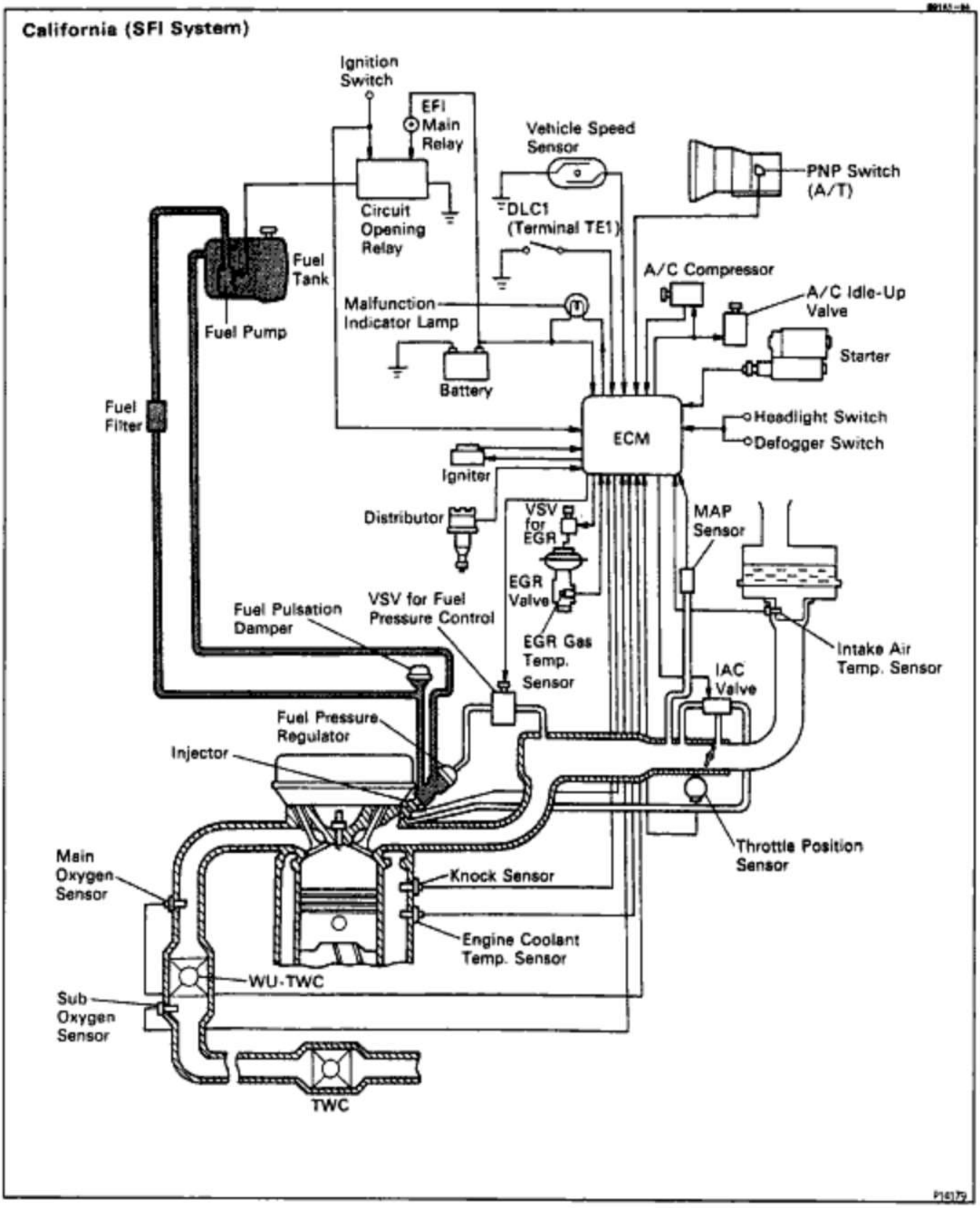
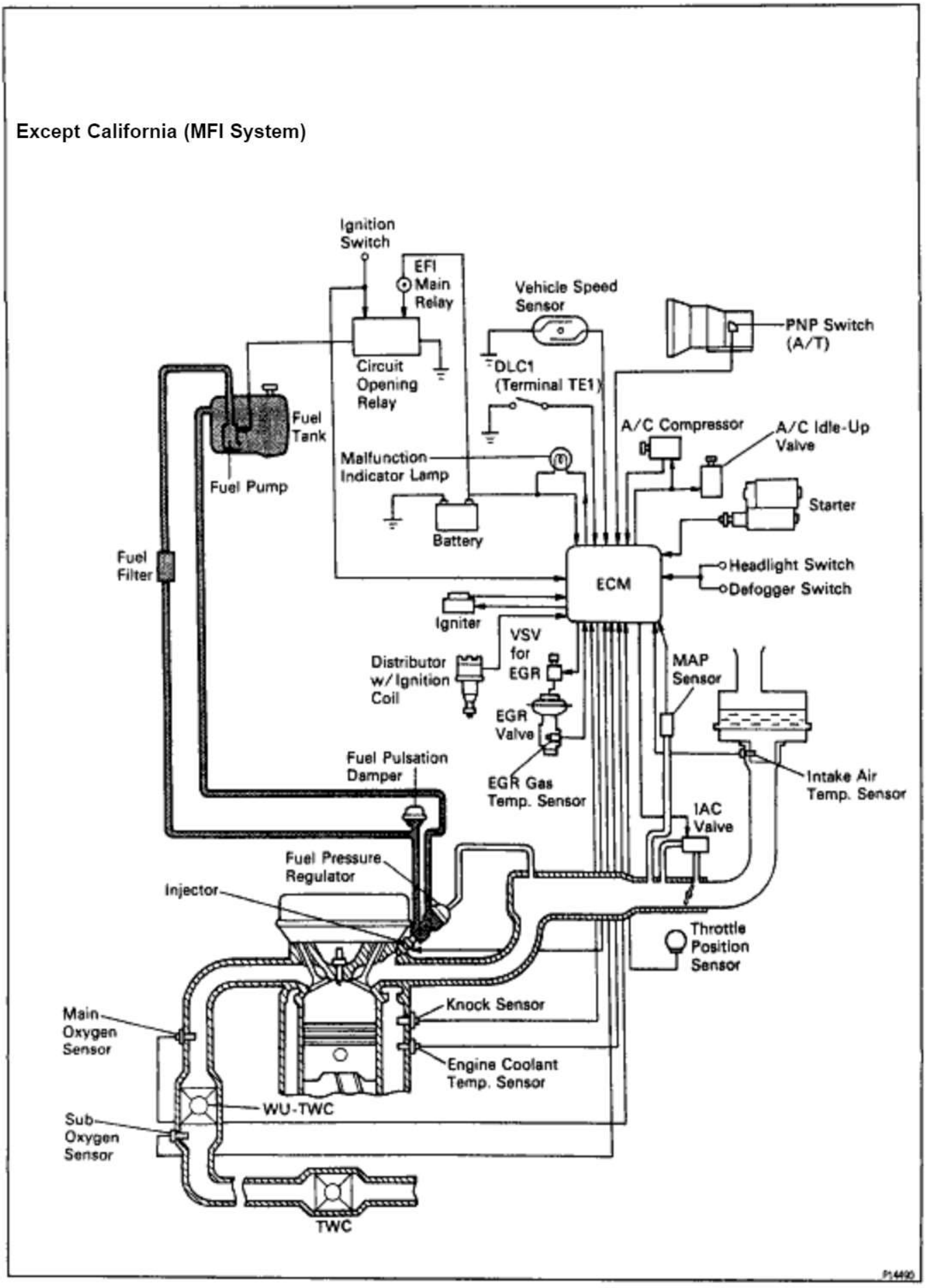
# MFI/SFI SYSTEM

## 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

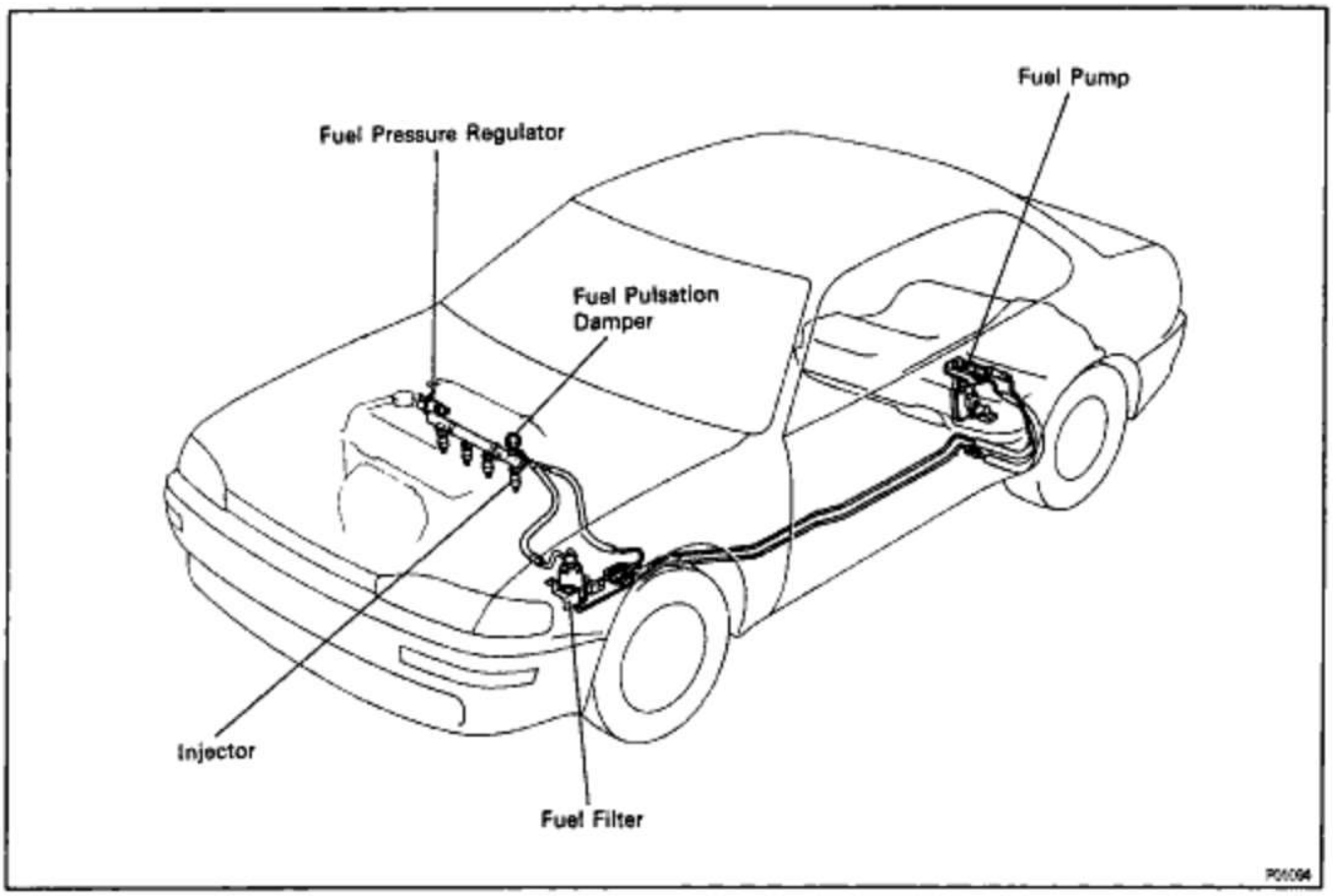
The air induction system provides sufficient air for engine operation.

## 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:

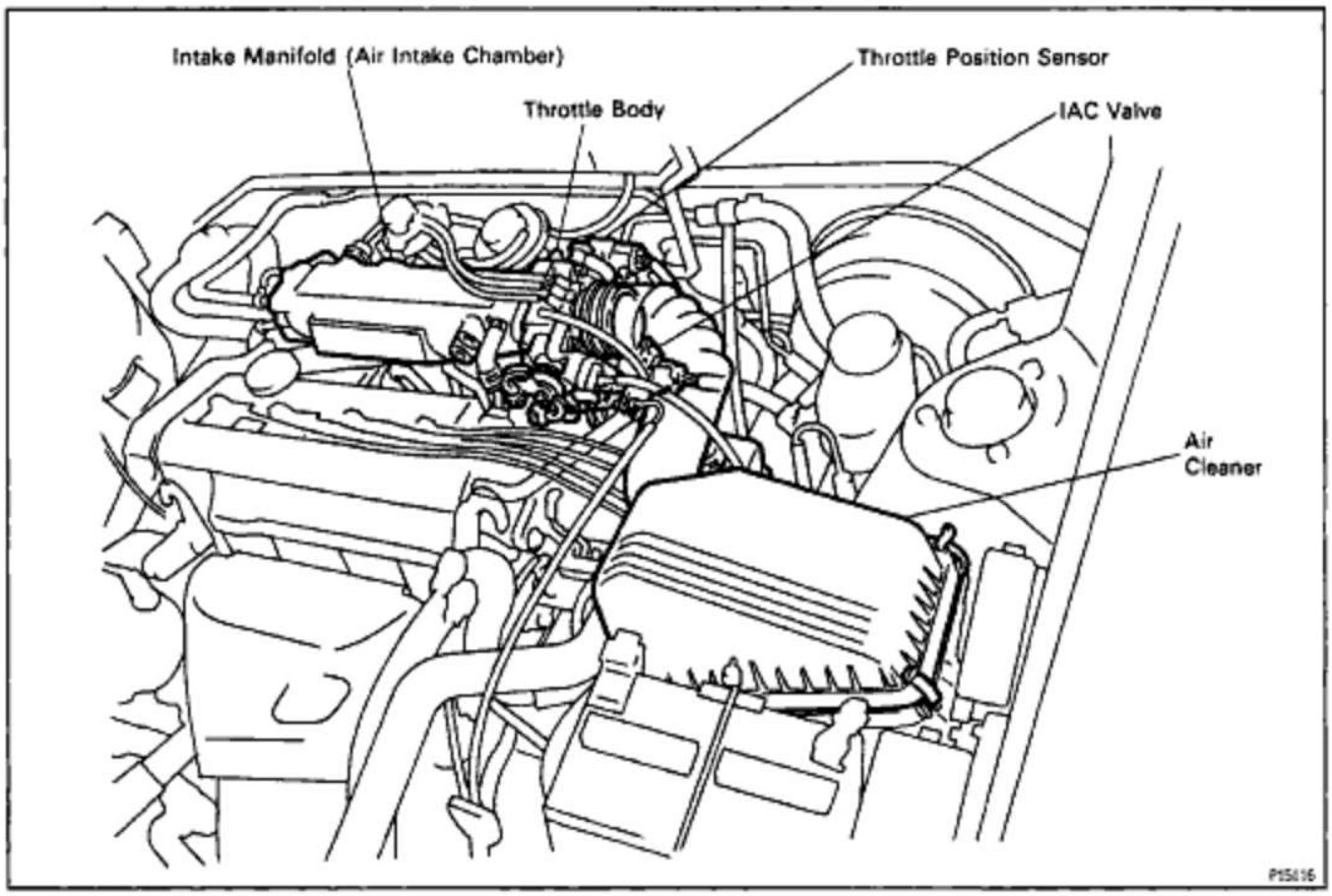
1. Multiport Fuel Injection (MFI)/Sequential Multiport Fuel Injection (SFI)
   The ECM receives signals from various sensors indicating changing engine operation conditions such as:
   Intake manifold pressure
   Intake air temperature
   Engine coolant temperature
   Engine speed
   Throttle valve opening 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

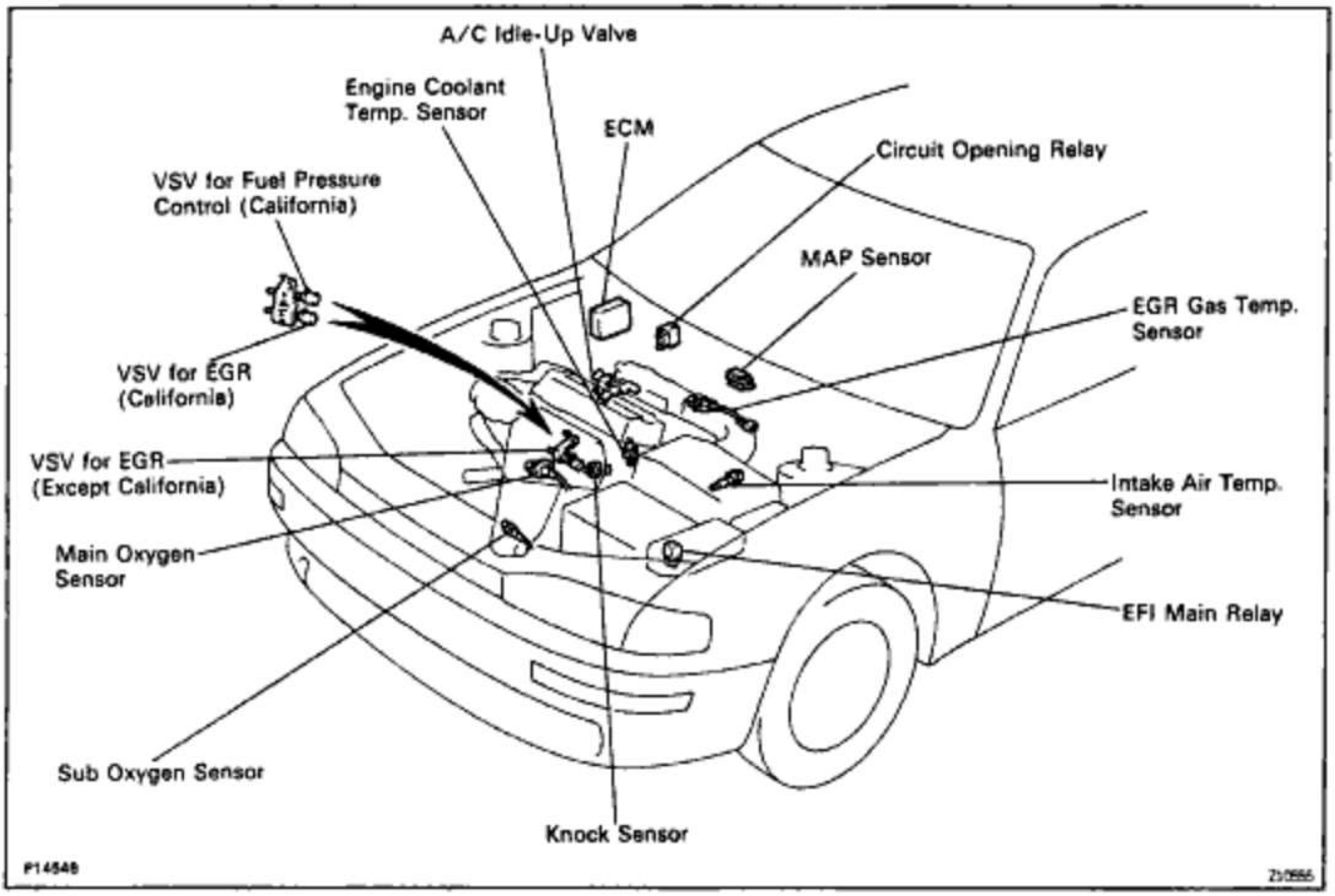



Air is filtered through the air cleaner and the amount flowing to the air intake chamber is determined according to the throttle valve opening in the throttle body and the engine speed. Intake air controlled by the throttle valve opening is distributed from the air intake chamber to the manifold of each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

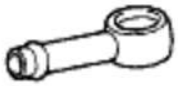
# ELECTRONIC CONTROL SYSTEM




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)

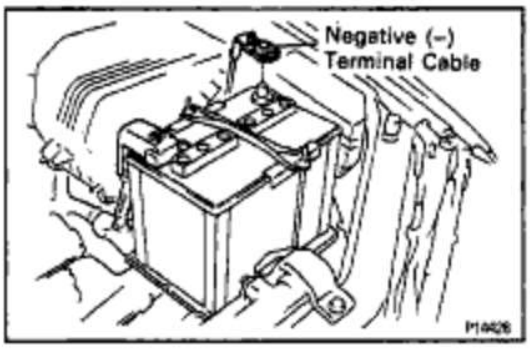
| | |
|---|---|
|  09268–41045 Injection Measuring Tool Set | |
|  (09268–41080) No.6 union | |
|  (09268–41090) No.7 union | |
|  (90405–09015) No.1 Union | |
|  09268–45012 EFI Fuel Pressure Gauge | |
|  09631–22020 Power Steering Hose Nut 14 x 17 mm Wrench Set | Fuel line flare nut |
|  09842–30070 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.**

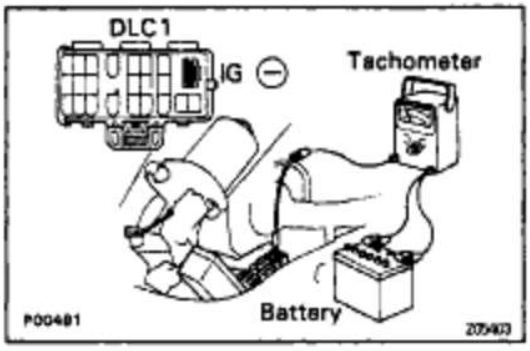
HINT: Any diagnostic trouble code retained by the computer will be erased when the battery terminal is removed.

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

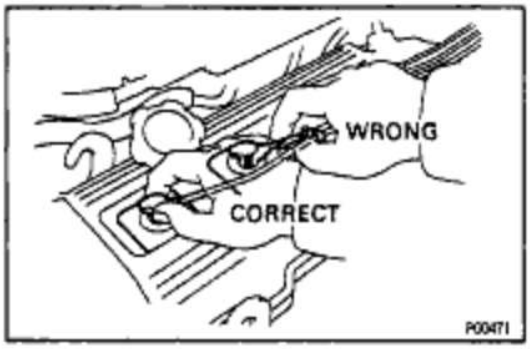
**1. CHECK CORRECT ENGINE TUNE–UP**

**(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.

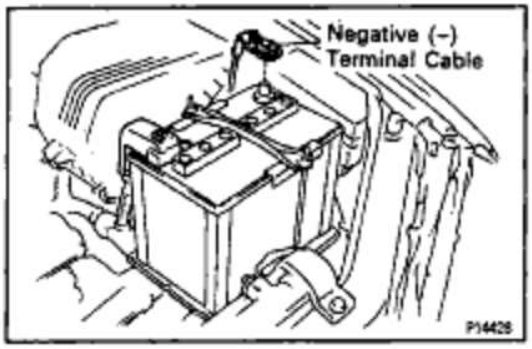
## IF VEHICLE IS EQUIPPED WITH MOBILE RADIO SYSTEM (HAM, CB, ETC.)

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

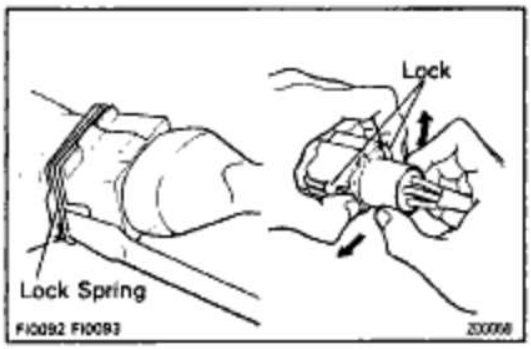
## AIR INDUCTION SYSTEM

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.

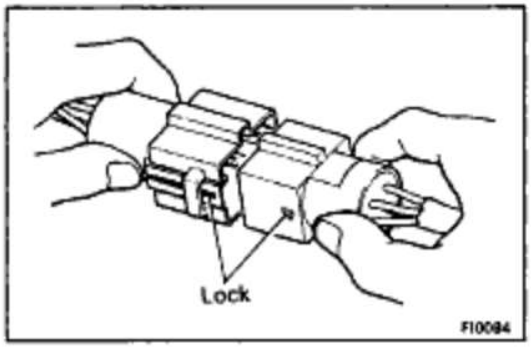
## ELECTRONIC CONTROL SYSTEM



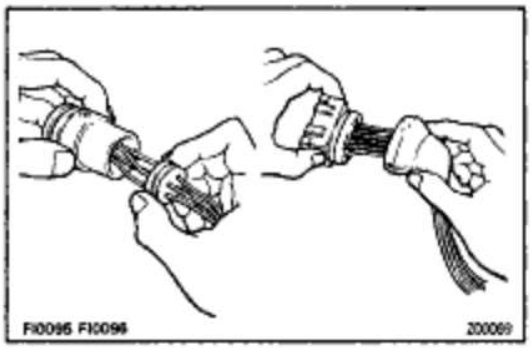

1. Before removing MFI/SFI wiring connectors, terminals, etc., first disconnect the power by either turning the ignition switch OFF or disconnecting the battery terminals.
HINT: Always check the diagnostic trouble code before disconnecting the negative (–) terminal cable from the battery.
2. When installing 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 carefully, 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.



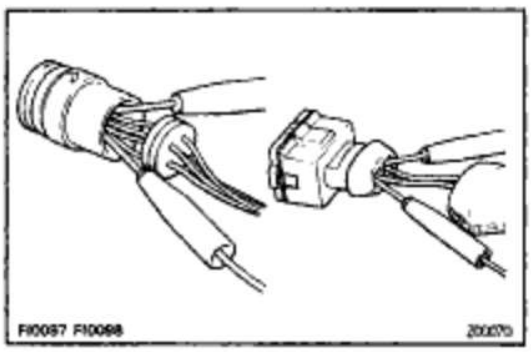

8. Care is required when pulling out and inserting wiring connectors.
(a) Release the lock and pull out the connector, pulling on the connectors.



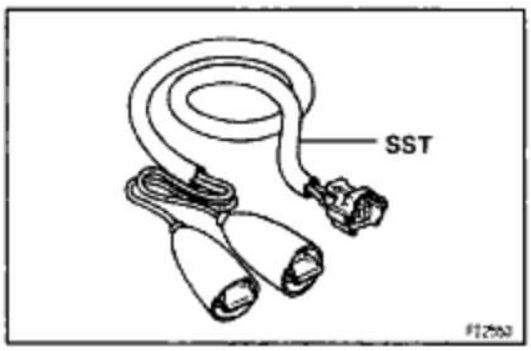

(b) Fully insert the connector and check that it is locked.



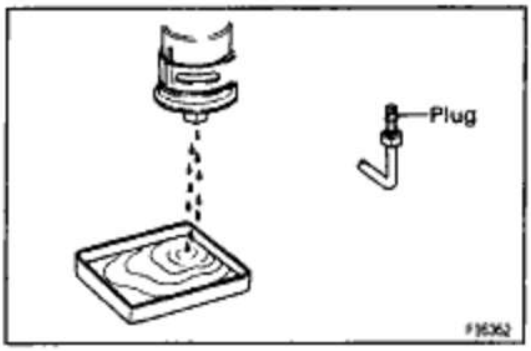

9. When inspecting a connector with a volt/ohmmeter.
(a) Carefully take out the water–proofing rubber if it is a water–proof type connector.




(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.

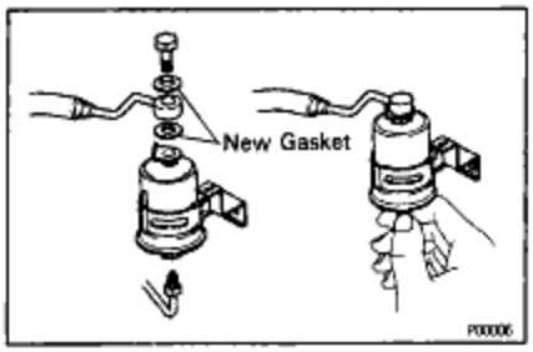


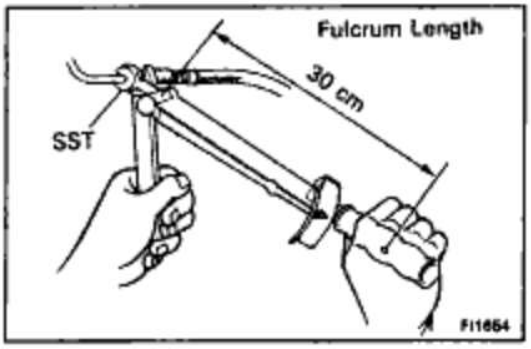

10. Use SST for inspection or test of the injector or its wiring connector.
SST 09842–30070




# 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)**



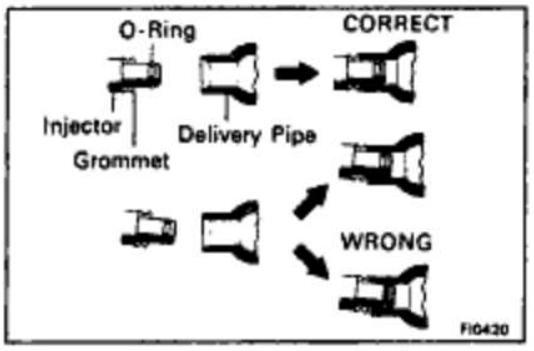



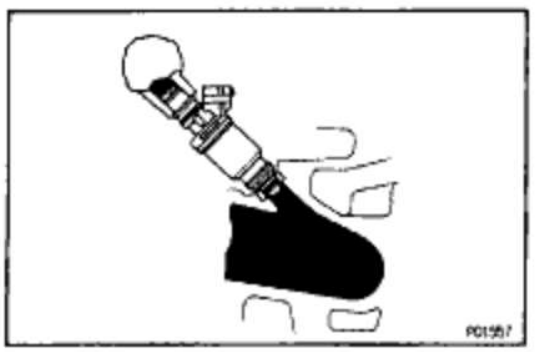

**Flare Nut Type:**

(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**

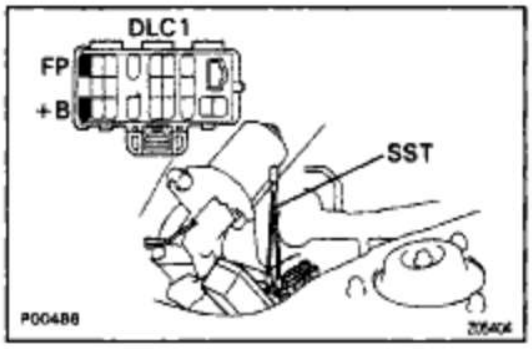
HINT: Use a torque wrench with a fulcrum length of 30 cm (11.81 in.).

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.

