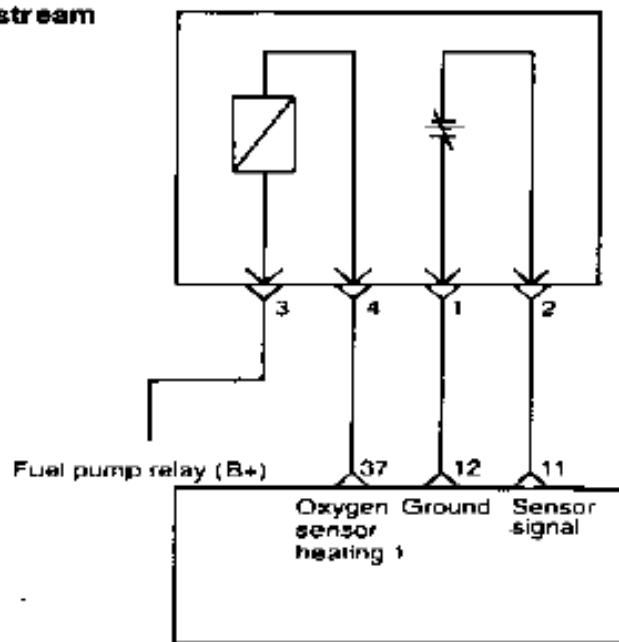


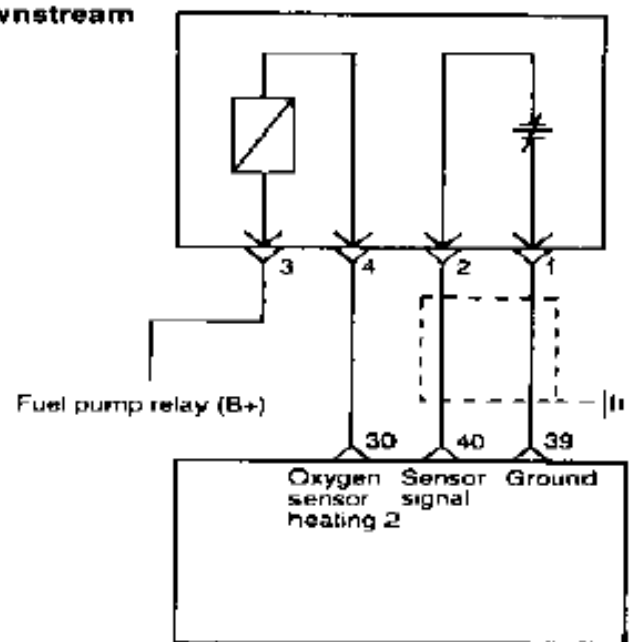
HEATED OXYGEN SENSOR (HO₂S)

1-CIRCUIT DIAGRAM

Upstream

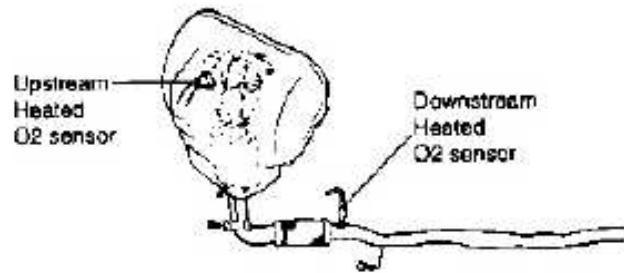


Downstream



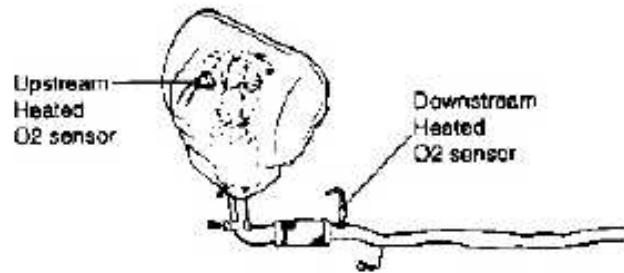
DESCRIPTION

The heated oxygen sensor senses the oxygen concentration in exhaust gas and converts it into a voltage which is sent to the ECM. The heated oxygen sensor outputs about 800mV when the air fuel ratio is richer than the theoretical ratio and outputs about 100mV when the ratio is leaner (higher oxygen concentration in exhaust gas.) The ECM controls the fuel injection ratio based on this signal so that the air fuel ratio is maintained at the theoretical ratio. The oxygen sensor has a heater element which ensures the sensor performance during all driving conditions.

