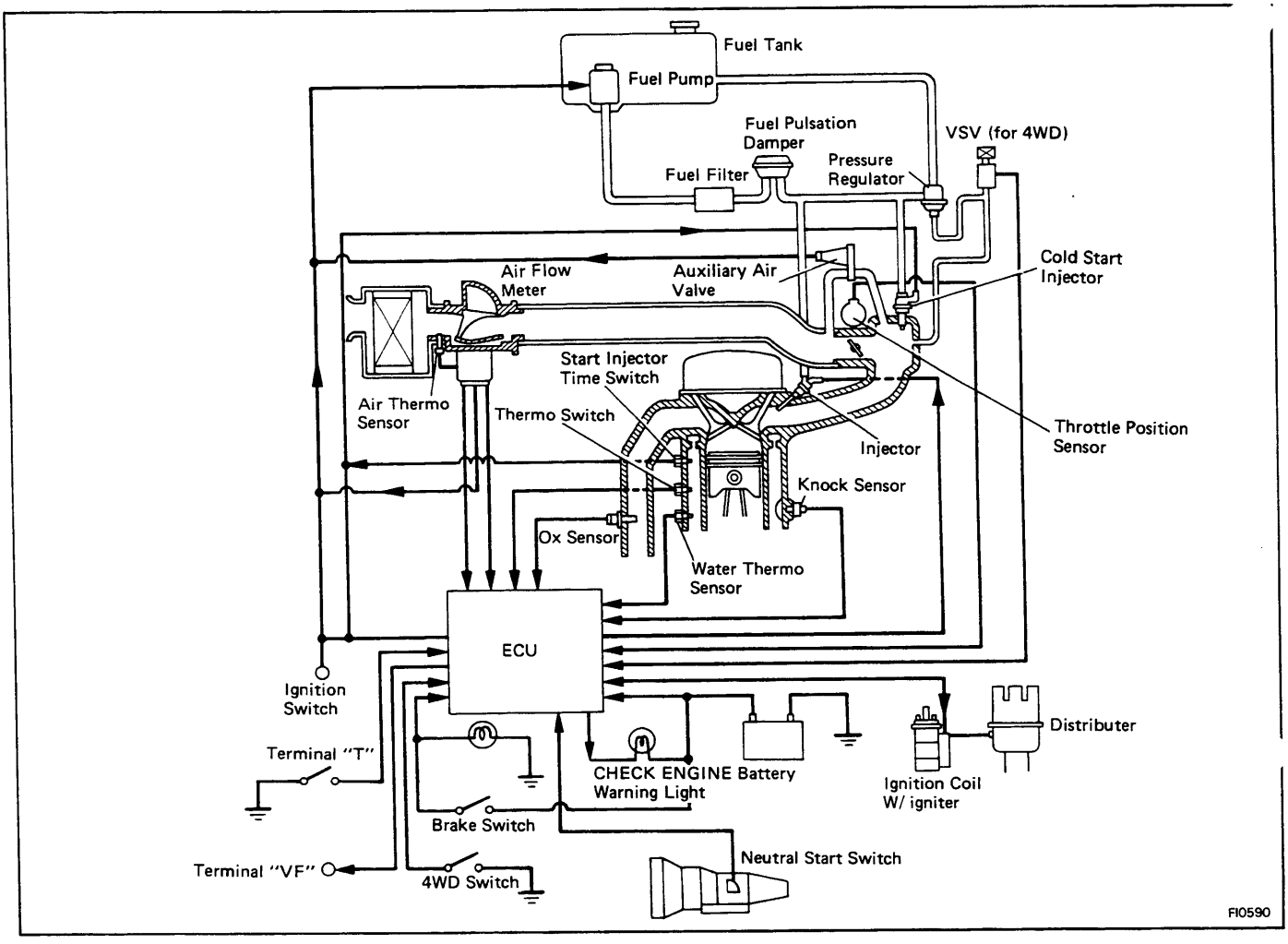
EFI SYSTEM

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SYSTEM DESCRIPTION



The EFI used on Toyotas has three basic systems.

FUEL SYSTEM

An electric fuel pump supplies sufficient fuel, under a constant pressure, to the EFI injectors.
These injectors inject a metered quantity of fuel into the intake manifold in accordance with signals from the ECU. Each injector injects, at the same time, one half of the fuel required for ideal combustion with each engine revolution.

AIR INDUCTION SYSTEM

The air induction system provides sufficient air for engine operation.

ELECTRONIC CONTROL SYSTEM

The 22R-EC engine is equipped with a Toyota Computer Control System (TCCS) which centrally controls the EFI, ESA, Diagnosis systems, etc. by means of an Electronic Control Unit (ECU — formerly EFI computer) employing a microcomputer.

By means of the ECU, the TCCS controls the following functions:

1. Electronic Fuel Injection (EFI)

   The ECU receives signals from various sensors indicating changing engine operation conditions such as:

   Intake air volume
   Intake air temperature
   Coolant temperature
   Engine rpm
   Acceleration/deceleration
   Exhaust Ox content etc.

   These signals are utilized by the ECU to determine the injection duration necessary for an optimum air-fuel ratio.

2. Electronic Spark Advance (ESA)

   The ECU is programmed with data for optimum ignition timing under any and all operating conditions. Using data provided by sensors which monitor various engine functions (rpm, intake air volume coolant temperature, etc.), the microcomputer (ECU) triggers the spark at precisely the right instant.
   (See IG section)

3. Diagnostics

   The ECU detects any malfunctions or abnormalities in the sensor network and lights a "CHECK ENGINE" warning light on the instrument panel. At the same time, the trouble is identified and a diagnostic code is recorded by the ECU. There are 12 different diagnostic codes, including "normal operation" and these can be confirmed by use of an analog voltmeter.
   (See page FI-22)

4. Fail-Safe Function

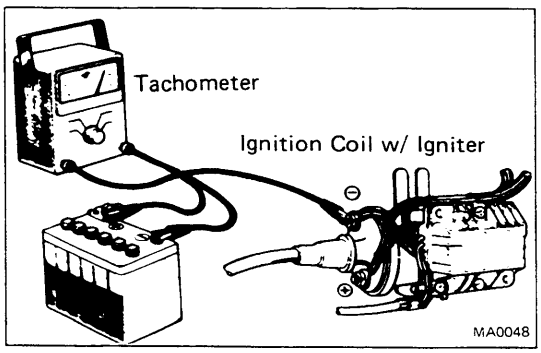
   In the event of ECU malfunction, a back-up circuit will take over to provide minimal drivability. Simultaneously, the "CHECK ENGINE" warning light is activated.

PRECAUTIONS

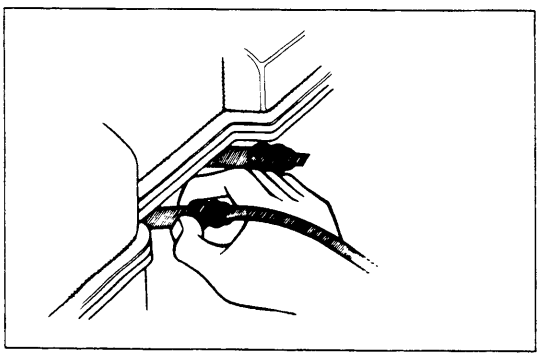
1. **Before working on the fuel system, disconnect the nega terminal from the battery.**

   NOTE: Any diagnosis code retained by the computer will be cleared when the battery terminal is removed. Therefore, if necessary, read the diagnosis before removing the battery terminal.

2. **When working on the fuel system, do not smoke or work near any fire hazard.**



3. **Keep gasoline off rubber or leather parts.**



INSPECTION PRECAUTIONS

MAINTENANCE PRECAUTIONS

1. **INSURE CORRECT ENGINE TUNE-UP**

2. **PRECAUTIONS WHEN CONNECTING GAUGE**
   (a) Connect the tachometer (+) terminal to the ignition (—) terminal.
   (b) Use the battery as the power source for the timing light, tachometer, etc.

3. **IN EVENT OF ENGINE MISFIRE, THE CATALYTIC CONVERTER MAY OVERHEAT. THEREFORE, THE FOLLOWING PRECAUTIONS SHOULD BE TAKEN**
   (a) Insure correct drive belt adjustment.
   (b) Insure proper connection of battery terminals, etc.
   (c) Handle high-tension wires carefully.
   (d) After repair work, insure that the ignition coil terminals and all other ignition system lines are reconnected securely.
   When cleaning the engine compartment, be especially careful to protect the electrical system from water.

4. **PRECAUTIONS WHEN HANDLING Ox SENSOR**
   (a) Do not allow Ox sensor to receive an impact.
   (b) Do not allow water to come into contact with the sensor or attempt to cool it.

WHEN CAR IS EQUIPPED WITH A MOBILE RADIO SYSTEM (HAM, CB, ETC.)

The ECU has been designed so that it will not be affected by outside interference.
However, if your vehicle is equipped with an amature radio transceiver, etc. (even one with about 10 W output), it may, at times, have an effect upon ECU operation, especially if the antenna and feeder are installed nearby.
Therefore, observe the following precautions.

(a) Install the antenna as far as possible from the ECU. The ECU is located into the right side kick panel so the antenna should be installed at the rear, left side of the vehicle.
If installing in the bumper, do so on the right side, if possible.

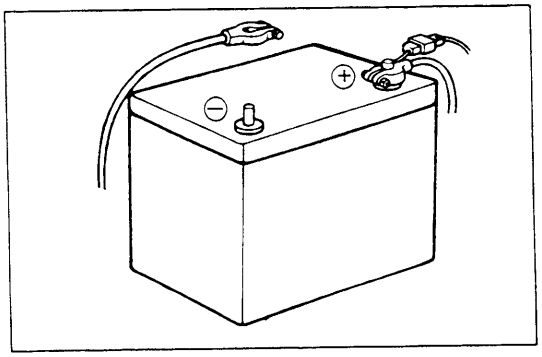
(b) Keep the antenna feeder as far away as possible from the ECU wires — at least 20 cm (7.87 in.) — and, especially, do not wind them together.

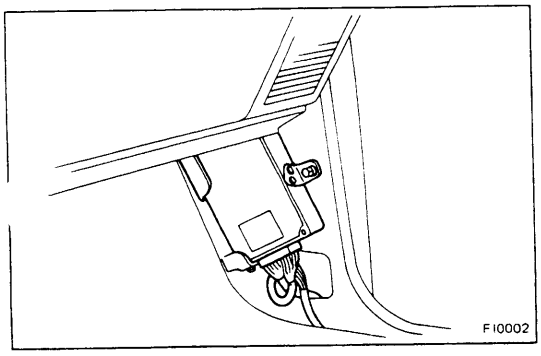
(c) Insure that the feeder and antenna are properly adjusted.

(d) Do not equip your vehicle with a powerful mobile radio system.

INTAKE SYSTEM

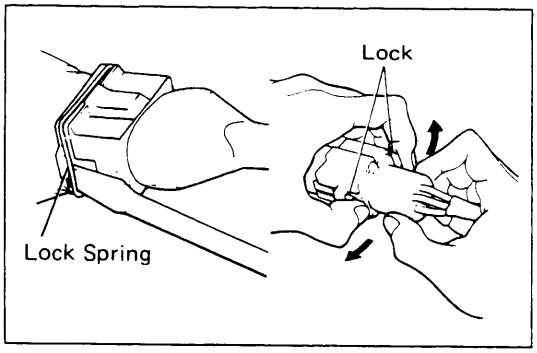
1. Separation of the engine oil level gauge, oil filler cap, PCV hose, etc. may cause the engine to run out of tune.
2. Disconnection, looseness or cracks in the parts of the air intake system between the air flow meter and cylinder head will allow air suction and cause bad engine tune.



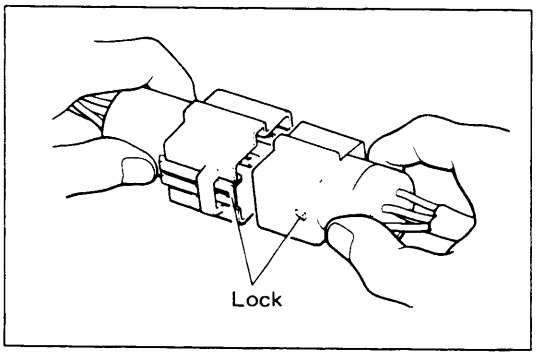


ELECTRONIC PARTS

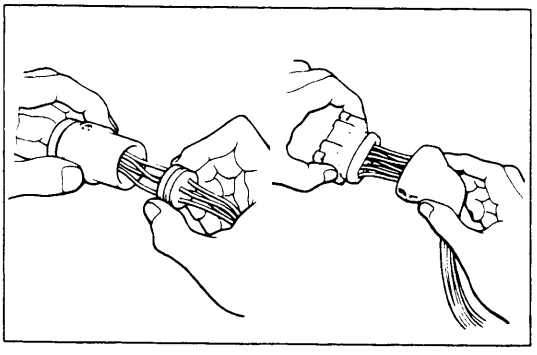
1. Before removing EFI wiring connectors, terminals, etc., first disconnect power by either turning OFF the ignition switch or disconnecting the battery terminals.
2. When installing a battery, be especially careful not to incorrectly connect the positive and negative cables.
3. Do not permit parts to receive a severe impact during removal or installation. Handle all EFI parts carefully and, in particular, the ECU.
4. Do not be careless during troubleshooting as there are numerous transistor circuits and even slight terminal contact can cause further troubles.
5. Do not open the ECU 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 EFI parts and wiring connectors.
7. Parts should be replaced as an assembly.



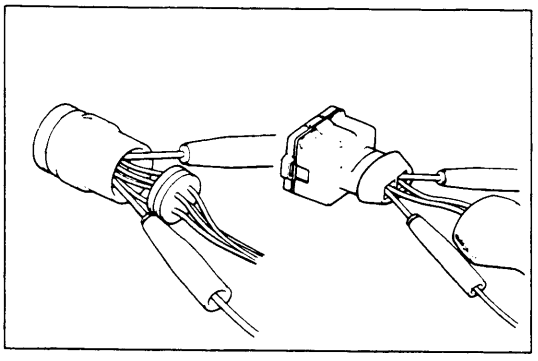
8. Sufficient care is required when pulling out and inserting wiring connectors.
   (a) Release the lock and pull out the connector, pul on the connectors.



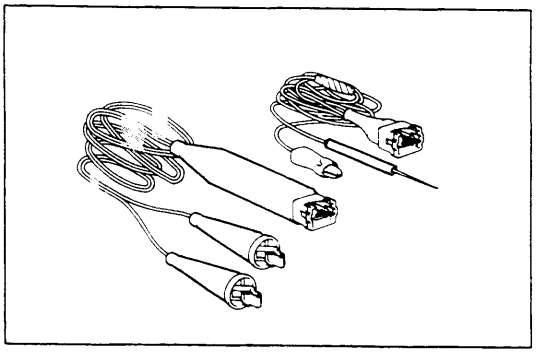
   (b) Fully insert the connector and insure that it is locked.



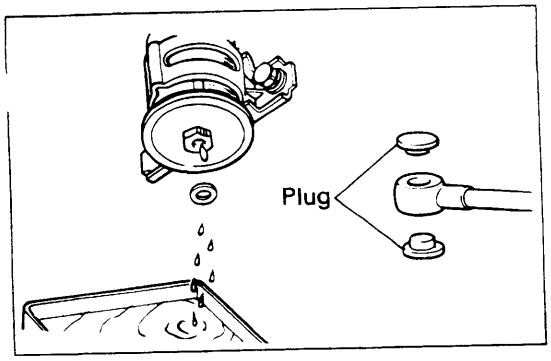
9. When inspecting a connector with a circuit tester.
   (a) Carefully take out the water-proofing rubber if it is a water-proof type connector.



   (b) Insert the tester probe into the connector from the 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.

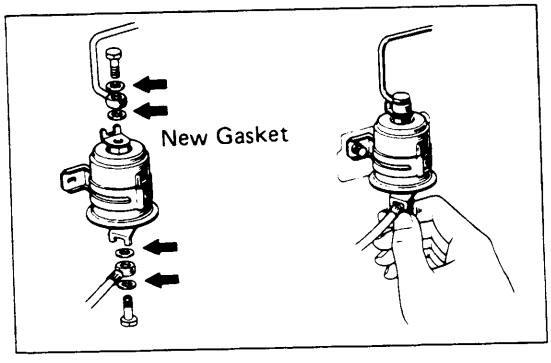


10. Use SST for inspection or test of the injector, cold start injector or its wiring connector.
    SST 09842-30020 and 09842-30050

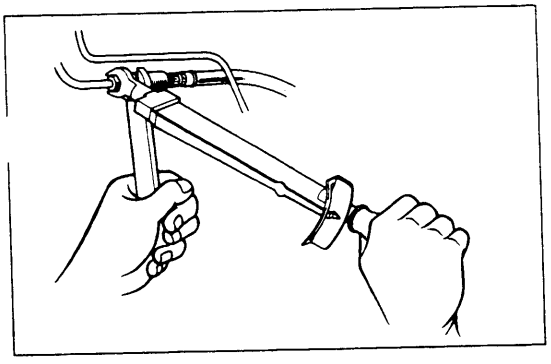


FUEL SYSTEM

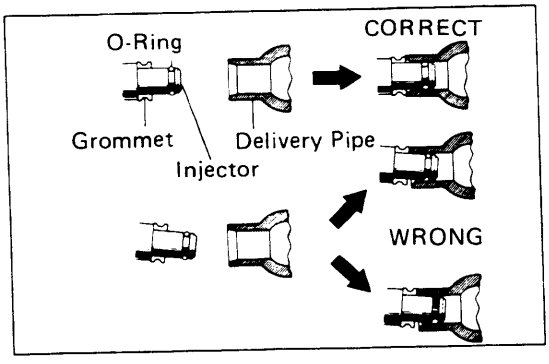
1. When disconnecting the connection of the high fuel pressure line, a large amount of gasoline will come out so observe the following procedure.
   (a) Put a container under the connection.
   (b) Slowly loosen the connection.
   (c) Disconnect the connection.
   (d) Plug the connection with a rubber plug.



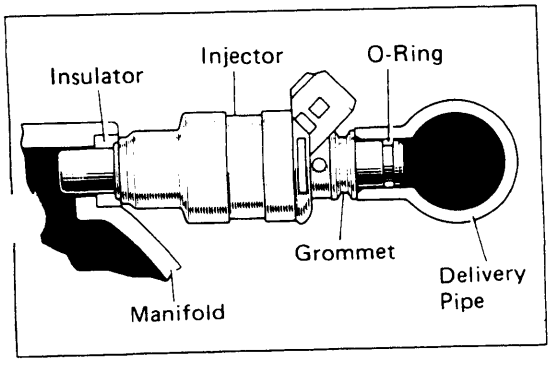
2. When connecting the flare nut on the high pressure pipe union, observe the following procedure.
   (a) Always use a new gasket.
   (b) Apply a thin coat of oil to the flare and first tighten the flare nut by hand.



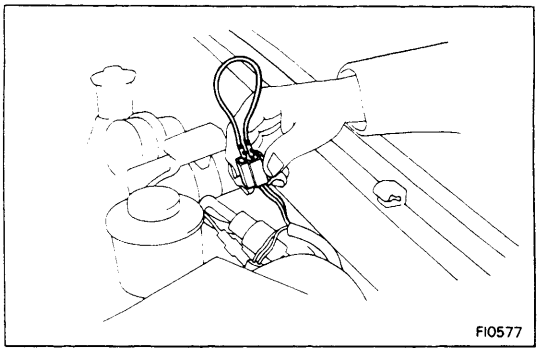
   (c) Then tighten the nut to the specified torque.
   Torque: 310 kg-cm (22 ft-lb, 30 N·m)



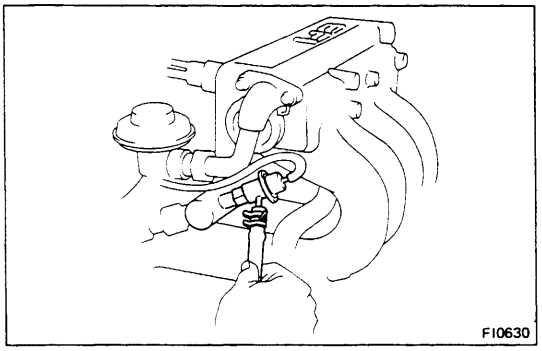
3. Take the following precautions when removing and installing the injectors.
   (a) Never re-use an O-ring.
   (b) When placing an O-ring on the injector,use care not to damage it in any way.
   (c) Lubricate the O-ring with spindle oil or gasoline before installing — never use engine, gear or brake oil.



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


FI0577

5. Confirm that there are no fuel leaks after performing maintenance on the fuel system.
   (a) With engine stopped, turn the ignition switch o
   (b) Short circuit terminals of the fuel pump check connector.


FI0630

(c) When the pressure regulator fuel return hose (shown in the figure at left), is pinched, the pressure within the high pressure line will rise to about 4 kg/cm² (57 psi, 392 kPa). In this state, check to see that there are no leaks from any part of the fuel system.

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

TROUBLESHOOTING

TROUBLESHOOTING HINTS

1. Engine troubles are usually not caused by the EFI system. When troubleshooting, always first check the condition of the other systems.
   (a) Electronic source
      - Battery
      - Fusible links
      - Fuses

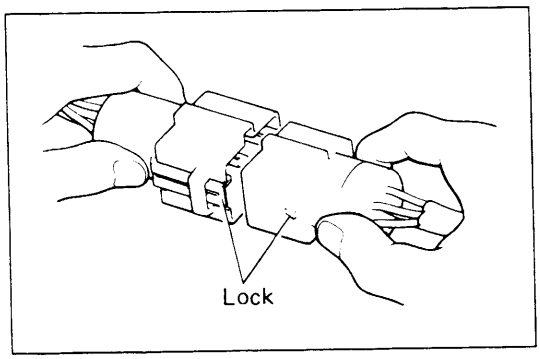
   (b) Fuel supply
      - Fuel leakage
      - Fuel filter
      - Fuel pump

   (c) Ignition system
      - Spark plug
      - High-tension cord
      - Distributor
      - Igniter and ignition coil

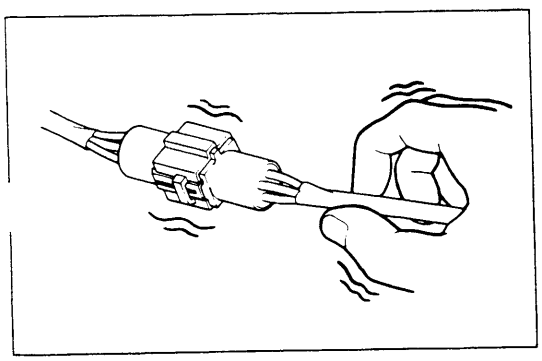
   (d) Air intake system
      - Vacuum leaks

   (e) Emission control system
      - EGR system
      - PCV system

   (f) Others
      - Ignition timing
      - Idle speed
      - etc.

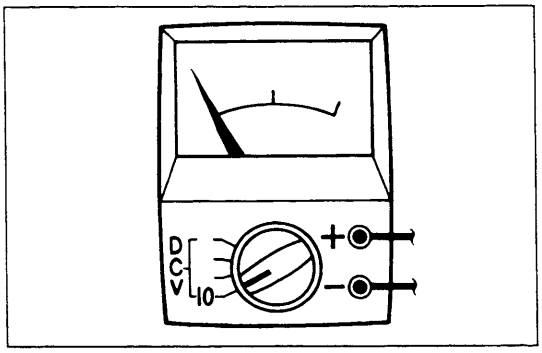


2. The most frequent cause of problems is simply a bad contact in wiring connectors. So always make sure that connections are secure.
   When inspecting the connector, pay particular attention to the following points:
   (a) Check to see that the terminals are not bent.
   (b) Check to see that the connector is pushed in completely and locked.



   (c) Check to see that there is no signal change when the connector is slightly tapped or wiggled.

3. Sufficiently troubleshoot for other causes before replacing the ECU. The ECU is of high quality and it is expensive.



4. Use a volt/ohmmeter with a high impedance (10 kΩ/V minimum) for troubleshooting an electrical circuit.

TROUBLESHOOTING PROCEDURES

SYMPTOM—DIFFICULT TO START OR NO START (ENGINE WILL NOT CRANK OR CRANKS SLOWLY)

CHECK ELECTRONIC SOURCE

BAD →
1. Battery
   (1) Connection
   (2) Gravity — Drive belt — Charging system
   (3) Voltage
2. Fusible link

OK ↓

CHECK STARTING SYSTEM

BAD →
1. Ignition switch
2. Neutral start switch for A/T
3. Starter
4. Wiring/Connection

SYMPTON — DIFFICULT TO START OR NO START (CRANKS OK)

CHECK DIAGNOSIS SYSTEM
Check for output of diagnostic code.
(See page FI-22)

Malfunction code → Diagnostic code(s) (See page FI-25)

Normal code ↓

CHECK FOR VACUUM LEAKS IN AIR INTAKE LINE

BAD →
1. Hose connections
2. PCV hoses
3. EGR system — EGR valve stays open

OK ↓

CHECK IGNITION SPARK
1. Unplug connectors of injector resistor and start injector time switch.
2. Check by holding spark plug cord 8 — 10 mm (0.31 — 0.39 in.)away from engine block while engine is cranking.
   A strong spark should be noted.

BAD →
1. Plug cords
2. High-tension cords
3. Distributor
4. Ignition coil, igniter
5. ECU

OK ↓

CHECK IGNITION TIMING
STD: 5° BTDC at idle
(T — E_1 Short Circuit)

NO → Adjust ignition timing

OK ↓

CHECK FUEL SUPPLY TO INJECTOR
1. Fuel in tank
2. Fuel pressure in fuel line
   (1) Short fuel pump check terminals.
   (2) Fuel pressure at fuel hose of cold start injector can be felt.
   (See page FI-43)

BAD →
1. Fuel line — Leakage — Deformation
2. Fuse
3. Circuit opening relay (See page FI-65)
4. Fuel pump (See page FI-42)
5. Fuel filter
6. Fuel pressure regulator (See page FI-49)

OK ↓

CHECK FUEL PUMP SWITCH IN AIR FLOW METER
Check continuity between terminals Fc and E_1 while measuring plate of air flow meter is open.

BAD → Air flow meter (See page FI-54)

OK ↓

CHECK SPARK PLUGS
Plug gap: 0.8 mm (0.031 in.)
NOTE:
Check compression pressure if necessary.

NO →
1. Spark plug
2. Compression pressure
   Limit: 10.0 kg/cm² (142 psi, 981 kPa) at 250 rpm
3. Injector — Leakage (See page FI-50)

NO (All Plugs Wet) →
1. Injector(s) — Shorted
2. Injector wiring between resistor and ECU shorted
3. Cold start injector — Leakage (See page FI-47)
4. Start injector time switch (See page FI-67)

OK CONTINUED ON PAGE FI-12

OK CONTINUED FROM PAGE FI-11

CHECK AIR VALVE
1. Disconnect air hose from air valve.
2. Check that the air valve opens when cold.

Room temp.: Below 20°C (68°F)

NO →
1. Air valve (See page FI-58)
2. Water hoses
3. Air hoses

OK

CHECK EFI ELECTRONIC CIRCUIT USING VOLT/OHMMETER

NO →
1. Wiring connection
2. Power to ECU
   (1) Fusible link
   (2) Fuse (EFI 15A)
   (3) Main relay
3. Air flow meter
4. Water thermo sensor
5. Injection signal
   (1) Injector wiring
   (2) Resistor
   (3) ECU

SYMPTOM — ENGINE OFTEN STALLS

HECK DIAGNOSIS SYSTEM
Check for output of diagnostic code.
(See page FI-22)

Malfunction code → Diagnostic code(s) (See page FI-25)

Normal code ↓

CHECK FOR VACUUM LEAKS IN AIR INTAKE LINE

BAD →
1. Hose connections
2. PCV hoses
3. EGR system — EGR valve stays open

OK ↓

CHECK FUEL SUPPLY TO INJECTOR
1. Fuel in tank
2. Fuel pressure in fuel line
   (1) Short fuel pump check terminals.
   (2) You can feel fuel pressure at fuel hose of fuel filter. (See page FI-6)

BAD →
1. Fuel line — Leakage — Deformation
2. Fuse
3. Circuit opening relay (See page FI-65)
4. Fuel pump (See page FI-42)
5. Fuel filter
6. Fuel pressure regulator (See page FI-49)

OK ↓

CHECK AIR FILTER ELEMENT

BAD → Element — Clean or replace

OK ↓

CHECK IDLE SPEED
STD: 750 rpm

BAD → Adjust idle speed

OK ↓

CHECK IGNITION TIMING
STD: 5° BTDC at idle
($T - E_1$ Short Circuit)

BAD → Adjust ignition timing

OK ↓

CHECK SPARK PLUGS
Plug gap: 0.8 mm (0.031 in.)
NOTE:
Check compression pressure if necessary.

BAD →
1. Spark plug
2. Compression pressure
   Limit: 10.0 kg/cm² (142 psi, 981 kPa) at 250 rpm

OK ↓

CHECK COLD START INJECTOR
(See page FI-47)

BAD →
1. Cold start injector
2. Start injector time switch
   (See page FI-67)

OK CONTINUED ON PAGE FI-14

OK CONTINUED FROM PAGE FI-13

CHECK AIR VALVE
1. Disconnect air hose from air valve.
2. Check that air valve opens when cold.

Room temp.: Below 20°C (68°F)

BAD → 1. Air valve (See page FI-58)
2. Water hoses
3. Air hoses

OK

RECHECK FUEL PRESSURE
(See page FI-42)

BAD → 1. Fuel pump (See page FI-42)
2. Fuel filter
3. Fuel pressure regulator (See page FI-49)

OK

CHECK INJECTORS
(See page FI-50)

BAD → Injection condition

OK

CHECK EFI ELECTRONIC CIRCUIT USING VOLT/OHMMETER

BAD → 1. Wiring connection
2. Power to ECU
   (1) Fusible link
   (2) Main relay
3. Air flow meter
4. Water thermo sensor
5. Injection signal
   (1) Injector wiring
   (2) Resistor
   (3) ECU

SYMPTOM — ENGINE SOMETIMES STALLS

CHECK DIAGNOSIS SYSTEM
Check for output of diagnostic code.
(See page FI-22)

Malfunction code → Diagnostic code(s) (See page FI-25)

Normal code

CHECK AIR FLOW METER
(See page FI-56)

BAD → Air flow meter

OK

CHECK WIRING CONNECTORS AND RELAYS
Check that there is a signal change when the connector or relay is slightly tapped or wiggled.

BAD → 1. Connector
2. Main relay (See page FI-64)
3. Circuit opening relay (See page FI-65)

SYMPTOM — ROUGH IDLING AND/OR MISSING

CHECK DIAGNOSIS SYSTEM
Check for output of diagnostic code.
(See page FI-22)

Malfunction code → Diagnostic code(s) (See page FI-25)

Normal code ↓

CHECK FOR VACUUM LEAKS IN AIR INTAKE LINE

BAD →
1. Hose connections
2. PCV hoses
3. EGR system — EGR valve stays open

OK ↓

CHECK AIR FILTER ELEMENT

BAD → Element — Clean or replace

OK ↓

CHECK IDLE SPEED
STD: 750 rpm

BAD → Adjust idle speed

OK ↓

CHECK IGNITION TIMING
STD: 5° BTDC at idle
(T — E_1 Short Circuit)

BAD → Adjust ignition timing

OK ↓

CHECK SPARK PLUGS AND PLUG CORDS
Plug gap: 0.8 mm (0.031 in.)
NOTE:
Check compression pressure if necessary.

