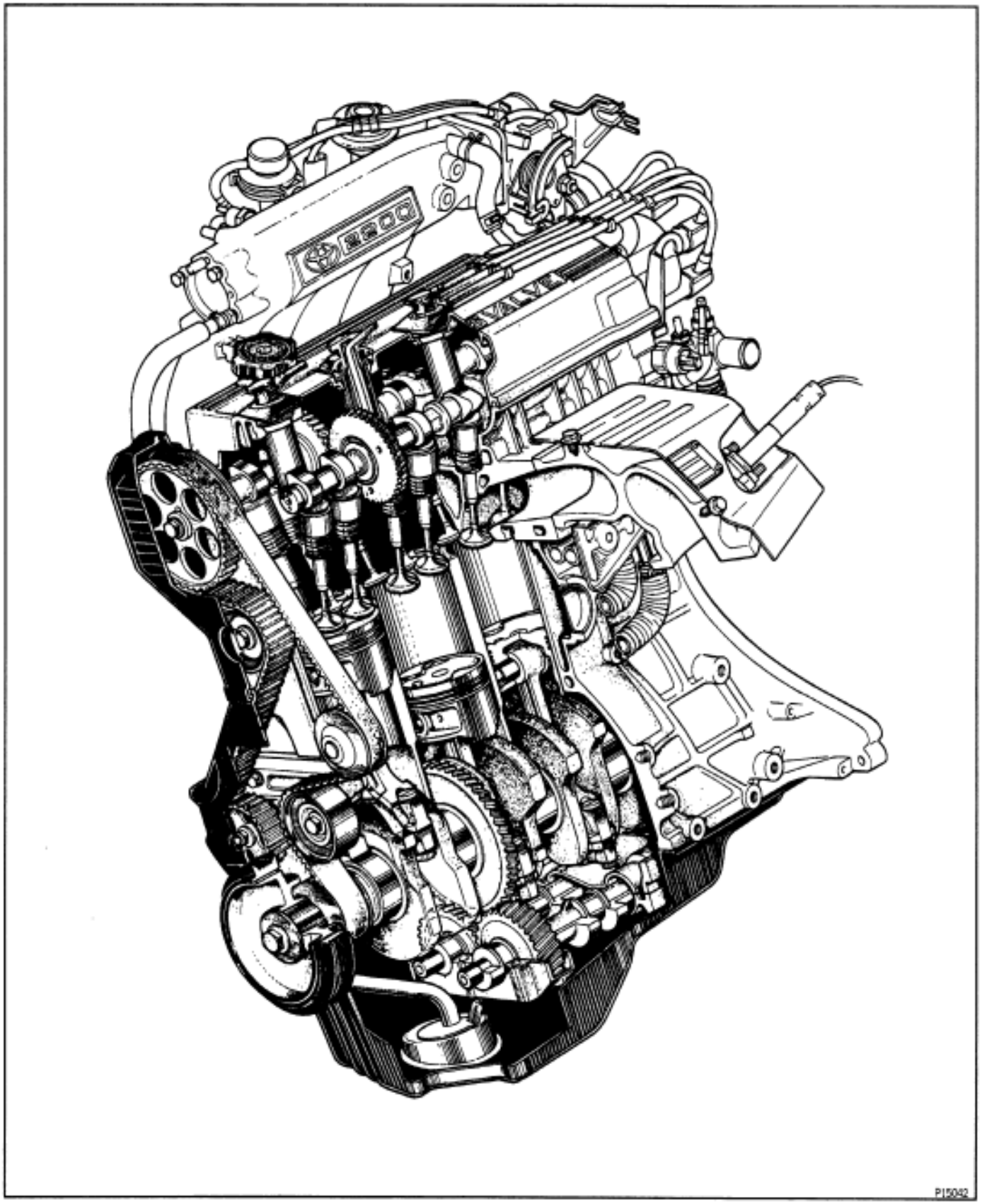
5S–FE ENGINE

ENGINE MECHANICAL

DESCRIPTION

The 5S–FE engine is an in–line, 4–cylinder, 2.2 liter DOHC 16–valve engine.



The 5S–FE engine is an in–line, 4–cylinder engine with the cylinders numbered 1–2–3–4 from the front. The crankshaft is supported by five bearings inside the crankcase. These bearings are made of aluminum alloy.

The crankshaft is integrated with eight weights for balance. Oil holes are placed in the center of the crankshaft to supply oil to the connecting rods, bearing, pistons and other components.

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

The intake manifold has four independent long ports and utilizes the inertial supercharging effect to improve engine torque at low and medium speeds.

Exhaust and intake valves are equipped with irregular pitch springs made of special valve spring carbon steel which are capable of functioning no matter what the engine speed.

The intake camshaft is driven by a timing belt, and a gear on the intake camshaft engages with a gear on the exhaust camshaft to drive it. The cam journal is supported at five 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.

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 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 scrape oil off the cylinder walls to prevent it from entering the combustion chambers.

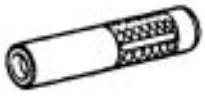
The cylinder block is made of cast iron. It has four cylinders which are approximately twice the length of the piston stroke. The top of each cylinder is closed off by the cylinder head and the lower end of the cylinders becomes the crankcase, in which the crankshaft is installed. In addition, the cylinder block contains a water jacket, through which coolant is pumped to cool the cylinders.

The oil pan is bolted onto the bottom of the cylinder block. The oil pan is an oil reservoir made of pressed sheet steel. A dividing plate is included ’inside the oil pan to keep sufficient oil in the bottom of the pan even when the vehicle is tilted. This dividing plate also prevents the oil from making waves when the vehicle is stopped suddenly and the oil shifts away from the oil pump suction pipe.

The 5S–FE engine uses two balance shafts. The balance shafts are fitted in balance shaft housings that are located at the bottom of the cylinder block. The No. 1 balance shaft is driven by the drive gear of the crankshaft No.3 counterweight at twice the speed of the crankshaft. The No. 2 balance shaft is driven by the No–1 balance shaft at the same speed in the same direction as the crankshaft. The balance shafts are designed to eliminate secondary inertia force from the engine, thereby reducing the engine noise (booming noise).

PREPARATION

SST (SPECIAL SERVICE TOOLS)

	09011–38121 12 mm Socket wrench for 12 Pointed Head	Cylinder head bolt and connecting rod bolt
	09201–41020 Valve Stem Oil Seal Replacer	
	09201–70010 Valve Guide Bushing Remover & Replacer	
	09202–70010 Valve Spring Compressor	
	09213–54015 Crankshaft Pulley Holding Tool	
	(91651 –60855) Bolt	
	09213–80017 Crankshaft Pulley & Gear Puller Set	
	(09213–00020) Body With Bolt	
	(09213–00030) Handle	
	(09213–00060) Bolt set	
	09222–30010 Connecting Rod Bushing Remover & Replacer	
	09223–46011 Crankshaft Front Oil Seal Replacer	Camshaft oil seal
	09223–63010 Crankshaft Rear Oil Seal Replacer	

 09224–74010 Engine Balancer Backlash Adjusting Tool	
 09248–55020 Valve Clearance Adjust Tool Set  (09248–05011) Valve Lifter Press  (09248–05021) Valve Lifter Stopper	
 09249–63010 Torque Wrench Adaptor	
 09226–10010 Crankshaft Front & Rear Bearing Replacer	
 09278–54012 Drive Shaft Holding Tool	Camshaft timing pulley
 09330–00021 Companion Flange Holding Tool	Crankshaft pulley
 09616–30011 Steering Worm Bearing Adjusting Screw Wrench	Oil pump pulley
 09816–30010 Oil Pressure Switch Socket	Knock sensor
 09843–18020 Diagnosis Check Wire	

RECOMMENDED TOOLS

 09090–04010 Engine Sling Device	For suspension engine
 09200–00010 Engine Adjust Kit	

 09256–00030 Hose Plug Set	Plug for vacuum hose, fuel hose etc.
 09904–00010 Expander Set	

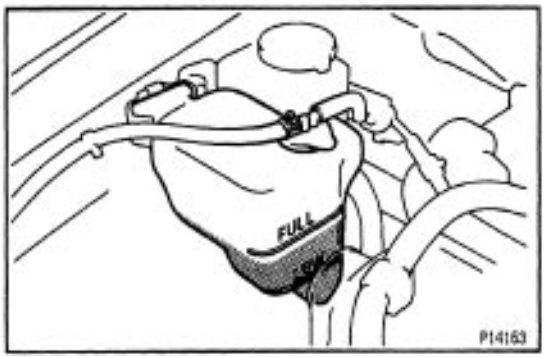
EQUIPMENT

Battery specific gravity gauge	
Caliper gauge	
CO/HC meter	
Compression gauge	
Connecting rod aligner	
Cylinder gauge	
Dial indicator	
Dye penetrant	
Engine tune–up tester	
Heater	
Magnetic finger	
Micrometer	
Piston ring compressor	
Piston ring expander	
Plastigage	
Precision straight edge	
Soft brush	
Spring tester	Valve spring
Steel square	Valve spring
Thermometer	
Torque wrench	

Valve seat cutter	
Vernier calipers	

SSM (SERVICE SPECIAL MATERIALS)

08826–00080 Seal packing or equivalent	Camshaft bearing cap Cylinder head cover Rear oil sear retainer
08833–00070 Adhesive 1311, THREE BOND 1311 or equivalent	Flywheel or drive plate bolt

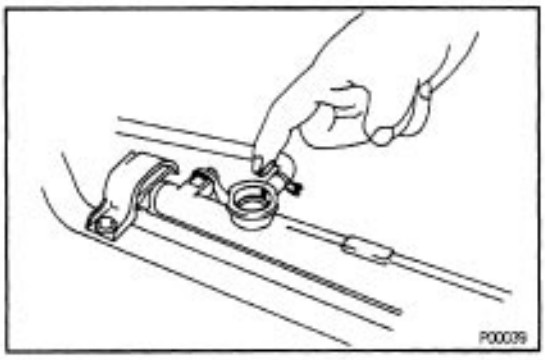


TUNE–UP

ENGINE COOLANT INSPECTION

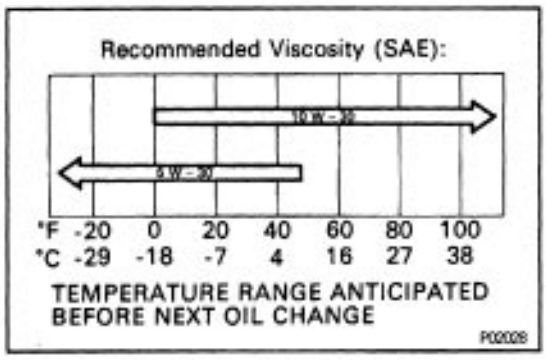
1. CHECK ENGINE COOLANT LEVEL AT RESERVOIR TANK

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



2. CHECK ENGINE COOLANT QUALITY

There should be no excessive deposits of rust or scales around the radiator cap or radiator filler hole, and the engine coolant should be free from oil.
If excessively dirty, replace the engine coolant.



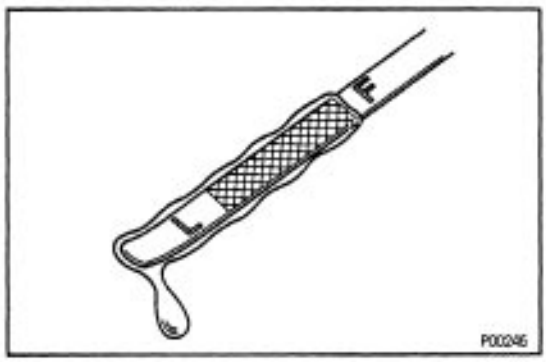
ENGINE OIL INSPECTION

1. CHECK OIL QUALITY

Check the oil for deterioration, entry of water, dis–coloring or thinning.
If oil quality is visibly poor, replace it.

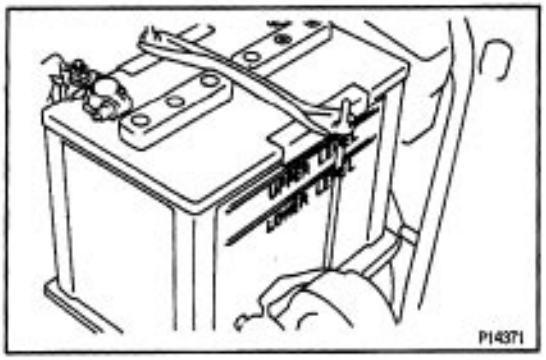
Oil grade:

API grade SG or SH, Energy Conserving II multi–grade engine oil or ILSAC multigrade engine oil. Recommended viscosity is as shown in the illustration.



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.



BATTERY INSPECTION

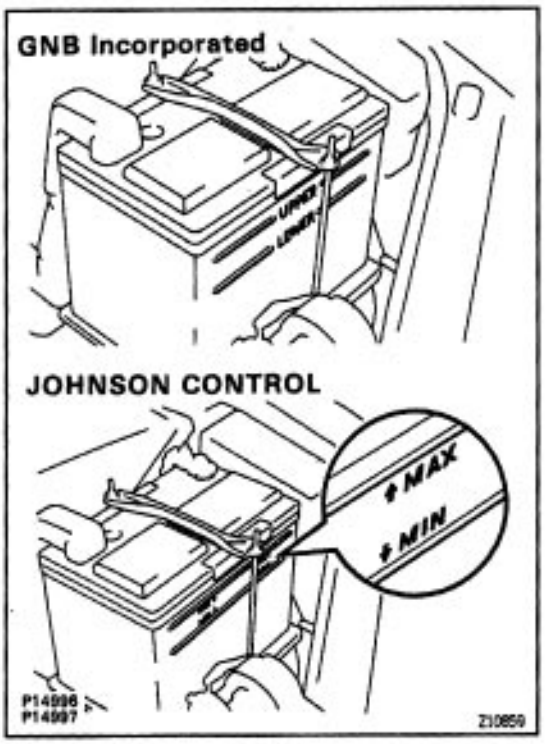
1. Except Delco Battery:

CHECK BATTERY ELECTROLYTE LEVEL

Check the electrolyte quantity of each cell.

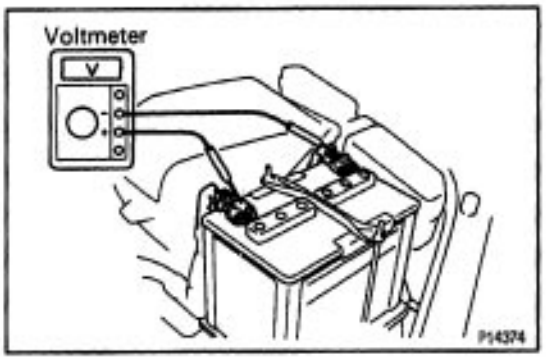
A. Maintenance Free Battery

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:

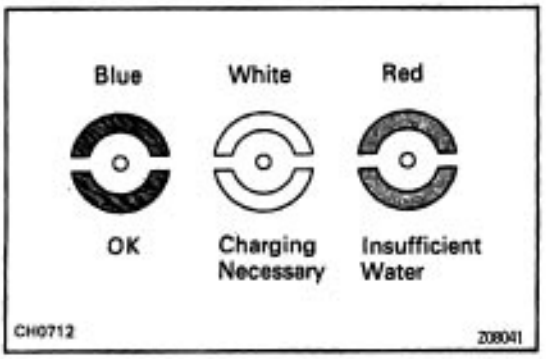
12.7 – 12.9 V at 20°C (68°F)

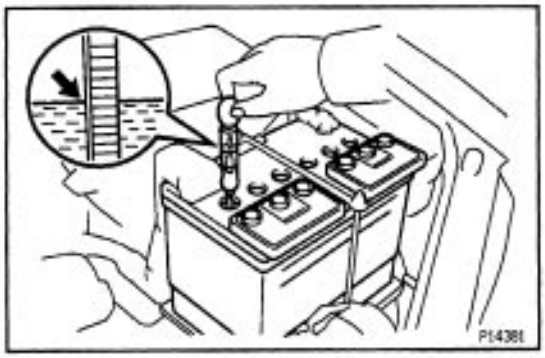
HINT:

- 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

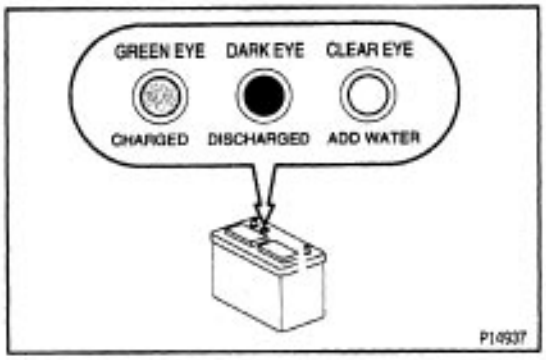
Check the specific gravity of each cell.

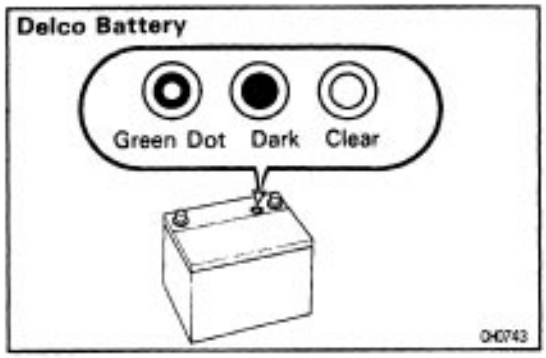
Standard specific gravity:

55D23L battery for GNB Incorporated
1.25 – 1.27 at 20°C (68°F)
55D23L 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 (81°F)

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

HINT: Check the indicator as shown in the illustration.



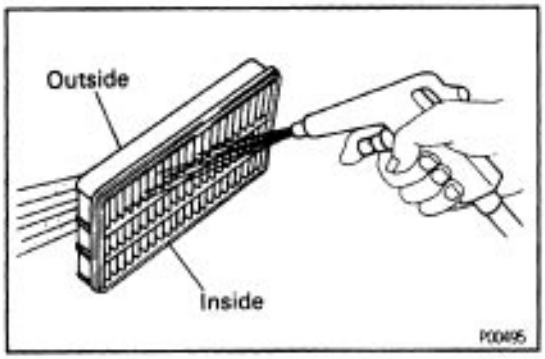


3. Delco Battery:

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.

AIR FILTER INSPECTION



1. INSPECT AIR FILTER

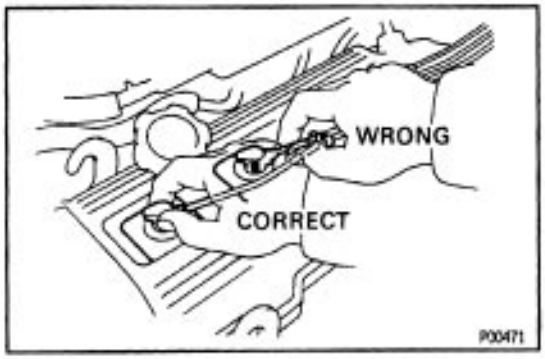
Visually check that the element is not excessively dirty, damaged or oily.

2. CLEAN AIR FILTER

Clean the element with compressed air.

First blow air from the inside thoroughly. Then blow off the outside of the element.

HIGH–TENSION CORDS INSPECTION

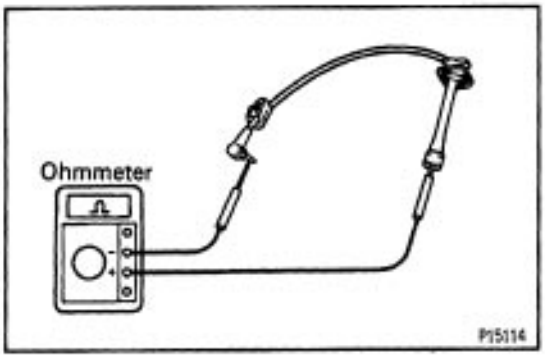


1. DISCONNECT HIGH–TENSION CORDS FROM SPARK PLUGS

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

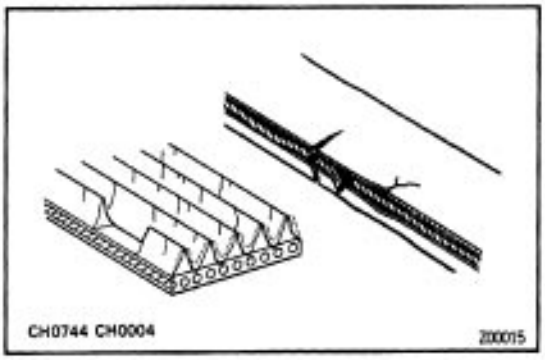
NOTICE: Pulling on or bending the cords may damage the conductor inside.

2. CALIFORNIA ONLY:
DISCONNECT HIGH–TENSION CORD FROM IGNITION COIL
3. DISCONNECT HIGH –TENSION CORDS FROM DISTRIBUTOR CAP



4. INSPECT HIGH–TENSION CORD RESISTANCE
Using an ohmmeter, measure the resistance.
Maximum resistance:
25 kΩ per cord
If the resistance is greater than maximum, check the terminals. If necessary, replace the high – tension cord.

5. RECONNECT HIGH–TENSION CORDS TO DISTRIBUTOR CAP
6. CALIFORNIA ONLY:
RECONNECT HIGH–TENSION CORD TO IGNITION COIL
7. RECONNECT HIGH–TENSION CORDS TO SPARK PLUGS

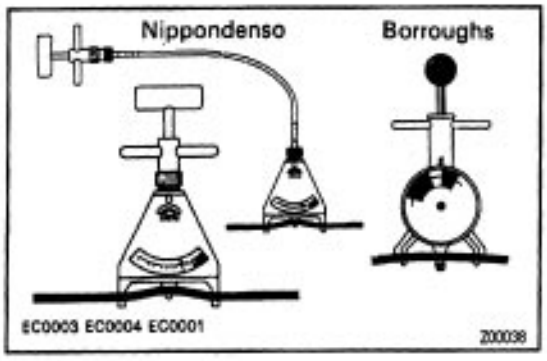


GENERATOR DRIVE BELT INSPECTION

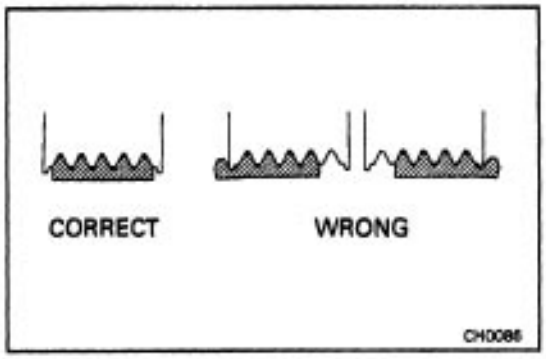
INSPECT DRIVE BELT

(a) Visually check the drive belt for excessive wear, frayed cords etc.
If any defect has been found, replace the drive belt.

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



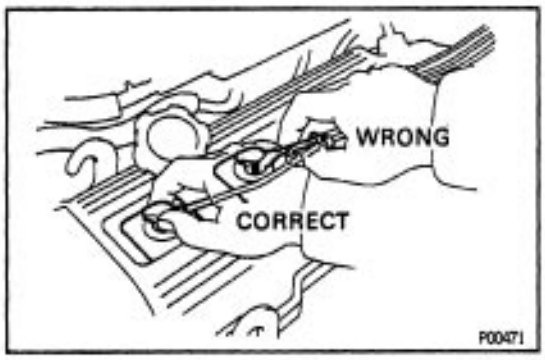
(b) Using a belt tension gauge, measure the belt tension.
Belt tension gauge:
Nippondenso BTG–20 (95506–00020)
Borroughs No. BT–33–73F

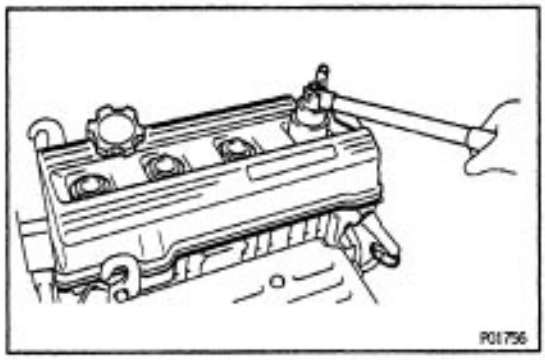


Drive belt tension:
w/ A/C
New belt
175 ± 5 lbf
Used belt
130 ± 10 lbf
w/o A/C
New belt
125 ± 25 lbf
Used belt
95 ± 20 lbf

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 a belt, check that it fits properly in the ribbed grooves.
- Check with your 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.

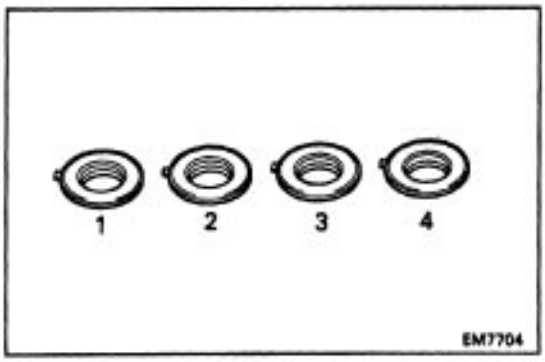
1. DISCONNECT HIGH – TENSION CORDS FROM SPARK PLUGS

Disconnect the high – tension cords at the rubber boot. DO NOT pull on the cords.

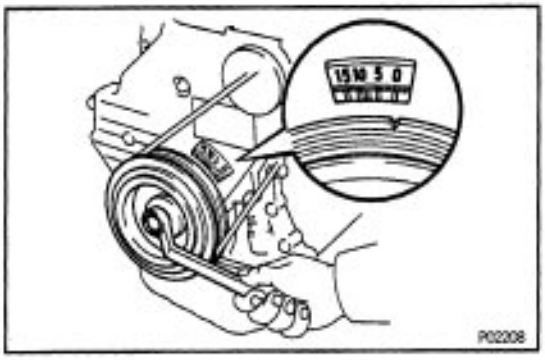
NOTICE: Pulling on or bending the cords may damage the conductor inside.

2. REMOVE CYLINDER HEAD COVER

(a) Disconnect the PCV hoses.
(b) Loosen the 2 wire harness clamp bolts (No.2 timing belt cover) mounting bolts.
(c) Remove the 4 nuts, grommets, head cover and gasket.



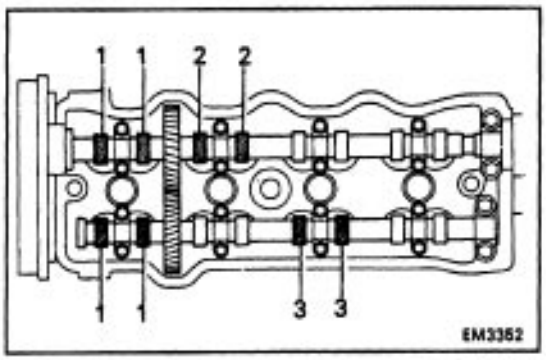
HINT: Arrange the grommets in correct order, so that they can be reinstalled into their original positions. This minimizes any possibility of oil leakage due to reuse of grommets.



3. SET NO.1 CYLINDER TO TDC/COMPRESSION

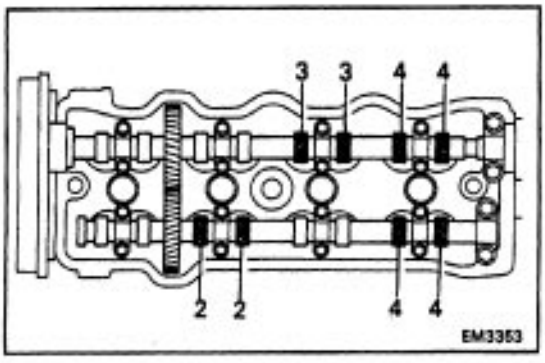
(a) Turn the crankshaft pulley and align its groove with timing mark “0” of the No.1 timing belt cover.

(b) Check that the valve lifters on the No.1 cylinder are loose and valve lifters on the No.4 are tight.
If not, turn the crankshaft one revolution (360*) and align the mark as above.



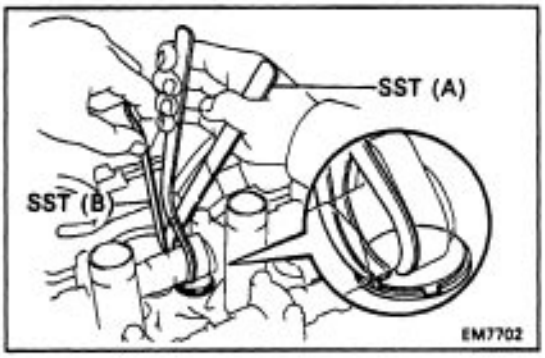
4. INSPECT VALVE CLEARANCE

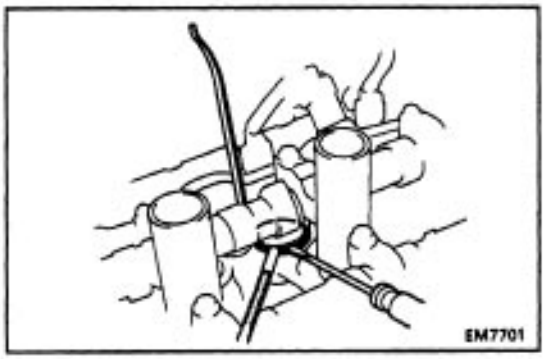
(a) Check only the valves indicated.
Using a thickness gauge, measure the clearance between the valve lifter and camshaft.
Record the out– of –specification valve clear– ance measurements. They will be used later to determine the required replacement adjusting shim.
Valve clearance (Cold):
Intake
0.19 – 0.29 mm (0.007 – 0.011 in.)
Exhaust
0.28 – 0.38 mm (0.011 – 0.015 in.)

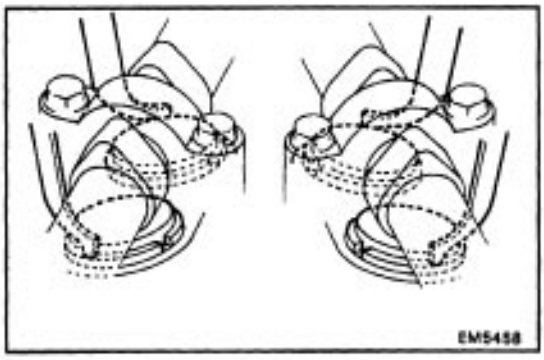


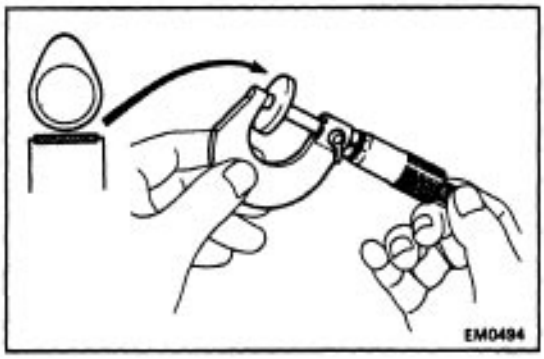
(b) Turn the crankshaft one revolution (3601) and align the mark as above. (See procedure in step 3)

(c) Check only the valves indicated as shown. Measure the valve clearance. (See procedure in step (a))









5. ADJUST VALVE CLEARANCE

(a) Remove the adjusting shim.

- Turn the crankshaft so that the cam lobe for the valve to be adjusted faces up.
- Using SST (A), press down the valve lifter and place SST (B) between the camshaft and valve lifter. Remove SST (A).

SST 09248 – 55020 (09248 – 05011, 09248–05021)

HINT: Before pressing down the valve lifter, position its notch toward the spark plug side.

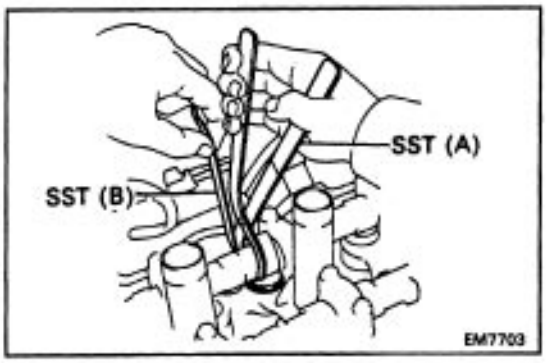
- Remove the adjusting shim with a' small screw–driver and magnetic finger.

HINT: For easy removed of the shim, when positioning SST (B), set it on the lifter so there is space enough to be able to remove the shim.

(b) Determine the replacement adjusting shim size by following the Formula or Charts:

- Using a micrometer, measure the thickness of the removed shim.
- Calculate the thickness of a new shim so that the valve clearance comes within specified value.
  T ..... Thickness of removed shim
  A ..... Measured valve clearance
  N ..... Thickness of new shim
  Intake:
  N = T + (A – 0.24 mm (0.009 in.))
  Exhaust:
  N = T + (A – 0.33 mm (0.013 In.))
- Select a new shim with a thickness as close as possible to the calculated value.

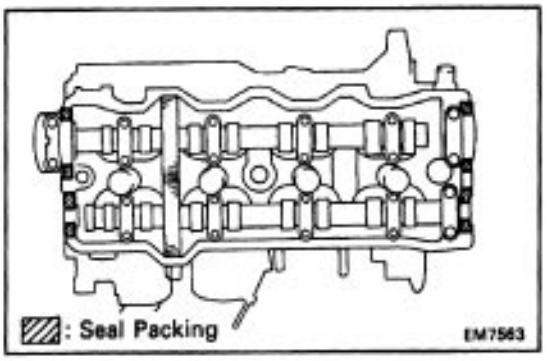
HINT: Shims are available in seventeen sizes in incre–ments of 0.05 mm (0.0020 in.), from 2.50 mm (0.0984 in.) to 3.30 mm (0.1299 in.).



(c) Install a new adjusting shim.

- Place a new adjusting shim on the valve lifter.
- Using SST (A), press down the valve lifter and remove SST (B).
  SST 09248–50020 (09248–05011, 09248–05021)

(d) Recheck the valve clearance.



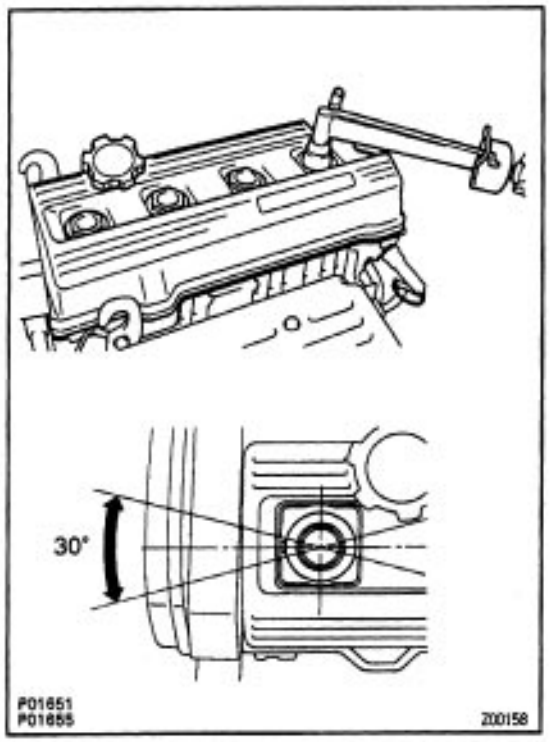
6. REINSTALL CYLINDER HEAD COVER

(a) Remove any old packing (FIPG) material.

(b) Apply seal packing to the cylinder head as shown in the illustration.

Seal pecking:

Part No.08826–00080 or equivalent



(c) Install the gasket to the head cover.

(d) Install the head cover with the 4 grommets and nuts. Uniformly tighten the nuts in several passes.

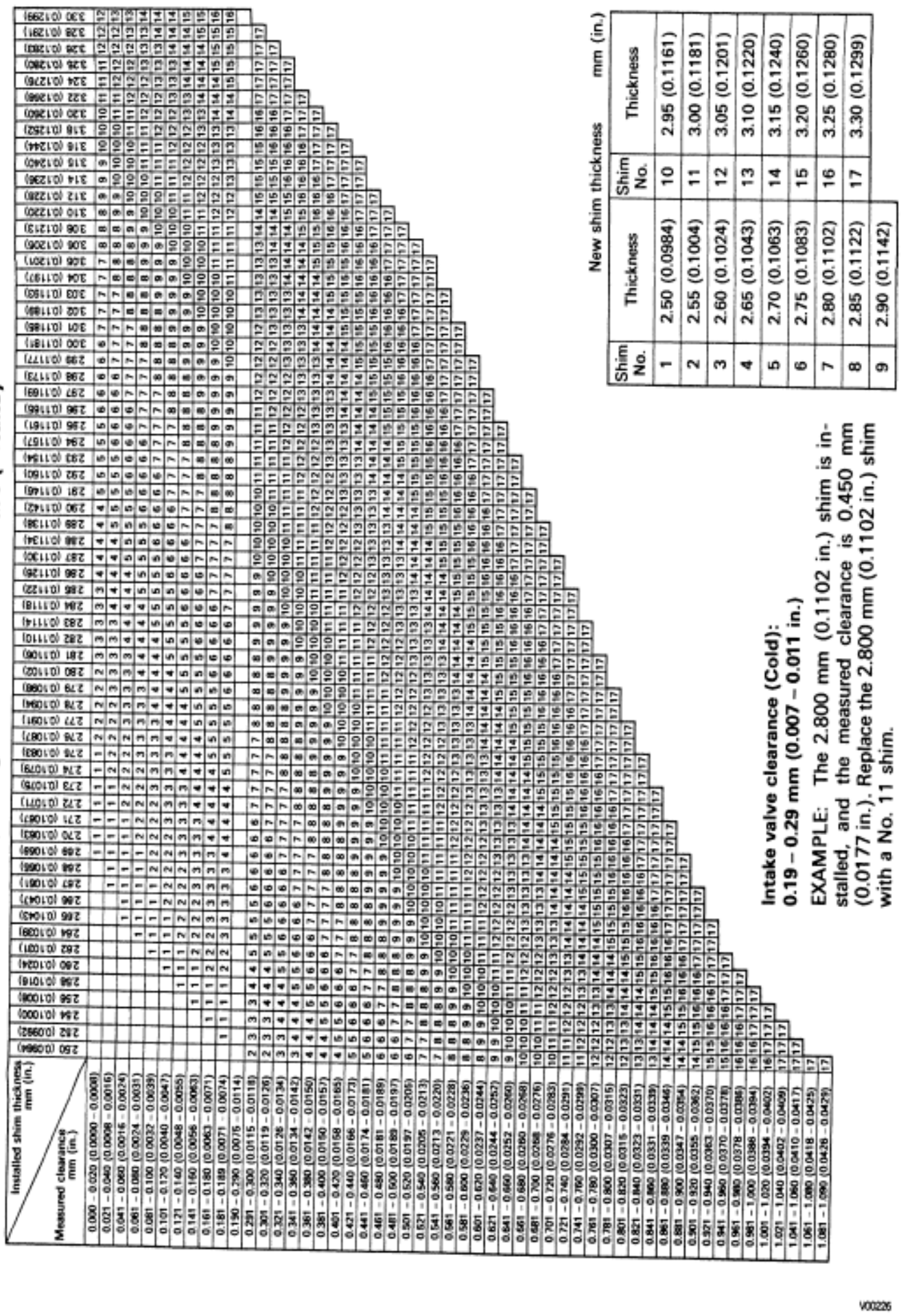
Torque: 23 N–m (230 kgf–cm. 17 ft–lbf)

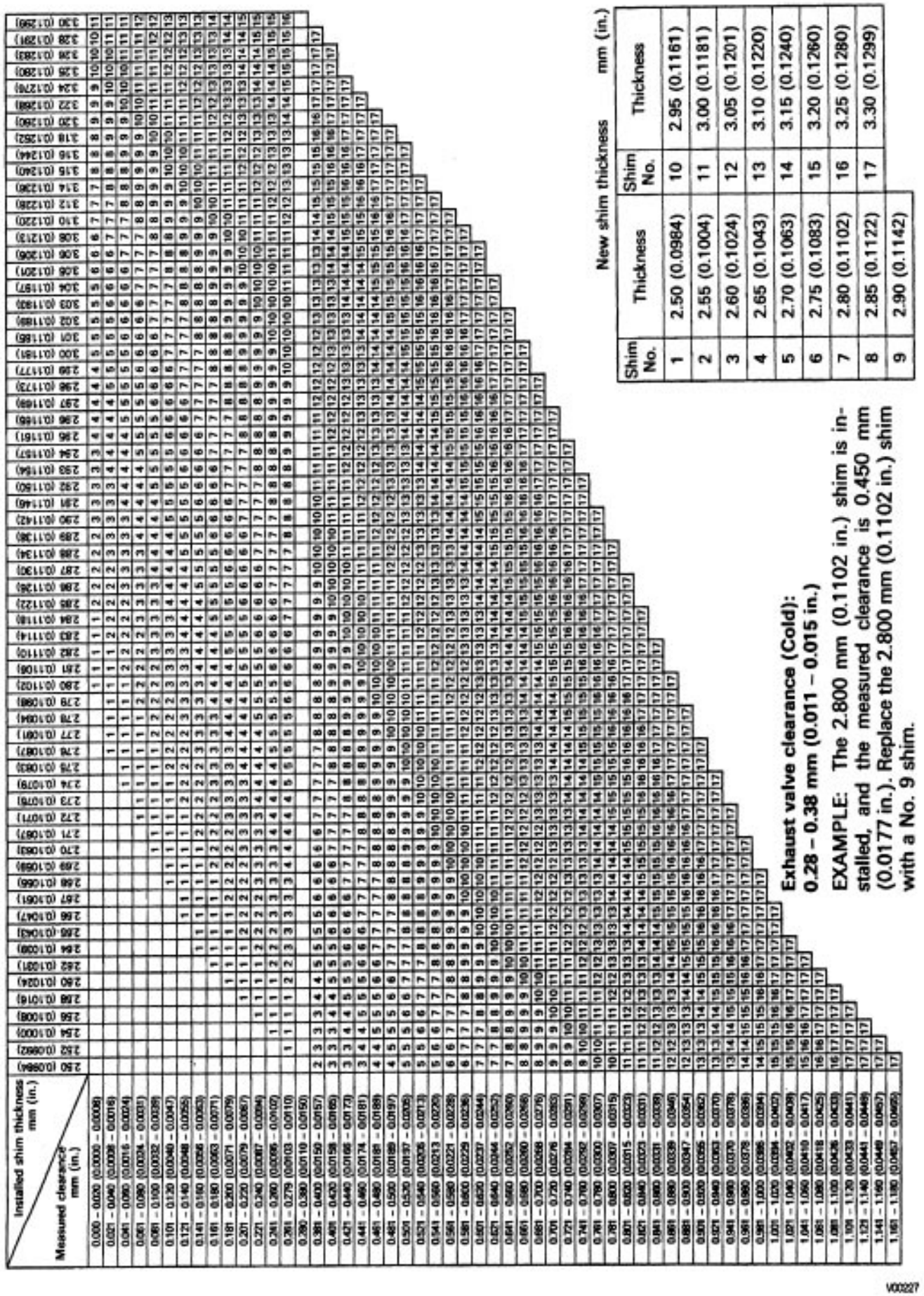
HINT: Install the grommets so that their markings are as shown in the illustration.

(e) Tighten the 2 wire harness clamp (No.2 timing belt cover) mounting bolts.

(f) Connect the PCV hoses.

7. RECONNECT HIGH–TENSION CORDS TO SPARK PLUGS

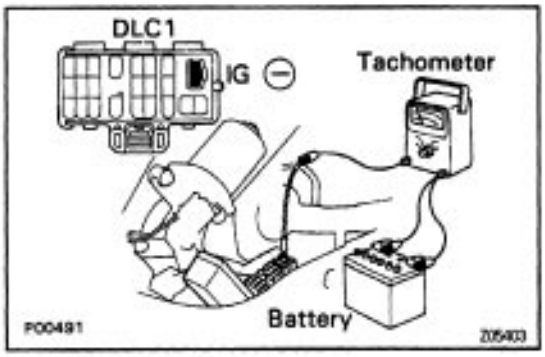

Adjusting Shim Selection Chart (Intake)
Installed shim thickness mm (in.)
Measured clearance mm (in.)
New shim thickness mm (in.)
Shim No. | Thickness | Shim No. | Thickness
1 | 2.50 (0.0984) | 10 | 2.95 (0.1161)
2 | 2.55 (0.1004) | 11 | 3.00 (0.1181)
3 | 2.60 (0.1024) | 12 | 3.05 (0.1201)
4 | 2.65 (0.1043) | 13 | 3.10 (0.1220)
5 | 2.70 (0.1063) | 14 | 3.15 (0.1240)
6 | 2.75 (0.1083) | 15 | 3.20 (0.1260)
7 | 2.80 (0.1102) | 16 | 3.25 (0.1280)
8 | 2.85 (0.1122) | 17 | 3.30 (0.1299)
9 | 2.90 (0.1142)
Intake valve clearance (Cold):
0.19 – 0.29 mm (0.007 – 0.011 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 No. 11 shim.
V00226


Adjusting Shim Selection Chart (Exhaust)
Installed shim thickness mm (in.)
Measured clearance mm (in.)
New shim thickness mm (in.)
Shim No. | Thickness | Shim No. | Thickness
1 | 2.50 (0.0984) | 10 | 2.95 (0.1161)
2 | 2.55 (0.1004) | 11 | 3.00 (0.1181)
3 | 2.60 (0.1024) | 12 | 3.05 (0.1201)
4 | 2.65 (0.1043) | 13 | 3.10 (0.1220)
5 | 2.70 (0.1063) | 14 | 3.15 (0.1240)
6 | 2.75 (0.1083) | 15 | 3.20 (0.1260)
7 | 2.80 (0.1102) | 16 | 3.25 (0.1280)
8 | 2.85 (0.1122) | 17 | 3.30 (0.1299)
9 | 2.90 (0.1142)
Exhaust valve clearance (Cold):
0.28 – 0.38 mm (0.011 – 0.015 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 No. 9 shim.
V00227

IGNITION TIMING INSPECTION AND ADJUSTMENT

1. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.

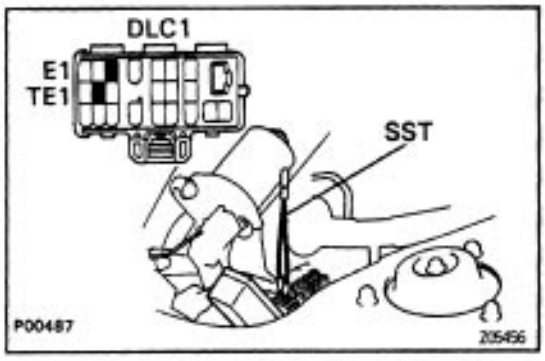


2. CONNECT TACHOMETER AND TIMING LIGHT TO ENGINE

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

NOTICE:

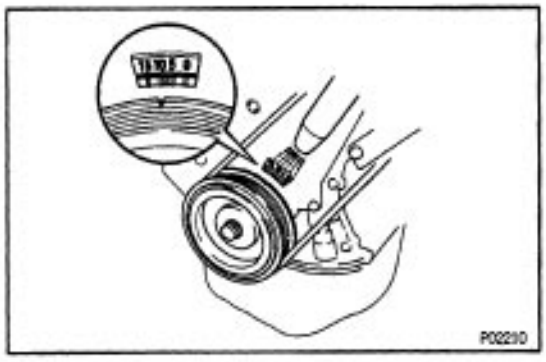
- **NEVER allow the tachometer terminal to touch ground as it could result in damage to the igniter and/or ignition coif.**
- **As some tachometers are not compatible with this Ignition system, we recommend that you confirm the compatibility of yours before use.**



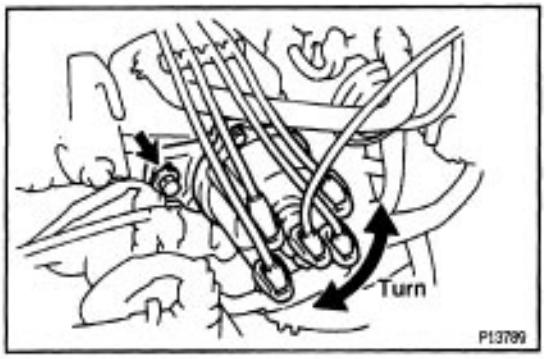
3. ADJUST IGNITION TIMING

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

HINT: After engine speed is kept at 1,000 – 1,300 rpm for 5 seconds, check that it returns to idle speed.

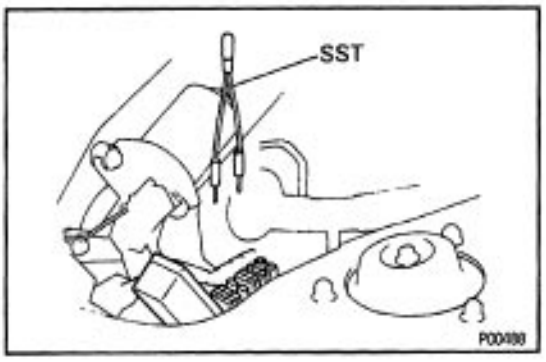


(b) Using a timing light, check the ignition timing.
Ignition timing:
10° BTDC @ idle
(Transmission in neutral position)

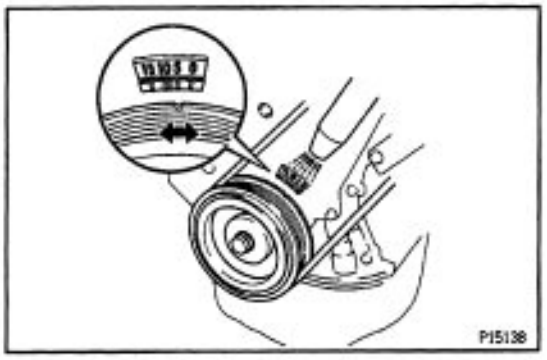


(c) Loosen the bolt (California) or 2 bolts (except Califor–nia), and adjust by turning the distributor.
(d) Tighten the bolt (California) or 2 bolts (except Califor–nia), and recheck the ignition timing.

Torque: 19 N–m (195 kgf–cm, 14 ft–lbf)



(e) Remove the SST.
SST 09843–18020



4. FURTHER CHECK IGNITION TIMING

Ignition timing:
0 – 10° BTDC @ idle
(Transmission in neutral position)

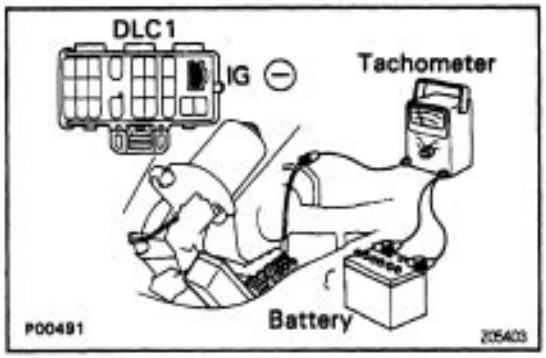
HINT: The timing mark moves in a range between 0° and 10°.

5. DISCONNECT TACHOMETER AND TIMING LIGHT 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 vacuum lines properly connected
(e) MFI/SFI system wiring connectors fully plugged
(f) All operating accessories switched OFF
(g) Ignition timing set correctly
(h) Transmission in neutral position

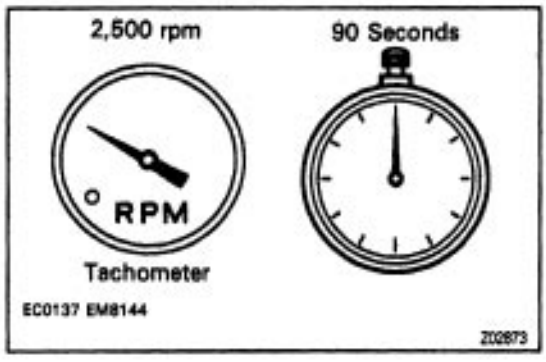


2. CONNECT TACHOMETER

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

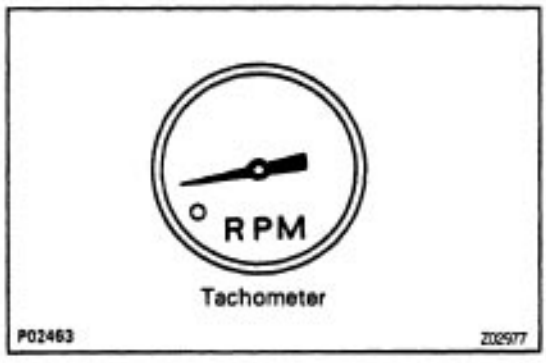
NOTICE:

- **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 yours before use.**



3. INSPECT IDLE SPEED

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



(b) Check the idle speed.

Idle speed (w/ Cooling fan OFF):
750±50 rpm

If the idle speed is not as specified, check the IAC system.

4. DISCONNECT TACHOMETER

IDLE AND OR 2,500 RPM CO/HC CHECK

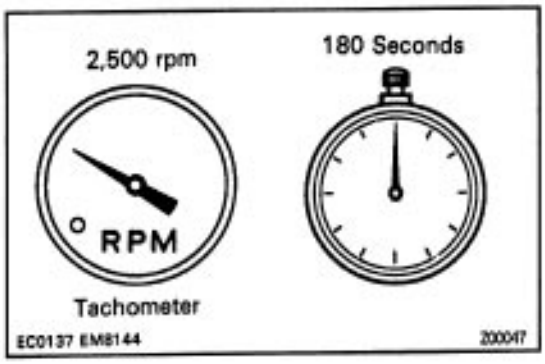
HINT: This check is used only to determine whether or not the idle CO/HC complies with regulations.

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

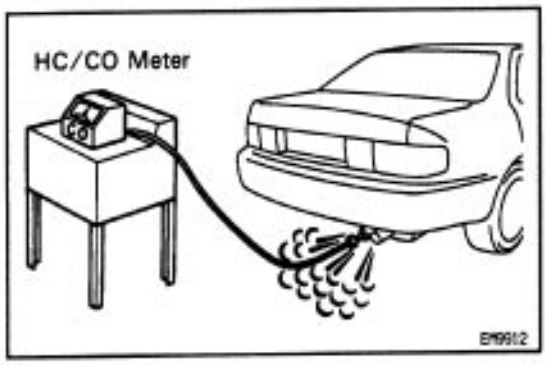
HINT: All vacuum hoses for EGR systems, etc. should be properly connected.

(f) MFI/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/HC METER TESTING PROBE AT LEAST 40 cm (1.3 ft) INTO TAILPIPE DURING IDLING

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

Complete the measuring within 3 minutes.

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.

(a) Check oxygen sensor operation.
(See page EG1–231)

(b) See the table below for possible causes, then inspect and correct the applicable causes if necessary.

HC	CO	Problems	Causes
High	Normal	Rough idle	1. Faulty ignitions: • Incorrect timing • Fouled, shorted or improperly gapped plugs • Open or crossed high–tension cords • Cracked distributor cap 2. Incorrect valve clearance 3. Leaky EGR valve 4. Leaky intake and exhaust valves 5. Leaky cylinder
High	Low	Rough idle (Fluctuating HC reading)	1. Vacuum leaks: • PCV hose • EGR valve • Intake manifold • Throttle body • !AC valve • Brake booster line 2. Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	1. Restricted air filter 2. Faulty MFI/SFI systems • Faulty pressure regulator • Clogged fuel return line • Defective engine coolant temp. sensor • Defective intake air temp. sensor • Faulty ECM • Faulty injector • Faulty throttle position sensor • MAP sensor

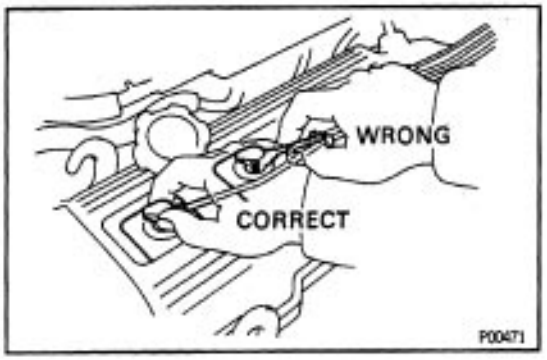
COMPRESSION CHECK

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. DISCONNECT DISTRIBUTOR CONNECTOR(S)

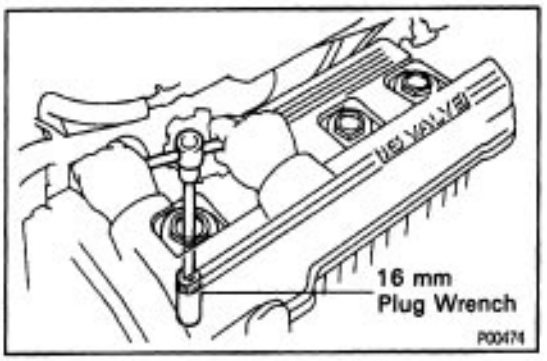


3. DISCONNECT HIGH –TENSION CORDS FROM SPARK PLUGS

Disconnect the high – tension cords at the rubber boot.

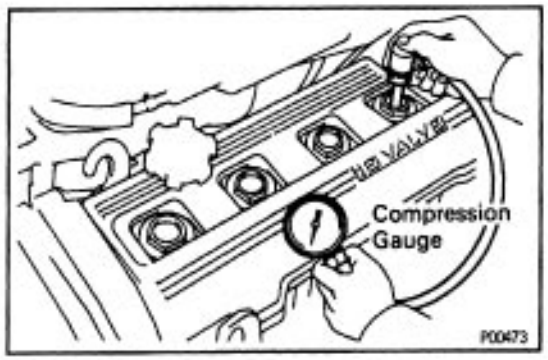
DO NOT pull on the cords.

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



4. REMOVE SPARK PLUGS

Using a 16 mm plug wrench, remove the spark plug.



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/cm1. 178 psi) or more

Minimum pressure:

981 kPa (10.0 kgf/cm1, 142 psi)

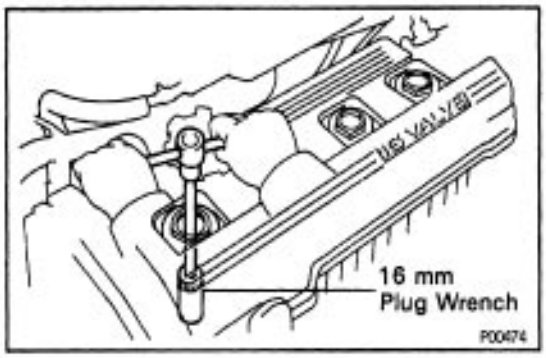
Difference between each cylinder:

98 kPa (1.0 kgf/cm1. 14 psi) or less

(e) If the cylinder compression in one or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps (a) through

(c) for cylinders with low compression.

- If adding oil helps the compression, chances are 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 spark plug.

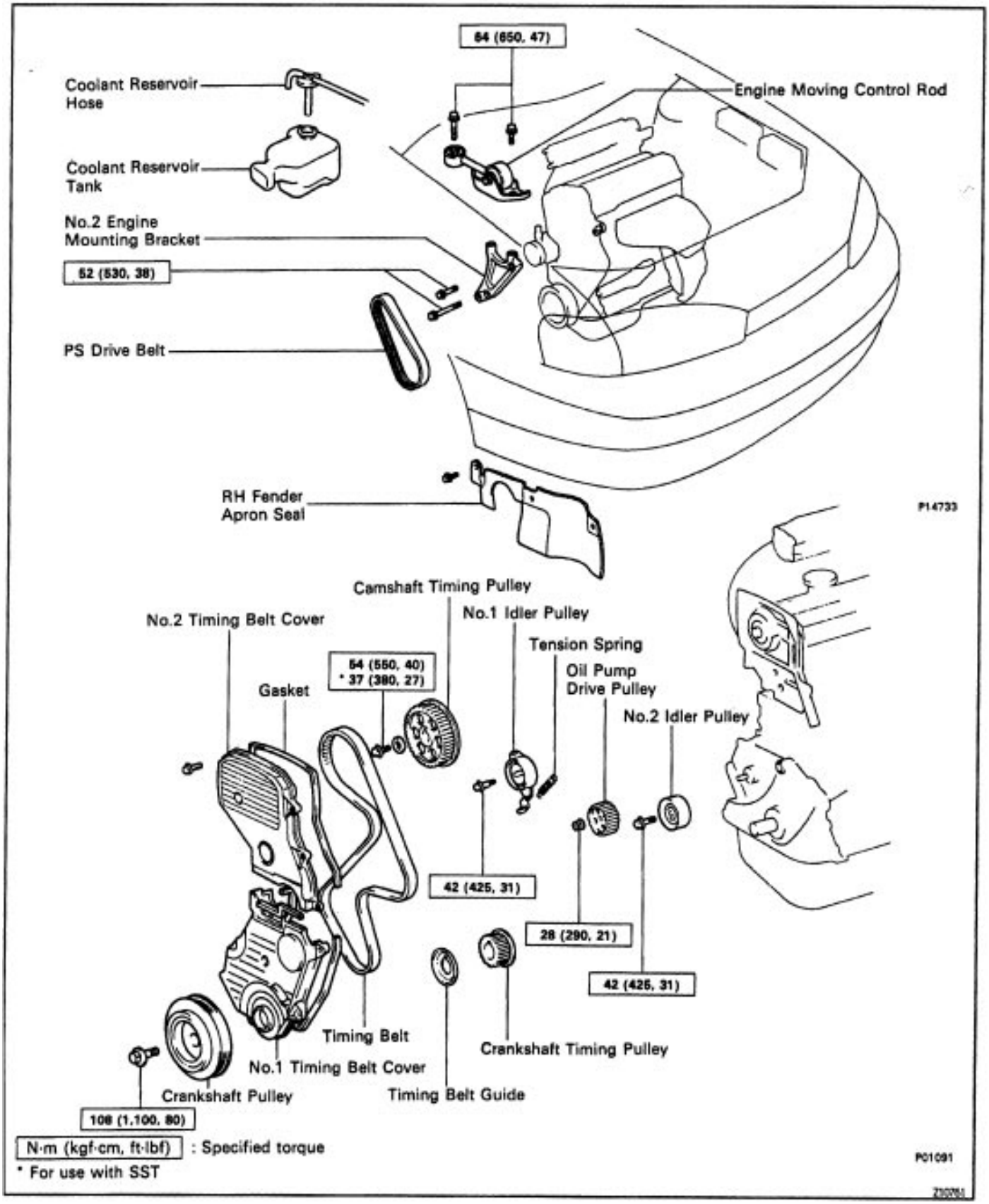
Torque: 18 N–m (180 kgf–cm, 13 ft–lbf)

7. RECONNECT HIGH–TENSION CORDS TO SPARK PLUGS

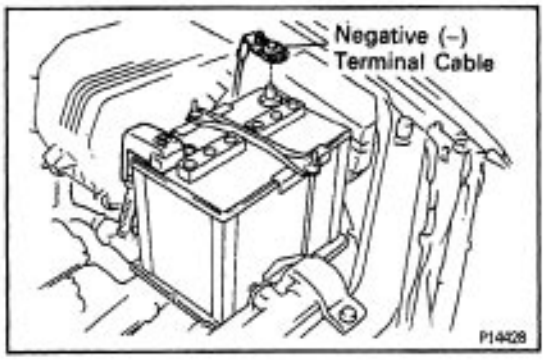
8. RECONNECT DISTRIBUTOR CONNECTOR(S)

TIMING BELT

COMPONENTS FOR REMOVAL AND INSTALLATION



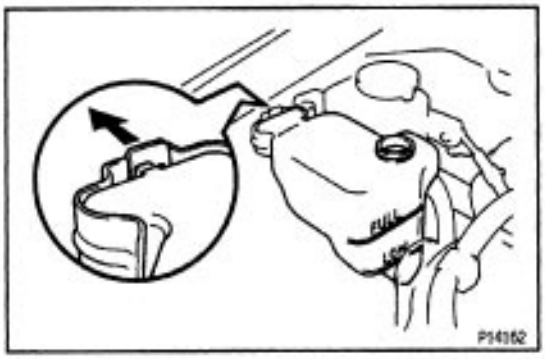
TIMING BELT REMOVAL



(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

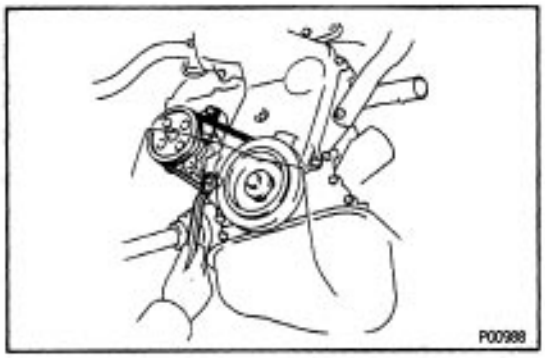
(a) Disconnect the reservoir hose.

(b) While pushing the tab of the bracket, remove the reservoir tank.

3. REMOVE GENERATOR (See page CH–10)

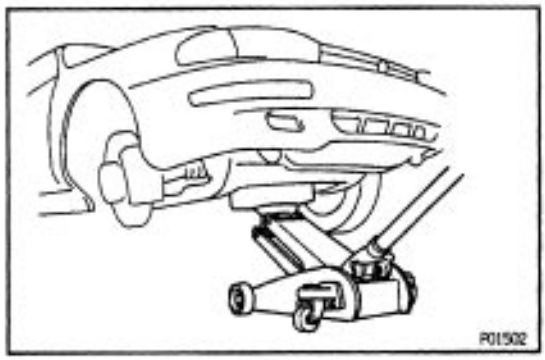
4. REMOVE RH FRONT WHEEL

5. REMOVE RH FENDER APRON SEAL



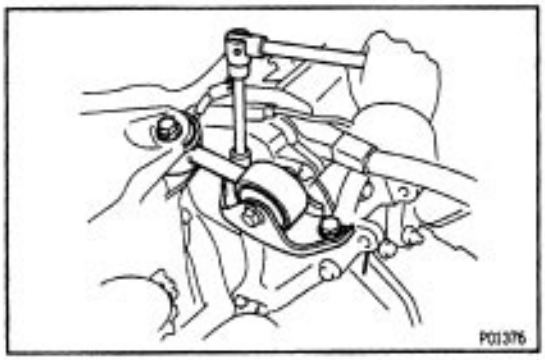
6. REMOVE PS DRIVE BELT

Loosen the 2 bolts, and remove the drive belt.



7. SLIGHTLY JACK UP ENGINE

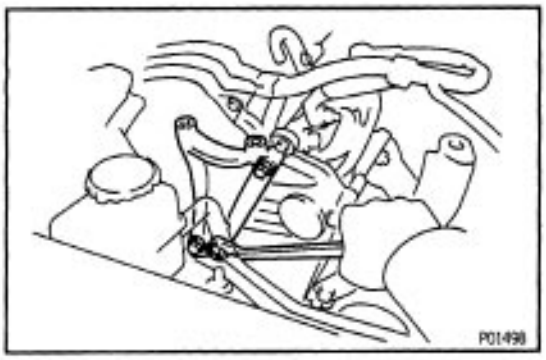
Raise the engine enough to remove the weight from the engine mounting on the right side.



8. REMOVE ENGINE MOVING CONTROL ROD

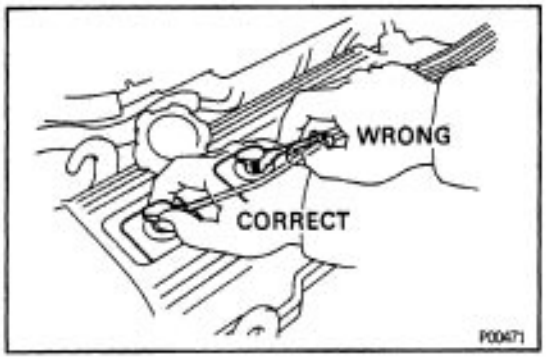
Remove the 3 bolts and control rod.

9. DISCONNECT CONNECTOR FROM GROUND WIRE ON RH FENDER APRON



10. REMOVE No.2 ENGINE MOUNTING BRACKET

Remove the 3 bolts and mounting bracket.

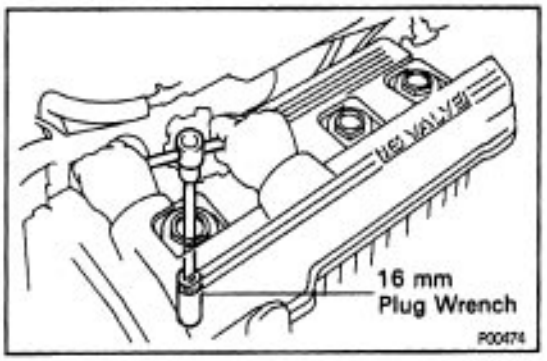


11. REMOVE SPARK PLUGS

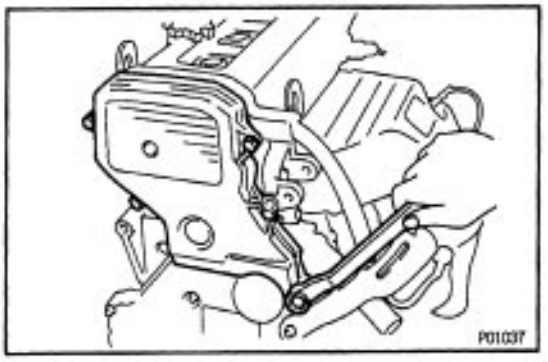
(a) Disconnect the high – tension cords at the rubber boot.

DO NOT pull on the cords.

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

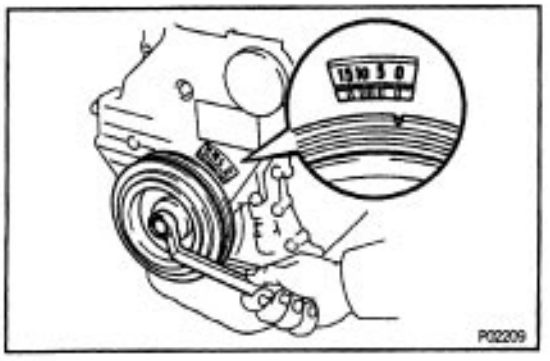


(b) Using a 16 mm plug wrench, remove the spark plug.



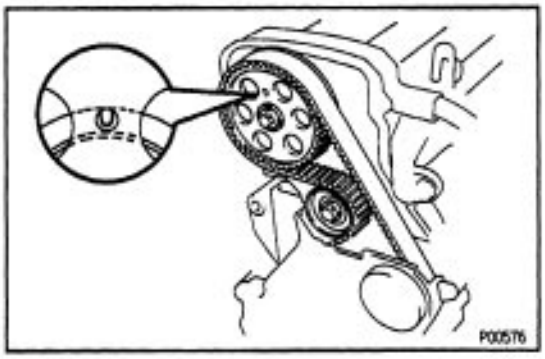
12. REMOVE NO.2 TIMING BELT COVER

Remove the 5 bolts, timing belt cover and 2 gaskets.

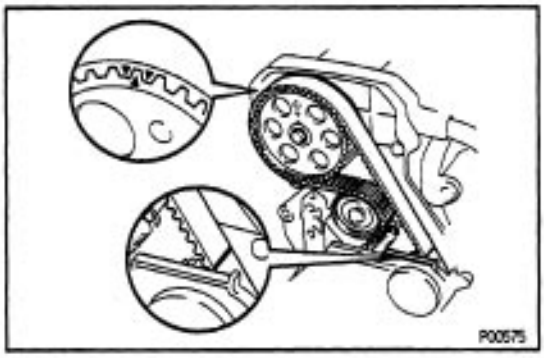


13. SET NO.1 CYLINDER TO TDC/COMPRESSION

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

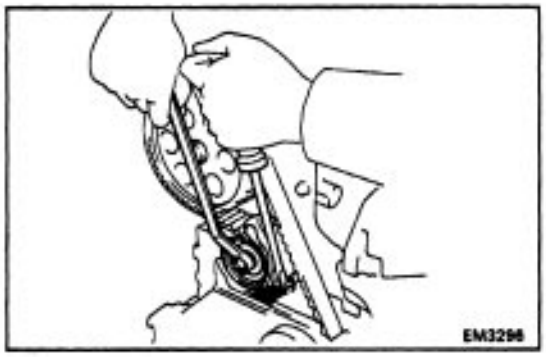


(b) Check that the hole of the camshaft timing pulley is aligned with the timing mark of the bearing cap. If not, turn the crankshaft one revolution (360'*).

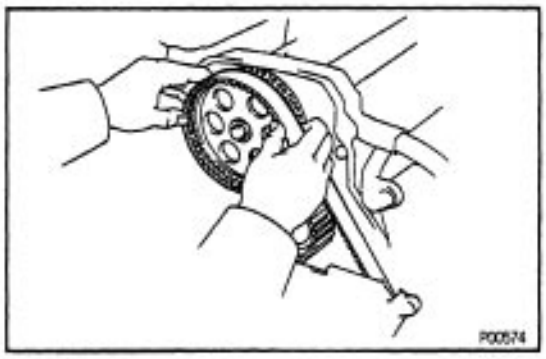


14. REMOVE TIMING BELT FROM CAMSHAFT TIMING PULLEY

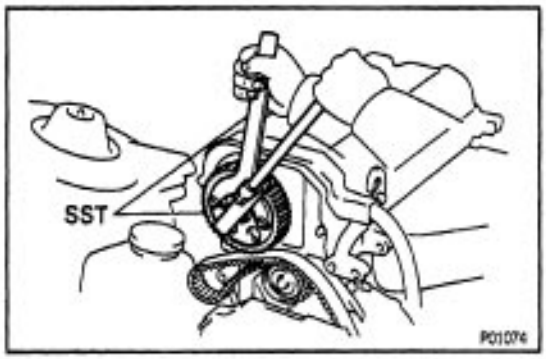
HINT (When re–using timing belt): Place the match–marks on the timing belt and camshaft timing pulley, and place matchmark on timing belt to match the end of the No.1 timing belt cover.



(a) Loosen the mounting bolt of the No.1 idler pulley and shift the pulley toward the left as far as it will go, and temporarily tighten it.



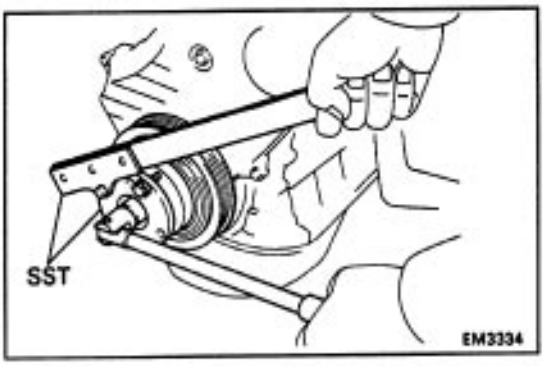
(b) Remove the timing belt from the camshaft timing pulley.



15. REMOVE CAMSHAFT TIMING PULLEY

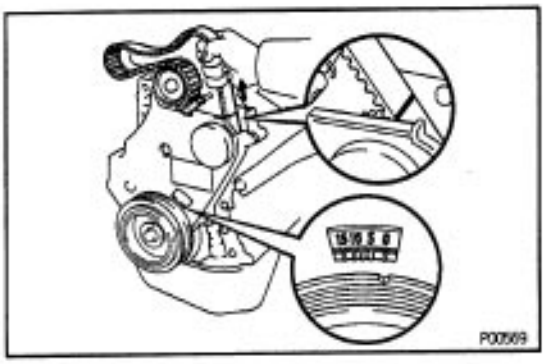
Using SST, remove the bolt, plate washer and timing pulley.

SST 09249–63010 and 09278–54012

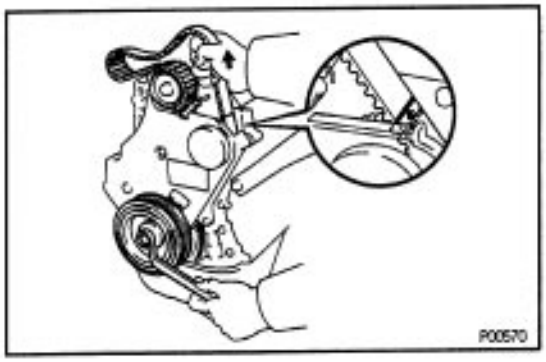


16. REMOVE CRANKSHAFT PULLEY

(a) Using SST, remove the pulley bolt.
SST 09213–54015 (91651– 60855), 09330–00021

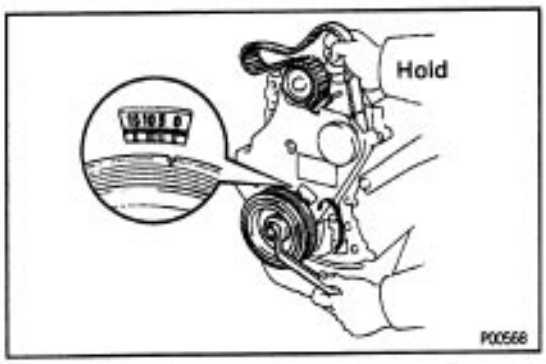


HINT (When re–using timing belt): After loosening the crankshaft pulley bolt, check that the timing belt matchmark aligns with the end of the No. 1 timing belt cover when the crankshaft pulley groove is aligned with the timing mark “0” of the No. 1 timing belt cover. If the matchmark does not align, align as follows**:**

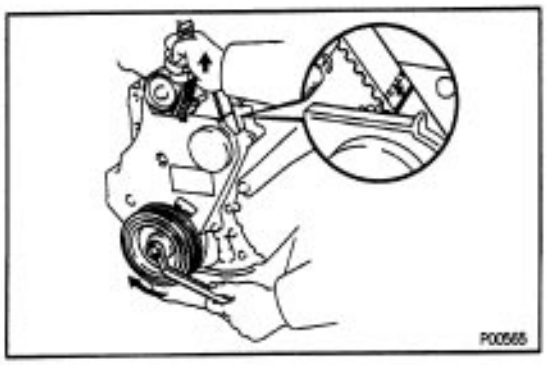


When matchmark is misaligned clockwise:

- Align the matchmark by pulling the timing belt up on the water pump pulley side while turning the crankshaft pulley counterclockwise.

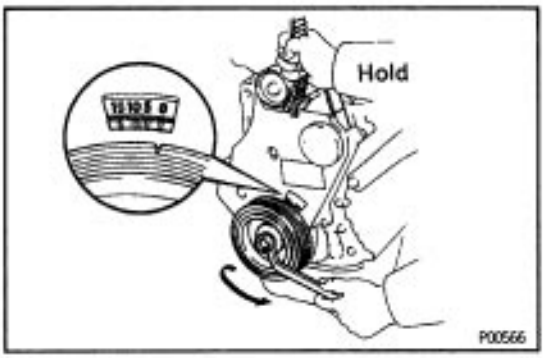


- After aligning the matchmark, hold the timing belt, turn the crankshaft pulley clockwise, and align its groove with timing mark “0” of the No.1 timing belt cover.

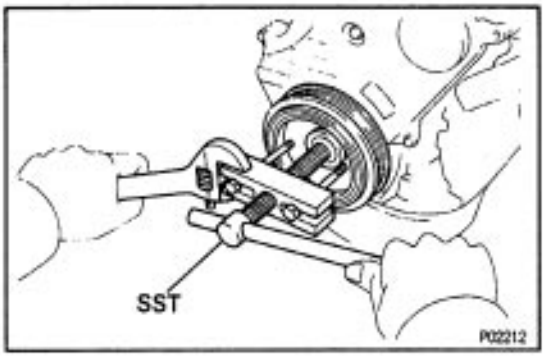


When matchmark is misaligned counterclockwise:

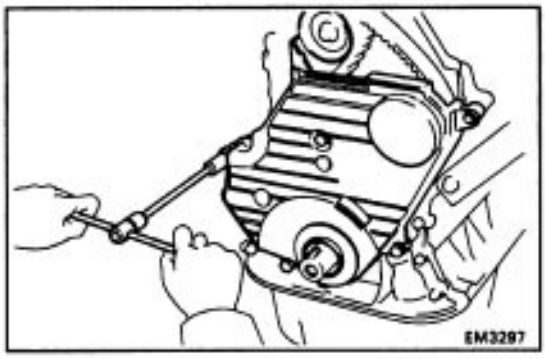
- Align the rnatchmarks by pulling the timing belt up on the No.1 idler pulley side while turning the crankshaft pulley clockwise.



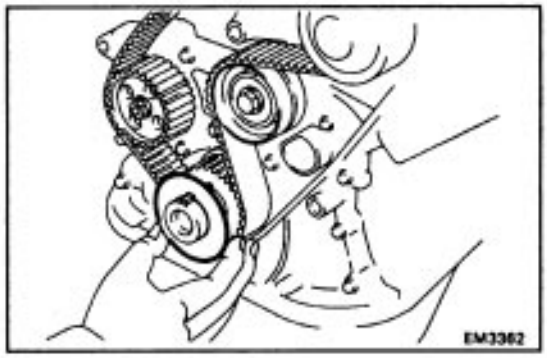
- After aligning the matchmark, hold the timing belt, turn the crankshaft pulley counterclockwise, and align its groove with timing mark “0” of the No.1 timing belt cover.



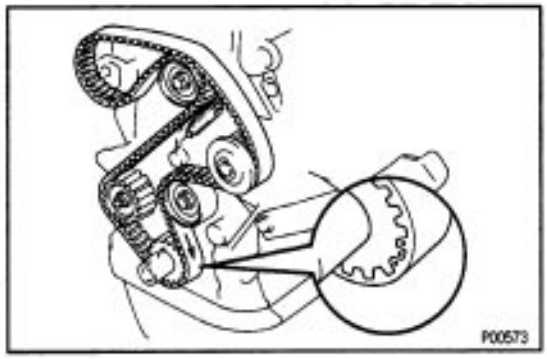
(b) Using SST, remove the pulley.
SST 09213–60017 (09213–00020, 09213–00030, 09213–00060)
HINT (When re–using timing belt): Remove the pulley without turning it.



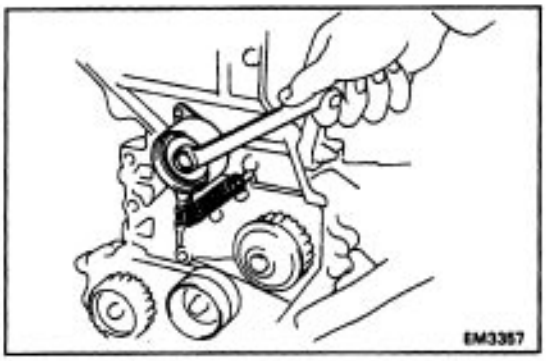
17. REMOVE No.1 TIMING BELT COVER
Remove the 4 bolts, timing belt cover and gasket.



18. REMOVE TIMING BELT GUIDE

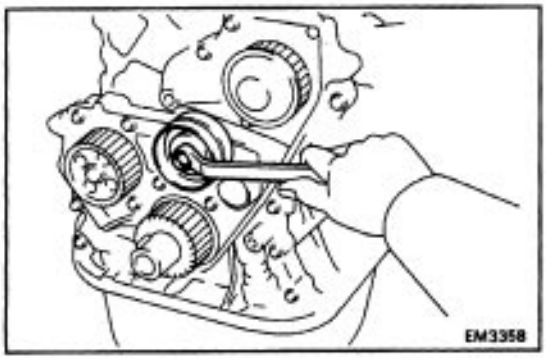


19. REMOVE TIMING BELT
HINT (When re–using timing belt): Draw a direction arrow on the timing belt (in the direction of engine revolution), and place matchmarks on the timing belt and crankshaft timing pulley.



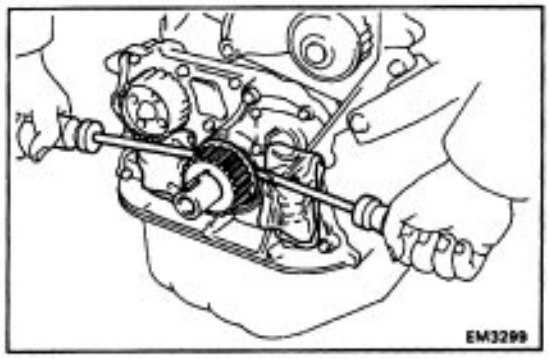
20. REMOVE NO.1 IDLER PULLEY AND TENSION SPRING

Remove the bolt, pulley and tension spring.



21. REMOVE NO.2 IDLER PULLEY

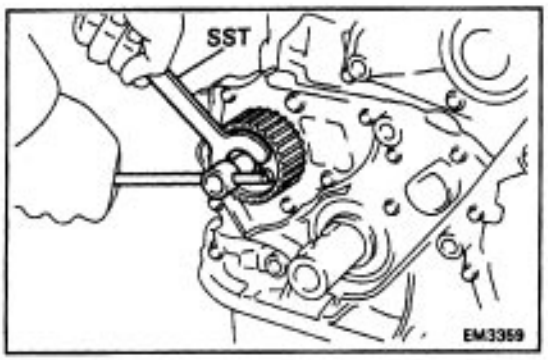
Remove the bolt and pulley.



22. REMOVE CRANKSHAFT TIMING PULLEY

If the pulley cannot be removed by hand, use 2 screw–drivers.

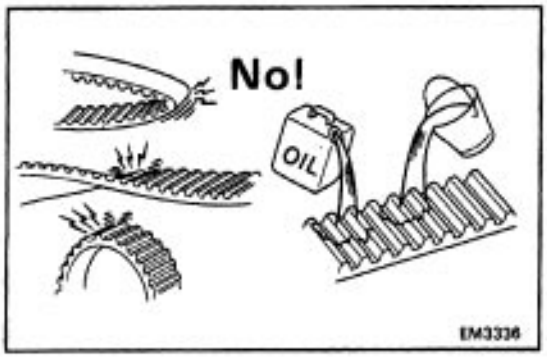
HINT: Position shop rags as shown to prevent damage.



23. REMOVE OIL PUMP PULLEY

Using SST, remove the nut and pulley.

SST 09616–30011

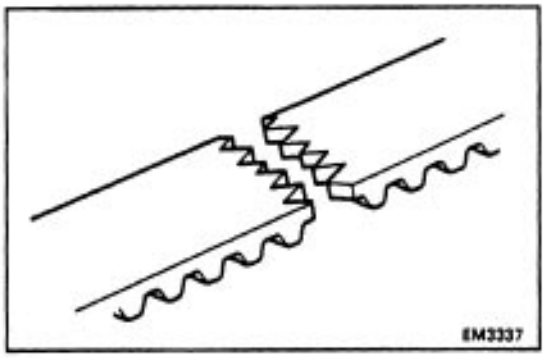


TIMING BELT COMPONENTS INSPECTION

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.**



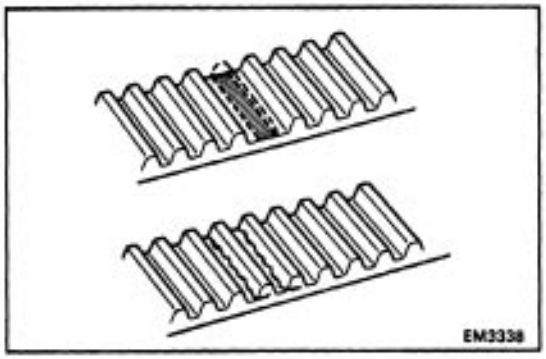
- **Do not utilize timing belt tension when installing or removing the mounting bolt of the camshaft timing pulley.**

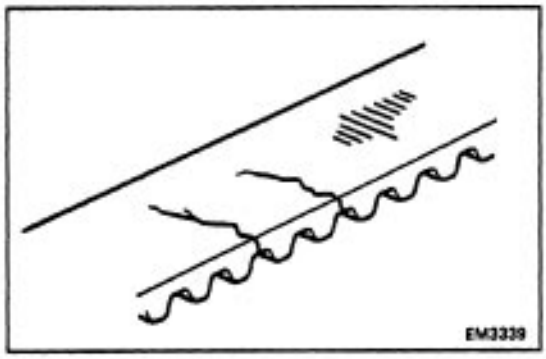
If there are any defects as shown in the illustration, check the following points:

(a) Premature parting

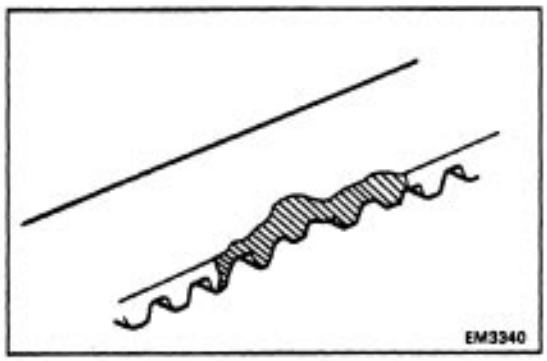
- Check for proper installation.
- Check the timing cover gasket for damage and proper installation.

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

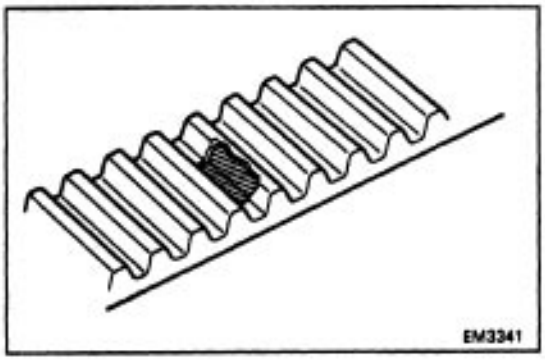




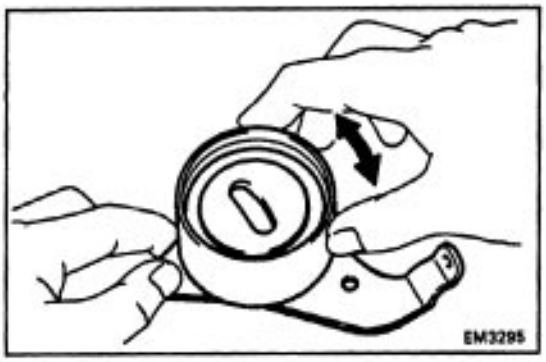
(c) If there is noticeable wear or cracks on the belt face, check to see if there are nicks on the side of the idler pulley lock.



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



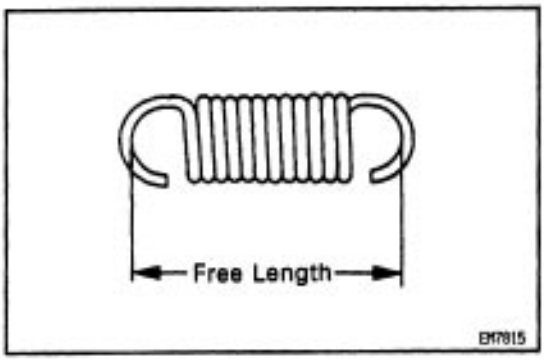
(e) If there is noticeable wear on the belt teeth, check the timing cover for damage, correct gasket installation, and for foreign material on the pulley teeth.
If necessary, replace the timing belt.



2. INSPECT IDLER PULLEYS

Check that the idler pulley turns smoothly.

If necessary, replace the idler pulley.



3. INSPECT TENSION SPRING

(a) Measure the free length of tension spring.

Free length:

46.0 mm (1.811 in.)

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

(b) Measure the tension of the tension spring at the specified installed length.

Installed tension (at 50.5 mm (1.988 in.)):

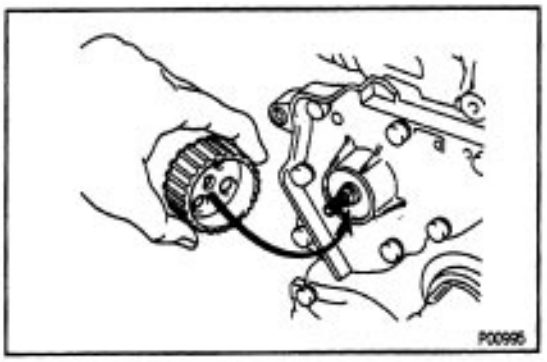
Green color

32 – 37 N (3.25 – 3.75 k9f, 7.2 – 8.3 lbf)

Silver color

47 – 52 N (4.75 – 5.25 kgf, 10.5 – 11.8 lbf)

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

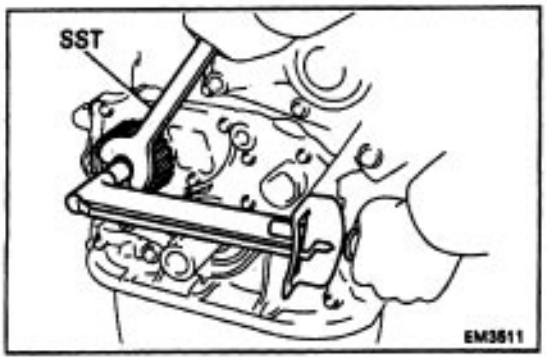


TIMING BELT INSTALLATION

(See Components for Removal and Installation)

1. INSTALL OIL PUMP PULLEY

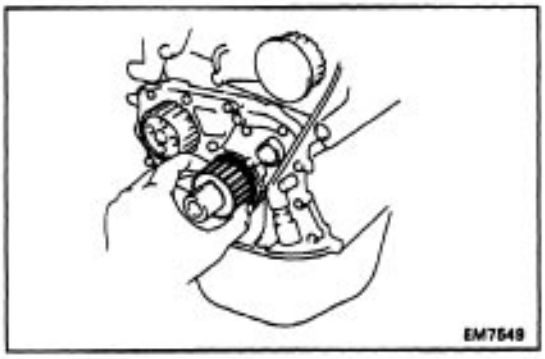
(a) Align the cutouts of the pulley and shaft, and slide on the pulley.



(b) Using SST, install the nut.

SST 09616 – 30011

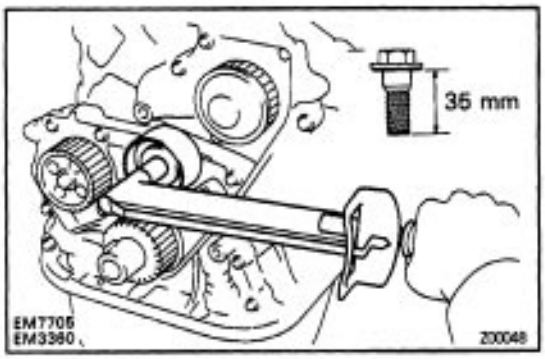
Torque: 28 N–m (290 kgf–cm, 21 ft–lbf)



2. INSTALL CRANKSHAFT TIMING PULLEY

(a) Align the timing pulley set key with the key groove of the pulley.

(b) Slide on the timing pulley, facing the flange side inward.



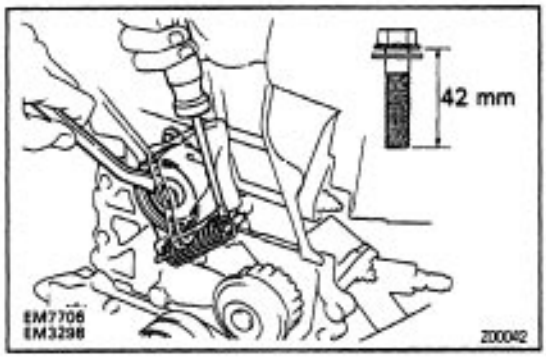
3. INSTALL NO.2 IDLER PULLEY

(a) Install the pulley with the bolt.

Torque: 42 N–m (425 kgf–cm, 31 ft–lbf)

HINT: Use a bolt 35 mm (1.38 in.) in length.

(b) Check that the idler pulley moves smoothly.



4. TEMPORARILY INSTALL NO.1 IDLER PULLEY AND TENSION SPRING

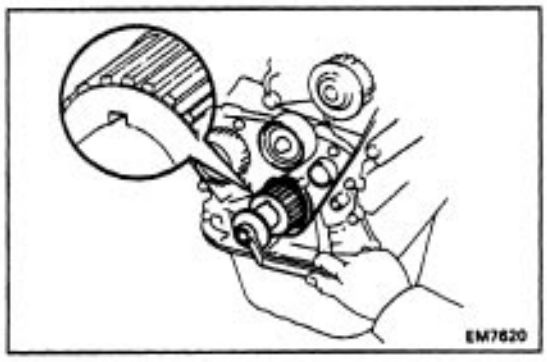
(a) Install the pulley with the bolt. Do not tighten the bolt yet.

HINT: Use a bolt 42 mm (1.65 in.) in length.

(b) Install the tension spring.

(c) Pry the pulley toward the left as far as it will go and tighten the bolt.

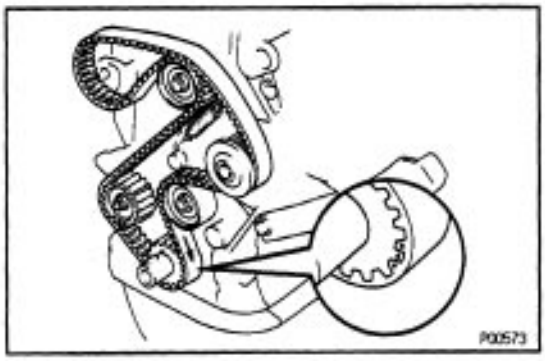
(d) Check that the idler pulley moves smoothly.



5. TEMPORARILY INSTALL TIMING BELT

NOTICE: The engine should be cold.

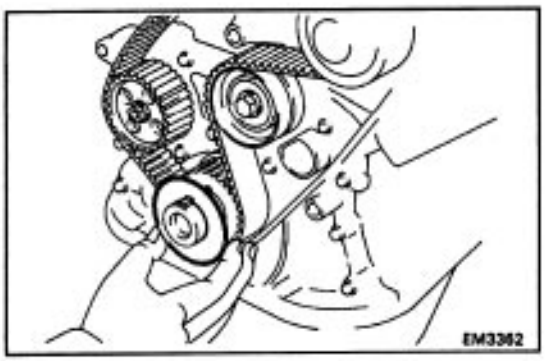
(a) Using the crankshaft pulley bolt, turn the crankshaft and position the key groove of the crankshaft timing pulley upward.



(b) Remove any oil or water on the crankshaft pulley, oil pump pulley, water pump pulley, No. 1 idler pulley, No. 2 idler pulley and keep them clean.

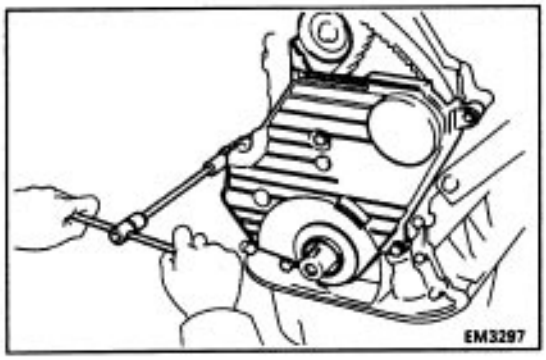
(c) Install the timing belt on the crankshaft timing pulley, oil pump pulley, No.1 idler pulley, water pump pulley and No.2 idler pulley.

HINT (When re–using timing belt): Align the points marked during removal, and install the belt with the arrow pointing in the direction of engine revolution.



6. INSTALL TIMING BELT GUIDE

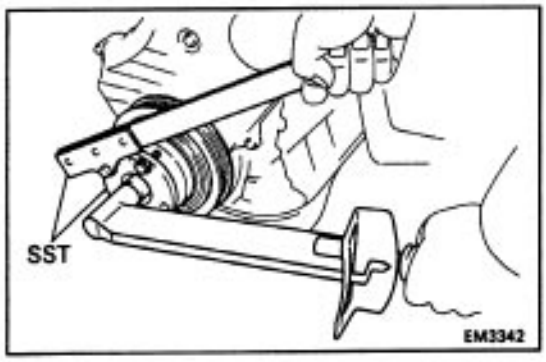
Install the guide, facing the cup side outward.



7. INSTALL NO.1 TIMING BELT COVER

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

(b) Install the timing belt cover with the 4 bolts.



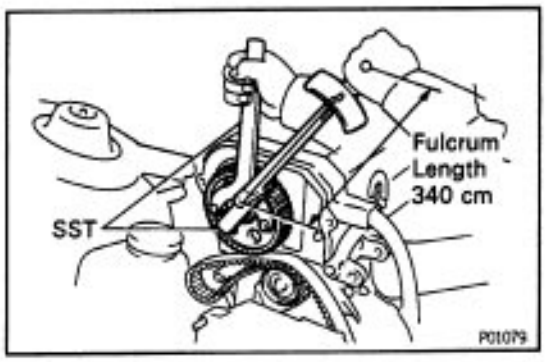
8. INSTALL CRANKSHAFT PULLEY

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

(b) Using SST, install the pulley bolt.

SST 09213–54015 (91651 –60855)
09330–00021

Torque: 108 N–m (1,100 kgf–cm, 80 ft–lbf)



9. INSTALL CAMSHAFT TIMING PULLEY

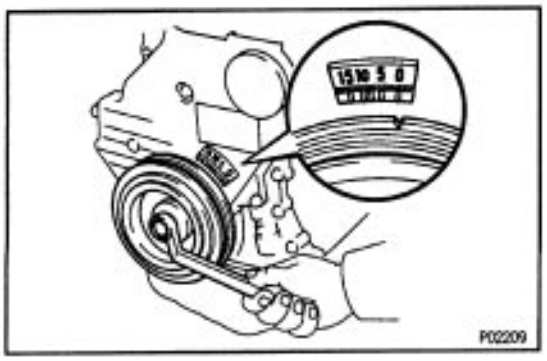
(a) Align the camshaft knock pin with the knock pin groove of the pulley, and slide on the timing pulley.

(b) Using SST, install the plate washer and bolt.

SST 09249 – 63010 and 09278 – 54012

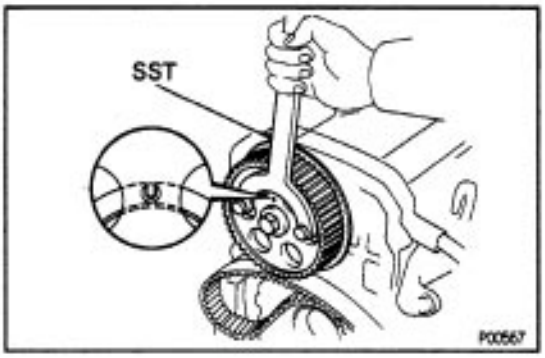
Torque: 37 N–m (380 kgf–cm, 27 ft–lbf)

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

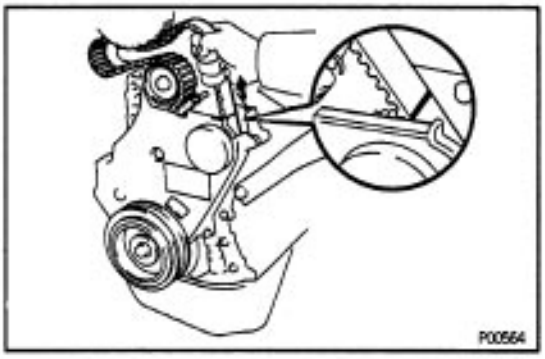


10. SET No.1 CYLINDER TO TDC/COMPRESSION

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



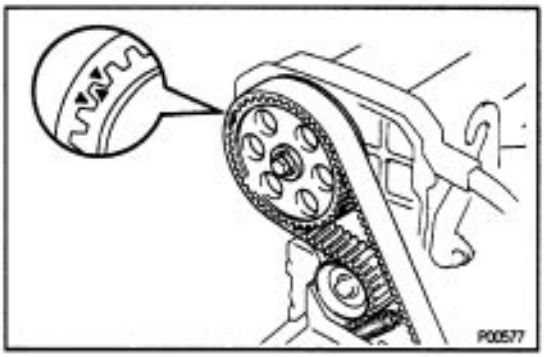
(b) Using SST, turn the camshaft, and align the hole of the camshaft timing pulley with the timing mark of the bearing cap.
SST 09278–54012



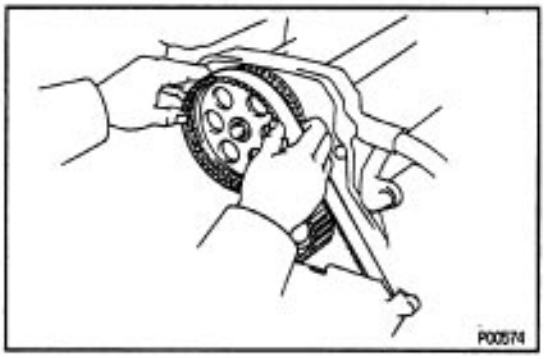
11. INSTALL TIMING BELT

HINT. (When re–using timing belt):

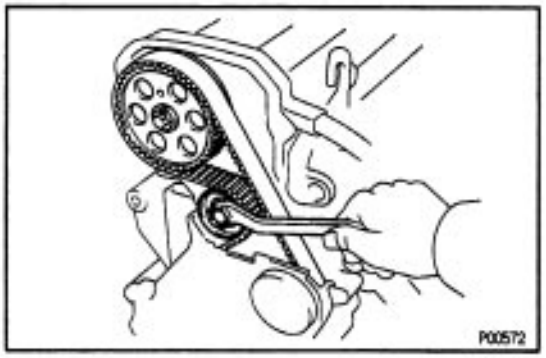
- Check that the matchmark on the timing belt matches the end of the No.1 timing belt cover.
  If the matchmark does not align, shift the meshing of the timing belt and crankshaft timing pulley until they align. (See page EG1–29)



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

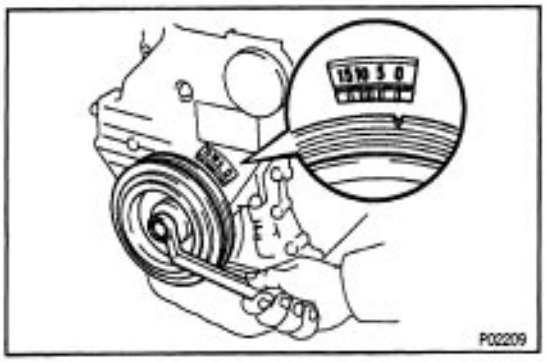


(a) Remove any oil or water on the camshaft timing pulley, and keep it clean.
(b) Install the timing belt, and check the tension between the crankshaft timing pulley and camshaft timing pulley.



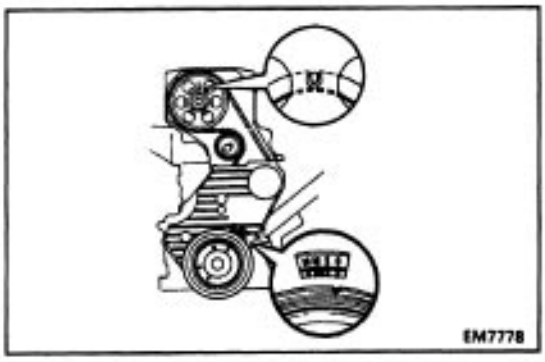
12. CHECK VALVE TIMING

(a) Loosen the No.1 idler pulley bolt 1/2 turn.



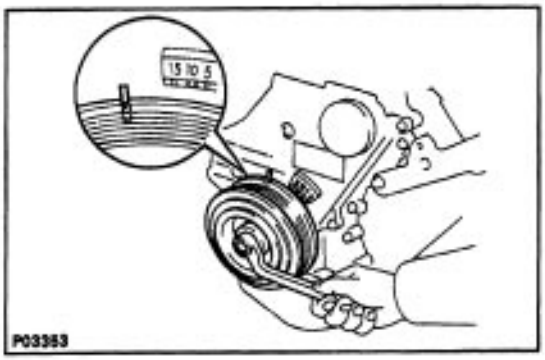
(b) Turn the crankshaft pulley 2 revolutions from TDC to TDC.

NOTICE: Always turn the crankshaft clockwise.



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

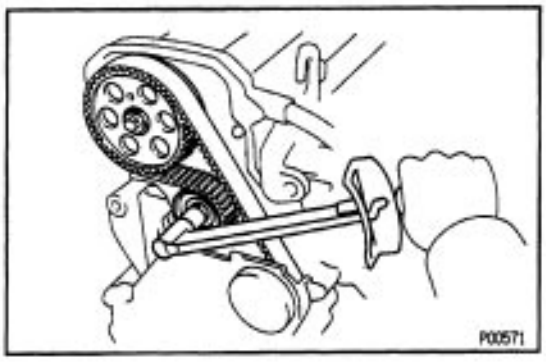
If the timing marks do not align, remove the timing belt and reinstall it.



(d) w/ Green Tension Spring:

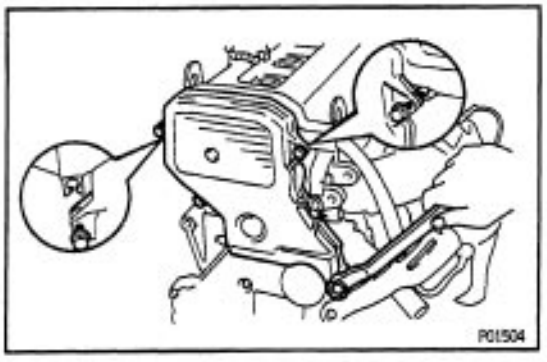
Slowly turn the crankshaft pulley 1 and 7/8 revolu–tions, and align its groove with the mark at 45˚ BTDC (for No.1 cylinder) of the No.1 timing belt cover.

NOTICE: Always turn the crankshaft clockwise.



(e) Torque the mounting bolt of the No.1 idler pulley.

Torque: 42 N–m (425 kgf–cm, 31 ft–lbf)

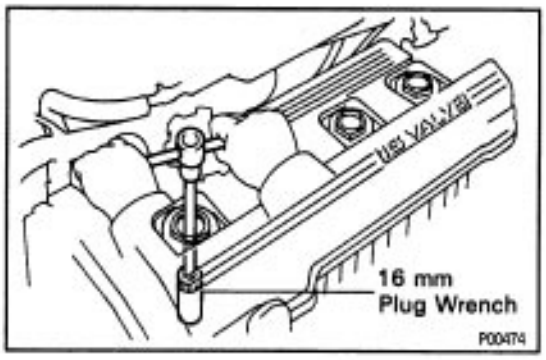


13. INSTALL NO.2 TIMING BELT COVER

(a) Install the 2 gaskets to the No. 1 and No.2 belt covers.

(b) install the belt cover with the 5 bolts.

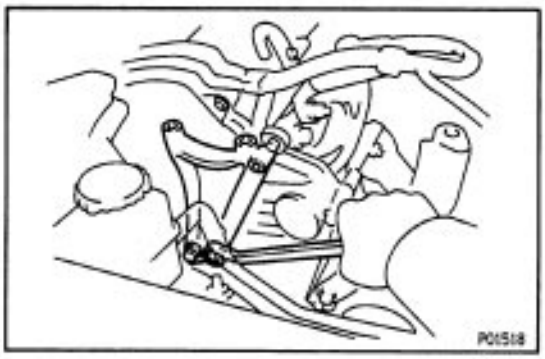
(c) Align the 2 clamps of the engine wire with cover mounting bolts.



14. INSTALL SPARK PLUGS

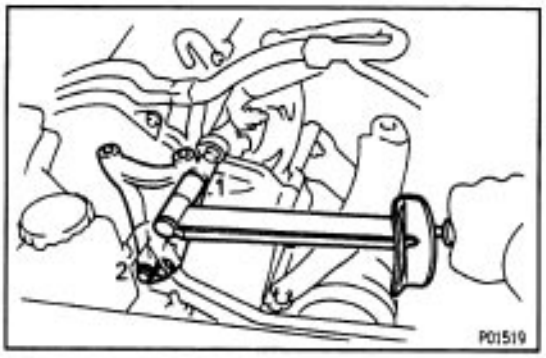
(a) Using a 16 mm plug wrench, install the spark plug.

(b) Connect the high–tension cords.



15. INSTALL NO.2 ENGINE MOUNTING BRACKET

(a) Temporarily install the No.2 engine mounting bracket with the 2 bolts.

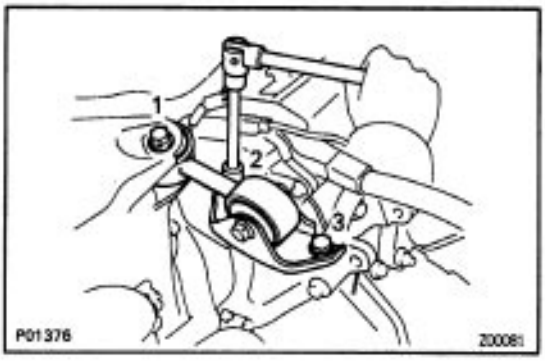


(b) Install the remaining bolt.

(c) Tighten the 3 bolts in the sequence shown.

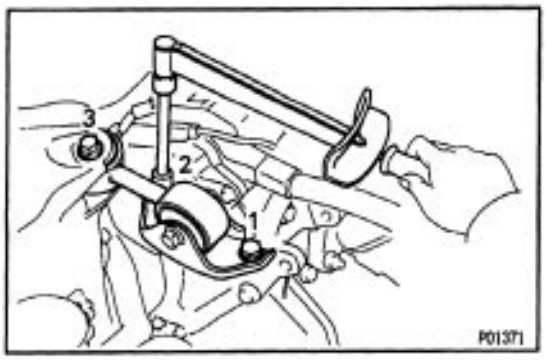
Torque: 52 N–m (530 kgf–cm, 38 ft–lbf)

16. CONNECT CONNECTOR TO GROUND WIRE ON RH FENDER APRON

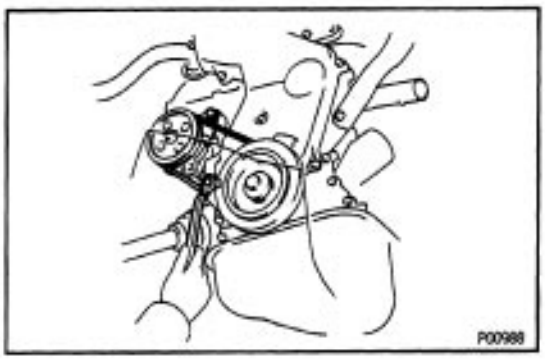


17. INSTALL ENGINE MOVING CONTROL ROD

(a) Temporarily install the engine moving control rod with the 3 bolts in the sequence shown.



(b) Tighten the 3 bolts in the sequence shown.
Torque: 64 N–m (650 kgf–cm. 47 ft–lbf)

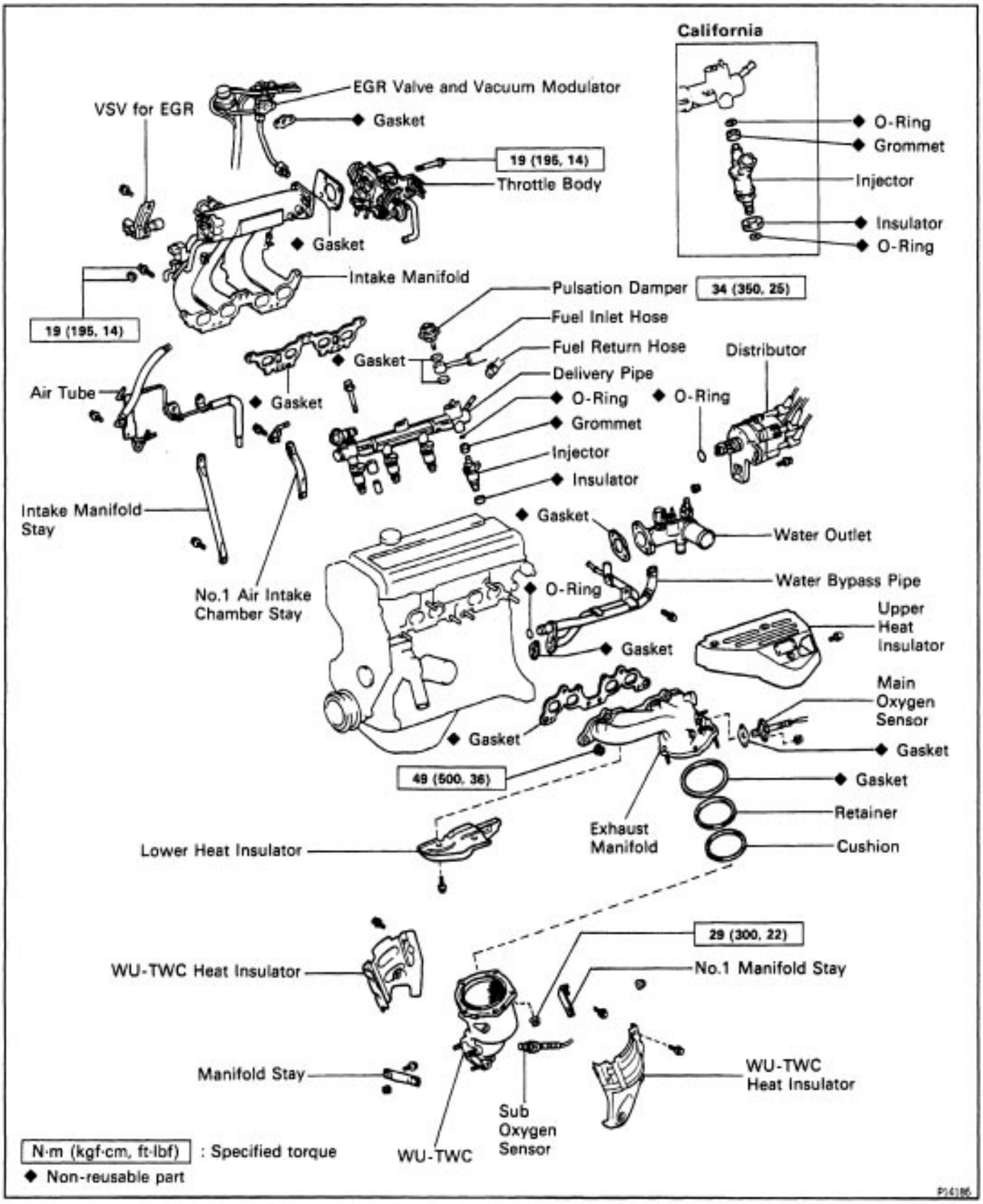


18. INSTALL AND ADJUST PS DRIVE BELT
Install the drive belt with the pivot and adjusting bolts.
Drive belt tension:
New belt
125 ± 25 lbf
Used belt
80 ± 20 I bf

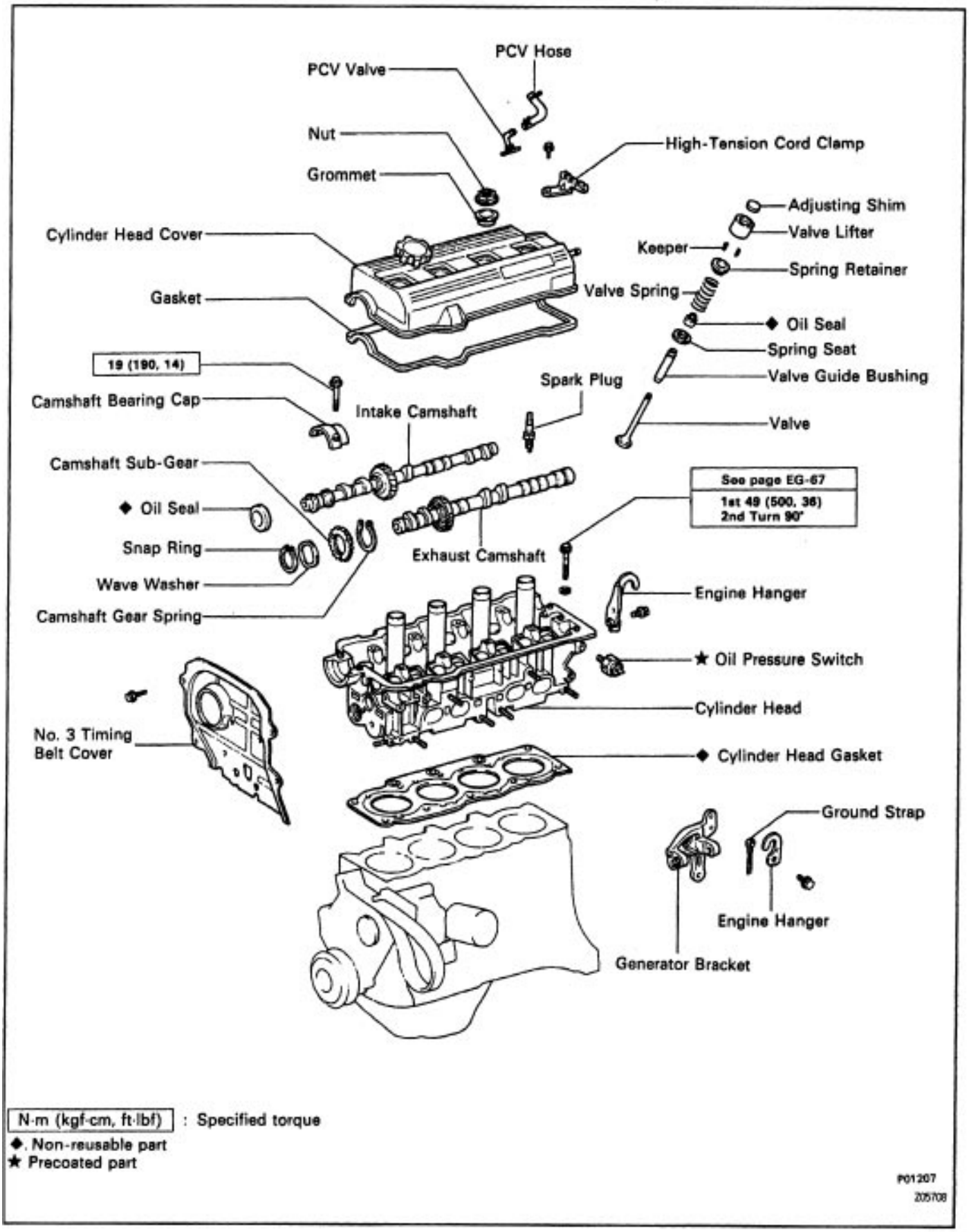
19. INSTALL RH FENDER APRON SEAL
20. INSTALL RH FRONT WHEEL
21. INSTALL GENERATOR (See page CH–24)
Drive belt tension:
w/ A/C
New belt
175 ± 5 lbf
Used belt
130 ± 10 lbf
w/o A/C
New belt
125 ± 25 lbf
Used belt
95 ± 20 lbf
22. INSTALL ENGINE COOLANT RESERVOIR TANK
23. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY

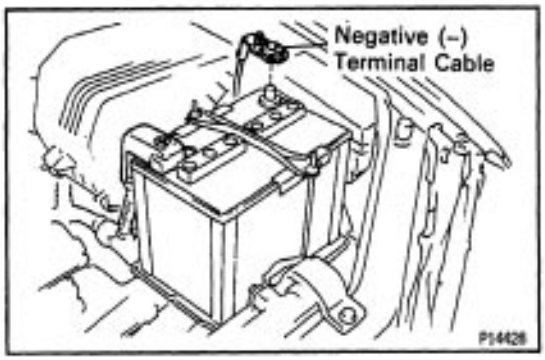
CYLINDER HEAD

COMPONENTS FOR REMOVAL AND INSTALLATION



COMPONENTS (Cont'd)





CYLINDER HEAD REMOVAL

(See Components for Removal and Installation)

1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY

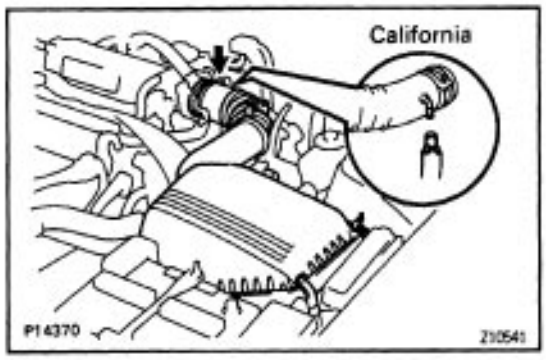
CAUTION: Work must be started after 90 seconds from the time the ignition switch is turned to the "LOCK" position and the negative (–) terminal cable is disconnected from the battery.

2. DRAIN ENGINE COOLANT

3. A/T:

DISCONNECT THROTTLE CABLE FROM THROTTLE BODY

4. DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY



5. REMOVE AIR CLEANER CAP, RESONATOR AND AIR CLEANER HOSE

(a) Disconnect the intake air temperature sensor connector.

(b) California only:
Disconnect the air hose from the air cleaner hose.

(c) Loosen the air cleaner hose clamp bolt.

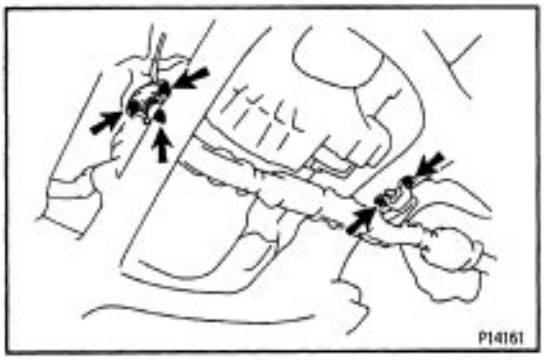
(d) Disconnect the 4 air cleaner cap clips.

(e) Disconnect the air cleaner hose from the throttle body, and remove the air cleaner cap together with the resonator and air cleaner hose.

6. REMOVE GENERATOR (See page CH–10)

7. REMOVE DISTRIBUTOR

(See page IG–13 end 32)

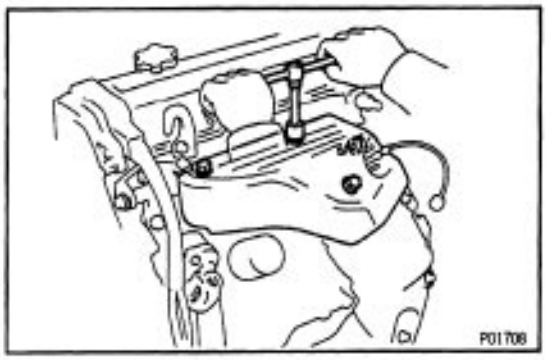


8. DISCONNECT FRONT EXHAUST PIPE

(a) Loosen the 2 bolts, and disconnect the bracket.

(b) Using a 14 mm deep socket wrench, remove the 3 nuts holding the front exhaust pipe to the WU–TWC.

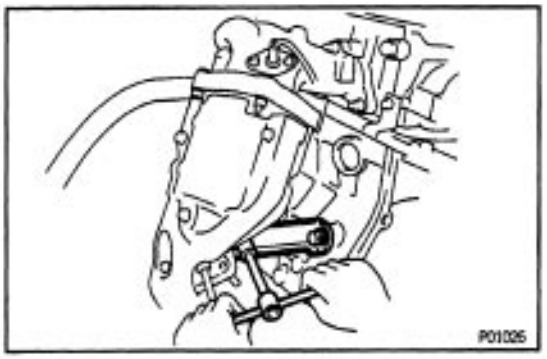
(c) Disconnect the front exhaust pipe and gaskets.



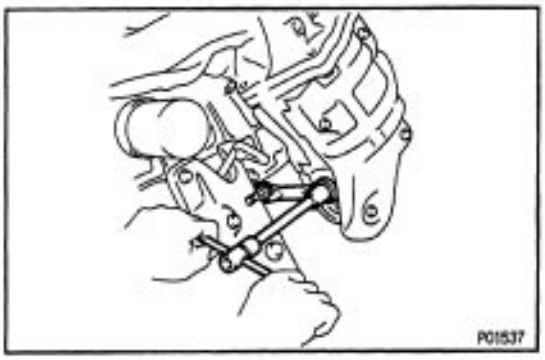
9. REMOVE EXHAUST MANIFOLD AND WARM UP THREE–WAY CATALYTIC CONVERTER ASSEMBLY

(a) Disconnect the main oxygen and sub oxygen sensor connectors.

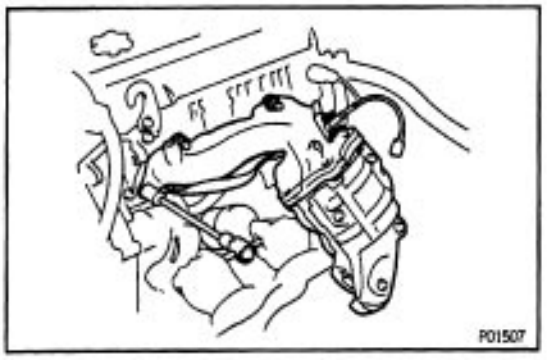
(b) Remove the 4 bolts and upper heat insulator.



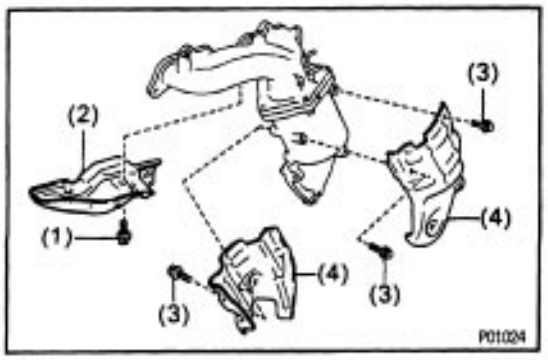
(c) Remove the bolt, nut and No. 1 manifold stay.



(d) Remove the bolt, nut and manifold stay.



(e) Remove the 6 nuts, the exhaust manifold and WU – TWC assembly.



10. SEPARATE EXHAUST MANIFOLD AND WARM UP THREE–WAY CATALYTIC CONVERTER

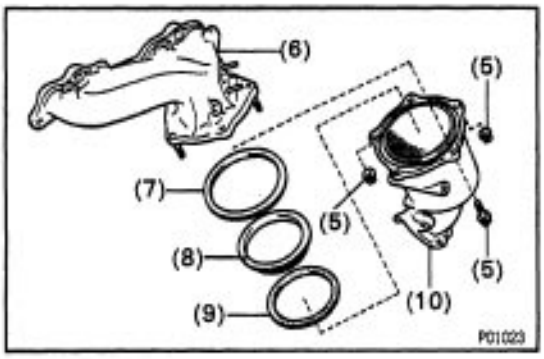
Remove the following parts:

(1) 3 bolts

(2) Manifold lower heat insulator

(3) 8 bolts

(4) 2 WU–TWC heat insulators



(5) 3 bolts and 2 nuts
(6) Exhaust manifold
(7) Gasket
(8) Retainer
(9) Cushion
(10) WU–TWC

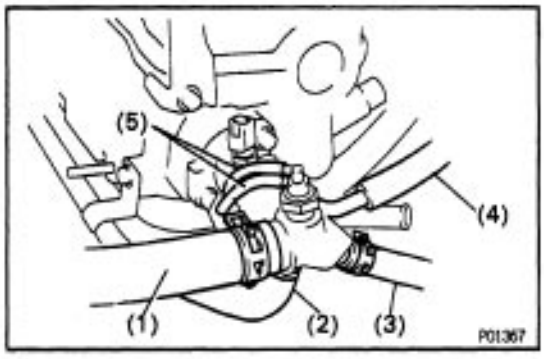
11. DISCONNECT OIL PRESSURE SWITCH CONNECTOR

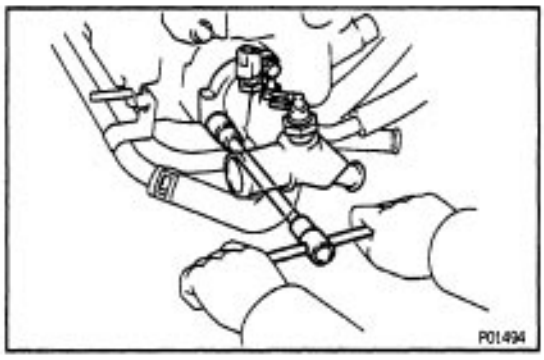
12. DISCONNECT ENGINE WIRE (FOR OXYGEN SENSORS) FROM ENGINE HANGER

13. REMOVE WATER OUTLET

(a) Disconnect the following connectors:
(1) Engine coolant temperature sender gauge con–nector
(2) Engine coolant temperature sensor connector

(b) Disconnect the following hoses:
(1) Upper radiator hose
(2) Water bypass pipe hose
(3) Heater water hose
(4) IAC water bypass hose
(5) 2 TVV (for EVAP) vacuum hoses

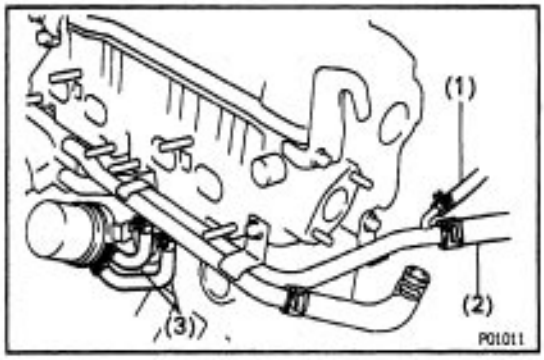


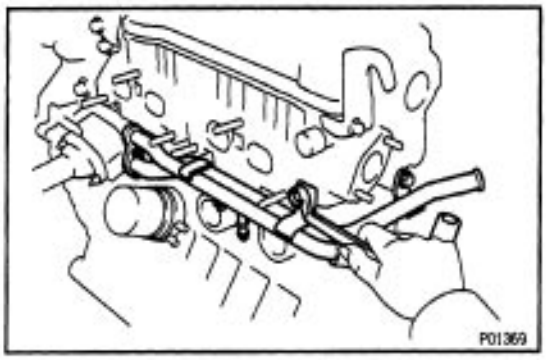


(c) Remove the 2 bolts, water outlet and gasket.

14. REMOVE WATER BYPASS PIPE

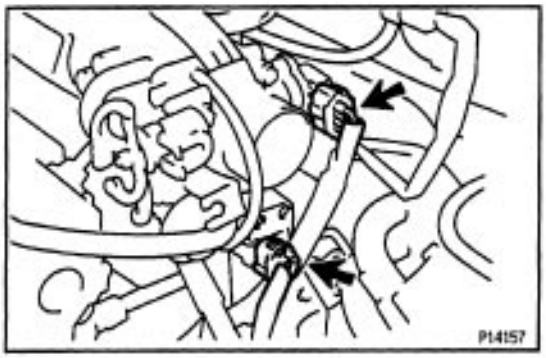
(a) Disconnect the following hoses:
(1) IAC water bypass hose
(2) Heater water hose
(3) w/ Oil Cooler:
2 oil cooler water bypass hoses



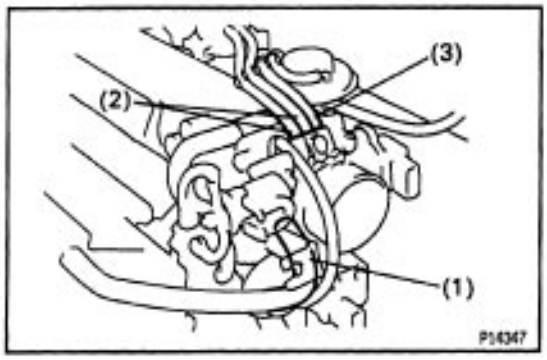


(b) Remove the 2 bolts, 2 nuts, water bypass pipe and gasket.
(c) Remove the O–ring from the water bypass hose.

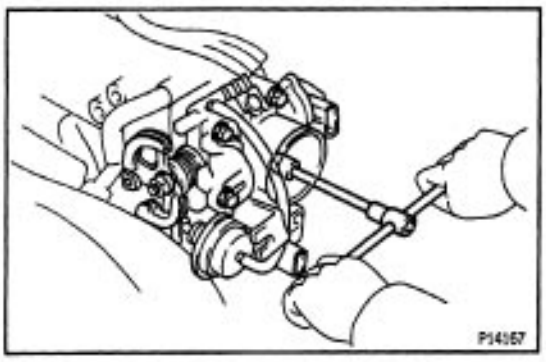
15. REMOVE THROTTLE BODY



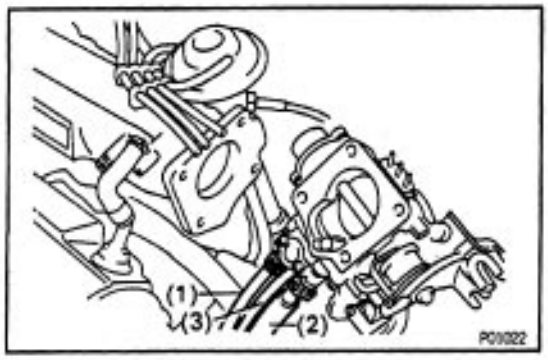
(a) Disconnect the throttle position sensor connector.
(b) Disconnect the IAC valve connector.



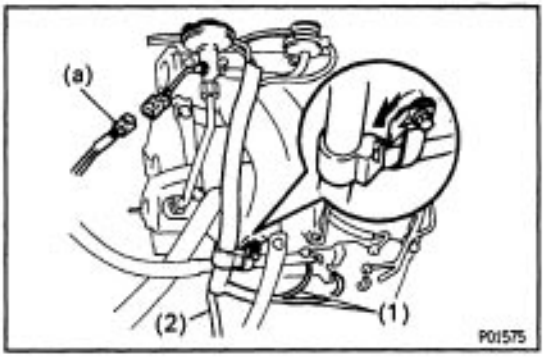
(c) Disconnect the following hoses from the throttle body.
(1) PCV hose
(2) 2 vacuum hoses from EGR vacuum modulator
(3) Vacuum hose from TVV (for EVAP)



(d) Type A:
Remove the 4 bolts.
(e) Type B:
Remove the 2 bolts and 2 nuts.

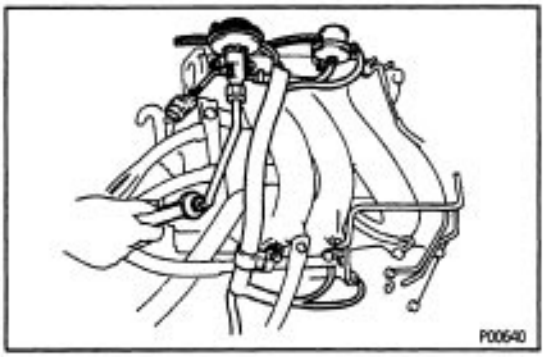


(f) Disconnect the following hoses from the throttle body, and remove the throttle body.
(1) Water bypass hose from water outlet
(2) Water bypass hose from water bypass pipe
(3) California:
Air hose from cylinder head
Except California:
Air hose from air tube

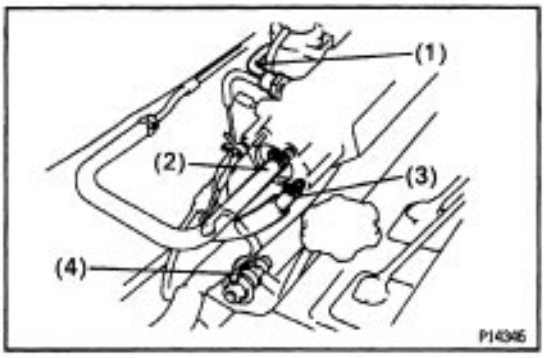


I6. REMOVE EGR VALVE AND VACUUM MODULATOR

(a) Disconnect the EGR gas temperature sensor connector.
(b) Disconnect the following hoses:
(1) 2 vacuum hoses from VSV (for EGR)
(2) Vacuum hose from charcoal canister
(c) Disconnect the vacuum hose clamp.



(d) Loosen the union nut of the EGR pipe, and remove the 2 nuts, EGR valve, vacuum modulator, vacuum hoses assembly and gasket.



17. DISCONNECT VACUUM HOSES

Disconnect the following hoses:
(1) MAP sensor hose from air intake chamber
(2) Brake booster vacuum hose from air intake chamber
(3) PS vacuum hose from air intake chamber
(4) Vacuum sensing hose from fuel pressure regulator 1

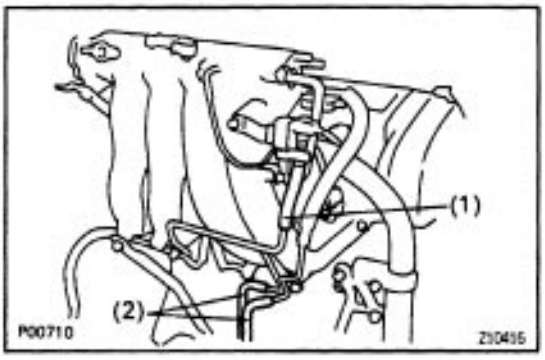
S. W/ A/C:

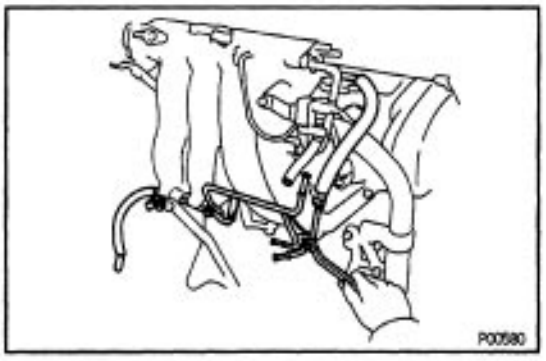
DISCONNECT A/C IDLE–UP VALVE CONNECTOR

19. EXCEPT CALIFORNIA:

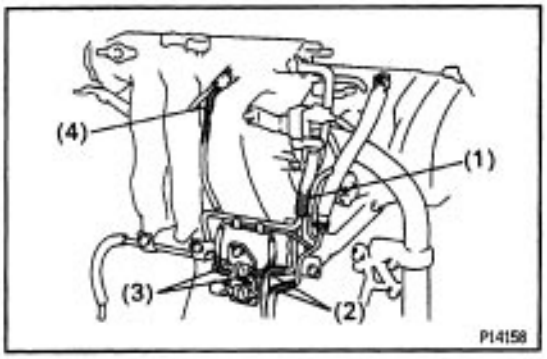
REMOVE AIR TUBE

(a) Disconnect the following hoses from the air tube:
(1) w/ A/C:
Air hose from ASV
(2) 2 air hoses from PS pump



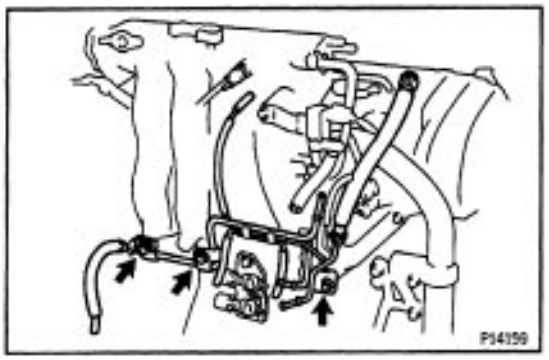


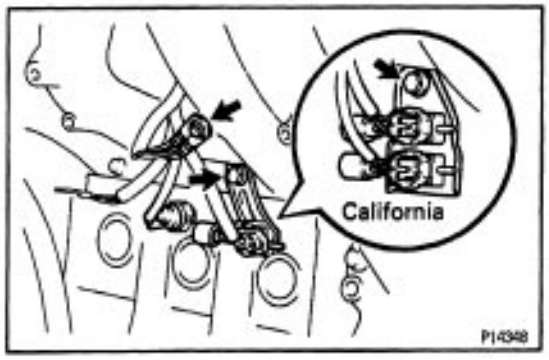
(b) Remove the 3 bolts, wire clamp and air tube.



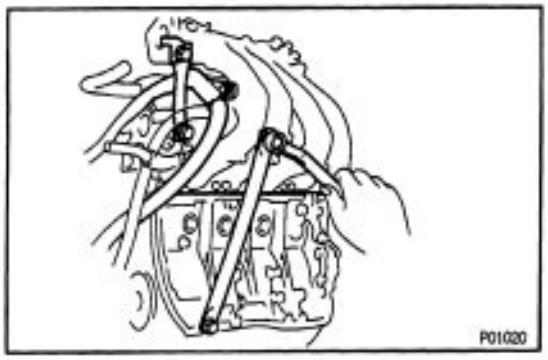
20. CALIFORNIA:
REMOVE AIR TUBE

(a) Disconnect the following hoses:
(1) w/ A/C:
A/C hose (from ASV) from air tube
(2) 2 air hoses (from PS pump) from air tube
(3) California only:
2 vacuum hoses from VSV (for fuel pressure control)
(4) Vacuum hose from air intake chamber
(b) Remove the 3 bolts, wire clamp and air tube.



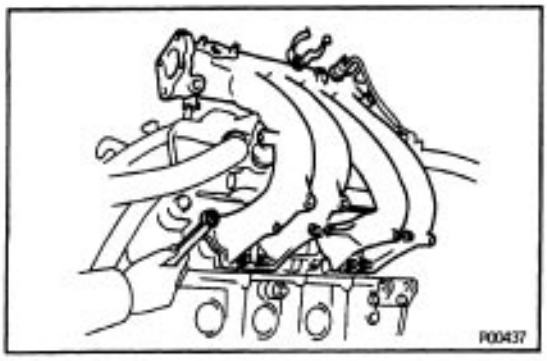


21. DISCONNECT 2 ENGINE WIRE GROUND STRAPS FROM INTAKE MANIFOLD
22. DISCONNECT KNOCK SENSOR AND VSV (FOR EGR) CONNECTORS
23. CALIFORNIA ONLY:
DISCONNECT VSV (FOR FUEL PRESSURE CONTROL) CONNECTOR
24. REMOVE VSV OR VSV ASSEMBLY

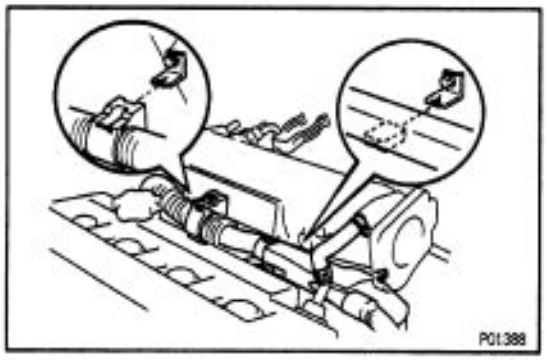


25. REMOVE INTAKE MANIFOLD

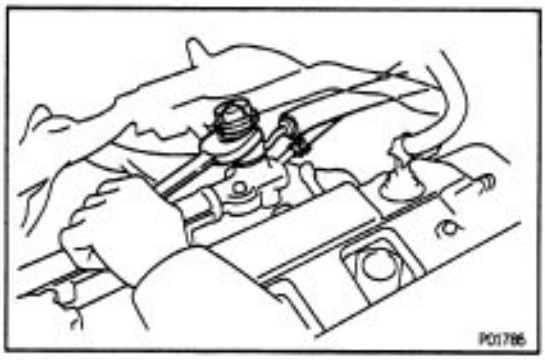
(a) Remove the 4 bolts, wire bracket, No.1 air intake chamber and manifold stays.
(b) Remove the bolt, vacuum hose bracket, and disconnect the engine wire.



(c) Remove the6 bolts, 2 nuts, intake manifold and gasket.



(d) Disconnect the 2 wire clamps from the wire brackets on the intake manifold.

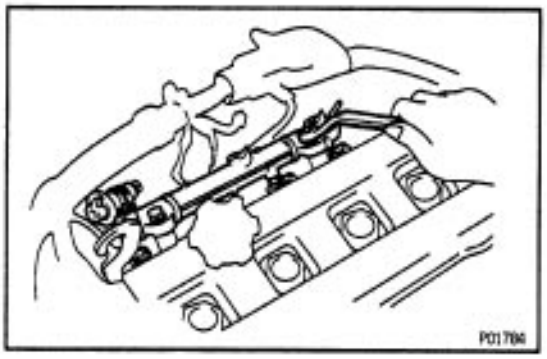


26. REMOVE DELIVERY PIPE AND INJECTORS

(a) Disconnect the injector connectors.

(b) Loosen the pulsation damper, and disconnect the fuel inlet hose.

(c) Disconnect fuel return hose.

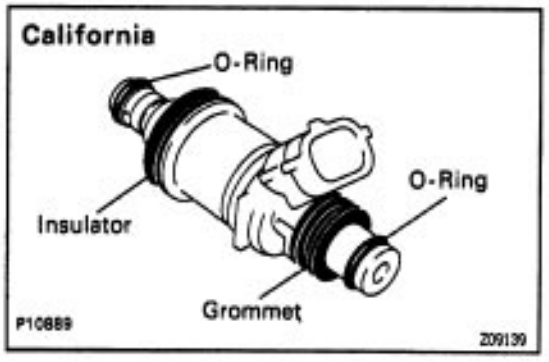


(d) Remove the 2 bolts and delivery pipe together with the 4 injectors.

NOTICE: Be careful not to drop the injectors when removing the delivery pips.

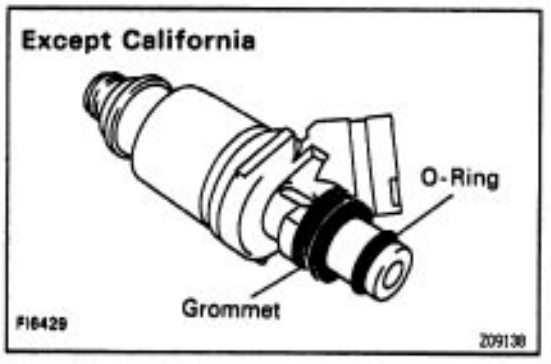
(e) Remove the 4 insulators (except California) and 2 spacers from the cylinder head.

(f) Pull out the 4 injectors from the delivery pipe.



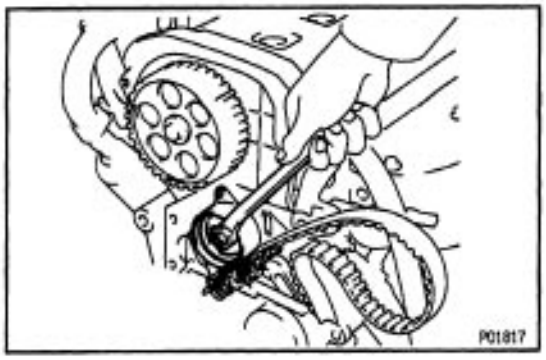
(g) California:

Remove the 2 O–rings, insulator and grommet from each injector.



(h) Except California:

Remove the 0–ring and grommet from each injector.

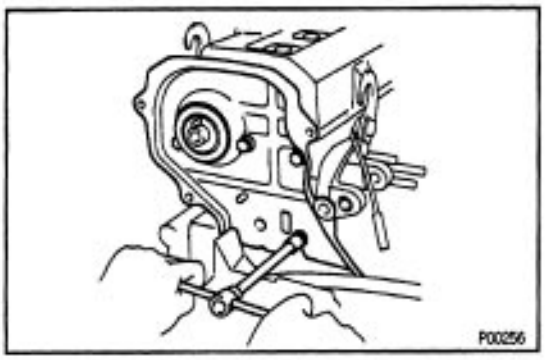


27. REMOVE CAMSHAFT TIMING PULLEY

(See steps 2 to 15 on pages EG1–26 to 28)

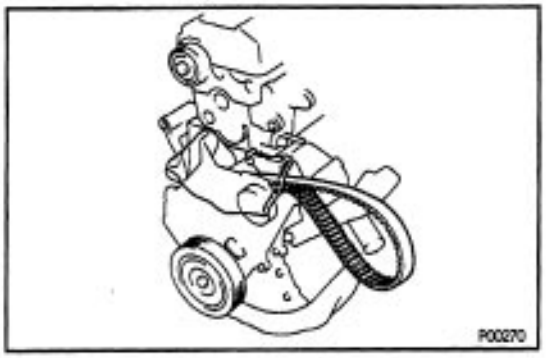
28. REMOVE NO. 1 IDLER PULLEY AND TENSION SPRING

Remove the bolt, pulley and tension spring.



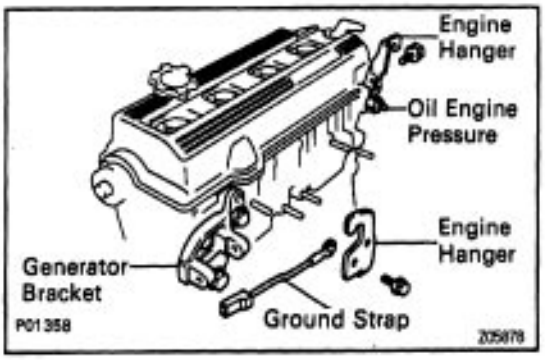
29. REMOVE NO.3 TIMING BELT COVER

Remove the 4 bolts and timing and cover.



NOTICE:

- **Support the timing belt, :o the meshing of crank–shaft timing pulley and timing belt does not shift.**
- **Be careful not to drop anything inside the timing belt cover.**
- **Do not allow the belt to come into correct with oil, water or dust.**



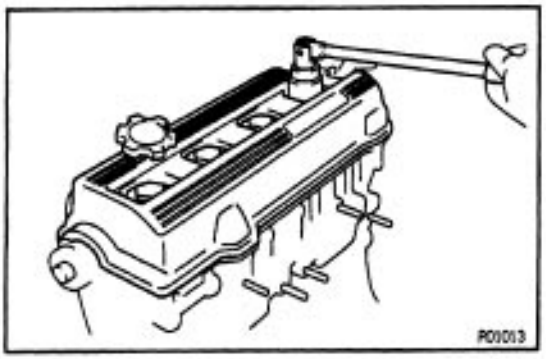
30. REMOVE ENGINE HANGERS

Remove the bolt and engine hanger. Remove the 2 engine hangers. Remove the ground strap.

31. REMOVE GENERATOR BRACKET

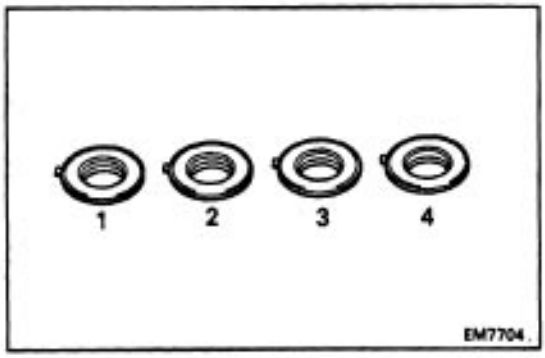
Remove the 3 bolts and generator bracket.

32. REMOVE OIL PRESSURE SWITCH

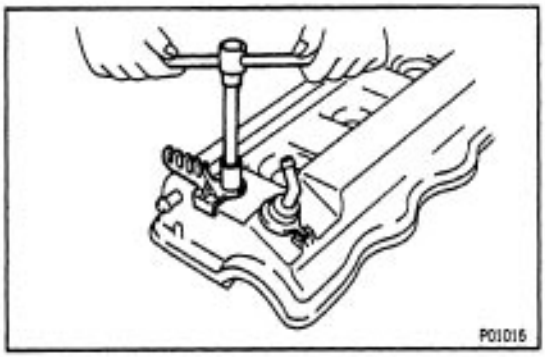


33. REMOVE CYLINDER HEAD COVER

Remove the 4 nuts, grommets, head cover and gasket.



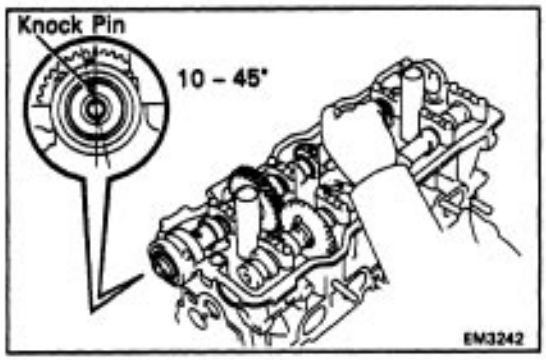
HINT: Arrange the grommets in correct order, so that they can be reinstalled into their original positions. This minimizes any possibility of oil leakage due to reuse of grommets.



34. REMOVE HIGH – TENSION CORDS CLAMP AND PCV VALVE

35. REMOVE CAMSHAFTS

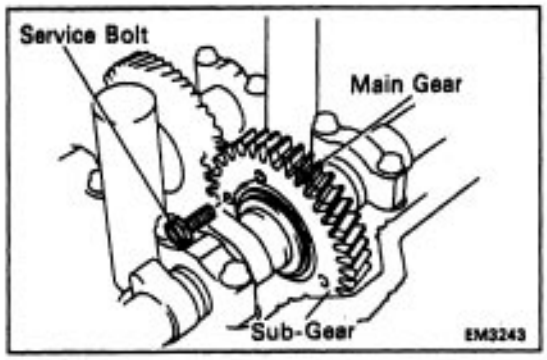
NOTICE: Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following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



A. Remove exhaust camshaft

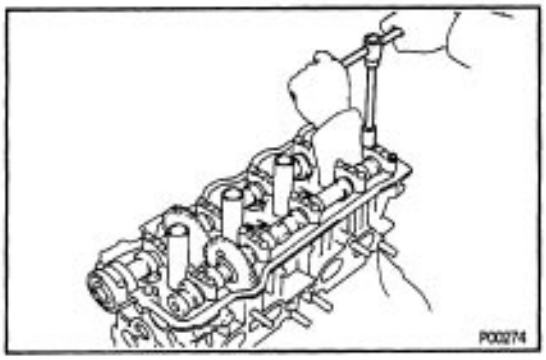
(a) Set the knock pin of the intake camshaft at 10–45° BTDC of camshaft position.

HINT: The above angle allows No.2 and No.4 cylinder cam lobes of the exhaust camshaft to push their valve lifters evenly.

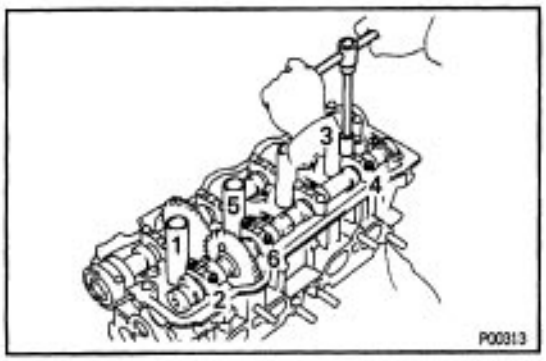


(b) Secure the exhaust camshaft sub gear to drive gear with a service bolt.
Recommended service bolt:
Thread diameter6 mm
Thread pitch 1.0 mm
Bolt length 16–20 m m (0.63–0.79 in.)

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



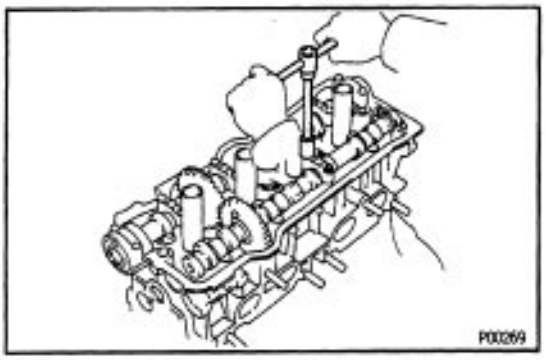
(c) Remove the 2 bolts and rear bearing cap.



(d) Uniformly loosen and remove the6 bolts on the No. 1, No.2 and No.4 bearing caps in several passes in the sequence shown.

NOTICE: Do not remove the No.3 bearing cap bolts at this stage.

(e) Remove the No. 1, No.2 and No.4 bearing caps.



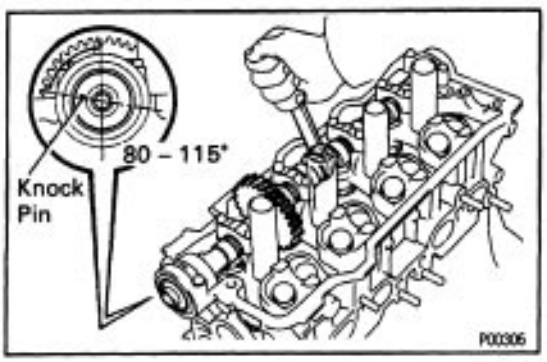
(f) Alternately loosen and remove the 2 bolts on the No. 3 bearing cap.

HINT:

- As the 2 No.3 bearing cap bolts are loosened, make sure that the camshaft is lifted out straight and level.
- If the camshaft is not being lifted out straight and level, retighten the 2 No.3 bearing cap bolts. Then reverse the order of above steps from (f) to (a) and reset the knock pin of the intake camshaft at 10–45° BTDC, and repeat steps from
  (b) to
  (f) once again.

NOTICE: Do not pry on or attempt to force the camshaft with a tool or other object.

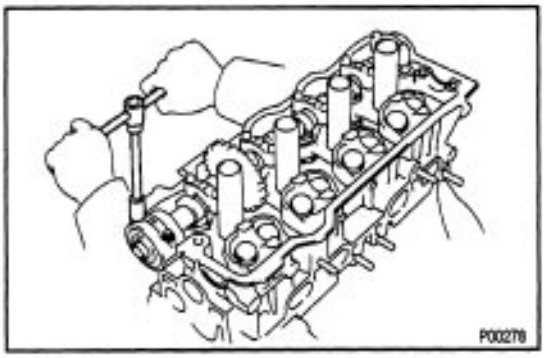
(g) Remove the No.3 bearing cap and exhaust camshaft.



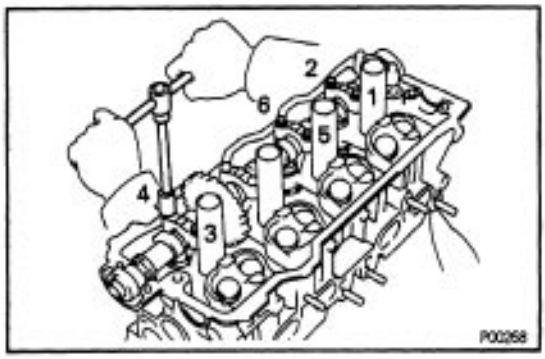
B. Remove intake camshaft

(a) Set the knock pin of the intake camshaft at 80–115° BTDC of camshaft angle.

HINT: The above angle allows the No.1 and No.3 cylinder cam lobes of intake camshaft to push their valve lifters evenly.



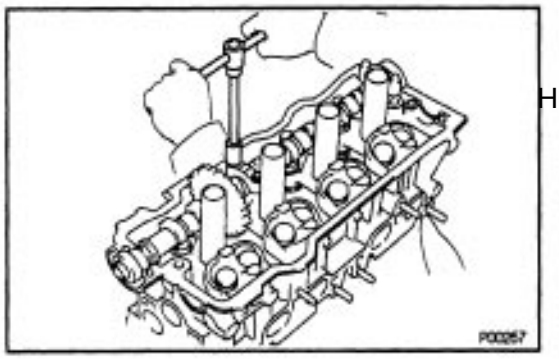
(b) Remove the 2 bolts, front bearing cap and oil seal.



(c) Uniformly loosen and remove the6 bolts on the No.1, No.3 and No.4 bearing caps in several passes in the sequence shown.

NOTICE: Do not remove the No.2 bearing cap bolts at this stage.

(d) Remove the No. 1, No.3 and No.4 bearing caps.



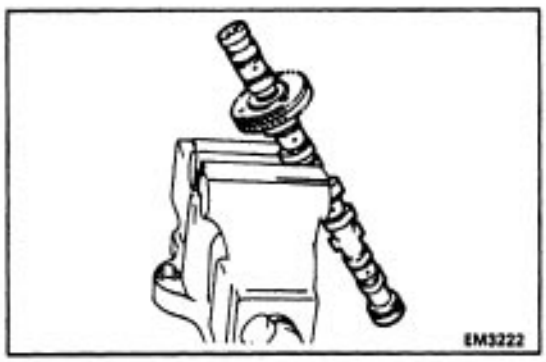
(e) Alternately loosen and remove the 2 bolts on the No. 2 bearing cap.

HINT:

- As the 2 No.2 bearing cap bolts are loosened, make sure that the camshaft is lifted out straight and level, after breaking adhesion on the front bearing cap.
- If the camshaft is not being lifted out straight and level, retighten the 2 No.2 bearing cap bolts. Reverse the order of above steps from (e) to (a) and reset the knock pin of the intake camshaft at 80–115*6TDC, and repeat steps from (b) to (e) once again.

NOTICE: Do not pry on or attempt to force the camshaft with a tool or other object.

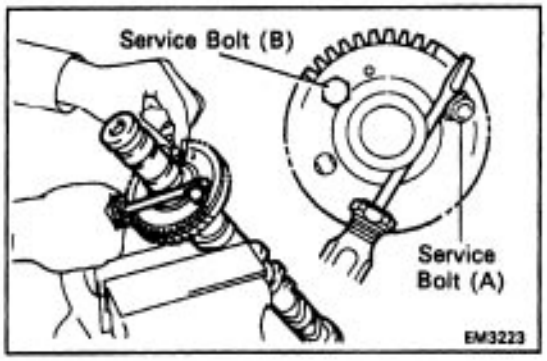
(f) Remove the No.2 bearing cap and camshaft.



36. DISASSEMBLE EXHAUST CAMSHAFT

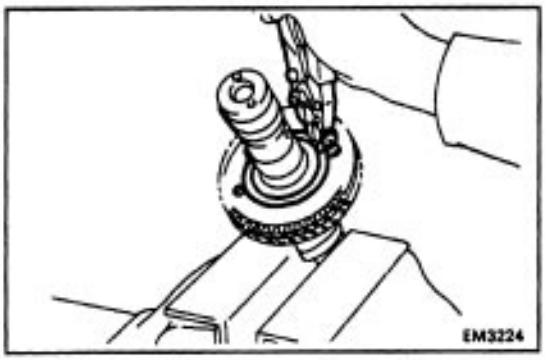
(a) Mount the hexagon wrench head portion of the cam–shaft in a vise.

NOTICE: Be careful not to damage the camshaft.

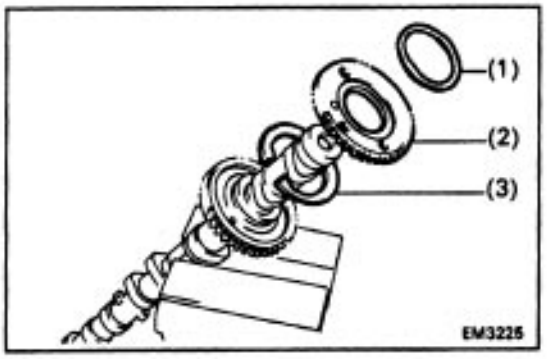


(b) Insert a service bolt (A) into the service hole of the camshaft sub gear.
(c) Using a screwdriver, turn the sub gear clockwise, and remove the service bolt (B).

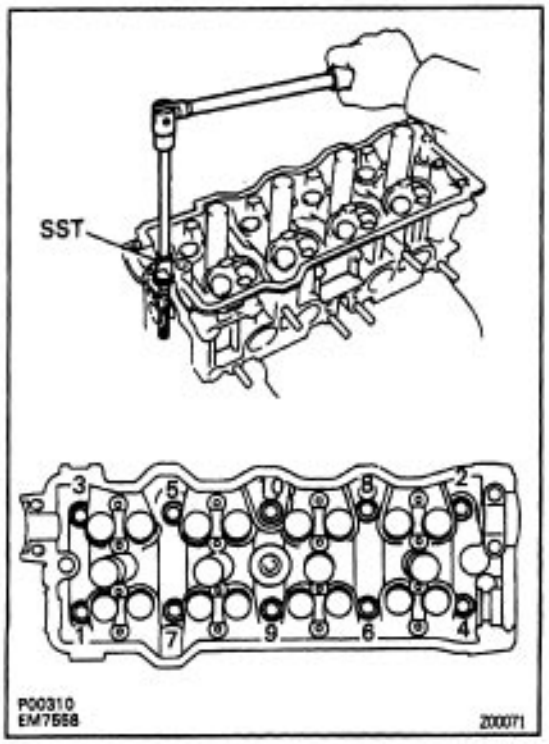
NOTICE: Be careful not to damage the camshaft.



