FUEL SYSTEM

Return To Main Table of Contents

GENERAL

SPECIFICATIONS

Fuel tank	
Capacity	**65 lit. (17.2 U.S. gal., 14.3 Imp.gal.)**
Fuel filter	
Type	**High pressure type**
Fuel pump	
Type	**Electrical, in-tank type**
Drive mechanism	**Electric motor**
Throttle body	
Throttle position sensor (TPS)	
Type	**Variable resistor type**
Resistance	**3.5-6.5 KΩ**
Output voltage at curb idle	**0.48-0.52 V**
Idle speed control (ISC) servo motor	
Type	**Stepper motor**
Resistance	**28-33 Ω at 20°C (68°)**
Idle position switch	
Type	**Contact switch type**
Input sensor	
Air flow sensor (AFS)	
Type	**Karman vortex type**
Output voltage	**2.7-3.2V**
Barometric pressure sensor	
Type	**Semiconductor diffusion type**
Output voltage	**4V at 101 kPa (1.0 kg/cm^2, 14.6 psi)** **3.5V at 88 kPa (0.9 kg/cm^2, 12.8 psi)**
Intake air temperature sensor	
Type	**Thermistor type**
Resistance	**2.33-2.97 kΩ at 20°C (68°F)**
Coolant temperature sensor	
Type	**Thermistor type**
Resistance	**2.5 kΩ at 20°C (68°F)** **0.3 kΩ at 80°C (176°F)**
Oxygen sensor	
Type	**Zirconia sensor**
Output voltage	**Approx. 1V**
Vehicle speed sensor	
Type	**Reed switch type**
No.1 cylinder TDC sensor	
Type	**Photo diode sensor**
Output voltage	**1.8-2.5V**
Crank angle sensor	
Type	**Photo diode sensor**
Output voltage	**2.0-2.5V**

Output actuator	
Injector	
Type	Electromagnetic type
Number	6
Coil resistance	13-16 Ω at 20°C (68°F)
Purge control solenoid valve [Except UK, Holland]	
Type	ON/OFF type
Resistance	36-44 Ω at 20°C (68°F)
EGR control solenoid valve [Only California]	
Type	Duty cycle type solenoid valve
Fuel pressure regulator	
Regulated pressure	330 KPa (3.35 kg/cm^2, 48 psi)

SEALANT

Water temperature sensor	LOCTITE 962T or equivalent

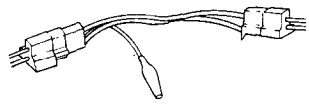
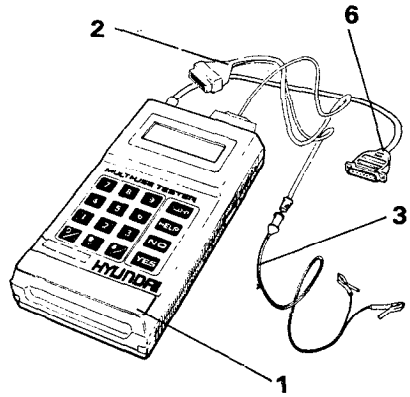
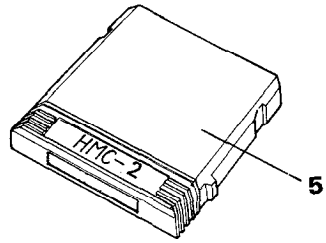
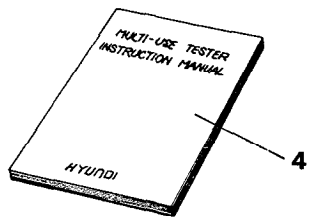
SERVICE STANDARD

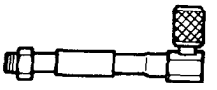
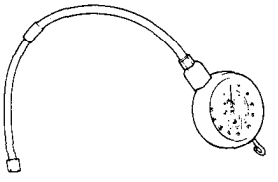
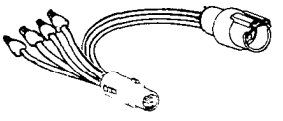
Basic ignition timing	BTDC 5° ± 2° at curb idle
Curb idle speed	700 ± 100 rpm
Throttle-position sensor (TPS) adjustment voltage	0.48-0.52V at curb idle

TIGHTENING TORQUE

	Nm	Kg.cm	lb.ft
Delivery pipe installation bolt	10-13	100-130	7 - 9
Coolant temperature sensor	20-39	200-400	14-29
Oxygen sensor	39-49	400-500	29-36
Oxygen sensor connector bracket bolt	8-12	80-120	5.8-8.7
Throttle position sensor (TPS) installation screw	2.5-4.4	25-45	1.8-3.2
Fuel pressure regulator installation bolt	7-11	70-110	5 - 8
High pressure hose and fuel main pipe	29-39	300-400	22-29
High pressure hose and fuel filter	25-34	250-350	18-25
High pressure hose to delivery pipe	3 - 4	30-40	2.2-3
Fuel pump assembly to fuel tank	2 - 3	20-30	1.4-2.2
High pressure hose at fuel tank	29-39	300-400	22-29
Throttle body to surge tank	10-13	100-130	7.2-9
Fuel tank drain plug	15-25	150-250	11-18
Fuel filter mounting bolt	9-14	90-140	6.5-10
Accelerator arm bracket bolts	8-12	80-120	5.8-8.7
ISC servo (stepper motor)	2.5-4.4	25-45	1.8-3.3
Fuel sender to fuel tank	2 - 3	20-30	1.4-2.2

SPECIAL TOOLS

Tool (Number and name)	Illustration	Use
09273—24000 Harness connector		Engine r.p.m. check
09391—33200 1. Multi-use tester 09391—33300 2. Test harness 09391—33500 3. Battery harness 09391—33600 4. Instruction manual 09391—33401 5. R.O.M. Pack (HMC-2)	  	Diagnostic tester for MPI, automatic transaxle and cruise control systems
09391—33700 6. Connector RS 232C		For connection to the external communication device such as personal computer etc. in using Multi-Use Tester.

Tool (Number and name)	Illustration	Use
09353—24000 Fuel pressure gauge connector		Connection of fuel pressure gauge to delivery pipe for measurement of fuel pressure.
09353—24100 Fuel pressure gauge & hose		
09353—33000 Fuel pressure gauge adapter		
09392—33000 Test harness	 31Y244	Oxygen sensor inspection

TROUBLESHOOTING

When checking and correcting engine troubles, it is important to start with an inspection of the basic systems. If one of the following conditions exists, (A) engine start failure, (B) unstable idling or (C) poor acceleration, begin by checking the following basic systems.

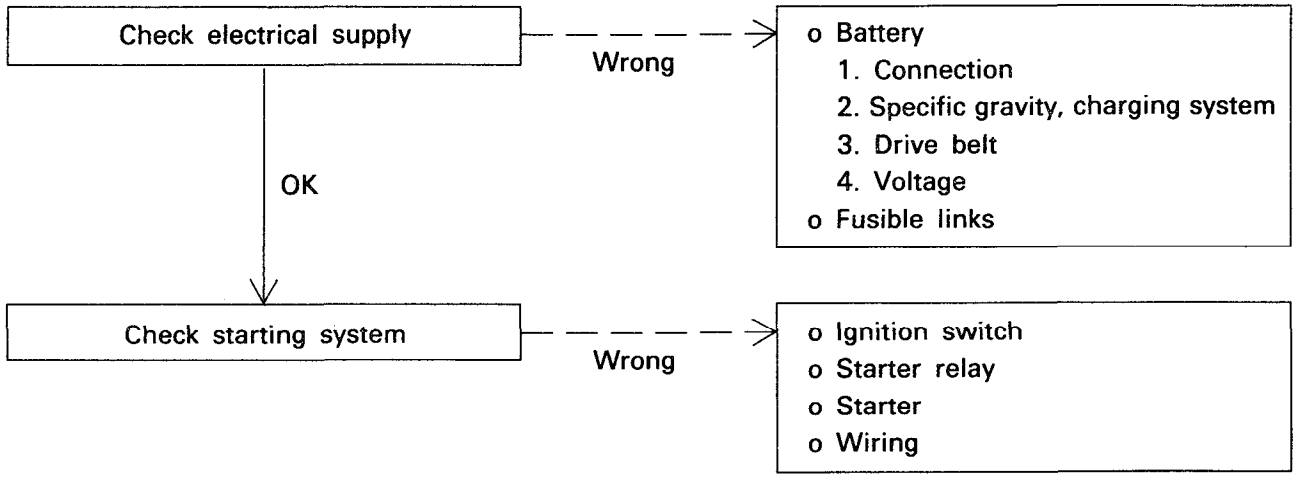
1. Power supply
   1) Battery
   2) Fusible links
   3) Fuses
2. Body grounds
3. Fuel supply
   1) Fuel line
   2) Fuel filter
   3) Fuel pump
4. Ignition system
   1) Spark plugs
   2) High-tension cables
   3) Distributor
   4) Ignition coil
5. Emission control system
   1) PCV system
   2) EGR system
   3) Vacuum leak
6. Others
   1) Ignition timing
   2) Idle speed

Troubles with the MPI system are often caused by poor contact of harness connectors. It is important to check all harness connectors and verify that they are securely connected.

MPI TROUBLESHOOTING PROCEDURES

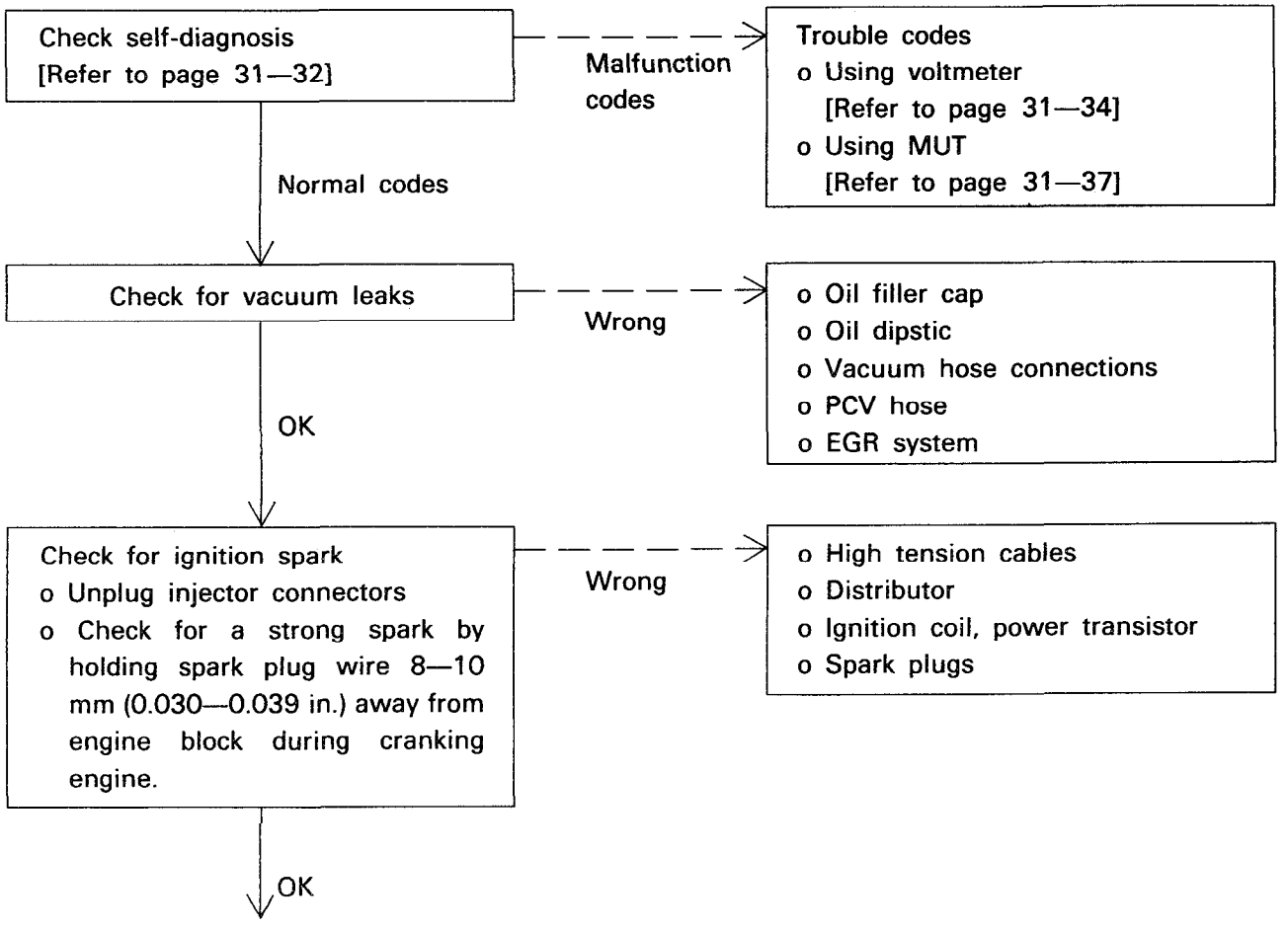
PROBLEM

Engine will not start

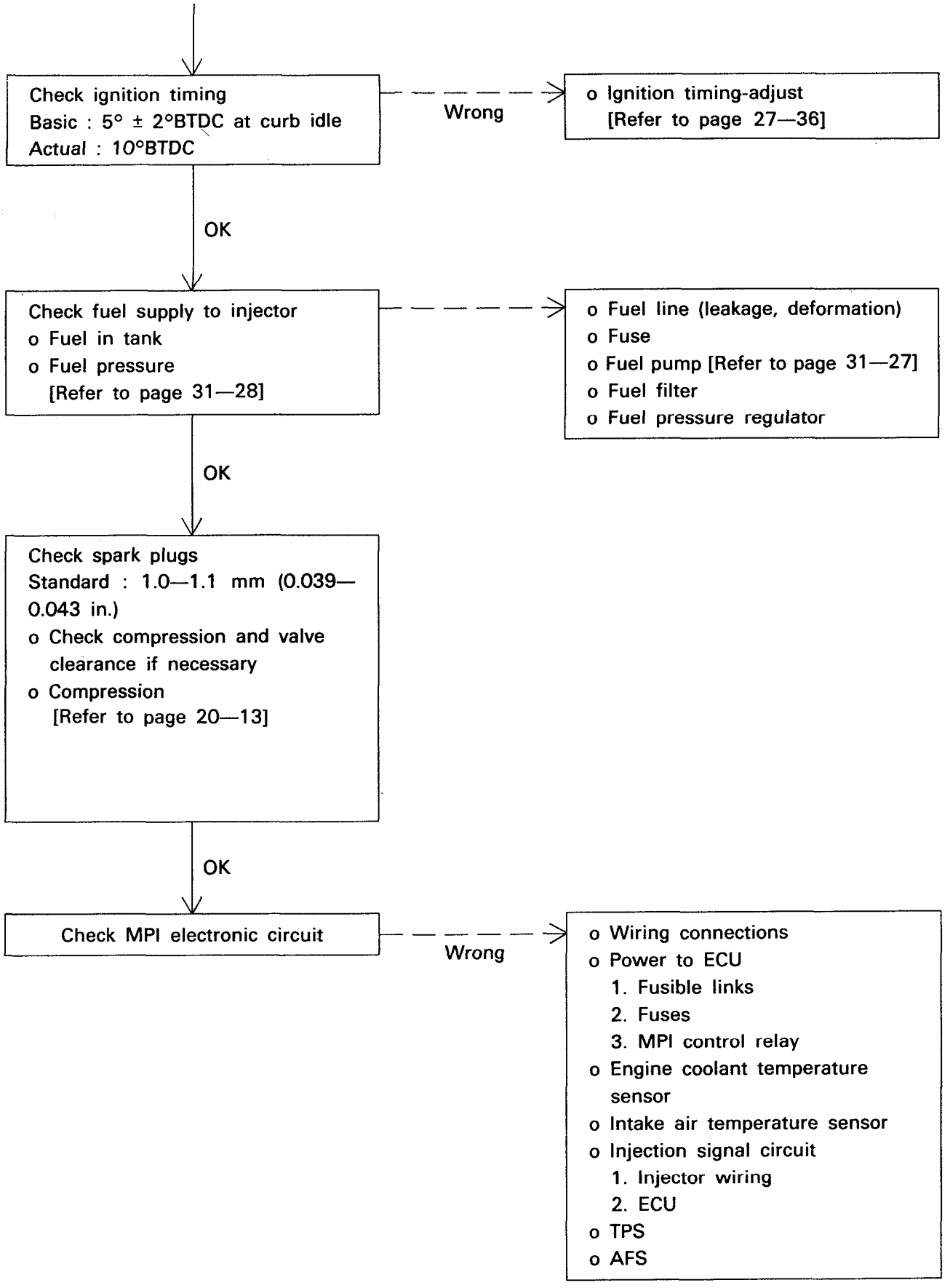


PROBLEM

Hard to start (Cranks OK)

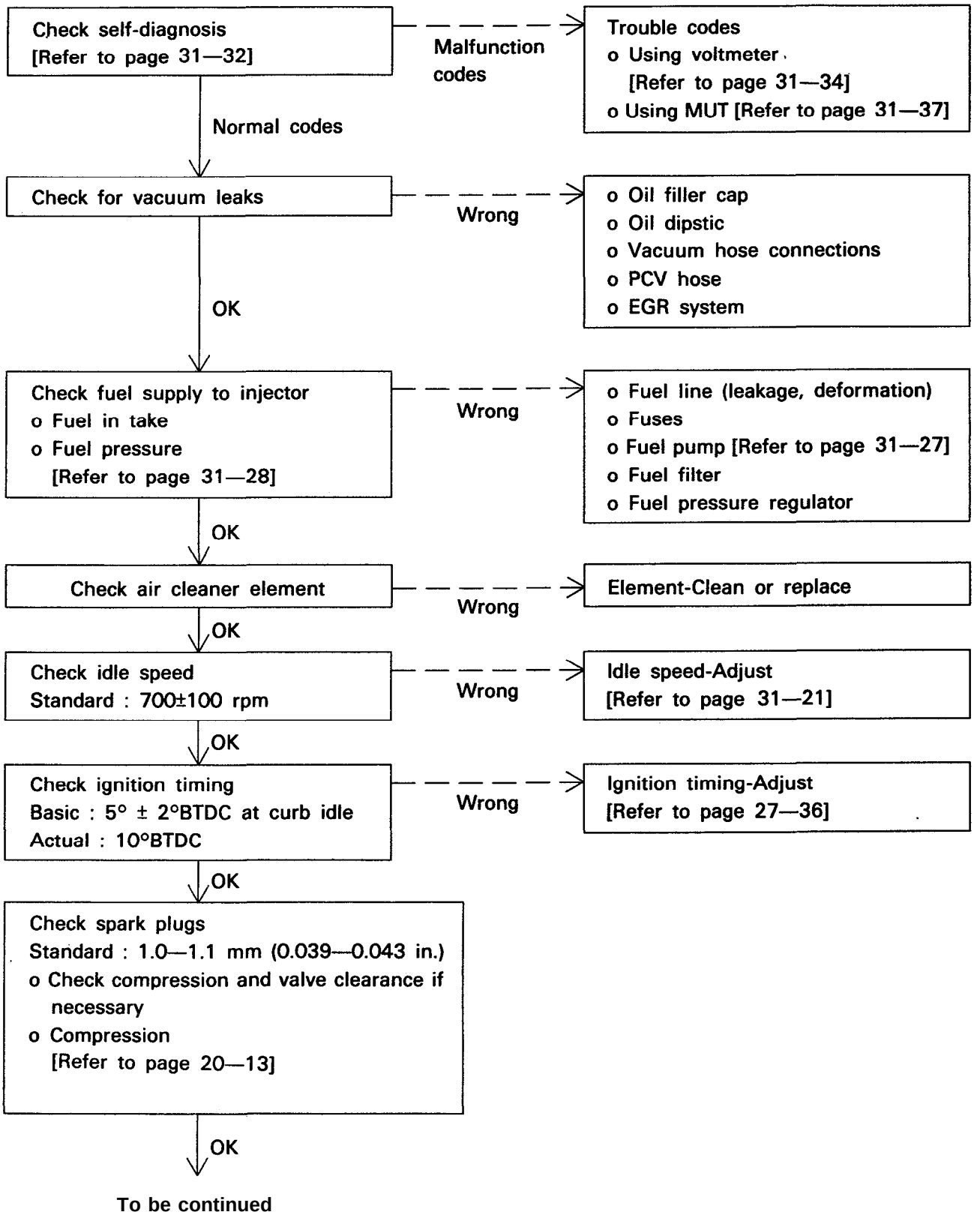


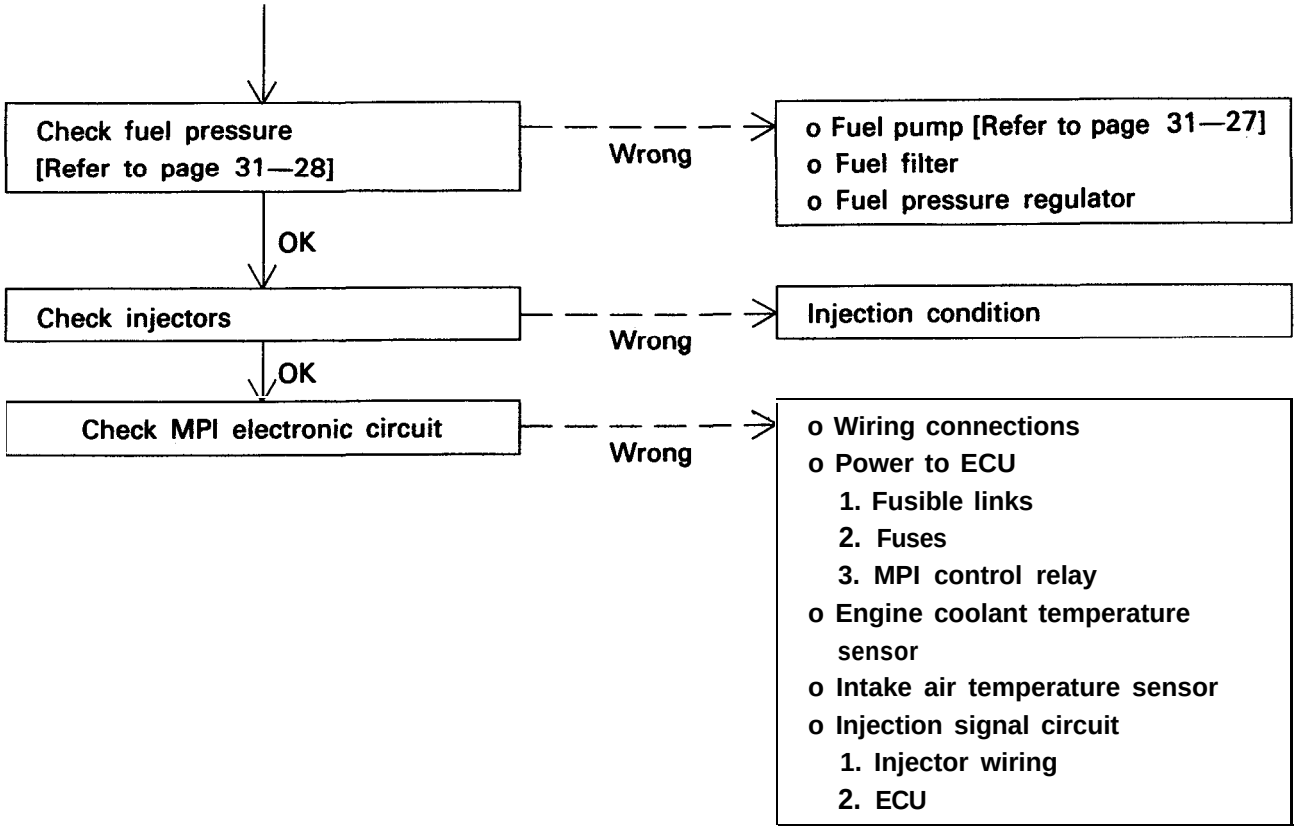
To be continued


Check ignition timing
Basic : 5° ± 2°BTDC at curb idle
Actual : 10°BTDC
Wrong
o Ignition timing-adjust
[Refer to page 27—36]
OK
Check fuel supply to injector
o Fuel in tank
o Fuel pressure
[Refer to page 31—28]
o Fuel line (leakage, deformation)
o Fuse
o Fuel pump [Refer to page 31—27]
o Fuel filter
o Fuel pressure regulator
OK
Check spark plugs
Standard : 1.0—1.1 mm (0.039—0.043 in.)
o Check compression and valve clearance if necessary
o Compression
[Refer to page 20—13]
OK
Check MPI electronic circuit
Wrong
o Wiring connections
o Power to ECU
1. Fusible links
2. Fuses
3. MPI control relay
o Engine coolant temperature sensor
o Intake air temperature sensor
o Injection signal circuit
1. Injector wiring
2. ECU
o TPS
o AFS