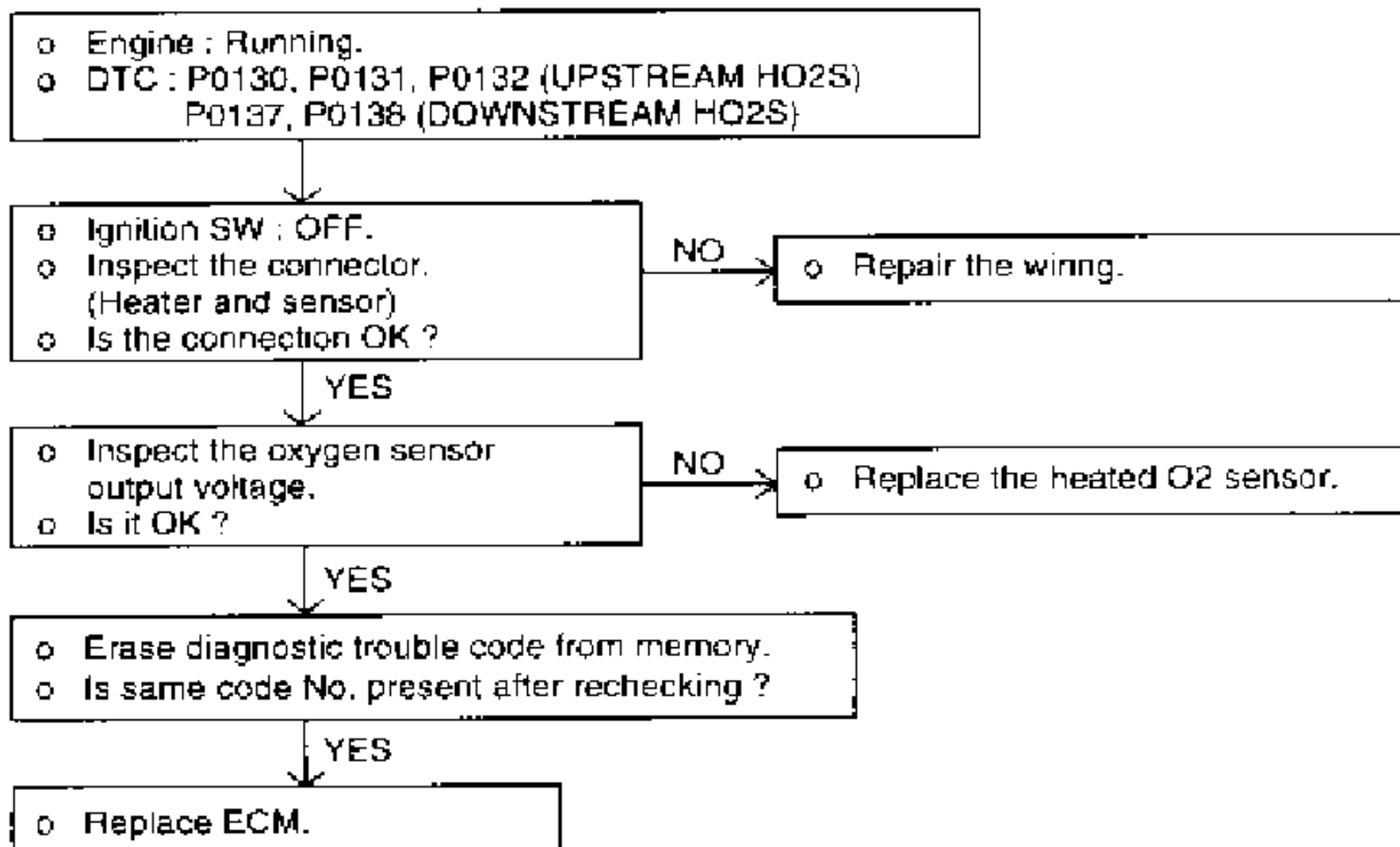


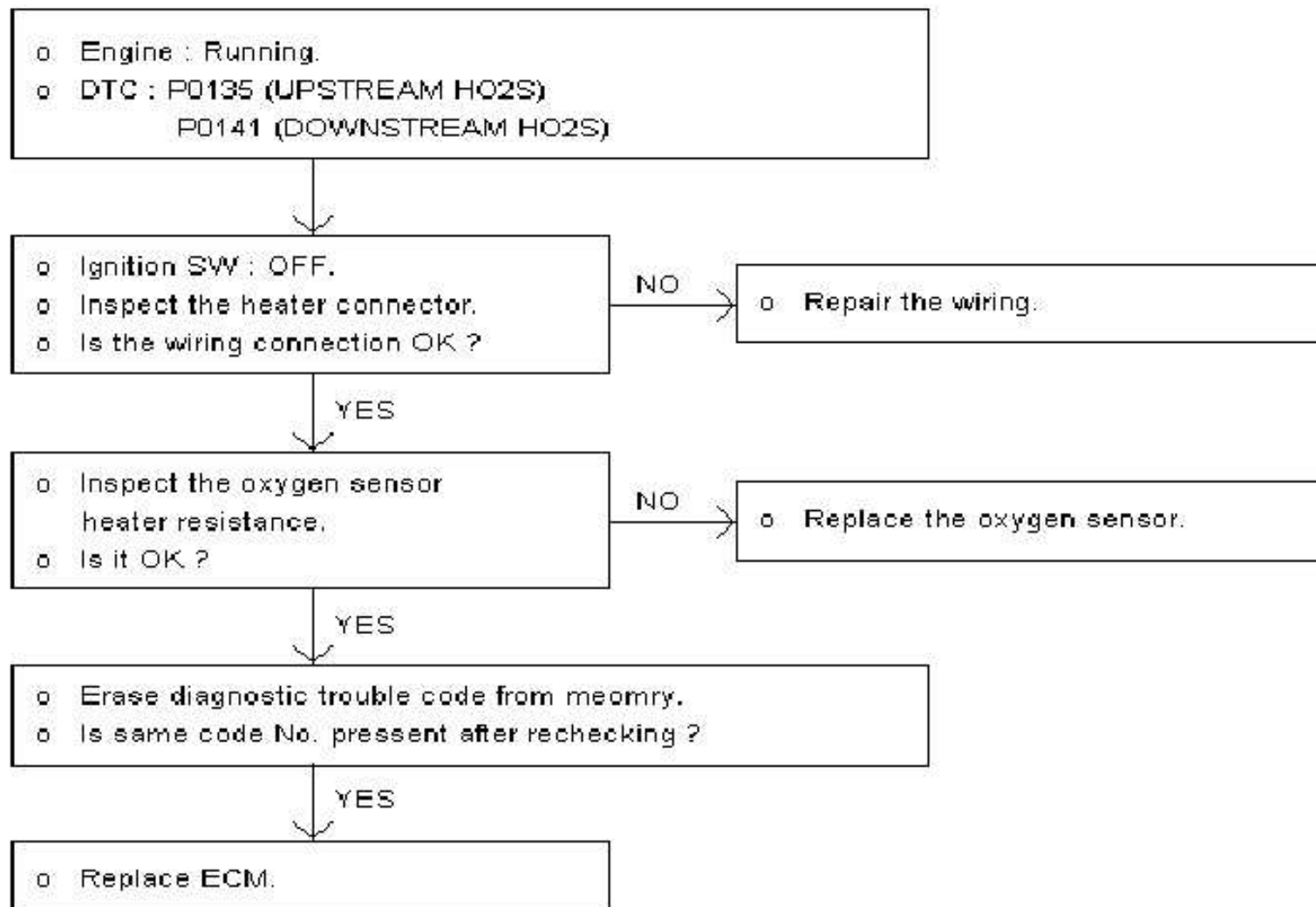
DESCRIPTION

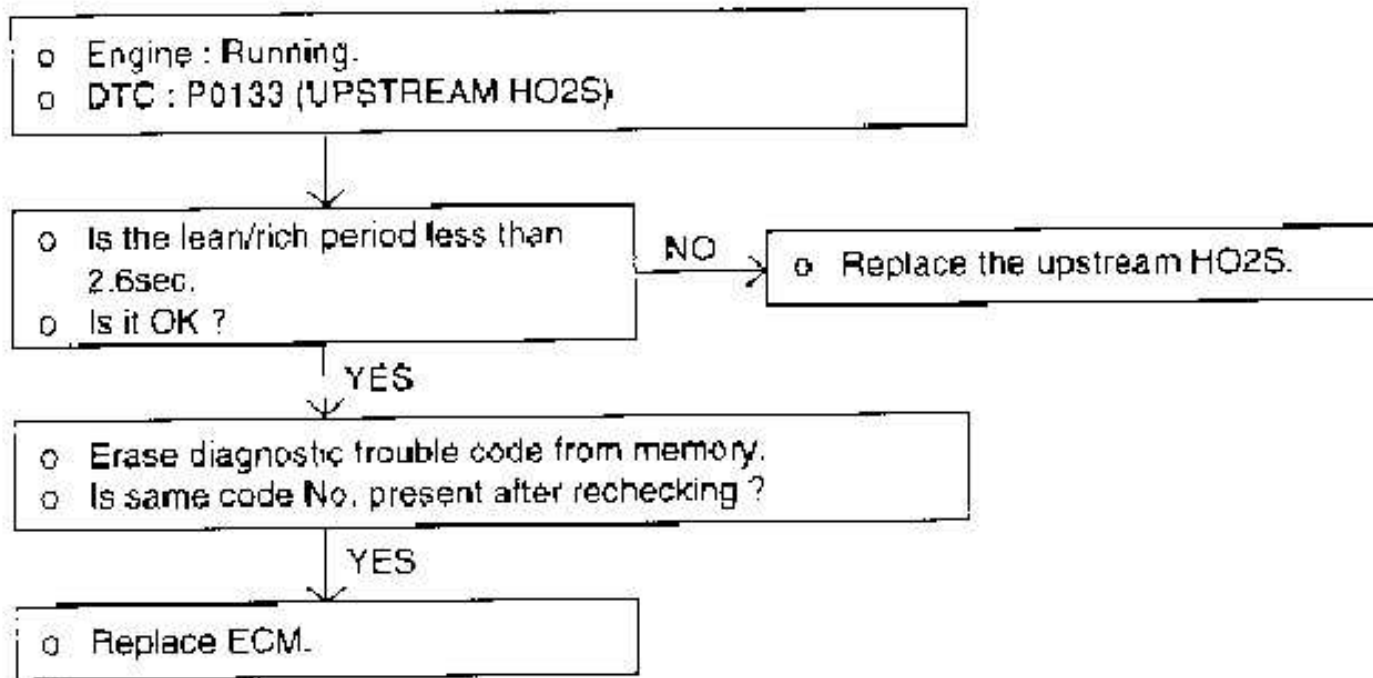
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3-DTC – P0130, P0131, P0132, P0137, P0138

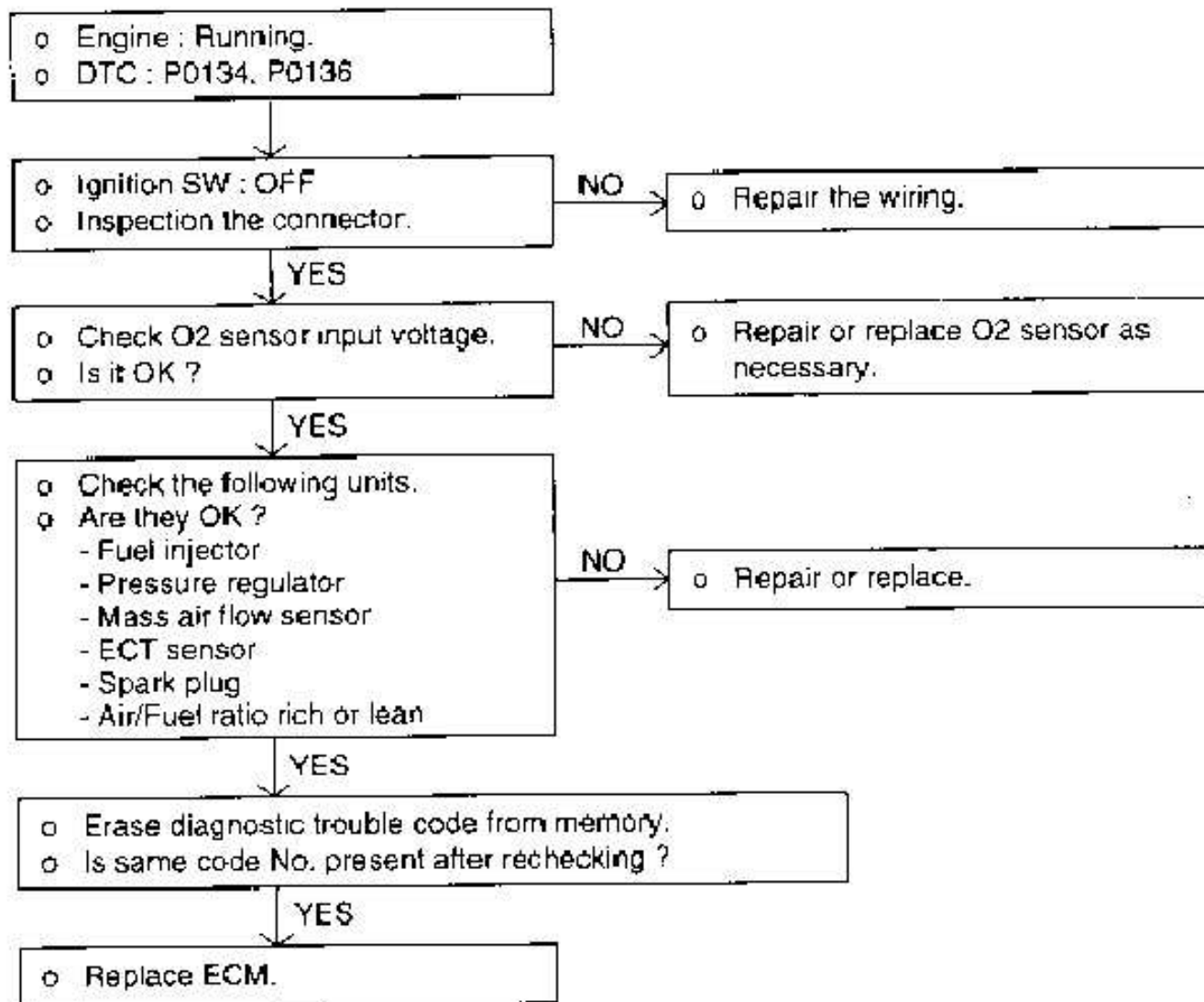






TROUBLESHOOTING HINTS

When the lean/rich period is above 2.6 seconds in a fully warmed-up engine is 2,000-3,000 rpm and engine is above middle load.



DTC : Diagnosis Trouble Code
ECM : Engine Control Module

TROUBLESHOOTING HINTS

1. If the heated oxygen sensor is defective, abnormally high emission may occur.
2. If the heated oxygen sensor check has been normal, but the sensor output voltage is out of specification, check for the following items related to air fuel ratio control system.

- Faulty injector.

Air leaks in the intake manifold.

Faulty mass air flow sensor, EVAP valve and engine coolant temperature sensor.

Wiring connection problem.