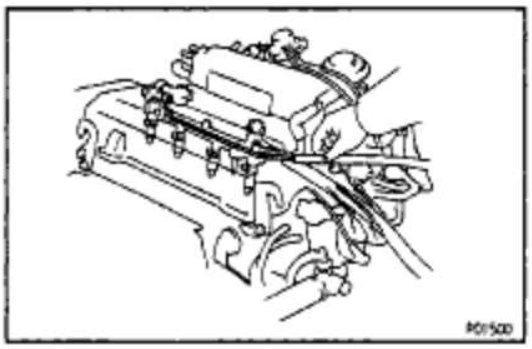


4. Install the injector to delivery pipe and intake manifold as shown in the illustration.

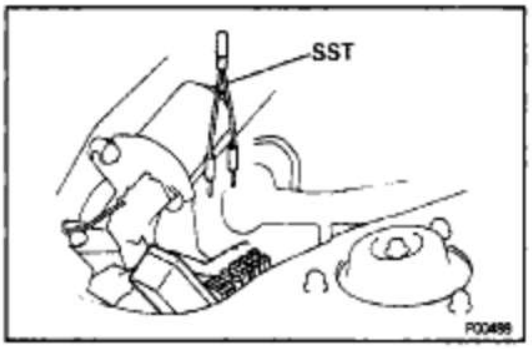



5. Check that there are no fuel leaks after performing maintenance anywhere on the fuel system.
   (a) Using SST, connect terminals + B and FP of the data link connector 1.
   SST 09843–18020
   (b) With engine stopped, turn the ignition switch ON.



   (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.

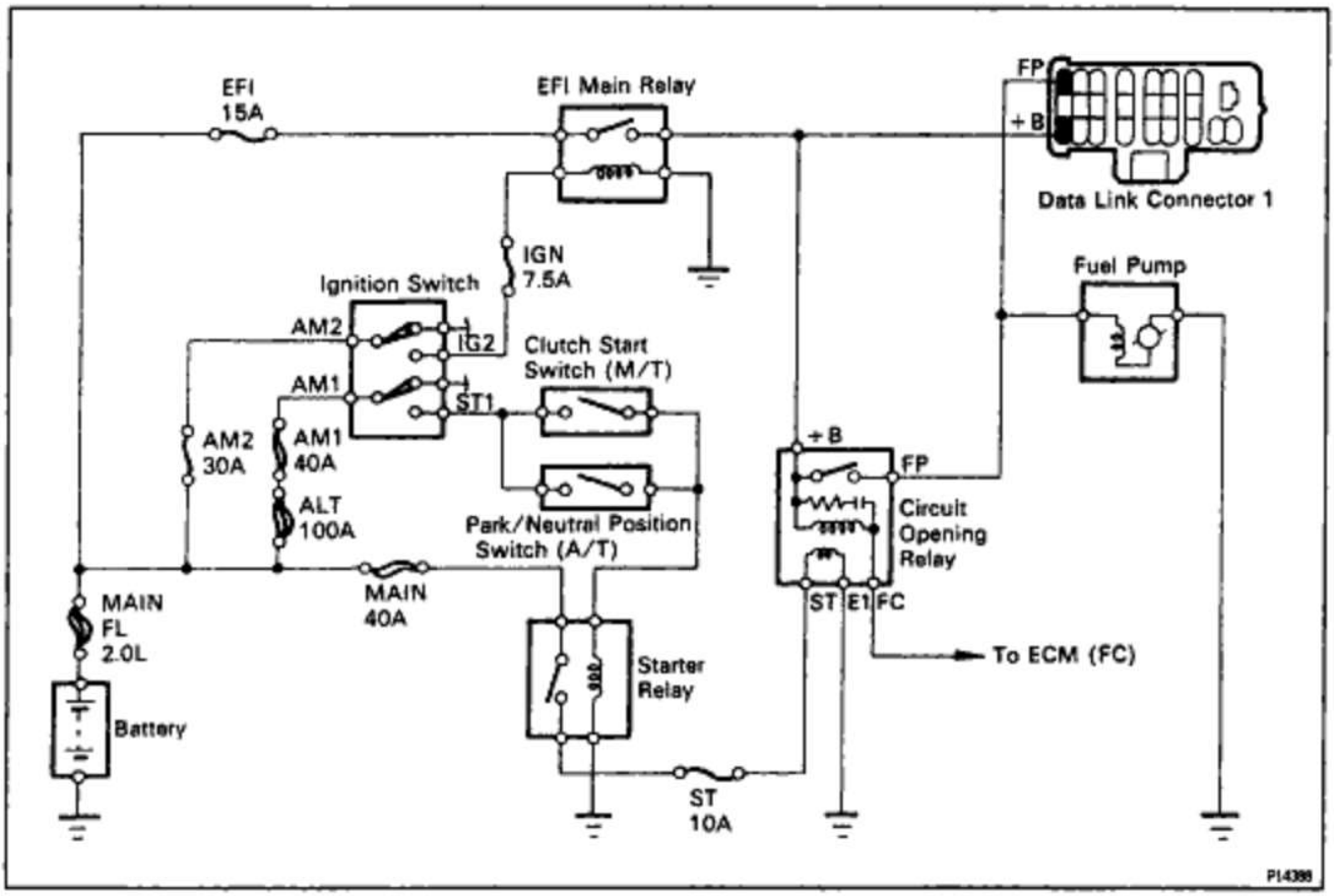
**NOTICE: Always pinch the hose. Avoid bending as it may cause the hose to crack.**

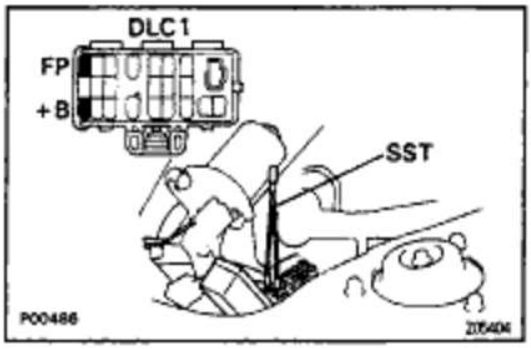



   (d) Turn the ignition switch OFF.
   (9) Remove the SST.
   SST 09843–18020

# FUEL PUMP

## SYSTEM CIRCUIT

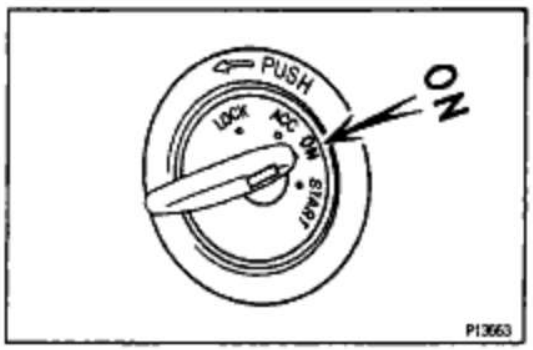


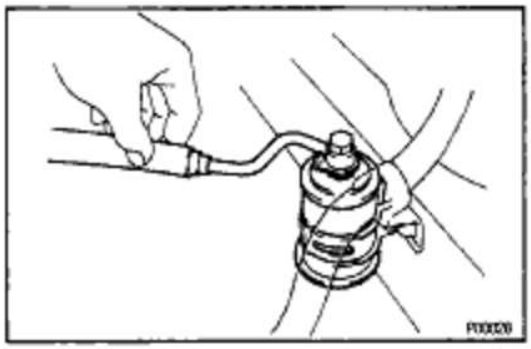

## ON–VEHICLE INSPECTION

### 1. CHECK FUEL PUMP OPERATION

(a) Using SST; connect terminals +B and FP of the data link connector 1.
SST 09843–18020

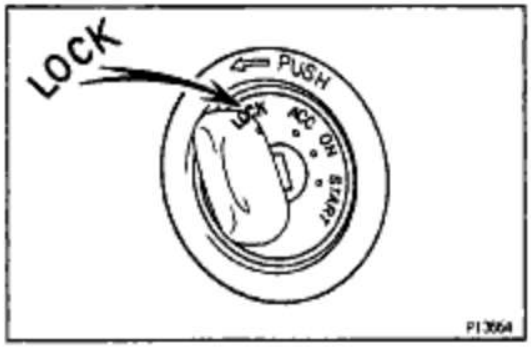



**(b) Turn the ignition switch ON.**
**NOTICE: Do not start the engine.**

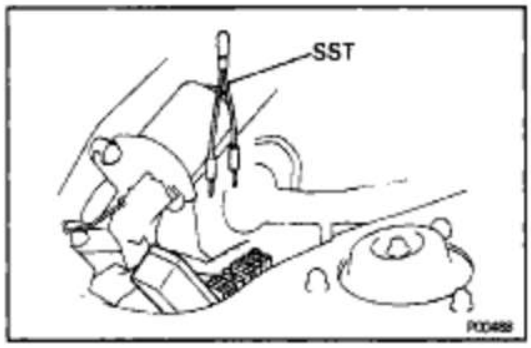


(c) Check that there is pressure in the hose from the fuel filter.

HINT: At this time, you will hear fuel return noise.



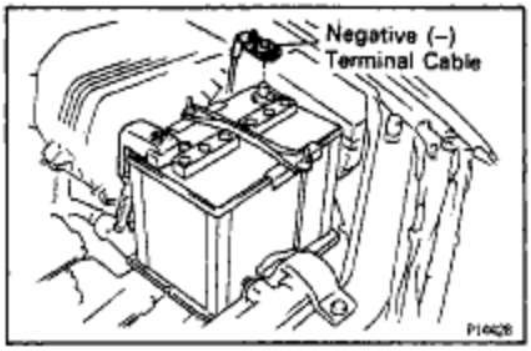

(d) Turn the ignition switch OFF.




(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

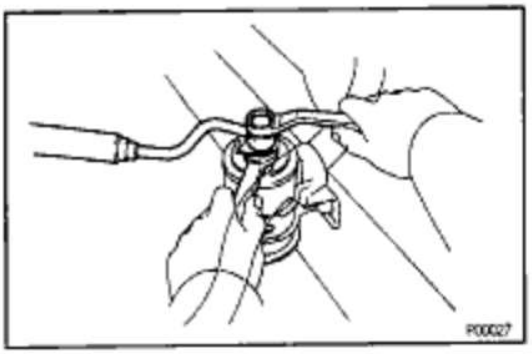



**2. CHECK FUEL PRESSURE**

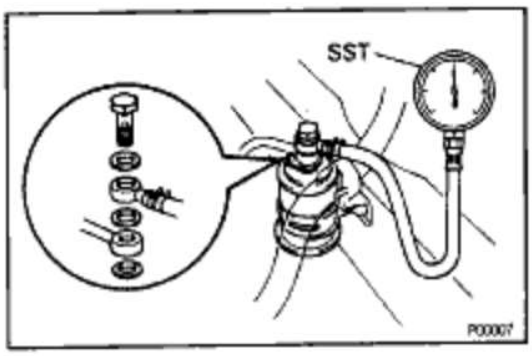
(a) Check that the battery voltages is above 12 volts.

(b) Disconnect the negative (–) terminal cable from the battery.

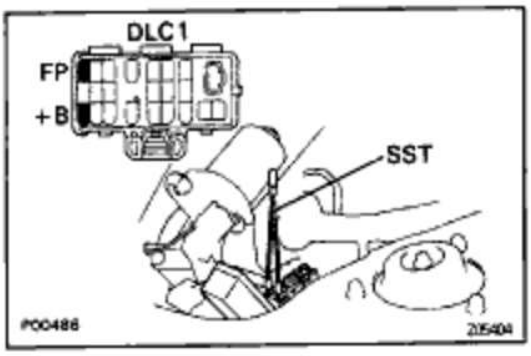
**CAUTION: Work must be started after 90 seconds from the time the ignition switch is turned to the "LOCK" position and the negative (–) terminal cable is discon–nected from the battery.**



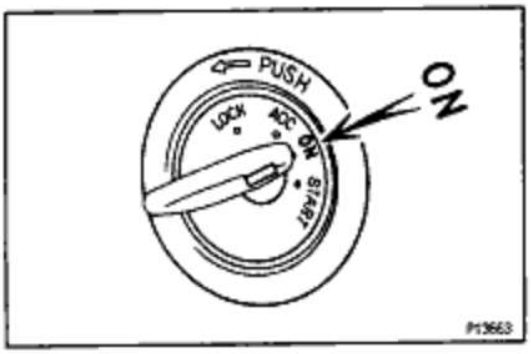
(c) Put a suitable container or shop towel under the fuel filter.
(d) Remove the union bolt and 2 gaskets, and disconnect the fuel inlet hose from the fuel filter outlet.
HINT: Slowly loosen the union bolt.



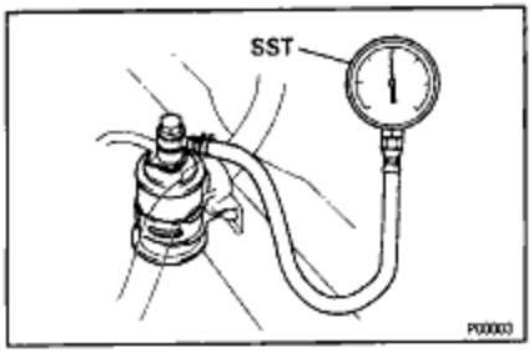

(e) Install the fuel inlet hose and SST (pressure gauge) to the fuel filter outlet with 3 new gaskets and the union bolt.
SST 09268–45012
**Torque: 29 N–m (300 kgf–cm, 22 ft–lbf)**
(f) Wipe off any splattered gasoline.
(g) Reconnect the battery negative (–) cable.



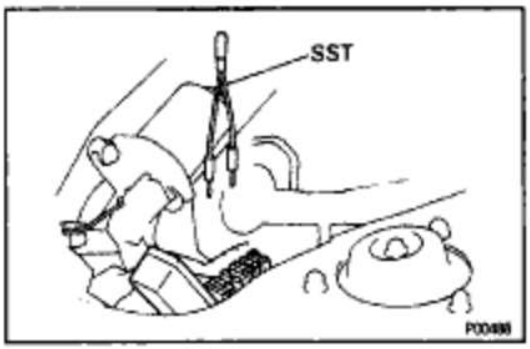

(h) Using SST, connect terminals +B and FP of the data link connector 1.
SST 09843–18020



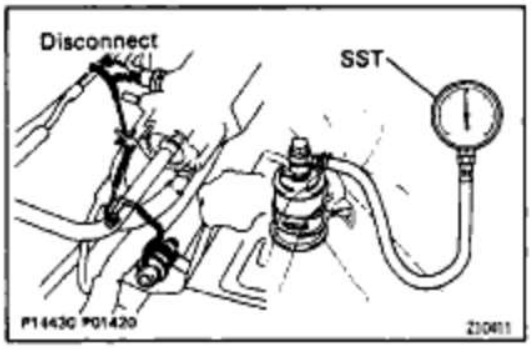

(i) Turn the ignition switch ON.



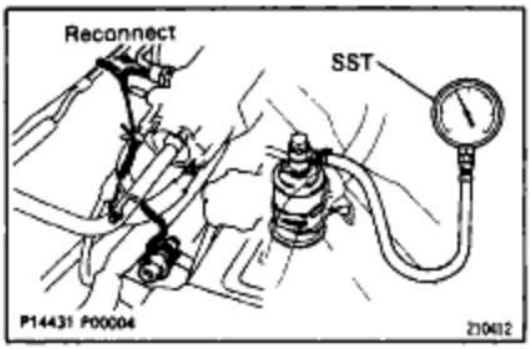

Measure the fuel pressure.
Fuel pressure:
265 – 304 kPa (2.7 – 3.1 kgf/cm1, 38 – 44 psi)
If pressure is high, replace the fuel pressure regulator.
If pressure is low, check the following parts:
- Fuel hoses and connections
- Fuel pump
- Fuel filter
- Fuel pressure regulator




(k) Remove the SST.
SST 09483–18020

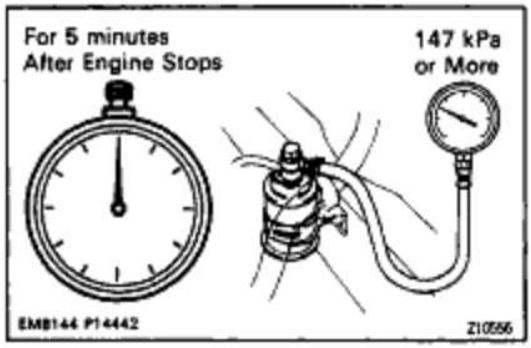



(l) Start the engine.
(m) Disconnect the vacuum sensing hose from the air intake chamber and plug the air intake chamber outlet.
(n) Measure the fuel pressure at idle.
**Fuel pressure:**
**265 – 304 kPa (2.7 – 3.1 kgf/cm1, 38 – 44 psi)**

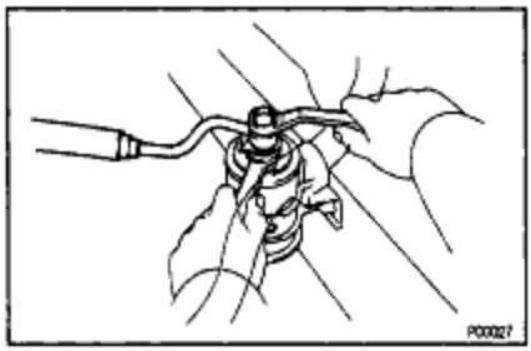



(o) Reconnect the vacuum sensing hose to the air intake chamber.
(p) Measure the fuel pressure at idle.
**Fuel pressure:**
**206 – 255 kPa (2.1 – 2.6 kgf/cm1, 31 – 37 psi)**

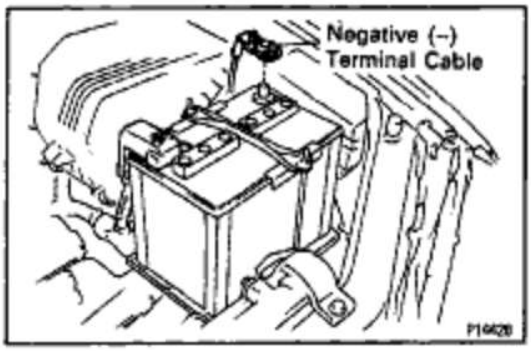
If pressure is not as specified, check the vacuum sensing hose and fuel pressure regulator.




(q) Stop the engine.
(r) Check that the fuel pressure remains 147 kPa (1.5 kgf/cm2, 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.



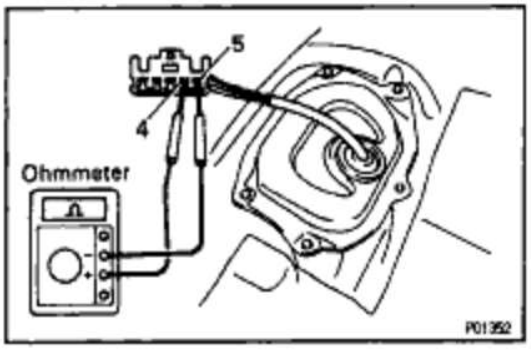

# FUEL PUMP INSPECTION

**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**

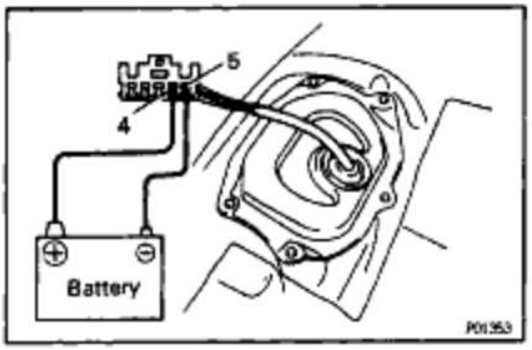
**A. Inspect fuel pump resistance**

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.**

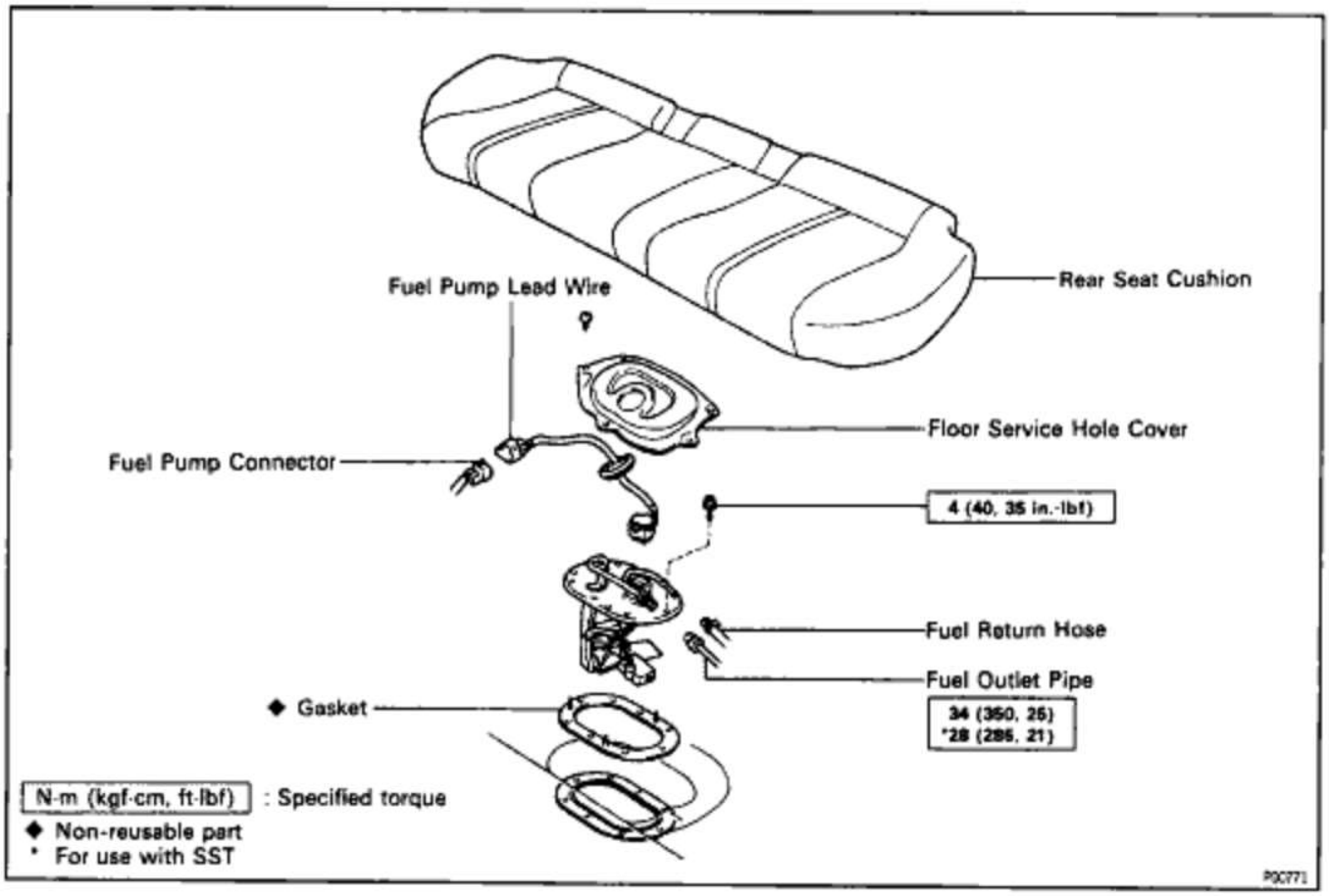
**If operation is not as specified, replace the fuel pump.**

**5. RECONNECT FUEL PUMP & SENDER GAUGE CONNECTOR**

**6. INSTALL REAR SEAT CUSHION**

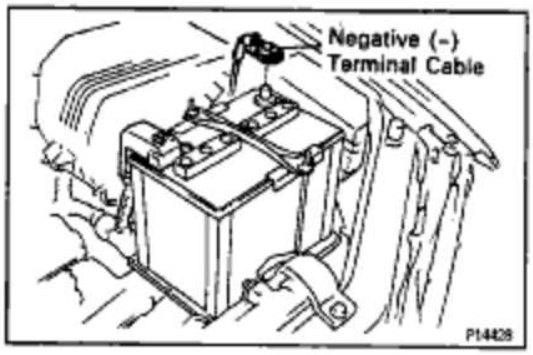
**7. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY**

# COMPONENTS FOR REMOVAL AND INSTALLATION




## FUEL PUMP REMOVAL

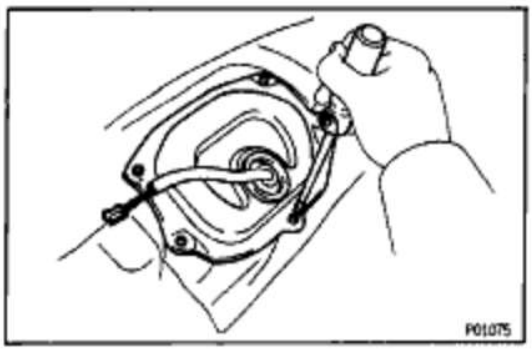
**CAUTION: Do not smoke or work near an open flame when working on the fuel pump.**




**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**

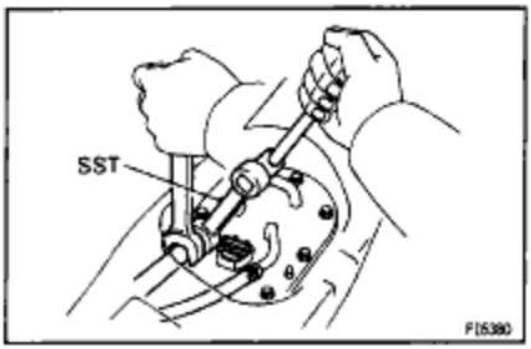



**3. REMOVE FLOOR SERVICE HOLE COVER**

(a) Disconnect the fuel pump connector.

(b) Remove the 5 screws and service hole cover.

**4. REMOVE FUEL PUMP LEAD WIRE**

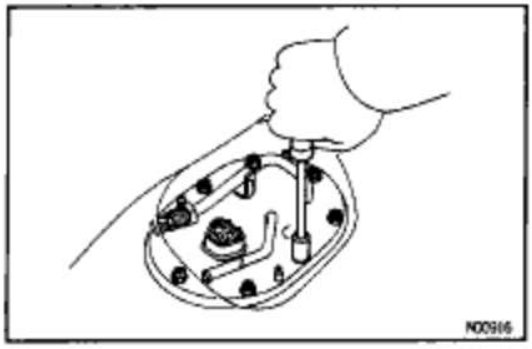



**5. DISCONNECT FUEL PIPE AND HOSE FROM FUEL PUMP BRACKET**

**CAUTION: Remove the fuel filter cap to prevent the fuel from flowing out.**

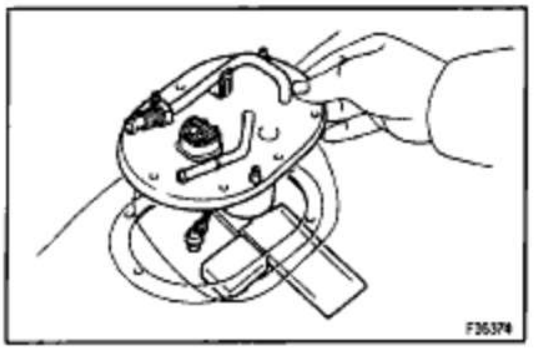
(a) Using SST, disconnect the outlet pipe from the pump bracket.
SST 09631–22020

(b) Disconnect the return hose from the pump bracket.




**6. REMOVE FUEL PUMP BRACKET ASSEMBLY FROM FUEL TANK**

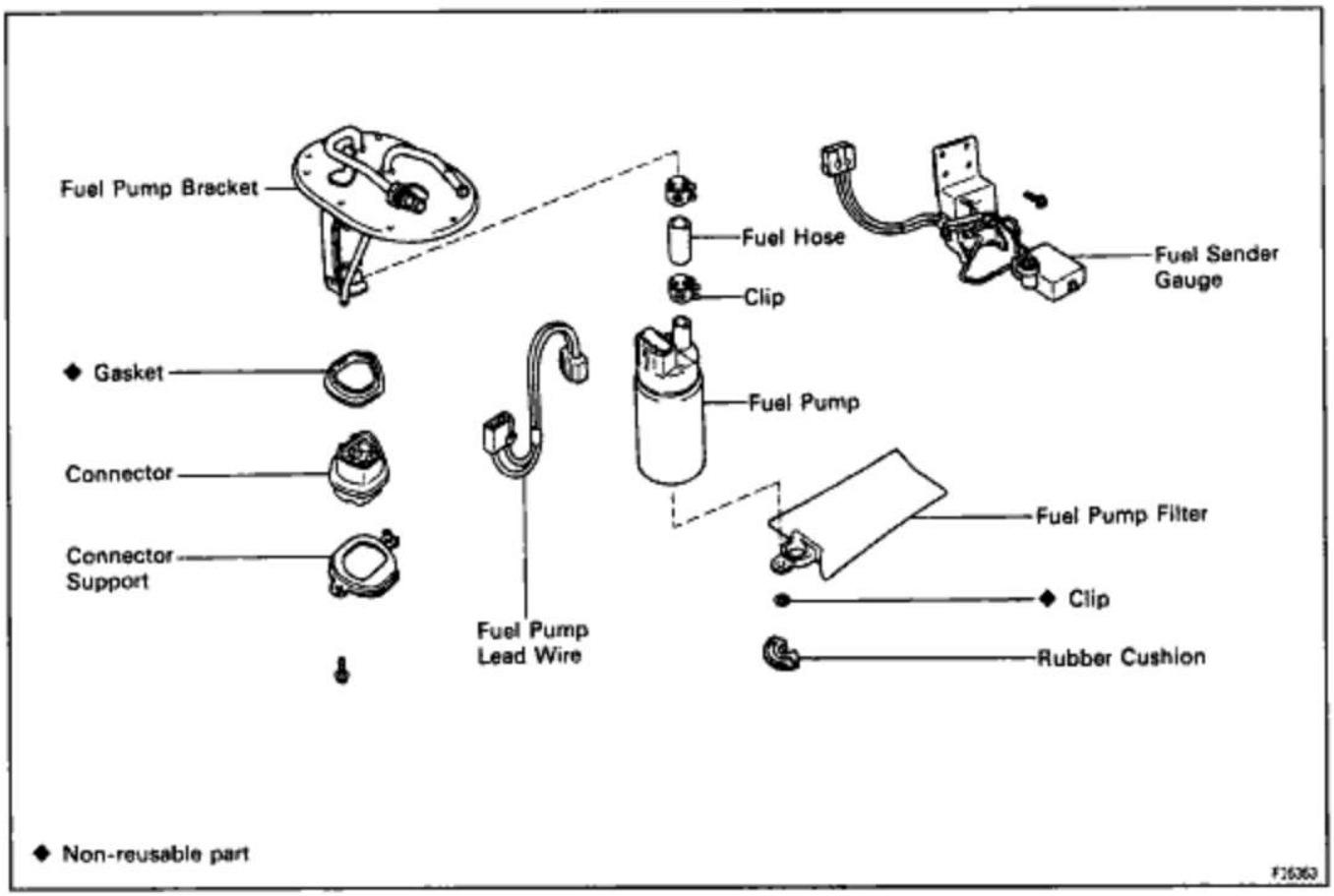
(a) Remove the 8 bolts.