PROBLEM

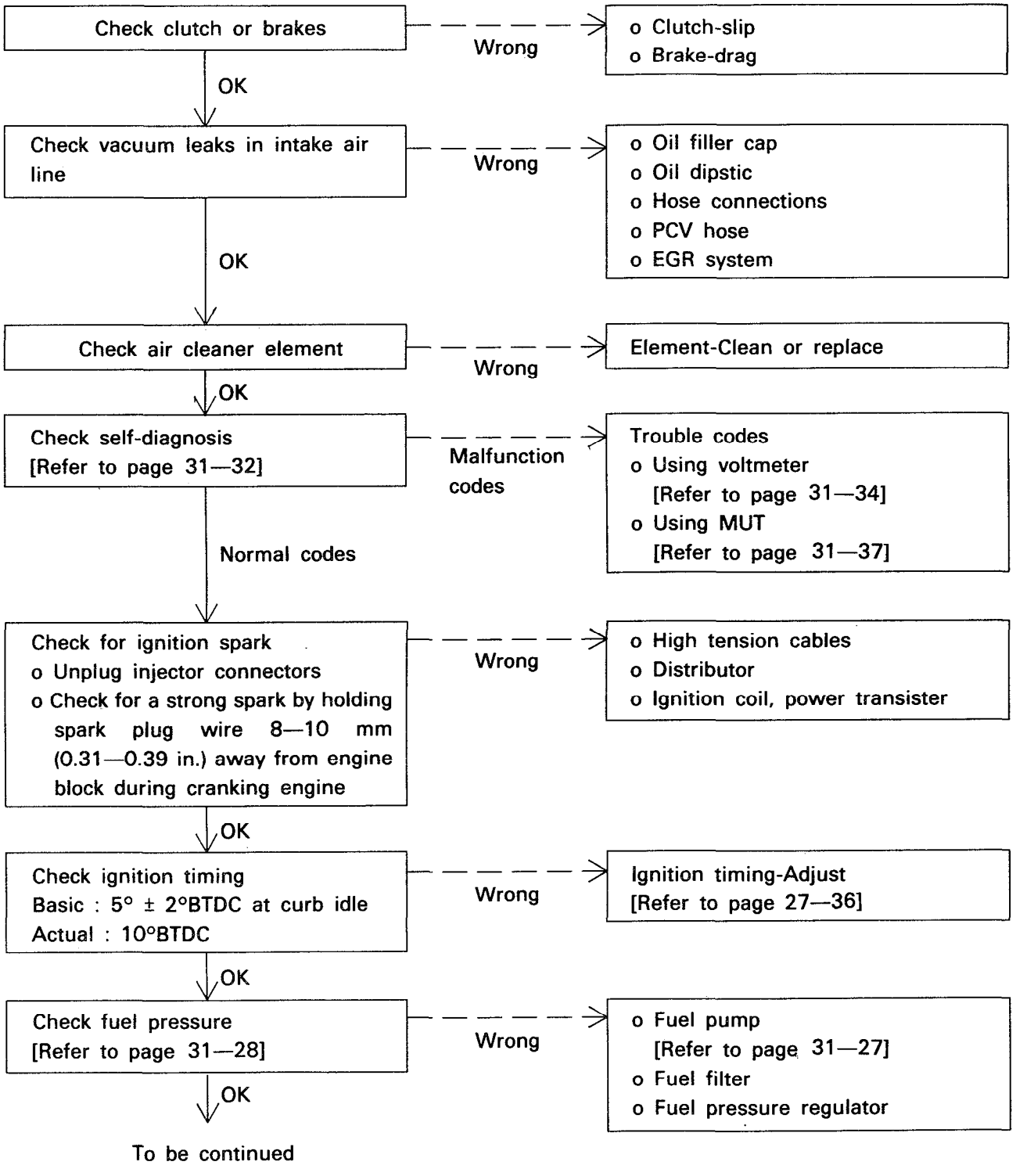
Rough idle or engine stalls

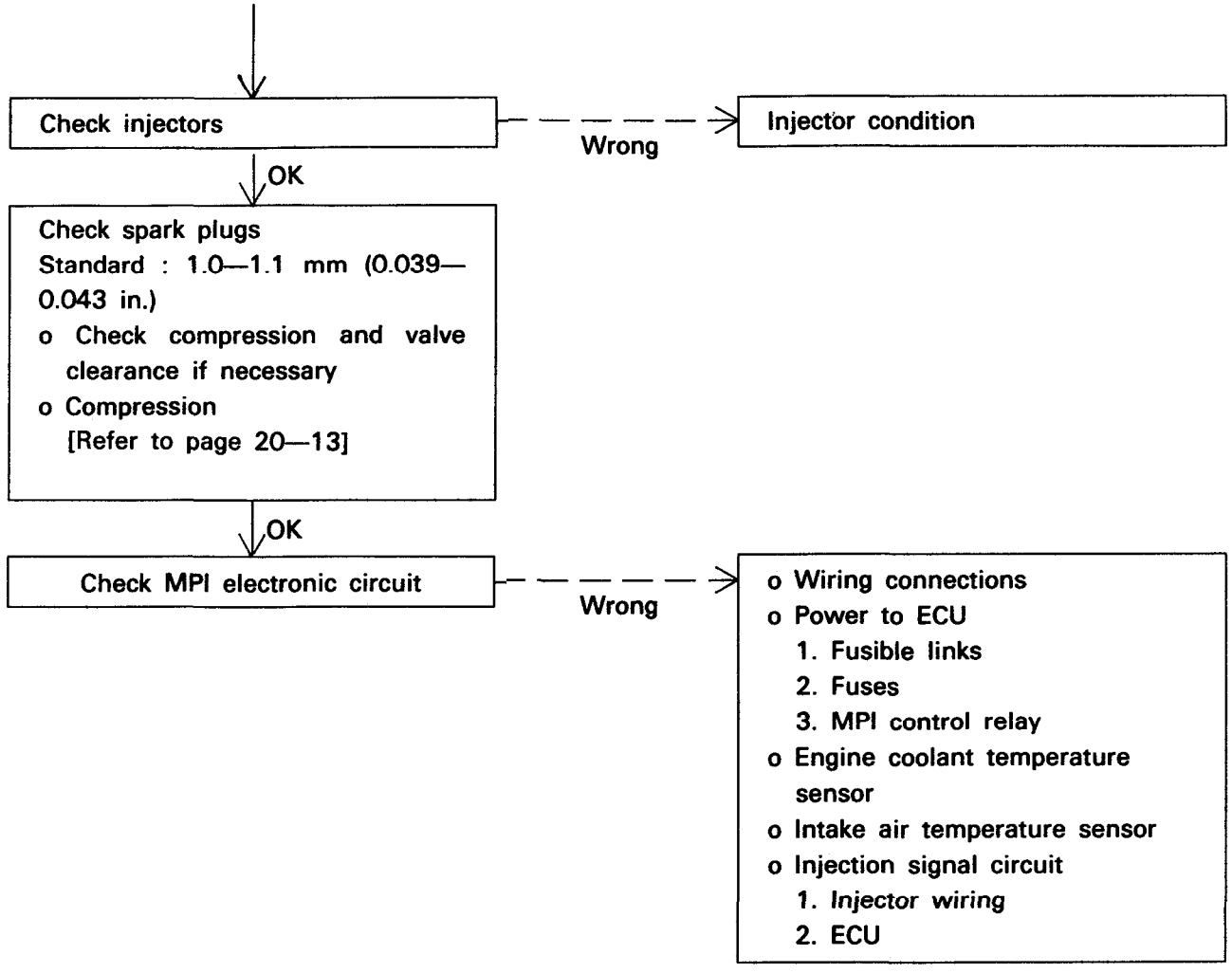



Check fuel pressure
[Refer to page 31—28]
Wrong
o Fuel pump [Refer to page 31—27]
o Fuel filter
o Fuel pressure regulator
OK
Check injectors
Wrong
Injection condition
OK
Check MPI electronic circuit
Wrong
o Wiring connections
o Power to ECU
1. Fusible links
2. Fuses
3. MPI control relay
o Engine coolant temperature sensor
o Intake air temperature sensor
o Injection signal circuit
1. Injector wiring
2. ECU

PROBLEM

Engine hesitates or accelerates poorly




Check injectors
Wrong
Injector condition
OK
Check spark plugs
Standard : 1.0—1.1 mm (0.039—0.043 in.)
o Check compression and valve clearance if necessary
o Compression
[Refer to page 20—13]
OK
Check MPI electronic circuit
Wrong
o Wiring connections
o Power to ECU
1. Fusible links
2. Fuses
3. MPI control relay
o Engine coolant temperature sensor
o Intake air temperature sensor
o Injection signal circuit
1. Injector wiring
2. ECU

Fuel Tank And Fuel Line

Symptom	Probable cause	Remedy
Engine malfunctions due to insufficient fuel Supply	Bent or kinked fuel pipe or hose Clogged fuel pipe or hose Clogged fuel filter or in-tank fuel filter Water in fuel filter Dirty or rusted fuel tank interior Malfunctioning fuel pump (Clogged filter in the pump)	Repair or replace Clean or replace Replace Replace the fuel filter or clean the fuel tank and fuel lines Clean or replace Replace
Evaporative emission control system malfunctions (when tank cap is removed, pressure is released)	Incorrect routing of vapor line Disconnected vapor line piping joint Folded, bent, cracked or clogged vapor line Faulty fuel tank cap Malfunctioning overfill limiter (Two-way valve)	Correct Correct Replace Replace

MPI SYSTEM

GENERAL INFORMATION

The basic function of the MPI (Multi-Point Injection) system is to control the air-fuel ratio, based on data from various sensors. The MPI system is composed of three basic systems : Fuel, Intake and Electronic Control.

Fuel System

Fuel is supplied under constant pressure to the injectors by an electric fuel pump in the fuel tank. The pressure is controlled by the pressure regulator. Based on ECU signals, the injectors inject fuel into the intake manifold in the firing order.

Intake System

The flow rate of the intake air is measured by the AFS (Air Flow Sensor) in the air cleaner. The amount of intake air during idling, warm-up and deceleration is adjusted by the ISC (Idle Speed Control) servo through the ECU.

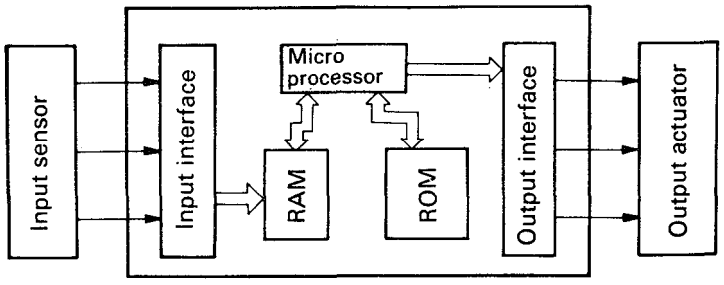
Electronic Control System

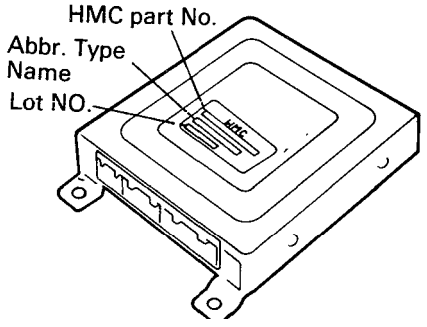
The electronic control system is composed of sensors, which monitor engine conditions, and an Electronic Control Unit (ECU), which calculates the injection timing and fuel amount according to the signals from the sensors.
The sensors convert such conditions as the amount of intake air, amount of oxygen in the exhaust gas, coolant temperature, intake air temperature, engine speed, and vehicle speed into electrical signals, which are sent to the ECU.
Analyzing these signals, the ECU determines the amount of fuel to inject and drives the injectors. The fuel injection is sequential injection type, in which six injectors are sequentially driven.
During idling, the ISC Servo is driven according to engine load to assure stable idling.

ECU Connector Pin Composition

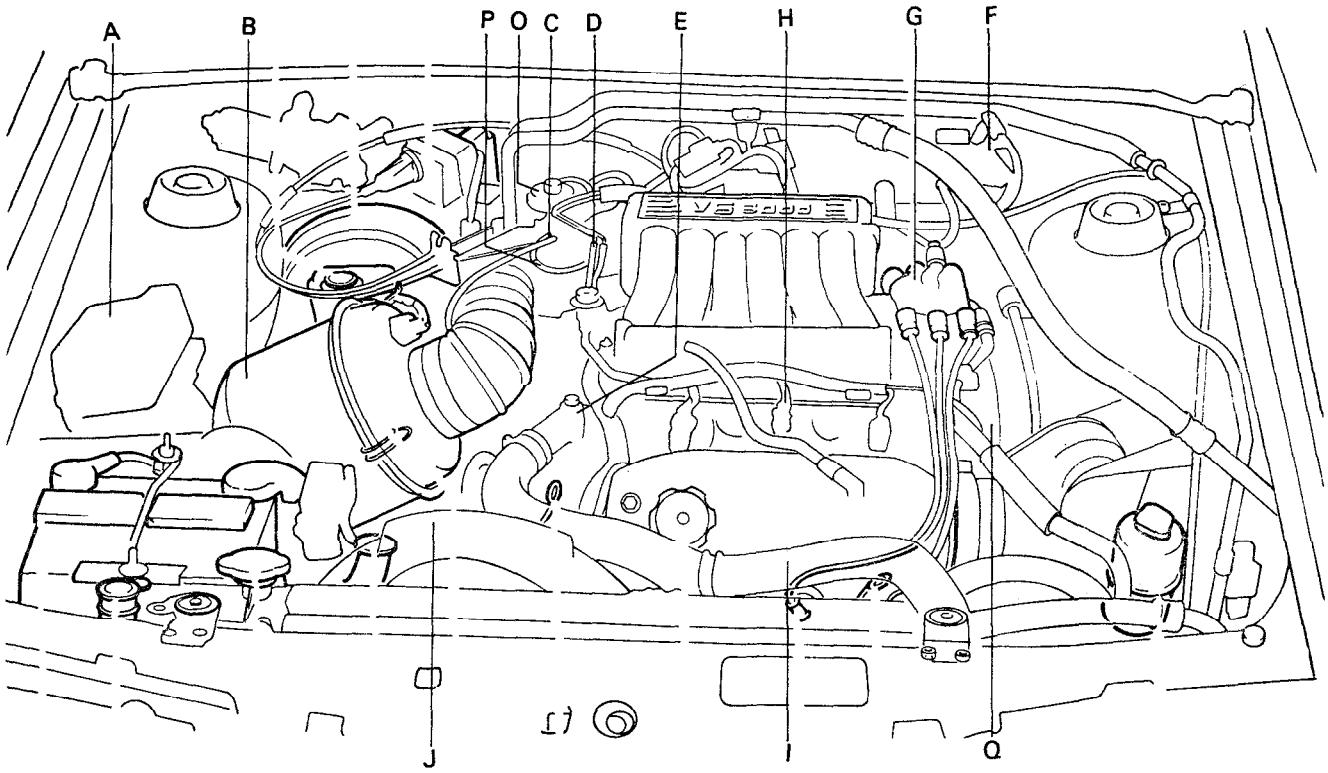
Based on the information from various sensors, the ECU determines (computes) the optimum operating condition and drives the output actuators.

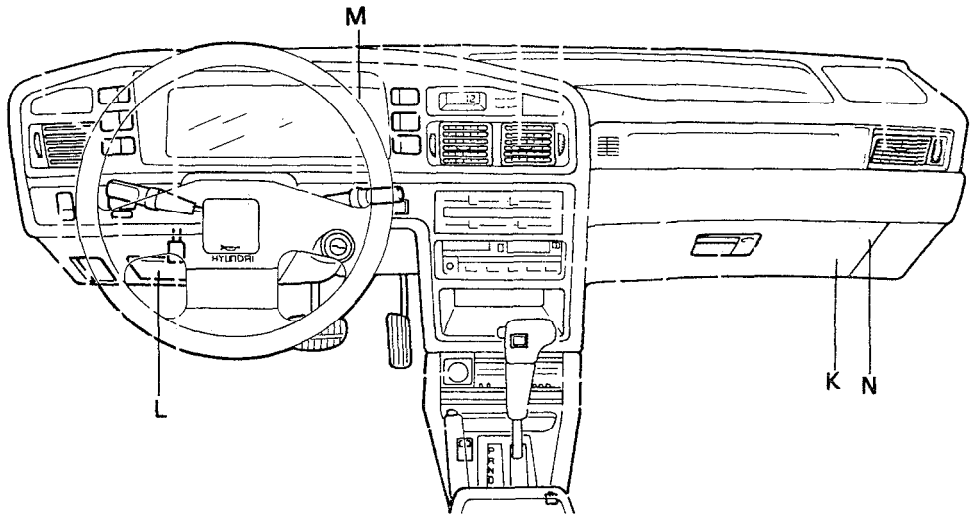
The ECU consists of an 8-bit microprocessor, random access memory (RAM), read only memory (ROM) and an input/output (I/O) interface.





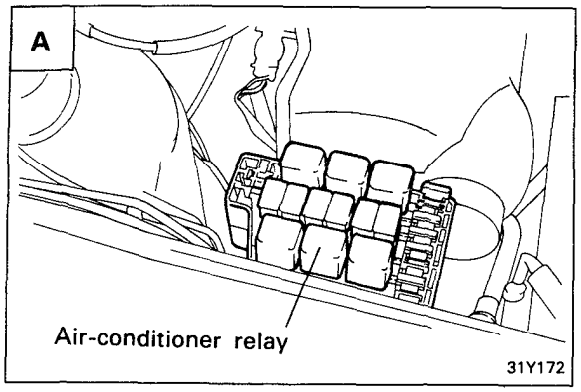
LOCATION OF COMPONENTS



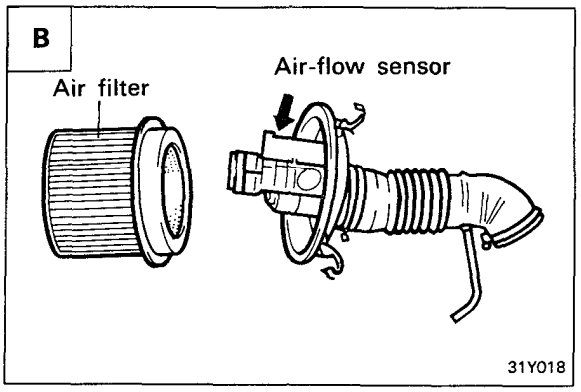


A. Air conditioner relay
B. Air flow sensor
C. ISC (idle Speed Control) servo
D. Throttle position sensor
E. Coolant temperature sensor
F. Power transistor
G. Crank angle sensor
H. Injector
I. Oxygen sensor
J. Inhibitor switch
K. MPI control relay
L. Diagnosis terminal
M. Vehicle speed sensor
N. Electronic control unit
O. EGR temperature sensor
(Only California vehicles)
P. Idle switch (Fixed SAS)
Q. Power steering oil pressureswitch

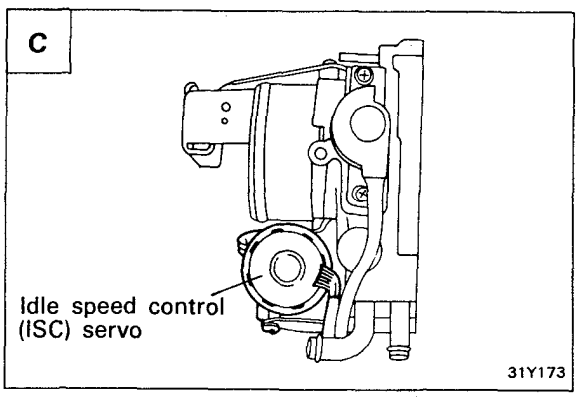
A


Air-conditioner relay
31Y172

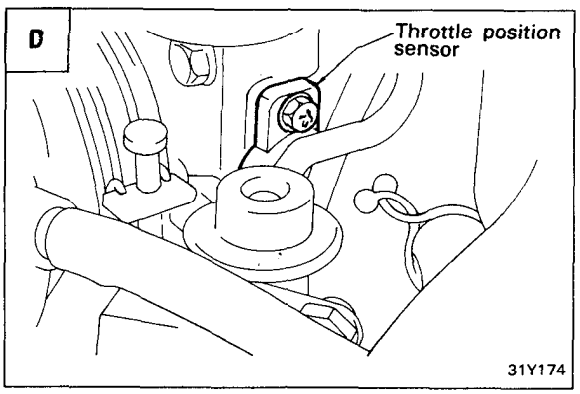
B


Air filter
Air-flow sensor
31Y018

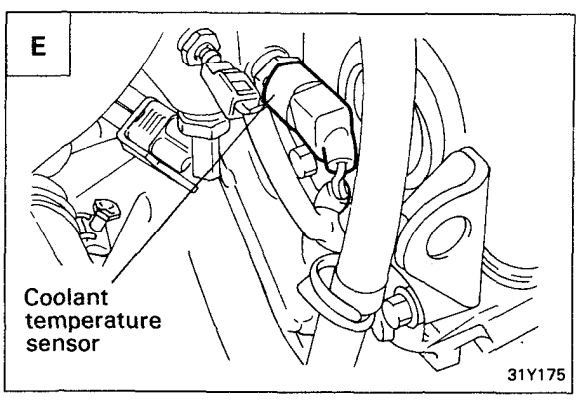
C


Idle speed control
(ISC) servo
31Y173

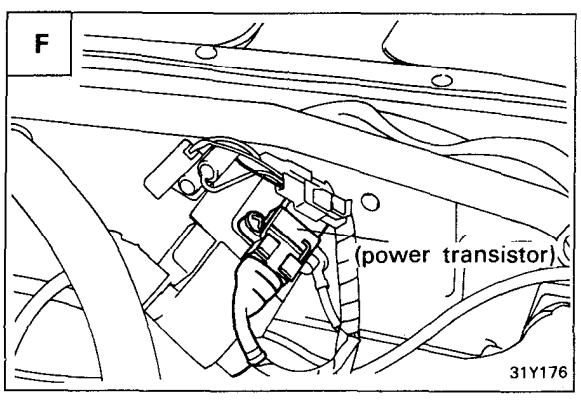
D


Throttle position
sensor
31Y174

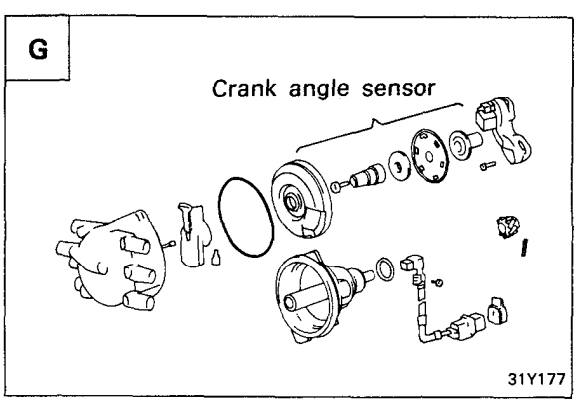
E


Coolant
temperature
sensor
31Y175

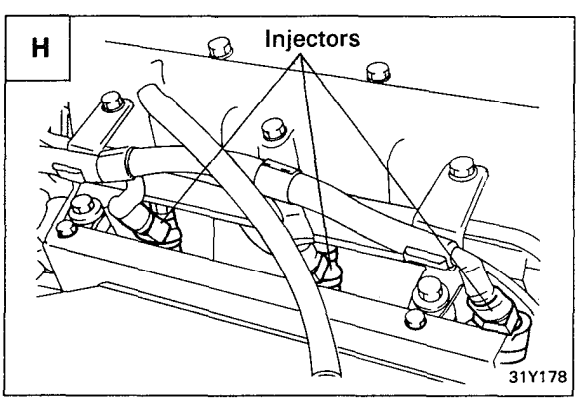
F


(power transistor)
31Y176

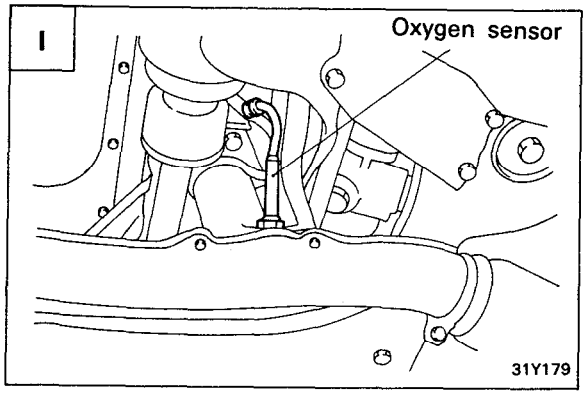
G


Crank angle sensor
31Y177

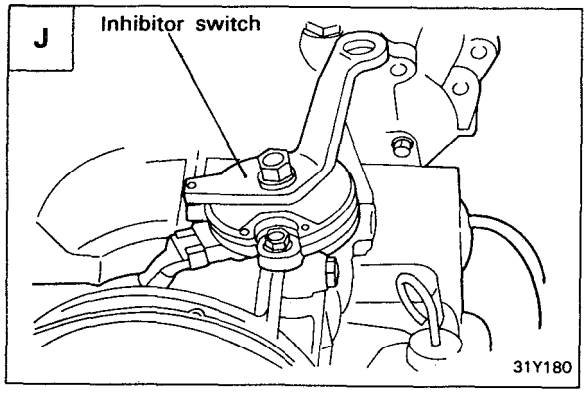
H


Injectors
31Y178

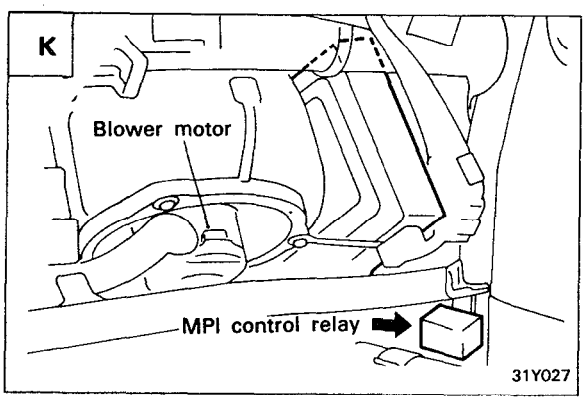
I


Oxygen sensor
31Y179

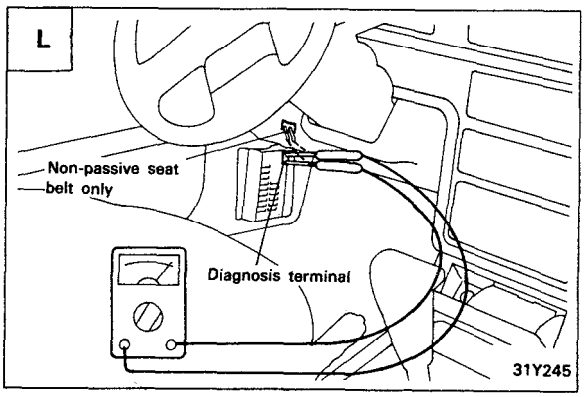
J


Inhibitor switch
31Y180

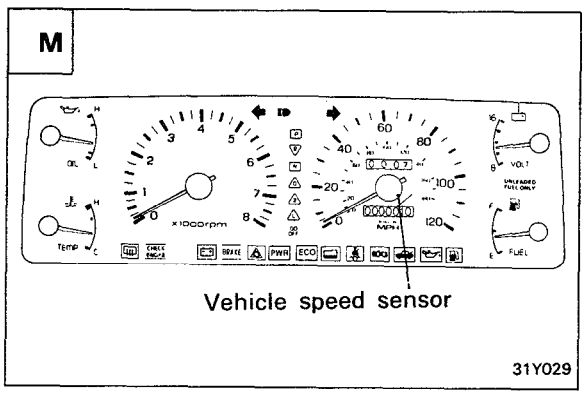
K


Blower motor
MPI control relay
31Y027

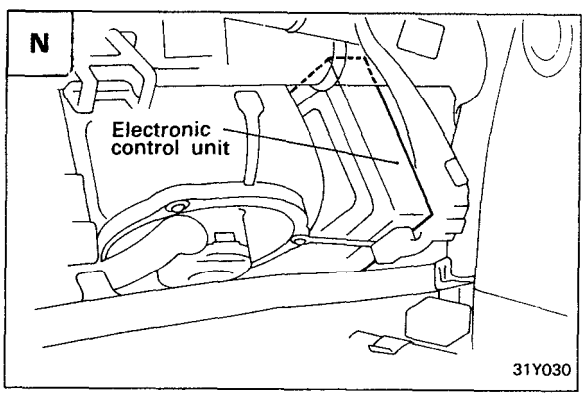
L


Non-passive seat
belt only
Diagnosis terminal
31Y245

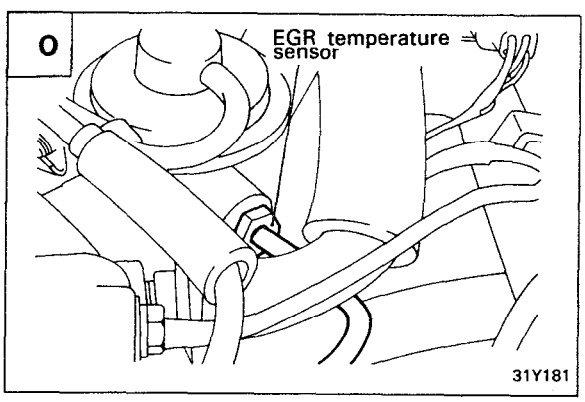
M


Vehicle speed sensor
31Y029

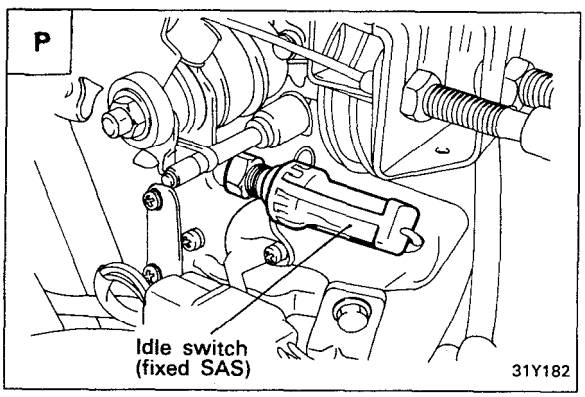
N

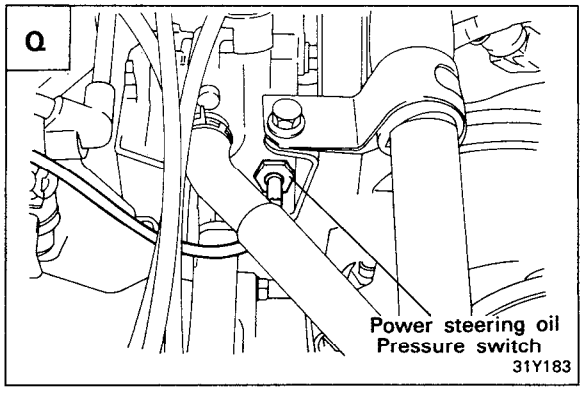

Electronic
control unit
31Y030

O


EGR temperature
sensor
31Y181

P


Idle switch
(fixed SAS)
31Y182


Q
Power steering oil
Pressure switch
31Y183

SERVICE ADJUSTMENT PROCEDURES

Idle Speed Check Procedure

CAUTION

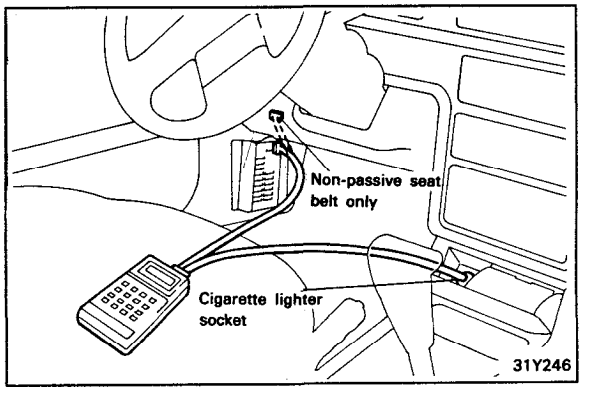
An improper throttle valve opening will increase exhaust gas temperature at deceleration, reducing catalyst life and performance. It also has an effect on fuel consumption and engine braking.