BAD →
1. Spark plugs and plug cords
2. Compression pressure
   Limit: 10.0 kg/cm² (142 psi, 981 kPa) at 250 rpm

OK ↓

CHECK COLD START INJECTOR
(See page FI-47)

BAD →
1. Cold start injector
2. Cold start injector time switch.
(See page FI-65)

OK ↓

CHECK FUEL PRESSURE
(See page FI-42)

BAD →
1. Fuel pump (See page FI-42)
2. Fuel filter
3. Fuel pressure regulator (See page FI-49)

OK ↓

CHECK INJECTORS
(See page FI-50)

BAD → Injection condition

OK ↓ CONTINUED ON PAGE FI-16

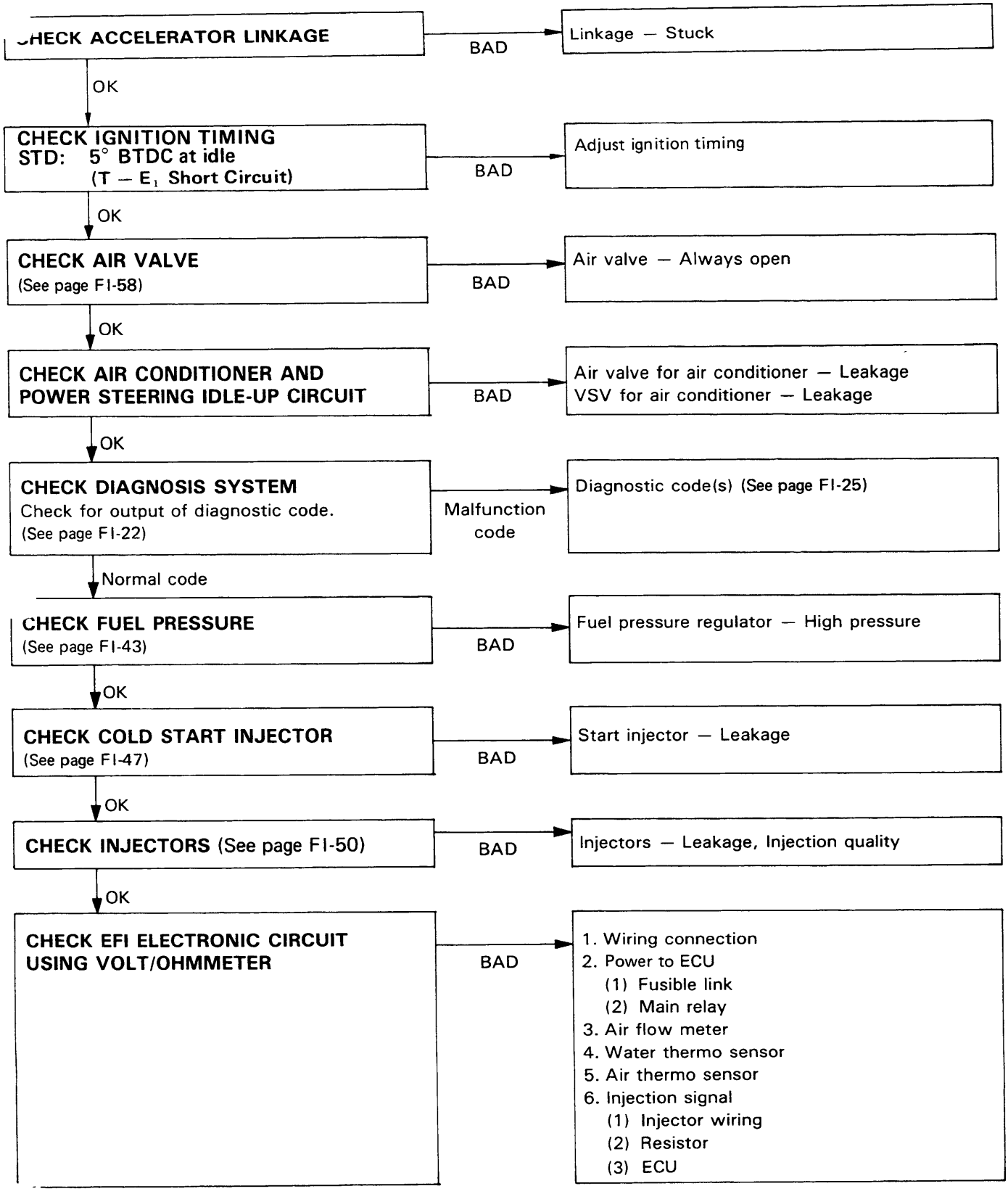
OK CONTINUED FROM PAGE FI-15

CHECK EFI ELECTRONIC CIRCUIT USING VOLT/OHMMETER

BAD →

1. Wiring connection
2. Power to ECU
   (1) Fusible link
   (2) Main relay
3. Air flow meter
4. Water thermo sensor
5. Air thermo sensor
6. Throttle position sensor
7. Injection signal
   (1) Injector wiring
   (2) Resistor
   (3) ECU
8. Ox sensor

SYMPTOM — HIGH ENGINE IDLE SPEED (NO DROP)



SYMPTOM — ENGINE BACKFIRES-Lean Air Fuel Mixture

CHECK DIAGNOSIS SYSTEM
Check for output of diagnostic code.
(See page FI-22)

→ Malfunction code → Diagnostic code(s) (See page FI-25)

↓ Normal code

CHECK FOR VACUUM LEAKS IN AIR INTAKE LINE

→ BAD →
1. Hose connections
2. PCV hoses
3. EGR system — EGR valve stays open

↓ OK

CHECK IGNITION TIMING
STD: 5° BTDC at idle
(T — E_1 Short Circuit)

→ BAD → Adjust ignition timing

↓ OK

CHECK COLD START INJECTOR
(See page FI-47)

→ BAD →
1. Cold start injector
2. Cold start injector time switch.
(See page FI-67)

↓ OK

CHECK FUEL PRESSURE
(See page FI-43)

→ BAD →
1. Fuel pump (See page FI-42)
2. Fuel filter
3. Fuel pressure regulator (See page FI-49)

↓ OK

CHECK INJECTORS
(See page FI-50)

→ BAD → Injectors — Clogged

↓ OK

CHECK EFI ELECTRONIC CIRCUIT USING VOLT/OHMMETER

→ BAD →
1. Wiring connection
2. Power to ECU
   (1) Fusible link
   (2) Main relay
3. Air flow meter
4. Water thermo sensor
5. Air thermo sensor
6. Throttle position sensor
7. Injection signal
   (1) Injection wiring
   (2) Resistor
   (3) ECU
   (4) Fuel cut signal
8. Ox sensor

SYMPTOM — MUFFLER EXPLOSION (AFTER FIRE) -Rich Air Fuel Mixture-Misfire

CHECK DIAGNOSIS SYSTEM
Check for output of diagnostic code.
(See page FI-22)

→ Malfunction code → Diagnostic code(s) (See page FI-25)

↓ Normal code

CHECK IGNITION TIMING
STD: 5° BTDC at idle
(T — E_1 Short Circuit)

→ BAD → Adjust ignition timing

↓ OK

CHECK COLD START INJECTOR
(See page FI-47)

→ BAD →
1. Cold start injector
2. Cold start injector time switch
(See page FI-67)

↓ OK

CHECK INJECTORS

→ BAD → Injectors — Leakage

↓ OK

CHECK SPARK PLUGS AND PLUG CORDS
Plug gap: 0.8 mm (0.031 in.)
OTE:
Check compression pressure if necessary.

→ BAD →
1. Spark plugs and plug cords
2. Compression pressure
Limit: 10.0 kg/cm² (142 psi, 981 kPa) at 250 rpm

↓ OK

CHECK EFI ELECTRONIC CIRCUIT USING VOLT/OHMMETER

→ BAD →
1. Throttle position sensor
2. Injection signal
(1) Fuel cut signal
(2) Injector wiring
(3) Resistor
(4) ECU
3. Ox sensor

SYMPTOM — ENGINE HESITATES AND/OR POOR ACCELERATION

CHECK CLUTCH, BRAKE
→ BAD → 1. Clutch — Slips
2. Brakes — Drag

↓ OK

CHECK FOR VACUUM LEAKS IN AIR INTAKE LINE
→ BAD → 1. Hose connections
2. PCV hoses
3. EGR system — EGR valve stays open

↓ OK

CHECK AIR FILTER ELEMENT
→ BAD → Element — Clean or replace

↓ OK

CHECK DIAGNOSIS SYSTEM
Check for output of diagnostic code.
(See page FI-22)
→ Malfunction code → Diagnostic code(s) (See page FI-25)

↓ Normal code

CHECK IGNITION SPARK
1. Unplug connectors of injector resistor and cold start injector time switch.
2. Check by holding spark plug cord 8 — 10 mm (0.31 — 0.39 in.) away from engine block while engine cranking.
   A strong spark should be noted.

→ BAD →
1. Plug cord
2. High tension cord
3. Distributor
4. Ignition coil, Igniter

↓ OK

CHECK IGNITION TIMING
STD: 5° BTDC at idle
(T — E_1 Short Circuit)
→ BAD → Adjust ignition timing

↓ OK

CHECK FUEL PRESSURE
(See page FI-43)
→ BAD →
1. Fuel pump (See page FI-42)
2. Fuel filter
3. Fuel pressure regulator (See page FI-49)

↓ OK CONTINUED ON PAGE FI-21

OK CONTINUED FROM PAGE FI-20

CHECK INJECTORS
(See page FI-50)

BAD → Injection condition

OK

CHECK SPARK PLUGS
Plug gap: 0.8 mm (0.031 in.)
NOTE:
Check compression pressure if necessary.

BAD →
1. Spark plugs
2. Compression pressure
   Limit: 10.0 kg/cm² (142 psi, 981 kPa) at 250 rpm

OK

CHECK EFI ELECTRONIC CIRCUIT USING VOLT/OHMMETER

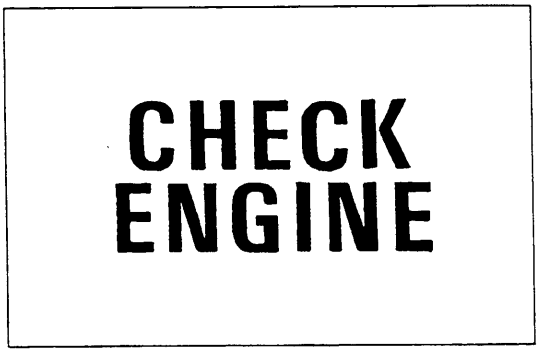
BAD →
1. Wiring connection
2. Power to ECU
   (1) Fusible link
   (2) Main relay
3. Air flow meter
4. Water thermo sensor
5. Air thermo sensor
6. Throttle position sensor
7. Injection signal
   (1) Injector wiring
   (2) Resistor
   (3) ECU

DIAGNOSIS SYSTEM

DESCRIPTION

By analyzing various signals as shown in the later table (page FI-25) the ECU detects system malfunctions which are related to the various operating parameter sensors or to the actuator. The ECU stores the failure code associated with the detected failure until the diagnostic system is cleared by removing the EFI fuse with ignition switch off.

A "CHECK ENGINE" warning light on the instrument panel informs the driver that a malfunction has been detected. The light goes out automatically when the malfunction has been cleared.



"CHECK ENGINE" LIGHT CHECK

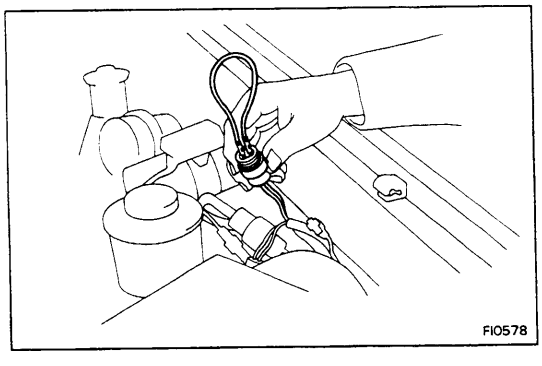
1. The "CHECK ENGINE" warning light will come on when the ignition switch is placed at ON and the engine is not running.
2. When the engine is started, the "CHECK ENGINE" warning light should go out.

   If the light remains on, the diagnosis system has detected a malfunction in or abnormality in the system.

OUTPUT OF DIAGNOSTIC CODES

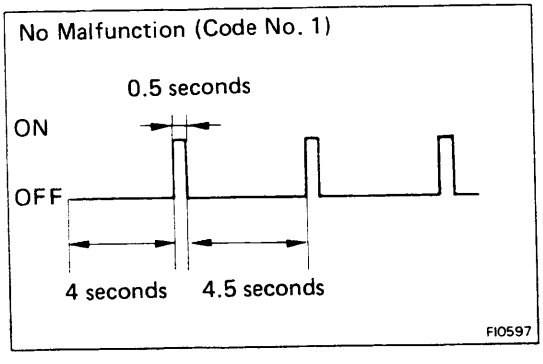
To obtain an output of diagnostic codes, proceed as follows:

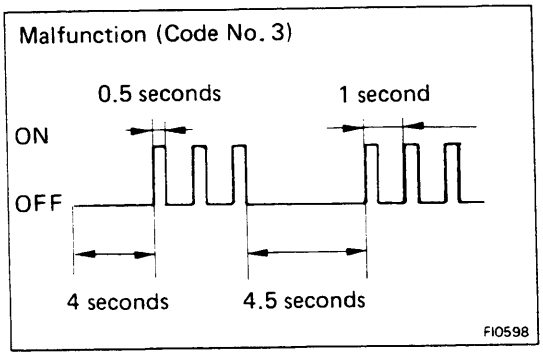
1. Initial conditions
   (a) Battery voltage above 11 volts.
   (b) Throttle valve fully closed (throttle position sensor IDL points closed).
   (c) Transmission in neutral postion.
   (d) Accessory switches OFF.
   (e) Engine at normal operating temperature.
2. Turn the ignition switch to ON. Do not start the engine.
3. Using a sub-wire short terminals $T-E_1$ of the Check Engine Connector located near the ignition coil.



A03885

4. Read the diagnostic code as indicated by the number of flashes of the "CHECK ENGINE" warning light.



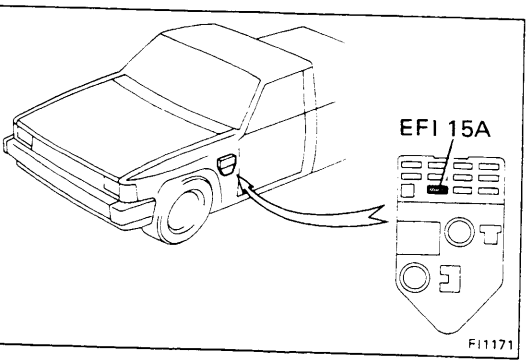


Diagnostic code (See page FI-25)

(a) Normal System Operation (code No.1) (no malfunction)
The light will blink once every 4.5 seconds.

(b) Malfunction Code Indication
The light will blink a number of times equal to the malfunction code indication every 4.5 seconds.
The diagnostic code series will be repeated as long as the check connector terminals (T and E_1) are shorted.

5. After the diagnosis check, remove the sub-wire.



CANCELLING OUT DIAGNOSTIC CODE

1. After repair of the trouble area, the diagnostic code retained in memory by the ECU must be cancelled out by removing the fuse EFI (15A) for 30 seconds or more, depending on ambient temperature (the lower the temperature, the longer the fuse must be left out) with the ignition switch off.

NOTE:

- Cancellation can also be done by removing the battery negative (—) terminal, but in this case other memory systems (radio ETR, etc.)will also be cancelled out.
- If the diagnostic code is not cancelled out, it will be retained by the ECU and appear along with a new code in event of future trouble.
- If it is necessary to work on engine components requiring removal of the battery terminal, a check must first be made to see if a diagnostic code has been recorded.

2. After cancellation, road test the vehicle, if necessary, confirm that a "normal" code (No. 1) is now read on the "CHECK ENGINE" warning light.

   If the same diagnostic code is still indicated, it indicates that the trouble area has not been repaired thoroughly.

DIAGNOSIS INDICATION

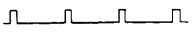
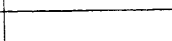
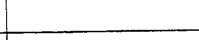
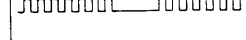
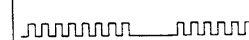
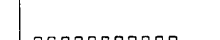
(1) Including "normal", the ECU is programmed with the following 13 (22R-E), 14 (22R-TE) diagnostic codes.

(2) When 2 or more codes are indicated, the lowest number (code) will appear first.

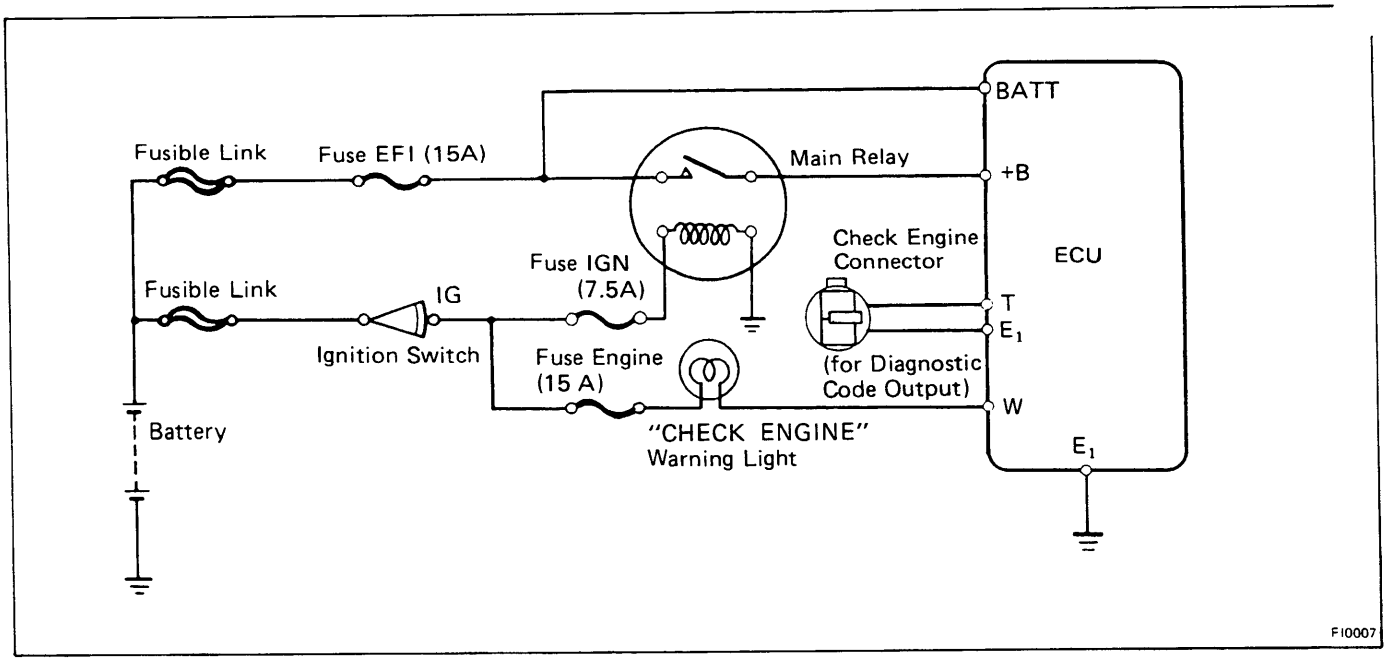
(3) All detected diagnostic codes, except 11 and 13, will be retained in memory be the ECU from the time of detection until cancelled out.

(4) Once the malfunction is cleared, the "CHECK ENGINE" warning light on the instrument panel will go out but the diagnostic code(s) remain stored in ECU memory (except for code 11 and 13).

DIAGNOSIS CODES

Code	Number of blinks "CHECK ENGINE"	System	Diagnosis	Trouble area	Page
1		Normal	This appears when none of other codes (2 thru 13) are identified.		
2		Air flow meter signal	• Open circuit in Vc, or Vs – E_2 short circuited. • Open circuit in E_2, or Vc – Vs short circuited.	1. Air flow meter circuit 2. Air flow meter 3. ECU	FI-56 FI-56 FI-73
3		Ignition signal	No signal from IGF four times in succession	1. Igniter circuit (+B, IGT, IGF) 2. Igniter 3. ECU	FI-73
4		Water thermo sensor signal	Open or short circuit in water thermo sensor signal	1. Water thermo sensor circuit 2. Water thermo sensor 3. ECU	FI-68 FI-68 FI-73
5		Ox sensor signal	Sufficiented feed back condition but not changed Ox sensor signal	1. Ox sensor circuit 2. Ox sensor 3. ECU	FI-69 FI-69 FI-73
6		RPM signal (crank angle pulse)	No Ne signal to ECU within cranking, or Ne value being over 1,000 rpm in spite of no Ne signal to ECU	1. Igniter circuit 2. Igniter 3. Distributor 4. ECU	FI-73
7		Throttle position sensor signal	Open or short circuit in throttle position sensor signal	1. Throttle position sensor circuit 2. Throttle position sensor 3. ECU	FI-59 FI-59 FI-73
8		Intake air thermo sensor signal	Open or short circuit in intake air thermo sensor signal	1. Intake air thermo sensor circuit 2. Intake air thermo sensor 3. ECU	FI-73
10		Starter signal	No STA signal to ECU when vehicle speed 0 km/h and engine is running over 800 rpm	1. Speed sensor circuit 2. Main relay circuit 3. IG switch circuit (Starter) 4. IG switch 5. ECU	FI-64 FI-73
11		Switch signal	Short circuit in terminal T when air conditioner switch ON or IDL point OFF	1. Air conditioner switch 2. Throttle position sensor circuit 3. Throttle position sensor 4. ECU	FI-59 FI-59 FI-73
12		Knock control sensor signal	Knock control sensor signal is not reached judgement level in succession	1. Knock control sensor circuit 2. Knock control sensor 3. ECU	
13		Knock control CPU (ECU)	Knock CPU faulty	Knock control CPU (ECU)	

INSPECTION OF DIAGNOSIS CIRCUIT



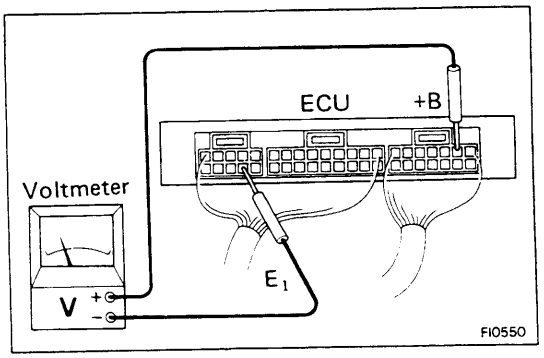
1. Does CHECK ENG. light come on when ignition switch is at ON?
   - YES → System Normal
   - NO → Does CHECK ENG. light come on when ECU terminal W is grounded to the body ?
     - YES → Check wiring between ECU terminal E_1 and body ground.
       - OK → Try another ECU.
       - BAD → Repair or replace
     - NO → Check bulb, fuse and wiring between ECU and ignition switch.
       - BAD → Repair or replace

2. Does CHECK ENG. light go OFF when engine is started?
   - YES → System Normal
   - NO → Check wiring between ECU and CHECK ENG. light.
     - BAD → Repair
     - OK → Is there diagnosis code output when CHECK ENG. connector T-E_1 is short circuited?
       - NO → Try another ECU.
       - YES → Does CHECK ENG. light go out after repair according to malfunction code?
         - NO → Further repair required.
         - YES → System OK
           - NO → Cancel out diagnostic code.

TROUBLESHOOTING WITH VOLT/OHMMETER

PREPARATION FOR TROUBLESHOOTING

1. **Remove the glove box.**
2. **Remove the ECU with the wire harness.**



EFI SYSTEM CHECK PROCEDURE

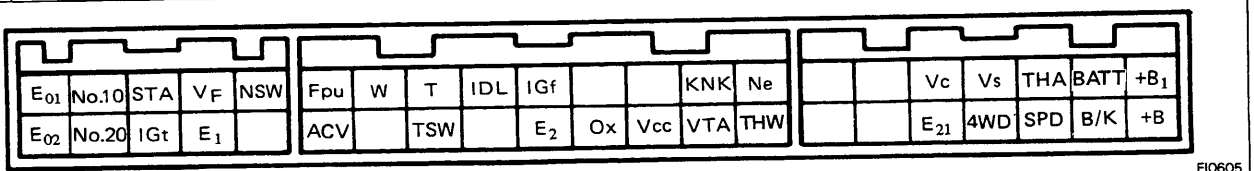
NOTE:
1. The EFI circuit can be checked by measuring the resistance and voltage at the wiring connectors of the ECU.
2. Perform all voltage measurement with the connectors connected.
3. Verify that the battery voltage is 11 V or above when the ignition switch is ON.

Using a voltmeter with high impedance (10 kΩ/V minimum) measure the voltage at each terminal of the wiring connector.

NOTE: If there is any problems, see TROUBLESHOOTING FOR EFI ELECTRONIC CIRCUIT WITH VOLT/OHMMETER.

Connectors of ECU

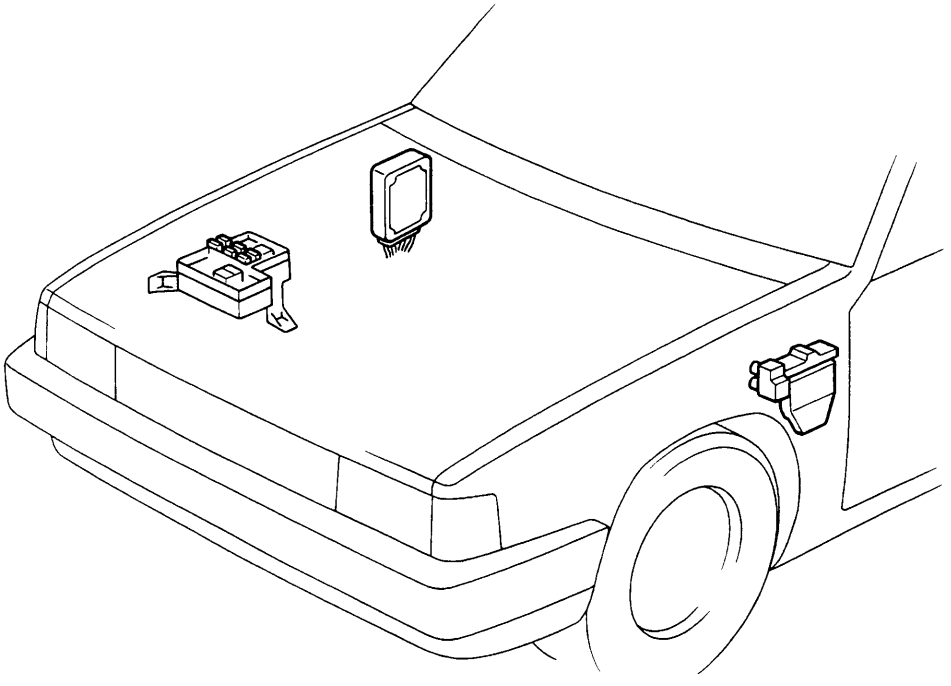
Symbol	Terminal Name	Symbol	Terminal Name
$+B_1$	MAIN RELAY	+B	MAIN RELAY
BATT	BATTERY +B	B/K	BRAKE SWITCH
THA	AIR THERMO SENSOR	SPD	SPEED SENSOR
Vs	AIR FLOW METER	4WD	4WD SWITCH
Vc	AIR FLOW METER	E_{21}	SENSOR EARTH
Ne	ENGINE REVOLUTION SENSOR	THW	WATER THERMO SENSOR
KNK	KNOCK SENSOR	VTA	THROTTLE
IGf	IGNITER	Vcc	THROTTLE SWITCH +B
IDL	THROTTLE SWITCH	Ox	Ox SENSOR
T	CHECK CONNECTOR	E_2	SENSOR EARTH
W	WARNING LIGHT	TSW	WATER THERMO SWITCH
Fpu	FUEL PRESSURE UP SWITCH	ACV	A/C IDLE UP
NSW	NEUTRAL START SWITCH	E_1	ENGINE EARTH
VF	CHECK CONNECTOR	IGt	IGNITER
STA	STARTER SWITCH	No. 20	INJECTOR
No. 10	INJECTOR	E_{02}	ENGINE GROUND
E_{01}	ENGINE GROUND		



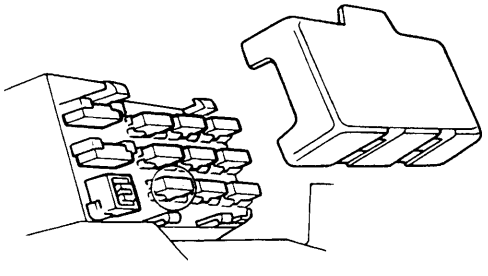
TROUBLESHOOTING FOR EFI ELECTRONIC CIRCUIT WITH VOLT/OHMMETER

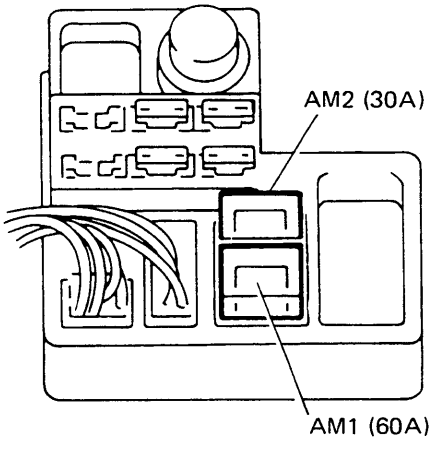
NOTE: Because the following troubleshooting procedures are designed for inspection of each separate system, the actual troubleshooting procedure may vary somewhat. However, please refer to these procedures and perform actual troubleshooting, conforming to the inspection methods described.
For example, it is better to first make a simple check of the fuses, fusible links and connecting condition of the connectors before making your inspection according to the procedures listed.