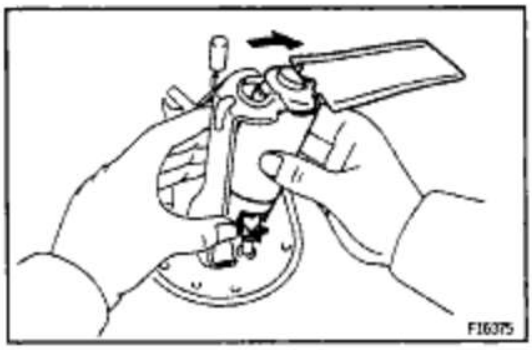



(b) Pull out the pump bracket assembly.

(c) Remove the gasket from the pump bracket.

# COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

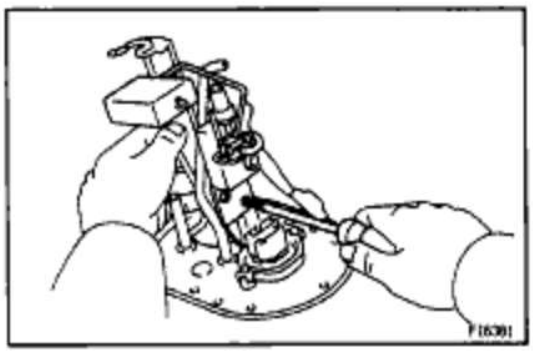



## FUEL PUMP DISASSEMBLY

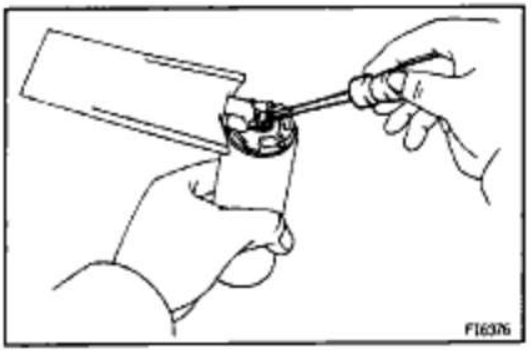
### 1. REMOVE FUEL PUMP FROM FUEL PUMP BRACKET

(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.



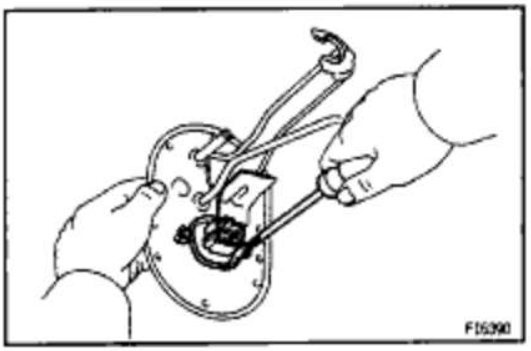

### 2. REMOVE FUEL SENDER GAUGE FROM FUEL PUMP BRACKET

(a) Disconnect the fuel sender gauge connector.
(b) Remove the 2 screws and sender gauge.



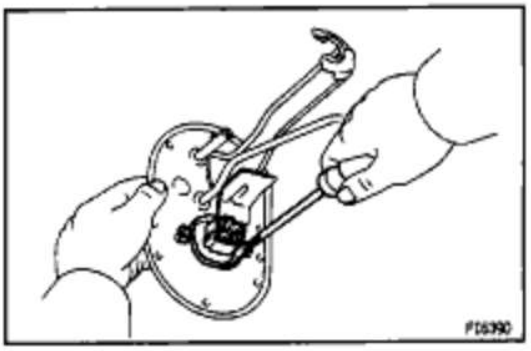
### 3. REMOVE FUEL PUMP FILTER FROM FUEL PUMP

(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

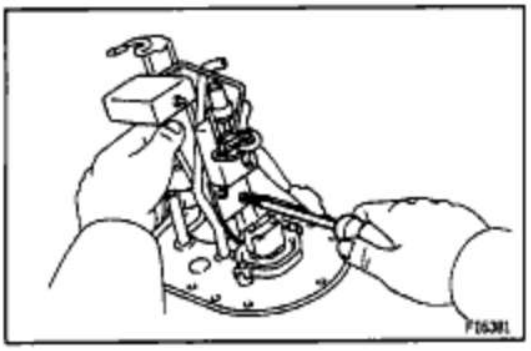
**(See Components for Disassembly and Assembly)**

### 1. INSTALL CONNECTOR

Install the gasket, connector and connector support with the 2 screws.

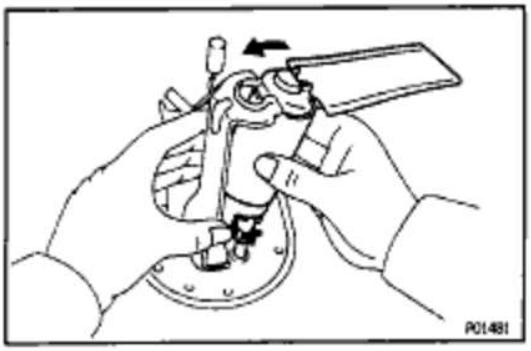
### 2. INSTALL FUEL PUMP FILTER TO FUEL PUMP

Install the pump filter with a new clip.



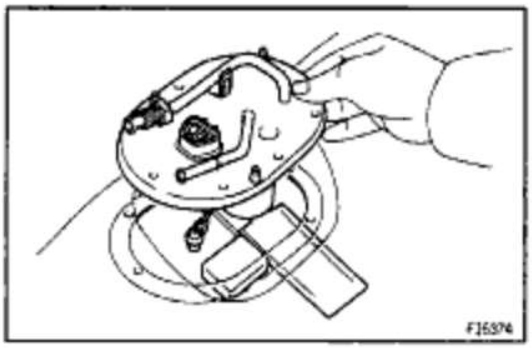
### 3. INSTALL FUEL SENDER GAUGE TO FUEL PUMP BRACKET

(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.



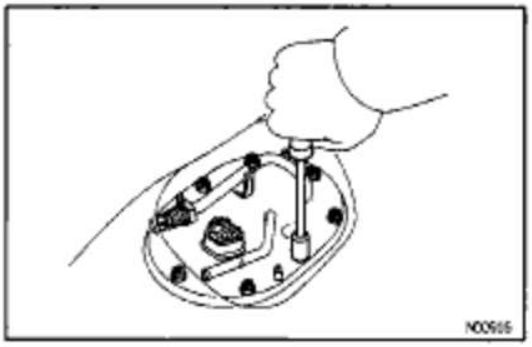
# FUEL PUMP INSTALLATION

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

**1. INSTALL FUEL PUMP BRACKET ASSEMBLY TO FUEL TANK**

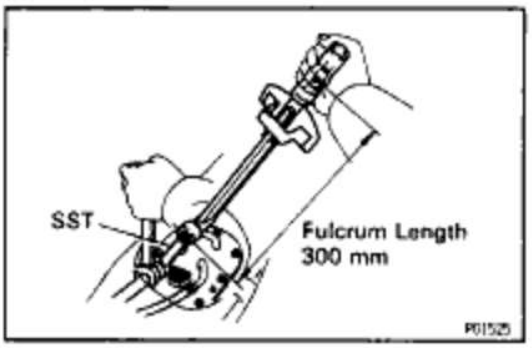
(a) Install a new gasket to the pump bracket.

(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**

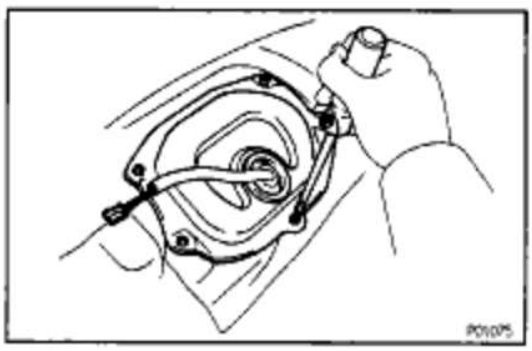
**(See page EG1–176)**

**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**

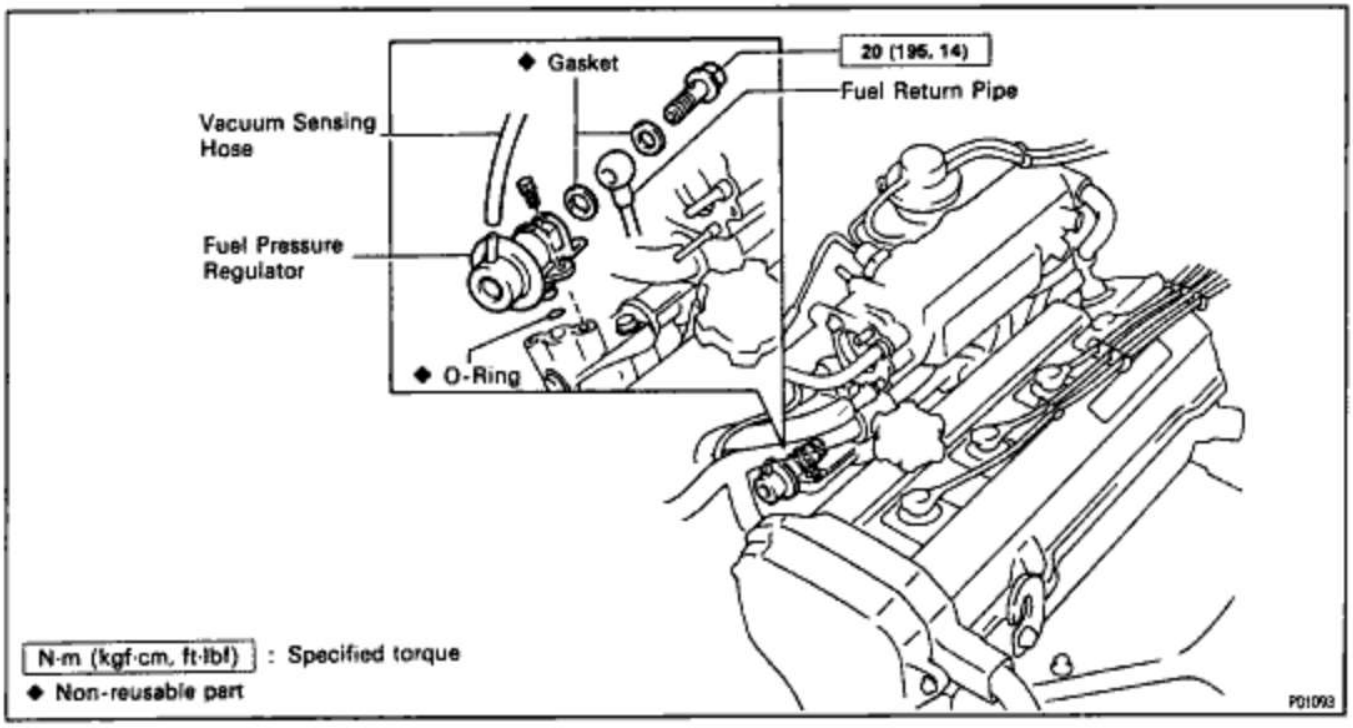
**7. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY**

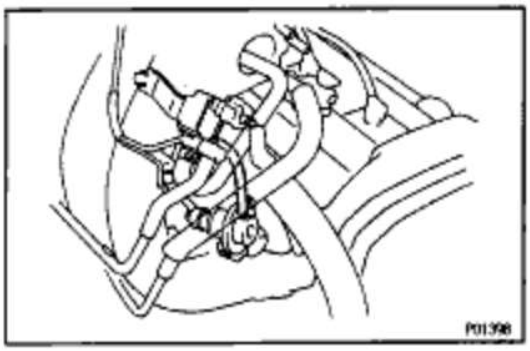
# FUEL PRESSURE REGULATOR

## ON–VEHICLE INSPECTION

INSPECT FUEL PRESSURE
(See page EG1–178)

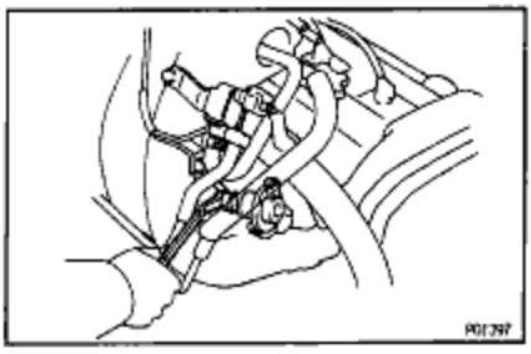
## COMPONENTS FOR REMOVAL AND INSTALLATION



## FUEL PRESSURE REGULATOR REMOVAL

1. DISCONNECT VACUUM SENSING HOSE FROM FUEL PRESSURE REGULATOR

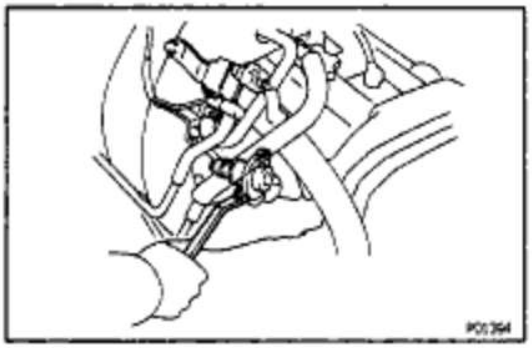


2. DISCONNECT FUEL RETURN PIPE FROM FUEL PRESSURE REGULATOR

(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.

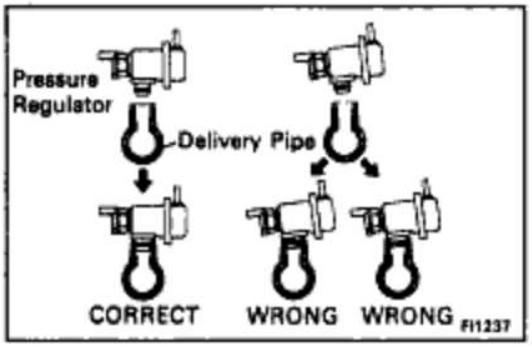
HINT: Slowly loosen the union bolt.



**3. REMOVE FUEL PRESSURE REGULATOR**

(a) Remove the 2 bolts, and pull out the pressure regulator.

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

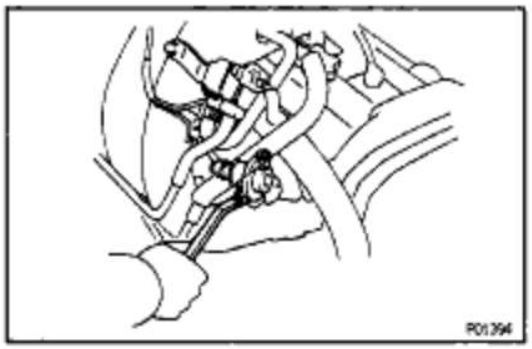



## FUEL PRESSURE REGULATOR INSTALLATION

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

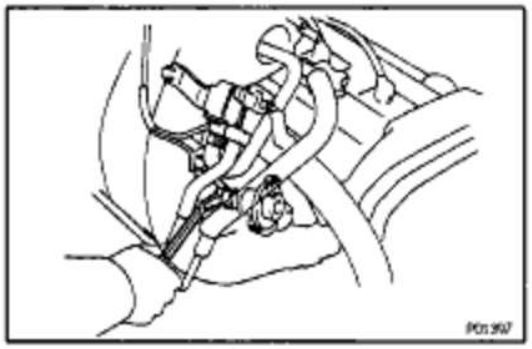
**1. INSTALL FUEL PRESSURE REGULATOR**

(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.

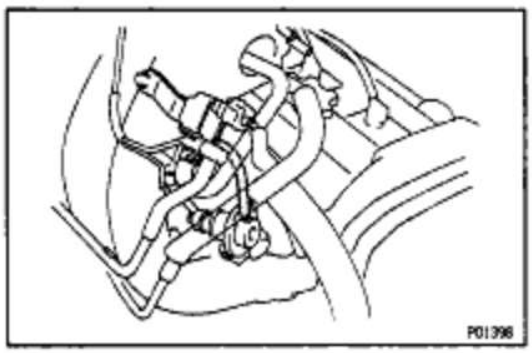
**Torque: 5.4 N–m (55 kgf–cm, 48 in.–lbf)**



**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)**

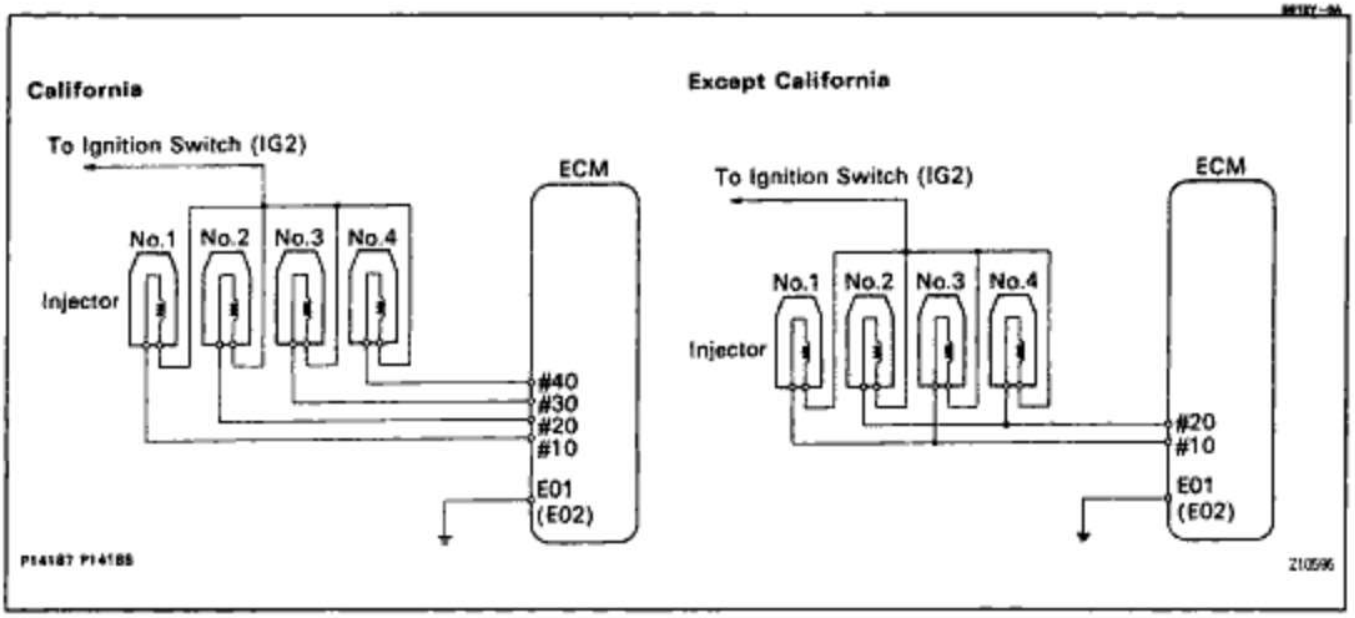


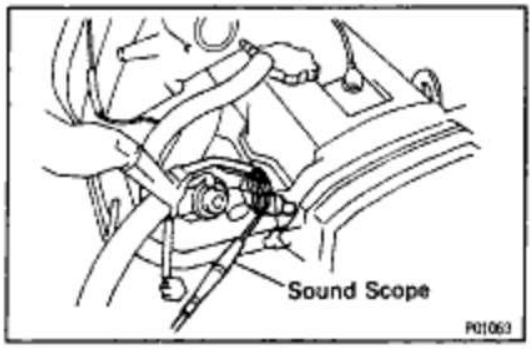
**3. CONNECT VACUUM SENSING HOSE TO FUEL PRESSURE REGULATOR**

**4. CHECK FOR FUEL LEAKAGE**

**(See page EG1–176)**

# INJECTOR



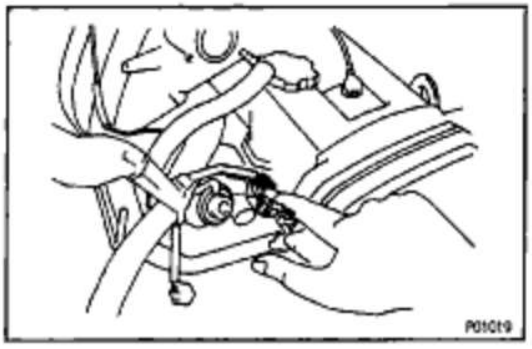




## ON–VEHICLE INSPECTION

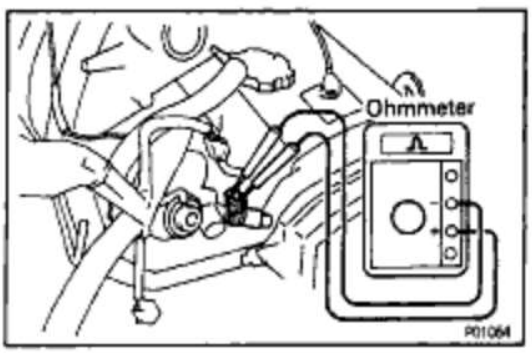
### 1. INSPECT INJECTOR OPERATION

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 injec–tor 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.

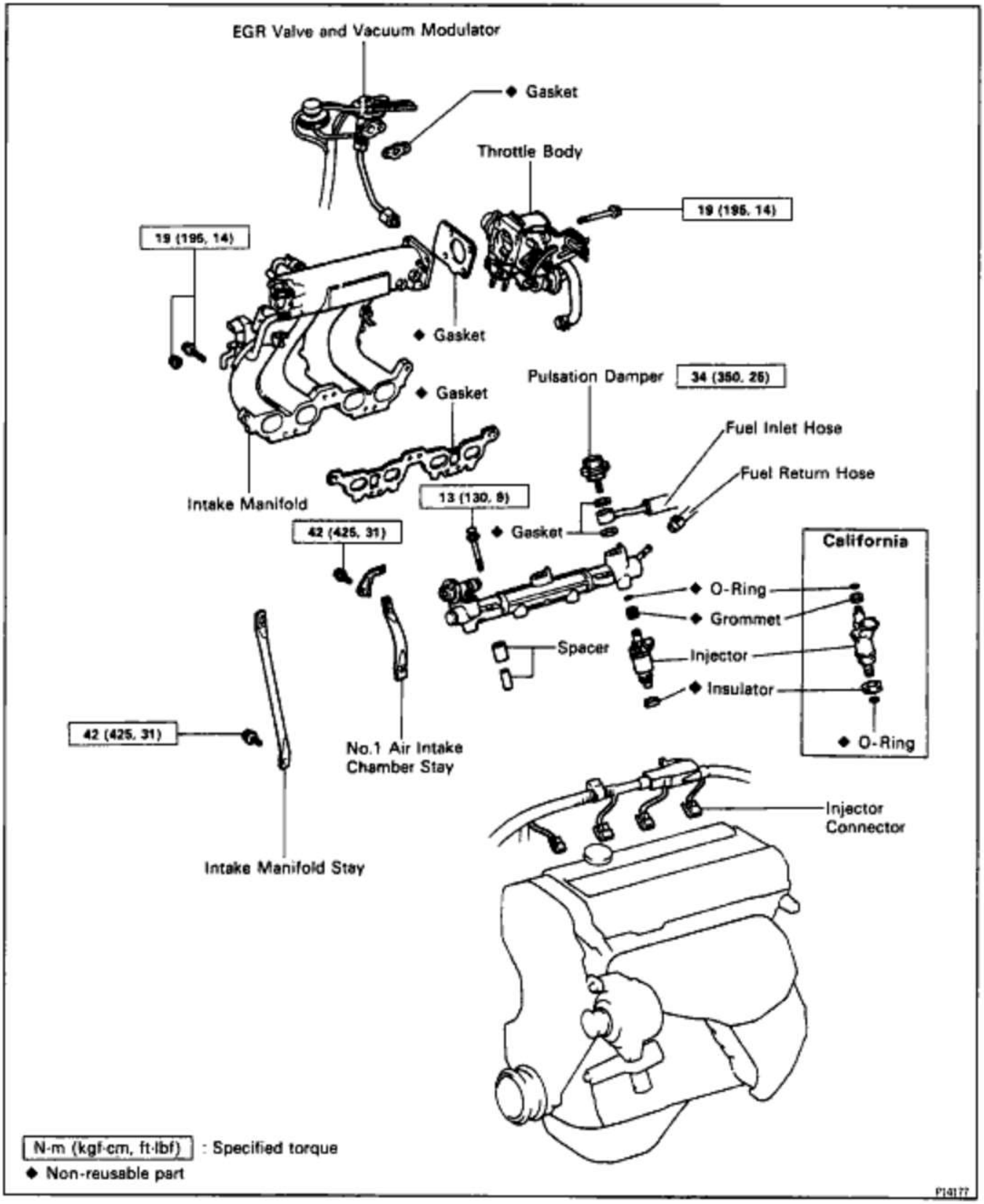
**Resistance:**

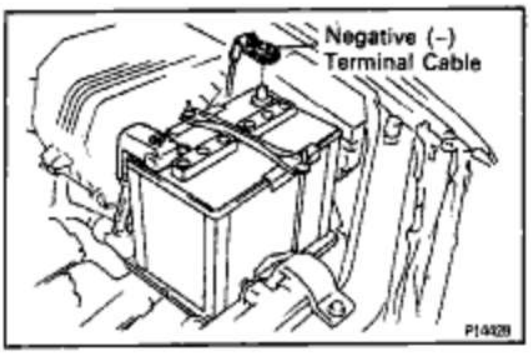
**Approx. 13.8Ω**

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)**

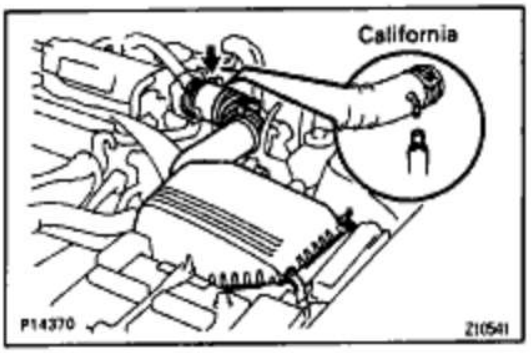
**1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY**

**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**

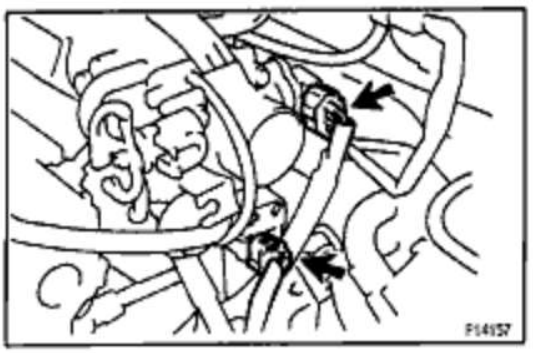
**3. A/T:**
**DISCONNECT THROTTLE CABLE FROM THROTTLE BODY**

**4. DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY**



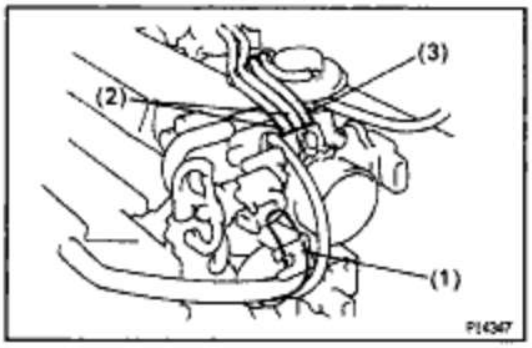

**5. REMOVE AIR CLEANER CAP, RESONATOR AND AIR CLEANER HOSE**

(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.

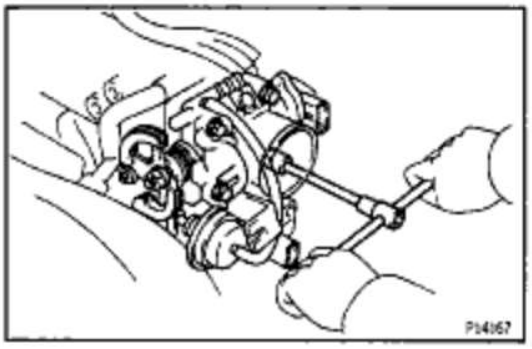



**6. REMOVE THROTTLE BODY**

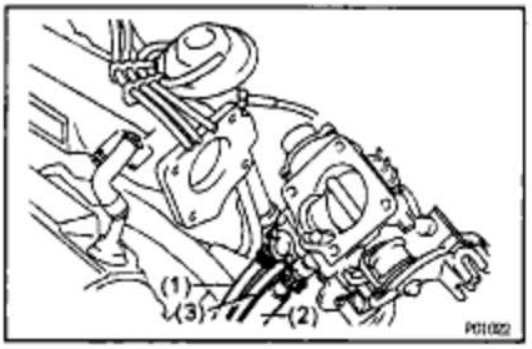
(a) Disconnect throttle position sensor connector.
(b) Disconnect IAC valve connector.



