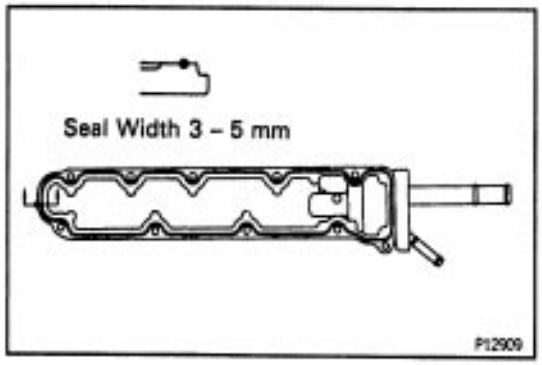
**Seal packing:**

**Part No. 08826–00100 or equivalent**

- Install a nozzle that has been cut to a 3–5 mm (0.12–0.20 in.) opening.

HINT: Avoid applying an excessive amount to the surface.

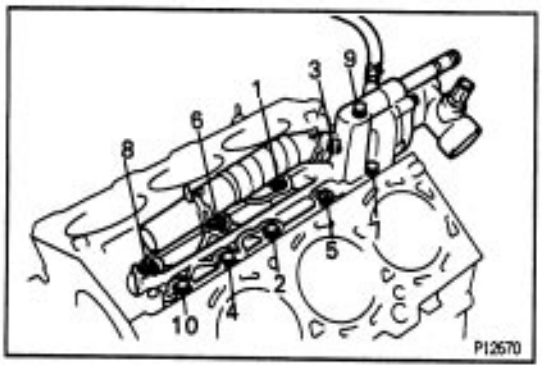
- Parts must be assembled within 3 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.






(c) Install the water inlet housing with the 8 bolts and 2 nuts, in the several passes, in the sequence shown.

**Torque: 8 N–m (80 kgf–cm, 69 in.–lbf)**

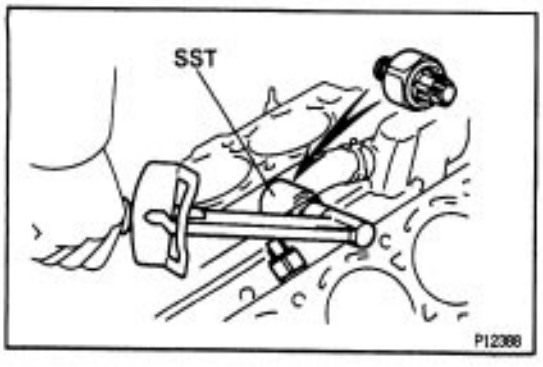


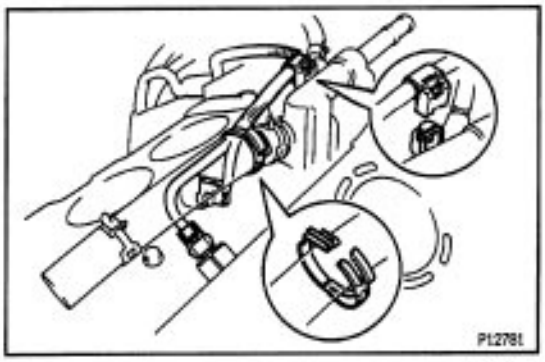

**13. INSTALL KNOCK SENSORS**

(a) Using SST, install the 2 knock sensors.

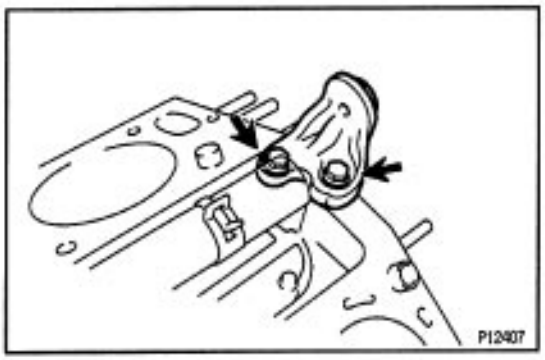
SST 09816 – 30010

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

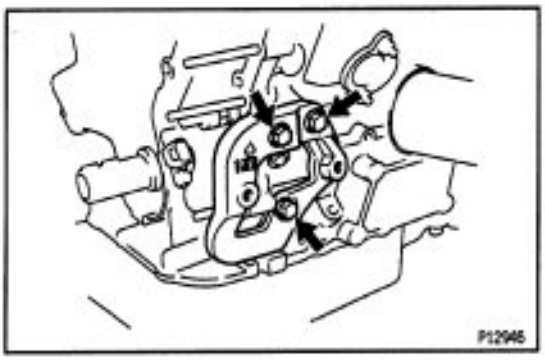





(b) Connect the 2 knock sensor connectors.
(c) Install the wire band.
(d) Connect the engine wire clamp.

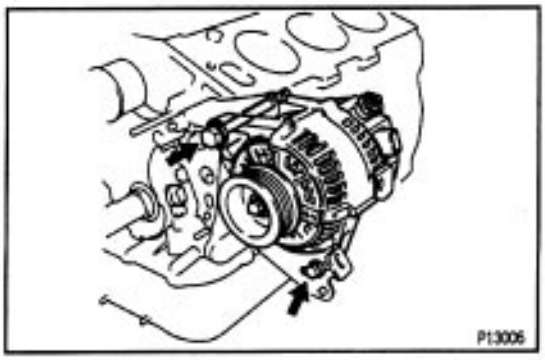



**14. INSTALL NO.2 IDLER PULLEY BRACKET**
Install the pulley bracket with the 2 bolts.
**Torque: 28 N–m (290 kgf–cm, 21 ft–lbf)**

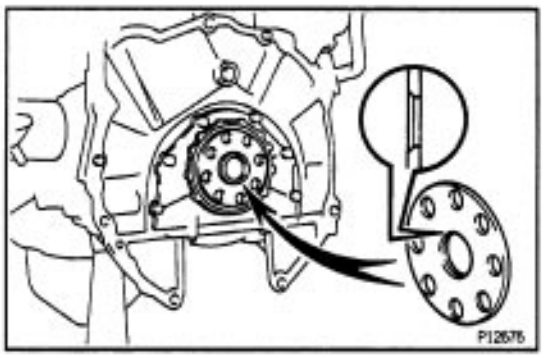



**15. INSTALL A/C COMPRESSOR HOUSING BRACKET**
Install the compressor housing bracket with the 3 bolts.
**Torque: 25 N–m (250 kgf–cm. 18 ft–lbf)**


**16. INSTALL GENERATOR BRACKET AND ADJUSTING BAR**
Install the generator bracket and adjusting bar with the 3 nuts.
**Torque: 43 N–m (440 kgf–cm, 32 ft–lbf)**




**17. INSTALL GENERATOR**
Install the generator with the 2 bolts. Do not tighten the bolts yet.
**18. INSTALL CYLINDER HEAD**
**(See pages** EG2–96 **to 118)**
**19. INSTALL TIMING PULLEYS AND BELT**
**(See pages** EG2–49 **to 55)**
**20. REMOVE ENGINE STAND**

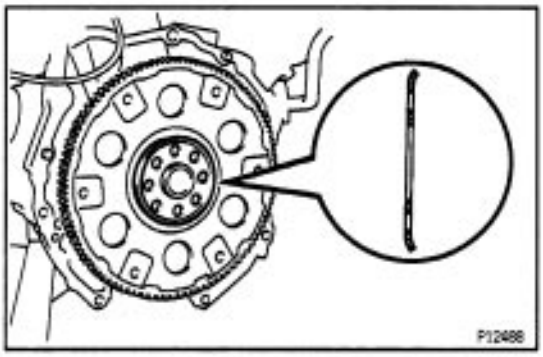



# ENGINE & TRANSAXLE ASSEMBLY

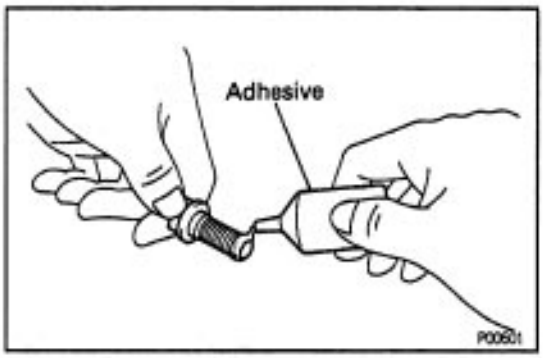
**(See Components for Engine & Transaxle Separation and Assembly)**

**1. INSTALL DRIVE PLATE**

(a) Install the front spacer on the crankshaft with the chamfered end facing the shaft.

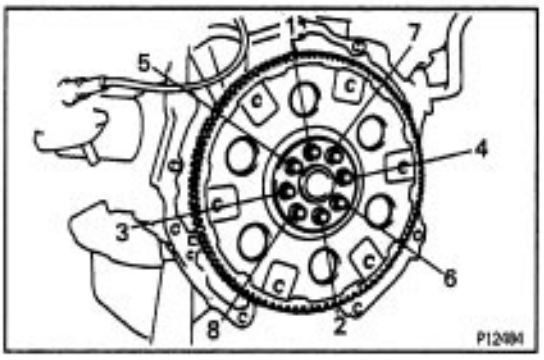



(b) Install the drive pate and rear spacer on the crank–shaft.

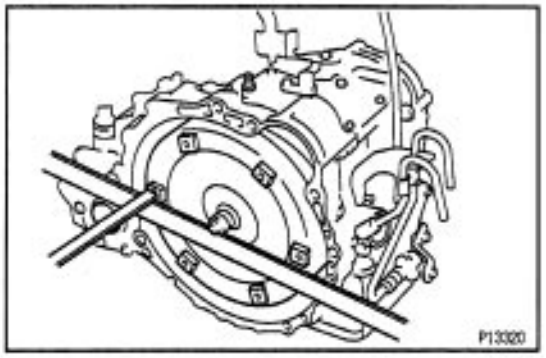



(c) Clean the threads of the bolt with the gasoline.
(d) Apply adhesive to 2 or 3 threads of the mount bolt.
**Adhesive:**

**Part No. 08833–00070. THREE BOND 1324 or equivalent**



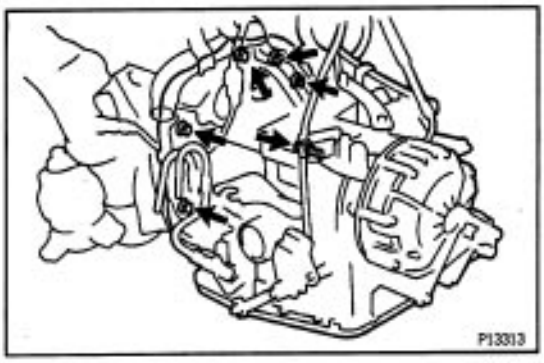

(e) Install and uniformly tighten the mounting bolts, in the several passes, in the sequence shown.
**Torque: 83 N–m (850 kgf–cm, 61 ft–lbf)**




**2. CHECK TORQUE CONVERTER CLUTCH INSTALLATION**

Using a scale and a straight edge, measure from the installed surface to the front surface of the transaxle housing.
**Correct distance:**

**13.7 mm (0.539 in.) or more**



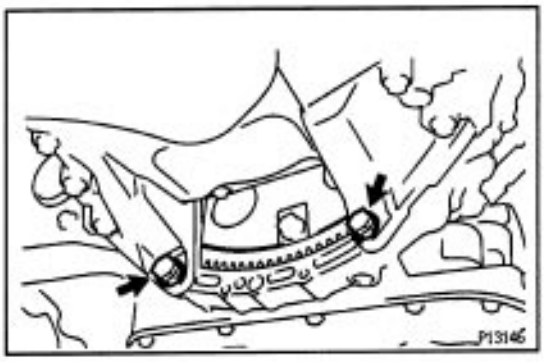

**3. INSTALL TRANSAXLE TO ENGINE**

**A. Install transaxle**

(a) Attach the transaxle to the engine.

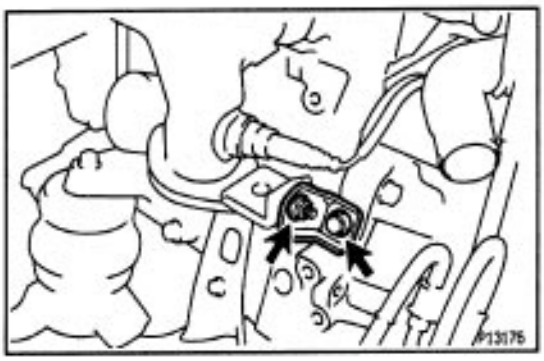
(b) Install the6 bolts.

**Torque: 64 N–m (650 kgf–cm, 47 ft–lbf)**



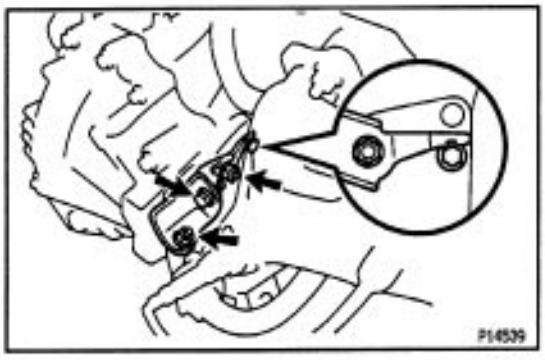

(c) Install the 2 bolts holding the No.2 oil pan to the transaxle.

**Torque: 46 N–m (470 kgf–cm, 34 ft–lbf)**




(e) Install the No.2 manifold stay with the bolt and nut.

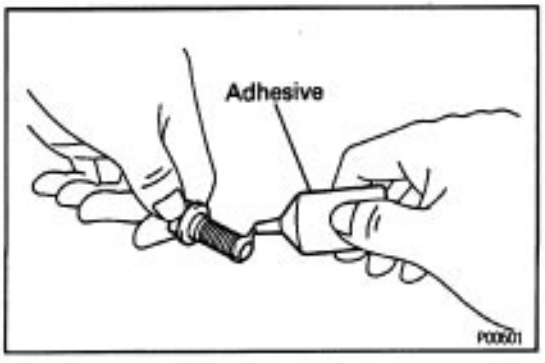
**Torque: 20 N–m (200 kgf–cm. 14 ft–lbf)**




(f) Install the manifold stay, exhaust manifold plate with the bolt and 2 nuts.

**Torque: 20 N–m (200 kgf–cm, 14 ft–lbf)**

HINT: Install the manifold so that the tip of the stay touches the head of the differential retainer installa–tion bolt as shown in the illustration.



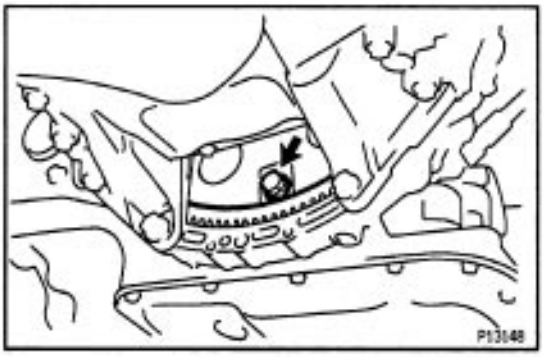

**B. Install torque converter clutch mounting bolts**

(a) Clean the threads of the bolt with the gasoline.

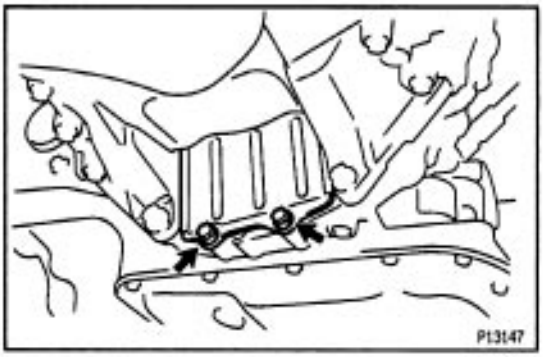
(b) Apply adhesive to 2 or 3 threads of the mount bolt.

**Adhesive:**

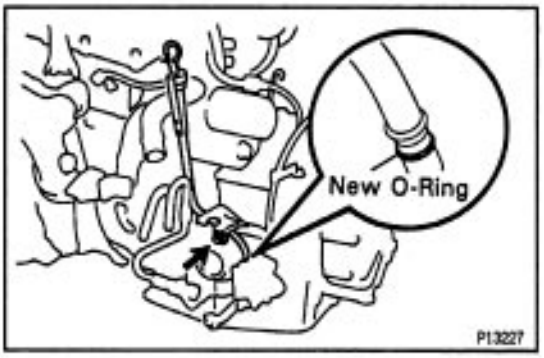
**Part No. 08833–00070, THREE BOND 1324 or equivalent**




(c) Hold the crankshaft pulley bolt with a wrench, and install the 6 bolts evenly.
**Torque: 41 N–m (420 kgf–cm, 30 ft–lbf)**
HINT: First install the dark green colored bolt, then install the other bolts.




(d) Install the flywheel housing under cover with the 2 bolts.
**Torque: 18 N–m (185 kgf–cm, 13 ft–lbf)**




**4. INSTALL OIL DIPSTICK GUIDE AND DIPSTICK FOR TRANSMISSION**
(a) Install a new 0–ring to the dipstick guide.
(b) Apply soapy water to the 0 – ring.
(c) Connect the dipstick guide end to the dipstick tube of the oil pan.
(d) Install the dipstick guide with the bolt.
(e) Install the dipstick.

**5. CONNECT ENGINE WIRE**
(a) Connect the following parts:
(1) O/D solenoid connector
(2) PNP switch speedometer
(3) Starter 50 terminal
(4) Starter B terminal
(5) Speed sensor connector
(b) Disconnect the 2 wire clamps from the transaxle.
(c) Install the 2 wire clamps to the transaxle.

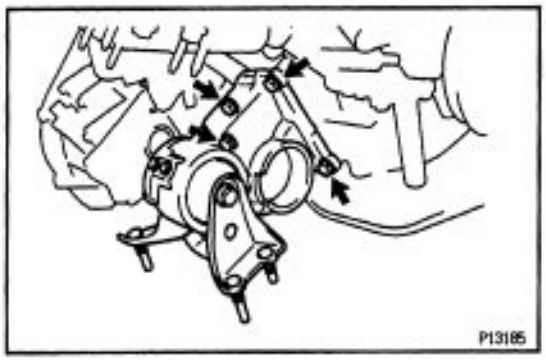
# ENGINE INSTALLATION

**(See Components for Engine Removal and Installation)**

**1. INSTALL FRONT EXHAUST PIPE STAY**

Install the pipe stay with the 2 bolts.

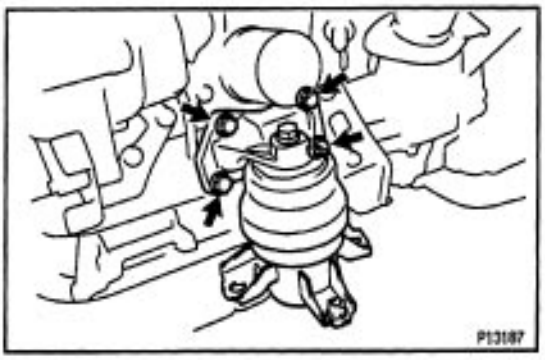
**Torque: 21 N–m (210 kgf–cm, 16 ft–lbf)**




**2. INSTALL RR ENGINE MOUNTING INSULATOR**

Install the mounting insulator with the 4 bolts.

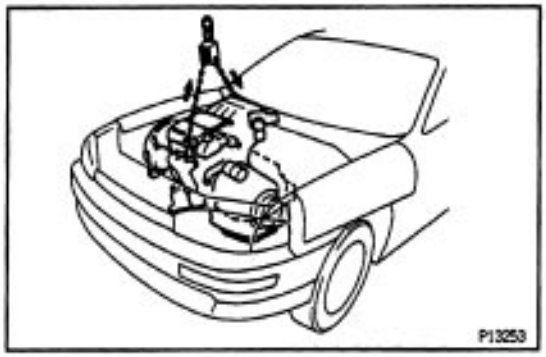
**Torque:63.7 N–m (650 kgf–cm, 47 ft–lbf)**




**3. INSTALL FR ENGINE MOUNTING INSULATOR**

Install the mounting insulator with the 4 bolts.

**Torque: 6.74 N–m (650 kgf–cm, 47 ft–lbf)**



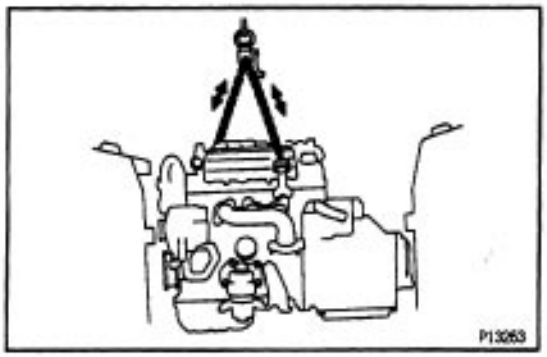

**4. INSTALL ENGINE AND TRANSAXLE ASSEMBLY IN VEHICLE**

(a) Attach the engine sling device to the engine hangers.

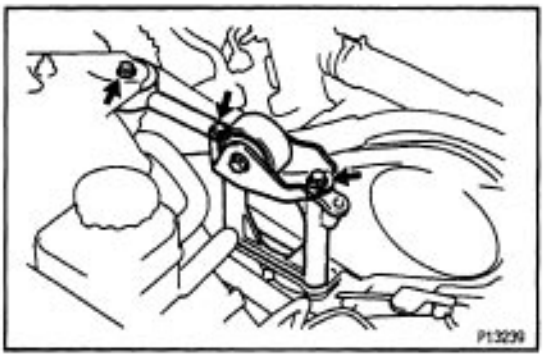
(b) Lower the engine into the engine compartment.

Tilt the transaxle downward, lower the engine and clear the LH mounting.

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



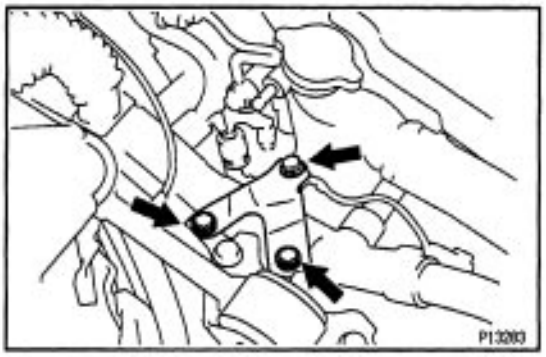

(c) Keep the engine level, and align RH and LH mountings with the body bracket.




**5. INSTALL N0.2 ENGINE MOUNTING BRACKET AND ENGINE MOVING CONTROL ROD**

Install the engine moving control rod and No.2 engine mounting bracket with the 3 bolts.

**Torque: 63.7 N–m (650 kgf–cm, 47 ft–lbf)**



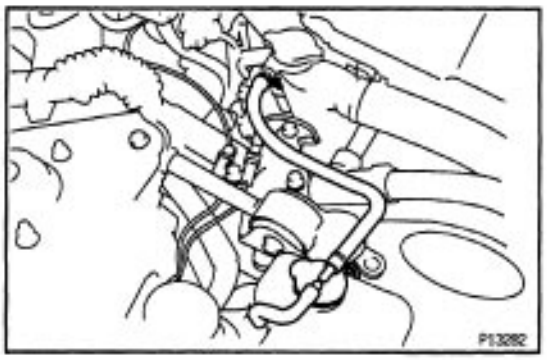

**6. INSTALL RH ENGINE MOUNTING STAY**

Install the RH mounting stay with the 3 bolts.

**Torque: 31.4 N–m (320 kgf–cm, 23 ft–lbf)**


**7. CONNECT GROUND STRAPS**

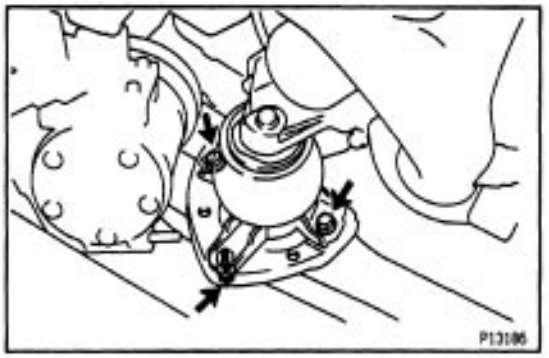
Connect the 2 straps.




**8. INSTALL COOLANT RESERVOIR TANK**

(a) Install the reservoir tank.

(b) Connect the reservoir hose.

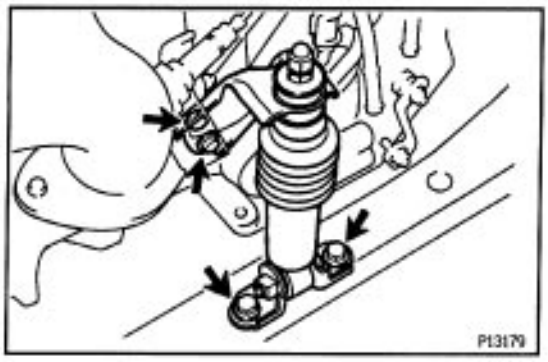



**9. CONNECT FR ENGINE MOUNTING INSULATOR**

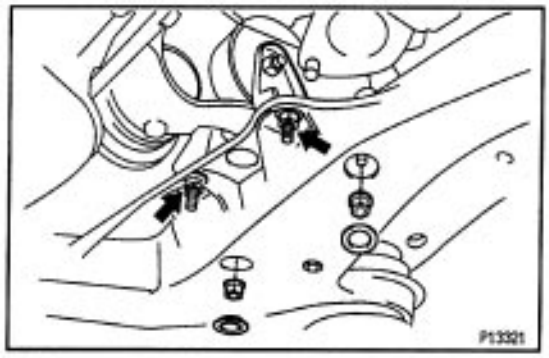
Connect the mounting insulator with the 3 bolts.

**Torque: 80.4 N–m (820 kgf–cm, 59 ft–lbf) for TMC made**

**Torque: 65.7 N–m (670 kgf–cm, 48 ft–lbf) for TMM made**

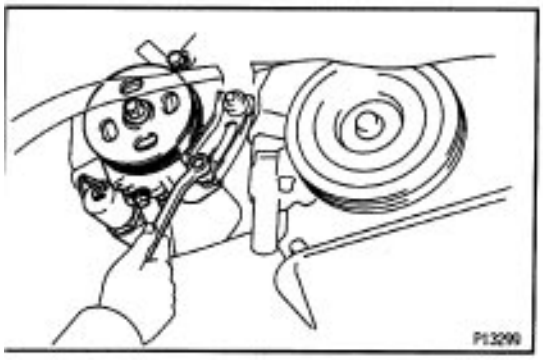



**10. INSTALL ENGINE MOUNTING ABSORBER**
Install the engine mounting absorber with the 4 bolts.
**Torque: 48 N–m (490 kgf–cm, 35 ft–lbf)**

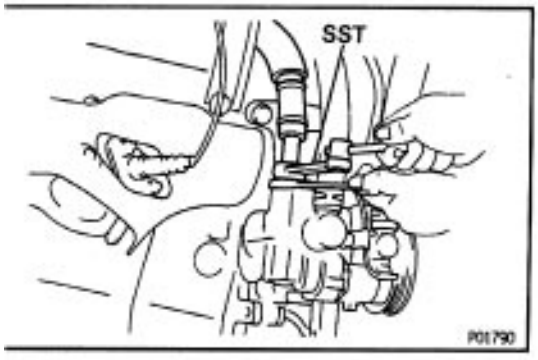



**11. CONNECT RR ENGINE MOUNTING INSULATOR**
(a) Connect the mounting insulator with the 4 nuts.
**Torque: 65.7 N–m (670 kgf–cm, 48 ft–lbf)**
(b) Install the 2 hole plugs.

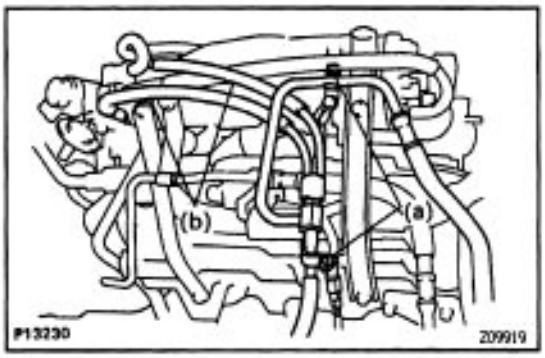

**12. CONNECT LH ENGINE MOUNTING INSULATOR**
Connect the mounting insulator with the 4 bolts.
**Torque: 63.7 N–m (650 kgf–cm, 47 ft–lbf)**
**13. REMOVE ENGINE SLING DEVICE**




**14. INSTALL PS PUMP**
(a) Install the PS pump with the 2 bolts.
**Torque: 43 N–m (440 kgf–cm, 31 ft–lbf)**
(b) Install the drive belt.




**15. CONNECT HYDRAULIC COOLING FAN PRESSURE HOSE**
Using SST, connect the pressure hose.
SST 09631– 22020
**Torque: 44 N–m (450 kgf–cm, 33 ft–lbf)**

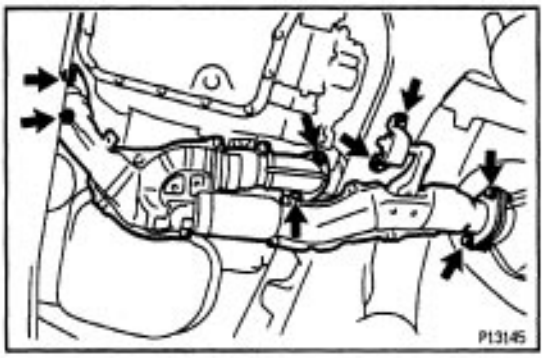



**16. CONNECT PS PRESSURE TUBE**

(a) Connect the PS pressure tube with the 2 nuts.

(b) Connect the 2 PS air hoses.

**17. INSTALL DRIVE SHAFTS (See SA section)**




**18. INSTALL FRONT EXHAUST PIPE**

(a) Temporarily install 3 new gaskets and the front exhaust pipe with the 2 bolts and 6 nuts.

(b) Tighten the 4 nuts holding the exhaust manifolds to the front exhaust pipe.

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

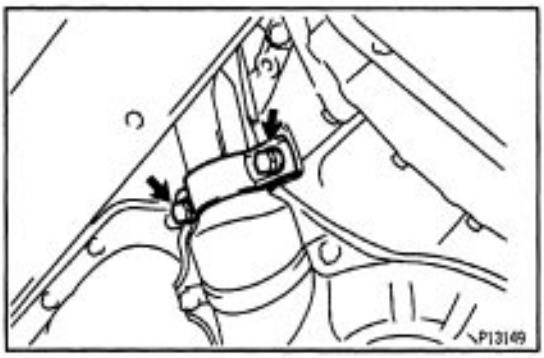
(c) Tighten the 2 bolts and 2 nuts holding the three–way catalytic converter to the front exhaust pipe.

**Torque: 56 N–m (570 kgf–cm, 41 ft–lbf)**

(d) Connect the bracket with the 2 bolts.

**Torque: 19 N–m (195 kgf–cm, 14 ft–lbf)**





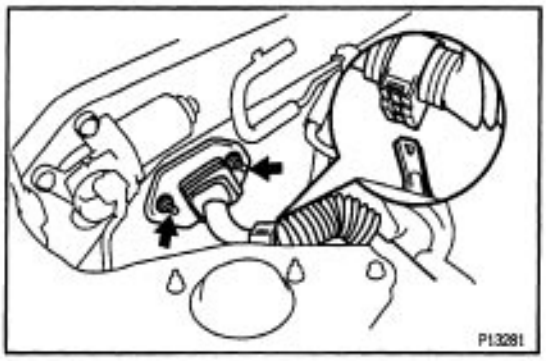

(e) Connect the front exhaust pipe clamp with the 2 bolts.

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


**19. INSTALL A/C COMPRESSOR**

(a) Install the A/C compressor and drive belt adjusting bar bracket with the 5 bolts.

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




**20. CONNECT ENGINE WIRE TO CABIN**

(a) Push in the engine wire through the cowl panel. Install the 2 nuts.

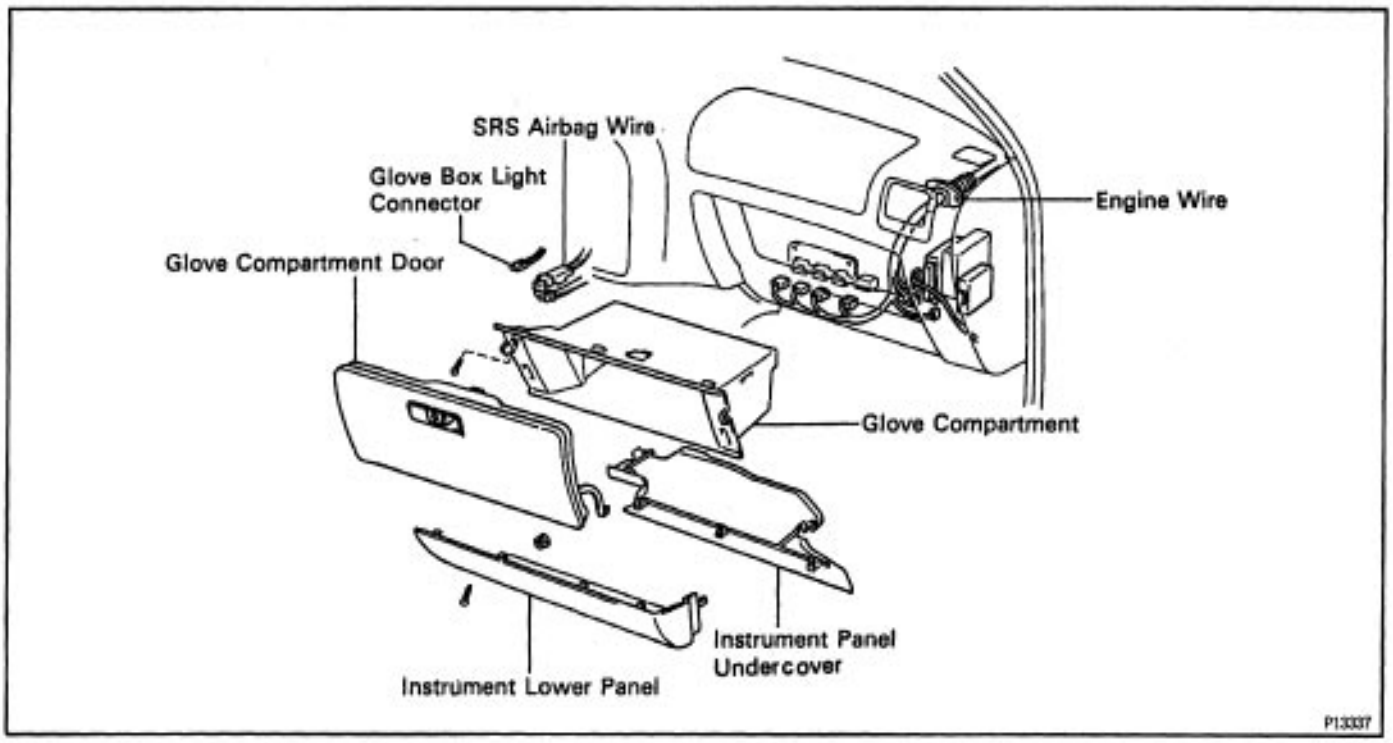
(b) Connect the wire clamp.

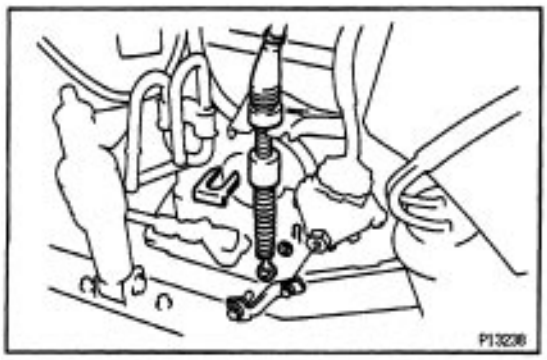
(c) Connect the following connectors:

(1) 3 engine ECM connectors
(2) 5 cowl wire connectors
(3) Cooling fan ECU connector

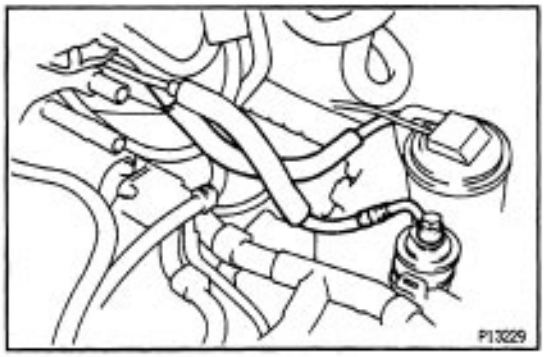
(d) Install the following parts:

(1) Glove compartment
(2) Glove compartment door
(3) Lower instrument panel
(4) Under cover



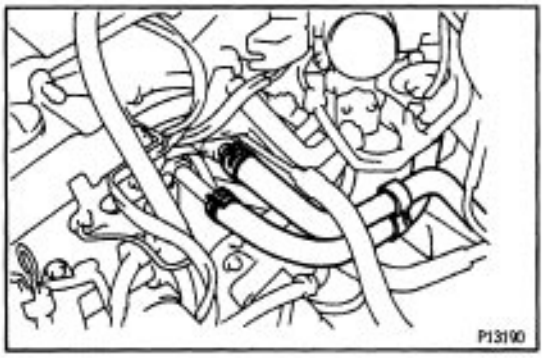




**21. CONNECT TRANSAXLE CONTROL CABLE TO TRANSAXLE**




**22. CONNECT FUEL HOSES**

(a) Connect the fuel return hose to the fuel pipe.
(b) Connect the fuel inlet hose to the fuel filter.
**Torque: 30 N–m (300 kgf–cm, 22 ft–lbf)**



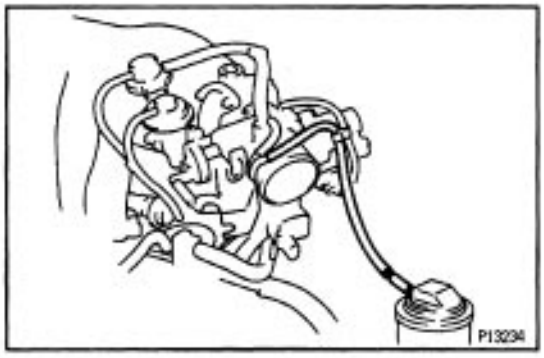

**23. CONNECT HEATER HOSES**

Connect the 2 hoses.

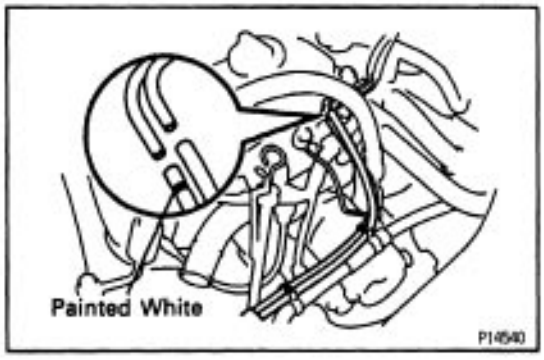

**24. CONNECT VACUUM HOSES**

Connect the following vacuum hoses:

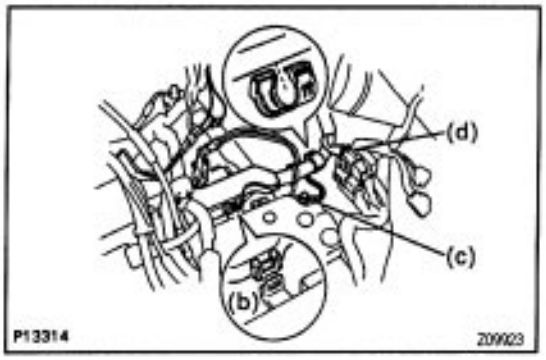
(1) Brake booster vacuum hose to air intake chamber




(2) Vacuum hose to charcoal canister

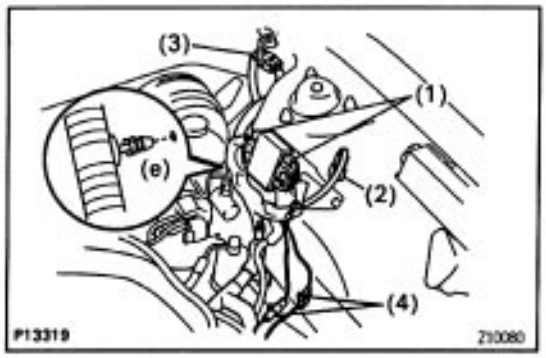



(3) Vacuum hoses to vacuum tank for intake air control valve

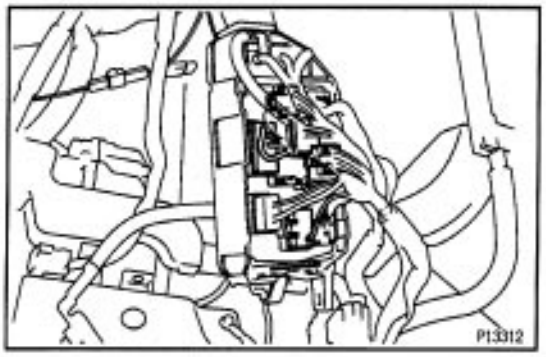



**25. CONNECT ENGINE WIRE**

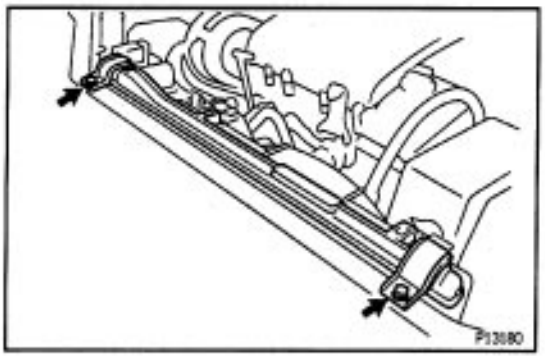
(a) Connect the wire clamps.
(b) Connect the ground strap with the bolt.
(c) Connect the connector to the LH fender apron.



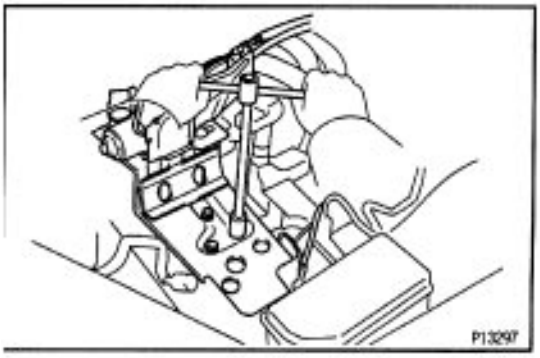

(d) Connect the wire clamps
(e) Connect the following wires and connectors:
(1) 2 igniter connectors
(2) Noise filter connector
(3) Connector to LH fender apron
(4) 2 ground straps




(5) 5 connectors to relay box
(f) Connect the engine relay box with the 2 bolts.

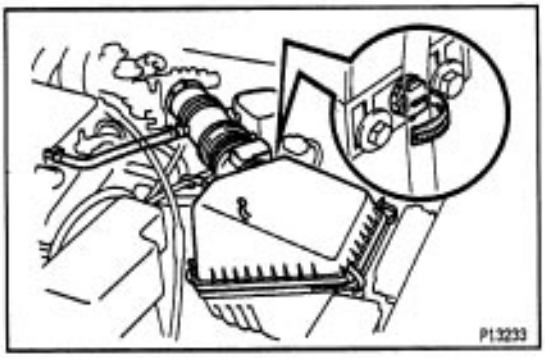



**26. INSTALL RADIATOR**
**(See page** EG2–342**)**



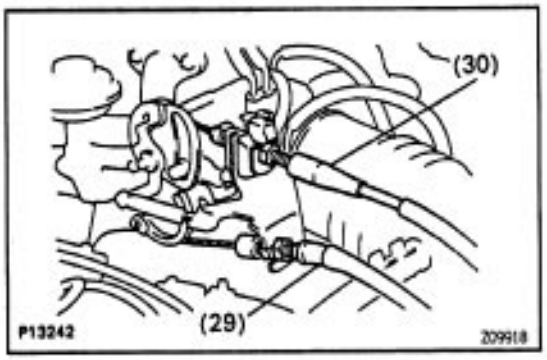

**27. w/ CRUISE CONTROL SYSTEM:**
**INSTALL CRUISE CONTROL ACTUATOR**

(a) Connect the actuator and bracket with the 3 bolts.
(b) Connect the actuator connector and clamp.
(c) Install the actuator cover with the bolt and clip.



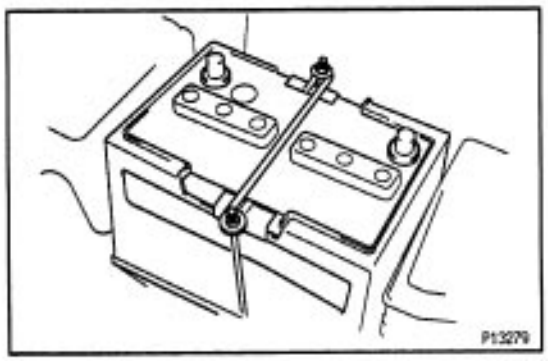

**28. INSTALL AIR CLEANER CAP, VOLUME AIR FLOW METER AND AIR CLEANER HOSE**

(a) Connect the air cleaner hose, and install the air clean–er cap and volume air flow meter with the 4 clips.
(b) Tighten the air cleaner hose clamp bolt.
(c) Connect the PCV hose.
(d) Connect the accelerator cable clamp.
(e) Connect the volume air flow meter connector and wire clamp.




**29. CONNECT THROTTLE CABLE**
**30. CONNECT ACCELERATOR CABLE**
**31. FILL ENGINE WITH OIL**
**Capacity:**
**Drain and refill**
**w/ Oil filter change**
**4.7 liters (5.0 US qts, 4.1 Imp. qts)**
**w/o Oil filter change**
**4.5 liters (4.8 US qts, 4.0 Imp. qts)**
**Dry fill**
**5.5 liters (5.8 US qts, 4.8 Imp. qts)**
**32. FILL WITH ENGINE COOLANT**
**Capacity:**
**8.7 liters (9.2 US qts, 7.7 Imp. qts)**





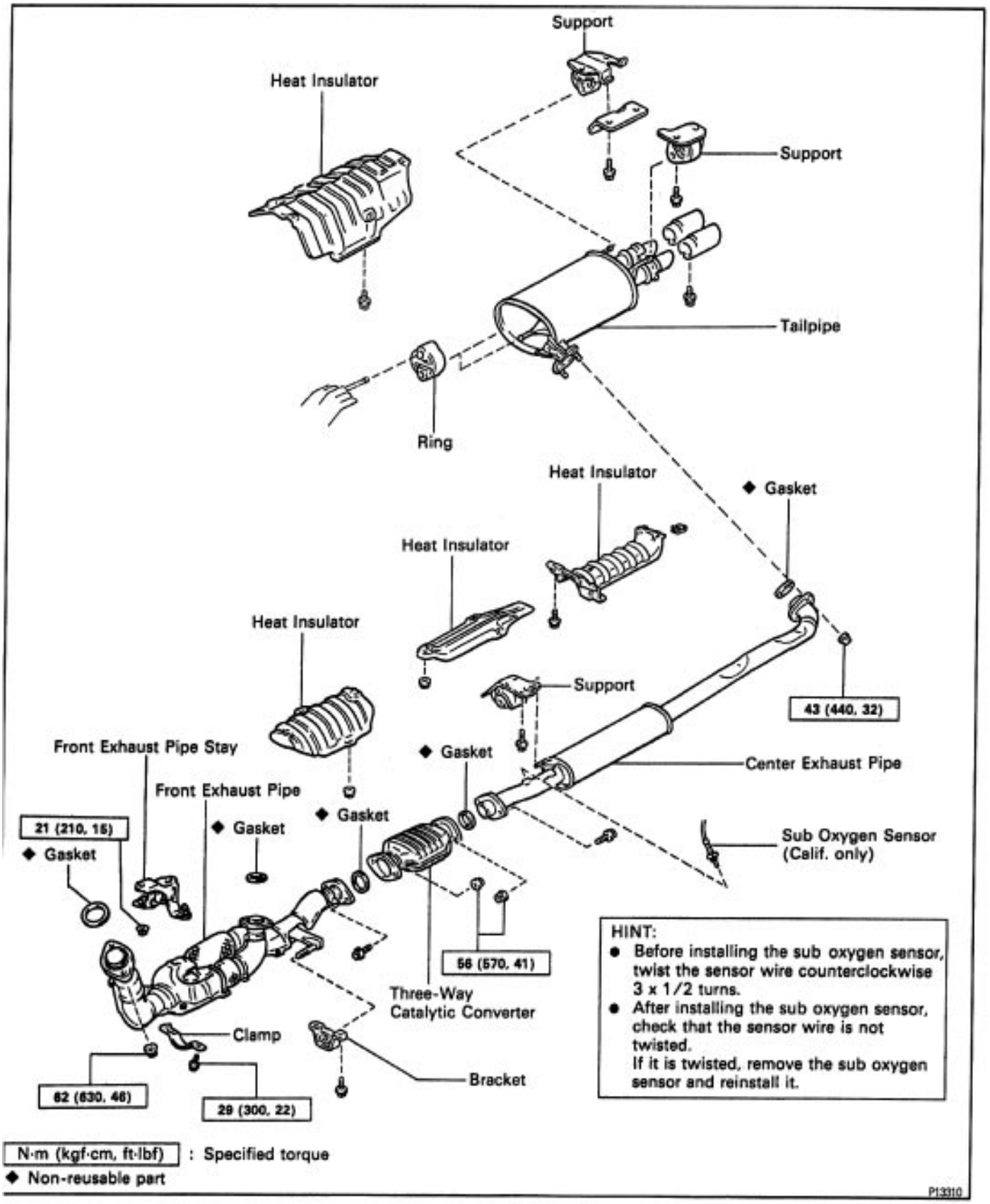

**33. INSTALL BATTERY TRAY AND BATTERY**
**34. START ENGINE AND CHECK FOR LEAKS**
**35. PERFORM ROAD TEST**

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

**36. RECHECK ENGINE COOLANT AND ENGINE OIL LEVELS**

# EXHAUST SYSTEM

## COMPONENTS



# SERVICE SPECIFICATIONS

## SERVICE DATA

| | | | |
|---|---|---|---|
| Engine tune – up | Battery (Except Delco Battery) | | |
| | Specific gravity (Except maintenance free battery) | | |
| | 55D23L Battery | | |
| | GNB Incorporated | at 20°C (68°F) | 1.25 – 1.27 |
| | JHONSON CONTROLS | at 27°C (81°F) | 1.26 – 1.28 |
| | 80D26L Battery | | |
| | GNB Incorporated | at 20°C (68°F) | 1.27 – 1.29 |
| | JHONSON CONTROLS | at 27°C (81°F) | 1.28 – 1.30 |
| | Voltage (Maintenance free battery) | at 20°C (68°F) | 12.7 – 12.9 V |
| | Drive belt tension | New belt | 175 ± 5 lbf |
| | | Used belt | 115 ± 20 lbf |
| | Valve clearance (Cold) | Intake | 0.15 – 0.25 mm (0.006 – 0.010 in.) |
| | | Exhaust | 0.25 – 0.35 mm (0.010 – 0.014 in.) |
| | Valve clearance adjusting shim (for repair part) | | |
| | | Mark 2.500 | 2.500 mm (0.0984 in.) |
| | | Mark 2.550 | 2.550 mm (0.1004 in.) |
| | | Mark 2.600 | 2.600 mm (0.1024 in.) |
| | | Mark 2.650 | 2.650 mm (0.1043 in.) |
| | | Mark 2.700 | 2.700 mm (0.1063 in.) |
| | | Mark 2.750 | 2.750 mm (0.1083 in.) |
| | | Mark 2.800 | 2.800 mm (0.1102 in.) |
| | | Mark 2.850 | 2.850 mm (0.1122 in.) |
| | | Mark 2.900 | 2.900 mm (0.1142 in.) |
| | | Mark 2.950 | 2.950 mm (0.1161 in.) |
| | | Mark 3.000 | 3.000 mm (0.1181 in.) |
| | | Mark 3.050 | 3.050 mm (0.1201 in.) |
| | | Mark 3.100 | 3.100 mm (0.1220 in.) |
| | | Mark 3.150 | 3.150 mm (0.1240 in.) |
| | | Mark 3.200 | 3.200 mm (0.1260 in.) |
| | | Mark 3.250 | 3.250 mm (0.1280 in.) |
| | | Mark 3.300 | 3.300 mm (0.1299 in.) |
| | Ignition timing | | 10° BTDC @ idle (w/ Terminals TE1 and E1 connected of DLC1) |
| | Idle speed | | 700 ± 50 rpm |
| Intake manifold vacuum | at idle speed | | 60 kPa (450 mmHg, 17.7 in.Hg) or more |
| Compression pressure | at 250 rpm | STD | 1,226 kPa (12.5 kgf/cm², 178 psi) or more |
| | | Limit | 981 kPa (10.0 kgf/cm², 142 psi) |
| | Difference of pressure between each cylinder | | 98 kPa (1.0 kgf/cm², 14 psi) or less |
| Tinning belt tensioner | Protrusion (from housing side) | | 10.0 – 10.8 mm (0.394 – 0.425 in.) |

| | | | |
|---|---|---|---|
| Cylinder head | Warpage | Limit | 0.10 mm (0.039 in.) |
| | Valve seat | | |
| | Refacing angle | | 30°, 45°, 75° |
| | Contacting angle | | 45° |
| | Contacting width | | 1.0 – 1.4 mm (0.039 – 0.055 in.) |
| | Cylinder head bolt thread inside diameter | STD | 10.70 – 11.00 mm (0.4213 – 0.4724 in.) |
| | | Limit | 9.60 mm (0.3780 in.) |
| Valve guide bushing | Inside diameter | | 5.510 – 5.530 mm (0.2169 – 0.2177 in.) |
| | Outside diameter (for repair part) | STD | 10.295 – 10.313 mm (0.4053 – 0.4060 in.) |
| | | O/S 0.05 | 10.345 – 10.363 mm (0.4073 – 0.4080 in.) |
| | Protrusion height | Intake | 11.1 – 11.3 mm (0.437 – 0.445 in.) |
| | | Exhaust | 8.9 – 9.3 mm (0.350 – 0.366 in.) |
| Valve | Valve overall length | STD (Intake) | 95.45 mm (3.5779 in.) |
| | | (Exhaust) | 95.40 mm (3.7559 in.) |
| | | Limit (Intake) | 94.95 mm (3.7382 in.) |
| | | (Exhaust) | 94.90 mm (3.7362 in.) |
| | Vale face angle | | 44.5° |
| | Stem diameter | Intake | 5.470 – 5.485 mm (0.2154 – 0.2159 in.) |
| | | Exhaust | 5.465 – 5.480 mm (0.2152 – 0.2157 in.) |
| | Stem oil clearance | STD (Intake) | 0.025 – 0.060 mm (0.0010 – 0.0024 in.) |
| | | (Exhaust) | 0.030 – 0.065 mm (0.0012 – 0.0026 in.) |
| | | Limit (Intake) | 0.08 mm (0.0031 in.) |
| | | (Exhaust) | 0.10 mm (0.0039 in.) |
| | Margin thickness | STD | 1.0 mm (0.039 in.) |
| | | Limit | 0.5 mm (0.020 in.) |
| Valve spring | Deviation | Limit | 2.0 mm (0.079 in.) |
| | Free length | | 45.50 mm (1.7913 in.) |
| | Installed tension at 33.8 mm (1.331 in.) | | 186 – 206 N (19.0 – 21.0 kgf, 41.9 – 46.3 lbf) |
| Valve lifter | Lifter diameter | | 30.966 – 30.976 mm (1.2191 – 2.2195 in.) |
| | Lifter bore diameter | | 31.000 – 31.016 mm (1.2205 – 1.2211 in.) |
| | Oil clearance | STD | 0.024 – 0.050 mm (0.0009 – 0.0020 in.) |
| | | Limit | 0.07 mm (0.0028 in.) |
| Camshaft | Thrust clearance | STD | 0.040 – 0.090 mm (0.0016 – 0.0035 in.) |
| | | Limit | 0.12 mm (0.0047 in.) |
| | Journal oil clearance | STD | 0.035 – 0.072 mm (0.0014 – 0.0028 in.) |
| | | Limit | 0.10 mm (0.0039 in.) |
| | Journal diameter | | 26.949 – 26.965 mm (1.0610 – 1.0616 in.) |
| | Circle runout | Limit | 0.06 mm (0.0024 in.) |
| | Cam lobe height | STD (Intake) | 42.11 – 42.21 mm (1.6579 – 1.6618 in.) |
| | | (Exhaust) | 41.96 – 42.06 mm (1.6520 – 1.6559 in.) |
| | | Limit (Intake) | 41.96 mm (1.6520 in.) |
| | | (Exhaust) | 41.81 mm (1.6461 in.) |
| | Camshaft gear backlash | STD | 0.020 – 0.200 mm (0.0008 – 0.0079 in.) |
| | | Limit | 0.30 mm (0.0188 in.) |
| | Camshaft gear spring end free distance | | 18.2 – 18.8 mm (0.712 – 0.740 in.) |
| Air intake chamber | Warpage | Limit | 0.10 mm (0.0039 in.) |

| | | | |
|---|---|---|---|
| Intake manifold | Warpage | | |
| | Air intake side | Limit | 0.15 mm (0.0059 in.) |
| | Cylinder head side | Limit | 0.08 mm (0.0031 in.) |
| Exhaust manifold | Warpage | Limit | 0.50 mm (0.0196 in.) |
| Cylinder block | Cylinder head surface warpage | Limit | 0.07 mm (0.0028 in.) |
| | Cylinder bore diameter | | 87.500 – 87.512 mm (3.4449 – 3.4453 in.) |
| | | Limit | 87.52 mm (3.4457 in.) |
| | Main journal bore diameter | | |
| | (Reference) | Mark 00 | 66.000 mm (2.5984 in.) |
| | | Mark 01 | 66.001 mm (2.5985 in.) |
| | | Mark 02 | 66.002 mm (2.5985 in.) |
| | | Mark 03 | 66.003 mm (2.5985 in.) |
| | | Mark 04 | 66.004 mm (2.5986 in.) |
| | | Mark 05 | 66.005 mm (2.5986 in.) |
| | | Mark 06 | 66.006 mm (2.5987 in.) |
| | | Mark 07 | 66.007 mm (2.5987 in.) |
| | | Mark 08 | 66.008 mm (2.5987 in.) |
| | | Mark 09 | 66.009 mm (2.5988 in.) |
| | | Mark 10 | 66.010 mm (2.5988 in.) |
| | | Mark 11 | 66.011 mm (2.5989 in.) |
| | | Mark 12 | 66.012 mm (2.5989 in.) |
| | | Mark 13 | 66.013 mm (2.5989 in.) |
| | | Mark 14 | 66.014 mm (2.5990 in.) |
| | | Mark 15 | 66.015 mm (2.5990 in.) |
| | | Mark 16 | 66.016 mm (2.5990 in.) |
| | Main bearing cap stud bolt tension portion diameter | | |
| | | STD | 7.500 – 7.600 mm (0.2953 – 0.2992 in.) |
| | | Limit | 7.40 mm (0.2913 in.) |
| Piston and piston ring | Piston diameter | | 87.406 – 87.416 mm (3.4412 – 3.4416 in.) |
| | Piston oil clearance | STD | 0.084 – 0.106 mm (0.0033 – 0.0042) |
| | | Limit | 0.13 mm (0.0051 in.) |
| | Piston ring groove clearance | No.1 | 0.020 – 0.070 mm (0.0008 – 0.0028 in.) |
| | | No.2 | 0.020 – 0.060 mm (0.0008 – 0.0024 in.) |
| | Piston ring end gap | STD (No.1) | 0.25 – 0.35 mm (0.0098 – 0.0138 in.) |
| | | (No.2) | 0.35 – 0.45 mm (0.0138 – 0.0177 in.) |
| | | (Oil) | 0.15 – 0.40 mm (0.0059 – 0.0157 in.) |
| | | Limit (No.1) | 0.95 mm (0.0374 in.) |
| | | (No.2) | 1.05 mm (0.0413 in.) |
| | | (Oil) | 1.00 mm (0.0394 in.) |
| Connecting rod | Thrust clearance | STD | 0.15 – 0.30 mm (0.0059 – 0.0118 in.) |
| | | Limit | 0.35 mm (0.0138 in.) |
| | Connecting rod thickness | | 20.80 – 20.85 mm (0.8189 – 0.8209 in.) |
| | Connecting rod big end inside diameter | | |
| | (Reference) | Mark 1 | 56.000 – 56.006 mm (2.2047 – 2.2050 in.) |
| | | Mark 2 | 56.006 – 56.012 mm (2.2050 – 2.2052 in.) |
| | | Mark 3 | 56.012 – 56.018 mm (2.2052 – 2.2054 in.) |
| | | Mark 4 | 56.018 – 56.024 mm (2.2054 – 2.2057 in.) |

| | | | |
|---|---|---|---|
| Connecting rod (Cont'd) | Connecting rod bearing center wall thickness | | |
| | (Reference) | Mark 1 | 1.484 – 1.487 mm (0.0584 – 0.0585 in.) |
| | | Mark 2 | 1.487 – 1.490 mm (0.0585 – 0.0587 in.) |
| | | Mark 3 | 1.490 – 1.493 mm (0.0587 – 0.0588 in.) |
| | | Mark 4 | 1.493 – 1.496 mm (0.0588 – 0.0589 in.) |
| | Connecting rod oil clearance | STD | 0.038 – 0.064 mm (0.0015 – 0.0025 in.) |
| | | Limit | 0.08 mm (0.0031 in.) |
| | Rod out–of–alignment Limit per 100mm (3.94 in.) | | 0.05 mm (0.0020 in.) |
| | Rod twist Limit per 100mm (3.94 in.) | | 0.15 mm (0.0059 in.) |
| | Bushing inside diameter | | 22.005 – 22.014 mm (0.8663 – 0.8667 in.) |
| | Piston pin diameter | | 21.997 – 22.006 mm (0.8660 – 0.8664 in.) |
| | Bushing oil clearance | STD | 0.005 – 0.011 mm (0.0002 – 0.0004 in) |
| | | Limit | 0.05 mm (0.0020 in.) |
| | Connecting rod bolt tension portion diameter | STD | 7.2 – 7.3 mm (0.284 – 0.287 in.) |
| | | Limit | 7.0 mm (0.276 in.) |
| Crankshaft | Thrust clearance | STD | 0.04 – 0.24 mm (0.0016 – 0.0095 in.) |
| | | Limit | 0.30 mm (0.0118 in.) |
| | Thrust washer thickness | | 1.930 – 1.980 mm (0.0760 – 0.0780 in.) |
| | Main journal oil clearance | STD | 0.026 – 0.046 mm (0.0010 – 0.0018 in.) |
| | | Limit | 0.06 mm (0.0024 in.) |
| | Main journal diameter | | 60.988 – 61.000 mm (2.4011 – 2.4016 in.) |
| | Main bearing center wall thickness | | |
| | (Reference) | Mark 1 | 2.486 – 2.489 mm (0.0979 – 0.0980 in.) |
| | | Mark 2 | 2.489 – 2.492 mm (0.0980 – 0.0981 in.) |
| | | Mark 3 | 2.492 – 2.495 mm (0.0981 – 0.0982 in.) |
| | | Mark 4 | 2.495 – 2.498 mm (0.0982 – 0.0983 in.) |
| | | Mark 5 | 2.498 – 2.501 mm (0.0983 – 0.0985 in.) |
| | Crank pin diameter | | 52.994 – 53.000 mm (2.0864 – 2.0866 in.) |
| | Circle runout | Limit | 0.06 mm (0.0024 in.) |
| | Main journal taper and out–of–round | Limit | 0.02 mm (0.0008 in.) |
| | Crank pin taper and out–of–round | Limit | 0.02 mm (0.0008 in.) |

# TORQUE SPECIFICATIONS

| Part tightened | N·m | kgf·cm | ft·lbf |
|---|---|---|---|
| Cylinder head cover x Cylinder head | 8 | 80 | 69 in.·lbf |
| Spark plug x Cylinder head | 18 | 180 | 13 |
| Ignition coil x Cylinder head cover | 8 | 80 | 69 in.·lbf |
| Air intake chamber x Intake manifold | 43 | 440 | 32 |
| EGR pipe x Exhaust manifold | 12 | 120 | 9 |
| EGR pipe x Air intake chamber | 12 | 120 | 9 |
| No.1 engine hanger x Air intake chamber | 39 | 400 | 29 |
| No.1 engine hanger x Cylinder heed | 39 | 400 | 29 |
| Air intake chamber stay x Air intake chamber | 19.5 | 200 | 14 |
| Air intake chamber stay x Cylinder head | 19.5 | 200 | 14 |
| Emission control valve set x Air intake chamber | 8 | 80 | 69 in.·lbf |
| Timing belt plate x Oil pump | 8 | 80 | 69 in.·lbf |
| No.1 idler pulley x Oil pump | 34 | 350 | 25 |
| No.2 idler pulley x No.2 idler pulley bracket | 43 | 440 | 32 |

| | | | |
|---|---|---|---|
| Camshaft timing pulley x Camshaft (For use with SST) | 88 | 900 | 65 |
| Camshaft timing pulley x Camshaft | 125 | 1,300 | 94 |
| Timing belt tensioner x Oil pump | 27 | 280 | 20 |
| Engine RH mounting bracket x Cylinder block | 28 | 290 | 21 |
| No.2 timing belt cover x No.3 timing belt cover | 8.5 | 85 | 74 in.-lbf |
| No.1 timing belt cover x Oil pump | 8.5 | 85 | 74 in.-lbf |
| Crankshaft pulley x Crankshaft | 215 | 2,200 | 159 |
| No.2 generator bracket x Engine RH mounting bracket | 28 | 290 | 21 |
| Engine moving control rod x Engine RH mounting bracket | 63.7 | 650 | 47 |
| Engine moving control rod x RH fender apron | 63.7 | 650 | 47 |
| RH engine mounting stay x Water outlet | 31.4 | 320 | 23 |
| RH engine mounting stay x Engine moving control rod | 31.4 | 320 | 23 |
| RH engine mounting stay x No.2 RH engine mounting bracket | 31.4 | 320 | 23 |
| Camshaft bearing cap x Cylinder head | 16 | 160 | 12 |
| Cylinder head x Cylinder block – 12–pointed head bolt (1 st) | 54 | 550 | 40 |
| Cylinder head x Cylinder block – 12–pointed head bolt (2nd) | Turn 90° | Turn 90° | Turn 90° |
| Cylinder head x Cylinder block – Recessed head bolt | 18.5 | 185 | 13 |
| Camshaft position sensor x Cylinder head | 8 | 80 | 69 in.-lbf |
| Exhaust manifold x Cylinder head | 49 | 500 | 36 |
| EGR pipe x RH exhaust manifold | 12 | 120 | 9 |
| EGR pipe x EGR cooler | 12 | 120 | 9 |
| Exhaust manifold stay x Exhaust manifold | 19.5 | 200 | 14 |
| Exhaust manifold stay x Transmission housing | 19.5 | 200 | 14 |
| Oxygen sensor x Exhaust manifold | 44 | 450 | 33 |
| PS bracket x RH cylinder head | 43 | 440 | 32 |
| Oil dipstick guide x LH cylinder head | 8 | 80 | 69 in.-lbf |
| No.2 engine hanger x LH cylinder head | 19.5 | 200 | 14 |
| Water outlet x Intake manifold | 15 | 150 | 11 |
| No.3 timing belt cover x Cylinder head | 8.5 | 85 | 74 in.-lbf |
| Intake manifold x Cylinder head | 15 | 150 | 11 |
| Delivery pipe x Intake manifold | 10 | 100 | 7 |
| No. 1 fuel pipe x Intake manifold | 19.5 | 200 | 14 |
| Cylinder head rear plate x LH cylinder head | 8 | 80 | 69 in.-lbf |
| Water inlet pipe x LH cylinder head | 19.5 | 200 | 14 |
| Front exhaust pipe x Exhaust manifold | 62 | 630 | 46 |
| Front exhaust pipe x Three–way catalytic converter | 56 | 570 | 41 |
| Front exhaust pipe bracket x Sub frame | 19 | 195 | 14 |
| Front exhaust pipe clamp x Front exhaust pipe stay | 29 | 300 | 22 |
| EGR valve x Air intake chamber | 12 | 120 | 9 |
| Throttle body x Air intake chamber | 19.5 | 200 | 14 |
| Intake air control valve x Air intake chamber | 14.5 | 145 | 10 |
| Fuel inlet hose x Fuel filter | 30 | 300 | 22 |
| Connecting rod cap x Connecting rod – 1 at | 24.5 | 250 | 18 |
| Connecting rod cap x Connecting rod – 2nd | Turn 90° | Turn 90° | Turn 90° |
| Main bearing cap x Cylinder block – 1 st (12 pointed head bolt) | 22 | 225 | 16 |
| Main bearing cap x Cylinder block – 2nd (12 pointed head bolt) | Turn 90° | Turn 90° | Turn 90° |
| Main bearing cap x Cylinder block (Hexagon head bolt) | 27 | 275 | 20 |
| Rear oil seal retainer x Cylinder block | 8 | 80 | 69 in.-lbf |
| EGR cooler x Cylinder block | 9 | 90 | 78 in.-lbf |

| | | | |
|---|---|---|---|
| Oil pressure switch x Cylinder block | 13 | 130 | 9 |
| Engine coolant drain cock x Cylinder block | 39 | 400 | 29 |
| Water seal plate x Cylinder block | 14.5 | 145 | 10 |
| Oil filter union x Cylinder block | 13 | 130 | 9 |
| Oil pump x Cylinder block (10 mm head bolt) | 8 | 80 | 69 in.·lbf |
| Oil pump x Cylinder block (12 mm head bolt) | 19.5 | 200 | 14 |
| No.1 oil pan x Cylinder block | 19.5 | 200 | 14 |
| No.1 oil pan x Oil pump | 8 | 80 | 69 in.·lbf |
| No.1 oil pan x Rear oil seal retainer | 8 | 80 | 69 in.·lbf |
| Oil strainer x Main bearing cap | 8 | 80 | 69 in.·lbf |
| Oil strainer x Oil pump | 8 | 80 | 69 in.·lbf |
| No.2 oil pan x No. 1 oil pan | 8 | 80 | 69 in.·lbf |
| Water pump x Cylinder block | 8 | 80 | 69 in.·lbf |
| Water inlet housing x Cylinder block | 8 | 80 | 69 in.·lbf |
| Knock sensor x Cylinder block | 39 | 400 | 29 |
| No.2 idler pulley bracket x Cylinder block | 28 | 290 | 21 |
| A/C compressor housing bracket x Cylinder block | 25 | 250 | 18 |
| Generator bracket x Cylinder block | 43 | 440 | 32 |
| Drive plate x Crankshaft | 83 | 850 | 61 |
| Transaxle x Engine | 64 | 650 | 47 |
| No.2 oil pan x Transaxle | 46 | 470 | 34 |
| Drive plate x Torque convertor clutch | 41 | 420 | 30 |
| Front exhaust pipe stay x No.1 oil pan | 21 | 210 | 15 |
| RR engine mounting insulator x Cylinder block | 63.7 | 650 | 47 |
| FR engine mounting insulator x Cylinder block | 63.7 | 650 | 47 |
| FR engine mounting insulator x Front suspension member (TMC made) | 80.4 | 820 | 59 |
| FR engine mounting insulator x Front suspension member (TM M made) | 65.7 | 670 | 48 |
| Engine mounting absorber x Front suspension member | 48 | 490 | 35 |
| Engine mounting absorber x Transaxle | 48 | 490 | 35 |
| RR engine mounting insulator x Front suspension member | 65.7 | 670 | 48 |
| LH engine mounting insulator x Transaxle | 63.7 | 650 | 47 |
| PS pump x PS pump bracket | 43 | 440 | 31 |
| PS pump x Hydraulic cooling fan pressure hose | 44 | 450 | 33 |
| A/C compressor x Generator bracket | 25 | 250 | 18 |
| A/C compressor x Cylinder block | 25 | 250 | 18 |

# EMISSION CONTROL SYSTEMS

## DESCRIPTION

The emission control systems are installed to reduce the amount of HC, CO and NOx emitted from the engine, and to also prevent release of evaporated fuel from the gasoline tank and prevent atmospheric release of blow–by gas.
The system consists of the PCV, EVAP, EGR and TWC.
The function of each system is shown in the following table.

| System | Abbreviation | Purpose |
|---|---|---|
| Positive crankcase ventilation | PCV | Reduces blow–by gas |
| Evaporative emission control | EVAP | Reduces evaporative HC |
| Exhaust gas recirculation | EGR | Reduces NOx |
| Three–way catalytic converter | TWC | Reduces C0, HC and NOx |
| Sequential multiport fuel injection' | SFI | Regulates all engine conditions for reduction of exhaust emissions. |

*For inspection and repair of the SFI system, refer to the SFI section.

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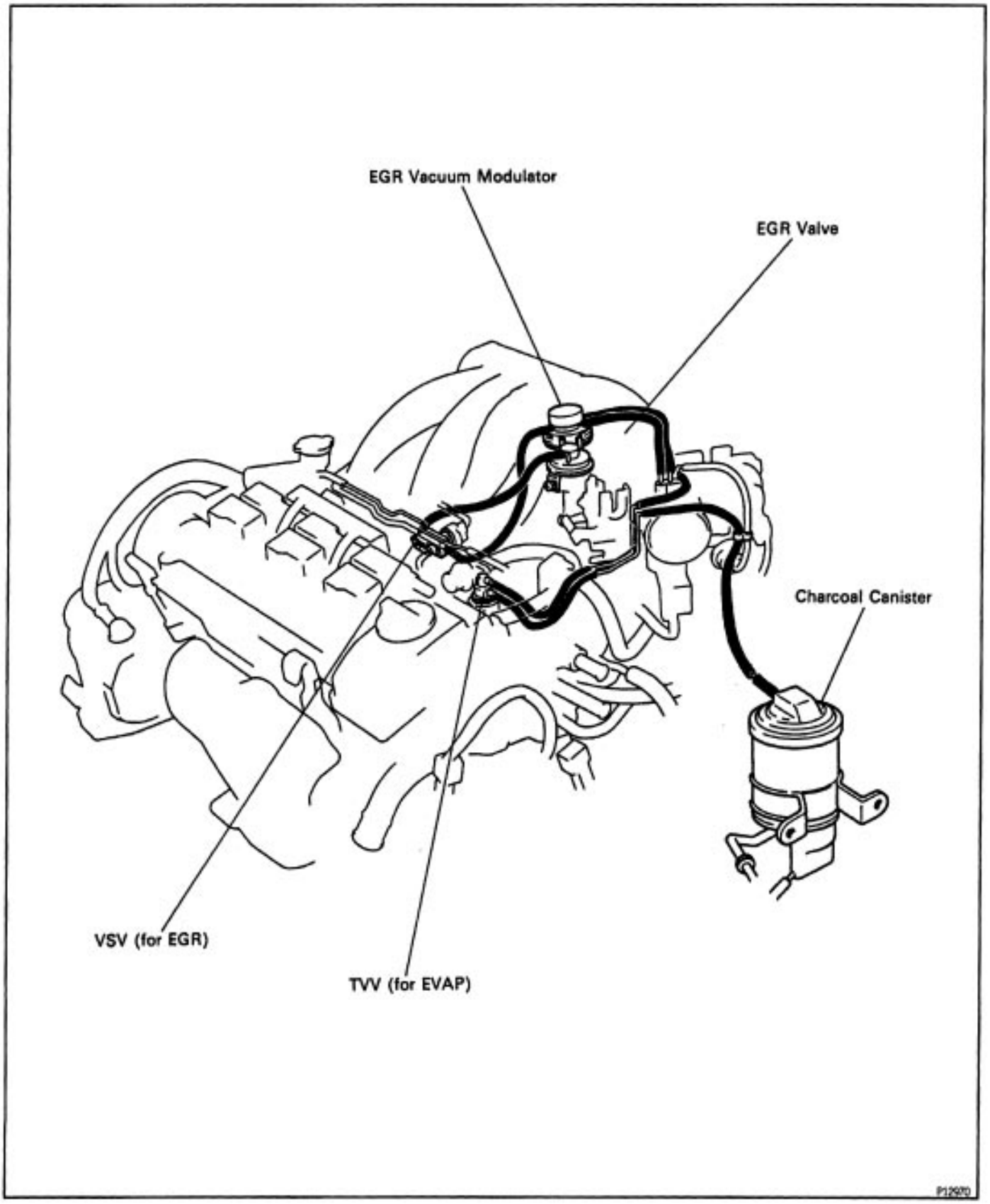
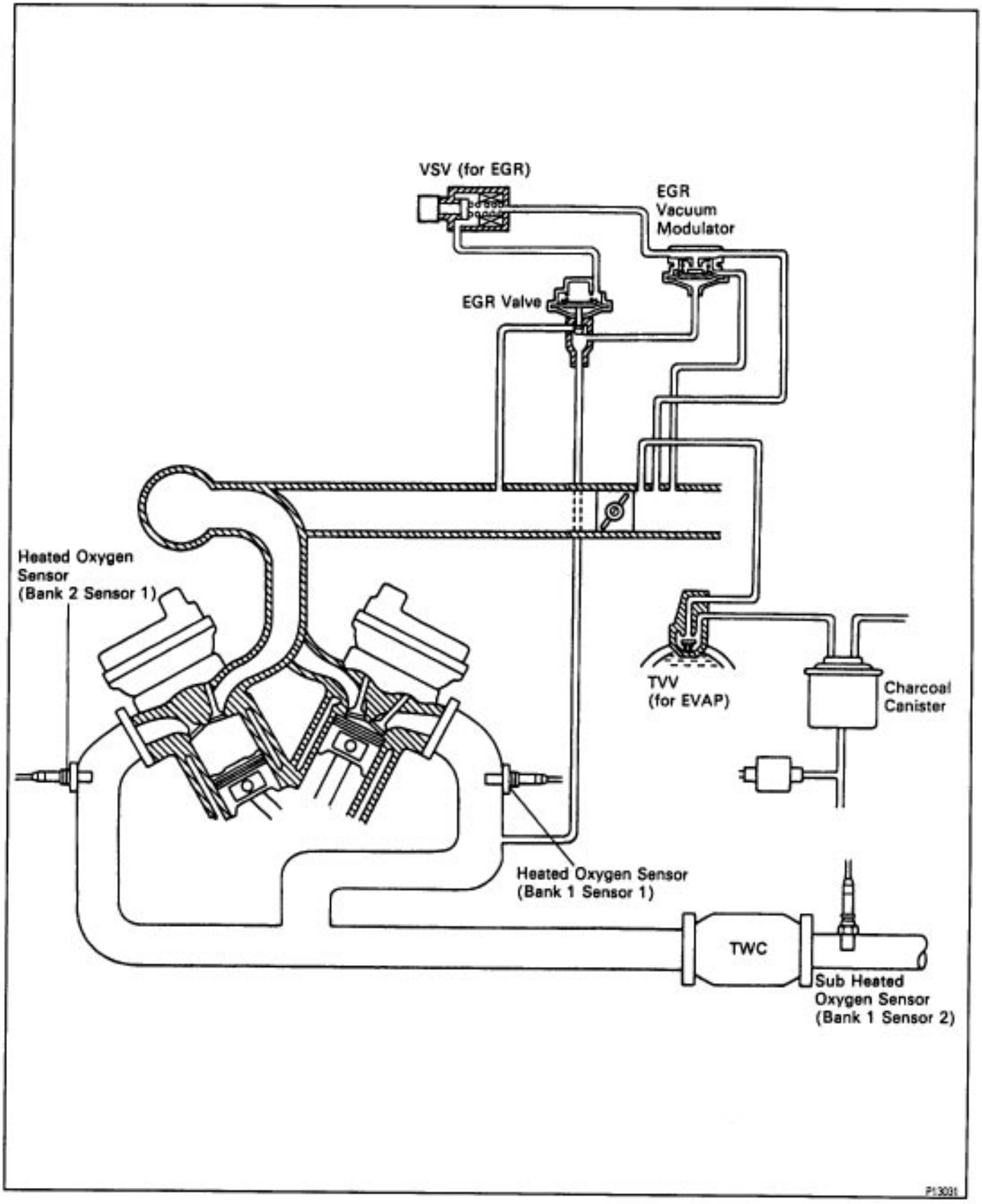
# COMPONENT LAYOUT



# SCHEMATIC DRAWING



# PREPARATION

## SST (SPECIAL SERVICE TOOL)

| | |
|---|---|
|  09843–18020 Diagnosis Check Wire | |

## RECOMMENDED TOOLS

| | |
|---|---|
|  09082–00050 TOYOTA Electrical Tester Set | |

## EQUIPMENT

| | |
|---|---|
| Tachometer | |
| Torque wrench | |
| Vacuum gauge | |

## SSM (SPECIAL SERVICE MATERIALS)

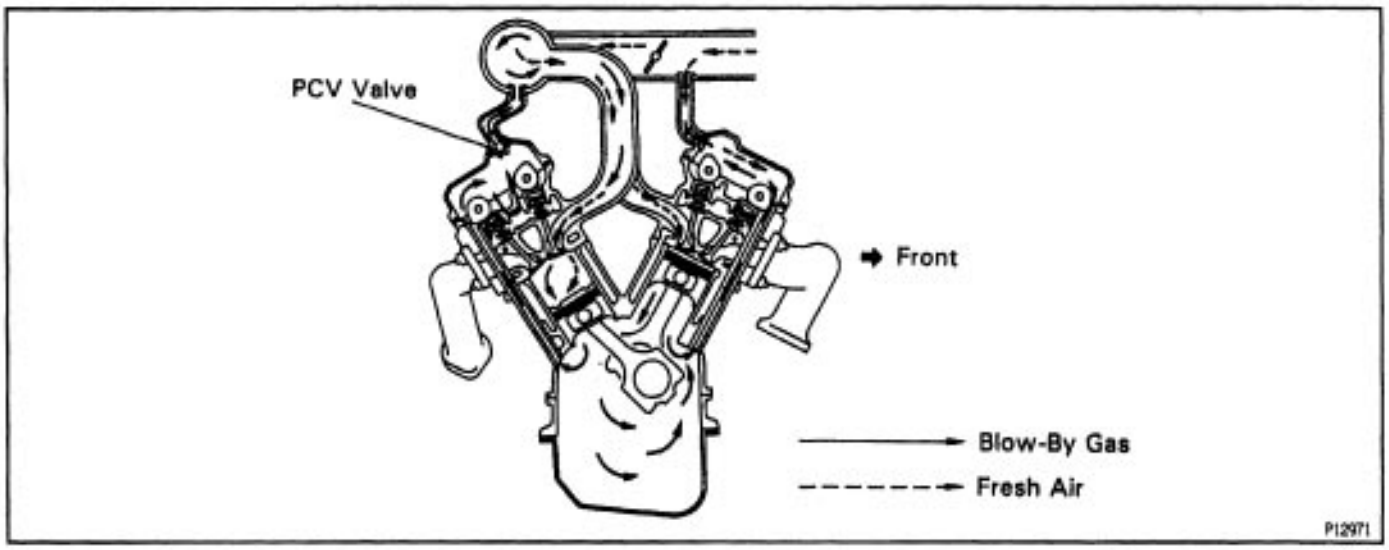
| | |
|---|---|
| 08833–00070 Adhesive 1311, THREE BOND 1311 or equivalent | TVV |

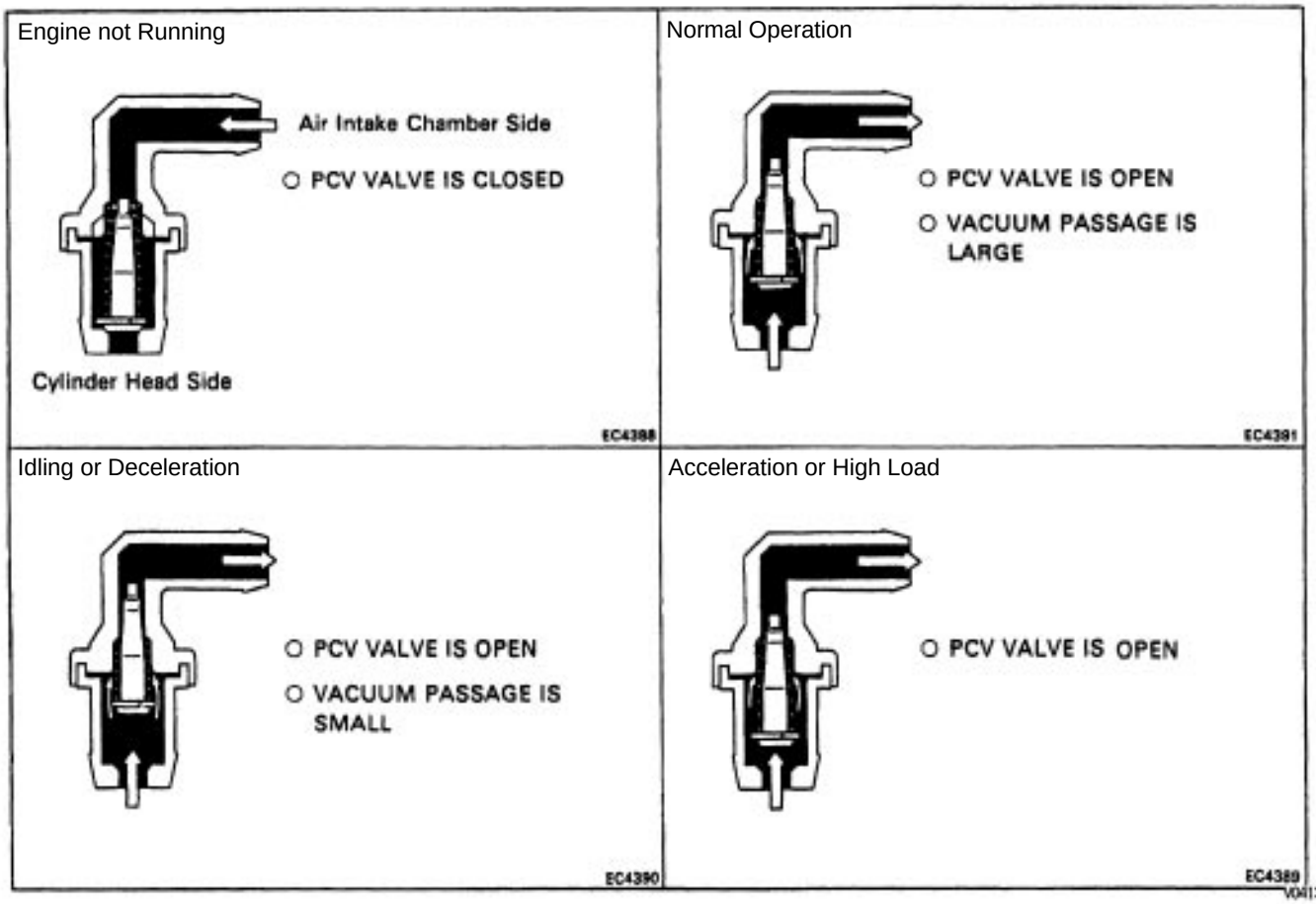
# POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

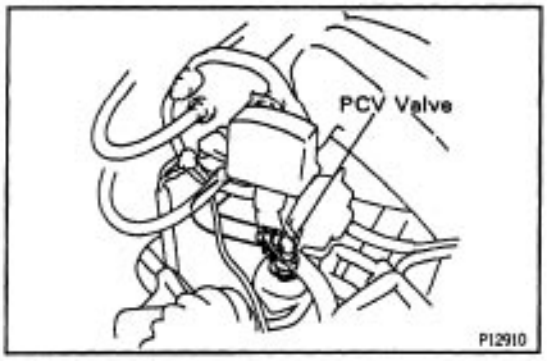
## DESCRIPTION

To reduce HC emission, crankcase blow–by gas is routed through the PCV valve to the air intake chamber for combustion in the cylinders.

## OPERATION



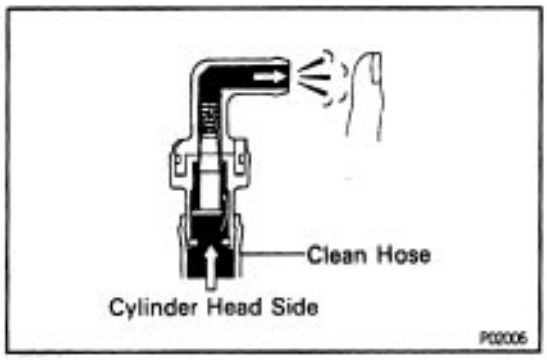



## PCV VALVE INSPECTION

**1. REMOVE PCV VALVE**

(a) Disconnect the PCV hose from the PCV valve.

(b) Remove the PCV valve.

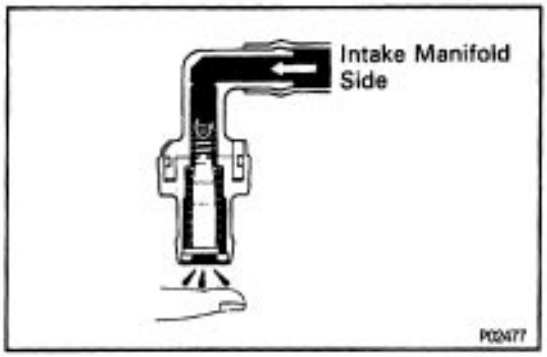



**2. INSTALL CLEAN HOSE TO PCV VALVE**

**3. INSPECT PCV VALVE OPERATION**

(a) Blow air into the cylinder head side, and check that air passes through easily.

**CAUTION: Do not suck sir through the valve. Petroleum substances inside the valve are harmful.**

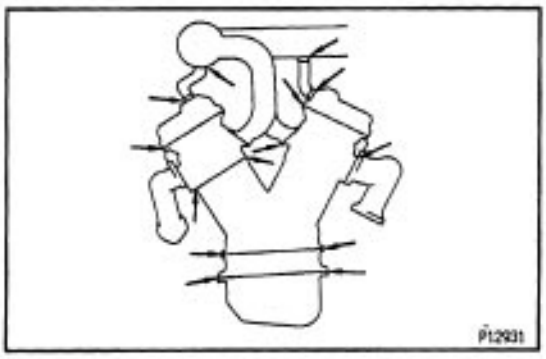



(b) Blow air into the intake manifold side, and check that air passes through with difficulty.

If operation is not as specified, replace the PCV valve.

**4. REMOVE CLEAN HOSE FROM PCV VALVE**

**5. REINSTALL PCV VALVE**




## PCV HOSES AND CONNECTORS INSPECTION

**VISUALLY INSPECT HOSES, CONNECTIONS AND GASKETS**

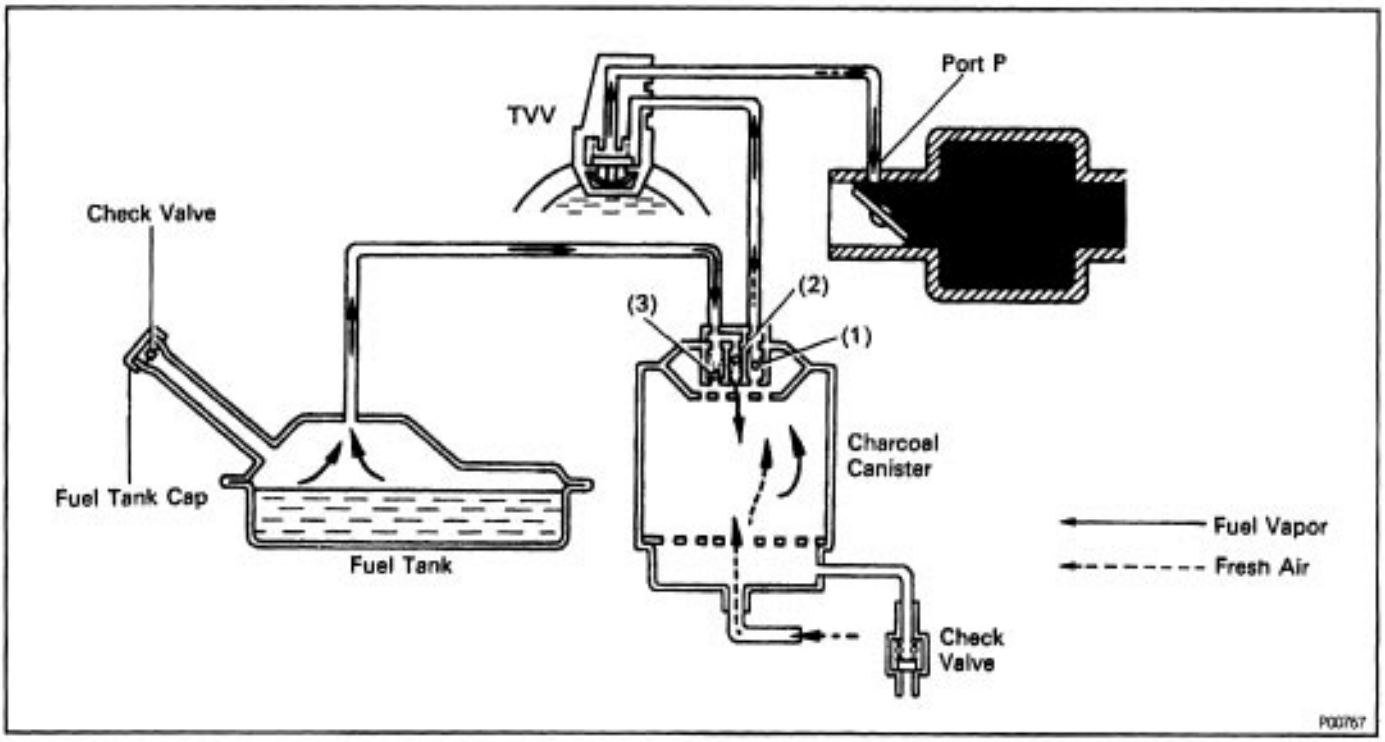
**Check for cracks, leaks or damage.**

# EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM

## DESCRIPTION

To reduce HC emission, evaporated fuel from the fuel tank is routed through the charcoal canister to the intake manifold for combustion in the cylinders.

## OPERATION




| Engine Coolant Temp. | TVV | Throttle Valve Position | Canister Check Valve | | | Check Valve in Tank Cap | Evaporated Fuel (HC) |
|---|---|---|---|---|---|---|---|
| | | | (1) | (2) | (3) | | |
| Below 40$_2$C (104$_2$F) | CLOSED | – | – | – | – | – | HC from tank is absorbed into the canister. |
| Above 59$_2$C (138$_2$F) | OPEN | Positioned below port P | CLOSED | – | – | – | |
| | | Positioned above port P | OPEN | – | – | – | HC from canister is led into air intake chamber. |
| Nigh pressure in tank | – | – | – | OPEN | CLOSED | CLOSED | HC from tank is absorbed into the canister. |
| High vacuum in take | – | – | – | CLOSED | OPEN | OPEN | Air is led into the fuel tank |

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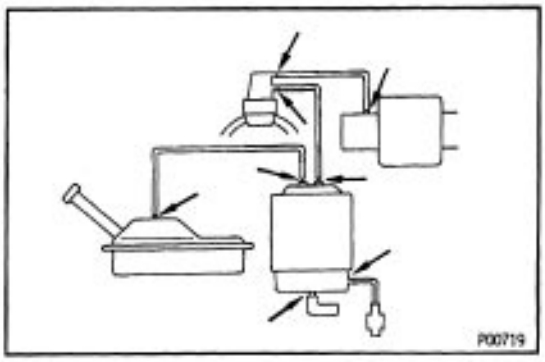


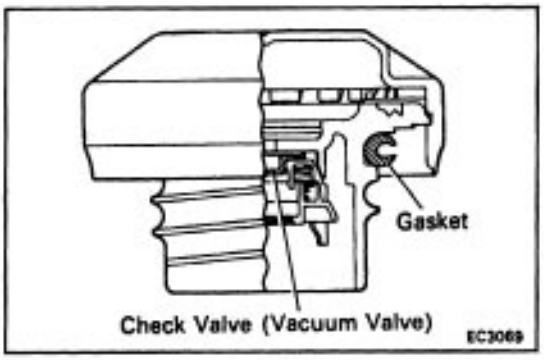

## FUEL VAPOR LINES, FUEL TANK AND TANK CAP INSPECTION

**1. VISUALLY INSPECT LINES AND CONNECTIONS**

Look for loose connections, sharp bends or damage.

**2. VISUALLY INSPECT FUEL TANK**

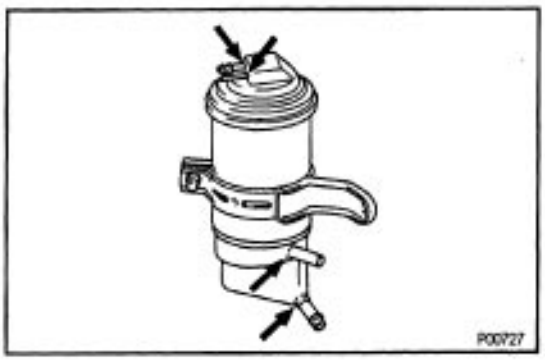
Look for deformation, cracks or fuel leakage.




**3. VISUALLY INSPECT FUEL TANK CAP**

Check if the cap and/or gasket are deformed or damaged.

If necessary, repair or replace the cap.

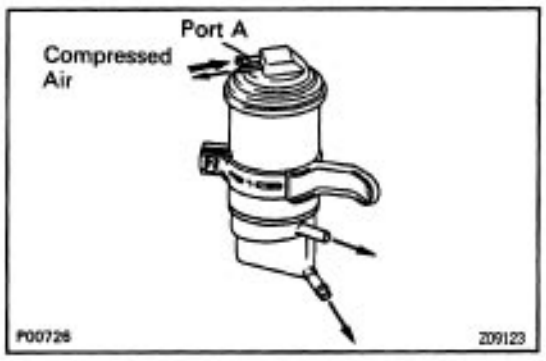



## CHARCOAL CANISTER INSPECTION

**1. REMOVE CHARCOAL CANISTER**

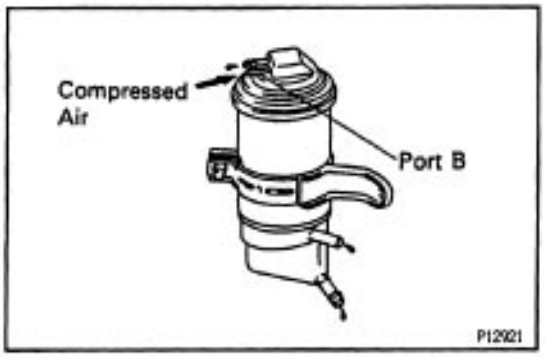
**2. VISUALLY INSPECT CHARCOAL CANISTER**

Look for cracks or damage.



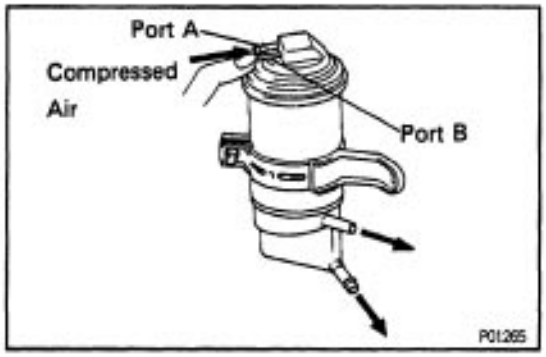

**3. CHECK FOR CLOGGED FILTER AND STUCK CHECK VALVE**

(a) Blow low pressure compressed air (4.71 kPa, 48 gf/cm$^2$. 0.68 psi) into port A and check that air flows without resistance from the other ports.




(b) Blow low pressure compressed air (4.71 kPa, 48 gf/cm$^2$, 0.68 psi) into port B and check that air does not flow from the other ports.

If a problem is found, replace the charcoal canister.




**4. CLEAN FILTER IN CANISTER**

Clean the filter by blowing 294 kPa (3 kgf/cm$^2$, 43 psi) of compressed air into port A while holding port B closed.

**NOTICE:**

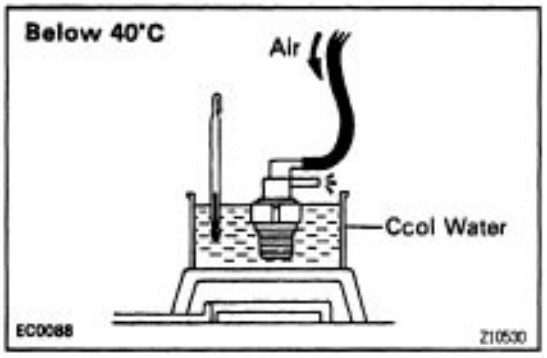
- **Do not attempt to wash the canister.**
- **No activated carbon should come out.**

**5. REINSTALL CHARCOAL CANISTER**

## TVV INSPECTION

**1. DRAIN ENGINE COOLANT**

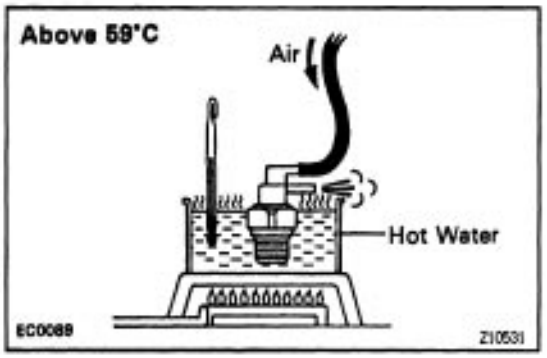
**2. REMOVE TVV FROM INTAKE MANIFOLD**




**3. INSPECT TVV OPERATION**

(a) Cool the TVV to below 40$_2$C (104$_2$F) with cool water.

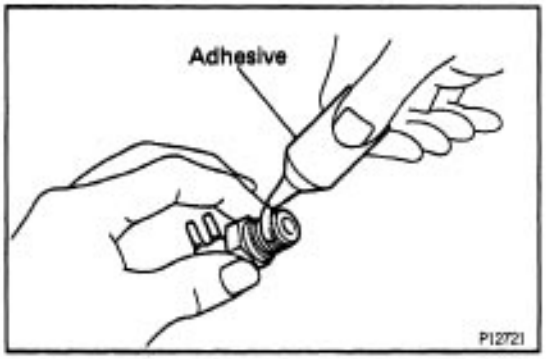
(b) Check that air does not flow from the upper port to lower port.




(c) Heat the TVV to above 59$_2$C (138$_2$F) with hot water.

(d) Check that air flows from the upper port to lower port.

If operation is not as specified, replace the TVV.




**4. REINSTALL TVV**

Apply adhesive to 2 or 3 threads of the TVV, and install it.

**Adhesive:**

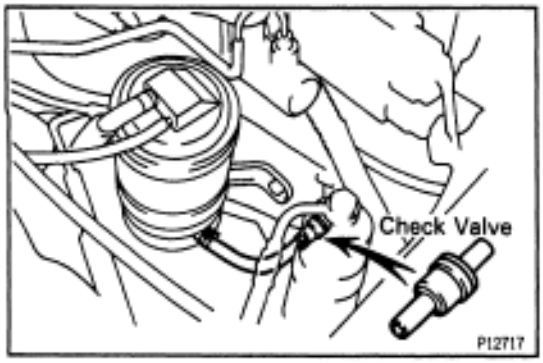
**Part No. 08833–00070, THREE BOND 1324 or equivalent**

**Torque: 30 N–m (305 kgf–cm, 22 ft–lbf)**

**5. REFILL WITH ENGINE COOLANT**

# CHECK VALVE INSPECTION

**1. REMOVE CHECK VALVE**

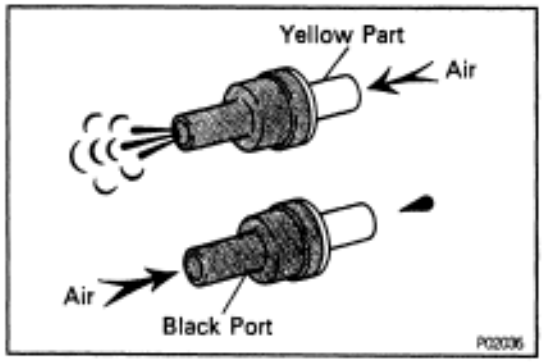



**2. INSPECT CHECK VALVE**

(a) Check that air flows from the yellow port to the black port.

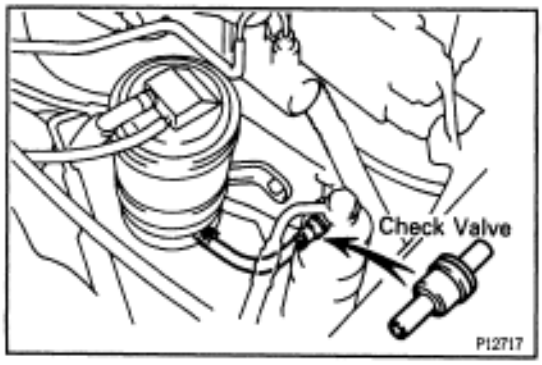
(b) Check that air does not flow from the black port to the yellow port.

If operation is not as specified, replace check valve.




**3. REINSTALL CHECK VALVE**

HINT: Reinstall the check valve with the black port facing the purge port side.

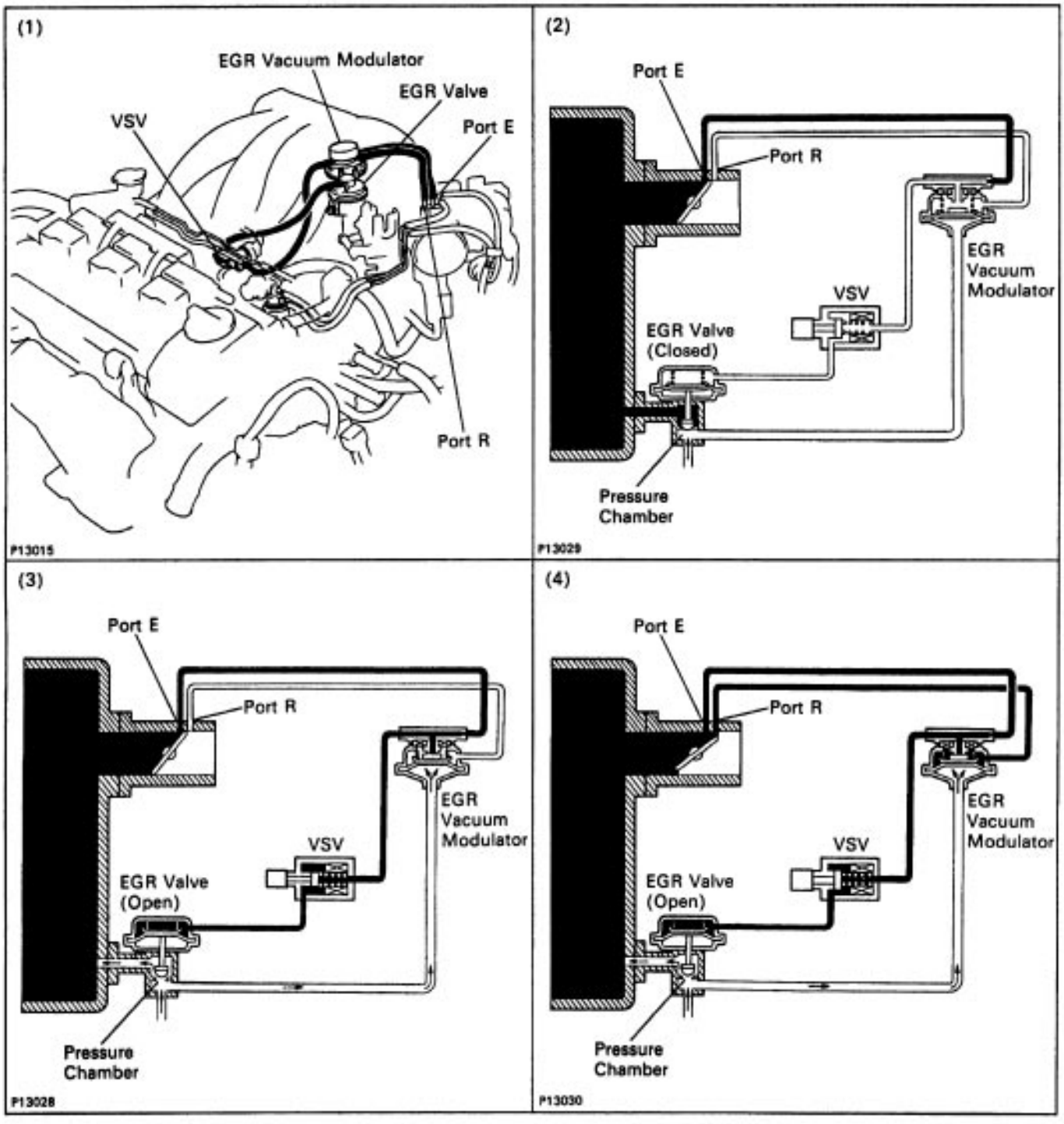


# EXHAUST GAS RECIRCULATION (EGR) SYSTEM

## DESCRIPTION

To reduce NOx emission, part of the exhaust gases are recirculated through the EGR valve to the intake manifold to lower the maximum combustion temperature.

## OPERATION

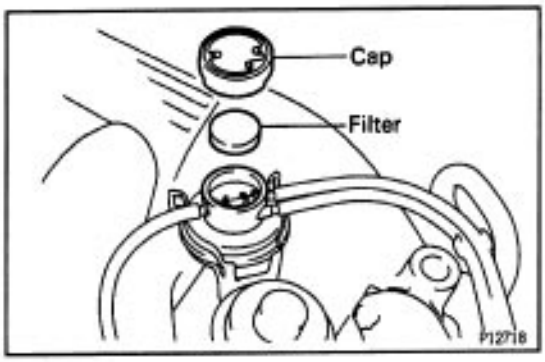


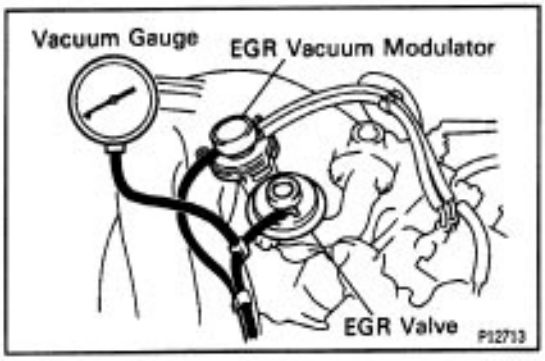

V03802

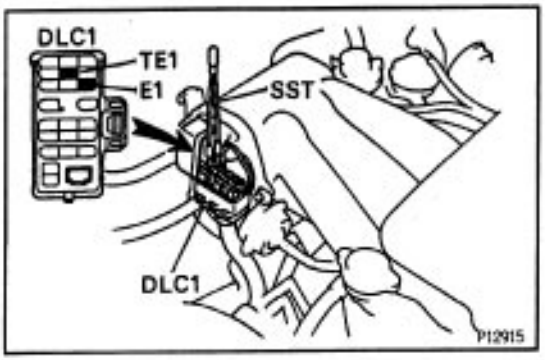
| Engine Coolant Temp. | VSV | Throttle Valve Position | Pressure in the EGR Valve Pressure Chamber | | EG R Vacuum Modulator | EG R Valve | Exhaust Gas |
|---|---|---|---|---|---|---|---|
| Below 55˚C (131˚F) | ON OPENS passage to atmosphere | – | – | | – | CLOSED | Not recirculated |
| Above 60˚C (140˚F) | OFF CLOSED passage to atmosphere | Positioned below port E | – | | – | CLOSED | Not recirculated |
| | | Positioned between port E and port R | (1) LOW | *Pressure con–stantly alternating between low and high | OPENS passage to atmosphere | CLOSED | Not recirculated |
| | | | (2) HIGH | | CLOSES passage to atmosphere’ | OPEN | Recirculated |
| | | Positioned above port R | (3) HIGH | ** | CLOSES passage to atmosphere | OPEN | Recirculated (increase) |

* Pressure increase → Modulator closes → EGR valve opens→ Pressure drops
EGR valve closes← Modulator opens
** When the throttle valve is positioned above port R, the EGR vacuum modulator will close the atmosphere passage and open the EGR valve to increase the EGR gas, even if the exhaust pressure is insufficiently low.

V03592




# EGR SYSTEM INSPECTION

**1. CHECK AND CLEAN FILTER IN EGR VACUUM MODULATOR**

(a) Remove the cap and filter.
(b) Check the filter for contamination or damage.
(c) Using compressed air, clean the filter.
(d) Reinstall the filter and cap.

HINT: Install the filter with the coarser surface facing out to the atmospheric side.

**2. INSTALL VACUUM GAUGE**

Using a 3–way connector, connect a vacuum gauge to the hose between the EGR valve and EGR VSV.

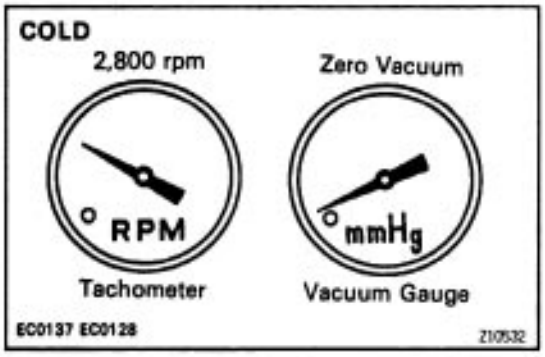
**3. INSPECT SEATING OF EGR VALVE**

Check that the engine starts and runs at idle.

**4. CONNECT TERMINALS TE1 AND E1**

Using SST, connect terminal TE1 and E1 of the data link connector 1.

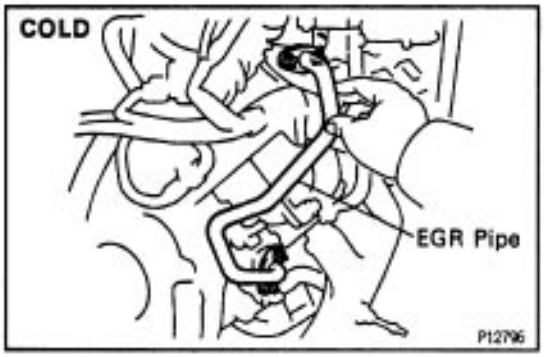
SST 09843–18020



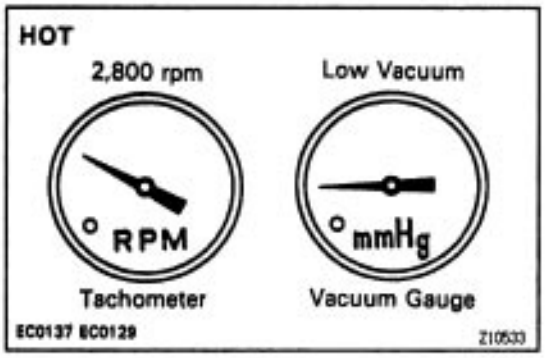

**5. INSPECT VSV OPERATION WITH COLD ENGINE**

(a) The engine coolant temperature should be below $55_2$ C ($1131_2$F).

(b) Check that the vacuum gauge indicates zero at 2,800 rpm.



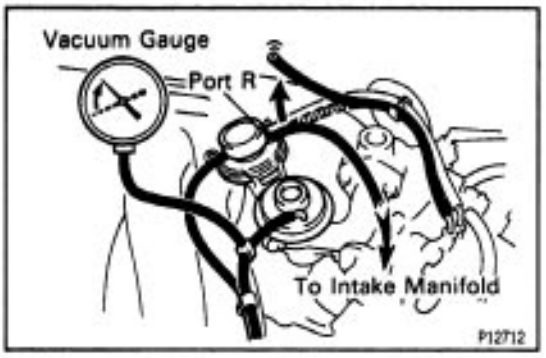

(c) Check that the EGR pipe is not hot.




**6. INSPECT OPERATION OF VSV AND EGR VACUUM MODULATOR WITH HOT ENGINE**

(a) Warm up the engine to above $80_2$C (176° F).

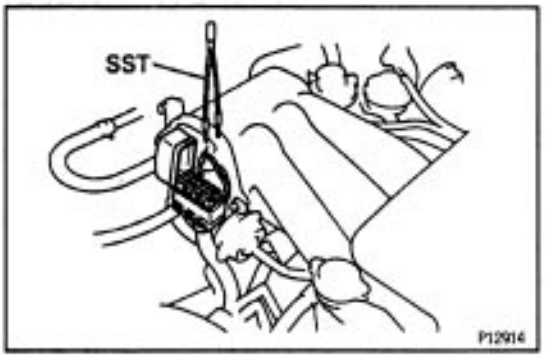
(b) Check that the vacuum gauge indicates low vacuum at 2,800 rpm.




(c) Disconnect the vacuum hose from port R of the EGR vacuum modulator and connect port R directly to the intake manifold with another hose.

(d) Check that the vacuum gauge indicates high vacuum at 3,500 rpm.

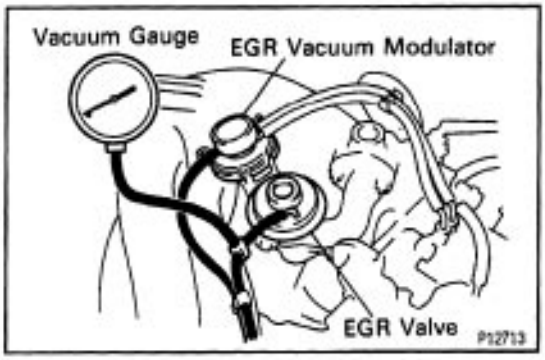
HINT: As exhaust gas is increasingly recirculated, the engine will start to misfire.




**7. DISCONNECT TERMINALS TE1 AND E1**

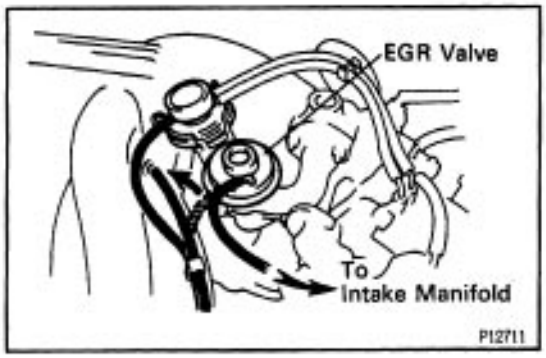
Remove the SST from the data link connector 1.

SST 09843–18020




**8. REMOVE VACUUM GAUGE**

Remove the vacuum gauge, and reconnect the vacuum hoses to their proper locations.




**9. INSPECT EGR VALVE**

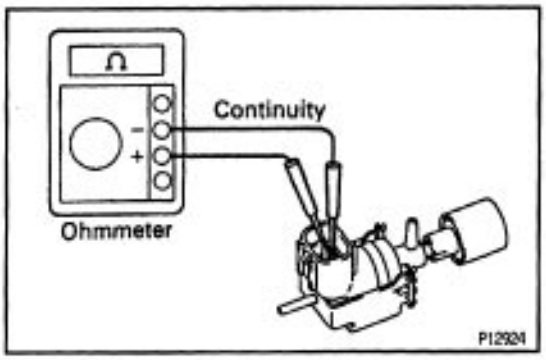
(a) Apply vacuum directly to the EGR valve with the engine idle.

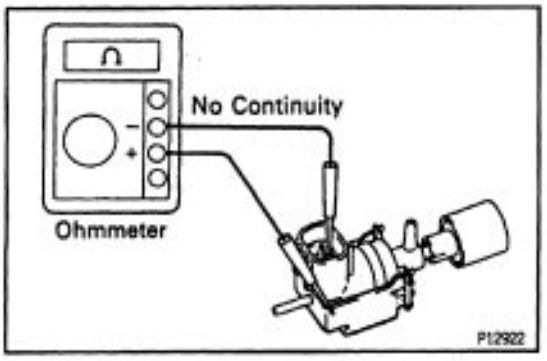
(b) Check that the engine runs rough or dies.

(c) Reconnect the vacuum hoses to their proper locations.

**IF NO PROBLEM IS FOUND DURING THIS INSPECTION, SYSTEM IS NORMAL; OTHERWISE INSPECT EACH PART**






# VSV INSPECTION

**1. REMOVE VSV**

**2. INSPECT VSV**

**A. Inspect VSV for open circuit**

Using an ohmmeter, check that there is continuity between the terminals.

**Resistance:**

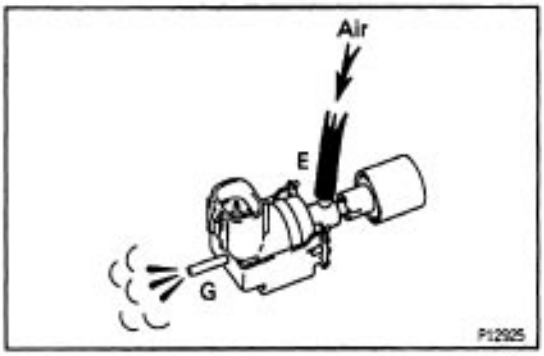
**33 – 39 Ω at 20$_2$C (68$_2$F)**

If there is no continuity, replace the VSV.

**B. Inspect VSV for ground**

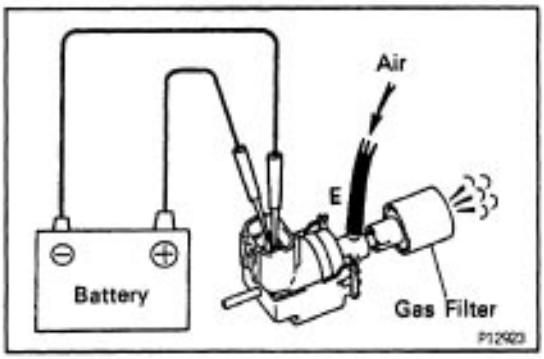
Using an ohmmeter, check that there is no continuity between each terminal and the body.

!f there is continuity, replace the VSV.




**C. Inspect VSV operation**

(a) Check that the air flows from ports E to G.



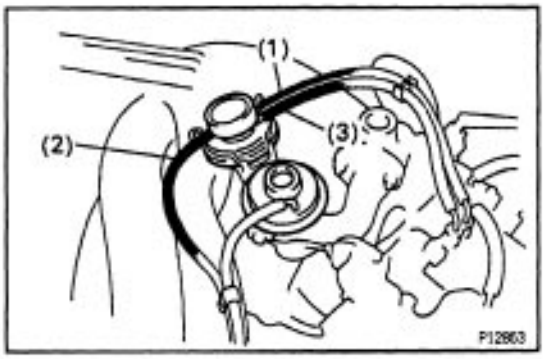

(b) Apply battery voltage across the terminals.
(c) Check that the air flows from port E to the gas filter.
If operation is not as specified, replace the VSV.

**3. REINSTALL VSV**

# EGR VACUUM MODULATOR INSPECTION

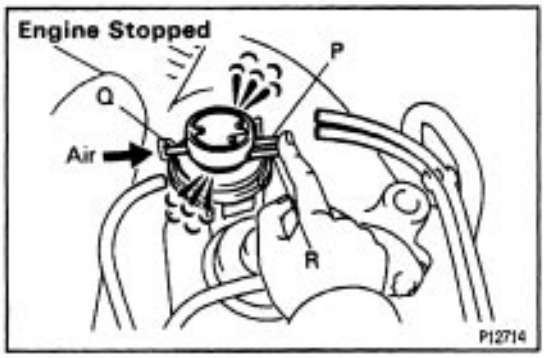
**1. DISCONNECT VACUUM HOSES FROM EGR VACUUM MODULATOR**

Disconnect the following vacuum hoses:
(1) Vacuum hose from P port
(2) Vacuum hose from Q port
(3) Vacuum hose from R port

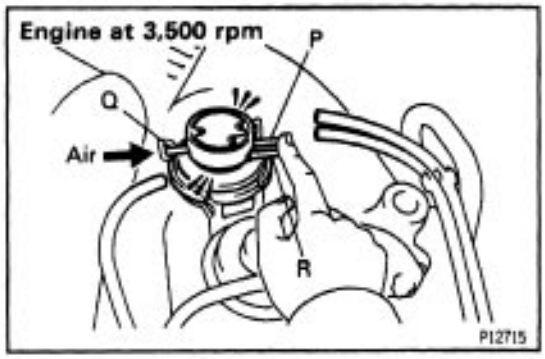


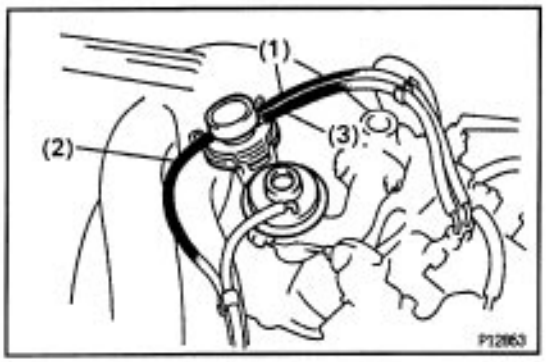

**2. INSPECT EGR VACUUM MODULATOR OPERATION**

(a) Block ports P and R with your finger.
(b) Blow air into port Q, and check that the air passes through to the air filter side freely.




(c) Start the engine, and maintain speed at 3,500 rpm.
(d) Repeat the above test. Check that there is a strong resistance to air flow.





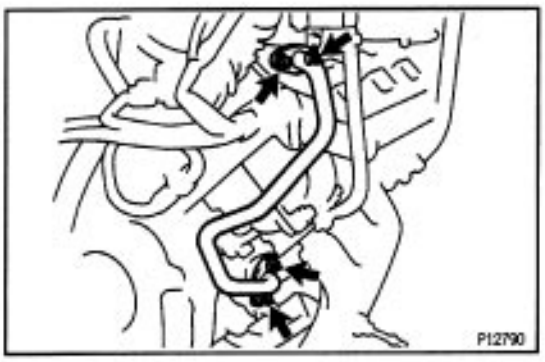

**3. RECONNECT VACUUM HOSES TO EGR VACUUM MODULATOR**

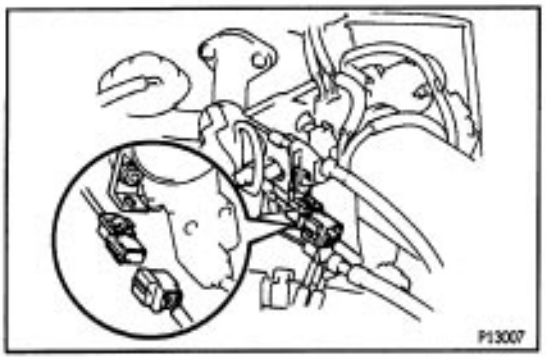
Connect the following vacuum hoses:
(1) Vacuum hose to P port
(2) Vacuum hose to Q port
(3) Vacuum hose to R port

# EGR VALVE INSPECTION

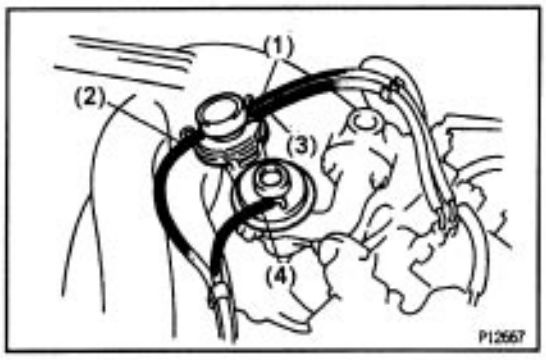
**1. REMOVE EGR PIPE**

Remove the 4 nuts, EGR pipe and 2 gaskets.



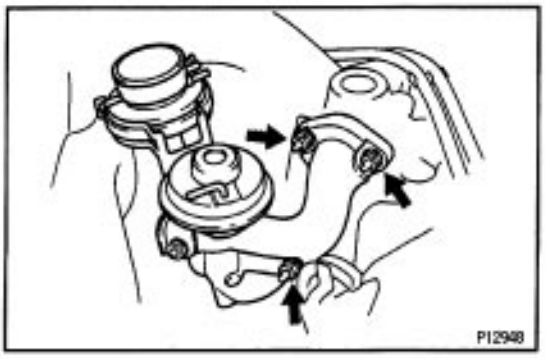

**2. DISCONNECT EGR GAS TEMPERATURE SENSOR CONNECTOR AND CLAMP**

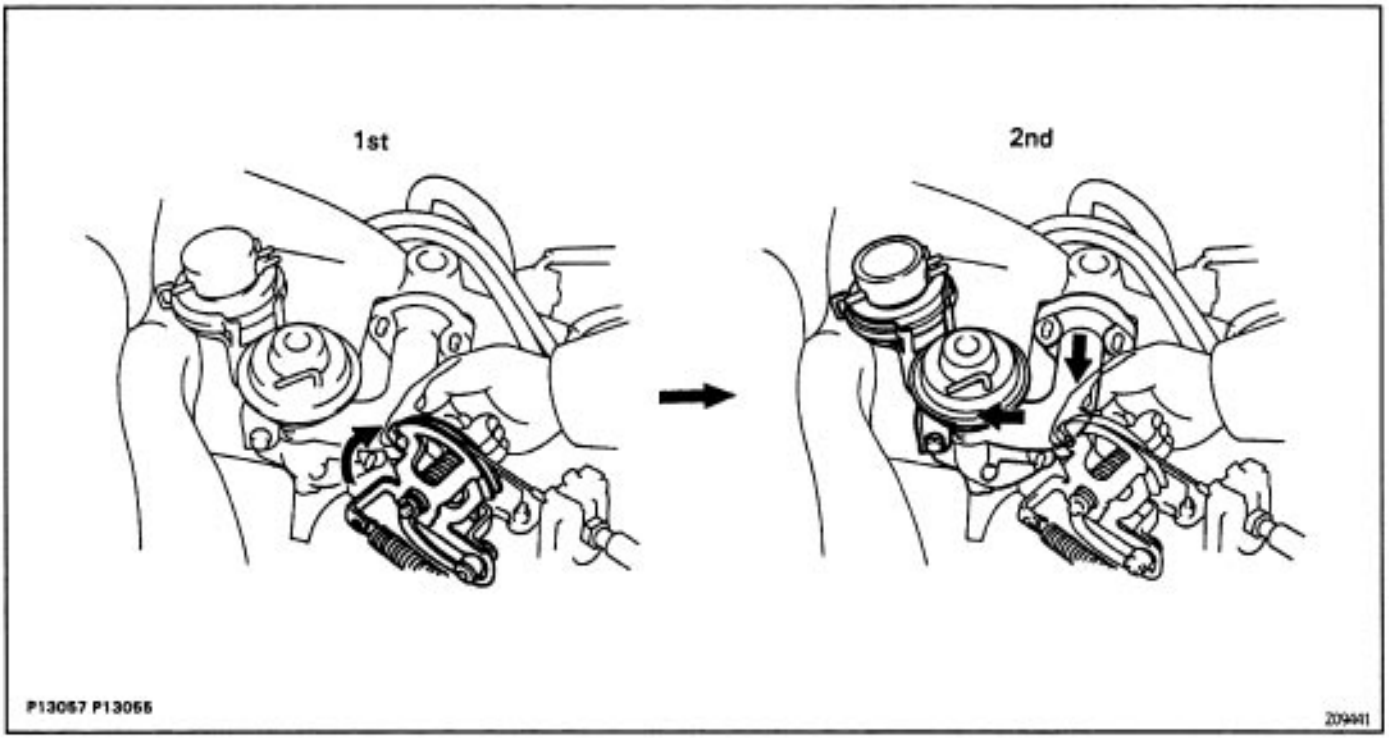


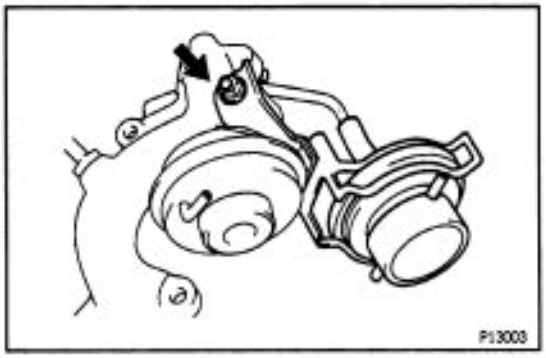

**3. REMOVE EGR VALVE AND VACUUM MODULATOR ASSEMBLY**

(a) Disconnect the following hoses: .
- (1) Vacuum hose from P port of EGR vacuum modu–lator
- (2) Vacuum hose from Q port of EGR vacuum modu–lator
- (3) Vacuum hose from R port of EGR vacuum modu–lator
- (4) Vacuum hose from EGR valve

(b) Remove the 3 nuts, EGR valve and vacuum modulator assembly and gasket.



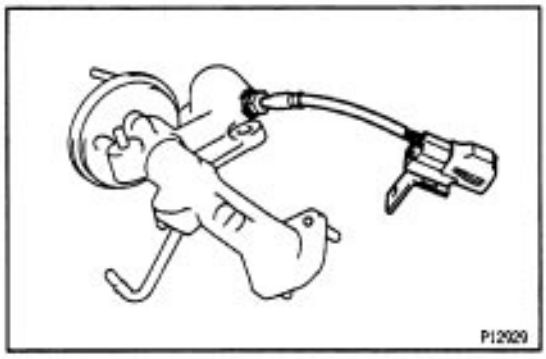


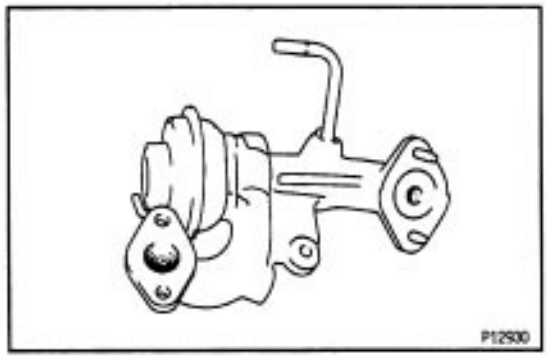

**4. SEPARATE EGR VALVE AND VACUUM MODULATOR**

(a) Remove the nut and disconnect the EGR vacuum modulator.

(b) Disconnect the pressure hose from the EGR valve and remove the EGR vacuum modulator.



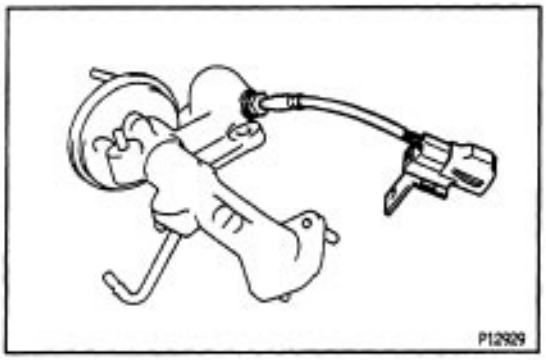

**5. REMOVE EGR GAS TEMPERATURE SENSOR**



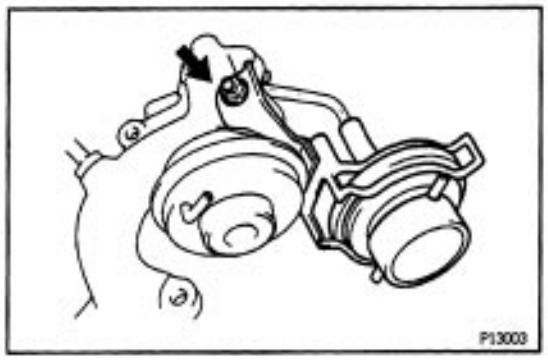

**6. INSPECT EGR VALVE**

Check for sticking and heavy carbon deposits.

If a problem is found, replace the EGR valve.

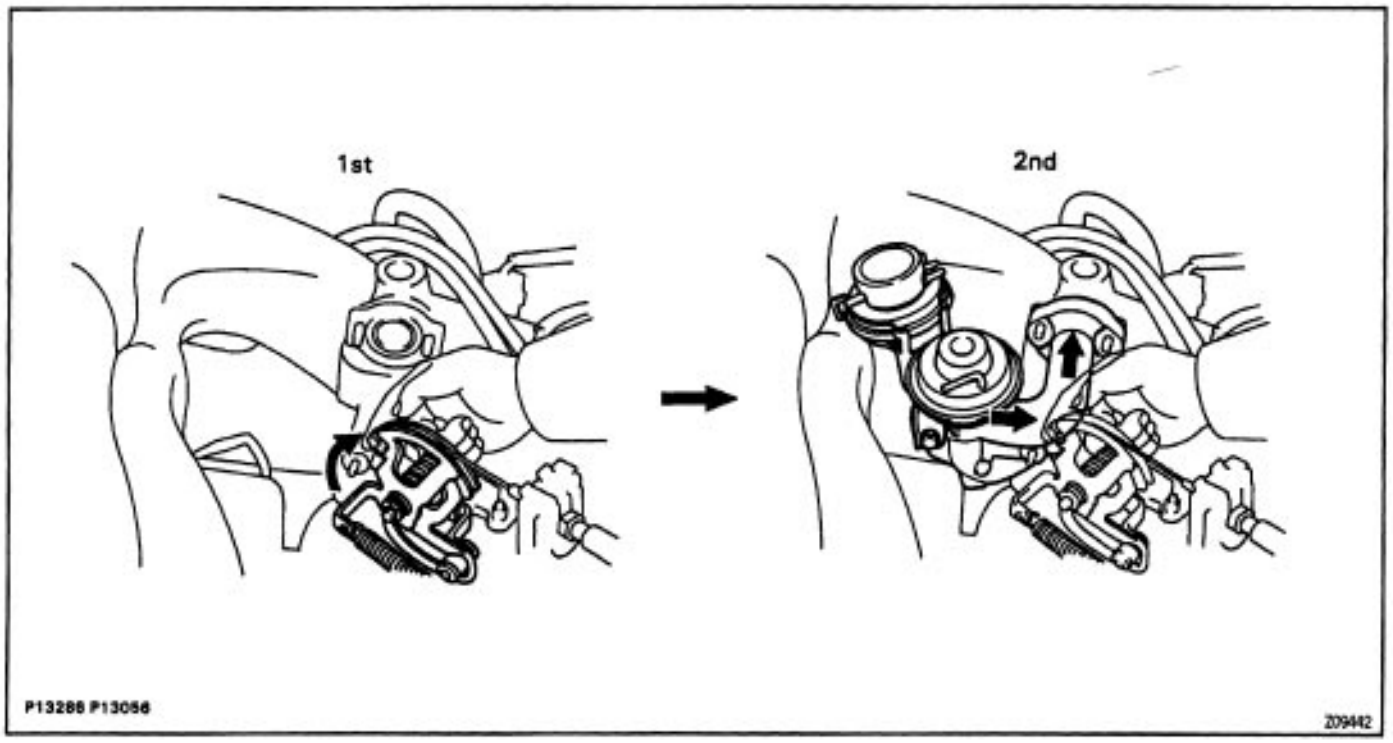


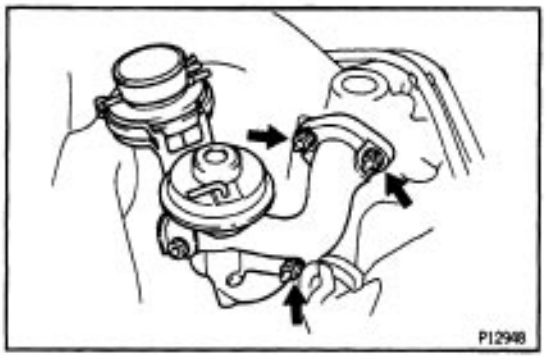

**7. REINSTALL EGR GAS TEMPERATURE SENSOR**
**Torque: 20 N–m (200 kgf–cm, 14 ft–lbf)**



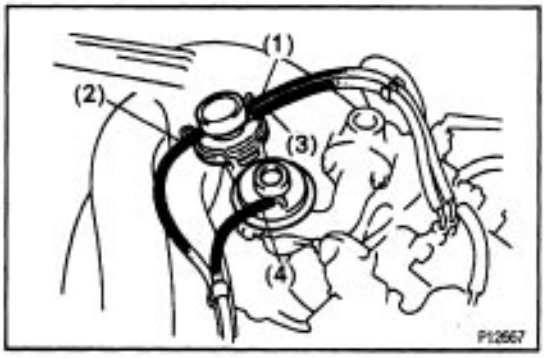

**8. REASSEMBLE EGR VALVE AND VACUUM MODULATOR**
(a) Connect the pressure hose to the EGR valve.
(b) Install the EGR vacuum modulator with the nut.
**Torque: 12 N–m (120 kgf–cm, 9 ft–lbf)**

**9. REINSTALL EGR VALVE AND VACUUM MODULATOR ASSEMBLY**
(a) Install the EGR valve and vacuum modulator assembly to the air intake chamber.

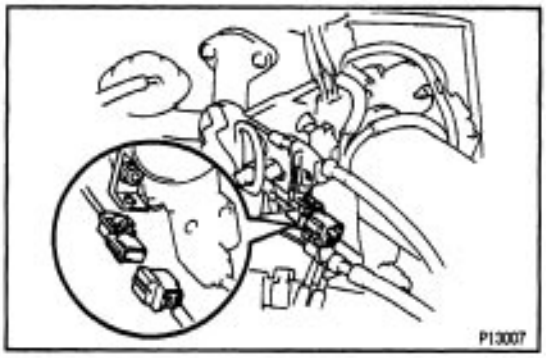





(b) Install and torque the 3 nuts.
**Torque: 12 N–m (120 kgf–cm, 9 ft–lbf)**




(c) Connect the following vacuum hoses:
(1) Vacuum hose to P port of EGR vacuum modulator
(2) Vacuum hose to a port of EGR vacuum modulator
(3) Vacuum hose to R port of EGR vacuum modulator
(4) Vacuum to EGR valve




**10. RECONNECT EGR GAS TEMPERATURE SENSOR CONNECTOR AND CLAMP**

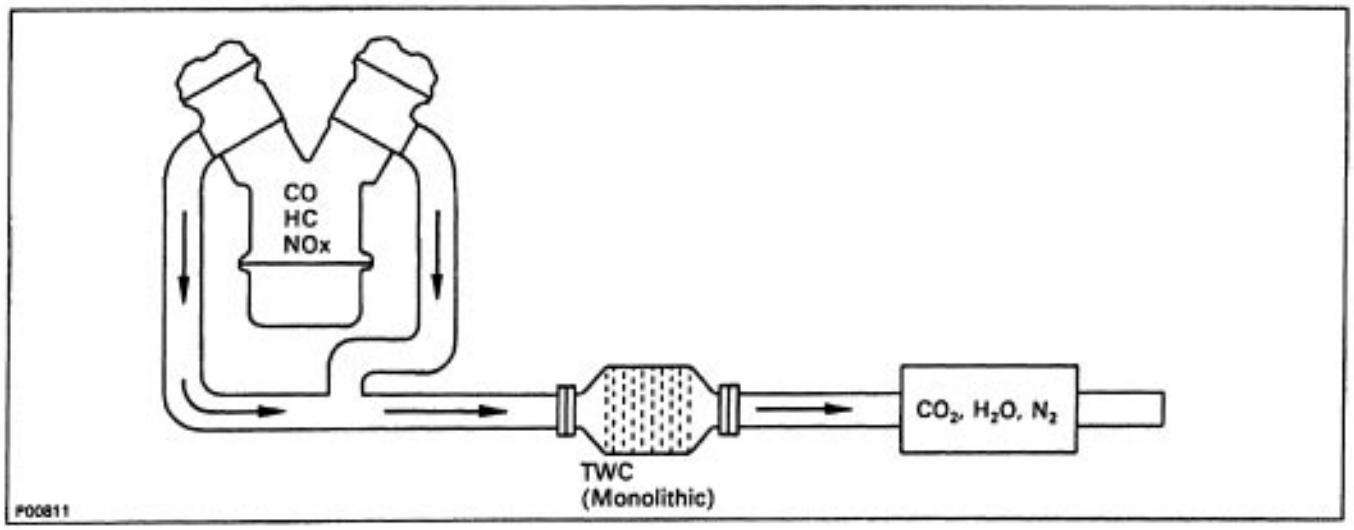

**11. REINSTALL EGR PIPE**
Install 2 new gaskets and the EGR pipe with the 4 nuts.
**Torque: 12 N–m (120 kgf–cm, 9 ft–lbf)**

# THREE–WAY CATALYTIC CONVERTER (TWC) SYSTEM

## DESCRIPTION

To reduce HC. CO and NOx emissions, they are oxidized, reduced and converted to nitrogen ($N_2$), carbon dioxide ($C0_2$) and water ($H_20$) by the three–way catalytic converter.

## OPERATION



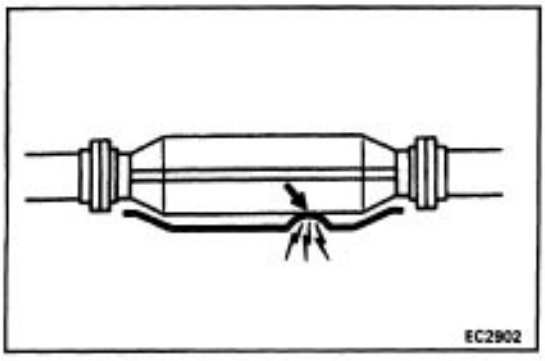

| Exhaust port | | TWC | | Exhaust Gas |
|---|---|---|---|---|
| HC, CO, AND NOx | → | OXIDATION AND REDUCTION | → | $CO_2$<br>$H_{2O}$<br>$N_2$ |

V03594

## EXHAUST PIPE ASSEMBLY INSPECTION

**1. CHECK CONNECTIONS FOR LOOSENESS OR DAMAGE**

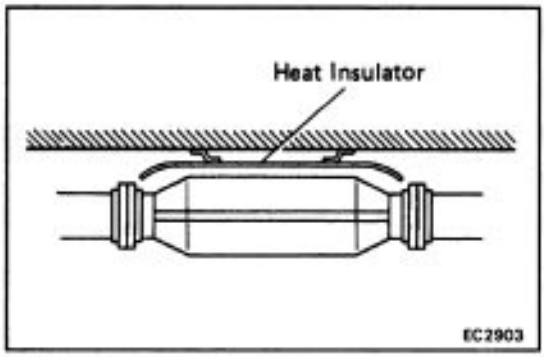
**2. CHECK CLAMPS FOR WEAKNESS. CRACKS OR DAMAGE**




## THREE–WAY CATALYTIC CONVERTER INSPECTION

**CHECK FOR DENTS OR DAMAGE**

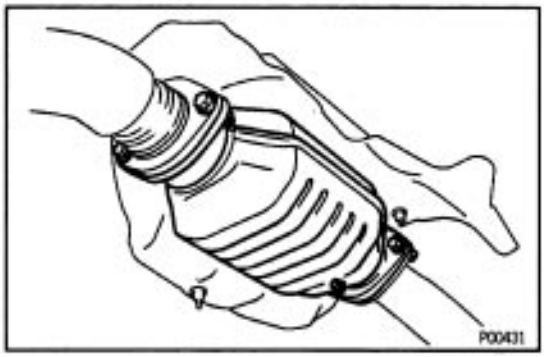
If any part of the protector is damaged or dented to the extent that it contacts the three–way catalytic converter, repair or replace it.




## HEAT INSULATOR INSPECTION

**1. CHECK HEAT INSULATOR FOR DAMAGE**

**2. CHECK FOR ADEQUATE CLEARANCE BETWEEN CATALYTIC CONVERTER AND HEAT INSULATOR**




## THREE–WAY CATALYTIC CONVERTER REPLACEMENT

**1. REMOVE CONVERTER**

(a) Jack up the vehicle.
(b) Check that the converter is cool.
(c) Remove the 4 bolts and nuts holding the pipes to the converter.
(d) Remove the converter and 2 gaskets.

**2. REINSTALL CONVERTER**

(a) Place 2 new gaskets on the front and rear pipes.
(b) Install the converter with the bolts and nuts. Torque the bolts and nuts.
**Torque: 43 N–m (440 kgf–cm, 32 ft–lbf)**



# SERVICE SPECIFICATIONS

## SERVICE DATA

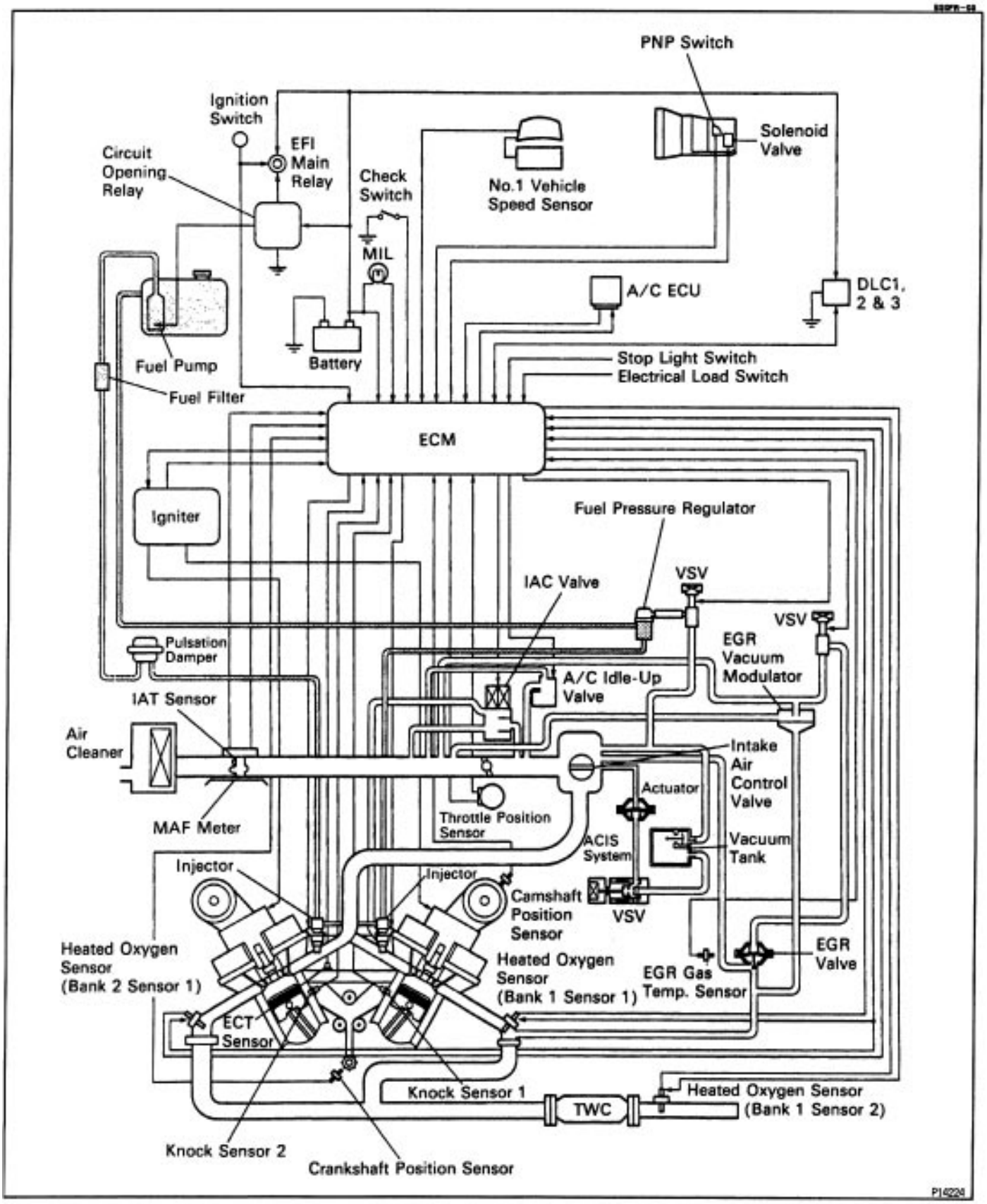
| | | | |
|---|---|---|---|
| VSV for EGR | Resistance | et $20_2$ C ($68_2$ F) | 33 –39Ω |

## TORQUE SPECIFICATIONS

| Part tightened | N-m | kgf-cm | ft·lbf |
|---|---|---|---|
| TVV x Cylinder heed | 30 | 305 | 22 |
| EGR gas temperature x EGR valve | 20 | 200 | 14 |
| EGR vacuum modulator x EGR valve | 20 | 200 | 14 |
| EGR valve x Air intake chamber | 12 | 120 | 9 |
| EGR pipe x Air intake chamber | 12 | 120 | 9 |
| EGR pipe x EGR cooler | 12 | 120 | 9 |
| Three –way catalytic converter x Front exhaust pipe | 43 | 440 | 32 |
| Three–way catalytic converter x Center exhaust pipe | 43 | 440 | 32 |

# SFI SYSTEM

## DESCRIPTION



The SFI (Sequential Multiport Fuel Injection) system is composed of 3 basic sub–systems: Fuel, Air Induction and Electronic Control Systems.