LOCATION OF FUSE AND FUSIBLE LINK



EFI Fuse (15A)



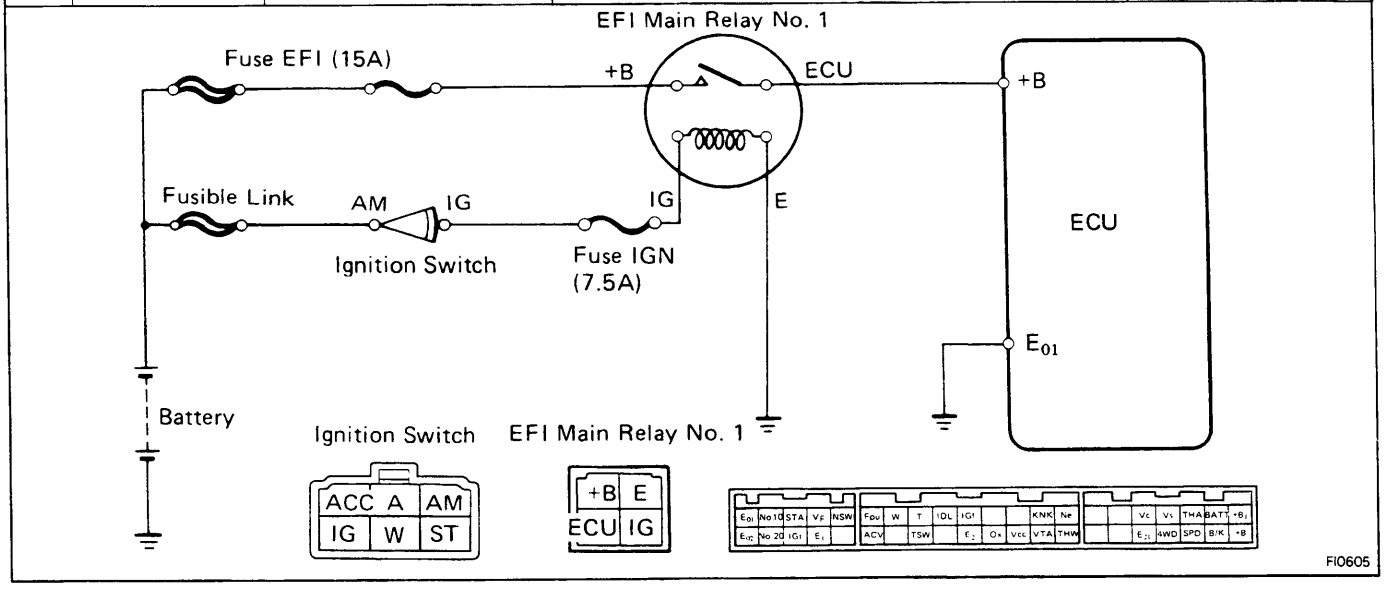


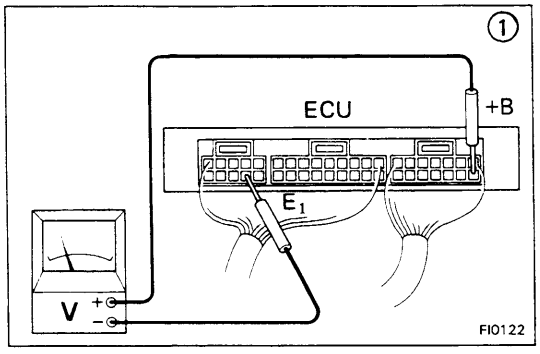
F10006 F10008

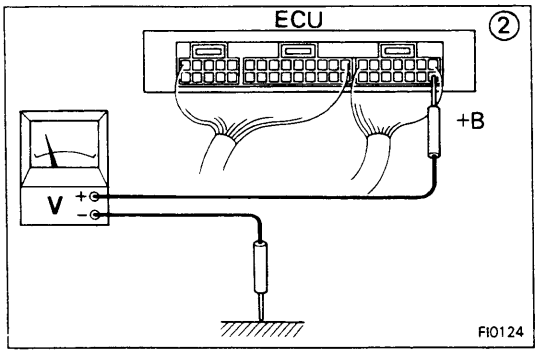
VOLTAGE AT ECU WIRING CONNECTORS

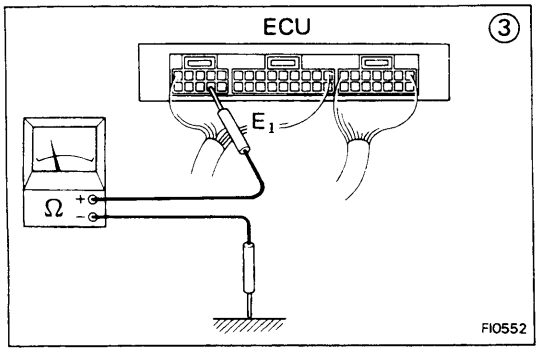
	Terminals	Condition		STD Voltage	See page
1	+B – E_1	Ignition switch ON		10 – 14	FI-30
2	BATT – E_1	–		10 – 14	FI-31
3	IDL – E_2	Ignition switch ON	Throttle valve open	4 – 10	FI-32
	VTA – E_2		Throttle valve fully closed	0.1 – 1.0	FI-33
			Throttle valve fully open	4 – 5	
	Vcc – E_2		–	4 – 6	
4	IGt – E_1	Idling		0.7 – 1.0	FI-34
5	STA – E_1	Ignition switch ST position		6 – 12	FI-35
6	No. 10 – E_1 No. 20 – E_1	Ignition switch ON		9 – 14	FI-36
7	W – E_1	No trouble (CHECK ENGINE light off) and engine running		8 – 14	FI-37
8	Vc – E_2	Ignition switch ON	–	4 – 9	FI-38
	Vs – E_2		Measuring plate fully closed	0.5 – 2.5	
			Measuring plate fully open	5 – 8	
		Idling		2.5 – 5.5	
9	THA – E_2	Ignition switch ON	Intake air temperature 20°C (68°F)	2 – 6	FI-39
10	THW – E_2	Ignition switch ON	Coolant temperature 80°C (176°F)	0.5 – 2.5	FI-40
11	B/K – E_1	Stop light switch ON		8 – 14	FI-41

No.	Terminals	Trouble	Condition	STD Voltage
1	+B — E_1	No voltage	IG S/W ON	10 — 14 V









① No voltage between ECU terminals +B and E_1. **(IG S/W ON)**

② Check that there is voltage between ECU terminal +B and body ground. **(IG S/W ON)**

NO — OK

③ Check wiring between ECU terminal E_1 and body ground.

OK — Try another ECU.

BAD — Repair or replace

Check fuse, fusible link and ignition switch. — BAD — Repair or replace

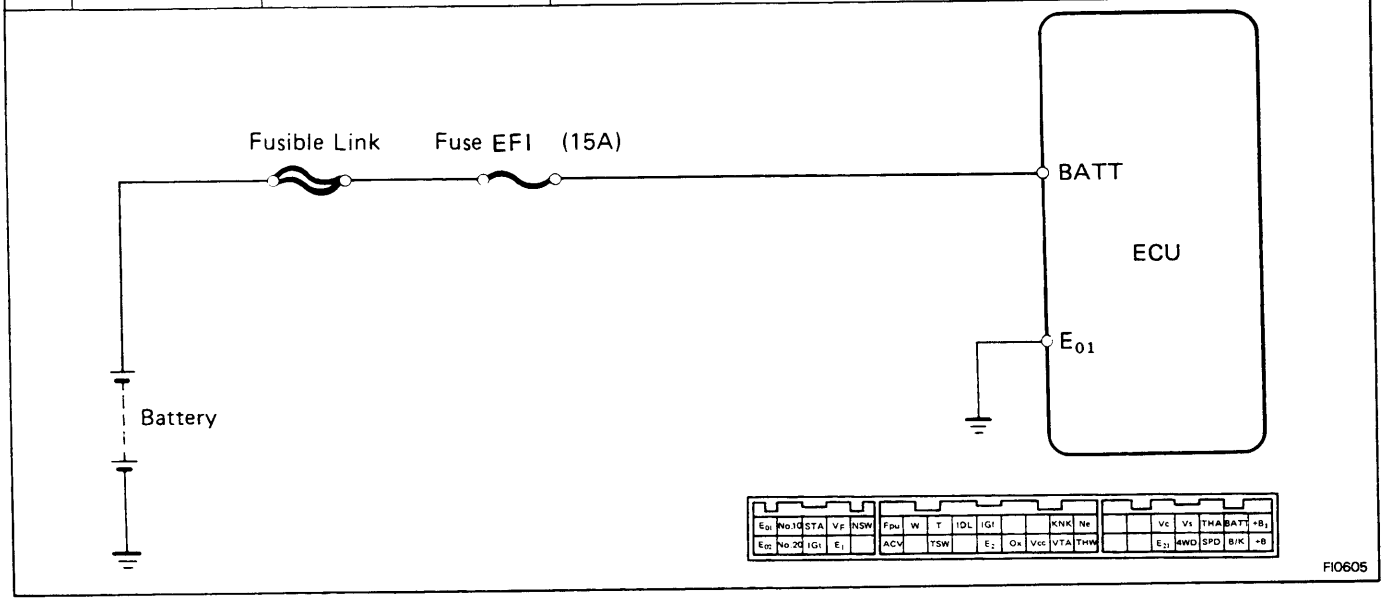
OK

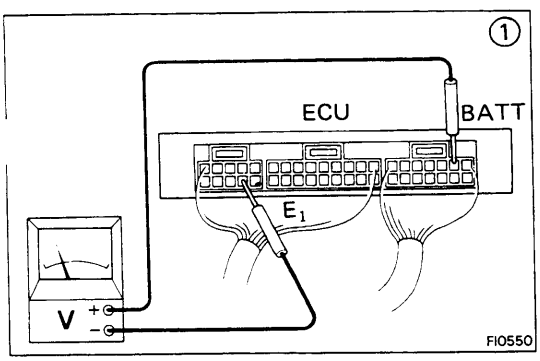
Check EFI main relay. — BAD — Replace

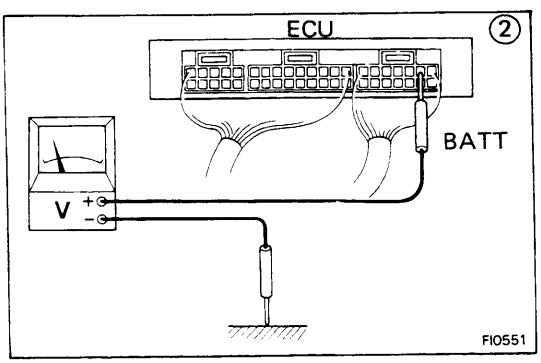
OK

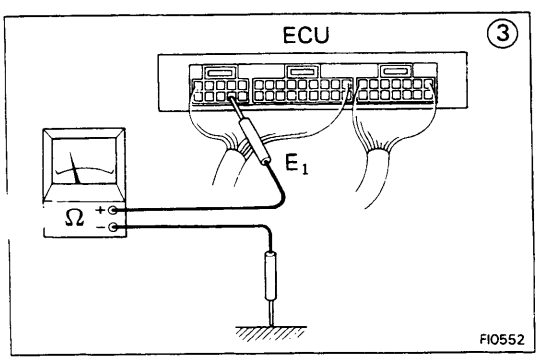
Check wiring between EFI main relay and battery. — BAD — Repair or replace

No.	Terminals	Trouble	Condition	STD Voltage
-	BATT — E_1	No voltage	——	10 — 14 V









① No voltage between ECU terminals BATT and E_1.

② Check that there is voltage between ECU terminal BATT and body ground.

NO

OK

③ Check wiring between ECU terminal E_1 and body ground.

OK → Try another ECU.

BAD → Repair or replace

Check fuse and fusible link.

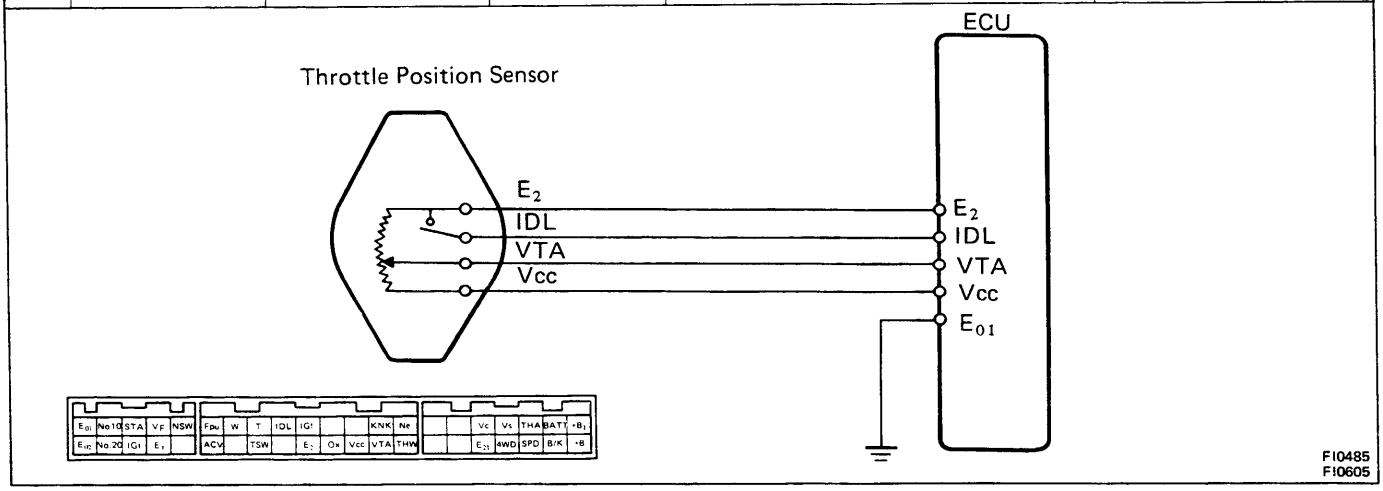
BAD → Replace

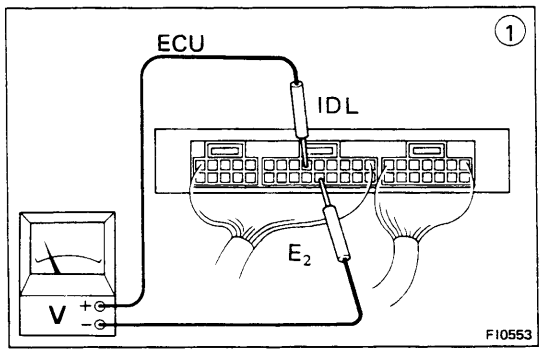
OK

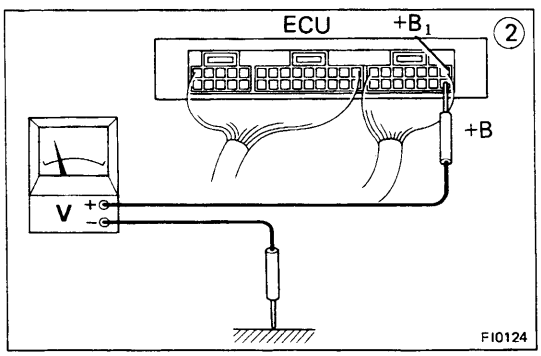
Check wiring between fuse and ECU.

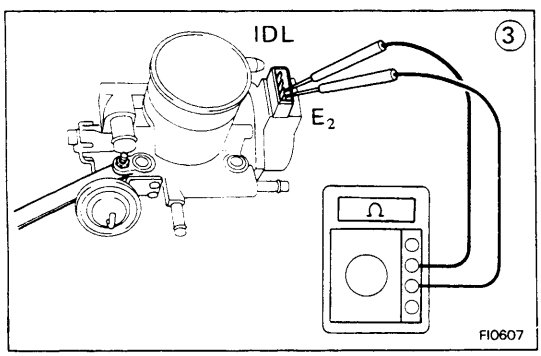
BAD → Repair or replace

No.	Terminals	Trouble	Condition		STD Voltage
3	IDL – E_2	No voltage	Ignition switch ON	Throttle valve open	4 – 10 V
	VTA – E_2			Throttle valve fully closed	0.1 – 1.0 V
				Throttle valve fully open	4 – 5 V
	Vcc – E_2			–	4 – 6 V









- **IDL ↔ E_2**

① There is no voltage between ECU terminals IDL and E_2. **(IG S/W ON)** (Throttle valve open)

↓

② Check that there is voltage between ECU terminal $+B_1$ or +B and body ground. **(IG S/W ON)**

NO → OK

OK → Check wiring between ECU terminal E_1 and body ground.

BAD → Replace or repair.

NO → Refer to No. 1

BAD → Replace or repair.

OK →

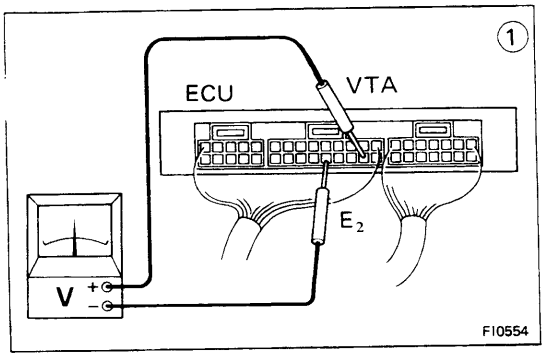
③ Check throttle position sensor.

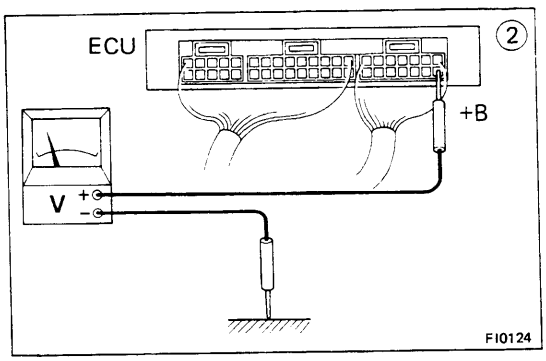
BAD → Replace or repair throttle position sensor.

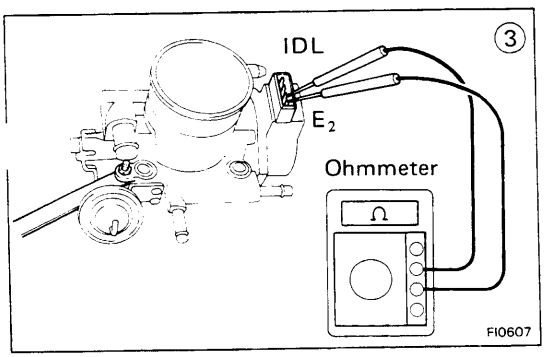
OK → Check wiring between ECU and throttle position sensor.

BAD → Replace or repair.

OK → Try another ECU.







- **VTA ↔ E_2**

① There is no specified voltage at ECU terminals VTA and E_2. **(IG S/W ON)**

↓

② Check that there is voltage between ECU terminal $+B_1$ or $+B$ and body ground. **(IG S/W ON)**

NO → Check wiring between ECU terminal E_1 and body ground.
- BAD → Replace or repair.

OK ↓

Refer to No. 1.
- BAD → Repair or replace.

OK ↓

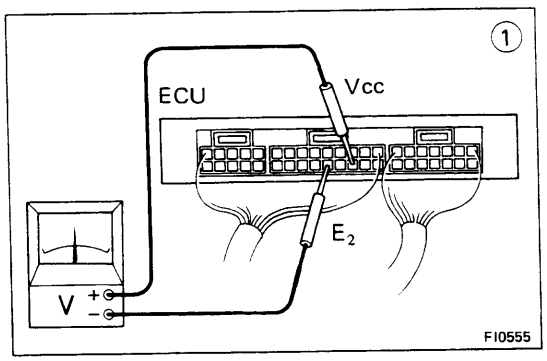
③ Check throttle position sensor.
- BAD → Repair or replace.

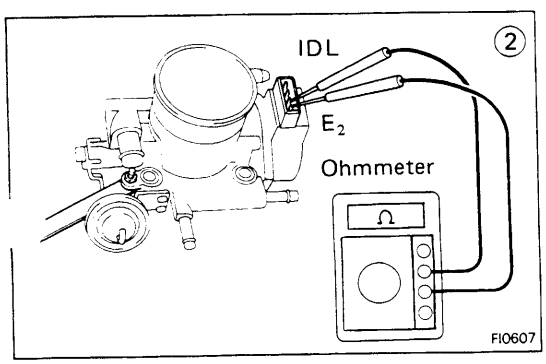
OK ↓

Check wiring between ECU and throttle position sensor.
- BAD → Repair or replace.

OK ↓

Try another ECU.





- **Vcc ↔ E_2**

① There is no voltage between ECU terminals Vcc and E_2. **(IG S/W ON)**

↓

Check that there is voltage between ECU terminal $+B_1$ or $+B$ and body ground. **(IG S/W ON)**

NO → Refer to No. 1.

OK ↓

② Check throttle position sensor.

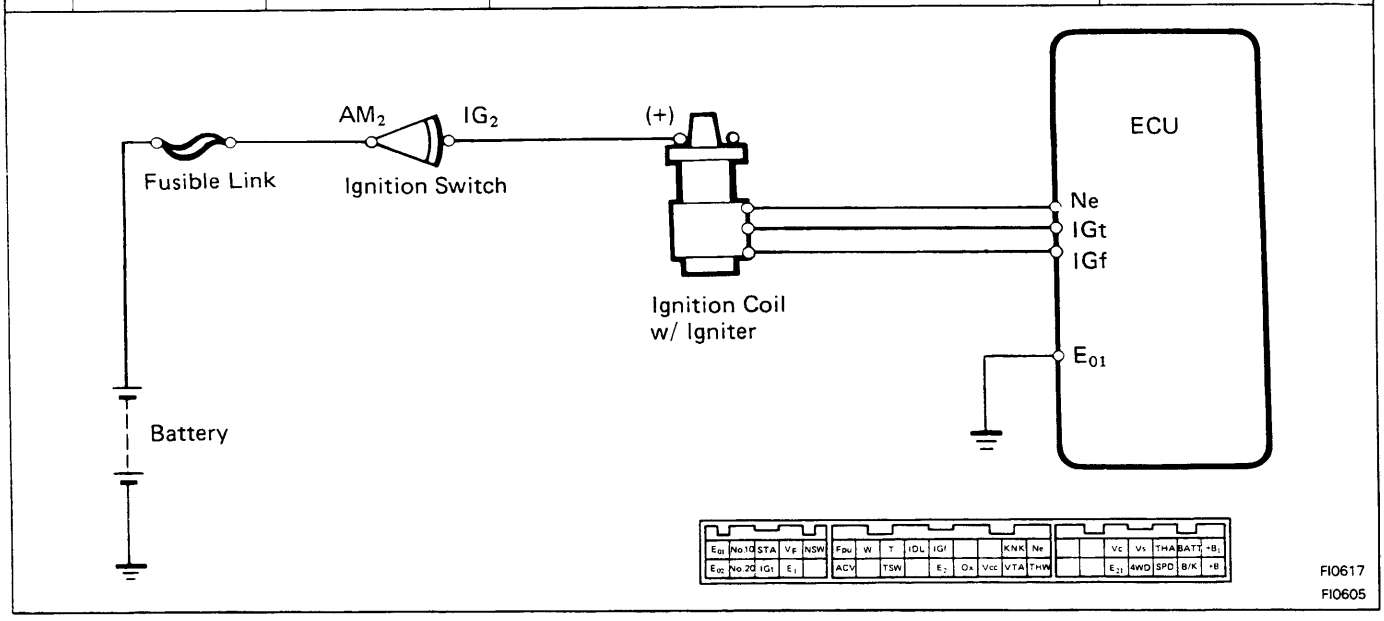
BAD → Repair or replace.

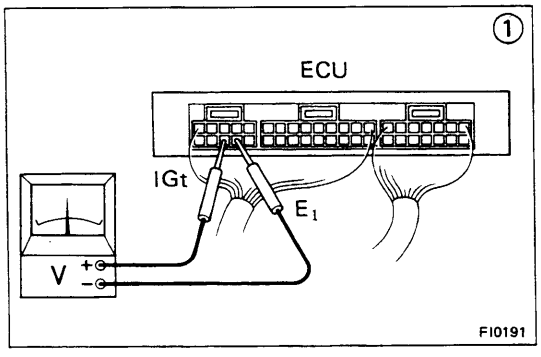
OK → Check wiring between ECU and throttle position sensor.
- BAD → Repair or replace wiring.

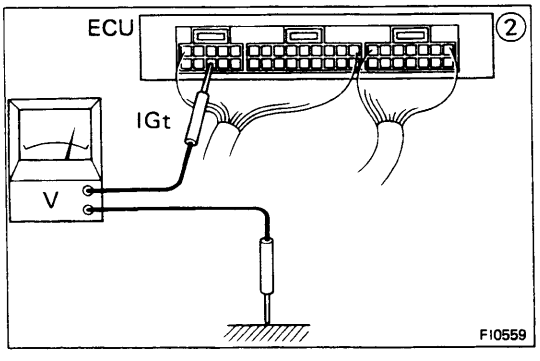
OK ↓

Try another ECU.

No.	Terminals	Trouble	Condition	STD Voltage
4	IGt – E_1	No voltage	Idling	0.7 – 1.0 V







① There is no voltage between ECU terminals IGt and E_1. (Idling)

↓

② Check that there is voltage between ECU terminal IGt and body ground. (Idling)

↓ OK

Check wiring between ECU terminal E_1 and body ground.

↓ BAD

Repair or replace.

② → Refer to No. 1. → BAD → Repair or replace.

↓ OK

Check wiring between igniter and distributor. → BAD → Repair or replace.

↓ OK

Check distributor. → BAD → Replace.

↓ OK

Check wiring between ECU and igniter. → BAD → Repair or replace.

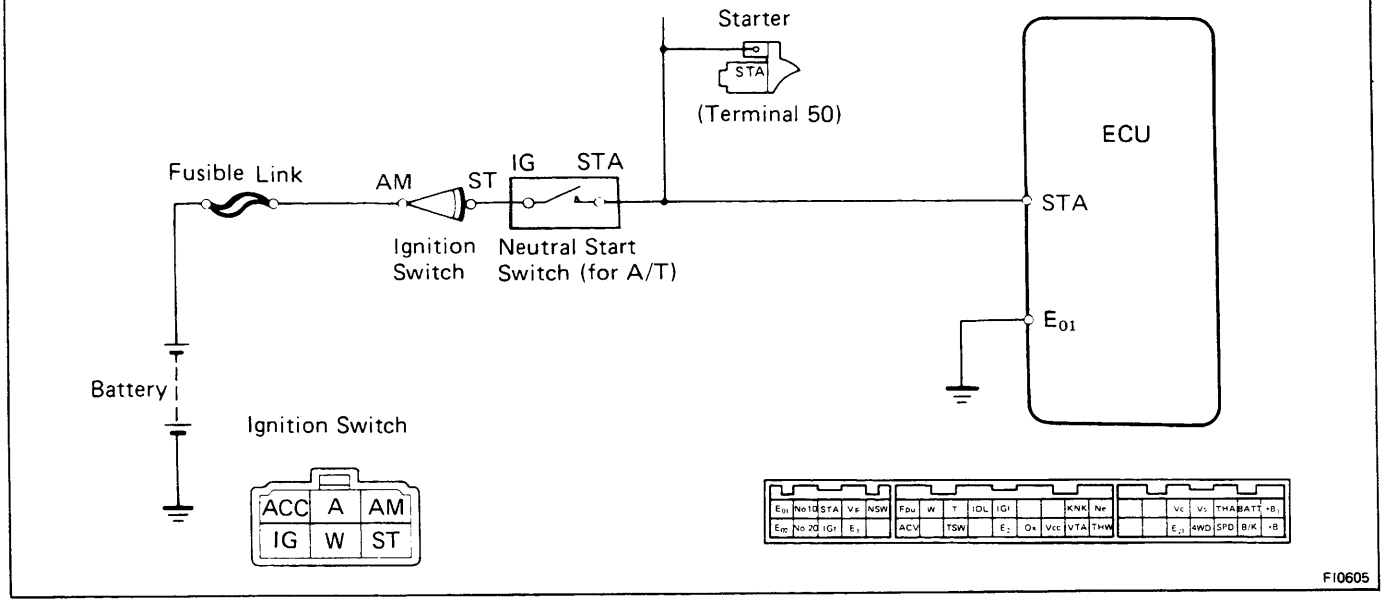
↓ OK

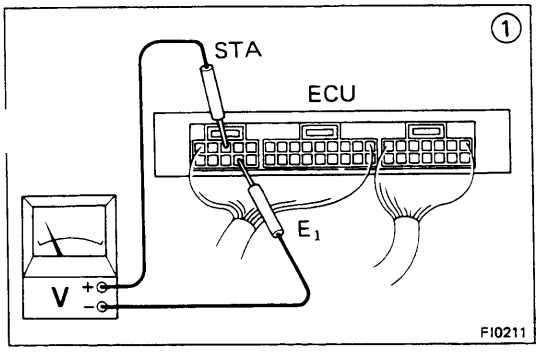
Check igniter. (See page IG-5) → BAD → Repair or replace.

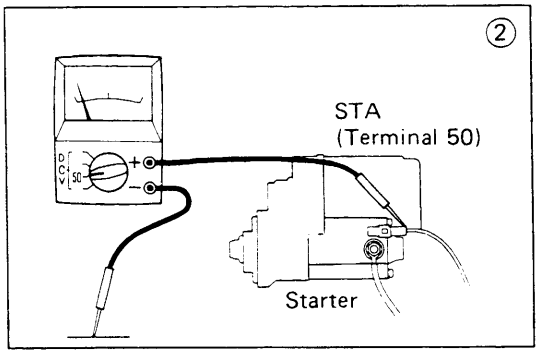
↓ OK

Try another ECU.

No.	Terminals	Trouble	Condition	STD Voltage
	STA – E_1	No voltage	Ignition switch ST position	6 – 12 V



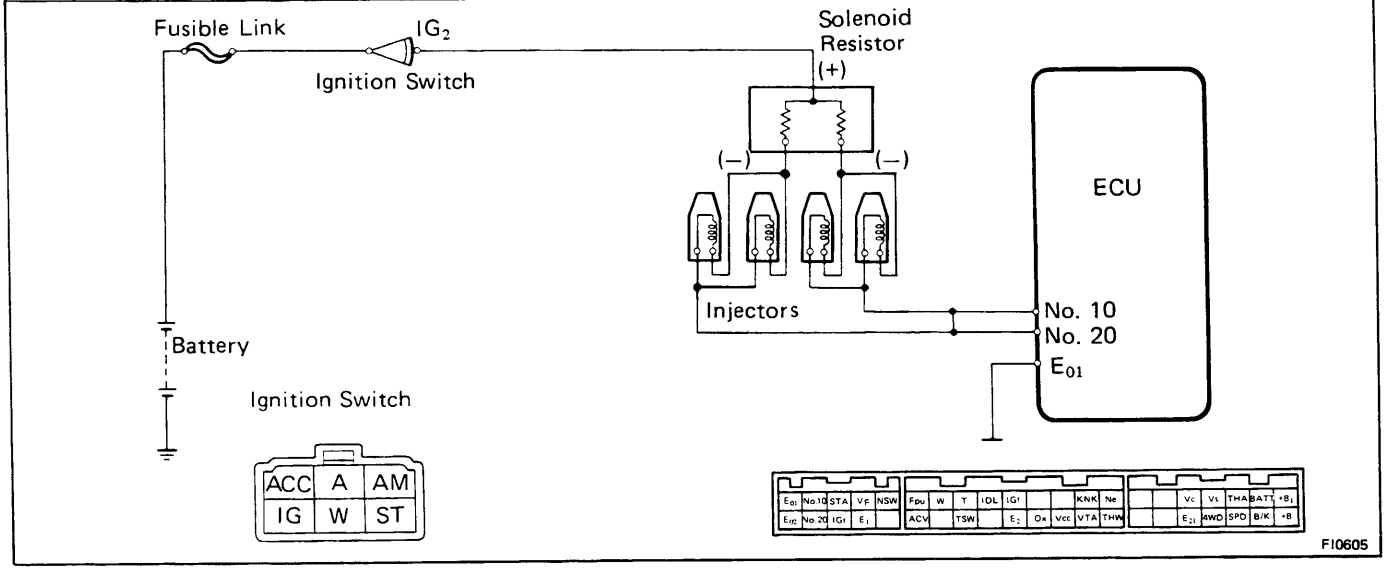


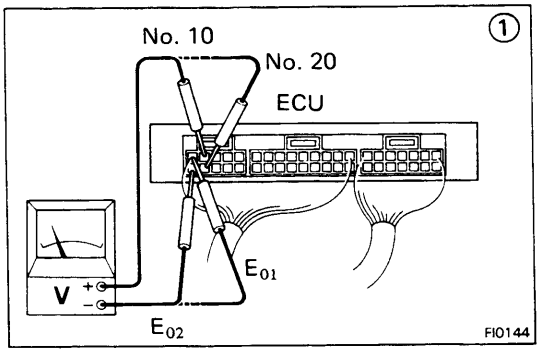


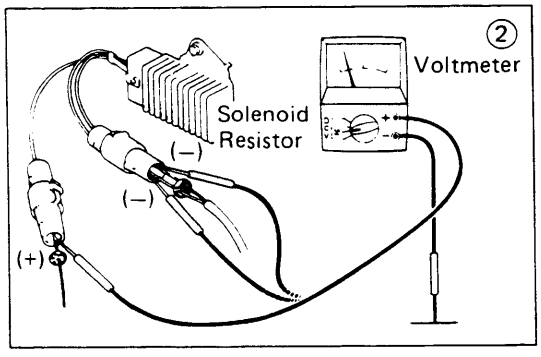
① No voltage between ECU terminals STA and E_1. **(IG S/W ST)**

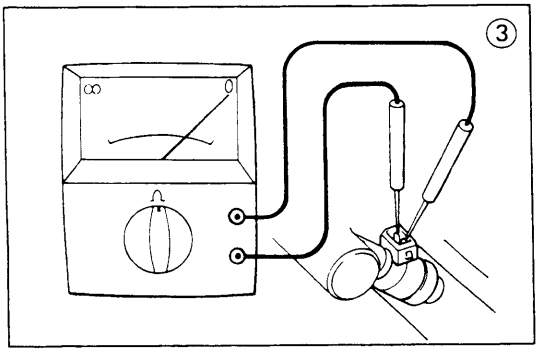
Check starter operation.
- OK → Check wiring between ECU and ignition switch terminal ST.
  - OK → Check wiring between ECU terminal E_1 and body ground.
    - OK → Try another ECU.
    - BAD → Repair or replace
  - BAD → Repair or replace
- BAD → Check fusible link, battery, wiring and ignition switch.
  - BAD → Repair or replace
  - OK → ② Check that there is voltage at STA (50) terminal of starter. **(IG S/W ST)** **STD voltage: 6 – 12 V**
    - OK → Check starter. (See page ST-3)
    - NO → Check wiring between ignition switch ST terminal and starter STA (50) terminal.