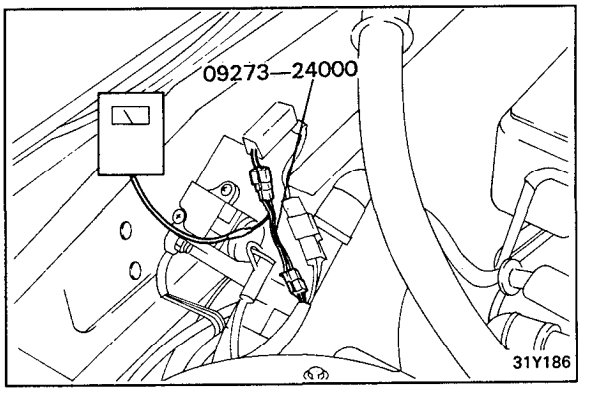
Checking conditions:

- **Engine coolant temperature is 80 to 95°C (176 to 203°F).**
- **Lights, electric cooling fan and all accessories are off.**
- **Transaxle is in neutral ["P" or "N" range].**
- **Steering wheel is a straight ahead position.**

1. **Install the tachometer and timing light, or connect the multi-use tester to the diagnostic connector in the fuse box.**
2. **Run the engine at curb idle speed.**
3. **Check the basic ignition timing and adjust if necessary. Refer to Group 27 "Ignition System" section.**
4. **Run the engine for more than 5 seconds at 2,000 to 3,000 rpm.**
5. **Run the engine at idle for 2 minutes.**
6. **Read the idle speed. If the multi-use tester is used, enter code No.22 and read the idle speed. If it is not within the specified value, check the idle speed control system.**

Curb idle rpm	**700 ± 100 rpm**



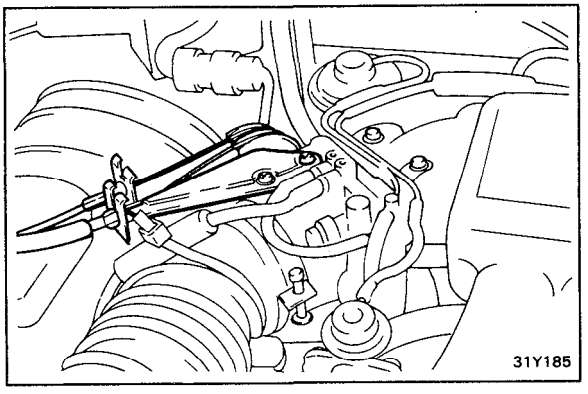


Speed Adjusting Screw (SAS) Adjustment

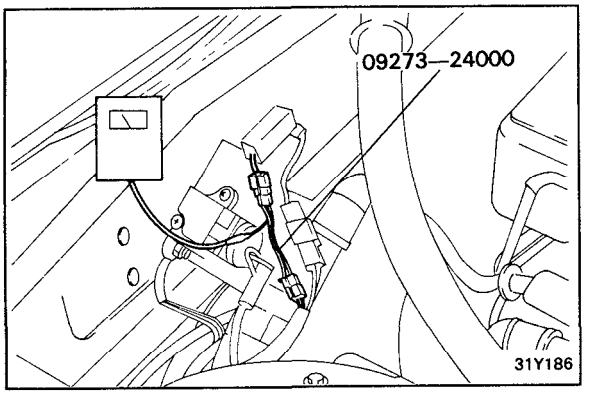
Adjustment conditions:

- **Engine coolant temperature is 80 to 95°C (176 to 203°F).**
- **Lights, electric cooling fan and all accessories are off.**
- **Transaxle is in neutral ["P" or "N" range].**
- **Steering wheel is central.**

1. Loosen the accelerator cable.



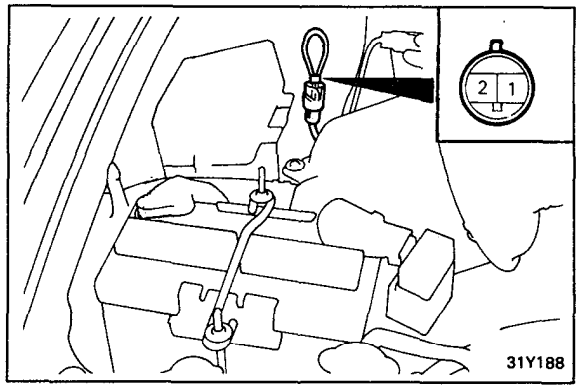
2. Connect the tachometer, if you do not use a multi-use tester.



3. Ground the terminal of the ignition timing adjusting connector.

   Start the engine and let it idle.
   Check ignition timing.
   Adjust the ignition timing if necessary.

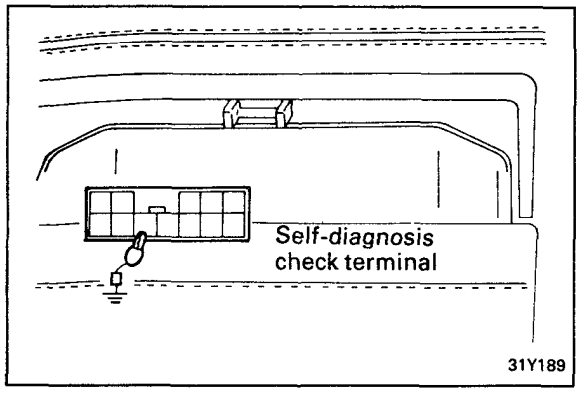
Standard ignition timing . . . . . .BTDC 5° ± 2°

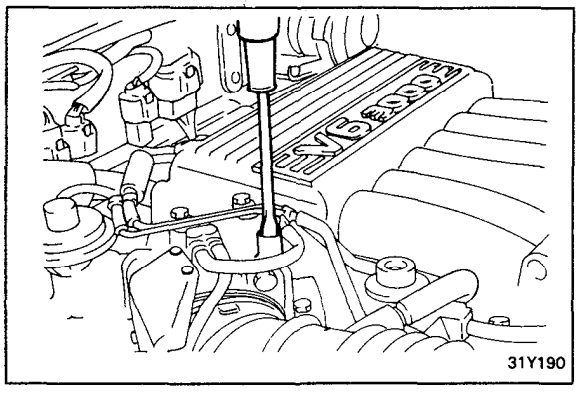


4. Turn off the ignition switch and ground the self-diagnosis check terminal. Alternatively, connect a multi-use tester to the diagnostic connector.
5. Run the engine for more than 5 seconds at an engine speed of 2,000 to 3,000 rpm.
   Run the engine at idle for 2 minutes.
   Read the idle speed.
   If it is not within the specified limits, adjust the speed adjusting screw (SAS).

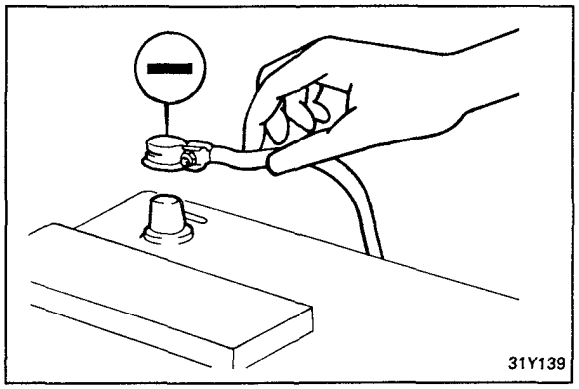
   Basic idle speed : 700 ± 50 rpm

   NOTE
   1. If the engine is insufficiently broken in, the engine speed is sometimes slightly below spec. In this case, adjustment is not necessary.
   2. If the idle speed is higher than specified, even with the speed adjusting screw (SAS) fully closed, check whether the idle switch (fixed SAS) moving mark exists or not. If it is found that the switch has moved, adjust the idle switch (fixed SAS) has been mis-adjusted.





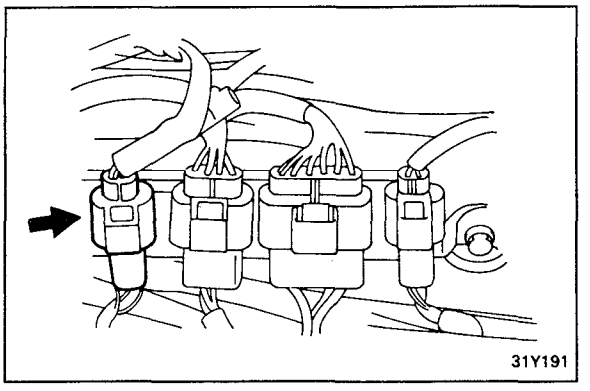
6. Turn off the ignition switch, and remove the ground from the ignition timing adjusting terminal and self-diagnosis check terminal or disconnect the multi-use tester.
7. Remove the tachometer and the paper clip.
8. Disconnect the battery terminal for 15 seconds or more, and reconnect it.
9. Adjust the tension of the acceleration cable.
10. Restart the engine, and keep it idling for 5 minutes or more.

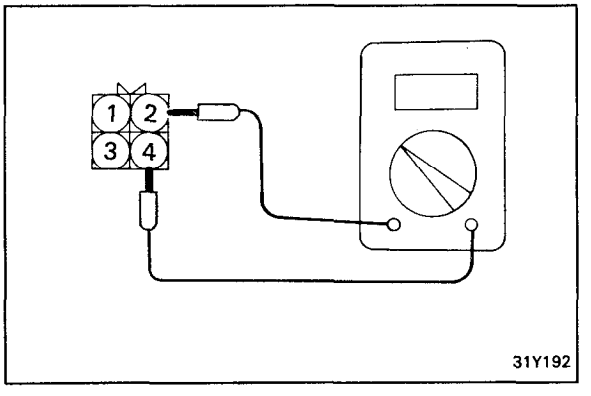


Throttle Position Sensor (TPS) Adjustment

1. Loosen the tension of the acceleration cable.
2. Connect the multi-use tester to the diagnosis connector in the fuse box.
3. If the multi-use tester is not used, connect a voltmeter between terminals 2 and 4 of the throttle posisiton sensor.

   NOTE
   1. Do not disconnect the TPS connector.
   2. The voltmeter used should be the digital type.



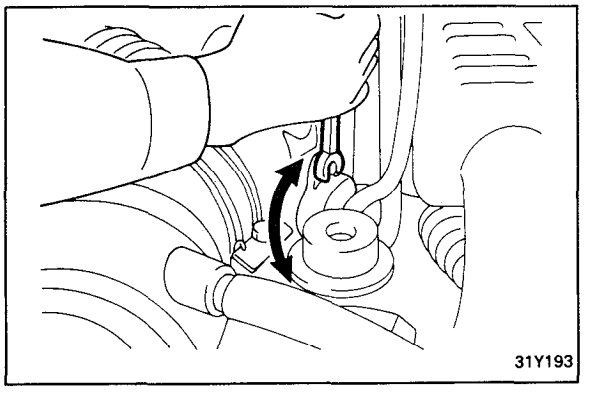


4. Turn on the ignition switch and check that the TPS output voltage is within specifications.

   Standard value . . . . . 0.48 - 0.52V

   If the voltage is out of specifications, loosen the TPS mounting bolt, and turn the TPS until the correct voltage is achieved.
   After adjustment, tighten the bolt.

   Tightening torque
   TPS installation screw . . . . . 2.5-4.4 Nm (25-45 kg.cm, 1.8-3.2 lb.ft)



5. Turn off the ignition switch.
6. Restart the engine and check the idle speed.

   Standard value . . . . . 700 ± 100 rpm

7. Disconnect the battery terminal for 5 seconds or more, and then reconnect it.
8. Adjust the tension of the acceleration cable.

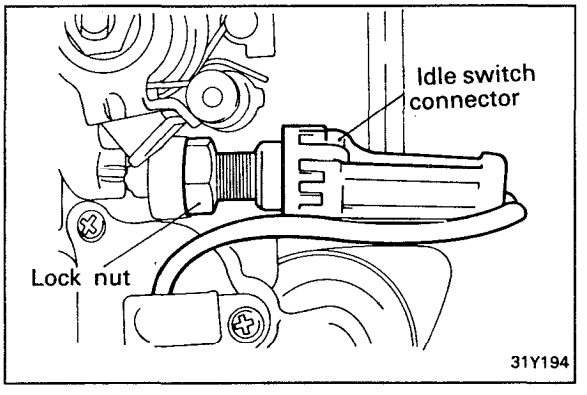
Idle Switch (Fixed SAS) Adjustment

NOTE
Since the idle switch (Fixed SAS) is adjusted at the factory, it is not necessary to adjust the idle switch in normal cases except during replacement.

1. **Loosen the tension of the acceleration cable.**
2. **Disconnect the idle switch (fixed SAS) connector.**
3. **Loosen the idle switch (fixed SAS) lock nut.**
4. **Turn the idle switch (fixed SAS) counterclockwise until the throttle valve closes.**
5. **Connect an ohmmeter between the terminal of the switch and the body.**
6. **Screw in the idle switch (fixed SAS) until continuity is found between the switch terminal and the body, and screw in the idle switch 1¼ turn from that point.**
7. **Tighten the lock nut and connect the idle switch connector.**

NOTE
Keep the idle switch (fixed SAS) from moving when tightening the lock nut.

8. **Adjust the acceleration cable.**
9. **Adjust the curb idle speed.**
10. **Adjust the TPS (Throttle position sensor).**



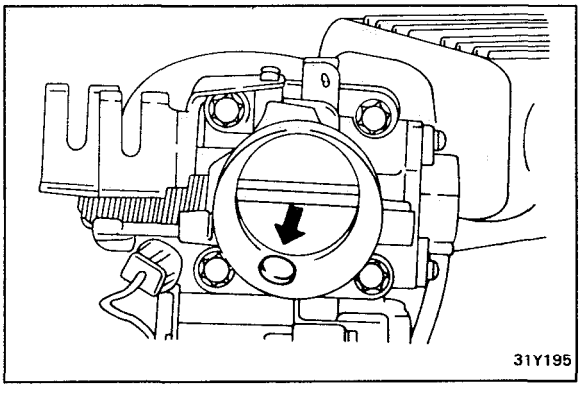
Throttle Body {Throttle Valve Area) Cleaning

NOTE
Disconnect the air intake hose from the throttle body, and check the throttle valve surface for carbon deposits. Spray cleaning solvent on the valve to remove carbon deposits.

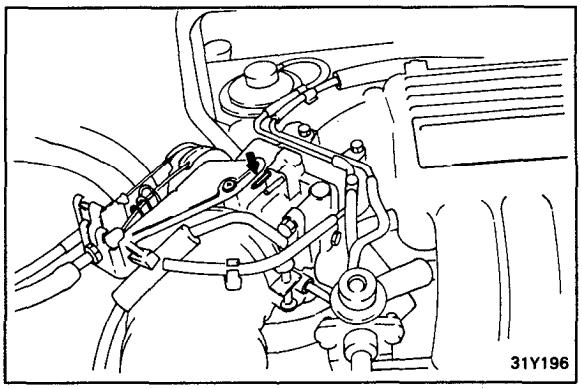
1. **Warm up the engine, then stop it.**
2. **Remove the air intake hose from the throttle body.**
3. **Plug the bypass passage inlet of the throttle body.**

NOTE
Make sure the solvent does not enter the by-pass passage.

4. **Spray cleaning solvent onto the valve through the throttle body intake port and let it soak for about 5 minutes.**
5. **Start the engine, race it several times and allow the engine to idle for 1 minute.**
6. **Repeat Steps 4 and 5.**
7. **Unplug the by-pass passage inlet.**
8. **Attach the air intake hose.**
9. **Adjust the SAS (Speed adjusting screw)**



EGR Valve Control Vacuum Check



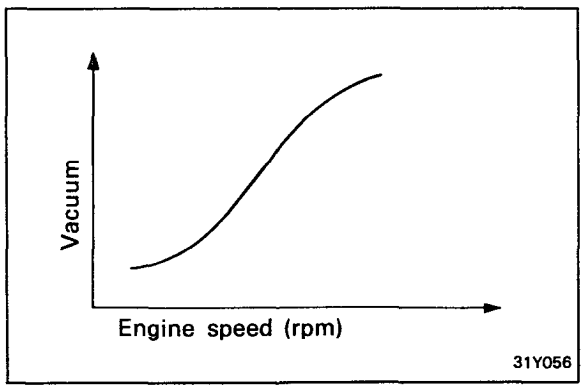
Checking Condition

Engine coolant temperature: 80-95°C (176-205°F)

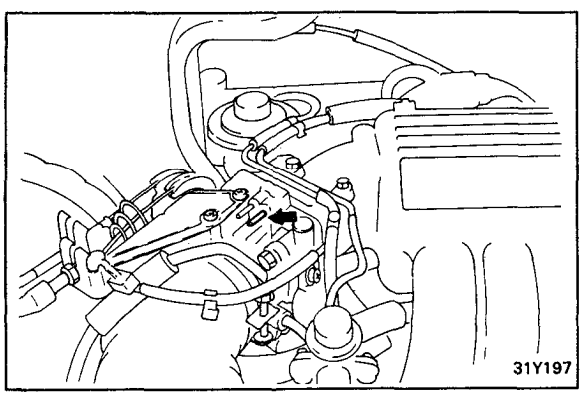
1. Disconnect the vacuum hose from the throttle body EGR vacuum fitting and connect a vacuum gauge to the fitting.
2. Start the engine and check that, after raising the engine speed, vacuum raises proportionately with the rise in engine speed.

NOTE

If vacuum does not increase, it is possible that the throttle body port may be clogged and require cleaning. :



Purge Port Vacuum Check [Except UK, Holland]



Checking Condition

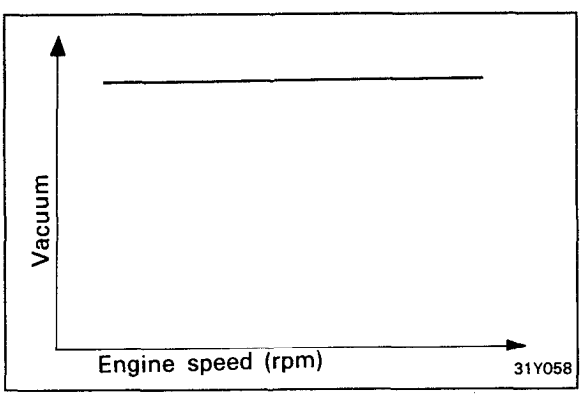
Engine coolant temperature: 80-95°C (176-205°F)

1. Disconnect the vacuum hose from the throttle body purge hose fitting and connect a vacuum gauge.

2. Start the engine and check that, after raising the engine speed, vacuum remains fairly constant.

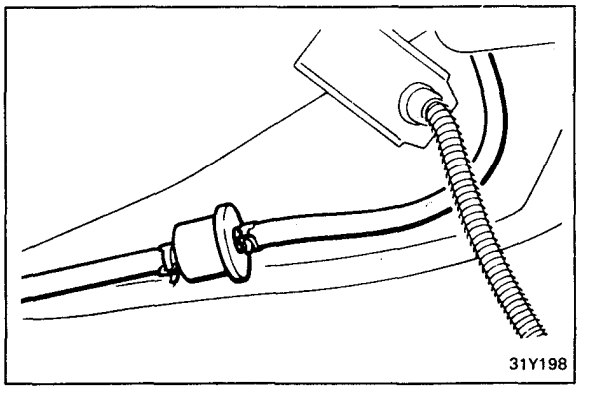
NOTE

If there is no vacuum, it is possible that the throttle body port may be clogged and require cleaning.



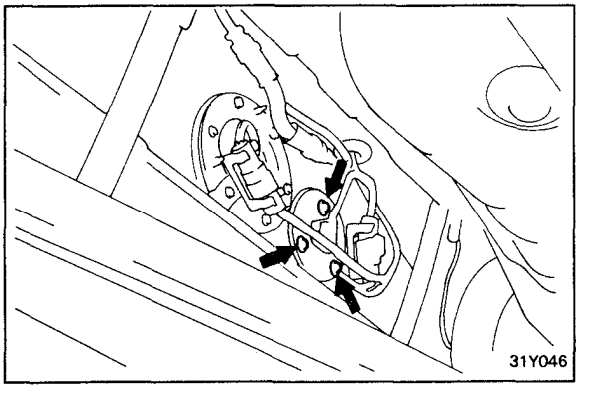
Overfill Limiter (Two-way Valve) Replacement

1. Disconnect the vapor hoses, and then remove the overfill limiter.



Fuel Sender Replacement

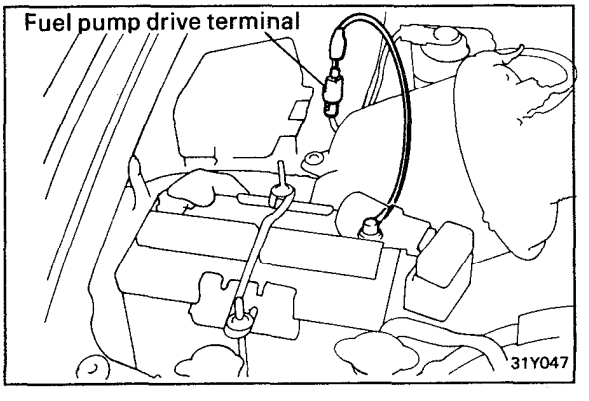
1. Remove the fuel tank cap to lower the tank's internal pressure.
2. Disconnect the harness connector from the fuel sender.
3. Remove the fuel tank unit installation screws, and then remove the fuel sender assembly from the fuel tank.



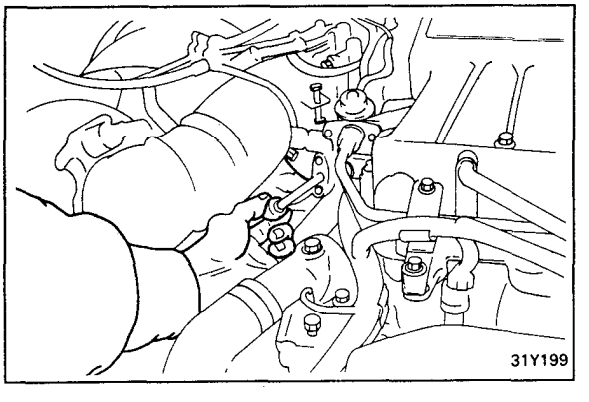
Fuel Pump Operation Check

1. Turn the ignition switch to OFF.
2. Apply battery voltage to the fuel pump drive connector to check that the pump operates.

   NOTE
   The fuel pump is an in-tank type and its operating sound is hard to hear without removing the fuel tank cap.

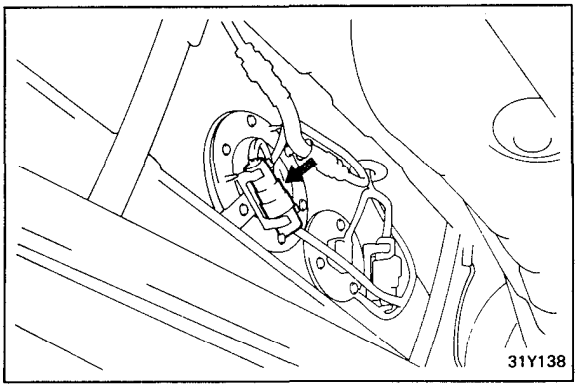


3. Pinch the fuel hose to check that fuel pressure is felt.



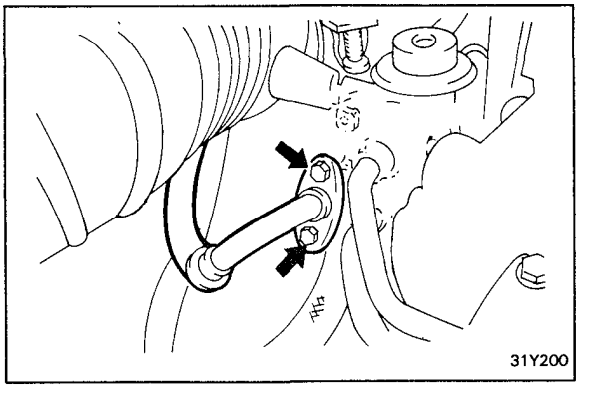
Fuel Pressure Test

1. Reduce the internal pressure of the fuel lines and hoses by the following procedures.
   - o Disconnect the fuel pump harness connector at the fuel tank rear side.
   - o Start the engine and after it stops, turn the ignition switch to OFF.
   - o Disconnect the battery negative (-) terminal.
   - o Connect the fuel pump harness connector.