**FUEL SYSTEM**

Fuel is supplied under constant pressure to the SFI injectors by an electric fuel pump. The injectors inject a metered quantity of fuel into the intake manifold in accordance with signals from the ECM (Engine Control Module).

**AIR INDUCTION SYSTEM**

The air induction system provides sufficient air for engine operation.

**ELECTRONIC CONTROL SYSTEM**

The 1 MZ–FE engine is equipped with a TOYOTA Computer Controlled System (TCCS) which centrally controls the SFI, ESA, IAC, diagnosis systems etc. by means of ECM–formerly SFI computer employing a microcomputer.

The ECM controls the following functions:

1. Sequential Multiport Fuel Injection (SFI)

The ECM receives signals from various sensors indicating changing engine operation conditions such as:

- Intake air volume
- Intake air temperature (IAT)
- Engine coolant temperature (ECT)
- Engine speed (RPM)
- Acceleration/deceleration
- Exhaust oxygen content etc.

The signals are utilized by the ECM to determine the injection duration necessary for an optimum air–fuel ratio.

2. Electronic Spark Advance (ESA)

The ECM is programmed with data for optimum ignition timing under all operating conditions. Using data provided by sensors which monitor various engine functions (RPM, ECT, etc.), the ECM triggers the spark at precisely the right instant.

3. Idle Air Control (IAC)

The ECM is programmed with target idling speed values to respond to different engine conditions (ECT, A/C (air conditioning) ON/OFF, etc.). Sensors transmit signals to the ECM which control the flow of air through the throttle valve bypass and adjust idle speed to the target value.

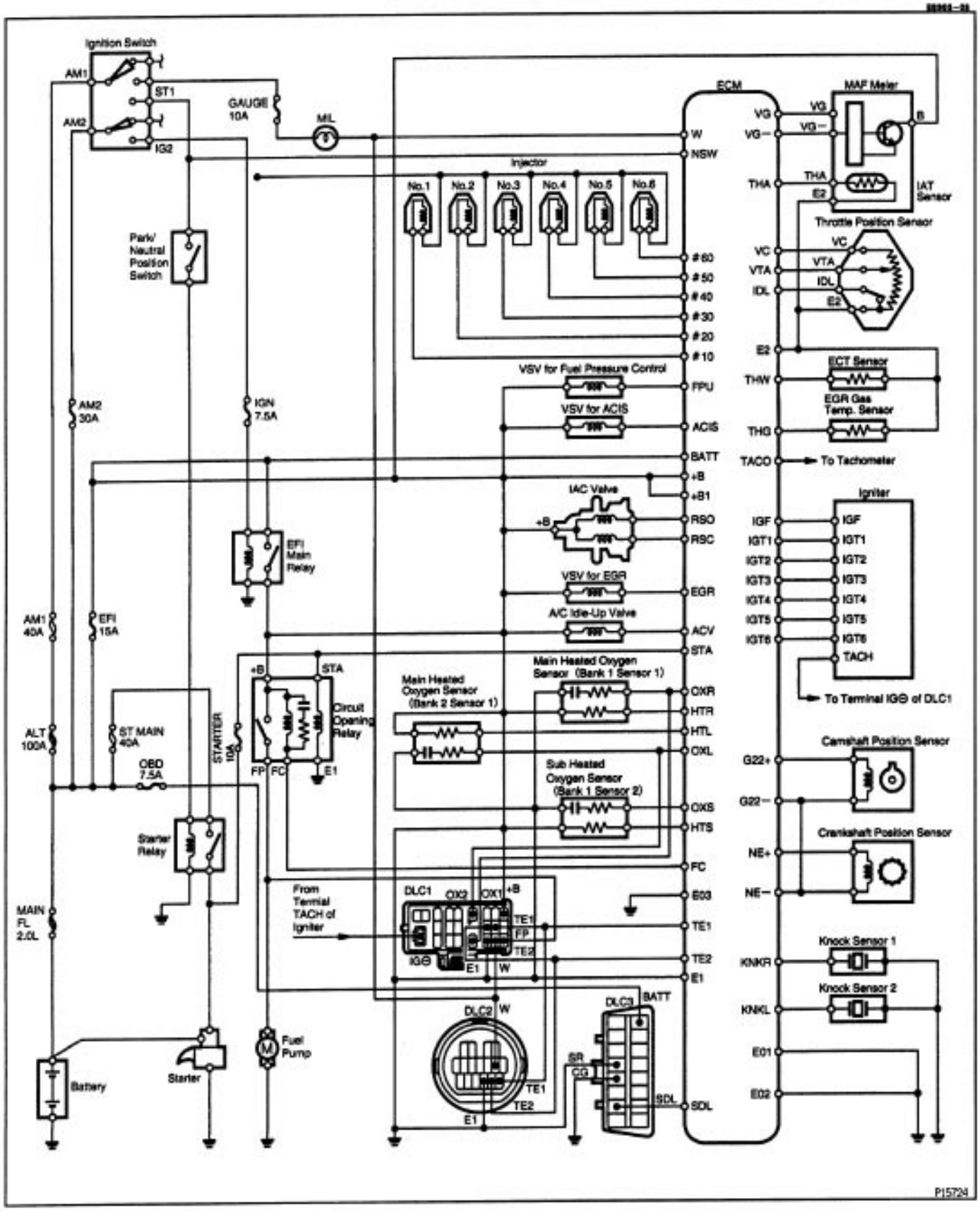
4. Diagnosis

The ECM detects any malfunctions and abnormalities in the sensor network and lights a malfunction indicator lamp (MIL) on the combination meter. At the same time, the trouble is identified and a diagnostic trouble code is recorded by the ECM. The diagnostic trouble codes are referred in the Engine Troubleshooting. (See page EG2–404)

5. Fail–Safe Function

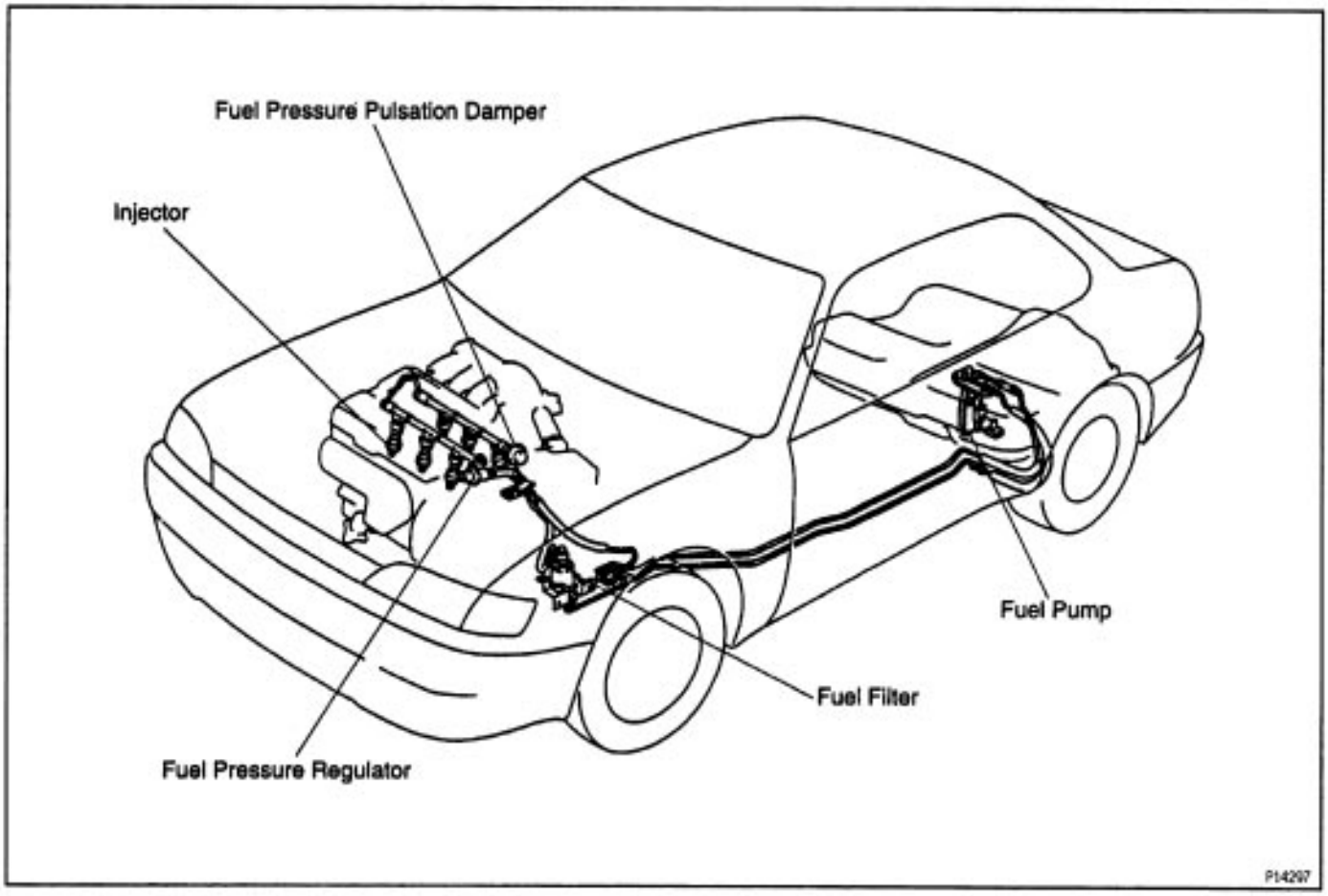
In the event of the sensor malfunctioning, a back–up circuit will take over to provide minimal driveability, and the malfunction indicator lamp will illuminate.

# SYSTEM CIRCUIT



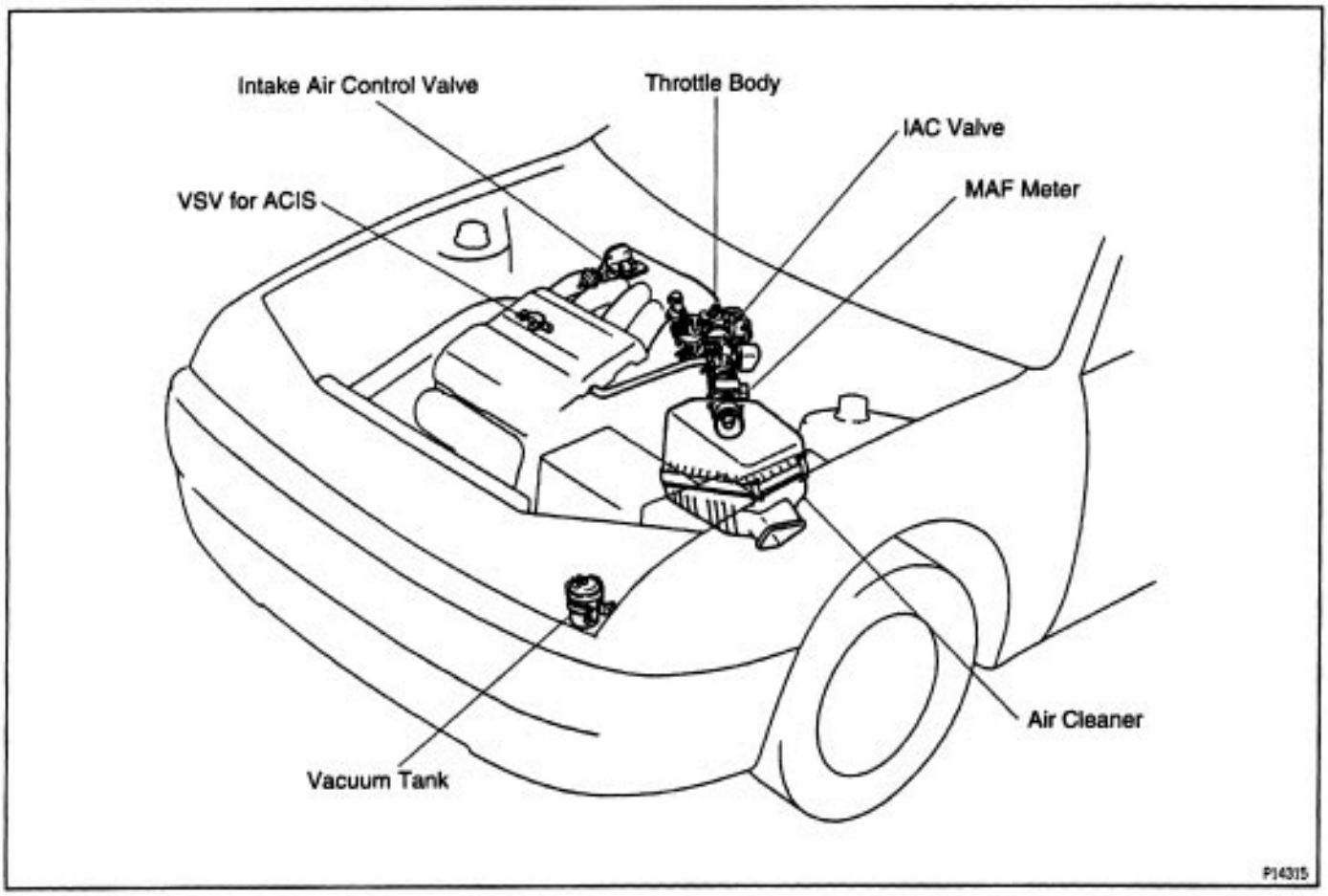
# OPERATION

## FUEL SYSTEM




Fuel is pumped up by the fuel pump, which flows through the fuel filter under pressure through the fuel pipe to the delivery pipe where it is distributed to each injector.
The fuel pressure regulator adjusts the pressure of the fuel from the fuel line (high pressure side) to a pressure 284 kPa (2.9 kgf/cm$^2$, 41 psi) higher than the pressure inside the intake manifold, and excess fuel is returned to the fuel tank through the return tube.
When the engine is hot, the fuel pressure is increased to control percolation in the fuel system and improve restartability and idling stability.
The pulsation damper absorbs the slight fluctuations in fuel pressure caused by the injector.
Fuel is injected into the intake manifold according to signals from the ECM.

# AIR INDUCTION SYSTEM




Air filtered through the air cleaner passes through the MAF meter and the amount flowing to the air intake chamber is determined by the throttle valve opening in the throttle body and the engine speed. The MAF meter measures the intake flow to the engine by measuring the air's cooling effect on the thermistor which is heated by the heater.

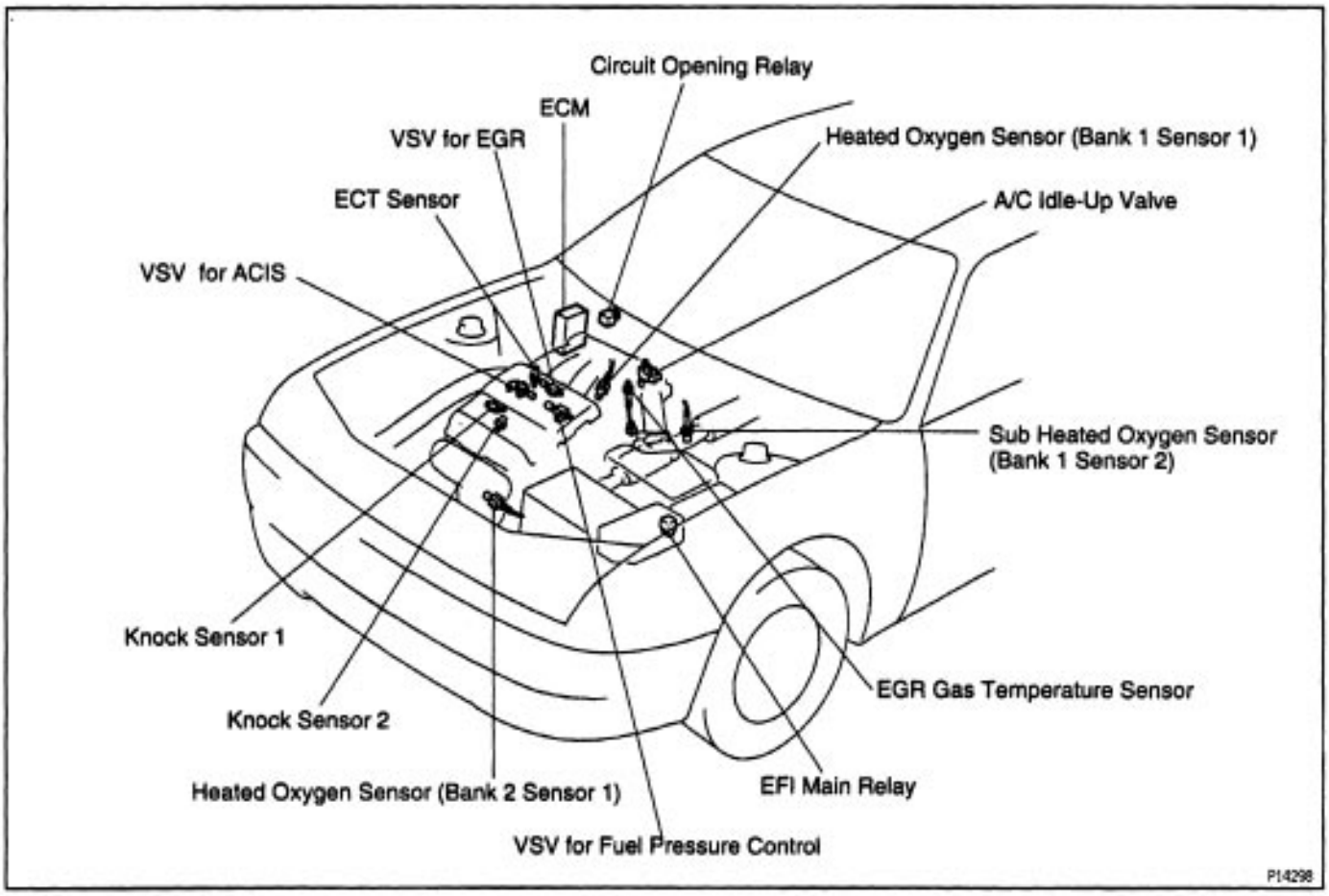
Located in the throttle body is the throttle valve, which regulates the volume of air intake to the engine. Air intake controlled by the throttle valve opening is distributed from the intake chamber to the manifold of each cylinder and is drawn into the combustion chamber.

At low air temperatures the IAC valve opens and the air flows through the IAC valve, as well as the throttle body, into the air intake chamber. During engine warm up, fast idle is accomplished by air flowing into the intake chamber via the IAC valve, even when the throttle valve is completely closed. In this way the IAC valve controls the idle speed to suit the operating conditions.

The air intake chamber prevents pulsation of the intake air, reduces the influence of the MAF meter and increases the air intake volume. It also prevents intake air interference in each cylinder.

There is also the intake air control valve attached to the air intake chamber. Part of the ACIS, the ECM provides signals to the VSV to open or close. This valve opens or closes the vacuum source to the actuator, which in turn opens or closes the intake air control valve. The intake air control valve is designed to modify the effective manifold length in 2 stages for increased power in all driving ranges.

# ELECTRONIC CONTROL SYSTEM




The control system consists of sensors which detect various engine conditions, and an ECM which determines the injection volume (timing) based on the signals from the sensors.
The various sensors detect the intake air volume, engine speed, oxygen density in the exhaust gas, engine coolant temperature and intake air temperature etc. and convert the information into an electrical signal which is sent to the ECM; Based on these signals, the ECM calculates the optimum ignition timing for the current conditions and operates the injectors.
The ECM not only controls the fuel injection timing, but also the self diagnostic function which records the occurrence of a malfunction, fuel volume and timing injection control, idle speed control, fuel pressure control, knock sensor control and EGR control.

# PREPARATION
# SST (SPECIAL SERVICE TOOLS)

| | | |
|---|---|---|
|  | 09268–41045 Injection Measuring Tool Set | |
|  | (09268–41080) No.6 union | |
|  | (09268–41090) No.7 Union | |
|  | (90405–09015) No.1 Union | |
|  | 09268–45012 EFI Fuel Pressure Gauge | |
|  | 09631 –22020 Power Steering Hose Nut 14 x 17 mm Wrench Set | Fuel line flare nut |
|  | 09842–30070 Wiring ”F” EFI Inspection | |
|  | 09843–18020 Diagnosis Check Wire | |

# RECOMMENDED TOOLS

| | | |
|---|---|---|
|  | 09082–00050 TOYOTA Electrical Tester Set | |
|  | 09200–00010 Engine Adjust Kit | |
|  | 09258–00030 Hose Plug Set | Plug for the vacuum hose, fuel hose etc. |

## EQUIPMENT

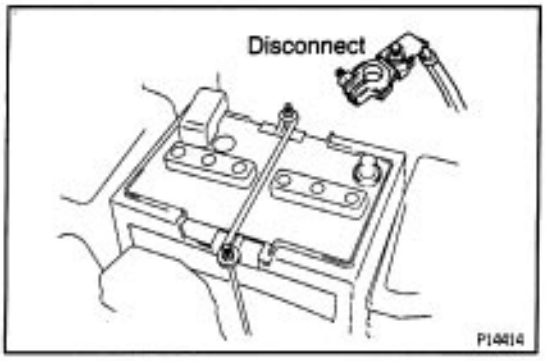
| | |
|---|---|
| Graduated cylinder | Injector |
| Carburetor cleaner | Throttle body |
| Sound scope | Injector |
| Tachometer | |
| Torque wrench | |
| Vacuum gauge | |
| Soft brush | Throttle body |

## SSM (SPECIAL SERVICE MATERIALS)

| | |
|---|---|
| 08826–00080 Seal packing or equivalent | Intake air control valve |

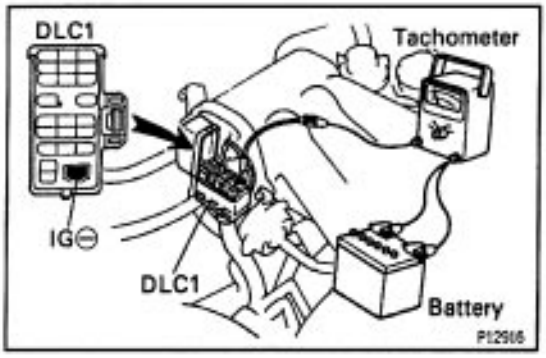
## COOLANT

| Item | Capacity | Classification |
|---|---|---|
| Engine coolant | 8.7 liters (9.2 US qts, 7.7 Imp. qts) | Ethylene–glycol base |




# PRECAUTION

1. Before working on the fuel system, disconnect the negative (–) terminal cable from the battery.
HINT: Any diagnostic trouble code retained by the computer will be erased when the battery terminal is removed.
Therefore, if necessary, read the diagnosis before removing the battery terminal.
CAUTION: Work must be started after 90 seconds from the time the Ignition switch is turned to the ”LOCK” position and the negative (–) terminal cable is discon–nected from the battery.
2. Do not smoke or work near an open flame when working on the fuel system.
3. Keep gasoline away from rubber or leather parts.




# MAINTENANCE PRECAUTIONS

**1. CHECK CORRECT ENGINE TUNE–UP**
**(See page** EG2–8**)**
**2. PRECAUTIONS WHEN CONNECTING GAUGE**
(a) Use the battery as the power source for the timing light, tachometer, etc.
(b) Connect the tester probe of a tachometer to the termi–nal IG(–) of the DLC1.

**3. IN EVENT OF ENGINE MISFIRE, FOLLOWING PRE–CAUTIONS SHOULD BE TAKEN**
(a) Check proper connection of battery terminals, etc.
(b) After repair work, check that the ignition coil termi–nals and all other ignition system lines are reconne–cted securely.
(c) When cleaning the engine compartment, be especially careful to protect the electrical system from water.
**4. PRECAUTIONS WHEN HANDLING OXYGEN SENSOR**
(a) Do not allow oxygen sensor to drop or hit against an object.
(b) Do not allow the sensor to come into contact with water.

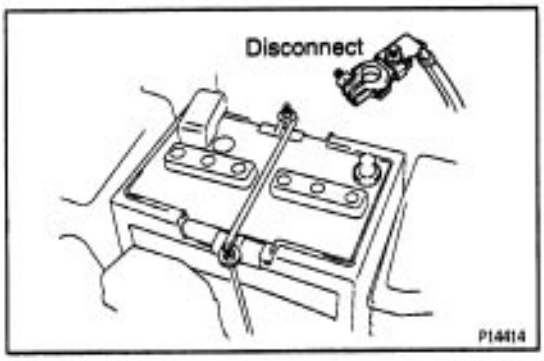
## IF VEHICLE IS EQUIPPED WITH MOBILE RADIO SYSTEM (HAM, CB, ETC.)

If the vehicle is equipped with a mobile communica–tion system, refer to the precaution in the IN section.

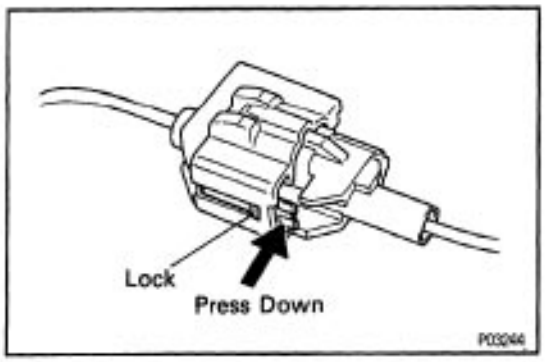
## AIR INDUCTION SYSTEM

1. Separation of the engine oil dipstick, oil filler cap, PCV hose, etc. may cause the engine to run out of tune.
2. Disconnection, looseness or cracks in the parts of the air induction system between the throttle body and cylinder head will allow air suction and cause the engine to run out of tune.

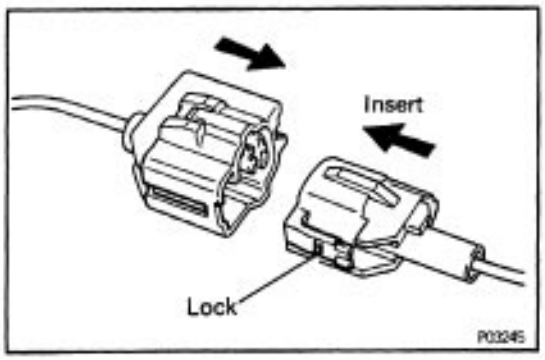
## ELECTRONIC CONTROL SYSTEM



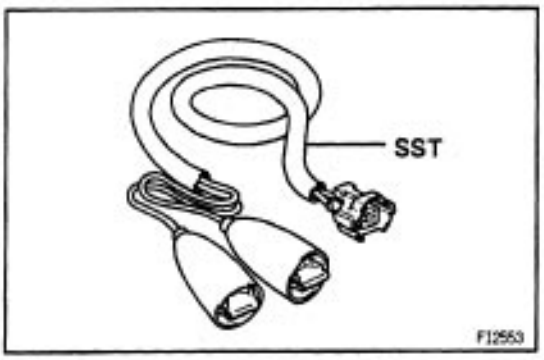

1. Before removing SFI wiring connectors, terminals, etc., first disconnect the power by either turning the ignition switch to LOCK or disconnecting the negative (–) terminal cable from the battery.
HINT: Always check the diagnostic trouble code before disconnecting the negative (–) terminal cable from the battery.
2. When installing the battery, be especially careful not to incorrectly connect the positive (+) and negative (–) cables.
3. Do not permit parts to receive a severe impact during removal or installation. Handle all SFI parts carefully, especially the ECM.
4. Do not be careless during troubleshooting as there are numerous transistor circuits and even slight terminal contact can cause further troubles.
5. Do not open the ECM cover.
6. When inspecting during rainy weather, take care to prevent entry of water. Also, when washing the engine compartment, prevent water from getting or the SFI parts and wiring connectors.
7. Parts should be replaced as an assembly.



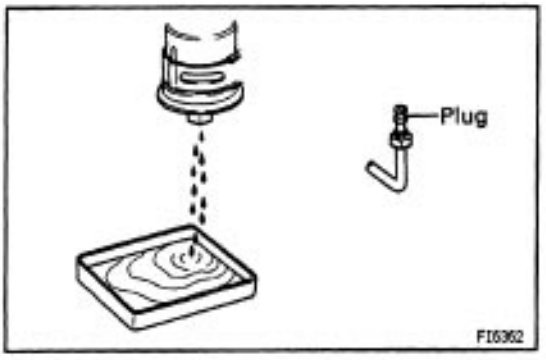

8. Care is required when pulling out and inserting wiring connectors.
(a) Release the lock and pull out the connector, pulling on the connectors.

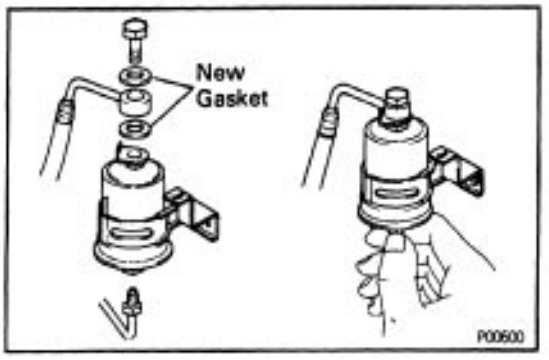



(b) Fully insert the connector and check that it is locked.



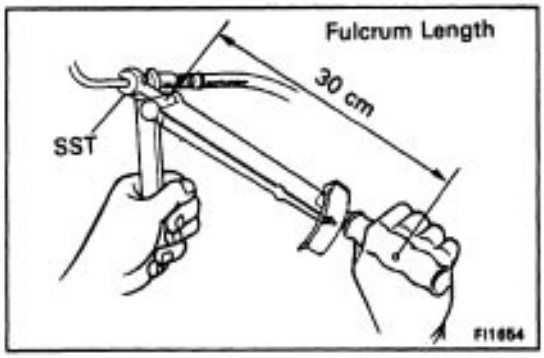

9. Use SST for inspection or test of the injector or its wiring connector.
SST 09842–30070



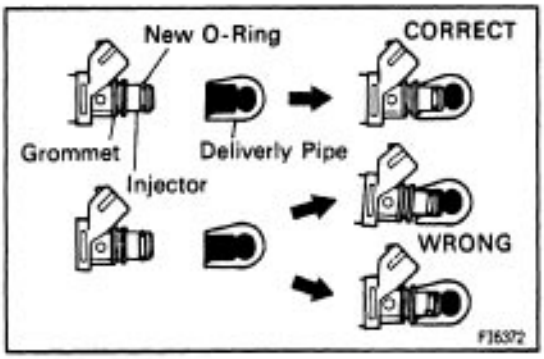




## FUEL SYSTEM

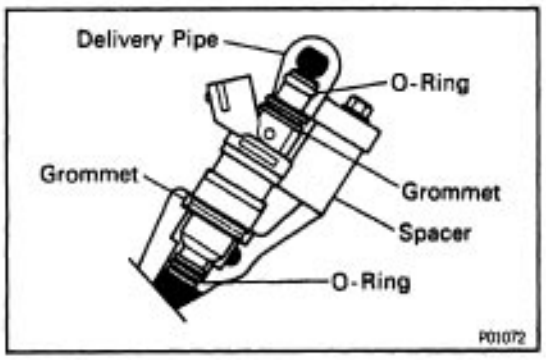
1. When disconnecting the high fuel pressure line, a large amount of gasoline will spill out, so observe the following procedures:
(a) Put a container under the connection.
(b) Slowly loosen the connection.
(c) Disconnect the connection.
(d) Plug the connection with a rubber plug.
2. When connecting the flare nut or union bolt on the high pressure pipe union, observe the following proce–dures:
Union Bolt Type:
(a) Always use 2 new gaskets.
(b) Tighten the union bolt by hand.
(c) Tighten the union bolt to the specified torque.
**Torque: 30 N–m (310 kgf–cm, 22 ft–lbf)**



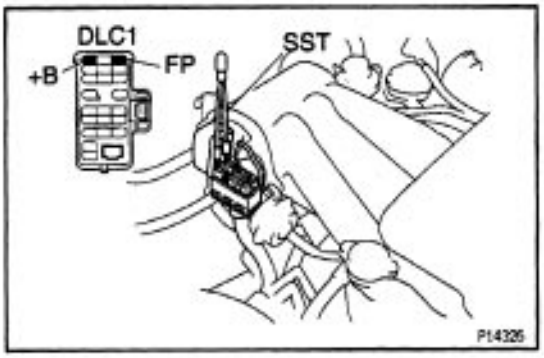

Flare Nut Type:
(a) Apply a light coat of engine oil to the flare nut, and tighten the flare nut by hand.
M Using SST, tighten the flare nut to specified torque.
SST 09631– 22020
**NOTICE: Do not rotate the fuel pipe, when tightening the flare nut.**
**Torque:**
**28 N–m (285 kgf–cm, 21 ft–lbf) for fuel pump side**
**30 N–m (310 kgf–cm, 22 ft–lbf) for others**
HINT: Use a torque wrench with a fulcrum length of 30 cm (111.81 in.).



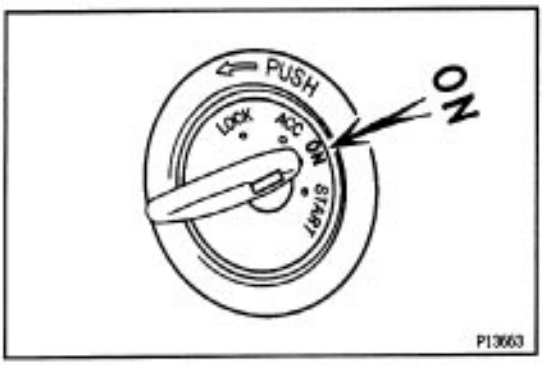

3. Observe the following precautions when removing and installing the injectors.
(a) Never reuse the O–ring.
(b) When placing a new 0 –ring on the injector, take care not to damage it in any way.
(c) Coat a new 0 –ring with spindle oil or gasoline before installing– never use engine, gear or brake oil.



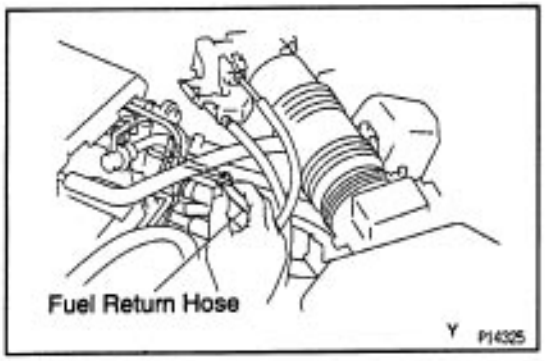

4. Install the injector to the delivery pipe and intake manifold as shown in the illustration.



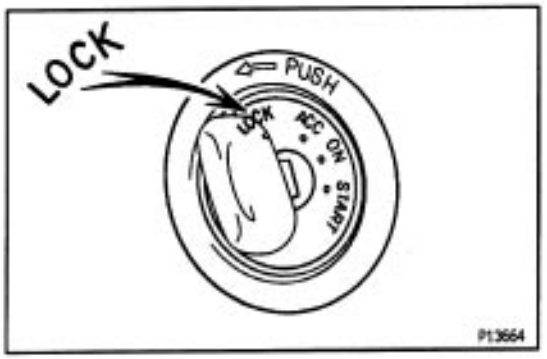

5. Check that there are no fuel leaks after performing any maintenance on the fuel system.
(a) Using SST, connect terminals +B and FP of the DLC 1.
SST 09843–18020



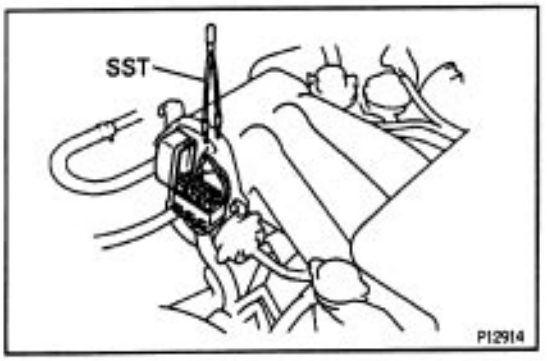

(b) With engine stopped, turn the ignition switch ON.



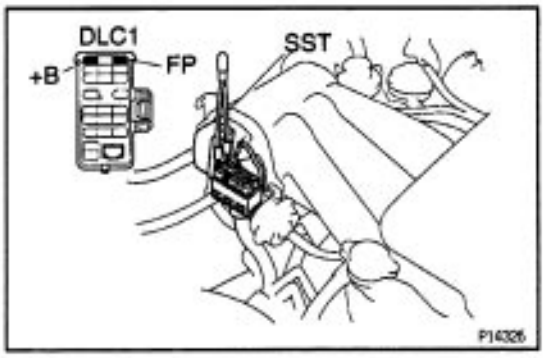

(c) Pinch the fuel return hose.
The pressure in the high pressure line will rise to approx. 392 kPa (4 kgf/cm$^2$ 57 psi). In this state, check to see that there are no leaks from any part of the fuel system.
**NOTICE: Always pinch the hose. Avoid bending as it may cause the hose to crack.**




(d) Turn the ignition switch to LOCK.




(e) Remove the SST from the DLC1.
SST 09843–18020



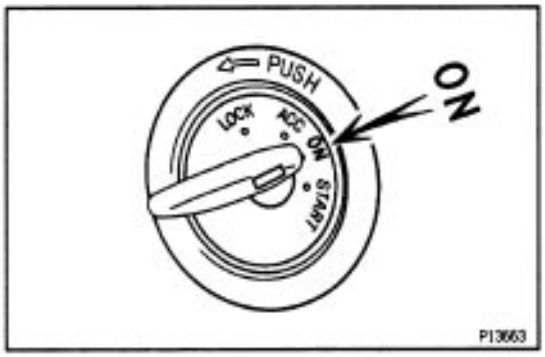

# FUEL PUMP

## ON–VEHICLE INSPECTION

**1. CHECK FUEL PUMP OPERATION**

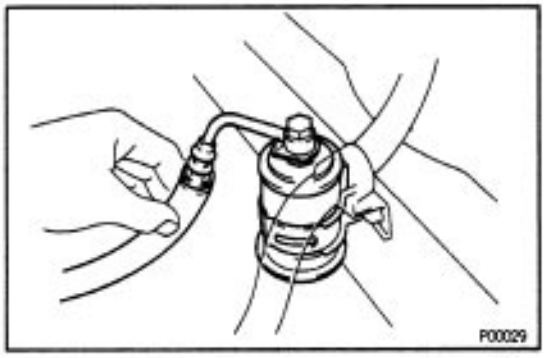
(a) Using SST, connect terminals +B and FP of the DLC 1.

SST 09843–18020




(b) Turn the ignition switch ON.

**NOTICE: Do not start the engine.**

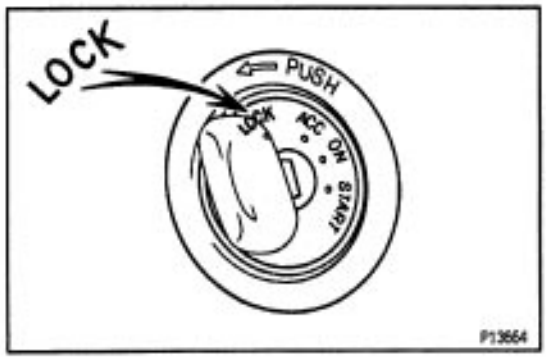



(c) Check that there is pressure in the fuel inlet hose from the fuel filter.

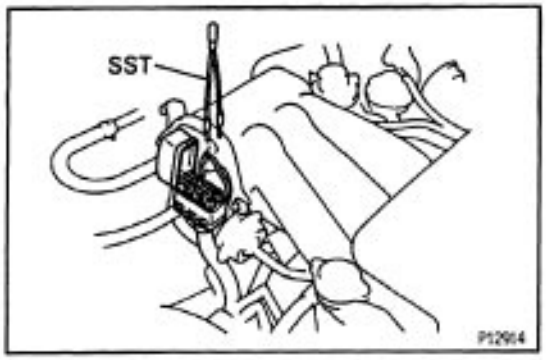
HINT: If there is fuel pressure, you will hear the sound of fuel flowing.

If there is no pressure, check the following parts:

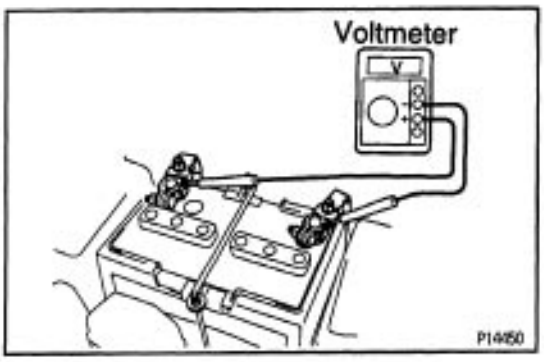
- Fusible link
- Fuses (AM2 30A, IGN 7.5A)
- EFI main relay
- Fuel pump
- ECM
- Wiring connections



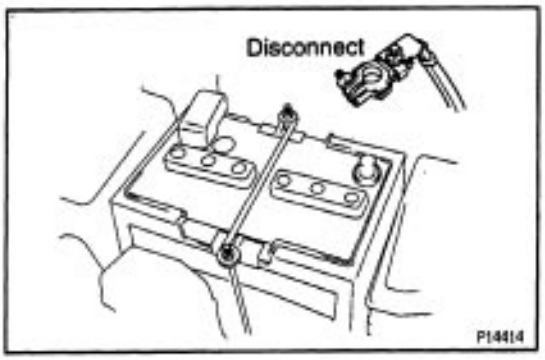

(d) Turn the ignition switch to LOCK.



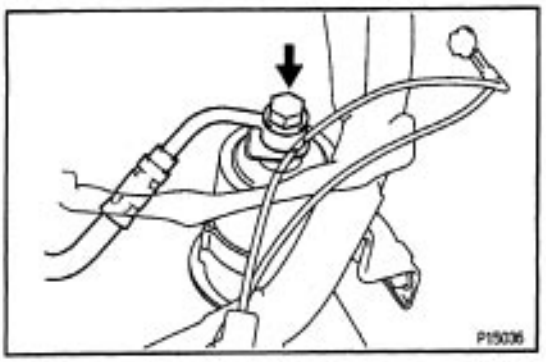

(e) Remove the SST from the DLC1.
SST 09843–18020



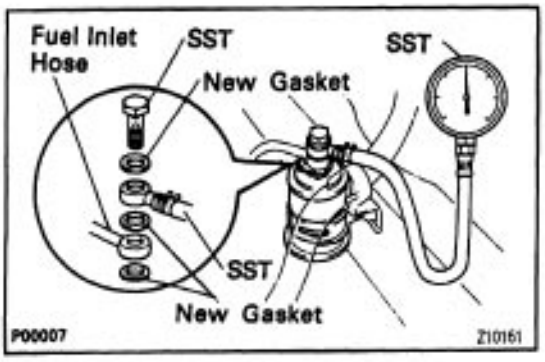

**2. CHECK FUEL PRESSURE**
(a) Check the battery voltage is above 12 V.



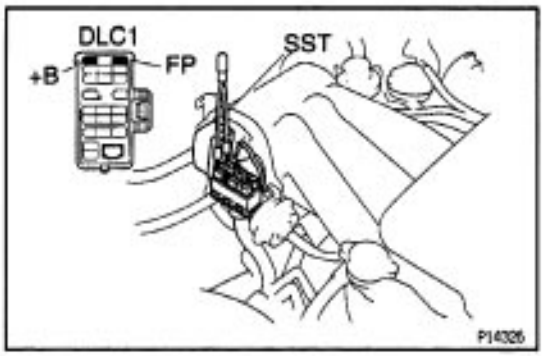

(b) Disconnect the negative (–) terminal cable from the battery.
**CAUTION: Work must be started after 90 seconds from the time the ignition switch Is turned to the ”LOCK” position and the negative (–) terminal cable is discon–nected from the battery.**



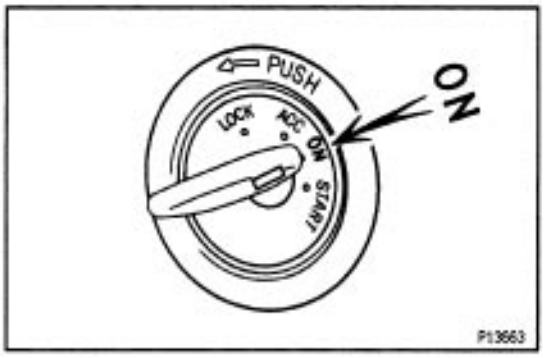

(c) Remove the union bolt and 2 gaskets, and disconnect the fuel inlet hose from the fuel filter outlet.
**CAUTION:**
- **Put a shop towel under the fuel filter.**
- **Slowly loosen the union bolt.**



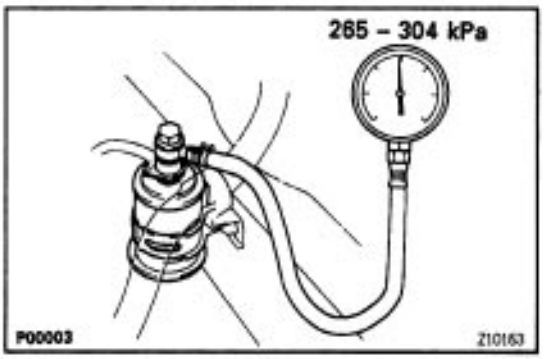

(d) Install the fuel inlet hose and SST (pressure gauge) to the fuel filter outlet with 3 new gaskets and the union bolt.
SST 09268–45012
**Torque: 29 N–m (300 kgf–cm, 22 ft–lbf)**
(e) Wipe off any splattered gasoline.



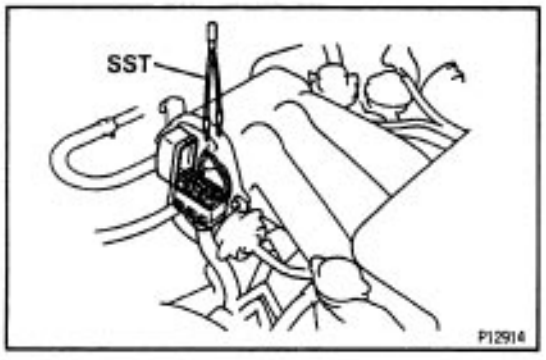

(f) Using SST, connect terminals +B and FP of the DLC 1.
(g) Reconnect the negative (–) terminal cable to the battery.



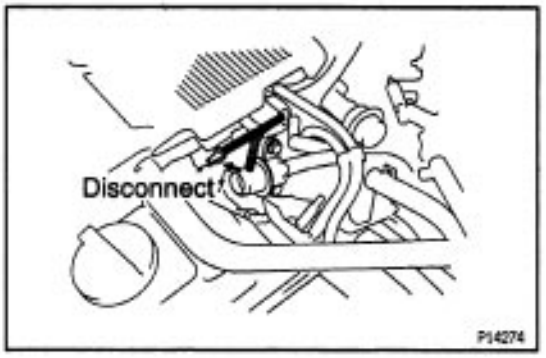

(h) Turn the ignition switch ON.



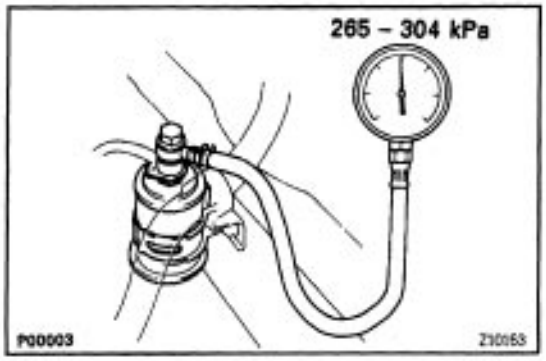

(i) Measure the fuel pressure.
**Fuel pressure:**
**266 – 304 kPa (2.7 – 3.1 kgf/cm$^2$, 38 – 44 psi)**
If pressure is high, replace the fuel pressure regulator.
If pressure is low, check the following parts:
- Fuel hoses and connections
- Fuel pump
- Fuel filter
- Fuel pressure regulator



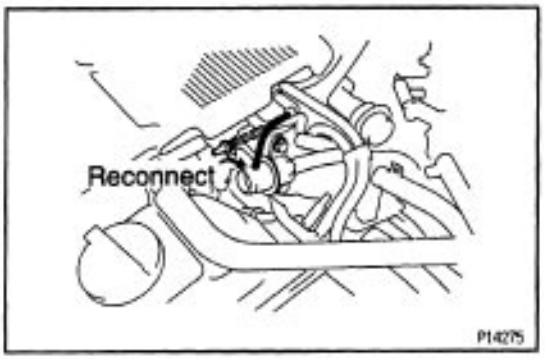

(j) Remove the SST from the DLC1.
SST 09843–18020



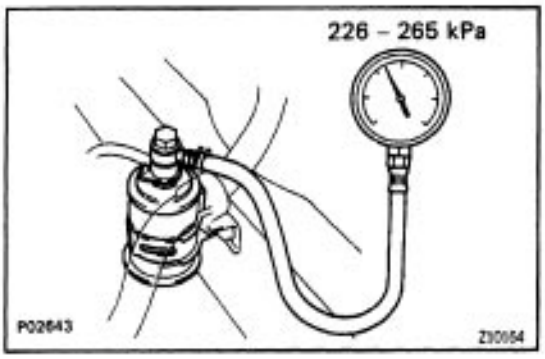

(k) Start the engine.
(l) Disconnect the vacuum sensing hose from the fuel pressure regulator, and plug the hose end.



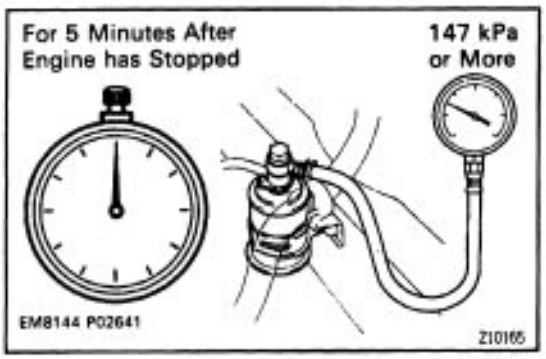

(m) Measure the fuel pressure at idle.
**Fuel pressure:**
**265 – 304 kPa (2.7 – 3.1 kgf/cm$^2$, 39 – 44 psi)**




(n) Reconnect the vacuum sensing hose to the fuel pressure regulator.

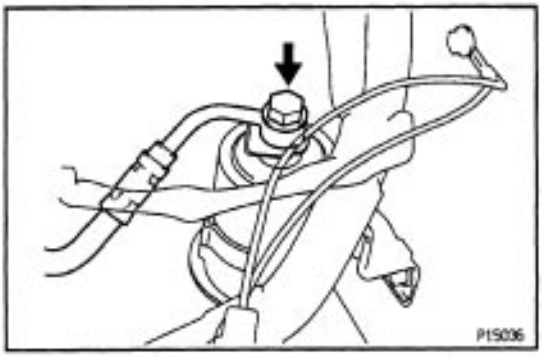



(o) Measure the fuel pressure at idle.
**Fuel pressure:**
**226 – 265 kPa (2.3 – 2.7 kgf/cm$^2$, 33 – 38 psi)**
If pressure is not as specified, check the vacuum sensing hose and fuel pressure regulator.

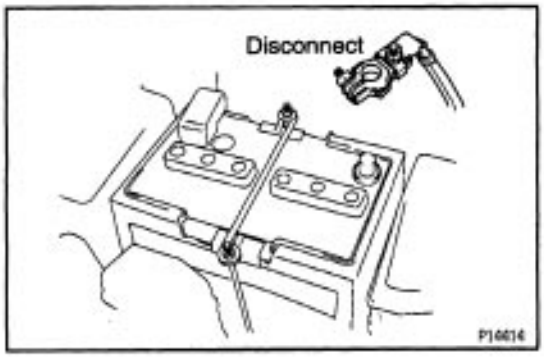



(p) Stop the engine.
(q) Check that the fuel pressure remains as specified for 5 minutes after the engine has stopped.
**Fuel pressure:**
**147 kPa (1.5 kgf/cm$^2$, 21 psi) or more**
If pressure is not as specified, check the fuel pump, pressure regulator and/or injectors.

(r) After checking fuel pressure, disconnect the negative (–) terminal cable from the battery and carefully remove the SST to prevent gasoline from splashing.
SST 09268–45012

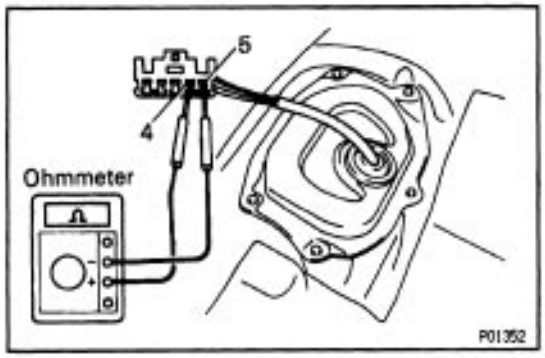



(s) Connect the fuel inlet hose with 2 new gaskets and the union bolt.
Torque: 29 N–m (300 kgf–cm, 22 ft–lbf)
(t) Reconnect the negative (–) terminal cable to the battery.
(u) Check for fuel leakage.
(See page EG2–228)

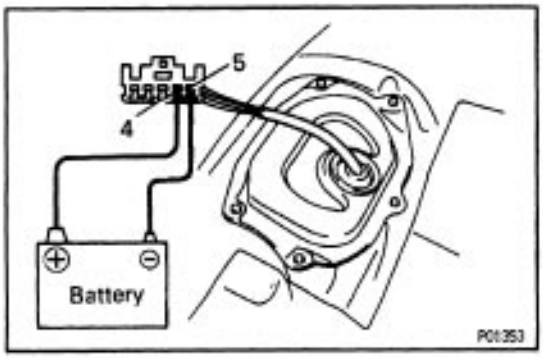



# FUEL PUMP INSPECTION

**1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY**
**CAUTION: Work must be started after 90 seconds from the time the ignition switch is turned to the "LOCK" position and the negative (–) terminal cable is disconnected from the battery.**
**2. REMOVE REAR SEAT CUSHION**



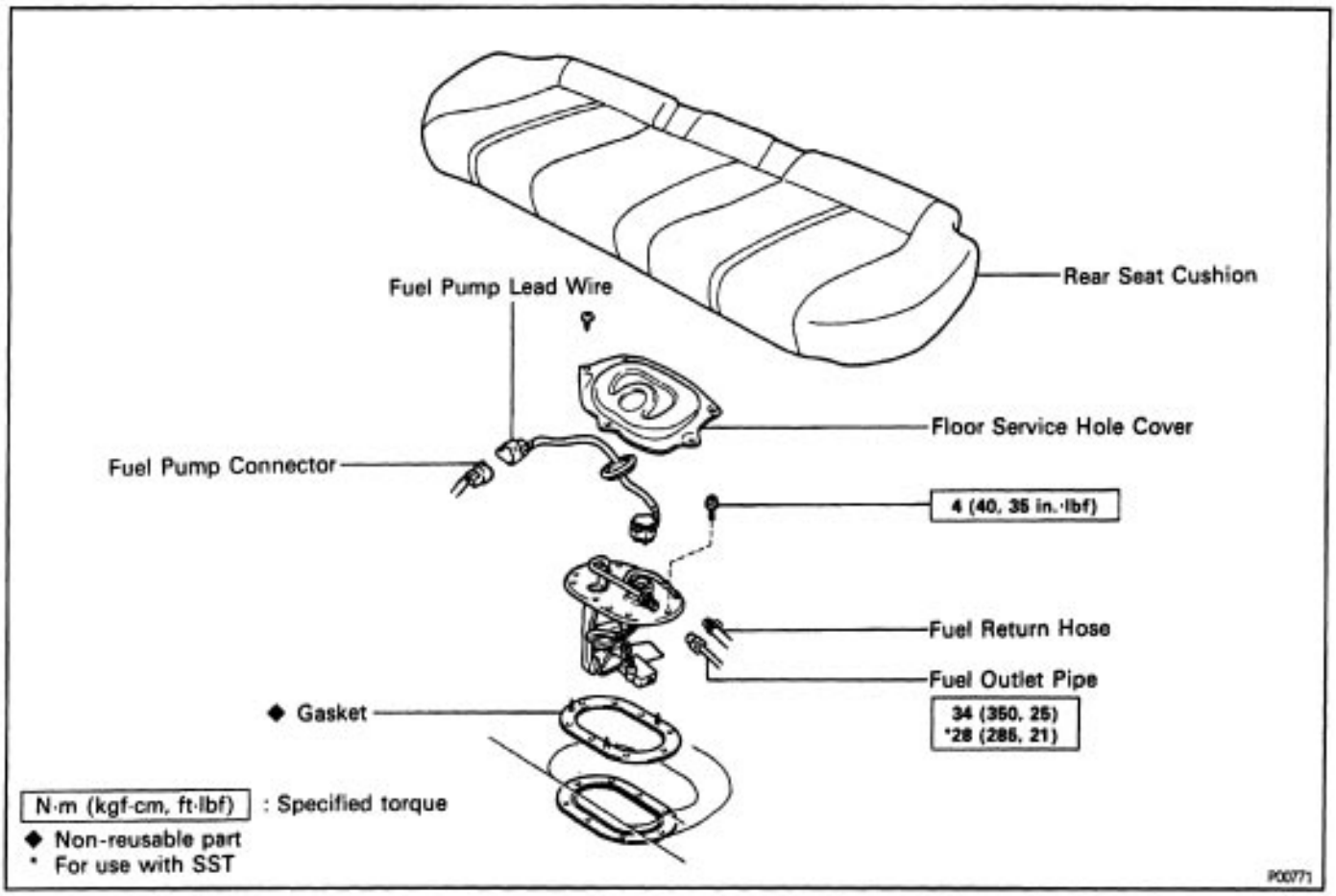

**3. INSPECT FUEL PUMP**
**A. Inspect fuel pump resistance**
Using an ohmmeter, measure the resistance between terminals 4 and 5.
**Resistance:**
**0.2–3.0 at 20°C (68°F)**
If the resistance is not as specified, replace the fuel pump.




**B. Inspect fuel pump operation**
Connect the positive (+) lead from the battery to terminal 4 of the connector, and the negative (–) lead to terminal
5. Check that the fuel pump operates.
**NOTICE:**
- **These tests must be performed quickly (within 10 seconds) to prevent the coil burning out.**
- **Keep the fuel pump as far away from the battery as possible.**
- **Always perform switching at the battery side.**

If operation is not as specified, replace the fuel pump or lead wire.
**4. REINSTALL REAR SEAT CUSHION**
**5. RECONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY**

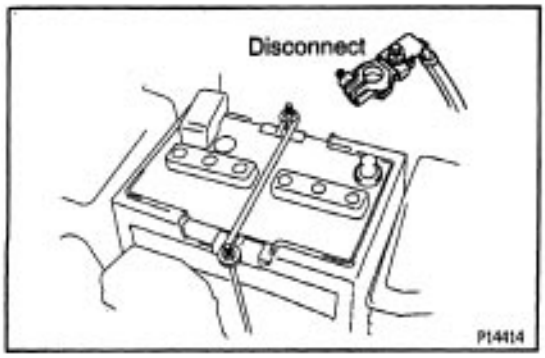
# COMPONENTS FOR REMOVAL AND INSTALLATION




## FUEL PUMP REMOVAL

**(See Components for Removal and Installation)**

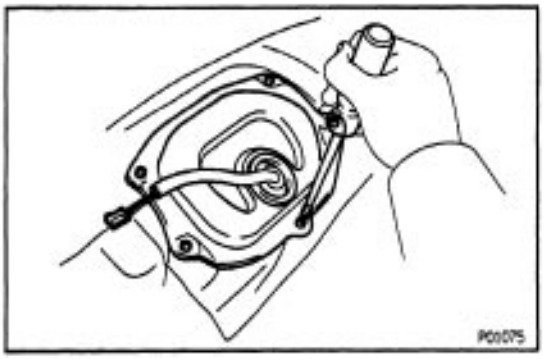
**CAUTION: Do not smoke or work near an open flame when working on the fuel pump.**




**1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY**

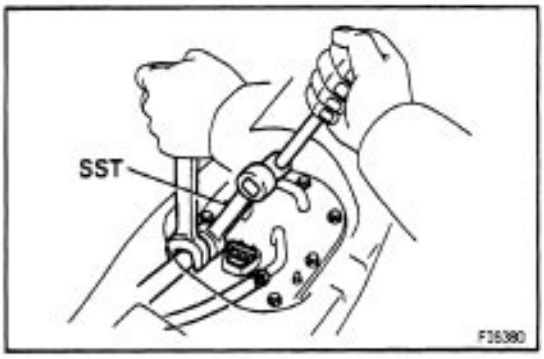
**CAUTION: Work must be started after 90 seconds from the time the ignition switch is turned to the 'LOCK' position and the negative (–) terminal cable is discon–nected from the battery.**

**2. REMOVE REAR SEAT CUSHION**

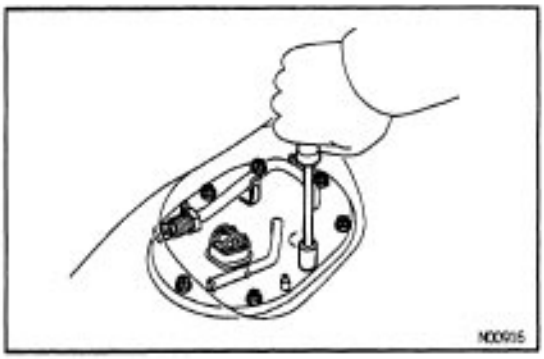


**3. REMOVE FLOOR SERVICE HOLE COVER**
(a) Disconnect the fuel pump connector.
(b) Remove the 5 screws and service hole cover.

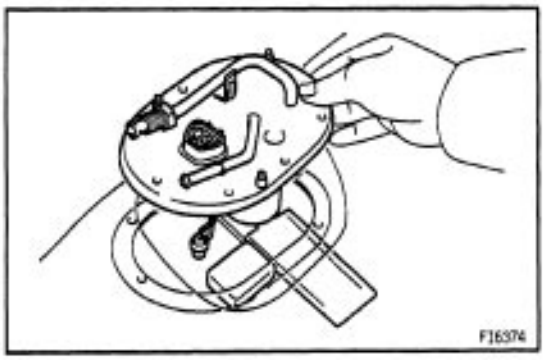
**4. REMOVE FUEL PUMP LEAD WIRE**
**NOTICE: Do not lift the fuel pump up with the wire harness picking.**




**5. DISCONNECT FUEL PIPE AND HOSE FROM FUEL PUMP BRACKET**
**CAUTION: Remove the fuel filter cap to prevent the fuel from flowing out.**
(a) Using SST, disconnect the outlet pipe from the pump bracket.
SST 09631– 22020
(b) Disconnect the return hose from the pump bracket.

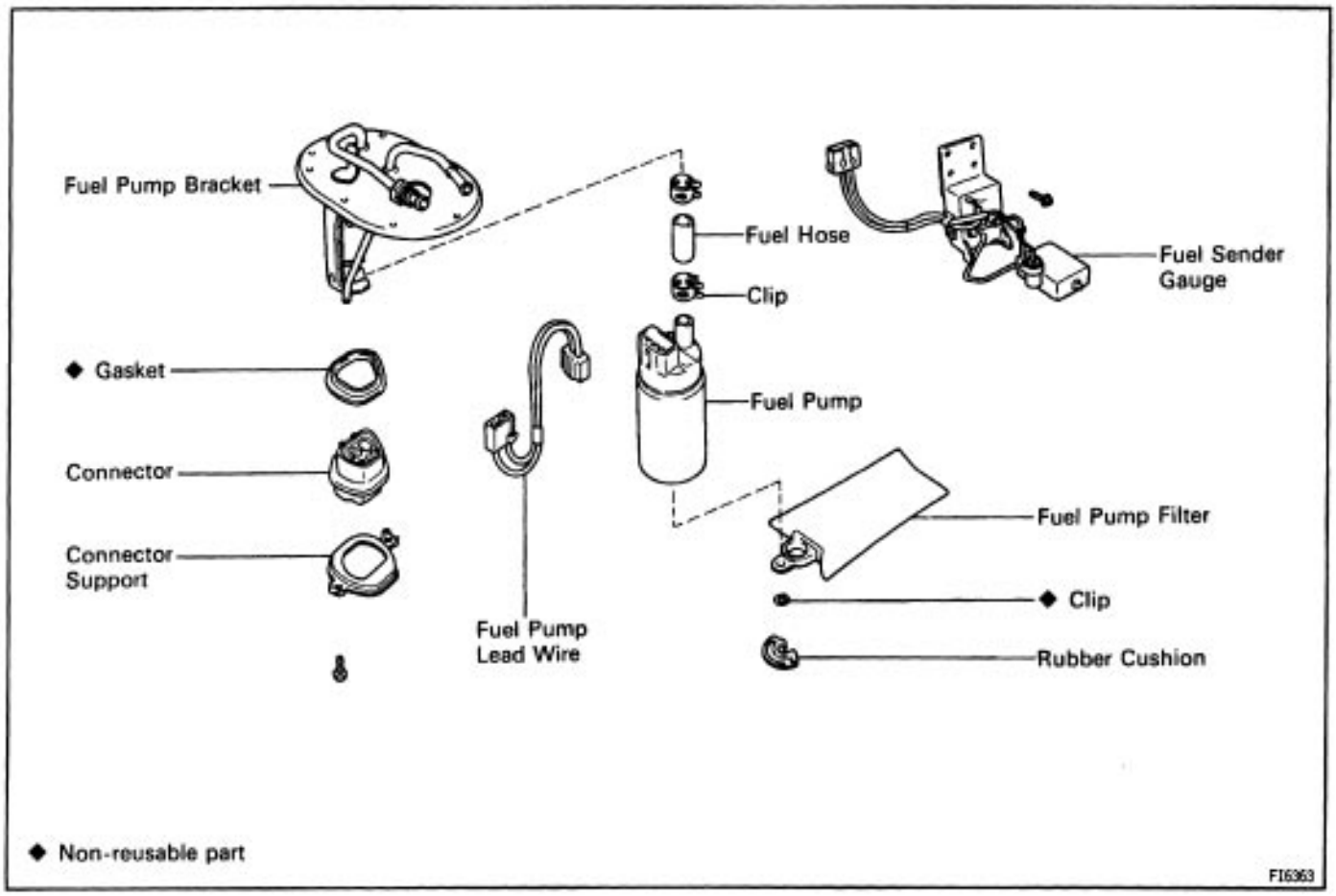


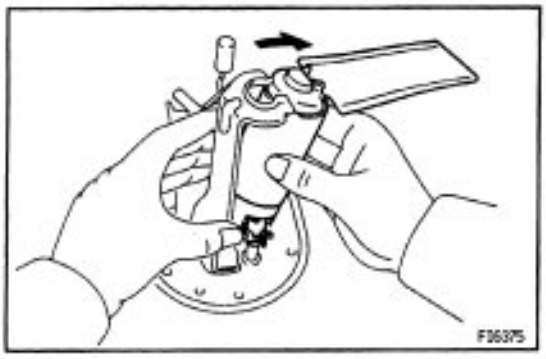
**6. REMOVE FUEL PUMP BRACKET ASSEMBLY FROM FUEL TANK**
(a) Remove the 8 bolts.

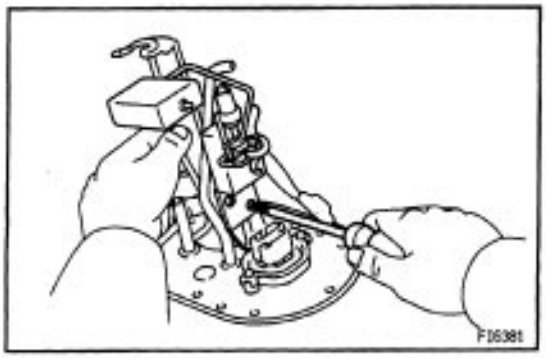


(b) Pull out the pump bracket assembly.
(c) Remove the gasket from the pump bracket.

# COMPONENTS FOR DISASSEMBLY AND ASSEMBLY




## FUEL PUMP DISASSEMBLY

**(See Components for Disassembly and Assembly)**

**1. REMOVE FUEL PUMP FROM FUEL PUMP BRACKET**

(a) Remove the fuel pump lead wire.

(b) Pull off the lower side of the fuel pump from the pump bracket.

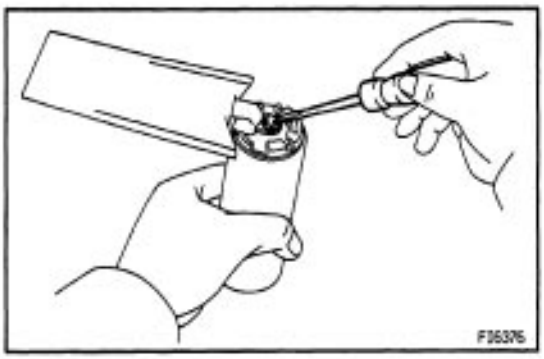
(c) Disconnect the fuel hose from the fuel pump, and remove the fuel pump.

(d) Remove the rubber cushion from the fuel pump.

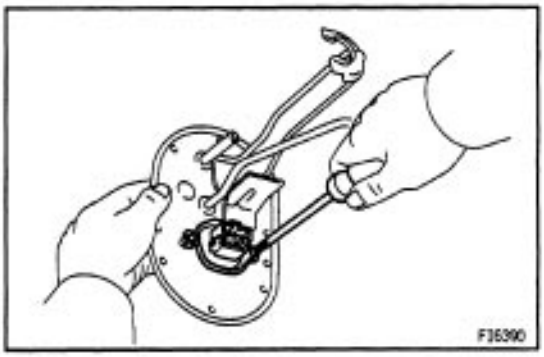
**2. REMOVE FUEL SENDER GAUGE FROM FUEL PUMP BRACKET**

(a) Disconnect the fuel sender gauge connector.

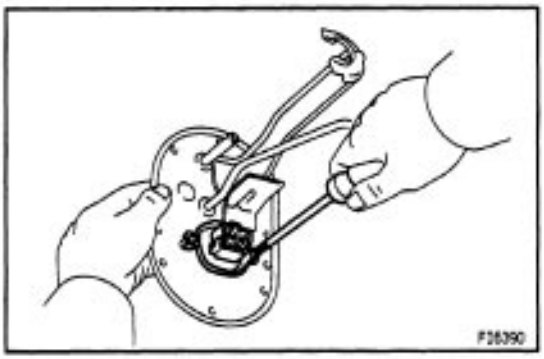
(b) Remove the 2 screws and sender gauge.




**3. REMOVE FUEL PUMP FILTER FROM FUEL PUMP**
(a) Using a small screwdriver, remove the clip.
(b) Pull out the pump filter.




**4. REMOVE CONNECTOR**
Remove the 2 screws, connector support, connector and gasket.

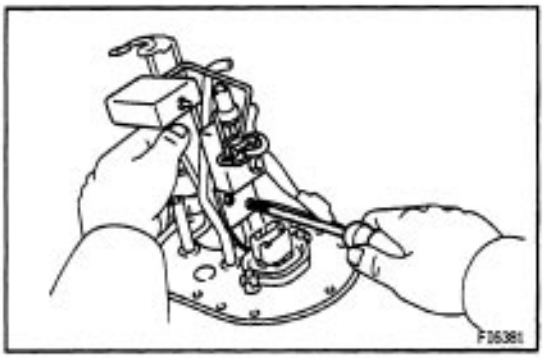



# FUEL PUMP ASSEMBLY

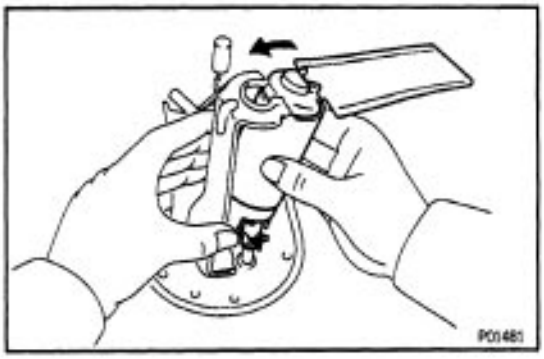
**(See Components for Disassembly and Assembly)**

**1. INSTALL CONNECTOR**
Install new gasket, the connector and connector support with the 2 screws.

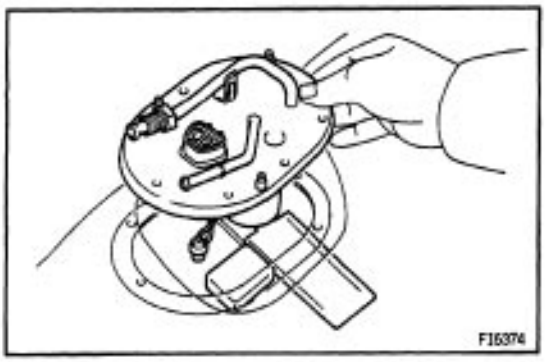
**2. INSTALL FUEL PUMP FILTER TO FUEL PUMP**
Install the pump filter with a new clip.




**3. INSTALL FUEL SENDER GAUGE TO FUEL PUMP BRACKET**
(a) Install the sender gauge with the 2 screws.
(b) Connect the fuel sender gauge connector.




**4. INSTALL FUEL PUMP TO FUEL PUMP BRACKET**
(a) Install the rubber cushion to the fuel pump.
(b) Connect the fuel hose to the outlet port of the fuel pump.
(c) Install the fuel pump by pushing the lower side of the fuel pump.
(d) Install the fuel pump connector.




# FUEL PUMP INSTALLATION

**(See Components for Removal and Installation)**

**1. INSTALL FUEL PUMP BRACKET ASSEMBLY TO FUEL TANK**

(a) Install a new gasket to the pump bracket.

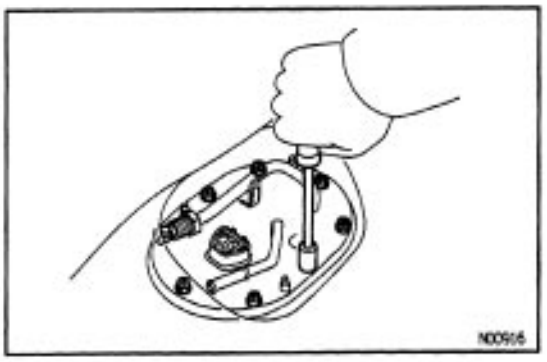
(b) Insert the pump bracket assembly into the fuel tank.

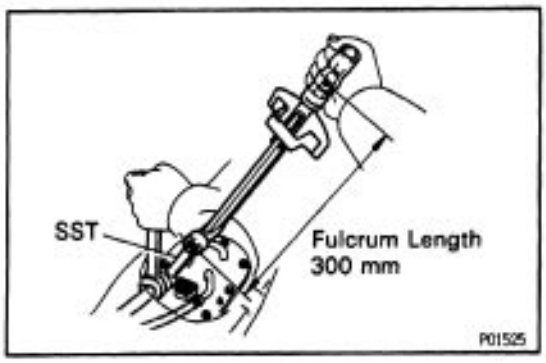
**NOTICE:**

- **Do not damage the fuel pump filter.**
- **Be careful that the arm of the sender gauge should not bent.**

(c) Install the pump bracket with the 8 screws.

**Torque: 4 N–m (40 kgf–cm, 35 in.–lbf)**






**2. CONNECT FUEL PIPE AND HOSE TO FUEL PUMP BRACKET**

(a) Using SST, connect the outlet pipe to the pump bracket.

SST 09631– 22020

**Torque: 28 N–m (285 kgf–cm, 21 ft–lbf) for use with SST**

(b) Connect the return hoses to the pump bracket.

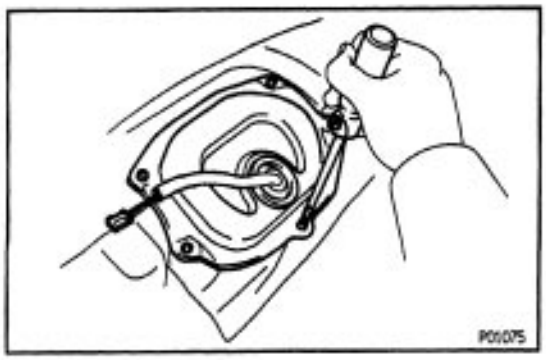
**3. CONNECT FUEL PUMP LEAD WIRE**

**4. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY**

**6. CHECK FOR FUEL LEAKAGE**

**(See page** EG2–228**)**

Connect the fuel pump (with fuel sender gauge) con–nector.

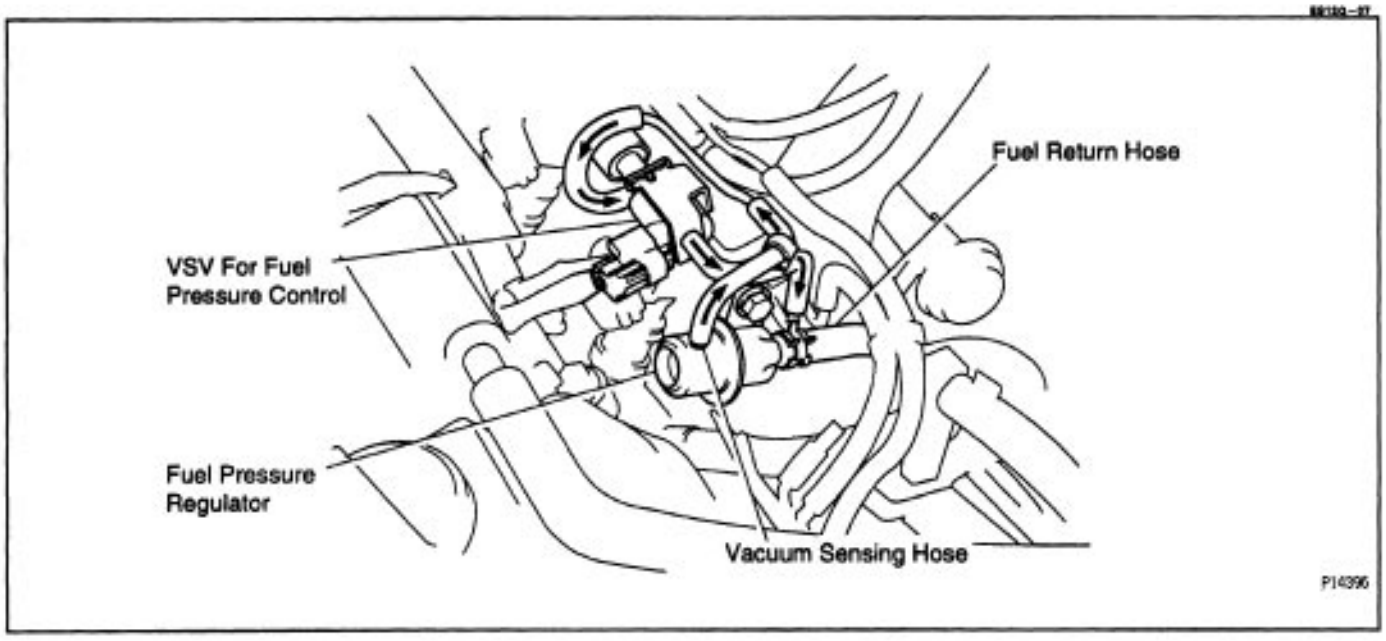



**6. INSTALL FLOOR SERVICE HOLE COVER**

Install the service hole cover with the 5 screws.

**7. INSTALL REAR SEAT CUSHION**

# FUEL PRESSURE REGULATOR

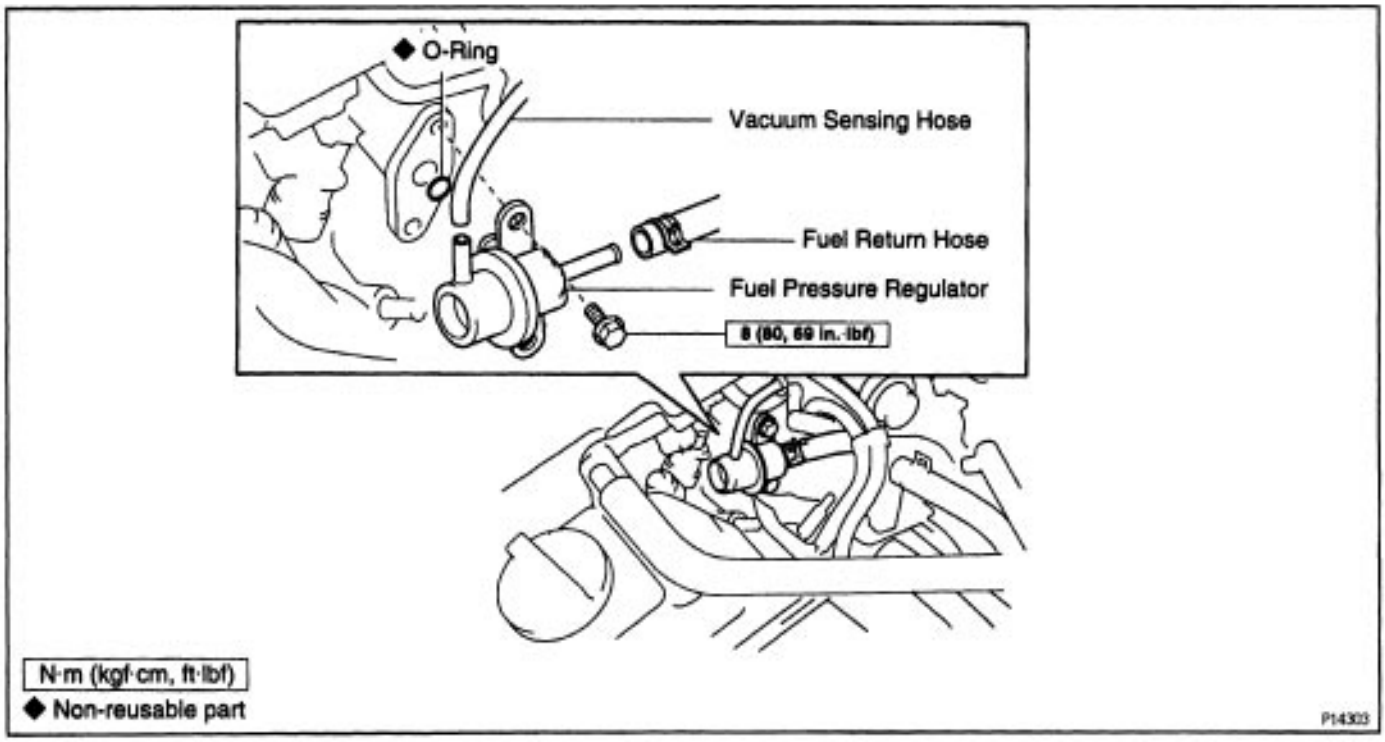


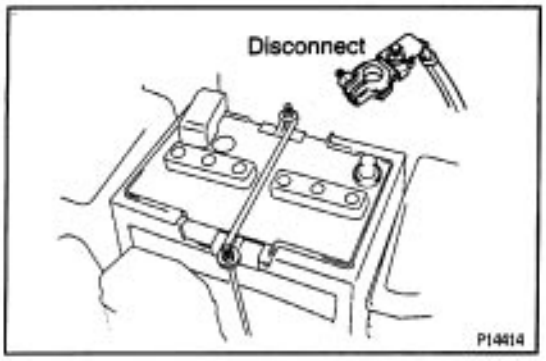

## ON–VEHICLE INSPECTION

**CHECK FUEL PRESSURE**

**(See page** EG2–231**)**

## COMPONENTS FOR REMOVAL AND INSTALLATION



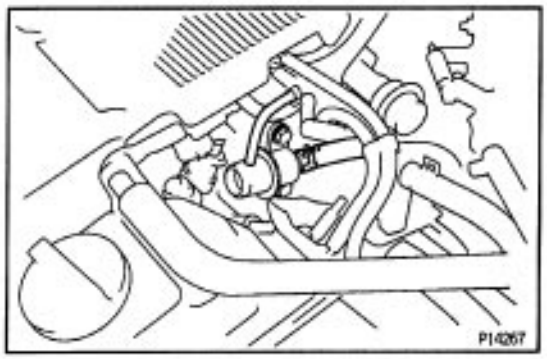



## FUEL PRESSURE REGULATOR REMOVAL

**(See Components for Removal and Installation)**

**1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY**

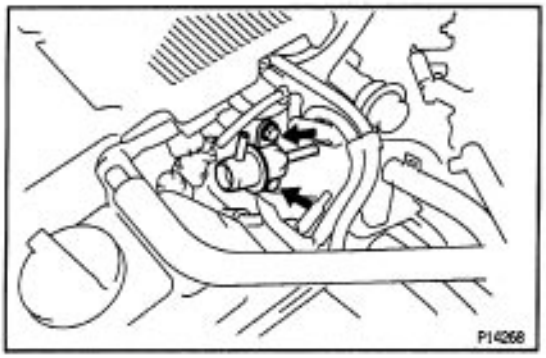
**CAUTION: Work must be started after 90 seconds from the time the ignition switch is turned to the 'LOCK' position and the negative (–) terminal cable is disconnected from the battery.**




**2. DISCONNECT VACUUM SENSING HOSE FROM FUEL PRESSURE REGULATOR**

**3. DISCONNECT FUEL RETURN HOSE FROM FUEL PRESSURE REGULATOR**

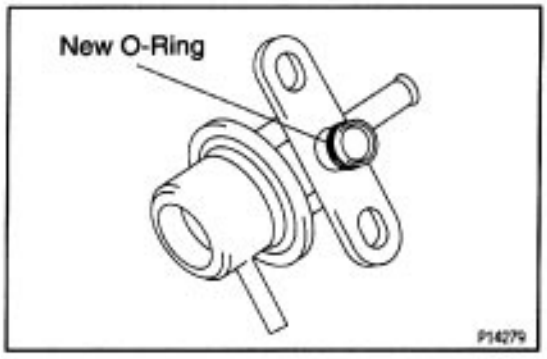
**CAUTION: Put a shop rag under the pressure regulator.**




**4. REMOVE FUEL PRESSURE REGULATOR**

(a) Remove the 2 bolts, and pull out the pressure regulator.

(b) Remove the 0–ring from the pressure regulator.



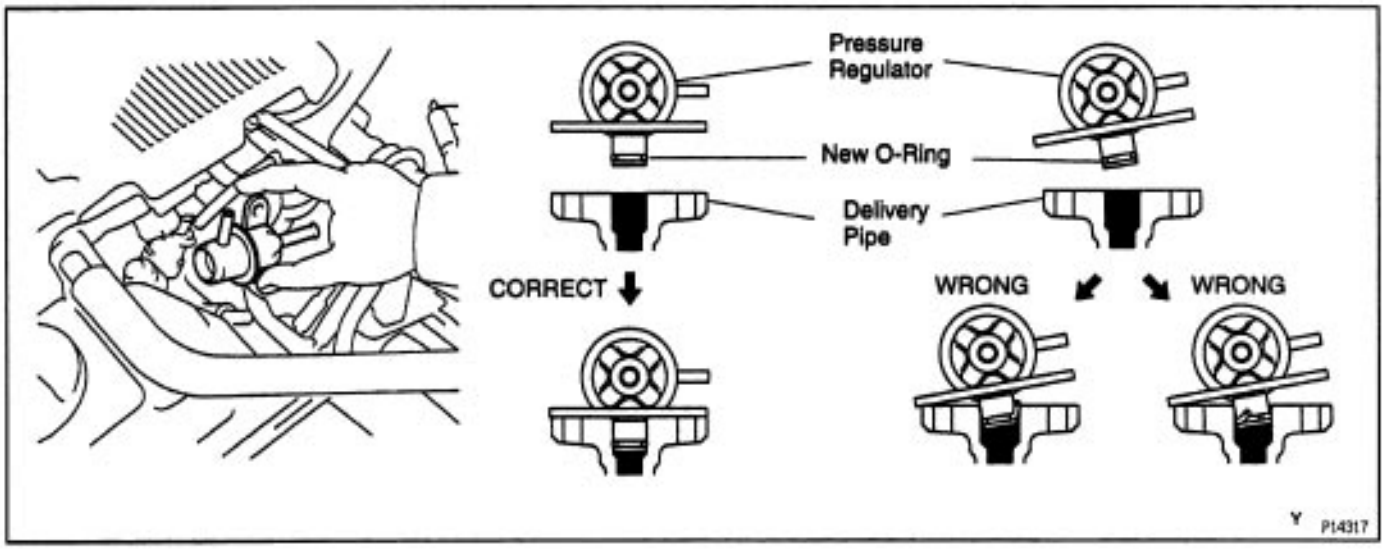

## FUEL PRESSURE REGULATOR INSTALLATION

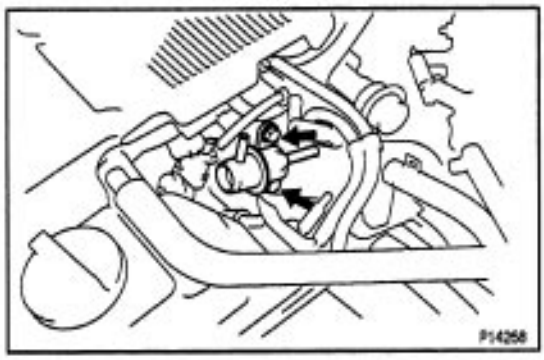
**(See Components for Removal and Installation)**

**1. INSTALL FUEL PRESSURE REGULATOR**

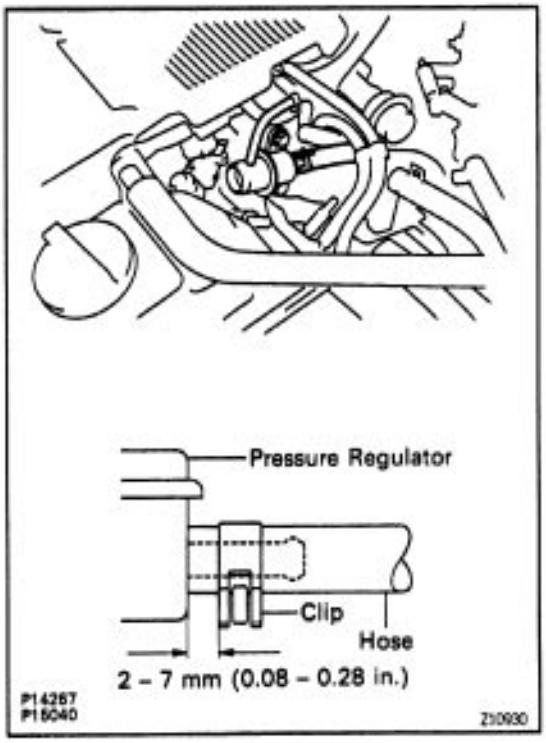
(a) Apply a light coat of gasoline to a new 0–ring, and install it to the pressure regulator.

(b) Attach the pressure regulator to the delivery pipe.
(c) Check that the pressure regulator rotates smoothly.
**NOTICE: If it does not rotate smoothly, the O–ring may be pinched, so remove the pressure regulator and repeat steps (a) to (e) above.**



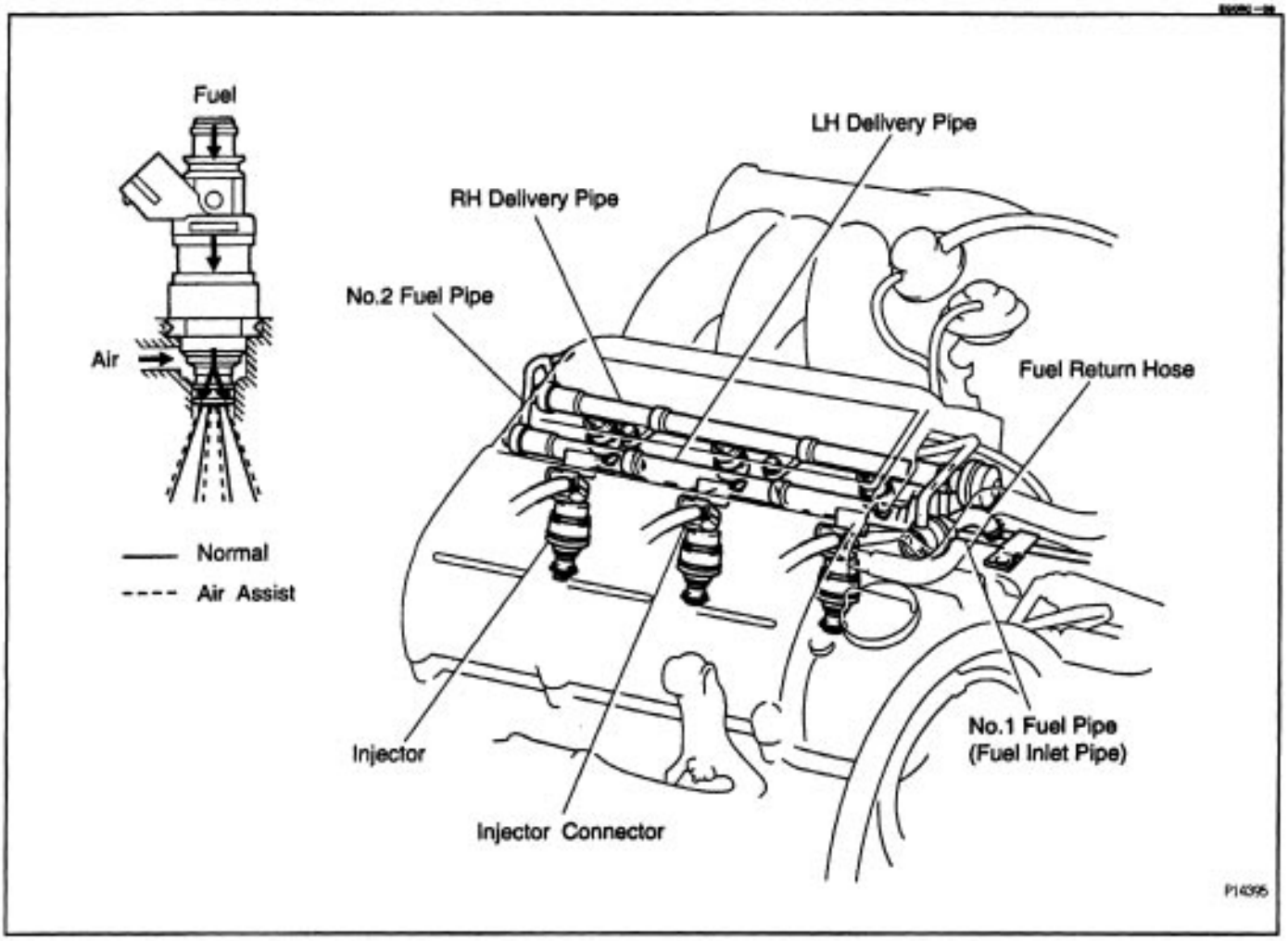



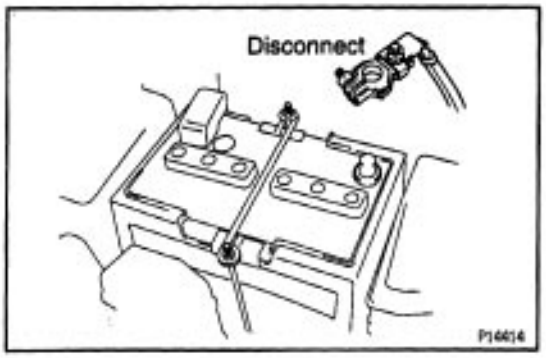

(d) Install the pressure regulator with the 2 bolts.
**Torque: 8 N–m (80 kgf–cm, 69 in.–lbf)**




**2. CONNECT FUEL RETURN HOSE TO FUEL PRES–SURE REGULATOR**
**NOTICE: Be sure insert the hose up to the stopper and clip It.**
**3. CONNECT VACUUM SENSING HOSE TO FUEL PRESSURE REGULATOR**
**4. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY**
**5. CHECK FOR FUEL LEAKS**
**(See page EC–228)**

# INJECTOR

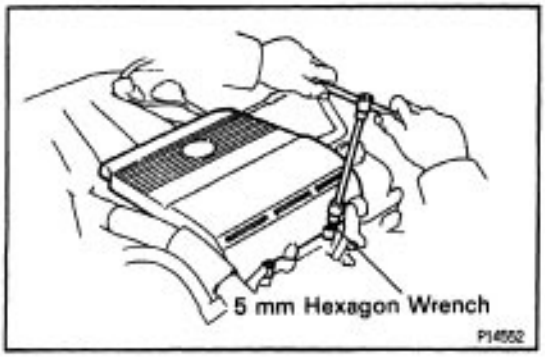



## ON–VEHICLE INSPECTION

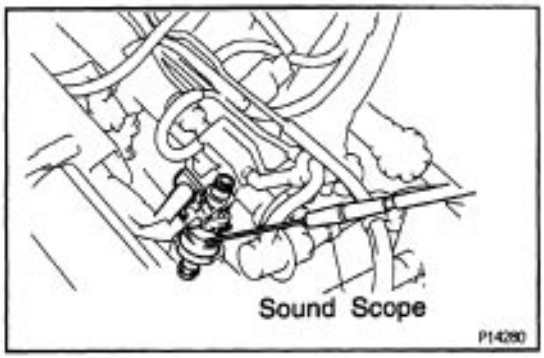
**1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY**

**CAUTION: Work must be started after 90 seconds from the time the ignition switch is turned to the 'LOCK' position and the negative (–) terminal cable is disconnected from the battery.**




**2. REMOVE V–BANK COVER**

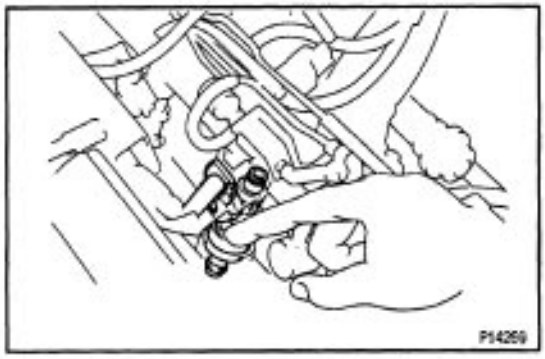
Using a 5 mm hexagon wrench, remove the 2 cap nuts and V–bank cover.




**3. INSPECT INJECTOR OPERATION**

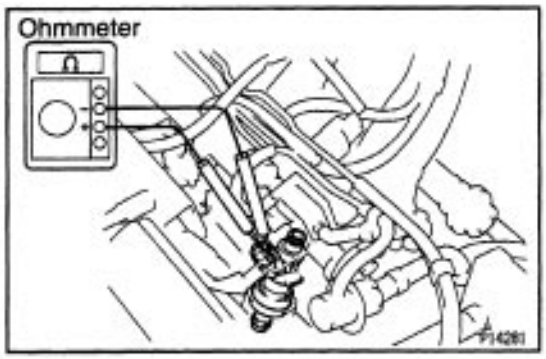
Check operation sound from each injector.

(a) With the engine running or cranking, use a sound scope to check that there is normal operating noise in proportion to engine speed.




(b) If you have no sound scope, you can check the injector operating vibration with your finger.

If no sound or unusual sound is heard, check the wiring connector, injector or injection signal from the ECM.




**4. INSPECT INJECTOR RESISTANCE**

(a) Disconnect the injector connector.

(b) Using an ohmmeter, measure the resistance between the terminals.

**Resistance:**

**Approx. 13.8 at 20˚ C (68˚ F)**

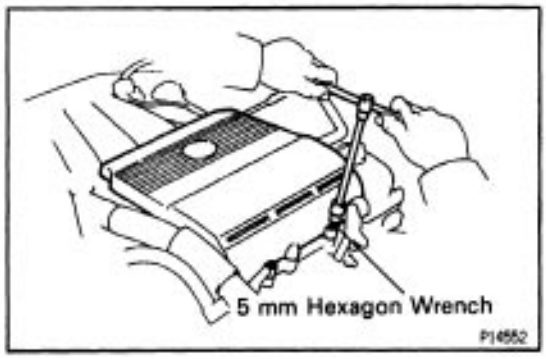
If the resistance is not as specified, replace the injector.

(c) Reconnect the injector connector.

**5. REINSTALL V–BANK COVER**

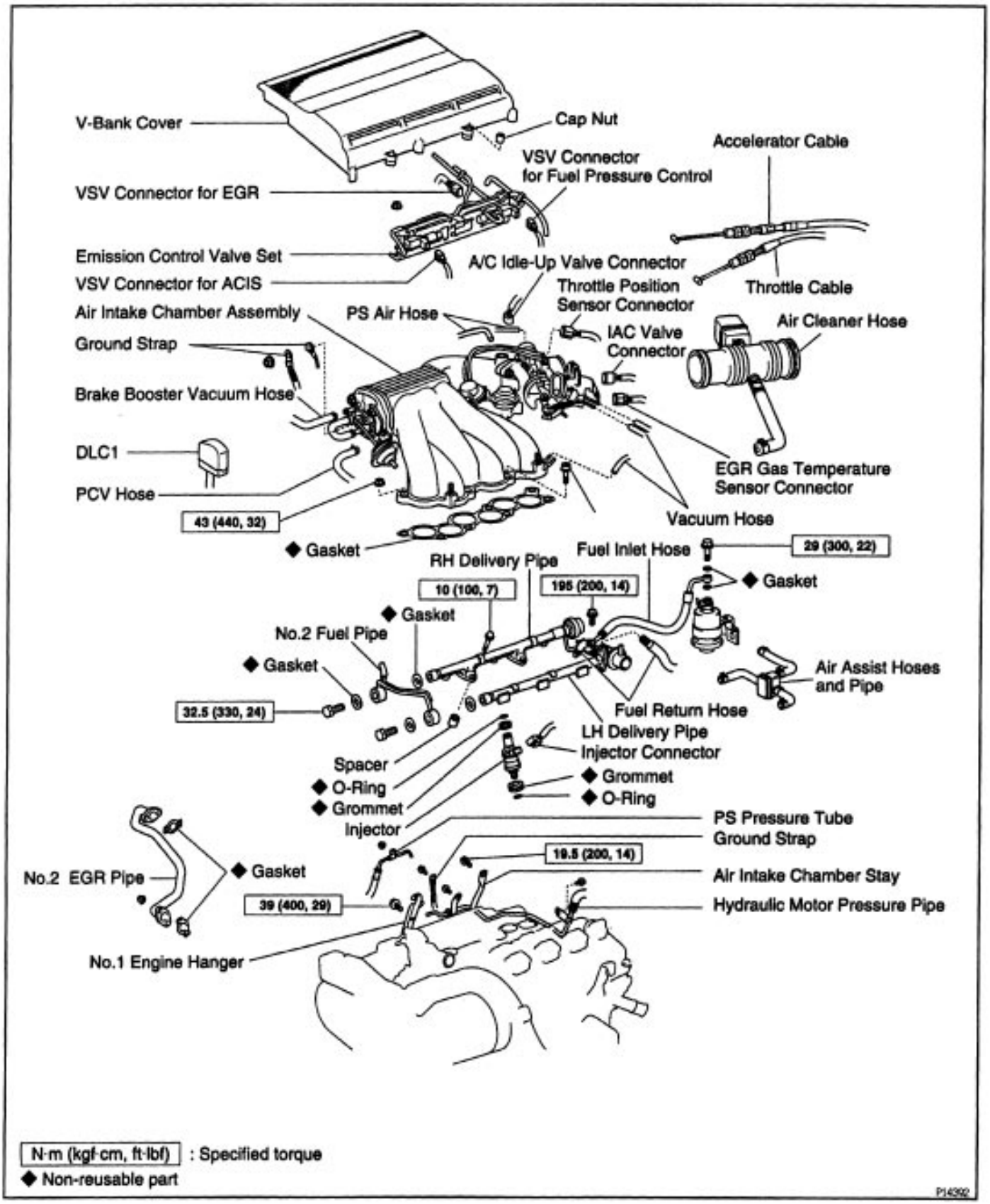
Using a 5 mm hexagon wrench, install the V–bank cover with the 2 cap nuts.

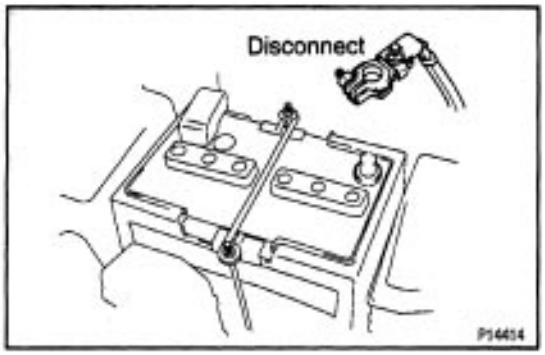
HINT: For fixing the V–bank cover, push on the cover until sense of ”click” is felt.




**6. RECONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY**

# COMPONENTS FOR REMOVAL AND INSTALLATION






# INJECTORS REMOVAL

**(See Components for Removal and Installation)**

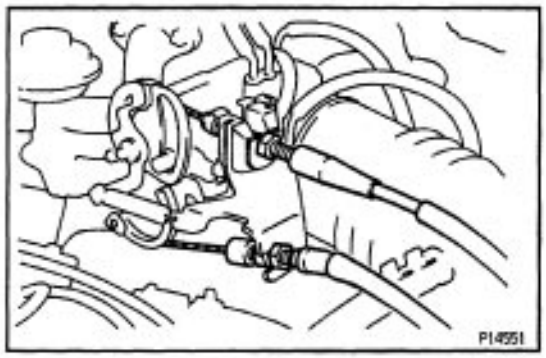
**1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY**

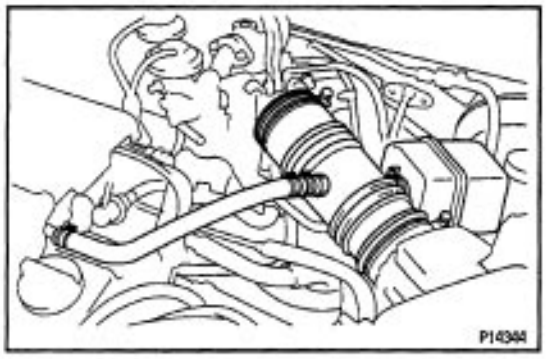
**CAUTION: Work must be started after 90 seconds from the time the Ignition switch is turned to the 'LOCK' position and the negative (–) terminal cable is disconnected from the battery.**

**2. DRAIN ENGINE COOLANT**

**3. DISCONNECT ACCELERATOR CABLE**

**4. DISCONNECT THROTTLE CABLE**

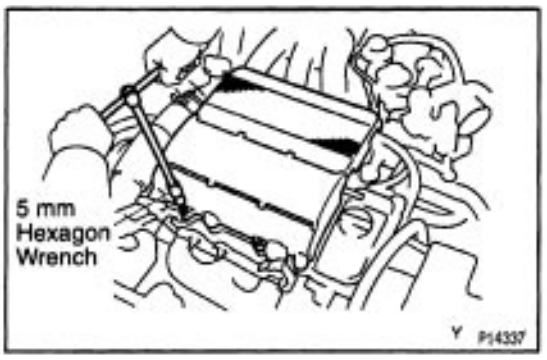



**6. REMOVE AIR CLEANER HOSE**

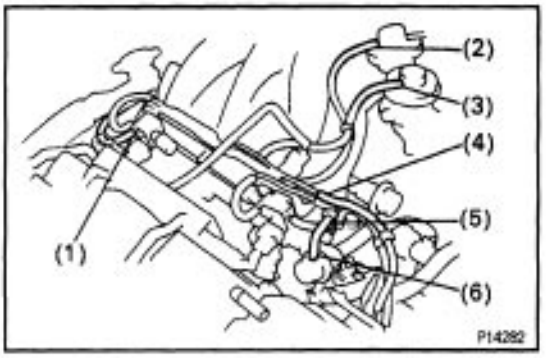
(a) Disconnect the PCV hose.

(b) Loosen the 2 hose clamps, and remove the air cleaner hose.




**6. REMOVE V–SANK COVER**

Using a 5 mm hexagon wrench, remove the 2 cap nuts and v–bank cover.




**7. REMOVE EMISSION CONTROL VALVE SET**

(a) Disconnect the following vacuum hoses:

(1) Vacuum hose from VSV for ACIS

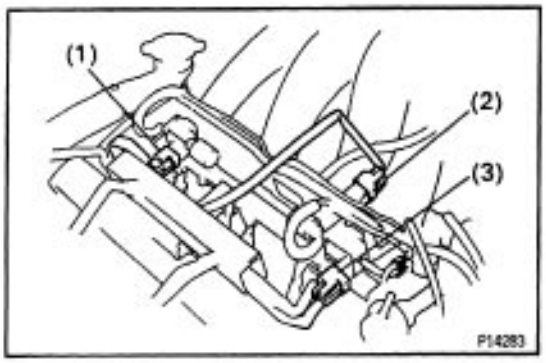
(2) Vacuum hose from EGR vacuum modulator

(3) Vacuum hose from EGR valve

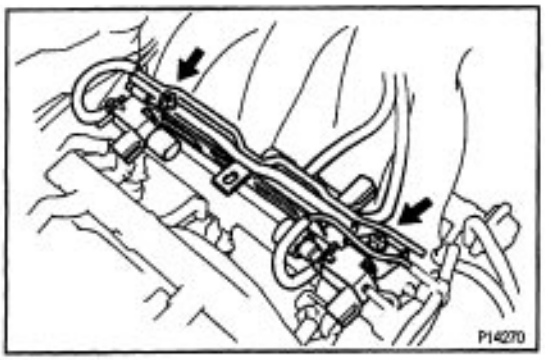
(4) Vacuum hose (from cylinder head rear plate)

(5) Vacuum hose from air intake chamber

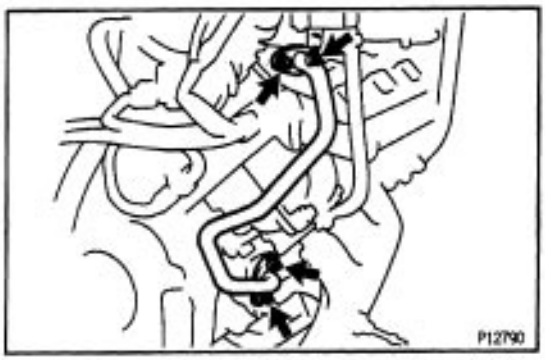
(6) Vacuum hose from fuel pressure regulator



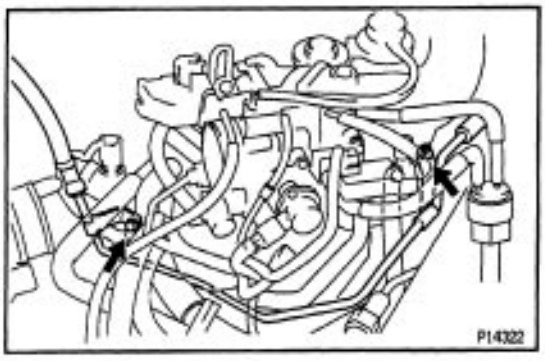

(b) Disconnect the following connectors:
(1) VSV connector for ACIS
(2) VSV connector for EGR
(3) VSV connector for fuel pressure control



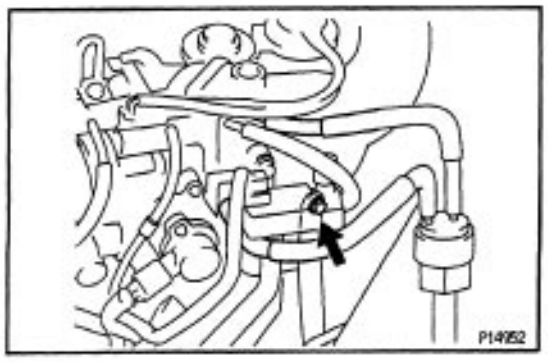

(c) Remove the 2 nuts and emission control valve set.



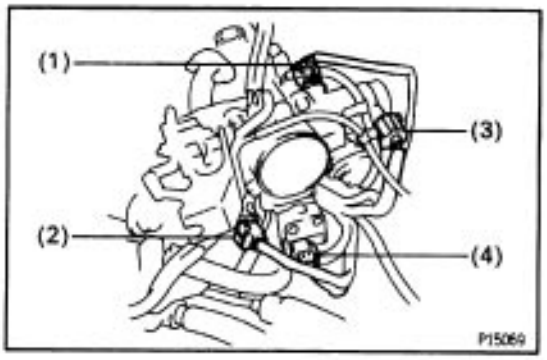

**8. REMOVE No.2 EGR PIPE**
Remove the 4 nuts, EGR pipe and 2 gaskets.



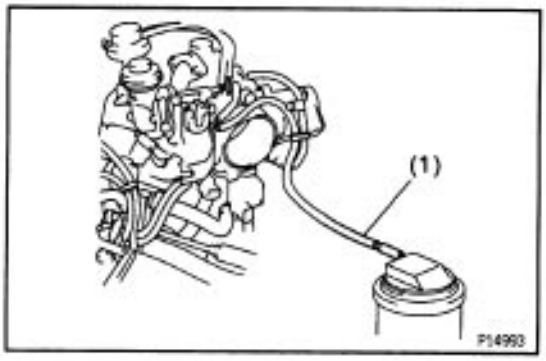

**9. DISCONNECT HYDRAULIC MOTOR PRESSURE PIPE**
Remove the 2 bolts, and disconnect the pressure pipe from the water inlet and air intake chamber.



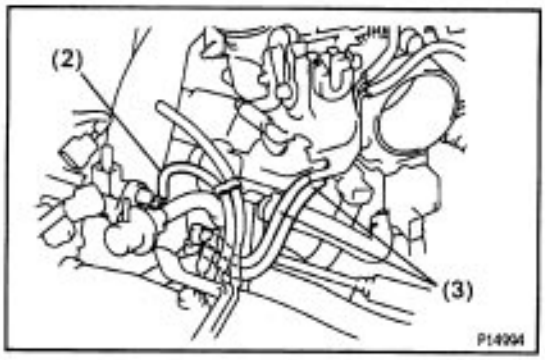

**10. REMOVE AIR INTAKE CHAMBER ASSEMBLY**
(a) Disconnect the 2 PS air hoses.
(b) Remove the bolt holding the air intake chamber stay to the air intake chamber.



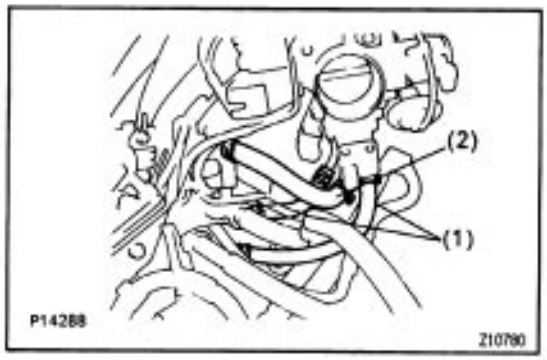

(c) Disconnect the following connectors:
(1) A/C idle–up valve connector
(2) EGR gas temperature sensor connector
(3) Throttle position sensor connector
(4) IAC valve connector



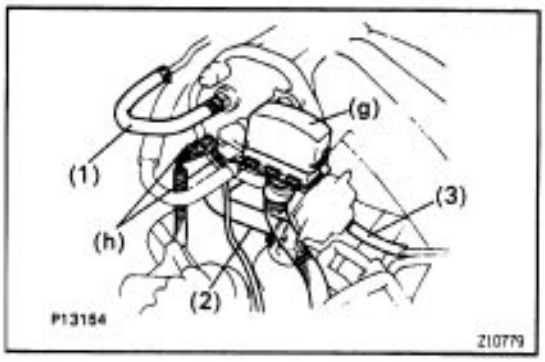

(d) Disconnect the following vacuum hoses:
(1) Vacuum hose from charcoal canister



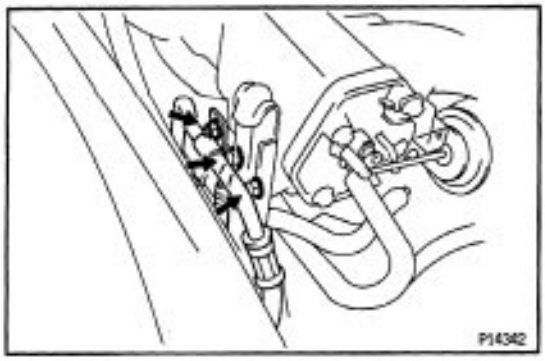

(2) Vacuum hose from air intake chamber
(3) 2 vacuum hoses from throttle body



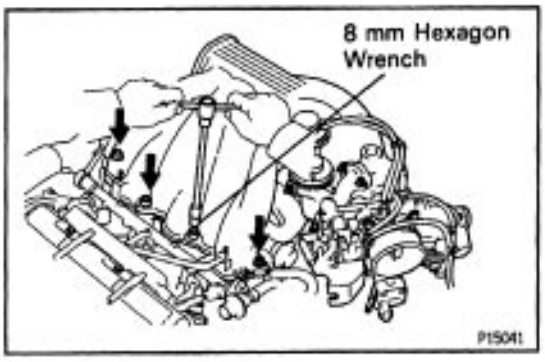

(e) Disconnect the following hoses:
(1) 2 water bypass hoses from throttle body
(2) Air assist hose from throttle body



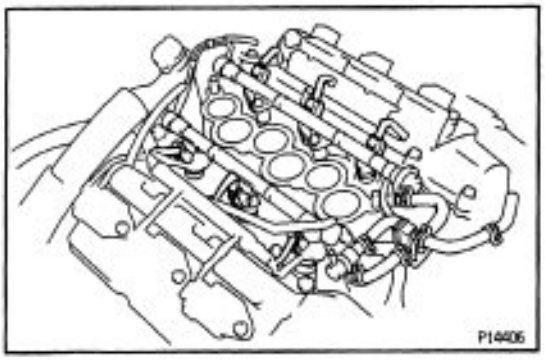

(f) Disconnect the following hoses:
(1) Brake booster vacuum hose
(2) PCV hose
(3) Actuator vacuum hose
(g) Disconnect the DLC1.
(h) Remove the nut and disconnect the 2 ground straps.



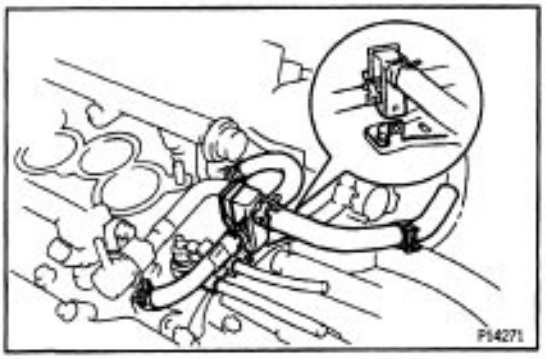

(i) Remove the nut and disconnect the PS pressure tube.
(j) Remove the bolt holding the No.1 engine hanger to the air intake chamber.
(k) Remove the bolt, and disconnect the ground strap.



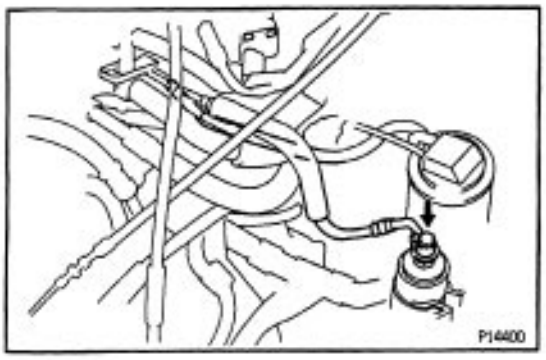

Using a 8 mm hexagon wrench, remove the 2 bolts, 2 nuts, air intake chamber assembly and gasket.



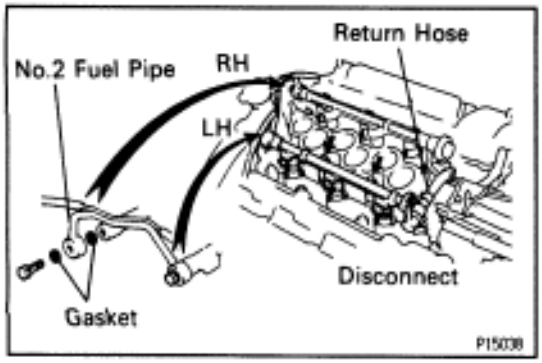

**11. DISCONNECT INJECTOR CONNECTORS**




**12. REMOVE AIR ASSIST HOSES AND PIPE**
(a) Disconnect the air assit pipe from the bracket on the No.1 fuel pipe.
(b) Remove the air assist hoses from the intake manifold.




**13. DISCONNECT FUEL INLET AND RETURN HOSES**
(a) Disconnect the fuel return hose from the No.1 fuel pipe.
(b) Disconnect the fuel inlet hose from the fuel filter.
**CAUTION: Catch leaking fuel in a container.**




**14. REMOVE DELIVERY PIPES AND INJECTORS**

**NOTICE: Be careful not to drop the injectors when removing the delivery pipes.**

(a) Loosen the 2 union bolts holding the No.2 fuel pipe to the delivery pipes.

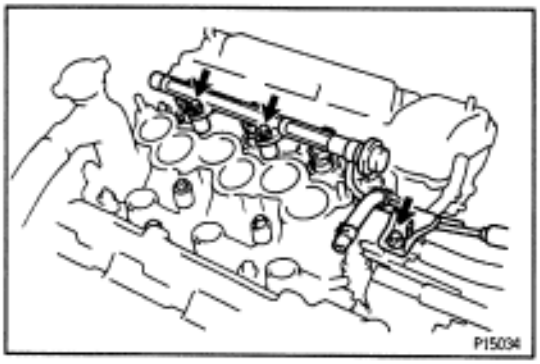
(b) Disconnect the fuel return hose from the fuel pressure regulator.

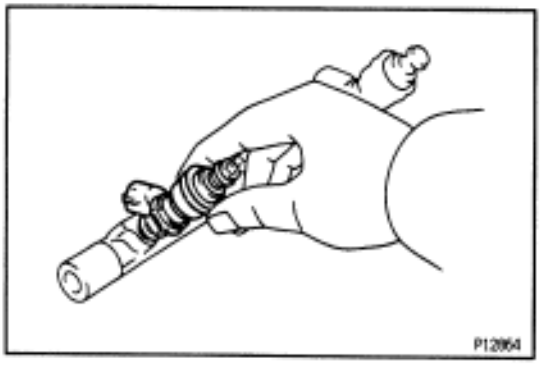
(c) Remove the union bolt for the RH delivery pipe, 2 gaskets, 2 bolts, LH delivery pipe together with the 3 injectors and No.2 fuel pipe.

(d) Remove the union bolt for the LH delivery pipe and 2 gaskets from the No.2 fuel pipe.

(e) Remove the 3 bolts, RH delivery pipe together with the 3 injectors and No.1 fuel pipe.

(f) Remove the 4 spacers from the intake manifold.



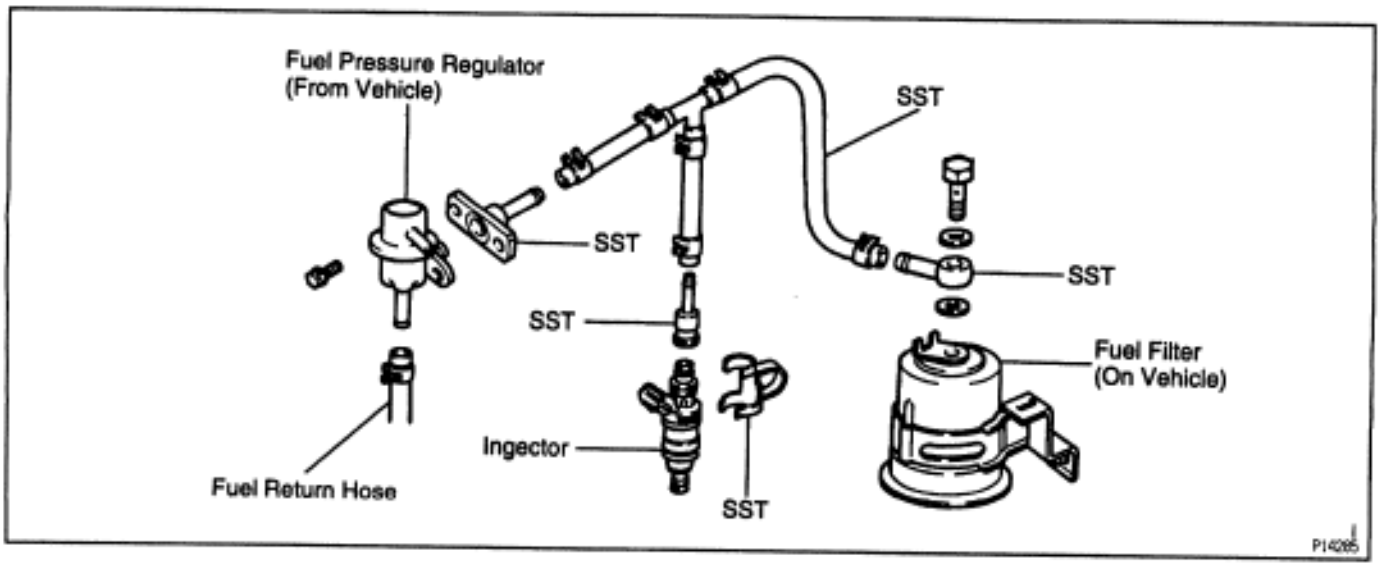

(g) Pull out the 6 injectors from the delivery pipes.

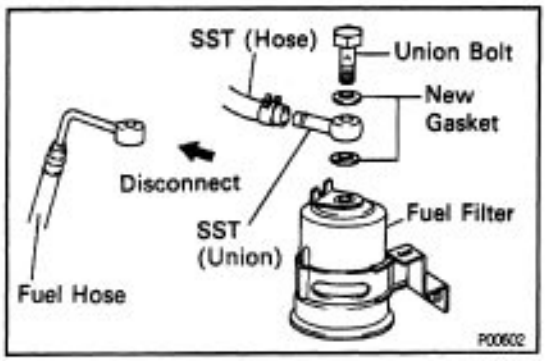
(h) Remove the 2 0 – rings and 2 grommets from each injector.

## INJECTORS INSPECTION

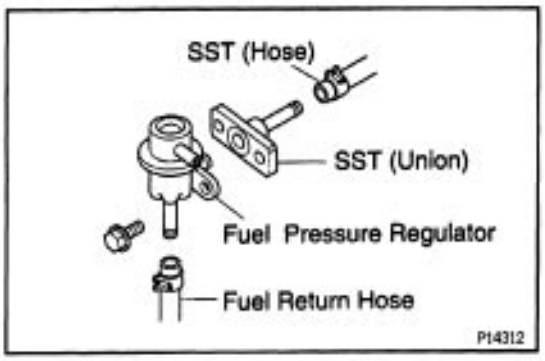
**1. INSPECT INJECTOR INJECTION**

**CAUTION: Keep injector clear of sparks during the test.**

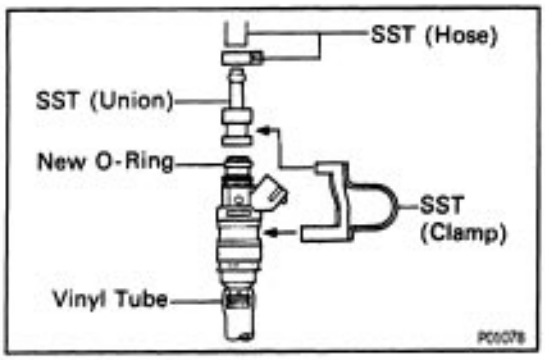




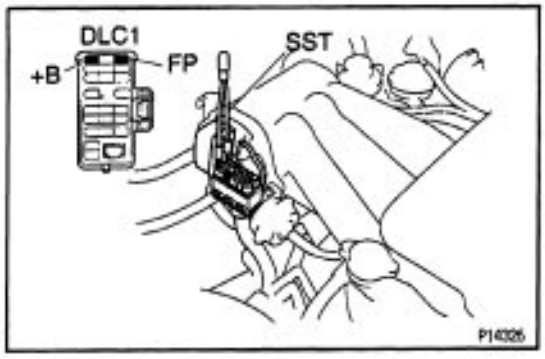

(a) Disconnect the fuel hose from the fuel filter outlet.
(b) Connect SST (union an hose) to the fuel filter outlet with 2 new gaskets and the union bolt.
SST 09268–41045 (90405–09015)
HINT: Use the vehicle's fuel filter.



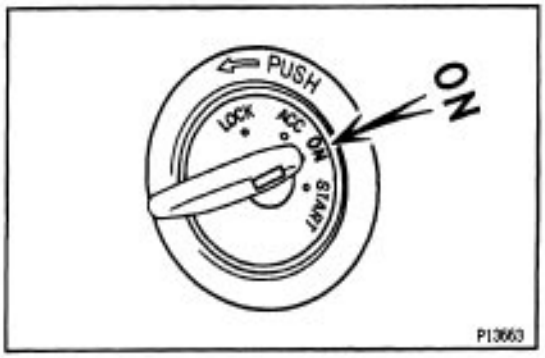

(c) Remove the fuel pressure regulator.
(d) Connect the fuel return hose, SST (hose) and SST (union) to the fuel pressure regulator.
SST 09268–41045 (09268–41090)



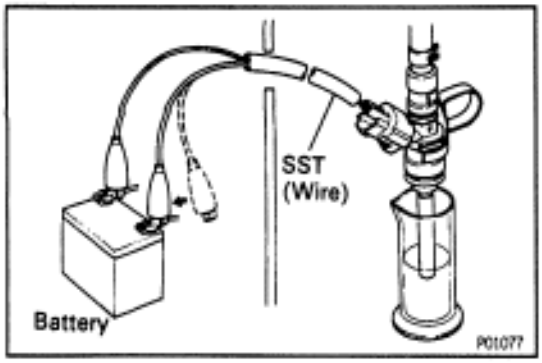

(e) Install a new O–ring to the injector.
(f) Connect SST (union and hose) to the injector, and hold the injector and union with SST (clamp).
SST 09268–41045
(g) Put the injector into the graduated cylinder.
HINT: Install a suitable vinyl hose onto the injector to prevent gasoline from splashing out.




(h) Using SST, connect terminals +B and FP of the DLC1.
SST 00843–18020
(i) Reconnect the negative (–) terminal cable to the battery.



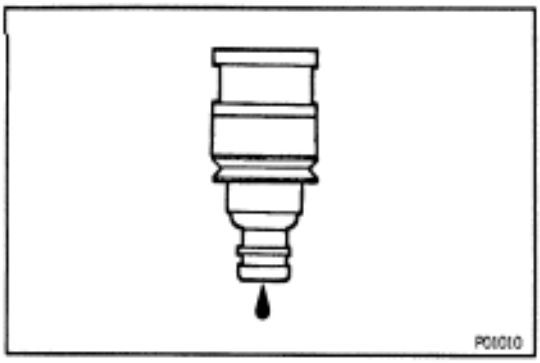

(j) Turn the ignition switch ON.
**NOTICE: Do not start the engine.**



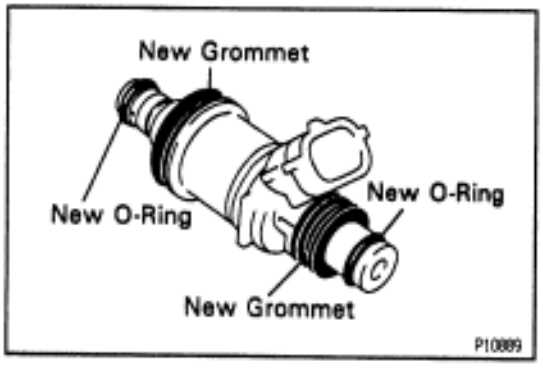

(k) Connect SST (wire) to the injector and battery for 15 seconds, and measure the injection volume with a graduated cylinder. Test each injector 2 or 3 times.
SST 09842–30070
**Volume:**
**54 – 64 cm$^3$ (3.3 – 3.9 cu in.) per 15 sec.**
**Difference between each injector:**
**5 cm$^3$ (0.3 cu in.) or less**
If the ignition volume is not as specified, replace the injector.

**2. INSPECT LEAKAGE**

(a) In the condition above, disconnect the test probes of SST (wire) from the battery and check the fuel leakage from the injector.
SST 09842–30070
**Fuel drop:**
**1 drop or less per minute**




(b) Disconnect the negative (–) terminal cable to the battery.
(c) Remove SST.
SST 09268–41045 and 09843–18020
(d) Reinstall the fuel pressure regulator to the delivery pipe. (See step 1 on pages EG2–241 and 242)
**Torque: 8 N–m (80 kgf–cm, 69 in.–lbf)**

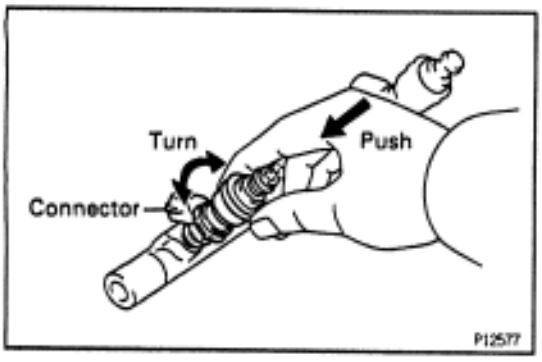



# INJECTORS INSTALLATION

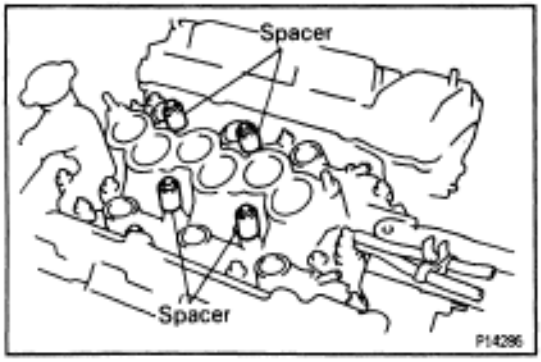
**(See Components for Removal and Installation)**

**1. INSTALL INJECTORS AND DELIVERY PIPES**

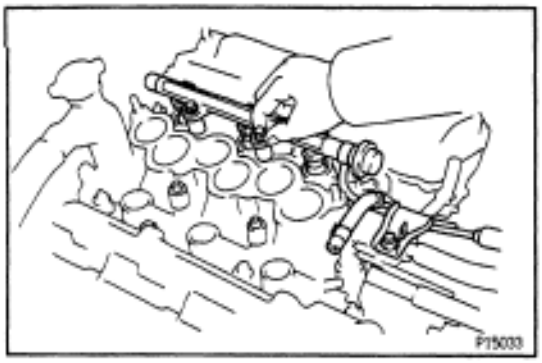
(a) Install 2 new grommets to each injector.
(b) Apply a light coat of spindle oil or gasoline to 2 new 0 –rings and install them to each injector.



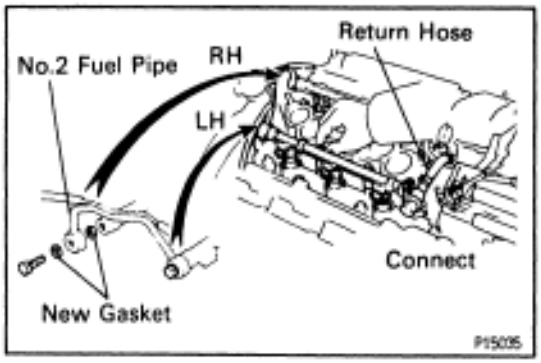

(c) While turning the injector clockwise and counter–clockwise, push it to the delivery pipes. Install the 6 injectors.
(d) Position the injector connector outward.



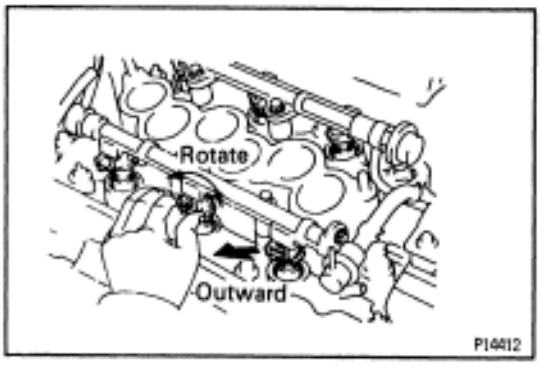

(e) Place the 4 spacers in position on the intake manifold.



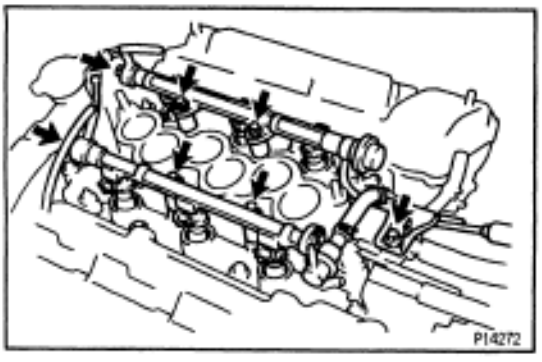

(f) Place the RH delivery pipe and No.1 fuel pipe together with the 3 injectors in position on the intake manifold.
(g) Temporarily install the 2 bolts holding the RH delivery pipe to the intake manifold.
(h) Temporarily install the bolt holding the No.1 fuel pipe to the intake manifold.



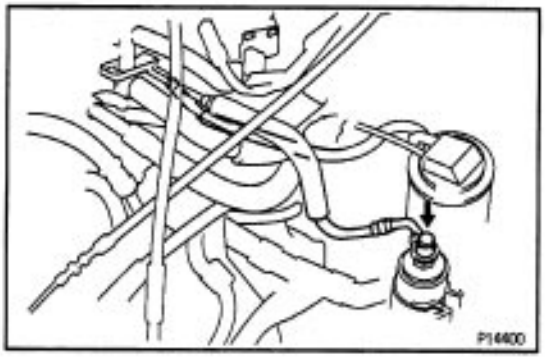

(i) Place the LH delivery pipe and No.2 fuel pipe together with the 3 injectors in position on the intake manifold.
(j) Connect the fuel return hose to the fuel pressure regulator.
(k) Temporarily install the 2 bolts holding the LH delivery pipe to the intake manifold.
(l) Temporarily install the No.2 fuel pipe to the LH deliv–ery pipe with the union bolt and 2 new gaskets.




(m) Check that the injectors rotate smoothly.
HINT: If injectors do not rotate smoothly, the probable cause is incorrect installation of 0–rings. Replace the O – rings.
(n) Position the injector connector outward.




(o) Tighten the 4 bolts holding the delivery pipes to the intake manifold.
**Torque: 10 N–m (100 kgf–cm, 7 ft–lbf)**
(p) Tighten the bolt holding the No.1 fuel pipe to the intake manifold.
**Torque: 19.5 N–m (200 kgf–cm, 14 ft–lbf)**
(q) Tighten the 2 union bolts holding the No.2 fuel pipe to the delivery pipes.
**Torque: 32.5 N–m (330 kgf–cm, 24 ft–lbf)**



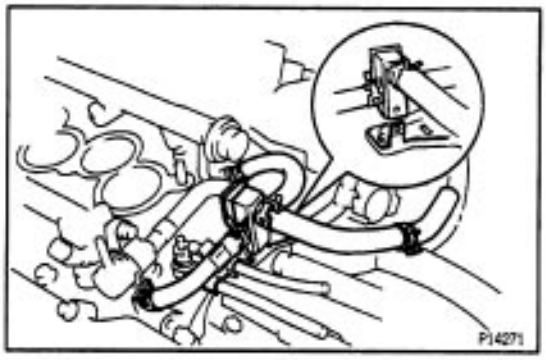

**2. CONNECT FUEL INLET AND RETURN HOSES**

(a) Connect the fuel inlet hose to the fuel filter with the 2 new gaskets and union bolt.

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

(b) Connect the fuel return hose to the No.1 fuel pipe.

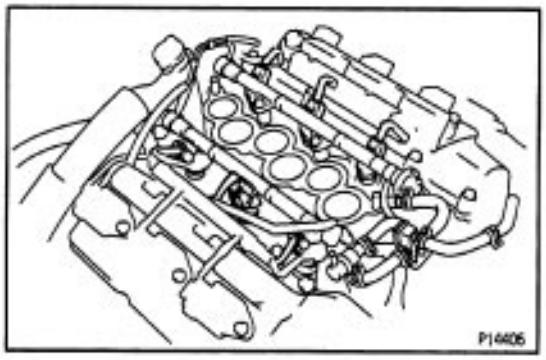
HINT: Pass the fuel return hose under the heater hoses.



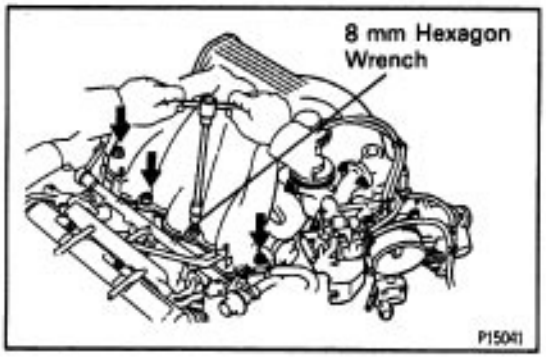

**3. INSTALL AIR ASSIST HOSES AND PIPE**

(a) Connect the air assist hoses to the intake manifold.

(b) Install the air assist pipe to the bracket on the No.1 fuel pipe.



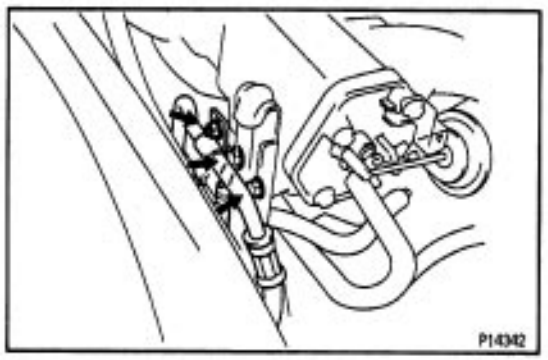

**4. CONNECT INJECTOR CONNECTORS**




**5. INSTALL AIR INTAKE CHAMBER ASSEMBLY**

(a) Using a 8 mm hexagon wrench, install a new gasket and the air intake chamber assembly with the 2 bolts and 2 nuts.

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

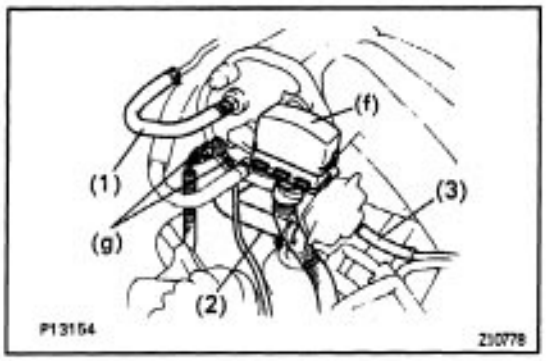



(b) Connect the ground strap with the bolt.

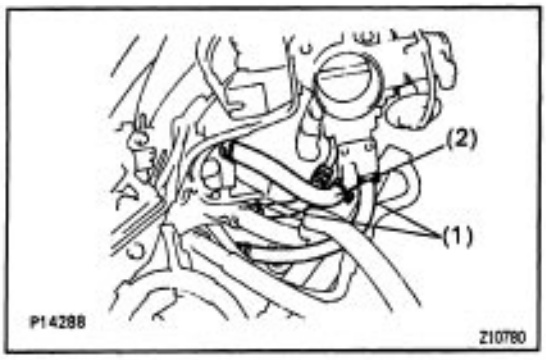
(c) Install the bolt holding the No.1 engine hanger to the air intake chamber.

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

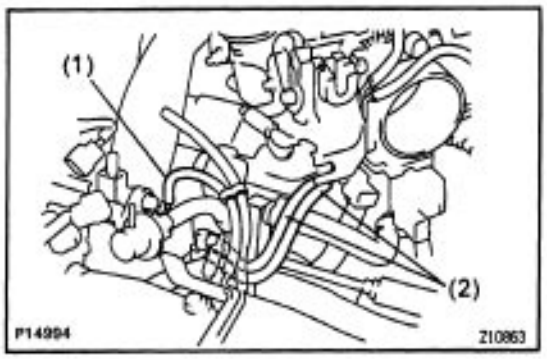
(d) Connect the PS pressure tube with the nut.



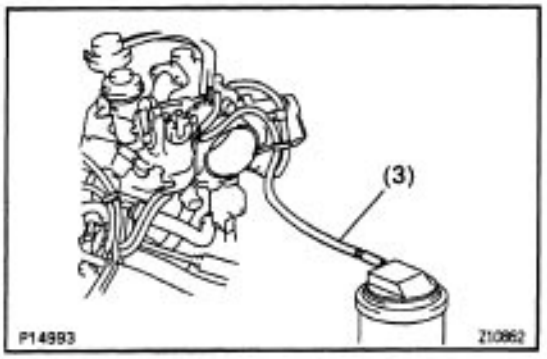

(e) Connect the following hoses:
(1) Brake booster vacuum hose
(2) PCV hose
(3) Actuator vacuum hose
(f) Connect the DLC1.
(g) Connect the 2 ground straps with the nut.
**Torque: 14.5 N–m (145 kgf–cm. 10 ft–lbf)**



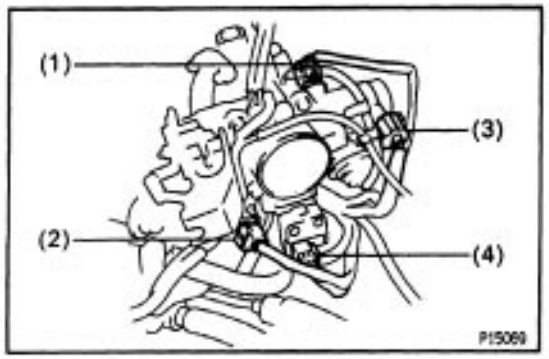

(h) Connect the following hoses:
(1) 2 water bypass hoses to throttle body
(2) Air assist hose to throttle body



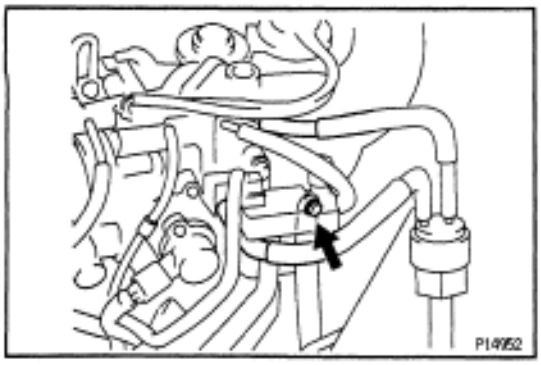

(i) Connect the following vacuum hoses:
(1) Vacuum hose to air intake chamber
(2) 2 vacuum hoses to throttle body



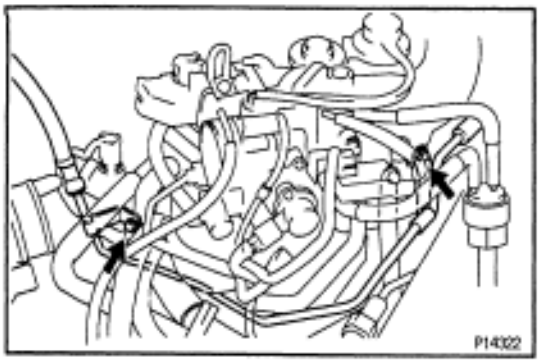

(3) Vacuum hose to charcoal canister




(j) Connect the following connectors:
(1) A/C idle–up valve connector
(2) EGR gas temperature sensor connector
(3) Throttle position sensor connector
(4) IAC valve connector

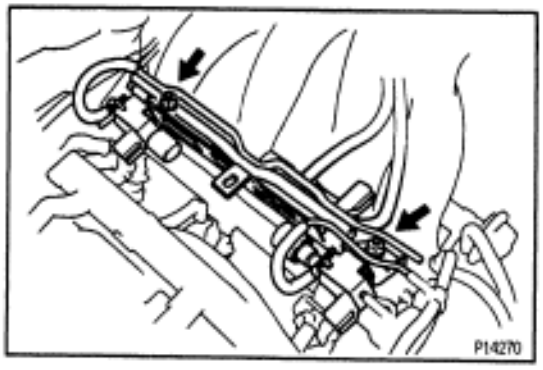



(k) Install the bolt holding the air intake chamber stay to the air intake chamber.
**Torque: 19.5 N–m (200 kgf–cm. 14 ft–lbf)**
(1) Connect the 2 PS air hoses.

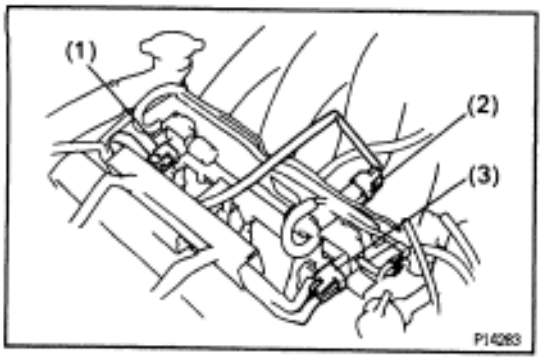



**6. CONNECT HYDRAULIC MOTOR PRESSURE PIPE**
Connect the pressure pipe to the air intake chamber and water inlet with the 2 bolts.
**Torque: 8 N–m (80 kgf–cm, 69 in.–lbf)**

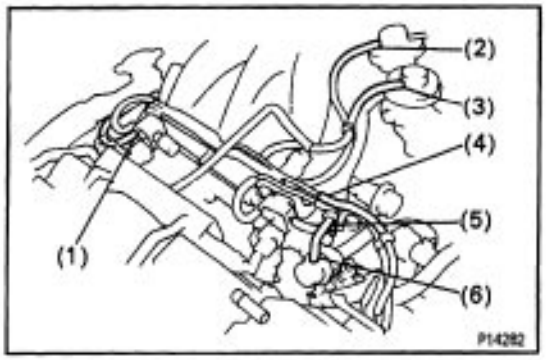

**7. INSTALL NO.2 EGR PIPE**
Install 2 new gaskets and the EGR pipe with the 4 nuts.
**Torque: 12 N–m (120 kgf–cm, 9 ft–lbf)**



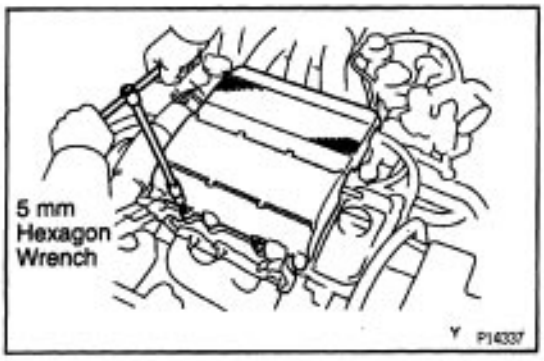

**8. INSTALL EMISSION CONTROL VALVE SET**
(a) Install the emission control valve set with 2 bolts.
**Torque: 8 N–m (80 kgf–cm, 69 in.–lbf)**




(b) Connect the following connectors:
(1) VSV connector for ACIS
(2) VSV connector for EGR
(3) VSV connector for fuel pressure control



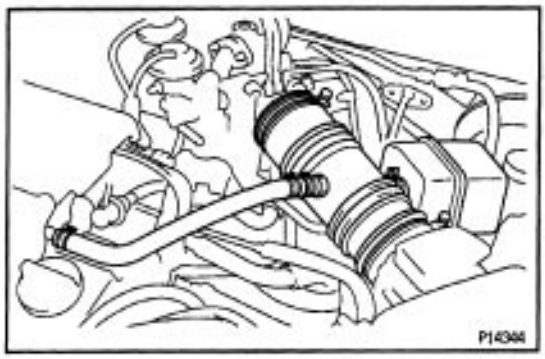

(c) Connect the following vacuum hoses:
(1) Vacuum hose to VSV for ACIS
(2) Vacuum hose to EGR vacuum modulator
(3) Vacuum hose to EGR valve
(4) Vacuum hose (from cylinder head rear plate)
(5) Vacuum hose from air intake chamber
(6) Vacuum hose to fuel pressure regulator




**9. INSTALL V–BANK COVER**

Using a 5 mm hexagon wrench, install the V– bank cover with the 2 cap nuts.