No.	Terminals	Trouble	Condition	STD Voltage
6	No. 10 — E_1 No. 20 — E_1	No voltage	Ignition switch ON	9 — 14 V









① No voltage between ECU terminals No. 10 and/or No. 20 and E_{01}. **(IG S/W ON)**

② Check that there is specified voltage between resistor terminal (+) and body ground. **STD voltage: 9 — 14 V**

OK → ② Check that there is specified voltage between resistor terminal (−) and body ground. **STD voltage: 9 — 14 V**

NO → Check fuse, fusible link and ignition switch. BAD → Repair or replace

OK → Check wiring between solenoid resistor and battery. BAD → Repair or replace

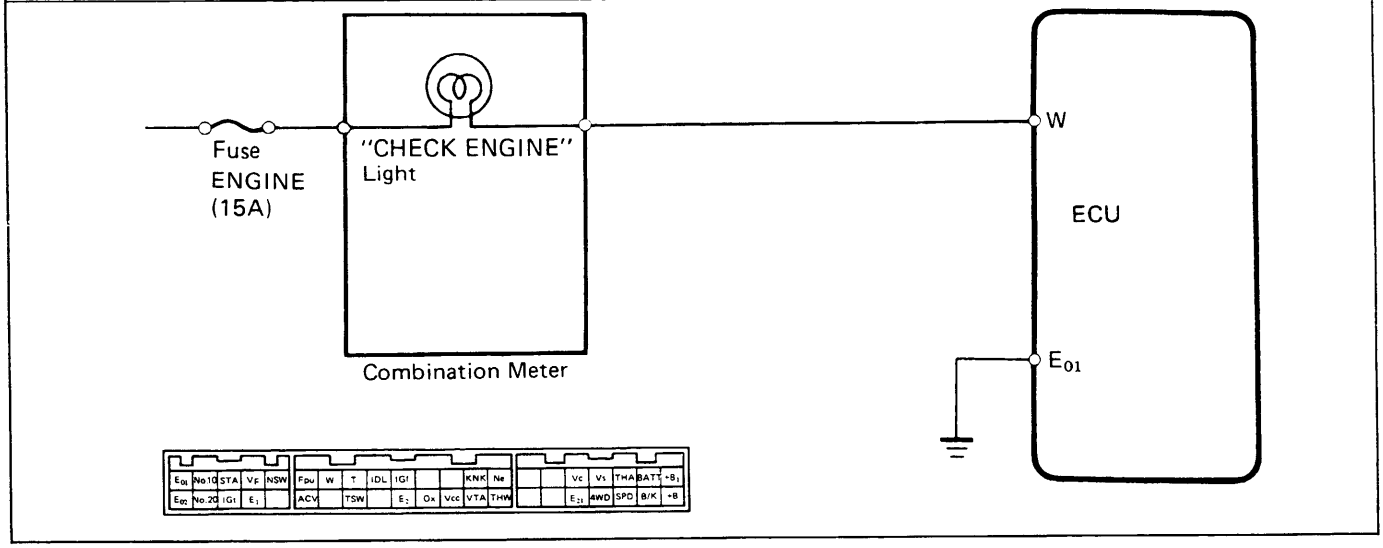
② OK → ③ Check resistance of magnetic coil in each injector. **STD resistance: 1.5—3.0 Ω**

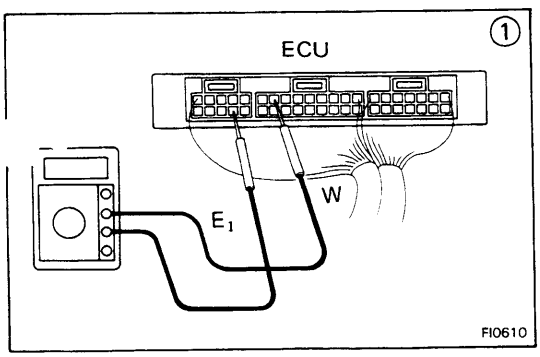
② NO → Replace resistor.

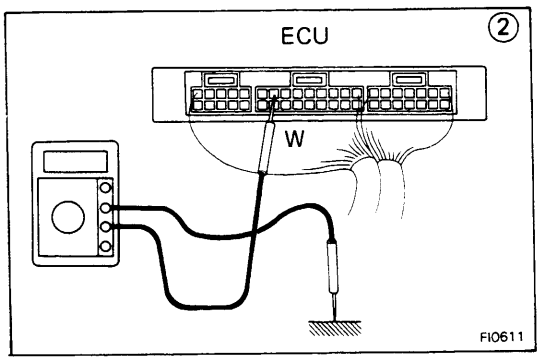
③ OK → Check wiring between ECU and resistor.

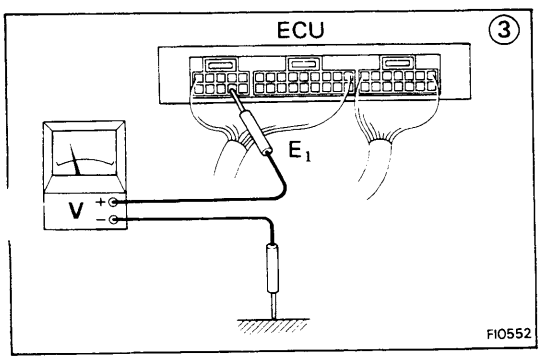
③ BAD → Replace injector.

No.	Terminals	Trouble	Condition	STD Voltage
	W – E_1	No voltage	No trouble (CHECK ENGINE light off) and engine running	8 – 14 V









① No voltage between ECU terminal W and E_1. (Idling)

↓

② Check that there is voltage between ECU terminal W and body ground.

NO → ③ Check wiring between ECU terminal E_1 and body ground.
- OK → Try another ECU.
- BAD → Repair or replace

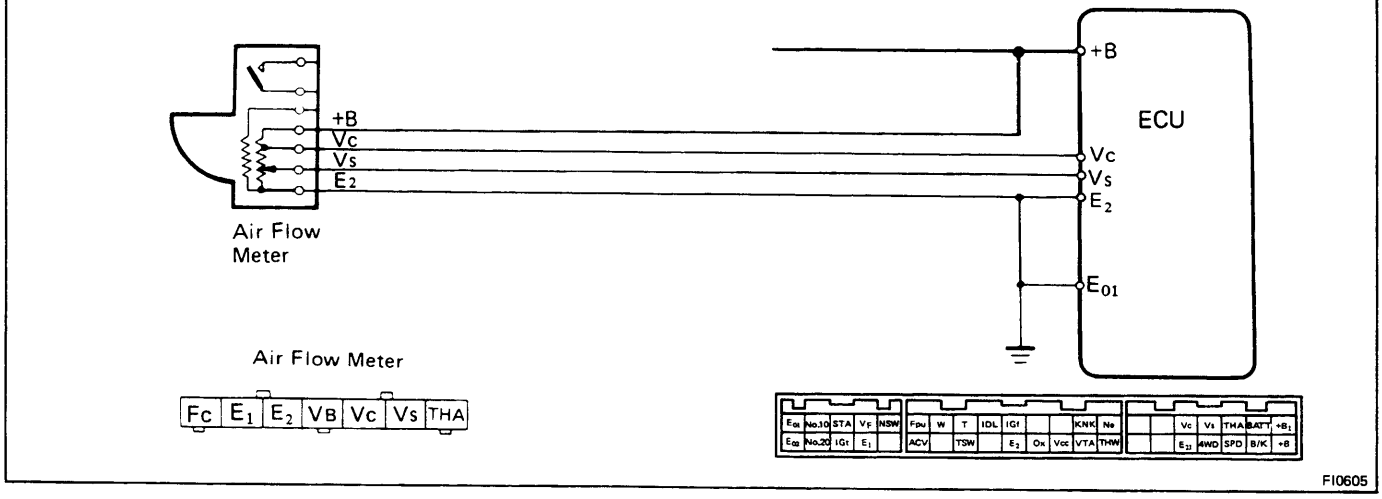
OK →

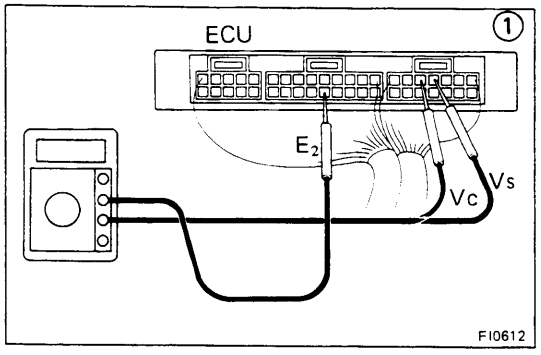
Check ENGINE fuse (15A) and Check Engine light.
- BAD → Repair or replace

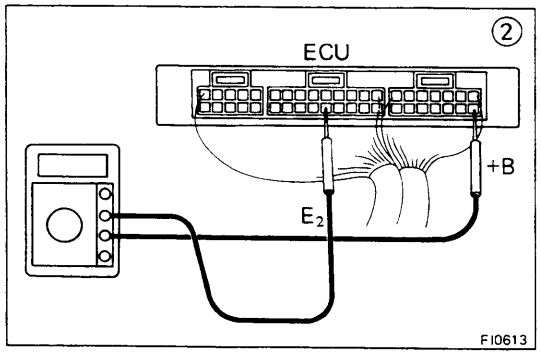
OK →

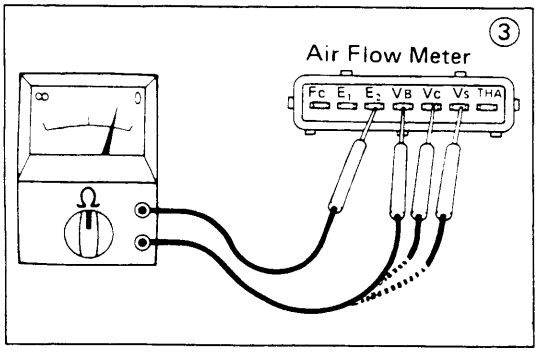
Check wiring between ECU terminal W and fuse.
- BAD → Repair or replace

No.	Terminals	Trouble	Condition		STD Voltage
8	Vc — E2	No voltage	Ignition switch ON	—	4 — 9 V
	Vs — E2			Measuring plate fully closed	0.5 — 2.5 V
	Vs — E2			Measuring plate fully open	5 — 8 V
	Vs — E2		Idling	—	2.5 — 5.5 V









- **Vc — E2, Vs — E2**

① No specified voltage at ECU terminals Vc or Vs and E_2 **(IG S/W ON)**

② Check that there is voltage between ECU terminals +B and E_2. **(IG S/W ON)**

OK → ③ Check air flow meter.

NO → Refer to +B — E2 trouble section.

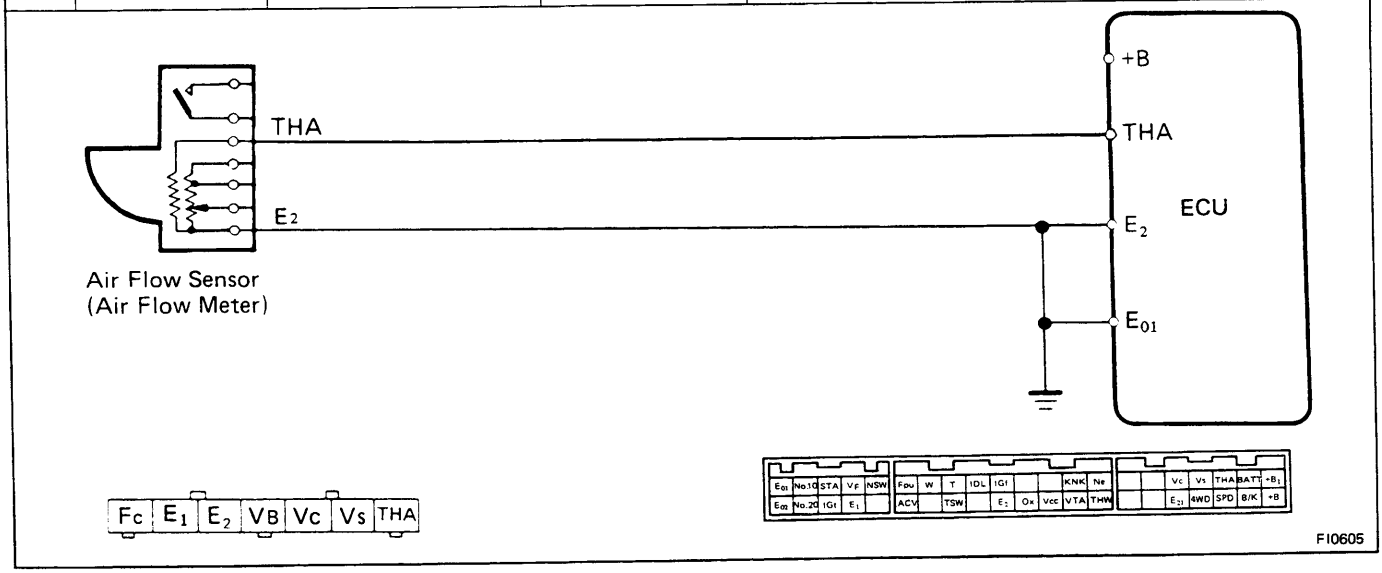
③ NO → Replace or repair air flow meter.

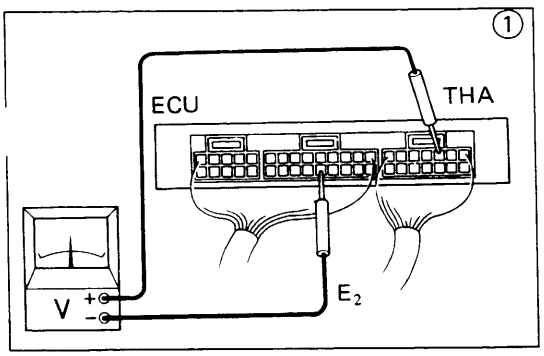
③ OK → Check wiring between ECU and air flow meter.

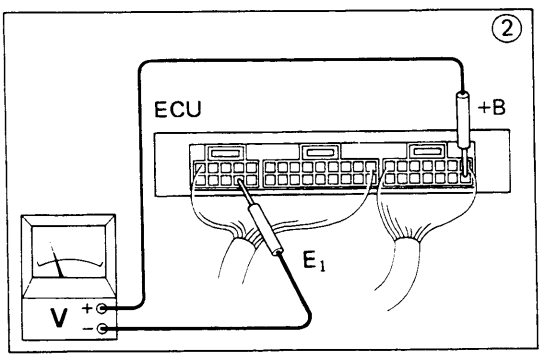
OK → Try another ECU.

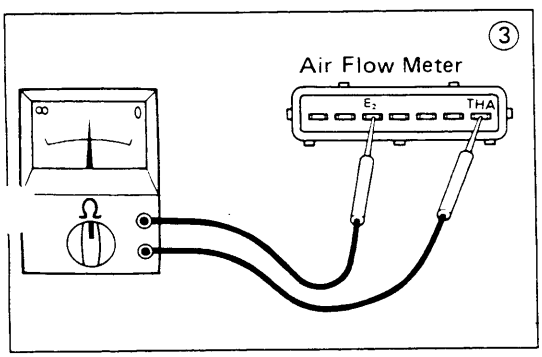
NO → Replace or repair wiring.

No.	Terminals	Trouble	Condition		STD Voltage
3	THA — E_2	No voltage	Ignition switch ON	Intake air temperature 20°C (68°F)	2 — 6 V









① No voltage between ECU terminals THA and E_2. **(IG S/W ON)**

② Check that there is voltage between ECU terminal +B and body ground. **(IG S/W ON)**

OK → ③ Check air thermo sensor.

NO → Refer to section 1.

③ Check air thermo sensor.

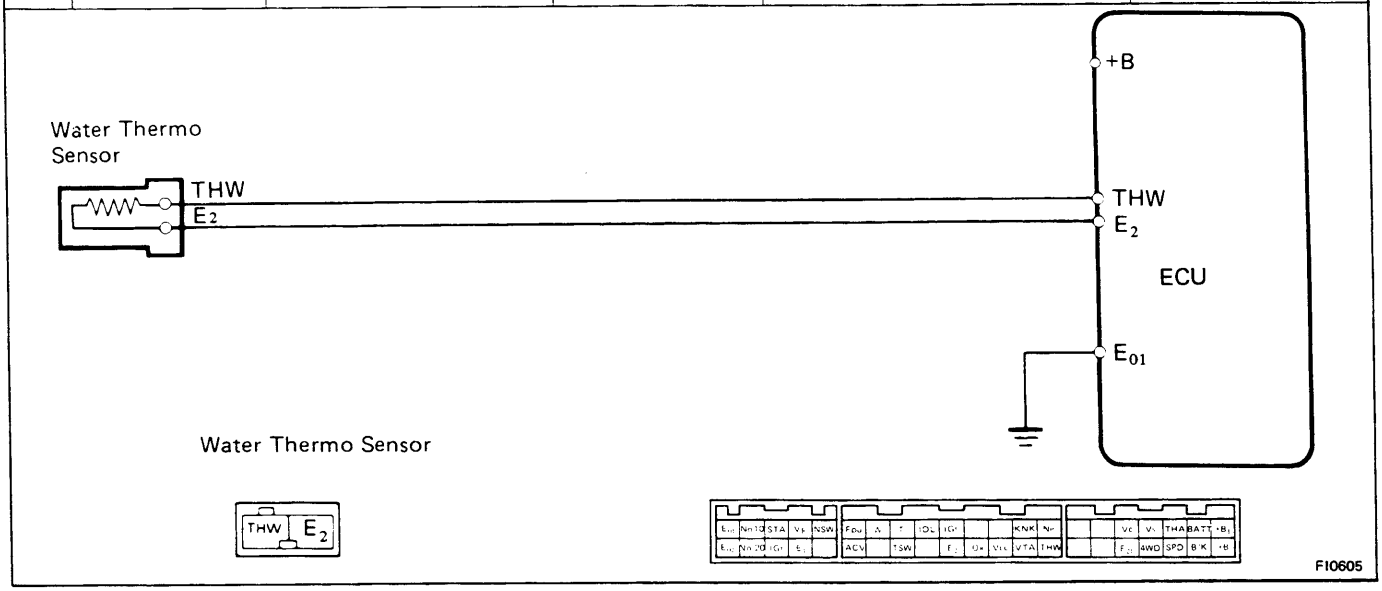
BAD → Replace air flow meter.

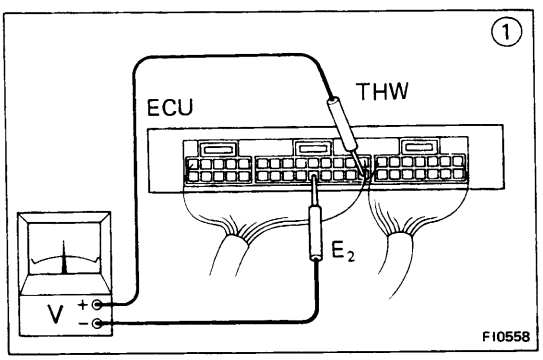
OK → Check wiring between ECU and air thermo sensor.

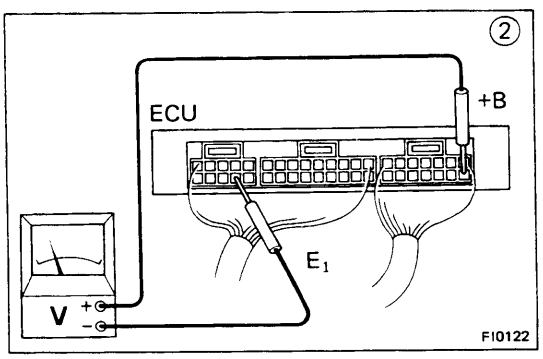
OK → Try another ECU.

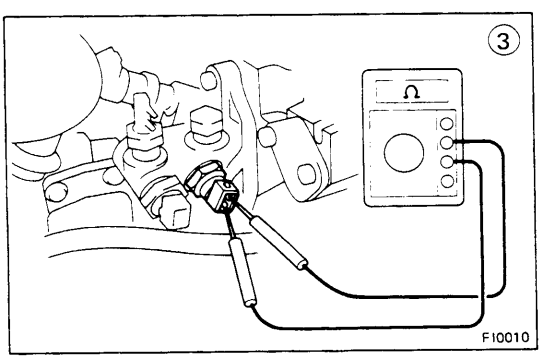
BAD → Repair or replace wiring.

No.	Terminals	Trouble	Condition		STD Voltage
10	THW – E_2	No voltage	Ignition switch ON	Coolant temperature 80°C (176°F)	0.5 – 2.5 V









① No voltage between ECU terminals THW and E_2. **(IG S/W ON)**

② Check that there is voltage between ECU terminal +B and body ground. **(IG S/W ON)**

OK → ③ Check water thermo sensor.

NO → Refer to section 1.

③ Check water thermo sensor.

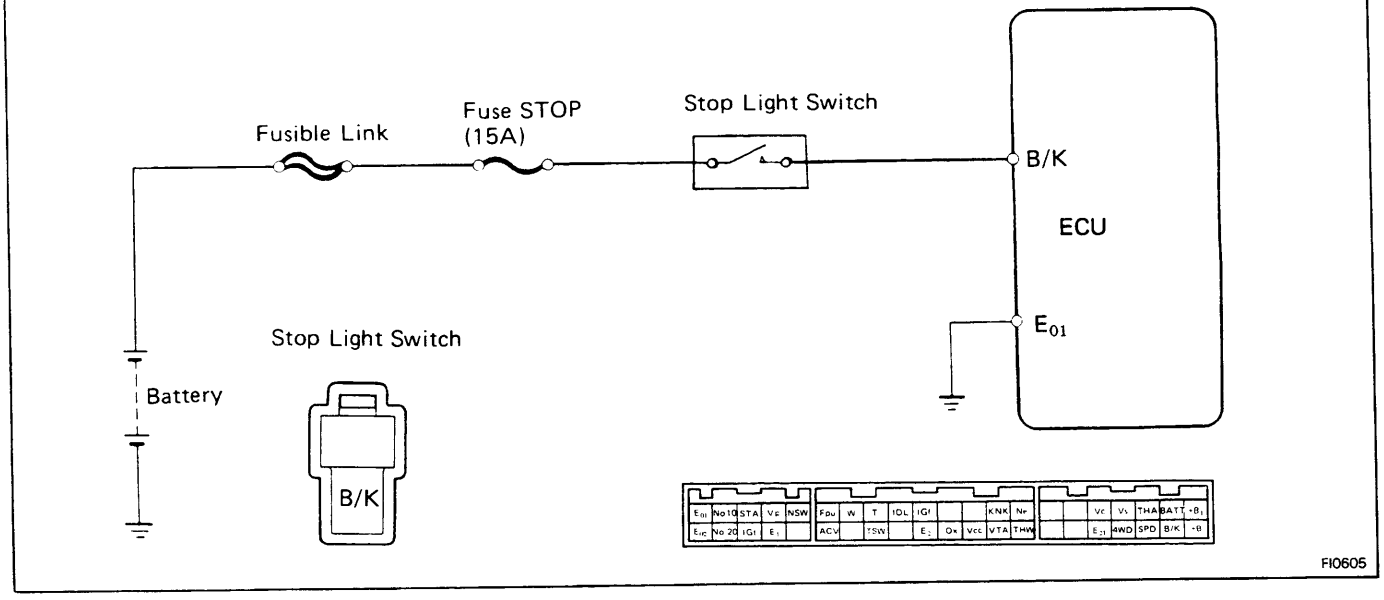
BAD → Replace water thermo sensor.

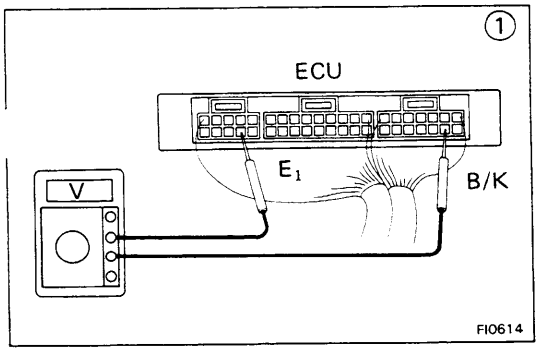
OK → Check wiring between ECU and water thermo sensor.

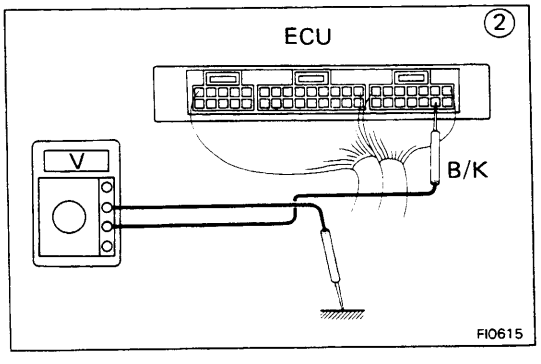
OK → Try another ECU.

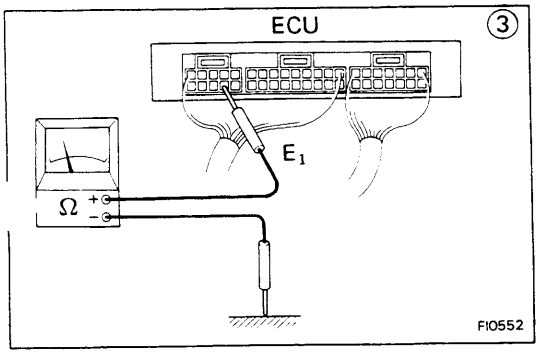
BAD → Repair or replace wiring

No.	Terminals	Trouble	Condition	STD Voltage
1	B/K – E_1	No voltage	Stop light switch ON	8 – 14 V









① No voltage between ECU terminals B/K and E_1.

② Check that there is voltage between ECU terminal B/K and body ground when the brake pedal is depressed.

NO

OK

③ Check wiring between ECU E_1 and body ground.

OK

Try another ECU.

BAD

Repair or replace

BAD

Repair or replace

Check STOP fuse (15A) and stop light switch.

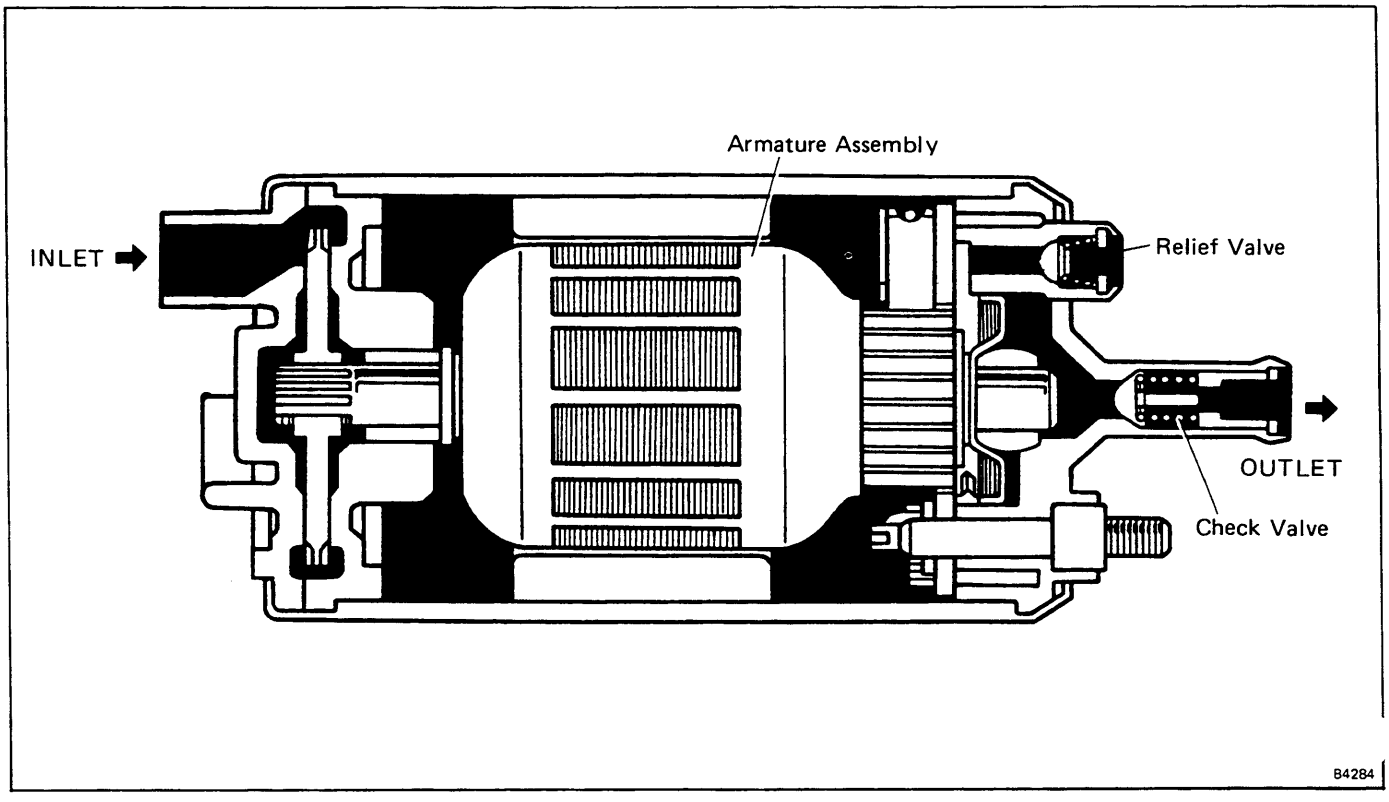
OK

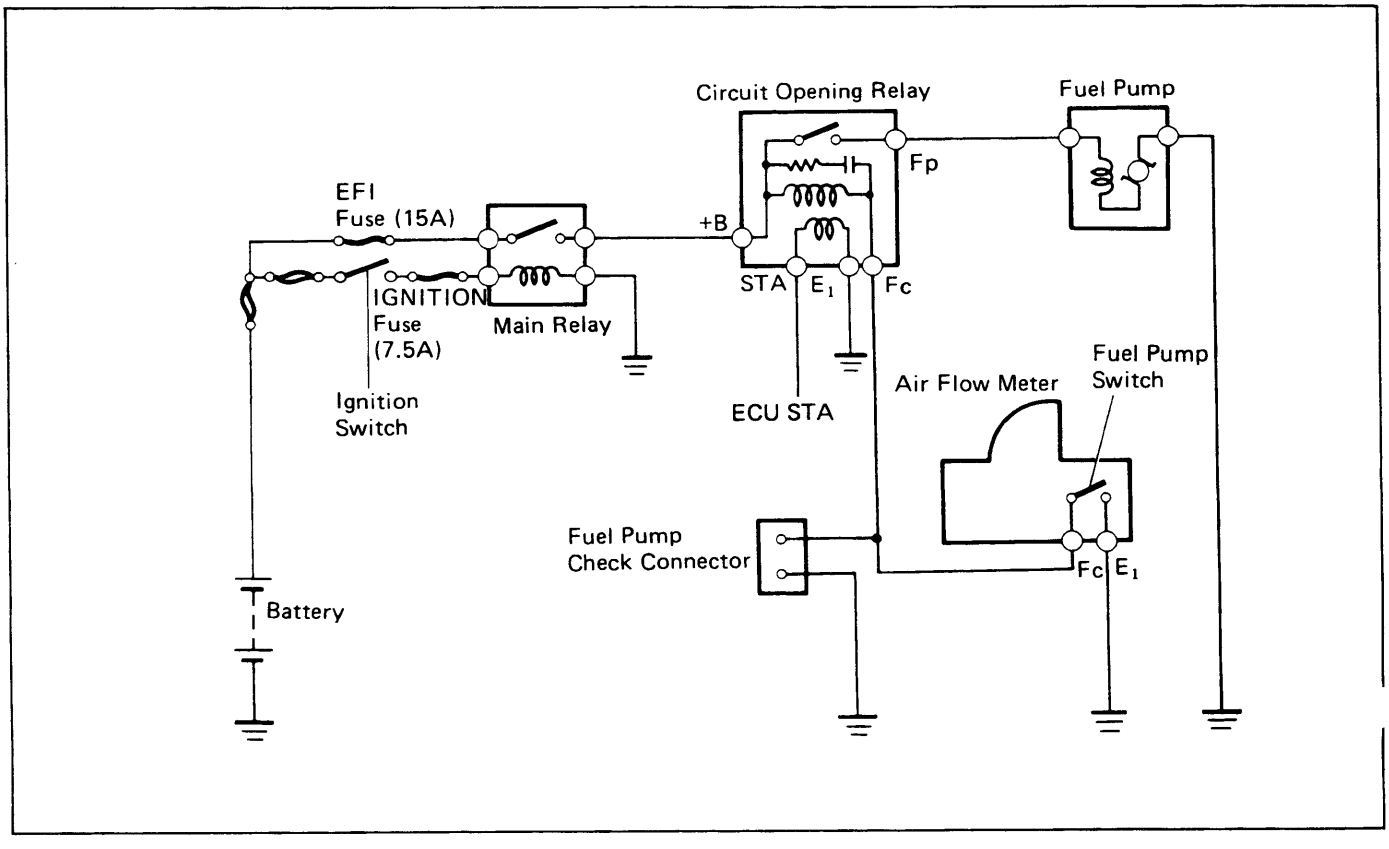
Check wiring between ECU terminal B/K and battery.