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



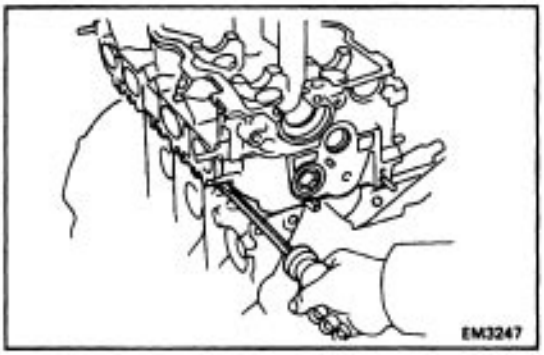
(e) Remove the following parts:
(1) Wave washer
(2) Camshaft sub gear
(3) Camshaft gear spring



37. REMOVE CYLINDER HEAD

(a) Using SST, uniformly loosen and remove the 10 cylin–der head bolts in several passes, in the sequence shown.
SST 09011– 38121

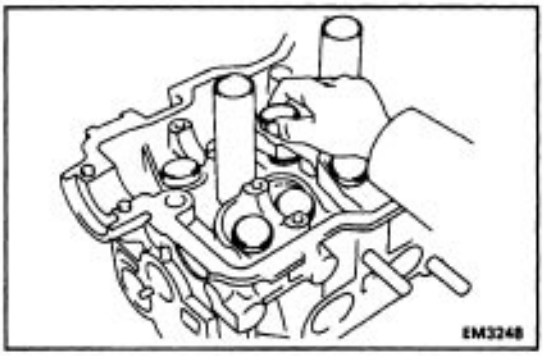
NOTICE: Cylinder head warpage or cracking could result from removing bolts in incorrect order.



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

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

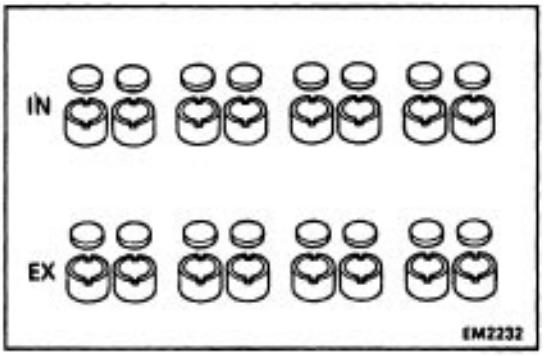
NOTICE: Be careful not to damage the contact surfaces of the cylinder head and cylinder block.



CYLINDER HEAD DISASSEMBLY

(See Components for Removal and Installation)

1. REMOVE VALVE LIFTERS AND SHIMS

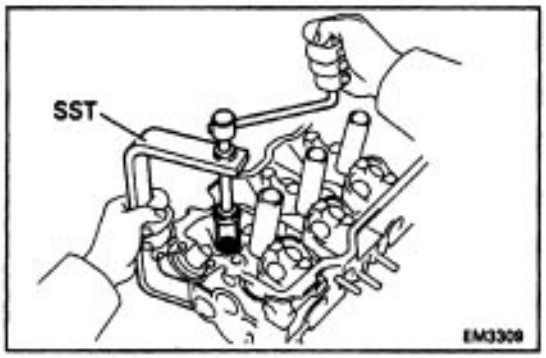


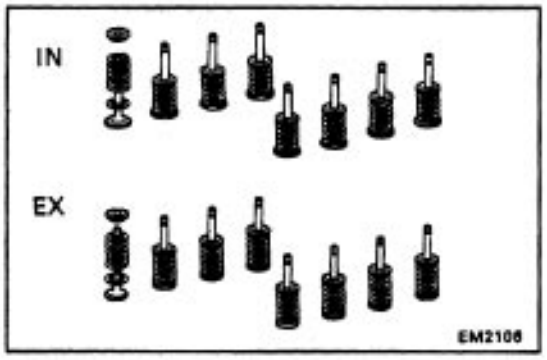
HINT: Arrange the valve lifters and shims in correct order.

2. REMOVE VALVES

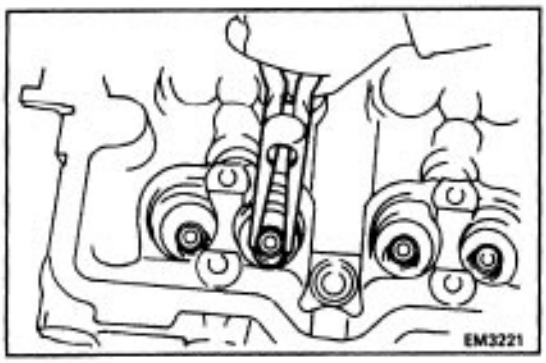
(a) Using SST, compress the valve spring and remove the 2 keepers.
SST 09202 – 70010

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

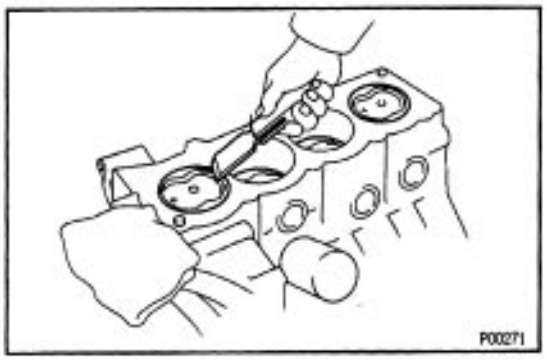




HINT: Arrange the valves, valve springs, spring seats and spring retainers in correct order.



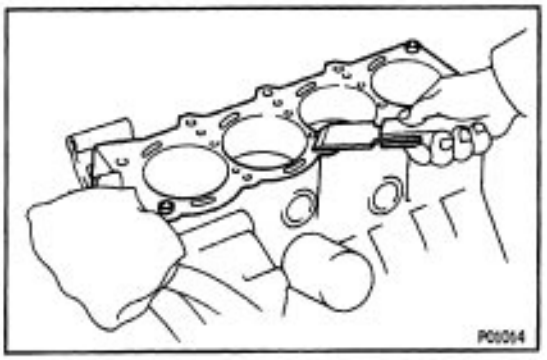
(c) Using needle–nose pliers, remove the oil seal.



CYLINDER HEAD COMPONENTS INSPECTION, CLEANING AND REPAIR

1. CLEAN TOP SURFACES OF PISTONS AND CYLINDER BLOCK

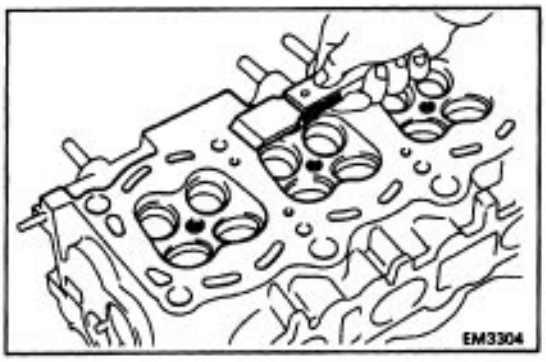
(a) Turn the crankshaft, and bring each piston to top dead center (TDC). Using a gasket scraper, remove all the carbon from the piston top surface.



(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.

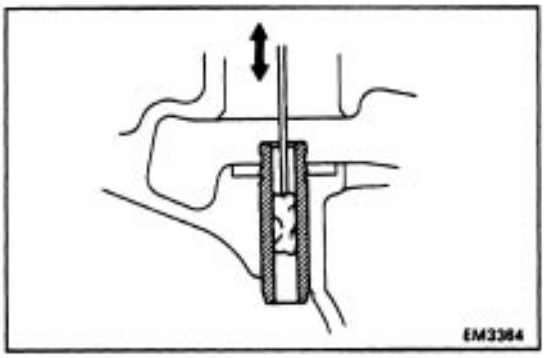
NOTICE: Be careful not to scratch the cylinder block contact surface.



B. Clean combustion chambers

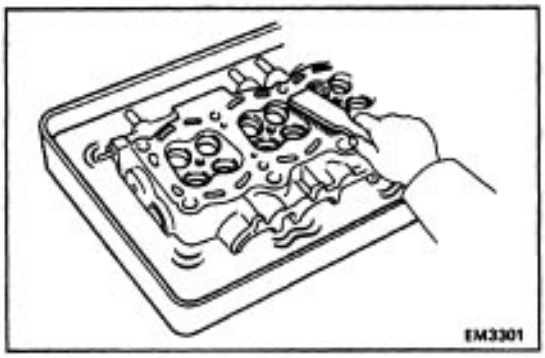
Using a wire brush, remove all the carbon from the combustion chambers.

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



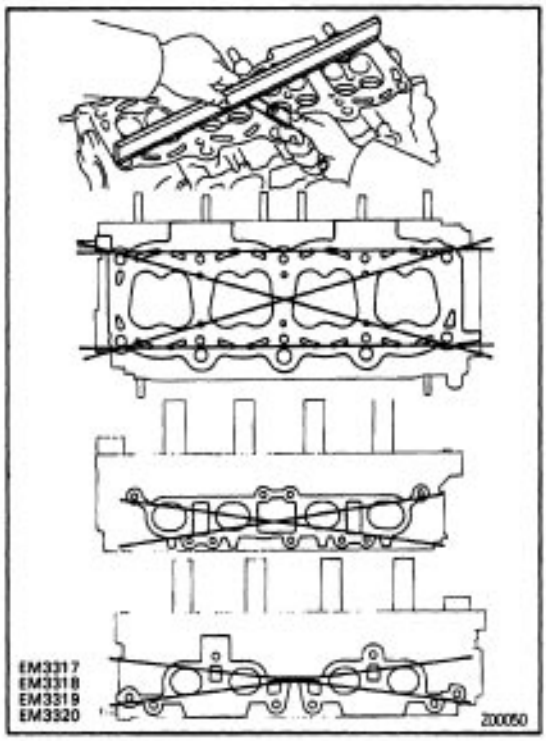
C. Clean valve guide bushings

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



D. Clean cylinder head

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



3. INSPECT CYLINDER HEAD

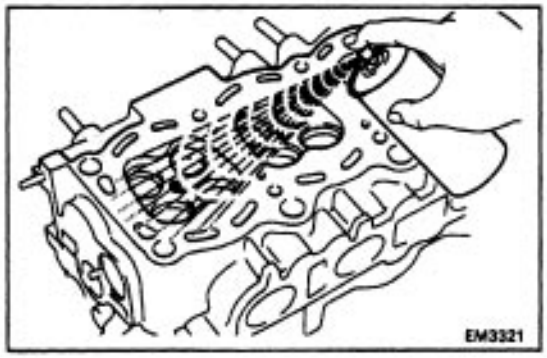
A. Inspect for flatness

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

Maximum warpage:

Cylinder block side
0.05 mm (0.0020 in.)
Manifold side
0.08 mm (0.0031 in.)

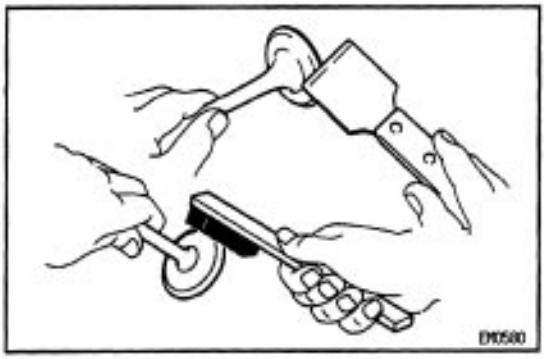
If warpage is greater than maximum, replace the cylin–der head.



B. Inspect for cracks

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

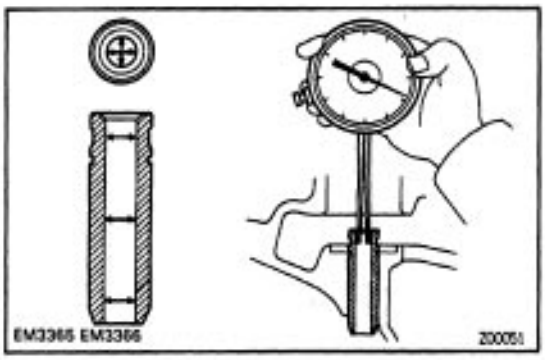
If cracked, replace the cylinder head.



4. CLEAN VALVES

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

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

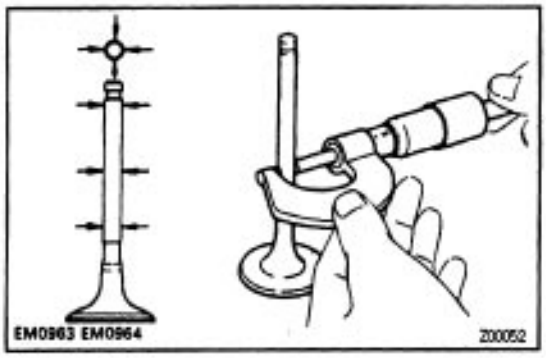


5. INSPECT VALVE STEMS AND GUIDE BUSHINGS

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

Bushing inside diameter:

6.010 –6.030 mm (0.2366 – 0.2374 in.)



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

Valve stem diameter:

Intake

5.970 – 5.985 mm (0.2350 – 0.2356 in.)

Exhaust

5.965 – 5.980 mm (0.2348 – 0.2354 In.)

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

Standard oil clearance:

Intake

0.025 – 0.060 mm (0.0010 – 0.0024 in.)

Exhaust

0.030 – 0.065 mm (0.0012 – 0.0028 in.)

Maximum oil clearance:

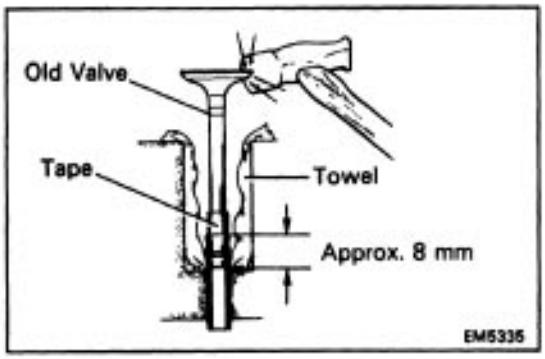
Intake

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.



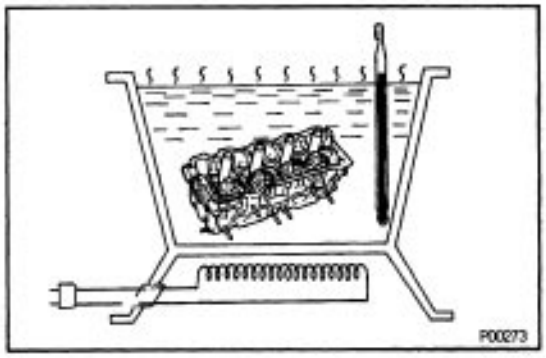
6. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS

(a) w/ Snap Ring:

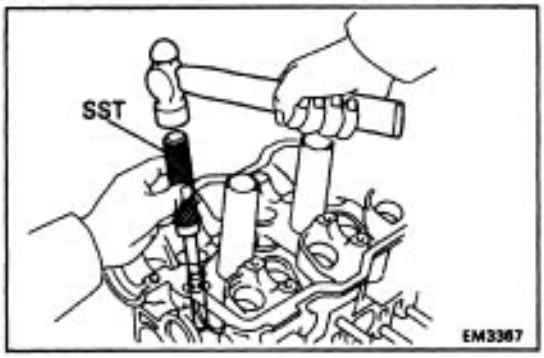
Insert an old valve wrapped with tape into the valve guide bushing, and break off the valve guide bushing by hitting it with a hammer. Remove the snap ring.

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

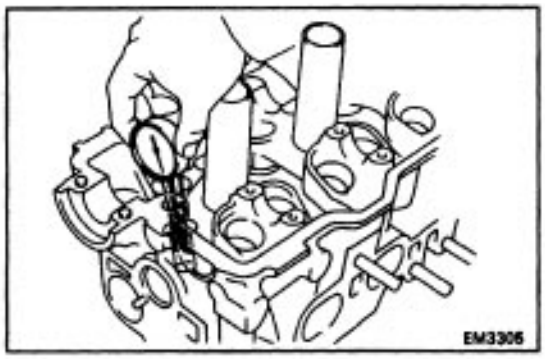
NOTICE: Be careful not to damage the valve lifter hole.



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



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



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

Both intake and exhaust

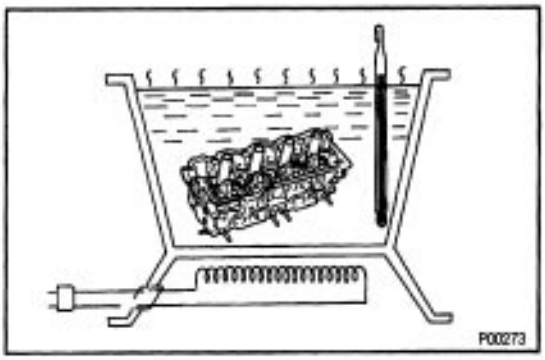
Bushing bore diameter mm (in.)	Bushing size
11.000 – 11.027 10.4331 – 0.4341)	Use STD
11.050 – 11.077 (0.4350 – 0.4361)	Use O/S 0.05

V00228

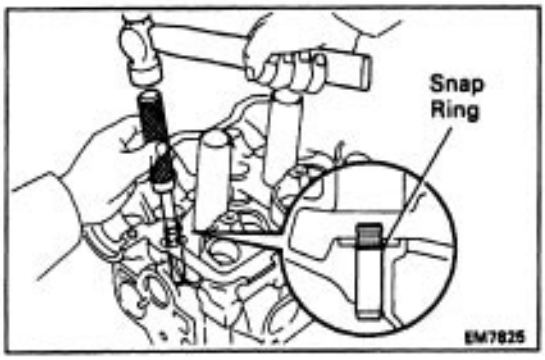
(e) Select a new guide bushing (STD size or O/S 0.05).

If the bushing bore diameter of the cylinder head is greater than 11.027 mm (0.4341 in.), machine the bushing bore to the following dimension:
11.050 – 11.077 mm (0.4350 – 0.4301 in.)

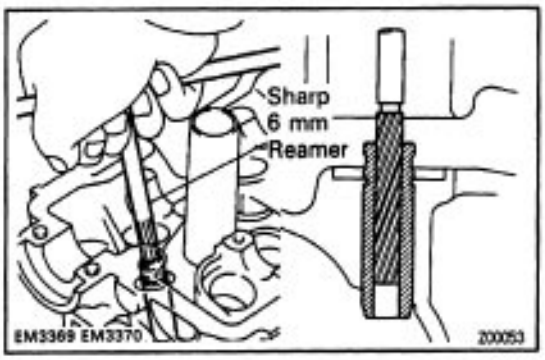
If the bushing bore diameter of the cylinder head is greater than 11.077 mm (0.4361 in.), replace the cylinder head.



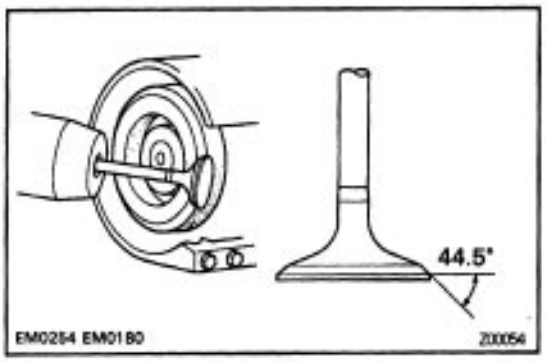
(f) Gradually heat the cylinder head to 80 –1001 C (1171 – 2121F).



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



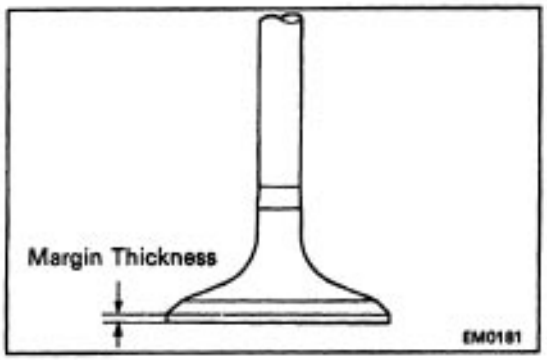
(h) Using a sharp6 mm reamer, ream the guide bushing to obtain the standard specified clearance (See page EG1–57) between the guide bushing and valve stem.



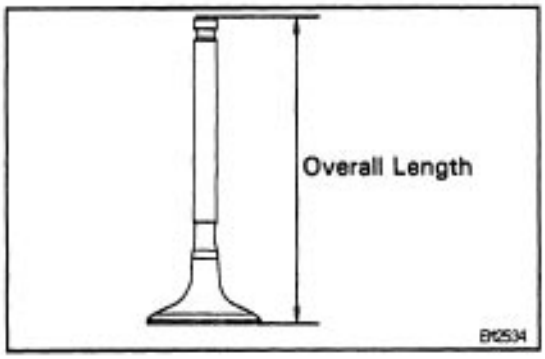
7. INSPECT AND GRIND VALVES

(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:
44.51



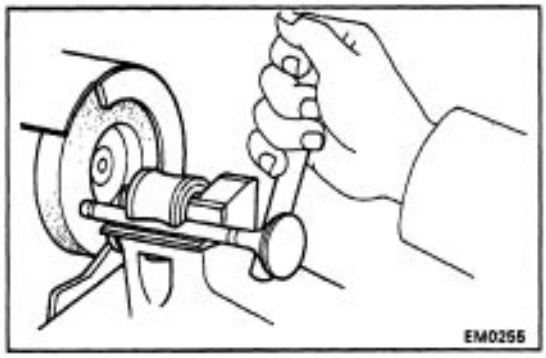
(c) Check the valve head margin thickness.
Standard margin thickness:
0.8 – 1.2 mm (0.031 – 0.047 in.)
Minimum margin thickness:
0.5 mm (0.020 in.)
If the margin thickness is less than minimum, replace the valve.



(d) Check the valve overall length.

Standard overall length:
Intake
97.60 mm (3.8425 in.)
Exhaust
98.45 mm (3.8760 in.)
Minimum overall length:
Intake
97.1 mm (3.823 in.)
Exhaust
98.0 mm (3.858 in.)

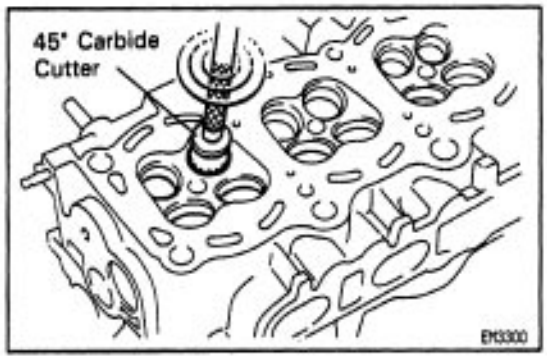
If the overall length is less than minimum, replace the valve.



(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.

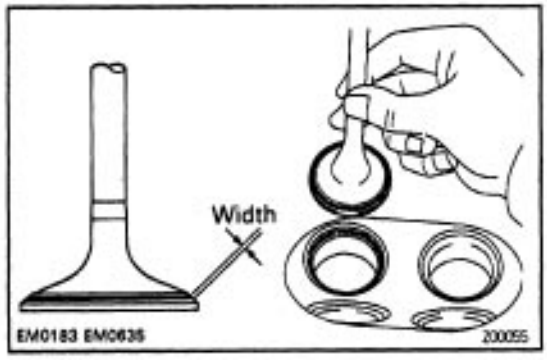
NOTICE: Do not grind off more than minimum.



8. INSPECT AND CLEAN VALVE SEATS

(a) Using a 45° carbide cutter, resurface the valve seats.

Remove only enough metal to clean the seats.

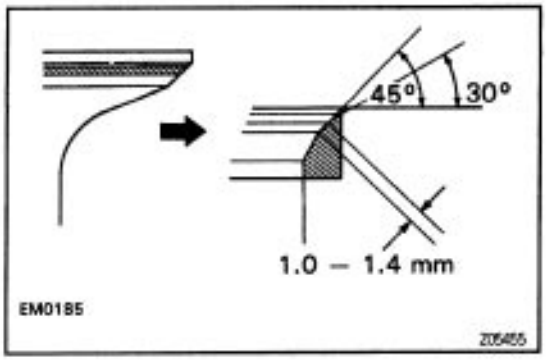


(b) Check the valve seating position.

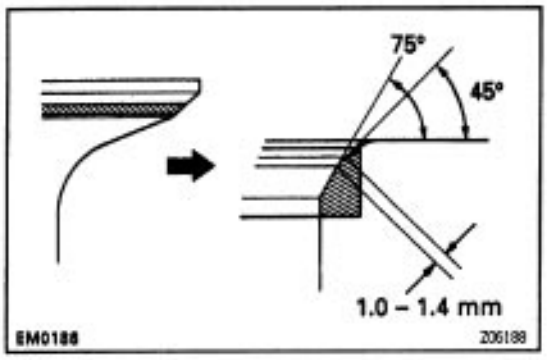
Apply a light coat of prussian blue (or white lead) to the valve face. Lightly press the valve against the seat. Do not rotate valve.

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

If blue appears 360° around the face, the valve is concentric. If not, replace the valve.

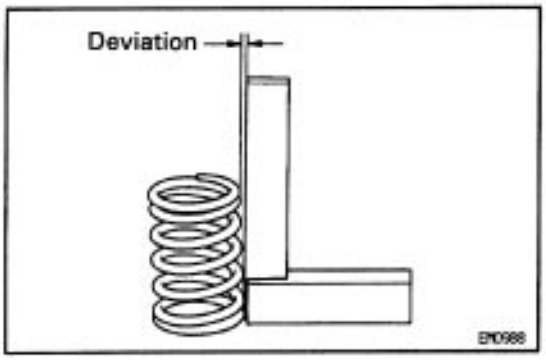


- If blue appears 3601 around the valve seat, the guide and face are concentric. If not, resurface the seat.
- Check that the seat contact is in the middle of the valve face with the following width:
  1.0 – 1.4 mm (0.039 – 0.055 in.)
  If not, correct the valve seat as follows:
  (1) If the seating is too high on the valve face, use 301 and 451 cutters to correct the seat.
  (2) If the seating is too low on the valve face, use 751 and 451 cutters to correct the seat.



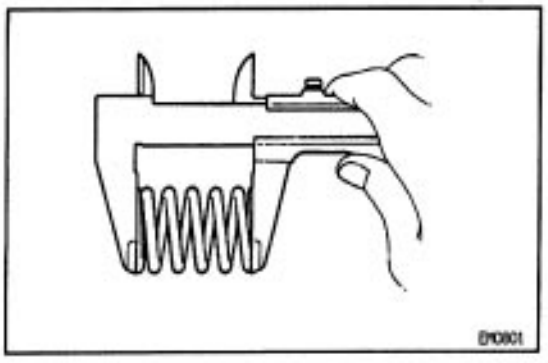


(d) Hand–lap the valve and valve seat with an abrasive compound.
(e) After hand–lapping, clean the valve and valve seat.

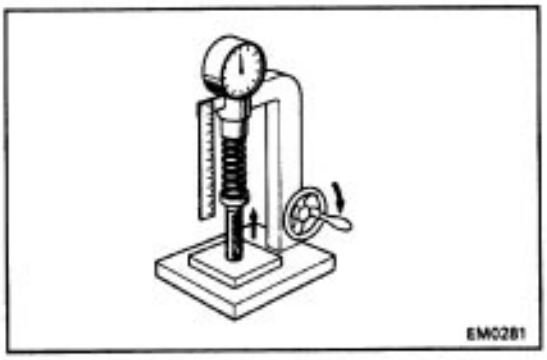


9. INSPECT VALVE SPRINGS

(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.



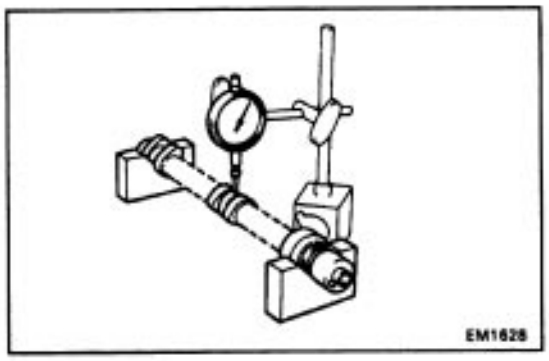
(b) Using a vernier caliper, measure the free length of the valve spring.
Free length:
41.96 – 41.99 mm (1.6520 – 1.6531 in.)
If the free length is not as specified, replace the valve spring.



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

Installed tension:
164 – 189 N (16.7 – 19.3 kgf, 36.8 – 42.5 lbf)
at 34.7 mm (1.336 in.)

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



10. INSPECT CAMSHAFTS AND BEARINGS

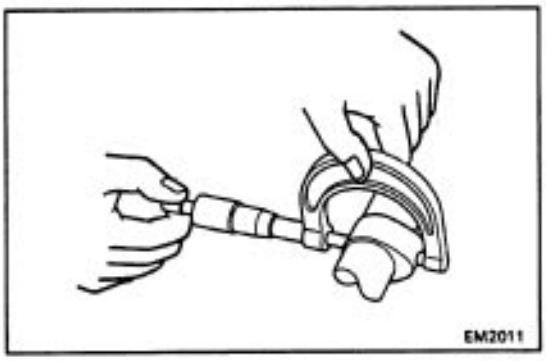
A. Inspect camshaft for runout

(a) Place the camshaft on V – blocks.

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

Maximum circle runout:
0.04 mm (0.0016 in.)

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

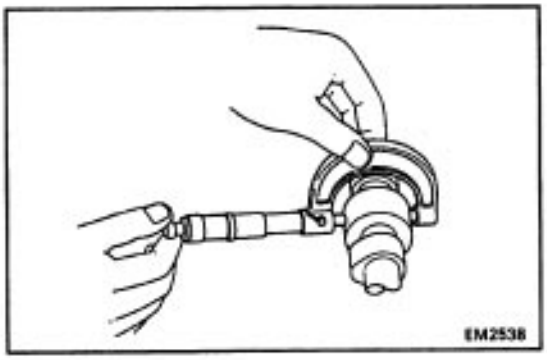


B. Inspect cam lobes

Using a micrometer, measure the cam lobe height.

Standard cam lobe height:
Intake
42.01 – 42.11 mm (1.6539 – 1.6579 in.)
Exhaust
40.06 – 40.18 mm (1.5772 – 1.5811 In.)
Minimum cam lobe height:
Intake
41.90 mm (1.6496 in.)
Exhaust
39.95 mm (1.5728 in.)

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

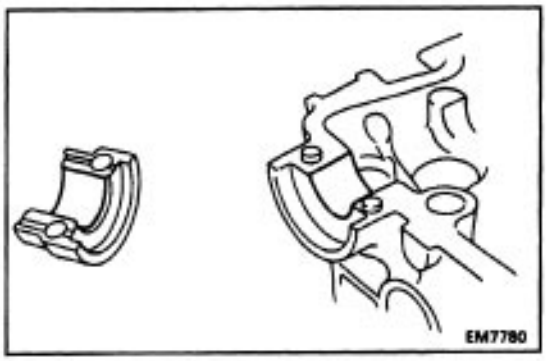


C. Inspect camshaft journals

Using a micrometer, measure the journal diameter.

Journal diameter:
26.959 – 28.975 mm 11.0814 – 1.0620 in.)

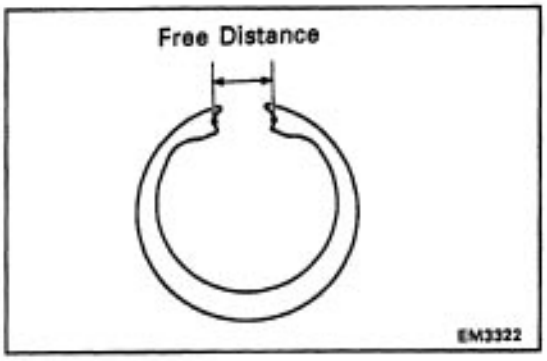
If the journal diameter is not as specified, check the oil clearance.



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.



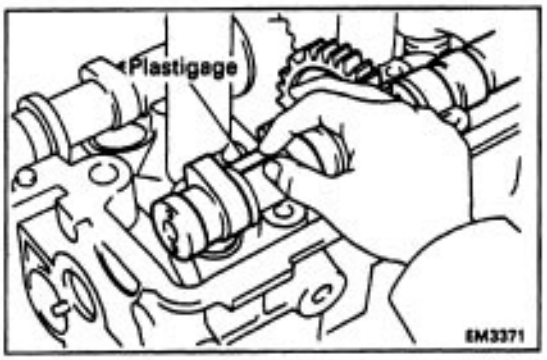
E. Inspect camshaft gear spring

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

Free distance:

22.5 – 22.9 mm (0.886 – 0.902 in.)

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

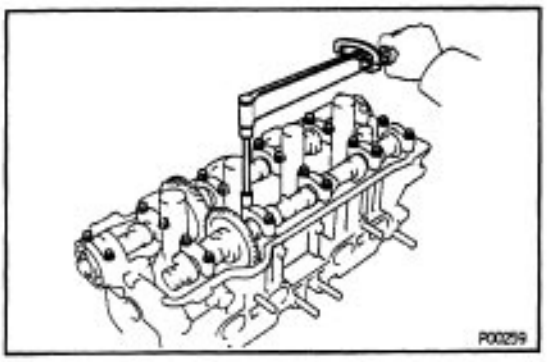


F. Inspect camshaft journal oil clearance

(a) Clean the bearing caps and camshaft journals.

(b) Place the camshafts on the cylinder head.

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

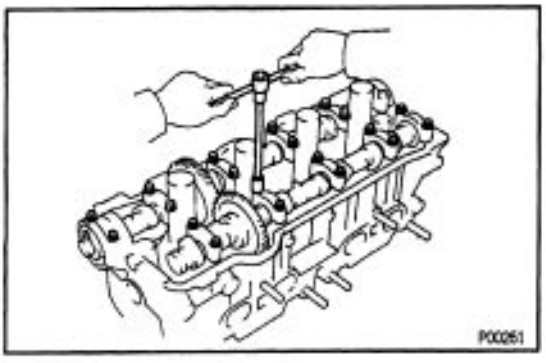


(d) Install the bearing caps.

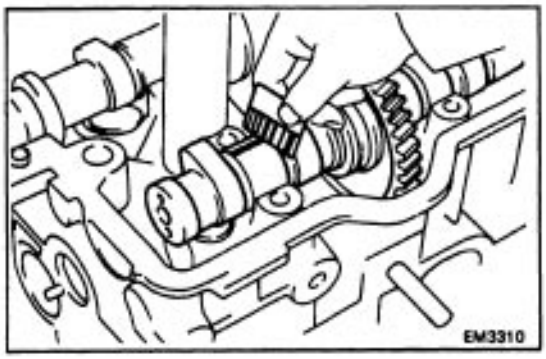
(See step 4 on pages EG1–69 to 71)

Torque: 19 N–m (190 kgf–cm, 14 ft–lbf)

NOTICE: Do not turn the camshaft.



(e) Remove the bearing caps.

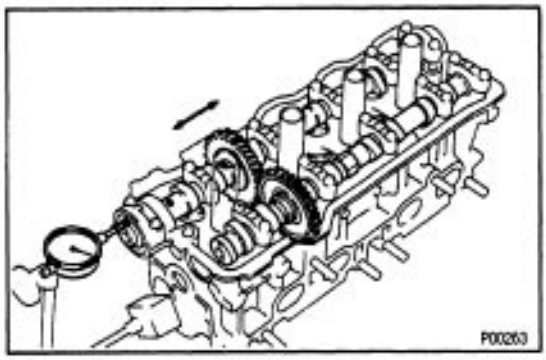


(f) Measure the Plastigage at its widest point.

Standard oil clearance:
0.025 – 0.062 mm (0.0010 – 0.0024 In.)
Maximum oil clearance:
0.10 mm (0.0039 in.)

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

(g) Completely remove the Plastigage.



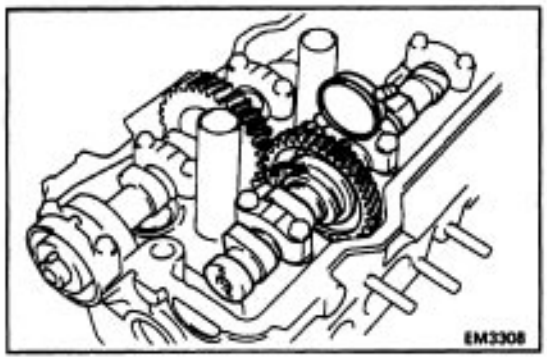
G. Inspect camshaft thrust clearance

(a) Install the camshaft.
(See step 4 on pages EG1–69 to 71)

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

Standard thrust clearance:
Intake
0.045 – 0.100 mm (0.0018 – 0.0039 in.)
Exhaust
0.030 – 0.085 mm (0.0012 – 0.0033 in.)
Maximum thrust clearance:
Intake
0.12 mm (0.0047 in.)
Exhaust
0.10 mm (0.0039 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.



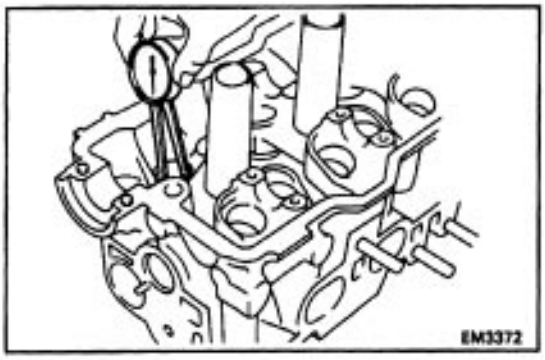
H. Inspect camshaft gear backlash

(a) Install the camshafts without installing the exhaust cam sub gear.
(See step 4 on pages EG1–69 to 71)

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

Standard backlash:
0.020 – 0.200 mm (0.0008 – 0.0079 in.)
Maximum backlash:
6.30 mm (0.0188 in.)

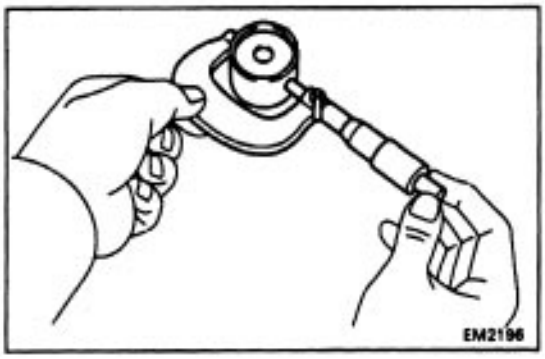
If the backlash is greater then maximum, replace the camshafts.



11. INSPECT VALVE LIFTERS AND LIFTER BORES

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

Lifter bore diameter:
31.000 – 31.018 mm (1.2205 – 1.2213 In.)

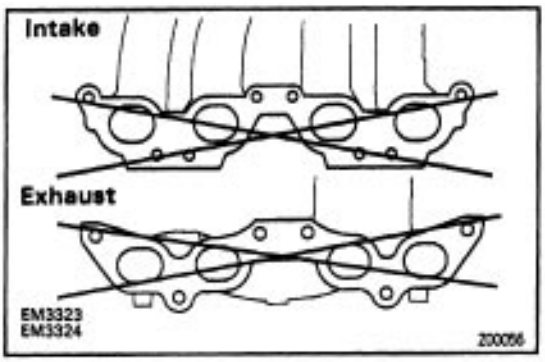


(b) Using a micrometer, measure the lifter diameter.

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

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

Standard oil clearance:
0.024 – 0.052 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 MANIFOLDS

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

Maximum warpage:
0.30 mm (0.0 118 In.)

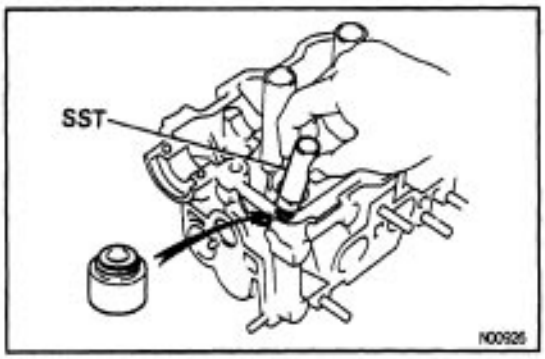
If warpage is greater than maximum, replace the manifold.

CYLINDER HEAD ASSEMBLY

(See Components for Removal and Installation)

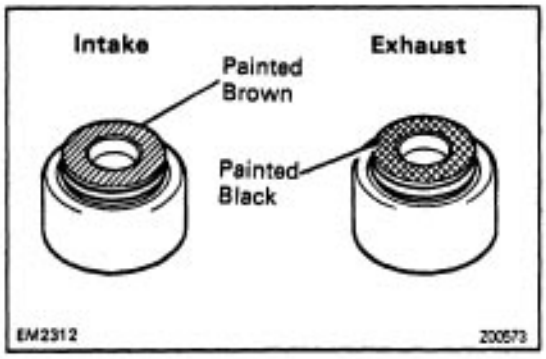
HINT:

- 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.

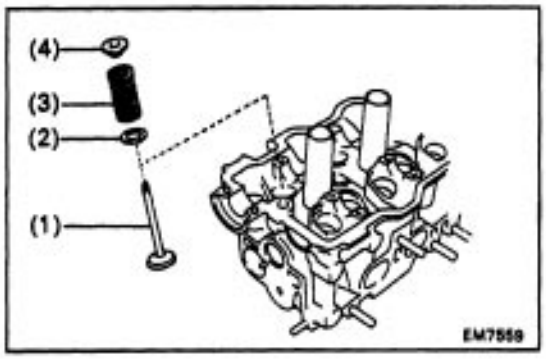


1. INSTALL VALVES

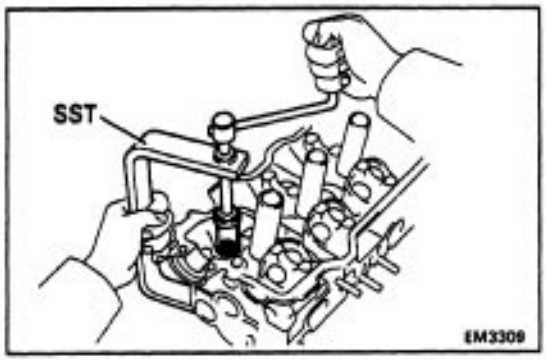
(a) Using SST, push in a new oil seal.
SST 09201 –41020



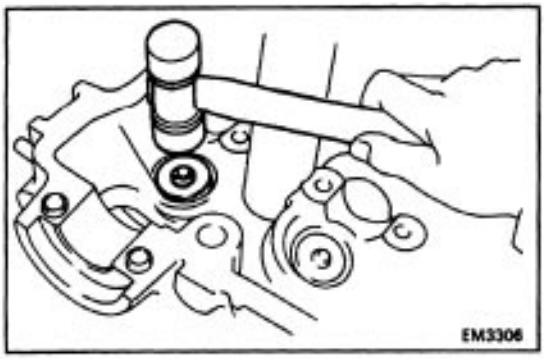
HINT: The intake valve oil seal is brown and the exhaust valve oil seal is black.



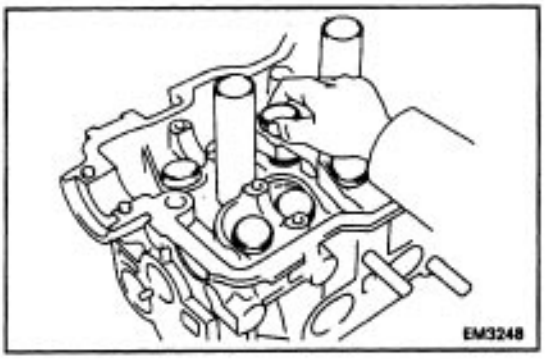
(b) Install the following parts:
(1) Valve
(2) Spring seat
(3) Valve spring
(4) Spring retainer



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



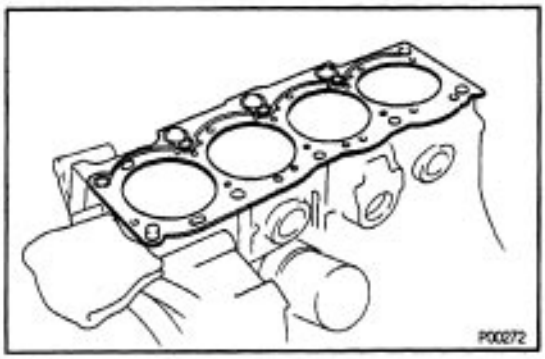
(d) Using a plastic–faced hammer, lightly tap the valve stem tip to assure proper fit.



2. 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 HEAD

A. Place cylinder head on cylinder block

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

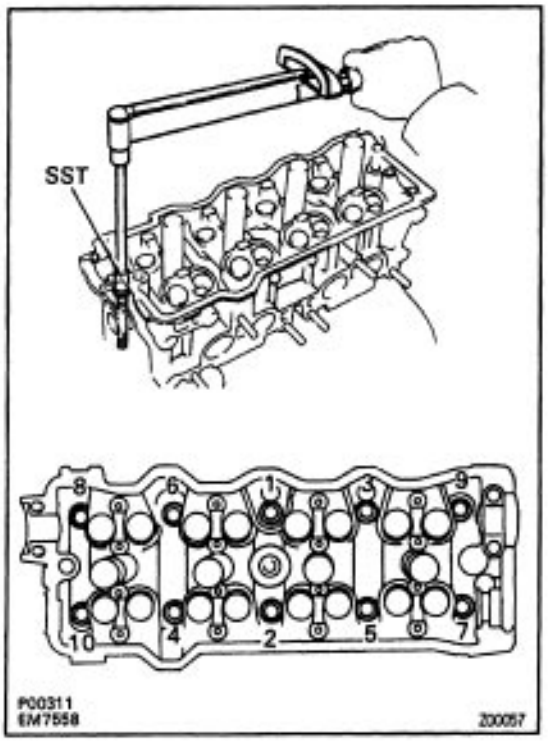
NOTICE: Be careful of the installation direction.

(b) Place the cylinder head in position on the cylinder head gasket.

B. Install cylinder head bolts

HINT:

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



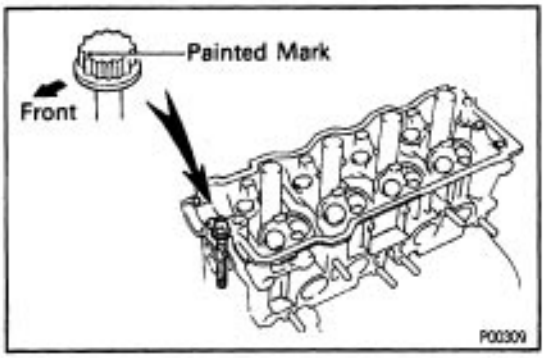
(a) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.

(b) Using SST, install and uniformly tighten the 10 cylin–der head bolts and plate washers in several passes, in the sequence shown.

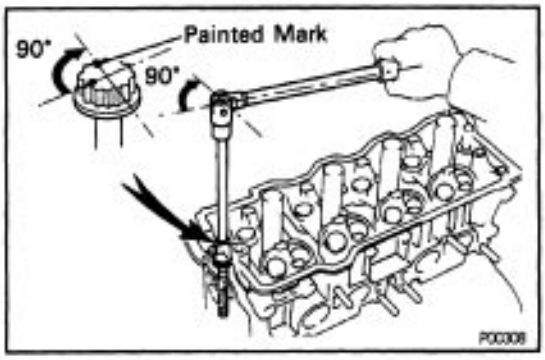
SST 09011– 38121

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

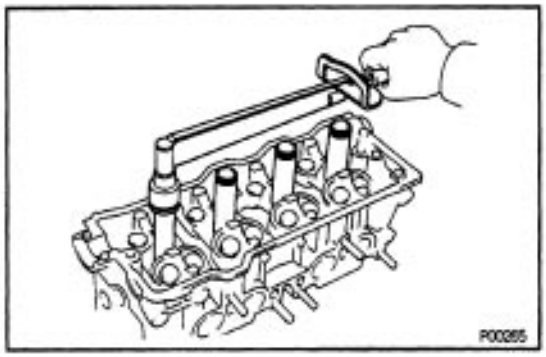
If any one of the cylinder head bolts does not meet the torque specification, replace the cylinder head bolt.



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



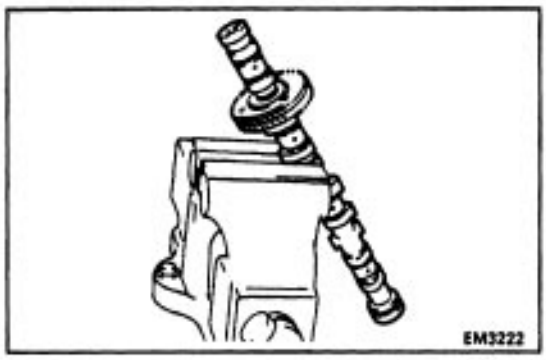
(d) Retighten the cylinder head bolts 90° in the sequence shown on the previous page.
(e) Check that the painted mark is now at a 90° angle to front.



2. INSTALL SPARK PLUG TUBES

(a) Clean the cylinder head tube holes of any residua! adhesive, oil or foreign particles. Remove any oil with kerosene or gasoline.
(b) Screw the threads of the spark plug tube coated with adhesive into the cylinder head.
(c) Using the spark plug tube nut and a 30 mm socket wrench, tighten the spark plug tubes.

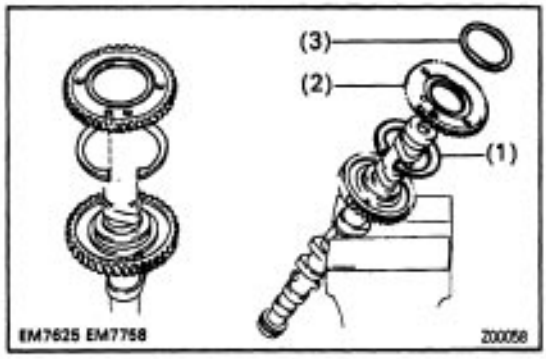
Torque: 39 N–m (400 kgf–cm, 29 ft–lbf)



3. ASSEMBLY EXHAUST CAMSHAFT

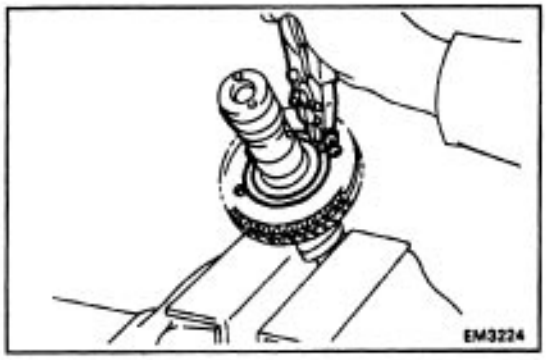
(a) Mount the hexagon wrench head portion of the cam–shaft in a vise.

NOTICE: Be careful not to damage the camshaft.

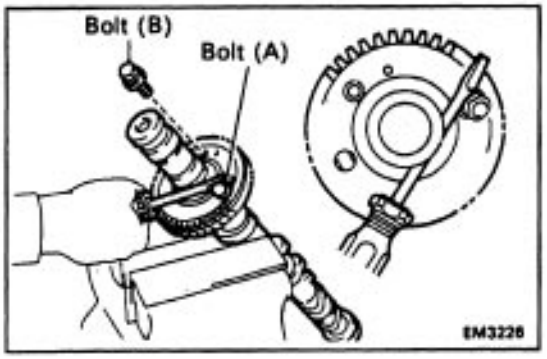


(b) Install the following parts:
(1) Camshaft gear spring
(2) Camshaft sub gear
(3) Wave washer

HINT: Align the pins on the gears with the spring ends.



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

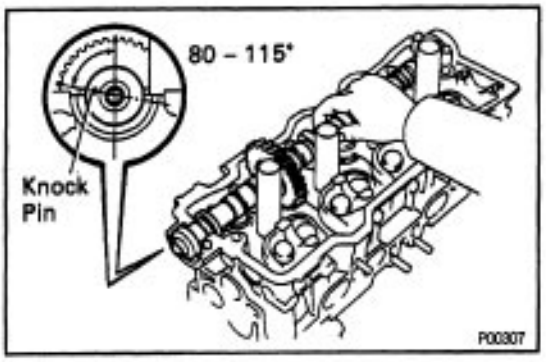


(d) Insert a service bolt (A) into the service hole of the camshaft sub gear.
(e) Using a screwdriver, align the holes of the camshaft main gear and sub gear by turning camshaft sub gear clockwise, and install a service bolt (13).

NOTICE: Be careful not to damage the camshaft.

4. INSTALL CAMSHAFTS

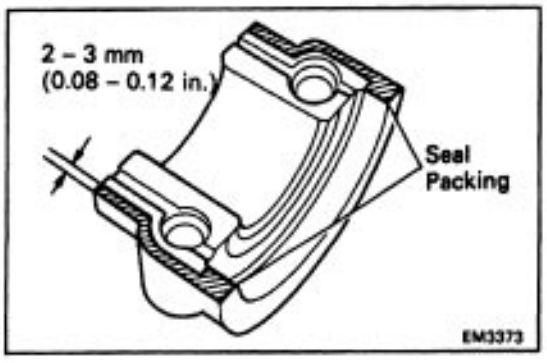
NOTICE: Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the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



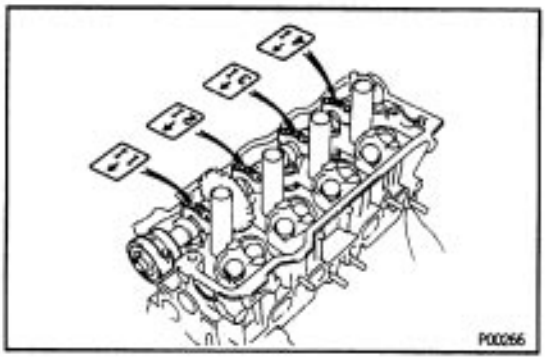
A. Install intake camshaft

(a) Apply MP grease to the thrust portion of the cam–shaft.
(b) Place the intake camshaft at 80–115° BTDC of cam–shaft angle, on the cylinder head.

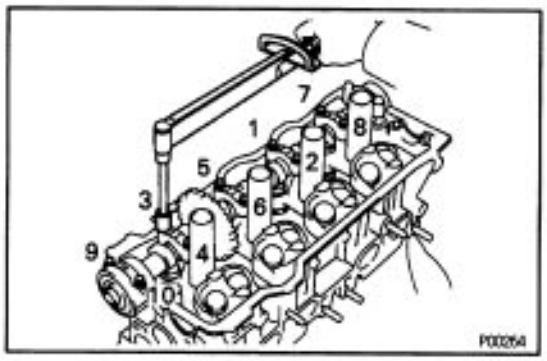
HINT: The above angle arrows the No.1 and No.3 cylinder cam lobes of the intake camshaft to push their valve lifters evenly.



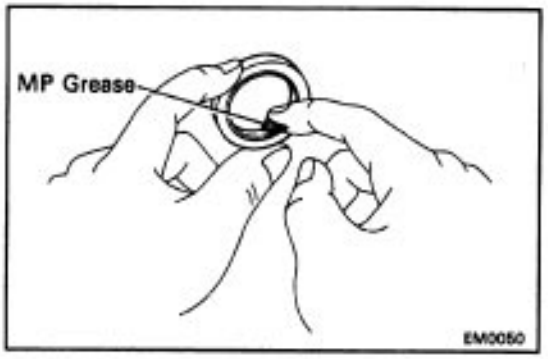
(c) Apply seal packing to the No. 1 bearing cap as shown.
Seal packing:
Part No.08826 –00080 or equivalent



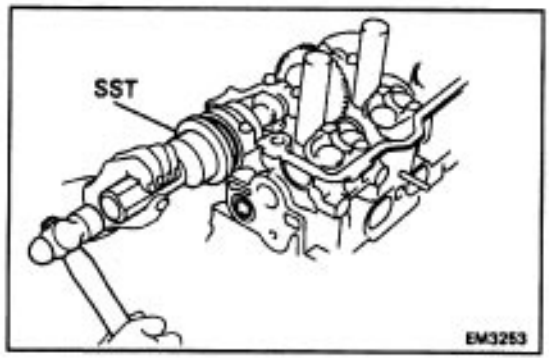
(d) Install the bearing caps in their proper locations.



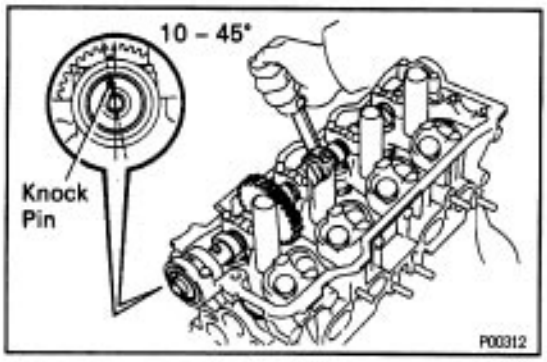
(e) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.
(f) Install and uniformly tighten the 10 bearing cap bolts in several passes, in the sequence shown.
Torque: 19 N–m (190 kgf–cm, 14 ft–lbf)



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



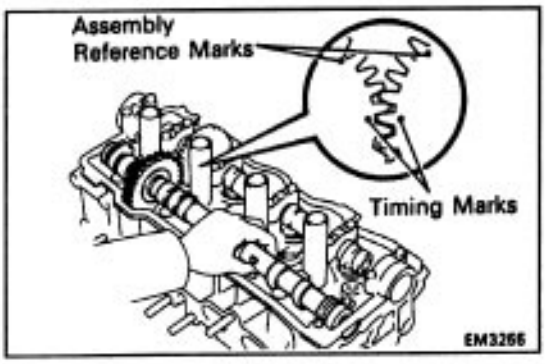
(h) Using SST, tap in the oil seal.
SST 09223–4601 1



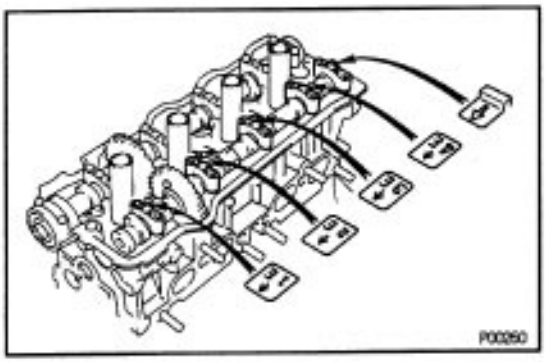
B. Install exhaust camshaft

(a) Set the knock pin of the intake camshaft at 10–45° BTDC of camshaft angle.

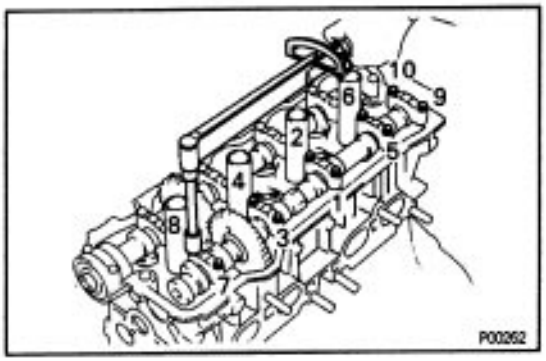
HINT: The above angle allows the No.2 and No.4 cylinder cam lobes of the exhaust camshaft to push their valve lifters evenly.



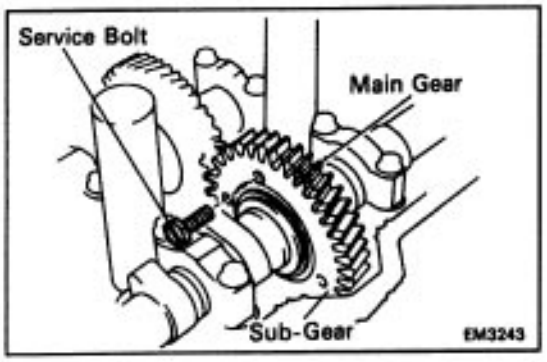
(b) Apply MP grease to the thrust portion of the cam–shaft.
(c) Engage the exhaust camshaft gear to the intake cam–shaft gear by matching the timing marks on each gear.
(d) Roll down the exhaust camshaft onto the bearing journals while engaging gears with each other.
NOTICE: There are also assembly reference marks on each gear as shown in the Illustration. Do not use these marks.



(e) Turn the intake camshaft clockwise or counterclockwise little by little until the exhaust camshaft sits in the bearing journals evenly without rocking the cam–shaft on the bearing journals.
NOTICE: It is very important to replace the camshaft in the bearing journals evenly while tightening bearing caps in the subsequent steps.
(f) Install the bearing caps in their proper locations.

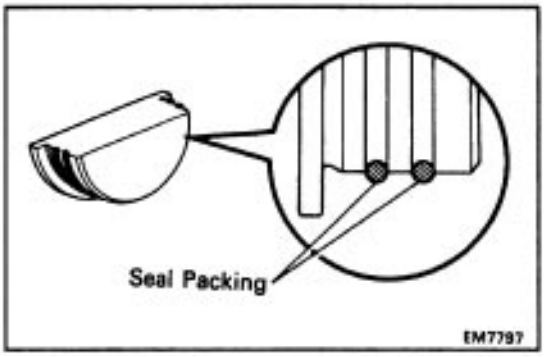


(g) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.
(h) Install and uniformly tighten the 10 bearing cap bolts in several passes, in the sequence shown.
Torque: 19 N–m (190 kgf–cm, 14 ft–lbf)



(i) Remove the service bolt (B).

5. CHECK AND ADJUST VALVE CLEARANCE
(See page EG1–12**)**
Turn the camshaft and position the cam lobe upward, and check and adjust the valve clearance.
Valve clearance (Cold):
Intake
0.19 – 0.29 mm (0.007 – 0.011 In.)
Exhaust
0.28 – 0.38 mm (0.011 – 0.015 In.)

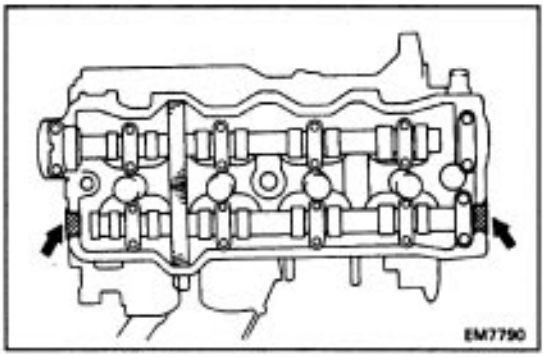


6. INSTALL SEMI–CIRCULAR PLUGS

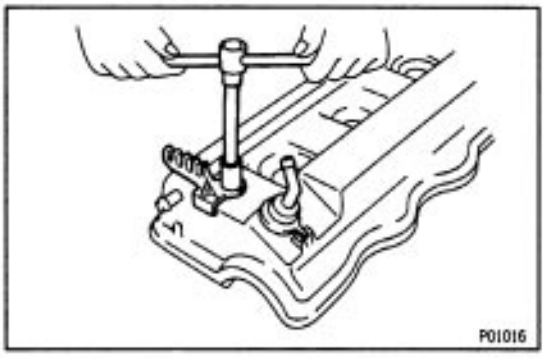
(a) Remove any old packing (FIPG) material.

(b) Apply seal packing to the semi–circular plug grooves.

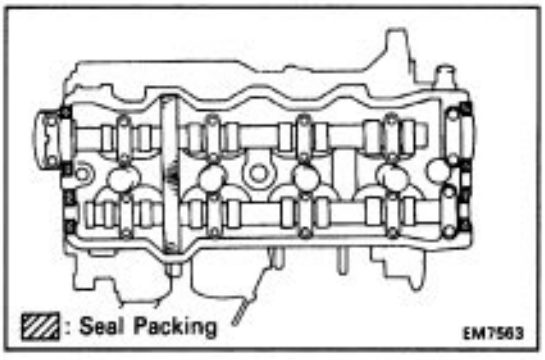
Seal packing:
Part No.08826–00080 or equivalent



(c) Install the 2 semi–circular plugs to the cylinder head.



7. INSTALL PCV VALVE AND HIGH–TENSION CORDS CLAMP

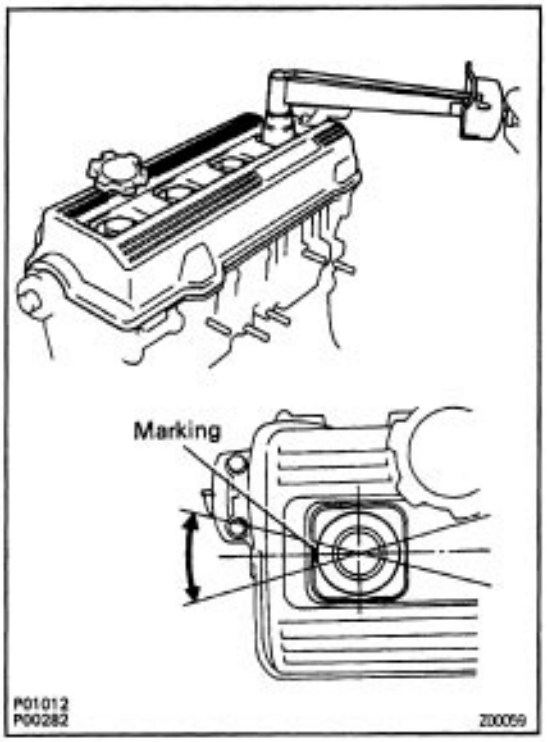


8. INSTALL CYLINDER HEAD COVER

(a) Remove any old packing (FIPG) material.

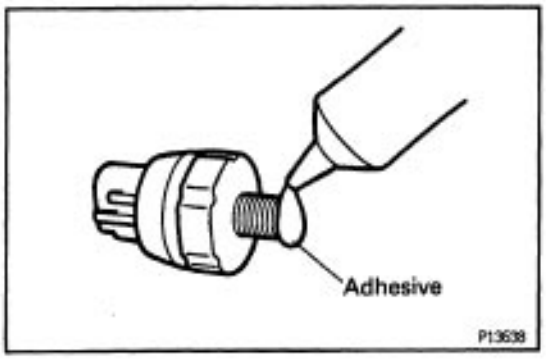
(b) Apply seal packing to the cylinder head as shown in the illustration.

Seal packing:
Part No.08826–00080 or equivalent



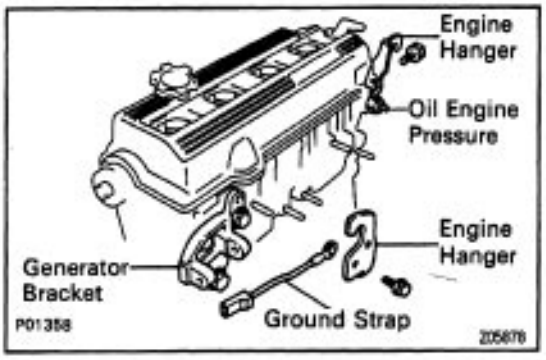
(c) Install the gasket to the head cover.
(d) Install the head cover with the 4 grommets and nuts.
Uniformly tighten the nuts in several passes.
Torque: 23 N–m (230 kgf–cm, 17 ft–lbf)

HINT: Install the grommets so that their markings are as shown in the illustration.



9. INSTALL OIL PRESSURE SWITCH

Apply adhesive to 2 or 3 threads.
Adhesive:
Part No.08833–00080, THREE BOND 1324 or equivalent

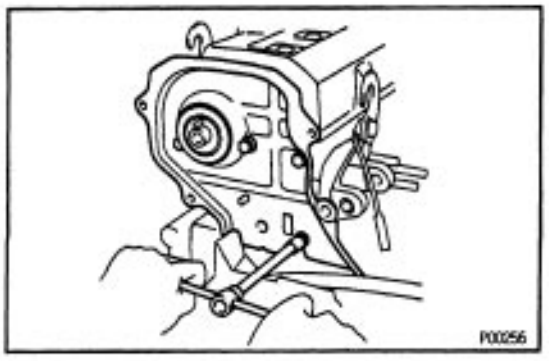


10. INSTALL GENERATOR BRACKET

Install the generator bracket with the 3 bolts.
Torque: 42 N–m (425 kgf–cm, 31 ft–lbf)

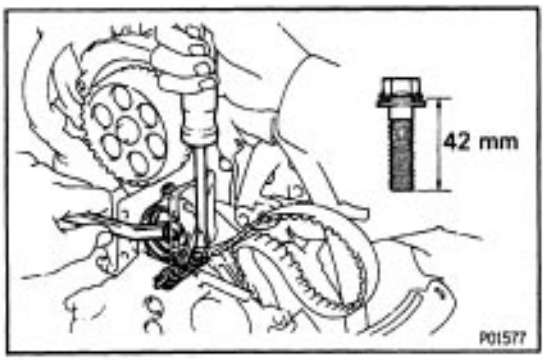
11. INSTALL ENGINE HANGERS

Install the engine hanger with the bolt. Install the 2 engine hangers. Install the ground strap.
Torque: 25 N–m (250 kgf–cm, 18 ft–lbf)



12. INSTALL NO.3 TIMING BELT COVER

Install the timing belt cover with the 4 bolts.
Torque: 7.8 N–m (80 kgf–cm, 69 in–lbf)



13. TEMPORARILY INSTALL NO.1 IDLER PULLEY AND TENSION SPRING

(a) Install the pulley with the bolt. Do not tighten the bolt yet.

HINT: Use bolt 42 mm (1.65 in.) in length.

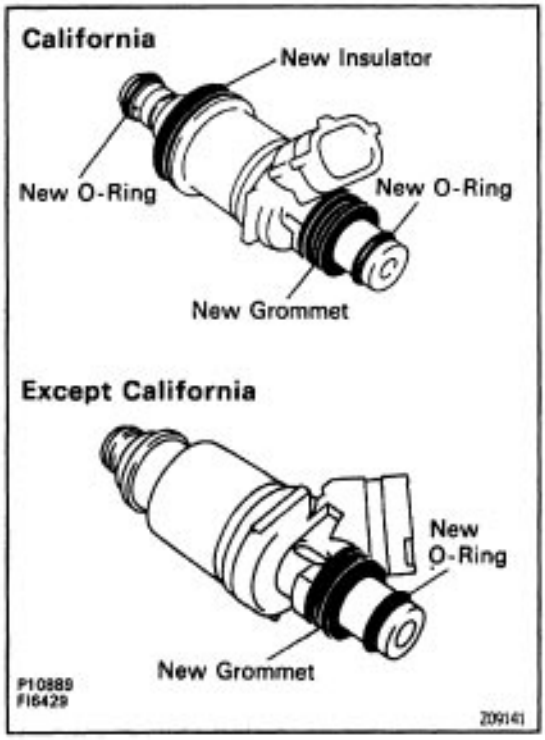
(b) Install the tension spring.

(c) Pry the pulley toward the left as far as it will go and tighten the bolt.

(d) Check that the idler pulley moves smoothly.

14. INSTALL CAMSHAFT TIMING PULLEY AND TIMING BELT

(See page EG1–33)



15. INSTALL INJECTORS AND DELIVERY PIPE

(a) California:

Install new insulator and grommet to each injector.

(b) Except California:

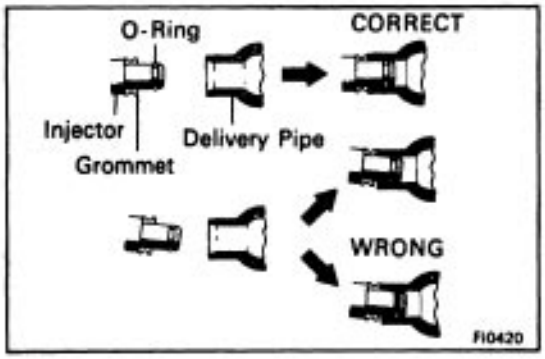
Install a new grommet to each injector.

(c) California:

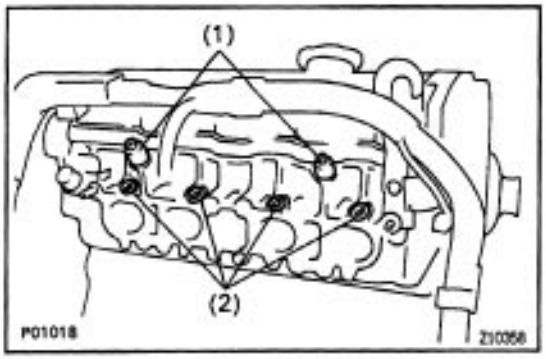
Apply a light coat of gasoline to 2 new 0–rings, and install them to each injector.

(d) Except California:

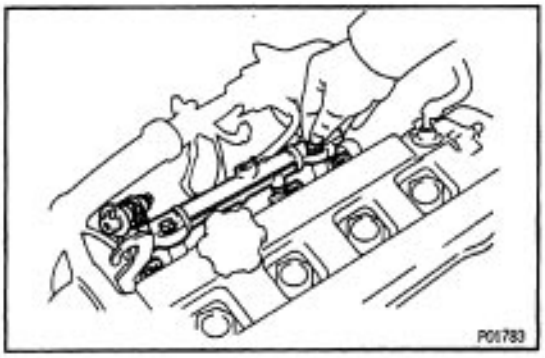
Apply a light coat of gasoline to a new 0–ring, and install it to each injector.



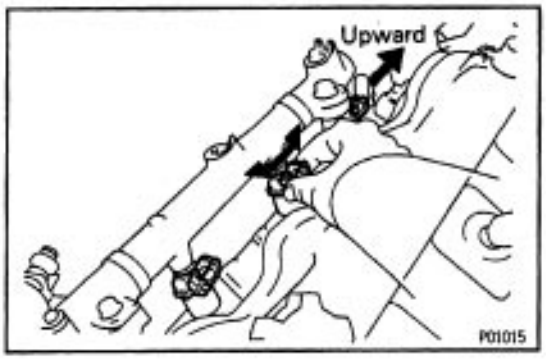
(e) While turning the injector left and right, install it to the delivery pipes. Install the 4 injectors.



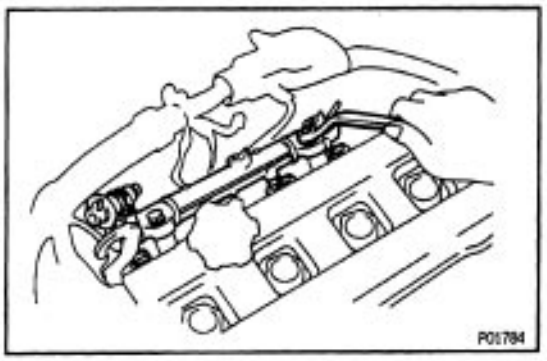
(f) Install the following parts to the intake manifold:
(1) 2 spacers
(2) Except California:
4 new insulators



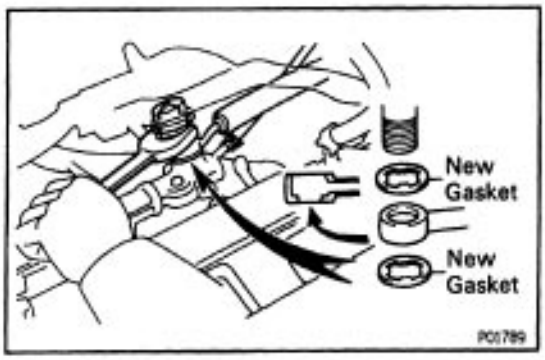
(g) Place the 4 injectors together with the delivery pipe in position on the cylinder head.
(h) Temporarily install the 2 bolts holding the delivery pipe to the cylinder head.



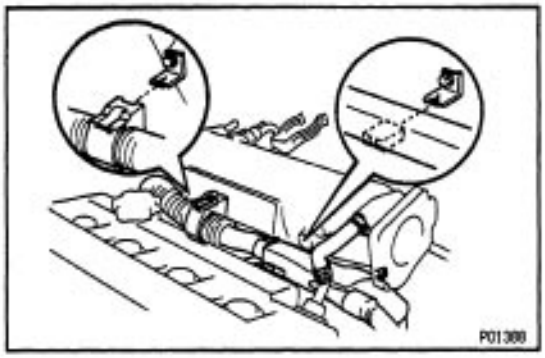
(i) Check that the injectors rotate smoothly.
HINT: If injectors do not rotate smoothly, the probable cause is incorrect installation of O–rings. Replace the O–rings.
(j) Position the injector connector upward.



(k) Tighten the 2 bolts holding the delivery pipe to the cylinder head.
Torque: 13 N–m (130 kgf–cm, 9 ft–lbf)

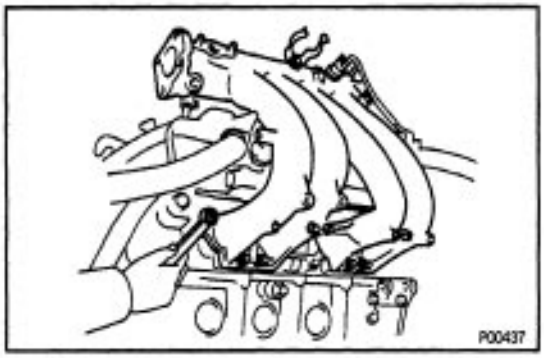


(l) Connect the fuel return hose.
(m) Connect the fuel inlet pipe to the delivery pipe with 2 new gaskets and the pulsation damper.
Torque: 34 N–m (350 kgf–cm, 25 ft–lbf)



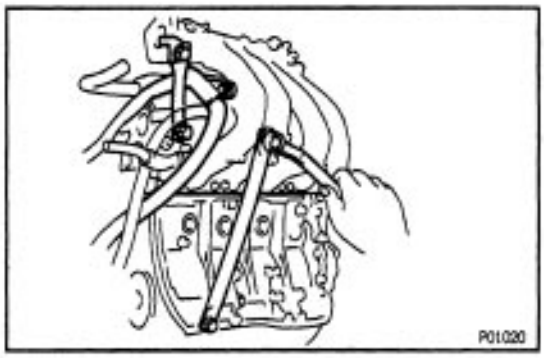
16. INSTALL INTAKE MANIFOLD

(a) Connect the 2 wire clamps to the wire brackets on the intake manifold.



(b) Install a new gasket and the intake manifold with the 6 bolts and 2 nuts. Uniformly tighten the bolts and nuts in several passes.

Torque: 19 N–m (195 kgf–cm, 14 ft–lbf)



(c) Install the vacuum hose bracket and engine wire har–ness with the bolt.

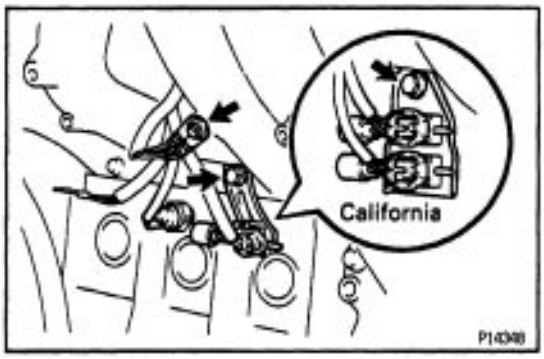
(d) Install the No.1 air intake chamber and manifold stays, wire bracket with the 4 bolts.

14 mm head bolt

Torque: 42 N–m (425 kgf–cm, 31 ft–lbf)

12 mm head bolt

Torque: 22 N–m (220 kgf–cm, 16 ft–lbf)

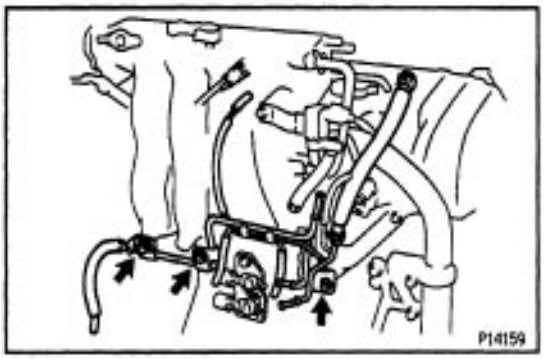


17. INSTALL VSV OR VSV ASSEMBLY

18. CALIFORNIA ONLY:
CONNECT VSV (FOR FUEL PRESSURE CONTROL) CONNECTOR

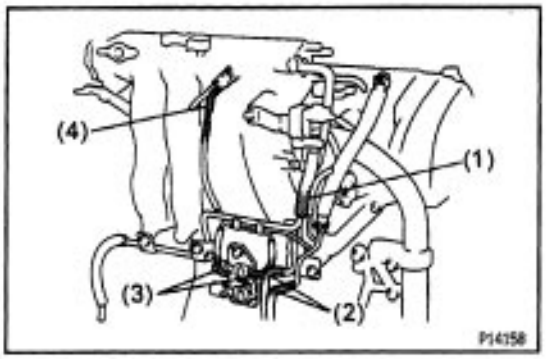
19. CONNECT KNOCK SENSOR AND VSV (FOR EGR) CONNECTORS

20. INSTALL 2 ENGINE WIRE GROUND STRAPS TO INTAKE MANIFOLD

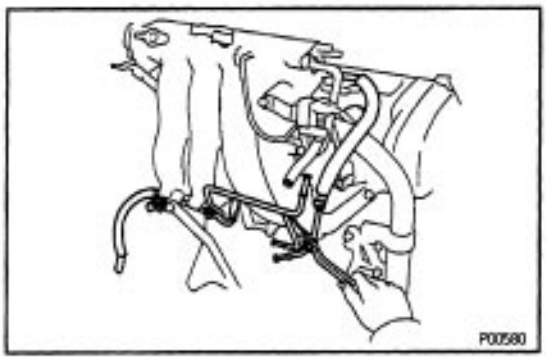


21. CALIFORNIA:
INSTALL AIR TUBE

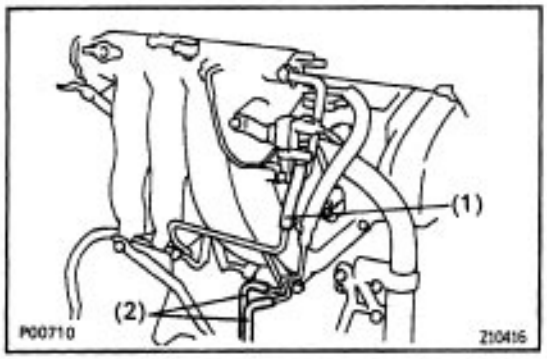
(a) Install the air tube and wire clamp with the 3 bolts.



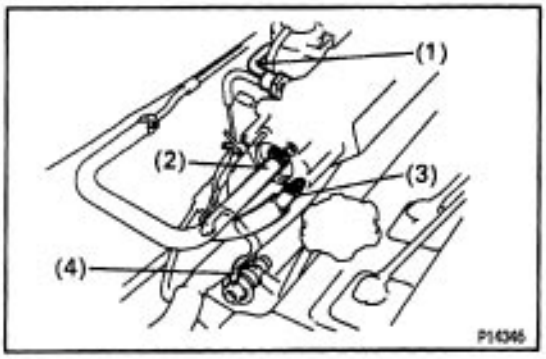
(b) Connect the following hoses:
(1) w/ A/C:
A/C hose (from ASV) to air tube
(2) 2 air hoses (from PS pump) to air tube
(3) 2 vacuum hoses to VSV (for fuel pressure con–trol)
(4) Vacuum hose to air intake chamber



22. EXCEPT CALIFORNIA:
INSTALL AIR TUBE
(a) Install the air tube and wire clamp with the 3 bolts.

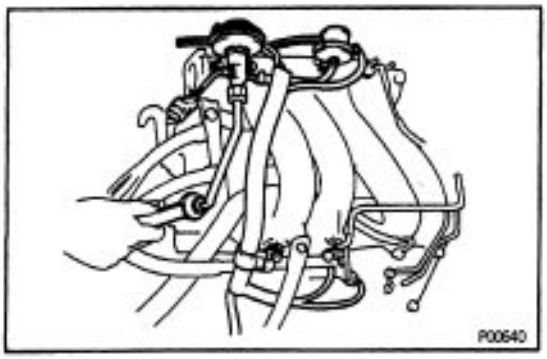


(b) Connect the following hoses to the air tube:
(1) w/ A/C:
Air hose from ASV
(2) 2 air hose from PS pump

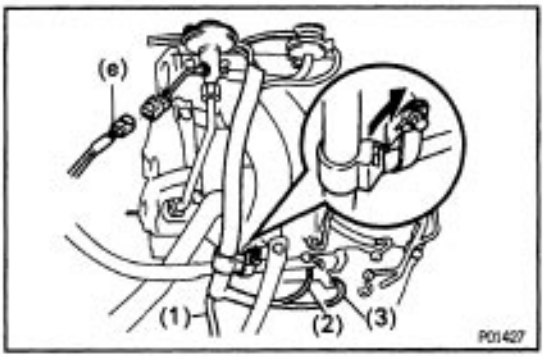


23. CONNECT VACUUM HOSES
Connect the following hoses:
(1) MAP sensor hose to air intake chamber
(2) Brake booster vacuum hose to air intake chamber
(3) PS vacuum hose to air intake chamber
(4) Vacuum sensing hose to fuel pressure regulator.

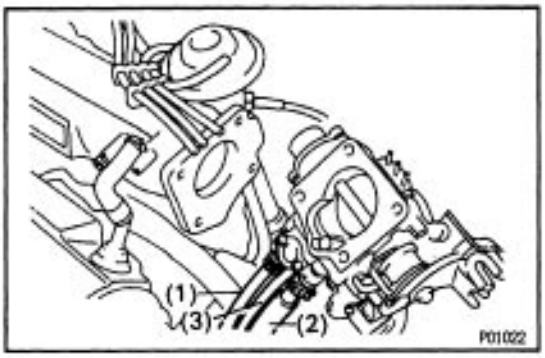
24. w/ A/C:
CONNECT A/C IDLE–UP VALVE CONNECTOR



25. INSTALL EGR VALVE AND VACUUM MODULATOR
(a) Install a new gasket and the EGR valve with the union nut and 2 nuts.
Union nut:
Torque: 59 N–m (600 kgf–cm, 43 ft–lbf)
Nut:
Torque: 13 N–m (130 kgf–cm, 9 ft–lbf)
(b) Install the EGR modulator to the clamp.

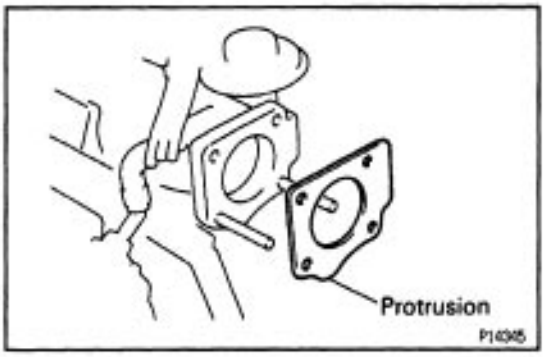


(c) Connect the vacuum hose clamp.
(d) Connect the following hoses:
(1) Vacuum hose to charcoal canister
(2) Vacuum hose (from EGR valve) to E port of VSV (for EGR)
(3) Vacuum hose (from Q port of EGR vacuum modulator) to G port of VSV (for EGR)
(e) Connect the EGR gas temperature sensor connector.

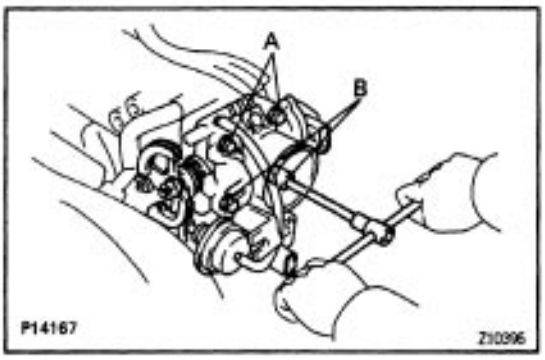


26. INSTALL THROTTLE BODY

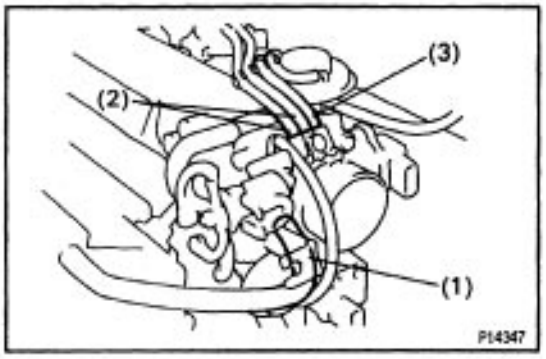
(a) Connect the following hoses to the throttle body:
(1) Water bypass hose from water outlet
(2) Water bypass hose from water bypass pipe
(3) California:
Air hose from cylinder head
Except California:
Air hose from air tube

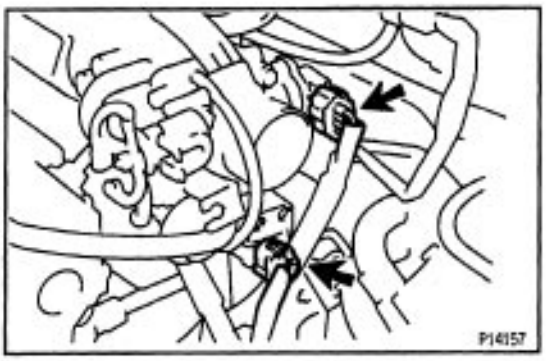


(b) Place a new gasket on the intake chamber, facing the protrusion downward.

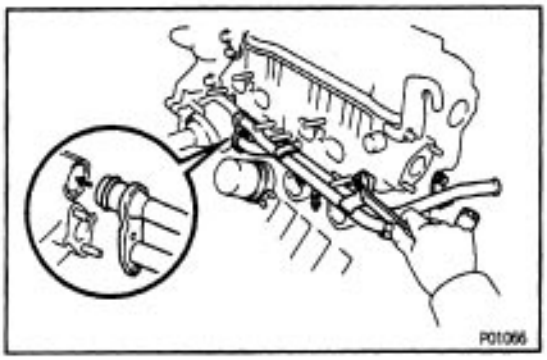


(c) Type A:
Install the throttle body with the 4 bolts.
Torque: 19 N–m (195 kgf–cm, 14 ft–lbf)
HINT: Each bolt is indicated in the illustration.
Bolt length:
A 45 mm (1.77 in.)
B 55 mm (2.17 in.)
(d) Type e:
Install the throttle body with the 2 bolts and 2 nuts.
Torque: 19 N–m (195 kgf–cm, 14 ft–lbf)
(e) Connect the following hoses to the throttle body:
(1) PCV hose
(2) 2 vacuum hoses from EGR vacuum modulator
(3) Vacuum hose from TVV (for EVAP)



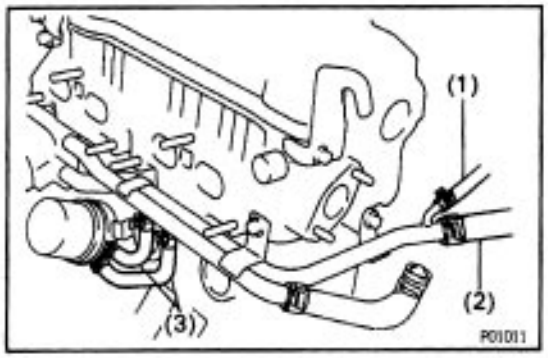


(f) Connect the IAC valve connector.
(g) Connect the throttle position sensor connector.

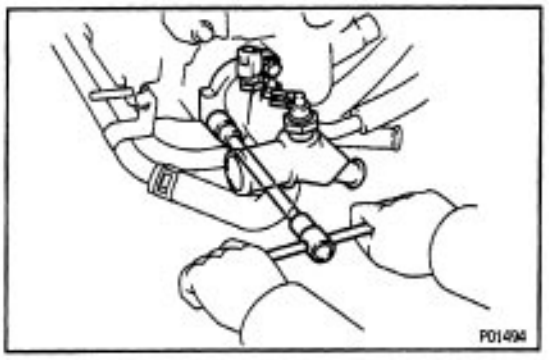


27. INSTALL WATER BYPASS PIPE

(a) Install a new 0–ring to the bypass pipe.
(b) Apply soapy water on the 0– ring.
(c) Install a new gasket and the bypass pipe with the 2 nuts and 2 bolts.
Torque (Nut): 8.8 N–m (90 kgf–cm. 78 in.–lbf)

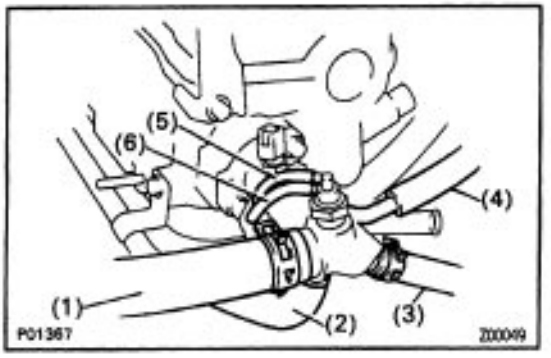


(d) Connect the following hoses:
(1) IAC water bypass hose
(2) Heater water hose
(3) w/ Oil Cooler:
2 oil cooler water bypass hoses



28. INSTALL WATER OUTLET

(a) Install a new gasket and the water outlet with the 2 bolts.
Torque: 15 N–m (150 kgf–cm, 11 ft–lbf)

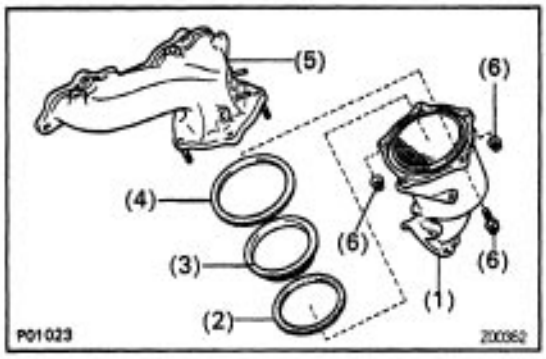


(b) Connect the following hoses:
(1) Upper radiator hose
(2) Water bypass pipe hose
(3) Heater water hose
(4) IAC water bypass hose
(5) TVV (for EVAP) vacuum hose (from P port of throttle body)
(6) TVV (for EVAP) vacuum hose (from charcoal canister)

(c) Connect the following connectors:
(1) Engine coolant temperature sender gauge con–nector
(2) Engine coolant temperature sensor connector

29. CONNECT ENGINE WIRE (FOR OXYGEN SENSORS) TO ENGINE HANGER

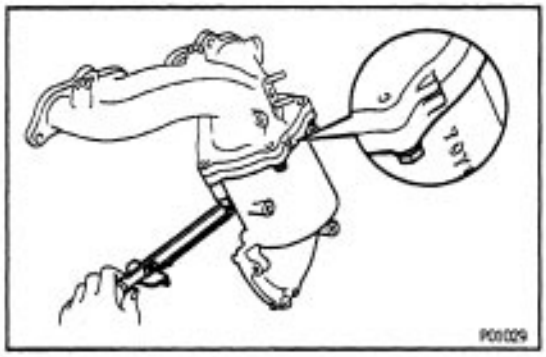
30. CONNECT OIL PRESSURE SWITCH CONNECTOR

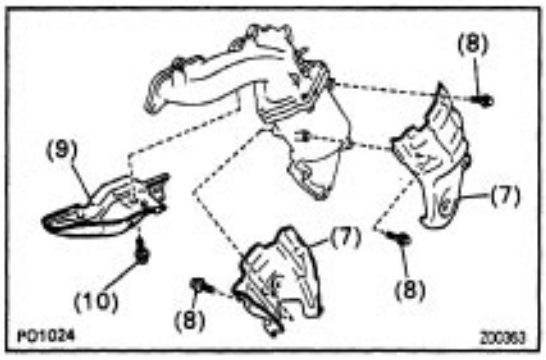


31. ASSEMBLE EXHAUST MANIFOLD AND WARM UP THREE–WAY CATALYTIC CONVERTER

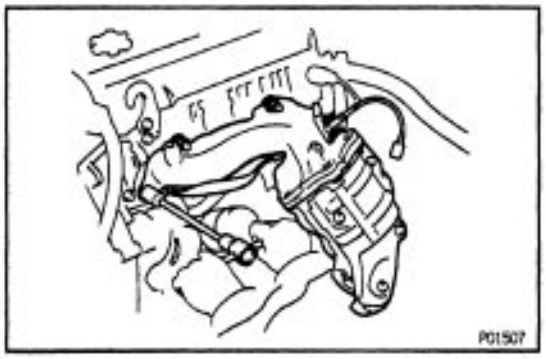
Assemble the following parts:
(1) WU–TWC
(2) Cushion
(3) Retainer
(4) Gasket
(5) Exhaust manifold
(6) 3 bolts and 2 nuts

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





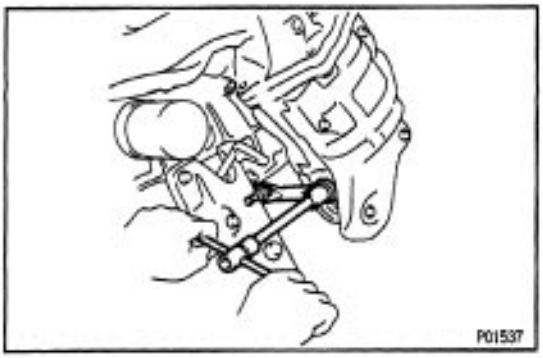
(7) 2 converter heat insulators
(8) 8 bolts
(9) Manifold lower heat insulator
(10) 3 bolts



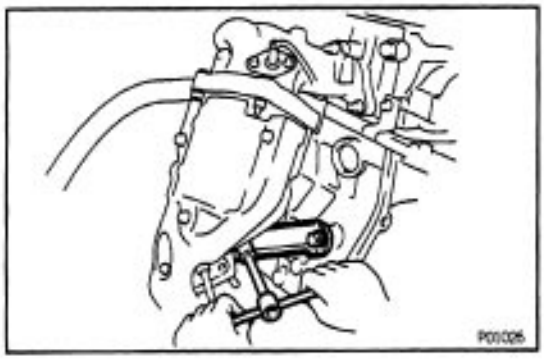
32. INSTALL EXHAUST MANIFOLD AND WARM UP THREE–WAY CATALYTIC CONVERTER ASSEMBLY

(a) Install a new gasket, the exhaust manifold and WU – TWC assembly with the 6 nuts. Uniformly tighten the nuts in several passes.

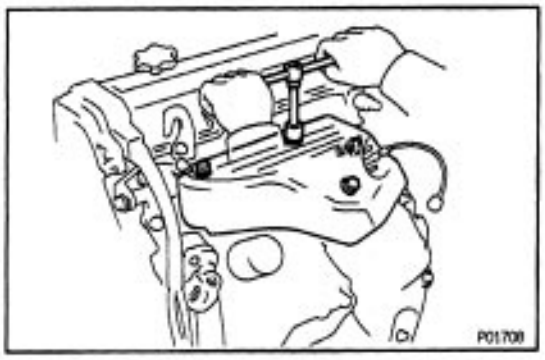
Torque: 49 N–m (540 kgf–cm, 36 ft–lbf)



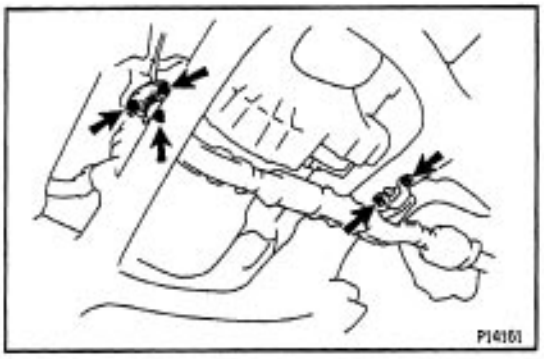
(b) Install the manifold stay with the bolt and nut.
Torque: 42 N–m (425 kgf–cm, 31 ft–lbf)



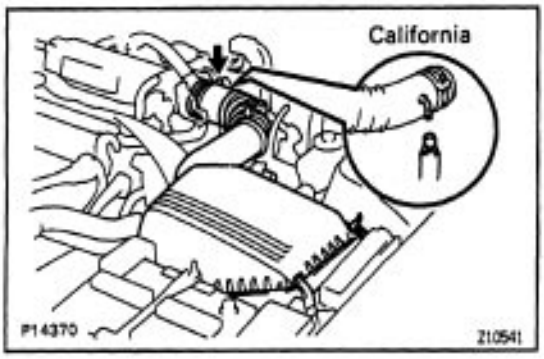
(c) Install the No. 1 manifold stay with the bolt and nut.
Torque: 42 N–m (425 kgf–cm, 31 ft–lbf)



(d) Install the manifold upper heat insulator with the 4 bolts.
(e) Connect the main oxygen and sub oxygen sensor connectors.



33. CONNECT FRONT EXHAUST PIPE
(a) Place a new gasket on the front exhaust pipe.
(b) Using a 14 mm deep socket wrench, install the 3 new nuts holding the front exhaust pipe to the WU –TWC.
Torque: 62 N–m (630 kgf–cm, 46 ft–lbf)
(c) Install the bracket with the 2 bolts.
34. INSTALL DISTRIBUTOR
(See page IG–17 and 37)
35. INSTALL GENERATOR (See page CH–24)

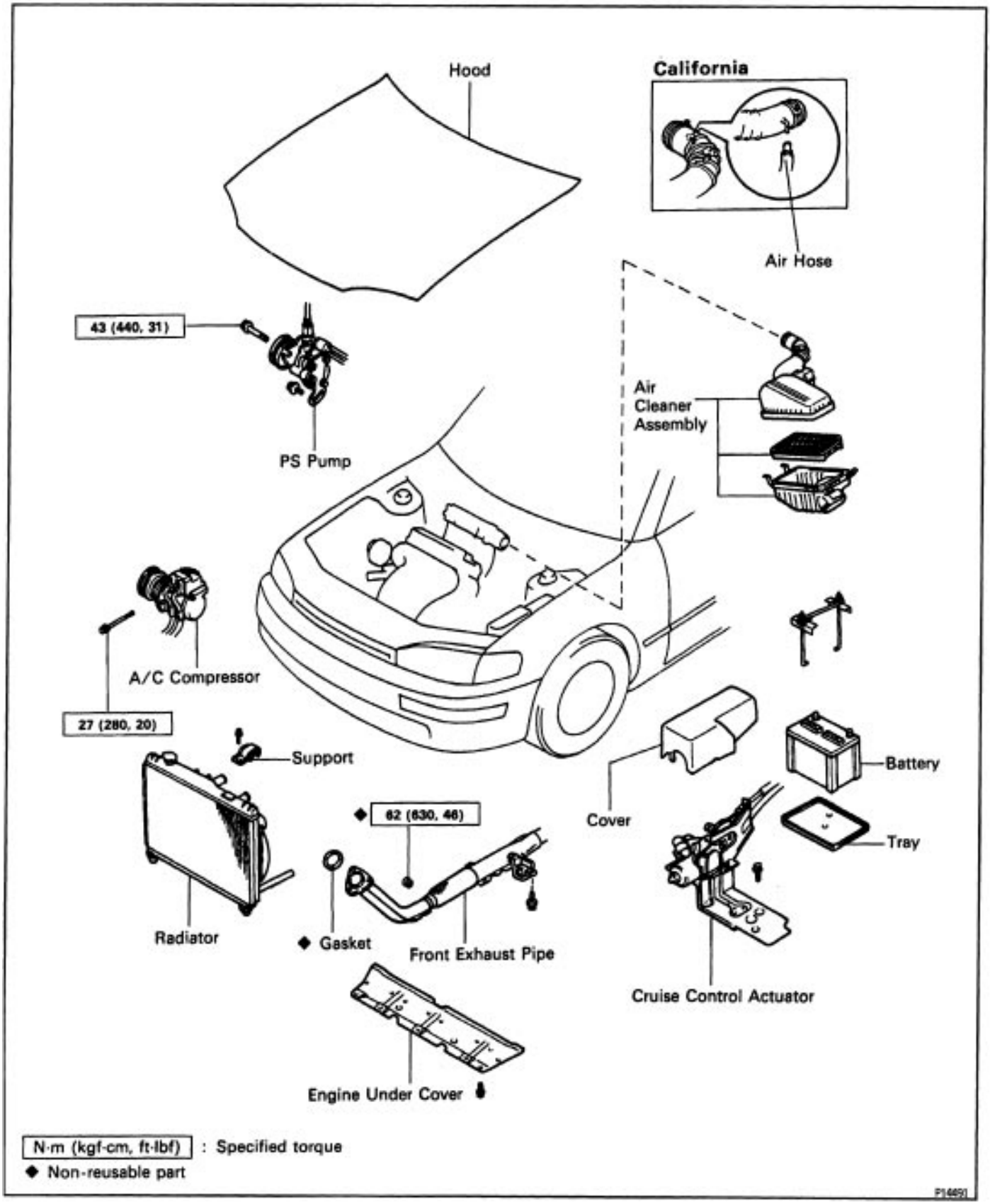


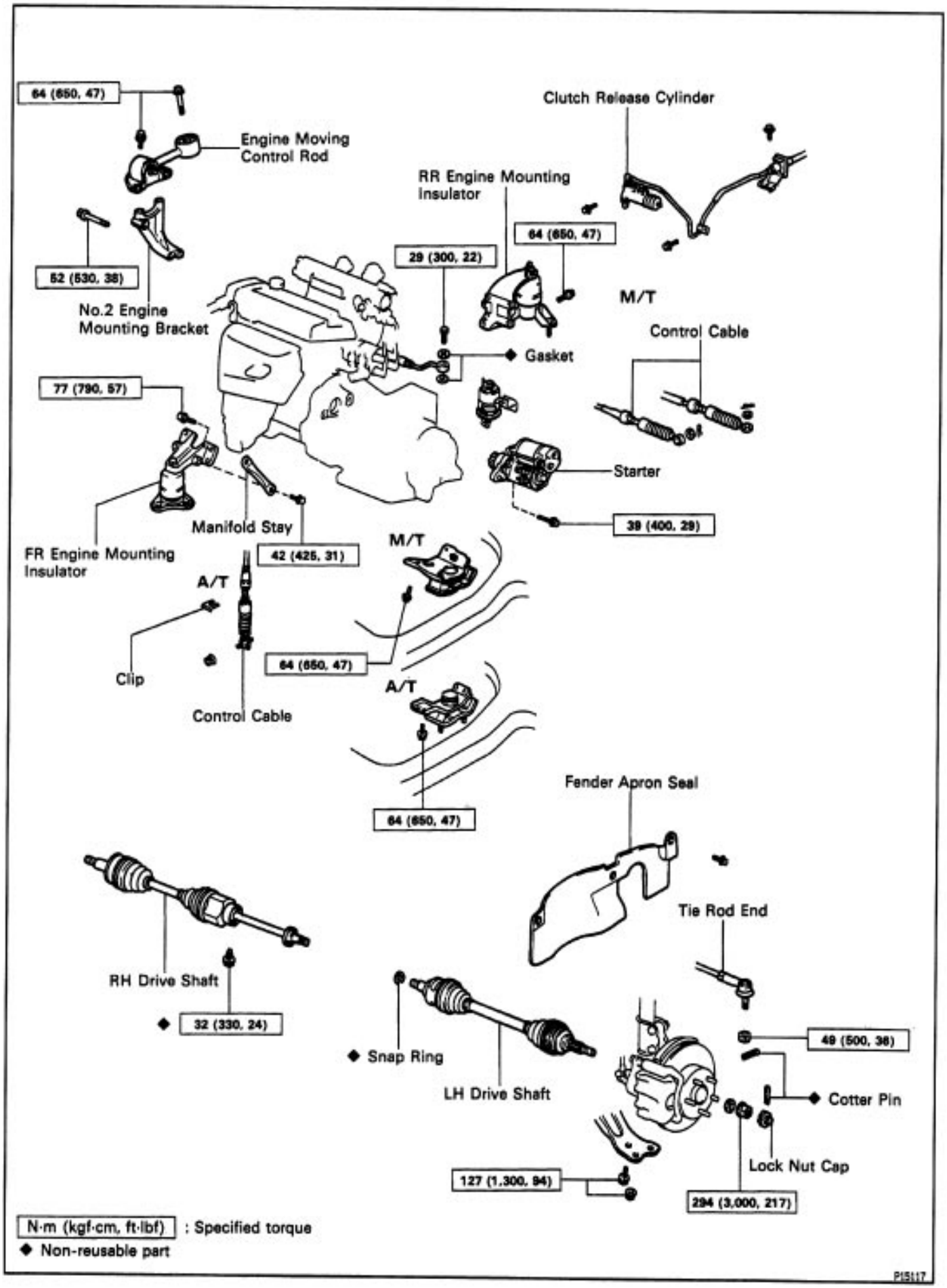
36. INSTALL AIR CLEANER CAP, RESONATOR AND AIR CLEANER HOSE
(a) Connect the air cleaner hose to the throttle body.
(b) Install the air cleaner cap together with the resonator and air cleaner hose.
(c) California only:
Connect the air hose to the air cleaner hose.
(d) Connect the intake air temperature sensor connector.

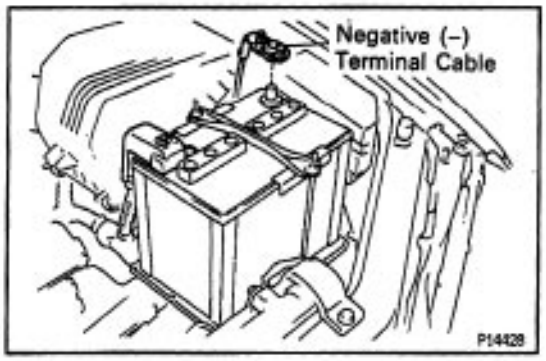
37. A/T:
CONNECT AND ADJUST THROTTLE CABLE
38. CONNECT AND ADJUST ACCELERATOR CABLE
39. FILL WITH ENGINE COOLANT
Capacity:
6.3 liters (6.7 US qts, 5.5 Imp. qts)
40. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY
41. START ENGINE AND CHECK FOR LEAKS
42. ADJUST IGNITION TIMING
(See page IG –19 and 38)
Ignition timing:
10° BTDC @ idle
(w/ Terminals TO and E1 connected)
43. PERFORM ROAD TEST
Check for abnormal noise, shock, slippage, correct shift points and smooth operation.
44. RECHECK ENGINE COOLANT LEVEL AND OIL LEVEL

CYLINDER BLOCK

COMPONENTS FOR ENGINE REMOVAL AND INSTALLATION




64 (650, 47)
Engine Moving Control Rod
52 (530, 38)
No.2 Engine Mounting Bracket
Clutch Release Cylinder
RR Engine Mounting Insulator
64 (650, 47)
29 (300, 22)
M/T
Gasket
Control Cable
77 (790, 57)
Starter
39 (400, 29)
Manifold Stay
42 (425, 31)
FR Engine Mounting Insulator
A/T
M/T
Clip
64 (650, 47)
Control Cable
A/T
64 (650, 47)
Fender Apron Seal
Tie Rod End
RH Drive Shaft
32 (330, 24)
Snap Ring
LH Drive Shaft
49 (500, 36)
Cotter Pin
Lock Nut Cap
127 (1,300, 94)
294 (3,000, 217)
N·m (kgf·cm, ft·lbf) : Specified torque
Non-reusable part
P15117



ENGINE REMOVAL

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 BATTERY AND TRAY

3. REMOVE HOOD

4. REMOVE ENGINE UNDER COVER

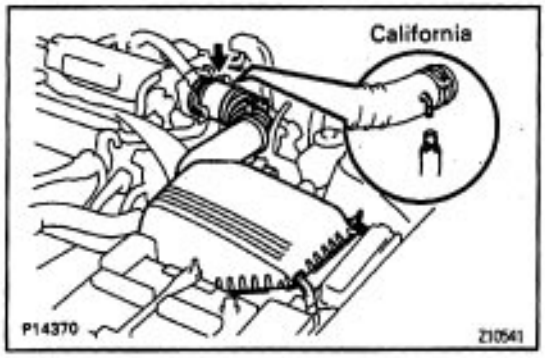
5. DRAIN ENGINE COOLANT

6. DRAIN ENGINE OIL

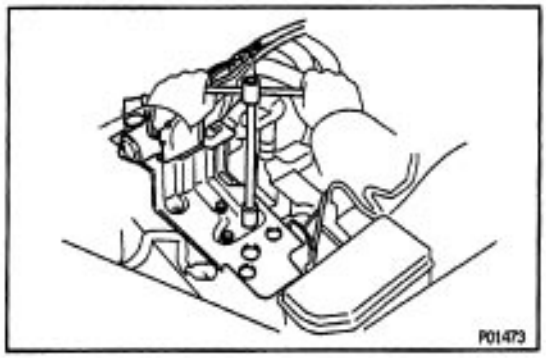
7. DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY

8. A/T:
DISCONNECT THROTTLE CABLE FROM THROTTLE BODY

9. REMOVE AIR CLEANER ASSEMBLY, RESONATOR AND AIR CLEANER HOSE



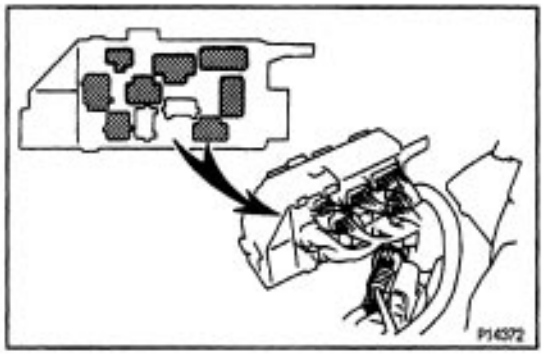
(a) Disconnect the intake air temperature sensor connec–tor.
(b) California only:
Disconnect the air hose from the air cleaner hose.
(c) Loosen the air cleaner hose clamp bolt.
(d) Disconnect the 4 air cleaner cap clips.
(e) Disconnect the air cleaner hose from the throttle body, and remove the air cleaner cap together with the resonator and air cleaner hose.
(f) Remove the element.
(g) Remove the 3 bolts and air cleaner case.



10. w/ CRUISE CONTROL SYSTEM:
REMOVE CRUISE CONTROL ACTUATOR

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

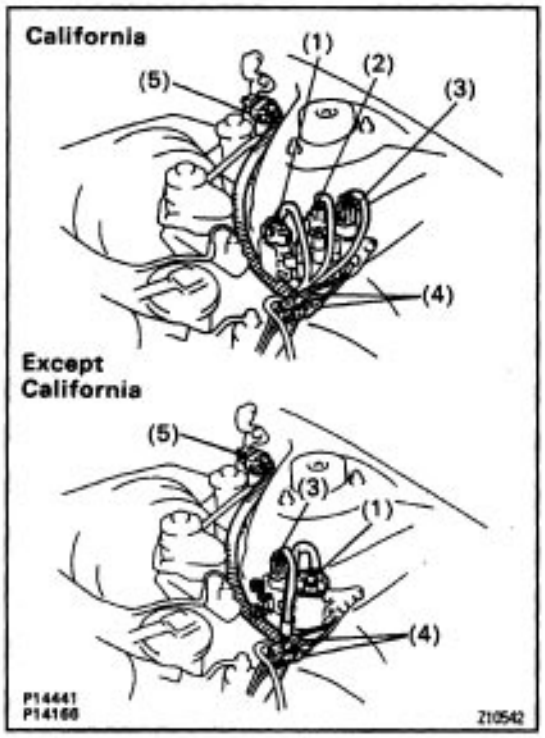
11. REMOVE RADIATOR



12. DISCONNECT WIRES AND CONNECTORS

(a) Remove the engine relay box, and disconnect the 5 connectors.

(b) Connector from LH fender apron



(c) Disconnect the following connectors:

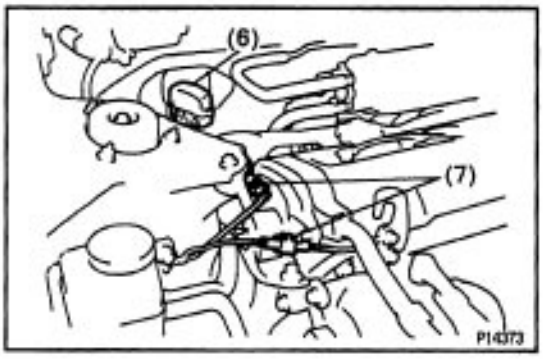
(1) Igniter connector

(2) California only:
Ignition coil connector

(3) Noise filter connector

(4) 2 ground straps from LH fender apron

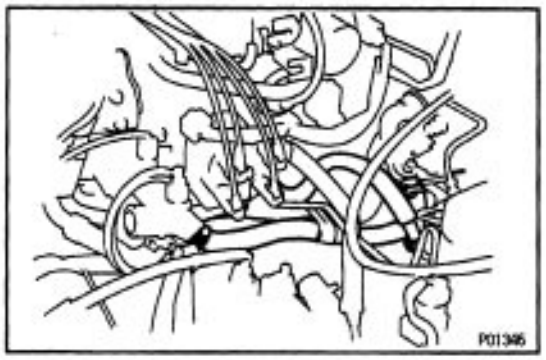
(5) Connector from LH fender apron



(6) Data link connector 1

(7) 2 ground straps from RH fender apron

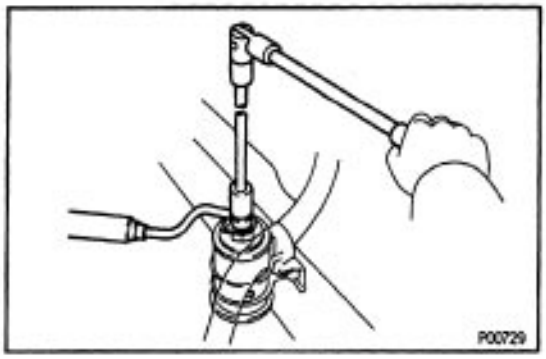
(d) Disconnect the MAP sensor connector.



13. DISCONNECT HEATER HOSES

14. DISCONNECT FUEL RETURN HOSE

CAUTION: Catch leaking fuel in a container.

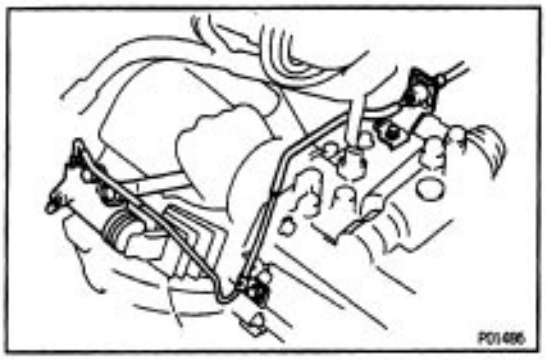


15. DISCONNECT FUEL INLET HOSE

CAUTION: Catch leaking fuel in a container.

16. M/T:

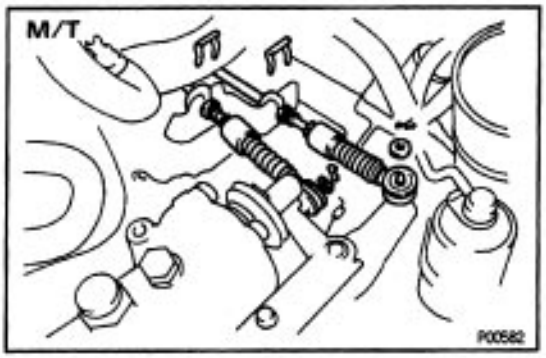
REMOVE STARTER



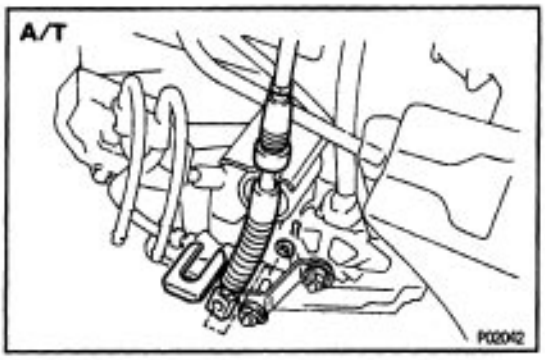
17. M/T:

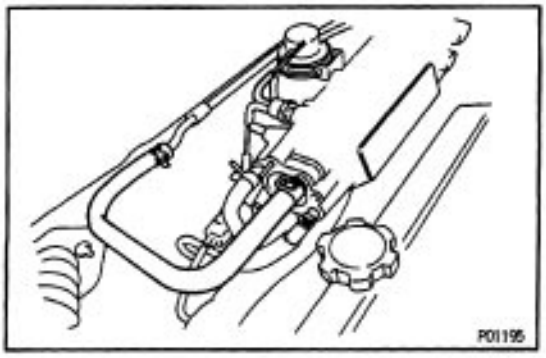
REMOVE CLUTCH RELEASE CYLINDER WITHOUT DISCONNECTING TUBE

Remove the 4 bolts, release cylinder and tube from the transaxle.



18. DISCONNECT TRANSAXLE CONTROL CABLE (S) FROM TRANSAXLE





19. DISCONNECT VACUUM HOSES

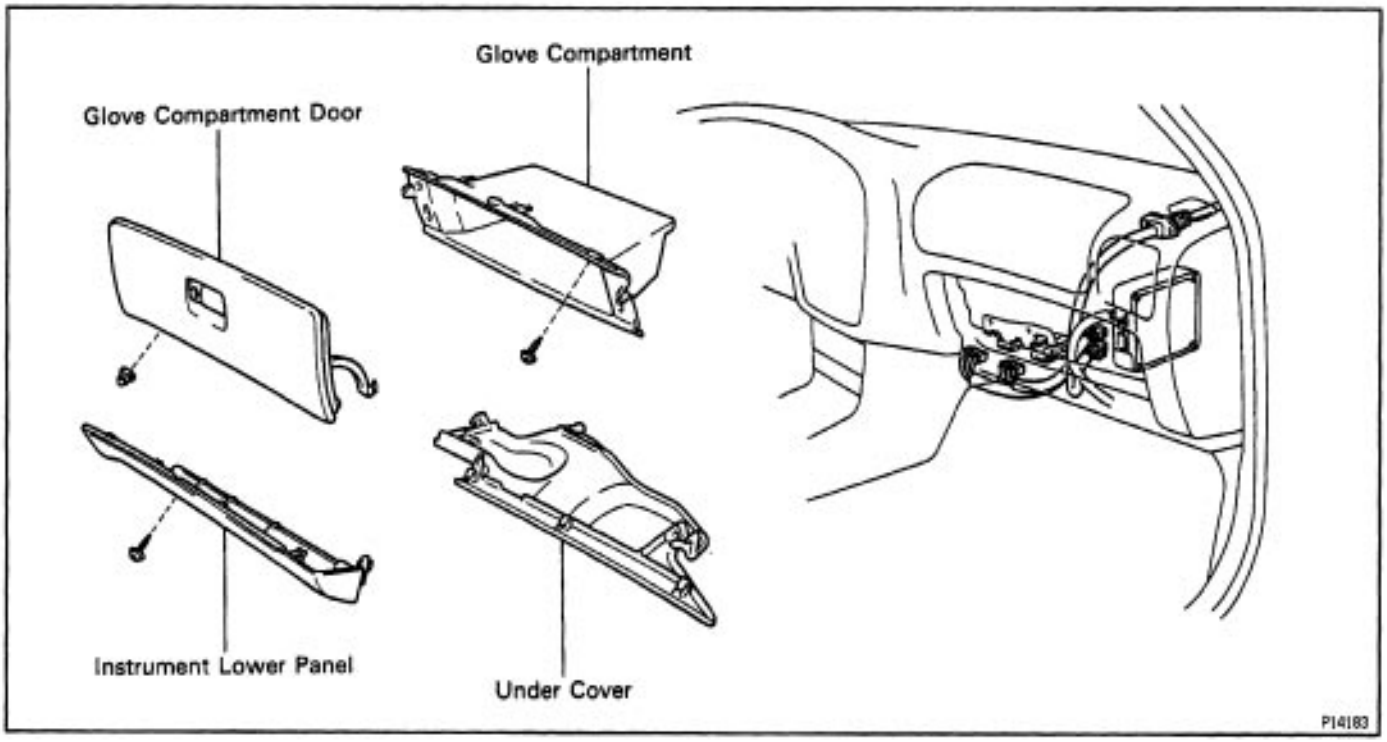
(a) MAP sensor hose from air intake chamber

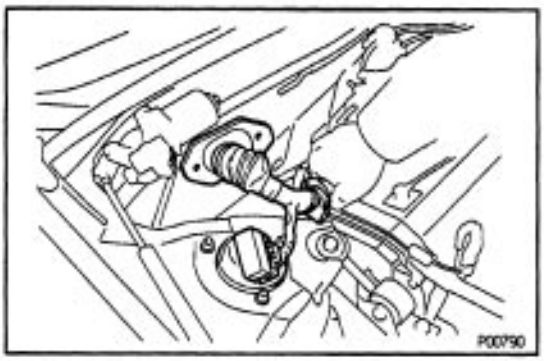
(b) Brake booster vacuum hose from air intake chamber

(c) Charcoal canister vacuum hose

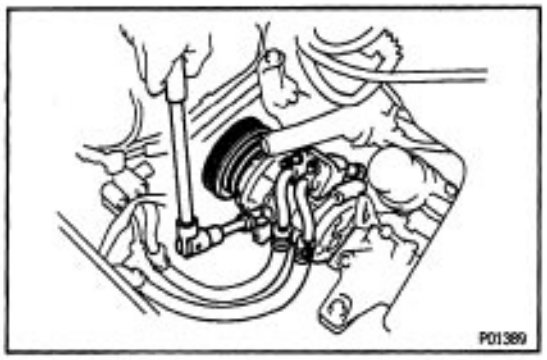
20. DISCONNECT ENGINE WIRE FROM CABIN

(a) Remove the under cover.
(b) Remove the lower instrument panel.
(c) Remove the glove compartment door.
(d) Remove the glove compartment.
(e) Disconnect the following connectors:
(1) 2 ECM connectors
(2) 2 cowl wire connector





(f) Remove the 2 nuts, and pull out the engine wire from the cowl panel.



21. w/ A/C:

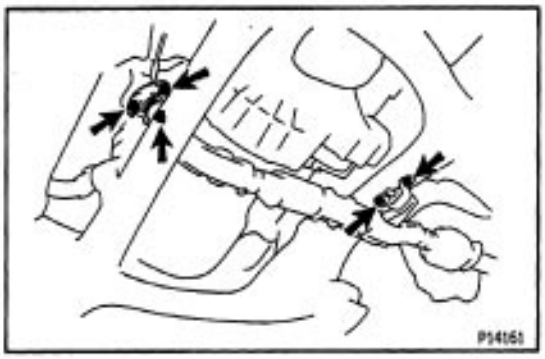
REMOVE A/C COMPRESSOR WITHOUT DISCONNECTING HOSES

(a) Disconnect the A/C compressor connector.

(b) Remove the drive belt.

(c) Remove the 3 bolts, and disconnect the A/C compres–sor.

HINT: Put aside the compressor, and suspend it to the radiator support with a string.



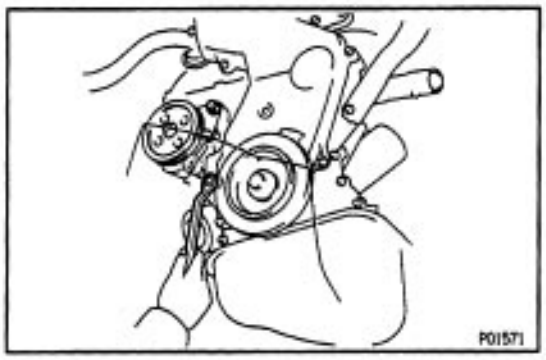
22. DISCONNECT FRONT EXHAUST PIPE

(a) Loosen the 2 bolts, and disconnect the bracket.

(b) Using a 14 mm deep socket wrench, remove the 3 nuts holding the front exhaust pipe to the WU–TWC.

(c) Disconnect the front exhaust pipe and gaskets.

23. REMOVE DRIVE SHAFTS (See page SA–38)



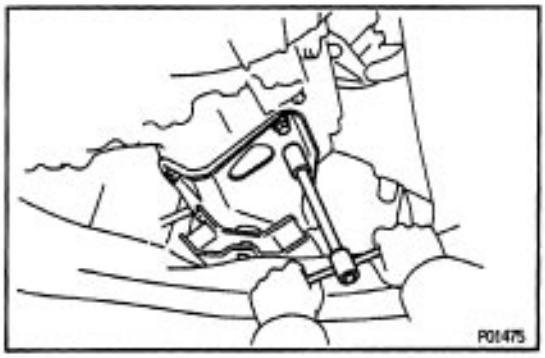
24. REMOVE PS PUMP WITHOUT DISCONNECTING HOSES

(a) Disconnect the 2 air hoses from the air pipe.

(b) Remove the PS drive belt.

(c) Remove the 2 bolts, and disconnect the PS pump from the engine.

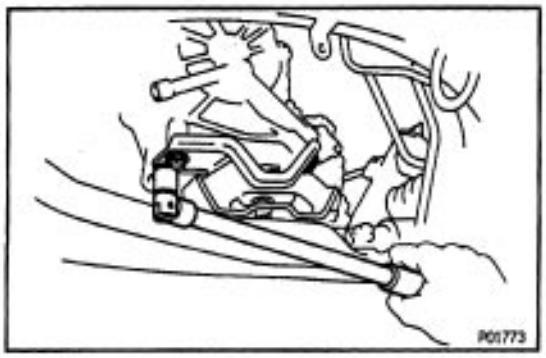
HINT: Put aside the pump and suspend it from the cowl with a string.



25. DISCONNECT LH ENGINE MOUNTING INSULATOR

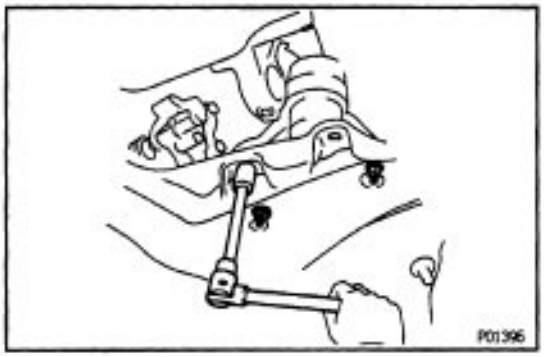
M/T:

Remove the 3 bolts, and disconnect the mounting insulator.



A/T:

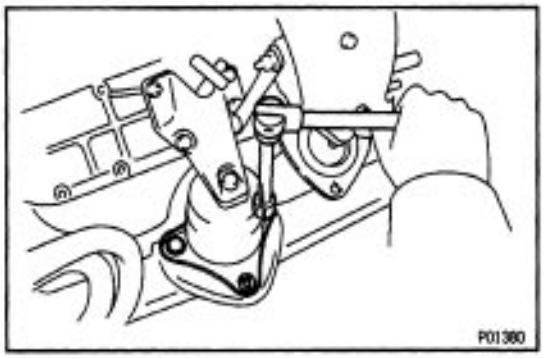
Remove the 4 bolts, and disconnect the mounting insulator.



26. DISCONNECT RR ENGINE MOUNTING INSULATOR

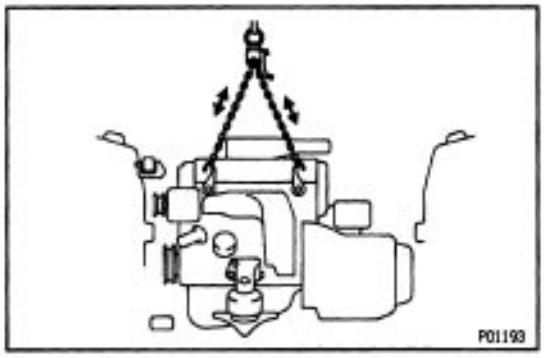
(a) Remove the hole plugs.

(b) Remove the 3 nuts, and disconnect the mounting insulator.

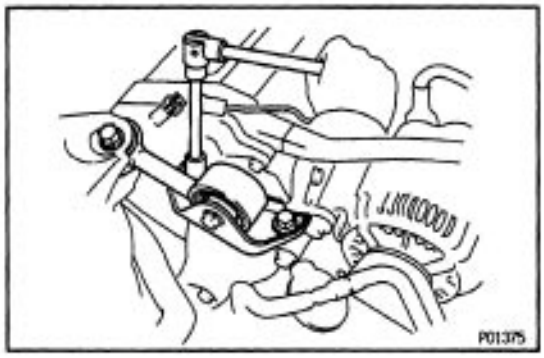


27. DISCONNECT FR ENGINE MOUNTING INSULATOR

Remove the 3 bolts, and disconnect the mounting insulator.

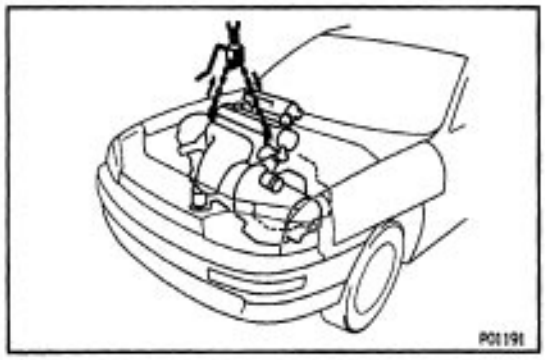


28. ATTACH ENGINE SLING DEVICE TO ENGINE HANGERS



29. REMOVE ENGINE MOVING CONTROL ROD

Remove the 3 bolts and control rod.



30. REMOVE ENGINE AND TRANSAXLE ASSEMBLY FROM VEHICLE

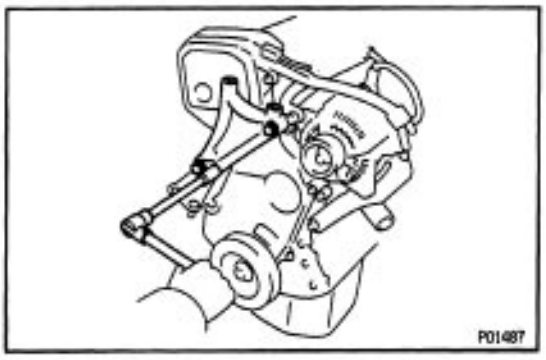
(a) Lift the engine out of the vehicle slowly and carefully.
NOTICE: Be careful not to hit the PS gear housing or perk/neutral position switch (A/T).

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

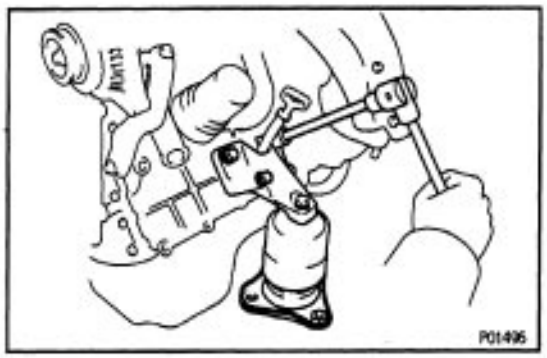
(c) Place the engine and transaxle assembly onto the stand.

31. A/T:
REMOVE STARTER

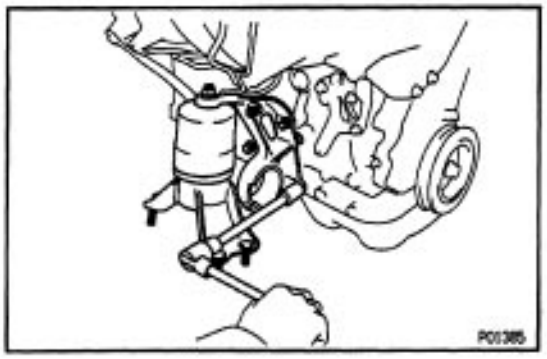
32. SEPARATE ENGINE AND TRANSAXLE
M/T (See page MX–10)
A/T (See page AX1–21)



33. REMOVE N0.2 RH ENGINE MOUNTING BRACKET
Remove the 3 bolts and engine mounting bracket.

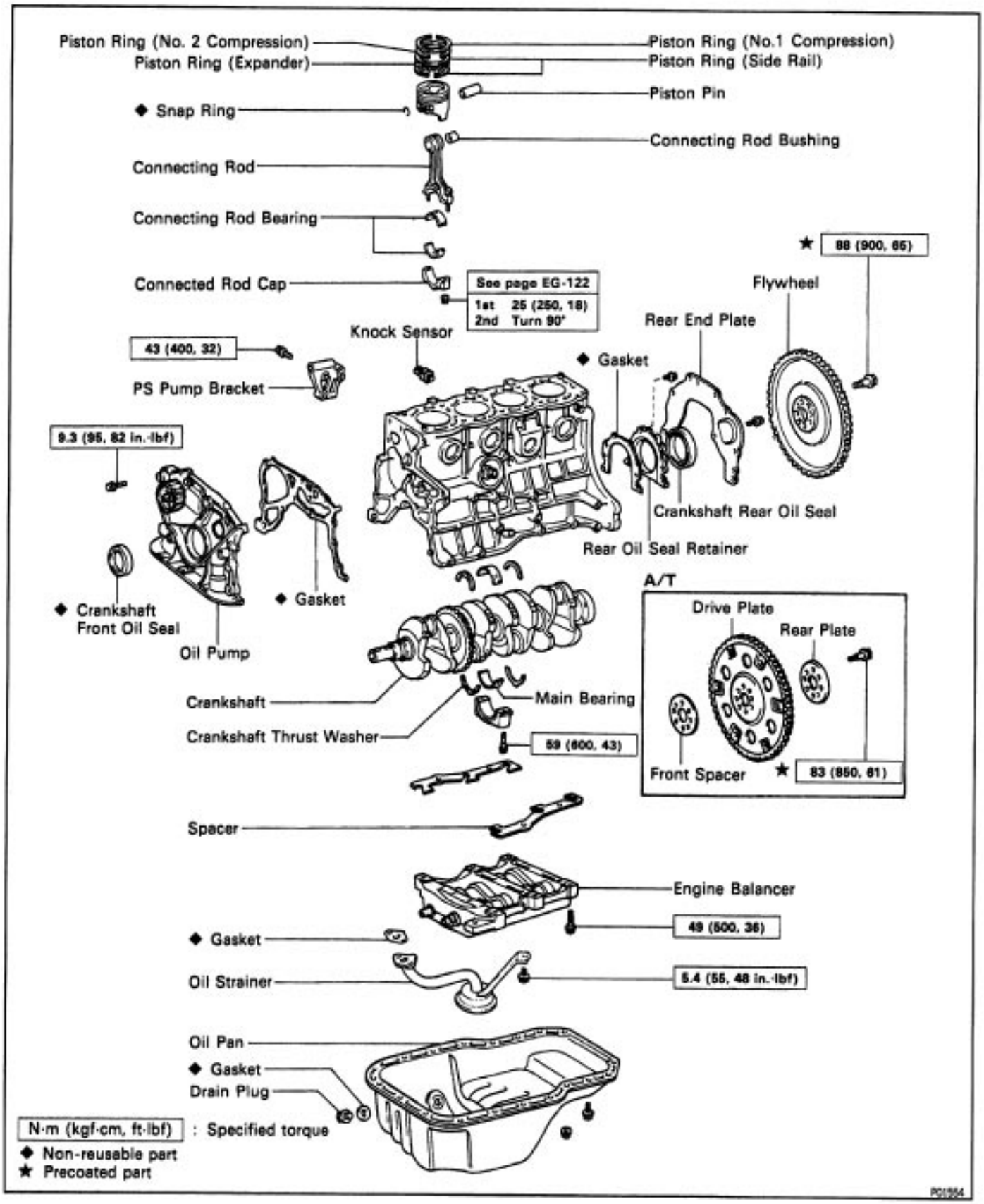


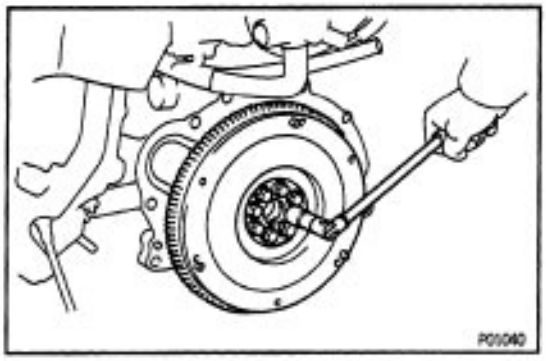
34. REMOVE FR ENGINE MOUNTING INSULATOR
(a) Remove the bolt, nut and manifold stay.
(b) Remove the 4 bolts and mounting insulator.



35. REMOVE RR ENGINE MOUNTING INSULATOR
Remove the 4 bolts and mounting insulator.

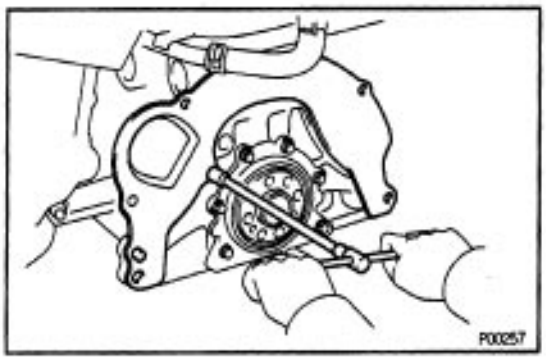
COMPONENTS FOR CYLINDER BLOCK DISASSEMBLY AND ASSEMBLY





PREPARATION FOR DISASSEMBLY

1. M/T:
REMOVE CLUTCH COVER AND DISC
2. M/T:
REMOVE FLYWHEEL
3. A/T:
REMOVE DRIVE PLATE

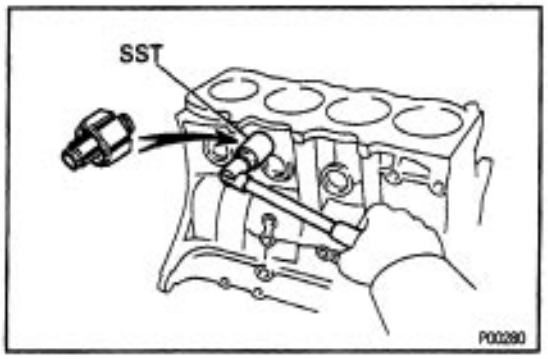


4. REMOVE REAR END PLATE
Remove the bolt and end plate.
5. INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY
6. REMOVE GENERATOR
7. REMOVE DISTRIBUTOR

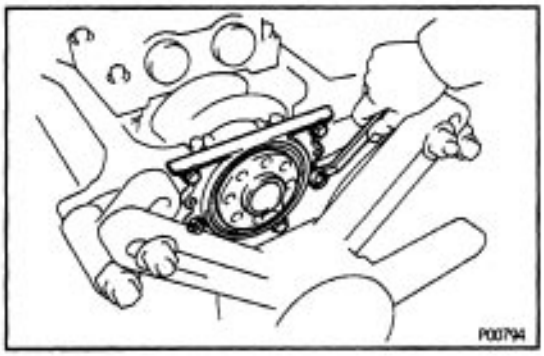


8. REMOVE PS PUMP BRACKET
Remove the 3 bolts and PS pump bracket.

9. REMOVE TIMING BELT AND PULLEYS
10. REMOVE CYLINDER HEAD
11. REMOVE WATER PUMP AND GENERATOR ADJUSTING BAR
12. REMOVE OIL PAN AND OIL PUMP
13. REMOVE OIL FILTER
14. w/ OIL COOLER:
REMOVE OIL COOLER



15. REMOVE KNOCK SENSOR
Using SST, remove the knock sensor.
SST 09816 – 30010

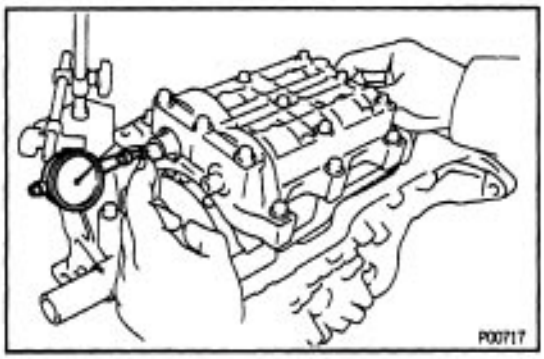


CYLINDER BLOCK DISASSEMBLY

(See Components for Cylinder Block Disassembly and Assembly)

1. REMOVE REAR OIL SEAL RETAINER

Remove the 6 bolts, retainer and gasket.

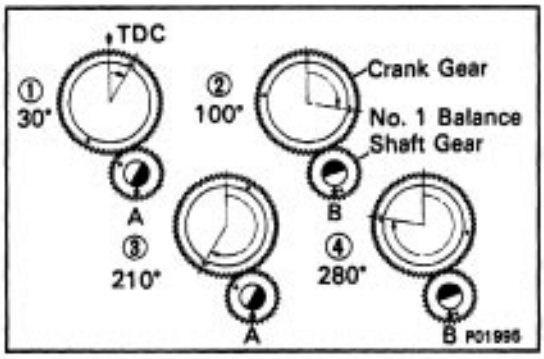


2. CHECK THRUST CLEARANCES OF NO.1 AND NO.2 BALANCE SHAFT OF ENGINE BALANCER

Using a dial indicator, measure the thrust clearance while moving the balance shaft back and forth.

Standard thrust clearance:
0.065 – 0.110 mm (0.0026 – 0.0043 in.)
Maximum clearance:
0.11 mm (0.0043 in.)

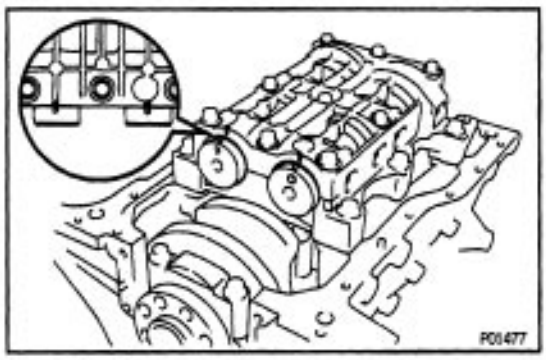
If the clearance is greater than maximum, replace the balance shaft housings and bearings. If necessary, replace the balance shafts.



3. CHECK BACKLASH OF CRANKSHAFT GEAR AND NO.1 BALANCE SHAFT GEAR

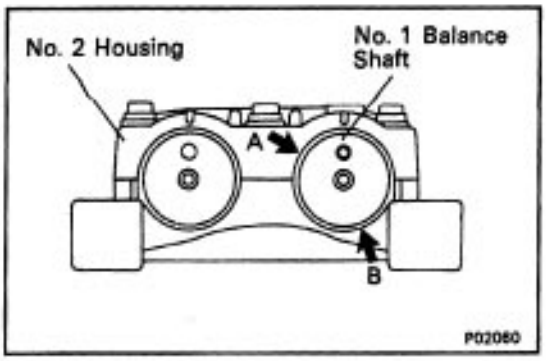
NOTICE:

- **Backlash between the crankshaft gear and No.1 balance shaft gear varies with the rotation of the balance shaft and the deviation of the crankshaft gear.**
- **Accordingly, it is necessary to measure the backlash at the 4 points shown in the illustration on the left. When this inspection is performed on–vehicle, the specifications are increased by approx. 0.025 mm (See specifications below)**

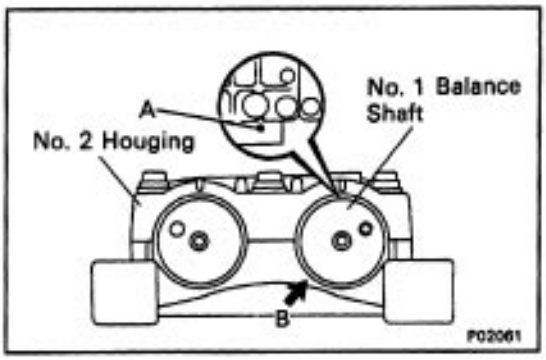


(a) Rotate the crankshaft 2 or 3 times to settle the crank–shaft gear and No.1 balance shaft gear.

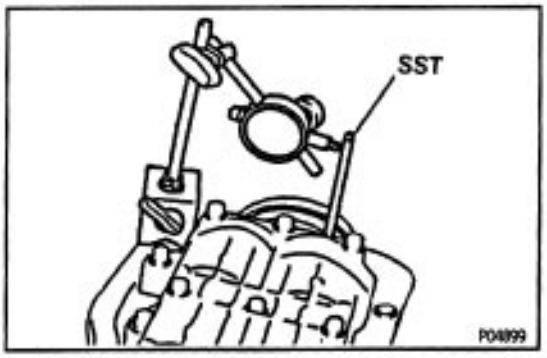
(b) When No.1 piston is at TDC, check that the punch marks shown in the illustration of the balance shafts are aligned with the grooves of the No.2 housing.



(c) Check that the punch marks A and B are at the positions on the No.1 balance shaft indicated in the illustration.

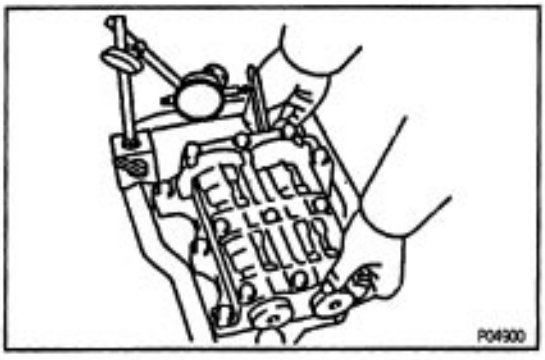


(d) 1 st turn the crankshaft clockwise, and align the groove of the No.2 balance shaft housing with the punch mark A of the No. 1 balance shaft.



(e) Set the SST and the dial indicator as shown in the illustration.
SST 09224– 74010

HINT: Make sure that the–needle of the dial indicator is perpendicular to the SST and that it is placed in the middle of the third indention.



(f) Lightly turn the No. 1 balance shaft by hand and meas–ure the backlash.

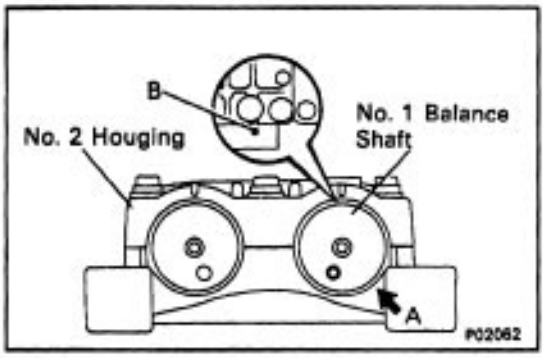
HINT:

- Turn the No.1 balance shaft 4 or 5 times to provide a steady backlash reading.
- To prevent excessive backlash due to thrust cle–arance, measure the backlash while pressing on the rear of the No.1 balance shaft.

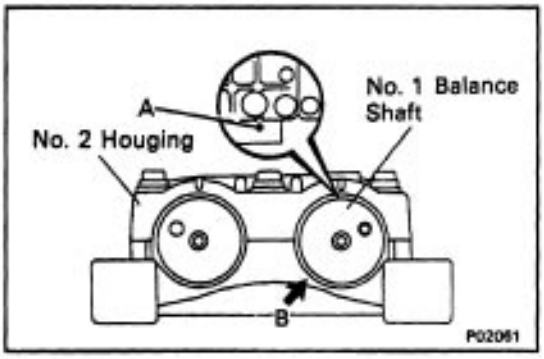
Standard backlash:
Off–vehicle
0–0.06 mm (0–0.0024 In.)
On–vehicle
0.025 – 0.080 mm (0.0010 – 0.0035 in.)

NOTICE: Do not turn the No.1 balance shaft strongly.

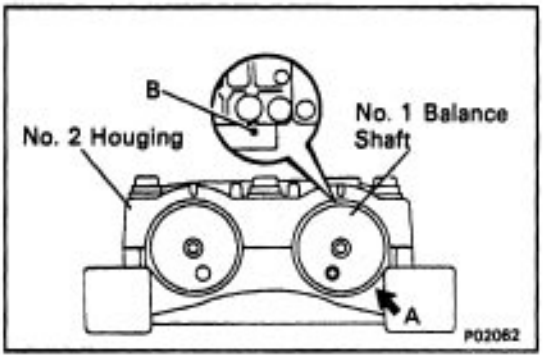
(g) Remove the dial gauge and the SST.



(h) Turn the crankshaft clockwise to align the groove of the No.2 housing with the punch mark B.
(i) Set the dial gauge. (See procedure in step (e))
(j) Measure the backlash. (See procedure in step (f))
Standard backlash:
0 – 0.06 mm (0 – 0.0024 in.)
(k) Remove the dial gauge.



(l) Turn the crankshaft clockwise again to align the groove of the No.2 housing with the punch mark A.
(m) Set the dial gauge. (See procedure in step (e))
(n) Measure the backlash. (See procedure in step (f))
Standard backlash:
0 – 0.06 mm (0 – 0.0024 in.)
(o) Remove the dial gauge.



(p) Turn the crankshaft clockwise again to align the groove of the No.2 housing with the punch mark B.
(q) Set the dial gauge. (See procedure in step (e))
(r) Measure the backlash. (See procedure in step (f))
Standard backlash:
0 – 0.06 mm (0 – 0.0024 In.)
(s) Remove the dial gauge.
If even one of the 4 points measured above exceeds the backlash specification, adjust the backlash with new spacers.

NOTICE: Use the same size spacers for both the left and right sides.

HINT:

- Varying the spacer thickness by 0.02 mm (0.0008 in.) change the backlash by about 0.014 mm (0.0006 in.).
- If the backlash is greater than permitted maxi–mum, select a thinner shim.
- If the backlash is less than the specification, select a thicker shim.

Adjusting Spacer Selection Chart

Measured clearance mm (in.) \ Installed spacer No.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
0.000 – 0.060 (0.0000 – 0.0022)																																								
0.061 – 0.067 (0.0023 – 0.0025)		01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31	33	33	35	35
0.068 – 0.074 (0.0025 – 0.0027)			01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31	33	33	35
0.075 – 0.081 (0.0028 – 0.0030)				01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31	33	33
0.082 – 0.088 (0.0030 – 0.0033)					01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31	33
0.089 – 0.095 (0.0033 – 0.0035)						01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31
0.096 – 0.102 (0.0035 – 0.0038)							01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31
0.103 – 0.109 (0.0038 – 0.0040)								01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29
0.110 – 0.116 (0.0040 – 0.0043)									01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29
0.117 – 0.123 (0.0043 – 0.0045)										01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27
0.124 – 0.130 (0.0046 – 0.0048)											01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27
0.131 – 0.137 (0.0048 – 0.0051)												01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25
0.138 – 0.144 (0.0051 – 0.0053)													01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25
0.145 – 0.151 (0.0054 – 0.0056)														01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23
0.152 – 0.158 (0.0056 – 0.0058)															01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23
0.159 – 0.165 (0.0059 – 0.0061)																01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21
0.166 – 0.172 (0.0061 – 0.0064)																	01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21
0.173 – 0.179 (0.0064 – 0.0066)																		01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19
0.180 – 0.186 (0.0067 – 0.0069)																			01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19
0.187 – 0.193 (0.0069 – 0.0071)																				01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17
0.194 – 0.200 (0.0072 – 0.0074)																					01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17
0.201 – 0.207 (0.0074 – 0.0077)																						01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15
0.208 – 0.214 (0.0077 – 0.0079)																							01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15
0.215 – 0.221 (0.0079 – 0.0082)																								01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13
0.222 – 0.228 (0.0082 – 0.0084)																									01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13
0.229 – 0.235 (0.0085 – 0.0087)																										01	01	01	01	01	03	03	05	05	07	07	09	09	11	11
0.234 – 0.242 (0.0087 – 0.0089)																											01	01	01	01	03	03	05	05	07	07	09	09	11
0.243 – 0.249 (0.0090 – 0.0092)																												01	01	01	01	01	03	03	05	05	07	07	09	09
0.250 – 0.256 (0.0092 – 0.0095)																													01	01	01	01	01	03	03	05	05	07	07	09
0.257 – 0.263 (0.0095 – 0.0097)																														01	01	01	01	01	03	03	05	05	07	07
0.264 – 0.270 (0.0098 – 0.0100)																															01	01	01	01	01	03	03	05	05	07
0.271 – 0.277 (0.0100 – 0.0102)																																01	01	01	01	01	03	03	05	05
0.278 – 0.284 (0.0103 – 0.0105)																																	01	01	01	01	01	03	03	05
0.285 – 0.291 (0.0105 – 0.0108)																																		01	01	01	01	01	03	03
0.292 – 0.298 (0.0108 – 0.0110)																																			01	01	01	01	01	03
0.299 – 0.305 (0.0110 – 0.0113)																																				01	01	01	01	01
0.306 – 0.312 (0.0113 – 0.0115)																																					01	01	01	01
0.313 – 0.319 (0.0116 – 0.0118)																																						01	01	01
0.320 – 0.326 (0.0118 – 0.0120)																																							01	01
0.327 – 0.333 (0.0120 – 0.0123)																																								01

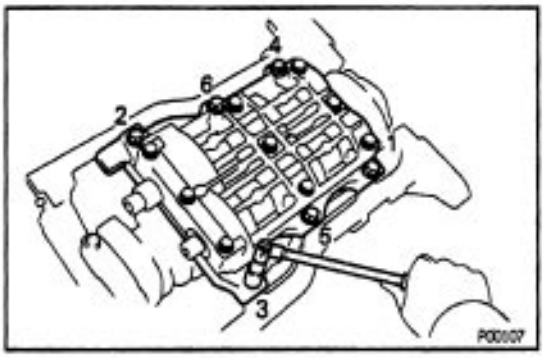
Backlash of crankshaft and No. 1 balance shaft gear:
0 – 0.60 mm (0 – 0.0022 in.)

EXAMPLE: The No. 25 spacers are installed and the measured clearance is 0.140 mm (0.0055 in.). Replace the No. 25 spacers with No. 9 spacers.

New spacer thickness mm (in.)

No.	Thickness	No.	Thickness	No.	Thickness	No.	Thickness
01	1.74 (0.0685)	11	1.84 (0.0724)	21	1.94 (0.0764)	31	2.04 (0.0803)
03	1.76 (0.0693)	13	1.86 (0.0732)	23	1.96 (0.0772)	33	2.06 (0.0811)
05	1.78 (0.0701)	15	1.88 (0.0740)	25	1.98 (0.0780)	35	2.08 (0.0819)
07	1.80 (0.0709)	17	1.90 (0.0748)	27	2.00 (0.0787)	37	2.10 (0.0827)
09	1.82 (0.0717)	19	1.92 (0.0756)	29	2.02 (0.0795)	39	2.12 (0.0835)

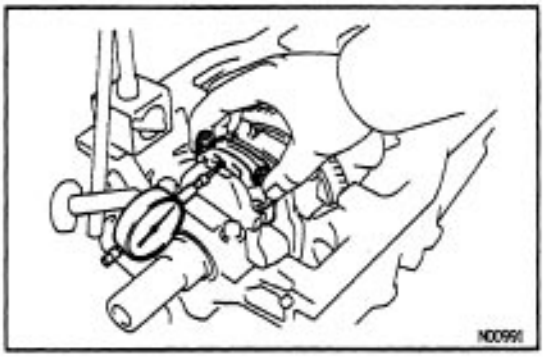
V00096



4. REMOVE ENGINE BALANCER

(a) Uniformly loosen and remove the 6 bolts in several passes, in the sequence shown.

(b) Remove the engine balancer and spacers.

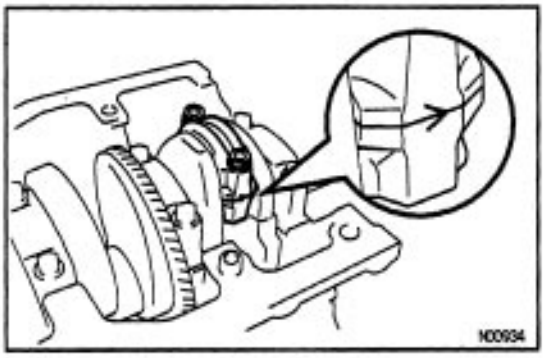


5. CHECK CONNECTING ROD THRUST CLEARANCE

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

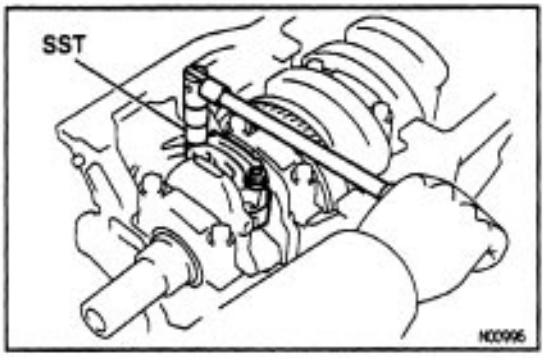
Standard thrust clearance:
0.160 – 0.312 mm (0.0063 – 0.0123 in.)
Maximum thrust clearance:
0.36 mm (0.0138 in.)

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

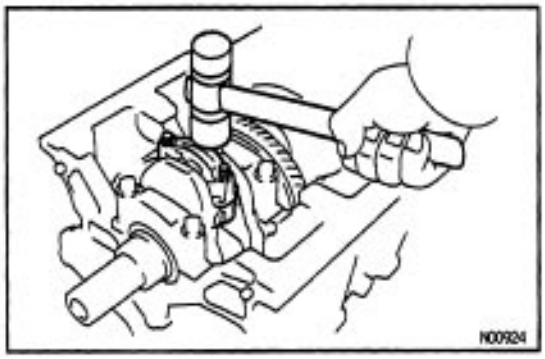


6. REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE

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

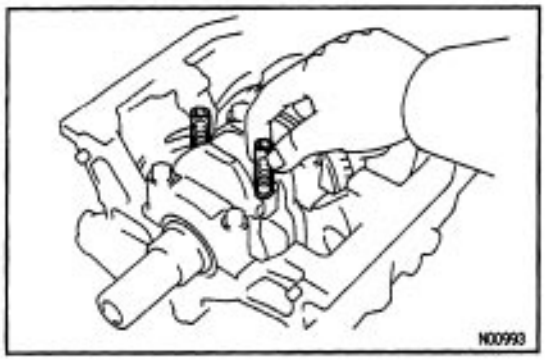


(b) Using SST, remove the connecting rod cap nuts.
SST 09011–38121

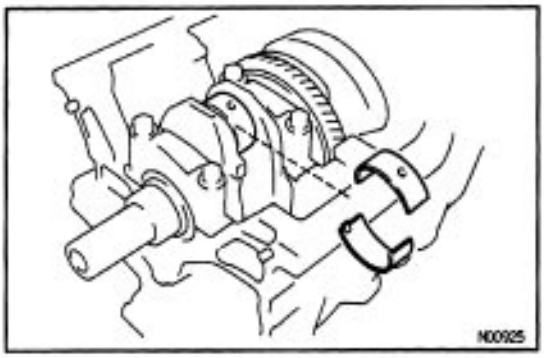


(c) Using a plastic–faced hammer, lightly tap the connecting rod bolts and lift off the connecting rod cap.

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



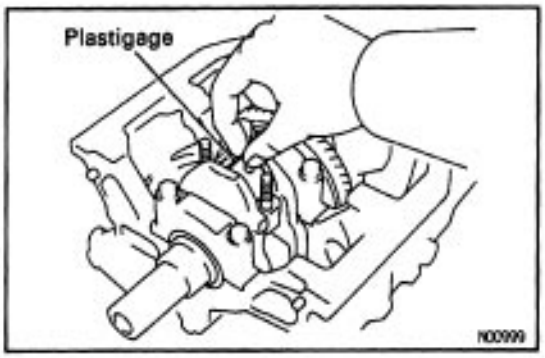
(d) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.



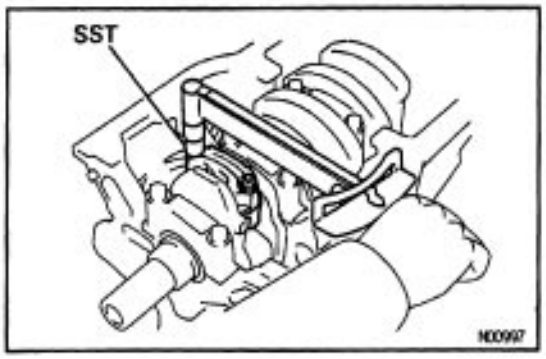
(e) Clean the crank pin and bearing.

(f) Check the crank pin and bearing for pitting and scratches.

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



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



(h) Install the connecting rod cap.

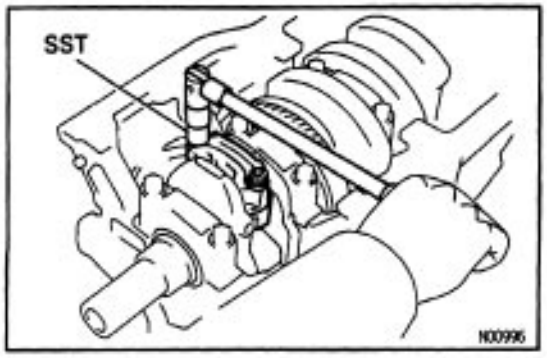
(See step 6 on pages EG1–122)

1st

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

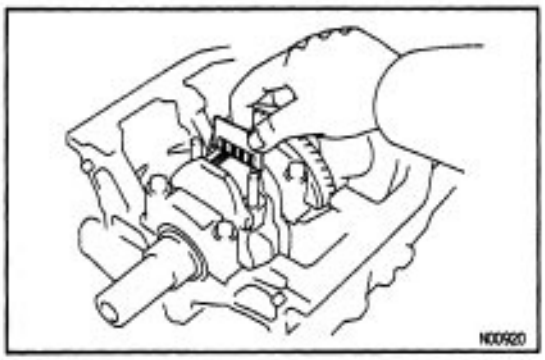
2nd Turn 90°

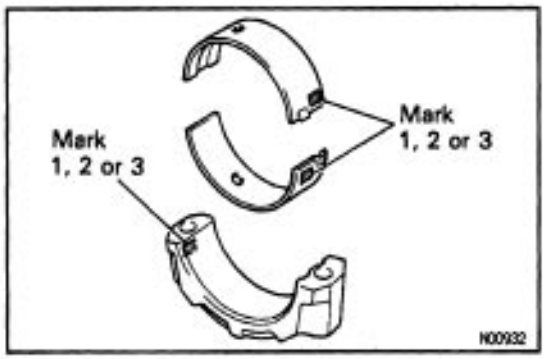
NOTICE: Do not turn the crankshaft.



(i) Remove the connecting rod cap.

(See procedure (b) and (c) on the previous page)





(j) Measure the Plastigage at its widest point.

Standard oil clearance:

STD

0.024 – 0.055 mm (0.0009 – 0.0022 in.)

U/S 0.25

0.023 – 0.069 mm (0.0009 – 0.0027 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 using a standard bearing, replace it with one having the same number marked on the connecting rod cap. There are 3 sizes of standard bearings, marked *11', "2" and "3" accordingly.