3. When O2 sensor output voltage is maintained as following for above 50 sec.

- Upstream: 0.4V - 0.6V

Downstream: 0.4V - 0.5V

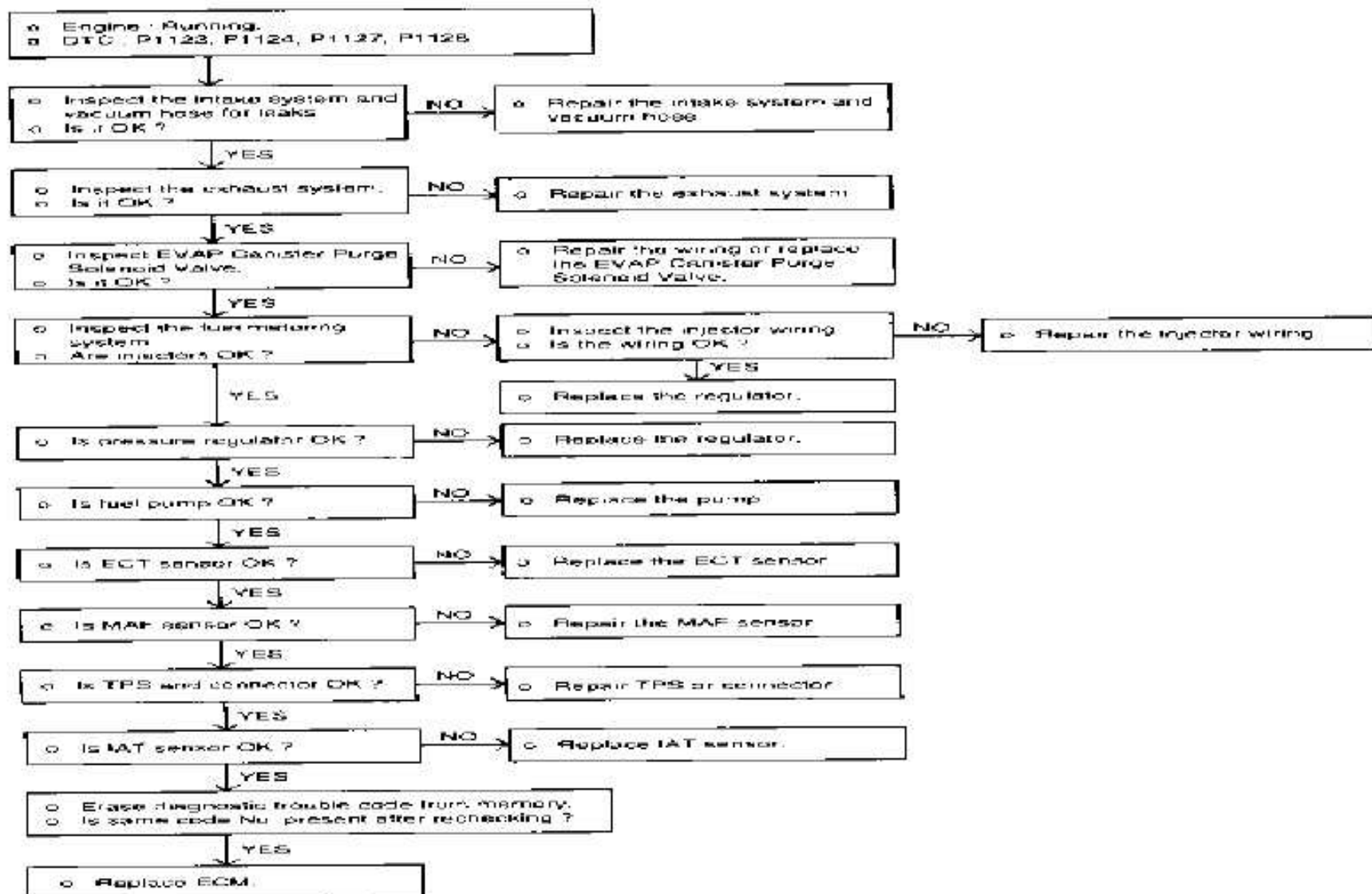
Check item	Check condition	Engine condition	Test specification
Heated oxygen sensor output voltage. (Heated oxygen sensor side connector No. 2 or ECM harness side connector)	Warm-up.	When decelerating suddenly from 4,000 rpm.	'A' 200 mV or lower.
		When engine is suddenly raced.	'B' 600-1,000 mV.
Heater resistance	Cooling (22°C)	Key OFF	2.1±0.4Ω

NOTE

If you release the accelerator pedal suddenly while the engine is running at about 4000 rpm, the fuel supply will be stopped for a while.

When you suddenly press the accelerator pedal, the voltage will reach 'B' range. Then, when you let the engine idle again, the voltage will fluctuates between 'A' and 'B' range. In this case, the O2 sensor can be determined as good.

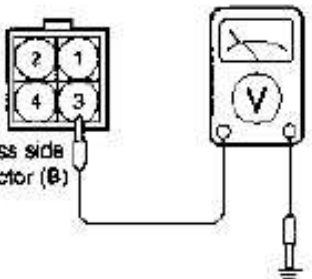
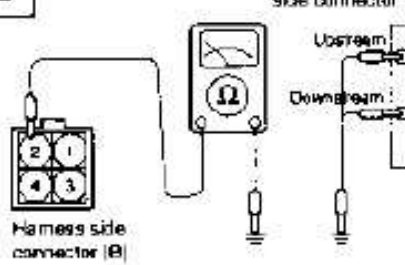
DTC - P0130, P0131, P0132, P0137, P0138 (AIR-FUEL CONTROL)

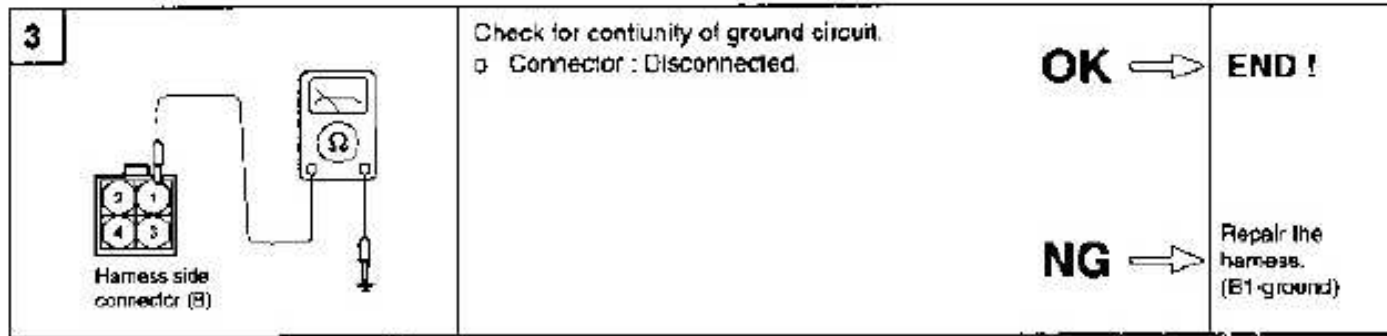


TROUBLESHOOTING HINTS

Air/Fuel ratio stays rich or lean longer than specified period because of system malfunction.

HARNESS INSPECTION PROCEDURE

<p>1</p>  <p>Harness side connector (B)</p>	<p>Measure the power supply voltage of the heated oxygen sensor.</p> <ul style="list-style-type: none"> o Connector: Disconnected o Ignition switch: ON (START) o Voltage (V): Battery voltage 	<p>OK → 2</p> <p>NG → Repair the harness. (B3-Fuse box)</p>
<p>2</p>  <p>Harness side connector (B)</p> <p>ECM harness side connector</p> <p>Upstream</p> <p>Downstream</p>	<p>Check for an open-circuit, or a short-circuit of ground between the engine control module and the heated oxygen sensor.</p> <ul style="list-style-type: none"> o Heated oxygen sensor connector: Disconnected o ECM connector: Disconnected 	<p>OK → 3</p> <p>NG → Repair the harness. (B2-11, 40)</p>



SENSOR INSPECTION

NOTE

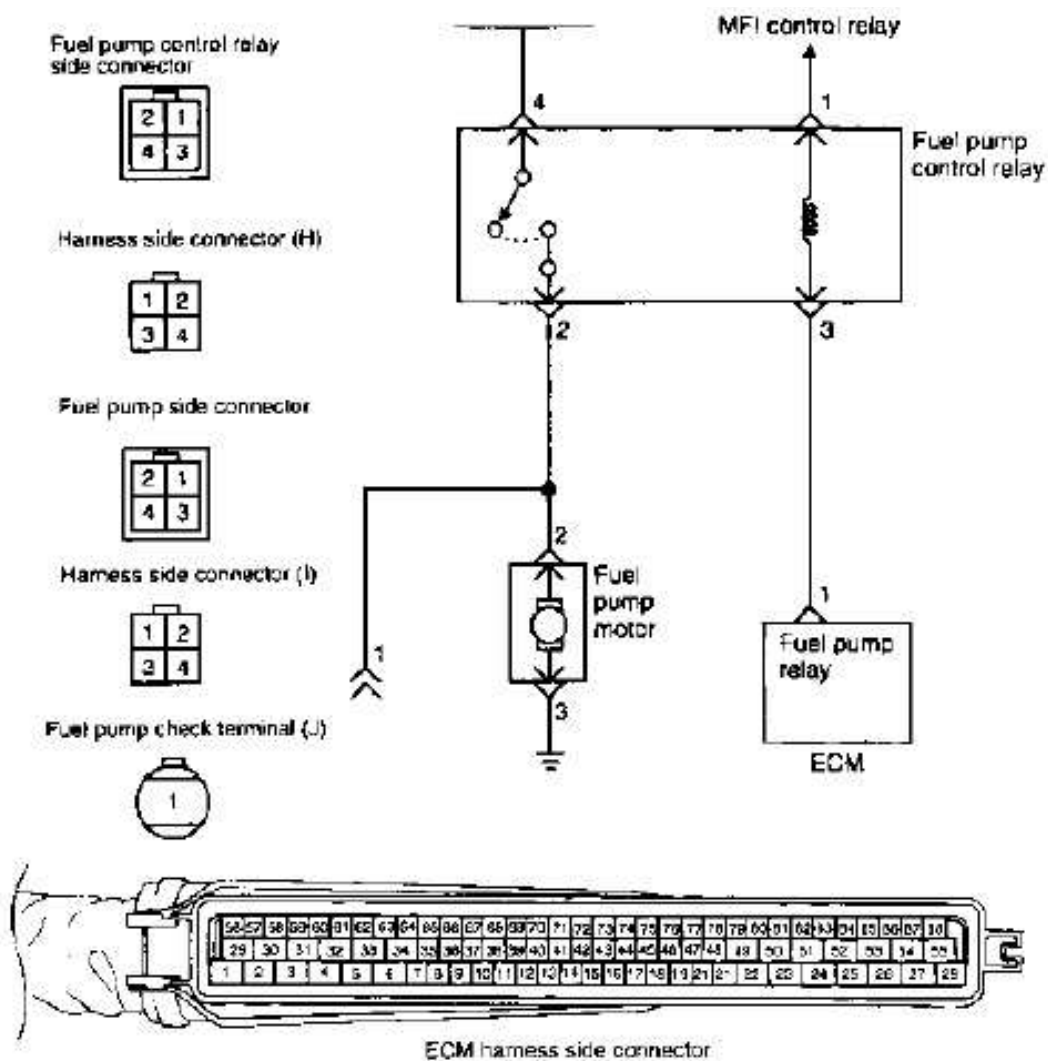
- Before checking, warm up the engine until the engine coolant temperature reaches 80 to 95°C (176 to 205°F).
- Use an accurate digital voltmeter.