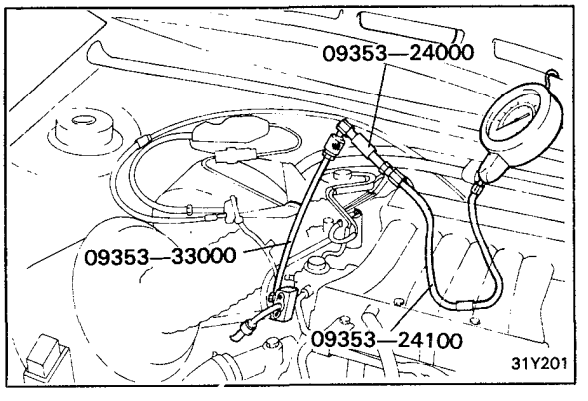


2. Disconnect the high pressure fuel hose at the delivery side.

   CAUTION
   Cover the hose connection with rags to prevent fuel from leaking out due to residual pressure in the fuel line line.

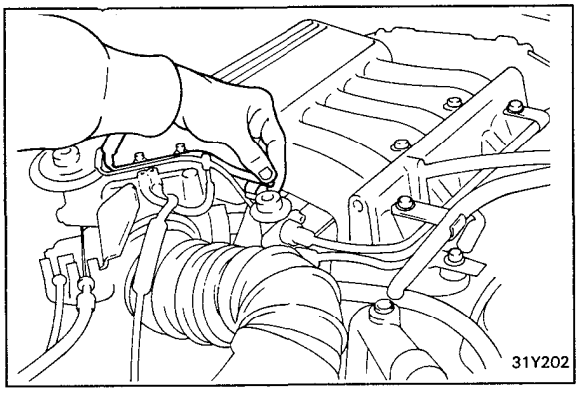


3. Using the fuel pressure gauge adaptor (09353-24000, 09353-24100, 09353-33000), install the fuel-pressure gauge to the delivery pipe.
4. Connect the battery negative (-) terminal.
5. Apply battery voltage to the fuel pump drive terminal and activate the fuel pump; check that there is no fuel leakage from the pressure gauge or connection part.



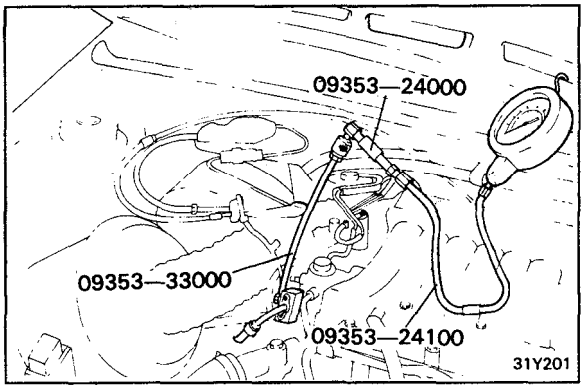
6. Disconnect the vacuum hose from the pressure regulator, and plug the hose end. Measure the fuel pressure at idle.

Standard value	320-340 kPa (3.26-3.47 kg/cm^2, 46-49 psi)



7. Measure the fuel pressure when the vacuum hose is connected to the pressure regulator.

Standard value .....
Approx. 270 kPa (2.75 kg/cm^2, 39 psi)



8. If the results of the measurements made in steps (6) and (7) above are not within the standard value, use the table below to determine the probable cause, and then make the necessary repair.

Condition	Probable cause	Remedy
Fuel pressure too low	a. Clogged fuel filter. b. Fuel leakage to the return side, caused by poor seating of the valve within the fuel-pressure regulator c. Low discharge pressure of the fuel pump	a. Replace fuel filter b. Replace fuel pressure regulator. c. Check the in-tank fuel hose for leakage or replace fuel pump
Fuel pressure too high	a. Sticking valve within the fuel-pressure regulator b. Clogged or bent fuel return hose or line.	a. Replace fuel pressure regulator b. Repair or replace hose or line.
There is no difference in fuel pressure when the vacuum hose is connected and when it is not.	a. Clogging, or damage, of the vacuum hose or the nipple b. Sticking or poor seating of the valve within the fuel-pressure regulator, or poor seating	a. Repair or replace the vacuum hose or the nipple b. Replace fuel pressure regulator

9. Stop the engine and check for a change in fuel pressure, it should not drop.
If the pressure drops, observe the rate of drop. Determine and repair the causes according to the following table.

Condition	Probable cause	Remedy
Fuel pressure drops slowly after engine is stopped	a. Injector leakage	a. Replace injector
Fuel pressure drops immediately after engine is stopped	a. The check valve within the fuel pump is not closed	a. Replace fuel pump

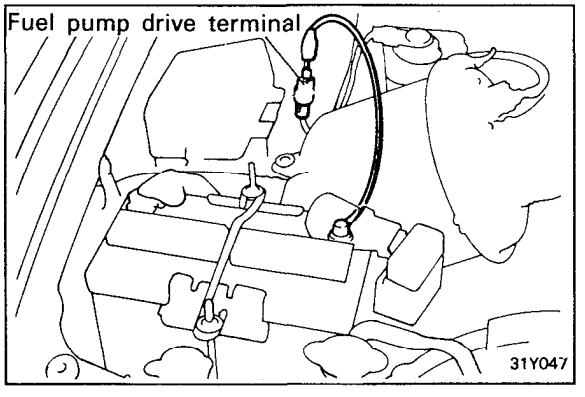
10. Reduce the fuel pressure in the fuel line. (Step 1)
11. Disconnect the high pressure hose and remove the fuel pressure gauge from the delivery pipe.

CAUTION
Cover the hose connection with rags to prevent fuel from leaking out due to by residual pressure in the fuel line line.

12. Install a new O-ring at the groove in the end of the high-pressure hose.
13. Connect the high pressure fuel hose to the delivery pipe, and tighten the screws to the specified torque.

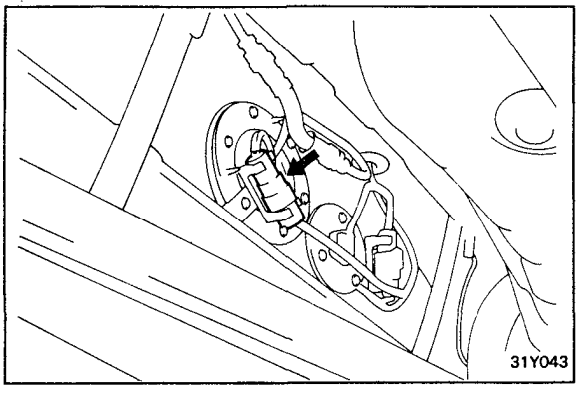
Tightening torque
High pressure fuel hose to delivery pipe . . . . . 3-4 Nm (30-40 kg.cm, 2.2-3 lb.ft)

14. Check for fuel leaks.
    - Apply battery voltage to the fuel pump drive terminal to operate the fuel pump.
    - With fuel pressure, check the fuel line for leaks.

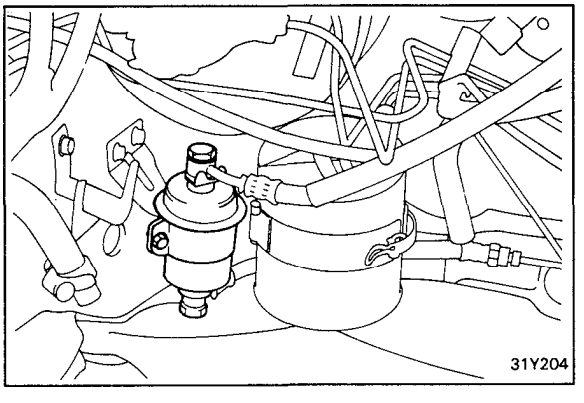


Fuel Filter Replacement

1. Reduce the internal pressure of the fuel lines and hoses and make the following operations.
    - Disconnect the fuel pump harness connector at the fuel tank rear side.
    - Start the engine and after it stops, turn the ignition switch to OFF.
    - Disconnect the battery negative (-) terminal.
    - Connect the fuel pump harness connector.



2. Remove the eye bolts while holding the fuel filter nuts securely.
3. Remove the fuel filter mounting bolts, and then remove the fuel filter from the fuel filter clamp.



MPI SYSTEM INSPECTION

If the MPI system components (sensors, ECU, injector, etc.) fail, interruption or failure to supply the proper amount of fuel for engine operating conditions will result. Therefore, the following situations will be encountered.

1. **Engine is hard to start or does not start at all.**
2. **Unstable idle**
3. **Poor driveability**

If any of the above conditions are noted, first check for any ECU diagnostic codes and then perform basic engine checks (ignition system malfunction, incorrect engine adjustment, etc.), and then inspect the MPI system components with the multi-use tester (MUT) service data test.

NOTE

1) **Before removing or installing any part, read any diagnostic codes and then disconnect the battery negative (-) terminal.**
2) **Before disconnecting the cable from battery terminal, turn the ignition switch to OFF. Removal or connection of battery cable during engine operation or while the ignition switch is ON could cause damage to the ECU.**
3) **The harness between the ECU and the oxygen sensor is shielded to prevent the influence of ignition noises and radio interference. When the wire is faulty, the harness must be replaced.**

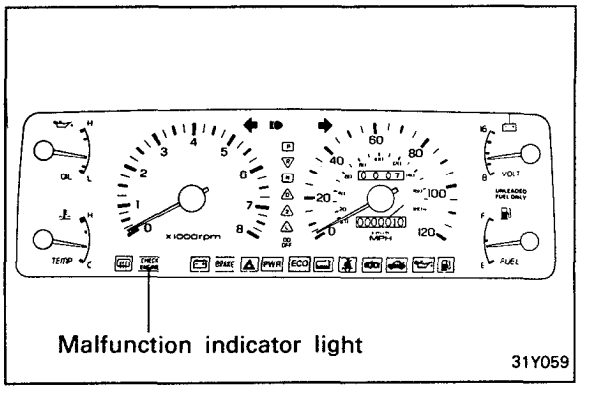
Malfunction Indicator Light (For U.S.A.)

Among the self-diagnostic items, a malfunction indicator light comes on to notify the driver of emission control items that are malfunctioning.

However, when a signal returns to normal and the ECU senses that it has returned to normal, the malfunction indicator light goes out.

Immediately after the ignition switch is turned on, the malfunction indicator light is lit for 5 seconds to indicate that it is operating normally.

The MIL will come ON only while the engine is running a problem is detected.



Items Indicated By The MIL (Malfunction Indicator Light)

- **Computer**
- **Oxygen sensor**
- **Air-flow sensor (AFS)**
- **Intake air, temperature sensor**
- **Throttle position sensor (TPS)**
- **Vehicle speed sensor**

o Barometric pressure sensor
o Coolant temperature sensor
o Crank angle sensor
o No.1 cylinder top dead center sensor
o Injector
o Fuel pump
o EGR temperature sensor (California vehicles only)

SELF-DIAGNOSIS

The electronic control unit monitors the input/output signals at all times.
When the ECU detects a problem for a specified time, the electronic control unit memorizes the trouble code, and outputs a signal to the self-diagnostic output terminal.
There are 14 diagnosis codes, including the normal code, that can be read out with a voltmeter or the multi-use tester.
The diagnosis codes are memorized even if the ignition key is turned off. The trouble codes will, however, be erased when the battery terminal or the electronic control unit harness is disconnected.

NOTE
If a sensor connector is disconnected with the ignition switch turned on, a diagnosis code will be memorized. To erase any diagnostic codes, disconnect the battery negative terminal (-) for 15 seconds or more, and the ECU memory will be erased.

The 12 diagnostic codes are listed below, and if more than one code is detected, they will be indicated sequentially from the smallest to the largest code number.

Malfunction code	Diagnosis item	Malfunction code	Diagnosis item
11	Oxygen sensor	23	No.1 cylinder top dead center sensor
12	Air-flow sensor	24	Vehicle-speed sensor
13	Intake air temperature sensor	25	Barometric pressure sensor
14	Throttle position sensor	41	Injector
21	Coolant temperature sensor	42	Fuel pump
22	Crank angle sensor	43	EGR temperature sensor (For California Vehicles)

CHECKING PROCEDURE (SELF-DIAGNOSIS)

CAUTION

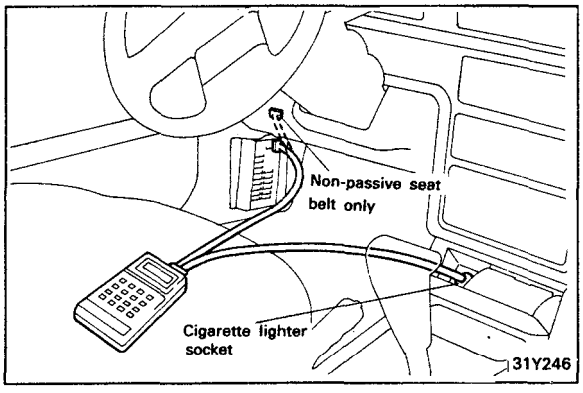
1) If the battery voltage is low, no trouble codes will be stored. Be sure to check the battery voltage before starting the test.
2) Diagnostic codes will be erased if the battery or the ECU harness is disconnected. Do not disconnect the battery before the diagnostic codes are read.
3) After checks and repairs are completed, disconnect the (-) ground cable for 15 or more seconds to make sure that the codes are erased.

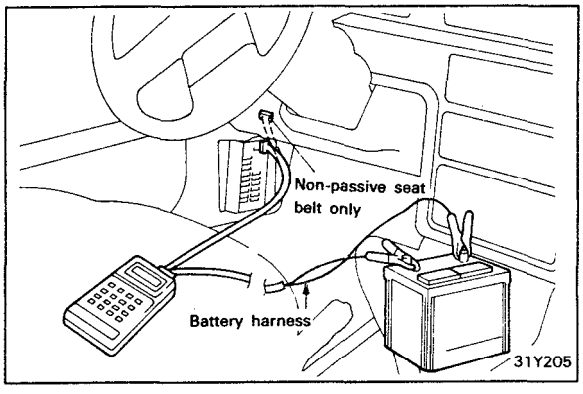
Inspection Procedure (Using the Multi-Use Tester)

1. Turn the ignition switch OFF.
2. Connect the harness connector of the multi-use tester to the diagnostic connector in the fuse box.
3. Connect the power-source terminal of the multi-use tester to the cigarette lighter socket.
4. Turn the ignition switch ON.
5. Use the multi-use tester to check the self-diagnostic codes.
6. After completion of the repair, turn the ignition switch OFF; then disconnect the battery negative terminal for 15 seconds. Then, check that no malfunction codes are displayed with the multi-use tester.
7. Disconnect the multi-use tester.

NOTE

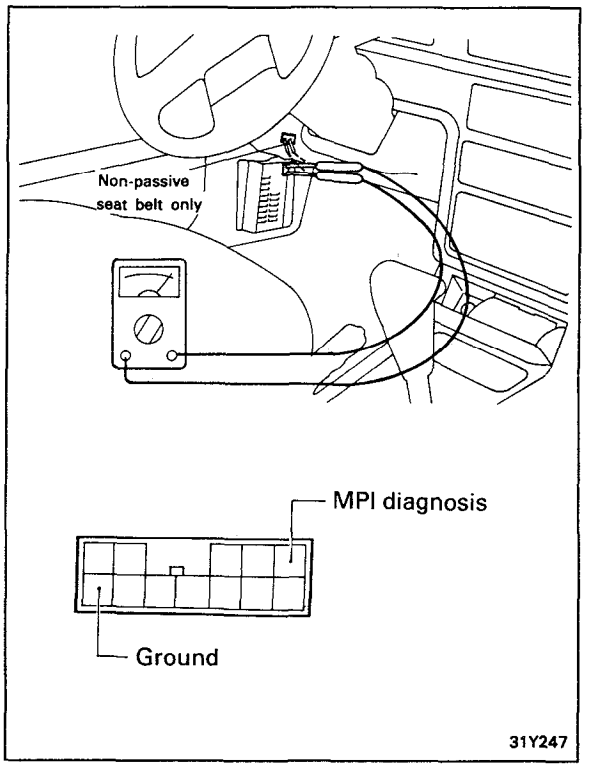
If a test is to be made during cranking, the power to the cigarette lighter will be interrupted. Therefore, use the separate battery harness for the multi-use tester.



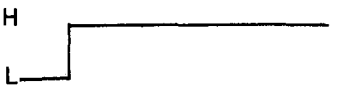


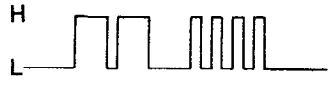
Inspection Procedure (Using Voltmeter)

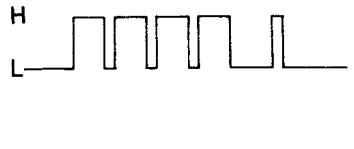
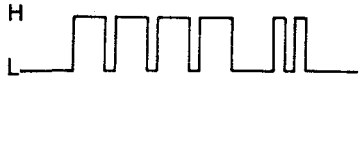
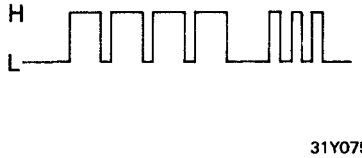
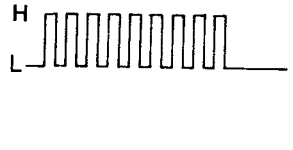
1. **Connect the voltmeter to the self diagnosis connector.**
2. **Turn the ignition switch, and indication of electronic control unit memory contents will immediately start. If the system is in normal condition, pointer of voltmeter indicates normal pattern. If any abnormality is in memory, the pointer of voltmeter will deflect, indicating abnormal item as described in "Diagnosis chart".**
   After recording the abnormal item, check and repair each part according to the check items in "Diagnosis Chart"
3. **When the defective parts have been repaired, disconnect the negative terminal of battery cable for 15 seconds or more and connect it again to make sure that the abnormal code has been erased.**



Diagnosis Chart

Output preference order	Diagnosis item	Malfunction code			Check item (Remedy)
		Output signal pattern	No.	Memory	
1	Electronic control unit	 31Y062	—	—	(Replace electronic control unit)
2	Oxygen sensor	 31Y063	11	Retained	o Harness and connector o Fuel pressure o Injectors (Replace if defective.) o Intake air leaks o Oxygen sensor
3	Air flow sensor	 31Y064	12	Retained	o Harness and connector (If harness and connector are normal, replace air flow sensor assembly.)

Output preference order	Diagnosis item	Malfunction code			Check item (Remedy)
		Output signal pattern	No.	Memory	
4	Intake air temperature sensor	 31Y065	13	Retained	o Harness and connector o Intake air temperature sensor
5	Throttle position sensor	 31Y066	14	Retained	o Harness and connector o Throttle position sensor o Idle position switch
6	Coolant temperature sensor	 31Y068	21	Retained	o Harness and connector o Coolant temperature sensor
7	Crank angle sensor	 31Y069	22	Retained	o Harness and connector (If harness and connector are normal, replace distributor assembly.)
8	No.1 cylinder top dead center sensor	 31Y070	23	Retained	o Harness and connector (If harness and connector are normal, replace distributor assembly.)
9	Vehicle-speed sensor (reed switch)	 31Y071	24	Retained	o Harness and connector o Vehicle-speed sensor (reed switch)
10	Barometric pressure sensor	 31Y072	25	Retained	o Harness and connector (If harness and connector are normal, replace barometric pressure sensor assembly.)

Output preference order	Diagnosis item	Malfunction code			Check item (Remedy)
		Output signal pattern	No.	Memory	
11	Injector	 31Y073	41	Retained	o Harness and connector o Injector coil resistance
12	Fuel pump	 31Y074	42	Retained	o Harness and connector o Control relay
13	EGR*	 31Y075	43	Retained	o Harness and connector o EGR temperature sensor o EGR valve o EGR control solenoid valve o EGR valve control vacuum
14	Normal state	 31Y076	—	—	—

NOTE

1. Replace the ECU only when all other possible causes for a malfunction have been explored.

2. The diagnostic item marked * is applicable to the vehicles for California only.

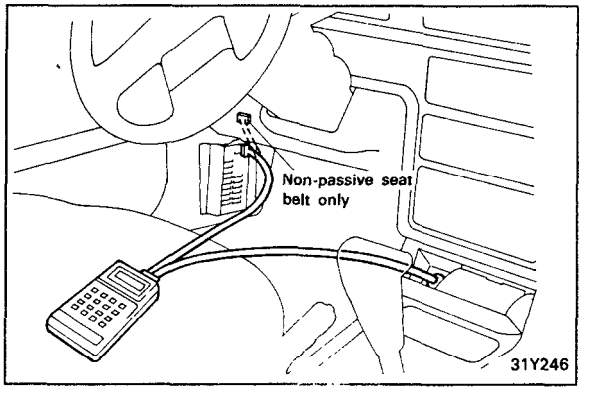
CHECKING (USING THE MULTI-USE TESTER)

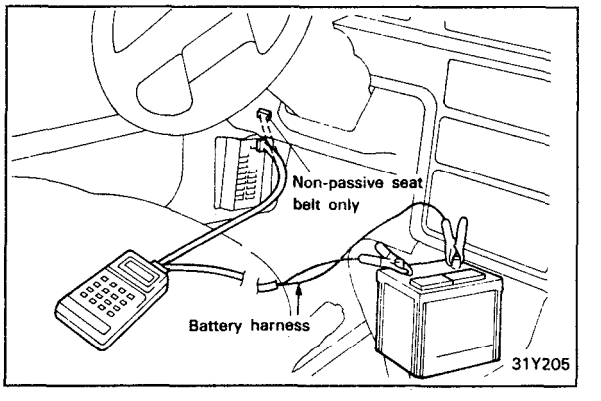
1. Turn the ignition switch OFF.
2. Connect the harness connector of the multi-use tester to the diagnostic connector in the fuse box.
3. Connect the power-source terminal of the multi-use tester to the cigarette lighter socket.
4. Turn the ignition switch ON.
5. Use the multi-use tester to make the system and sensor checks.

   NOTE
   If the malfunction indicator light (engine-check light) illuminates while the checks are being made, check the self-diagnostic output.

6. After the repair, check again to be sure the problem has been corrected.
7. Turn the ignition switch OFF.
8. Disconnect the multi-use tester.
9. Disconnect the battery negative terminal for 15 seconds or longer. This erases the self-diagnostic code.
10. Restart the engine. Check (by a driving test and other means) that the problem has been corrected.

    NOTE
    If a test is to be made during cranking, the power to the cigarette lighter will be interrupted, therefore, use the separate battery harness for the multi-use tester.





Cranking Check

Item No.: Multi-use tester code number

Check points	Check conditions	Test specification	Probable cause of malfunction
Battery voltage o Service data o Item No.16	o Ignition switch: ON	11-13 V	o Low battery voltage o Power not supplied to the electronic control unit 1) Check the power-supply circuit. 2) Check the ignition switch. 3) Check the control relay. o Malfunction of the electronic control unit ground circuit

Check points	Check conditions		Test specification	Probable cause of malfunction
Malfunction code read out o Self diagnostic	o Crank for four seconds or longer. o Ignition switch: "ON" (Check for damage or disconnection of the injector or crank angle sensor circuit.)		Normal	o Check in accordance with the diagnostic code. (Note that the diagnostic code will be erased if there is disconnection or damage of the electronic control unit back-up power-supply circuit.) o If various diagnostic codes are output, the most frequent cause is damage or disconnection of the power-supply or ground circuit.
Fuel pump o Actuator test o Item No.7	Try under both conditions: o Engine cranking o Forced fuel pump activation	Pinch the return hose.	The pulsations of the fuel flow can be felt.	o Voltage is not supplied to the fuel pump. 1) Check the ignition switch (IG and ST) 2) Check the control relay. 3) Check the related circuits. o Malfunction of the fuel pump.
		Listen at the fuel tank.	The pump can be heard.	
Crank angle sensor o Service data o Item No.22	o Engine cranking o Tachometer connected (check, by using the tachometer for interruptions of the ignition coil primary current.)	Cranking speed (rpm)	Engine speed (rpm)	o If the tachometer reading is 0, there is no interruption of the ignition coil primary current. 1) Check the power transistor and the control circuit. 2) Check the ignition coil and the coil power supply circuit. o If the multi-use tester's indicated rpm is abnormal 1) Malfunction of the crank angle sensor circuit. 2) Malfunction of the crank angle sensor. 3) Damage to the timing belt.
		Approx. 200	Approx. 200	
Crank signal o Service data o Item No.18	Ignition switch: ON	Engine stop	OFF	o Ignition switch-ST signal circuit check o Ignition switch check
		Cranking	ON	

Check points	Check conditions		Test specification	Probable cause of malfunction
Injectors o Service data o Item No.41	o Engine cranking	Listen for operation	Injectors should be heard	o Injector malfunction. o Improper contact of the connector and control relay contacts.
		Engine coolant temperature 1°C (°F)]	Injector activation time *2 (msec.)	o Malfunction of the engine coolant temperature sensor. o Malfunction of the ignition switch-ST.
		0 (32)*1	Approx. 14	
		20 (68)	Approx. 40	
		80 (176)	Approx. 9	

NOTE
*1: When the engine coolant temperature is O°C (32°F). injectors inject simultaneously at all cylinders.
*2: Injector activation times are at a battery voltage of 11V and a cranking speed of 250 rpm or lower.