HINT: For fixing the V – bank cover, push on the cover until sense of ”click” is felt.




**10. INSTALL AIR CLEANER HOSE**

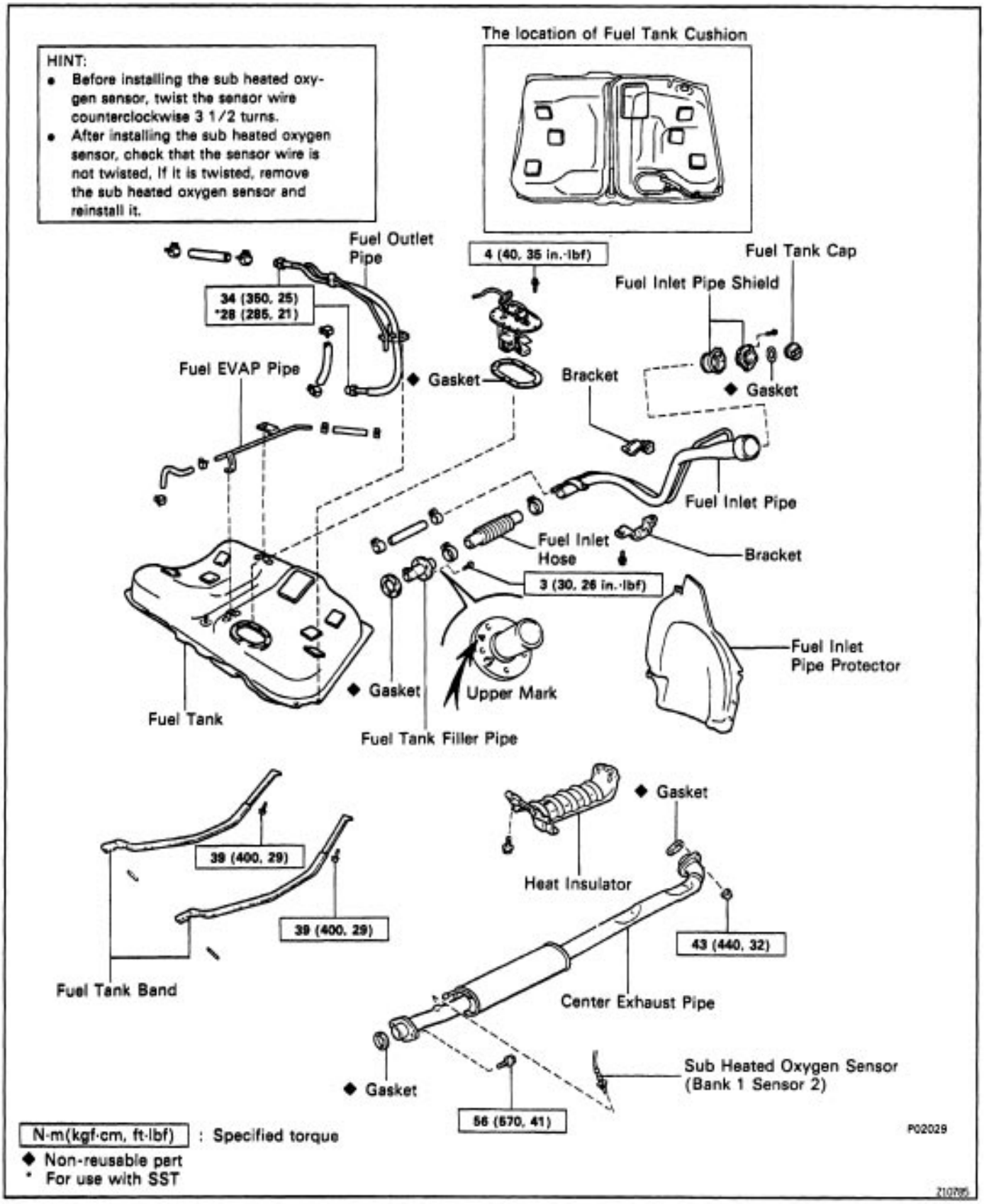
(a) Connect the air cleaner hose with the 2 hose clamps.
(b) Connect the PCV hose.


**11. CONNECT THROTTLE CABLE**
**12. CONNECT ACCELERATOR CABLE**

**13. FILL WITH ENGINE COOLANT**
**Capacity:**
**8.7 liters (9.2 US qts. 7.7 Imp. qts)**
**14. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY**

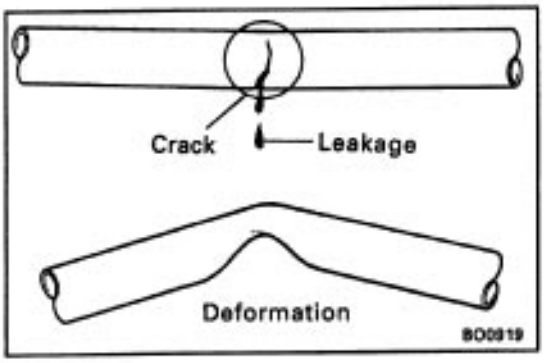
# FUEL TANK AND LINE

## COMPONENTS



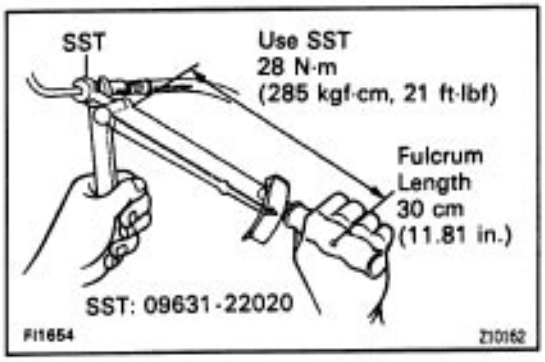
## PRECAUTIONS

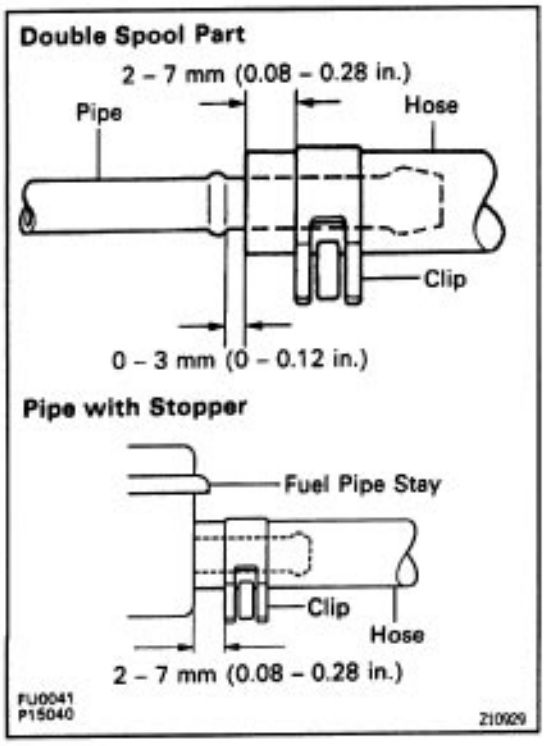
**1. Always use new gaskets when replacing the fuel tank or component parts.**
**2. Apply the proper torque to all parts tightened.**



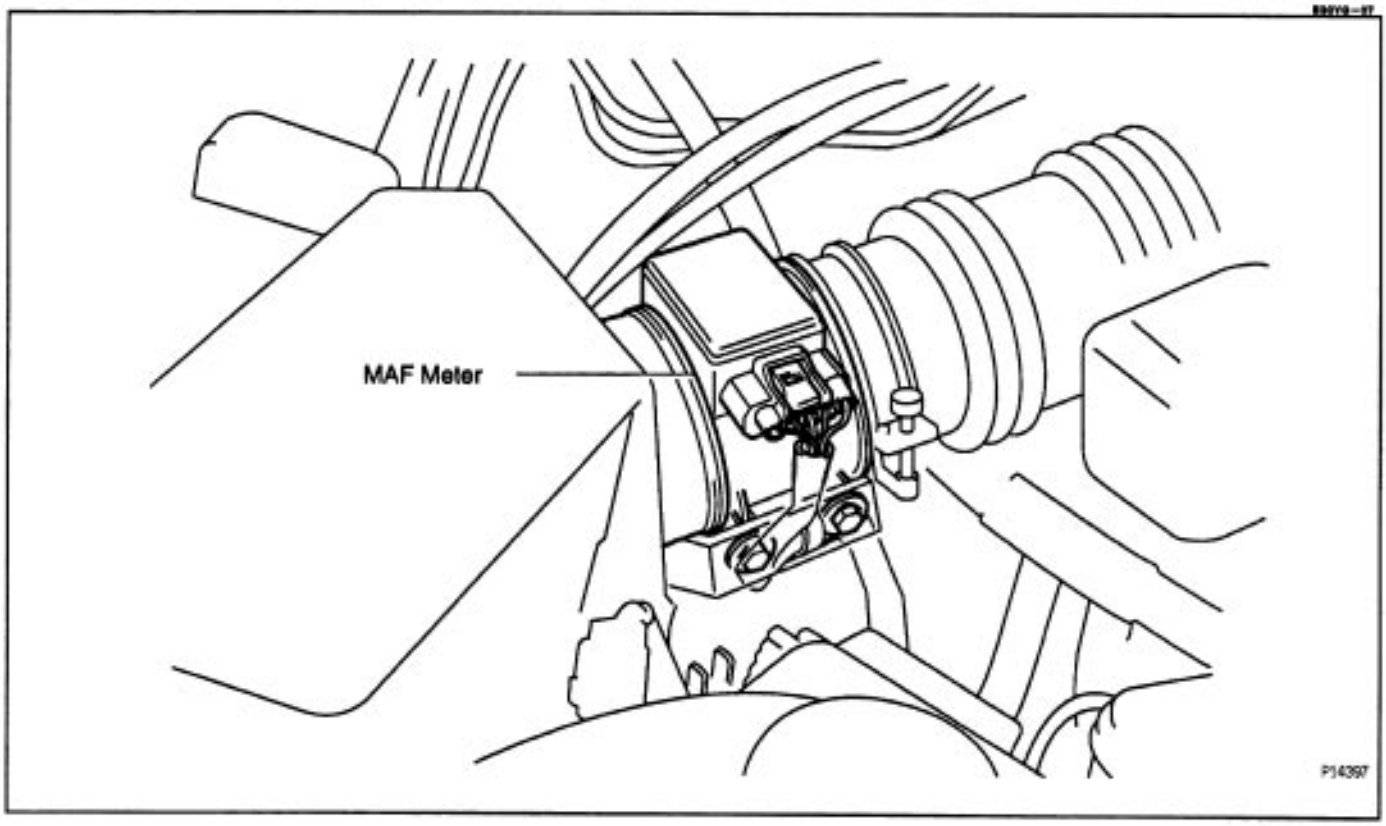

## FUEL LINES AND CONNECTIONS INSPECTION

(a) Check the fuel lines for cracks or leakage, and all connections for deformation.
(b) Check the fuel tank vapor vent system hoses and connections for looseness, sharp bends or damage.
(c) Check the fuel tank for deformation, cracks, fuel leak–age or tank band looseness.
(d) Check the filler neck for damage or fuel leakage.
(e) Hose and pipe connections are as shown in the illus–tration.
If a problem is found, repair or replace the parts as necessary.

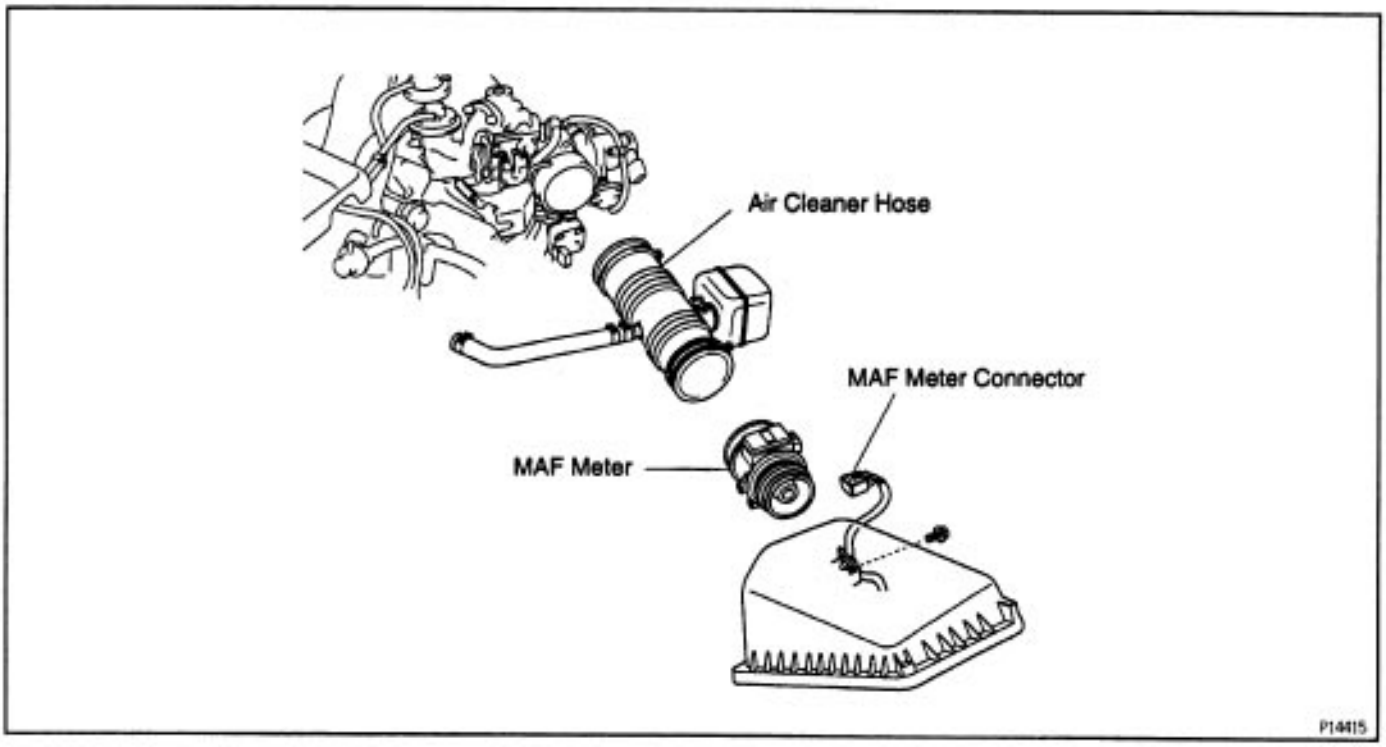


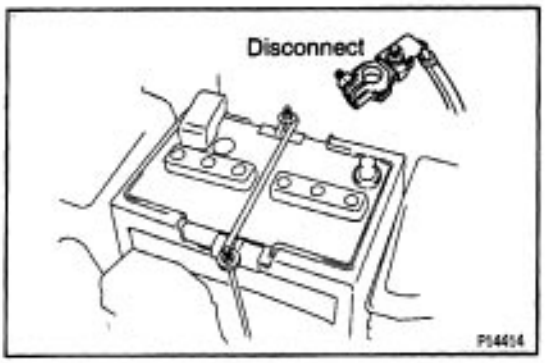



# MASS AIR FLOW (MAF) METER




## COMPONENTS FOR REMOVAL AND INSTALLATION



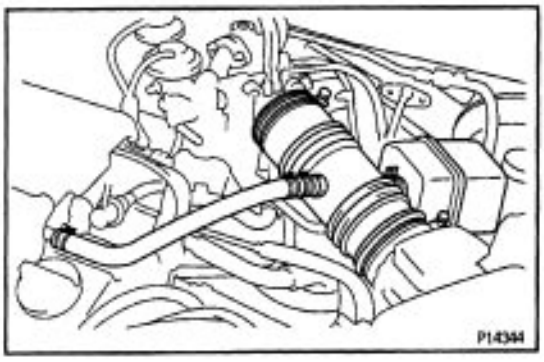



# MAF METER REMOVAL

**(See Components for Removal and Installation)**

**1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY**

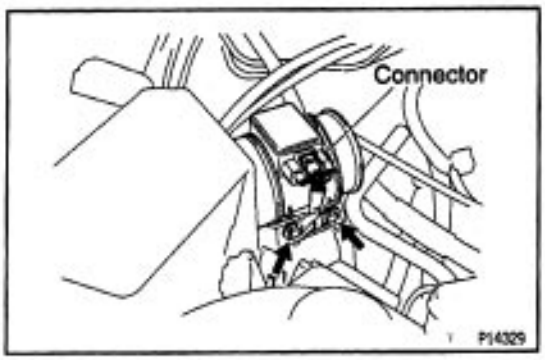
**CAUTION: Work must be started after 90 seconds from the time the Ignition switch is turned to the 'LOCK' position and the negative (–) terminal cable Is discon–nected from the battery.**




**2. REMOVE AIR CLEANER NOSE**

(a) Disconnect the PCV hose.

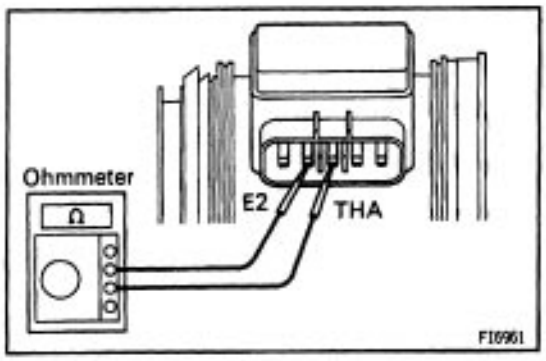
(b) Loosen the 2 hose clamps, and remove the air cleaner hose.




**3. REMOVE MAP METER**

(a) Disconnect the MAF meter connector.

(b) Remove the 2 bolts and MAF meter.



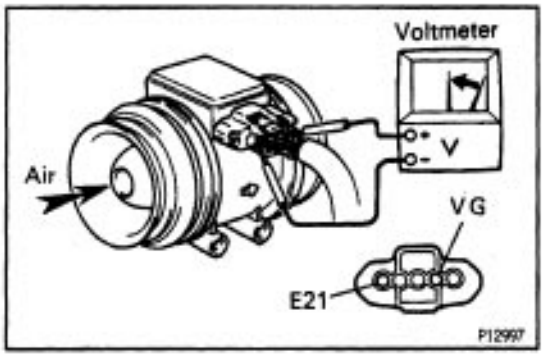

# MAF METER INSPECTION

**1. INSPECT MAF METER RESISTANCE**

Using an ohmmeter, measure the resistance between terminals THA and E2.

| Between terminals | Resistance | Temperature |
|---|---|---|
| THA – E2 | 10–20kΩ | – 20° C (–4° F) |
| THA – E2 | 4 –7kΩ | 0°C (32° F) |
| THA – E2 | 2 –3kΩ | 20°C (68°F) |
| THA – E2 | 0.9 – 1.3 kΩ | 40° C (104° F) |
| THA = E2 | 0.4 – 0.7 kΩ | 60° C (140° F) |

If the resistance is not as specified, replace the MAF meter.




**2. INSPECT MAF METER OPERATION**

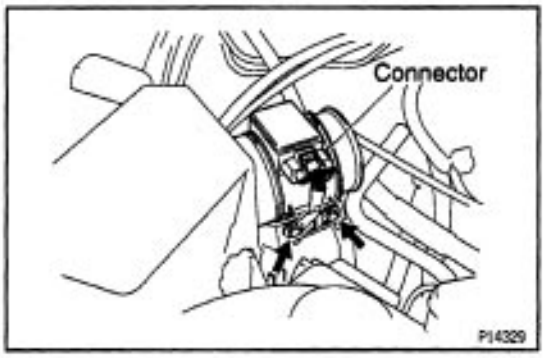
(a) Connect the MAF meter connector.

(b) Using a voltmeter, connect the positive (+) tester probe to terminal VG, and negative (–) tester probe to terminal E21.

(c) Blow air into the MAF meter, and check that the voltage fluctuates.

If operation is not as specified, replace the MAF meter.

(d) Disconnect the MAF meter connector.




# MAF METER INSTALLATION

**(See Components for Removal and Installation)**

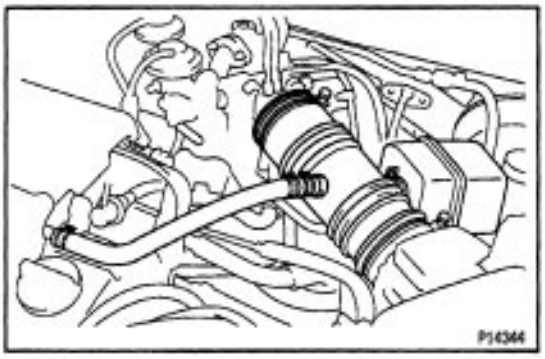
**1. INSTALL MAF METER**

(a) Insert the MAF meter end into the air cleaner case.

(b) Install the MAF meter with the 2 bolts.

**Torque: 6.9 N–m (70 kgf–cm, 61 in.–lbf)**

(c) Connect the MAF meter connector.



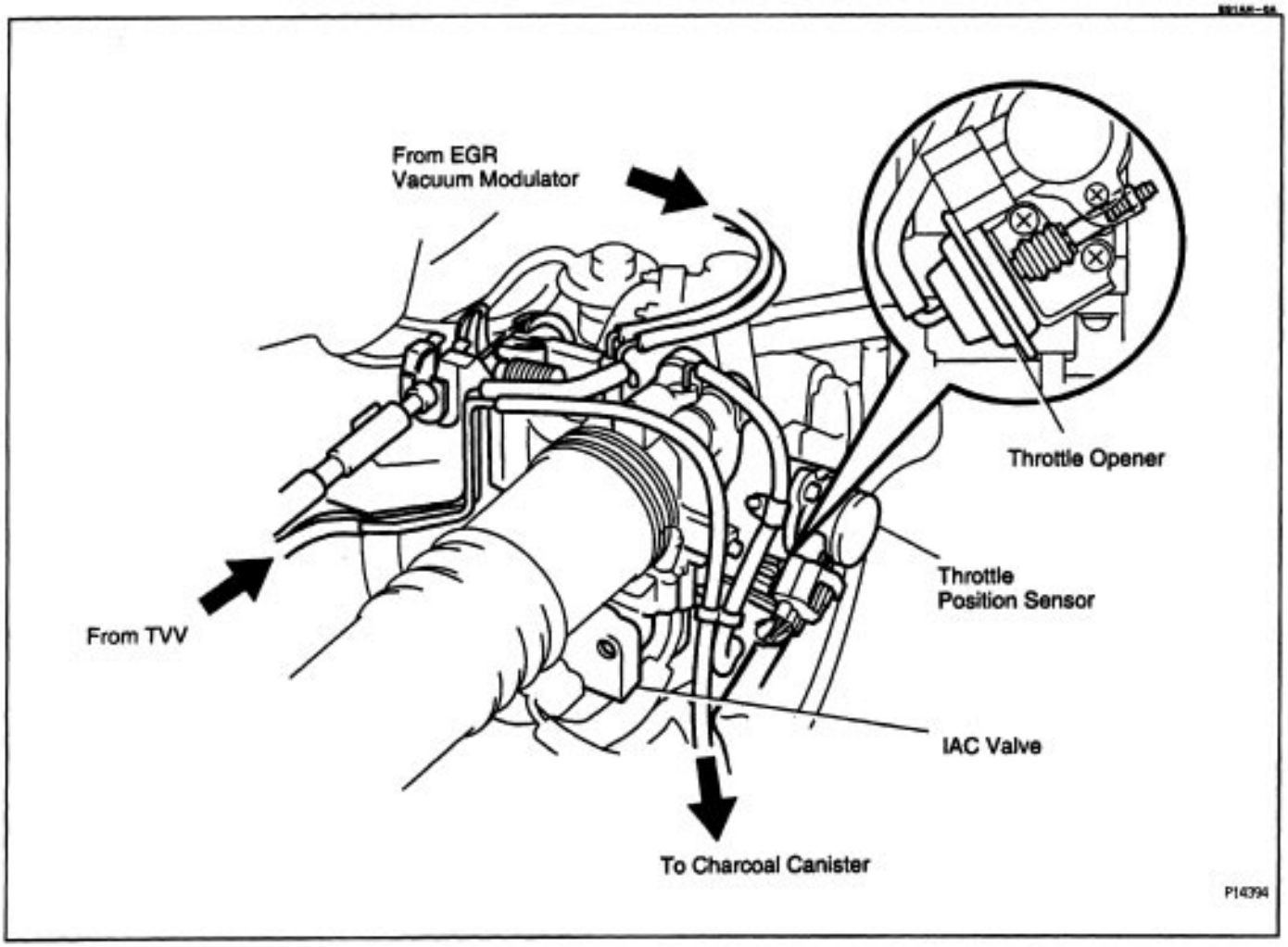

**2. INSTALL AIR CLEANER HOSE**

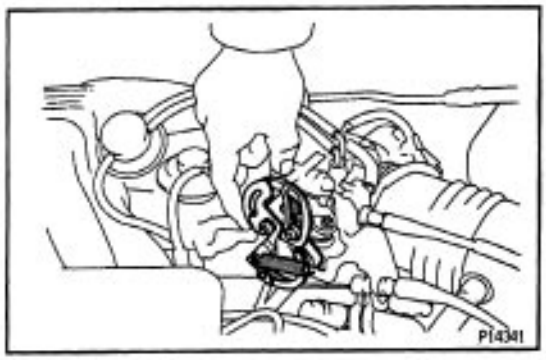
(a) Install the air cleaner hose with the 2 hose clamps.

(b) Connect the PCV hose.

**3. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY**

# THROTTLE BODY

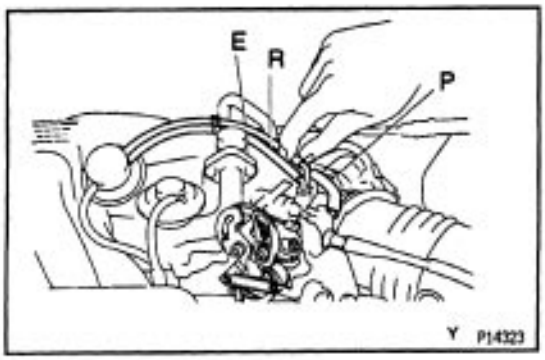



## ON–VEHICLE INSPECTION

### 1. INSPECT THROTTLE BODY

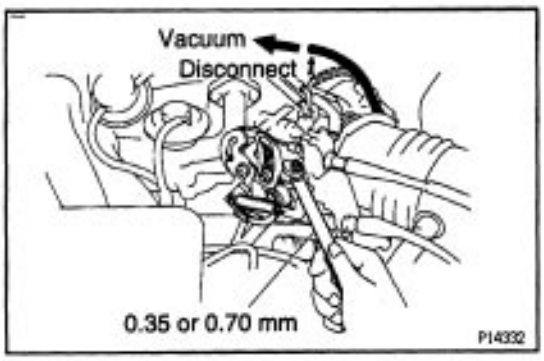
(a) Check that the throttle linkage moves smoothly.




(b) Check the vacuum at each port.

- Start the engine.
- Check the vacuum with your finger.

| Port name | At idle | 3,000 rpm or more |
|---|---|---|
| P | No vacuum | Vacuum |
| E | No vacuum | Vacuum |
| R | No vacuum | Vacuum |

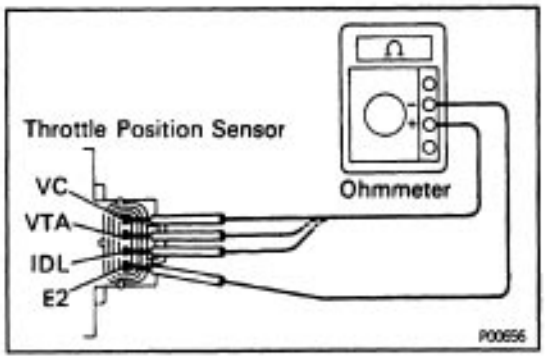



**2. INSPECT THROTTLE POSITION SENSOR**

(a) Apply vacuum to the throttle opener.

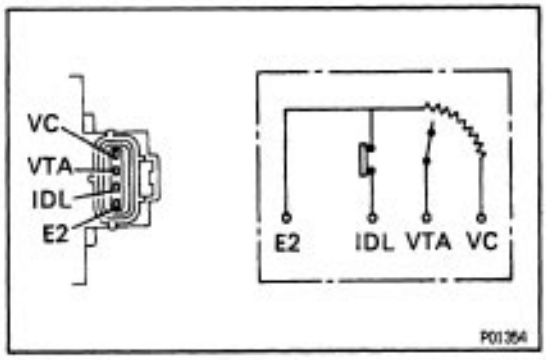
(b) Disconnect the sensor connector.

(c) Insert a thickness gauge between the throttle stop screw and stop lever.

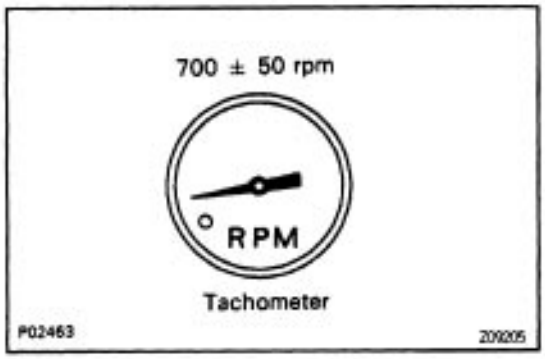



(d) Using an ohmmeter, measure the resistance between each terminal.

| Clearance between fever and stop screw | Between terminals | Resistance |
|---|---|---|
| 0 mm (0 in.) | VTA – E2 | 0.28 – 6.4 kΩ |
| 0.35 mm (0.014 in.) | IDL – E2 | 0.5 kΩ or less |
| 0.70 mm (0.028 in.) | IDL– E2 | Infinity |
| Throttle valve fully open | VTA – E2 | 2.0 – 11.6 kΩ |
| – | VC –E2 | 2.7 – 7.7 kΩ |




(e) Reconnect the sensor connector.




**3. INSPECT THROTTLE OPENER**

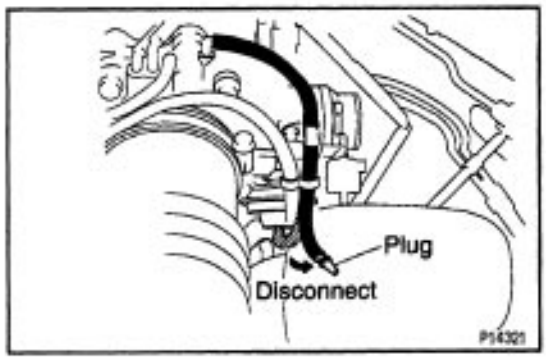
**A. Warm up engine**

Allow the engine to warm up to normal operating temperature.

**B. Check idle speed**

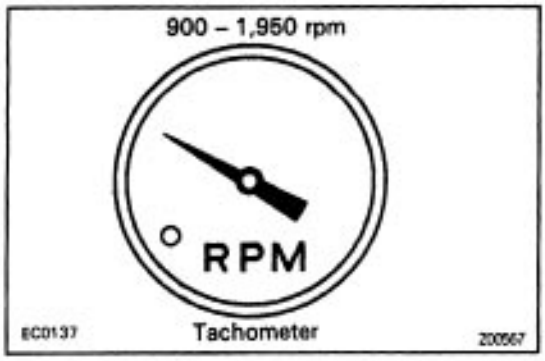
**Idle speed:**

**700 ± 50 rpm**




**C. Check throttle opener setting speed**

(a) Disconnect the vacuum hose from the throttle opener, and plug the hose end.



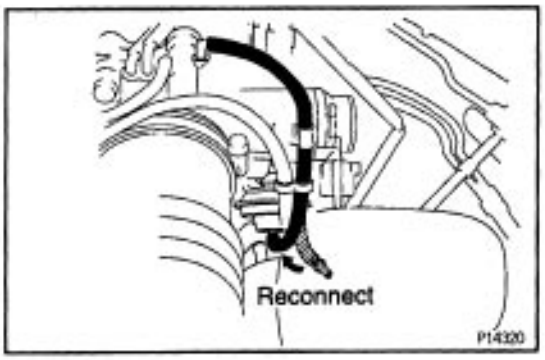

(b) Check the throttle opener setting speed.

**Throttle opener setting speed:**

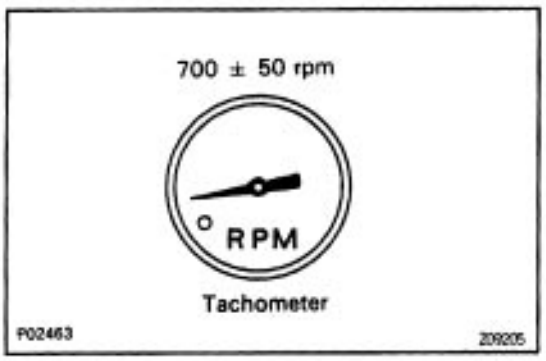
**900–1,950 rpm**

If the throttle opener setting is not as specified, replace the throttle body.

(c) Stop the engine.

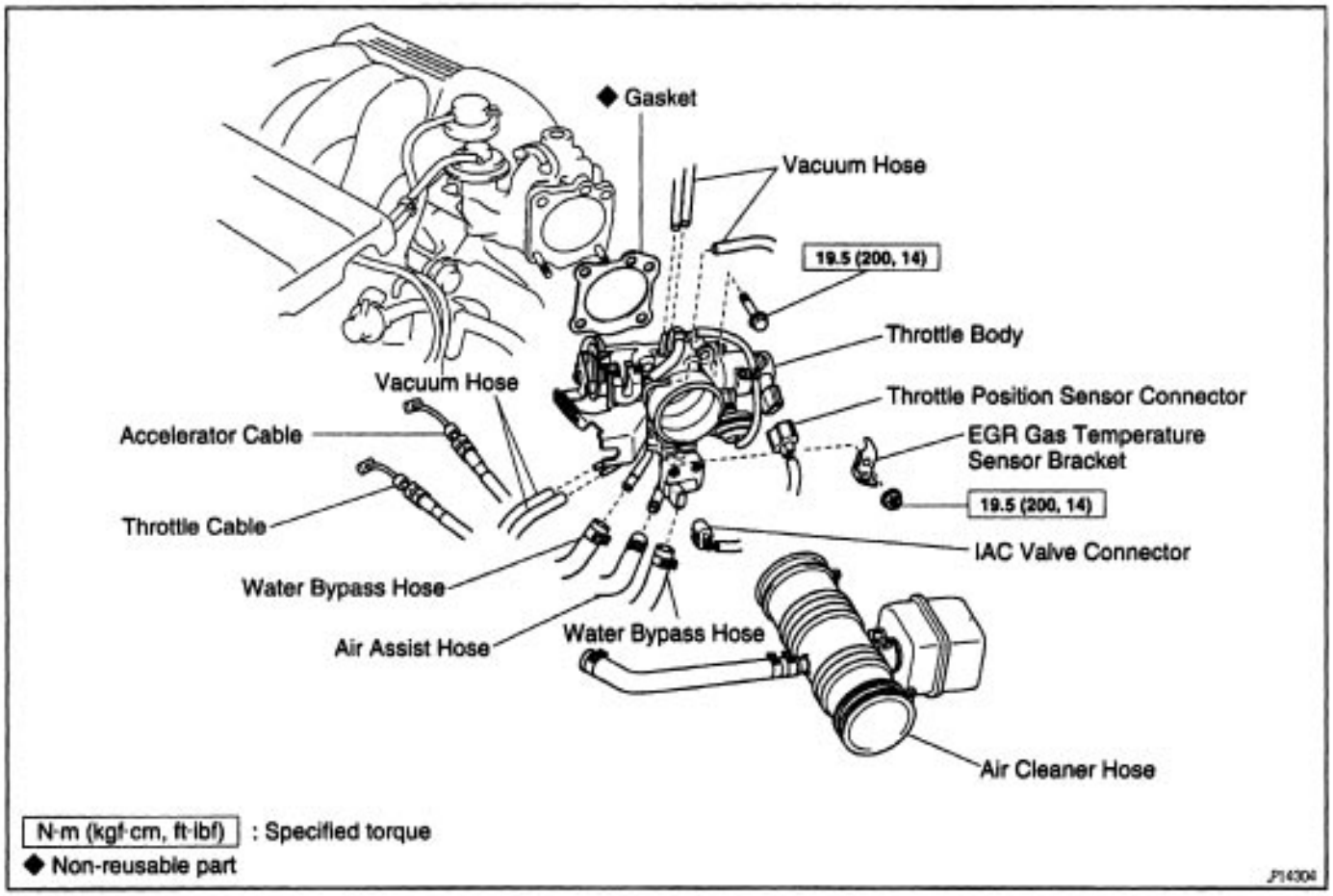


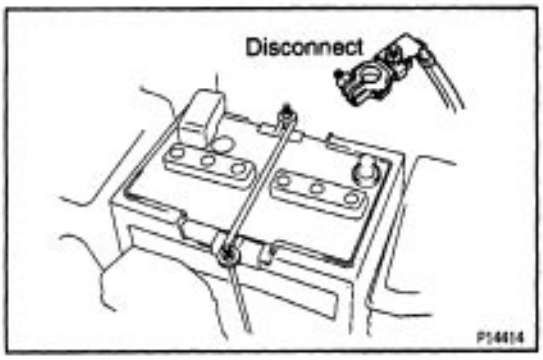

(d) Reconnect the vacuum hose to the throttle opener.




(e) Start the engine and check that the idle speed returns to the correct speed.

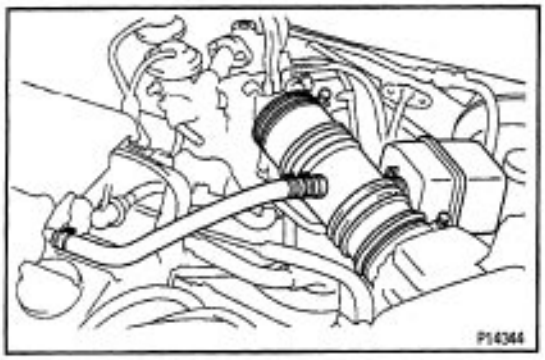
# COMPONENTS FOR REMOVAL AND INSTALLATION





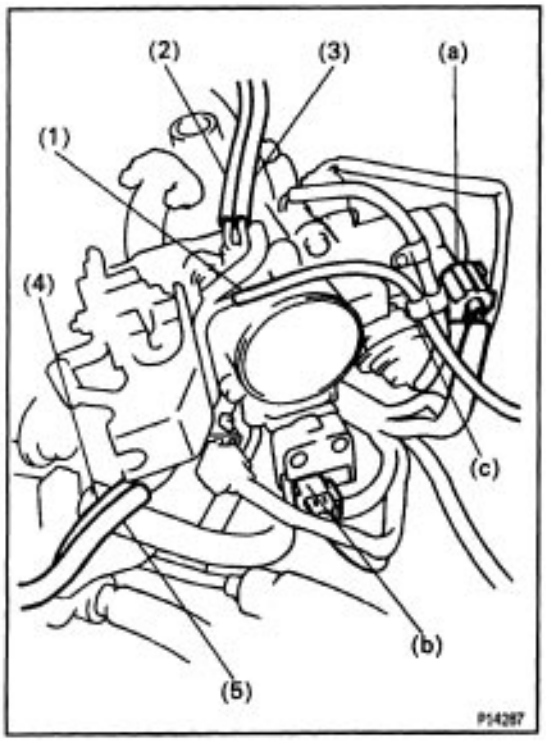
**THROTTLE BODY REMOVAL**
**(See Components for Removal and Installation)**
**1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY**
**CAUTION: Work must be started after 90 seconds from the time the ignition switch is turned to the 'LOCK' position and the negative (–) terminal cable is disconnected from the battery.**
**2. DRAIN ENGINE COOLANT**
**3. DISCONNECT ACCELERATOR CABLE**
**4. DISCONNECT THROTTLE CABLE**




**5. REMOVE AIR CLEANER HOSE**

(a) Disconnect the PCV hose.

(b) Loosen the 2 hose clamps, and remove the air cleaner hose.




**6. REMOVE THROTTLE BODY**

(a) Disconnect the throttle position sensor connector.

(b) Disconnect the IAC valve connector.

(c) Remove the hose clamp.

(d) Disconnect the following vacuum hoses:

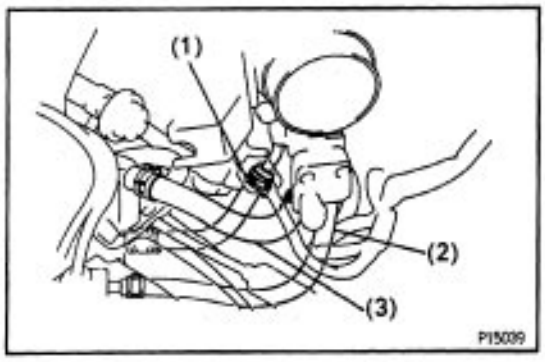
(1) Vacuum hose (from charcoal canister)

(2) Vacuum hose (from port R of EGR vacuum modulator)

(3) Vacuum hose (from port E of EGR vacuum modulator)

(4) Vacuum hose (from upper port of TVV)

(5) Vacuum hose (from lower port of TVV)

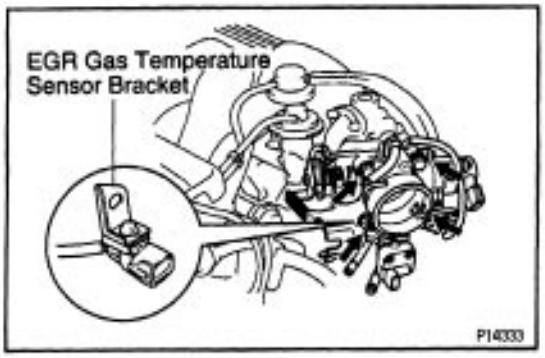



(e) Disconnect the following hoses:

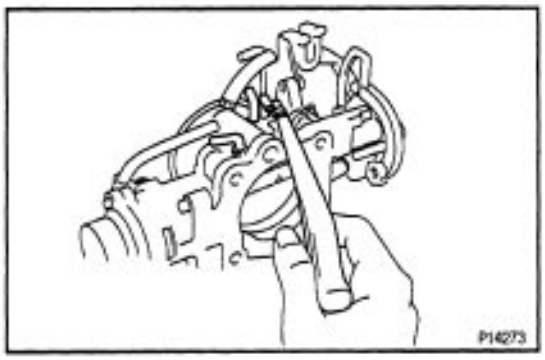
(1) Water bypass hose (from intake manifold)

(2) Water bypass hose (from water inlet housing)

(3) Air assist hose




(f) Remove the 2 bolts, 2 nuts, EGR gas temperature sensor bracket, throttle body and gasket.



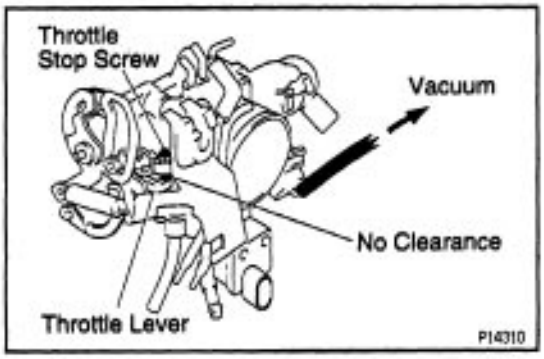

# THROTTLE BODY INSPECTION

**1. CLEAN THROTTLE BODY**

(a) Using a soft brush and carburetor cleaner, clean the cast parts.

(b) Using compressed air, clean all the passages and apertures.

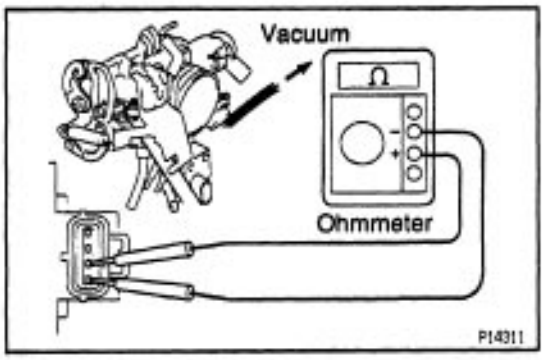
**NOTICE: To prevent deterioration, do not clean the throt–tle position sensor.**




**2. INSPECT THROTTLE VALVE**

(a) Apply vacuum to the throttle opener.

(b) Check that there is no clearance between the throttle stop screw and throttle lever when the throttle valve is fully closed.



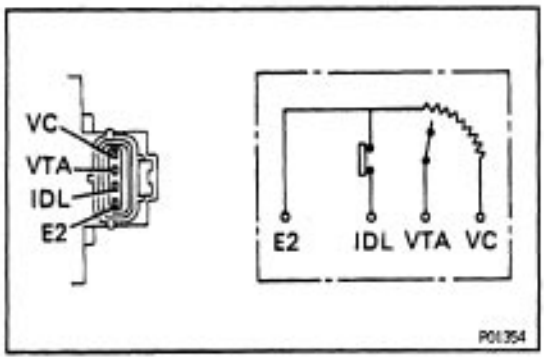

**3. INSPECT THROTTLE POSITION SENSOR**

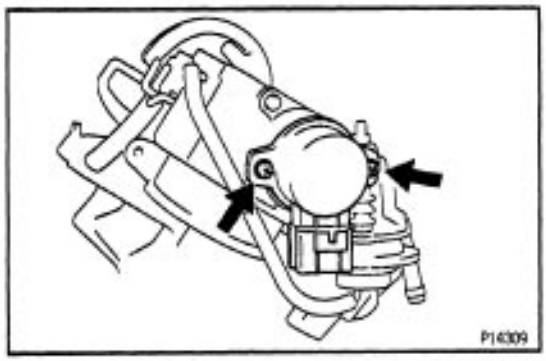
(a) Apply vacuum to the throttle opener.

(b) Insert a thickness gauge between the throttle stop screw and stop lever.

(c) Using an ohmmeter, measure the resistance between each terminal.

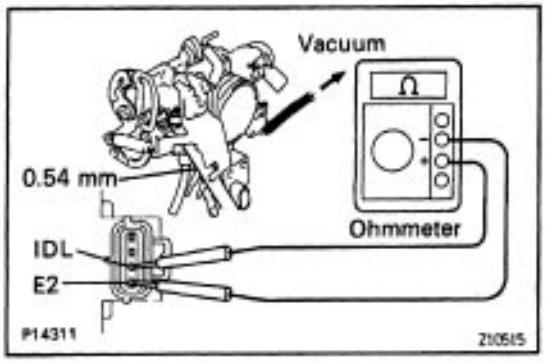
| Clearance between lever and stop screw | Between terminals | Resistance |
|---|---|---|
| 0 mm (0 in.) | VTA –.E2 | 0.28 – 6.4 kΩ |
| 0.35 mm (0.014 in.) | IDL – E2 | 0.5 k(Ω or less |
| 0.70 mm (0.028 in.) | IDL – E2 | Infinity |
| Throttle valve fully open | VTA – E2 | 2.0 – 11.6 k Ω |
| – | VC – E2 | 2.7 – 7.7 kΩ |



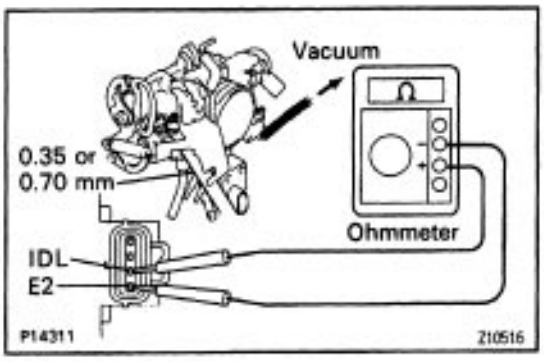




**4. IF NECESSARY, ADJUST THROTTLE POSITION SENSOR**

(a) Loosen the 2 set screws of the sensor.

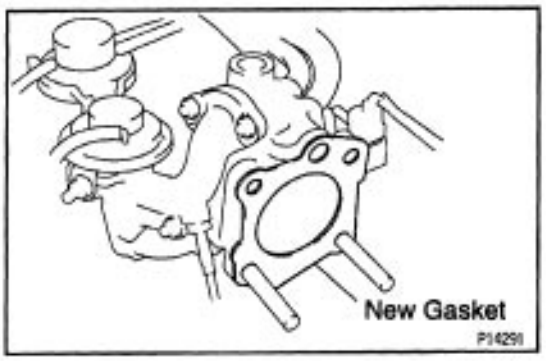



(b) Apply vacuum to the throttle opener.
(c) Insert a 0.54 mm (0.021 in.) thickness gauge, between the throttle stop screw and stop lever.
(d) Connect the test probe of an ohmmeter to the terminals IDL and E2 of the sensor.
(e) Gradually turn the sensor clockwise until the ohmmeter deflects, and secure it with the 2 set screws.

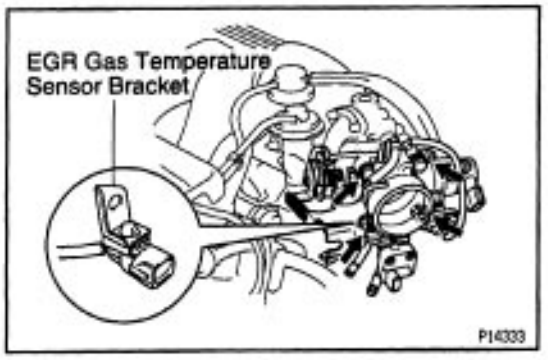



(f) Recheck the continuity between terminals IDL and E2.

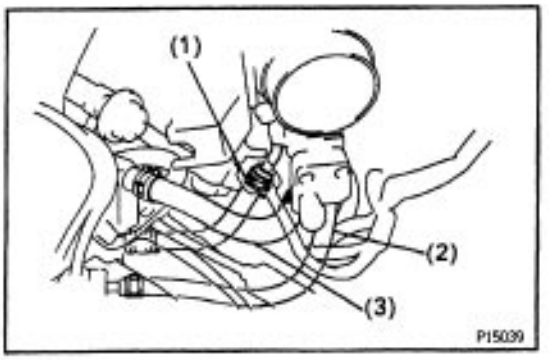
| Clearance between lever and stop screw | Continuity (IDL – E2) |
|---|---|
| 0.35 mm (0.014 in.) | Continuity |
| 0.70 mm (0.028 in.) | No continuity |



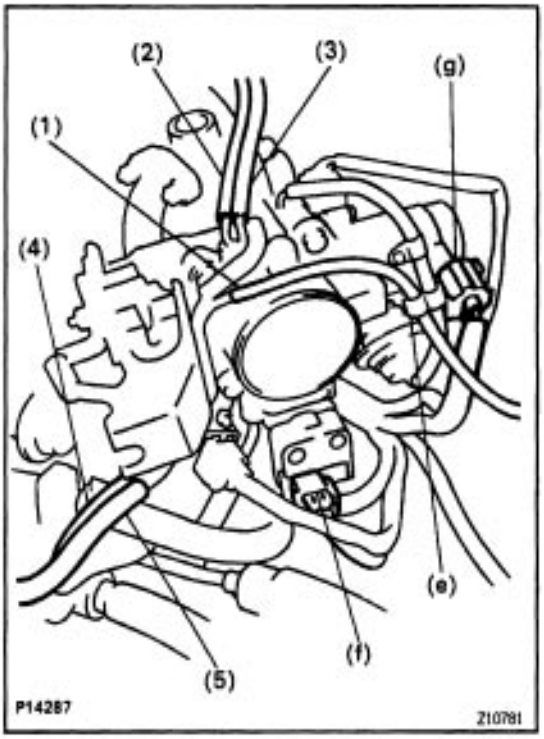

**THROTTLE BODY INSTALLATION**
**(See Components for Removal and Installation)**
**1. INSTALL THROTTLE BODY**
(a) Place a new gasket on the air intake chamber.



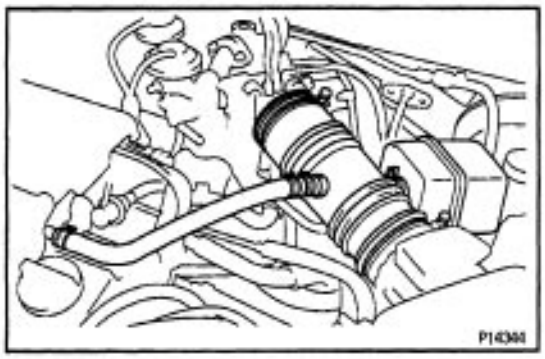

(b) Install the throttle body, EGR gas temperature sensor bracket with the 2 bolts and 2 nuts.
**Torque: 19.5 N–m (200 kgf–cm, 14 ft–lbf)**



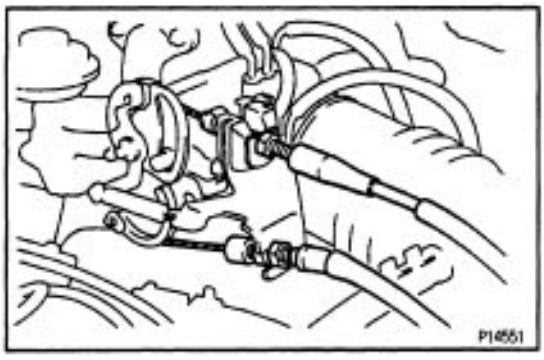

(c) Connect the following hoses:
(1) Water bypass hose (from intake manifold)
(2) Water bypass hose (from water inlet housing)
(3) Air assist hose




(d) Connect the following vacuum hoses:
(1) Vacuum hose (from charcoal canister)
(2) Vacuum hose (from port R of EGR vacuum modulator)
(3) Vacuum hose (from port R of EGR vacuum modulator)
(4) Vacuum hose (from upper port of TVV)
(5) Vacuum hose (from lower port of TVV)
(e) Install the hose clamp.
(f) Connect the IAC valve connector.
(g) Connect the throttle position sensor connector.



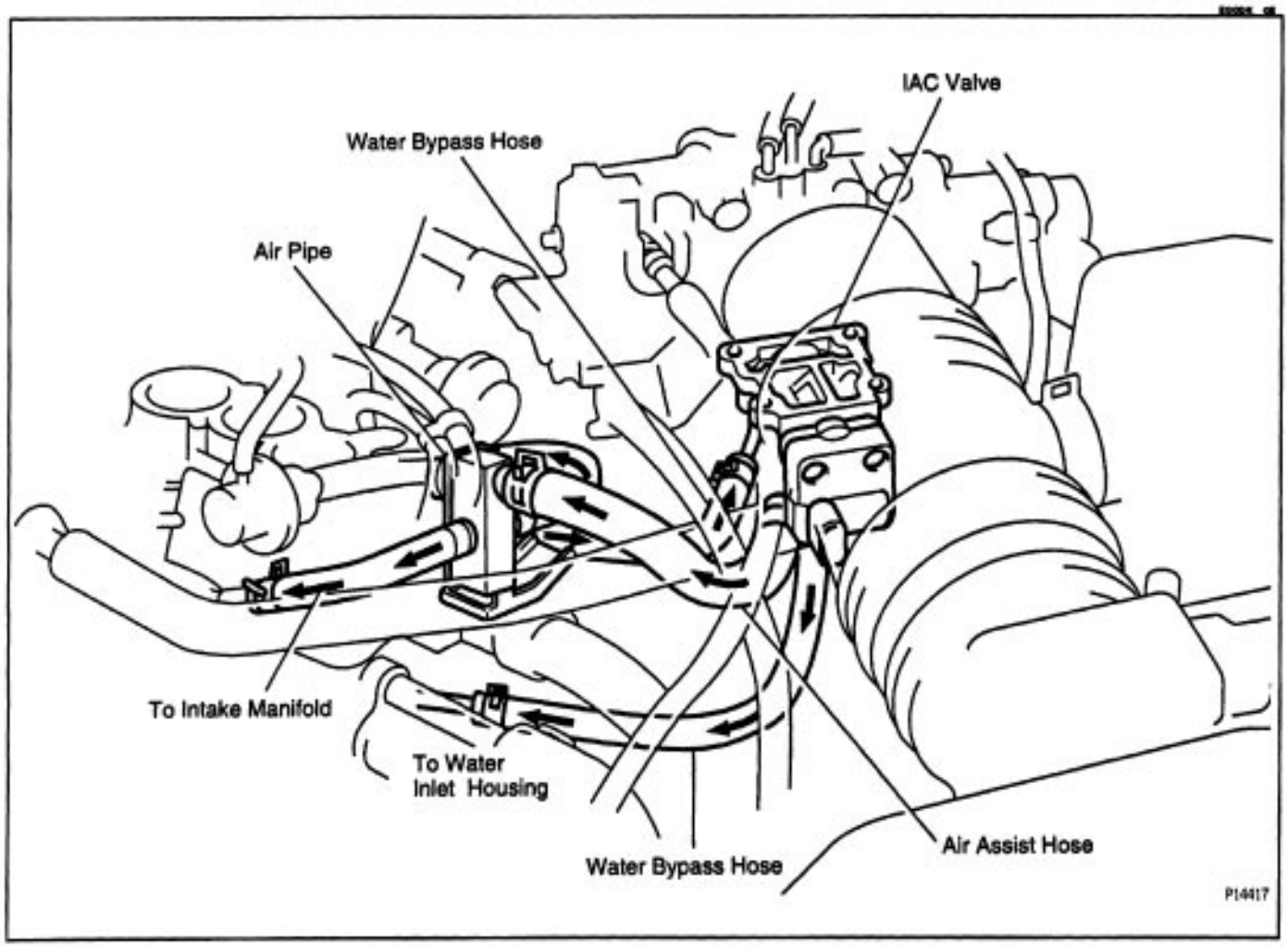

**2. INSTALL AIR CLEANER HOSE**
(a) install the air cleaner hose with the 2 hose clamps.
(b) Connect the PCV hose.




**3. CONNECT THROTTLE CABLE**
**4. CONNECT ACCELERATOR CABLE**

**5. FILL WITH ENGINE COOLANT**
**Capacity:**
**8.7 liters (9.2 US qts, 7.7 Imp.qts)**
**6. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY**

# IDLE AIR CONTROL (IAC) VALVE

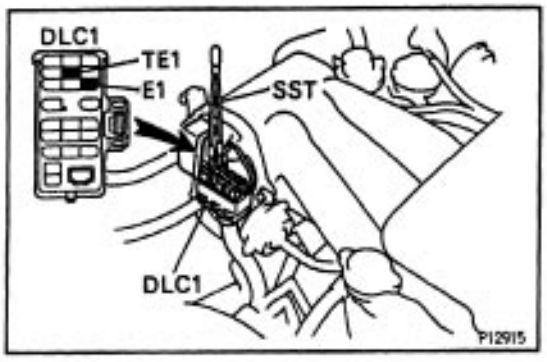



## ON–VEHICLE INSPECTION

**1. INSPECT IAC VALVE OPERATION**

(a) Initial conditions:

- Engine at normal operating temperature
- Idle speed set correctly
- Transmission in neutral position
- A/C switch OFF

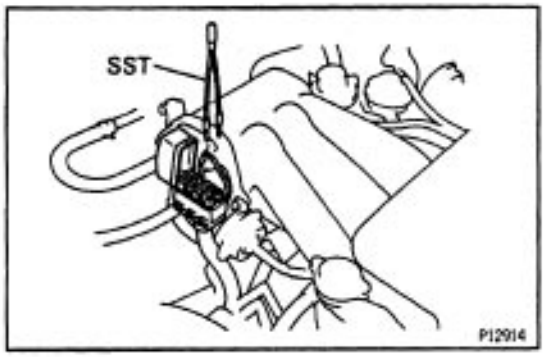



(b) Using SST, connect terminals TE1 and E1 of the DLC 1.

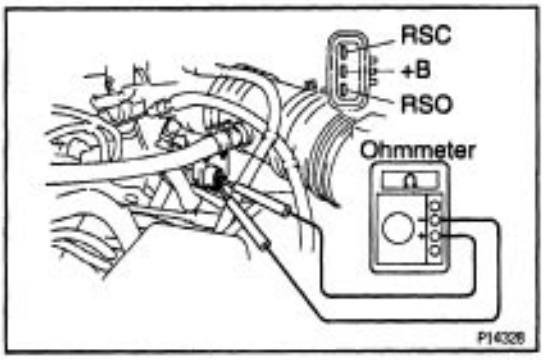
SST 09843–18020

(c) After engine speed are kept at approx. 1,000 rpm for 5 seconds, check that they return to idle speed.

If the engine speed operation is not as specified, check the IAC valve, wiring and ECM.

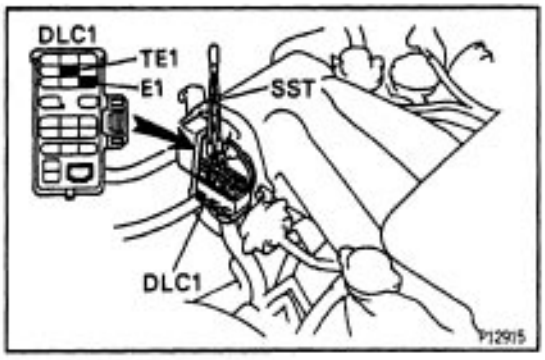



(d) Remove the SST from the DLC1.
SST 09843–18020

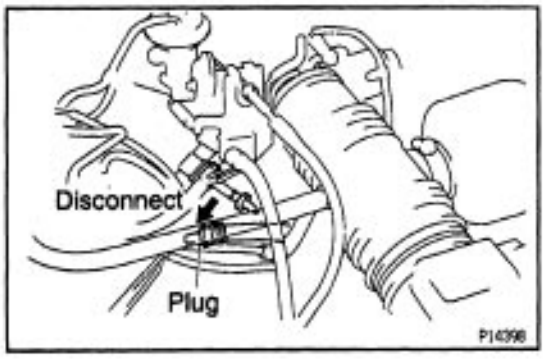



**2. INSPECT IAC VALVE RESISTANCE**
(a) Disconnect the IAC valve connector.
(b) Using an ohmmeter, measure the resistance between terminal +B and other terminals (RSC, RSO).
**Resistance:**
**19.3 – 22.3Ω at 20˚C (68˚F)**
If resistance is not as specified, replace the IAC valve.
(c) Reconnect the IAC valve connector.

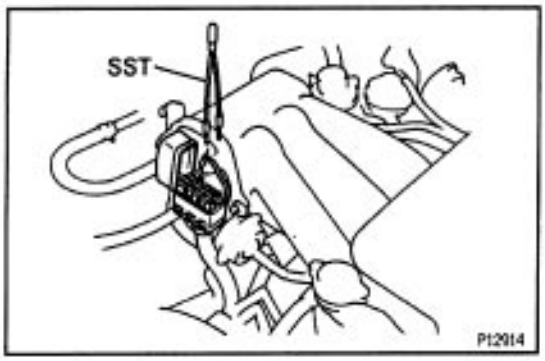
**3. INSPECT AIR ASSIST SYSTEM**
(a) Initial conditions:
- Engine at normal operating temperature
- Idle speed set correctly
- Transmission in neutral position
- A/C switch OFF




(b) Using SST, connect terminals TE1 and E1 of the DLC 1.
SST 09843–18020
(c) After engine speed are kept at 900 – 1,300 rpm for 10 seconds, check that they return to idle speed.

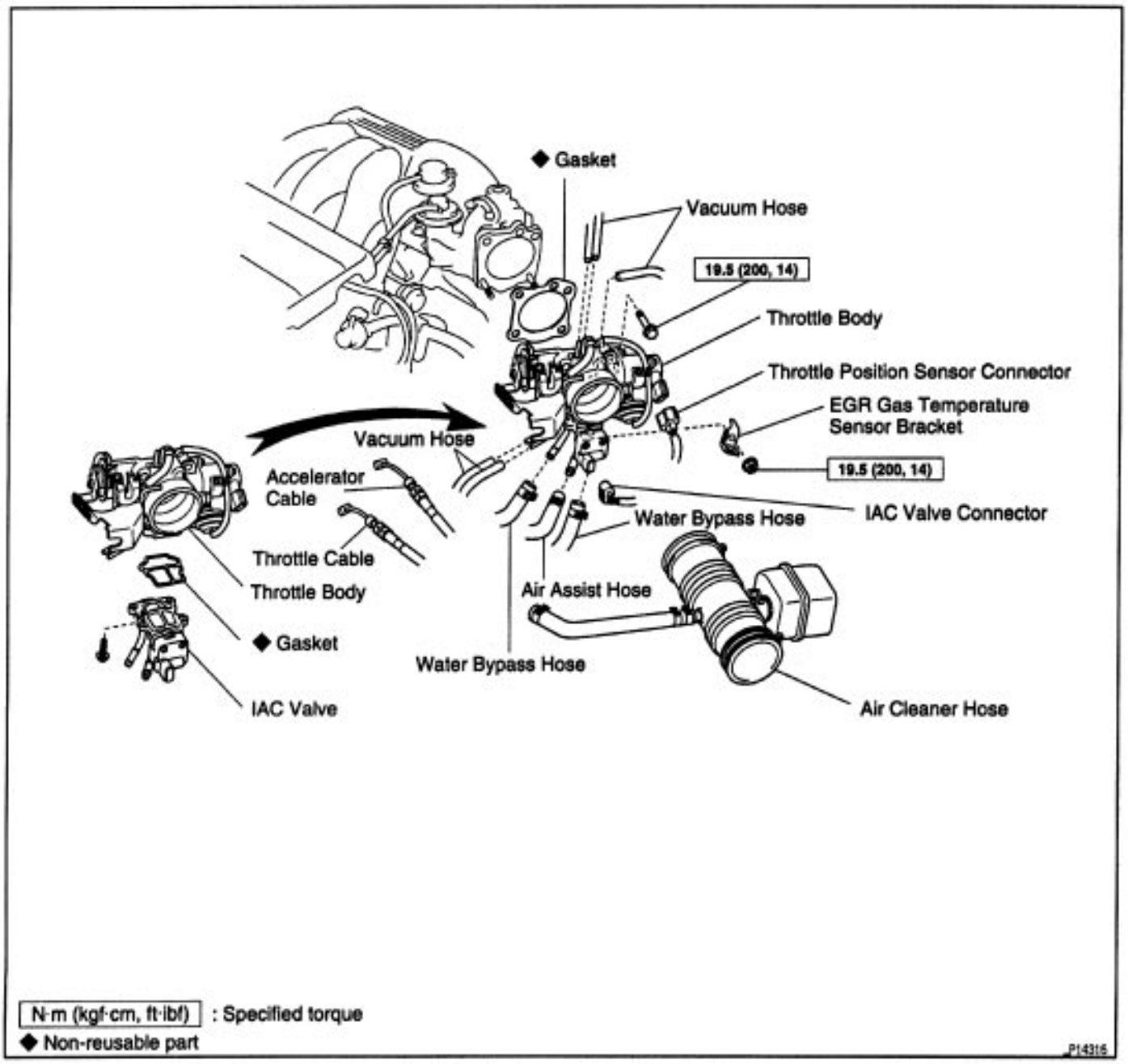


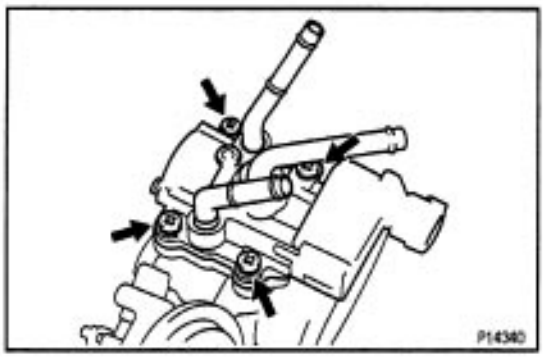

(d) Stop the engine.
(e) Disconnect the air assist hose from the air pipe, and block off the IAC valve exit and the entry to the pipe.
(f) Start the engine and check that the idle speed reaches 500 rpm or below (the engine may stall).
If the idle does not reach 500 rpm or below, check for a leak between the air pipe and injector.




(g) Remove the SST from the DLC 1.
SST 09843–18020
(h) Reconnect the air assist hose to the air pipe.

## COMPONENTS FOR REMOVAL AND INSTALLATION






## IAC VALVE REMOVAL

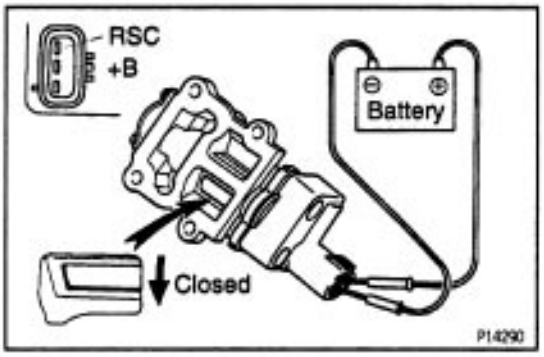
**(See Components for Removal and Installation)**

**1. REMOVE THROTTLE BODY**

**(See page** EG2–266**)**

**2. REMOVE IAC VALVE**

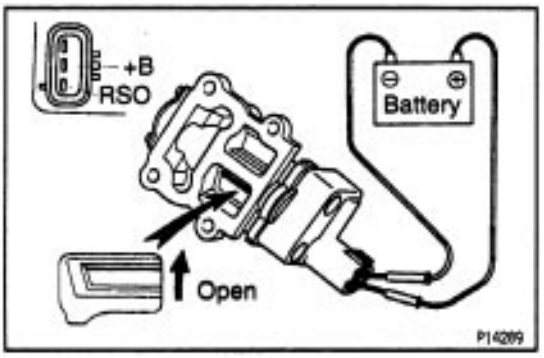
Remove the 4 screws, IAC valve and gasket.




## IAC VALVE INSPECTION

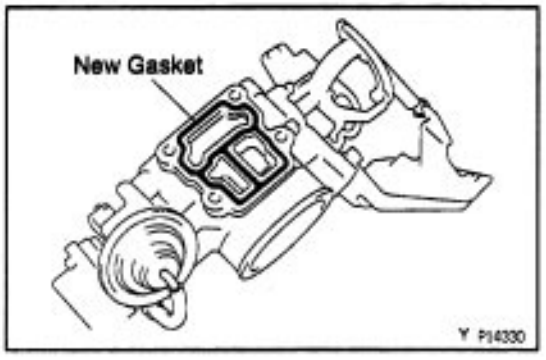
**INSPECT IAC VALVE OPERATION**

(a) Connect the positive (+) lead from the battery to terminal +B and negative (–) lead to terminal RSC, and check that the valve is closed.




(b) Connect the positive (+) lead from the battery to terminal +B and negative (–) lead to terminal RSO, and check that the valve is open.

If operation is not as specified, replace the IAC valve.

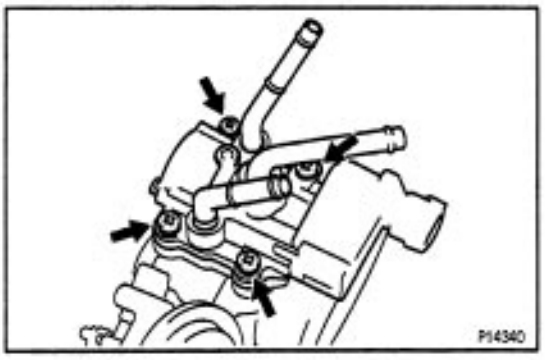



## IAC VALVE INSTALLATION

**(See Components for Removal and Installation)**

**1. INSTALL IAC VALVE**

(a) Place a new gasket on the throttle body.

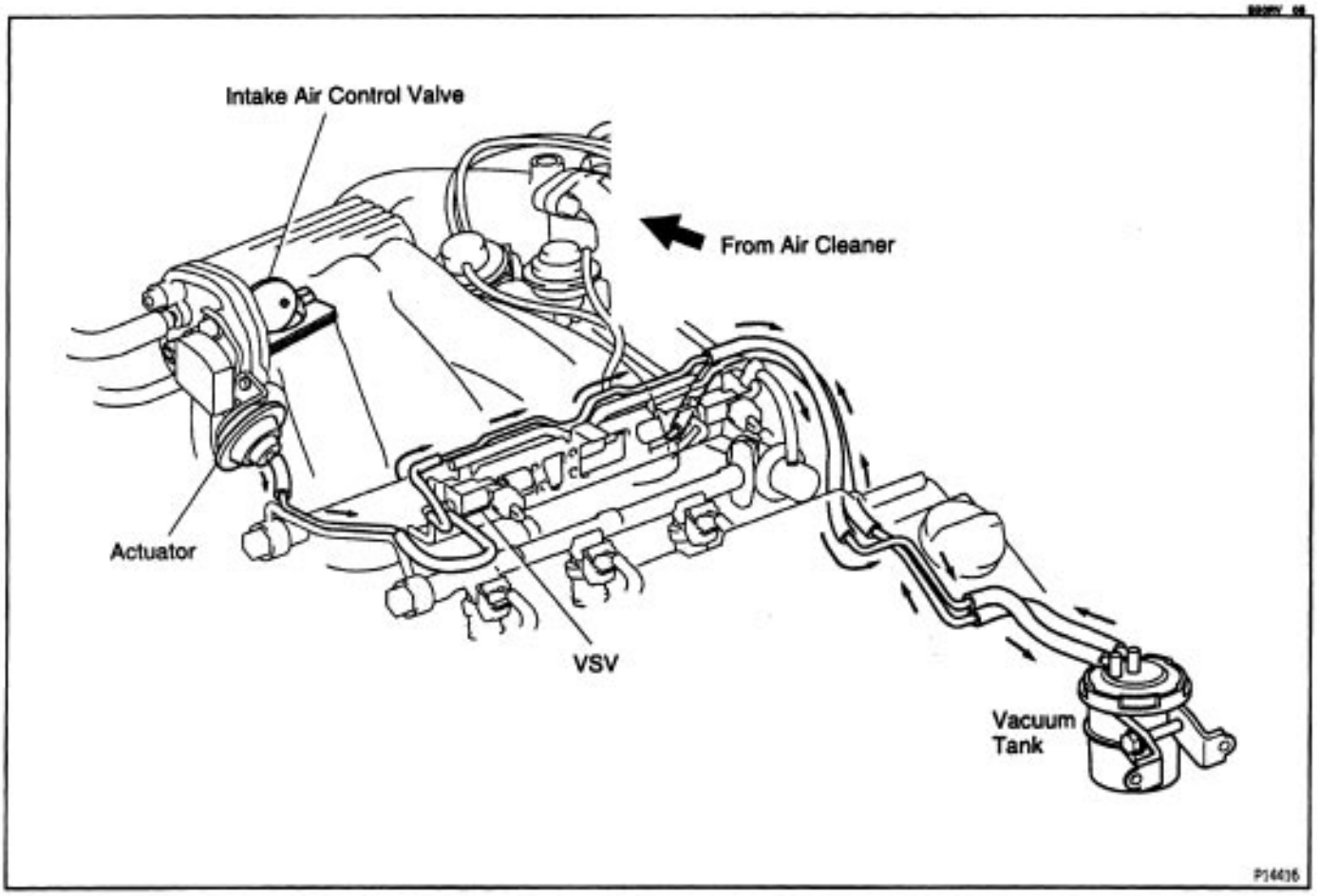


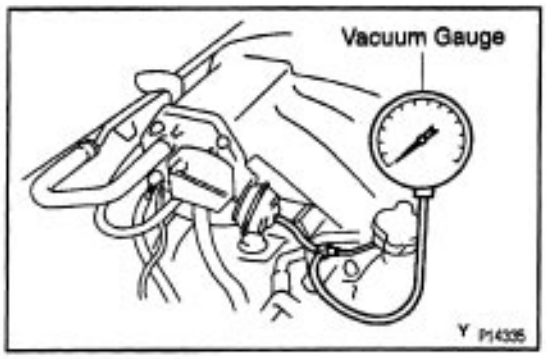

(b) Install the IAC valve with the 4 screws.

**2. INSTALL THROTTLE BODY**

**(See page** EG2–269**)**

# ACOUSTIC CONTROL INDUCTION SYSTEM (ACIS)

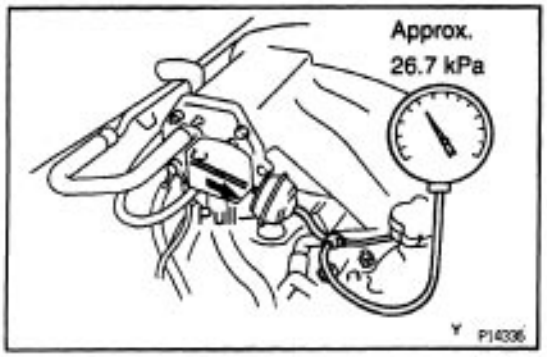



## ON–VEHICLE INSPECTION

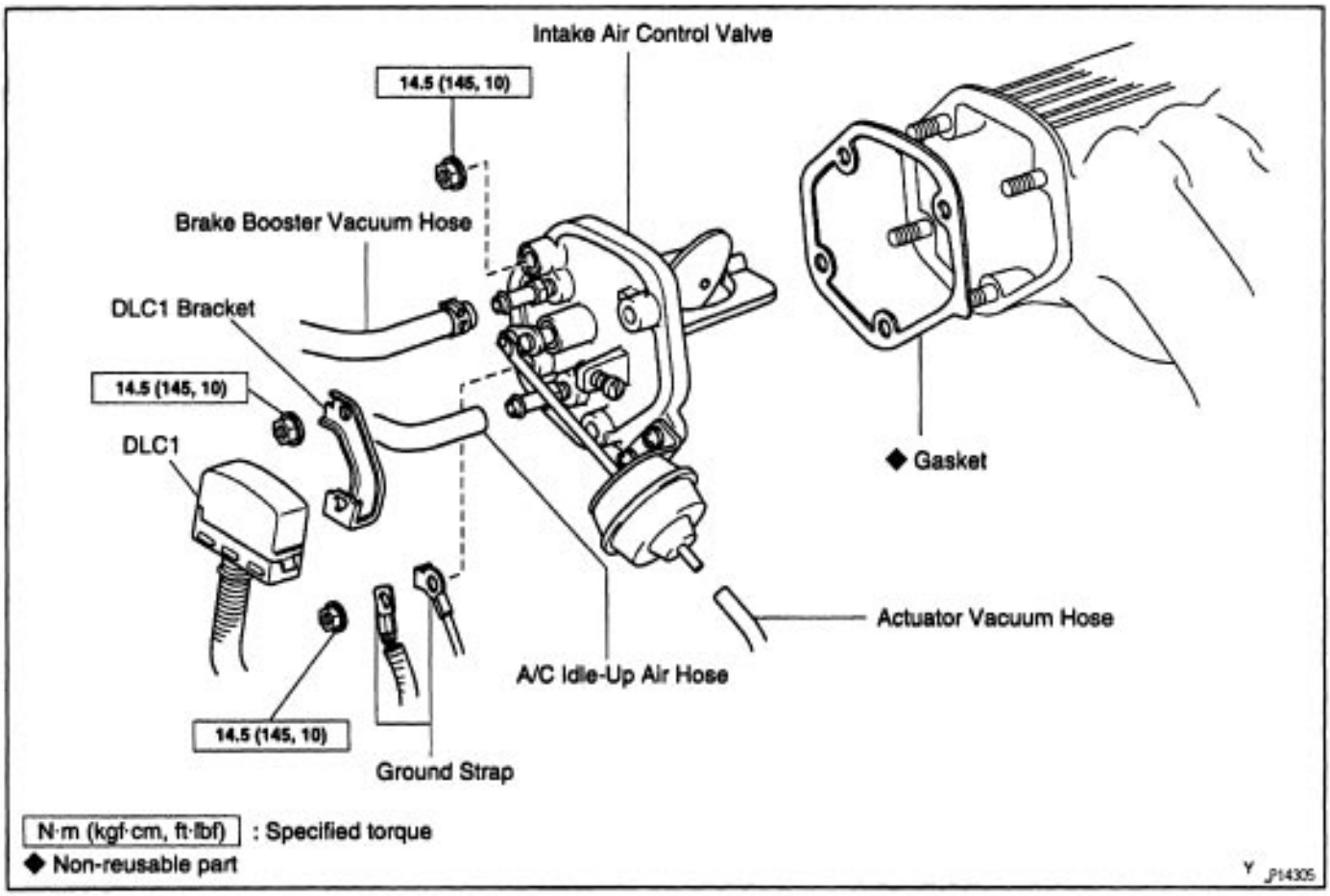
### INSPECT INTAKE AIR CONTROL VALVE

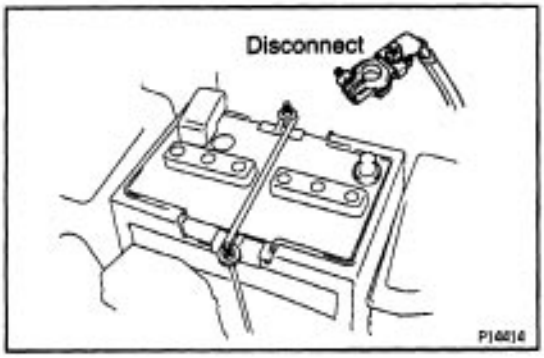
(a) Using a 3–way connector, connect vacuum gauge to the actuator hose.
(b) Start the engine.
(c) While the engine is idling, check that the vacuum gauge needle does not move.




(d) Rapidly depress the accelerator pedal to fully open position and check that the vacuum gauge needle momentarily fluctuates up to approx. 26.7 kPa (200 mmHg, 7.9 in.Hg). (The actuator rod is pulled out.)

# COMPONENTS FOR INTAKE AIR CONTROL VALVE REMOVAL AND INSTALLATION



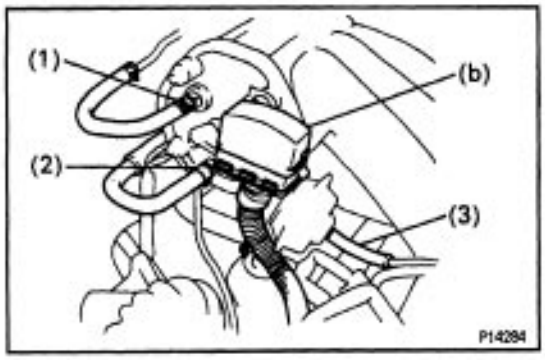




## INTAKE AIR CONTROL VALVE REMOVAL

**(See Components for Removal and Installation)**

**1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY**

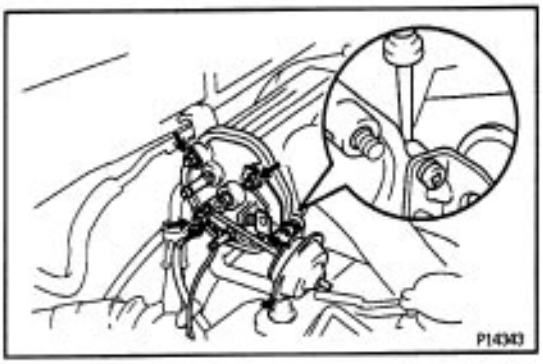
**CAUTION: Work must be started after 90 seconds from the time the ignition switch is turned to the "LOCK" position and the negative (–) terminal cable is disconnected from the battery.**




**2. DISCONNECT HOSES FROM INTAKE AIR CONTROL VALVE**

(a) Disconnect the following hoses:
(1) Brake booster vacuum hose
(2) A/C idle–up air hose
(3) Actuator vacuum hose

(b) Disconnect the DLC1.

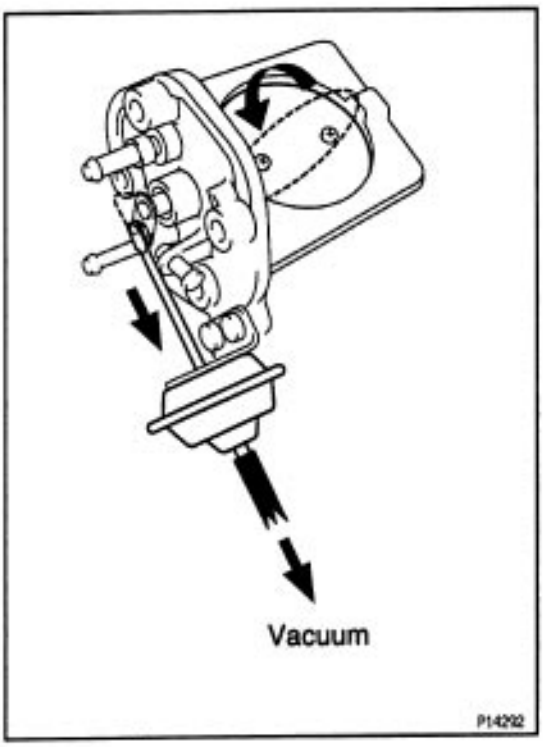



**3. REMOVE INTAKE AIR CONTROL VALVE**

(a) Remove the 4 nuts and DLC1 bracket, and disconnect the 2 ground straps.

(b) Remove the intake air control valve by prying a screw–driver between the intake air control valve and air intake chamber.

(c) Remove the gasket.



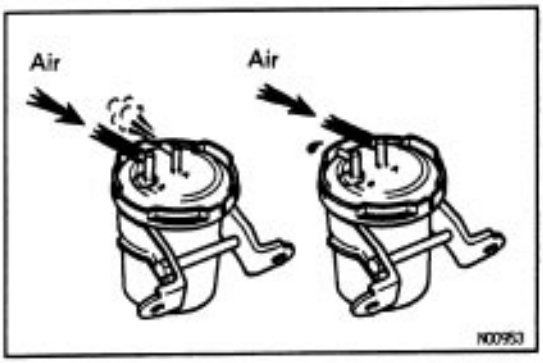

## INTAKE AIR CONTROL VALVE AND COMPONENTS INSPECTION

**1. INSPECT INTAKE AIR CONTROL VALVE**

(a) With 26.7 kPa (200 mmHg, 7.9 in.Hg) of vacuum applied to the actuator, check that the actuator rod moves.

(b) One minute after applying the vacuum in (a), check that the actuator rod does not return.

If the operation is not as specified, replace the intake air control valve.

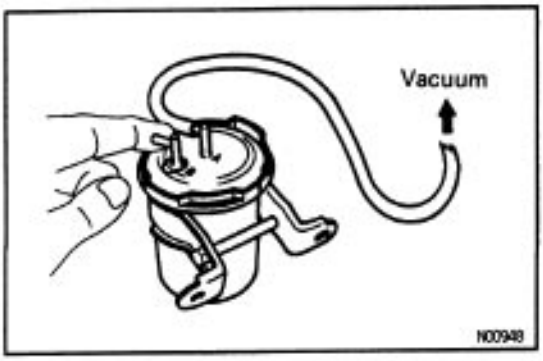



**2. INSPECT VACUUM TANK**

LOCATION: The LH side member under the battery tray.

(a) Check that air flows from port B to port A.

(b) Check that air does not flow from port A to port B.




(c) Plug port B with your finger, and apply 26.7 kPa (200 mrnHg, 7.9 in.Hg) of vacuum to port A, and check that there is no change in vacuum after one minute.

If the operation is not as specified, replace the vacuum tank.

**3. INSPECT VSV**

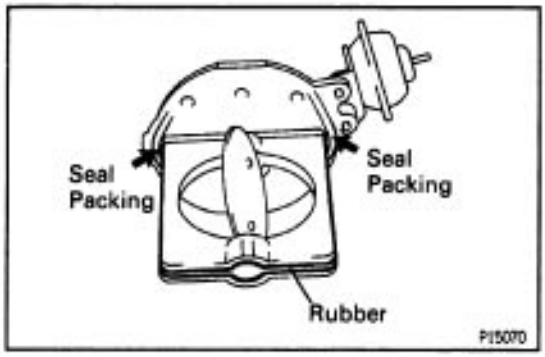
**(See page** EG2–293**)**


# INTAKE AIR CONTROL VALVE INSTALLATION

**(See Components for Removal and Installation)**

**1. INSTALL INTAKE AIR CONTROL VALVE**

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

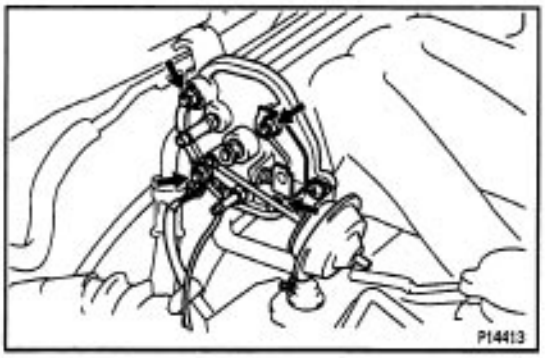



(b) Apply a light coat of engine oil to the rubber portions.

(c) Apply seal packing to the positions of the intake air control valve shown in the

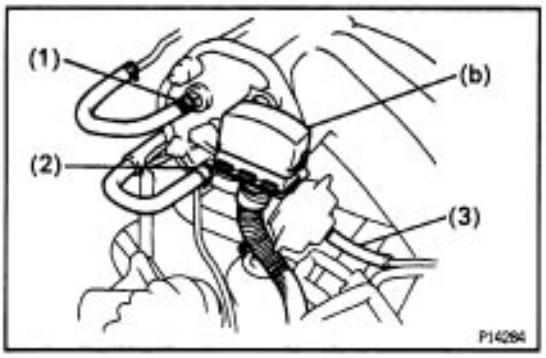
**Seal packing:**

**Part No.08826–00080 or equivalent illustration.**




(d) Install the intake air control valve, DLC 1 bracket and 2 ground straps with the 4 nuts.

**Torque: 14.5 N–m (145 kgf–cm, 10 ft–lbf)**




**2. CONNECT HOSES TO INTAKE AIR CONTROL VALVE**

(a) Connect the following hoses:

(1) Brake booster vacuum hose

(2) A/C idle–up air hose

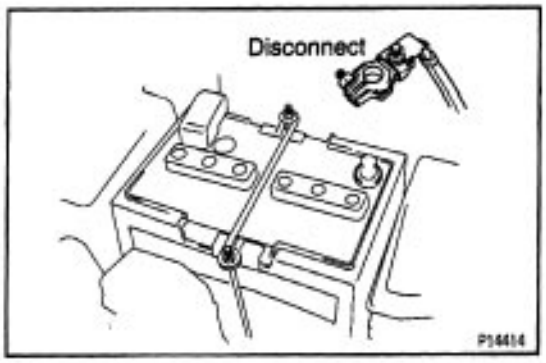
(3) Actuator vacuum hose

(b) Install the DLC1.

**3. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY**

**4. CHECK FOR FUEL LEAKAGE**

**(See page** EG2–228**)**

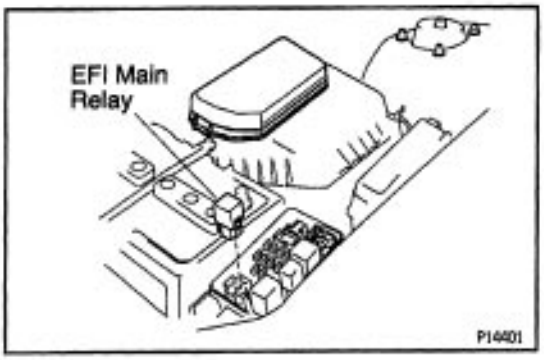



# EFI MAIN RELAY

## EFI MAIN RELAY INSPECTION

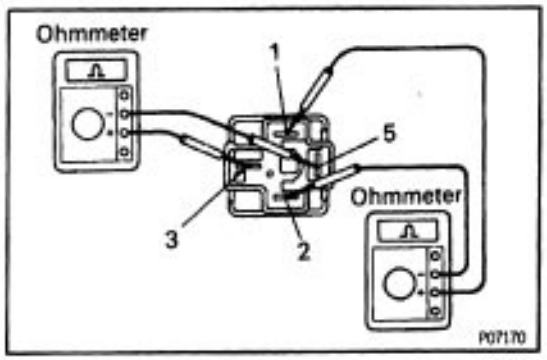
**1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY**

**CAUTION: Work must be started after 90 seconds from the time the ignition switch Is turned to the ”LOCK” position and the negative (–) terminal cable is discon–nected from the battery.**




**2. REMOVE EFI MAIN RELAY**

LOCATION: In the engine compartment relay box.



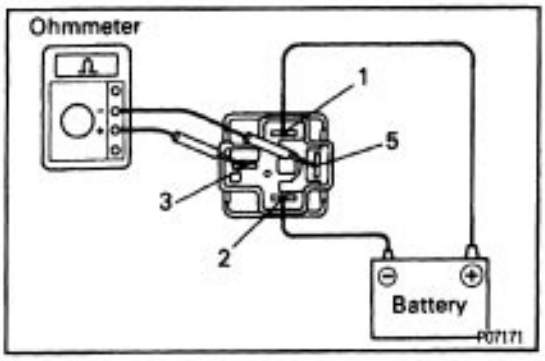

**3. INSPECT EFI MAIN RELAY**

**A. Inspect relay continuity**

(a) Using an ohmmeter, check that there is continuity between terminals 1 and 2.

(b) Check that there is no continuity between terminals 3 and 5.

If continuity is not as specified, replace the relay.




**B. Inspect relay operation**

(a) Apply battery voltage across terminals 1 and 2.

(b) Using an ohmmeter, check that there is continuity between terminals 3 and 5.

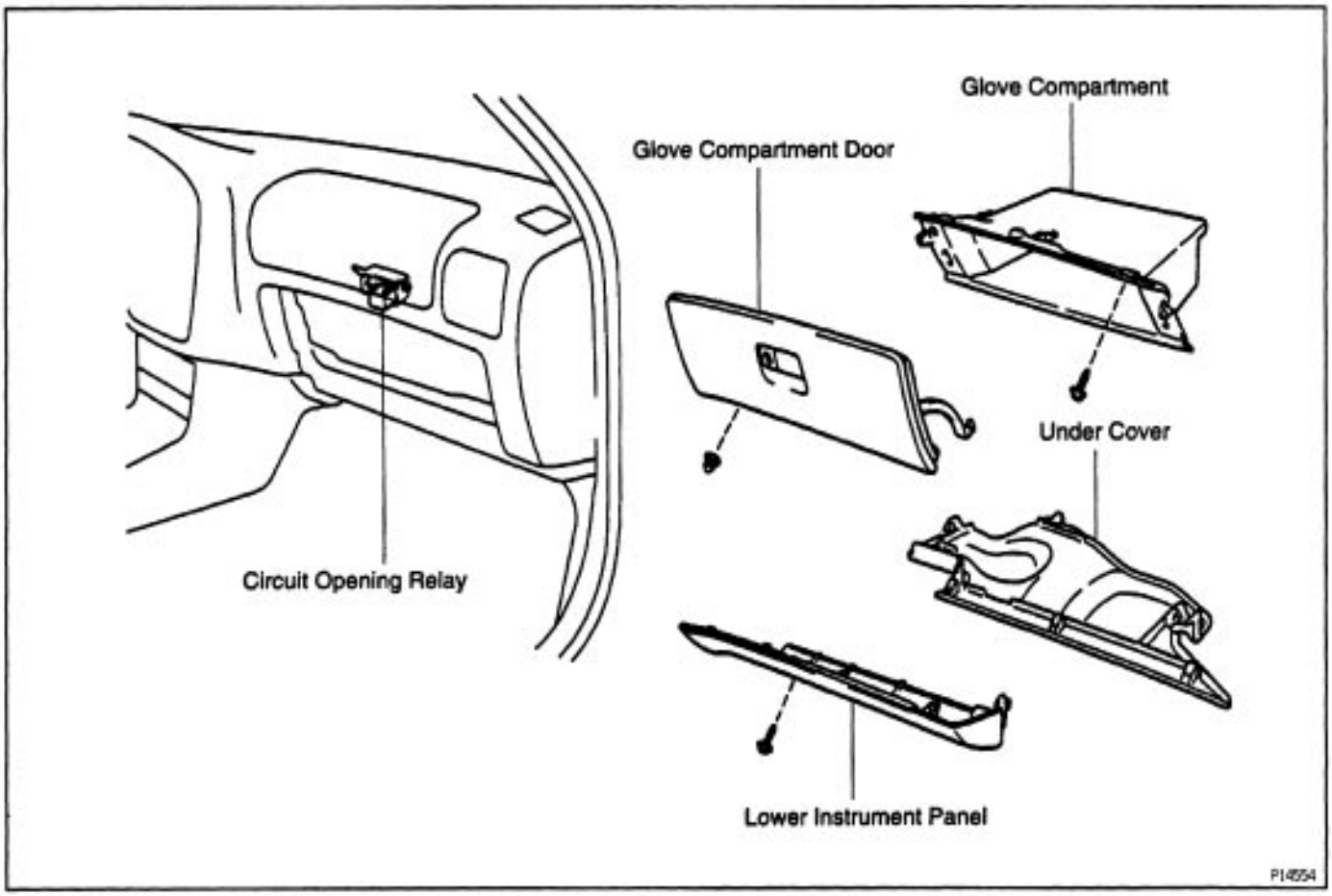
If operation is not as specified, replace the relay.

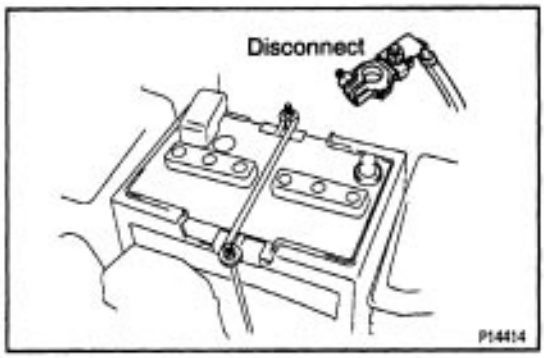
**4. REINSTALL EFI MAIN RELAY**

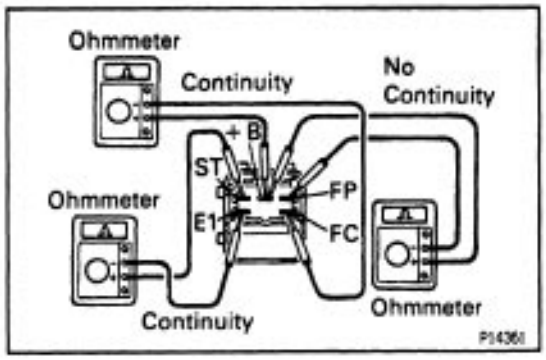
**5. RECONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY**

# CIRCUIT OPENING RELAY

## COMPONENTS FOR REMOVAL AND NOW INSTALLATION




## CIRCUIT OPENING RELAY INSPECTION

**(See Components for Removal and Installation)**

**1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY**

**CAUTION: Work must be started after 90 seconds from the time the ignition switch 1s turned to the 'LOCK' position and the negative (–) terminal cable Is discon–nected from the battery.**

**2. REMOVE CIRCUIT OPENING RELAY**

**3. INSPECT CIRCUIT OPENING RELAY**

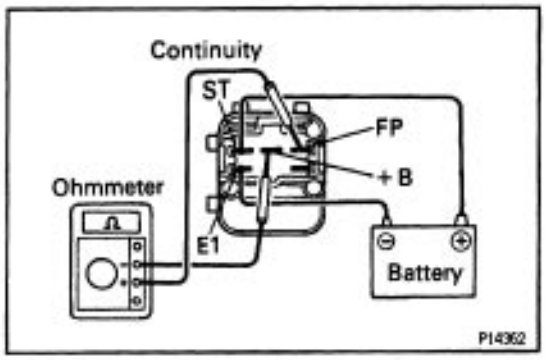
**A. Inspect relay continuity**

(a) Using an ohmmeter, check that there is continuity between terminals ST and E1.

(b) Check that there is continuity between terminals +B and FC.

(c) Check that there is no continuity between terminals + B and FP.

If continuity is not as specified, replace the relay.

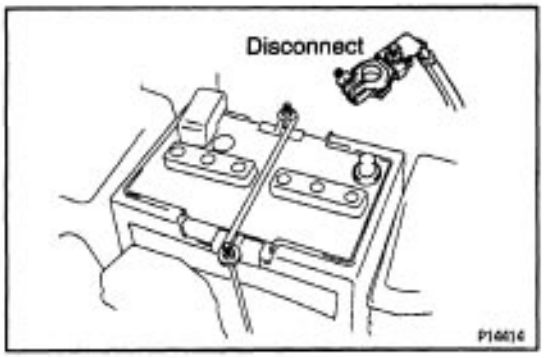



**B. Inspect relay operation**

(a) Apply battery voltage across terminals ST and El.
M Using an ohmmeter, check that there is continuity between terminals +B and FP.
If operation is not as specified, replace the relay.

**4. REINSTALL CIRCUIT OPENING RELAY**

**5. RECONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY**




# ENGINE COOLANT TEMPERATURE (ECT) SENSOR

## ECT SENSOR INSPECTION

**1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY**

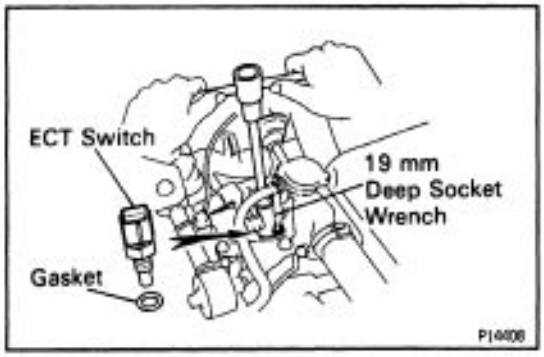
**CAUTION: Work must be started after 90 seconds from the time the ignition switch is turned to the "LOCK" position and the negative (–) terminal cable is disconnected from the battery.**

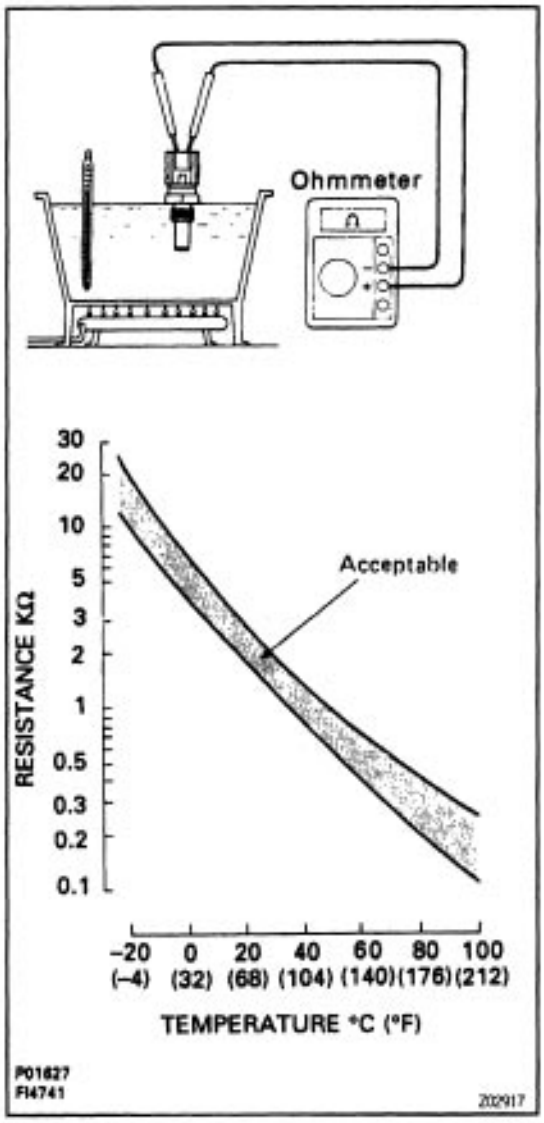
**2. DRAIN ENGINE COOLANT**

**3. REMOVE ECT SENSOR**

(a) Disconnect the ECT sensor connector.

(b) Using a 19 mm deep socket wrench, remove the ECT sensor and gasket.




**4. INSPECT ECT SENSOR**

Using an ohmmeter, measure the resistance between the terminals.

**Resistance:**

**Refer to the graph**

If the resistance is not as specified, replace the ECT sensor.

**5. REINSTALL ECT SENSOR**

(a) Install a new gasket to the ECT sensor.

(b) Using a 19 mm deep socket, install the ECT sensor.

**Torque: 20 N–m (200 kgf–cm, 14 ft–lbf)**

(c) Connect the ECT sensor connector.

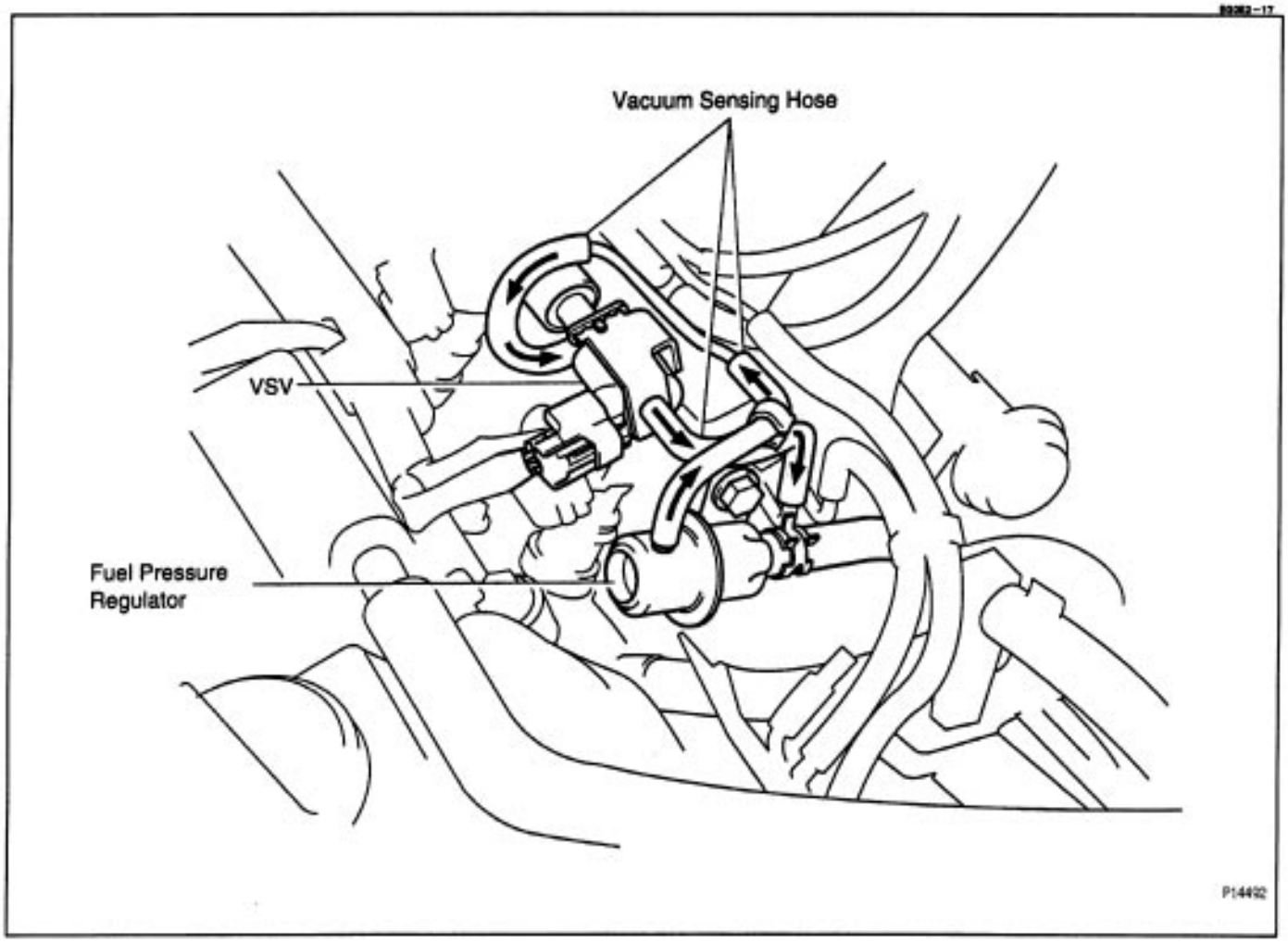
**6. REFILL WITH ENGINE COOLANT**

**Capacity:**

**8.7 liters (9.2 US qts, 7.7 Imp. qts)**

**7. RECONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY**

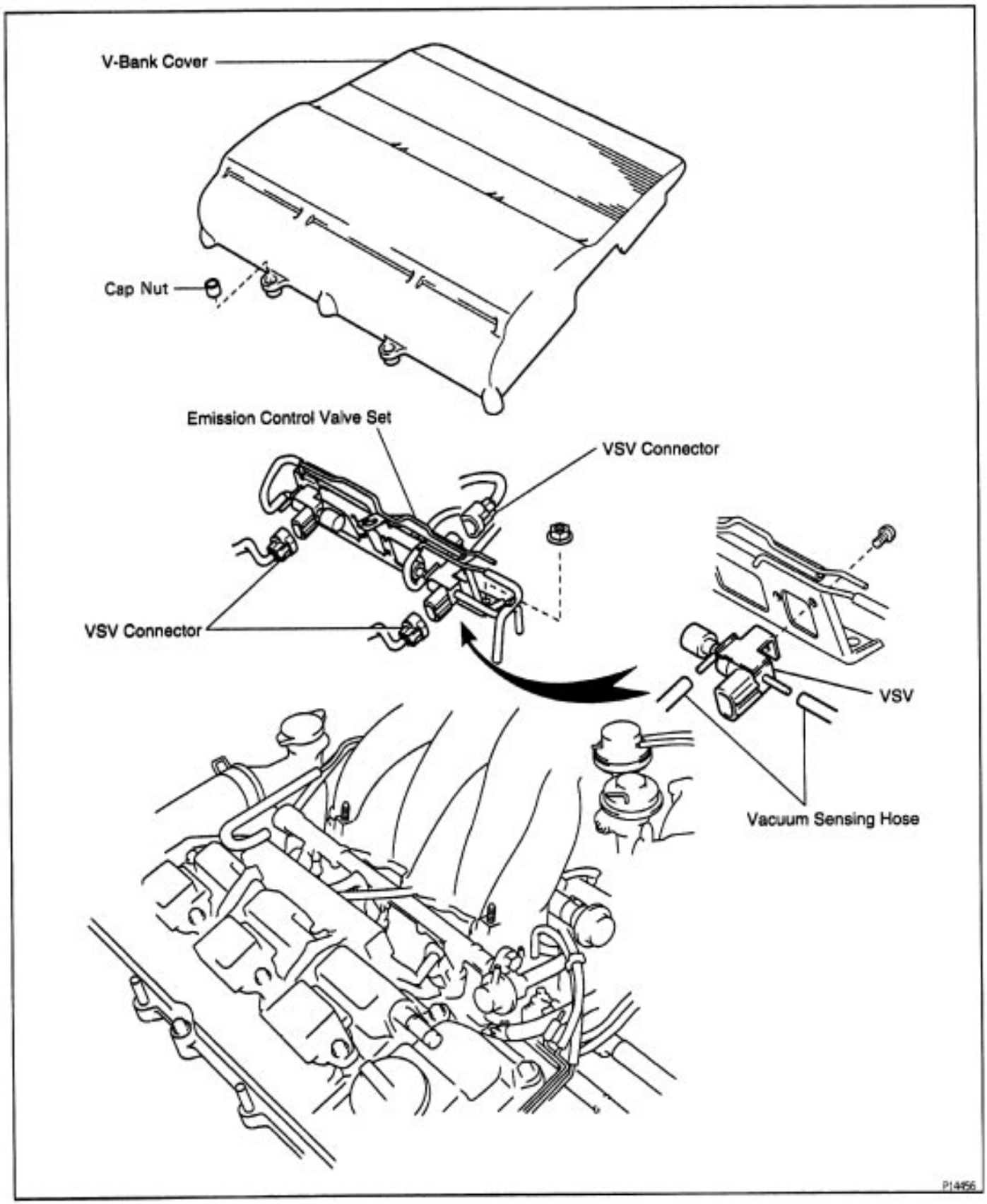
# VSV FOR FUEL PRESSURE CONTROL

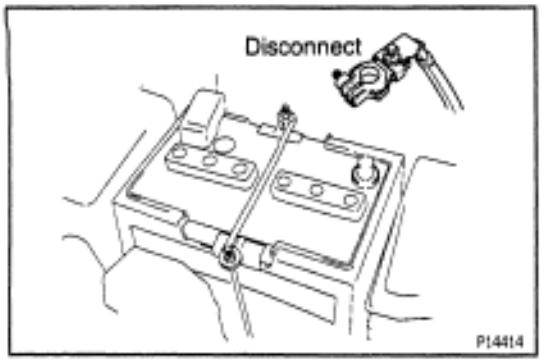



## ON–VEHICLE INSPECTION

**CHECK FUEL PRESSURE**
**(See step 2 on page EG2–231)**

# COMPONENTS FOR REMOVAL AND INSTALLATION



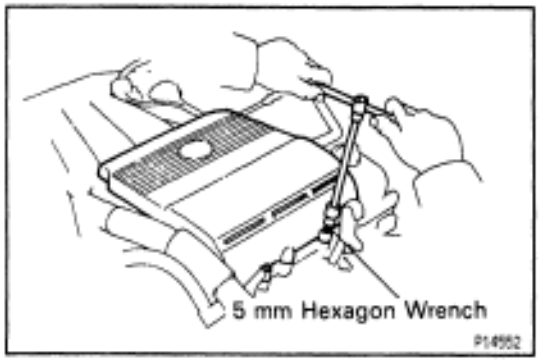



# VSV INSPECTION

**(See Components for Removal and Installation)**

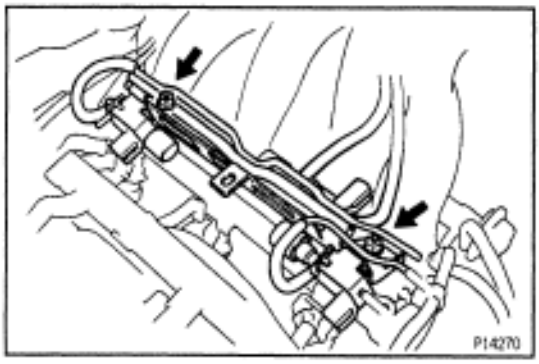
**1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY**

**CAUTION: Work must be started after 90 seconds from the time the ignition switch is turned to the 'LOCK' position and the negative (–) terminal cable is disconnected from the battery.**




**2. REMOVE V–BANK COVER**

Using a 5 mm hexagon wrench, remove the 2 cap nuts and V–bank cover.



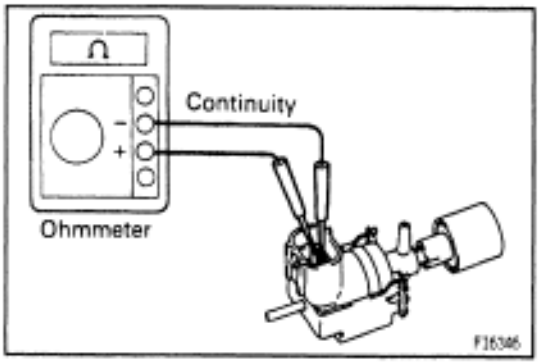

**3. REMOVE EMISSION CONTROL VALVE SET**

**(See step 7 on page** EG2–246**)**

**4. REMOVE VSV**

(a) Disconnect the 2 vacuum sensing hoses from the VSV.

(b) Remove the screw and VSV.




**5. INSPECT VSV**

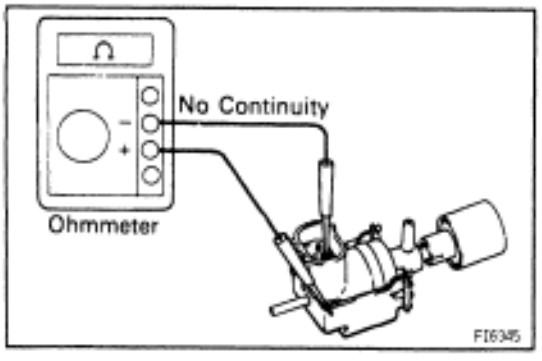
**A. Inspect VSV for open circuit**

Using an ohmmeter, check that there is continuity between the terminals.

**Resistance:**

**33 – 39 Ω at 20°C (68°F)**

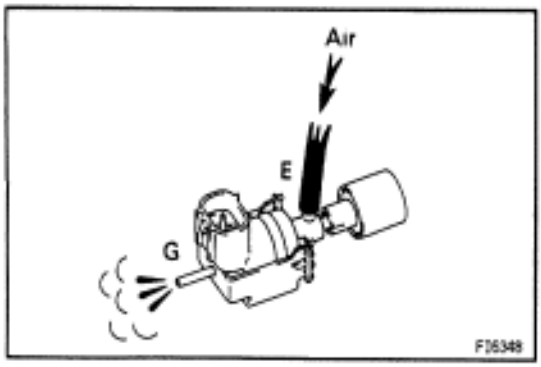
If there is no continuity, replace the VSV.




**B. Inspect VSV for ground**

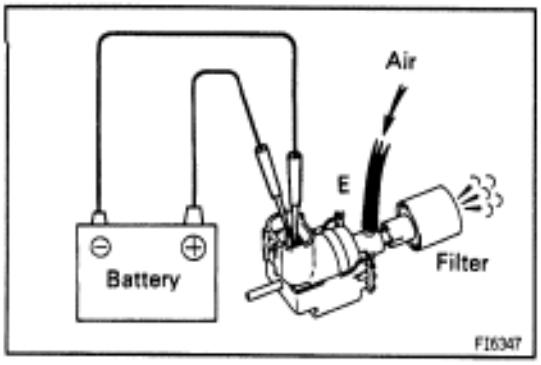
Using an ohmmeter, check that there is no continuity between each terminal and the body.

If there is continuity, replace the VSV.

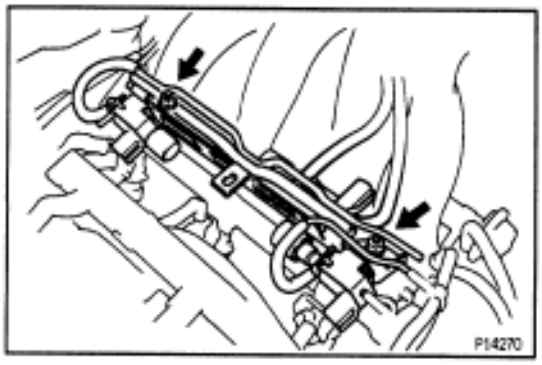



**C. Inspect VSV operation**

(a) Check that the air flows from ports E to G.



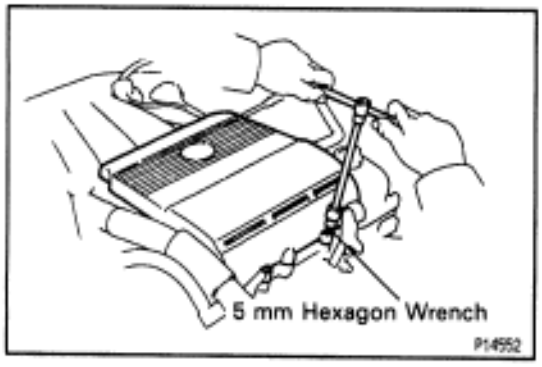

(b) Apply battery voltage across the terminals.
(c) Check that the air flows from port E to the filter.
If operation is not as specified, replace the VSV.




**6. REINSTALL EMISSION CONTROL VALVE SET**
**(See step 8 on page** EG2–256**)**

**7. REINSTALL VSV**

(a) Install the VSV with the screw.
(b) Connect the 2 vacuum sensing hoses to the VSV.

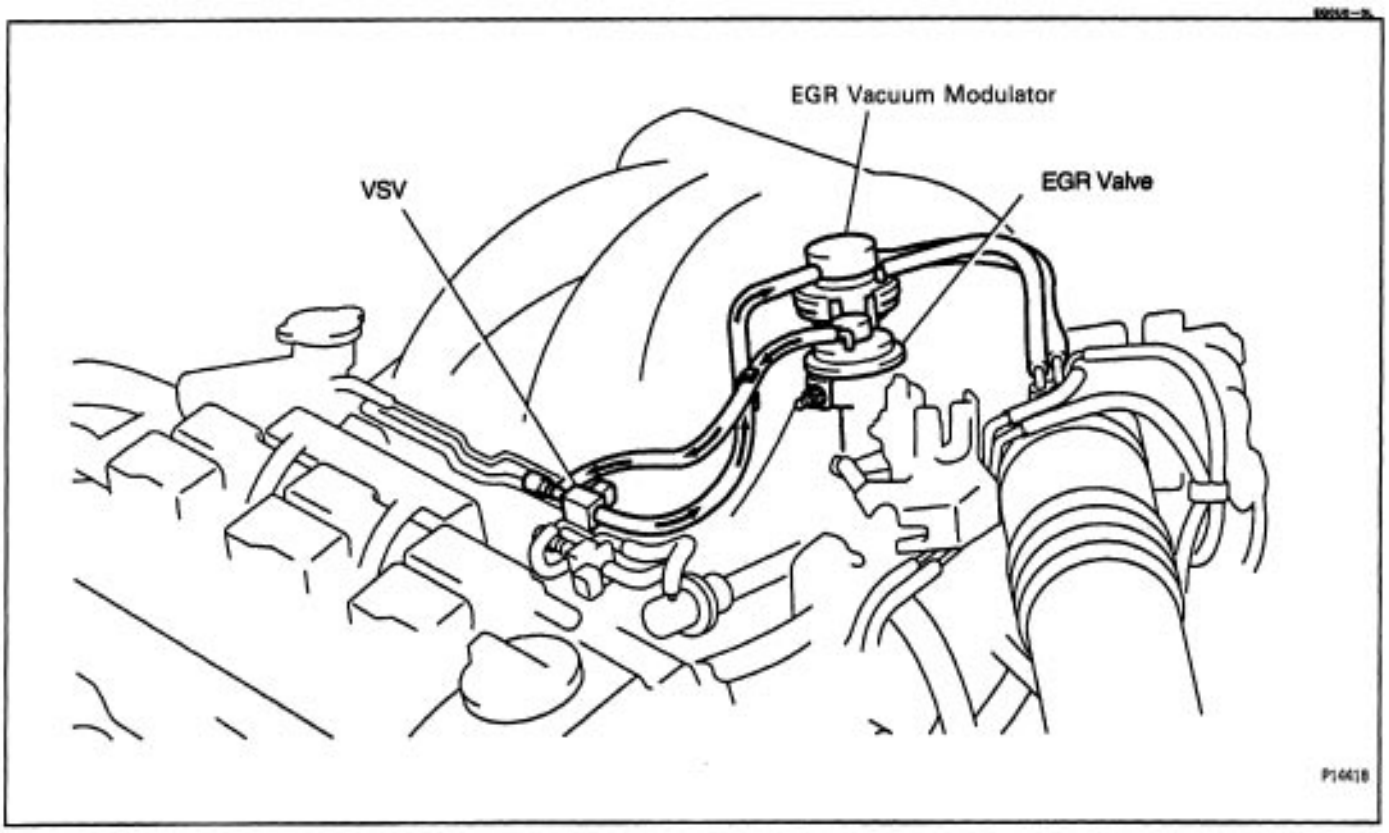



**8. REINSTALL V–BANK COVER**

Using a 5 mm hexagon wrench, install the V–bank cover with the 2 cap nuts.
HINT: For fixing the V–bank cover, push on the cover until sense of ”click” is felt.

**9. RECONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY**

# VSV FOR EGR

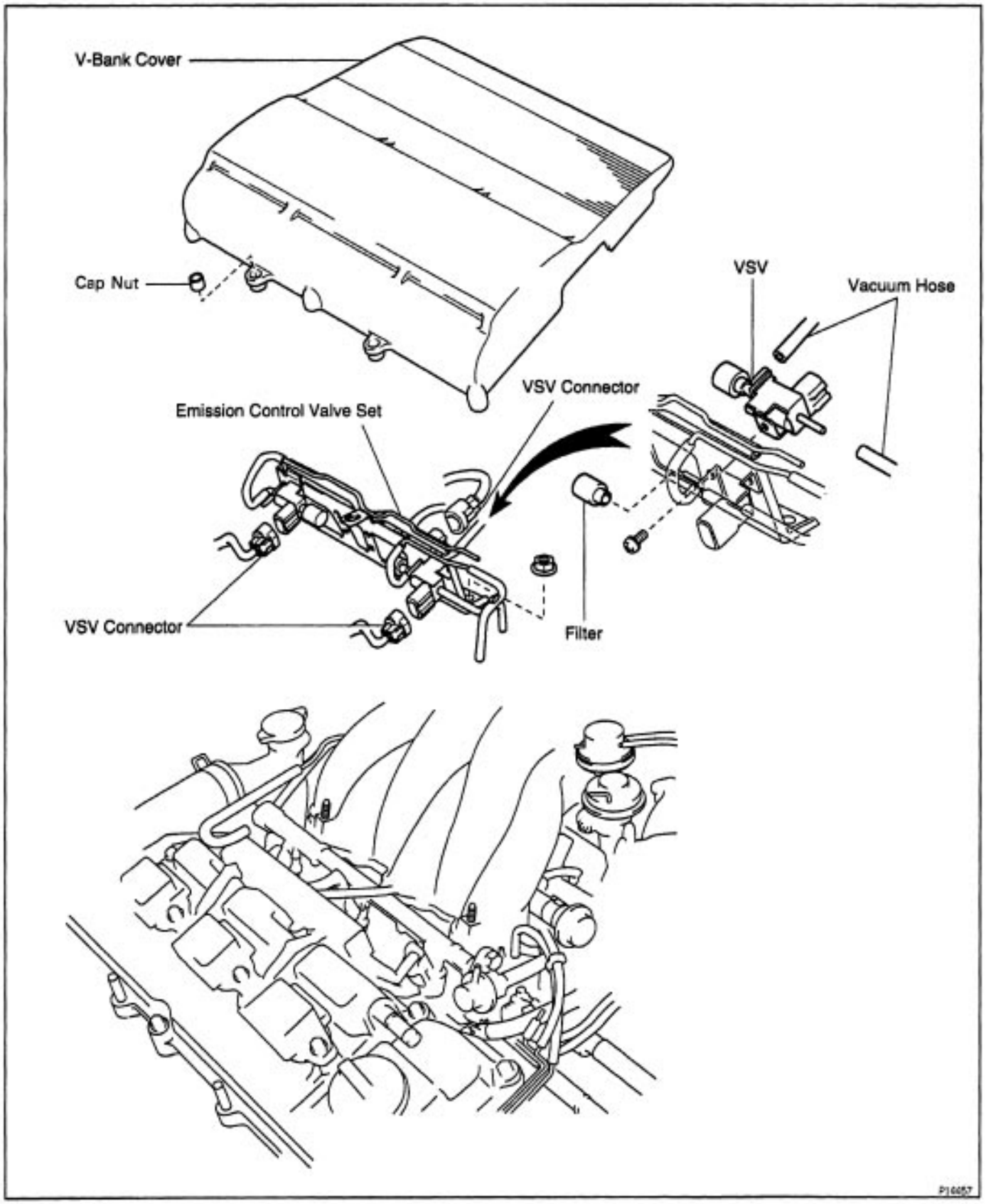



## ON–VEHICLE INSPECTION

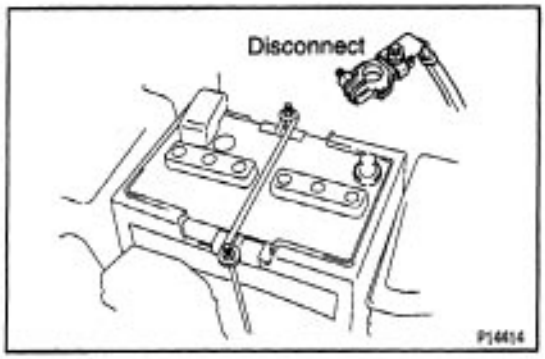
**EGR SYSTEM INSPECTION**

**(See steps 2 to 6 on pages EG2–207 and 208)**

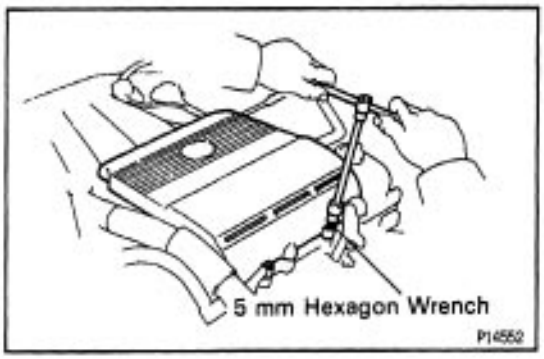
# COMPONENTS FOR REMOVAL AND INSTALLATION



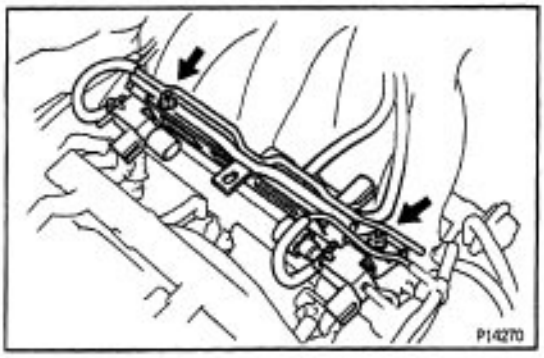
# VSV INSPECTION



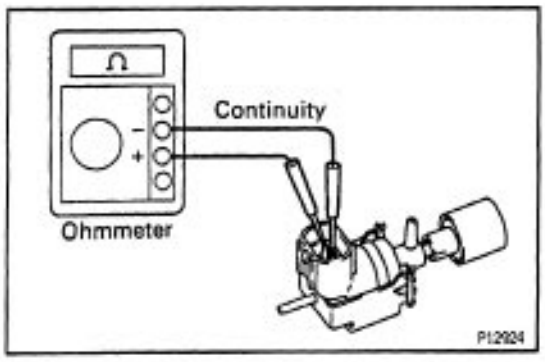

**(See Components for Removal and Installation)**
**1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY**
**CAUTION: Work must be started after 90 seconds from the time the Ignition switch Is turned to the "LOCK" position and the negative (–) terminal cable is disconnected from the battery.**



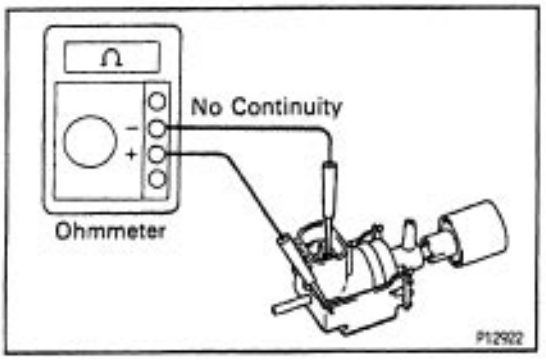

**2. REMOVE V–BANK COVER**
Using a 5 mm hexagon wrench, remove the 2 cap nuts and V – bank cover.




**3. REMOVE EMISSION CONTROL VALVE SET**
**(See step 7 on page** EG2–246**)**
**4. REMOVE VSV**
(a) Remove the filter.
(b) Disconnect the 2 vacuum hoses from the VSV.
(c) Remove the screw and VSV.



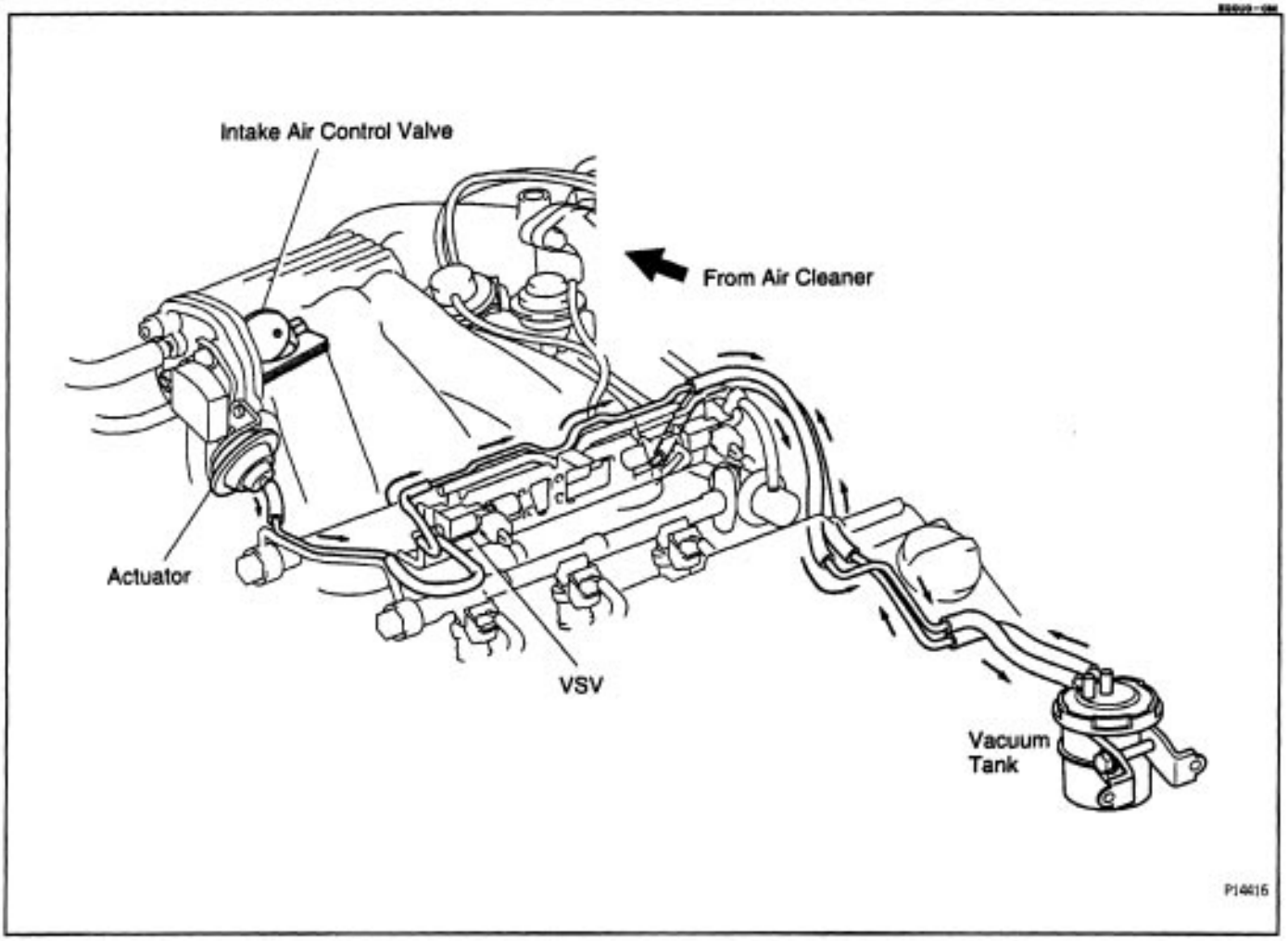

**5. INSPECT VSV**
**A. Inspect VSV for open circuit**
Using an ohmmeter, check that there is continuity between the terminals.
**Resistance:**
**33 – 39 at 20° C (68° F)**
If there is no continuity, replace the VSV.




**B. Inspect VSV for ground**
Using an ohmmeter, check that there is no continuity between each terminal and the body.
If there is continuity, replace the VSV.

-Memo

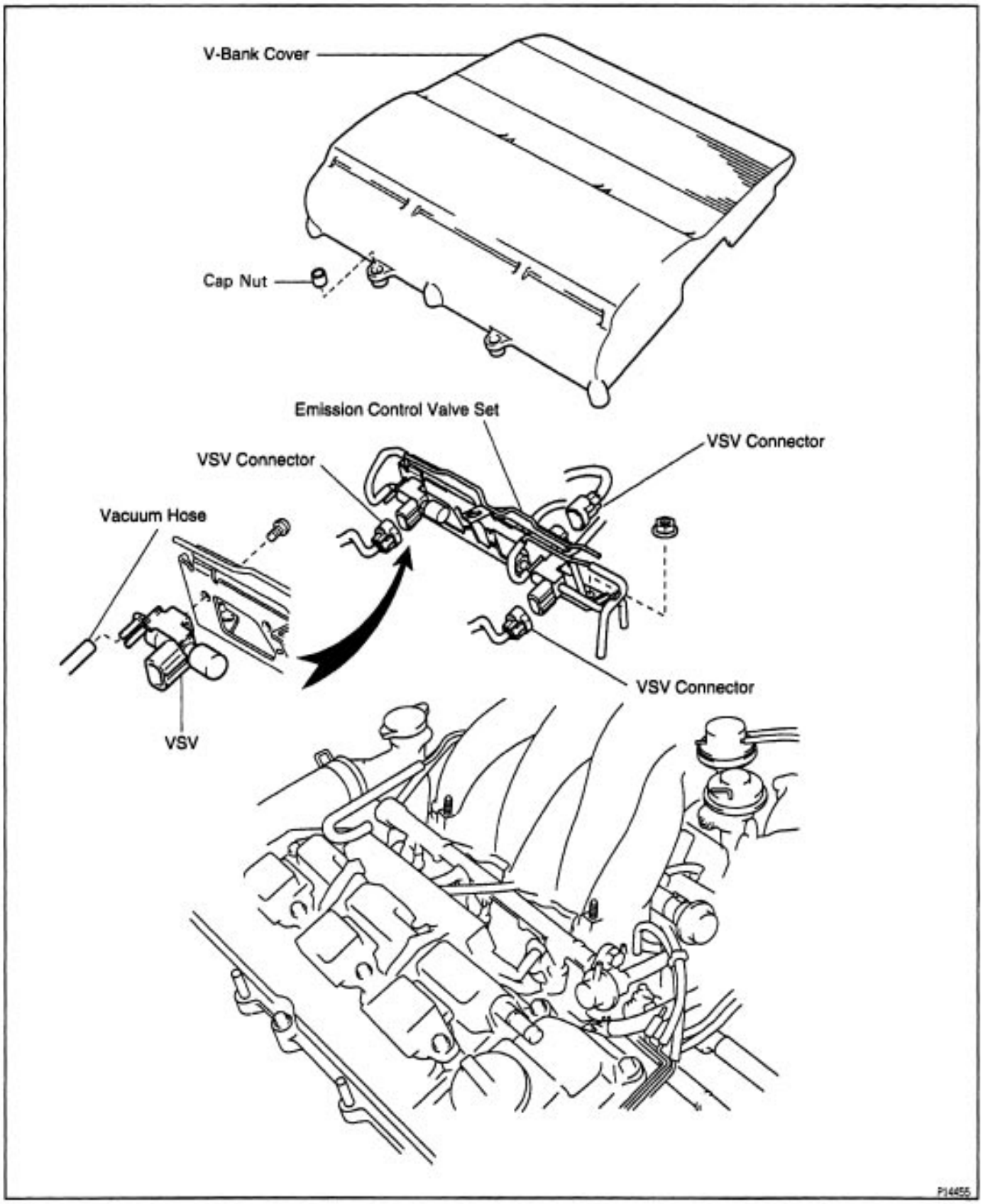
# VSV FOR ACIS



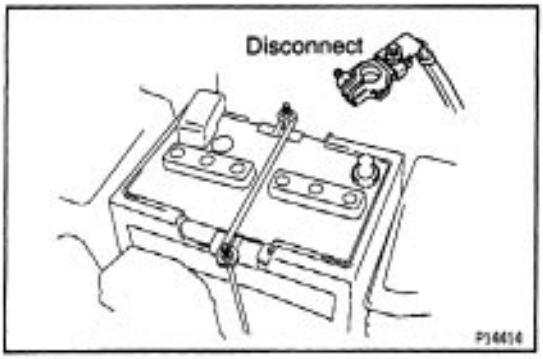

## ON–VEHICLE INSPECTION

**INSPECT INTAKE AIR CONTROL VALVE**
**(See page EG2–275)**

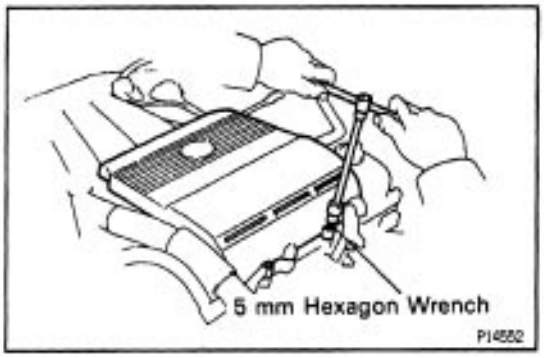
# COMPONENTS FOR REMOVAL AND INSTALLATION



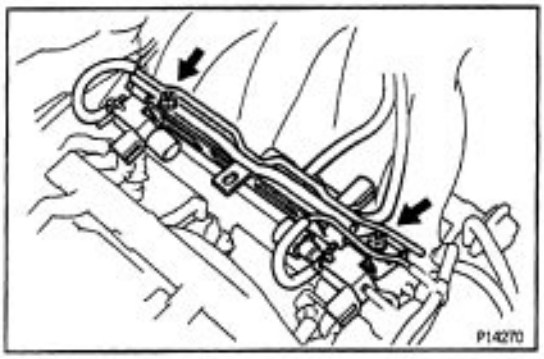
# VSV INSPECTION



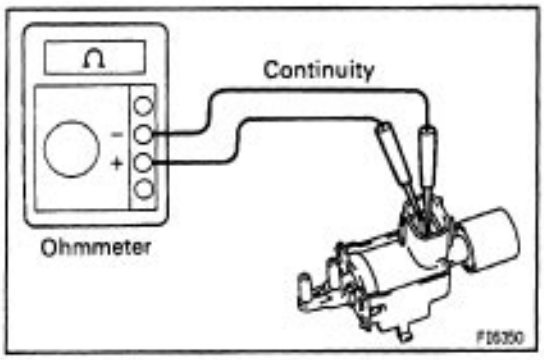

**(See Components for Removal and Installation)**
**1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY**
**CAUTION: Work must be started after 90 seconds from the time the ignition switch is turned to the "LOCK" position and the negative (–) terminal cable is disconnected from the battery.**



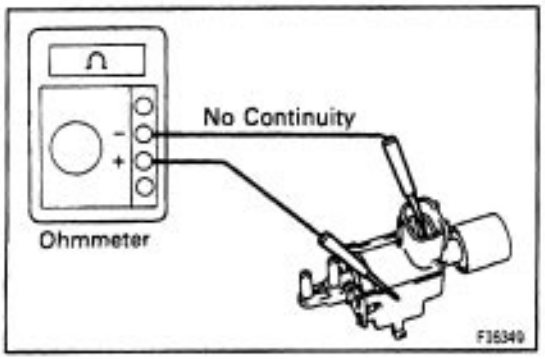

**2. REMOVE V – BANK COVER**
Using a 5 mm hexagon wrench, remove the 2 cap nuts and V–bank cover.



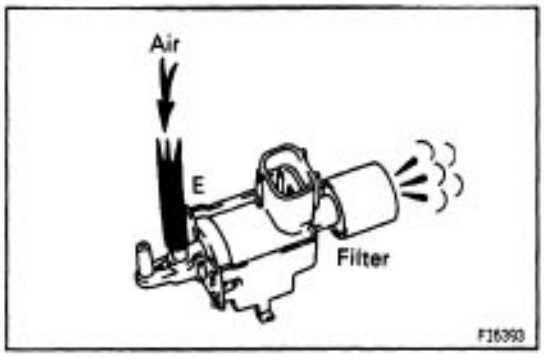

**3. REMOVE EMISSION CONTROL VALVE SET**
**(See step 7 on page** EG2–246**)**
**4. REMOVE VSV**
(a) Disconnect the 2 vacuum hoses from the VSV.
(b) Remove the screw and VSV.




**5. INSPECT VSV**
**A. Inspect VSV for open circuit**
Using an ohmmeter, check that there is continuity between each terminals.
**Resistance:**
**33 – 39 Ω at 20˚C (68˚F)**
If there is no continuity, replace the VSV.

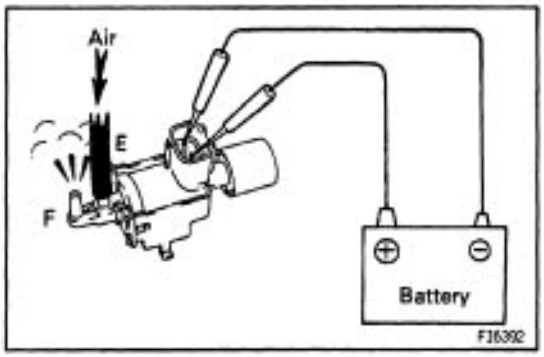



**B. Inspect VSV for ground**
Using an ohmmeter, check that there is no continuity between each terminal and the body.
If there is continuity, replace the VSV.

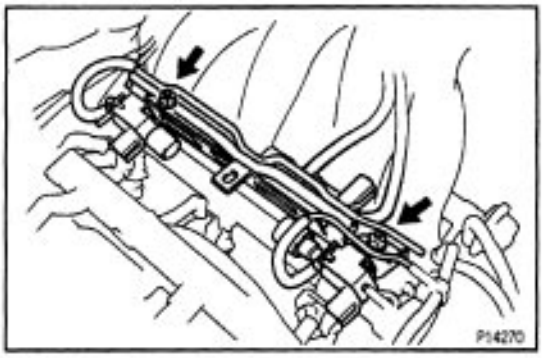



**C. Inspect VSV operation**

(a) Check that air flows from pipe E to the filter.



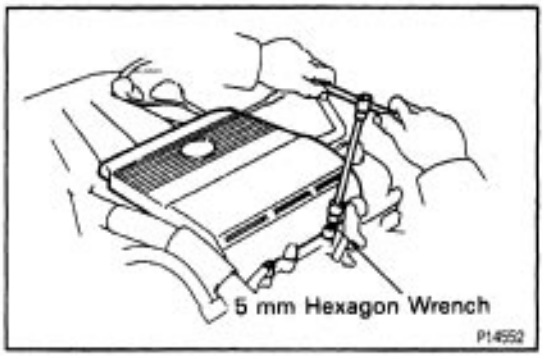

(b) Apply battery voltage across the terminals.
(c) Check that air flows from pipe E to pipe F.
If operation is not as specified, replace the VSV.




**6. REINSTALL EMISSION CONTROL VALVE SET**
**(See step 8 on page** EG2–256**)**

**7. REINSTALL VSV**

(a) Install the VSV with the screw.
(b) Connect the 2 vacuum to the VSV.

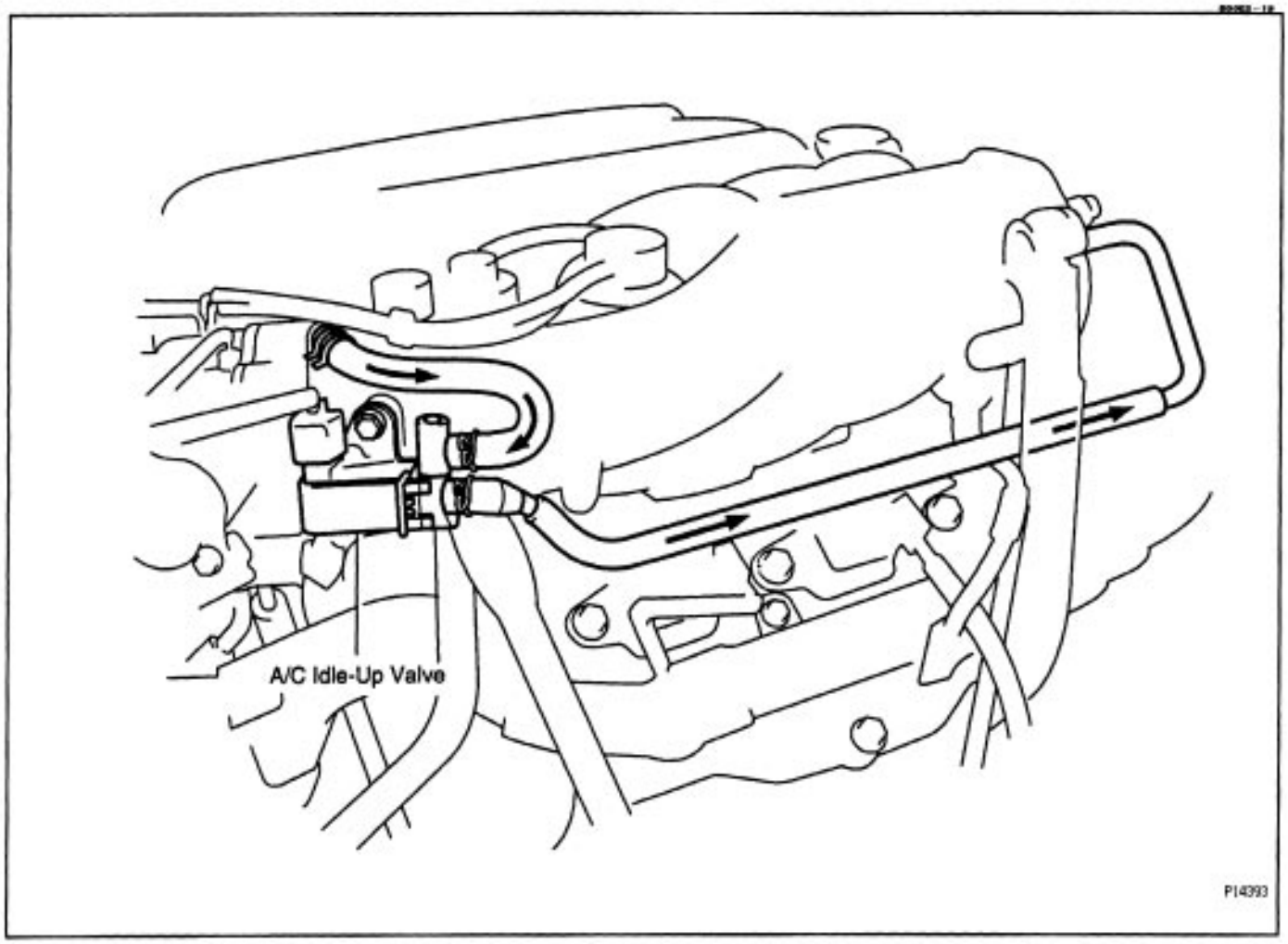



**8. REINSTALL V–BANK COVER**

Using a 5 mm hexagon wrench, install the V – bank cover with the 2 cap nuts.
HINT: For fixing the V–bank cover, push on the cover until sense of ”click” is felt.