Replace the oxygen sensor if there is a malfunction.

TORQUE SPECIFICATION

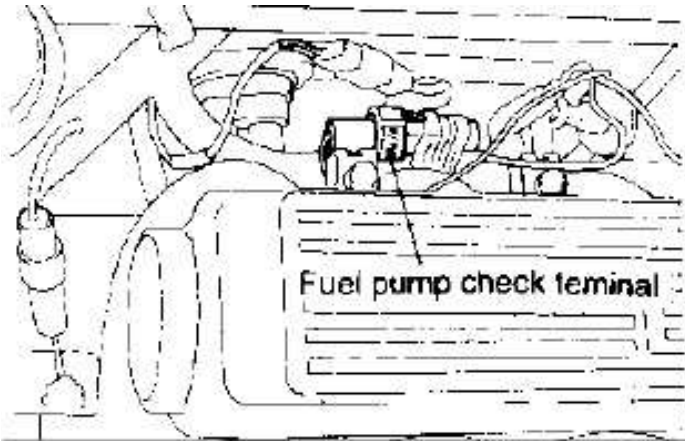
Heated oxygen sensor 50-60 Nm 500-600 kg·cm 37-44 lb·ft

CIRCUIT DIAGRAM



Description

The fuel pump inspection terminal, located in the engine compartment, is used to check fuel pump operation by connecting battery voltage directly to the terminal.



FUEL PUMP OPERATING CHECK

1. Turn the ignition switch 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. Its operating sound is difficult to hear without removing the fuel tank cap.

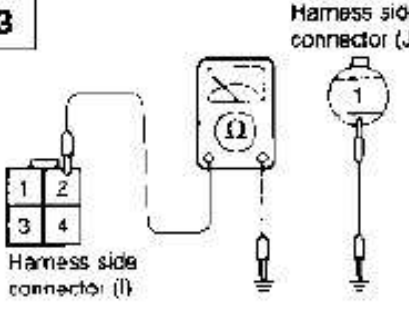
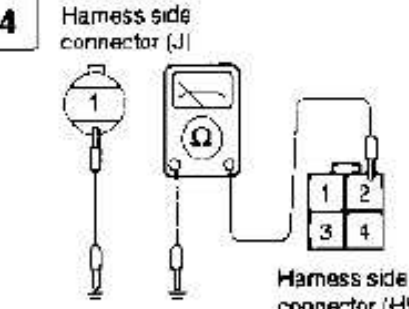
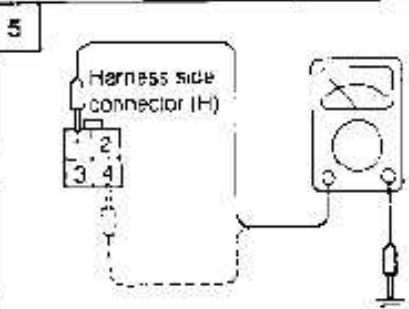


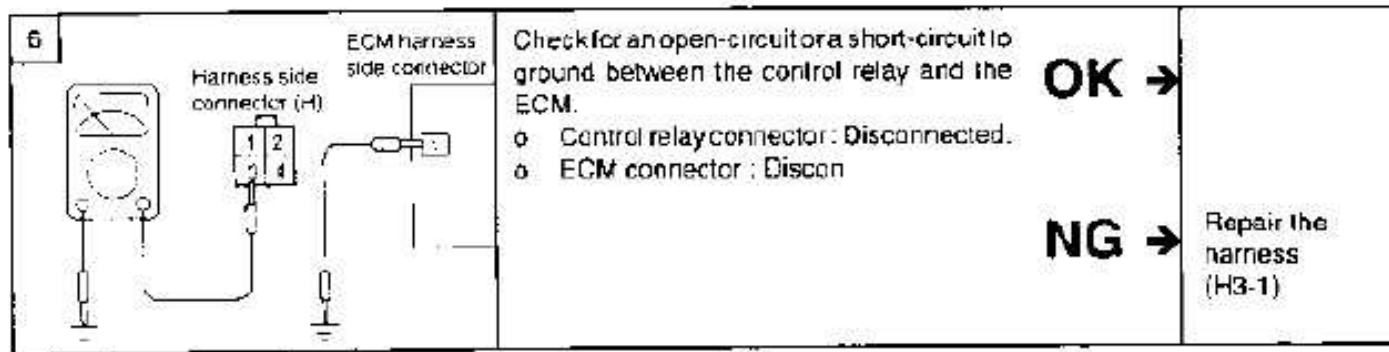
3. Pinch the hose to check that fuel pressure is felt.



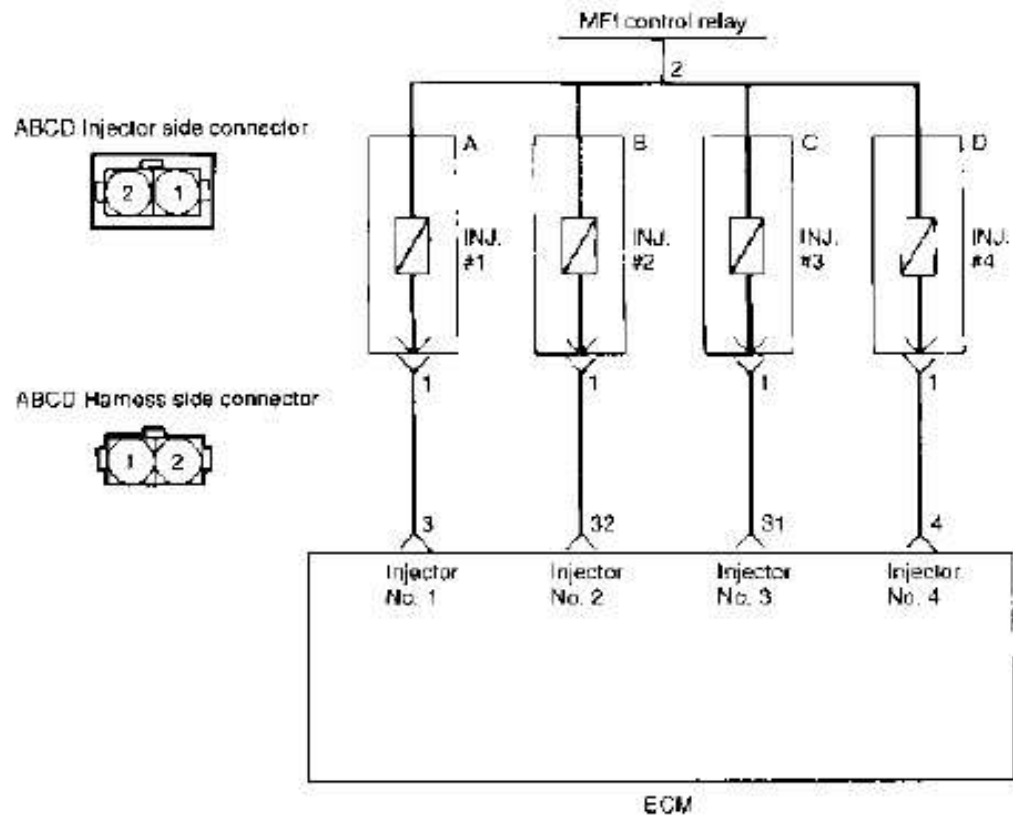
HARNESS INSPECTION PROCEDURES

<p>1</p> <p>Fuel pump check terminal</p>	<p>Check the fuel pump</p> <ul style="list-style-type: none"> o Apply battery voltage to the checking terminal and operate the pump. <p>OK → 4</p> <p>NG → 2</p>	
<p>2</p> <p>Harness side connector (I)</p>	<p>Check the ground circuit of the fuel pump.</p> <ul style="list-style-type: none"> o Connector : Disconnected. <p>OK → 3</p> <p>NG → Repair the harness (13-g round)</p>	

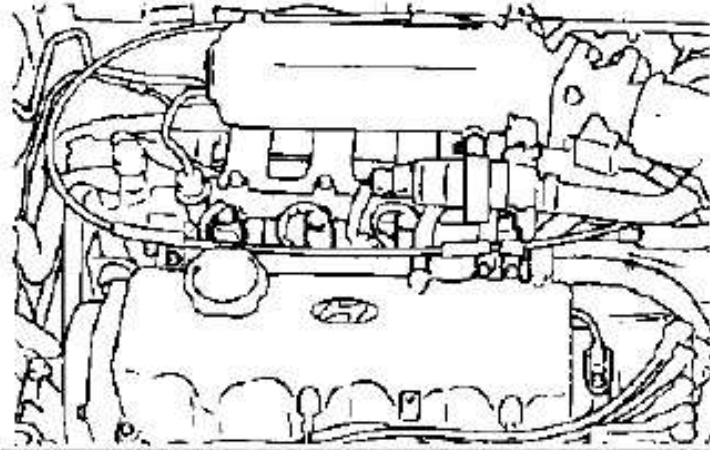
<p>3</p>  <p>Harness side connector (I)</p> <p>Harness side connector (J)</p>	<p>Check for continuity between the fuel pump and the checking terminal.</p> <ul style="list-style-type: none"> o Connector : Disconnected. <p>OK →</p> <p>NG →</p>	<p>4</p> <p>Repair the harness (I2-J1)</p>
<p>4</p>  <p>Harness side connector (J)</p> <p>Harness side connector (H)</p>	<p>Check for continuity between the checking terminal and the fuel pump control relay terminal.</p> <ul style="list-style-type: none"> o Control relay connector : Disconnected <p>OK →</p> <p>NG →</p>	<p>5</p> <p>Repair the harness (H2-J1)</p>
<p>5</p>  <p>Harness side connector (H)</p> <p>Harness side connector (J)</p>	<p>Measure the power supply voltage of the control relay.</p> <ul style="list-style-type: none"> o Control relay connector : Disconnected. o Ignition switch : START o Voltage (V) : System voltage. <p>OK →</p> <p>NG →</p>	<p>END !</p> <p>Repair the harness (H4-Battery) (H1-power relay harness side connector 3)</p>