Sensor Check

Check points	Check conditions		Test specification	Probable cause of malfunction
Self-diagnostic output	o Engine: idling (2 minutes or more after engine start)		Normal	o Check in accordance with the diagnostic code. (Note that the diagnostic code will be erased if there is disconnection or damage of the engine control unit back-up power-supply circuit.) o If numerous diagnostic codes are output, the most frequent cause is damage or disconnection of the power-supply or earth circuit.
Oxygen sensor o Service data o Item No.11	o Engine warm (Make the mixture lean by engine speed reduction, and rich by racing.)	Engine condition	Voltage (mV)	o If the oxygen sensor output voltage is high during sudden deceleration 1) Check for injector leakage. 2) Check the oxygen sensor signal circuit. o If the oxygen sensor output voltage is low during high engine speed 1) Check the oxygen sensor and signal circuit.
		When sudden deceleration from 4,000 rpm	200 or lower	
		When engine is suddenly rewed	600-1,000	
	o Engine warm (Using the oxygen sensor signal, check the air/fuel mixture ratio, and also check the condition of the electronic control unit.)	Engine speed (rpm)	Voltage (mV)	o If the oxygen sensor signal is normal, the electronic control unit is regulating the air/fuel mixture ratio normally. o If the oxygen sensor output voltage is low at all times, check for intake air restriction. o If the oxygen sensor output voltage is high at all times, check for leakage of the injector.
		700 (idle)	400 or lower ↕ (changes) 600-1,000	
		2,000		
Air-flow sensor o Service data o Item No.12	o Engine warm	Engine condition	Frequency (Hz)	o If the air-flow sensor output suddenly changes greatly, improper contact of the air-flow sensor or connector is probable. o If the output frequency of the air-flow sensor is unusually high or low, check the air cleaner element. o If the output frequency of the air-flow sensor is high, an increase of engine resistance or leakage of compression pressure is probable.
		700 rpm (Idle)	30-45	
		2,000 rpm	85-105	
		Revving	Increases	

Check points	Check conditions		Test specification	Probable cause of malfunction
Intake-air temperature sensor o Service data o Item No.13	o Ignition switch: ON, or engine running	Intake-air temperature °C (°F)	Temperature °C (°F)	o Malfunction of the intake-air temperature or related circuit
		-20 (-4)	-20 (-4)	
		0 (32)	0 (32)	
		20 (68)	20 (68)	
		40 (104)	40 (104)	
		80 (176)	80 (176)	
	o Ignition switch: ON	Warm by using a hair dryer or other method.	Increases	
Throttle-position sensor o Service data o Item No.14	o Hold for 15 seconds or longer with the ignition switch "ON".	Throttle valve	Voltage (mV)	o Throttle position sensor misadjusted o Throttle position sensor or related circuit malfunction
		Idling position	480-520	
		Opens slowly.	Becomes higher in proportion to valve opening	
		Fully open	4,500-5,500	
Battery voltage o Service data o Item No.16	o Ignition switch: ON		11-13v	o Measure the battery voltage o Check the circuit that supplies the ECU power.
Crank signal o Service data o Item No.18	o Ignition switch: ON		OFF	o Ignition switch-ST signal circuit check o Ignition switch check
Coolant temperature sensor o Service data o Item No.21	o Ignition switch: ON	Engine coolant temperature °C (°F)	Temperature °C (°F)	o Coolant temperature sensor or related circuit malfunction
		-20 (-4)	-20 (-4)	
		0 (32)	0 (32)	
		20 (68)	20 (68)	
		40 (104)	40 (104)	
		80 (176)	80 (176)	

Check points	Check conditions		Test specification	Probable cause of malfunction
Crank angle sensor o Service data o Item No.22	o Engine: idling (Check with the ignition switch ON.)	Engine coolant temperature °C (°F)	Idling rpm	o If the idle speed suddenly increases, a malfunction of the crank angle sensor or improper contact of the connector is probable.
		-20 (-4)	1,500-1,700	
		0 (32)	1,350-1,550	
		20 (68)	1,150-1,350	
		40 (104)	950-1,150	
		80 (176)	600-800	
Barometric pressure sensor o Service data o Item No.25	o Ignition switch: ON	Altitude m (ft.)	Pressure mm Hg	o Barometric pressure sensor or related circuit malfunction. (If the barometric pressure sensor pressure is low at high speed, clogging of the air cleaner element is probable.)
		0 (0)	760	
		600 (1,968)	710	
		1,200 (3,937)	660	
		1,800 (5,905)	610	
	o Engine: 2,000 rpm	Gradually close the air-intake duct by using a hand.	Decreases.	
Idle position switch o Service data o Item No.26	o Ignition switch: ON (Check by pressing the accelerator pedal several times)	Throttle valve idling position	ON	o Idle position switch or related circuit malfunction o Improper adjustment of the accelerator cable or the auto-cruise cable. o Misadjusted fixed SAS.
		Open the throttle valve slightly.	OFF	
Power steering oil-pressure switch o Service data o Item No.27	o Engine: idling	Steering wheel neutral position (wheels in a straight-ahead direction)	OFF	o Power steering oil-pressure switch or signal circuit malfunction
		Steering wheel half turn	ON	

Check points	Check conditions		Test specification	Probable cause of malfunction
Air-conditioner switch o Service data o Item No.28	o Engine: idling (The air conditioner compressor will be activated when the air-conditioner switch is ON.)	Air-conditioner switch "OFF"	OFF	o Check the air conditioner system.
		Air-conditioner switch "ON"	ON	
Inhibitor switch o Service data o Item No.29	o Ignition switch: ON	Shift lever: "P" or "N"	"P", "N"	o Malfunction of the inhibitor switch or the signal circuit. o improper adjustment of the control cable between the shift lever and the inhibitor switch.
		Shift lever: "D", "2", "L" or "R"	"D", "2", "L", "R"	
EGR temperature sensor (California Only) o Service data o Item No.43	o Engine: warm	Engine condition	Temperature °C (°F)	o Check the EGR temperature sensor. o Check the EGR control system. o Check the EGR valve. o Check the EGR control solenoid valve. o Check the EGR control vacuum.
		700 rpm (idling)	100 (212) or less	
		o 3,500 rpm o Disconnect the vacuum hose (yellow stripe) from the A port nipple of the throttle body, and pinch the hose.	150 (302) or more	
Injectors o Actuator test o Item No. 1-6	o Engine: idling after warm-up (Cut off the injectors in sequence during idle after engine warm-up; check the idle condition.)	Injector No.	Engine	o If the idling condition doesn't change, check the cylinder. 1) Check the injector operation sound. 2) Check the spark plug and high-tension cable. 3) Check the power transistor unit and control circuit.
		1	Unstable idle	
		2		
		3		
		4		
		5		
		6		

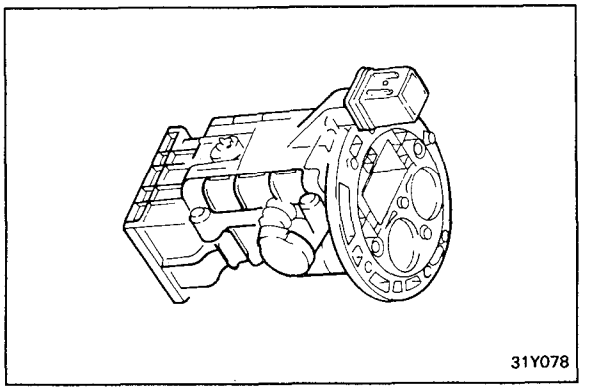
Check points	Check conditions		Test specification	Probable cause of malfunction
Injector o Service data o Item No.41	o Engine: warmed up	Engine condition	Activation time (msec.)	o If the injector activation time is unusually long or short, there is a malfunction of the air-flow sensor, engine coolant temperature sensor, intake-air temperature sensor, or barometric pressure sensor. o If the injector activation time is long, increased engine resistance or leakage of compression pressure is probable.
		700 rpm (Idling)	2.7-3.2	
		2,000 rpm	2.4-2.9	
		Rapid racing	Increases.	
gnition advance (power transistor) o Service data o Item No.44	o Engine: warmed up o Timing light: set (The timing light is set so as to check the actual ignition timing.)	Engine speed (rpm)	Ignition advance (°BTDC)	o If the ignition advance and actual ignition timing are different, adjust the ignition timing. [The ignition timing may fluctuate during idling, but this is not a problem. The advance is greater (approx. 5°) at high altitude.]
		700 (Idling)	5-15	
		2,000	30-40	
Stepper motor o Service data o Item No.45	Engine: After warming up, idle the engine. NOTE The compressor clutch operates when the air conditioner switch is turned on.	Engine condition	Step	o If the number of steps increases to 100 or 120 or decreases to 0, a malfunction of the stepper motor or the activation circuit is probable. o If the number of steps is small, check whether or not air is being sucked in. o If the number of steps is large, either of the following is probable: 1) Deposits adhered to the throttle valve part. 2) Increased engine resistance o If the number of steps is abnormal even though the engine is normal, adjust the basic idle speed.
		700 rpm (Idling)	2-12	
		Air conditioner switch ON (900 rpm)	30-70	o Check the air conditioner system. o If the engine speed does not increases when the air conditioner switch is switched from OFF to ON, check the stepper motor or ther activation circuit.
		Air conditioner switch ON Shift lever “D” (700 rpm)	20-60	o Malfunction of the inhibitor switch and signal circuit. o Incorrect adjustment of the control cable between the shift lever and inhibitor switch.

Check points	Check conditions		Test specification	Probable cause of malfunction
Air conditioner relay o Service data o Item No.49	o Engine: idling after warm-up	Air conditioner switch	Air conditioner relay	o If the air conditioner relay output is abnormal, check the air conditioner signal input circuit and the air conditioner system. o If the activation of the air conditioner compressor clutch is not normal, check the compressor clutch and the relay circuit.
		OFF	OFF (compressor clutch not-activated)	
		ON	ON (compressor clutch actived)	
Purge control solenoid valve (Except UK, Holland) o Actuator test o Item No.8	o Ignition switch: ON (Engine stop)	Solenoid is turned ON	Operation is audible	o Check the purge control solenoid valve. o Check the purge control solenoid valve drive circuit.
EGR control solenoid valve (California Only) o Actuator test o Item No.10	o Ignition switch: ON (Engine stop)	Solenoid is turned ON	Operation is audible	o Check the EGR control solenoid valve. o Check the EGR control solenoid valve drive circuit.

MPI SYSTEM COMPONENTS INSPECTION

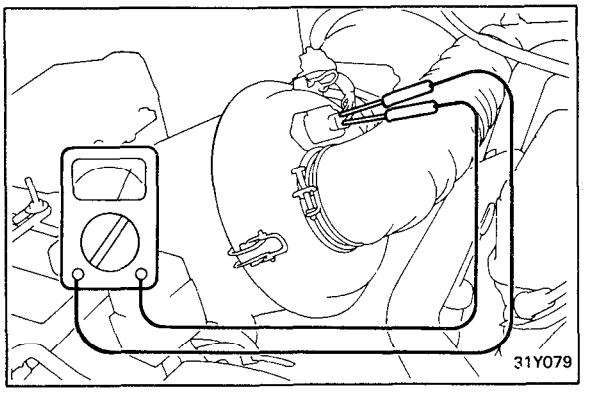
Air Flow Sensor (AFS)

The AFS measures the intake air volume. It makes use of a Karman vortex to detect air flow rate and sends it to the ECU as the intake air volume signal.
The ECU uses this intake air volume signal to decide the basic fuel injection duration.

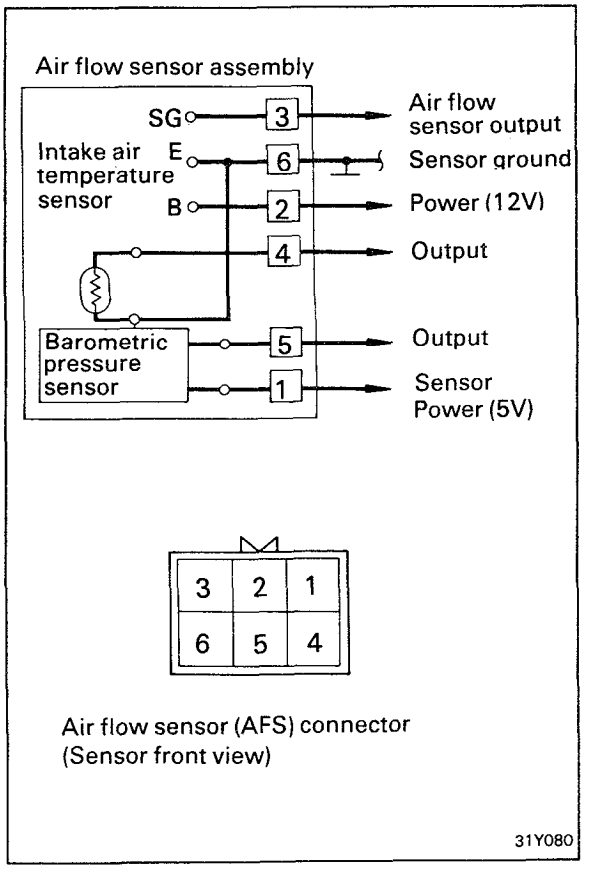


1. **Connect a voltmeter between terminals 6 and 3 of the AFS connector.**
   Terminal 6 : Sensor ground
   Terminal 3 : AFS output
2. **Warm the engine and bring it to a normal idle.**
3. **Measure the voltage between the terminals.**

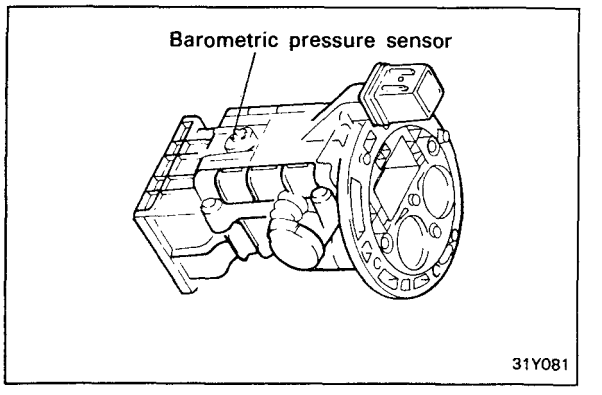
Engine speed (rpm)	Output voltage (V)
Idling	2.7—3.2
3,000	



NOTE
If the air flow sensor fails, the intake air volume cannot be measured and as a result, normal fuel injection control is no longer available. The vehicle will continue to run in a pre-programed back-up mode.

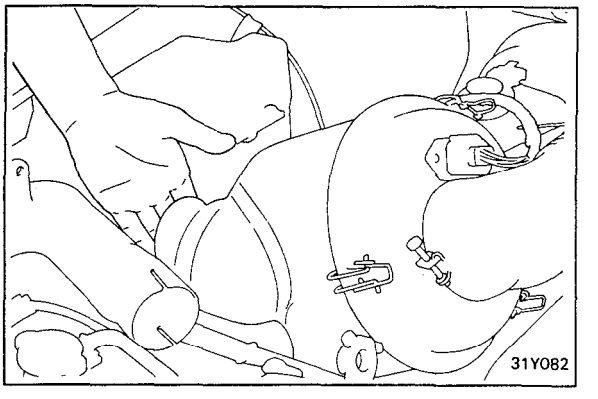


Barometric Pressure Sensor



The barometric pressure sensor installed on the AFS senses the barometric pressure and converts it into a voltage which is sent to the ECU.
The ECU uses this signal to compute the altitude at which the vehicle is running and corrects the air-fuel ratio and the ignition timing, thus improving driveability at high altitude.

1. **Connect a voltmeter between the terminals 5 and 6 of the barometric pressure sensor connector.**
   Terminal 5 : Barometric sensor output
   Terminal 6 : Sensor ground

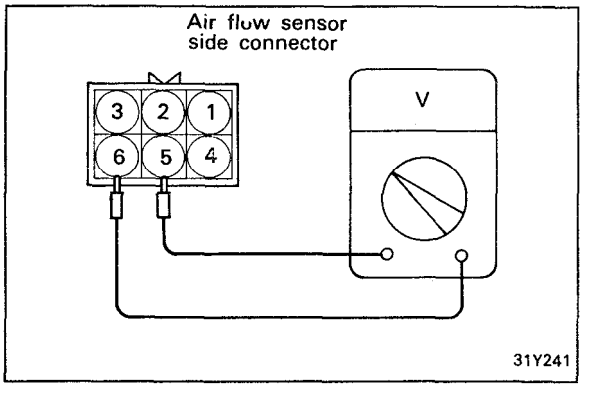


2. **Warm the engine and bring it to a normal idle.**
3. **Slowly cover about half of the air cleaner air intake, checking for a change in voltage.**

Pressure	Voltage
Fall	Drop

Reference

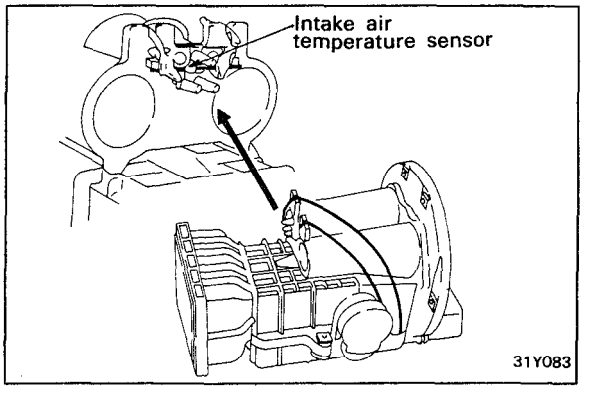
Pressure mmHg (kPa, psi)	150 (20, 2.9)	350 (49, 6.9)	760 (103, 15)
Central voltage (V)	0.79	1.84	4.00



4. **Replace the air flow sensor if necessary.**

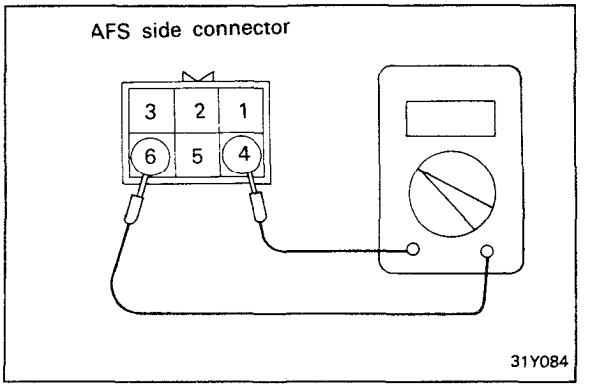
Intake Air Temperature Sensor

The intake air temperature sensor, shown in the illustration, is a resistor-based sensor which senses the intake air temperature. The ECU corrects the air/fuel ratio to compensate for changes in the air temperature.



1. Disconnect the air flow sensor connectors.
2. Measure the resistance between the terminals 4 and 6.
   Terminal 4 : Intake air temperature output
   Terminal 6 : Sensor ground

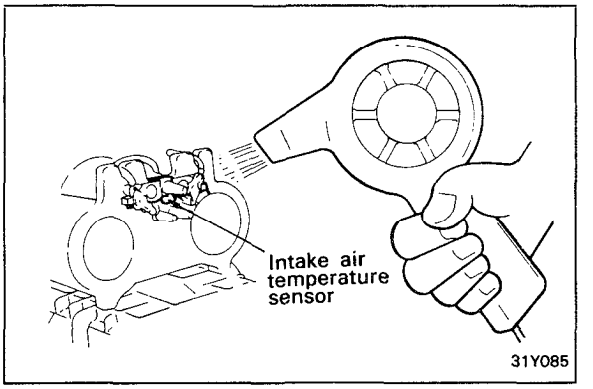
Temperature °C (°F)	Resistance (kΩ)
0 (32)	5.4—6.6
20 (68)	2.33—2.97
80 (176)	0.31—0.43



3. Measure the resistance while heating the sensor using a hair drier.

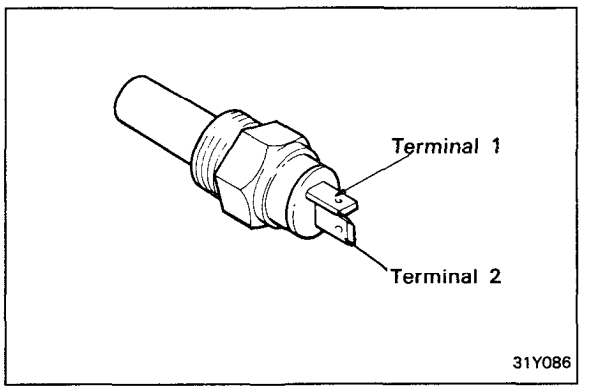
Temperature °C (°F)	Resistance (kΩ)
Higher	Smaller

4. If the value deviates above or below the specifications or the resistance remains unchanged, replace the air flow sensor assembly.

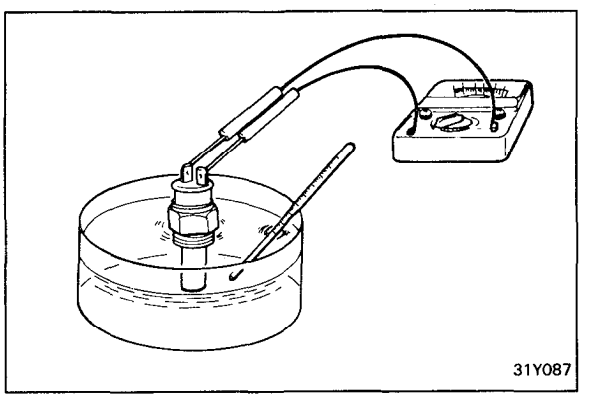


Coolant Temperature Sensor

The coolant temperature sensor installed in the engine coolant passage of the intake manifold is a resistor-based sensor. The ECU determines engine temperature by the sensor output voltage and provides fuel enrichment when the engine is cold.

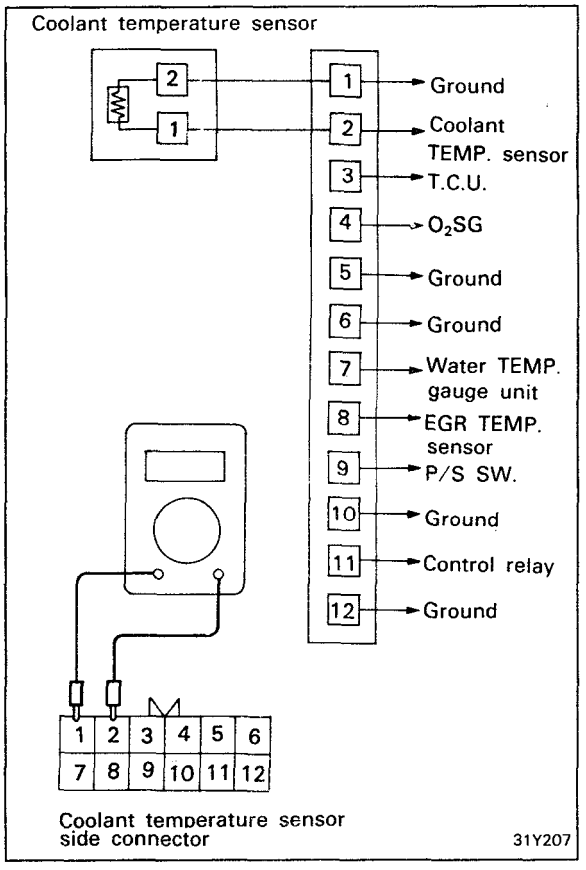


1. Remove the coolant temperature sensor from the intake manifold.
2. With the sensing portion of coolant temperature sensor immersed in hot water, check the resistance.



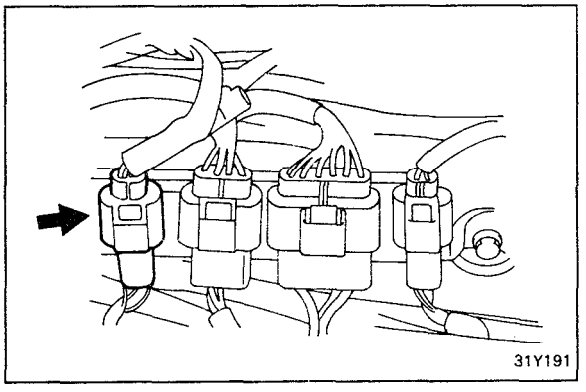
Temperature °C (°F)	Resistance (kΩ)
0 (32)	5.9
20 (68)	2.5
40 (104)	1.1
80 (176)	0.3

3. If the resistance deviates from specifications greatly, replace the sensor.



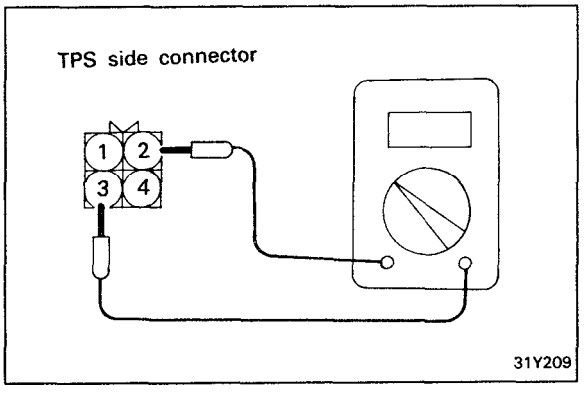
Throttle Position Sensor (TPS)

The TPS is a rotating type variable resistor that is driven by the throttle shaft and senses the throttle valve angle. As the throttle shaft rotates, the output voltage of the TPS changes. The ECU determines the throttle valve opening based on the TPS voltage. Based on this output voltage, the ECU corrects fuel injection amount during acceleration.



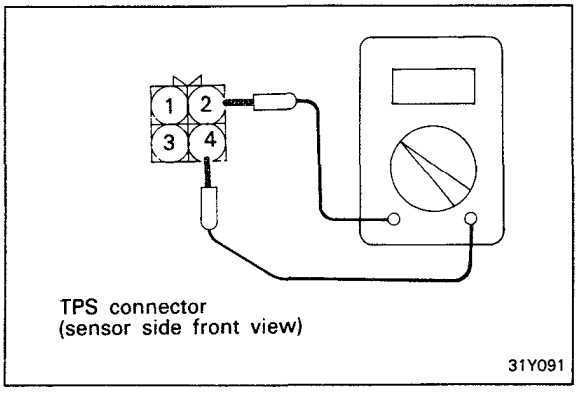
1. Disconnect the throttle position sensor connector.
2. Measure the resistance between terminals 2 and 3 of the throttle position sensor connector.
   Terminal 2 : Sensor ground
   Terminal 3 : Sensor power

Standard value ..... 3.5-6.5 kΩ



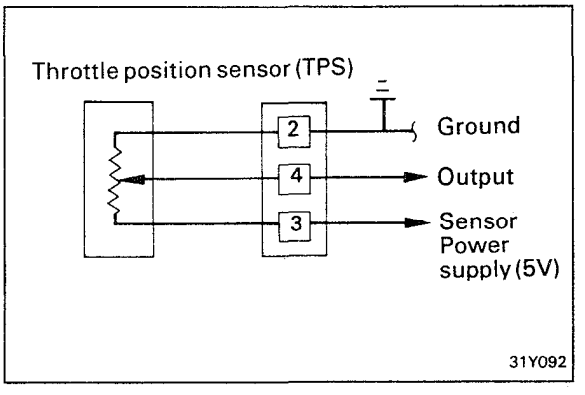
3. Connect an analog type ohmmeter between terminals 2 and 4.
   Terminal 2 : Sensor ground
   Terminal 4 : Throttle position sensor
4. Slowly open the throttle valve from the idle position to the fully open position and check that the resistance values change smoothly with the opening of the throttle valve.

Standard value . . . . . .
Approx 0.5 - (3.5-6.5) kΩ



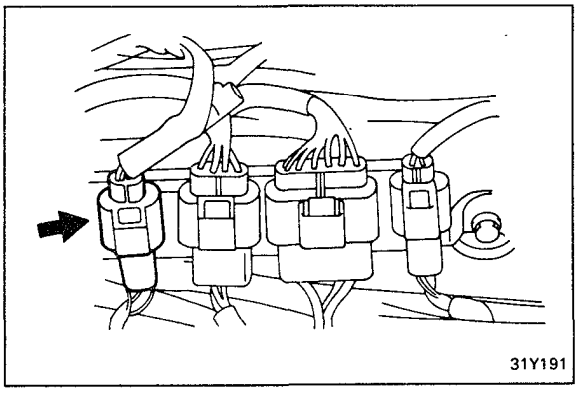
5. If a resistance is out of specification, or if the change is not smooth, replace the throttle position sensor.