Standard sized bearing center wall thickness:

Mark "1"

1.484 – 1.488 mm (0.0584 – 0.0586 in.)

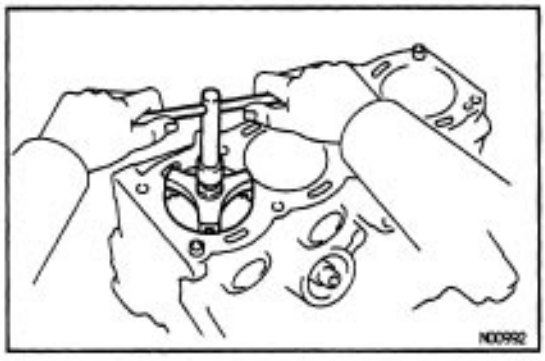
Mark "2"

1.488 – 1.492 mm (0.0586 – 0.0587 in.)

Mark "3"

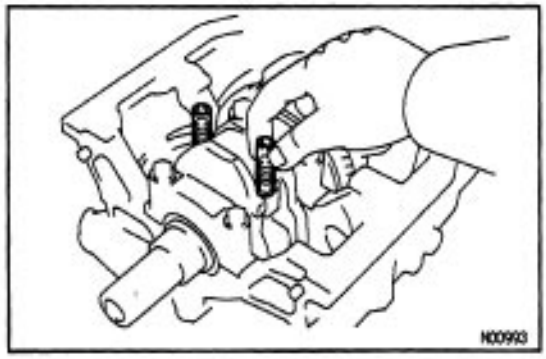
1.492 – 1.498 mm (0.0587 – 0.0589 in.)

(k) Completely remove the Plastigage.



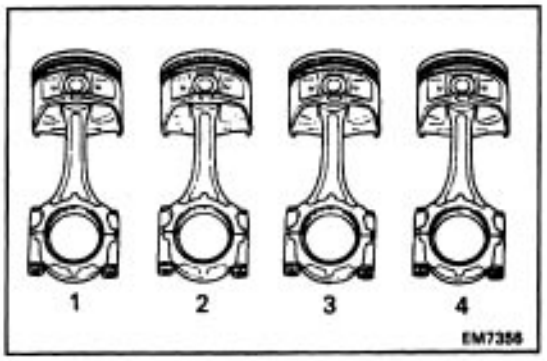
7. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

(a) Using a ridge reamer, remove all the carbon from the top of the cylinder.



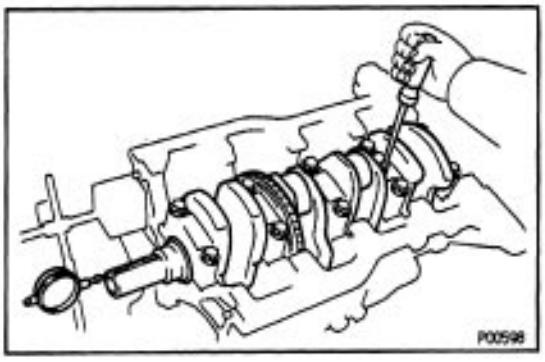
(b) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.

(c) 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.



8. CHECK CRANKSHAFT THRUST CLEARANCE

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

Standard thrust clearance:

0.020 – 0.220 mm (0.0008 – 0.0087 in.)

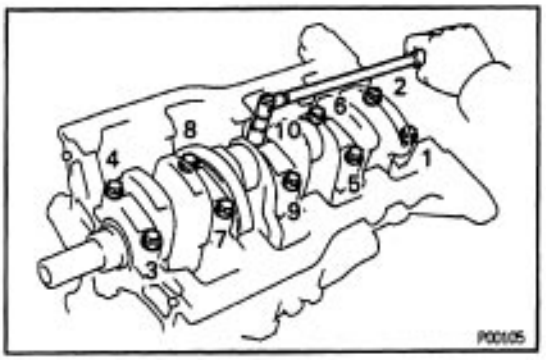
Maximum thrust clearance:

0.30 mm l0.0118 in.)

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

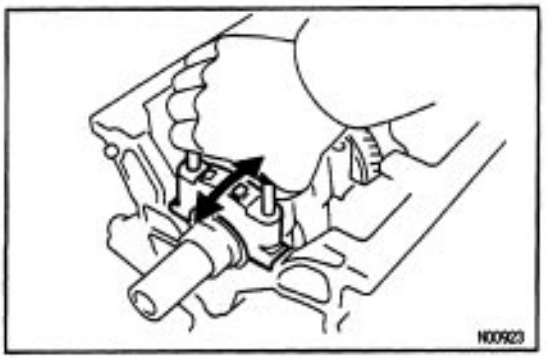
Thrust washer thickness:

2.440 – 2.490 mm 10.0961 – 0.0980 in.)



9. REMOVE MAIN BEARING CAPS AND CHECK OIL CLEARANCE

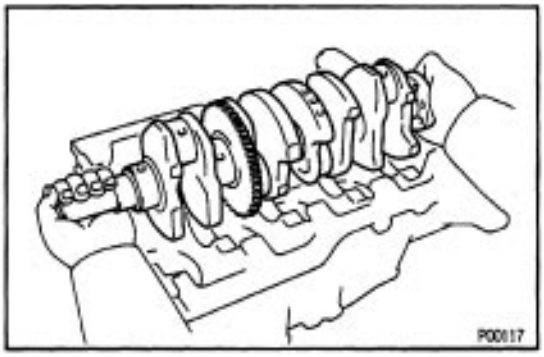
(a) Uniformly loosen and remove the main bearing cap bolts in several passes, in the sequence shown.



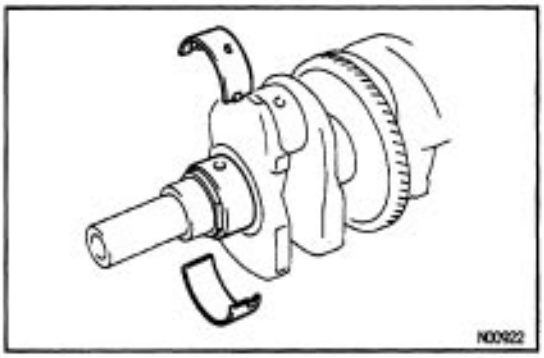
(b) Using the removed main bearing cap bolts, pry the main bearing cap back and forth, and remove the main bearing caps, lower bearings and lower thrust washers (No.3 main bearing cap only).

HINT:

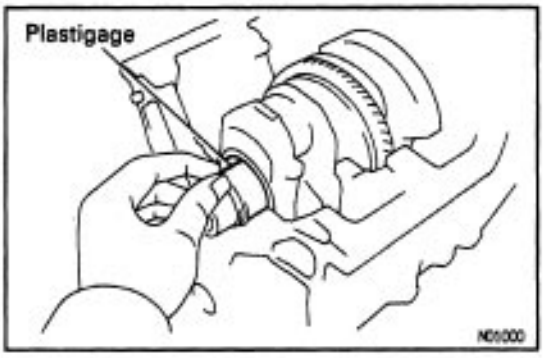
- Keep the lower bearing and main bearing cap together.
- Arrange the main bearing caps and lower thrust washers in correct order.



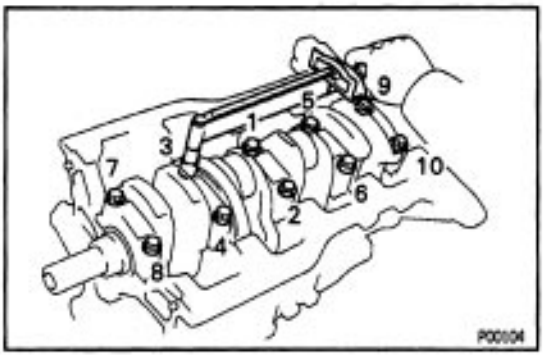
(c) Lift out the crankshaft.
HINT: Keep the upper bearing and upper thrust washers together with the cylinder block.



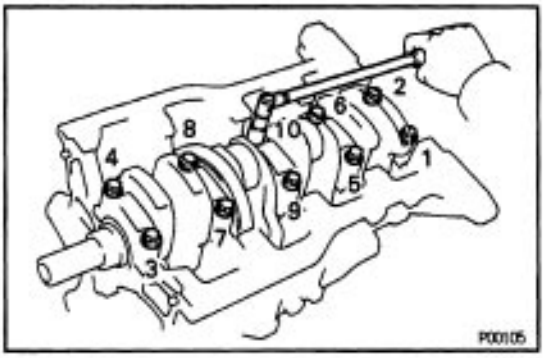
(d) Clean each main journal and bearing.
(e) Check each main journal and bearing for pitting and scratches.
If the journal or bearing is damaged, replace the bearings. If necessary, grind or replace the crankshaft.



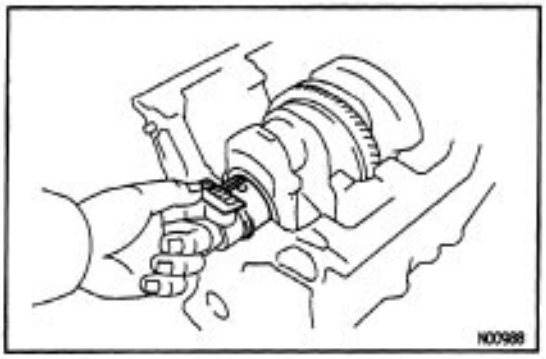
(f) Place the crankshaft on the cylinder block.
(g) Lay a strip of Plastigage across each journal.



(h) Install the main bearing caps.
(See step 4 on page EG1–121)
Torque: 59 N–m (600 kgf–cm, 43 ft–lbf)
NOTICE: Do not turn the crankshaft.



(i) Remove the main bearing caps.
(See procedure (a) and (b) on the previous page)



Measure the Plastigage at its widest point.

Standard clearance:

No.3

STD

0.025 – 0.044 mm (0.0010 – 0.0017 in.)

U/S 0.25

0.027 – 0.067 mm (0.0011 – 0.0026 in.)

Others

STD

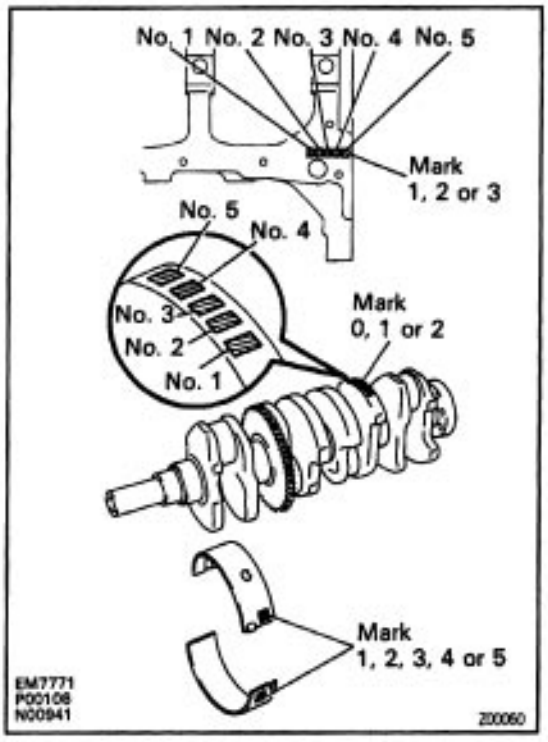
0.015 – 0.034 mm (0.00015 – 0.0013 in.)

U/S 0.25

0.019 – 0.059 mm (0.0007 – 0.0023 in.)

Maximum clearance:

0.08 mm (0.0031 In.)



HINT: If replacing the cylinder block subassembly, the bearing standard clearance will be:

No.3:

0.027 – 0.054 mm (0.0011 – 0.0021 in.)

Others

0.017 – 0.044 mm (0.0007 – 0.0017 in.)

If the oil clearance is greater than maximum, replace the bearings. If necessary, grind or replace the crank–shaft.

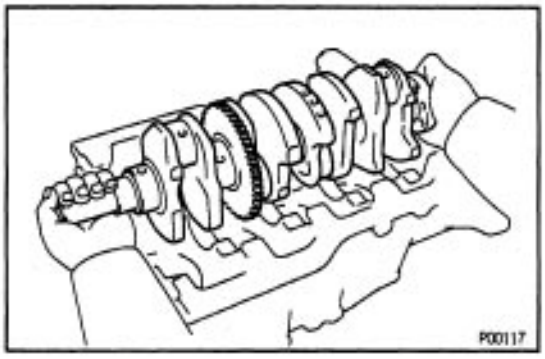
HINT: If using a standard bearing, replace it with one having the same number. If the number of the bearing cannot be determined, select the correct bearing by adding together the numbers imprinted on the cylin–der block and crankshaft, then selecting the bearing with the same number as the total. There are 5 sizes of standard bearings, marked “1”, “2”, “3”, “4” and “5” accordingly.

	Number marked								
Cylinder block	1			2			3		
Crankshaft	0	1	2	0	1	2	0	1	2
Use bearing	1	2	3	2	3	4	3	4	5

EXAMPLE: Cylinder block “2” + Crankshaft “11”
= Total number 3 (Use bearing “3”)

V00240

Reference:
Cylinder block main journal bore diameter:
Mark "1"
59.020 – 59.026 mm (2.32318 – 2.3239 in.)
Mark "2"
59.026 – 59.032 mm (2.3239 – 2.3241 in.)
Mark "3"
59.032 – 59.038 mm (2.3241 – 2.3243 in.)
Crankshaft journal diameter:
Mark "0"
54.998 – 55.003 mm (2.1653 – 2.1655 in.)
Mark "11"
54.993–54.998 mm (2.1651 – 2.1653 in.)
Mark "2"
54.988 – 54.993 mm (2.1649 – 2.1651 in.)
Standard sized bearing center wall thickness:
No–3
Mark "I"
1.992 – 1.995 mm (0.0784 – 0.0785 in.)
Mark '2"
1.995 – 1.998 mm (0.0785 – 0.0787 in.)
Mark "3"
1.998 – 2.001 mm (0.0787 – 0.0788 in.)
Mark '4"
2.001 – 2.004 mm (0.0788 – 0.0789 in.)
Mark '5'
2.004 – 2.007 mm (0.0789 – 0.0790 in.)
Others
Mark "I"
1.997 – 2.000 mm (0.0786 – 0.0787 in.)
Mark '2'
2.000 – 2.003 mm (0.0787 – 0.0789 in.)
Mark "3"
2.003 – 2.006 mm (0.0789 – 0.0790 in.)
Mark '4'
2.006 – 2.009 mm (0.0790 – 0.0791 in.)
Mark '5'
2.009 – 2.012 mm (0.0791 – 0.0792 in.)

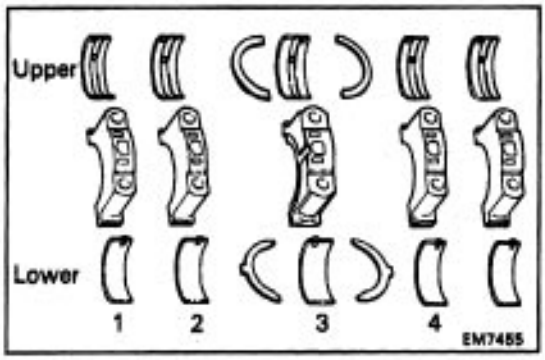


(k) Completely remove the Plastigage.

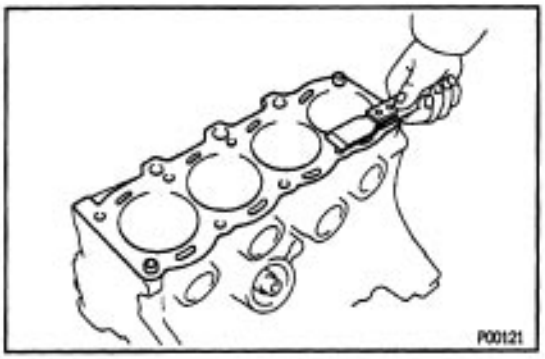
10. REMOVE CRANKSHAFT

(a) Lift out the crankshaft.

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



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



CYLINDER BLOCK INSPECTION

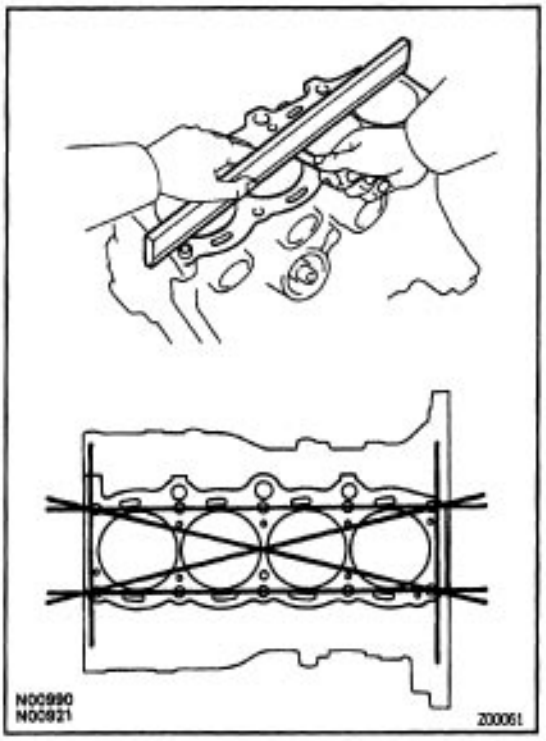
1. CLEAN CYLINDER BLOCK

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.

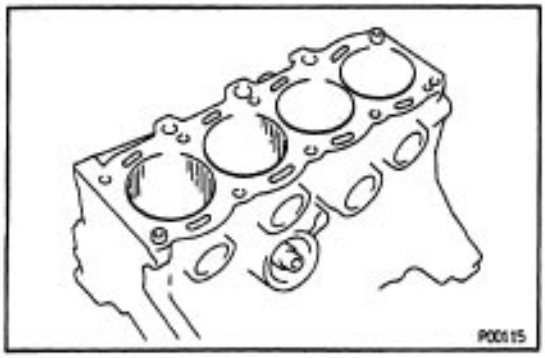


2. INSPECT TOP SURFACE OF CYLINDER BLOCK FOR FLATNESS

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

Maximum warpage:
0.05 mm (0.0020 In.)

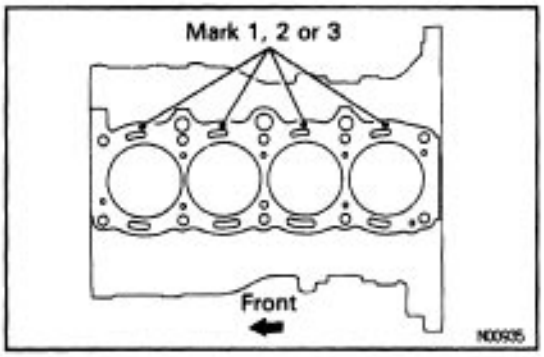
If warpage is greater than maximum, replace the cylin–der block.



3. INSPECT CYLINDER FOR VERTICAL SCRATCHES

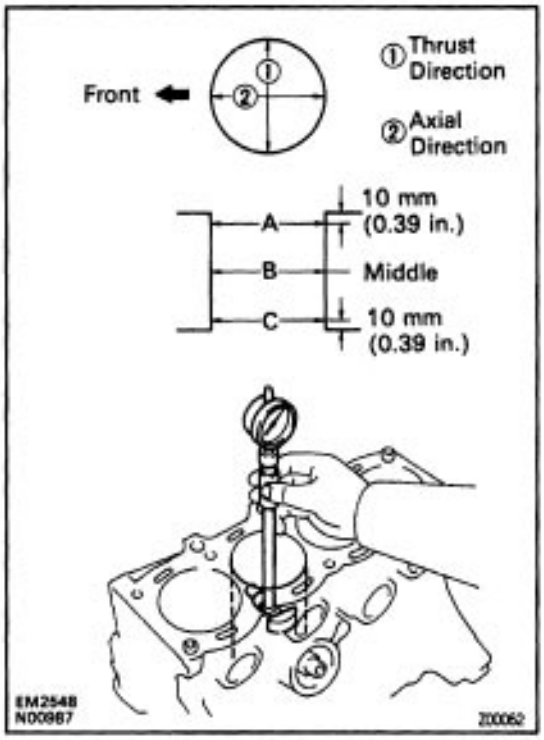
Visually check the cylinder for vertical scratches.

If deep scratches are present, rebore all the 4 cylin–ders. If necessary, replace the cylinder block.



4. INSPECT CYLINDER BORE DIAMETER

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



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

Standard diameter:

STD

Mark “1”

87.000 – 87.010 mm (3.4252 – 3.4256 in.)

Mark “2”

87.010 – 87.020 mm (3.4256 – 3.4260 in.)

Mark “3”

87.020 – 87.030 mm (3.4260 – 3.4264 In.)

Maximum diameter:

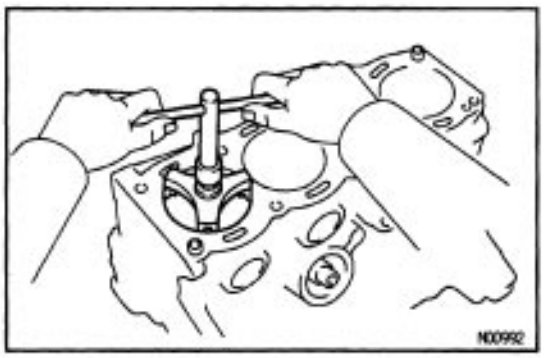
STD

87.23 mm (3.4342 in.)

O/S 0.50

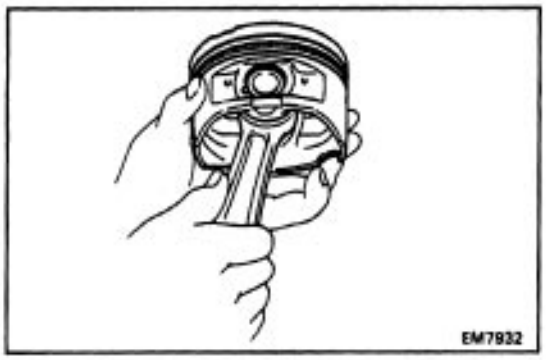
87.73 mm (3.4350 In.)

If the diameter is greater than maximum, rebore all the 4 cylinders. If necessary, 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.

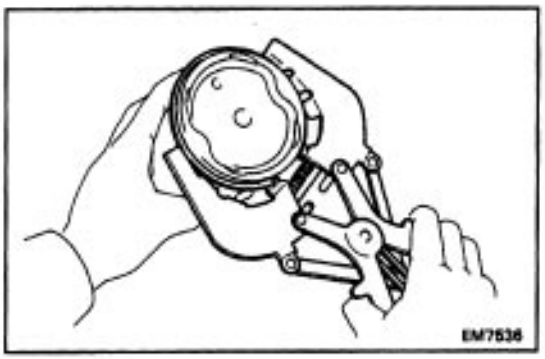


PISTON AND CONNECTING ROD ASSY DISASSEMBLY

1. CHECK FIT BETWEEN PISTON AND PISTON PIN

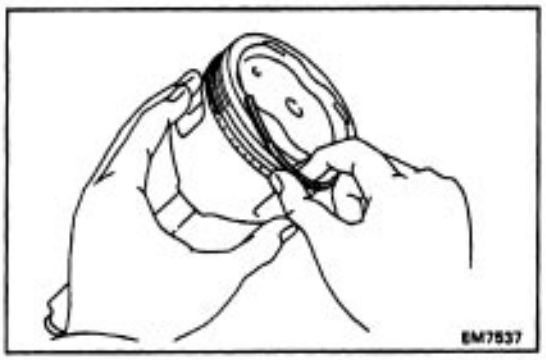
Try to move the piston back and forth on the piston pin.

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



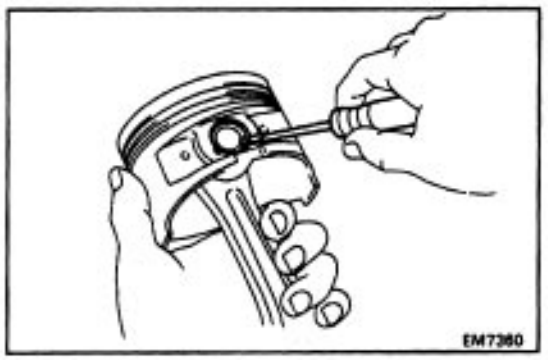
2. REMOVE PISTON RINGS

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



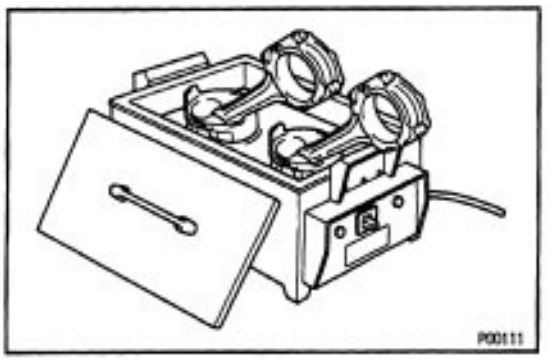
(b) Remove the 2 side rails and oil ring by hand.

HINT: Arrange the rings in correct order only.

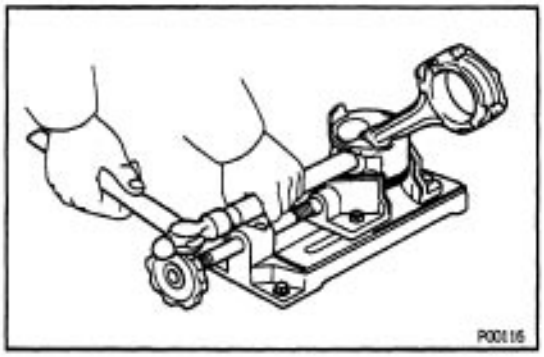


3. DISCONNECT CONNECTING ROD FROM PISTON

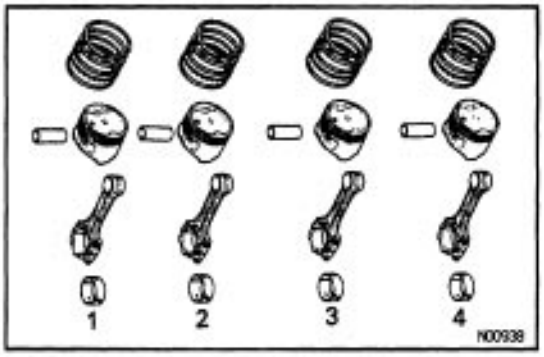
(a) Using a small screwdriver, pry out the 2 snap rings.



(b) Gradually heat the piston to 80–90°C (176–194°F).



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



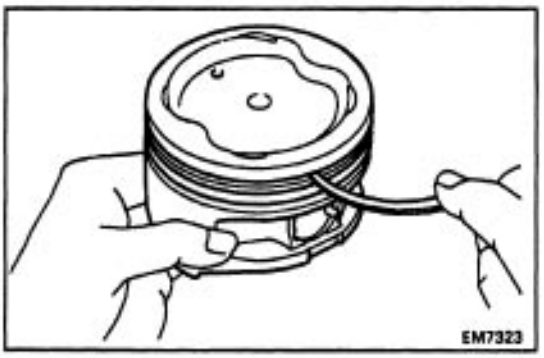
HINT:
The piston and pin are a matched set.
Arrange the pistons, pins, rings, connecting rods and bearings in correct order.



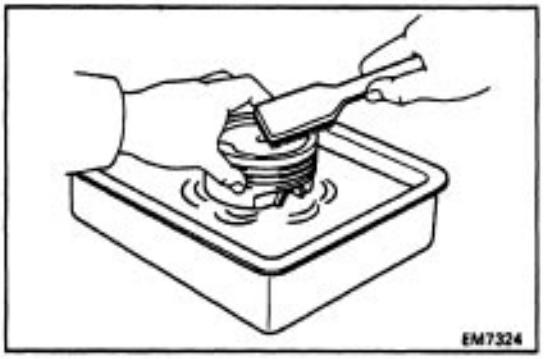
PISTON AND CONNECTING ROD INSPECTION

1. CLEAN PISTON

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

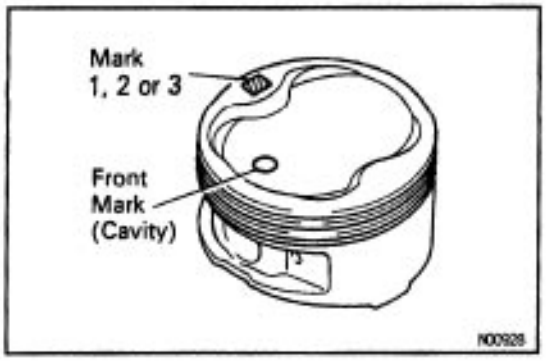


(b) Using a groove cleaning tool or broken ring, clean the piston ring grooves.



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

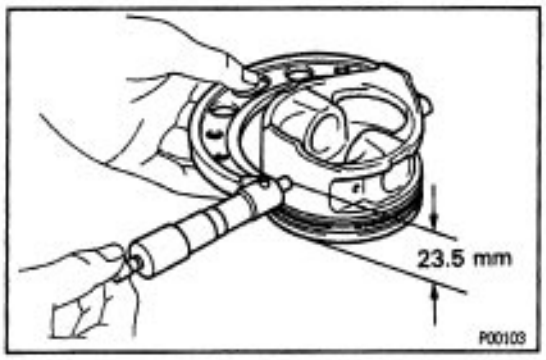
NOTICE: Do not use a wire brush.



2. INSPECT PISTON

A. Inspect piston oil clearance

HINT: There are 3 sizes of the standard piston diame–ter, marked “1”, “2” and “3” accordingly. The mark is stamped on the piston top.



(a) Using a micrometer, measure the piston diameter at ring angles to the piston pin center line, 23.5 mm (0.925 in.) from the piston head.

Piston diameter:

STD

Mark “I”

86.85–86.86 mm (3.4193 – 3.4197 in.)

Mark “2”

86.86–86.87 mm (3.4197 – 3.4201 In.)

Mark “3”

86.87 – 86.88 mm (3.4201 – 3.4205 in.)

O/S 0.50

87.35 – 87.38 mm (3.4390 – 3.4402 in.)

(b) Measure the cylinder bore diameter in the thrust di–rections.

(See step 4 on page EG1–106)

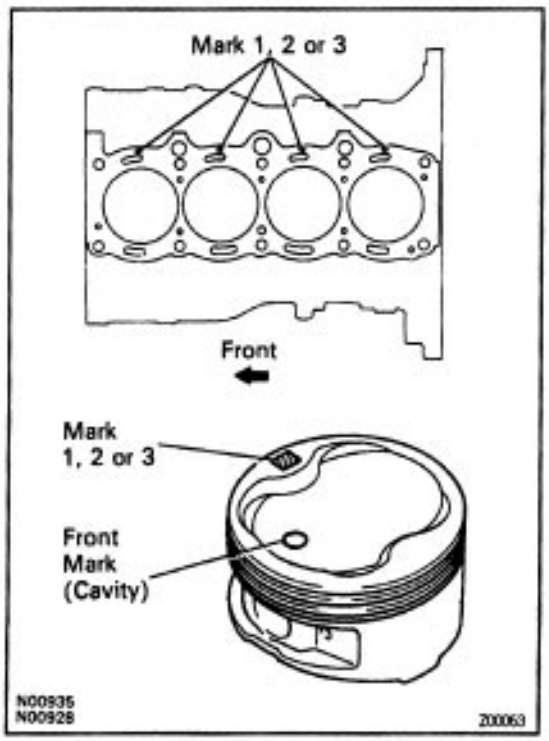
(c) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Standard oil clearance:

0.14 – 0.16 mm (0.0055 – 0.0063 in.)

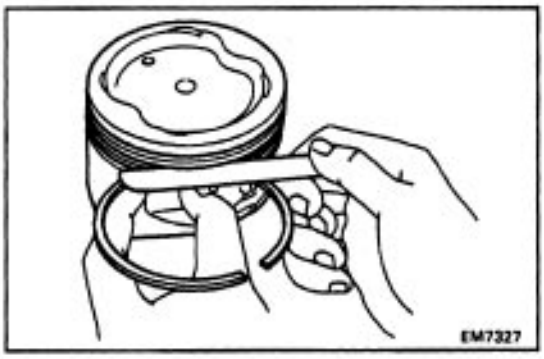
Maximum oil clearance:

0.18 mm (0.0071 in.)



If the oil clearance is greater than maximum, replace all the 4 pistons and rebore all the 4 cylinders. If necessary, replace the cylinder block.

HINT (Use new cylinder block): Use a piston with the same number mark as the cylinder bore diameter marked on the cylinder block.



B. Inspect piston ring groove clearance

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

Ring groove clearance:

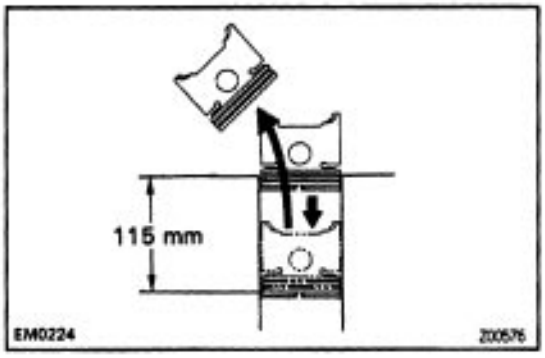
No.1

0.040 – 0.080 mm (0.0016 – 0.0031 In.)

No.2

0.030 – 0.070 mm (0.0012 – 0.0028 in.)

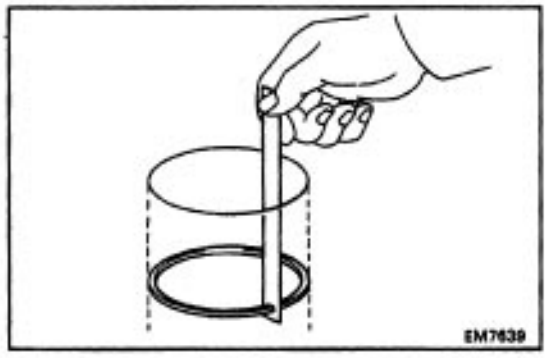
If the clearance is greater than maximum, replace the piston.



C. Inspect piston ring end gap

(a) Insert the piston ring into the cylinder bore.

(b) Using a piston, push the piston ring a little beyond the bottom of the ring travel, 115 mm (4.53 in.) from the top of the cylinder block.



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

Standard and gap:

No.1

0.270 – 0.500 mm (0.0106 – 0.0197 in.)

No.2

0.350 – 0.600 mm (0.0138 – 0.0234 in.)

Oil (Side rail)

0.200 – 0.550 mm (0.0079 – 0.0217 in.)

Maximum end gap:

No.1

1.10 mm (0.0433 in.)

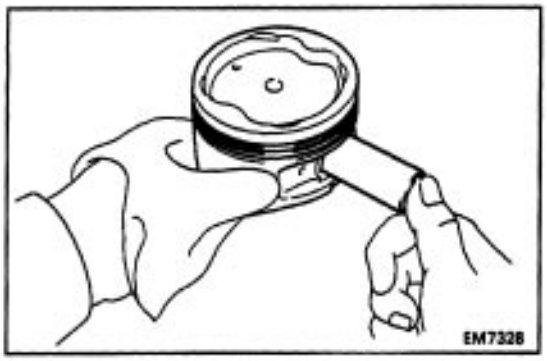
No.2

1.20 mm (0.0472 In.)

Oil (Side rail)

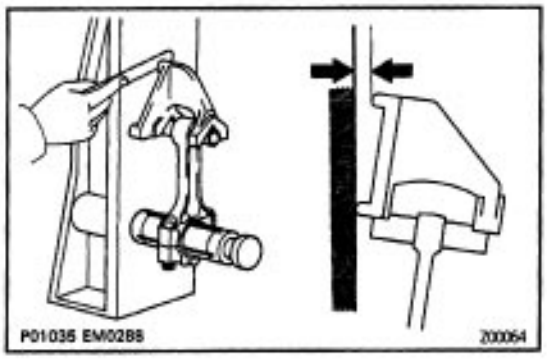
1.15 mm (0.0453 In.)

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, rebore all the 4 cylinders or replace the cylinder block.



D. Inspect–piston pin fit

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

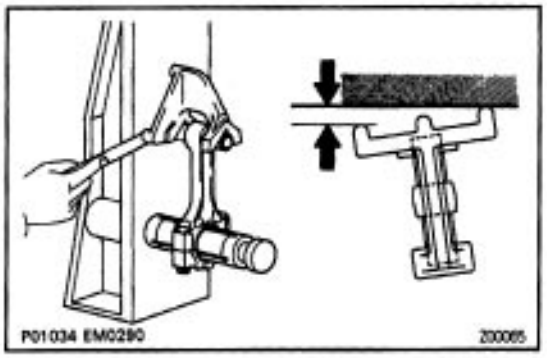


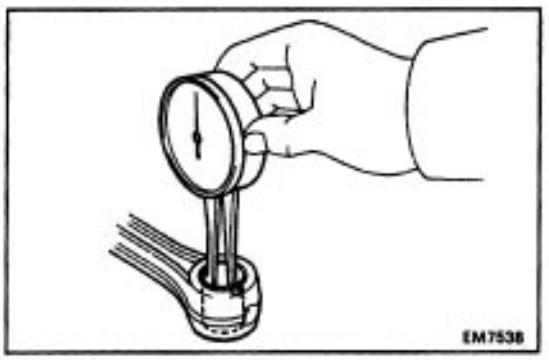
3. INSPECT CONNECTING ROD

A. Inspect connecting rod alignment

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

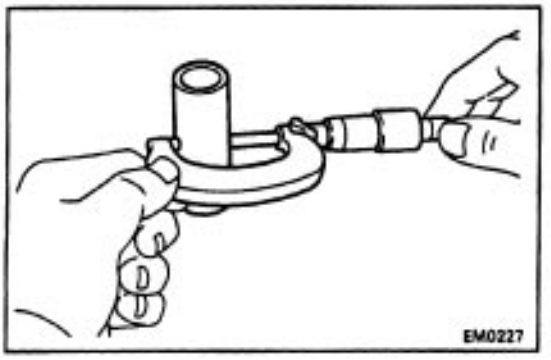
- Check for bend.
  Maximum bend:
  0.05 mm (0.0020 in.) per 100 mm (3.94 In.)
  If bend is greater than maximum, replace the connect–ing rod assembly.
- Check for twist
  Maximum twist:
  0.15 mm (0.0059 in.) per 100 mm (3.94 in.)
  If twist is greater than maximum, replace the connect–ing rod assembly.





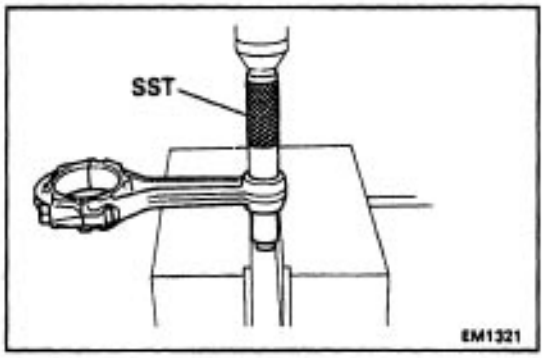
B. Inspect piston pin oil clearance

(a) Using a caliper gauge, measure the inside diameter of the connecting rod bushing.
Bushing inside diameter:
22.005 – 22.017 mm (0.8663 – 0.8668 in.)



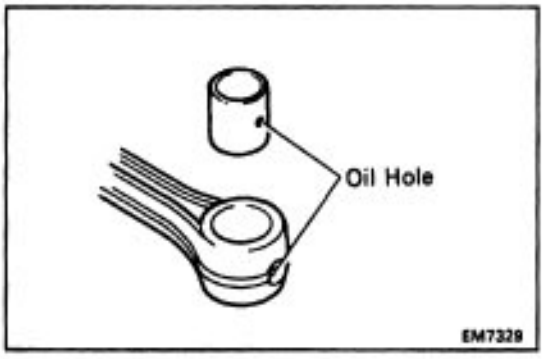
(b) Using a micrometer, measure the piston pin diameter.
Piston pin diameter:
21.997 – 22.009 mm (0.8660 – 0.8865 in.)

(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.



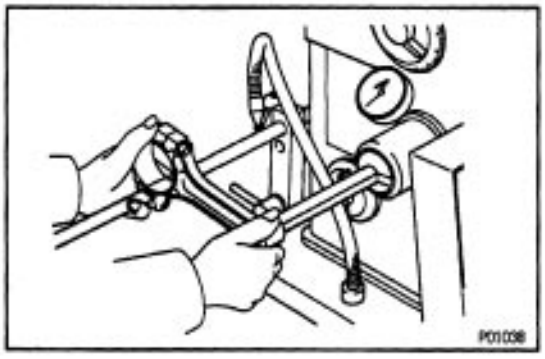
C. If necessary, replace connecting rod bushing

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

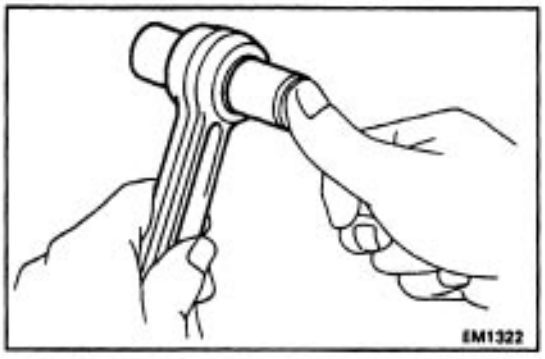


(b) Align the oil holes of a new bushing and the connecting rod.

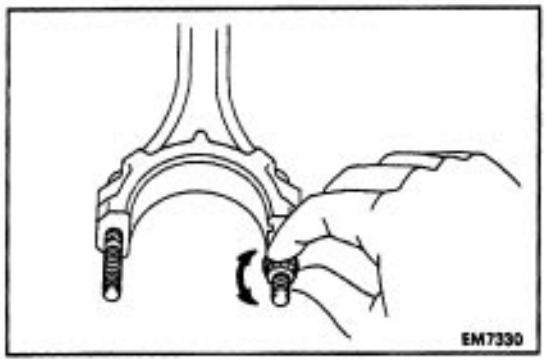
(c) Using SST and a press, press in the bushing.
SST 09222–30010



(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.

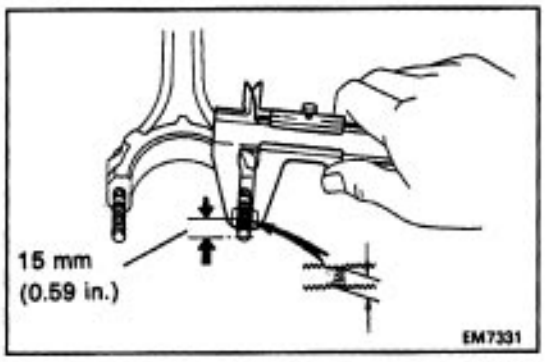


(e) Check the piston pin fit at normal room temperature.
Coat the piston pin with engine oil, and push it into the connecting rod with your thumb.



D. Inspect connecting rod bolts

(a) Install the cap nut to the connecting rod bolt. Check that the cap nut can be turned easily by hand to the end of the thread.



(b) If the cap nut cannot be turned easily, measure the outside diameter of the connecting rod bolt with a vernier caliper.

Standard outside diameter:

7.860–8.000 mm (0.3094–0.3150 in.)

Minimum outside diameter:

7.60 mm (0.2992 in.)

HINT: If the location of this area cannot be judged by visual inspection, measure the outer diameter at the location shown in the illustration.

If the outside diameter is less than minimum, replace the connecting rod bolt and nut as a set.

CYLINDER BORING

HINT:

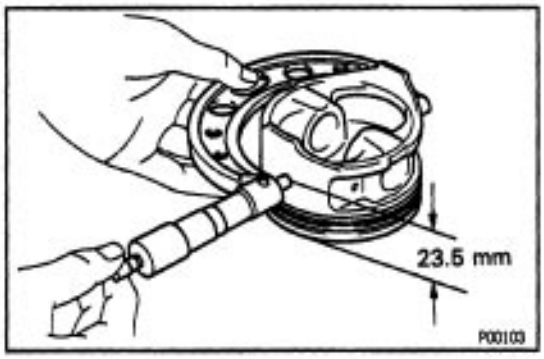
- Bore all the 4 cylinders for the oversized piston outside diameter.
- Replace all the piston rings with ones to match the oversized pistons.

1. KEEP OVERSIZED PISTONS

Oversized piston diameter:

O/S 0.50

87.35 – 87.38 mm (3.4390–3.4402 in.)



2. CALCULATE AMOUNT TO BORE CYLINDERS

(a) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 23.5 mm (0.925 in.) from the piston head.

(b) Calculate the amount of each cylinder is to be rebored as follows:

Size to be rebored = P + C–H

P = Piston diameter

C = Piston clearance

0.14 – 0.18 mm (0.0055 – 0.0063 in.)

H = Allowance for honing

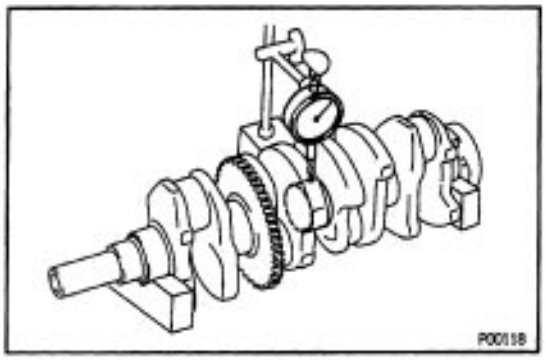
0.20 mm (0.0008 in.) or less

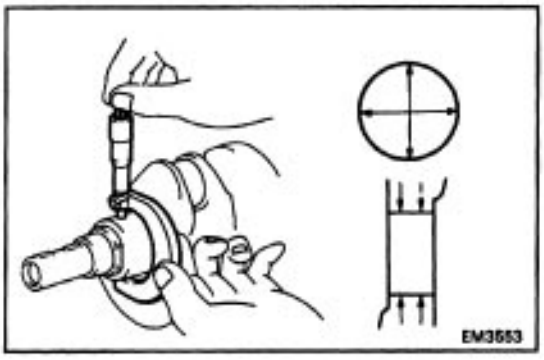
3. BORE AND HONE CYLINDER TO CALCULATED DIMENSIONS

Maximum honing:

0.02 mm (0.0008 in.)

NOTICE: Excess honing will destroy the finished round–ness.





CRANKSHAFT INSPECTION AND REPAIR

1. INSPECT CRANKSHAFT FOR RUNOUT

(a) Place the crankshaft on V–blocks.

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

Maximum circle runout:
0.06 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:
STD size
54.988 – 55.003 mm (2.1653–2.1655 in.)
U/S 0.25
54.745 – 54.755 mm (2.1553–2.1557 in.)
Crank pin diameter:
STD size
51.985 – 52.000 mm (2.0466–2.0472 in.)
U/S 0.25
51.745 – 51.755 mm (2.0372–2.0376 in.)

If the diameter is not as specified, check the oil clearance (See pages EG1–98 to 104). If necessary, grind or 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.

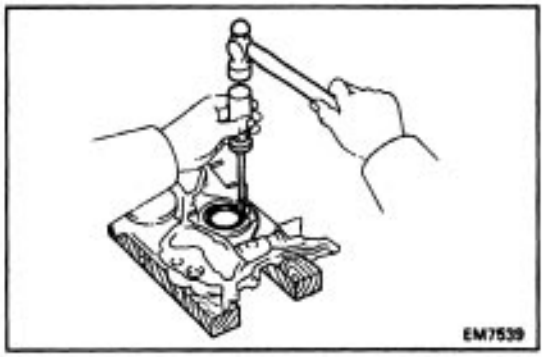
3. IF NECESSARY. GRIND AND HONE MAIN JOURNALS AND/OR CRANK PINS

Grind and hone the main journals and/or crank pins to the finished undersized diameter (See procedure in step 2).

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

CRANKSHAFT OIL SEALS REPLACEMENT

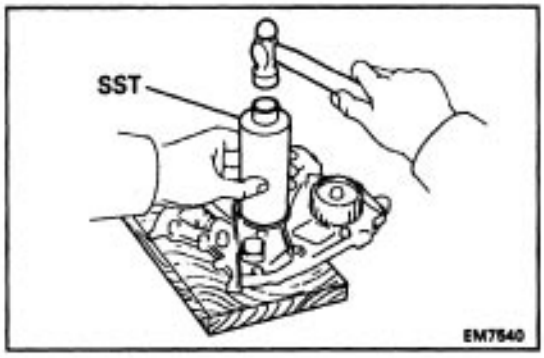
HINT: There are 2 methods (A and B) to replace the oil seal which are as follows:



1. REPLACE CRANKSHAFT FRONT OIL SEAL

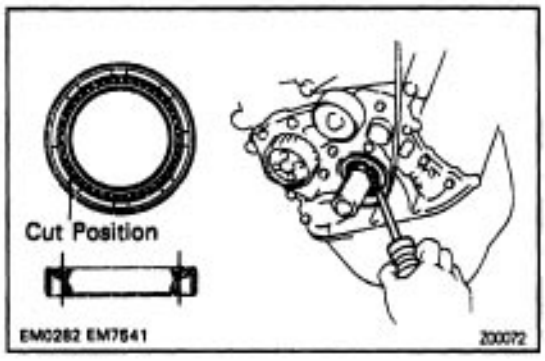
A. If oil pump is removed from cylinder block:

(a) Using a screwdriver and a 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 oil pump case edge.
SST 09223 – 63010

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

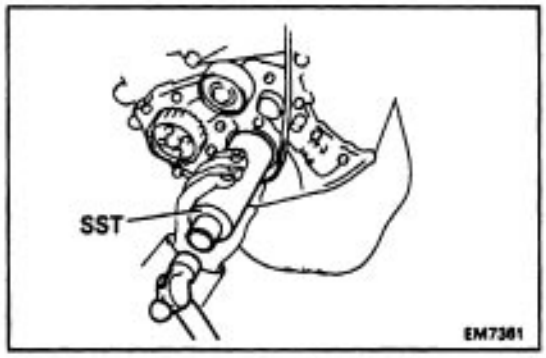


B. If oil pump is installed to the cylinder block:

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

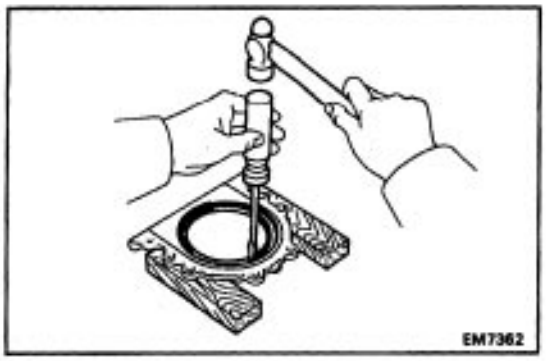
(b) Using a screwdriver, pry out the oil seal.

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



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

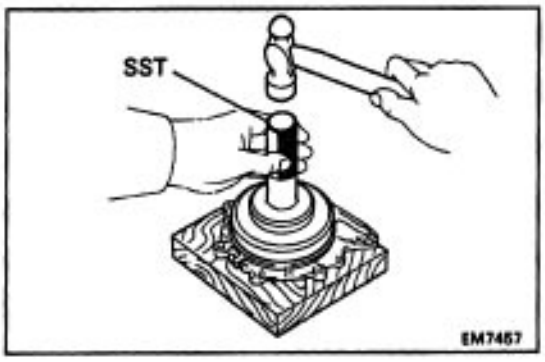
(d) Using SST and a hammer, tap in the oil seal until its surface is flush with the oil pump case edge.
SST 09226 –10010



2. REPLACE CRANKSHAFT REAR OIL SEAL

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

(a) Using 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 edge.
SST 09223–63010

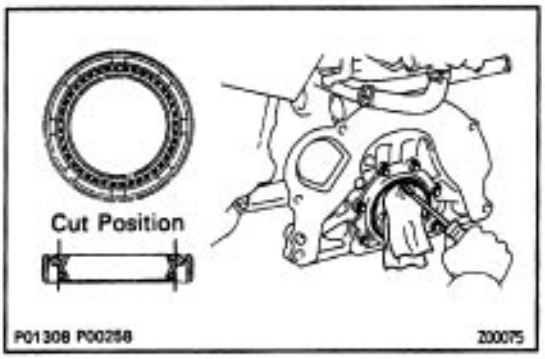
(c) Apply MP grease to the oil seal lip.

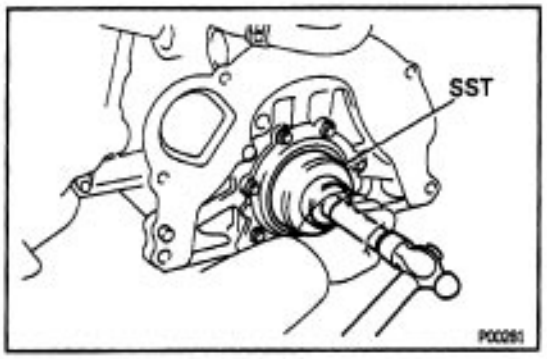
B. If rear oil seal retainer Is installed to cylinder block:

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

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

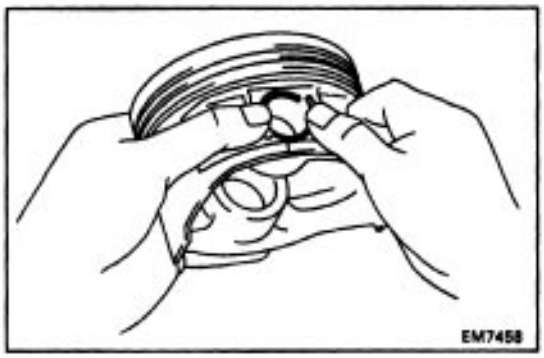
NOTICE: Be careful not to damage the crankshaft. Tape the screwdriver tip.





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

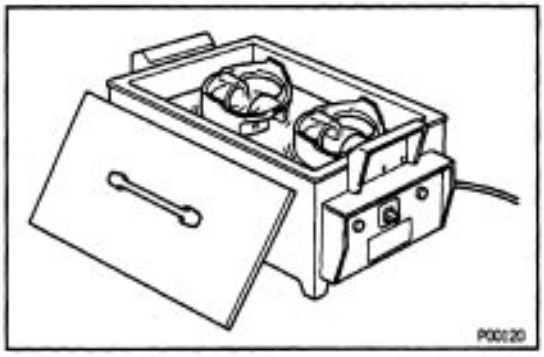
(d) Using SST and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.
SST 09223 – 63010



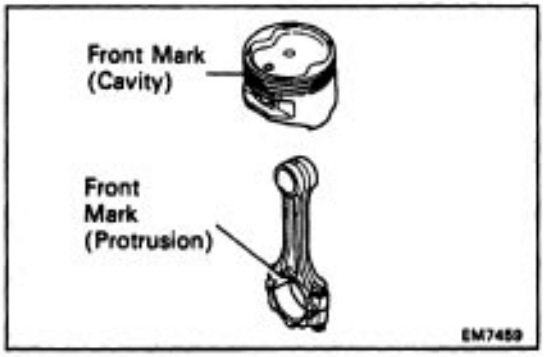
PISTON AND CONNECTING ROD ASSEMBLY

1. ASSEMBLE PISTON AND CONNECTING ROD

(a) Install a new snap ring on one side of the piston pin hole.



(b) Gradually heat the piston to 80–90°C (176–194°F).

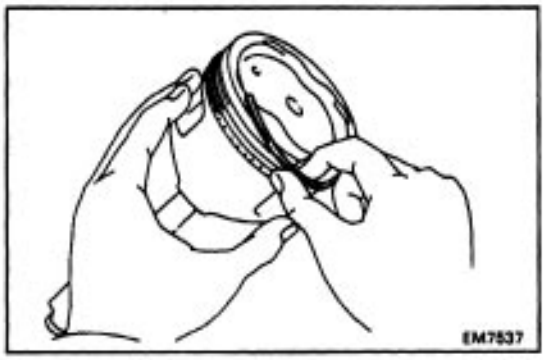


(c) Coat the piston pin with engine oil.

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

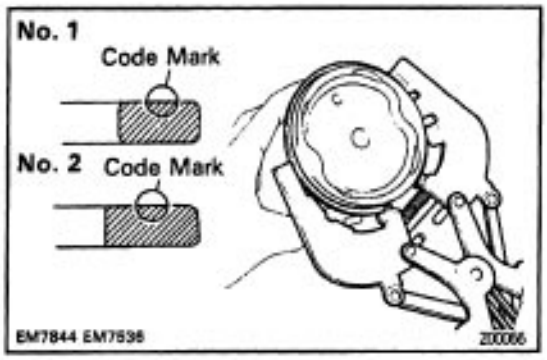


(e) Install a new snap ring on the other side of the piston pin hole.



2. INSTALL PISTON RINGS

(a) Install the oil ring expander and 2 side rails by hand.



(b) Using a piston ring expander, install the 2 compres–sion rings with the code mark facing upward.

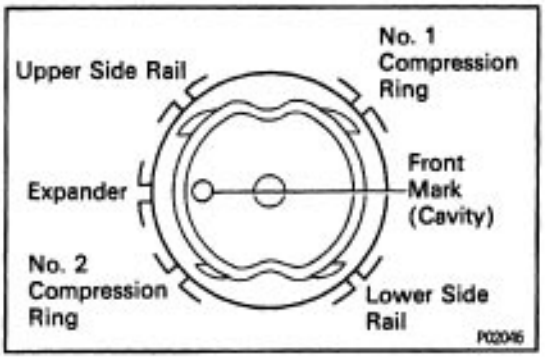
Code mark:

N o.1

1N orT

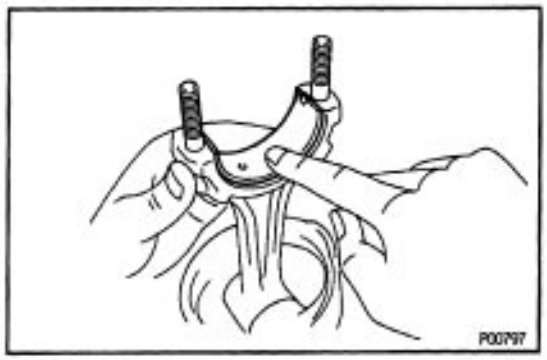
No.2

2N 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 Cylinder Block Disassembly and Assembly)

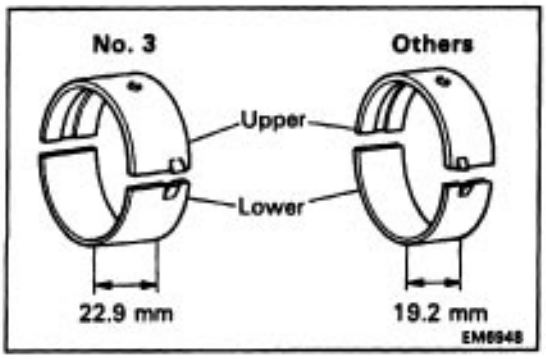
HINT:

- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets, 0–rings and oil seals with new parts.

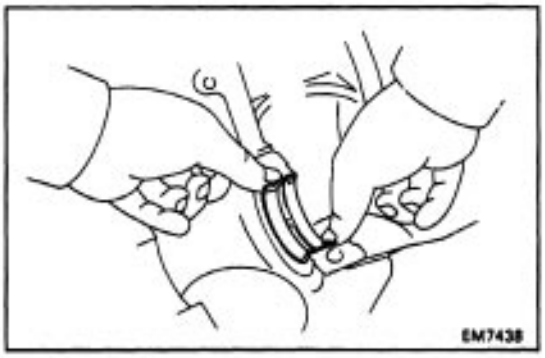
1. INSTALL MAIN BEARINGS

HINT:

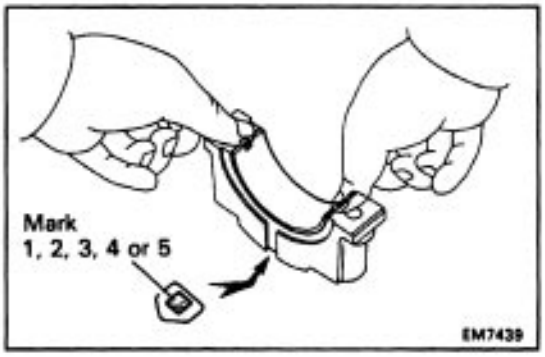
- Main bearings come in widths of 19.2 mm (0.756 in.) and 22.9 mm (0.902 in.). Install the 22.9 mm (0.902 in.) bearings in the No.3 cylinder block journal position with the main bearing cap. Install the 19.2 mm (0.756 in.) bearings in the other positions.



- Upper bearings have an oil groove and oil holes; lower bearings do not.

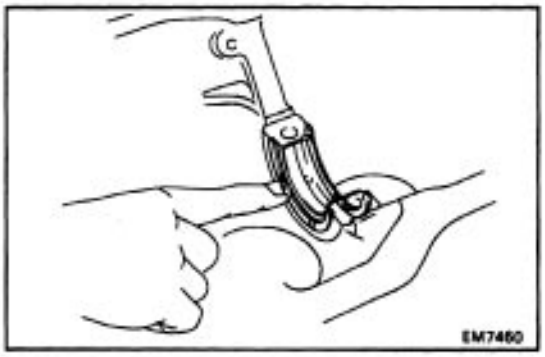


(a) Align the bearing claw with the claw groove of the cylinder block, and push in the 5 upper bearings.



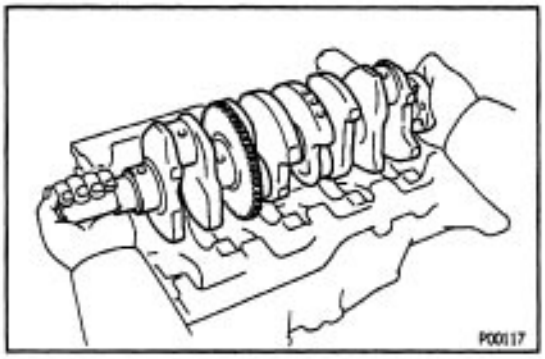
(b) Align the bearing claw with the claw groove of the main bearing cap, and push in the 5 lower bearings.

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

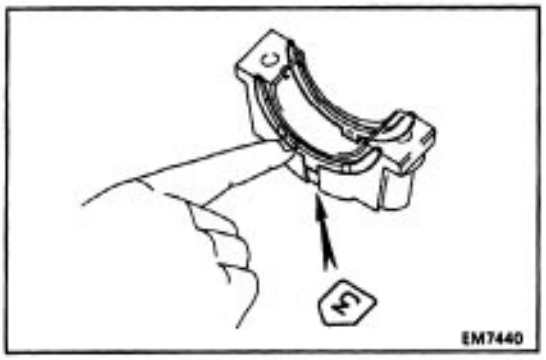


2. INSTALL UPPER THRUST WASHERS

Install the 2 thrust washers under the No.3 journal position of the cylinder block with the oil grooves facing outward.

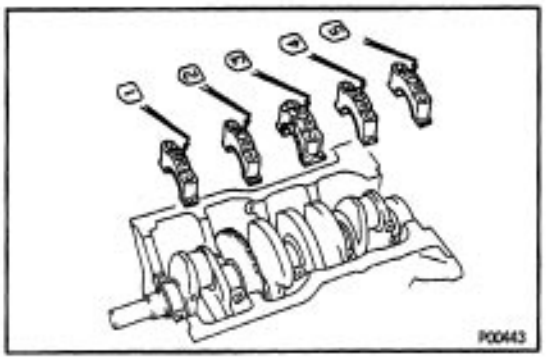


3. PLACE CRANKSHAFT ON CYLINDER BLOCK



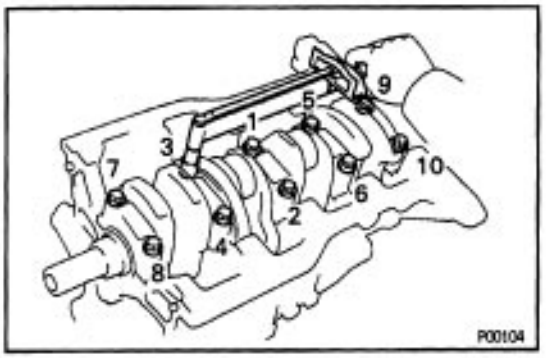
4. INSTALL MAIN BEARING CAPS AND LOWER THRUST WASHERS

(a) Install the 2 thrust washers on the No.3 bearing cap with the grooves facing outward.



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

HINT: Each bearing cap has a number and front mark.

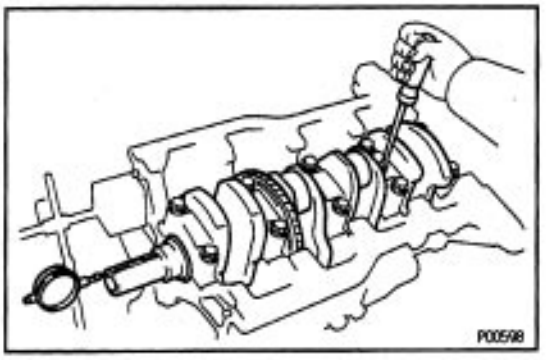


(c) Apply a light coat of engine oil on the threads and under the heads of the main bearing cap bolts.

(d) Install and uniformly tighten the 10 bolts of the main bearing caps in several passes, in the sequence shown.

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

(e) Check that the crankshaft turns smoothly.

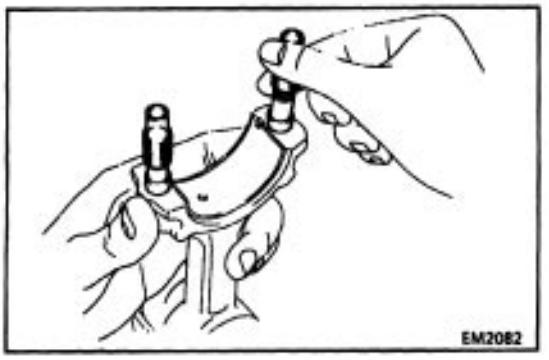


(f) Check the crankshaft thrust clearance.

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

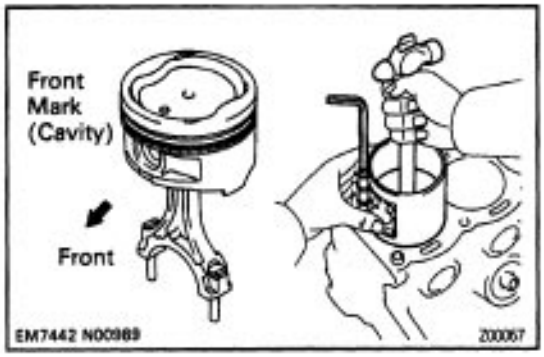
Standard thrust clearance:
0.020 – 0.220 mm (0.0008 – 0.0087 in.)
Maximum thrust clearance:
0.30 mm (0.0118 In.)

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

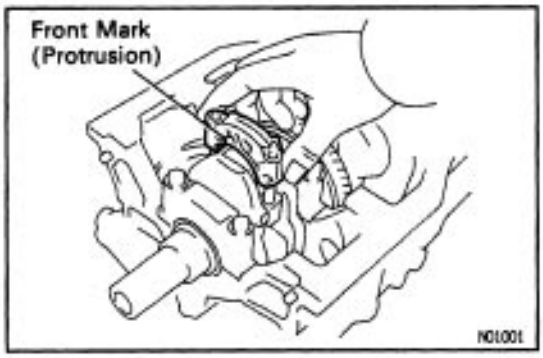


5. INSTALL PISTON AND CONNECTING ROD ASSEMBLES

(a) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.



(b) 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.



6. INSTALL CONNECTING ROD CAPS

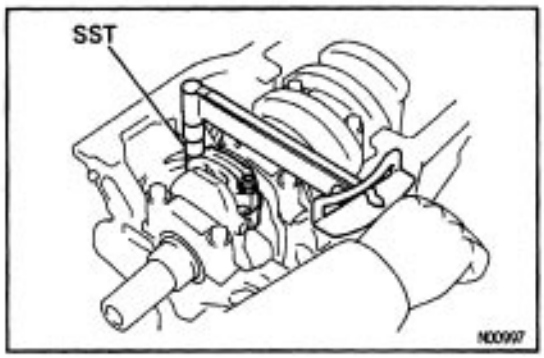
A. Place connecting rod cap on connecting rod

(a) Match the numbered connecting rod cap with the connecting rod.

(b) Install the connecting rod cap with the front mark facing forward.

B. Install connecting rod cap nuts

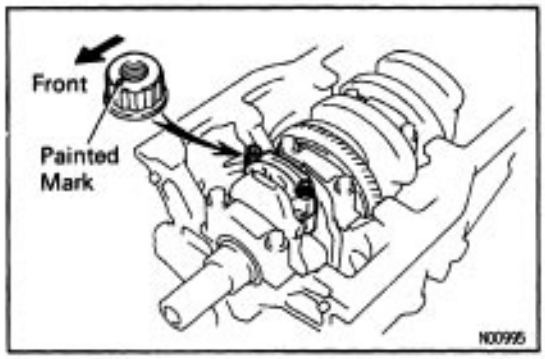
HINT:
The cap nuts are tightened in 2 progressive steps
(steps
(b) and
(d)).
If any one of the connecting rod bolts is broken or deformed, replace it.



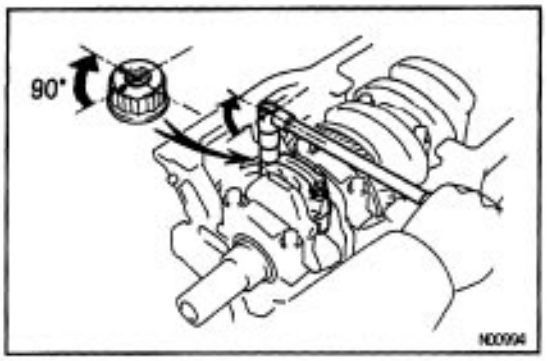
(a) Apply a light of engine oil on the threads and under the nuts of the connecting rod cap.

(b) Using SST, install and alternately tighten the cap nuts in several passes.
SST 09011– 38121

Torque: 25 N–m (250 kgf–cm, 18 ft–lbf)
If any one of the cap nuts does not meet the torque specification, replace the connecting rod bolt and cap nut as a set.



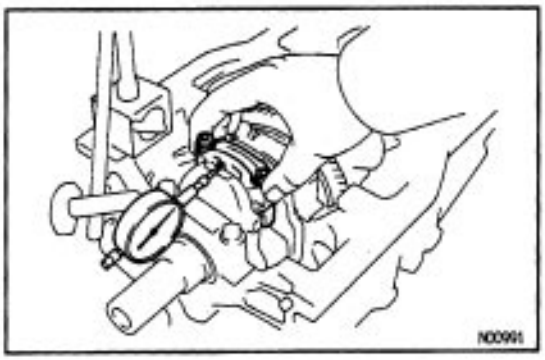
(c) Mark the front of the cap nut with the paint.



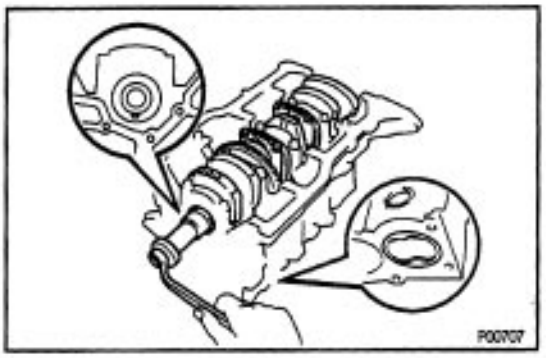
(d) Retighten the cap nuts 90° as shown.

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

(f) Check that the crankshaft turns smoothly.

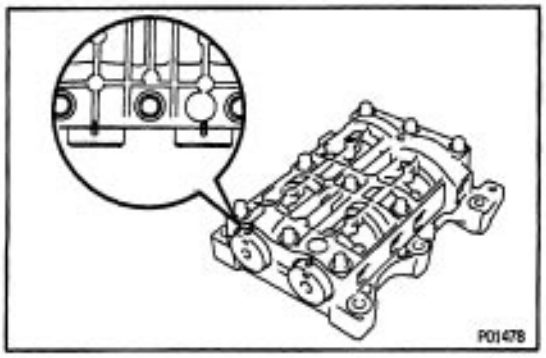


(g) Check the connecting rod thrust clearance.
Using a dial indicator, measure the thrust clearance while moving the connecting rod back an forth.
Standard thrust clearance:
0.160 – 0.312 mm (0.0063 – 0.0123 In.)
Maximum thrust clearance:
0.35 mm 10.0138 In.)
If the thrust clearance is greater than maximum, replace the connecting rod assembly. If necessary, replace the crankshaft.

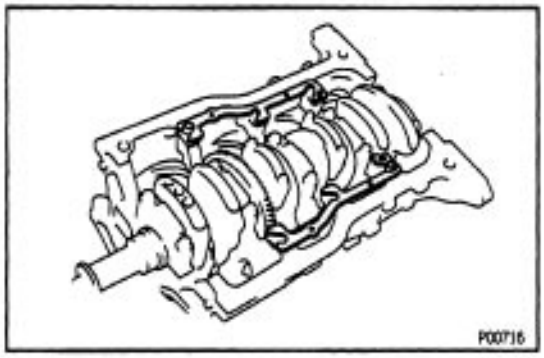


7. INSTALL ENGINE BALANCER

(a) Turn the crankshaft, and set the No. 1 cylinder TDC as shown in the illustration.

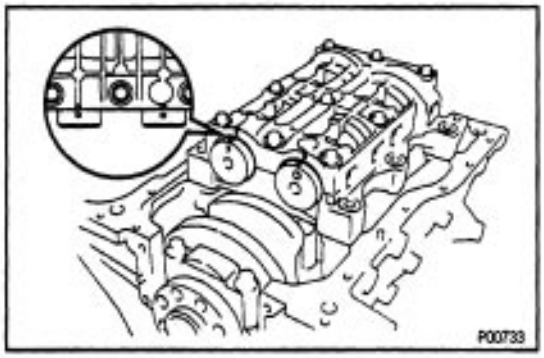


(b) Set the balance shafts so that the punch marks of the balance shafts are aligned with the grooves of the No.
2 housing.

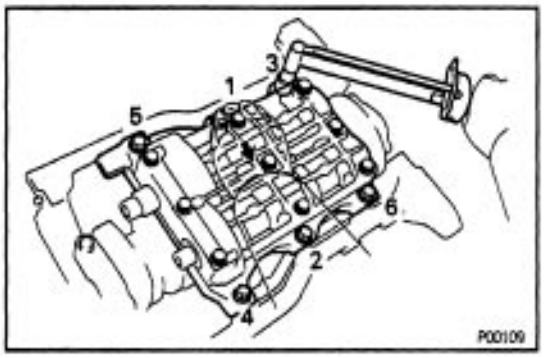


(c) Wipe clean the installation surface of the spacer.
(d) Place the spacers on the cylinder block.

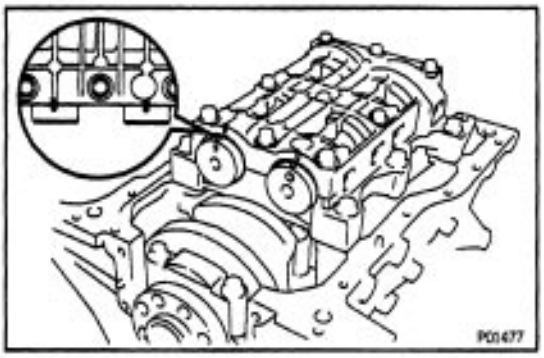
HINT: When replacing the crankshaft and/or balance shaft, use the thickest spacers.



(e) Place the engine balancer on the cylinder block.
(f) Check that punch marks shown in the illustration of the balance shafts are align with the grooves of the No.2 housing.

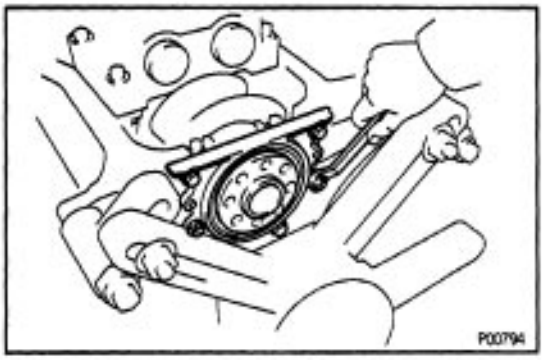


(g) While pulling the center part of the engine balancer in the direction of the arrow, uniformly tighten the 6 bolts in several passes, in the sequence shown.
Torque: 49 N–m (500 kgf–cm, 36 ft–lbf)



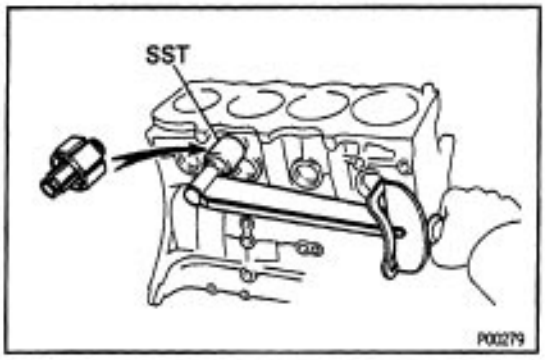
(h) Recheck that the punch marks of the balance shafts are aligned with the grooves of No.2 housing.

8. CHECK AND ADJUST BACKLASH OF CRANKSHAFT GEAR AND NO.1 BALANCE SHAFT GEAR (See page EG1–94)



9. INSTALL REAR OIL SEAL RETAINER

Install a new gasket and the retainer with the 6 bolts.
Torque: 9.3 N–m (95 kgf–cm, 82 in.–lbf)



POST ASSEMBLY

1. INSTALL KNOCK SENSOR

Using SST, install the knock sensor.
SST 09816–30010

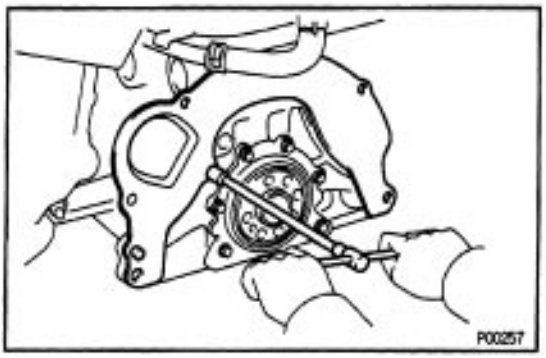
Torque: 37 N–m (380 kgf–cm. 27 ft–lbf)

2. w/ OIL COOLER:
INSTALL OIL COOLER
3. INSTALL OIL FILTER
4. INSTALL OIL PUMP AND OIL PAN
5. INSTALL WATER PUMP AND GENERATOR ADJUSTING BAR
6. INSTALL CYLINDER HEAD
7. INSTALL PULLEYS AND TIMING BELT

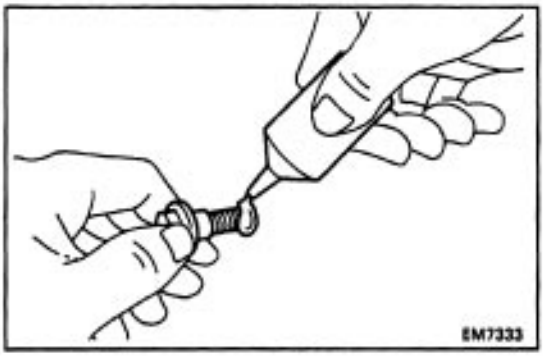


8. INSTALL PS PUMP BRACKET
Install the PS pump bracket with 3 bolts.
Torque: 43 N–m (440 kgf–cm, 32 ft–lbf)

9. INSTALL GENERATOR
10. INSTALL DISTRIBUTOR
11. REMOVE ENGINE STAND



12. INSTALL REAR END PLATE
Torque: 9.3 N–m (95 kgf–cm, 82 in.–lbf)



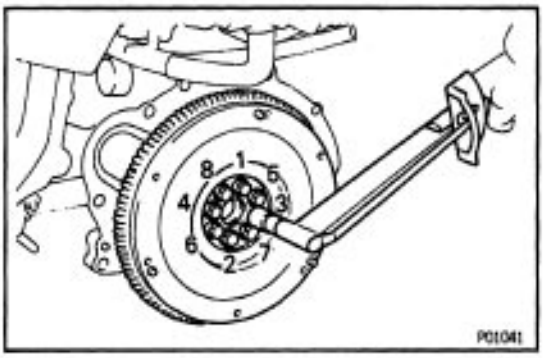
13. M/T:

INSTALL FLYWHEEL

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

Adhesive:

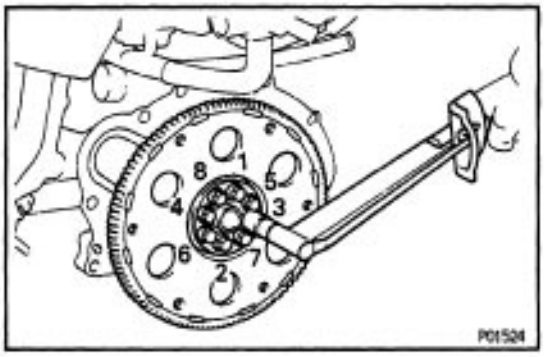
Part No.08833–00070. THREE BOND 1324 or equivalent



(b) Install the flywheel on the crankshaft.

(c) install and uniformly tighten the mounting bolts in several passes, in the sequence shown.

Torque: 88 N–m (900 kgf–cm, 66 ft–lbf)



14. A/T:

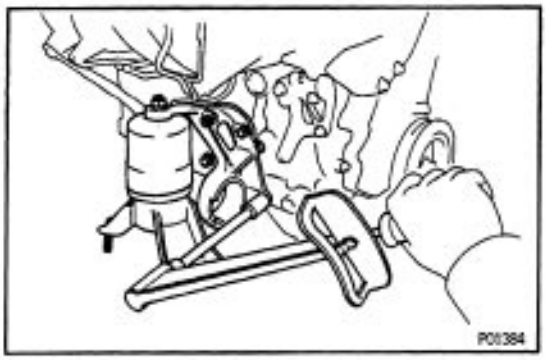
INSTALL DRIVE PLATE (See procedure step 13)

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

15. M/T:

INSTALL CLUTCH DISC AND COVER

ENGINE INSTALLATION

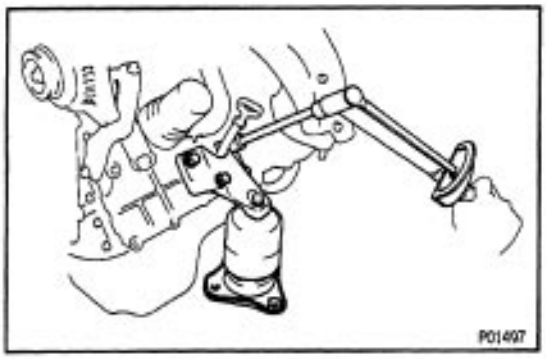


(See Components for Engine Removal and Installation)

1. INSTALL RR ENGINE MOUNTING INSULATOR

Install the mounting insulator with the 4 bolts.

Torque: 64 N–m (650 kgf–cm. 47 ft–lbf)



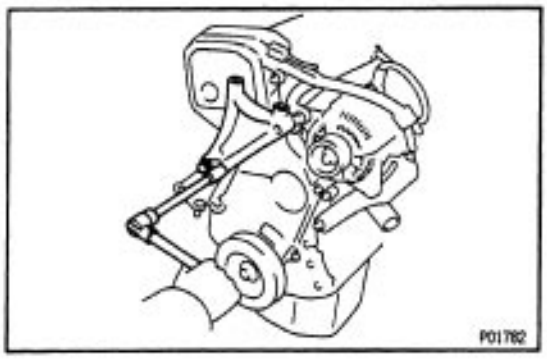
2. INSTALL FR ENGINE MOUNTING INSULATOR

(a) Install the mounting insulator with the 4 bolts.

Torque: 77 N–m (790 kgf–cm. 57 ft–lbf)

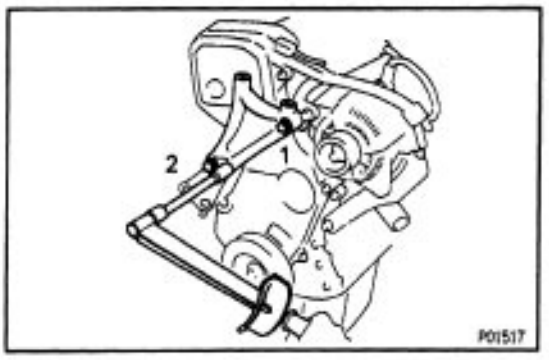
(b) Install the manifold stay with the bolt and nut.

Torque: 42 N–m (425 kgf–cm, 31 ft–lbf)



3. INSTALL N0.2 ENGINE MOUNTING BRACKET

(a) Temporarily install the No.2 engine mounting bracket with the 2 bolts.



(b) Install the remain bolt.

(c) Tighten the 3 bolts in the sequence shown.

Torque: 52 N–m (530 kgf–cm, 38 ft–lbf)

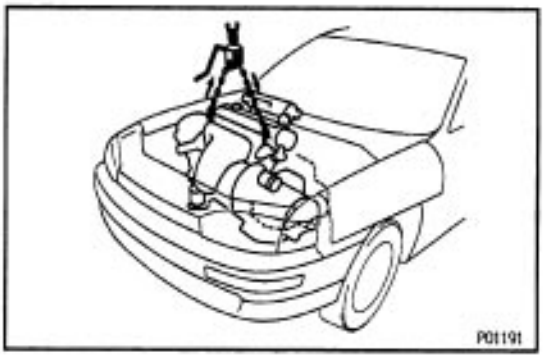
4. ASSEMBLE ENGINE AND TRANSAXLE

M/T (See page MX–15)

A/T (See page AX1–27)

5. A/T:

INSTALL STARTER



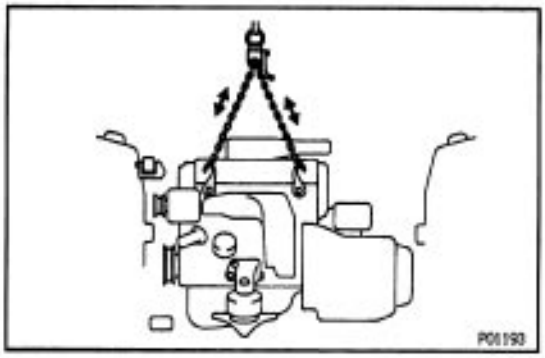
6. INSTALL ENGINE AND TRANSAXLE ASSEMBLY IN VEHICLE

(a) Attach the engine sling device to the engine hangers.

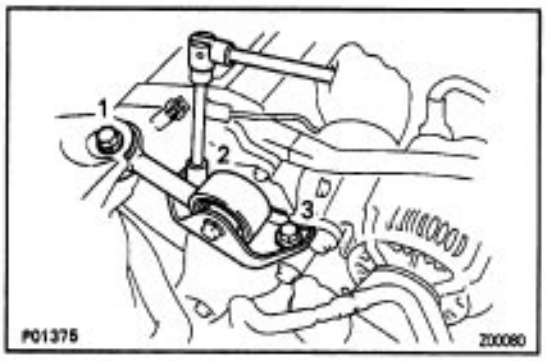
(b) Lower the engine into the engine compartment.

Tilt the transaxle downward, lower the engine and clear the LH mounting.

NOTICE: Be careful not to hit the PS gear housing or park/neutral position switch (A/T).

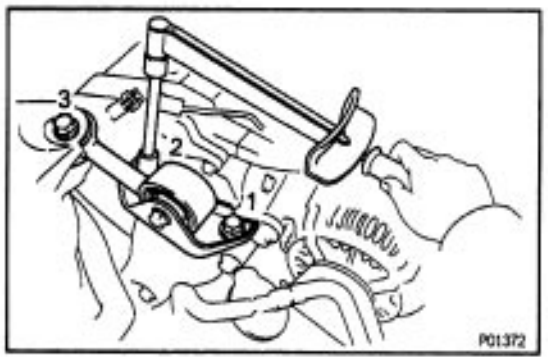


(c) Keep the engine level, and align RH and LH mountings with the body bracket.



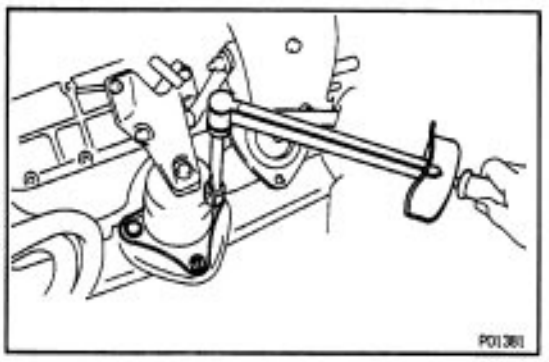
7. INSTALL ENGINE MOVING CONTROL ROD

(a) Temporarily install the engine moving control rod with the 3 bolts in the sequence shown.



(b) Tighten the 3 bolts in the sequence shown.

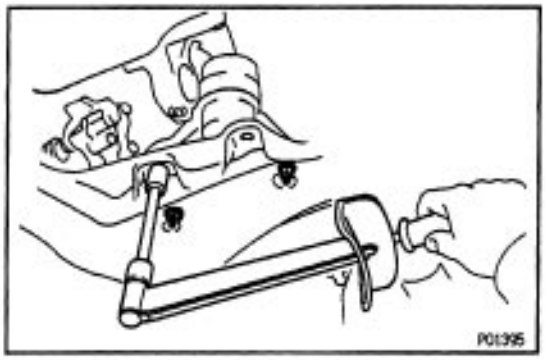
Torque: 64 N–m (650 kgf–cm, 47 ft–lbf)



8. CONNECT FR ENGINE MOUNTING INSULATOR

Connect the mounting insulator with the 3 bolts.

Torque: 80 N–m (820 kgf–cm. 59 ft–lbf)

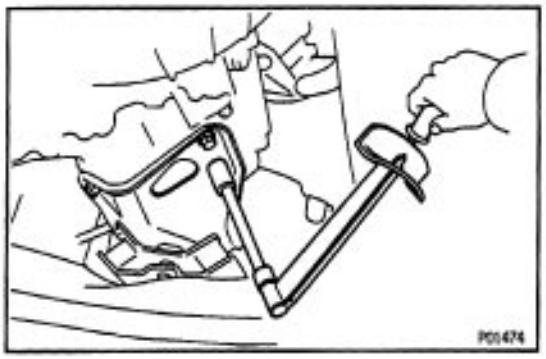


9. CONNECT RR ENGINE MOUNTING INSULATOR

(a) Connect the mounting insulator with the 3 nuts.

Torque: 66 N–m (670 kgf–cm, 48 ft–lbf)

(b) Install the hole plugs:

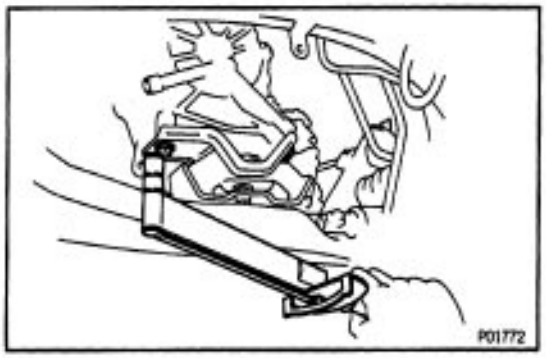


10. CONNECT LH ENGINE MOUNTING INSULATOR

M/T:

Connect the mounting insulator with the 3 bolts.

Torque: 64 N–m (650 kgf–cm, 47 ft–lbf)

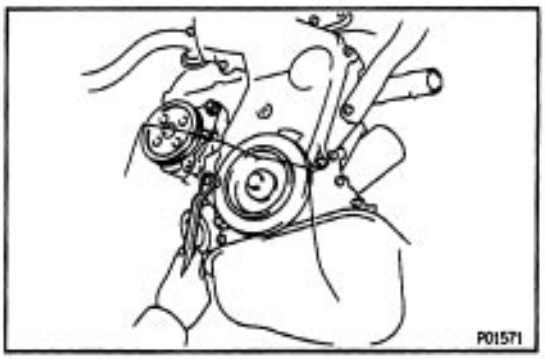


A/T:

Connect the mounting insulator with the 4 bolts.

Torque: 64 N–m (650 kgf–cm, 47 ft–lbf)

11. REMOVE ENGINE SLING DEVICE



12. INSTALL PS PUMP

(a) Install the PS pump with the 2 bolts.

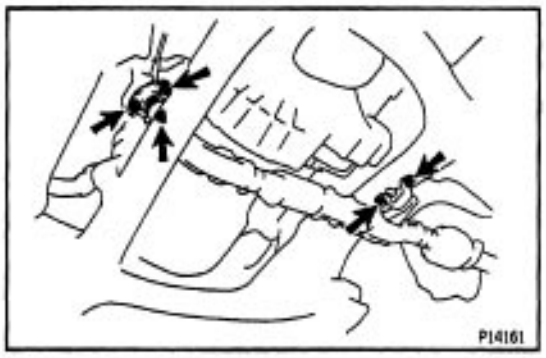
Torque: 43 N–m (440 kgf–cm. 31 ft–lbf)

(b) Install the drive belt.

(c) Connect the 2 air hoses to the air pipe.

13. INSTALL DRIVE SHAFTS

(See page SA–40)



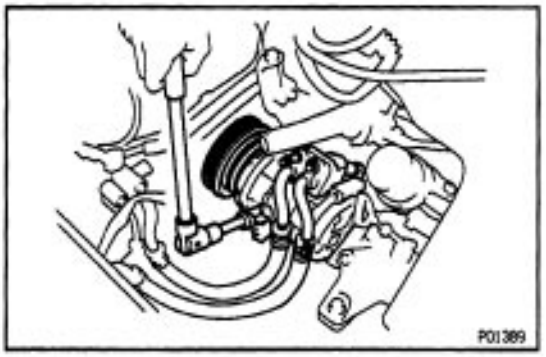
14. CONNECT FRONT EXHAUST PIPE

(a) Place a new gasket on the front exhaust pipe.

(b) Using a 14 mm deep socket wrench, install the 3 new nuts holding the front exhaust pipe to the WU–TWC.

Torque: 82 N–m (630 kgf–cm, 46 ft–lbf)

(c) Install the bracket with the 2 bolts.



15. w/ A/C:

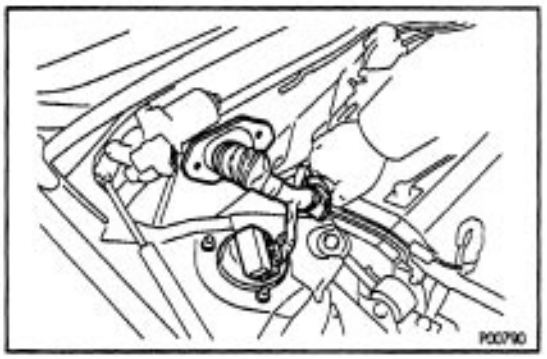
INSTALL A/C COMPRESSOR

(a) Install the compressor with the 3 bolts.

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

(b) Install the drive belt.

(c) Connect the A/C compressor connector.



16. CONNECT ENGINE WIRE TO CABIN

(a) Push in the engine wire through the cowl panel. Install the 2 nuts.

(b) Connect the following connectors:

(1) 2 ECM connectors

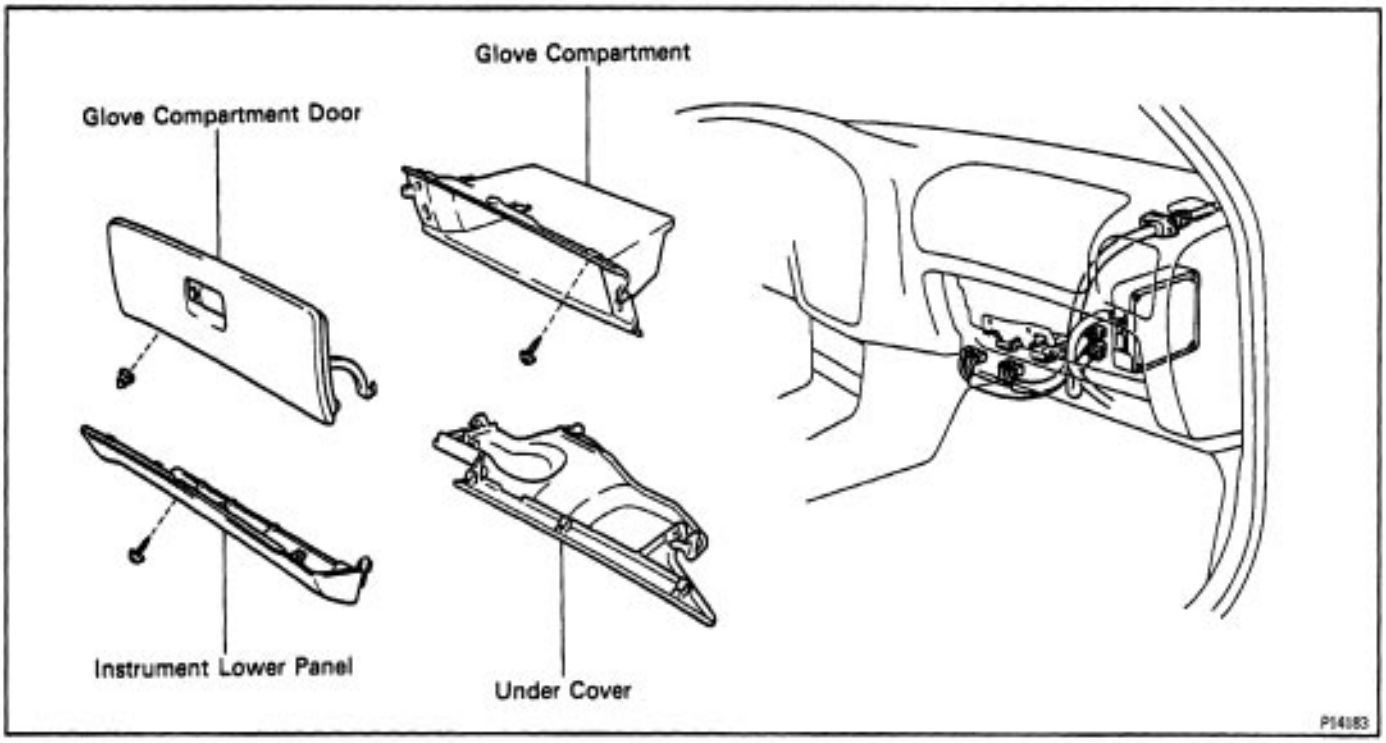
(2) 2 cowl wire connectors

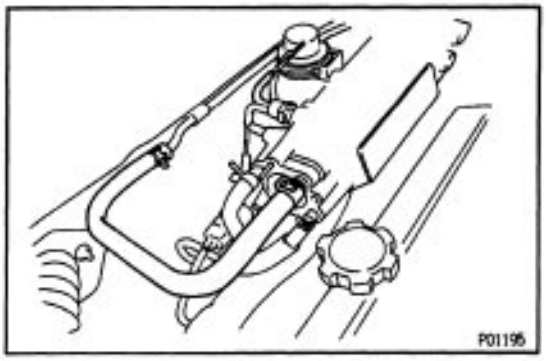
(c) Install the glove compartment.

(d) Install the glove compartment door.

(e) Install the lower instrument panel.

(f) Install the under cover.



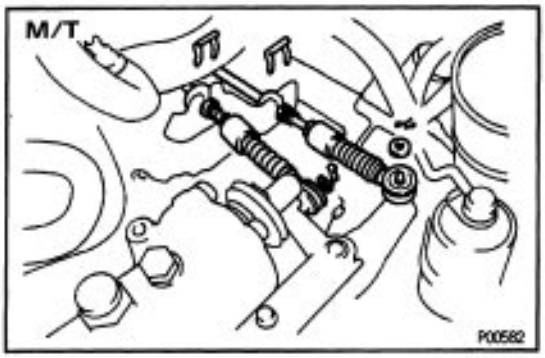


17. CONNECT VACUUM HOSES

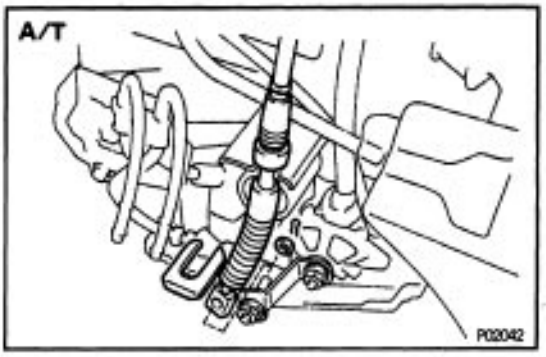
(a) MAP sensor hose to air intake chamber

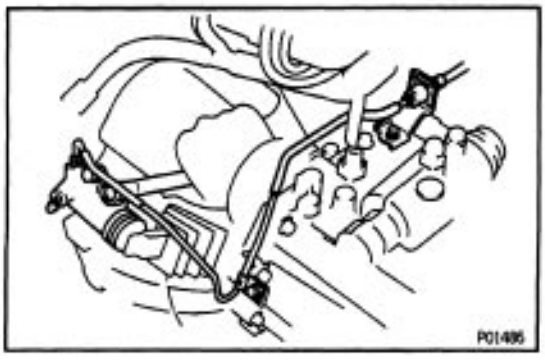
(b) Brake booster vacuum hose to air intake chamber

(c) Charcoal canister vacuum hose



18. CONNECT TRANSAXLE CONTROL CABLE (S) TO TRANSAXLE





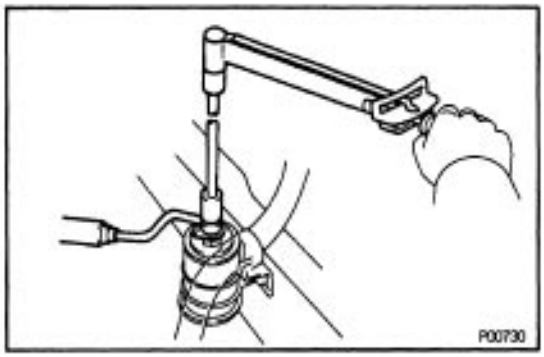
19. M/T:

INSTALL CLUTCH RELEASE CYLINDER

Install the release cylinder and tube with the 4 bolts.

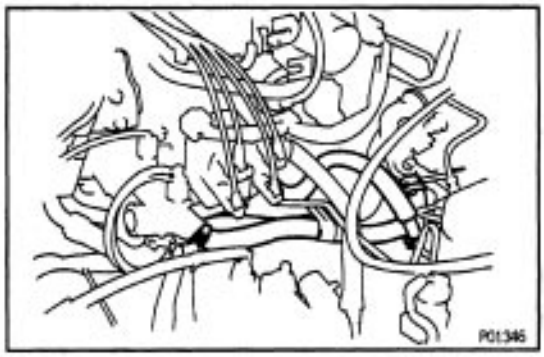
20. M/T:

INSTALL STARTER



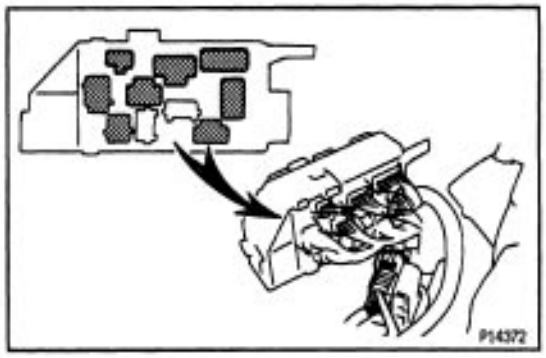
21. CONNECT FUEL INLET HOSE

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



22. CONNECT FUEL RETURN HOSE

23. CONNECT HEATER HOSES

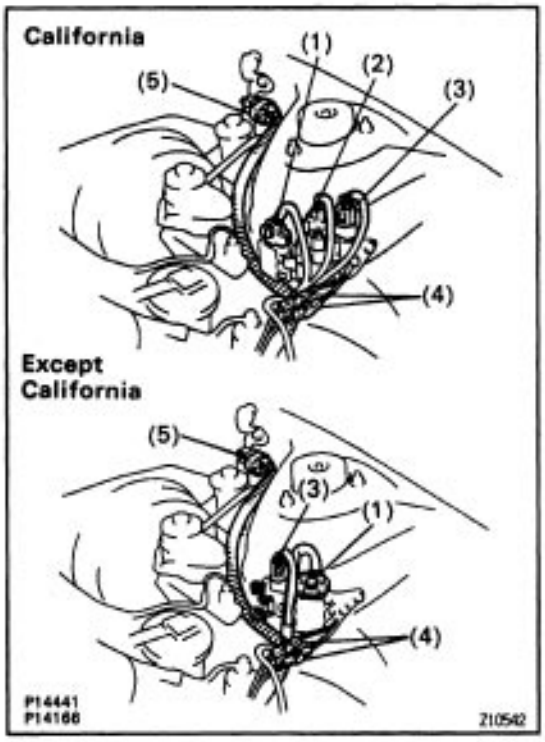


24. CONNECT WIRES AND CONNECTORS

(a) Connect the 5 connectors to the relay box.

(b) Connectors from LH fender apron.

(c) Install the engine relay box.



(d) Connect the following connectors:

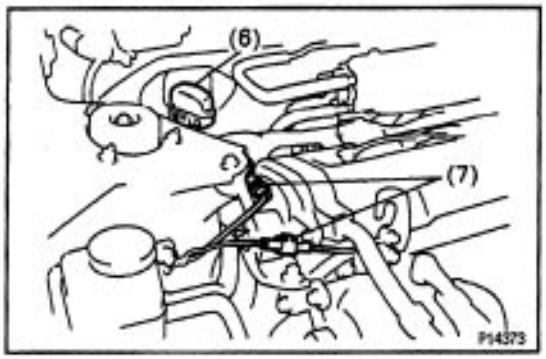
(1) Igniter connector

(2) California only:
Ignition coil connector

(3) Noise filter connector

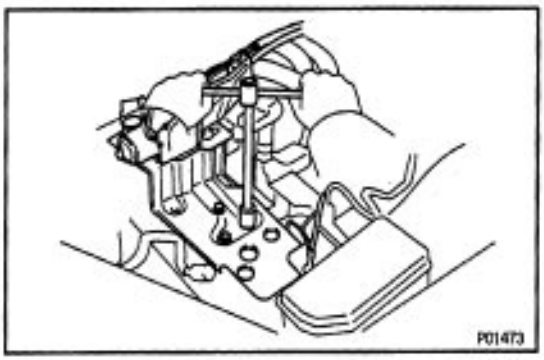
(4) 2 ground straps from LH fender apron

(5) Connector from LH fender apron

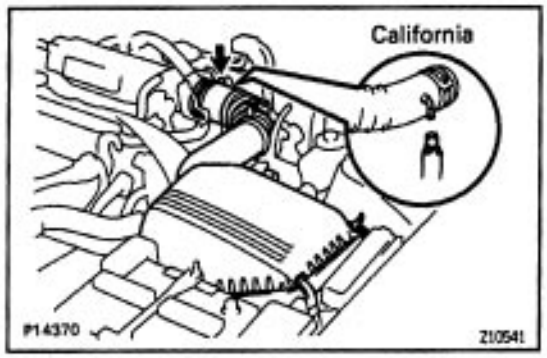


(6) Data link connector 1
(7) 2 ground straps from RH fender apron
(e) Connect the MAP sensor connector.

25. INSTALL RADIATOR



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



27. INSTALL AIR CLEANER ASSEMBLY, RESONATOR AND AIR CLEANER HOSE
(a) Install the air cleaner case with 3 bolts.
(b) Install the element.
(c) Connect the air cleaner hose to the throttle body.
(d) Install the air cleaner cap together with the resonator and air cleaner hose.
(e) California only:
Connect the air hose to the air cleaner hose.
(f) Connect the intake air temperature sensor connector.

28. A/T:
CONNECT AND ADJUST THROTTLE CABLE

29. CONNECT AND ADJUST ACCELERATOR CABLE

30. FILL WITH ENGINE COOLANT

31. FILL WITH ENGINE OIL

32. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY

33. START ENGINE AND CHECK FOR LEAKS

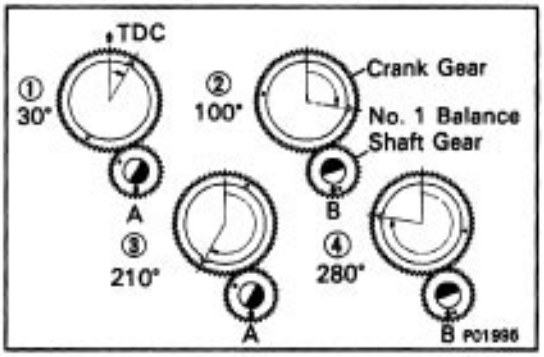
34. PREFORM ENGINE ADJUSTMENT

35. INSTALL ENGINE UNDER COVERS

36. INSTALL HOOD

37. PERFORM ROAD TEST
Check for abnormal noises, shock, slippage, correct shift points and smooth operation.

38. RECHECK ENGINE COOLANT AND ENGINE OIL LEVELS



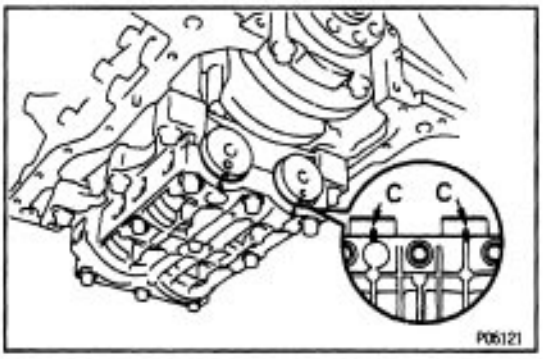
BALANCE SHAFT BACKLASH ADJUSTMENT ON VEHICLE

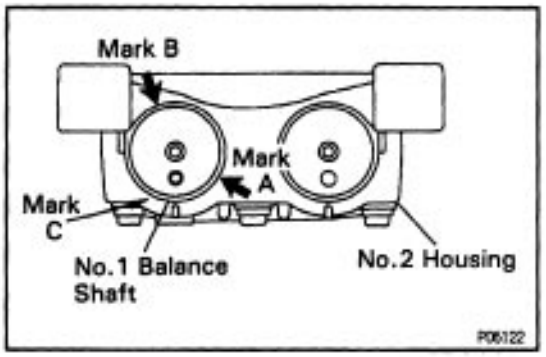
1. CHECK BACKLASH OF CRANKSHAFT GEAR AND NO.1 BALANCE SHAFT GEAR

NOTICE: Backlash between the crankshaft gear and No.1 balance shaft gear varies with the rotation of the balance shaft and the deviation of the crankshaft gear. Accordingly, it is necessary to measure the backlash at the 4 points shown in the illustration on the left.

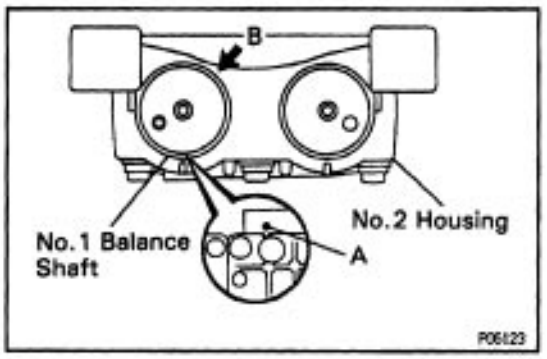
(a) Rotate the crankshaft 2 or 3 times to settle the crank–shaft gear and No. 1 balance shaft gear.

(b) When No.1 piston is at TDC, check that the punch marks C shown in the illustration of the balance shafts are aligned with the grooves of the No. 2 housing.

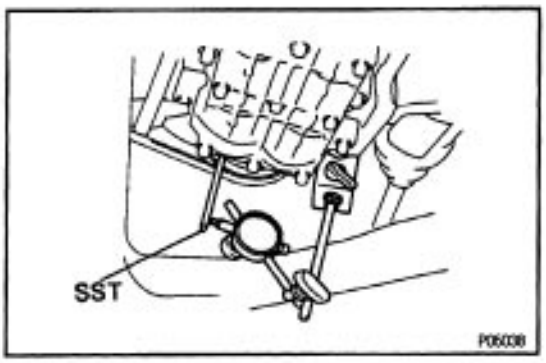




(c) Check that the punch marks A and B are at the positions on the No.1 balance shaft indicated in the illustration.

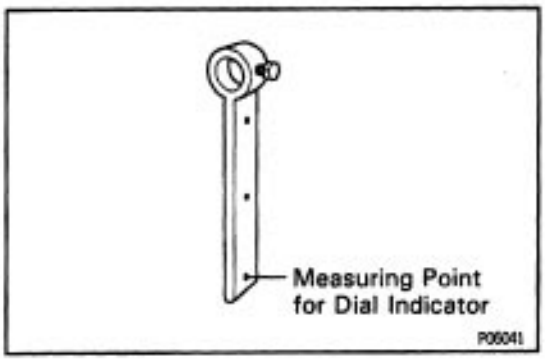


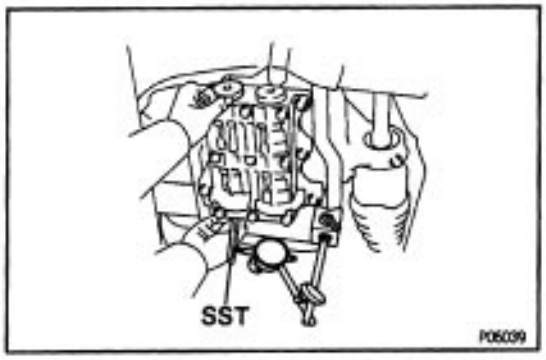
(d) First turn the crankshaft clockwise, and align the groove of the No.2 balance shaft housing with the punch mark A of the No. 1 balance shaft.



(e) Position the SST and dial indicator as shown in the illustration.
SST 09224 – 74010

HINT: Make sure that the stem of the dial indicator is perpendicular to the SST and that it is placed in the middle of the 3rd indentation.





(f) Gently turn the No.1 balance shaft by hand, until resistance is felt, and measure the backlash.

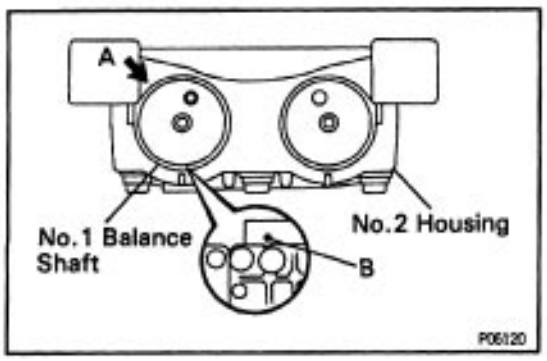
HINT:

- Rotate the No. 1 balance shaft 4 or 5 times to provide a steady backlash reading.
- To prevent excessive backlash due to thrust cle–arance, measure the backlash while pressing on the rear of the No.1 balance shaft.

Standard backlash (use SST):
0.060 – 0.100 mm (0.0024 – 0.0039 In.)

NOTICE: Do not turn the No.1 balance shaft strongly.

(g) Remove the dial gauge and the SST.



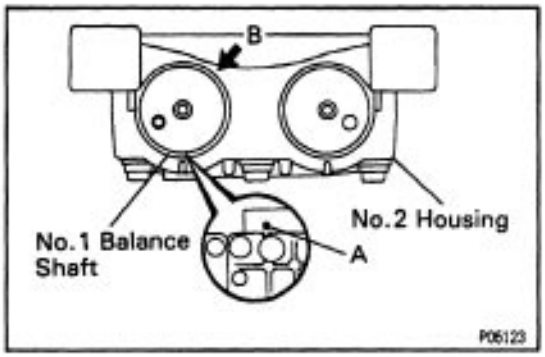
(h) Turn the crankshaft clockwise to align the groove of the No.2 housing with the punch mark B.

(i) Set the dial gauge. (See procedure in step (e))

(j) Measure the backlash. (See procedure in step (f))

Standard backlash (use SST):
0.080 – 0.100 mm (0.0024 – 0.0039 in.)

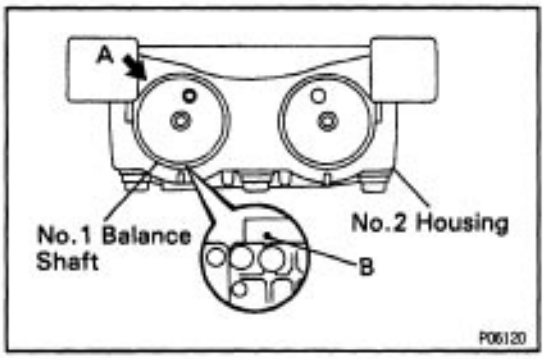
(k) Remove the dial gauge.



(l) Turn the crankshaft clockwise again to align the groove of the No.2 housing with the punch mark A.
(m) Set the dial gauge. (See procedure in step (e))
(n) Measure the backlash. (See procedure in step (f))

Standard backlash (use SST):
0.060 – 0.100 mm (0.0024 – 0.0039 in.)

(o) Remove the dial gauge.



(p) Turn the crankshaft clockwise again to align the groove of the No.2 housing with the punch mark B.
(q) Set the dial gauge. (See procedure in step (e))
(r) Measure the backlash. (See procedure in step (f))

Standard backlash(use SST):
0.06 – 0.100 mm (0.0024 – 0.0039 in.)

(s) Remove the dial gauge.

If even one of the 4 points measured above exceeds the backlash specification, adjust the backlash with new spacers.

NOTICE: Use the same size spacers for both the left and right sides.

HINT:

- Varying the spacer thickness by 0.02 mm (0.0008 in.) changes the backlash by about 0.042 mrn (0.0017 in.).
- If the backlash is greater than permitted maxi– mum, select a thinner shim.
- If the backlash is less than the specification, select a thicker shim.

Adjusting Spacer Selection Chart (On Vehicle)

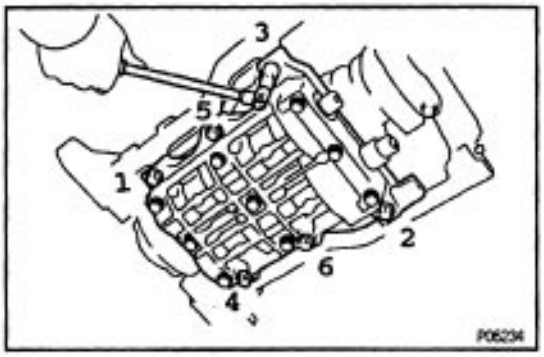
Measured clearance mm (in.) \ Installed spacer No.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
0.000 – 0.017 (0.0000 – 0.0007)	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31	33	33	35	35	37	37	39	39				
0.018 – 0.038 (0.0008 – 0.0015)	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31	33	33	35	35	37	37	39	39			
0.039 – 0.059 (0.0016 – 0.0023)	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31	33	33	35	35	37	37	39	39		
0.060 – 0.100 (0.0024 – 0.0039)																																								
0.101 – 0.121 (0.0040 – 0.0047)		01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31	33	33	35	35	37	37	39
0.122 – 0.142 (0.0048 – 0.0056)			01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31	33	33	35	35	37	37	
0.143 – 0.163 (0.0057 – 0.0064)				01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31	33	33	35	35	37	
0.164 – 0.184 (0.0065 – 0.0072)					01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31	33	33	35	35	
0.185 – 0.205 (0.0073 – 0.0081)						01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31	33	33	35	
0.206 – 0.226 (0.0082 – 0.0089)							01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31	33	33
0.227 – 0.247 (0.0090 – 0.0097)								01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31	33
0.248 – 0.268 (0.0098 – 0.0105)									01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31
0.269 – 0.289 (0.0106 – 0.0114)										01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31
0.290 – 0.310 (0.0115 – 0.0122)											01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	
0.311 – 0.331 (0.0123 – 0.0130)												01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	
0.332 – 0.352 (0.0131 – 0.0138)													01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	
0.353 – 0.373 (0.0139 – 0.0147)														01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	
0.374 – 0.394 (0.0148 – 0.0155)															01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	
0.395 – 0.415 (0.0156 – 0.0163)																01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	
0.416 – 0.436 (0.0164 – 0.0172)																	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	
0.437 – 0.457 (0.0173 – 0.0180)																		01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	
0.458 – 0.478 (0.0181 – 0.0188)																			01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	
0.479 – 0.499 (0.0189 – 0.0196)																				01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	
0.500 – 0.520 (0.0197 – 0.0205)																					01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	
0.521 – 0.541 (0.0206 – 0.0213)																						01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	
0.542 – 0.562 (0.0214 – 0.0221)																							01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	
0.563 – 0.583 (0.0222 – 0.0230)																								01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	
0.584 – 0.604 (0.0231 – 0.0238)																									01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	
0.605 – 0.625 (0.0239 – 0.0246)																										01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	
0.626 – 0.646 (0.0247 – 0.0254)																											01	01	03	03	05	05	07	07	09	09	11	11	13	13	
0.647 – 0.667 (0.0255 – 0.0263)																												01	01	03	03	05	05	07	07	09	09	11	11	13	
0.668 – 0.688 (0.0264 – 0.0271)																													01	01	03	03	05	05	07	07	09	09	11	11	
0.689 – 0.709 (0.0272 – 0.0279)																														01	01	03	03	05	05	07	07	09	09	11	
0.710 – 0.730 (0.0280 – 0.0287)																															01	01	03	03	05	05	07	07	09	09	
0.731 – 0.751 (0.0288 – 0.0296)																																01	01	03	03	05	05	07	07	09	
0.752 – 0.772 (0.0297 – 0.0304)																																	01	01	03	03	05	05	07	07	
0.773 – 0.793 (0.0305 – 0.0312)																																		01	01	03	03	05	05	07	
0.794 – 0.814 (0.0313 – 0.0320)																																			01	01	03	03	05	05	
0.815 – 0.835 (0.0321 – 0.0329)																																				01	01	03	03	05	
0.836 – 0.856 (0.0330 – 0.0337)																																					01	01	03	03	
0.857 – 0.877 (0.0338 – 0.0345)																																						01	01	03
0.878 – 0.898 (0.0346 – 0.0354)																																							01	01
0.899 – 0.919 (0.0355 – 0.0362)																																								01

Backlash of crankshaft and No. 1 balance shaft gear:
0.060 - 0.100 mm (0.0024 - 0.0039 in.)

EXAMPLE: The No. 25 spacers are installed and the measured clearance is 0.342 mm (0.0135 in.). Replace the No. 25 spacers with No. 13 spacers.

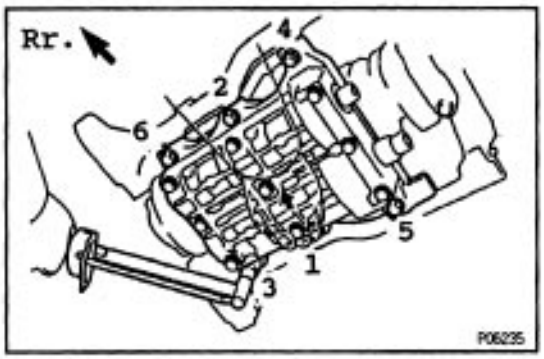
New spacer thickness mm (in.)

No.	Thickness	No.	Thickness	No.	Thickness	No.	Thickness
01	1.74 (0.0685)	11	1.84 (0.0724)	21	1.94 (0.0764)	31	2.04 (0.0803)
03	1.76 (0.0693)	13	1.86 (0.0732)	23	1.96 (0.0772)	33	2.06 (0.0811)
05	1.78 (0.0701)	15	1.88 (0.0740)	25	1.98 (0.0780)	35	2.08 (0.0819)
07	1.80 (0.0709)	17	1.90 (0.0748)	27	2.00 (0.0787)	37	2.10 (0.0827)
09	1.82 (0.0717)	19	1.92 (0.0756)	29	2.02 (0.0795)	39	2.12 (0.0835)



2. REPLACE THE SPACERS

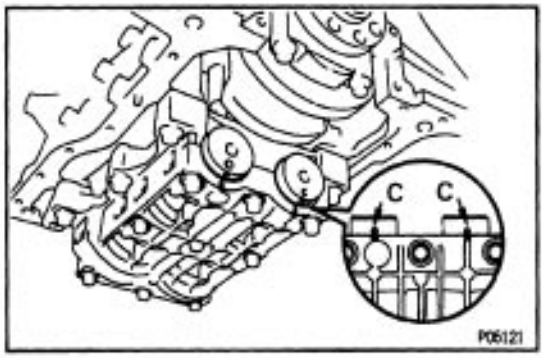
(a) Uniformly loosen the6 bolts in the sequence shown.
(b) Replace the spacers with new ones.



3. TORQUE BALANCESHAFT ASSEMBLY

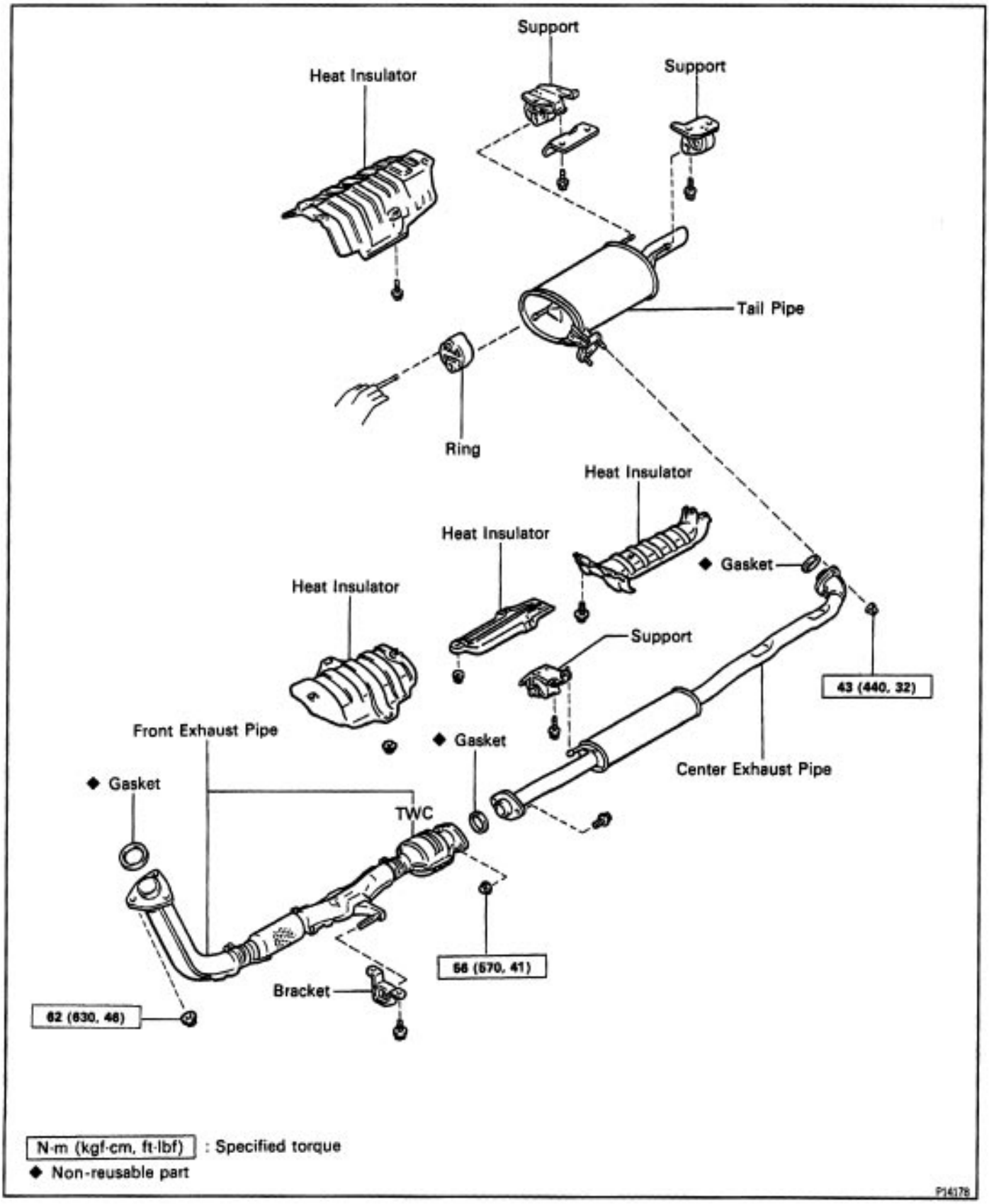
While pulling the center part of the engine balancer in the direction of the arrow, uniformly tighten the6 bolts in several passes, in the sequence shown.

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



4. CHECK AND ADJUST BACKLASH OF CRANK–SHAFT GEAR AND No.1 BALANCE SHAFT GEAR (See procedure in step 1)

EXHAUST SYSTEM COMPONENTS



SERVICE SPECIFICATIONS

SERVICE DATA

Idle speed	–		750 ± 50 rpm
Intake manifold vacuum	at idle speed		60 kPa (450 mmHg, 17.7 in.Hg)
Compression pressure	et 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
Idler pulley tension spring	Free length		46.0 mm (1.811 in.)
	Installed load at 50.5 mm (1.988 in.)	Green color	32 – 37 N (3.25 – 3.75 kgf, 7.2 – 8.3 lbf)
		Silver color	47 – 52 N (4.75 – 5.25 kgf, 10.5 – 11.6 lbf)
Cylinder head	Warpage		
	Cylinder block side	Limit	0.05 mm (0.020 in.)
	Manifold side	Limit	0.08 mm (0.031 in.)
	Valve seat		
	Refacing angle		30°, 45°, 75°
	Contacting angle		45°
	Contacting width		1.0 – 1.4 mm (0.039 – 0.055 in.)
Valve guide bushing	Inside diameter		6.010 – 6.030 mm (0.2366 – 0.2374 in.)
	Outside diameter (for repair part)	STD	11.048 – 11.059 mm (0.4350 – 0.4354 in.)
		O/S 0.05	11.098 – 11.109 mm (0.4369 – 0.4374 in.)
Valve	Valve overall length	STD (Intake)	97.60 mm (3.8425 in.)
		(Exhaust)	98.45 mm (3.8760 in.)
		Limit (Intake)	97.1 mm (3.823 in.)
		(Exhaust)	98.0 mm (3.853 in.)
	Vale face angle		44.5°
	Stem diameter	(Intake)	5.970 – 5.985 mm (0.2350 – 0.2356 in.)
		(Exhaust)	5.965 – 5.980 mm (0.2348 – 0.2354 in.)
	Stem oil clearance	STD (Intake)	0.025 – 0.060 mm (0.0010 – 0.0024 in.)
		(Exhaust)	0.030 – 0.065 mm (0.0012 – 0.0026 in.)
		Limit (Intake)	0.08 mm (0.0031 in.)
		(Exhaust)	0.10 mm (0.0039 in.)
	Margin thickness	STD	0.8 – 1.2 mm (0.031 – 0.047 in.)
		Limit	0.5 mm (0.020 in.)
Valve spring	Deviation	Limit	2.0 mm (0.079 in.)
	Free length		41.96 – 41.99 mm (1.6520 – 1.6531 in.)
	Installed tension et 34.7 mm (1.366 in.)		164 – 189 N (16.7 – 19.3 kgf, 36.8 – 42.5 lbf)
Valve lifter	Lifter diameter		30.966 – 30.976 mm (1.2191 – 1.2195 in.)
	Lifter bore diameter		31.000 – 31.018 mm (1.2205 – 1.2213 in.)
	Oil clearance	STD	0.024 – 0.052 mm (0.0009 – 0.0020 in.)
		Limit	0.07 mm (0.0028 in.)
Manifold	Warpage	Limit	0.30 mm (0.0118 in.)

Camshaft	Thrust clearance	STD (Intake)	0.045 – 0.100 mm (0.0018 – 0.0039 in.)
		(Exhaust)	0.030 – 0.085 mm (0.0012 – 0.0033 in.)
		Limit (Intake)	0.12 mm (0.0047 in.)
		(Exhaust)	0.10 mm (0.0039 in.)
	Journal oil clearance	STD	0.025 – 0.062 mm (0.0010 – 0.0024 in.)
		Limit	0.10 mm (0.0039 in.)
	Journal diameter		26.959 – 26.975 mm (1.0614 – 1.0620 in.)
	Circle runout	Limit	0.04 mm (0.0016 in.)
	Cam lobe height	STD (Intake)	42.01 – 42.11 mm (1.6539 – 1.6579 in.)
		(Exhaust)	40.06 – 40.16 mm (1.5772 – 1.5811 in.)
		Limit (Intake)	41.90 mm (1.6496 in.)
		(Exhaust)	39.95 mm (1.5728 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		22.5 – 22.9 mm (0.886 – 0.902 in.)
Cylinder block	Cylinder head surface warpage	Limit	0.05 mm (0.0020 in.)
	Cylinder bore diameter	STD (Mark 1)	87.000 – 87.010 mm (3.4252 – 3.4256 in.)
		(Mark 2)	87.010 – 87.020 mm (3.4256 – 3.4260 in.)
		(Mark 3)	87.020 – 87.030 mm (3.4260 – 3.4264 in.)
		Limit (STD)	87.23 mm (3.4342 in.)
		(O/S 0.50)	87.73 mm (3.4350 in.)
Piston and piston ring	Piston diameter	STD (Mark 1)	86.850 – 86.860 mm (3.4193 – 3.4197 in.)
		(Mark 2)	86.860 – 86.870 mm (3.4197 – 3.4201 in.)
		(Mark 3)	86.870 – 86.880 mm (3.4201 – 3.4205 in.)
		O/S 0.50	87.350 – 87.380 mm (3.4390 – 3.4402 in.)
	Piston oil clearance	STD	0.14 – 0.016 mm (0.0055 – 0.0063 in.)
		Limit	0.18 mm (0.0071 in.)
	Piston ring groove clearance	No.1	0.040 – 0.080 mm (0.0016 – 0.0031 in.)
		No.2	0.030 – 0.070 mm (0.0012 – 0.0028 in.)
	Piston ring end gap	STD (No.1)	0.270 – 0.500 mm (0.0106 – 0.0197 in.)
		(No.2)	0.350 – 0.600 mm (0.0138 – 0.0234 in.)
		(Oil)	0.200 – 0.550 mm (0.0079 – 0.0217 in.)
		Limit (No.1)	1.10 mm (0.0433 in.)
		(No.2)	1.20 mm (0.0472 in.)
		(Oil)	1.15 mm (0.0453 in.)

Connecting rod	Thrust clearance STD	0.160 – 0.312 mm (0.0063 – 0.0123 inb.)
	Limit	0.35 mm (0.0138 in.)
	Connecting rod bearing center wall thickness (Reference)	
	STD (Mark 1)	1.484 – 1.488 mm (0.0584 – 0.0586 in.)
	(Mark 2)	1.488 – 1.492 mm (0.0586 – 0.0587 in.)
	(Mark 3)	1.492 – 1.496 mm (0.0587 – 0.0589 in.)
	Connecting rod oil clearance STD (STD)	0.024 – 0.055 mm (0.0009 – 0.0022 in.)
	(U/S 0.25)	0.023 – 0.069 mm (0.0009 – 0.0027 in.)
	Limit	0.08 mm (0.0031 in.)
	Rod bend Limit per 100 mm (3.94 in.)	0.05 mm (0.0020 in.)
	Rod twist Limit per 100 mm (3.94 in.)	0.15 mm (0.0059 in.)
	Bushing inside diameter	22.005 – 22.017 mm (0.8663 – 0.8668 in.)
	Piston pin diameter	21.997 – 22.009 mm (0.8660 – 0.8665 in.)
	Piston pin oil clearance	
	Connecting rod bolt outside diameter STD	0.005 – 0.011 mm (0.0002 – 0.0004 in.)
	Limit	0.05 mm (0.0020 in.)
	STD	7.860 – 8.000 mm (0.3094 – 0.3150 in.)
	Limit	7.60 mm (0.2992 in.)
Crankshaft	Thrust clearance STD	0.020 – 0.220 mm (0.0008 – 0.0087 in.)
	Limit	0.30 mm (0.0118 in.)
	Thrust washer thickness	2.440 – 2.490 mm (0.0961 – 0.0980 in.)
	Main journal oil clearance STD (No.3 STD)	0.025 – 0.044 mm (0.0010 – 0.0017 in.)
	(No.3 U/S 0.25)	0.027 – 0.067 mm (0.0011 – 0.0026 in.)
	(Others STD)	0.015 – 0.034 mm (0.0006 – 0.0013 in.)
	(Others U/S 0.25)	0.019 – 0.059 mm (0.0007 – 0.0023 in.)
	Limit	0.08 mm (0.0031 in.)
	Main journal diameter STD	54.988 – 55.003 mm (2.1653 – 2.1655 in.)
	U/S 0.25	54.745 – 54.755 mm (2.1553 – 2.1557 in.)
	Main bearing center wall thickness (Reference)	
	STD (No.3 Mark 1)	1.992 – 1.995 mm (0.0784 – 0.0785 in.)
	(No.3 Mark 2)	1.995 – 1.998 mm (0.0785 – 0.0787 in.)
	(No.3 Mark 3)	1.998 – 2.001 mm (0.0787 – 0.0788 in.)
	(No.3 Mark 4)	2.001 – 2.004 mm (0.0788 – 0.0789 in.)
	(No.3 Mark 5)	2.004 – 2.007 mm (0.0789 – 0.0790 in.)
	(Others Mark 1)	1.997 – 2.000 mm (0.0786 – 0.0787 in.)
	(Others Mark 2)	2.000 – 2.003 mm (0.0787 – 0.0789 in.)
	(Others Mark 3)	2.003 – 2.006 mm (0.0789 – 0.0790 in.)
	(Others Mark 4)	2.006 – 2.009 mm (0.0790 – 0.0791 in.)
	(Others Mark 5)	2.009 – 2.012 mm (0.0791 – 0.0792 in.)
	Crank pin diameter STD	51.985 – 52.000 mm (2.0466 – 2.0472 in.)
	U/S 0.25	51.745 – 51.755 mm (2.0372 – 2.0376 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.)

Engine balancer	Thrust clearance	STD	0.065 – 0.110 mm (0.0026 – 0.0043 in.)
		Limit	0.110 mm (0.0043 in.)
	Backlash Crankshaft x No. 1 balance shaft Off–vehicle	STD	0 – 0.06 mm (0 – 0.0024 in.)
	On–vehicle No. 1 balance shaft x No.2 balance shaft at D mark	STD	0.025 – 0.090 mm (0.0010 – 0.0035 in.)
	at E mark at F mark	STD	0.020 – 0.075 mm (0.0008 – 0.0030 in.)
	Spacer thickness	STD	0.005 – 0.075 mm (0.0002 – 0.0030 in.)
		STD	0.005 – 0.055 mm (0.0002 – 0.0022 in.)
		No.01	1.74 mm (0.0685 in.)
		No.03	1.76 mm (0.0693 in.)
		No.05	1.78 mm (0.0701 in.)
		No.07	1.80 mm (0.0709 in.)
		No.09	1.82 mm (0.0717 in.)
		No.11	1.84 mm (0.0724 in.)
		No.13	1.86 mm (0.0732 in.)
		No.15	1.88 mm (0.0740 in.)
		No.17	1.90 mm (0.0748 in.)
		No.19	1.92 mm (0.0756 in.)
		No.21	1.94 mm (0.0764 in.)
		No.23	1.96 mm (0.0772 in.)
		No.25	1.98 mm (0.0780 in.)
		No.27	2.00 mm (0.0787 in.)
		No.29	2.02 mm (0.0795 in.)
		No.31	2.04 mm (0.0803 in.)
		No.33	2.06 mm (0.0811 in.)
		No.35	2.08 mm (0.0819 in.)
		No.37	2.10 mm (0.0827 in.)
		No.39	2.12 mm (0.0835 in.)
	Balance shaft housing bolt outer diameter		
		STD	6.5 – 6.7 mm (0.2559 – 0.2638 in.)
		Limit	6.3 mm (0.2480 in.)

TORQUE SPECIFICATIONS

Part tightened	N·m	kgf·cm	ft·lbf
Cylinder head cover x Cylinder head	23	230	17
Spark plug x Cylinder head	18	180	13
Oil pump pulley x Oil pump drive 'shaft	28	280	21
No. 2 idler pulley x Cylinder block	42	425	31
Crankshaft pulley x Crankshaft	108	1,100	80
Camshaft timing pulley x Camshaft	54	550	40
Camshaft timing pulley x Camshaft (For use with SST)	37	380	27
No. 1 idler pulley x Cylinder heed	42	425	31
No. 2 engine mounting bracket x Cylinder block	52	530	38
Engine moving control rod X Fender apron	64	650	47
Engine moving control rod x No. 2 engine mounting bracket	64	650	47
Cylinder head x Cylinder block (1 sty	49	500	36

Cylinder head x Cylinder block (2nd)	Turn 90°		
Spark plug tube x Cylinder head	39	400	29
Camshaft bearing cap x Cylinder head	19	190	14
Generator bracket x Cylinder head	42	425	31
Engine hanger x Cylinder head	25	250	18
No. 3 timing belt cover x Cylinder head	7.8	80	69 in.·lbf
Delivery pipe x Cylinder head	13	130	9
Pulsation damper x Delivery pipe	34	350	25
Intake manifold x Cylinder heed	19	195	14
Intake manifold stay x Intake manifold	22	220	16
Intake manifold stay x Cylinder block	42	425	31
No. 1 air intake chamber stay x Intake manifold	42	425	31
No. 1 air intake chamber stay x Cylinder head	42	425	31
EGR valve x intake manifold	13	130	9
EGR pipe x Cylinder head	59	600	43
Throttle body x Intake manifold	19	195	14
Water bypass pipe x Water pump cover	8.8	90	78 in.·lbf
Water outlet x Cylinder head	15	150	11
WU–TWC x Exhaust manifold	29	300	22
Exhaust manifold x Cylinder head	49	500	36
Exhaust manifold stay x WU –TWC	42	425	31
Exhaust manifold stay x FR engine mounting insulator	42	425	31
No. 1 exhaust manifold stay x WU –TWC	42	425	31
No. 1 exhaust manifold stay x Cylinder block	42	425	31
Main bearing cap x Cylinder block	59	600	43
Connecting rod cap x Connecting rod (1 st)	25	250	18
Connecting rod cap x Connecting rod (2nd)	Turn 90°		
No. 1 balance shaft housing x No. 2 balance shaft housing (1st)	22	220	16
No. 1 balance shaft housing x No. 2 balance shaft housing (2nd)	Turn 90°		
Engine balancer x Cylinder block	49	500	36
Rear oil seal retainer x Cylinder block	9.3	95	82 in.·lbf
Knock sensor x Cylinder block	37	380	27
PS pump bracket x Cylinder block	43	440	32
Rear end plate x Cylinder block	9.3	95	82 in.·lbf
Flywheel x Crankshaft (M/T)	88	900	65
Drive plate x Crankshaft (A/T)	83	850	61
RR engine mounting insulator x Cylinder block	64	650	47
FR engine mounting insulator x Cylinder block	77	790	57
FR engine mounting insulator x Front suspension member	80	820	59
RR engine mounting insulator x Front suspension member	66	670	48
LH engine mounting insulator x Transaxle	64	650	47
PS pump x PS pump bracket	43	440	31
Front exhaust pipe x WU –TWC	62	630	46
A/C compressor x Cylinder block	27	280	20
Fuel inlet hose x Fuel filter (Union bolt)	29	300	22

EMISSION CONTROL SYSTEMS

SYSTEM PURPOSE

system	Abbreviation	Purpose
Positive crankcase ventilation	PCV	Reduces blow–by gas (HC)
Fuel evaporative emission control	EVAP	Reduces evaporative HC
Exhaust gas recirculation	EG R	Reduces NOx
Three–way catalytic converter	TWC	Reduces C0, HC and NOx
*Multiport fuel injection/Sequential multiport fuel injection	MFI/SFI	Regulates all engine conditions for reduction of exhaust emissions.

” For inspection and repair of the MFI/SFI system, refer to MFI/SFI Section.

PREPARATION

SST (SPECIAL SERVICE TOOLS)

 09843–18020 Diagnosis Check Wire	

RECOMMENDED TOOLS

 09082–00050 TOYOTA Electrical Tester Set	

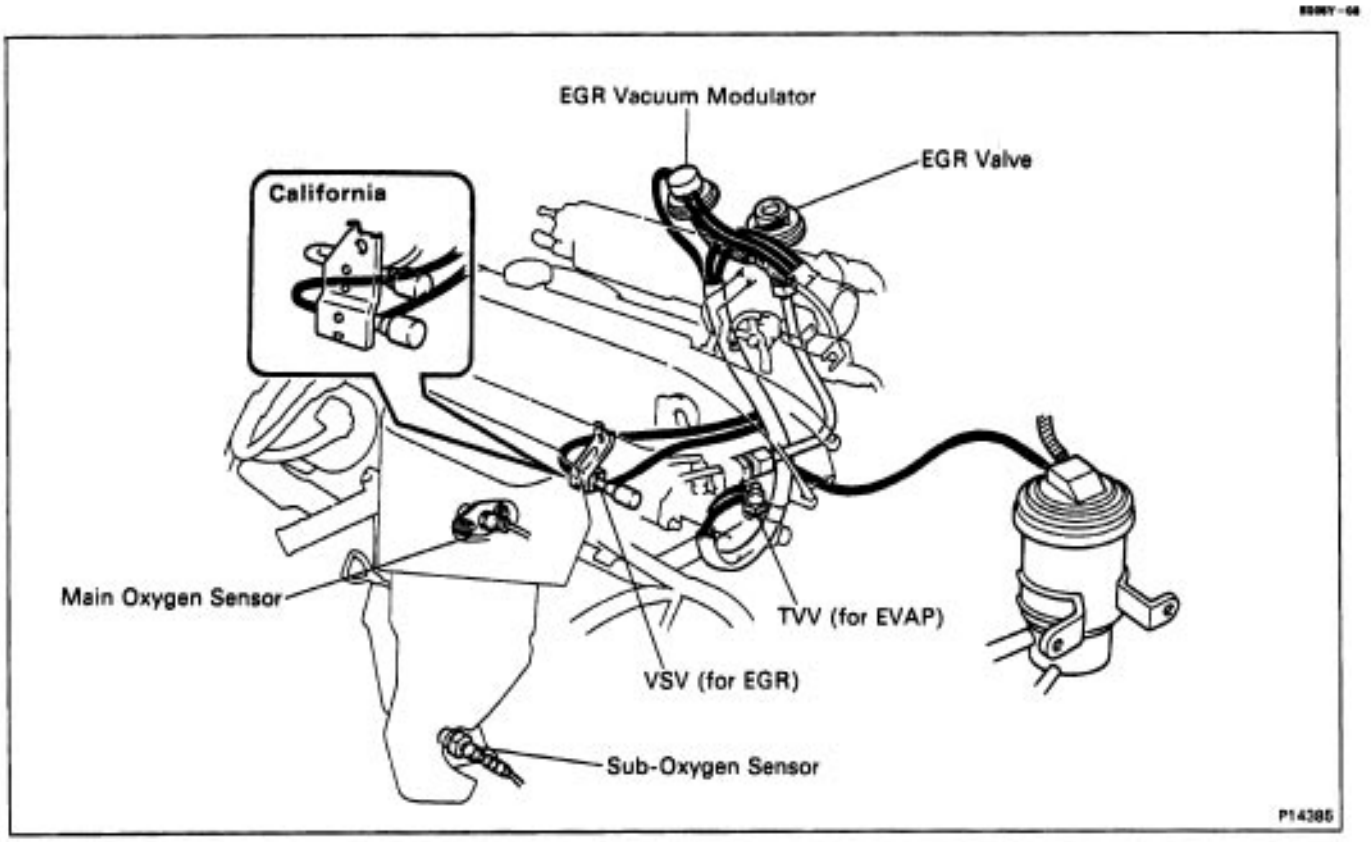
EQUIPMENT

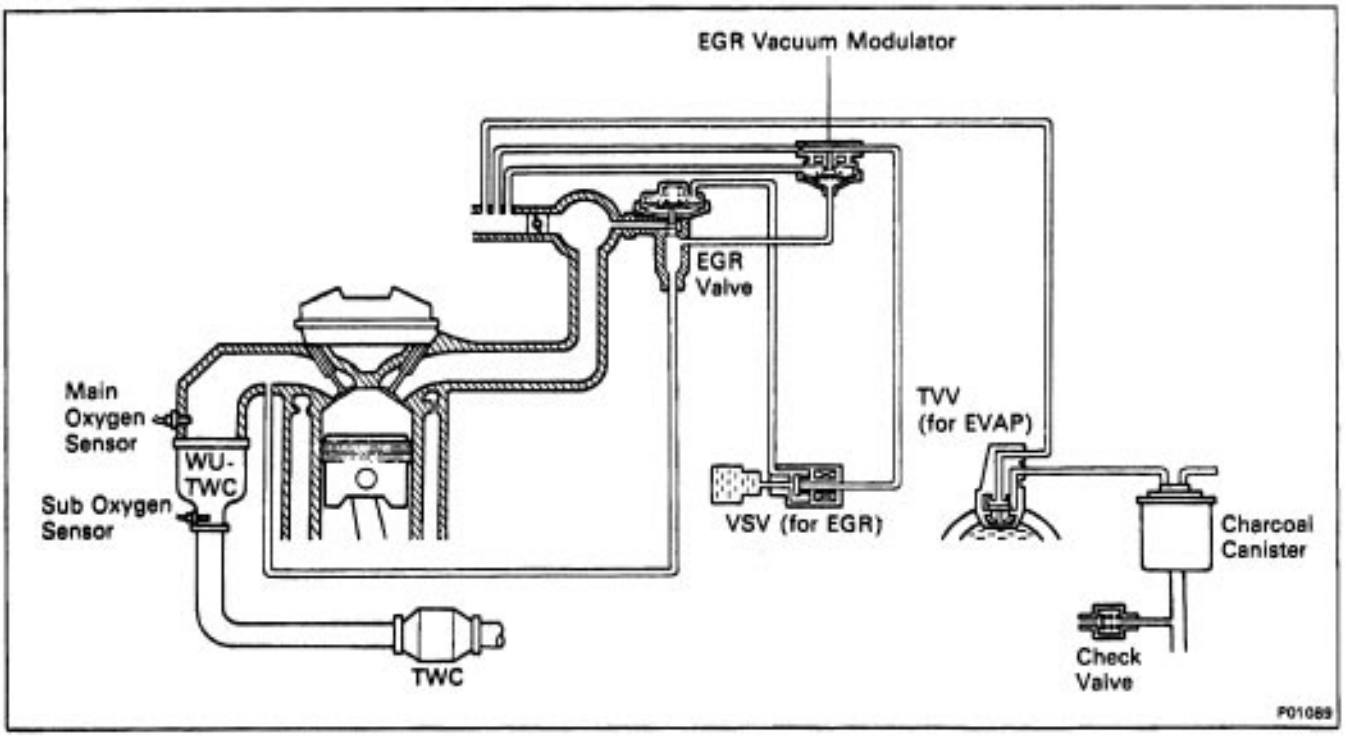
Heater	TVV
Thermometer	TVV
Tachometer	
Torque wrench	
Vacuum gauge	

SSM (SPECIAL SERVICE MATERIALS)

08833–00070 Adhesive 1311, THREE BOND 1311 or equivalent	¿¿V

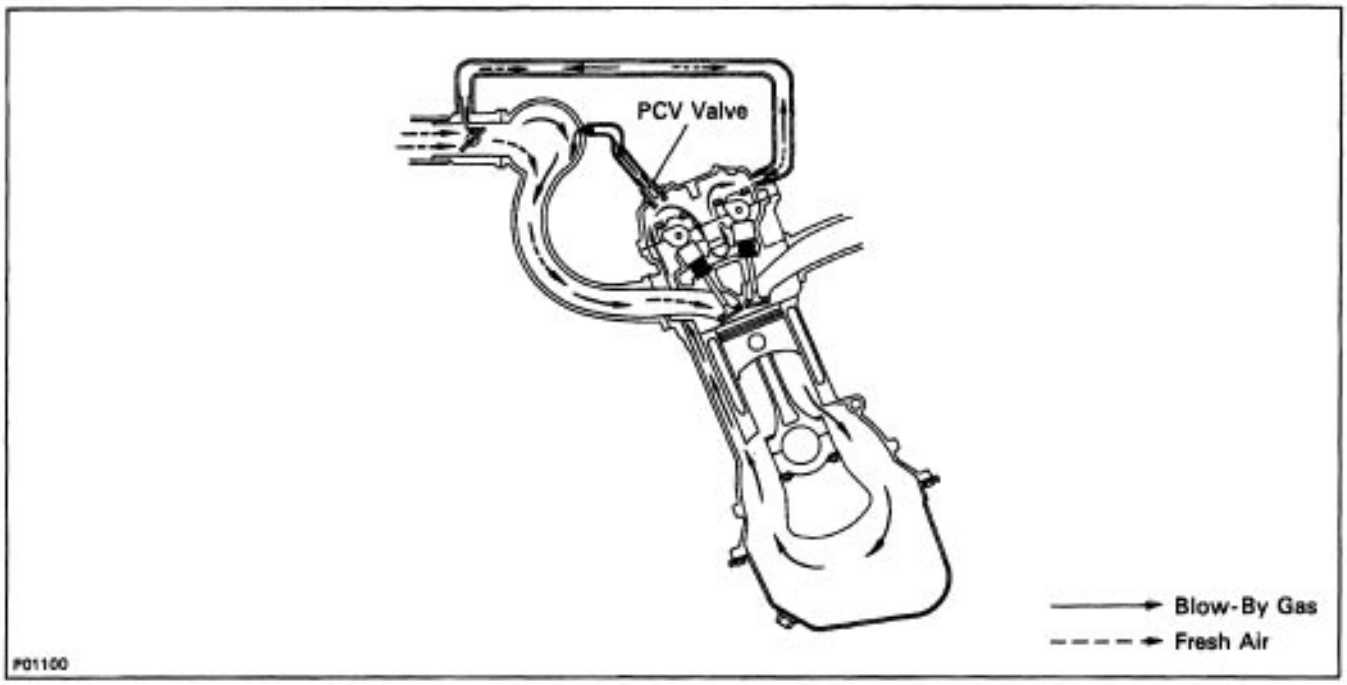
LAYOUT AND SCHEMATIC DRAWING





V04424

POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM



To reduce HC emission, crankcase blow–by gas is routed through the PCV valve to the air intake chamber for combustion in the cylinders.

Engine not Running



- PCV VALVE IS CLOSED.

Normal Operation



- PCV VALVE IS OPEN.
- VACUUM PASSAGE IS LARGE.

Idling or Deceleration

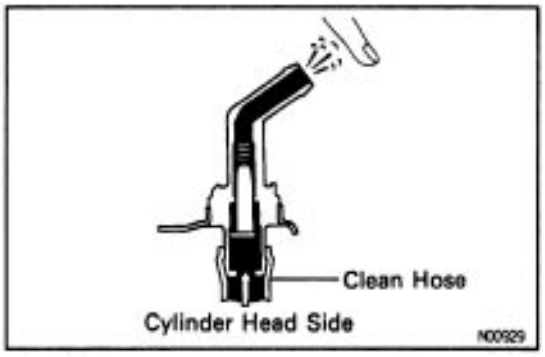


- PCV VALVE IS OPEN.
- VACUUM PASSAGE IS SMALL.

Acceleration or High Load



- PCV VALVE IS FULLY OPEN.



PCV VALVE INSPECTION

1. REMOVE PCV VALVE

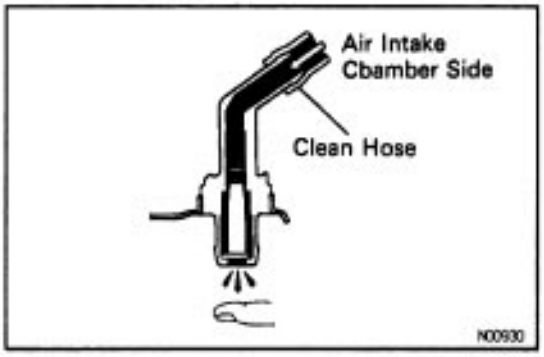
2. INSTALL CLEAN HOSE TO PCV VALVE

3. BLOW AIR FROM CYLINDER HEAD SIDE

Check that air passes through easily.

NOTICE: Do not suck air through the valve.

Petroleum substances inside the valve are harmful.



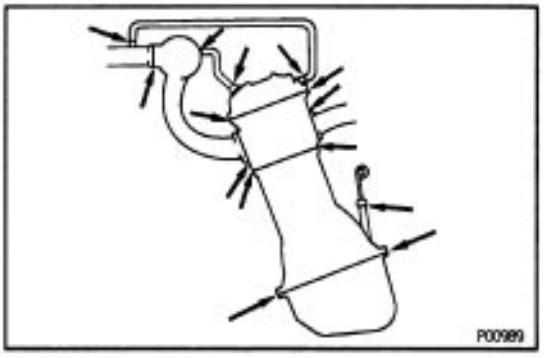
4. BLOW AIR FROM AIR INTAKE CHAMBER SIDE

Check that air passes through with difficulty.

If the PCV valve fails either of the checks, replace it.

5. REMOVE CLEAN HOSE FROM PCV VALVE

6. REINSTALL PCV VALVE

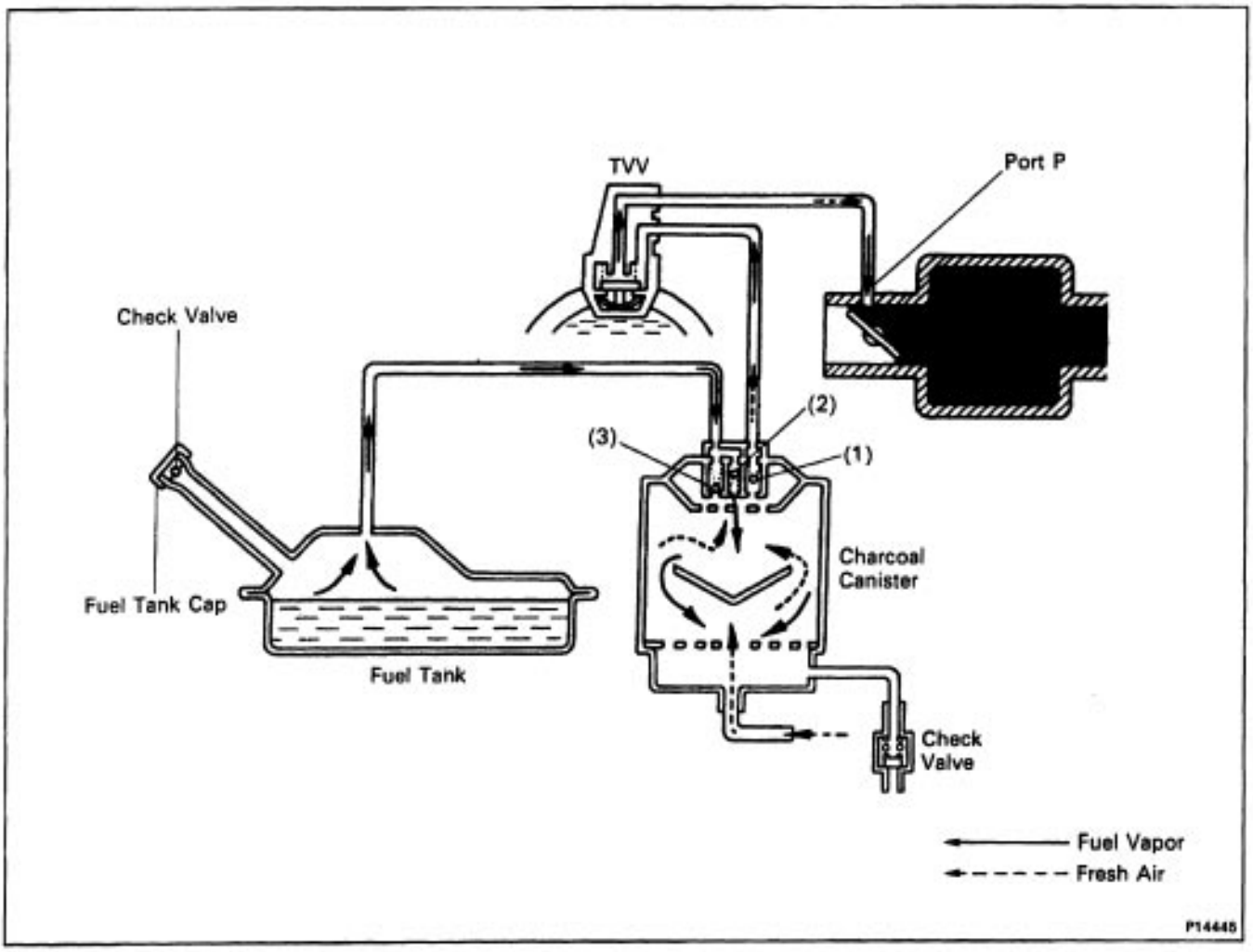


PCV HOSES AND CONNECTIONS INSPECTION

VISUALLY INSPECT HOSES, CONNECTIONS AND GASKETS

Check for cracks, leaks or damage.

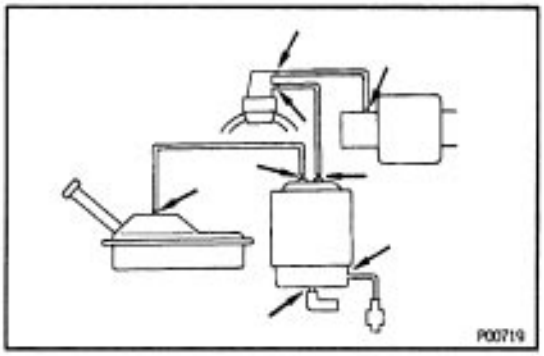
EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM



To reduce NC emissions, evaporated fuel from the fuel tank is routed through the charcoal canister to the intake manifold for combustion in the cylinders.

Engine Coolant Temp.	TVV	Throttle Valve Opening	Canister Check Valve			Check Valve In Cap	Evaporated Fuel (HC)
			(1)	(2)	(3)		
Below 35 C (95 F)	CLOSED	–	–	–	–	–	NC from tank is absorbed into the canister
Above 54 C (129 F)	OPEN	Positioned below port P	CLOSED	–	–	–	
		Positioned above port P	OPEN	–	–	–	HC from canister is led into air intake chamber.
High pressure in tank	–	–	–	OPEN	CLOSED	CLOSED	HC from tank is absorbed into the canister.
High vacuum in tank	–	–	–	CLOSED	OPEN	OPEN	Air is led into the fuel tank.

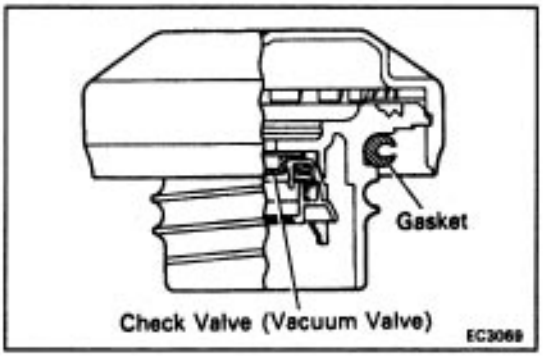
V04477



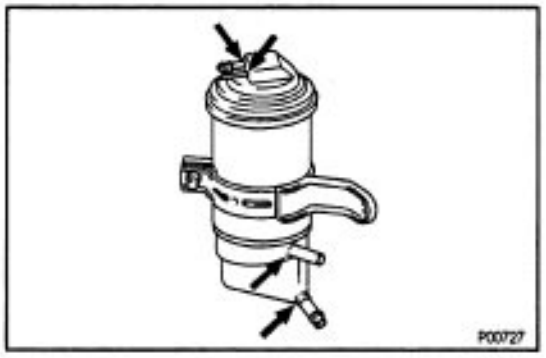
FUEL VAPOR LINES. FUEL TANK AND TANK CAP INSPECTION

1. VISUALLY INSPECT LINES AND CONNECTIONS
Look for loosen connections, sharp bends or damage.
2. VISUALLY INSPECT FUEL TANK

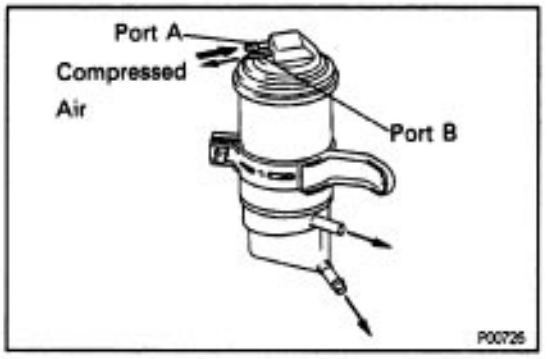
Look for deformation, cracks or fuel leakage.



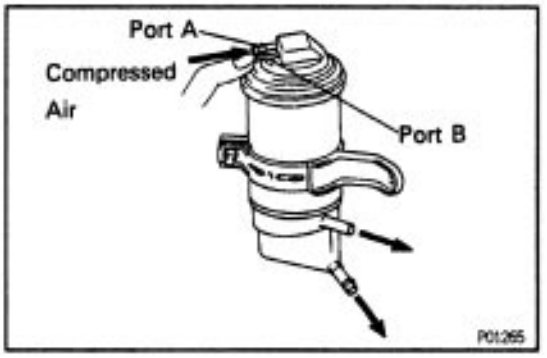
3. VISUALLY INSPECT FUEL TANK CAP
Check if the cap and/or gasket are deformed or dam–aged.
If necessary, repair or replace the cap.



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) Using low pressure compressed air (4.71 kPa, 48 gf/cm^2, 0.68 psi), blow into port A and check that air flows without resistance from the other ports.
(b) Blow air (4.71 kPa, 48 gf/cm1, 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.

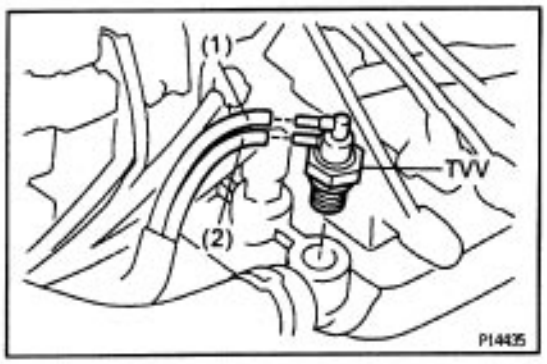


4. CLEAN FILTER IN CANISTER
Clean the filter by blowing 294 kPa (3 kgf/cm1, 43 psi) of compressed air into port A while holding port B closed.