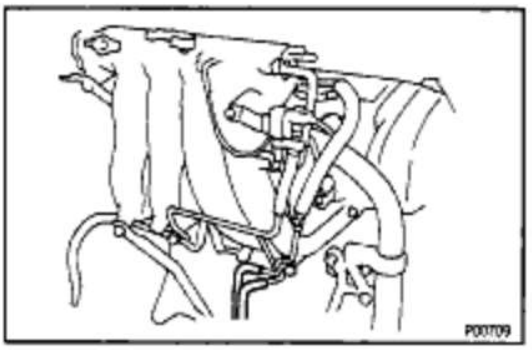

(c) Disconnect the following hoses from the throttle body.
(1) PCV hose
(2) 2 vacuum hoses from EGR vacuum modulator
(3) Vacuum hose from TVV (for EVAP)



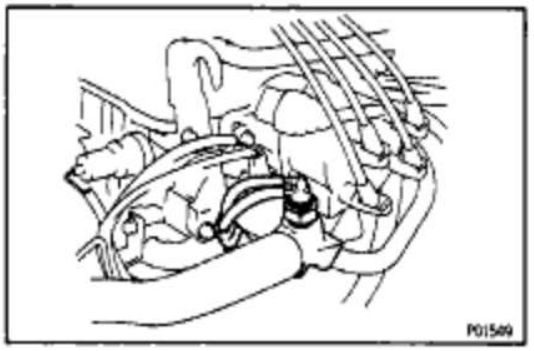

(d) Type A:
Remove the 4 bolts.
(e) Type B:
Remove the 2 bolts and 2 nuts.



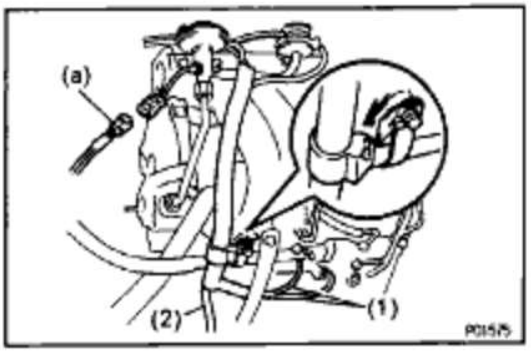

(f) Disconnect the following hoses from the throttle body, and remove the throttle body.
(1) Water bypass hose from water outlet
(2) Water bypass hose from water bypass pipe
(3) California:
Air hose from cylinder head
Except California:
Air hose from air tube




**7. DISCONNECT PS VACUUM HOSES**

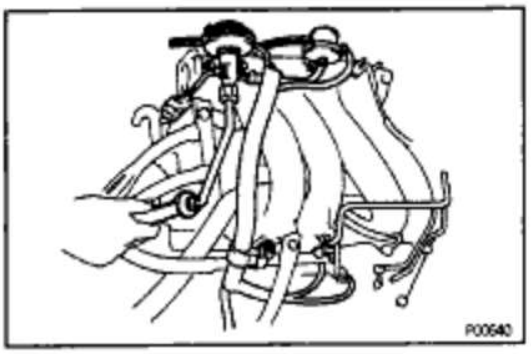



**8. DISCONNECT VACUUM HOSES FROM TVV (FOR EVAP)**

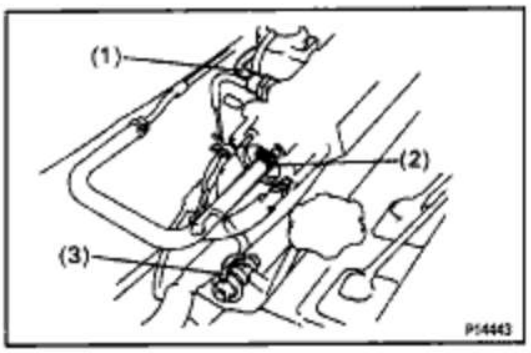



**9. REMOVE EGR VALVE AND VACUUM MODULATOR**

(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.



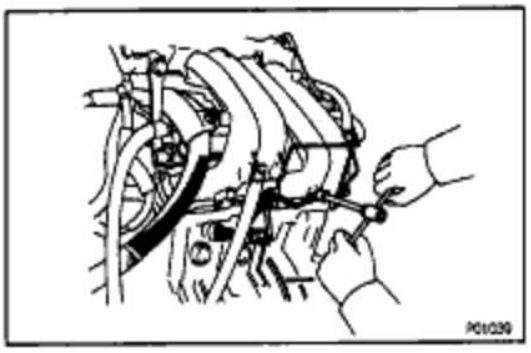
(d) Loosen the union nut of the EGR pipe, and remove the 2 nuts, the EGR valve, vacuum modulator, vacuum hoses assembly and gasket.



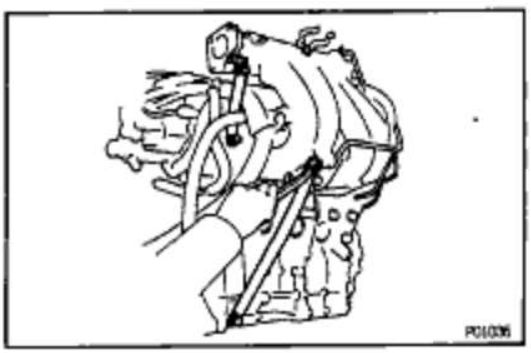

**10. DISCONNECT VACUUM HOSES**

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**

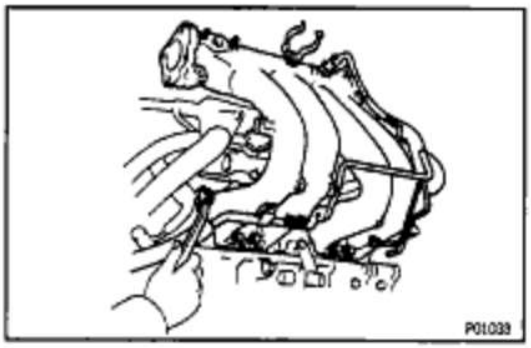


**12. DISCONNECT 2 ENGINE WIRE GROUND STRAPS FROM INTAKE MANIFOLD**
**13. DISCONNECT KNOCK SENSOR AND VSV (FOR EGR) CONNECTORS**
**14. CALIFORNIA ONLY:**
**DISCONNECT VSV (FOR FUEL PRESSURE CONTROL) CONNECTOR AND VACUUM HOSES**
**15. REMOVE BOLT AND WIRE CLAMP, AND DISCONNECT ENGINE WIRE HARNESS**

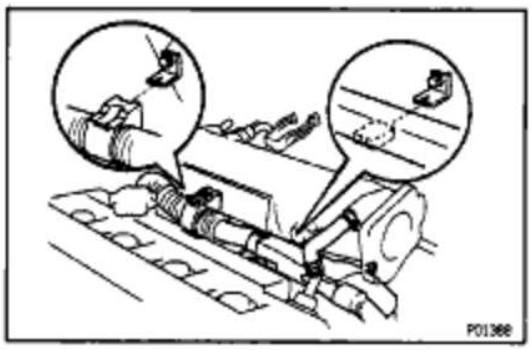


**16. REMOVE INTAKE MANIFOLD**

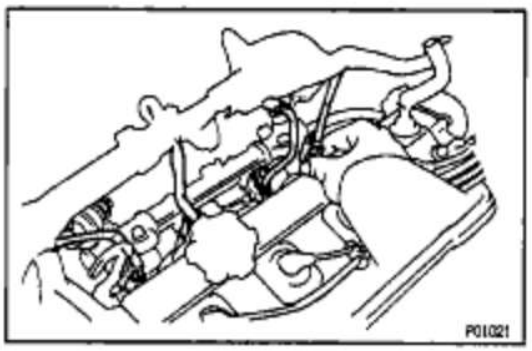
(a) Remove the 4 bolts, wire bracket, No.1 air intake chamber and manifold stays.



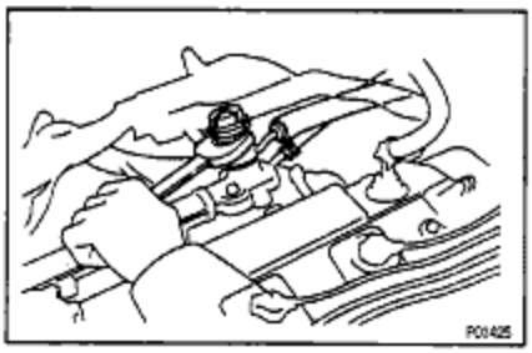

(b) Remove the 6 bolts, 2 nuts, intake manifold and gasket.




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



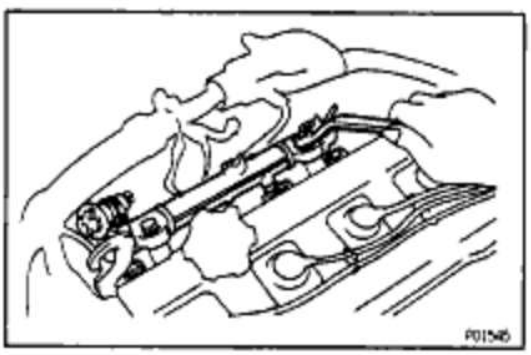

**17. DISCONNECT INJECTOR CONNECTORS**




**18. REMOVE DELIVERY PIPE AND INJECTORS**

(a) Loosen the pulsation damper, and disconnect the fuel inlet pipe.

(b) Disconnect the fuel return hose.

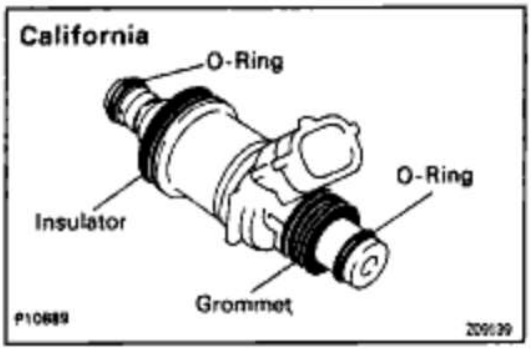



(c) Remove the 2 bolts and delivery pipe together with the 4 injectors.

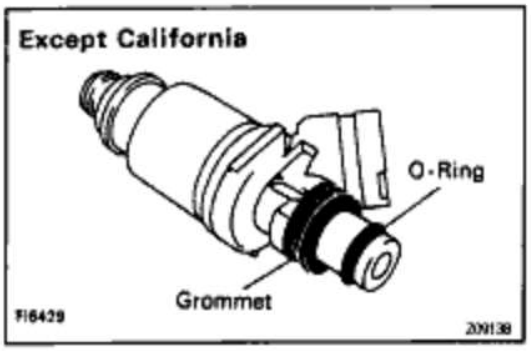
**NOTICE: Be careful not to drop the injectors when removing the delivery pipe.**

(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.

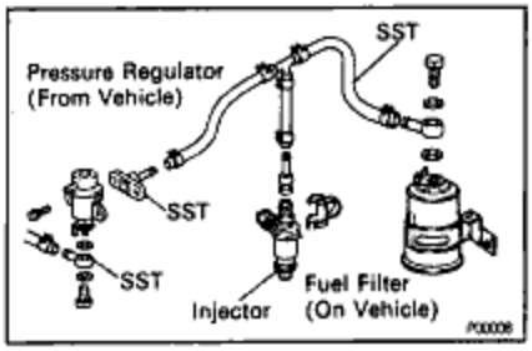


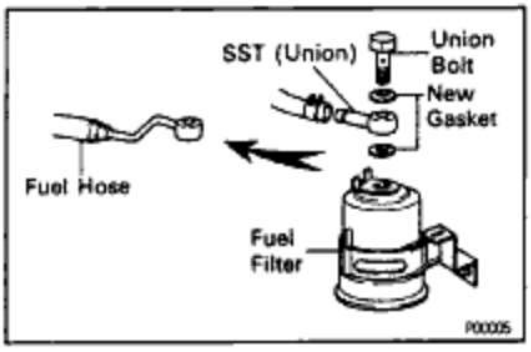

(g) Except California:
Remove the O–ring and grommet from each injector.

## INJECTORS INSPECTION

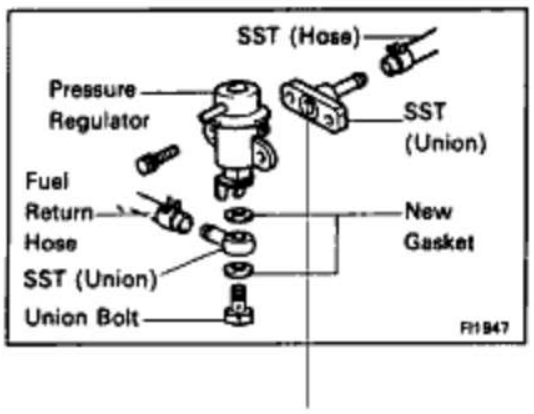
### 1. INSPECT INJECTOR INJECTION

**CAUTION: Keep injector clear of sparks during the test.**

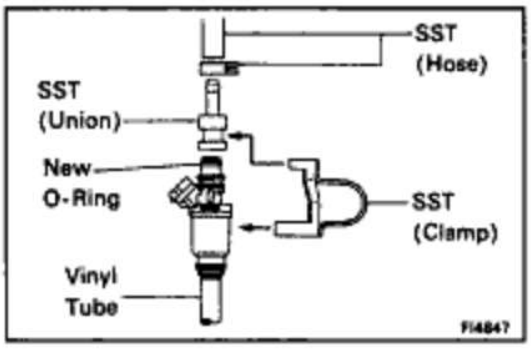



(a) Disconnect the fuel hose from the fuel filter outlet.
(b) Connect SST (union and hose) to the fuel filter outlet with 2 new gaskets and union bolts.
SST 09268–41045 (90405–09015)
**Torque: 29 N–m (300 kgf–cm, 22 ft–lbf)**
HINT: Use the vehicle's fuel filter.




(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)

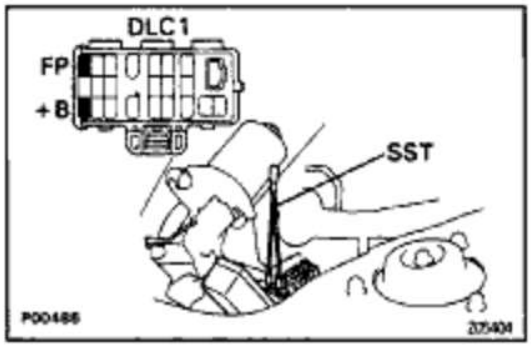
**Torque: 18 N–m (180 kgf–cm, 13 ft–lbf)**

(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.

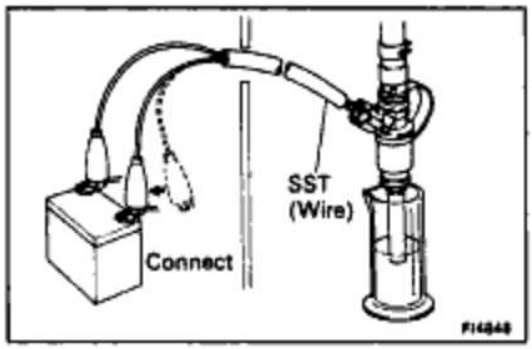



(i) Using SST, connect terminals +B and FP of the data link connector 1.
SST 09843–18020

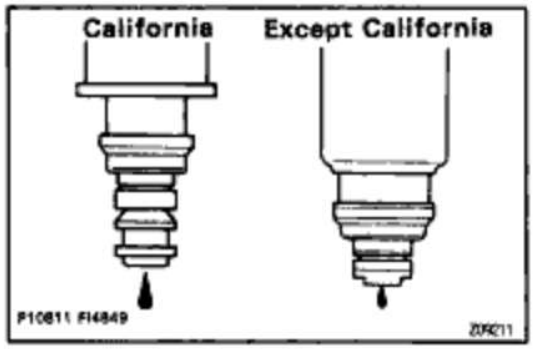
(j) Reconnect the negative (–) terminal cable to the battery.

(k) Turn the ignition switch ON.

**NOTICE: Do not start the engine.**



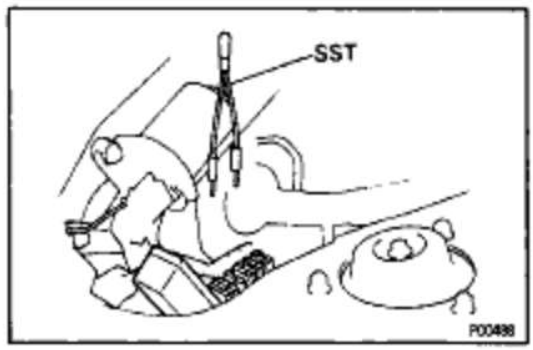

(l) Connect SST (wire) to the injector and battery for 15 seconds, and measure the injection volume with a graduated cylinder. Test each injector 2 or 3 times.
SST 09842–30070
**Volume:**
**49 – 59 cm1 (3.0–3.6 cu in.) per 15 sec.**
**Difference between each Injector:**
**5 cm1 (0.3 cu in.) or less**
If the injection volume is not as specified, replace the injector.



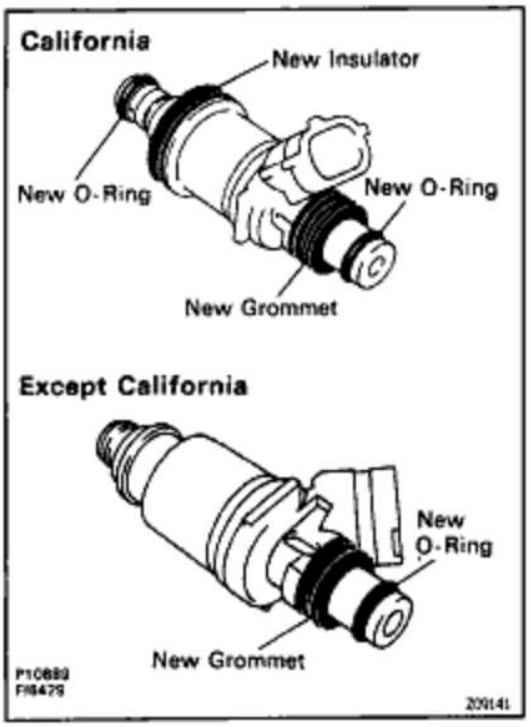

**2. INSPECT LEAKAGE**

(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)**

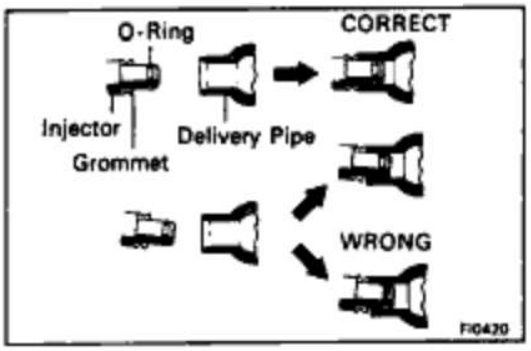
**1. INSTALL INJECTORS AND DELIVERY PIPE**

(a) California:
Install new insulator and grommet to each injector.

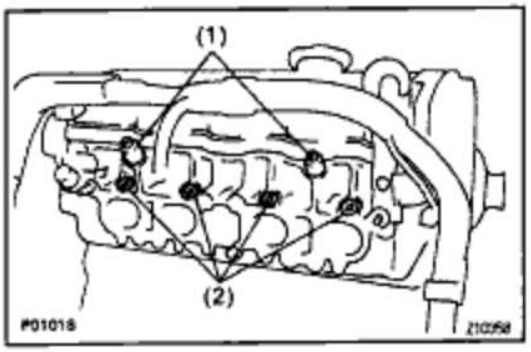
(b) Except California:
Install a new grommet to each injector.

(c) California:
Apply a light coat of gasoline to 2 new O–rings, and install them to each injector.

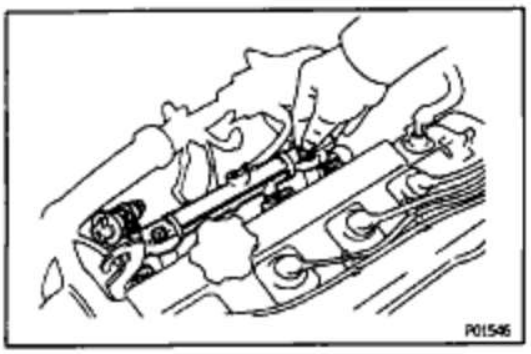
(d) Except California:
Apply a light coat of gasoline to a new O–ring, and install it to each injector.




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

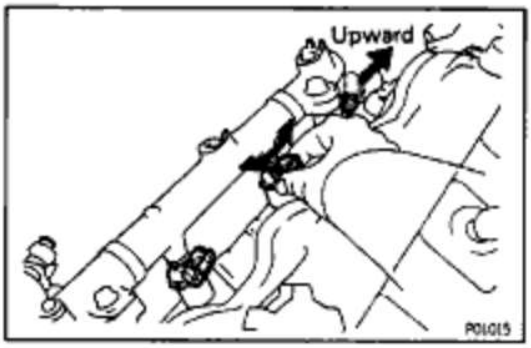



(f) Install the following parts to the cylinder head:
(1) 2 spacers
(2) Except California:
4 new insulators

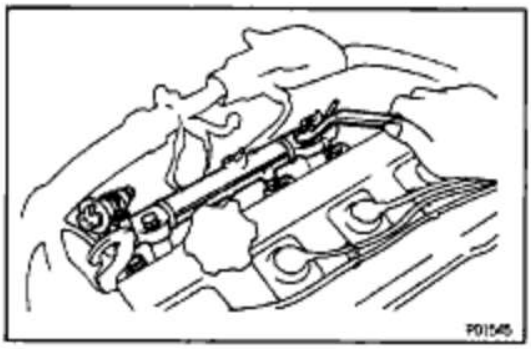



(g) Place the 4 injectors together with the delivery pipe in position on the cylinder head.

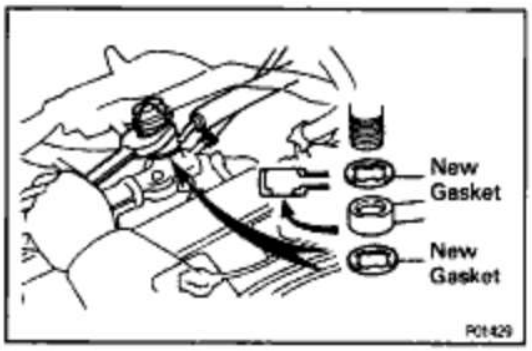
(h) Temporarily install the 2 bolts holding the delivery pipe to the cylinder head.



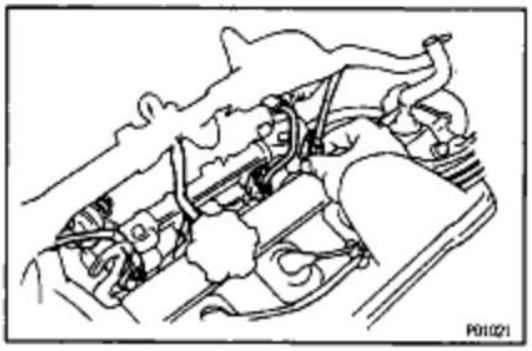

(i) Check that the injectors rotate smoothly.
HINT: If injectors do not rotate smoothly, the probable cause is incorrect installation of O – rings. Replace the O–rings.
(j) Position the injector connector upward.



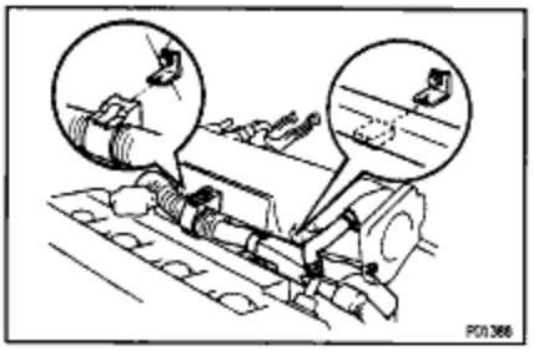

(k) Tighten the 2 bolts holding the delivery pipe to the cylinder head.
**Torque: 13 N–m (130 kgf–cm, 9 ft–lbf)**




(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)**

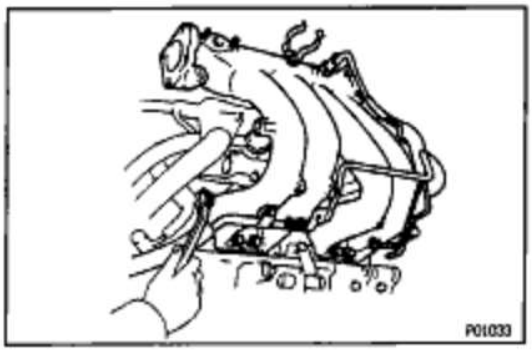



## 2. CONNECT INJECTOR CONNECTORS



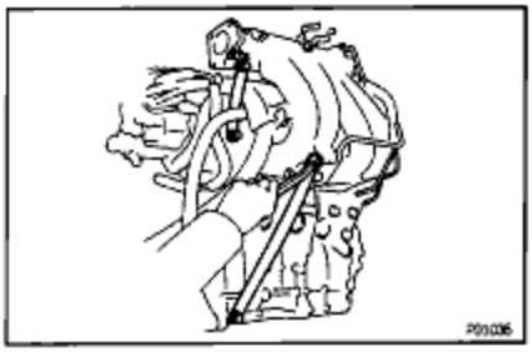

## 3. INSTALL INTAKE MANIFOLD

(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)**



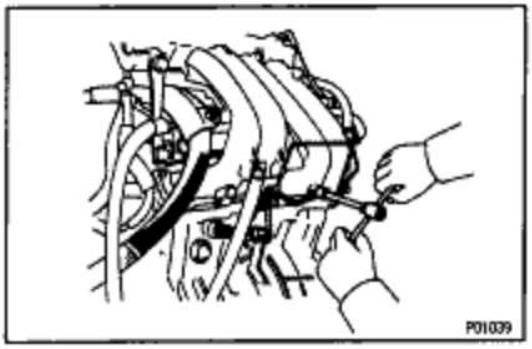

(c) Install the No. 1 air intake chamber and manifold stays, wire bracket with the 4 bolts.

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)**

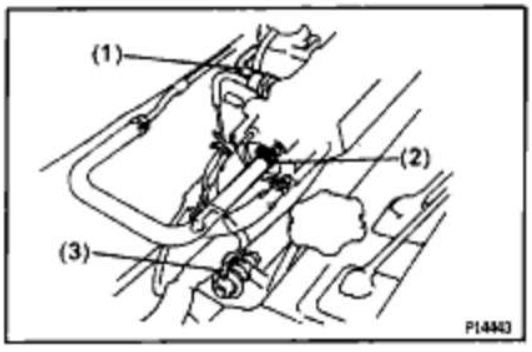



**4. CONNECT ENGINE WIRE HARNESS WITH WIRE CLAMP AND BOLT**

**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**

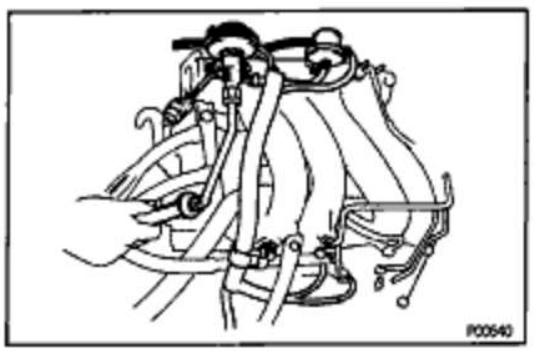
Connect the following hoses:

(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.

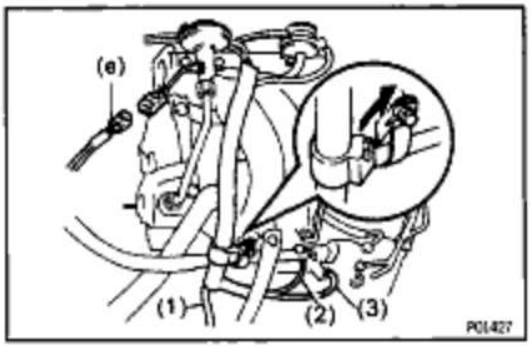
**Union nut**

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

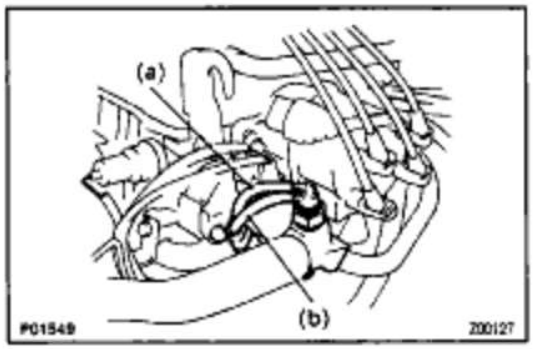
**Nut**

**Torque: 13 N–m (130 kgf–cm. 9 ft–lbf)**

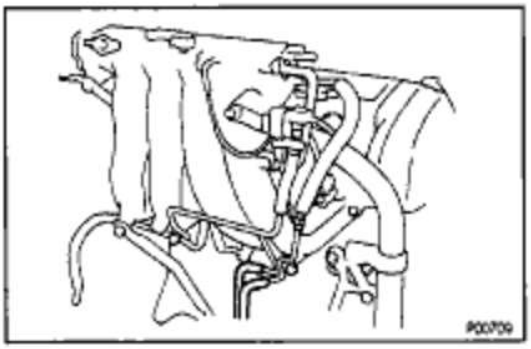
(b) Install the EGR vacuum modulator to the clamp.



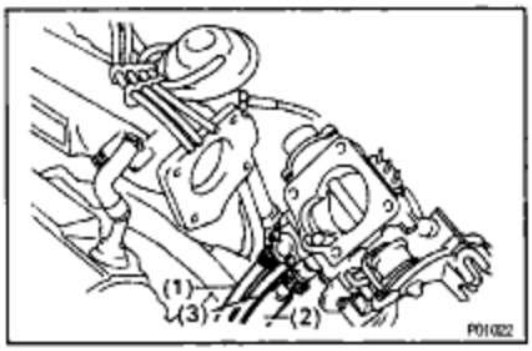

(c) Connect the vacuum hose clamp.
(d) Connect the following hoses:
(1) Vacuum hose to charcoal canister
(2) Vacuum hose (from EGR valves) to E port of VSV (for EGR)
(3) Vacuum hose (from Q port EGR vacuum modulator) to G port of VSV (for EGR)
(e) Connect the EGR gas temperature sensor connector.