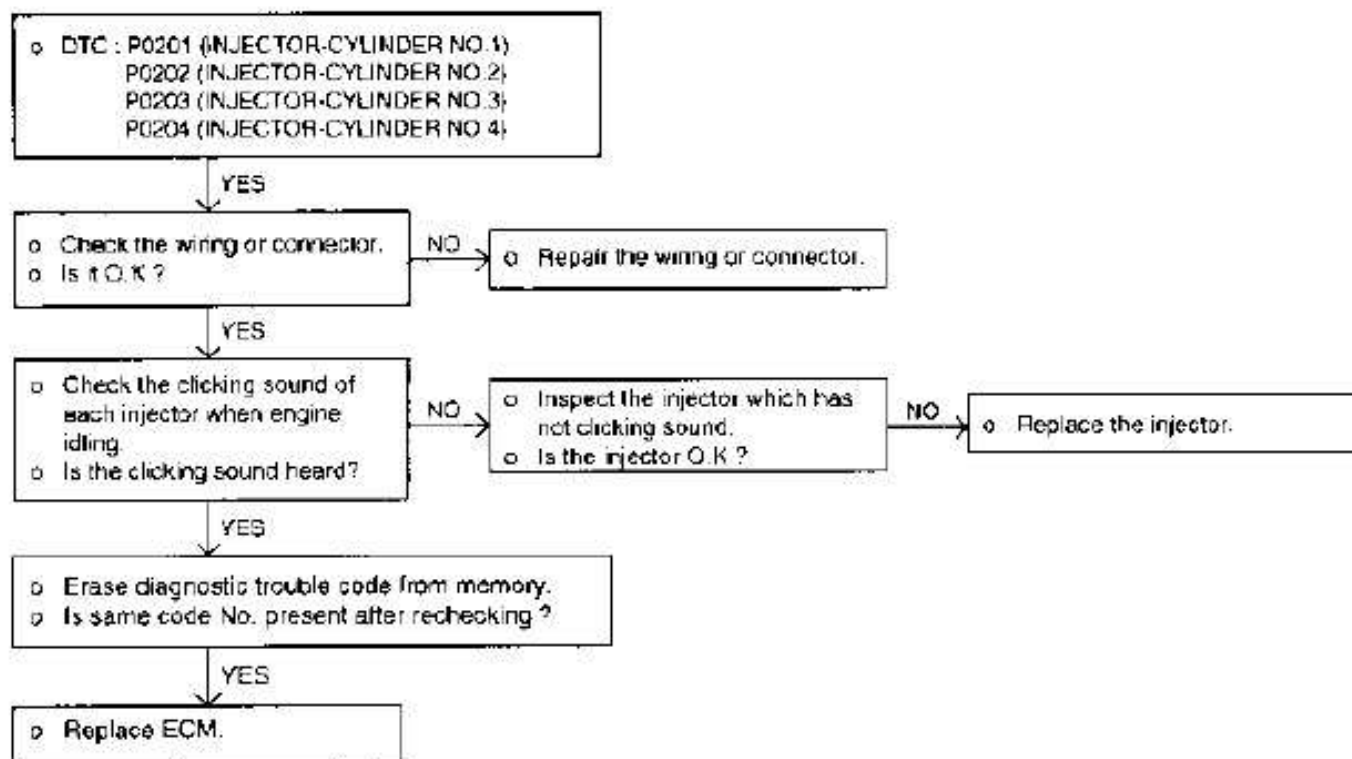


CIRCUIT DIAGRAM



The injectors inject fuel according to a signal coming from the ECM. The volume of fuel injected by the injector is determined by the time during which the solenoid valve is energized.





DTC : Diagnosis Trouble Code
ECM : Engine Control Module

1. If the engine is hard to start when hot, check for fuel pressure and injector leaks.
2. If the injector does not operate when the engine is cranked, then check the following:
 - Faulty power supply circuit to the ECM and faulty ground circuit

Faulty MFI control relay

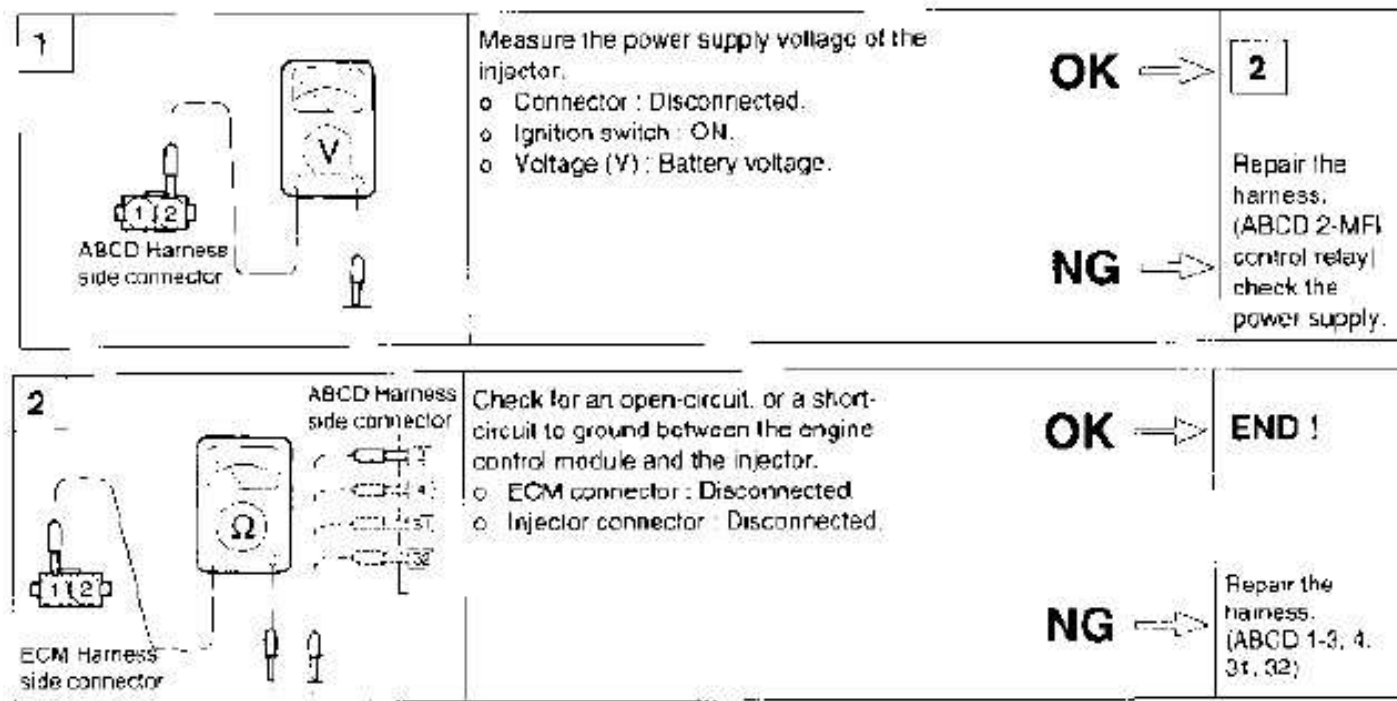
Faulty crankshaft position sensor and camshaft position sensor

3. If there is any cylinder whose idle state remains unchanged when the fuel injection of injectors is cut one after another during idling, check each cylinder for the following:
 - Injector and harness

Ignition plug and high tension cable

Compression pressure

4. If the injection system is OK but the injector drive time is out of specification, check for the following items.
 - Poor combustion in the cylinder. (faulty ignition plug, ignition coil, compression pressure and etc.)
 5. The MIL is on or the DTC is displayed on the SCAN TOOL under the following condition.
 - When the injector itself is faulty.
-



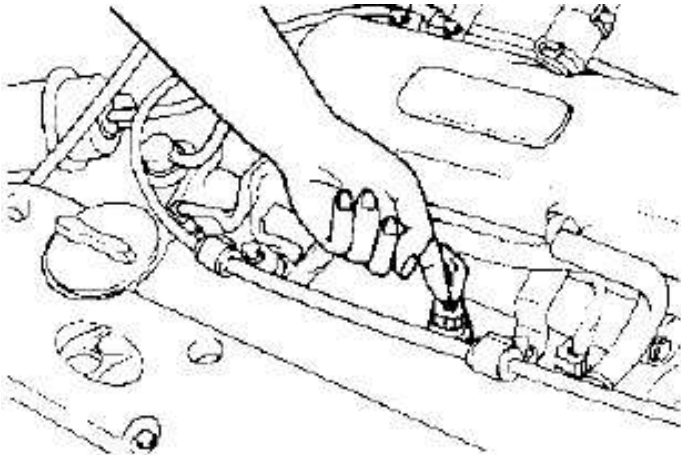
INSPECTION

1. Operation Sound Check

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

NOTE

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 available, check the injector operation with your finger. If no vibrations are felt, check the wiring connector, injector, or injection signal from ECM.

3. Resistance Measurement Between Terminals

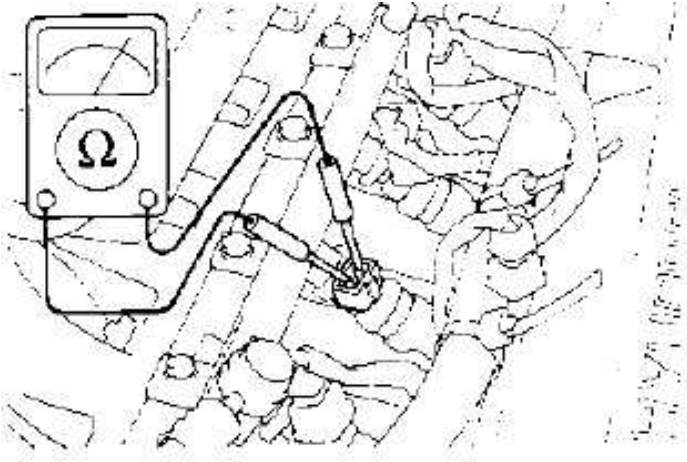
Disconnect the connector at the injector.