NOTICE:

- **Do not attempt to wash the canister.**
- **No activated carbon should come out.**

5. REINSTALL CHARCOAL CANISTER



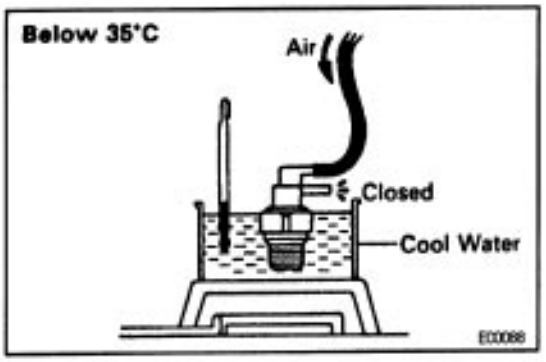
TVV INSPECTION

1. DRAIN ENGINE COOLANT

2. REMOVE TVV FROM WATER INLET HOUSING

(a) Disconnect the following hoses:
(1) Vacuum hose (from throttle body)
(2) Vacuum hose (from charcoal canister)

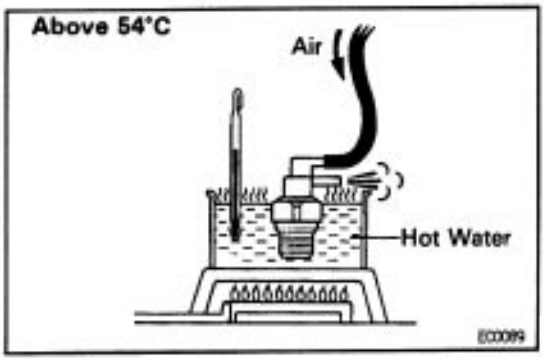
(b) Remove the TVV.



3. INSPECT TVV OPERATION

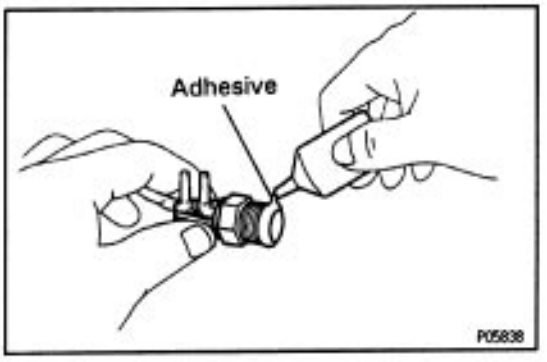
(a) Cool the TVV to below 35 C (95 F) with cool water.

(b) Check that air does not flow from the upper port to lower port.



(c) Heat the TVV to above 54 C (129 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.

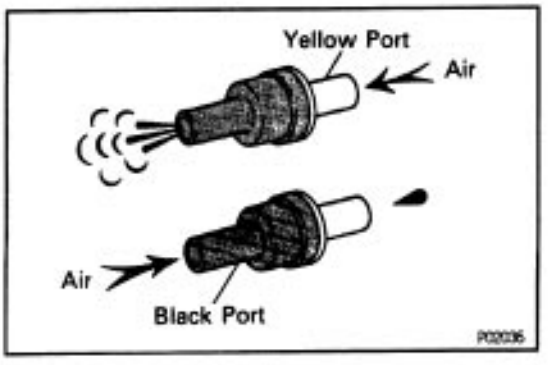


4. REINSTALL TVV

(a) Apply adhesive to 2 or 3 threads of the TVV, and install it.
Adhesive:
Part No. 08833–00070, THREE BOND 1324 or equivalent
Torque: 29 N–m (300 kgf–cm, 22 ft–lbf)

(b) Reconnect 2 vacuum hoses.

5. REFILL WITH ENGINE COOLANT



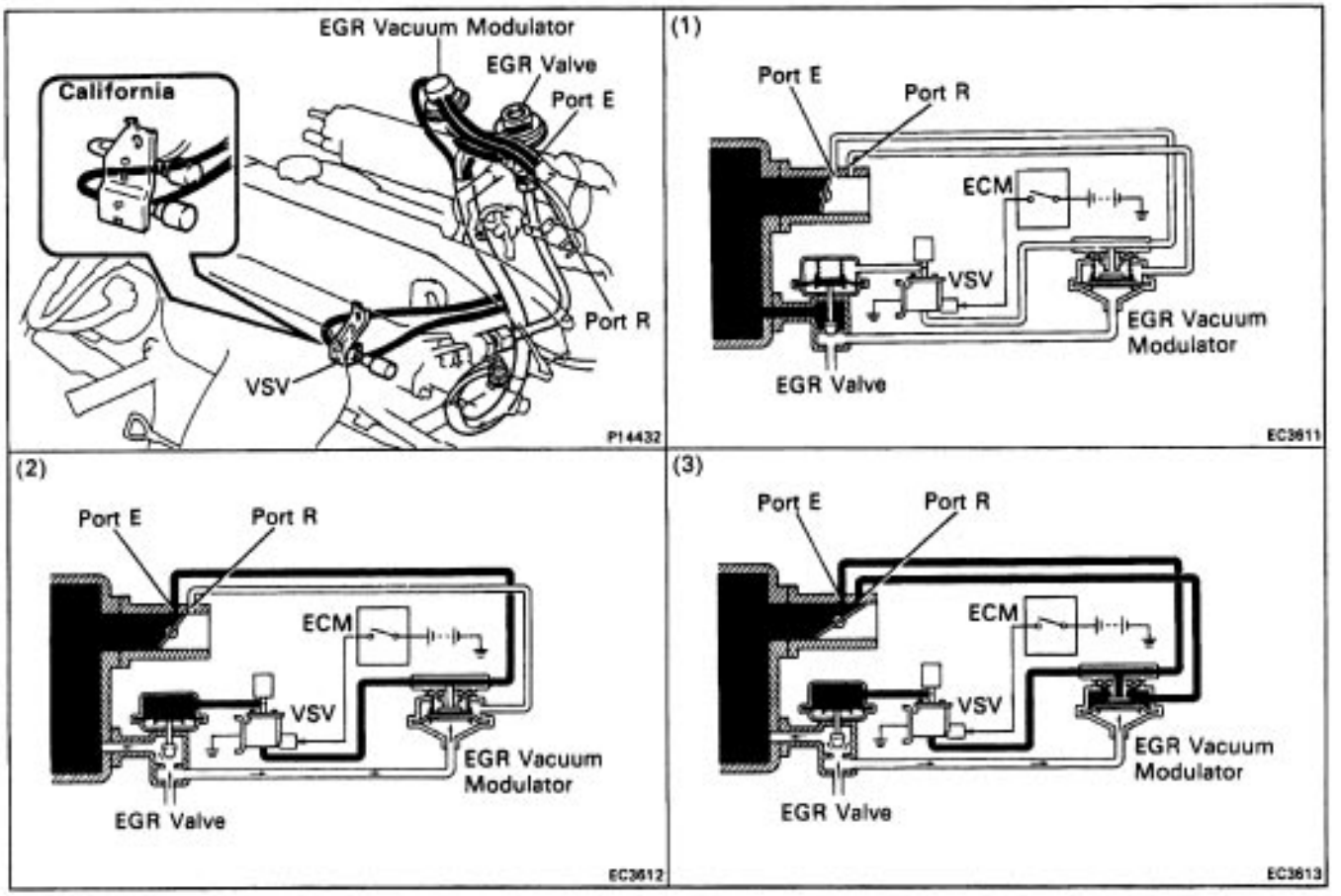
CHECK VALVE INSPECTION

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 the check valve.

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

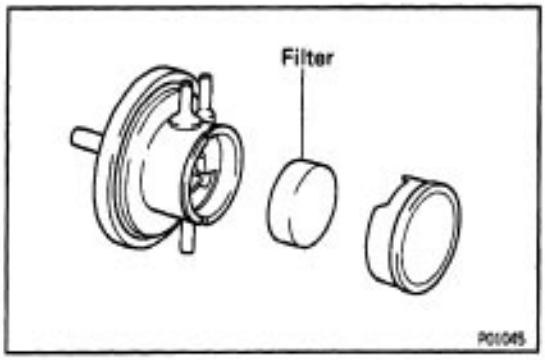


ECT	RPM	PIM (ECM)	VSV	Throttle Valve Opening Aigle	Pressure the EGR Valve Pressure Chamber		EGR Vacuum Modulator	EGR Valve	Exhaust Gas
Below 55°C (131°F)	–	–	CLOSED	–	–		–	CLOSED	Not recirculated
Above 60°C (140°F)	Below 4,000 rpm	OFF	CLOSED	Position below port E	–		–	CLOSED	Not recirculated
			CLOSED	Position below port E	(1)	–	–	CLOSED	Not recirculated
		***ON	OPEN	Positioned between port E and port R	(2) HIGH	*	CLOSES passage to atmosphere	OPEN	Recirculated
				Position above port R	(3) HIGH	**	CLOSES passage to atmosphere	OPEN	Recirculated (increase)
	Above 4,000 rpm	OFF	CLOSED	–	–		–	CLOSED	Not Recirculated

* Pressure increases → 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 exhaust gas, even if the exhaust pressure is insufficiently low.

*** If terminals TE1 and E1 of data link connector 1 are connected, the VSV switches ON.



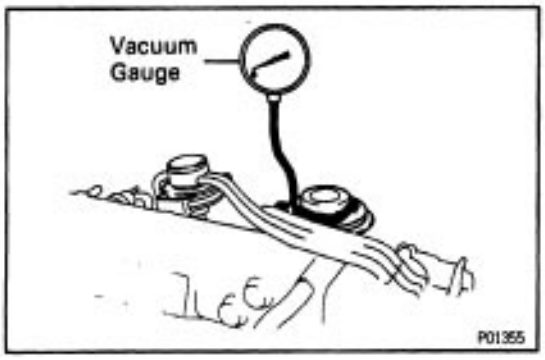
EGR SYSTEM INSPECTION

1. CHECK AND CLEAN FILTER IN EGR VACUUM MODULATOR

(a) Check the filter for contamination or damage.

(b) Using compressed air, clean the filter.

HINT: Install the filter with the coarser surface facing the atmospheric side (outward).

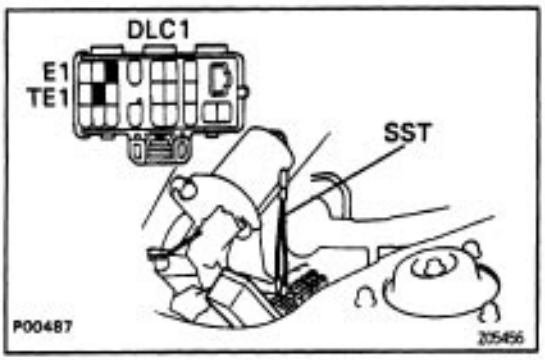


2. PREPARATION

Using a 3–way connector, connect a vacuum gauge to the hose between the EGR valve and VSV.

3. CHECK SEATING OF EGR VALVE

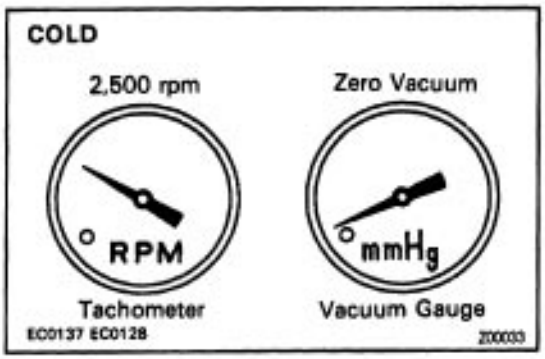
Start the engine and check that the engine starts and runs at idle.



4. CONNECT TERMINALS TE1 AND E1

Using SST, connect terminals TE 1 and E 1 of the data link connector 1.

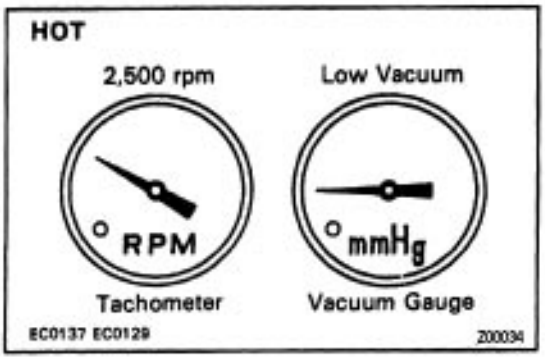
SST 09843–18020



5. CHECK VSV

(a) The engine coolant temperature should be below 601C (1401F) (A/T) or 551C (131 1F) (M/T).

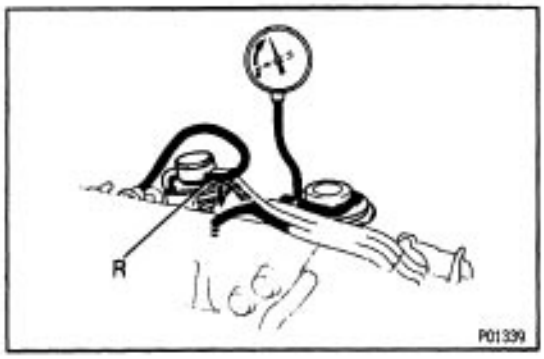
(b) Check that the vacuum gauge indicates zero at 2.500 rpm.



6. CHECK VSV AND EGR VACUUM MODULATOR WITH HOT ENGINE

(a) Warm up the engine.

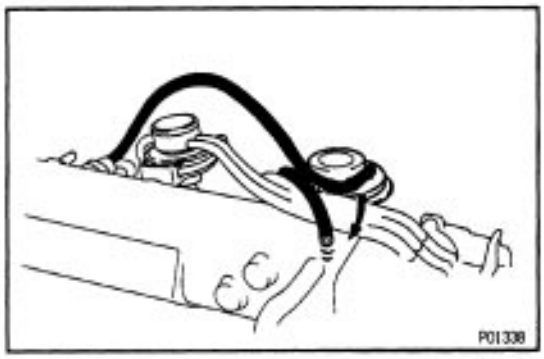
(b) Check that the vacuum gauge indicates low vacuum at 2,500 rpm.



(c) Disconnect the vacuum hose 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 2,500 rpm.

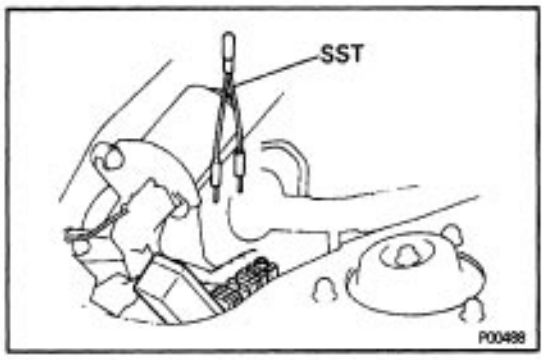
HINT: As a large amount of exhaust gas enters, the engine will misfire slightly.

(e) Remove the vacuum gauge, and reconnect the vacuum hoses to the proper locations.



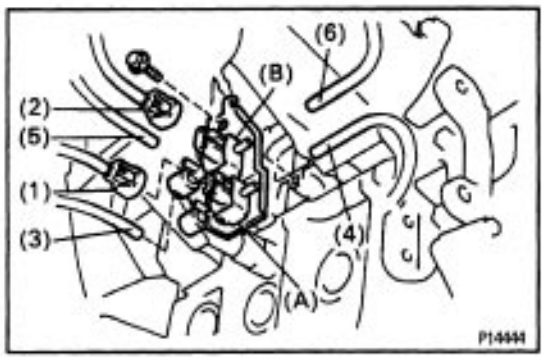
7. CHECK EGR VALVE

(a) Apply vacuum directly to the EGR valve with the engine idling.
(b) Check that the engine runs rough or dies.
(c) Reconnect the vacuum hoses to the proper locations.



8. DISCONNECT TERMINALS TE1 AND E1

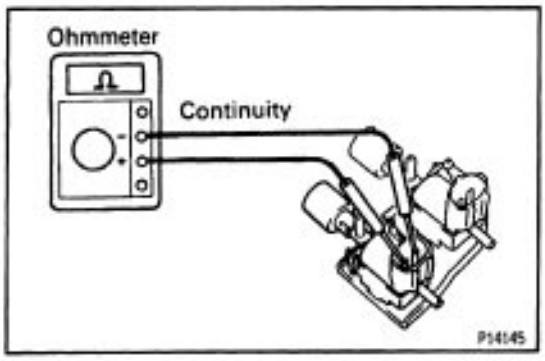
Remove the SST.
SST 09843–18020
IF NO PROBLEM IS FOUND WITH THIS INSPECTION, SYSTEM IS NORMAL; OTHERWISE INSPECT EACH PART



VSV INSPECTION (California)

1. REMOVE VSV

(a) Disconnect the following connectors and hoses:
(1) VSV for EGR
(A) connector
(2) VSV for fuel pressure control
(B) connector
(3) Vacuum hose (from EGR valve) from port E of VSV (A)
(4) Vacuum hose (from port “a” of EGR vacuum modulator) from port G of VSV (A)
(5) Vacuum hose (from fuel pressure regulator) from port E of VSV (B)
(6) Vacuum hose (from air intake chamber) from port G of VSV (B)
(b) Remove the bolt and VSV assembly.



2. INSPECT VSV

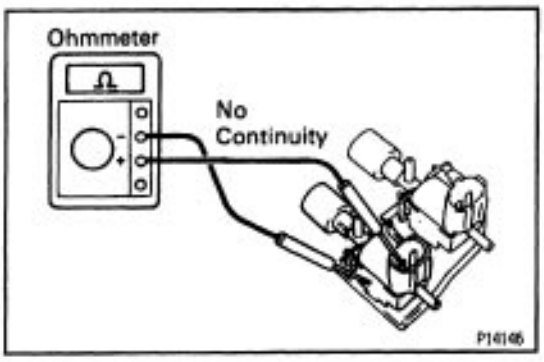
A. Inspect VSV for open circuit

Using an ohmmeter, check that there is continuity between the terminals.

Resistance (Cold):

33–39Ω

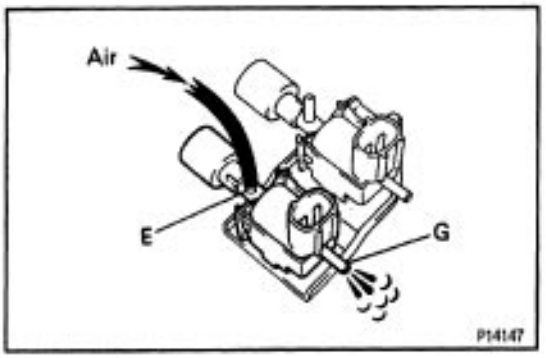
If there is no continuity, replace the VSV.



B. Inspect VSV for ground

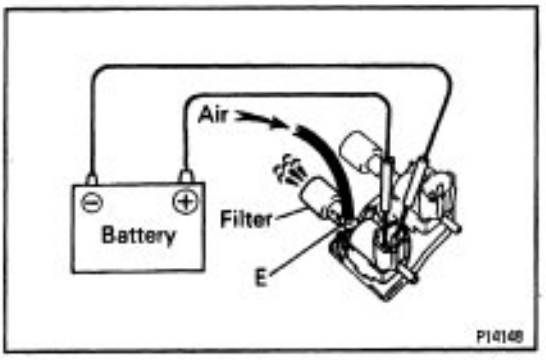
Using an ohmmeter, check that there is no continuity between each terminal and the body.

If there is continuity, replace the VSV.



C. Inspect VSV operation

(a) Check that air flows from port E to port G.

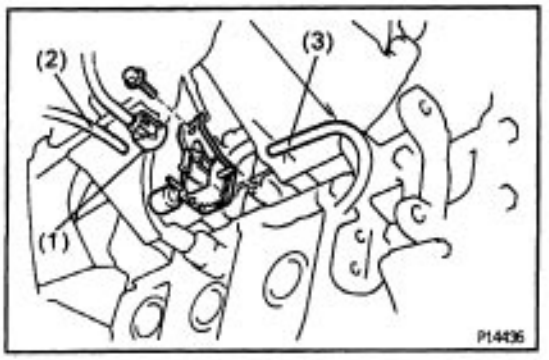


(b) Apply battery voltage across the terminals.

(c) Check that air flows from port E to the filter.

If operation is not as specified, replace the VSV.

3. REINSTALL VSV



VSV INSPECTION (Except California)

1. REMOVE VSV

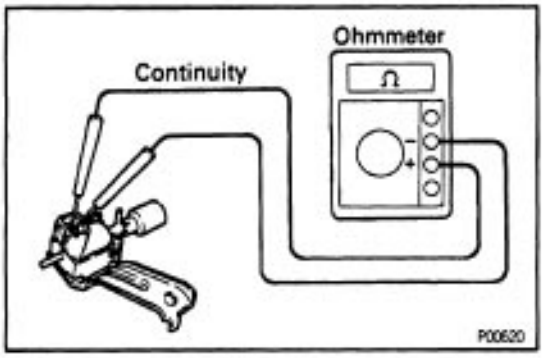
(a) Disconnect the following connector and hoses:

(1) VSV connector

(2) Vacuum hose (from EGR valve) from port E of VSV

(3) Vacuum hose (from port “Q” of EGR vacuum modulator) from port G of VSV

(b) Remove the bolt and VSV.



2. INSPECT VSV

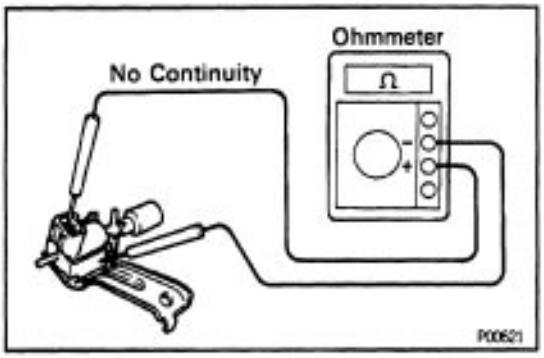
A. Inspect VSV for open circuit

Using an ohmmeter, check that there is continuity between the terminals.

Resistance (Cold):

33–39Ω

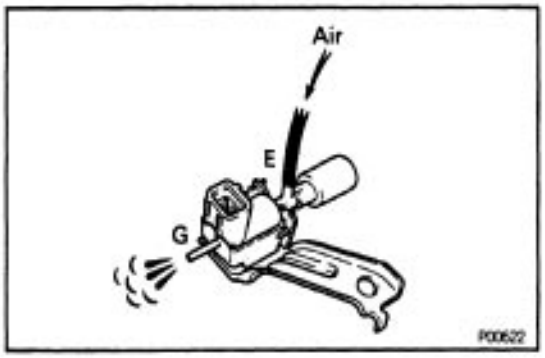
If there is no continuity, replace the VSV.



B. Inspect VSV for ground

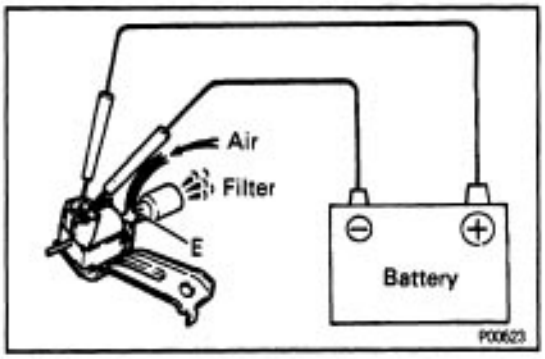
Using an ohmmeter, check that there is no continuity between each terminal and the body.

If there is continuity, replace the VSV.



C. Inspect VSV operation

(a) Check that air flows from port E to port G.

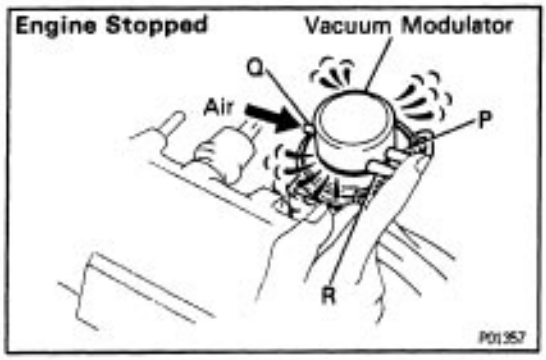


(b) Apply battery voltage across the terminals.

(c) Check that air flows from port E to the filter.

If operation is not as specified, replace the VSV.

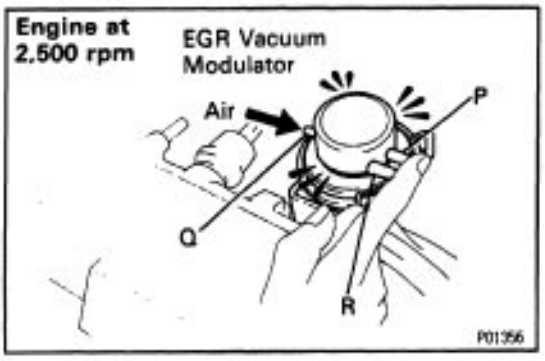
3. REINSTALL VSV



EGR VACUUM MODULATOR INSPECTION

CHECK EGR VACUUM MODULATOR OPERATION

(a) Disconnect the vacuum hoses from ports P, Q and R of the EGR vacuum modulator.
(b) Block ports P and R with your finger.
(c) Blow air into port Q, and check that the air passes through to the air filter side freely.



(d) Start the engine, and maintain speed at 2.500 rpm.
(e) Repeat the above test. Check that there is a strong resistance to air flow.
(f) Reconnect the vacuum hoses to the proper locations.

EGR VALVE INSPECTION

1. REMOVE EGR VALVE

Check for sticking and heavy carbon deposits.
If a problem is found, replace the valve.

2. REINSTALL EGR VALVE WITH NEW GASKET

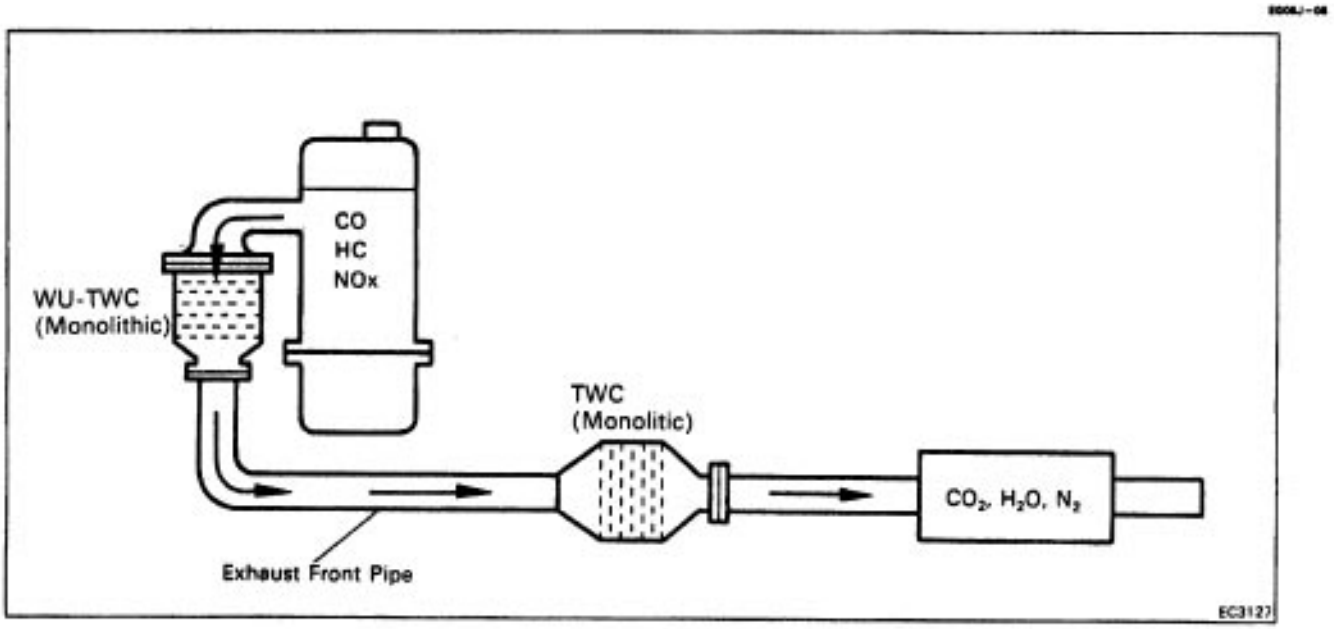
Nut

Torque: 13 N–m (130 kgf–cm, 9 ft–lbf)

Union nut

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

THREE–WAY CATALYTIC CONVERTER (TWC) SYSTEM

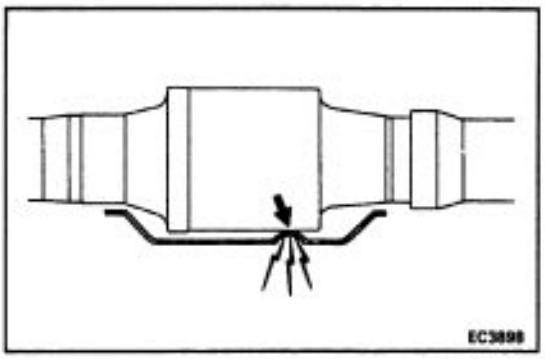


To reduce C0, HC end NOx emissions, they are oxidized, reduced and converted to carbon dioxide (CO_2), water (H_20) and nitrogen (N_2) by the catalyst.

Exhaust Port		WU–TWC		TWC		Exhaust Gas
CO HC NOx	→	OXIDATION AND REDUCTION	→	OXIDATION AND REDUCTION	→	CO_2 H_2O N_2

EXHAUST PIPE ASSEMBLY INSPECTION

1. CHECK CONNECTIONS FOR LOOSENESS OR DAMAGE
2. CHECK CLAMPS FOR WEAKNESS, CRACKS OR DAMAGE

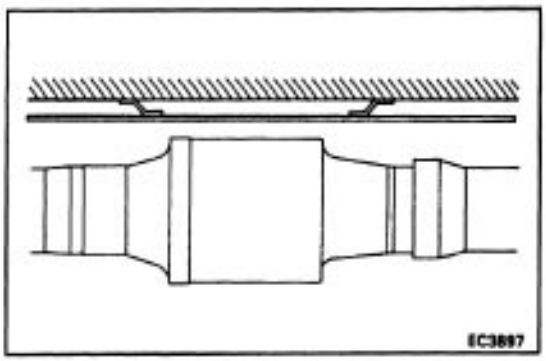


THREE–WAY CATALYTIC CONVERTER INSPECTION

TWC:

CHECK FOR DENTS OR DAMAGE

If any part of protector is damaged or dented to the extent that it contacts the TWC, repair or replace it.

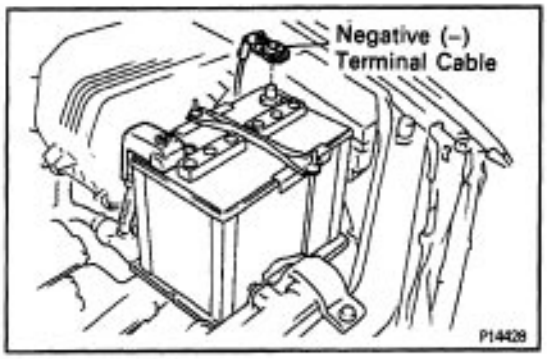


HEAT INSULATOR INSPECTION

TWC:

1. CHECK HEAT INSULATOR FOR DAMAGE

2. CHECK FOR ADEQUATE CLEARANCE BETWEEN THREE – WAY CATALYTIC CONVERTER AND HEAT INSULATOR

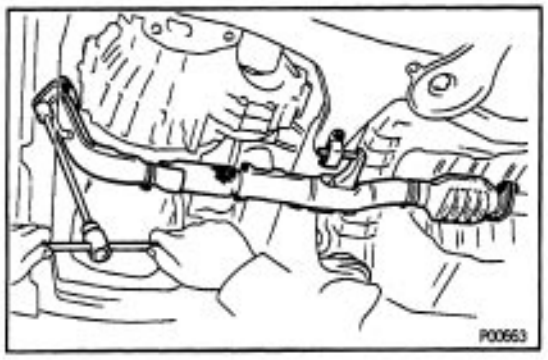


THREE–WAY CATALYTIC CONVERTER REPLACEMENT

WU–TWC:

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 FRONT EXHAUST PIPE

(a) Loosen the 2 bolts, and disconnect the bracket.

(b) Remove the 2 bolts and nuts holding the front exhaust pipe to the center exhaust pipe.

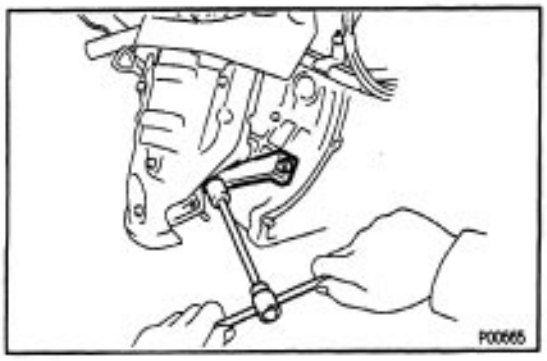
(c) Using a 14 mm deep socket wrench, remove the 3 nuts holding the front exhaust pipe to the WU–TWC.

(d) Remove the front exhaust pipe and gaskets.

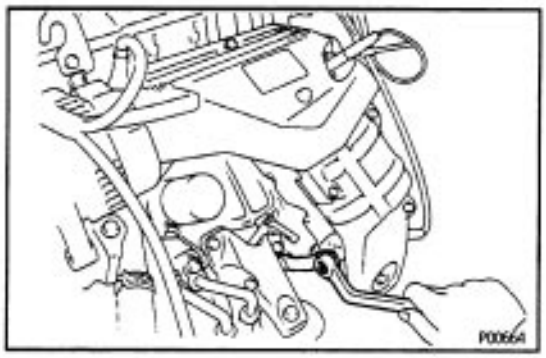
3. REMOVE WARM UP THREE – WAY CATALYTIC CONVERTER

(a) Check that the WU–TWC is cool.

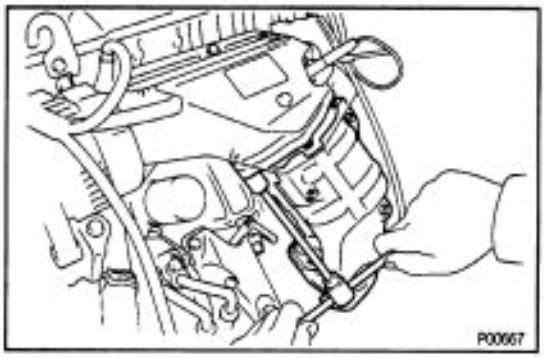
(b) Disconnect the sub oxygen sensor connector.



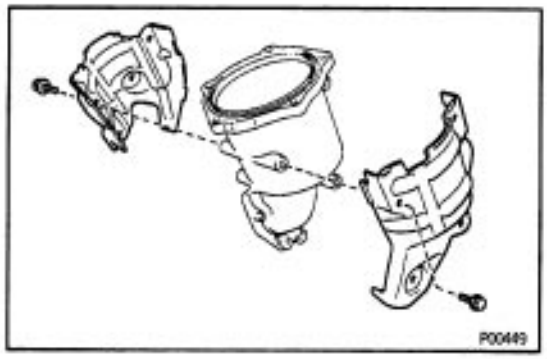
(c) Remove the bolt, nut and No. 1 manifold stay.



(d) Remove the bolt, nut and manifold stay.

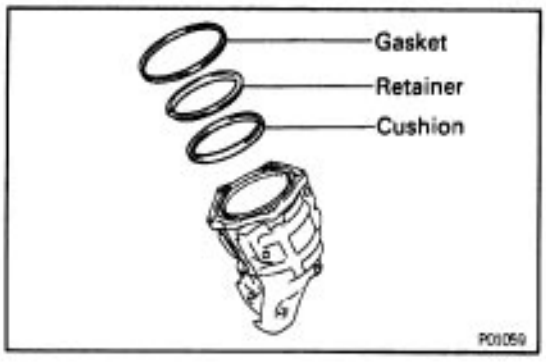


(e) Remove the 3 bolts, 2 nuts, WU –TWC, gasket, retainer and cushion.
(f) Remove the 8 bolts and 2 heat insulators from the WU –TWC.

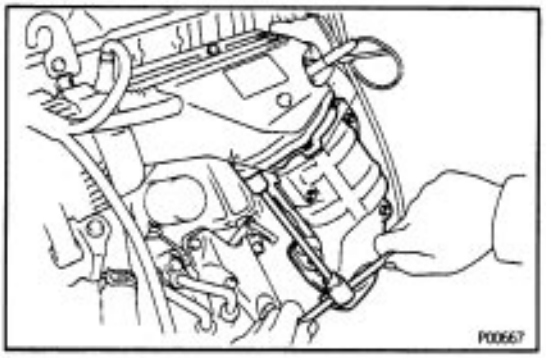


4. REINSTALL WARM–UP THREE–WAY CATALYTIC CONVERTER

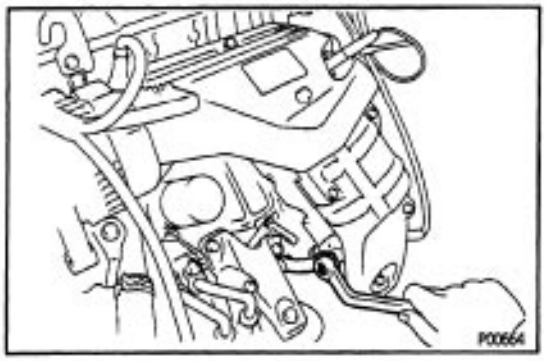
(a) Install the 2 heat insulators to a new WU –TWC with the 8 bolts.



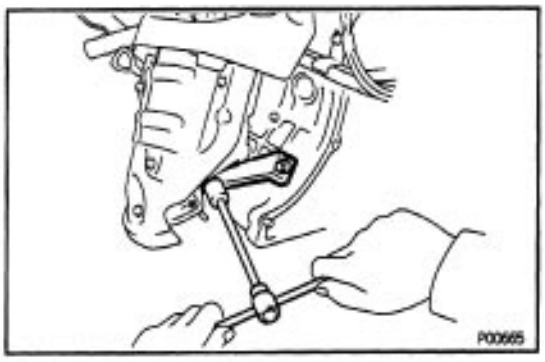
(b) Place new cushion, retainer and gasket on the WU–TWC.



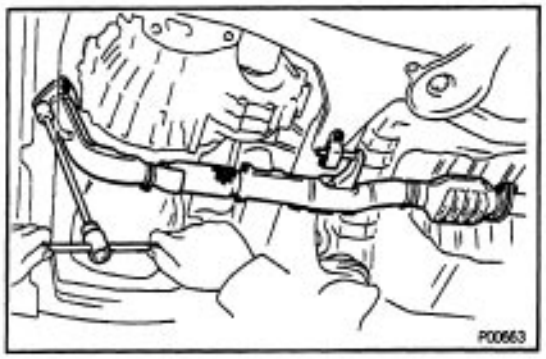
(c) Install the WU–TWC with the 3 bolts and 2 new nuts.
Torque: 29 N–m (300 kgf–cm, 22 ft–lbf)



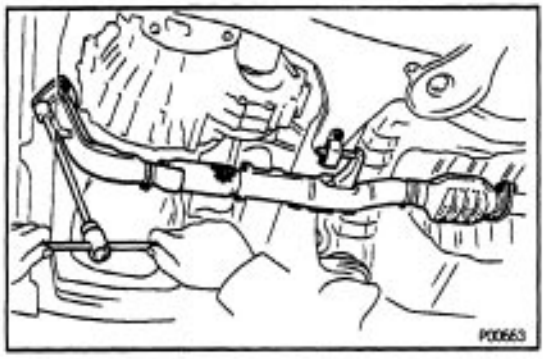
(d) Install the manifold stay with the bolt and nut.
Torque: 42 N–m (425 kgf–cm. 31 ft–lbf)



(e) Install the No. 1 manifold stay with the bolt and nut.
Torque: 42 N–m (425 kgf–cm. 31 ft–lbf)
(f) Connect the sub oxygen sensor connector.



5. REINSTALL FRONT EXHAUST PIPE
(a) Place 2 new gaskets on the front and rear of the front exhaust pipe.
(b) Temporarily install the 2 bolts and 2 new nuts holding the front exhaust pipe to the center exhaust pipe.
(c) Using a 14 mm deep socket wrench, install the 3 new nuts holding the front exhaust pipe to the WU –TWC.
Torque: 62 N–m (630 kgf–cm, 46 ft–lbf)
(d) Tighten the 2 bolts and nuts holding the front exhaust pipe to the center exhaust pipe.
Torque: 58 N–m (570 kgf–cm, 41 ft–lbf)
(e) Install the bracket with the 2 bolts.
6. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY



TWC:

1. REMOVE FRONT EXHAUST PIPE (THREE – WAY CATALYTIC CONVERTER)

(a) Loosen the 2 bolts, and disconnect the bracket.
(b) Remove the 2 bolts and nuts holding the front exhaust pipe to the center exhaust pipe.
(c) Using a 14 mm deep socket wrench, remove the 3 nuts holding the front exhaust pipe to the WU–TWC.
(d) Remove the front exhaust pipe and gasket.

2. REINSTALL FRONT EXHAUST PIPE (THREE–WAY CATALYTIC CONVERTER)

(a) Place 2 new gaskets on the front and rear of the front exhaust pipe.
(b) Temporarily install the 2 bolts and 2 new nuts holding the front exhaust pipe to the center exhaust pipe.
(c) Using a 14 mm deep socket wrench, install the 3 new nuts holding the front exhaust pipe to the WU –TWC.
Torque: 412 N–m (630 kgf–cm, 46 ft–lbf)
(d) Tighten the 2 bolts and nuts holding the front exhaust pipe to the center exhaust pipe.
Torque: 58 N–m (570 kgf–cm, 41 ft–lbf)
(e) Install the bracket with the 2 bolts.

SERVICE SPECIFICATIONS

SERVICE DATA

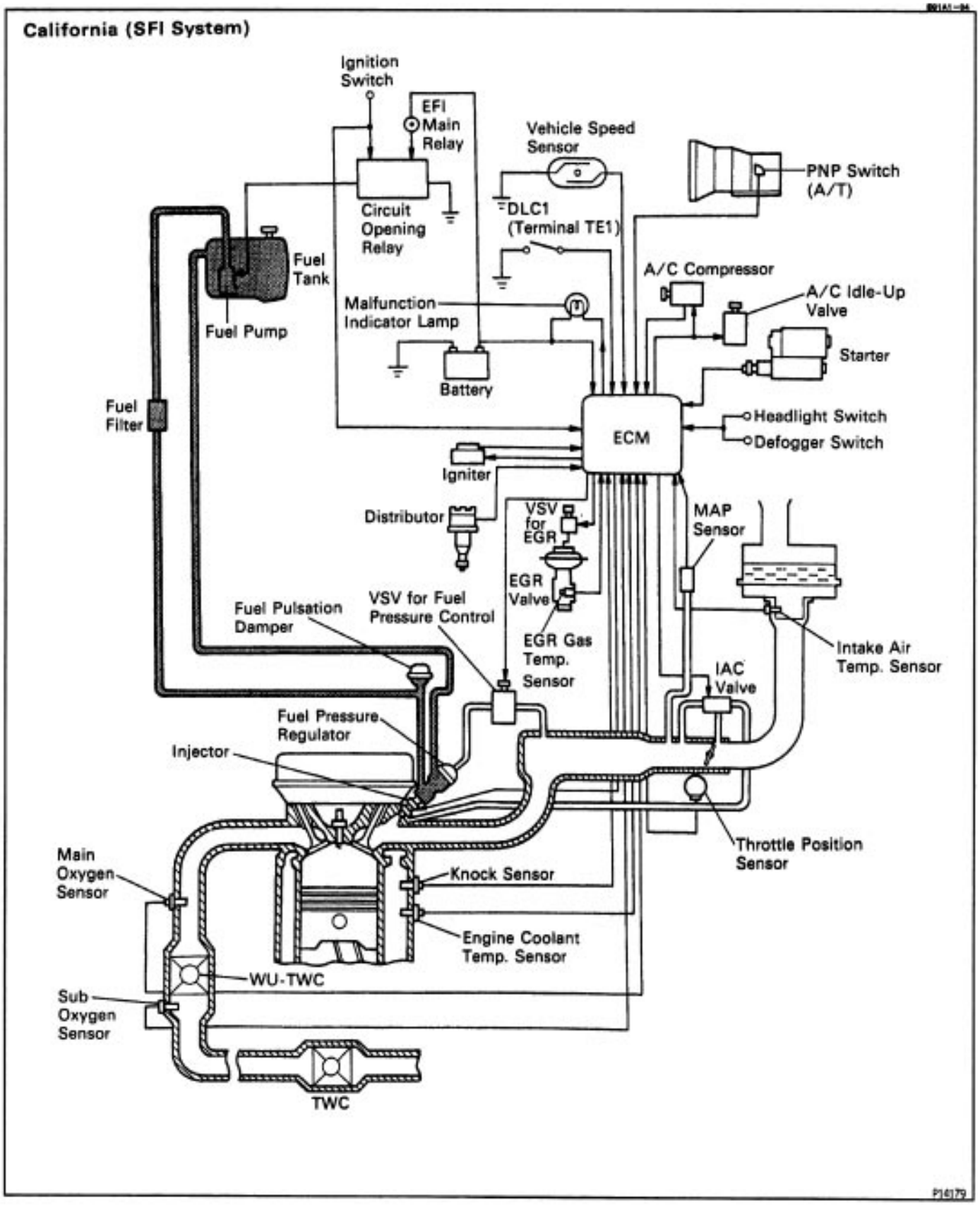
VSV (for EGR)	Resistance at 20°C (68°F)	33 – 39 Ω

TORQUE SPECIFICATIONS

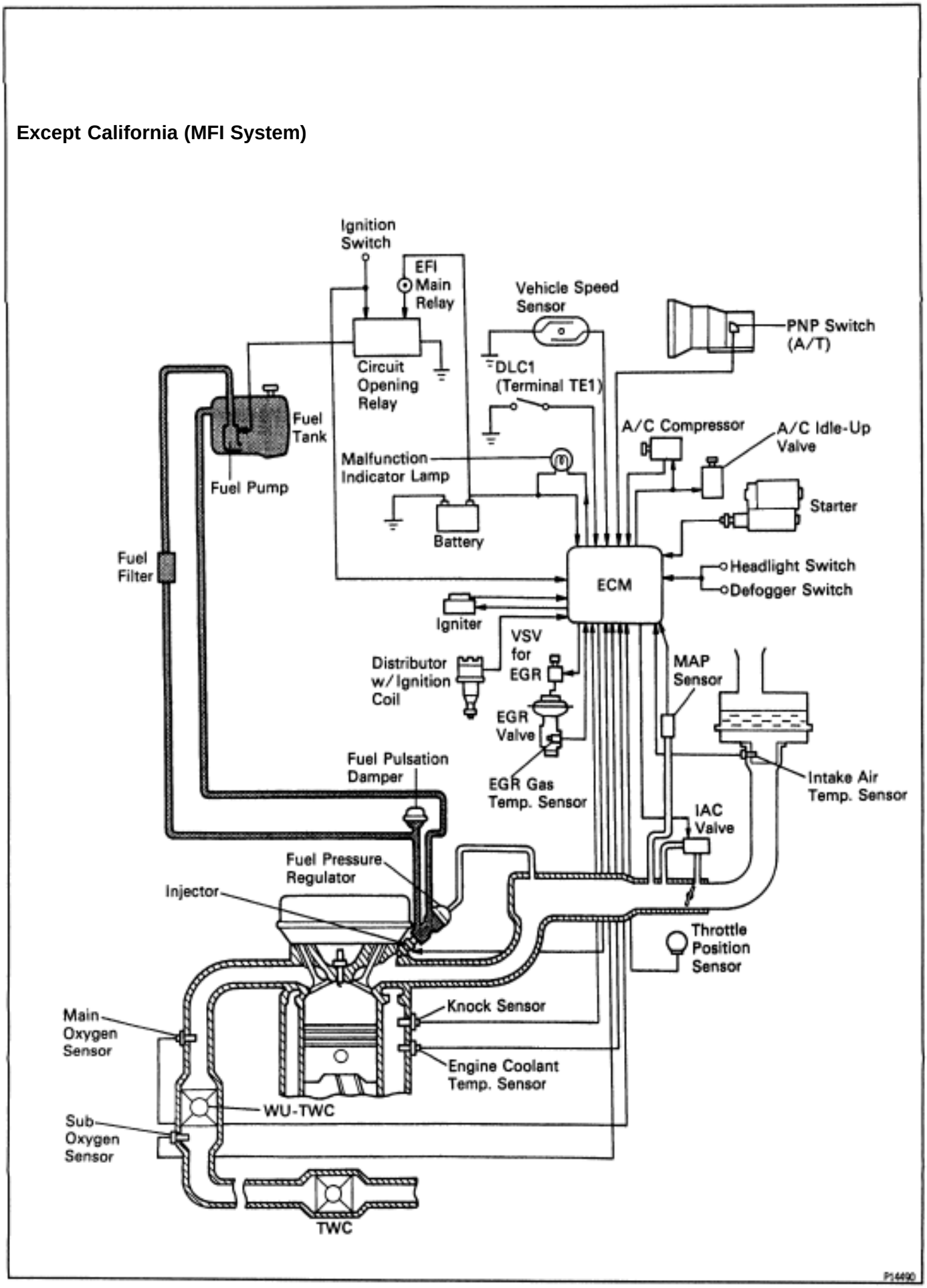
Part tightened	N·m	kgf·cm	ft·lbf
TVV x Water outlet housing	29	300	22
EGR valve x Intake manifold	13	130	9
EG R valve x EGR pipe	59	600	43
WU–TWC x Exhaust manifold	29	300	22
Exhaust manifold stay x WU–TWC	42	425	31
Exhaust manifold stay x FR engine mounting insulator	42	425	31
No.1 exhaust manifold stay x WU–TWC	42	425	31
No.1 exhaust manifold stay x Cylinder block	42	425	31
Front exhaust pipe x WU–TWC	62	630	46
Front exhaust pipe x Center exhaust pipe	56	570	41

MFI/SFI SYSTEM

DESCRIPTION



Except California (MFI System)



The MFI (Multiport Fuel Injection)/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 MFI/SFI injectors by an electric fuel pump. The injectors inject a metered quantity of fuel into the intake port in accordance with signals from the ECM (Engine Control Module).

AIR INDUCTION SYSTEM

The air induction system provides sufficient air for engine operation.

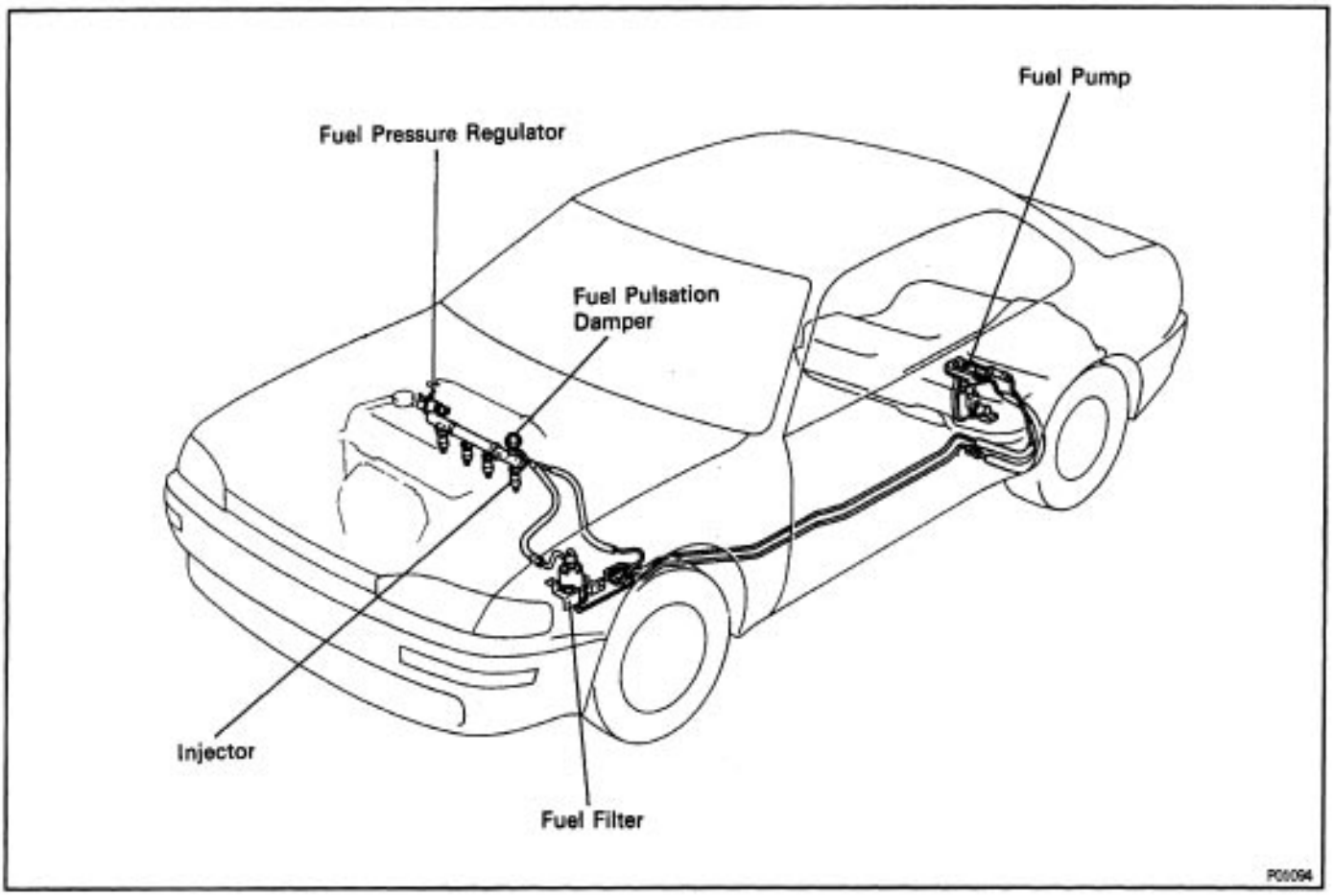
ELECTRONIC CONTROL SYSTEM

The CAMRY 5S–FE engine is equipped with a TOYOTA Computer Controlled System (TCCS) which centrally controls the MFI/SFI, ESA, IAC diagnosis systems etc. by means of an Engine Control Module (ECM–formerly MFI/SFI computer) employing a microcomputer.
The ECM controls the following functions:

1. Multiport Fuel Injection (MFI)/Sequential Multiport Fuel Injection (SFI)
   The ECM receives signals from various sensors indicating changing engine operation conditions such as:
   Intake manifold pressure
   Intake air temperature
   Engine coolant temperature
   Engine speed
   Throttle valve opening angle
   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, engine coolant temperature, etc.), the microcomputer (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 (engine coolant temperature, air conditioning ON/OFF, etc.). Sensors transmit signals to the ECM which controls the flow of air through the bypass of the throttle valve and adjusts 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 in the combination meter. At the same time, trouble is identified and a diagnostic trouble code is recorded by the EC
5. The diagnostic trouble code can be read by the
   number of blinks of the malfunction indicator lamp when terminals TE1 and E1 are connected. The diagnostic trouble codes are referred to in later page. (See page EG1–300)
   Fail–Safe Function
   In the event of the sensor malfunction, a back–up circuit will take over to provide minimal driveability, and the malfunction indicator lamp will illuminate.

OPERATION

FUEL SYSTEM



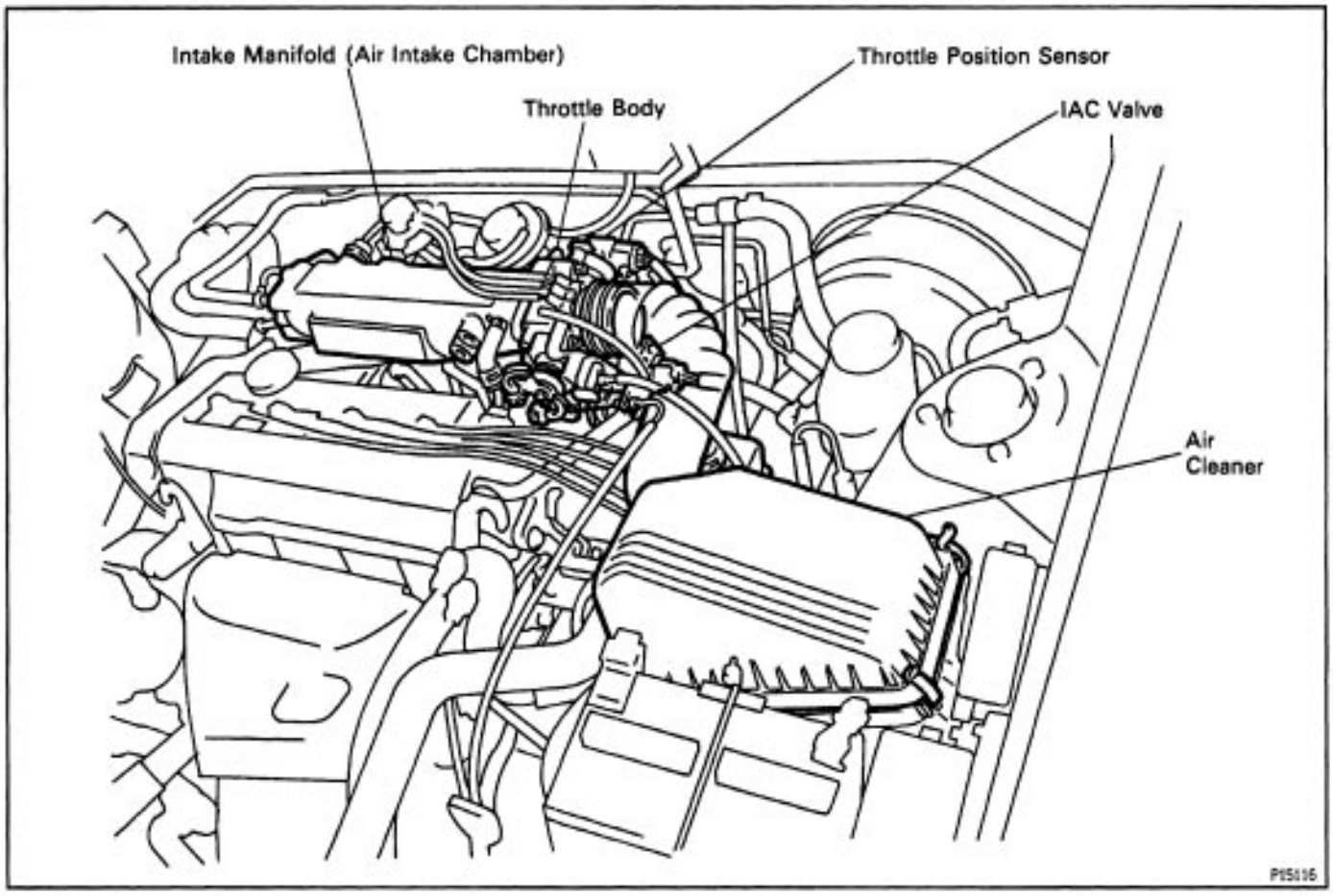
Fuel pumped up by the fuel pump, flows through the fuel filter and is distributed to each injector at a set pressure maintained by the pressure regulator.

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/cm1, 41 psi) higher than the pressure inside the cylinder head, and excess fuel is returned to the fuel tank through the return pipe.

The pulsation damper absorbs the slight fluctuations in fuel pressure caused by fuel injector from the injector.

The injectors operate on input of injection signals from the ECM and inject fuel into the cylinder head.

AIR INDUCTION SYSTEM

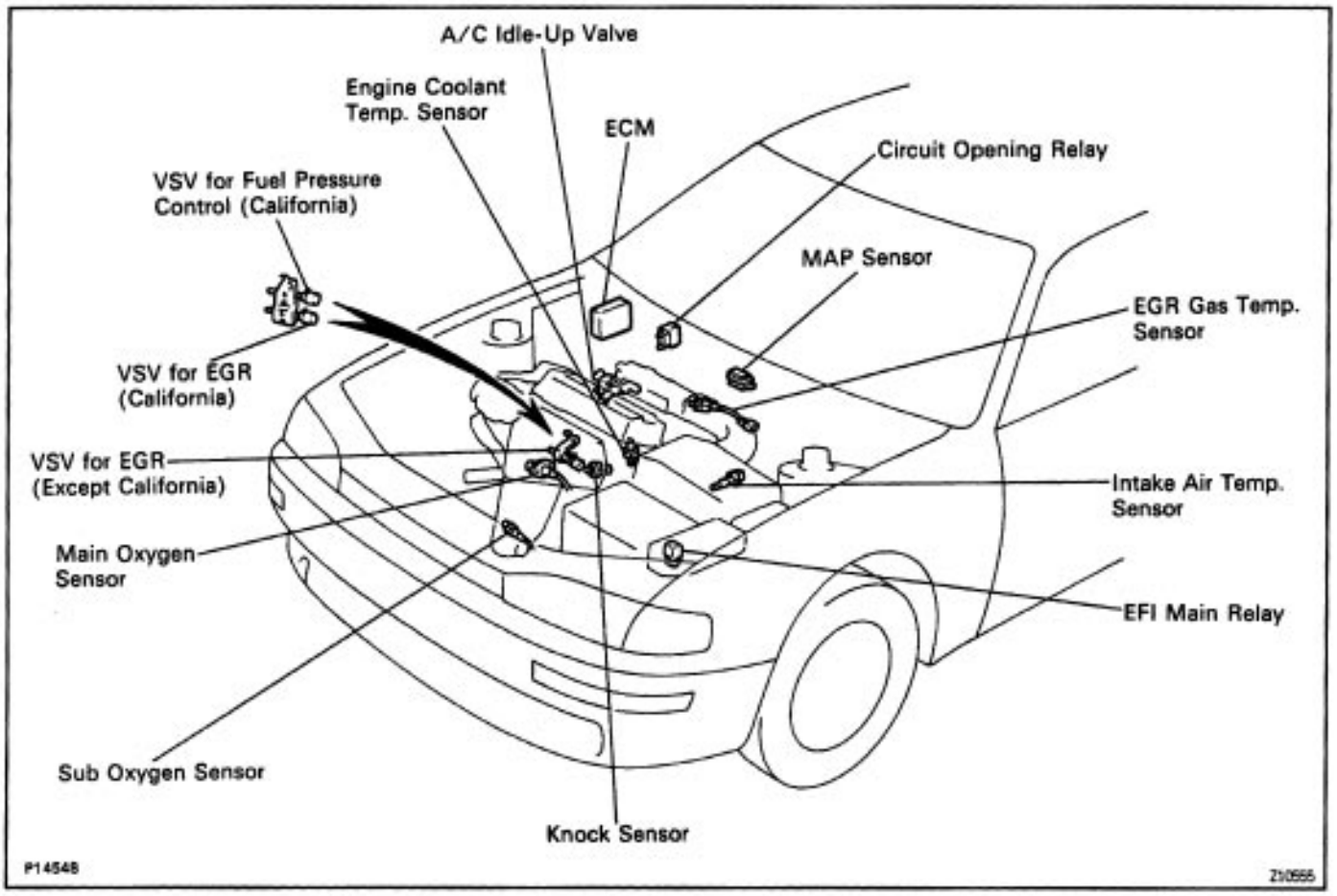


Air is filtered through the air cleaner and the amount flowing to the air intake chamber is determined according to the throttle valve opening in the throttle body and the engine speed. Intake air controlled by the throttle valve opening is distributed from the air intake chamber to the manifold of each cylinder and is drawn into the combustion chamber.

At low temperatures the IAC valve opens and the air flows through the IAC valve and the throttle body, into the air intake chamber. During engine warming up, even if the throttle valve is completely closed, air flows to the air intake chamber, thereby increasing the idle speed (first idle operation).

The air intake chamber prevents pulsation of the intake air. It also prevents intake air interference in each cylinder.

ELECTRONIC CONTROL SYSTEM



The control system consists of sensors which detect various engine conditions, and a ECM which determines the injection volume (timing) based on the signals from the sensors.
The various sensors detect the intake air pressure, engine speed, oxygen density in the exhaust gas, engine coolant temperature, intake air temperature and atmospheric pressure 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, ignition timing control, idle speed control and EGR control.

PREPARATION

SST (SPECIAL SERVICE TOOLS)

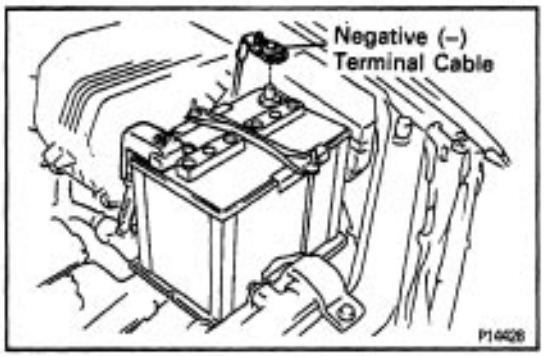
 09268–41045 Injection Measuring Tool Set	
 (09268–41080) No.6 union	
 (09268–41090) No.7 union	
 (90405–09015) No.1 Union	
 09268–45012 EFI Fuel Pressure Gauge	
 09631–22020 Power Steering Hose Nut 14 x 17 mm Wrench Set	Fuel line flare nut
 09842–30070 Wiring “F” EFI Inspection	
 09843–18020 Diagnosis Check Wire	

RECOMMENDED TOOLS

 09082–00050 TOYOTA Electrical Tester Set	
 09200–00010 Engine Adjust Kit	
 09258–00030 Hose Plug Set	Plug for vacuum hose, fuel hose etc.

EQUIPMENT

Carburetor cleaner	Throttle body
Graduated cylinder	Injector
Soft brush	Throttle body
Sound scope	Injector
Tachometer	
Torque wrench	
Vacuum gauge	



PRECAUTION

1. Before working on the fuel system, disconnect the negative (–) terminal cable from the battery.

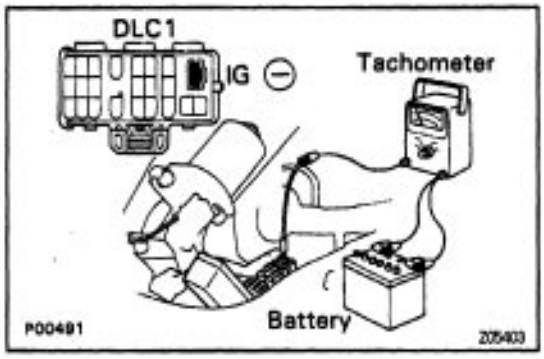
HINT: Any diagnostic trouble code retained by the computer will be erased when the battery terminal is removed.

Therefore, if necessary, read the diagnosis before removing the 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 disconnected 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.



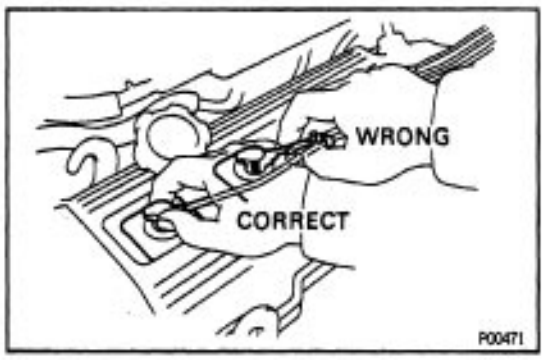
MAINTENANCE PRECAUTIONS

1. CHECK CORRECT ENGINE TUNE–UP
(See page EG1–8)

2. PRECAUTION WHEN CONNECTING GAUGE

(a) Use battery as the power source for the timing light, tachometer, etc.

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



3. IN EVENT OF ENGINE MISFIRE, FOLLOWING PRECAUTIONS SHOULD BE TAKEN

(a) Check proper connection of battery terminals, etc.

(b) Handle high–tension cords carefully.

(c) After repair work, check that the ignition coil terminals and all other ignition system lines are reconnected securely.

(d) 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.

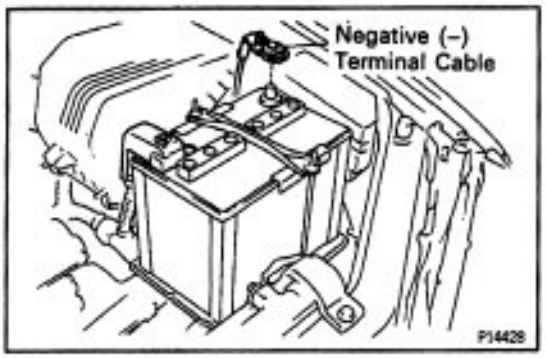
IF VEHICLE IS EQUIPPED WITH MOBILE RADIO SYSTEM (HAM, CB, ETC.)

If the vehicle is equipped with a mobile communica–tion system, refer to the precaution in the IN section.

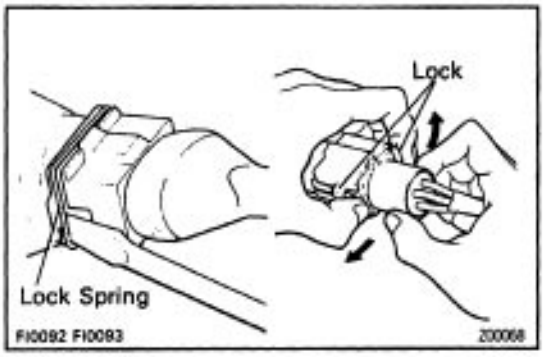
AIR INDUCTION SYSTEM

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.

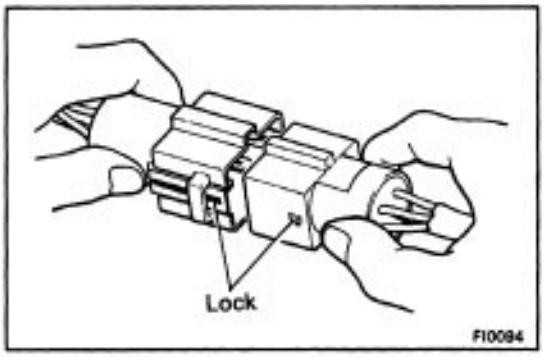
ELECTRONIC CONTROL SYSTEM



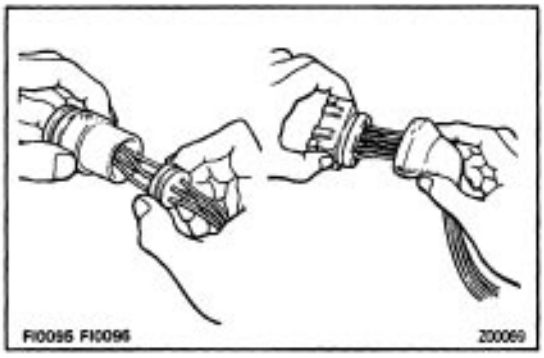
1. Before removing MFI/SFI wiring connectors, termi–nals, etc., first disconnect the power by either turning the ignition switch OFF or disconnecting the battery terminals.
HINT: Always check the diagnostic trouble code before disconnecting the negative (–) terminal cable from the battery.
2. When installing 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 MFI/SFI parts care–fully, especially the ECM.
4. Do not be careless during troubleshooting as there are numerous transistor circuits and even slight terminal contact can 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 on the MFI/SFI parts and wiring connectors.
7. Parts should be replaced as an assembly.



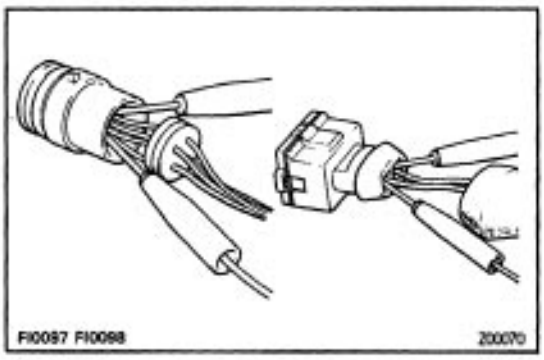
8. Care is required when pulling out and inserting wiring connectors.
(a) Release the lock and pull out the connector, pulling on the connectors.



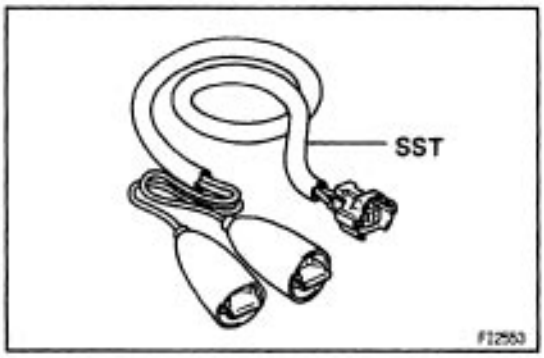
(b) Fully insert the connector and check that it is locked.



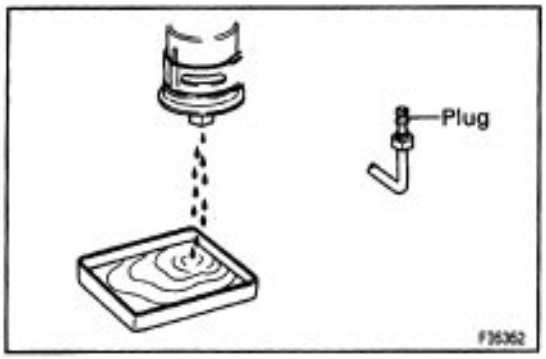
9. When inspecting a connector with a volt/ohmmeter.
(a) Carefully take out the water–proofing rubber if it is a water–proof type connector.



(b) Insert the test probe into the connector from wiring side when checking the continuity, amperage or voltage.
(c) Do not apply unnecessary force to the terminal.
(d) After checking, install the water–proofing rubber on the connector securely.

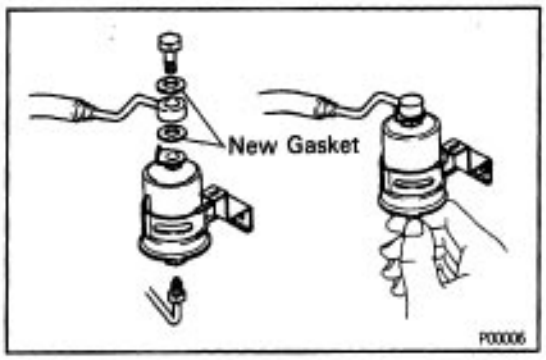


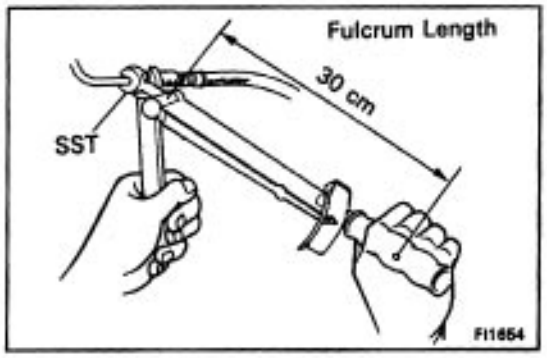
10. Use SST for inspection or test of the injector or its wiring connector.
SST 09842–30070



FUEL SYSTEM

1. When disconnecting the high pressure fuel 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 a new gasket.
   (b) Tighten the union bolt by hand.
   (c) Tighten the union bolt to the specified torque.
   Torque: 29 N–m (300 kgf–cm, 22 ft–lbf)



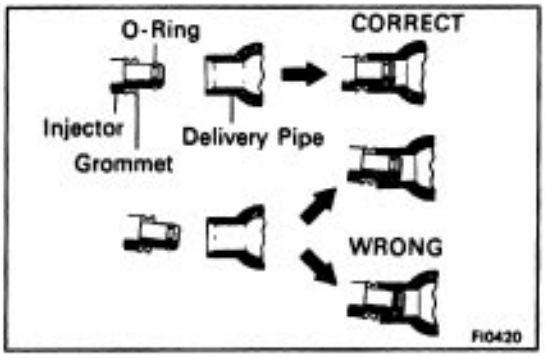


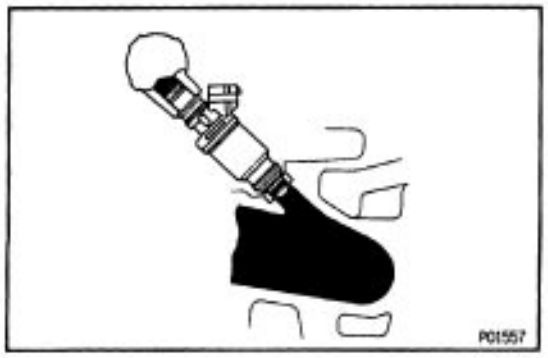
Flare Nut Type:

(s) Apply alight coat of engine oil to the flare and tighten the flare nut by hand.
(b) Using SST, torque the flare nut.
SST 09631–22020
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

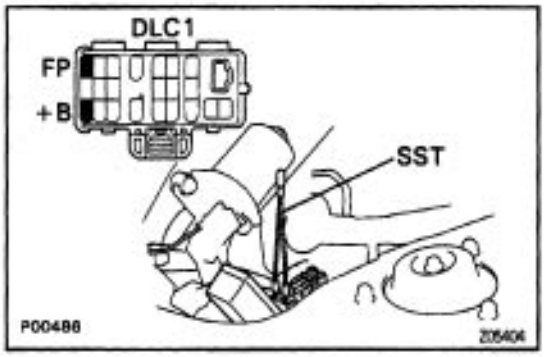
HINT: Use a torque wrench with a fulcrum length of 30 cm (11.81 in.).

3. Observe the following precautions when removing and installing the injectors.
   (a) Never reuse the O–ring.
   (b) When placing a new O–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.

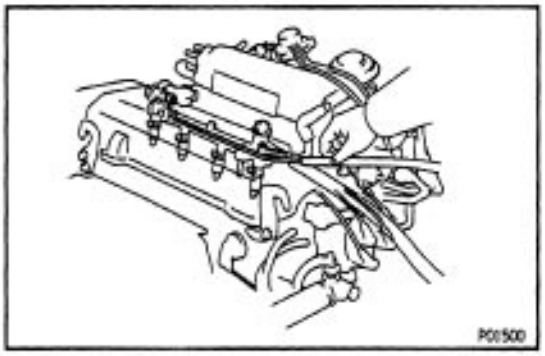




4. Install the injector to delivery pipe and intake manifold as shown in the illustration.

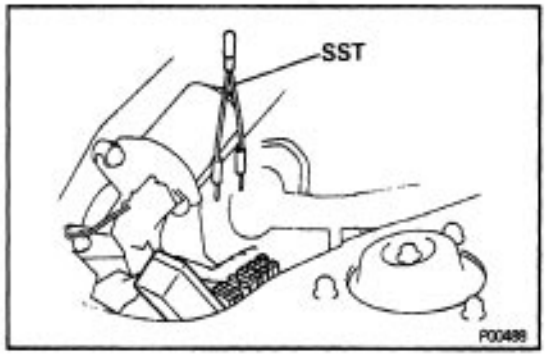


5. Check that there are no fuel leaks after performing maintenance anywhere on the fuel system.
   (a) Using SST, connect terminals + B and FP of the data link connector 1.
   SST 09843–18020
   (b) With engine stopped, turn the ignition switch ON.



   (c) Pinch the fuel return hose. The pressure in high pressure line will rise to approx. 392 kPa (4kgf/cm2, 57 psi). In this state, check to see that there are no leaks from any part of the fuel system.

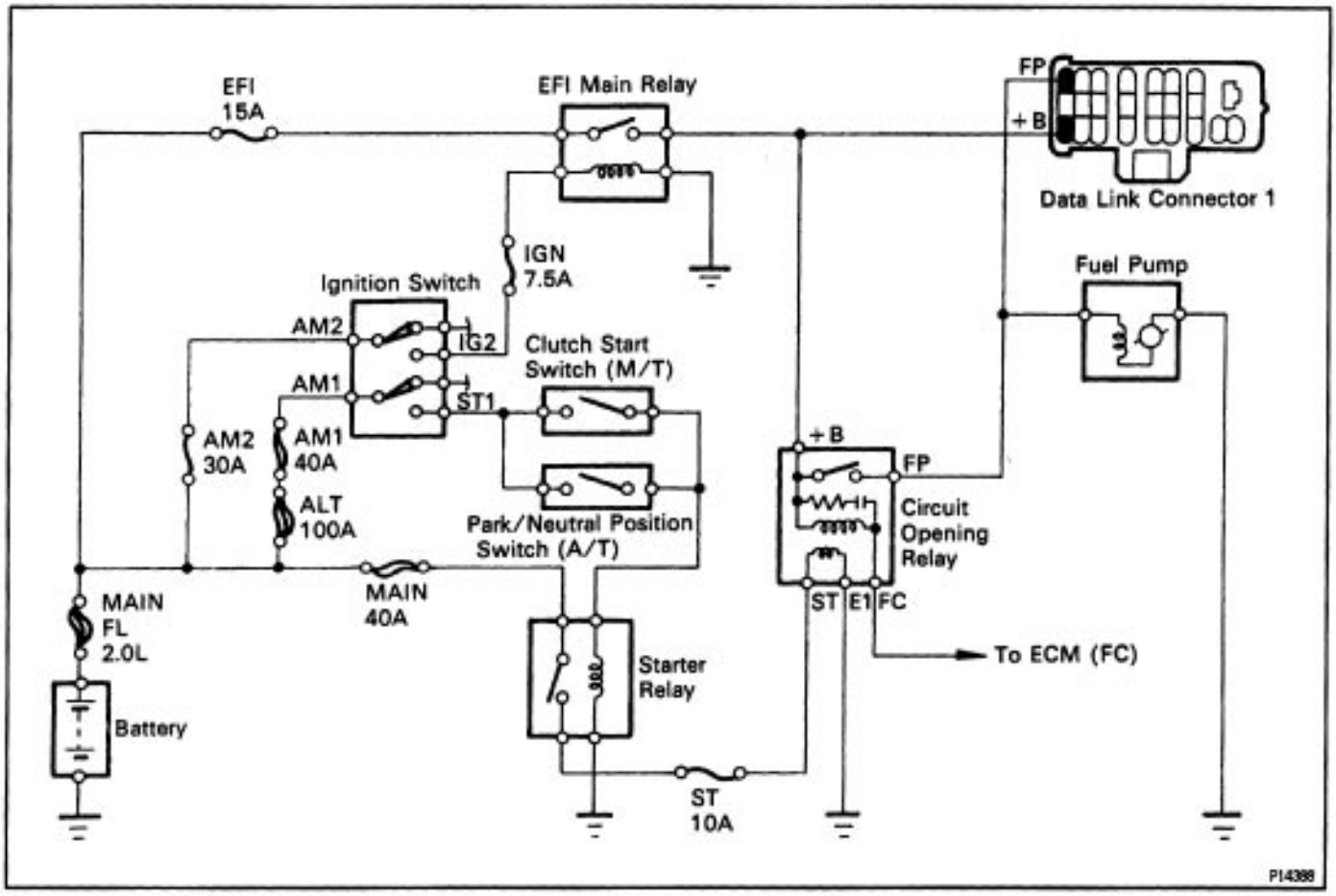
NOTICE: Always pinch the hose. Avoid bending as it may cause the hose to crack.



   (d) Turn the ignition switch OFF.
   (9) Remove the SST.
   SST 09843–18020

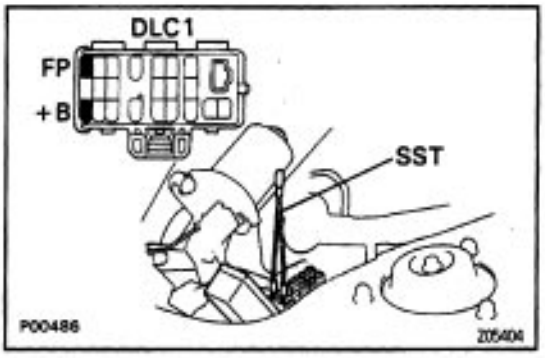
FUEL PUMP

SYSTEM CIRCUIT

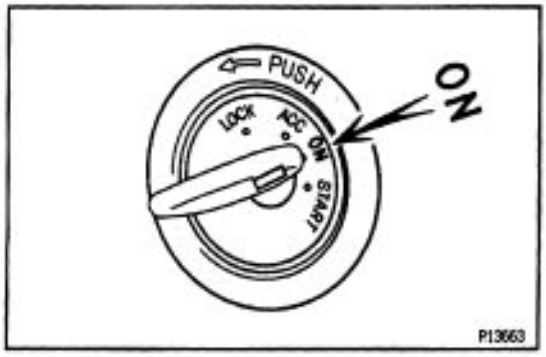


ON–VEHICLE INSPECTION

1. CHECK FUEL PUMP OPERATION

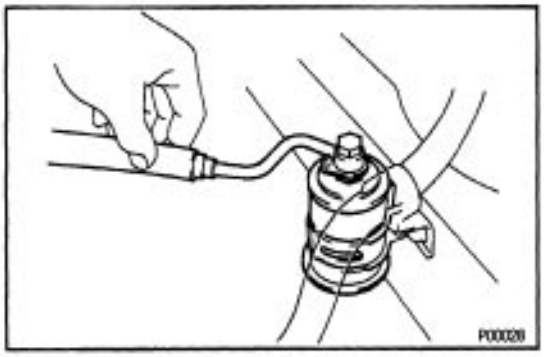


(a) Using SST; connect terminals +B and FP of the data link connector 1.
SST 09843–18020



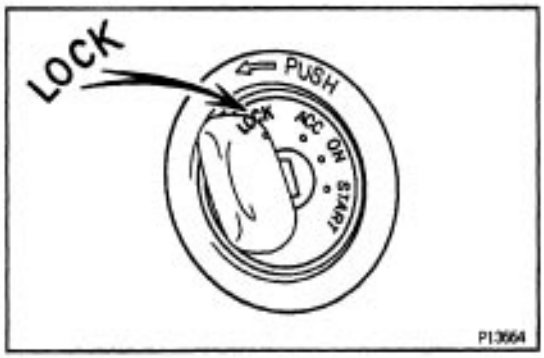
(b) Turn the ignition switch ON.

NOTICE: Do not start the engine.

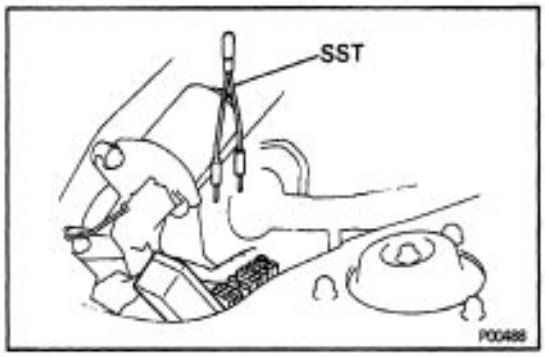


(c) Check that there is pressure in the hose from the fuel filter.

HINT: At this time, you will hear fuel return noise.



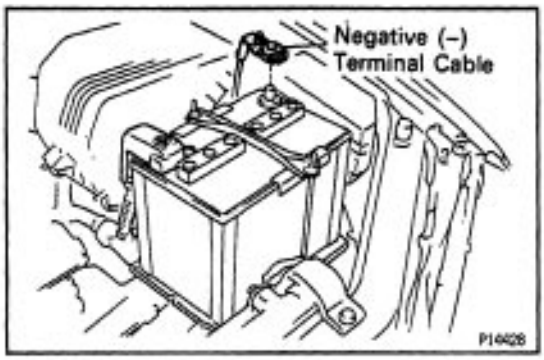
(d) Turn the ignition switch OFF.



(e) Remove the SST.
SST 09843–18020

If there is no pressure, check the following parts:

- Fusible link
- Fuses (AM2 30A, EFI 15A, IGN 7.5A)
- EFI main relay
- Fuel pump
- Wiring connections

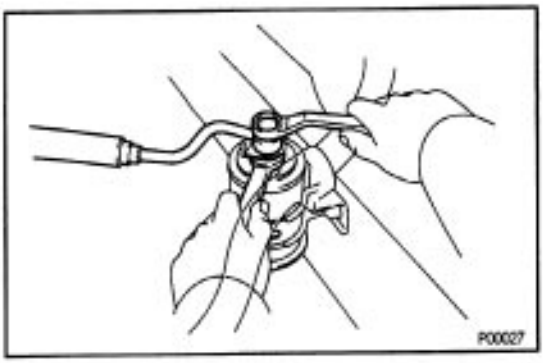


2. CHECK FUEL PRESSURE

(a) Check that the battery voltages is above 12 volts.

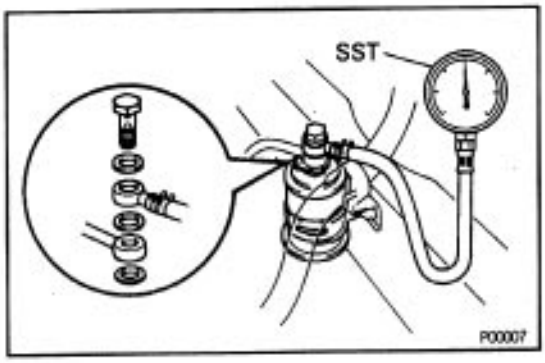
(b) Disconnect the negative (–) terminal cable from the battery.

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.

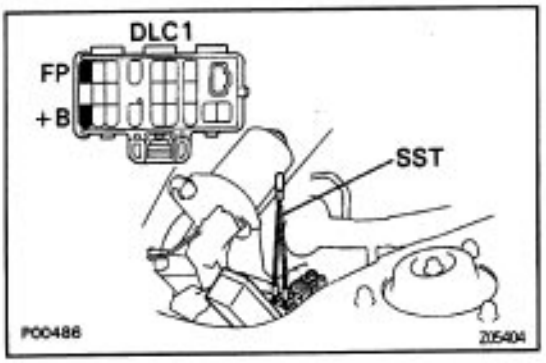


(c) Put a suitable container or shop towel under the fuel filter.
(d) Remove the union bolt and 2 gaskets, and disconnect the fuel inlet hose from the fuel filter outlet.

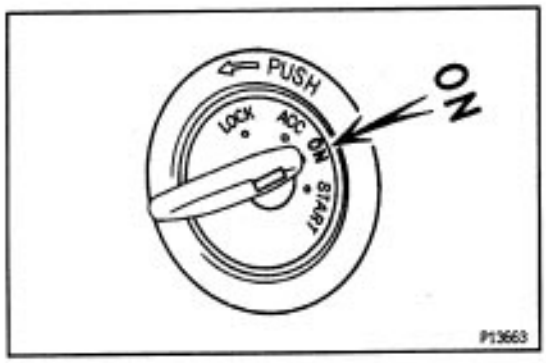
HINT: Slowly loosen the union bolt.



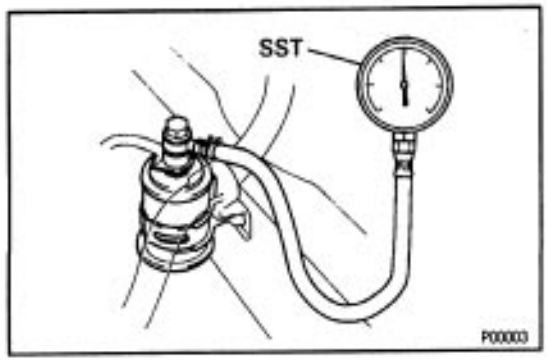
(e) Install the fuel inlet hose and SST (pressure gauge) to the fuel filter outlet with 3 new gaskets and the union bolt.
SST 09268–45012
Torque: 29 N–m (300 kgf–cm, 22 ft–lbf)
(f) Wipe off any splattered gasoline.
(g) Reconnect the battery negative (–) cable.



(h) Using SST, connect terminals +B and FP of the data link connector 1.
SST 09843–18020

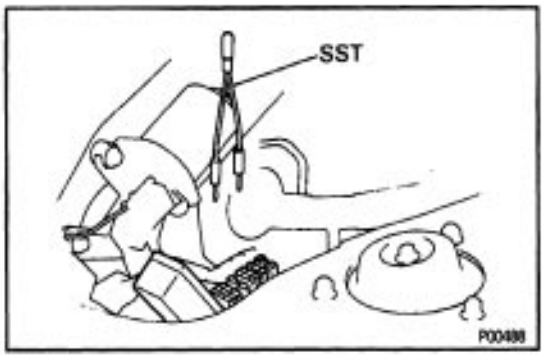


(i) Turn the ignition switch ON.

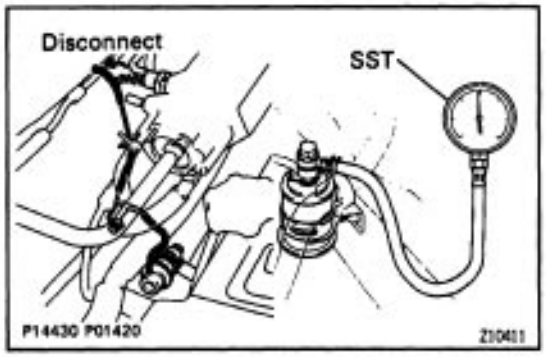


Measure the fuel pressure.
Fuel pressure:
265 – 304 kPa (2.7 – 3.1 kgf/cm1, 38 – 44 psi)
If pressure is high, replace the fuel pressure regulator.
If pressure is low, check the following parts:

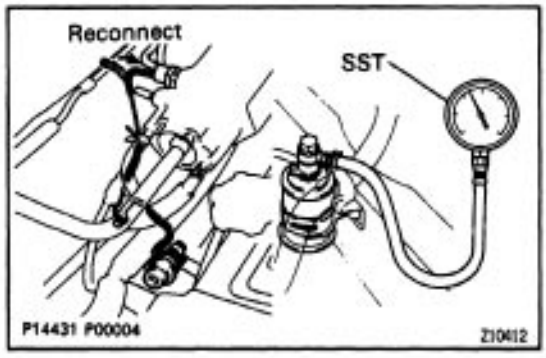
- Fuel hoses and connections
- Fuel pump
- Fuel filter
- Fuel pressure regulator



(k) Remove the SST.
SST 09483–18020

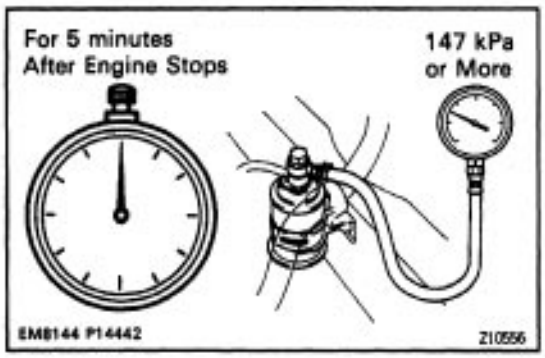


(l) Start the engine.
(m) Disconnect the vacuum sensing hose from the air intake chamber and plug the air intake chamber outlet.
(n) Measure the fuel pressure at idle.
Fuel pressure:
265 – 304 kPa (2.7 – 3.1 kgf/cm^1, 38 – 44 psi)

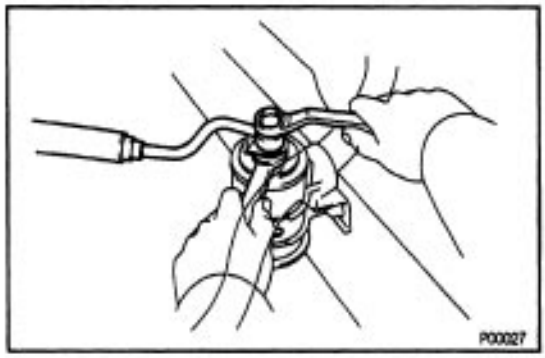


(o) Reconnect the vacuum sensing hose to the air intake chamber.
(p) Measure the fuel pressure at idle.
Fuel pressure:
206 – 255 kPa (2.1 – 2.6 kgf/cm^1, 31 – 37 psi)

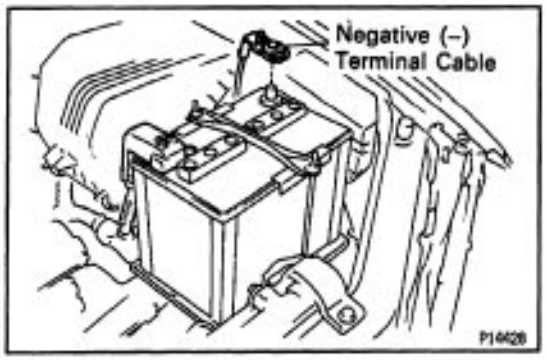
If pressure is not as specified, check the vacuum sensing hose and fuel pressure regulator.



(q) Stop the engine.
(r) Check that the fuel pressure remains 147 kPa (1.5 kgf/cm^2, 21 psi) or more for 5 minutes after the engine is turned off.
If pressure is not as specified, check the fuel pump, pressure regulator and/or injector.
(s) After checking fuel pressure, disconnect the battery negative (–) cable and carefully remove the SST to prevent gasoline from splashing.
SST 09268–45012



(t) Connect the fuel inlet hose with 2 new gaskets and the union bolt.
Torque: 29 N–m (300 kgf–cm. 22 ft–lbf)
(u) Reconnect the cable to the negative (–) terminal of the battery.
(v) Check for fuel leakage.



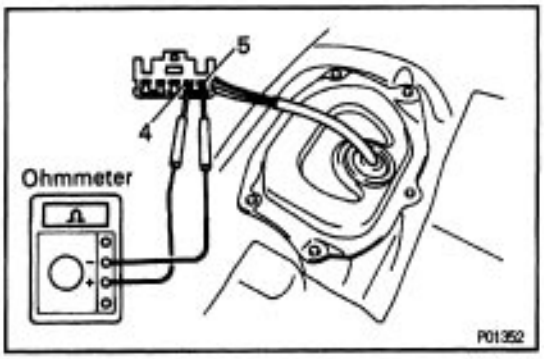
FUEL PUMP INSPECTION

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 discon–nected from the battery.

2. REMOVE REAR SEAT CUSHION

3. DISCONNECT FUEL PUMP & SENDER GAUGE CON–NECTOR



4. INSPECT FUEL PUMP

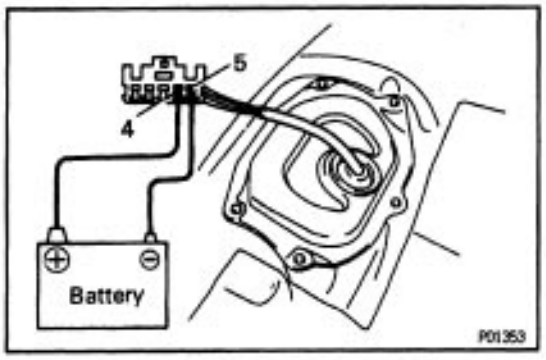
A. Inspect fuel pump resistance

Using an ohmmeter, measure the resistance between terminals 4 and 5.

Resistance (Cold):

0.2–3.0 Ω

If the resistance is not as specified, replace the fuel pump.



B. Inspect fuel pump operation

Connect the positive (+) lead from the battery 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 from burning out.**
- **Keep the fuel pump a: far away from the battery as possible.**
- **Always perform switching at the battery side.**

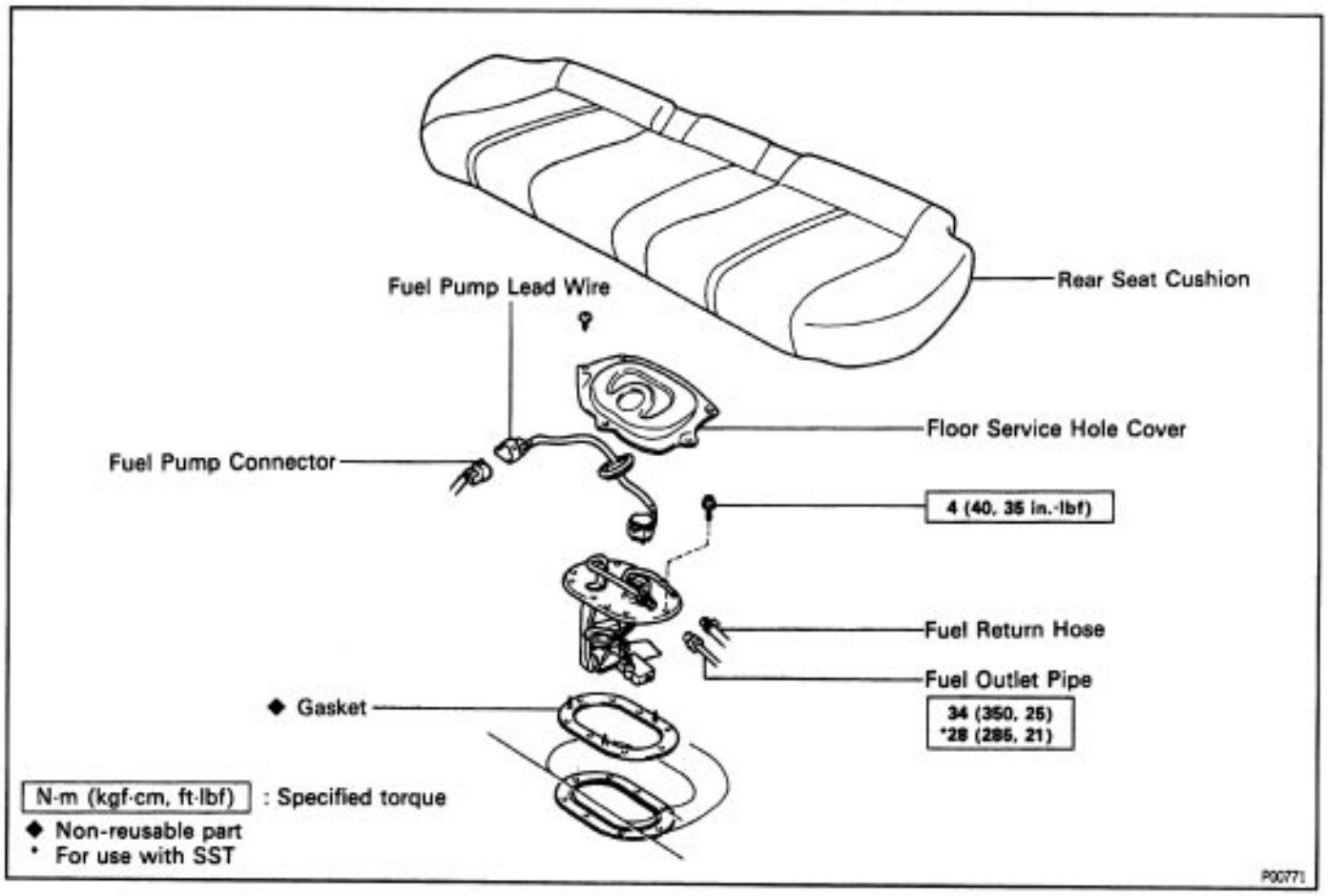
If operation is not as specified, replace the fuel pump.

5. RECONNECT FUEL PUMP & SENDER GAUGE CONNECTOR

6. INSTALL REAR SEAT CUSHION

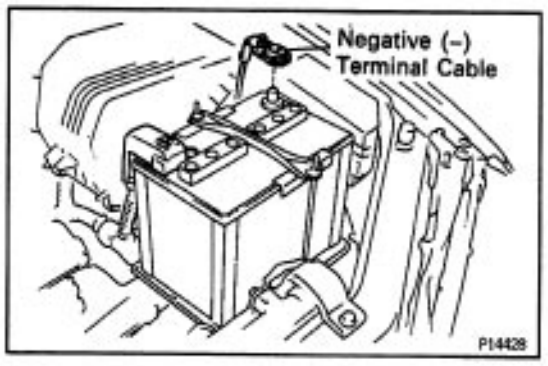
7. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY

COMPONENTS FOR REMOVAL AND INSTALLATION



FUEL PUMP REMOVAL

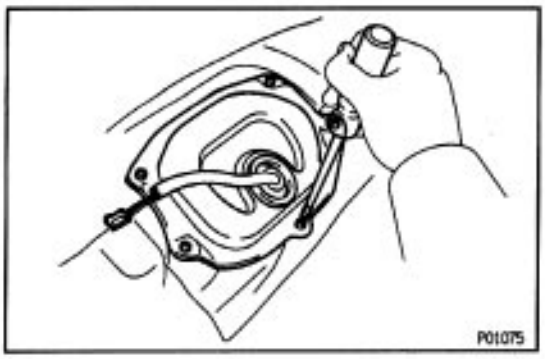
CAUTION: Do not smoke or work near an open flame when working on the fuel pump.



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 disconnected from the battery.

2. REMOVE REAR SEAT CUSHION

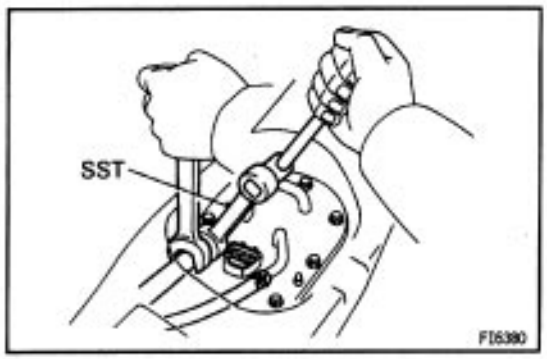


3. REMOVE FLOOR SERVICE HOLE COVER

(a) Disconnect the fuel pump connector.

(b) Remove the 5 screws and service hole cover.

4. REMOVE FUEL PUMP LEAD WIRE

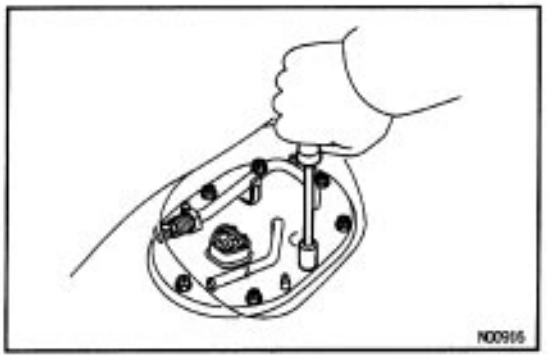


5. DISCONNECT FUEL PIPE AND HOSE FROM FUEL PUMP BRACKET

CAUTION: Remove the fuel filter cap to prevent the fuel from flowing out.

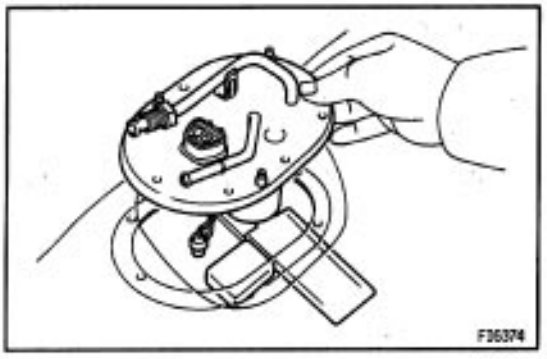
(a) Using SST, disconnect the outlet pipe from the pump bracket.
SST 09631–22020

(b) Disconnect the return hose from the pump bracket.



6. REMOVE FUEL PUMP BRACKET ASSEMBLY FROM FUEL TANK

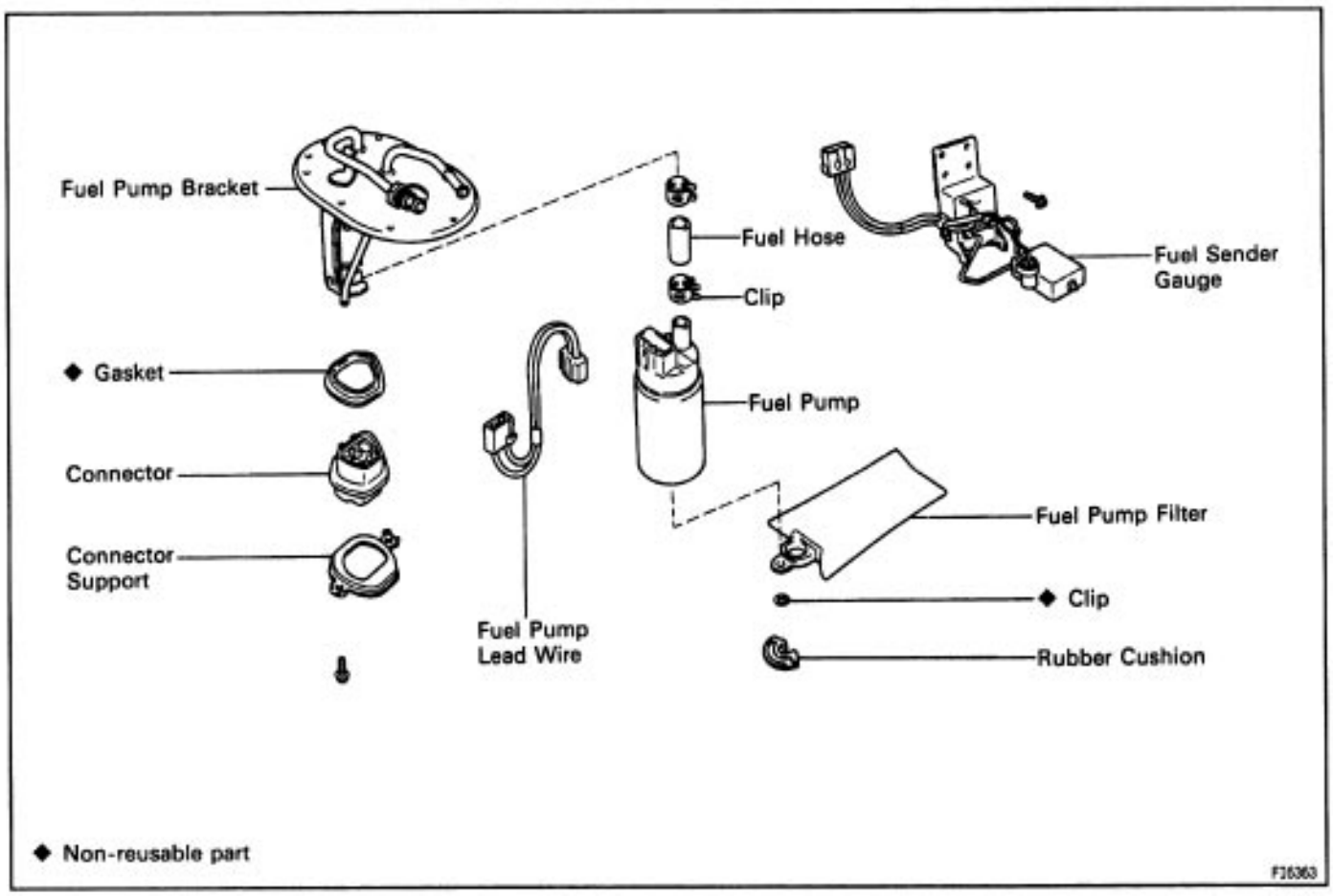
(a) Remove the 8 bolts.

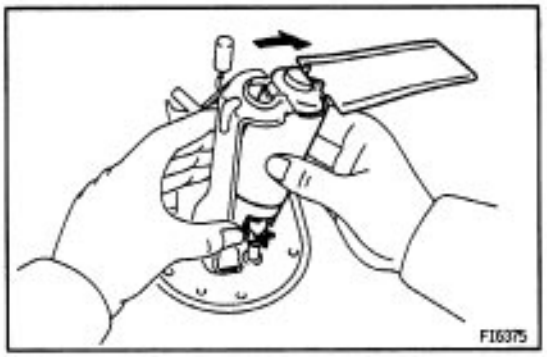


(b) Pull out the pump bracket assembly.

(c) Remove the gasket from the pump bracket.

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

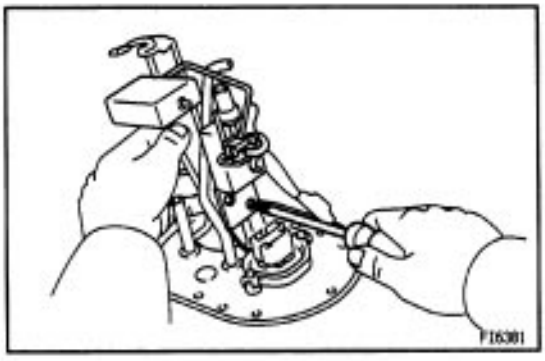




FUEL PUMP DISASSEMBLY

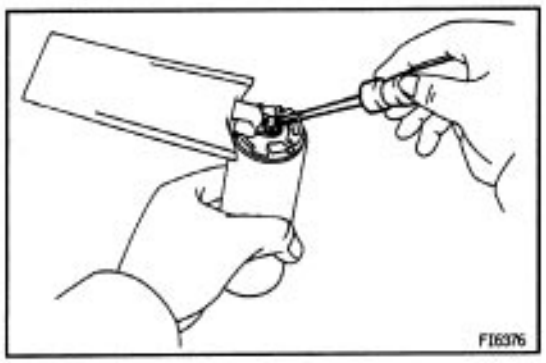
1. REMOVE FUEL PUMP FROM FUEL PUMP BRACKET

(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

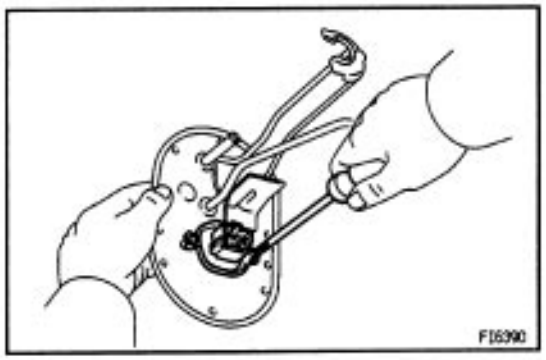
(a) Disconnect the fuel sender gauge connector.
(b) Remove the 2 screws and sender gauge.



3. REMOVE FUEL PUMP FILTER FROM FUEL PUMP

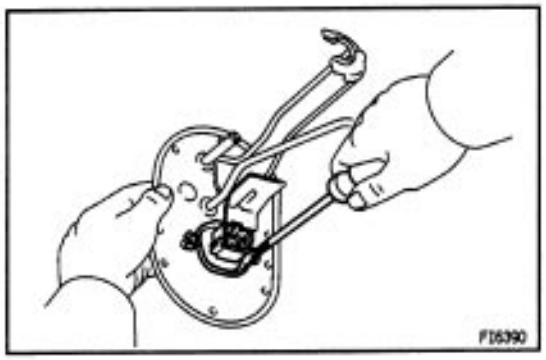
(a) Using a small screwdriver, remove the clip.

(b) Pull out the pump filter.



4. REMOVE CONNECTOR

Remove the 2 screws, connector support, connector and gasket.



FUEL PUMP ASSEMBLY

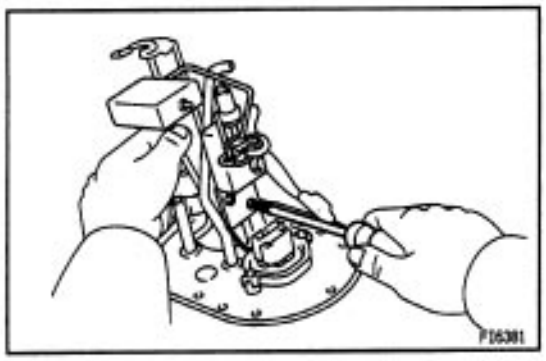
(See Components for Disassembly and Assembly)

1. INSTALL CONNECTOR

Install the gasket, connector and connector support with the 2 screws.

2. INSTALL FUEL PUMP FILTER TO FUEL PUMP

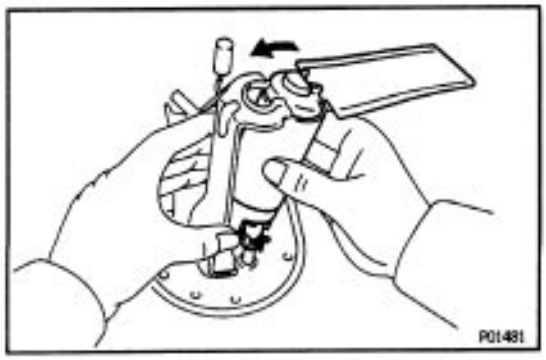
Install the pump filter with a new clip.



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.



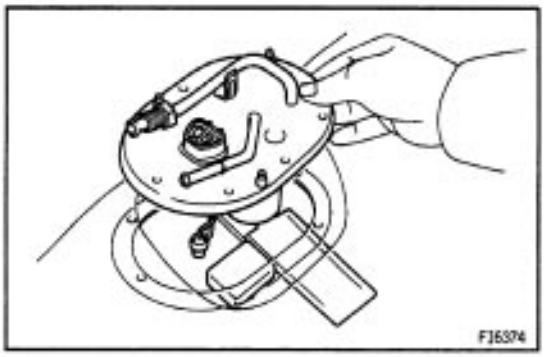
4. INSTALL FUEL PUMP TO FUEL PUMP BRACKET

(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.



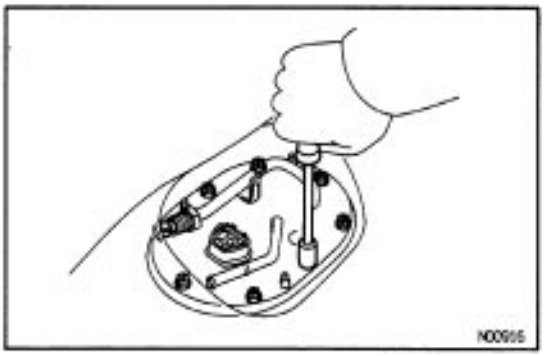
FUEL PUMP INSTALLATION

(See Components for Removal and Installation)

1. INSTALL FUEL PUMP BRACKET ASSEMBLY TO FUEL TANK

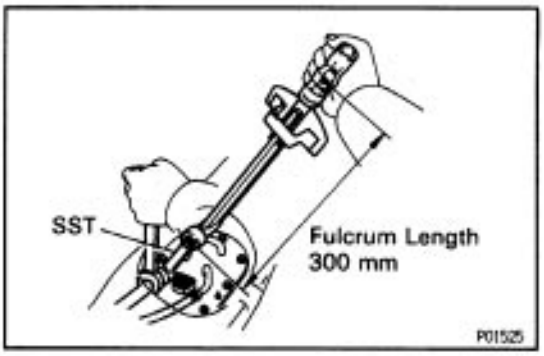
(a) Install a new gasket to the pump bracket.

(b) Insert the pump bracket assembly into the fuel tank.



(c) Install the pump bracket with the 8 screws.

Torque: 3.9 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.

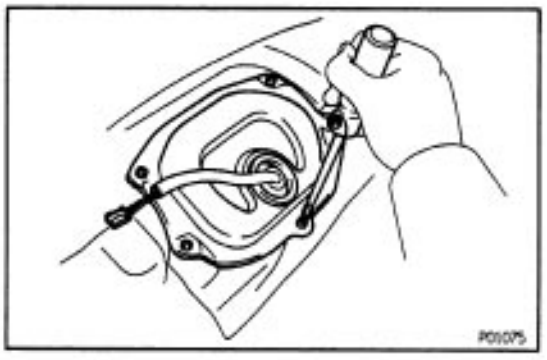
SST 09631–22020

Torque: 28 N–m (285 kgf–cm, 21 ft–lbf)

(b) Connect the return hoses to the pump bracket.

3. CHECK FOR FUEL LEAKAGE

(See page EG1–176**)**



4. CONNECT FUEL PUMP LEAD WIRE

5. INSTALL FLOOR SERVICE HOLE COVER

(a) Install the service hole cover with the 5 screws.

(b) Connect the fuel pump (with fuel sender gauge) connector.

6. INSTALL REAR SEAT CUSHION

7. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY

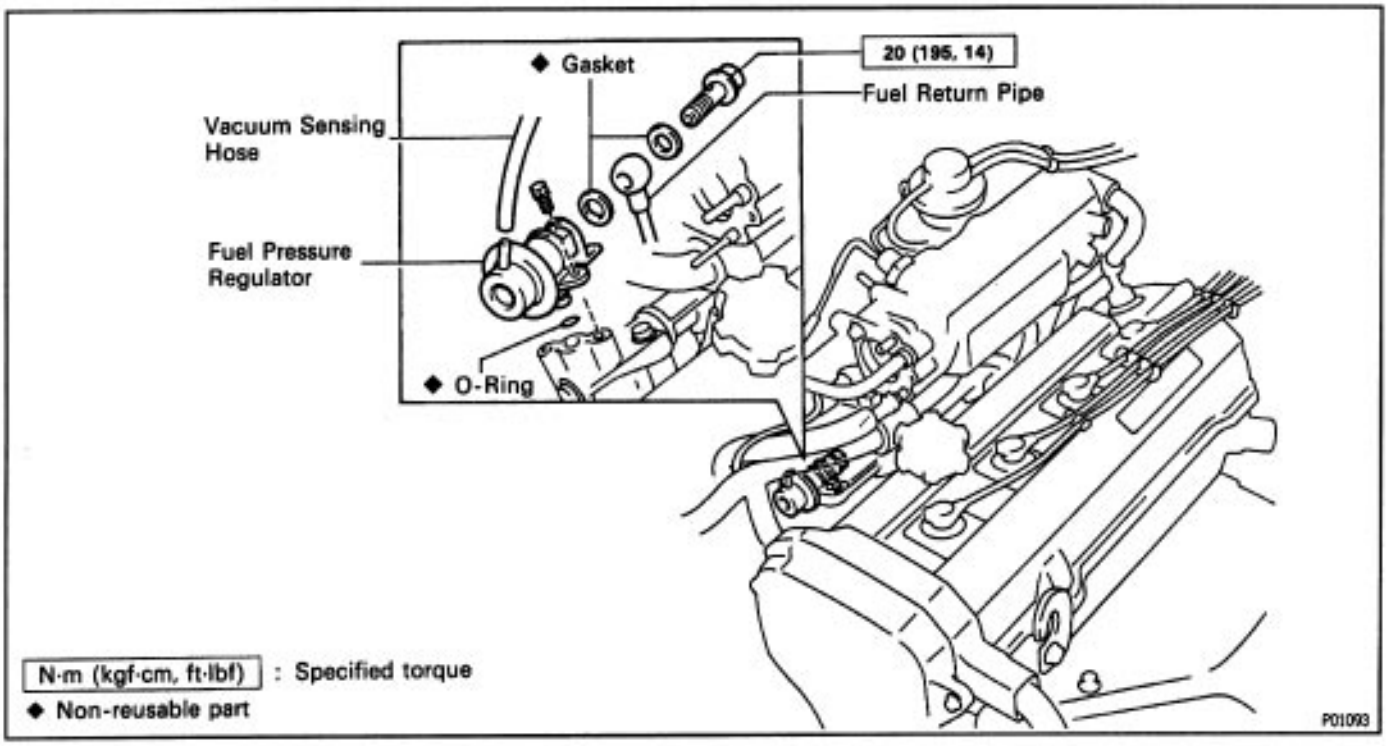
FUEL PRESSURE REGULATOR

ON–VEHICLE INSPECTION

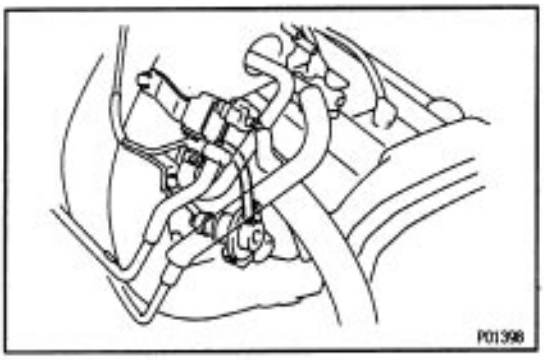
INSPECT FUEL PRESSURE

(See page EG1–178)

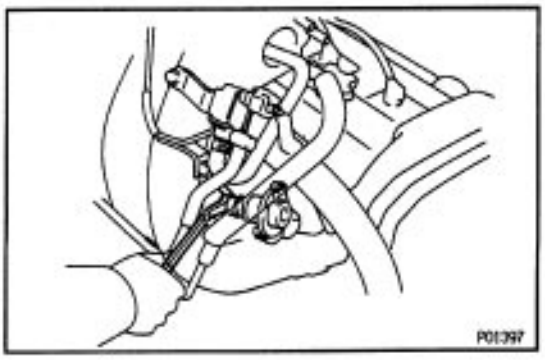
COMPONENTS FOR REMOVAL AND INSTALLATION



FUEL PRESSURE REGULATOR REMOVAL



1. DISCONNECT VACUUM SENSING HOSE FROM FUEL PRESSURE REGULATOR

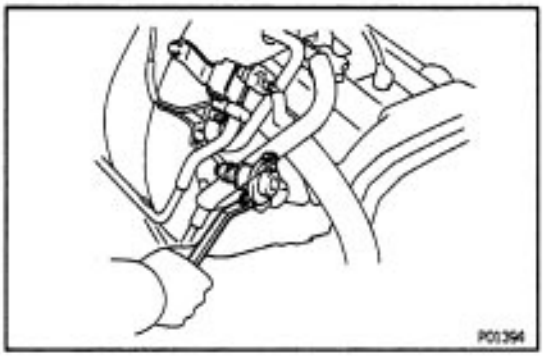


2. DISCONNECT FUEL RETURN PIPE FROM FUEL PRESSURE REGULATOR

(a) Put a suitable container or shop rag under the pres–sure regulator.

(b) Remove the union bolt and 2 gaskets, and disconnect the return pipe from the pressure regulator.

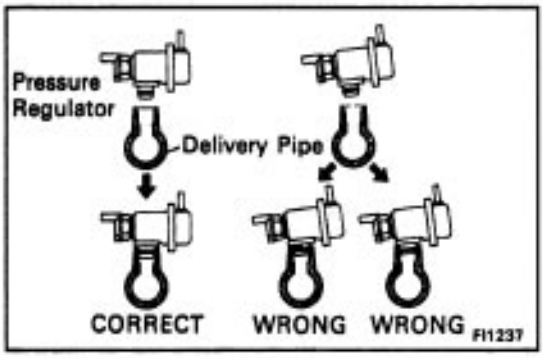
HINT: Slowly loosen the union bolt.



3. REMOVE FUEL PRESSURE REGULATOR

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

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

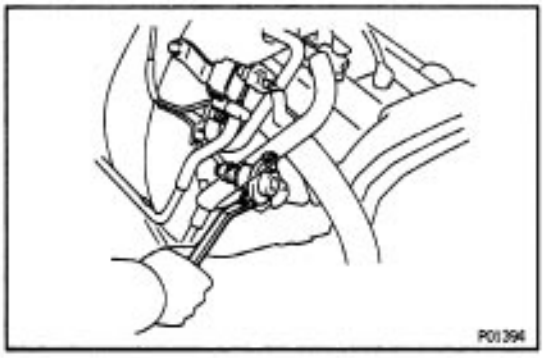


FUEL PRESSURE REGULATOR INSTALLATION

(See Components for Removal and Installation)

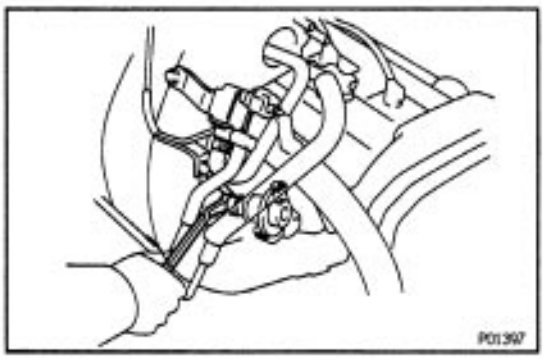
1. INSTALL FUEL PRESSURE REGULATOR

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



(b) Install the pressure regulator with the 2 bolts.

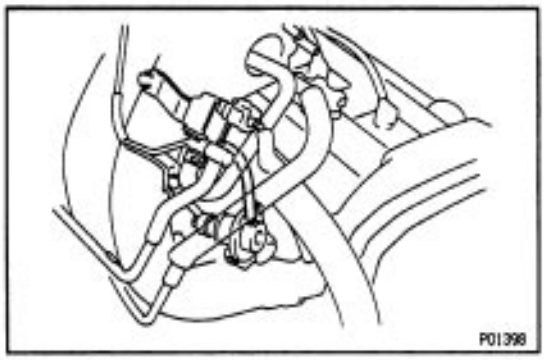
Torque: 5.4 N–m (55 kgf–cm, 48 in.–lbf)



2. CONNECT FUEL RETURN PIPE TO FUEL PRESSURE REGULATOR

Install the return pipe with 2 new gaskets and the union bolt.

Torque: 19 N–m (195 kgf–cm, 14 ft–lbf)

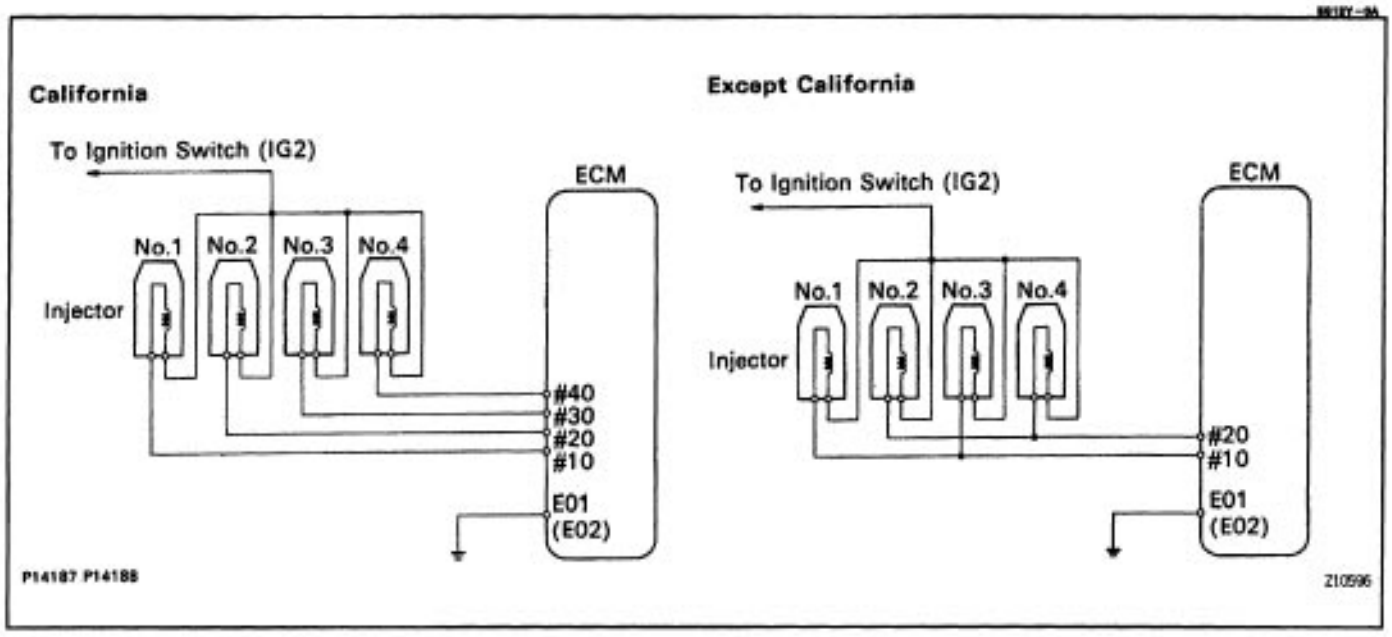


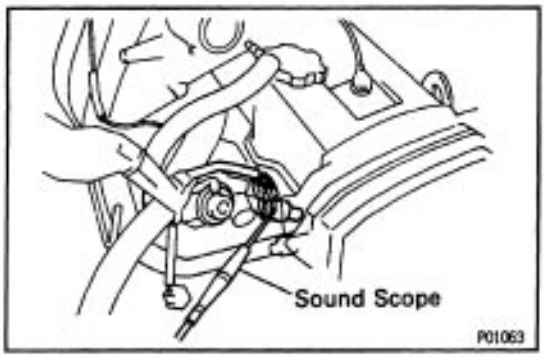
3. CONNECT VACUUM SENSING HOSE TO FUEL PRESSURE REGULATOR

4. CHECK FOR FUEL LEAKAGE

(See page EG1–176)

INJECTOR



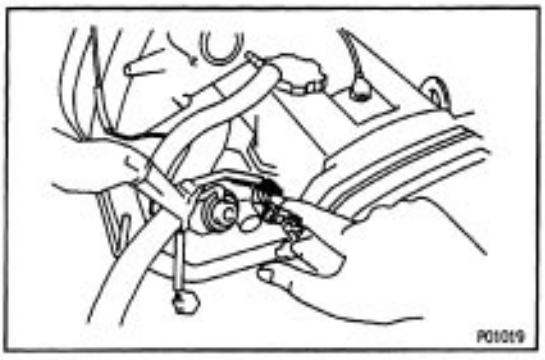


ON–VEHICLE INSPECTION

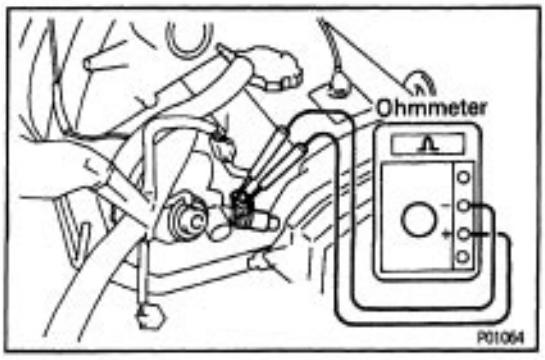
1. INSPECT INJECTOR OPERATION

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 transmission operation with your finger.
If no sound or unusual sound is heard, check the wiring connector, injector or injection signal from the ECM.



2. INSPECT INJECTOR RESISTANCE

(a) Disconnect the injector connector.

(b) Using an ohmmeter, measure the resistance between the terminals.

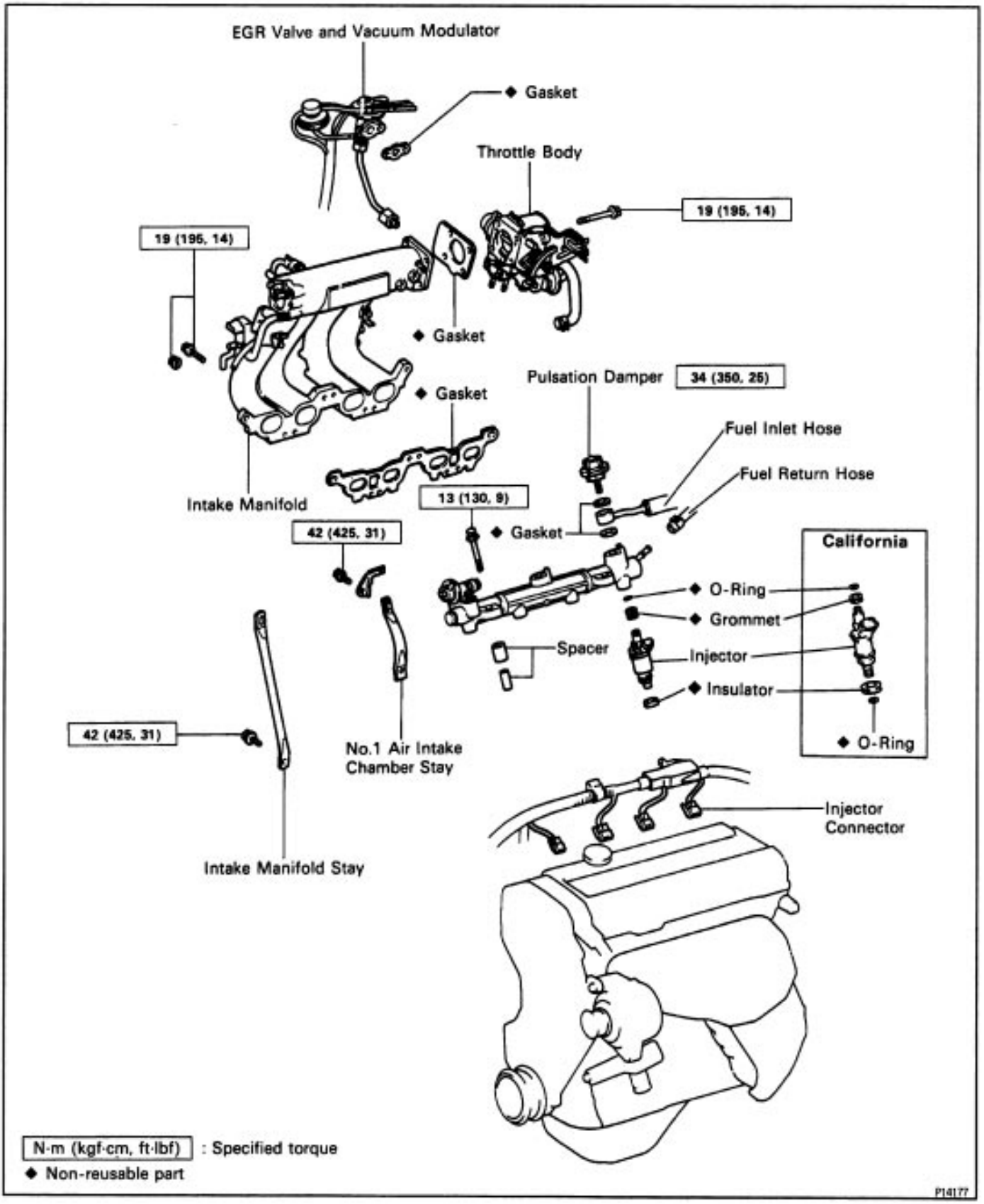
Resistance:

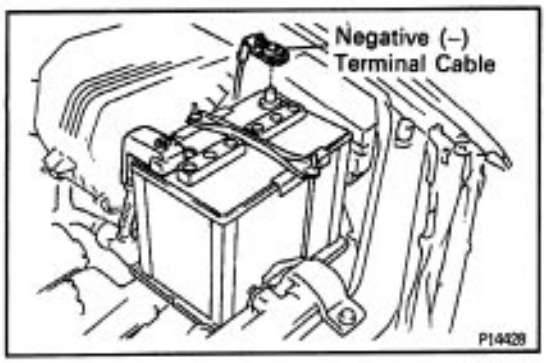
Approx. 13.8Ω

If the resistance is not as specified, replace the injector.

(c) Reconnect the injector connector.

COMPONENTS FOR REMOVAL AND INSTALLATION





INJECTORS REMOVAL

(See Components for Removal and Installation)

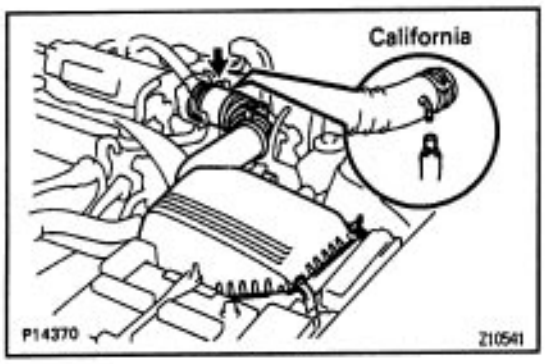
1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY

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

2. DRAIN ENGINE COOLANT

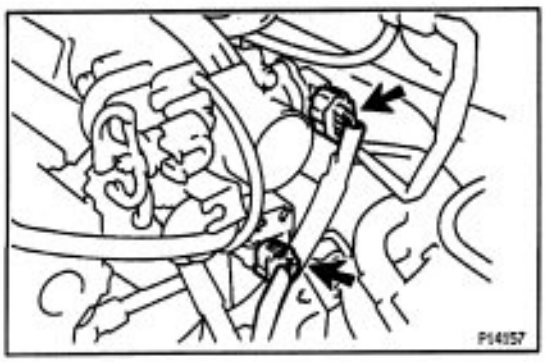
3. A/T:
DISCONNECT THROTTLE CABLE FROM THROTTLE BODY

4. DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY



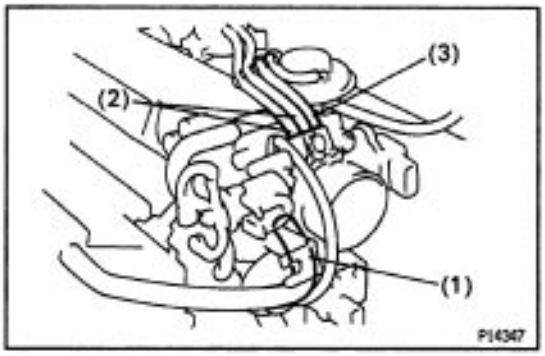
5. REMOVE AIR CLEANER CAP, RESONATOR AND AIR CLEANER HOSE

(a) Disconnect the intake air temperature sensor connector.
(b) California only:
Disconnect the air hose from the air cleaner hose.
(c) Loosen the air cleaner hose clamp bolt.
(d) Disconnect the 4 air cleaner cap clips.
(e) Disconnect the air cleaner hose from the throttle body, and remove the air cleaner cap together with the resonator and air cleaner hose.

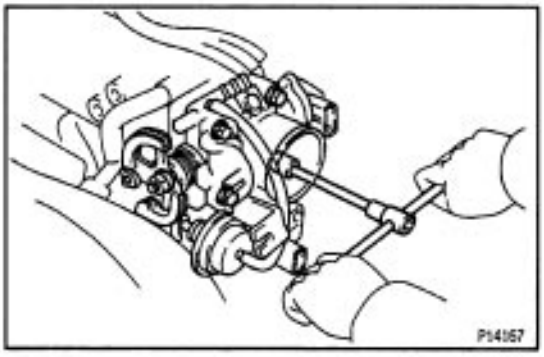


6. REMOVE THROTTLE BODY

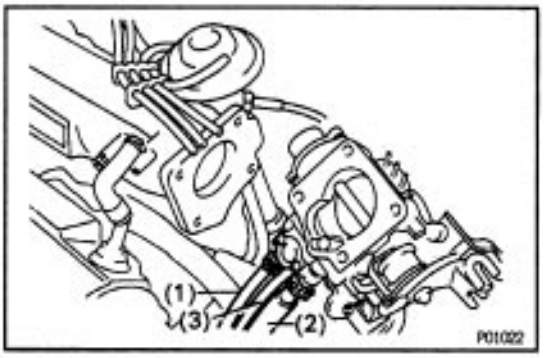
(a) Disconnect throttle position sensor connector.
(b) Disconnect IAC valve connector.



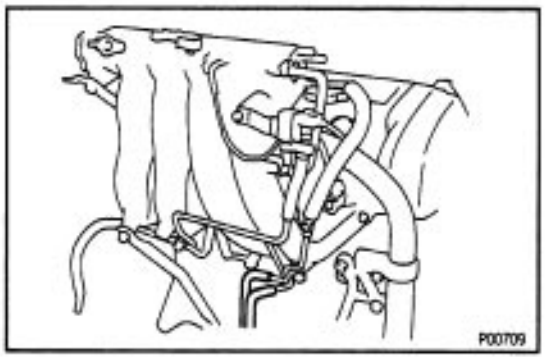
(c) Disconnect the following hoses from the throttle body.
(1) PCV hose
(2) 2 vacuum hoses from EGR vacuum modulator
(3) Vacuum hose from TVV (for EVAP)



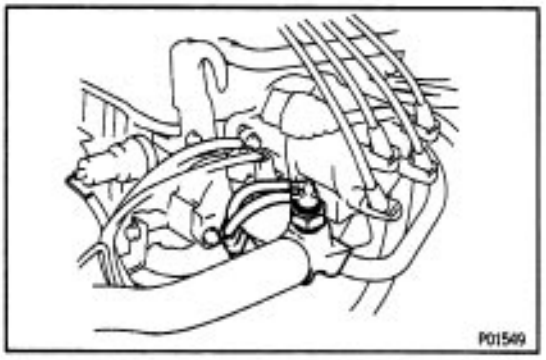
(d) Type A:
Remove the 4 bolts.
(e) Type B:
Remove the 2 bolts and 2 nuts.



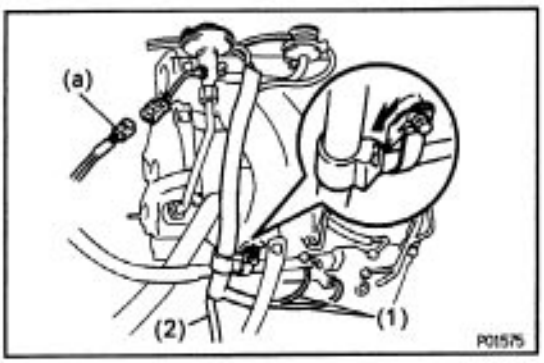
(f) Disconnect the following hoses from the throttle body, and remove the throttle body.
(1) Water bypass hose from water outlet
(2) Water bypass hose from water bypass pipe
(3) California:
Air hose from cylinder head
Except California:
Air hose from air tube



7. DISCONNECT PS VACUUM HOSES



8. DISCONNECT VACUUM HOSES FROM TVV (FOR EVAP)



9. REMOVE EGR VALVE AND VACUUM MODULATOR

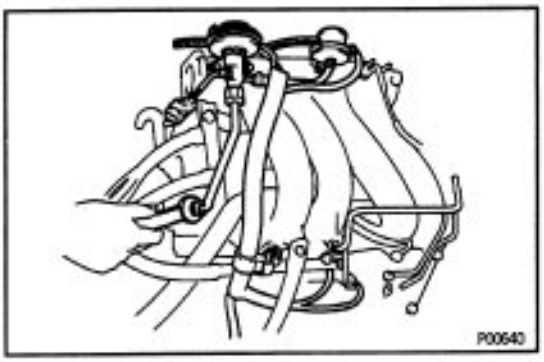
(a) Disconnect the EGR gas temperature sensor connector.

(b) Disconnect the following hoses:

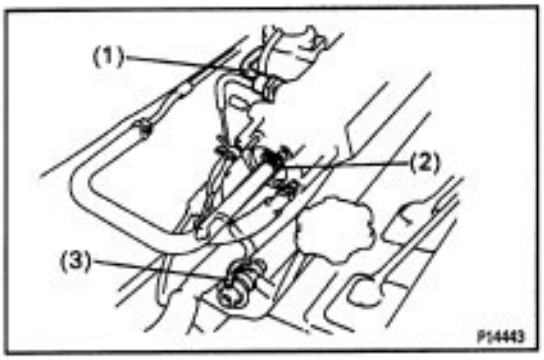
(1) 2 vacuum hoses from VSV (for EGR)

(2) Vacuum hose from charcoal canister

(c) Disconnect the vacuum hose clamp.



(d) Loosen the union nut of the EGR pipe, and remove the 2 nuts, the EGR valve, vacuum modulator, vacuum hoses assembly and gasket.



10. DISCONNECT VACUUM HOSES

Disconnect the following hoses:

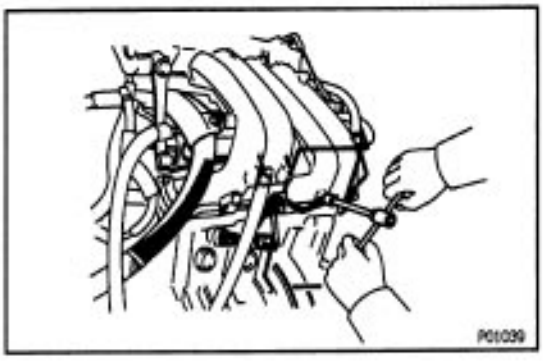
(1) MAP sensor hose from air intake chamber

(2) Brake booster vacuum hose from air intake chamber

(3) Vacuum sensing hose from fuel pressure regulator

11. w/ A/C:

DISCONNECT A/C IDLE–UP VALVE CONNECTOR



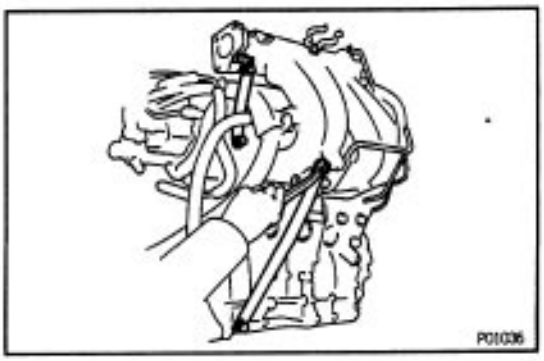
12. DISCONNECT 2 ENGINE WIRE GROUND STRAPS FROM INTAKE MANIFOLD

13. DISCONNECT KNOCK SENSOR AND VSV (FOR EGR) CONNECTORS

14. CALIFORNIA ONLY:

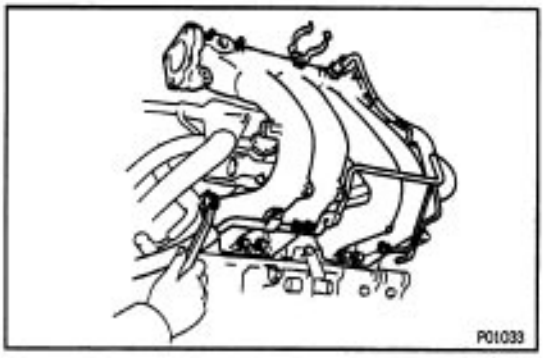
DISCONNECT VSV (FOR FUEL PRESSURE CONTROL) CONNECTOR AND VACUUM HOSES

15. REMOVE BOLT AND WIRE CLAMP, AND DISCONNECT ENGINE WIRE HARNESS

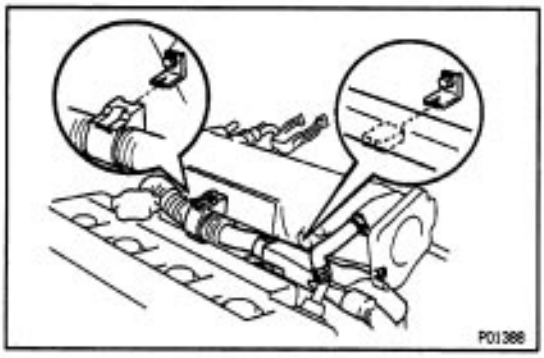


16. REMOVE INTAKE MANIFOLD

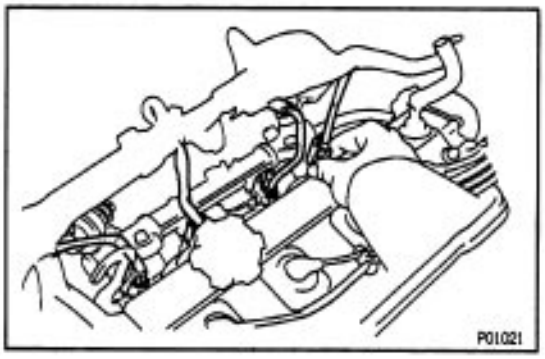
(a) Remove the 4 bolts, wire bracket, No.1 air intake chamber and manifold stays.



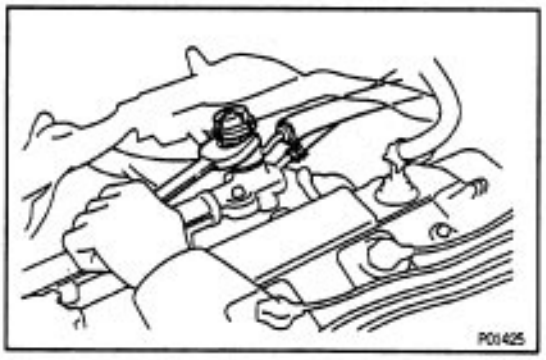
(b) Remove the 6 bolts, 2 nuts, intake manifold and gasket.



(c) Disconnect the 2 wire clamps from the wire brackets on the intake manifold.



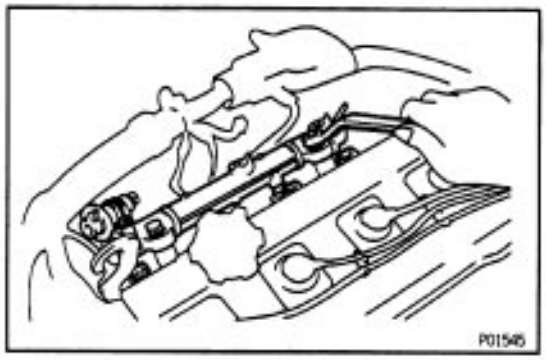
17. DISCONNECT INJECTOR CONNECTORS



18. REMOVE DELIVERY PIPE AND INJECTORS

(a) Loosen the pulsation damper, and disconnect the fuel inlet pipe.

(b) Disconnect the fuel return hose.

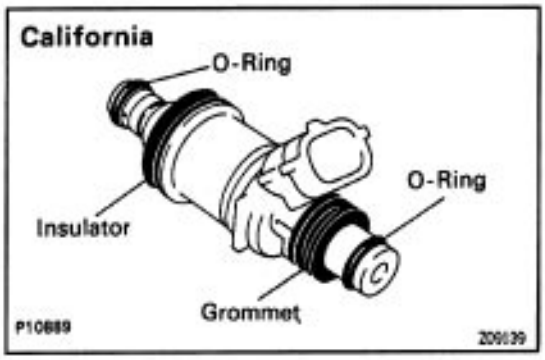


(c) Remove the 2 bolts and delivery pipe together with the 4 injectors.

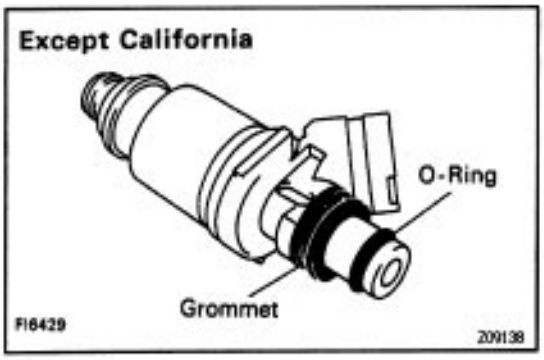
NOTICE: Be careful not to drop the injectors when removing the delivery pipe.

(d) Remove the 4 insulators (except California) and 2 spacers from the cylinder head.

(e) Pull out the 4 injectors from the delivery pipe.

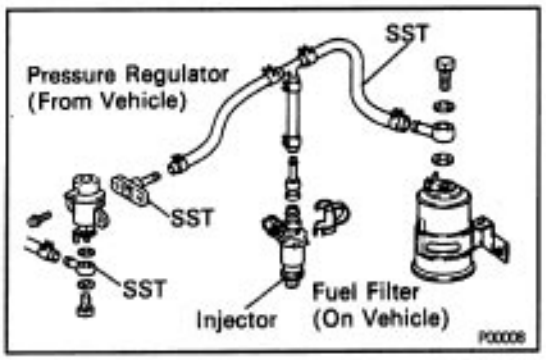


(f) California:
Remove the 2 O–rings, insulator and grommet from each injector.



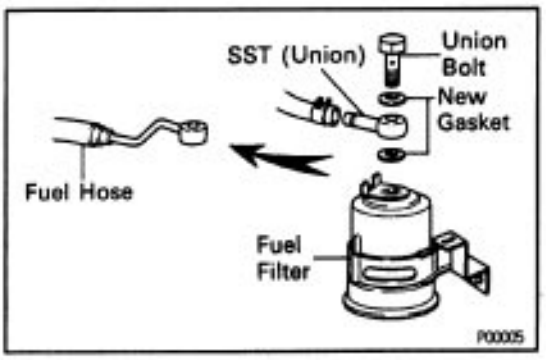
(g) Except California:
Remove the O–ring and grommet from each injector.

INJECTORS INSPECTION



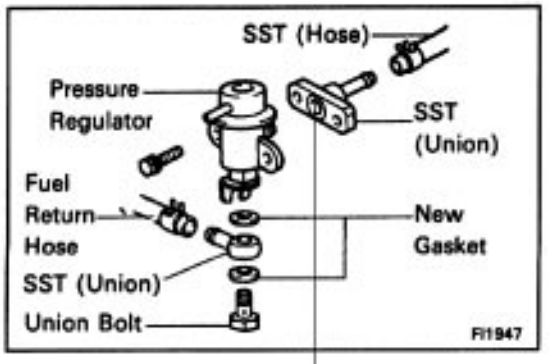
1. INSPECT INJECTOR INJECTION

CAUTION: Keep injector clear of sparks during the test.

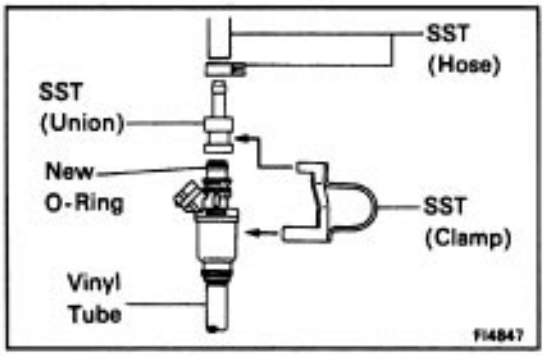


(a) Disconnect the fuel hose from the fuel filter outlet.
(b) Connect SST (union and hose) to the fuel filter outlet with 2 new gaskets and union bolts.
SST 09268–41045 (90405–09015)
Torque: 29 N–m (300 kgf–cm, 22 ft–lbf)

HINT: Use the vehicle's fuel filter.



(c) Install a new O–ring to the fuel inlet of pressure regulator.
(d) Connect SST (hose) to the fuel inlet of the pressure regulator with SST (union) and the 2 bolts.
SST 09268–41045 (09268–41090)
Torque: 5.4 N–m (55 kgf–cm, 48 ft–lbf)
(e) Connect the fuel return hose to the fuel outlet of the pressure regulator with SST (union), 2 new gaskets and union bolts.



SST 09268–41045 (09268–41080)

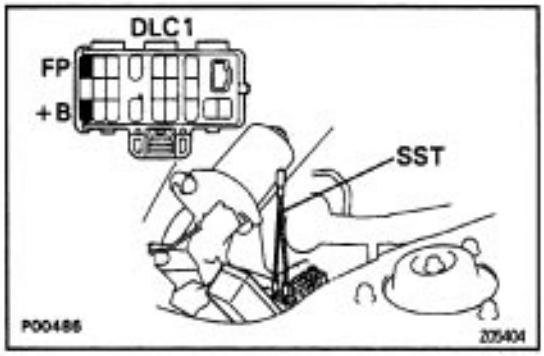
Torque: 18 N–m (180 kgf–cm, 13 ft–lbf)

(f) Install the grommet and a new O–ring to the injector.

(g) Connect SST (union and hose) to the injector, and hold the injector and union with SST (clamp).
SST 09268–41045

(h) Put the injector into a graduated cylinder.

HINT: Install a suitable vinyl hose onto the injector to prevent gasoline from splashing out.

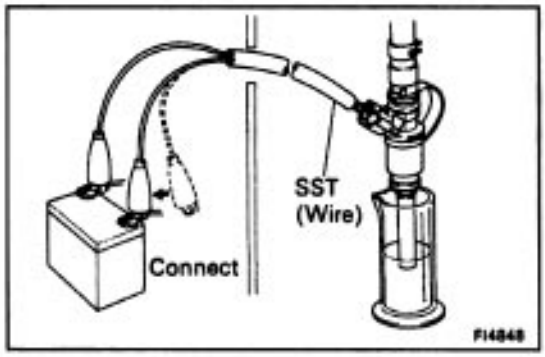


(i) Using SST, connect terminals +B and FP of the data link connector 1.
SST 09843–18020

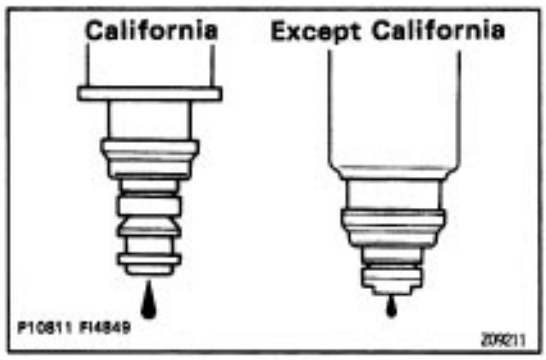
(j) Reconnect the negative (–) terminal cable to the battery.

(k) Turn the ignition switch ON.

NOTICE: Do not start the engine.



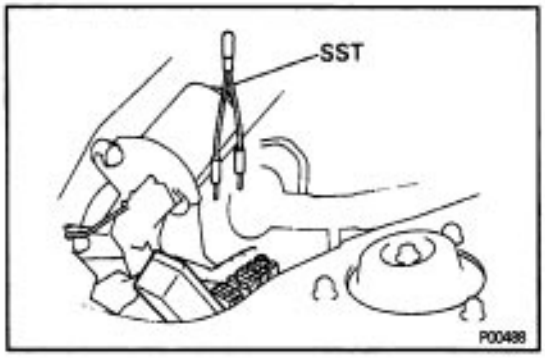
(l) Connect SST (wire) to the injector and battery for 15 seconds, and measure the injection volume with a graduated cylinder. Test each injector 2 or 3 times.
SST 09842–30070
Volume:
49 – 59 cm^3 (3.0–3.6 cu in.) per 15 sec.
Difference between each Injector:
5 cm^3 (0.3 cu in.) or less
If the injection volume is not as specified, replace the injector.



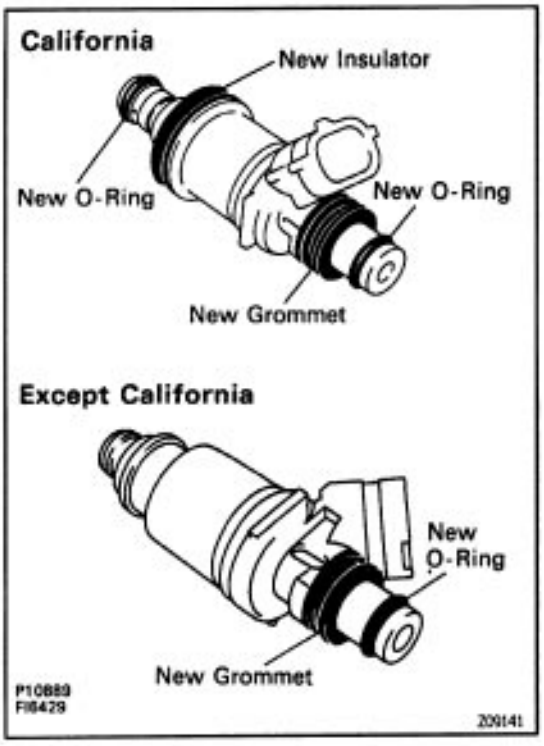
2. INSPECT LEAKAGE

(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:
One drop or less per minute

(b) Disconnect the negative (–) terminal cable from the battery.



(c) Remove the SST.
SST 09268–41045 and 09843–18020



INJECTORS INSTALLATION

(See Components for Removal and Installation)

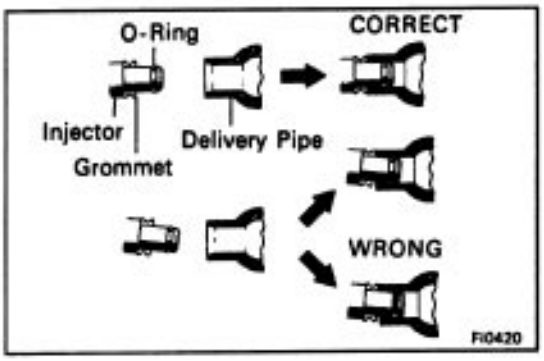
1. INSTALL INJECTORS AND DELIVERY PIPE

(a) California:
Install new insulator and grommet to each injector.

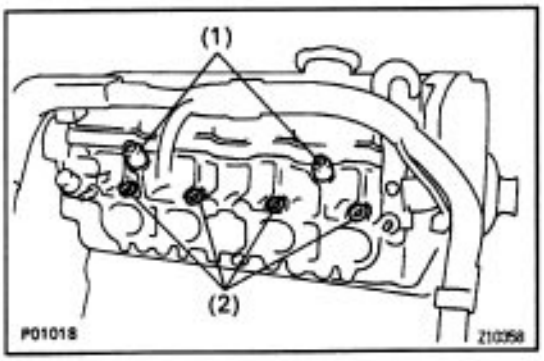
(b) Except California:
Install a new grommet to each injector.

(c) California:
Apply a light coat of gasoline to 2 new O–rings, and install them to each injector.

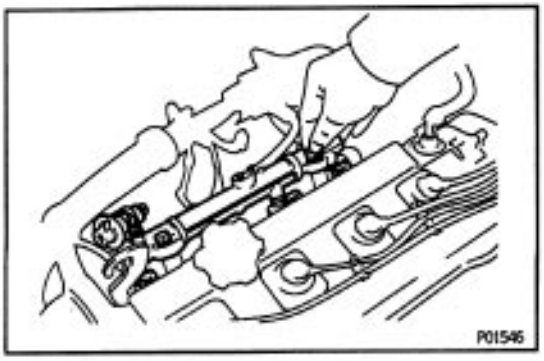
(d) Except California:
Apply a light coat of gasoline to a new O–ring, and install it to each injector.



(e) While turning the injector left and right, install it to the delivery pipes. Install the 4 injectors.

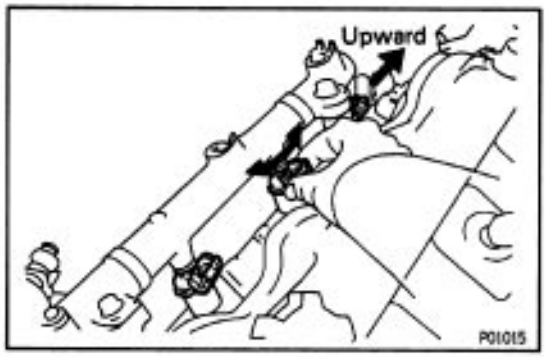


(f) Install the following parts to the cylinder head:
(1) 2 spacers
(2) Except California:
4 new insulators

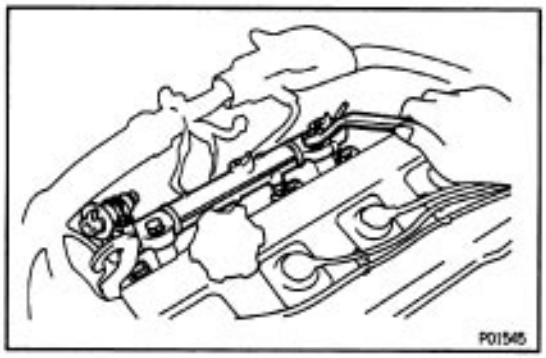


(g) Place the 4 injectors together with the delivery pipe in position on the cylinder head.

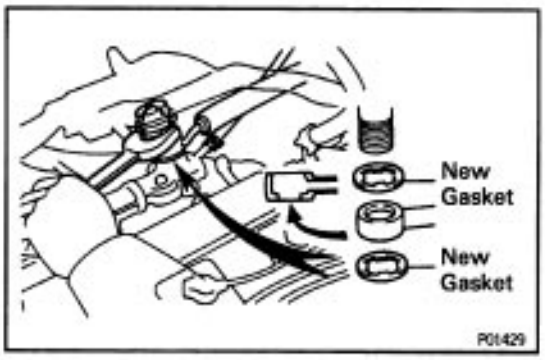
(h) Temporarily install the 2 bolts holding the delivery pipe to the cylinder head.



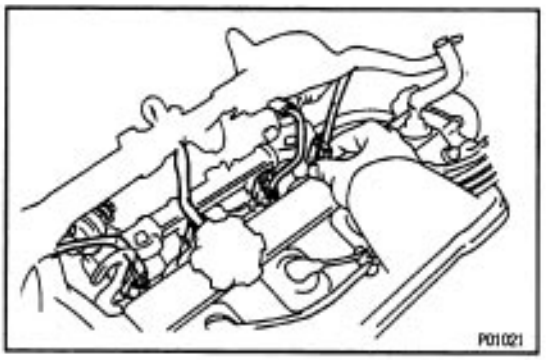
(i) Check that the injectors rotate smoothly.
HINT: If injectors do not rotate smoothly, the probable cause is incorrect installation of O – rings. Replace the O–rings.
(j) Position the injector connector upward.