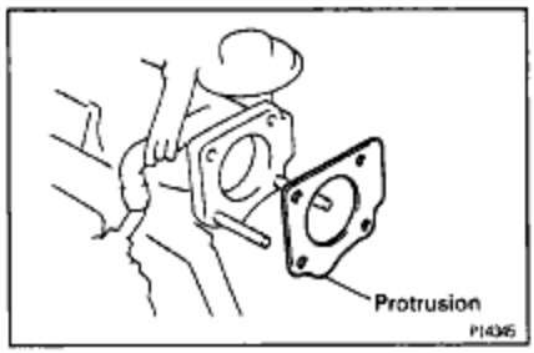

**11. CONNECT VACUUM HOSES TO VSV (FOR EVAP)**
(a) From P port of throttle body
(b) From charcoal canister



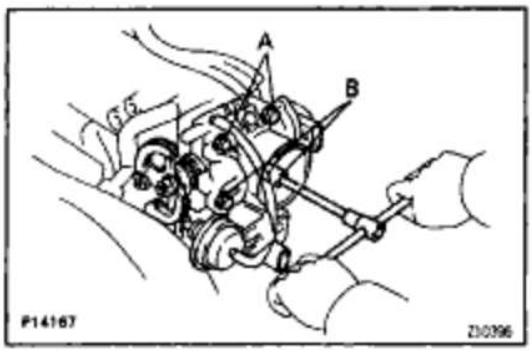

**12. CONNECT PS VACUUM HOSES**



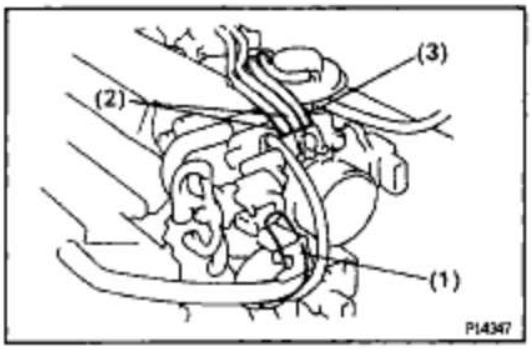

**13. INSTALL THROTTLE BODY**
(a) Connect the following hoses to the throttle body:
(1) Water bypass hose from water outlet
(2) Water bypass hose from water bypass pipe
(3) California:
Air hose from cylinder head
Except California:
Air hose to air tube



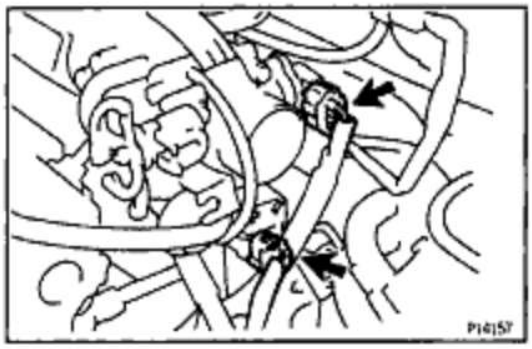

(b) Place a new gasket on the intake chamber, facing the protrusion downward.



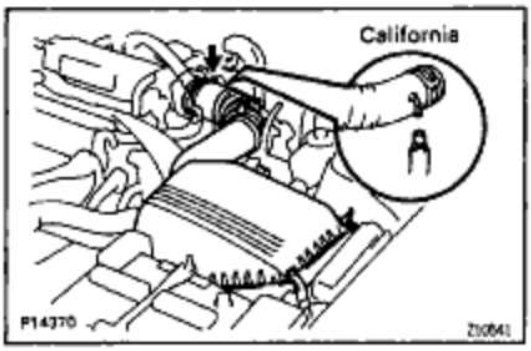

(c) Type A:
Install the throttle body with the 4 bolts.
**Torque: 19 N–m (195 kgf–cm, 14 ft–lbf)**
Bolt length:
A 45 mm (1.77 in.)
B 55 mm (2.17 in.)
(d) Type B:
Install the throttle body with the 2 bolts and 2 nuts.
**Torque: 19 N–m (195 kgf–cm, 14 ft–lbf)**




(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)



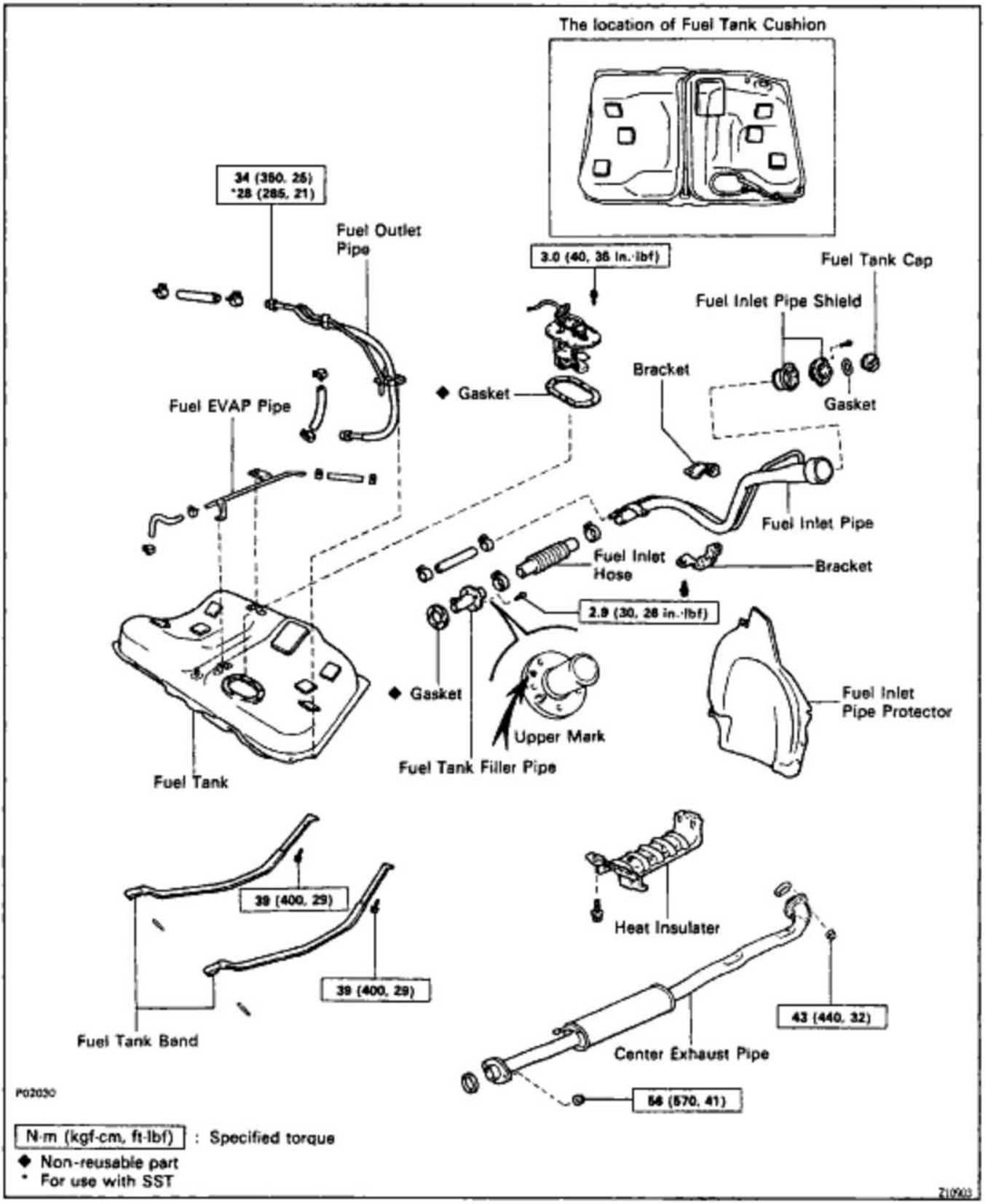

(f) Connect the IAC valve connector.
(g) Connect the throttle position sensor connector.




**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.

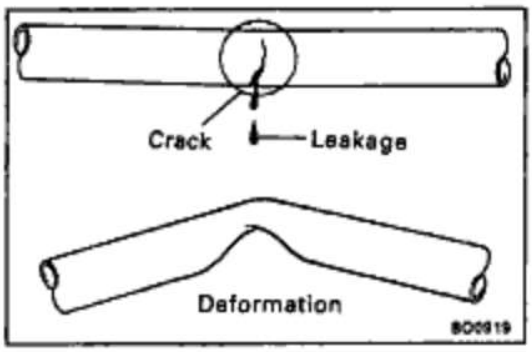
**15. A/T:**
**CONNECT AND ADJUST THROTTLE CABLE**
**16. CONNECT AND ADJUST ACCELERATOR CABLE**
**17. FILL WITH ENGINE COOLANT**
**Capacity:**
**6.3 liters (6.7 US qts. 5.5 Imp. qts)**
**18. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY**

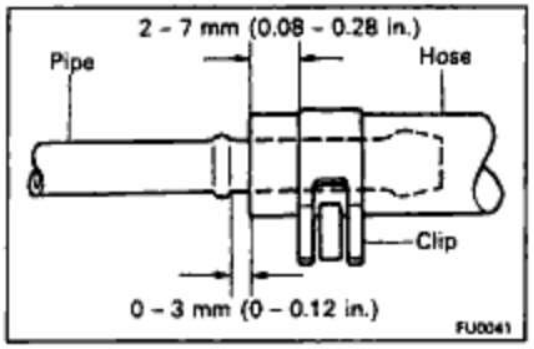
# FUEL TANK AND LINE
## COMPONENTS



## PRECAUTIONS

1. Always use new gaskets when replacing the fuel tank or component parts.
2. Apply the proper torque to all parts tightened.

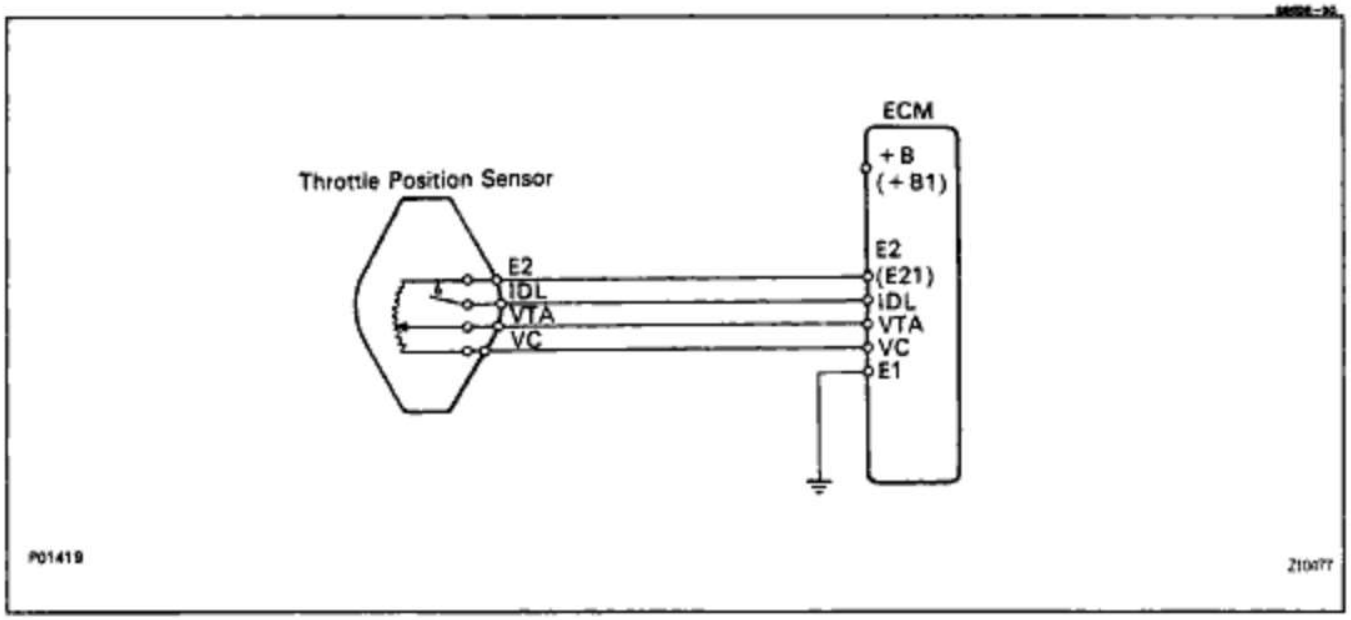


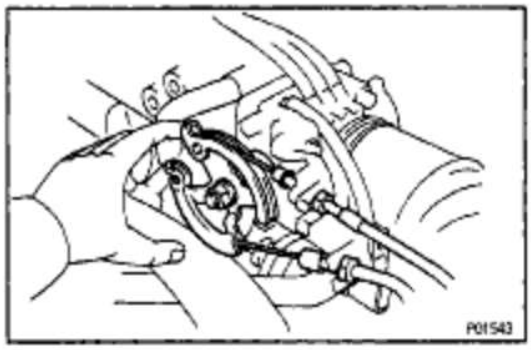




## FUEL LINES AND CONNECTIONS INSPECTION

(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

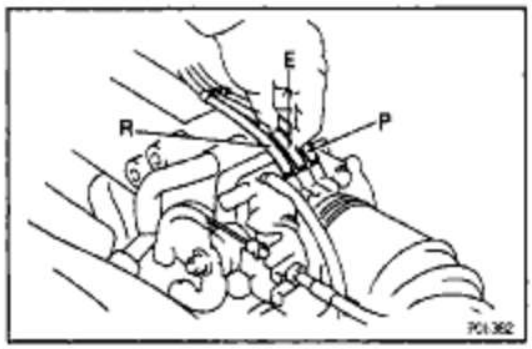



## ON–VEHICLE INPSECTION

### 1. INSPECT THROTTLE BODY

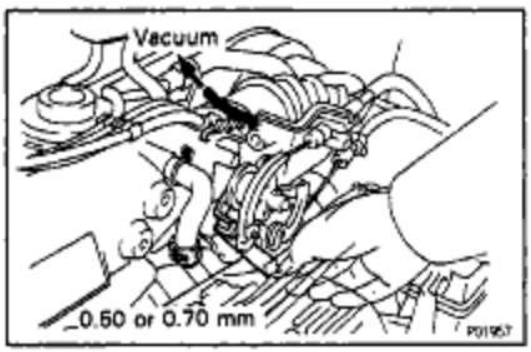
(a) Check that the throttle linkage moves smoothly.




(b) Check the vacuum at each port.

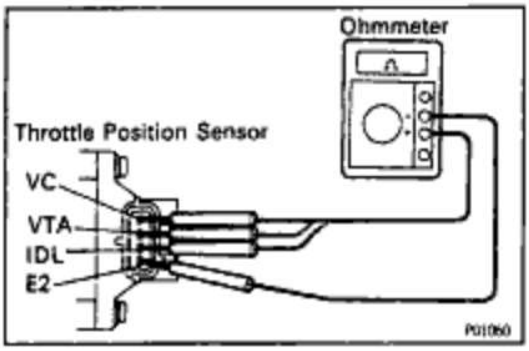
- Start the engine.
- Check the vacuum with your finger.

| Port name | At idle | Other than idle |
|---|---|---|
| P | No vacuum | Vacuum |
| E | No vacuum | Vacuum |
| R | No vacuum | No vacuum |



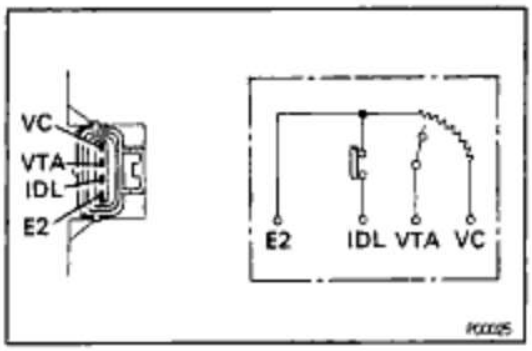

### 2. INSPECT THROTTLE POSITION SENSOR

(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**

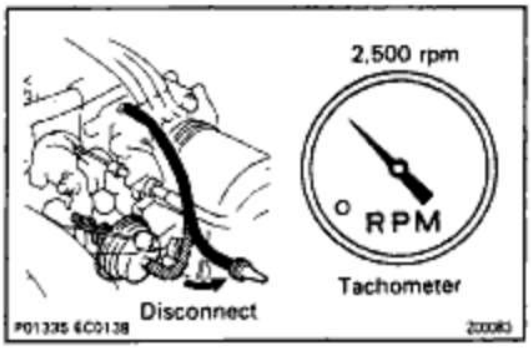
**A. Warm up engine**

Allow the engine to warm up to normal operating temperature.

**B. Check idle speed**

**Idle speed:**

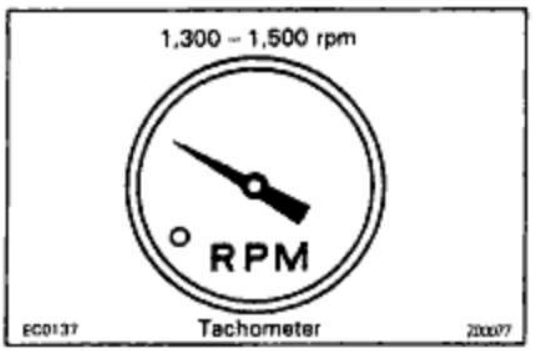
**750 ± 50 rpm**




**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.

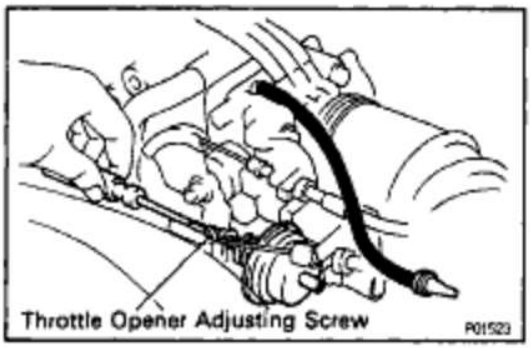



(c) Release the throttle valve.

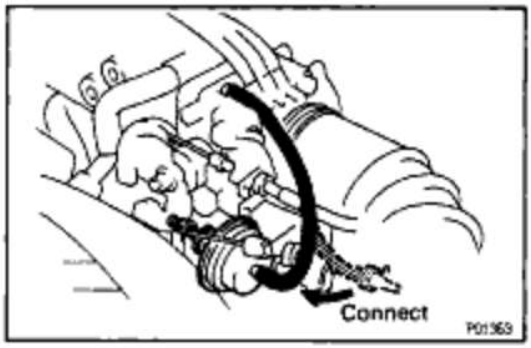
(d) Check that the throttle opener is set.

**Throttle opener setting speed:**

**1,300 – 1,500 rpm (w/ Cooling fan OFF)**

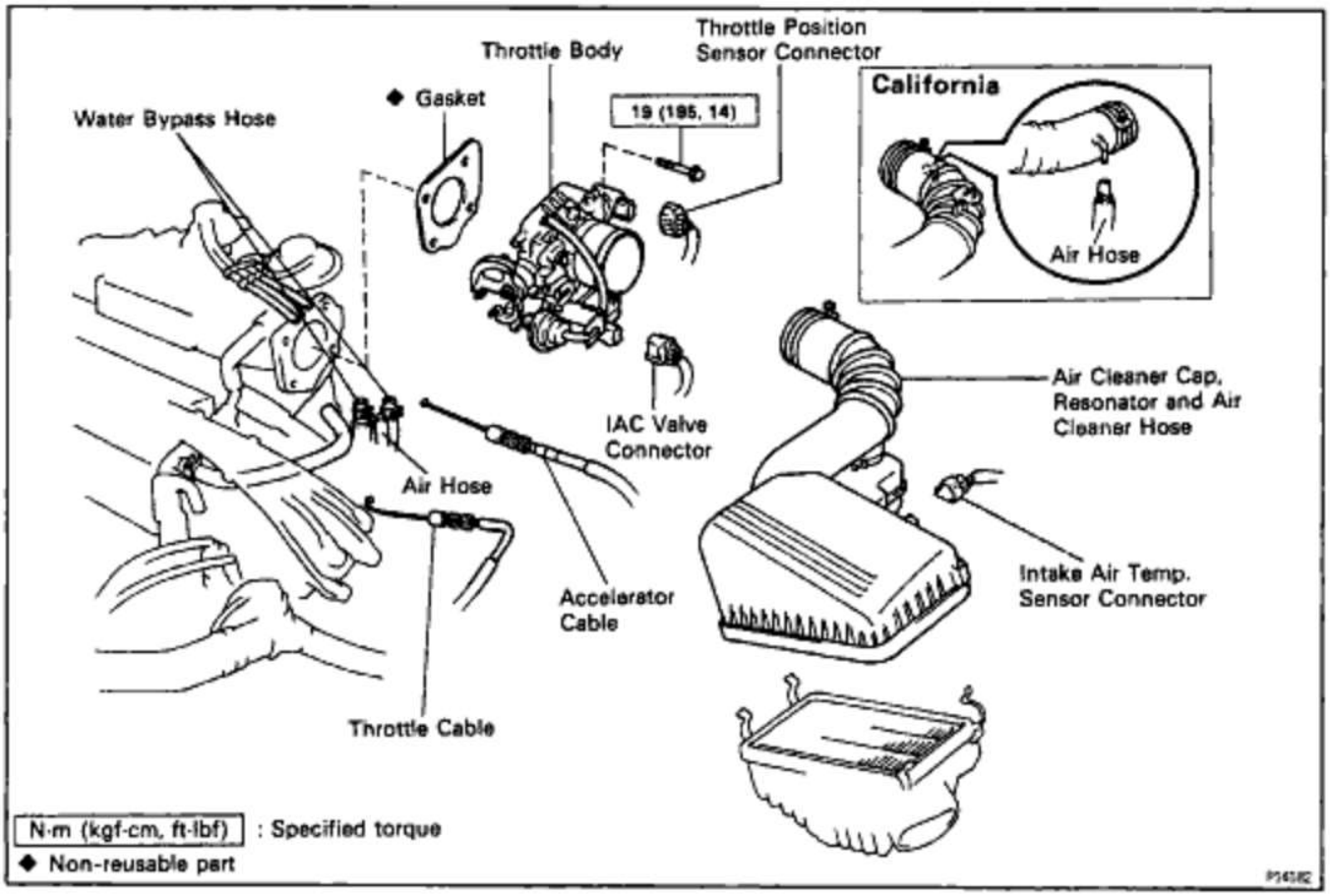


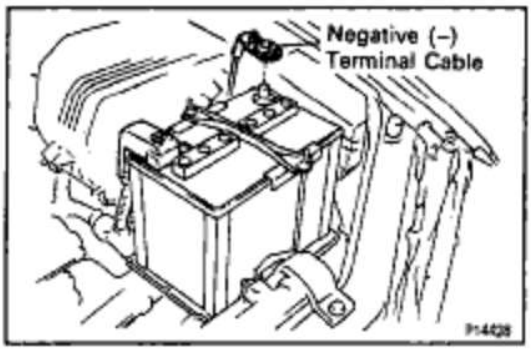

(e) Adjust the throttle opener setting speed by turning the throttle opener adjusting screw.




(f) Reconnect the vacuum hose to the throttle opener.

## COMPONENTS FOR REMOVAL AND INSTALLATION






# THROTTLE BODY REMOVAL

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

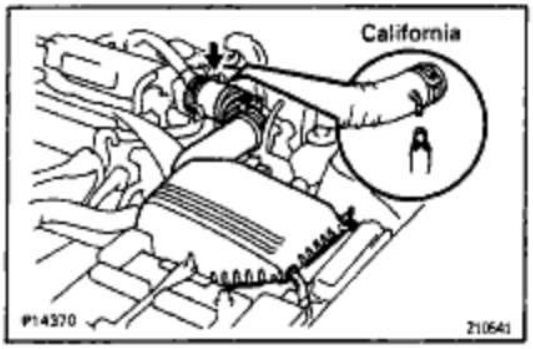
**CAUTION: Work must be started after 90 seconds from the time the ignition switch is turned to the "LOCK" position and the negative (–) terminal cable is disconnected from the battery.**

**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**

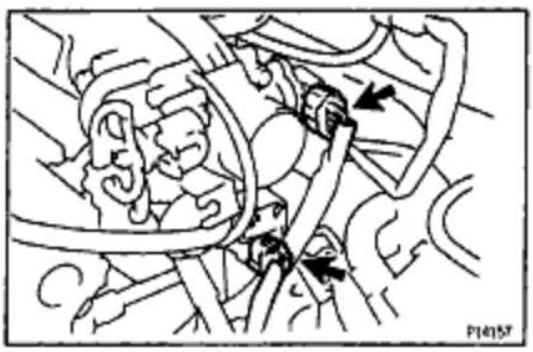
(a) Disconnect the intake air temperature sensor connector.

(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.

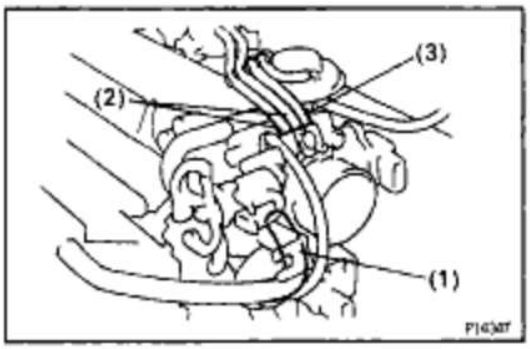
(e) Disconnect the air cleaner hose from the throttle body, and remove the air cleaner cap together with the resonator and air cleaner hose.



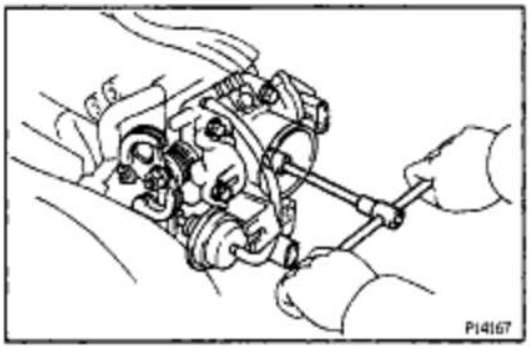
**6. REMOVE THROTTLE BODY**

(a) Disconnect the throttle position sensor connector.

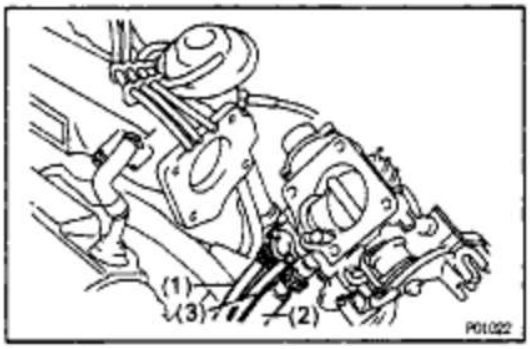
(b) Disconnect the IAC valve connector.



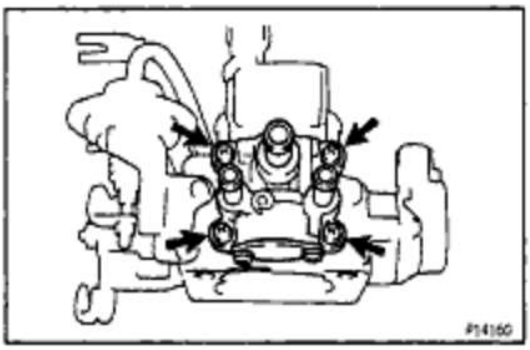

(c) Disconnect the following hoses from the throttle body.
(1) PCV hose
(2) 2 vacuum hoses from EGR vacuum modulator
(3) Vacuum hose from TVV (for EVAP)



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

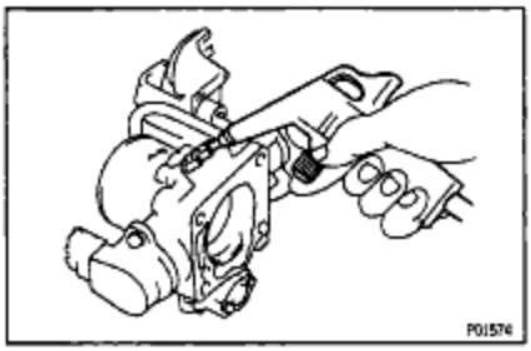



(f) Disconnect the following hoses from the throttle body, and remove the throttle body.
(1) Water bypass hose from water outlet
(2) Water bypass hose from water bypass pipe
(3) California:
Air hose from cylinder head
Except California:
Air hose from air tube



**7. IF NECESSARY, REMOVE IAC VALVE FROM THROTTLE BODY**

Remove the 4 screws, IAC valve and gasket.

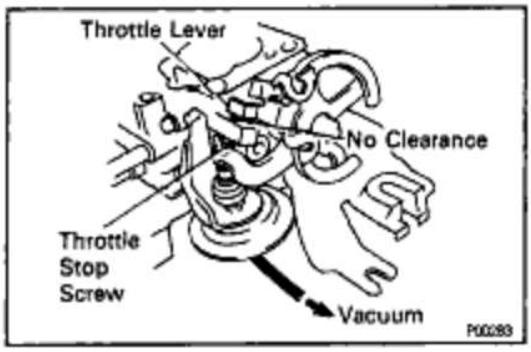


## THROTTLE BODY INSPECTION

**1. CLEAN THROTTLE BODY**

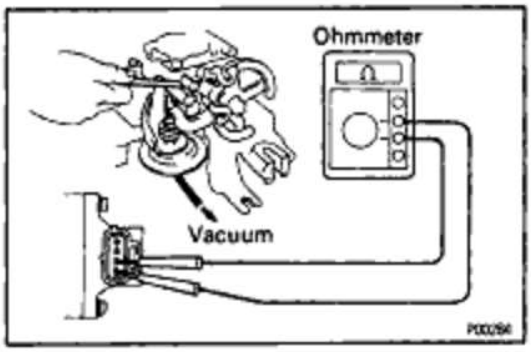
(a) Using a soft brush and carburetor cleaner, clean the cast parts.
(b) Using compressed air, clean all the passengers and apertures.

**NOTICE: To prevent deterioration, do not clean the throttle position sensor.**




### 2. INSPECT THROTTLE VALVE

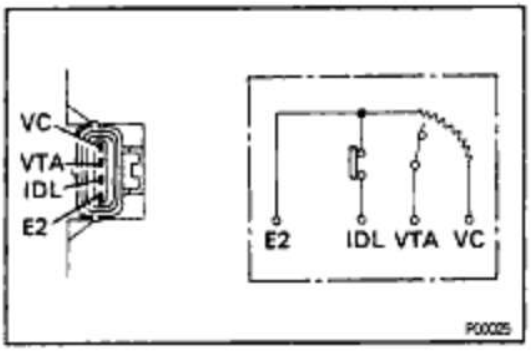
(a) Apply vacuum to the throttle opener.
(b) Check that there is no clearance between the throttle stop screw and throttle lever when the throttle valve is fully closed.