**9. RECONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY**

# AC IDLE–UP VALVE

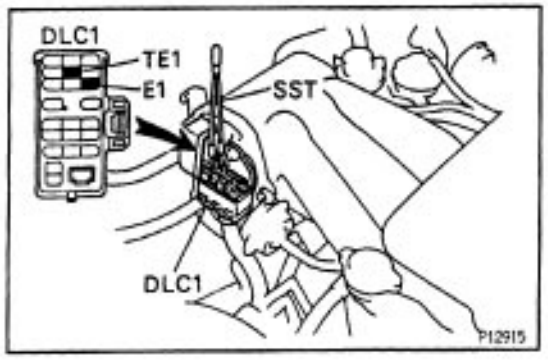



## ON–VEHICLE INSPECTION

### INSPECT A/C IDLE–UP VALVE OPERATION

(a) Initial conditions:

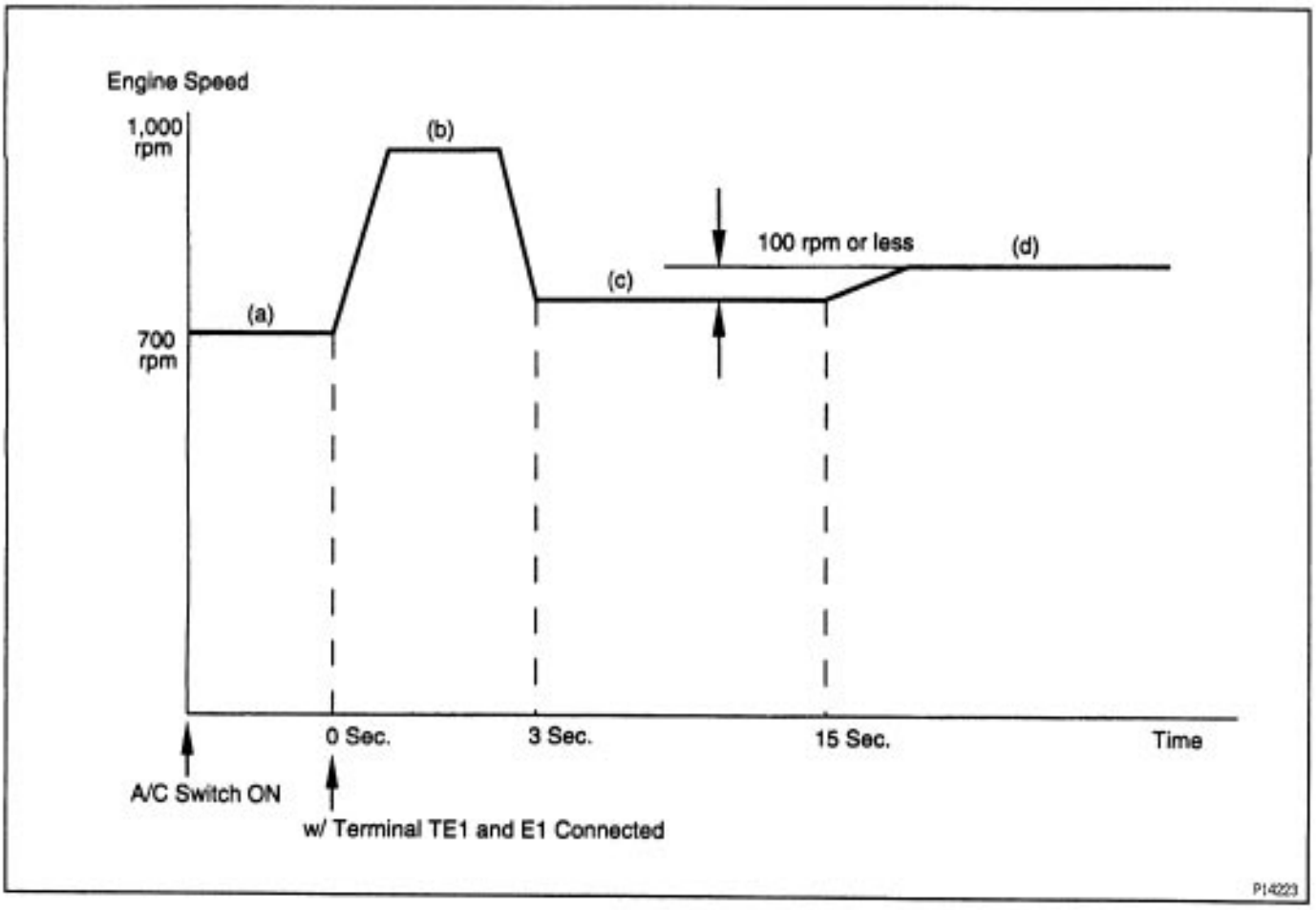
- Engine at normal operating temperature
- Idle speed set correctly
- Transmission in neutral position
- A/C switch ON

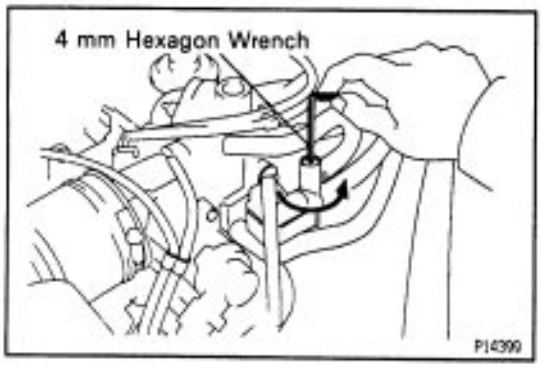



(b) Using SST, connect terminals TE1 and E1 of the DLC 1, check that idle–up occurs for approx. 3 seconds.
SST 09843–18020
Valve operation is faulty if during the idle–up period the engine speed drops by 100 rpm or more, rough idle occurs, or the engine stalls.

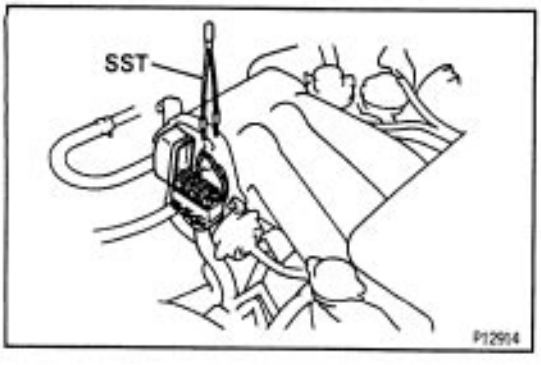
(c) Observe the idle speed for approx. 3 to 15 seconds. During this time the idle –up valve should go off, the IAC valve half –open and idle –up should occur.

(d) Check that the idle speed after approx. 15 seconds, does not vary greatly from the idle speed observed in step
(c). The idle–up valve should now be in ON position.



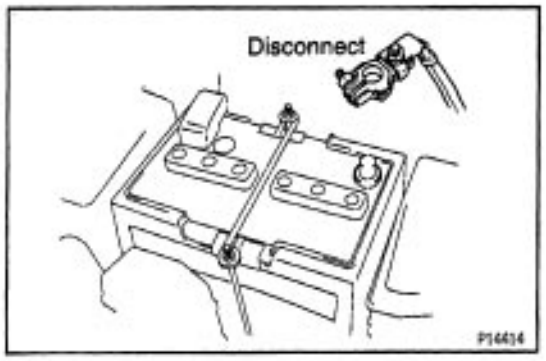




If the idle speed is increases by more 100 rpm, using a 4 mm hexagon wrench, turn the idle–up valve adjustment screw to correct the idle–up valve.



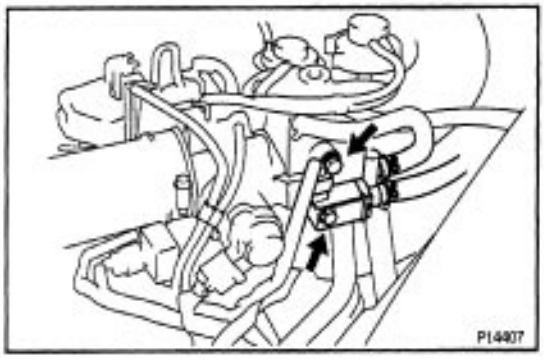

(e) Remove the SST from the DLC1.
SST 09843–18020
(f) A/C switch OFF.

# A/C IDLE–UP VALVE INSPECTION



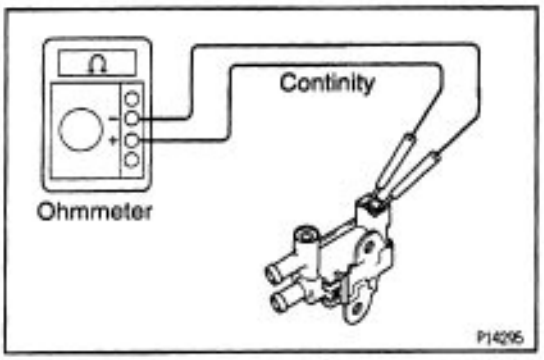

**1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY**

**CAUTION: Work must be started after 90 seconds from the time the ignition switch Is turned to the ”LOCK” position and the negative (–) terminal cable is discon–nected from the battery.**




**2. REMOVE A/C IDLE–UP VALVE**

(a) Disconnect the idle–up valve connecter.
(b) Disconnect the 2 air hoses.
(c) Remove the 2 bolts and idle–up valve.




**3. INSPECT A/C IDLE– UP VALVE**

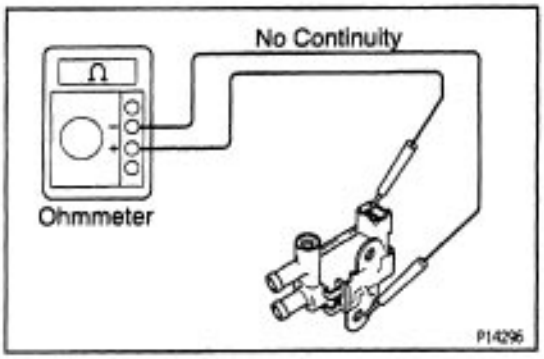
**A. Inspect idle–up valve for open circuit**

Using an ohmmeter, check that there is continuity between the terminals.

**Resistance:**

**30 – 33 Ω at 20˚C (68˚F)**

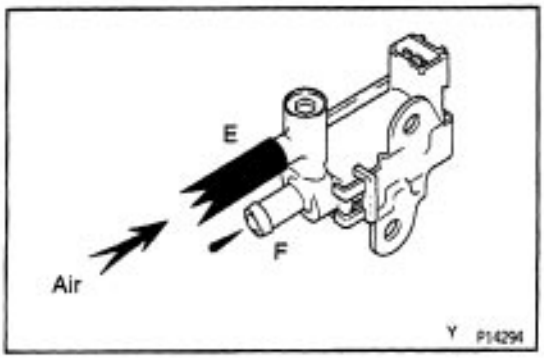
If there is no continuity, replace the idle–up valve.




**B. Inspect A/C idle–up valve for ground**

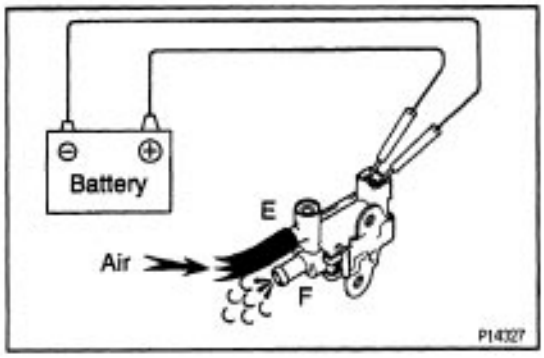
Using an ohmmeter, check that there is no continuity between each terminal and the body.

If there is continuity, replace the idle–up valve.

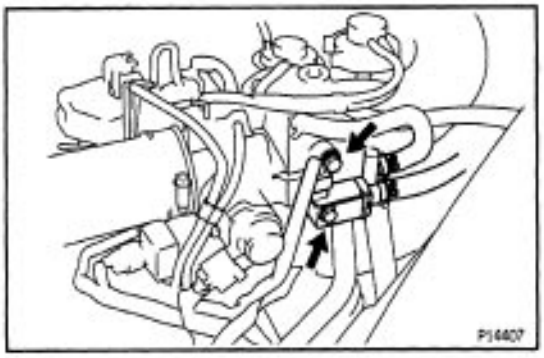



**C. Inspect A/C idle–up valve operation**

(a) Check that the air does not flow from port E to port F.




(b) Apply battery voltage across the terminals.
(c) Check that the air flows from port E to port F.
If operation is not as specified, replace the idle–up valve.



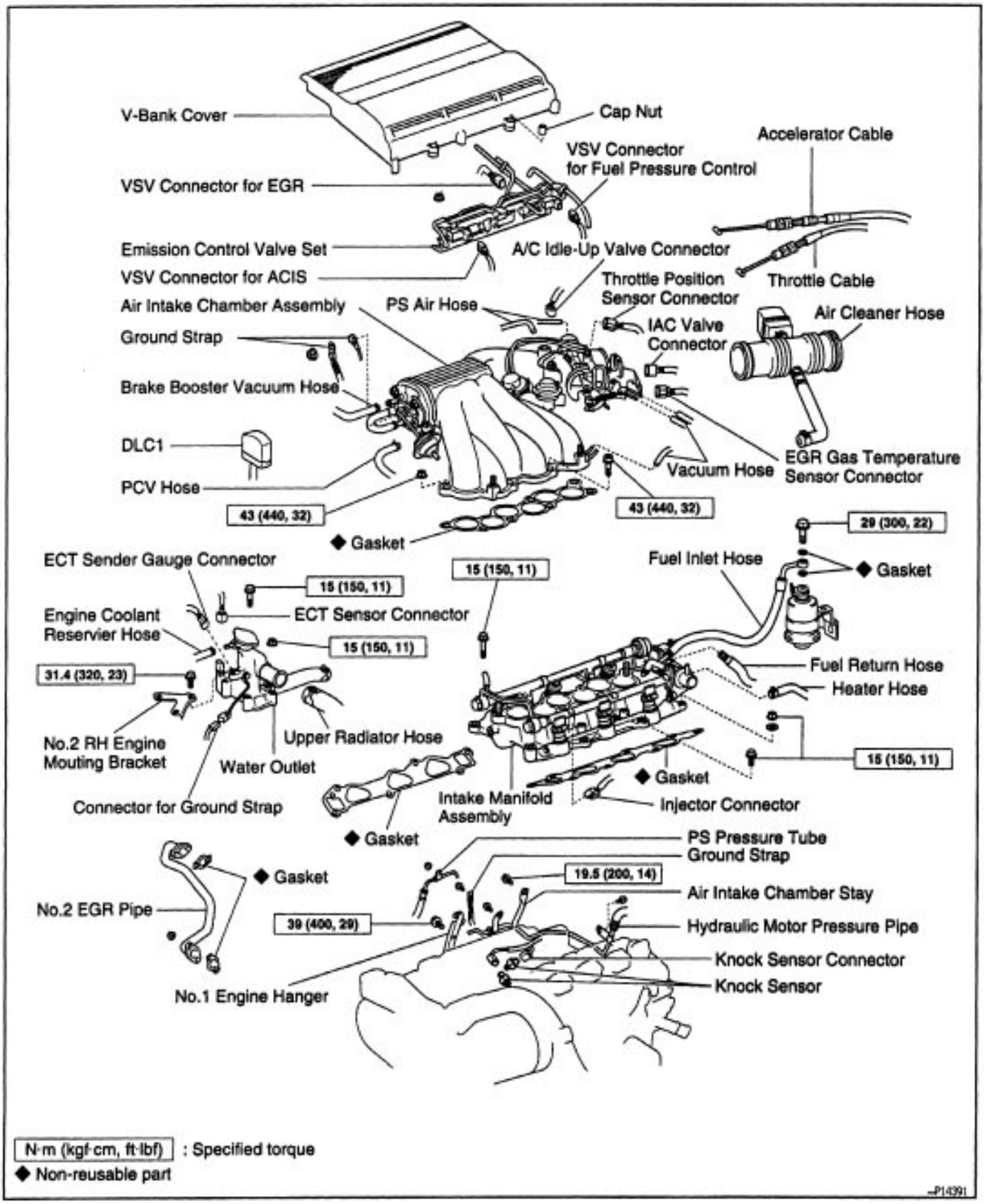

**4. REINSTALL A/C IDLE– UP VALVE**

(a) Install the idle–up valve with the 2 bolts.
(b) Connect the air hose.
(c) Connect the idle–valve connector.

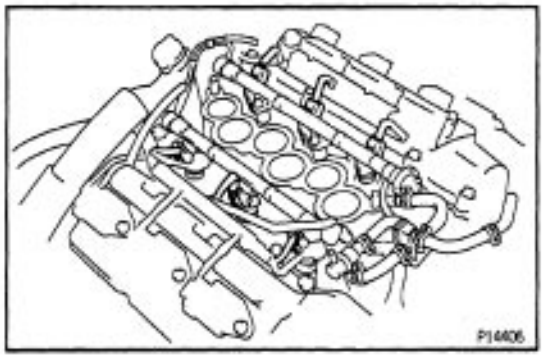
**5. RECONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY**

# KNOCK SENSOR

## COMPONENTS FOR REMOVAL AND INSTALLATION



# KNOCK SENSORS INSPECTION

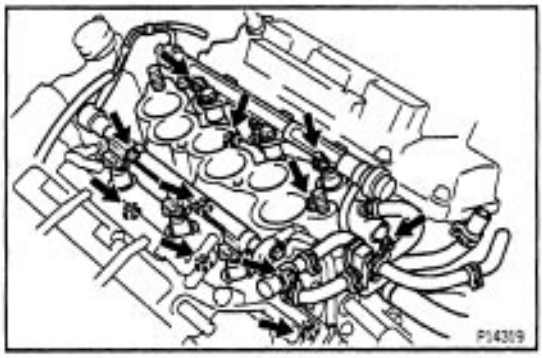



**(See Components for Removal and Installation)**

**1. REMOVE AIR INTAKE CHAMBER ASSEMBLY**

**(See steps 1 to 10 on pages EG2–246 to 249)**

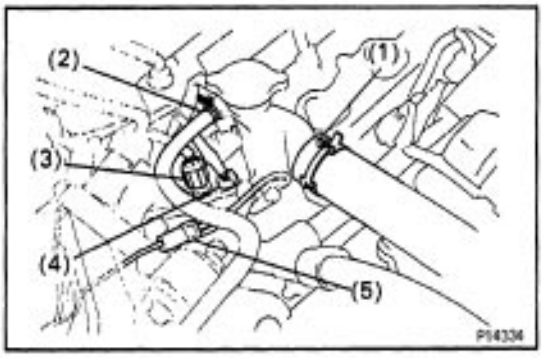
**2. DISCONNECT INJECTOR CONNECTORS**




**3. REMOVE INTAKE MANIFOLD ASSEMBLY**

(a) Disconnect the heater hose from the intake manifold.

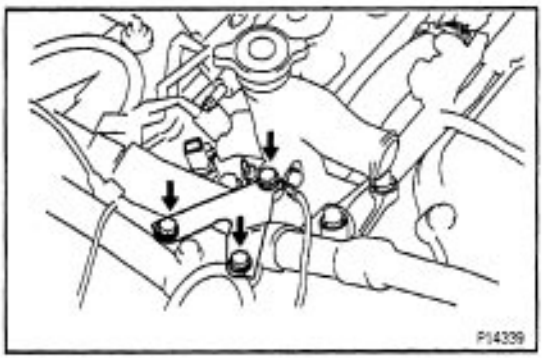
(b) Remove the 9 bolts, 2 nuts, 2 plates washers and intake manifold assembly.



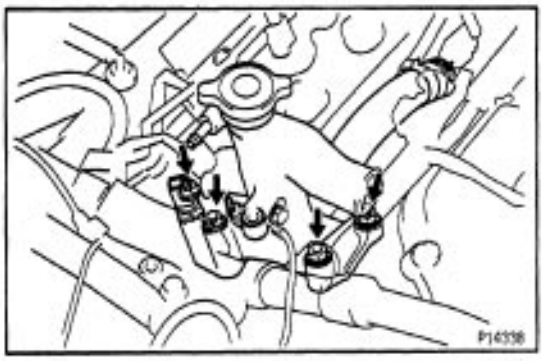

**4. REMOVE RH ENGINE MOUNTING STAY AND WATER OUTLET**

(a) Disconnect the following hoses and connectors:

(1) Radiator inlet hose
(2) Engine coolant reservoir hose
(3) ECT sensor connector
(4) ECT switch connector
(5) Ground strap connector



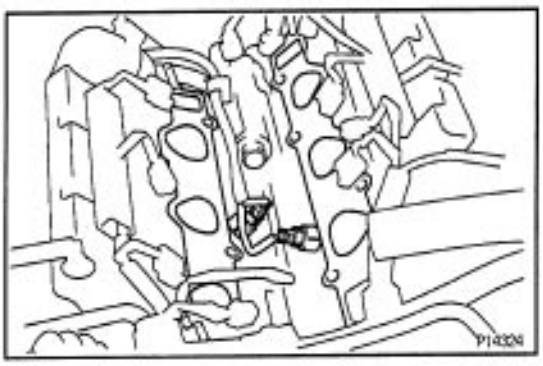

(b) Remove the 3 bolts and RH mounting stay.




(c) Remove the wire band.

(d) Disconnect the water bypass hose from the inlet housing.

(e) Remove the 2 bolts, 2 nuts, 2 plate washers and water outlet.

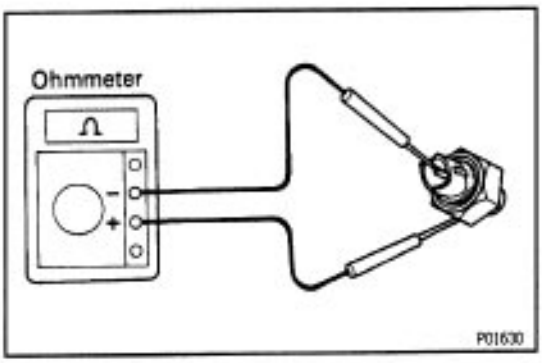


(f) Remove the 2 gaskets.

**5. REMOVE KNOCK SENSORS**

(a) Disconnect the knock sensor connector.

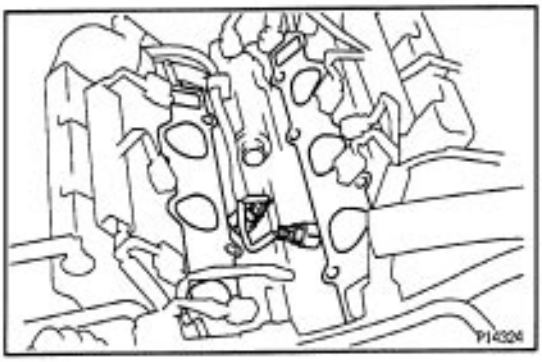
(b) Remove the knock sensor.




**6. INSPECT KNOCK SENSORS**

Using an ohmmeter, check that there is no continuity between the terminal and body.

If there is continuity, replace the sensor.



**7. REINSTALL KNOCK SENSORS**

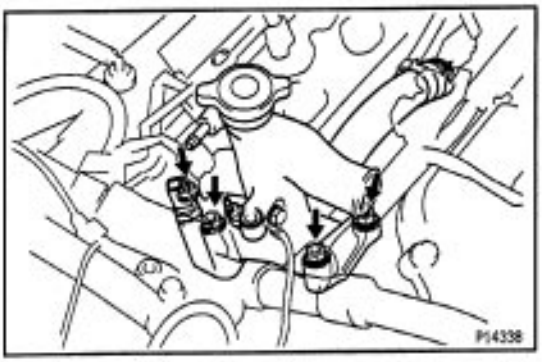
(a) Install the knock sensor.

**Torque: 39 N–m (400 kgf–cm. 29 ft–lbf)**

(b) Connect the knock sensor connector.

**8. REINSTALL WATER OUTLET AND RH ENGINE MOUNTING STAY**

(a) Install 2 new gaskets on the cylinder head.



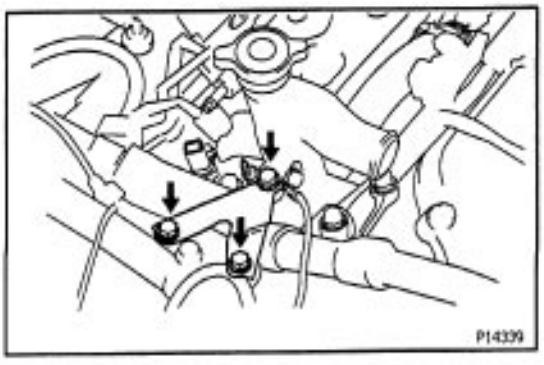
(b) Install the water outlet with the the 2 bolts, 2 plate washers and 2 nuts.

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

**NOTICE: Do not scratch the seal surface of the water outlet with the stud bolt.**

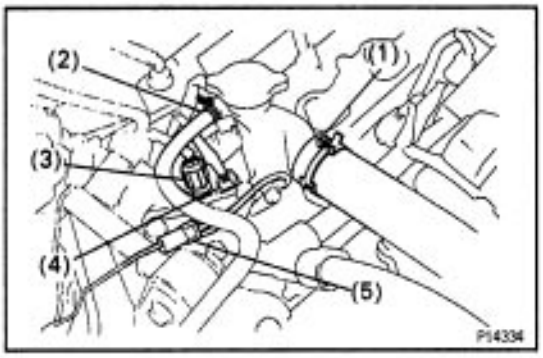
(c) Connect the water bypass hose to the inlet housing.

(d) Install the wire band.

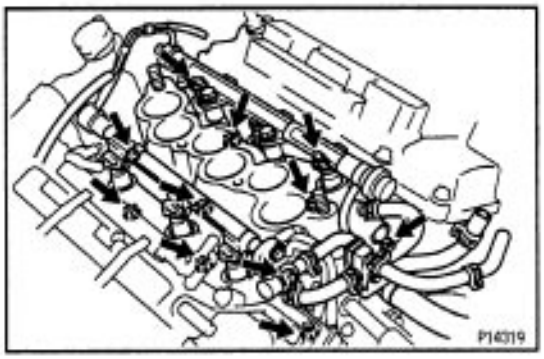


(e) Install the RH mounting stay with the 3 bolts.

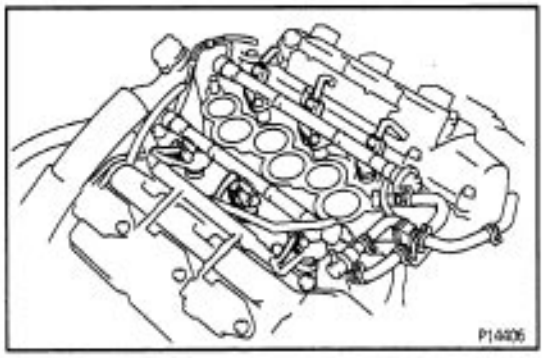
**Torque: 31.4 N–m (320 kgf–cm, 23 ft–lbf)**



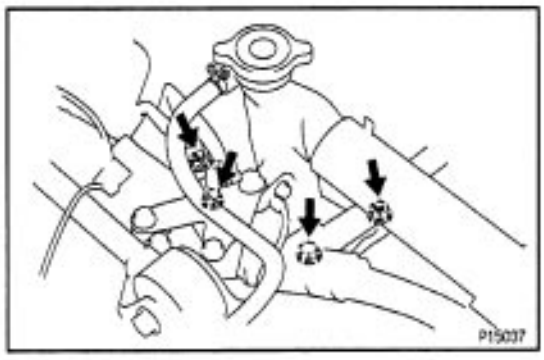

(f) Connect the following hoses and connectors:
(1) Radiator inlet hose
(2) Engine coolant reservoir hose
(3) ECT sensor connector
(4) ECT switch connector
(5) Ground strap connector




**9. REINSTALL INTAKE MANIFOLD ASSEMBLY**
(a) Install the intake manifold assembly with the 9 bolts, 2 plate washers and 2 nuts.
**Torque: 15 N–m (150 kgf–cm, 11 ft–lbf)**
(b) Connect the heater hose to the intake manifold.

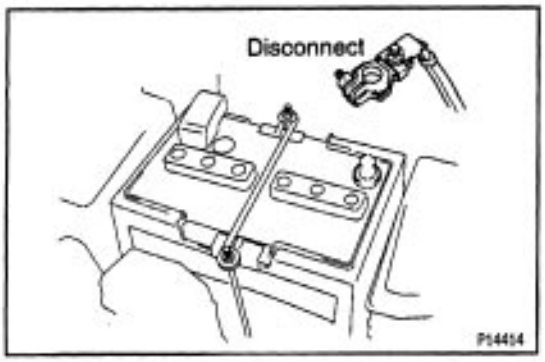



**10. RECONNECT INJECTOR CONNECTORS**




**11. RETIGHTENING WATER OUTLET MOUNTING BOLTS AND NUTS**
**Torque: 15 N–m (150 kgf–cm, 11 ft–lbf)**

**12. REINSTALL AIR INTAKE CHAMBER ASSEMBLY**
**(See steps 5 to 14 on pages EG2–254 to 257)**




# EGR GAS TEMPERATURE SENSOR

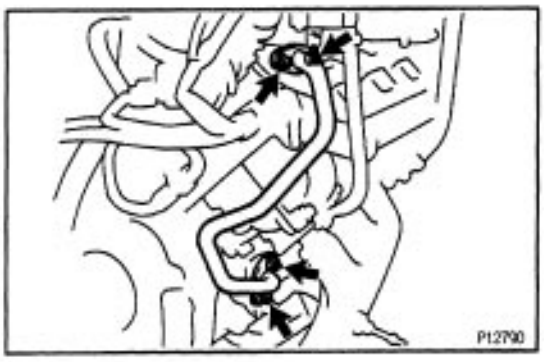
## EGR GAS TEMPERATURE SENSOR INSPECTION

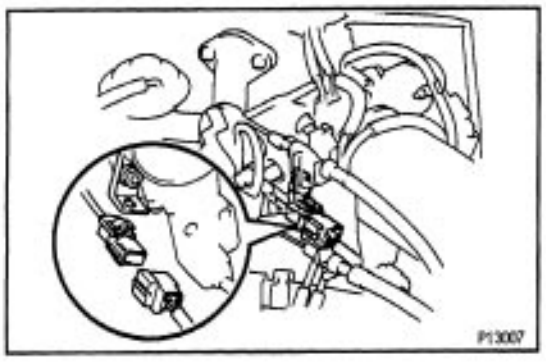
**1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY**

**CAUTION: Work must be started after 90 seconds from the time the ignition switch Is turned to the 'LOCK' position and the negative (–) terminal cable is discon–nected from the battery.**

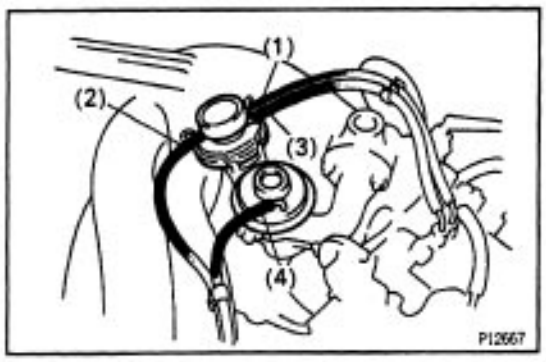
**2. REMOVE NO.2 EGR PIPE**

Remove the 4 nuts, EGR pipe and 2 gaskets.




**3. DISCONNECT EGR GAS TEMPERATURE SENSOR CONNECTOR AND CLAMP**




**4. REMOVE EGR VALVE AND VACUUM MODULATOR ASSEMBLY**

(a) Disconnect the following hoses:

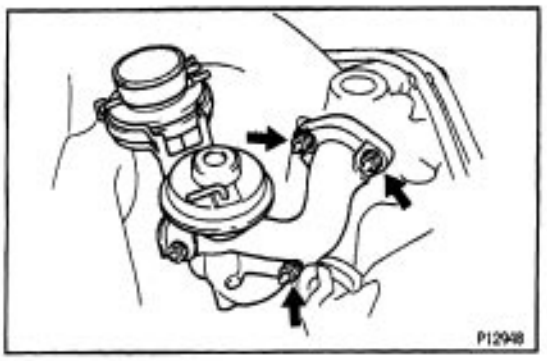
(1) Vacuum hose from port P of EGR vacuum modulator

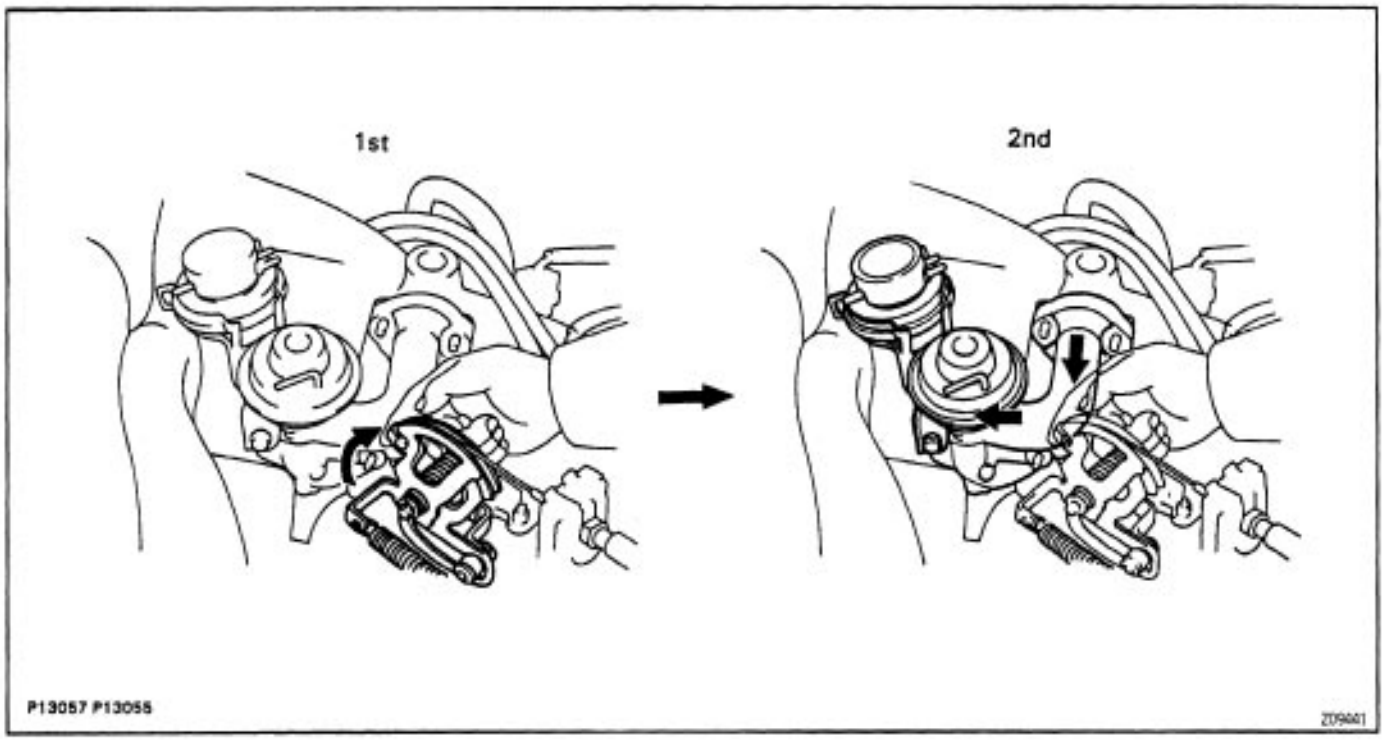
(2) Vacuum hose from port Q of EGR vacuum modulator

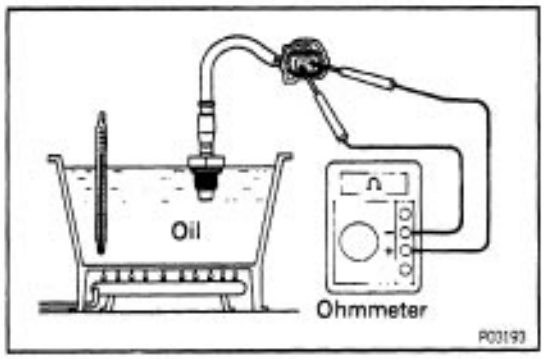
(3) Vacuum hose from port R of EGR vacuum modulator

(4) Vacuum hose from EGR valve

(b) Remove the 3 nuts, EGR valve and vacuum modulator assembly and gasket.






**5. REMOVE EGR GAS TEMPERATURE SENSOR**

**6. INSPECT EGR GAS TEMPERATURE SENSOR**

Using an ohmmeter, measure the resistance between the terminals.

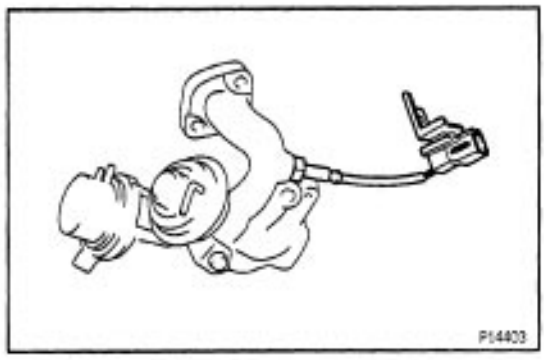
**Resistance:**

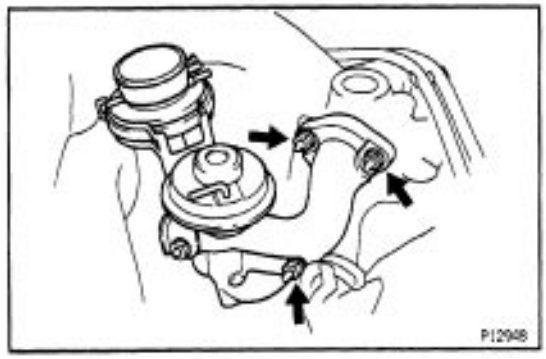
**64 – 97 k at 50$_2$C (112$_2$ F)**
**11 – 16 k et 100$_2$C (212$_2$F)**
**2 – 4 k at 150$_2$C (302$_2$F)**

If the resistance is not as specified, replace the sensor.

**7. REINSTALL EGR GAS TEMPERATURE SENSOR**

**Torque: 20 N–m (200 kgf–cm, 14 ft–lbf)**

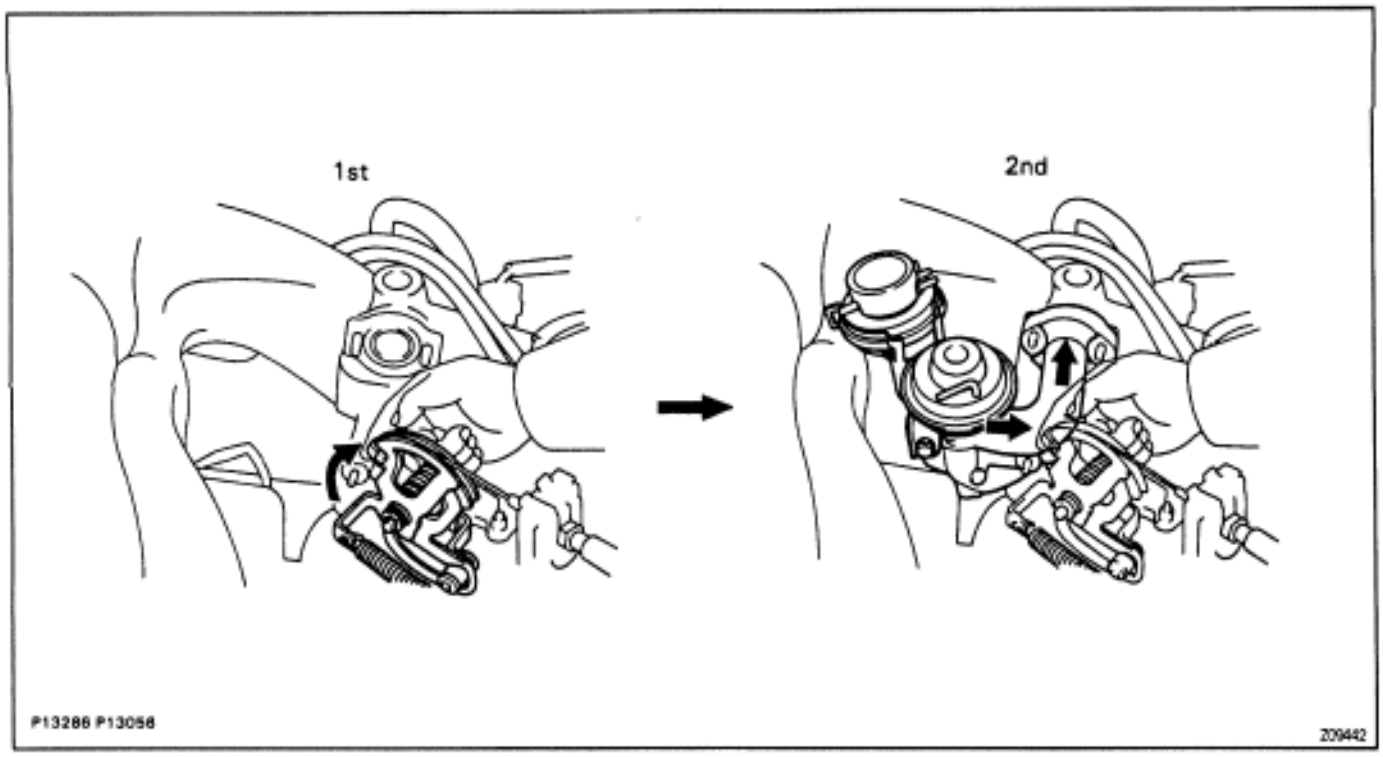


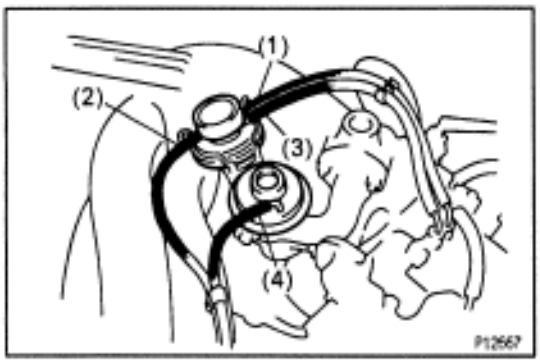




**8. REINSTALL EGR VALVE AND VACUUM MODULATOR ASSEMBLY**

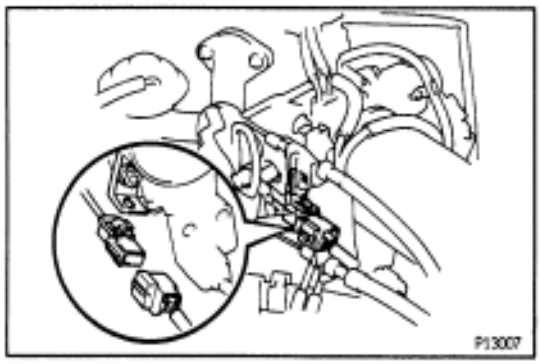
(a) Install the EGR valve and vacuum modulator assembly with the 3 nuts.

**Torque: 12 N–m (120 kgf–cm, 9 ft–lbf)**



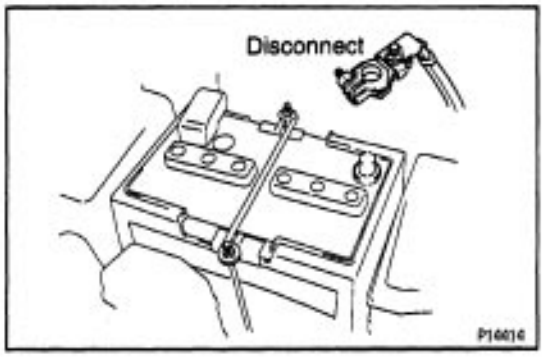




(b) Connect the following vacuum hoses:
(1) Vacuum hose to port P of EGR vacuum modulator
(2) Vacuum hose to port Q of EGR vacuum modulator
(3) Vacuum hose to port R of EGR vacuum modulator
(4) Vacuum to EGR valve




**9. RECONNECT EGR GAS TEMPERATURE SENSOR CONNECTOR AND CLAMP**


**10. REINSTALL N0.2 EGR PIPE**
Install 2 new gaskets and the EGR pipe with the 4 nuts.
**Torque: 12 N–m (120 kgf–cm, 9 ft–lbf)**
**11. RECONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY**

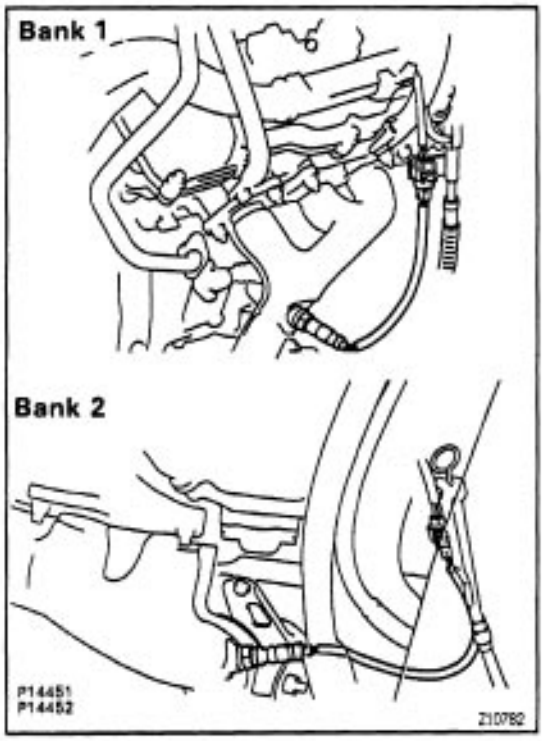



# OXYGEN SENSOR

## OXYGEN SENSORS INSPECTION

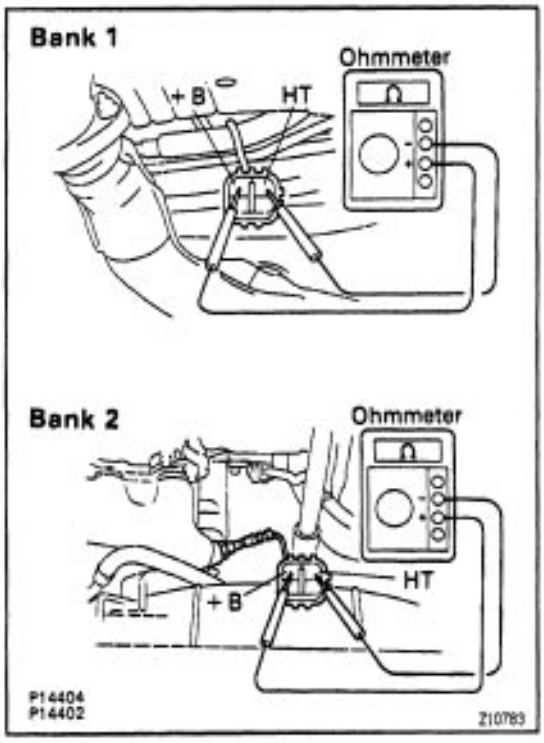
**1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY**

**CAUTION: Work must be started after 90 seconds from the time the ignition switch is turned to the 'LOCK' position and the negative (–) terminal cable is disconnected from the battery.**




**2. INSPECT HEATER RESISTANCE OF MAIN HEATED OXYGEN SENSORS**

(a) Disconnect the oxygen sensor connectors.




(b) Using an ohmmeter, measure the resistance between the terminals + B and HT.

**Resistance:**

**11 – 16Ω at 20$_2$ C (68$_2$ F)**

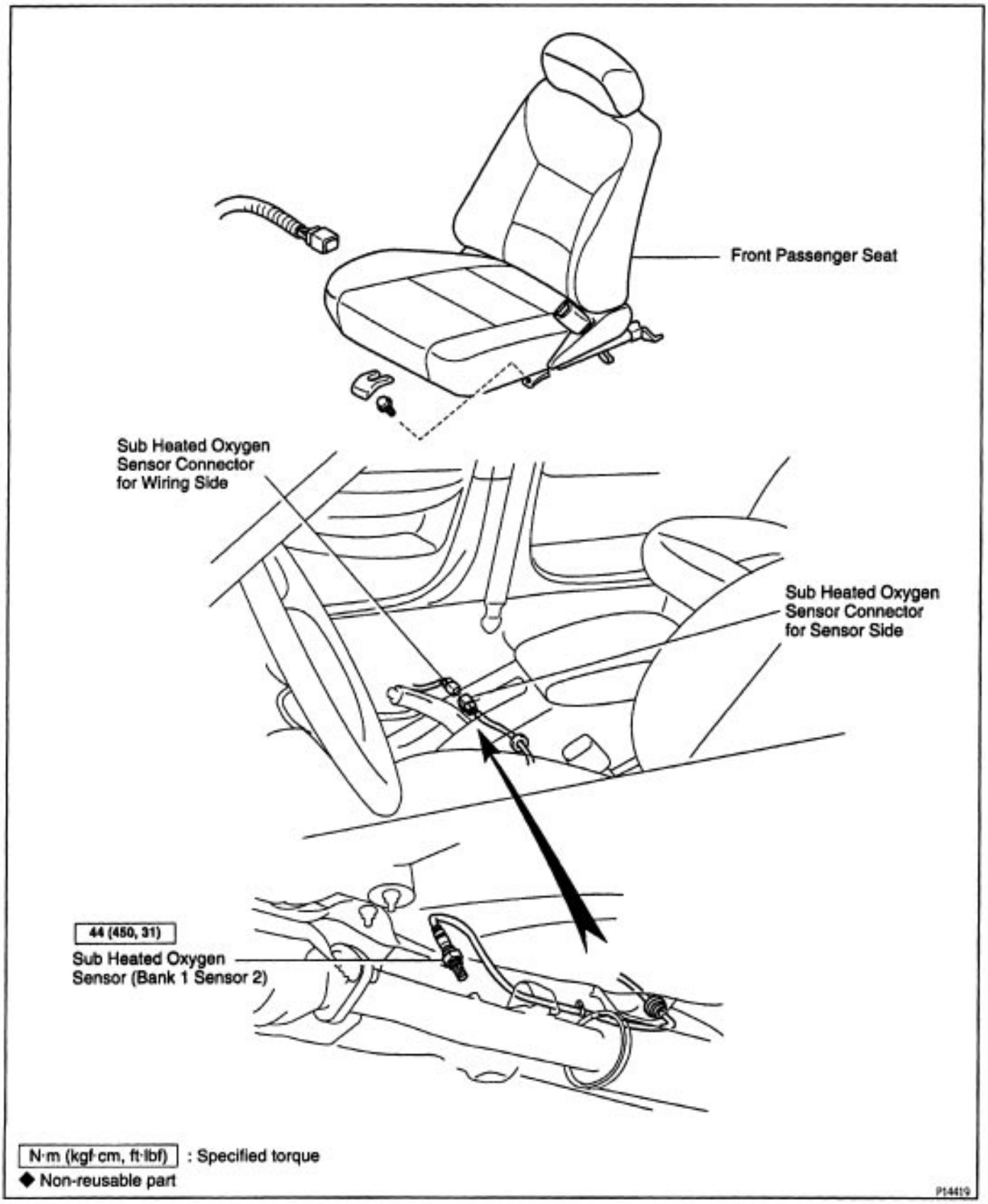
If the resistance is not as specified, replace the sensor.

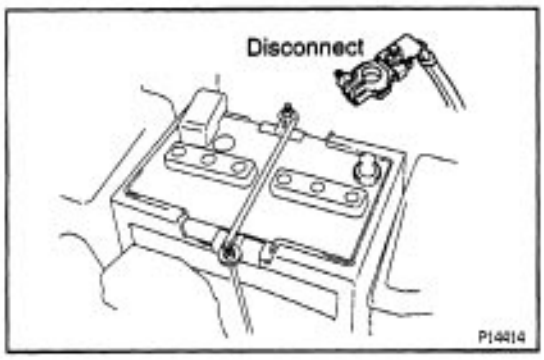
**Torque: 44 N–m (450 kgf–cm, 31 ft–lbf)**

(c) Reconnect the oxygen sensor connectors.

**3. RECONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY**

# Sub Heated Oxygen Sensor COMPONENTS FOR REMOVAL AND INSTALLATION



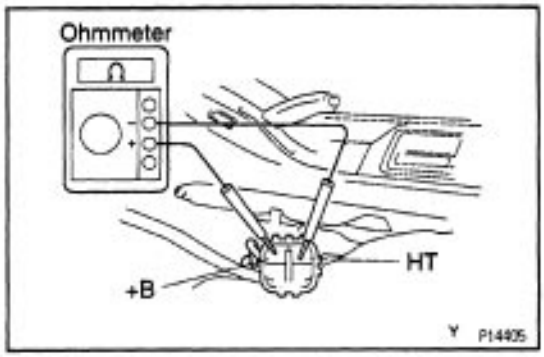



# OXYGEN SENSOR INSPECTION

**(See Components for Removal and Installation)**

**1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY**

**CAUTION: Work must be started after 90 seconds from the time the ignition switch is turned to the 'LOCK' position and the negative (–) terminal cable is disconnected from the battery.**




**2. INSPECT HEATER RESISTANCE OF SUB HEATED OXYGEN SENSOR**

(a) Remove the passenger's seat.
(b) Take out the consol box side of the floor carpet.
(c) Disconnect the oxygen sensor connector.
(d) Using an ohmmeter, measure the resistance between the terminals + B and HT.

**Resistance:**

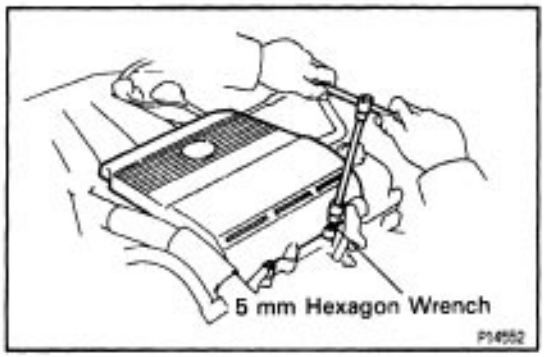
**11 – 16 at 20$_2$ C (68$_2$ F)**

If the resistance is not as specified, replace the sensor.

(e) Reconnect the oxygen sensor connector.
(f) Reinstall the floor carpet.
(g) Reinstall the passenger's seat.

**3. RECONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY**

-Memo




# FUEL CUT RPM

## FUEL CUT OFF INSPECTION

**1. REMOVE V– BANK COVER**

Using a 5 mm hexagon wrench, remove the 2 cap nuts and V–bank cover.

**2. WARM UP ENGINE**

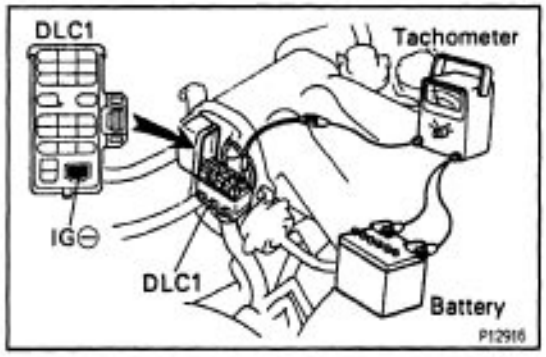
Allow the engine to warm up to normal operating temperature.

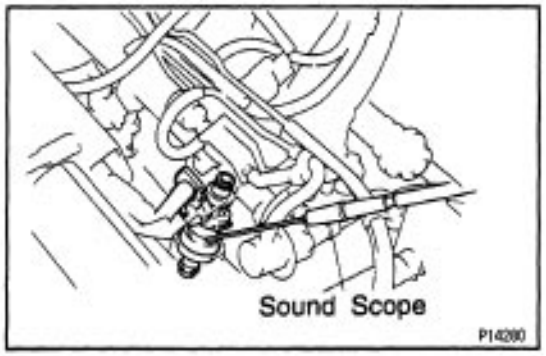
**3. CONNECT TACHOMETER TO ENGINE**

Connect the test probe of a tachometer to terminal IG (1) of the DLC1.

**NOTICE:**

- **NEVER allow the tachometer terminal to touch ground as It could result in damage to the igniter and/or ignition coil.**
- **As some tachometers are not compatible with this ignition system, we recommend that you confirm the compatibility of your until before use.**




**4. INSPECT FUEL CUT OFF PRM**

(a) Increase the engine speed to at least 3,500 rpm.

(b) Use a sound scope to check for injector operating noise.

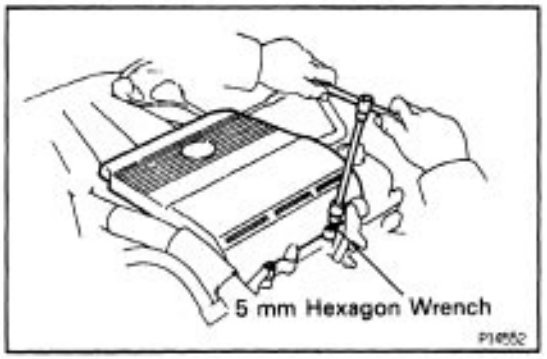
(c) Check that when the throttle lever is released, injector operation noise stops momentarily and then resumes.

HINT: Measure with the A/C OFF.

**Fuel return rpm:**

**1,200 rpm**

**5. DISCONNECT TACHOMETER**




**6. REINSTALL V–BANK COVER**

Using a 5 mm hexagon wrench, install the V– bank cover with the 2 cap nuts.

HINT: For fixing the V– bank cover, push on the cover until sense of ”click” is felt.

# SERVICE SPECIFICATIONS

## SERVICE DATA

| | | | |
|---|---|---|---|
| Fuel pressure regulator | Fuel pressure | at no vacuum | 265 – 304 kPa (2.7 – 3.1 kgf/cm², 38 – 44 psi) |
| Fuel pump | Resistance | at 20°C (68°F) | 0.2 – 3.0 Ω |
| Injector | Resistance | | Approx. 13.8 Ω |
| | Injection volume | | 54 – 64 cm³ (3.5 – 3.9 cu in.) per 15 sec. |
| | Difference between each cylinder | | 5 cm³ (0.31 cu in.) or less |
| | Fuel leakage | | 1 drop or less per minute |
| MAF meter | Resistance (THA – E2) | at –20°C (–4°F) | 10 – 20 kΩ |
| | | at 0°C (32°F) | 4 – 7 kΩ |
| | | at 20°C (68°F) | 2 – 3 kΩ |
| | | at 40°C (104°F) | 0.9 – 1.3 kΩ |
| | | at 60°C (140°F) | 0.4 – 0.7 kΩ |
| Throttle body | Throttle body fully closed angle | | 10° |
| | Throttle opener setting speed | | 900 –1,950 rpm |
| Throttle position sensor | Clearance between stop screw and lever | | |
| | 0 mm (0 in.) | VTA – E2 | 0.28 – 6.4 kΩ |
| | 0.35 mm (0.014 in.) | IDL – E2 | 0.5 kΩ or less |
| | 0.70 mm (0.028 in.) | IDL – E2 | Infinity |
| | Throttle valve fully open | VTA – E2 | 2.0 – 11.6 kΩ |
| | – | VC – E2 | 2.7 – 7.7 kΩ |
| IAC valve | Resistance | +B – RSO (or RSC) | 19.3 – 22.3 Ω |
| VSV for Fuel pressure control | Resistance | at 20°C (68°F) | 33 – 39 Ω |
| VSV for ACIS | Resistance | at 20°C (68°F) | 33 – 39 Ω |
| VSV for EGR | Resistance | at 20°C (68°F) | 33 – 39 Ω |
| A/C idle–up valve | Resistance | at 20°C (68°F) | 30 – 33 Ω |
| ECT sensor | Resistance | at –20°C (–4°F) | 10 – 20 kΩ |
| | | at 0°C (32°F) | 4 – 7 kΩ |
| | | at 20°C (68°F) | 2 – 3 kΩ |
| | | at 40°C (104°F) | 0.9 – 1.3 kΩ |
| | | at 60°C (140°F) | 0.4 – 0.7 kΩ |
| | | at 80°C (176°F) | 0.2 – 0.4 kΩ |
| EGR gas temperature sensor | Resistance | at 50°C (122°F) | 64 – 97 kΩ |
| | | at 100°C (212°F) | 11 – 16 kΩ |
| | | at 150°C (302°F) | 2 – 4 kΩ |
| Main heated oxygen sensor | Heater coil resistance | at 20°C (68°F) | 11 – 16 Ω |
| Sub heated oxygen sensor | Heater coil resistance | at 20°C (68°F) | 11 – 16 Ω |
| Fuel cut rpm | Fuel return rpm | | 1,200 rpm |

# TORQUE SPECIFICATIONS

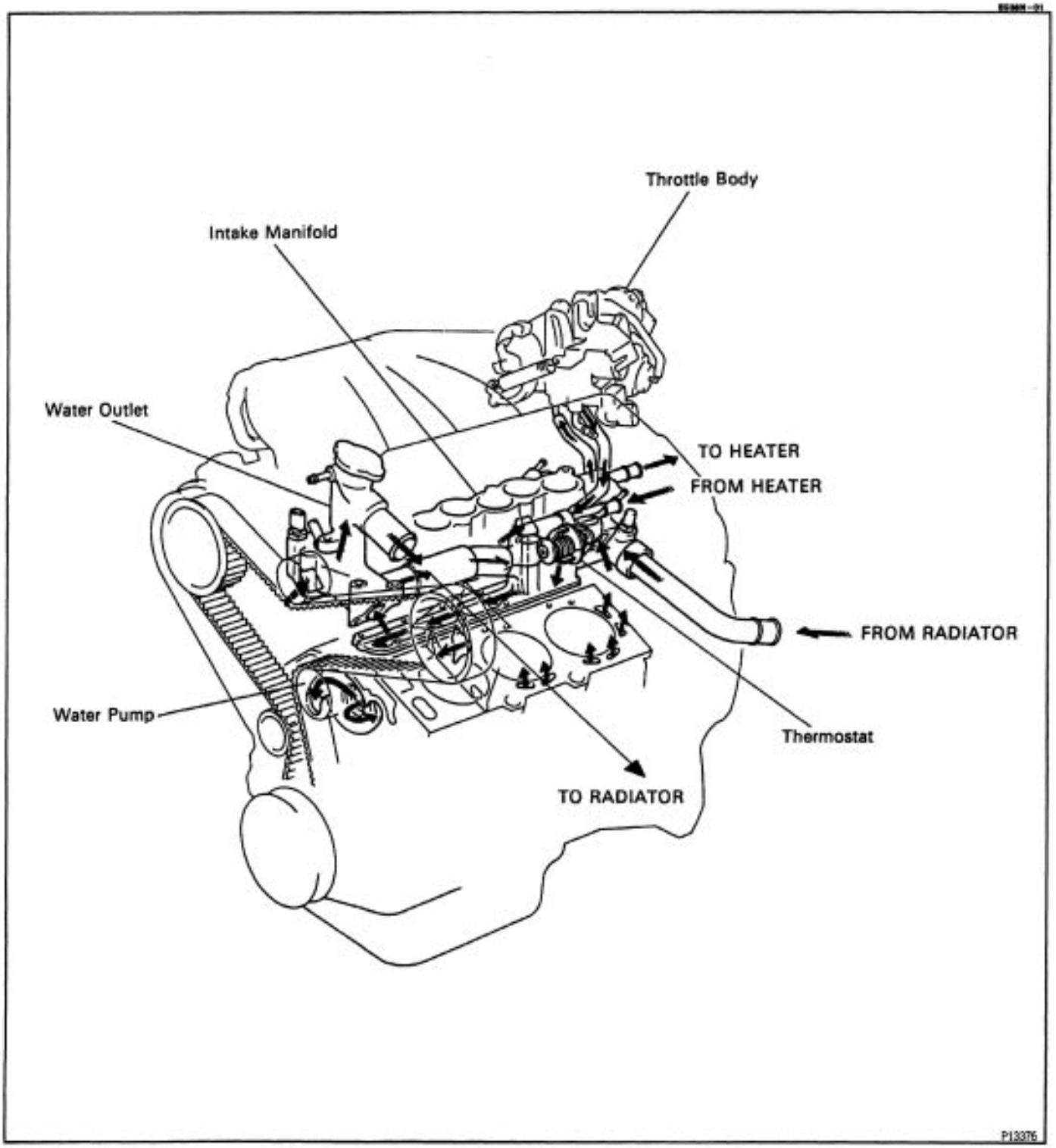
| Part tightened | N·m | kgf-cm | ft·lbf |
|---|---|---|---|
| Fuel line (Union bolt type) | 29 | 300 | 22 |
| Fuel line (Flare nut type for fuel pump side) | 28 | 285 | 21 |
| Fuel line (Flare nut type for others) | 30 | 310 | 22 |
| Fuel tank band x Body | 39 | 400 | 29 |
| Fuel pump x Fuel tank | 4 | 40 | 35 in.·lbf |
| Fuel pressure regulator x Delivery pipe | 8 | 80 | 69 in.·lbf |
| Delivery pipe x Cylinder head | 10 | 100 | 7 |
| No.1 fuel pipe x Intake manifold | 19.5 | 200 | 14 |
| No.2 fuel pipe x Delivery pipe | 19.5 | 200 | 14 |
| Air intake chamber x Intake manifold | 43 | 440 | 32 |
| EGR pipe x EGR vacuum modulator | 12 | 120 | 9 |
| EGR pipe x RH exhaust manifold | 12 | 120 | 9 |
| No. 1 engine hanger x Air intake chamber | 39 | 400 | 29 |
| Air intake chamber stay x Air intake chamber | 19.5 | 200 | 14 |
| Ground stop x Intake air control valve | 14.5 | 145 | 10 |
| Emission control valve set x Air intake chamber | 8 | 80 | 69 |
| MAF meter x Air cleaner | 6.9 | 70 | 61 |
| Throttle body x air intake chamber | 19.5 | 200 | 14 |
| Intake air control valve x Air intake chamber | 14.5 | 145 | 10 |
| ECT switch x Water outlet | 20 | 200 | 14 |
| Knock sensor x Cylinder head | 39 | 400 | 29 |
| Water outlet x Cylinder head | 15 | 150 | 11 |
| RH engine mounting stay x Water outlet | 31.4 | 320 | 23 |
| RH engine mounting stay x No.2 RH engine mounting bracket | 31.4 | 320 | 23 |
| Intake manifold x Cylinder head | 15 | 150 | 11 |
| EGR gas temperature sensor x EGR valve | 20 | 200 | 14 |
| EGR valve x Air intake chamber | 12 | 120 | 9 |
| Main heated oxygen sensor x Exhaust manifold | 44 | 450 | 31 |
| Sub heated oxygen sensor x Exhaust pipe | 44 | 450 | 31 |

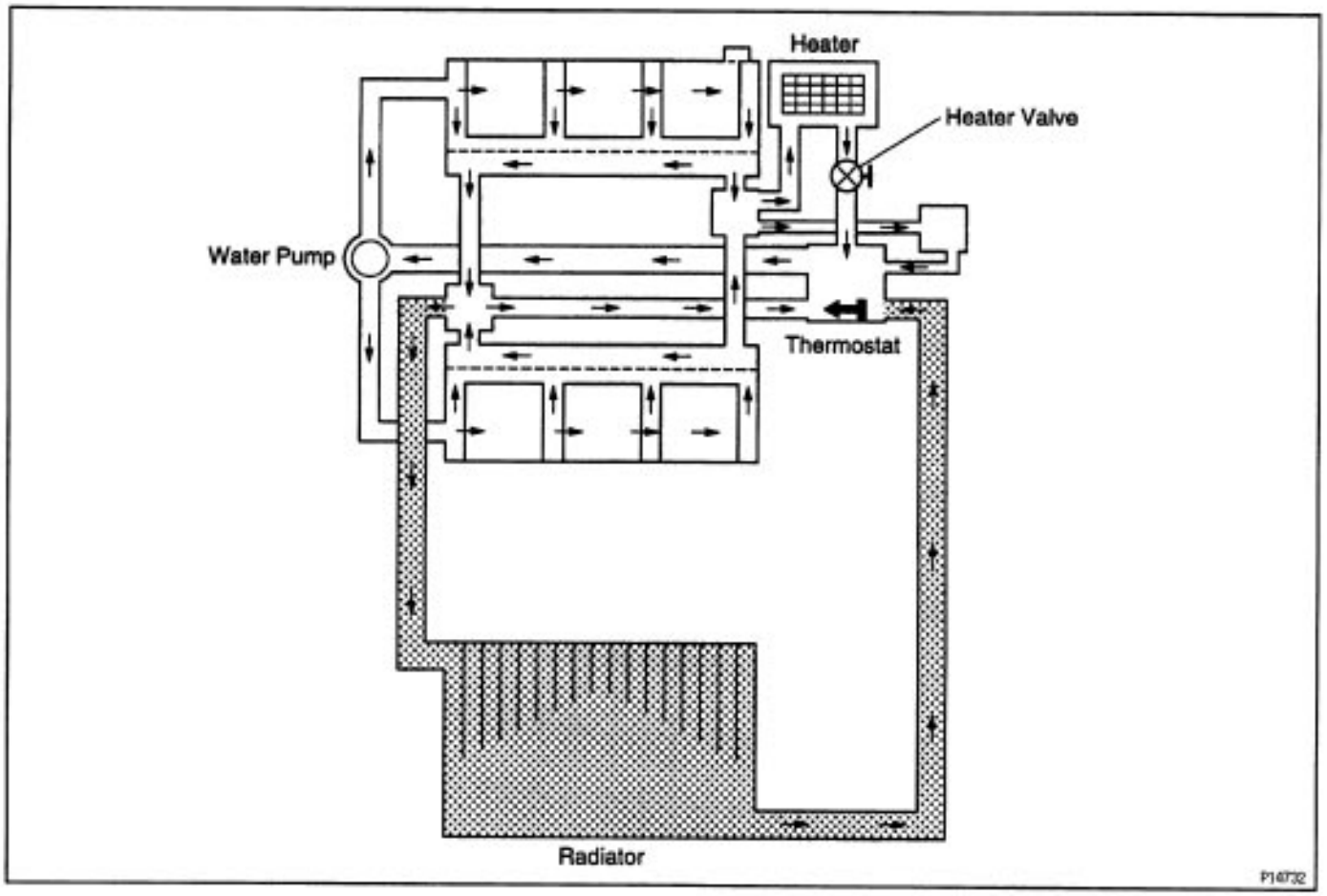
# COOLING SYSTEM

## DESCRIPTION

This engine utilizes a pressurized forced circulation cooling system which includes a thermostat equipped with a bypass valve mounted on the inlet side.

## OPERATION






The cooling system is composed of the water jacket (inside the cylinder block and cylinder head), radiator, water pump, thermostat, electronically controlled hydraulic cooling fan, hoses and other components.

Coolant which is heated in the water jacket is pumped to the radiator, through which a cooling fan blows air to cool the coolant as it passes through. Coolant which has been cooled is then sent back to the engine by the water pump, where it cools the engine.

The water jacket is a network of channels in the shell of the cylinder block and cylinder head through which coolant passes. It is designed to provide adequate cooling of the cylinders and combustion chambers which become heated during engine operation.

**RADIATOR**

The radiator, mounted in the front of the vehicle, performs the function of cooling the coolant which has passed through the water jacket and become hot. The radiator consists of an upper tank and lower tank, and a core which connects the two tanks. The upper tank contains the inlet for coolant from the water jacket. The lower tank has an outlet and drain plug for the coolant. The core contains many tubes through which coolant flows from the upper tank to the lower tank as well as cooling fins which radiate heat away from the coolant in the tubes.

The air sucked through the radiator by the cooling fan, as well as the wind generated by the vehicle's travel, passes through the radiator, cooling the coolant. Models with an automatic transmission include an automatic transmission fluid cooler built into the lower tank of the radiator. A cooling fan is mounted behind the radiator to assist the flow of air through the radiator. When the coolant temperature is low, the fan operates slowly to help the engine warm up, and when the coolant temperature becomes high, the fan speed is increased to provide the air flow required for cooling.

**RADIATOR CAP (on water outlet)**

The radiator cap is a pressure–type cap which seals the engine coolant circuit and the resulting pressurization of the engine as the coolant expands. The pressurization prevents the coolant from boiling even when the coolant temperature exceeds $100_2$C ($212_2$F). A relief valve (pressurization valve) and a vacuum valve (negative pressure valve) are built into the radiator cap. The relief valve opens and lets steam escape through the overflow pipe when the pressure generated inside the cooling system exceeds the limit (coolant temperature: 110 – $120_2$C (230 – $248_2$F), pressure: 83 – 113 kPa (0.85 – 1.15 kgf/cm$^2$,12.1 – 16.4 psi). The vacuum valve opens to alleviate the vacuum which develops in the coolant system after the engine is stopped and the coolant temperature drops. The valve's opening allows the coolant in the reservoir tank to return to the cooling system.

**RESERVOIR TANK**

The reservoir tank is used to catch coolant which overflows the cooling system as a result of volumetric expansion when the coolant is heated. The coolant in the reservoir tank returns to the water outlet when the coolant temperature drops thus keeping the radiator full at all times and avoiding needless coolant loss. Check the reservoir tank level to learn if the coolant needs to be replenished.

**WATER PUMP**

The water pump is used for forced circulation of coolant through the cooling system. It is mounted on the front of the cylinder block and driven by a timing belt.

**THERMOSTAT**

The thermostat has a wax type bypass valve and is mounted in the water inlet housing. The thermostat includes a type of automatic valve operated by fluctuations in the coolant tempera–ture. This valve closes when the coolant temperature drops, preventing the circulation of coolant through the engine and thus permitting the engine to warm up rapidly. The valve opens when the coolant temperature has risen, allowing the circulation of coolant. Wax inside the thermostat expands when heated and contracts when cooled. Heating the wax thus generates pressure which overpowers the force of the spring which keeps the valve closed, thus opening the valve. When the wax cools, its contraction allows the force of the spring to take effect once more, closing the valve. The thermostat in this engine operates at a temperature of $82_2$ C ($180_2$ F).

**ELECTRONICALLY CONTROLLED HYDRAULIC COOLING FAN (See page EG2–346)**

# PREPARATION

## SST (SPECIAL SERVICE TOOLS)

| | | |
|---|---|---|
|  | 09230–01010 Radiator Service Tool Set | |
|  | 09249–63010 Torque Wrench Adaptor | RH camshaft timing pulley |
|  | 09620–30010 Steering Gear Box Replacer Set | |
|  | (09627–30010) Steering Sector Shaft Bushing Replacer | Hydraulic motor oil seal |
|  | (09631 –00020) Handle | Hydraulic motor oil seal |
|  | 09843–18020 Diagnosis Check Wire | |
|  | 09960–10010 Variable Pin Wrench Set | |
|  | (09962–01000) Variable Pin Wrench Arm Assy | |

## RECOMMENDED TOOLS

| | | |
|---|---|---|
|  | 09025–00010 Smell Torque Wrench | For measuring preload |
|  | 09082–00050 TOYOTA Electrical Tester Set | |
|  | 09905–00013 Snap Ring Pliers | |

## EQUIPMENT

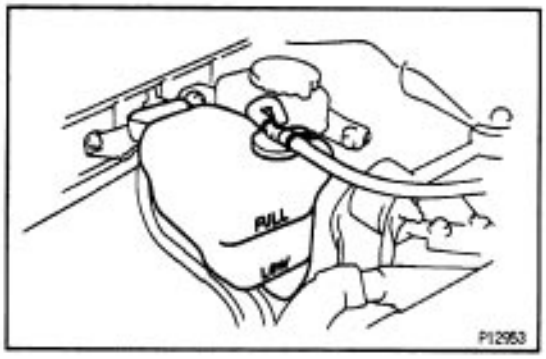
| | |
|---|---|
| Caliper gauge | |
| Heater | ECT sensor |
| Precision straight edge | |
| Radiator cap tester | |
| Micrometer | |
| Thermometer | ECT sensor |
| Torque wrench | |
| Vernier calipers | |

## LUBRICANT

| Item | Capacity | Classification |
|---|---|---|
| Power steering fluid (Total)<br>(Hydraulic cooling fan fluid) | 2.2 liters (2.3 US qts, 1.9 Imp. qts) | ATF DEXRON$_2$ II |

## COOLANT

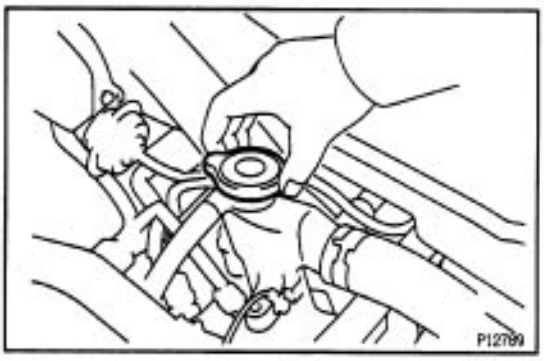
| Item | Capacity | Classification |
|---|---|---|
| Engine coolant | 8.7 liters (9.2 US qts, 7.7 Imp. qts) | Ethylene–glycol base |




# COOLANT CHECK

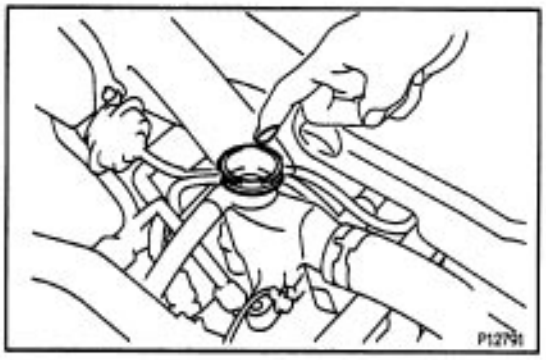
**1. CHECK ENGINE COOLANT LEVEL AT RESERVOIR TANK**

The engine coolant level should be between the ”LOW” and ”FULL” lines.
If low, check for leaks and add engine coolant up to the ”FULL’ line.

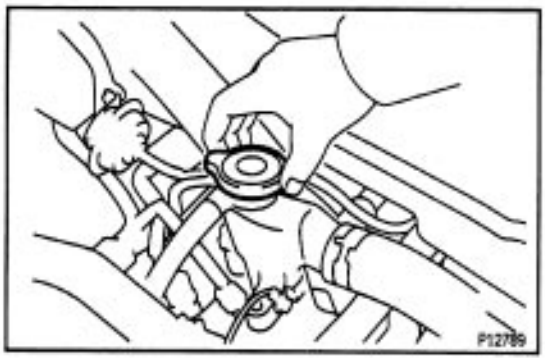



**2. CHECK ENGINE COOLANT QUALITY**

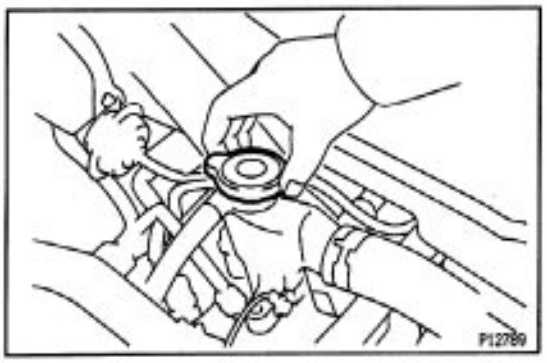
(a) Remove the radiator cap from the water outlet.
**CAUTION: To avoid the danger of being burned, do not remove the radiator cap while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.**




(b) There should not be any excessive deposits of rust or scale around the radiator cap or water outlet filler hole, and the coolant should be free from oil.
If excessively dirty, clean the coolant passages and replace the coolant.




(c) Reinstall the radiator cap.

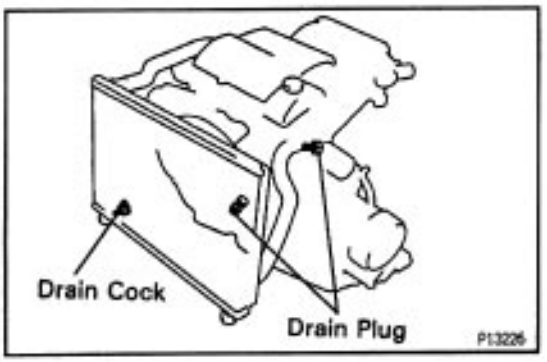



# COOLANT REPLACEMENT

**1. DRAIN ENGINE COOLANT**

(a) Remove the radiator cap from the water outlet.

**CAUTION: To avoid the danger of being burned, do not remove the radiator cap while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.**

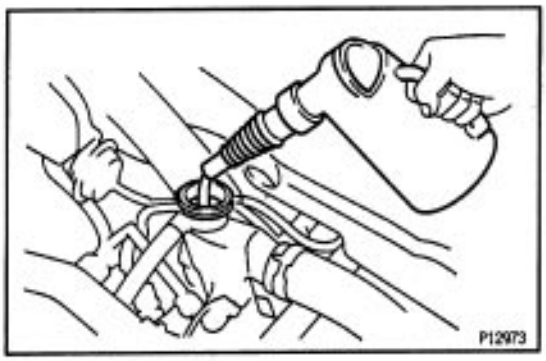



(b) Loosen the drain cock (for the radiator) and drain plugs (for the engine), and drain the coolant.

(c) Close the drain plugs and cock.

**Torque:**

**7 N–m (70 kgf–cm, 61 in.–lbf) for RH drain plug**
**13 N–m (130 kgf–cm, 9 ft–lbf) for LH drain plug**




**2. FILL ENGINE COOLANT**

(a) Slowly fill the system with coolant.

- Use a good brand of ethylene–glycol base cool–ant and mix it according to the manufacturer's directions.
- Using coolant which includes more than 50% ethylene–glycol (but not more than 70 96) is recommended.

**NOTICE:**

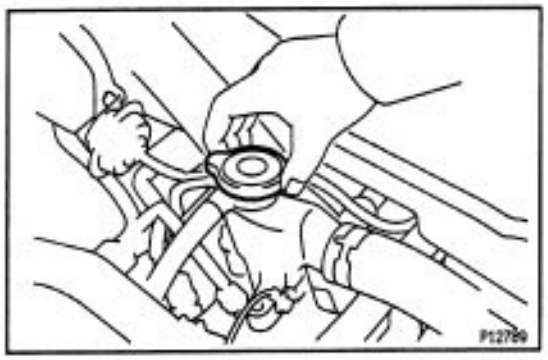
- **Do not use an alcohol type coolant.**
- **The coolant should be mixed with demineralized water or distilled water.**

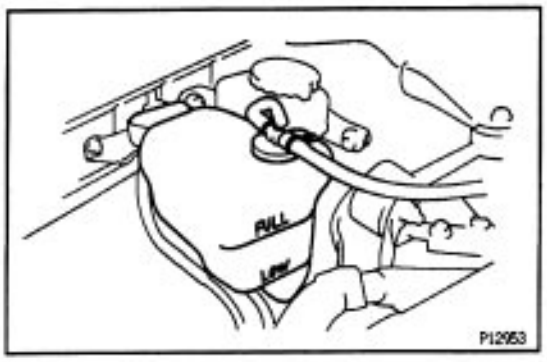
**Capacity:**

**8.7 liters (9.2 US qts. 7.7 Imp. qts)**

(b) Install the radiator cap.

(c) Start the engine, and bleed the cooling system.



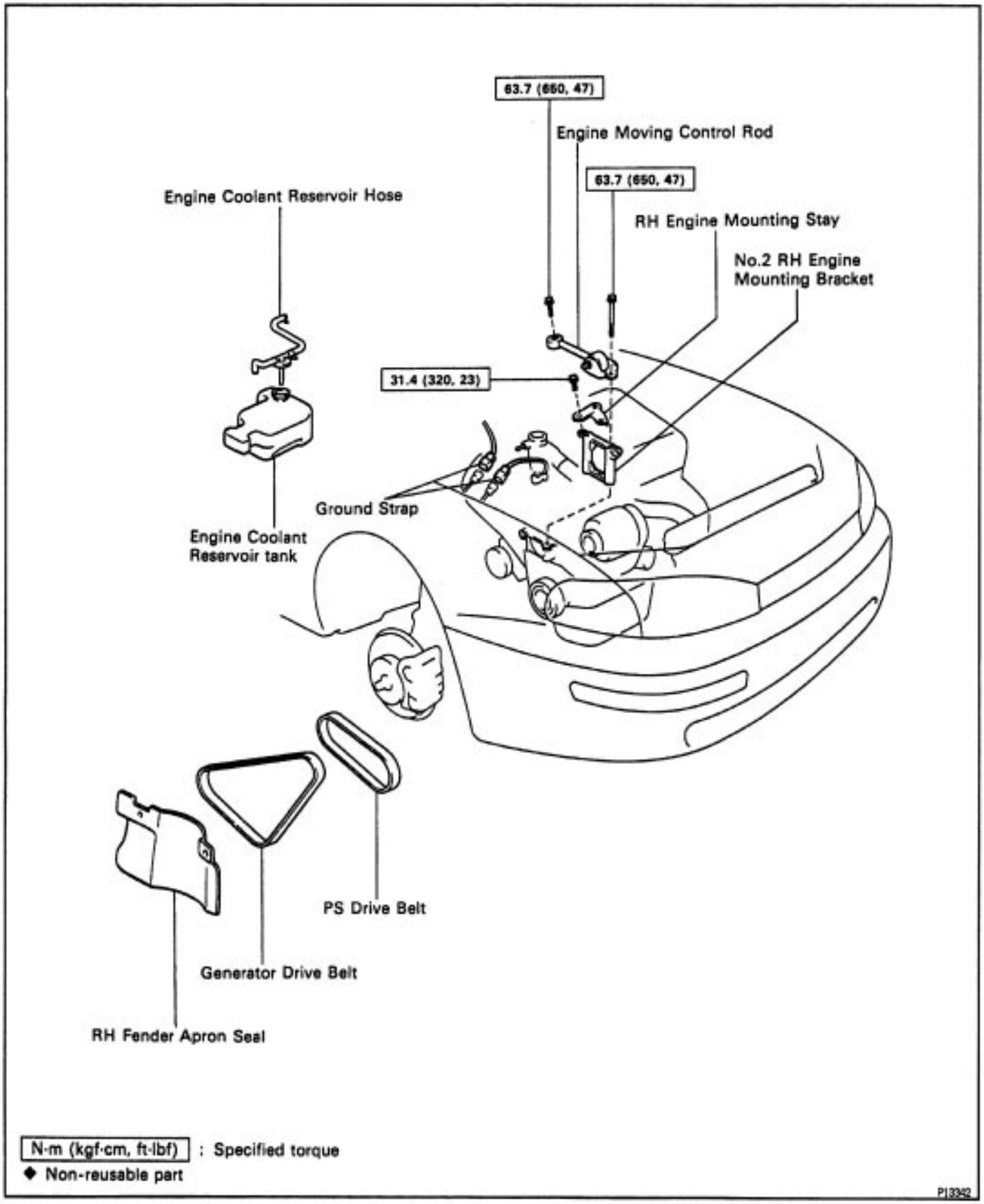



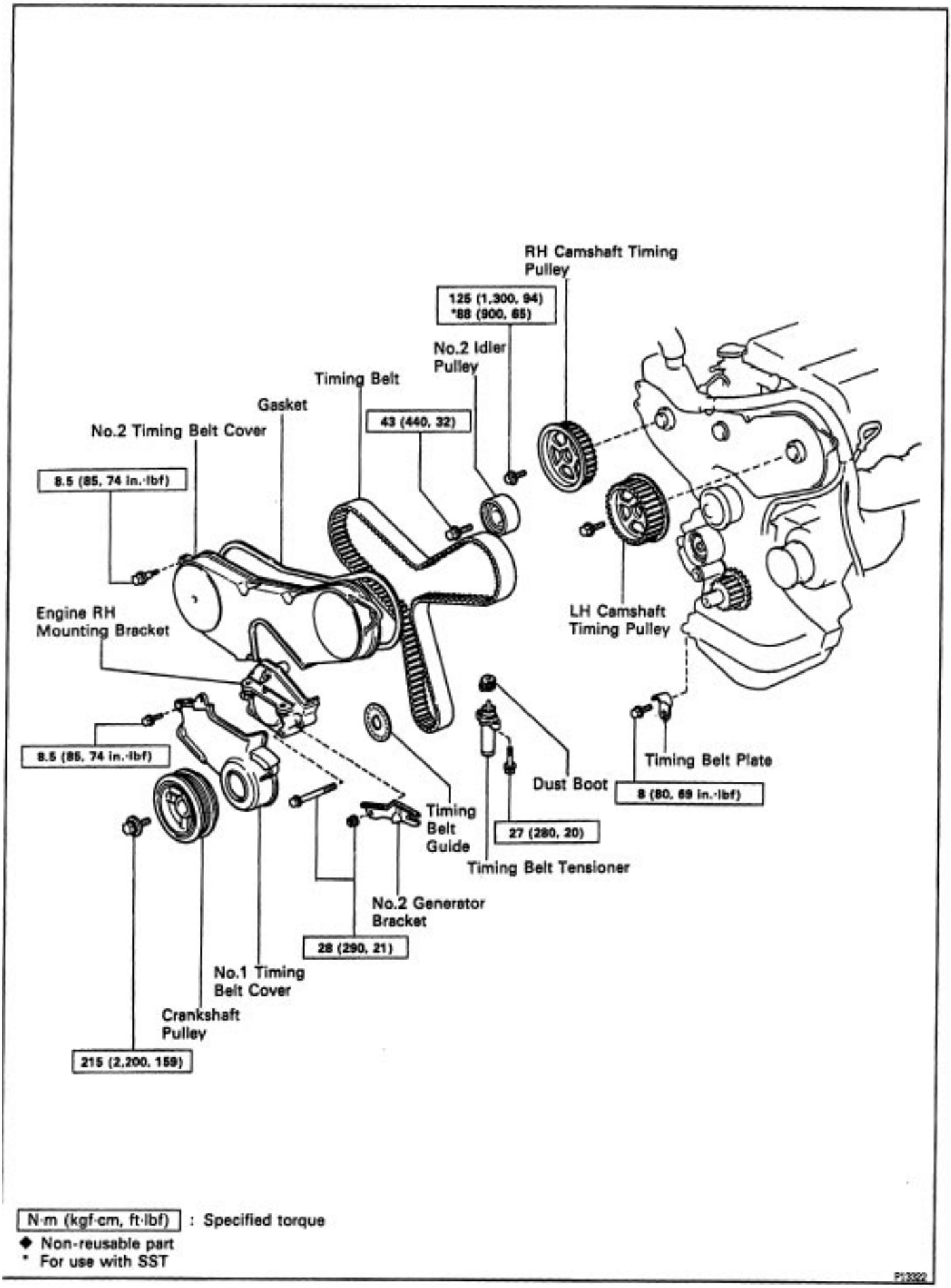

(d) If necessary, refill coolant into the reservoir tank up to the "FULL" line.

**3. CHECK ENGINE COOLANT FOR LEAKS**

# WATER PUMP

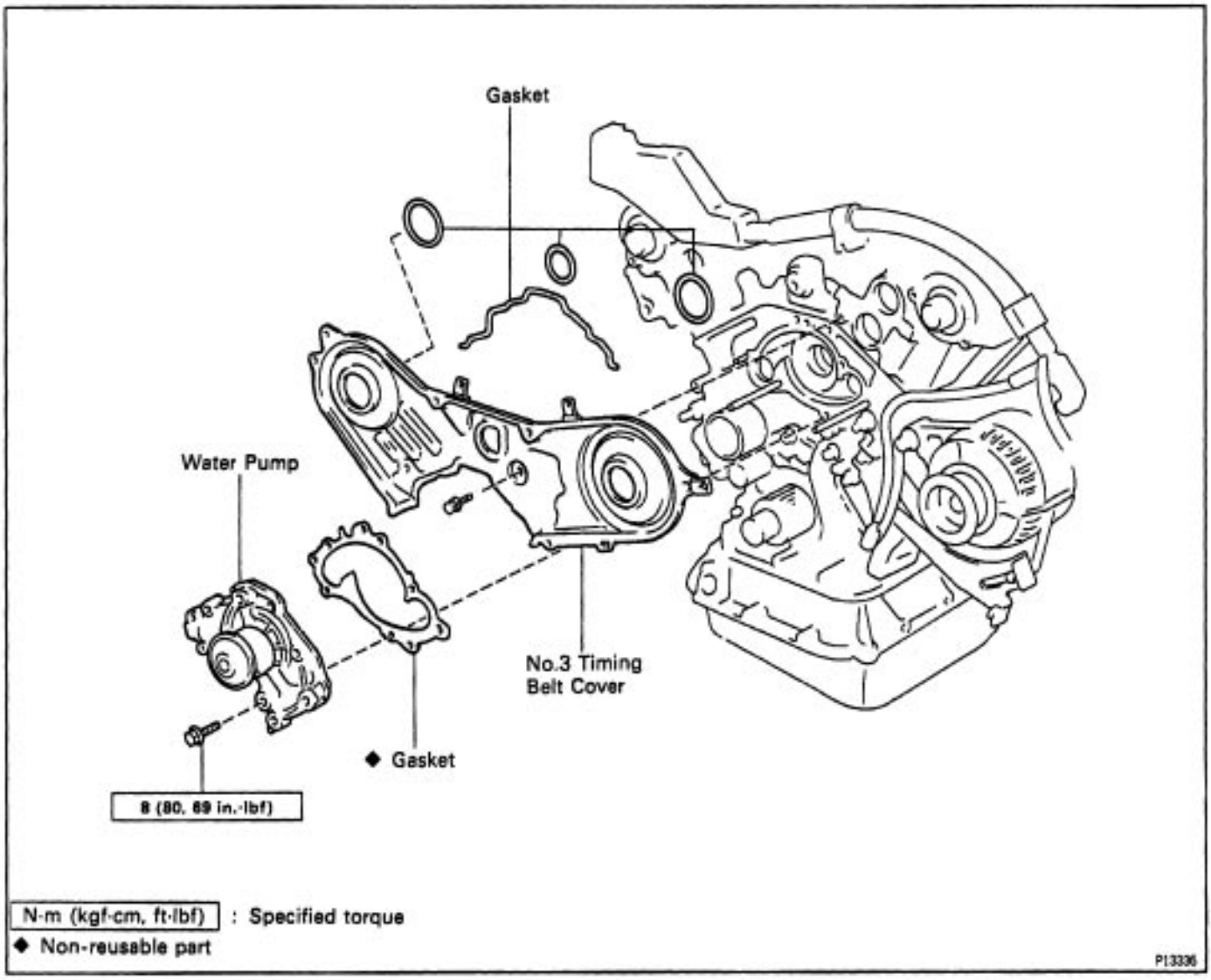
## COMPONENTS FOR REMOVAL AND INSTALLATION

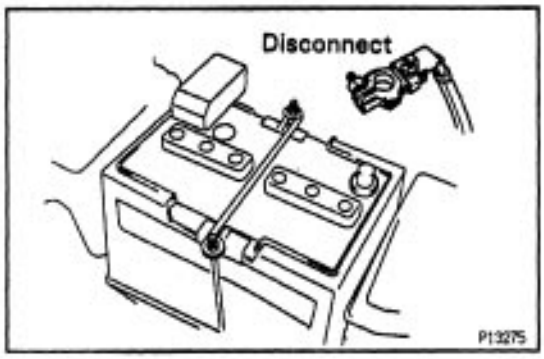





N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
* For use with SST

P13322




# WATER PUMP REMOVAL

**(See Components for Removal and Installation)**

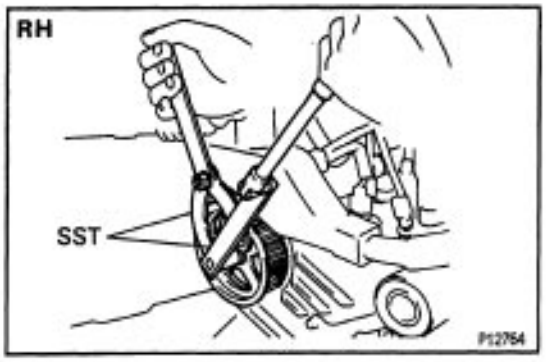
**1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY**

**CAUTION: Work must be started after 90 seconds from the time the ignition switch is turned to the 'LOCK' position and the negative (–) terminal cable is disconnected from the battery.**

**2. DRAIN ENGINE COOLANT**

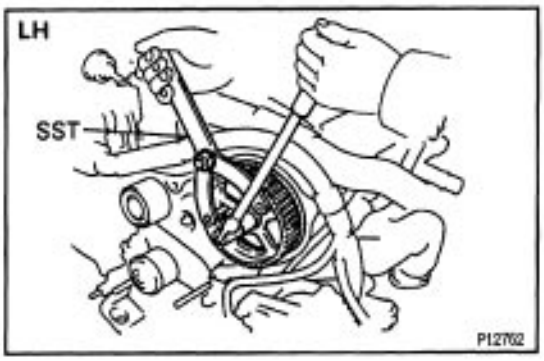
**3. REMOVE TIMING BELT**

**(See steps 2 to 20 on pages EG2–41 to 45)**

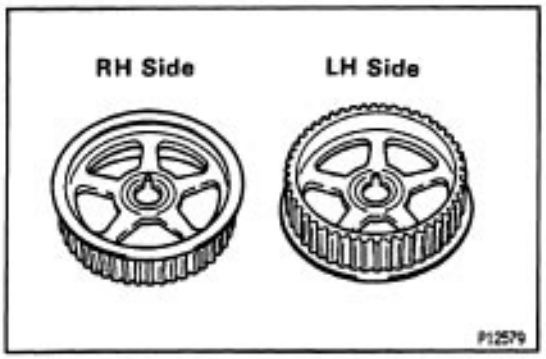



**4. REMOVE CAMSHAFT TIMING PULLEYS**

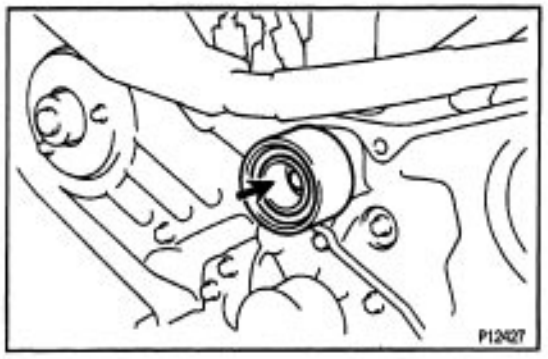
(a) Using SST, remove the bolt and RH timing pulley.
SST 09249–63010, 09960–10010 (09962–01000)




(b) Using SST, remove the bolt and LH timing pulley.
SST 09960–01000 (09962–01000)

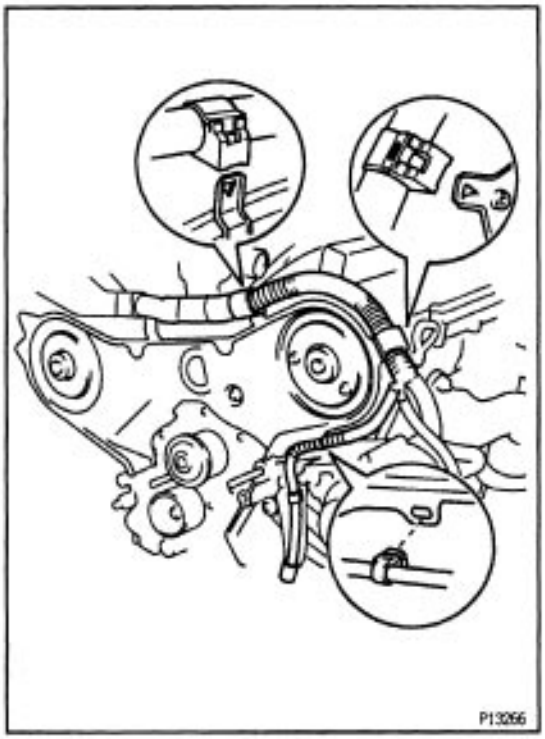



HINT: Arrange the camshaft timing pulleys (RH and LH sides).



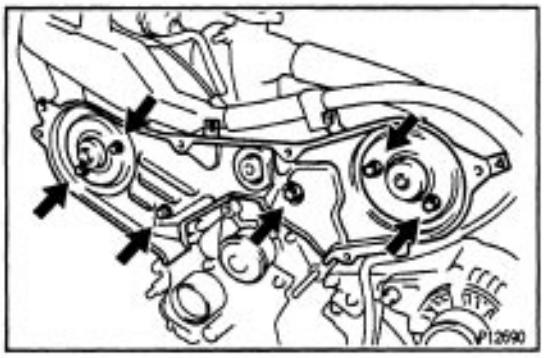

**5. REMOVE NO.2 IDLER PULLEY**

Remove the bolt and idler pulley.



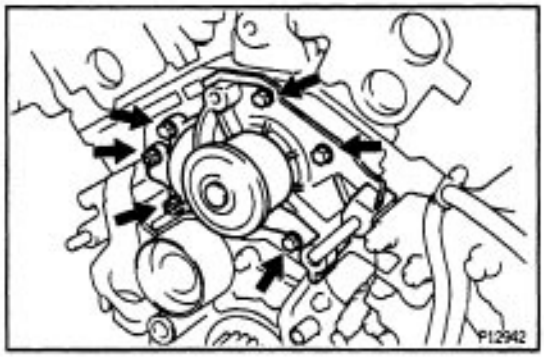

**6. DISCONNECT ENGINE WIRE**

Disconnect the 3 clamps and engine wire from the No. 3 timing belt cover.



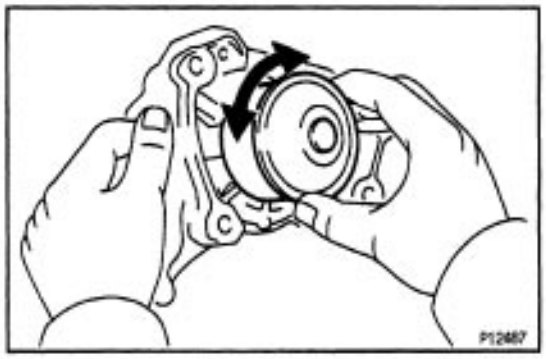

**7. REMOVE NO.3 TIMING BELT COVER**

Remove the 6 bolts and belt cover.




**8. REMOVE WATER PUMP**

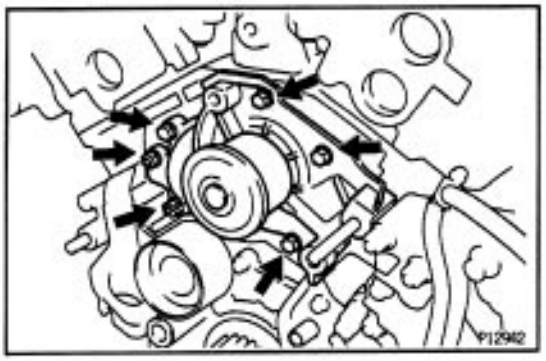
Remove the 4 bolts, 2 nuts, water pump and gasket.




## WATER PUMP INSPECTION

**INSPECT WATER PUMP**

Turn the pulley and check that the water pump bearing moves smoothly and quietly.




# WATER PUMP INSTALLATION

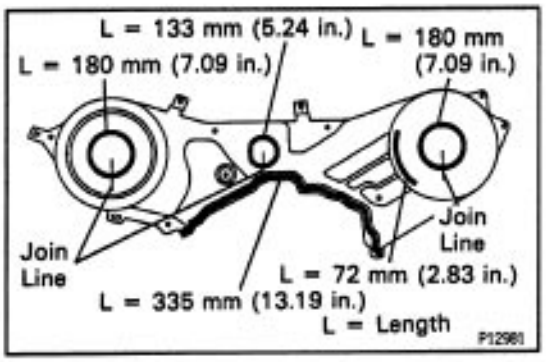
**(See Components for Removal and Installation)**

**1. INSTALL WATER PUMP**

Install a new gasket and the water pump with the 4 bolts and 2 nuts.

**Torque: 8 N–m (80 kgf–cm, 69 in.–lbf)**

**NOTICE: Do not get oil on the gasket.**




**2. INSTALL N0.3 TIMING BELT COVER .**

(a) Check that the timing belt cover gaskets have no cracks or peeling, etc.

If the gaskets do have cracks or peeling, etc., replace them using the following steps.

(1) Using a screwdriver and gasket scraper, remove all the old gasket material.

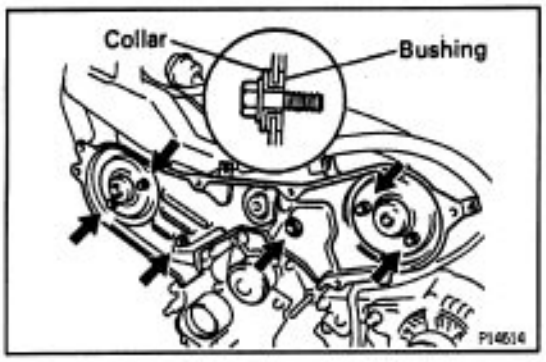
(2) Thoroughly clean all components to remove all the loose material.

(3) Remove the backing paper from a new gasket and install the gasket evenly to the part of the belt cover shaded black in the illustration.

**NOTICE: When joining gaskets, do not leave a gap between them. Cut off any excess gasket.**

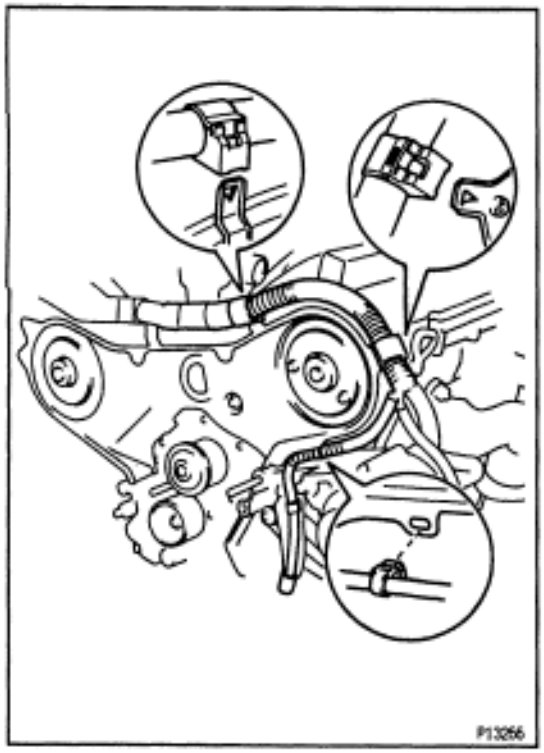
(4) After installing the gasket, press down on it so that the adhesive firmly sticks to the belt cover.

(b) Install new gaskets to the No.3 belt cover.



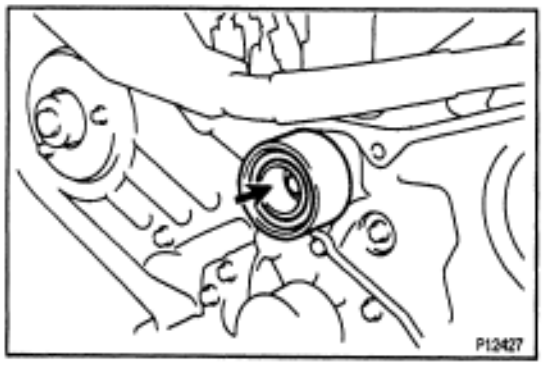

(c) Install the belt cover with the6 bolts.

**Torque: 8.5 N–m (85 kgf–cm, 74in.–lbf)**




**3. CONNECT ENGINE WIRE**

Connect the engine wire with the 3 clamps.

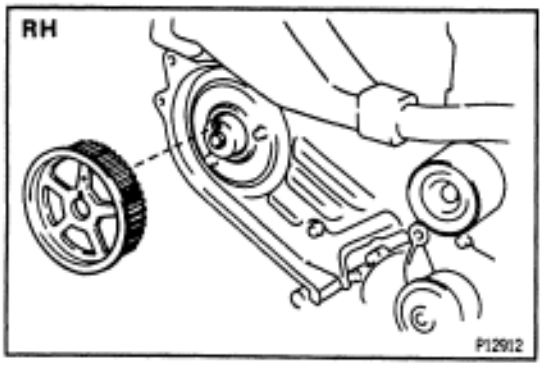



**4. INSTALL N0.2 IDLER PULLEY**

(a) Install the idler pulley with the bolt.

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

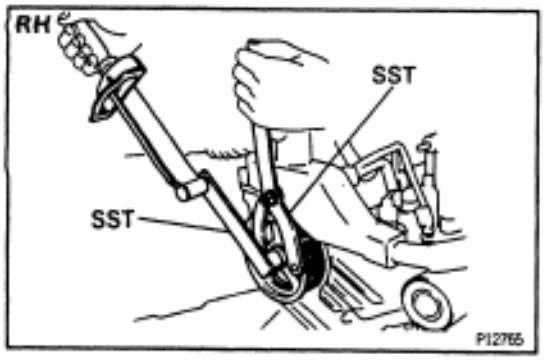
(b) Check that the idler pulley moves smoothly.




**5. INSTALL RH CAMSHAFT TIMING PULLEY**

(a) Install the timing pulley, facing the flange side outward.

(b) Align the knock pin hole of the camshaft with the knock pin groove of the timing pulley as shown.

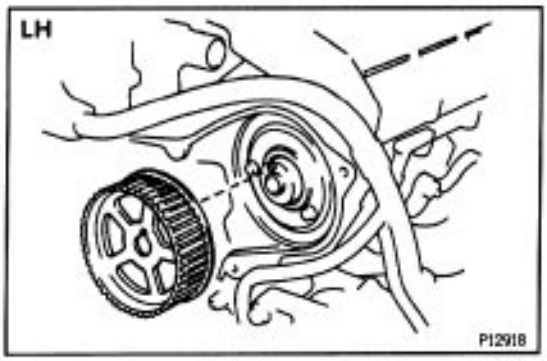



(c) Using SST, install and torque the bolt.

SST 09249–63010, 09960–10010 (09962–01000)

**Torque: 88 N–m (900 kgf–cm, 65 ft–lbf)**

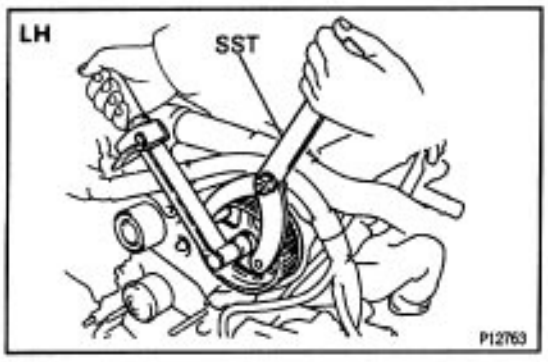
HINT: Use a torque wrench with a fulcrum length of 340 mm (13.39 in.)




**6. INSTALL LH CAMSHAFT TIMING PULLEY**

(a) Install the timing pulley, facing the flange side inward.

(b) Align the knock pin hole of the camshaft with the knock pin groove of the timing pulley as shown.




(c) Using SST, install and torque the bolt.

SST 09960–10010 (09962–01000)

**Torque: 125 N–m (1,300 kgf–cm, 94 ft–lbf)**

**7. INSTALL TIMING BELT**

**(See steps6 to 27 on pages** EG2–51 **to 56)**

**8. FILL WITH ENGINE COOLANT**

**Capacity:**

**8.7 liters (9.2 US qts, 7.7 Imp. qts)**

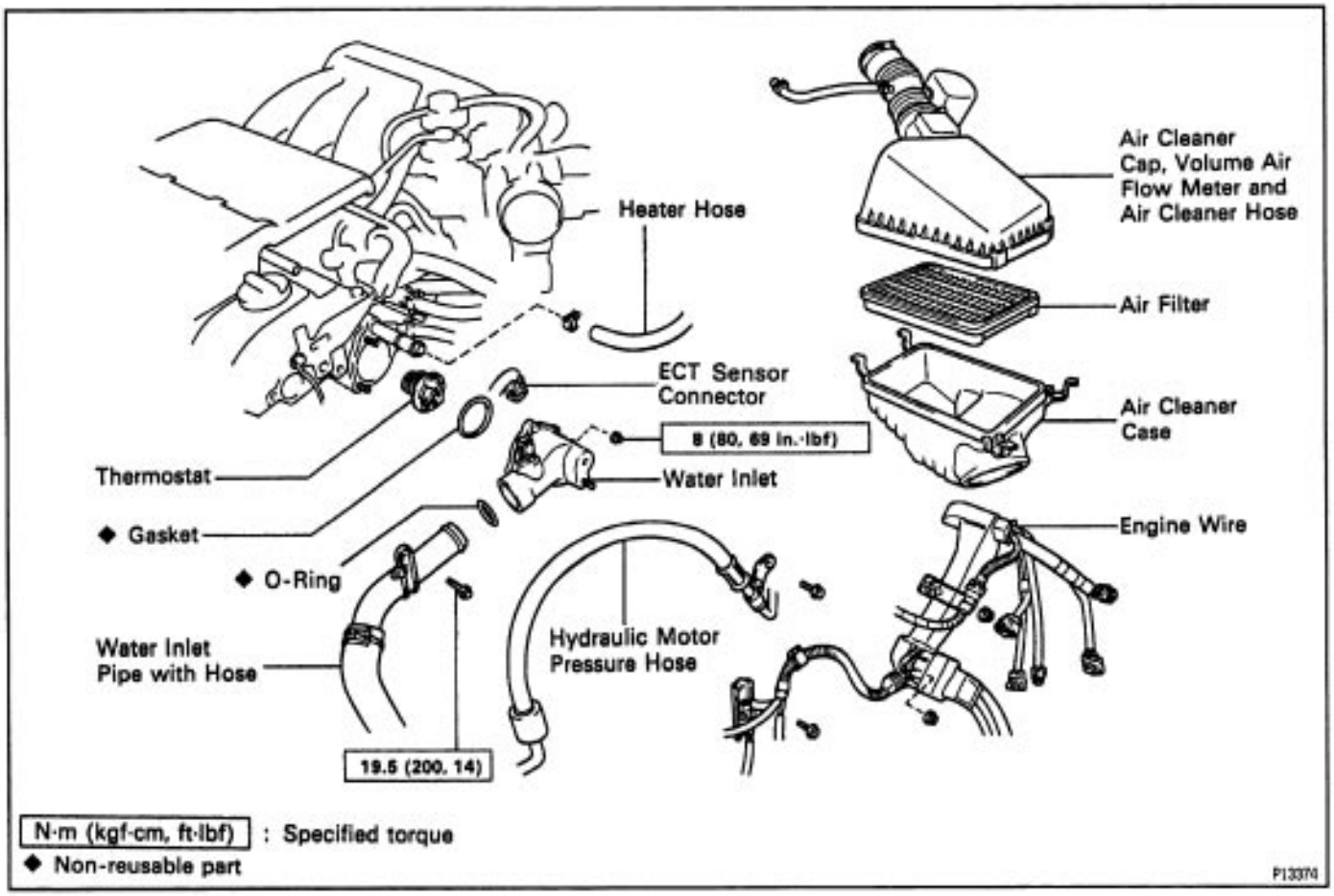
**9. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY**

**10. START ENGINE AND CHECK FOR LEAKS**

**11. RECHECK ENGINE COOLANT LEVEL**

# THERMOSTAT

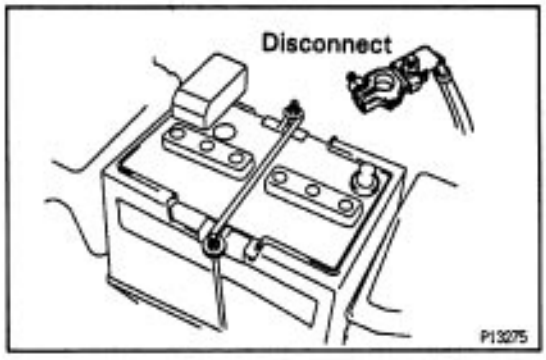
## COMPONENTS FOR REMOVAL AND INSTALLATION




## THERMOSTAT REMOVAL

**(See Components for Removal and Installation)**

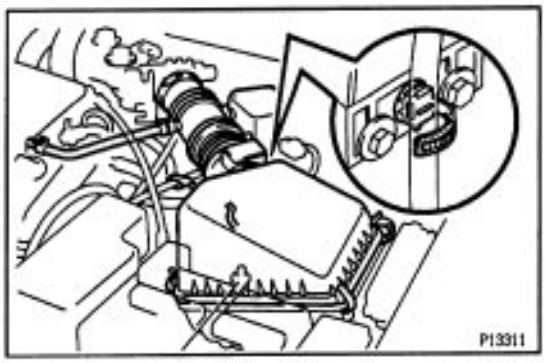
HINT: Removal of the thermostat would have an ad–verse effect, causing a lowering of cooling efficiency. Do not remove the thermostat, even if the engine tends to overheat.




**1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY**

**CAUTION: Work must be started after 90 seconds from the time the Ignition switch is turned to the ”LOCK” position and the negative (–) terminal cable is discon–nected from the battery.**

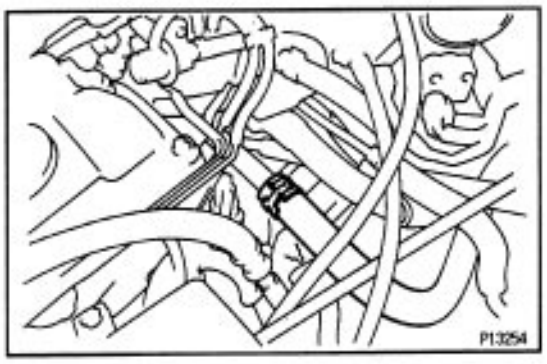
**2. DRAIN ENGINE COOLANT**




**3. REMOVE AIR CLEANER CAP, VOLUME AIR FLOW METER AND AIR CLEANER HOSE**

(a) Disconnect the volume air flow meter connector and wire clamp.
(b) Disconnect the accelerator cable clamp.
(c) Disconnect the PCV hose.
(d) Loosen the air cleaner hose clamp bolt.
(e) Disconnect the 4 air cleaner cap clips.
(f) Remove the air cleaner cap and volume air flow meter together with the air cleaner hose.

**4. DISCONNECT HEATER HOSE**



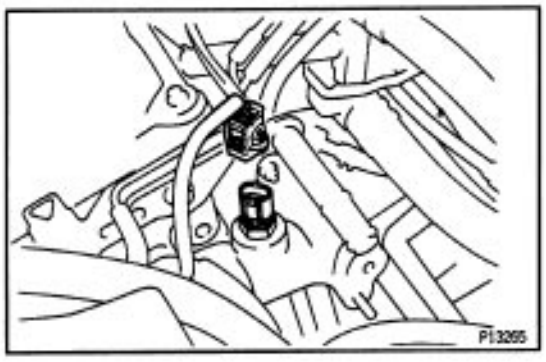

**5. DISCONNECT PRESSURE HOSE OF HYDRAULIC MOTOR**

Remove the bolt and disconnect the pressure hose from the water inlet.

**6. DISCONNECT ENGINE WIRE**

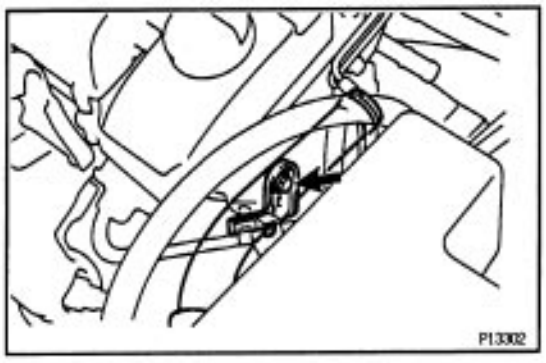
Remove the 2 nuts and disconnect the engine wire from the water inlet and cylinder head.

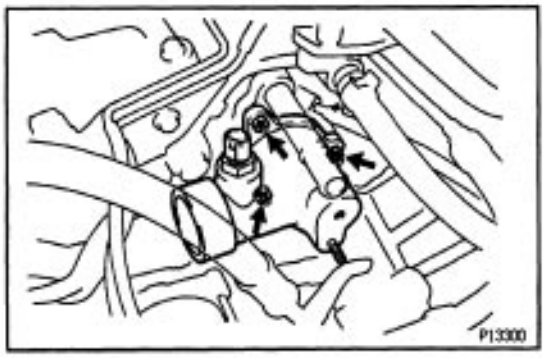

**7. DISCONNECT ENGINE COOLANT TEMPERATURE (ECT) SENSOR CONNECTOR**




**8. DISCONNECT WATER INLET PIPE**

(a) Remove the bolt holding the water inlet pipe to the cylinder head.
(b) Disconnect the water inlet pipe and remove the 0–ring.

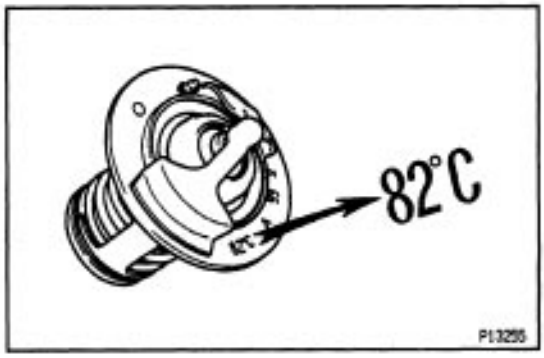





**8. REMOVE WATER INLET**

Remove the 3 nuts and water inlet from the water inlet housing.

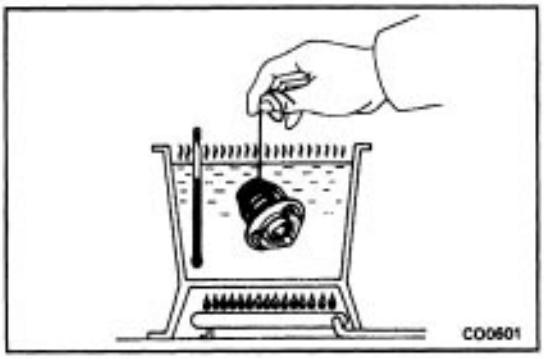
**10. REMOVE THERMOSTAT AND GASKET**




# THERMOSTAT INSPECTION

**INSPECT THERMOSTAT**

HINT: The thermostat is numbered with the valve opening temperature.



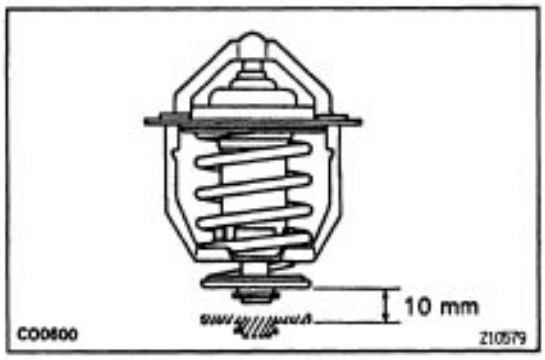

(a) Immerse the thermostat in water and gradually heat the water.

(b) Check the valve opening temperature.

**Valve opening temperature:**

**80 – 84˚C (176 – 183˚F)**

If the valve opening temperature is not as specified, replace the thermostat.




(c) Check the valve lift.

**Volvo lift:**

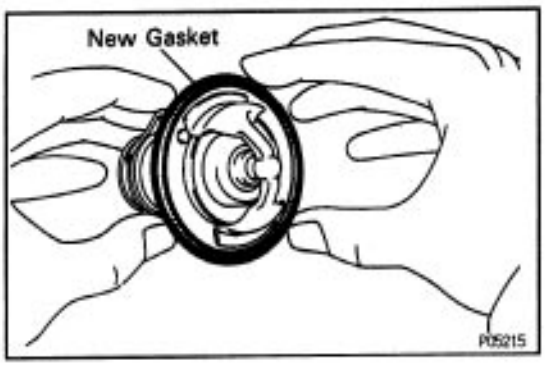
**10.0 mm (0.394 In.) or more at 95˚ C (203$_2$ F)**

If the valve lift is not as specified, replace the thermo–stat.

(d) Check that the valve spring is tight when the thermo–stat is fully closed.

If not closed, replace the thermostat.

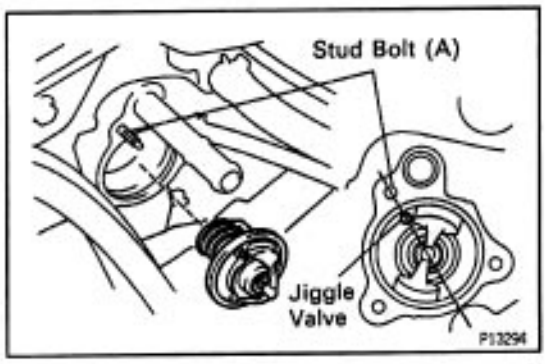
# THERMOSTAT INSTALLATION




**(See Components for Removal and Installation)**

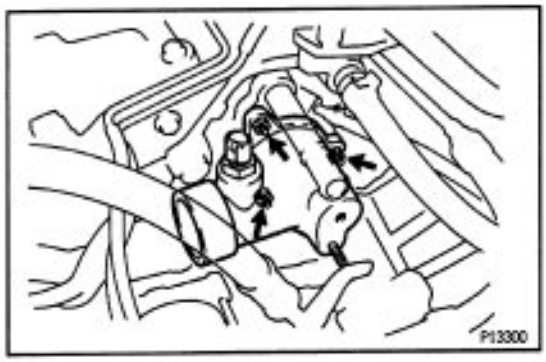
**1. PLACE THERMOSTAT IN WATER PUMP**

(a) Install a new gasket to the thermostat.




(b) Align the jiggle valve of the thermostat with stud bolt (A), and insert the thermostat in the water inlet housing.

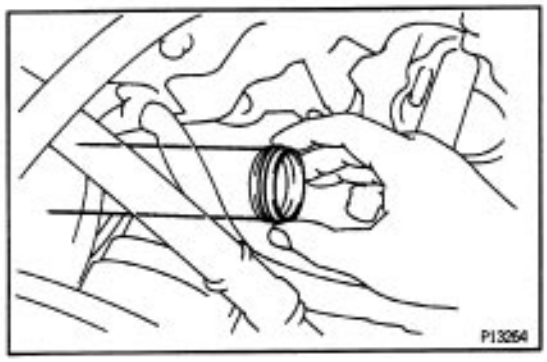
HINT: The jiggle valve may be set within $30_2$ of either side of the prescribed position.




**2. INSTALL WATER INLET**

Install the water inlet with the 3 nuts.

**Torque: 8 N–m (80 kgf–cm, 69 in.–lbf)**




**3. INSTALL WATER INLET PIPE**

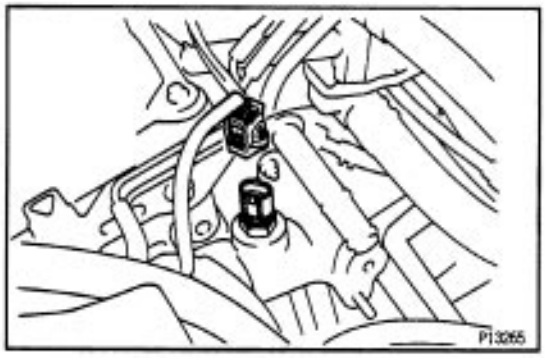
(a) Install a new 0 – ring to the water inlet pipe.


(b) Apply soapy water to the 0 – ring.

(c) Connect the water inlet pipe to the water inlet.

(d) Install the bolt holding the water inlet pipe to the cylinder head.

**Torque: 19.5 N–m (200 kgf–cm, 14 ft–lbf)**




**4. CONNECT ENGINE COOLANT TEMPERATURE SENSOR (ECT) CONNECTOR**

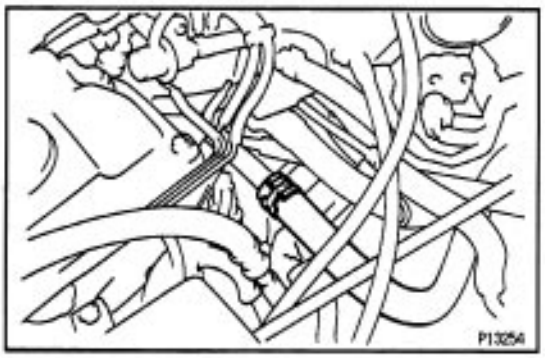

**5. CONNECT ENGINE WIRE**

Connect the engine wire to the water inlet and cylin–der head with the 2 nuts.

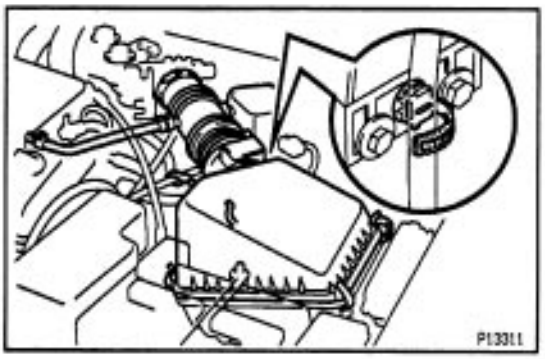
**6. CONNECT HYDRAULIC MOTOR PRESSURE HOSE**

Connect the pressure hose with the bolt.

**Torque: 8 N–m (80 kgf–cm, 69 in.–lbf)**




**7. CONNECT HEATER HOSE**




**8. REINSTALL AIR CLEANER CAP, VOLUME AIR FLOW METER AND AIR CLEANER HOSE**

(a) Connect the air cleaner hose, and install the air clean–er cap and volume air flow meter with the 4 clips.
(b) Tighten the air cleaner hose clamp bolt.
(c) Connect the PCV hose.
(d) Connect the accelerator cable clamp.
(e) Connect the volume air flow meter connector and wire clamp.

**9. FILL WITH ENGINE COOLANT**

**Capacity:**

**8.7 liters (9.2 US qts, 7.7 Imp. qts)**

**10. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY**

**11. START ENGINE AND CHECK FOR LEAKS**

**12. RECHECK ENGINE COOLANT LEVEL**

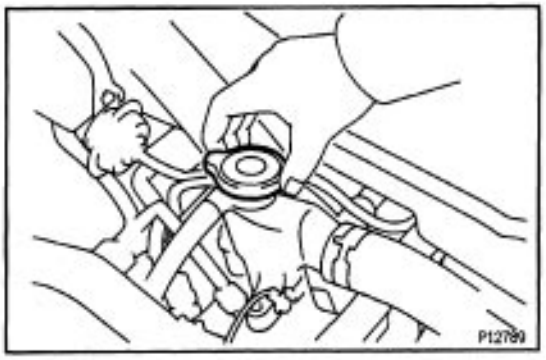
# RADIATOR

## RADIATOR CLEANING

Using water or a steam cleaner, remove any mud and dirt from the radiator core.

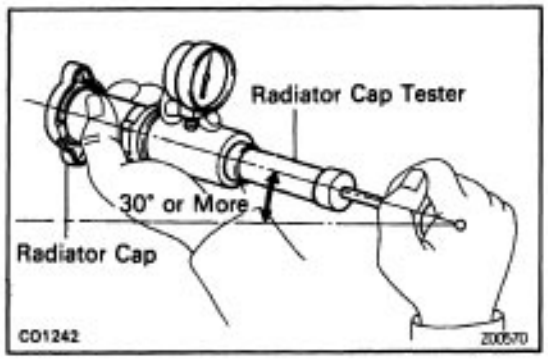
**NOTICE: If using a high pressure type cleaner, be careful not to deform the fins of the radiator core. If the cleaner nozzle pressure is 2,942 – 3,432 kPa (30 – 35 kgf/cm$^2$, 427 – 498 psi), keep a distance of at least 40 cm (15.75 in.) between the radiator core and cleaner nozzle.**

## RADIATOR INSPECTION




**1. REMOVE RADIATOR CAP FROM WATER OUTLET**

**CAUTION: To avoid the danger of being burned, do not remove the radiator cap while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.**




**2. INSPECT RADIATOR CAP**

**NOTICE: When performing steps (a) and (b) below, keep the radiator pump tester at an angle of over 30$_2$ above the horizontal.**

(a) Using a radiator cap tester, slowly pump the tester and check that air is coming from the relief valve.

**Pump speed:**

**1 push/3 seconds or more**

**NOTICE: Push the pump at a constant speed.**

If air is not coming from the relief valve, replace the radiator cap.

(b) Pump the tester several times and measure the relief valve opening pressure.

**Pump speed:**

**1 at time**

**1 push/1 second or less**

**2nd time or more**

**Any speed**

**Standard opening pressure:**

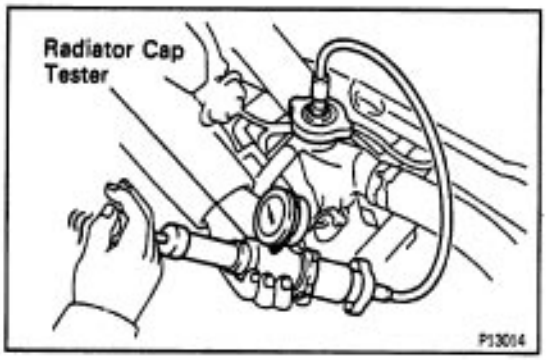
**83 – 113 kPa**

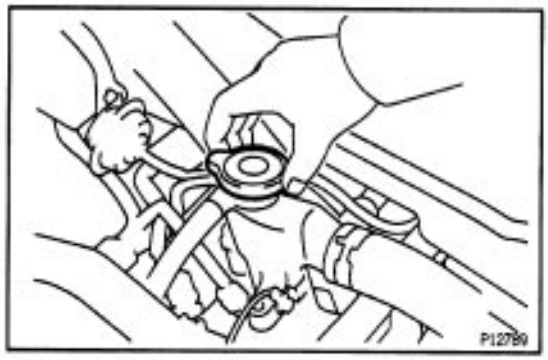
**(0.85 – 1.15 kgf/cm$^2$, 12.1 – 16.4 psi)**

**Minimum opening pressure:**

**69 kPa (0.7 kgf/cm$^2$, 10.0 psi)**

If the opening pressure is less than minimum, replace the radiator cap.




**3. INSPECT COOLING SYSTEM FOR LEAKS**

(a) Fill the radiator and engine with coolant and attach a radiator cap tester.

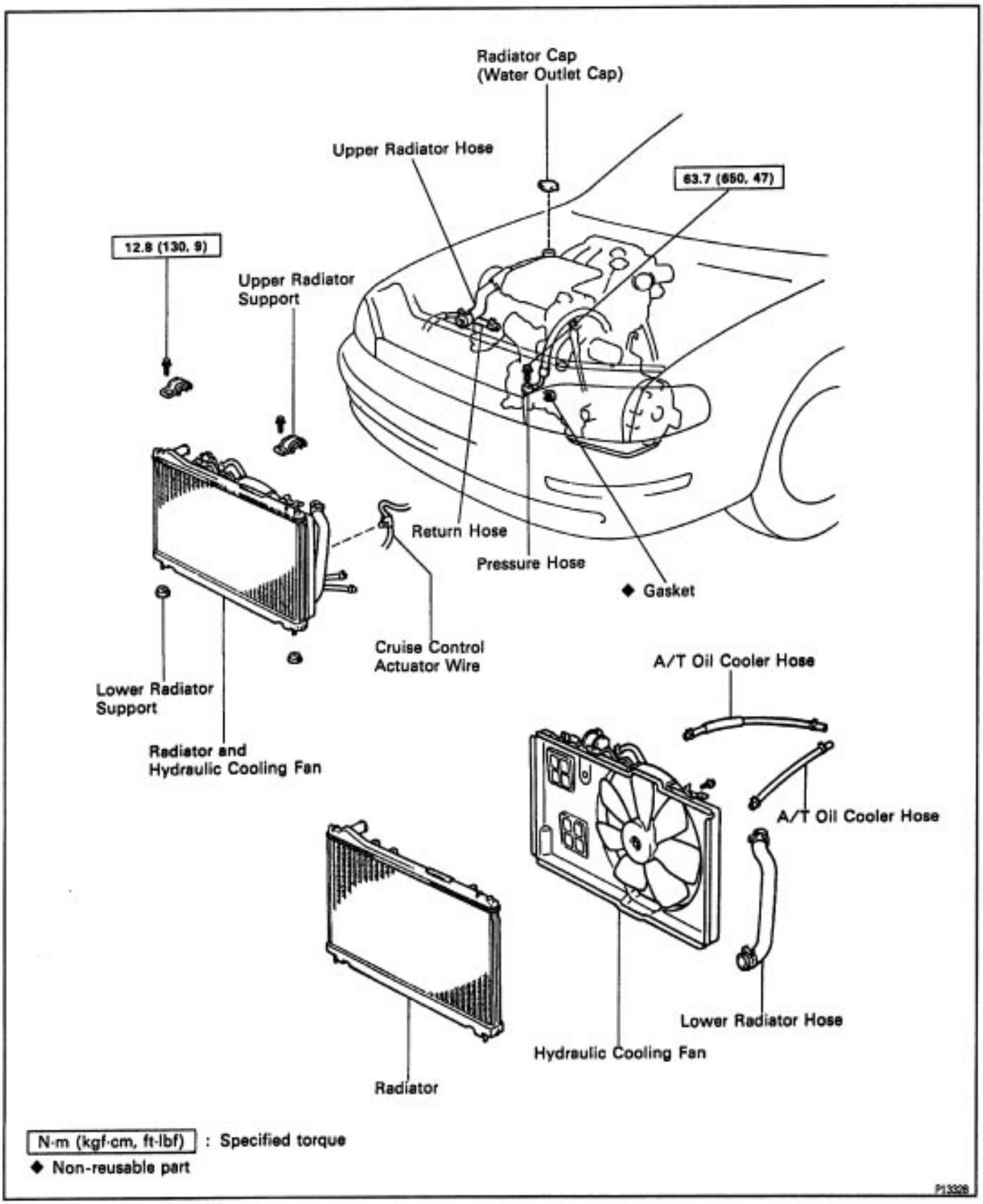
(b) Warm up the engine.

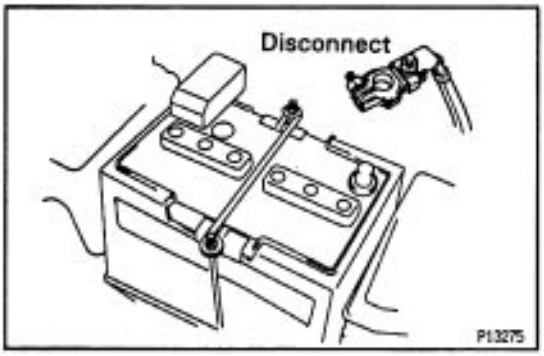
(c) Pump it to 127 kPa (1.3 kgf/cm$^2$, 18.5 psi), and check that the pressure does not drop.

If the pressure drops, check the hoses, radiator or water pump for leaks. If no external leaks are found, check the heater core, cylinder block and cylinder head.

**4. REINSTALL RADIATOR CAP**

# COMPONENTS FOR REMOVAL AND INSTALLATION






# RADIATOR REMOVAL

**(See Components for Removal and Installation)**

**1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY**

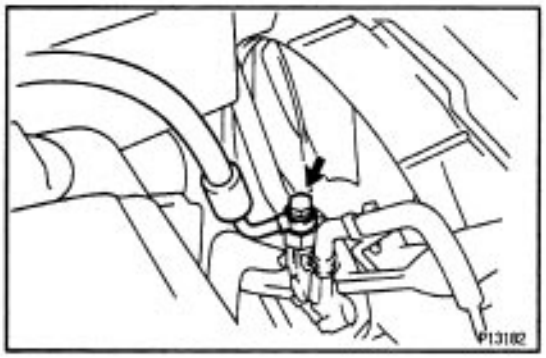
**CAUTION: Work must be started after 90 seconds from the time the ignition switch is turned to the 'LOCK' position and the negative (–) terminal cable is disconnected from the battery.**

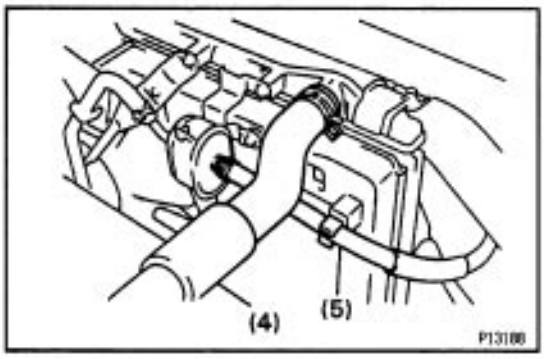
**2. DRAIN ENGINE COOLANT**

**3. DISCONNECT PRESSURE HOSE**

Remove the union bolt and gasket, and disconnect the pressure hose from the hydraulic motor.

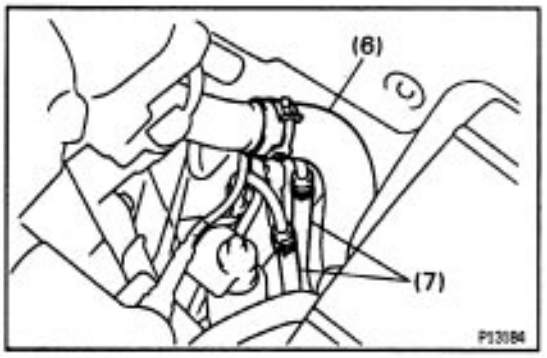
**NOTICE: Catch leaking oil in a container.**




**4. DISCONNECT UPPER RADIATOR HOSE**

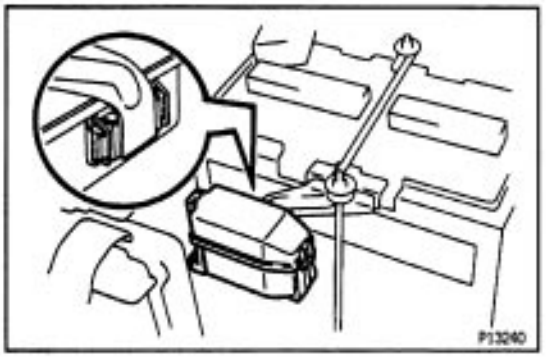
**5. DISCONNECT HYDRAULIC MOTOR RETURN HOSE**




**6. DISCONNECT LOWER RADIATOR HOSE FROM WATER INLET PIPE**

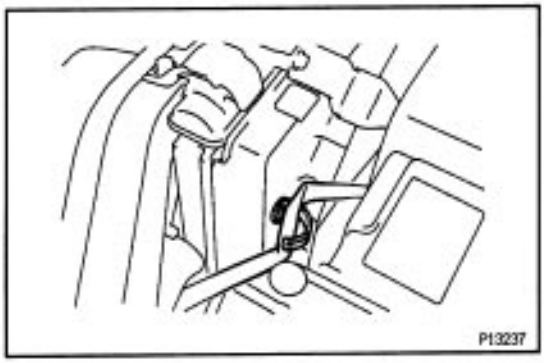
**7. DISCONNECT OIL COOLER HOSES FROM OIL COOLER PIPES**

Disconnect the 2 hoses.

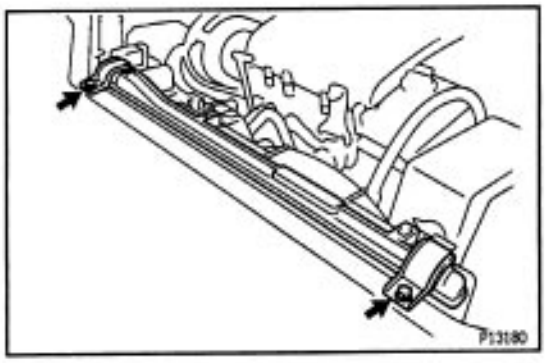



**8. Canada only:**

**REMOVE NO.7 RELAY BLOCK**

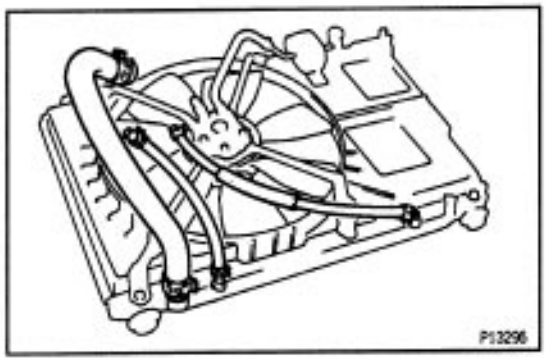



**9. DISCONNECT CRUISE CONTROL ACTUATOR WIRE CLAMP**




**10. REMOVE RADIATOR AND HYDRAULIC COOLING FAN**

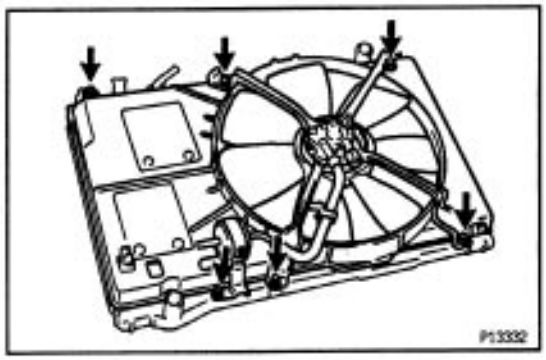
(a) Remove the 2 bolts and 2 upper supports.
(b) Lift out the radiator.




**11. REMOVE A/T OIL COOLER HOSES**

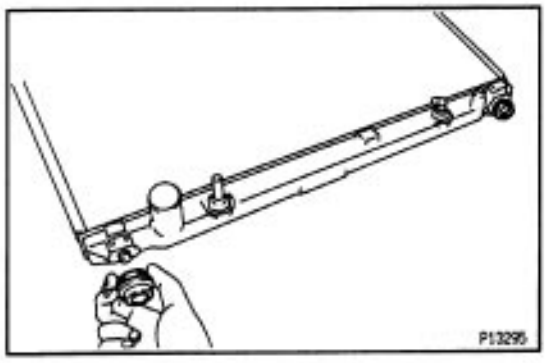
Remove the 2 hoses.

**12. REMOVE RADIATOR LOWER HOSE**




**13. REMOVE HYDRAULIC COOLING FAN FROM RADIATOR**

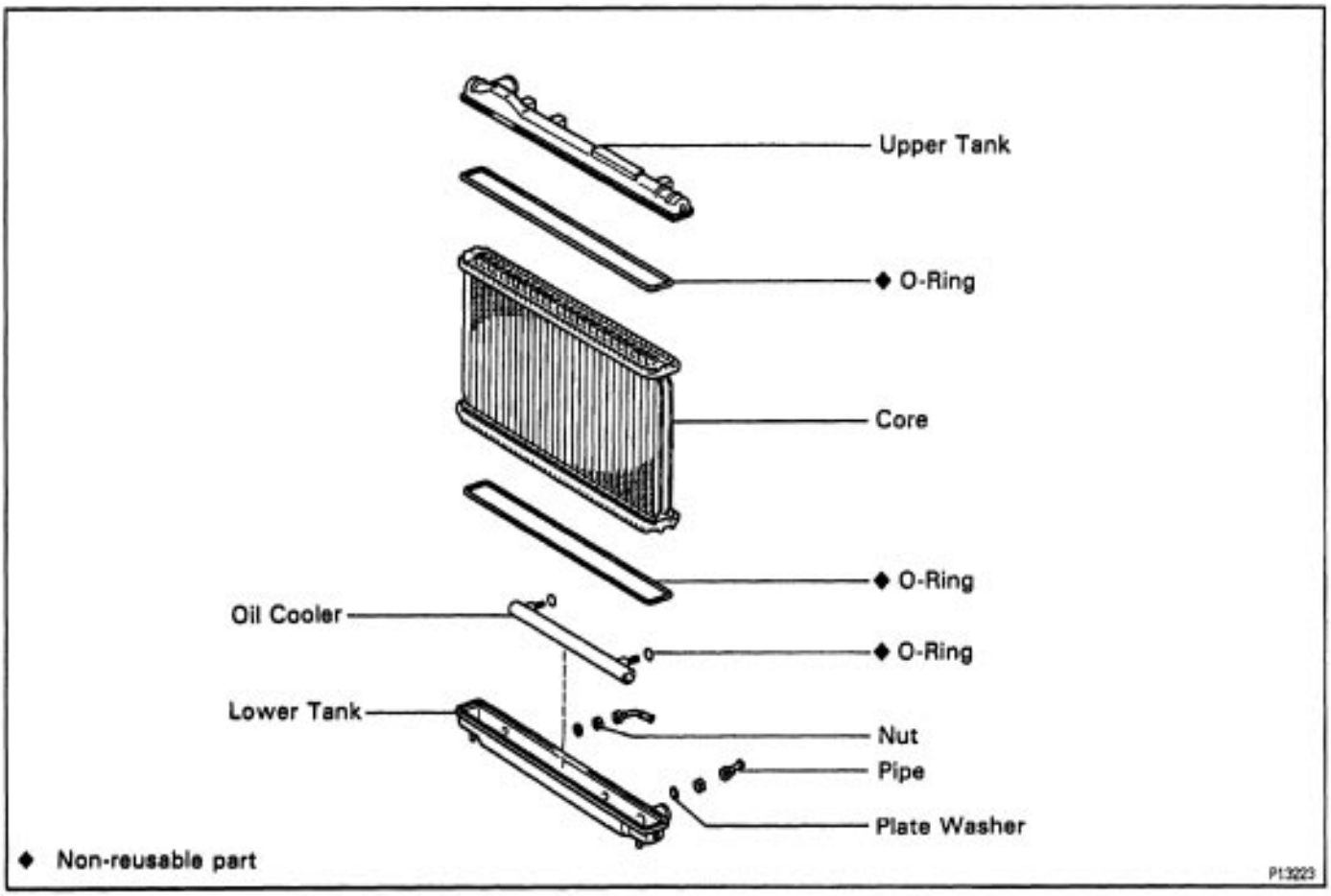
Remove the 6 bolts and cooling fan.

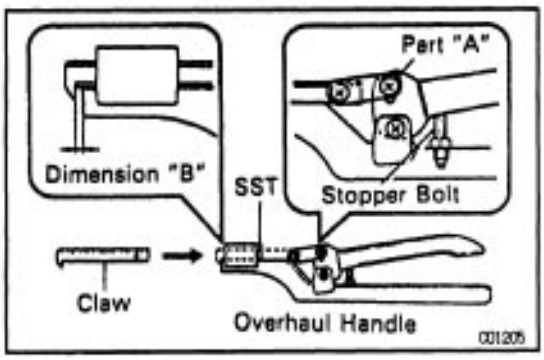



**14. REMOVE LOWER RADIATOR SUPPORTS**

Remove the 2 lower radiator supports.

# COMPONENTS FOR DISASSEMBLY AND ASSEMBLY




## RADIATOR DISASSEMBLY

**(See Components for Disassembly and Assembly)**

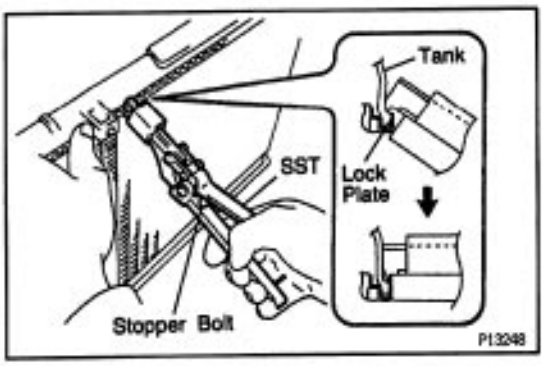
**ASSEMBLY OF SST**

**09230 – 01010**

(a) Install the claw to the overhaul handle, inserting it in the hole in part ”A” as shown in the diagram.