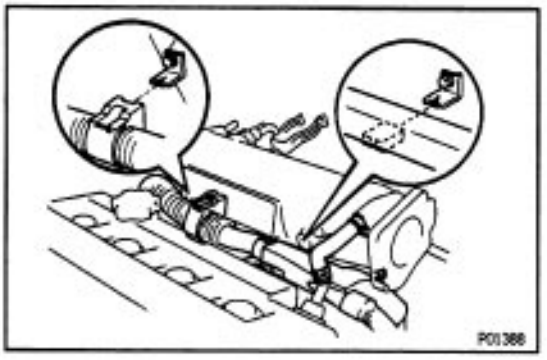
(k) Tighten the 2 bolts holding the delivery pipe to the cylinder head.
Torque: 13 N–m (130 kgf–cm, 9 ft–lbf)



(l) Connect the fuel return hose.
(m) Connect the fuel inlet pipe to the delivery pipe with 2 new gaskets and the pulsation damper.
Torque: 34 N–m (350 kgf–cm, 25 ft–lbf)

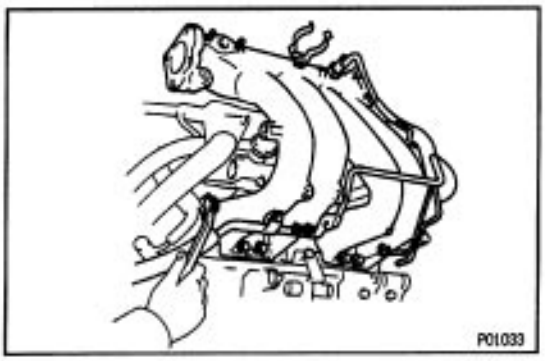


2. CONNECT INJECTOR CONNECTORS



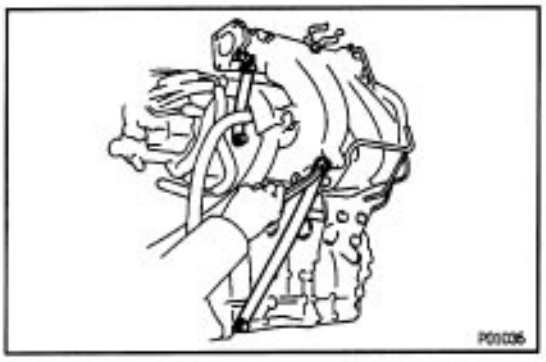
3. INSTALL INTAKE MANIFOLD

(a) Connect the 2 wire clamps to the wire brackets on the intake manifold.



(b) Install a new gasket and the intake manifold with the 6 bolts and 2 nuts. Uniformly tighten the bolts and nuts in several passes.

Torque: 19 N–m (195 kgf–cm, 14 ft–lbf)



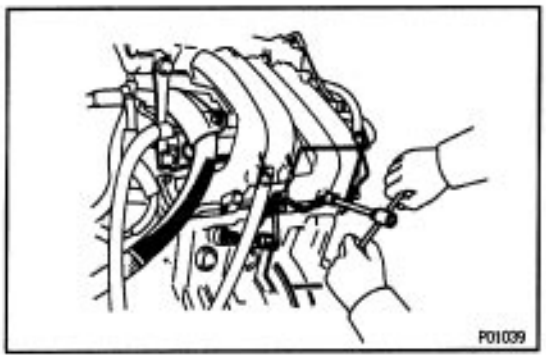
(c) Install the No. 1 air intake chamber and manifold stays, wire bracket with the 4 bolts.

14 mm head bolt

Torque: 42 N–m (425 kgf–cm, 31 ft–lbf)

12 mm head bolt

Torque: 22 N–m (220 kgf–cm, 16 ft–lbf)

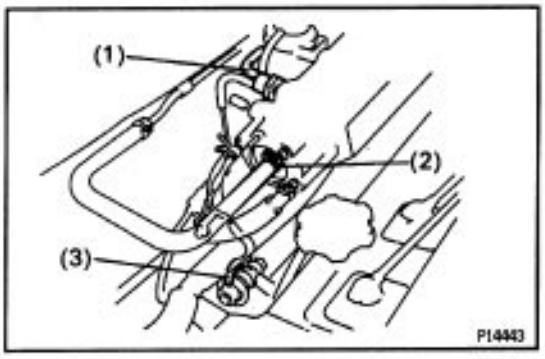


4. CONNECT ENGINE WIRE HARNESS WITH WIRE CLAMP AND BOLT

5. CALIFORNIA ONLY:
CONNECT VSV (FOR FUEL PRESSURE CONTROL) CONNECTOR AND VACUUM HOSES

6. CONNECT KNOCK SENSOR AND VSV (FOR EGR) CONNECTORS

7. CONNECT 2 ENGINE WIRE GROUND STRAPS TO INTAKE MANIFOLD



8. CONNECT VACUUM HOSES

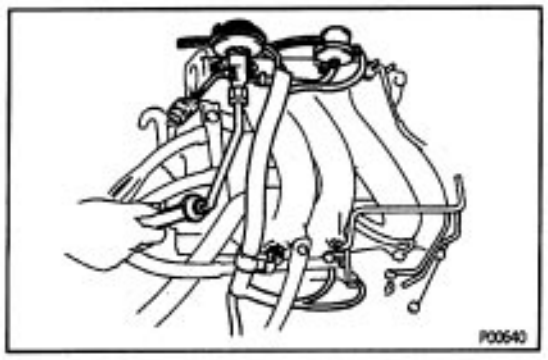
Connect the following hoses:

(1) MAP sensor hose to air intake chamber

(2) Brake booster vacuum hose to air intake chamber

(3) Vacuum sensing hose to fuel pressure regulator.

9. w/ A/C:
CONNECT A/C IDLE–UP VALVE CONNECTOR



10. INSTALL EGR VALVE AND VACUUM MODULATOR

(a) Install a new gasket and the EGR valve with the union nut and 2 nuts.

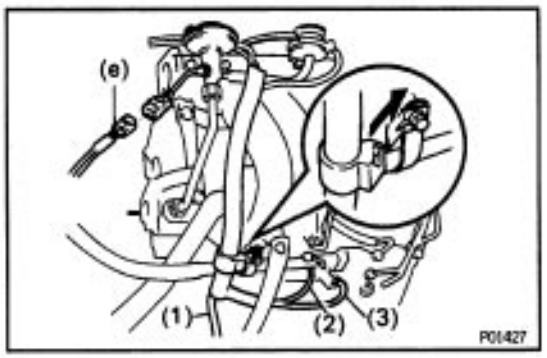
Union nut

Torque: 59 N–m (600 kgf–cm. 43 ft–lbf)

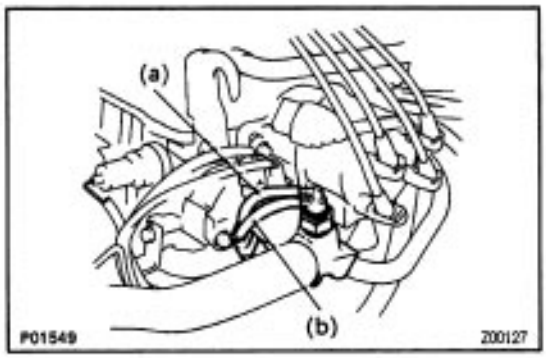
Nut

Torque: 13 N–m (130 kgf–cm. 9 ft–lbf)

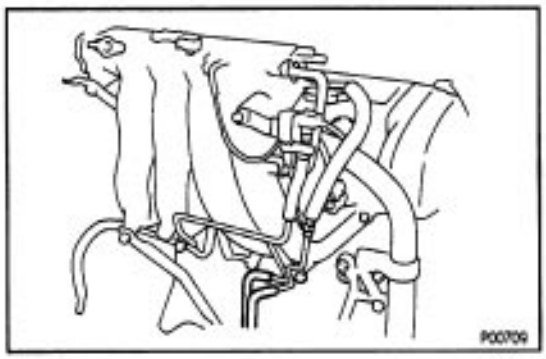
(b) Install the EGR vacuum modulator to the clamp.



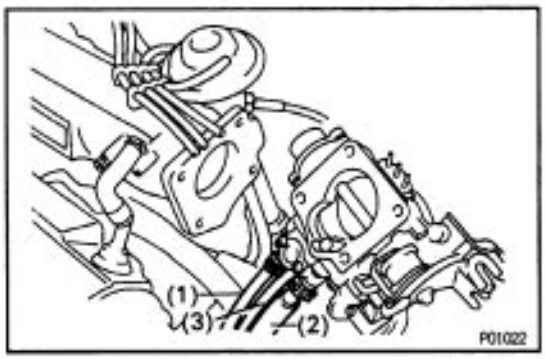
(c) Connect the vacuum hose clamp.
(d) Connect the following hoses:
(1) Vacuum hose to charcoal canister
(2) Vacuum hose (from EGR valves) to E port of VSV (for EGR)
(3) Vacuum hose (from Q port EGR vacuum modulator) to G port of VSV (for EGR)
(e) Connect the EGR gas temperature sensor connector.



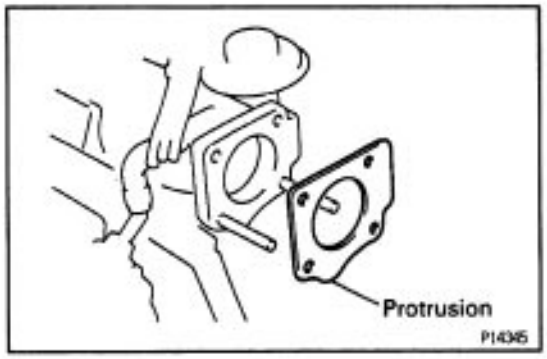
11. CONNECT VACUUM HOSES TO VSV (FOR EVAP)
(a) From P port of throttle body
(b) From charcoal canister



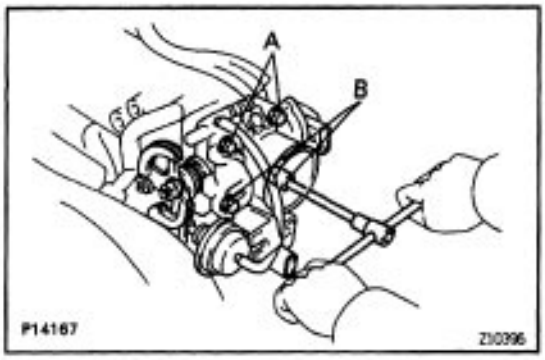
12. CONNECT PS VACUUM HOSES



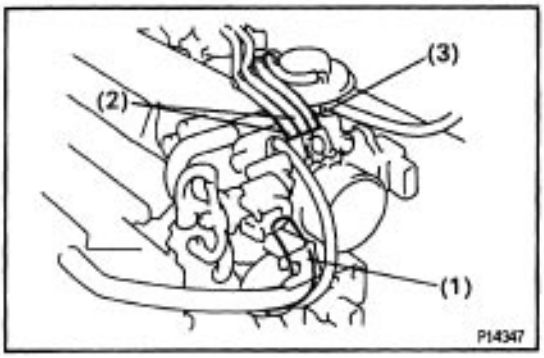
13. INSTALL THROTTLE BODY
(a) Connect the following hoses to the throttle body:
(1) Water bypass hose from water outlet
(2) Water bypass hose from water bypass pipe
(3) California:
Air hose from cylinder head
Except California:
Air hose to air tube



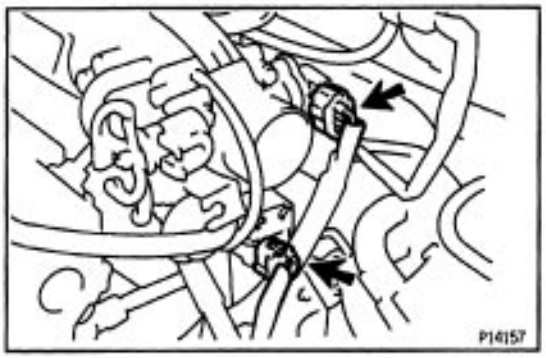
(b) Place a new gasket on the intake chamber, facing the protrusion downward.



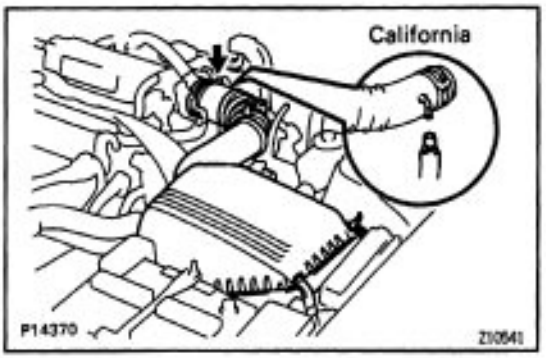
(c) Type A:
Install the throttle body with the 4 bolts.
Torque: 19 N–m (195 kgf–cm, 14 ft–lbf)
Bolt length:
A 45 mm (1.77 in.)
B 55 mm (2.17 in.)
(d) Type B:
Install the throttle body with the 2 bolts and 2 nuts.
Torque: 19 N–m (195 kgf–cm, 14 ft–lbf)



(e) Connect the following hoses to the throttle body:
(1) PCV hose
(2) 2 vacuum hoses from EGR vacuum modulator
(3) Vacuum hose from TVV (for EVAP)



(f) Connect the IAC valve connector.
(g) Connect the throttle position sensor connector.

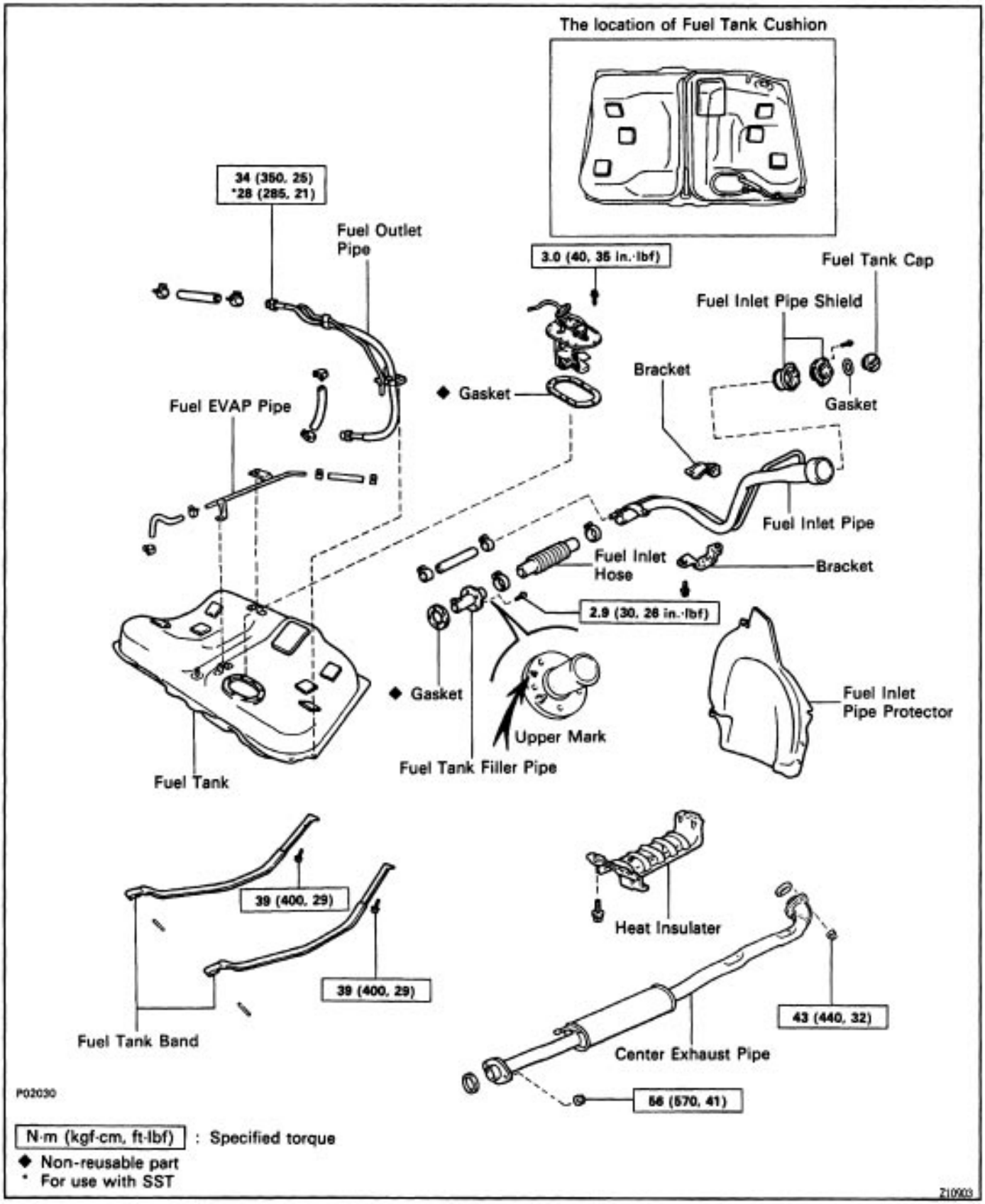


14. INSTALL AIR CLEANER CAP, RESONATOR AND AIR CLEANER HOSE
(a) Connect the air cleaner hose to the throttle body.
(b) Install the air cleaner cap together with the resonator and air cleaner hose.
(c) California only:
Connect the air hose to the air cleaner hose.
(d) Connect the intake air temperature sensor connector.

15. A/T:
CONNECT AND ADJUST THROTTLE CABLE
16. CONNECT AND ADJUST ACCELERATOR CABLE
17. FILL WITH ENGINE COOLANT
Capacity:
6.3 liters (6.7 US qts. 5.5 Imp. qts)
18. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY

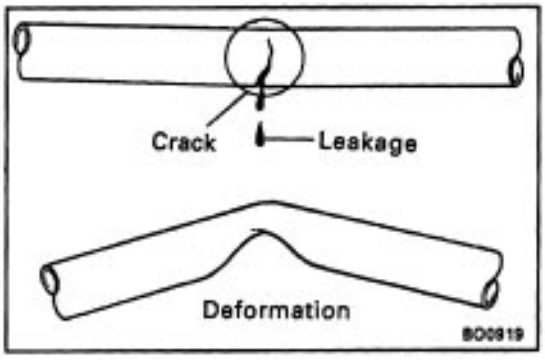
FUEL TANK AND LINE

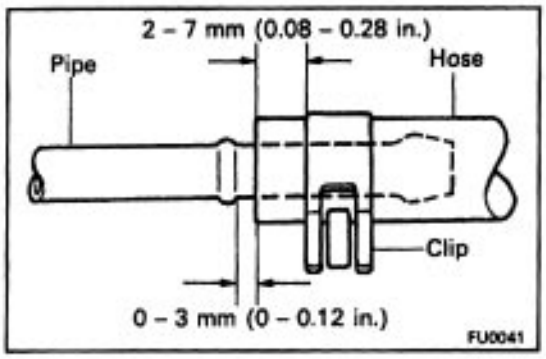
COMPONENTS



PRECAUTIONS

1. Always use new gaskets when replacing the fuel tank or component parts.
2. Apply the proper torque to all parts tightened.



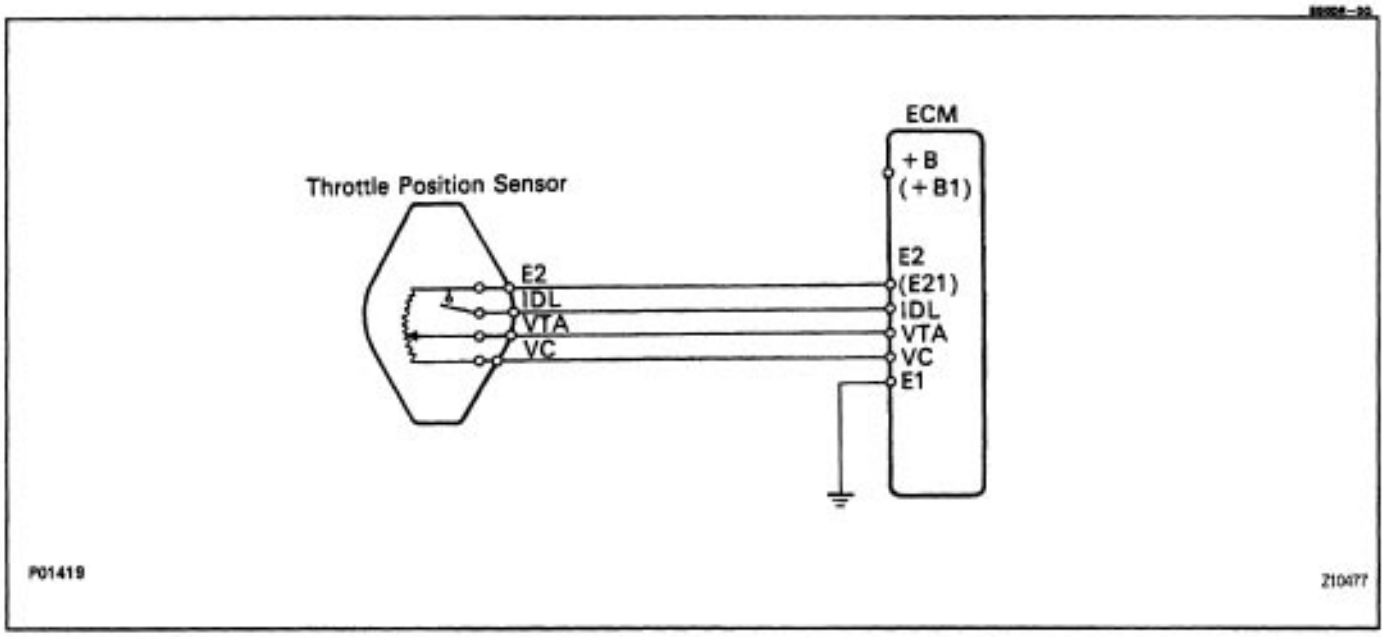


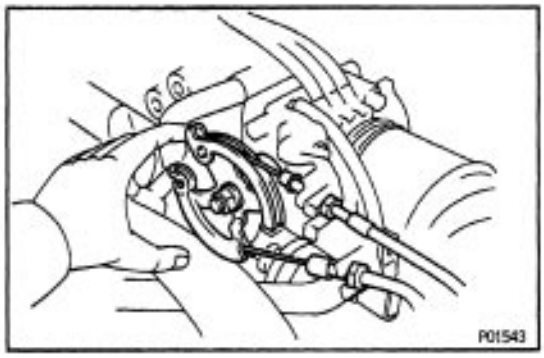
FUEL LINES AND CONNECTIONS INSPECTION

(a) Check the fuel lines for cracks, 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 leakage and tank band looseness.
(d) Check the filler neck for damage or fuel leakage.
(e) Hose and tube connections are as shown in the illustration.

If a problem is found, repair or replace the part as necessary.

THROTTLE BODY

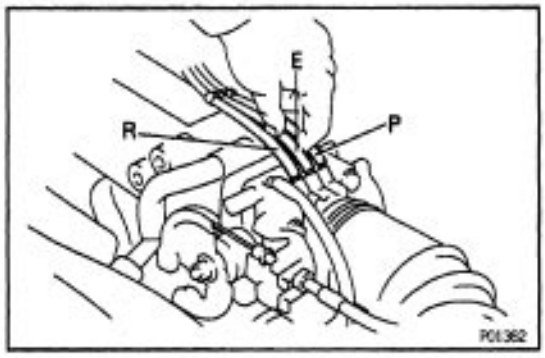




ON–VEHICLE INPSECTION

1. INSPECT THROTTLE BODY

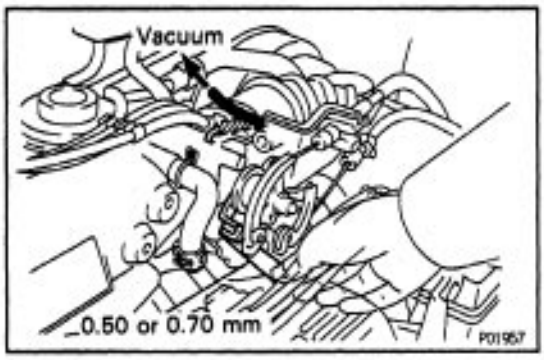
(a) Check that the throttle linkage moves smoothly.



(b) Check the vacuum at each port.

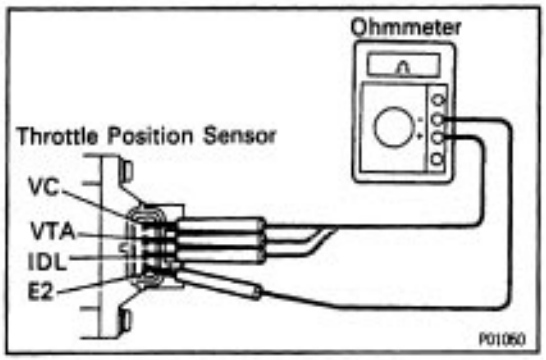
- Start the engine.
- Check the vacuum with your finger.

Port name	At idle	Other than idle
P	No vacuum	Vacuum
E	No vacuum	Vacuum
R	No vacuum	No vacuum



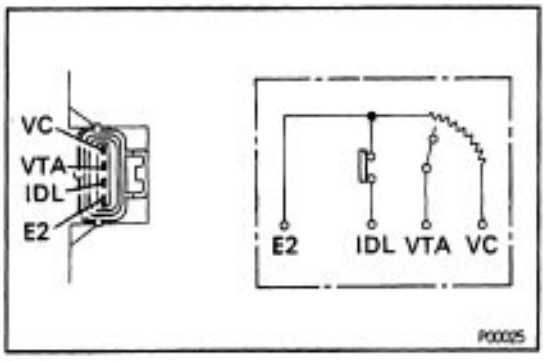
2. INSPECT THROTTLE POSITION SENSOR

(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 lever and stop screw	Between terminals	Resistance
0 mm (0 in.)	VTA – E2	0.2 – 5.7 kΩ
0.50 mm (0.020 in.)	IDL – E2	2.3 kΩ or less
0.70 mm (0.028 in.)	IDL – E2	Infinity
Throttle valve fully open	VTA – E2	2.0 – 10.2 kΩ
–	VC – E2	2.5 – 5.9 kΩ



(e) Reconnect the sensor connector.

3. INSPECT AND ADJUST THROTTLE OPENER

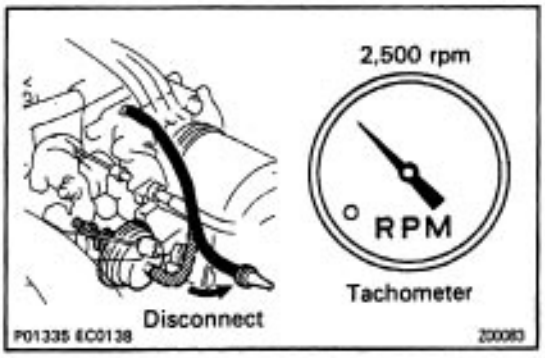
A. Warm up engine

Allow the engine to warm up to normal operating temperature.

B. Check idle speed

Idle speed:

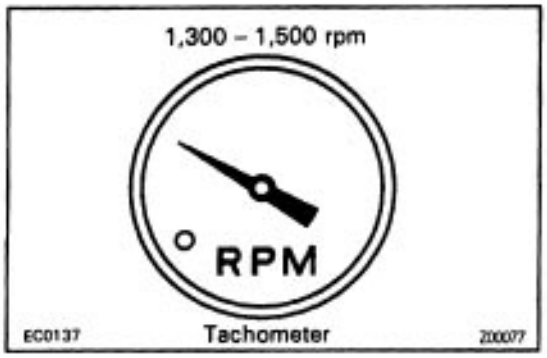
750 ± 50 rpm



C. Check and adjust throttle opener setting speed

(a) Disconnect the vacuum hose from the throttle opener, and plug the hose end.

(b) Maintain the engine at 2,500 rpm.

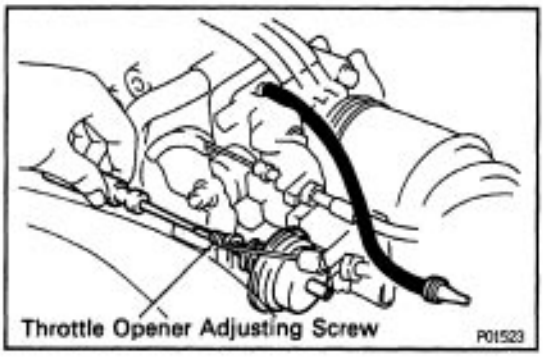


(c) Release the throttle valve.

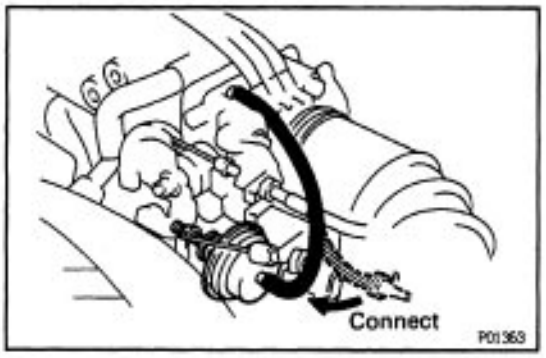
(d) Check that the throttle opener is set.

Throttle opener setting speed:

1,300 – 1,500 rpm (w/ Cooling fan OFF)

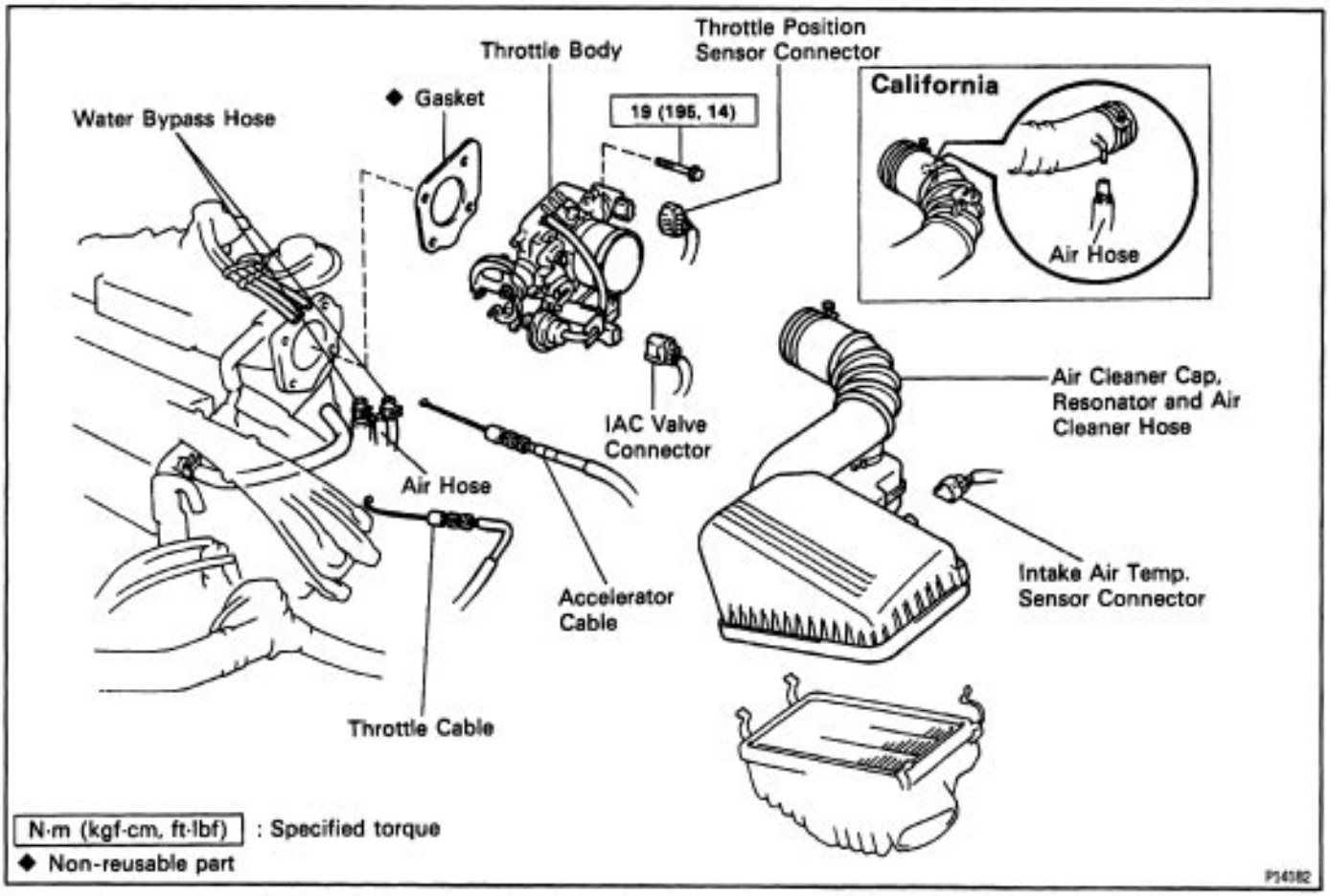


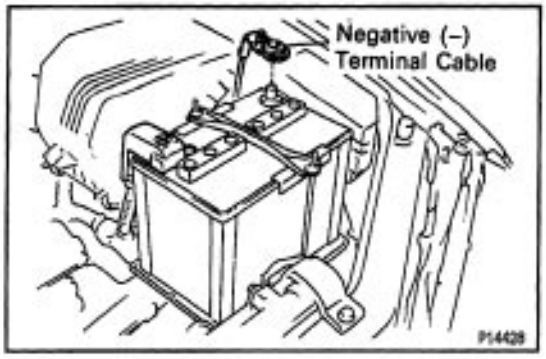
(e) Adjust the throttle opener setting speed by turning the throttle opener adjusting screw.



(f) Reconnect the vacuum hose to the throttle opener.

COMPONENTS FOR REMOVAL AND INSTALLATION





THROTTLE BODY REMOVAL

1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY

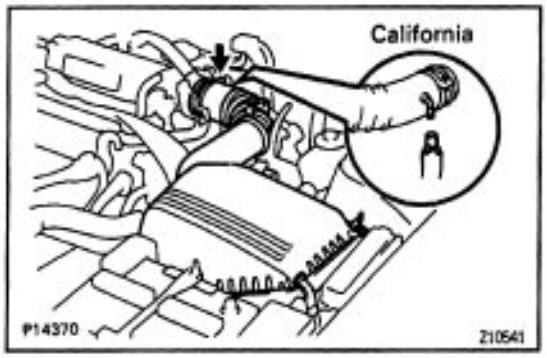
CAUTION: Work must be started after 90 seconds from the time the ignition switch is turned to the "LOCK" position and the negative (–) terminal cable is disconnected from the battery.

2. DRAIN ENGINE COOLANT

3. DISCONNECT ACCELERATOR CABLE FROM THROTTLE LINKAGE

4. A/T:

DISCONNECT THROTTLE CABLE FROM THROTTLE LINKAGE



5. REMOVE AIR CLEANER CAP, RESONATOR AND AIR CLEANER HOSE

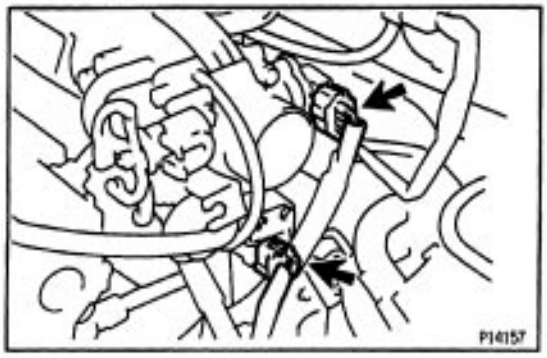
(a) Disconnect the intake air temperature sensor connector.

(b) California only:
Disconnect the air hose from the air cleaner hose.

(c) Loosen the air cleaner hose clamp bolt.

(d) Disconnect the 4 air cleaner cap clips.

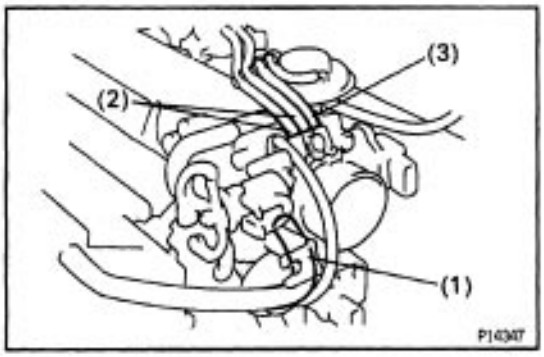
(e) Disconnect the air cleaner hose from the throttle body, and remove the air cleaner cap together with the resonator and air cleaner hose.



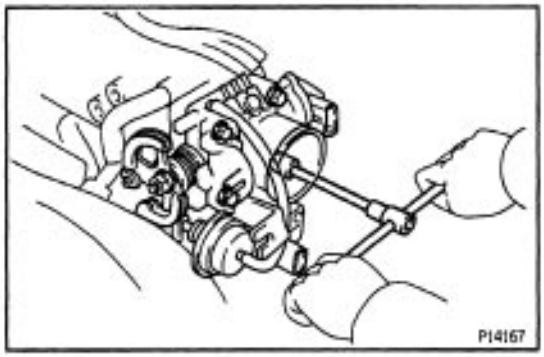
6. REMOVE THROTTLE BODY

(a) Disconnect the throttle position sensor connector.

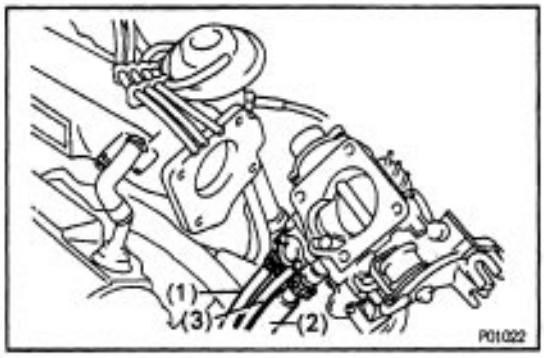
(b) Disconnect the IAC valve connector.



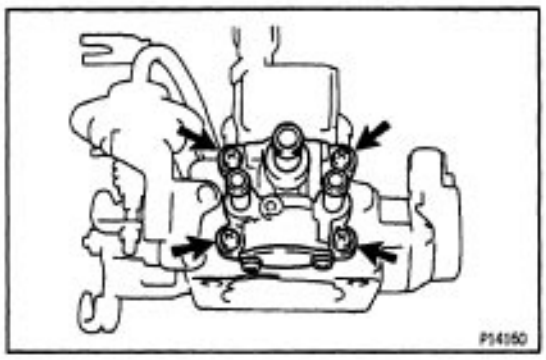
(c) Disconnect the following hoses from the throttle body.
(1) PCV hose
(2) 2 vacuum hoses from EGR vacuum modulator
(3) Vacuum hose from TVV (for EVAP)



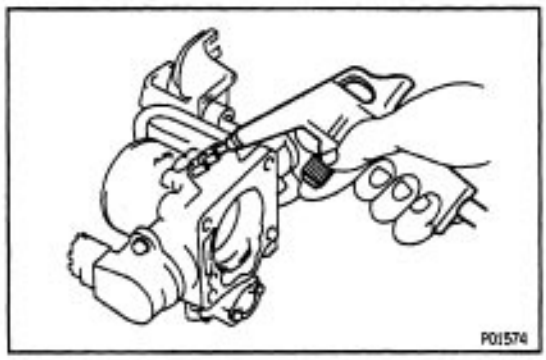
(d) Type A:
Remove the 4 bolts.
(e) Type B:
Remove the 2 bolts and 2 nuts.



(f) Disconnect the following hoses from the throttle body, and remove the throttle body.
(1) Water bypass hose from water outlet
(2) Water bypass hose from water bypass pipe
(3) California:
Air hose from cylinder head
Except California:
Air hose from air tube

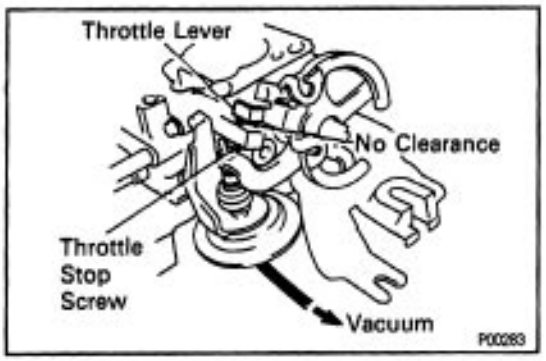


7. IF NECESSARY, REMOVE IAC VALVE FROM THROTTLE BODY
Remove the 4 screws, IAC valve and gasket.



THROTTLE BODY INSPECTION

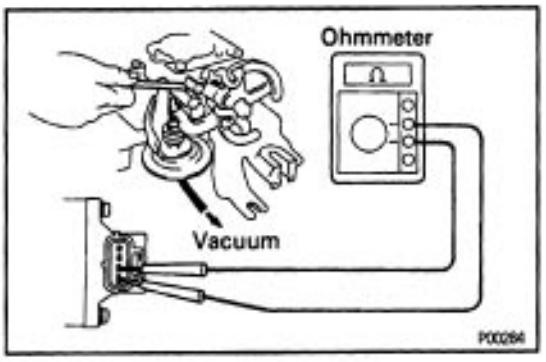
1. CLEAN THROTTLE BODY
(a) Using a soft brush and carburetor cleaner, clean the cast parts.
(b) Using compressed air, clean all the passengers and apertures.
NOTICE: To prevent deterioration, do not clean the throttle position sensor.



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.



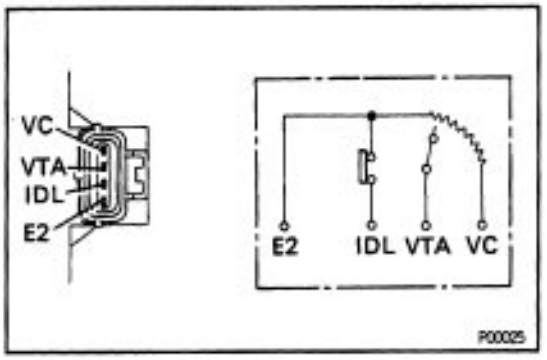
3. INSPECT THROTTLE POSITION SENSOR

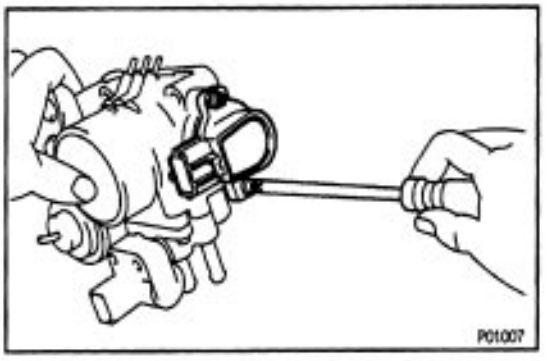
(a) Apply vacuum to the throttle opener.

(b) Insert a thickness gauge between the throttle stop screw and stop lever.

(c) Using an ohmmeter, measure the resistance between each terminal.

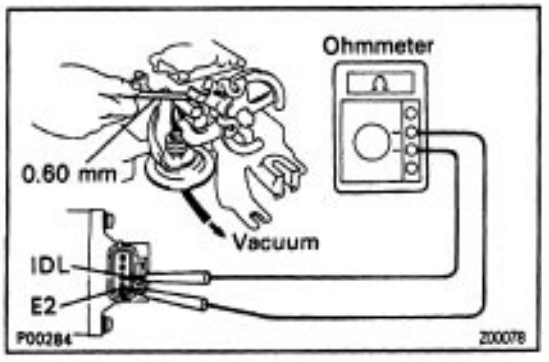
Clearance between lever and stop screw	Between terminals	Resistance
0 mm (0 in.)	VTA – E2	0.2 – 5.7 kΩ
0.50 mm (0.020 in.)	IDL–E2	2.3 kΩ or less
0.70 mm (0.028 in.)	IDL–E2	Infinity
Throttle valve fully open	VTA – E2	2.0 – 10.2 kΩ
–	VC – E2	2.5 – 5.9 kΩ





4. IF NECESSARY, ADJUST THROTTLE POSITION SENSOR

(a) Loosen the 2 set screws of the sensor.

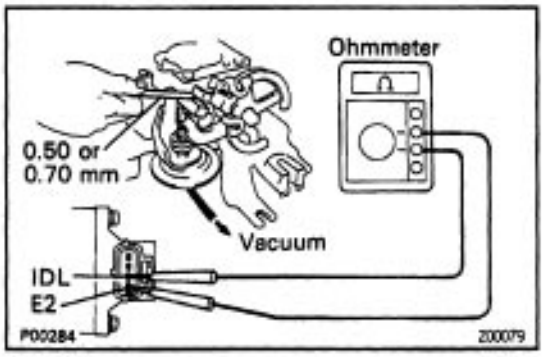


(b) Apply vacuum to the throttle opener.

(c) Insert a 0.60 mm (0.024 in.) thickness gauge between the throttle stop screw and stop lever.

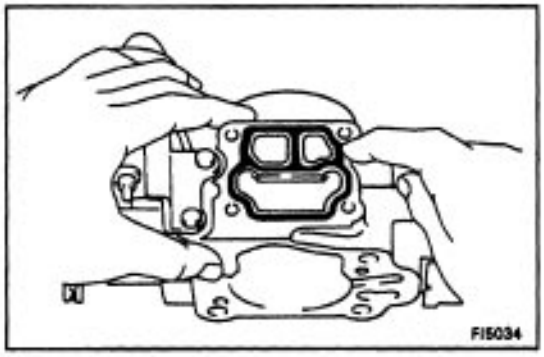
(d) Connect the test probe of an ohmmeter to the terminals IDL and E2 of the sensor.

(e) Gradually turn the sensor clockwise until the ohmmeter deflects, and secure it with the 2 set screws.

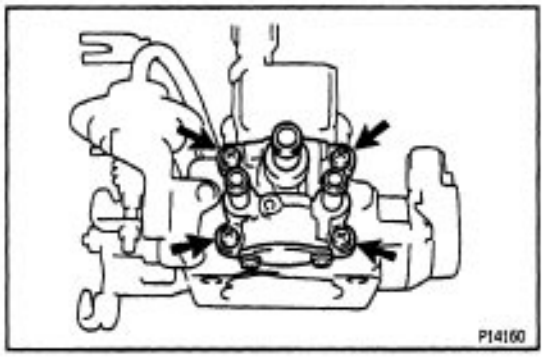


(f) Recheck the continuity between terminals IDL and E2.

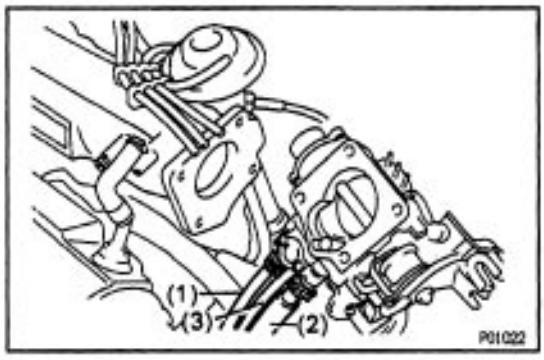
Clearance between lever and stop screw	Continuity (IDL – E2)
0.50 mm (0.020 in.)	Continuity
0.70 mm (0.028 in.)	No continuity



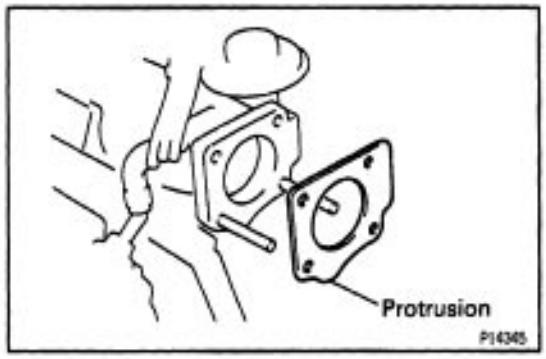
THROTTLE BODY INSTALLATION
(See Components for Removal and Installation)
1. INSTALL IAC VALVE TO THROTTLE BODY
(a) Place a new gasket on the throttle body.



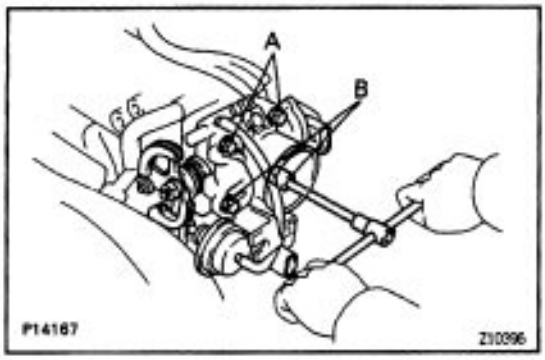
(b) install the IAC valve with the 4 screws.



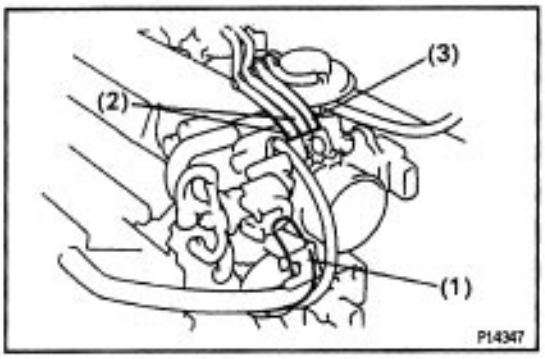
2. INSTALL THROTTLE BODY
(a) Connect the following hoses to the throttle body:
(1) Water bypass hose from water outlet
(2) Water bypass hose from water bypass pipe
(3) California:
Air hose from cylinder head
Except California:
Air hose from air tube



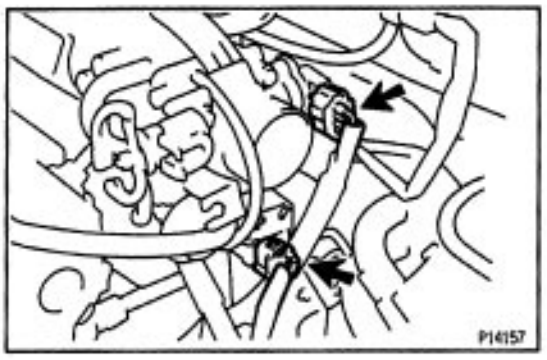
(b) Place a new gasket on the intake chamber, facing the protrusion downward.



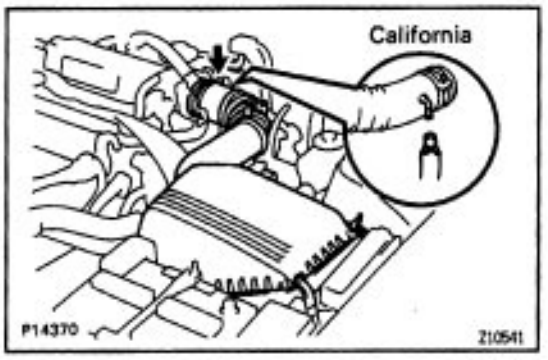
(c) Type A:
Install the throttle body with the 4 bolts.
Torque: 19 N–m (195 kgf–cm, 14 ft–lbf)
Bolt length:
A 45 mm (1.77 in.)
B 55 mm (2.17 in.)
(d) Type B:
Install the throttle body with the 2 bolts and 2 nuts.
Torque: 19 N–m (195 kgf–cm, 14 ft–lbf)



(e) Connect the following hoses to the throttle body:
(1) PCV hose
(2) 2 vacuum hoses from EGR vacuum modulator
(3) Vacuum hose from TVV (for EVAP)



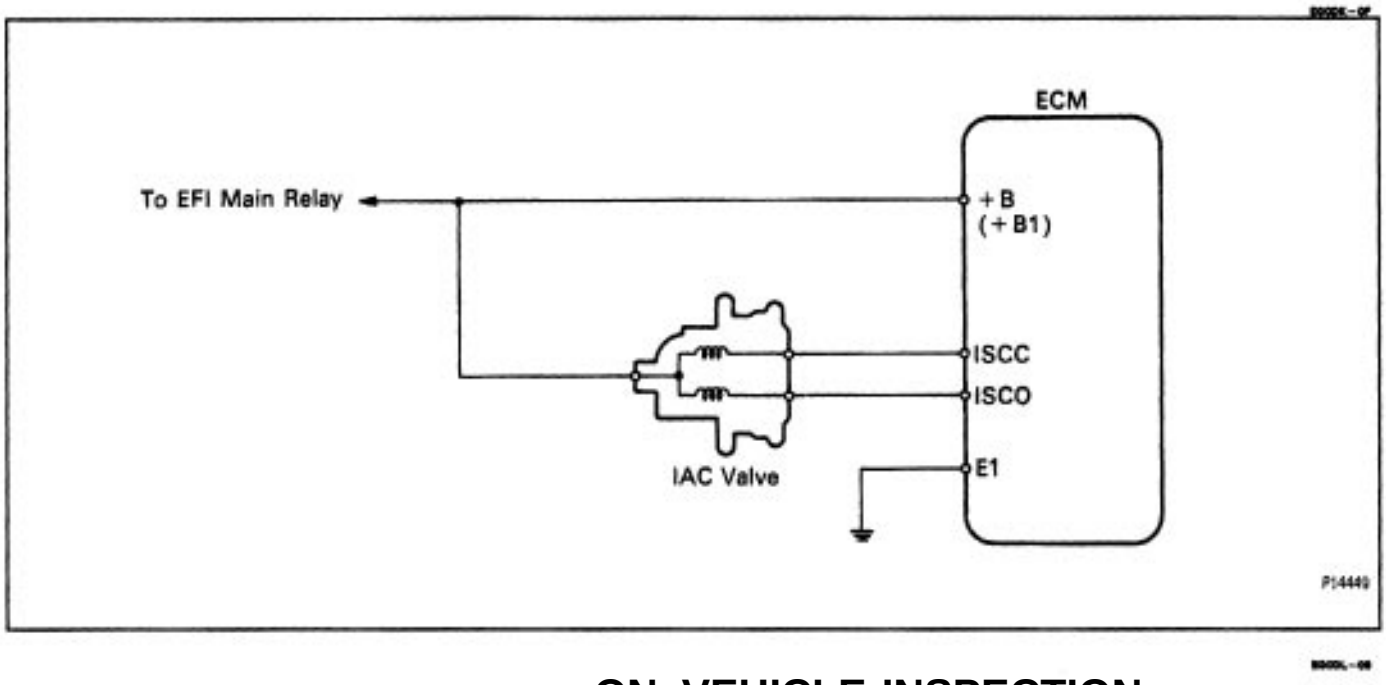
(f) Connect the IAC valve connector.
(g) Connect the throttle position sensor connector.



3. INSTALL AIR CLEANER CAP, RESONATOR AND AIR CLEANER HOSE
(a) Connect the air cleaner hose to the throttle body.
(b) Install the air cleaner cap together with the resonator and air cleaner hose.
(c) California only:
Connect the air hose to the air cleaner hose.
(d) Connect the intake air temperature sensor connector.

4. A/T:
CONNECT AND ADJUST THROTTLE CABLE
5. CONNECT AND ADJUST ACCELERATOR CABLE
6. FILL WITH ENGINE COOLANT
7. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY

IDLE AIR CONTROL (IAC) VALVE

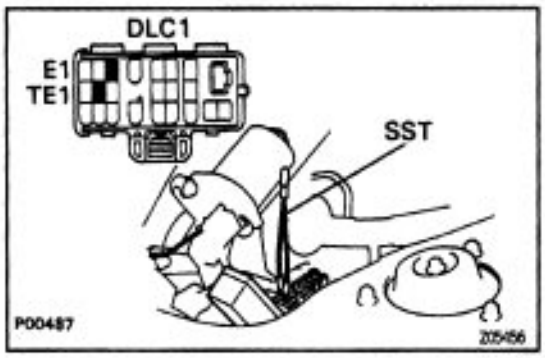


ON–VEHICLE INSPECTION

1. INSPECT IAC VALVE OPERATION

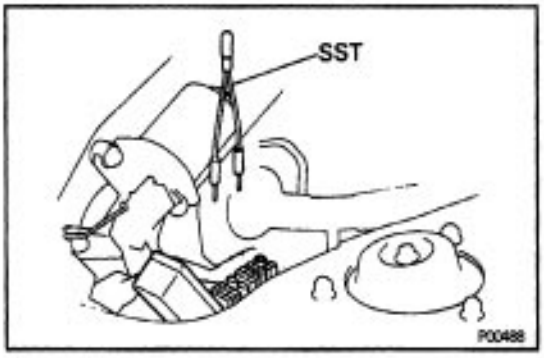
(a) Initial conditions:

- Engine at normal operating temperature
- Idle speed set correctly
- Transmission in neutral position

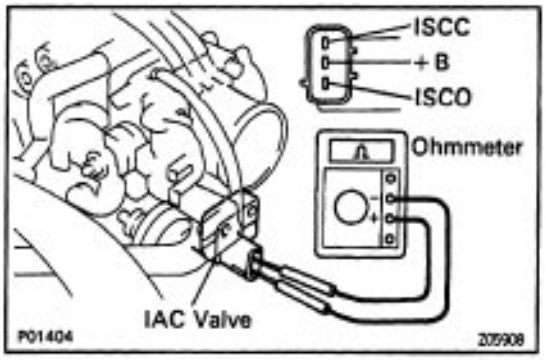


(b) Using SST, connect terminals TE1 and E1 of the data link connector 1.
SST 09843–18020

(c) Maintain engine speed in the range between 900 – 1,300 rpm for 5 seconds. Check that it returns to idle speed.
If the engine speed operation is not as specified, check the IAC valve, wiring and ECM.



(d) Remove the SST.
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 (ISCC, ISCO).

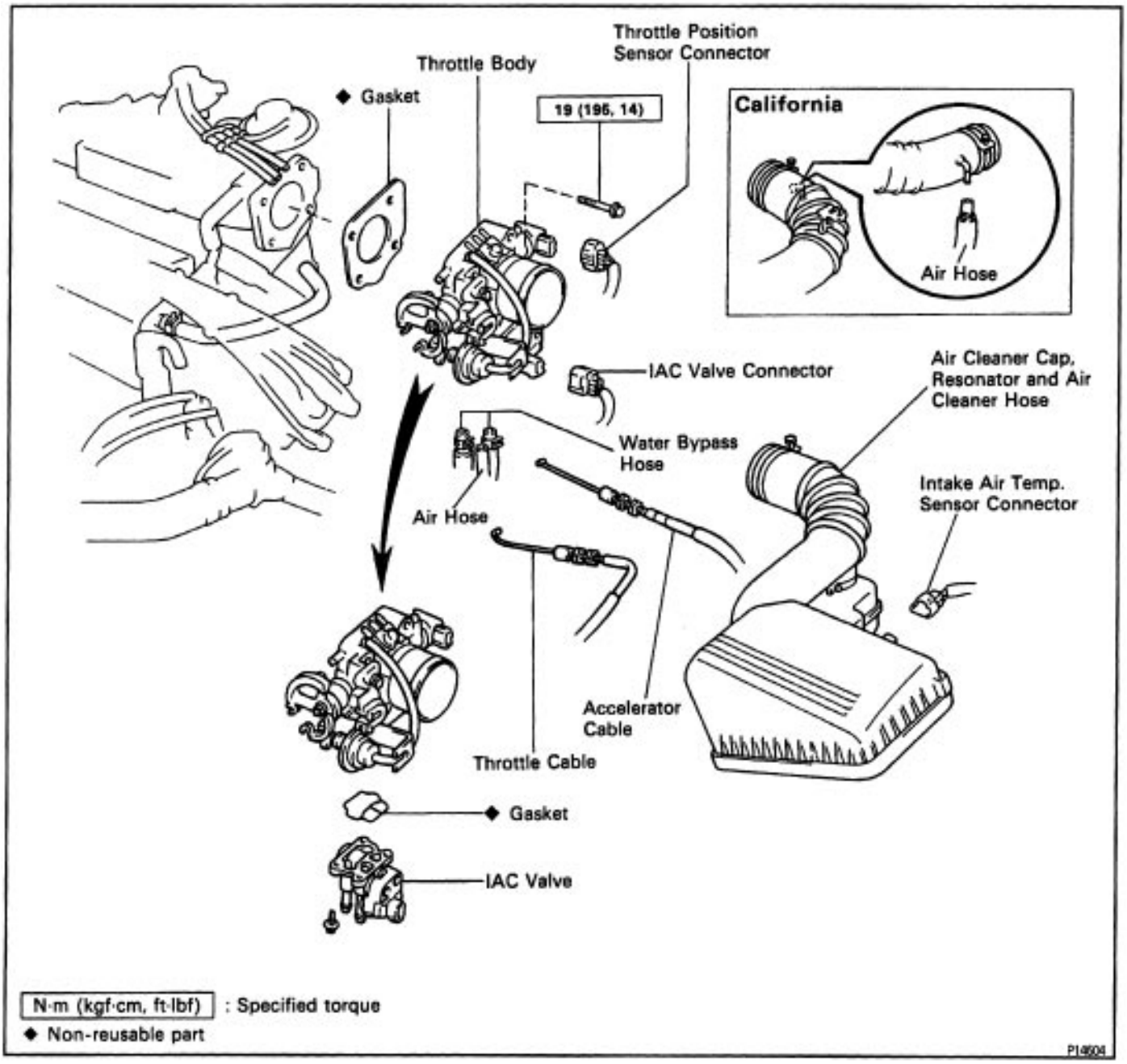
Resistance:

19.3–22–3Ω

If resistance is not as specified, replace the IAC valve.

(c) Reconnect the IAC valve connector.

COMPONENTS FOR REMOVAL AND INSTALLATION

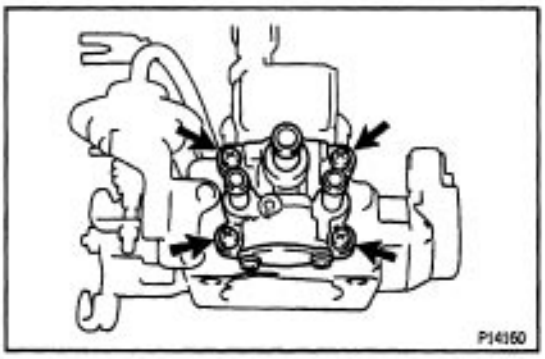


IAC VALVE REMOVAL

(See Components for Removal and Installation)

1. REMOVE THROTTLE BODY

(See steps 1 to 6 on pages EG1–207 and 208)



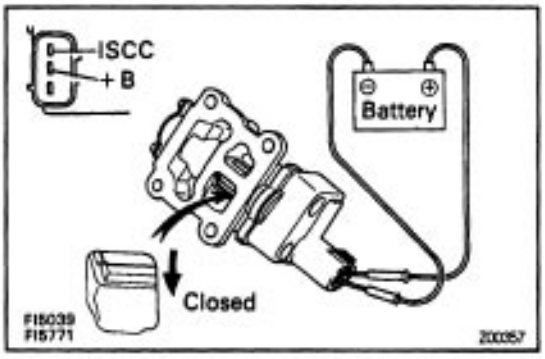
2. REMOVE IAC VALVE

Remove the 4 screws, IAC valve and gasket.

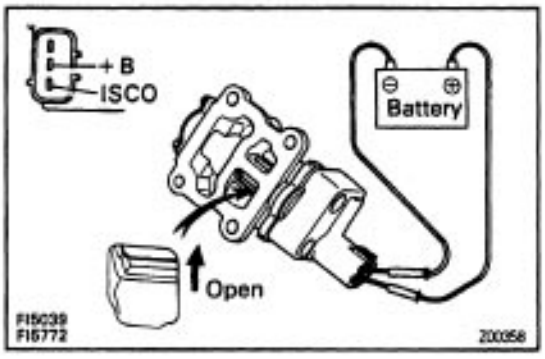
IAC VALVE INSPECTION

INSPECT IAC VALVE OPERATION

(a) Connect the positive (+) lead from the battery to terminal +B and negative (–) lead to terminal ISCC, and check that the valve is closed.



(b) Connect the positive (+) lead from the battery to terminal +B and negative (–) lead to terminal ISCO, and check that the valve is open.

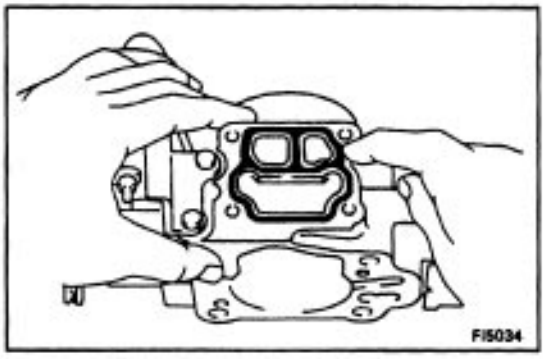


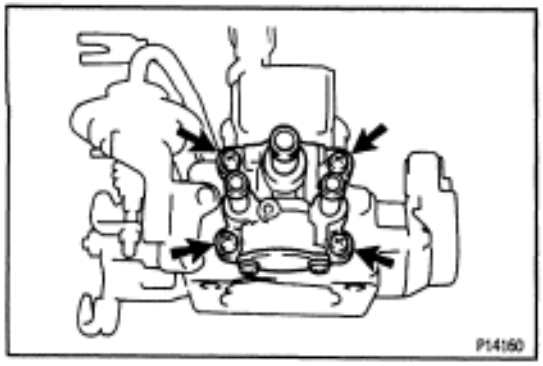
IAC VALVE INSTALLATION

(See Components for Removal and Installation)

1. INSTALL IAC VALVE

(a) Place a new gasket on the throttle body.

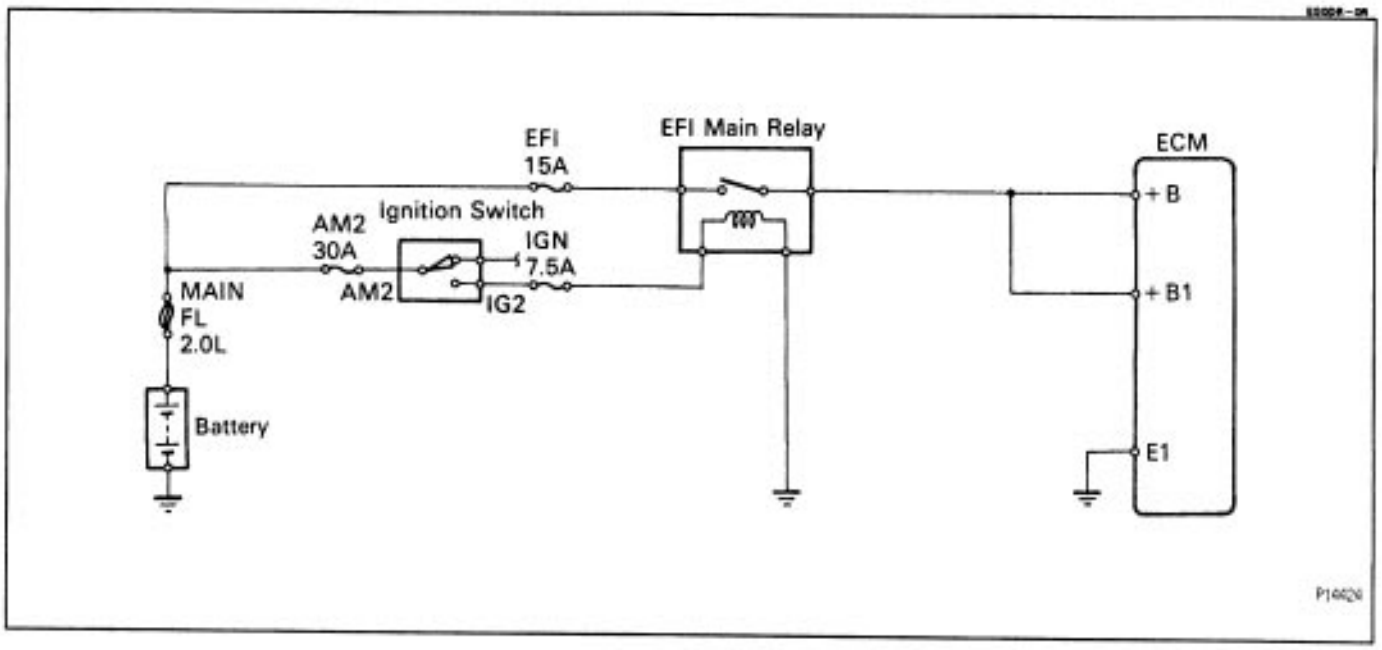


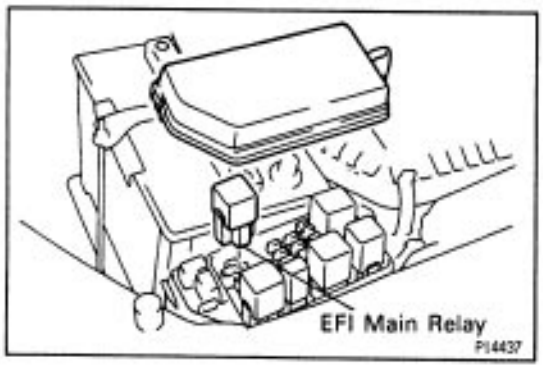


(b) Install the IAC valve with the 4 screws.

2. INSTALL THROTTLE BODY
(See steps 2 to 7 on pages EG1–210 **and 211)**

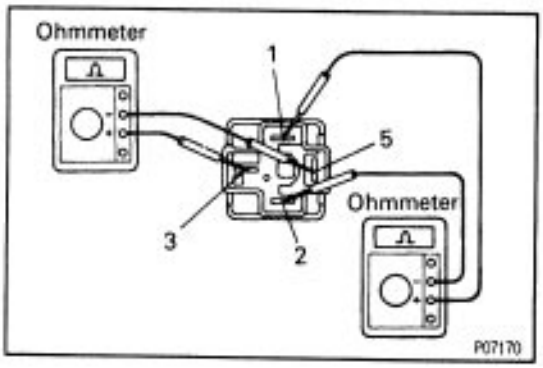
EFI MAIN RELAY





EFI MAIN RELAY INSPECTION

7. REMOVE EFI MAIN RELAY



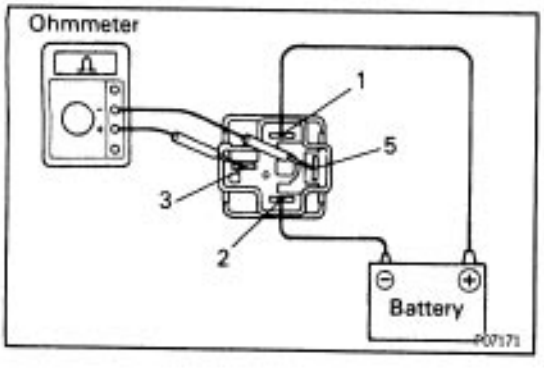
2. INSPECT EFI MAIN RELAY

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

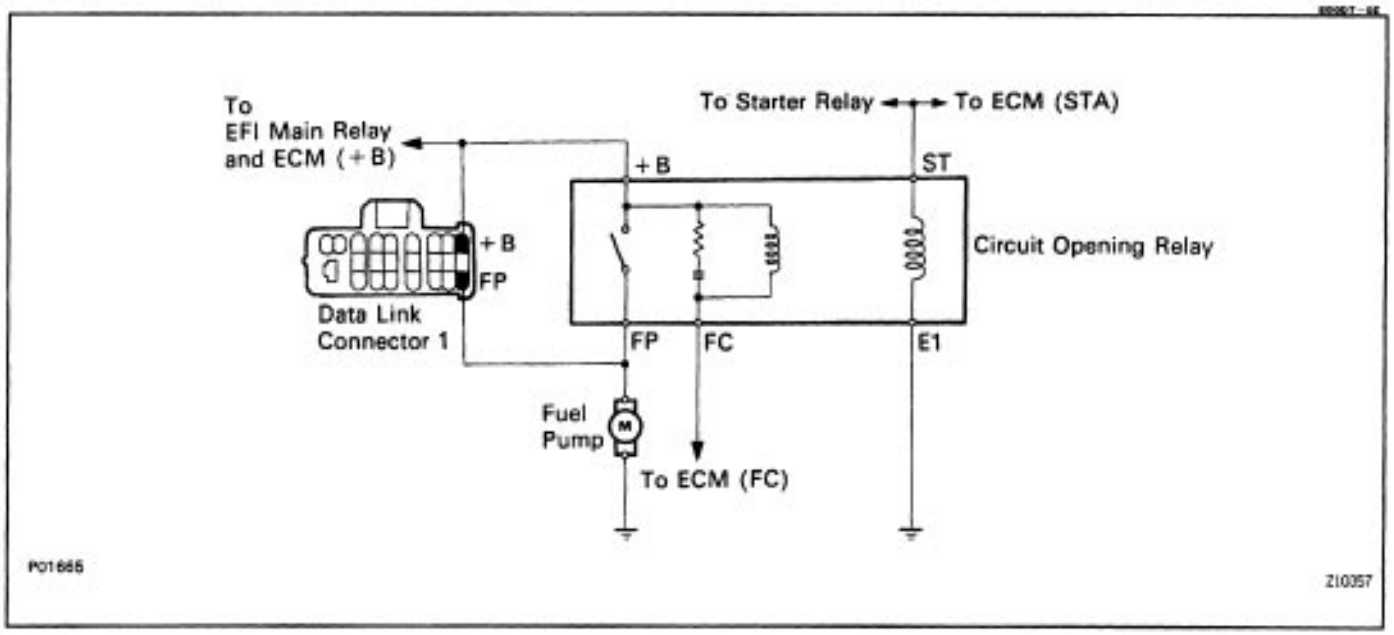
(a) Apply battery voltage across terminals 1 and 2.

(b) Using an ohmmeter, check that there is continuity between terminals 3 and 5.

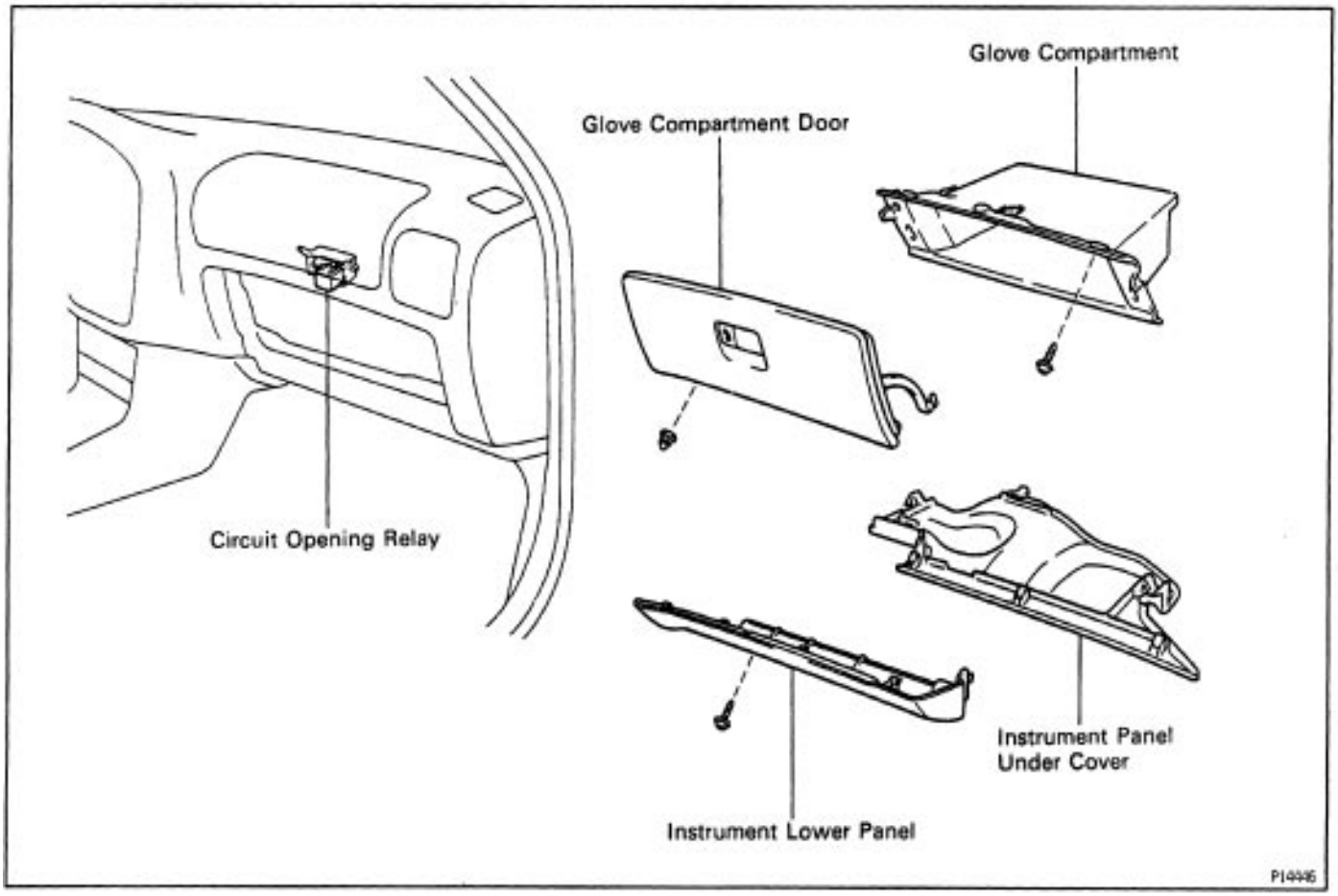
If operation is not as specified, replace the relay.

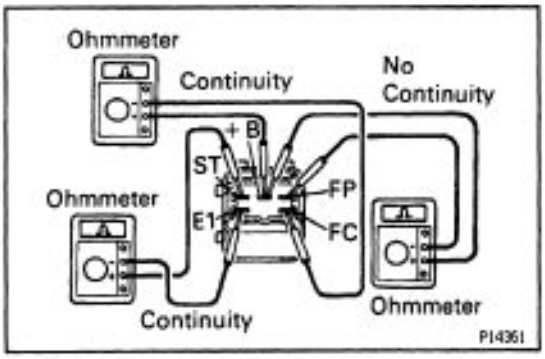
3. REINSTALL EFI MAIN RELAY

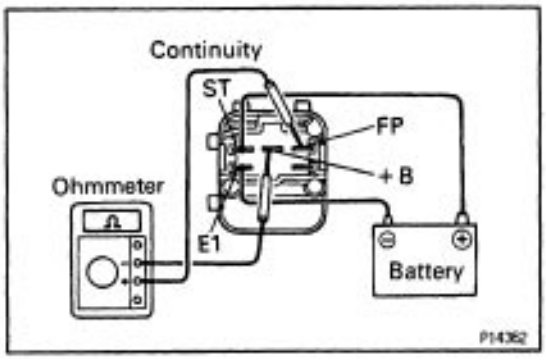
CIRCUIT OPENING RELAY



CIRCUIT OPENING RELAY REMOVAL AND INSTALLATION







CIRCUIT OPENING RELAY INSPECTION

1. 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.

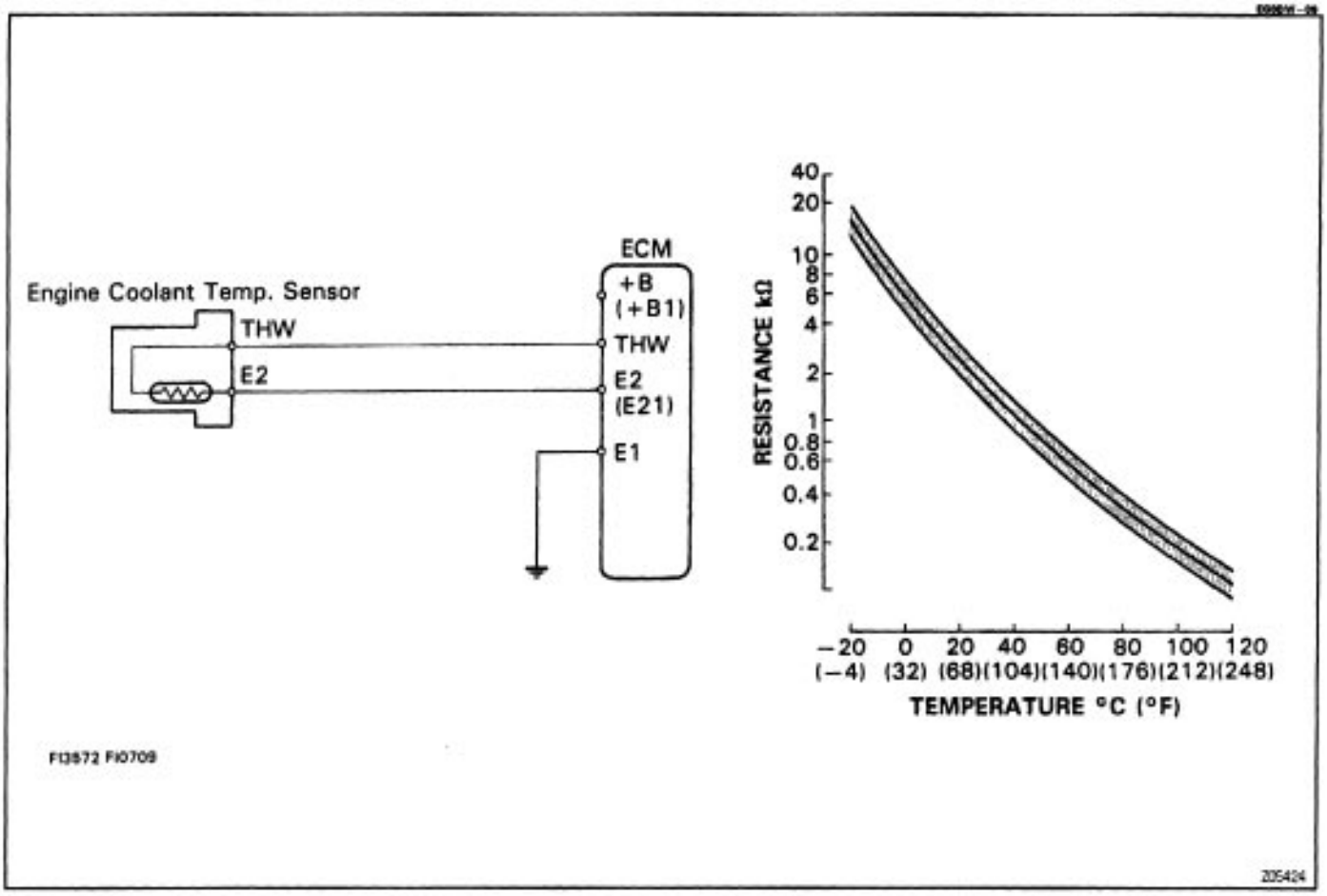
If continuity is not as specified, replace the relay.

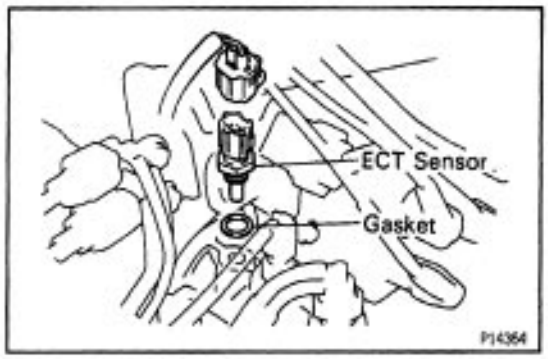
2. INSPECT RELAY OPERATION

(a) Apply battery voltage across terminals ST and E1.

(b) Using an ohmmeter, check that there is continuity between terminals +B and FP.
If operation is not as specified, replace the relay.

ENGINE COOLANT TEMPERATURE (ECT) SENSOR

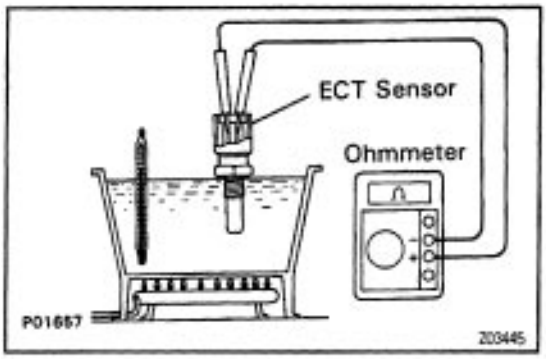




ECT SENSOR INSPECTION

1. DRAIN ENGINE COOLANT

2. REMOVE ECT SENSOR



3. INSPECT ECT SENSOR RESISTANCE

Using an ohmmeter, measure the resistance between the terminals.

Resistance:

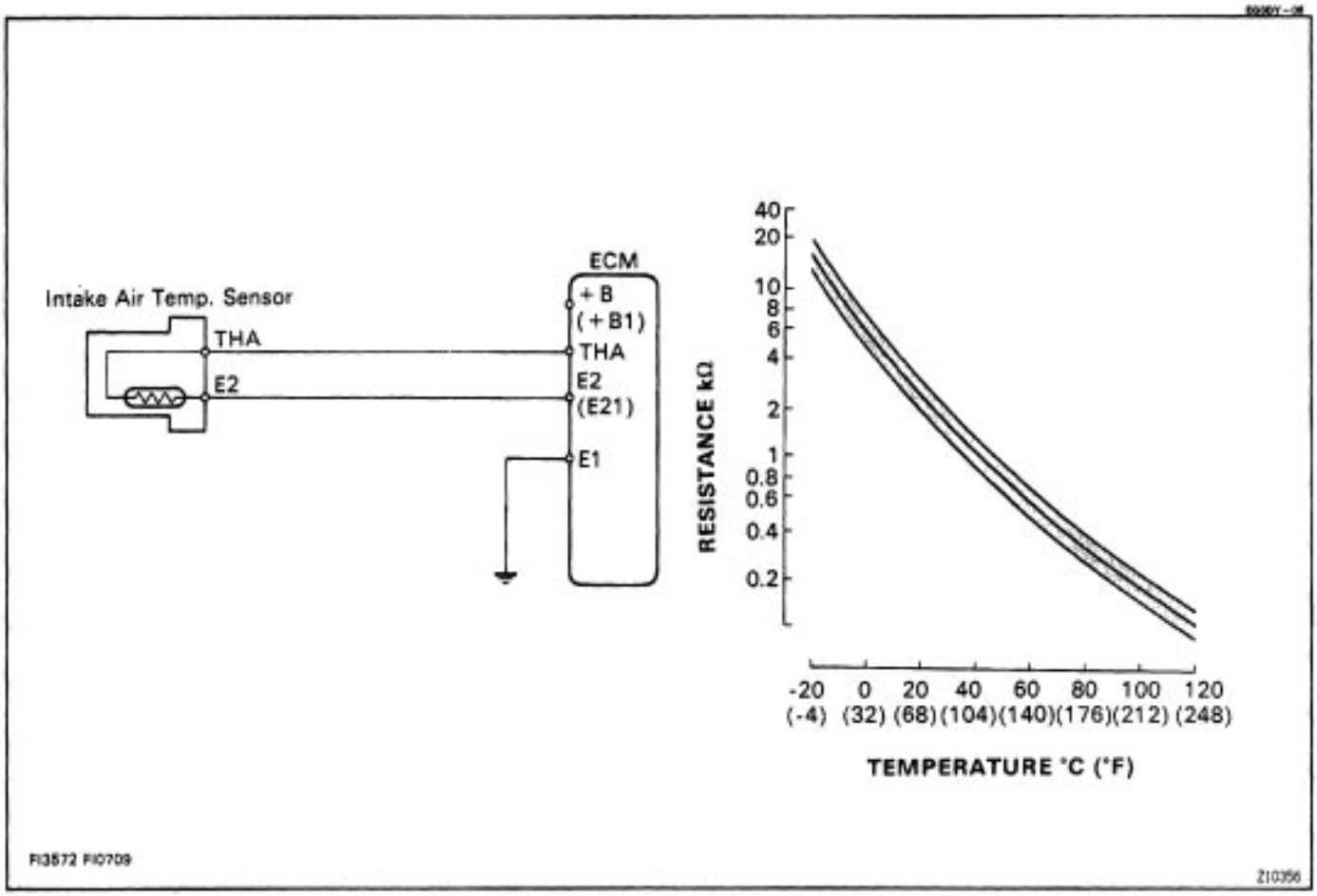
Refer to the graph above

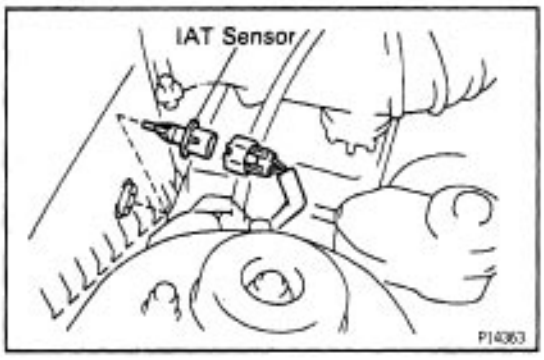
If the resistance is not as specified, replace the sensor.

4. REINSTALL ECT SENSOR

5. FILL WITH ENGINE COOLANT

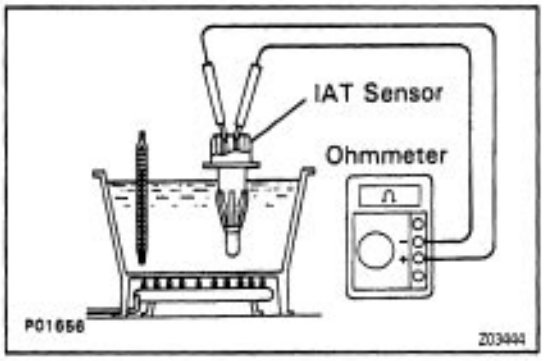
INTAKE AIR TEMPERATURE (IAT) SENSOR





IAT SENSOR INSPECTION

1. REMOVE IAT SENSOR



2. INSPECT IAT SENSOR RESISTANCE

Using an ohmmeter, measure the resistance between the terminals.

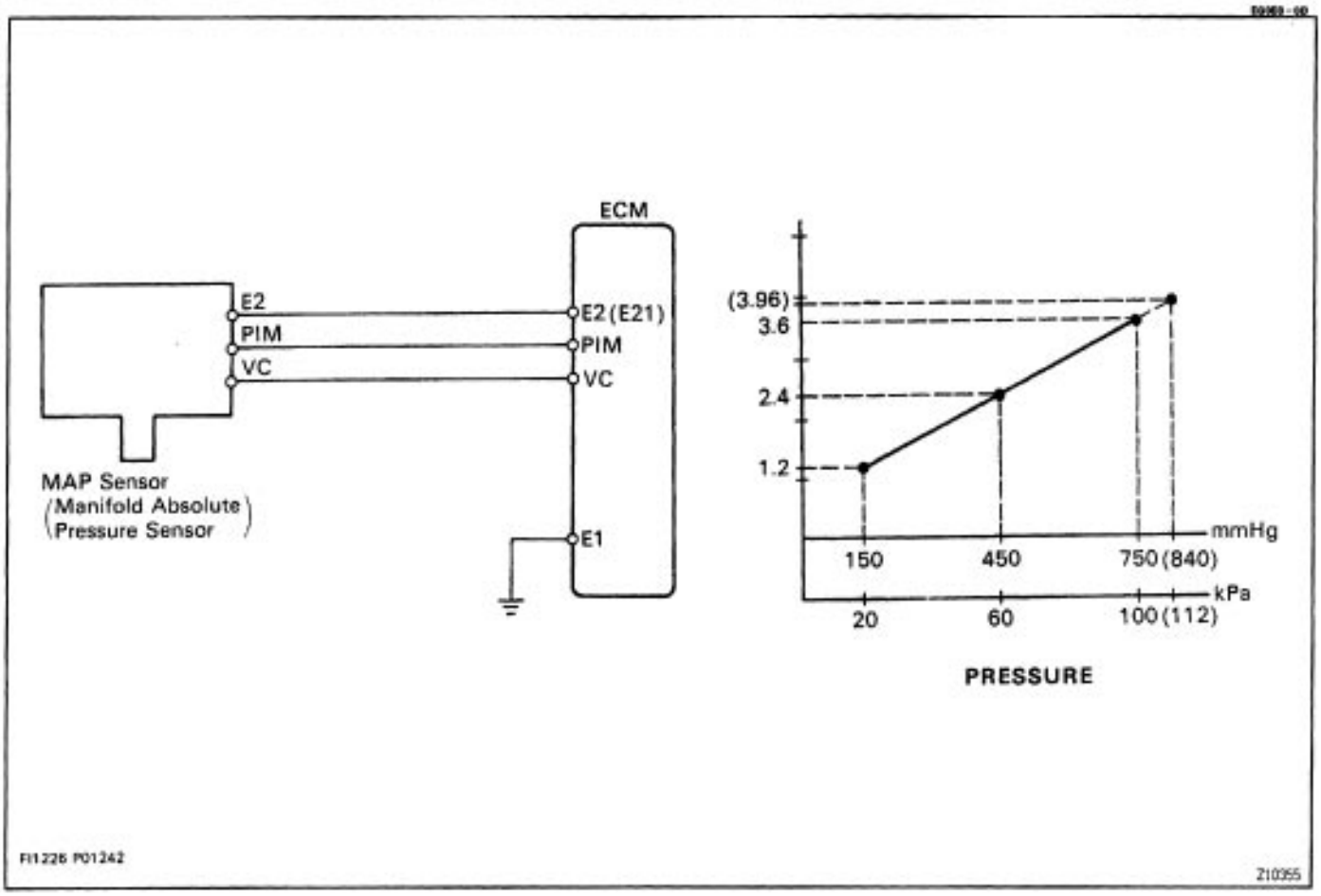
Resistance:

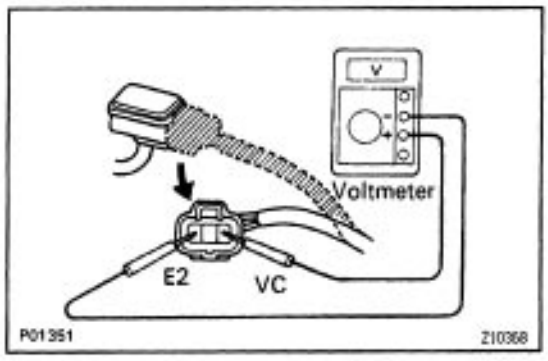
Refer to the graph above

If the resistance is not as specified, replace the sensor.

3. REINSTALL IAT SENSOR

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR





MAP SENSOR INSPECTION

1. INSPECT POWER SOURCE VOLTAGE OF MAP SENSOR

(a) Disconnect the MAP sensor connector.

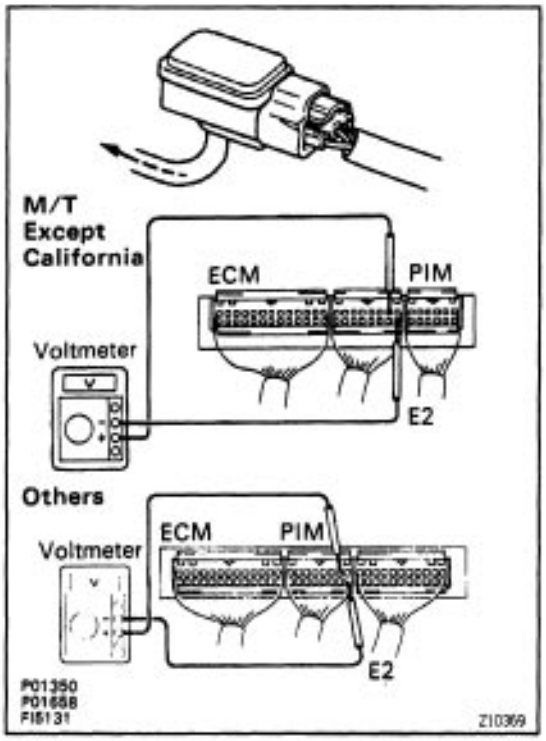
(b) Turn the ignition switch ON.

(c) Using a voltmeter measure the voltage between connector terminals VC and E2 of the wiring harness side.

Voltage:

4.75 – 5.25 V

(d) Reconnect the MAP sensor connector.



2. INSPECT POWER OUTPUT OF MAP SENSOR

(a) Turn the ignition switch ON.

(b) Disconnect the vacuum hose on the air intake cham–ber side.

(c) Connect a voltmeter to terminals PIM and E2 of the ECM, and measure the output voltage under ambient atmospheric pressure.

(d) Apply vacuum to the MAP sensor in 13.3 kPa (100 mmHg, 3.94 in.Hg) segments to 66.7 kPa (500 mmHg, 19.69 in.Hg).

(e) Measure the voltage drop from step

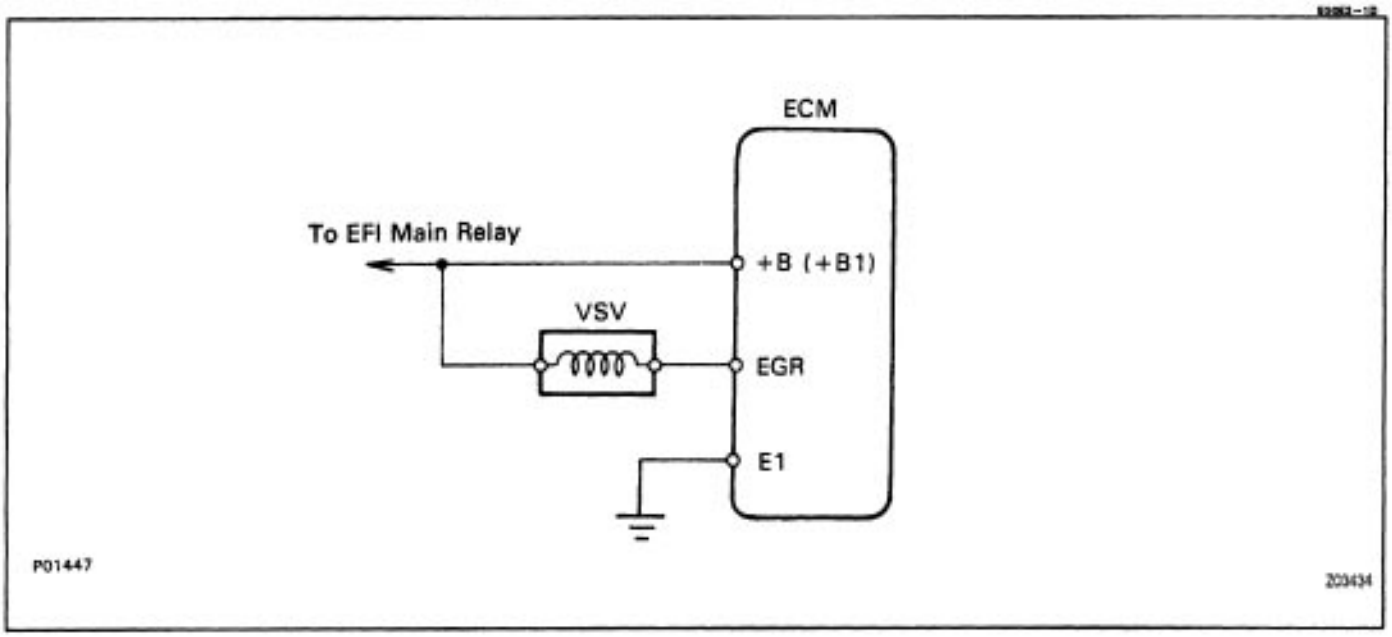
(c) above for each segment.

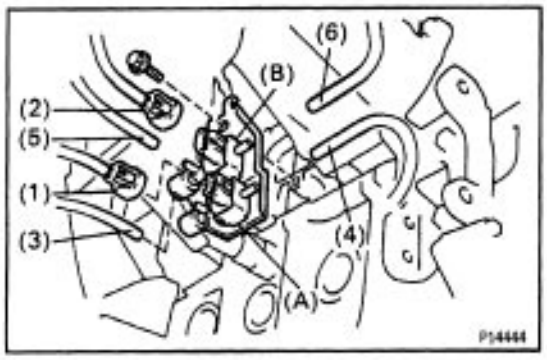
Voltage drop:

Applied Vacuum kPa (mmHg in.Hg)	13.3 (100 3.94)	26.7 (200 7.87)	40.0 (300 111.8)	53.5 (400 15.75)	66.7 (500 19.69)
Voltage drop V	0.3–0.5	0.7–0.9	1.1 –1.3	1.5 – 1.7	1.9 – 2.1

V00494

VSV FOR EGR





VSV INSPECTION (California)

1. REMOVE VSV

(a) Disconnect the following connectors and hoses:

(1) VSV for EGR (A) connector

(2) VSV for fuel pressure control (B) connector

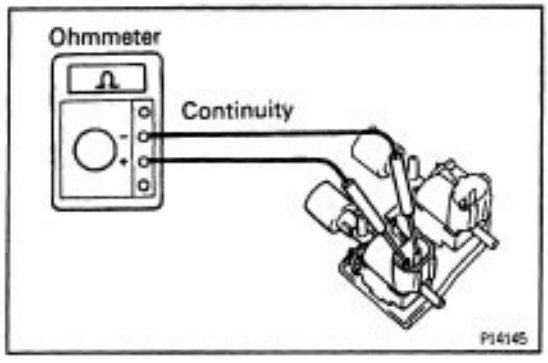
(3) Vacuum hose (from EGR valve) from port E of VSV (A)

(4) Vacuum hose (from port “Q” of EGR vacuum modulator) from port G of VSV (A)

(5) Vacuum hose (from fuel pressure regulator) from port E of VSV (B)

(6) Vacuum hose (from air intake chamber) from port G of VSV (B)

(b) Remove the bolt and VSV assembly.



2. INSPECT VSV

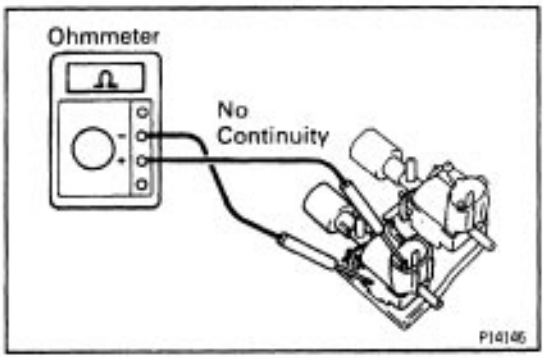
A. Inspect VSV for open circuit

Using an ohmmeter, check that there is continuity between the terminals.

Resistance (Cold):

33–39Ω

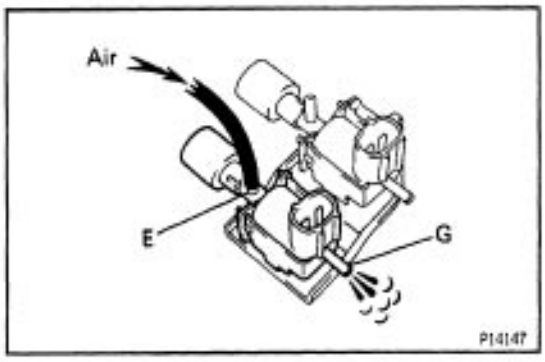
If there is no continuity, replace the VSV.



B. Inspect VSV for ground

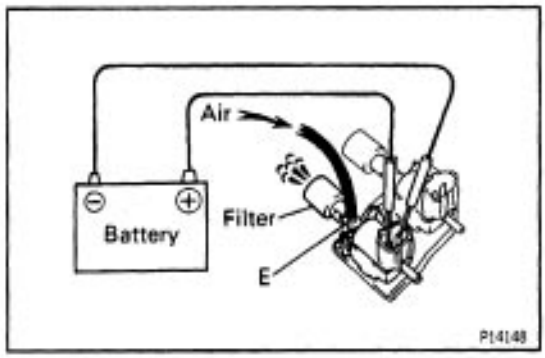
Using an ohmmeter, check that there is no continuity between each terminal and the body.

If there is continuity, replace the VSV.



C. Inspect VSV operation

(a) Check that air flows from port E to port G.

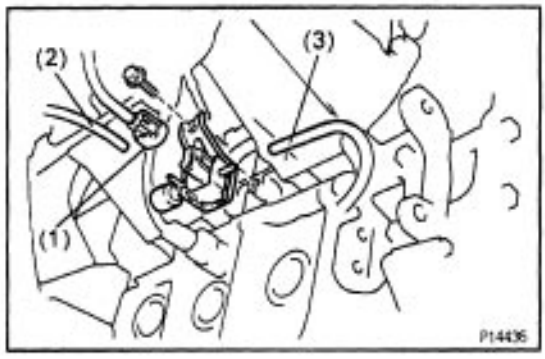


(b) Apply battery voltage across the terminals.

(c) Check that air flows from port E to the filter.

If operation is not as specified, replace the VSV.

3. REINSTALL VSV



VSV INSPECTION (Except California)

1. REMOVE VSV

(a) Disconnect the following connector and hoses:

(1) VSV connector

(2) Vacuum hose (from EGR valve) from port E of VSV

(3) Vacuum hose (from port “a” of EGR vacuum modulator) from port G of VSV

(b) Remove the bolt and VSV.

2. INSPECT VSV

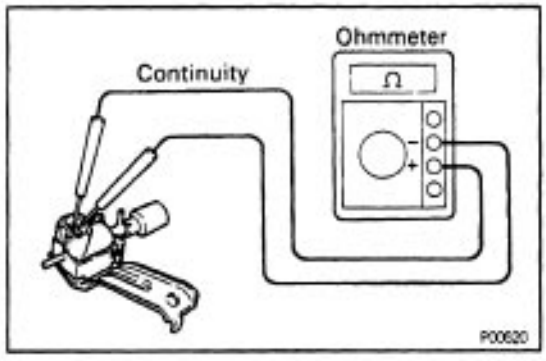
A. Inspect VSV for open circuit

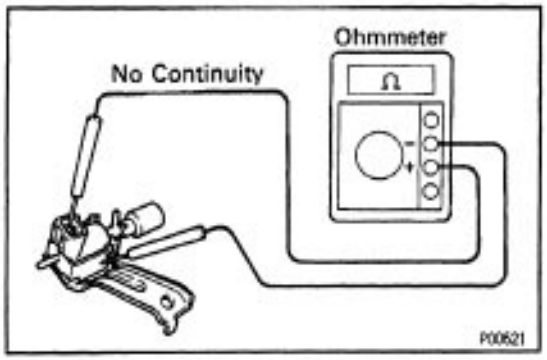
Using an ohmmeter, check that there is continuity between the terminals.

Resistance (Cold):

33–39Ω

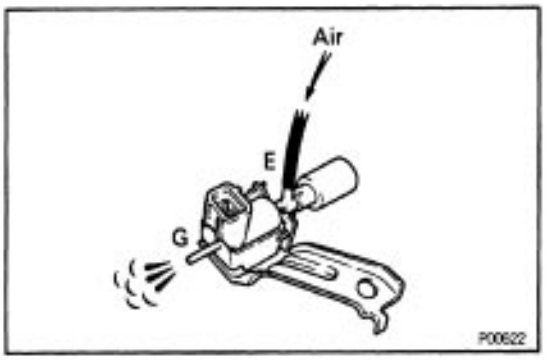
If there is no continuity, replace the VSV.





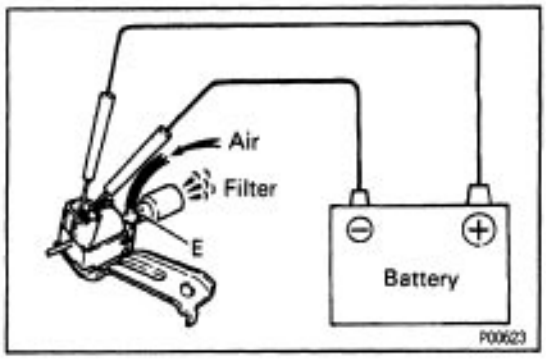
B. Inspect VSV for ground

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

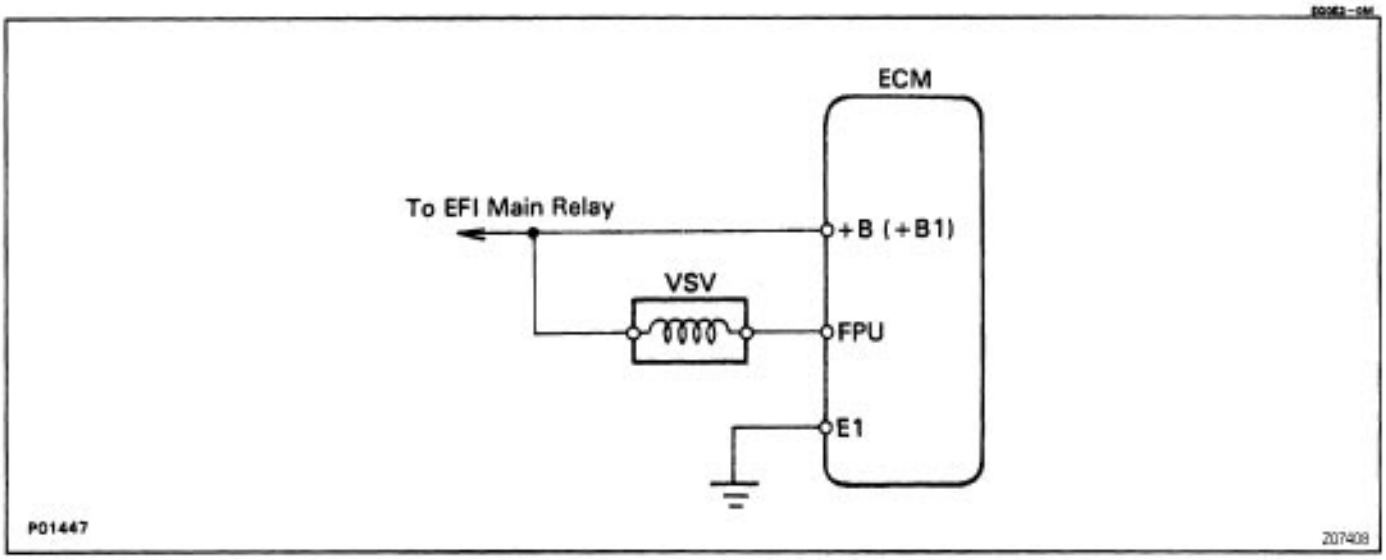
(a) Check that air flows from port E to port G.

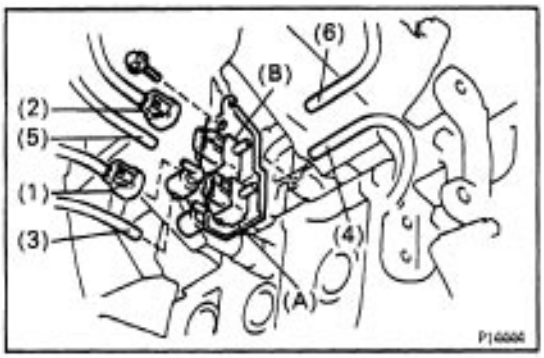


(b) Apply battery voltage across the terminals.
(c) Check that air flows from port E to the filter.
If operation is not as specified, replace the VSV.

3. REINSTALL VSV

VSV FOR FUEL PRESSURE CONTROL (California only)



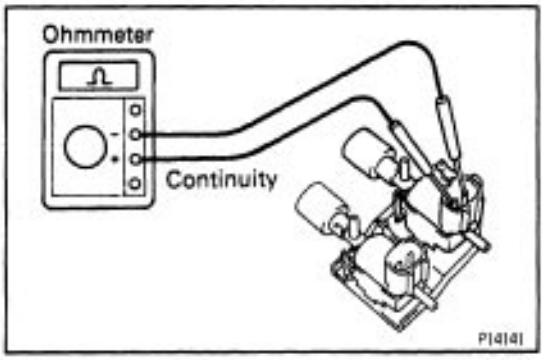


VSV INSPECTION

1. REMOVE VSV

(a) Disconnect the following connectors and hoses:
- (1) VSV for EGR (A) connector
- (2) VSV for fuel pressure control (B) connector
- (3) Vacuum hose (from EGR valve) from port E of VSV (A)
- (4) Vacuum hose (from port “a” of EGR vacuum modulator) from port G of VSV (A)
- (5) Vacuum hose (from fuel pressure regulator) from port E of VSV (B)
- (6) Vacuum hose (from air intake chamber) from port G of VSV (B)

(b) Remove the bolt and VSV assembly.



2. INSPECT VSV

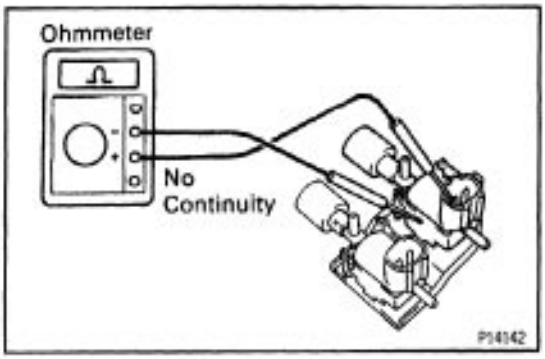
A. Inspect VSV for open circuit

Using an ohmmeter, check that there is continuity between the terminals.

Resistance (Cold):

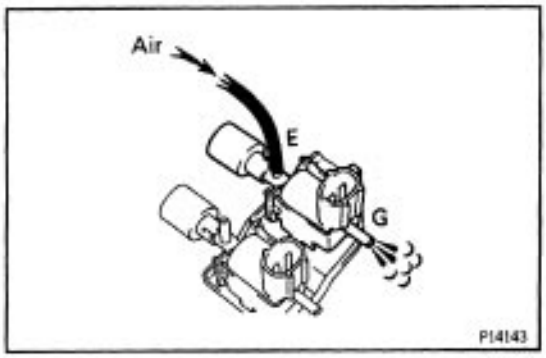
33–39Ω

If there is no continuity, replace the VSV.



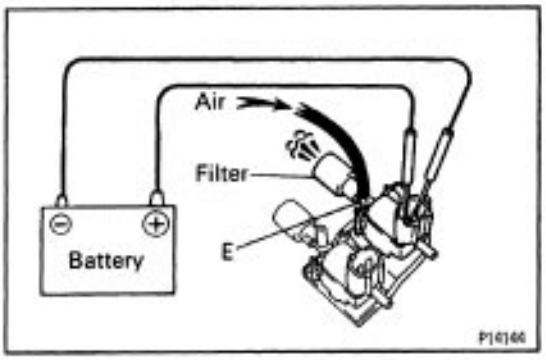
B. Inspect VSV for ground

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

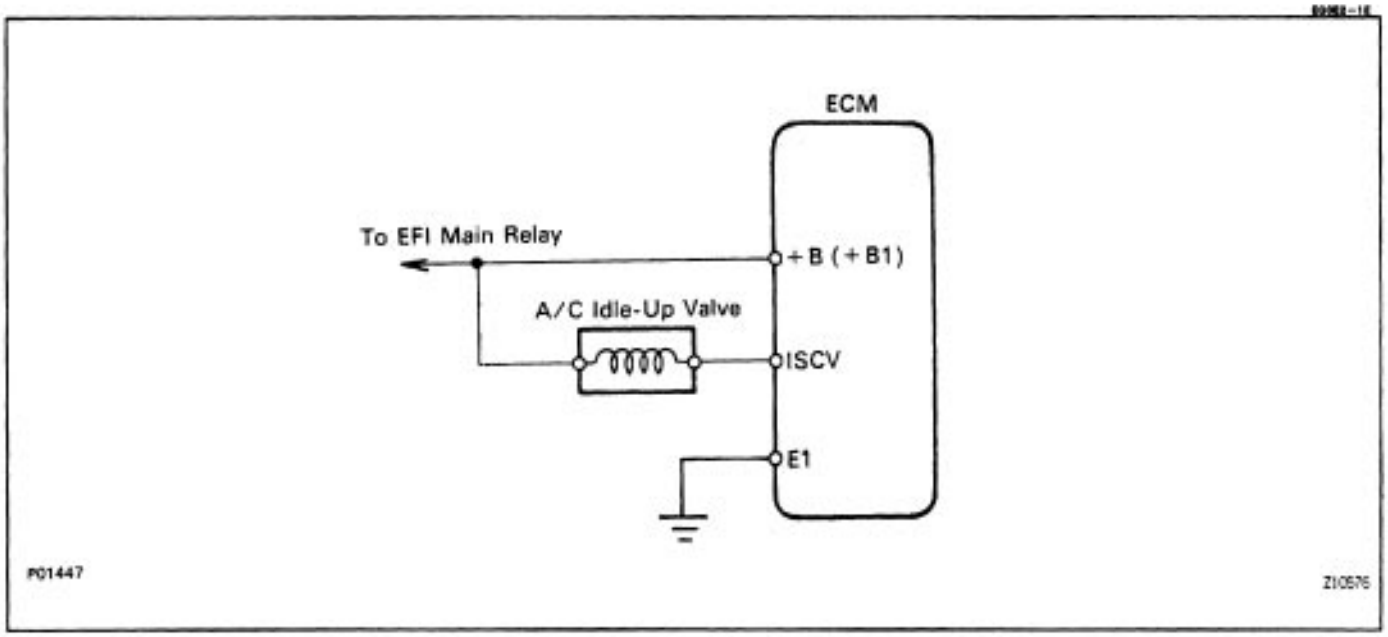
(a) Check that air flows from pipe E to pipe G.

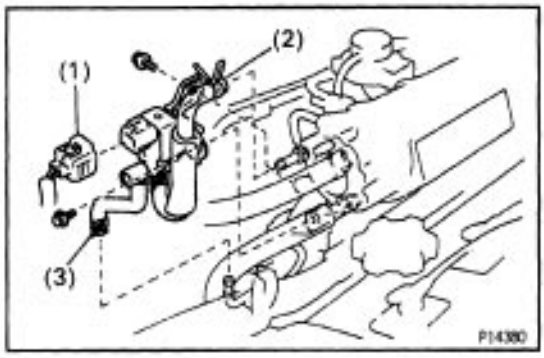


(b) Apply battery voltage across the terminals.
(c) Check that air flows from pipe E to the filter.
If operation is not as specified, replace the VSV.

3. REINSTALL VSV

A–C IDLE–UP VALVE





A/C IDLE– UP VALVE INSPECTION

1. REMOVE IDLE–UP VALVE

(a) Disconnect the following connector and hoses:
(1) Idle–up valve connector
(2) Air hose from air intake chamber
(3) Air hose from air tube
(b) Remove the 2 bolts and idle–up valve together with the 2 air hoses.
(c) Disconnect the 2 air hoses from the idle–up valve.

2. INSPECT IDLE–UP VALVE

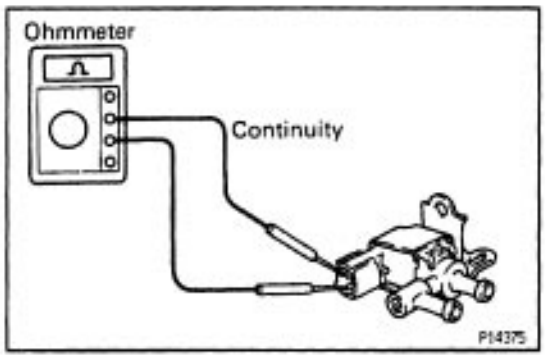
A. Inspect idle–up valve for open circuit

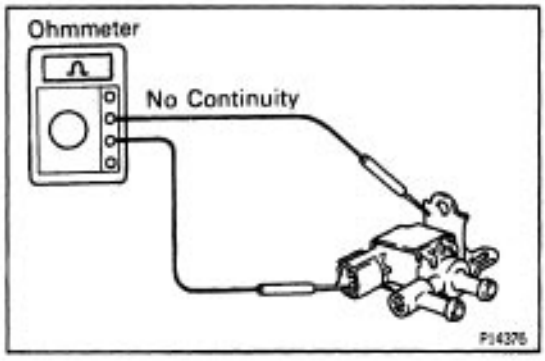
Using an ohmmeter, check that there is continuity between the terminals.

Resistance (Cold):

30–34Ω

If there is no continuity, replace the idle–up valve.

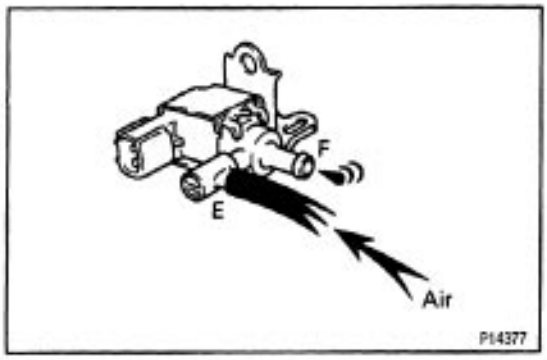




B. Inspect idle–up valve for ground

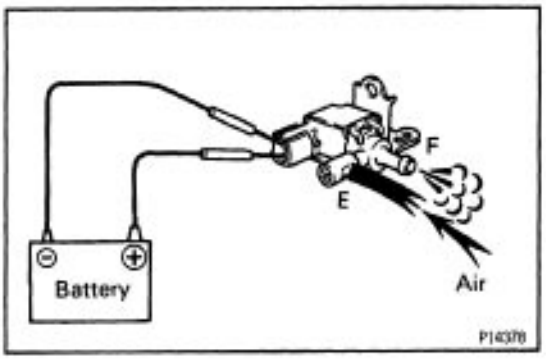
Using an ohmmeter, check that there is no continuity between each terminal and the body.

If there is continuity, replace the idle–up valve.



C. Inspect idle–up valve operation

(a) Check that air does not flow from port E to port F.



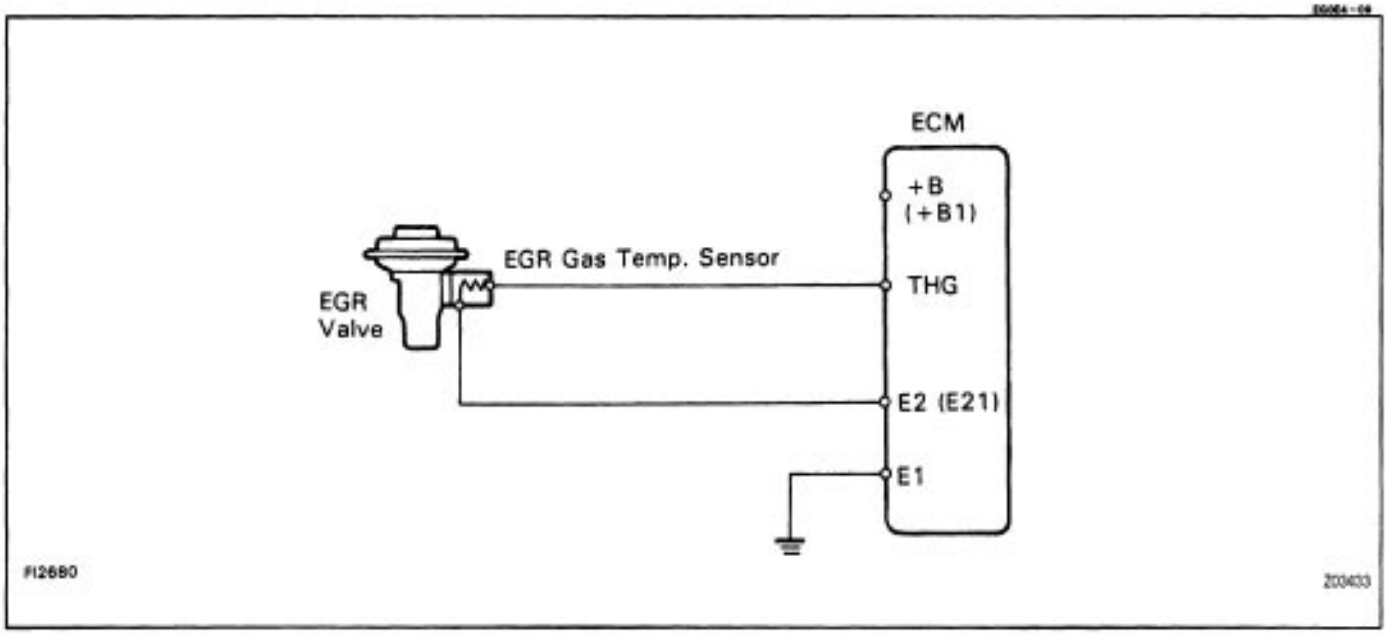
(b) Apply battery voltage across the terminals.

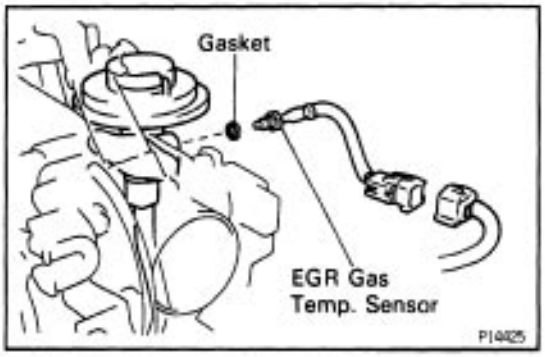
(c) Check that air flows from port E to port F.

If operation is not as specified, replace the idle–up valve.

3. REINSTALL IDLE– UP VALVE

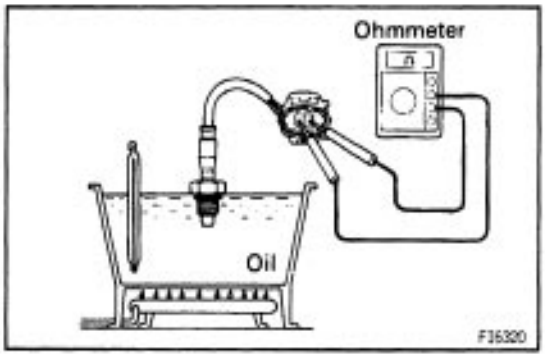
EGR GAS TEMPERATURE SENSOR





EGR GAS TEMPERATURE SENSOR INSPECTION

1. REMOVE EGR GAS TEMPERATURE SENSOR



2. INSPECT EGR GAS TEMPERATURE SENSOR

Using an ohmmeter, measure the resistance between the terminals.

Resistance:

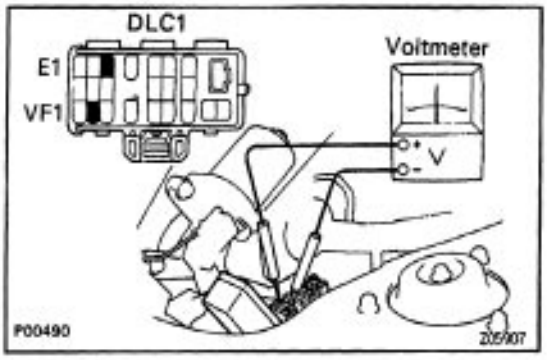
64–97 kΩ at 50°C (122°F)

11–16 kΩ at 100°C (212°F)

2–4 kΩ at 150°C (302°F)

If the resistance is not as specified, replace the sensor.

3. REINSTALL EGR GAS TEMPERATURE SENSOR



OXYGEN SENSOR

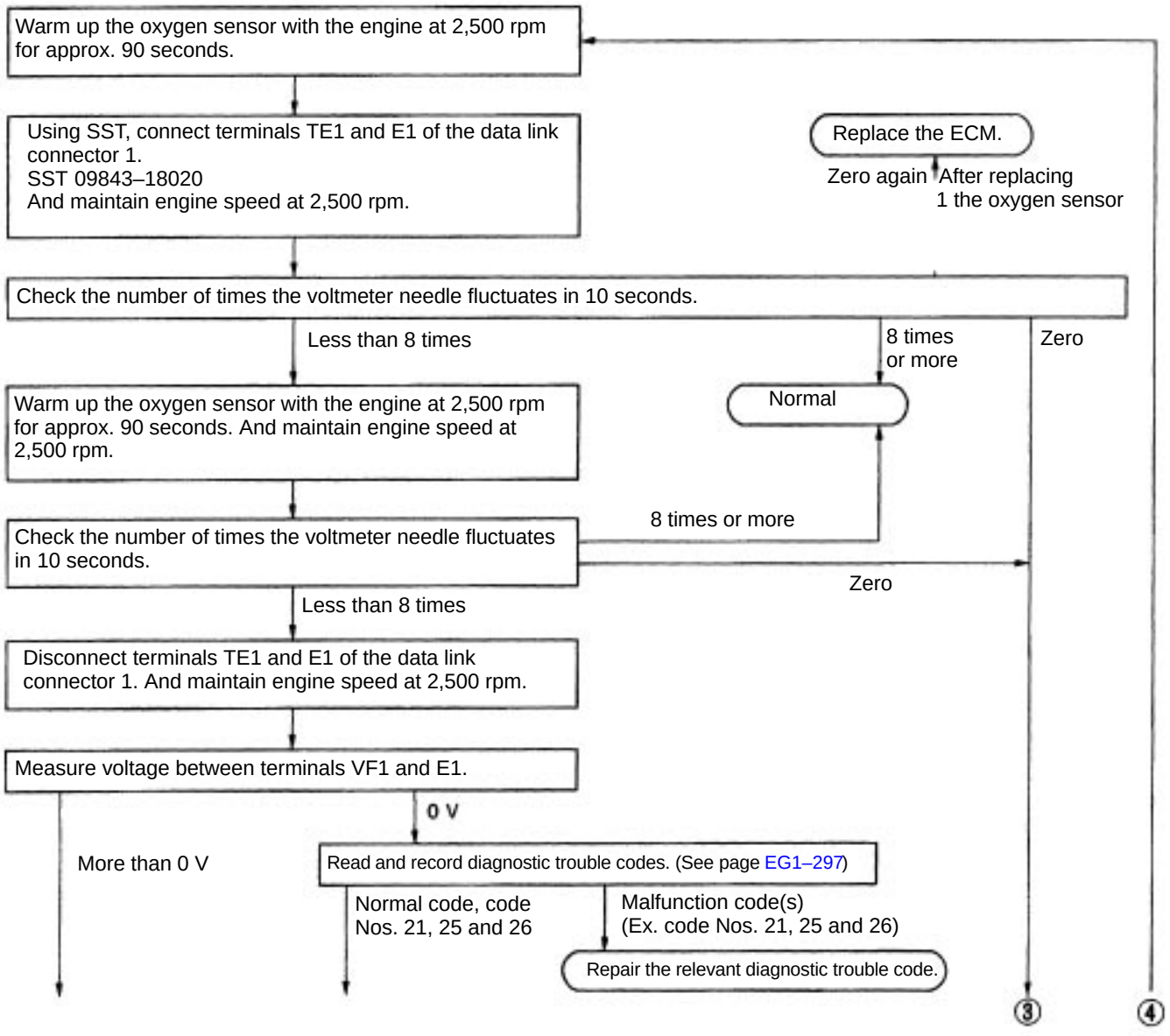
OXYGEN SENSOR INSPECTION

1. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.

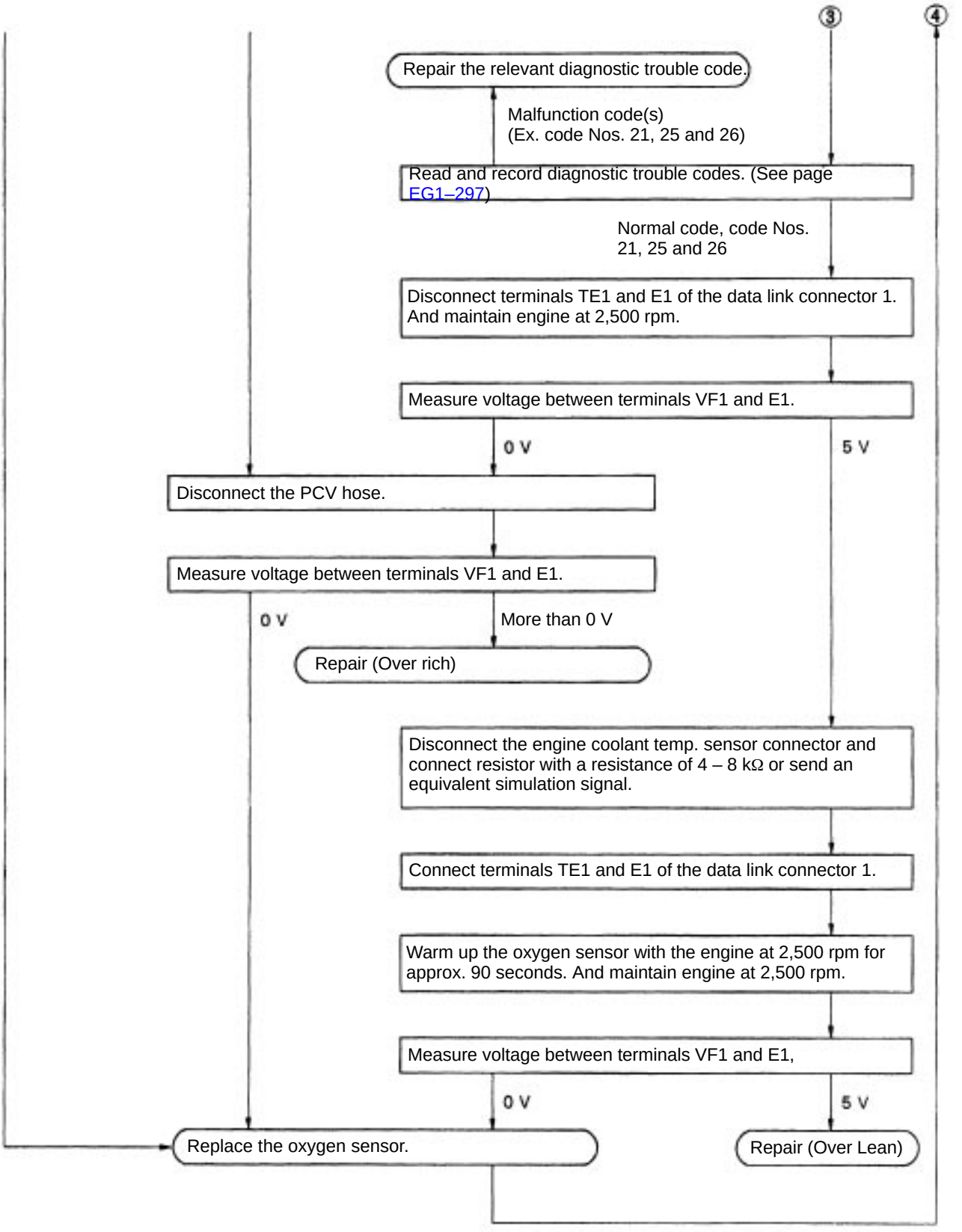
2. INSPECT FEEDBACK VOLTAGE

Connect the positive (+) probe of a voltmeter to terminal VF1 of the data link connector 1 and negative (–) probe to terminal E1. Perform the test as follows:



CONTINUED ON PAGE EG1–232

CONTINUED FROM PAGE EG1–231



V02581

SUB OXYGEN SENSOR

SUB OXYGEN SENSOR INSPECTION

INSPECT SUB OXYGEN SENSOR

HINT: Inspect only when code No. 27 is displayed.

(a) Cancel the diagnostic trouble code. (See page EG1–299)

(b) Warm up the engine until it reaches normal operating temperature.

(c) M/T:

Drive for 5 minutes or more at a speed less than 80 km/h (50 mph) in 4th or 5th gear.

A/T:

Drive for 5 minutes or more at a speed less than 80 km/h (50 mph) in “D” position.

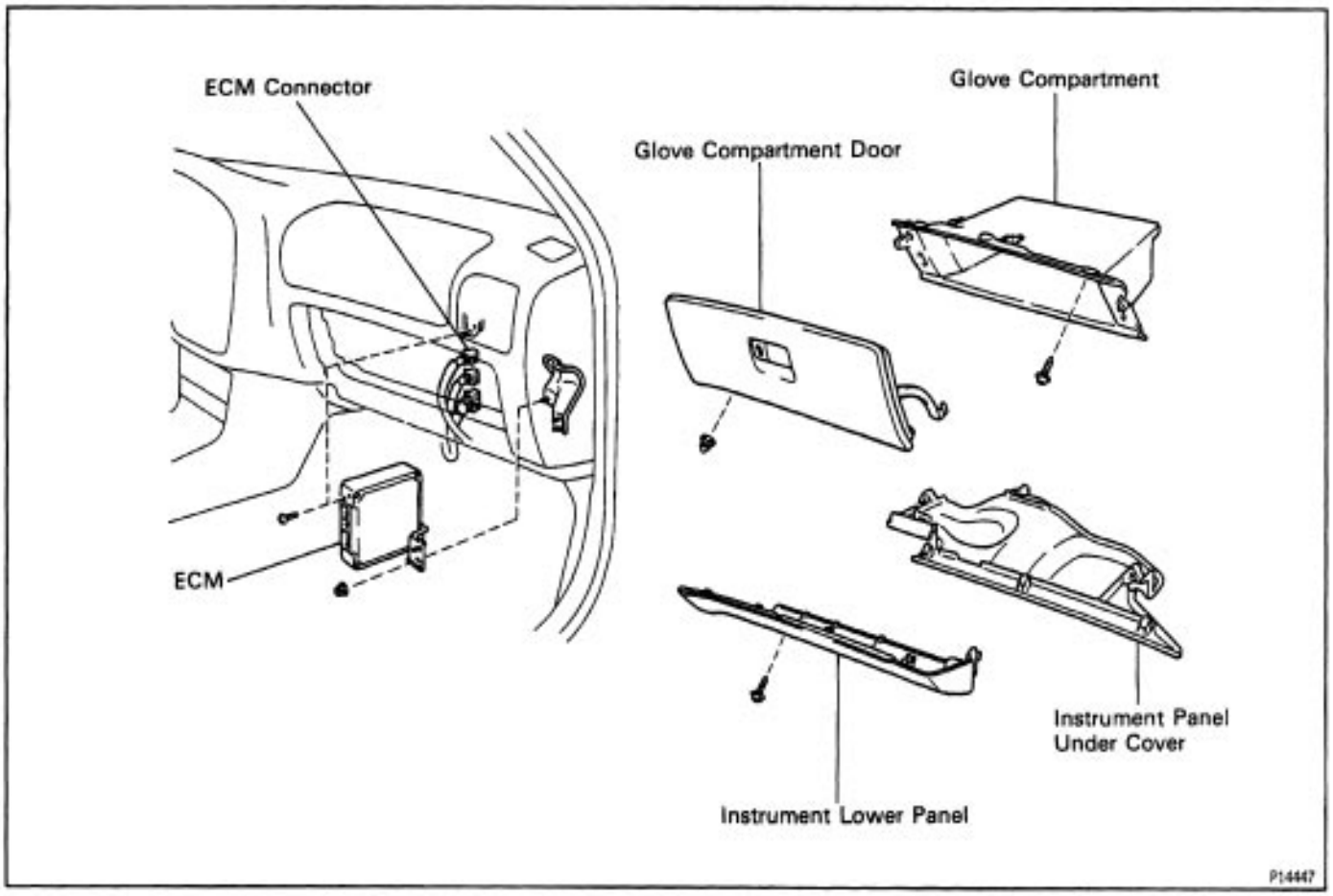
(d) Following the conditions in step (c), fully depress on the accelerator pedal for 2 seconds or more.

(e) Stop the vehicle and turn the ignition switch OFF.

(f) Carry out steps (b), (c) and (d) again to test accelera–tion. If code No.27 appears again, check the sub oxygen sensor circuit. If the circuit is normal, replace the sub oxygen sensor.

ENGINE CONTROL MODULE (ECM)

ECM REMOVAL AND INSTALLATION



ECM INSPECTION

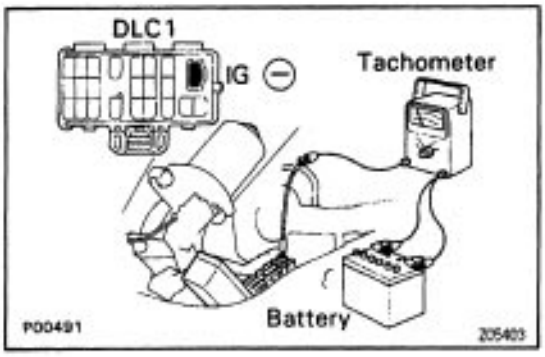
(See page EG1–318)

FUEL CUT RPM

FUEL CUT RPM INSPECTION

1. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.

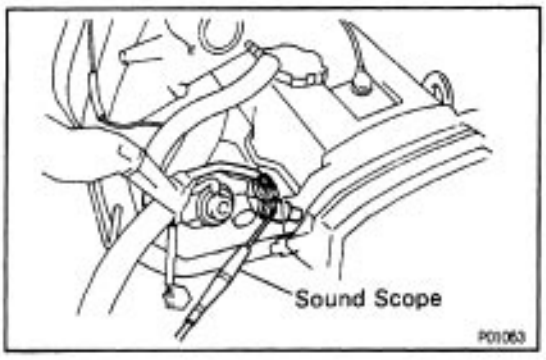


2. CONNECT TACHOMETER TO ENGINE

Connect the test 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 yours before use.**



3. INSPECT FUEL CUT RPM

(a) Increase the engine speed to at least 2,500 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 speed:

1,500 rpm

4. DISCONNECT TACHOMETER

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		0.2 – 3.0 Ω
Injector	Resistance		Approx. 13.8 Ω
	Injection volume		49 – 59 cm³ (3.0 – 3.6 cu in.) per 15 sec.
	Difference between each cylinder		5 cm³ (0.3 cu in.) or less
	Fuel leakage		One drop or less per minute
Throttle body	Throttle body fully closed angle		6°
	Throttle opener setting speed		1,300 – 1,500 rpm (w/ Cooling fan OFF)
Throttle position sensor	Clearance between stop screw and lever		
	0 mm (0 in.)	VTA – E2	0.2 – 5.7 kΩ
	0.50 mm (0.020 in.)	IDL – E2	2.3 kΩ or less
	0.70 mm (0.028 in.)	IDL – E2	Infinity
	Throttle valve fully open	VTA – E2	2.0 – 10.2 kΩ
		VC – E2	2.5 – 5.9 kΩ
IAC valve	Resistance (+B – ISCC or ISCO)		19.3 – 22.3 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
IAT 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
MAP sensor	Power source voltage		4.75 – 5.25 V
VSV for EG R	Resistance		33 – 39 Ω
VSV for Fuel pressure (California only)	Resistance		33 – 39 Ω
A/C idle –up valve	Resistance		30 – 34 Ω
EG R 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
Fuel cut rpm	Fuel return rpm		1,500 rpm

TORQUE SPECIFICATIONS

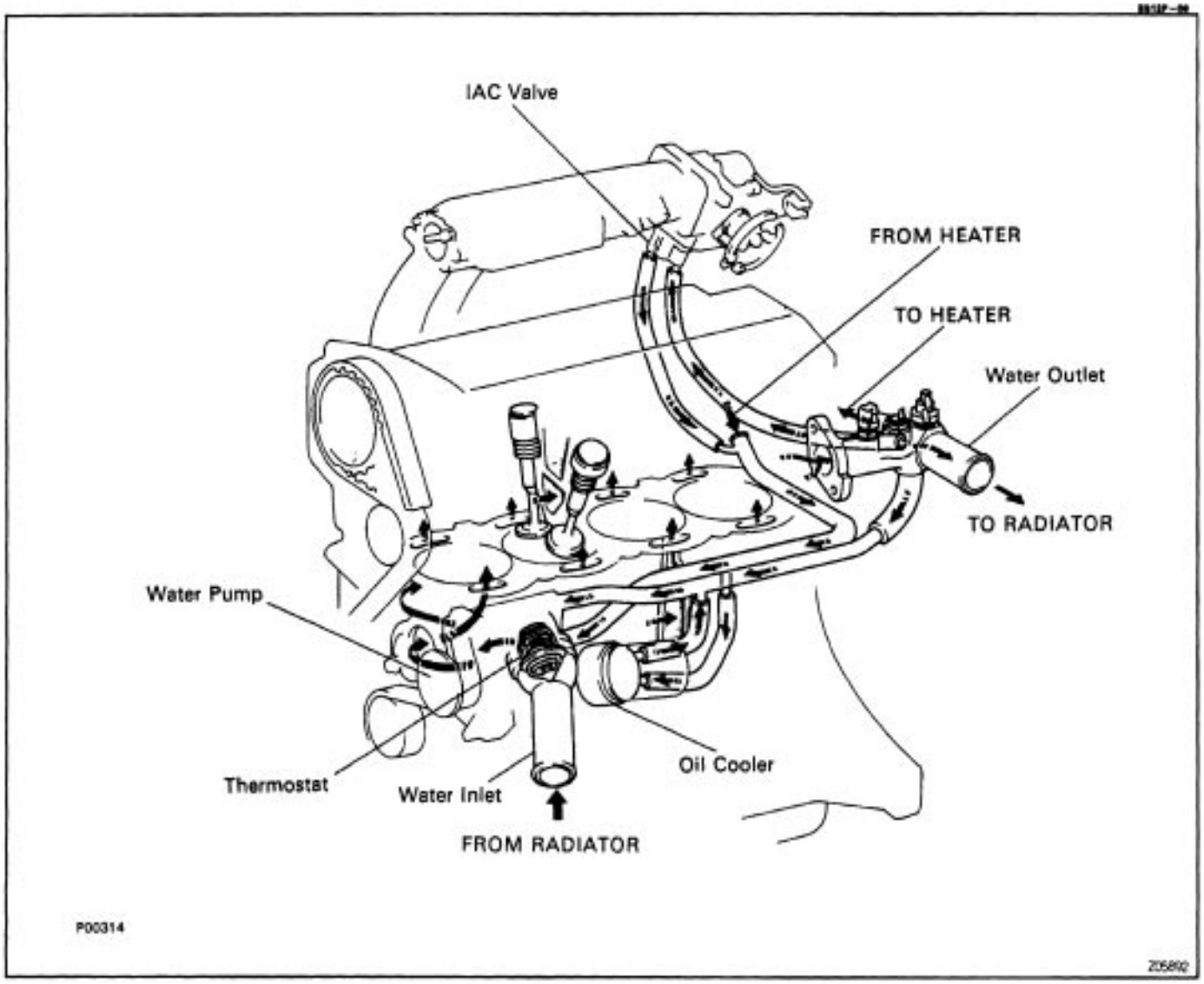
Part tightened		N·m	kgf·cm	ft·lbf
Fuel line (Union bolt type)		29	300	22
Fuel line (Flare nut type – use SST)	Fuel pump side	28	285	21
	Others	30	310	22
Fuel tank band x Body		39	400	29
Fuel pump x Fuel tank		3.9	40	35 in.·lbf
Fuel pressure regulator x Delivery pipe		5.4	55	48 in.·lbf
Fuel return pipe x Fuel pressure regulator		19	195	14
Delivery pipe x Cylinder head		13	130	9
Fuel pulsation damper x Delivery pipe		34	350	25
Intake manifold x Cylinder head		19	195	14
Intake manifold stay x Intake manifold		22	220	16
Intake manifold stay x Cylinder block		42	425	31
No.1 air intake chamber stay x Intake manifold		42	425	31
No.1 air intake chamber stay x Cylinder head		42	425	31
EGR pipe union nut		59	600	43
EGR pipe x Intake manifold		13	130	9
Throttle body x Intake manifold		19	195	14

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, electric fan, hoses and other components.

Engine coolant which is heated in the water jacket is pumped to the radiator, through which an electric fan blows air to cool the coolant as it passes through. Engine 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 performs the function of cooling the coolant which has passed through the water jacket and become hot, and it is mounted in the front of the vehicle. 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 and the filler inlet. It also has a hose attached through which excess coolant or steam can flow. The lower tank has an outlet and drain cock for the coolant. The core contains many tubes through which coolant flows from the upper tank to the lower tank as well as to cooling fins which radiate heat away from the coolant in the tubes. The air sucked through the radiator by the electric fan, as well as the wind generated by the vehicle's travel, passes through the radiator, cooling the coolant. Models with automatic transmission include an automatic transmission fluid cooler built into the lower tank of the radiator. A fan with an electric motor is mounted behind the radiator to assist the flow of air through the radiator. The fan operates when the engine coolant temperature becomes high in order to prevent it from becoming too high.

RADIATOR CAP

The radiator cap is a pressure type cap which seals the radiator, resulting in pressurization of the radiator as the coolant expands. The pressurization prevents the coolant from boiling even when the engine coolant temperature exceeds 100˚C (212˚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˚C (230–248˚F), pressure; 58.8103.0 kpa (0.6–1.05 kgf/cm^2, 8.5–14.9 psi). The vacuum valve opens to alleviate the vacuum which develops in the cooling system after the engine is stopped and the engine 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 from the cooling system as a result of volumetric expansion when the coolant is heated. The coolant in the reservoir tank returns to the radiator 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 engine coolant temperature. This valve closes when the engine 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 engine 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±1C (180±1F).

PREPARATION

SST (SPECIAL SERVICE TOOLS)

	09228–06500 Oil Filter Wrench	
	09230–01010 Radiator Service Tool Set	

RECOMMENDED TOOLS

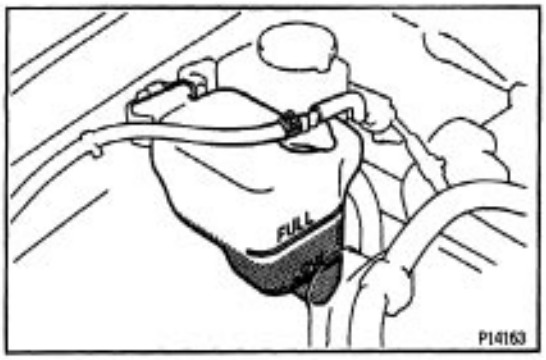
	09082–00050 TOYOTA Electrical Tester Set	

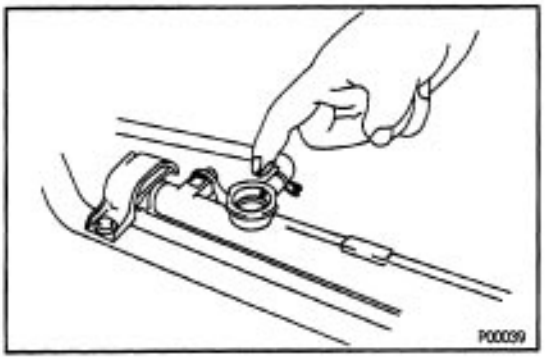
EQUIPMENT

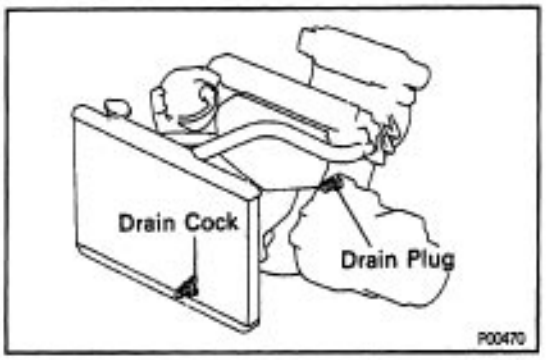
Heater	Engine coolant temperature switch
Radiator cap tester	
Thermometer	Engine coolant temperature switch
Torque wrench	

COOLANT

Item	Capacity	Classification
Engine coolant (w/ Heater)	6.3 liters (6.7 US qts, 5.5 Imp. qts)	Ethylene–glycol base







COOLANT CHECK AND REPLACEMENT

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

There should not be any excessive deposits of rust or scales around the radiator cap or radiator filler hole, and the engine coolant should be free from oil.
If excessively dirty, replace the engine coolant.

3. REPLACE ENGINE COOLANT

(a) Remove the radiator cap.

CAUTION: To avoid the danger of being burned, do not remove It while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.

(b) Drain the engine coolant from the radiator drain cock and engine drain plug. (Engine drain plug at the right rear of cylinder block.)

(c) Close the drain cock and plug.

Torque (Engine drain plug):
13 N–m (130 kgf–cm, 9 ft–lbf)

(d) Slowly fill the system with coolant.
Use a good brand of ethylene–glycol base coolant and mix it according to the manufacturer’s directions.
Using engine coolant which includes more than 5096 ethylene–glycol (but not more than 7096) is recommended.

NOTICE:

- **Do not use a alcohol type coolant.**
- **The engine coolant should be mixed with demineral–ized water or distilled water.**
  Capacity (w/ Heater):
  8.3 liters (6.7 US qts, 5.5 Imp.qts)

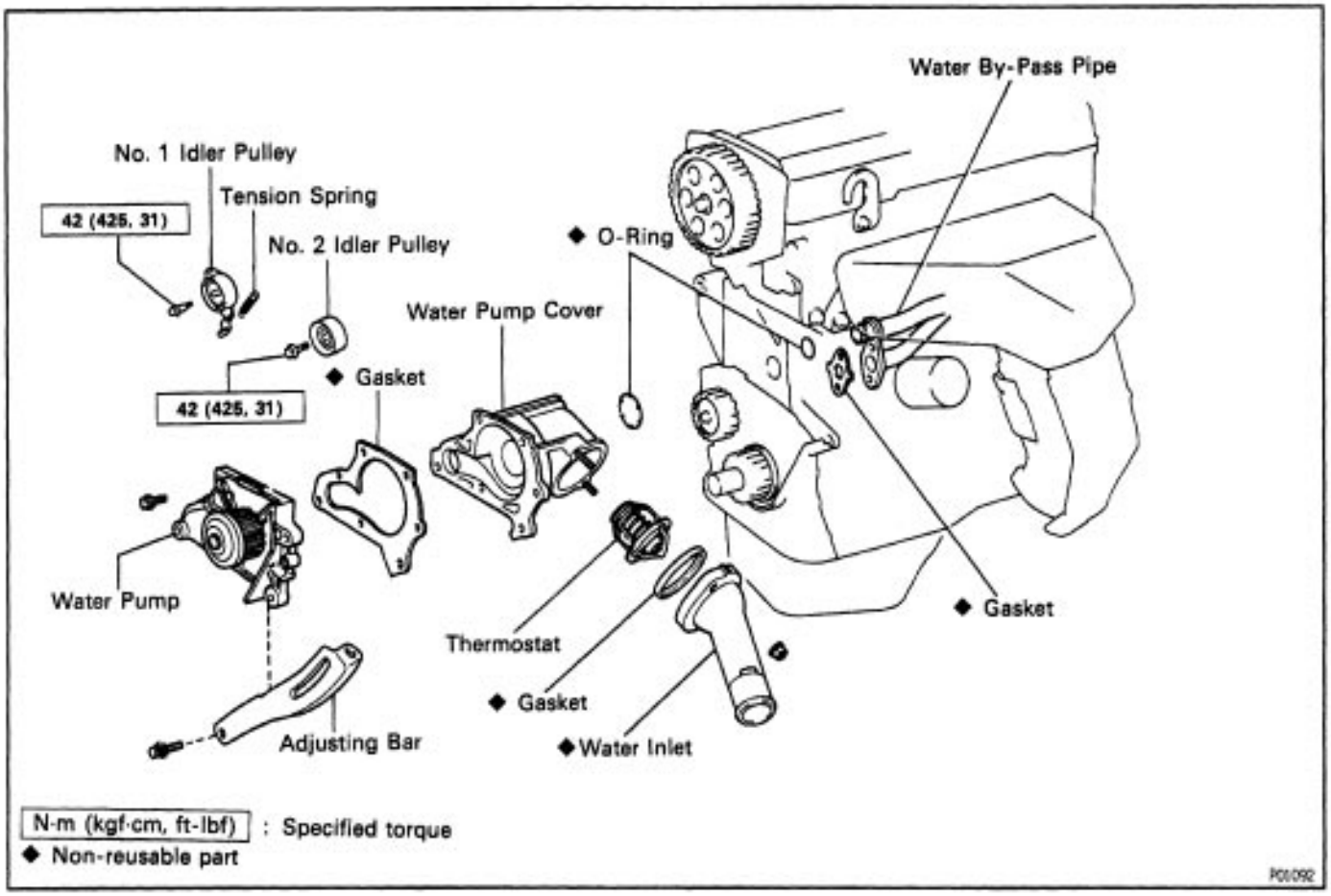
(a) Reinstall the radiator cap.

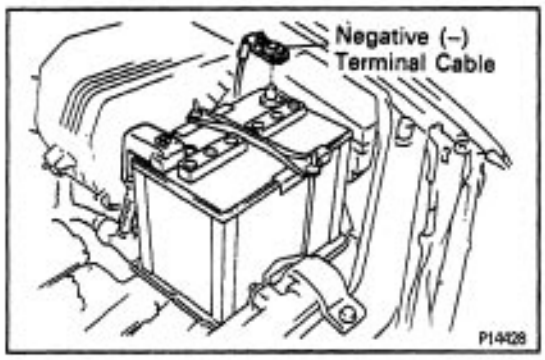
(f) Warm up the engine and check for leaks.

(g) Recheck the engine coolant level and refill as neces–sary.

WATER PUMP

COMPONENTS FOR REMOVAL AND INSTALLATION



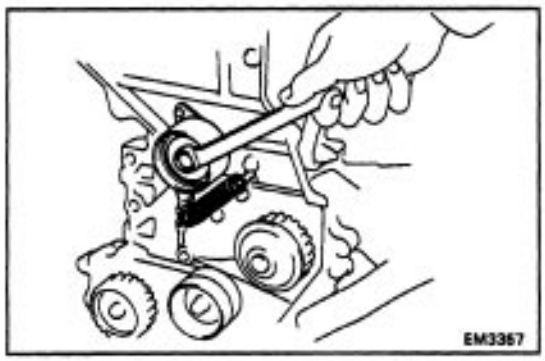


WATER PUMP REMOVAL

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.

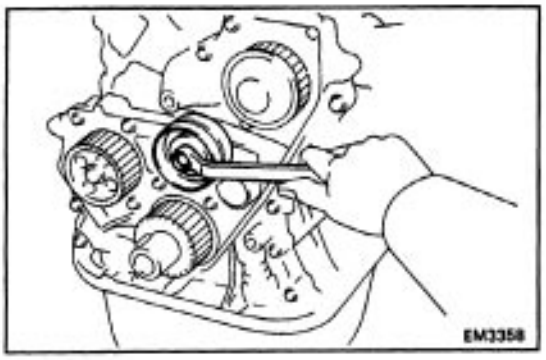
2. DRAIN ENGINE COOLANT (See page EG1–241)



3. REMOVE TIMING BELT (See page EG1–26)

4. REMOVE NO. 1 IDLER PULLEY AND TENSION SPRING

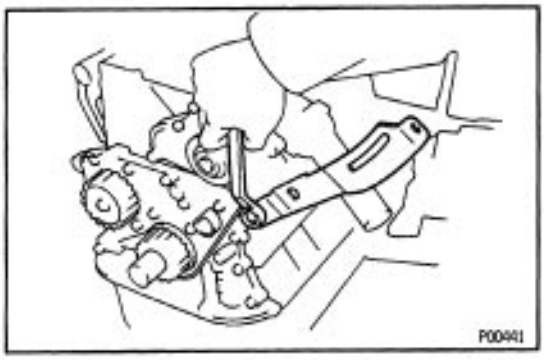
Remove the bolt, pulley and tension spring.



5. REMOVE NO.2 IDLER PULLEY

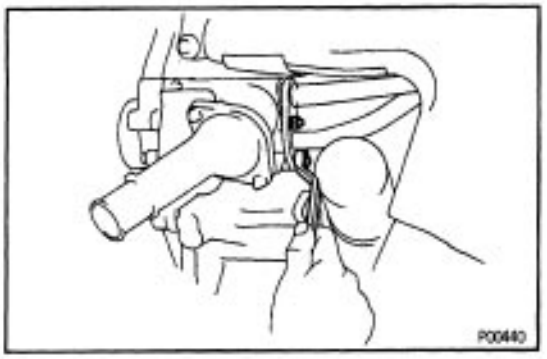
Remove the bolt and pulley.

6. DISCONNECT LOWER RADIATOR HOSE FROM WATER INLET



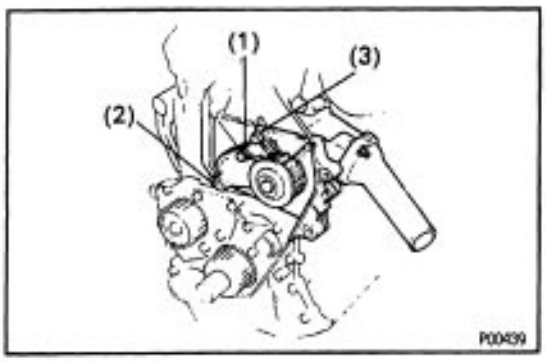
7. REMOVE GENERATOR BELT ADJUSTING BAR

Remove the bolt and adjusting bar.



8. REMOVE WATER PUMP AND WATER PUMP COVER ASSEMBLY

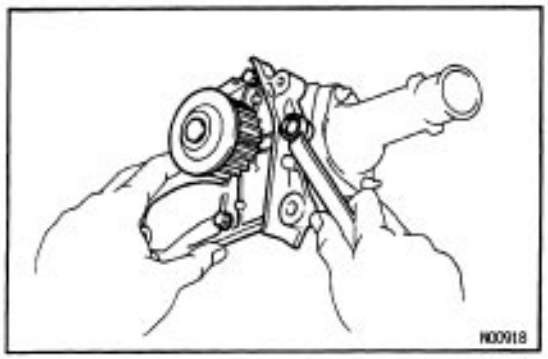
(a) Remove the 2 nuts holding the pump to the water bypass pipe.



(b) Remove the 3 bolts in the sequence shown.

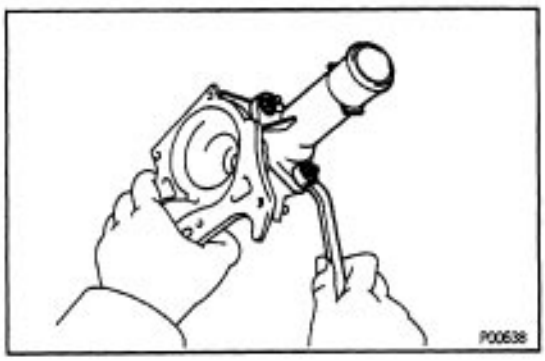
(c) Pull out the water pump together with the water pump cover.

(d) Remove the gasket and 2 O–rings from the water pump and water bypass pipe.



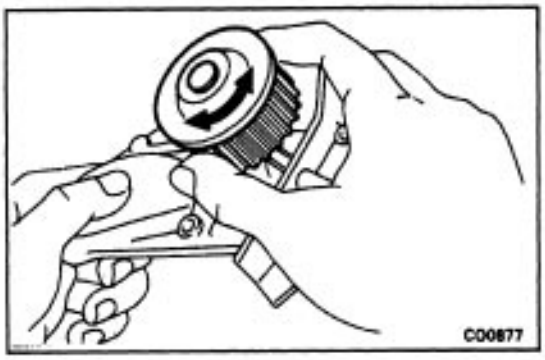
9. SEPARATE WATER PUMP AND WATER PUMP COVER

Remove the 3 bolts, water pump and gasket from the water pump cover.



10. REMOVE WATER INLET AND THERMOSTAT FROM WATER PUMP COVER

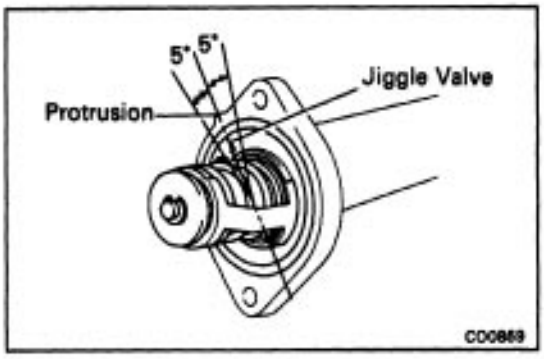
(a) Remove the 2 nuts and water inlet from the water pump.
(b) Remove the thermostat.
(c) Remove the gasket from the thermostat.



WATER PUMP INSPECTION

INSPECT WATER PUMP

Turn the pulley and check that the water pump bearing moves smoothly and quietly.



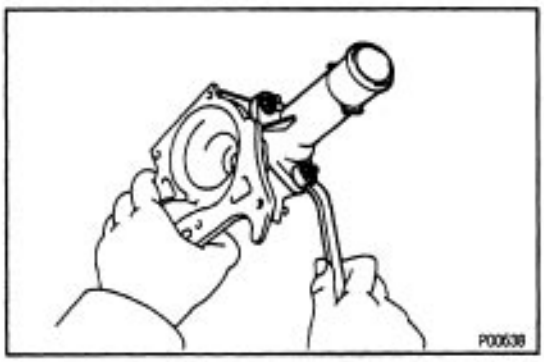
WATER PUMP INSTALLATION

(See Components for Removal and Installation)

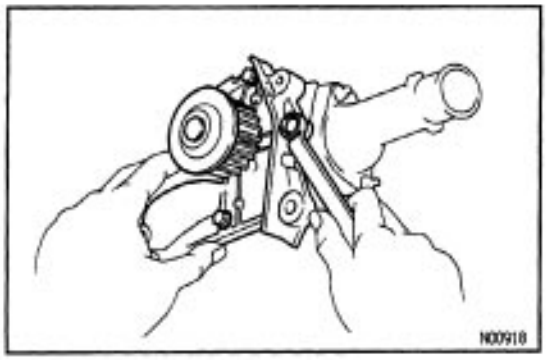
1. INSTALL THERMOSTAT AND WATER INLET TO WATER PUMP COVER

(a) Install a new gasket to the thermostat.
(b) Align the jiggle valve of the thermostat with the upper side of the stud bolt, and insert the thermostat in the water pump.

HINT: The jiggle valve may be set within 5° of either side of the prescribed position.



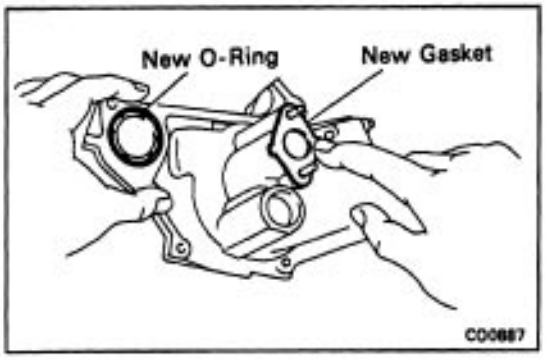
(c) Install the water inlet with the 2 nuts.
Torque: 8.8 N–m (90 kgf–cm. 78 in.–lbf)



2. ASSEMBLE WATER PUMP AND WATER PUMP COVER

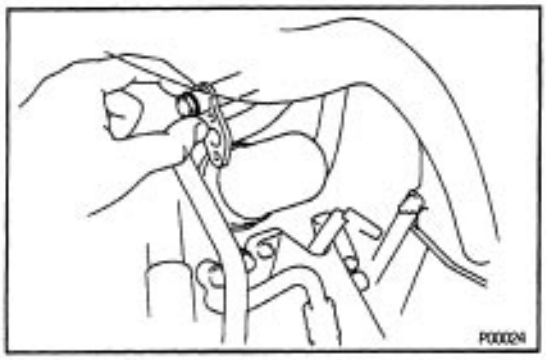
Install a new gasket and the water pump to the pump cover with the 3 bolts.