4. Measure the resistance between terminals.

SPECIFICATION

Standard value $15.9 \pm 0.35 \Omega$ [at 20°C (68°F)]

5. If the resistance is not within specification, replace the injector.



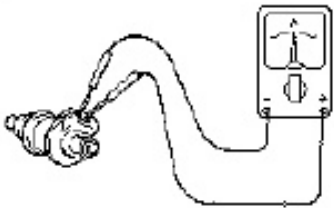
INSPECTION

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

SPECIFICATION

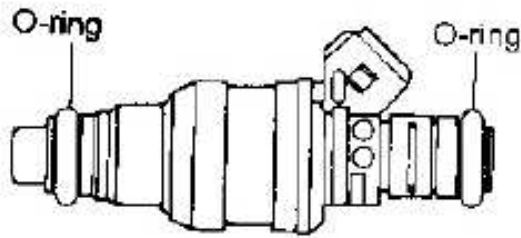
Resistance $15.9 \pm 0.35 \Omega$ [at 20°C 68°F]

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



INSTALLATION

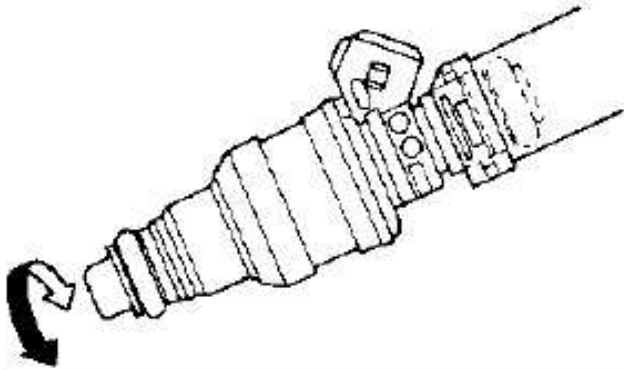
1. Install a new grommet and O-ring to the injector.
2. Apply a coating of solvent, spindle oil gasoline to the O-ring of the injector.



3. While turning the injector to the left and right, install it on to the delivery pipe.
4. Be sure the injector turns smoothly.

NOTE

If it does not turn smoothly, the O-ring may be jammed; remove the injector and re-insert it into the delivery pipe and re-check.



REMOVAL

1. Release residual pressure from the fuel line to prevent fuel from spilling.

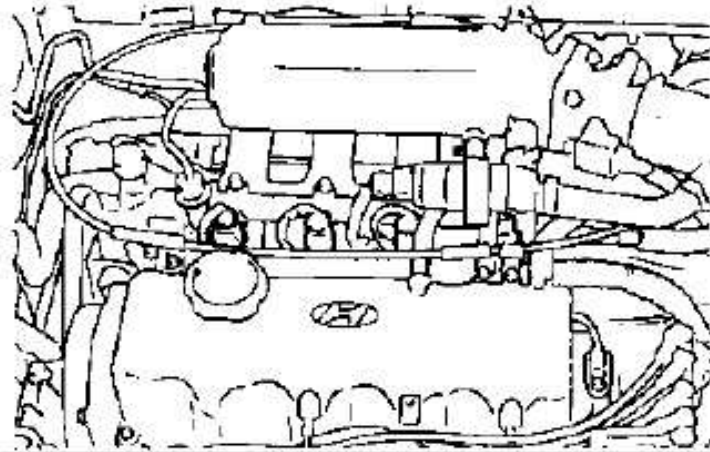
CAUTION

Cover the hose connection with rags to prevent splashing of fuel that could be caused by residual pressure in the fuel line.

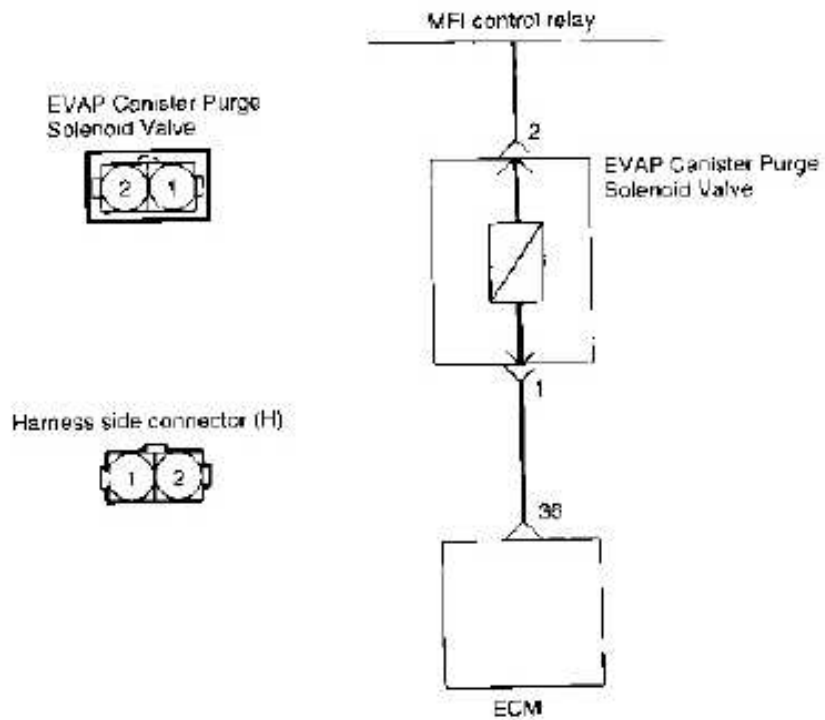
2. Remove the delivery pipe with fuel injector and pressure regulator.

CAUTION

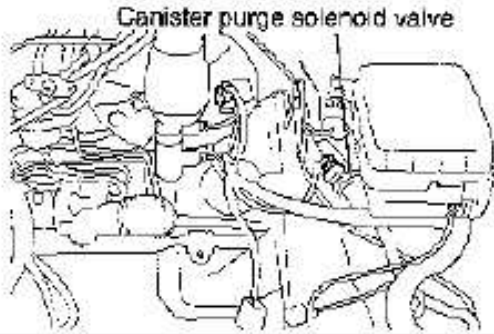
1. Be careful not to drop any injectors when removing the delivery pipe.
2. Be aware that fuel may flow out when removing the injector.



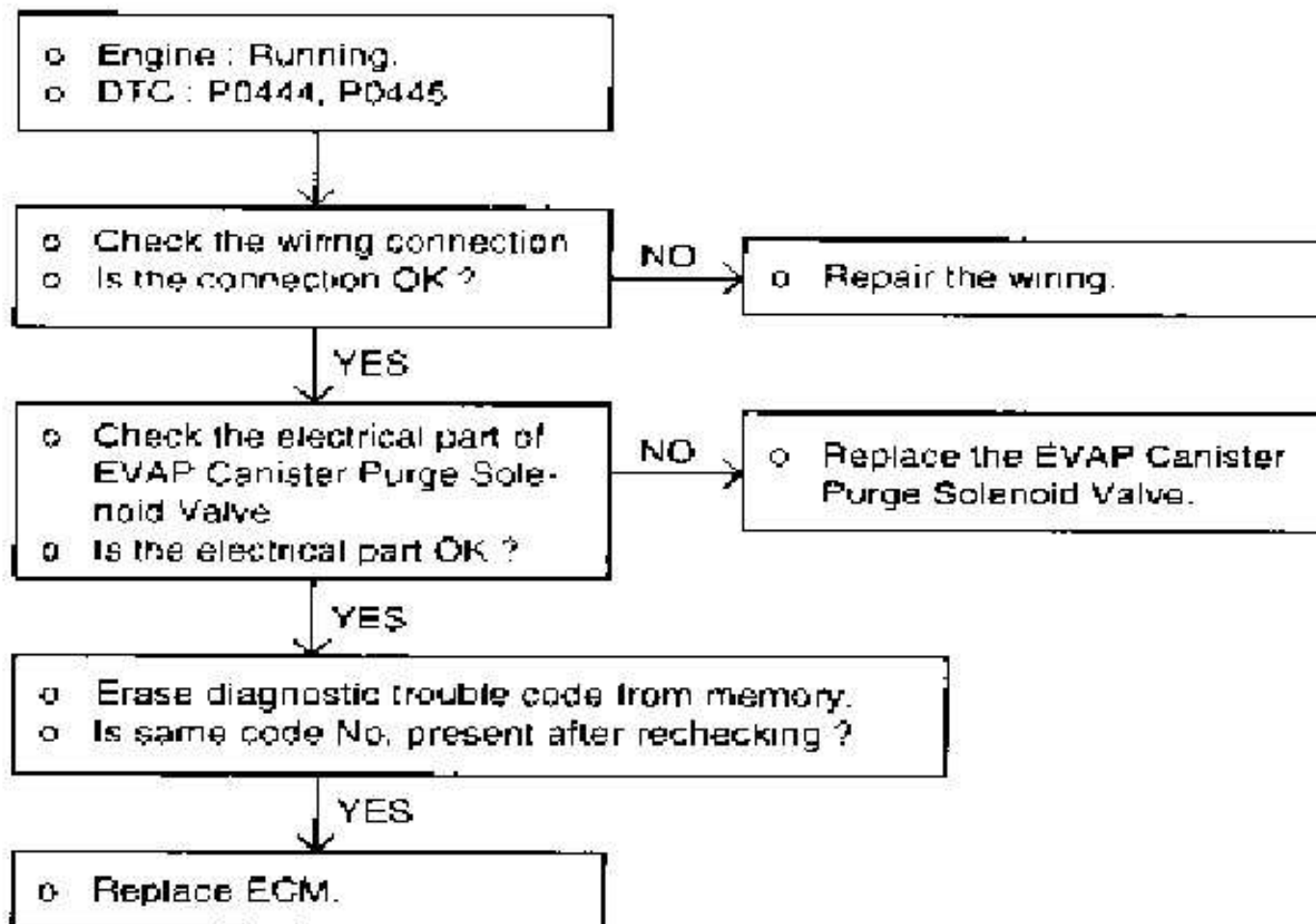
CIRCUIT DIAGRAM



The evaporative emission canister purge solenoid valve is a duty control type, which controls introduction of purge air from the evaporative emission canister.