Tightening torque
Throttle position sensor.. . . . . .
2.5-4.4 Nm (25-45 kg.cm, 1.8-3.2 lb.ft)



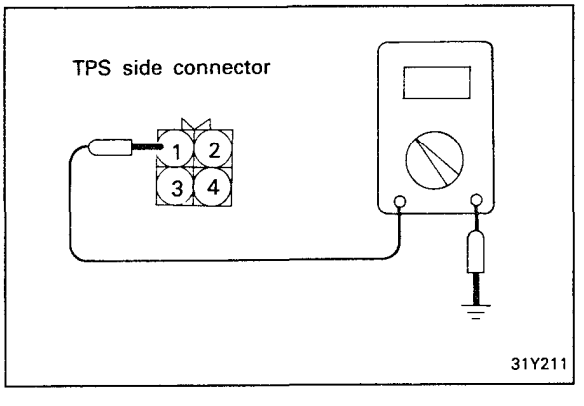
Idle Switch

1. Disconnect the TPS (Throttle position sensor) connector.



2. Check for continuity between terminal 1 and body ground.
   Terminal 1 : Idle Switch

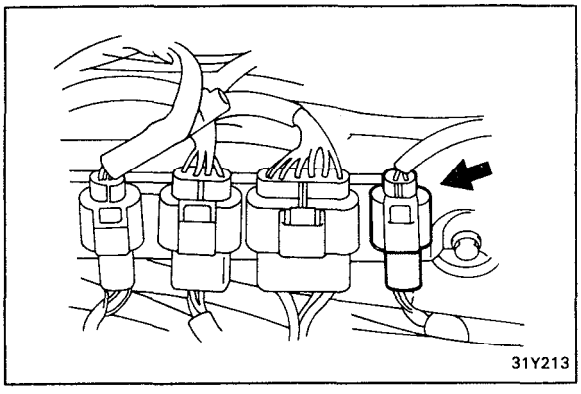
Accelerator pedal	Continuity
Depressed	Non-conductive (∞Ω)
Released	Conductive (0Ω)



No.1 Cylinder TDC Sensor And Crankshaft Angle Sensor

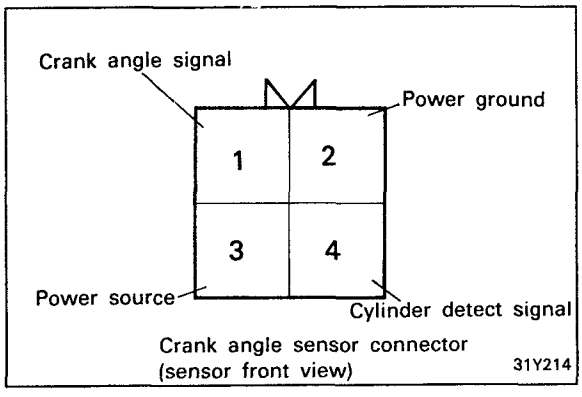
The No.1 cylinder TDC sensor and the crankshaft angle sensor are composed of a disc and unit assembly.
The disc is a metal disc which has six light-transmission slits located 60° apart around its circumference.
Use a multi-use tester for inspection. Refer to P31-37.

1. **Connect a voltmeter between terminal 1 and 2, and 2 and 4.**

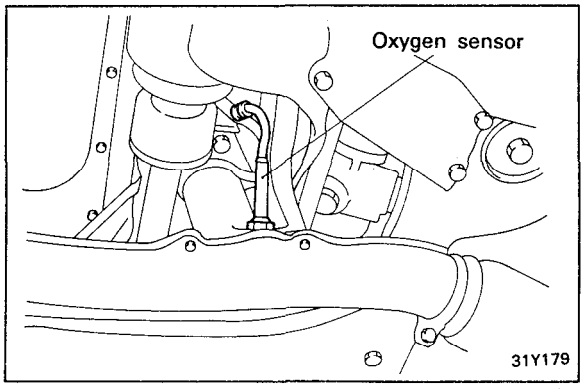


2. **Measure the output voltage of the terminals while cranking or idle.**

Sensor	Terminal	Voltage
No.1 cylinder TDC sensor	Ground	1.8—2.5V (The needle fluctuates)
Crankshaft angle sensor	Ground	2.0—2.5V



Oxygen Sensor



MOTE

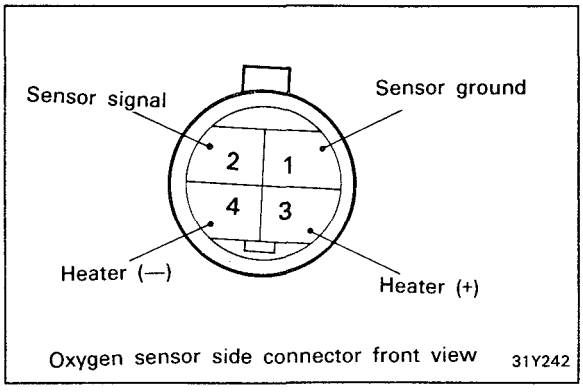
1) Before checking, warm up the engine until the engine coolant temperature reaches 80 to 95°C (176 to 203°F).
2) Use an accurate digital voltmeter.

1. Disconnect the oxygen sensor connector, and measure the resistance between terminal 3 and terminal 4.

   Standard value

Temperature °C (°F)	Resistance (Ω)
400 (752)	30 or more

2. Replace the oxygen sensor if there is a malfunction.



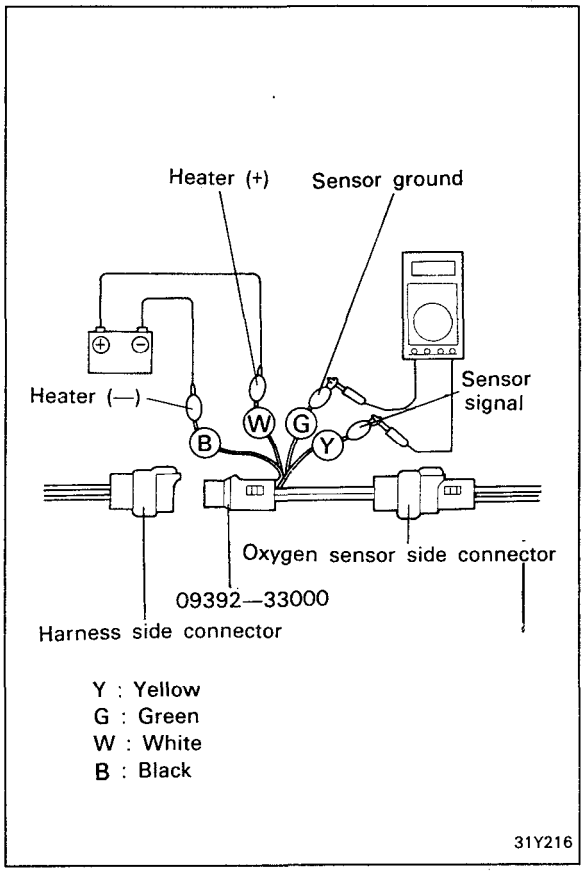
3. Using the special tool (09392-33000), apply battery voltage directly between terminal 3 and terminal 4.

   CAUTION
   Take care when applying the voltage, because damage will result if the terminals are incorrect or are short-circuited.

4. Connect a digital-type voltmeter between terminal 1 and terminal 2.
5. While repeatedly racing the engine, measure the oxygen sensor output voltage.

Engine	Oxygen sensor output voltage	Remarks
Race	Min. 0.6V	Makes the air/fuel mixture rich by increased engine speed

6. If there is a problem, it is probable that there is a malfunction of the oxygen sensor.



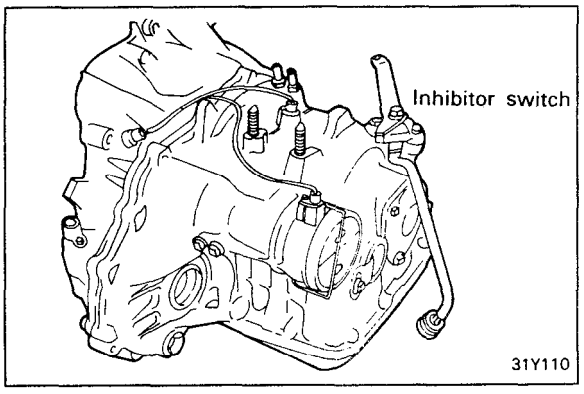
Tightening torque
Oxygen sensor . . . . . 39-49 Nm (400-500 kg.cm, 29-36 lb.ft)

Vehicle Speed Sensor

The vehicle speed sensor uses a reed switch. The speed sensor is built into the speedometer and converts the transaxle gear revolutions into pulse signals, which are sent to the ECU.

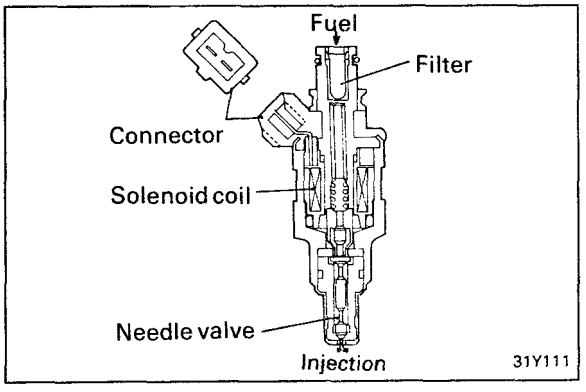
Inhibitor Switch

This switch detects whether the gear selector lever is positioned in N or P. Based on this signal, the ECU determines the automatic transaxle load and drives the ISC servo to maintain optimum idle speed.



Injectors

The injector, is a solenoid valve, which injects fuel based on the injection signal from the ECU.
The injectors are installed in the intake manifold and are mounted on the delivery pipe.
When the solenoid coil is energized, fuel is injected through the valve.
Since the injection nozzle opening is a fixed size and the fuel pressure is also fixed, the injection amount is determined by the duration which the needle valve is open.



Operation Check

Using a multi-use tester, check as described below.

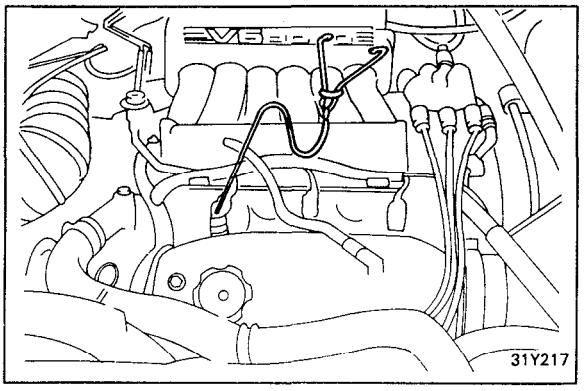
- Cut off the fuel injection of the injectors in sequence.
- Check the operation time of the injectors.

Injector Sound Check

1. Using a stethoscope, check the injectors for a clicking sound during idle. Check that the sound is produced at shorter intervals as the engine speed increases.

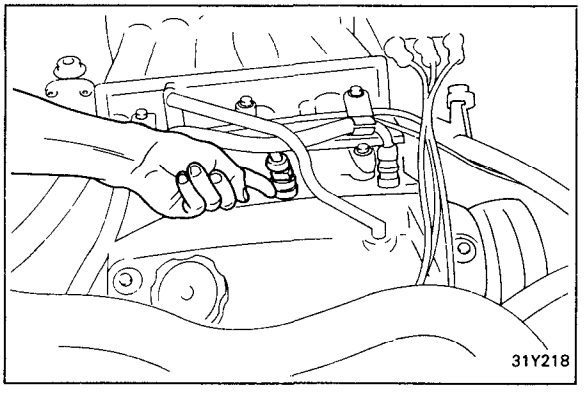
   NOTE

   1) Other injectors may produce sound as they operate even if the injector being checked does not operate.
   2) Ensure that the sound from an adjacent injector is not being transmitted along the delivery pipe to an inoperative injector.



2. If a stethoscope is not found, check the injector operation with your finger.

   If no vibrations are felt, check the wiring connector, injector, or injection signal from ECU.

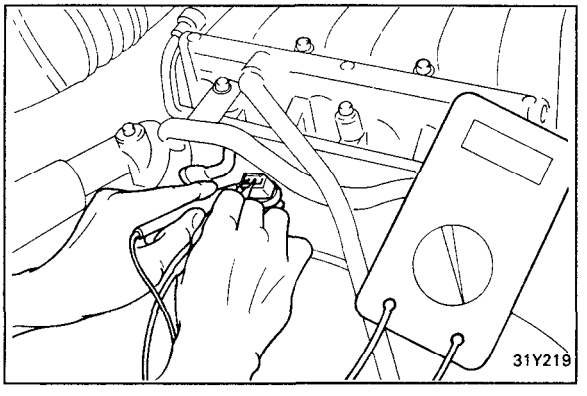


Resistance Measurement Between Terminals

1. Disconnect the connector at the injector.
2. Measure the resistance between terminals.

Standard value	13-16 Ω [at 20°C (68°F)]

3. Connect the connector to the injector.

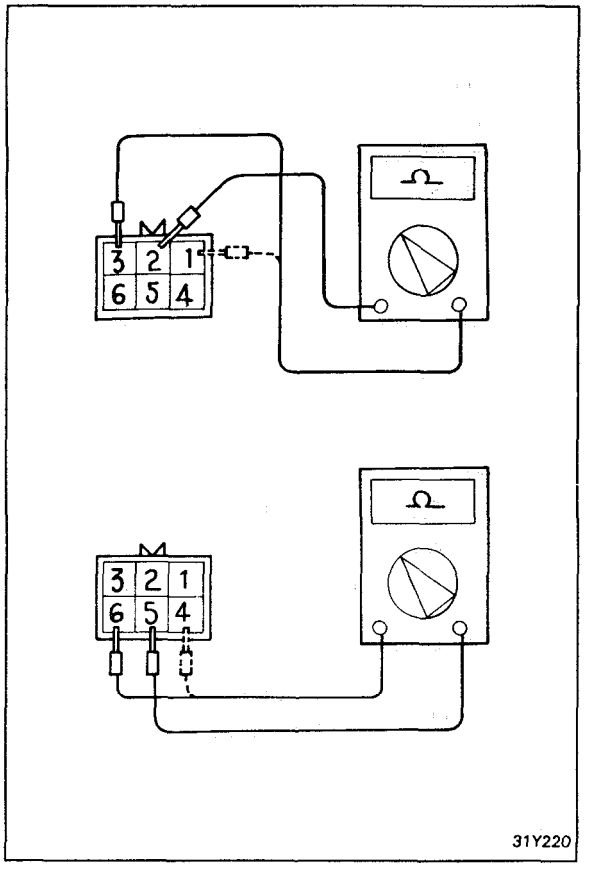


ISC (Idle Speed Control) Servo (Stepper

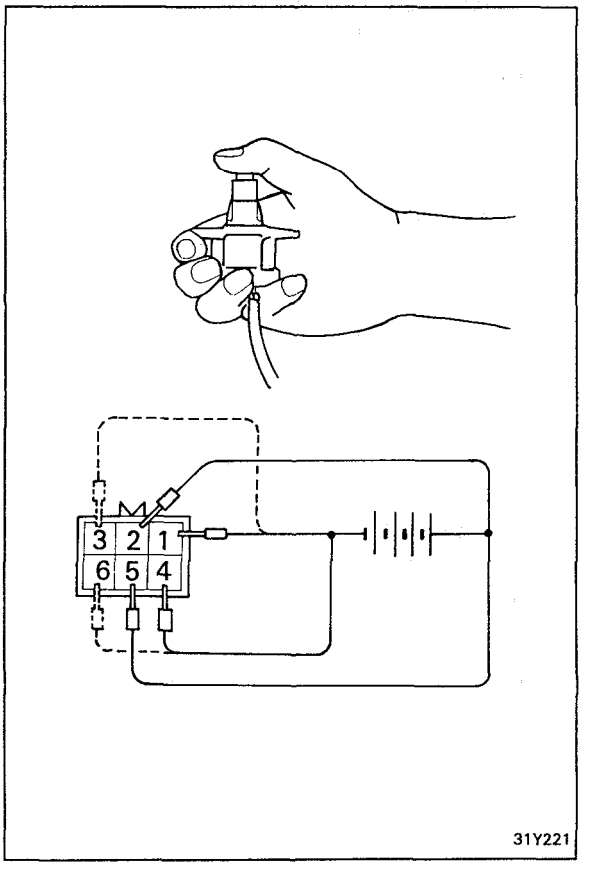
1. Measure the resistance between the respective terminals.

Standard value:

Terminals 2 - 3 and 1	28-33 Ω [at 20°C (68°F)]
Terminals 5 - 4 and 6	28-33 Ω [at 20°C (68°F)]



2. Apply voltage as follows and check whether *or* not stepper motor movement occurs.
   - o Connect the power supply (approx. 6V) terminal (+) to terminals 2 and 5 of the connector.
   - o Connect the power supply (-) terminal to terminals 1 and 4.
   - o Connect the power supply (-) terminal to terminals 3 and 4.
   - o Connect the power supply (-) terminal to terminals 3 and 6.
   - o Connect the power supply (-) terminal to terminals 1 and 6.
   - o Connect the power supply (-) terminal to terminals 1 and 4.
3. If movement occurs during inspection, the stepper motor is considered to be functioning properly.



Control Relay

CAUTION

When applying battery voltage directly, make sure that it is applied to the correct terminal. Otherwise, the relay could be damaged.

NOTE

Failure of the control relay interrupts power supply to the fuel pump, injectors and ECU, resulting in start failure.

7. **Check continuity the between terminals when the relay coil is energized and when it is not.**

   NOTE

   In the following tables, the arrows indicate the direction of current flow.

   Confirm circuit tester polarity before checking continuity.

   o Coils L_1 and L_2

Condition	Measuring terminals	Continuity
Not energized	3 — 4	Non-conductive (∞Ω)
	3 — 9	Conductive (approx. 95Ω)
	10 — 7	Conductive (approx. 35Ω)
Energized	3 — 4	Conductive (0Ω)

NOTE:

"Energized" means voltage applied across terminals 7 and 10.

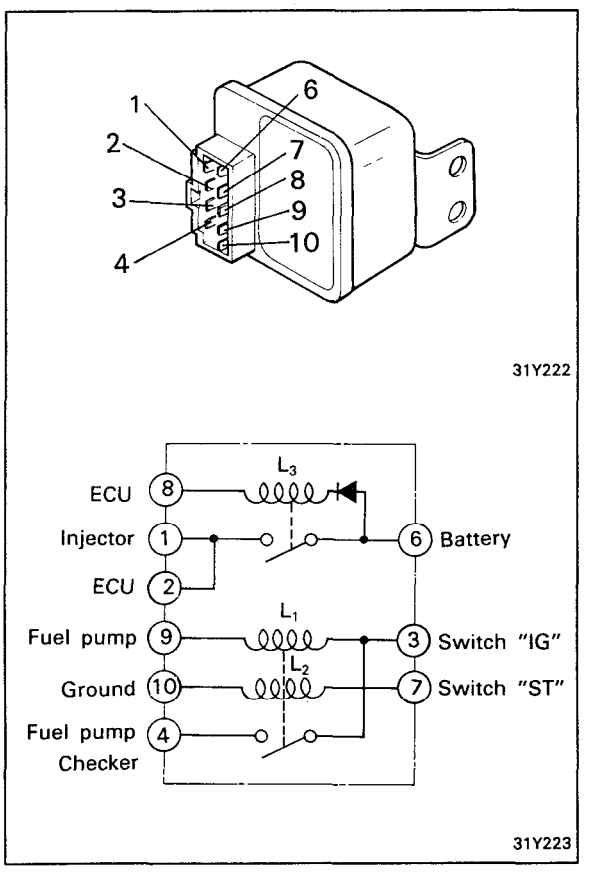
o Coil L_3

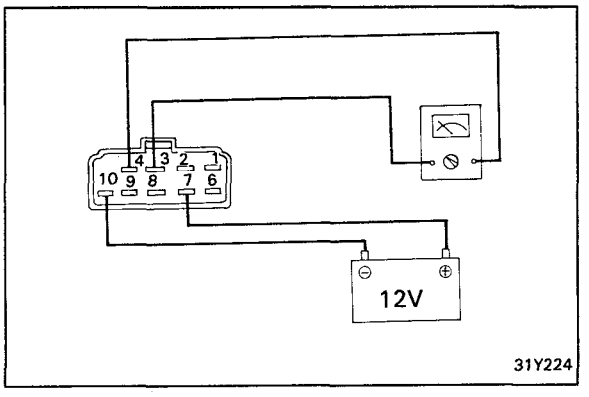
Condition	Measuring terminals	Continuity
Not energized	1 — 6	Non-conductive (∞Ω)
	8 → 6	Non-conductive (∞Ω)
	8 ← 6	Conductive (0Ω)
Energized	1—6	Conductive (0Ω)

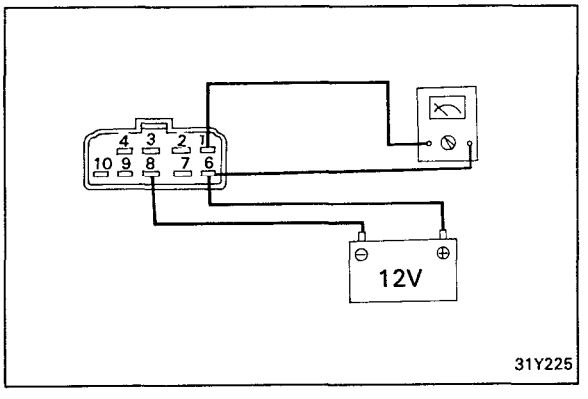
NOTE:

"Energized" means voltage applied across terminals 6 and 8.

2. If the result is not satisfactory, replace the control relay.

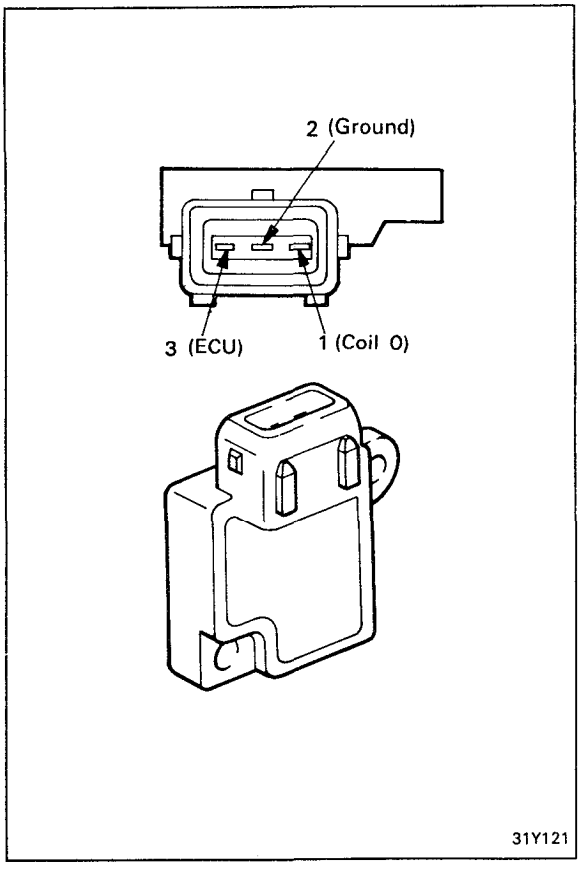






Power Transistor

The power transistor is installed beside the ignition coil; it controls the ignition timing by switching the ignition coil primary current ON and OFF by signals from the ECU.

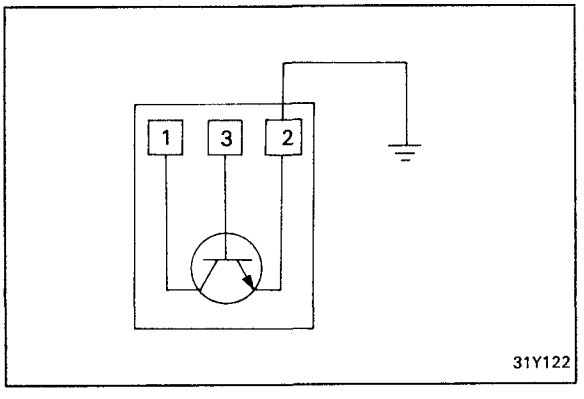


1. **Disconnect the power transistor connector.**
2. **Connect a power supply of 1.5V (one dry cell) between the power transistor and then check for continuity terminals 3 and 2 under power-ON and power-OFF conditions.**

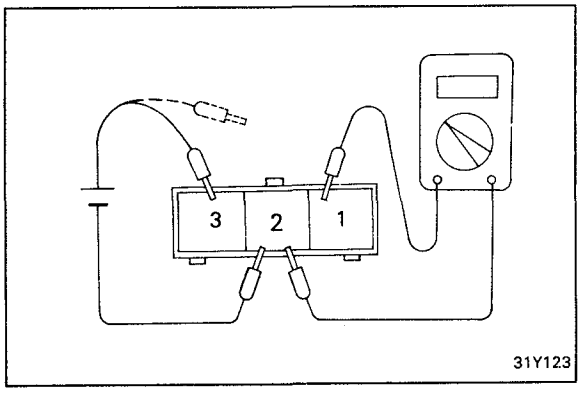
   NOTE

   1) When checking for continuity, connect the circuit-tester to terminal 2 on the positive side and terminal 1 on the negative side.

   2) Check with an analog-type circuit tester.