### 3. INSPECT THROTTLE POSITION SENSOR

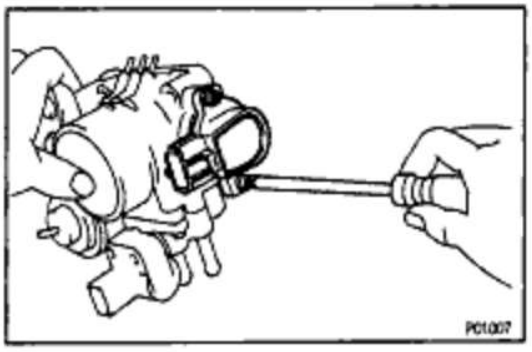
(a) Apply vacuum to the throttle opener.
(b) Insert a thickness gauge between the throttle stop screw and stop lever.
(c) Using an ohmmeter, measure the resistance between each terminal.

| 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 |

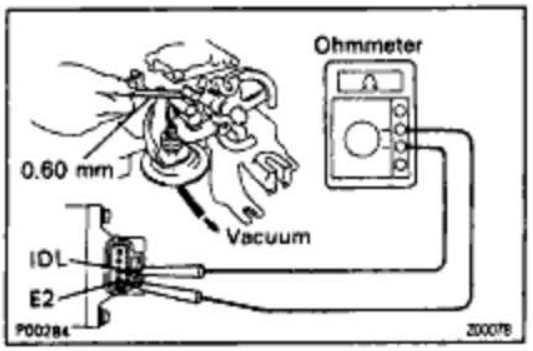


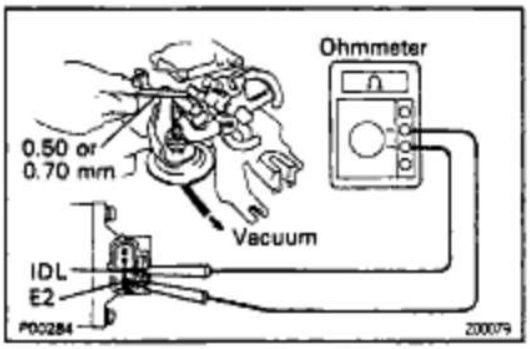

### 4. IF NECESSARY, ADJUST THROTTLE POSITION SENSOR

(a) Loosen the 2 set screws of the sensor.



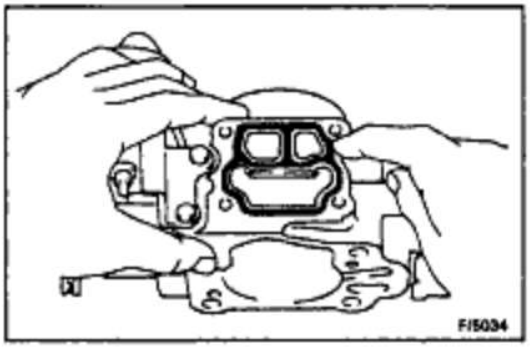
(b) Apply vacuum to the throttle opener.
(c) Insert a 0.60 mm (0.024 in.) thickness gauge between the throttle stop screw and stop lever.
(d) Connect the test probe of an ohmmeter to the terminals IDL and E2 of the sensor.
(e) Gradually turn the sensor clockwise until the ohmmeter deflects, and secure it with the 2 set screws.



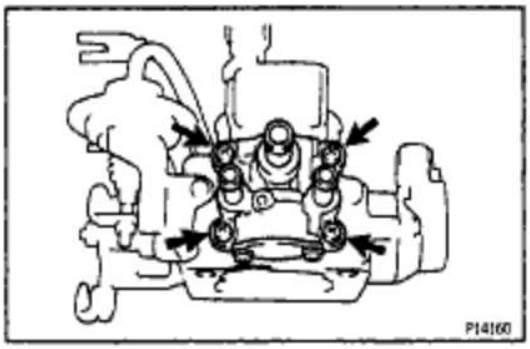



(f) Recheck the continuity between terminals IDL and E2.

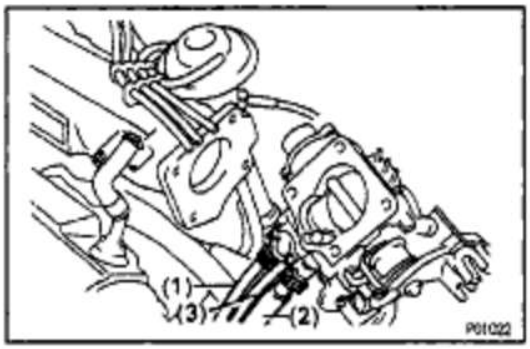
| Clearance between lever and stop screw | Continuity (IDL – E2) |
|---|---|
| 0.50 mm (0.020 in.) | Continuity |
| 0.70 mm (0.028 in.) | No continuity |



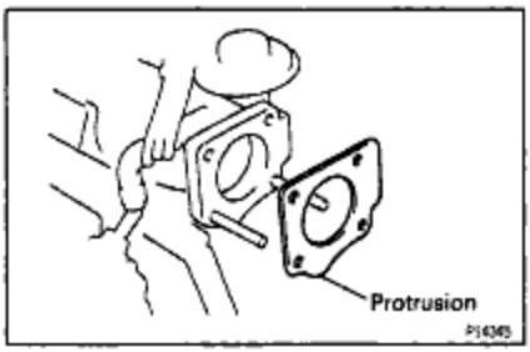

**THROTTLE BODY INSTALLATION**
**(See Components for Removal and Installation)**
**1. INSTALL IAC VALVE TO THROTTLE BODY**
(a) Place a new gasket on the throttle body.



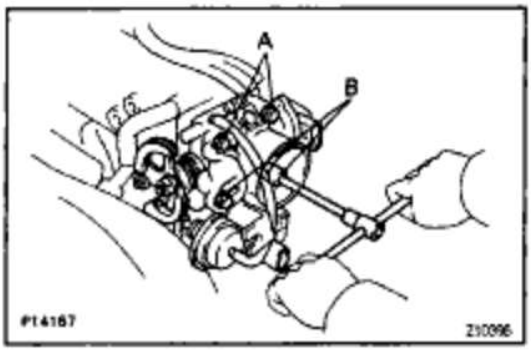

(b) install the IAC valve with the 4 screws.



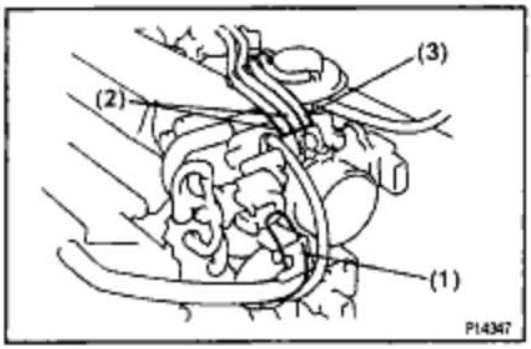

**2. INSTALL THROTTLE BODY**
(a) Connect the following hoses to the throttle body:
(1) Water bypass hose from water outlet
(2) Water bypass hose from water bypass pipe
(3) California:
Air hose from cylinder head
Except California:
Air hose from air tube



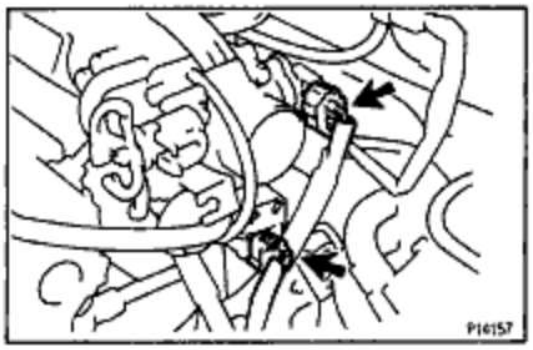

(b) Place a new gasket on the intake chamber, facing the protrusion downward.



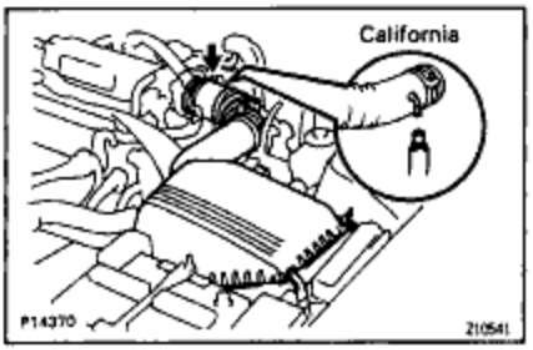

(c) Type A:
Install the throttle body with the 4 bolts.
**Torque: 19 N–m (195 kgf–cm, 14 ft–lbf)**
Bolt length:
A 45 mm (1.77 in.)
B 55 mm (2.17 in.)
(d) Type B:
Install the throttle body with the 2 bolts and 2 nuts.
**Torque: 19 N–m (195 kgf–cm, 14 ft–lbf)**




(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)



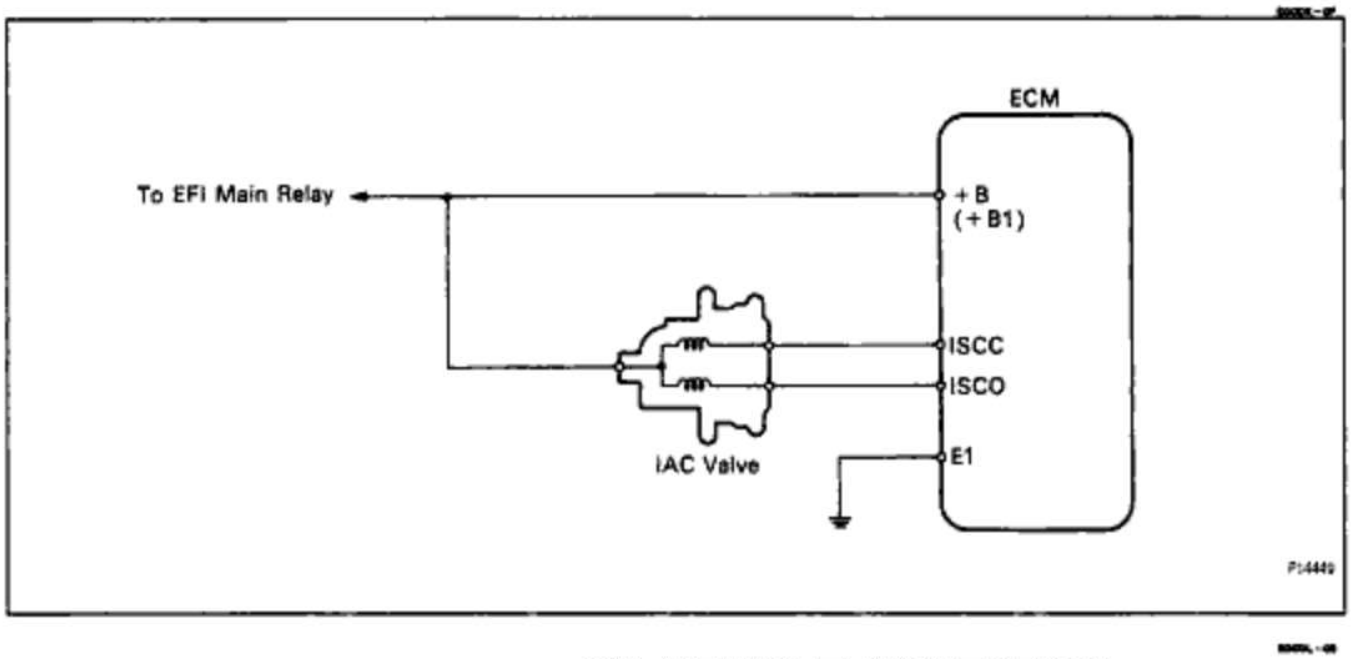

(f) Connect the IAC valve connector.
(g) Connect the throttle position sensor connector.




**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

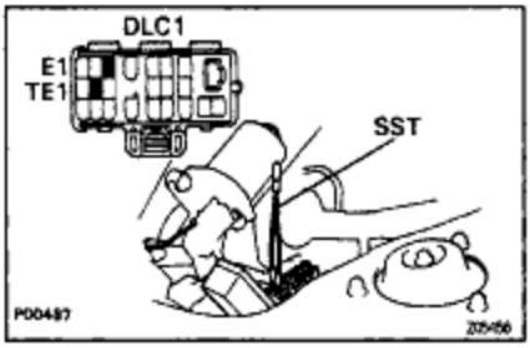



## ON–VEHICLE INSPECTION

### 1. INSPECT IAC VALVE OPERATION

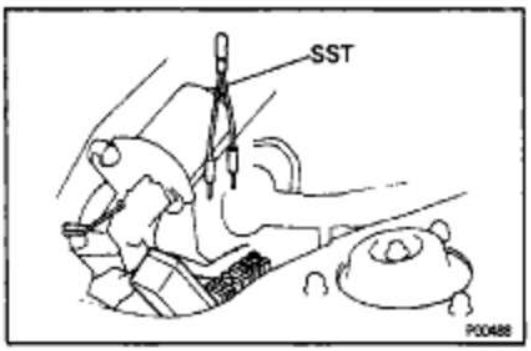
(a) Initial conditions:

- Engine at normal operating temperature
- Idle speed set correctly
- Transmission in neutral position

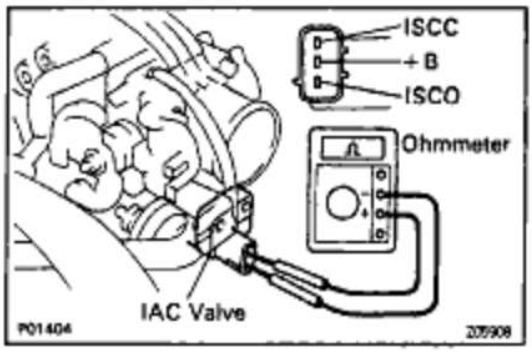



(b) Using SST, connect terminals TE1 and E1 of the data link connector 1.
SST 09843–18020

(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).

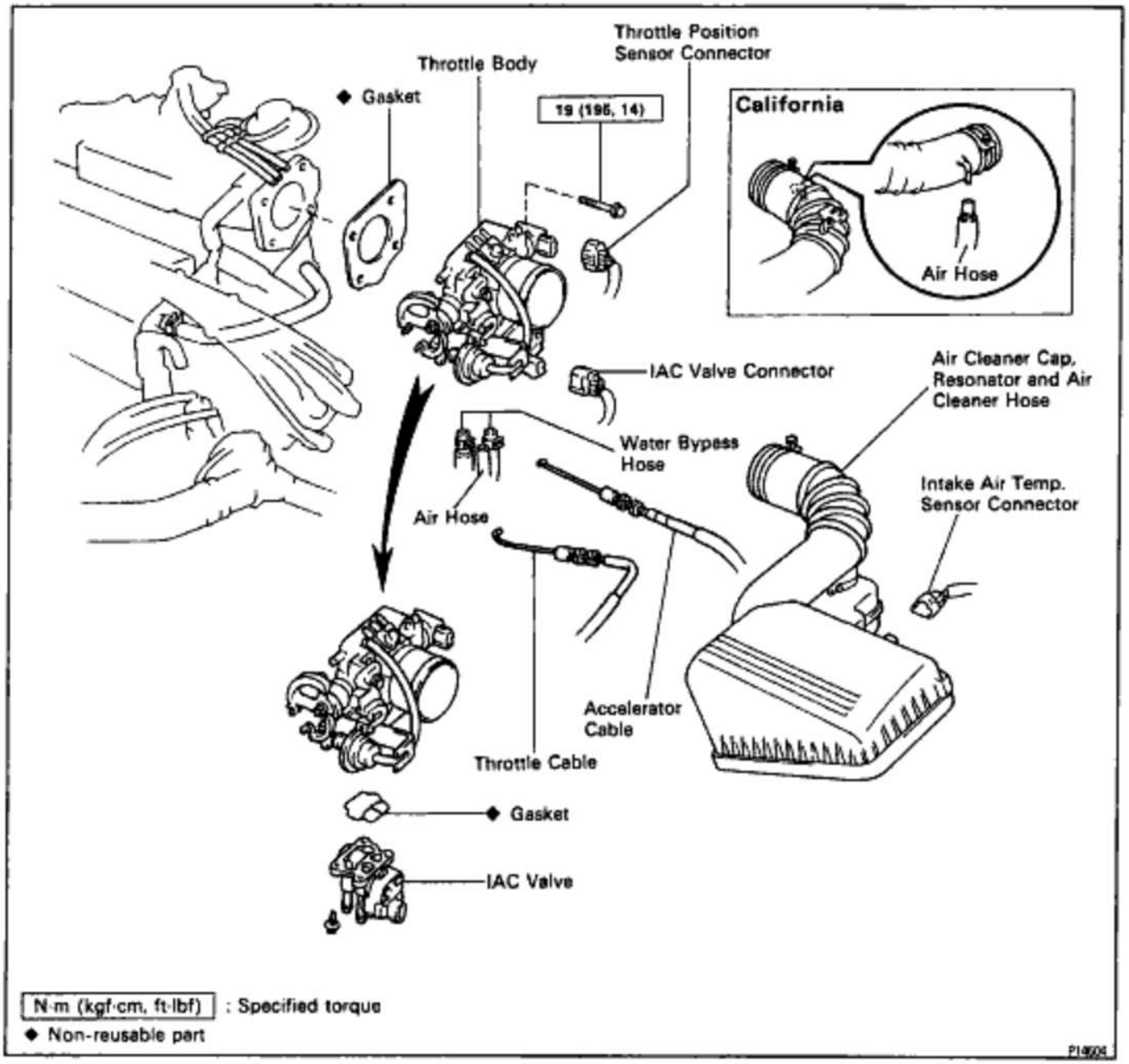
**Resistance:**

**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

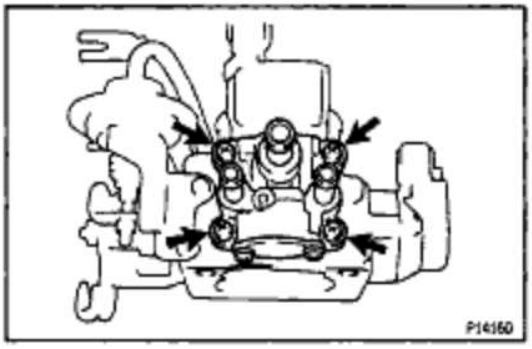


# IAC VALVE REMOVAL

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

**1. REMOVE THROTTLE BODY**

**(See steps 1 to 6 on pages EG1–207 and 208)**



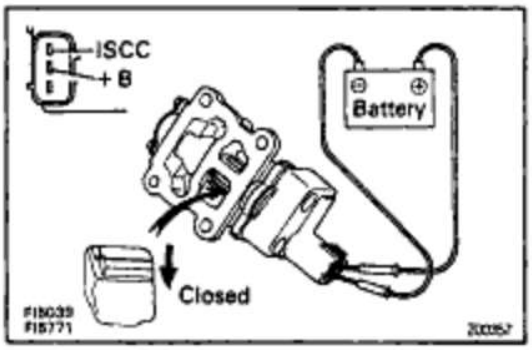

**2. REMOVE IAC VALVE**

Remove the 4 screws, IAC valve and gasket.

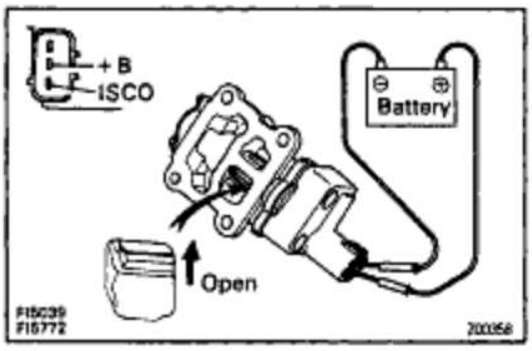
# IAC VALVE INSPECTION

**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.

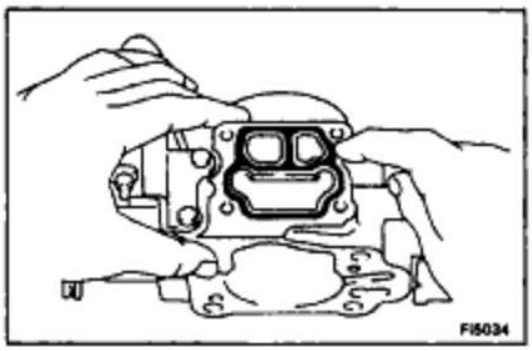


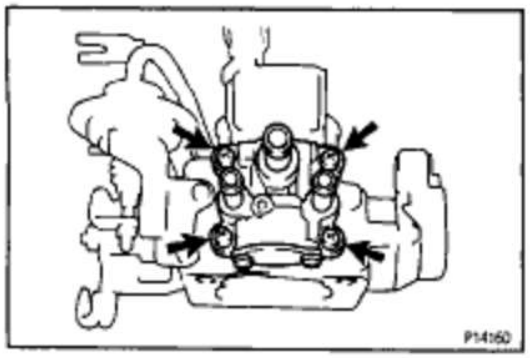

# IAC VALVE INSTALLATION

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

**1. INSTALL IAC VALVE**

(a) Place a new gasket on the throttle body.

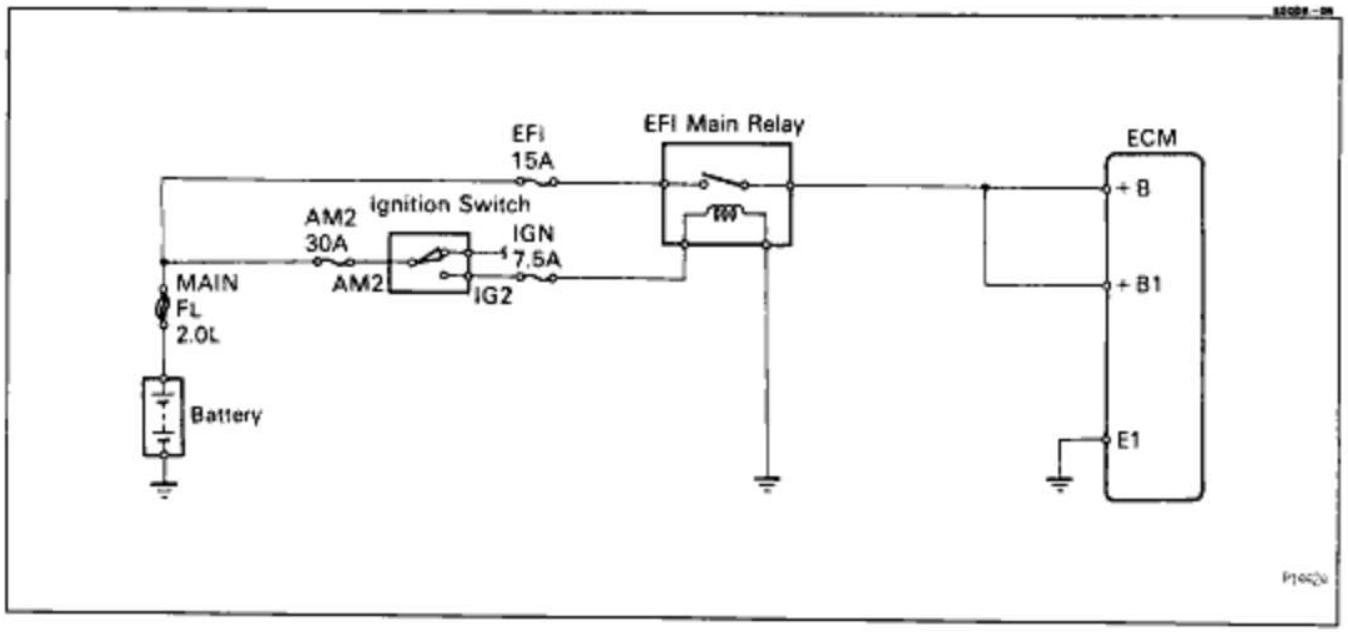


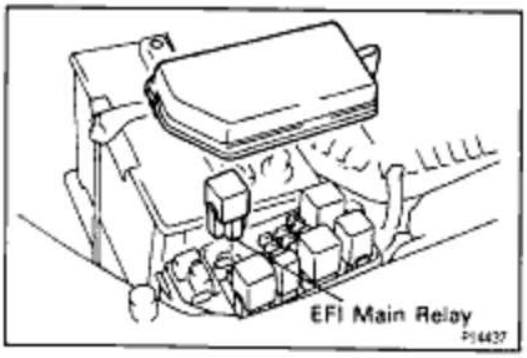



(b) Install the IAC valve with the 4 screws.

**2. INSTALL THROTTLE BODY**
**(See steps 2 to 7 on pages EG1–210 and 211)**

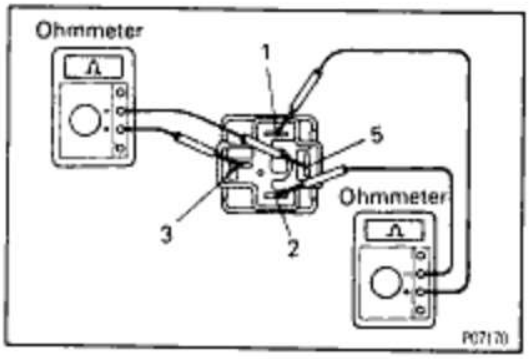
# EFI MAIN RELAY




## EFI MAIN RELAY INSPECTION

**7. REMOVE EFI MAIN RELAY**



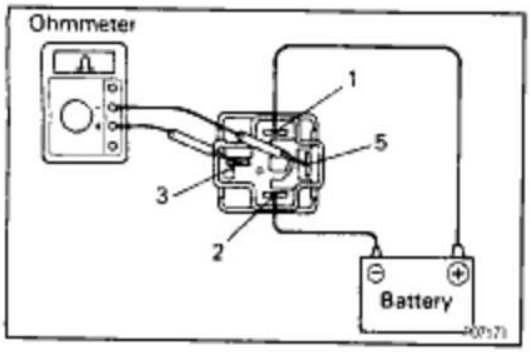

**2. INSPECT EFI MAIN RELAY**

**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**

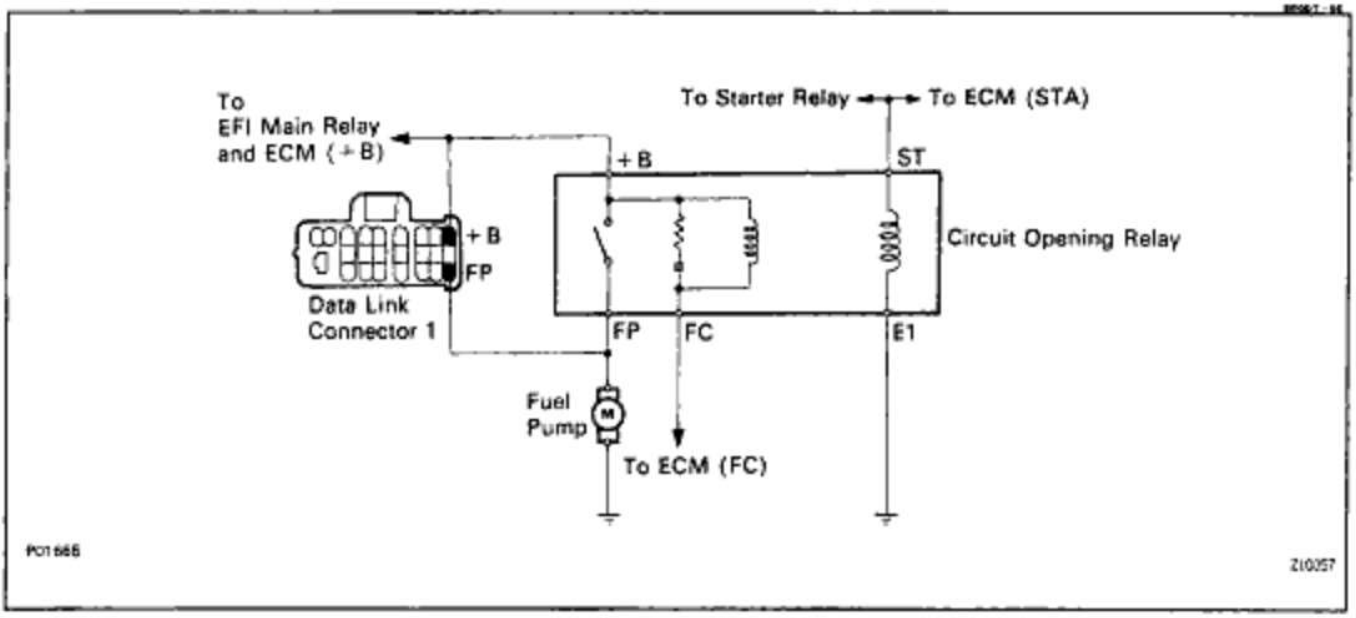
(a) Apply battery voltage across terminals 1 and 2.

(b) Using an ohmmeter, check that there is continuity between terminals 3 and 5.