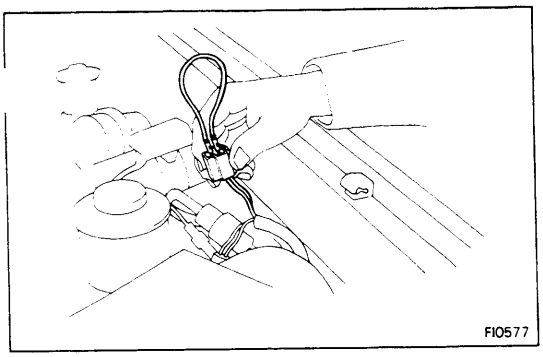
BAD

Repair or replace

FUEL SYSTEM
Fuel Pump







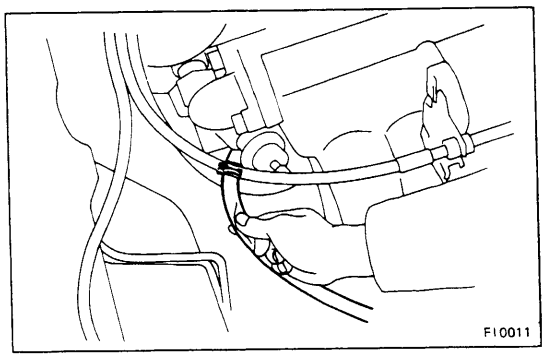
ON-VEHICLE INSPECTION

1. CHECK FUEL PUMP OPERATION

(a) Turn on the ignition switch.

NOTE: Do not start the engine.

(b) Short the terminals Fp and +B of the check connector (diagnosis).



(c) Check that there is a pressure in the hose to the cold start injector.

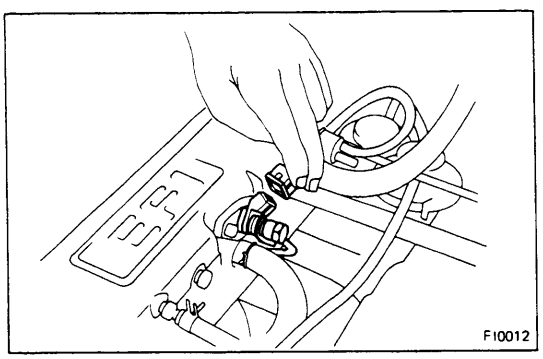
NOTE: At this time, you will hear fuel return noise from the pressure regulator.

(d) Remove service wire and install the rubber cap to the check connector.

(e) Turn off the ignition switch.

If there is no pressure, check the following parts.

- Fusible link
- Fuse (EFI 15A, IGN. 7.5A)
- Circuit opening relay
- Fuel pump
- Wiring connections



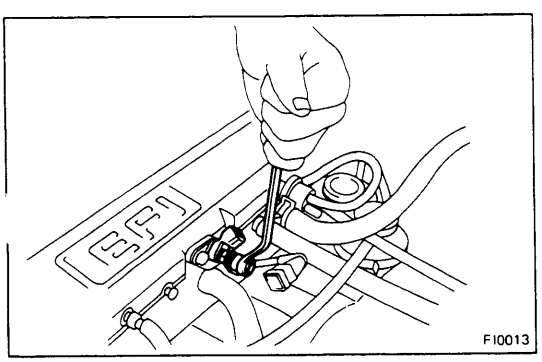
2. CHECK FUEL PRESSURE

(a) Check the battery voltage above 12 volts.

(b) Disonnect the cable from the negative terminal of the battery.

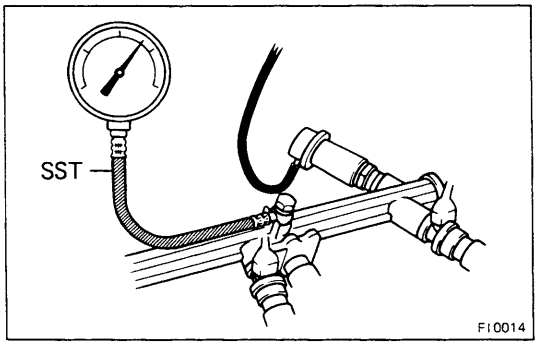
(c) Disconnect the wiring connector from the cold start injector.

(d) Put a suitable container or shop towel under rear end of the delivery pipe.



(e) Slowly loosen the union bolt of the cold start injector hose and remove the bolt and two gaskets from the delivery pipe.

(f) Drain the fuel from the delivery pipe.

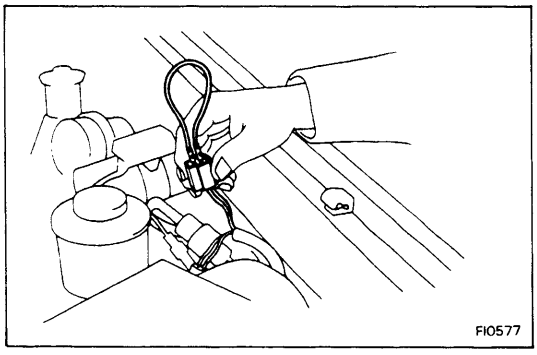


(g) Install a gasket, SST, another gasket and union bolt to the delivery pipe as shown in the figure.

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(h) Wipe off any splattered gasoline.

(i) Reconnect the battery cable.



(j) Short both terminals of the fuel pump check connector with a wire.

(k) Turn on the ignition switch.

(l) Measure the fuel pressure.

Fuel pressure: 2.3 — 2.7 kg/cm^2 (33 — 38 psi, 226 — 265 kPa)

If high pressure, replace the pressure regulator.
If low pressure, check the following parts.

- Fuel hoses and connection
- Fuel pump
- Fuel filter
- Pressure regulator

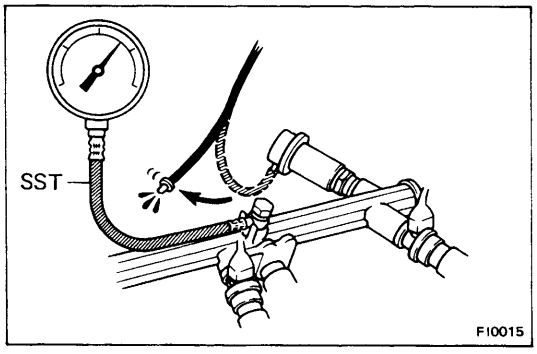
(m) Remove the service wire from the service connector

(n) Start the engine.

(o) Disconnect the vacuum sensing hose from the pressure regulator and plug it off.

(p) Measure the fuel pressure at idling.

Fuel pressure: 2.3 — 2.7 kg/cm^2 (33 — 38 psi, 226 — 265 kPa)

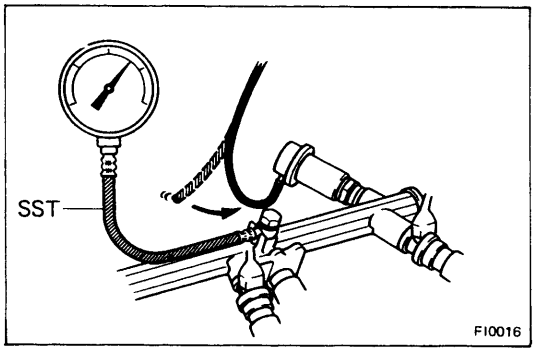


(q) Reconnect the vacuum sensing hose to the pressure regulator.

(r) Measure the fuel pressure at idling.

Fuel pressure: 1.9 — 2.2 kg/cm^2 (27 — 31 psi, 186 — 216 kPa)

If not pressure, check the vacuum sensing hose and pressure regulator.



(s) Stop the engine. Check that the fuel pressure remains above 1.5 kg/cm^2 (21 psi, 147 kPa) for 5 minutes after the engine is turned off.

If not within specification, check the fuel pump, pressure regulator and/or injectors.

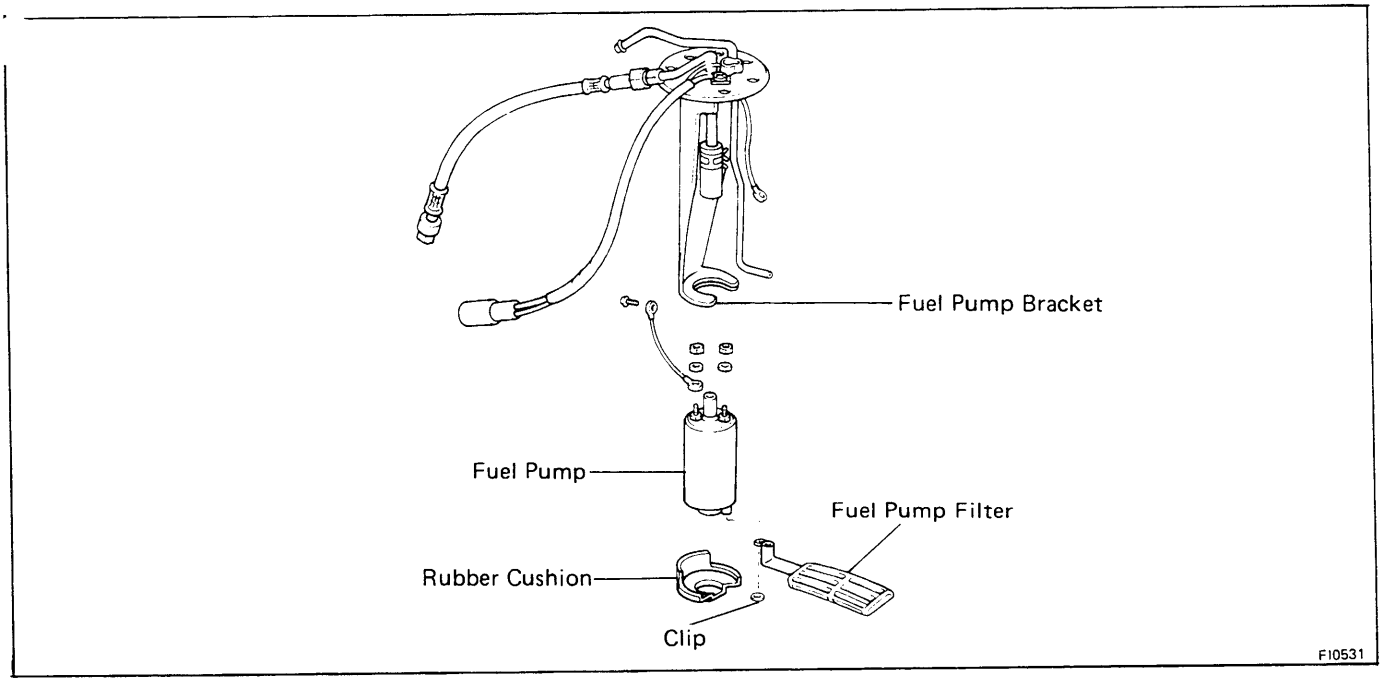
(t) After checking fuel pressure, disconnect the battery ground cable and carefully remove the SST to prevent gasoline from splashing.

(u) Using new gaskets, reconnect the cold start injector hose to the delivery pipe.

(v) Connect the wiring connector to the cold start injector.

(w) Check for fuel leakage.

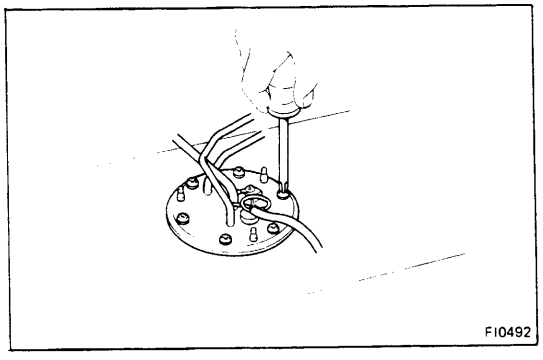
REMOVAL OF FUEL PUMP



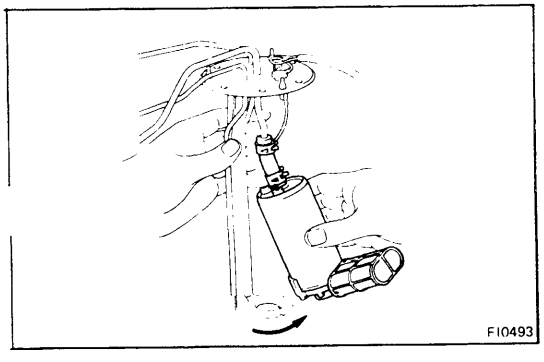
1. DRAIN FUEL FROM FUEL TANK

   WARNING: Avoid smoking and open flame when working on the fuel pump.

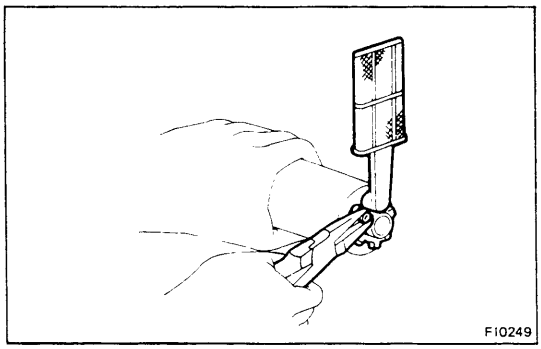
2. REMOVE FUEL TANK



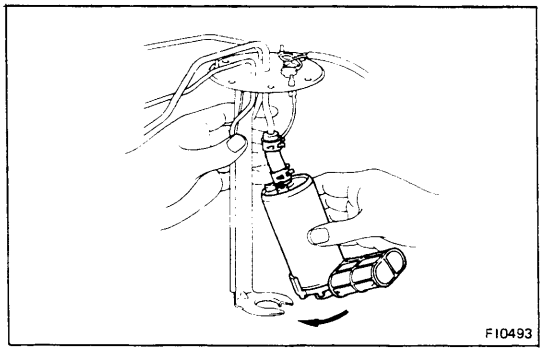
3. REMOVE FUEL PUMP BRACKET FROM FUEL TANK
   (a) Remove the seven bolts.
   (b) Pull out the fuel pump bracket.



4. REMOVE FUEL PUMP FROM FUEL PUMP BRACKET
   (a) Remove the two nuts and disconnect the wires from the fuel pump.
   (b) Pull off the bracket from the lower side of the fuel pump.
   (c) Remove the fuel pump from the fuel hose.



5. REMOVE FUEL PUMP FILTER FROM FUEL PUMP
   (a) Remove the rubber cushion.
   (b) Remove the clip and pull out the filter.

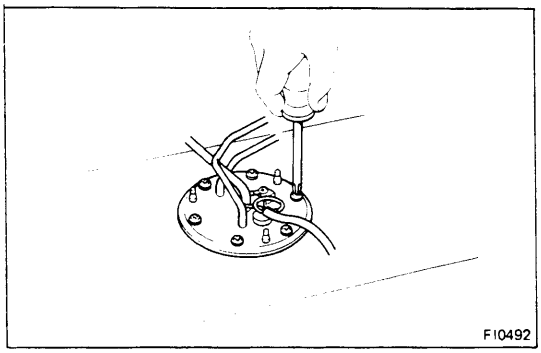


INSTALLATION OF FUEL PUMP

(See page FI-45)

1. INSTALL FUEL PUMP FILTER TO FUEL PUMP

2. INSTALL FUEL PUMP TO FUEL PUMP BRACKET
   (a) Insert the outlet port of the fuel pump into the fuel hose.
   (b) Install the rubber cushion to the lower side of the fuel pump.
   (c) Push the lower side of the fuel pump, together with the rubber cushion, into the fuel pump bracket.



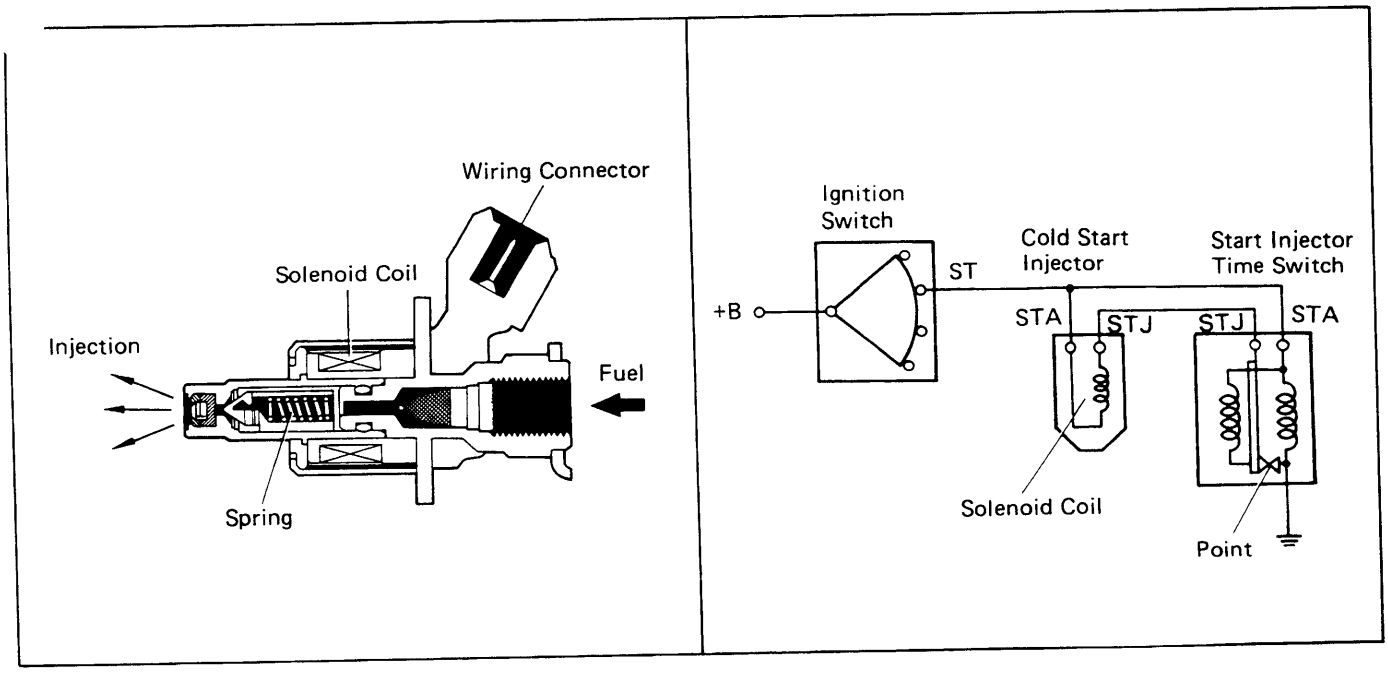
3. INSTALL FUEL PUMP BRACKET
   (a) Place the bracket with a new gasket on the fuel tank.
   (b) Install the tighten the seven bolts.

4. INSTALL FUEL TANK

   When installing the fuel tank, refer to FI-55 for the installation position of the protector and hose and the tightening torque.

   After installation, check for leaks.

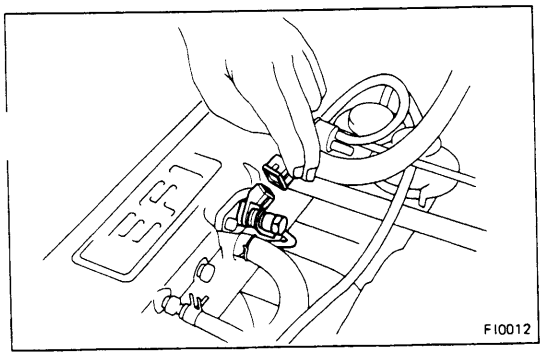
Cold Start Injector

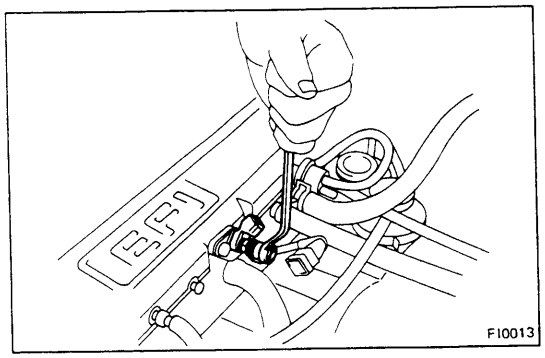


REMOVAL OF COLD START INJECTOR

REMOVE COLD START INJECTOR

(a) Disconnect the cold start injector wire.



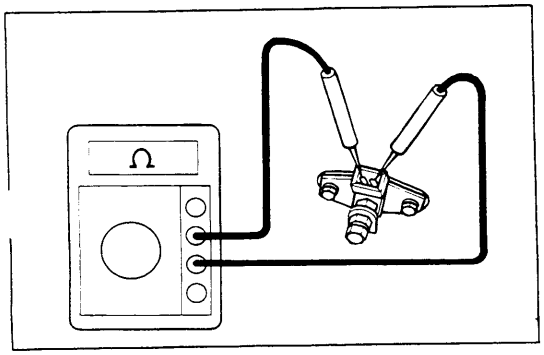


(b) Remove the fuel pipe between the cold start injector and fuel delivery pipe.

(c) Remove the cold start injector wire gasket.

(d) Put a suitable container or shop towel under rear end of the delivery pipe.

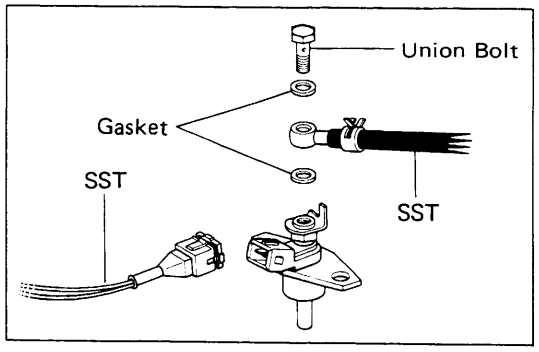
INSPECTION OF COLD START INJECTOR

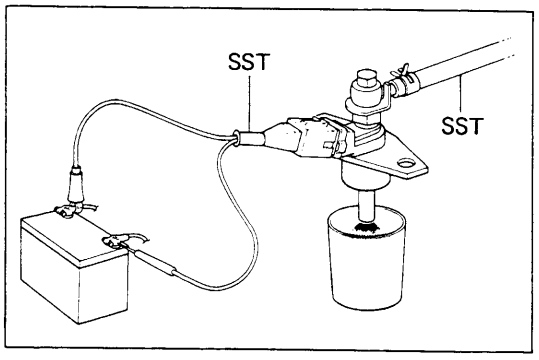


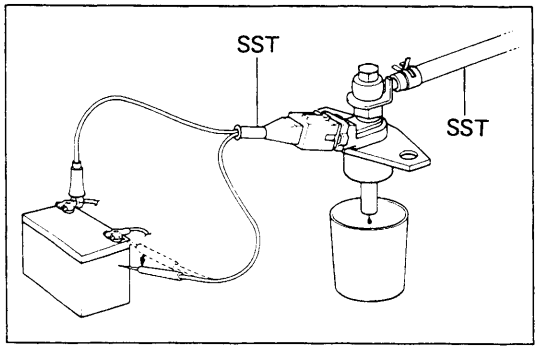
1. **MEASURE RESISTANCE OF COLD START INJECTOR**

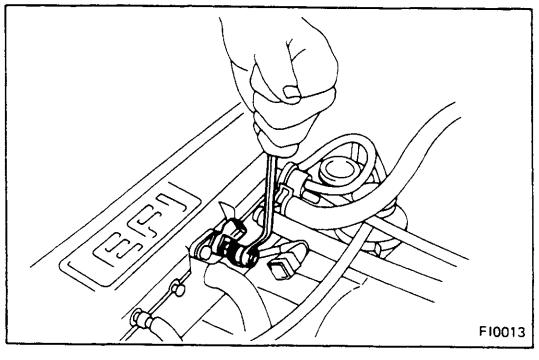
Using an ohmmeter, check the resistance of the injector.

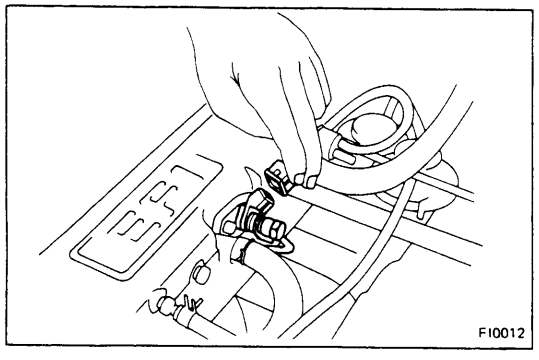
Resistance: 2 — 4 Ω











2. CHECK INJECTION OF COLD START INJECTOR

(a) Install the gasket, SST (two unions), another gasket and two union bolts to the delivery pipe and injec

(b) Connect the SST (hose) from the unions.

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(c) Connect the SST (wire) to the injector.

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NOTE: Position the injector as far away from the battery as possible.

(d) Put a container under the injector.

(e) Turn on the ignition switch.

NOTE: Do not start the engine.

(f) Short both terminals of the fuel pump check connector with a service wire.

(g) Connect the test probes of the SST to the battery and check that the fuel spray is as shown.

SST 09842-30050

NOTE: Perform this check within the shortest possible time.

(h) Disconnect the test probes from the battery and check that fuel does not leak from the injector.

Fuel drop: Less than one drop of fuel per minute

(i) After checking, restore the following to the previc state.

- Fuel pump check connector
- Ignition switch
- SST
- Cold Start injector
- Injector wiring

INSTALLATION OF COLD START INJECTOR

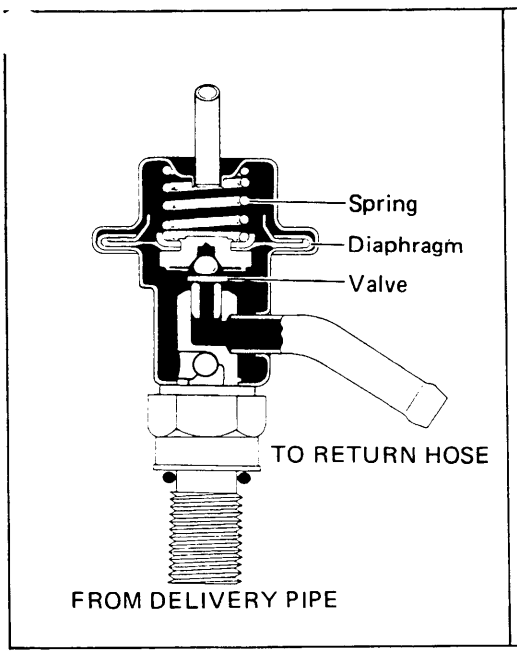
INSTALL COLD START INJECTOR

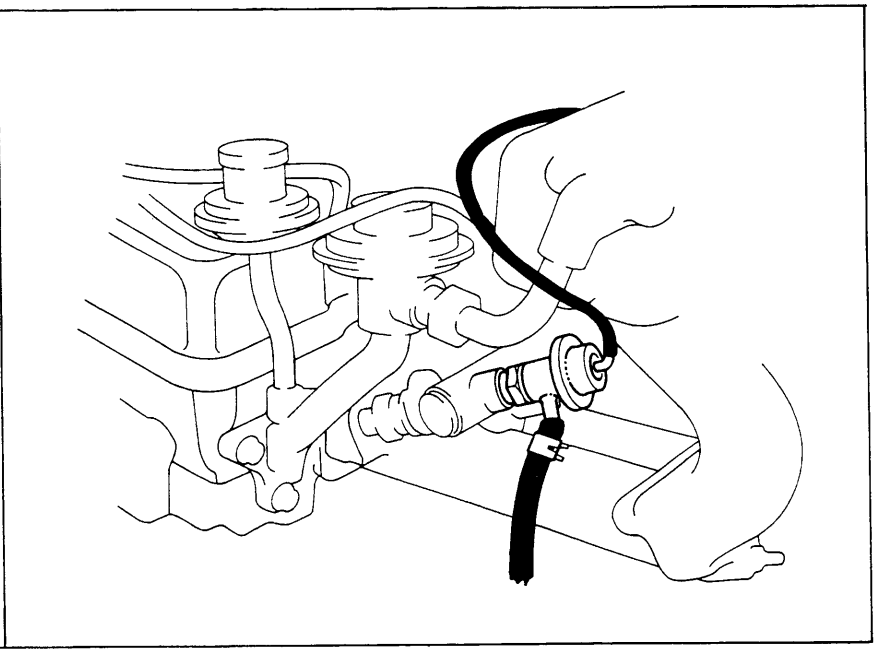
(a) Using new gaskets, install the cold start injector and two bolts.