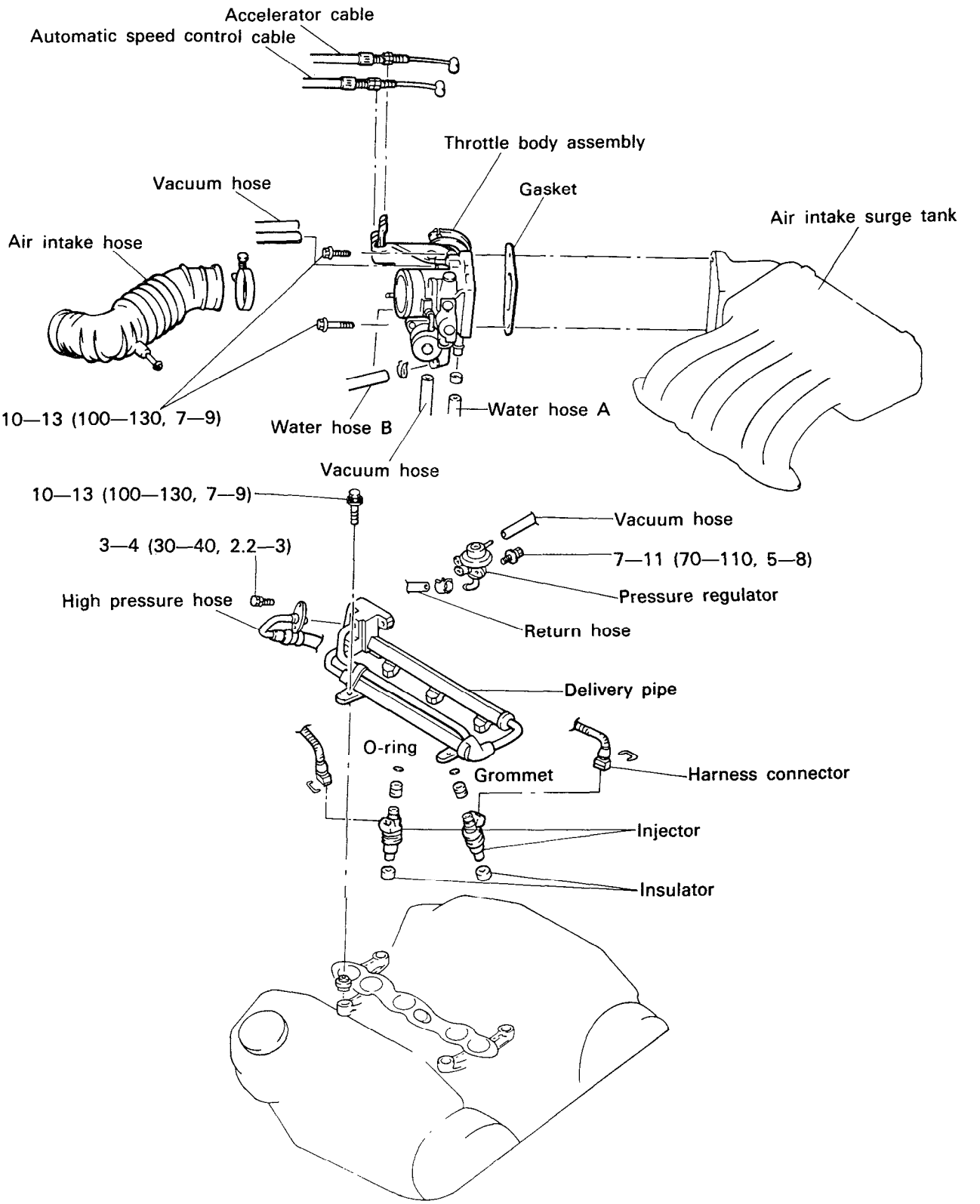


2-3 Terminal	1-2 Terminal
Power ON	Continuity
Power OFF	Non-continuity



INJECTOR AND THROTTLE BODY

COMPONENTS



TORQUE : Nm (kg.cm. lb.ft)

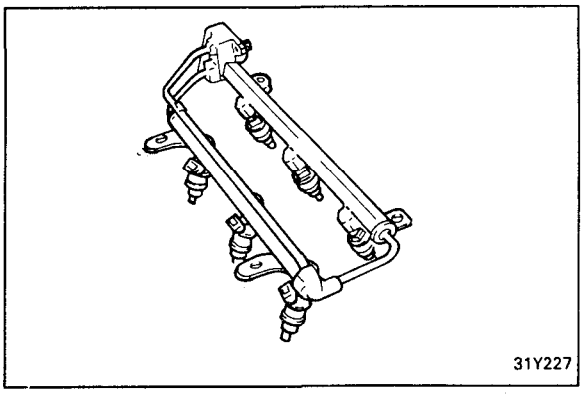
REMOVAL

1. Remove the air intake surge tank.
2. Release residual pressure from the fuel line to prevent fuel from spilling.

CAUTION
Cover the hose connection with rags to prevent fuel from leaking out due to residual pressure in the fuel line.

3. Remove the delivery pipe with the fuel injectors.

CAUTION
1. Be careful not to drop any injectors when removing the delivery pipe.
2. Be aware that fuel may flow out when removing the injector.

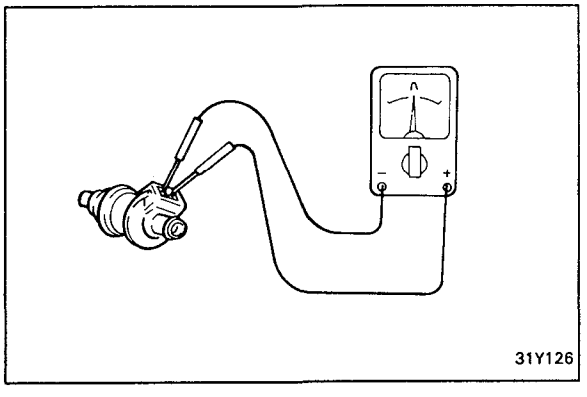


INSPECTION

1. Measure the resistance of the injectors, between the terminals, using an ohmmeter.

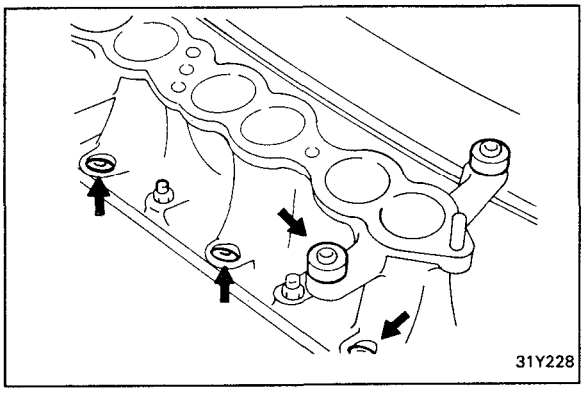
Resistance	13—16Ω [at 20°C (68°F)]

2. If the resistance is not within specifications, replace the injector.



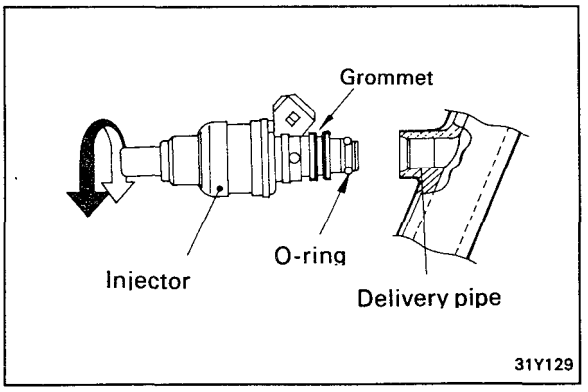
INSTALLATION

1. Install a new insulator to the intake manifold.

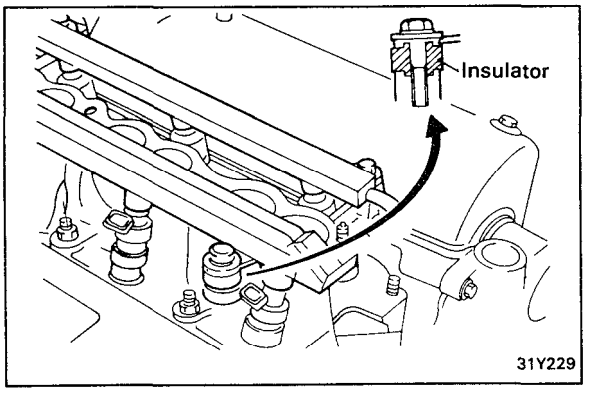


2. Install a new grommet and O-ring to the injector.
3. Apply a coating of solvent or gasoline to the O-ring of the injector.
4. While rotating the injector, install it on to the delivery pipe.
5. Be sure that the injector turns smoothly in the delivery pipe.

NOTE
If it does not turn smoothly, the O-ring may not installed properly. Remove the injector, re-insert it into the delivery pipe and re-check.

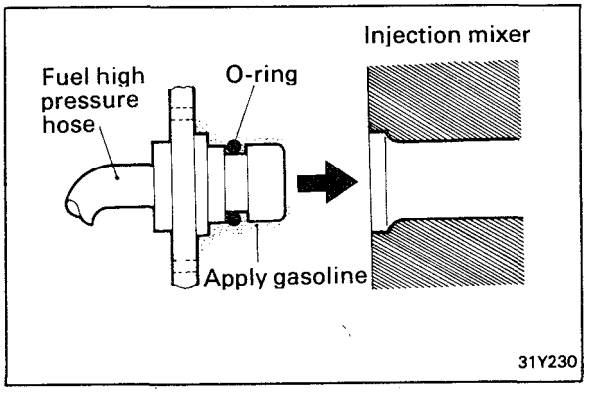


6. When installing the delivery pipe, check that the insulator is correctly inserted into the delivery pipe's installation hole.

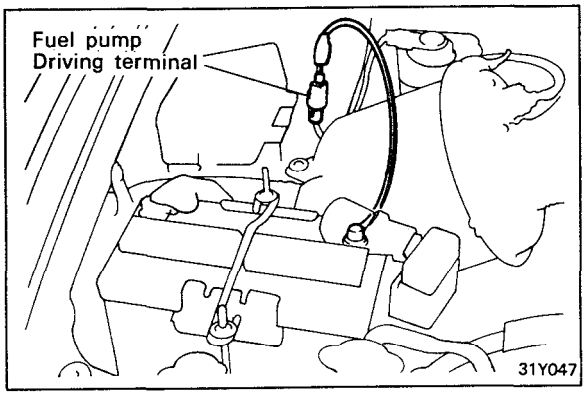


7. Apply engine oil to the hose union before installing the high pressure hose. Then insert the high pressure hose, being careful not to damage the O-ring, and tighten securely.

CAUTION
Because high pressure is present between the fuel pump and the delivery pipe, be sure that there is no fuel leakage in this area.

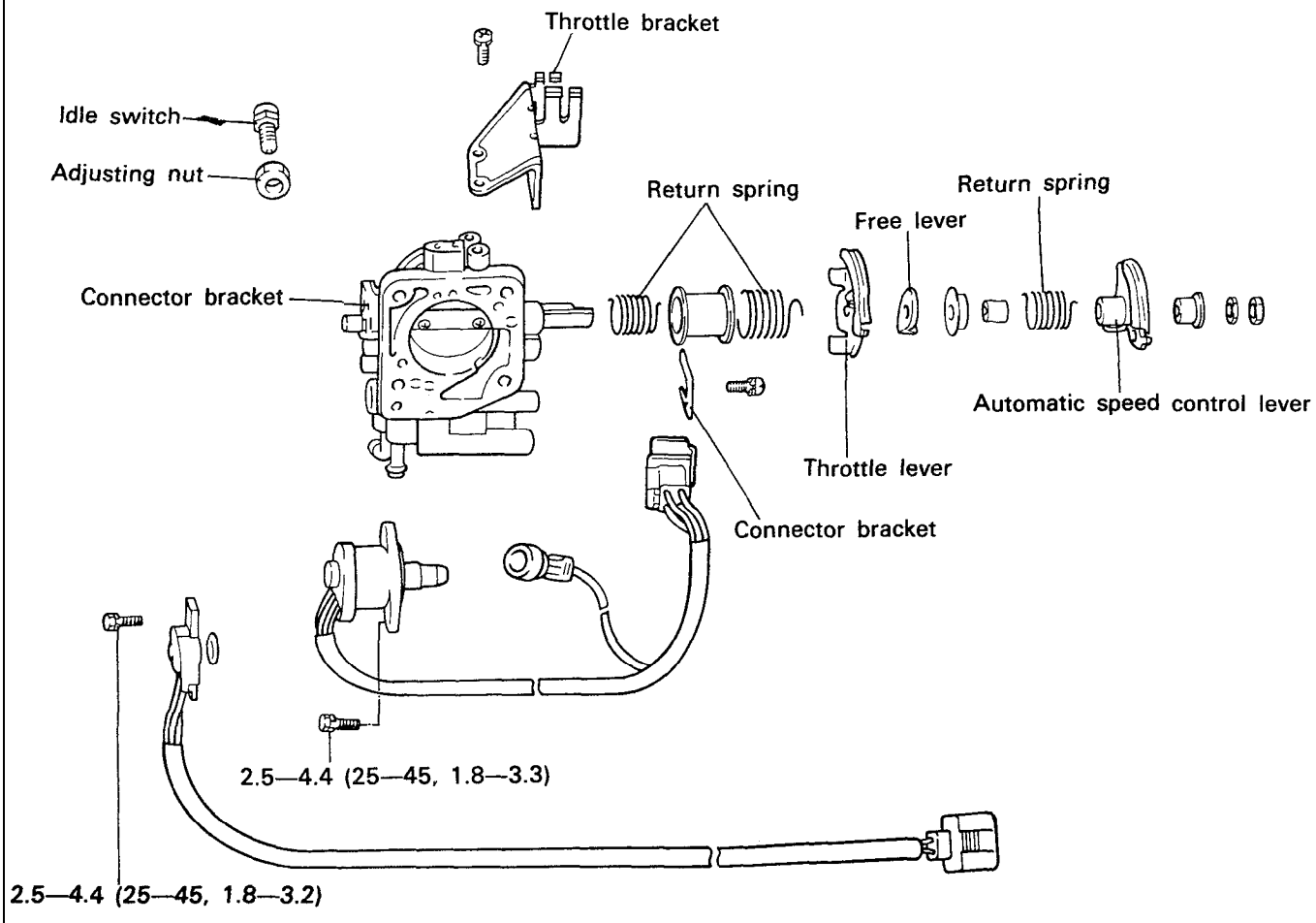


8. Check for fuel leakage in the following manner.
   1) Apply battery voltage to the fuel pump drive terminal which branches off from a harness on the upper part of the firewall.
   2) Check for fuel leakage in the system, particularly from the connection between the high pressure fuel hose and the fuel line.



THROTTLE BODY

COMPONENTS



TORQUE : Nm (kg.cm, lb.ft)

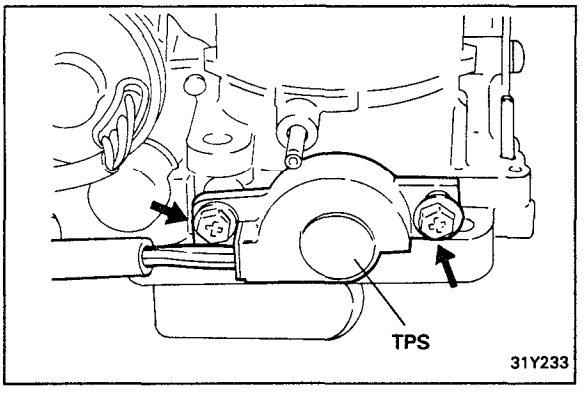
REMOVAL

CAUTION

1) Phillips-head screws are installed tightly, a screwdriver that fits the slots must be used for loosening them.
2) The throttle valve must not be removed.

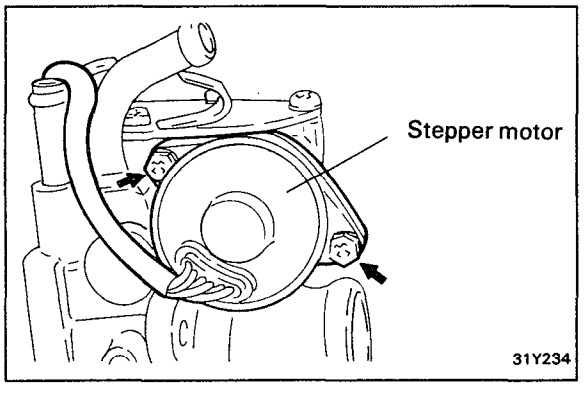
1. Remove the throttle position sensor by unscrewing the Phillips-head screws.

   NOTE
   Except when necessary for replacement, the throttle position sensor must not be removed.



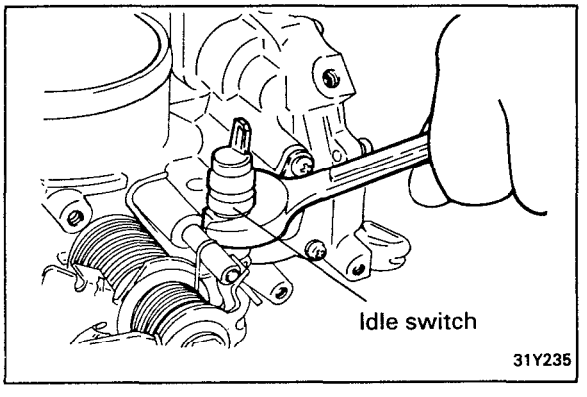
2. Remove the ISC servo assembly (STEPPER MOTOR).

   NOTE
   1) Except when necessary for replacement, the ISC servo assembly should not be removed.
   2) The ISC servo assembly should not be disassembled.



3. Remove the idle switch.

   NOTE
   1) Except when necessary for replacement or adjustment, the idle switch should not be removed.
   2) Securely apply a wrench to the nut during removal.



INSPECTION

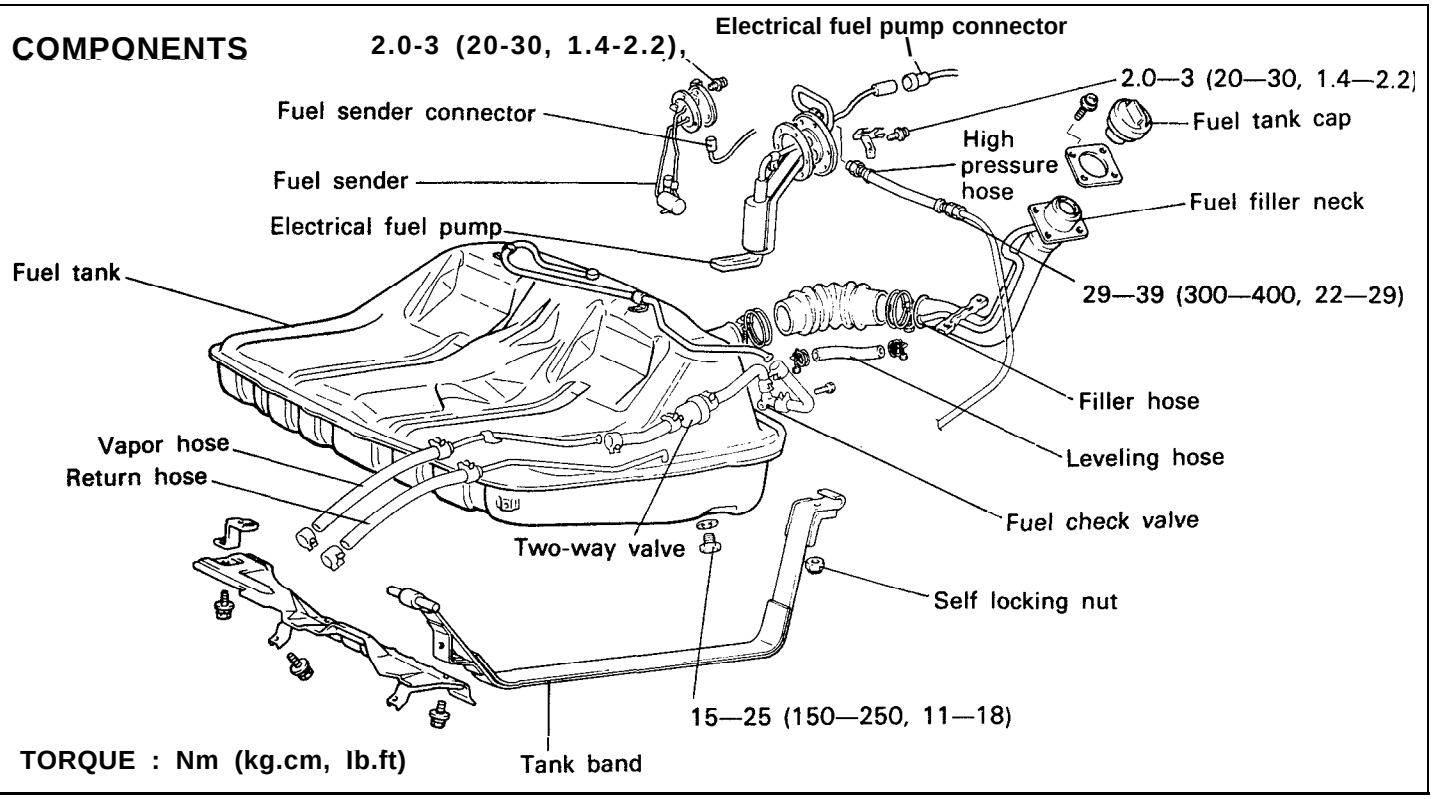
Cleaning Throttle Body Components

1. Clean all components. The following components must not be cleaned by immersion in cleaning solvents.
   - o Throttle position sensor
   - o ISC servo assembly
   - o Idle position switch

   The insulation of these components will be damaged if they are immersed in a cleaning solvent. They should only be cleaned with a piece of cloth.
2. Check for restriction of the vacuum port or passage. Clean the vacuum passage by using compressed air.

FUEL TANK

COMPONENTS

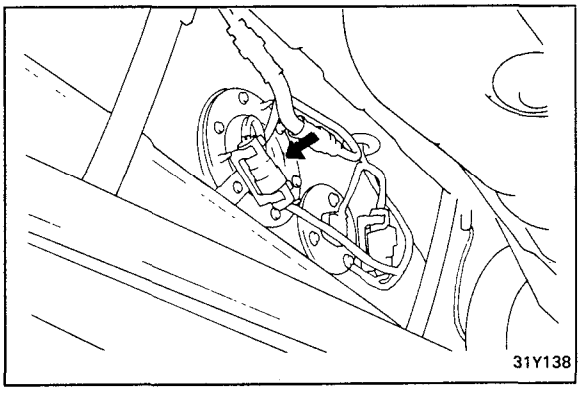


REMOVAL

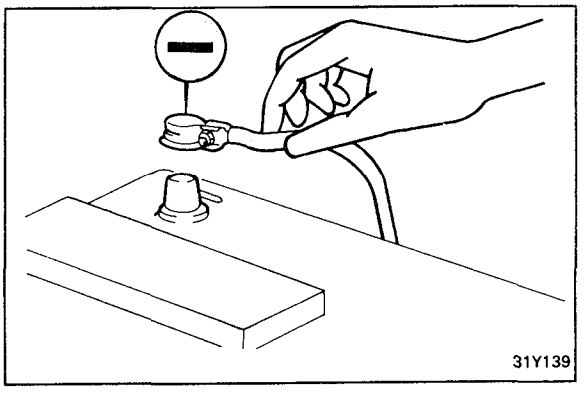
1. **To reduce the internal pressure of the fuel lines and hoses, disconnect the fuel pump connector and then start the engine.**

   CAUTION

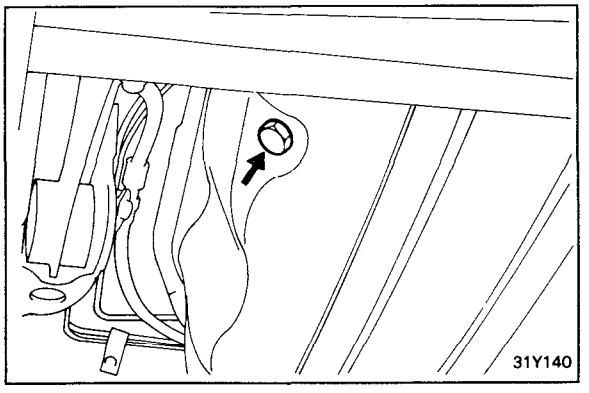
   Be sure to reduce fuel pressure before disconnecting the fuel line and hose otherwise fuel will spill out.



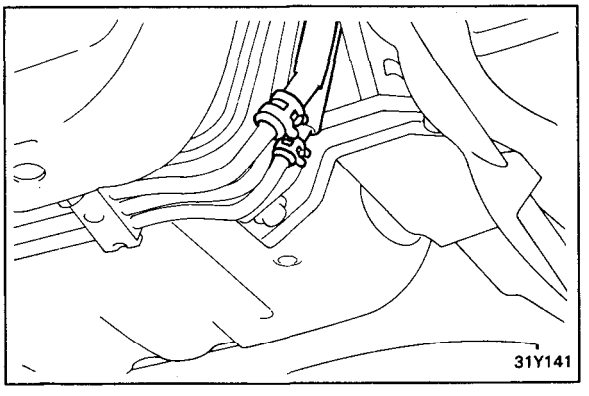
2. **Disconnect the battery cable from the negative terminal of the battery.**



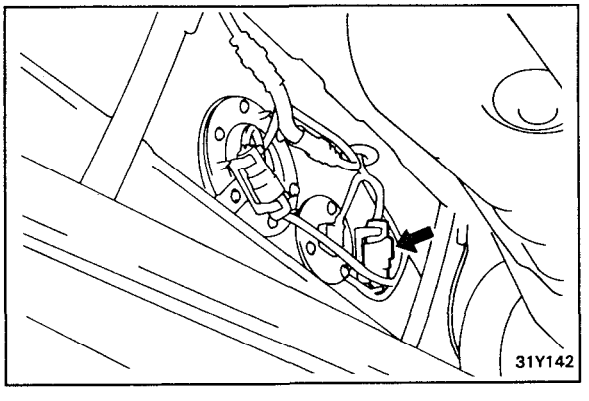
3. Remove the fuel tank cap.
4. Remove the drain plug and drain the fuel.



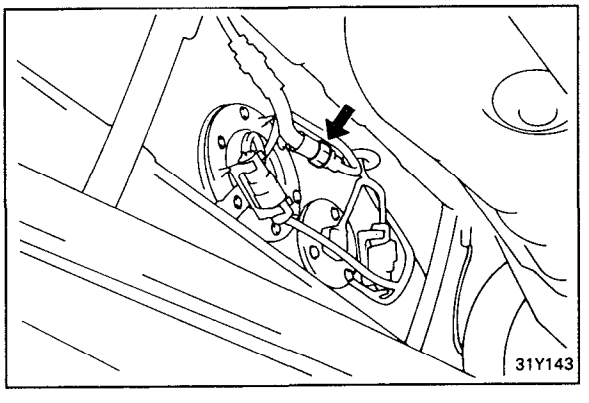
5. Disconnect the return and vapor hoses.



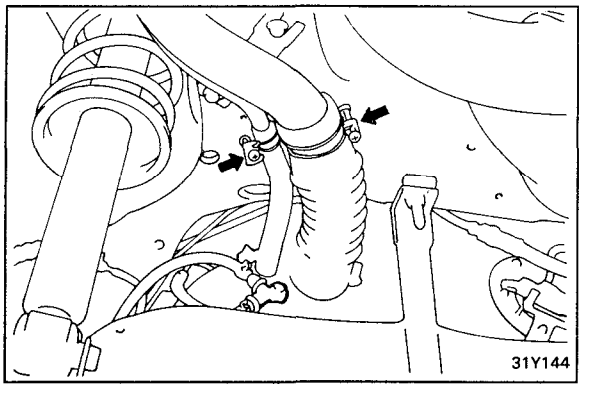
6. Disconnect the fuel sender connector.



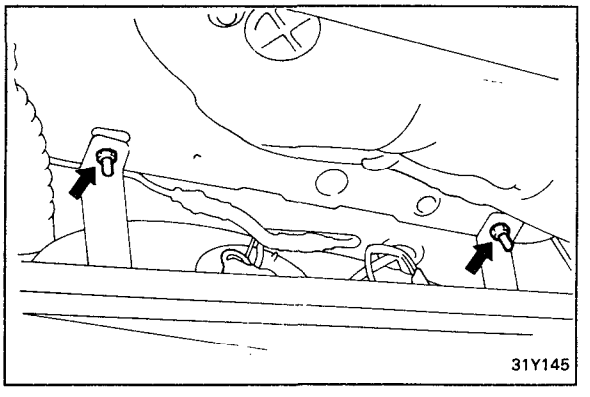
7. Disconnect the high pressure hose from the fuel tank.