Torque: 9.3 N–m (95 kgf–cm, 82 In.–lbf)

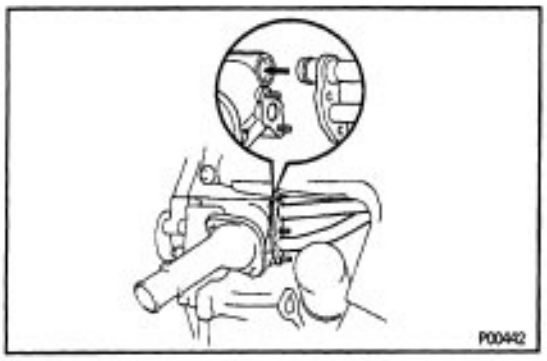


3. INSTALL WATER PUMP AND WATER PUMP COVER ASSEMBLY

(a) Install new O–ring and gasket to water pump cover.

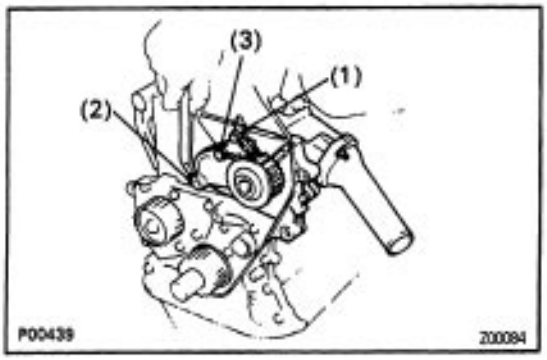


(b) Instal a new O–ring to the water bypass pipe.



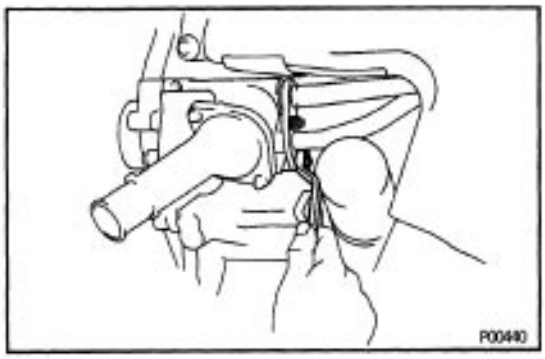
(c) Apply soapy water to the O–ring on the water bypass pipe.

(d) Connect the pump cover to the water bypass pipe. Do not install the nuts yet.



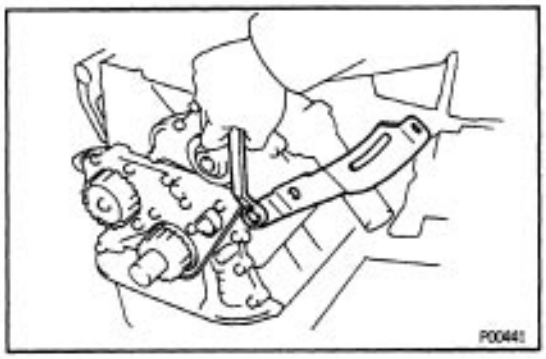
(e) Install the water pump with the 3 bolts. Tighten the bolts in the sequence shown.

Torque: 9.3 N–m (95 kgf–cm, 82 in.–lbf)



(f) Install the 2 nuts holding the water pump cover to the water bypass pipe.

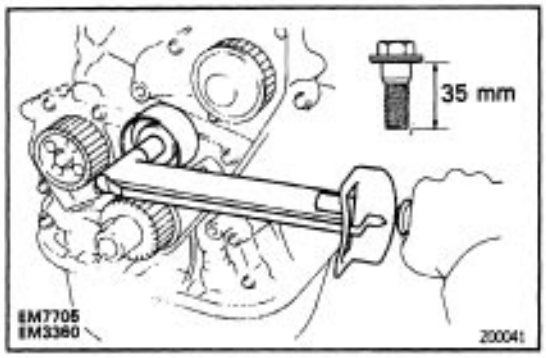
Torque: 8.8 N–m (90 kgf–cm, 78 in.–lbf)



4. INSTALL GENERATOR BELT ADJUSTING BAR

Temporarily install the adjusting bar with the bolt.

5. CONNECT LOWER RADIATOR HOSE TO WATER INLET



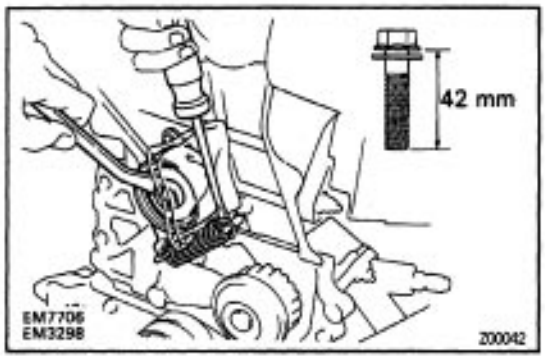
6. INSTALL NO.2 IDLER PULLEY

(a) Install the pulley with the bolt.

Torque: 42 N–m (425 kgf–cm, 31 ft–lbf)

HINT: Use a bolt 35 mm (1.38 in.) in length.

(b) Check that the idler pulley moves smoothly.



7. TEMPORARILY INSTALL NO.1 IDLER PULLEY AND TENSION SPRING

(a) Install the pulley with the bolt. Do not tighten the bolt yet.

HINT: Use bolt 42 mm (1.65 in.) in length.

(b) Install the tension spring.

(c) Pry the pulley toward the left as far as it will go and tighten the bolt.

(d) Check that the idler pulley moves smoothly.

8. INSTALL TIMING BELT (See page EG1–33)

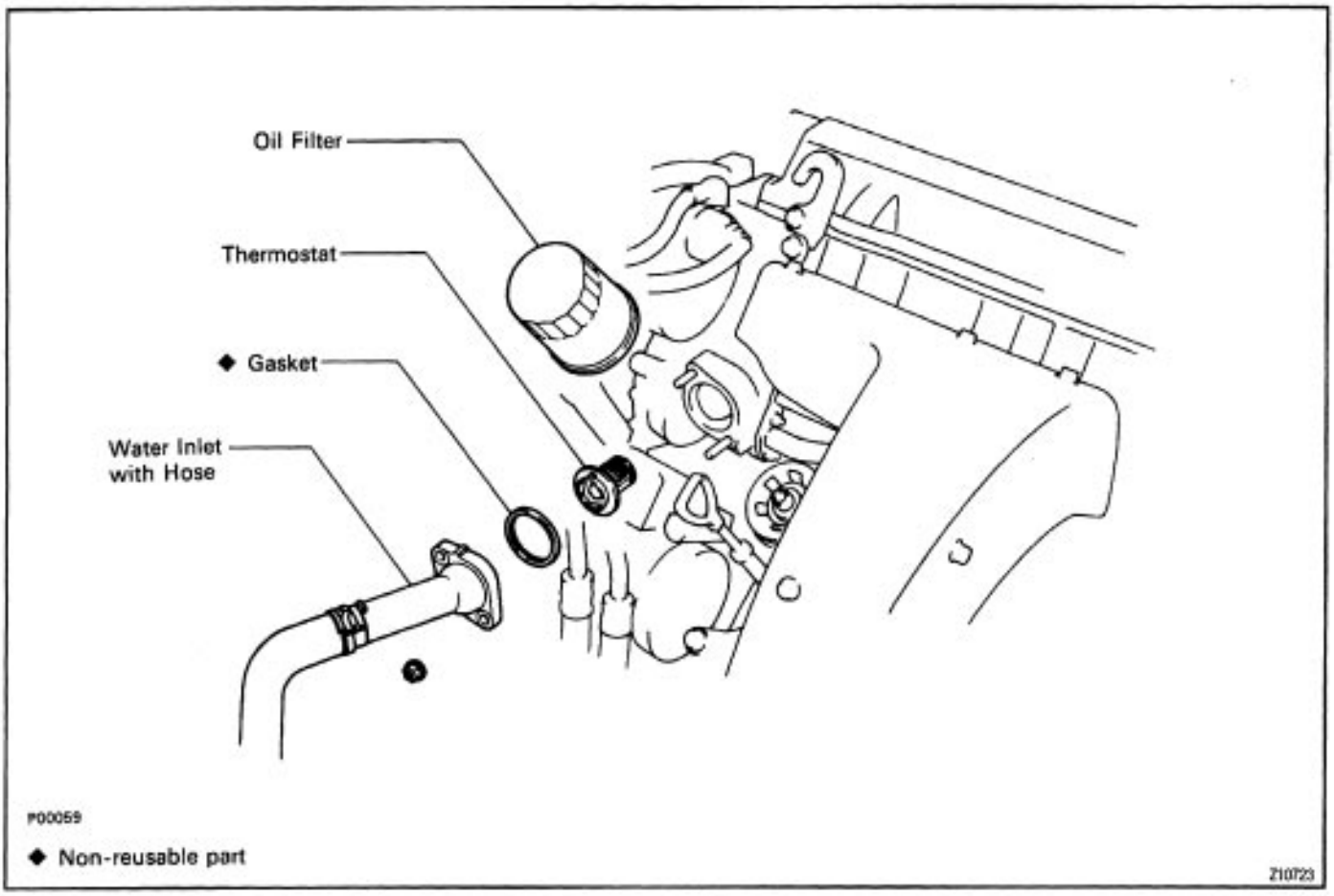
9. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY

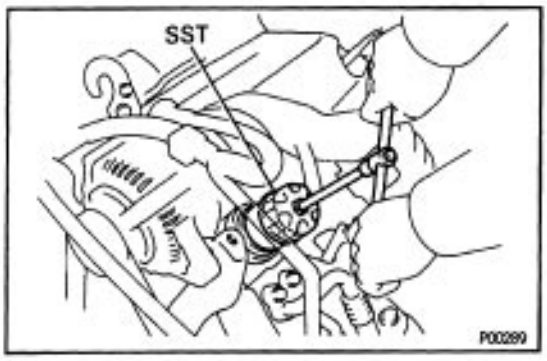
10. FILL WITH ENGINE COOLANT

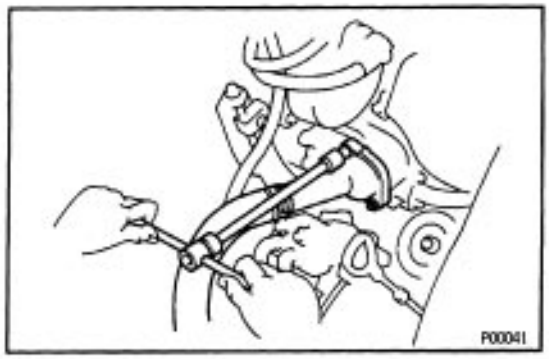
(See page EG1–241)

THERMOSTAT

COMPONENTS FOR REMOVAL AND INSTALLATION







THERMOSTAT REMOVAL

HINT: Removal of the thermostat would have an adverse effect, causing a lowering of cooling efficiency. Do not remove the thermostat, even if the engine tends to overheat.

1. DRAIN ENGINE COOLANT (See page EG1–241)

2. REMOVE OIL FILTER

Using SST, remove the oil filter.

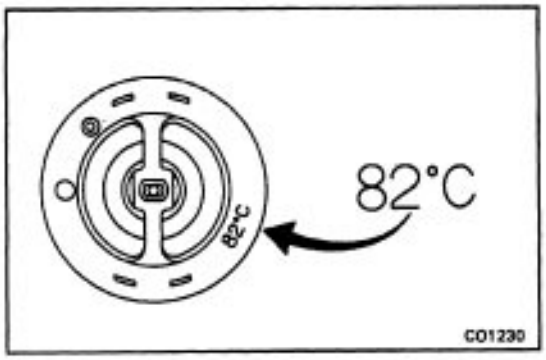
SST 09228–06500

3. REMOVE WATER INLET AND THERMOSTAT

(a) Remove the 2 nuts and water inlet from the water pump.

(b) Remove the thermostat.

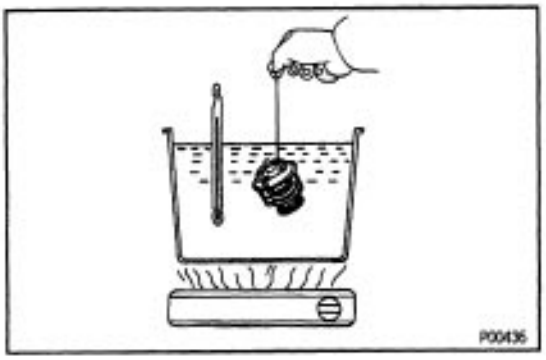
(c) Remove the gasket from the thermostat.



THERMOSTAT INSPECTION

INSPECT THERMOSTAT

HINT: The thermostat is numbered with the valve opening temperature.



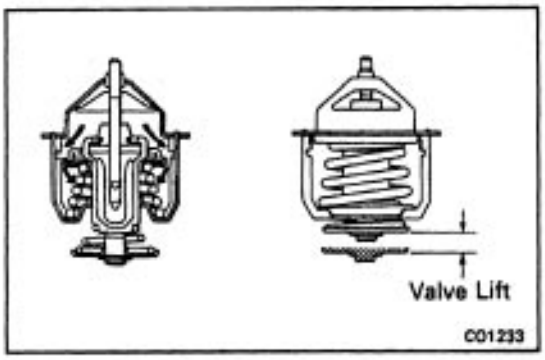
(a) Immerse the thermostat in water and gradually heat the water.

(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.

Valve rift:

8 mm (0.31 in.) or more at 95°C (203°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.

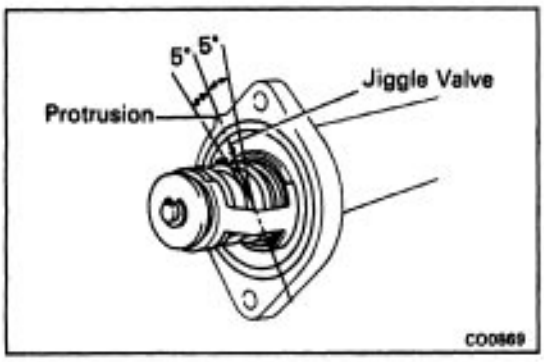
THERMOSTAT INSTALLATION

(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 the upper side of the stud bolt, and insert the thermostat in the water pump.

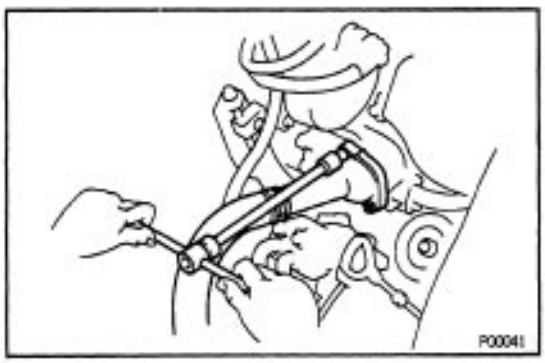


HINT: The jiggle valve may be set within 5°of either side of the prescribed position.

2. INSTALL WATER INLET

Install the water inlet with the 2 nuts.

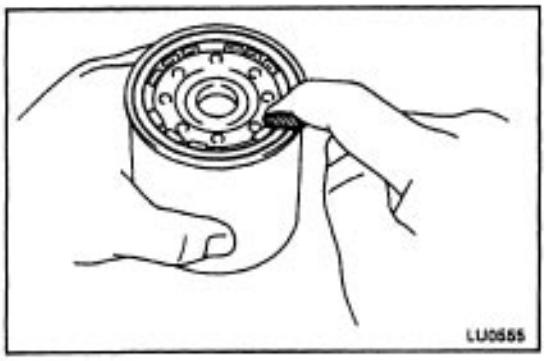
Torque: 8.8 N–m (90 kgf–cm, 78in.–lbf)



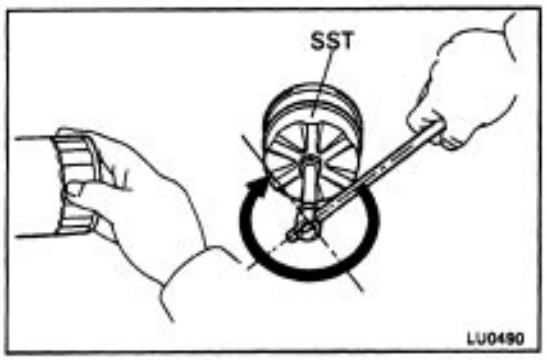


3. INSTALL OIL FILTER

(a) Clean the oil filter contact surface on the filter mounting.



(b) Lubricate the filter rubber gasket with engine oil.

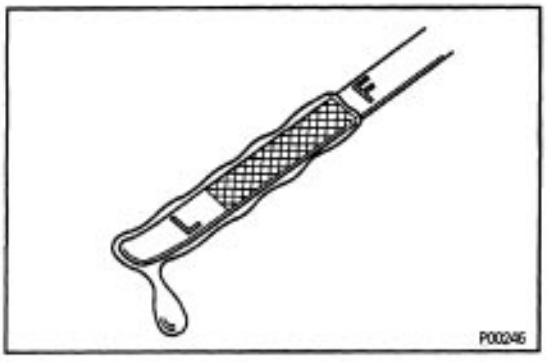


(c) Tighten the oil filter by hand until the rubber gasket contacts the seat of the filter mounting. Then using SST, give it an additional 3/4 turn to seat the oil filter.
SST 09228–06500

4. FILL WITH ENGINE OIL

5. FILL WITH ENGINE COOLANT (SEE PAGE EG1–241)

6. START ENGINE AND CHECK FOR LEAKS



7. CHECK ENGINE OIL LEVEL

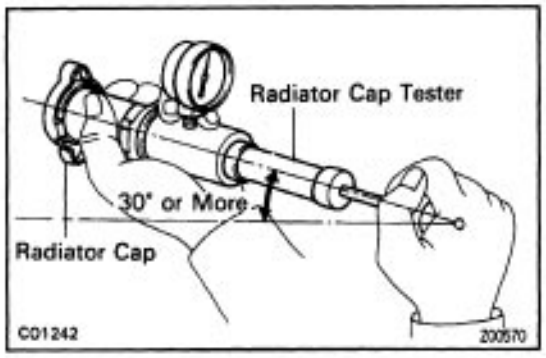
The oil level should be between the “L” and “F” marks on the dipstick.
If low, check for leakage and add oil up to “F” mark.

RADIATOR

RADIATOR CLEANING

Using water or a steam cleaner, remove any mud or 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^1, 427 – 498 psi), keep a distance of at least 40 cm (15.75 in.) between the radiator core and cleaner nozzle.



RADIATOR INSPECTION

1. INSPECT RADIATOR CAP

NOTICE: When performing steps (a) and (b) below, keep the radiator pump tester at an angle of over 30 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

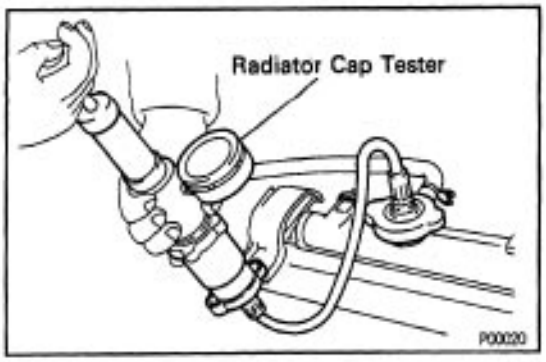
NOTICE: Push the pump at a constant speed.

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:
74–103 kPa
(0.75–1.05 kgf/cm^1, 10.7 – 14.9 psi)
Minimum opening pressure:
59 kPa (0.6 kgf/cm^1, 8.5 psi)

If the opening pressure is less than minimum, replace the radiator cap.



2. INSPECT COOLING SYSTEM FOR LEAKS

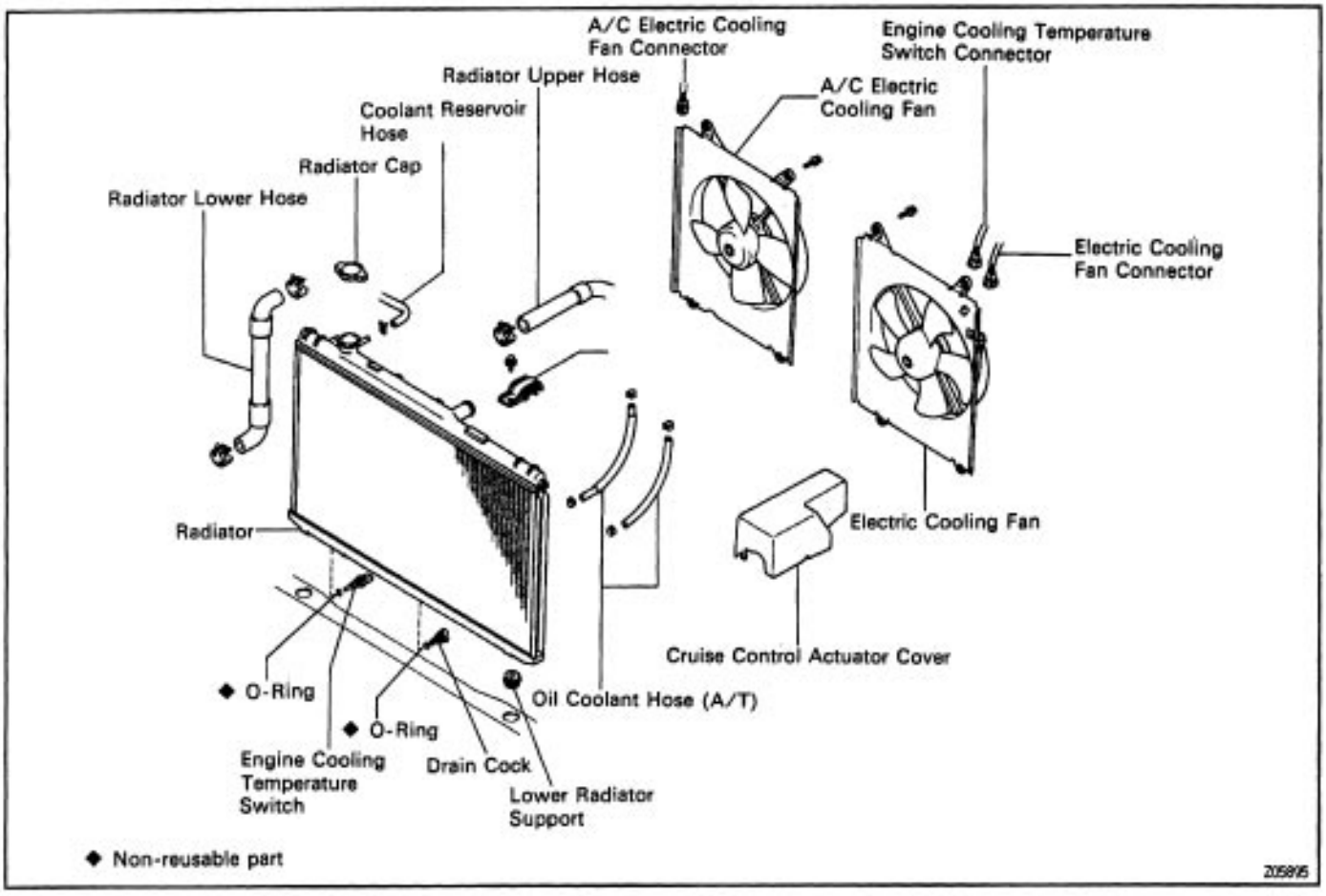
(a) Fill the radiator with coolant and attach a radiator cap tester.

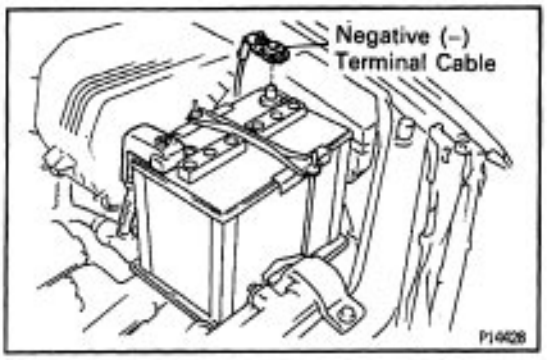
(b) Warm up the engine.

(c) Pump it to 118 kPa (1.2 kgf/cm1, 17.1 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 head.

COMPONENTS FOR REMOVAL AND INSTALLATION



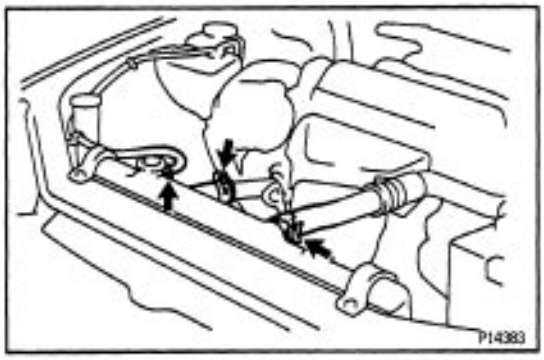


RADIATOR REMOVAL

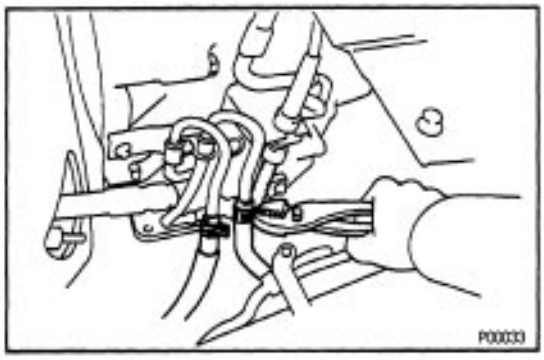
1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY

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.

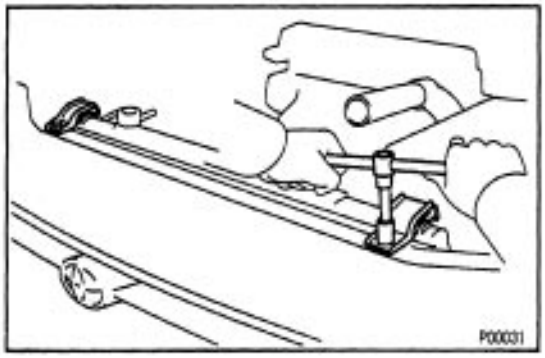
2. DRAIN ENGINE COOLANT (See page EG1–241)
3. w/ CRUISE CONTROL SYSTEM:
REMOVE CRUISE CONTROL ACTUATOR COVER
4. DISCONNECT ENGINE COOLANT TEMPERATURE SWITCH CONNECTOR FROM FAN SHROUD
5. DISCONNECT ELECTRIC COOLING FAN CONNECTORS



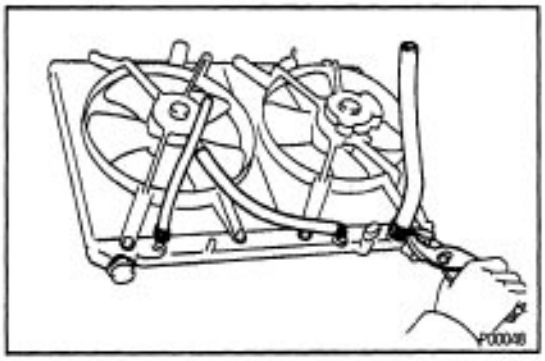
6. DISCONNECT RADIATOR HOSES
(a) Disconnect the upper hose from the radiator side.
(b) Disconnect the lower from the water inlet pipe.
7. DISCONNECT ENGINE COOLANT RESERVOIR HOSE



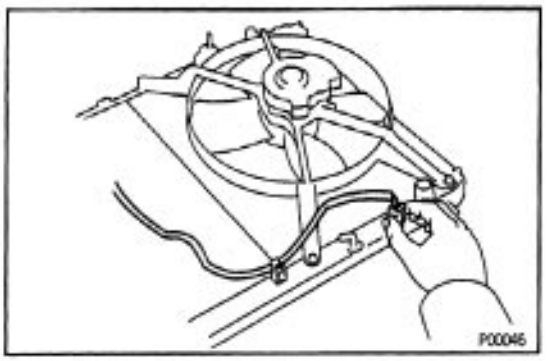
8. A/T:
DISCONNECT OIL COOLER HOSES



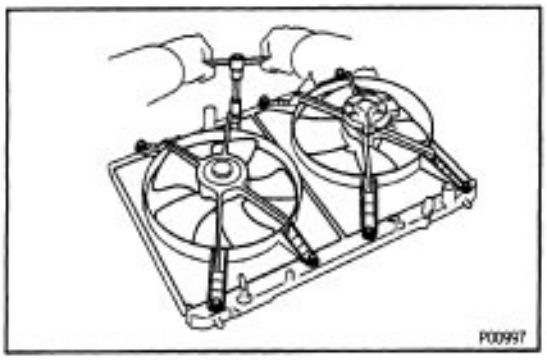
9. REMOVE RADIATOR AND ELECTRIC COOLING FANS
(a) Remove the 2 bolts and 2 upper supports.
(b) Lift out the radiator.
(c) Remove the 2 lower radiator supports.



10. REMOVE RADIATOR LOWER HOSE
11. A/T:
REMOVE A/T OIL COOLER HOSES

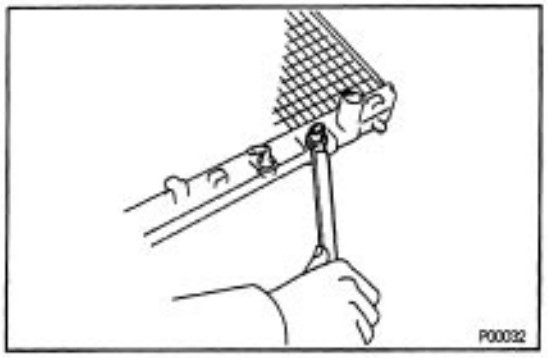


12. REMOVE ENGINE COOLANT TEMPERATURE SWITCH WIRE



13. REMOVE ELECTRIC COOLING FANS FROM RADIATOR

Remove the 8 bolts and cooling fans.

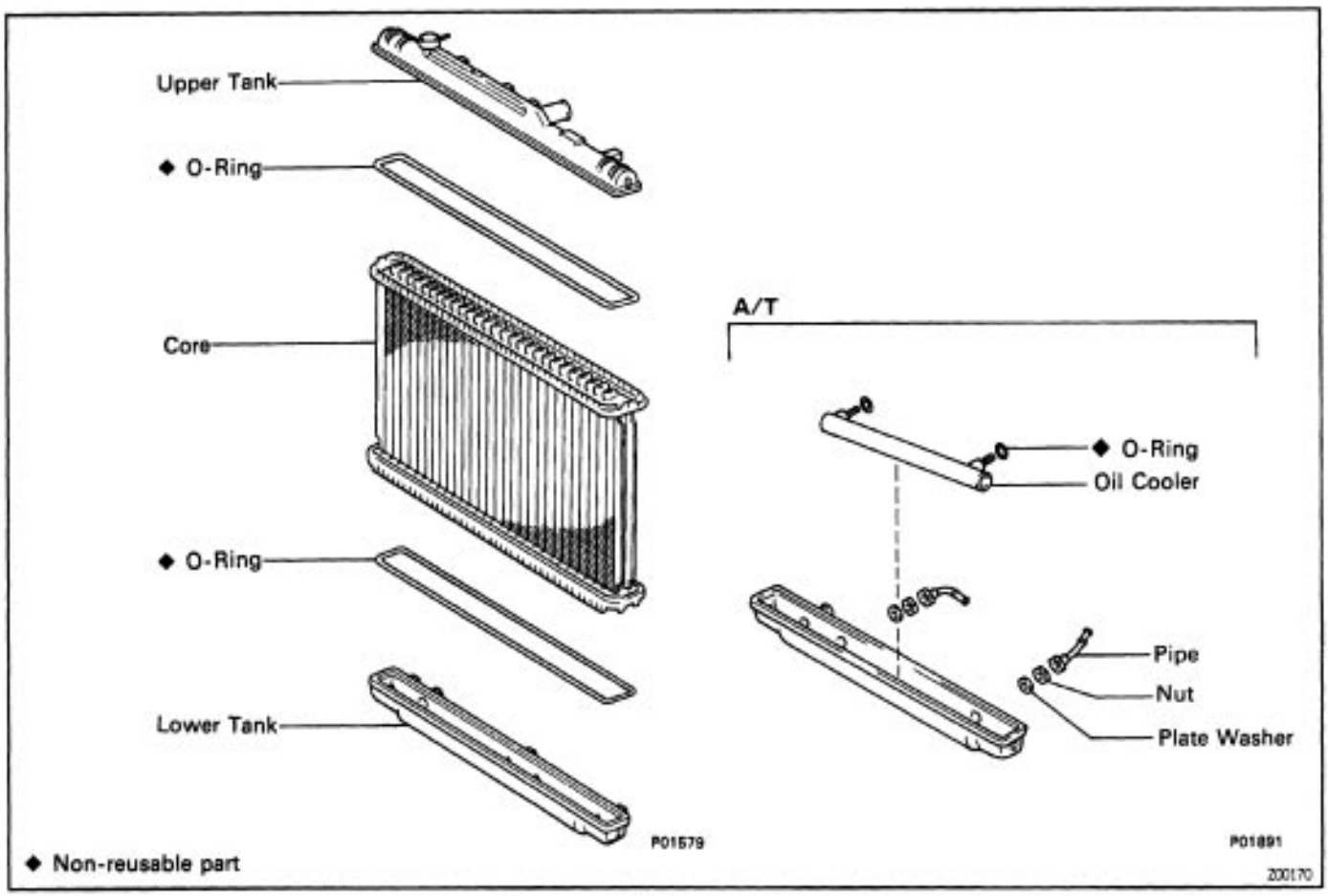


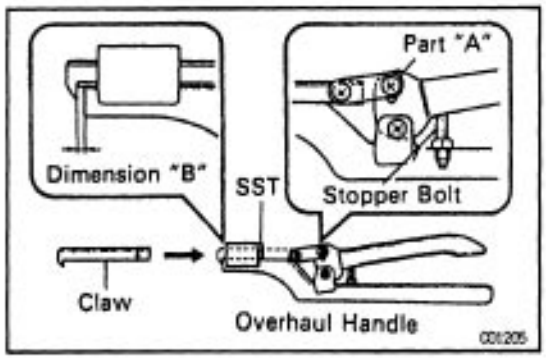
14. REMOVE ENGINE COOLANT TEMPERATURE SWITCH

(a) Remove the engine coolant temperature switch.

(b) Remove the 0–ring.

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY





RADIATOR DISASSEMBLY

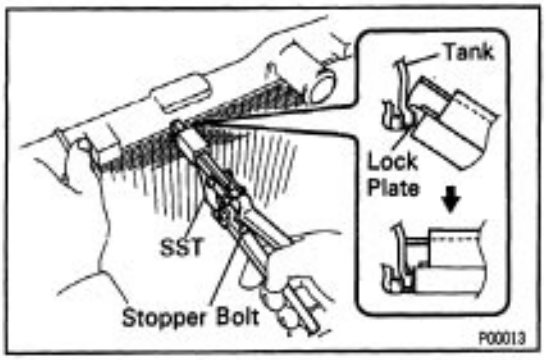
1. ASSEMBLE SST

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.).

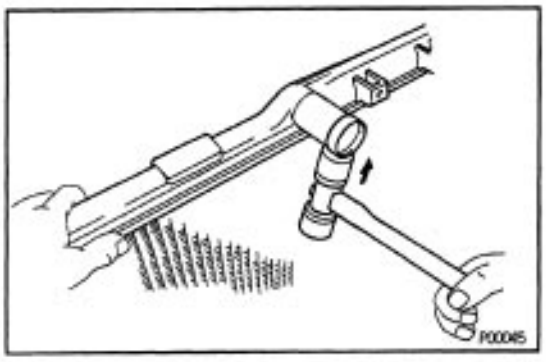
NOTICE: If this adjustment is not performed, the claw may be damaged.



2. UNCAULK LOCK PLATES

Using SST to release the caulking, squeeze the handle until stopped by the stopper bolt.

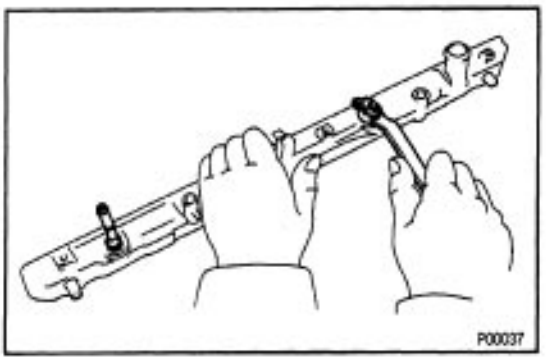
SST 09230–01010



3. REMOVE TANKS AND O–RINGS

(a) Lightly tap the radiator hose inlet (or outlet) with a soft–faced hammer and remove the tank.

(b) Remove the 0–ring.



4. A/T:

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. A/T:

INSTALL OIL COOLER TO LOWER TANK

(a) Clean the 0–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).

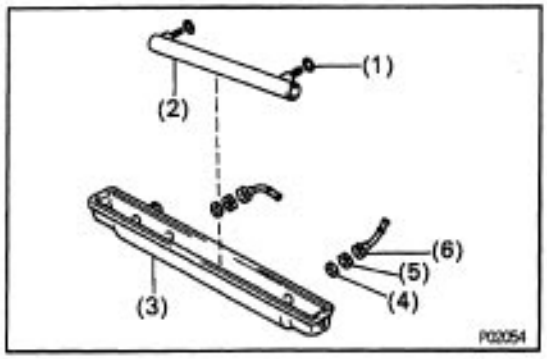
(d) Install the plate washers (4) and nuts (5). Torque the nuts.

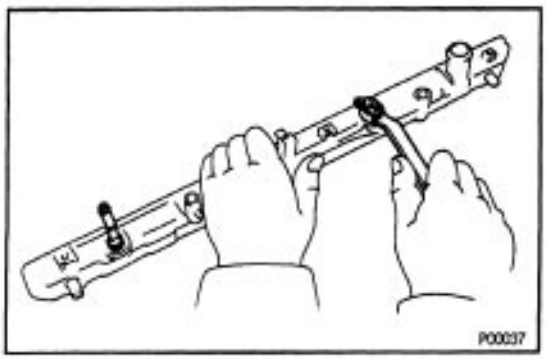
Torque: 8.3 N–m (85 kgf–cm, 74 in.–lbf)

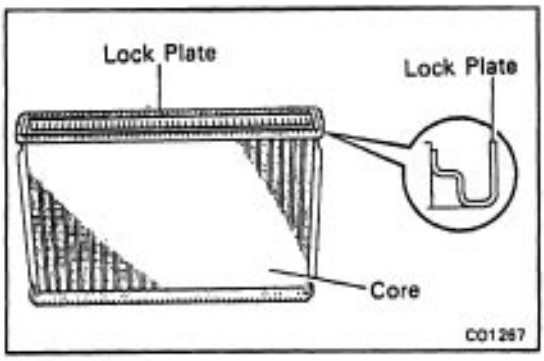
(e) Install the pipes (6).

Torque: 22 N–m (220 kgf–cm, 16 ft–lbf)

HINT: Face the pipes in the same direction as before disassembly.





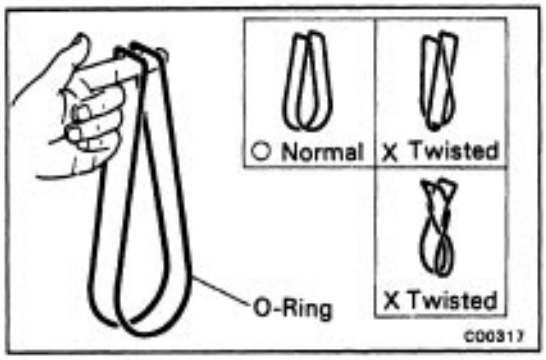


2. INSPECT LOCK PLATE

Inspect the lock plate for damage.

HINT:

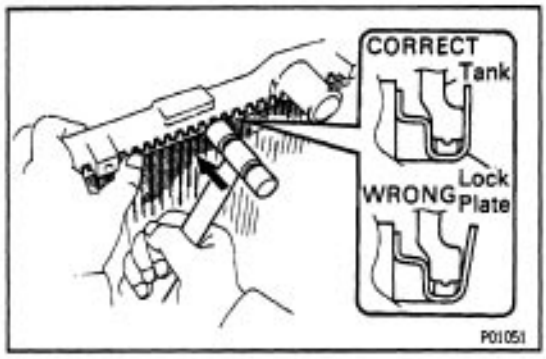
- If the sides of the lock plate groove are deformed, reassembly of the tank will be impossible.
- Therefore, first correct any deformation with pliers or similar object. Water leakage will result if the bottom of the lock plate groove is damaged or dented. Therefore, repair or replace if necessary.



3. INSTALL NEW O–RINGS AND TANKS

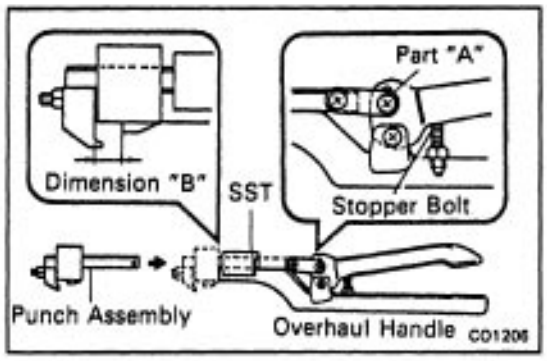
(a) After checking that there are no foreign objects in the lock plate groove, install the new O–ring without twisting it.

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.

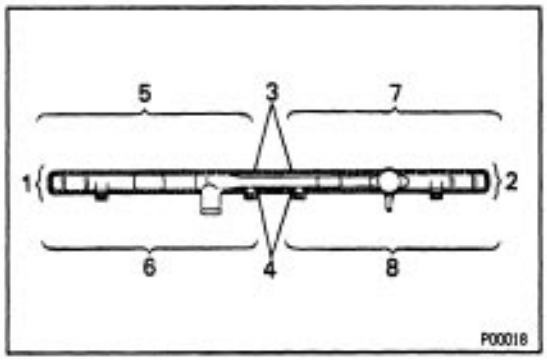


4. ASSEMBLE SST

SST 09230–01010

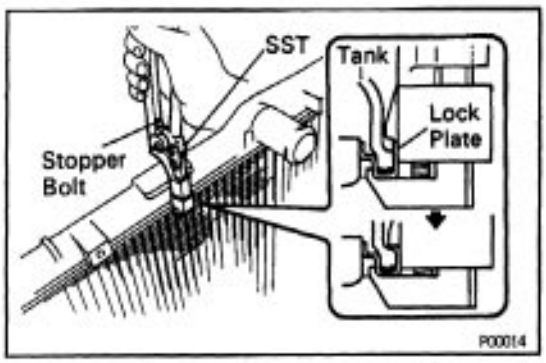
(a) Install the punch assembly to the overhaul handle, inserting it in the hole in part “A” as shown in the illustration.

(b) While gripping the handle, adjust the stopper bolt so that dimension “B” shown in the diagram is 7.7 mm (0.03 in.)

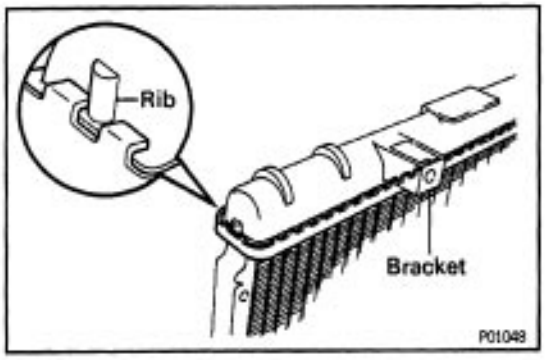


5. CAULK LOCK PLATE

(a) Lightly press SST against the lock plate in the order shown in the illustration.

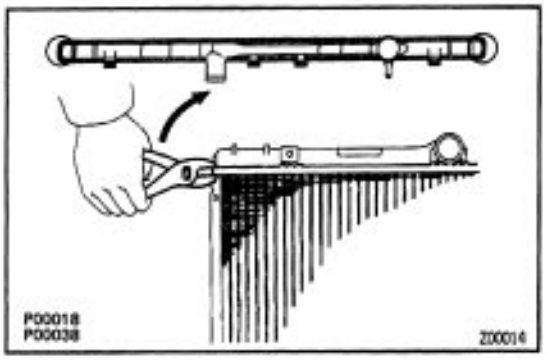


After repeating this a few times, fully caulk the lock plate by squeezing the handle until stopped by the stopper plate.
SST 09230 – 01010

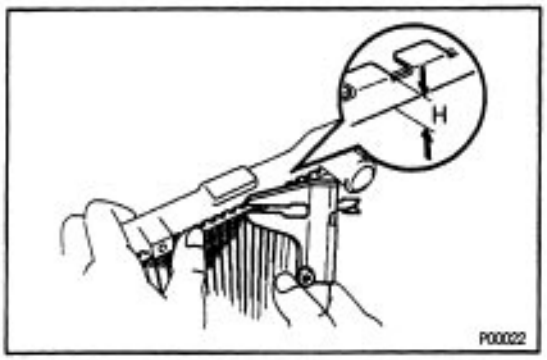


HINT:

- Do not stake the areas protruding around the pipes, brackets or tank ribs.

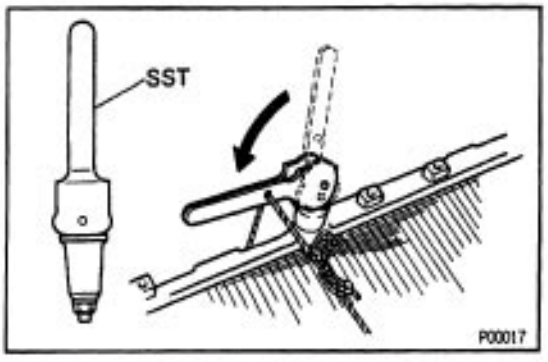


- The points shown in the illustration and oil cooler near here (A/T) cannot be staked with the SST. Use a plier or like object and be careful not to damage the core plates.



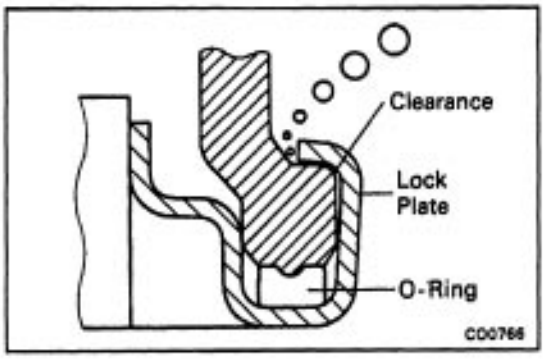
(b) Check the lock plate height (H) after completing the caulking.
Plate height:
7.75–8.25 mm (0–3051–0.3248 in.)

If not within the specified height, adjust the stopper bolt of the handle again and perform the caulking again.



6. INSPECT FOR WATER LEAKS

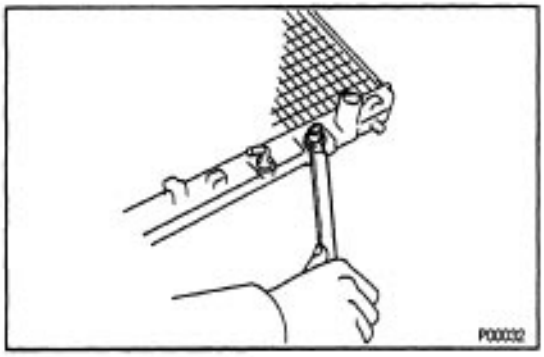
(a) Tighten the drain cock.
(b) Plug the inlet and outlet pipes of the radiator with SST.
SST 09230 – 01010
(c) Using a radiator cap tester, apply pressure to the radiator.
Test pressure:
177 kPa (1.8 kgf/cm1, 26 psi)



(d) Inspect for water leaks.
HINT: On radiators with resin tanks, there is a clear–ance between the tank and lock plate where a minute amount of air will remain, giving the appearance of an air leak when the radiator is submerged in water. Therefore, before performing the water leak test, first switch the radiator around in the water until all air bubbles disappear.

7. PAINT LOCK PLATES

HINT: If the water leak test checks out okay, allow the radiator to completely dry and then paint the lock plates.

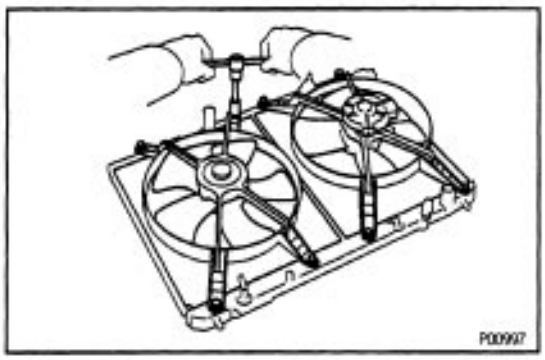


RADIATOR INSTALLATION

(See Components for Removal and installation)

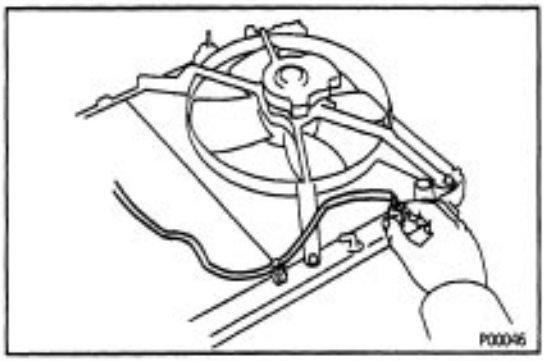
1. INSTALL ENGINE COOLANT TEMPERATURE SWITCH

(a) Install a new O–ring to the engine coolant tempera–ture switch.
(b) Install the engine coolant temperature switch.

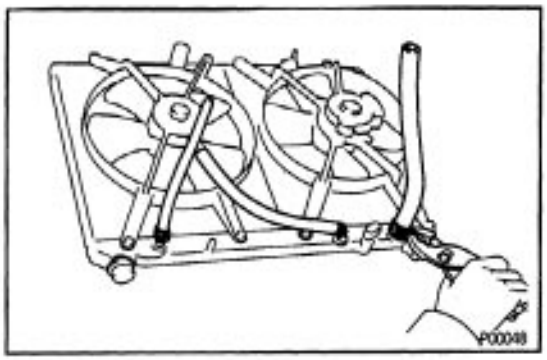


2. INSTALL ELECTRIC COOLING FANS TO RADIATOR

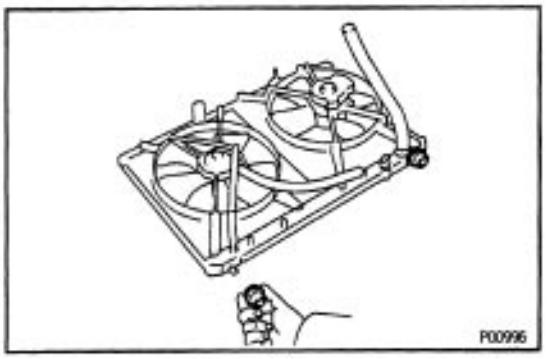
Install the cooling fans with the 8 bolts.



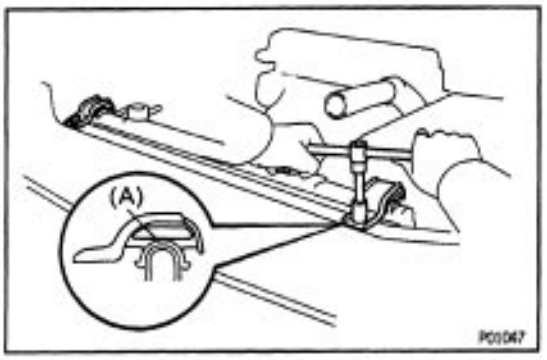
3. INSTALL ENGINE COOLANT TEMPERATURE SWITCH WIRE



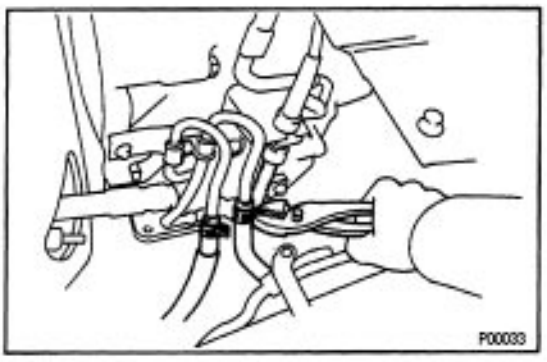
4. A/T:
INSTALL A/T OIL COOLER HOSES
5. INSTALL RADIATOR LOWER HOSE



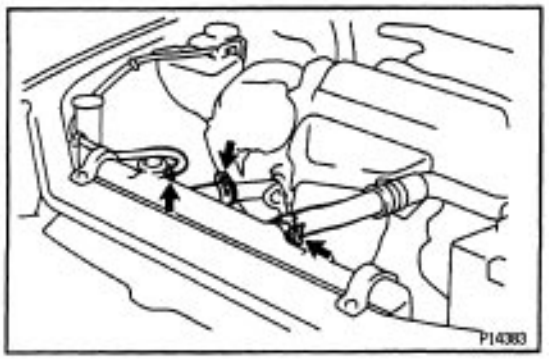
6. INSTALL RADIATOR AND ELECTRIC COOLING FANS
(a) Place the 2 lower radiator supports in position on the body.



(b) Place the radiator in position, and install the 2 upper supports with the 2 bolts.
HINT: After installation, check that the rubber cushion (A) of the support is not depressed.
Torque: 13 N–m (130 kgf–cm, 9 ft–lbf)



7. A/T:
CONNECT OIL COOLER HOSES

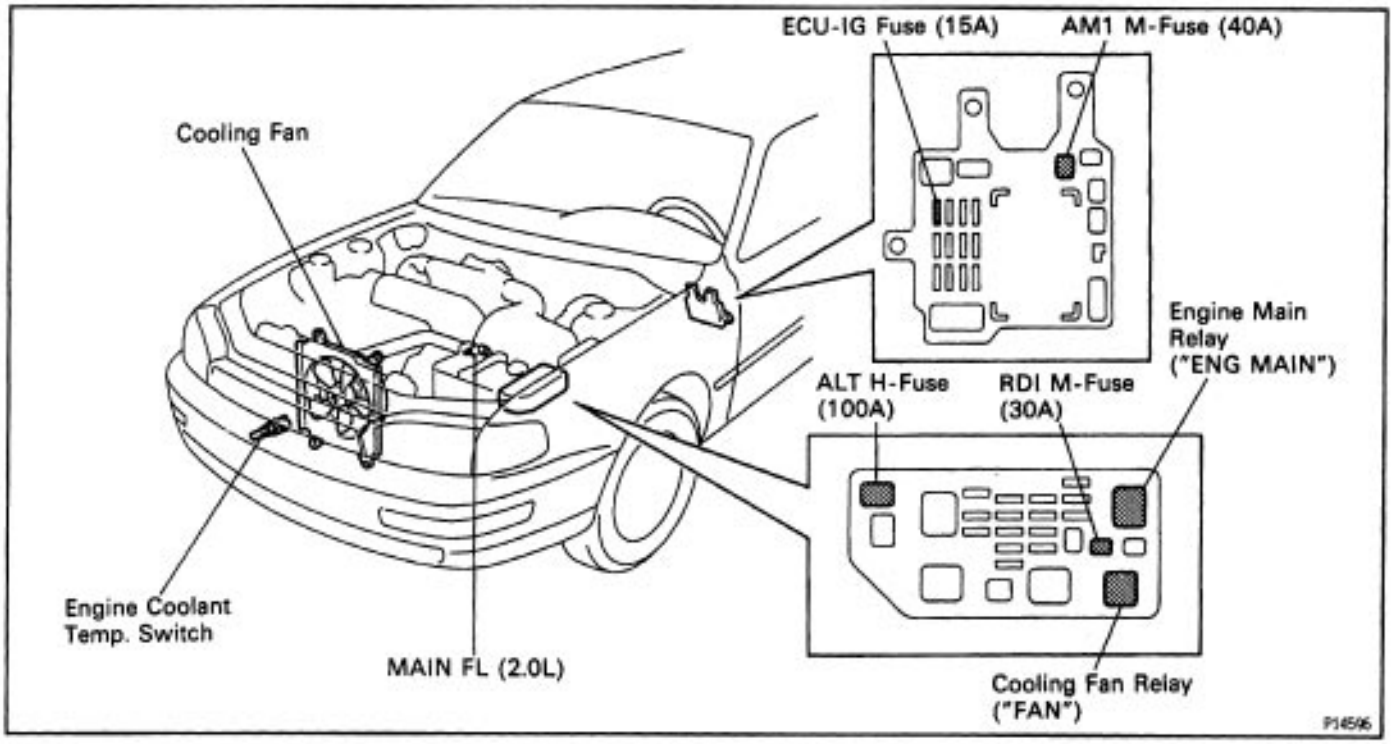


8. CONNECT ENGINE COOLANT RESERVOIR HOSE
9. CONNECT RADIATOR HOSES

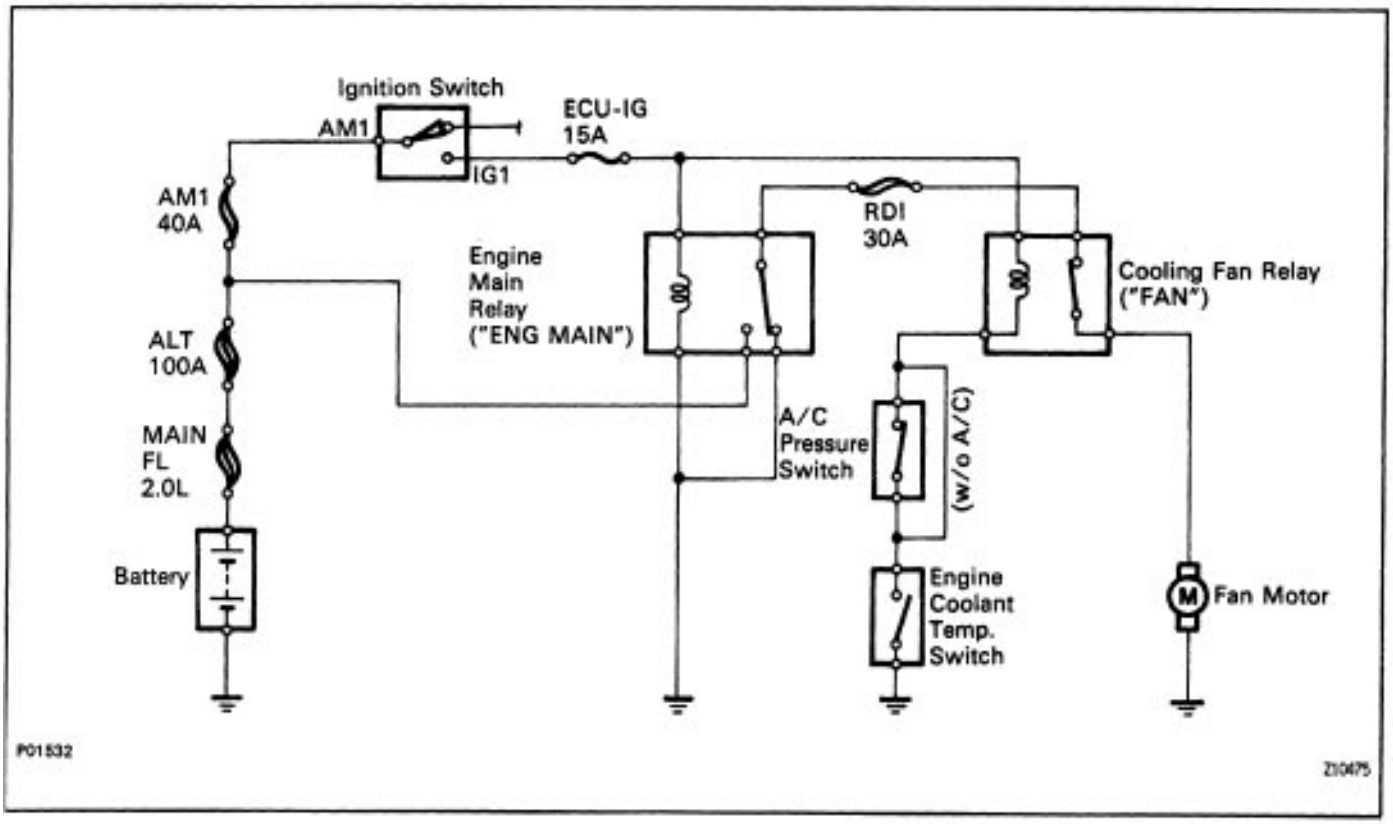
10. CONNECT ELECTRIC COOLING FAN CONNECTORS
11. CONNECT ENGINE COOLANT TEMPERATURE SWITCH CONNECTOR TO FAN SHROUD
12. w/ CRUISE CONTROL SYSTEM:
INSTALL CRUISE CONTROL ACTUATOR COVER
13. FILL WITH ENGINE COOLANT
(See page EG1–241**)**
14. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY
15. START ENGINE AND CHECK FOR LEAKS
16. A/T:
CHECK AUTOMATIC TRANSMISSION (A/T) FLUID LEVEL
NOTICE: Do not overfill.

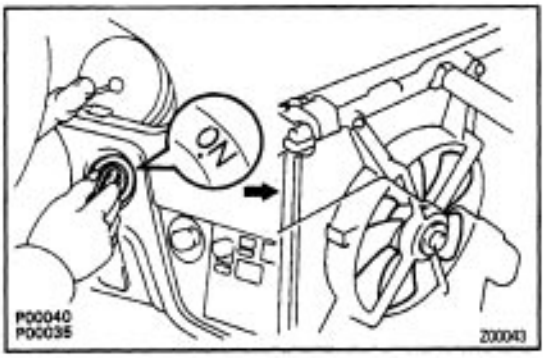
ELECTRIC COOLING FAN

PART LOCATION



SYSTEM CIRCUIT





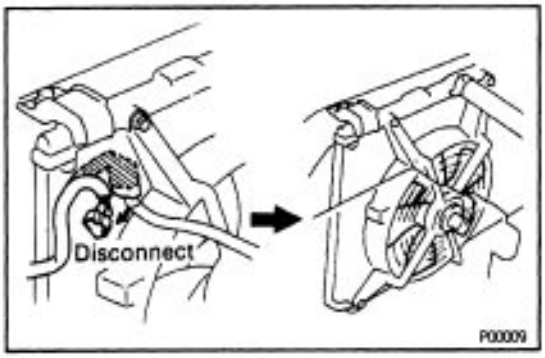
ON–VEHICLE INSPECTION

Low Temperature (Below 83°C (181°F))

1. TURN IGNITION SWITCH “ON”

Check that the cooling fan stops.

If not, check the cooling fan relay and engine coolant temperature switch, and check for a separated con–nector or severed wire between the cooling fan relay and engine coolant temperature switch.

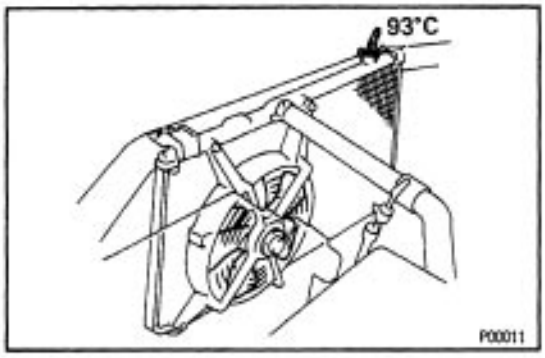


2. DISCONNECT ENGINE COOLANT TEMPERATURE SWITCH CONNECTOR

Check that the cooling fan rotates.

If not, check the cooling fan relay, cooling fan, engine main relay and fuse, and check for a short circuit between the cooling fan relay and engine coolant temperature switch.

3. CONNECT ENGINE COOLANT TEMPERATURE SWITCH CONNECTOR



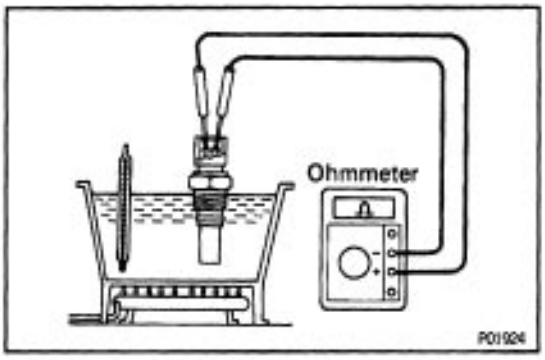
High Temperature (Above 93°C (199°F))

4. START ENGINE

(a) Raise engine coolant temperature to above 93°C (199°F).

(b) Check that the cooling fan rotates.

If not, replace the engine coolant temperature switch.



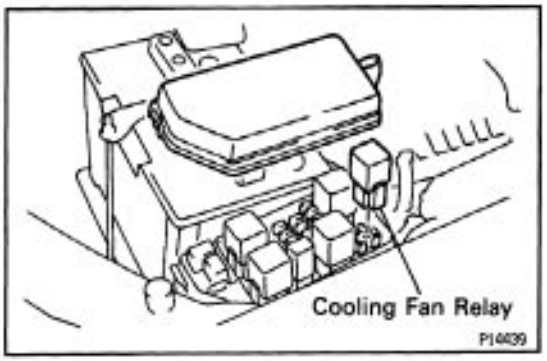
ELECTRIC COOLING FAN COMPONENTS INSPECTION

1. INSPECT ENGINE COOLANT TEMPERATURE SWITCH

(a) Using an ohmmeter, check that there is no continuity between the terminals when the engine coolant tem–perature is above 93°C (199°F).

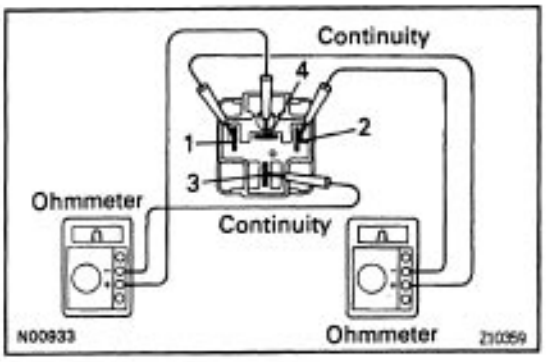
(b) Using an ohmmeter, check that there is continuity between the terminals when the engine coolant tem–perature is below 83°C (181 °F).

If continuity is not as specified, replace the switch.



2. INSPECT COOLING FAN RELAY (”FAN’)

A. Remove cooling fan relay

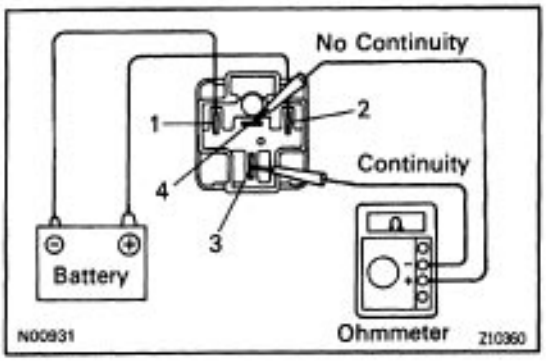


B. Inspect relay continuity

(a) Using an ohmmeter, check that there is continuity between terminals 1 and 2.

(b) Check that there is continuity between terminals 3 and 4.

If continuity is not as specified, replace the relay.



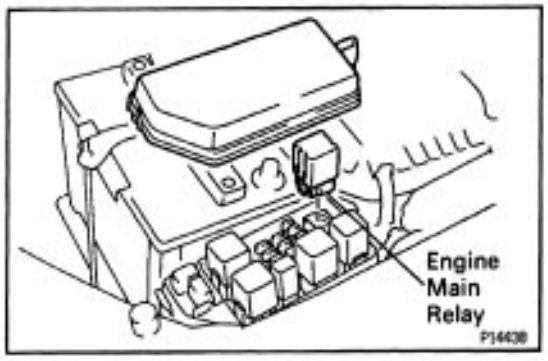
C. Inspect relay operation

(a) Apply battery voltage across terminals 1 and 2.

(b) Using an ohmmeter, check that there is no continuity between terminals 3 and 4.

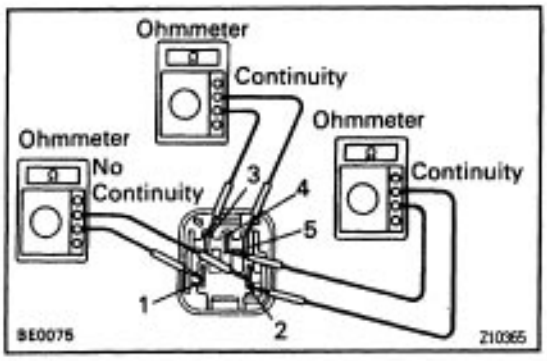
If operation is not as specified, replace the relay.

D. Reinstall cooling fan relay



3. INSPECT ENGINE MAIN RELAY (“ENG MAIN”)

A. Remove engine main relay



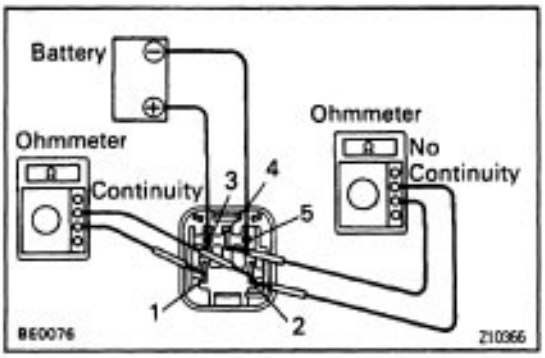
B. Inspect relay continuity

(a) Using an ohmmeter, check that there is continuity between terminals 3 and 5.

(b) Check that there is continuity between terminals 2 and 4.

(c) Check that there is no continuity between terminals 1 and 2.

If continuity is not as specified, replace the relay.



C. Inspect relay operation

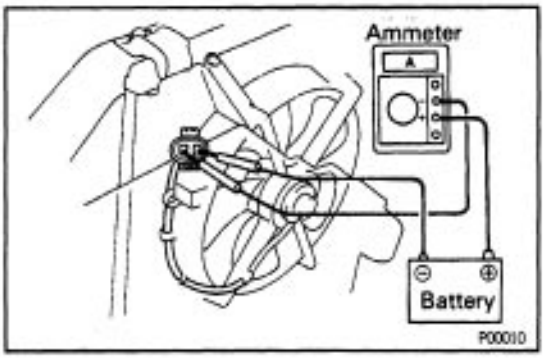
(a) Apply battery voltage across terminals 3 and 5.

(b) Using an ohmmeter, check that there is no continuity between terminals 2 and 4.

(c) Check that there is continuity between terminals 1 and 2.

If operation is not as specified, replace the relay.

D. Reinstall engine main relay



4. INSPECT COOLING FAN

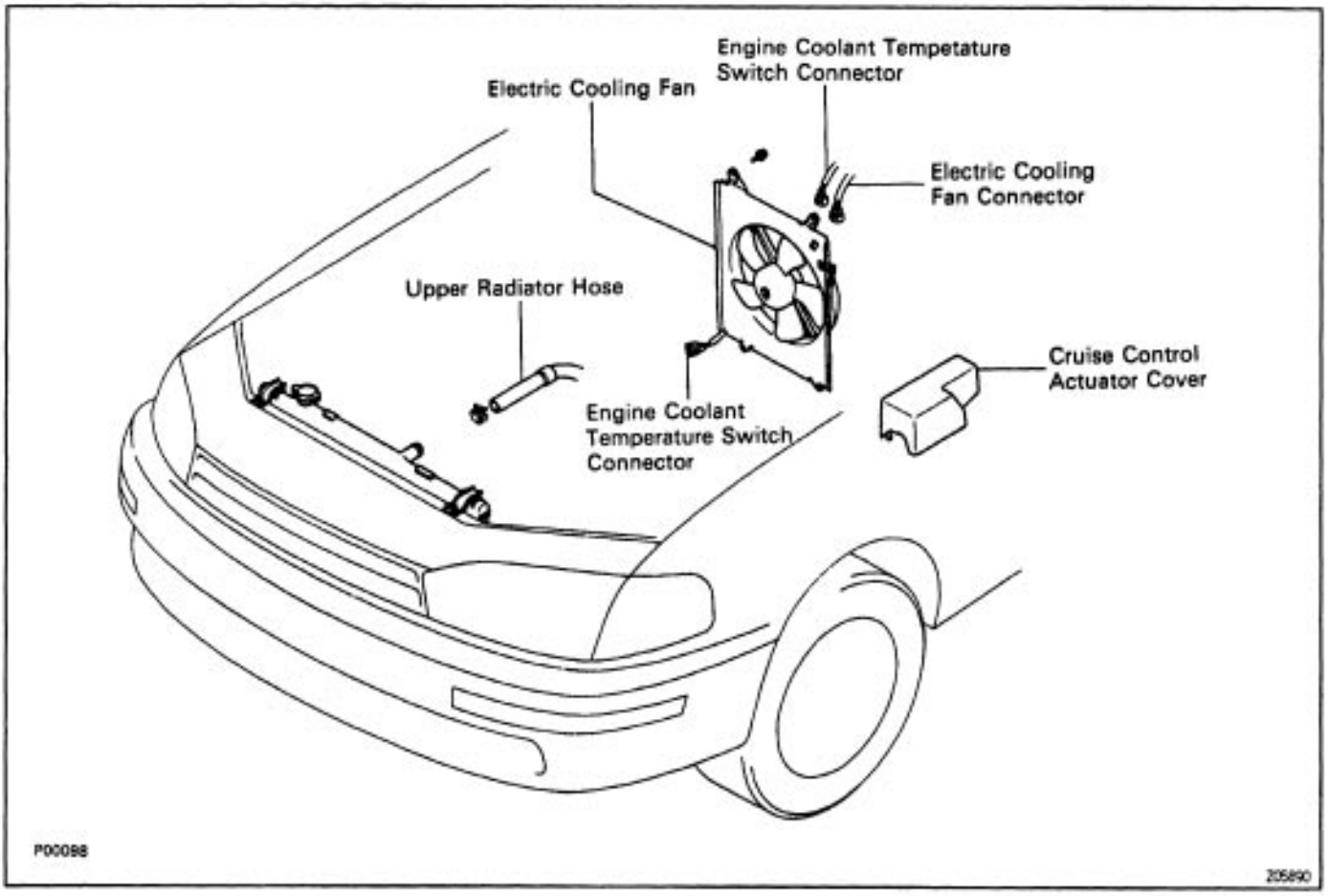
(a) Connect battery and ammeter to the cooling fan connector.

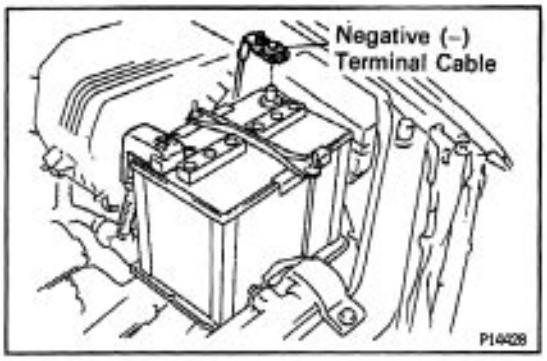
(b) Check that the cooling fan rotates smoothly, and check the reading on the ammeter.

Standard amperage:

5.8 – 7.4 A

COMPONENTS FOR REMOVAL AND INSTALLATION





ELECTRIC COOLING FAN REMOVAL

(See Components for Removal and Installation)

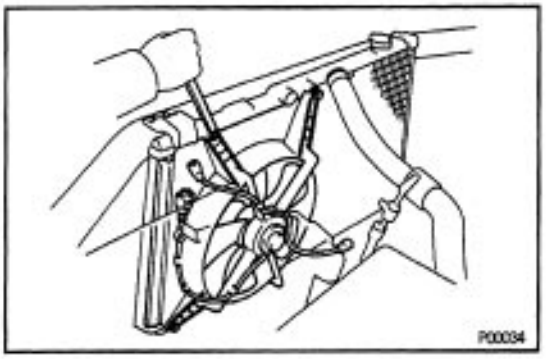
1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY

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 (See page EG1–241)

3. w/ CRUISE CONTROL SYSTEM:
REMOVE CRUISE CONTROL ACTUATOR COVER

4. DISCONNECT UPPER RADIATOR HOSE FROM RADIATOR



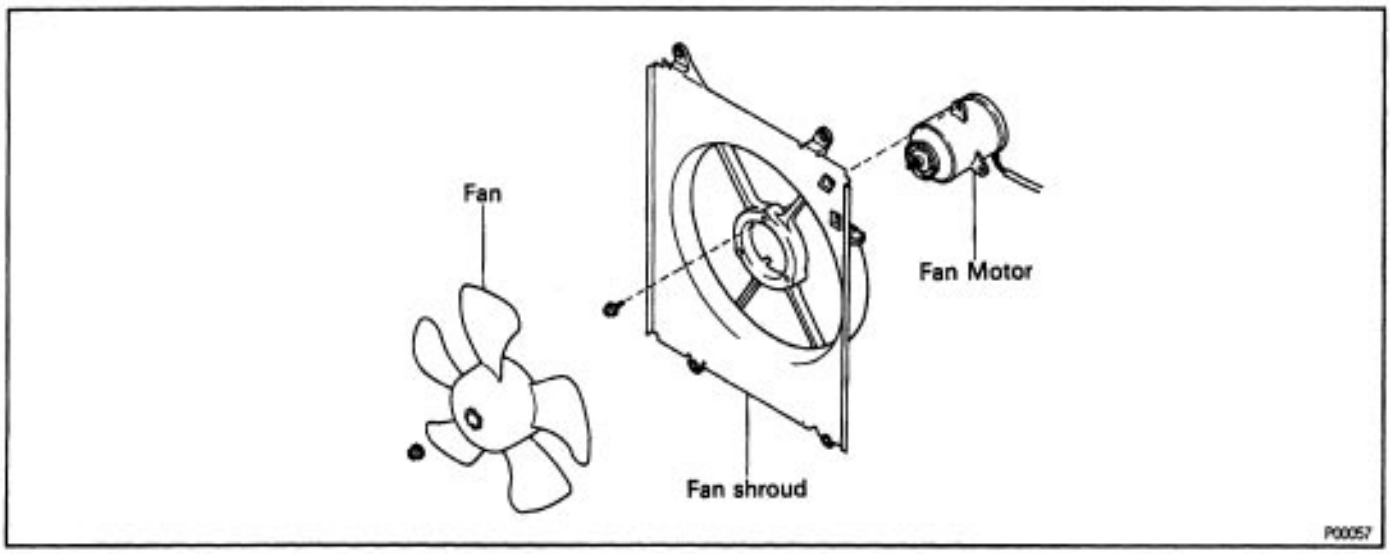
5. REMOVE ELECTRIC COOLING FAN

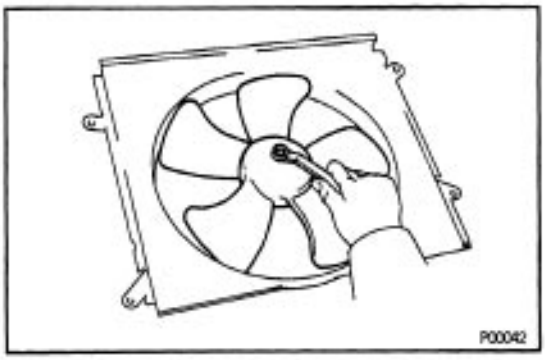
(a) Disconnect the engine coolant temperature switch connector from the radiator.

(b) Disconnect the engine coolant temperature switch and electric cooling fan connectors from the fan shroud.

(c) Remove the 4 bolts and cooling fan.

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY



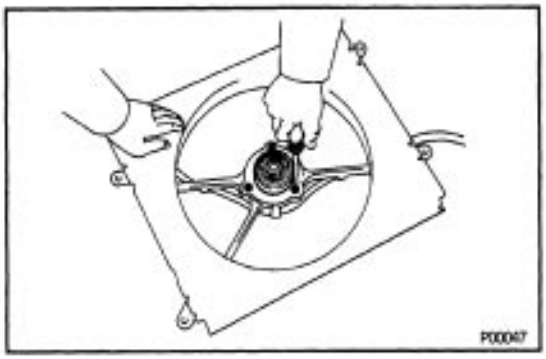


ELECTRIC COOLING FAN DISASSEMBLY

(See Components for Disassembly and Assembly)

1. REMOVE FAN

Remove the nut and fan.



2. REMOVE FAN MOTOR

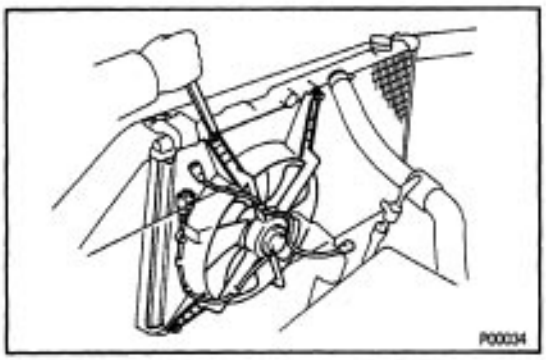
Remove the screws and fan motor.

ELECTRIC COOLING FAN ASSEMBLY

(See Components for Disassembly and Assembly)

1. INSTALL FAN MOTOR

2. INSTALL FAN



ELECTRIC COOLING FAN INSTALLATION

(See Components for Removal and Installation)

1. INSTALL ELECTRIC COOLING FAN

(a) Install the cooling fan with the 4 bolts.

(b) Connect the engine coolant temperature switch and electric cooling fan connectors to the fan shroud.

(c) Connect the engine coolant temperature switch connector to the radiator.

2. CONNECT UPPER RADIATOR HOSE TO RADIATOR

3. w/ CRUISE CONTROL SYSTEM:
INSTALL CRUISE CONTROL ACTUATOR COVER

4. FILL WITH ENGINE COOLANT

(See page EG1–241)

5. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY

6. START ENGINE AND CHECK FOR LEAKS

SERVICE SPECIFICATIONS

SERVICE DATA

Thermostat	Valve opening temperature	80 – 84°C (176 – 183°F)
	Valve lift at 95°C (203°F)	8 mm (0.31 in.) or more
Radiator cap	Relief valve opening pressure STD	74 – 103 kPa (0.75 – 1.05 kgf/cm², 10.7 – 14.9 psi)
	Limit	59 kPa (0.6 kgf/cm², 8.5 psi)
Radiator	Plate height	7.75 – 8.25 mm (0.3051 – 0.3248 in.)
Electric cooling fan	Rotating amperage	5.8 – 7.4 A

TORQUE SPECIFICATIONS

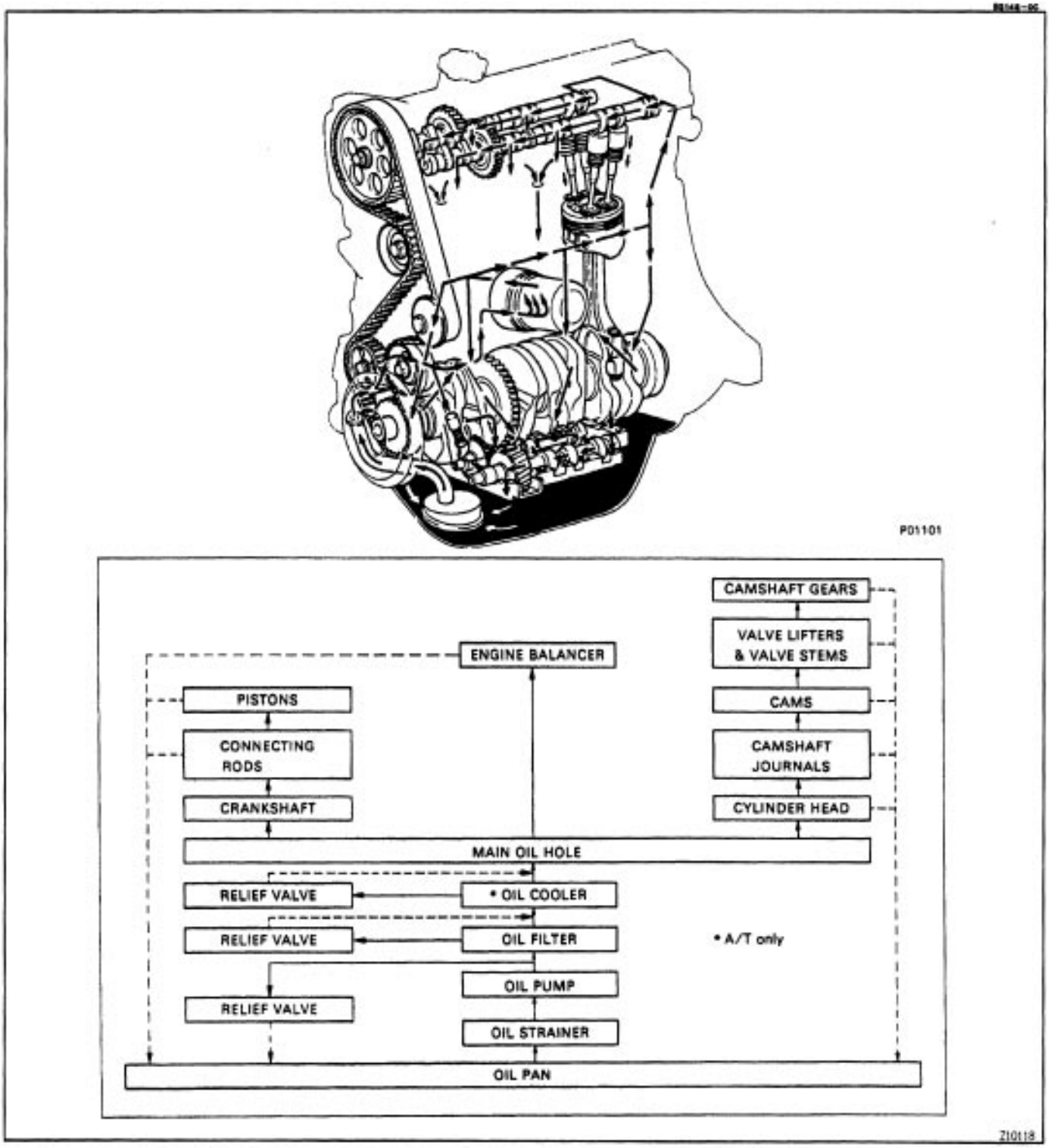
Part tightened	N·m	kgf·cm	ft·lbf
Cylinder block x Drain plug	13	130	9
Water inlet x Water pump cover	8.8	90	78 in.·lbf
Water pump x Water pump cover	9.3	95	82 in.·lbf
Water pump x Cylinder block	9.3	95	82 in.·lbf
Water bypass pipe x Water pump cover	8.8	90	78 in.·lbf
No.2 idler pulley x Cylinder block	42	425	31
Water inlet x Water pump	8.8	90	78 in.·lbf
Radiator oil cooler x Radiator lower tank	8.3	85	74 in.·lbf
Radiator oil cooler pipe	22	220	16
Radiator support bolt	13	130	9

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 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 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 widens and is discharged when the space becomes 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 becomes extremely high, overpowering the force of the spring and opening the valves. This allows the excess oil to flow through the valve and return to the oil pan.

OIL FILTER

The oil filter is a full flow type filter with a relief valve built into the 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 Seat Cutter	
	09226–10010 Crankshaft Front & Rear Bearing Replacer	Crankshaft front oil seal
	09228–06500 Oil Filter wrench	
	09616–30011 Steering Worm Bearing Adjusting Screw Wrench	Oil pump pulley
	09620–30010 Steering Gear Box Replacer Set	
	(09627–30010) Steering Sector Shaft Bushing Replacer	Oil pump oil seal
	(09631–00020) Handle	Oil pump oil seal

RECOMMENDED TOOLS

	09090–04000 Engine Sling Device	For suspending engine
	09200–00010 Engine Adjust Kit	
	09905–00013 Snap Ring Pliers	

EQUIPMENT

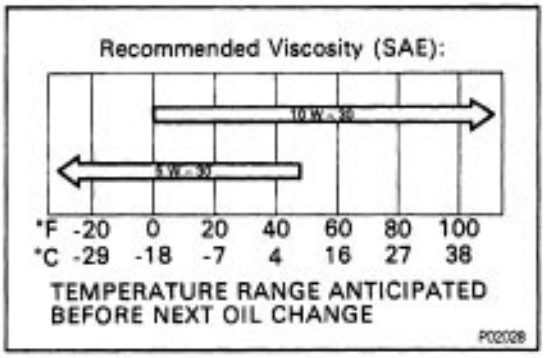
Oil pressure gauge	
Precision straight edge	Oil pump
Torque wrench	

LUBRICANT

Item	Capacity	Classification
Engine oil (M/T)		API grade SG or SH, Energy–Conserving II mutigrade engine oil or ILSAC multigrade engine oil and recommended viscosity oil
Dry fill	4.2 liters (4.4 US qts, 3.7 Imp. qts)	
Drain and refill		
w/ Oil filter change	3.6 liters (3.8 US qts, 3.2 Imp. qts)	
w/o Oil filter change	3.4 liters (3.6 US qts, 3.0 Imp. qts)	
Engine oil (A/T)		
Dry fill	4.3 liters (4.5 US qts, 3.8 imp. qts)	
Drain and refill		
w/ Oil filter change	3.6 liters (3.8 US qts, 3.2 Imp. qts)	
w/o Oil filter change	3.4 liters (3.6 US qts, 3.0 Imp. qts)	

SSM (SPECIAL SERVICE MATERIALS)

08826–00080 Seal packing or equivalent	Oil pan
08833–00080 Adhesive 1344, THREE BOND 1344, LOCTITE 242 or equivalent	Oil pressure switch



OIL PRESSURE CHECK

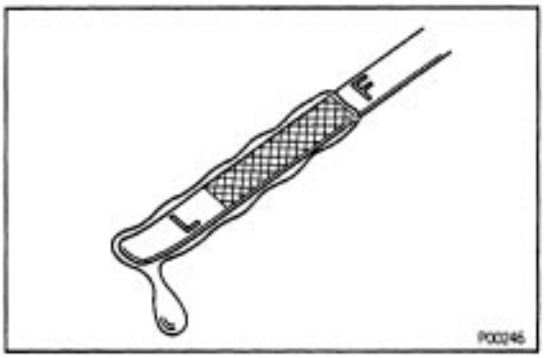
1. CHECK ENGINE OIL QUALITY

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

If the quality is visibly poor, replace the oil.

Oil grade:

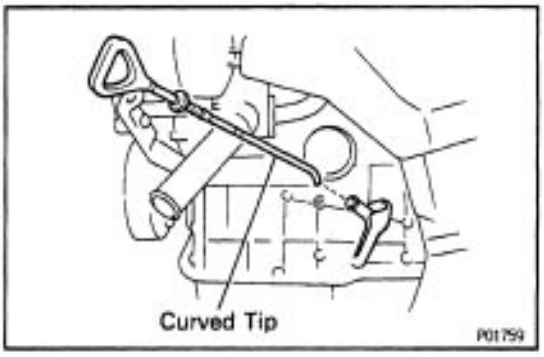
API grade SG or SH, Energy Conserving II multi–grade engine oil or ILSAC multigrade engine oil. Recommended viscosity is as shown in the illustration.



2. CHECK ENGINE OIL LEVEL

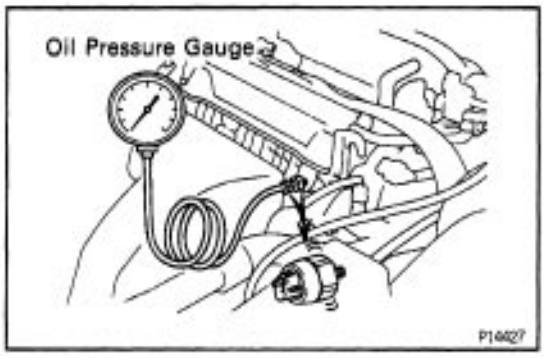
The oil level should be between the “L” and “F” marks on the dipstick.

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



NOTICE:

- **When inserting the oil dipstick, insert the curved tip of the dipstick facing the same direction as the curve of the guide.**
- **If the dipstick gets caught while inserting it, do not force it in. Reconfirm the direction of the dipstick.**



3. REMOVE OIL PRESSURE SWITCH, AND INSTALL OIL PRESSURE GAUGE

4. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.

5. CHECK OIL PRESSURE

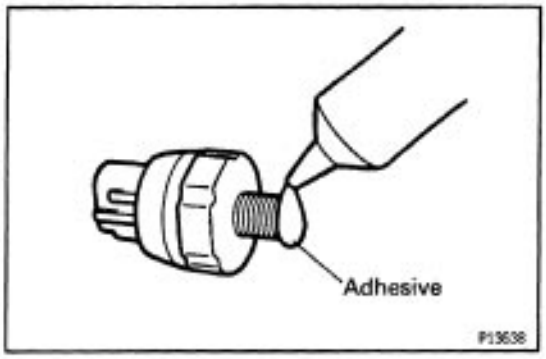
Oil pressure:

At idle

29 kPa (0.3 kgf/cm^1, 4.3 psi) or more

At 3,000 rpm

245 – 490 kPa (2.5 – 5.0 kg f/cm^1, 36 – 71 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

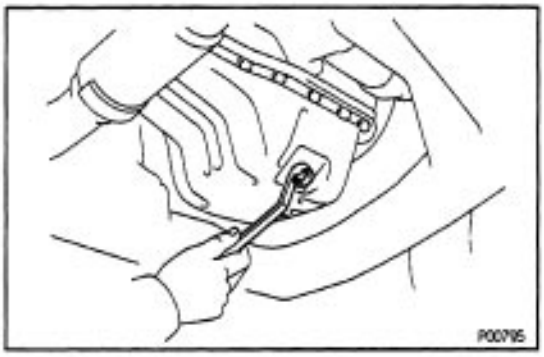
(c) Reinstall the oil pressure switch.

7. START ENGINE AND CHECK FOR LEAKS

OIL AND FILTER REPLACEMENT

CAUTION:

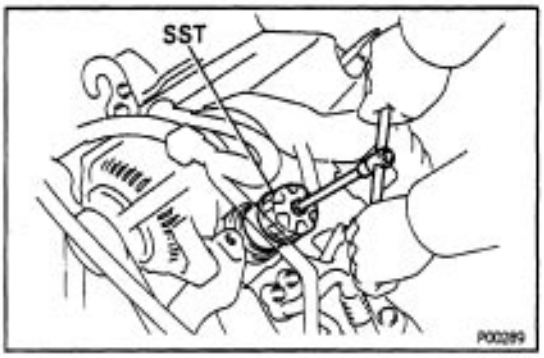
- **Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer.**
- **Care should be taken, therefore, when changing engine, oil to minimize the frequency and length of time your skin is exposed to used engine oil. Protective clothing and gloves that cannot be penetrated by oil should be worn. The skin should be thoroughthly washed with soap and water, or use water–less 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.

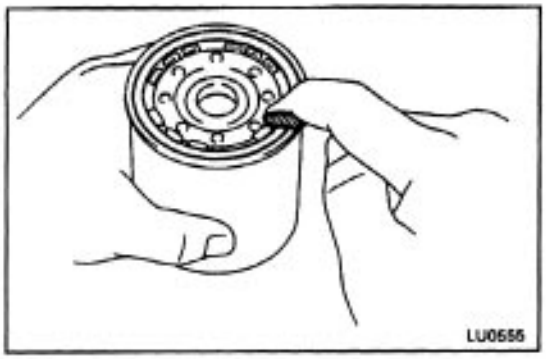


2. REPLACE OIL FILTER

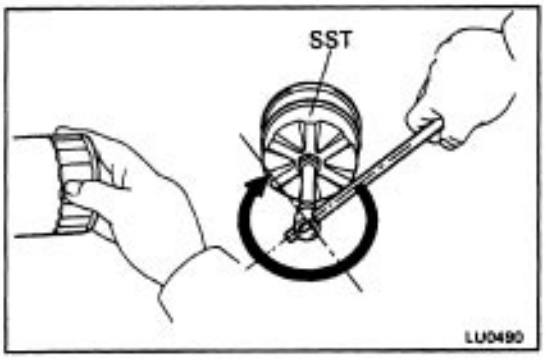
(a) Using SST, remove the oil filter.
SST 09228–06500



(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 09228–06500

3. FILL WITH ENGINE OIL

(a) Clean and install the oil drain plug with a new gasket.
Torque: 39 N–m (400 kgf–cm, 29 ft–lbf)

(b) Fill with new engine oil.
Oil grade: (See step 1 on page EG1–272)
Capacity (M/T):
Drain and refill
w/ Oil filter change
3.6 liters (3.8 US qts, 3.2 Imp. qts)
w/o Oil filter change
3.4 liters (3.6 US qts, 3.0 Imp. qts)
Dry fill
4.2 liters (4.4 US qts, 3.7 Imp. qts)
Capacity (A/T):
Drain and refill
w/ Oil filter change
3.6 liters (3.8 US qts, 3.2 Imp. qts)
w/o Oil filter change
3.4 liters (3.6 US qts, 3.0 Imp. qts)
Dry fill
4.3 liters (4.5 US qts, 3.8 Imp. qts)

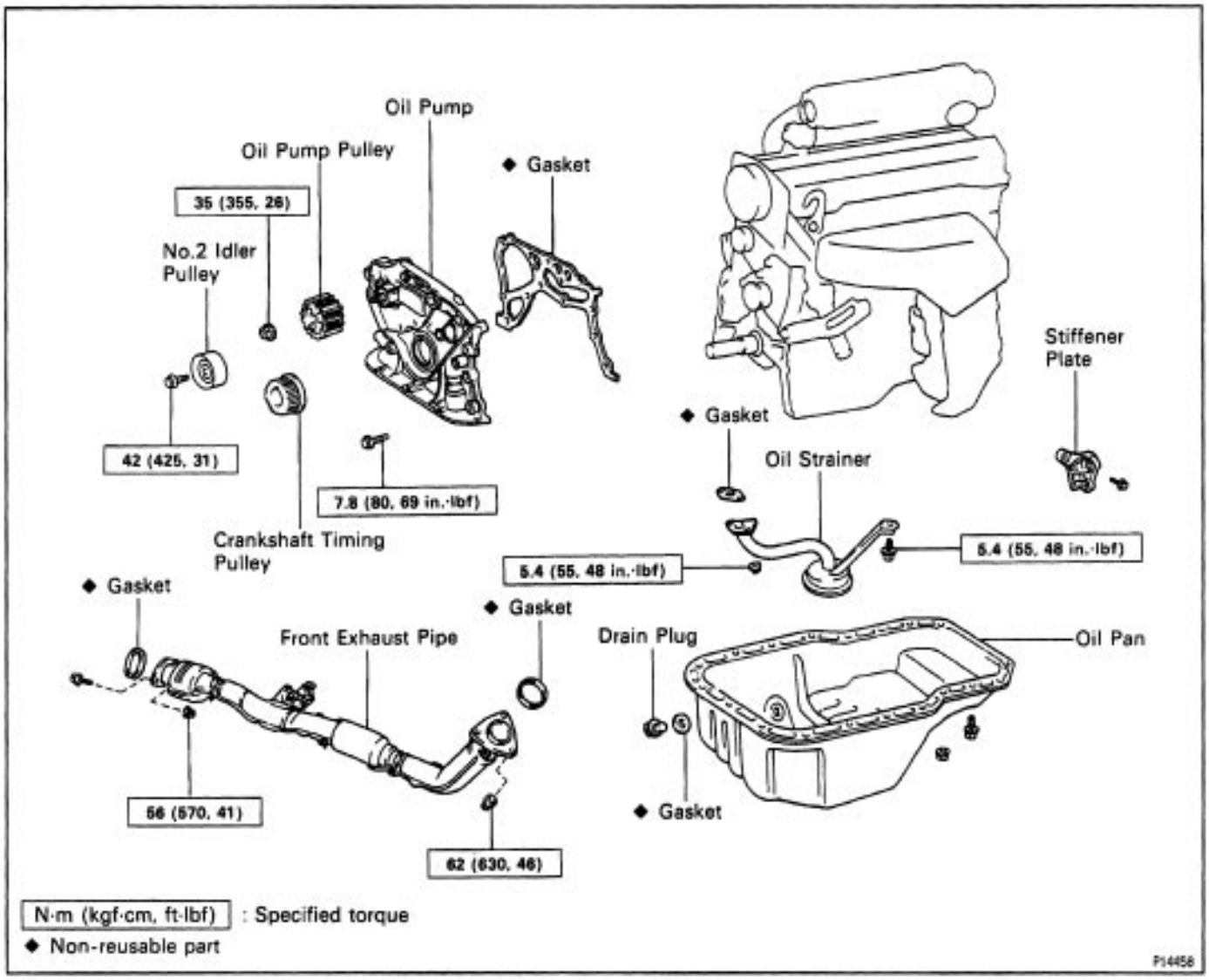
(c) Reinstall the oil filler cap.

4. START ENGINE AND CHECK FOR LEAKS

5. RECHECK ENGINE OIL LEVEL
(See page EG1–272)

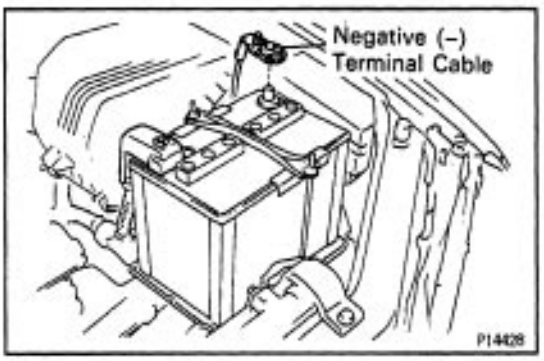
OIL PUMP

COMPONENTS FOR REMOVAL AND INSTALLATION



OIL PUMP REMOVAL

HINT: When repairing the oil pump, the oil pan and strainer should be removed and cleaned.

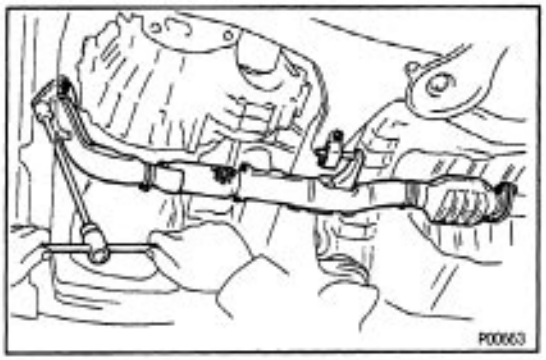


1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY

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.

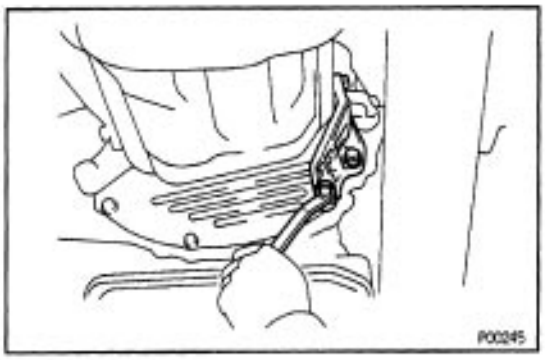
2. REMOVE HOOD

3. DRAIN ENGINE OIL (See page EG1–274)



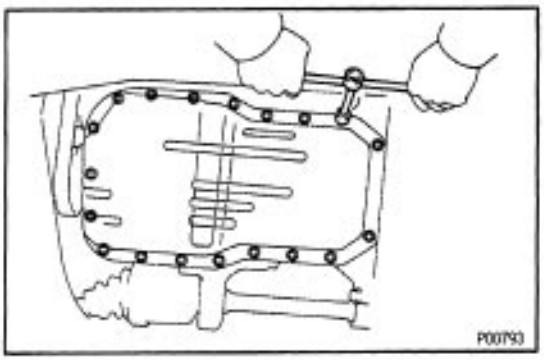
4. REMOVE FRONT EXHAUST PIPE

(a) Loosen the 2 bolts, and disconnect the bracket.
(b) Remove the 2 bolts and nuts holding the front exhaust pipe to the center exhaust pipe.
(c) Using a 14 mm deep socket wrench, remove the 3 nuts holding the front exhaust pipe to the WU–TWC.
(d) Remove the front exhaust pipe and gaskets.



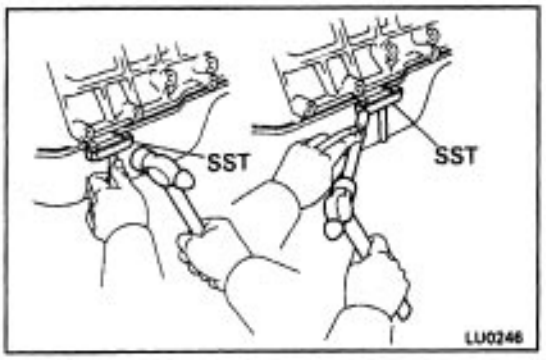
5. REMOVE STIFFENER PLATE

Remove the 3 bolts and stiffener plate.



6. REMOVE OIL PAN

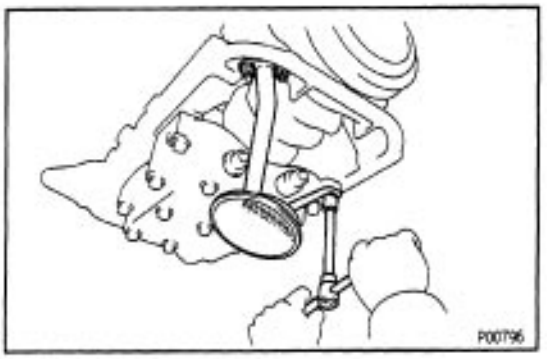
(a) Remove the dipstick.
(b) Remove the 17 bolts and 2 nuts.



(c) Insert the blade of SST between the cylinder block and oil pan, and cut off applied sealer and remove the oil pan.
SST 09032 – 00100

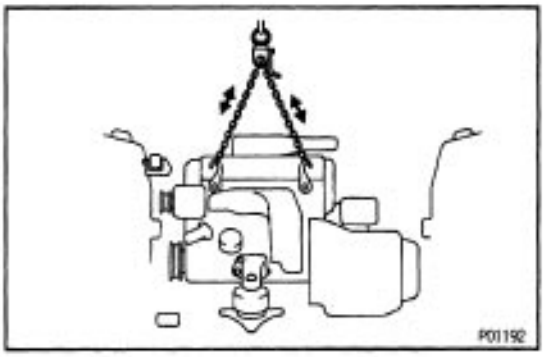
NOTICE:

- **Do not use SST for the oil pump body side and rear oil seal retainer.**
- **Be careful not to damage the oil pan flange.**



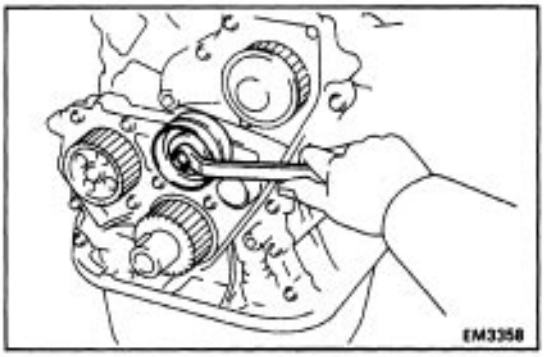
7. REMOVE OIL STRAINER

Remove the bolt, nuts, oil strainer and gasket.



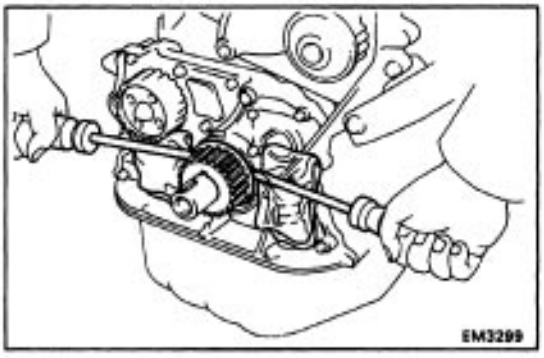
8. SUSPEND ENGINE WITH ENGINE SLING DEVICE

9. REMOVE TIMING BELT (See page EG1–26)



10. REMOVE NO.2 IDLER PULLEY

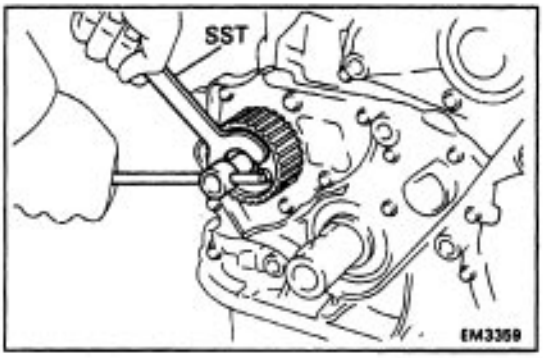
Remove the bolt and pulley.



11. REMOVE CRANKSHAFT TIMING PULLEY

If the pulley cannot be removed by hand, use 2 screw–drivers.

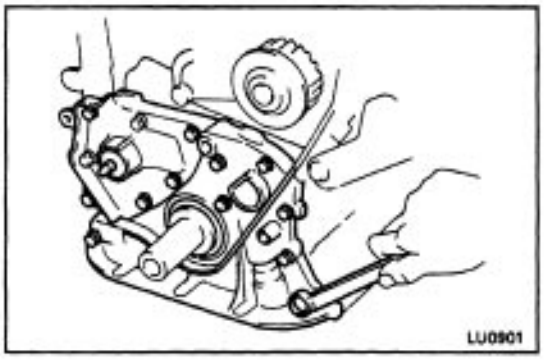
HINT: Position shop rags as shown to prevent damage.



12. REMOVE OIL PUMP PULLEY

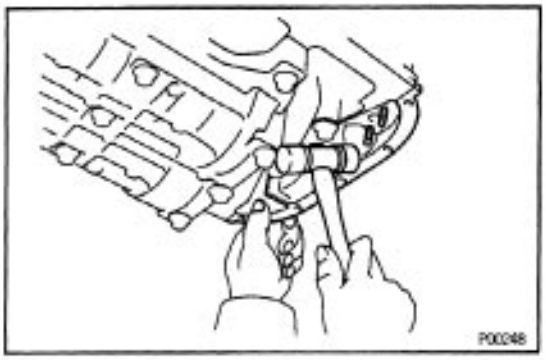
Using SST, remove the nut and pulley.

SST 09616 – 30011



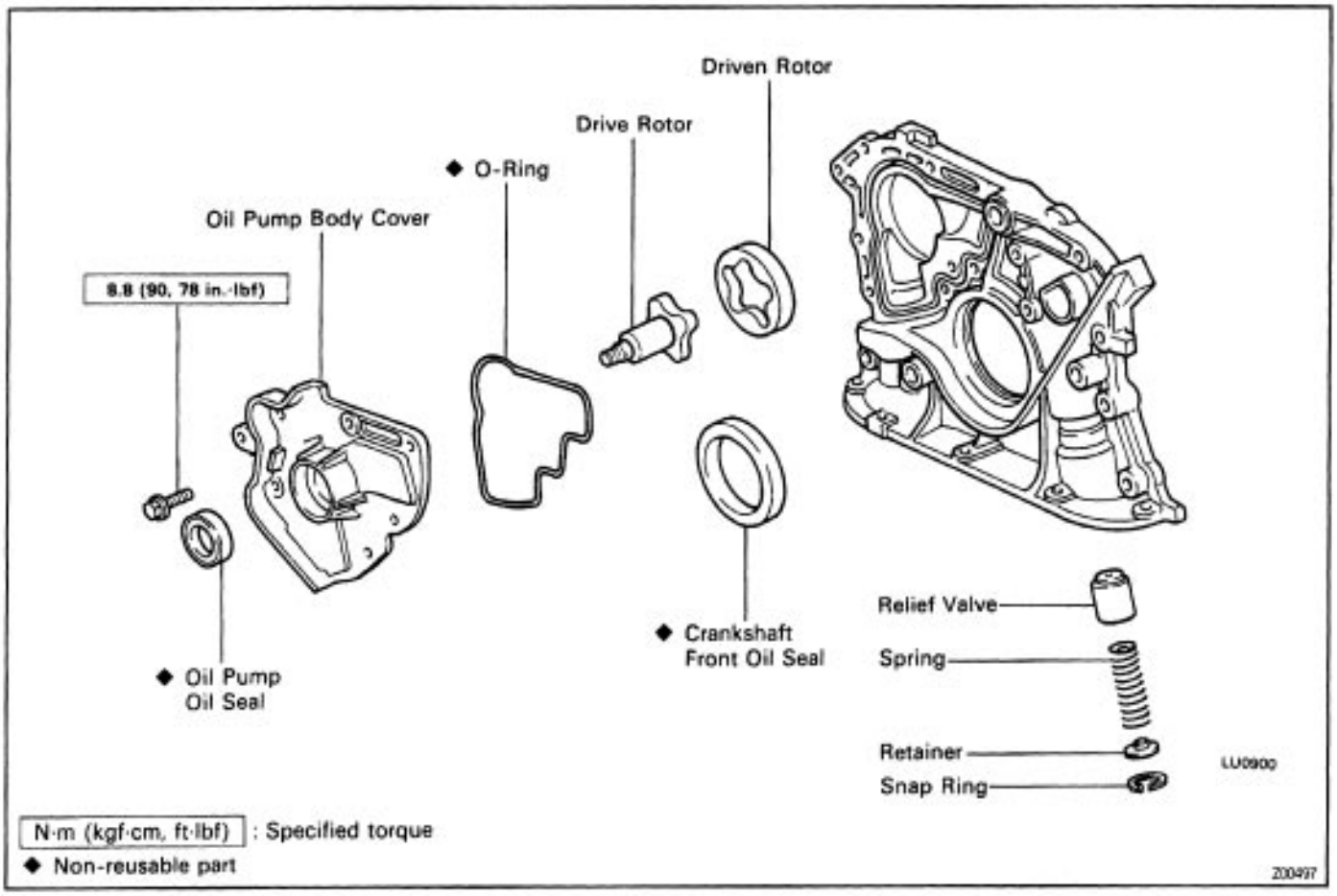
13. REMOVE OIL PUMP

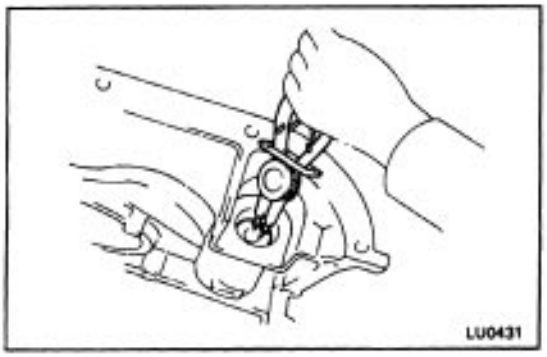
(a) Remove the 12 bolts.



(b) Using a plastic–faced hammer, remove the oil pump by carefully tapping the oil pump body.
(c) Remove the gasket.

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

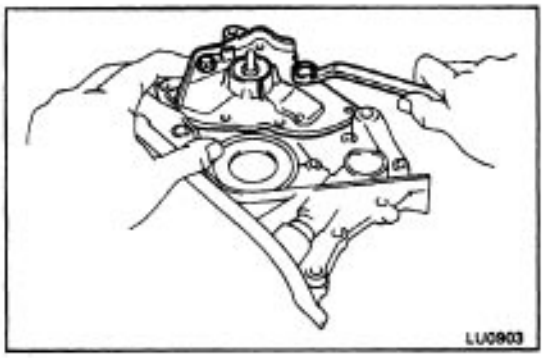




OIL PUMP DISASSEMBLY

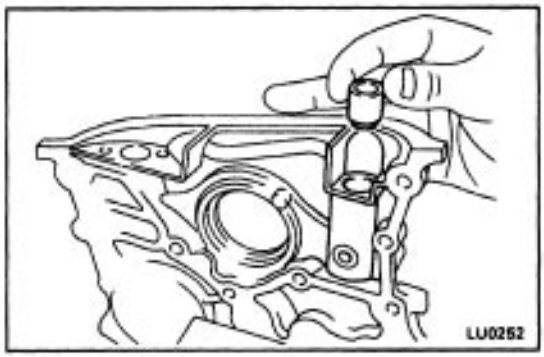
1. REMOVE RELIEF VALVE

(a) Using snap ring pliers, remove the snap ring.
(b) Remove the retainer, spring and relief valve.



2. REMOVE DRIVE AND DRIVEN ROTORS

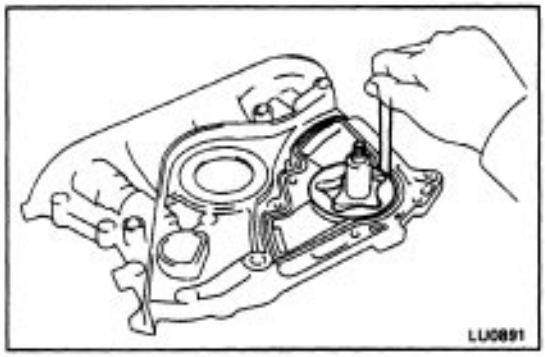
Remove the 2 bolts, pump body cover, O–ring, the drive and driven rotors.

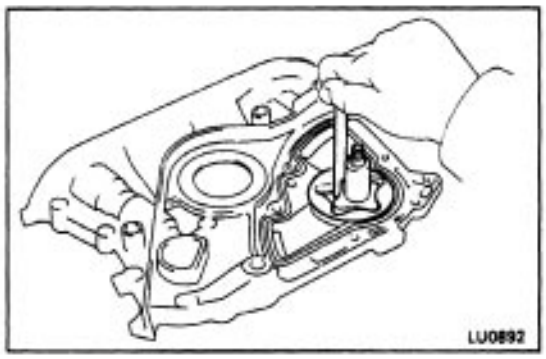


OIL PUMP INSPECTION

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 doesn't, replace the relief valve. If necessary, replace the oil pump assembly.





2. INSPECT DRIVE AND DRIVEN ROTORS

A. Inspect rotor body clearance

Using a thickness gauge, measure the clearance between the driven rotor and body.

Standard body clearance:
0.10 – 0.16 mm (0.0039 – 0.0063 in.)

Maximum body clearance:
0.20 mm (0.0079 in.)

If the body clearance is greater than maximum, replace the rotors as a set. If necessary, replace the oil pump assembly.

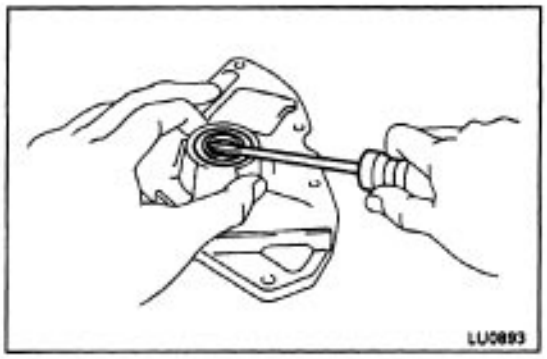
B. Inspect rotor tip clearance

Using a thickness gauge, measure the clearance between the drive and driven rotor tips.

Standard tip clearance:
0.04 – 0.16 mm (0.0016 – 0.0063 in.)

Maximum tip clearance:
0.20 mm (0.0079 in.)

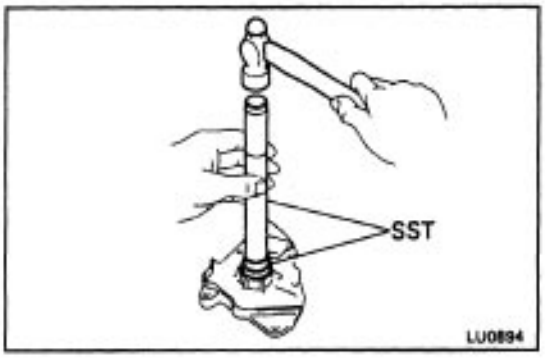
If the tip clearance is greater than maximum, replace the rotors as a set.



OIL PUMP OIL SEAL REPLACEMENT

1. REMOVE OIL SEAL

Using a screwdriver, pry out the oil seal.



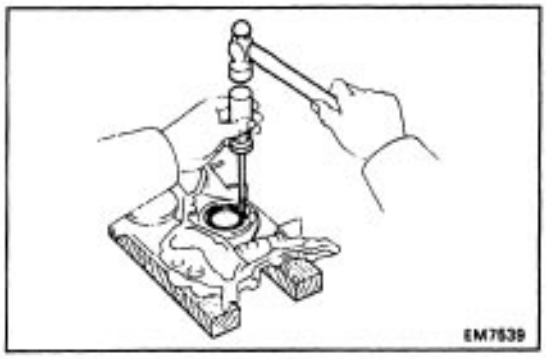
2. INSTALL OIL SEAL

(a) Using SST and a hammer, tap in a new oil seal until its surface is flush with the oil pump cover edge.
SST 09620–30010 (09627–30010, 09631–00020)

(b) Apply MP grease to the oil seal lip.

CRANKSHAFT FRONT OIL SEAL REPLACEMENT

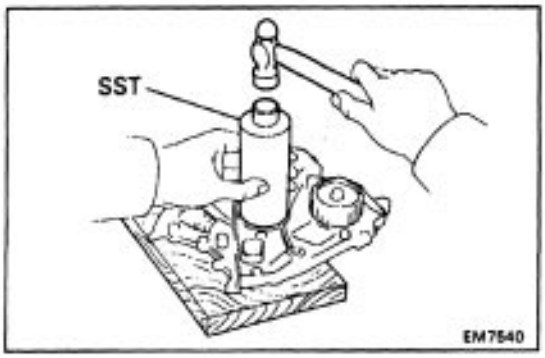
HINT: There are 2 methods (A and B) to replace the oil seal which are as follows:



REPLACE CRANKSHAFT FRONT OIL SEAL

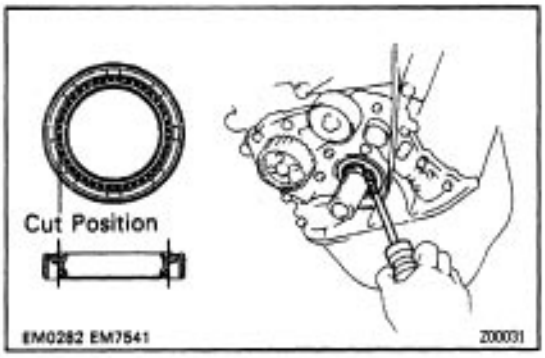
A. If oil pump is removed from cylinder block:

(a) Using 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 oil pump case edge.
SST 09226 –10010

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

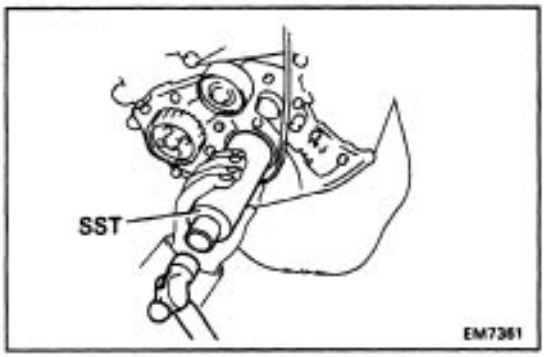


B. If oil pump is installed to the cylinder block:

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

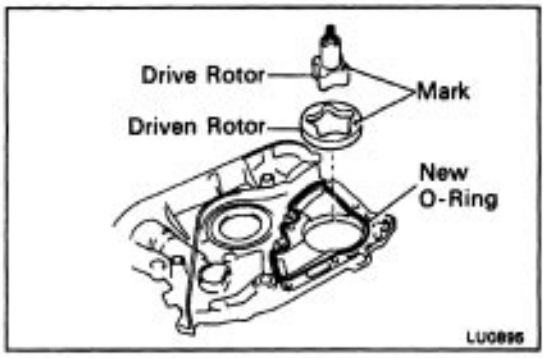
(b) Using a screwdriver, pry out the oil seal.

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 case edge.
SST 09226 –10010

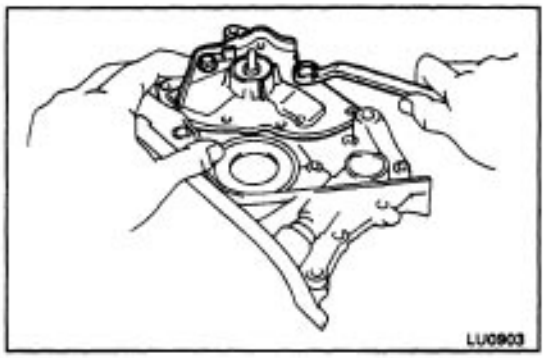


OIL PUMP ASSEMBLY

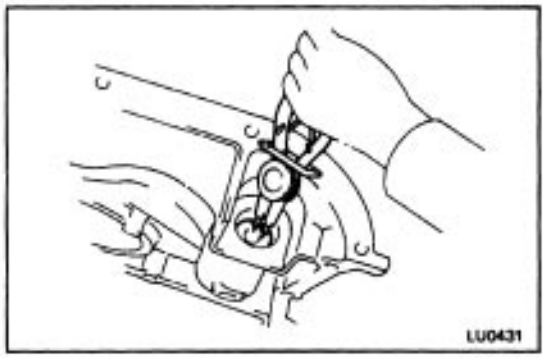
(See Components for Disassembly and Assembly)

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.



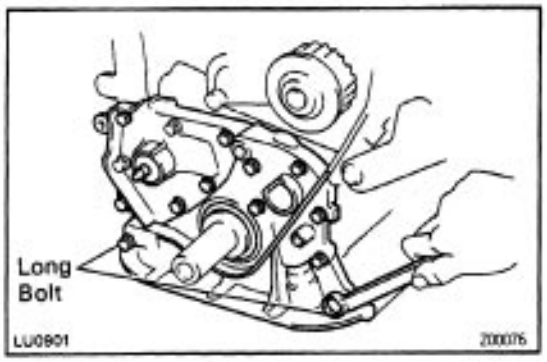
(b) Install the pump body cover with the 2 bolts.
Torque: 8.8 N–m (90 kgf–cm. 78 in.–lbf)



2. INSTALL RELIEF VALVE

(a) Insert the relief valve, spring and retainer into the pump body hole.

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



OIL PUMP INSTALLATION

(See Components for Removal and Installation)

1. INSTALL OIL PUMP

Install a new gasket and the oil pump with the 12 bolts.

Torque: 9.3 N–m (95 kgf–cm, 82 in.–lbf)

HINT: Long bolts are indicated in the illustration.

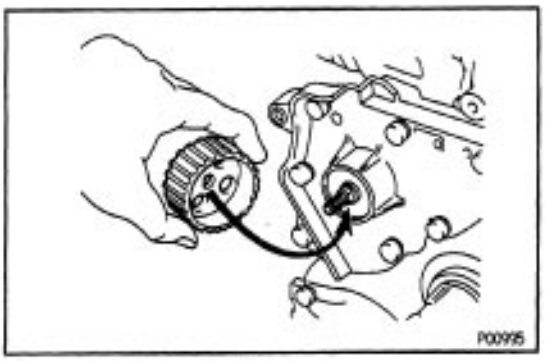
Bolt length:

Long bolt

35 mm (1.38 in.)

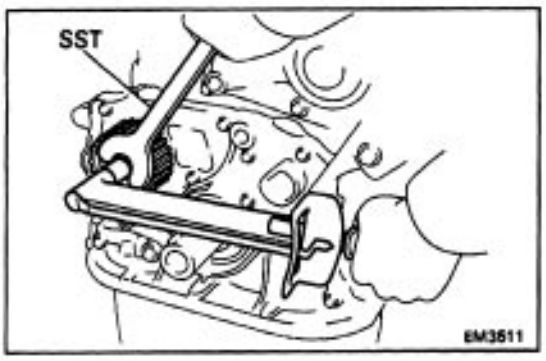
Others

25 mm (0.98 in.)



2. INSTALL OIL PUMP PULLEY

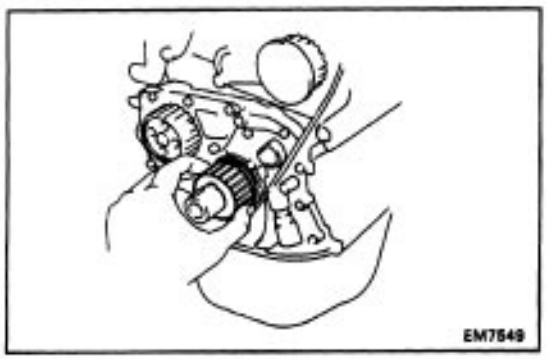
(a) Align the cutouts of the pulley and shaft, and slide on the pulley.



(b) Using SST, install the nut.

SST 09616–30011

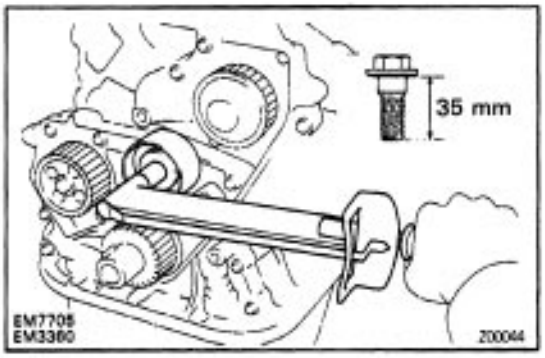
Torque: 28 N–m (290 kgf–cm, 21 ft–lbf)



3. INSTALL CRANKSHAFT TIMING PULLEY

(a) Align the timing pulley set key with the key groove of the pulley.

(b) Slide on the timing pulley, facing the flange side inward.



4. INSTALL NO.2 IDLER PULLEY

(a) Install the pulley with the bolt.

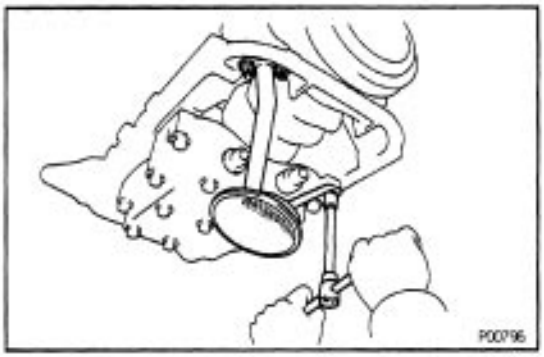
Torque: 42 N–m (425 kgf–cm, 31 ft–lbf)

HINT: Use a bolt 35 mm (1.38 in.) in length.

(b) Check that the idler pulley moves smoothly.

5. INSTALL TIMING BELT (See page EG1–33)

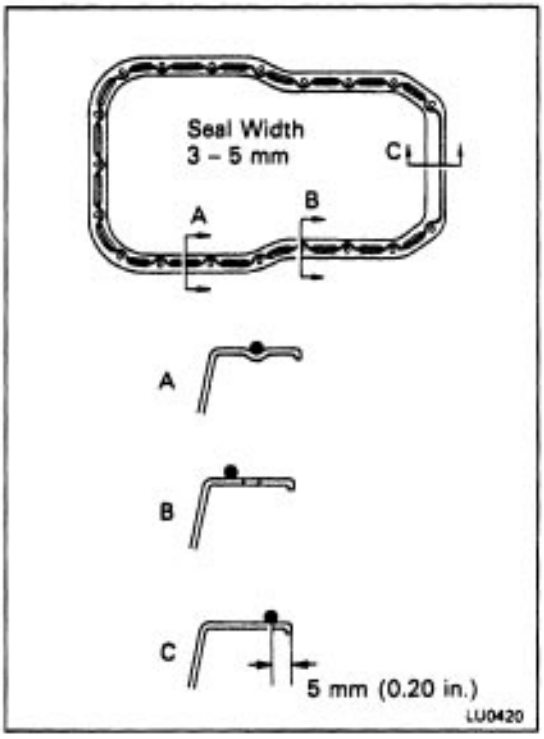
6. REMOVE ENGINE SLING DEVICE



7. INSTALL OIL STRAINER

Install a new gasket and the oil strainer with bolt and nuts.

Torque: 5.4 N–m (55 kgf–cm, 48 in.–lbf)



8. INSTALL OIL PAN

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the oil pan and cylinder block.

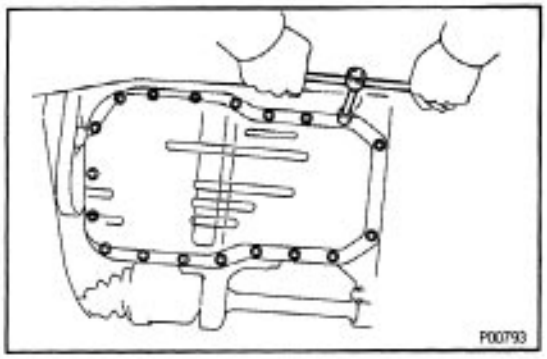
- Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing groove.
- Thoroughly clean all components to remove all the loose material.
- Using a non–residue solvent, clean both sealing surfaces.

NOTICE: Do not use a solvent which will affect the painted surfaces.

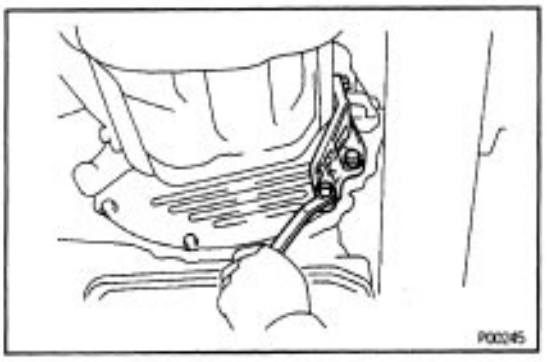
(b) Apply seal packing to the oil pan as shown in the illustration.

Seal packing:
Part No.08826 – 00080 or equivalent

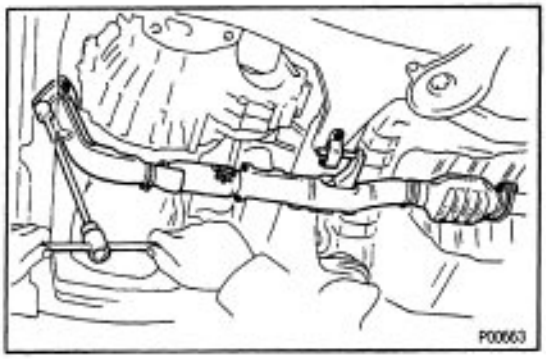
- Install a nozzle that has been cut to a 3–5 mm (0.12–0.20 in.) opening.
- Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.



(c) Install the oil pan with 17 bolts and 4 nuts.
Torque: 5.4 N–m (55 kgf–cm, 48 in.–lbf)
(d) Install the dipstick.



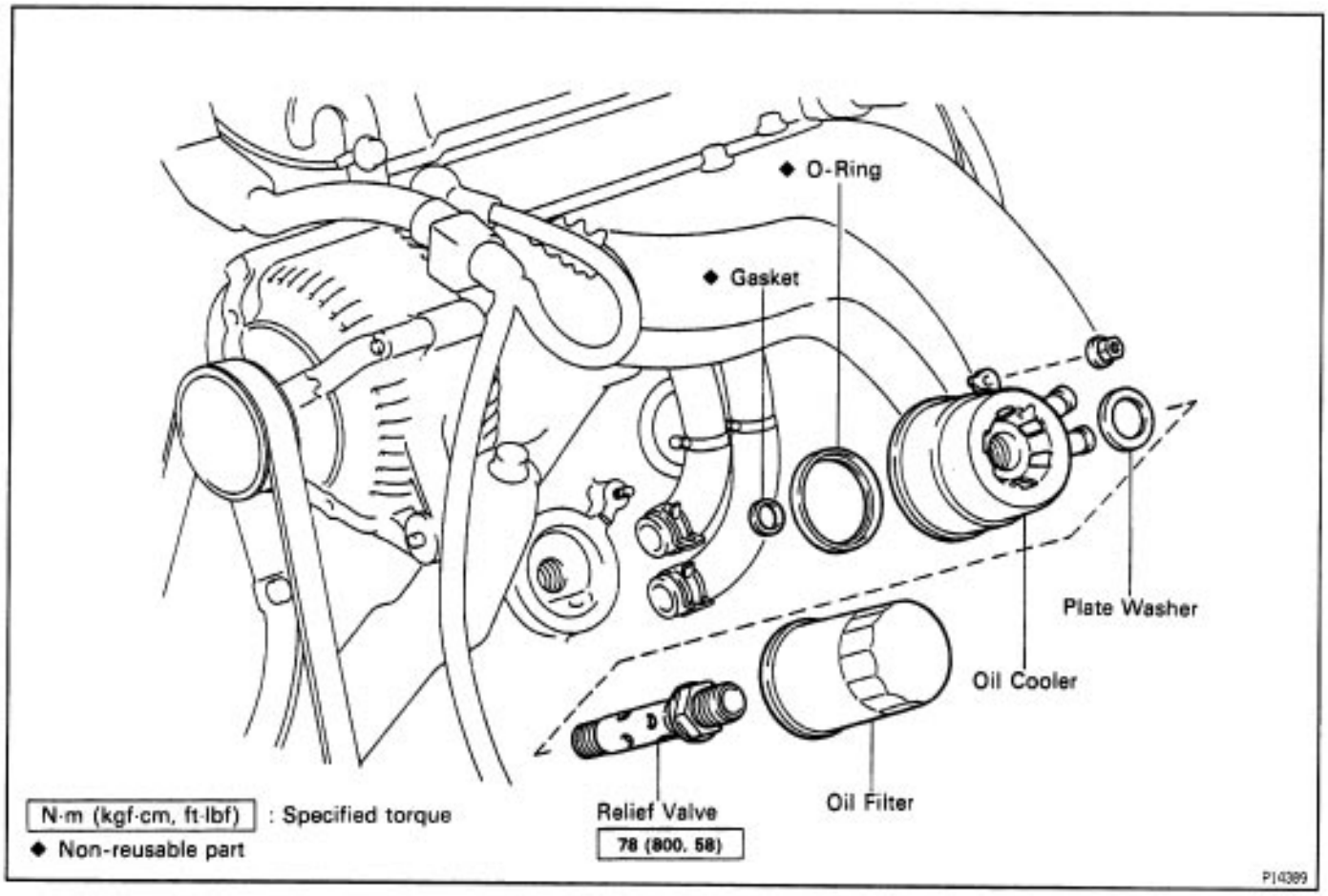
9. INSTALL STIFFENER PLATE
Install the stiffener plate with the 3 bolts.
Torque: 37 N–m (380 kgf–cm, 27 ft–lbf)



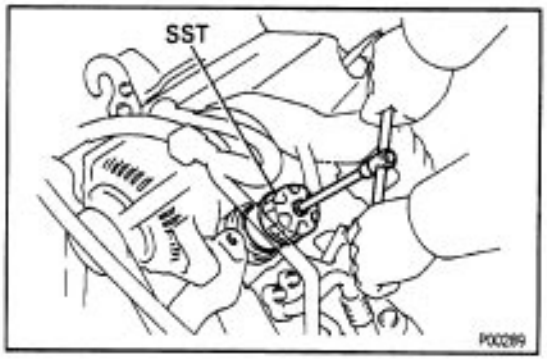
10. INSTALL FRONT EXHAUST PIPE
(a) Place 2 new gaskets on the front and rear of the front exhaust pipe.
(b) Temporarily install the 2 bolts and 2 new nuts holding front exhaust pipe to the center exhaust pipe.
(c) Using a 14 mm deep socket wrench, install the 3 new nuts holding the front exhaust pipe to the WU–TWC.
Torque: 62 N–m (630 kgf–cm, 46 ft–lbf)
(d) Tighten the 2 bolts and 2 nuts holding front exhaust pipe to the center exhaust pipe.
Torque: 56 N–m (570 kgf–cm, 41 ft–lbf)
(e) Install the bracket with the 2 bolts.
11. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY
12. FILL WITH ENGINE OIL (See page EG1–275)
13. START ENGINE AND CHECK FOR LEAKS
14. RECHECK ENGINE OIL LEVEL
15. INSTALL HOOD

OIL COOLER

COMPONENTS FOR REMOVAL AND INSTALLATION



OIL COOLER REMOVAL

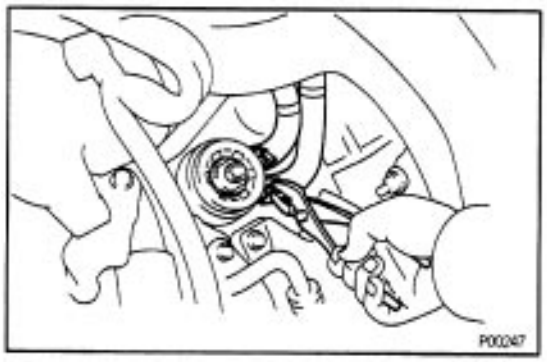


1. DRAIN ENGINE COOLANT

2. REMOVE OIL FILTER

Using SST, remove the oil filter.

SST 09228–06500



3. DISCONNECT WATER BYPASS HOSES FROM OIL COOLER

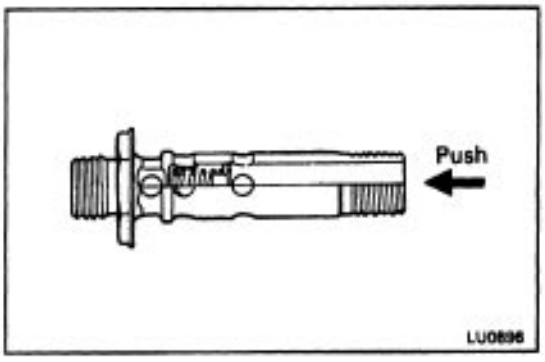
Disconnect the 2 water bypass hoses.



4. REMOVE OIL COOLER

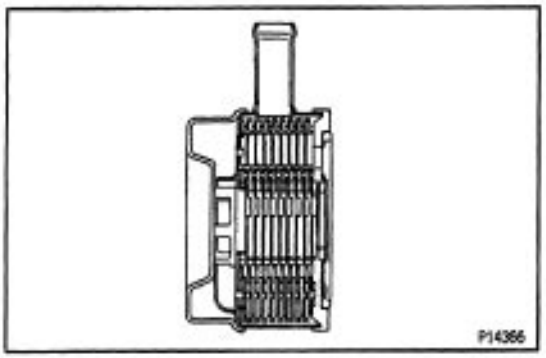
(a) Remove the relief valve and plate washer.
(b) Remove the nut and oil cooler.
(c) Remove the O–ring and gasket from the oil cooler.

OIL COOLER INSPECTION



1. INSPECT RELIEF VALVE

Push the valve with a wooden stick to check if it is stuck.
If stuck, replace the relief valve.



2. INSPECT OIL COOLER

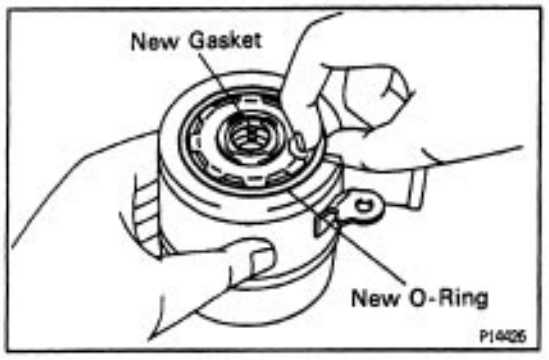
Check the oil cooler for damage or clogging.
If necessary, replace the oil cooler.

OIL COOLER INSTALLATION

(See Components for Removal and Installation)

1. INSTALL OIL COOLER

(a) Install new O–ring and gasket to the oil cooler.





(b) Apply a light coat of engine oil on the threads and under the head of the relief valve.
(c) Temporarily install the oil cooler with the nut.
(d) Install the plate washer and relief valve.
Torque: 78 N–m (800 kgf–cm, 58 ft–lbf)
(e) Tighten the nut.
Torque: 7.8 N–m (80 kgf–cm, 69 In.–lbf)



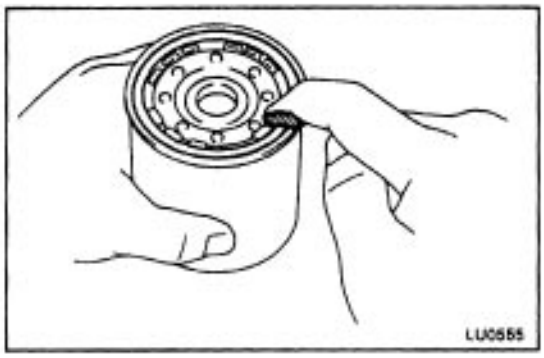
2. CONNECT WATER BYPASS HOSES

Connect the 2 water bypass hoses.

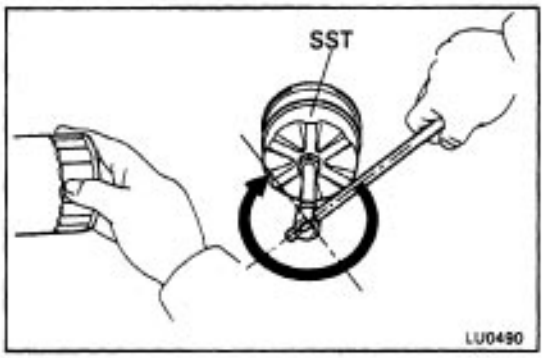


3. INSTALL OIL FILTER

(a) Clean the oil filter contact surface on the filter mounting.



(b) Lubricate the filter rubber gasket with engine oil.



(c) Tighten the oil filter by hand until the rubber gasket contacts the seat of the filler mounting. Then using SST, give it an additional 3/4 turn to seat the oil filter.
SST 09228–06500

4. FILL WITH ENGINE COOLANT
(See page EG1–241**)**
5. START ENGINE AND CHECK FOR LEAKS
6. CHECK ENGINE OIL LEVEL

SERVICE SPECIFICATIONS

SERVICE DATA

Oil pressure		at idle speed	29 kPa (0.3 kgf/cm², 43 psi) or more
		at 3,000 rpm	245 – 490 kPa (2.5 – 5.0 kgf/cm², 36 – 71 psi)
Oil pump	Body clearance	STD	0.10 – 0.16 mm (0.0039 – 0.0063 in.)
		Limit	0.20 mm (0.0079 in.)
	Tip clearance	STD	0.04 – 0.16 mm (0.0016 – 0.0063in.)
		Limit	0.20 mm (0.0079 in.)

TORQUE SPECIFICATIONS

Part tightened	N·m	kgf·cm	ft·lbf
Oil pan x Drain plug	39	400	29
Oil pump body cover x Oil pump body	8.8	90	78 in.·lbf
Oil pump x Cylinder block	9.3	95	82 in.·lbf
Oil pump pulley x Oil pump drive shaft	28	290	21
No.2 idler pulley x Cylinder block	42	425	31
Oil strainer x Cylinder block	5.4	55	48 in.·lbf
Oil strainer x Oil pump	5.4	55	48 in.·lbf
Oil pan x Cylinder block	5.4	55	48 in.·lbf
Oil pan x Oil pump	5.4	55	48 in.·lbf
Stiffener plate x Cylinder block	37	380	27
Stiffener plate x Transaxle case	37	380	27
Front exhaust pipe x WU–TWC	62	630	46
Front exhaust pipe x Center exhaust pipe	56	570	41
Oil cooler x Cylinder block (Relief valve)	78	800	58
Oil cooler x Cylinder block (Nut)	7.8	80	69 in.·lbf

-Memo

5S–FE ENGINE TROUBLESHOOTING

HOW TO PROCEED WITH TROUBLESHOOTING

The Engine Control System broadly consists of the sensors, Engine Control Module (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 proceed to inspect the circuit one by one following the procedures directed in this manual, troubleshooting of this system is not complex.

This section explains the most ideal method of troubleshooting and tells how to carry out the necessary repairs.

1. CUSTOMER PROBLEM ANALYSIS

Using the customer problem analysis check sheet for reference, ask the customer in as much details as possible about the problem.

2. CHECK AND CLEAR DIAGNOSTIC TROUBLE CODE (PRECHECK)

Before confirming the problem symptom, first check the diagnostic trouble code and make a note of any malfunction code which is output, then clear the code.

HINT: Output of the malfunction code indicates that there is a malfunction in the circuit indicated. However, it does not indicate whether the malfunction is still occurring or occurred in the past and returned to normal. In order to determine this, the problem sym toms should be confirmed in step 4 first and the diagnostic trouble code be rechecked in step [6].

Accordingly, if troubleshooting is begun based on the malfunction code only in diagnostic trouble code check in step [2], it could result in a misdiagnosis, leading to troubleshooting of circuits which are normal and making it more difficult to locate the cause of the problem.

3. SETTING THE TEST MODE DIAGNOSIS, [4] PROBLEM SYMPTOM CONFIRMATION, [5] SYMPTOM SIMULATION

In order to find out the trouble more quickly, set the diagnosis check in test mode and with higher sensing ability of the ECM, confirm the problem symptoms. If the trouble does not reappear, use the symptom simulation method to make sure the trouble is reproduced.

6. DIAGNOSTIC TROUBLE CODE CHECK IN TEST MODE

Check the diagnostic trouble code in test mode. If the malfunction code is output, proceed to step. If the normal code is output, proceed to step [7].

7. BASIC INSPECTION

Carry out basic inspection such as the spark check and fuel pressure check, etc.

8. DIAGNOSTIC TROUBLE CODE CHART

If the malfunction code is displayed, proceed to inspect the circuit indicated by the chart for each code.

9. MATRIX CHART OF PROBLEM SYMPTOMS

If the normal code is displayed in the diagnosis in test mode, perform troubleshooting according to the inspection order in the Matrix Chart of Problem Symptoms.

10. PARTS INSPECTION

When the Matrix Chart of Problem Symptoms instructs to check the parts, proceed to parts inspection section included in this manual.

11. CIRCUIT INSPECTION

Determine if the malfunction is the sensor, actuator, wire harness, connector or the ECM.

12 CHECK FOR MOMENTARY INTERRUPTION

By performing the check for momentary interruption, the place where momentary interruptions or momentary shorts are occurring due to poor contacts can be isolated.

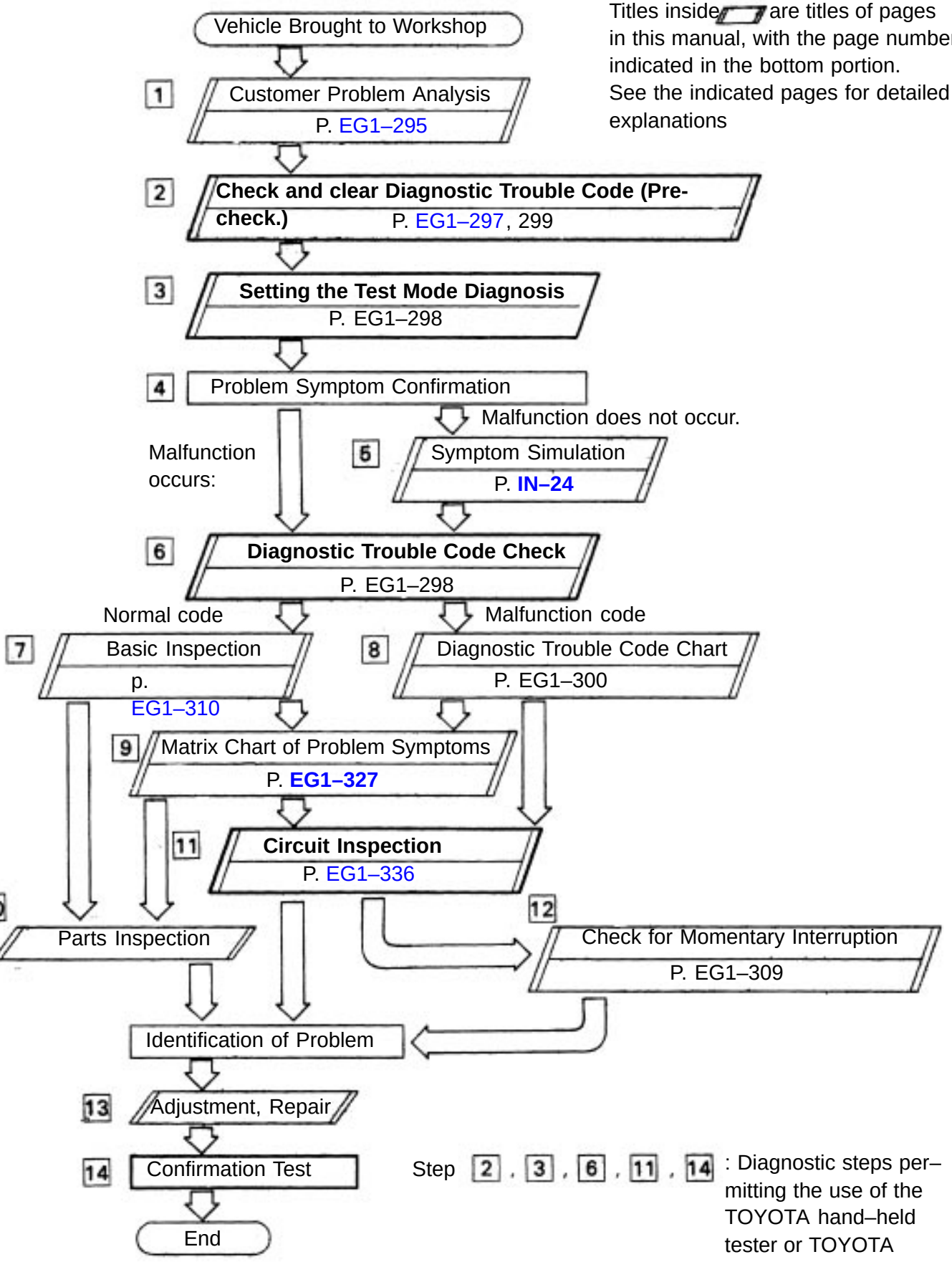
13 ADJUSTMENT, REPAIR

After the cause of the problem is located, perform adjustment or repairs by following the inspection and replacement procedures in this manual.

14 CONFIRMATION TEST

After completing adjustment or repairs, confirm not only that the malfunction is eliminated, but also conduct a test drive, etc., 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



Step 2 , 3 , 6 , 11 , 14 : Diagnostic steps permitting the use of the TOYOTA hand–held tester or TOYOTA break–out–box.

CUSTOMER PROBLEM ANALYSIS CHECK SHEET

ENGINE CONTROL System Check Sheet

Inspector's Name :

Customer's Name		Registration No.	
		Registration Year	/ /
		Frame No.	
Date Vehicle Brought In		Odometer Reading	km Miles

Dates Problem Occured		
Frequency Problem Occurs		☐ Constant ☐ Sometime (times per day/month) ☐ Once only ☐ Other ( )
Conditions When Problem Occurrence	Weather	☐ Fine ☐ Cloudy ☐ Rainy ☐ Snowy ☐ Various/Other
	Outdoor Temperature	☐ Hot ☐ Warm ☐ Cool ☐ Cold (Approx. °F (°C))
	Place	☐ Highway ☐ Suburbs ☐ Inner City ☐ Hill (☐ Up, ☐ Down) ☐ Rough road ☐ Other ( )
	Engine Temp.	☐ Cold ☐ Warming up ☐ After warming up ☐ Any temp. ☐ Other
	Engine Operation	☐ Starting ☐ Just after starting ☐ Idling ☐ Racing without load ☐ Driving (☐ Constant speed ☐ Acceleration ☐ Deceleration ☐ Other ( ))

Problem Symptoms	☐ Engine does not Start	☐ Engine does not crank ☐ No initial combustion ☐ No complete combustion
	☐ Difficult to Start	☐ Engine cranks slowly ☐ Other ( )
	☐ Poor Idling	☐ Incorrect first idle ☐ Idling rpm is abnormal [☐ High ☐ Low (rpm)] ☐ Rough idling ☐ Other ( )
	☐ Poor Driveability	☐ Hesitation ☐ Back fire ☐ Muffler explosion (after fire) ☐ Surging ☐ Knocking ☐ Other ( )
	☐ Engine Stall	☐ Engine stall soon after starting ☐ After acceleration pedal depressed ☐ After acceleration pedal released ☐ During A/C operation ☐ When N to D shift ☐ Other ( )
	☐ Others	

Condition of Malfunction Indicator Lamp		☐ Remains on ☐ Sometimes lights up ☐ Does not light up
Diagnostic Trouble Code Inspection	Normal Mode (Precheck)	☐ Normal code ☐ Malfunction code [code]
	Test Mode	☐ Normal code ☐ Malfunction code [code]



DIAGNOSIS SYSTEM

DESCRIPTION

The ECM contains a built–in self–diagnosis system by which troubles with the engine signal network are detected and a Malfunction indicator lamp on the instrument panel lights up. By analyzing various signals as shown in the later table (See page EG1–300) the Engine Control Module (ECM) detects system malfunctions relating to the sensors or actuators.

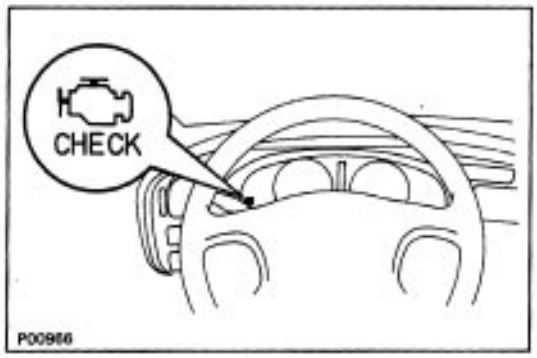
In the normal mode, the self–diagnosis system monitors 14 items, indicated by code No. as shown in EG1–300. A malfunction indicator lamp informs the driver that a malfunction has been detected. The light goes off automatically when the malfunction has been repaired. But the diagnostic trouble code(s) remains stored in the ECM memory (except for code Nos. 16). The ECM stores the code(s) until it is cleared by removing the EFI fuse with the ignition switch off.

The diagnostic trouble code can be read by the number of blinks of the malfunction indicator lamp when TE1 and E1 terminals on the data link connector 1 or 2 are connected. When 2 or more codes are indicated, the lowest number (code) will appear first.

In the test mode, 9 items, indicated by code No. as shown in EG1–300 are monitored. If a malfunction is detected in any one of the systems indicated by code Nos. 13, 22, 24, 25, 26, 27, 31, 41 and 71 the ECM lights the malfunction indicator lamp to warn the technician that malfunction has been detected. In this case, TE2 and E1 terminals on the data link connector 1 or 2 should be connected as shown later. (See page EG1–298).

In the test mode, even if the malfunction is corrected, the malfunction code is stored in the ECM memory even when the ignition switch is off (except code Nos. 43 and 51). This also applies in the normal mode. The diagnostic mode (normal or test) and the output of the malfunction indicator lamp can be selected by connecting the TE1, TE2 and E1 terminals on the data link connector 1 or 2, as shown later.

A test mode function has been added to the functions of the self–diagnostic system of the normal mode for the purpose of detecting malfunctions such as poor contact, which are difficult to detect in the normal mode. This function fills up the self–diagnosis system. The test mode can be implemented by the technician following the appropriate procedures of check terminal connection and operation described later. (See page EG1–298)



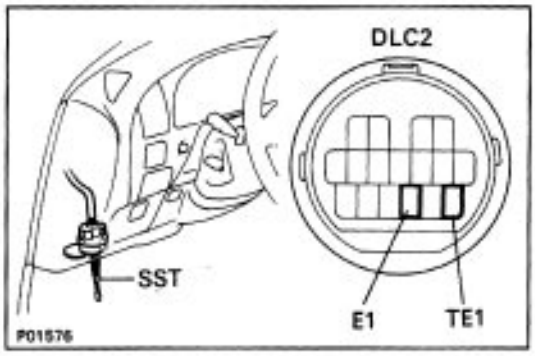
Diagnosis Inspection (Normal Mode)

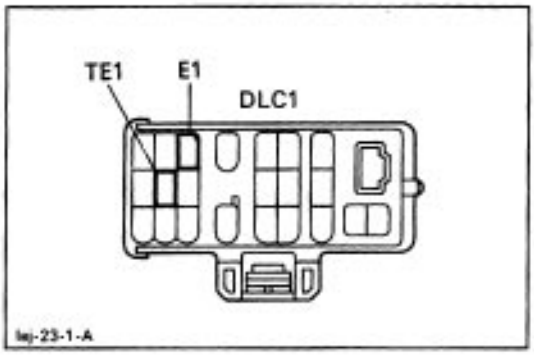
MALFUNCTION INDICATOR LAMP CHECK

1. The Malfunction indicator lamp will come on when the ignition switch is turned ON and the engine is not running.
   HINT: If the malfunction indicator lamp does not light up, proceed to troubleshooting of the combination meter (See page BE–64).
2. When the engine is started, the malfunction indicator lamp should go off.
   If the light remains on, the diagnosis system has detected a malfunction or abnormality in the system.

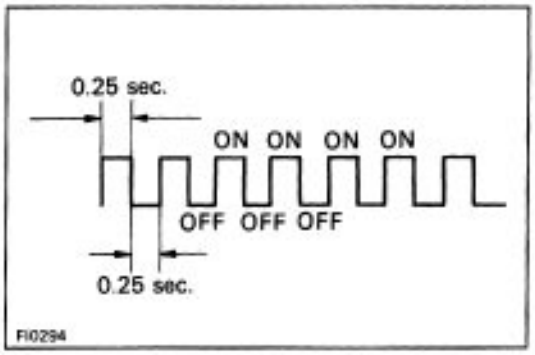
DIAGNOSTIC TROUBLE CODE CHECK

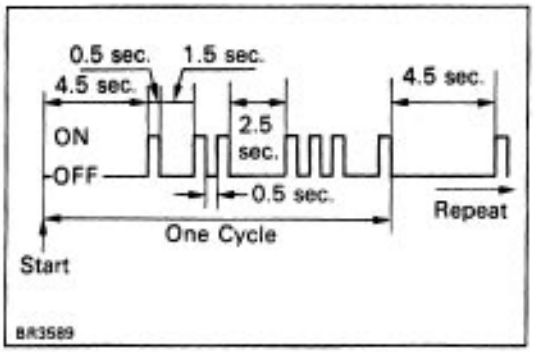
1. Turn ignition switch on.
2. Using SST, connect terminals between TE1 and E1 of data link connector 1 or 2.
   SST 09843–18020





3. Read the diagnostic trouble code from malfunction indicator lamp.
   HINT: If a diagnostic trouble code is not output, check the TE1 terminal circuit (See page EG1–430).

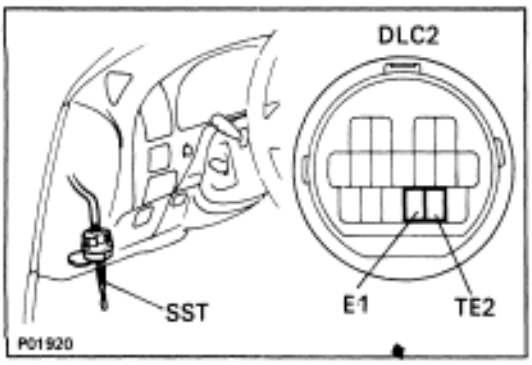


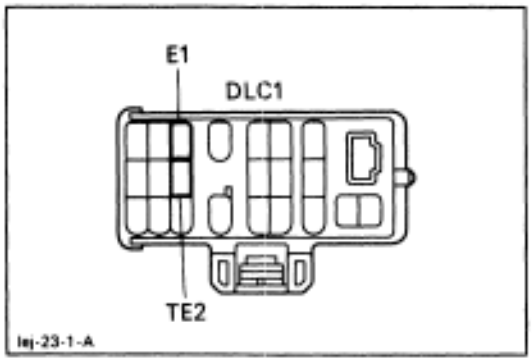


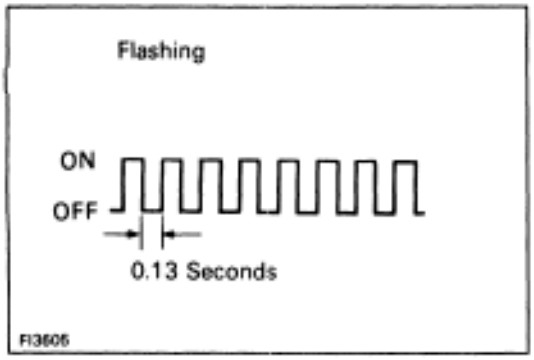
As an example, the blinking patterns for codes;normal, 12 and 31 are as shown on the illustration.

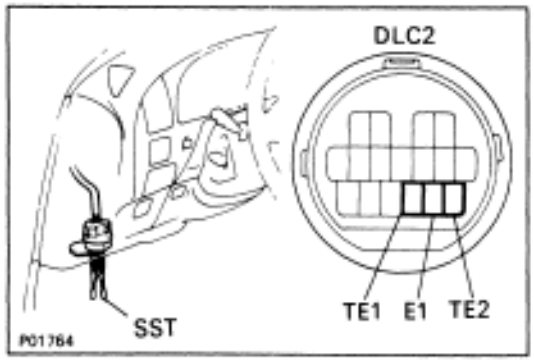
4. Check the details of the malfunction using the diagnostic trouble code table on page EG1–300.
5. After completing the check, disconnect terminals TE1 and E1, and turn off the display.

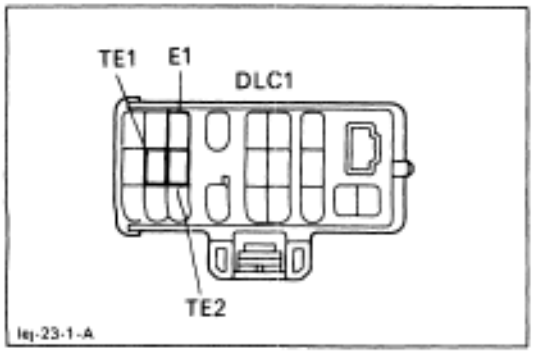
HINT: I n the event of 2 or more malfunction codes, indication will begin from the smaller numbered code and continue in order to the larger.











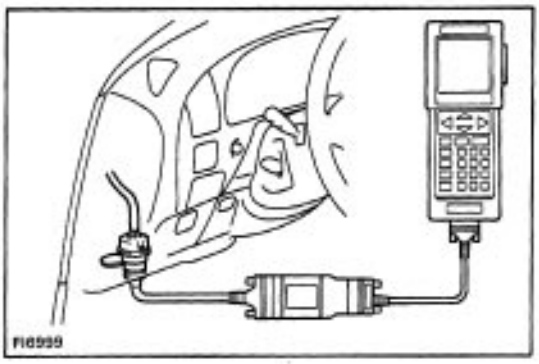
Diagnosis Inspection (Test Mode)

Compared to the normal mode, the test mode has high sens–ing ability to detect malfunctions.
It can also detect malfunctions in the starter signal circuit, the IDL contact signal of the throttle position sensor, air condi–tioning signal and Park/Neutral Position switch signal.
Furthermore, the same diagnostic items which are detected in the normal mode can also be detected in the test mode.