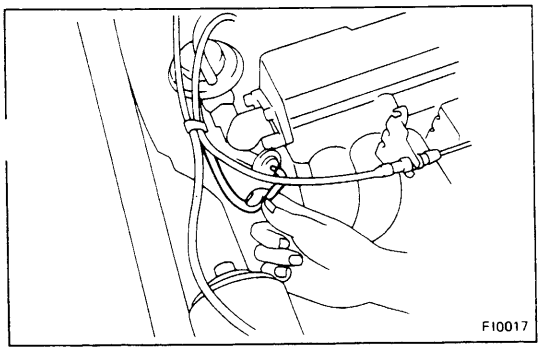
(b) Install the fuel pipe between the cold start injector and fuel delivery pipe with new gaskets.

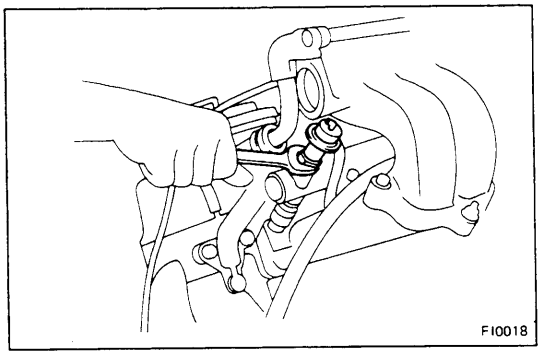
(c) Connect the cold start injector wire.

Pressure Regulator









ON-VEHICLE INSPECTION
CHECK FUEL PRESSURE (See page FI-43)

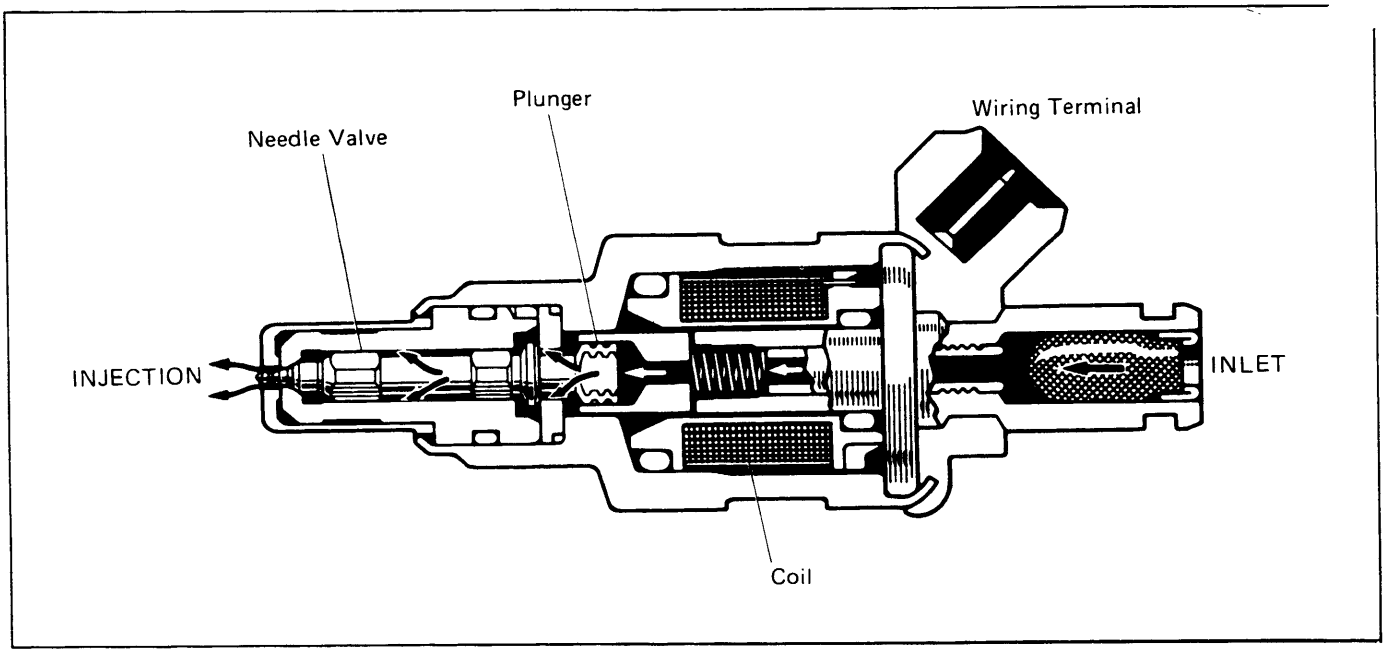
REMOVAL OF PRESSURE REGULATOR

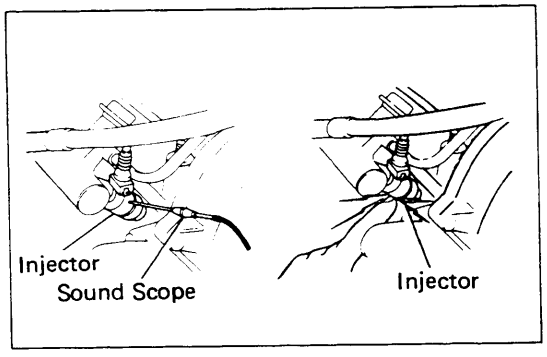
1. **DISCONNECT VACUUM SENSING HOSE**
2. **DISCONNECT FUEL HOSE**
   (a) Put a suitable container or shop towel under the pressure regulator.
   (b) Disconnect the fuel hose from the pressure regulator.
3. **REMOVE PRESSURE REGULATOR**
   Remove the lock nut, and remove pressure regulator.

INSTALLATION OF PRESSURE REGULATOR

1. **INSTALL PRESSURE REGULATOR**
   Install the pressure regulator and lock nut.
   Torque the lock nut.
   Torque: 300 kg-cm (22 ft-lb, 29 N·m)
2. **CONNECT FUEL HOSE**
3. **CONNECT VACUUM SENSING HOSE**

Injector





ON-VEHICLE INSPECTION

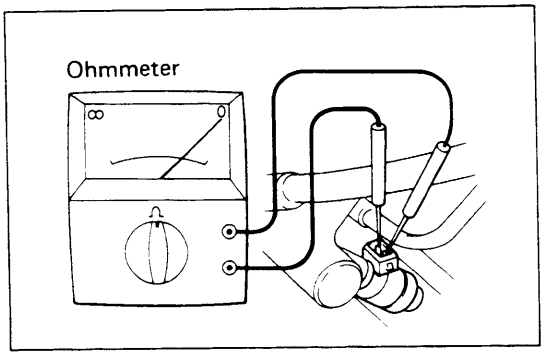
1. **CHECK INJECTOR OPERATION**

Check for operating 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 rpm.

(b) If you have no sound scope, you can check the injector transmission operation with your finger.

If no sound or an unusual sound is heard, check the wiring connector, injector, resistor or injection signal from ECU.

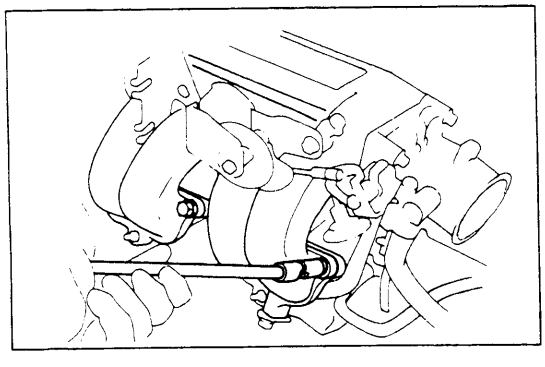


2. **MEASURE RESISTANCE OF INJECTOR**

(a) Unplug the wiring connector from the injector.

(b) Using an ohmmeter, check the continuity of both terminals.

Resistance: 1.5 — 3.0 Ω

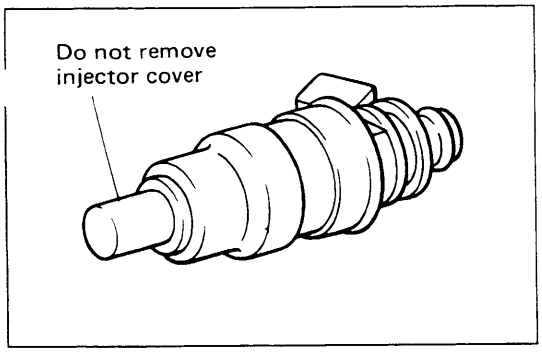


REMOVAL OF INJECTOR

1. **REMOVE CHAMBER WITH THROTTLE BODY**
(See steps 8 to 12 on page EM-13)

2. **DISCONNECT WIRES**
(See step 13 on page EM-13)

3. **DISCONNECT FUEL HOSE FROM DELIVERY PIPE**
(See step 14 on page EM-13)



4. REMOVE DELIVERY PIPE WITH INJECTORS

Remove two bolts and then remove the delivery pipe with the injectors.

NOTE:
1. When removing the delivery pipe, be careful not to drop the injectors.
2. Do not remove the injector cover.

INSPECTION OF INJECTOR

1. TEST INJECTION OF INJECTORS

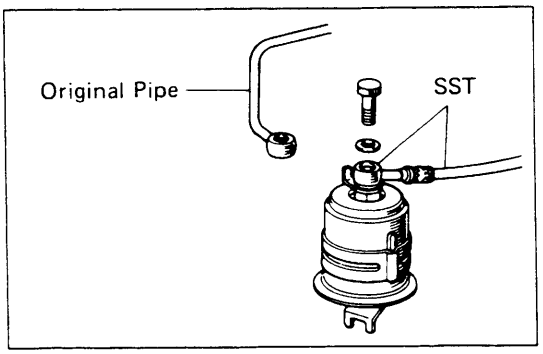
CAUTION: Keep clear of sparks during the test.

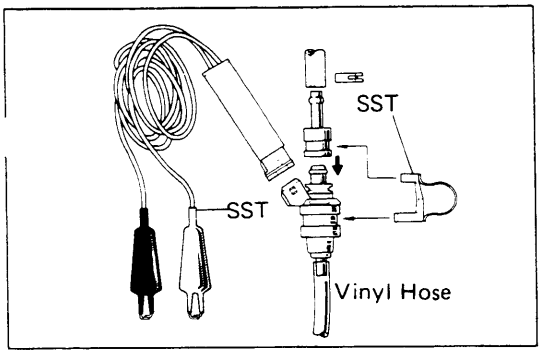
(a) Connect the SST to the fuel filter outlet.

SST 09268-41045

(b) Connect the SST to the pressure regulator and the injector.

SST 09268-41045





(c) Hold the injector and hose with SST.

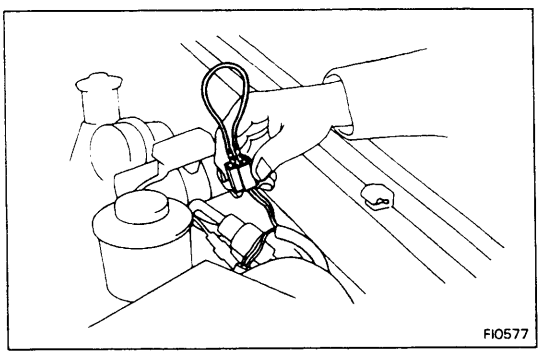
SST 09842-30020

(d) Put the injector into the graduated cylinder.

NOTE: Install a suitable vinyl hose onto the injector to prevent gasoline from splashing out.

(e) Connect the ground cable to the battery.

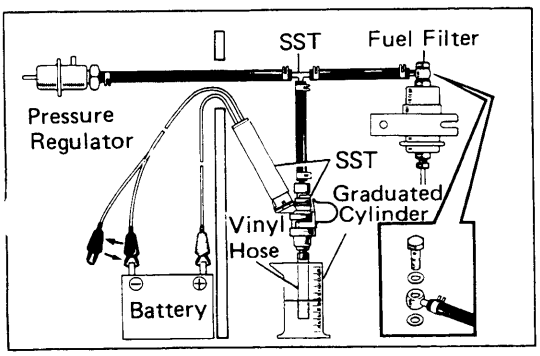
(f) Turn the ignition switch ON.



NOTE: Do not start the engine.

(g) Using a service wire, short both terminals of the fuel pump check connector.

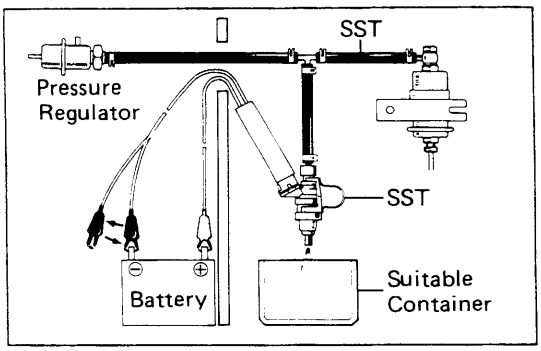
NOTE: Fuel pump will operate.



(h) Connect the SST to the battery for 15 seconds and measure the injection volume with a graduated cylinder.
Test each injector two or three times.If not within specified volume, clean or replace.

SST 09842-30020

Volume: 40 — 50 cc/15 sec. (2.4 — 3.1 cu in.)
Difference between each injector: Less than 6 cc (0.37 cu in.)



NOTE: If not within specified volume, clean or replace the injector.

(i) Remove the vinyl hose.

(j) Connect the SST to the battery, and test the injection spray pattern in a suitable container.

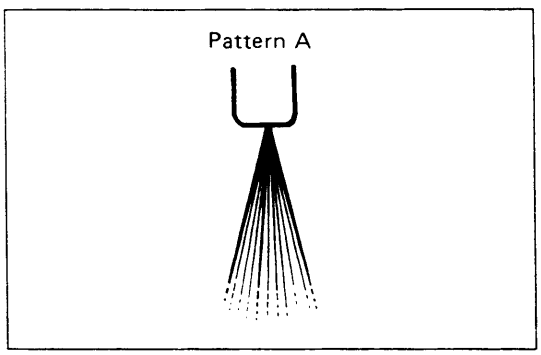
WARNING: Be careful to keep clear of sparks during the test.

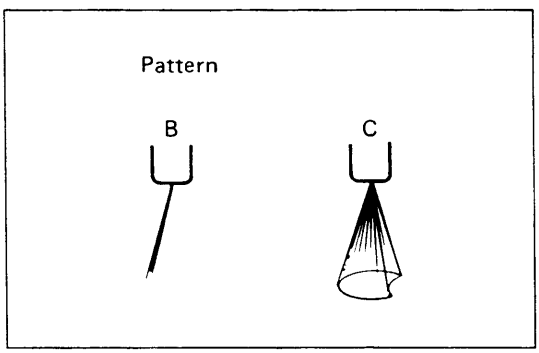
Proper injection spray pattern:

- A fine mist spreading out into a conical shape (pattern A).

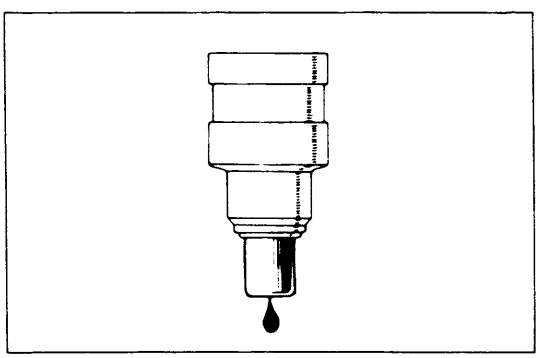
Faulty injection spray pattern:

- Injection is in 1 or more streams, not forming into a conical shape (pattern B).
- Imperfect conical shape (pattern C).





NOTE: If injection spray pattern is not within specification, clean or replace the injector.



2. TEST LEAKAGE

(a) From the previous condition, disconnect the SST from the battery and check the fuel leakage from the injection nozzle.

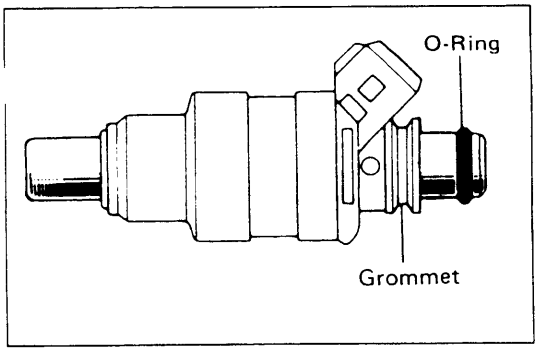
SST 09842-30020

Fuel drop: Less than one fuel drop of fuel per minute

(b) Disconnect the battery ground cable.

Remove the SST and disconnect the service wire from the fuel pump service connector.

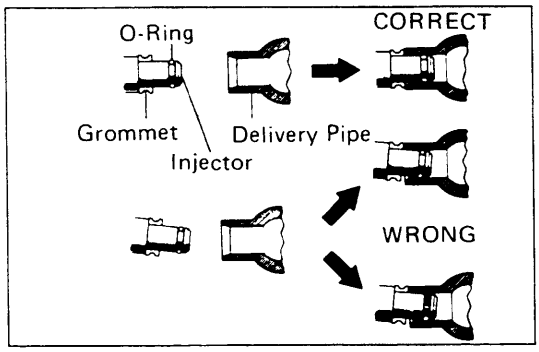
SST 09268-41045



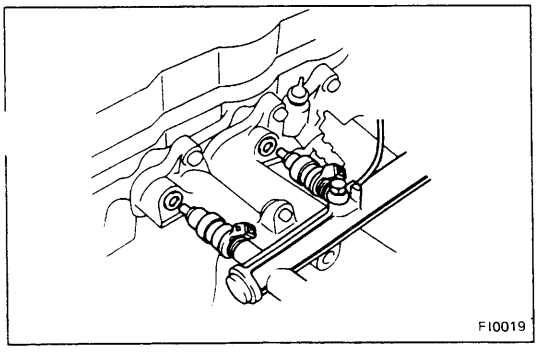
INSTALLATION OF INJECTORS

1. INSTALL INJECTORS INTO DELIVERY PIPE

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



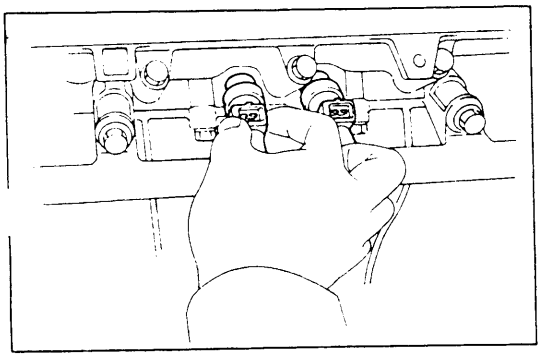
(b) Apply a thin coat of gasoline to the O-rings and install the injectors into the delivery pipe.



2. INSTALL DELIVERY PIPE WITH INJECTORS

(a) Install the four insulators into the injector hole of the intake manifold.

(b) Install the injectors together with the delivery pipe to the manifold.



(c) Make sure that the injectors rotate smoothly.

NOTE: If the injectors do not rotate smoothly, probable cause may be incorrect installation of O-rings. Replace O-rings again after removing the injectors.

(d) Install and torque the bolts.

Torque: 195 kg-cm (14 ft-lb, 19 N·m)

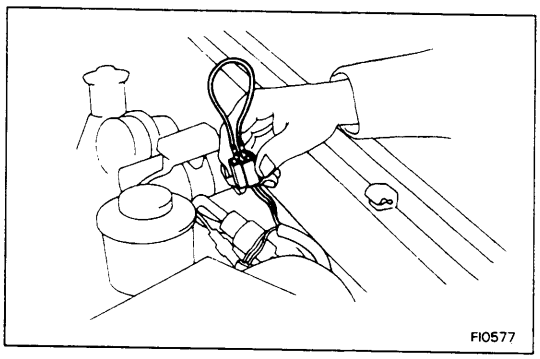
3. CONNECT FUEL HOSE TO DELIVERY PIPE

(See step 5 on page EM-30)

4. **CONNECT WIRES**
(See step 5 on page EM-30)

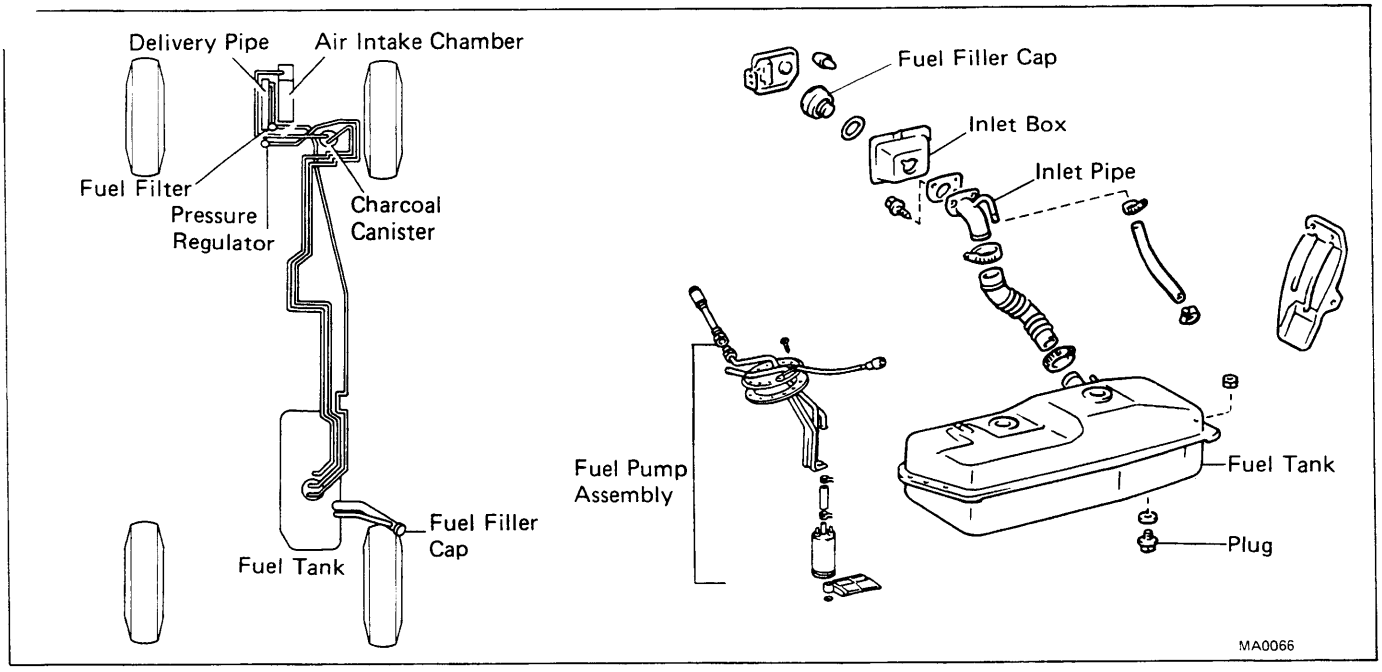
5. **INSTALL CHAMBER WITH THROTTLE BODY**
(See step 7 on page EM-30)

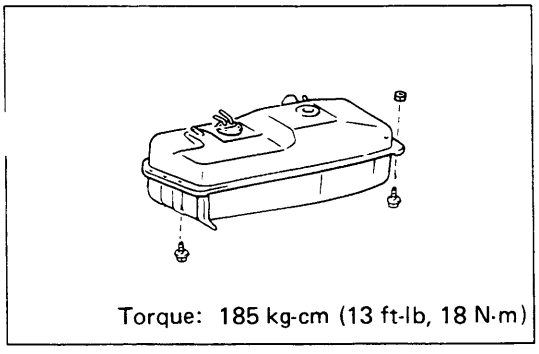
6. **CONNECT CABLES TO BRACKET**
(See step 11 on page EM-31)



7. **CHECK FOR FUEL LEAKAGE**
   (a) With the ignition switch ON, use a service wire to short both terminals of the fuel pump check connector.
   (b) Check for fuel leakage.
   (c) Remove the service wire from the fuel pump check connector.

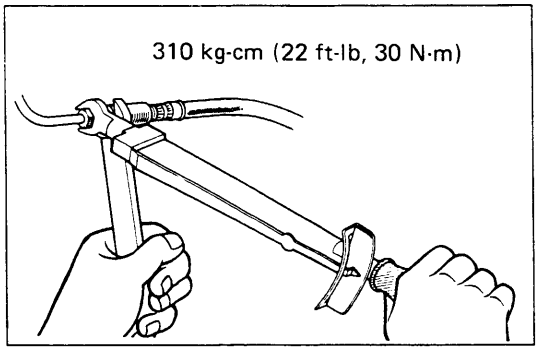
Fuel Tank and Line





PRECAUTIONS

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



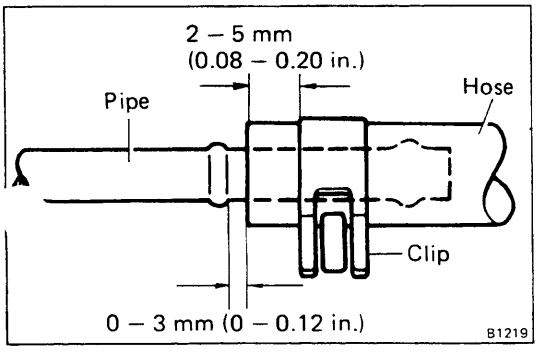
INSPECT FUEL LINES AND CONNECTIONS

(a) Inspect the fuel lines for cracks, or leakage and connections for deformation.

(b) Inspect the fuel tank vapor vent system hoses and connections for looseness, sharp bends or damage.

(c) Inspect the fuel tank for deformation, cracks, fuel leakage or tank band looseness.

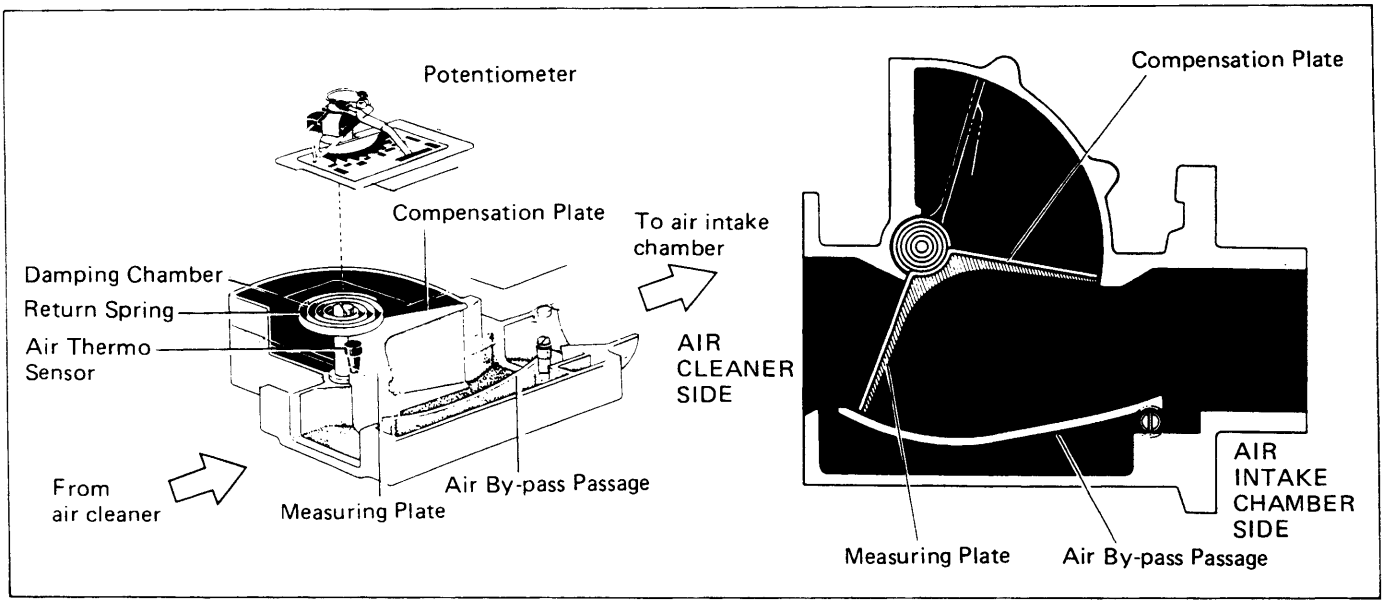
(d) Inspect the pipe for damage or fuel leakage.

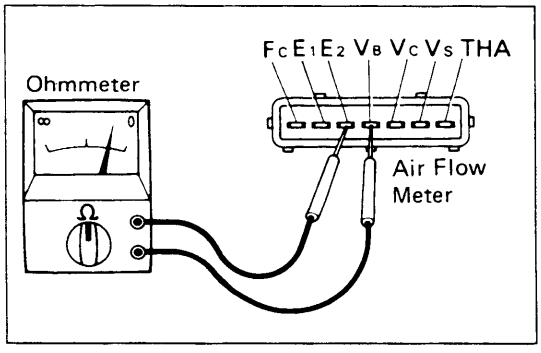


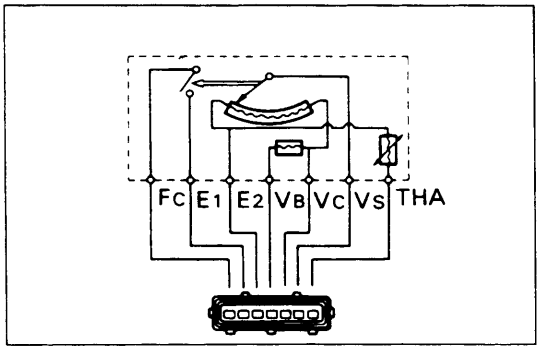
(e) The hose and tube connections are as shown in the illustration.

If a problem is found, repair or replace the parts as necessary.

AIR INTAKE SYSTEM
Air Flow Meter







ON-VEHICLE INSPECTION

MEASURE RESISTANCE OF AIR FLOW METER

(a) Unplug the wiring connector from the air flow met

(b) Using an ohmmeter, measure the resistance between each terminal.

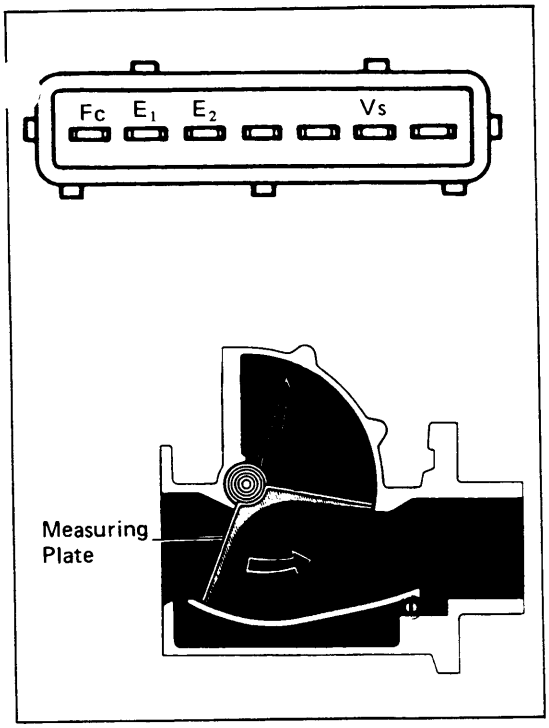
Between terminals	Resistance	Temperature
E_2 — V_S	20 — 400 Ω	—
E_2 — V_C	100 — 300 Ω	—
E_2 — V_B	200 — 400 Ω	—
E_2 — THA	10 — 20 KΩ 4 — 7 KΩ 2 — 3 KΩ 0.9 — 1.3 KΩ 0.4 — 0.7 KΩ	−20°C (−4°F) 0°C (32°F) 20°C (68°F) 40°C (104°F) 60°C (140°F)
E_1 — F_C	Infinity	—

If not within specification, replace the air flow meter.

REMOVAL OF AIR FLOW METER

1. **DISCONNECT AIR HOSES**
2. **DISCONNECT AIR FLOW METER CONNECTOR**
3. **REMOVE AIR FLOW METER**

Remove the bolt and three nuts.