(b) While gripping the handle, adjust the stopper bolt so that dimension ”B” shown in the diagram is 0.2–0.5 mm (0.008–0.020 in.).

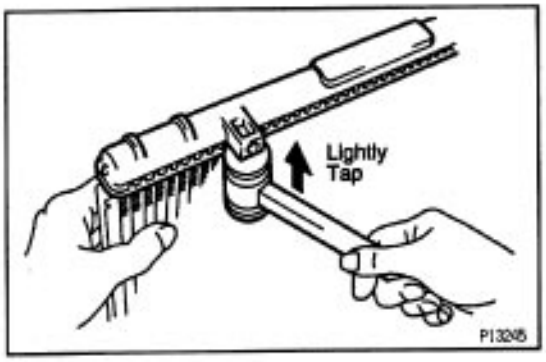
**NOTICE: If this adjustment is not performed, the claw may be damaged.**




**2. UNCAULK LOCK PLATES**

Using SST to release the caulking, squeeze the handle until stopped by the stopper bolt.

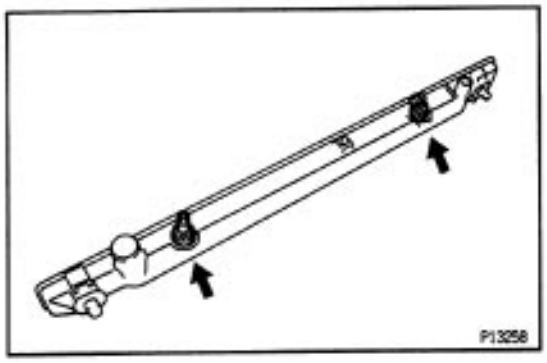
SST 09230 – 01010




**3. REMOVE TANKS AND O–RINGS**

(a) Lightly tap the bracket of the radiator (or radiator hose inlet or outlet) with a soft–faced hammer and remove the tank.

(b) Remove the O–ring.




**4. REMOVE OIL COOLER FROM LOWER TANK**

(a) Remove the pipes.

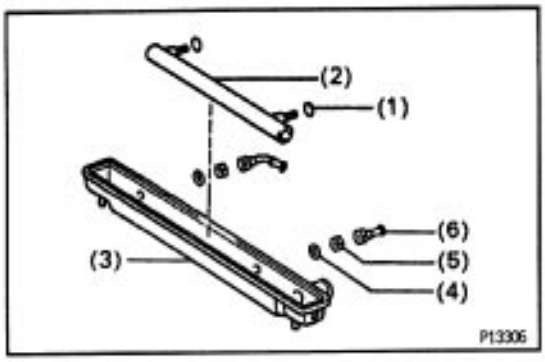
HINT: Make a note of the direction to face the pipes.

(b) Remove the nuts, and plate washers.

(c) Remove the oil cooler and 0–rings.

**RADIATOR ASSEMBLY**

**(See Components for Disassembly and Assembly)**




**1. INSTALL OIL COOLER TO LOWER TANK**

(a) Clean the O–ring contact surface of the lower tank and oil cooler.

(b) Install new 0–rings (1) to the oil cooler (2).

(c) Install the oil cooler with the 0–rings to the lower tank (3).

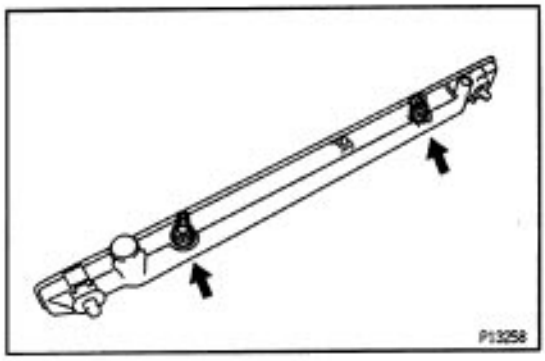
(d) Install the plate washers (4), and nuts (5). Torque the nuts.

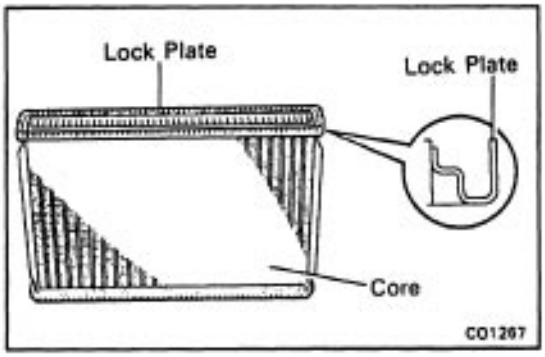
**Torque: 8.3 N–m (85 kgf–cm, 74 ft–lbf)**

(e) Install the pipes (6).

**Torque: 14.7 N–m (150 kgf–cm, 11 ft–lbf)**

HINT: Face the pipes in the same direction as before disassembly.






**2. INSPECT LOCK PLATE**

Inspect the lock plate for damage.

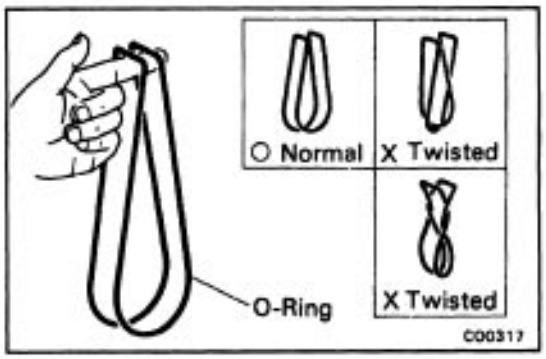
HINT:

- If the sides of the lock plate groove are deformed, reassembly of the tank will be impossible.
- Therefore, first correct any deformation with pliers or similar object. Water leakage will result if the bottom of the lock plate groove is damaged or dented, Therefore, repair or replace if neces–sary.

**3. INSTALL NEW O–RINGS AND TANKS**

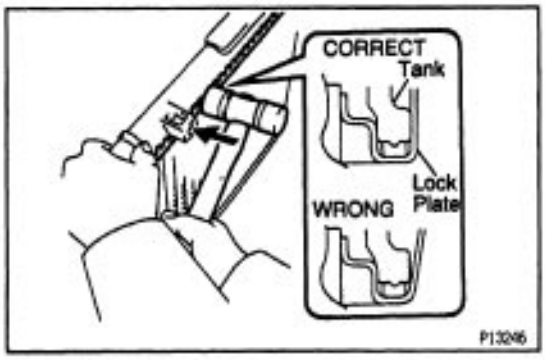
(a) After checking that there are no foreign objects in the lock plate groove, install the new 0–ring without twisting it.

HINT: When cleaning the lock plate groove, lightly rub it with sand paper without scratching it.




(b) Install the tank without damaging the 0 – ring.

(c) Tap the lock plate with a soft–faced hammer so that there is no gap between it and the tank.

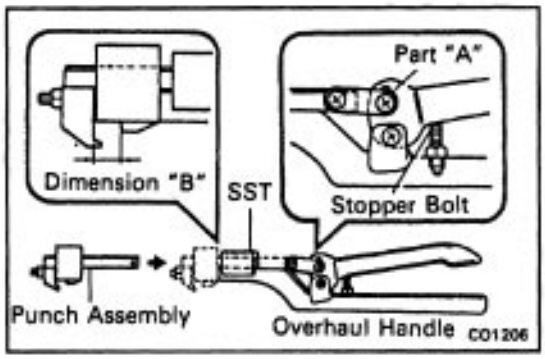



**4. ASSEMBLY OF SST**

SST 09230 – 01010

(a) Install the punch assembly to the overhaul handle, inserting it in the hole in part ”A” as shown in the illustration.

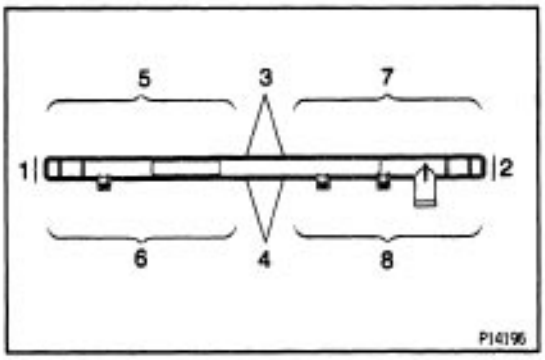
(b) While gripping the handle, adjust the stopper bolt so that dimension ”B” shown in the diagram is 7.7 mm (0.30 in.).

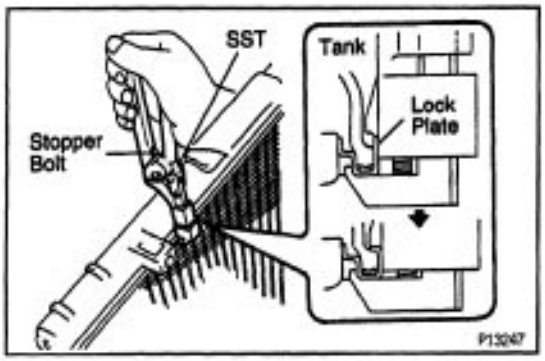


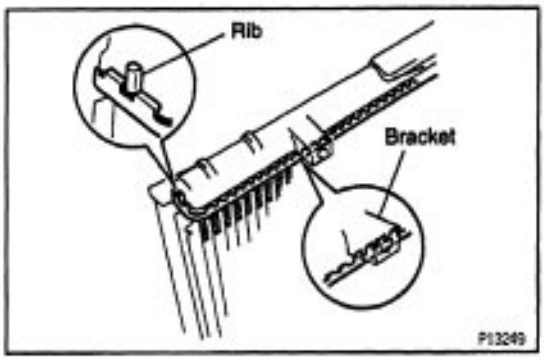

**5. CAULK LOCK PLATE**

(a) Lightly press SST against the lock plate in the order shown in the illustration. After repeating this a few times, fully caulk the lock plate by squeezing the handle until stopped by the stopper plate.

SST 09230 – 01010

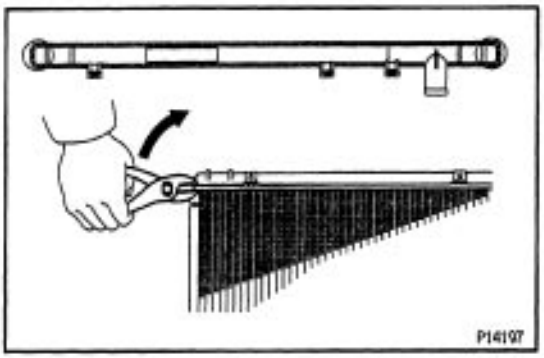




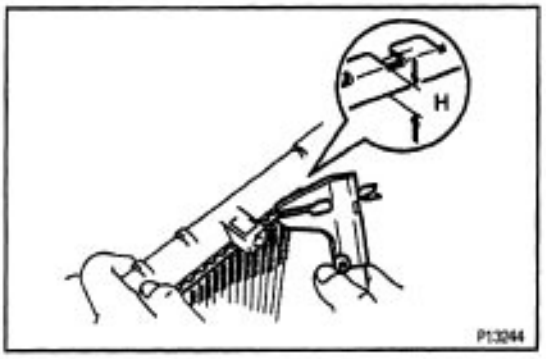




HINT:

- Do not stake the areas protruding around the pipes, brackets or tank ribs.




- The points shown in the illustration and oil cooler near here cannot be staked with the SST. Use a plier or similar object and be careful not to damage the core plates.




(b) Check the lock plate height (H) after completing the caulking.

**Plate height:**

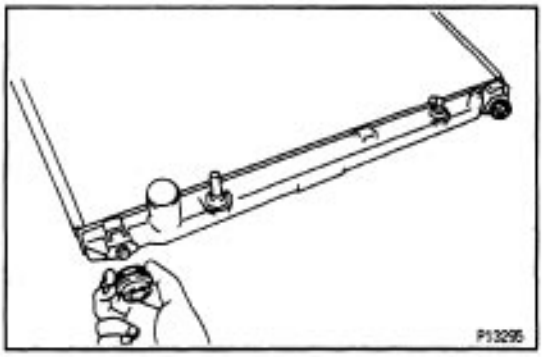
**7.75 – 8.25 mm (0.305 – 0.325 in.)**

If not within the specified height, adjust the stopper bolt of the handle again and perform the caulking again.

**6. PAINT LOCK PLATES**

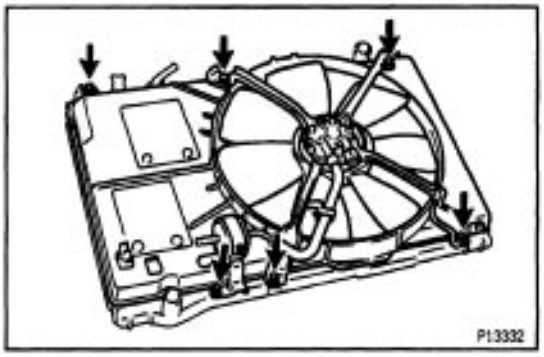
# RADIATOR INSTALLATION

**(See Components for Removal and Installation)**




**1. INSTALL RADIATOR SUPPORTS**

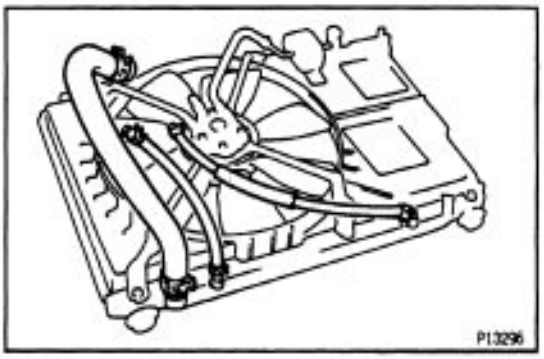
Install the 2 supports.




**2. INSTALL HYDRAULIC COOLING FAN TO RADIATOR**

Install the cooling fan with the6 bolts.

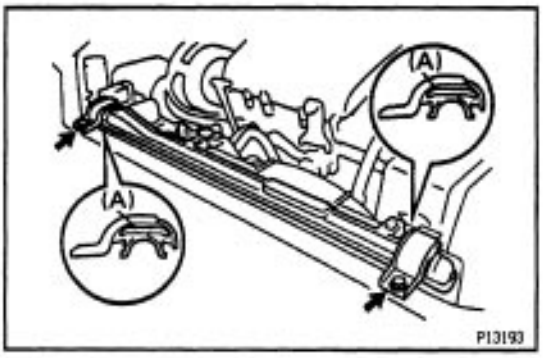
**Torque: 4.9 N–m (50 kgf–cm, 43 in.–lbf)**




**3. INSTALL RADIATOR LOWER HOSE**

**4. INSTALL A/T OIL COOLER HOSES**

Install the 2 hoses.

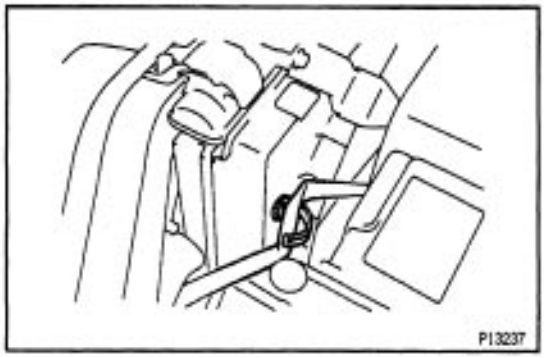



**6. INSTALL RADIATOR AND HYDRAULIC COOLING FAN**

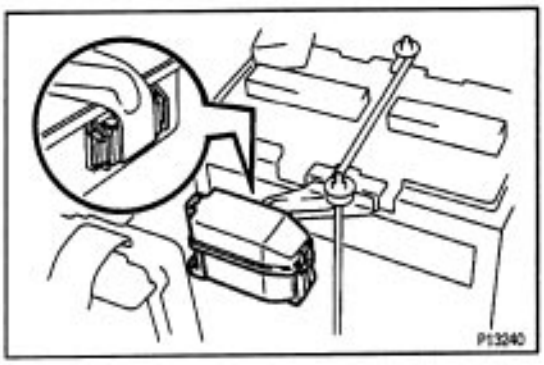
Place the radiator in position, and install the 2 upper supports with the 2 bolts.

**Torque: 12.8 N–m (130 kgf–cm, 9 ft–lbf)**

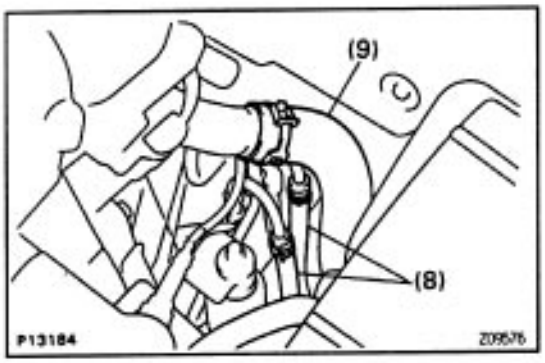
HINT: After installation, check that the rubber cushion (A) of the support is not depressed.



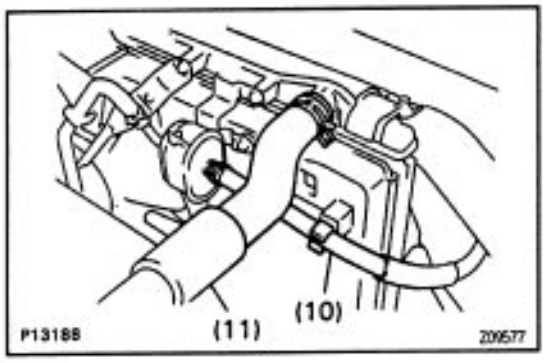

**6. CONNECT CRUISE CONTROL ACTUATOR WIRE CLAMP**



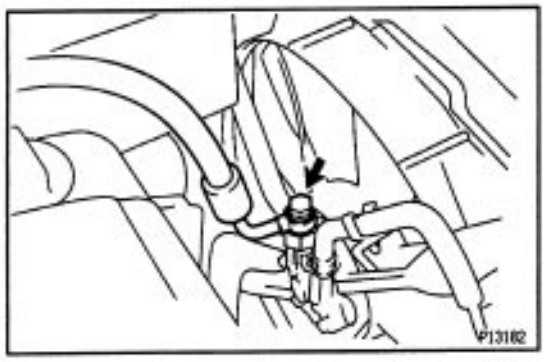

**7. Canada only:**
**INSTALL NO.7 RELAY BLOCK**




**8. CONNECT OIL COOLER HOSES**
**9. CONNECT LOWER RADIATOR HOSE**




**10. CONNECT HYDRAULIC MOTOR RETURN HOSE**
**11. CONNECT UPPER RADIATOR HOSE**




**12. CONNECT PRESSURE HOSE TO HYDRAULIC MOTOR**
Connect the pressure hose with a new gasket and the union bolt.
**Torque: 63.7 N–m (650 kgf–cm, 47 ft–lbf)**

**13. FILL WITH ENGINE COOLANT**
**Capacity:**
**8.7 liters (9.2 US qts, 7.7 Imp. qts)**
**14. FILL COOLING FAN (PS) RESERVOIR TANK WITH FLUID**
**15. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY**
**16. START ENGINE AND CHECK FOR LEAKS**

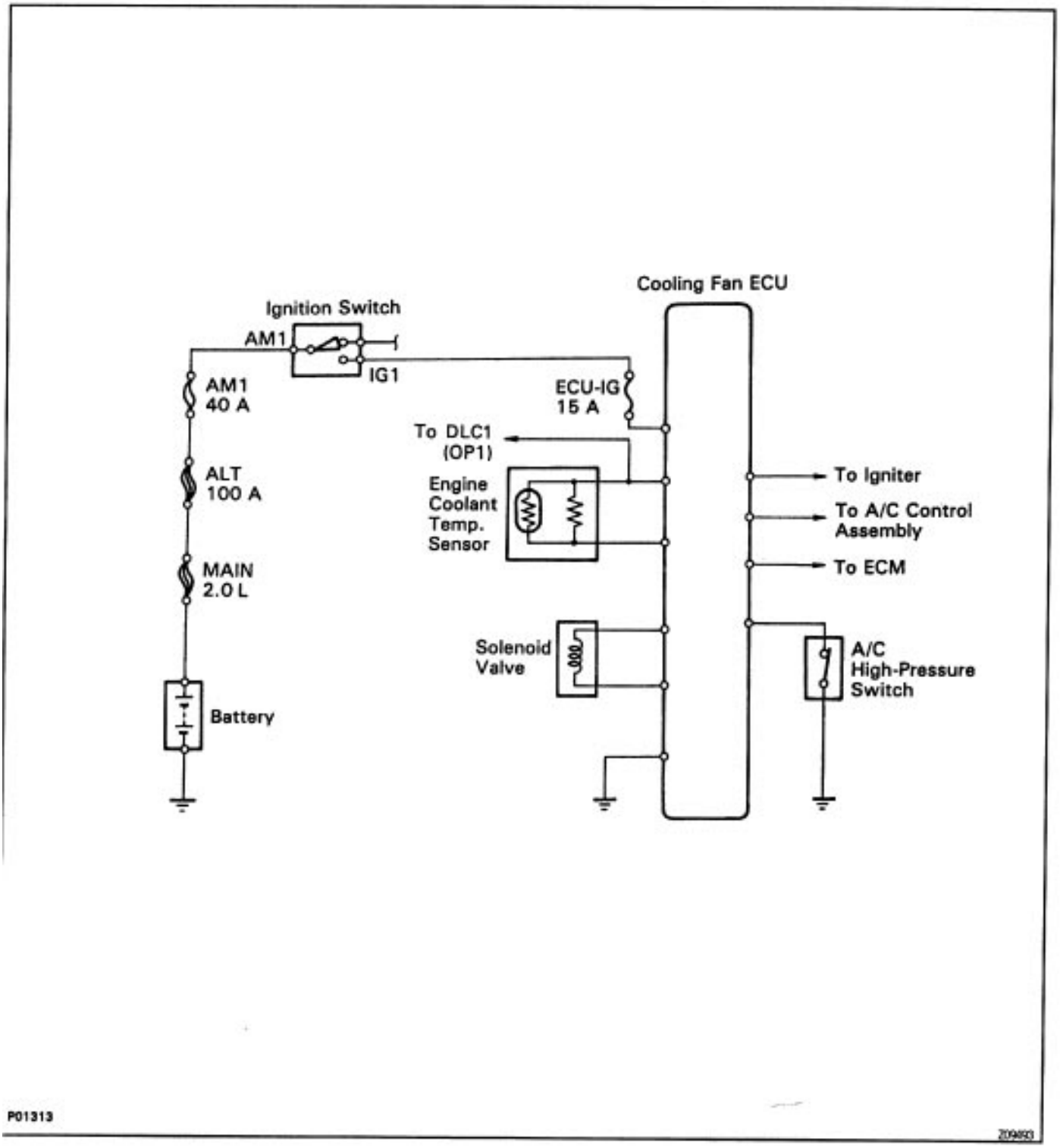
**17. BLEED ELECTRONICALLY CONTROLLED HYDRAULIC COOLING FAN SYSTEM**
**(See page EG2–348)**
**18. CHECK AUTOMATIC TRANSMISSION FLUID LEVEL**
**NOTICE: Do not overfill.**
**19. RECHECK ENGINE COOLANT LEVEL**

# ELECTRONICALLY CONTROLLED HYDRAULIC COOLING FAN SYSTEM

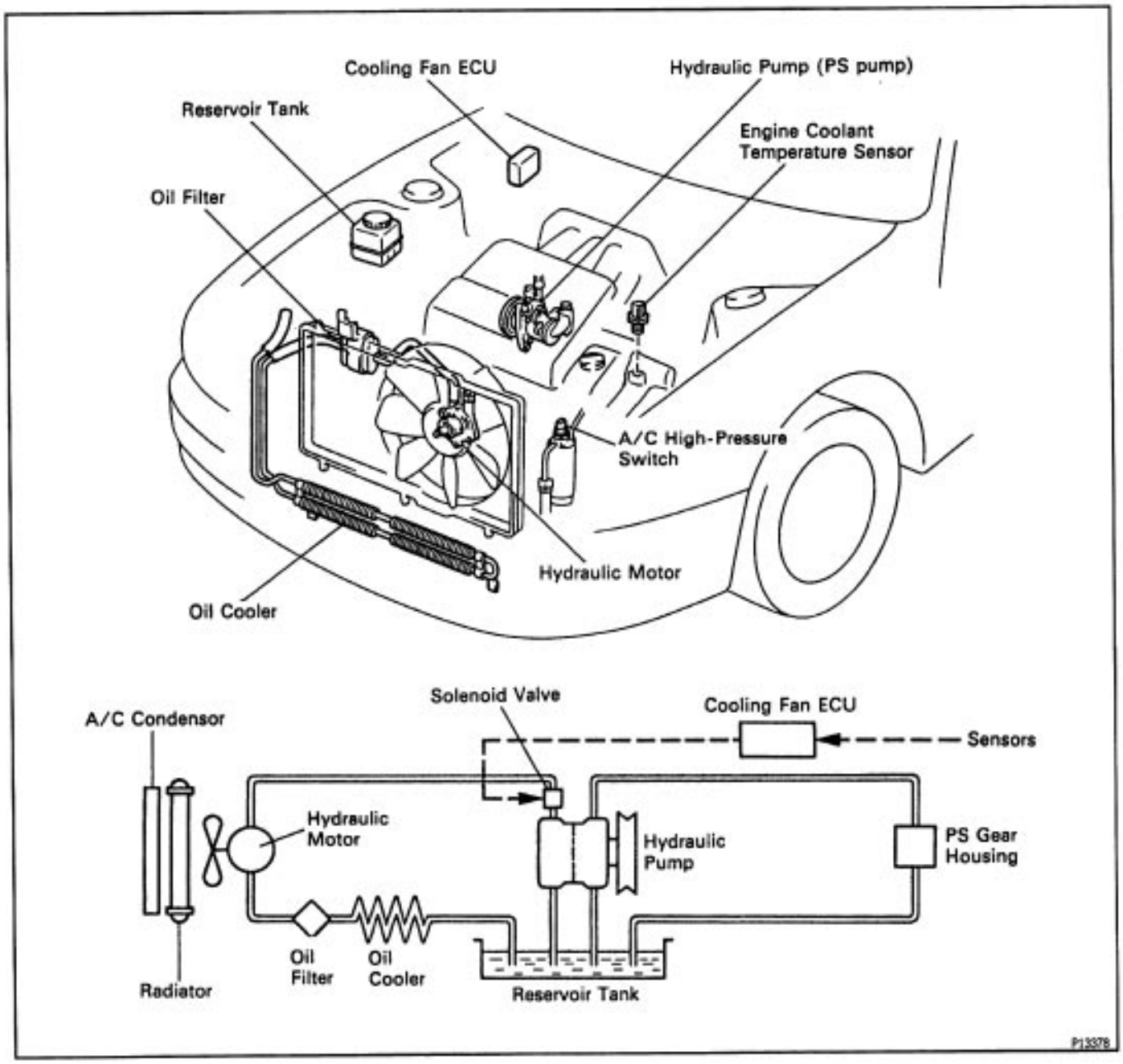
## Description

In this system, the cooling fan ECU controls the hydraulic pressure acting on the hydraulic motor, thus controlling the speed of the cooling fan steplessly in response to the condition of the engine and air conditioning.

## System Circuit



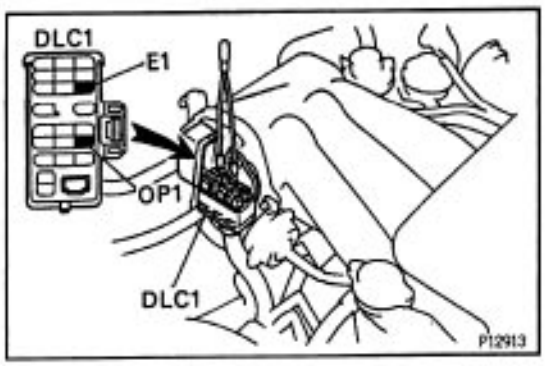
# Operation




The hydraulic pump is integrated with the PS pump and is driven by a drive belt. The solenoid valve adjusts the volume of oil sent from the hydraulic pump to the hydraulic motor which drive; the fan directly, thereby controlling the fan speed.

Oil which has passed through the hydraulic motor is cooled by the oil cooler before returning to the PS pump reservoir tank.

The solenoid valve is controlled by the cooling fan ECU in accordance with the engine rpm, engine coolant temperature and A/C signals.




# On–Vehicle Inspection
# FLUID LEVEL INSPECTION

**1. KEEP VEHICLE LEVEL**

**2. INSPECT FLUID LEVEL**

(a) Using SST, connect terminals OP1 and E1 of the data link connector 1.

SST 09843–18020

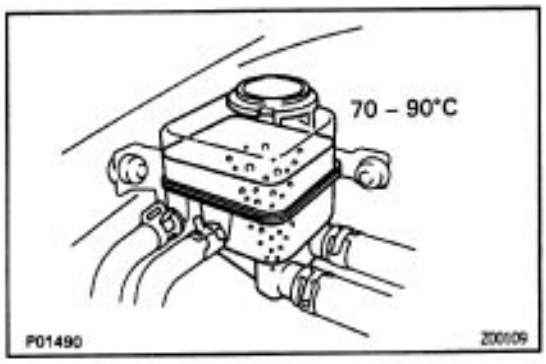
HINT: When terminals OP1 and E1 are connected, the circuit of the ECT sensor is grounded, fixing the cooling fan speed at approx. 1,100 rpm. (Fail–safe operation occurs.)

(b) Keep the engine speed at 2,000 rpm until the fluid temperature reaches the specified temperature.

**Fluid temperature:**

**70 – 90˚C (158 – 195˚F)**

(c) Check that there is no foaming and emulsification of the fluid in the reservoir tank.



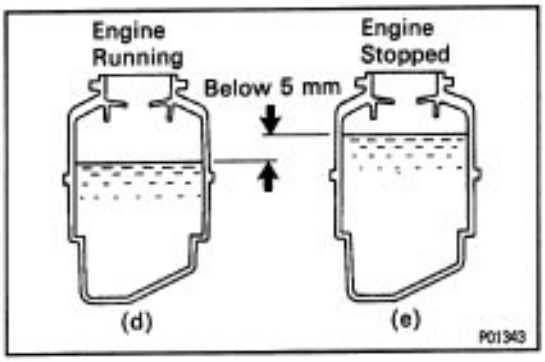

(d) Measure the fluid level with the engine running.

(e) Stop the engine, and measure the fluid level.

(f) Subtract level (d) from (e).

**Maximum level difference:**

**5 mm (0.20 in.)**



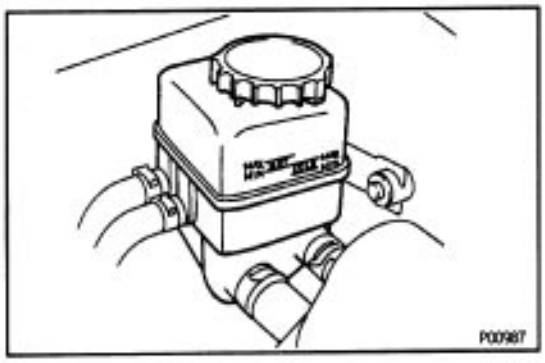

(g) Check the fluid level.

If low, add fluid.

**Fluid:**

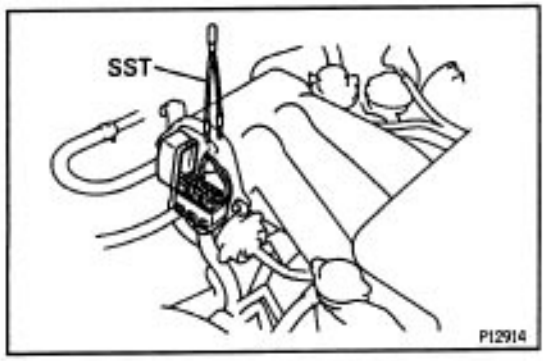
**ATF DEXRON © II**

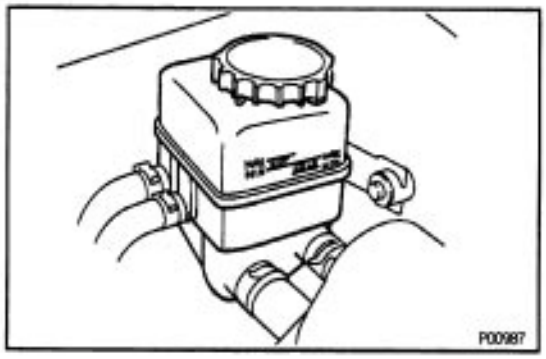
HINT: Check that fluid level is within the ”HOT” level on reservoir tank. If the fluid is cold, check that it is within the ”COLD” level on the reservoir tank.




(h) Remove the SST from the data link connector 1.

SST 09843–18020






# HYDRAULIC COOLING FAN SYSTEM BLEEDING

**1. CHECK FLUID LEVEL IN RESERVOIR TANK**

If low, add fluid.

**Fluid:**

**ATF DEXRON©II**

HINT: Check that fluid level is within the ”HOT” level on reservoir tank. If the fluid is cold, check that it is within the ”COLD” level on the reservoir tank.

**2. BLEED COOLING SYSTEM**

(a) Using SST, connect terminals OP1 and E1 of the data link connector 1.

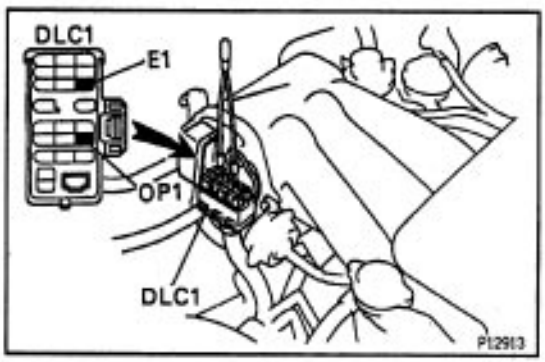
SST 09843–18020

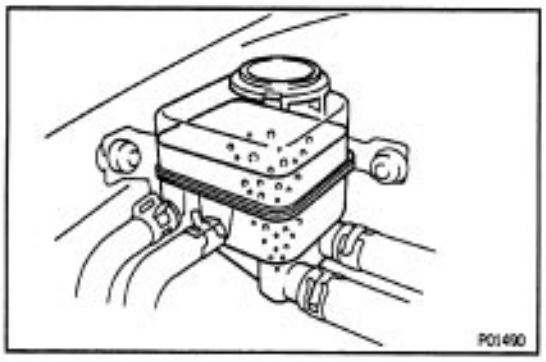
HINT: When terminals OP1 and E1 are connected, the circuit of the ECT sensor is grounded, fixing the cooling fan speed at approx. 1,100 rpm. (Fail–safe operation occurs.)

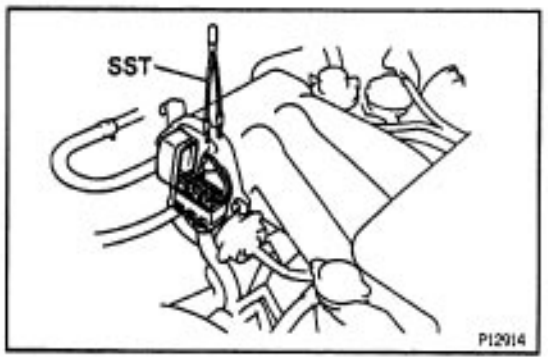
(b) Start the engine without depressing the accelerator pedal.

(c) Leave the engine running for several seconds.

(d) Check that there is no foaming and emulsification of the fluid in the reservoir tank.

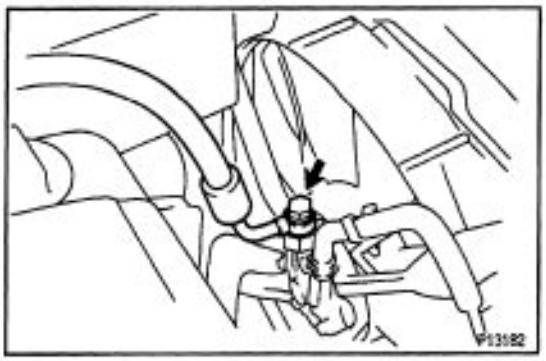



(e) Remove the SST from the data link connector 1.

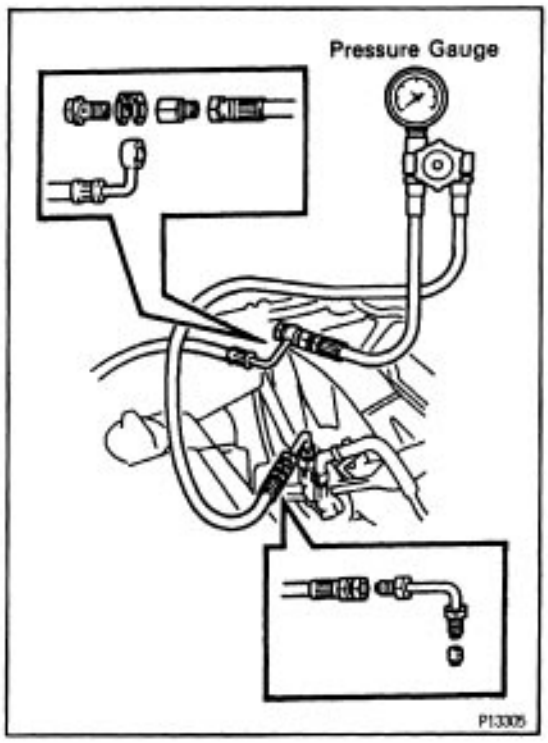
SST 09843–18020



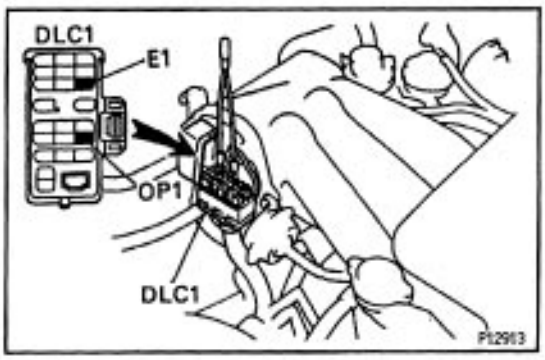
# OIL PRESSURE INSPECTION

**1. DISCONNECT PRESSURE HOSE FROM HYDRAULIC MOTOR, AND INSTALL OIL PRESSURE GAUGE**

(a) Remove the union bolt and gasket, and disconnect the pressure hose from the hydraulic motor.




(b) Connect the gauge side of a pressure gauge to pressure hose, and the valve side to the hydraulic motor.




**2. INSPECT OIL PRESSURE**

HINT: Before inspecting the oil pressure, first check that the A/C is off.

(a) Using SST, connect terminals OP1 and E1 of the data link connector 1.

SST 09843–18020

HINT: When terminals OP1 and E1 are connected, the circuit of the ECT sensor is grounded, fixing the cooling fan speed at approx. 1,100 rpm. (Fail–safe operation occurs.)

(b) Bleed the hydraulic cooling system.

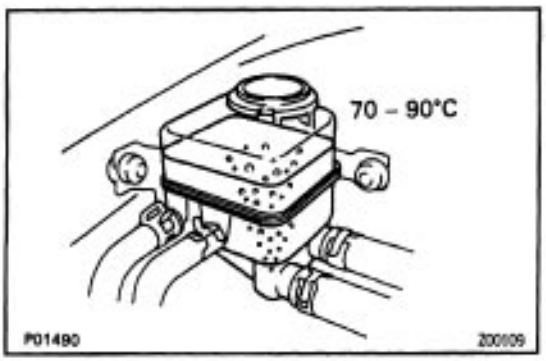
(See page EG2–348)

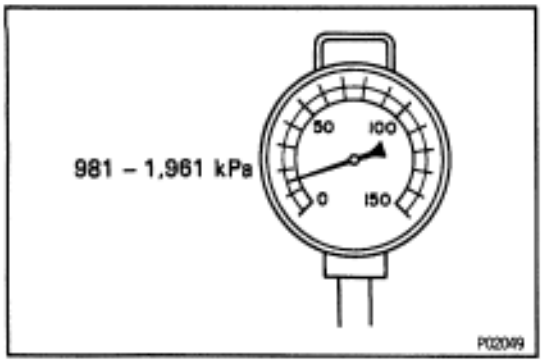
(c) Keep the engine speed at 2,000 rpm until the fluid temperature reaches the specified temperature.

**Fluid temperature:**

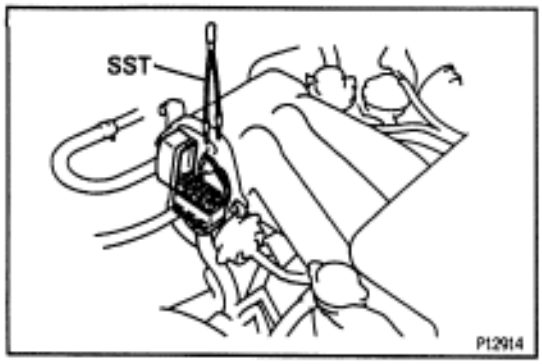
**70 – 90° C (158 – 195° F)**

(d) Check the fluid level is correct.

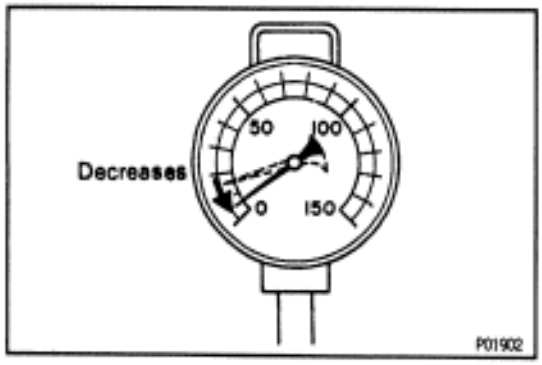




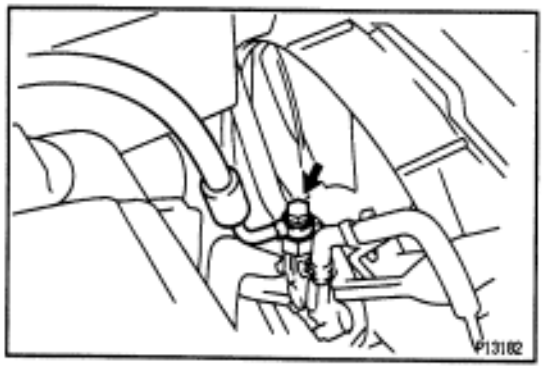

(e) Measure the oil pressure at idling.
**Oil pressure:**
**981 – 1,961 kPa**
**(10 – 20 kgf/cm$^2$, 142 – 284 pal)**




(f) Remove the SST from the data link connector 1.
SST 09843–18020




(g) Check that the oil pressure decreases.

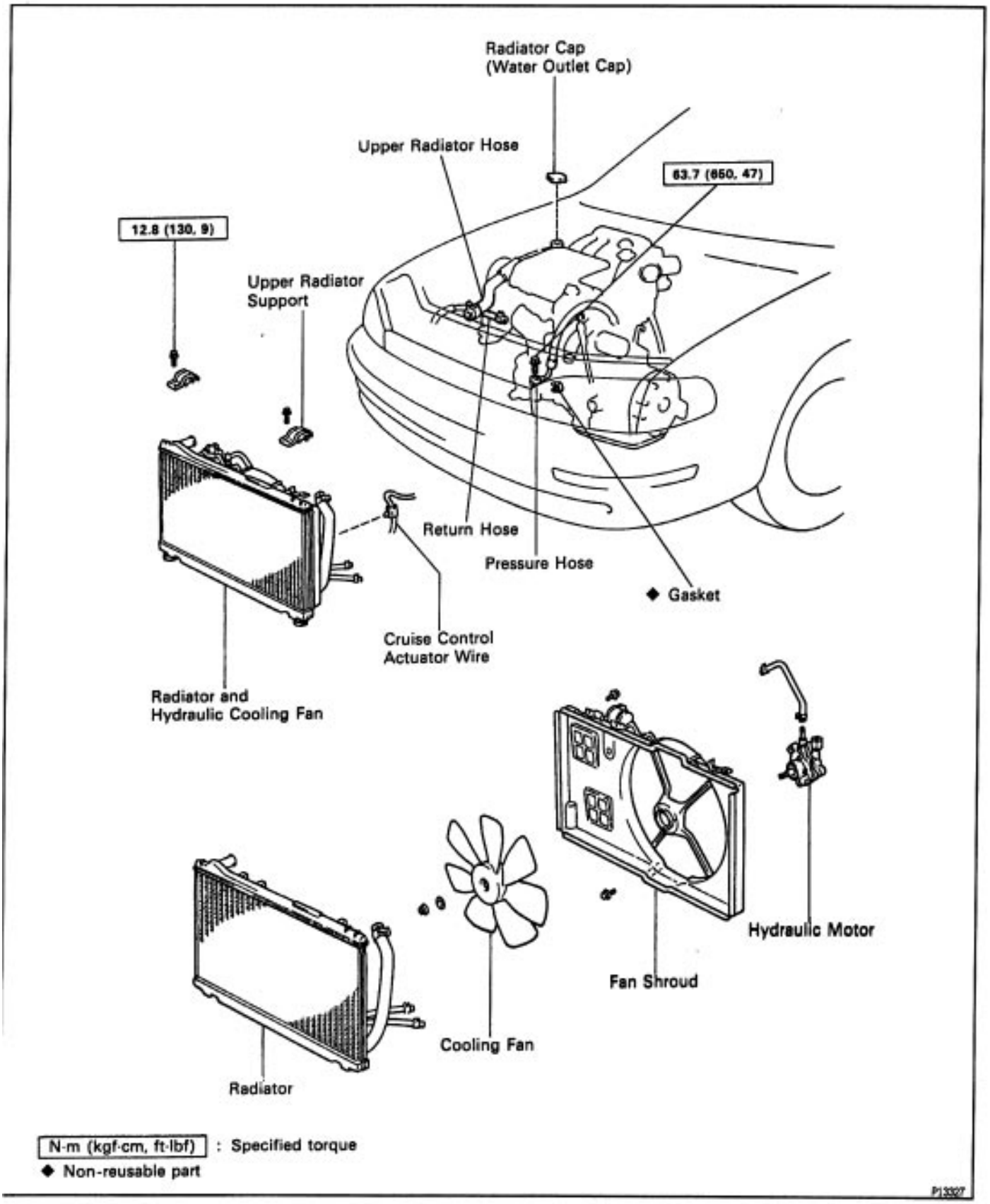



**3. REMOVE OIL PRESSURE GAUGE, AND RECONNECT PRESSURE HOSE TO HYDRAULIC MOTOR**
(a) Remove the pressure gauge.
(b) Connect the pressure hose to the hydraulic motor with a new gasket and the union bolt.
**Torque: 63.7 N–m (650 kgf–cm, 47 ft–lbf)**

## Hydraulic Pump (PS pump)

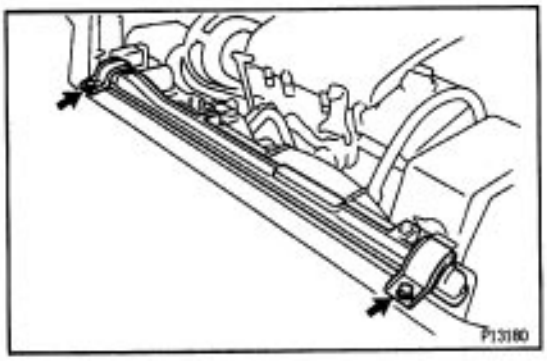
**(See SR section)**

# Hydraulic Motor
# COMPONENTS FOR REMOVAL AND INSTALLATION




N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part

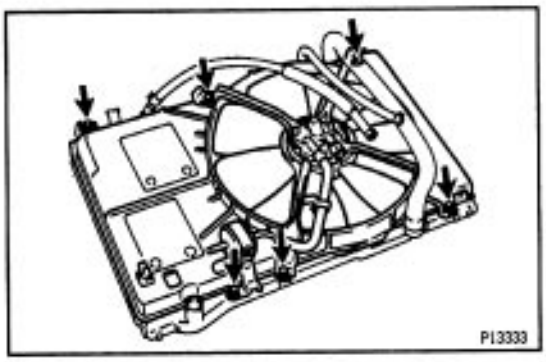
P13327



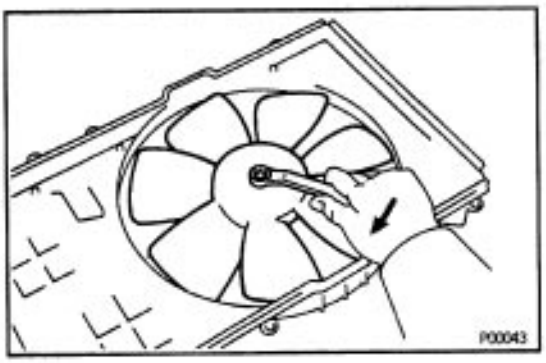

# HYDRAULIC MOTOR REMOVAL

**(See Components for Removal and Installation)**

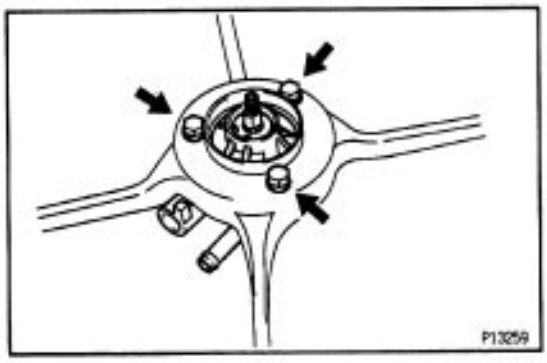
**1. REMOVE RADIATOR**
**(See page** EG2–336**)**




**2. REMOVE HYDRAULIC COOLING FAN**
Remove the 6 bolts and hydraulic cooling fan.

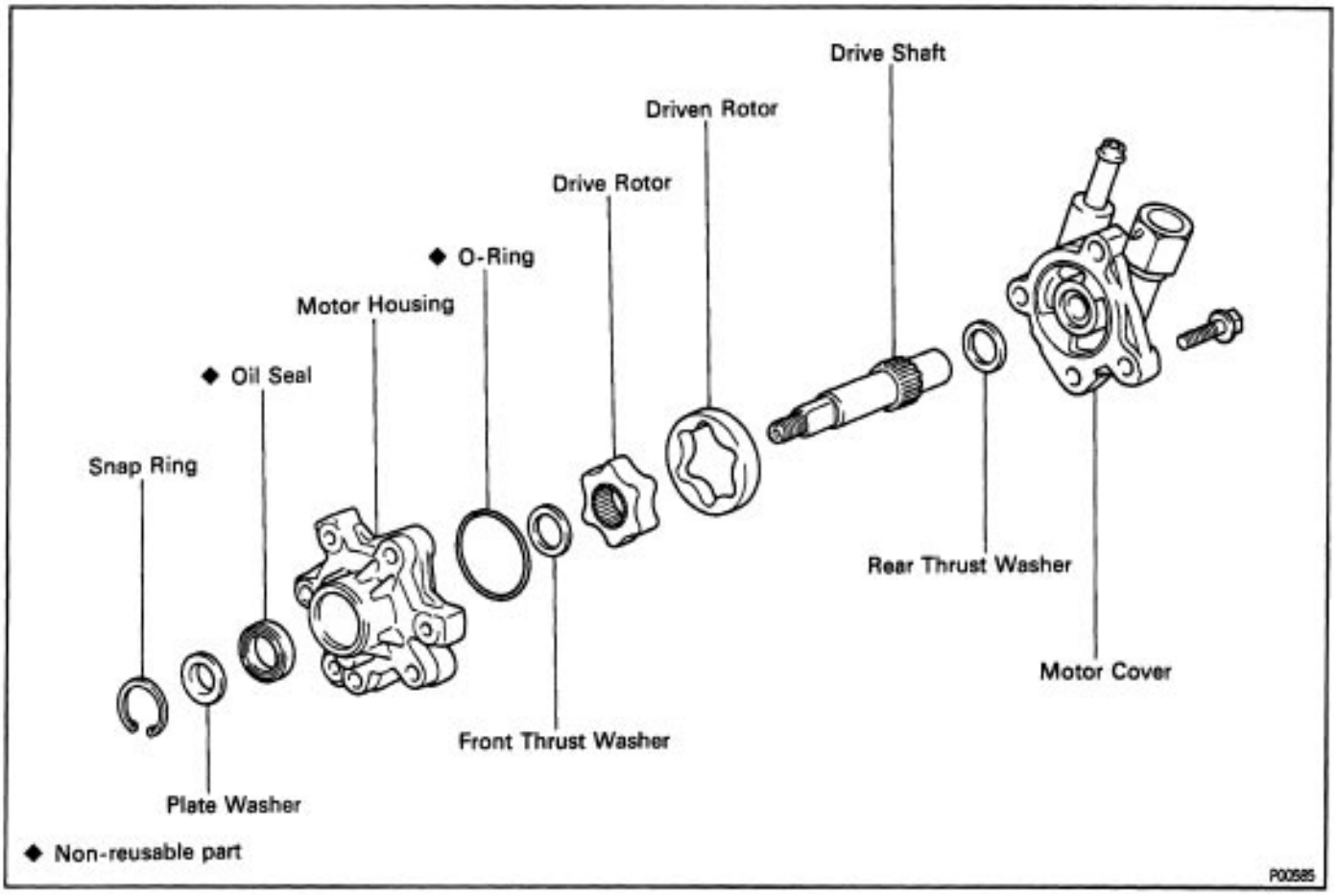


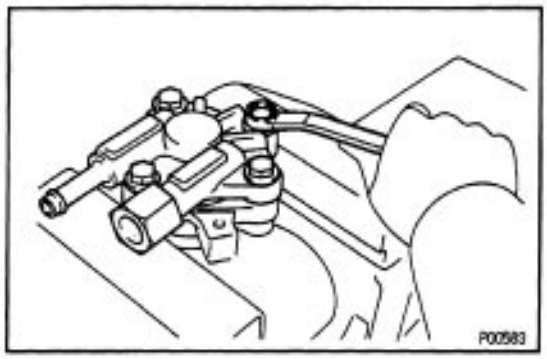

**3. REMOVE COOLING FAN FROM HYDRAULIC MOTOR**
Loosen the fan mounting nut clockwise, and remove the nut, plate washer and fan.

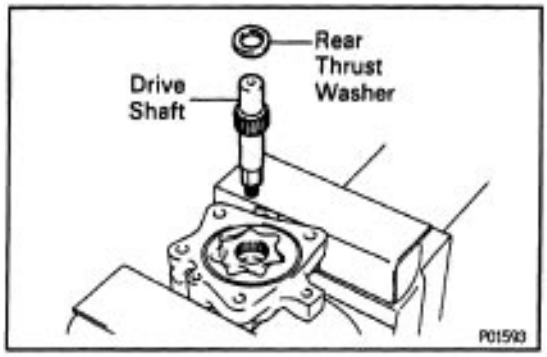



**4. REMOVE HYDRAULIC MOTOR FROM FAN SHROUD**
Remove the 3 bolts and hydraulic motor.

# COMPONENTS FOR DISASSEMBLY AND ASSEMBLY




## HYDRAULIC MOTOR DISASSEMBLY

**(See Components for Disassembly and Assembly)**

**1. MOUNT MOTOR HOUSING**

Carefully mount the motor housing in a vise.

**NOTICE: Be careful not to damage the motor housing.**

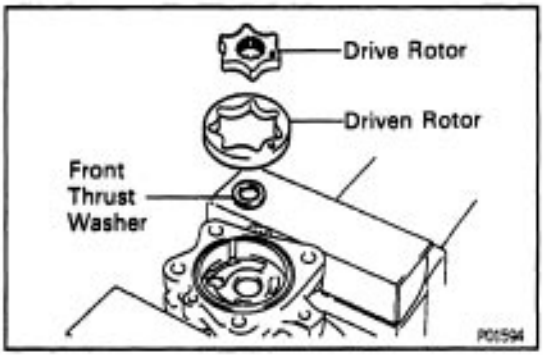
**2. REMOVE MOTOR COVER**

(a) Remove the 4 bolts and motor cover.

(b) Remove the 0–ring from the motor housing.

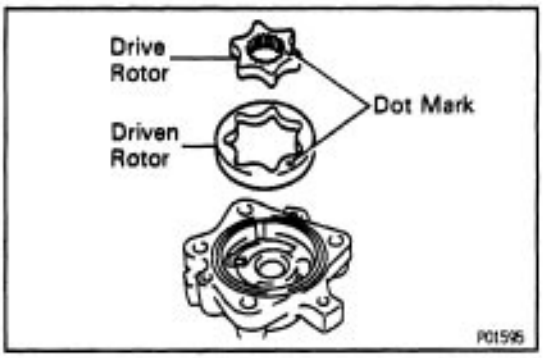
**3. REMOVE REAR THRUST WASHER**

**4. REMOVE DRIVE SHAFT**




**5. REMOVE DRIVE AND DRIVEN ROTORS**

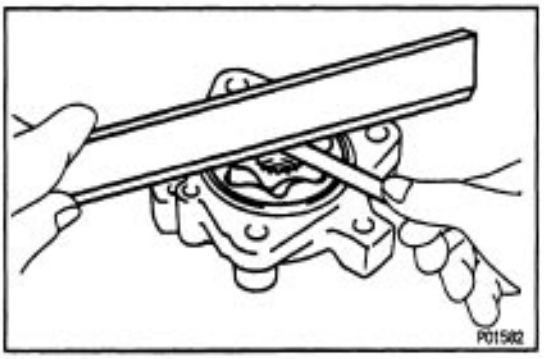
**6. REMOVE FRONT THRUST WASHER**




# HYDRAULIC MOTOR INSPECTION

**1. INSPECT DRIVE AND DRIVEN ROTORS**

(a) Install the drive and driven rotors to the motor housing with the dot mark facing upward.




(b) Using a feeler gauge and precision straight edge, measure the side clearance between the rotor and precision straight edge.

**Standard side clearance:**

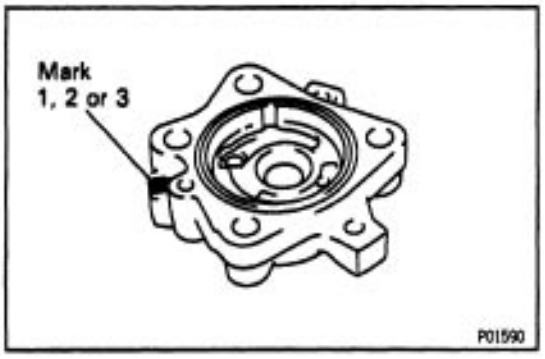
**0.01 – 0.04 mm (0.0004 – 0.0016 in.)**

**Maximum side clearance:**

**0.05 mm (0.0020 in.)**

If the clearance is greater than maximum, replace the rotors as a set. If necessary, replace the motor assembly.

HINT: When replacing the rotors, select a new rotor set according to the imprinted mark on the motor housing.




| Imprinted mark on housing | Rotor set |
|---|---|
| 1 | 16906–50010 |
| 2 | 16906–50020 |
| 3 | 16906–50030 |

**2. INSPECT CLEARANCE OF DRIVE SHAFT**

(a) Using a caliper gauge, measure the, shaft hole inside diameter of the housing and cover.

**Shaft hole inside diameter:**

**14.000 – 14.011 mm (0.5512 – 0.5516 in.)**

(b) Using a micrometer, measure the drive shaft diameter.

**Shaft diameter:**

**13.973 – 13.984 mm (0.5501 – 0.5506 in.)**

(c) Subtract the drive shaft diameter measurement from the shaft hole diameter measurement.

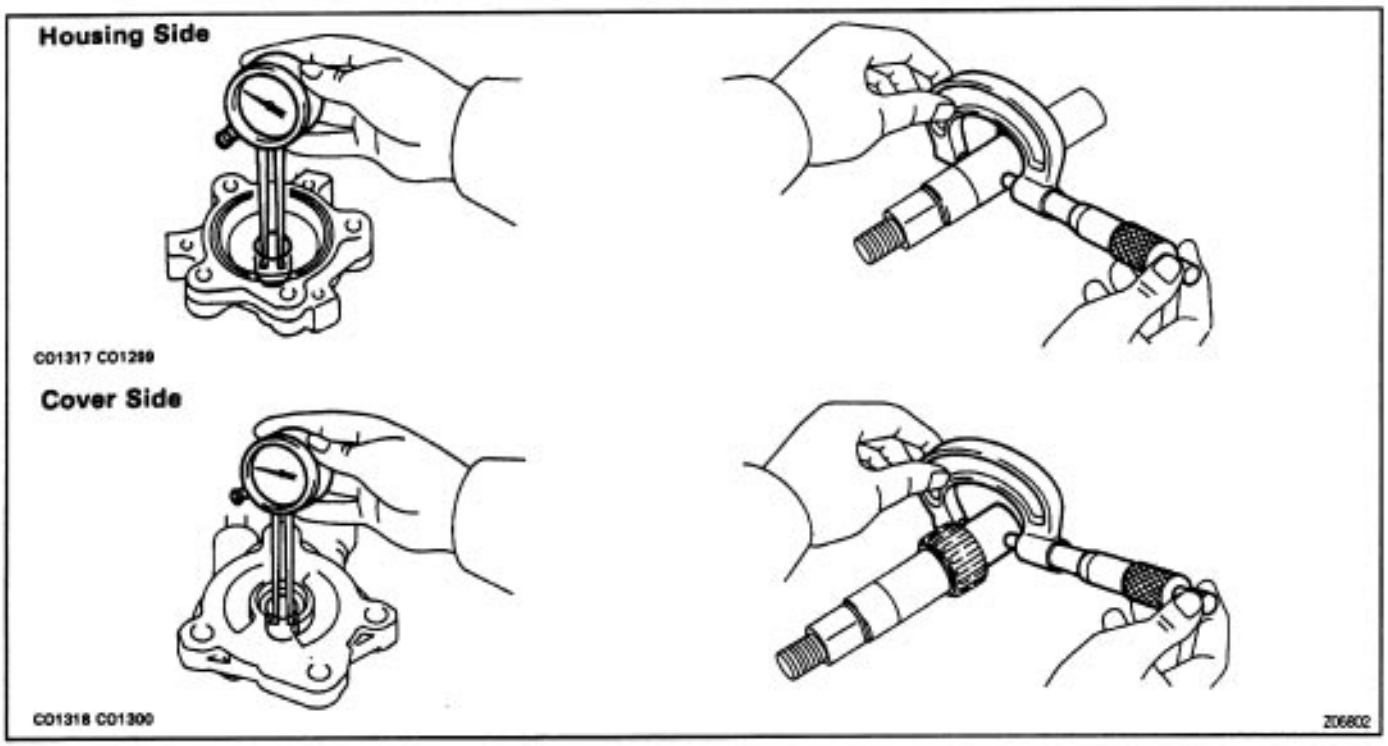
**Standard clearance:**

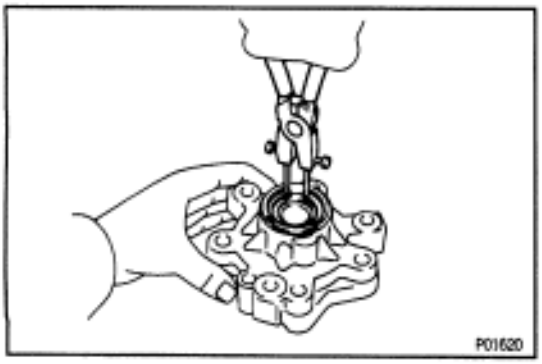
**0.016 – 0.038 mm (0.0006 – 0.0015 in.)**

**Maximum clearance:**

**0.04 mm (0.0016 In.)**

If the clearance is greater than maximum, replace the shaft. If necessary, replace the motor assembly.

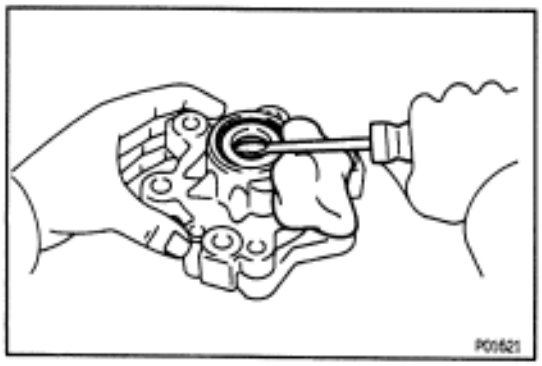





# OIL SEAL REPLACEMENT

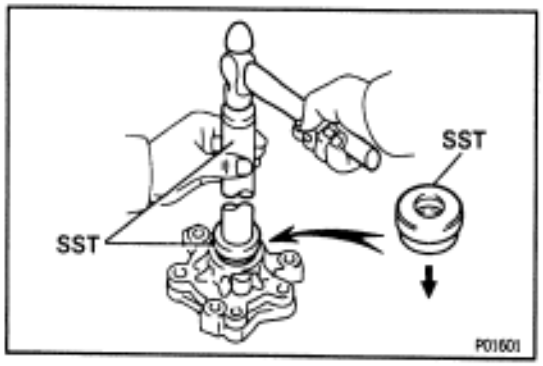
**1. REMOVE OIL SEAL**

(a) Using snap ring pliers, remove the snap ring and plate washer.




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

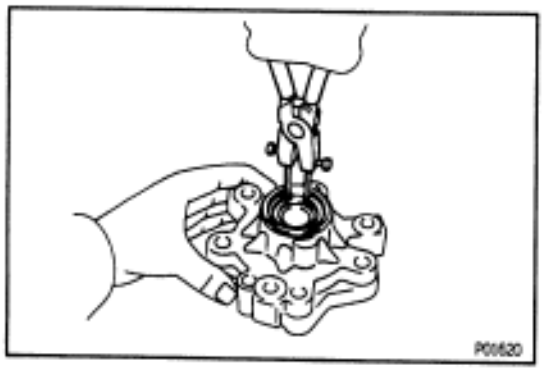
**NOTICE: Be careful not to damage the housing.**




**2. INSTALL OIL SEAL**

(a) Using SST and a hammer, tap in a new oil seal to a depth of 4.5 – 5.5 mm (0.177 – 0.217 in.) from the housing edge.

SST 09620–30010 (09627–30010, 09631– 00020)




(b) Using snap ring pliers, install the plate washer and snap ring.

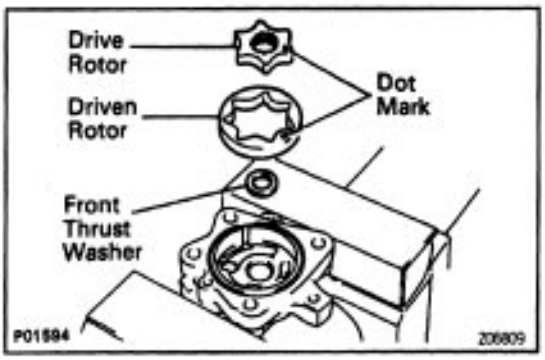
(c) Apply fluid to the oil seal lip.

# HYDRAULIC MOTOR ASSEMBLY

**(See Components for Disassembly and Assembly)**

HINT:

- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new fluid to all sliding and rotating surfaces.




**1. MOUNT MOTOR HOUSING**

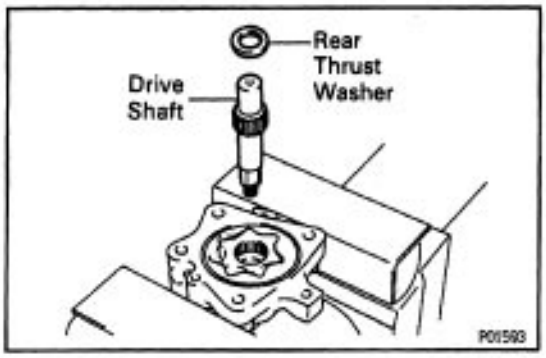
Slightly mount the motor housing in a vise.

**NOTICE: Be careful not to damage the motor housing.**

**2. INSTALL FRONT THRUST WASHER**

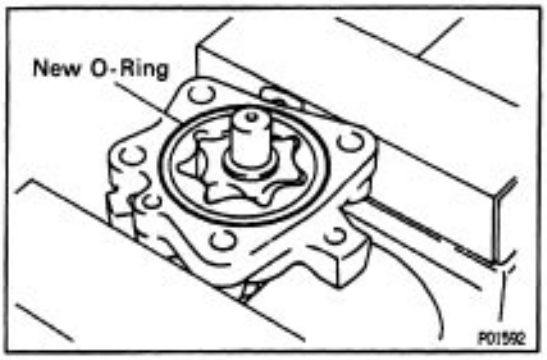
**3. INSTALL DRIVEN AND DRIVE ROTORS**

Install the drive and driven rotors with the dot mark facing upward.



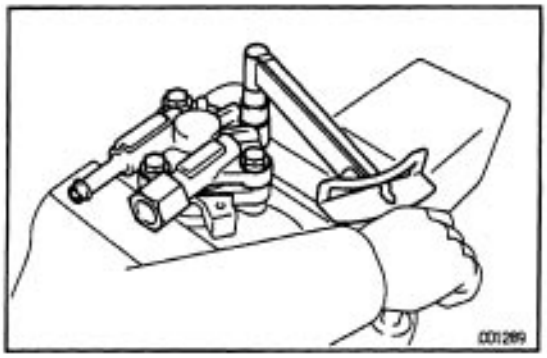

**4. INSTALL DRIVE SHAFT**

**5. INSTALL REAR THRUST WASHER**



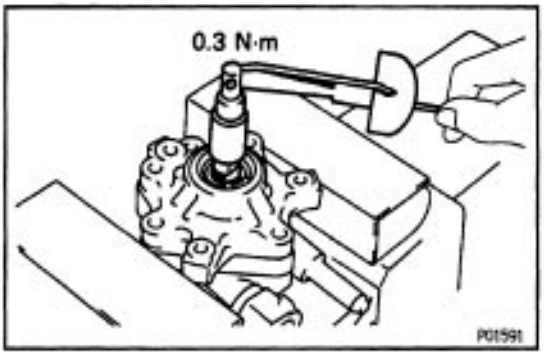

**6. INSTALL MOTOR COVER**

(a) Install a new 0–ring to the motor housing groove.




(b) Install the motor cover with the 4 bolts.

**Torque: 28 N–m (290 kgf–cm, 21 ft–lbf)**



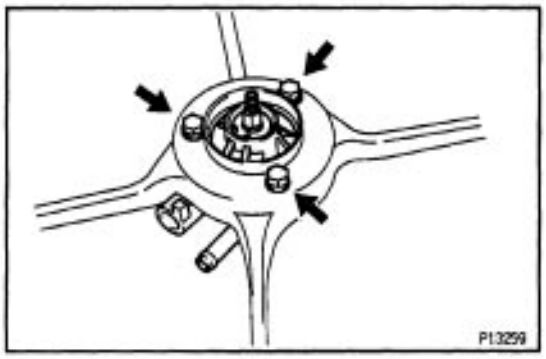

**7. INSPECT DRIVE SHAFT PRELOAD**

(a) Check that the drive shaft rotates smoothly without abnormal noise.

(b) Temporarily install the pulley nut, and check the rotating torque.

**Rotating torque:**

**0.3 N–m (3.0 kgf–cm, 2.6 in.–lbf)**



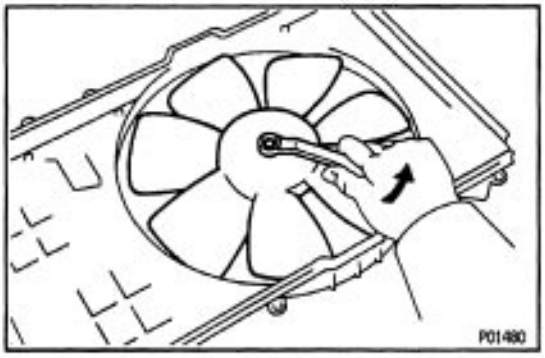

**HYDRAULIC MOTOR INSTALLATION**

**(See Components for Removal and Installation)**

**1. INSTALL HYDRAULIC MOTOR TO FAN SHROUD**

Install the hydraulic motor with the 3 bolts.

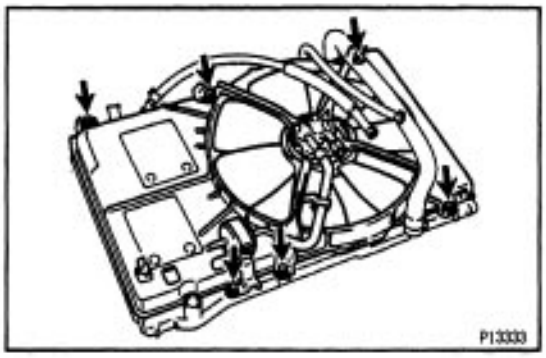
**Torque: 4.9 N–m (50 kgf–cm. 43 in.–lbf)**




**2. INSTALL COOLING FAN TO HYDRAULIC MOTOR**

Install the fan with the plate washer and nut. Tighten the nut by turning it counterclockwise.

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




**3. INSTALL HYDRAULIC COOLING FAN**

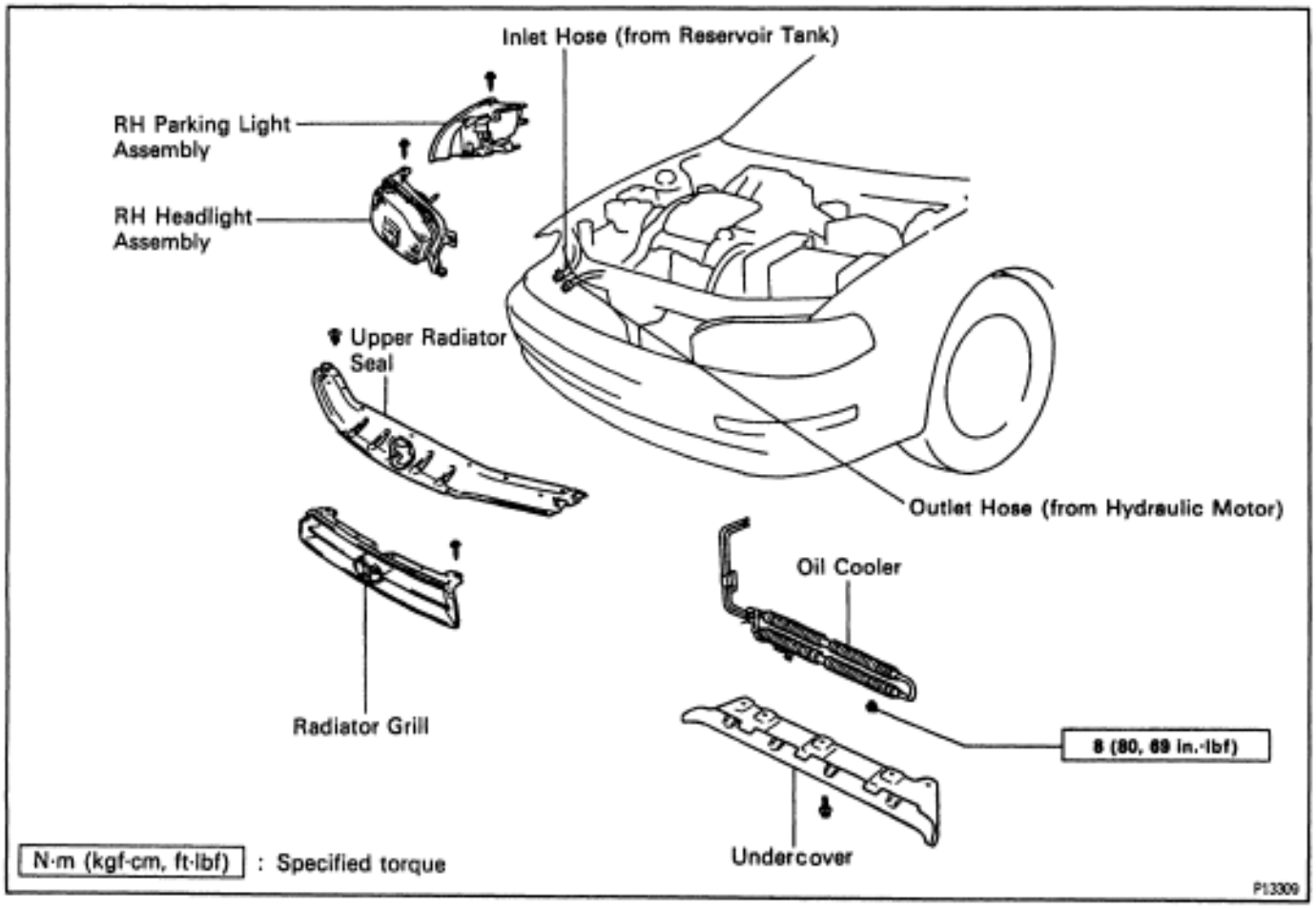
Install the hydraulic cooling fan with the6 bolts.

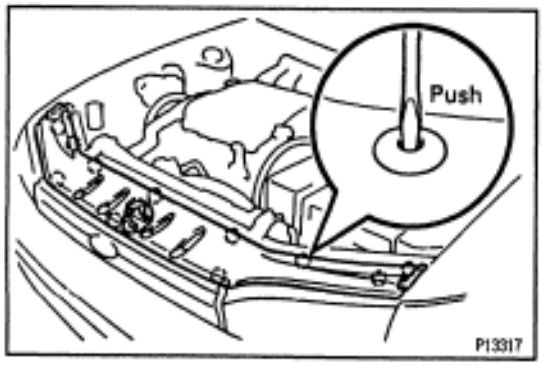
**Torque: 4.9 N–m (50 kgf–cm, 43 In.–lbf)**

**4. INSTALL RADIATOR**

**(See page** EG2–342**)**

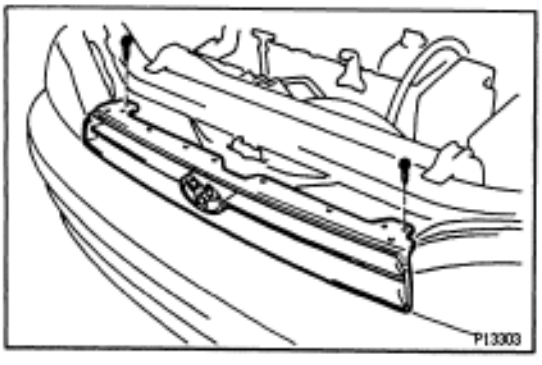
# Oil Cooler
## COMPONENTS FOR REMOVAL AND INSTALLATION



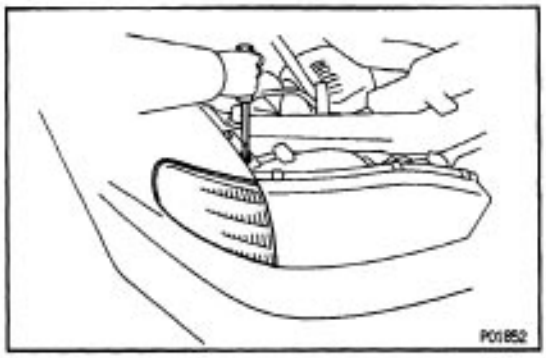




## OIL COOLER REMOVAL
**(See Components for Removal and Installation)**

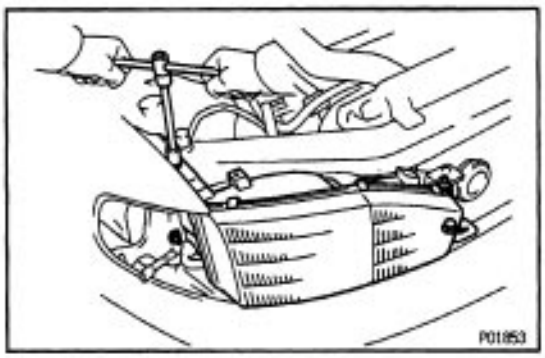
**1. REMOVE UPPER RADIATOR SEAL**
Remove the 12 clips and radiator seal.



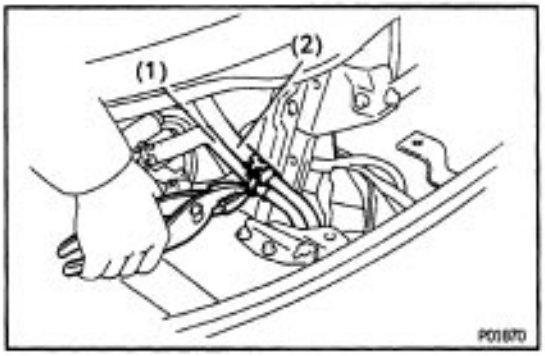

**2. REMOVE RADIATOR GRILLE**
Remove the 2 mounting screws and radiator grille.



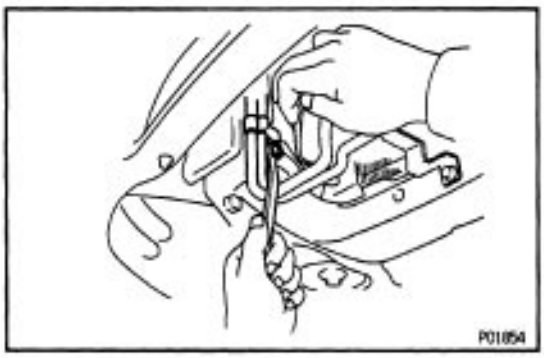

**3. REMOVE RH PARKING LIGHT ASSEMBLY**
(a) Remove the screw.
(b) Disconnect the connector and remove the parking light assembly.



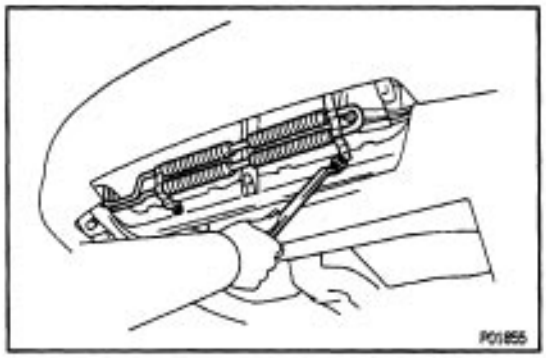

**4. REMOVE RH HEADLIGHT ASSEMBLY**
(a) Remove the 3 bolts and nut.
(b) Disconnect the 2 connectors and remove the head–light assembly.



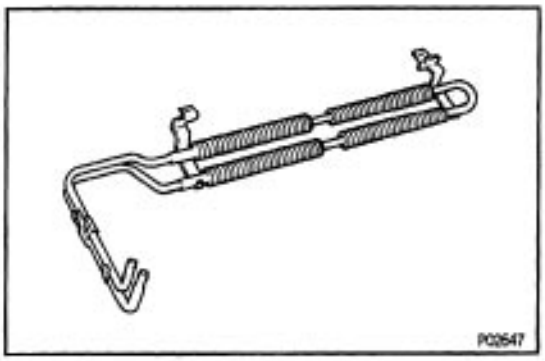

**5. DISCONNECT HOSES FROM OIL COOLER**
Disconnect the following hoses:
(1) Outlet hose (to reservoir tank)
(2) Inlet hose (from hydraulic motor)
**6. REMOVE UNDERCOVER**




**7. REMOVE OIL COOLER**
(a) Pull aside the shroud to expose the bolt in the stay. Remove the bolt.



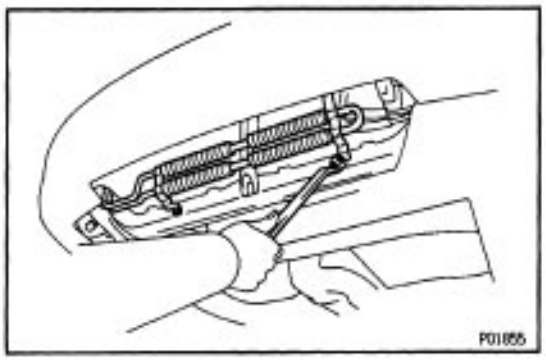

(b) Remove the 2 nuts and remove the oil cooler.




# OIL COOLER INSPECTION

**INSPECT OIL COOLER**

Check the oil cooler for damage or clogging.
If necessary, replace the oil cooler.

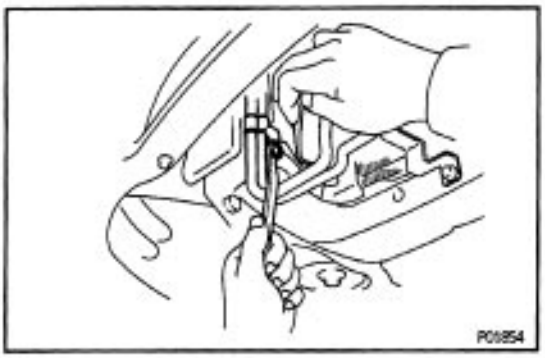



# OIL COOLER INSTALLATION

**(See Components for Removal and Installation)**

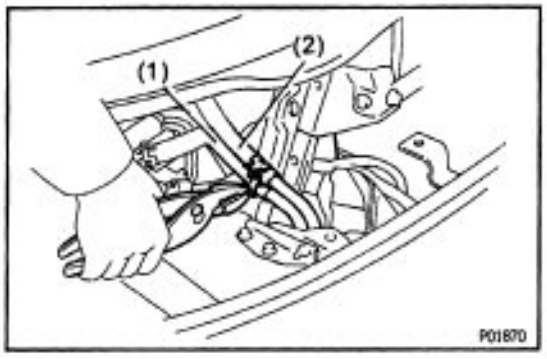
**1. INSTALL OIL COOLER**

(a) Install the oil cooler with the 2 nuts.
**Torque: 8 N–m (80 kgf–cm, 69 in.–lbf)**



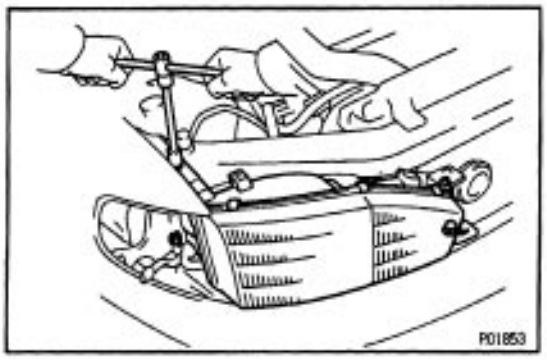

(b) Install the bolt while pulling aside the shroud.

**2. INSTALL UNDERCOVER**



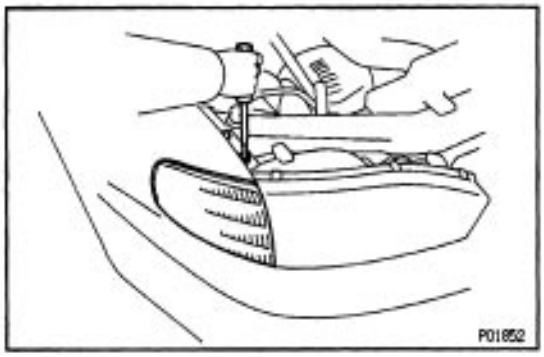

**3. CONNECT HOSES TO OIL COOLER**

Connect the following hoses:
(1) Outlet hose (to reservoir)
(2) Inlet hose (from hydraulic motor)




**4. INSTALL RH HEADLIGHT ASSEMBLY**

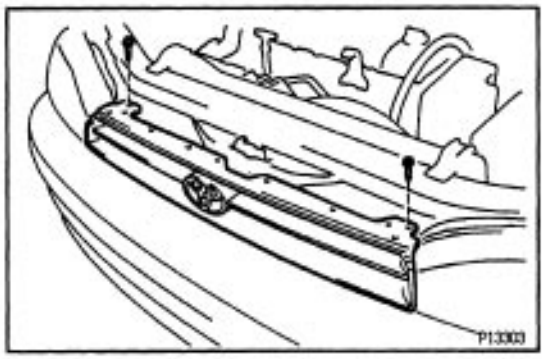
(a) Connect the 2 connectors.
(b) Install the headlight assembly with the 3 bolts and nut.




**5. INSTALL RH PARKING LIGHT ASSEMBLY**

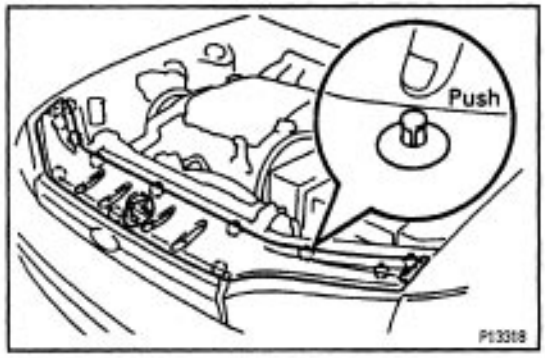
(a) Connect the connector.

(b) Install the parking light assembly with the screw.




**6. INSTALL RADIATOR GRILLE**

Install the radiator grille with the 2 mounting screws.




**7. INSTALL UPPER RADIATOR SUPPORT SEAL**

Install the support seal with the 12 clips.

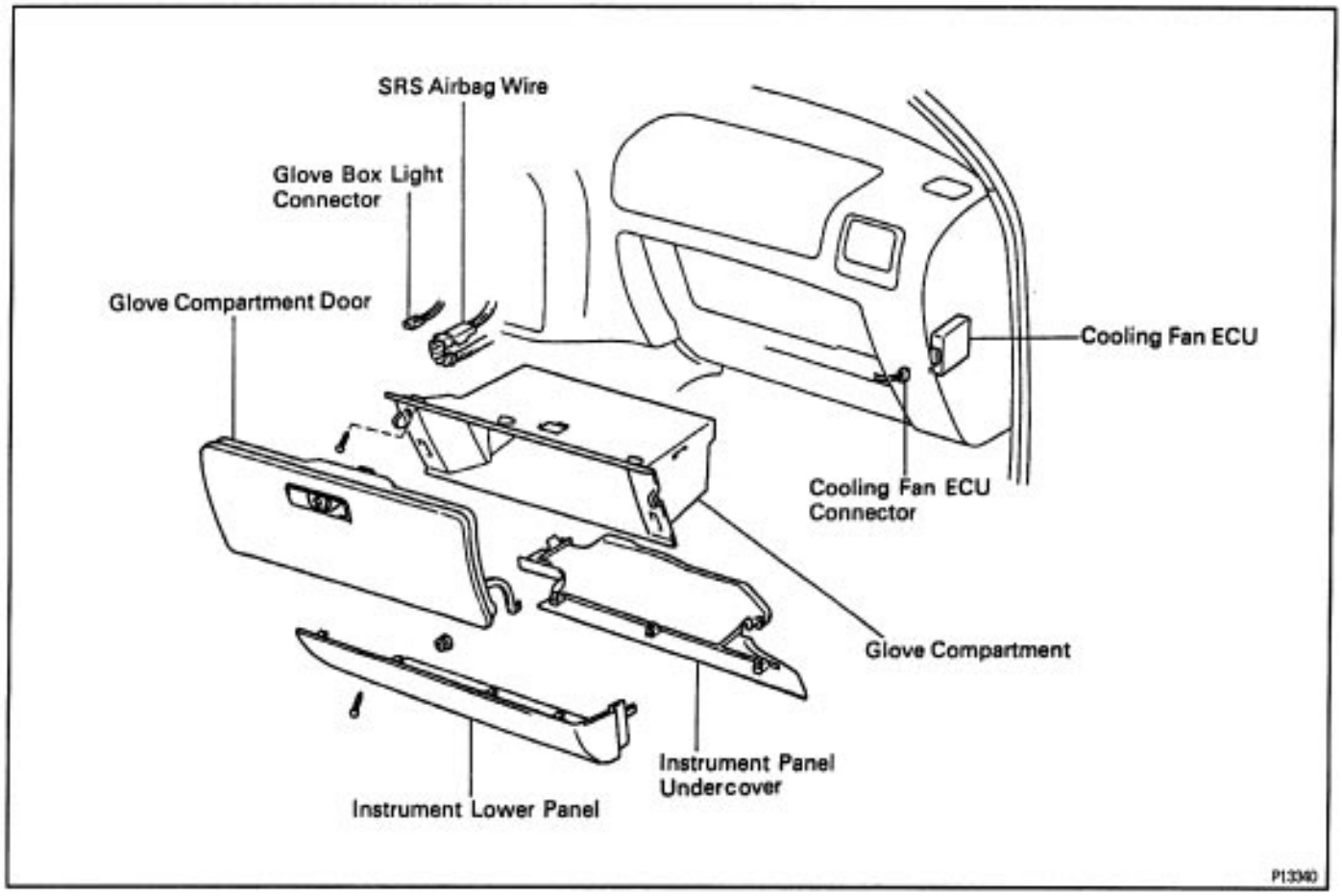
**8. FILL PS RESERVOIR TANK WITH FLUID**

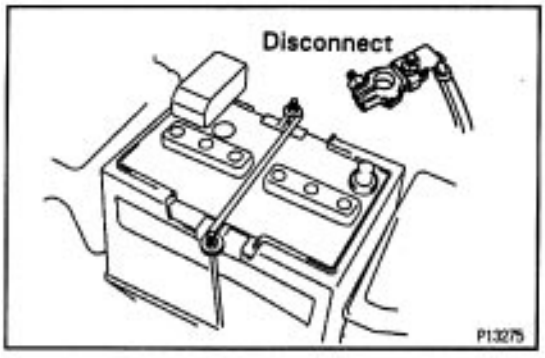
**(See page** EG2–347**)**

**9. BLEED ELECTRONICALLY CONTROLLED HYDRAULIC COOLING FAN SYSTEM**

**(See page** EG2–348**)**

# Cooling Fan ECU
# COMPONENTS FOR REMOVAL AND INSTALLATION



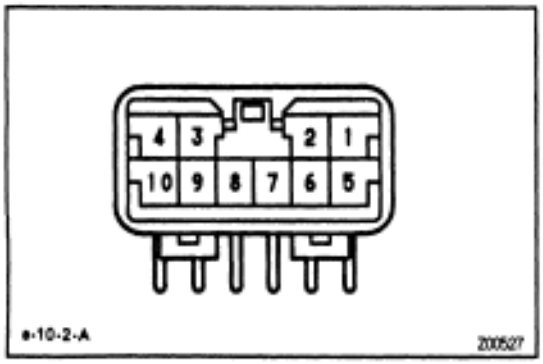

## COOLING FAN ECU INSPECTION

**1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY**

**CAUTION: Work must be started after 90 seconds from the time the ignition switch is turned to the 'LOCK' position and the negative (–) terminal cable is disconnected from the battery.**

**2. DISCONNECT COOLING FAN ECU CONNECTOR (See Components)**

(a) Remove the instrument panel undercover.
(b) Remove the instrument lower panel.
(c) Remove the glove compartment door.
(d) Remove the glove compartment.
(e) Disconnect the cooling fan ECU connector.




**3. INSPECT COOLING FAN ECU**

(a) Connect the cable to the negative (–) terminal of the battery.

(b) Check the connector on the wiring harness side as shown in the chart.

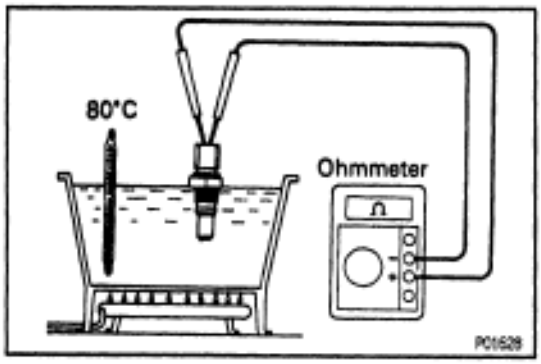
| Check for | Tester connection | Condition | Specified value |
|---|---|---|---|
| Voltage | 1 – Ground | Ignition switch ON | Battery voltage |
| Resistance | 2–3 | Solenoid valve at cold (25˚C (77˚F) ) | 7.6 – 8.0Ω |
| Continuity | 4 – Ground | – | Continuity |
| Continuity | 5 – Ground | Throttle valve open | No continuity |
| | | Throttle valve closed | Continuity |
| Continuity | 8 – Ground | A/C pressure SW connector disconnected | No continuity |
| | | A/C pressure SW connector connected | Continuity |
| Resistance | 9–10 | Coolant temperature at 80˚C (176˚F) | 1.48 – 1.58 kΩ |

V00331

(c) Disconnect the cable from the negative (–) terminal of the battery.

**4. RECONNECT COOLING FAN ECU CONNECTOR**

**5. RECONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY**




# ECT SENSOR INSPECTION

**INSPECT ECT SENSOR**

Using an ohmmeter, measure the resistance between the terminals.

**Resistance:**

**1.48 – 1.58 Ω at 80˚ C (176˚ F)**

If the resistance is not as specified, replace the sensor.

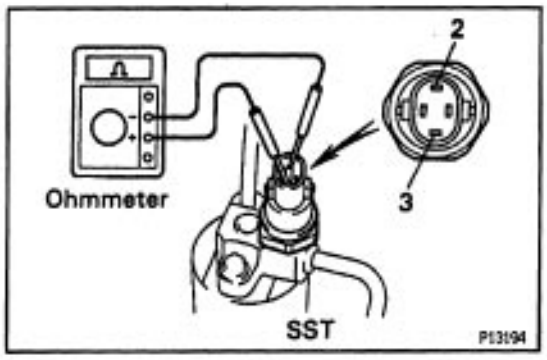
## A/C High –Pressure Switch

## A/C HIGH–PRESSURE SWITCH INSPECTION

**1. DISCONNECT A/C HIGH–PRESSURE SWITCH CONNECTOR**

**2. INSTALL MANIFOLD GAUGE SET**

**(See page AC–23)**




**3. INSPECT A/C HIGH–PRESSURE SWITCH**

(a) When the A/C switch is OFF, check that there is continuity between terminals 2 and 3. (When the pressure is 1,226 kPa (12.5 kgf/cm$^2$, 178 psi) or lower.)

(b) When the A/C and blower switches are ON, check that there is no continuity between terminals 2 and 3. (When the pressure is 1,520 kPa (15.5 kgf/cm$^2$, 220 psi) or higher.)

If continuity is not as specified, replace the switch.

**4. REMOVE MANIFOLD GAUGE SET**

**5. RECONNECT A/C HIGH–PRESSURE SWITCH CONNECTOR**



## Solenoid Valve

## SOLENOID VALVE INSPECTION

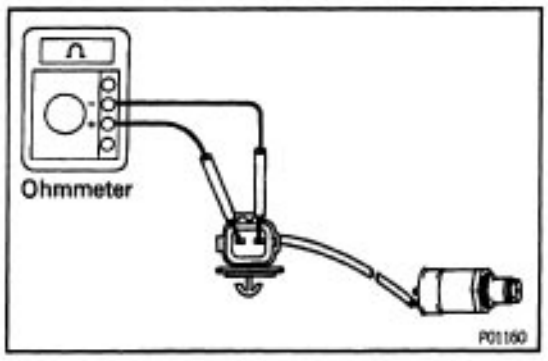
**INSPECT SOLENOID VALVE**

**Using an ohmmeter, measure the resistance between the terminals**

**Resistance:**

**7.6 – 8.0Ω at 25°C (77°F)**

**If the resistance is not as specified, replace the sole–noid valve.**



# SERVICE SPECIFICATIONS

## SERVICE DATA

| | | |
|---|---|---|
| Thermostat | Valve opening pressure | 80 – 84°C (176 – 183°F) |
| | Valve lift at 95°C (203°F) | 10.0 mm (0.394 in.) or more |
| Radiator cap | Relief valve opening pressure (STD) | 83 – 113 kPa (0.85 – 1.15 kgf/cm², 12.1 – 16.4 psi) |
| | Relief valve opening pressure (Limit) | 69 kPa (0.7 kgf/cm², 10.0 psi) |
| Radiator | Plate height | 7.75 – 8.25 mm (0.3051 – 0.3248 in.) |
| On–vehicle inspection for hydraulic–driven cooling motor | Oil pressure | 981 – 1,961 kPa (10 – 20 kgf/cm², 142 – 284 psi) |
| Hydraulic motor | Rotor side clearance (STD) | 0.01 – 0.04 mm (0.0004–0.0016 in.) |
| | Rotor side clearance (Limit) | 0.05 mm (0.0020 in.) |
| | Drive shaft hole inside diameter | 14.000 – 14.011 mm (0.5512 – 0.5516 in.) |
| | Drive shaft diameter | 13.973–13.984 mm (0.5501 – 0.5506 in.) |
| | Drive shaft oil clearance (STD) | 0.016 – 0.038 mm (0.0006 – 0.0015 in.) |
| | Drive shaft oil clearance (Limit) | 0.04 mm (0.0031 in.) |
| | Drive shaft preload (rotating torque) | 0.03 N·m (3.0 kgf·cm, 2.6 in.·lbf) |
| ECT sensor | Resistance at 80°C (176°F) | 1.48 – 1.58 kΩ |

## TORQUE SPECIFICATIONS

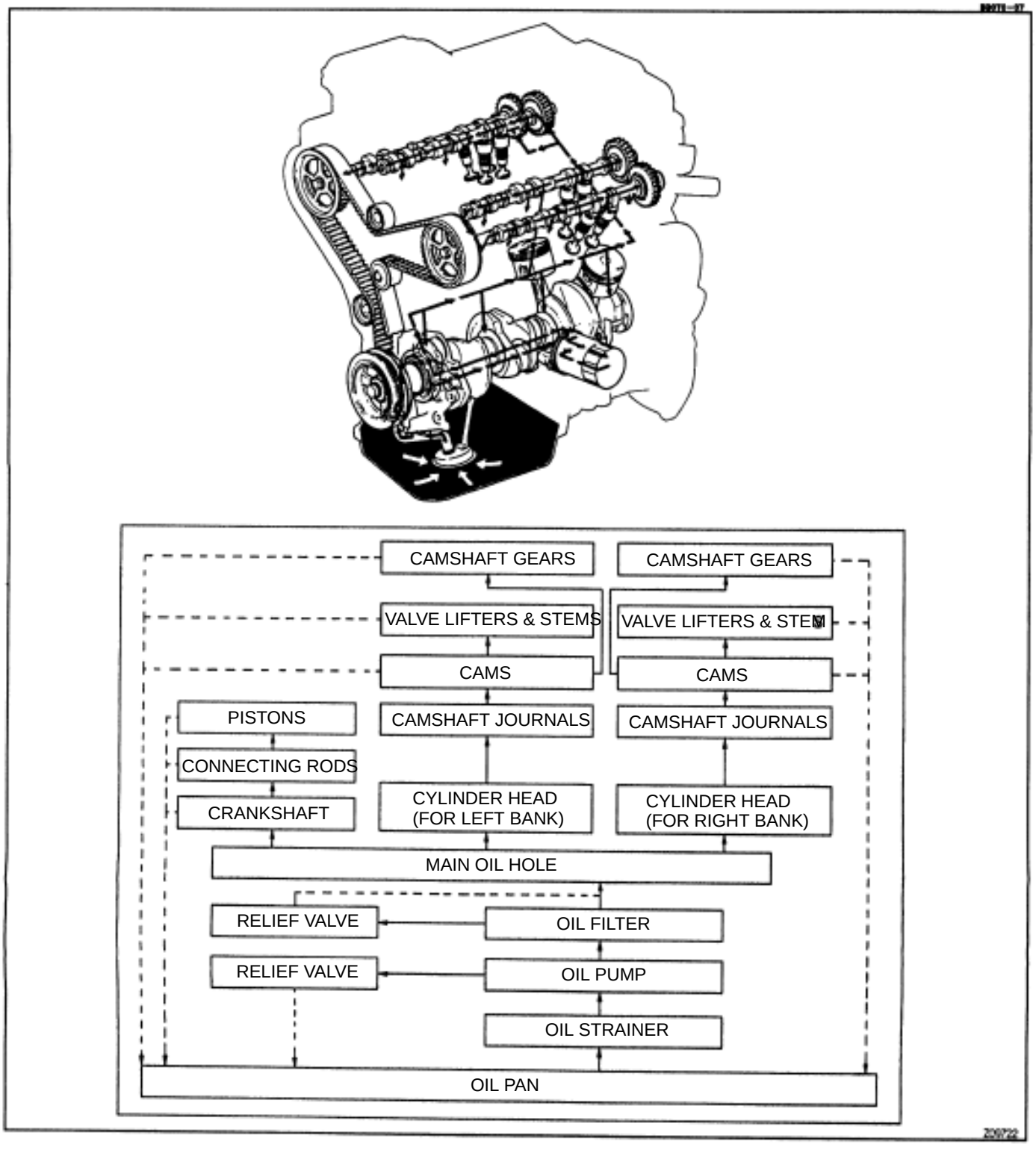
| Part tightened | N·m | kgf·cm | ft·lbf |
|---|---|---|---|
| RH Drain plug x Cylinder block | 7 | 70 | 61 in.·lbf |
| LH Drain plug x Cylinder block | 13 | 130 | 9 |
| Water pump x Cylinder block | 8 | 80 | 69 in.·lbf |
| No.3 timing belt cover x Cylinder head | 8.5 | 85 | 74 in.·lbf |
| No.2 idler pulley x Cylinder heads | 43 | 440 | 32 |
| Camshaft pulley x Camshaft | 125 | 1,300 | 94 |
| Camshaft pulley x Camshaft (For use with SST) | 88 | 900 | 65 |
| Water inlet x Water inlet housing | 8 | 80 | 69 in.·lbf |
| Water inlet pipe x LH cylinder head | 19.5 | 200 | 14 |
| Hydraulic motor pressure hose x Water inlet | 8 | 80 | 69 in.·lbf |
| Radiator oil cooler x Radiator lower tank | 8.3 | 85 | 7.4 in.·lbf |
| Radiator pipe x Radiator lower tank | 14.7 | 150 | 11 |
| Pressure hose x Hydraulic motor | 63.7 | 650 | 47 |
| Radiator support bolt | 12.8 | 130 | 9 |
| Hydraulic motor housing x Motor cover | 28 | 290 | 21 |
| Hydraulic motor x Fan shroud | 4.9 | 50 | 43 in.·lbf |
| Cooling fen x Hydraulic motor | 15 | 150 | 11 |
| Hydraulic cooling fan x Radiator | 4.9 | 50 | 43 in.·lbf |
| Oil cooler (for hydraulic cooling fan) x RadiAtor lower support | 8 | 80 | 69 in.·lbf |

# LUBRICATION SYSTEM

## DESCRIPTION

A fully pressurized, fully filtered lubrication system has been adopted for this engine.

## OPERATION



A pressure feeding lubrication system has been adopted to supply oil to the moving parts of this engine. The lubrication system consists of an oil pan, oil pump, oil filter and other external parts which supply oil to the moving parts in the engine block. The oil circuit is shown in the illustration at the top of the previous page. Oil from the oil pan is pumped up by the oil pump. After it passes through the oil filter, it is fed through the various oil holes in the crankshaft and cylinder block. After passing through the cylinder block and performing its lubricating function, the oil is returned by gravity to the oil pan. A dipstick on the center left side of the cylinder block is provided to check the oil level.

**OIL PUMP**

The oil pump pumps up oil from the oil pan and feeds it under pressure to the various parts of the engine. An oil strainer is mounted in front of the inlet to the oil pump to remove impurities. The oil pump itself is a trochoid type pump, inside of which there is a drive rotor and a driven rotor. When the drive rotor rotates, the driven rotor rotates in the same direction, and since the axis of the drive rotor shaft is different from the center of the driven rotor, the space between the two rotors changes as they rotate. Oil is drawn in when the space is wide and is discharged when the space in narrow.

**OIL PRESSURE REGULATOR (RELIEF VALVE)**

At high engine speeds, the engine oil supplied by the oil pump exceeds the capacity of the engine to utilize it. For that reason, the oil pressure regulator works to prevent an oversupply of oil.
–During normal oil supply, a coil spring and valve keep the bypass closed, but when too much oil is being fed, the pressure become extremely high, overpowering the force of the spring and opening the valves. This allows the excess oil to flow through the relief valve and return to the oil pan.

**OIL FILTER**

The oil filter is a full flow type filter with a built–in paper filter element. Particles of metal from wear, airborne dirt, carbon and other impurities can get into the oil during use and could cause accelerated wear or seizing if allowed to circulate through the engine. The oil filter, integrated into the oil line, removes these impurities as the oil passes through it. The filter is mounted outside the engine to simplify replacement of the filter element. A relief valve is also included ahead of the filter element to relieve the high oil pressure in case the filter element becomes clogged with impurities. The relief valve opens when the oil pressure overpowers the force of the spring. Oil passing through the relief valve bypasses the oil filter and flows directly into the main oil hole in the engine.

# PREPARATION

## SST (SPECIAL SERVICE TOOLS)

| | | |
|---|---|---|
|  | 09032–00100 Oil Pan Seal Cutter | No.2 oil pan |
|  | 09223–00010 Cover & Seal Replacer | Crankshaft front oil seal |
|  | 09226–07500 Oil Filter Wrench | |
|  | 09816–30010 Oil Pressure Switch Socket | |

## RECOMMENDED TOOLS

| | | |
|---|---|---|
|  | 09200–00010 Engine Adjust Kit | |

## EQUIPMENT

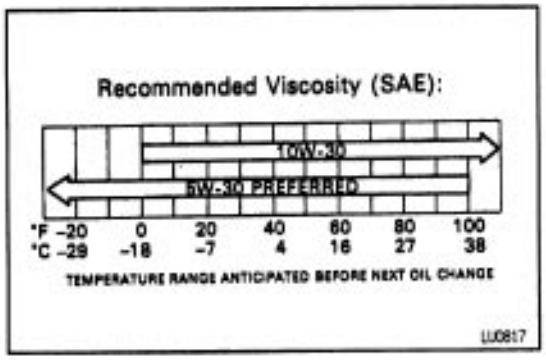
| | |
|---|---|
| Oil pressure gauge | |
| Precision straight edge | Oil pump |
| Torque wrench | |

## LUBRICANT

| Item | Capacity | Classification |
|---|---|---|
| Engine oil<br>Dry fill<br>Drain and refill<br>w/ Oil filter change<br>w/o Oil filter change | 5.5 liters (5.8 US qts, 4.8 Imp. qts)<br><br>4.7 liters (5.0 US qts, 4.1 Imp. qts)<br>4.5 liters (4.8 US qts, 4.0 Imp. qts) | API grade SG or SH, Energy–Conserving II or ILSAC multigrade and recommended viscosity oil with SAE 5W–30 being the preferred engine oil |

## SSM (SPECIAL SERVICE MATERIALS)

| | |
|---|---|
| 08826–00080 Seal packing or equivalent | Oil pump<br>No.1 oil pan<br>No.2 oil pan |
| 08833–00080 Adhesive 1344,<br>THREE BOND 1344,<br>LOCTITE 242 or equivalent | Oil pressure switch |




# OIL PRESSURE CHECK

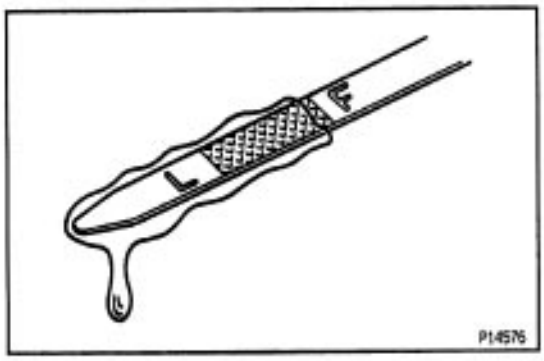
**1. CHECK ENGINE OIL QUALITY**

Check the oil for deterioration, entry of water, dis–coloring or thinning.

If the quality is visibly poor, replace the oil.

**Oil grade:**

**API grade SG or SH, Energy – Conserving II or ILSAC multigrade engine oil. Recommended viscosi–ty is as shown in the illustration with SAE 5W–30 being the preferred engine oil.**



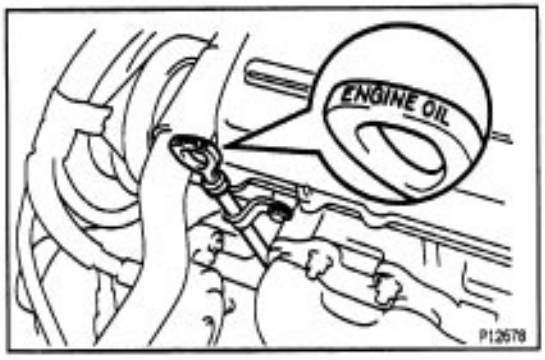

**2. CHECK ENGINE OIL LEVEL**

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

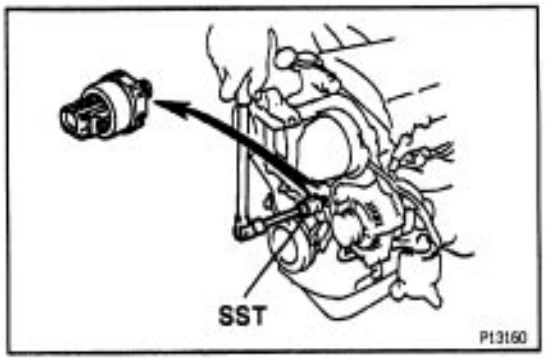
If low, check for leakage and add oil up to the ”F” mark.

**NOTICE:**

- **Do not fill with engine oil above the ”F” mark.**



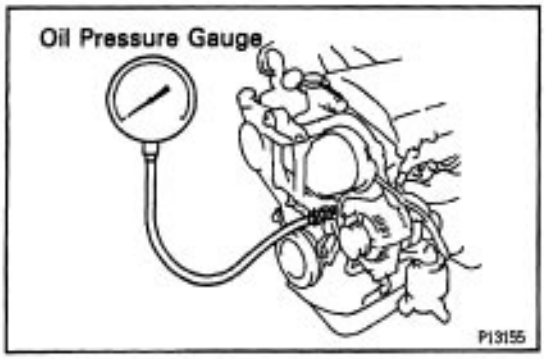

- **Install the oil dipstick facing the direction shown in the illustration.**




**3. REMOVE OIL PRESSURE SWITCH, AND INSTALL OIL PRESSURE GAUGE**

(a) Using SST, remove the oil pressure switch.

SST 09816 – 30010




(b) Install the oil pressure gauge.

**4. WARM UP ENGINE**

Allow the engine to warm up to normal operating temperature.

**5. CHECK OIL PRESSURE**

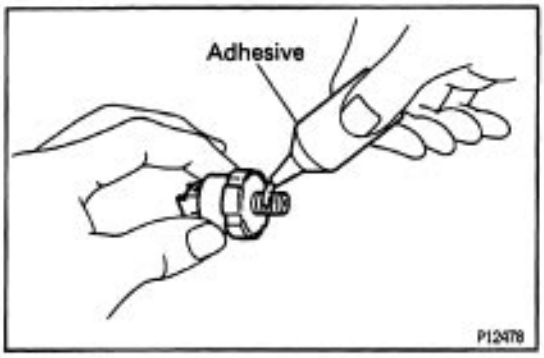
**Oil pressure:**

**At idle speed**

**29 kPa (0.3 kgf/cm$^2$, 4.3 psi) or more**

**At 3,000 rpm**

**294 – 539 kPa (3.0 – 5.5 kgf/cm$^2$, 43 – 78 psi)**



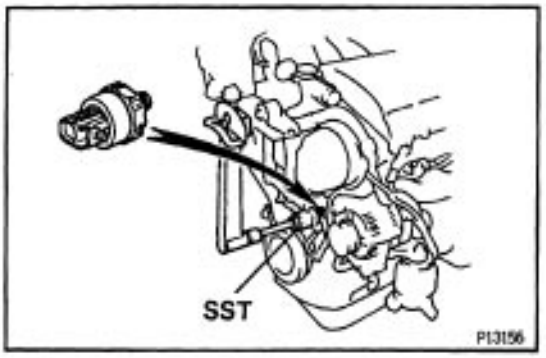

**6. REMOVE OIL PRESSURE GAUGE AND REINSTALL OIL PRESSURE SWITCH**

(a) Remove the oil pressure gauge.

(b) Apply adhesive to 2 or 3 threads of the oil pressure switch.

**Adhesive:**

**Part No. 08833–00080, THREE BOND 1344, LOCTITE 242 or equivalent**




(c) Using SST, reinstall the oil pressure switch.

SST 09816–30010

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

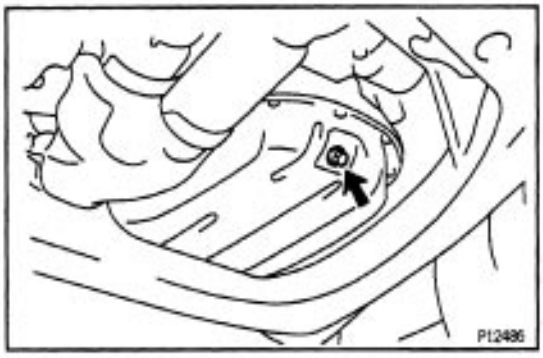
**7. START ENGINE AND CHECK FOR LEAKS**

# OIL AND FILTER REPLACEMENT

**CAUTION:**

- **Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer.**
- **Exercise caution in order to minimize the length and frequency of contact of your skin to used oil. Wear protective clothing end gloves. Wash your skin thoroughly with soap and water, or use waterless hand cleaner, to remove any used engine oil. Do not use gasoline, thinners, or solvents.**
- **In order to preserve the environment, used oil and used oil filter must be disposed of only at designated disposal sites.**

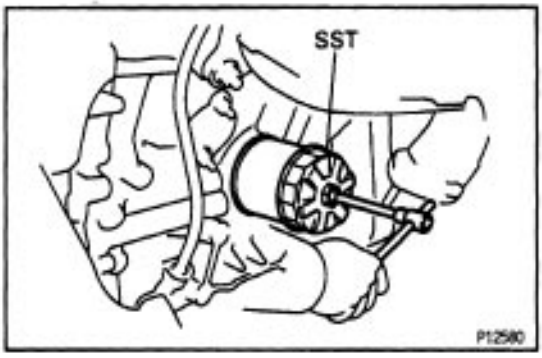





**1. DRAIN ENGINE OIL**

(a) Remove the oil filler cap.

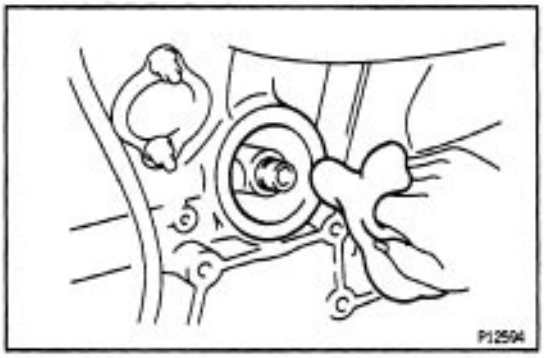
(b) Remove the oil drain plug, and drain the oil into a container.




## 2. REPLACE OIL FILTER

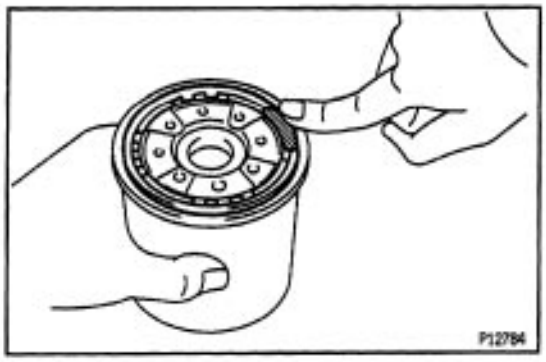
(a) Using SST, remove the oil filter.

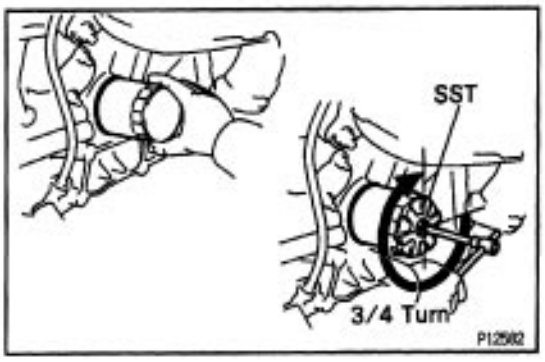
SST 09228–07500



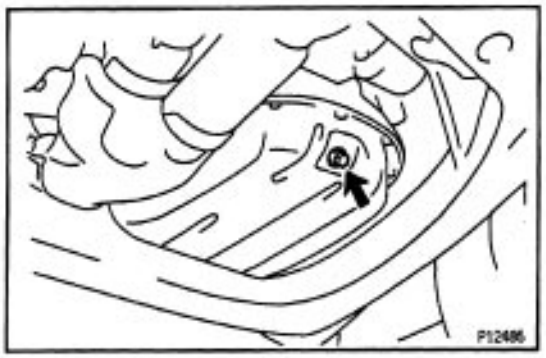

(b) Check and clean the oil filter installation surface.

(c) Apply clean engine oil to the gasket of a new oil filter.




(d) Lightly screw the oil filter into place, and tighten it until the gasket contacts the seat.
(e) Using SST, tighten it an additional 3/4 turn.
SST 09228–07500




**3. REFILL WITH ENGINE OIL**

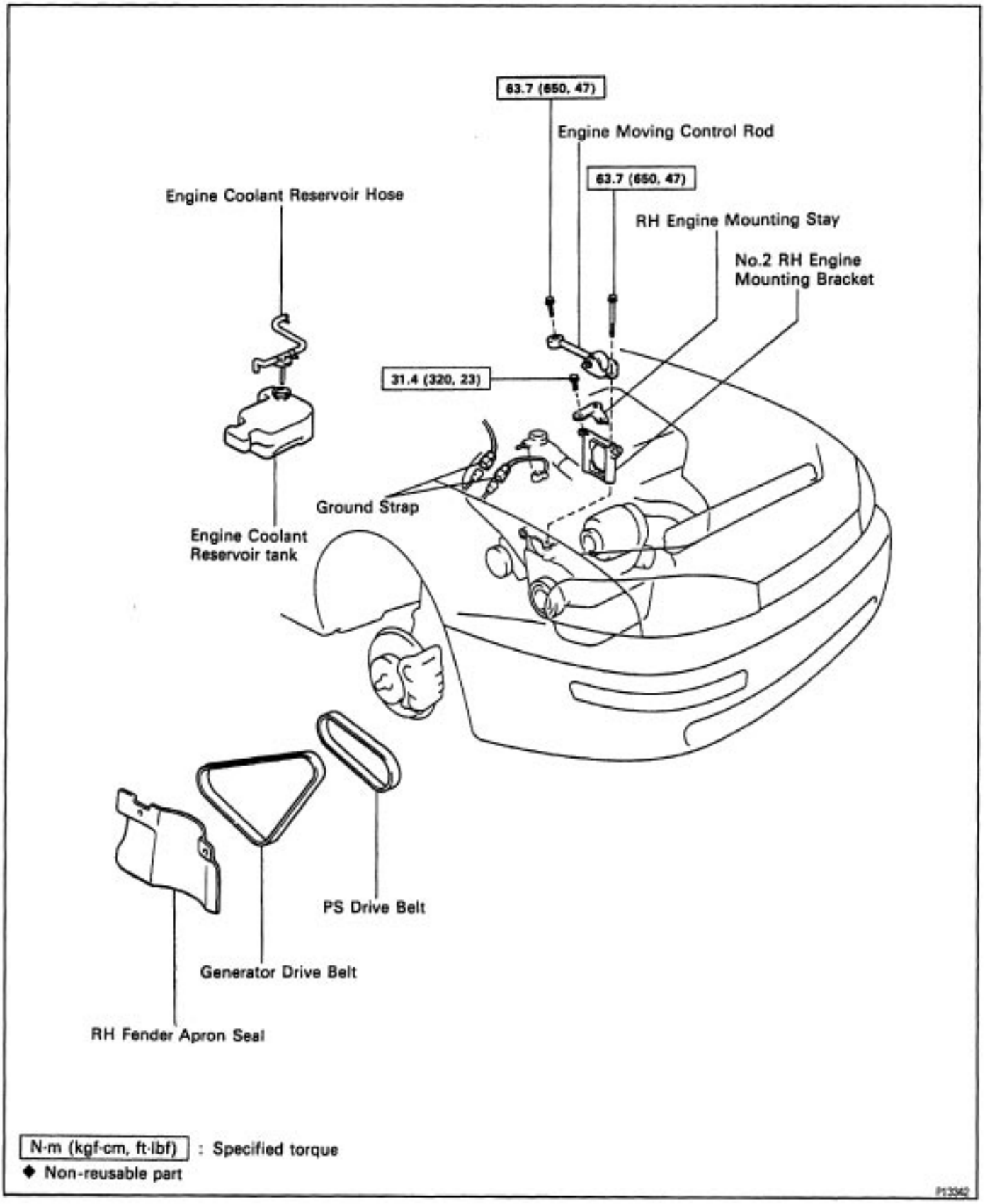
(a) Clean and install the oil drain plug with a new gasket.
**Torque: 37 N–m (375 kgf–cm, 27 ft–lbf)**
(b) Fill with fresh engine oil.
**Oil grade:**
**API grade SG or SH, Energy – Conserving II or ILSAC multigrade and recommended viscosity oil, with SAE 5W–30 being the preferred engine oil.**
**Capacity:**
**Drain and refill**
**w/ Oil filter change**
**4.7 liters (5.0 US qts, 4.1 Imp. qts)**
**w/o Oil filter change**
**4.5 liters (4.8 US qts, 4.0 Imp. qts)**
**Dry fill**
**5.5 liters (5.8 US qts, 4.8 Imp. qts)**
(c) Reinstall the oil filler cap.

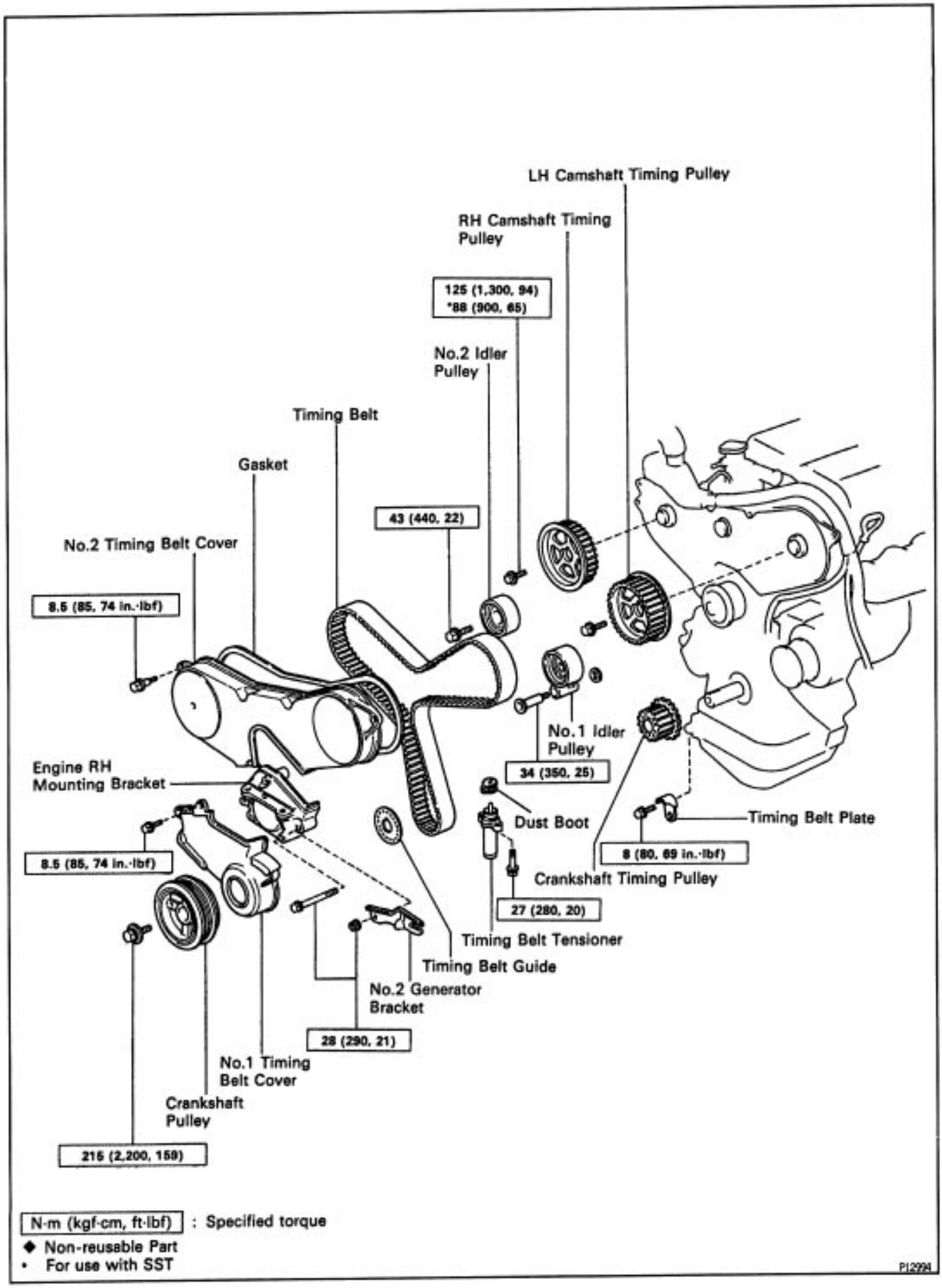
**4. START ENGINE AND CHECK FOR OIL LEAKS**

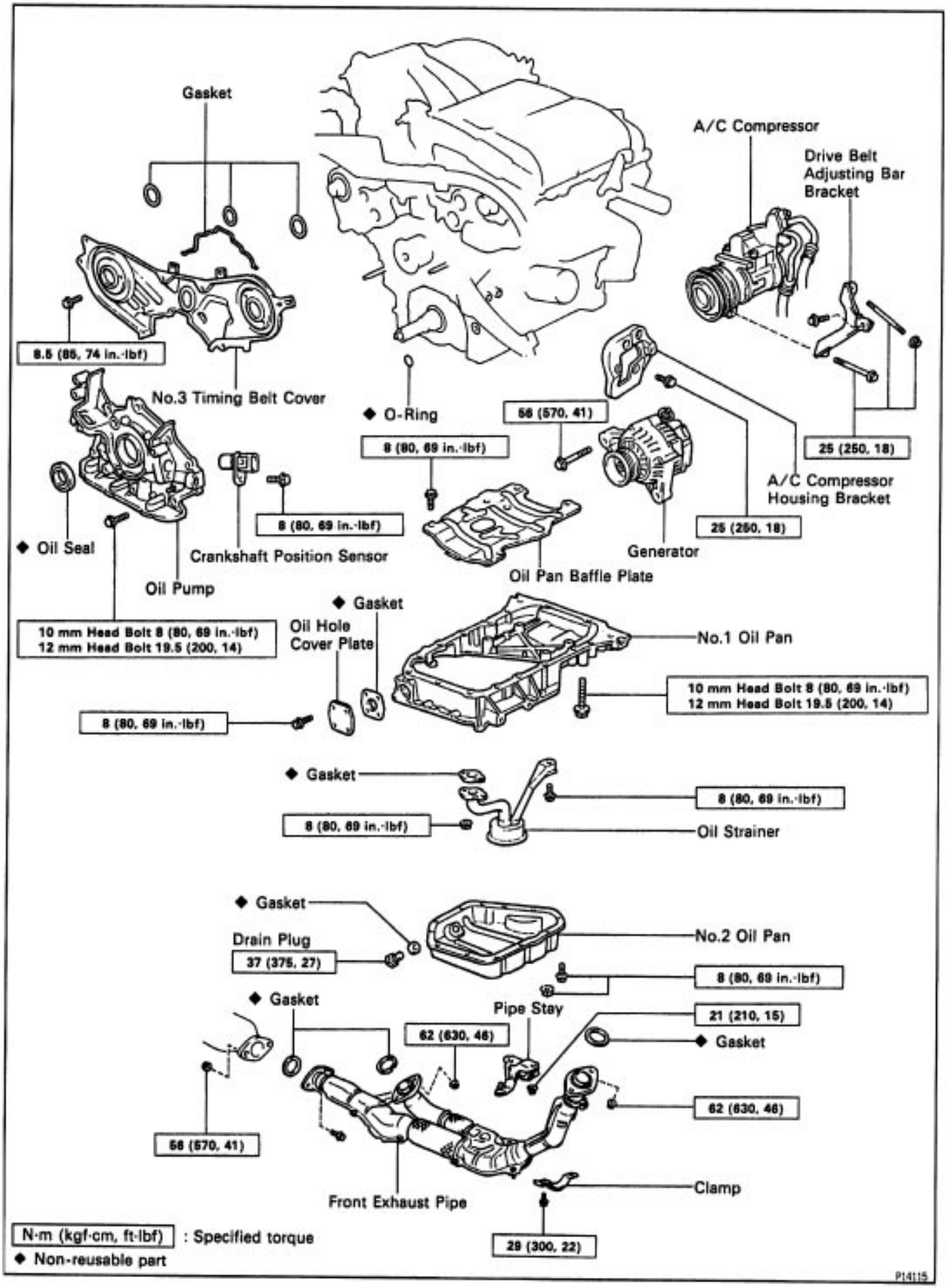
**5. RECHECK ENGINE OIL LEVEL**

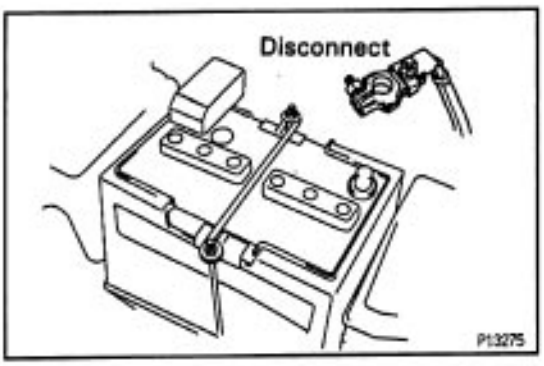
# OIL PUMP

## COMPONENTS FOR REMOVAL AND INSTALLATION










# OIL PUMP REMOVAL

**(See Components for Removal and Installation)**

HINT: When repairing the oil pump, the oil pan and strainer should be removed and cleaned.

**1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY**

**CAUTION: Work must be started after 90 seconds from the time the Ignition switch is turned to the 'LOCK' position and the negative (–) terminal cable Is disconnected from the battery.**

**2. DRAIN ENGINE OIL**

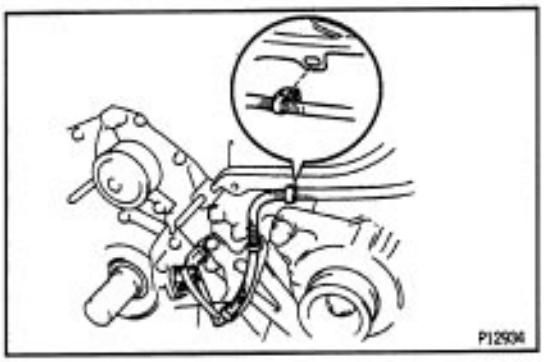
**3. REMOVE OIL DIPSTICK**

**4. REMOVE TIMING BELT**

**(See step 2 to 20 on pages EG2–41 to 45)**

**5. REMOVE TIMING PULLEYS**

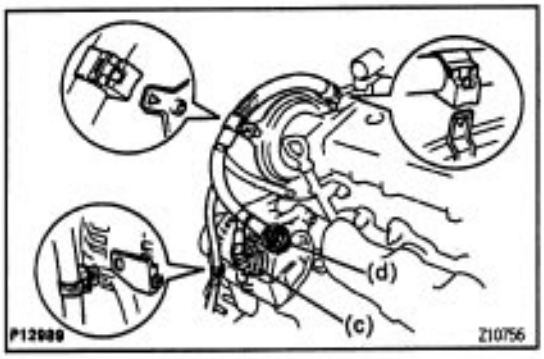
**(See step 21 to 24 on pages EG2–45 to 47)**




**6. DISCONNECT ENGINE WIRE**

(a) Disconnect the crankshaft position sensor connector.

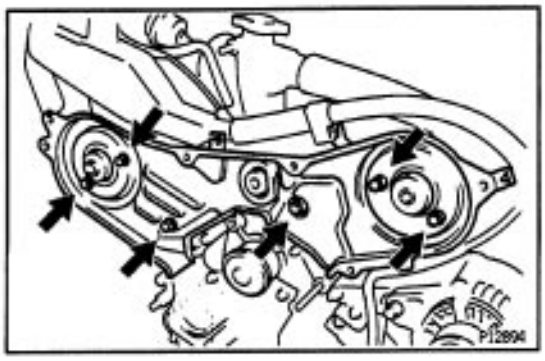
(b) Disconnect the engine wire from the wire clamp.




(c) Disconnect the generator connector.

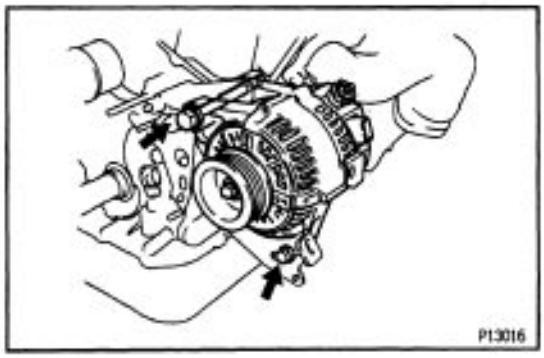
(d) Remove the nut and disconnect the generator wire.

(e) Disconnect the engine wire from the 3 clamps.

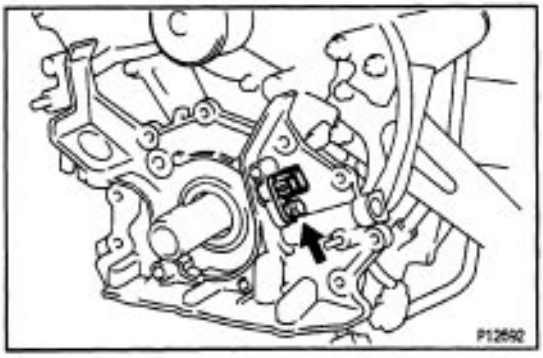



**7. REMOVE No.3 TIMING BELT COVER**

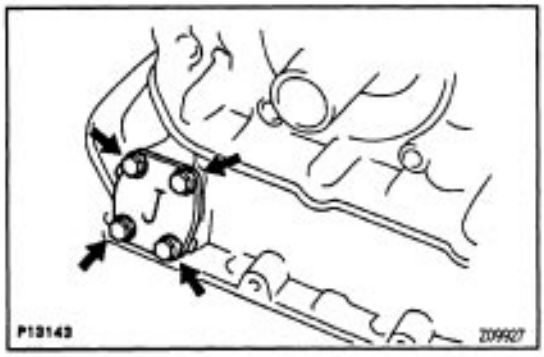
**Remove the 6 bolts and belt cover.**




**8. REMOVE GENERATOR**
Remove the 2 bolts and generator.

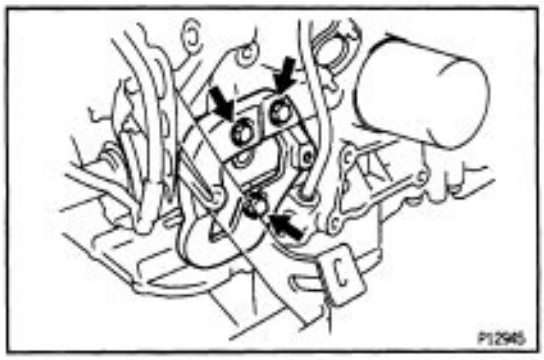



**9. REMOVE CRANKSHAFT POSITION SENSOR**
Remove the bolt and position sensor.

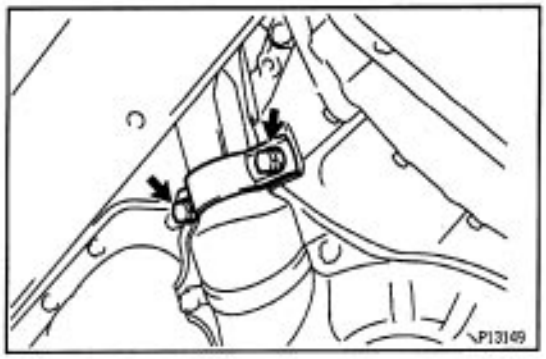



**10. REMOVE OIL HOLE COVER PLATE**
Remove the 4 bolts and cover plate.


**11. REMOVE A/C COMPRESSOR WITHOUT DISCONNECTING HOSES**
(a) Disconnect the A/C compressor connector.
(b) Remove the drive belt.
(c) Remove the 5 bolts, 2 nuts and drive belt adjusting bar bracket, and disconnect the A/C compressor.
(d) Move the compressor aside and suspend it.

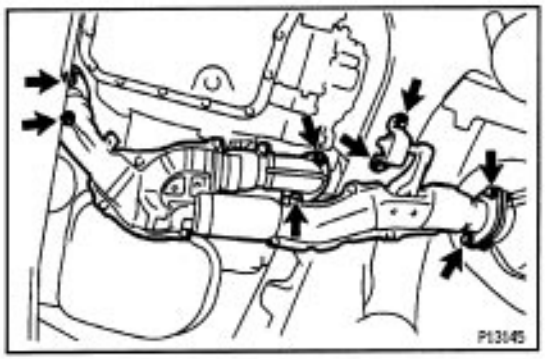



**12. REMOVE A/C COMPRESSOR HOUSING BRACKET**
Remove the 3 bolts and A/C compressor housing bracket.




**13. REMOVE FRONT EXHAUST PIPE**

(a) Remove the 2 bolts and exhaust pipe clamp.

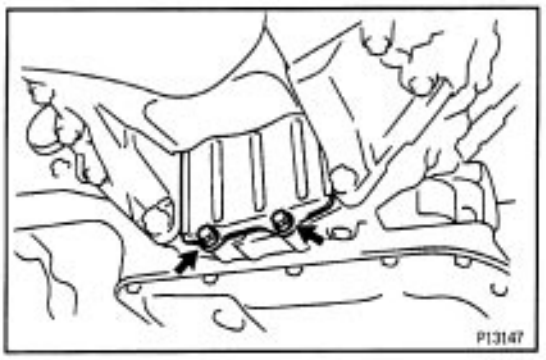



(b) Remove the 2 bolts, and disconnect the bracket.
(c) Remove the 2 bolts and 2 nuts holding the front exhaust pipe to the three–way catalytic converter.
(d) Remove the 4 nuts holding the front exhaust pipe to the exhaust manifolds.
(e) Remove the front exhaust pipe and 3 gaskets.

**14. REMOVE FRONT EXHAUST PIPE STAY**

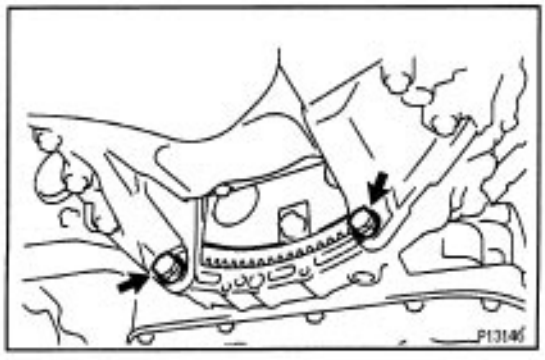
Remove the 2 bolts and pipe stay.





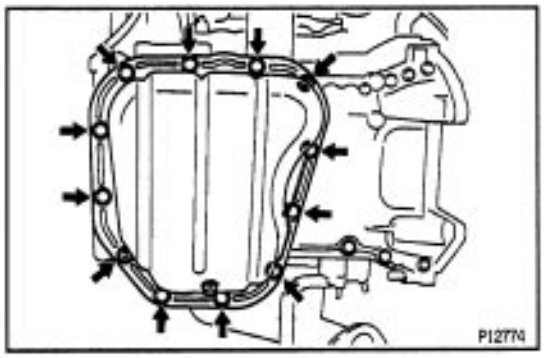

**15. REMOVE FLYWHEEL HOUSING UNDERCOVER**

Remove the 2 bolts and undercover.



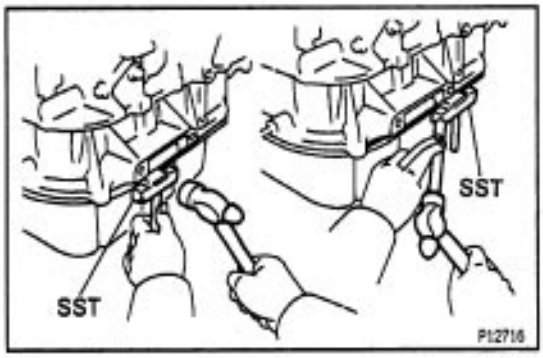

**16. REMOVE BOLTS HOLDING NO.1 OIL PAN TO TRANSAXLE**

Remove the 2 bolts.




**17. REMOVE NO.2 OIL PAN**

(a) Remove the 10 bolts and 2 nuts.

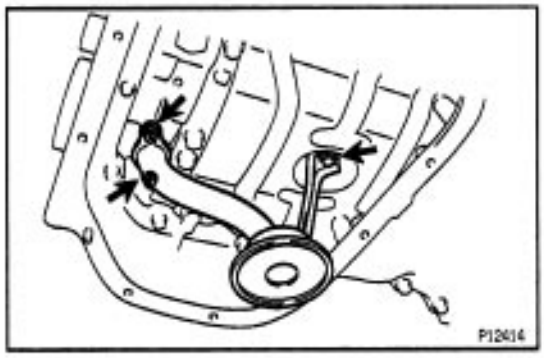



(b) Insert the blade of SST between the No. 1 and No.2 oil pans, and cut off applied sealer and remove the No. 1 oil pan.

SST 09032 – 00100

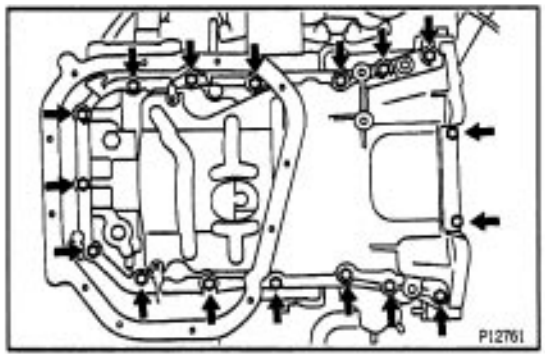
**NOTICE:**

- **Be careful not to the damage the No.2 oil pan con–tact surface of the No.1 oil pan.**
- **Be careful not to damage the No..2 oil pan flange.**



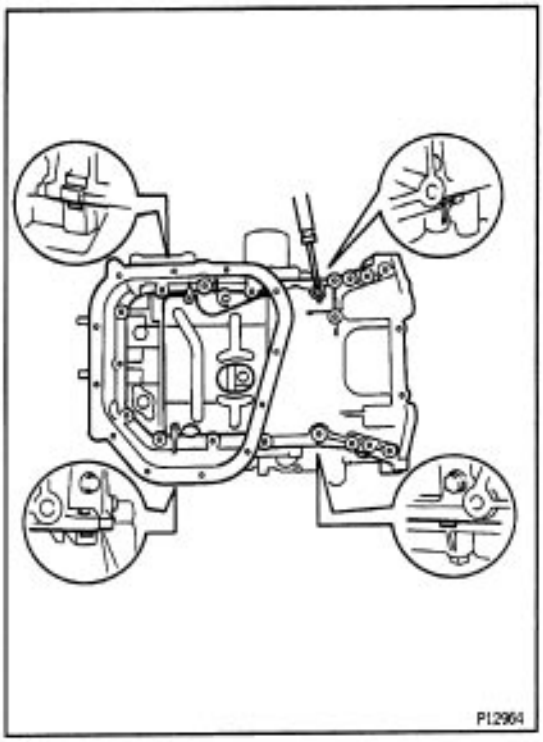

**18. REMOVE OIL STRAINER**

Remove the bolt, 2 nuts, oil strainer and gasket.



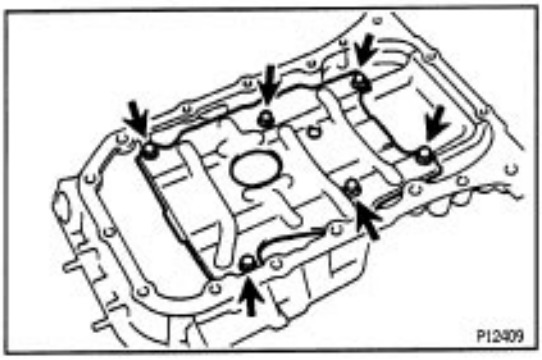

**19. REMOVE NO.1 OIL PAN**

(a) Remove the 17 bolts.



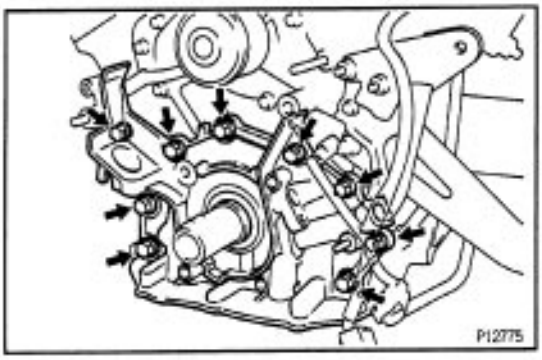

(b) Using a screwdriver, remove the No. 1 oil pan by prying the portions between the cylinder block and No.1 oil pan.

**NOTICE: Be careful not to damage the contact surfaces of the cylinder block and No.1 oil pan.**



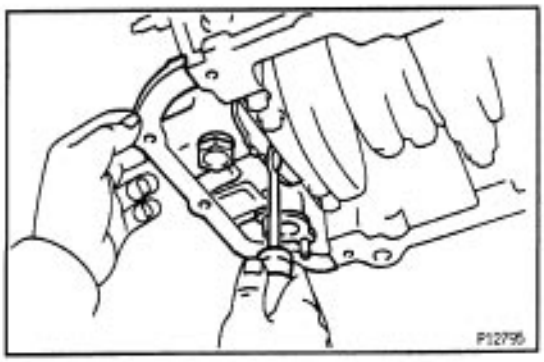

**20. REMOVE OIL PAN BAFFLE PLATE**

Remove the 6 bolts and baffle plate.