DIAGNOSTIC TROUBLE CODE CHECK

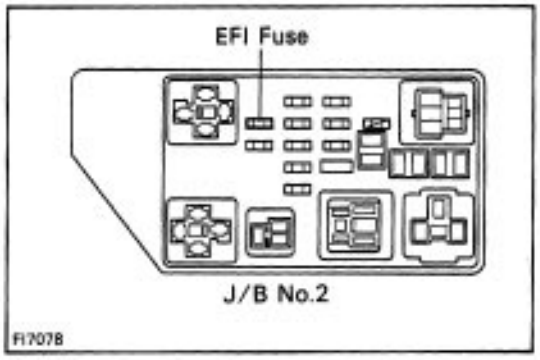
1. Initial conditions.
   (a) Battery voltage 11 V or more.
   (b) Throttle valve fully closed.
   (c) Transmission in neutral position.
   (d) Air conditioning switched off.
2. Turn ignition switch off.
3. Using SST, connect terminals TE2 and E1 of data link connector 1 or 2.
   SST 09843–18020
4. Turn ignition switch on.
   HINT:
   - To confirm that the test mode is operating, check that the malfunction indicator lamp flashes when the igni–tion switch is turned to ON.
   - If the malfunction indicator lamp does not flash, pro–ceed to troubleshooting of the TE2 terminal circuit on page EG1–430.
5. Start the engine.
6. Simulate the conditions of the malfunction described by the customer.
7. After the road test, using SST, connect terminals TE1 and E1 of data link connector 1 or 2.
   SST 09843–18020
8. Read the diagnostic trouble code on malfunction indica–tor lamp on the combination meter (See page EG1–297).
9. After completing the check, disconnect terminals TE1, TE2 and E1, and turn off the display.
   HINT:

- The test mode will not start if terminals TE2 and E1 are connected after the ignition switch is turned on.
- When vehicle speed is 3 mph (5 km/h) or below, diagnostic trouble code “42” (Vehicle speed signal) is output, but this is not abnormal.
- When the engine is not cranked, diagnostic trouble code “43” (Starter signal) output, but this is not ab–normal.
- When the automatic transmission shift lever is in the “D”, “2”, “L” or “R” shift position, or when the air conditioning is on or when the accelerator pedal is depressed, code “51” (Switch condition signal) is output, but this is not abnormal.



DIAGNOSTIC TROUBLE CODE CHECK USING TOYOTA HAND–HELD TESTER

1. Hook up the TOYOTA hand–held tester to the DLC2.
2. Read the diagnostic trouble codes by following the prompts on the tester screen.
   Please refer to the TOYOTA hand–held tester operator's manual for further details.



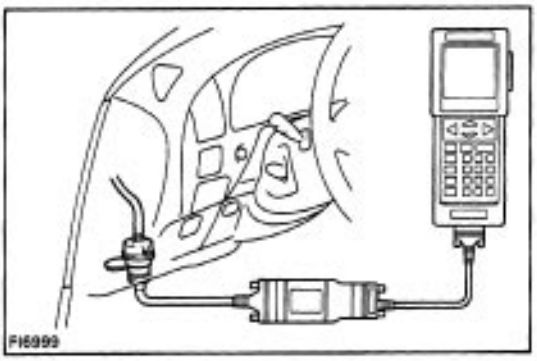
DIAGNOSTIC TROUBLE CODE CLEARANCE

1. After repair of the trouble areas, the diagnostic trouble code retained in the ECM memory must be cleared out by removing the E F I fuse (15A) from J/13 No. 2 for 10 seconds or more, with the ignition switch OFF.

HINT:

- Cancellation can also be done by removing the battery negative (–) terminal, but in this case, other memory systems (clock, etc.) will also be cancelled out.
- If it is necessary to work on engine components requir–ing removal of the battery terminal, a check must first be made to see if a diagnostic trouble code has been recorded.

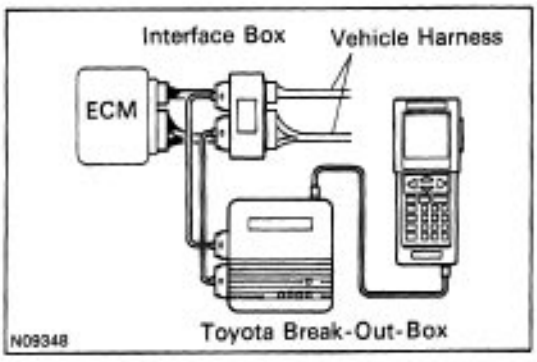
2. After cancellation, road test the vehicle to check that a normal code is now read on the malfunction indicator lamp.
   If the same diagnostic trouble code appears, it indicates that the trouble area has not been repaired thoroughly.



ECM DATA MONITOR USING TOYOTA HAND–HELD TESTER

1. Hook up the TOYOTA hand–held tester to the D LC2.
2. Monitor the ECM data by following the prompts on the tester screen.

HINT: TOYOTA hand–held tester has a "Snapshot" function which records the monitored data.
Please refer to the TOYOTA hand–held tester operator's manual for further details.



ECM TERMINAL VALUES MEASUREMENT USING TOYOTA BREAK–OUT–BOX AND TOYOTA HAND–HELD TESTER

1. Hook up the TOYOTA break–out–box and TOYOTA hand–held tester to the vehicle.
2. Read the ECM input/output values by following the prompts on the tester screen.

HINT: TOYOTA hand–held tester has "Snapshot" func–tion. This records the measured values and is effective in the diagnosis of intermittent problems.
Please refer to the TOYOTA hand–held tester/Toyota break–out–box operator's manual for further details.

DIAGNOSTIC TROUBLE CODE CHART

HINT: Parameters listed in the chart may not be exactly same as your reading due to type of the instruments or other factors.

DTC No.	Number of MIL Blinks	Circuit	Diagnostic Trouble Code Detecting Condition
	 BE3931	Normal	No code is recorded.
12	 BE3931	G, NE Signal Circuit (No. 1) (Exc. California spec.)	No NE signal to ECM within 2 sec. or more after cranking.
			No G signal to ECM for 3 sec. or more with engine speed between 600 rpm and 4,000 rpm.
		G, N E Signal Circuit (No. 1) (Only for California spec,)	No N E or G 1 and G2 signal to ECM for 2 sec. or more after cranking.
			Open in G (–) circuit
13	 BE3931	G, NE Signal Circuit (No. 2)	No NE signal to ECM for 0.3 sec. or more at 1,500 rpm or more.
			No G signal to ECM while NE signal is input 4 times to ECM when engine speed is between 500 rpm and 4,000 rpm.
			* No N E signal to ECM for 0.1 sec. or more at 1,000 rpm or more.
			* NE signal does not pulse 12 times to ECM during the interval between G1 and G2 pulses.
14	 BE3931	Ignition Signal Circuit	No IGF signal to ECM for 4 consecutive IGT signals.
			* No IGF signal to ECM for 8 consecutive IGT signals.
16*4	 BE3931	A/T Control Signal	Fault in communications between the engine CPU and A/T CPU in the ECM

* ,*4 : See page EG1–306

If a malfunction code is displayed during the diagnostic trouble code check in test mode, check the circuit for that code listed in the table below (Proceed to the page given for that circuit).

Trouble Area	Malfunction Indicator Lamp*1		Memory*	See page
	Normal Mode	Test Mode		
———			———	
• Open or short in NE, G circuit • Distributor • Open or short in STA circuit 9 ECM	ON	N.A.	○	EG1–336 EG1–339
• Open or short in NE circuit • Distributor • ECM	ON	N.A.	○	E G –343
	N.A.	ON		
	ON	N.A.		
	N.A.	ON		
• Open or short in IGF or IGT circuit from igniter to ECM • Igniter • ECM	ON	N.A.	○	EG1–344
• ECM	ON	N.A.	X	EG1–351

1, : See page EG1–306

DTC No.	Number of MIL Blinks	Circuit	Diagnostic Trouble Code Detecting Condition
21	 BE3932	Main Oxygen Sensor Signal	Main oxygen sensor signal voltage is reduced to between 0.35 V and 0.70 V for 60 sec. under conditions (a) ~ (d). (2 trip detection logic) *5 (a) Engine coolant temp.: 80 C (176 F) or more. (b) Engine speed: 1,500 rpm or more. (c) Load driving (Ex. A/T in overdrive (5th for M/T), A/C ON, Flat road, 50 mph (80 km/h)). (d)Main oxygen sensor signal voltage: Alternating above and below 0.45 V.
22	 BE3932	Engine Coolant Temp. Sensor Signal	Open or short in engine coolant temp. sensor circuit for 0.5 sec. or more.
24	 BE3932	Intake Air Temp. Sensor Signal	Open or short in intake air temp. sensor circuit for 0.5 sec. or more.
25	 BE3932	Air–Fuel Ratio Lean Malfunction	(1) Main oxygen sensor voltage is 0.45 V or less (lean) for 90 sec. under conditions (a) and (b). (2 trip detection logic)*5 (a) Engine coolant temp.: 60 C (140 F) or more. (b) Engine speed: 1,500 rpm or more. (2) Engine speed varies by more than 15 rpm over the preceding crankshaft position period during a period of 50 sec. or more under conditions (a) and (b). (2 trip detection logic)*5 (a) Engine speed: Idling (b) Engine coolant temp.: 60 C (140 F) or more.

*5: See page EG1–307

Trouble Area	Malfunction Indicator Lamp*1		Memory‘	See page
	Normal Mode	Test Mode		
• Main oxygen sensor circuit • Main oxygen sensor	ON	ON	○	EG1–352
• Open or short in engine coolant temp. sensor circuit • Engine coolant temp. sensor • ECM	ON	ON	○	EG1–356
• Open or short in intake air temp. sensor circuit • Intake air temp. sensor • ECM	ON	ON	○	EG1–360
• Open or short in main oxygen sensor circuit • Main oxygen sensor • ignition system • ECM	ON	ON	○	EG1–363
• Open or short in injector circuit • Fuel line pressure (injector leak, blockage) • Mechanical system malfunction (skipping teeth of timing belt) • Ignition system • Compression pressure (foreign object caught in valve) • Air leakage • ECM				

1, : See page EG1–306

DTC No.	Number of MIL Blinks	Circuit	Diagnostic Trouble Code Detecting Condition
26	 BE3932	Air–Fuel Ratio Rich Malfunction	Engine speed varies by more than 15 rpm over the preceding crankshaft position period during a period of 50 sec. or more under conditions (a) and (b), (2 trip detection logic)*5 (a) Engine speed: Idling (b) Engine coolant temp.:60 C (140 F) or more.
27	 BE3932	Sub Oxygen Sensor Signal	Main oxygen sensor signal is 0.45 V or more and sub oxygen sensor signal is 0.45 V or less under conditions (a) and (b). (2 trip detection logic)*5 (a) Engine coolant temp.: 80 C (176 F) or more. (b) Accel. pedal: Fully depressed for 2 sec. or more.
31	 BE3933	Manifold Absolute Pressure Sensor Signal	Open or short in manifold absolute pressure sensor circuit for 0.5 sec. or more.
41	 BE3934	Throttle Position Sensor Signal	Open or short in throttle position sensor circuit for 0.5 sec. or more.
42	 BE3934	No–1 Vehicle Speed Sensor Signal (for A/T)	All conditions below are detected continuously for 8 sec. or more. (a) No.1 vehicle speed sensor signal: 0 mph (km/h) (b) Engine speed: 3,100 rpm or more. (c) Park/Neutral position switch: OFF
		No.1 Vehicle Speed Sensor Signal (for M /T)	All conditions below are detected continuously for 8 sec. or more. (a) No.1 vehicle speed sensor signal: 0 mph (km/h) (b) Engine speed: Between 3,100 rpm and 5,000 rpm. (e) Engine coolant temp.: 80 C (176 F) or more. (d) Load driving.

*5: See page EG1–307

Trouble Area	Malfunction Indicator Lamp*1		Memory*	See page
	Normal Mode	Test Mode		
• Open or short in injector circuit • Fuel line pressure (injector leak, blockage) • Mechanical system malfunction (skipping teeth of timing belt) • Ignition system • Compression pressure (foreign object caught in valve) • Air leakage • ECM	ON	ON	○	EG1–363
• Open or short in sub oxygen sensor circuit • Sub oxygen sensor • ECM	ON	ON	○	EG1–369
• Open or short in manifold absolute pressure sensor circuit. • Manifold absolute pressure sensor • ECM	ON	ON	○	EG1–372
• Open or short in throttle position sensor circuit • Throttle position sensor • ECM	ON	ON	○	EG1–376
• Open or short in No.1 vehicle speed sensor circuit • No.1 vehicle speed sensor • Combination meter • ECM	OFF	OFF	○	EG1–380

1, : See page EG1–306

DTC No.	Number of MIL Blinks	Circuit	Diagnostic trouble Code Detecting Condition
43	 BE3934	Starter Signal	No starter signal to ECM.
52	 BE3935	Knock Sensor Signal	Open or short in knock sensor circuit with engine speed between 1,200 rpm and 6,000 rpm.
71	 BE3937	EG R System Malfunction	EGR gas temp. is 70 C (158 F) or below for 50 sec. under conditions (a) and (b). (2 trip detection logic)*5 (a) Engine coolant temp.: 80 C (176 F) or more. (b) EGR operation possible (Ex. A/T in 3rd speed (5th for M/T), 55 – 60 mph (88 – 96 km/h), Flat road).
51	 BE3936	Switch Condition Signal	(1) 3 sec. or more after engine starts with closed throttle position switch OFF (IDL). (2) *4 Park/Neutral switch OFF (PNP). (Shift position in “R”, “D”, “2”, or “L” positions). (3) A/C switch ON.

*1; “ON” displayed in the diagnosis mode column indicates that the Malfunction Indicator Lamp is lighted up when a malfunction is detected. “OFF” indicates that the “CHECK” does not light up during malfunction diagnosis, even if a malfunction is detected. “N.A.” indicates that the item is not included in malfunction diagnosis.

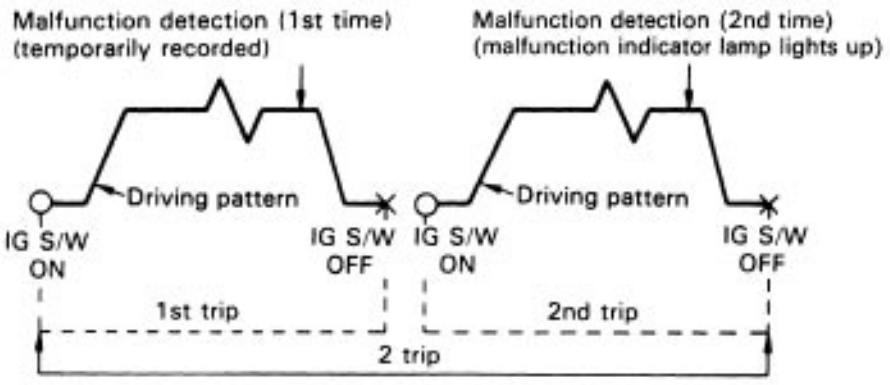
*2; “O” in the memory column indicates that a diagnostic trouble code is recorded in the ECM memory when a malfunction occurs. “X” indicates that a diagnostic trouble code is not recorded in the ECM memory even if a malfunction occurs. Accordingly, output of diagnostic results in normal or test mode is performed with the IG switch ON.

*3; Only for California specification vehicles.

*4; Only vehicles with A/T.

Trouble Area	Malfunction Indicator Lamp*1		Memory*	See page
	Normal Mode	Test Mode		
• Open or short in starter signal circuit • Open or short in ignition switch or starter relay circuit ECM	N.A.	OFF	X	EG1–383
• Open or short in knock sensor circuit • Knock sensor (looseness). • ECM	ON	N.A.	○	EG1–385
• open in EGR gas temp. sensor circuit • Short in VSV circuit for EGR • EGR hose disconnected, valve stuck • Clogged EGR gas passage • ECM	ON	ON	○	EG1–390
• Throttle position sensor IDL circuit • Accelerator pedal and cable • Park/Neutral Position switch circuit • A/C switch circuit • ECM	N.A.	OFF	X	EG1–396

*5: This indicates items for which “2 trip detection logic” is used. With this logic, when a logic malfunction is first detected, the malfunction is temporarily stored in the ECM memory. If the same case is detected again during the second drive test, this second detection causes the Malfunction Indicator Lamp to light up.
The 2 trip repeats the same mode a 2nd time. (However, the IG switch must be turned OFF between the 1st trip and 2nd trip),
In the Test Mode, the Malfunction Indicator Lamp lights up the 1st trip a malfunction is detected.



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
14	Fuel cut	1 IGF detected in consecutive 2 (4*) ignitions.
16	Torque control prohibited.	Returned to normal condition.
22	THW is fixed at 801C (1761F).	Returned to normal condition.
24	THA is fixed at 201C (681F).	Returned to normal condition.
31	• Ignition timing fixed at 51 BTDC. • Injection time fixed Starting ..... 12.1 m sec. I D L 0 N ..... 3.3 m sec. IDL OFF .... 6.1 m sec. • Intake manifold vacuum is fixed at 46.7 kPa. (350 mmHg, 13.8 inHg)	Returned to normal condition.
41	VTA1 is fixed at 01.	The following must each be repeated at least 2 time consecutively. • 0.1 V ≦VTA ≦ 0.95 V • IDL : ON
52	Max. timing retardation.	IG switch OFF.

*: Only for California specification vehicles.

Back–Up Function

If there is trouble with the program in the ECM and the ignition signals (IGT) are not output from 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 throttle position signal (IDL). Also, the ignition timing is fixed at the initial ignition timing, 51 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.

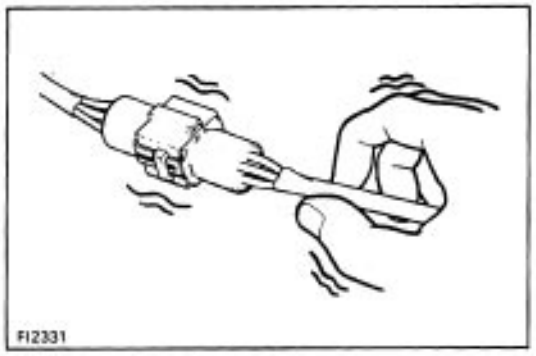
CHECK FOR MOMENTARY INTERRUPTION

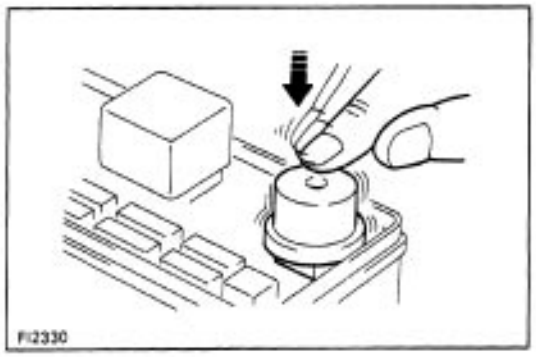
As described in the preceding paragraph, abnormality detec–tion ability in the test mode is increased compared to that in the normal mode, so that when momentary interruptions or momentary shorts occur in the ECM signal circuits (G, NE, THW, THA, PIM, VTA) shown in the table below, the appro–priate diagnostic trouble code is output.

Accordingly, when the diagnostic trouble codes shown in the table below (13, 22, 24, 31, 41) are output during the diag–nostic trouble code check, and inspection of the appropriate circuits reveals no abnormality, perform the check for momen–tary interruption as described below.

By performing the check for momentary interruption, the place where momentary interruptions or momentary shorts are occurring due to poor contacts can be isolated.

DTC	Circuit
13	G, NE signal circuit (No.2)
22	Engine coolant temp. sensor circuit
24	Intake air temp. sensor circuit
31	Manifold absolute pressure sensor circuit
41	Throttle position sensor circuit





CLEAR DIAGNOSTIC TROUBLE CODES

See page EG1–299.

SET TEST MODE

1. With the ignition switch off, using SST, connect the ter–minals TE2 and E1 of the data link connector 1 and 2.
   SST 09843–18020
2. Start the engine and check to see the malfunction indica–tor lamp to go off.

PERFORM A SIMULATION TEST

Using the symptom simulation (See page IN –24), apply vibra–tion to 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 light up, it indi–cates that the place where the wire harness, connector or terminals being pulled or vibrated has faulty contact. Check that point for loose connections, dirt on the terminals, poor fit or other problems and repair as necessary.

HINT: After cancelling out the diagnostic trouble code in memory and set the test mode, if the malfunction indicator lamp does not go off after the engine is started, check thor–oughly for faulty contact, etc., then try the check again. If the malfunction indicator lamp still does not go off, check and replace ECM.

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

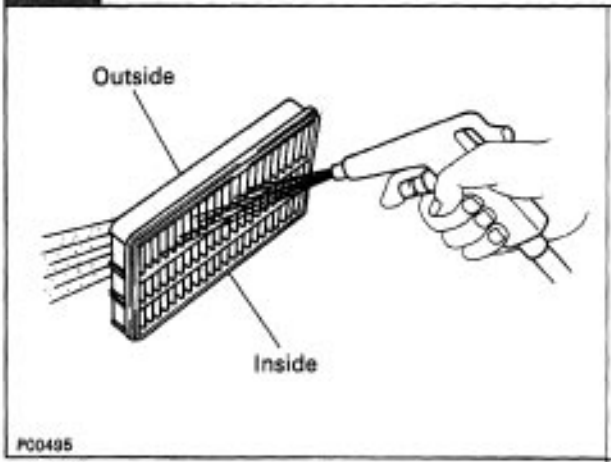
NO → **Proceed to matrix chart of problem symptoms on page EG1–327.**

3 **Does engine start**

YES

NO → **Go to step 7**

4 **Check air filter.**



P Remove air filter.

C Visually check that the air filter is not excessively damaged or oily.

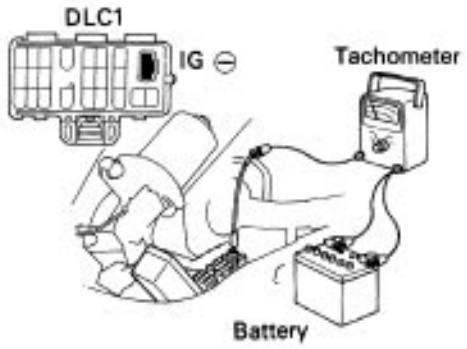
Hint If necessary, clean the air filter with compressed air. First blow from inside thoroughly, then blow off outside of the air filter.

OK

NG → **Repair or replace.**

Go to step 5

5 Check idle speed.



P (1) Shift transmission into “N” position or neutral.
(2) Warm up engine at normal operating temperature.
(3) Switched off all accessories.
(4) Switched off air conditioning.
(5) Connect tachometer test probe to terminal IG (–) of data link connector 1, and set the tachometer to the 4–cylinder range.

C Check idle speed.

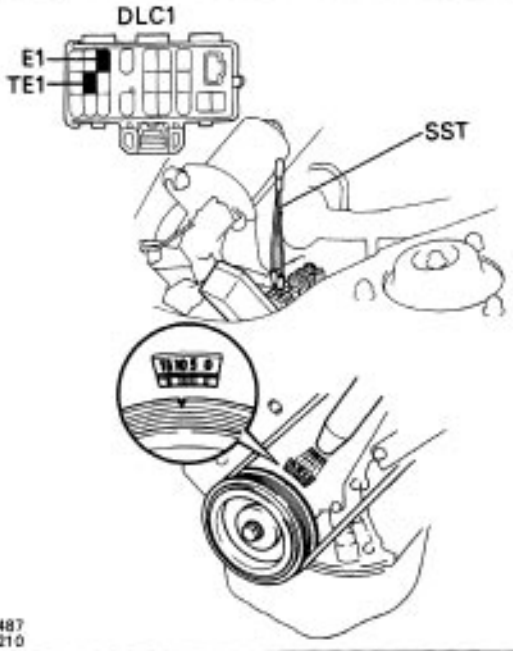
OK **Idle speed: 700 ~ 800 rpm**

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

OK

NG → **Proceed to matrix chart of problem symptoms on page EG1–327.**

6 Check ignition timing.



P (1) Shift transmission into “N” position or neutral.
(2) Warm up engine at normal operating temperature.
(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 No. 1 high–tension cord.

C Check ignition timing.

OK **Ignition timing: 10° BTDC at idle**

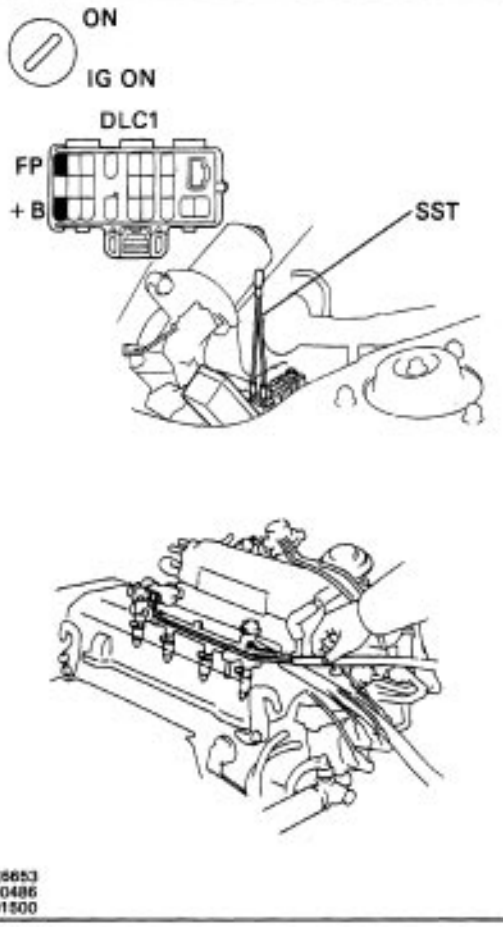
OK

NG → **Proceed to page IG–19, 38* and continue to troubleshoot.**

*Except California specification vehicles.

Proceed to matrix chart of problem symptoms on page EG1–327.

7 Check fuel pressure.



P (1) Be sure that fuel is enough in tank.
(2) Turn ignition switch on.
(3) Using SST, connect terminals FP and + B of data link connector 1.
SST 09843–18020

C Check for fuel pressure in the return hose when it is pinched off.

Hint At this time, you will hear fuel return noise.

Caution **Never make a mistake with the terminal connection position as this will cause a malfunction.**

OK

NG **Proceed to page EG1–178 and continue to troubleshoot.**

8 Check for spark.

C Disconnect the high–tension cord from the distributor and, hold the end about 12.5 mm (1/2”) from the ground, see if spark occurs while the engine is being cranked.

Hint To prevent excessive fuel injected from the injectors during this test, don’t crank the engine for more than 1–2 seconds at a time.

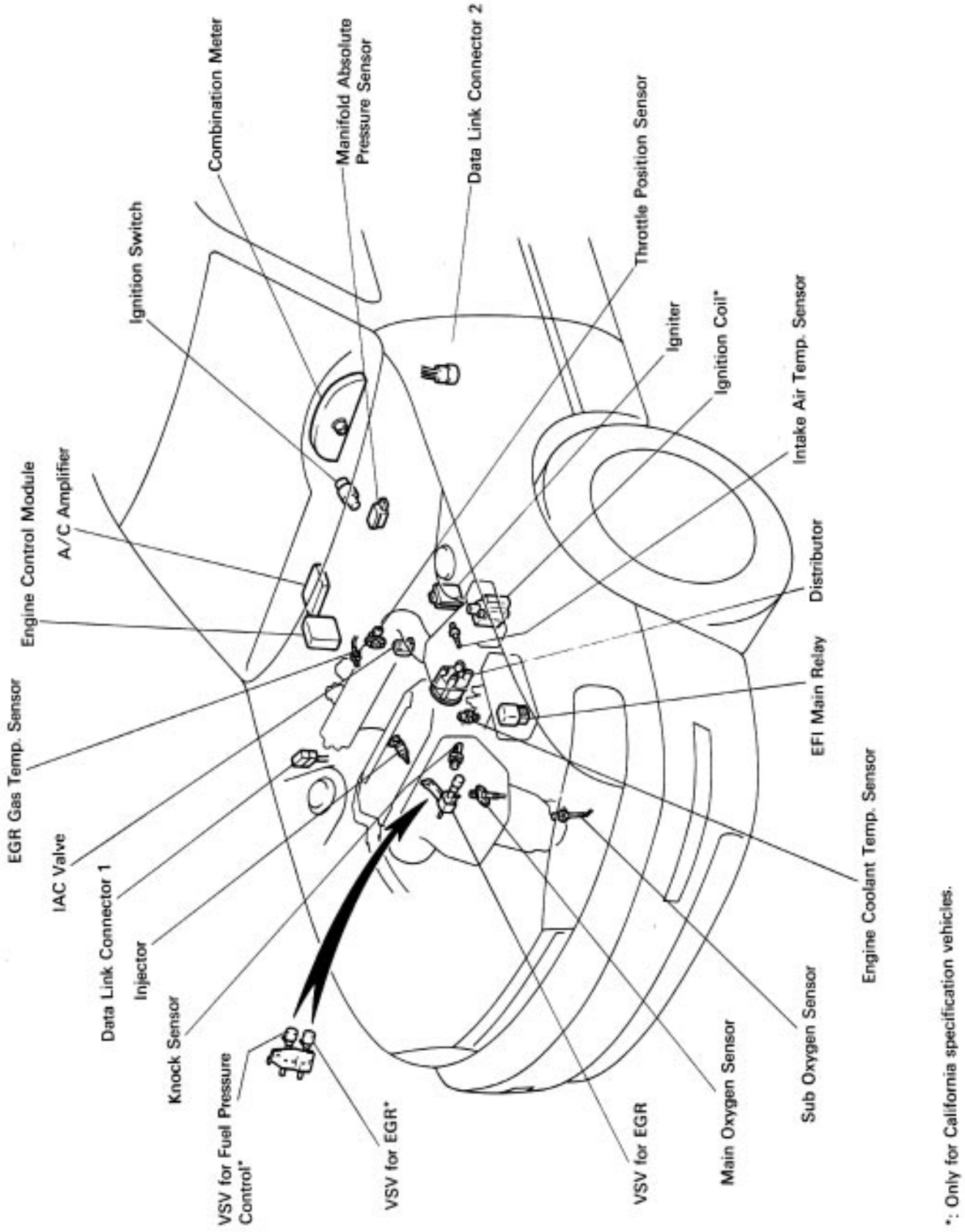
OK

NG **Proceed to page IG–6, 26* and continue to troubleshoot.**

* : Except California specification vehicles.

Proceed to matrix chart of problem symptoms on page EG1–327.

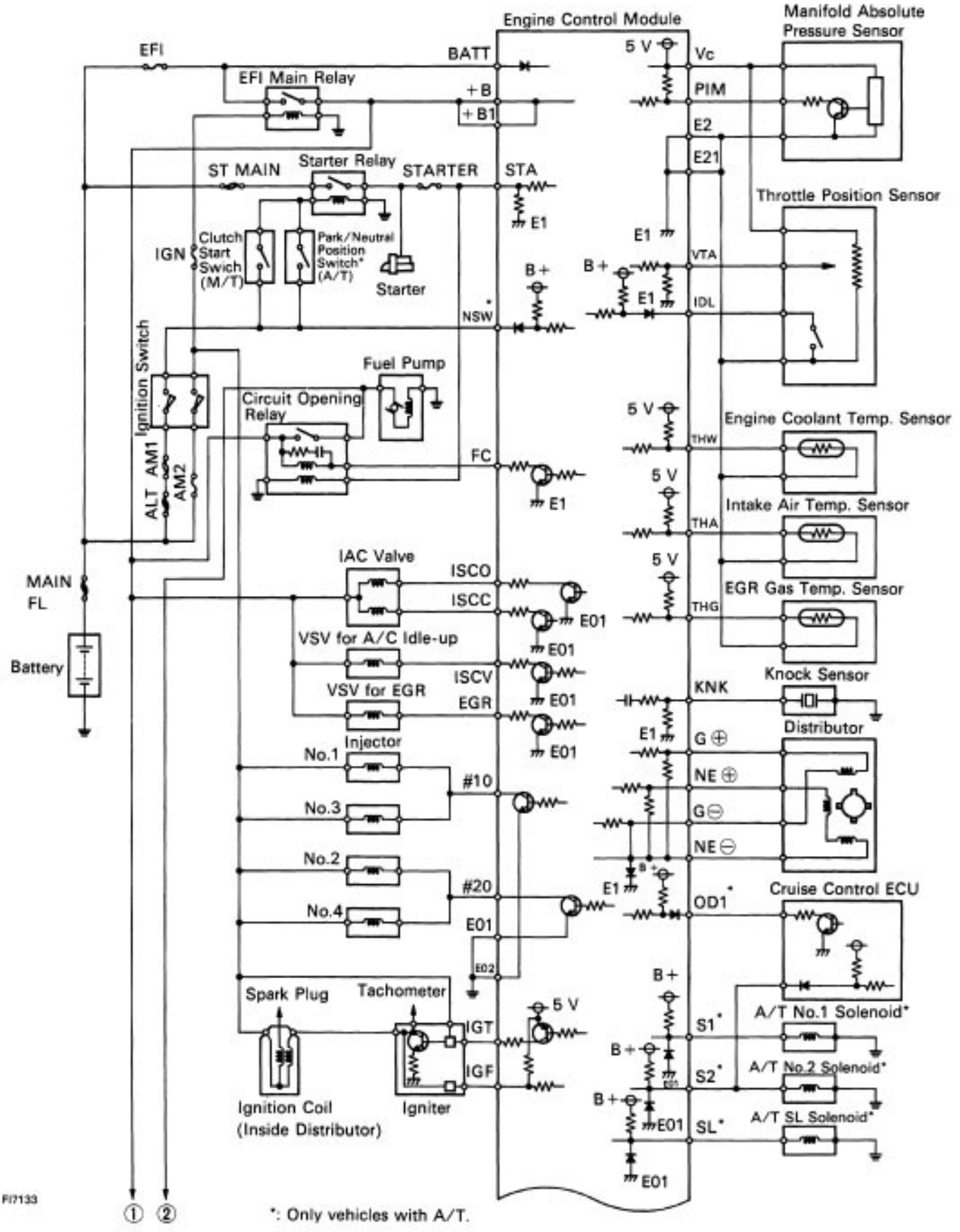
PARTS LOCATION

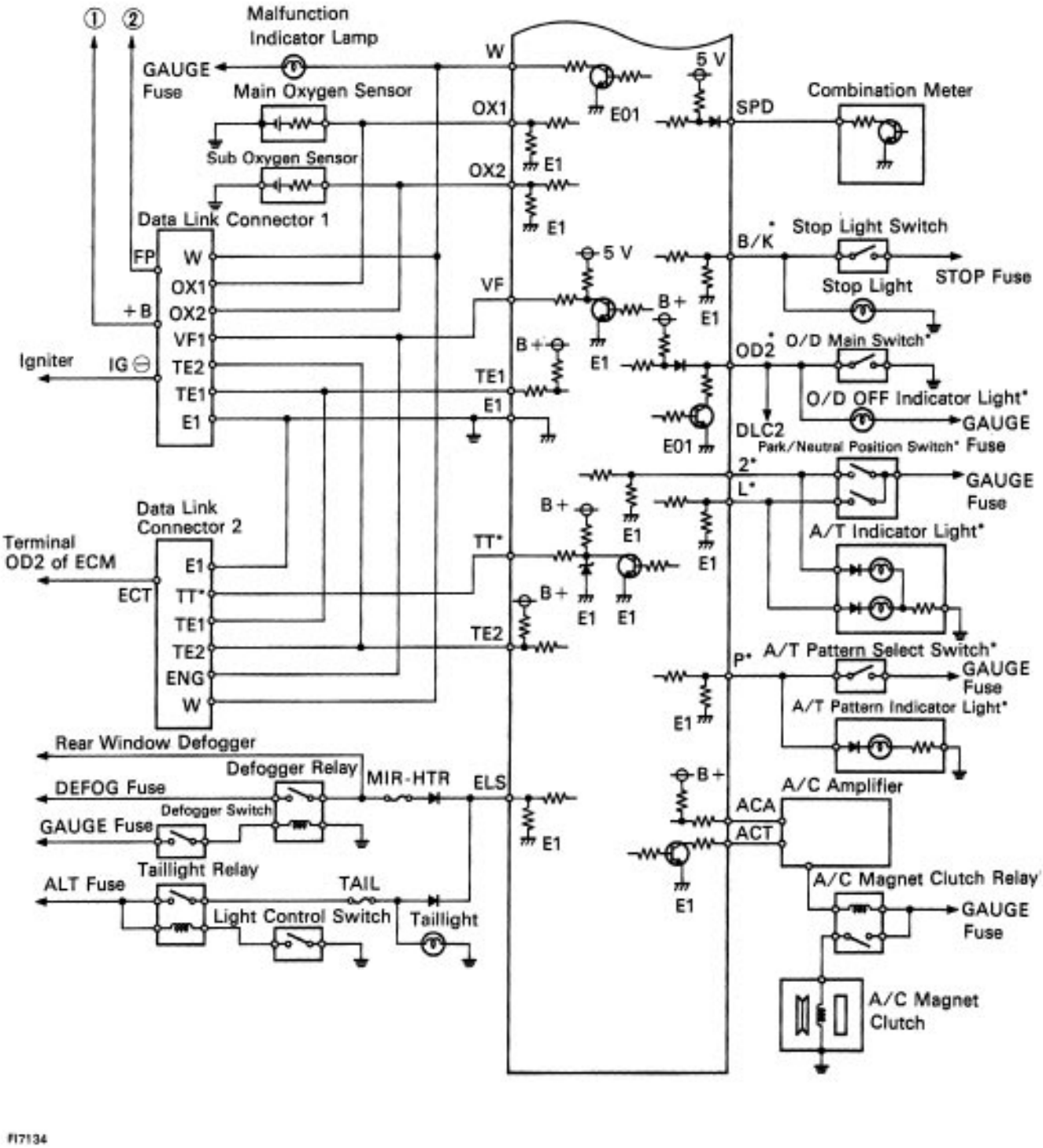


FI7194

WIRING DIAGRAM

Except California specification vehicles.



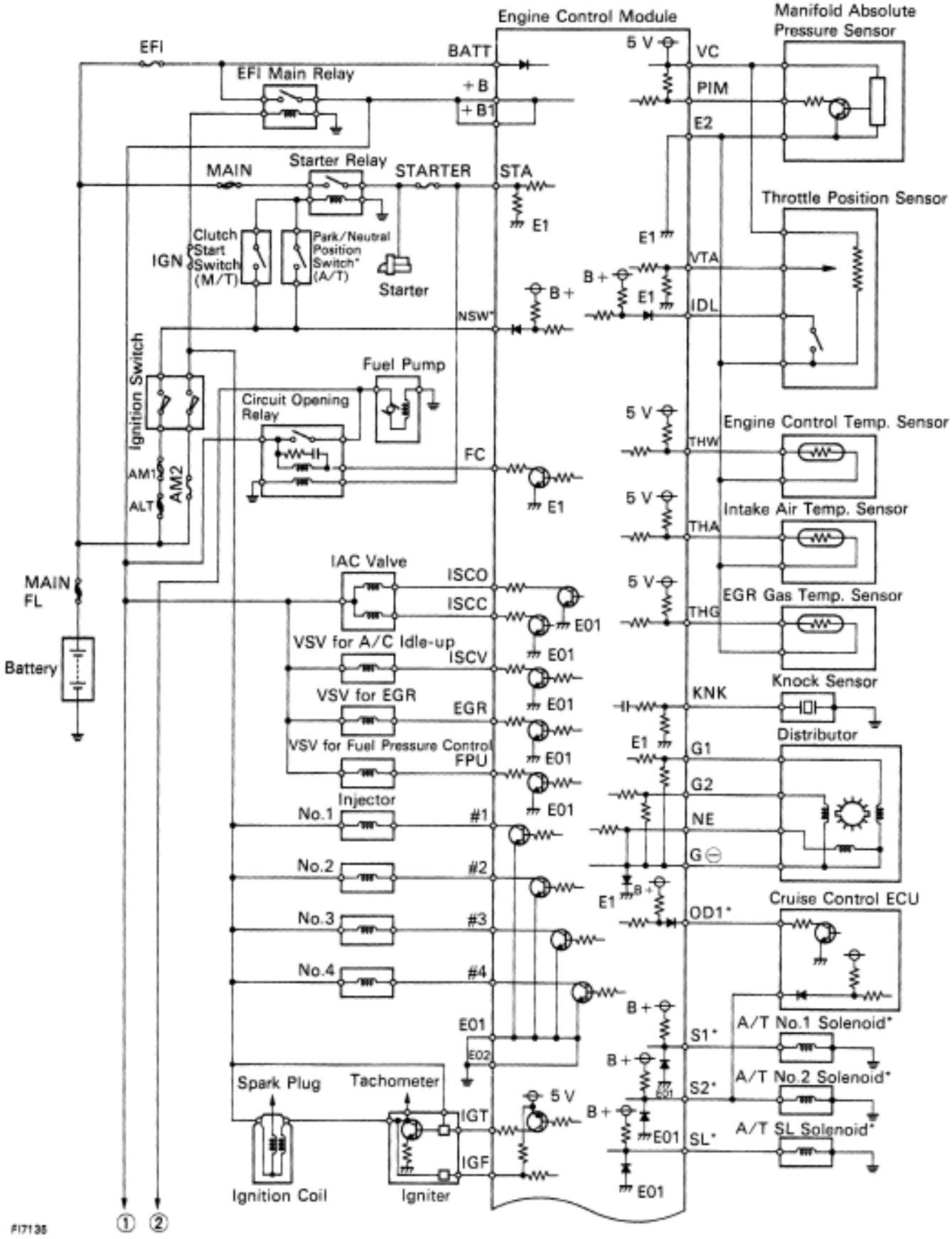


FI7134

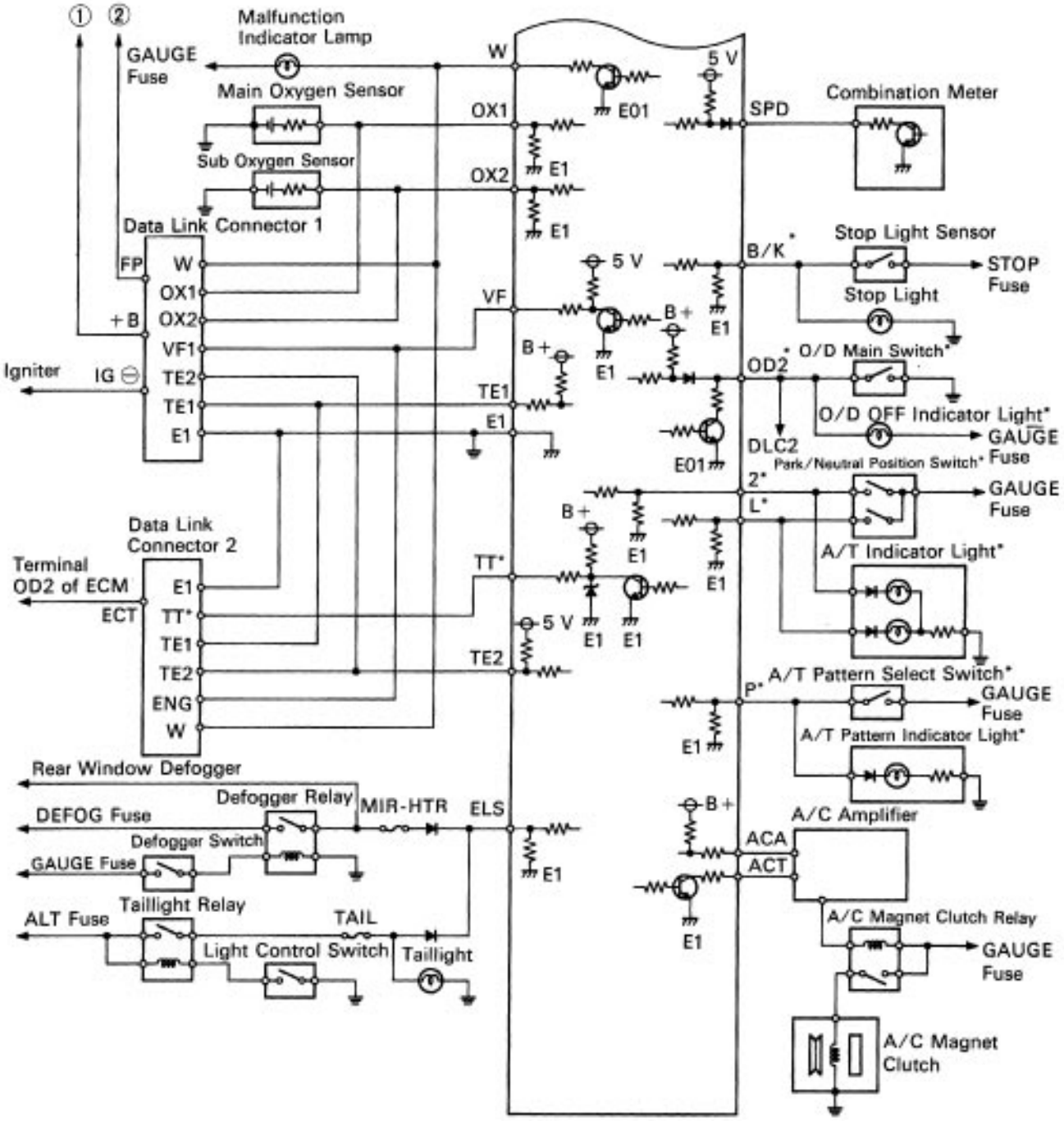
*: Only vehicles with A/T.

WIRING DIAGRAM (Cont'd)

Only for California specification vehicles.



*: Only vehicles with A/T.



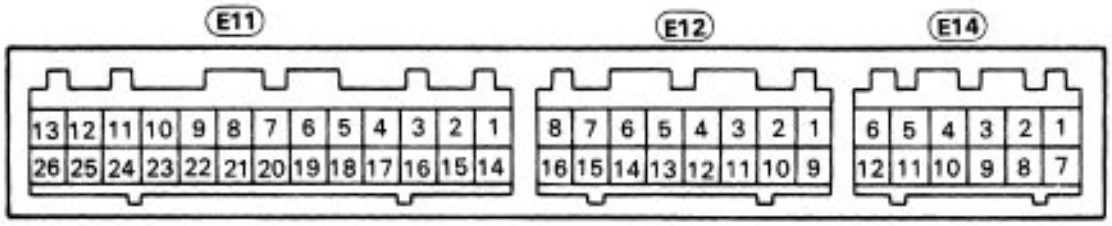
RI7134

*: Only vehicles with A/T.

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 (Except California specification vehicles with M/T)



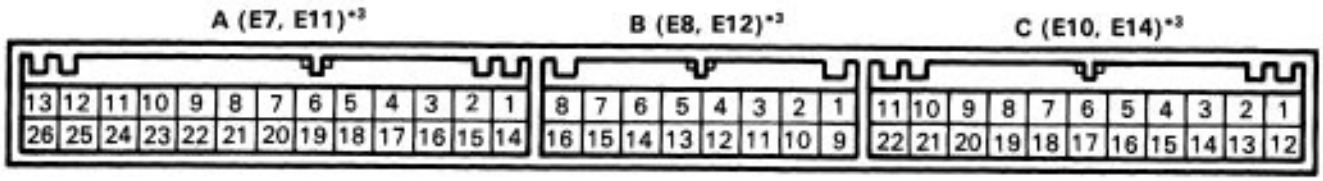
P01821

Terminal No.	Symbol	Connection	Terminal No.	Symbol	Connection
E11– 1	ISCV	VSV for A/C Idle up	E11-11	–	———
- 2	STA	Starter relay	-12	#10	Injectors (No.1 and No.3)
- 3	IGF	Igniter	-13	E01	Power ground
- 4	NE⊕	Distributor	-14	–	———
- 5	G⊕	Distributor	-15	–	———
- 6	–	———	-16	–	———
- 7	–	———	-17	NE⊖	Distributor
- 8	–	———	-18	G⊖	Distributor
- 9	ISCC	IAC valve	-19	–	———
-10	ISCO	IAC valve	-20	–	———

Terminal No.	Symbol	Connection	Terminal No.	Symbol	Connection
E11-21	–	———	E12-12	IDL	Throttle position sensor
-22	IGT	Igniter	-13	THG	EG R gas temp. sensor
-23	EGR	VSV for EG R	-14	–	———
-24	E1	ECM ground	-15	TE1	Data link connector 1 and 2
-25	#20	Injectors (No.2 and No.4)	-16	E21	Sensor ground
-26	E02	Power ground	E14- 1	+B1	EFI main relay
E12- 1	OX2	Sub oxygen sensor	- 2	BATT	Battery
- 2	PIM	Manifold absolute pressure sensor	- 3	ACA	A/C amplifier
- 3	THA	Intake air temp. sensor	- 4	FC	Circuit opening relay
- 4	THW	Engine coolant temp. sensor	- 5	–	———
- 5	KNK	Knock sensor	- 6	ACT	A/C amplifier
- 6	OX1	Main oxygen sensor	- 7	+B	EFI main relay
- 7	TE2	Data link connector 1 and 2	- 8	W	Malfunction indicator lamp
- 8	VF	Data link connector 1	- 9	–	———
- 9	E2	Sensor ground	-10	–	———
-10	VTA	Throttle position sensor	-11	SPD	No.1 vehicle speed sensor
-11	VC	• Manifold absolute pressure sensor • Throttle position sensor	-12	ELS	• Defogger relay • Taillight relay

TERMINAL OF ECM (Cont'd)

ECM (California specification vehicles and except California specification vehicles with A/T)



FI2796

Terminal No.*	Symbol	Connection	Terminal No.*	Symbol	Connection
A- 1	SL	A/T SL solenoid	A-17	G ⊖	Distributor
- 2	S1	A/T No.1 solenoid	-18	G1*1 / G ⊕ *2	Distributor
- 3	IGF	Igniter	-19	–	———
- 4	NE*1 / NE ⊕ *2	Distributor	-20	IGT	Igniter
- 5	G2*1 / NE ⊖ *2	Distributor	-21	–	———
- 6	–	———	-22	–	———
- 7	ISCV	VSV for A/C Idle up	-23	EGR	VSV for EG R
- 8	FPU*1	VSV for fuel pressure control	-24	#4*1	No.4 injector
- 9	ISCC	IAC valve	-25	#3*1	No.3 injector
-10	ISCO	IAC valve	-26	E02	Power ground
-11	#2*1 / #20*2	No.2 injector / No.2 and No.4 injectors	B- 1	VC	• Manifold absolute pressure sensor • Throttle position sensor
-12	#1*1 / #20*2	No.1 injector / No.1 and No.3 injectors	- 2	PIM	Manifold absolute pressure sensor
-13	E01	Power ground	- 3	THA	Intake air temp. sensor
-14	E1	ECM ground	- 4	THW	Engine coolant temp. sensor
-15	S2	A/T No,2 solenoid	- 5	OX2	Sub oxygen sensor
-16	–	———	- 6	OX1	Main oxygen sensor

*1: Only for California specification vehicles.
*4: Except California specification vehicles with A/T.

*3:

Connector Mark	A	B	C
ECM for A/T	E7	E8	E10
ECM for M/T	E11	E12	E14

Terminal No.	Symbol	Connection	Terminal No.	Symbol	Connection
B- 7	TT	Data link connector 2	C- 7	OD2	O/D main switch
- 8	VF	Data link connector 1	- 8	–	———
- 9	E2	Sensor ground	- 9	SPD	No.1 vehicle speed sensor
-10	THG	EGR gas temp. sensor	-10	ACA	A/C amplifier
-11	VTA	Throttle position sensor	-11	STA	Starter relay
-12	IDL	Throttle position sensor	-12	+B	EFI main relay
-13	KNK	Knock sensor	-13	+B1	EFI main relay
-14	TE2	Data link connector 1 and 2	-14	FC	Circuit opening relay
-15	TE1	Data link connector 1 and 2	-15	–	———
-16	E21*2	Sensor ground	-16	–	———
C- 1	BATT	Battery	-17	–	———
- 2	ELS	• Defogger relay • Taillight relay	-18	2	Park/neutral position switch
- 3	–	———	-19	L	Park/neutral position switch
- 4	B/K	• Stoplight switch • Stoplight	-20	OD1	Cruise control ECU
- 5	W	Malfunction indicator lamp	-21	ACT	A/C amplifier
- 6	P	• Park/neutral position switch	-22	NSW	Park/neutral position switch

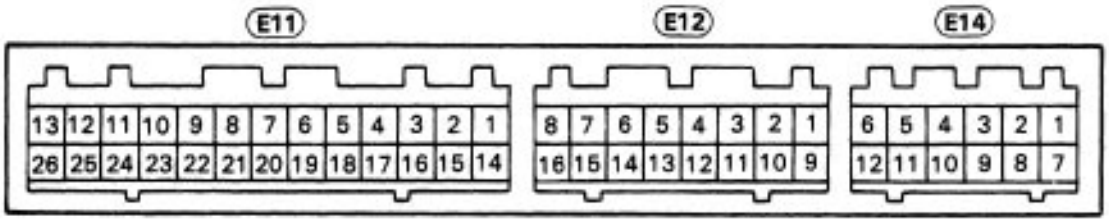
*1: Only for California specification vehicles.
*4: Except California specification vehicles with A/T.

*3.

Connector Mark	A	B	C
ECM for A/T	E7	E8	E10
ECM for M/T	E11	E12	E14

STANDARD VALUE OF ECM TERMINALS

ECM (Except California specification vehicles with M/T)



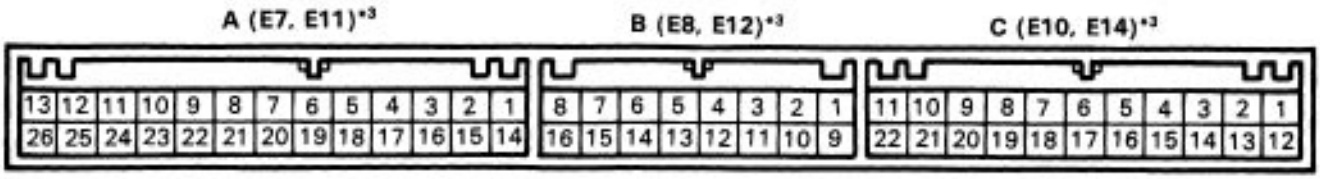
P01821

Symbols (Terminals No.)	Wiring Color	STD Voltage (V)	Condition
BATT (E14-2) – E1 (E11-24)	W-L ↔ BR	9 ~ 14	Always
+B (E14-7) +B1 (E14-1) – E1 (E11-24)	B-O B-O ↔ BR	9 ~ 14	IG switch ON
VC (E12-11) – E2 (E12-9)	R ↔ BR	4.5 ~ 5.5	IG switch ON
IDL (E12 – 12) – E2 (E12-9)	L ↔ BR	0 ~ 3.0	IG switch ON and apply vacuum to the throttle opener. Throttle valve fully closed.
		9 ~ 14	IG switch ON Throttle valve fully open
VTA (E12 – 10) – E2 (E12-9)	B ↔ BR	0.3 ~ 0.8	IG switch 0 N Throttle valve fully closed
		3.2 ~ 4.9	IG switch ON Throttle valve fully open
PIN (E12-2) – E2 (E12-9)	B-Y ↔ BR	3.3 ~ 3.9	IG switch ON
		2.5 ~ 3.1	Idling
THA (E12-3) – E2 (E12-9)	L-B ↔ BR	0.5 ~ 3.4	Idling, Intake air temp. 20°C (68°F)
THW (E12-4) – E2 (E12-9)	LG ↔ BR	0.2 ~ 1.0	Idling, Engine coolant temp, 80°C (176°F)
#10 (E11-12) – E01 (E11-13) #20 (E11-25) – E02 (E11-26)	W ↔ W-B Y ↔ W-B	9 ~ 14	IG switch ON
		Pulse generation	Idling
IGT (E11-22) – E1 (E11-24)	W ↔ BR	Pulse generation (See page EG1–347)	Idling
IGF (E11-3) – E1 (E11-24)	W-R ↔ BR	Below 2.0	IG switch ON
		Pulse generation (See page EG1–347)	Idling
G ⊕ (E11-5) – G ⊖ (E11-18)	Y ↔ B	Pulse generation (See page EG1–336)	Idling
NE ⊕ (E11-4) – NE ⊖ (E11-17)	R ↔ L	Pulse generation (See page EG1–336)	Idling

Symbols (Terminals No.)	Wiring Color	STD Voltage (V)	Condition
ISCC (E11-9) – E01 (E11-3) ISCO (E11-10) – E01 (E11-3)	G-R ↔ W-B G-Y ↔ W-B	9 ~ 14	IG switch ON
VF (E12-8) – E1 (E11-24)	R-W ↔ BR	1.8 ~ 3.2	Maintain engine speed at 2,500 rpm for 2 minutes after warming up then return to idling
OX1 (E12-6) – E1 (E11-24)	W ↔ BR	Pulse generation (See page EG1–355)	Maintain engine speed at 2,500 rpm for 2 minutes after warming up
EGR (E11-23) – E01 (E11-13)	G ↔ W-B	9 ~ 14	IG switch ON
KNK (E12-5) – E1 (E11-24)	W ↔ BR	Pulse generation (See page EG1–389)	Idling
SPD (E14-11) – E1 (E11-24)	V-Y ↔ BR	Pulse generation (See page EG1–380)	IG switch ON Rotate driving wheel slowly
TE1 (E12-15) – E1 (E11-24)	GR ↔ BR	9 ~ 14	IG switch ON
TE2 (E12-7) – E1 (E11-24)	G-W ↔ BR	9 ~ 14	IG switch ON
W (E14-8) – E1 (E11-24)	G-R ↔ BR	9 ~ 14	Idling
		Below 3.0	IG switch ON
ACA (E14-3) – E1 (E11-24)	B-Y ↔ BR	Below 1.5	A/C switch ON (at idling)
		9 ~ 14	A/C switch OFF
ISCV (E11-1) – E01 (E11-13)	LG ↔ W-B	Below 2.0	Idling, A/C switch ON
		9 ~ 14	Idling, A/C switch OFF

STANDARD VALUE OF ECM TERMINALS (Cont'd)

ECM (California specification vehicles and except California specification vehicles with A/T)



Symbols (Terminals No.)*3	Wiring Color	STD Voltage (V)	Condition
BATT (C-1) – E1 (A-14)	W-L ↔ BR	9 ~ 14	Always
+B (C-12), +B1 (C-13) – E1 (A-14)	B-O, B-O ↔ BR	9 ~ 14	IG switch ON
VC (B-1) – E2 (B-9)	R ↔ BR	4.5 ~ 5.5	IG switch ON
IDL (B-12) – E2 (B-9)	L ↔ BR	0 ~ 3.0	IG switch ON and apply vacuum to the throttle opener. Throttle valve fully closed.
		9 ~ 14	IG switch ON Throttle valve fully open
VTA (B-11) – E2 (B-9)	B ↔ BR	0.3 ~ 0.8	IG switch ON Throttle valve fully closed
		3.2 ~ 4.9	IG switch ON Throttle valve fully open
PIM (B-2) – E2 (B-9)	B-Y ↔ BR	3.3 ~ 3.9	IG switch ON
		2.5 ~ 3.1	Idling
THA (B-3) – E2 (B-9)	L-B ↔ BR	0.5 ~ 3.4	Idling, Intake air temp. 20°C (68°F)
THW (B-4) – E2 (B-9)	LG ↔ BR	0.2 ~ 1.0	Idling, Engine coolant temp. 80°C (176°F)
#10 (#1*1) (A-12) – E01 (A-13) #20 (#2*1) (A-11) – E01 (A-13) #3*1 (A-25) – E01 (A-13) #4*1 (A-24) – E01 (A-13)	W ↔ W-B Y ↔ W-B R-L ↔ W-B R-B ↔ W-B	9 ~ 14	IG switch ON
		Pulse generation (See page EG1–410)	Idling
IGT (A-20) – E1 (A-14)	W ↔ BR	Pulse generation (See page EG1–347)	Idling
IGF (A-3) – E1 (A-14)	W-R ↔ BR	Below 2.0	IG switch ON
		Pulse generation (See page EG1–347)	Idling
G1 (A-18), G2 (A-5) – G⊖ (A-17)*1	Y, L ↔ B	Pulse generation (See page EG1–341)	Idling
NE (A-4) – G⊖ (A-17)*1	R ↔ B	Pulse generation (See page EG1–341)	Idling
G⊕ (A-18) – G⊖ (A-17)*2	Y ↔ B	Pulse generation (See page EG1–336)	Idling
NE⊕ (A-4) – NE⊖ (A-5)*2	R ↔ L	Pulse generation (See page EG1–336)	Idling

*1: Only for California specification vehicles.
*2: Except California specification vehicles with A/T.

*3.

Connector Mark	A	B	C
ECM for A/T	E7	E8	E10
ECM for M/T	E11	E12	E14

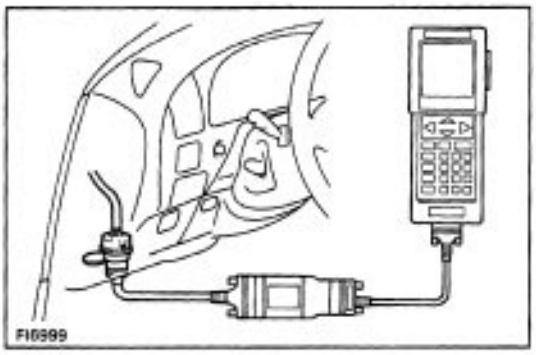
Symbols (Terminals No.)*3	Wiring Color	STD Voltage (V)	Condition
ISCC (A-9) ISCO (A-10) – E01 (A-13)	G-R G-Y ↔ W-B	9 ~ 14	IG switch ON
VF (B-8) – E1 (A-14)	R-W ↔ BR	1.8 ~ 3.2	Maintain engine speed at 2,500 rpm for 2 minutes after warming up then return to idling
OX1 (B-6) – E1 (A-14)	W ↔ BR	Pulse generation (See page EG1–355)	Maintain engine speed at 2,500 rpm for 2 minutes after warming up
EGR (A-23) – E01 (A-13)	G ↔ W-B	9 ~ 14	IG switch ON
KNK (B-13) – E1 (A-14)	W ↔ BR	Pulse generation (See page EG1–389)	Idling
NSW (C-22) – E1 (A-14)	B-W ↔ BR	9 ~ 14	IG switch ON Other shift position in “P”, “N” position
		0 ~ 3.0	IG switch ON Shift position in “P”, “N” position
SPD (C-9) – E1 (A-14)	V-Y ↔ BR	Pulse generation (See page EG1–380)	IG switch ON Rotate driving wheel slowly
TE1 (B-15) – E1 (A-14)	GR ↔ BR	9 ~ 14	IG switch ON
TE2 (B-14) – E1 (A-14)	G-W ↔ BR	9 ~ 14	IG switch O N
W (C-5) – E1 (A-14)	G-R ↔ BR	9 ~ 14	Idling
		Below 3.0	IG switch ON
OD1 (C-20) – E1 (A-14)	Y-B ↔ BR	9 ~ 14	IG switch ON
OD2 (C-7) – E01 (A-13)	G-O ↔ W-B	9 ~ 14	IG switch ON O/D main switch pushed in
		Below 1.0	IG switch ON 0/D main switch pushed out
ACA (C-8) – E1 (A-14)	B-Y ↔ BR	Below 1.5	A/C switch ON (At idling)
		9 ~ 14	A/C switch OFF
ISCV (A-7) – E01 (A-13)	LG ↔ W-B	Below 2.0	Idling, A/C switch ON
		9 ~ 14	Idling, A/C switch OFF
FPU (A-8) – E01 (A-13)*1	B-R ↔ W-B	9 ~ 14	IG switch ON
		Below 2.0	Restarting at high engine coolant temp.

*1: Only for California specification vehicles.

*3:

Connector Mark	A	B	C
ECM for A/T	E7	E8	E10
ECM for M/T	E11	E12	E14

REFERENCE VALUE OF ECM DATA



HINT: ECM data can be monitored by TOYOTA hand–held tester.

1. Hook up the TOYOTA hand–held tester to the DLC2.
2. Monitor ECM data by following the prompts on the tester screen.

Please refer to the TOYOTA hand–held tester operator's manual for further details.

REFERENCE VALUE

Item	Inspection condition	Reference value
INJECTOR	Engine cold to hot Engine idling at normal operating temp.	Gradually decreases Approx. 2 ~ 5 msecs
IGNITION	Increase engine speed	Gradually increases
IAC DUTY	Engine idling at normal operating temp.	30~60%
ENGINE SPEED	RPM kept stable (Comparison with tachometer)	No great changes
MAP	Engine idling at normal operating temp. increase engine load	Approx. 180 ~ 280 mm Hg Gradually increases
ECT	Engine at normal operating temp.	75 – 951C (185 – 2031F) *1
THROTTLE	Closed throttle position Wide open throttle From closed throttle position to wide open throttle	Below 51 Above 701 Gradually increases
VEHICLE SPD	During driving (Comparison with speedometer)	No large differences
TARGET A/F L	Engine idling at normal operating temp.	2.50± 1.25 V *2
A/F FB LEFT	RPM stable at 2,500 rpm with normal operating temp.	ON
STA SIGNAL	During cranking	ON
CTP SIGNAL	Closed throttle position	ON
A/C SIGNAL	A/C switch ON	ON
PNP SIGNAL *3	When shifting from "P" or "N" position into a position other than "P" or "N"	G EAR
OxL	PRM stable at 2,500 rpm with normal operating temp.	RICH LEAN is repeated

*1: If the engine coolant temp, sensor circuit is open or shorted, the ECM assumes an engine coolant temp, value of 801C (1761F).
*2: When feedback control is forbidden, 0 V is displayed,
*3: A/T only.

MATRIX CHART OF PROBLEM SYMPTOMS

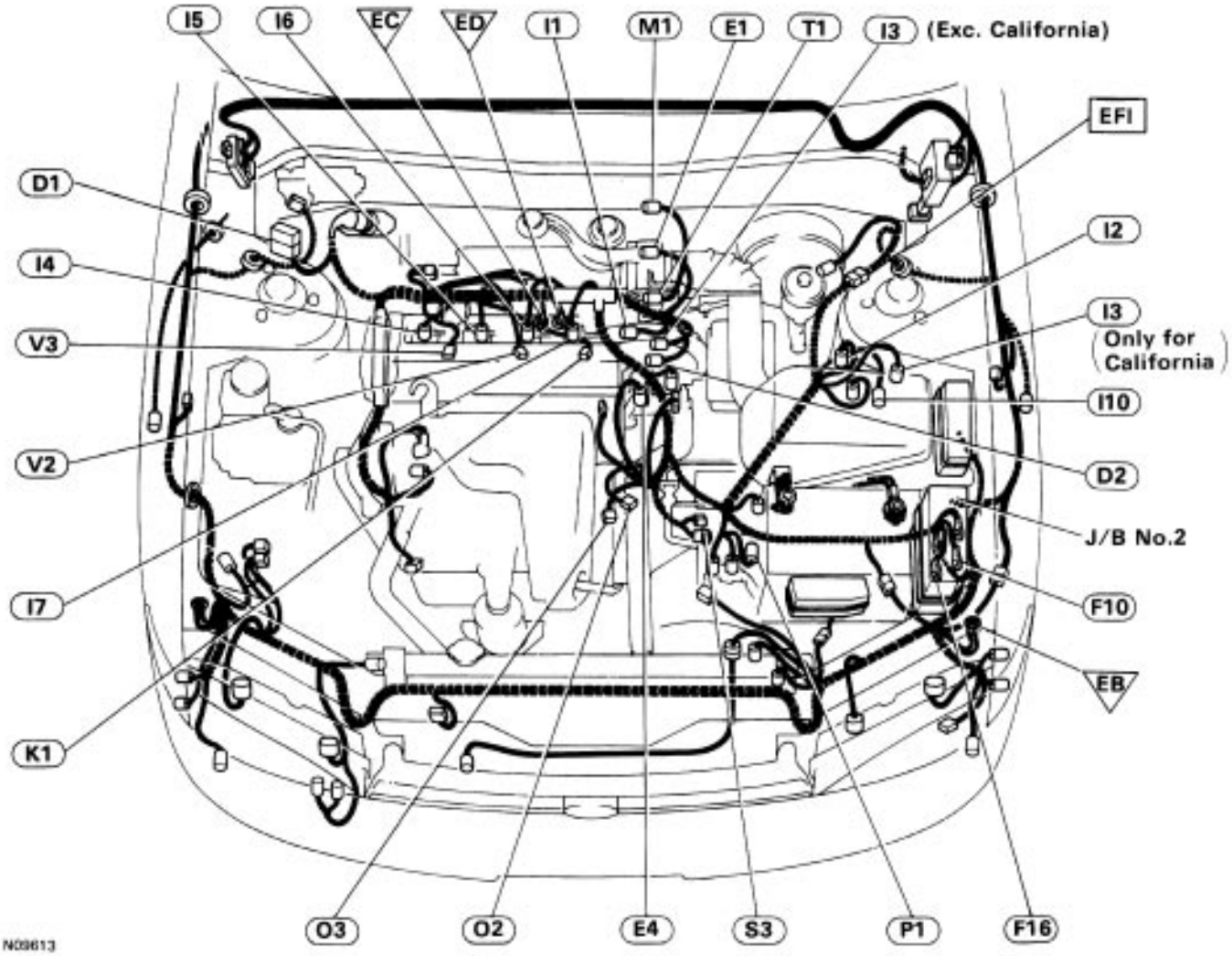
When the malfunction code is not confirmed in the diagnostic trouble code check and the problem still can not be confirmed in the basic inspection, then proceed to this step and perform troubleshooting according to the numbered order given in the table below.

Symptom	Suspect area	See page	Manifold absolute pressure sensor circuit	Starter signal circuit	EG R system	Switch condition signal circuit	Park/Neutral position switch circuit	ECM power source circuit	Back up power source circuit	Injector circuit	IAC valve circuit	Fuel system circuit	A/C cut control circuit	VSV circuit for fuel pressure control	Starter and Starter relay	Ignition signal circuit (Spark test)	Spark plug	Ignition coil	Distributor	Compression	A/T faulty	Engine control module
			EG1–372	EG1–383	EG1–390	EG1–396	EG1–400	EG1–403	EG1–408	EG1–410	EG1–415	EG1–419	EG1–428	EG1 –424	ST–19,21	IG–6,26*	IG–8,28*	IG–10,30*	IG–11,30	EG1–23	AX1–68	IN–36
Does not start	Engine does not crank						2								1							
	No initial combustion							1		5		3				2	4					
	No complete combustion									6		1				5	4	2	3			
Difficult to start	Under normal condition			1						8	2	3					6	4	5	7		
	Cold engine			1						4	2	3					7	5	6			
	Hot engine			1						5	2	4		3			8	6	7			
Poor Idling	Incorrect first idle					1					2											
	High engine idle speed					1	4	3	5		2											
	Low engine idle speed		6			2	3		7	5	1	4										
	Rough idling		3		5	1			12	4	2	8				6	11	9	10	7		
	Hunting		3			1		4			2	5										
Poor Driveability	Hesitation/Poor acceleration		2			1				3		4	9			5	8	6	7		10	
	Muffler explosion (after fire)					1				5							4	2	3			
	Surging					1				5		2					4		3			
Engine Stall	Soon after starting		2								3	1										
	After acceleration pedal depressed		2			1																
	After acceleration pedal released									1	2											3
	During A/C operation										1											2
	When N to D shift						1				2											

*: Except California specification vehicles.

LOCATION OF CONNECTORS

Location of Connectors in Engine Compartment

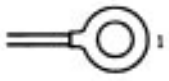
























K1
Knock Sensor



Ie-1-1-B

M1
Manifold Absolute Pressure Sensor



Ie-3-1-B

O2
Sub Oxygen Sensor



Ie-2-1-C

O3
Main Oxygen Sensor



Ie-1-1

P1
Park/Neutral Position Switch



Ie-10-1-B

S3
Starter



Ig-1-1-A

T1
Throttle Position Sensor



IS-4-1-C

V2
VSV for EGR



Ie-2-1-X

V3
VSV for Fuel Pressure Control



Ie-2-1-X

EFI

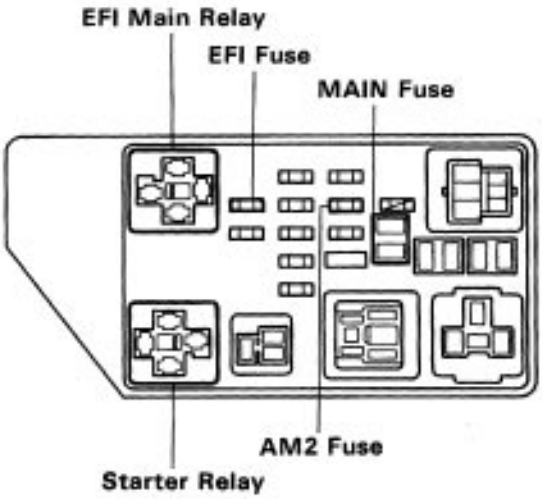


Ifg-4-1

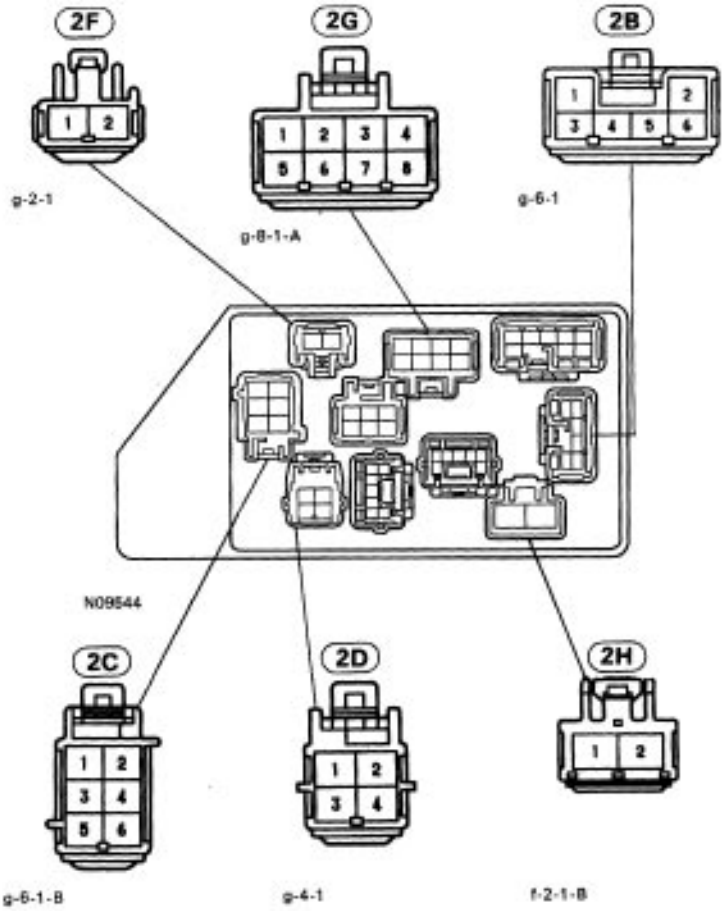


Ifg-4-2

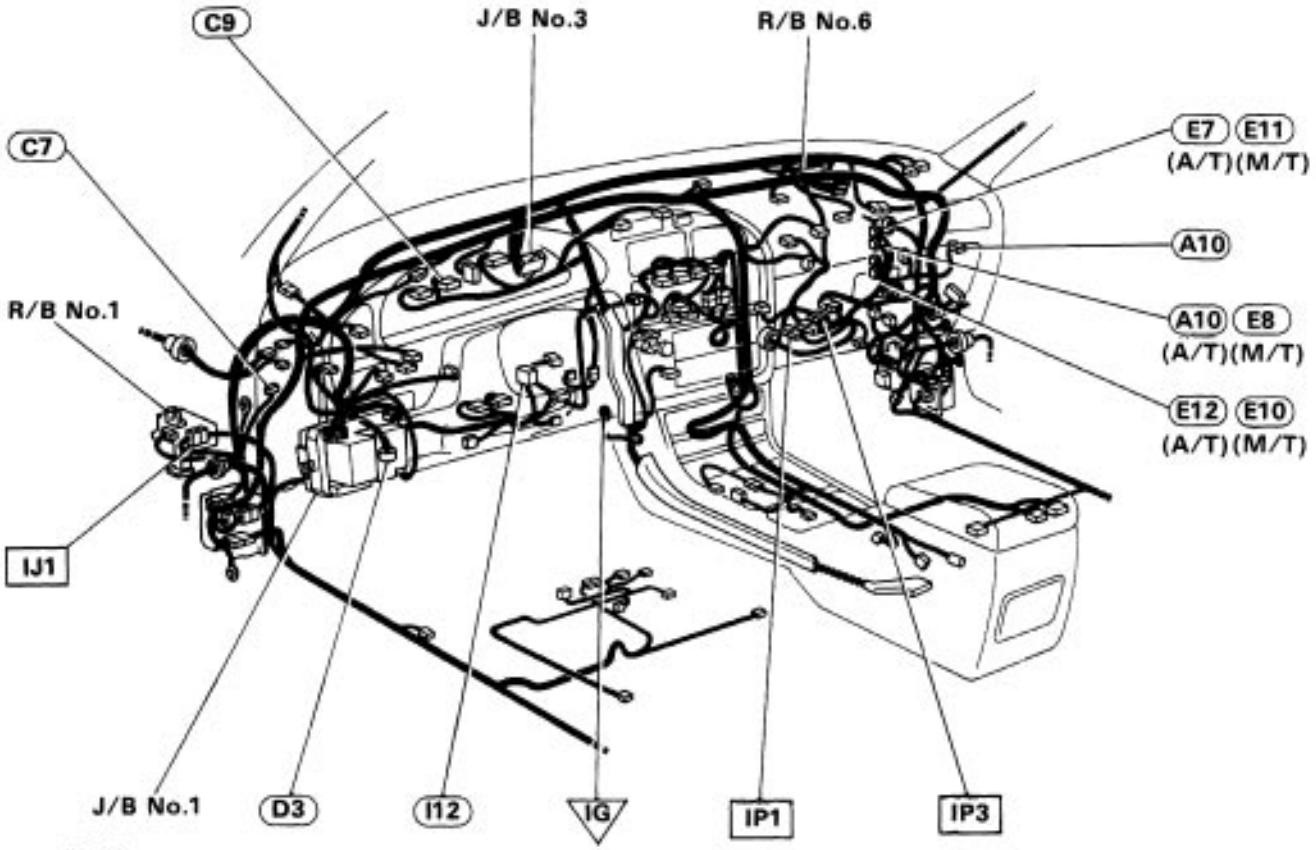
J/B No.2



FI7078



Location of Connectors in Instrument Panel



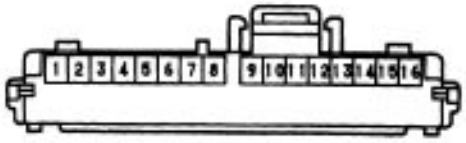
A10
A/C Amplifier



C7
Clutch Start Switch (M/T)



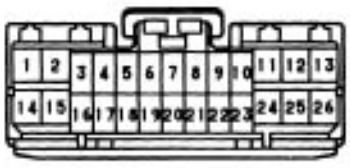
C9
Combination Meter



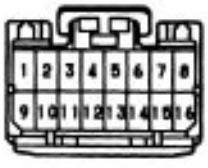
D3
Data Link Connector 2



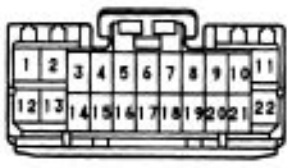
E7 (A/T)
E11 (M/T)
Engine Control Module



E8 (A/T)
E12 (M/T)
Engine Control Module



E10 (A/T)
E14 (California spec. with M/T)
Engine Control Module

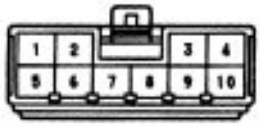


E14 (Exc. California spec. with M/T)
Engine Control Module



I12

Ignition Switch



g-10-1-B

IJ1

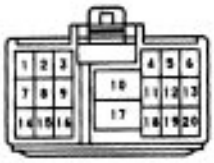


eg-19-1

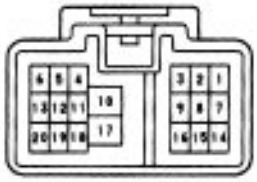


eg-19-2

IP1



e-20-1-B



e-20-2-B

IP3

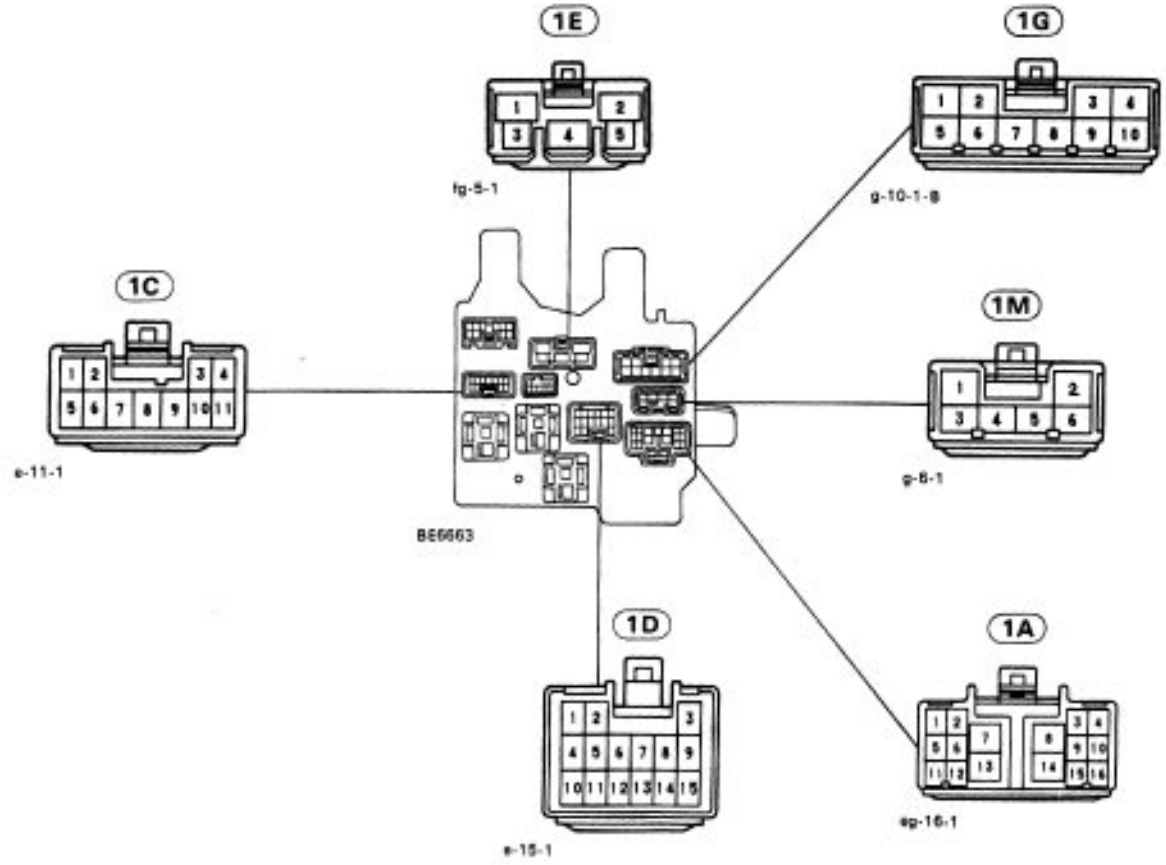


ef-19-1



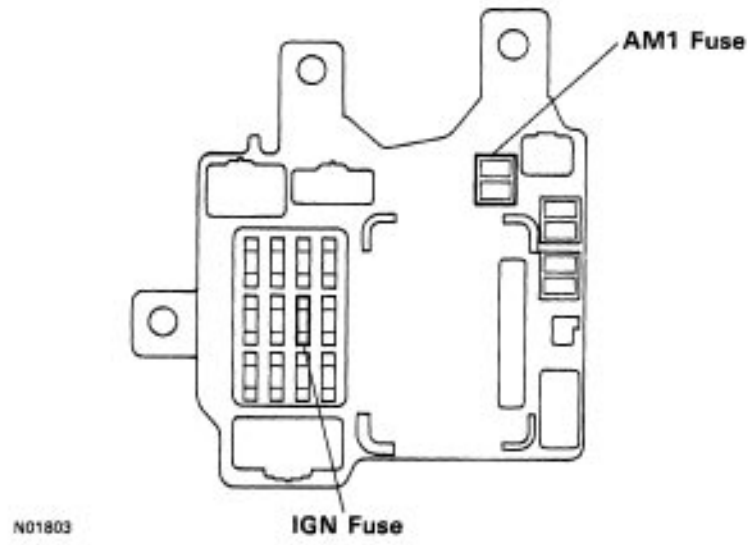
ef-19-2

!/B No.1

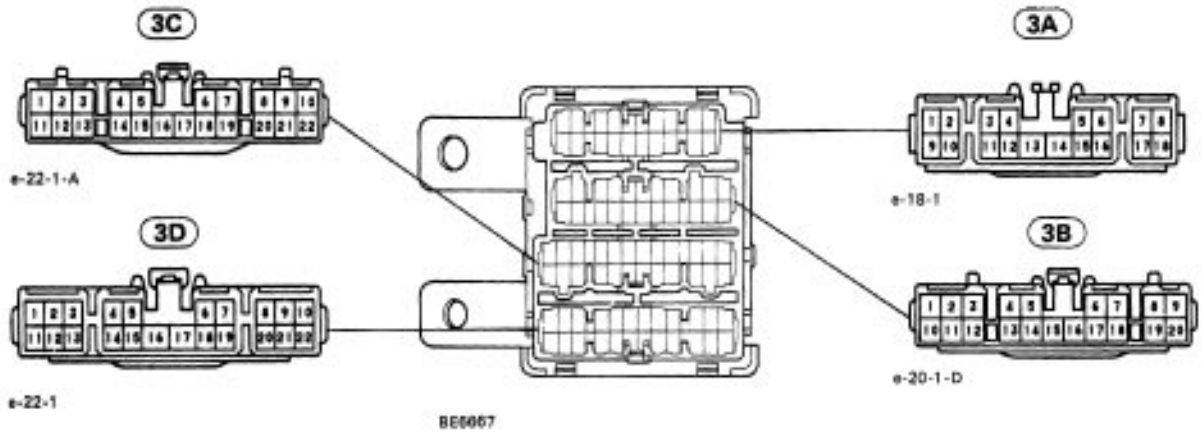


Location of Connectors in Instrument Panel (Cont'd)

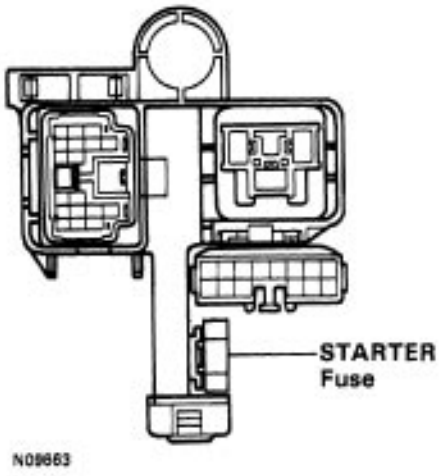
J/B No.1



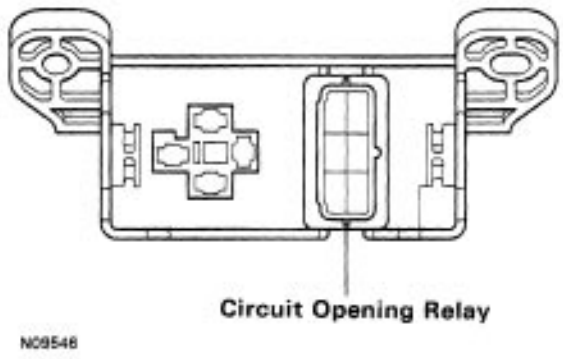
J/B No.3



R/B No.1

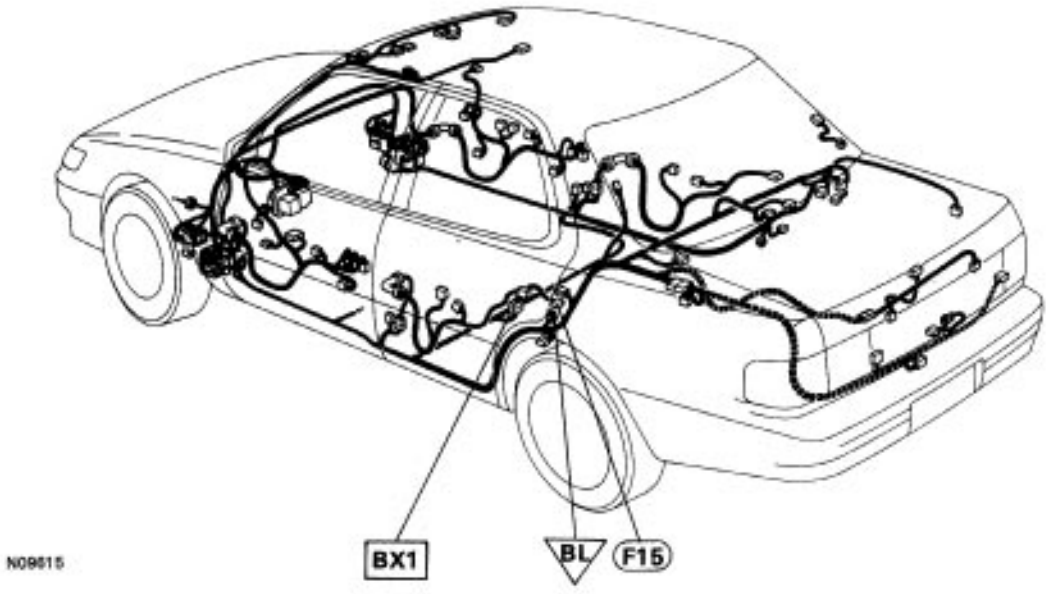


R/B No.6

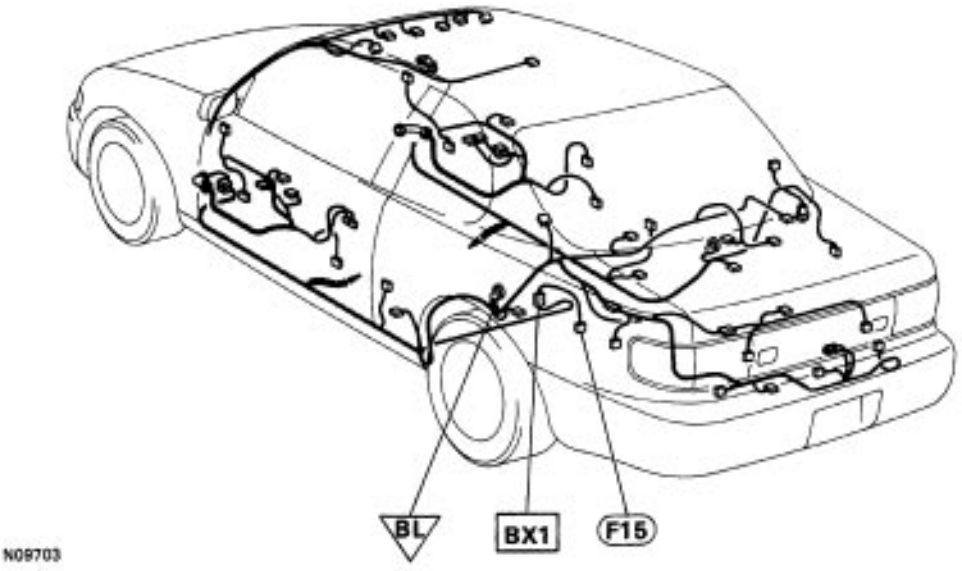


Location of Connectors in Body

Sedan

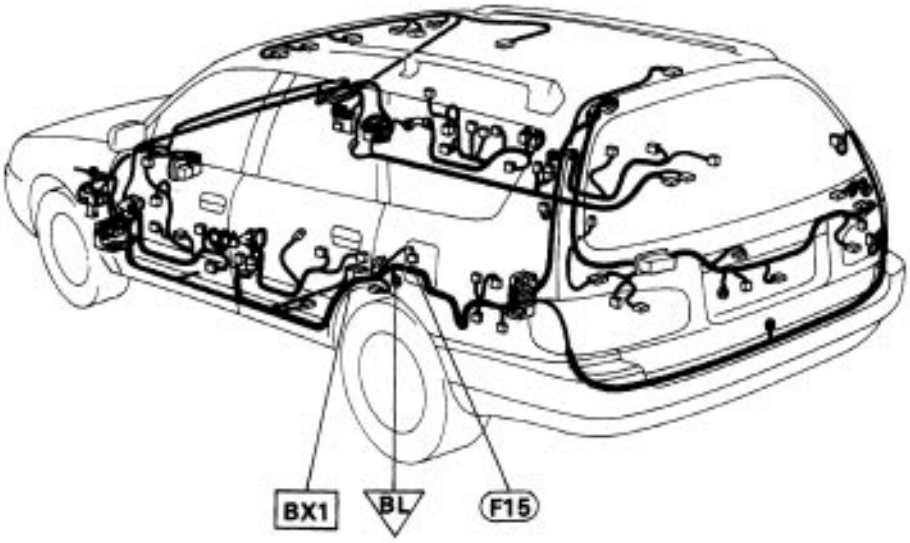


Coupe



Location of Connectors in Body (Cont’d)

Wagon



N09704

F15

Fuel Pump

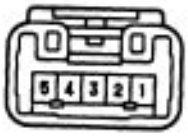


Ie-5-1-A

BX1



e-5-1



e-5-2

-Memo

CIRCUIT INSPECTION

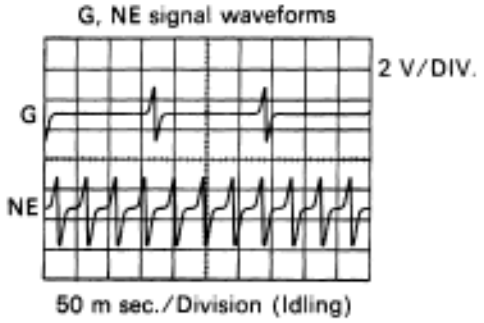
DTC 12 G NE Signal Circuit (No.1) (Exc. California spec.)

CIRCUIT DESCRIPTION

The distributor in the Engine Control System contains 3 pickup coils.
The G signals inform the ECM of the standard crankshaft position.
The NE signals inform the ECM of the crankshaft position and the engine speed.

DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
12	No N E signal to ECM with 2 sec. or more after cranking.	• Open or short in NE, G circuit • Distributor • Open or short in STA circuit • ECM
	No G signal to ECM for 3 sec. or more with engine speed between 600 rpm and 4,000 rpm.	

Reference **INSPECTION USING OSCILLOSCOPE**



FI6674

- During cranking or idling, check waveforms between terminals G (+) and G (–), NE (+) and NE (–) of engine control module.

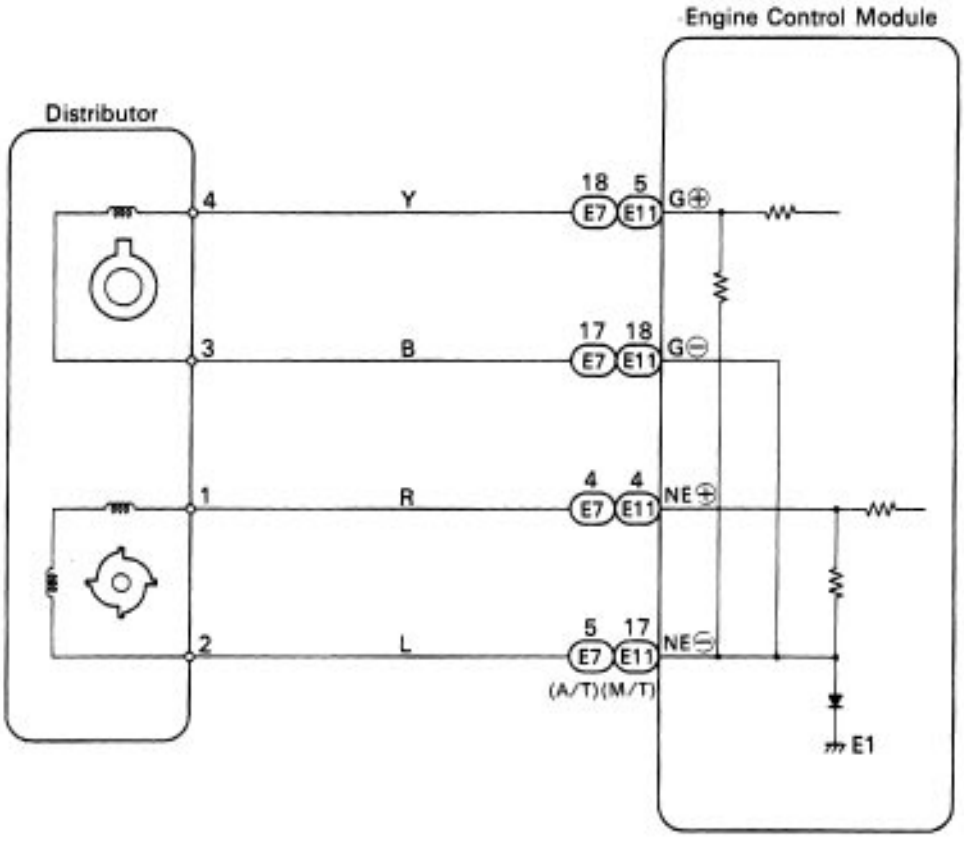
HINT: The correct waveforms appear as shown in the illustration on the left.

DIAGNOSTIC CHART

1. Check resistance of each pickup coils in distributor.
   - NG → Replace distributor housing.
   - OK ↓
2. Check for open and short in harness and connector between ECM and distributor.
   - NG → Repair or replace harness or connector.
   - OK ↓
3. Check air gap.
   - NG → Replace distributor housing.
   - OK ↓

Check and replace ECM.

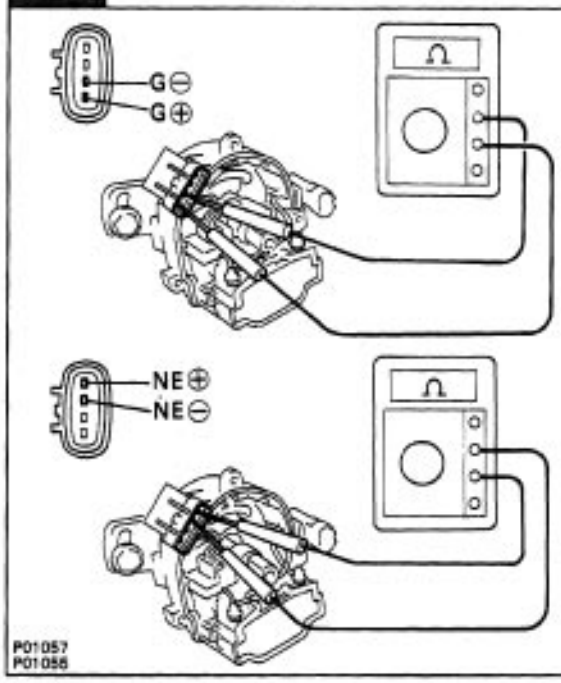
WIRING DIAGRAM



FI6690

INSPECTION PROCEDURE

1 Check resistance of each pickup coils in distributor.



P Disconnect distributor connector.

C Measure resistance between each terminal shown in table below.

OK

		Resistance
G Pickup Coil (G1 –G (–))	Cold	185 ~ 275Ω
	Hot	240 ~ 325 Ω
NE Pickup Coil (NE (+) – NE (–))	Cold	370 ~ 550Ω
	Hot	475 ~ 650Ω

"Cold" is from –10°C (14°F) to 50°C (122°F) and "Hot" is from 50°C (122°F) to 100°C (212°F).

OK

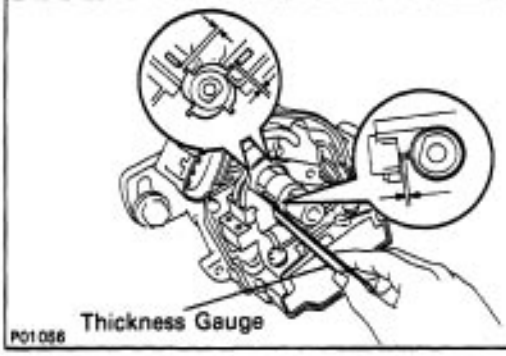
NG → **Replace distributor housing.**

2 Check for open and short in harness and connector between engine control module and distributor (See page IN–31).

OK

NG → **Repair or replace harness or connector.**

3 Check air gap.



P Remove distributor cap and rotor.

C Using a thickness gauge, measure the air gap between the signal rotor and pickup coil projection.

OK **Air gap: 0.2 – 0.4 mm (0.008 – 0.006 in.)**

OK

NG → **Replace distributor housing.**

Check and replace engine control module.

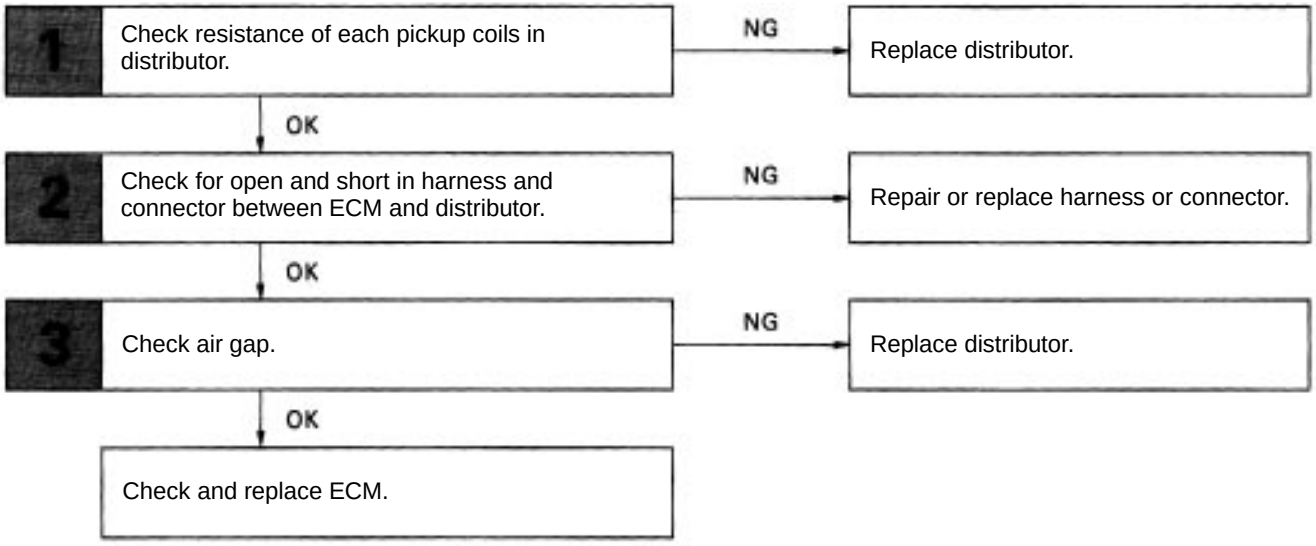
DTC 12 G NE Signal Circuit (No.1) (Only for California spec.)

CIRCUIT DESCRIPTION

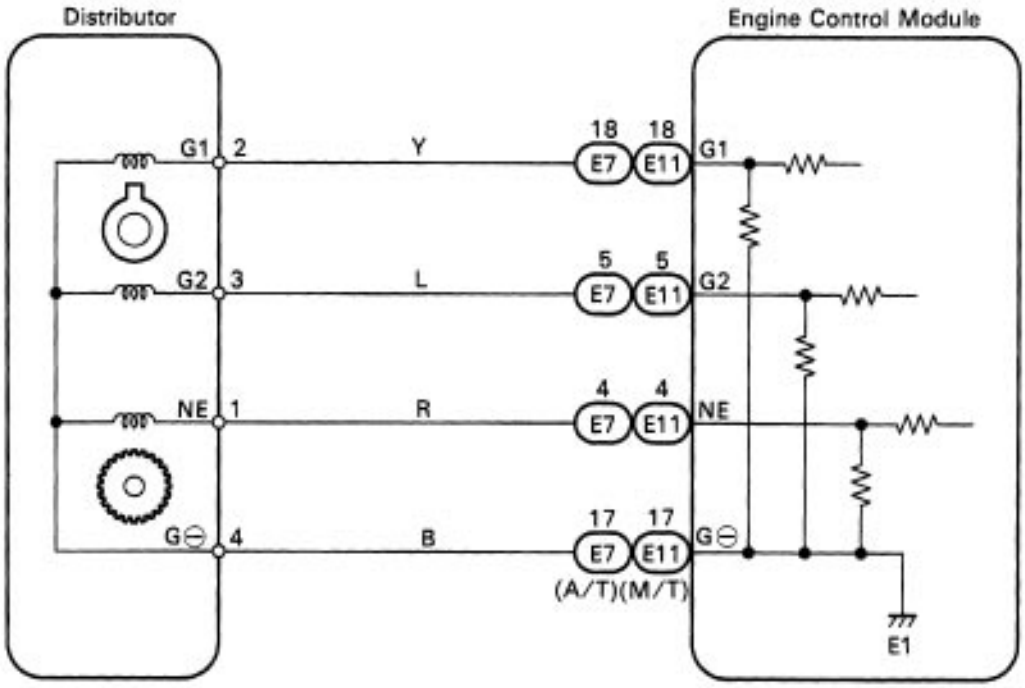
The distributor in the Engine Control System contains 3 pick–up coils (G1, G2 and NE).
The G1, G2 signals inform the ECM of the standard crankshaft angle.
The NE signals inform the ECM of the crankshaft angle and the engine speed.

DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
12	No NE or G1 and G2 signal to ECM for 2 sec. or more after cranking.	• Open or short in NE, G circuit. • Distributor • Open or short in STA circuit. • ECM
	Open in G (–) circuit.	

DIAGNOSTIC CHART



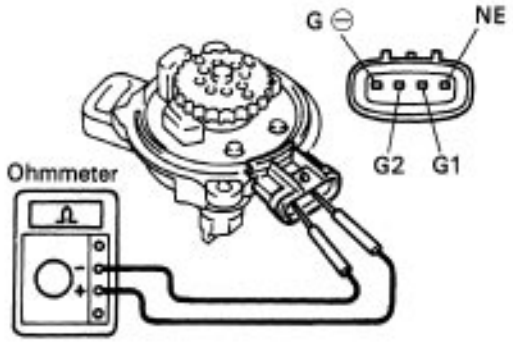
WIRING DIAGRAM



FI7177

INSPECTION PROCEDURE

1 **Check resistance of each pickup coils in distributor.**



P13791

P Disconnect distributor connector.

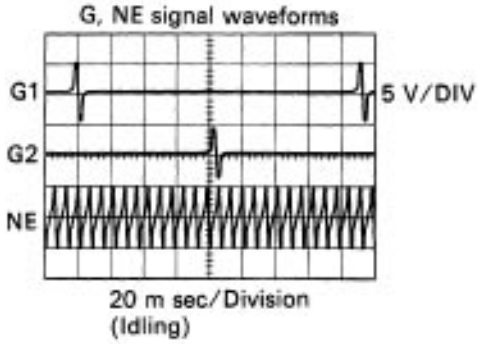
C Measure resistance between each terminal shown in table below.

OK

		Resistance
G1 pickup coil (G1 – G ⊖)	Cold	125 ~ 200 Ω
	Hot	160 ~ 235 Ω
G2 pickup coil (G2 – G ⊖)	Cold	125 ~ 200 Ω
	Hot	160 ~ 235 Ω
NE pickup coil (NE – G ⊖)	Cold	155 ~ 250 Ω
	Hot	190 ~ 290 Ω

"Cold" is from –10°C (14°F) to 50°C (122°F) and "Hot" is from 50°C (122°F) to 100°C (212°F).

Reference **INSPECTION USING OSCILLOSCOPE**



FI6519

- During cranking or idling, check waveforms between terminals G1, G2, NE and G O of engine control module.

HINT: The correct waveforms appear as shown in the illustration on the left.

OK

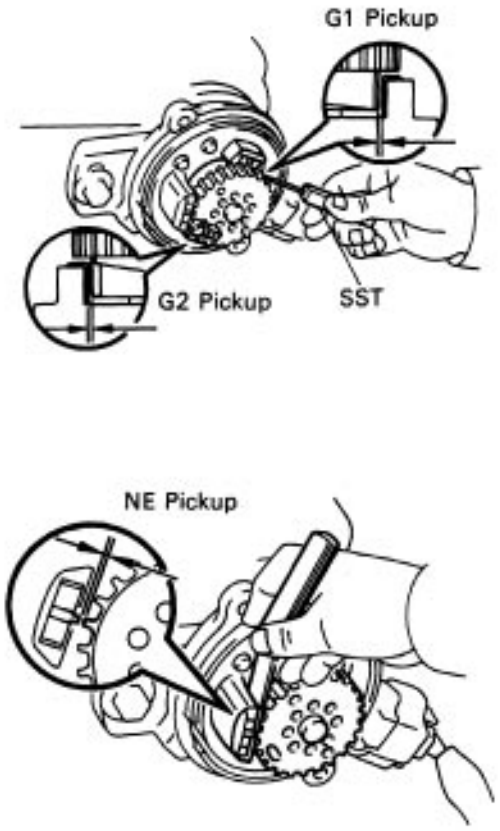
NG Replace distributor.

2 **Check for open and short in harness and connector between engine control module and distributor (See page IN–31).**

OK

NG **Repair or replace harness or connector.**

3 **Check air gap.**



P Remove distributor cap & rotor.

C Using SST (G1 and G2 pickups) and a thickness gauge (NE pickup), measure the air gap between the signal rotor and pickup coil projection.
SST 09240–00020 for G1 and G2 pickups

OK **Air gap: 0.2–0.5 mm (0.008–0.020 in.)**

OK

NG > **Replace distributor housing assembly.**

Check and replace engine control module.

DTC 13 G NE Signal Circuit (No.2)

CIRCUIT DESCRIPTION

Refer to G, NE signal circuit (No. 1) on page EG1–336, 339.

DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
13	No NE signal to ECM for 0.3 sec. or more at 1,500 rpm or more.	• Open or short in NE circuit • Distributor • ECM
	No G signal to ECM while N E signal is input 4 times to ECM when engine speed is between 500 rpm and 4,000 rpm.	
	* No NE signal to ECM for 0.1 sec. or more at 1,000 rpm or more.	
	* NE signal does not pulse 12 times to ECM during the interval between G1 and G2 pulses.	

*: Only for California specification vehicles.

DIAGNOSIS

This code indicates that a momentary interruption of the G, N E signal from the distributor to the ECM has occurred, but that it is returned to normal. Note that although this problem may not necessarily appear at the time of inspection, it cannot be ignored because this diagnostic trouble code is output, indicating that there is or was a malfunction in the G, NE signal circuit; this “malfunction” is usually a loose connector.

The distributor connector and the N E terminal of the ECM connector must therefore be checked for the following:

1. Loose connectors
2. Dirty connector terminals
3. Loose connector terminals

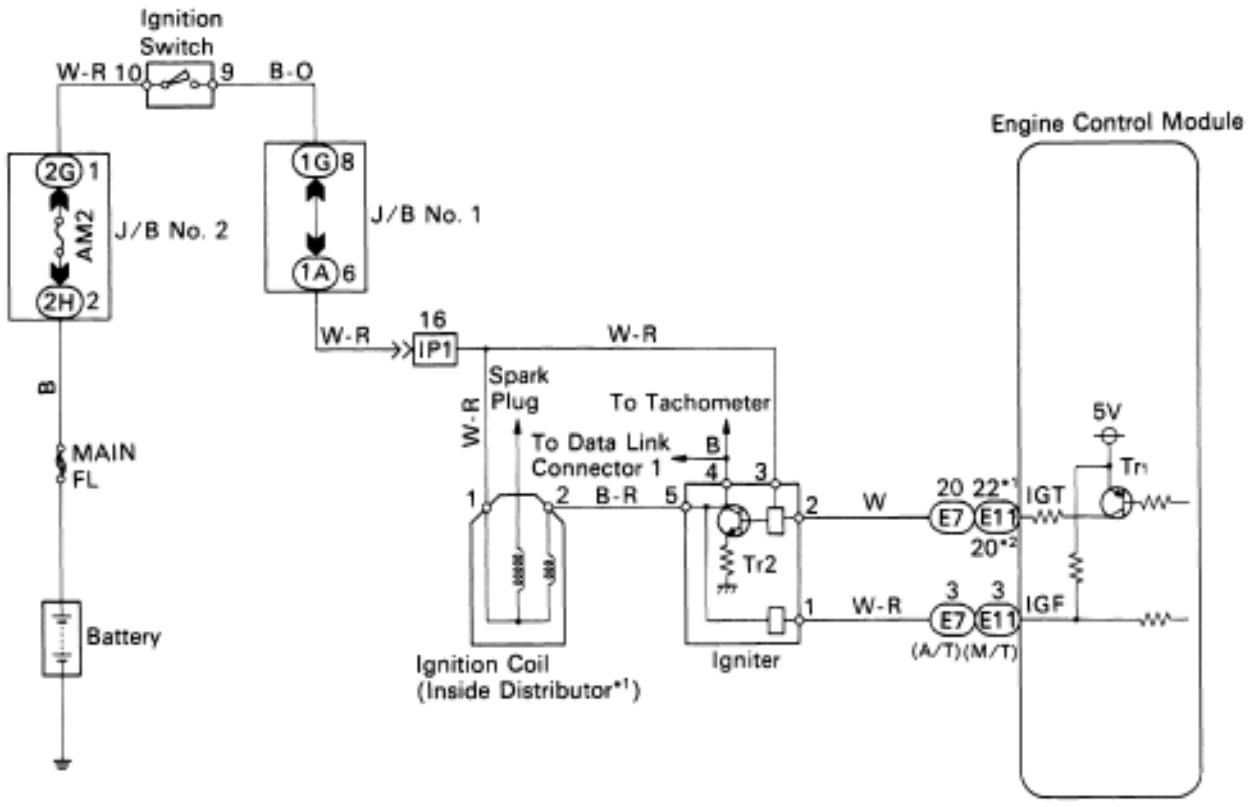
DTC 14 Ignition Signal Circuit

CIRCUIT DESCRIPTION

The ECM determines the ignition timing, turns on Tr, 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 Tr_2 turns on.
When it reaches the ignition timing, the ECM turns Tr, off and outputs the IGT signal “O”.
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 IG F signal is not input to the ECM.

DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
14	No IGF signal to ECM for 4 (8*2) consecutive IGT signals.	• Open or short in IG F or IGT circuit from igniter to ECM. • Igniter • ECM

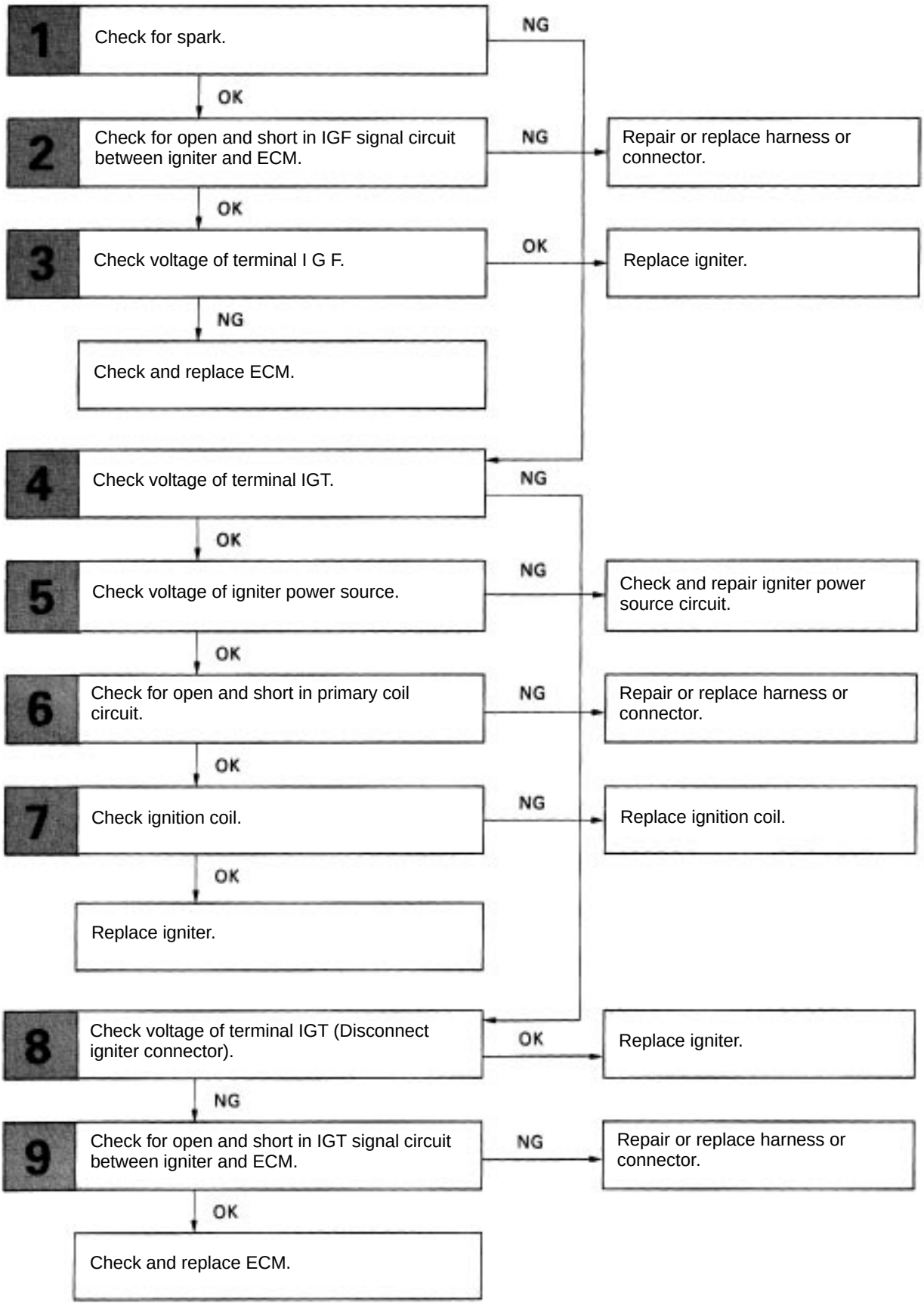
WIRING DIAGRAM



*1: Except California specification vehicles.
*2: Only for California specification vehicles.

FI0691

DIAGNOSTIC CHART



INSPECTION PROCEDURE

1 **Check for spark.**

C Disconnect the high–tension cord from the distributor, hold its end about 12.5 mm (11 /2”) from the ground, see if spark occurs while the engine is being cranked.

OK **Spark should be generated.**

Hint To prevent excessive fuel injected from the injectors during this check, don’t crank the engine for more than 1 – 2 seconds at a time.

OK

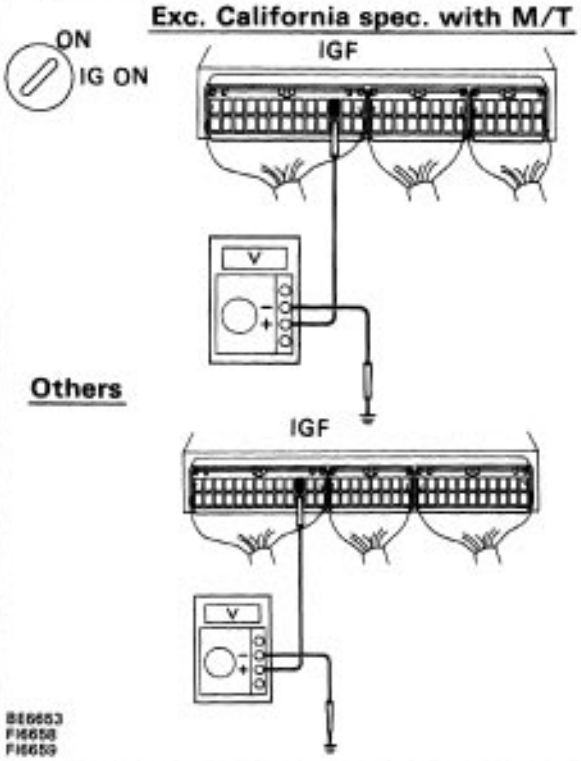
NG → **Go to step 4**

2 **Check for open and short in harness and connector in IGF signal circuit between engine control module and igniter (See page IN–31).**

OK

NG → **Repair or replace harness or connector.**

3 **Disconnect igniter connector and check voltage between terminal IGF of engine control module connector and body ground.**



P (1) Disconnect igniter connector.
(2) Remove glove compartment.
(See page EG1–234).
(3) Turn ignition switch on.

C Measure voltage between terminal IGF of engine control module connector and body ground.

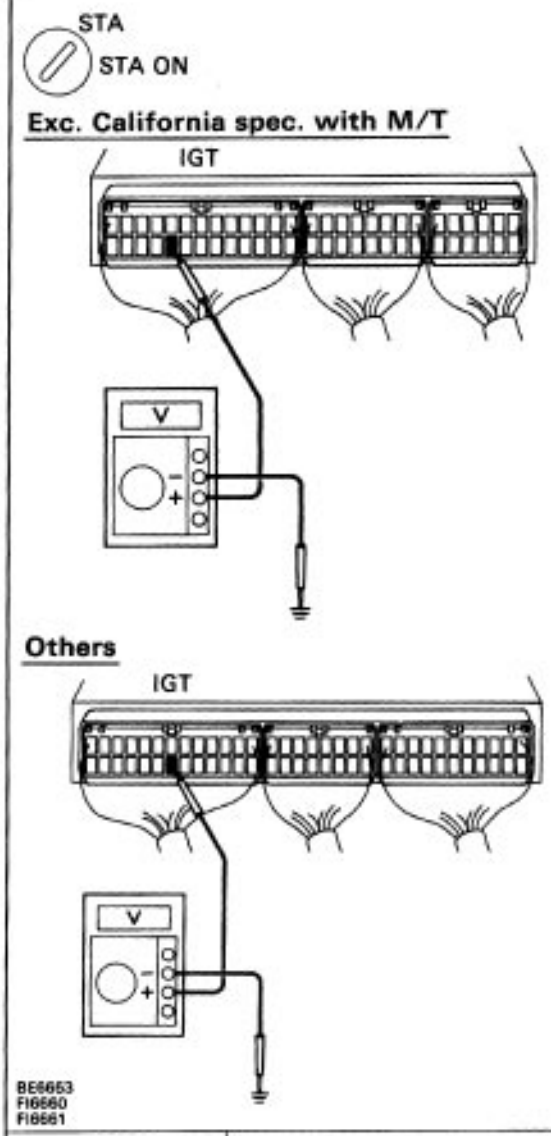
OK **Voltage: 4.5 ~ 5.5 V**

NG

OK → **Replace igniter.**

Check and replace engine control module.

4 **Check voltage between terminal IGT of engine control module connector and body ground.**

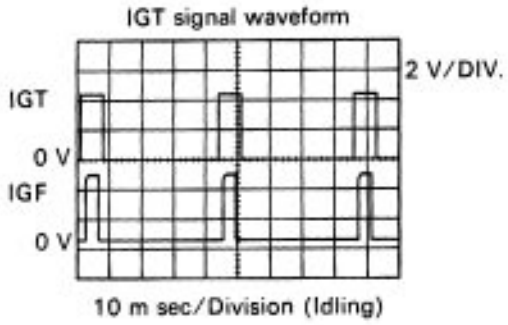


P Remove glove compartment.
(See page EG1–234) .

C Measure voltage between terminal IGT of engine control module connector and body ground when engine is cranked.

OK **Voltage: 0.5 – 1.0 V**
(Neither 0 V nor 5 V)

Reference **INSPECTION USING OSCILLOSCOPE**



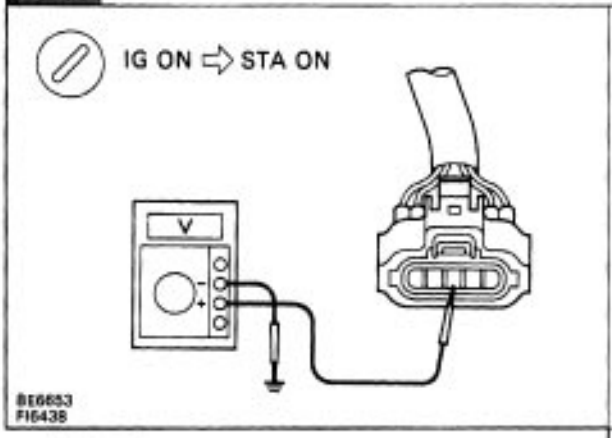
- During cranking or idling, check waveform between terminal IGT and E1 of engine control module.

HINT: The correct waveform appears as shown in the illustration on the left, with rectangle waves.

OK

NG → Go to step 8

5 **Check voltage between terminal 3 of igniter connector and body ground.**



P Disconnect igniter connector.

C Measure voltage between terminal 3 of igniter connector and body ground, when ignition switch is turned to “ON” and “STA” position.

OK **Voltage: 9 ~ 14 V**

OK

NG → **Check and repair igniter power source circuit.**

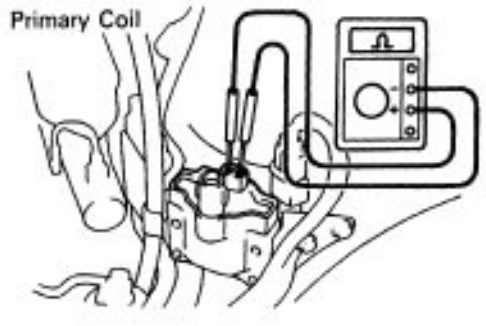
6 **Check for open and short in harness and connector between ignition switch and ignition coil, ignition coil and igniter (See page IN–31).**

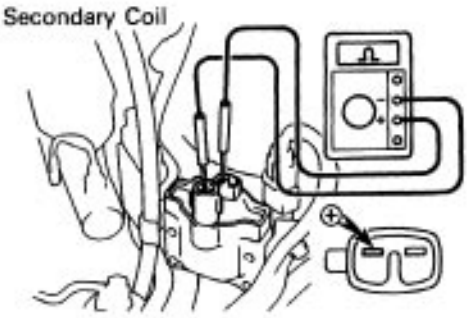
OK

NG → **Repair or replace harness or connector.**

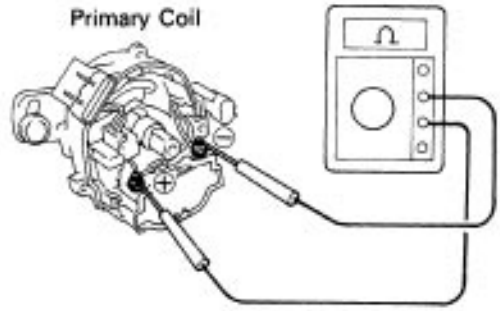
7 Check ignition coil.

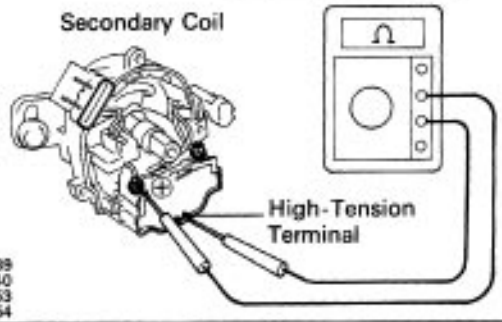
For California spec.





Exc. California spec.





P14139
P14140
P01053
P01054

P For California spec.

(1) Disconnect ignition coil connector.

(2) Disconnect high–tension cord from ignition coil.

Exc. California spec.

(1) Disconnect distributor connectors.

(2) Remove distributor cap and rotor.

(3) Remove ignition coil dust cover.

C (1) Check primary coil.
Measure resistance between the positive (+) and negative (–) terminals.

(2) Check secondary coil.
Measure resistance between the positive (+) and high–tension terminals.

OK

		Resistance
Primary Coil	Cold	0.36 ~ 0.55 Ω
	Hot	0.45 ~ 0.65 Ω
Secondary Coil	Cold	9.0 ~ 15.4 kΩ
	Hot	11.4 ~ 18.1 kΩ

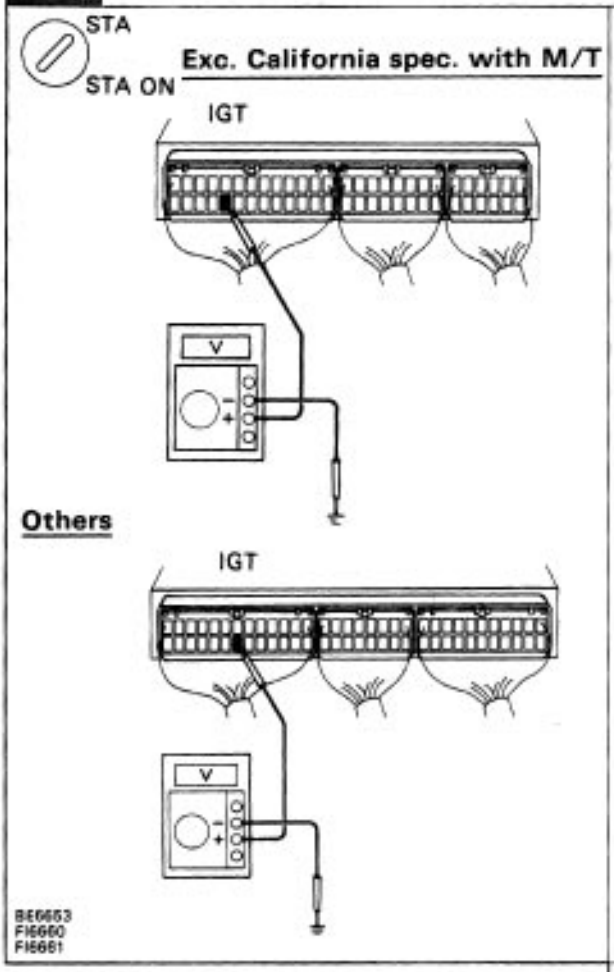
"Cold" is from –10°C (14°F) to 50°C (122°F) and "Hot" is from 50°C (122°F) to 100°C (212°F).

OK

NG → **Replace ignition coil.**

Replace igniter.

8 **Disconnect igniter connector and check voltage between terminal IGT of engine control module connector and body ground.**



P Disconnect igniter connector.

C Measure voltage between terminal IGT of engine control module connector and body ground when engine is cranked.

OK **Voltage: 0.5–1.0 V**
(Neither 0 V nor 5 V)

NG

OK 〉 **Replace igniter.**

9 **Check for open and short in harness and connector in IGT signal circuit between engine control module and igniter (See page IN–31).**

OK

NG 〉 **Repair or replace harness or connector.**

Check and replace engine control module.

DTC 16 A–T Control Signal Malfunction

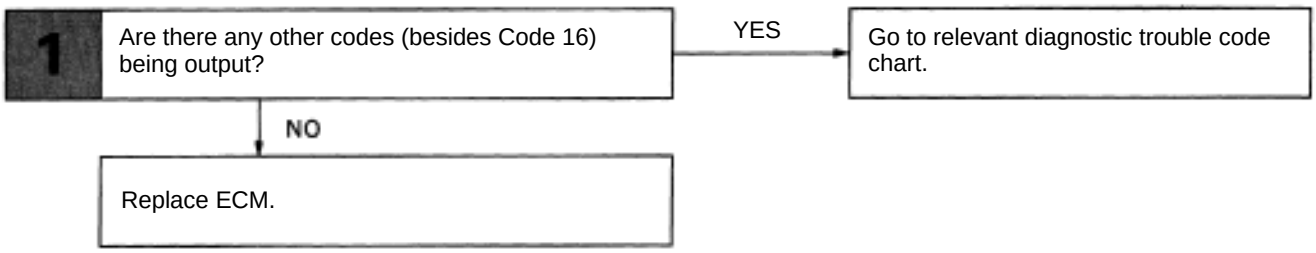
CIRCUIT DESCRIPTION

The signal from the A/T CPU retards the ignition timing of the engine during A/T shifting, thus momentarily reducing torque output of the engine for smooth clutch operation inside the transmission and reduced shift shock.

DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
16	Fault in communications between the engine CPU and A/T CPU in the ECM	• ECM

If the ECM detects the diagnostic trouble code “16” in memory, it prohibits the torque control of the A/T which performs smooth gear shifting.

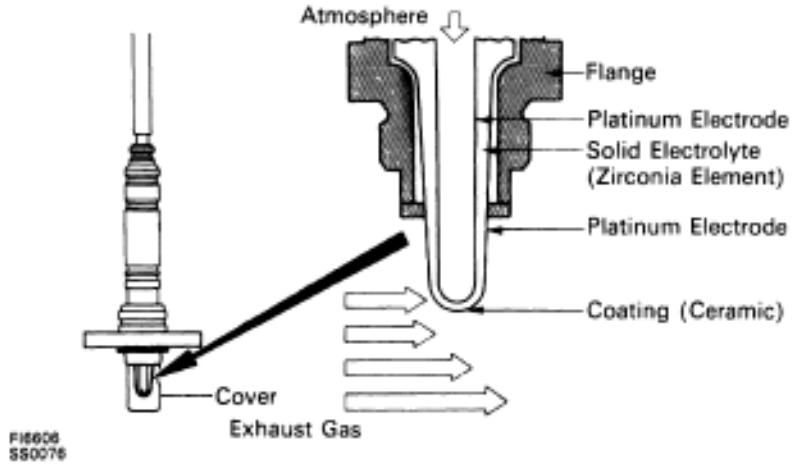
DIAGNOSTIC CHART

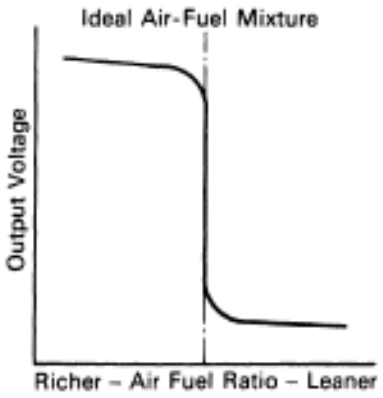


DTC 21 Main Oxygen Sensor Circuit

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 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: 1 V). The ECM judges by the electromotive force from the oxygen sensor whether the air–fuel ratio is RICH or LEAN and controls the injection time accordingly. However, if malfunction of the oxygen sensor causes output of abnormal electromotive force, the ECM is unable to perform accurate air–fuel ratio control.





DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
21	Main oxygen sensor signal voltage is reduced to between 0.35 V and 0.70 V for 60 sec. under conditions (a) – (d). (2 trip detection logic) * (a) Engine coolant temp. : 80°C (176°F) or more. (b) Engine speed : 1,500 rpm or more. (c) Load driving (EX. A/T in overdrive (5th for M/T), A/C ON, Flat road, 50 mph (80km/h)). (d) Main oxygen sensor signal voltage : Alternating above and below 0.45 V.	• Main oxygen sensor circuit. • Main oxygen sensor.

*See page EG1–307

CIRCUIT DESCRIPTION (Cont'd)

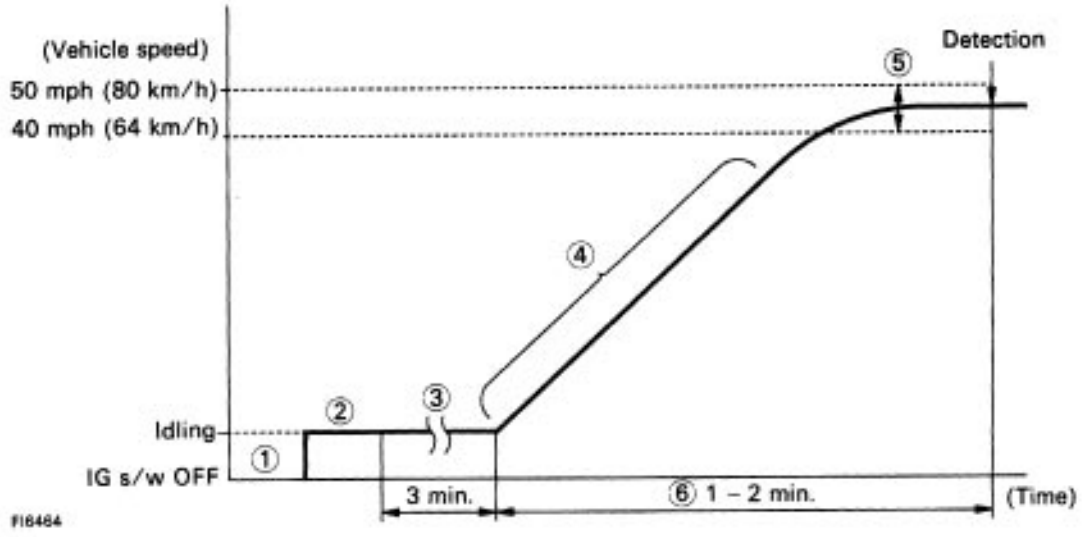
DIAGNOSIS TROUBLE CODE DETECTION DRIVING PATTERN

Purpose of the driving pattern.

(a) To simulate diagnostic trouble code detecting condition after diagnostic trouble code is recorded.

(b) To check that the malfunction is corrected when the repair is completed confirming that diagnostic trouble code is no longer detected.

Malfunction: Main Oxygen Sensor Deterioration



① Disconnect the EFI fuse (15A) for 10 sec. or more, with IG switch OFF.
Initiate test mode (Connect terminal TE2 and E1 of data link connector 1 or 2 with IG switch OFF).

② Start the engine and warm up with all ACC switch OFF.

③ After the engine is warmed up, let it idle for 3 min.

④ After performing the idling in (3) , perform gradual acceleration with in the range 1,300~1,700 rpm (centered around 1,500 rpm) with the A/C switch ON and D position for A/T (5th for M /T).
(Take care that the engine speed does not fall below 1,200 rpm when shifting. Gradually depress the accelerator pedal and keep it. Steady so that engine braking does not occur).

⑤ Maintain the vehicle speed at 40 – 50 mph (64 – 80 km/h).

⑥ Keep the vehicle running for 1 – 2 min. after starting acceleration.
HINT: If a malfunction exists, the malfunction indicator lamp will light up after approx. 60 sec. from the start of acceleration.

NOTICE: If the conditions in this test are not strictly followed, detection of the malfunction will not be possible.

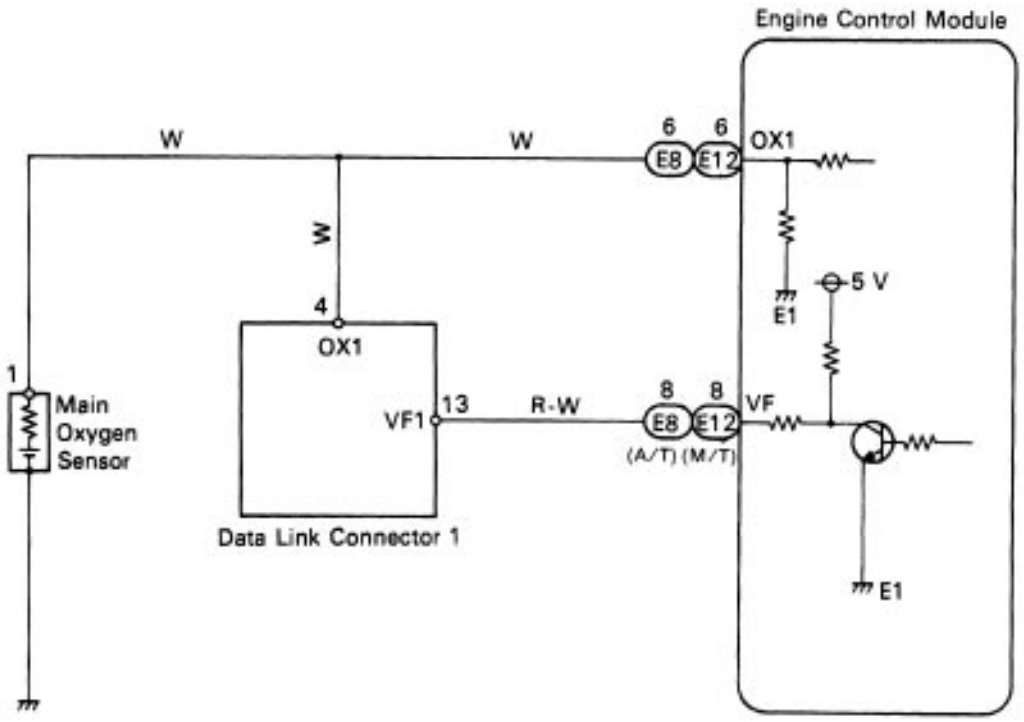
DIAGNOSTIC CHART

1	Are there any other codes (besides code 21) being output ?	YES	Go to relevant diagnostic trouble code chart.

NO

Replace main oxygen sensor.

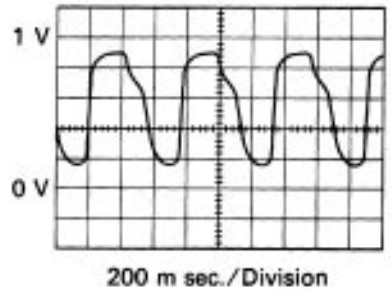
WIRING DIAGRAM



FI6681

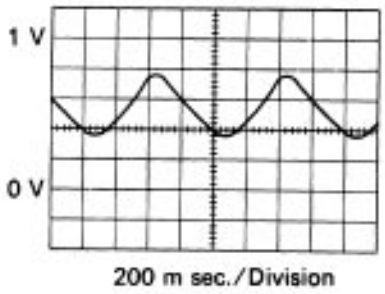
Reference **INSPECTION USING OSCILLOSCOPE**

Ox signal waveform



- With the engine racing (4,000 rpm) measure wave–form between terminals OX1 and E1 of engine con–trol module.

HINT: The correct waveform appears as shown in the illustration on the left, oscillating between approx. 0.1 V and 0.9 V.



If the oxygen sensor is deteriorated, the amplitude of the voltage is reduced as shown on the left.

FI6514
FI6515

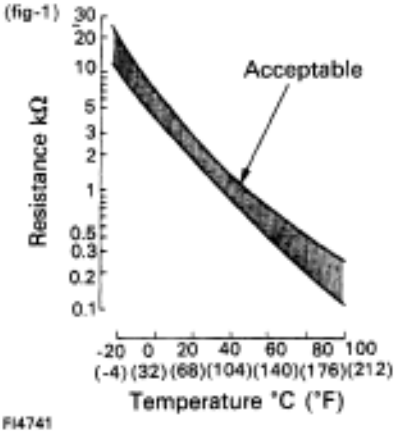
DTC 22 Engine coolant Temp. Sensor Circuit

CIRCUIT DESCRIPTION

The engine coolant temperature sensor senses the engine coolant temperature. A thermistor built in the sensor changes its resistance value according to the engine coolant temperature. The lower the engine coolant temperature, the greater the thermistor resis–tance value, and the higher the engine coolant tem–perature, the lower the thermistor resistance value (See Fig. 1.).

The engine coolant temperature sensor is connected to the ECM (See next page). The 5 V power source voltage in the ECM is applied to the engine coolant temperature sensor from the terminal THW via a resis-tor R. That is, resistor R and the engine coolant tem–perature sensor are connected in series. When the resistance value of the engine coolant temperature sensor changes in accordance with changes in the engine coolant temperature, the potential at the ter–minal THW also changes. Based on this signal, the ECM increases the fuel injection volume to improve driveability during cold engine operation. If the ECM detects the diagnostic trouble code 22, it operates the fail safe function in which the engine coolant temper–ature is assumed to be 80°C (176°F).

(fig-1)



(Reference)

Engine coolant Temp. °C (°F)	Resistance (kΩ)	Voltage (V)
–20 (–4)	16.0	4.3
0 (32)	5.9	3.4
20 (68)	2.5	2.4
40 (104)	1.2	1.5
60 (140)	0.6	0.9
80 (176)	0.3	0.5
100 (212)	0.2	0.3

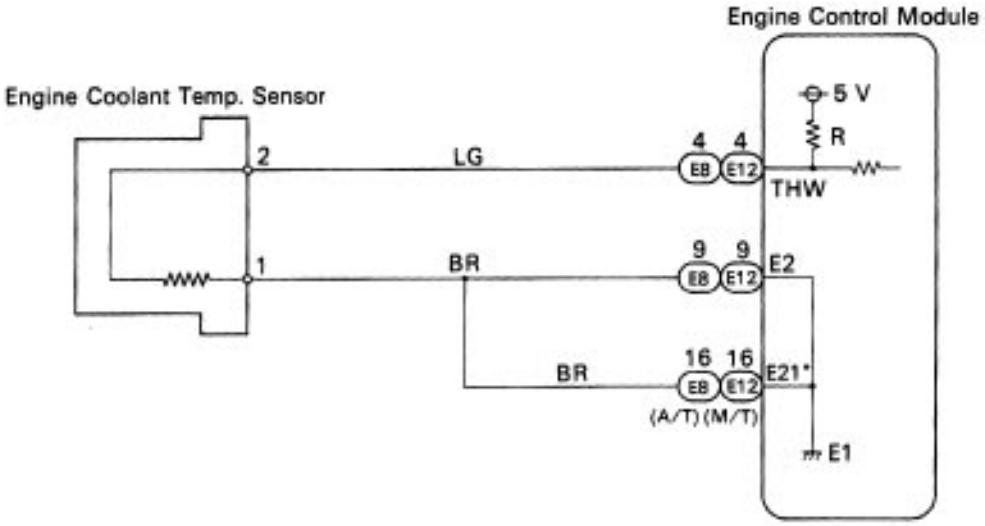
DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
22	Open or short in engine coolant temp. sensor circuit for 0.5 sec. or more.	• Open or short in engine coolant temp, sensor circuit • Engine coolant temp. sensor • ECM

DIAGNOSTIC CHART

HINT If diagnostic trouble codes “22” (engine coolant temperature sensor circuit), “24” (intake air temperature sensor circuit), “31” (manifold absolute pressure sensor circuit) and “41” (throttle position sensor circuit) are output simultaneously, E2 (sensor ground) may be open, OK Check for momentary interruption

1	Check voltage of sensor.		Check for momentary interruption (See page EG1–309).
	NG		
2	Check resistance of sensor.	NG	Replace engine coolant temp. sensor.
	OK		
3	Check for open and short in harness and connector between ECM and engine coolant temp. sensor.	NG	Repair or replace harness or connector.
	OK		
	Check and replace ECM.		

WIRING DIAGRAM



*: Except California specification vehicles.

FI6696

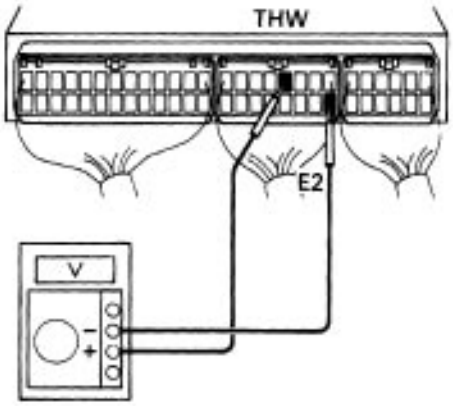
INSPECTION PROCEDURE

HINT: If diagnostic trouble codes “22” (engine coolant temperature sensor circuit), “24” (intake air temperature sensor circuit), “31” (manifold absolute pressure sensor circuit) and “41 “ (throttle position sensor circuit) are output simultaneously, E2 (sensor ground) may be open,

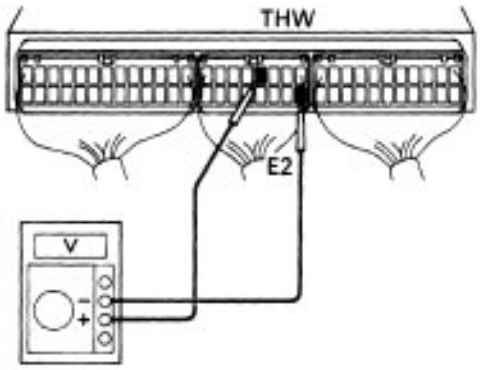
1 Check voltage between terminals THW and E2 of engine control module connector.

ON
IG ON

Exc. California spec. with M/T



Others



BE6653
FI6662
FI6663

P (1) Remove glove compartment
(See page EG1–234)
(2) Turn ignition switch on.
C Measure voltage between terminals THW and E2 of engine control module connector.

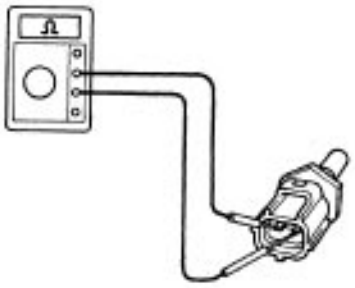
OK

Engine Coolant Temp. °C (°F)	Voltage
20 (68) (Engine is cool)	0.5 ~ 3.4 V
80 (176) (Engine is hot)	0.2 ~1.0 v

NG

OK → **Check for momentary interruption (See page EG1–309)**

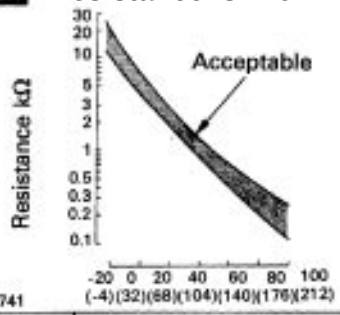
2 **Check engine coolant temp. sensor.**



P Disconnect the engine coolant temp. sensor connector.

C Measure resistance between terminals.

OK **Resistance is within Acceptable Zone on chart.**



Engine coolant Temp. °C (°F)	Resistance
20(68)	2 – 3 kΩ
80(176)	0.2 – 0.4 kΩ

OK

NG → **Replace engine coolant temp. sensor.**

3 **Check for open and short in harness and connector between engine control module and engine coolant temp. sensor (See page IN–31).**

OK

NG → **Repair or replace harness or connector.**

Check and replace engine control module.

DTC 24 Intake Air Temp. Sensor Circuit

CIRCUIT DESCRIPTION

The intake air temp. sensor is built into the air cleaner cap and senses the intake air temperature. The structure of the sensor and connection to the ECM is the same as in the engine coolant temp. sensor shown on page EG1–356.

If the ECM detects the diagnostic trouble code “24”, it operates the fail safe function in which the intake air temperature is assumed to be 20°C (68°F)

DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
24	Open or short in intake air temp. sensor circuit for 0.5 sec. or more.	• Open or short in intake air temp. sensor circuit • Intake air temp. sensor • ECM

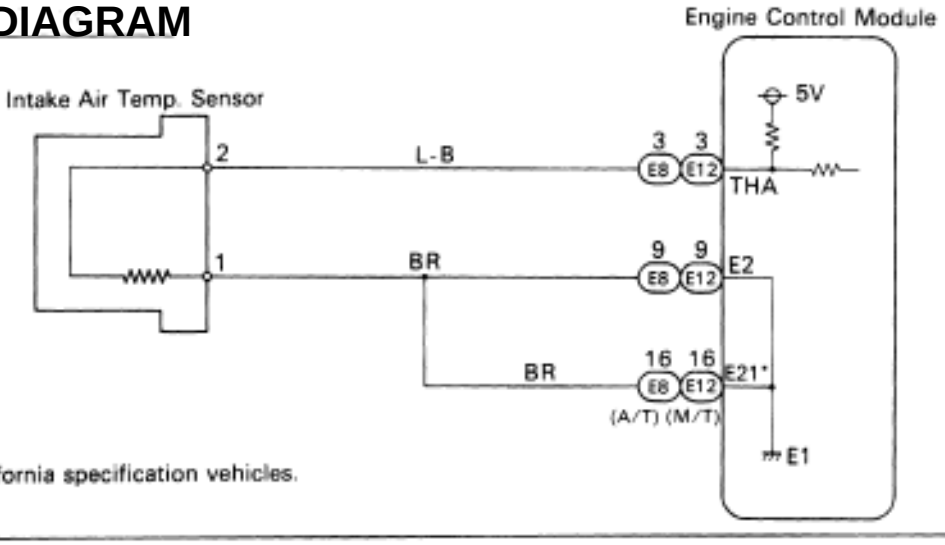
DIAGNOSTIC CHART

HINT: If diagnostic trouble codes “22” (engine coolant temperature sensor circuit), “24” (intake air temperature sensor circuit), “31” (manifold absolute pressure sensor circuit) and “41” (throttle position sensor circuit) are output simultaneously, E2 (sensor ground) may be open.

1. Check voltage of sensor.
   - NG → Check for momentary interruption (See page EG1–309).
   - OK ↓
2. Check resistance of sensor.
   - NG → Replace intake air temp. sensor.
   - OK ↓
3. Check for open and short in harness and connector between ECM and intake air temp. sensor.
   - NG → Repair or replace harness or connector.
   - OK ↓

Check and replace ECM.

WIRING DIAGRAM



*: Except California specification vehicles.

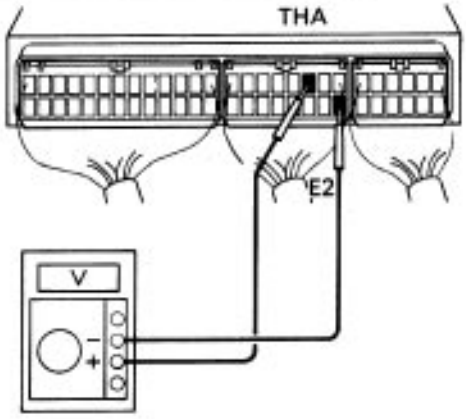
FI6696

INSPECTION PROCEDURE

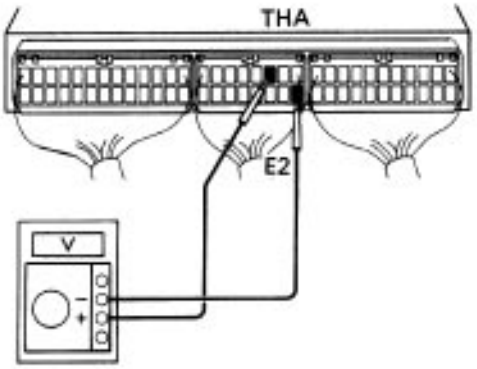
1 **Check voltage between terminals THA and E2 of engine control module connector.**

ON
IG ON

Exc. California spec. with M/T



Others



BE6653
FI6664
FI6665

P (1) Remove glove compartment.
(See page EG1–234)
(2) Turn ignition switch on.

C Measure voltage between terminals THA and E2 of engine control module connector.

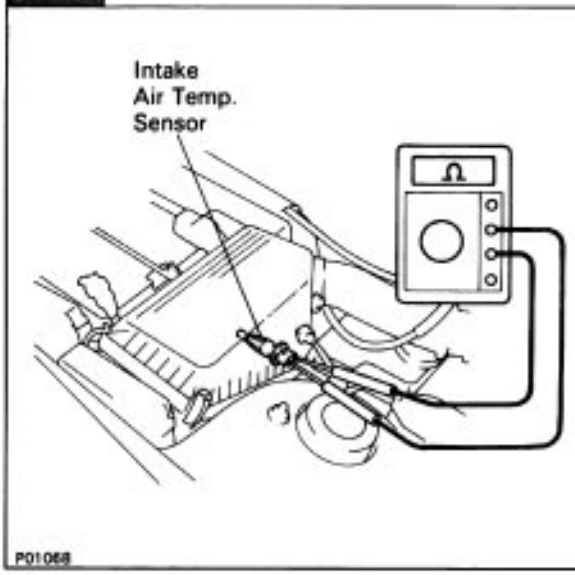
OK

Intake air temp. °C (°F)	Voltage
20 (68)	0.5 ~ 3.4 V
60 (140)	0.2 ~ 1.0 V

NG

OK → **Check for momentary interruption (See page EG1–309).**

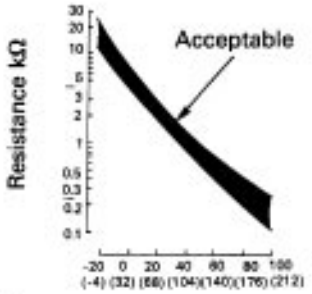
2 Check intake air temp. sensor.



P Disconnect the air temp. sensor connector.

C Measure resistance between terminals.

OK **Resistance is within Acceptable Zone on chart.**



Intake air temp. °C (° F)	Resistance
20(68)	2 –3kΩ
60 (140)	0.4 – 0.7 kΩ

OK

NG **Replace intake air temp. sensor.**

3 Check for open and short in harness and connector between engine control module and intake air temp. sensor (See page IN–31).

OK

NG **Repair or replace harness or connector.**

Check and replace engine control module.

DTC 25 26 Air–Fuel Ratio Lean Rich Malfunction

CIRCUIT DESCRIPTION

The main oxygen sensor is located in the exhaust manifold.
It indirectly determines whether the fuel mixture is rich or lean by detecting the concentration of oxygen present in the exhaust gas.

DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
25	(1) Main oxygen sensor voltage is 0.45 V or less (lean) for 90 sec. under conditions (a) and (b). (2 trip detection logic) * (a) Engine coolant temp.: 601C (1401F) or more. (b) Engine speed: 1,500 rpm or more.	• Open or short in main oxygen sensor circuit • Main oxygen sensor • Ignition system • ECM
	(2) Engine speed varies by more than 15 rpm over the preceding crank position period during a period of 50 sec. or more under conditions (a) and (b). (2 trip detection logic) * (a) Engine speed: Idling (b) Engine coolant temp.: 601C (1401F) or more.	• Open or short in injector circuit • Fuel line pressure (injector leak, blockage) • Mechanical system malfunction (skipping teeth of timing belt) • Ignition system • Compression pressure (foreign object caught in valve) • Air leakage • ECM
26	Engine speed varies by more than 15 rpm over the preceding crank position period during a period of 50 sec. or more under conditions (a) and (b). (2 trip detection logic) * (a) Engine speed: Idling (b) Engine coolant temp.: 601C (1401F) or more	• Open or short in injector circuit • Fuel line pressure (injector leak, blockage) • Mechanical system malfunction (skipping teeth of timing belt) • Ignition system • Compression pressure (foreign object caught in valve) • Air leakage • ECM

*: See page EG1–307

CIRCUIT DESCRIPTION (Cont'd)

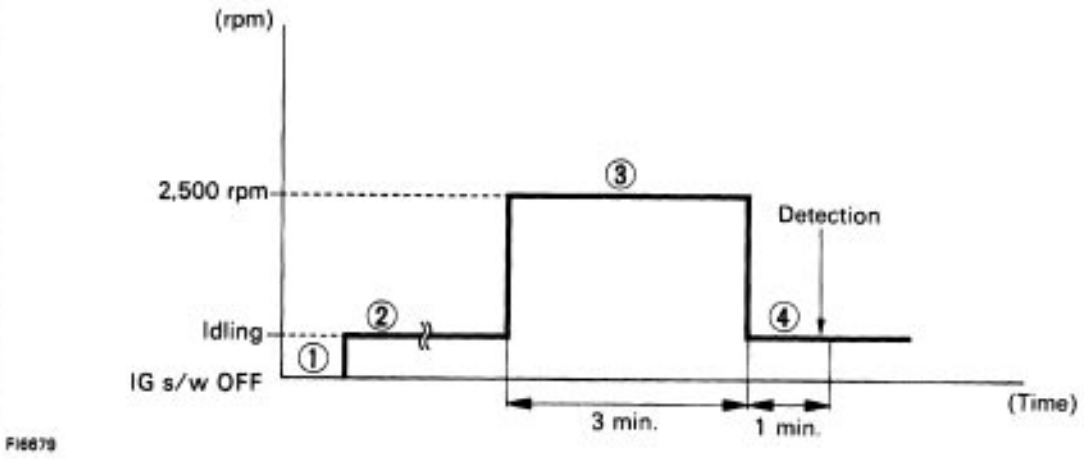
DIAGNOSIS TROUBLE CODE DETECTION DRIVING PATTERN

Purpose of the driving pattern.

(a) To simulate diagnostic trouble code detecting condition after diagnostic trouble code is recorded.

(b) To check that the malfunction is corrected when the repair is completed confirming that diagnostic trouble code is no longer detected.

Malfunction: Open or Short in Main Oxygen Sensor.
Open or Short in Injector Circuit, Injector Leak or Blockage.



H I NT: Before this test, check the feedback voltage for oxygen sensor.

①Disconnect the EFI fuse (15 A) for 10 sec. or more, with IG switch OFF.
Initiate test mode (Connect terminal TE2 and E1 of data link connector 1 or 2 with IG switch OFF).

②Start engine and warm up.

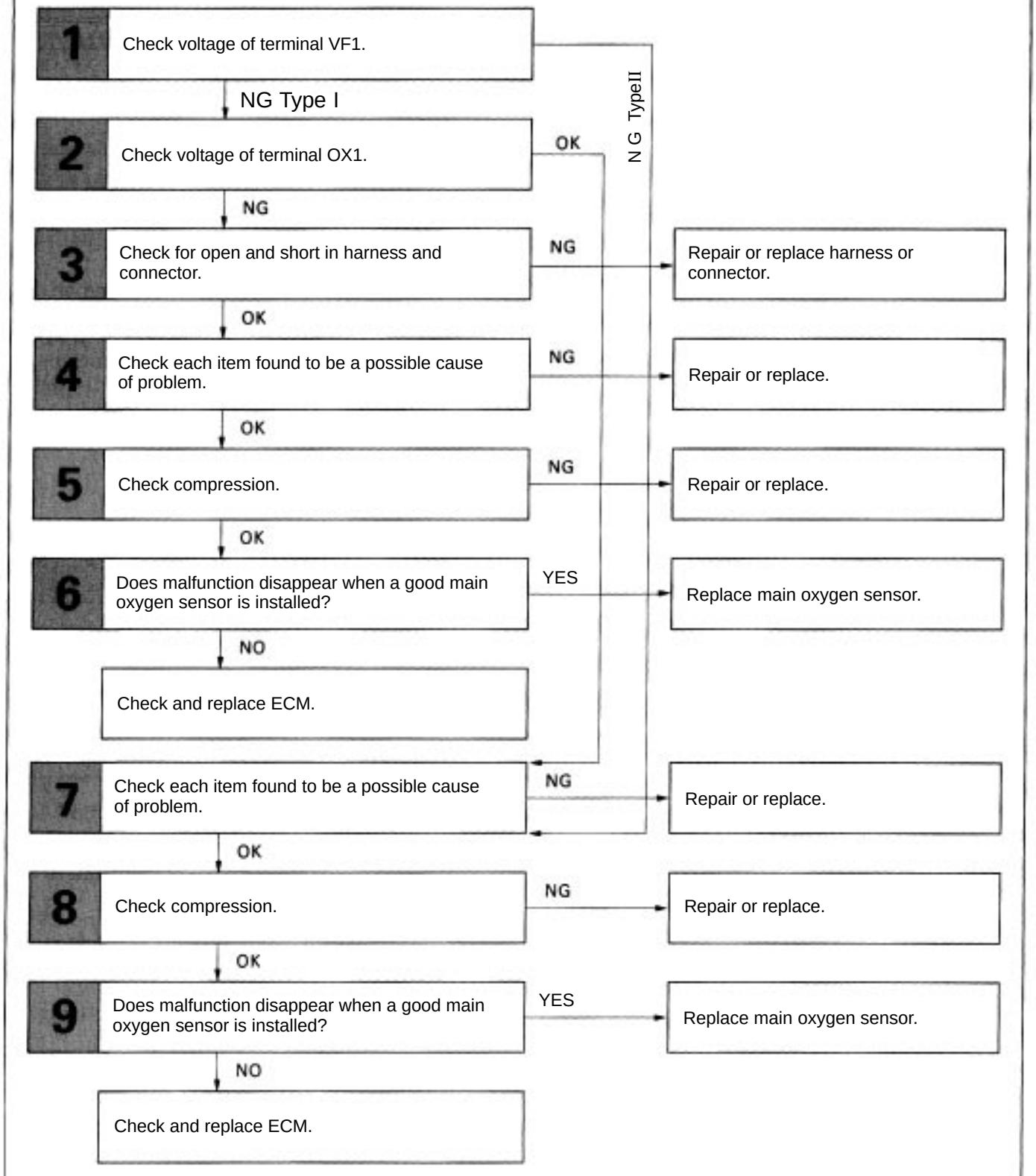
③After the engine is warmed up, let it race at 2,500 rpm for 3 min.

④After performing the racing in (3) , perform idling 1 min.

HINT: If a malfunction exists, the malfunction indicator lamp will light up during step (4).

NOTICE: If the conditions in this test are not strictly followed, detection of the malfunction will not be possible.

DIAGNOSTIC CHART

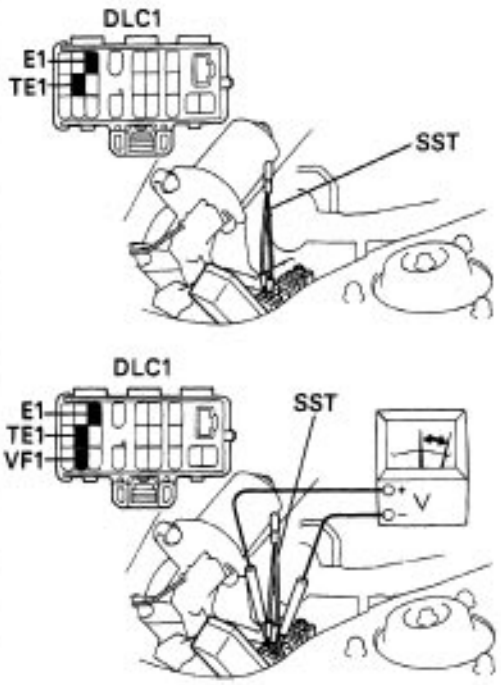


WIRING DIAGRAM

Refer to page EG1–354 for the WIRING DIAGRAM.

INSPECTION PROCEDURE

1 Check voltage between terminals VF1 and E1 of data link connector 1.



P (1) Warm up engine at normal operating tem–perature.
(2) Connect terminals TE1 and E1 of data link connector 1.
(3) Connect positive prove to terminal VF1 and negative prove to terminal E1 of data link connector 1.

C (1) Warm up the oxygen sensor by running en–gine at 2,500 rpm for about 2 minutes.
(2) Then, maintaining engine at 2,500 rpm, count how many times needle of voltmeter fluctuates between 0 and 5 V.

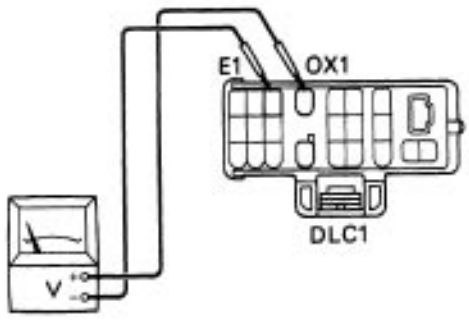
Result

Result	
Needle fluctuates of 8 times or more for every ten seconds	OK
Continue at 0 V	NG Type II
Continue at 5 V	NG Type II

NG Type I

NG Type II → Go to step 7

2 **Check voltage between terminals OX1 and E1 of data link connector 1.**



P Warm up engine at normal operating temperature.