INSPECTION OF AIR FLOW METER

MEASURE RESISTANCE OF AIR FLOW METER

Move the measuring plate and, using ohmmeter, measure the resistance between each terminal.

Between terminals	Resistance (Ω)	Measuring plate opening
E_1 — Fc	Infinity	Fully closed
	Zero	Other than closed position
E_2 — Vs	20 — 400	Fully closed
	20 — 1,000	Fully closed to fully open position

NOTE: Resistance between E_2 and Vs will change in accordance with the measuring plate opening.

INSTALLATION OF AIR FLOW METER

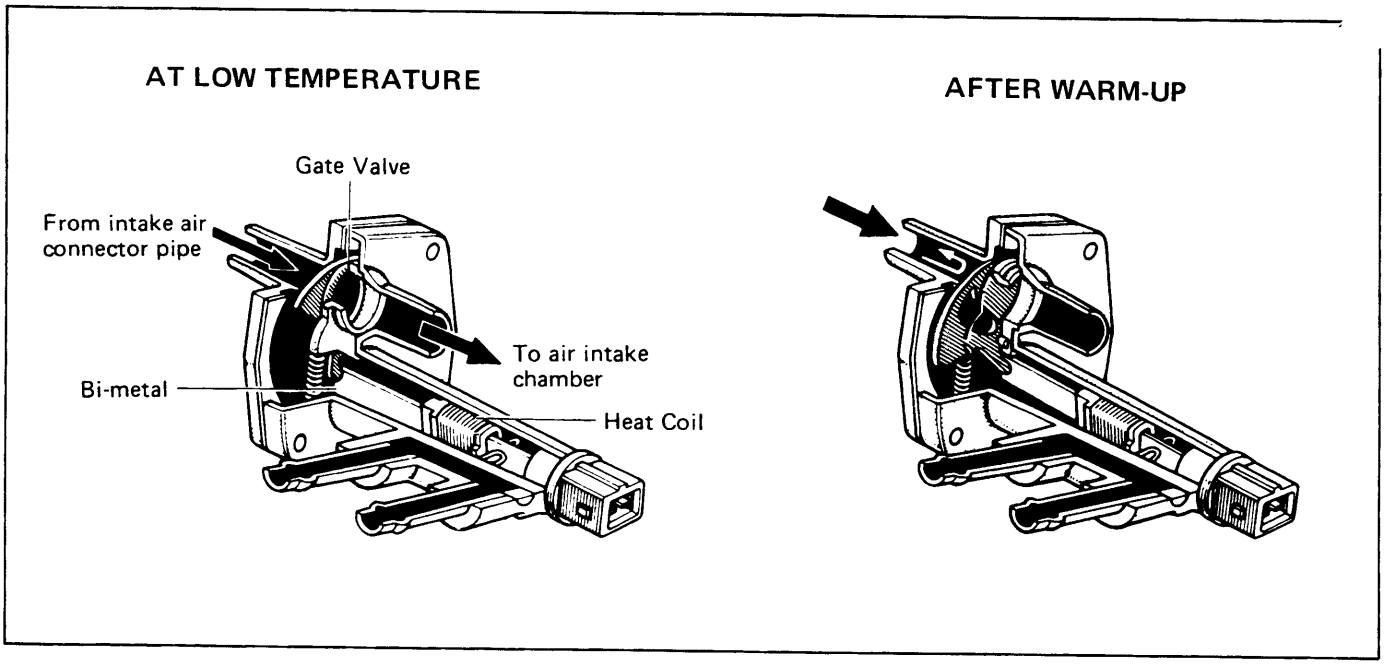
1. **INSTALL AIR FLOW METER**

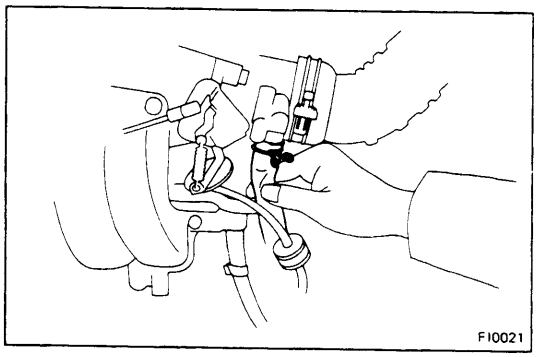
   Install the three nuts and a bolt.

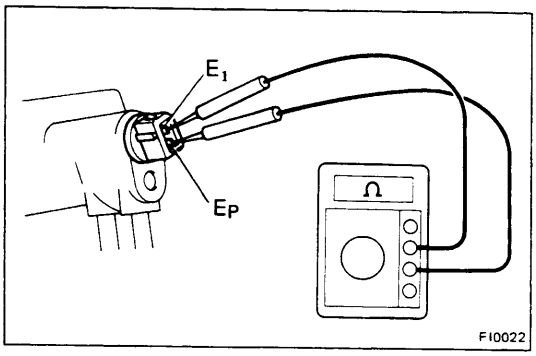
2. **CONNECT AIR FLOW METER CONNECTOR**

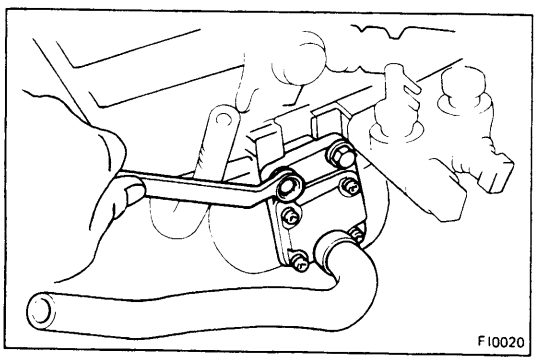
3. **INSTALL AIR HOSE**

Air Valve









ON-VEHICLE CHECK

1. **CHECK OPERATION OF AIR VALVE**

   Check the engine RPM by pinching shut the air hose.

   At Low Temp. (Coolant Temp. : below 60°C or 140°F)

   - When the hose is pinched, the engine RPM should drop.

   After warm-up

   - When the hose is pinched, check that the engine RPM does not drop more than 50 RPM.

2. **MEASURE RESISTANCE OF AIR VALVE**

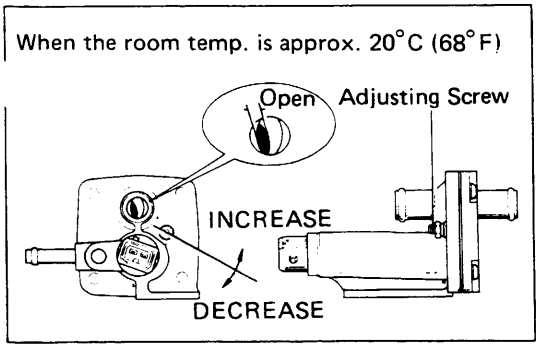
   Using an ohmmeter, measure the heat coil resistance of the air valve.

   Resistance (Ep–E1): 39–59 Ω

REMOVAL OF AIR VALVE

1. **DISCONNECT TWO AIR VALVE HOSES**
2. **DISCONNECT AIR VALVE CONNECTOR**
3. **DISCONNECT WATER BY-PASS HOSE**
4. **REMOVE AIR VALVE**

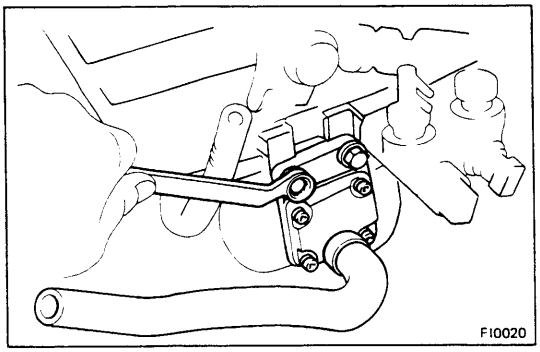
   Remove the two bolts and the air valve and gasket.



INSPECTION OF AIR VALVE

CHECK OPENING CONDITION OF AIR VALVE

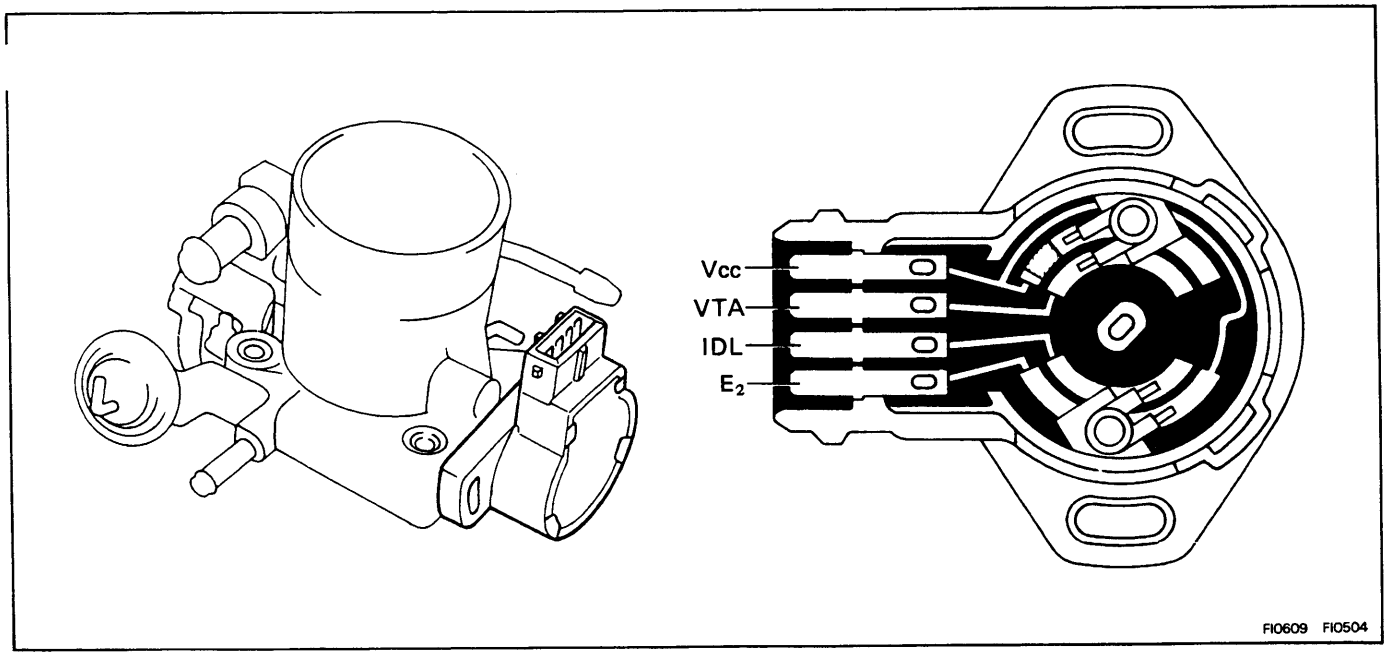
Check that the valve opens slightly, as illustrated, when room temp. is about 20°C (68°F).

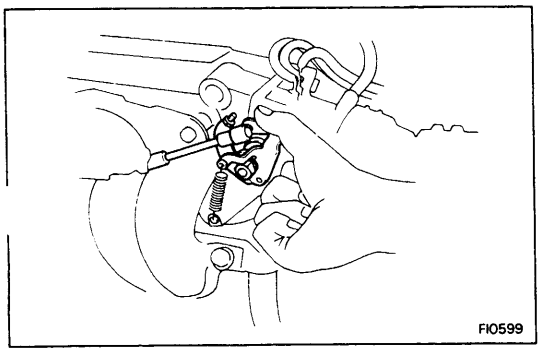


INSTALLATION OF AIR VALVE

1. **INSTALL AIR VALVE**
   Use a new gasket and install the air valve and two bolts.
2. **CONNECT WATER BY-PASS HOSE**
3. **CONNECT AIR VALVE CONNECTOR**
4. **CONNECT TWO AIR VALVE HOSES**

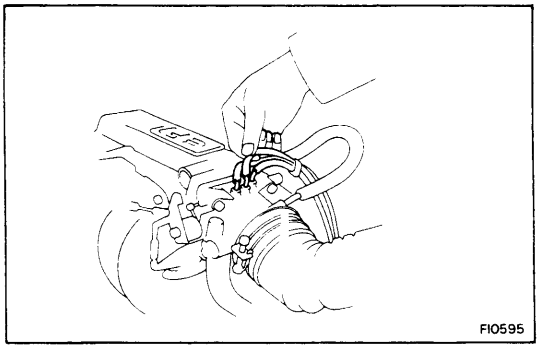
Throttle Body





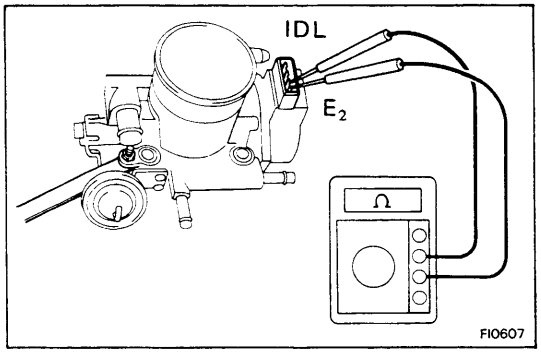
ON-VEHICLE CHECK

1. **CHECK THROTTLE BODY**
   (a) Check that the throttle linkage moves smoothly.



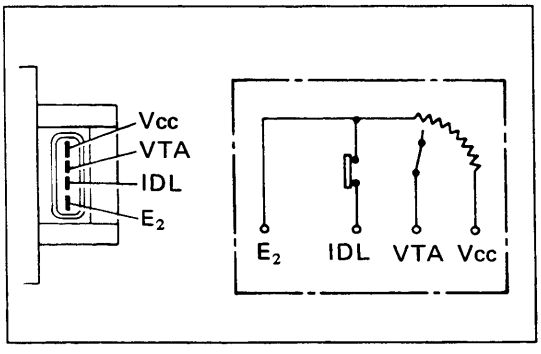
(b) Check the vacuum at each port.
- Start the engine.
- Check the vacuum with your finger.

Port No.	At idling	At 3,000 rpm
E	No vacuum	Vacuum
R	No vacuum	Vacuum
P	No vacuum	Vacuum



2. CHECK THROTTLE POSITION SENSOR

Check the resistance between the terminals.
- Unplug the connector from the sensor.
- Insert a thickness gauge between the throttle stop screw and stop lever.
- Using an ohmmeter, check the resistance between each terminal.



Clearance between lever and stop screw	Between terminals	Resistance
0 mm (0 in.)	VTA – E_2	0.2 – 0.8 kΩ
0.57 mm (0.0224 in.)	IDL – E_2	Less than 2.3 kΩ
0.85 mm (0.0335 in.)	IDL – E_2	Infinity
Throttle valve fully opened position	VTA – E_2	3.3 – 10 kΩ
–	Vcc – E_2	3 – 7 kΩ

REMOVAL OF THROTTLE BODY

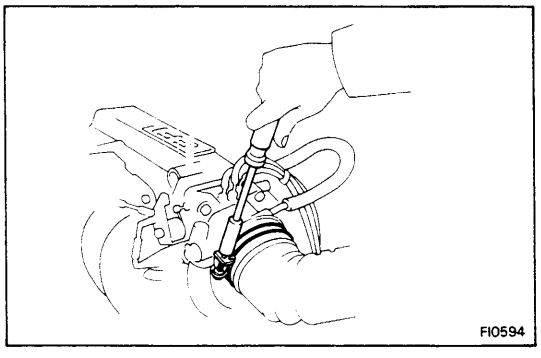
1. REMOVE AIR INTAKE CONNECTOR

2. DISCONNECT FOLLOWING HOSES:

(a) No. 1 and No. 2 water by-pass hoses

(b) PCV hose from the throttle body

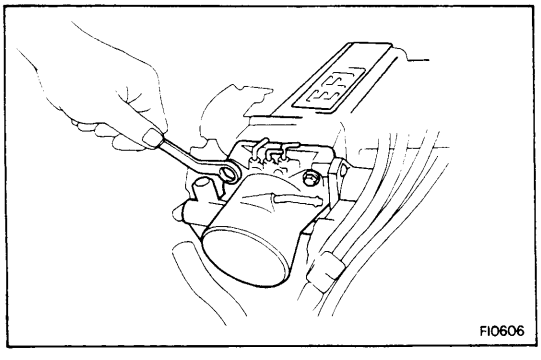
(c) Label and disconnect the emission control hoses.

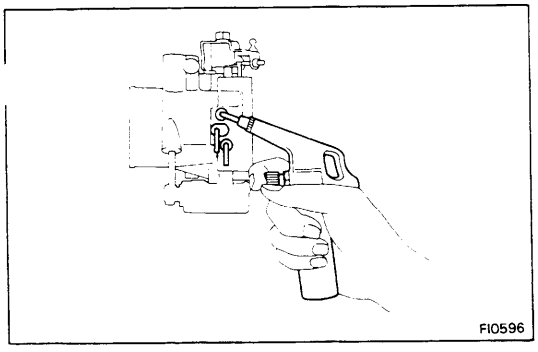


3. DISCONNECT THROTTLE SENSOR CONNECTOR

4. REMOVE THROTTLE BODY

Remove the four bolts and remove the throttle body and gasket.





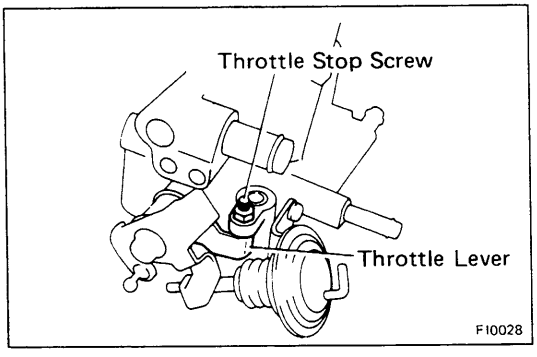
INSPECTION OF THROTTLE BODY

1. CLEAN THROTTLE BODY BEFORE INSPECTION

(a) Wash and clean the cast parts with a soft brush in carburetor cleaner.

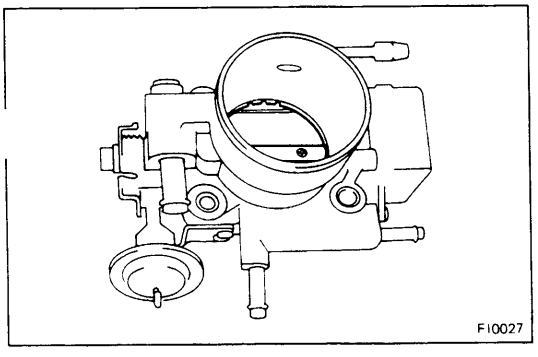
(b) Using compressed air, blow all passages and apertures in the throttle body.

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



2. CHECK THROTTLE VALVE

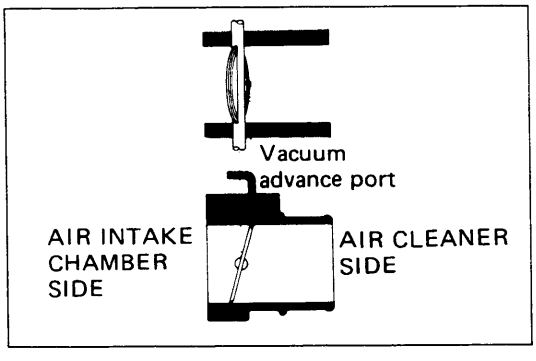
(a) Check that there is no clearance between the throttle stop screw and throttle lever when the throttle valve is fully closed.



(b) When the throttle valve is fully closed, check that advancer port is located on the air cleaner side as shown in the figure.

If not, adjust the throttle valve closing angle.

NOTE: Do not adjust the throttle valve closing angle if unnecessary.

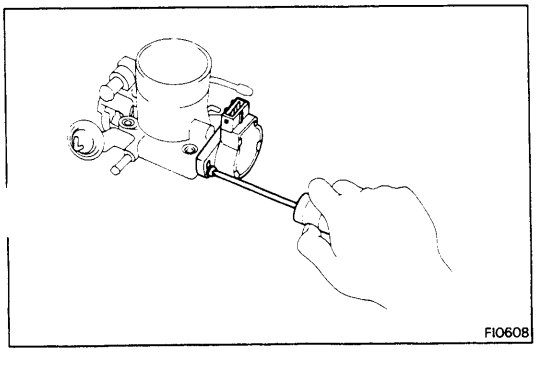


3. IF NECESSARY, ADJUST THROTTLE STOP SCREW

(a) After loosening the lock nut of the throttle stop screw, loosen the stop screw until it is about to touch at the lever.

(b) Have the throttle stopper screw touch the lever. Then screw it in 1/4 turns and lock it with the lock nut.

(c) After installation of the throttle body, make sure that engine rpm.

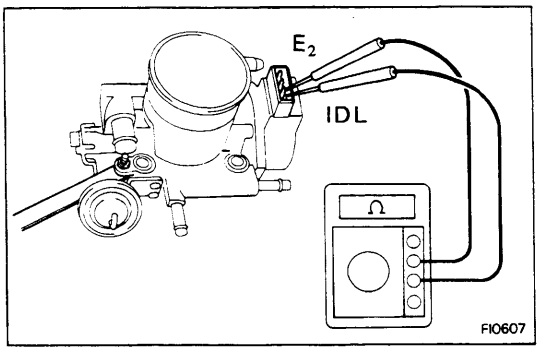


4. CHECK THROTTLE POSITION SENSOR

(See step 2 on page FI-59)

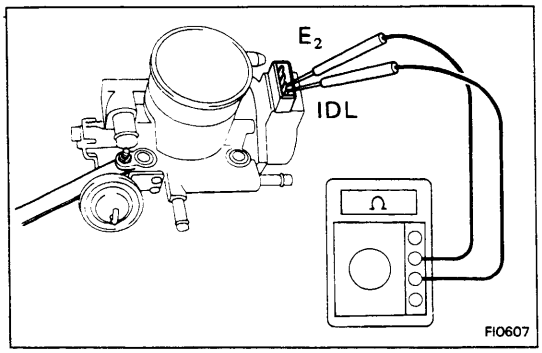
5. IF NECESSARY, ADJUST THROTTLE POSITION SENSOR

(a) Loosen the two screws of the sensor.



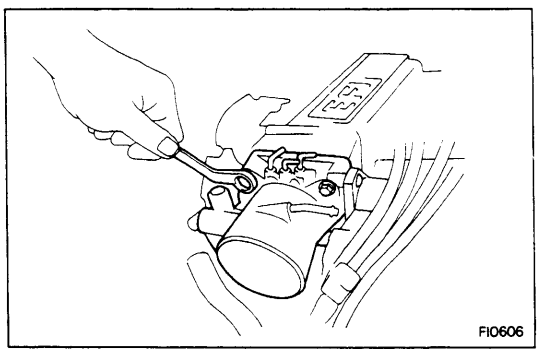
(b) Insert a thickness gauge (0.47 mm or 0.0185 in.) between the throttle stop screw and lever, and connect the ohmmeter to terminals IDL and E_2.

Gradually turn the sensor clockwise until the ohmmeter deflects, and secure the sensor with two screws.



(c) Using a thickness gauge, recheck the continuity between terminals IDL and E_2.

Clearance between lever and stop screw	Continuity (IDL – E_2)
0.57 mm (0.0224 in.)	Continuity
0.85 mm (0.0335 in.)	No continuity



INSTALLATION OF THROTTLE BODY

1. INSTALL THROTTLE BODY

Using new gaskets, install the throttle body and four bolts

2. CONNECT THROTTLE SENSOR CONNECTOR

3. CONNECT FOLLOWING HOSES:

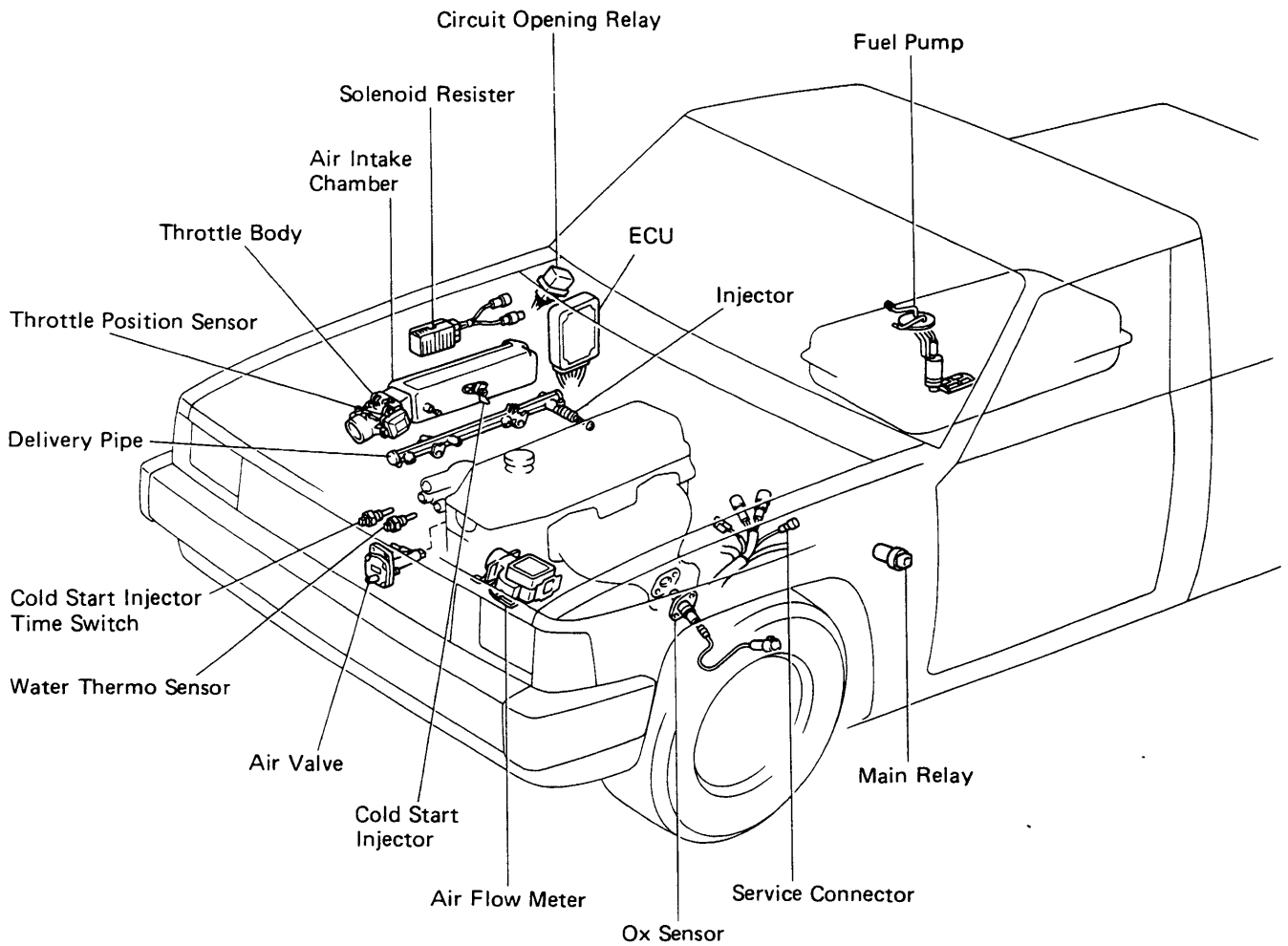
(a) Emission control hoses

(b) PCV hose to throttle body

(c) No. 1 and No. 2 water by-pass hoses.

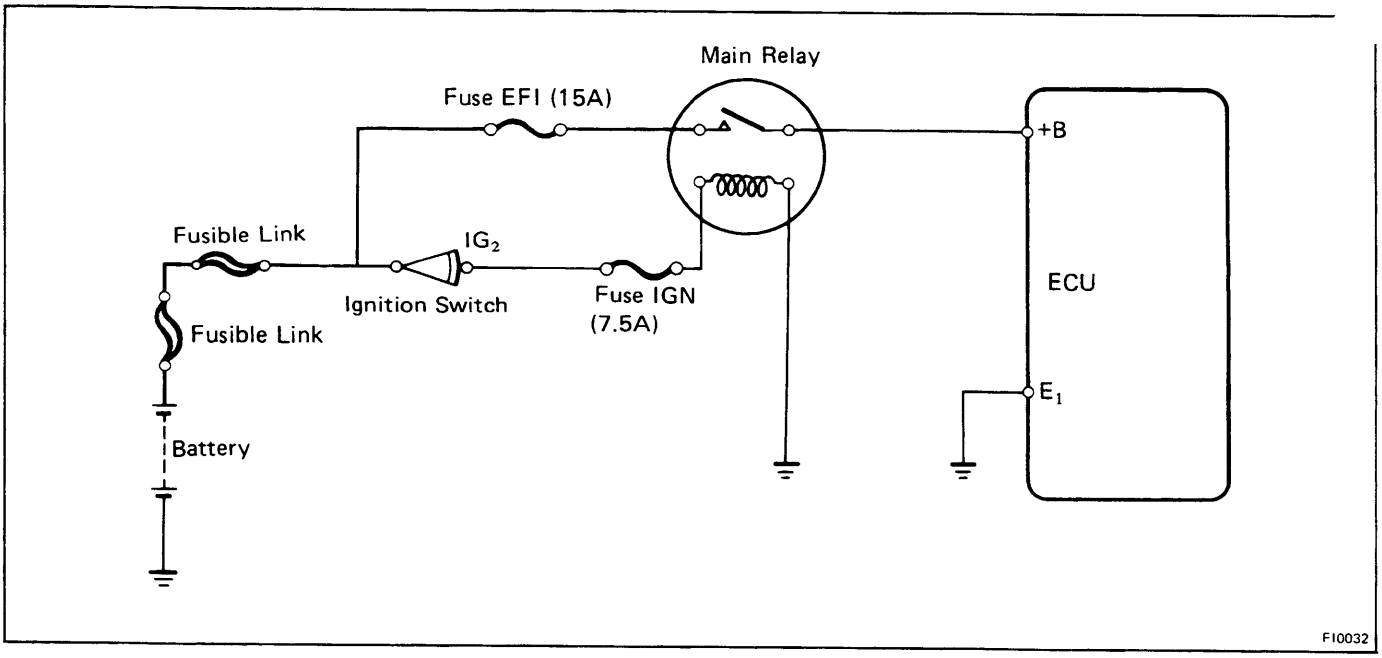
4. INSTALL AIR INTAKE CONNECTOR

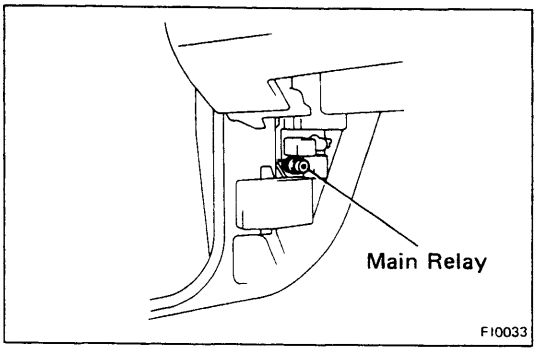
ELECTRONIC CONTROL SYSTEM
Location of Electronic Control Parts



A03956

Main Relay



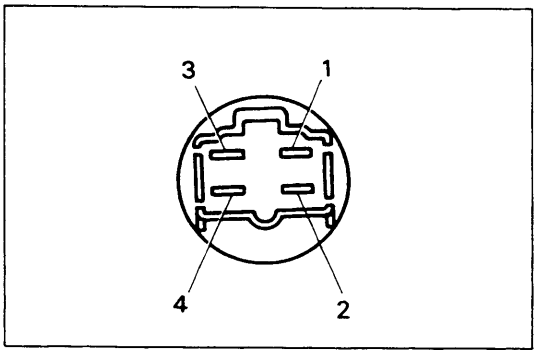


INSPECTION OF MAIN RELAY

1. CHECK MAIN RELAY OPERATION

(a) Turn on the ignition switch.