**21. REMOVE OIL PUMP**

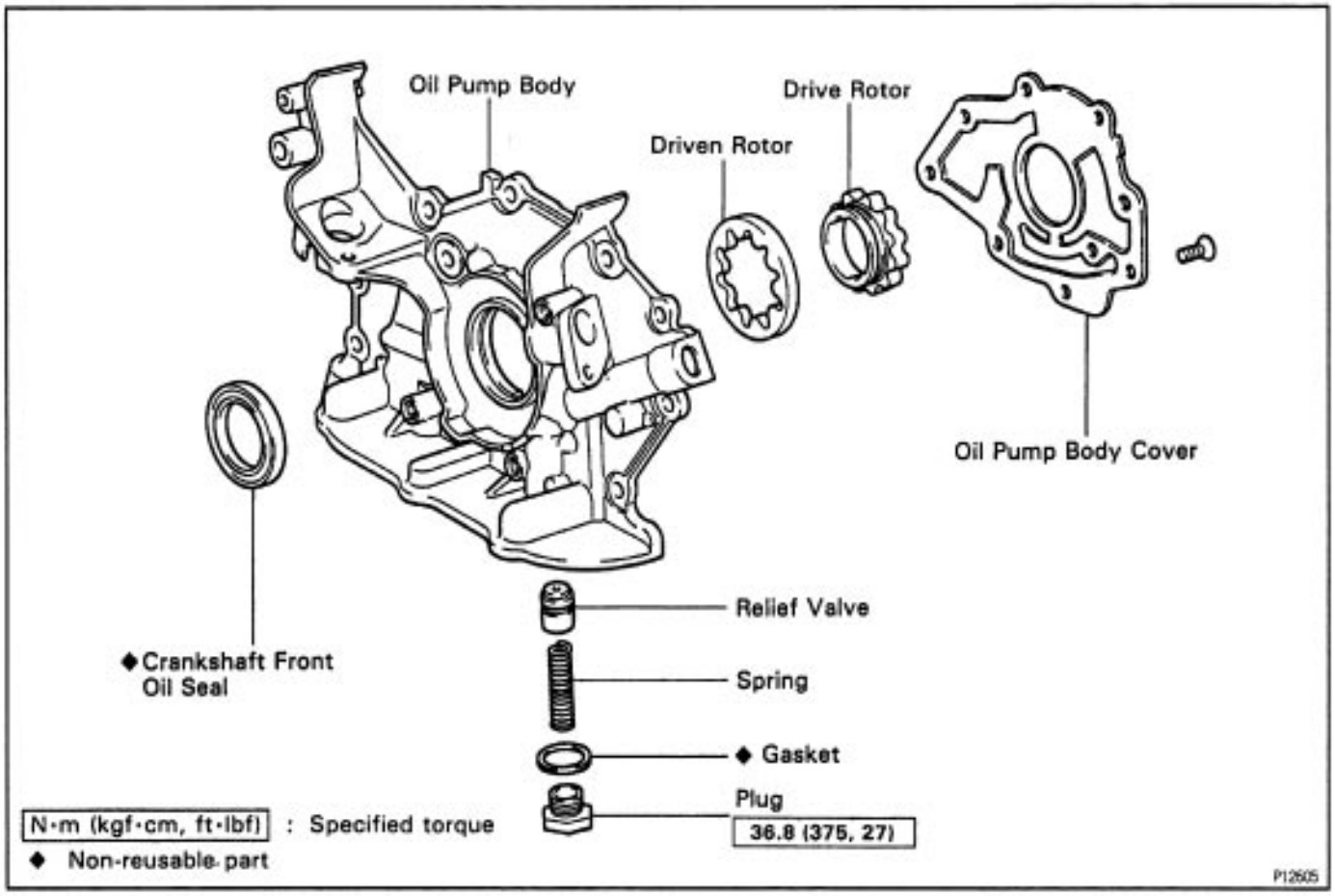
(a) Remove the 9 bolts.

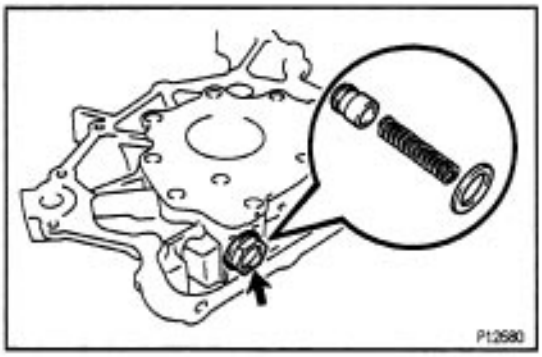



(b) Remove the oil pump by prying a screwdriver between the oil pump and main bearing cap.

(c) Remove the 0–ring.

# COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

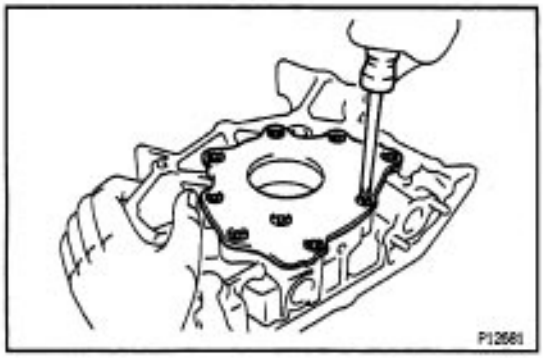



## OIL PUMP DISASSEMBLY

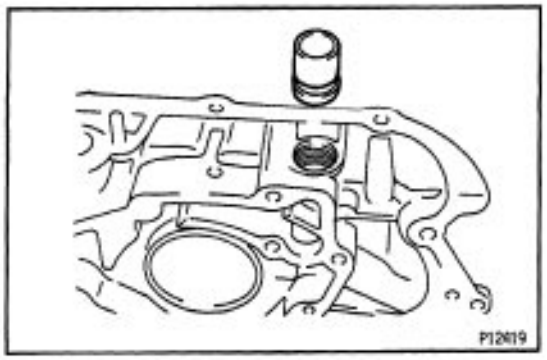
### 1. REMOVE RELIEF VALVE

Remove the plug, gasket, spring and relief valve.




### 2. REMOVE DRIVE AND DRIVEN ROTORS

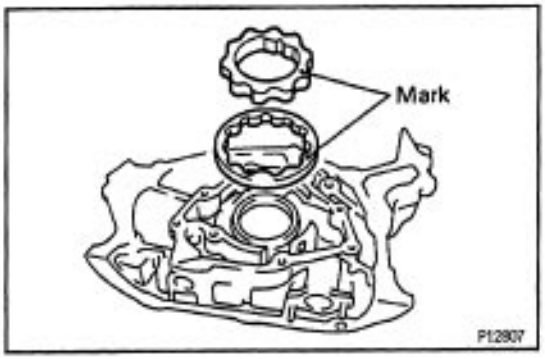
Remove the 9 screws, pump body cover, drive and driven rotors.




# OIL PUMP INSPECTION

**1. INSPECT RELIEF VALVE**

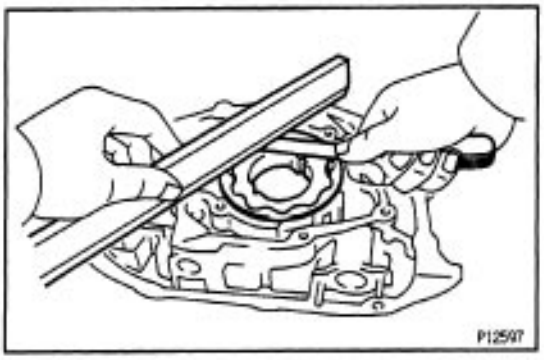
Coat the valve with engine oil and check that it falls smoothly into the valve hole by its own weight.
If it does not, replace the relief valve. If necessary, replace the oil pump assembly.




**2. INSPECT DRIVE AND DRIVEN ROTORS**

**A. Place drive and driven rotors into oil pump body**

Place the drive and driven rotors into the oil pump body with the mark facing upward.




**B. Inspect rotor side clearance**

Using a feeler gauge and precision straight edge, measure the clearance between the rotors and precision straight edge.

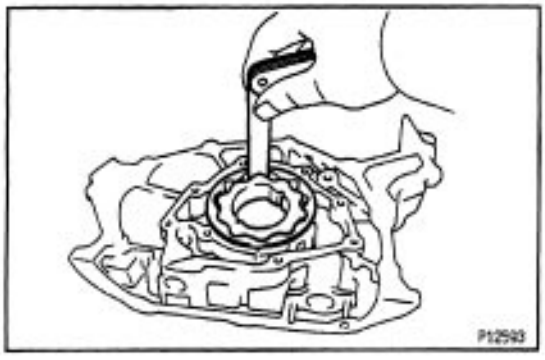
**Standard side clearance:**

**0.030 – 0.090 mm (0.0012 – 0.0035 in.)**

**Maximum side clearance:**

**0.15 mm (0.0059 in.)**

If the side clearance is greater than maximum, replace the rotors as a set. If necessary, replace the oil pump assembly.




**C. Inspect rotor tip clearance**

Using a feeler gauge, measure the clearance between the drive and driven rotor tips.

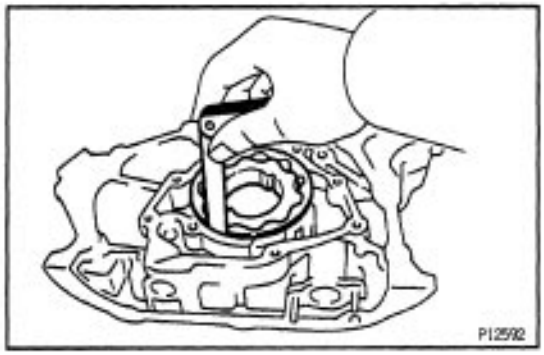
**Standard tip clearance:**

**0.110 – 0.240 mm (0.0043 – 0.0094 In.)**

**Maximum tip clearance:**

**0.35 mm (0.0138 in.)**

If the tip clearance is greater than maximum, replace the rotors as a set.

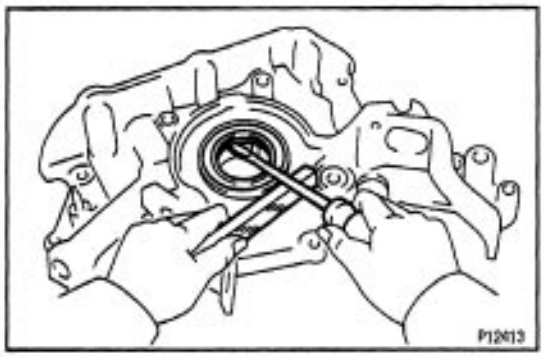



**D. Inspect rotor body clearance**
Using a feeler gauge, measure the clearance between the driven rotor and body.
**Standard body clearance:**
**0.100 – 0.175 mm (0.0039 – 0.0069 In.)**
**Maximum body clearance:**
**0.30 mm (0.0118 in.)**
If the body clearance is greater than maximum, re–place the rotors as a set. If necessary, replace the oil pump assembly.

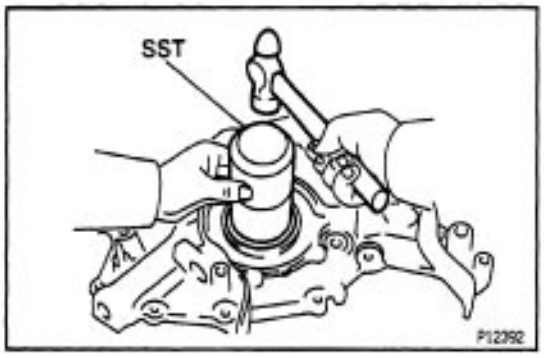
## CRANKSHAFT FRONT OIL SEAL REPLACEMENT

HINT: There are 2 methods (A and B) to replace the oil seal which are as follows:

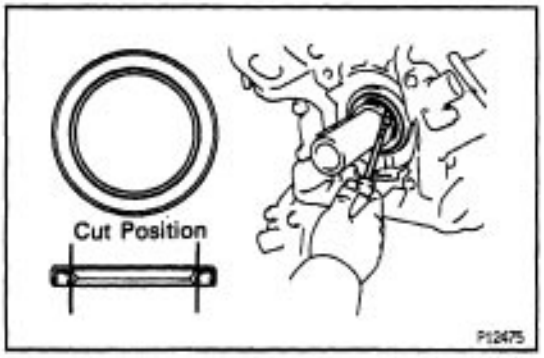




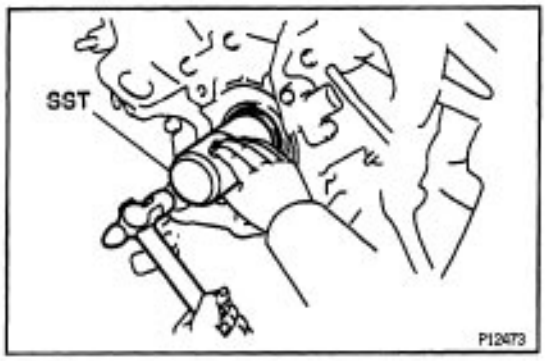

**REPLACE CRANKSHAFT FRONT OIL SEAL**
**A. If oil pump is removed from cylinder block:**
(a) Using a screwdriver, pry out the oil seal.



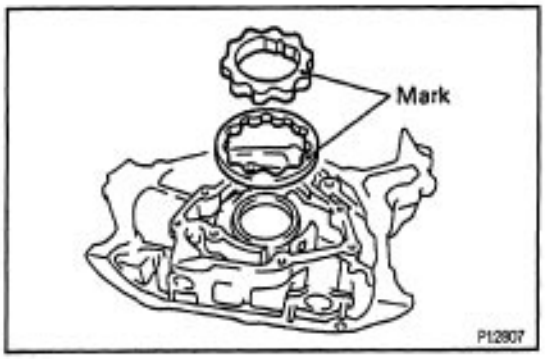

(b) Using SST and a hammer, tap in a new oil seal until its surface is flush with the oil pump body edge.
SST 09223 – 00010
(c) Apply MP grease to the oil seal lip.




**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 09223 – 00010

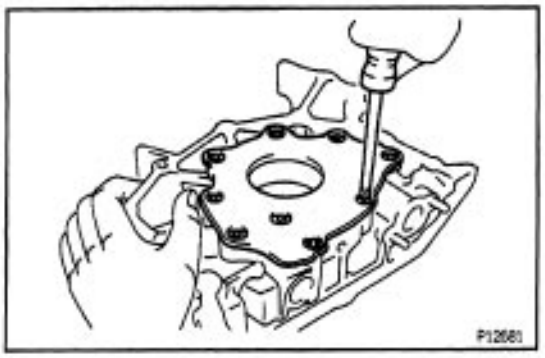



## OIL PUMP ASSEMBLY

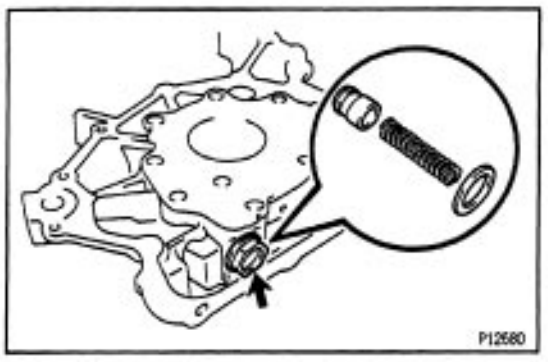
**(See Components for Disassembly and Assembly)**

**1. INSTALL DRIVE AND DRIVEN ROTORS**

(a) Place the drive and driven rotors into pump body with the marks facing the pump body cover side.

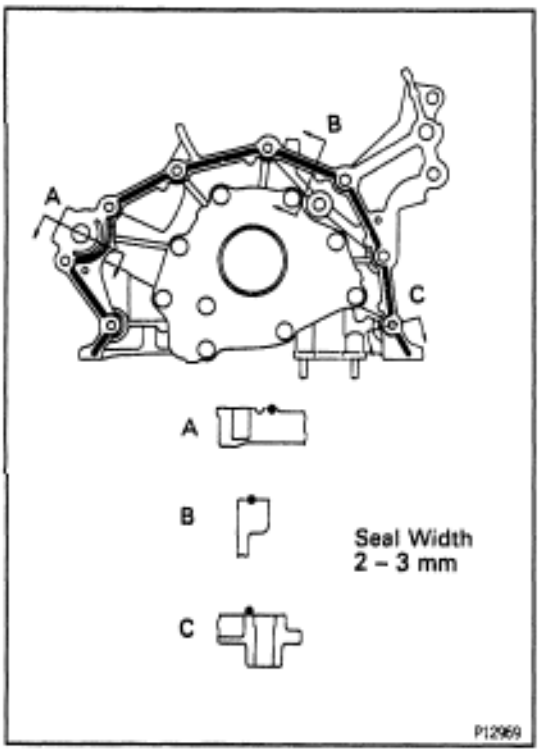



(b) Install the pump body cover with the 9 screws.




**2. INSTALL RELIEF VALVE**

(a) Insert the relief valve and spring into the pump body hole.
(b) Install the plug with a new gasket.
**Torque: 36.8 N–m (375 kgf–cm, 37 ft–lbf)**




# OIL PUMP INSTALLATION

**(See Components for Removal and Installation)**

**1. 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 grooves.
- 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.

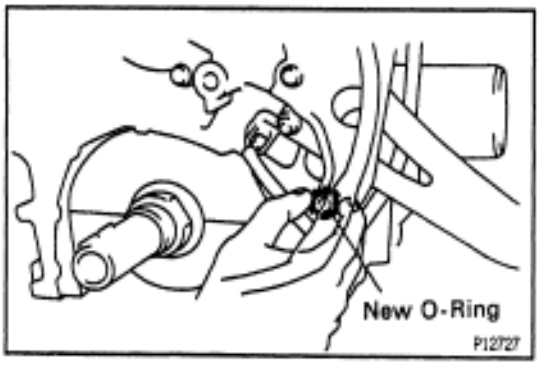
**Seal packing:**

**Part No. 08826–00080 or equivalent**

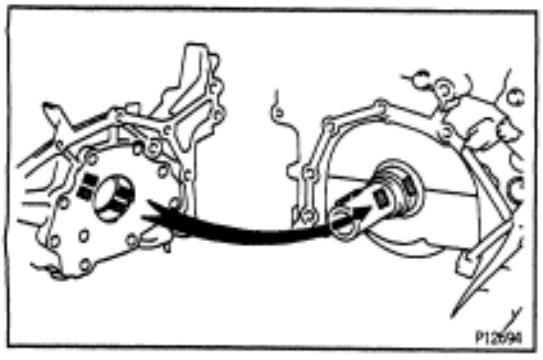
- Install a nozzle that has been cut to a 2–3 mm (0.08–0.12 in.) opening.

HINT: Avoid applying an excessive amount to the surface.

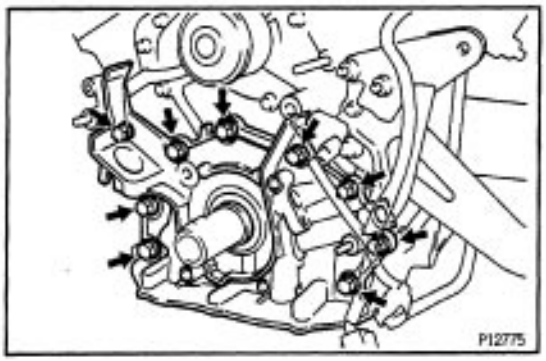
- Parts must be assembled within 3 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.



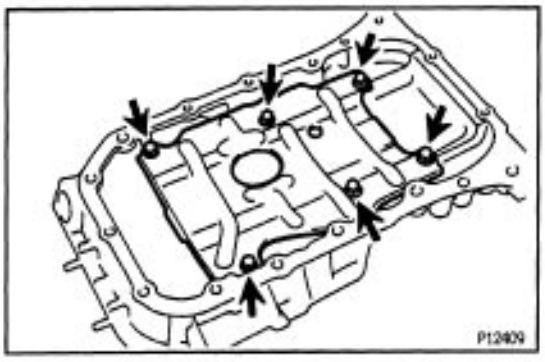

(c) Place a new 0 – ring in position on the cylinder block.



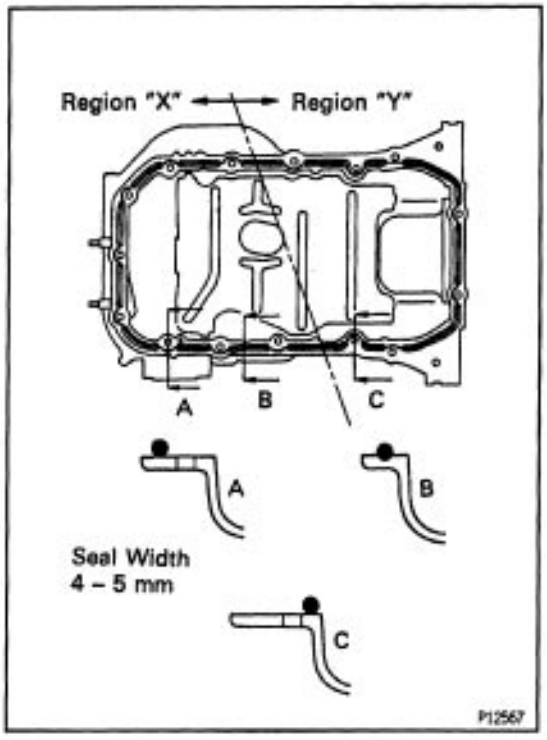

(d) Engage the spline teeth of the oil pump drive gear with the large teeth of the crankshaft, and slide the oil pump on the crankshaft.




(e) Install the oil pump with the 9 bolts.
**Torque:**
**8 N–m (80 kgf–cm, 69 in.–lbf) for 10 mm head bolt**
**19.5 N–m (200 kgf–cm, 14 ft–lbf) for 12 mm head bolt**



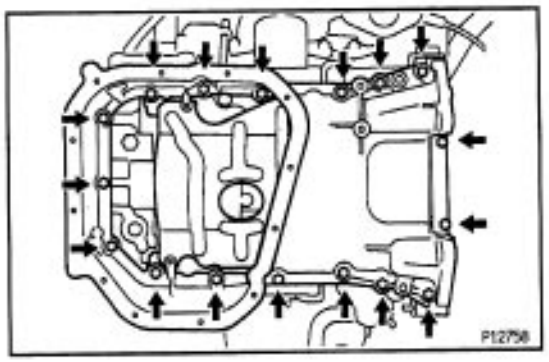

**2. INSTALL OIL PAN BAFFLE PLATE**
Install the baffle plate with the 6 bolts.
**Torque: 8 N–m (80 kgf–cm, 69 in.–lbf)**




**3. INSTALL NO.1 OIL PAN**
(a) Remove any old packing (FIPG) material and be care–f ul not to drop any oil on the contact surfaces of the oil pan, 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 grooves.
- 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 pan as shown in the illustration.
**Seal packing:**
**Part No. 08826–00080 or equivalent**
**Region “X” is at the outer side of the bolt hole.**
**Region “Y” Is at the inner side of the bolt hole.**
- Install a nozzle that has been cut to a 4–5 mm (0.16–0.20 in.) opening.

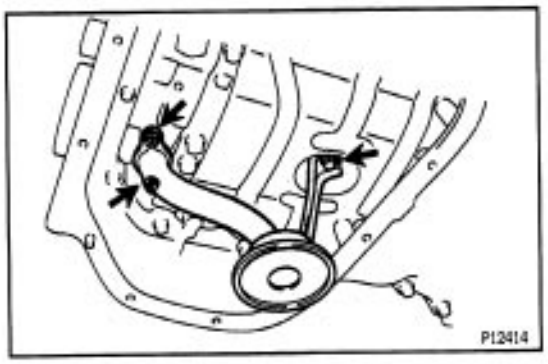
HINT: Avoid applying an excessive amount to the surface.
- Parts must be assembled within 3 minutes of application. Otherwise the material must be re–moved and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.




(c) Install the oil pan with the 17 bolts.

**Torque:**

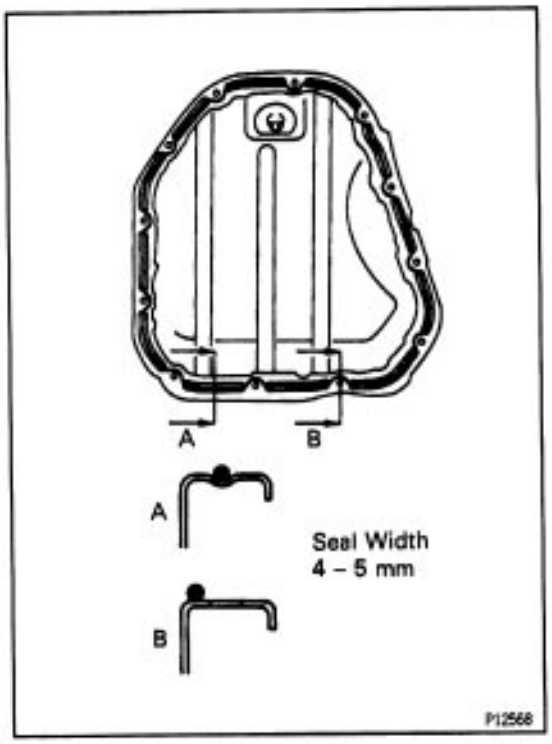
**8 N–m (80 kgf–cm, 69 in.–lbf) for 10 mm head bolt**
**19.5 N–m (200 kgf–cm. 14 ft–lbf) for 12 mm head bolt**




**4. INSTALL OIL STRAINER**

Install a new gasket and the oil strainer with the bolt and 2 nuts.

**Torque: 8 N–m (80 kgf–cm, 69 in.–lbf)**




**5. INSTALL NO.2 OIL PAN**

(a) Remove any old packing (FIPG) material and be care. ful not to drop any oil on the contact surface of the No. 1 and No.2 oil pans.

- Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing grooves.
- Thoroughly clean all components to remove al the loose material.
- Using a non–residue solvent, clean both sealing surfaces.

**NOTICE: Do not use a solvent which will affect the paint ed surfaces.**

(b) Apply seal packing to the No.2 oil pan as shown in the illustration.

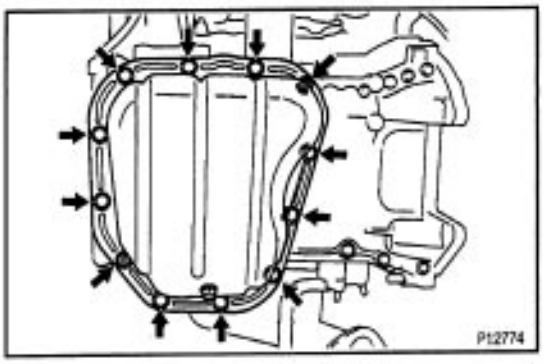
**Seal packing:**

**Part No. 088218–00080 or equivalent**

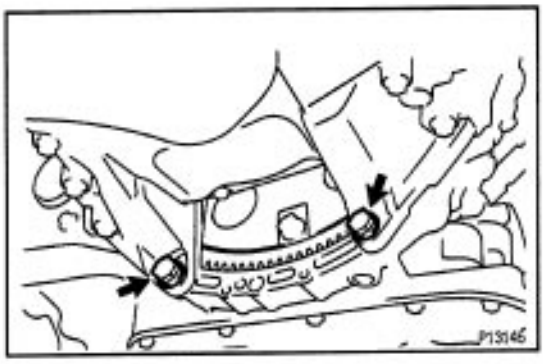
- Install a nozzle that has been cut to a 4–5 mm (0.16 – 0.20 in.) opening.

HINT: Avoid –applying an excessive amount to the surface.

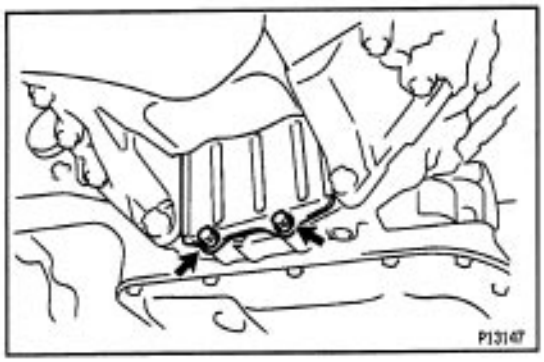
- Parts must be assembled within 3 minutes an application. Otherwise the material must be re–moved and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.




(c) Install the No.2 oil pan with the 10 bolts and 2 nuts.
**Torque: 8 N–m (80 kgf–cm, 69 in.–lbf)**

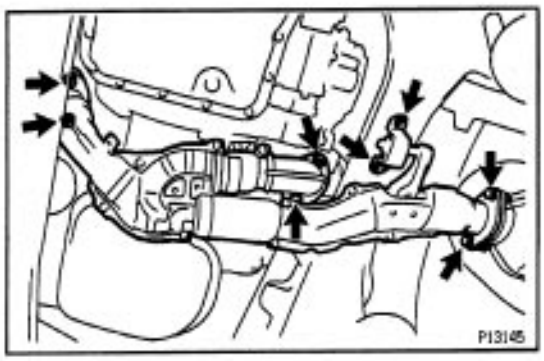



**6. INSTALL BOLTS HOLDING NO.1 OIL PAN TO TRANSAXLE**
Install the 2 bolts.
**Torque: 37 N–m (380 kgf–cm, 27 ft–lbf)**

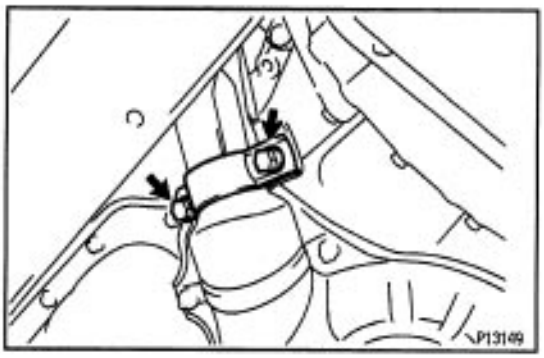



**7. INSTALL FLYWHEEL HOUSING UNDERCOVER**
Install the undercover with the 2 bolts.
**Torque: 7.8 N–m (80 kgf–cm, 69 in.–lbf)**

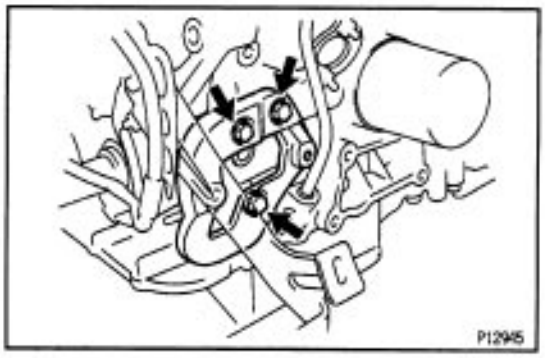
**8. INSTALL FRONT EXHAUST PIPE STAY**
Install the pipe stay with the 2 bolts.
**Torque: 21 N–m (210 kgf–cm, 15 ft–lbf)**




**9. INSTALL FRONT EXHAUST PIPE**
(a) Temporarily install 3 new gaskets and the front ex–haust pipe with the 2 bolts and6 nuts.
(b) Tighten the 4 nuts holding the exhaust manifolds to the front exhaust pipe.
**Torque: 62 N–m (630 kgf–cm, 46 ft–lbf)**
(c) Tighten the 2 bolts and 2 nuts holding the three–way catalytic converter to the front exhaust pipe.
**Torque: 56 N–m (570 kgf–cm, 41 ft–lbf)**
(d) Connect the bracket with the 2 bolts.
**Torque: 19 N–m (195 kgf–cm, 14 ft–lbf)**

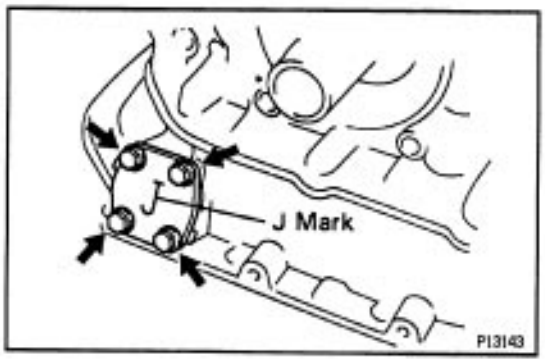



(e) Connect the front exhaust pipe clamp with the 2 bolts.
**Torque: 29 N–m (300 kgf–cm, 22 ft–lbf)**

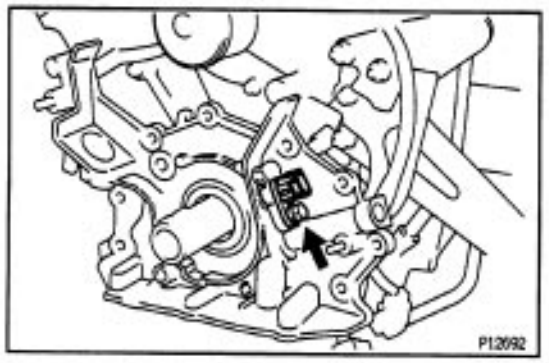



**10. INSTALL A/C COMPRESSOR HOUSING BRACKET**
Install the housing bracket with the 3 bolts.
**Torque: 26 N–m (250 kgf–cm, 18 ft–lbf)**

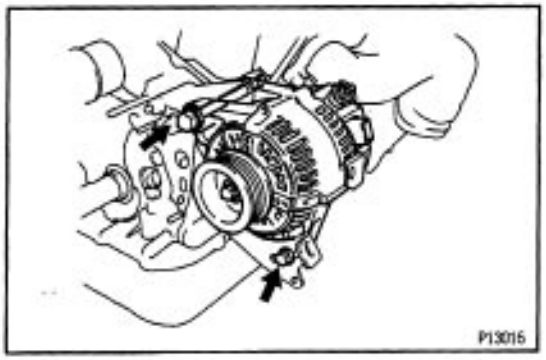

**11. INSTALL A/C COMPRESSOR**
(a) Install the A/C compressor and drive belt adjusting bar bracket with the 5 bolts.
**Torque: 25 N–m (250 kgf–cm, 18 ft–lbf)**




**12. INSTALL OIL HOLE COVER PLATE**
Install a new gasket and the hole cover plate (J mark facing outward) with the 4 bolts.
**Torque: 8 N–m (80 kgf–cm, 69 in.–lbf)**

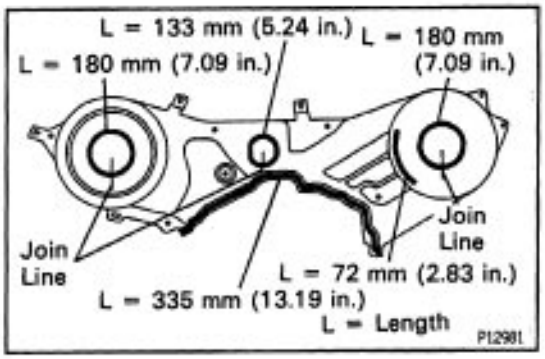



**13. INSTALL CRANKSHAFT POSITION SENSOR**
Install the position sensor with the bolt.
**Torque: 8 N–m (80 kgf–cm, 89 in.–lbf)**




**14. INSTALL GENERATOR**

Install the generator with the 2 bolts. Do not tighten the bolts yet.




**15. INSTALL NO.3 TIMING BELT COVER**

(a) Check that the timing belt cover gaskets have no cracks or peeling, etc.

If the gaskets do have cracks or peeling etc., replace them using the following steps.

(1) Using a screwdriver and gasket scraper, remove all the old gasket material.

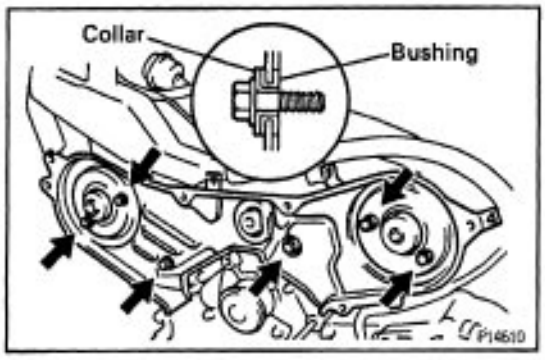
(2) Thoroughly clean all components to remove all the loose material.

(3) Remove the backing paper from a new gasket and install the gasket evenly to the part of the belt cover shaded black in the illustration.

**NOTICE: When joining gaskets, do not leave a gap between them. Cut off any excess gasket.**

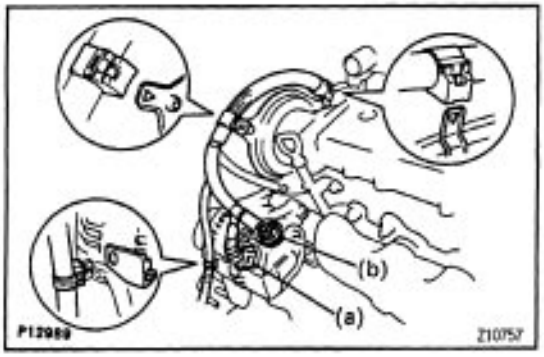
(4) After installing the gasket, press down on it so that the adhesive firmly sticks to the belt cover.

(b) Install new gaskets to the No.3 belt cover.




(c) Install the belt cover with the 6 bolts.

**Torque: 8.5 N–m (85 kgf–cm. 74 in.–lbf)**

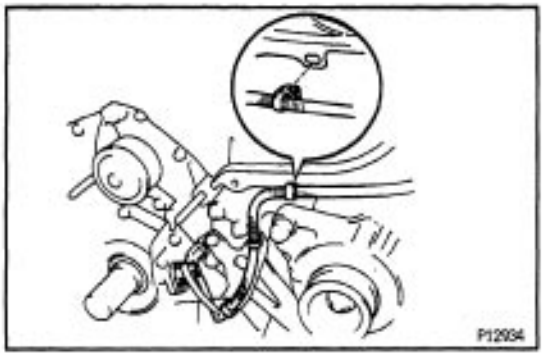



**16. CONNECT ENGINE WIRE**

(a) Connect the generator connector.

(b) Connect the generator wire with the nut.

(c) Connect the engine wire with the 3 clamps.




(d) Connect the crankshaft position sensor connector.
(e) Connect the engine wire with the wire clamp.

**17. INSTALL TIMING PULLEYS**
**(See steps 1 to 5 on pages EG2–49, 50)**
**18. INSTALL TIMING BELT**
**(See steps6 to 27 on pages EG2–51 to 66)**
**19. FILL ENGINE WITH OIL**
**Capacity:**
**Drain and refill**
**w/ Oil filter change**
**4.7 liters (5.0 US qts, 4.1 Imp. qts)**
**w/o Oil filter change**
**4.5 liters (4.8 US qts, 4.0 Imp. qts)**
**20. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY**
**21. START ENGINE AND CHECK FOR LEAKS**
**22. RECHECK ENGINE ENGINE OIL LEVEL**

# SERVICE SPECIFICATIONS

## SERVICE DATA

| | | | |
|---|---|---|---|
| Oil pressure | At idle speed (normal operating temperature)<br>At 3,000 rpm (normal operating temperature) | | 29 kPa (0.3 kgf/cm², 43 psi) or more<br>294 – 539 kPa (3.0 – 5.5 kgf/cm², 43 – 78 psi) |
| Oil pump | Side clearance | STD | 0.030 – 0.090 mm (0.0012 – 0.0035 in.) |
| | | Maximum | 0.15 mm (0.0059 in.) |
| | Body clearance | STD | 0.100 – 0.175 mm (0.0039 – 0.0069 in.) |
| | | Maximum | 0.30 mm (0.0118 in.) |
| | Tip clearance | STD | 0.110 – 0.240 mm (0.0043 – 0.0094 in.) |
| | | Maximum | 0.35 mm (0.0138 in.) |

## TORQUE SPECIFICATIONS

| Pert tightened | N·m | kgf·cm | ft·lbf |
|---|---|---|---|
| Oil pressure switch x Cylinder block | 13 | 130 | 9 |
| No.2 oil pan x Drain plug | 37 | 375 | 27 |
| Oil pump x Plug (for relief valve) | 36.8 | 375 | 37 |
| Oil pump x Cylinder block (10 mm head bolt) | 8 | 80 | 69 in.·lbf |
| Oil pump x Cylinder block (12 mm head bolt) | 19.5 | 200 | 14 |
| Oil pan baffle plate x No.1 oil pan | 8 | 80 | 69 in.·lbf |
| No.1 idler pulley x Oil pump | 34 | 350 | 25 |
| No. 1 oil pan x Cylinder block | 19.5 | 200 | 14 |
| No. 1 oil pan x Oil pump | 8 | 80 | 69 in.·lbf |
| No.1 oil pan x Rear oil seal retainer | 8 | 80 | 69 in.·lbf |
| Oil strainer x Main bearing cap | 8 | 80 | 69 in.·lbf |
| Oil strainer x Oil pump | 8 | 80 | 69 in.·lbf |
| No.2 oil pan x No. 1 oil pan | 8 | 80 | 69 in.·lbf |
| Flywheel housing under cover x Transaxle | 8 | 80 | 69 in.·lbf |
| Exhaust pipe stay x No.1 oil pan | 21 | 210 | 15 |
| Exhaust pipe clamp x Exhaust pipe stay | 29 | 300 | 22 |
| A/C compressor housing bracket x Cylinder block | 25 | 250 | 18 |
| A/C compressor x A/C compressor housing bracket | 25 | 255 | 18 |
| Oil hole cover plate x No.2 oil pan | 8 | 80 | 69 in.·lbf |
| No.1 oil pan x Transaxle case | 37 | 380 | 27 |
| Front exhaust pipe x Exhaust manifold | 62 | 630 | 46 |
| Front exhaust pipe x Converter | 56 | 570 | 41 |
| Crankshaft position sensor x Oil pump | 8 | 80 | 69 in.·lbf |
| No.3 timing belt cover x Cylinder head | 8.5 | 85 | 74 in.·lbf |

# 1MZ–FE ENGINE TROUBLESHOOTING

# HOW TO PROCEED WITH TROUBLESHOOTING

The Engine Control System broadly consists of the sensors, ECM and actuators. The ECM receives signals from various sensors, judges the operating conditions and determines the optimum injection duration, timing, ignition timing and idle speed.
In general, the Engine Control System is considered to be a very intricate system to troubleshoot. But, the fact is that if you inspect each circuit in order following the procedures in this manual, troubleshooting of this system is not complex.
When troubleshooting OBDll vehicles, use an OBDII scan tool complying with SAE J1978 or TOYOTA hand–held –tester to confirm the diagnostic trouble codes, freezed frame data and engine data.
This will enable you to determine the system causing the problem.
This section explains the best method of troubleshooting and how to carry out the necessary repairs.

**(1) CUSTOMER PROBLEM ANALYSIS**

Using the customer problem analysis check sheet for reference, ask the customer in detail about the problem.

**(2) CONNECT OBDII SCAN TOOL OR TOYOTA HAND–HELD TESTER TO DLC 3**

Connect the OBDII scan tool complying with SAE J1978 or TOYOTA hand–held tester to the vehicle's data link connector 3.

**NOTICE: For OBDII scan tool or TOYOTA hand–held tester operating instructions, see the in–struction booklet accompanying the scan tool or tester.**

If your display shows "UNABLE" TO CONNECT TO VEHICLE" when you have connected the scan tool/TOYOTA hand–held tester cable to DLC 3, turn the ignition switch ON and operate the scan tool/TOYOTA hand–held tester, inspect DLC (See page **EG2–401**)

**(3) CHECK DIAGNOSTIC TROUBLE CODE AND FREEZED FRAME DATA (PRECHECK)**

First check the diagnostic trouble codes. If a code is output, make a note of it.
Also check and note the freezed frame data.
HINT: Output of the malfunction code indicates a circuit malfunction. However, it does not indicate whether the malfunction is still occurring or occurred in the past and returned to normal. To determine this, first confirm the problem symptoms in (7) and then recheck the diagnostic trouble code in (9).
If troubleshooting started based only on the malfunction code in the diagnostic trouble code check in (3) , it could result in a misdiagnosis and troubleshooting of circuits which are normal, making it more difficult to locate the cause of the problem.

**(4) CLEAR DIAGNOSTIC TROUBLE CODE AND FREEZED FRAME DATA**

Use the OBDII scan tool or TOYOTA hand–held tester to erase the diagnostic trouble codes and freezed frame data.

**NOTICE: For OBDII scan tool or TOYOTA hand–held tester operating instructions, see the in–struction booklet accompanying the scan tool.**

**(5) VISUAL INSPECTION**

**(6) SETTING CHECK MODE DIAGNOSIS**

**(7) PROBLEM SYMPTOM CONFIRMATION**

If the engine does not start, first carry out steps (10) and (12) while referring to the diagnostic trouble codes confirmed in step (4) .

**(8) SYMPTOM SIMULATION**

To find the trouble more quickly, set the diagnosis check to check mode and confirm the problem symptoms with the higher sensing ability of the ECM. If the trouble does not reappear, use the symptom simulation method to make sure the trouble can be reproduced.

**(9) DIAGNOSTIC TROUBLE CODE CHECK IN CHECK MODE**

Check the diagnostic trouble code in check mode. If a malfunction code is output, proceed to step (11) of the Diagnostic Trouble Code Chart. If a malfunction code is not output, proceed to step (10) Basic Inspection.

**(10) BASIC INSPECTION**

Carry out basic inspection such as the spark check and fuel pressure check, etc.

**(11) DIAGNOSTIC TROUBLE CODE CHART**

If a malfunction code is displayed, inspect the circuit indicated by the chart for each code.

**(12) MATRIX CHART OF PROBLEM SYMPTOMS**

If a diagnostic trouble code is not displayed in the diagnosis in check mode, troubleshoot according to the inspection order in the Matrix Chart of Problem Symptoms.

**(13) CIRCUIT INSPECTION**

Determine if the malfunction is in the sensor, actuator, wire harness, connector or the ECM.

**(14) PARTS INSPECTION**

When the Matrix Chart of Problem Symptoms instructs you to check the parts, refer to the parts inspection section in this manual.

**(15) CHECK FOR INTERMITTENT PROBLEMS**

By checking for intermittent problems, you can isolate the place where momentary interruptions or momentary shorts are occurring due to poor contacts.

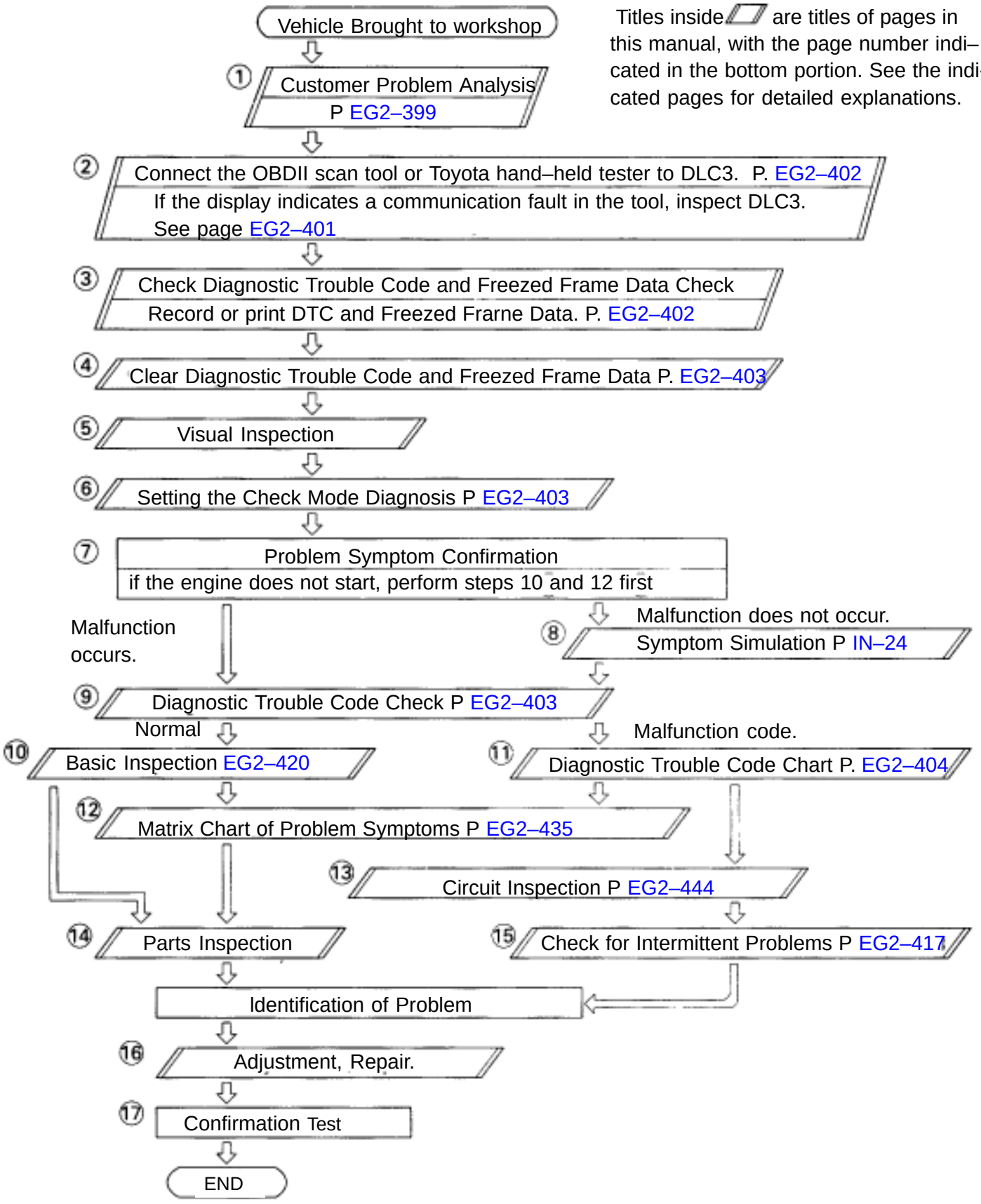
**(16) ADJUSTMENT, REPAIR**

After you locate the cause of the problem, follow the inspection and replacement procedures in this manual and adjust or repair as necessary.

**(17) CONFIRMATION TEST**

After completing adjustment or repairs, confirm not only that the malfunction is eliminated, but also test drive the vehicle, to make sure the entire Engine Control System is operating normally.

Titles inside ▱ are titles of pages in this manual, with the page number indicated in the bottom portion. See the indicated pages for detailed explanations.



# CUSTOMER PROBLEM ANALYSIS CHECK SHEET

## ENGINE CONTROL System Check Sheet

Inspector's Name _____

| | | | |
|---|---|---|---|
| Customer's name | | Model and model year | |
| Driver's name | | Frame no. | |
| Date vehicle brought in | | Engine model | |
| License no. | | Odometer reading | km / miles |

| | | |
|---|---|---|
| Problem Symptoms | ☐ Engine does not Start | ☐ Engine does not crank ☐ No initial combustion ☐ No complete combustion |
| | ☐ Difficult to Start | ☐ Engine cranks slowly<br>☐ Other _____ |
| | ☐ Poor Idling | ☐ Incorrect first idle ☐ Idling rpm is abnormal [☐ High ☐ Low ( rpm)]<br>☐ Rough idling ☐ Other _____ |
| | ☐ Poor Driveability | ☐ Hesitation ☐ Back fire ☐ Muffler explosion (after-fire) ☐ Surging<br>☐ Knocking ☐ Other _____ |
| | ☐ Engine Stall | ☐ Soon after starting ☐ After accelerator pedal depressed<br>☐ After accelerator pedal released ☐ During A/C operation<br>☐ Shifting from N to D ☐ Other _____ |
| | ☐ Others | |

| | | |
|---|---|---|
| Dates Problem Occurred | | |
| Problem Frequency | | ☐ Constant ☐ Sometimes ( times per day/month) ☐ Once only<br>☐ Other _____ |
| Conditions When Problem Occurs | Weather | ☐ Fine ☐ Cloudy ☐ Rainy ☐ Snowy ☐ Various/Other _____ |
| | Outdoor Temperature | ☐ Hot ☐ Warm ☐ Cool ☐ Cold (approx. ___ °F/ ___ °C) |
| | Place | ☐ Highway ☐ Suburbs ☐ Inner City ☐ Uphill ☐ Downhill<br>☐ Rough road ☐ Other _____ |
| | Engine Temp. | ☐ Cold ☐ Warming up ☐ After warming up ☐ Any temp. ☐ Other _____ |
| | Engine Operation | ☐ Starting ☐ Just after starting [ min.] ☐ Idling ☐ Racing<br>☐ Driving ☐ Constant speed ☐ Acceleration ☐ Deceleration<br>☐ A/C switch ON/OFF ☐ Other _____ |

| | | |
|---|---|---|
| Condition of Malfunction Indicator Lamp | | ☐ Remains on ☐ Sometimes lights up ☐ Does not light up |
| Diagnostic Trouble Code Inspection | Normal Mode (Precheck) | ☐ Normal ☐ Malfunction code(s) [code ]<br>☐ Freezed frame data [ ] |
| | Check Mode | ☐ Normal ☐ Malfunction code(s) [code ]<br>☐ Freezed frame data [ ] |

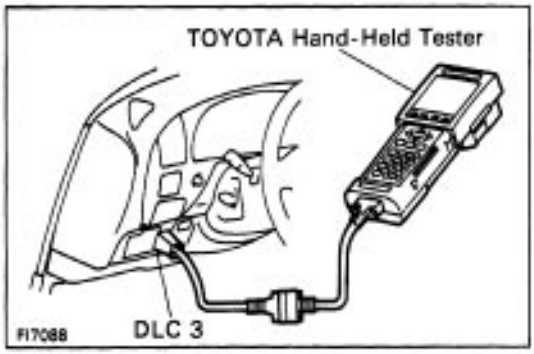

# DIAGNOSIS SYSTEM

## DESCRIPTION

When troubleshooting OBDII vehicles, the only difference from the usual troubleshooting procedure is that you connect to the vehicle the OBDll scan tool complying with SAE J1978 or TOYOTA hand–held tester, and read off various data output from the vehicle's ECM.

OBDll regulations require that the vehicle's on–board com–puter lights up the Malfunction Indicator Lamp (MIL) on the instrument panel when the computer detects a malfunction in the computer itself or in drive system components which af–fect vehicle emissions. In addition to the MIL lighting up when a malfunction is detected, the applicable diagnostic trouble codes prescribed by SAE J2012 are recorded in the ECM memory. (See page EG2–404)

If the malfunction does not reoccur in 3 trips, the MIL goes off but the diagnostic trouble codes remain recorded in the ECM memory.




To check the diagnostic trouble codes, connect the OBDII scan tool or TOYOTA hand–held tester to Data Link Connec–tor 3 on the vehicle. The OBDII scan tool or TOYOTA hand–held tester also enables you to erase the diagnostic trouble codes and check freezed frame data and various forms of engine data. (For operating instructions, see the OBDII scan tool's instruction book.)

Diagnostic trouble codes include SAE controlled codes and Manufacturer controlled codes.

SAE controlled codes must be set as prescribed by the SAE, while Manufacturer controlled codes can be set freely by the manufacturer within the prescribed limits.

(See diagnostic trouble code chart on page EG2–404)

The diagnosis system operates in normal mode during normal vehicle use. It also has a check mode for technicians to simu–late malfunction symptoms and troubleshoot. Most diagnos–tic trouble codes use 2 trip detection logic*to prevent erro–neous detection and ensure thorough malfunction detection. By switching the ECM to check mode when troubleshooting, the technician can cause the MIL to light up for a malfunction that is only detected once or momentarily. (TOYOTA hand–held tester only)

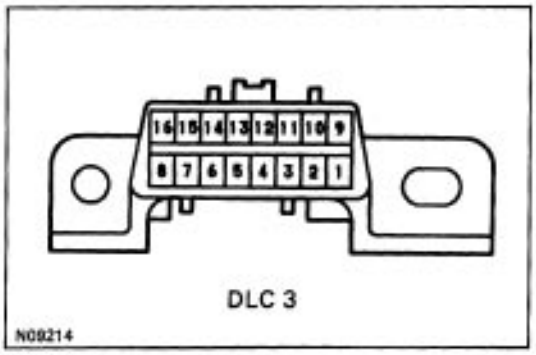
(See page EG2–403)

*2 trip detection logic

When a logic malfunction is first detected, the malfunction is temporarily stored in the ECM memory. If the same malfunc–tion is detected again during the second drive test, this sec–ond detection causes the MIL to light up.

The 2 trip repeats the same mode a 2nd time. (However, the IG switch must be turned OFF between the 1 st trip and 2nd trip).

**Freeze frame data:**
Freeze frame data records the engine condition when a misfire (DTC P0300 – P0306) or fuel trim malfunction (DTC P0171, P0172), or other malfunction (first malfunc–tion only), is detected.
Because freeze frame data records the engine conditions (fuel system, calculator load, engine coolant temperature, fuel trim, engine speed, vehicle speed, etc.) when the mal–function is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.
**Priorities for Troubleshooting:**
If troubleshooting priorities for multiple diagnostic codes are given in the applicable diagnostic chart, these should be followed.
If no instructions are given, troubleshoot diagnostic trouble codes according to the following priorities.
(1) Diagnostic trouble codes other than fuel trim malfunc–tion (DTC P0171, P0172) and EGR (DTC P0401, P0402) and misfire (DTC P0300 – P0306).
(2) Fuel trim malfunction (DTC P0171, P0172) and EGR (DTC P0401, P0402)
(3) Misfire (DTC P0300 – P0306).

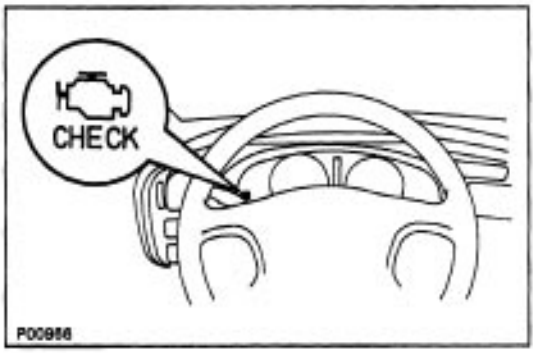



## DATA LINK CONNECTOR 3 INSPECTION

The vehicle's ECM uses V.P.W. (Variable Pulse Width) for communication to comply with SAE J1850. The terminal ar–rangement of DLC 3 complies with SAE J1962 and matches the V. P.W. format.

| Terminal No. | Connection | Voltage or Resistance | Condition |
|---|---|---|---|
| 2 | Bus (+) Line | Pulse generation | During transmission |
| 4 | Chassis Ground | ↔ Body Ground 1 0 or less | Always |
| 5 | Signal Ground | ↔ Body Ground 1 0 or less | Always |
| 16 | Battery Positive | ↔ Body Ground 9 – 14 V | Always |

HINT: If your display shows "UNABLE TO CONNECT TO VEHICLE" when you have connected the cable of the OBDII scan tool or TOYOTA hand–held tester to DLC 3, turned the ignition switch ON and operated the scan tool, there is a problem on the vehicle side or tool side.
1) If communication is normal when the tool is connected to another vehicle, inspect DLC 3 on the original vehicle.
2) If communication is still not possible when the tool is connected to another vehicle, the problem is probably in the tool itself, so consult the Service Department listed in the tool's instruction manual.



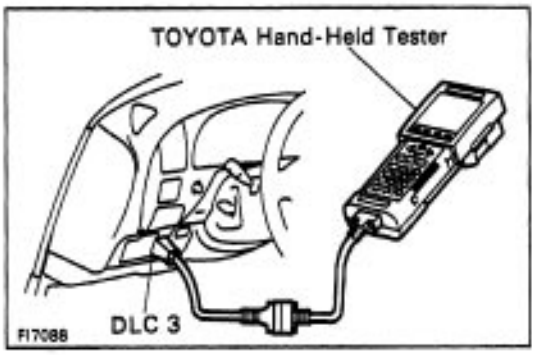

# Diagnosis Inspection (Normal Mode)

## MALFUNCTION INDICATOR LAMP CHECK

1. The malfunction indicator lamp comes on when the igni–tion switch is turned ON and the engine is not running.
HINT: If the malfunction indicator lamp does not light up, troubleshoot the combination meter.
(See page BE–64).
2. When the engine is started, the malfunction indicator lamp should go off. If the lamp remains on, the diagnosis system has detected a malfunction or abnormality in the system.

## DIAGNOSTIC TROUBLE CODE CHECK

**NOTICE (TOYOTA hand–held tester only): When the diag–nosis system is switched from normal mode to check mode, it erases all diagnostic trouble codes and freezed frame data recorded in normal mode. So before switching modes, always check the diagnostic trouble codes and freezed frame data, and note them down.**

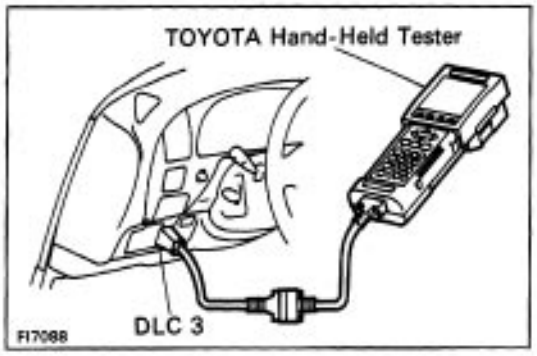


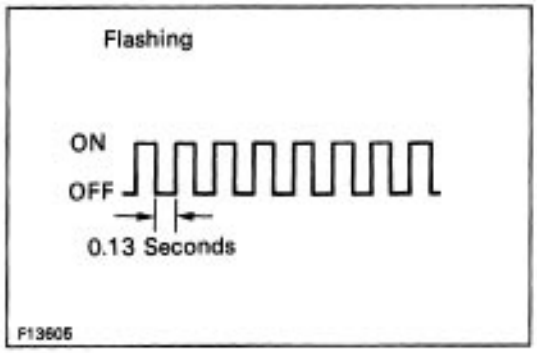

1. Prepare the OBDII scan tool (complying with SAE J1978) or TOYOTA hand–held tester.
2. Connect the OBDll scan tool or TOYOTA hand–held tester to data link connector 3 in the fuse box at the lower left of the instrument panel.
3. Turn the ignition switch ON and turn the OBDII scan tool or TOYOTA hand–held tester switch ON.
4. Use the OBDII scan tool or TOYOTA hand–held tester to check the diagnostic trouble codes and freezed frame data, note them down. (For operating instructions, see the OBDll scan tool's instruction book.)
5. See page EG2–404 to confirm the details of the diagnostic trouble codes.

**NOTICE: When simulating symptoms with an OBDll scan tool (excluding TOYOTA hand–held tester) to check the di–agnostic trouble codes, use normal mode. For codes on the diagnostic trouble code chart subject to "2 trip detection logic", turn the ignition switch OFF after the symptom is simulated the first time. Then repeat the simulation process again. When the problem has been simulated twice, the MIL lights up and the diagnostic trouble codes are recorded in the ECM .**

# Diagnosis Inspection (Check Mode)

TOYOTA HAND–HELD TESTER only
Compared to the normal mode, the check mode has an in–creased sensitivity to detect malfunctions.
Furthermore, the same diagnostic items which are detected in the normal mode can also be detected in the check mode.



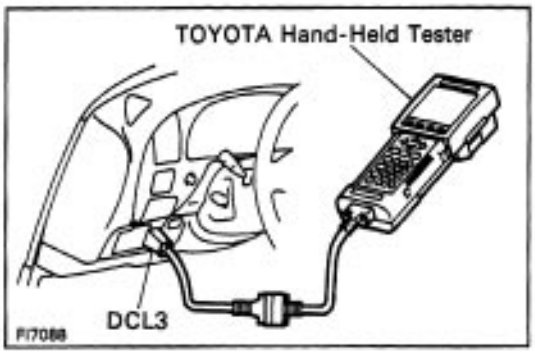




# DIAGNOSTIC TROUBLE CODE CHECK

1. Initial conditions.
(a) Battery positive voltage 11 V or more.
(b) Throttle valve fully closed.
(c) Transmission in park or neutral position.
(d) Air conditioning switched OFF.
2. Turn ignition switch OFF.
3. Prepare the TOYOTA hand–held tester.
4. Connect the TOYOTA hand–held tester to data link connector 3 in the fuse box at the lower left of the instrument panel.
5. Turn the ignition switch ON and switch the TOYOTA hand–held tester ON.
6. Switch the TOYOTA hand–held tester normal mode to check mode. (Check that the MIL flashes.)
7. Start the engine. (The MIL goes out after the engine start.)
8. Simulate the conditions of the malfunction described by the customer.

**NOTICE: Leave the ignition switch ON until you have checked the diagnostic trouble codes, etc.**

9. After simulating the malfunction conditions, use the TOYOTA hand–held tester diagnosis selector to check the diagnostic trouble codes and freezed frame data, etc.
HINT: Take care not to turn the ignition switch OFF. Turning the ignition switch OFF switches the diagnosis system from check mode to normal mode, so all diagnostic codes, etc. are erased.
10. After checking the diagnostic trouble code, inspect the applicable circuit.




# DIAGNOSTIC TROUBLE CODE CLEARANCE

The following actions will erase the diagnostic trouble codes and freezed frame data.
1. Operating the OBDII scan tool (complying with SAE J1978) or TOYOTA hand–held tester to erase the codes. (See the OBDII scan tool's instruction book for operating instructions.)
2. Disconnecting the battery terminals or EFI fuse.

**NOTICE: If the TOYOTA hand–held tester switches the ECM from normal mode to check mode or vice–versa, or if the ignition switch is turned from ON to ACC or OFF during check mode, the diagnostic trouble codes and freezed frame data will be erased.**

# DIAGNOSTIC TROUBLE CODE CHART (SAE Controlled)

HINT: Parameters listed in the chart may not be exactly the same as your reading due to the type of instrument or other factors.

| DTC No. | Detection Item | Diagnostic Trouble Code Detecting Condition |
|---|---|---|
| **P0100** | Mass Air Flow Circuit Malfunction | Open or short in mass air flow meter circuit with engine speed 4,000 rpm or less. |
| **P0101** | Mass Air Flow Circuit Range/ Performance Problem | Conditions a) and b) continue with engine speed 900 rpm or less. (2 trip detection logic)<br>a) Closed throttle position switch: ON<br>b) Mass air flow meter output ) ≧2.2 V |
| **P0110** | Intake Air Temp. Circuit Malfunction | Open or short in intake air temp. sensor circuit. |
| **P0115** | Engine Coolant Temp. Circuit Malfunction | Open or short in engine coolant temp. sensor circuit. |
| **P0116** | Engine Coolant Temp. Circuit Range/ Performance Problem | 20 min. or more after starting engine, engine coolant temp. sensor value is 30°C (86°F) or less. (2 trip detection logic) |
| **P0120** | Throttle Position Circuit Malfunction | Condition a) or b) continues.<br>a) VTA ≤ ( 0.1 V, and closed throttle position switch is OFF.<br>b) VTA ) ≧ 4.9 V |
| **P0121** | Throttle Position Circuit Range/ Performance Problem | When closed throttle position switch is ON, condition a) continues. (2 trip detection logic)<br>a ) VTA ) ≧ 2.0 V |
| **P0125** | Insufficient Coolant Temp. for Closed Loop Fuel Control | After the engine is warmed up, heated oxygen sensor output does not indicate RICH even once when conditions a) and b) continue for at least 2 minutes.<br>a) Engine speed: 1,500 rpm or more<br>b) Vehicle speed: 40 km/h (25 mph) or more |
| **P01 30** | Heated Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 1) | Voltage output of heated oxygen sensor remains at 0.4 V or more, or 0.55 V or less, during idling after the engine is warmed up. (2 trip detection logic) |
| **P0133** | Heated Oxygen Sensor Circuit Slow Response (Bank 1 Sensor 1) | Response time for the heated oxygen sensor's voltage output to change from rich to lean, or from lean to rich, is 1 sec. or more during idling after the engine is warmed up. (2 trip detection logic) |

If a malfunction code is displayed during the diagnostic trouble code check in check mode, check the circuit for that code listed in the table below (Proceed to the page given for that circuit).

| Trouble Area | MIL | Memory | See Page |
|---|---|---|---|
| • Open or short in mass air flow meter circuit.<br>• Mass air flow meter<br>• ECM | ○ | ○ | EG2–444 |
| • Mass air flow meter | ○ | ○ | EG2–450 |
| • Open or short in intake air temp. sensor circuit.<br>• Intake air temp. sensor<br>• ECM | ○ | ○ | EG2–451 |
| • Open or short in engine coolant temp. sensor circuit.<br>• Engine coolant temp. sensor<br>• ECM | ○ | ○ | EG2–457 |
| • Engine coolant temp. sensor<br>• Coolant system | ○ | ○ | EG2–462 |
| • Open or short in throttle position sensor circuit.<br>• Throttle position sensor.<br>• ECM | ○ | ○ | EG2–463 |
| • Throttle position sensor | ○ | ○ | EG2–472 |
| • Open or short in heated oxygen sensor circuit.<br>• Heated oxygen sensor. | ○ | ○ | EG2–473 |
| • Heated oxygen sensor<br>• Fuel trim malfunction | ○ | ○ | EG2–476 |
| • Heated oxygen sensor | ○ | ○ | EG2–480 |

# DIAGNOSTIC TROUBLE CODE CHART (Cont'd)

| DTC No. | Detection Item | Diagnostic Trouble Code Detecting Condition |
|---|---|---|
| P0135 | Heated Oxygen Sensor Heater Circuit Malfunction (Bank 1 Sensor 1) | When the heater operates, heater current exceeds 2 A or voltage drop for the heater circuit exceeds 5 V.<br>(2 trip detection logic) |
| | | Heater current of 0.25 A or less when the heater operates.<br>(2 trip detection logic) |
| P0136 | Heated Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 2) | Voltage output of the heated oxygen sensor (bank1 sensor 2) remains at 0.4 V or more or 0.5 V or less when the vehicle is driven at 50 km/h (31 mph) or more after the engine is warmed up.<br>(2 trip detection logic) |
| P0141 | Heated Oxygen Sensor Heater Circuit Malfunction (Bank 1 Sensor 2) | Same as DTC No. P01 35. |
| P0150 | Heated Oxygen Sensor Circuit Malfunction (Bank 2 Sensor 1) | Same as DTC No. P01 30. |
| P0153 | Heated Oxygen Sensor Circuit Slow Response (Bank 2 Sensor 1) | Same as DTC No. P01 33. |
| P0155 | Heated Oxygen Sensor Heater Circuit Malfunction (Bank 2 Sensor 1) | Same as DTC No. P01 35. |
| P0171 | System too Lean (Fuel Trim) | When the air fuel ratio feedback is stable after engine warming up, the fuel trim is considerably in error on the RICH side.<br>(2 trip detection logic) |
| P0172 | System too Rich (Fuel Trim) | When the air fuel ratio feedback is stable after engine warming up, the fuel trim is considerably in error on the LEAN side.<br>(2 trip detection logic) |
| P0201<br>P0202<br>P0203<br>P0204<br>P0205<br>P0206 | Injector Circuit Malfunction<br>– Cylinder 1<br>– Cylinder 2<br>– Cylinder 3<br>– Cylinder 4<br>– Cylinder 5<br>– Cylinder 6 | A specified cylinder misfire continuously.<br>(2 trip detection logic) |

| Trouble Area | MIL | Memory | See Page |
|---|---|---|---|
| • Open or short in heater circuit of heated oxygen sensor.<br>• Heated oxygen sensor heater<br>• ECM | ○ | ○ | EG2–481 |
| • Heated oxygen sensor | ○ | ○ | EG2–484 |
| • Same as DTC No. P01 35. | ○ | ○ | EG2–481 |
| • Same as DTC No. P01 30. | ○ | ○ | EG2–476 |
| • Same as DTC No. P01 33. | ○ | ○ | EG2–480 |
| • Same as DTC No. P01 35. | ○ | ○ | EG2–481 |
| • Air intake (hose loose)<br>• Fuel line pressure<br>• Injector blockage<br>• Heated oxygen sensor malfunction<br>• Mass air flow meter<br>• Engine coolant temp. sensor | ○ | ○ | EG2–486 |
| • Fuel line pressure<br>• Injector leak, blockage<br>• Heated oxygen sensor malfunction<br>• Mass air flow meter<br>• Engine coolant temp. sensor | ○ | ○ | EG2–486 |
| • Open or short in injector circuit<br>• Injector blockage, seized<br>• Ignition system<br>• Valve clearance not to specification<br>• Compression pressure | ○ | ○ | EG2–491 |

# DIAGNOSTIC TROUBLE CODE CHART (Cont'd)

| DTC No. | Detection Item | Diagnostic Trouble Code Detecting Condition |
|---|---|---|
| **P0300** | Random Misfire Detected | Misfiring of multiple cylinders is detected during the same 200 or 1,000 revolutions. |
| **P0301**<br>**P0302**<br>**P0303**<br>**P0304**<br>**P0305**<br>**P0306** | Misfire Detected<br>– Cylinder 1<br>– Cylinder 2<br>– Cylinder 3<br>– Cylinder 4<br>– Cylinder 5<br>– Cylinder 6 | For each 200 revolutions of the engine, misfiring is detected which can cause catalyst overheating.<br>(This causes MIL to blink.) |
| | | For each 1,000 revolutions of the engine, misfiring is detected which causes emissions deterioration.<br>(2 trip detection logic) |
| **P0325** | Knock Sensor 1 Circuit Malfunction | No knock sensor 1 signal to ECM with engine speed 2,000 rpm or more. |
| **P0330** | Knock Sensor 2 Circuit Malfunction | No knock sensor 2 signal to ECM with engine speed 2,000 rpm or more. |
| **P0335** | Crankshaft Position Sensor Circuit Malfunction | No crankshaft position sensor signal to ECM during cranking.<br>(2 trip detection logic) |
| | | No crankshaft position sensor signal to ECM during engine running. |
| **P0336** | Crankshaft Position Sensor Circuit Range/ Performance | Deviation in crankshaft position sensor signal and camshaft position sensor signal.<br>(2 trip detection logic) |
| **P0340** | Camshaft Position Sensor Circuit Malfunction | No camshaft position sensor signal to ECM during cranking.<br>(2 trip detection logic) |
| | | No camshaft position sensor signal to ECM during engine running. |
| **P0401** | Exhaust Gas Recirculation Flow Insufficient Detected | After the engine is warmed up and run at 80 km/h (50 mph) for 3 to 5 minutes, the EGR gas temperature sensor value does not exceed 40°C (104°F) above the ambient air temperature,<br>(2 trip detection logic) |

| Trouble Area | MIL | Memory | See Page |
|---|---|---|---|
| • Ignition system<br>• Injector<br>• Fuel line pressure<br>• EG R<br>• Compression pressure<br>• Valve clearance not to specification<br>• Valve timing<br>• Mass air flow meter<br>• Engine coolant temp. sensor | ○ | ○ | EG2–493 |
| • Open or short in knock sensor 1 circuit.<br>• Knock sensor 1 (looseness)<br>• ECM | ○ | ○ | EG2–499 |
| • Open or short in knock sensor 2 circuit.<br>• Knock sensor 2 (looseness)<br>• ECM | ○ | ○ | EG2–499 |
| • Open or short in crankshaft position sensor circuit.<br>• Crankshaft position sensor<br>• Starter<br>• ECM | ○ | ○ | EG2–503 |
| • Mechanical system malfunction (skipping teeth of timing belt, belt stretched)<br>• ECM | ○ | ○ | EG2–507 |
| • Open or short in camshaft position sensor circuit.<br>• Camshaft position sensor<br>• Starter<br>• ECM | ○ | ○ | EG2–508 |
| • EGR valve stuck closed<br>• Short in EGR VSV circuit<br>• Open in EGR gas temp. sensor circuit<br>• EGR hose disconnected<br>• ECM | ○ | ○ | EG2–512 |

# DIAGNOSTIC TROUBLE CODE CHART (Cont'd)

| DTC No. | Detection Item | Diagnostic Trouble Code Detecting Condition |
|---|---|---|
| **P0402** | Exhaust Gas Recirculation Flow Excessive Detected | EG R gas temp. sensor value is high during EGR cut–off when engine is cold (Race engine at about 4,000 rpm without load so that vacuum is applied to port E).<br>(2 trip detection logic) |
| | | EG R valve is always open.<br>(2 trip detection logic) |
| **P0420** | Catalyst System Efficiency Below Threshold | After the engine is warmed up and the vehicle driven for 5 min. at 32 – 80 km/h (20 – 50 mph), the waveforms of the heated oxygen sensors, bank 1, 2 sensor 1 and bank 1 sensor 2 have the same amplitude. |
| **P0500** | Vehicle Speed Sensor Malfunction | No vehicle speed sensor signal to ECM under conditions a) and b).<br>a) Park/neutral position switch is OFF.<br>b) Vehicle is being driven. |
| **P0505** | Idle Control System Malfunction | Idle speed continues to vary greatly from the target speed.<br>(2 trip detection logic) |
| **P0510** | Closed Throttle Position Switch Malfunction | The closed throttle position switch does not turn ON even once when the vehicle is driven.<br>(2 trip detection logic) |

| Trouble Area | MIL*1 | Memory | See Page |
|---|---|---|---|
| • EGR valve stuck open<br>• EGR VSV open malfunction<br>• Open in EGR VSV circuit<br>• Short in EGR gas temp. senor circuit<br>• ECM | O | O | EG2–527 |
| • Three–way catalytic converter<br>• Open or short in heated oxygen sensor circuit<br>• Heated oxygen sensor | O*2 | O | EG2–534 |
| • Open or short in vehicle speed sensor circuit.<br>• Vehicle speed sensor<br>• Combination meter<br>• ECM | O | O | EG2–537 |
| • IAC valve is stuck or closed<br>• Open or short in IAC valve circuit<br>• Air conditioner idle up VSV<br>• Air intake (hose loose) | O | O | EG2–541 |
| • Open in closed throttle position switch circuit.<br>• Closed throttle position switch<br>• ECM | O | O | EG2–546 |

*1.... MIL does not light up
O .... MIL lights up
O .... MIL lights up, 0/D OFF indicator light blinks
*2.... MIL lights up only on USA specification vehicles.

# DIAGNOSTIC TROUBLE CODE CHART (Cont'd)

| DTC No. | Detection Item | Diagnostic Trouble Code Detecting Condition |
|---|---|---|
| **P0720** | Output Speed Sensor Circuit Malfunction (for Electronically Controlled Transaxle) | DTC No. P0500 is detected. |
| **P0750** | Shift Solenoid A Malfunction (Shift Solenoid Valve No.1) | During normal driving the gear required by the ECM does not match the actual gear, (2 trip detection logic) |
| **P0753** | Shift Solenoid A Electrical (Shift Solenoid Valve No,1) | Open or short in shift solenoid valve No.1 circuit. |
| **P0755** | Shift Solenoid6 Malfunction (Shift Solenoid Valve No.2) | Same as for DTC No. P0750. |
| **P0758** | Shift Solenoid B Electrical (Shift Solenoid Valve No.2) | Open or short in shift solenoid valve No.2 circuit. |
| **P0770** | Shift Solenoid E Malfunction (Shift Solenoid Valve SL) | Lock–up does not occur when driving in the lock–up range (normal driving at 80 km/h [50 mph]), or lock–up remains ON in the lock–up OFF range. (2 trip detection logic) |
| **P0773** | Shift Solenoid E Electrical (Shift Solenoid Valve SL) | Open or short in shift solenoid valve SL circuit. (2 trip detection logic) |

| Trouble Area | MIL* | Memory | See Page |
|---|---|---|---|
| • Same as for DTC No. P0500. | ◎ | ○ | AX2–92 |
| • Shift solenoid valve No.1 is stuck open or closed.<br>• Valve body is blocked up or stuck. | ◎ | ○ | AX2–96 |
| • Open or short in shift solenoid valve No.1 circuit.<br>• Shift solenoid valve No.1<br>• ECM | ◎ | ○ | AX2–98 |
| • Shift solenoid valve No.2 is stuck open or closed. | ◎ | ○ | AX2–96 |
| • Open or short in shift solenoid valve No.2 circuit.<br>• Shift solenoid valve No.2<br>• ECM | ◎ | ○ | AX2–98 |
| • Shift solenoid valve SL is stuck open or closed.<br>• Lock–up clutch<br>9 Valve body is blocked up or stuck. | ◎ | ○ | AX2–102 |
| • Open or short in shift solenoid valve SL circuit.<br>• Shift solenoid valve SL<br>• ECM | ◎ | ○ | AX2–104 |

***** – . . . . . MIL does not light up
O . . . . .MIL lights up
◎ . . . . MIL lights up, 0/D OFF indicator light blinks

# DIAGNOSTIC TROUBLE CODE CHART (Manufacturer Controlled)

| DTC No. | Detection Item | Diagnostic Trouble Code Detecting Condition |
|---|---|---|
| **P1300** | Igniter Circuit Malfunction | No IGF signal to ECM for 6 consecutive IGT signals during engine running. |
| **P1500** | Starter Signal Circuit Malfunction | No starter signal to ECM. |
| **P1600** | ECM BATT Malfunction | Open in back up power source circuit. |
| **P1605** | Knock Control CPU Malfunction | Engine control computer malfunction (for knock control). |
| **P1705** | ”NC2” Revolution Sensor Circuit Malfunction (Direct Clutch Speed Sensor) | Output of direct clutch speed sensor (NC2) is 300 rpm or less under conditions a) and b).<br>(2 trip detection logic)<br>a) Vehicle speed: 32 km/h (20 mph) or more<br>b) Park/neutral position switch: OFF |
| **P1765** | Linear Solenoid for Accumulator Pressure Control Circuit Malfunction (Shift Solenoid Valve SLN) | After the engine is warmed up, the current flow to the shift solenoid valve SLN is 0.2 A or less for at least 1 sec. under condition a) or b).<br>(2 trip detection logic)<br>a) Engine speed: 500 rpm or more<br>b) Park/neutral position switch: ON (P or N position) |
| **P1780** | Park/Neutral Position Switch Malfunction | Two or more switches are ON simultaneously for ”N”, ”2” and ”L” position.<br>(2 trip detection logic) |
| | | When driving under conditions a) and b)for 30 sec. or more, the park/neutral position switch is ON (N position).<br>(2 trip detection logic)<br>a) Vehicle speed: 70 km/h (44 mph) or more<br>b) Engine speed: 1,500 – 2,500 rpm |

| Trouble Area | MIL* | Memory | See Page |
|---|---|---|---|
| • Open or short in IGF or IGT circuit from igniter to ECM.<br>• Igniter<br>• ECM | O | O | EG2–550 |
| • Open or short in starter signal circuit.<br>• Open or short in ignition switch or starter relay circuit,<br>• ECM | – | O | EG2–557 |
| • Open in back up power source circuit.<br>• ECM | O | O | EG2–559 |
| • ECM | O | O | EG2–561 |
| • Open or short in direct clutch speed sensor circuit.<br>• Direct clutch speed sensor<br>• ECM | ◎ | O | AX2–108 |
| • Open or short in shift solenoid valve SLN circuit.<br>• Shift solenoid valve SLN<br>• ECM | – | O | AX2–112 |
| • Short in park/neutral position switch circuit.<br>• Park/neutral position switch<br>• ECM | O | O | EG2–562 |

*: – . . . . . MIL does not light up
O . . . . MIL lights up
◎ . . . . MIL lights up, 0/D OFF indicator light blinks

# FAIL–SAFE CHART

If any of the following codes is recorded, the ECM enters fail–safe mode.

| DTC No. | Fail–Safe Operation | Fail–safe Deactivation Conditions |
|---|---|---|
| P0100 | • Ignition timing fixed at $5_2$ BTDC.<br>• Injection time fixed<br>Starting ..... 11.0 m sec.<br>CTP Switch ON ..... 3.5 m sec.<br>CTP Switch OFF ..... 6.3 m sec. | Returned to normal condition |
| P0110 | Intake air temp. is fixed at $68_2$F ($20_2$C). | Returned to normal condition |
| P0115 | Engine coolant temp. is fixed at $176_2$F ($80_2$C). | Returned to normal condition |
| P0120 | VTA is fixed at $0_2$. | The following condition must be repeated at least 2 times consecutively.<br>When closed throttle position switch is ON:<br>0.1 V ≤ VTA ≧ 0.95 V |
| P0135<br>P0141<br>P0155 | The heater circuit in which an abnormality is detected is turned off. | Ignition switch OFF |
| P0325<br>P0330 | Max. timing retardation. | Ignition switch OFF |
| P0720 | Gears are shifted according to the engine rpm and throttle angle. | Returned to normal condition |
| P0753 | Power to the solenoid valve and lock–up solenoid valve is cut off. | Returned to normal condition |
| P0758 | Power to the solenoid valve and lock–up solenoid valve is cut off. | Returned to normal condition |
| P0773 | Power to the solenoid valve is cut off. | Returned to normal condition |
| P1300 | Fuel cut | IGF signal is detected for 6 consecutive ignitions. |
| P1605 | Max. timing retardation. | Returned to normal condition |
| P1766 | Power to the solenoid valve is cut off. | Returned to normal condition |

**Back–up Function**

If there is trouble with the program in the ECM and ignition signals (IGT) are not output from the microcomputer, the ECM controls fuel injection and ignition timing at predetermined levels as a back–up function to make it possible to continue to operate the vehicle.

Furthermore, the injection duration is calculated from the starting signal (STA) and the closed throttle position switch signal (IDL). Also, the ignition timing is fixed at $5_2$ BTDC, without relation to the engine speed,

HINT: If the engine is controlled by the back–up function, the malfunction indicator lamp lights up to warn the driver of the malfunction but the diagnostic trouble code is not output.

# CHECK FOR INTERMITTENT PROBLEMS

TOYOTA HAND–HELD TESTER only

By putting the vehicle's ECM in check mode, 1 trip detection logic is possible instead of 2 trip detection logic and sensitivity to detect open circuits is increased. This makes it easier to detect intermittent problems.

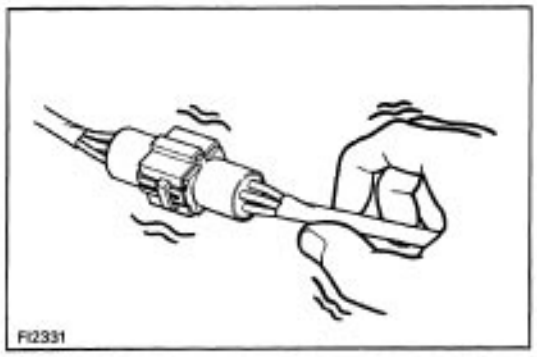
## CLEAR DIAGNOSTIC TROUBLE CODES

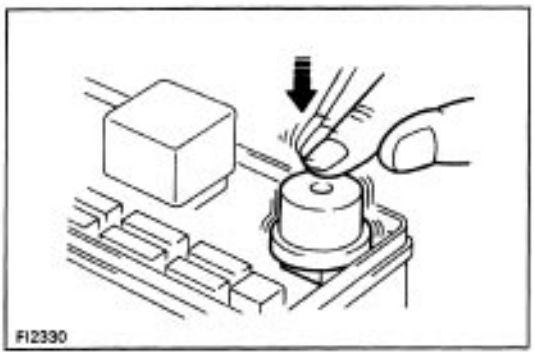
**See page** EG2–403

## SET CHECK MODE

**See page** EG2–403

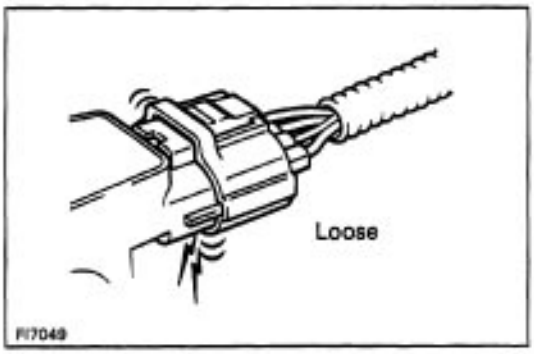
## PERFORM A SIMULATION TEST

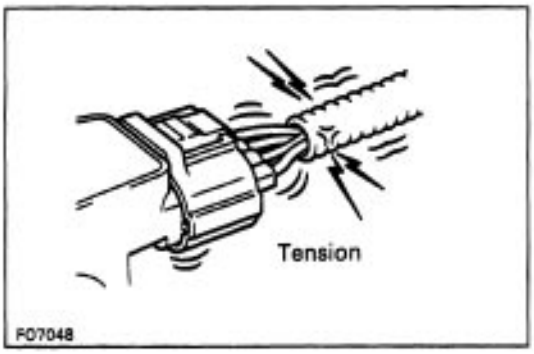



Using the symptom simulation (see page IN–24), shake and pull lightly on the wire harness, connector or terminals in the circuit indicated by the malfunction code. In this test, if the malfunction indicator lamp lights up, it indicates that the place where the wire harness, connector or terminals being pulled or shake has faulty contact. Check that point for loose connec–tions, dirt on the terminals, poor fit or other problems and repair as necessary.

HINT: After cancelling out the diagnostic trouble code in memory and setting the check mode, if the malfunction indi–cator lamp does not go off after the engine is started, check thoroughly for faulty contacts, etc., then try the check again. If the malfunction indicator lamp still does not go off, check and replace the ECM.




## CONNECTOR CONNECTION AND TERMINAL INSPECTION

When checking for an open circuit or short circuit, it is impor–tant to check the connector connection and the condition of the terminals.

OPEN CIRCUIT:

This could be due to a disconnected wire harness, faulty con–tact in the connector, a connector terminal pulled out, etc.

HINT:

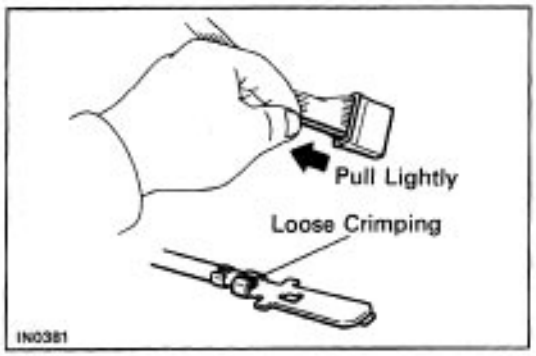
1. A wire rarely breaks in the middle of it's length. Most cases occur at the connector. In particular, carefully check the connectors of sensors and actuators.
2. Faulty contact could be due to rusting of the connector terminals, to foreign materials entering the terminals or a drop in the contact pressure between the male and fe–male terminals of the connector. Simply disconnecting and reconnecting the connectors once changes the con–dition of the connection and may result in a return to normal operation. Therefore, in troubleshooting, if no abnormality is found in the wire harness and connector check, but the problem disappears after the check, them the cause is considered to be in the wire harness or con–nectors.

SHORT CIRCUIT:

This could be due to a short circuit between the wire harness and the body ground or to a short inside the switch, etc.

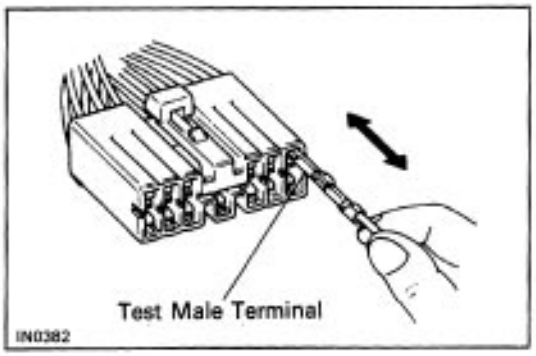
HINT:

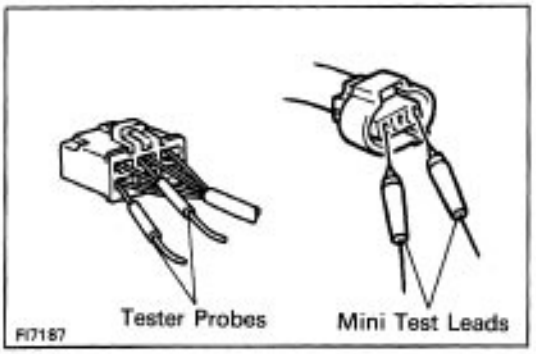
When there is a short between the wire harness and body ground, check thoroughly whether the wire harness is caught in the body or is clamped properly.




## VISUAL CHECK AND CONTACT PRESSURE CHECK

(a) Disconnect the connectors at both ends.
(b) Check for rust or foreign material, etc. on the terminals of the connectors.
(c) Check crimped portions for looseness or damage and check if the terminals are secured in the lock position.
HINT: The terminals should not come out when pulled lightly.
(d) Prepare a test male terminal and insert it in the female terminal, then pull it out.
**NOTICE: When testing a gold–plated female terminal, always use a gold–plated male terminal.**
HINT: When the test terminal is pulled out more easily than others, there may be poor contact in that section.




## CONNECTOR HANDLING

When inserting tester probes into a connector, insert them from the rear of the connector. When necessary, use mini test leads. For water resistant connectors which cannot be accessed from behind, take good care not to deform the connector terminals.

# BASIC INSPECTION

When the normal code is displayed in the diagnostic trouble code check, troubleshooting should be performed in the order for all possible circuits to be considered as the causes of the problems.
In many cases, by carrying out the basic engine check shown in the following flow chart, the location causing the problem can be found quickly and efficiently. Therefore, use of this check is essential in engine troubleshooting.

**1** **Is battery positive voltage 11 V or more when engine is stopped?**

**YES**

**NO** → **Charge or replace battery.**

**2** **Is engine cranked?**

**YES**

**NO** → **Proceed to page ST–47, 63 and continue to troubleshoot.**

**3** **Does engine start?**

**YES**

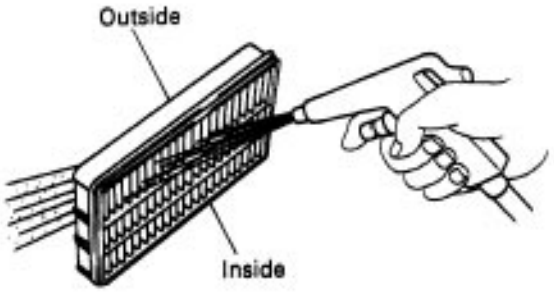
**NO** → **Go to step 7**

**4** **Check air filter.**

P Remove air filter.

C Visually check that the air cleaner element is not damaged or excessively oily.

Hint If necessary, clean element with compressed air. First blow from inside thoroughly, then blow from outside of element.



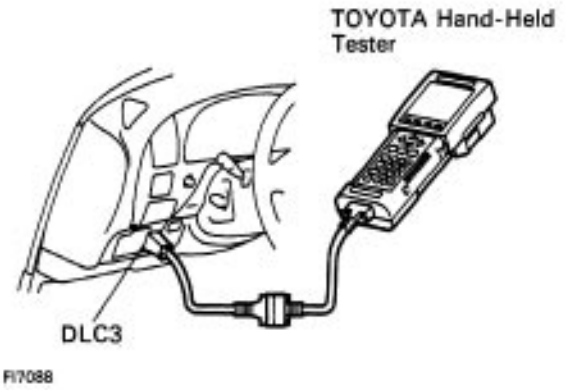

P00495

**OK**

**NG** → **Repair or replace.**

**Go to step 5**

**5** **Check idle speed.**




P (1) Warm up engine to normal operating temperature.
(2) Switch off all accessories.
(3) Switch off air conditioning.
(4) Shift transmission into ”N” position.
(5) Connect the OBDII scan tool or TOYOTA hand–held tester to data link connector 3 on the vehicle.

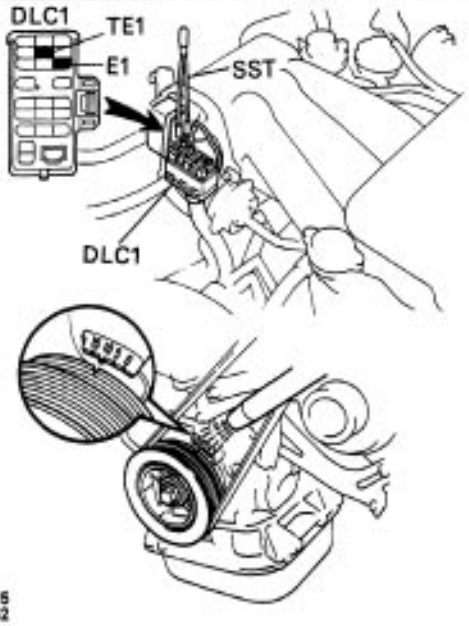
C Use CURRENT DATA to check the engine idle speed.

OK **Idle speed: 650 – 750 rpm**

OK

NG **Proceed to matrix chart of problem symptoms on page EG2–435.**

**6** **Check ignition timing.**




P (1) Warm up engine to normal operating temperature.
(2) Shift transmission into ”N” position.
(3) Keep the engine speed at idle.
(4) Using SST, connect terminals TE1 and E1 of data link connector 1.
SST 09843–18020
(5) Using a timing light, connect the tester to check wire. (See page IG–81)

C Check ignition timing.

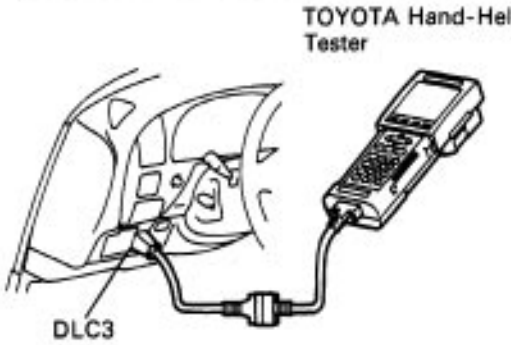
OK **Ignition timing: $10_2$ BTDC at idle**

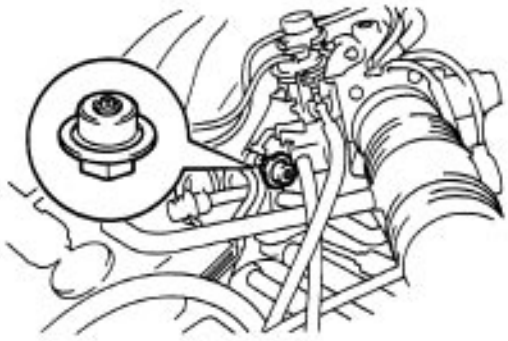
OK

NG **Proceed to page IG–80 and continue to troubleshoot.**

**Proceed to matrix chart of problem symptoms on page EG2–435.**

**7** **Check fuel pressure.**



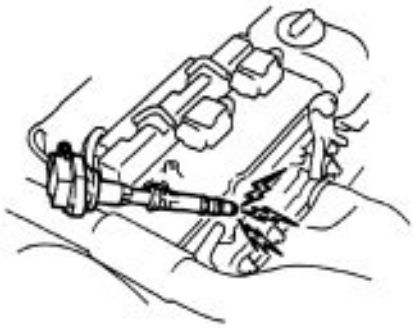

P (1) Be sure that enough fuel is in the tank.
(2) Turn ignition switch ON.
(3) Connect the TOYOTA hand–held tester to data link connector 3 on the vehicle.
(4) Use ACTIVE TEST mode to operate the fuel pump.

C Check that the pulsation damper screw rises up when the fuel pump operates.

OK

NG **Proceed to page EG2–230 and continue to troubleshoot.**

**8** **Check for spark.**




P (1) Remove ignition coil (See page IG–89). .
(2) Remove spark plug.
(3) Install the spark plug to the ignition coil, and connect the ignition coil connector.
(4) Ground the spark plug.
(5) Disconnect injector connector.

C Check if spark occurs while engine is being cranked.

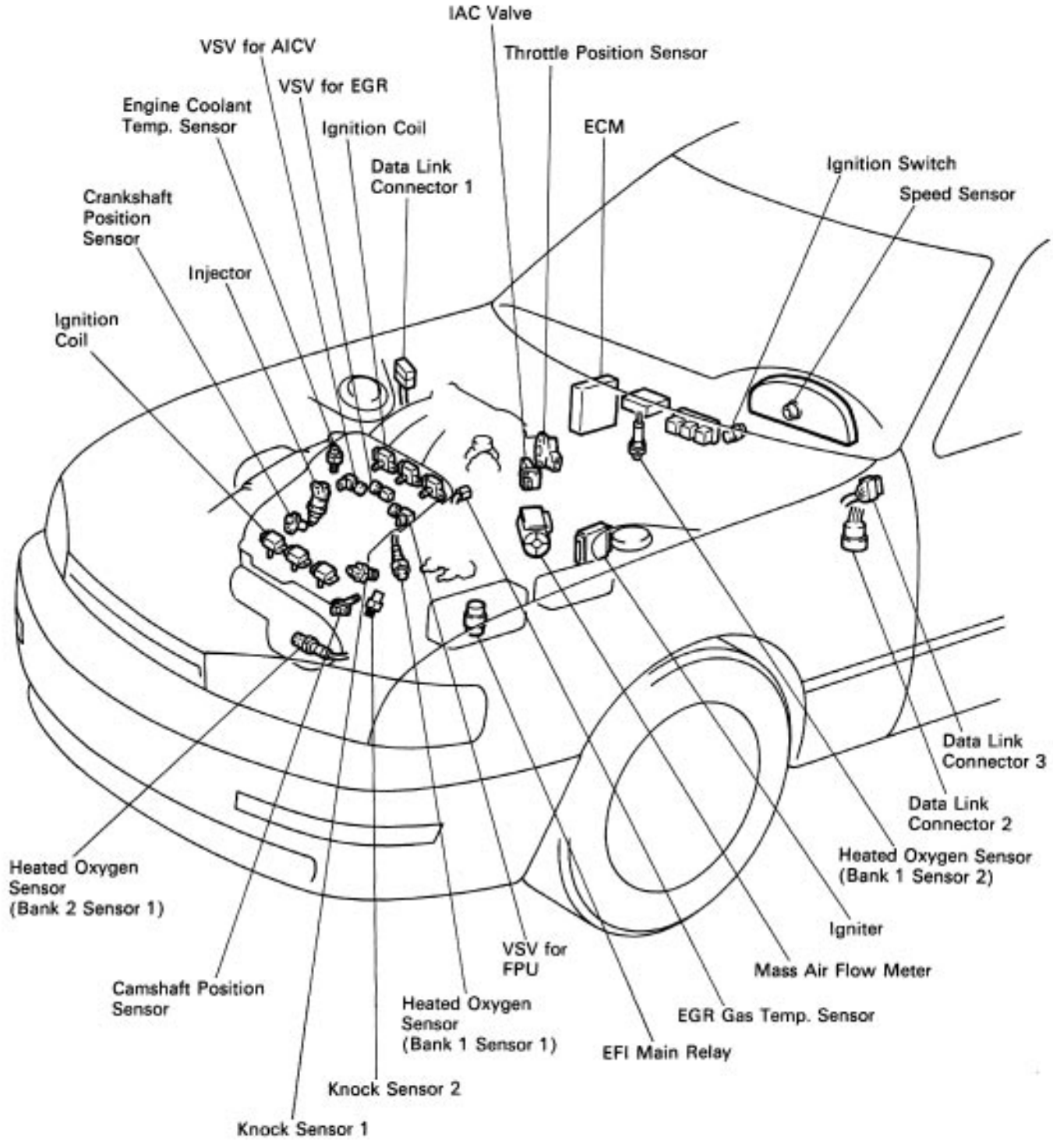
**NOTICE: To prevent excess fuel being injected from the injectors during this test, don't crank the engine for more than 5 –10 seconds at a time.**

OK

NG **Proceed to page IG–87 and continue to troubleshoot.**

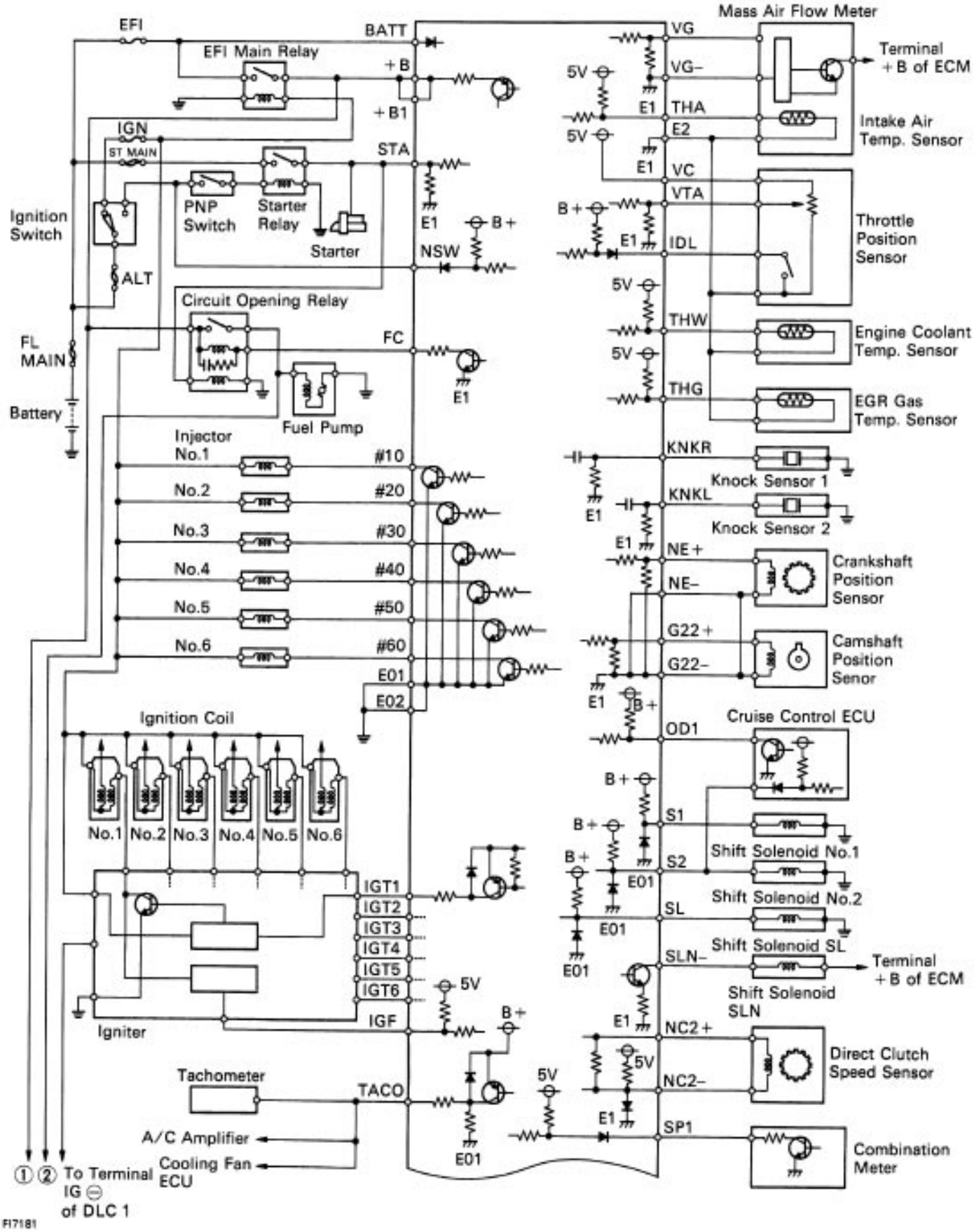
**Proceed to matrix chart of problem systems on page EG2–435.**

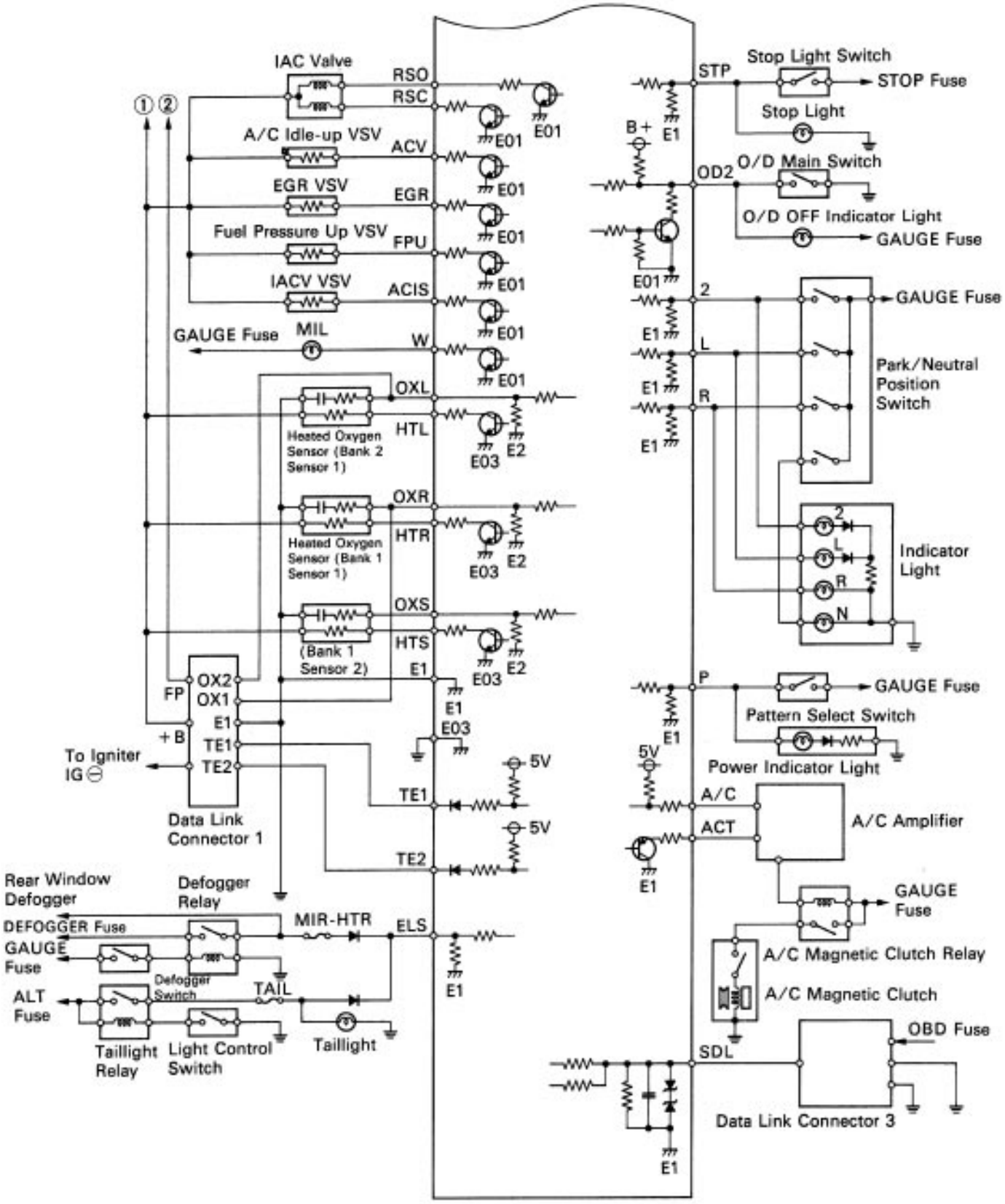
# PARTS LOCATION




FI7089

# WIRING DIAGRAM



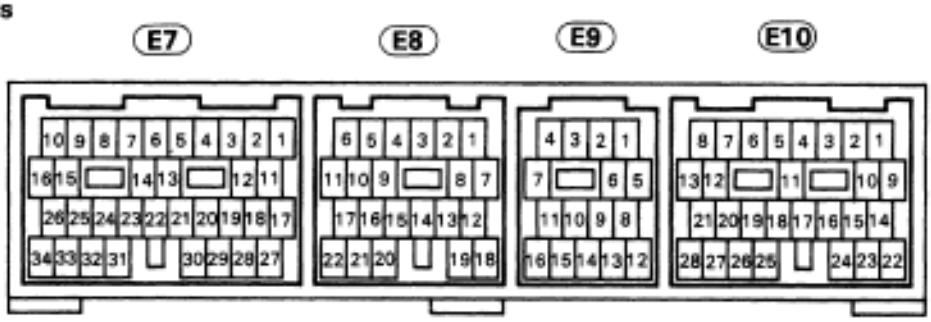



FI7145

# TERMINALS OF ECM

When measuring the voltage or resistance of the connector part of the ECM, always insert the test probe into the connector from the wire harness side.

**ECM Terminals**



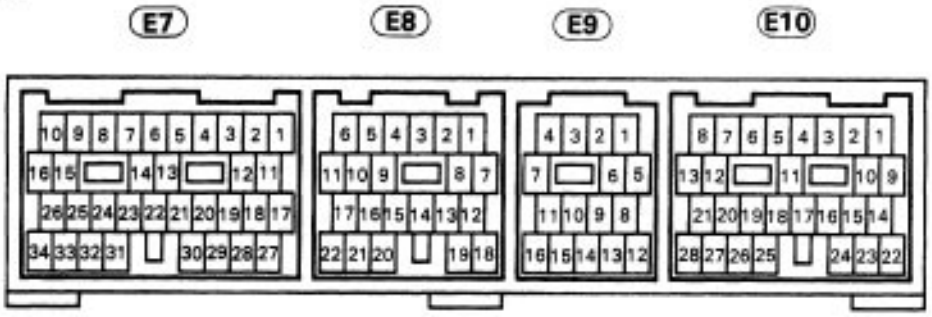

FI6810

| Terminal No. | Symbol | Connection | Terminal No. | Symbol | Connection |
|---|---|---|---|---|---|
| E7- 1 | – | ——— | E7–15 | IG T3 | Igniter |
| 2 | – | ——— | 16 | IG T2 | Igniter |
| 3 | SLN ⊖ | Shift solenoid SLN | 17 | S2 | Shift Solenoid No.2 |
| 4 | – | | 18 | – | |
| 5 | #60 | Injector (No.6) | 19 | – | ——— |
| 6 | #50 | Injector (No.5) | 20 | – | ——— |
| 7 | #40 | Injector (No.4) | 21 | – | ——— |
| 8 | #30 | Injector ( No.3 ) | 22 | RSC | IAC valve |
| 9 | #20 | Injector (No.2) | 23 | RSO | IAC valve |
| 10 | #10 | Injector (No.1) | 24 | IGT1 | Igniter |
| 11 | S1 | Shift solenoid No.1 | 25 | FPU | Fuel pressure up VSV |
| 12 | IGF | Igniter | 26 | IGT4 | Igniter |
| 13 | STA | Starter relay | 27 | SL | Shift solenoid SL |
| 14 | NSW | Park/Neutral position switch | 28 | E03 | Oxygen sensor heater ground |

| Terminal No. | Symbol | Connection | Terminal No. | Symbol | Connection |
|---|---|---|---|---|---|
| E7-29 | IGT6 | Igniter | E8-19 | OXL | Heated oxygen sensor (Bank 2 Sensor 1) |
| 30 | IGT5 | Igniter | 20 | THW | Engine coolant temp. sensor |
| 31 | – | ——— | 21 | THA | Intake air temp. sensor |
| 32 | IDL | Throttle position sensor | 22 | E2 | Sensor ground |
| 33 | E02 | Power ground | E9- 1 | ACV | A/C idle–up VSV |
| 34 | E01 | Power ground | 2 | – | ——— |
| E8- 1 | VC | Throttle position sensor | 3 | W | Malfunction indicator lamp |
| 2 | – | | 4 | – | ——— |
| 3 | – | | 5 | TE1 | Data link connector 1 |
| 4 | NC2 ⊖ | Direct clutch speed sensor | 6 | ACIS | Intake air control valve VSV |
| 5 | NE ⊕ | Crankshaft position sensor | 7 | VG ⊖ | Mass air flow meter |
| 6 | NE ⊖ | Crankshaft position sensor | 8 | – | ——— |
| 7 | VTA | Throttle position sensor | 9 | – | ——— |
| 8 | VG | Mass air flow meter | 10 | HTL | Heated oxygen sensor heater (Bank 2 Sensor 1 ) |
| 9 | NC2 ⊕ | Direct clutch speed sensor | 11 | HTR | Heated oxygen sensor heater (Bank 1 Sensor 1) |
| 10 | – | ——— | 12 | EGR | EGR VSV |
| 11 | – | | 13 | – | ——— |
| 12 | – | ——— | 14 | THG | EG R gas temp. sensor |
| 13 | OXR | Heated oxygen sensor (Bank 1 Sensor 1) | 15 | – | ——— |
| 14 | KNKL | Knock sensor 2 | 16 | E1 | ECM ground |
| 15 | KNKR | Knock sensor 1 | E10- 1 | – | ——— |
| 16 | G22 ⊕ | Camshaft position sensor | 2 | L | Park/Neutral position switch |
| 17 | G22 ⊖ | Camshaft position sensor | 3 | P | Electronically controlled transmission select switch |
| 18 | FC | Circuit opening relay | 4 | – | ——— |

# TERMINALS OF ECM (Cont'd)

**ECM Terminals**




FI6810

| Terminal No. | Symbol | Connection | Terminal No. | Symbol | Connection |
|---|---|---|---|---|---|
| E10- 5 | ACT | A/C control assembly | E10-17 | – | ——— |
| 6 | OD2 | 0/D main switch | 18 | – | ——— |
| 7 | OD1 | Cruise control ECU | 19 | – | ——— |
| 8 | – | ——— | 20 | A/C | A/C control assembly |
| 9 | – | ——— | 21 | ELS | Defogger relay<br>Taillight relay |
| 10 | 2 | Park/Neutral position switch | 22 | +B | EFI Main relay |
| 11 | – | ——— | 23 | +B1 | EFI Main relay |
| 12 | SP1 | Vehicle speed sensor | 24 | STP | Stop light switch<br>Stop light |
| 13 | TACO | Tachometer | 25 | HTS | Heated oxygen sensor heater<br>(Bank 1 Sensor 2) |
| 14 | BATT | Battery | 26 | OXS | Heated oxygen sensor<br>(Bank 1 Sensor 2) |
| 15 | R | Park/Neutral position switch | 27 | – | ——— |
| 16 | – | ——— | 28 | SDL | Data link connector 3 |

– MEMO –

# STANDARD VALUE OF ECM TERMINALS

| Symbols (Terminals No.) | Wiring Color | STD Voltage (V) | Condition |
|---|---|---|---|
| BATT (E10-14) – E1 (E9-16) | W-L ↔ BR | 9 ~ 14 | Always |
| +B (E10-22)<br>+B1 (E10-23) – E1 (E9-16) | B-O<br>B-O ↔ BR | 9 ~ 14 | IG switch ON |
| VC (E8-1) – E2 (E8-22) | L-R ↔ BR | 4.5 ~ 5.5 | IG switch ON |
| IDL (E7-32) – E2 (E8-22) | L ↔ BR | 0 ~ 3 | IG switch 0 N<br>Throttle valve fully closed. |
| | | 9 ~ 14 | IG switch ON<br>Throttle valve fully open. |
| VTA (E10-7) – E2 (E8-22) | B-Y ↔ BR | 0.3 ~ 0.8 | IG switch ON<br>Throttle valve fully closed. |
| | | 3.2 ~ 4.9 | IG switch O N<br>Throttle valve fully open. |
| VG (E8-8) – VG – (E9-7) | R ↔ R-B | 1.1 – 1.5 | Idling, P or N Position, A/C switch off. |
| THA (E8-21) – E2 (E8-22) | L-B ↔ BR | 0.5 ~ 3.4 | Idling, Intake air temp. 20°C (68°F) |
| THW (E8-20) – E2 (E8-22) | G-B ↔ BR | 0.2 ~ 1.0 | Idling, Engine coolant temp. 80°C (176°F) |
| STA (E7-13) – E1 (E9-16) | B-W ↔ BR | 6.0 or more | Cranking |
| #10 (E7-10)<br>#20 (E7-9)<br>#30 (E7-8)<br>#40 (E7-7)<br>#50 (E7-6)<br>#60 (E7-5) – E01 (E7-34) | W<br>Y<br>GR<br>L<br>R<br>G ↔ W-B | 9 ~ 14 | IG switch 0 N |
| | | Pulse generation (See page EG2–492) | Idling |
| IGT1 (E7-24)<br>IGT2 (E7-16)<br>IGT3 (E7-15)<br>IGT4 (E7-26)<br>IGT5 (E7-30)<br>IGT6 (E7-29) – E1 (E9-16) | W-G<br>Y-R<br>GR-B<br>L-B<br>R-B<br>G-R ↔ BR | Pulse generation (See page EG2–556) | Idling |
| IGF (E7-12) – E1 (E9-16) | W-R ↔ BR | 4.5 ~ 5.5 | IG switch ON |
| | | Pulse generation (See page EG2–556) | Idling |
| G22 ⊕ (E8-16) – G22 ⊖ (E8-17) | B-W ↔ L | Pulse generation (See page EG2–505) | Idling |
| NE ⊕ (E8-5) – NE ⊖ (E8-6) | R ↔ G | Pulse generation (See page EG2–505) | Idling |
| FPU (E7-25) – E1 (E9-16) | B-R ↔ BR | 9 ~ 14 | IG switch ON |
| | | 0 ~ 3 | Restarting at high engine coolant temp. |
| ELS (E10-21) – E1 (E9-16) | B-R ↔ BR | 7.5 ~ 14 | Defogger switch and taillight switch ON. |
| | | 0 ~ 1.5 | Defogger switch and taillight switch OFF. |
| EGR (E9-12) – E1 (E9-16) | B-L ↔ BR | 9 ~ 14 | IG switch ON |
| ACIS (E9-6) – E1 (E9-16) | R-Y ↔ BR | 9 ~ 14 | IG switch ON |

# STANDARD VALUE OF ECM TERMINALS (Cont'd)

| Symbols (Terminals No.) | Wiring Color | STD Voltage (V) | Condition |
|---|---|---|---|
| RSC (E7-22) – E1 (E9-16)<br>RSO (E7-23) – E1 (E9-16) | Y-B ↔ BR<br>G-B ↔ BR | 9 ~ 14 | IG switch ON<br>Disconnect (E7)of ECM connector |
| ACV (E9-1) – E1 (E9-16) | W-L ↔ BR | 0 ~ 3 | Idling, A/C switch ON |
| | | 9 ~ 14 | Idling, A/C switch OFF |
| OXR (E8-13) – E1 (E9-16)<br>OXL (E8-19) – E1 (E9-16) | R-L ↔ BR<br>R-L ↔ BR | Pulse generation | Maintain engine speed at 2,500 rpm for 2 mins. after warming up. |
| HTL (E9-10)<br>HTR (E9-11) – E03 (E7-28)<br>HTS (E10-25) | V-R<br>L-B ↔ W-B<br>P-B | Below 3.0 | Idling |
| | | 9 ~ 14 | IG switch 0 N |
| KNKR (E8-15) – E1 (E9-16)<br>KNKL (E8-14) – E1 (E9-16) | W ↔ BR<br>W ↔ BR | Pulse generation (See page EG-502) | Idling |
| NSW (E7-14) – E1 (E9-16) | B-W ↔ BR | 9 ~ 14 | IG switch ON<br>Other shift position in "P", "N" position |
| | | 0 ~ 3.0 | IG switch ON<br>Shift position in "P", "N" position |
| SP1 (E10-12) – E1 (E9-16) | V-Y ↔ BR | Pulse generation | IG switch 0 N<br>Rotate driving wheel slowly. |
| TE1 (E9-5) – E1 (E9-16) | GR-B ↔ BR | 4.5 ~ 5.5 | IG switch ON |
| OD1 (E10-7) – E1 (E9-16) | Y-B ↔ BR | 4.5 ~ 5.5 | IG switch ON |
| ACT (E10-5) – E1 (E9-16) | LG-B ↔ BR | 4.5 ~ 5.5 | Idling, A/C switch ON |
| | | Below 2.0 | Idling, A/C switch OFF |
| A/C (E10-20) – E1 (E9-16) | B-Y ↔ BR | Below 2.0 | Idling, A/C switch ON |
| | | 4.5 ~ 5.5 | Idling, A/C switch OFF |

# ENGINE OPERATING CONDITION

**NOTICE: The values given below for ”Normal Condition” are representative values, so a vehicle may still be normal even if its value varies from those listed here. So do not decide whether a part is faulty or not solely according to the ”Normal Condition” here.**

## CARB Mandated Signals

| TOYOTA hand–held tester display | Measurement Item | Normal Condition |
|---|---|---|
| FUEL SYS #1 | Fuel System Bank 1<br>OPEN: Air–fuel ratio feedback stopped<br>CLOSED: Air–fuel ratio feedback operating | Idling after warning up:<br>CLOSED |
| FUEL SYS #2 | Fuel System Bank 2<br>OPEN: Air–fuel ratio feedback stopped<br>CLOSED: Air–fuel ratio feedback operating | Idling after warning up,<br>CLOSED |
| CALC LOAD | Calculator Load:<br>Current intake air volume as a proportion of max. intake air volume | Idling: 12.9 – 25.2%<br>Racing without load (2,500 rpm):<br>11.7 – 23.9% |
| COOLANT TEMP | Engine Coolant Temperature Sensor Value | After warning up:<br>80 – 95°C (176 – 203°F) |
| SHORT FT #1 | Short–term Fuel Trim Bank 1 | 0 ± 20% |
| LONG FT #1 | Long–term Fuel Trim Bank 1 | 0 ± 20% |
| SHORT FT #2 | Short–term Fuel Trim Bank 2 | 0 ± 20% |
| LONG FT #2 | Long–term Fuel Trim Bank 2 | 0 ± 20% |
| ENGINE SPD | Engine Speed | Idling: 700 ± 50 rpm |
| VEHICLE SPD | Vehicle Speed | Vehicle Stopped: p km/h<br>mph |
| IGN ADVANCE | Ignition Advance<br>Ignition Timing of Cylinder No.1 | Idling: BTDC 12 ±5° |
| INTAKE AIR | Intake Air Temperature Sensor Value | Equivalent to Ambient Temp. |
| MAF | Air Flow Rate Through Mass Air Flow Meter | Idling: 2.4 – 4.8 gm/sec<br>Racing without load (2,500 rpm):<br>7.9 –.– 16.2 gm/sec |
| THROTTLE POS | Voltage Output of Throttle Position Sensor<br>Calculated as a Percentage<br>0 V→ 0%, 5 V → 100% | Throttle<br>Fully Closed: 7 – 11%<br>Fully Open: 65 – 75% |
| 02S B1, S1 | Voltage Output of Oxygen Sensor<br>Bank 1, Sensor 1 | Idling: 0.1 – 0.9 V |

If no conditions are specifically stated for ”Idling”, it means the shift lever is at N or P position, the A/C switch is OFF and all accessory switches are OFF.

| TOYOTA hand–held tester display | Measurement Item | Normal Condition |
|---|---|---|
| O2FT B1, S1 | Oxygen Sensor Fuel Trim Bank 1, Sensor 1 (Same as SHORT FT #1) | 0 ± 20% |
| O2S B1, S2 | Voltage Output of Oxygen Sensor Bank 1, Sensor 2 | Driving (50 km/h, 31 mph): 0.1 – 0.9 V |
| O2S B2, S1 | Voltage Output of Oxygen Sensor Bank 2, Sensor 1 | Idling: 0.1 – 0.9 V |
| O2FT B2, S1 | Oxygen Sensor Fuel Trim Bank 2, Sensor 1 (Same as SHORT FT #2) | 0 ± 20% |

## TOYOTA Enhanced Signals

| TOYOTA hand–held tester display | Measurement Item | Normal Condition |
|---|---|---|
| MISFIRE RPM | Engine RPM for first misfire range | Misfire 0: 0 RPM |
| MISFIRE LOAD | Engine load for first misfire range | Misfire 0: 0 g/r |
| INJECTOR | Fuel injection time for cylinder No.1 | Idling: 2.2 – 5.1 ms |
| IAC DUTY RATIO | Intake Air Control Valve Duty Ratio Opening ratio rotary solenoid type IAC valve | Idling: 30 – 40% |
| STARTER SIG | Starter Signal | Cranking: ON |
| CTP SW | Closed Throttle Position Switch Signal | Throttle Fully Closed: ON |
| A/C SIG | A/C Switch Signal | A/C ON: ON |
| PNP SW | Park/Neutral Position Switch Signal | P or N position: ON |
| ELCTRCL LOAD SIG | Electrical Load Signal | Defogger S/W ON: ON |
| STOP LIGHT SW | Stop Light Switch Signal | Stop light switch ON: ON |
| FC IDL | Fuel Cut Idle: Fuel cut when throttle valve fully closed, during deceleration | Fuel cut operating: ON |
| FC TAU | Fuel Cut TAU: Fuel cut during very light load | Fuel cut operating: ON |
| CYL #1 \| CY L #6 | Ratio of revolution variation for each cylinder when variation is large | 0 % |
| IGNITION | Ignition rate for all cylinders every 1,000 revolutions | 0 – 3,000 |
| EGRT GAS | EGR Gas Temperature Sensor Value | EG R not operating: Temperature between intake air temp. and engine coolant temp. |
| INTAKE CTRL VSV | Intake Air Control Valve VSV Signal | VSV operating: ON |
| EGR SYSTEM | EG R system operating condition | Idling: OFF |
| FUEL PRES UP VSV | Fuel Pressure Up VSV Signal | High temp. restarting: ON |
| A/C CUT SIG | A/C Cut Signal | A/C S/W OFF: ON |
| A/C IDLE U P VSV | A/C Idle Up Signal | A/C S/W ON & D position & headlight ON: ON |

| TOYOTA hand–held tester display | Measurement Item | Normal Condition * |
|---|---|---|
| TOTAL FT B1 | Total Fuel Trim Bank 1: Average value for fuel trim system of bank 1 | Idling: 0.8 – 1.2 |
| TOTAL FT B2 | Total Fuel Trim Bank 2: Average value for fuel trim system of bank 2 | Idling: 0.8 – 1.2 |
| 02 LR B1, S1 | Oxygen Sensor Lean Rich Bank 1, Sensor 1 Response time for oxygen sensor output to switch from lean to rich. | Idling after warned up: 0 – 1,000 m sec. |
| 02 LR B2, S1 | Oxygen Sensor Lean Rich Bank 2, Sensor 1 Response time for oxygen sensor output to switch from lean to rich. | Idling after warned up: 0 – 1,000 msec. |
| 02 RL B1, S1 | Oxygen Sensor Rich Lean Bank 1, Sensor 1 Response time for oxygen sensor output to switch from rich to lean. | Idling after warned up: 0 – 1,000 msec. |
| 02 RL B2, S1 | Oxygen Sensor Rich Lean Bank 2, Sensor 1 Response time for oxygen sensor output to switch from rich to lean. | Idling after warned up: 0 – 1,000 msec. |

*; If no conditions are specifically stated for ”Idling”, it means the shift lever is at Nor P position, the A/C switch is OFF and all accessory switches are OFF.

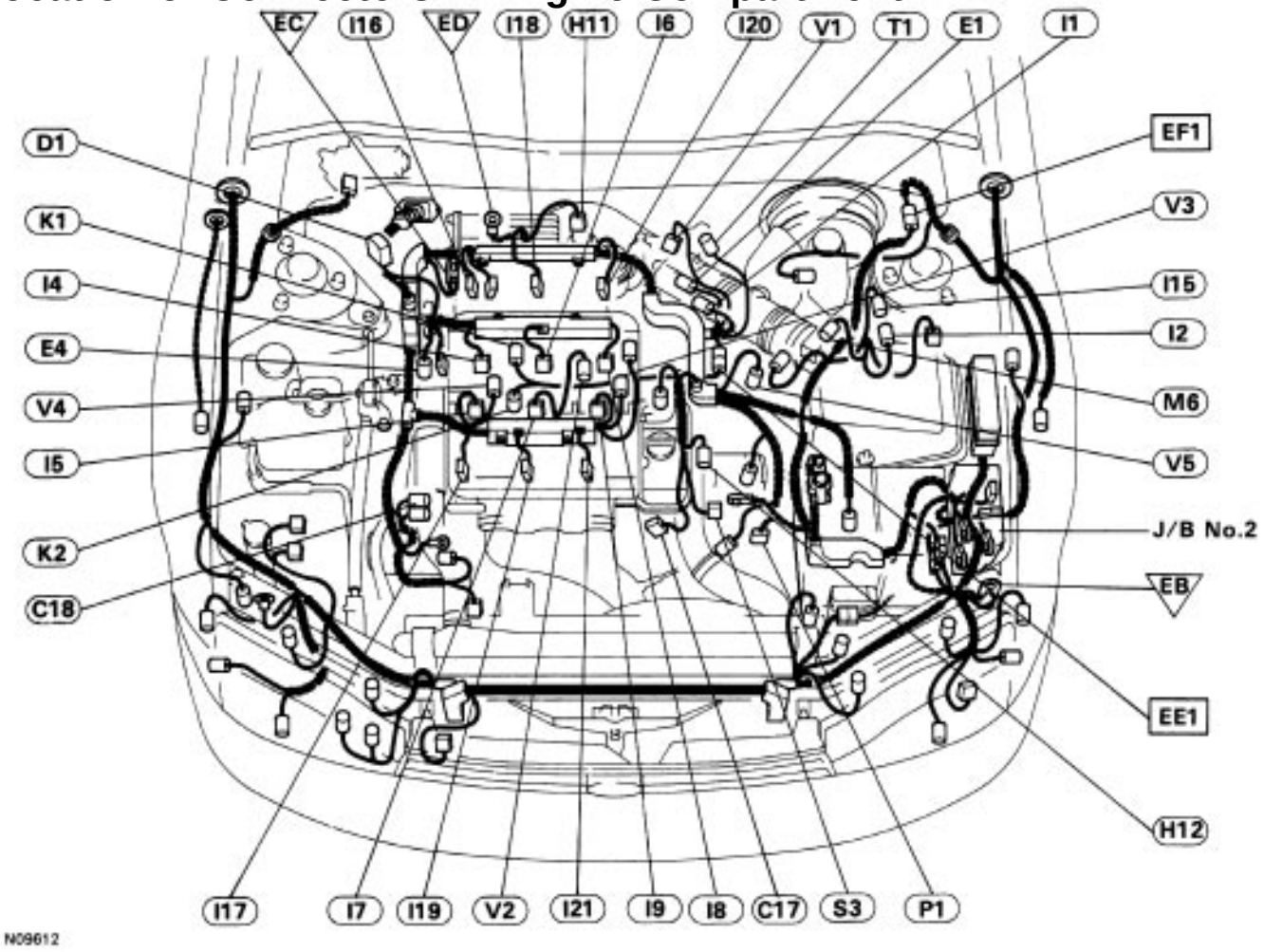
# MATRIX CHART OF PROBLEM SYMPTOMS

When the malfunction code is not confirmed in the diagnostic trouble code check and the problem still can not be confirmed in the basic inspection, then proceed to this step and perform troubleshooting according to the numbered order given in the table below.

| Symptom | Suspect area | Starter signal circuit | ECM power source circuit | Fuel pump control circuit | Fuel pressure control VSV circuit | A/C signal circuit (Compressor circuit) | Starter and Starter relay | Compression | A/T faulty | Engine control module (ECM) |
|---|---|---|---|---|---|---|---|---|---|---|
| | See page | EG2–557 | EG2–565 | EG2–575 | EG2–586 | AC–36 | ST–47, 63 | EG2–36 | AX2–81 | IN–36 |
| Does not start | Engine does not crank | | | | | | 1 | | | |
| | No initial combustion | | 1 | 2 | | | | | | |
| | No complete combustion | | | 1 | | | | | | |
| Difficult to start | Under normal condition | 1 | | 2 | | | | 3 | | |
| | Cold engine | 1 | | 2 | | | | | | |
| | Hot engine | 1 | | 3 | 2 | | | | | |
| Poor Idling | High engine idle speed | | 2 | | | 1 | | | | |
| | Low engine idle speed | | | 2 | | 1 | | | | |
| | Rough idling | | | 2 | | | | 1 | | |
| | Hunting | | 1 | 2 | | | | | | |
| Poor Drive–ability | Hesitation/Poor acceleration | | | 1 | | | | | 2 | |
| | Surging | | | 1 | | | | | | |
| Engine stall | Soon after starting | | | 1 | | | | | | |
| | During A/C operation | | | | | 1 | | | | 2 |

# LOCATION OF CONNECTORS

## Location of Connectors in Engine Compartment




C17

Camshaft Position Sensor

Ie-2-1-D

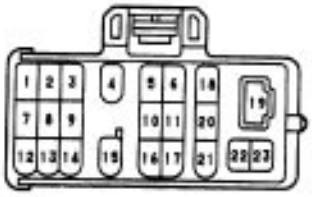
C18

Crankshaft Position Sensor

Ie-2-1-D

D1

Data Link Connector 1



Ie-23-1

E1

EGR Gas Temp. Sensor

Ie-2-1-C

E4

Engine Coolant Temp. Sensor

V-2-1-C

H11

Heated Oxygen Sensor ( Bank 1 Sensor 1)

Ie-4-1-D

H12

Heated Oxygen Sensor (Bank 2 Sensor 1)

Ie-4-1-D

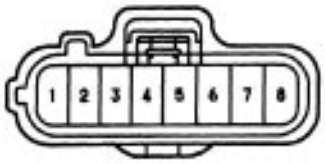
I1

Idle Air Control Valve

Ie-3-1-H

I2

ign¿ter




e-8-1-G

I4

Injector No.1


Ie-2-1-a

I5

**Injector No.2¿**


Ie-2-1-a

I6

Injector No.3


Ie-2-1-a

I7

Injector No.4


Ie-2-1-a

I8

Injector No.5


Ie-2-1-a

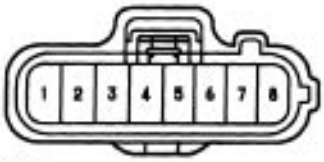
I9

Injector No.6


Ie-2-1-a

I15

Igniter




e-8-1-F

I16

Ignition Coil No.1


Ie-2-1-n

I17

Ignition Coil No.2


Ie-2-1-n

I18

Ignition Coil No.3


Ie-2-1-n

I19

Ignition Coil No.4


Ie-2-1-n

I20

Ignition Coil No.3


Ie-2-1-n

I21

Ignition Coil No.6


Ie-2-1-n

K1

Knock Sensor 1


Ie-1-1-F

K2

Knock Sensor 2


Ie-1-1-F

M6

Mass Air Flow Meter


Ie-5-1-D

P1

Park/Neutral Position Switch


Ie-10-1-B

S3

Starter

H-1-1

T1

Throttle Position Sensor

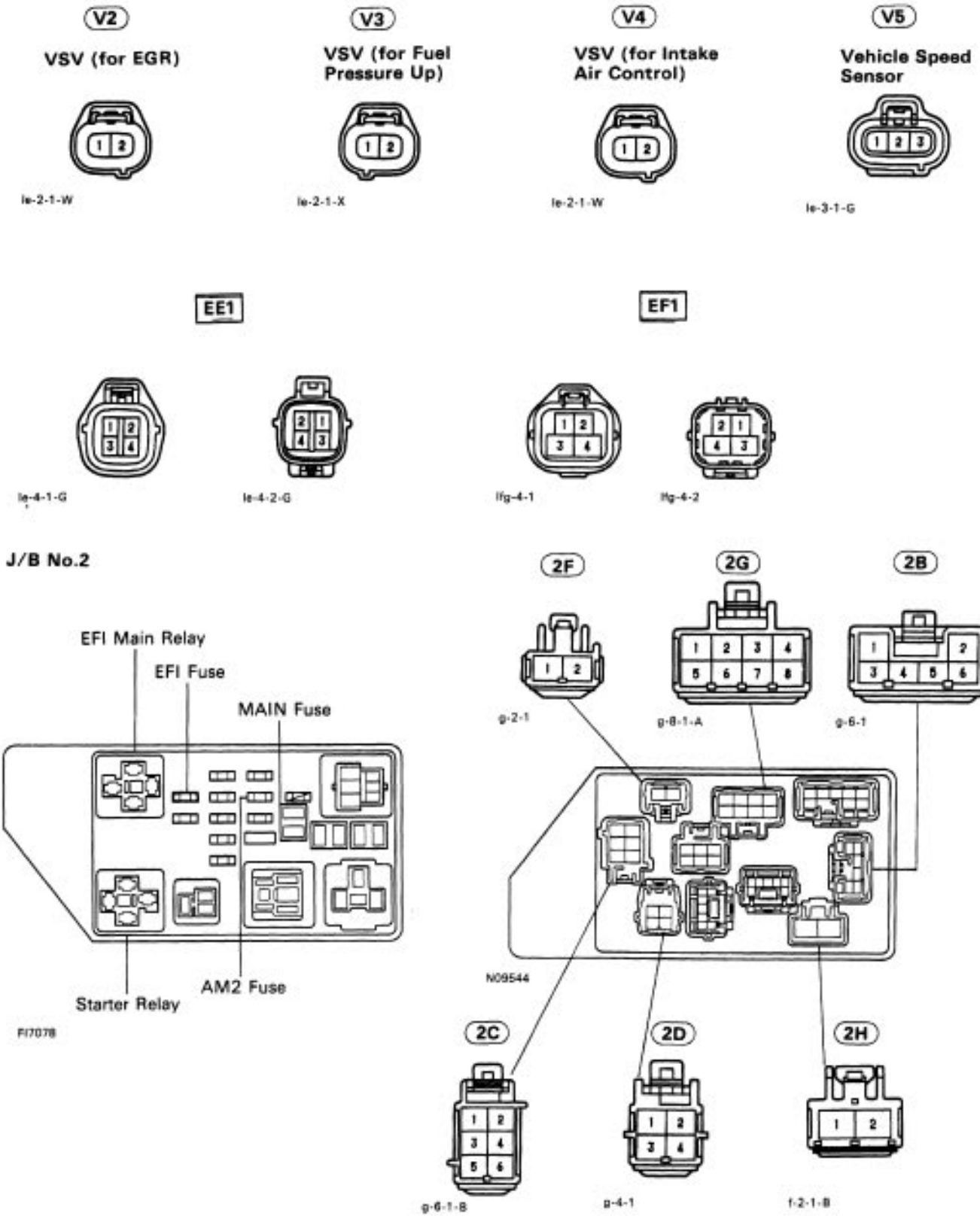

IV-4-1-A

V1

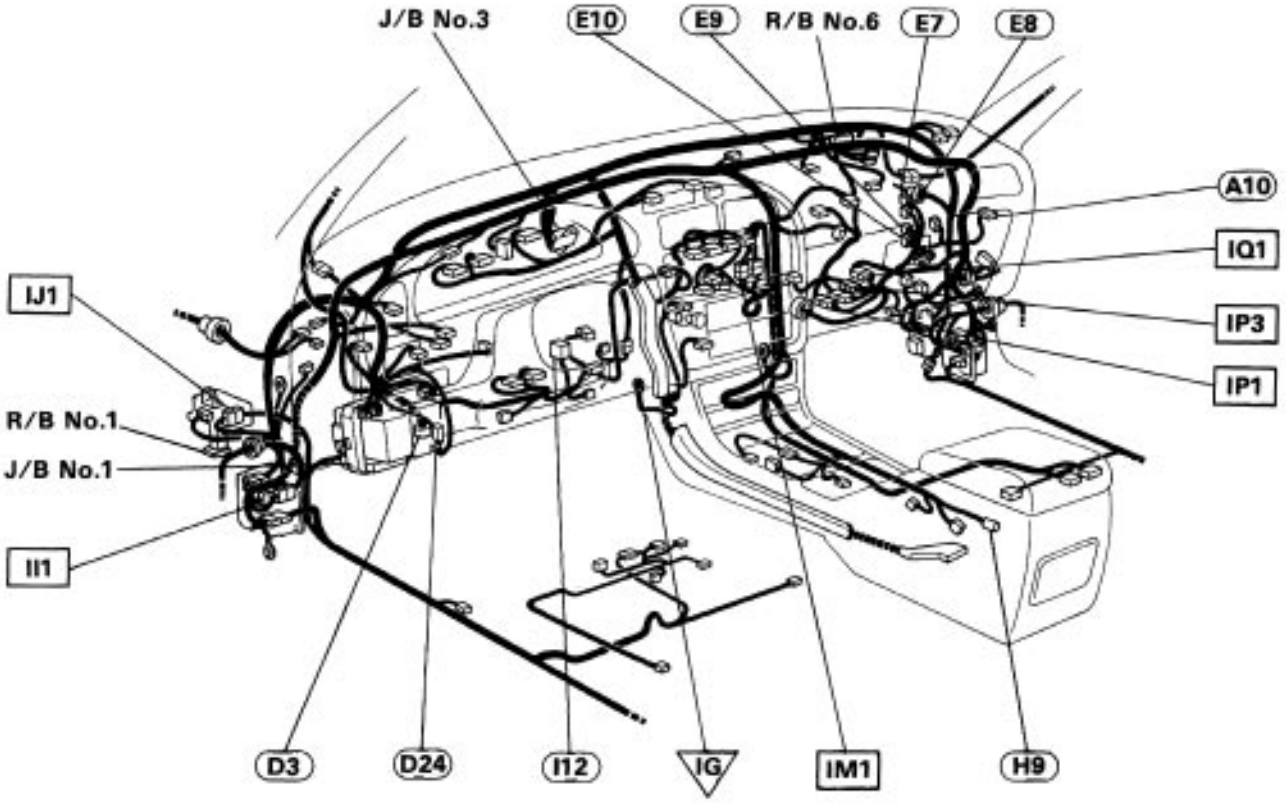
VSV (for A/C Idle Up)


Ie-2-1-N

# Location of Connectors in Engine Compartment (Cont'd)



# Location of Connectors in Instrument Panel




N09614

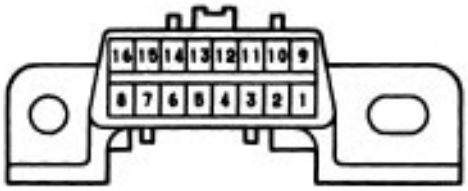
**A10**
A/C Amplifier

e-14-1-A

**D3**
Data Link Connector 2

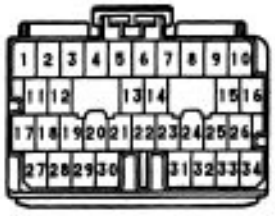
S-17-1

**D24**
Data Link Connector 3



N09214

**E7**
Engine Control Module



n-34-1

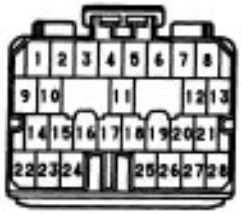
**E8**
Engine Control Module

n-22-1

**E9**
Engine Control Module

n-16-1

**E10**
Engine Control Module

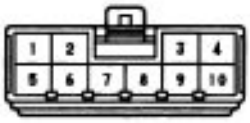


n-28-1

**H9**
Heated Oxygen Sensor (Bank 1 Sensor 2)

le-4-1-D

**I12**
Ignition Switch



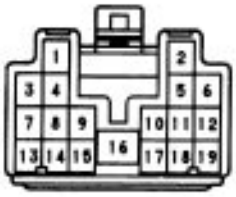
g-10-1-B

**II1**

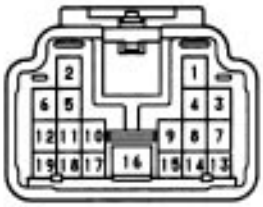
e-10-1

e-10-2

**IJ1**



eg-19-1



eg-19-2

**IM1**

le-6-1-A

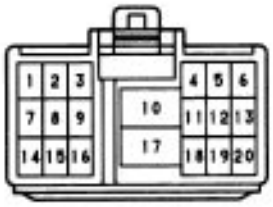
le-6-2-A

**IQ1**

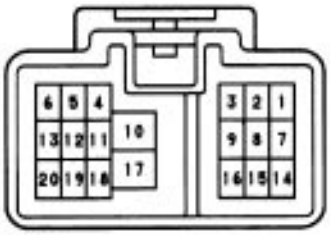
e-6-1

e-6-2

**IP1**



e-20-1-B



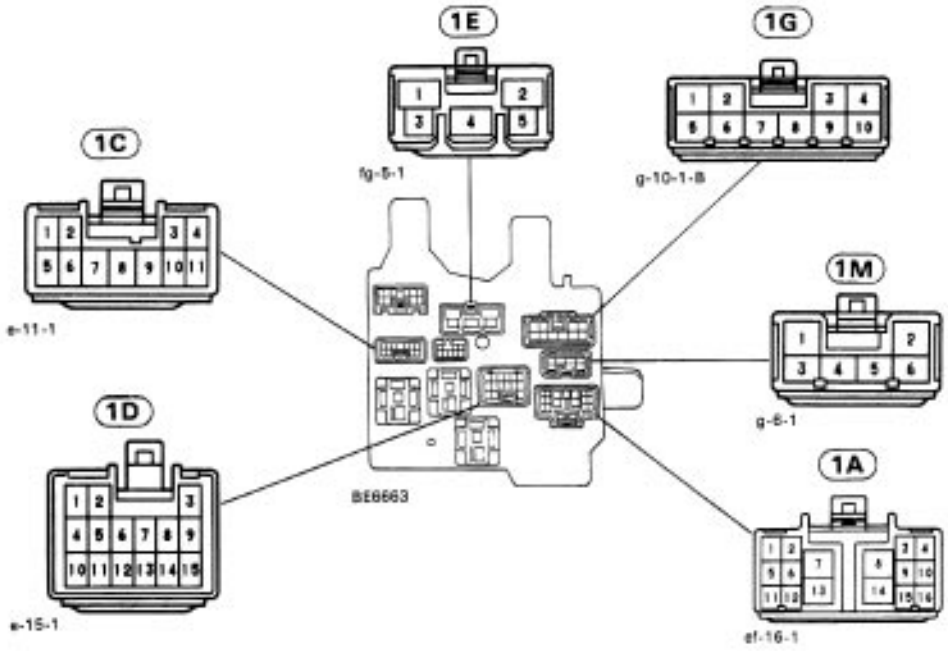
e-20-2-B

**IP3**

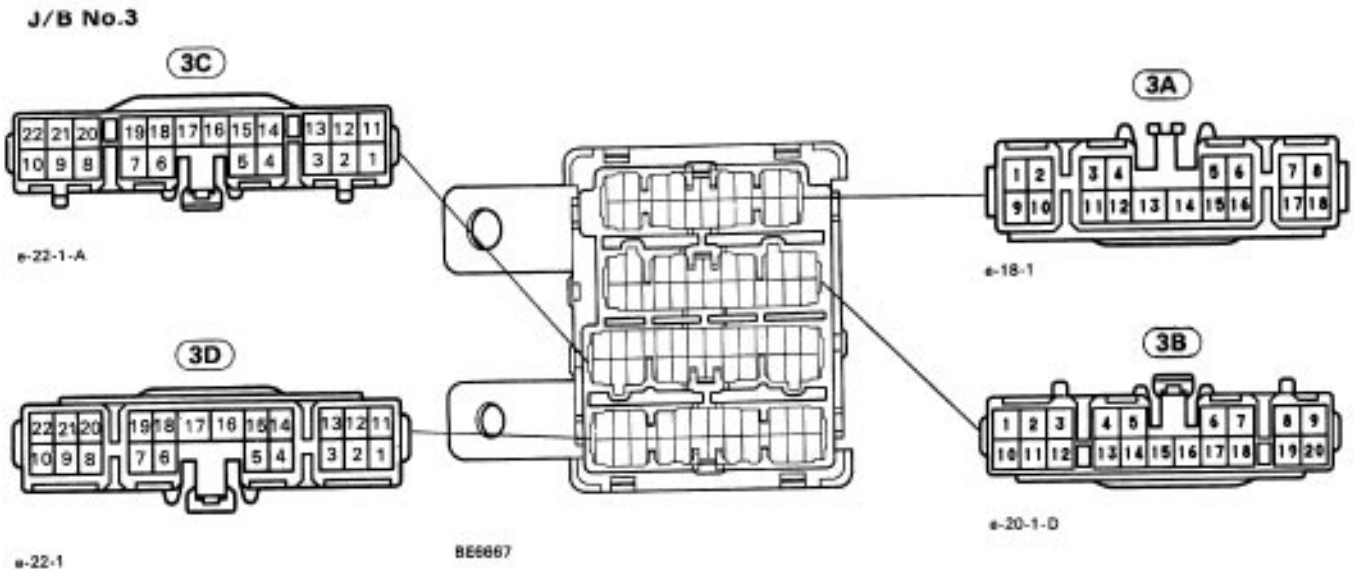
ef-19-1

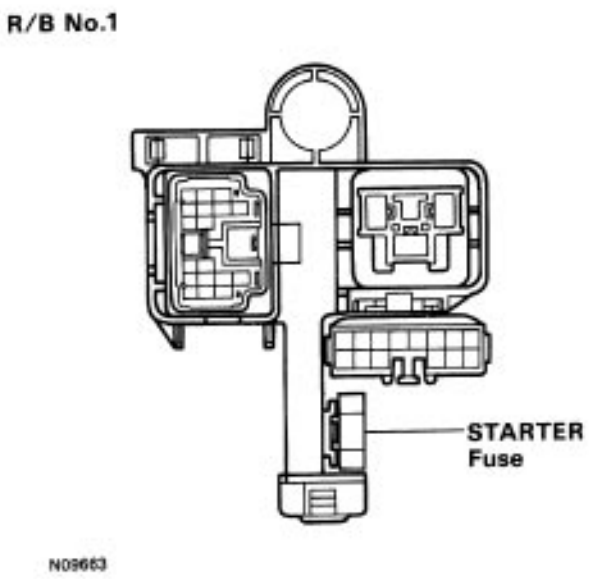
ef-19-2

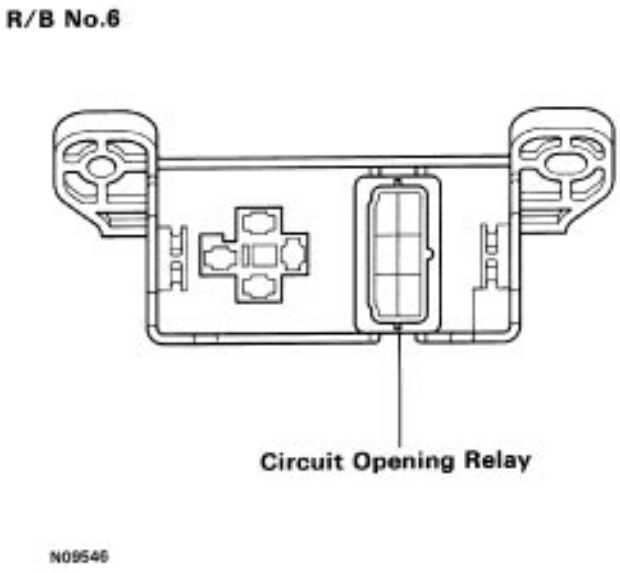
**J/B No.1**



# Location of Connectors in Instrument Panel (Cont'd)

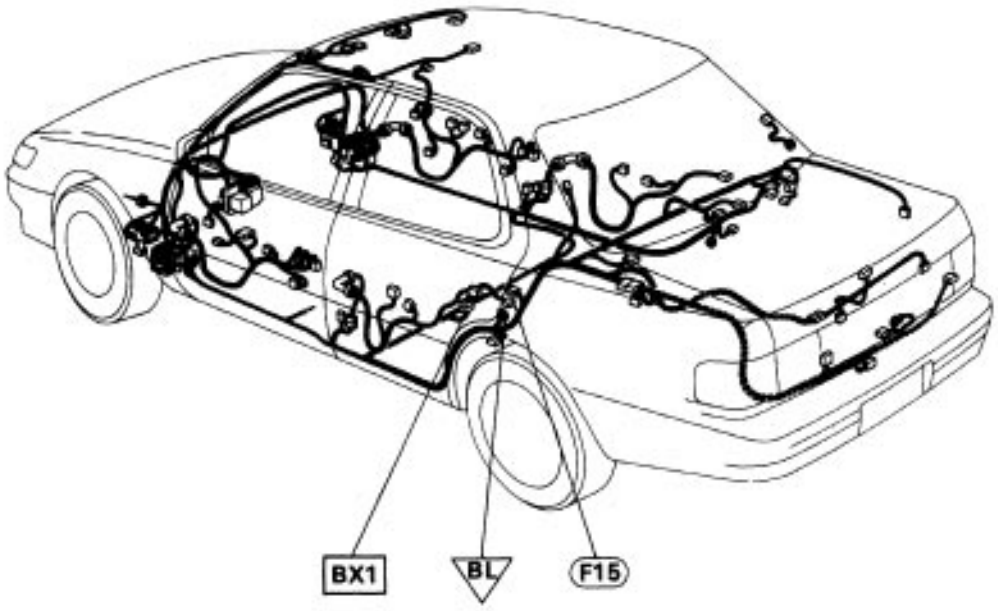


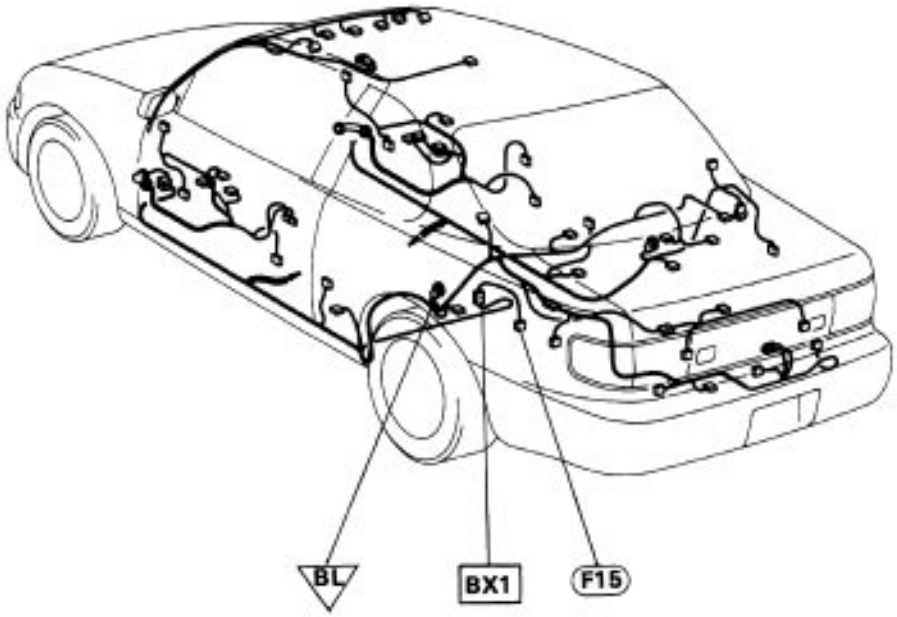
# Location of Connectors in Body

**Sedan**



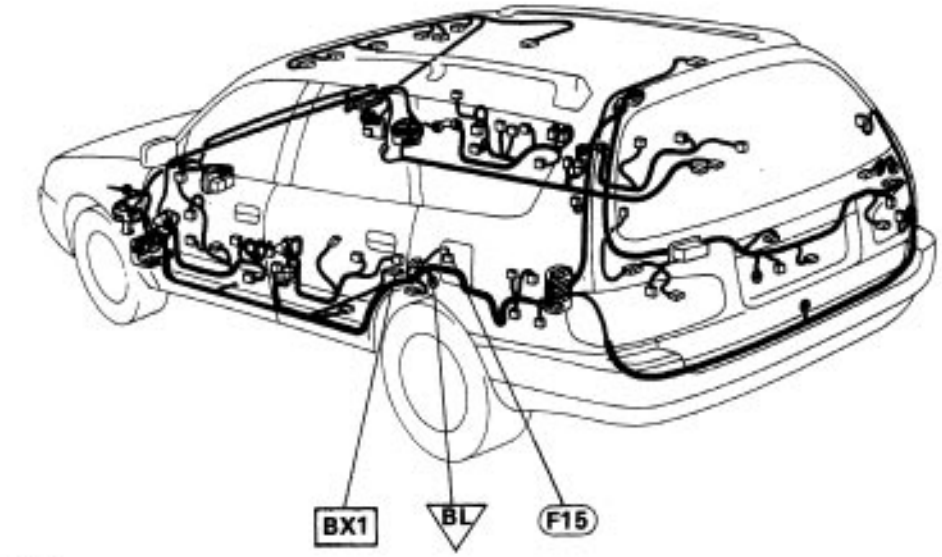

N09615

**Coupe**




N09703

Wagon



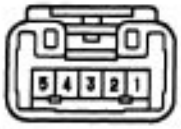

F15

Fuel Pump


Ie-5-1-A

BX1


e-5-1




e-5-2

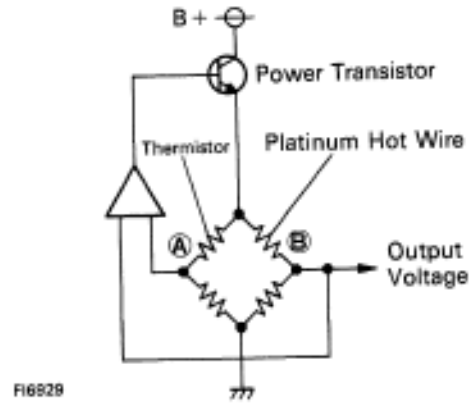
# DTC P0100 Mass Air Flow Circuit Malfunction

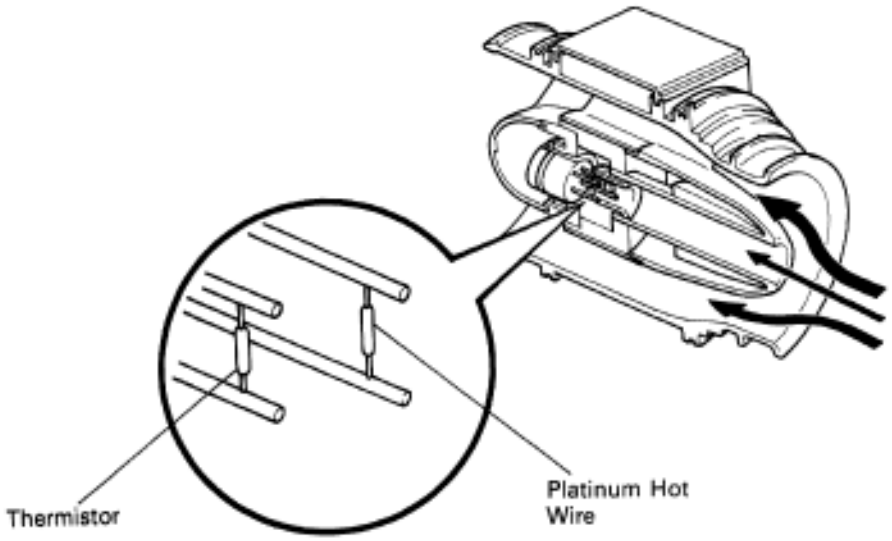
## CIRCUIT DESCRIPTION

The mass air flow meter uses a platinum hot wire. The hot wire air flow meter consists of a platinum hot wire, thermistor and a control circuit installed in a plastic housing. The hot wire air flow meter works on the principle that the hot wire and thermistor located in the intake air bypass of the housing detect any changes in the intake air temperature.