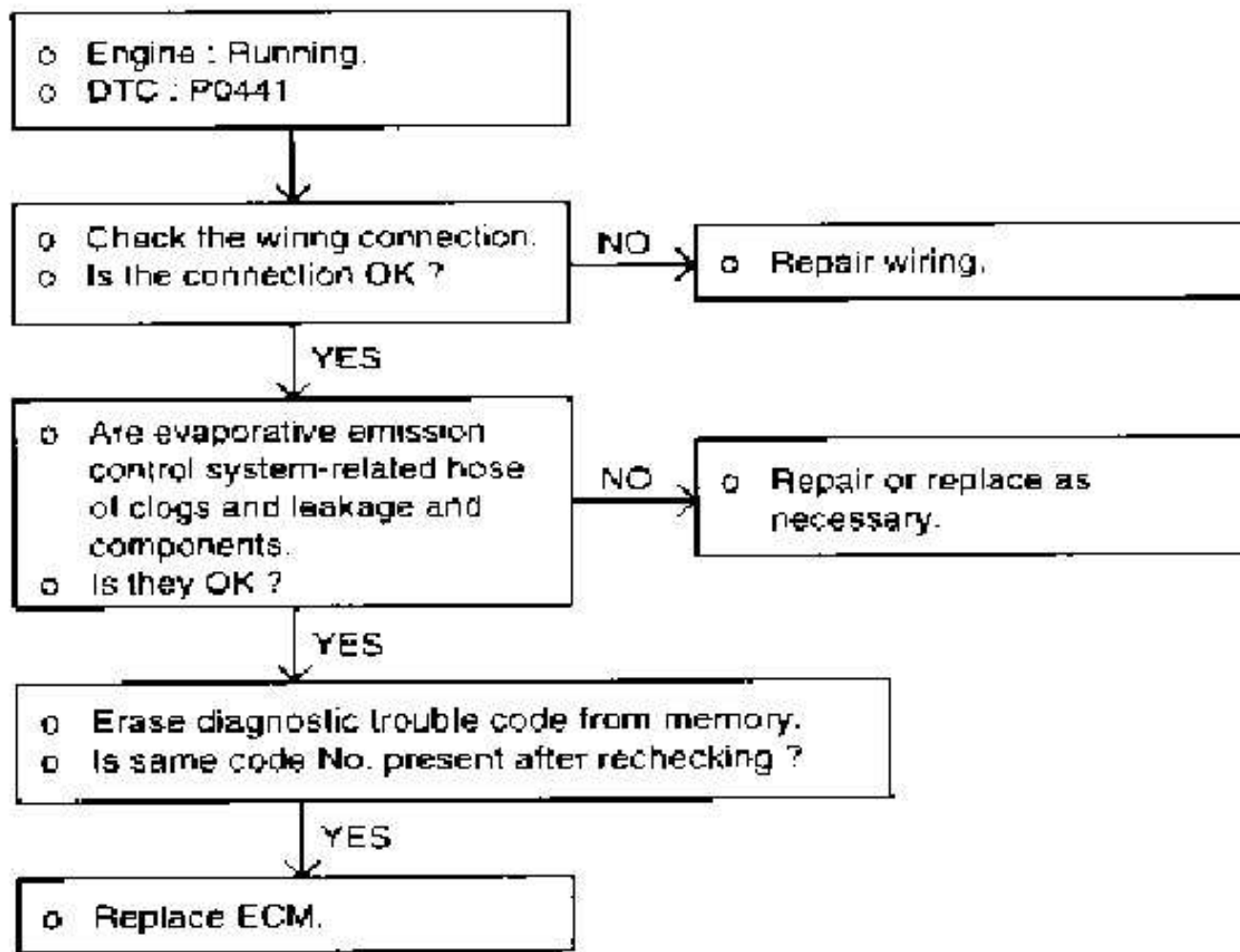


DTC - P0441, P0444, P0445



TROUBLESHOOTING HINTS

Open or short circuit is observed in purge solenoid valve (High) system when ignition switch is turned on.

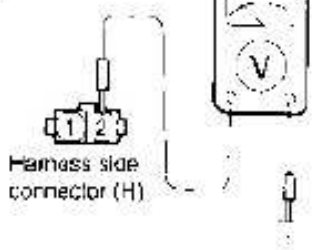
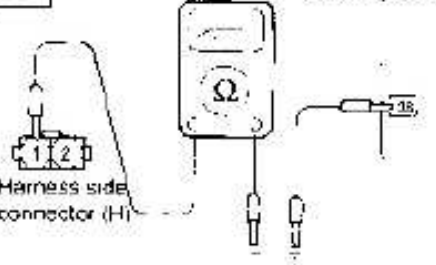


DTC : Diagnosis Trouble Code
ECM : Engine Control Module

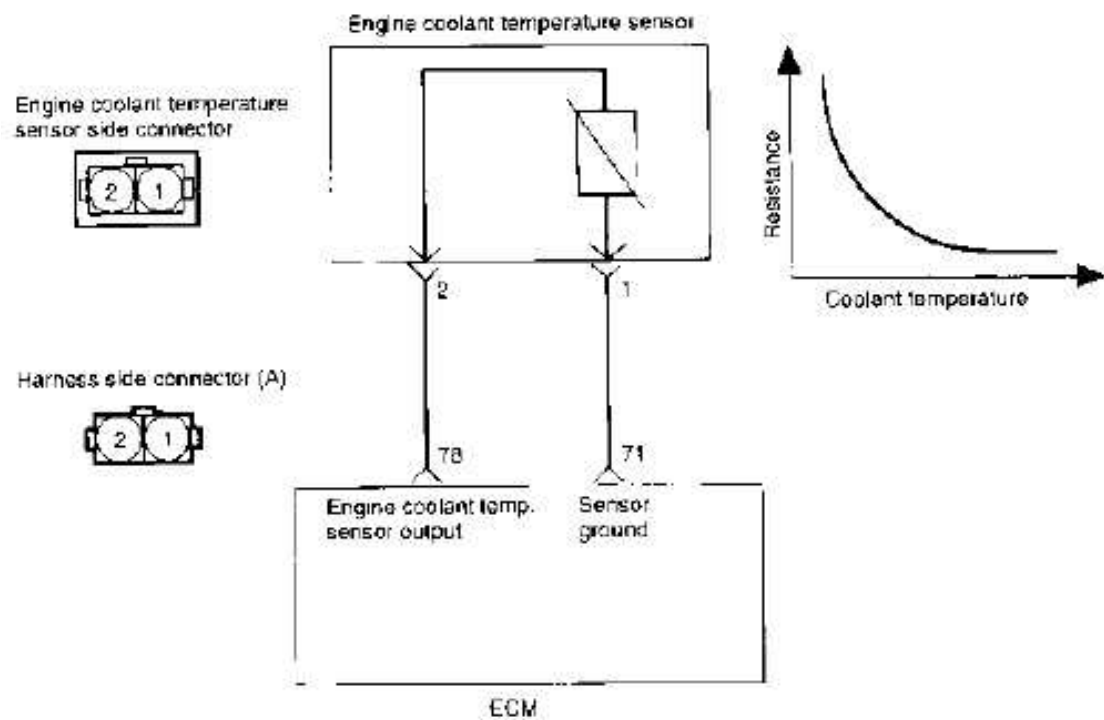
TROUBLESHOOTING HINTS

Evaporative emission control system does not function normally because of mechanical trouble.

HARNESS INSPECTION

<p>1</p> 	<p>Measure the power supply voltage.</p> <ul style="list-style-type: none"> Connector : Disconnected. Ignition switch : ON Voltage : Battery voltage. 	<p>OK ⇒ 2</p> <p>NG ⇒ Repair the harness. (MFI control relay-H2)</p>
<p>2</p> 	<p>Check for an open-circuit, or a short-circuit to ground between the evaporative emission canister purge solenoid valve and the engine control module.</p> <ul style="list-style-type: none"> Engine control module connector : Disconnected. Evaporative emission canister purge solenoid valve connector : Disconnected. 	<p>OK ⇒ END !</p> <p>NG ⇒ Repair the harness. (H1-36)</p>