C Measure voltage between terminals OX1 and E1 of data link connector 1 when engine is suddenly raced to full throttle.

OK **The voltage should be 0.5 V or higher at least once.**

Hint Perform inspection within 1 second.

NG

OK → Go to step 7

3 **Check for open and short in harness and connector between engine control module and main oxygen sensor, engine control module and data link connector 1 (See page IN–31).**

OK

NG → **Repair or replace harness or connector.**

4 **Check each item found to be a possible cause of problem.**

Check each circuit found to be a possible cause of trouble according to the results of the check in 1 or 2. The numbers in the table below show the order in which the checks should be performed.

Main oxygen sensor signal continue at OV.	Possible Cause	See page
1	Faulty sensor installation.	–
5	Injector circuit	EG1–410
3	Misfire	IG–6, 26*
9	Valve timing	EG1–36
2	Air leakage	EG1–173
4	Fuel system	EG1–419
8	Characteristics deviation in manifold absolute pressure sensor.	EG1–372
6	Characteristics deviation in engine coolant temp. sensor.	EG1–356
7	Characteristics deviation in intake air temp. sensor.	EG1–360

*: Except California specification vehicles.

OK

NG → **Repair or replace.**

5 **Check compression (See page EG1–23).**

OK

NG → **Repair or replace.**

6 **Does malfunction disappear when a good main oxygen sensor is installed?**

NO

YES → **Replace main oxygen sensor.**

Check and replace engine control module.

7 **Check each item found to be a possible cause of problem.**

Check each circuit found to be a possible cause of trouble according to the results of the check in 1. The numbers in the table below show the order in which the checks should be performed.

Main oxygen sensor signal continue at 5.0 V.	Main oxygen sensor signal is normal.	Possible Cause	See page
2	7	Injector circuit	EG1–410
	3	Misfire	IG–6, 26*
6	4	Valve timing	EG1–36
	1	Air leakage	EG1–173
1	2	Fuel system	EG1–419
5	8	Characteristics deviation in manifold absolute pressure sensor.	EG1–372
3	5	Characteristics deviation in engine coolant temp. sensor.	EG1–356
4	6	Characteristics deviation in intake air temp. sensor.	EG1–360

x: Except California specification vehicles.

OK

NG → **Repair or replace.**

8 **Check compression (See page EG1–23).**

OK

NG → **Repair or replace.**

9 **Does malfunction disappear when a good main oxygen sensor is installed?**

NO

YES → **Replace main oxygen sensor.**

Check and replace engine control module.

DTC 27 Sub Oxygen Sensor Circuit

CIRCUIT DESCRIPTION

The sub oxygen sensor is installed on the exhaust pipe. Its construction and operation is the same as the main oxygen sensor on page EG1–352.

DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
27	Main oxygen sensor signal is 0.45 V or more and sub oxygen sensor signal is 0.45 V or less under conditions (a) and (b). (2 trip detection logic) * (a) Engine coolant temp. : 80°C (176°F) or more. (b) Accel. pedal : Fully depressed for 2 sec. or more.	• Open or short in sub oxygen sensor circuit. • Sub oxygen sensor • ECM

* : See page EG1–307.

CIRCUIT DESCRIPTION (Cont'd)

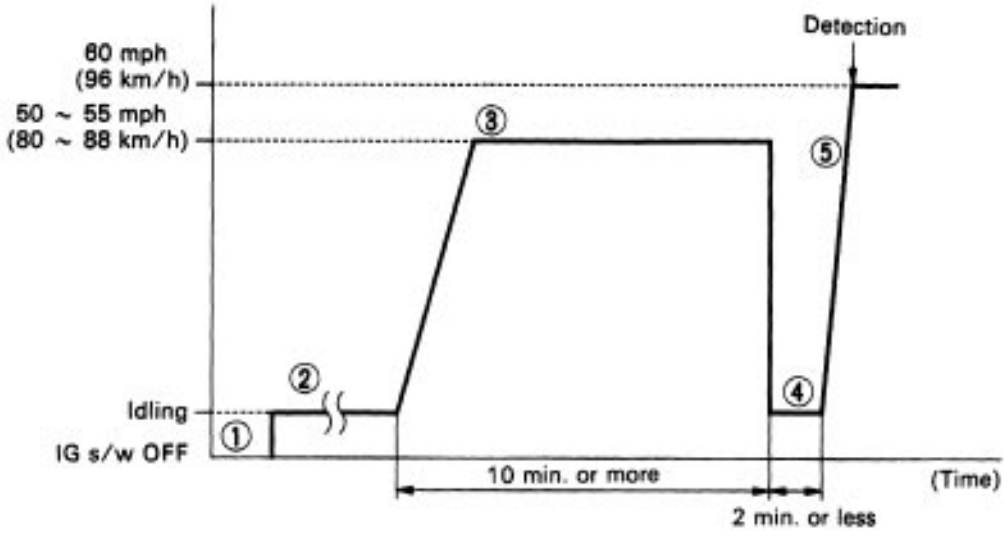
DIAGNOSIS TROUBLE CODE DETECTION DRIVING PATTERN

Purpose of the driving pattern.

(a) To simulate diagnostic trouble code detecting condition after diagnostic trouble code is recorded.

(b) To check that the malfunction is corrected when the repair is completed confirming that diagnostic trouble code is no longer detected.

Malfunction: Open or Short in Sub Oxygen Sensor



① Disconnect the E F I fuse (15 A) for 10 sec. or more, with IG switch OFF. Initiate test mode (Connect terminals TE2 and E1 of data link connector 1 or 2 with I G switch OFF).

② Start the engine and warm up, with all ACC switch OFF.

③ After the engine is warmed up, let it drive at 50 ~ 55 mph (80 ~ 88 km/h) for 10 min. or more.

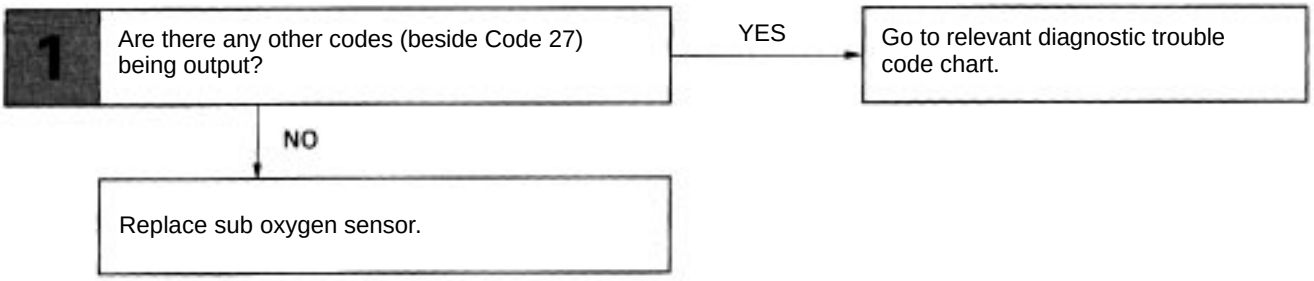
④ After driving, stop at a safe place and perform idling for 2 min. or less.

⑤ After performing the idling in (4) , perform acceleration to 60 mph (96 km/h) with the throttle valve fully open.

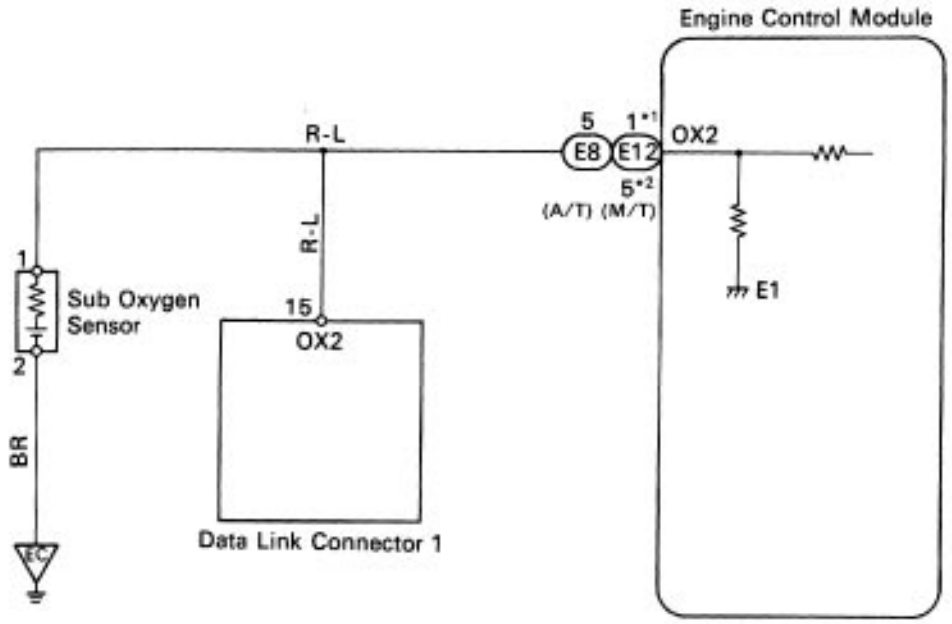
HINT: If a malfunction exists, the malfunction indicator lamp will light up during step.

NOTICE: If the conditions in this test are not strictly followed, detection of the malfunction will not be possible.

DIAGNOSTIC CHART



WIRING DIAGRAM



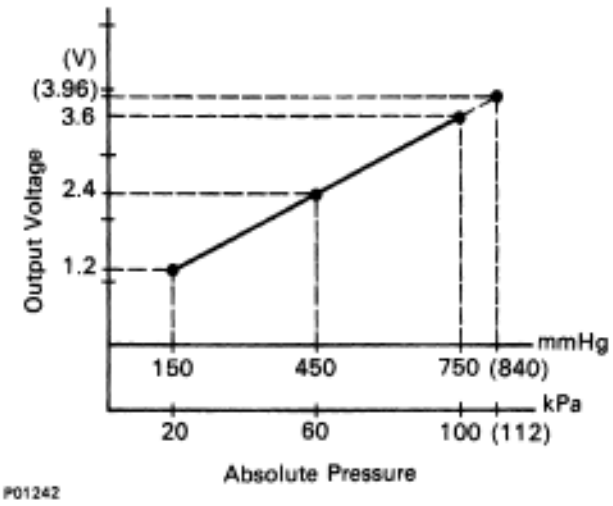
*1: Except California specification vehicles with M/T.
*2: Only for California specification vehicles with M/T.

FI6594

DTC 31 Manifold Absolute Pressure Sensor Circuit

CIRCUIT DESCRIPTION

By a built–in sensor unit, the manifold absolute pressure sensor detects the intake manifold absolute pressure as a voltage.
The ECM then determines the basic injection dura–tion and basic ignition advance angle based on this voltage.
Since the manifold absolute pressure sensor does not use the atmospheric pressure as a criterion, but senses the absolute pressure inside the intake man–ifold (the pressure in proportion to the preset abso–lute vacuum O), it is not influenced by fluctuations in the atmospheric, pressure due to high altitude and other factors. This permits it to control the air–fuel ratio at the proper level under all conditions.



DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
31	Open or short in manifold absolute pressure sensor circuit for 0.5 sec. or more.	• Open or short in manifold absolute pressure sensor circuit. • Manifold absolute pressure sensor. • ECM

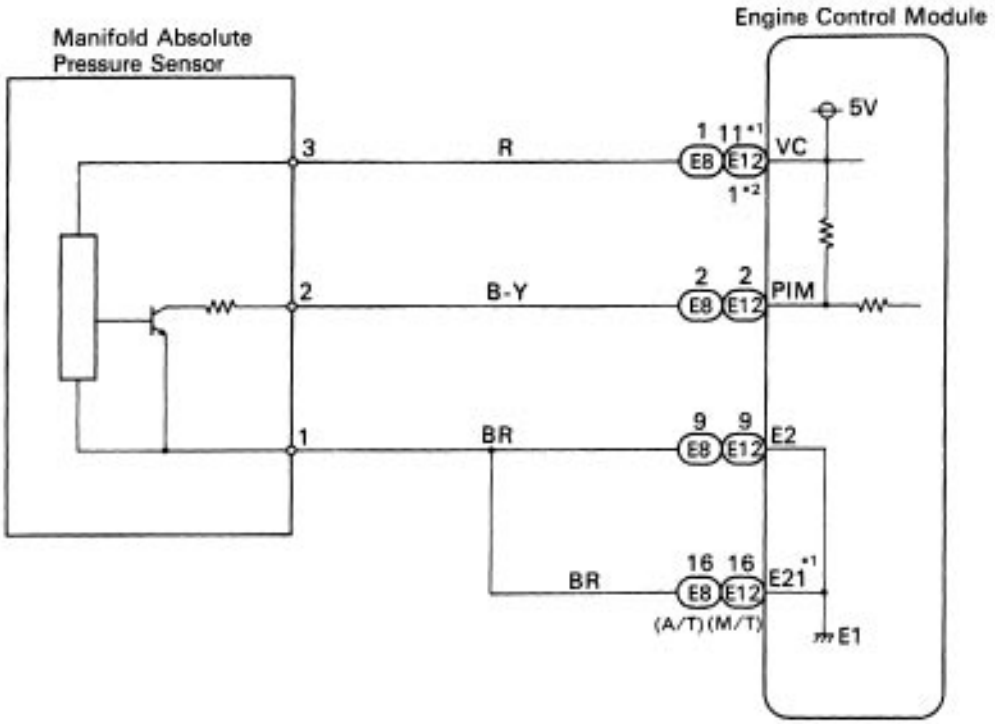
If the ECM detect diagnostic trouble code “31 “, it operates the fail safe function, keeping the ignition timing and fuel injection volume constant and making it possible to drive the vehicle.

DIAGNOSTIC CHART

1. Check voltage of terminal VC.
   - NG → Check and replace ECM.
   - OK ↓
2. Check voltage of terminal PIM.
   - OK → When diagnostic trouble code 31 is displayed, check and replace ECM.
   - NG ↓
3. Check for open and short in harness and connector between manifold absolute pressure sensor and ECM.
   - NG → Repair or replace harness or connector.
   - OK ↓

Check and replace manifold absolute pressure sensor.

WIRING DIAGRAM

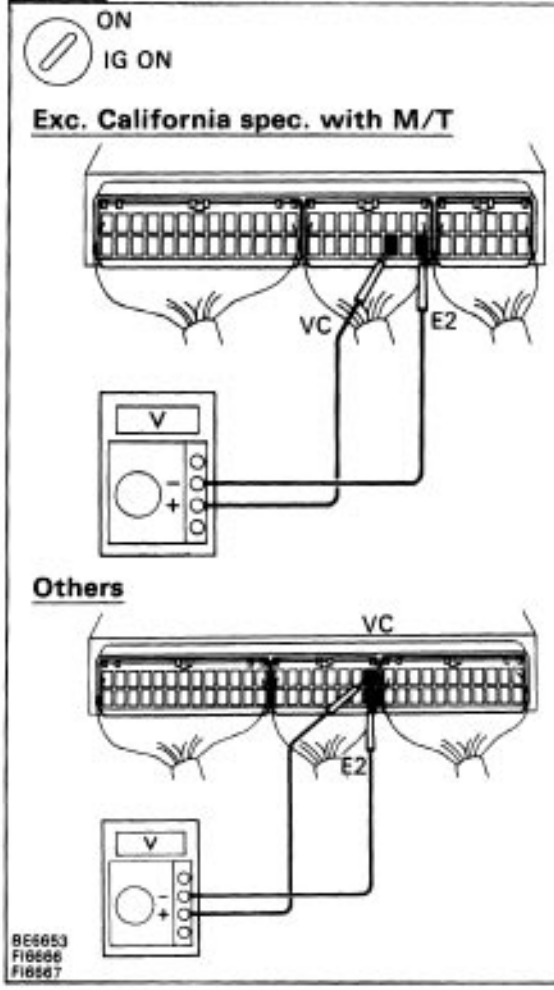


*1: Except California specification vehicles.
*2: Only for California specification vehicles.

FI6697

INSPECTION PROCEDURE

1 **Check voltage between terminals VC and E2 of engine control module connector.**



P (1) Remove glove compartment.
(See page EG1–234).
(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**

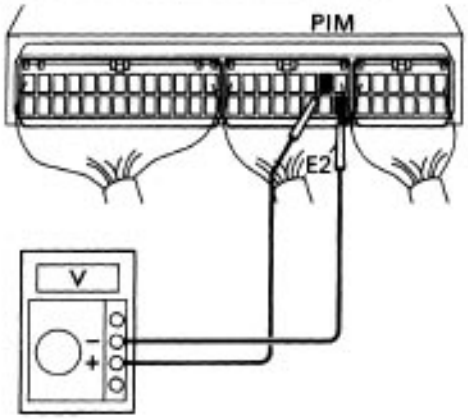
OK

NG **Check and replace engine control module.**

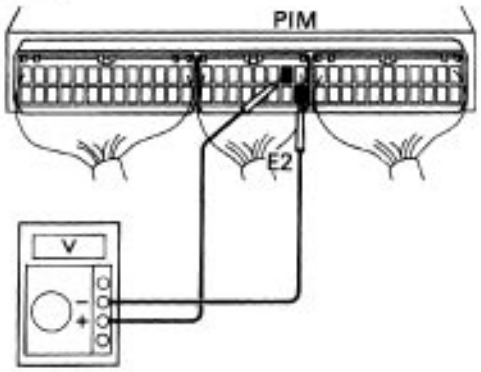
2 **Check voltage between terminals PIM and E2 of engine control module connector.**

ON
IG ON

Exc. California spec. with M/T



Others



BE6853
FI6668
FI6669

P Turn ignition switch on

C Measure voltage between terminals PI M and E2 of engine control module connector.

OK **Voltage: 13 – 3.9 V**

NG

OK → **When diagnostic trouble code 31 is displayed, check and replace engine control module.**

3 **Check for open and short in harness and connector between engine control module and manifold absolute pressure sensor (See page IN–31).**

OK

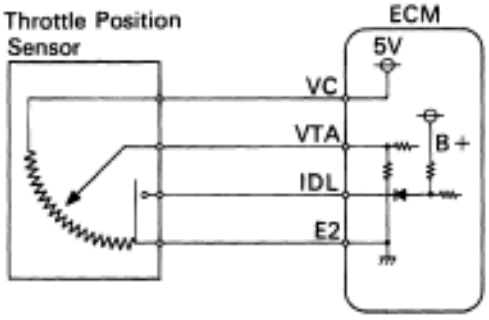
NG → **Repair or replace harness or connector.**

Check and replace manifold absolute pressure sensor.

DTC 41 Throttle Position Sensor Circuit

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 I D L contacts in the throttle position sensor are on, so the voltage at the ter–minal I D L of the ECM become 0 V. At this time, a voltage of approximately 0.7 V is applied to the terminal VTA of the ECM. When the throttle valve is opened, the I D L 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 3.2 – 4.9 V when the throttle valve is fully opened. The ECM judges the vehicle driving conditions from these signals input from the terminals VTA and IDL, and uses them as one of the conditions for deciding the air–fuel ratio cor–rection, power increase correction and fuel–cut control etc.



DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
41	Open or short in throttle position sensor circuit for 0.5 sec. or more.	• Open or short in throttle position sensor circuit. • Throttle position sensor. • ECM

HINT;

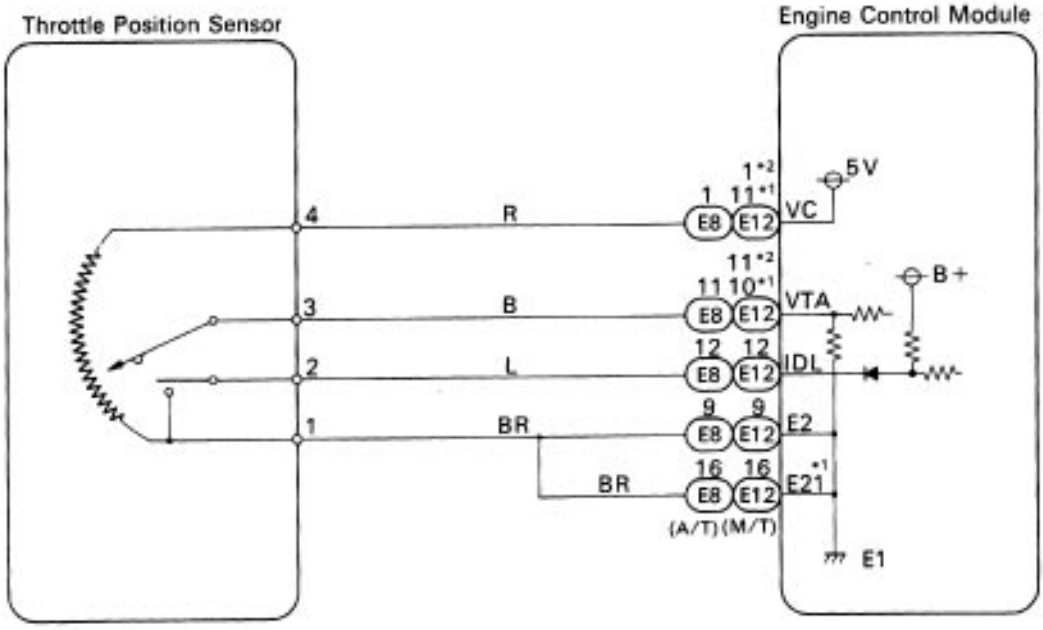
- When the connector for the throttle position sensor is disconnected, diagnostic trouble code 41 is not displayed. Diagnostic trouble code 41 is displayed only when there is an open or short in the VTA signal circuit of the throttle position sensor.

DIAGNOSTIC CHART

HINT: If diagnostic trouble codes “22” (engine coolant temperature sensor circuit), “24” (intake air temperature sensor circuit),“31” (manifold absolute pressure sensor circuit) and “41” (throttle position sensor circuit) are output simultaneously, E2 (sensor ground) may be open.

1	Check voltage of throttle position sensor.	→	Check for momentary interruption (See page EG1–309).
↓ NG			
2	Check operation for throttle position sensor.	NG →	Adjust or replace throttle position sensor.
↓ OK			
3	Check for open and short in harness and connector between throttle position sensor and ECM.	NG →	Repair or replace harness or connector.
↓ OK			
Check and replace ECM.			

WIRING DIAGRAM



*1: Except California specification vehicles.
*2: Only for California specification vehicles.

FI8692

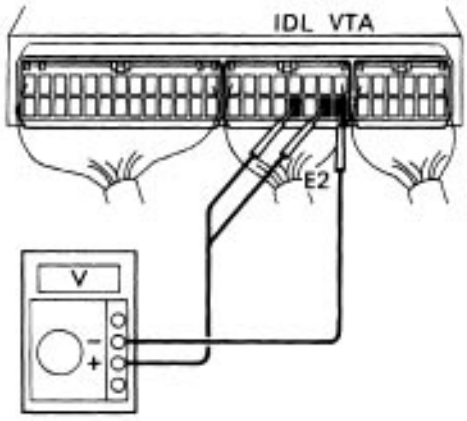
INSPECTION PROCEDURE

HINT: If diagnostic trouble code “22” (engine coolant temperature sensor circuit), “24” (intake air temperature sensor circuit), “31” (manifold absolute pressure sensor circuit) and “41 “ (throttle position sensor circuit) are output simultaneously, E2 (sensor ground) may be open.

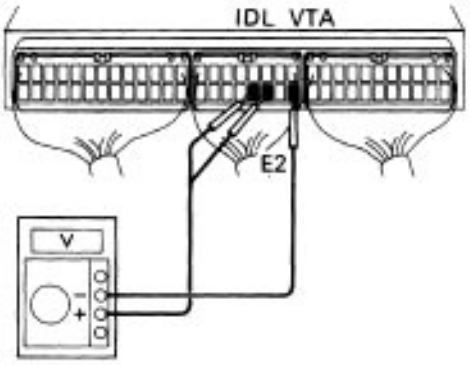
1 Check voltage between terminals VTA, IDL and E2 of engine control module connector.

ON
IG ON

Exc. California spec. with M/T



Others



B86653
FI8670
FI8671

P (1) Remove glove compartment.
(See page EG1–234).
(2) Disconnect the vacuum hose from the throt–tle body, then apply vacuum to the throttle opener (See page EG1–204).
(3) Turn ignition switch ON.

C Measure voltage between terminals VTA, IDL and E2 of engine control module connector when the throttle valve is opened gradually from the closed condition.

OK

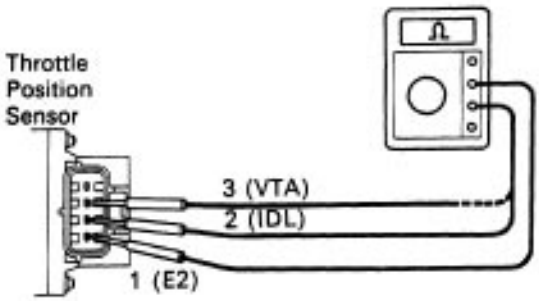
Terminal / Throttle Valve	VTA – E2	IDL – E2
Fully Closed	0.3 – 0.8 V	0 – 3.0 V
Fully Open	3.2 – 4.9 V	9 – 14 V

Hint The voltage should increase steadily in propor–tion to the throttle valve opening angle.

NG

OK → **Check for momentary interruption (See page EG1–309).**

2 Check throttle position sensor.



P (1) Disconnect throttle position sensor connector.
(2) Disconnect the vacuum hose from the throttle body, then apply vacuum to the throttle opener (See page EG1–204).

C Measure resistance between terminals 3 (VTA), 2 (IDL) and 1 (E2) of throttle position sensor connector when the throttle valve is opened gradually from the closed condition.

OK

Terminal / Throttle Valve	3 (VTA) – 1 (E2)	2 (IDL) – 1 (E2)
Fully Closed	0.2 – 5.7 kΩ	Less than 2.3 kΩ
Fully Open	2.0 – 10.2 kΩ	1MΩ or higher

Hint Resistance between terminals 3 (VTA) and 1 (E2) should increase gradually in accordance with the throttle valve opening angle.

OK

NG **Adjust or replace throttle position sensor (See page EG1–209).**

3 Check for open and short in harness and connector between engine control module and throttle position sensor (See page IN–31).

OK

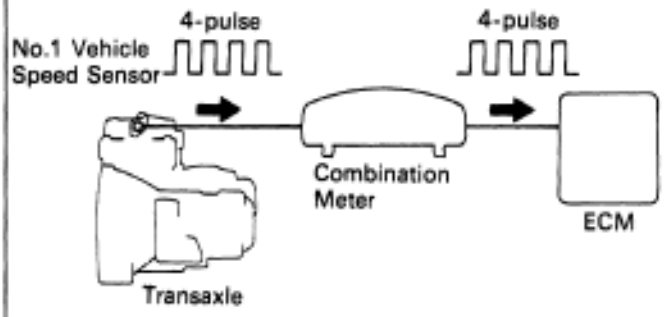
NG **Repair or replace harness or connector.**

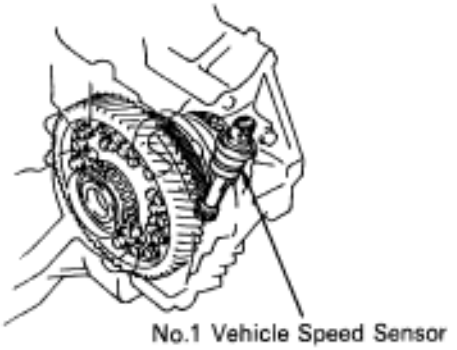
Check and replace engine control module.

DTC 42 No.1 Vehicle Speed Sensor Signal Circuit

CIRCUIT DESCRIPTION

The No.1 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.



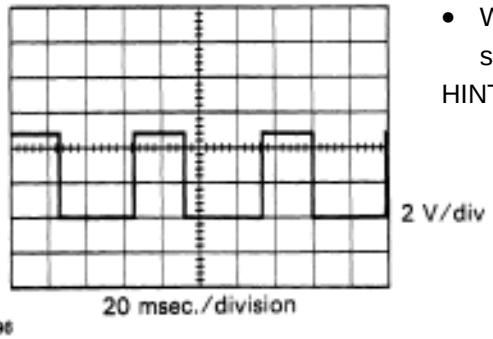


G00515
G00514

DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
42	For A/T All conditions below are detected continuously for 8 sec. or more. (a) No.1 Vehicle speed signal: 0 mph (km/h) (b) Engine speed: 3,100 rpm or more (c) Park/Neutral position switch: OFF	• Open or short in No.1 vehicle speed sensor circuit. • No.1 vehicle speed sensor. • Combination meter. • ECM
	For M /T All conditions below are detected continuously for 8 sec. or more. (a) No.1 vehicle speed signal: 0 mph (km/h) (b) Engine speed: Between 3,100 rpm and 5,000 rpm (c) Engine coolant temp.: 80°C (176°F) or more (d) Load driving	

HINT: In test mode, diagnostic trouble code 42 is output when vehicle speed is 3 mph (5 km/h) or below.

< Reference >

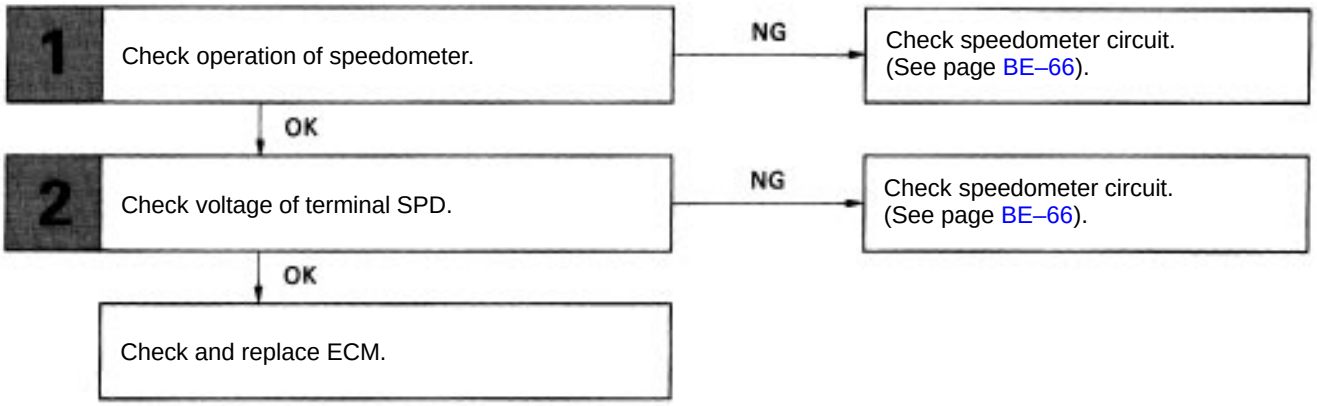


V01496

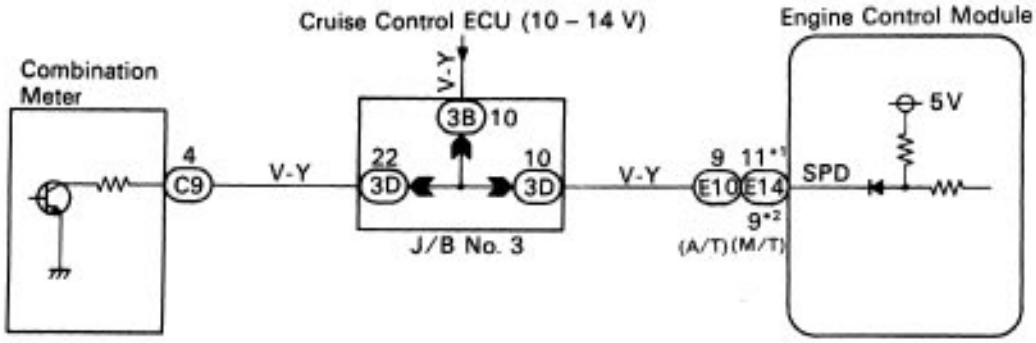
- Waveform between terminals SPD and E1 when vehicle speed is approx. 12 mph (20 km/h).

HINT: The greater the vehicle speed, the greater the number of No.1 vehicle speed sensor signals produced.

DIAGNOSTIC CHART



WIRING DIAGRAM



*1: Except California specification vehicles.
*2: Only for California specification vehicles.

FI8682

INSPECTION PROCEDURE

1 Check operation of speedometer.

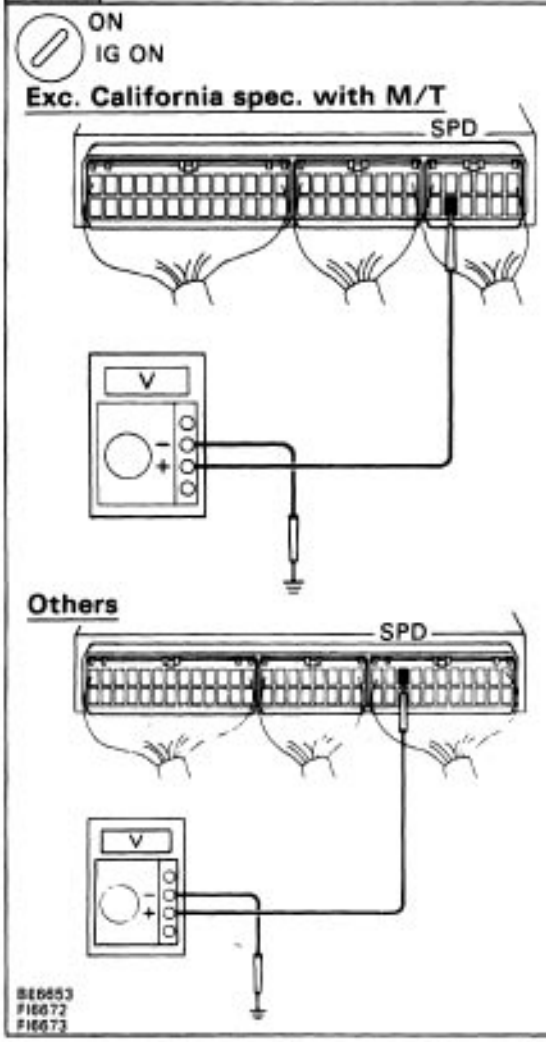
C Drive the vehicle and check if the operation of the speedometer in the combination meter is normal.

Hint The No. 1 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.**

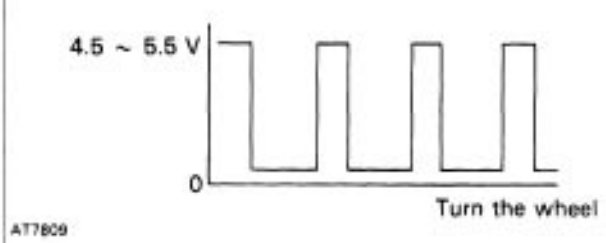
2 Check voltage between terminal SPD of engine control module connector and body ground.



P (1) Remove glove compartment.
(See page EG1–234).
(2) Disconnect cruise control ECU connector.
(3) Shift the shift lever to N position or neutral.
(4) Jack up a front wheel on one side.
(5) Turn ignition switch on.

C Measure voltage between terminal SPD of engine control module connector and body ground when the wheel is turned slowly.

OK **Voltage is generated intermittently.**



OK

NG → **Check speedometer circuit. See combination meter troubleshooting on page BE–66.**

Check and replace engine control module.

DTC 43 Starter Signal Circuit

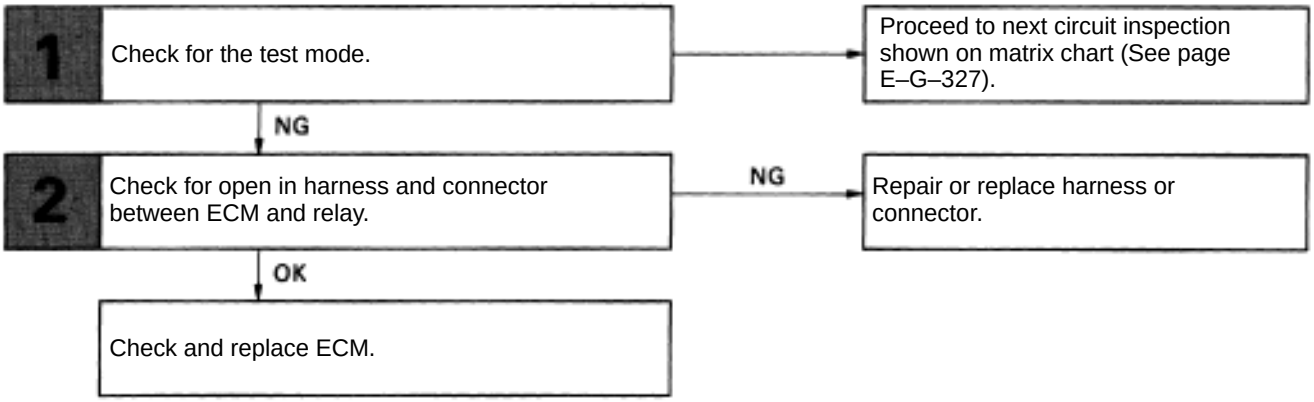
CIRCUIT DESCRIPTION

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 positive 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.

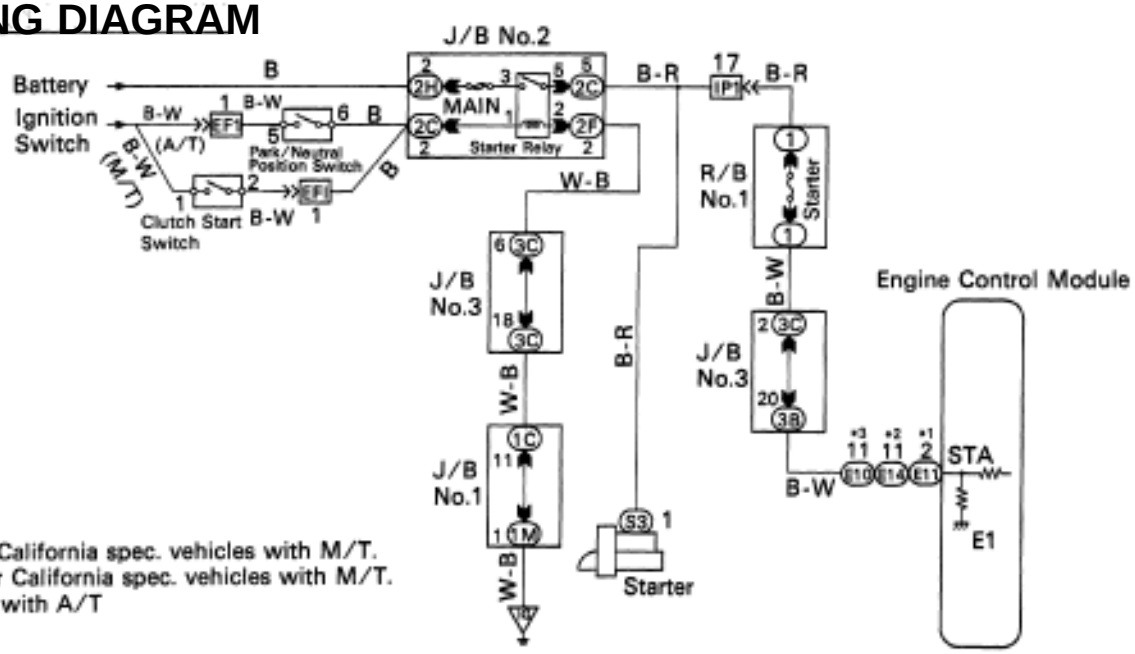
DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
43	No starter signal to ECM.	• Open or short in starter signal circuit. • Open or short in ignition switch or starter relay circuit. • ECM

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 EG1–327,



WIRING DIAGRAM



INSPECTION PROCEDURE

1 **Check output condition of diagnostic trouble code 43.**



P00956

P Setting the test mode.
(1) Turn ignition switch OFF.
(2) Connect terminals TE2 and E1 of DLC2.
(3) Turn ignition switch ON.
(Don't start the engine)
(4) Connect terminals TE1 and E1 of DLC2.

C Check if code "43" is output by the malfunction indicator lamp.

OK **Code "43" is output.**

C Start the engine.
Check if the code "43" disappear.

OK **Code "43" is not output.**

NG

OK → **Proceed to next circuit inspection shown on matrix chart (See page EG1–327).**

2 **Check for open in harness and connector between engine control module and starter relay (See page IN–31).**

OK

NG → **Repair or replace harness or connector.**

Check and replace engine control module.

DTC 52 Knock Sensor Circuit

CIRCUIT DESCRIPTION

Knock sensor is fitted 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
52	Open or short in knock sensor circuit with engine speed between 1,200 rpm and 6,000 rpm.	• Open or short in knock sensor circuit. • Knock sensor (looseness) • 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.

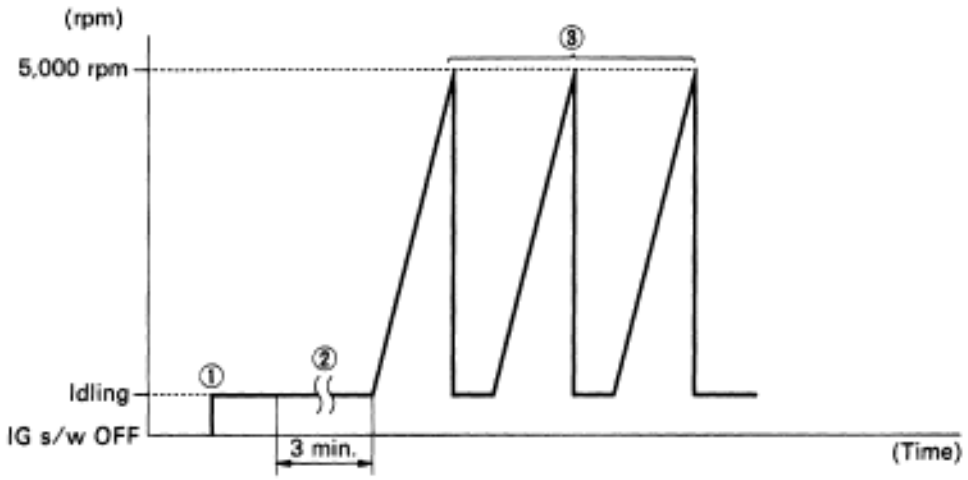
DIAGNOSIS TROUBLE CODE DETECTION DRIVING PATTERN

Purpose of the driving pattern.

(a) To simulate diagnostic trouble code detecting condition after diagnostic trouble code is recorded.

(b) To check that the malfunction is corrected when the repair is completed confirming that diagnostic trouble code is no longer detected.

Malfunction: Open or Short in Knock Sensor



FI6461

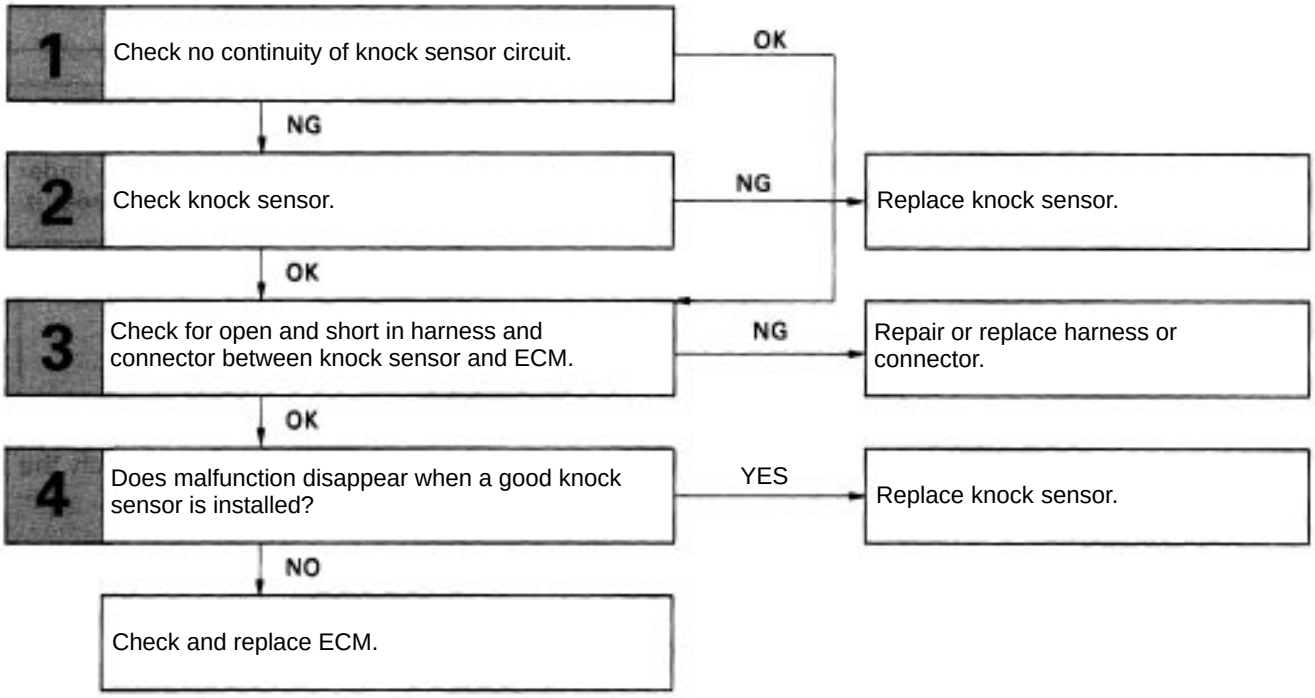
① Start engine and warm up.

② After engine is warmed up, let it idle for 3 min.

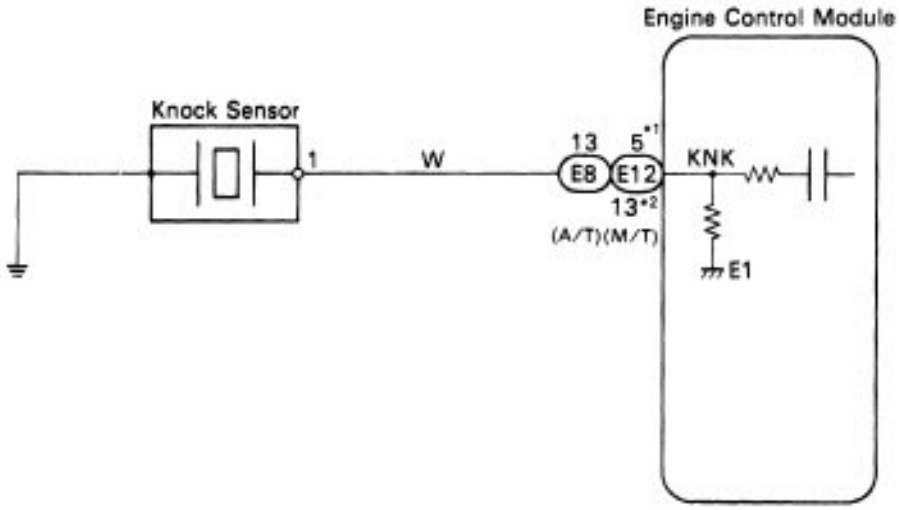
③ With the A/C ON, perform quick racing (5,000 rpm) 3 times.
(Rapidly depress the accelerator pedal and suddenly release it.)
HINT: If a malfunction exists, the malfunction indicator lamp will light up when sudden racing is performed.

NOTICE: If the conditions in this test are not strictly followed, detection of the malfunction will not be possible.

DIAGNOSTIC CHART



WIRING DIAGRAM

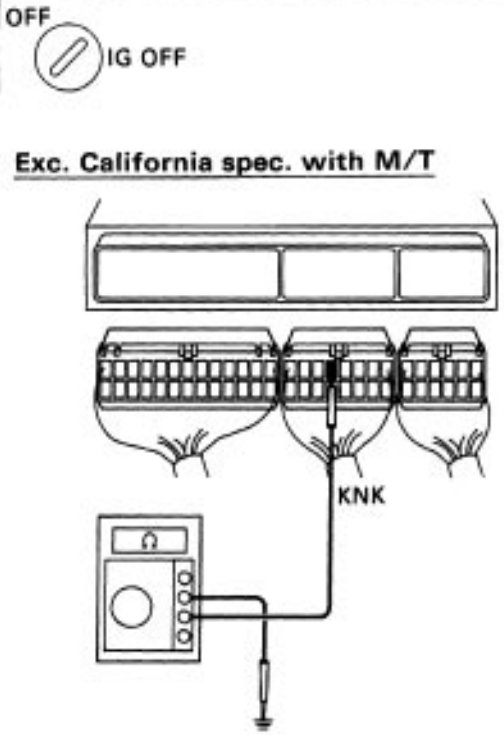


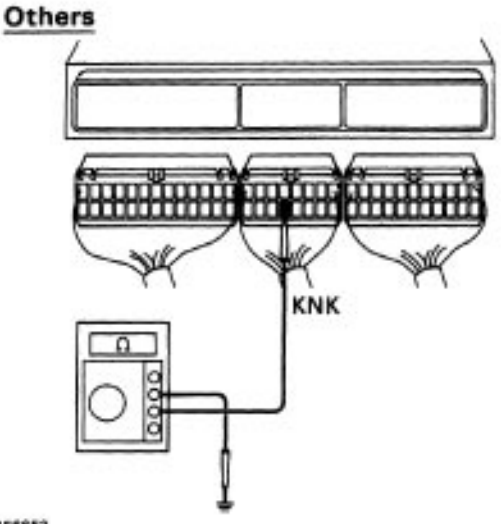
*1: Except California specification vehicles with M/T.
*2: Only for California specification vehicles with M/T.

FI6696

INSPECTION PROCEDURE

1 **Check continuity between terminal KNK of engine control module connector and body ground.**





BE6853
FI6723
FI6724

P (1) Remove glove compartment.
(See page EG1–234)

(2) Disconnect the engine control module connector.

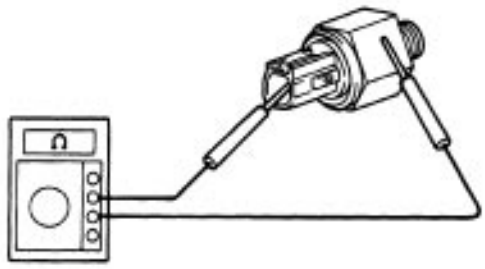
C Measure resistance between terminal KNK of engine control module connector and body ground.

OK **Resistance: 1 MΩ or higher**

NG

OK → Go to step 3

2 **Check knock sensor.**



P Disconnect knock sensor connector.

C Measure resistance between the knock sensor terminal and body.

OK **Resistance: 1 MΩ or higher**

OK

NG → **Replace knock sensor (See page EG1–93).**

3 **Check for open and short in harness and connector between engine control module and knock sensor (See page IN–31).**

OK

NG → **Repair or replace harness or connector.**

4 **Does malfunction disappear when a good knock sensor is installed?**

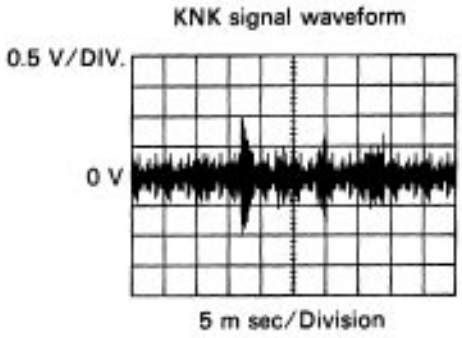
NO

YES → **Replace knock sensor (See page EG1–93).**

Check and replace engine control module.

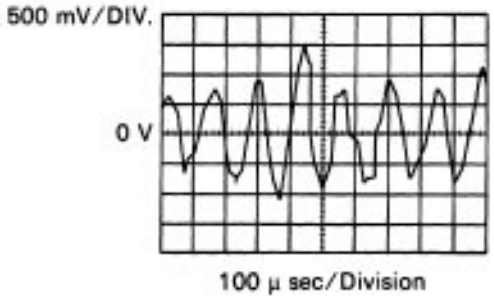
Reference

INSPECTION USING OSCILLOSCOPE



- With the engine racing (4,000 rpm) measure waveform between terminal KN K of engine control module and body ground.

HINT: The correct waveform appears as shown in the illustration on the left.



- Spread the time on the horizontal axis, and confirm that period of the wave is 132 ¿ sec. (Normal mode vibration frequency of knock sensor: 7.6 KHz).

HINT: If normal mode vibration frequency is not 7.6 KHz, the sensor is malfunctioning.

FI6510
FI6675

DTC 71 EGR System Malfunction

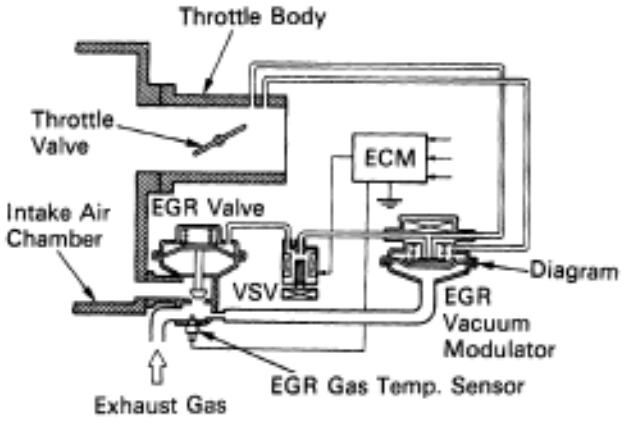
CIRCUIT DESCRIPTION

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 reduces 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.

- Engine coolant temp. below 60°C (140°F).
- During deceleration (throttle valve closed).
- Light engine load (amount of intake air very small).
- Engine speed over 4,400 rpm.
- Engine racing.



FI7193

DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
71	EG R gas temp. is 70°C (158°F) or below for 50 sec. under conditions (a) and (b). (2 trip detection logic) * (a) Engine coolant temp.: 80°C (176°F) or more. (b) EGR operation possible (EX. A/T in 3rd speed (5th for M/T), 55 – 60 mph (88 – 96 km/h), Flat road).	• Open in EGR gas temp. sensor circuit. • Short in VSV circuit for EGR. • EGR hose disconnected, valve stuck. • Clogged EGR gas passage. • ECM

*: See page EG1–307.

CIRCUIT DESCRIPTION (Cont'd)

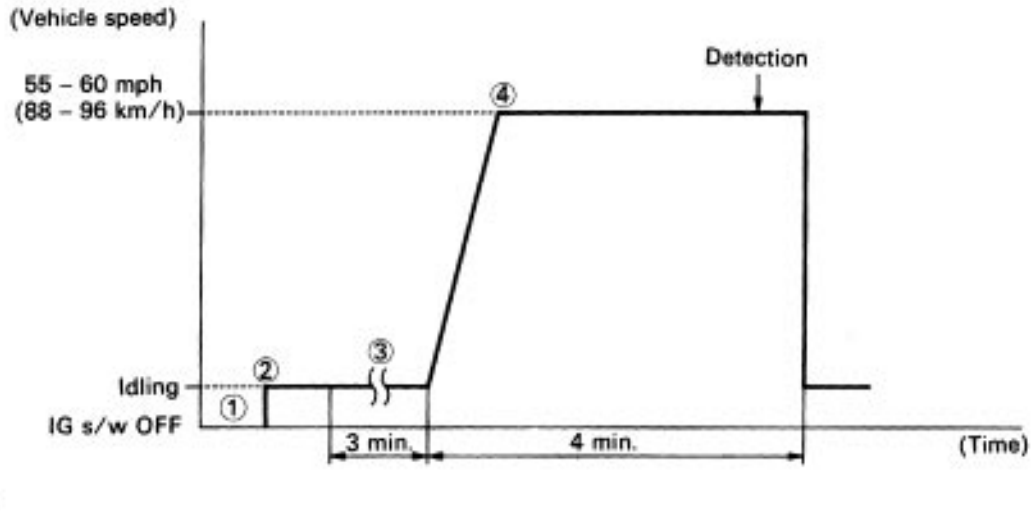
DIAGNOSIS TROUBLE CODE DETECTION DRIVING PATTERN

Purpose of the driving pattern.

(a) To simulate diagnostic trouble code detecting condition after diagnostic trouble code is recorded.

(b) To check that the malfunction is corrected when the repair is completed confirming that diagnostic trouble code is no longer detected.

Malfunction: Open in EGR gas temp. sensor circuit



FI6528

① Disconnect the EFI fuse (15 A) for 10 sec. or more, with IG switch OFF. Initiate test mode (Connect terminals TE2 and E1 of data link connector, 1 or 2 with IG switch OFF).

② Start the engine and warm up.

③ After the engine is warmed up, let it idle for 3 min.

④ With the A/C ON and transmission in 5th gear A/T in "D" position), drive at 55 – 60 mph (88 – 96 km/h) for 4 min. or less.

HINT: If a malfunction exists, the malfunction indicator lamp will light up during step (4) .

NOTICE: If the conditions in this test are not strictly observed, detection of the malfunction will not be possible.

DIAGNOSTIC CHART

1 Check voltage of VSV for EGR Power source.
- OK → 4
- NG → 2

2 Check resistance of VSV for EG R.
- NG → Replace VSV for EG R.
- OK → 3

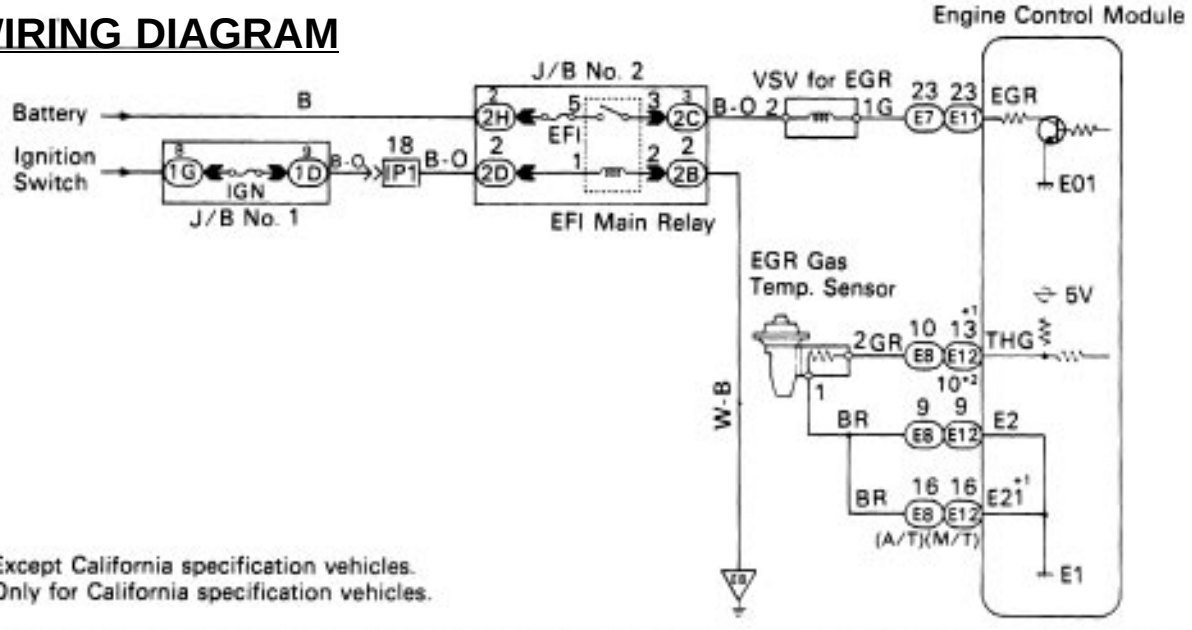
3 Check for open and short in harness and connector between EFI main relay and ECM.
- NG → Repair or replace harness or connector.
- OK → Check and replace ECM.

4 Check EGR system (See page EG1–153) .
- NG → Repair EGR system.
- OK → 5

5 Check resistance of EGR gas temp. sensor.
- NG → Replace EGR gas temp. sensor.
- OK → 6

6 Check for open in harness and connector between EGR gas temp. sensor and ECM.
- NG → Repair or replace harness or connector.
- OK → Check and replace ECM.

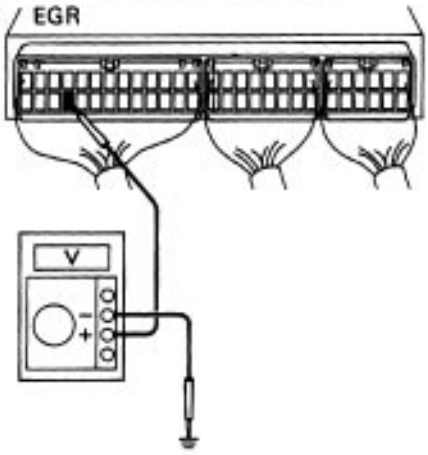
WIRING DIAGRAM



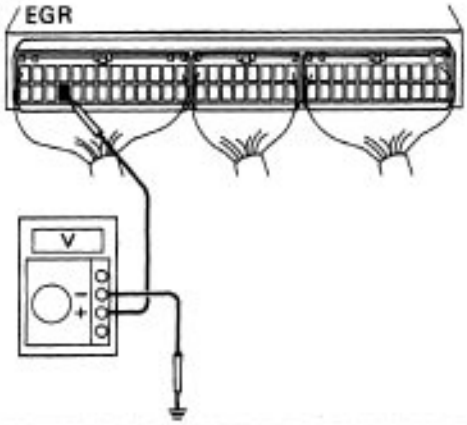
INSPECTION PROCEDURE

1 **Check voltage between terminal EGR of engine control module connector and body ground.**

Exc. California spec. with M/T



Others



FI6726
FI6725

P (1) Remove glove compartment.
(See page EG1–234).
(2) Warm up engine to normal operating temperature.

C Measure voltage between terminal EGR of engine control module connector and body ground.

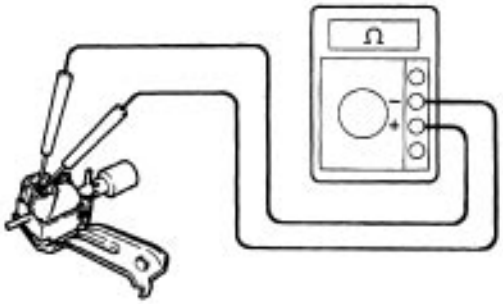
OK **Voltage: 9 –14 V**

NG

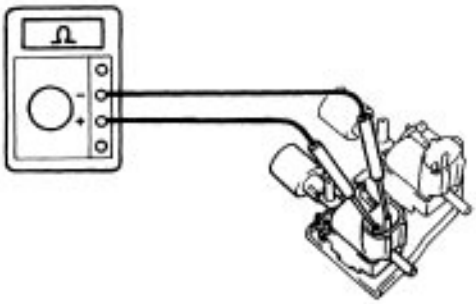
OK 〉 **Go to step** 4

2 **Check resistance between terminals of VSV for EGR.**

Exc. California spec.



Only for California spec.



P00820
P14145

P Remove VSV for EGR. (See page EG1–154, 155*).

C Measure resistance between terminals of VSV for EG R.

OK **Resistance: 33 – 39Ω (Cold)**

*: Except California specification vehicle.

OK

NG > **Replace VSV for EGR.**

3 **Check for open and short in harness and connector between EFI main relay and VSV for EGR, VSV and engine control module. (See page IN–31).**

OK

NG > **Repair or replace harness or connector.**

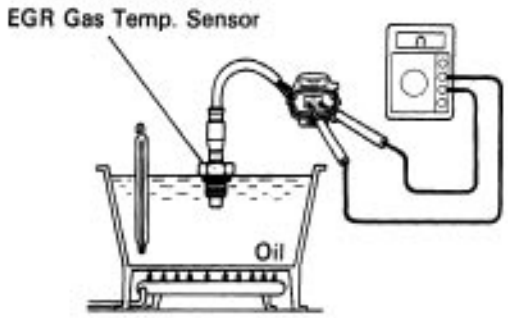
Check and replace engine control module.

4 **Check EGR system (See page EG1–153).**

OK

NG > **Repair EGR system.**

5 **Check resistance of EGR gas temp, sensor.**



P Remove EGR gas temp. sensor.

C Measure resistance between terminals of EG R gas temp. sensor connector.

OK **Resistance: 64 – 97 kΩ at 50°C (122°F)**
11 –16 kΩ at 100°C (212°F)
2 – 4 kΩ at 150°C (302°F)

OK

NG → **Replace EGR gas temp. sensor.**

6 **Check for open in harness and connector between EGR gas temp. sensor and engine control module (See page IN–31).**

OK

NG → **Repair or replace harness or connector.**

Check and replace engine control module.

DTC 51 Switch Condition Signal Circuit

CIRCUIT DESCRIPTION

Park/Neutral Position Switch Signal*

The ECM uses the signals from the park/neutral position switch to determine whether the transmis–sion is in park or neutral, or in some other gear.

Air Conditioning Switch Signal

The ECM uses the output from the air conditioning switch to determine whether or not the air conditioning is operating so that it can increase the idling speed of the engine if necessary.

Throttle Position Sensor IDL Signal

The IDL contacts are mounted in the throttle position sensor, and detects the idle condition.

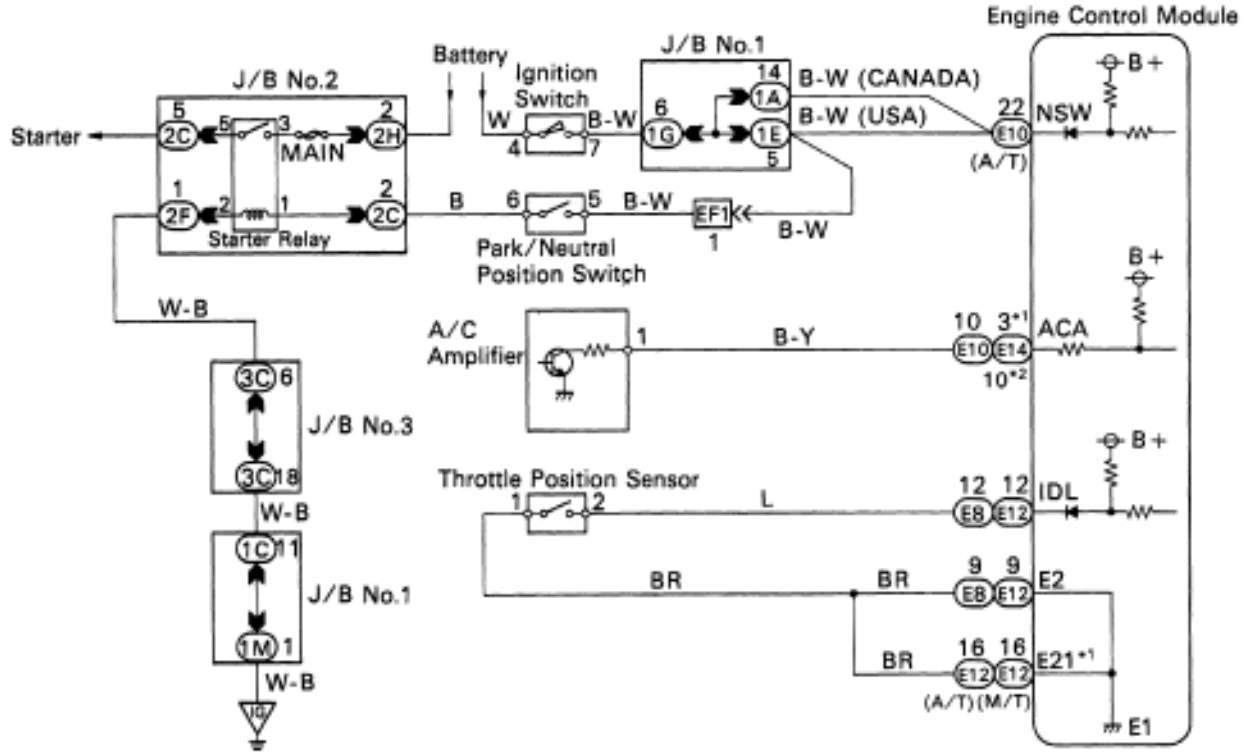
DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
51	(1) 3 sec. or more after engine starts with closed throttle position switch OFF (IDL). (2) * Park/ Neutral position switch OFF. (Shift position in “R”, “D”, “2” or “L” positions). (3) A/C switch ON.	• Throttle position sensor IDL circuit • Accelerator pedal and cable • Park/Neutral position switch circuit • A/C switch circuit • ECM

*: Only vehicles with A/T.

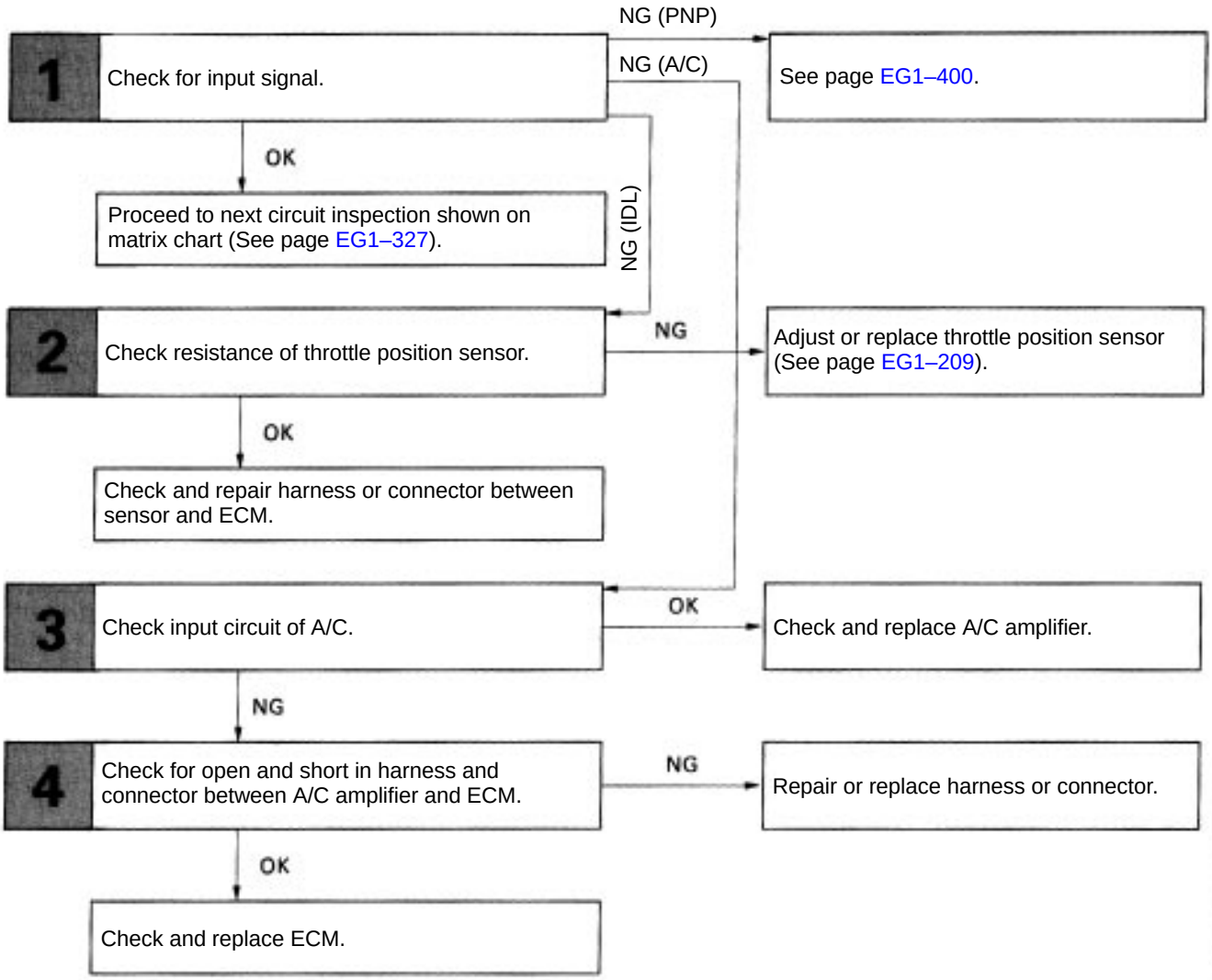
HINT: In this circuit, diagnosis can only be made in the test mode.

DIAGNOSTIC CHART

WIRING DIAGRAM



DIAGNOSTIC CHART



INSPECTION PROCEDURE

1 Check output condition of diagnostic trouble code 51.



P00365

P Setting the test mode.

(1) Turn ignition switch OFF.

(2) Connect terminals TE2 and E1 of DLC2.

(3) Turn ignition switch ON.

(For checking terminal IDL, disconnect the vacuum hose from the throttle body, then apply vacuum to the throttle opener (See page EG1–204).)

(For checking terminal A/C, start the engine.)

(4) Connect terminals TE1 and E1 of DLC2.

C Check if code "51" is output by the malfunction indicator lamp.

OK

	Condition	Code
Park/Neutral Position Switch (PNP)	P or N position	Normal*
	R, D, 2 or L position	51*
Throttle Position Sensor (IDL)	Accelerator pedal released	Normal*
	Accelerator pedal depressed	51*
A/C Switch (A/C)	A/C SW ON	51
	A/C SW OFF	Normal

*: Before the STA signal is input (ST is not ON), diagnostic trouble code 43 is also output.

Hint Diagnostic trouble code 42 is output with vehicle speed 3 mph (5 km/h) or below.

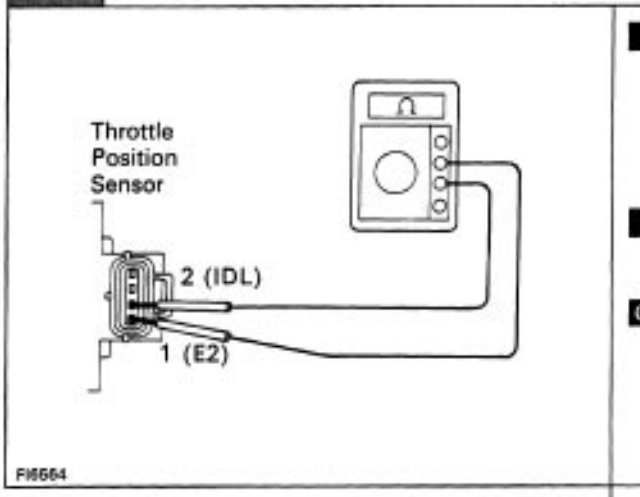
OK

NG **IDL .... Go to step 2**
A/C ... Go to step 3

PN P ... Go to page EG1–400.

Proceed to next circuit inspection shown on matrix chart (See page EG1–327).

2 Check resistance of throttle position sensor.



P (1) Disconnect throttle position sensor connector.
(2) Disconnect the vacuum hose from the throttle body, then apply vacuum to the throttle opener (See page EG1–204).

C Measure resistance between terminals 2 (IDL) and 1(E2) of throttle position sensor connector.

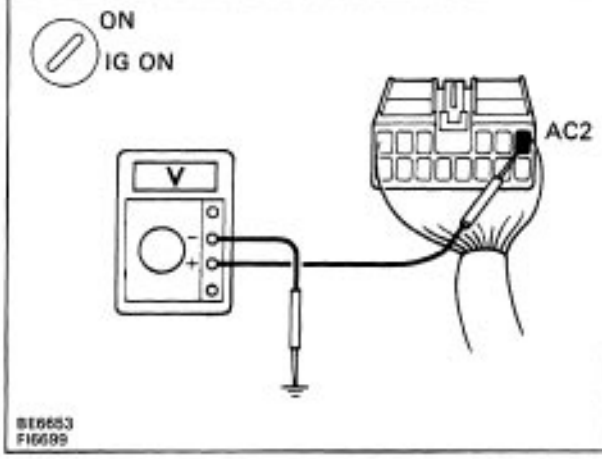
OK

Throttle Valve	Resistance
Fully closed	Less than 2.3 kΩ
Opened	1 MΩ or higher

OK → Check and repair harness or connector between engine control module and throttle position sensor.

NG → **Adjust or replace throttle position sensor (See page EG1–209).**

3 Disconnect A/C amplifier connector, check voltage between terminal AC2 of A/C amplifier connector and body ground.



P (1) Remove glove compartment (See page BO–114).
(2) Disconnect A/C amplifier connector.

C (3) Turn ignition switch on.
Measure voltage between terminal AC2 of A/C amplifier connector and body ground.

OK **Voltage: 9 –14 V**

OK → **Check and replace A/C amplifier.**

4 Check for open and short in harness and connector between engine control module and A/C amplifier (See page IN–31).

OK → **Check and replace engine control module.**

NG → **Repair or replace harness or connector.**

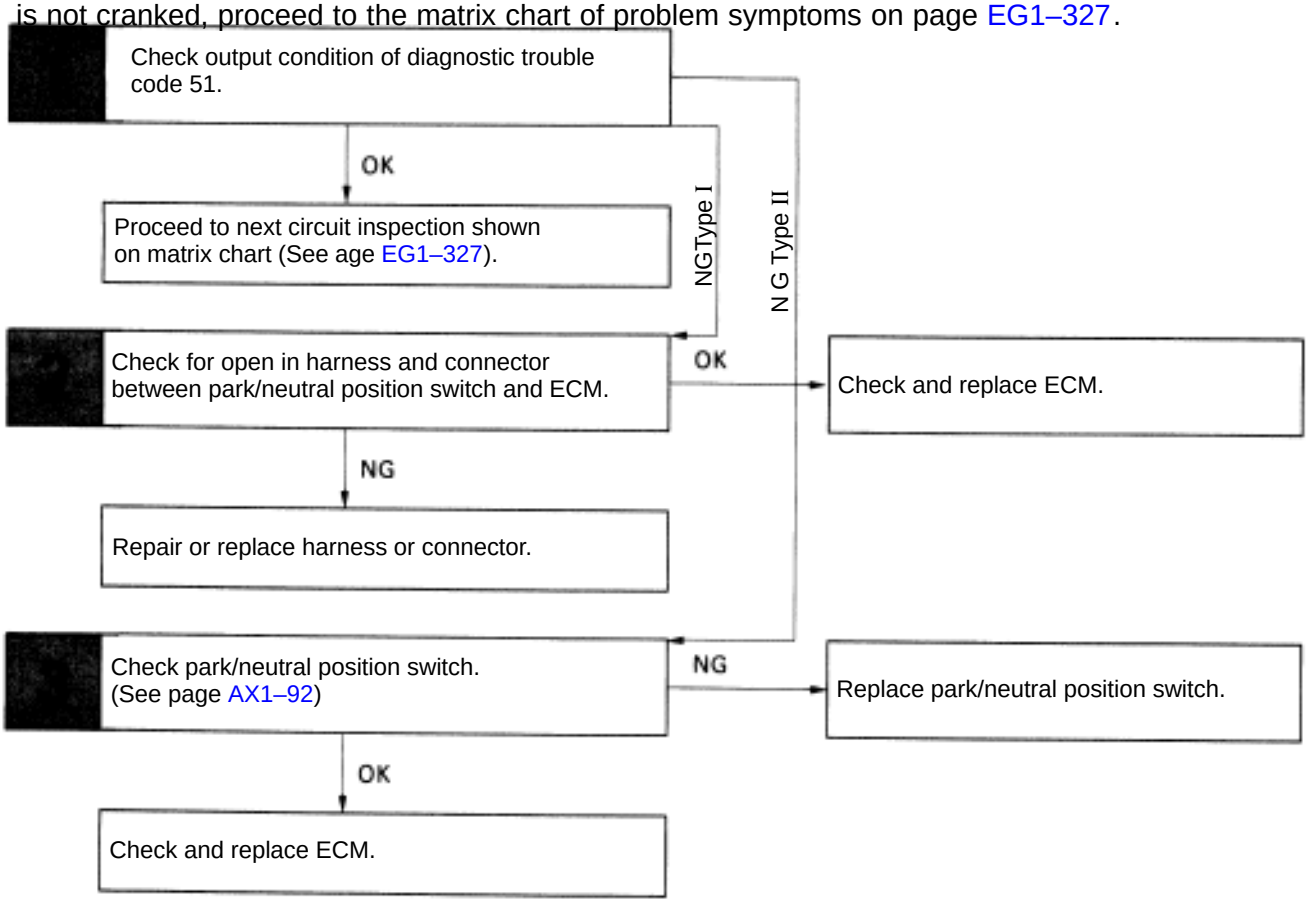
Park Neutral Position Switch Circuit (Only vehicles with A–T)

CIRCUIT DESCRIPTION

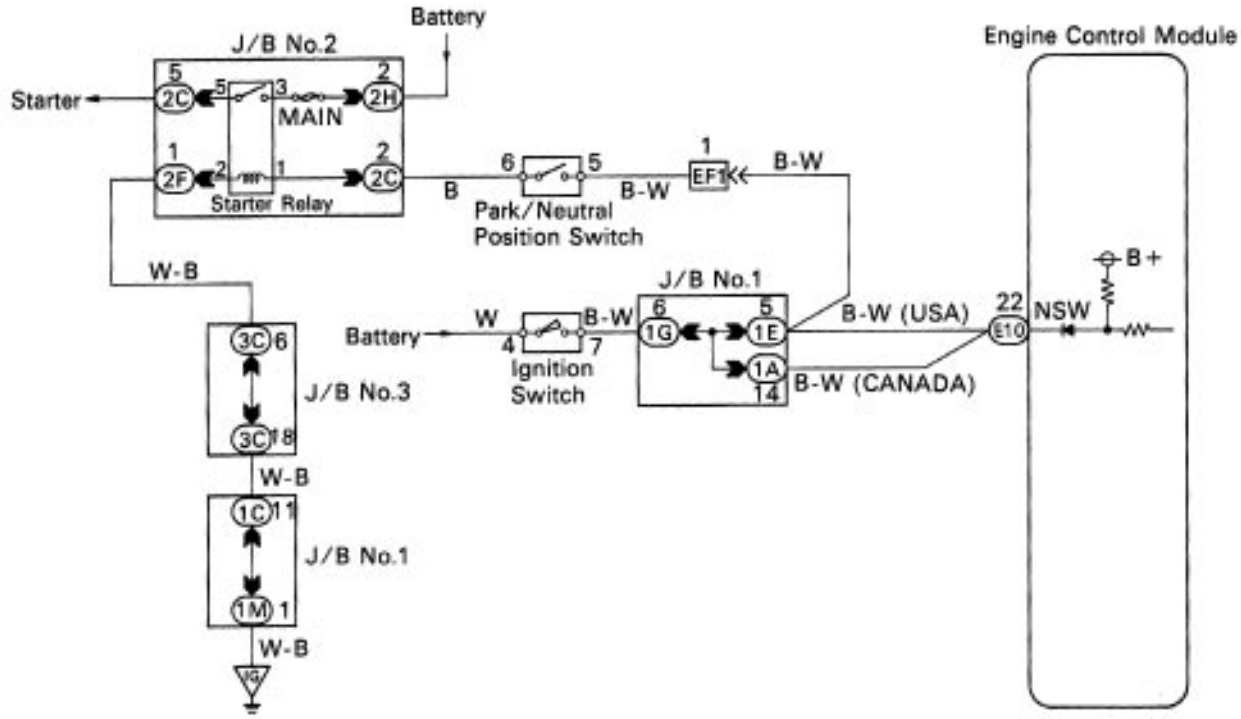
The Park/Neutral position switch goes on when the shift lever is in the N or P shift position. When it goes on the terminal NSW of the ECM is grounded to body ground via the starter relay and theft deterrent ECU, thus the terminal NSW voltage becomes 0V. When the shift lever is in the D, 2, L or R position, 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. When the Park/Neutral position switch is off, code “51” is output in the test mode diagnosis. (This is not abnormal.)

DIAGNOSTIC CHART

HINT: This diagnosis chart is based on premise that the engine is cranked normally. If the engine is not cranked, proceed to the matrix chart of problem symptoms on page EG1–327.

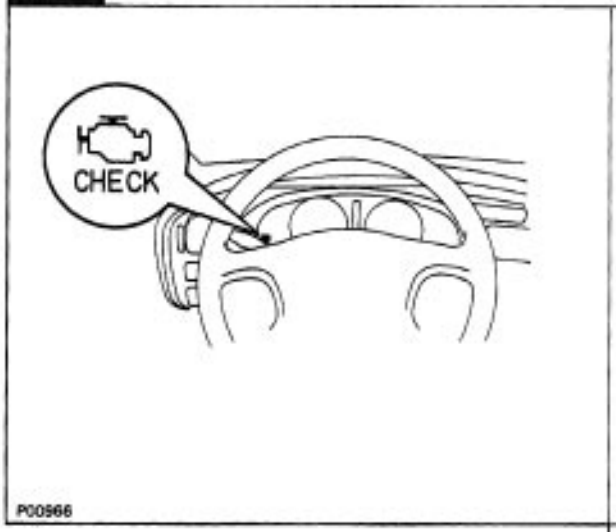


WIRING DIAGRAM



INSPECTION PROCEDURE

1 Check output condition of diagnostic trouble code 51.



P (1) Connect terminals TE2 and E1 of DLC2.
(2) Turn ignition switch on.
(3) Crank the engine.
(4) Connect terminals TE1 and E1 of DLC2.

C Check if diagnostic trouble code "51" is output when the shift lever is in the P and D shift positions.

Result

Shift Position	Result		
	OK	N G Type I	NG Type II
"P"	Normal Code	Code 51	Normal Code
"D"	Code 51	Code 51	Normal Code

OK

NG Type I → **Go to step 2**

NG Type II → **Go to step 3**

Proceed to next circuit inspection shown on matrix chart (See age EG1–327).

2 Check for open in harness and connector between engine control module and park/neutral position switch (See page IN–31).

NG

OK → **Check and replace engine control module.**

Repair or replace harness or connector.

3 Check park/neutral position switch (See page AX1–92).

OK

NG → **Replace park/neutral position switch.**

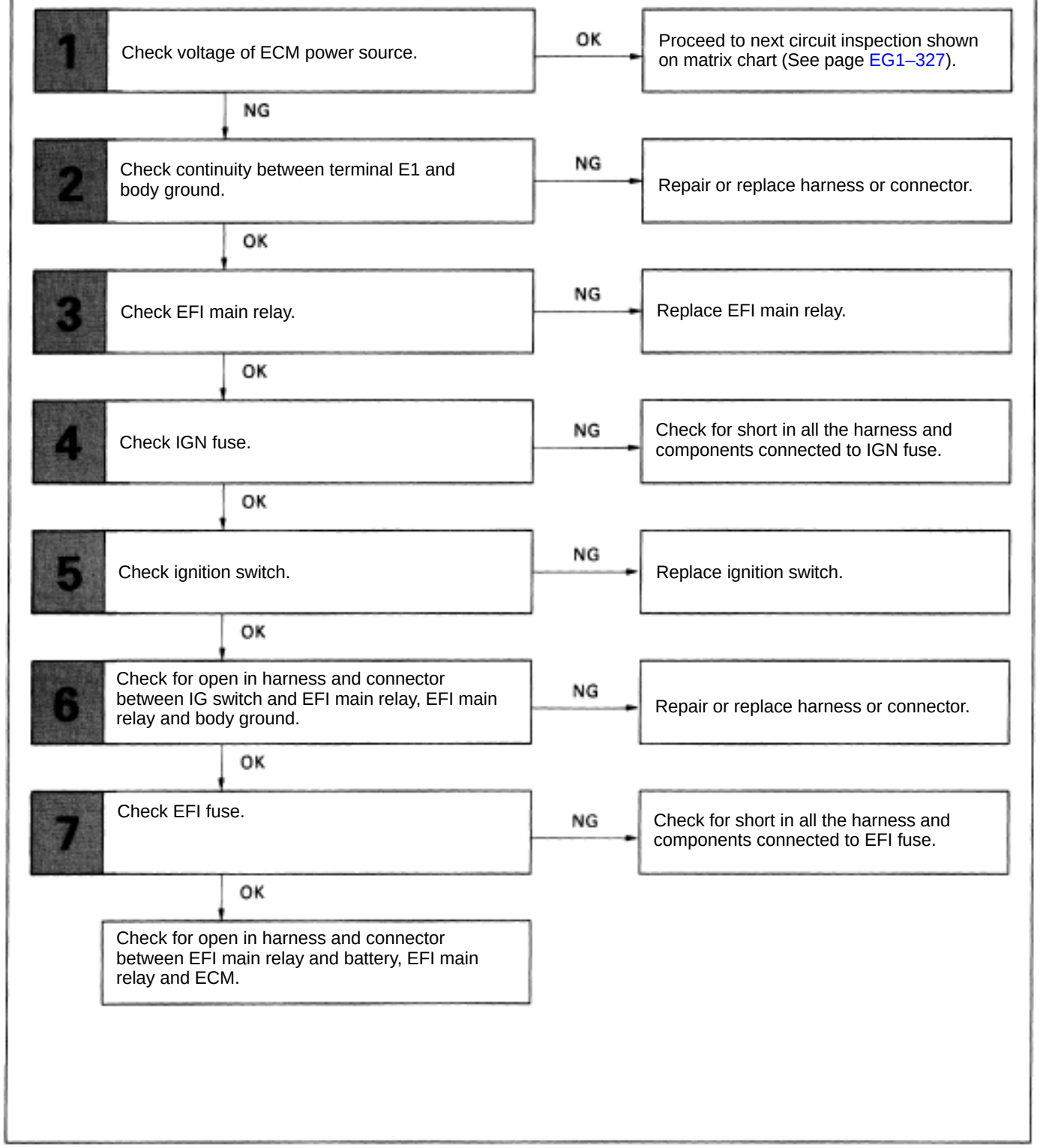
Check and replace engine control module.

ECM Power Source Circuit

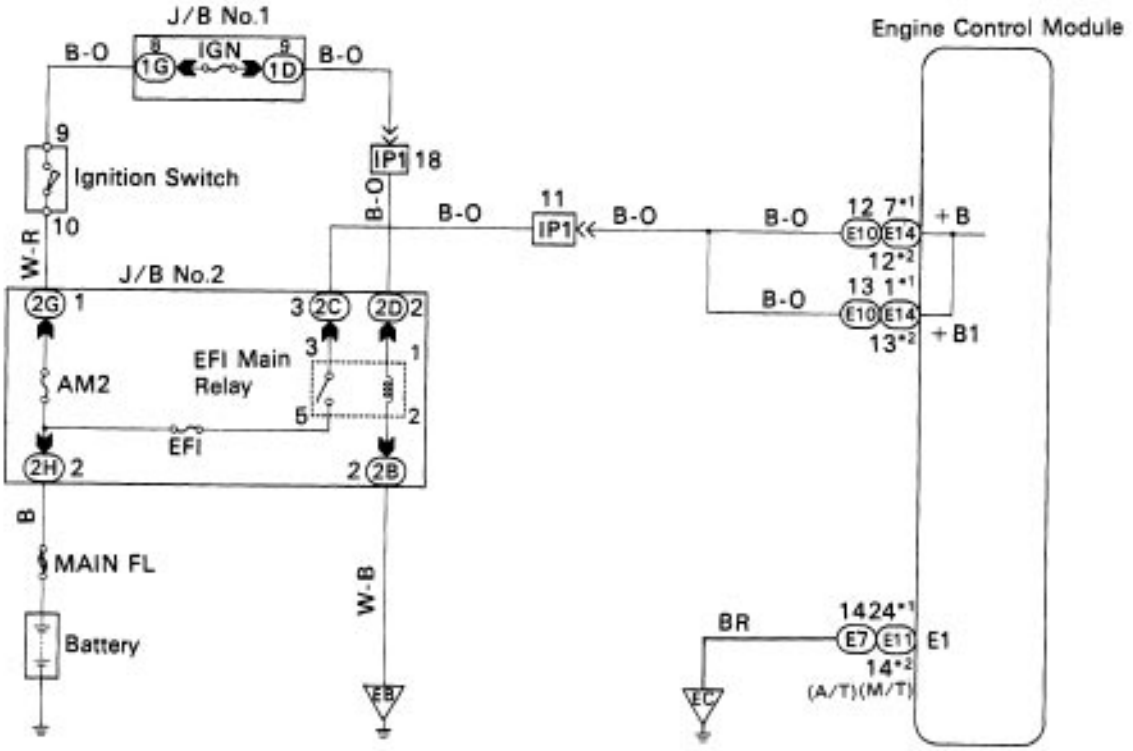
CIRCUIT DESCRIPTION

When the ignition switch is turned on, battery positive voltage is applied to the coil, closing the contacts of the EFI main relay and supplying power to the terminals + B and + 131 of the ECM.

DIAGNOSTIC CHART



WIRING DIAGRAM



*1: Except California specification vehicles with M/T.
*2: Only for California specification vehicles with M/T.

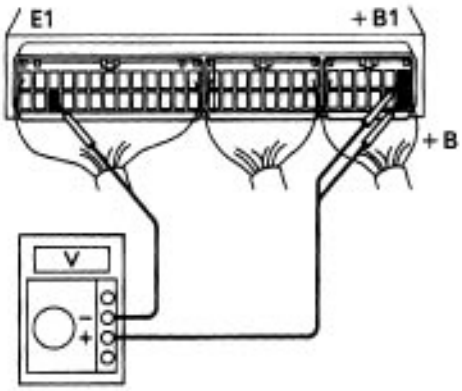
FI0685

INSPECTION PROCEDURE

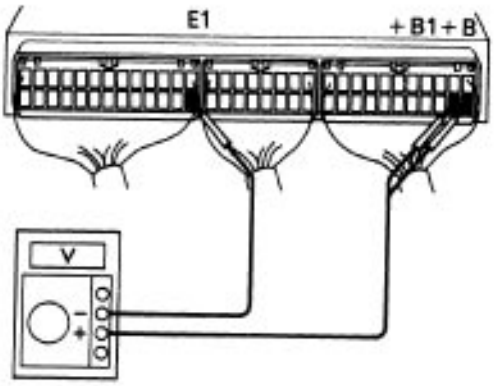
1 **Check voltage between terminals + B, + 131 and E1 of engine control module connector.**

ON
IG ON

Exc.California spec. with M/T



Others



88663
FI6727
FI6728

P (1) Remove glove compartment.
(See page EG1–234)

(2) Turn ignition switch ON.

C Measure voltage between terminals + B, + 131 and E1 of engine control module connector.

OK **Voltage: 9 –14 V**

NG

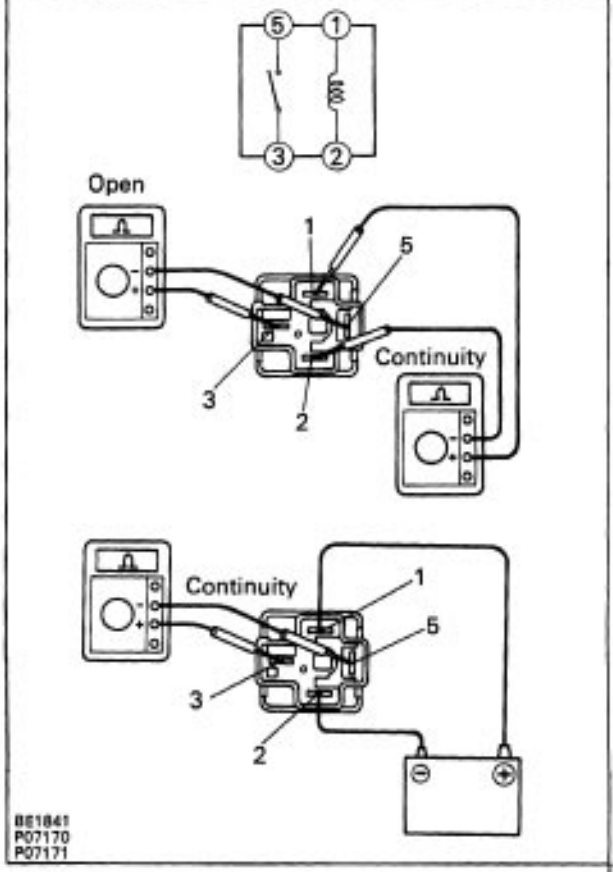
OK → **Proceed to next circuit inspection shown on matrix chart (See page EG1–327).**

2 **Check for open in harness and connector between terminal E1 of engine control module 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.

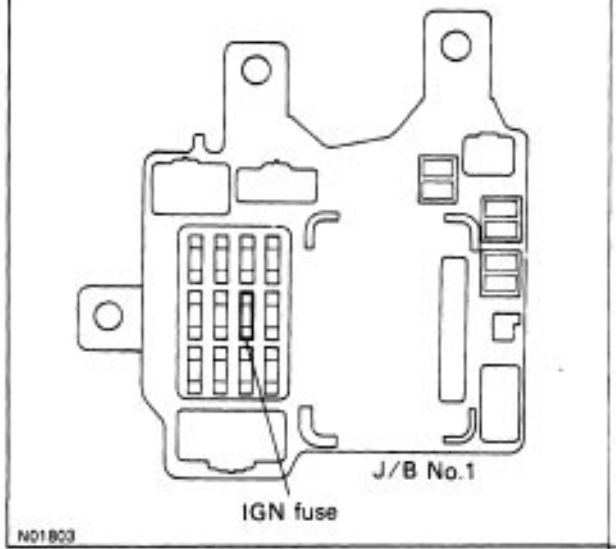
OK

Terminals 3 and 5	Continuity

OK

NG **Replace EFI main relay.**

4 Check IGN fuse.



P Remove IGN fuse from J/B No.1.

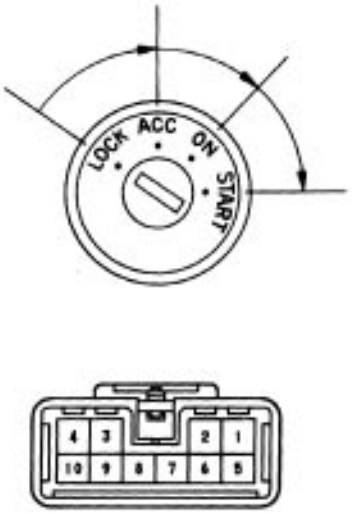
C Check continuity of IGN fuse.

OK **Continuity**

OK

NG **Check for short in all the harness and components connected to IGN fuse (See attached wiring diagram).**

5 **Check ignition switch.**



P Remove under cover and finish panel.

C Check continuity between terminals.

OK

○—○ continuity

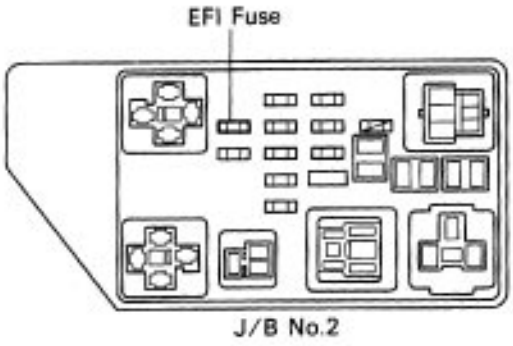
Terminal / Switch position	2 IG1	3 ACC	4 AM1	6 ST2	7 ST1	9 IG2	10 AM2
LOCK							
ACC		○—○	○—○				
ON	○—○	○—○	○—○			○—○	○—○
START	○—○		○—○	○—○	○—○	○—○	○—○

OK → **NG** → Replace ignition switch.

6 **Check for open in harness and connector between IG switch and EFI main relay, EFI main relay and body ground (See page IN–31).**

OK → **NG** → **Repair or replace harness or connector.**

7 **Check EFI fuse.**



P Remove EFI fuse from J/B No.2.

C Check continuity of EFI fuse.
Continuity

OK

OK → **NG** → **Check for short in all the harness and components connected to EFI fuse (See attached wiring diagram).**

Check for open in harness and connector between EFI main relay and battery, EFI main relay and engine control module.

Back Up Power Source Circuit

CIRCUIT DESCRIPTION

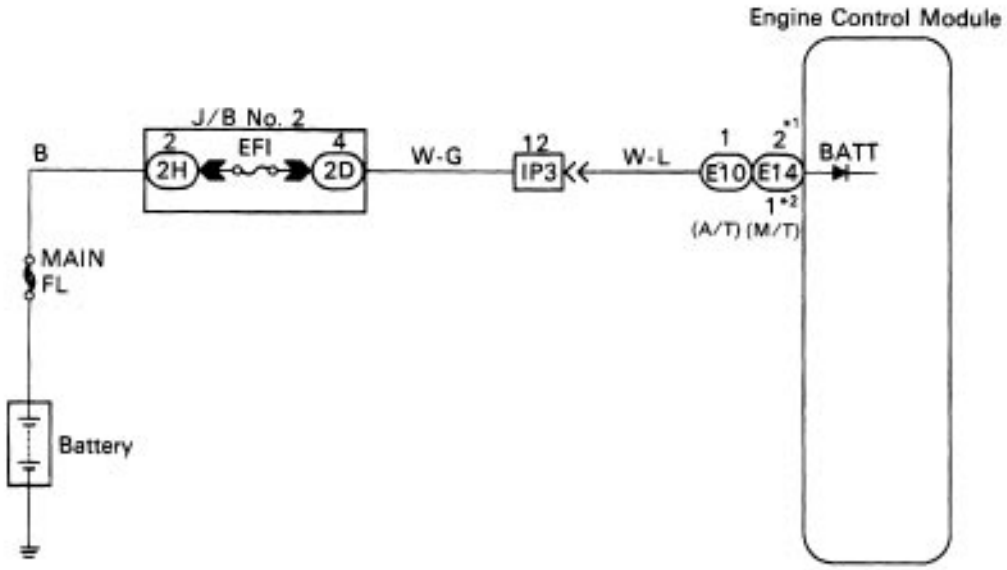
Battery positive voltage is supplied to terminal BATT of the ECM even when the ignition switch is off for use by the diagnostic trouble code memory and air–fuel ratio adaptive control value memory, etc.

DIAGNOSTIC CHART

1. Check EFI fuse.
   - NG → Check for short in all the harness and components connected to EFI fuse.
   - OK ↓
2. Check voltage of terminal6ATT.
   - NG → Check and repair harness or connector between battery, EFI fuse and ECU.
   - OK ↓
3. Check operation for the back up.
   - NG → Check and replace ECM.
   - OK ↓

Proceed to next circuit inspection shown on matrix chart (See page EG1–327).

WIRING DIAGRAM

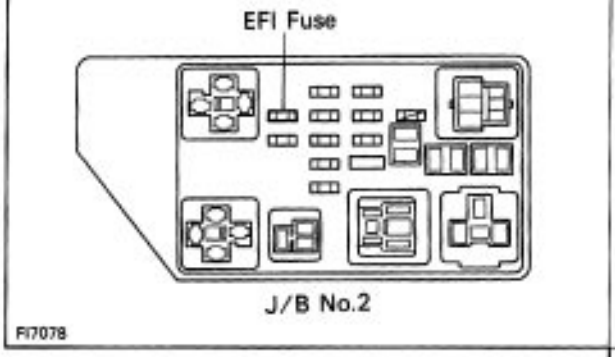


*1: Except California specification vehicles with M/T.
*2: Only for California specification vehicles with M/T.

FI6685

INSPECTION PROCEDURE

1 Check EFI fuse.



P Remove EFI fuse from J/B No.2.
C Check continuity of EFI fuse.
OK Continuity

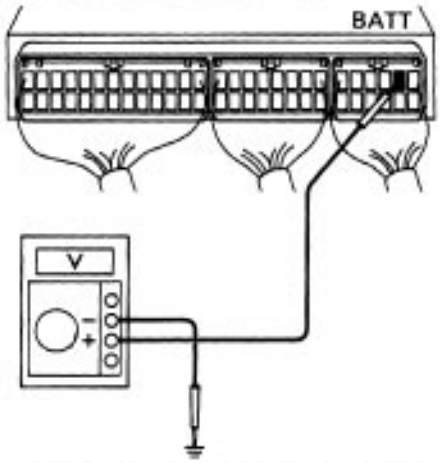
OK

NG → **Check for short in all the harness and components connected to EFI fuse (See attached wiring diagram).**

2 Check voltage between terminal BATT of engine control module connector and body ground.

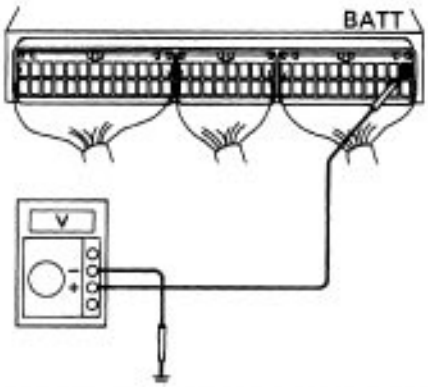
OFF
IG OFF

Exc. California spec. with M/T



P Remove glove compartment.
(See page EG1–234)
C Measure voltage between terminal BATT of engine control module connector and body ground.
OK **Voltage: 9 –14 V**

Others



OK

NG → **Check and repair harness or connector between engine control module and EN fuse, EFI fuse and battery.**

3 Are the diagnostic trouble codes still in the memory when the ignition switch is turned OFF?

YES

NO → Check and replace engine control module.

Proceed to next circuit inspection shown on matrix chart (See page EG1–327).

Injector Circuit

CIRCUIT DESCRIPTION

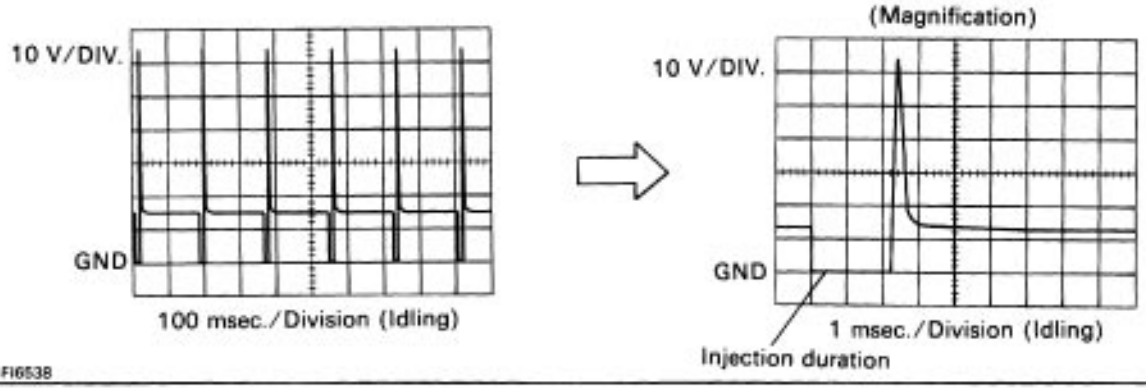
The injectors are provided to the intake manifold. They inject fuel into the cylinders based on the signals from the engine control module.

Reference INSPECTION USING OSCILLOSCOPE

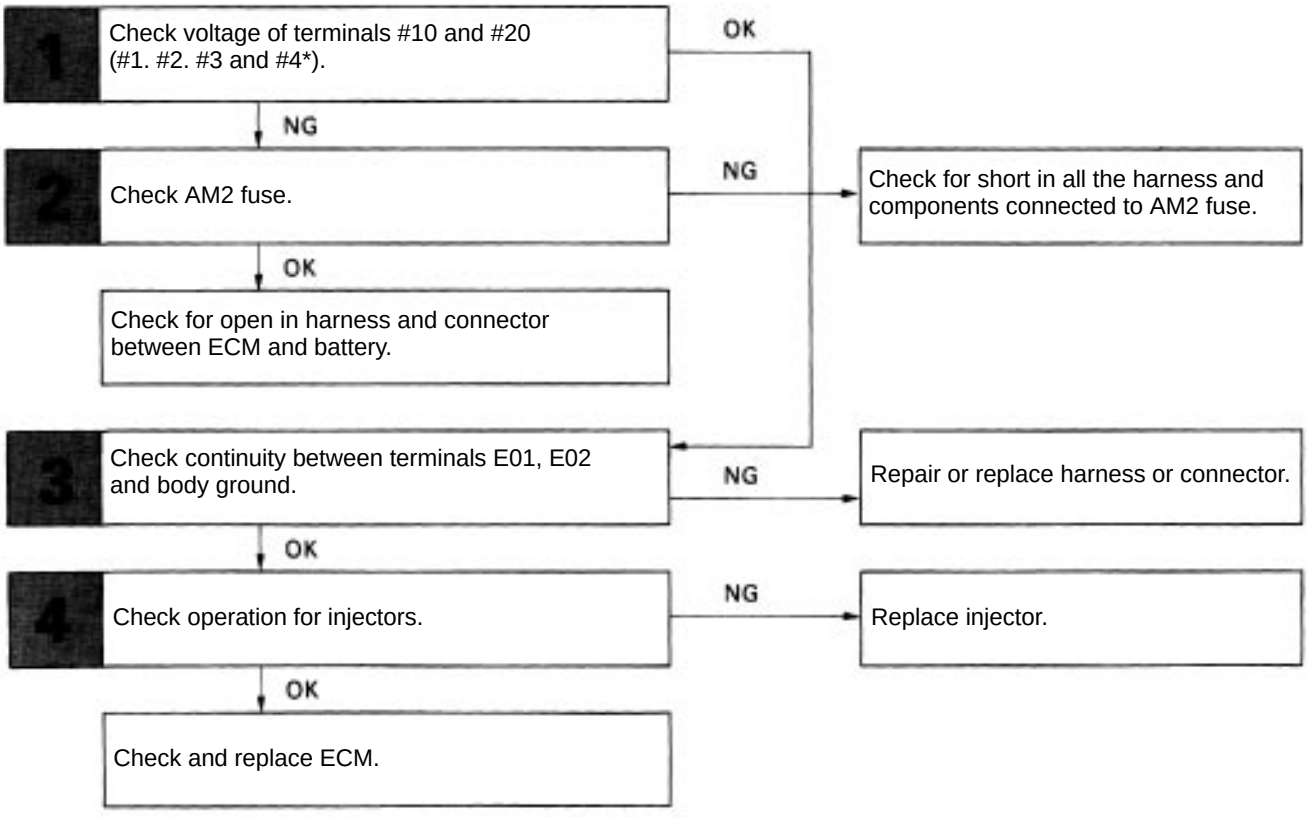
INJECTOR SIGNAL WAVEFORM

- With the engine idling measure waveform between terminals #10, #20 (#1, #2, #3 and #4*) and E01 of engine control module.

HINT: The correct waveform appears as shown in the illustration on the below.



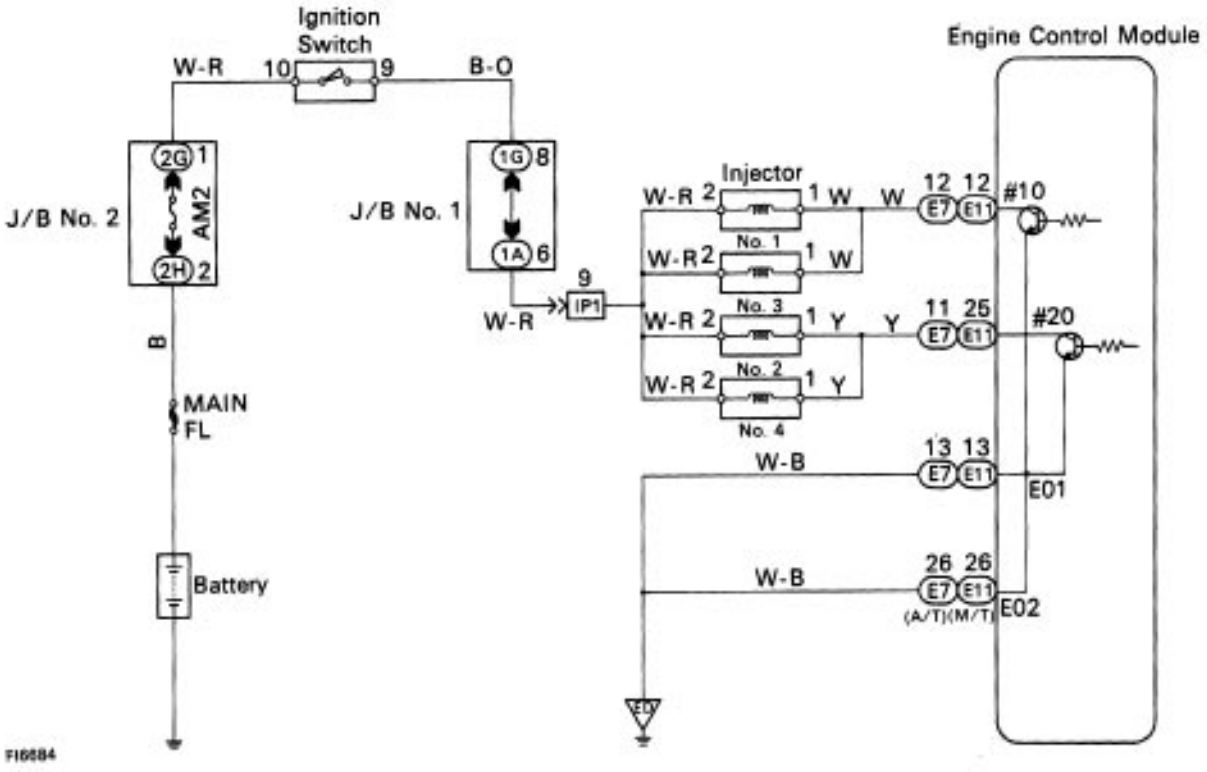
DIAGNOSTIC CHART



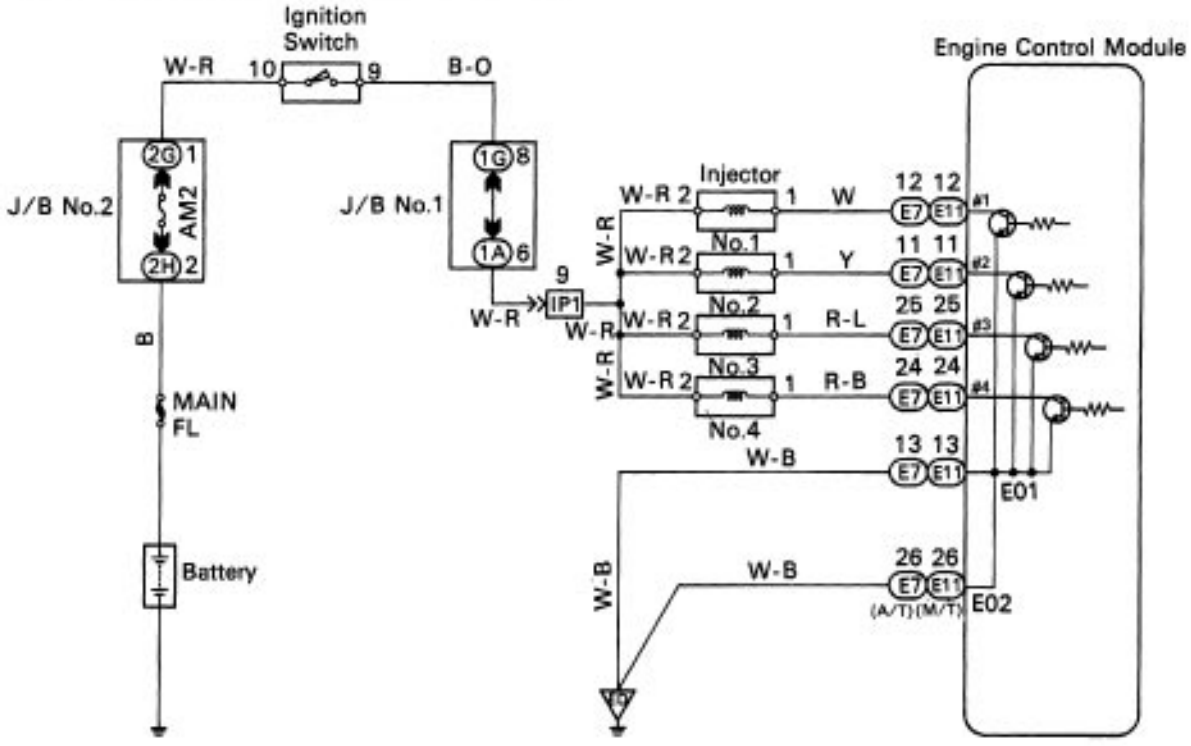
*: Only for California specification vehicles.

WIRING DIAGRAM

Except California specification vehicles.

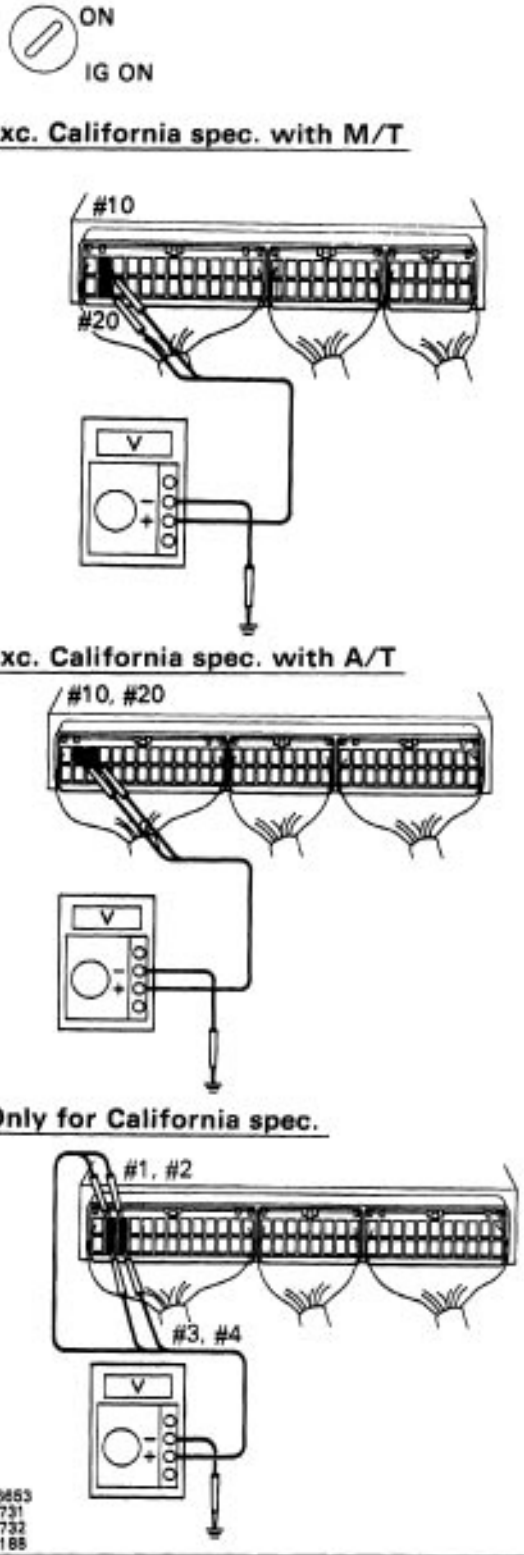


Only for California specification vehicles.



INSPECTION PROCEDURE

1 **Check voltage between terminals #10, #20 (#1, #2, #3 and #4) of engine control module connector and body ground.**



P (1) Remove glove compartment.
(See page EG1–234)
(2) Turn ignition switch ON.

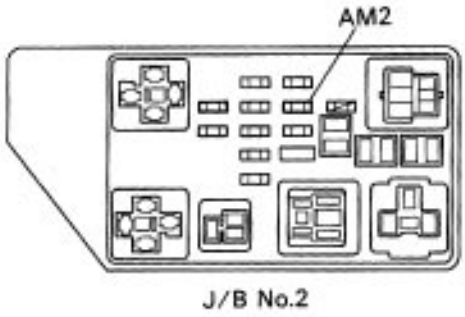
C Exc. California spec.
Measure voltage between terminals #10, #20 of engine control module connector and body ground.
Only for California spec.
Measure voltage between terminals #1, #2, #3 and #4 of engine control module connector and body ground.

OK **Voltage: 9 –14 V**

NG

OK 〉 **Go to step 3**

2 Check AM2 fuse.



P Remove AM2 fuse from J/B No. 2.

C Check continuity of AM2 fuse.
Continuity

OK

OK

NG → Check for short in all the harness and components connected to AM2 fuse.

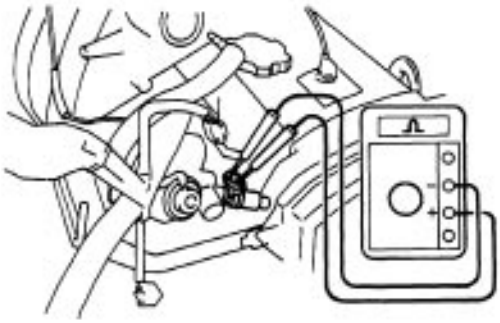
Check for open in harness and connector between engine control module and battery.

3 Check for open in harness and connector between terminals E01, E02 of engine control module connector– and body ground (See page IN–31).

OK

NG → **Repair or replace harness or connector.**

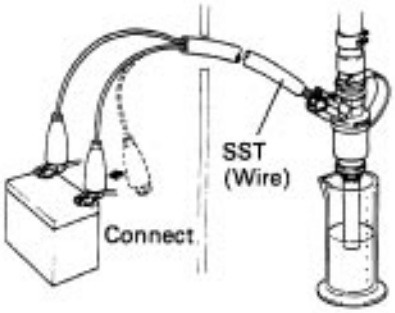
Check injectors.



P Disconnect injector connector
(See page EG1–189) .

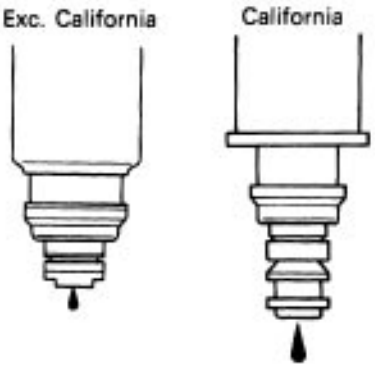
C Measure resistance of injector.

OK **Resistance: Approx. 13.8Ω at 20 C (68 F)**



C Check injection volume of injector
(See page EG1–195).

OK
- **Injection volume**
  49 – 59 cm1 (3.0 – 3.6 cu in.)/15 sec.
  Difference between each injector:
  Less than 5 cm3 (0.3 cu in.)
- **Leakage**
  Fuel drop: One drop or less per minute.



P01064
FI4848
FI4849
P10811

OK

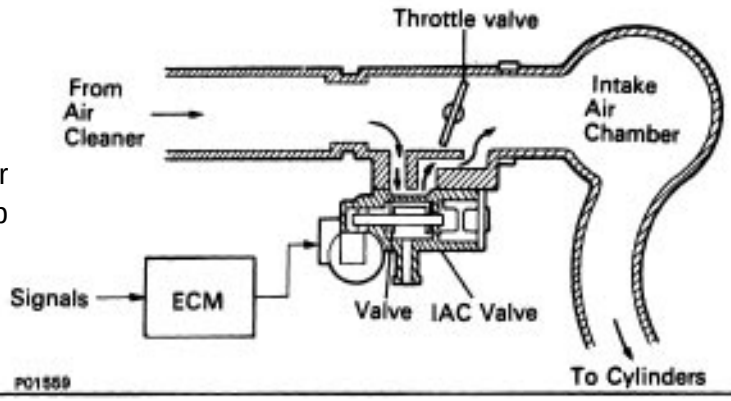
NG → **Replace injector.**

Check and replace engine control module.

IAC Valve Circuit

CIRCUIT DESCRIPTION

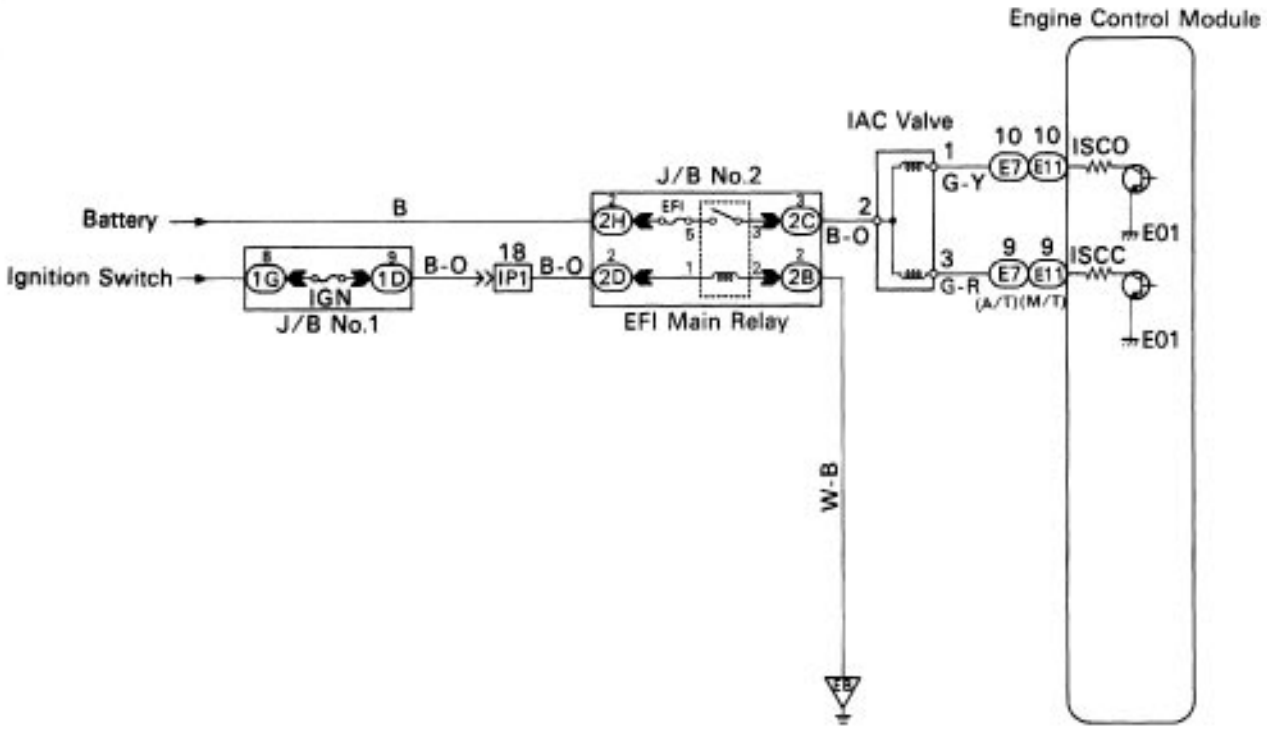
The rotary solenoid type IAC valve is provided on the intake air chamber and intake air bypassing the throttle valve is directed to the IAC valve through a passage.
In this way the intake air volume bypas–sing the throttle valve is regulated, con–trolling the engine speed.
The ECM operated only the IAC valve to perform idle–up and provide feedback for the target idling speed, a VSV for idle–up control is also added (for air condition–ing).



DIAGNOSTIC CHART

1	Check voltage terminals ISCO, ISCC.	OK	Check and replace ECM.
NG			
2	Check operation of the IAC valve.	NG	Replace IAC valve.
OK			
3	Check for open and short in harness and connector between J/B No.2 and IAC valve, IAC valve and ECM.	NG	Repair or replace harness or connector.
OK			
	Check for ECM power source circuit.		

WIRING DIAGRAM

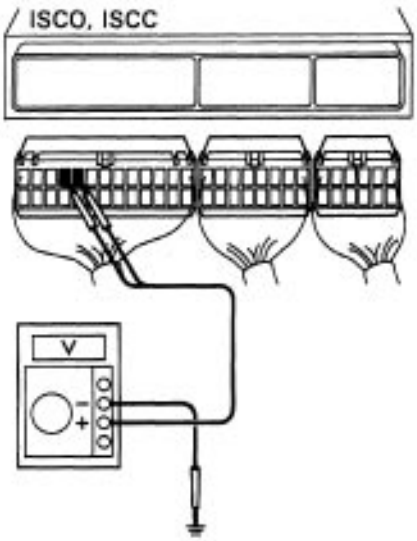


INSPECTION PROCEDURE

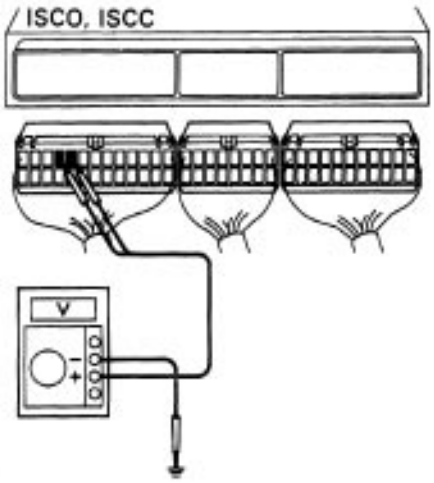
1 **Check voltage between terminals ISCO, ISCC of engine control module connector and body ground.**



Exc. California spec. with M/T



Others



BE6653
FI7100
FI7171

P (1) Remove glove compartment (See page EG1–234),

(2) Disconnect the engine control module connectors.

(3) Turn ignition switch ON.

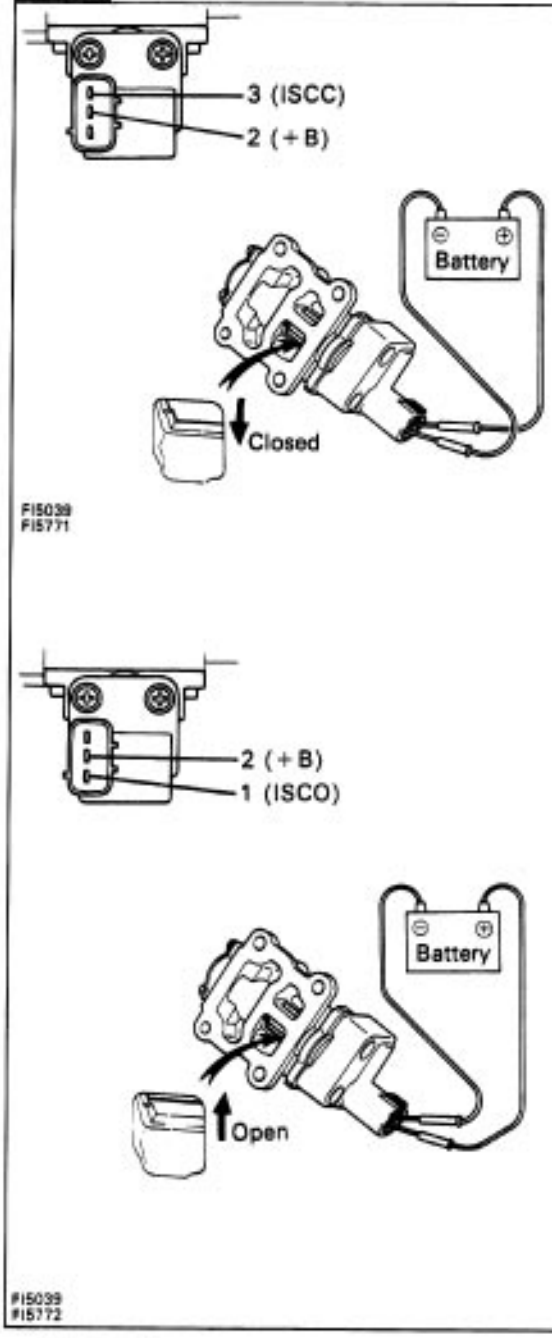
C Measure voltage between terminals ISCO, ISCC of engine control module connector and body ground.

OK **Voltage: 9 –14 V**

NG

OK → **Check and replace engine control module.**

2 Check operation of the IAC valve.



P (1) Disconnect IAC valve connector.
(2) Remove IAC valve (See page EG1–213).

C (1) Connect the positive (+) lead from the battery to terminal 2 (+ B) and negative (–) lead to terminal 3 (ISCC), and check that the valve is closed.
(2) Connect the. positive (+) lead from the battery to terminal 2 (+ B) and negative (–) lead to terminal 1 (ISCO), and check that the valve is open.

OK **(1) The valve is closed.**
(2) The valve is open.

OK

NG → **Replace IAC valve.**

3 Check for open and short in harness and connector between J/B No.2 and IAC valve, IAC valve and engine control module (See page IN–31).

OK

NG → **Repair or replace harness or connector.**

Check for ECM power source circuit (See page EG1–403).

Fuel System Circuit

CIRCUIT DESCRIPTION

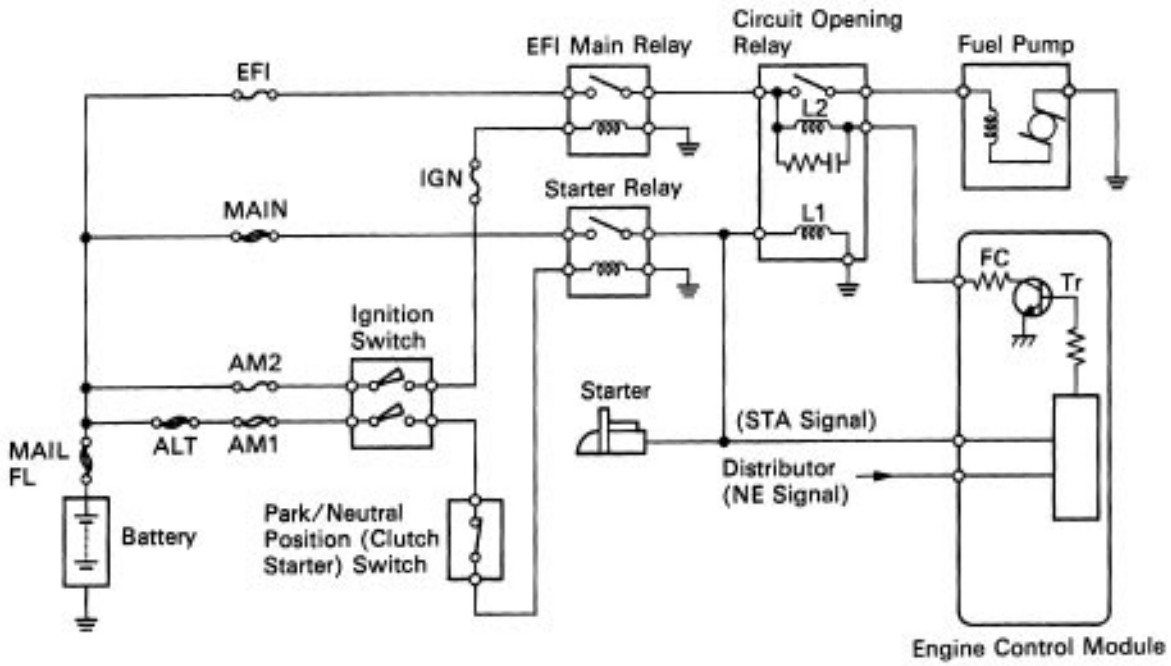
Fuel pump control

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.

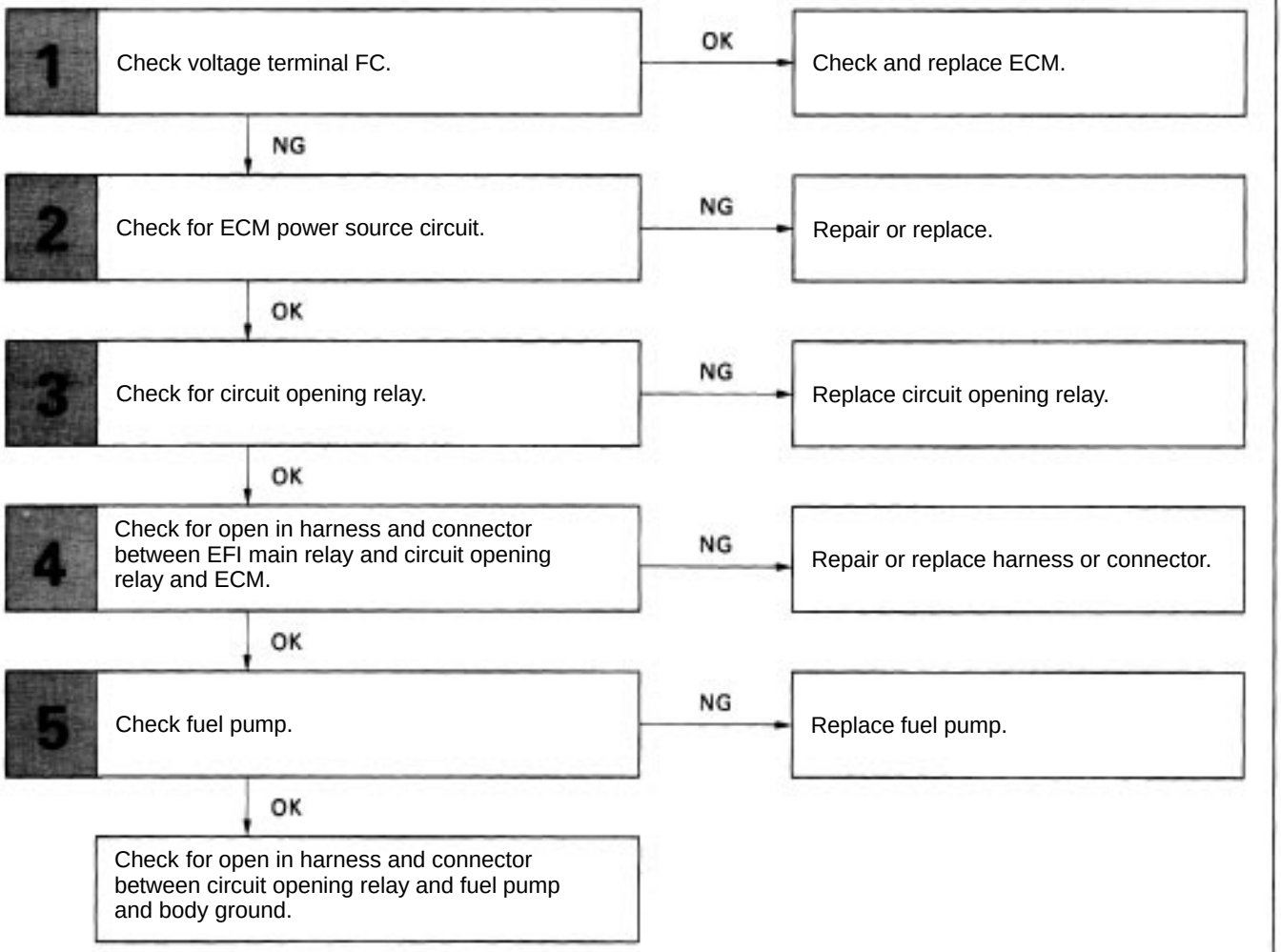
When the STA signal and NE signal are input to the ECM, Tr is turned ON, current flows to coil L2 of the circuit opening relay, the relay switches on and the fuel pump operates.

While the NE signal is generated (engine running), the ECM keeps Tr ON (circuit opening relay ON) and the fuel pump also keeps operating.

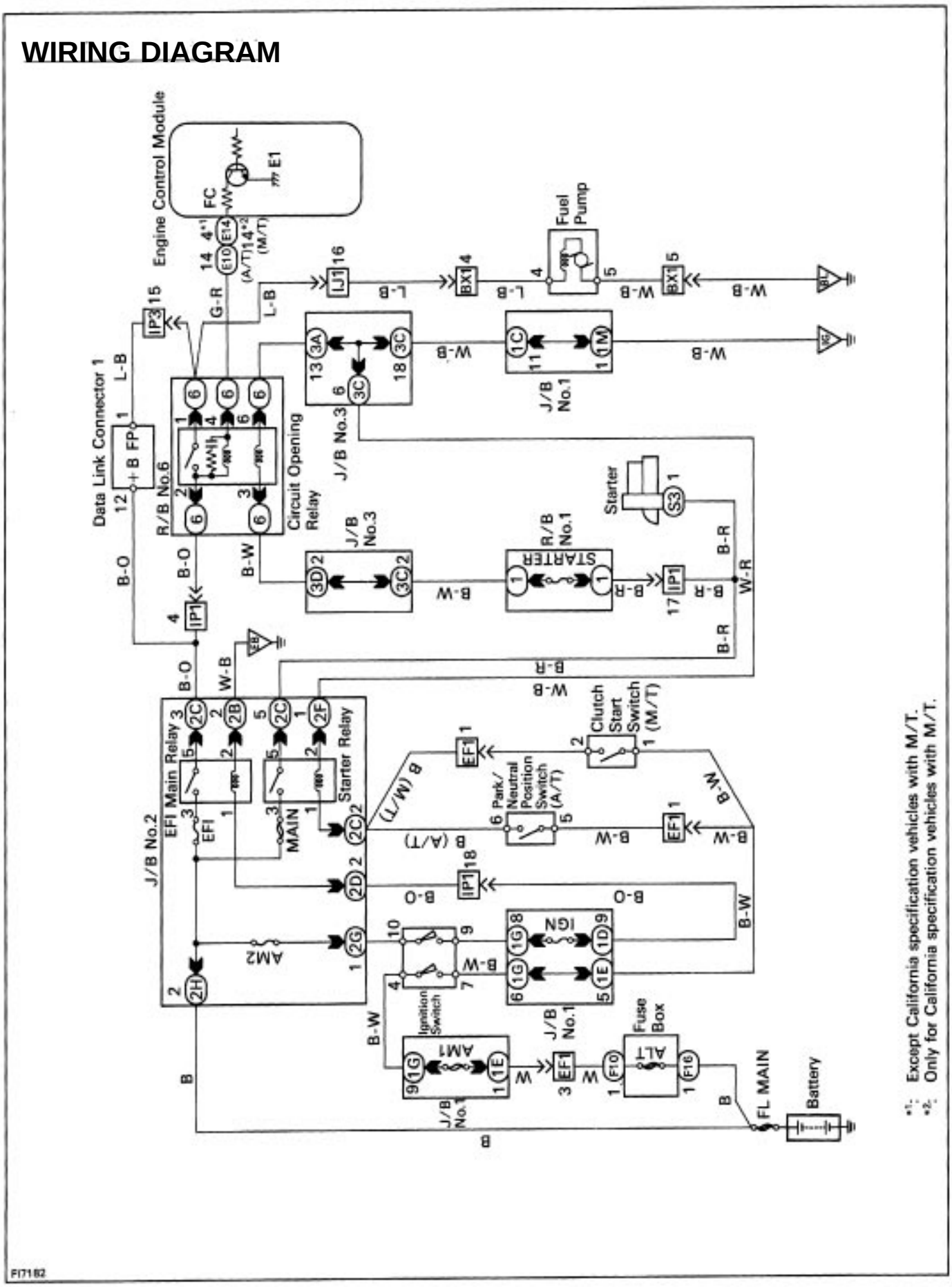


FI7230

DIAGNOSTIC CHART



WIRING DIAGRAM

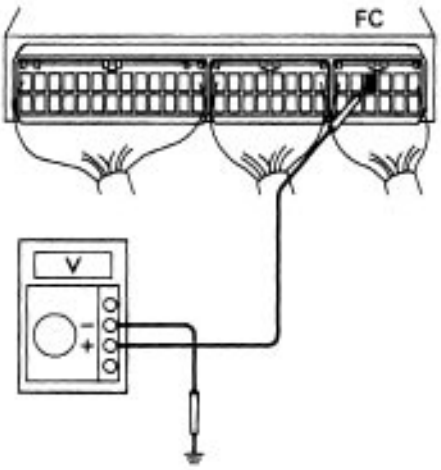


INSPECTION PROCEDURE

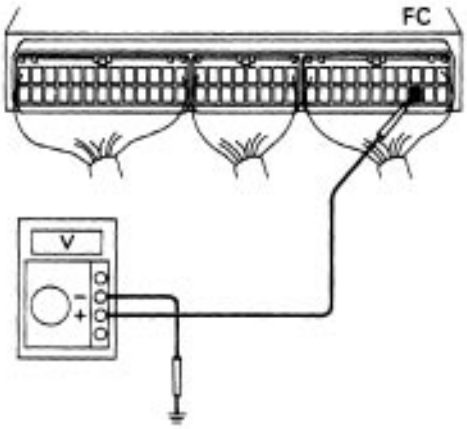
1 **Check voltage between terminals FC of engine control module connector and body ground.**

ON
IG ON

Exc. California spec. with M/T



Others



BE6653
FI6735
FI6736

P (1) Remove glove compartment.
(See page EG1–234).

(2) Turn ignition switch ON.

C Measure voltage between terminal FC of engine control module connector and body ground.

OK **Voltage: 9 –14 V**

NG

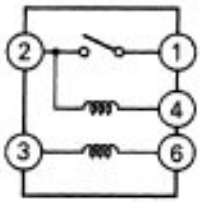
OK → **Check and replace engine control module.**

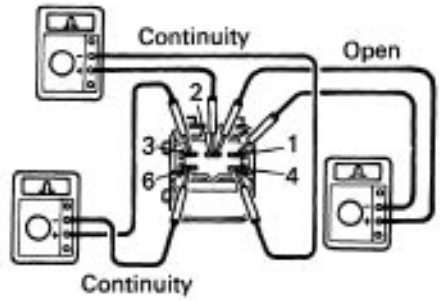
2 **Check for ECM power source circuit (See page EG1–403).**

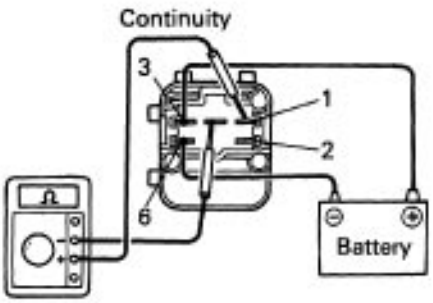
OK

NG → **Repair or replace.**

3 **Check circuit opening relay.**







FI6782
P14361
P14362

P (1) Remove glove compartment (See page EG1–217).

(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 2 and 4	Continuity
Terminals 3 and 6	Continuity

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.**

4 **Check for open in harness and connector between EFI main relay and circuit opening relay, circuit opening relay and engine control module (See page IN–31).**

OK → NG → **Repair or replace harness or connector.**

5 **Check fuel pump (See page EG1–177).**

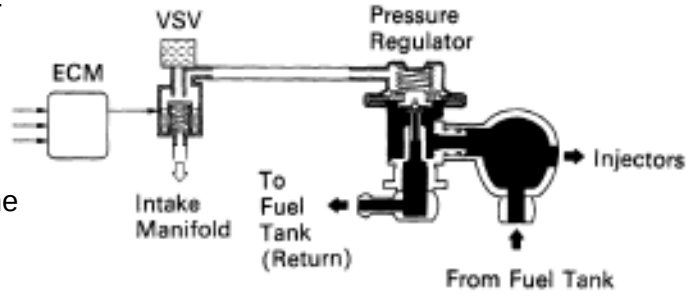
OK → NG → **Replace fuel pump.**

Check for open in harness and connector between circuit opening relay and fuel pump, fuel pump and body ground.

VSV Circuit for Fuel Pressure Control (Only for California spec.)

CIRCUIT DESCRIPTION

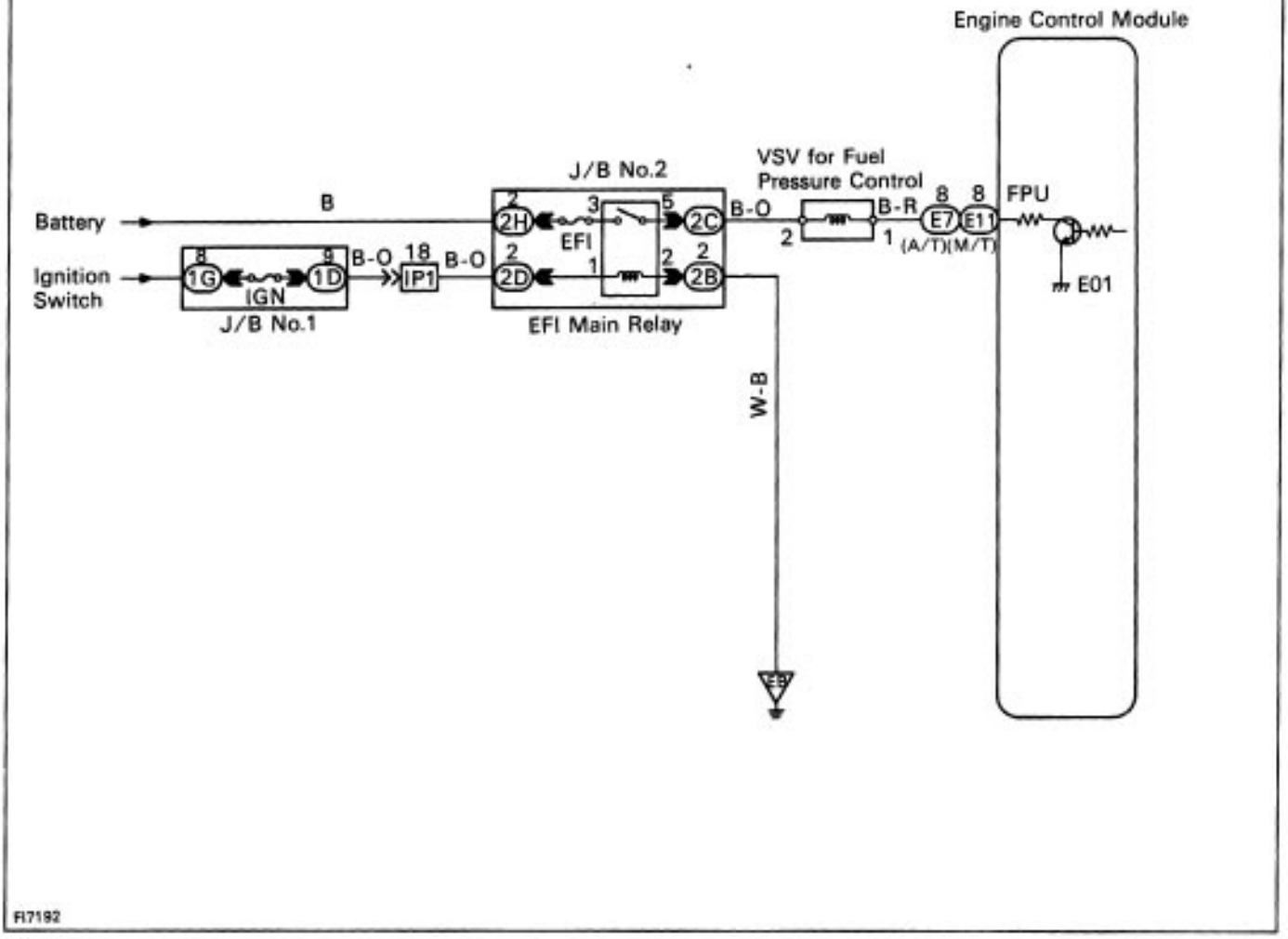
The ECM turns on a VSV (Vacuum Switching Valve) to draw the air into the diaphragm chamber of the pressure regulator if it detects that the temperature of the engine coolant is too high during engine starting. The air drawn into the chamber increases the fuel pressure to prevent fuel vapor lock at high engine temperature in order to help the engine start when it is warm.
Fuel pressure control ends approx. 90 secs. after the engine is started.



DIAGNOSTIC CHART

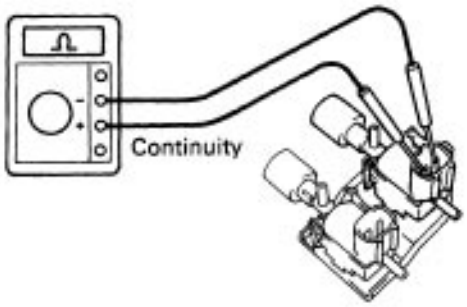
1	Check VSV for fuel pressure control.	NG	Replace VSV.
OK			
2	Check voltage of VSV power source.	OK	Proceed to next circuit inspection shown on matrix chart (See page EG1–327).
NG			
3	Check for open and short in harness and connector between EFI main relay and ECM.	NG	Repair or replace harness or connector.
OK			
Check and replace ECM.			

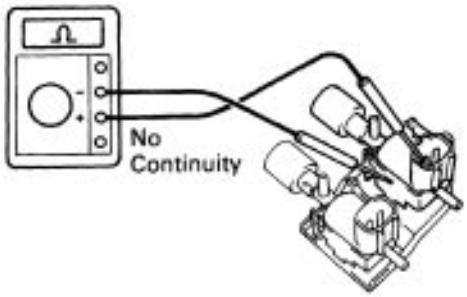
WIRING DIAGRAM

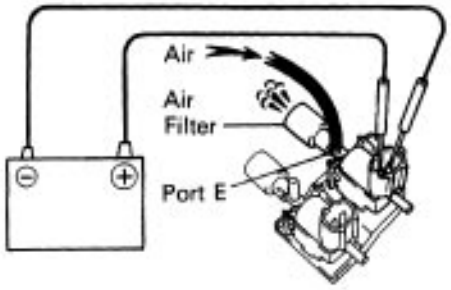


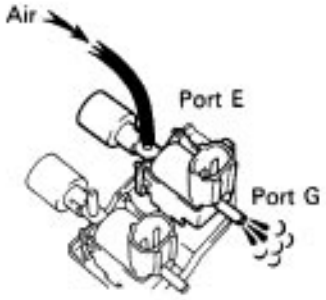
INSPECTION PROCEDURE

1 Check VSV for fuel pressure control.









P14141
P14142
P14144
P14143

P (1) Disconnect VSV connector.
(2) Remove VSV.

C (1) Measure resistance between terminals.
(2) Measure resistance between each terminal and the body.

OK **(1) Resistance: 33 – 39Ω at 20°C (68°F)**
(2) Resistance: 1 MΩ or higher.

C Check operation of VSV when battery positive voltage is applied and released to the VSV terminals.

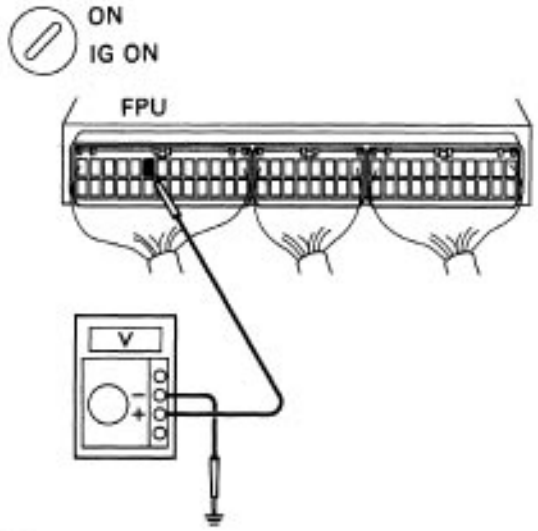
OK **Battery positive voltage is applied:**
The air from port E is flowing out through the air filter.
Battery positive voltage is not applied:
The air from port E is flowing out through port G.

OK

NG → **Replace VSV for fuel pressure control VSV.**

Go to step 2

2 **Check voltage between terminal FPU of engine control module connector and body ground.**



P (1) Remove glove compartment
(See page EG1–234).
(2) Turn ignition switch ON.

C Measure voltage between terminal FPU of engine control module connector and body ground.

OK **Voltage: 9 –14 V**

NG

OK → **Proceed to next circuit inspection shown on matrix chart (See page EG1–327).**

3 **Check for open and short in harness and connector between engine control module and VSV, VSV and EFI main relay (See page IN–31).**

OK

NG → **Repair or replace harness or connector.**

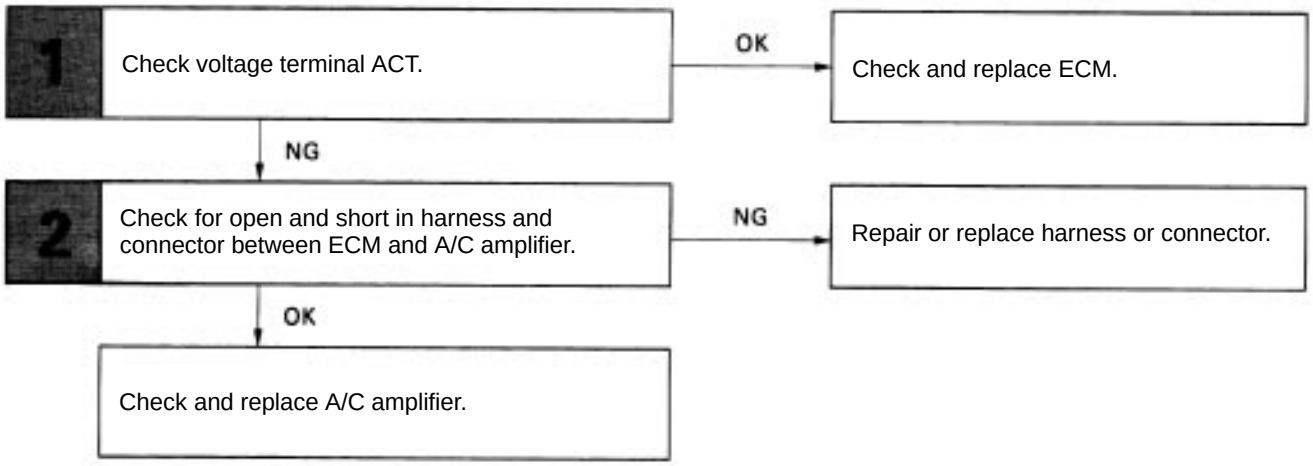
Check and replace engine control module.

Air Conditioning Cut Control Circuit

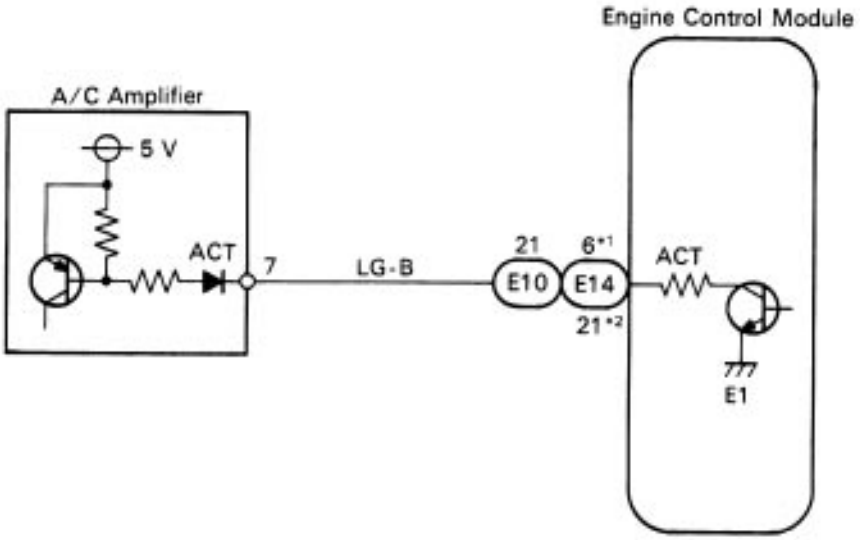
CIRCUIT DESCRIPTION

This circuit cuts air conditioning operation during vehicle acceleration in order to increase accelera–tion performance. During acceleration with the vehicle speed at 16 mph (25 km/h) or less, engine speed at 1,200 rpm or less and throttle valve opening angle at 60 or more, the A/C magnet switch is turned OFF for several seconds.

DIAGNOSTIC CHART



WIRING DIAGRAM



*1: Except California specification vehicles with M/T.
*2: Only for California specification vehicles with M/T.

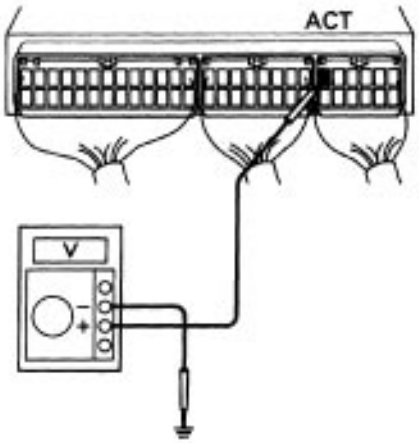
FI6677

INSPECTION PROCEDURE

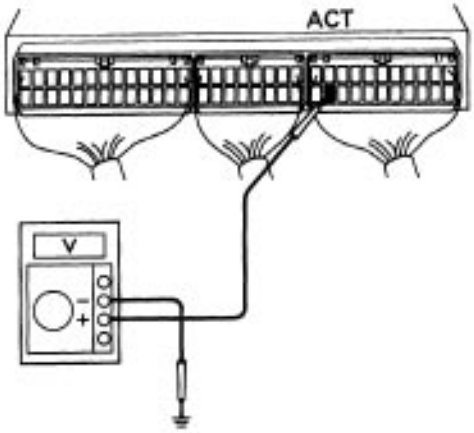
1 **Check voltage between terminal ACT of engine control module connector and body ground.**



Exc. California spec. with M/T



Others



BE6653
FI6737
FI6738

P (1) Remove glove compartment.
(See page EG1–234).

(2) Turn ignition switch ON.

C Measure voltage between terminal ACT of engine control module connector and body ground when A/C switch is turned to ON.

OK **Voltage: 9 –14 V**

NG

OK → **Check and replace engine control module.**

2 **Check for open and short in harness and connector between engine control module and A/C amplifier (See page IN–31).**

OK

NG → **Repair or replace harness or connector.**

Check and replace A/C amplifier.

TE1 TE2 Terminal Circuit

CIRCUIT DESCRIPTION

Terminals TE1 and TE2 are located in the data link connector 1 and 2.
The data link connector 1 located in the engine compartment and the data link connector 2 located in the cabin. When these terminals are connected with the E1 terminal, diagnostic trouble codes in normal mode or test mode can be read from the malfunction indicator lamp on the combination meter.

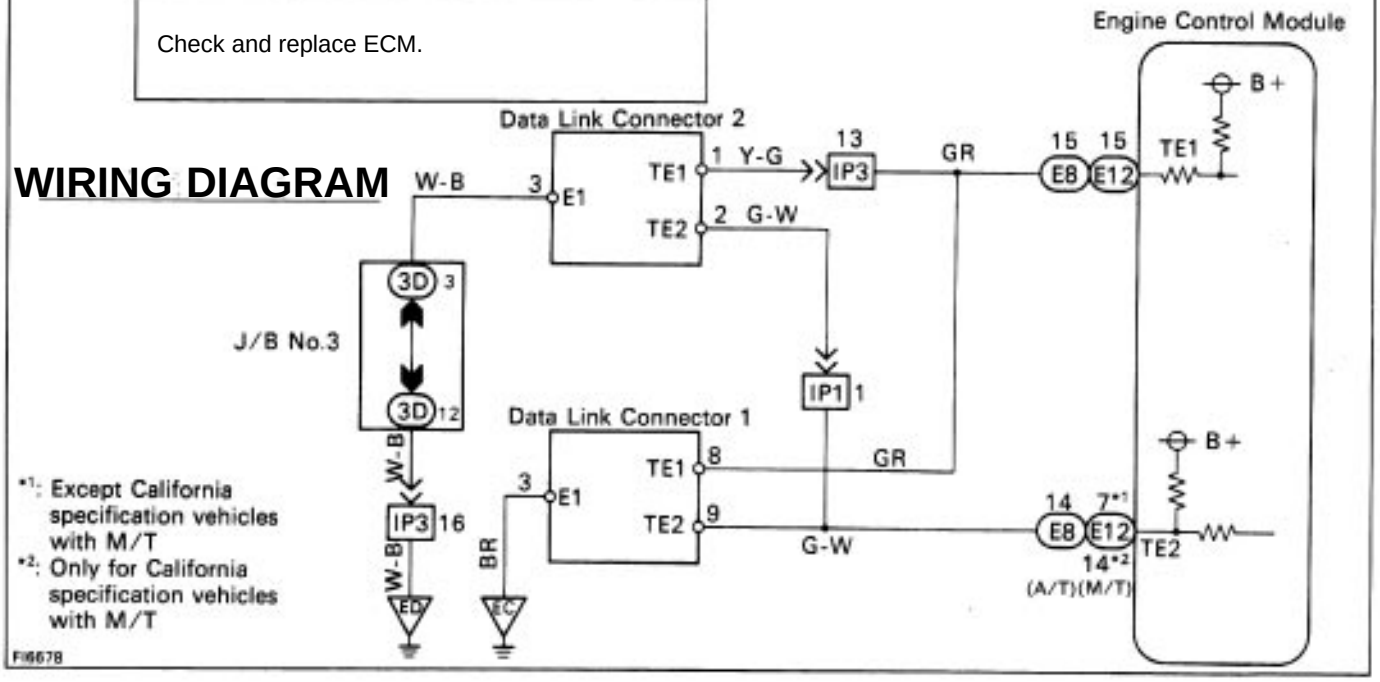
DIAGNOSTIC CHART

HINT: If terminals TE1 and TE2 are connected with terminal E1, diagnostic trouble code is not output or test mode is not activated.
Even though terminal TE1 is not connected with terminal E1, the malfunction indicator lamp blinks.
For the above phenomenon, the likely cause is an open or short in the wire harness, or malfunction inside the ECM.

1. Check voltage of terminals TE1, TE2.
   - OK → Check and replace ECM.
   - NG ↓
2. Check continuity between terminal E1 and body ground.
   - NG → Repair or replace harness or connector.
   - OK ↓
3. Check for open and short in harness and connector between data link connector 1, 2 and ECM.
   - NG → Repair or replace harness or connector.
   - OK ↓

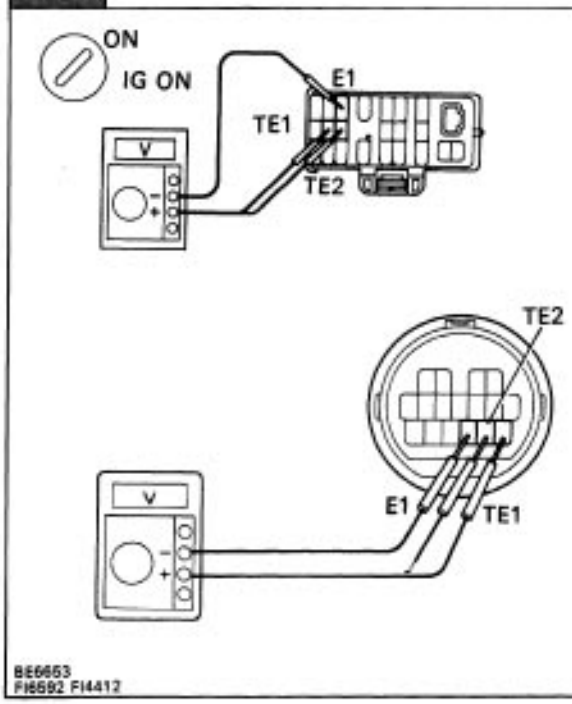
Check and replace ECM.

WIRING DIAGRAM



INSPECTION PROCEDURE

1 **Check voltage between terminals TE1, TE2, and E1 of data link connector 1 and 2.**



P Turn ignition switch ON.

C Measure voltage between terminals TE1, TE2 and E1 of data link connector 1 and 2.

OK **Voltage: 9 –14 v**

NG

OK → **Check and replace engine control module.**

2 **Check continuity between terminal E1 of data link connector 1, 2 and body ground.**

OK

NG → **Repair or replace harness or connector.**

3 **Check for open and short in harness and connector between engine control module and data link connector 1, 2 (See page IN–31).**

OK

NG → **Repair or replace harness or connector.**

Check and replace engine control module.