(b) At this time an operation noise will occur from the relay.



2. MEASURE RESISTANCE OF MAIN RELAYS

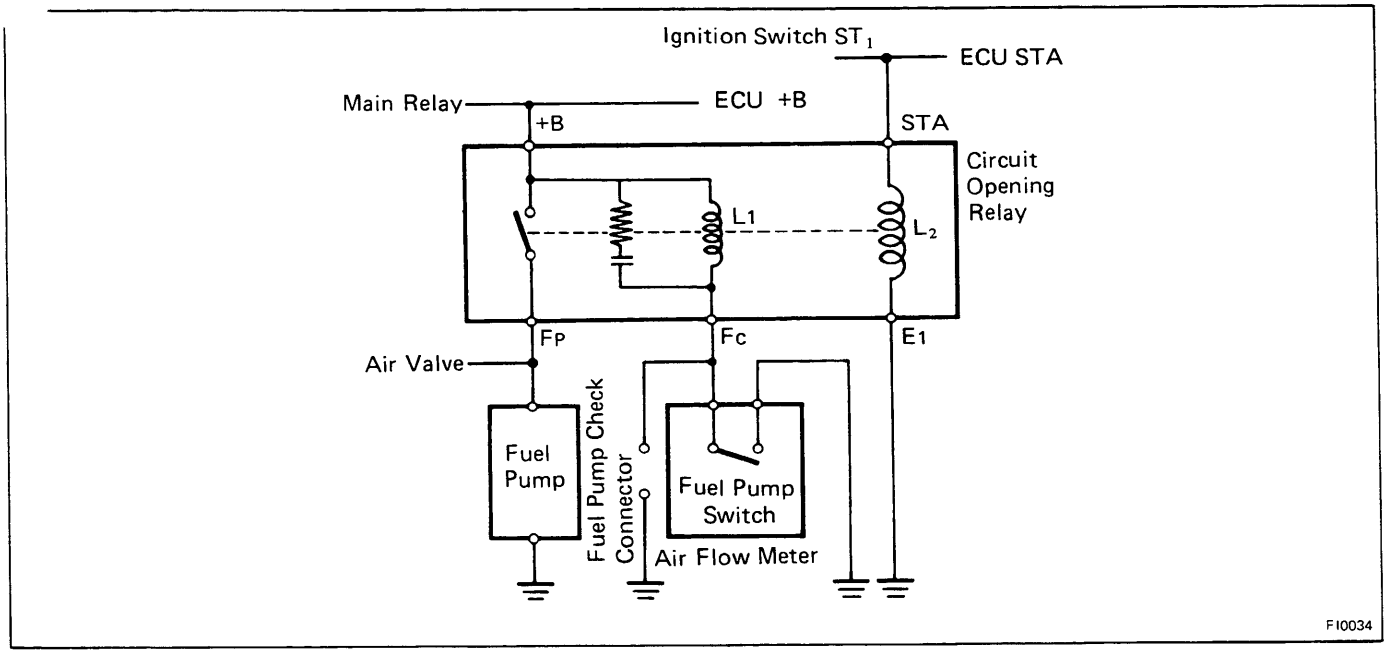
(a) Remove the main relay from the relay block.

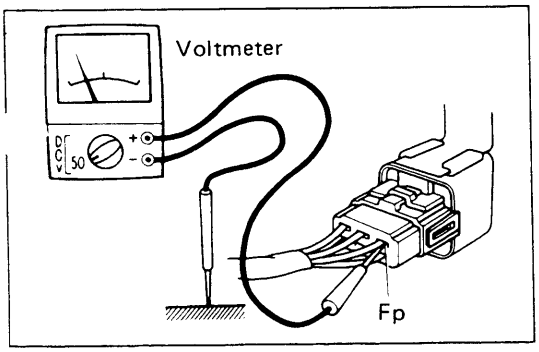
(b) Measure the resistance between each terminal.

	Between terminals	Resistance (Ω)
Main relay	1 — 2	60 — 80
	3 — 4	Infinity

A03958

Circuit Opening Relay





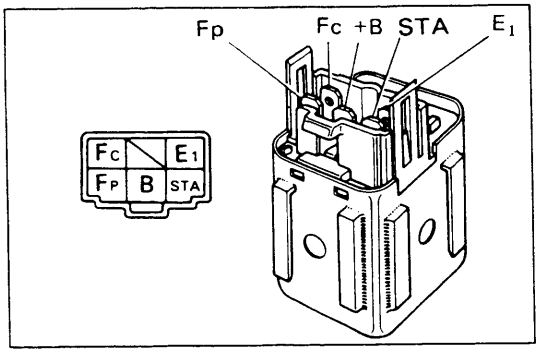
INSPECTION OF CIRCUIT OPENING RELAY

1. CHECK CIRCUIT OPENING RELAY OPERATION

(a) Remove the left kick panel.

(b) Using a voltmeter, check that the meter indicates voltage at Fp terminal during engine cranking and running.

(c) Stop the engine.



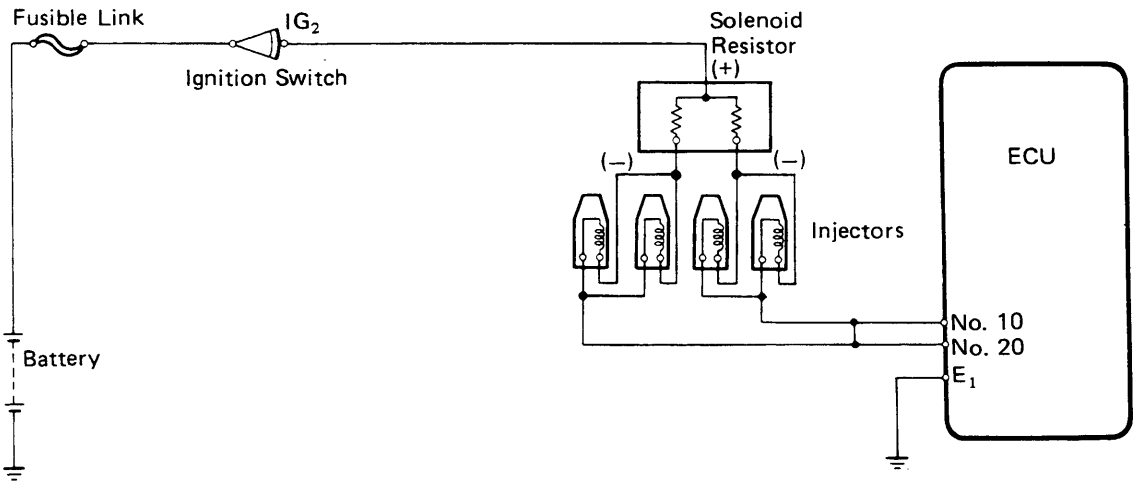
2. MEASURE RESISTANCE OF CIRCUIT OPENING RELAY

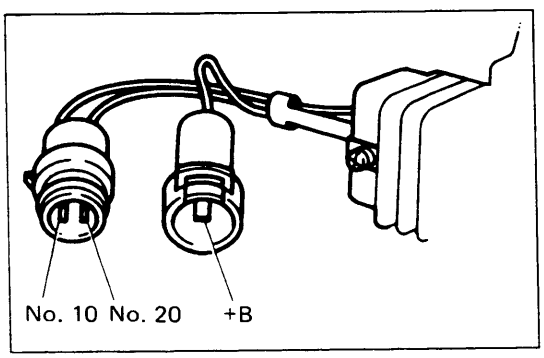
(a) Disconnect the connector.

(b) Measure the resistance between each terminal.

Between terminals	Resistance (Ω)
STA — E1	17 — 25
+B — FC	88 — 132
+B — FP	Infinity

Solenoid Resistor





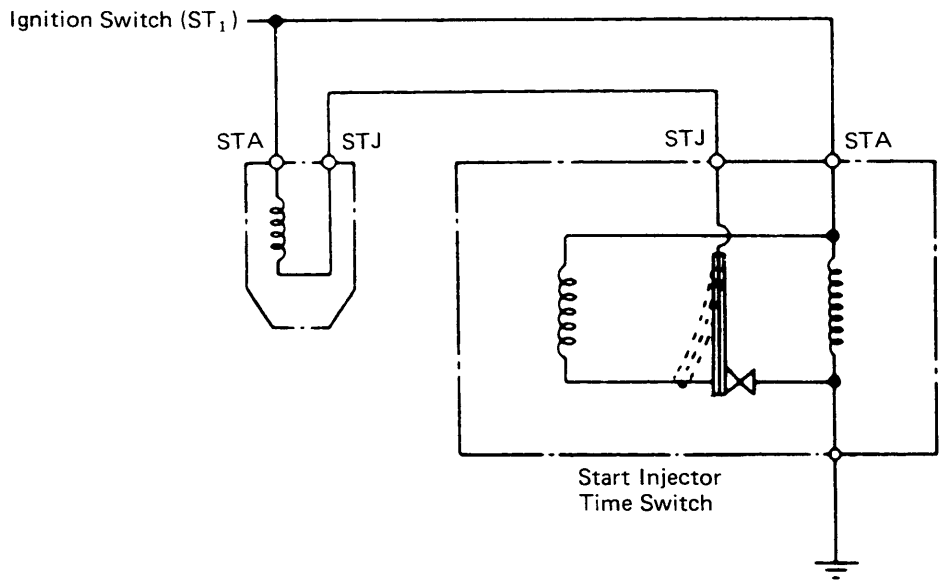
INSPECTION OF SOLENOID RESISTOR

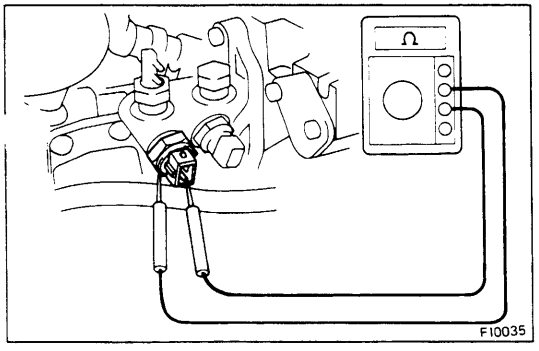
MEASURE RESISTANCE OF SOLENOID RESISTOR

Using an ohmmeter, measure the resistance between and other terminals.

Resistance: 2 — 3 Ω each

Start Injector Time Switch





INSPECTION OF START INJECTOR TIME SWITCH

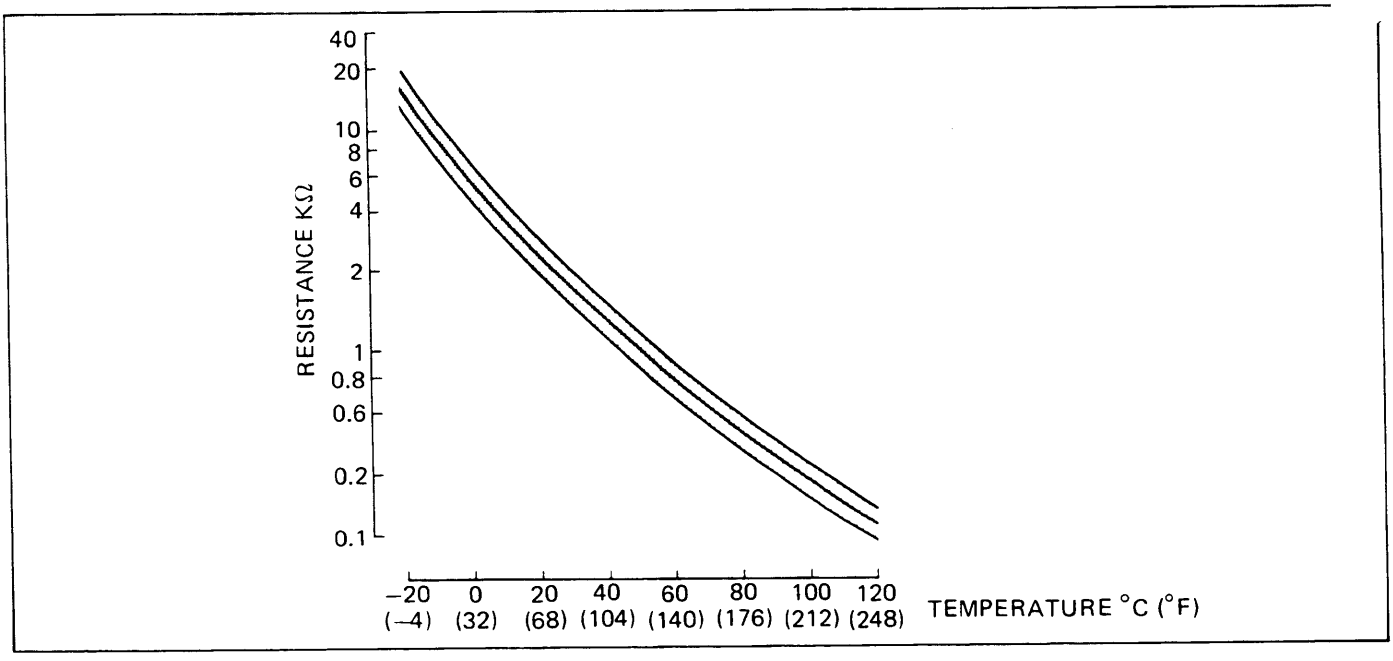
MEASURE RESISTANCE OF START INJECTOR TIME SWITCH

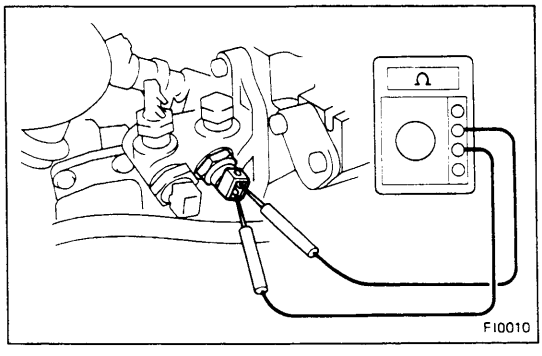
(a) Disconnect the connector.

(b) Using an ohmmeter, measure the resistance between each terminal.

Between terminals	Resistance (Ω)	Coolant temp.
STA – STJ	20 – 40	below 30°C (86°F)
	40 – 60	above 40°C (104°F)
STA – Ground	20 – 80	–

Water Thermo Sensor





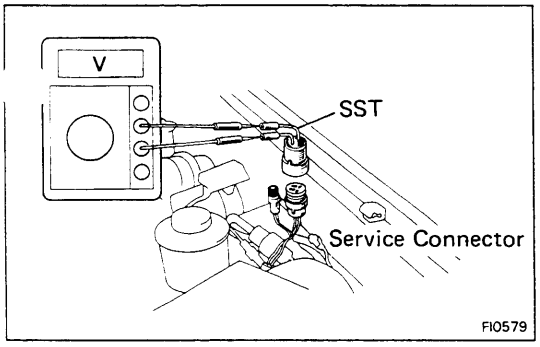
INSPECTION OF WATER THERMO SENSOR

MEASURE RESISTANCE OF WATER THERMO SENSOR

(a) Disconnect the connector.

(b) Using an ohmmeter, measure the resistance between both terminals.

Resistance: Refer to the chart



Ox Sensor

INSPECTION OF FEED BACK CONTROL

1. **CONNECT SST AND ANALOG VOLTMETER**

   Connect SST to the service connector and connect a voltmeter to SST.

   SST 09842-14010

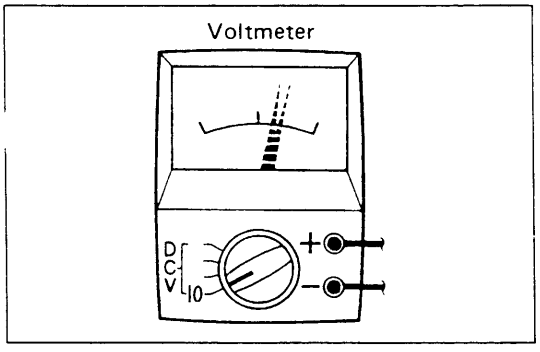
   Connect the (+) testing probe to the red wire of the SST and (—) testing probe to the black wire.

2. **WARM-UP ENGINE TO NORMAL OPERATING TEMPERATURE**

3. **CONNECT A TACHOMETER TO ENGINE**

4. **RACE ENGINE AT 2,500 RPM FOR ABOUT 90 SECONDS**

5. **MAINTAIN ENGINE SPEED AT 2,500 RPM**



6. **CHECK THAT NEEDLE OF VOLTMETER FLUCTUATES 8 TIMES OR MORE IN 10 SECONDS**

   If not, inspect the EFI system and replace the Ox sensor, if necessary.

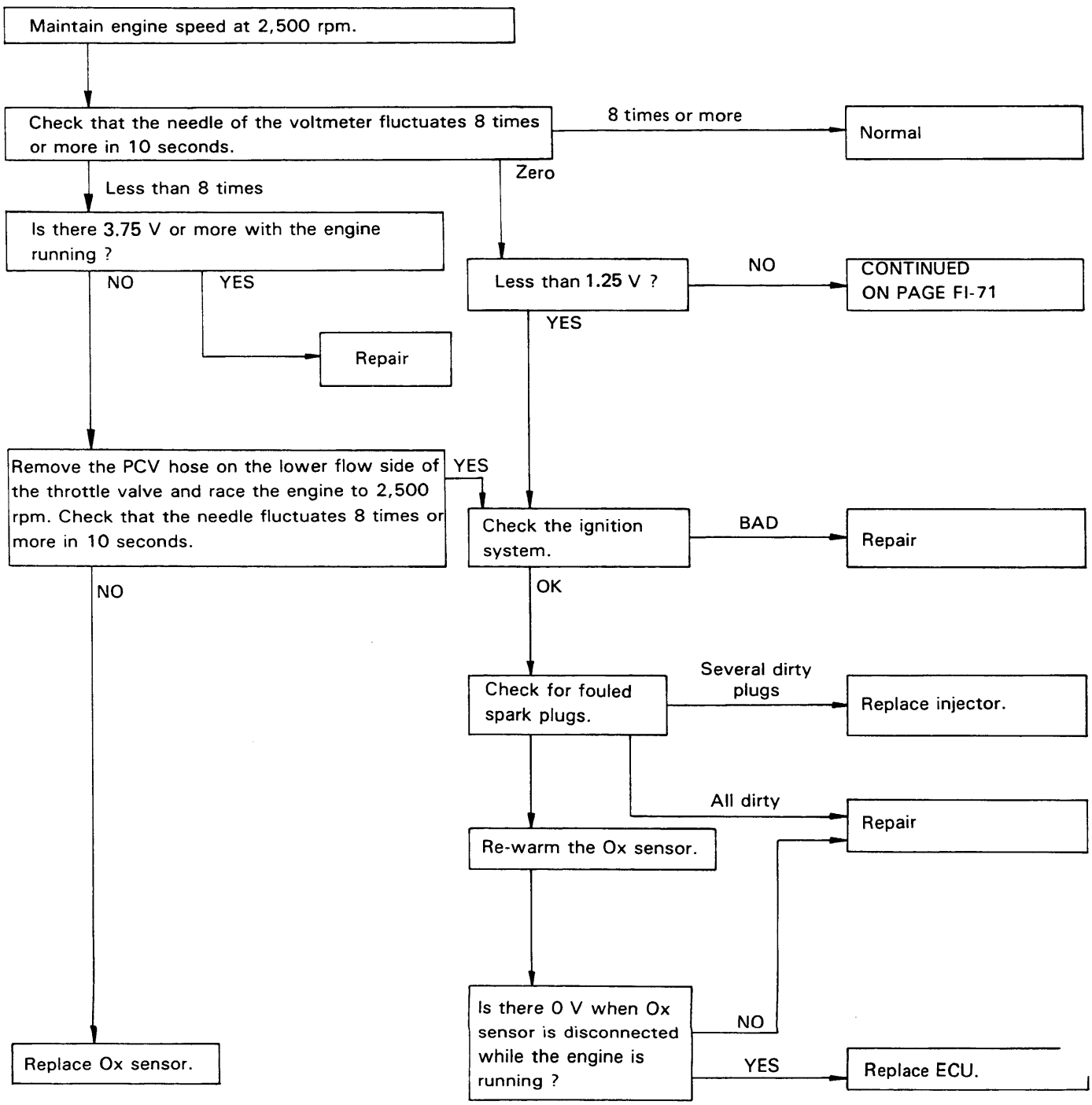
7. **STOP ENGINE**

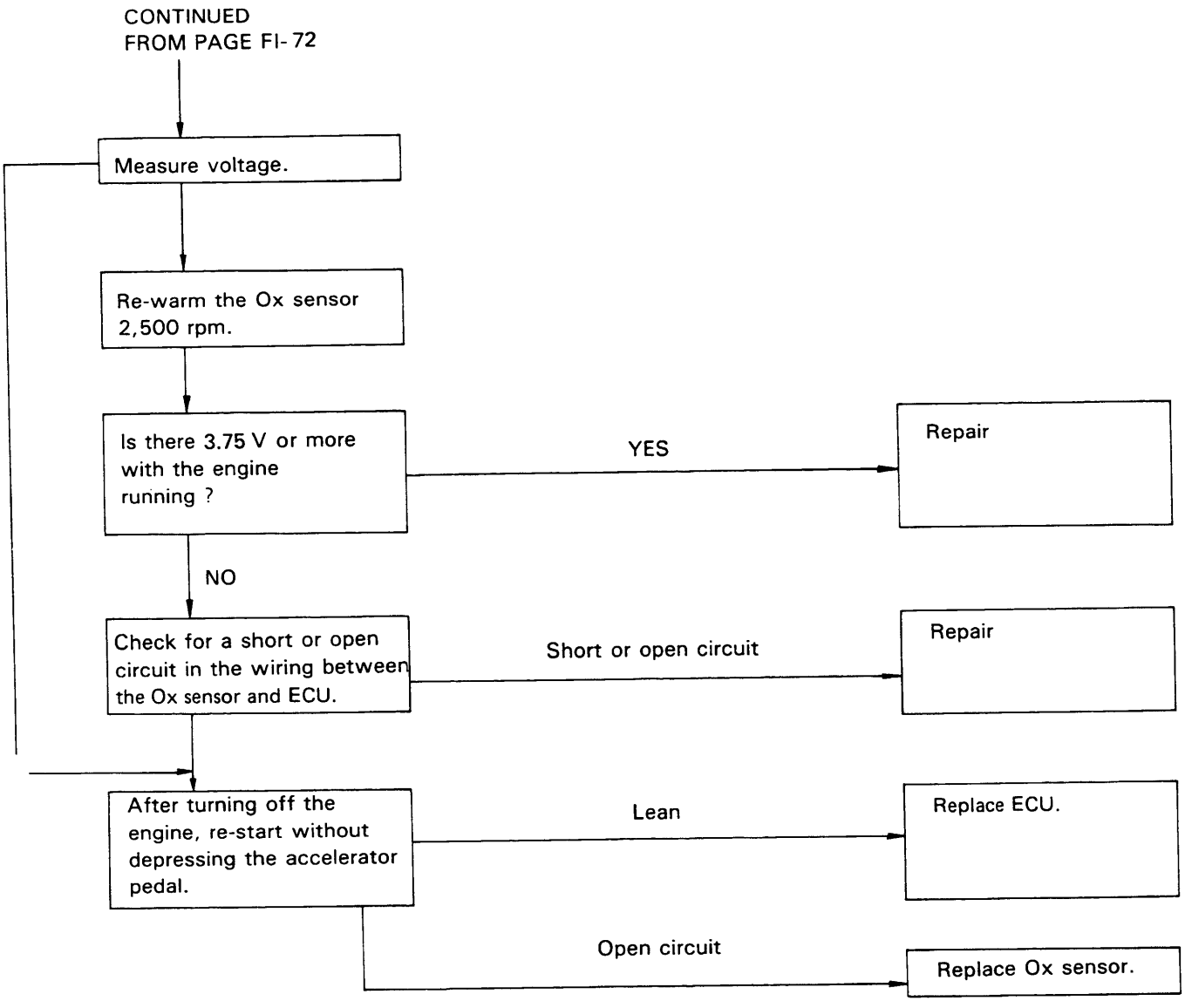
8. **REMOVE VOLTMETER AND SST 09842-14010**

9. **INSTALL RUBBER CAP TO SERVICE CONNECTOR**

INSPECTION OF OX SENSOR

1. Warm-up the engine.
2. Connect a SST to the 4-terminal connector. SST 09842-14010
3. Using a voltmeter connect the positive probe to the red wire of the SST and negative testing probe to the block wire.
4. Warm up the Ox sensor with the engine at 2,500 rpm for about 90 seconds.



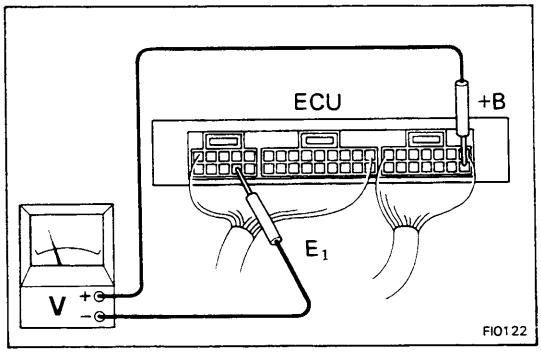

CONTINUED
FROM PAGE FI-72
Measure voltage.
Re-warm the Ox sensor
2,500 rpm.
Is there 3.75 V or more
with the engine
running ?
YES
Repair
NO
Check for a short or open
circuit in the wiring between
the Ox sensor and ECU.
Short or open circuit
Repair
After turning off the
engine, re-start without
depressing the accelerator
pedal.
Lean
Replace ECU.
Open circuit
Replace Ox sensor.

ECU

INSPECTION OF ECU

1. MEASURE VOLTAGE OF ECU

NOTE:
1. The ECU itself cannot be checked directly.
2. The EFI circuit can be checked by measuring the resistance and voltage at the wiring connectors of the ECU.



Check the voltages at the wiring connectors.

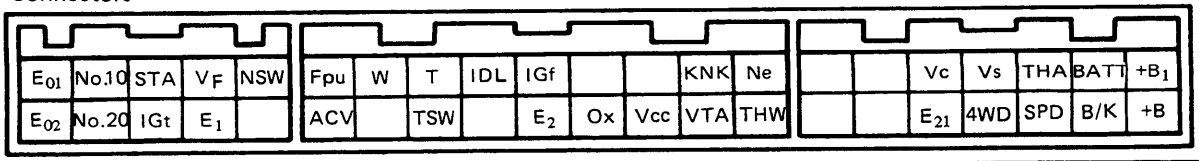
- Remove the right kick panel.
- Turn the igniton switch ON.
- Measure the voltage at each terminal.

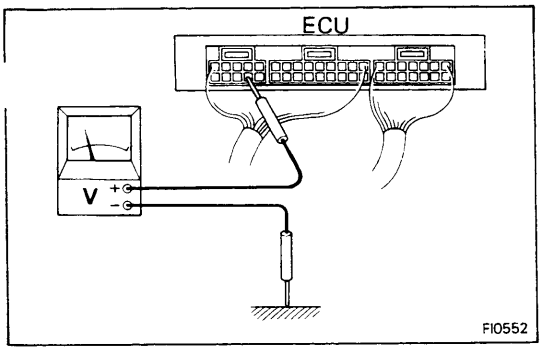
NOTE: 1. Perform all voltage measurements with the connectors connected.
2. Verify that the battery voltage is 11V or above when the ignition switch is ON.

Voltage at ECU Wiring Connectors

Terminals	Condition		STD voltage
+B – E_1	Ignition switch ON		10 – 14
BATT – E_1	–		10 –14
IDL – E_2	Ignition switch ON	Throttle valve open	4 – 10
VTA – E_2		Throttle valve fully closed	0.1 – 1.0
		Throttle valve fully open	4 – 5
Vcc – E_2		–	4 – 6
IGt – E_1	Idling		0.7 – 1.0
STA – E_1	Ignition switch ST position		6 – 12
No. 10 – E_1 No. 20 – E_1	Ignition switch ON		9 – 14
W – E_1	No trouble (CHECK ENGINE light off) and engine running		8 – 14
Vc – E_2	Ignition switch ON	–	4 – 9
Vs – E_2		Measuring plate fully closed	0.5 – 2.5
		Measuring plate fully open	5 – 8
	Idling		2.5 – 7.5
THA – E_2	Ignition siwtch ON	Intake air temperature 20°C (68°F)	2 – 6
THW – E_2	Ignition switch ON	Coolant temperature 80°C (176°F)	0.5 – 2.5
B/K – E_1	Stop light switch ON		8 – 14

ECU Connectors





2. MEASURE RESISTANCE OF ECU

CAUTION:

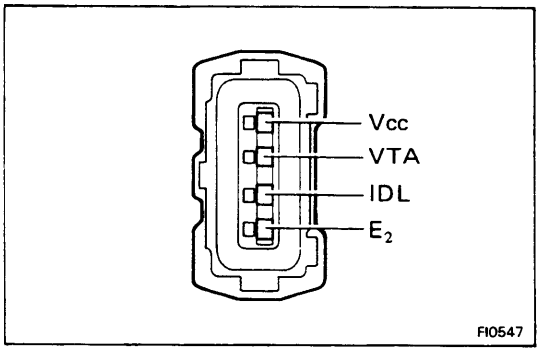
1. **Do not touch the ECU terminals.**
2. **The tester probe should be inserted into wiring connector from the wiring side.**

Check the resistance between each terminal of the wiring connector.

- Remove the right kick panel.
- Unplug the wiring connectors from the ECU.
- Measure the resistance between each terminal of the wiring connectors.

Resistance at ECU Wiring Connectors

Terminals	Condition	Resistance (kΩ)
IDL – E_2	Throttle valve open	Infinity
	Throttle valve fully closed	0 – 0.1
VTA – E_2	Throttle valve fully open	3.3 – 10
	Throttle valve fully closed	0.2 – 0.8
V_{cc} – E_2	–	3 – 7
THA – E_2	Intake air temperature 20°C (68°F)	2 – 3
THW – E_2	Coolant temperature 80°C (176°F)	0.2 – 0.4
+B – E_2	–	0.2 – 0.4
V_c – E_2	–	0.1 – 0.3
V_s – E_2	Measuring plate fully closed	0.02 – 0.1
	Measuring plate fully open	0.02 – 1
Ne – E_1	–	0.14 – 0.18



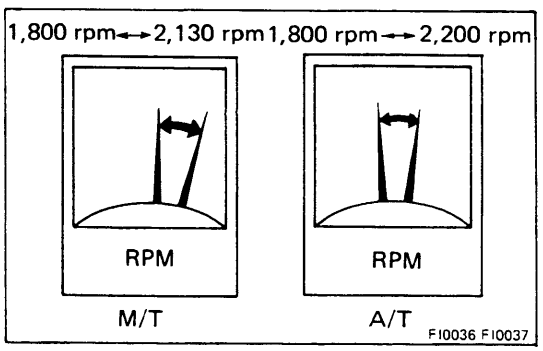
Fuel Cut RPM

INSPECTION OF FUEL CUT RPM

(a) Start and warm up the engine.

(b) Disconnect the throttle position sensor connector from the throttle position sensor.

(c) Short circuit termianls IDL and E_2 on wire connector side.



(d) Gradually raise the engine rpm and check that there is fluctuation between the fuel cut and fuel return points.

NOTE: The vehicle should be stopped.

	Fuel Cut rpm	Fuel Return rpm
M/T	2,130 rpm	1,800 rpm
A/T	2,200 rpm	1,800 rpm