The hot wire is maintained at the set temperature by controlling the current flow through the hot wire. This current flow is then measured as the output voltage of the air flow meter.

The circuit is constructed so that the platinum hot wire and thermistor provide a bridge circuit, with the power transistor controlled so that the potential of (A) and (B) remains equal to maintain the set tem–perature.



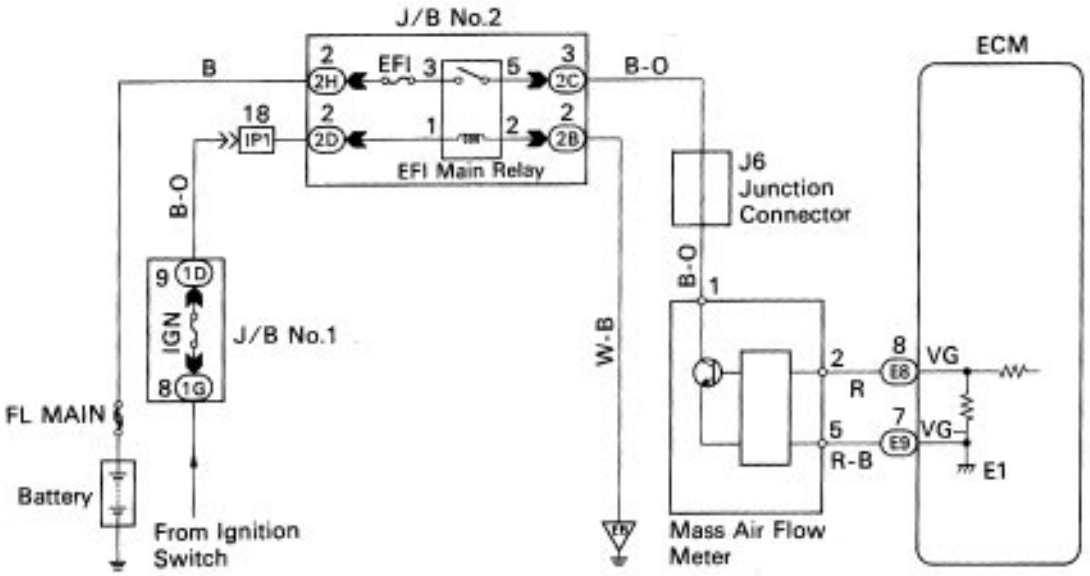

| DTC No. | Diagnostic Trouble Code Detecting Condition | Trouble Area |
|---|---|---|
| P0I00 | Open or short in mass air flow meter circuit with engine speed 4,000 rpm or less. | • Open or short in mass air flow meter circuit<br>• Mass air flow meter<br>• ECM |

If the ECM detects diagnostic trouble code ”P01 00” it operates the fail safe function, keeping the ignition timing and injection volume constant and making it possible to drive the vehicle.

HINT: After confirming DTC P01 00 use the OBDll scan tool or TOYOTA hand–held tester to confirm the mass air flow ratio from ”CURRENT DATA”.

| Mass Air Flow Value (gm/sec.) | Malfunction |
|---|---|
| 0.0 | • + B circuit open<br>• VG circuit open or short |
| 271.0 or more | • VG– circuit open |

## WIRING DIAGRAM



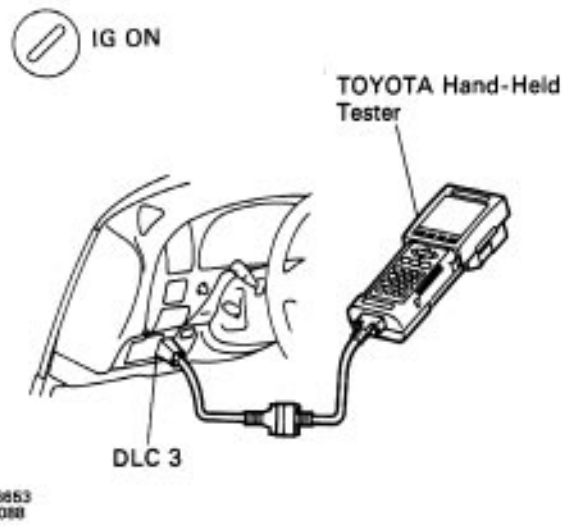

FI7047

# DIAGNOSTIC CHART

| | | | |
|---|---|---|---|
| 1 | Connect the OBDII scan tool or TOYOTA hand–held tester, and read value of mass air flow rate. | Type II | Go to step 5 |
| Type I | | | |
| 2 | Check voltage of mass air flow meter power source. | NG | Check for open in harness and connector between EFI main relay and mass air flow meter. |
| OK | | | |
| 3 | Check voltage between terminal VG and body ground. | OK | Check and replace ECM. |
| NG | | | |
| 4 | Check for open and short in harness and connector between mass air flow meter and ECM. | NG | Repair or replace harness or connector. |
| OK | | | |
| Replace mass air flow meter. | | | |
| 5 | Check continuity between terminal VG– and body ground. | NG | Check and replace ECM. |
| OK | | | |
| 6 | Check for open in harness and connector between mass air flow meter and ECM. | NG | Repair or replace harness or connector. |
| OK | | | |
| Replace mass air flow meter. | | | |

# INSPECTION PROCEDURE

**1** **Connect the OBDII scan tool or TOYOTA hand–held tester, and read value of mass air flow rate.**




P (1) Remove the fuse cover on the instrument panel.
(2) Connect the OBDII scan tool or TOYOTA hand–held tester to the DLC 3.
(3) Turn ignition switch ON and OBDII scan tool or TOYOTA hand–held tester main switch ON.
(4) Start the engine.

C Read mass air flow rate on the OBDII scan tool or TOYOTA hand–held tester.

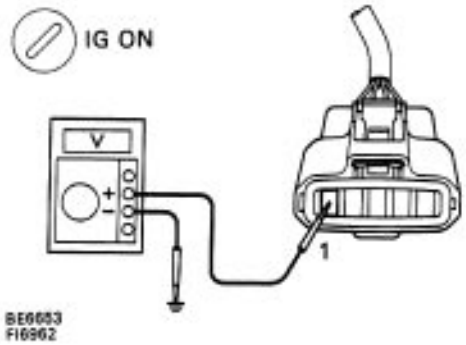
Result

| | Mass air flow rate |
|---|---|
| Type I | 0.0 gm/sec. |
| TypeII | 271.0 gm/sec. or more |

Type I

Type II → **Go to step 5.**

**2** **Check voltage of mass air flow meter power source.**




P (1) Disconnect the mass air flow meter connector.
(2) Turn ignition switch ON.

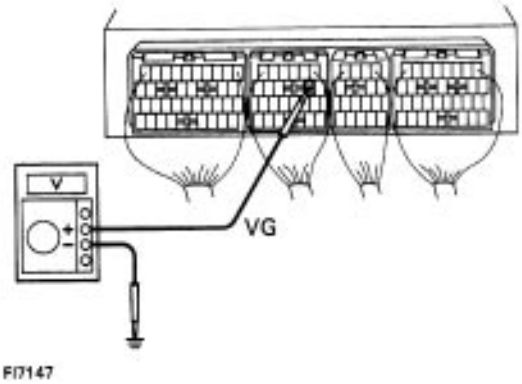
C Measure voltage between terminal 1 of mass air flow meter connector and body ground.

OK **Voltage: 9 –14 V**

OK

NG → **Check for open in harness and connector between EFI main relay and mass air flow meter (See page IN–31).**

**3** **Check voltage between terminal VG of ECM and body ground.**




P (1) Remove glove compartment.
(See page EG2–309)
(2) Start the engine.

C Measure voltage between terminal VG of ECM and body ground while engine is idling.

OK **Voltage: 1.1 – 1.5 V**
**(P position and A/C switch OFF)**

NG

OK → **Check and replace ECM (See page IN–36).**

**4** **Check for open and short in harness and connector between mass air flow meter and ECM (See page IN–31).**

OK

NG → **Repair or replace harness or connector.**

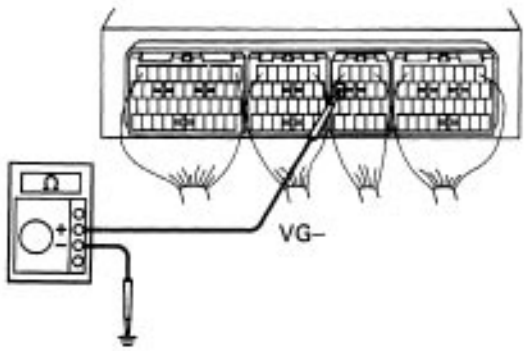
**Replace mass air flow meter.**

**5** **Check continuity between terminal VG of ECM and body ground.**

P Remove glove compartment (See page EG2–309).

C Check continuity between terminal VG– of ECM and body ground.

OK **Continuity (1 or less)**




FI7148

OK

NG → **Check and replace ECM (See page IN–36).**

**6** **Check for– open in harness and connector between mass air flow meter– and ECM (See page IN–31).**

OK

NG → **Repair or replace harness or connector.**

**Replace mass air flow meter.**

# DTC P0101 Mass Air Flow Circuit Range Performance Problem

## CIRCUIT DESCRIPTION

Refer to mass air flow circuit malfunction on page EG2–444.

| DTC No. | Diagnostic Trouble Code Detecting Condition | Trouble Area |
|---|---|---|
| P0101 | Conditions a) and b) continue with engine speed 900 rpm or less.<br>(2 trip detection logic)<br>a) Closed throttle position switch: ON<br>b) Mass air flow meter output ) 2.2 V | • Mass air flow meter |

## WIRING DIAGRAM

Refer to mass air flow circuit malfunction on page EG2–445.

## DIAGNOSTIC CHART

| | | | |
|---|---|---|---|
| 1 | Are there any other codes (besides DTC P0101) being output? | YES | Go to relevant diagnostic trouble code chart. |

NO

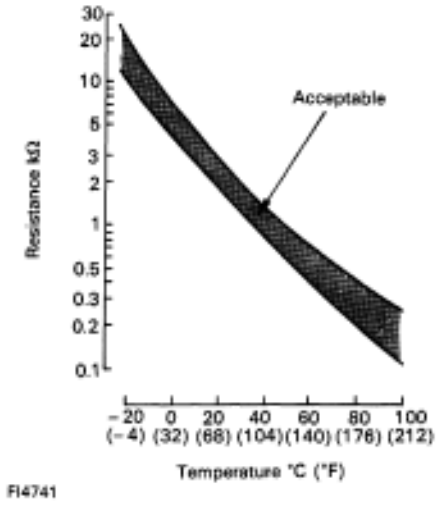
Replace mass air flow meter.

# DTC P0110 Intake Air Temp Circuit Malfunction

## CIRCUIT DESCRIPTION

The intake air temp. sensor is built into the air flow meter and senses the intake air temperature.
A thermistor built in the sensor changes the resistance value according to the intake air temperature.
The lower the intake air temperature, the greater the thermistor resistance value, and the higher the intake air temperature, the lower the thermistor resistance value (See Fig. 1.).
The intake air temperature sensor is connected to the ECM (See next page). The 5V power source voltage in the ECM is applied to the intake air temperature sensor from the terminal THA via a resistor R.
That is, the resistor R and the intake air temperature sensor are connected in series. When the resistance value of the intake air temperature sensor changes in accordance with changes in the intake air temperature, the potential at terminal THA also changes. Based on this–signal, the ECM increases the fuel injection volume to improve driveability during cold engine operation.
If the ECM records the diagnostic trouble code ”P0110”, it operates the fail safe function in which the intake temperature is assumed to be 20 C (68 F). Intake Air Ter

(fig. 1)




(Reference )

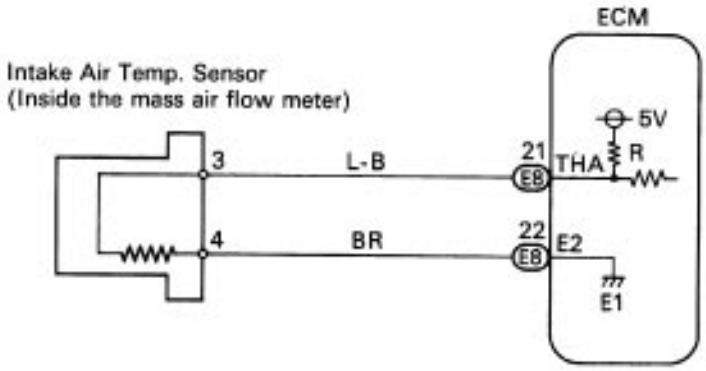
| Intake Air Temp. °C (° F) | Resistance (kΩ) | Voltage M |
|---|---|---|
| – 20 (– 4) | 16.2 | 4.3 |
| 0 (32) | 5.9 | 3.4 |
| 20 (68) | 2.5 | 2.4 |
| 40 (104) | 1.1 | 1.4 |
| 60 (140) | 0.6 | 0.9 |
| 80 (176) | 0.3 | 0.5 |
| 100 (212) | 0.1 | 0.2 |

| DTC No. | Diagnostic Trouble Code Detecting Condition | Trouble Area |
|---|---|---|
| **P0110** | Open or short in intake air temp. sensor circuit. | • Open or short in intake air temp. sensor circuit.<br>• Intake air temp. sensor<br>• ECM |

Hint; After confirming DTC P01 10 use the OBDII scan tool or TOYOTA hand–held tester to confirm the intake air temperature from ”CURRENT DATA”.

| Temperature Displayed | Malfunction |
|---|---|
| – 40 C (–40 F) | Open circuit |
| 120 C (248 F) or more | Short circuit |

# WIRING DIAGRAM




FI5448

# DIAGNOSTIC CHART

HINT; If diagnostic trouble codes ”P0110” (intake air temp. circuit malfunction), ”P0115” (engine coolant temp. circuit malfunction), ”P0120” (throttle position circuit malfunction) are output simultaneously, E2 (sensor ground) may be open.

| | | | |
|---|---|---|---|
| 1 | Connect the OBDII scan tool or TOYOTA hand–held tester and read value of intake air temp. | NG | – 40 C (– 40 F) ..... Go to step 2<br>120 C (248 F) or more .. Go to step 4 |

OK

Check for intermittent problems.

| | | | |
|---|---|---|---|
| 2 | Check for open in harness or ECM. | OK | Confirm good connection at sensor. If OK, replace mass air flow meter. |

NG

| | | | |
|---|---|---|---|
| 3 | Check for open in harness or ECM. | OK | Open in harness between ECM and intake air temp. sensor. |

NG

Confirm good connection at ECM. If OK, replace ECM.

| | | | |
|---|---|---|---|
| 4 | Check for short in harness and ECM. | OK | Replace mass air flow meter. |

NG

| | | | |
|---|---|---|---|
| 5 | Check for short in harness or ECM. | OK | Repair or replace harness or connector. |

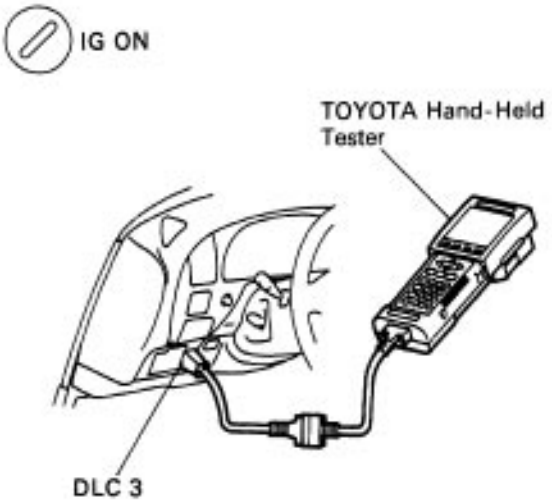
NG

Check and replace ECM.

# INSPECTION PROCEDURE

HINT: If diagnostic trouble codes ”P0110” (intake air temp. circuit malfunction), ”P0115” (engine coolant temp. circuit malfunction), ”P0120” (throttle position circuit malfunction) are output simultaneously, E2 (sensor ground) may be open.

**1** **Connect the OBDII scan tool or TOYOTA hand–held tester, and read value of intake air temperature.**




P (1) Remove the fuse cover on the instrument panel.

(2) Connect the OBDII scan tool or TOYOTA hand–held tester to the DLC 3.

(3) Turn ignition switch ON and OBDII scan tool or TOYOTA hand–held tester main switch ON.

C Read temperature value on the OBDII scan tool or TOYOTA hand–held tester.

OK Same as actual intake air temperature.

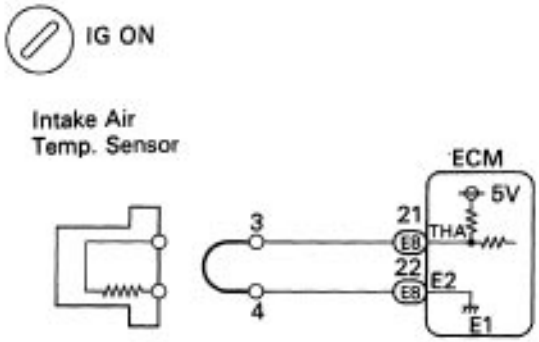
Hint If there is open circuit, OBDII scan tool or TOYOTA hand–held tester indicates – 40 C (– 40 F).
If there is short circuit, OBDII scan tool or TOYOTA hand–held tester indicates 120 C (248 F) or more.

**OK**

**NG** – 40 C (– 40 F) ..... Go to step 2
120 C (248 F) or more ... Go to step 3

**Check for intermittent problems.**
**(See page EG2–417)**

**2** **Check for open in harness or ECM.**




BE6653
FI7065

P (1) Disconnect the mass air flow meter connector.
(2) Connect sensor wire harness terminals together.
(3) Turn ignition switch ON.

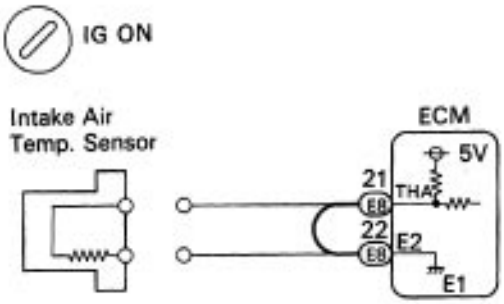
C Read temperature value on the OBDII scan tool or TOYOTA hand–held tester.

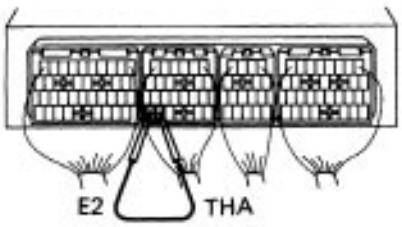
OK **Temperature value: 120 C (248 F) or more**

NG

OK **Confirm good connection at sensor. If OK, replace mass air flow meter.**

**3** **Check for open in harness or ECM.**




BE6653
FI7067
FI7031

P (1) Remove glove compartment.
(See page EG2–309)
(2) Connect between terminals THA and E2 of ECM E8 connector.
HINT: Mass air flow meter connector is disconnected. Before checking, do a visual and contact pressure check for the ECM connector. (See page EG2–418)

C (3) Turn ignition switch ON.
Read temperature value on the OBDII scan tool or TOYOTA hand–held tester.

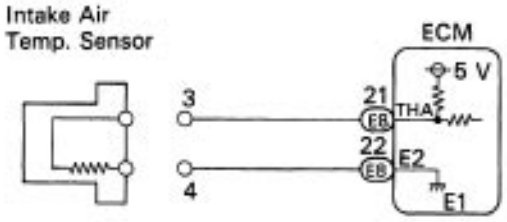
OK **Temperature value: 120 C (248 F) or more**

NG

OK **Open in harness between terminals E2 or THA, repair or replace harness.**

**Confirm good connection at ECM. If OK, replace ECM..**

**4** **Check for short in harness and ECM.**


B86853
FI7054

P (1) Disconnect the mass air flow meter connector.
(2) Turn ignition switch ON.

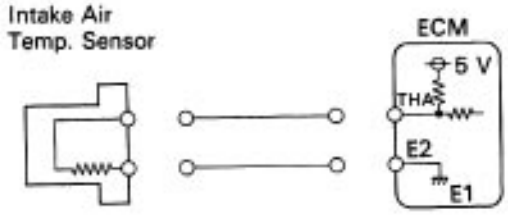
C Read temperature value on the 0BDII scan tool or TOYOTA hand–held tester.

OK **Temperature value: – 40 C (– 40 F).**

NG

OK **Replace mass air flow meter.**

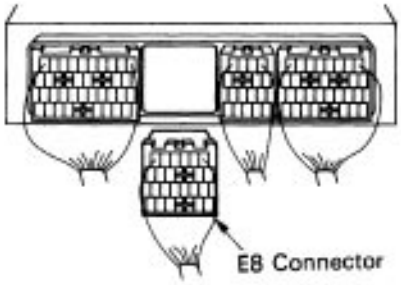
**5** **Check for short in harness or ECM.**


P (1) Remove glove compartment.
(See page EG2–309)
(2) Disconnect the E8 connector of ECM.
HINT: Mass air flow meter connector is disconnected.
(3) Turn ignition switch ON.

C Read temperature value on the OBDII scan tool or TOYOTA hand–held tester.

OK **Temperature value: –40 C (–40 F)**




B86853
FI7056
FI7034

NG

OK **Repair or replace harness or connector.**

**Check and replace ECM (See page IN–36).**

# DTC P0115 Engine Coolant Temp Circuit Malfunction

## CIRCUIT DESCRIPTION

A thermistor built into the engine coolant temperature sensor changes the resistance value according to the coolant temperature.

The structure of the sensor and connection to the ECM is the same as in the intake air temp. circuit malfunction shown on page EG2–451.

If the ECM records the diagnostic trouble code P01 15, it operates the fail safe function, keeping the engine coolant temp. at a constant $80_2$C ($176_2$F).

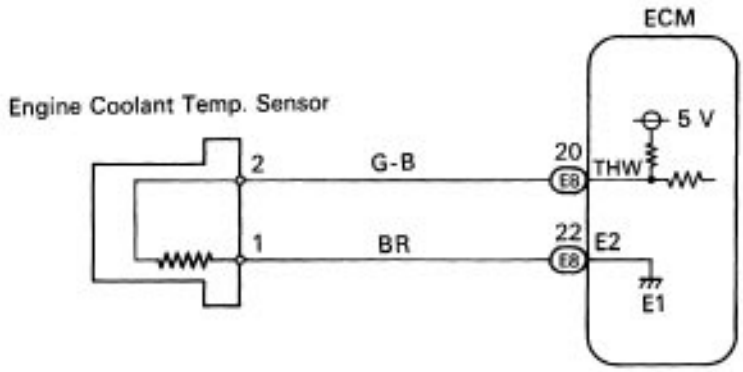
| DTC No. | Diagnostic Trouble Code Detecting Condition | Trouble Area |
|---|---|---|
| **P0115** | Open or short in engine coolant temp. sensor circuit. | • Open or short in engine coolant temp. sensor circuit.<br>• Engine coolant temp. sensor.<br>• ECM |

HINT: After confirming DTC P01 15 use the OBDll scan tool or TOYOTA hand–held tester to confirm the engine coolant temperature from ”CURRENT DATA”.

Temperature Displayed Malfunction

| | |
|---|---|
| – $40_2$C (– $40_2$F) | Open circuit |
| $120_2$C ($248_2$F) or more | Short circuit |

## WIRING DIAGRAM




FI6448

# DIAGNOSTIC CHART

HINT: If diagnostic trouble codes ”P0110” (intake air temp. circuit malfunction), ”P0115” (engine coolant temp. circuit malfunction) and ”P0120” (throttle position circuit malfunction) are output simultaneously, E2 (sensor ground) may be open.

| | | | |
|---|---|---|---|
| 1 | Connect the OBDII scan tool or TOYOTA hand–held tester and read value of engine coolant temp. | NG | – $40_2$C (– $40_2$F) ..... Go to step 2<br>$120_2$C ($248_2$F) or more .. Go to step 4 |

OK

Check for intermittent problems.

| | | | |
|---|---|---|---|
| 2 | Check for open in harness or ECM. | OK | Confirm good connection at sensor.<br>If OK, replace engine coolant temp. sensor. |

NG

| | | | |
|---|---|---|---|
| 3 | Check for open in harness or ECM. | OK | Open in harness between ECM and engine coolant temp. sensor. |

NG

Confirm connection at ECM. If OK, replace ECM.

| | | | |
|---|---|---|---|
| 4 | Check for short in harness and ECM. | OK | Replace engine coolant temp. sensor. |

NG

| | | | |
|---|---|---|---|
| 5 | Check for short in harness or ECM. | OK | Repair or replace harness or connector. |

NG

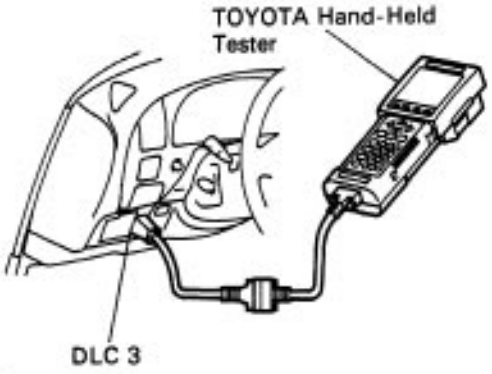
Check and replace ECM.

# INSPECTION PROCEDURE

HINT; If diagnostic trouble codes ”P0110” (intake air temp. circuit malfunction), ”P0115” (engine coolant temp. circuit malfunction), ”P0120” (throttle position circuit malfunction) are output simultaneously, E2 (sensor ground) may be open.

**1** **Connect the OBD II scan tool or TOYOTA hand–held tester, and read value of engine coolant temperature.**

IG ON




P (1) Remove the fuse cover on the instrument panel.
(2) Connect the 0BDII scan tool or TOYOTA hand–held tester to the DLC 3.
(3) Turn ignition switch ON and OBDII scan tool or TOYOTA hand–held tester main switch ON.

C Read temperature value on the OBDII scan tool or TOYOTA hand–held tester.

OK Same as actual engine coolant temperature.

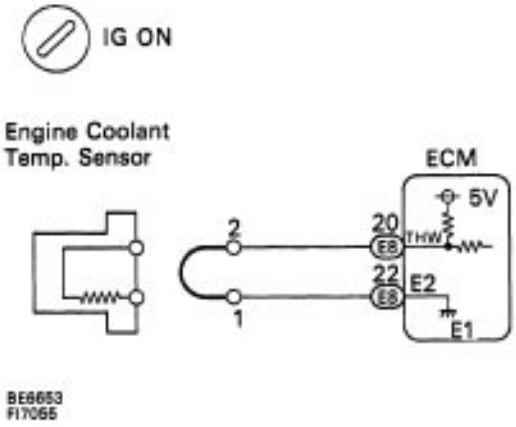
Hint If there is open circuit, OBD II scan tool or TOYOTA hand–held tester indicates – $40_2$C (– $40_2$ F).
If there is short circuit, OBD II scan tool or TOYOTA hand–held tester indicates $120_2$C ($248_2$F) or more.

**OK**

**NG** **– $40_2$C (– $40_2$F) ..... Go to step 2.**
**$120_2$C ($248_2$F) or more . . Go to step 3.**

**Check for intermittent problems.**
**(See page EG2–417)**

**2** **Check for open in harness or ECM.**




P (1) Disconnect the engine coolant temp. sensor connector.
(2) Connect sensor wire harness terminals to–gether.
(3) Turn ignition switch ON.

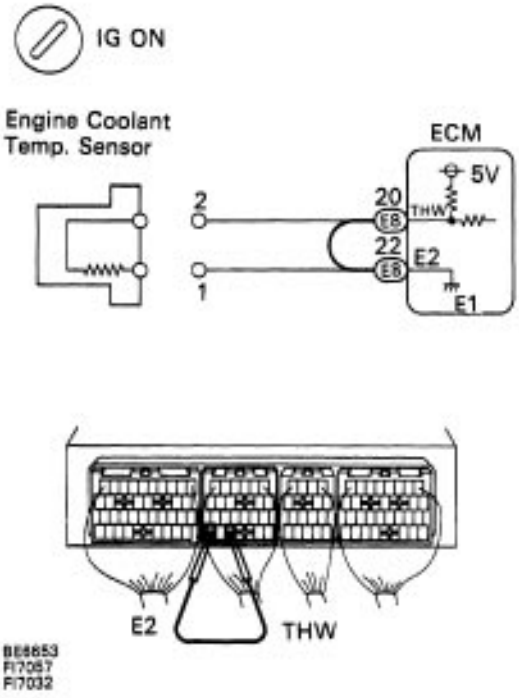
C Read temperature value on the OBDII scan tool or TOYOTA hand–held tester.

OK **Temperature value: 120$_2$C (248$_2$F) or more**

NG

OK → **Confirm good connection at sensor. If OK, replace engine coolant temp. sensor.**

**3** **Check for open in harness or ECM.**




P (1) Remove glove compartment.
(See page EG2–309)
(2) Connect between terminals THW and E2 of ECM E8 connector.
HINT: Engine coolant temp. sensor connector is dis–connected. Before checking, do a visual and contact pressure check for the ECM connector.
(See page EG2–418)

C (3) Turn ignition switch ON.
Read temperature value on the OBDII scan tool or TOYOTA hand–held tester.

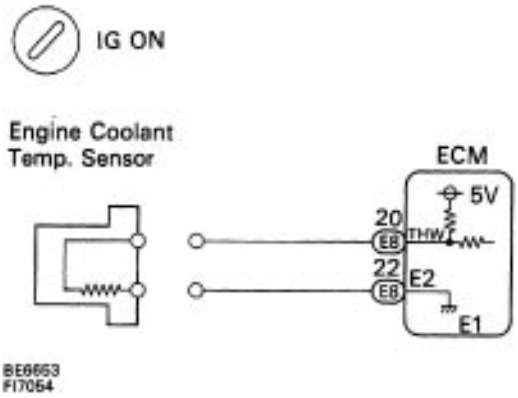
OK **Temperature value: 120$_2$C (248$_2$F) or more**

NG

OK → **Open in harness between terminals E2 or THW, repair or replace harness.**

**Confirm good connection at ECM.
If OK, replace ECM .**

**4** **Check for short in harness and ECM.**




P (1) Disconnect the engine coolant temp. sensor connector.
(2) Turn ignition switch ON.

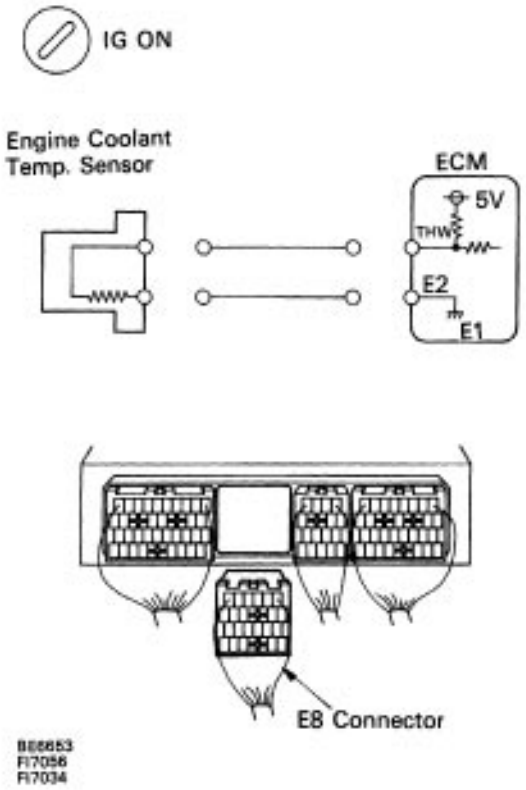
C Read temperature value on the OBDII scan tool or TOYOTA hand–held tester.

OK **Temperature value: – 40$_2$C (– 40$_2$F)**

NG

OK **Replace engine coolant temp. sensor.**

**5** **Check for short in harness or ECM.**




P (1) Remove glove compartment.
(See page EG2–309)
(2) Disconnect the E8 connector of ECM.
HINT: Engine coolant temp. sensor connector is dis–connected.
(3) Turn ignition switch ON.

C Read temperature value on the OBDII scan tool or TOYOTA hand–held tester.

OK **Temperature value: –40$_2$C (–40$_2$F)**

NG

OK **Repair or replace harness or connector.**

**Check and replace ECM (See page IN–36).**

# DTC P0116 Engine Coolant Temp Circuit Range Performance Problem

## CIRCUIT DESCRIPTION

Refer to engine coolant temp. circuit malfunction on page EG2–457.

| DTC No. | Diagnostic Trouble Code Detecting Condition | Trouble Area |
|---|---|---|
| P0116 | 20 min. or more after starting engine, engine coolant temp. sensor value is 30°C (86°F) or less. (2 trip detection logic) | • Engine coolant temp. sensor.<br>• Cooling system. |

## DIAGNOSTIC CHART

HINT: If diagnostic trouble codes ”P0115” (engine coolant temp. circuit malfunction) and ”P0116” (engine coolant temp. circuit range/ performance) are output simultaneously, engine coolant temp. sensor circuit may be open.
Perform troubleshooting of diagnostic trouble code P0115 first.

| | | | |
|---|---|---|---|
| 1 | Are there any other codes (besides DTC P0116) being output? | YES | Go to relevant diagnostic trouble code chart. |

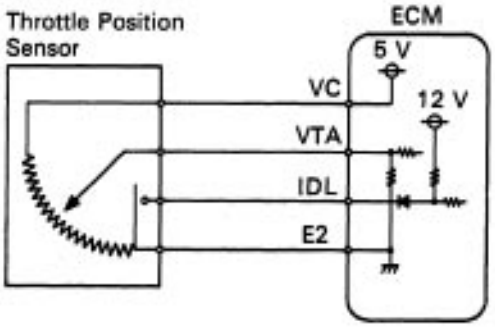
NO

Replace engine coolant temp. sensor. (See page EG2–282)

# DTC P0120 Throttle Position Circuit Malfunction

## CIRCUIT DESCRIPTION

The throttle position sensor is mounted in the throttle body and detects the throttle valve opening angle. When the throttle valve is fully closed, the IDL contacts in the throttle position sensor are on, so the voltage at the terminal IDL of the ECM becomes 0V. At this time, a voltage of approximately 0.7 V is applied to terminal VTA of the ECM. When the throttle valve is opened, the IDL contacts go off and thus the power source voltage of approximately 12 V in the ECM is applied to the terminal IDL of the ECM. The voltage applied to the terminal VTA of the ECM increases in proportion to the opening angle of the throttle valve and becomes approximately 3.5 – 5.0 V when the throttle valve is fully opened. The ECM judges the vehicle driving conditions from these signals input from terminals VTA and IDL, and uses them as one of the condithins for deciding the air–fuel ratio correction, power increases correction and fuel–cut control etc.



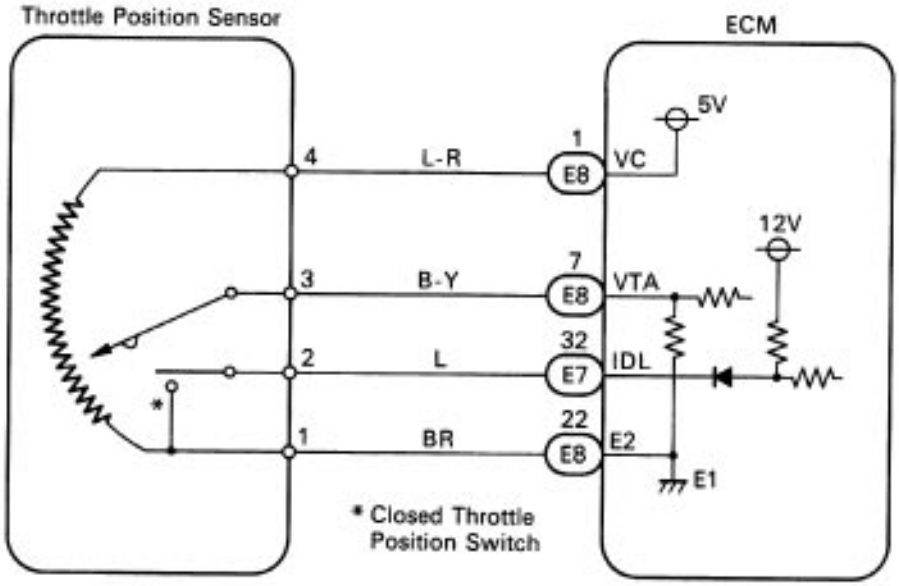

| DTC No. | Diagnostic Trouble Code Detecting Condition | Trouble Area |
|---|---|---|
| P0120 | Condition a) or b) continues.<br>a) VTA ( 0.1 V, and closed throttle position switch is OFF.<br>b ) VTA ) 4.9 V | • Open or short in throttle position sensor circuit.<br>• Throttle position sensor.<br>• ECM |

HINT:

- If there is open circuit in IDL line, diagnostic trouble code P0120 does not indicate,
- After confirming DTC P0120 use the OBDII scan tool or TOYOTA hand–held tester to confirm the throttle valve opening percentage and closed throttle position switch condition.

| Throttle valve opening position expressed as percentage | | Trouble Area |
|---|---|---|
| Throttle valve fully closed | Throttle valve fully open | |
| 0% | 0 % | VC line open<br>VTA line open or short |
| Approx. 99% | Approx. 100% | E2 line open |

# WIRING DIAGRAM




FI6573

**DIAGNOSTIC CHART**

HINT: If diagnostic trouble codes P0110, P01 15 and P0120 are output simultaneously, E2 (sensor ground) may be open.

TOYOTA hand–held tester

| | | | |
|---|---|---|---|
| 1 | Connect the TOYOTA hand–held tester and read the throttle valve opening percentage. | OK | Check for intermittent problems. |

NG

| | | | |
|---|---|---|---|
| 2 | Read closed throttle position switch condition. | OK | G o to step 5 |

NG

| | | | |
|---|---|---|---|
| 3 | Check voltage of terminal VC. | NG | Go to step 6 |

OK

| | | | |
|---|---|---|---|
| 4 | Check throttle position sensor. | NG | Replace throttle position sensor. |

OK

| | | | |
|---|---|---|---|
| 5 | Check voltage of terminal VTA and E2 of ECM. | NG | Check for open and short in harness and connector between ECM and throttle position sensor (VTA line). |

OK

Check and replace ECM.

| | | | |
|---|---|---|---|
| 6 | Check voltage of terminal VC and E2 of ECM. | NG | Check and replace ECM. |

OK

Check for open in harness and connector between ECM and sensor (VC line).

## OBDII scan tool (excluding TOYOTA hand–held tester)

| | | | |
|---|---|---|---|
| 1 | Connect the OBDII scan tool and read the throttle valve opening percentage. | OK | Check for intermittent problems. |

NG

| | | | |
|---|---|---|---|
| 2 | Check voltage of terminal IDL and E2 of ECM. | OK | Go to step 5 |

NG

| | | | |
|---|---|---|---|
| 3 | Check voltage of terminal VC on wire harness side connector. | NG | G o to step 6 |

OK

| | | | |
|---|---|---|---|
| 4 | Check throttle position sensor. | NG | Replace throttle position sensor. |

OK

| | | | |
|---|---|---|---|
| 5 | Check voltage of terminal VTA and E2 of ECM. | NG | Check for open and short in harness and connector between ECM and throttle position sensor (VTA line). |

OK

Check and replace ECM.

| | | | |
|---|---|---|---|
| 6 | Check voltage of terminal VC and E2 of ECM. | NG | Check and replace ECM. |

OK

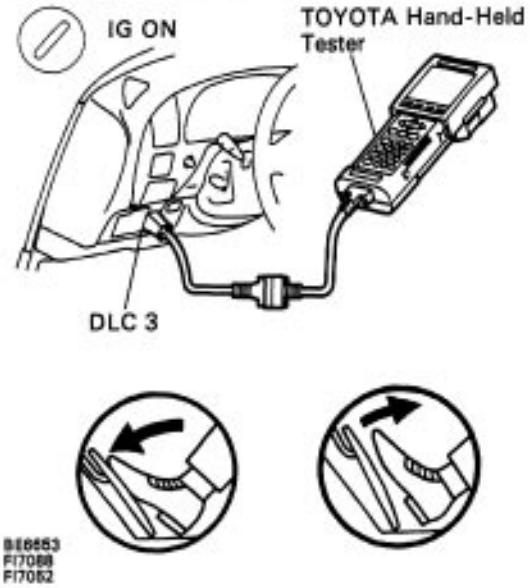
Check for open in harness and connector between ECM and sensor (VC line).

# INSPECTION PROCEDURE

TOYOTA hand–held tester

HINT: If diagnostic trouble codes P01 10, P01 15 and P0120 are output simultaneously, E2 (sensor ground) may be open.

**1** **Connect the TOYOTA hand–held tester and read the throttle valve opening percentage.**




P (1) Remove the fuse cover on the instrument panel.
(2) Connect the TOYOTA hand–held tester to the DLC 3.
(3) Turn ignition switch ON and TOYOTA hand–held tester main switch ON.

C Read the throttle valve opening percentage.

OK

| Throttle valve | Throttle valve opening position expressed as percentage |
|---|---|
| Fully open | Approx. 70% |
| Fully closed | Approx. 10% |

NG

OK → **Check for intermittent problems (See page EG2–417).**

**2** **Read closed throttle position switch condition.**


P (1) Remove the fuse cover on the instrument panel.
(2) Connect the TOYOTA hand–held tester to the DLC 3.
(3) Turn ignition switch ON and TOYOTA hand–held tester main switch ON.

C Read closed throttle position switch condition.

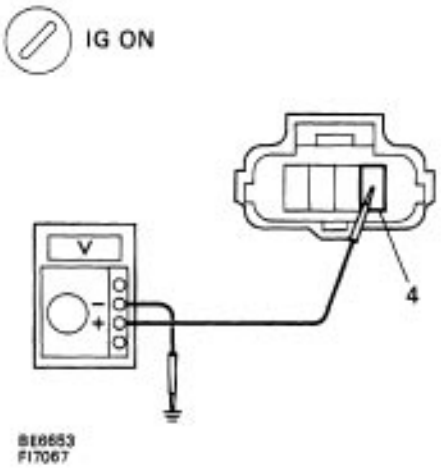
OK

| Throttle valve | Closed throttle position switch condition |
|---|---|
| Fully open | OFF |
| Fully closed | ON |

NG

OK → **Go to step 5**

**3** **Check voltage between terminal VC of wire harness side connector and body ground.**



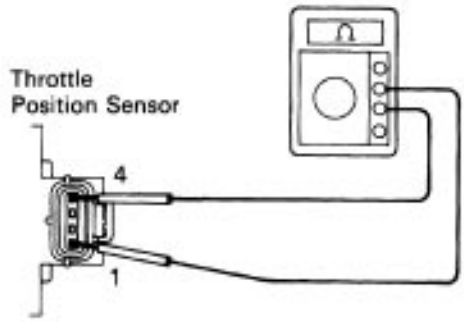

P (1) Disconnect the throttle position sensor connector.
(2) Turn ignition switch ON.

C Measure voltage between terminal VC of wire harness side connector and body ground.

OK **Voltage: 4.5 – 5.5 V**

OK → NG → **Go to step 6**

**4** **Check throttle position sensor.**

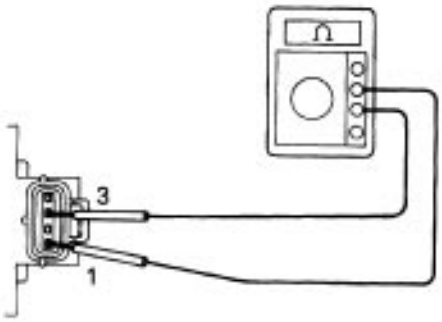



P Disconnect the throttle position sensor connector.

C Measure resistance between terminals 4, 3 and 1 of throttle position sensor.

OK

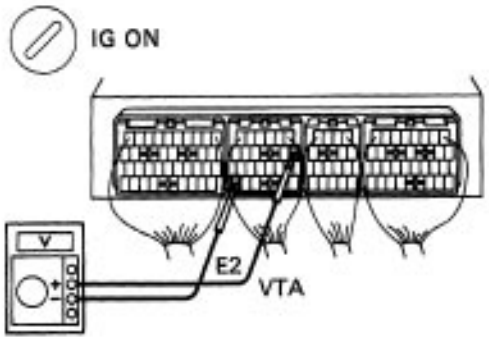
| Terminals | Throttle valve | Resistance |
|---|---|---|
| 1 –4 | – | 4.25 – 8.25 kΩ |
| 1 –3 | Fully closed | 0.3 – 6.3 kΩ |
| | Fully open | 3.5 – 10.3 kΩ |




FI6561
FI6562

OK → NG → **Replace throttle position sensor.**

**5** **Check voltage between terminals VTA and E2 of ECM.**




P (1) Remove glove compartment.
(See page EG2–309)
(2) Turn ignition switch ON.

C Measure voltage between terminals VTA and E2 of ECM.

OK

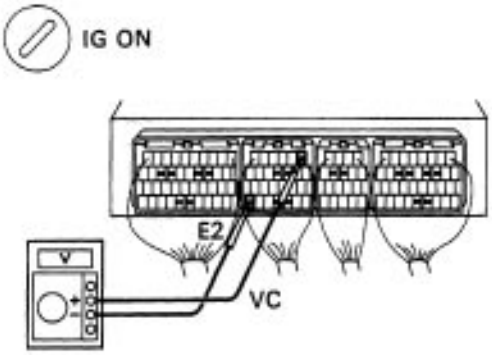
| Throttle Valve | Voltage |
|---|---|
| Fully closed | 0.3 – 0.8 V |
| Fully open | 2.7 – 5.2 V |

OK

NG **Check for open and short in harness and connector between ECM and throttle position sensor (VTA line) (See page IN–31).**

**Check and replace ECM (See page IN–36).**

**6** **Check voltage between terminals VC and E2 of ECM.**




P (1) Remove glove compartment.
(See page EG2–309)
(2) Turn ignition switch ON.

C Measure voltage between terminals VC and E2 of engine control module connector.

OK **Voltage: 4.5 – 5.5 V**

OK

NG **Check and replace ECM (See page IN–36).**

**Check for open in harness and connector between ECM and sensor (VC line) (See page IN–31).**

# INSPECTION PROCEDURE

OBD II scan tool (excluding TOYOTA hand–held tester)

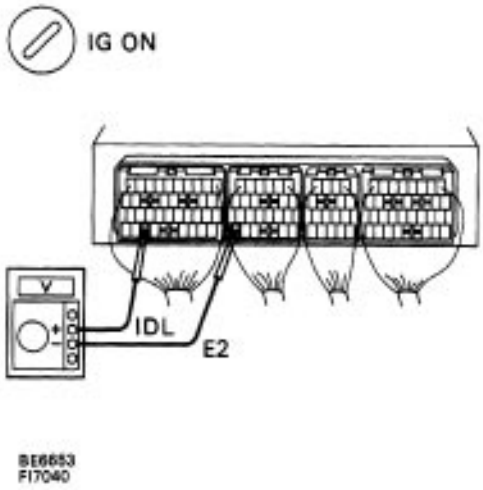
HINT: If diagnostic trouble codes P0110, P0115, and P0120 are output simultaneously, E2 (sensor ground) may be open.

**1** **Connect the OBD II scan tool and read the throttle valve opening percentage (See page EG2–467, step 1 ).**

**NG**

**OK** → **Check for intermittent problems. (See page EG2–417)**

**2** **Check voltage of terminal IDL and E2 of ECM.**




P (1) Remove glove compartment.
(See page EG2–309)
(2) Turn ignition Switch ON.

C Measure voltage between terminals IDL and E2 of ECM.

OK

| Throttle Valve | Voltage |
|---|---|
| Fully closed | 0 – 3.0 V |
| Fully open | 9–14V |

**NG**

**OK** → **Go to step**

**3** **Check voltage between terminal VC of wire harness side connector and body ground (See page EG2–468, step 3).**

**OK**

**NG** → **Go to step 6**

**4** **Check throttle position sensor (See page EG2–468, step 4).**

**OK**

**NG** → **Replace throttle position sensor.**

| | |
|---|---|
| 5 | Check voltage between terminals VTA and E2 of ECM (See page EG2–469, step 5). |

OK

Check and replace ECM (See page IN–36).

NG

Check for open and short in harness and connector between ECM and throttle position sensor (VTA line) (See page IN–31).

| | |
|---|---|
| 6 | Check voltage terminals VC and E2 of ECM (Seepage EG2–469, step 6). |

OK

Check for open in harness and connector between ECM and sensor (VC line) (See page IN–31).

NG

Check and replace ECM (See page IN–36).

# DTC P0121 Throttle Position Circuit Range Performance Problem

## CIRCUIT DESCRIPTION

Refer to throttle position circuit malfunction on page EG2–463.

| DTC No. | Diagnostic Trouble Code Detecting Condition | Trouble Area |
|---|---|---|
| P0121 | When closed throttle position switch is ON, condition a) continues.<br>(2 trip detection logic)<br>a ) VTA ) 2.0 V | • Throttle position sensor. |

## DIAGNOSTIC CHART

| | | | |
|---|---|---|---|
| 1 | Are there any other codes (besides DTC P0121) being output? | YES | Go to relevant diagnostic trouble code chart. |

NO

Replace throttle position sensor.

# DTC P0125 Insufficient Coolant Temp for Closed Loop Fuel Control

## CIRCUIT DESCRIPTION

To obtain a high purification rate for the C0, HC and NOx components of the exhaust gas, a three–way catalytic converter is used, but for the most efficient use of the three–way catalytic converter, the air–fuel ratio must be precisely controlled so that it is always close to the stoichiometric air–fuel ratio.

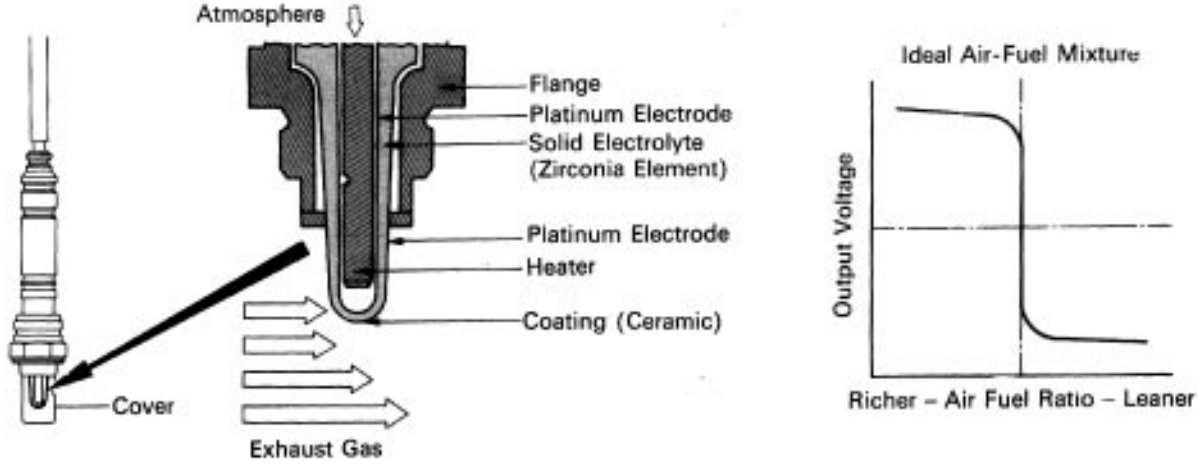
The oxygen sensor has the characteristic whereby its output voltage changes suddenly in the vicinity of the stoichiometric air–fuel ratio. This characteristic is used to detect the oxygen concentration in the exhaust gas and provide feedback to the computer for control of the air–fuel ratio.

When the air–fuel ratio becomes LEAN, the oxygen concentration in the exhaust increases and the oxygen sensor informs the ECM of the LEAN condition (small electromotive force: 0 V).

When the air–fuel ratio is RICHER than the stoichiometric air–fuel ratio the oxygen concentration in the exhaust gas is reduced and the oxygen sensor informs the ECM of the RICH condition (large electromotive force:1V)

The EMC judges by the electromotive force from the oxygen sensor whether the air–fuel ration is RICH or LEAN and controls the injection time accordingly. However, if malfunction of the oxygen sensor causes output of abnormal electromotive force, the EMC is unable to perform accurate air–fuel ration control.

The main heated oxygen sensors include a heater which heats the Zirconia element. The heater is controlled by the EMC. When the intake air volume is low (the temperature of the exhaust gas is low) current flows to the heater to heat the sensor for accurate oxygen concentration detection.




FI4835 FI7210

| DTC No. | Diagnostic Trouble Code Detecting Condition | Trouble Area |
|---|---|---|
| P0125 | After the engine is warmed up, heated oxygen sensor output does not indicate RICH even once when conditions a) and b) continue for at least 2 minutes.<br>a) Engine speed: 1,500 rpm or more<br>b) Vehicle speed: 40 km/h (25 mph) or more | • Open or short in heated oxygen sensor circuit.<br>• Heated oxygen sensor. |

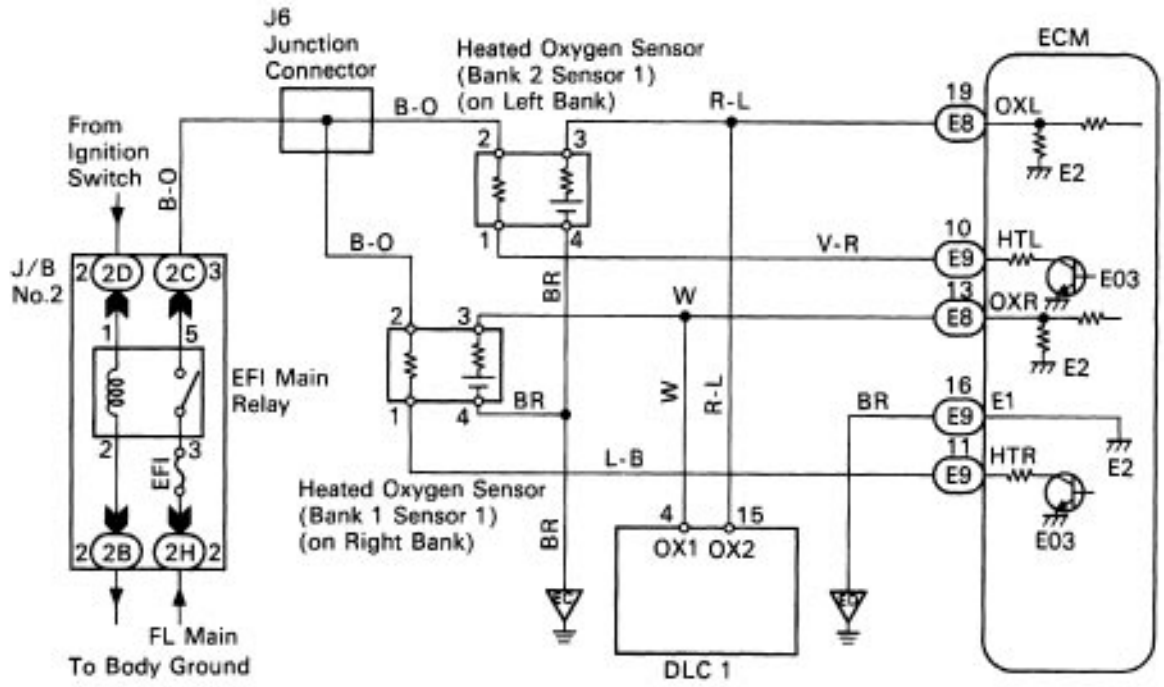
HINT: After confirming DTC P0125 use the 0BDll scan tool or TOYOTA hand–held tester to confirm voltage output of heated oxygen sensor from current data.

If voltage output of heated oxygen sensor is 0 V, heated oxygen sensor circuit may be open or short.

# DIAGNOSTIC CHART

| | | | |
|---|---|---|---|
| 1 | Connect the OBDII scan tool or TOYOTA hand–held tester and read value for voltage output of heated oxygen sensor. | OK | Check and replace ECM. |
| NG | | | |
| 2 | Check for open and short in harness and connector between ECM and heated oxygen sensor. | NG | Repair or replace harness or connector. |
| OK | | | |
| Replace heated oxygen sensor. | | | |

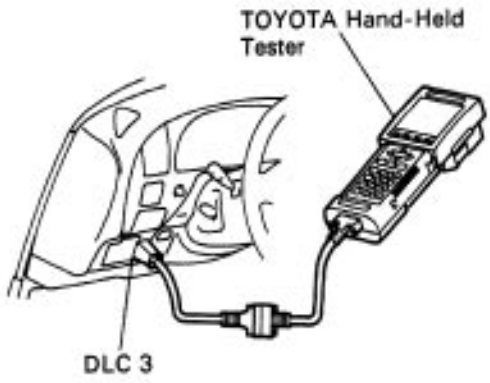
# WIRING DIAGRAM




FI7013

# INSPECTION PROCEDURE

**1** **Connect the OBDII scan tool or TOYOTA hand–held tester and read value for voltage output of heated oxygen sensor.**




P (1 ) Remove the fuse cover on the instrument panel.
(2) Connect the OBDII scan tool or TOYOTA hand–held tester to the DLC 3.
(3) Warm up engine to normal operating temper–ature.

C Read voltage output of heated oxygen sensor (bank 1,2 sensor 1) when engine is suddenly raced.

Hint Perform quick racing to 4,000 rpm three times us–ing accelerator pedal.

OK **Both heated oxygen sensors [(bank 1 sensor 1) (bank 2 sensor 1)] output a RICH signal (0.45 V or more) at least once.**

NG

OK → **Check and replace ECM (See page IN–36).**

**2** **Check for open and short in harness and connector between ECM and heated oxygen sensor (See page IN–31).**

OK

NG → **Repair or replace harness or connector.**

**Replace heated oxygen sensor.**

# DTC P0130 P0150 Heated Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 1 Bank 2 Sensor 1)

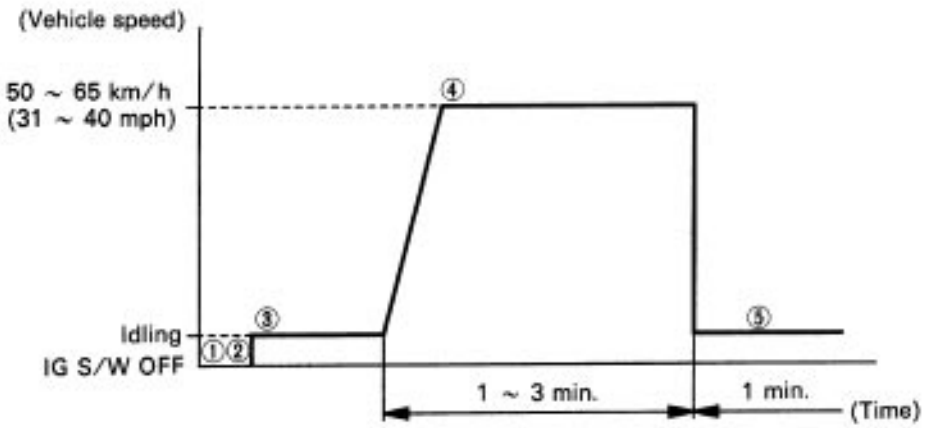
## CIRCUIT DESCRIPTION

Refer to ”Insufficient coolant temp. for closed loop fuel control” on page EG2–473.

| DTC No. | Diagnostic Trouble Code Detecting Condition | Trouble Area |
|---|---|---|
| **P0130**<br>**P0150** | Voltage output of heated oxygen sensor remains at 0,4 V or more, or 0,55 V or less, during idling after the engine is warmed up.<br>(2trip detection logic) | • Heated oxygen sensor<br>• Fuel trim malfunction |

H I NT: Bank 1 refers to the bank that includes cylinder No.1.
Bank 2 refers to the bank that does not include cylinder No,1.
Sensor 1 refers to the sensor closer to the engine body.
The heated oxygen sensor’s output voltage and the short–term fuel trim value can be read using the OBDll scan tool or TOYOTA hand–held tester.

# CONFIRMATION DRIVING PATTERN



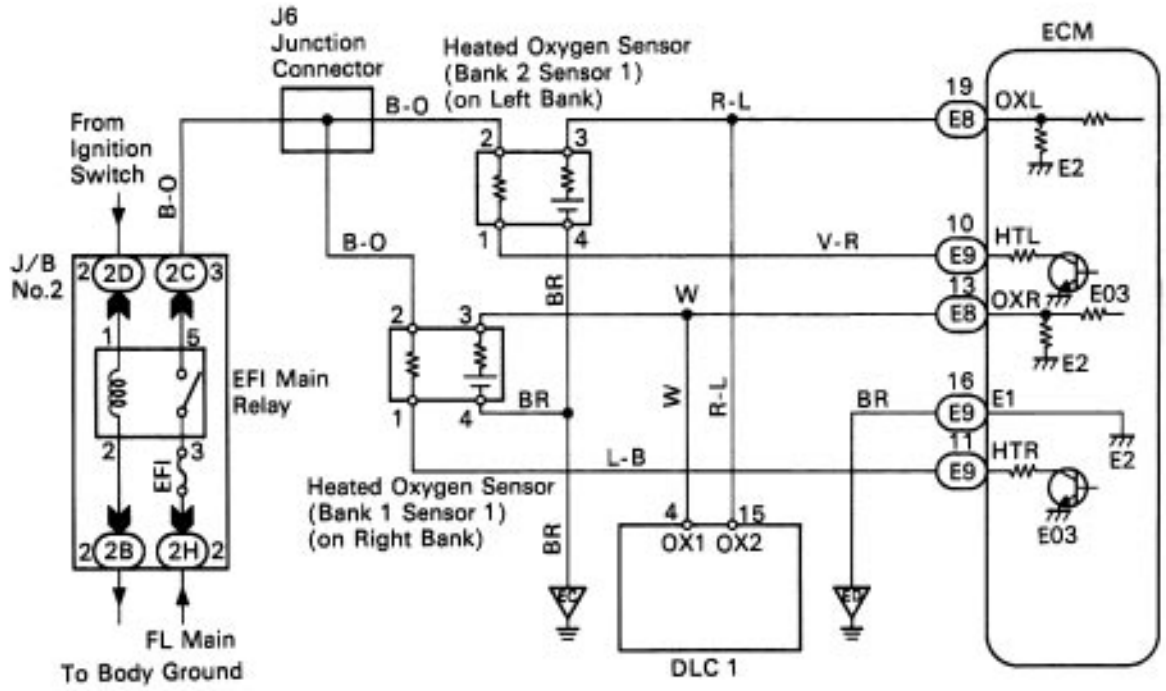

FI7130

(1)Connect the TOYOTA hand–held tester to the DLC 3.
(2)Switch the TOYOTA hand–held tester from normal mode to check mode (See page EG2–403).
(3) Start the engine and warm it up with all accessory switches OFF.
(4) After the engine is warmed up, drive at 50 – 65 km/h (31 – 40 mph) for 1 – 3 minutes to warm up the heated oxygen sensor.
(5) After driving let the engine idle for 1 minute.
HINT: If a malfunction exists, the MIL will light up during step (5) .
**NOTICE: If the conditions in this test are not strictly followed, detection of the malfunction will not be possible.**
**If you do not hove a TOYOTA hand–held tester, turn the ignition switch OFF after perform–ing steps (3) to (5), then perform steps (3) to (5) again.**

# DIAGNOSTIC CHART

| | | | |
|---|---|---|---|
| 1 | Check for open and short in harness and connector between ECM and heated oxygen sensor. | NG | Repair or replace harness or connector. |
| OK | | | |
| 2 | Check heated oxygen sensor data. | OK | Check fuel trim system. |
| NG | | | |
| 3 | Check output voltage of heated oxygen sensor. | OK | Perform confirmation driving pattern. |
| NG | | | |
| Replace heated oxygen sensor. | | | |

# WIRING DIAGRAM




FI7013

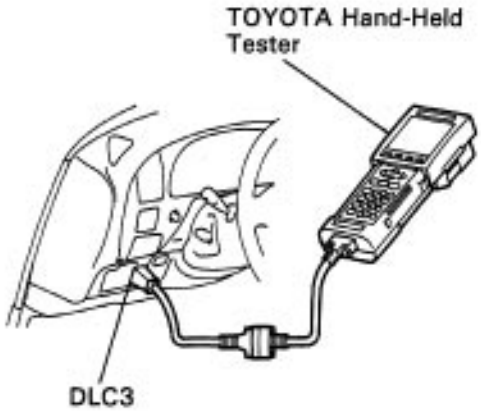
# INSPECTION PROCEDURE

**1** **Check for open and short in harness and connector between ECM and heated oxygen sensor (See page IN–31).**

OK

NG → **Repair or replace harness or connector.**

**2** **Check for heated oxygen sensor data.**




FI7088

P (1) Remove the fuse cover on the instrument panel.
(2) Connect the OBD II scan tool or TOYOTA hand–held tester to the DLC 3.
(3) Warm up engine to normal operating temperature.

C Read the heated oxygen sensor output voltage and short–term fuel trim.

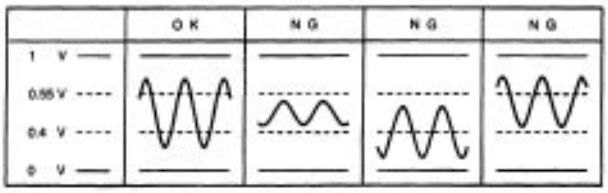
Hint Read the values for the same bank.

Result

| Pattern | Heated oxygen sensor output voltage | Short–term fuel trim |
|---|---|---|
| ① | Lean condition (Changes at 0.55 V or less) | Changes at about +20% |
| ② | Rich condition (Changes at 0.4 V or more) | Changes at about –20% |
| ③ | Except (1) and (2) | |

③ → (1),(2) → **Check fuel trim system. (See page EG2–486).**

**3** **Check the output voltage of heated oxygen sensor during idling.**




P18349

P Warm up the heated oxygen sensor with the engine at 2,500 rpm for approx. 90 sec.

C Use the OBD II scan tool or TOYOTA hand–held tester read the output voltage of the heated ox–ygen sensor during idling.

OK **Heated oxygen sensor output voltage: Alternates repeatedly between less than 0.4 V and more than 0.55 V (See the adjacent table).**

NG → **Replace heated oxygen sensor.**

OK → **Perform confirmation driving pattern. (See page EG2–477).**

# DTC P0133 P0153 Heated Oxygen Sensor Circuit Slow Response (Bank 1 Sensor 1 Bank 2 Sensor 1)

## CIRCUIT DESCRIPTION

Refer to ”Insufficient coolant temp. for closed loop fuel control” on page EG2–473.

| DTC No. | Diagnostic Trouble Code Detecting Condition | Trouble Area |
|---|---|---|
| P0133<br>P0153 | Response time for the heated oxygen sensor’s voltage output to change from rich to lean, or from lean to rich, is 1 sec. or more during idling after the engine is warmed up.<br>(2 trip detection logic) | • Heated oxygen sensor |

HINT: Bank 1 refers to the bank that includes cylinder No.1.
Bank 2 refers to the bank that does not include cylinder No.1.
Sensor 1 refers to the sensor closer to the engine body.

## DIAGNOSTIC CHART

| | | | |
|---|---|---|---|
| 1 | Are there any other codes (besides DTC P0133, P0153) being output? | YES | Go to relevant diagnostic trouble code chart. |

NO

Replace heated oxygen sensor.

# DTC P0135 P0141 P0155 Heated Oxygen Sensor Heater Circuit Malfunction (Bank 1 Sensor 1 – Bank 1 Sensor 2 – Bank 2 Sensor 1)

## CIRCUIT DESCRIPTION

Refer to ”Insufficient coolant temp. for closed loop fuel control” on page EG2–473.

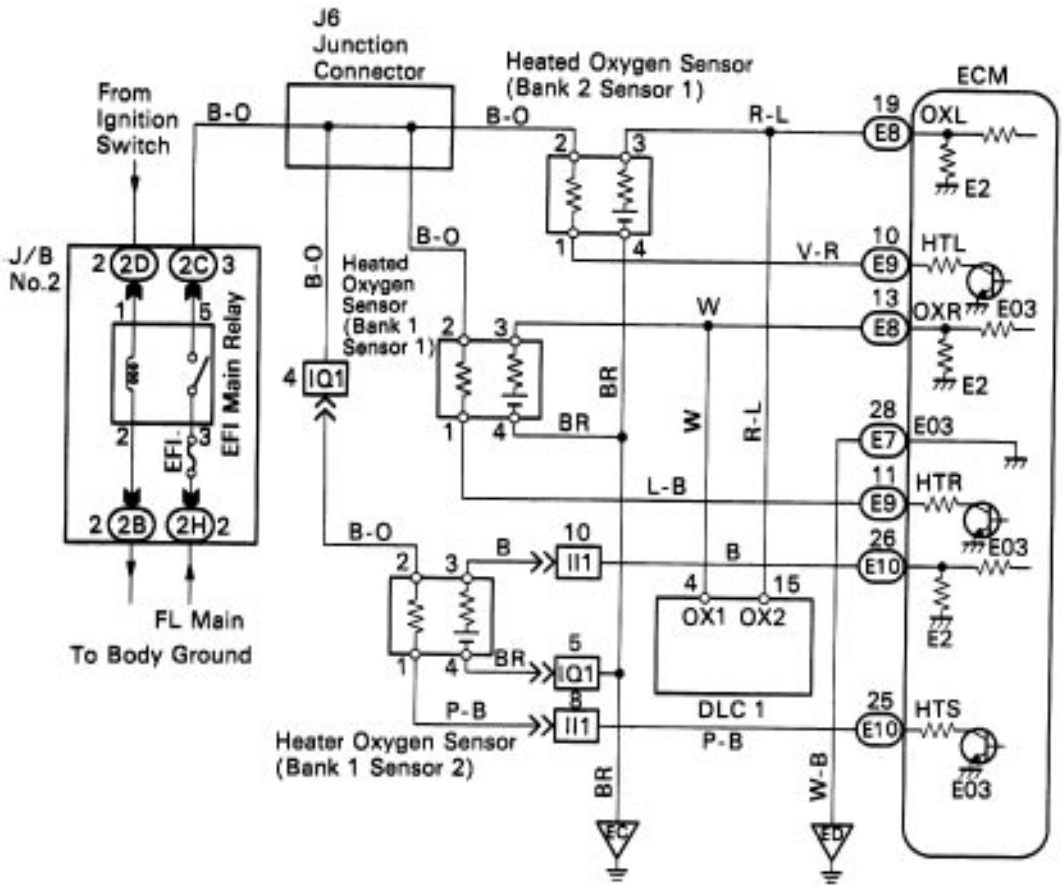
| DTC No. | Diagnostic Trouble Code Detecting Condition | Trouble Area |
|---|---|---|
| P0135<br>P0141<br>P0155 | When the heater operates, heater current exceeds 2 A or voltage drop for the heater circuit exceeds 5 V.<br>(2 trip detection logic) | • Open or short in heater circuit of heated oxygen sensor.<br>• Heated oxygen sensor heater<br>• ECM |
| | Heater current of 0.25 A or less when the heater operates.<br>(2 trip detection logic) | |

H I NT: Bank 1 refers to the bank that includes cylinder No.1.
Bank 2 refers to the bank that does not include cylinder No.1.
Sensor 1 refers to the sensor closer to the engine body.
Sensor 2 refers to the sensor farther away from the engine body.

## DIAGNOSTIC CHART

| | | | |
|---|---|---|---|
| 1 | Check voltage of terminals HTR, HTS, HTL. | OK | Check and replace ECM. |
| NG | | | |
| 2 | Check resistance of heated oxygen sensor heater. | NG | Replace heated oxygen sensor. |
| OK | | | |
| Check and repair harness or connector between main relay and heated oxygen sensor and ECM. | | | |

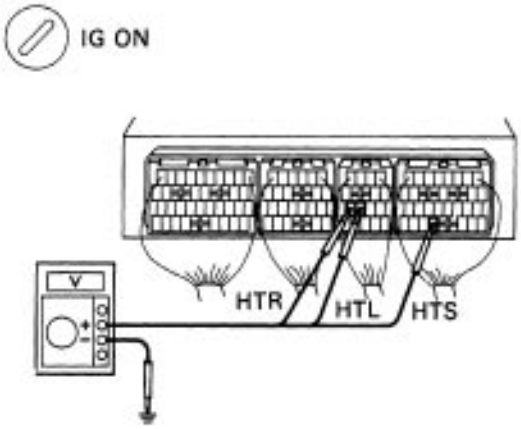
## WIRING DIAGRAM




FI7077

## INSPECTION PROCEDURE

**1** **Check voltage between terminals HTR, HTS, HTL of ECM connector and body ground.**




BE6653
FI7033

P (1) Remove glove compartment (See page EG2–309).
(2) Turn ignition switch ON.

C Measure voltage between terminals HTR, HTS, HTL of ECM connector and body ground.

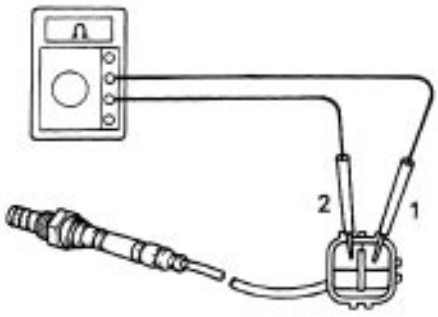
Hint Connect terminal HTR to bank 1 sensor 1.
Connect terminal HTS to bank 1 sensor 2.
Connect terminal HTL to. bank 2 sensor 1.

OK **Voltage: 9 –14 V**

NG

OK → **Check and replace ECM (See page IN–36).**

**2** **Check resistance of heated oxygen sensor heater.**




FI6613

P Disconnect heated oxygen sensor connector.

C Measure resistance between terminals 1 and 2 of heated oxygen sensor connector.

OK **Resistance: 11 –16 at 20$_2$C (68$_2$F)**

OK

NG → **Replace heated oxygen sensor.**

**Check and repair harness or connector between main relay and heated oxygen sensor and ECM.**

# DTC P0136 Heated Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 2)

## CIRCUIT DESCRIPTION

Refer to ”Insufficient coolant temp. for closed loop fuel control” on page EG2–473.

| DTC No. | Diagnostic Trouble Code Detecting Condition | Trouble Area |
|---|---|---|
| P01 36 | Voltage output of the heated oxygen sensor (bank 1 sensor 2) remains at 0.4 V or more or 0.5 V or less when the vehicle is driven at 50 km/h (31 mph) or more after the engine is warmed up. (2 trip detection logic) | • Heated oxygen sensor |

HINT: Bank 1 refers to the bank that includes cylinder No.1.
Sensor 2 refers to the sensor farther away from the engine body.

## DIAGNOSTIC CHART

| | | | |
|---|---|---|---|
| 1 | Are there any other codes (besides DTC P01 36) being output? | YES | Go to relevant diagnostic trouble code chart. |
| NO | | | |
| 2 | Check for open and short in harness and connector between ECM and heated oxygen sensor. | NG | Repair or replace harness or connector. |
| OK | | | |
| 3 | Check the output voltage of the heated oxygen sensor. | OK | Check that each connector is properly connected. |
| NG | | | |
| Replace heated oxygen sensor. | | | |

## WIRING DIAGRAM

Refer to page EG2–482 for the WIRING DIAGRAM.

## INSPECTION PROCEDURE

**1** Are there any other codes (besides DTC P0136) being output?

NO

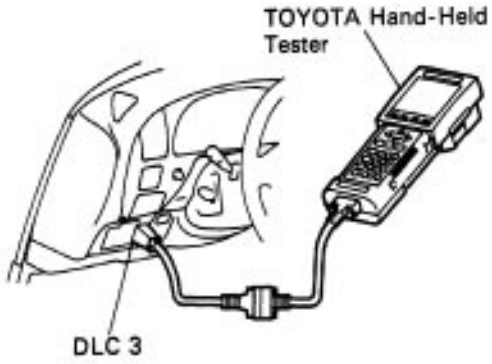
YES → **Go to relevant diagnostic trouble code chart.**

**2** Check for open and short in harness and connector between ECM and heated oxygen sensor (See page IN–31).

OK

NG → **Repair or replace harness or connector.**

**3** Check the output voltage of heated oxygen sensor (bank 1 sensor 2).




FI7088

P (1) Remove the fuse cover on the instrument panel.

(2) Connect the OBDII scan tool or TOYOTA hand–held tester to the DLC 3.

(3) After warming up the engine, race the engine at 2,500 rpm for 3 mins.

C Read the output voltage of heated oxygen sensor (bank 1 sensor 2) when racing the engine after 3 mins. have elapsed.

OK **Heated oxygen sensor output voltage: Alternates from 0.4 V or less to 0,5 V or more.**

NG

OK → **Check that each connector is properly connected.**

**Replace heated oxygen sensor.**

# DTC P0171 System too Lean (Fuel Trim)
# DTC P0172 System too Rich (Fuel Trim)

## CIRCUIT DESCRIPTION

”Fuel trim” refers to the feedback compensation value compared against the basic injection time. Fuel trim includes short–term fuel trim and long–term fuel trim.
”Short–term fuel trim” is the short–term fuel compensation used to maintain the air–fuel ratio at its ideal theoretical value. The signal from the heated oxygen sensor indicates whether the air–fuel ratio is RICH or LEAN compared to the ideal theoretical value, triggening a reduction in fuel volume if the air–fuel ratio is rich, and an increase in fuel volume if it is lean.
”Long–term fuel trim” is overall fuel compensation carried out long–term to compensate for continual deviation of the short–term fuel trim from the central value due to individual engine differences, wear over time and changes in the usage environment.
If both the short–term fuel trim and long–term fuel trim are LEAN or RICH beyond a certain value, it is detected as a malfunction and the MIL lights up.

| DTC No. | Diagnostic Trouble Code Detecting Condition | Trouble Area |
|---|---|---|
| **P0171** | When the air fuel ratio feedback is stable after engine warming up, the fuel trim is considerably in error on the RICH side.<br>(2 trip detection logic) | • Air intake (hose loose)<br>• Fuel line pressure<br>• Injector blockage<br>• Heated oxygen sensor malfunction<br>• Mass air flow meter<br>• Engine coolant temp. sensor |
| **P0172** | When the air fuel ratio feedback is stable after engine warming up, the fuel trim is considerably in error on the LEAN side.<br>(2 trip detection logic) | • Fuel line pressure<br>• Injector leak, blockage<br>• Heated oxygen sensor malfunction<br>• Mass air flow meter<br>• Engine coolant temp. sensor |

HINT;

- When DTC P0171 is recorded, the actual air–fuel ratio is on the LEAN side. When DTC P0172 is recorded, the actual air–fuel ratio is on the RICH side,
- Fuel trim applies separately to bank 1 and bank 2, so the ECM lights up the MIL if a problem occurs with either bank.
- You can tell which bank is malfunctioning by looking at the short–term fuel trim and long–term fuel trim, thus allowing you to focus your inspection.
- If the total of the short–term fuel trim value and long–term fuel trim value for each bank is within ± 25%, the system is functioning normally.

## DIAGNOSTIC CHART

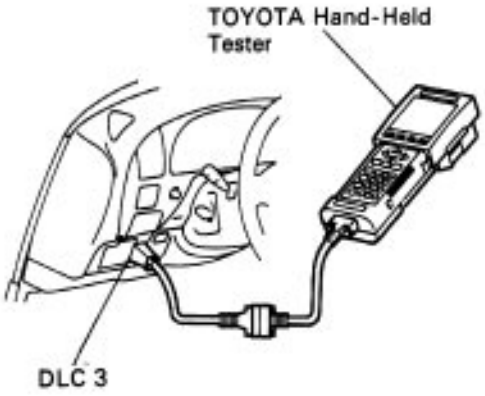
| | | | |
|---|---|---|---|
| 1 | Check air induction system. | NG | Repair or replace. |
| OK | | | |
| 2 | Check heated oxygen sensor data. | NG | Check heated oxygen sensor. |
| OK | | | |
| 3 | Check fuel pressure. | NG | Check and repair fuel pump, pressure regulator, fuel pipe line and filter. |
| OK | | | |
| 4 | Check injector injection. | NG | Replace injector. |
| OK | | | |
| 5 | Check mass air flow meter and engine coolant temp. sensor | NG | Repair or replace. |
| OK | | | |
| 6 | Check for spark and ignition. | NG | Repair or replace. |
| OK | | | |
| Check and replace ECM. | | | |

## INSPECTION PROCEDURE

**1** **Check air induction system (See page EG2–221).**

OK → NG: **Repair or replace.**

**2** **Check for– heated oxygen sensor data.**




P (1) Remove the fuse cover on the instrument panel.
(2) Connect the OBDII scan tool or TOYOTA hand–held tester to the DLC 3.
(3) Warm up engine to normal operating temper–ature.

C Read the heated oxygen sensor output voltage and short–term fuel trim.

Hint Read the values for the same bank.

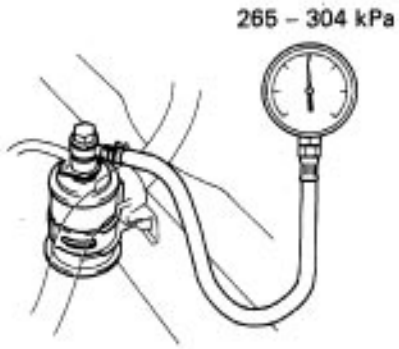
OK

| Pattern | Heated oxygen sensor out put voltage | Short–term fuel trim |
|---|---|---|
| ① | Lean condition Changes at 0.55 V or less | Changes at about + 20% |
| ② | Rich condition Changes at 0.4 V or more | Changes at about – 20% |

OK

NG: **Check for heated oxygen sensor (See page EG2–476).**

**3** **Check fuel pressure.**


B86653
P00003

P (1) Install the SST (pressure gauge) to the fuel filter output (See page EG2–231).
SST 09268–45012

(2) Turn ignition switch ON.

(3) Connect the TOYOTA hand–held tester to data link connector 3 on the vehicle.

(4) Use ACTIVE TEST mode to operate the fuel pump.

Hint Connecting terminals B and FP of data link connector 1 allows the fuel pump to be operated.

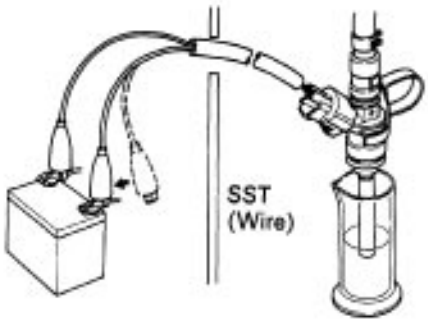
C Measure the fuel pressure

OK **Fuel pressure: 265 – 304 kPa (2.7 – 3.1 kg f/cm$^2$, 38 – 44 psi)**

OK

NG **Check and repair fuel pump, pressure regulator, fuel pipe line and filter. (See page EG2–230).**

**4** **Check injector injection.**




P01077
P01010

P Remove the delivery pipe and injectors from the bank that has the malfunction (See page EG2–246).

C Check injection volume of injector (See page EG2–250) .

OK **Injection volume:**
**56 – 69 cm$^3$/15 sec. (3.4 – 4.2 cu in.)**
**Difference between each injector:**
**Less than 6 cm$^3$ (0.4 cu in.)**
**Fuel drop (leakage):**
**One drop or less per minute.**

OK

NG **Replace injector.**

| | |
|---|---|
| 5 | Check mass air flow meter– and engine coolant temp. sensor (See page EG2–444, 457). |

OK

NG → Repair or replace.

| | |
|---|---|
| 6 | Check for spark and ignition (See page IG–84). |

OK

NG → Repair or replace.

Check and replace ECM (See page IN–36).

# DTC P0201 P0202 P0203 P0204 P0205 P0206 Injector Circuit Malfunction (Cylinder 1–6)

## CIRCUIT DESCRIPTION

The injectors are located in the intake manifold. They inject fuel into the cylinders based on signals from the ECM.

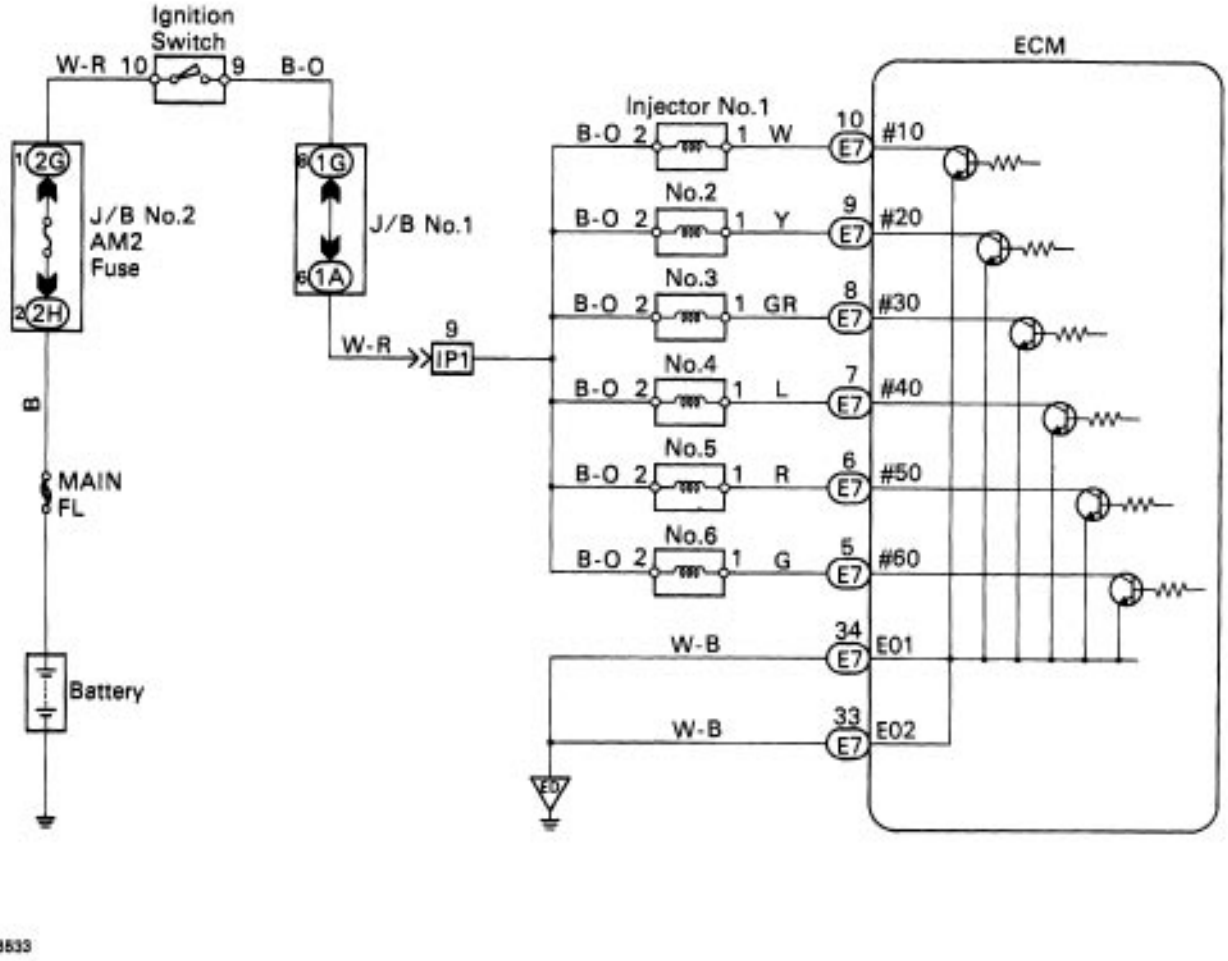
The ECM detects a malfunction of the injector circuit by counting the number of misfires of a specific cylinder.

For an explanation of misfire detection requirements, see page DTC P0301.

| DTC No. | Diagnostic Trouble Code Detecting Condition | Trouble Area |
|---|---|---|
| **P0201**<br>**P0202**<br>**P0203**<br>**P0204**<br>**P0205**<br>**P0206** | A specified cylinder misfire continuously.<br>(2 trip detection logic) | • Open or short in injector circuit<br>• Injector blockage, seized<br>• Ignition system<br>• Valve clearance not to specification<br>• Compression pressure |

See the Diagnostic Chart and Inspection Procedure under ”Misfiring”.

# WIRING DIAGRAM

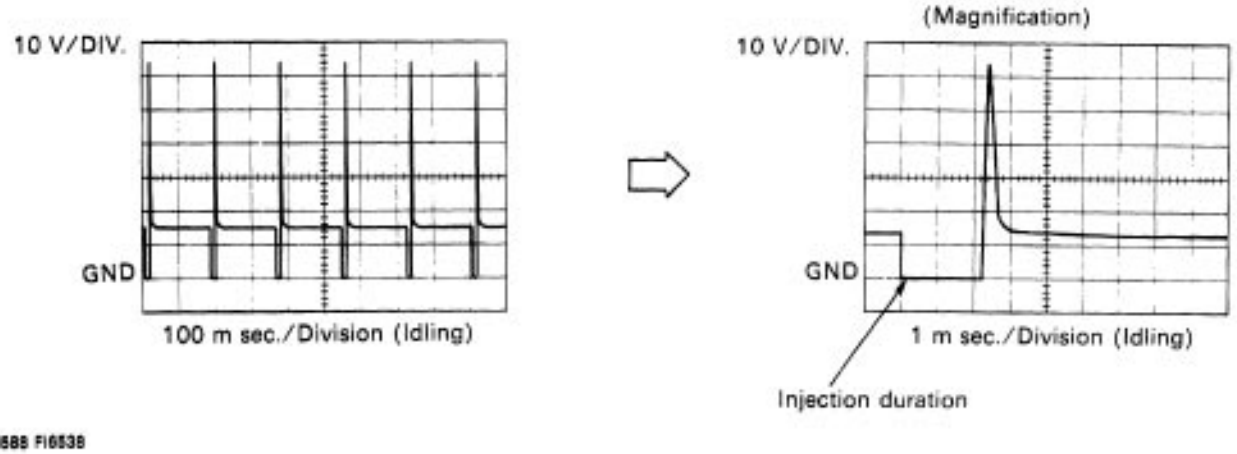



# Reference INSPECTION USING OSCILLOSCOPE

**INJECTOR SIGNAL WAVEFORM**

- With the engine idling, measure between terminals #10 – #60 and E01 of ECM.

HINT: The correct waveform appears as shown in the illustration below.



# DTC P0300 Random Misfire Detected

# DTC P0301 P0302 P0303 P0304 P0305 P0306 Misfire Detected (Cylinder 1–6)

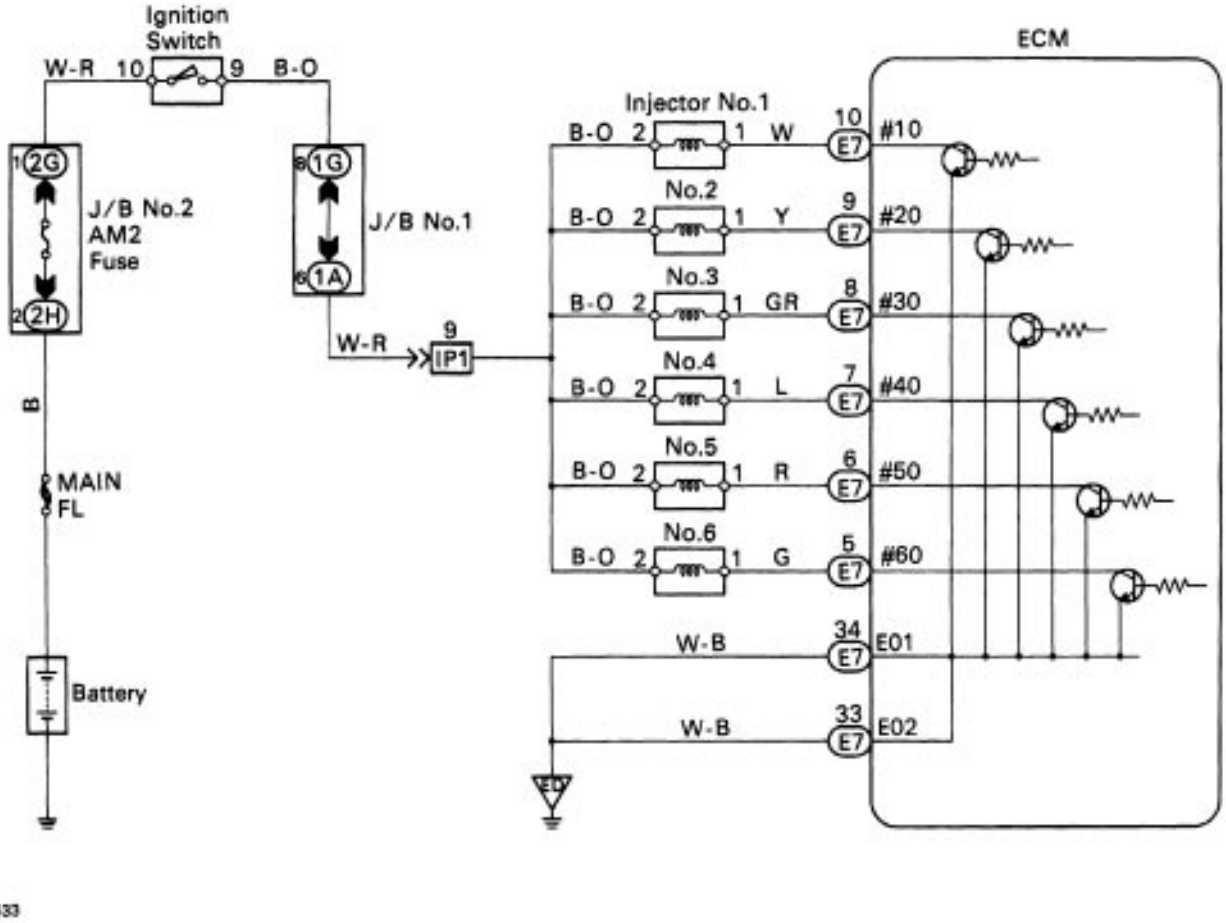
## CIRCUIT DESCRIPTION

Misfire: The ECM uses the crankshaft position sensor and camshaft position sensor to monitor changes in the crankshaft rotation for each cylinder.
The ECM counts the number of times the engine speed change rate indicates that misfire has occurred. And when the misfire rate equals or exceeds the count indicating that the engine condition has deteriorated, the MIL lights up.
If the misfire rate is high enough and the driving conditions will cause catalyst overheating, the MIL blinks when misfiring occurs.

| DTC No. | Diagnostic Trouble Code Detecting Condition | Trouble Area |
|---|---|---|
| **P0300** | Misfiring of multiple cylinders is detected during the same 200 or 1,000 revolutions. | • Ignition system<br>• Injector<br>• Fuel line pressure<br>• EG R<br>• Compression pressure<br>• Valve clearance not to specification<br>• Valve timing<br>• Mass air flow meter<br>• Engine coolant temp. sensor |
| **P0301**<br>**P0302**<br>**P0303** | For each 200 revolutions of the engine, misfiring is detected which can cause catalyst overheating. (This causes MIL to blink) | |
| **P0304**<br>**P0305**<br>**P0306** | For each 1,000 revolutions of the engine, misfiring is detected which causes emissions deterioration. (2 trip detection logic) | |

HINT; When the code for a misfiring cylinder is recorded repeatedly but no Random Misfire code is recorded, it indicates that the misfires were detected and recorded at different times.

# WIRING DIAGRAM

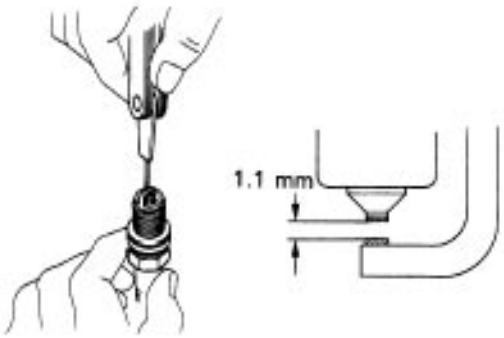


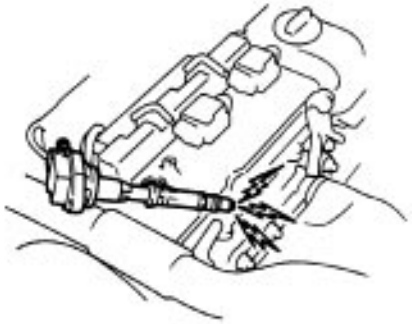
# DIAGNOSTIC CHART

| | | | |
|---|---|---|---|
| 1 | Check spark plug and spark of misfiring cylinder. | NG | Replace or check ignition system. |
| OK | | | |
| 2 | Check voltage of ECM terminal for injector of failed cylinder. | OK | Go to step 4 |
| NG | | | |
| 3 | Check injector of misfiring cylinder. | NG | Replace injector. |
| OK | | | |
| Check for open and short in harness and connector between injector and ECM. | | | |
| 4 | Check fuel pressure. | NG | Repair or replace fuel pump. |
| OK | | | |
| 5 | Check injector injection. | NG | Replace injector. |
| OK | | | |
| 6 | Check EGR system. | NG | Repair EGR system. |
| OK | | | |
| 7 | Check mass air flow meter and engine coolant temp. sensor. | NG | Repair or replace. |
| OK | | | |
| Check engine mechanical systems. | | | |

# INSPECTION PROCEDURE

**1** **Check spark plug and spark of misfiring cylinder.**



IG0317 IG0151
FI7084

P (1) Remove ignition coil (See page IG–87).
(2) Remove spark plug.

C (1) Check the carbon deposits on electrode.
(2) Check electrode gap.

OK **(1) No large carbon deposit present.**
**Not wet with gasoline or oil.**
**(2) Electrode gap: 1.1 – 1.3 mm**
**(0.043 – 0.051 in.)**

P (1) Install the spark plug to the ignition coil, and connect the ignition coil connector.
(2) Ground the spark plug.
(3) Disconnect injector connector.

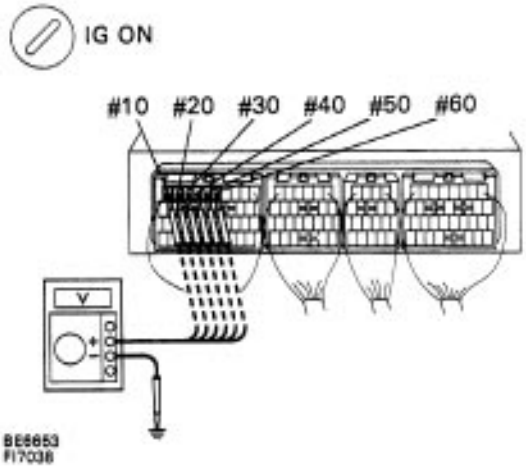
C Check if spark occurs while engine is being cranked.
**NOTICE: To prevent excess fuel being injected from the injectors during this test, don't crank the engine for more than 5–10 seconds at a time.**

OK **Spark jumps across electrode gap.**

OK

NG → **Replace or check ignition system (See page IG–84).**

**2** **Check voltage of ECM terminal for injector of failed cylinder.**




BE6653
FI7038

P (1) Remove glove compartment (See page EG2–309) .
(2) Turn ignition switch ON.

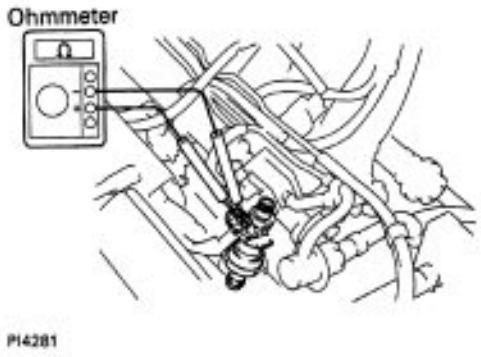
C Measure voltage between applicable terminal of ECM and body ground.

OK **Voltage: 9 – 14 V**

NG

OK → **Go to step 4**

**3** **Check injector of misfiring cylinder.**




P Disconnect injector connector (See page EG2–243) .

C Measure resistance of injector.

OK **Resistance: 5 – 23 Ω at 20$_2$C (68$_2$F)**

OK

NG **Replace injector.**

**Check for open and short in harness and connector between injector and ECM (See page IN–31).**

**4** **Check fuel pressure.**


P (1) Install the SST (pressure gauge) to the fuel filter outlet. (See page EG2–231) .
SST 09268–45012
(2) Turn ignition switch ON.
(3) Connect the TOYOTA hand–held tester to the DLC3.
(4) Use ACTIVE TEST mode to operate the fuel pump.
HINT: The fuel pump can be operated by connecting terminals B and FP of data link connector 1.

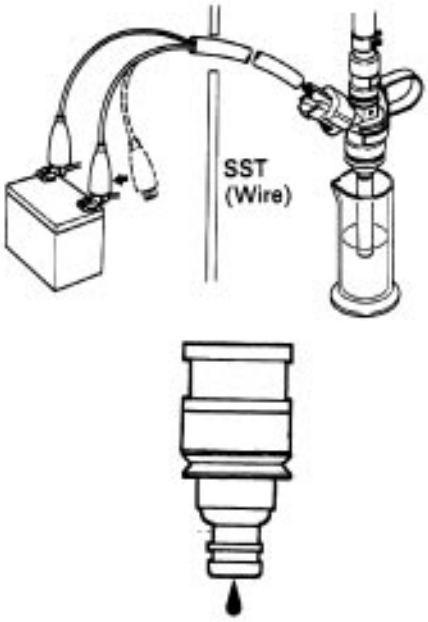
C Measure the fuel pressure.

OK **Fuel pressure: 265 – 304 kPa (2.7 – 3.1 kgf/cm$^2$, 38 – 44 psi)**

OK

NG **Check and repair fuel pump, pressure regulator, fuel pipe line and filter (See page EG2–230).**

**5** **Check injector injection.**




P Remove delivery pipe and injectors (See page EG2–246) .

C Check injection volume of injector (See page EG2–250) .

OK **Injection volume:**
**56 – 69 cm$^3$/15 sec. (3.4 – 4.2 cu in.)**
**Difference between each injector:**
**Less than 6 cm$^3$ (0.4 cu in.)**
**Fuel drop (leakage):**
**One drop or less per minute.**

OK → **6** **Check EGR system (See page EG2–207).**

NG → **Replace injector.**

OK → **7** **Check mass air flow meter and engine coolant temp. sensor (See page EG2–444, 457).**

NG → **Repair or replace.**

OK → **Check engine mechanical systems.**
- Compression pressure (See page EG2–36).
- Valve clearance (See page EG2–13).
- Valve timing (See page EG2–52).

# DTC P0325 P0330 Knock Sensor Circuit Malfunction (Knock Sensor 1 Knock Sensor 2)

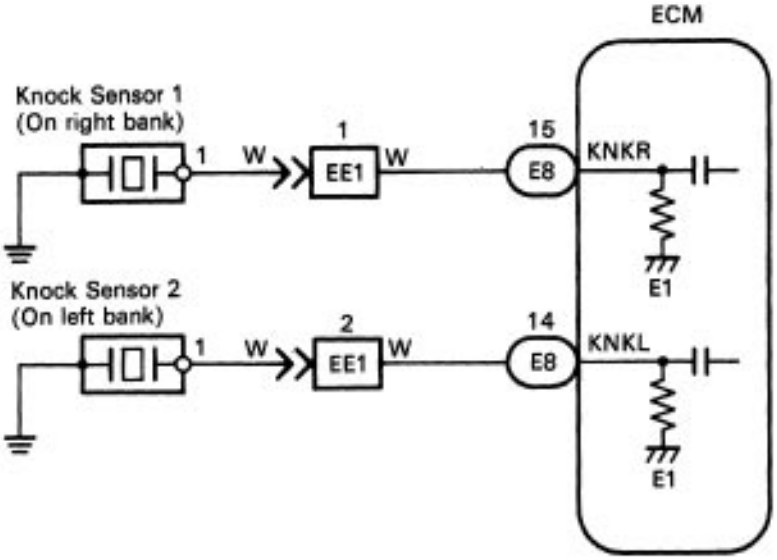
## CIRCUIT DESCRIPTION

Knock sensors are fitted one each to the right bank and left bank of the cylinder block to detect engine knocking. This sensor contains a piezoelectric element which generates a voltage when it becomes deformed, which occurs when the cylinder block vibrates due to knocking. If engine knocking occurs, ignition timing is retarded to suppress it.

| DTC No. | Diagnostic Trouble Code Detecting Condition | Trouble Area |
|---|---|---|
| **P0325** | No knock sensor 1 signal to ECM with engine speed 2,000 rpm or more. | • Open or short in knock sensor 1 circuit.<br>• Knock sensor 1 (looseness).<br>• ECM |
| **P0330** | No knock sensor 2 signal to ECM with engine speed 2,000 rpm or more. | • Open or short in knock sensor 2 circuit.<br>• Knock sensor 2 (looseness).<br>• ECM |

If the ECM detects the above diagnosis conditions, it operates the fail safe function in which the corrective retard angle value is set to the maximum value.

## WIRING DIAGRAM




FI6610

# DIAGNOSTIC CHART

HINT: DTC P0325 is for the right bank knock sensor circuit.
DTC P0330 is for the left bank knock sensor circuit.

| | | | |
|---|---|---|---|
| 1 | Check knock sensor circuit. | Type II | G o to step 3 |

Type I

| | | | |
|---|---|---|---|
| 2 | Check for open and short in harness and connector between EE1 connector and ECM. | NG | Repair or replace harness or connector. |

OK

Check and replace ECM.

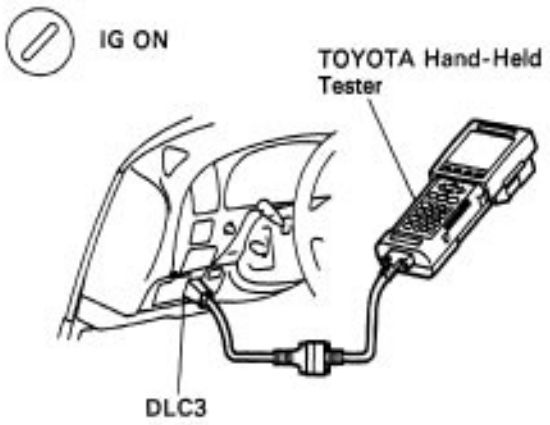
| | | | |
|---|---|---|---|
| 3 | Check for open and short in harness and connector between EE1 connector and knock sensor. | NG | Repair or replace harness or connector. |

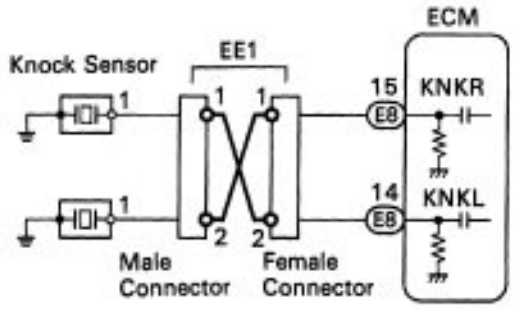
OK

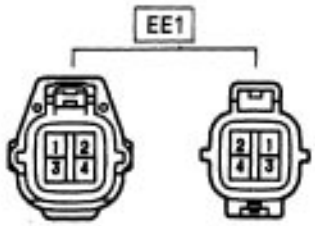
Replace knock sensor.

# INSPECTION PROCEDURE

**1** **Connect the OBDII scan tool or TOYOTA hand–held tester and check the knock sensor circuit.**




BE6653
FI7088
FI7060
Ie-4-1
Ie-4-2

P (1) Remove the fuse cover on the instrument panel.

(2) Connect the OBDII scan tool or TOYOTA hand–held tester to the DLC 3.

(3) Disconnect the wire to wire connector EE1.

(4) Connect the terminals of the disconnected EE1 male connector and EE1 female as follows.

| Male connector ↔ Female connector |
|---|
| Terminal 1↔ Terminal 2 |
| Terminal 2↔ Terminal 1 |

(5) Turn ignition switch ON and OBDII scan tool or TOYOTA hand–held tester main switch ON.

(6) After the engine is warmed up, perform quick racing (4,000 rpm) three times.

C Check the diagnostic trouble code.

Result

| | |
|---|---|
| Type I | DTC same as when vehicle brought in. P0325→ P0325 or P0330→ P0330 |
| Type II | DTC different to when vehicle brought in. P0325→ P0330 or P0330→ P0325 |

Type I

Type II → **Go to step 3.**

**2** **Check for open and short in harness and connector between EE1 connector and ECM (See page IN–31).**

OK

NG → **Repair or replace harness or connector.**

**Check and replace ECM (See page IN–36).**

| 3 | Check for open and short in harness and connector between EE1 connector and knock sensor (See page IN–31). |
|---|---|

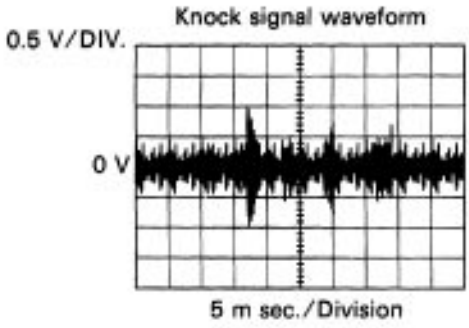
HINT: If DTC P0325 has changed to P0330, check the knock sensor circuit on the right bank side.
If DTC P0330 has changed to P0325, check the knock sensor circuit on the left bank side.

OK

NG → **Repair or replace harness or connector.**

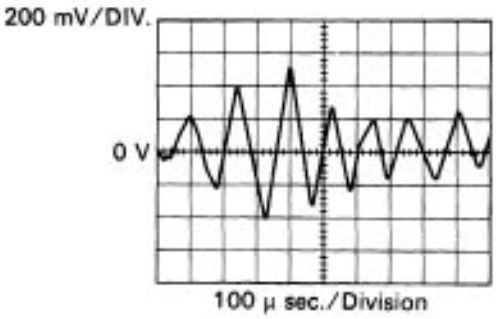
**Replace knock sensor.**

**Reference** **INSPECTION USING OSCILLOSCOPE**




- With the engine racing (4,000 rpm) measure between terminals KNKR, KNKL of ECM and body ground.

HINT: The correct waveform appears as shown i n the illustration on the left.




- Spread the time on the horizontal axis, and confirm that period of the wave is 141 μ sec.
  (Normal mode vibration frequency of knock sensor: 7.1 KHz).

HINT: If normal mode vibration frequency is not 7.1 KHz, the sensor is malfunctioning.

FI6510
FI6607

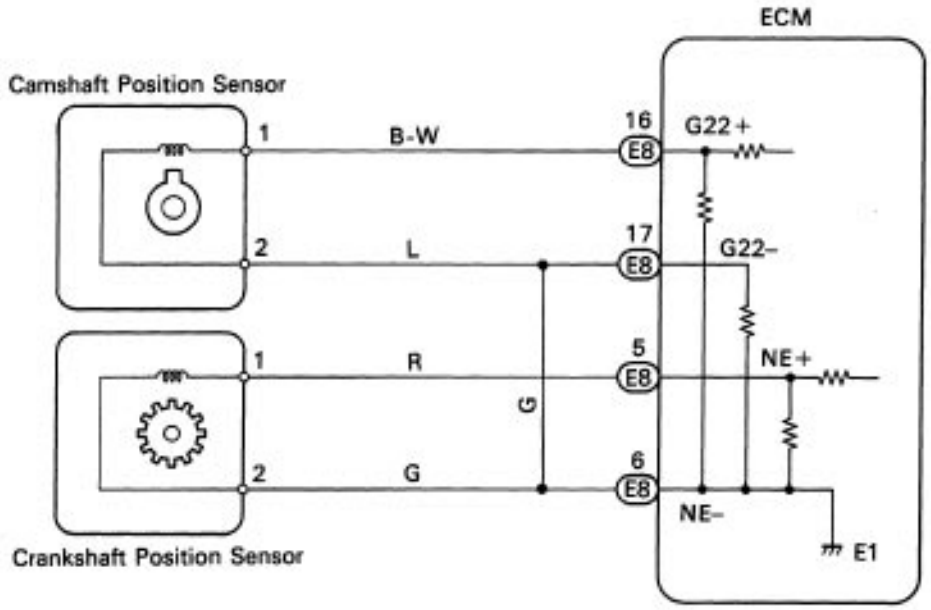
# DTC P0335 Crankshaft Position Sensor Circuit Malfunction

## CIRCUIT DESCRIPTION

Crankshaft position sensor (NE signal) consist of a signal plate and pick up coil.
The NE signal plate has 34 teeth and is mounted on the crankshaft. The NE signal sensor generates 34 signals for every engine revolution. The ECM detects the standard crankshaft angle based on the G22 signals, and the actual crankshaft angle and the engine speed by the NE signals.

| DTC No. | Diagnostic Trouble Code Detecting Condition | Trouble Area |
|---|---|---|
| P4335 | No crankshaft position sensor signal to ECM during cranking. (2 trip detection logic) | • Open or short in crankshaft position sensor circuit.<br>• Crankshaft position sensor.<br>• Starter<br>• ECM |
| | No crankshaft position sensor signal to ECM during engine running. | |

## WIRING DIAGRAM




FI7016

# DIAGNOSTIC CHART

HINT: Perform troubleshooting of diagnostic trouble code P0335 first, If no trouble is found, trou–bleshoot the following mechanical systems.

| | | | |
|---|---|---|---|
| 1 | Check resistance of crankshaft position sensor. | NG | Replace sensor. |

OK

| | | | |
|---|---|---|---|
| 2 | Check for open and short in harness and connector between ECM and crankshaft position sensor. | NG | Repair or replace harness or connector. |

OK

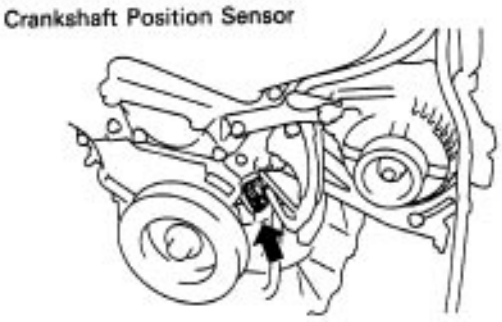
| | | | |
|---|---|---|---|
| 3 | Inspect sensor installation and teeth of signal plate. | NG | Tighten the sensor.<br>Replace signal plate. |

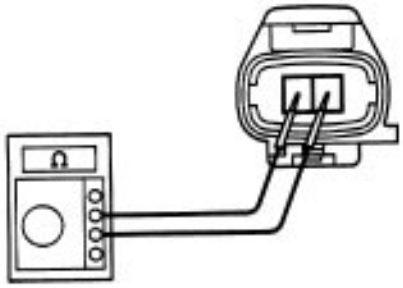
OK

Check and replace ECM.

## INSPECTION PROCEDURE

**1** **Check resistance of crankshaft position sensor.**



FI7087
FI7066

P Disconnect crankshaft position sensor connector.

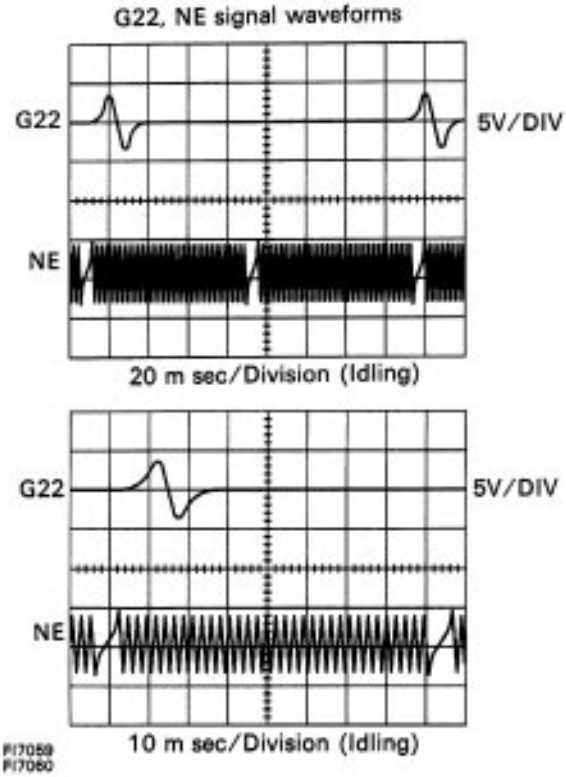
C Measure resistance of crankshaft position sensor.

OK

| | Resistance |
|---|---|
| Cold | 1,630 – 2,740 Ω |
| Hot | 2,065 – 3,225 Ω |

"Cold" is from $-10_2$C ($14_2$ F) to $50_2$C ($122_2$ F) and "Hot" is from $50_2$C ($122_2$F) to 1 $00_2$C ($212_2$F).

## Reference INSPECTION USING OSCILLOSCOPE




FI7059
FI7060

- During cranking or idling, check between terminals G22(+) and G22 (–) , NE(+) and NE (–) of engine control module.

HINT: The correct waveforms appear as shown in the illustration on the left.

OK

NG **Replace crankshaft position sensor.**

| | |
|---|---|
| 2 | Check for open and short in harness and connector between ECM and crankshaft position sensor (See page IN–31). |

OK → NG: Repair or replace harness or connector.

| | |
|---|---|
| 3 | Inspect sensor installation and teeth of signal plate. |

OK → NG: Tighten the sensor. Replace signal plate.

Check and replace ECM (See page IN–36).

# DTC P0336 Crankshaft Position Sensor Circuit Range Performance

## CIRCUIT DESCRIPTION

Refer to crankshaft position sensor circuit malfunction on page EG2–503.

| DTC No. | Diagnostic Trouble Code Detecting Condition | Trouble Area |
|---|---|---|
| P0336 | Deviation in crankshaft position sensor signal and camshaft position sensor signal.<br>(2 trip detection logic) | • Mechanical system malfunction.<br>(Skipping teeth of timing belt, belt stretched.)<br>• ECM |

### DIAGNOSTIC CHART

| | | | |
|---|---|---|---|
| 1 | Check valve timing (Check for loose and jumping teeth of timing belt) (See page EG2–52). | NG | Adjust valve timing.<br>(Repair or replace timing belt.) |

OK

Check and replace ECM (See page IN–36).

# DTC P0340 Camshaft Position Sensor Circuit Malfunction

## CIRCUIT DESCRIPTION

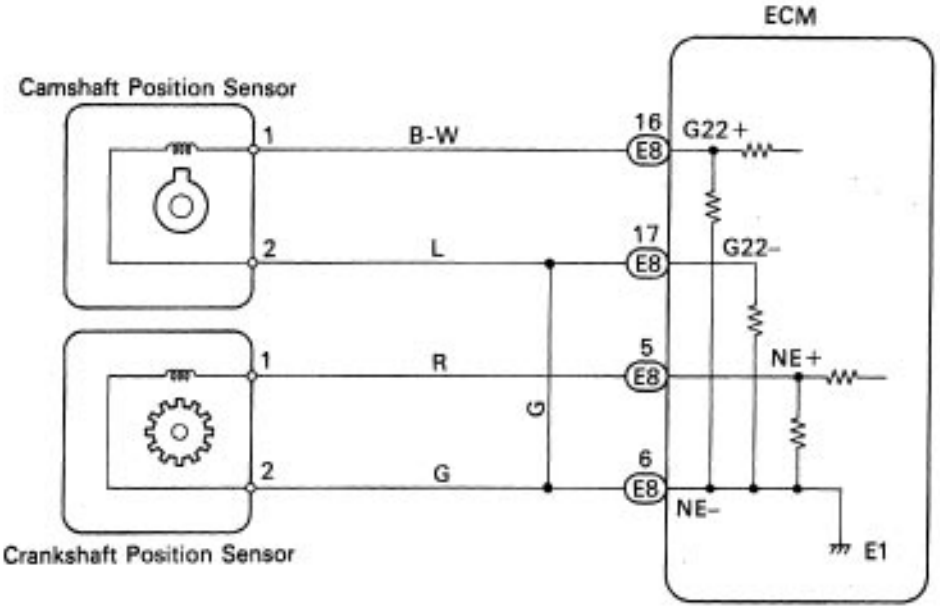
Camshaft position sensor (G22 signal) consist of a signal plate and pick up coil.
The G22 signal plate has one tooth, on its outer circumference and is mounted on the left bank camshafts. When the camshafts rotate, the protrusion on the signal plate and the air gap on the pick up coil change, causing fluctuations in the magnetic field and generating an electromotive force in the pick up coil.
The NE signal plate has 34 teeth and is mounted on the crankshaft. The NE signal sensor generates 34 signals for every engine revolution. The ECM detects the standard crankshaft angle based on the G22 signal and the actual crankshaft angle and the engine speed by the NE signals.

| DTC No. | Diagnostic Trouble Code Detecting Condition | Trouble Area |
|---|---|---|
| P0340 | No camshaft position sensor signal to ECM during cranking.<br>(2 trip detection logic) | • Open or short in camshaft position sensor circuit.<br>• Camshaft position sensor.<br>• Starter.<br>• ECM |
| | No camshaft position sensor signal to ECM during engine running. | |

## DIAGNOSTIC CHART

| | | | |
|---|---|---|---|
| 1 | Check resistance of camshaft position sensor. | NG | Replace sensor. |
| OK | | | |
| 2 | Check for open and short in harness and connector between ECM and camshaft position sensor. | NG | Repair or replace harness or connector. |
| OK | | | |
| 3 | Inspect sensor installation. | NG | Tighten the sensor. |
| OK | | | |
| Check and replace ECM. | | | |

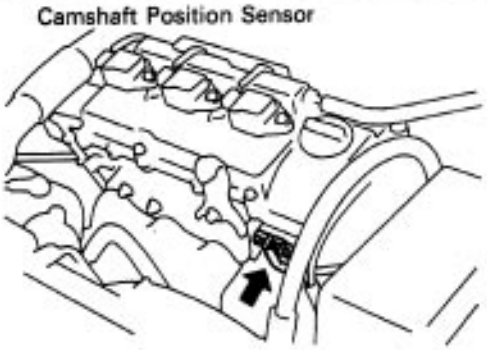
## WIRING DIAGRAM

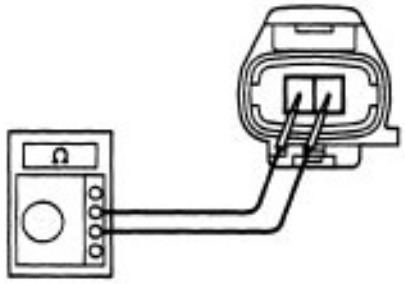



FI7016

# INSPECTION PROCEDURE

| 1 | Check resistance of camshaft position sensor. |
|---|---|




P Disconnect camshaft position sensor connector.

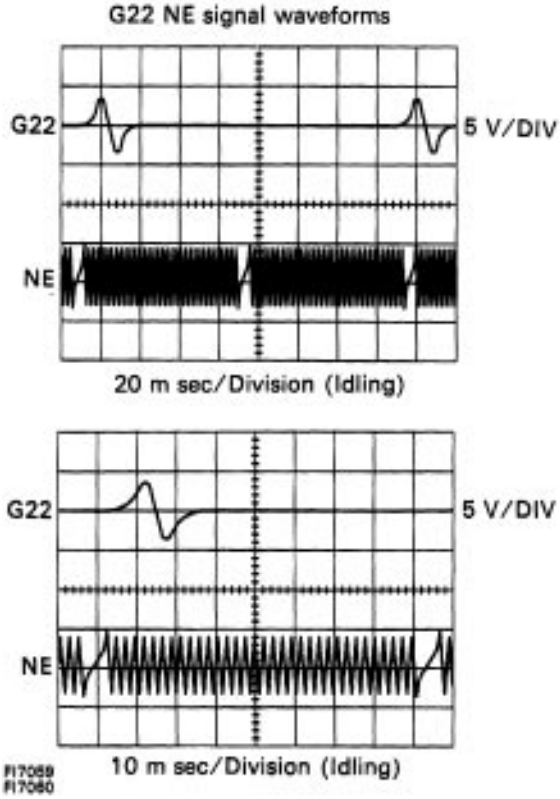
C Measure resistance of camshaft position sensor.

OK

| | Resistance |
|---|---|
| Cold | 835 – 1,400Ω |
| Hot | 1,060 – 1,645Ω |

"Cold is form $-10_2$C ($140_2$F) to $50_2$C ($122_2$F) and "Hot" is form $50_2$C ($122_2$ F) to $100_2$C ( $212_2$F).

## Reference INSPECTION USING OSCILLOSCOPE




- During cranking or idling, check between terminals G 22(+) and G22(–), NE(+) and NE (–) of engine control module.

HINT: The correct waveforms appear as shown in the illustration on the left.

OK

NG **Replace camshaft position sensor.**

| | |
|---|---|
| 2 | Check for open and short in harness and connector between ECM and camshaft position sensor (See page IN–31). |

OK

NG → Repair or replace harness or connector.

| | |
|---|---|
| 3 | Inspect sensor installation. |

OK

NG → Tighten the sensor.

Check and replace ECM (See page IN–36).

# DTC P0401 Exhaust Gas Recirculation Flow Insufficient Detected

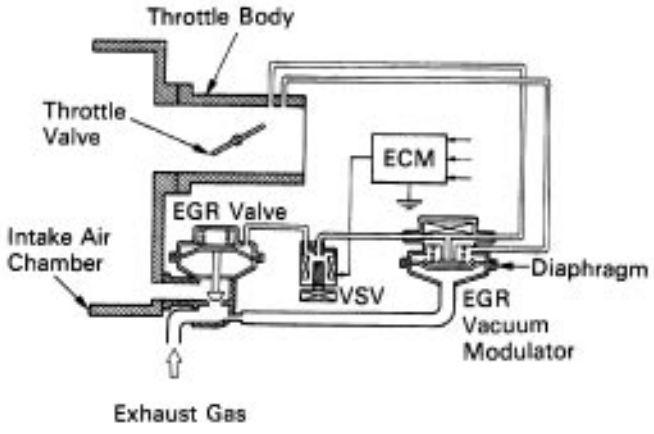
## CIRCUIT DESCRIPTION

The EGR system recirculates exhaust gas, which is controlled to the proper quantity to suit the driving conditions, into the intake air mixture to slow down combustion, reduce the combustion temperature and reduce NOx emissions. The amount of EGR is regulated by the EGR vacuum modulator according to the engine load.

If even one of the following conditions is fulfilled, the VSV is turned ON by a signal from the ECM. This results in atmospheric air acting on the EGR valve, closing the EGR valve and shutting off the exhaust gas (EGR cut–off).

Under the following conditions, EGR is cut to maintain driveability.

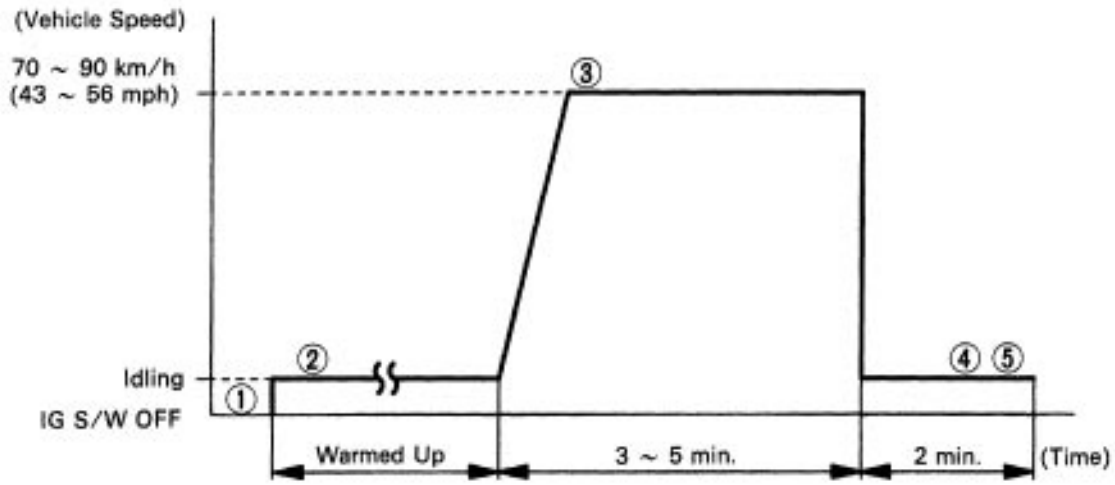
- Coolant temp. below $60_2$C ($140_2$F).
- During deceleration (throttle valve closed).
- Light engine load (amount of intake air very small).
- Engine racing.




FI4825

| DTC No. | Diagnostic Trouble Code Detecting Condition | Trouble Area |
|---|---|---|
| **P0401** | After the engine is warmed up and run at 80 km/h (50 mph) for 3 to 5 minutes, the EGR gas temperature sensor value does not exceed $40_2$C ($104_2$F) above the ambient air temperature. (2 trip detection logic) | • EGR valve stuck closed.<br>• Short in EGR VSV circuit.<br>• Open in EGR gas temp. sensor circuit.<br>• EGR hose disconnected.<br>• ECM |

# SYSTEM CHECK DRIVING PATTERN




FI7131

① Connect the OBDII scan tool or TOYOTA hand–held tester to the DLC 3.

② Start and warm up the engine with all accessories switched OFF.

③ After the engine is warmed up, run the vehicle at 70 – 90 km/h (43 – 56 mph) for 3 min, or more.

④ After driving, idle the engine for about 2 mins.

⑤ After idling, check the ”READINESS TESTS”. If ”COMPL” (test completed) is displayed and the MIL does not light up, the system is normal. If ”INCPL” is displayed, run the vehicle again and check it.
HINT: If a malfunction exists, the MIL will light up during step (4).

# DIAGNOSTIC CHART
# TOYOTA hand–held tester

| | | | |
|---|---|---|---|
| 1 | Connect the TOYOTA hand–held tester and read value of EGR gas temperature. | OK | Go to step 4 |
| NG | | | |
| 2 | Check for open in harness or ECM. | OK | Confirm good connection at sensor. If OK, replace EGR gas temp. sensor. |
| NG | | | |
| 3 | Check for open in harness or ECM. | OK | Open in harness between terminals E2 or THG. Repair or replace harness. |
| NG | | | |
| Confirm connection at ECM, If OK, replace ECM. | | | |
| 4 | Check connection of vacuum hose, EGR hose. | NG | Repair or replace. |
| OK | | | |
| 5 | Check the VSV for EG R, | OK | Go to step 7 |
| NG | | | |
| 6 | Check operation of the VSV for EG R. | NG | Replace VSV for EG R. |
| OK | | | |
| Check for short in harness and connector between VSV and ECM. | | | |

| | | | |
|---|---|---|---|
| 7 | Check EGR Vacuum modulator. | NG | Repair or replace. |

OK

| | | | |
|---|---|---|---|
| 8 | Check EGR Valve. | NG | Repair or replace. |

OK

| | | | |
|---|---|---|---|
| 9 | Check value of EGR gas temp. sensor. | NG | Replace EGR gas temp. sensor. |

OK

Check and replace ECM.

# OBD II scan tool (excluding TOYOTA hand–held tester)

1 Check resistance of EGR gas temp. sensor.

NG → Check and replace EGR gas temp. sensor.

OK

2 Check for open in harness or ECM.

OK → Go to step 4

NG

3 Check for open in harness or ECM.

OK → Open in harness between terminals E2 or THG. Repair or replace harness.

NG

Confirm connection at ECM. If OK, replace ECM.

4 Check connection of vacuum hose, EGR hose.

NG → Repair or replace.

OK

5 Check the VSV for EG R.

OK → Go to step 7

NG

6 Check operation of the VSV for EG R.

NG → Replace VSV for EG R.

OK

Check for open in harness and connector between J/B No,2 and ECM.

| | | | |
|---|---|---|---|
| 7 | Check EGR vacuum modulator. | NG | Repair or replace. |

OK

| | | | |
|---|---|---|---|
| 8 | Check EGR valve. | NG | Repair or replace. |

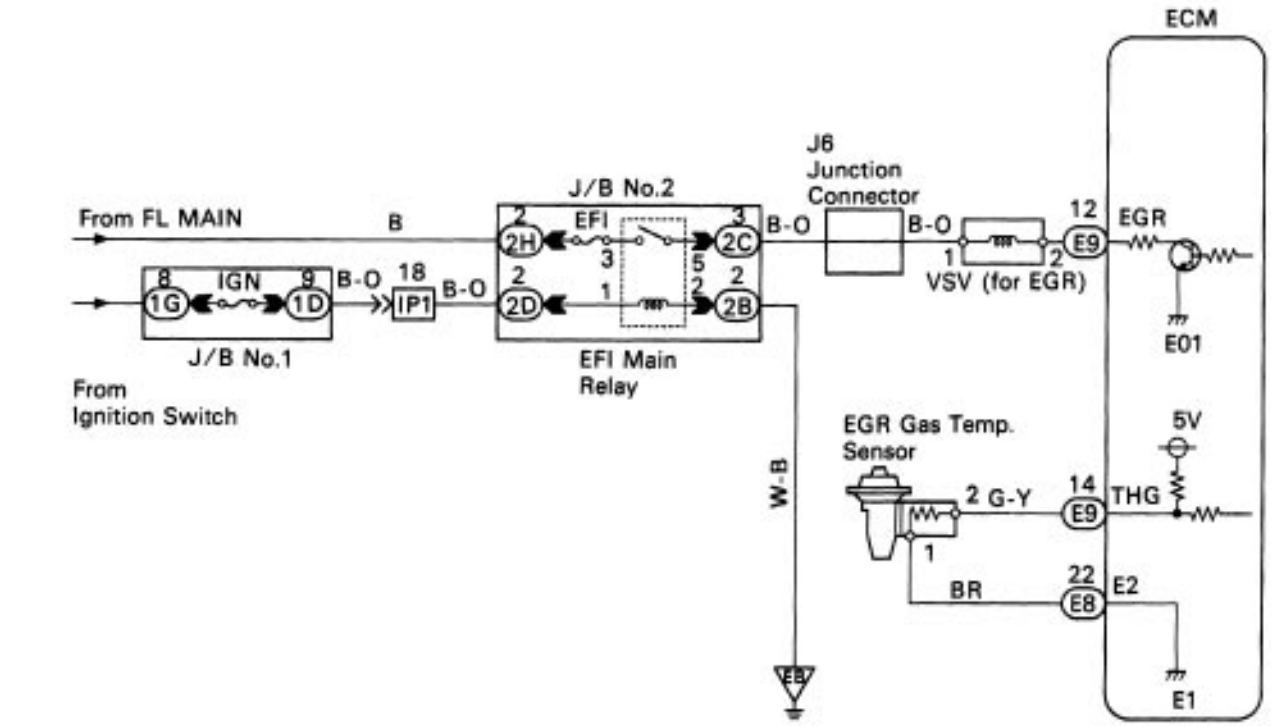
OK

| | | | |
|---|---|---|---|
| 9 | Check resistance of EGR gas temp. sensor. | NG | Replace EGR gas temp. sensor. |

OK

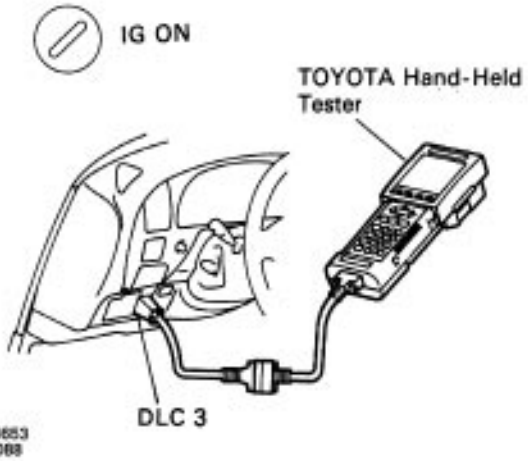
Check and replace ECM.

# WIRING DIAGRAM



# INSPECTION PROCEDURE
# TOYOTA hand–held tester

**1** **Connect the TOYOTA hand–held tester and read value of EGR gas temperature value.**




P (1) Remove the fuse cover on the instrument panel.
(2) Connect the TOYOTA hand–held tester to the D LC 3.
(3) Turn ignition switch ON and TOYOTA hand–held tester main switch ON.

C Read EGR gas temperature on the TOYOTA hand–held tester.

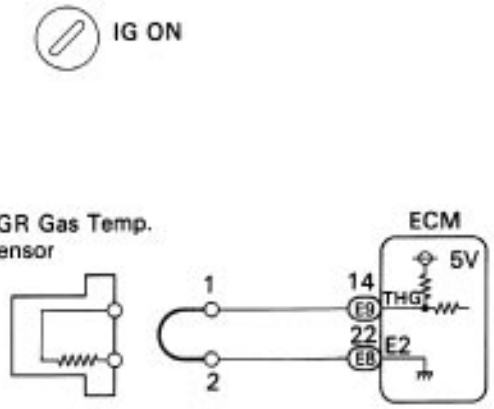
OK **EGR gas temp.: 10$_2$C (50$_2$F) or more.**

Hint If there is an open circuit, the TOYOTA hand–held tester indicates 3.1 $_2$C (37.6$_2$F).

NG

OK → **Go to step 4**

**2** **Check for open in harness or ECM.**




P (1) Disconnect the EGR gas temp. sensor connector.
(2) Connect sensor wire harness terminals together.
(3) Turn ignition switch ON.

C Read EGR gas temperature on the TOYOTA hand–held tester.

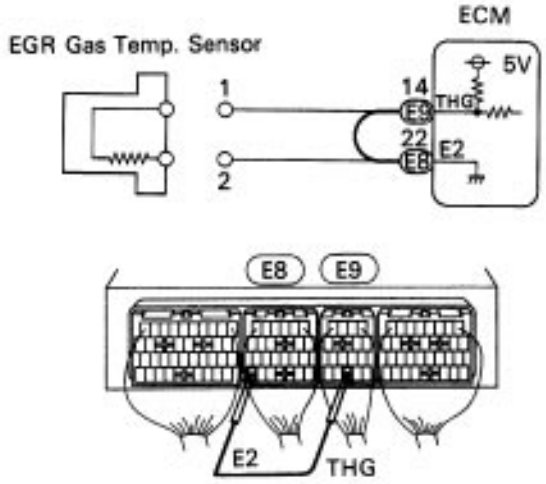
OK **EGR gas temp.: 159.3$_2$C (318.7$_2$F)**

NG

OK → **Confirm good connection at sensor.**
**If OK, replace EGR gas temp. sensor.**

**3** **Check for open in harness or ECM.**

IG ON




P (1) Remove glove compartment (See page EG2–309).
(2) Connect between terminals THG and E2 of ECM E8 and E9 connectors.
HINT: EGR gas temp. sensor connector is disconnected.
Before checking, do a visual check and contact pressure check for the ECM connector (See page EG2–418).

C Read EGR temperature on the TOYOTA hand–held tester.

OK **EGR gas temp.: 159.3$_2$C (318.7$_2$F)**

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NG

OK → **Open in harness between terminals E2 or THG. Repair or replace harness.**

**Confirm connection at ECM.**
**If OK, replace ECM.**

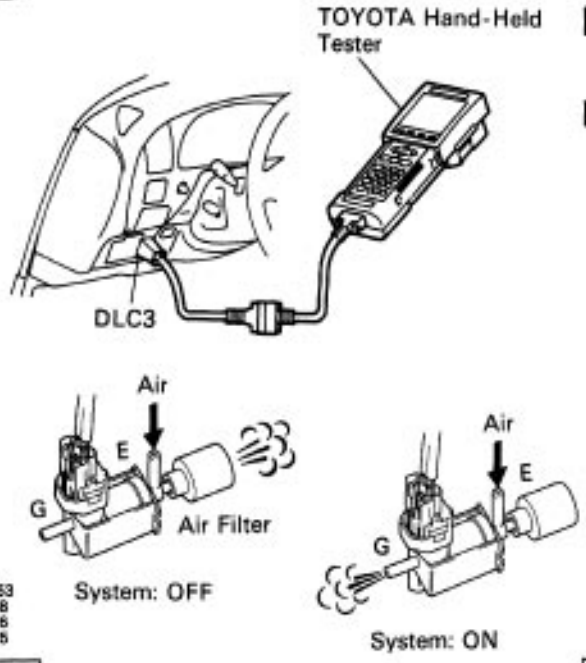
**4** **Check the connection of the vacuum hose, EGR hose (See page EG2–287).**

OK

NG → **Repair or replace.**

| 5 | Check the VSV for EGR. |
|---|---|

IG ON




P Select the active test mode on the TOYOTA hand–held tester.

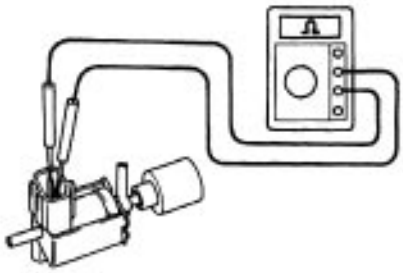
C Check operation of EGR VSV, when it is operated by the TOYOTA hand–held tester.

OK **EGR system is OFF:**
**The air from pipe E is flowing out through the air fitter.**
**EGR system is ON:**
**The air from pipe E is flowing out pipe G.**

NG

OK → **Go to step 7**

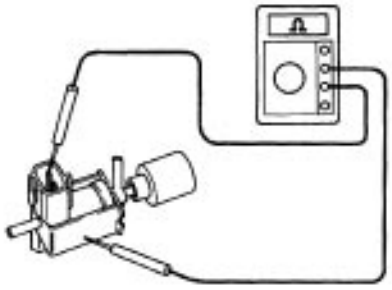
**6** **Check operation of the VSV for EGR.**

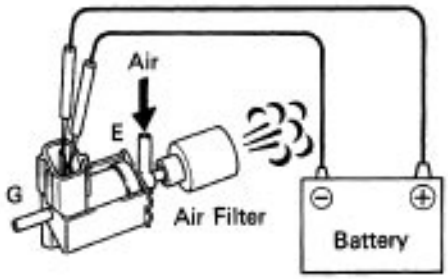


P (1) Remove EGR VSV.
(2) Disconnect EGR VSV connector.