8. Detach the fuel filler hose and leveling hose.



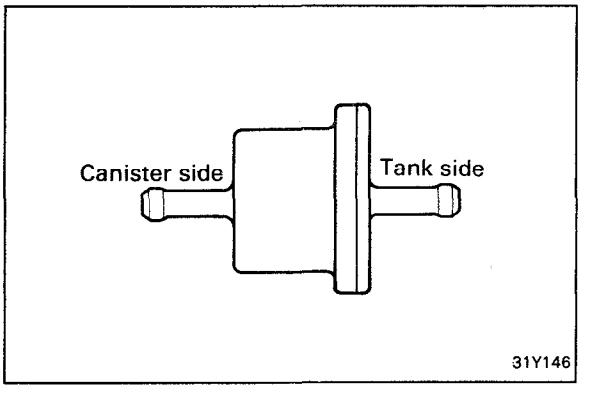
9. Loosen the two self-locking nuts that hold tank in the position and remove the two tank bands.
10. Remove the fuel vapor hose and remove the fuel tank.



INSPECTION

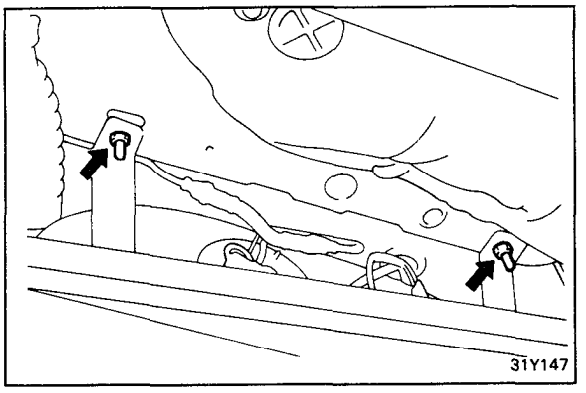
1. Check the hoses and the pipes for cracks or damage.
2. Check the fuel tank cap for proper operation.
3. Check the fuel tank for deformation, corrosion or cracking.
4. Check inside of the fuel tank for dirt or foreign material.
5. Check the in-tank fuel filter for damage or restriction.

6. Test the two-way valve for proper operation.
7. To check the two-way valve, lightly blow into the inlet and outlet. If the air passes through after slight resistance, then the valve is good.

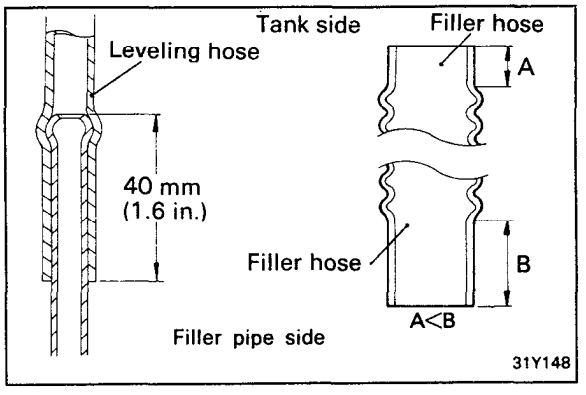


INSTALLATION

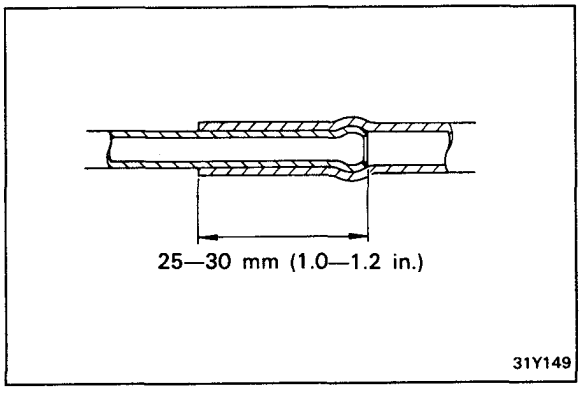
1. Confirm that the pad is fully bonded to the fuel tank, and install the fuel tank by tightening the self-locking nuts to the tank bands until the rear end of the tank band contacts the body.



2. Connect the leveling hose to the tank and approximately 40 mm (1.6 in.) at the filler neck.
3. When connecting the filler hose, the end with the shorter straight line should be connected to the tank side.



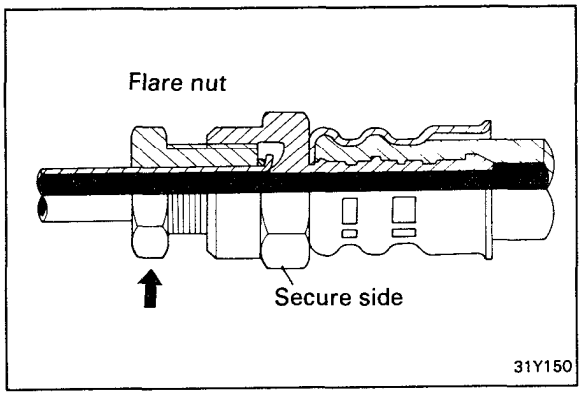
4. Connect the vapor hose and return hose.
   When attaching the fuel hose to the line, be sure that the hose is attached as shown in the illustration.



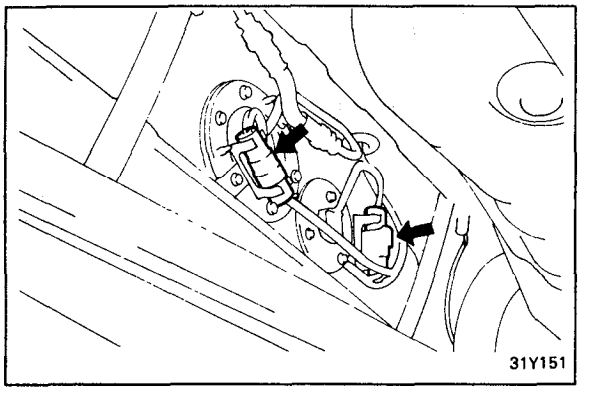
5. To connect the high pressure hose to the fuel pump, temporarily tighten the flare nut by hand, and then tighten it to the specified torque. Be careful that the fuel hose does not twist.

Tightening torque
High pressure hose flare nut . . . . . 29-39 Nm (300-400 kg.cm, 22-29 lb.ft)

NOTE
When tightening flare nut, be careful not to bend or twist the line to prevent damage to the fuel pump connection.

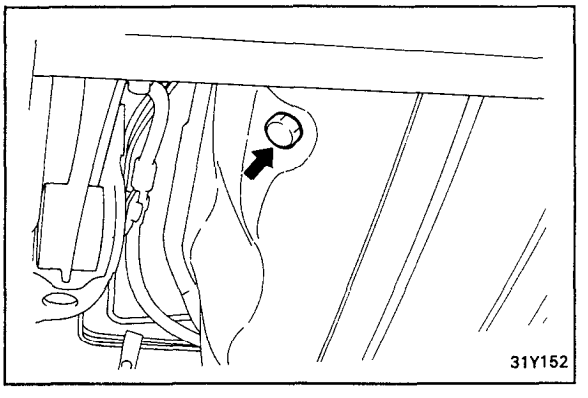


6. **Connect the electrical fuel pump and fuel sender connector.**



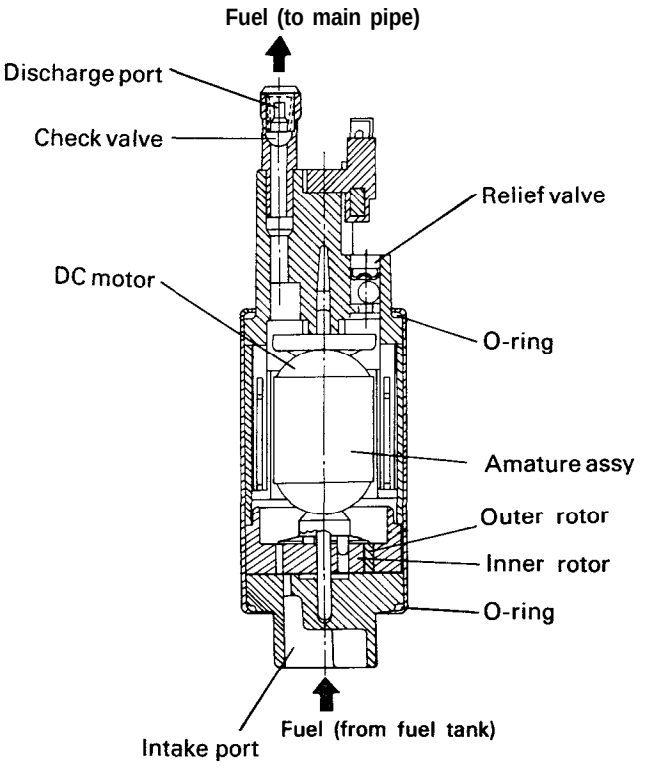
7. **Tighten the drain plug to the specified torque.**

Tightening torque	
Drain plug	15-25 Nm (150-250 kg.cm, 11-18 lb.ft)



FUEL PUMP

COMPONENTS



GENERAL INFORMATION

Fuel within the fuel tank is pumped to the injectors under pressure.

This fuel pump, is installed within the fuel tank, and is submerged in the fuel. It features excellent performance while having low operating noise. This pump is also called a "wet type" of pump because the inside is also filled with fuel. It consists of a ferrite-type DC motor unified with a Ge-rotor type pump. The pump itself is composed of a motor-driven gear, casing and cover. A relief valve and check valve are also used.

Relief Valve

If the fuel line becomes restricted or blocked, the relief valve opens and relieves the pressure, preventing fuel pressure in the fuel line from rising above the specified pressure.

Check Valve

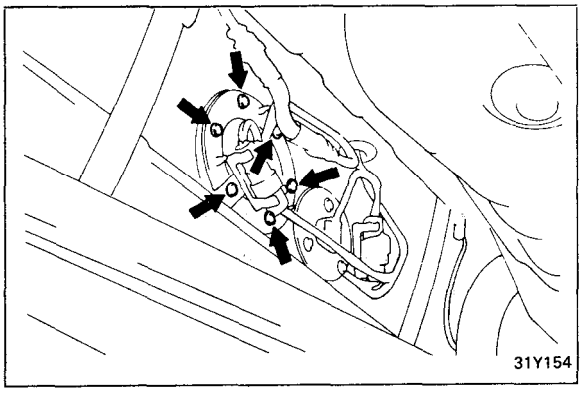
When the pump stops, the check valve is closed by spring force, thus assuring that residual pressure will remain in the fuel line. By maintaining fuel pressure in this way, restarting of the engine becomes easier. In addition vapor locking at high temperature is reduced.

REPLACEMENT

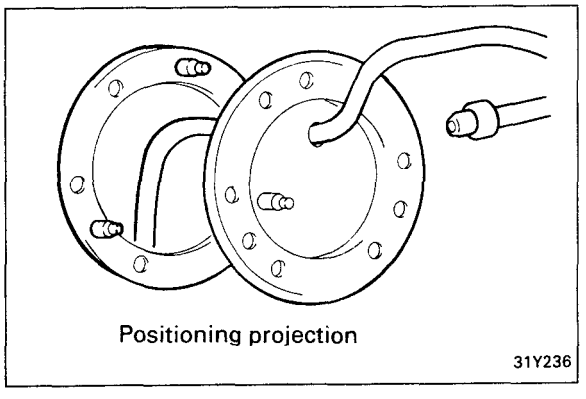
1. Disconnect the fuel pump connector.
2. Remove the fuel tank cap.
3. Drain the fuel.
4. Disconnect the fuel high pressure hose.

CAUTION
Cover the hose connection with rags to prevent fuel from leaking out due to residual pressure in the fuel pipe line.

5. Remove the fuel pump installation screws and the bolt for holding the fuel pump (at the lower side of the fuel tank), and then remove it from the fuel tank.

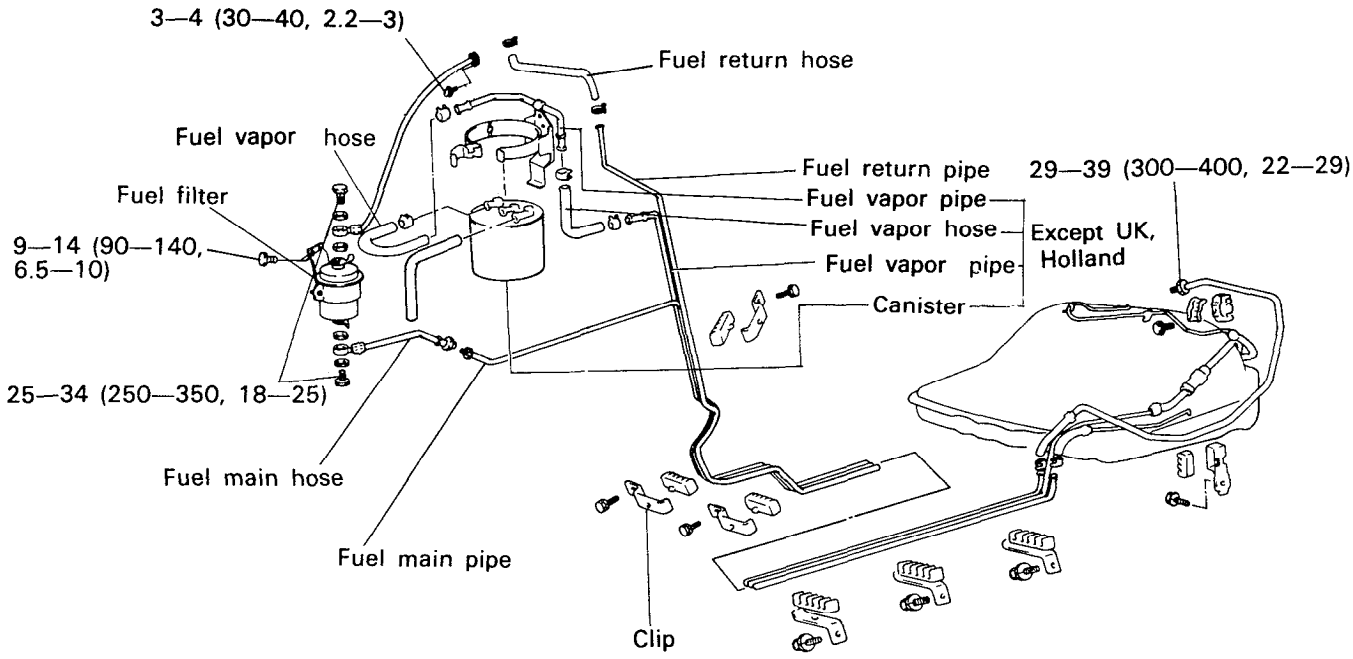


6. Align the three positioning projections of the packing with the holes in the fuel pump.



FUEL AND VAPOR LINES

COMPONENTS



TORQUE : Nm (kg.cm. lb.ft)

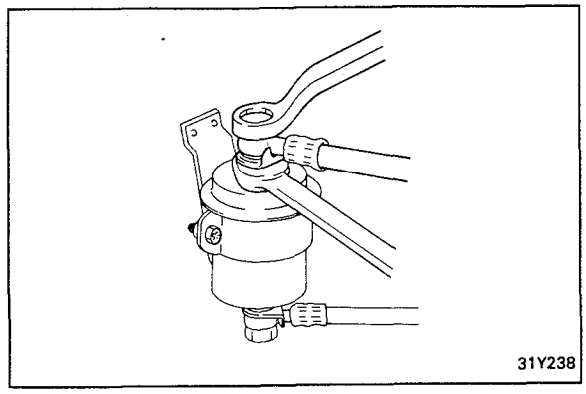
REMOVAL

1. **Remove the upper eye bolt while holding the fuel filter nut securely and remove the high pressure fuel hose.**

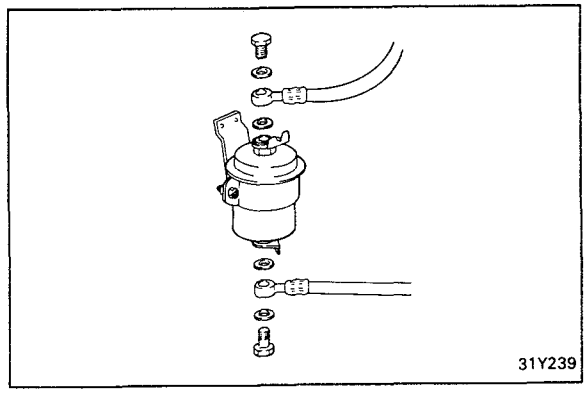
   CAUTION

   1) Be sure to reduce the fuel pressure before disconnecting the fuel line and hose, otherwise fuel will spill out.

   2) Cover the hose connection with rags to prevent fuel from leaking out due to residual pressure in the fuel line.



2. **Remove the lower eye bolt while holding the fuel filter nut assembly.**
3. **Remove the fuel filter mounting bolts, and then remove the fuel filter from the bracket.**
4. **Remove the fuel return hose and line.**
5. **Remove the fuel vapor hose and line.**

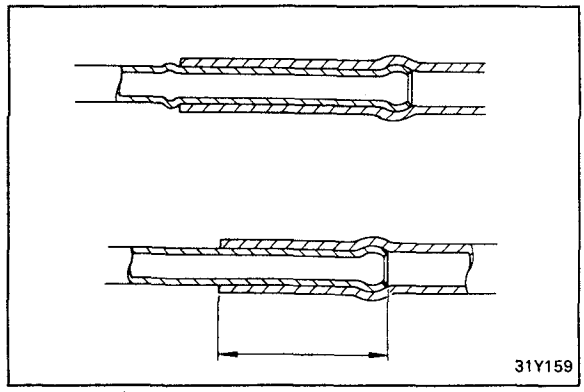


INSPECTION

1. Check the hoses and lines for cracking, bending, deformation or restrictions.
2. Check the canister for restrictions.
3. Check the fuel filter for restrictions and damage.

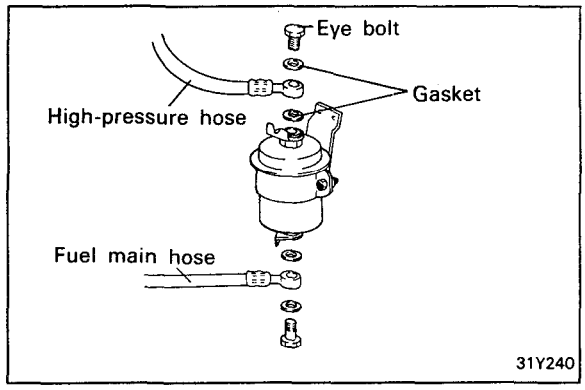
INSTALLATION

1. Install the fuel vapor hose and return hoses.
   - o If the fuel fine has a stepped, section connect the fuel hose to the line securely, as shown in the illustration.
   - o If the fuel line does not have a stepped section, connect the fuel hose to the line securely.

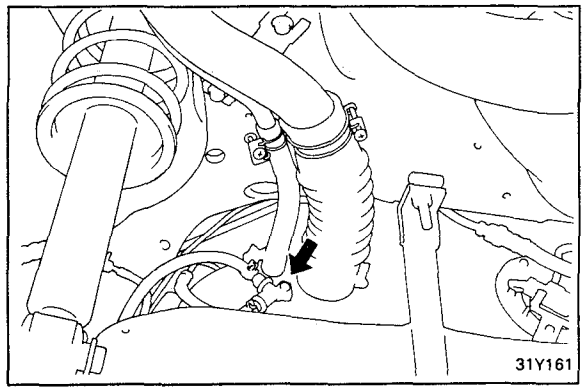


2. Install the fuel filter, and tighten the fuel filter bracket.
3. . Insert the main line on the filter and tighten the eye bolts while holding the fuel filter nuts.

Tightening torque	
Eye bolt	25-34 Nm (250-350 kg.cm, 18-25 lb.ft)

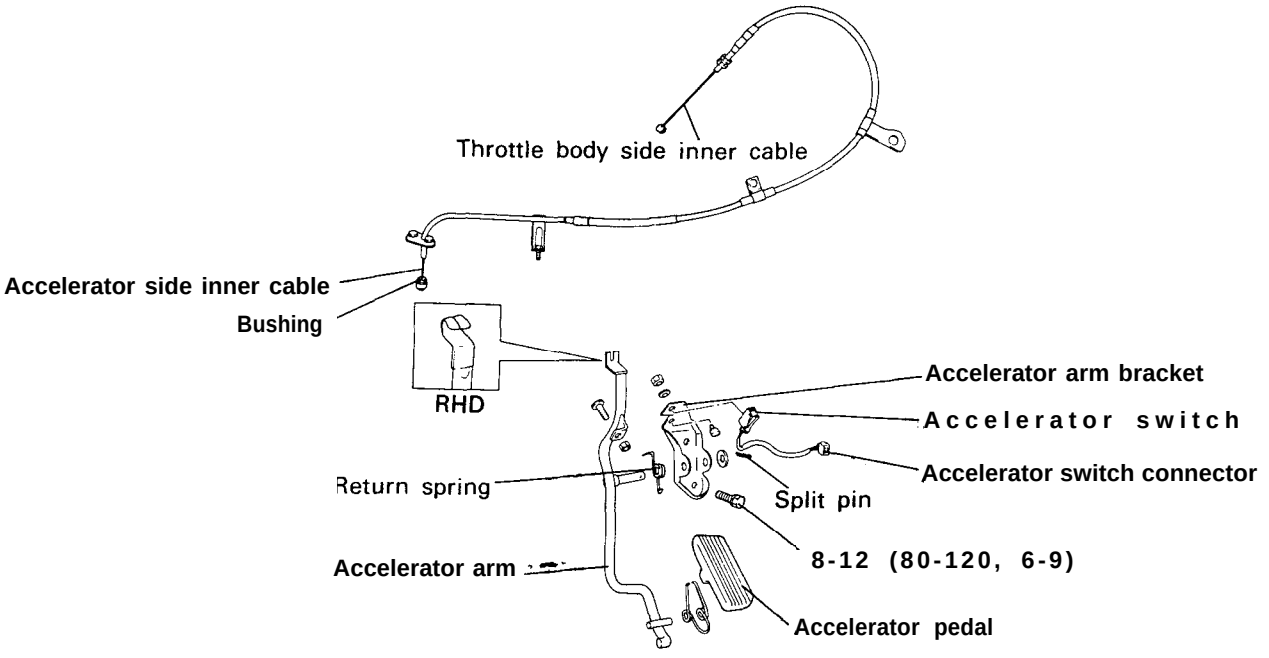


4. Install the clips and make sure that they do not interfere with other components.
5. When installing the check valve, install it so that the valve is facing in the direction shown in the illustration.



ENGINE CONTROL

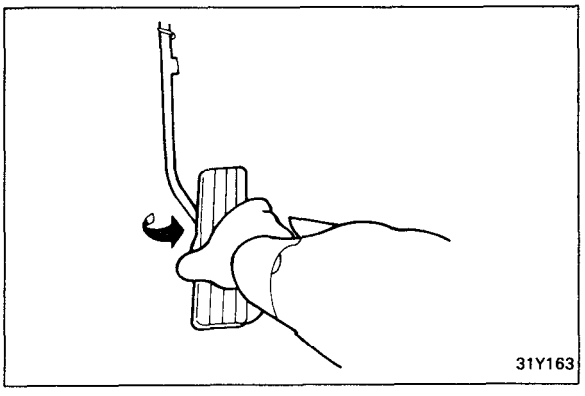
COMPONENTS



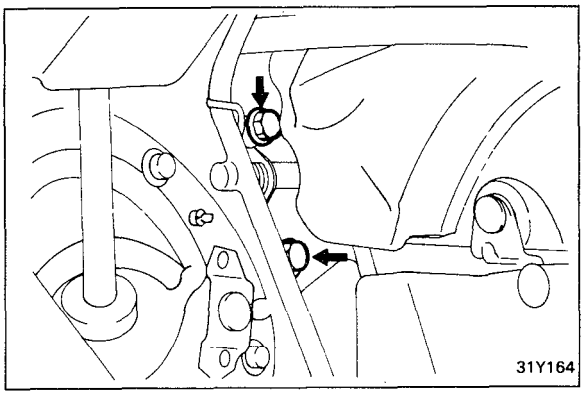
TORQUE : Nm (kg.cm, lb.ft)

REMOVAL

1. Remove the bushing and inner cable of the accelerator arm side.
2. Pull the left side of the accelerator pedal toward you, and then remove the accelerator pedal from the accelerator arm.



3. After disconnecting the accelerator switch connector, loosen the bolts of the accelerator arm bracket and remove.

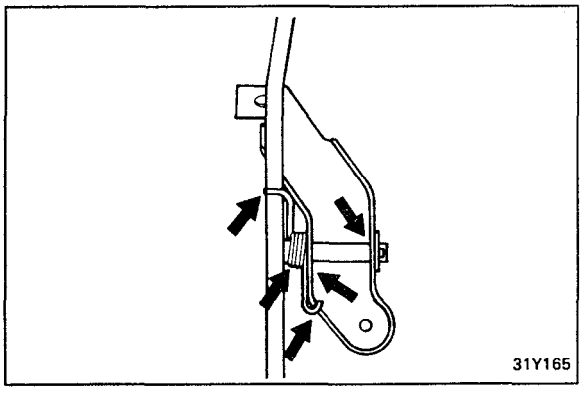


INSPECTION

1. Check the inner and outer cable for damage.
2. Check the cable for smooth movement.
3. Check the accelerator arm for deformation.
4. Check the return spring for deterioration.
5. Check the connection of bushing to end metal fitting.
6. Check the accelerator proper operation.

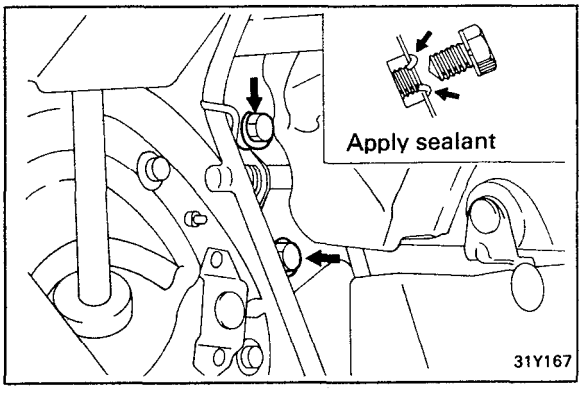
INSTALLATION

1. When installing the return spring and accelerator arm, apply multi-purpose grease around each moving point of the accelerator arm.



2. Apply sealant to the bolt mounting hole, and tighten the accelerator arm bracket.

Tightening torque
Accelerator arm bracket bolts . . . . . 8-12 Nm (80-120 kg.cm, 5.8-7.2 lb.ft)



3. Securely install the resin bushing of the accelerator cable on the end of the accelerator arm.
4. Apply multipurpose grease around the cable end.