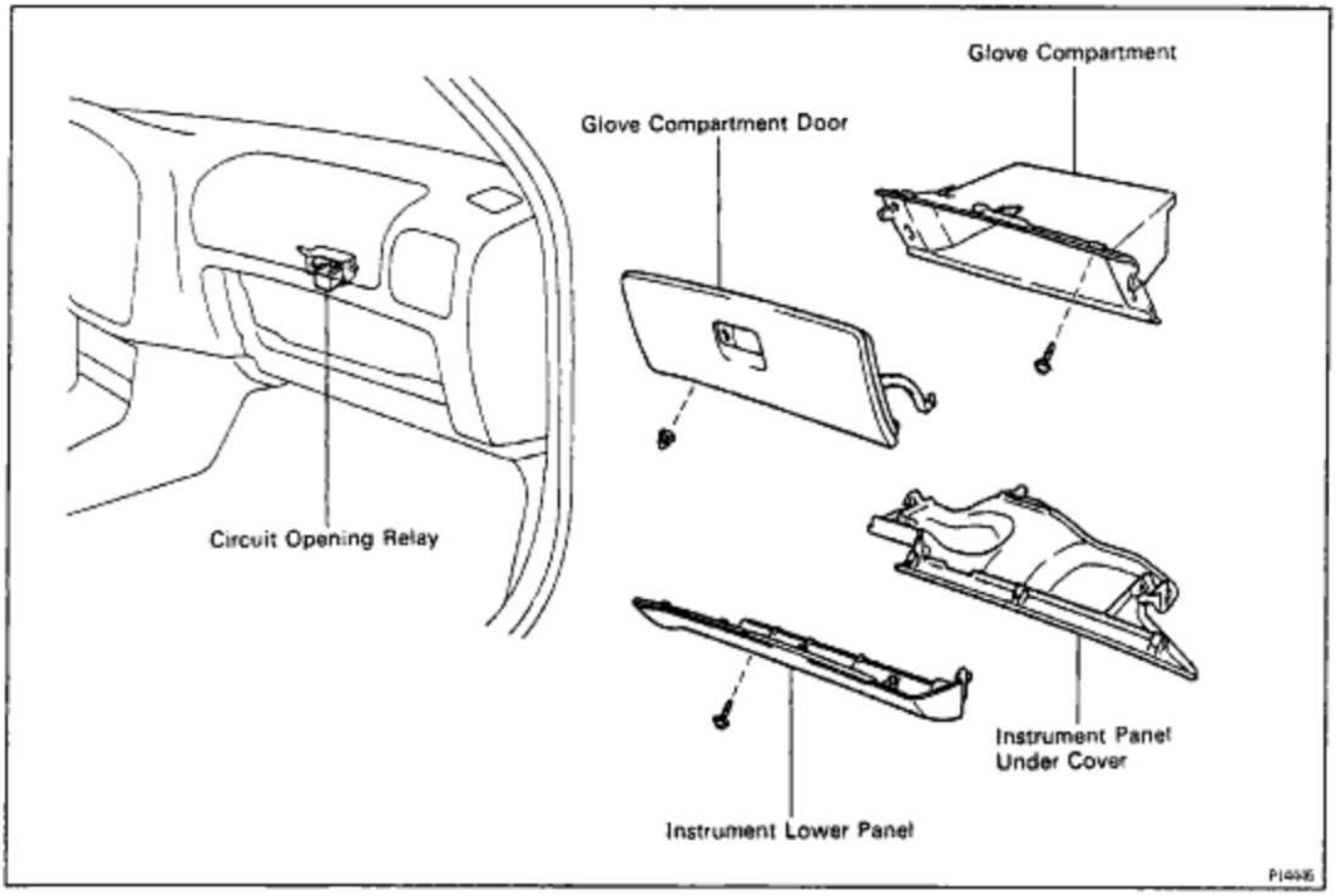
If operation is not as specified, replace the relay.

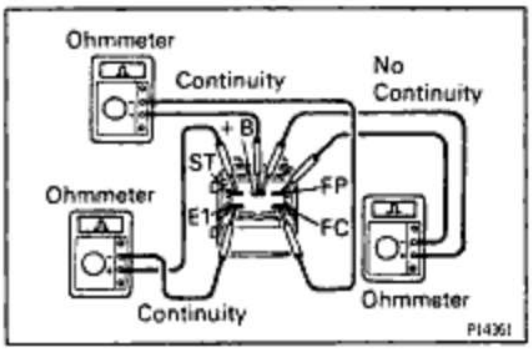
**3. REINSTALL EFI MAIN RELAY**

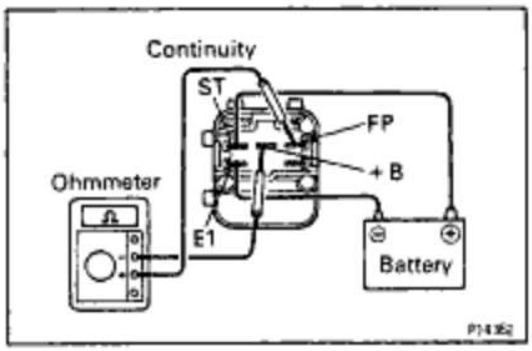
# CIRCUIT OPENING RELAY




# 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.

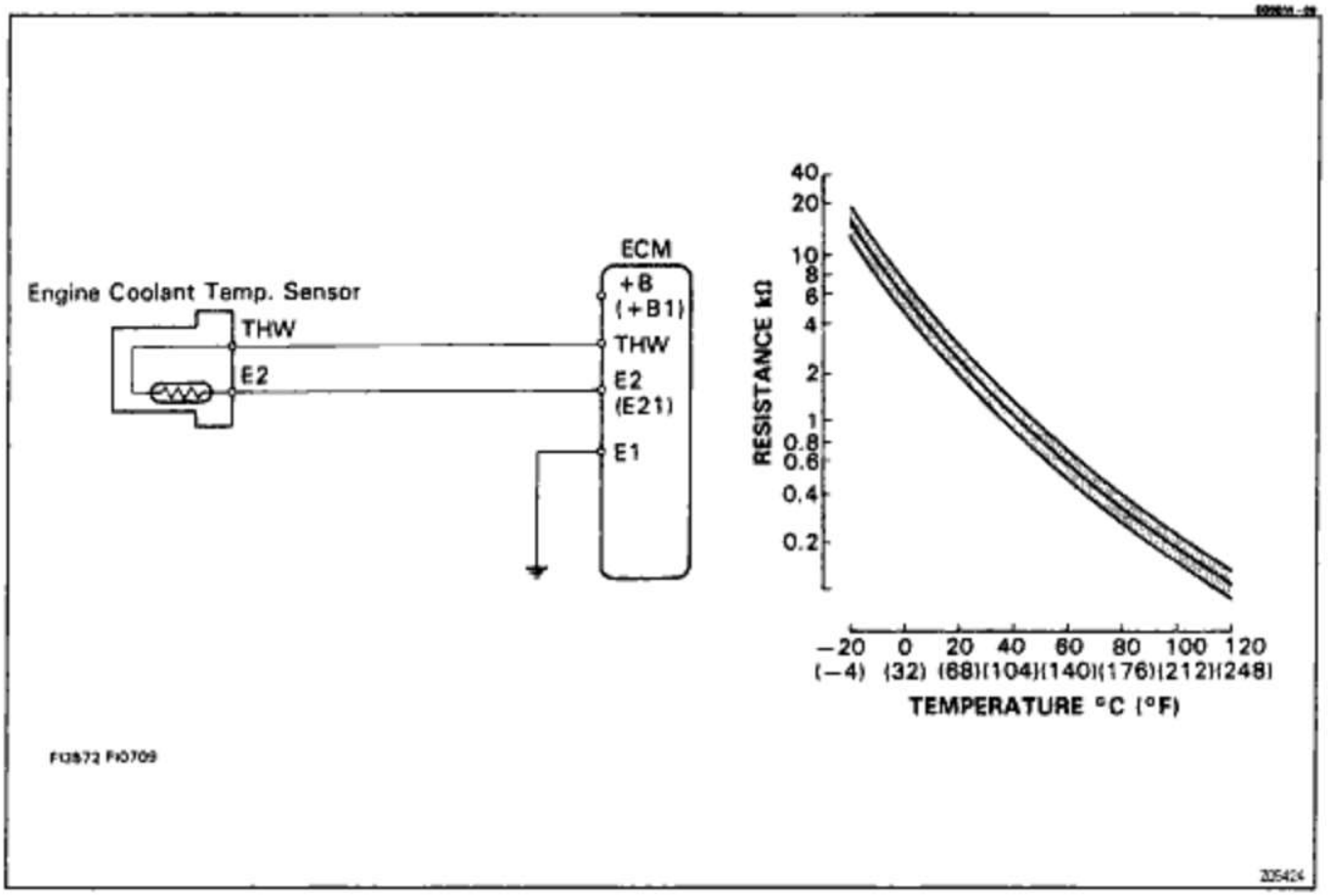
**2. INSPECT RELAY OPERATION**

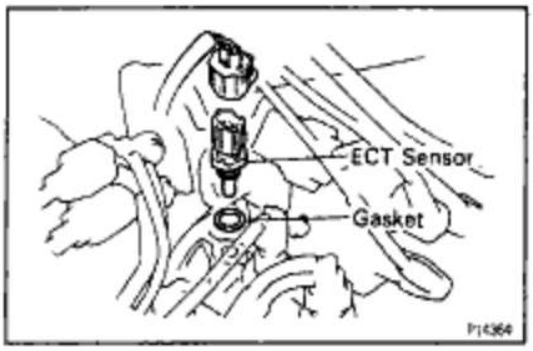
(a) Apply battery voltage across terminals ST and E1.

(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

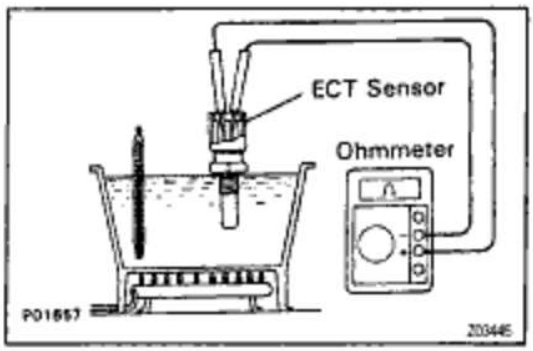



## ECT SENSOR INSPECTION

**1. DRAIN ENGINE COOLANT**

**2. REMOVE ECT SENSOR**




**3. INSPECT ECT SENSOR RESISTANCE**

Using an ohmmeter, measure the resistance between the terminals.

**Resistance:**

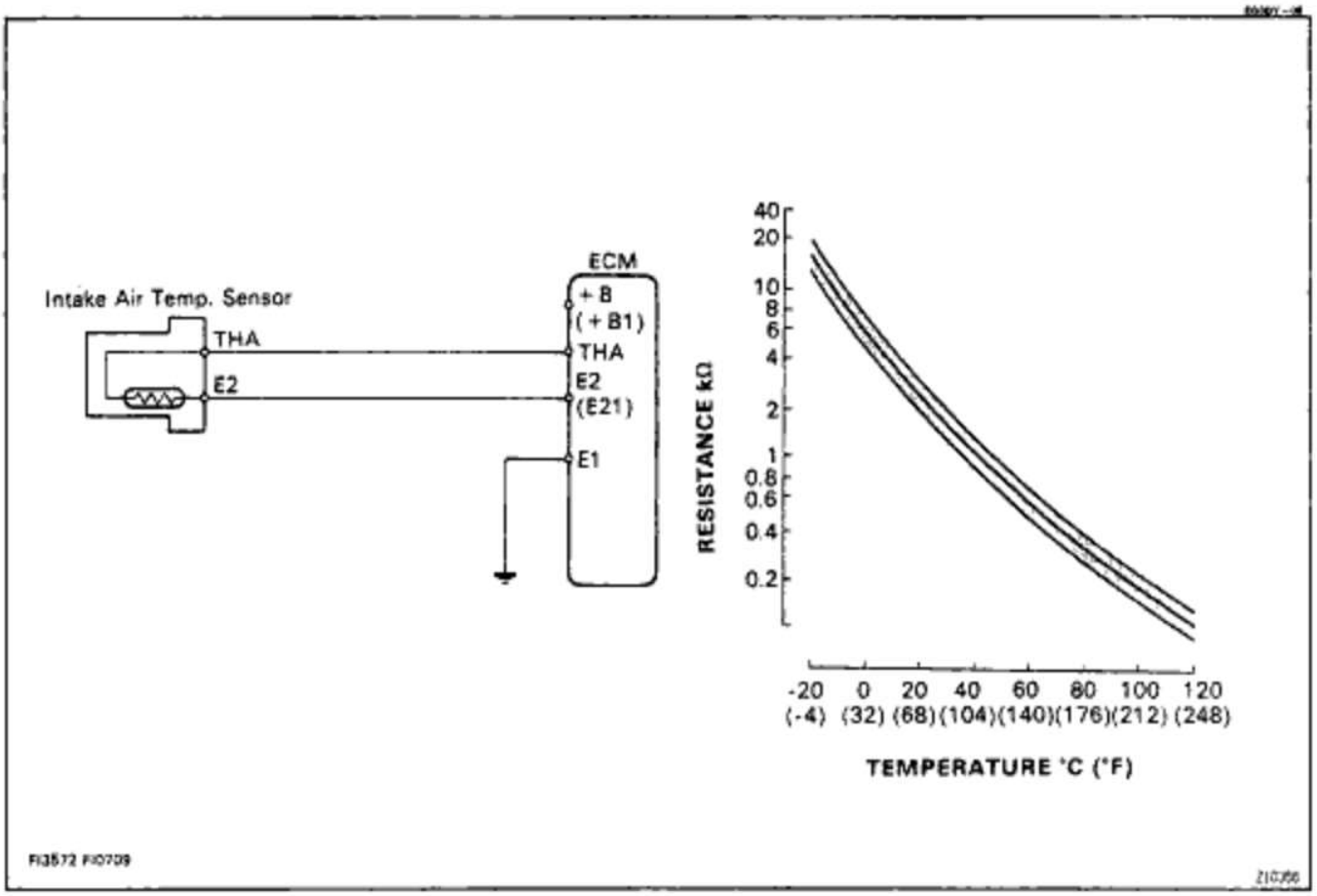
**Refer to the graph above**

If the resistance is not as specified, replace the sensor.

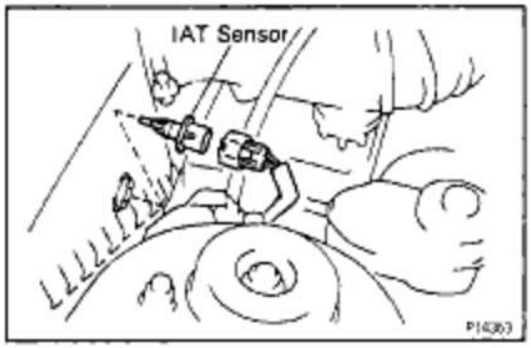
**4. REINSTALL ECT SENSOR**

**5. FILL WITH ENGINE COOLANT**

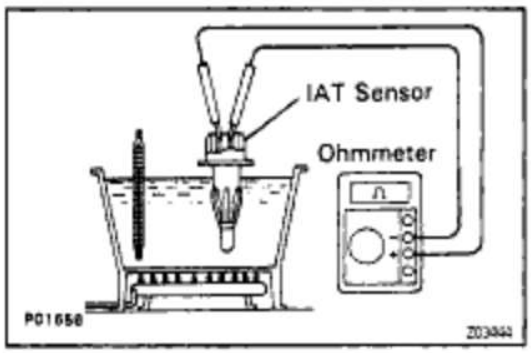
# INTAKE AIR TEMPERATURE (IAT) SENSOR




## IAT SENSOR INSPECTION




**1. REMOVE IAT SENSOR**




**2. INSPECT IAT SENSOR RESISTANCE**

Using an ohmmeter, measure the resistance between the terminals.

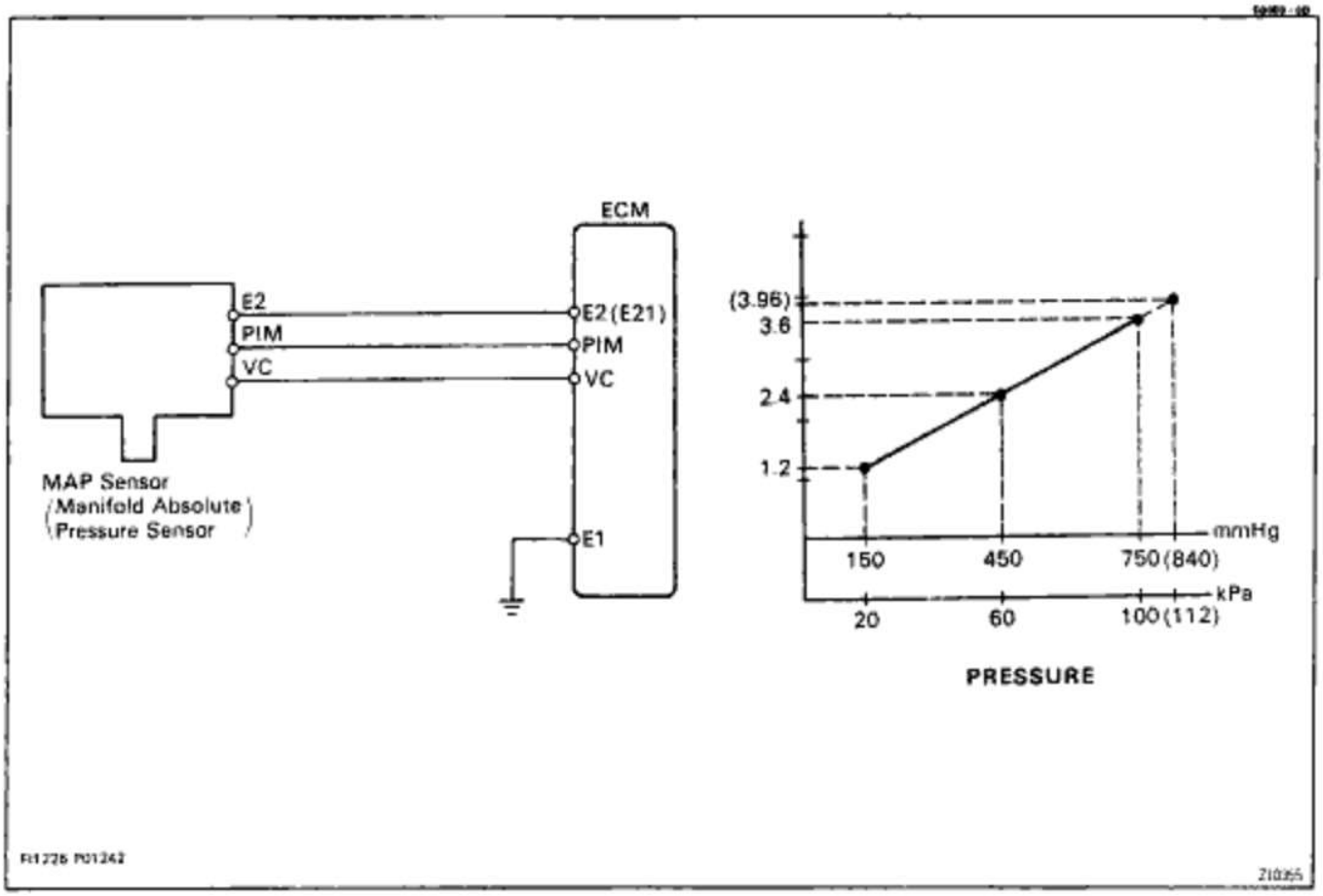
**Resistance:**

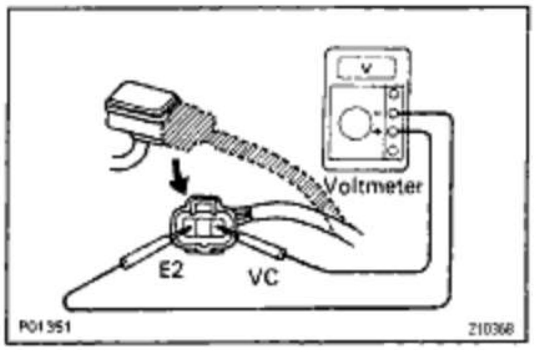
**Refer to the graph above**

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.

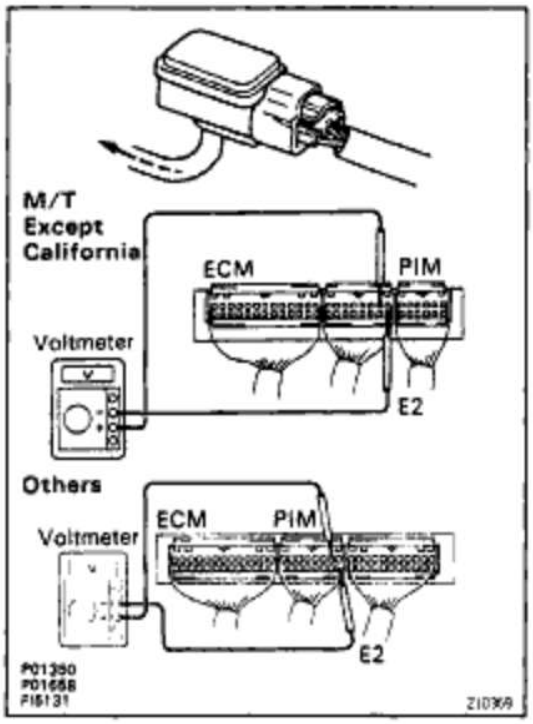
(b) Turn the ignition switch ON.

(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 chamber side.

(c) Connect a voltmeter to terminals PIM and E2 of the ECM, and measure the output voltage under ambient atmospheric pressure.

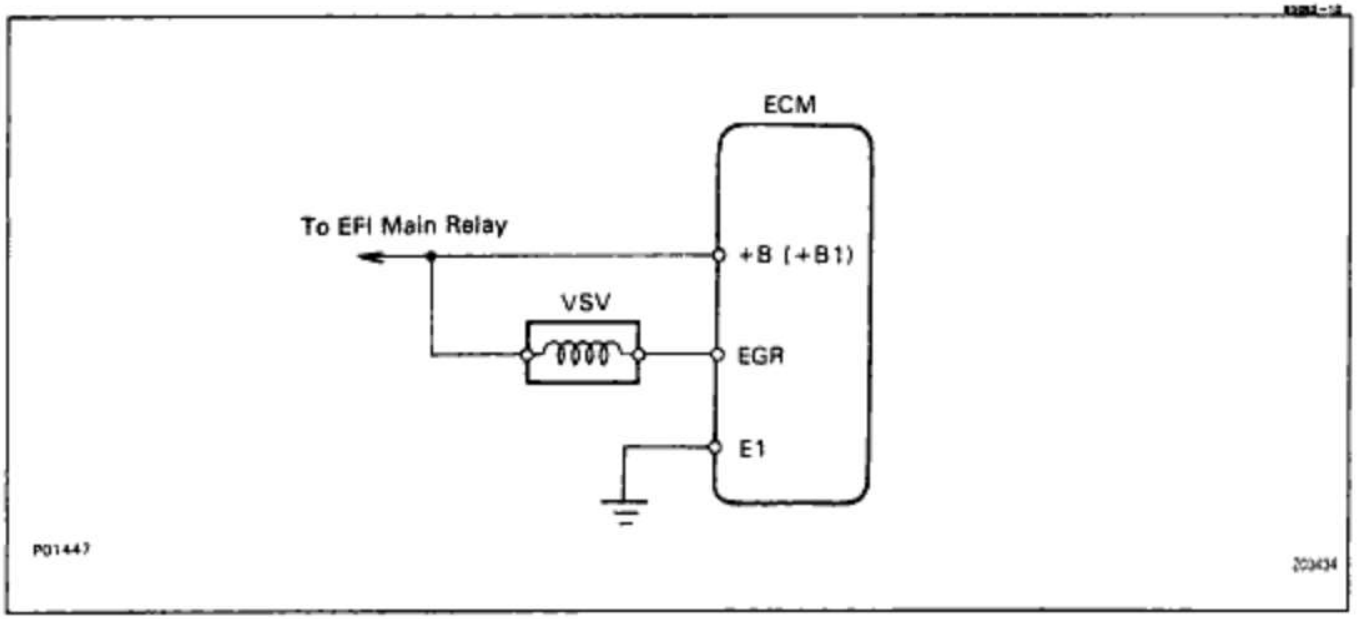
(d) Apply vacuum to the MAP sensor in 13.3 kPa (100 mmHg, 3.94 in.Hg) segments to 66.7 kPa (500 mmHg, 19.69 in.Hg).

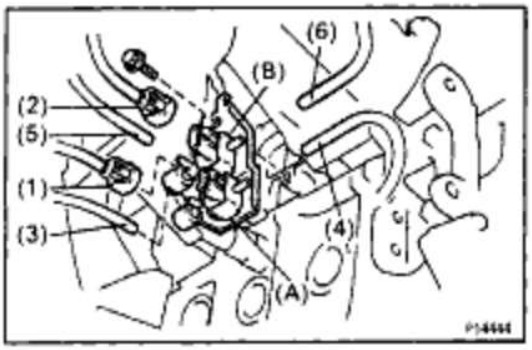
(e) Measure the voltage drop from step (c) above for each segment.

**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 |

# VSV FOR EGR



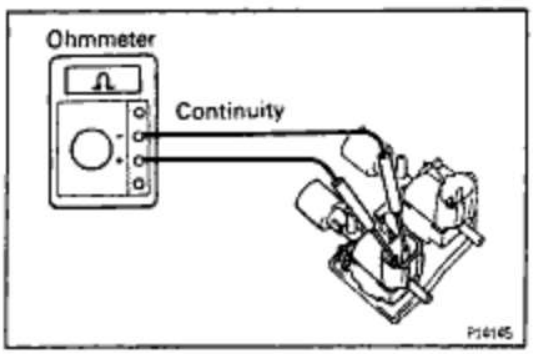




## VSV INSPECTION (California)

**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**

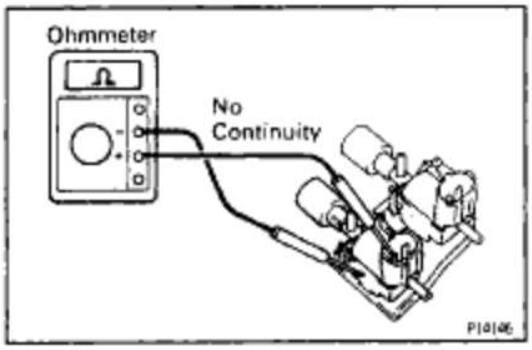
**A. Inspect VSV for open circuit**

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

**Resistance (Cold):**

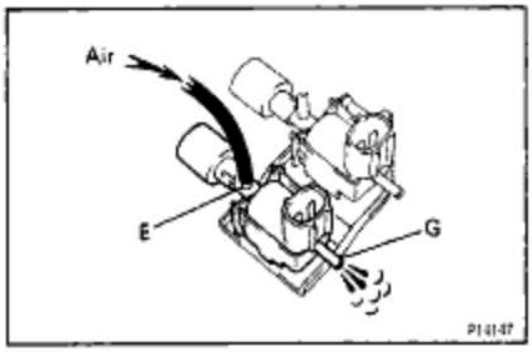
**33–39Ω**

If there is no continuity, replace the VSV.



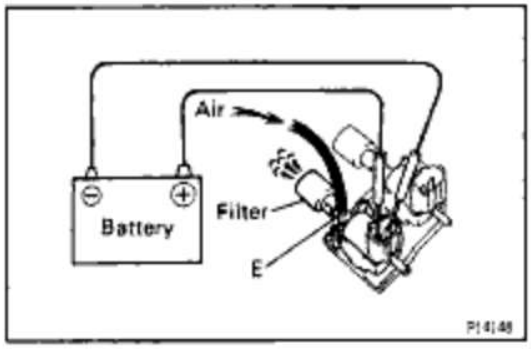

**B. Inspect VSV for ground**

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



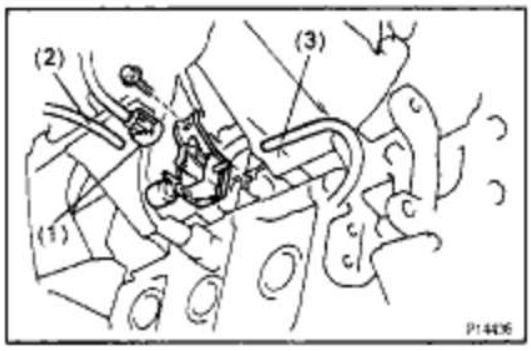

**C. Inspect VSV operation**

(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**

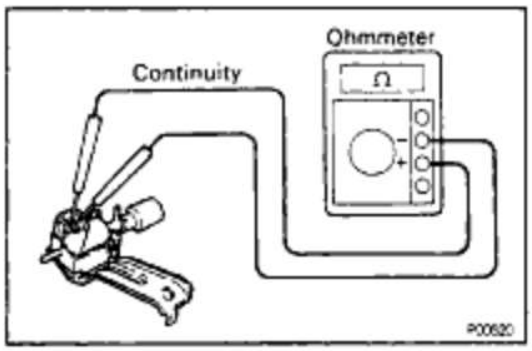
A. Inspect VSV for open circuit

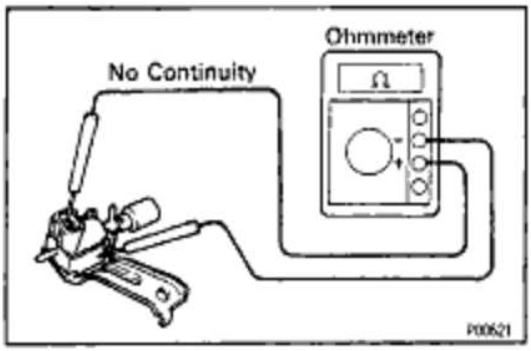
Using an ohmmeter, check that there is continuity between the terminals.

**Resistance (Cold):**

**33–39Ω**

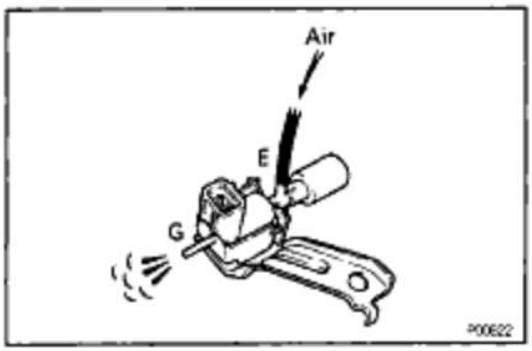
If there is no continuity, replace the VSV.