C (1) Measure resistance between terminals.
(2) Measure resistance between each terminal and the body.

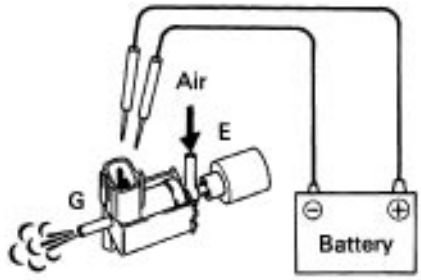
OK **(1 ) Resistance: 26 – 46 at 20$_2$C (68$_2$F)**
**(2) Resistance: 1 M or higher.**






C Check operation of EGR VSV when battery voltage is applied, and is not applied to the terminals of EGR VSV connector.

OK **Battery voltage is applied:**
**The air from pipe E flows out through the air filter.**
**Battery voltage is not applied:**
**The air from pipe E flows out through pipe G.**




EC2939
EC2940
EC2941
EC2942

OK

NG **Replace VSV for EGR.**

**Check for short in harness and connector between VSV and ECM (See page IN–31).**

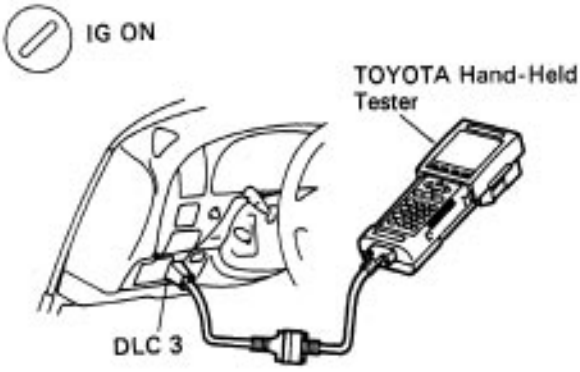
**7** Check EGR vacuum modulator (See page EG2–210).

OK → NG: **Repair or replace.**

**8** Check EGR valve (See page EG2–211).

OK → NG: **Repair or replace.**

**9** Check value of EGR gas temp. sensor.

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P (1) Connect the TOYOTA hand–held tester to the DLC3.
(2) Turn ignition switch ON and TOYOTA hand–held tester main switch ON'
(3) Select the active test mode on the TOYOTA hand–held tester.
(EGR system ON)
(4) Race the engine at 4,000 rpm for 3 mins.

C Measure the EGR gas temp. while racing engine at 4,000 rpm.

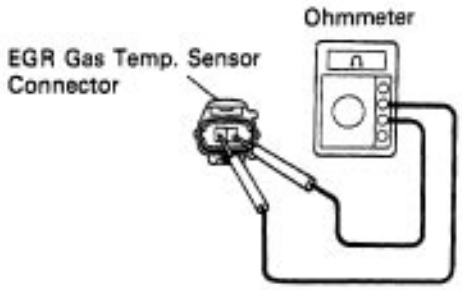
OK **EGR gas temp. after 3 mins.: $140_2$C ($284_2$F) or more**

OK → NG: **Replace EGR gas temp. sensor.**

**Check and replace ECM (See page IN–36).**

## OBDII scan tool (excluding TOYOTA hand–held tester)

**1** **Check resistance of EGR gas temp. sensor.**

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P Disconnect EGR gas temp. sensor connector.

C Measure resistance between terminals of EGR gas temp. sensor connector.

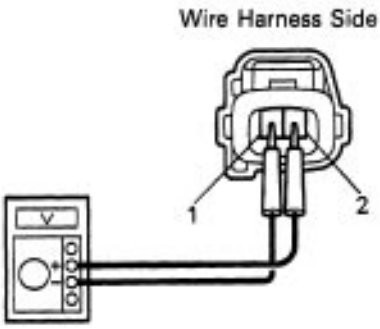
OK **Resistance: 600 k or less.**

Hint If there is open circuit, ohmmeter indicates 720 kΩ or more.

OK

NG **Check and replace EGR gas temp. sensor (See page EG2–303).**

**2** **Check for open in harness or ECM.**




FI7098

P Disconnect EGR gas temp. sensor connector.

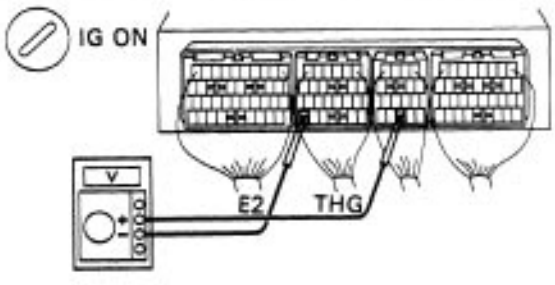
C Measure voltage between terminals of EGR gas temp. sensor wire harness side connector.

OK **Voltage: 4.5 – 5.5 V**

NG

OK **Go to step 4**

**3** **Check for open in harness or ECM.**

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P (1) Remove glove compartment (See page EG2–309 ) .
(2) Turn ignition switch ON.

C Measure voltage between terminals THG and E2 of ECM.
HINT: EG R gas temp. sensor connector is dis–connected.

OK **Voltage: 4.5 – 5.5 V**

NG

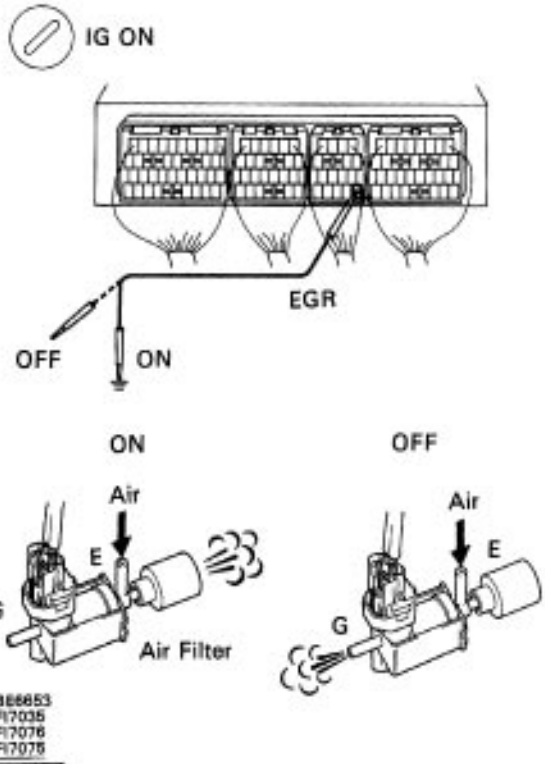
OK **Open in harness between terminals E2 or THG. repair or replace harness.**

**Confirm connection at ECM.
If OK, replace ECM.**

**4** **Check connection of vacuum hose, EGR hose (See page EG2–287).**

**OK** → **NG** → **Repair or replace.**

**5** **Check the VSV for EGR.**




P (1) Remove glove compartment (See page EG2–309).
(2) Turn ignition switch ON.

C Check EGR VSV function
(1) Connect between terminal EGR of ECM and body ground. (ON)
(2) Disconnect between terminal EGR of ECM and body ground (OFF).

OK **(1) VSV is ON:**
**The air from pipe E flows out through the air filter.**
**(2) VSV is OFF:**
**The air from pipe E flows out through pipe G.**

**NG** → **OK** → **Go to step 7**

**6** **Check operation of the VSV for– EGR (See page EG2–522, step 6).**

**OK** → **NG** → **Replace VSV for EGR.**

**Check for open in harness and connector between J/B No.2 and ECM (See page IN–31).**

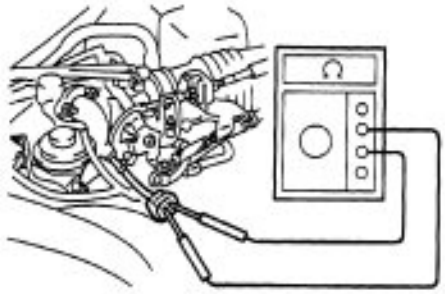
**7** Check EGR vacuum modulator (See page EG2–210).

OK → NG: **Repair or replace.**

**8** Check EGR valve (See page EG2–211).

OK → NG: **Repair or replace.**

**9** Check resistance of EGR gas temp. sensor.


FI7176

P (1) Disconnect EGR gas temp. sensor connector.
(2) Start the engine and warm it up.
(3) Disconnect EGR VSV connector.
(4) Race the engine at 4,000 rpm for 3 mins.

C Measure the resistance of the EGR gas temp. sen–sor while racing the engine at 4,000 rpm.

OK **Resistance of EGR gas temp. sensor after 3 mins: 4.3 k or less**

Hint Resistance: 188.6 – 439.0 kΩ at $20_2$C ($68_2$F)

OK → NG: **Replace EGR gas temp. sensor.**

**Check and replace ECM (See page IN–36).**

# DTC P0402 Exhaust Gas Recirculation Flow Excessive Detected

## CIRCUIT DESCRIPTION

Refer to Exhaust gas recirculation flow insufficient detected on page EG2–512.

| DTC No. | Diagnostic Trouble Code Detecting Condition | Trouble Area |
|---|---|---|
| P0402 | EG R gas temp. sensor value is high during EG R cut–off when engine is cold (Race engine at about 4,000 rpm without load so that vacuum is applied to port E).<br>(2 trip detection logic) | • EGR valve stuck open<br>• EGR VSV open malfunction<br>• Open in EGR VSV circuit<br>• Short in EGR gas temp. sensor circuit<br>• ECM |
| | EG R valve is always open<br>(2 trip detection logic) | |

See DTC P0401 for System Check Driving Pattern and Wiring Diagram.

# DIAGNOSTIC CHART
# TOYOTA hand–held tester

| | | | |
|---|---|---|---|
| 1 | Connect the TOYOTA hand–held tester and read value of EGR gas temperature. | OK | G o to step 4 |

NG

| | | | |
|---|---|---|---|
| 2 | Check for short in harness and ECM. | OK | Replace EGR gas temp. sensor. |

NG

| | | | |
|---|---|---|---|
| 3 | Check for short in harness or ECM. | OK | Repair or replace harness or connector. |

NG

Check and replace ECM.

| | | | |
|---|---|---|---|
| 4 | Check the VSV for EG R. | OK | Check EGR valve. |

NG

| | | | |
|---|---|---|---|
| 5 | Check operation of the VSV for EG R. | NG | Replace VSV for EG R. |

OK

Check for open in harness and connector between J/B No.2 and ECM.

## OBD II scan tool (excluding TOYOTA hand–held tester)

1 Check resistance of EGR gas temp. sensor.
NG → Replace EGR gas temp. sensor.
OK ↓

2 Check for short in harness and connector between EGR gas temp. sensor and ECM.
NG → Repair or replace harness or connector.
OK ↓

3 Check the VSV for EG R.
OK → Check EGR valve.
NG ↓

4 Check operation of the VSV for EG R.
NG → Replace VSV for EG R.
OK ↓

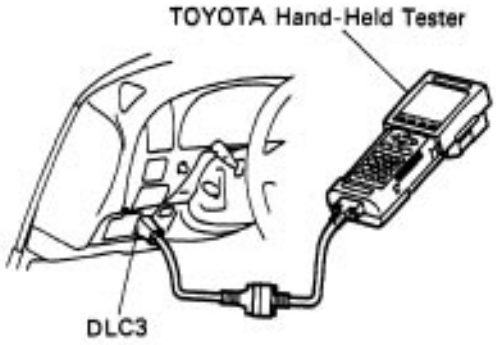
5 Check for open in harness and connector between J/B No.2 and ECM.
NG → Repair or replace harness or connector.
OK ↓

Check and replace ECM.

# INSPECTION PROCEDURE
# TOYOTA hand–held tester

**1** **Connect the TOYOTA hand–held tester and read EGR gas temperature value.**

IG ON

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P (1) Remove the fuse cover on the instrument panel.
(2) Connect the TOYOTA hand–held tester to the D LC 3.
(3) Turn ignition switch ON and TOYOTA hand–held tester main switch ON.

C Read EGR gas temperature on the TOYOTA hand–held tester.

OK **EGR gas temp.: 150$_2$C (302$_2$F) or less. (Not immediately after driving)**

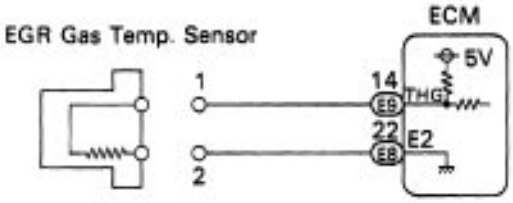
Hint If there is a short circuit, the TOYOTA hand–held tester indicates 159.3$_2$C (318.7$_2$F) .

NG

OK → **G o to step 4**

**2** **Check for short in harness and ECM.**

IG ON




BE6653
FI7054

P Disconnect the EGR gas temperature sensor connector.

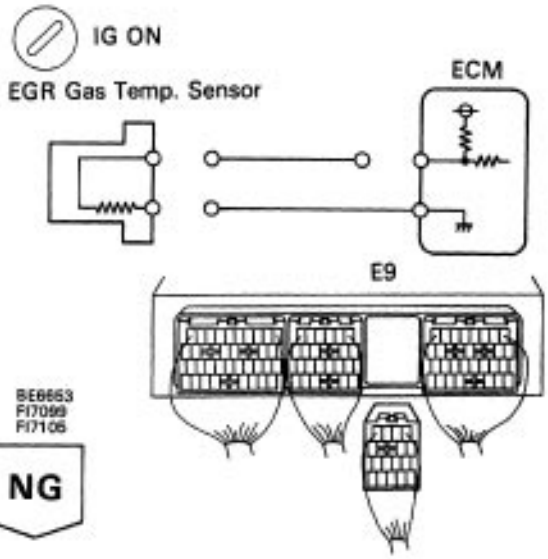
C Rear EGR gas temperature on the TOYOTA hand–held tester.

OK **EGR gas temp.: 3.1$_2$C (37.6$_2$F)**

NG

OK → **Replace EGR gas temp. sensor.**

**3** **Check for short in harness or ECM.**




P (1) Remove glove compartment (See page EG2–309) .
(2) Disconnect the E9 connector of ECM.
HINT: EGR gas temp. sensor is disconnected.

C Read EGR gas temp. on the TOYOTA hand–held tester.

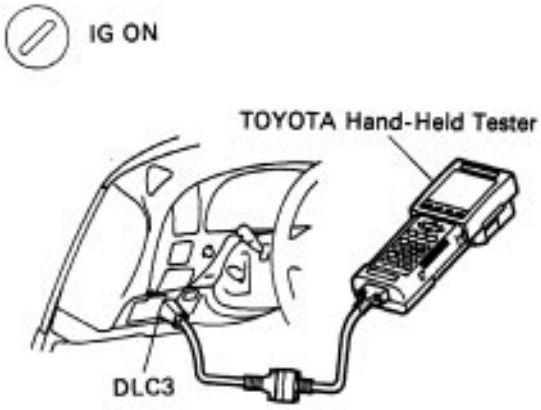
OK **EGR gas temp.: 3.1 $_2$C (37.6$_2$F)**

NG

OK → **Repair or replace harness or connector.**

**Check and replace ECM (See page IN–36).**

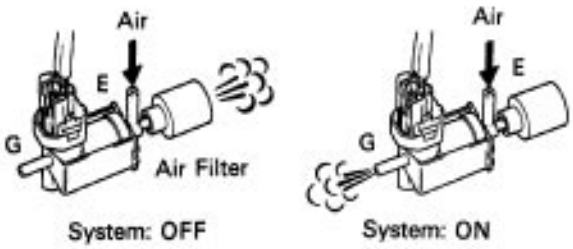
**4** **Check the VSV for EGR.**




P Select the active test mode on the TOYOTA hand–held tester.

C Check operation of EGR VSV, when it is operated by the TOYOTA hand–held tester.

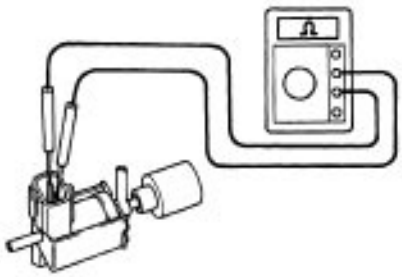
OK **EGR system is OFF:**
**The air from pipe E flows out through the air filter.**
**EG R system is ON:**
**The air from pipe E flows out through pipe G.**

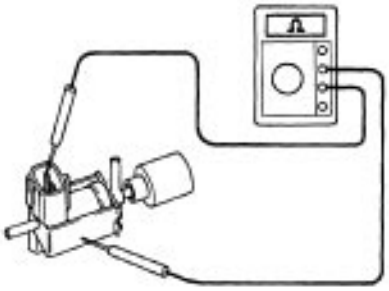



NG

OK → **Check EGR valve (See page EG2–211).**

**5** **Check operation of the VSV for EGR.**

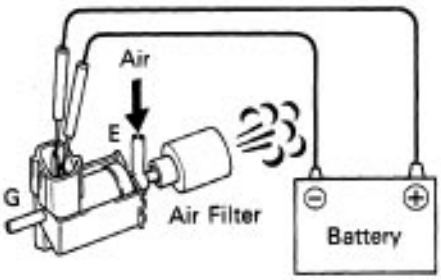




P (1) Remove EGR VSV.
(2) Disconnect EGR VSV connector.

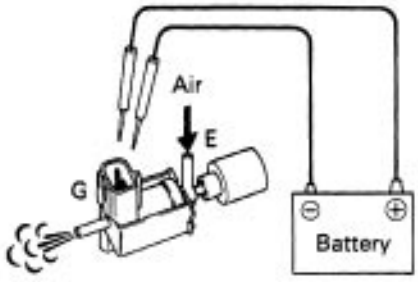
C (1) Measure resistance between terminals.
(2) Measure resistance between each terminal and the body.

OK **(1) Resistance: 26 – 46 at 20°C (68°F)**
**(2) Resistance: 1 M or higher.**




C Check operation of EGR VSV when battery voltage is applied, and not applied to the terminals of EGR VSV connector or not.

OK **Battery voltage is applied:**
**The air from pipe E flows out through the air filter.**
**Battery voltage is not applied:**
**The air from pipe E flows out through pipe G.**




EC2939
EC2940
EC2941
EC2942

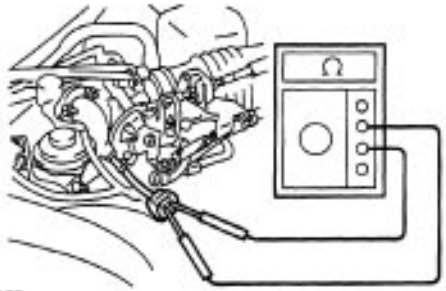
**OK**

**NG** **Replace VSV for EG R.**

**Check for open in harness and connector between J/B No.2 and ECM (See page IN–31).**

## OBDII scan tool (excluding TOYOTA hand–held tester)

**1** Check resistance of EGR gas temp. sensor.




P Disconnect EGR gas temp. sensor connector (See page EG2–303) .

C Measure resistance between terminals of EGR gas temp. sensor connector.

OK **Resistance: 2.5 k or more.**
**(Not immediately after driving)**

Hint If there is short circuit, ohmmeter indicates 200Ω or less.

OK → NG → **Replace EG R gas temp. sensor.**

**2** Check for short in harness and connector between EGR gas temp. sensor and ECM (See page IN–31)..

OK → NG → **Repair or replace harness or connector.**

**3** Check the VSV for EGR (See page EG2–525, step 5 ).

NG → OK → **Check EGR valve (See page EG2–211).**

**4** Check operation of the VSV for EGR (See page EG2–532, step 5 ).

OK → NG → **Replace VSV for EG R.**

**5** Check for open in harness and connector between J/B No.2 and ECM (See page IN–31).

OK → NG → **Repair or replace harness or connector.**

**Check and replace ECM (See page IN–36).**

# DTC P0420 Catalyst System Efficiency Below Threshold

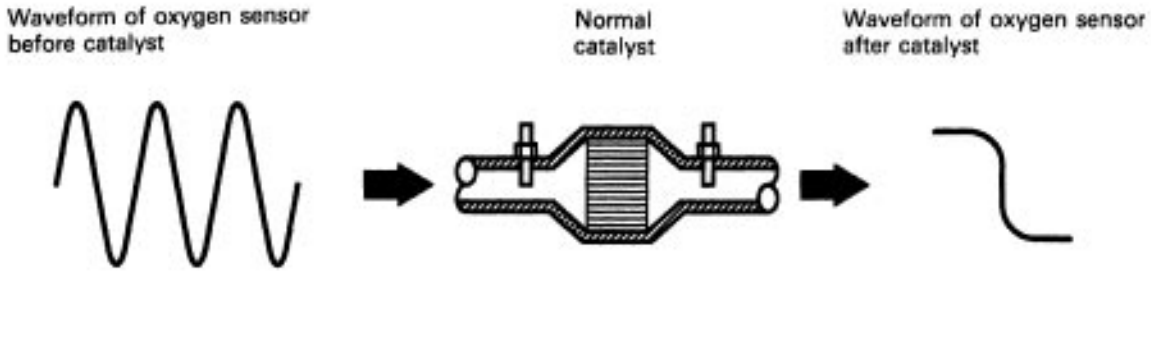
## CIRCUIT DESCRIPTION

The ECM compares the waveform of the oxygen sensor located before the catalyst with the waveform of the oxygen sensor located after the catalyst to determine whether or not catalyst performance has deteri–orated.

Air–fuel ratio feedback compensation keeps the waveform of the oxygen sensor before the catalyst re-peatedly changing back and forth from rich to lean.

If the catalyst is functioning normally, the waveform of the oxygen sensor after the catalyst switches back and forth between rich and lean much more slowly than the waveform of the oxygen sensor before the catalyst.

But when both waveforms change at a similar rate, it indicates that catalyst performance has deteriorated.

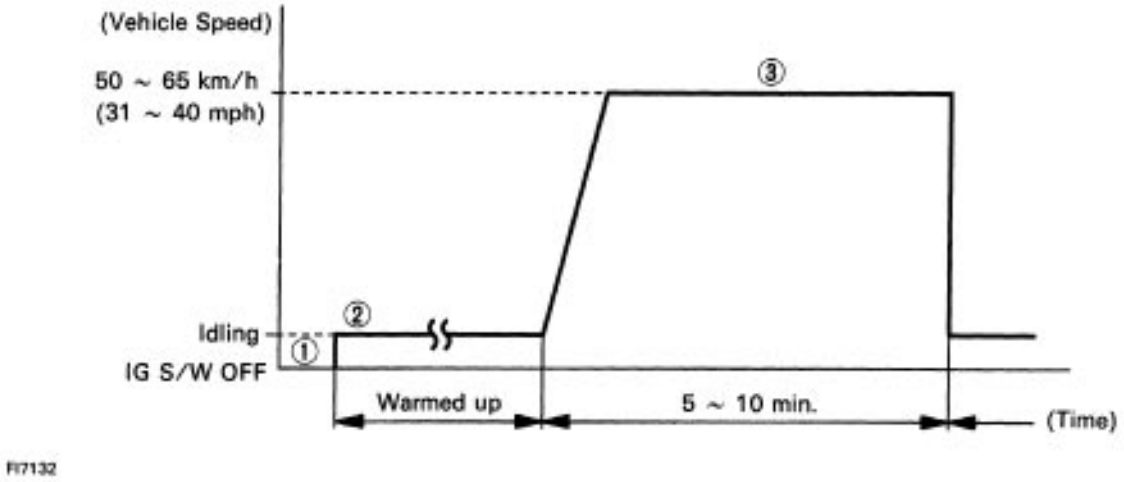



FI7081

| DTC No. | Diagnostic Trouble Code Detecting Condition | Trouble Area |
|---|---|---|
| **P0420** | After the engine is warmed up and the vehicle driven for 5 min. at 32 – 80 km/h (20 – 50 mph), the waveforms of the heated oxygen sensors, bank 1, 2 sensor 1 and bank 1 sensor 2 have the same amplitude. | • Three–way catalytic converter<br>• Open or short in heated oxygen sensor circuit<br>• Heated oxygen sensor |

HINT: Only on U.S. vehicles does the MIL light up when a malfunction is detected.

# SYSTEM CHECK DRIVING PATTERN




① Connect the OBDII scan tool or TOYOTA hand–held tester to the DLC3.
② Start and warm up the engine with all accessories switched OFF.
③ After the engine is warmed up, run the vehicle at 50 – 65 km/h (31 – 40 mph) for 5 – 10 min.
HINT: If a malfunction exists, the MIL will light up during step (3) .

## DIAGNOSTIC CHART

| | | | |
|---|---|---|---|
| 1 | Are there any other codes (besides DTC P0420) being output? | YES | Go to relevant diagnostic trouble code chart. |

NO

| | | | |
|---|---|---|---|
| 2 | Check heated oxygen sensor. (See page EG2–476). | NG | Repair or replace. |

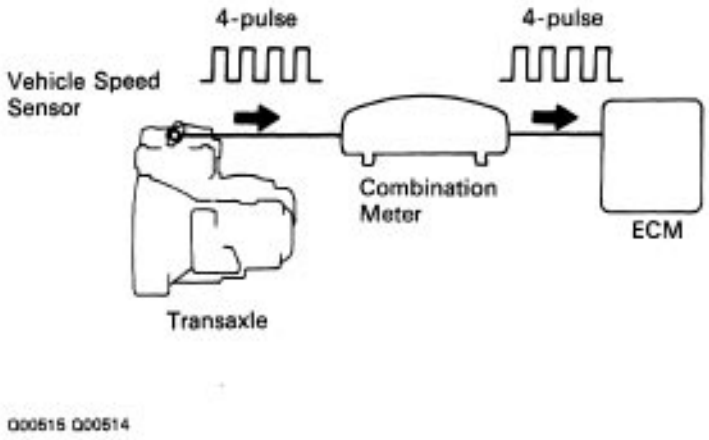
OK

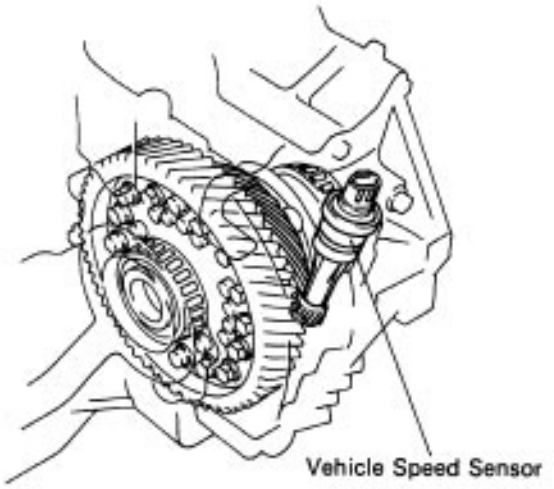
Replace three–way catalytic converter.

# DTC P0500 Vehicle Speed Sensor Malfunction

## CIRCUIT DESCRIPTION

The vehicle speed sensor outputs a 4–pulse signal for every revolution of the rotor shaft, which is rotated by the transmission output shaft via the driven gear. After this signal is converted into a more precise rectangular waveform by the waveform shaping circuit inside the combination meter, it is then transmitted to the ECM. The ECM determines the vehicle speed based on the frequency of these pulse signals.

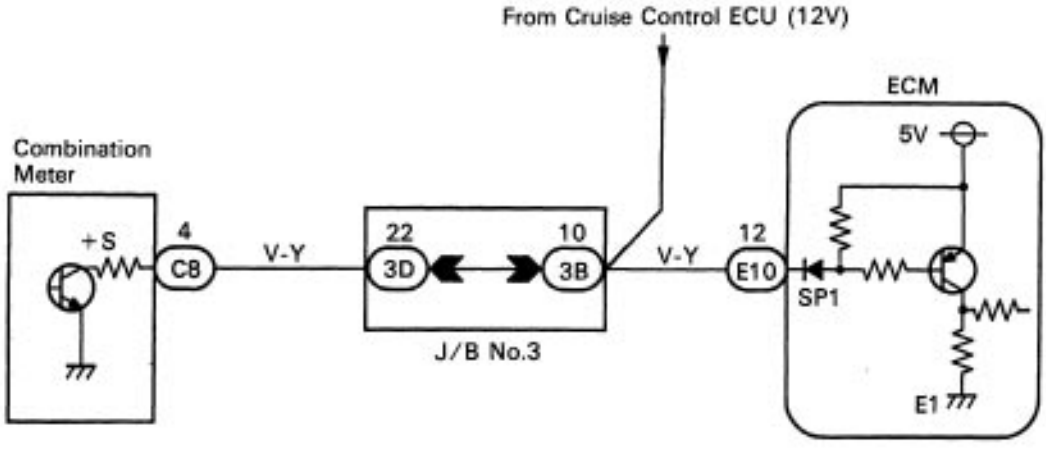



Q00515 Q00514

| DTC No. | Diagnostic Trouble Code Detecting Condition | Trouble Area |
|---|---|---|
| **P0500** | No vehicle speed sensor signal to ECM under conditions (a) and (b).<br>(a) Park/neutral position switch is OFF.<br>(b) Vehicle is being driven. | • Open or short in vehicle speed sensor circuit.<br>• Vehicle speed sensor<br>• Combination meter<br>• ECM |

## WIRING DIAGRAM




FI7138

# DIAGNOSTIC CHART

| | | | |
|---|---|---|---|
| 1 | Check operation of speedometer. | NG | Check speedometer circuit |
| OK | | | |
| 2 | Check for short in harness and connector between terminal SP1 and body ground. | NG | Repair or replace harness or connector. |
| OK | | | |
| 3 | Check voltage of terminal SP1. | NG | Check for open in harness and connector between J/B No.3 and ECM. |
| OK | | | |
| 4 | Check for open in harness and connector between J/6 No.3 and combination meter. | NG | Repair or replace harness or connector. |
| OK | | | |
| Check and replace ECM. | | | |

# INSPECTION PROCEDURE

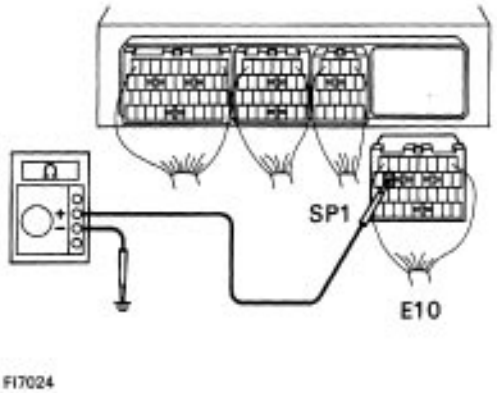
**1** **Check operation of speedometer.**

C Drive the vehicle and check if the operation of the speedometer in the combination meter is normal,
HINT: The vehicle speed sensor is operating normally if the speedometer display is normal.

OK

NG **Check speedometer circuit. See combination meter troubleshooting on page BE–66.**

**2** **Check for short in harness and connector between terminal SP1 of ECM and body ground.**




FI7024

P (1) Remove glove compartment
(See page EG2–309).
(2) Disconnect the E10 ECM connector.

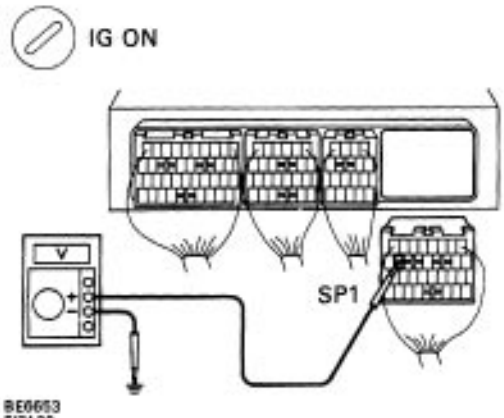
C Check continuity between terminal SP1 of ECM and body ground.

OK **No continuity (1 M or higher)**

OK

NG **Repair or replace harness or connector.**

**3** **Check voltage between terminal SP1 of ECM and body ground.**




BE6653
FI7129

P Turn ignition switch ON.

C Measure voltage between terminal SP1 of ECM and body ground.

OK **Voltage: 9 –14 V**

OK

NG **Check for open in harness and connector between J/B No.3 and ECM (See page IN–31).**

| | |
|---|---|
| 4 | **Check for open in harness and connector between J/B No.3 and combination meter (See page IN–31).** |

**OK**

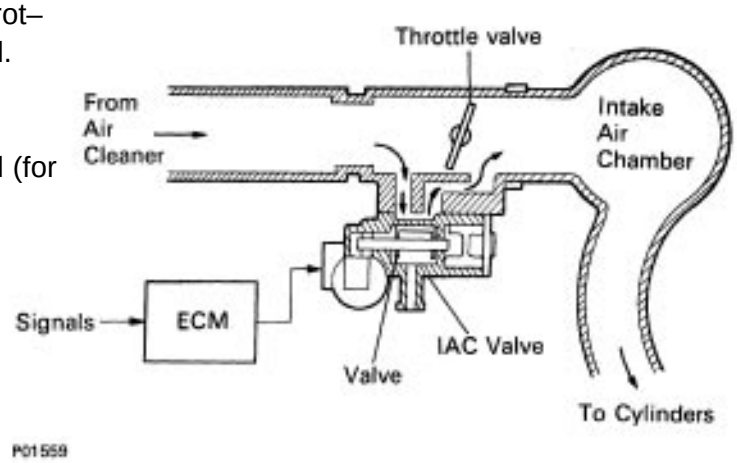
**NG** → **Repair or replace harness or connector.**

**Check and replace ECM (See page IN–36).**

# DTC P0505 Idle Control System Malfunction

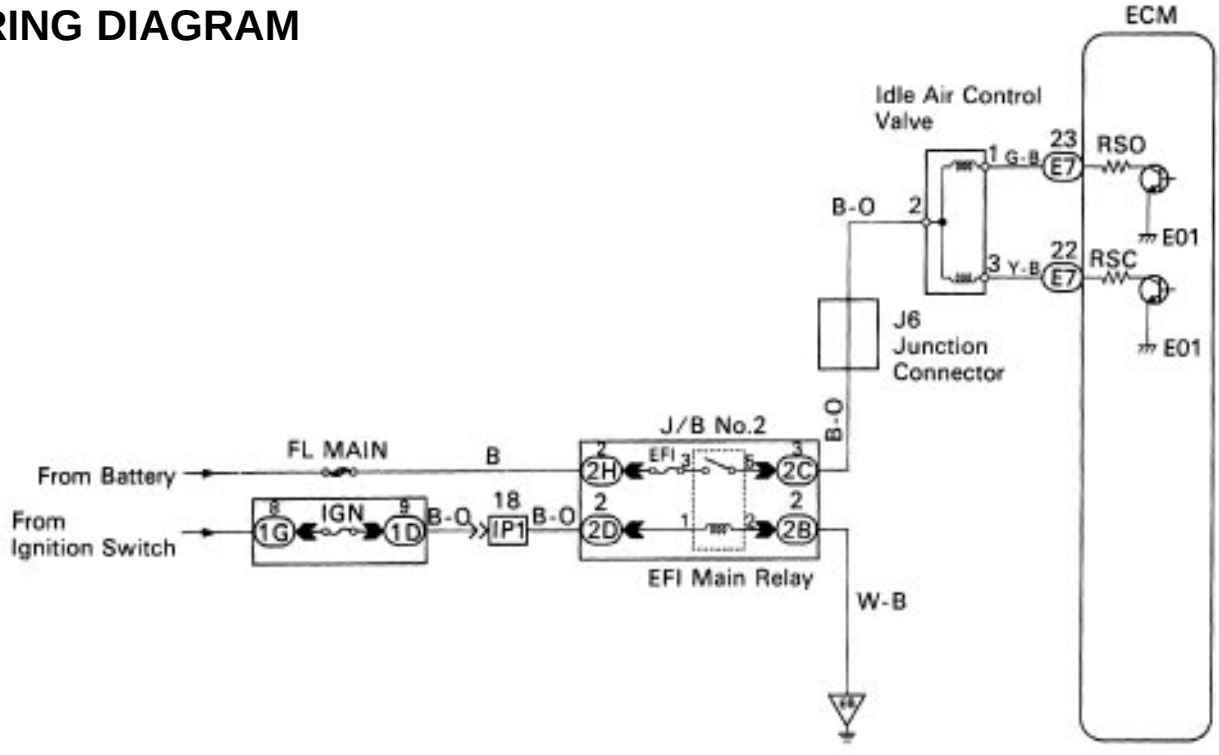
## CIRCUIT DESCRIPTION

The rotary solenoid type IAC valve is located in front of the intake air chamber and intake air bypassing the throttle valve is directed to the IAC valve through a passage.
In this way the intake air volume bypassing the throt–tle valve is regulated, controlling the engine speed.
The ECM operates only the IAC valve to perform idle–up and provide feedback for the target idling speed and a VSV for idle–up control is also added (for air conditioning).




| DTC No. | Diagnostic Trouble Code Detecting Condition | Trouble Area |
|---|---|---|
| P0505 | Idle speed continues to vary greatly from the target speed.<br>(2 trip detection logic) | • IAC valve is stuck or closed<br>• open or short in IAC valve circuit<br>• Air conditioner idle up VSV<br>• Air intake (hose loose) |

## WIRING DIAGRAM



# DIAGNOSTIC CHART

| | | | |
|---|---|---|---|
| 1 | Check air induction system. | NG | Repair or replace. |
| OK | | | |
| 2 | Check A/C idle up VSV. | NG | Repair or replace. |
| OK | | | |
| 3 | Check voltage terminals RSO, RSC. | OK | G o to step 5 |
| NG | | | |
| 4 | Check IAC valve. | NG | Replace IAC valve. |
| OK | | | |
| Check for open and short in harness and connector between J/B No.2 and IAC valve, IAC valve and ECM. | | | |
| 5 | Check operation of the IAC valve. | NG | Repair or replace IAC valve. |
| OK | | | |
| Check and replace ECM. | | | |

# INSPECTION PROCEDURE

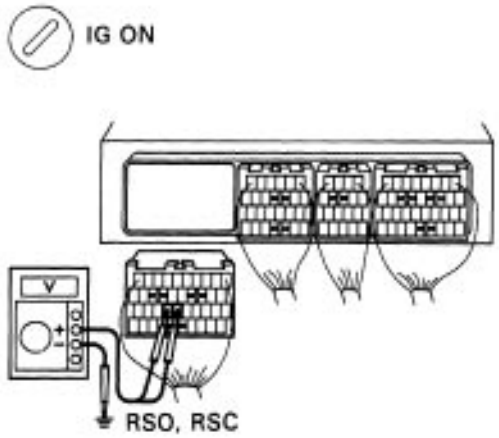
**1** Check air induction system (See page EG2–221).

OK → NG: Repair or replace.

**2** Check A/C idle up VSV (See page EG2–570).

OK → NG: Repair or replace.

**3** Check voltage terminals RSO, RSC.




P (1) Remove glove compartment (See page EG2–309).
(2) Disconnect the ECM connector (P).
(3) Turn ignition switch ON.

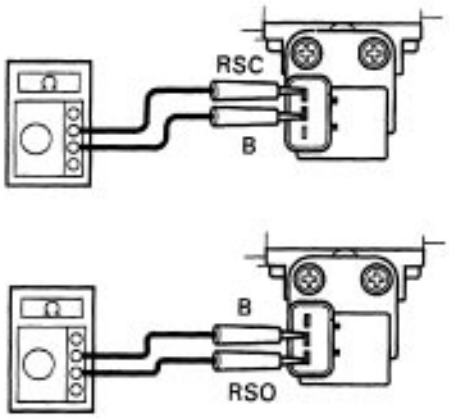
C Measure voltage between terminals RSO, RSC of ECM connector and body ground.

OK **Voltage: 9 –14 V**

NG

OK → Go to step 5.

**4** **Check IAC valve.**




F17063
F17062

P Disconnect the IAC valve connector.

C Check continuity between terminals RSO, RSC and B of IAC valve connector.

OK

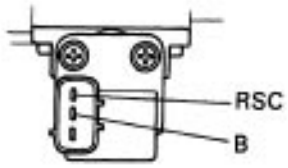
| | |
|---|---|
| Terminals<br>RSO and B | Continuity<br>(Reference value 10 – 30Ω) |
| Terminals<br>RSC and B | Continuity<br>(Reference value 10 – 30Ω) |

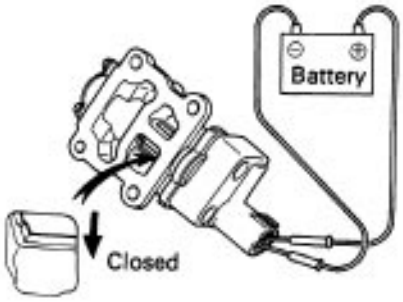
**OK**

**NG** **Replace IAC valve.**

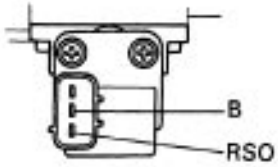
**Check for open and short in harness and connector between J/B No.2 and IAC valve, IAC valve and ECM (See page IN–31).**

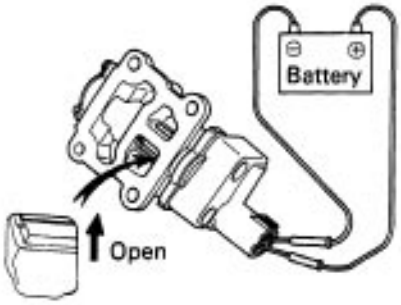
## 5 Check operation of the IAC valve




FI5039
FI5771




FI5039
FI5772

P Remove IAC valve (See page EG2–274).

C (1) Connect the positive (+) lead from the battery to terminal B and negative (–) lead to terminal RSC, and check that the valve is closed.
(2) Connect the positive (+) lead from the battery to terminal B and negative (–) lead to terminal RSO, and check that the valve is open.

OK **(1) The valve moves to close direction.**
**(2) The valve moves to open direction.**

Hint The ACTIVE TEST mode of the TOYOTA hand–held tester can be used to change the duty of the IAC valve as desired.

OK

NG **Repair or replace IAC valve.**

**Check and replace ECM (See page IN–36).**

# DTC P0510 Closed Throttle Position Switch Malfunction

## CIRCUIT DESCRIPTION

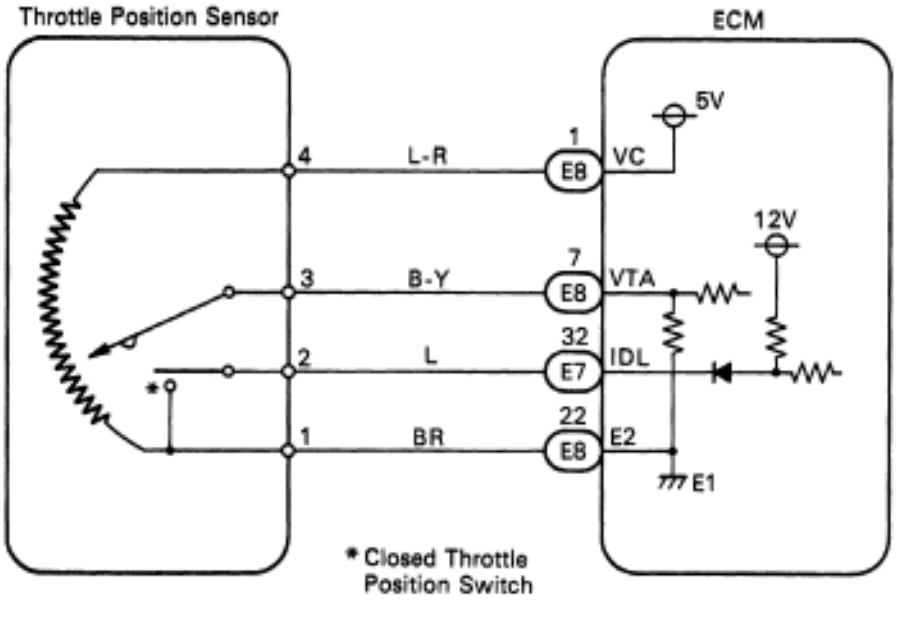
Refer to throttle Position Circuit on page EG2–463.

| DTC No. | Diagnostic Trouble Code Detecting Condition | Trouble Area |
|---|---|---|
| P0510 | The closed throttle position switch does not turn ON even once when the vehicle is driven, (2 trip detection logic) | • Open in closed throttle position switch circuit.<br>• Closed throttle position switch.<br>• ECM |

HINT: After confirming DTC P0510 use the TOYOTA hand–held tester to confirm the closed throttle position switch signal from ”CURRENT DATA”.

| Throttle Valve | Closed throttle position switch signal | Malfunction |
|---|---|---|
| Fully Closed | OFF | Open Circuit |
| Fully Open | ON | Short Circuit |

## WIRING DIAGRAM



# DIAGNOSTIC CHART

HINT: If diagnostic trouble codes ”P0110” (intake air temp. circuit malfunction), ”P0115” (engine coolant temp. circuit malfunction) and ”P0120” (throttle position circuit malfunction) are output simultaneously, E2 (sensor ground) may be open.
TOYOTA hand–held tester

| | | | |
|---|---|---|---|
| 1 | Check for open in harness or ECM. | OK | Confirm good connection at sensor. If OK, replace throttle position sensor. |
| NG | | | |
| 2 | Check for open in harness or ECM. | OK | Open in harness between ECM and throttle position sensor. |
| NG | | | |
| Confirm connection at ECM. If OK, replace ECM. | | | |

## OBDII scan tool (excluding TOYOTA hand–held tester)

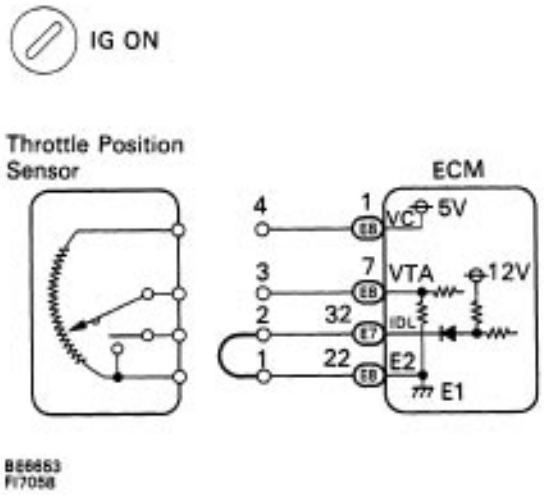
| | | | |
|---|---|---|---|
| 1 | Check for open in harness or ECM. | OK | Confirm good connection at sensor. If OK, replace throttle position sensor. |
| NG | | | |
| 2 | Check for open in harness and connector between throttle position sensor and ECM. | NG | Open in harness between ECM and throttle position sensor. |
| OK | | | |
| Confirm connection at ECM. If OK, replace ECM. | | | |

# INSPECTION PROCEDURE

HINT: If diagnostic trouble codes P0110, P0115 and P0120 are output simultaneously, E2 (sensor ground) may be open.

## TOYOTA hand–held tester

**1** **Check for open in harness or ECM.**




P (1) Remove the fuse cover on the instrument panel.
(2) Connect the TOYOTA hand–held tester to the DLC 3.
(3) Disconnect the throttle position sensor connector.
(4) Connect sensor wire harness terminals between terminals 1 and 2.
(5) Turn ignition switch ON.

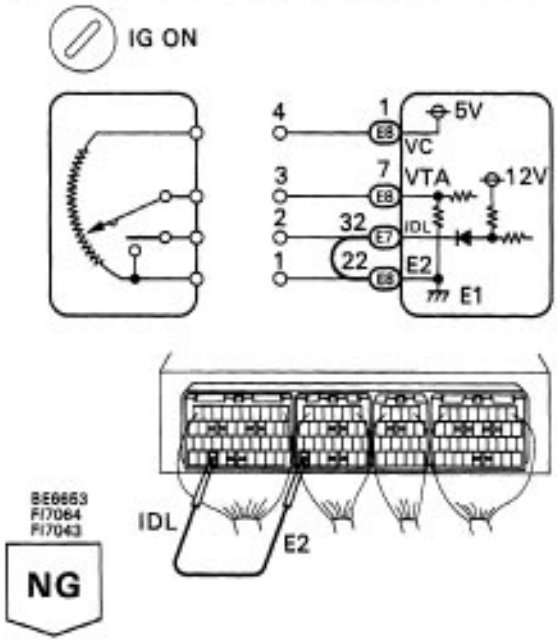
C Read CTP switch signal on the TOYOTA hand–held tester.

OK **CTP switch signal: ON**

NG

OK → **Confirm good connection at sensor. If OK, replace throttle position sensor.**

**2** **Check for open in harness or ECM.**




P (1) Remove glove compartment.
(See page BO–309)
(2) Connect between terminals IDL and E2 of ECM connectors.
H I NT: Throttle position sensor connector is disconnected.
Before checking, do a visual check and contact pressure –check for the connector.
(See page EG2–418)
(3) Turn ignition switch ON.

C Read CTP switch signal on the TOYOTA hand–held tester.

OK **CTP switch signal: ON**

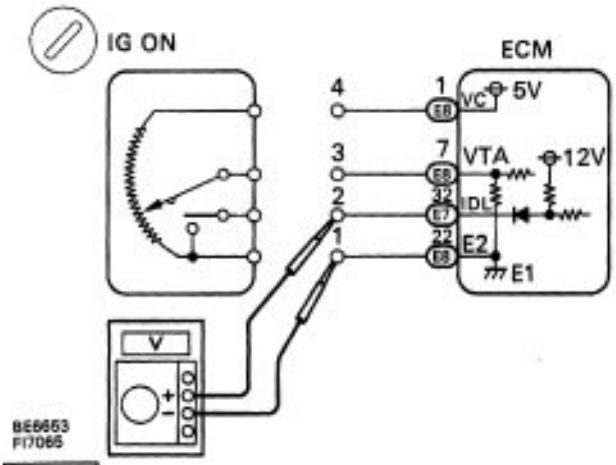
NG

OK → **Open in harness between ECM and throttle position sensor, repair or replace harness.**

**Confirm connection at ECM. If OK, replace ECM.**

# OBDII scan tool (excluding TOYOTA hand–held tester)

**1** **Check for open in harness or ECM.**




P (1) Disconnect the throttle position sensor connector.
(2) Turn ignition switch ON.

C Measure voltage between terminals 1 and 2 of throttle position sensor connector.

OK **Voltage: 9 –14 V**

NG

OK → **Confirm good connection at sensor. If OK, replace throttle position sensor.**

**2** **Check for open in harness and connector between throttle position sensor and ECM (See page IN–31).**

OK

NG → **Open in harness between ECM and throttle position sensor.**

**Confirm connection at ECM. If OK, replace ECM.**

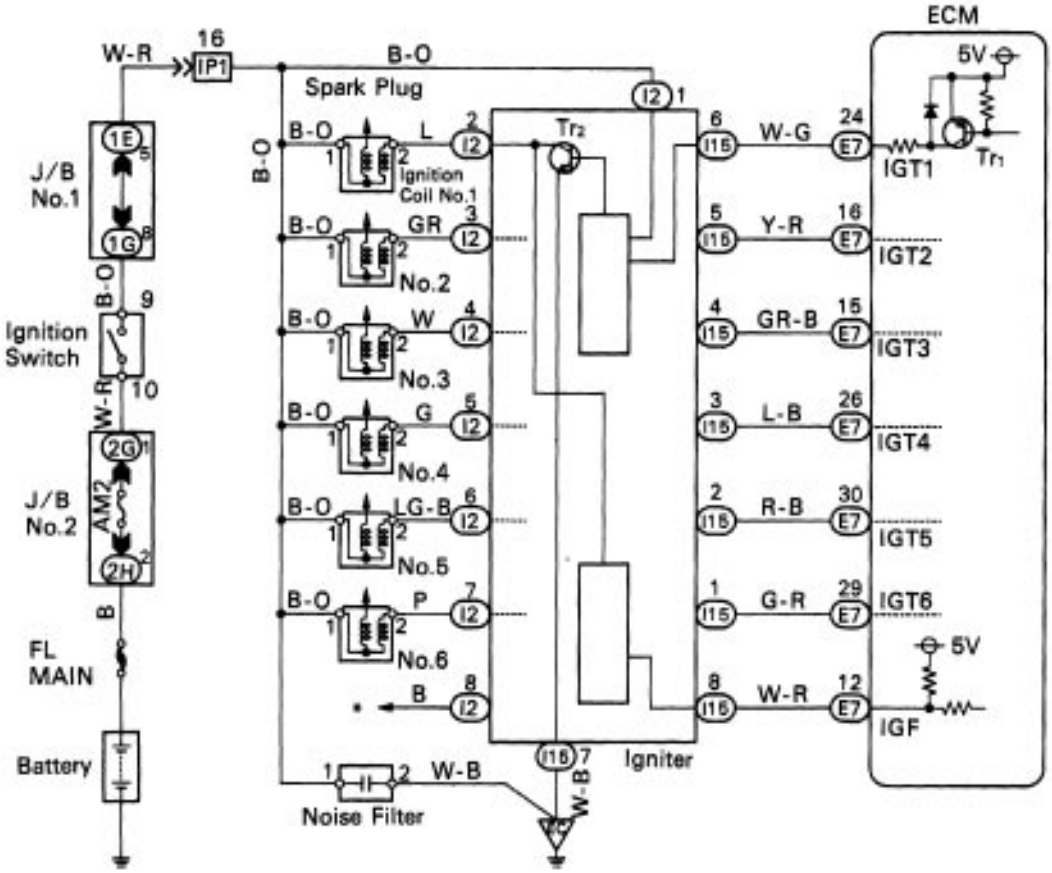
# DTC P1300 Igniter Circuit Malfunction

## CIRCUIT DESCRIPTION

The ECM determines the ignition timing, turns on Tr1 at a predetermined angle (”CA) before the desired ignition timing and outputs an ignition signal (IGT) ”1” to the igniter.
Since the width of the IGT signal is constant, the dwell angle control circuit in the igniter determines the time the control circuit starts primary current flow to the ignition coil based on the engine rpm and ignition timing one revolution ago, that is, the time the Tr2 turns on.
When it reaches the ignition timing, the ECM turns Tr1 off and outputs the IGT signal ”0”.
This turns Tr2 off, interrupting the primary current flow and generating a high voltage in the secondary coil which causes the spark plug to spark. Also, by the counter electromotive force generated when the primary current is interrupted, the igniter sends an ignition confirmation signal (IGF) to the ECM.
The ECM stops. fuel injection as a fail safe function when the IGF signal is not input to the ECM.

| DTC No. | Diagnostic Trouble Code Detecting Condition | Trouble Area |
|---|---|---|
| **P1300** | No IGF signal to ECM for 6 consecutive IGT signals during engine running. | • Open or short in IGF or IGT circuit from igniter to ECM.<br>• Igniter<br>• ECM |

## WIRING DIAGRAM



# DIAGNOSTIC CHART

| | | | |
|---|---|---|---|
| 1 | Check voltage igniter power source. | NG | Check and repair igniter power source circuit. |

OK

| | | | |
|---|---|---|---|
| 2 | Check voltage between terminals 2 – 7 of igniter connector (12) and body ground. | OK | G o to step 4 |

NG

| | | | |
|---|---|---|---|
| 3 | Check ignition coil. | NG | Replace ignition coil. |

OK

Check for open and short in harness and connector between J/B No.1 and ignition coil, ignition coil and igniter.

| | | | |
|---|---|---|---|
| 4 | Check continuity between terminal 7 of igniter and body ground. | NG | Repair or replace harness or connector. |

OK

| | | | |
|---|---|---|---|
| 5 | Check voltage between terminal 8 of igniter connector (115) and body ground. | OK | Go to step 7 |

NG

| | | | |
|---|---|---|---|
| 6 | Check for open and short in IGF circuit. | NG | Repair or replace harness or connector. |

OK

Check and replace ECM.

| | | | |
|---|---|---|---|
| 7 | Check for open and short in IGT circuit. | NG | Repair or replace harness or connector. |

OK

| | | | |
|---|---|---|---|
| 8 | Check voltage between terminals IGT 1 – 6 of ECM and body ground. | OK | Replace igniter. |

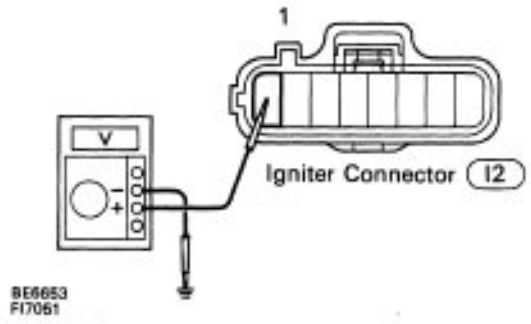
NG

Check and replace ECM.

# INSPECTION PROCEDURE

**1** **Check voltage between terminal 1 of igniter connector (12) and body ground.**

IG ON




P (1) Disconnect igniter connector (12)
(2) Turn ignition switch ON.

Hint Connector 12 color is dark gray

C Measure voltage between terminal 1 of igniter connector 12 and body ground.

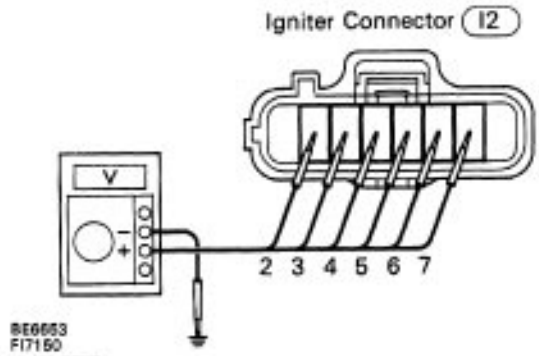
OK **Voltage: 9 –14 V**

OK

NG **Check and repair igniter power source circuit.**

**2** **Check voltage between terminals 2 – 7 of igniter connector and body ground.**

IG ON



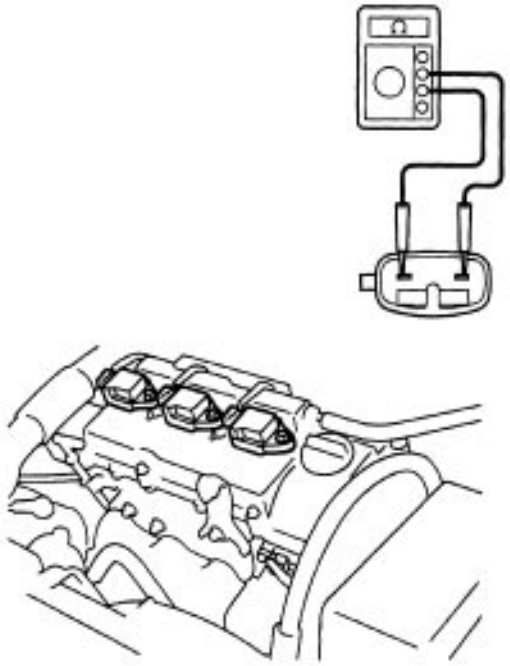

C Measure voltage between terminals 2 – 7 of igniter connector (12) and body ground.

OK **Voltage: 9 – 14 V**

NG

OK **Go to step 4**

**3** **Check ignition coil.**



FI7079
FI7086

P Disconnect ignition coil connector.
(See page IG–87).

Hint Refer to the wiring diagram and inspect the ignition coil connected to the terminal which was without voltage in step (2) .

C Measure resistance between terminals of ignition coil connector.

OK

| | Resistance |
|---|---|
| Cold | 0.54 – 0.84Ω |
| Hot | 0.68 – 0.98Ω |

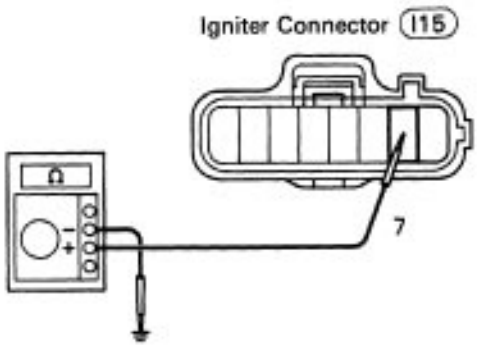
"Cold" is from $-10_2$C ($14_2$F) to $50_2$C ($122_2$F) and "Hot" is from $50_2$C ($122_2$F) to $100_2$C ($212_2$F).

**OK**

**NG** **Replace ignition coil.**

**Check for open and short in harness and connector between J/B No.1 and ignition coil, ignition coil and igniter (See page IN–31).**

**4** **Check continuity between terminal 7 of igniter connector (I15) and body ground.**




FI7149

P Disconnect igniter connector(I15)

Hint Connector (I15) is black.

C Check continuity between terminal 7 of igniter connector (I15) and body ground.

OK **Continuity (1 or less)**

**OK**

**NG** **Repair or replace harness or connector.**

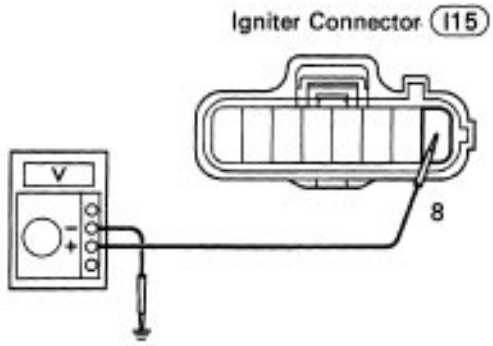
| 5 | Check voltage between terminal 8 of igniter connector (I15) and body ground. |
|---|---|

IG ON

P Turn ignition switch ON.

C Measure voltage between terminal 8 of igniter connector (I15) and body ground.

OK **Voltage: 4.5 – 5.5 V**




NG

OK → **Go to step (7)**

| 6 | Check for open and short in harness and connector between terminal IGF of ECM and igniter (See page IN–31). |
|---|---|

OK

NG → **Repair or replace harness or connector.**

**Check and replace ECM (See page IN–36).**

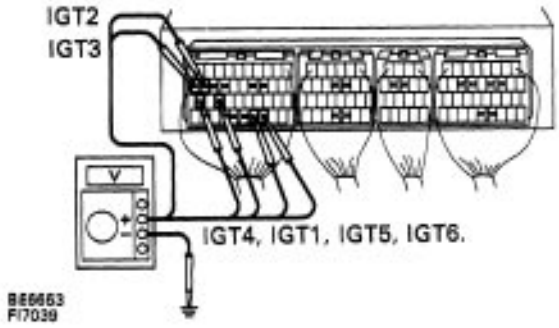
| 7 | Check for open and short in harness and connector between terminals IGT1 – of ECM and igniter (See page IN–31). |
|---|---|

OK

NG → Repair or replace harness or connector.

| 8 | Check voltage between terminals IGT1 – 6 of ECM and body ground. |
|---|---|

STA ON




P Remove glove compartment (See page EG2–309).

Hint Leave igniter connector 115 disconnected.

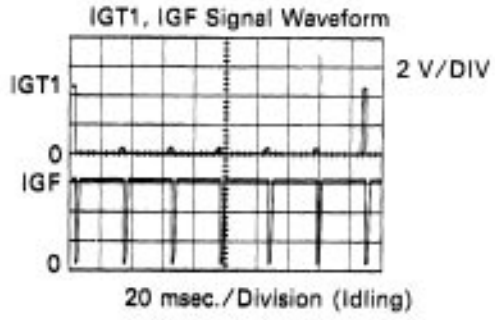
C Measure voltage between terminals IGT1 – 6 of ECM and body ground when engine is cranked.

OK **Voltage: 0.5 – 1.0 v (Neither 0 v nor 5 v)**

NG → OK → Replace igniter.

Check and replace ECM (See page IN–36).

## Reference INSPECTION USING OSCILLOSCOPE




- During idling, check waveform between terminal IGT1, IGF and E1 of ECM.

HINT: The correct waveform appears as shown in the illustration on the left, with rectangular waves.
IGT2, IGT3, IGT4, IGT5 and IGT6 signal wave–forms are the same as the IGT1 signal waveform.

# DTC P1500 Starter Signal Circuit Malfunction

## CIRCUIT DESCRIPTION

When the engine is cranked, the intake air flow is slow, so fuel vaporization is poor. A rich mixture is therefore necessary in order to achieve good startability. While the engine is being cranked, the battery voltage is applied to terminal STA of the ECM. The starter signal is mainly used to increase the fuel injection volume for the starting injection control and after–start injection control.

| DTC No. | Diagnostic Trouble Code Detecting Condition | Trouble Area |
|---|---|---|
| P1500 | No starter signal to ECM. | • Open or short in starter signal circuit.<br>• Open or short in ignition switch or starter relay circuit.<br>• ECM |

HINT: In this circuit, diagnosis can only be made in the check mode.

## DIAGNOSTIC CHART

HINT: This diagnostic chart is based on the premise that the engine is cranked normally. If the engine is not cranked, proceed to the matrix chart of problem symptoms on page EG2–435.

| | | | |
|---|---|---|---|
| 1 | Connect the TOYOTA hand–held tester and check STA signal. | OK | Proceed to next circuit inspection shown on matrix chart. |

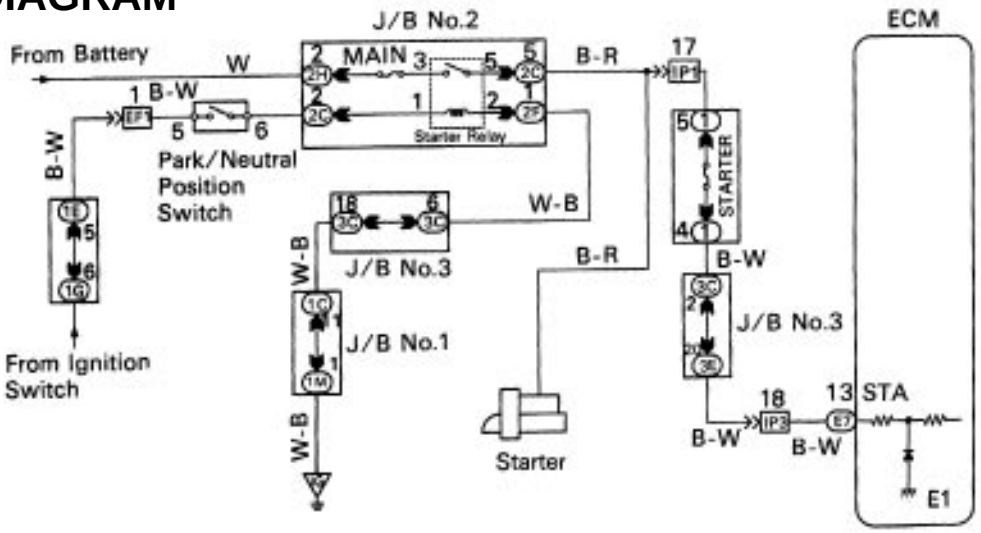
NG

| | | | |
|---|---|---|---|
| 2 | Check for open in harness and connector between ECM and starter relay. | NG | Repair or replace harness or connector. |

OK

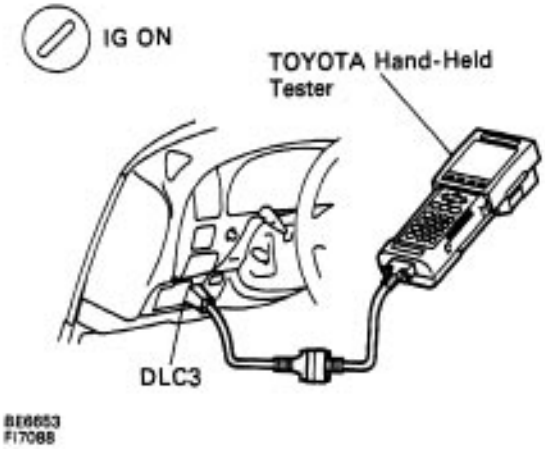
Check and replace ECM.

## WIRING DIAGRAM



# INSPECTION PROCEDURE

**1** **Connect the TOYOTA hand–held tester and check STA signal.**




P (1) Remove the fuse cover on the instrument panel.
(2) Connect the TOYOTA hand–held tester to the DLC 3.
(3) Turn ignition switch ON and TOYOTA hand–held tester main switch ON.

C Read STA signal on the TOYOTA hand–held tester while starter operates.

OK

| Ignition Switch Position | STA Signal |
|---|---|
| ON | OFF |
| START | ON |

NG

OK → **Proceed to next circuit inspection shown on matrix chart (See page EG2–435).**

**2** **Check for open in harness and connector between ECM and starter relay (See page IN–31).**

OK

NG → **Repair or replace harness or connector.**

**Check and replace ECM (See page IN–36).**

# DTC P1600 EMC BATT Malfunction

### CIRCUIT DESCRIPTION

Battery voltage is supplied to terminal BATT of the ECM even when the ignition switch is OFF for use by the diagnostic trouble code memory and air–fuel ratio adaptive control value memory, etc.

| DTC No. | Diagnostic Trouble Code Detecting Condition | Trouble Area |
|---|---|---|
| P1600 | Open in back up power source circuit. | • Open in back up power source circuit.<br>• ECM |

HINT: If DTC P1600 appear, the ECM does not store another diagnostic trouble code.

## DIAGNOSTIC CHART

1 Check voltage of terminal BATT.

OK → Check and replace ECM.

NG

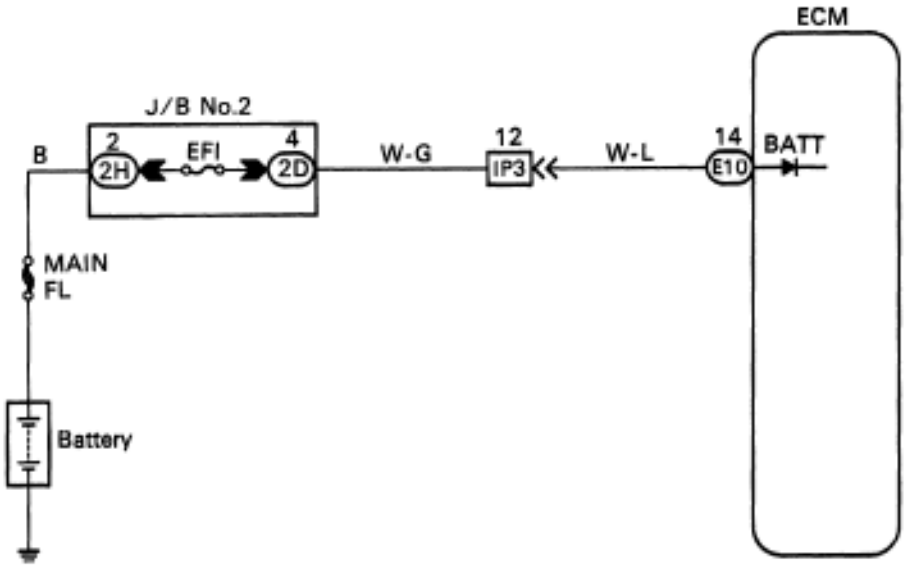
2 Check EFI fuse.

NG → Check for short in all the harness and components connected to EFI fuse.

OK

Check and repair harness or connector between battery, EFI fuse and ECM.

## WIRING DIAGRAM

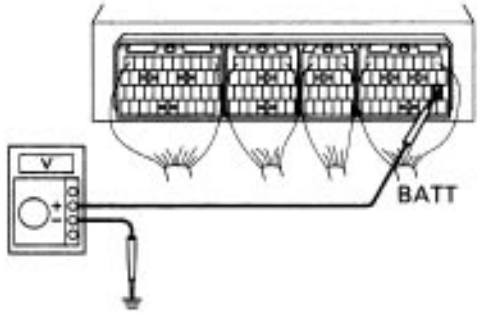



FI6681

# INSPECTION PROCEDURE

**1** **Check voltage between terminal BATT of ECM connector and body ground.**

IG OFF




B66653
FI6807

P Remove glove compartment.
(See page EG2–309)

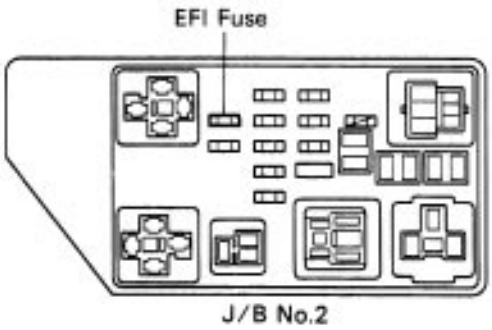
C Measure voltage between terminal BATT of ECM connector and body ground.

OK **Voltage: 9 –14 V**

NG

OK → **Check and replace ECM (See page IN–36).**

**2** **Check EFI fuse.**




FI7078

P Remove EFI fuse from J/B No.2.

C Check continuity of EFI fuse.

OK **Continuity**

OK

NG → **Check for short in all the harness and components connected to EFI fuse.**

**Check and repair harness or connector between battery, EFI fuse and ECM.**

# DTC P1605 Knock Control CPU Malfunction

## CIRCUIT DESCRIPTION

Refer to knock sensor 1 circuit malfunction on page EG2–499.

| DTC No. | Diagnostic Trouble Code Detecting Condition | Trouble Area |
|---|---|---|
| P1605 | Engine control computer malfunction. (for knock control) | • ECM |

## WIRING DIAGRAM

Refer to knock sensor 1 circuit malfunction on page EG2–499.

## DIAGNOSTIC CHART

| | | | |
|---|---|---|---|
| 1 | Are there any other codes (besides DTC P1605) being output? | YES | Go to relevant diagnostic trouble code chart. |

NO

Check and replace ECM (See page IN–36).

# DTC P1780 Park Neutral Position Switch Malfunction

## CIRCUIT DESCRIPTION

The park/neutral position switch goes on when the shift lever is in the N or P shift position. When it goes on terminal NSW of the ECM is grounded to body ground via the starter relay thus the terminal NSW voltage becomes 0 V, When the shift lever is in the D, 2, L or R position, the park/neutral position switch goes off, so the voltage of ECM terminal NSW becomes battery voltage, the voltage of the ECM internal power source.

If the shift lever is moved from the N position to the D position, this signal is used for air–fuel ratio correction and for idle speed control (estimated control), etc.

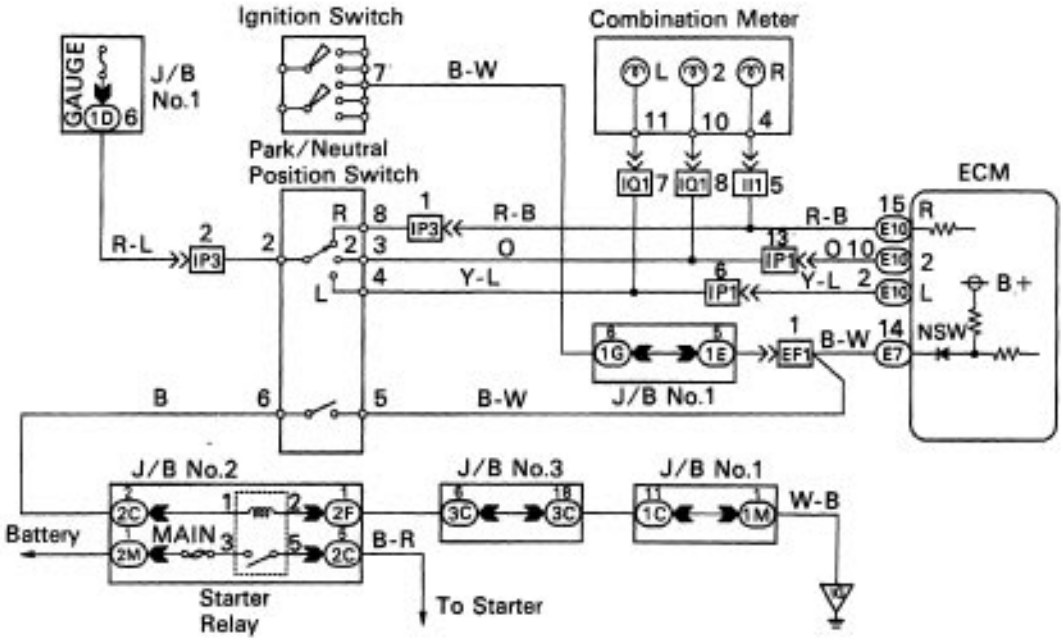
| DTC No. | Diagnostic Trouble Code Detecting Condition | Trouble Area |
|---|---|---|
| P1780 | Two or more switches are ON simultaneously for ”N”, ”2” and ”L” position.<br>(2 trip detection logic) | • Short in park/neutral position switch circuit.<br>• Park/neutral position switch.<br>• ECM |
| | When driving under conditions a) and b) for 30 sec. or more the park/neutral position switch is ON ( N position).<br>(2 trip detection logic)<br>a) Vehicle speed; 70 km/h (44 mph) or more<br>b) Engine speed; 1,500 – 2,500 rpm | |

HINT: After confirming DTC P1780 use the TOYOTA hand–held tester to confirm the PNP switch signal from ”CURRENT DATA”.

## DIAGNOSTIC CHART

| | | | |
|---|---|---|---|
| 1 | Check park/neutral position switch. | NG | Replace park/neutral position switch. |
| OK | | | |
| 2 | Check voltage between terminal NSW of ECM connector and body ground. | OK | Check and replace ECM. |
| NG | | | |
| Check for open and short in harness and connector between ECM and park/neutral position switch. | | | |

## WIRING DIAGRAM



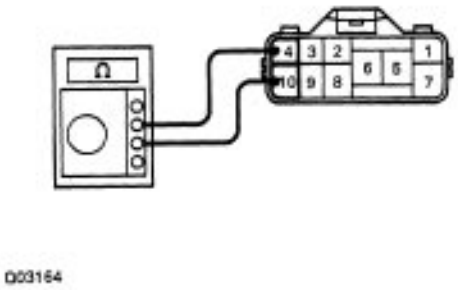

FI7141

# INSPECTION PROCEDURE

**1** Check park/neutral position switch.

P Disconnect park/neutral position switch connector.

C Check continuity between each terminal shown below when the shift lever is positioned to each range.




D03164

OK

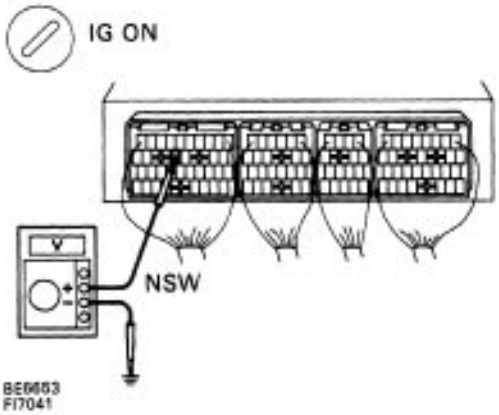
○—○ Continuity

| Shift Position \ Terminal | 5 | 6 | 2 | 7 | 8 | 9 | 10 | 3 | 4 |
|---|---|---|---|---|---|---|---|---|---|
| P | ○ | ○ | ○ | ○ | | | | | |
| R | | | ○ | | ○ | | | | |
| N | ○ | ○ | ○ | | | ○ | | | |
| D | | | ○ | | | | ○ | | |
| 2 | | | ○ | | | | | ○ | |
| L | | | ○ | | | | | | ○ |

OK → **2**

NG → **Replace park/neutral position switch.**

**2** **Check voltage between terminal NSW of ECM connector and body ground.**




BE6653
FI7041

P Remove glove compartment.
(See page EG2–309)

C (1) Turn ignition switch ON.
(2) Measure voltage between terminal NSW of ECM connector and body ground when the shift lever is positioned to the following positions.

OK

| Shift lever position | P or N | L,2,D or R |
|---|---|---|
| Voltage | 0 V | 9–14V |

NG → **Check for open and short in harness and connector between ECM and park/neutral position switch (See page IN–31).**

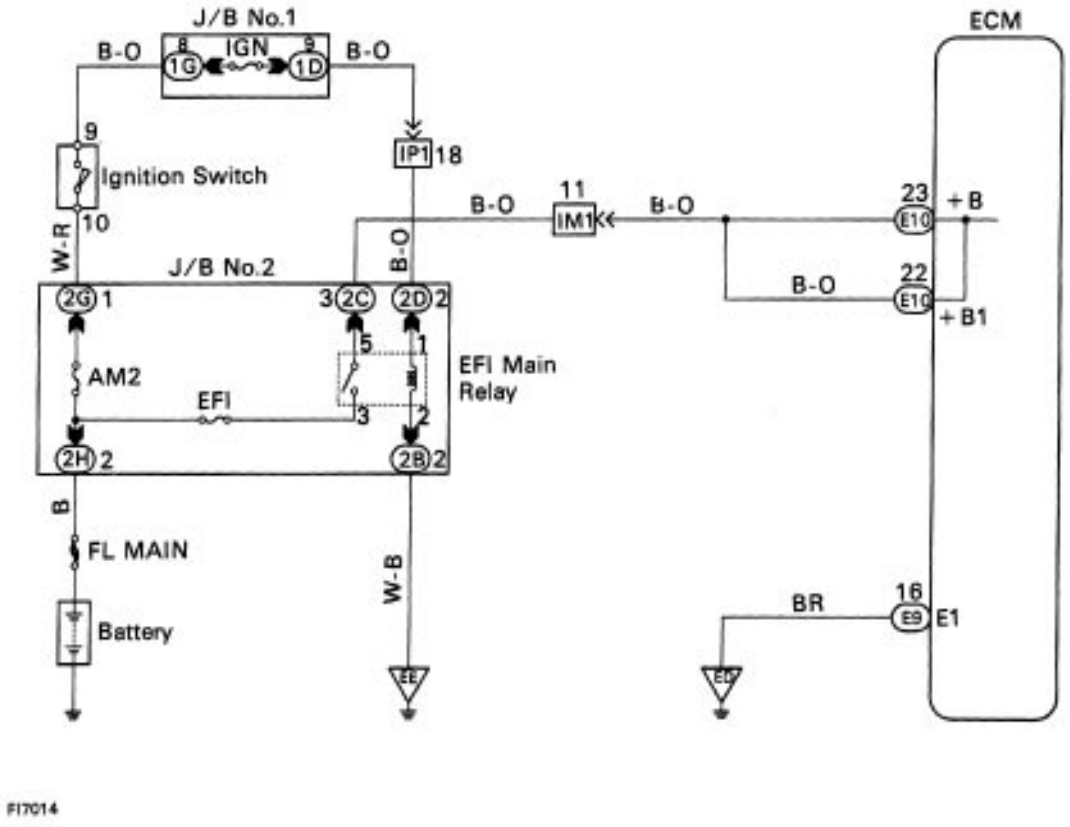
OK → **Check and replace ECM (See page IN–36).**

# ECM Power Source Circuit

## CIRCUIT DESCRIPTION

When the ignition switch is turned ON, battery voltage is applied to the coil, closing the contacts of the EFI main relay and supplying power to the terminals + B and + B1 of the ECM.

## WIRING DIAGRAM



# DIAGNOSTIC CHART

| | | | |
|---|---|---|---|
| 1 | Check voltage of ECM power source. | OK | Proceed to next circuit inspection shown on matrix chart . |

NG

| | | | |
|---|---|---|---|
| 2 | Check continuity between terminal E1 and body ground. | NG | Repair or replace harness or connector. |

OK

| | | | |
|---|---|---|---|
| 3 | Check EFI main relay. | NG | Replace EFI main relay. |

OK

| | | | |
|---|---|---|---|
| 4 | Check EFI fuse. | NG | Check for short in all the harness and components connected to EFI fuse. |

OK

| | | | |
|---|---|---|---|
| 5 | Check for open in harness and connector between main relay and battery, main relay and ECM. | NG | Repair or replace harness or connector. |

OK

| | | | |
|---|---|---|---|
| 6 | Check I G N fuse. | NG | Check for short in all the harness and components connected to IGN fuse. |

OK

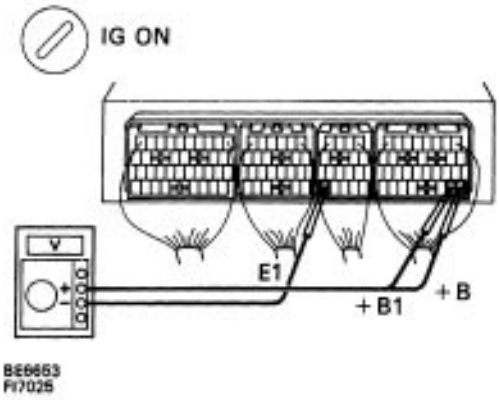
| | | | |
|---|---|---|---|
| 7 | Check ignition switch. | NG | Replace ignition switch. |

OK

Check for open in harness and connector between IG switch and main relay, main relay and body ground.

# INSPECTION PROCEDURE

**1** **Check voltage between terminals + B, + B1 and E1 of ECM connector.**




P (1) Remove glove compartment.
(See page EG2–309)
(2) Turn ignition switch ON.

C Measure voltage between terminals + B, + 1B and E1 of ECM connector.

OK **Voltage: 9 –14 V**

NG

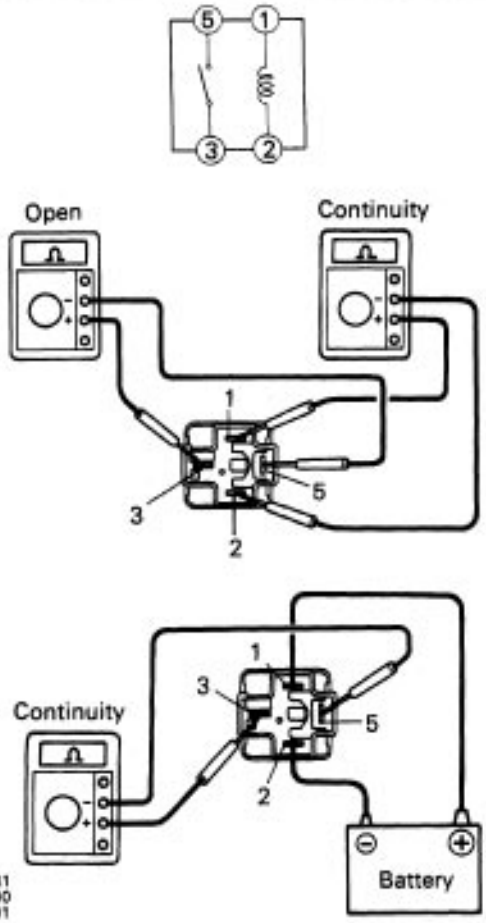
OK **Proceed to next circuit inspection shown on matrix chart (See page EG2–435).**

**2** **Check for open in harness and connector between terminal E1 of ECM and body ground (See page IN–31).**

OK

NG **Repair or replace harness or connector.**

## 3 Check EFI main relay.




P Remove EFI main relay from J/B No–2.

C Check continuity between terminals of EFI main relay shown below.

OK

| | |
|---|---|
| Terminals 3 and 5 | Open |
| Terminals 1 and 2 | Continuity (Reference value 72Ω) |

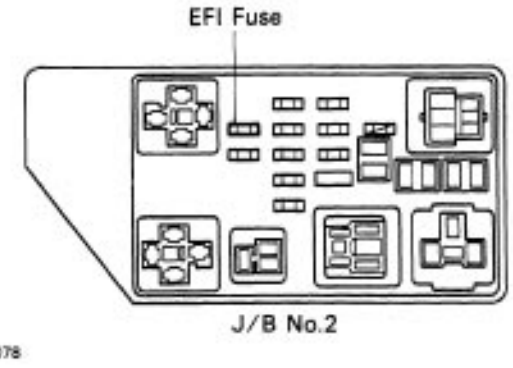
C (1) Apply battery voltage between terminals 1 and 2.
(2) Check continuity between terminals 3 and 5.

OK

| | |
|---|---|
| Terminals 3 and 5 | Continuity |

OK → NG → **Replace EFI main relay.**

## 4 Check EFI fuse.




P Remove EFI fuse from J/B No.2.

C Check continuity of EFI fuse.

OK **Continuity**

OK → NG → **Check for short in all the harness and components connected to EFI fuse.**

| | |
|---|---|
| 5 | **Check for open in harness and connector between main relay and battery, main relay and ECM (See page IN–31).** |

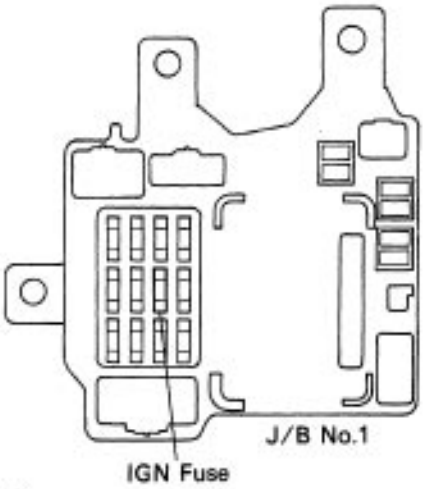
**OK** → **NG** → **Repair or replace harness or connector.**

| | |
|---|---|
| 6 | **Check IGN fuse.** |

P Remove IGN fuse from J/B No–1

C Check continuity of IGN fuse.

OK **Continuity**




**OK** → **NG** → **Check for short in all the harness and components connected to IGN fuse.**

| | |
|---|---|
| 7 | **Check ignition switch (See page BE–14).** |

**OK** → **NG** → **Replace ignition switch.**

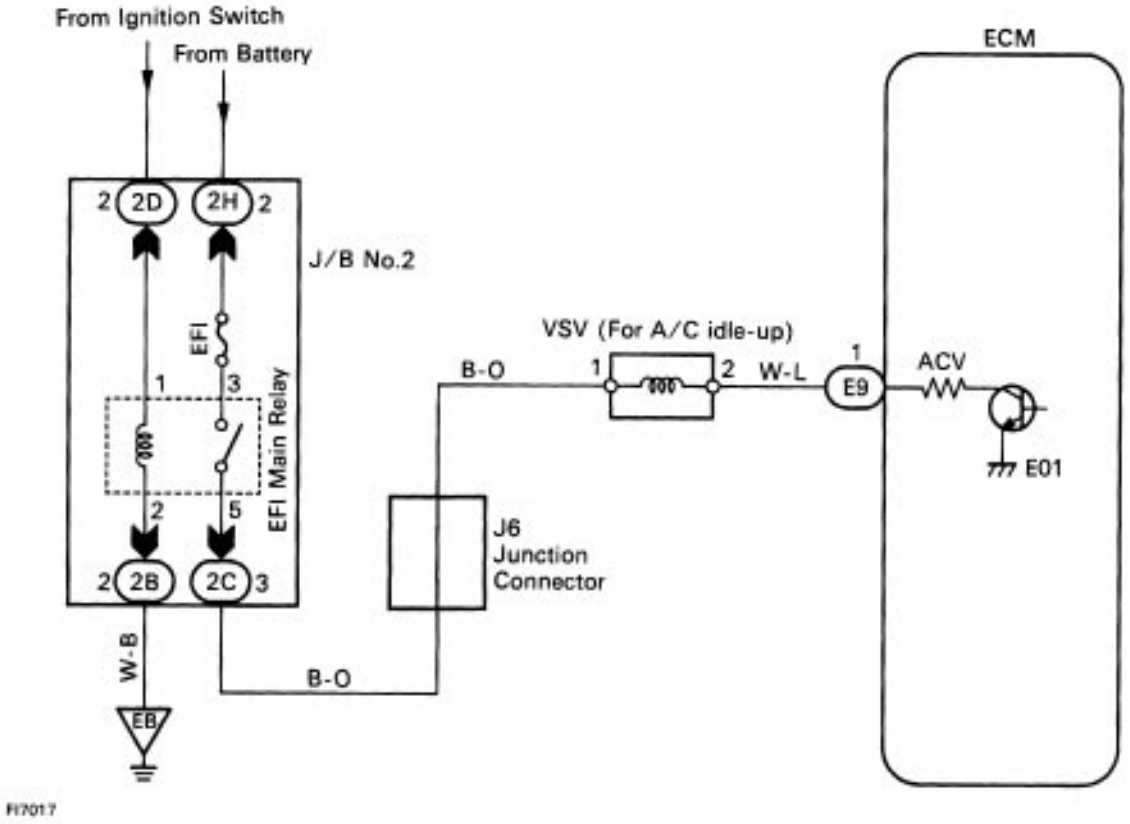
**Check for open in harness and connector between IG switch and main relay, main relay and body ground (See page IN–31).**

# AC Idle Up Circuit

## CIRCUIT DESCRIPTION

When the air conditioning operates (increased engine load), this circuit switch is on the VSV and increases the amount of bypass air to increase the idle speed, thus maintaining driveability.

## WIRING DIAGRAM



## DIAGNOSTIC CHART
## TOYOTA hand–held tester

1. Connect the TOYOTA hand–held tester and check operation of A/C idle–up VSV.
   - OK → Check and repair air hose and air pipe.
   - NG ↓
2. Check A/C idle–up VSV.
   - NG → Replace A/C idle–up VSV.
   - OK ↓
3. Check for open and short in harness and connector between EFI main relay and ECM.
   - NG → Repair or replace harness or connector.
   - OK ↓

Check and replace ECM.

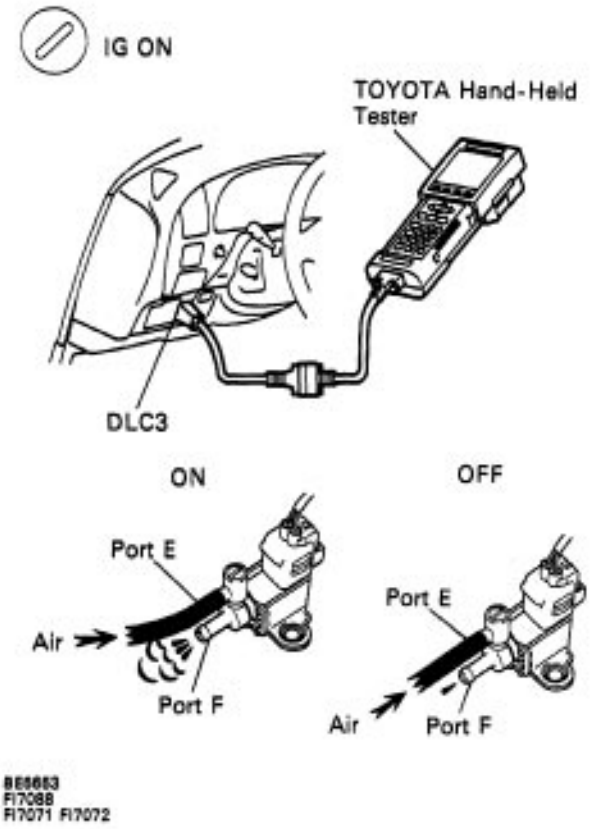
## OBDII scan tool (excluding TOYOTA hand–held tester)

1. Check A/C idle–up VSV.
   - NG → Replace A/C idle–up VSV.
   - OK ↓
2. Check voltage between terminal ACV and body ground.
   - NG → Check and repair harness or connector.
   - OK ↓
3. Check air hose and air pipe.
   - NG → Repair or replace.
   - OK ↓

Check and replace ECM.

# INSPECTION PROCEDURE
# TOYOTA hand–held tester

**1** **Connect the TOYOTA hand–held tester and check operation of A/C idle–up VSV.**




P (1) Remove the fuse cover on the instrument panel.
(2) Connect the TOYOTA hand–held tester to the DLC 3.
(3) Turn ignition switch ON and TOYOTA hand–held tester main switch ON.
(4) Select the active test mode on the TOYOTA hand–held tester.

C Check operation of A/C idle–up VSV when A/C idle–up VSV is operated by the TOYOTA hand–held tester.

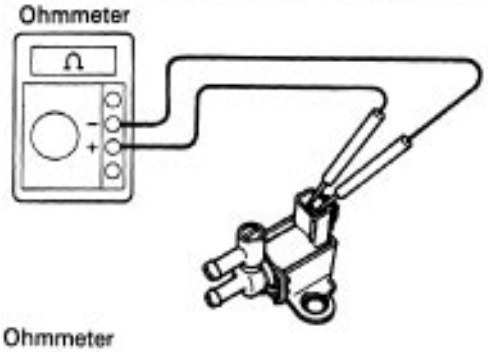
OK **A/C idle–up VSV is ON:**
**The air from port E is flowing out through port F.**
**A/C idle–up VSV is OFF:**
**The air does not flow from port E to port F.**

NG

OK → **Check and repair air hose and air pipe.**

**(See page EG2–295)**

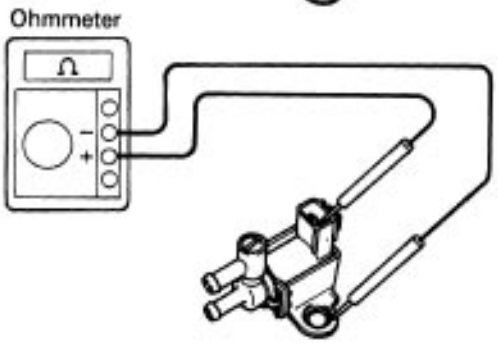
**2** **Check A/C idle–up VSV.**

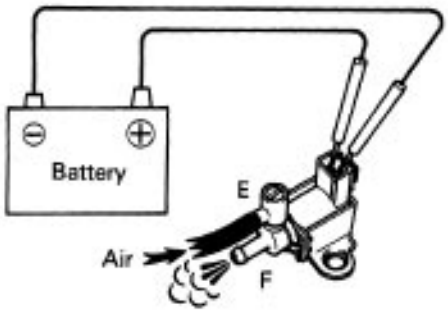



P (1) Remove A/C idle–up VSV.
(2) Disconnect A/C idle–up VSV connector.

C (1) Measure resistance between terminals.
(2) Measure resistance between each terminal and the body.

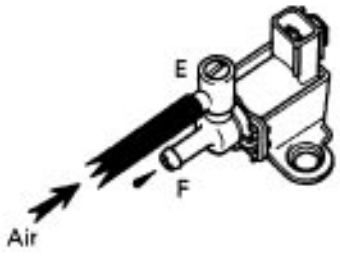
OK **(1) Resistance: 22 – 42 at $20_2$C ($68_2$F)**
**(2) Resistance: 1 M or higher**




C Check operation of A/C idle–up VSV when battery positive voltage is applied to the terminals of A/C idle–up VSV connector or not.

OK **Battery positive voltage is applied:**
**The air from pipe E is flowing out through pipe F.**
**Battery positive voltage is not applied:**
**The air from pipe E is not flowing out through pipe F.**




P04118
P04117
P04276
P04275

OK

NG → **Replace A/C idle–up VSV.**

**3** **Check for open and short in harness and connector between EFI main relay and ECM (See page IN–31).**

OK

NG → **Repair or replace harness or connector.**

**Check and replace ECM (See page IN–36).**

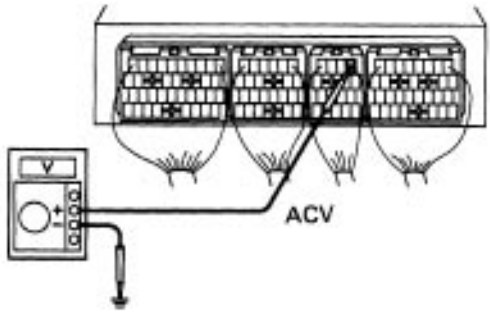
# INSPECTION PROCEDURE
# OBDII scan tool (excluding TOYOTA hand–held tester)

**1** **Check A/C idle–up VSV (See page EG2–573, step 2)**

**OK** → **NG** → **Replace A/C idle–up VSV.**

**2** **Check voltage between terminal ACV of ECM connector and body ground.**

IG ON




B85653
FI7029

P (1) Remove glove compartment.
(See page EG2–309)
(2) Turn ignition switch ON.

C Measure voltage between terminal ACV of ECM connector and body ground.

OK **Voltage: 9 –14 V**

**OK** → **NG** → **Check for open and short in harness and connector between EFI main relay and ECM (See page IN–31).**

**3** **Check air hose and air pipe (See page EG2–295).**

**OK** → **NG** → **Repair or replace.**

**Check and replace ECM (See page IN–36).**

# Fuel Pump Control Circuit

## CIRCUIT DESCRIPTION

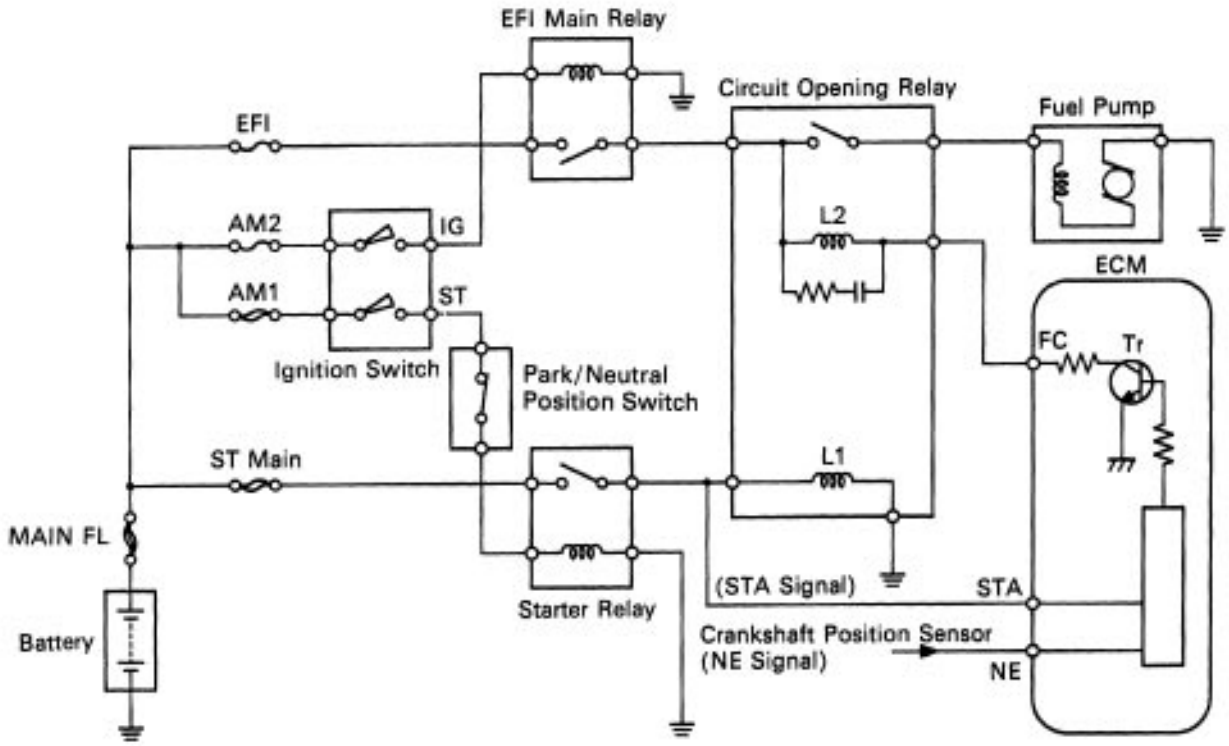
Fuel pump control

The fuel pump is switched on (low voltage at terminal FC) when STA is on or while the NE signal is input to the ECM.

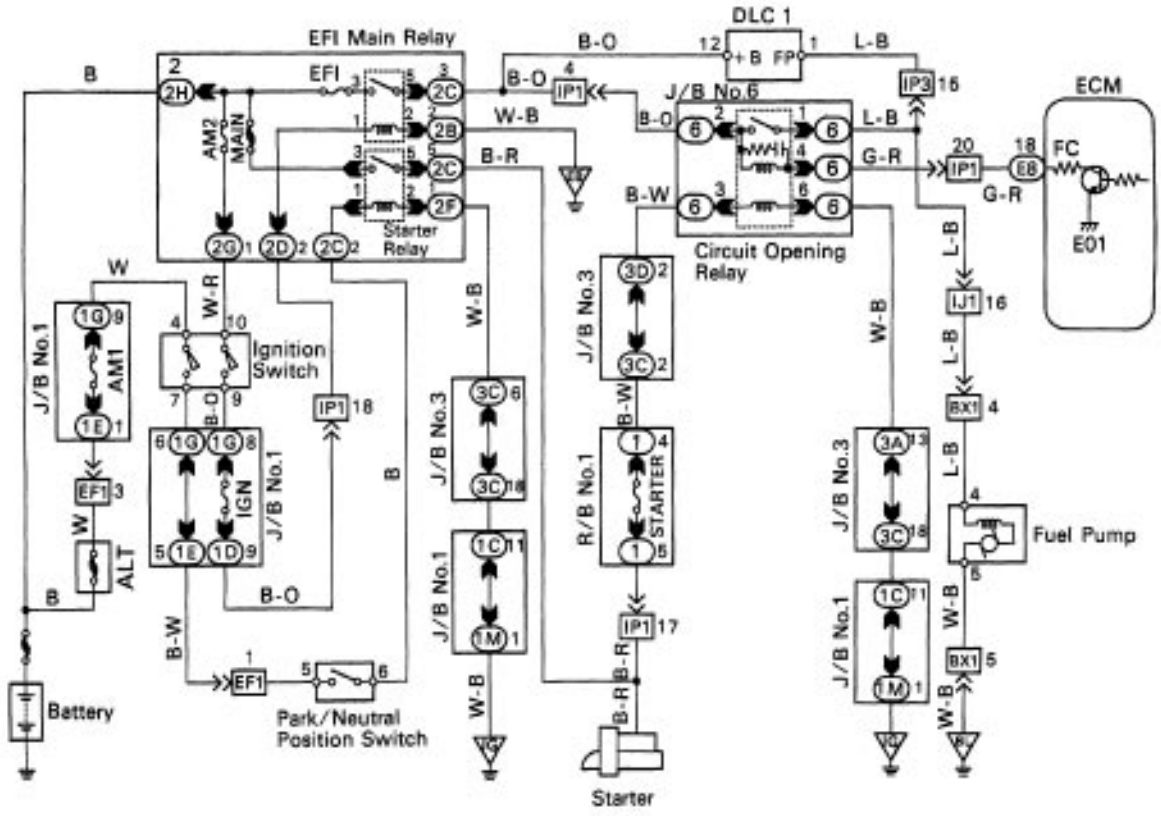
In the diagram below, when the engine is cranked, current flows from terminal ST of the ignition switch to the starter relay coil, the starter relay switches on and current flows to coil L1 of the circuit opening relay. Thus the circuit opening relay switches on, power is supplied to the fuel pump and the fuel pump operates.

When the STA signal and NE signal are input to the ECM, Tr is turned ON, current flows to coil L2 of the circuit opening relay, the relay switches on and the fuel pump operates.

While the NE signal is generated (engine running), the ECM keeps Tr ON (circuit opening relay ON) and the fuel pump also keeps operating.



# WIRING DIAGRAM




FI7143

# DIAGNOSTIC CHART
# TOYOTA hand – held tester

| | | | |
|---|---|---|---|
| 1 | Check fuel pump operation. | OK | Go to step 4 |

NG

| | | | |
|---|---|---|---|
| 2 | Check for ECM power source circuit. | NG | Repair or replace. |

OK

| | | | |
|---|---|---|---|
| 3 | Check fuel pump. | NG | Repair or replace fuel pump. |

OK

Check for open in harness and connector between terminal FP of DLC1 and fuel pump. fuel pump and body ground.

| | | | |
|---|---|---|---|
| 4 | Connect the TOYOTA hand – held tester and check operation of fuel pump. | OK | Go to step 7 |

NG

| | | | |
|---|---|---|---|
| 5 | Check circuit opening relay. | NG | Replace circuit opening relay. |

OK

| | | | |
|---|---|---|---|
| 6 | Check voltage terminal FC. | OK | Check and replace ECM. |

NG

Check for open in harness and connector between ER main relay and circuit opening relay, circuit opening relay and ECM.

| | | | |
|---|---|---|---|
| 7 | Check circuit opening relay. | NG | Replace circuit opening relay. |

OK

| | | | |
|---|---|---|---|
| 8 | Check voltage terminal 3 of circuit opening relay. | NG | Check for starter signal circuit. |

OK

Check for open in harness and connector between terminal 6 of circuit opening relay and body ground,

## OBD II scan tool (excluding TOYOTA hand – held tester)

| | | | |
|---|---|---|---|
| 1 | Check fuel pump operation. | OK | Go to step 4 |

NG

| | | | |
|---|---|---|---|
| 2 | Check for ECM power source circuit. | NG | Repair or replace. |

OK

| | | | |
|---|---|---|---|
| 3 | Check fuel pump. | NG | Repair or replace fuel pump. |

OK

Check for open in harness and connector between terminal FP of DLC1 and fuel pump, fuel pump and body ground.

| | | | |
|---|---|---|---|
| 4 | Check circuit opening relay. | NG | Replace circuit opening relay. |

OK

| | | | |
|---|---|---|---|
| 5 | Check voltage terminal FC. | OK | Check and replace ECM. |

NG

| | | | |
|---|---|---|---|
| 6 | Check for open in harness and connector between EFI main relay and ECM. | NG | Repair or replace harness or connector. |

OK

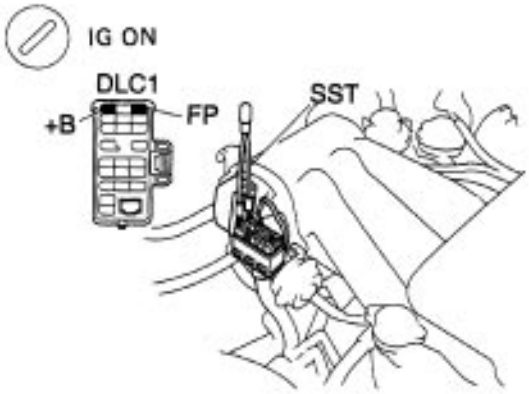
| | | | |
|---|---|---|---|
| 7 | Check voltage terminal 3 of circuit opening relay. | NG | Check for starter signal circuit. |

OK

Check for open in harness and connector between terminal 6 of circuit opening relay and body ground.

# INSPECTION PROCEDURE
# TOYOTA hand–held tester

**1** **Check fuel pump operation.**

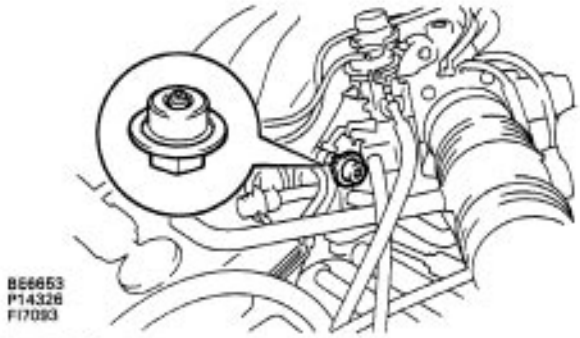



P (1) Be sure that enough fuel is in the tank.
(2) Turn ignition switch ON.
(3) Using SST, connect terminals FP and + B of DLC 1,
SST 09843–18020

C Check that pulsation damper screw rises up when terminals are connected.

Caution
**Never make a mistake with the terminal connection position as this will cause a malfunction.**

OK **The pulsation damper screw rises up.**




NG

OK → **Go to step 4**

**2** **Check for ECM power source circuit (See page EG2–565).**

OK

NG → **Repair or replace.**

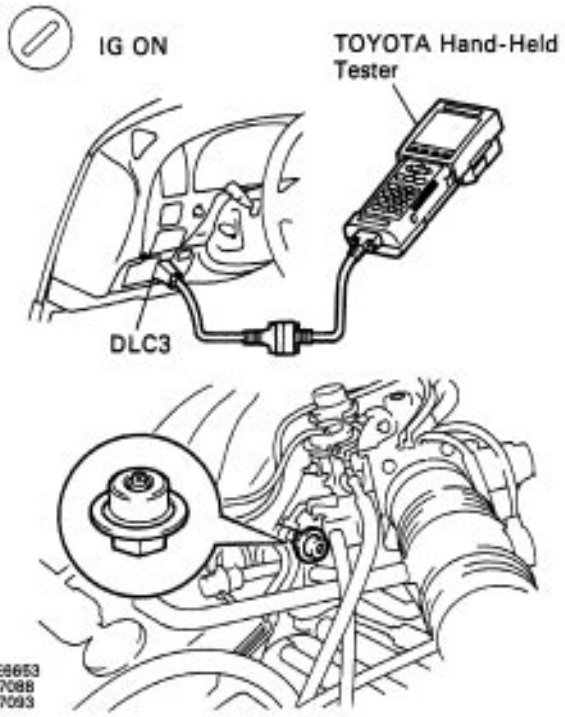
**3** **Check fuel pump (See page EG2–234).**

OK

NG → **Repair or replace fuel pump.**

**Check for open in harness and connector between terminal FP of DLC 1 and fuel pump, fuel pump and body ground (See page IN–31).**

| 4 | **Connect the TOYOTA hand–held tester and check operation of fuel pump.** |
|---|---|




P (1) Remove the fuse cover on the instrument panel.
(2) Connect the TOYOTA hand–held tester to the DLC 3.
(3) Turn ignition switch ON and TOYOTA hand–held tester main switch ON.
(4) Select the active test mode on the TOYOTA hand–held tester.

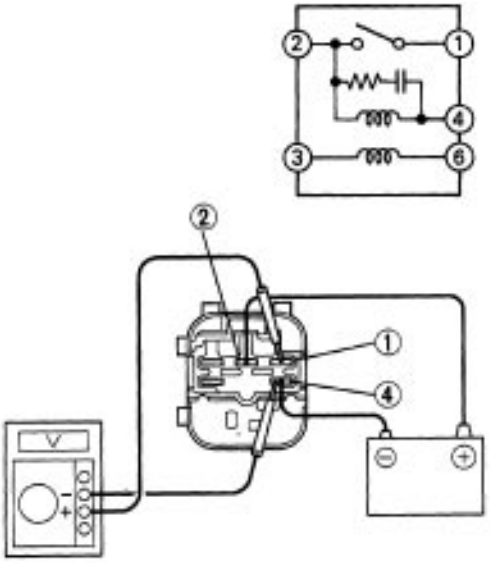
C Check that pulsation damper screw rises up when fuel pump is on by TOYOTA hand–held tester.

OK **The pulsation damper screw rises up.**

NG

OK → **Go to step 7**

**5** **Check circuit opening relay.**




FI7063
FI7068

P Remove circuit opening relay from R/B No.6.

C (1) Apply battery voltage between terminals 2 and 4.
(2) Measure voltage between terminals 1 and 4.

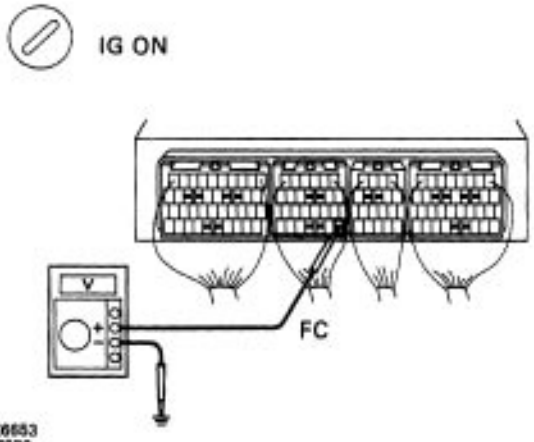
OK

| | |
|---|---|
| Terminals 1 and 4 | Same as battery |

**OK**

**NG** **Replace circuit opening relay.**

**6** **Check voltage between terminal FC of ECM and body ground.**




BE6653
FI7030

P (1) Remove glove compartment (see page EG2–309).
(2) Turn ignition switch ON.

C Measure voltage between terminal FC of ECM and body ground.

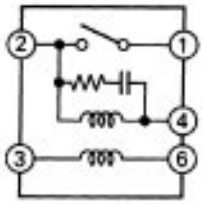
OK **Voltage: 9 –14 V**

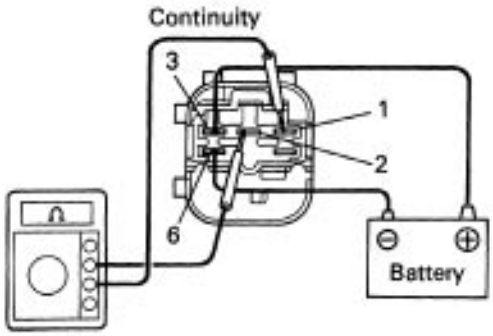
**NG**

**OK** **Check and replace ECM (See page IN–36).**

**Check for open in harness and connector between EFI main relay and circuit opening relay, circuit opening relay and ECM (See page IN–31).**

**7** **Check circuit opening relay.**




FI7053
FI1909

P (1) Remove glove compartment (See page EG2–309).
(2) Remove circuit opening relay from R/B No.6.

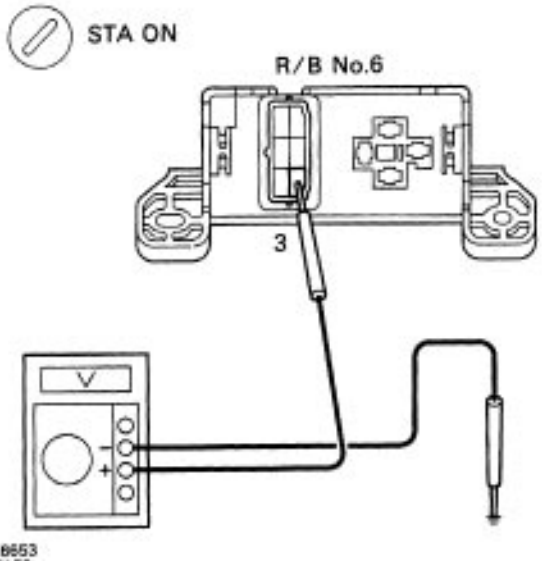
C (1) Apply battery voltage between terminals 3 and 6.
(2) Check continuity between terminals 1 and 2.

OK

| Terminals 1 and 2 | Continuity |
|---|---|

OK → **NG** → **Replace circuit opening relay.**

**8** **Check voltage between terminal 3 of R/B No.6 (for circuit opening relay) and body ground.**




BE8653
FI7152

C Measure voltage between terminal 3 of R/B No.6 (for circuit opening relay) and body ground when engine is cranked.

OK **Voltage: 9 –14 V**

OK → **NG** → **Check for starter signal circuit (See page EG2–557).**

**Check for open in harness and connector between terminal 6 of R/6 No.6 (for circuit opening relay) and body ground (See page IN–31).**

# OBDII scan tool (excluding TOYOTA hand–held tester)

**1** Check fuel pump operation (See page EG2–580, step

NG

OK → Go to step 4

**2** Check for ECM power source circuit (See page EG2–565).

OK

NG → Repair or replace.

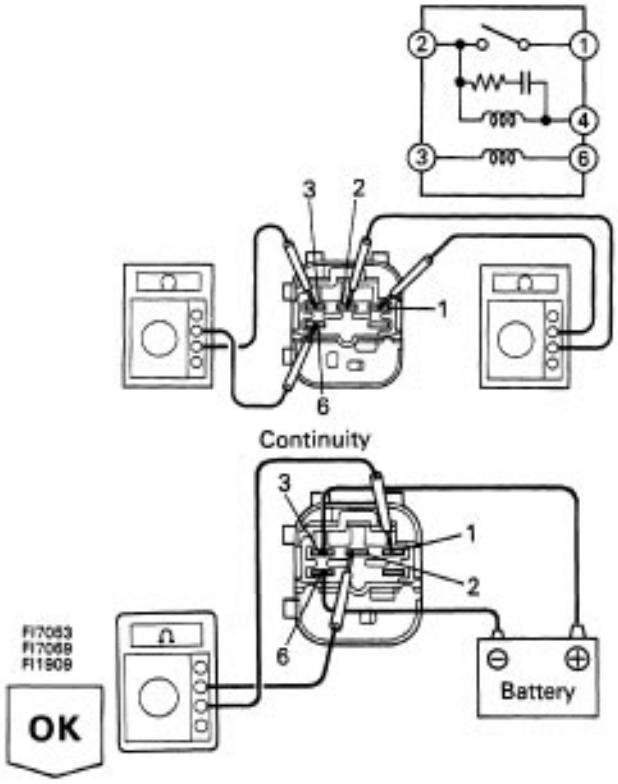
**3** Check fuel pump (See page EG2–234).

OK

NG → Repair or replace fuel pump.

Check for open in harness and connector between terminal FP of DLC1 and fuel pump, fuel pump and body ground (See page IN–31).

**4** Check circuit opening relay.




P (1) Remove glove compartment (See page EG2–309).
(2) Remove circuit opening relay from R/B No.6.

C Check continuity between terminals of circuit opening relay shown below.

OK

| | |
|---|---|
| Terminals 1 and 2 | Open |
| Terminals 3 and 6 | Continuity (Reference value 30Ω) |

C (1) Apply battery voltage between terminals 3 and 6.
(2) Check continuity between terminals 1 and 2.

OK

| | |
|---|---|
| Terminals 1 and 2 | Continuity |

NG → Replace circuit opening relay.

| | |
|---|---|
| 5 | Check voltage between terminal FC of ECM and body ground (Seepage EG2–582, step 6 ). |

NG → OK → Check and replace ECM (See page IN–36).

| | |
|---|---|
| 6 | Check for open in harness and connector between ER main relay and circuit opening relay, circuit opening relay and ECM (See page IN–31). |

OK → NG → Repair or replace harness or connector.

| | |
|---|---|
| 7 | Check voltage between terminal 3 of R/B No–6 (for circuit opening relay) and body ground (See page EG2–583, step 8 ). |

OK → NG → Check for starter signal circuit (See page EG2–557).

Check for open in harness and connector between terminal 6 of circuit opening relay and body ground (See page IN–31).

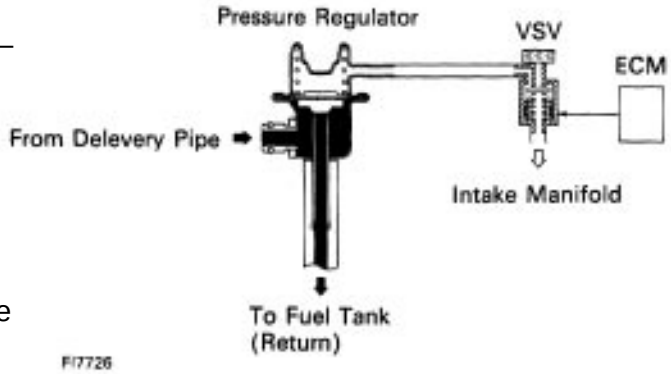
# Fuel Pressure Control VSV Circuit

## CIRCUIT DESCRIPTION

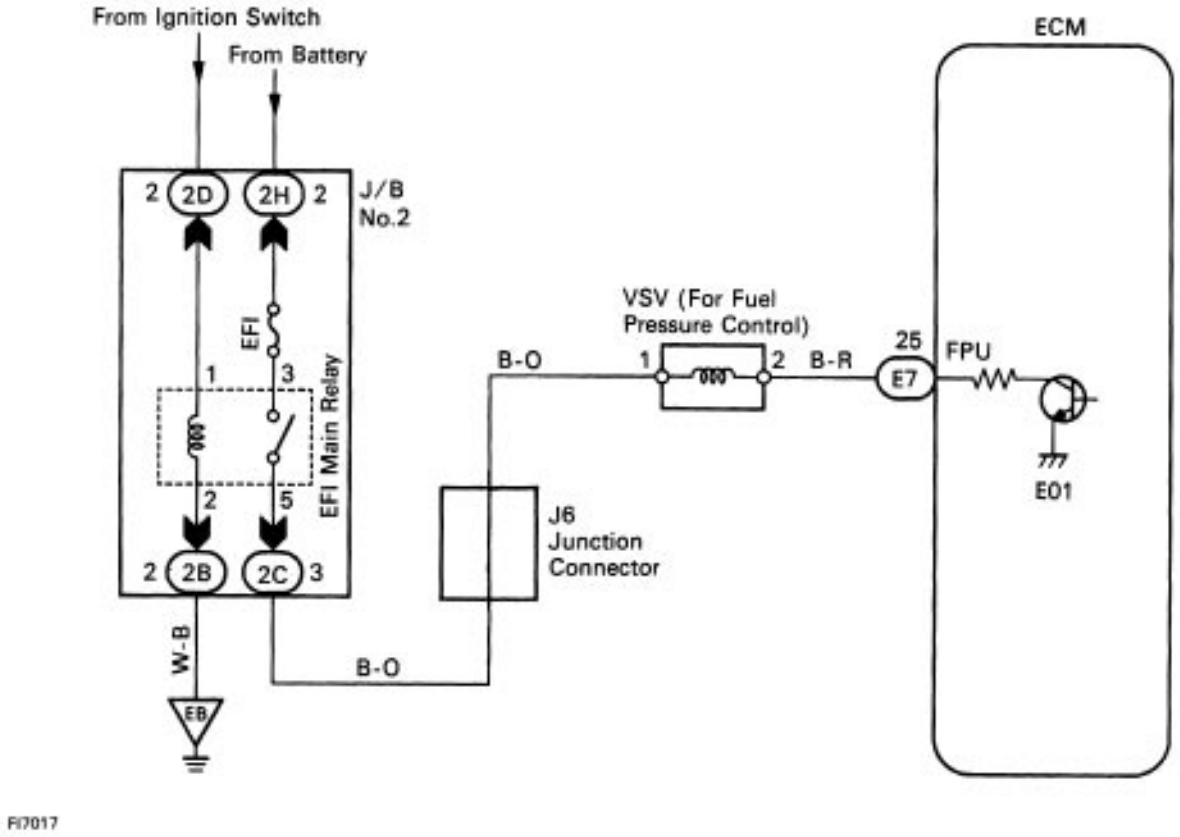
The ECM turns on a VSV (Vacuum Switching Valve) to draw the air into the diaphragm chamber of the pressure regulator if it detects that the temper–ature of the engine coolant is too high during engine starting.

The air drawn into the chamber increases the fuel pressure to prevent fuel vapor lock at high engine temperature in order to help the engine start when it is warm.

Fuel pressure control ends approx. 120 sec. after the engine is started.




## WIRING DIAGRAM



# DIAGNOSTIC CHART
# TOYOTA hand–held tester

1 Connect the TOYOTA hand–held tester and check operation of fuel pressure control VSV.

OK → Check and repair fuel pressure regulator.

NG

2 Check fuel pressure control VSV.

NG → Replace fuel pressure control VSV.

OK

3 Check for open and short in harness and connector between EFI main relay and ECM.

NG → Repair or replace harness or connector.

OK

Check and replace ECM.

## OBDII scan tool (excluding TOYOTA hand–held tester)

1 Check fuel pressure control VSV.

NG → Replace fuel pressure control VSV.

OK

2 Check voltage between terminal FPU and body ground.

NG → Check and repair harness or connector.

OK

3 Check fuel pressure regulator.

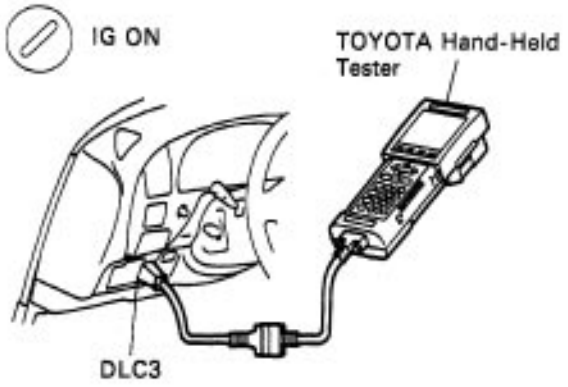
NG → Repair or replace.

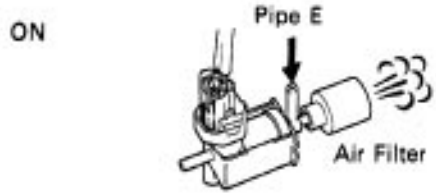
OK

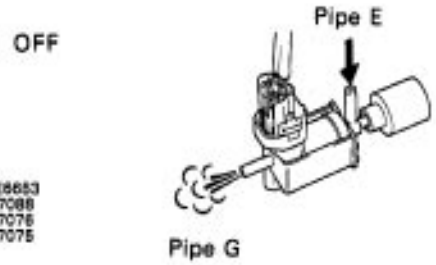
Check and replace ECM.

# INSPECTION PROCEDURE
# TOYOTA hand–held tester

**1** **Connect the TOYOTA hand–held tester and check operation of fuel pressure control VSV.**




B06653
F17068
F17076
F17075

P (1) Remove the fuse cover on the instrument panel.
(2) Connect the TOYOTA hand–held tester to the DLC 3.
(3) Turn ignition switch ON and TOYOTA hand–held tester main switch ON.
(4) Select the active test mode on the TOYOTA hand–held tester.

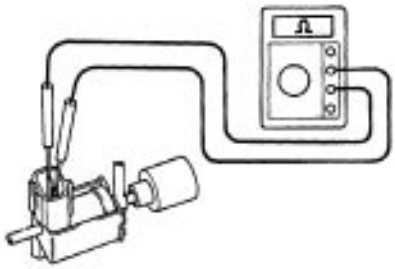
C Check operation of fuel pressure control VSV when fuel pressure control VSV is operated by the TOYOTA hand–held tester.

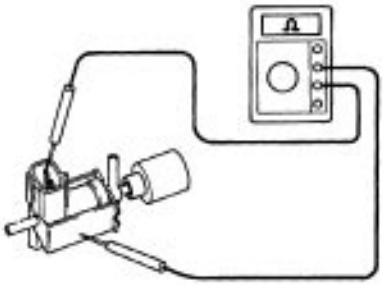
OK **Fuel pressure control VSV is ON:**
**The air from pipe E is flowing out through the air filter.**
**Fuel pressure control VSV is OFF:**
**The air from pipe E is flowing out through pipe G.**

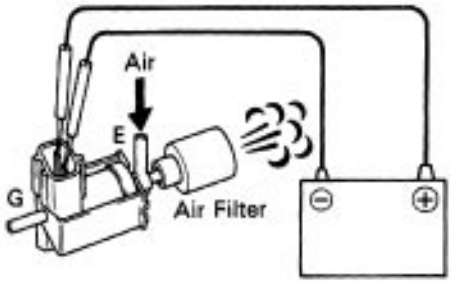
**NG**

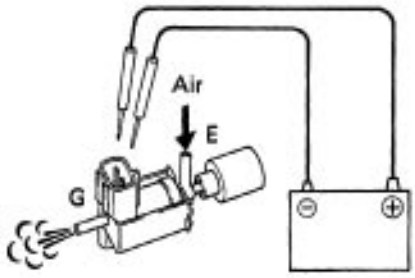
**OK** → **Check and repair fuel pressure regulator (See page EG2–240).**

**2** **Check fuel pressure control VSV.**








EC2939
EC2940
EC2941
EC2942

P (1) Remove fuel pressure control VSV.
(2) Disconnect fuel pressure control VSV connector.

C (1) Measure resistance between terminals.
(2) Measure resistance between each terminal and the body.

OK **(1) Resistance: 26 – 46 at 20$_2$C (68$_2$F)**
**(2) Resistance: 1 M or higher**

C Check operation of fuel pressure control VSV when battery positive voltage is applied to the terminals of fuel pressure control VSV connector or not.

OK **Battery positive voltage is applied:**
**The air from pipe E is flowing out through the air filter.**
**Battery positive voltage is not applied:**
**The air from pipe E is flowing out through pipe G.**

OK

NG → **Replace fuel pressure control VSV.**

**3** **Check for open and short in harness and connector between EFI main relay and ECM (See page IN–31).**

OK

NG → **Repair or replace harness or connector.**

**Check and replace ECM (See page IN–36).**

# INSPECTION PROCEDURE
# OBDII scan tool (excluding TOYOTA hand–held tester)

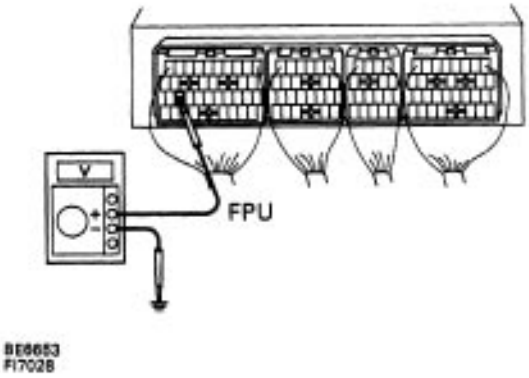
**1** **Check fuel pressure control VSV (See page EG2–589, step**

OK

NG **Replace fuel pressure control VSV.**

**2** **Check voltage between terminal FPU of ECM connector and body ground.**

IG ON




P (1) Remove glove compartment (See page EG2–309).
(2) Turn ignition switch ON.

C Measure voltage between terminal FPU of ECM connector and body ground.

OK **Voltage: 9 –14 V**

OK

NG **Check for open and short in harness and connector between EFI main relay and ECM (See page IN–31).**

**3** **Check fuel pressure regulator (See page EG2–240).**

OK

NG **Repair or replace.**

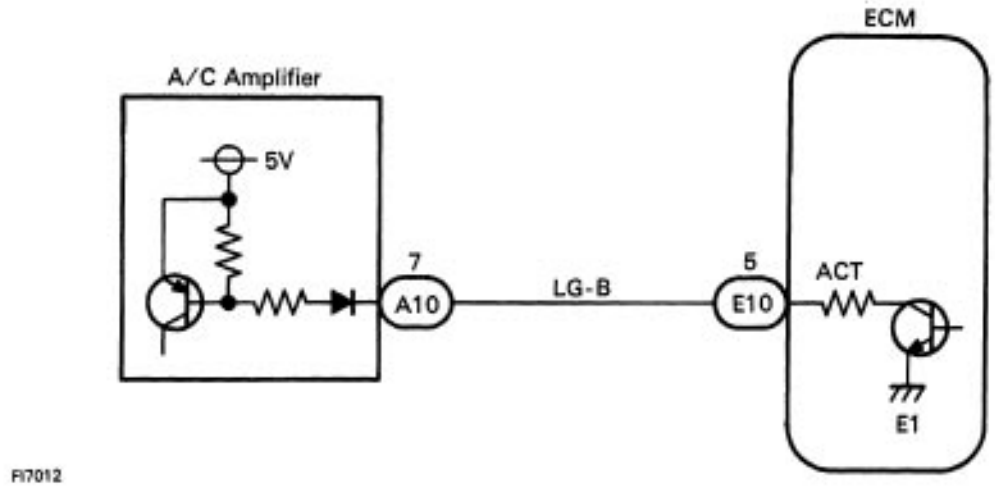
**Check and replace ECM (See page IN–36).**

# AC Cut Control Circuit

## CIRCUIT DESCRIPTION

This circuit cuts air conditioning operation during vehicle acceleration in order to increase acceleration performance. During acceleration with the vehicle speed at 25 km/h (16 mph) or less, engine speed at 1,600 rpm or less and throttle valve opening angle at $60_2$ or more, the A/C magnet switch is turned OFF for several seconds.

## WIRING DIAGRAM



# DIAGNOSTIC CHART
# TOYOTA hand–held tester

| | | | |
|---|---|---|---|
| 1 | Connect the TOYOTA hand–held tester and check operation of air conditioning cut control. | OK | Proceed to next circuit inspection shown on matrix chart. |

NG

| | | | |
|---|---|---|---|
| 2 | Check for open and short in harness and connector between ECM and A/C amplifier. | NG | Repair or replace harness or connector. |

OK

| | | | |
|---|---|---|---|
| 3 | Check voltage terminal ACT. | NG | Check and replace A/C amplifier. |

OK

Check and replace ECM.

# OBDII scan tool (excluding TOYOTA hand–held tester)

| | | | |
|---|---|---|---|
| 1 | Check voltage terminal ACT. | OK | Check and replace ECM. |

NG

| | | | |
|---|---|---|---|
| 2 | Check for open and short in harness and connector between ECM and A/C amplifier. | NG | Repair or replace harness or connector. |

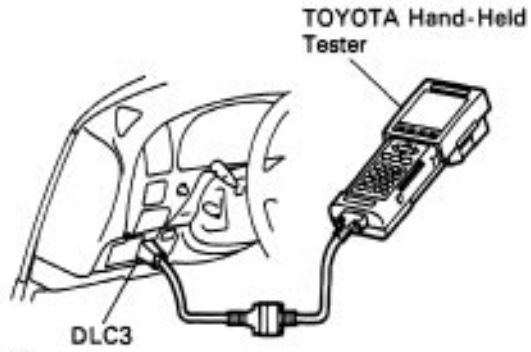
OK

Check and replace A/C amplifier.

# INSPECTION PROCEDURE
# TOYOTA hand–held tester

**1** **Connect the TOYOTA hand–held tester and check operation of air conditioning cut control.**

IG ON




P (1) Remove the fuse cover on the instrument panel.
(2) Connect the TOYOTA hand–held tester to the DLC3.
(3) Turn ignition switch ON and TOYOTA hand–held tester main switch ON.
(4) Start the engine and air conditioning switch ON.
HINT: A/C magnet clutch is turned ON.
(5) Select the active test mode on the TOYOTA hand–held tester.

C Check operation of A/C magnet clutch cut when air conditioning cut control is operated by the TOYOTA hand–held tester.

OK **A/C magnet clutch is turned OFF.**

NG

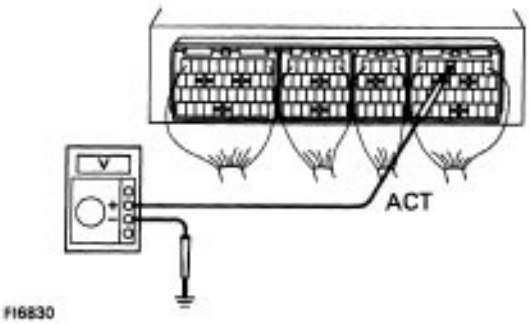
OK → **Proceed to next circuit inspection shown on matrix chart (See page EG2–435).**

**2** **Check for open and short in harness and connector between ECM and A/C amplifier (See page IN–31).**

OK

NG → **Repair or replace harness or connector.**

**3** **Check voltage between terminal ACT of ECM and body ground.**




P (1) Remove glove compartment (See page EG2–309).
(2) Start the engine.

C Measure voltage between terminal ACT of ECM connector and body ground when A/C switch is turned to ON and OFF.

OK

| A/C switch condition | Voltage |
|---|---|
| ON | 4.5 – 5.5 V |
| OFF | 0 –2 V |

OK

NG → **Check and replace A/C amplifier.**

**Check and replace ECM (See page IN–36).**

# INSPECTION PROCEDURE
## OBDII scan tool (excluding TOYOTA hand–held tester)

| | |
|---|---|
| 1 | Check voltage between terminal ACT of ECM and body ground (See page EG2–593, step 3 ). |

NG → OK: Check and replace ECM (See page IN–36).

| | |
|---|---|
| 2 | Check for open and short in harness and connector between ECM and A/C amplifier (See page IN–31). |

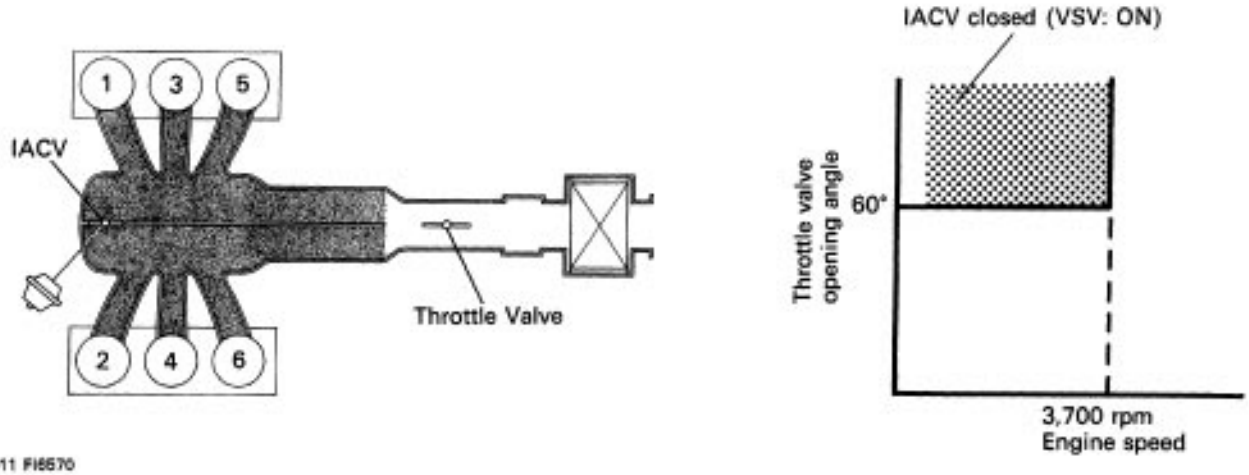
OK → NG: Repair or replace harness or connector.

OK: Check and replace A/C amplifier.

# IACV Control VSV Circuit

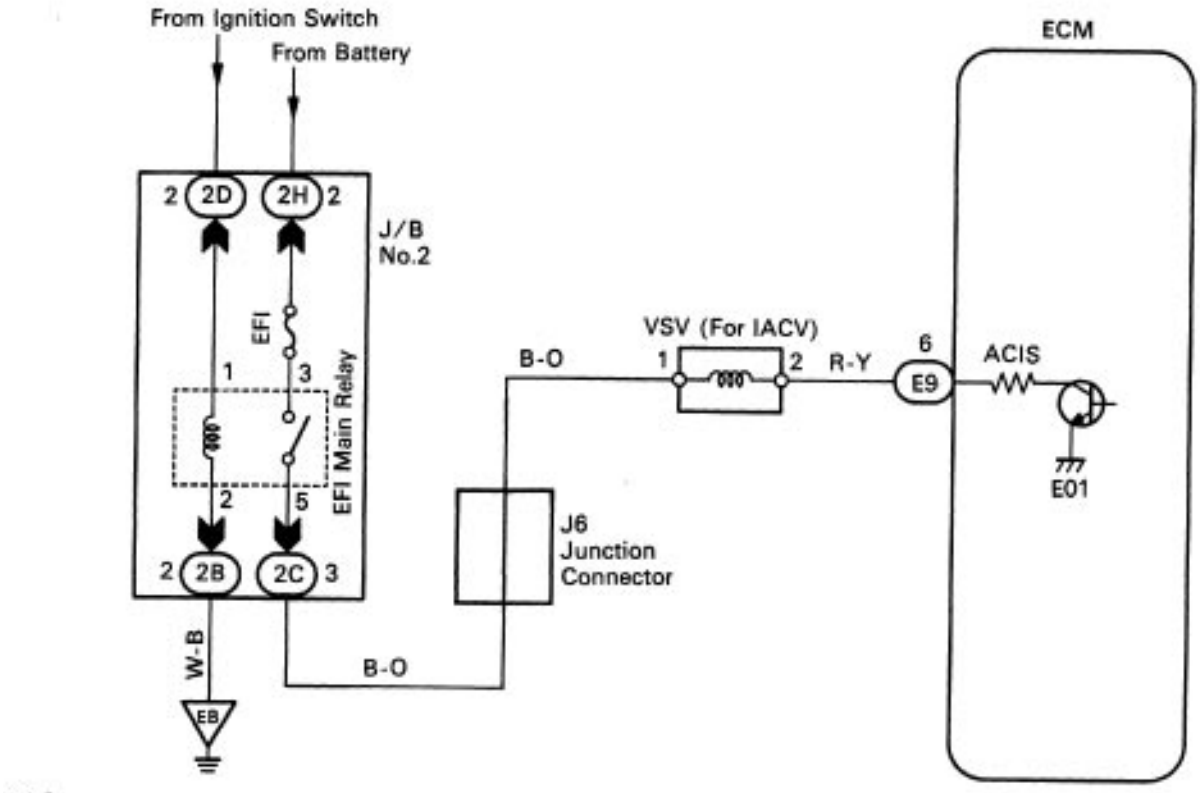
## CIRCUIT DESCRIPTION

This circuit opens and closes the IACV (Intake Air Control Valve) in response to the engine load in order to increase the intake efficiency (ACIS: Acoustic Control Induction System).
When the engine speed is 3,700 rpm or less and the throttle valve opening angle is $60_2$ or more, the ECM turns the VSV ON and closes the IACV. At all other times, the VSV is OFF, so the IACV is open.




FI7011 FI6570

## WIRING DIAGRAM




FI7017

# DIAGNOSTIC CHART
# TOYOTA hand–held tester

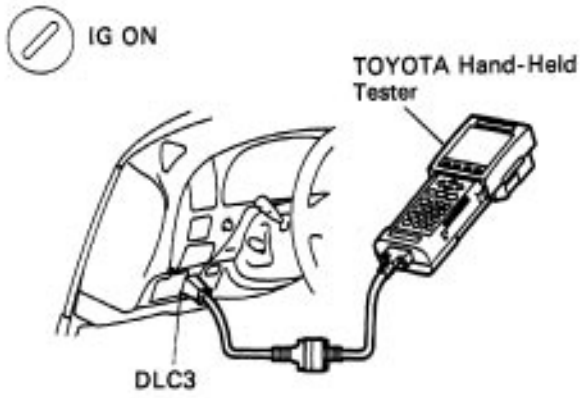
| | | | |
|---|---|---|---|
| 1 | Connect the TOYOTA hand–held tester and check operation of IACV control VSV. | OK | Check for vacuum tank. |
| NG | | | |
| 2 | Check IACV control VSV. | NG | Replace IACV control VSV. |
| OK | | | |
| 3 | Check for open and short in harness and connector between EFI main relay and ECM. | NG | Repair or replace harness or connector. |
| OK | | | |
| Check and replace ECM. | | | |

# OBDII scan tool (excluding TOYOTA hand–held tester)

| | | | |
|---|---|---|---|
| 1 | Check IACV control VSV. | NG | Replace IACV control VSV. |
| OK | | | |
| 2 | Check voltage between terminal ACIS and body ground. | NG | Check and repair harness or connector. |
| OK | | | |
| 3 | Check vacuum tank. | NG | Repair or replace. |
| OK | | | |
| Check and replace ECM. | | | |

# INSPECTION PROCEDURE
# TOYOTA hand–held tester

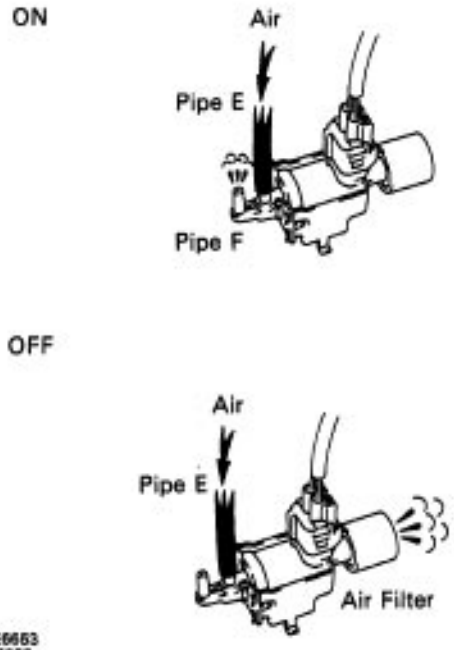
**1** **Connect the TOYOTA hand–held tester and check operation of IACV control VSV.**




P (1) Remove the fuse cover on the instrument panel.
(2) Connect the TOYOTA hand–held tester to the D LC3.
(3) Turn ignition switch ON and TOYOTA hand–held tester main switch ON.
(4) Select the active test mode on the TOYOTA hand–held tester.

C Check operation of IACV control VSV when IACV control VSV is operated by TOYOTA hand–held tester.

OK **IACV control VSV is ON:**
**The air from port E is flowing out through port F.**
**IACV control VSV is OFF:**
**The air from port E is flowing through the air filter.**

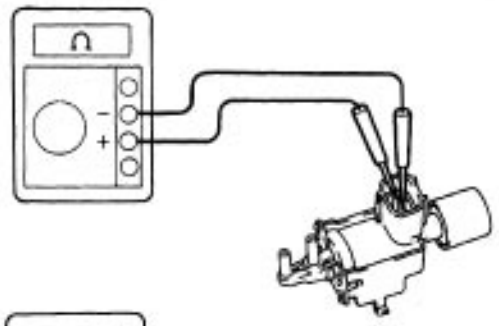



BE6663
FI7088
FI7073
FI7074

NG

OK → **Check for vacuum tank (See page EG2–277).**

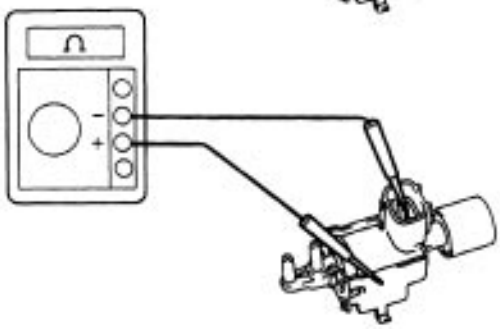
**2** **Check IACV control VSV.**

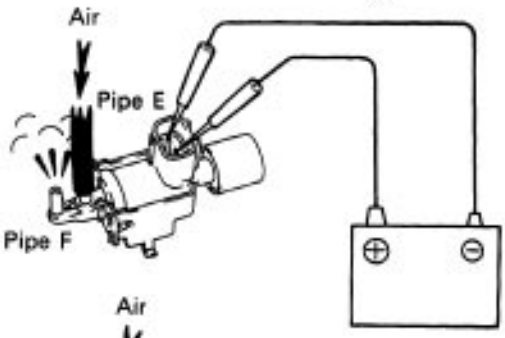


P
(1) Remove IACV control VSV.
(2) Disconnect IACV control VSV connector.

C
(1) Measure resistance between terminals.
(2) Measure resistance between each terminal and the body.

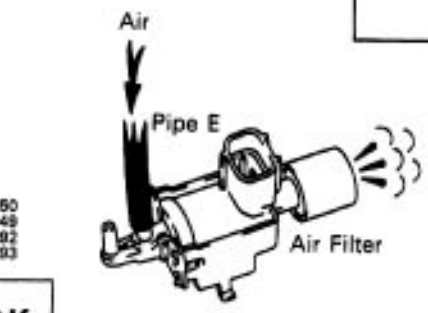
OK
**(1) Resistance: 26 – 46 at 20$_2$C (68$_2$F)**
**(2) Resistance: 1 M or higher.**






C
Check operation of IACV control VSV when battery positive voltage is applied to the terminals of IACV control VSV connector or not.

OK
**Battery positive voltage is applied:**
**The air from pipe E is following out through pipe F.**
**Battery positive voltage is not applied:**
**The air from pipe E is flowing out through the air filter.**




FI6350
FI6348
FI6392
FI6393

OK

NG → **Replace IACV control VSV.**

**3** **Check for open and short in harness and connector between EFI main relay and ECM (See page IN–31).**

OK

NG → **Repair or replace harness or connector.**

**Check and replace ECM (See page IN–36).**

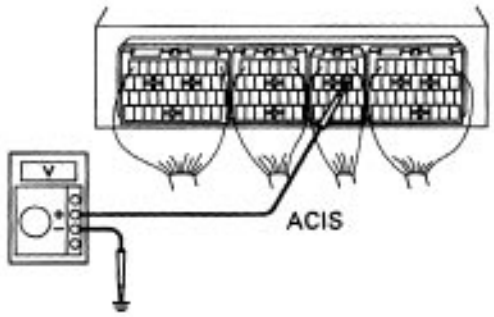
# INSPECTION PROCEDURE
# OBDII scan tool (excluding TOYOTA hand–held tester)

**1** **Check IACV control VSV (See page EG2–598, step 2)**

OK → NG: **Replace IACV control VSV.**

**2** **Check voltage between terminal ACIS of ECM connector and body ground.**

IG ON




BE6653
FI7026

P (1) Remove glove compartment (See page EG2–309).
(2) Turn ignition switch ON.
C Measure voltage between terminal ACIS of ECM connector and body ground.
OK **Voltage: 9 –14 V**

OK → NG: **Check for open and short in harness and connector between EFI main relay and ECM (Seepage IN–31).**

**3** **Check for vacuum tank (See page EG2–277).**

OK → NG: **Repair or replace.**

**Check and replace ECM (See page IN–36).**