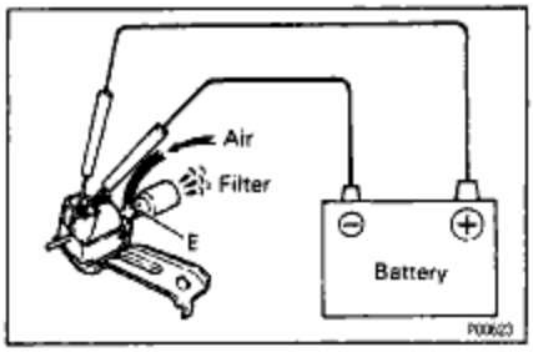

**B. Inspect VSV for ground**

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**

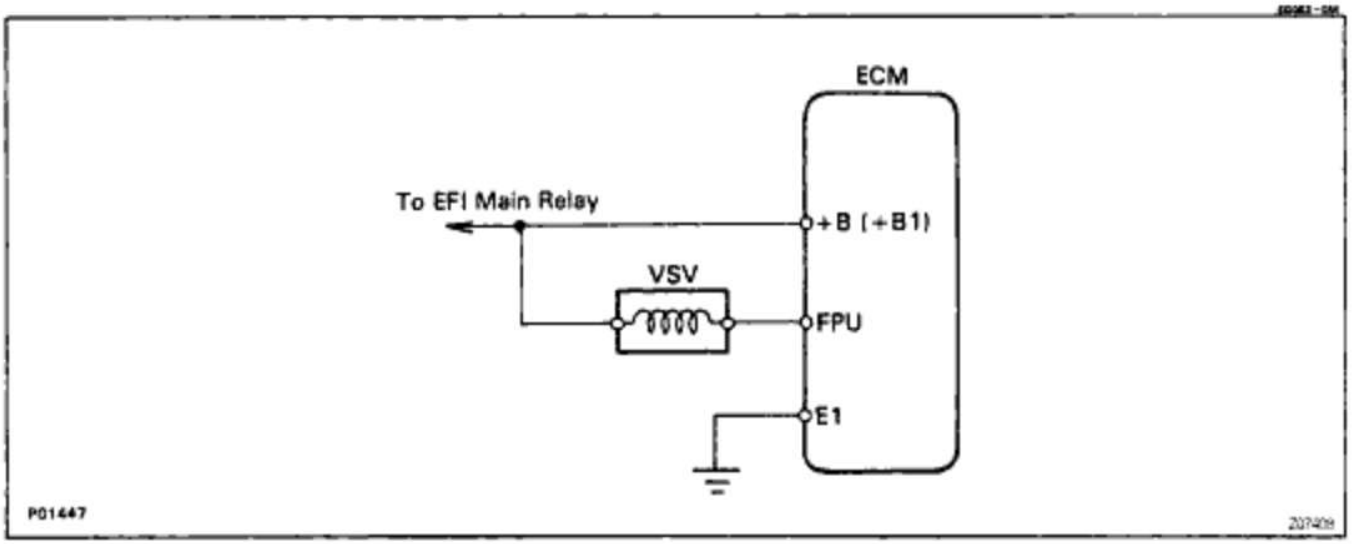
(a) Check that air flows from port E to port G.

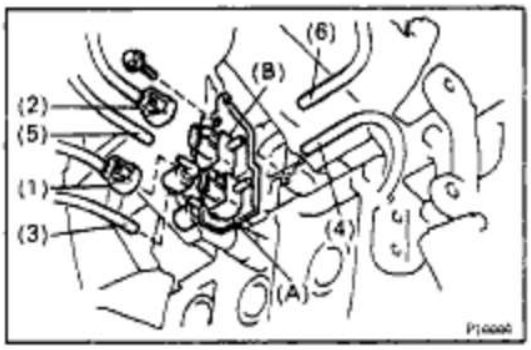



(b) Apply battery voltage across the terminals.
(c) Check that air flows from port E to the filter.
If operation is not as specified, replace the VSV.

**3. REINSTALL VSV**

# VSV FOR FUEL PRESSURE CONTROL (California only)



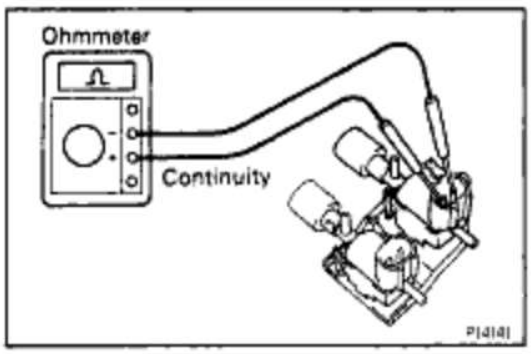




## VSV INSPECTION

**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**

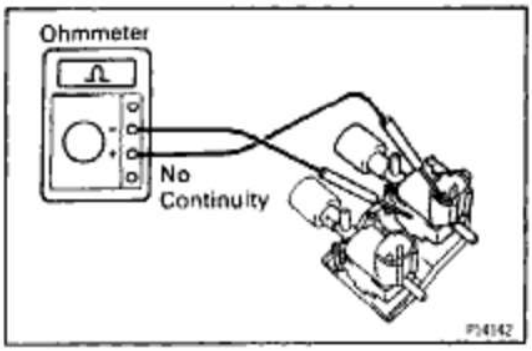
**A. Inspect VSV for open circuit**

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

**Resistance (Cold):**

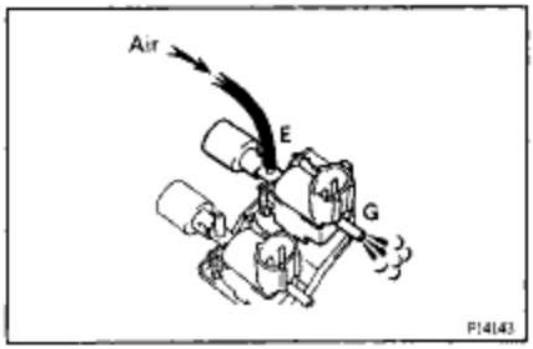
**33–39Ω**

If there is no continuity, replace the VSV.



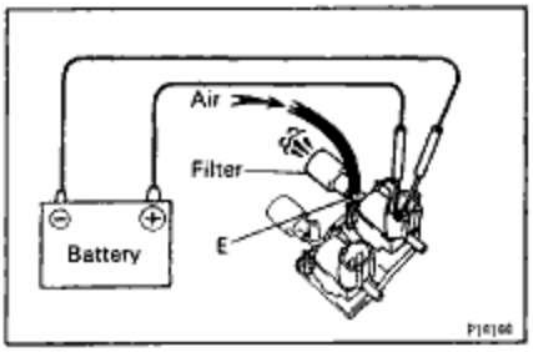

**B. Inspect VSV for ground**

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**

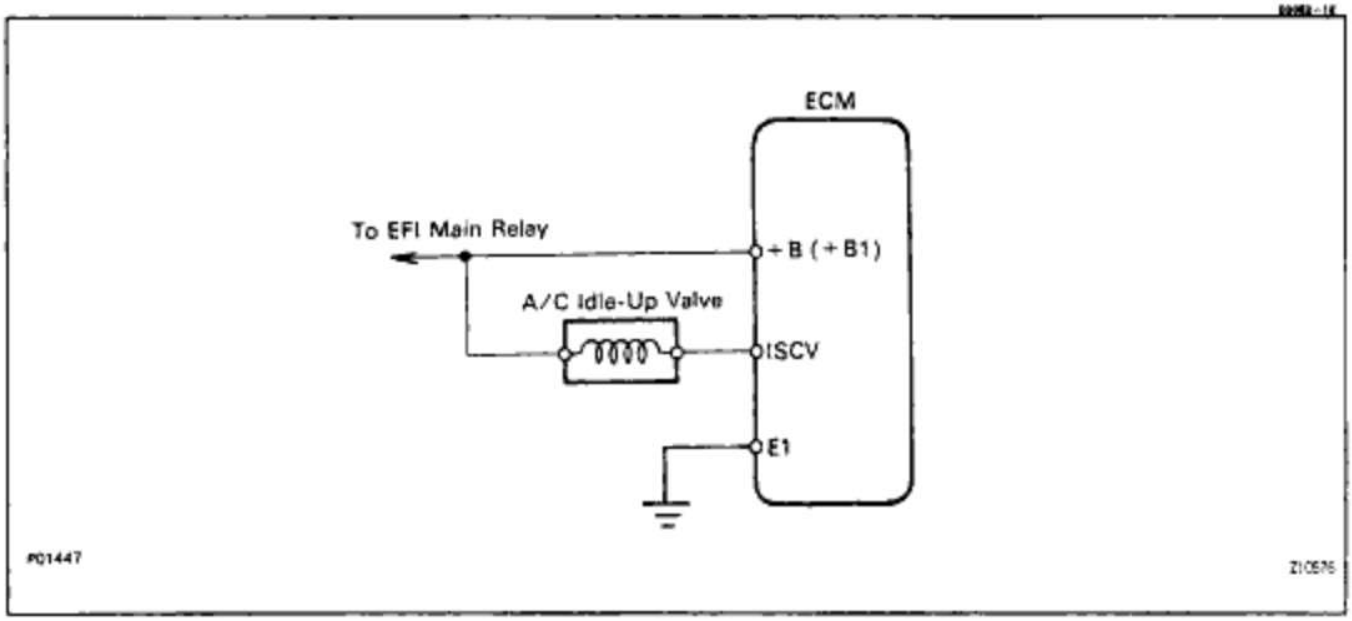
(a) Check that air flows from pipe E to pipe G.

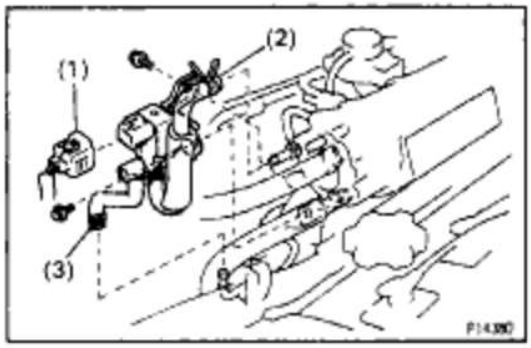



(b) Apply battery voltage across the terminals.
(c) Check that air flows from pipe E to the filter.
If operation is not as specified, replace the VSV.

**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**

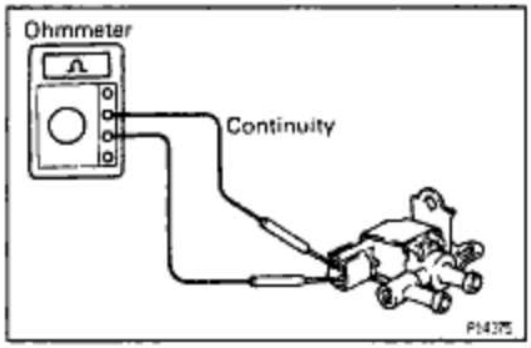
**A. Inspect idle–up valve for open circuit**

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

**Resistance (Cold):**

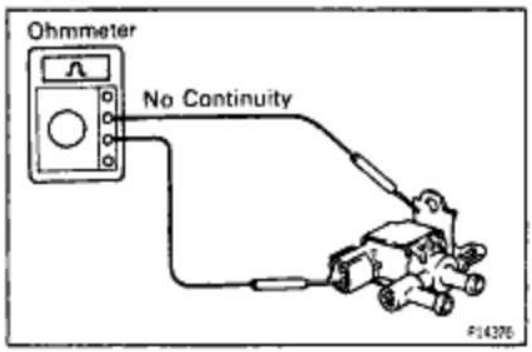
**30–34Ω**

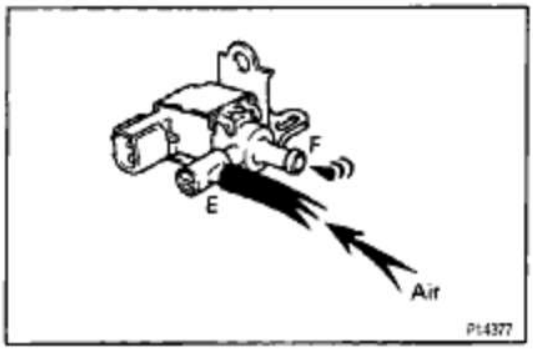
If there is no continuity, replace the idle–up valve.




**B. Inspect idle–up valve for ground**

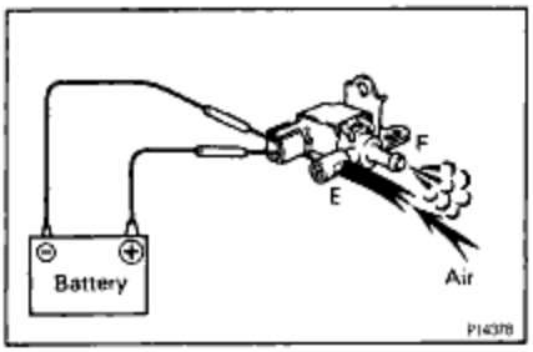
Using an ohmmeter, check that there is no continuity between each terminal and the body.
If there is continuity, replace the idle–up valve.






**C. Inspect idle–up valve operation**

(a) Check that air does not flow from port E to port F.



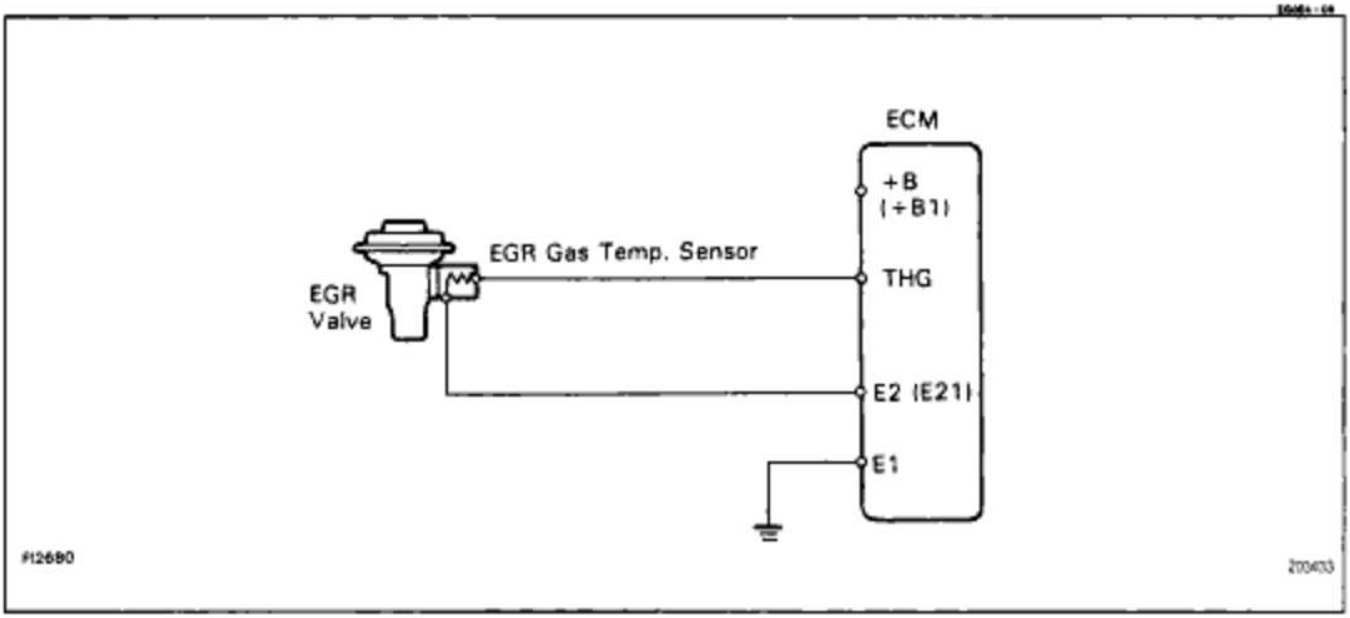

(b) Apply battery voltage across the terminals.

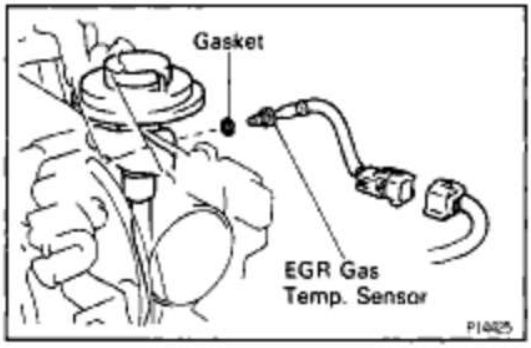
(c) Check that air flows from port E to port F.

If operation is not as specified, replace the idle–up valve.

**3. REINSTALL IDLE– UP VALVE**

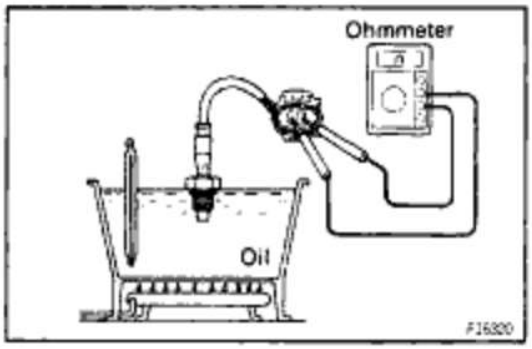
# EGR GAS TEMPERATURE SENSOR




## EGR GAS TEMPERATURE SENSOR INSPECTION

### 1. REMOVE EGR GAS TEMPERATURE SENSOR




### 2. INSPECT EGR GAS TEMPERATURE SENSOR

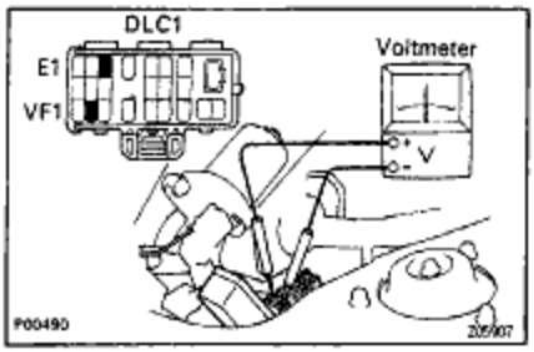
Using an ohmmeter, measure the resistance between the terminals.

**Resistance:**

**64–97 kΩ at 501C (1221F)**
**11–16 kΩ at 1001C (2121F)**
**2–4 kΩ at 1501C (3021F)**

If the resistance is not as specified, replace the sensor.

### 3. REINSTALL EGR GAS TEMPERATURE SENSOR




# OXYGEN SENSOR

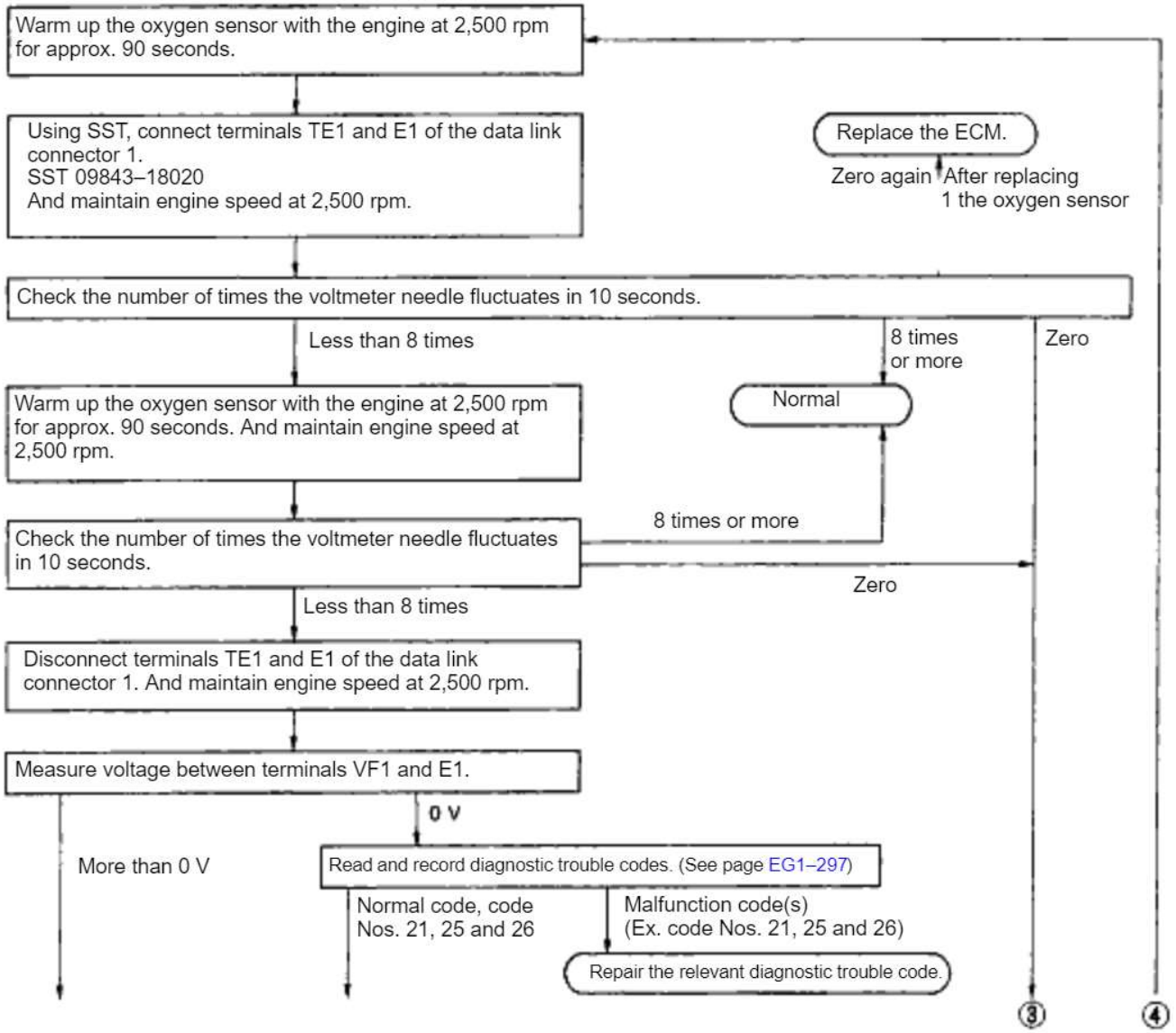
## OXYGEN SENSOR INSPECTION

### 1. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.

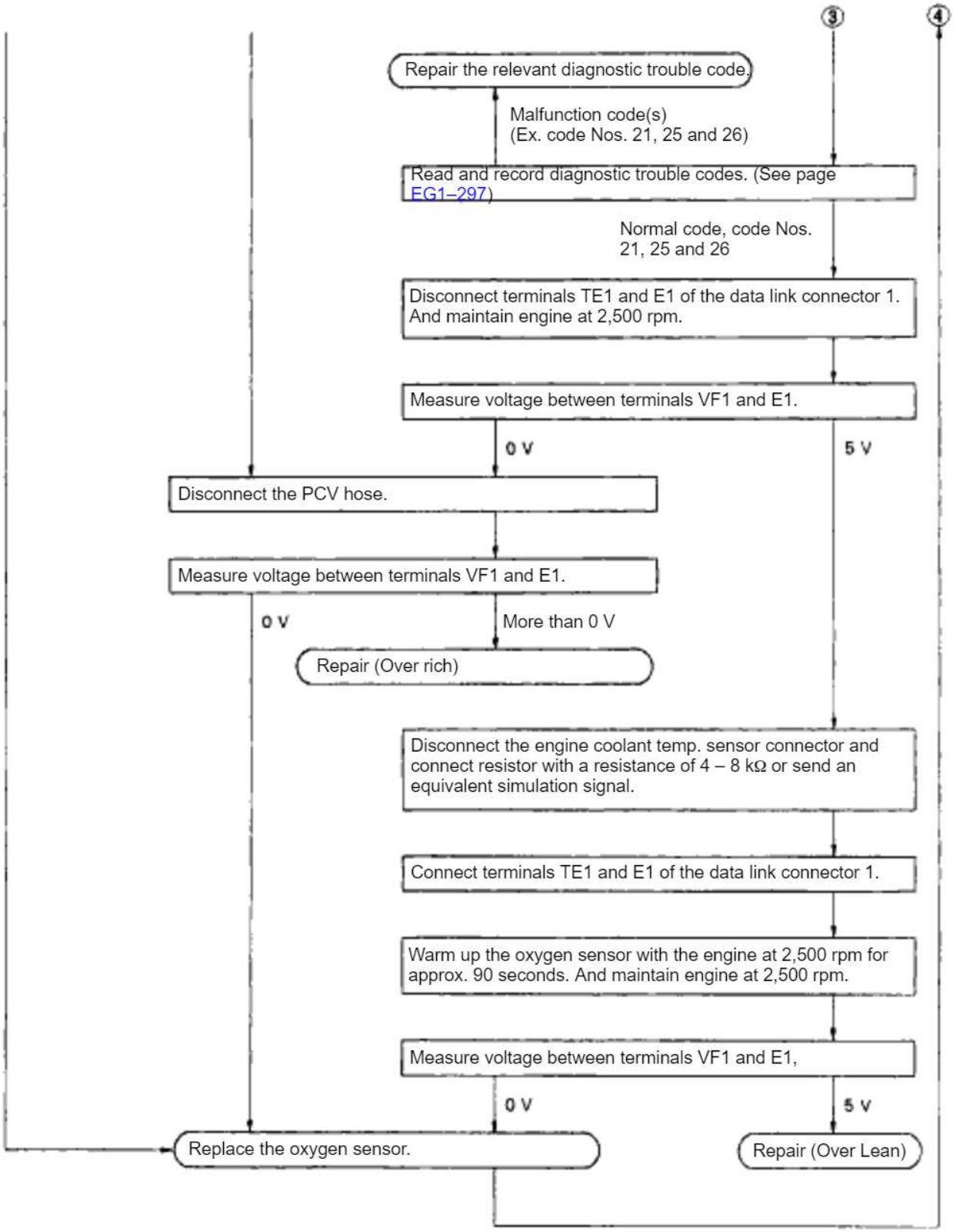
### 2. INSPECT FEEDBACK VOLTAGE

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



# 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.

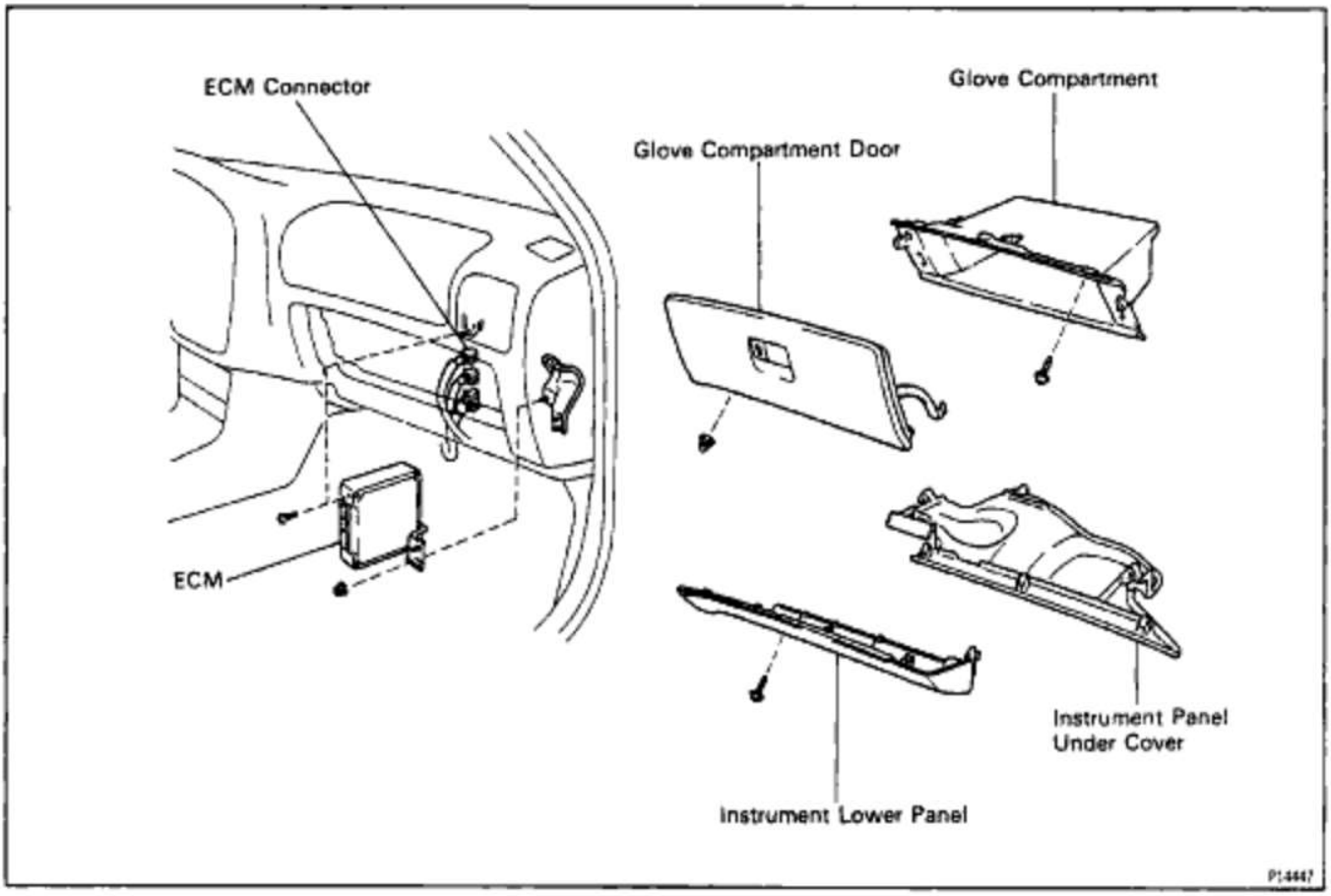
(d) Following the conditions in step (c), fully depress on the accelerator pedal for 2 seconds or more.

(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

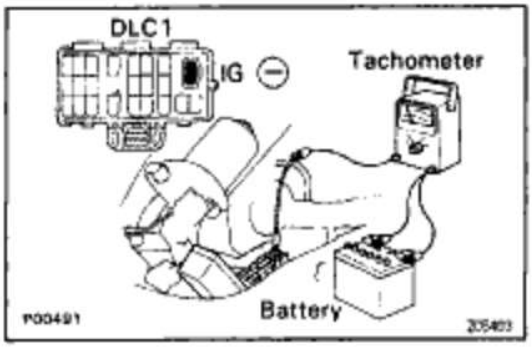
(See page EG1–318)

# FUEL CUT RPM

## FUEL CUT RPM INSPECTION

### 1. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.

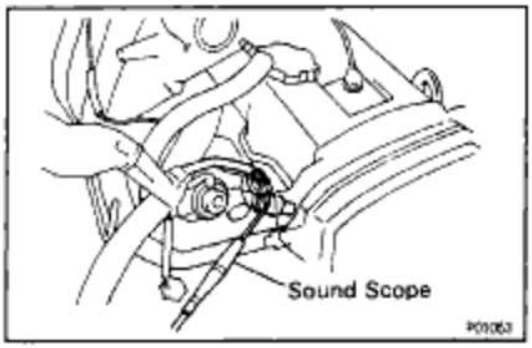



### 2. CONNECT TACHOMETER TO ENGINE

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 |