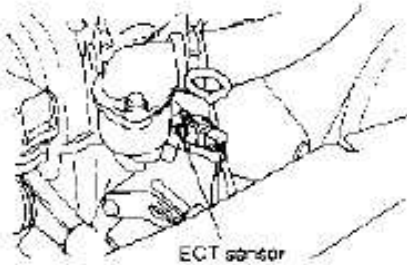
CIRCUIT DIAGRAM



ECM harness side connector

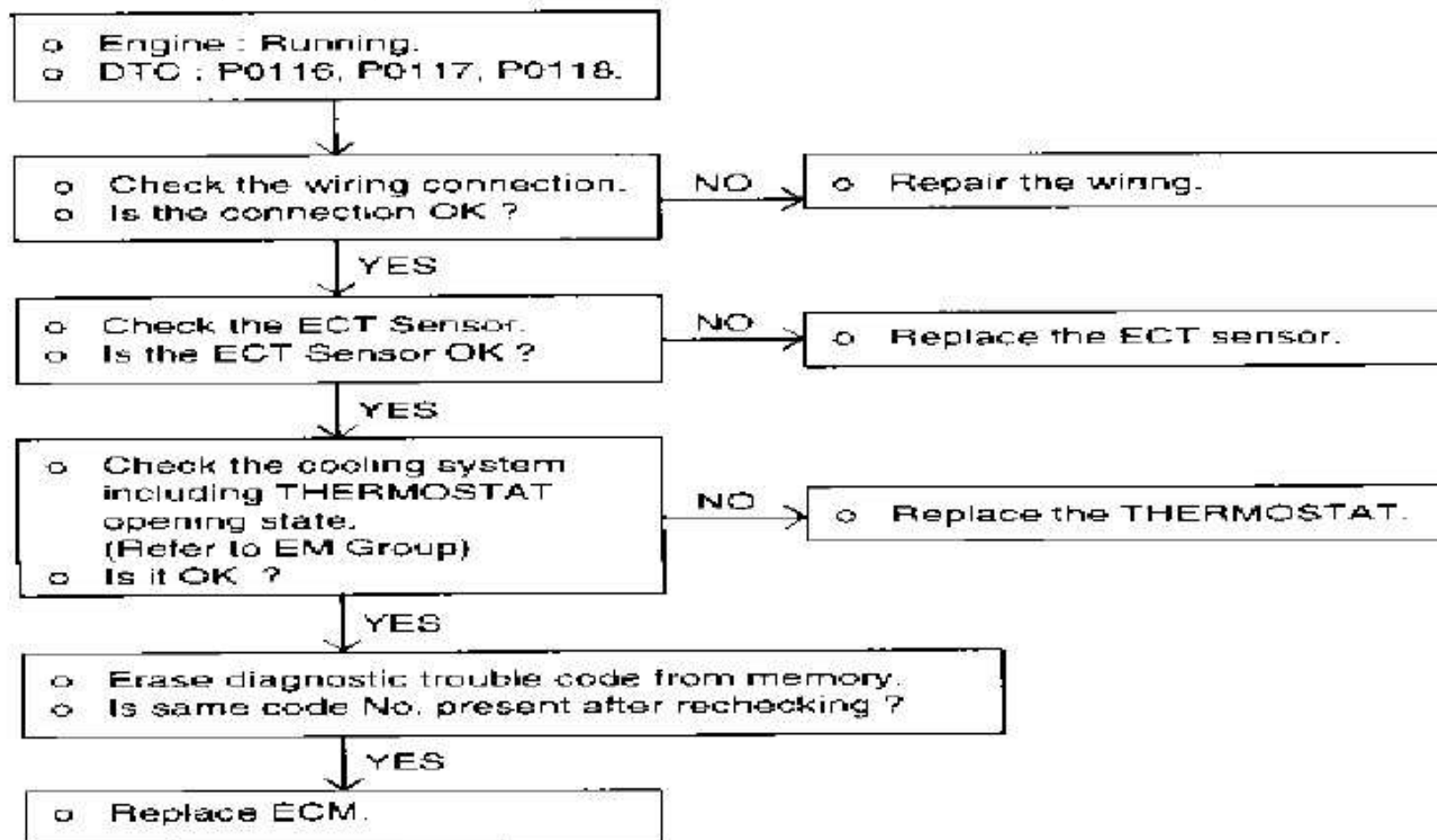
Description

The engine coolant temperature sensor is installed in the engine coolant passage of the cylinder head. It detects engine coolant temperature and emits signals to the ECM. This part employs a Thermistor which is sensitive to changes in temperature. The electric resistance of a Thermistor decreases in response to temperature rise. The ECM judges engine coolant temperature by the sensor output voltage and provides optimum fuel enrichment when the engine is cold.



ECT sensor

DTC - P0116, P0117, P0118 (ECT SENSOR)



DTC : Diagnosis Trouble Code

ECM : Engine Control Module

ECT : Engine Coolant Temperature

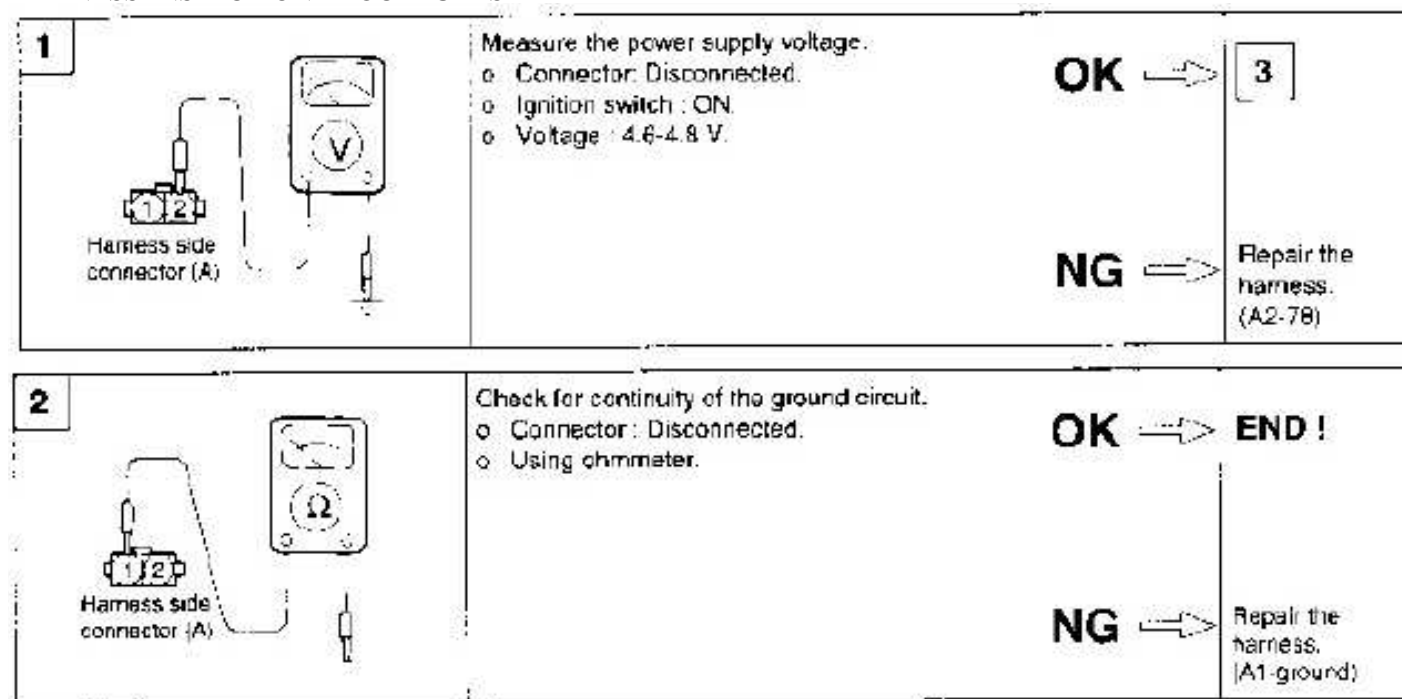
TROUBLESHOOTING HINTS

If the fast idle speed is not enough or the engine gives off dark smoke during the engine warm-up operation, it might be caused by the engine coolant temperature sensor.

USING VOLTMETER

Check item	Coolant temperature	Test specification
Engine coolant temperature sensor output voltage (ECT Sensor side connector No.2 or ECM harness side connector No.78)	When 0°C	4.05 V
	When 20°C	3.44 V
	When 40°C	2.72 V
	When 80°C	1.25 V

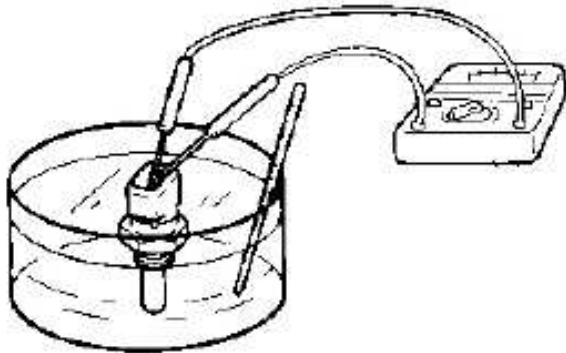
HARNESS INSPECTION PROCEDURES



SENSOR INSPECTION

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

Temperature °C(°F)	Resistance (kΩ)
-30 (-22)	22.22-31.78
-10 (14)	8.16-10.74
0 (32)	5.18-6.60
20 (68)	2.27-2.73
40 (104)	1.059-1.281
60 (140)	0.538-0.650
80 (176)	0.298-0.322
90 (194)	0.219-0.243



3. If the resistance deviates greatly from the standard value, replace the sensor.

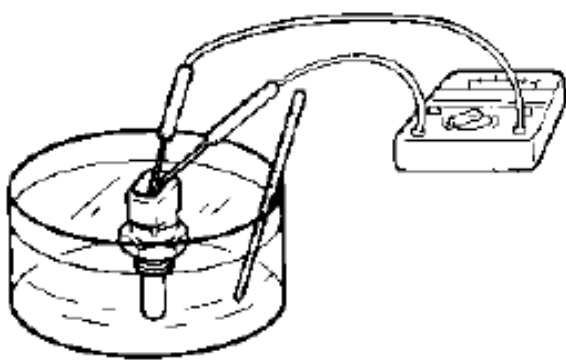
Coolant Temperature Sensor

1. Heat the sensor by submerging it in hot water.
2. Check that the resistance is within the specified range.

RESISTANCE SPECIFICATION

At 20°C (68°F) 2.21-2.69 Ohm

At 80°C (176°F) 290-354 Ohm



INSTALLATION

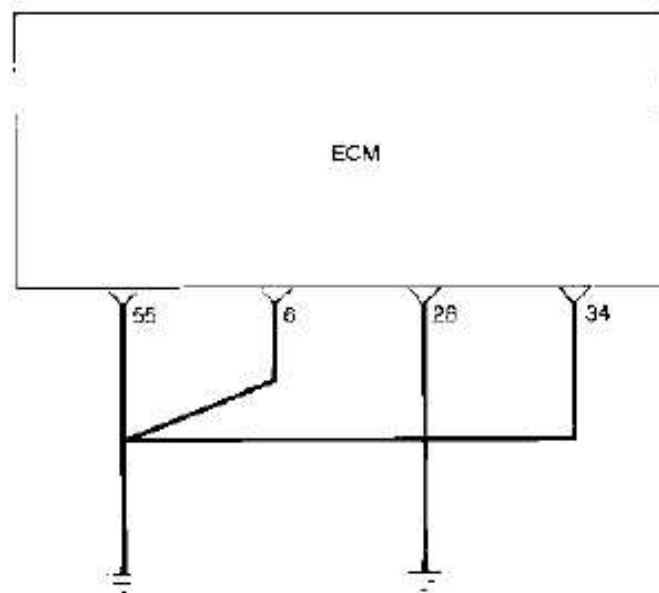
1. Apply sealant LOCTITE 962T or equivalent to threaded portion.
2. Install engine coolant temperature sensor and tighten it to specified torque.

TORQUE SPECIFICATION

Engine coolant temperature sensor 15-20 Nm 150-200 kg·cm 11-15 lb·ft

3. Connect the harness connector securely.
-

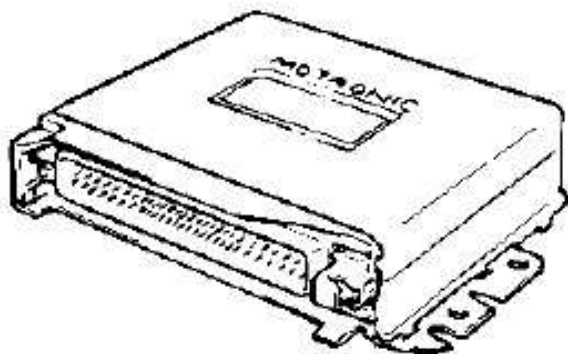
CIRCUIT DIAGRAM



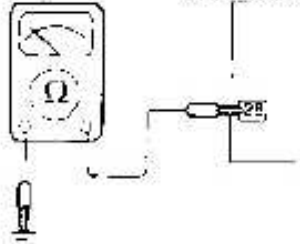
ECM harness side connector

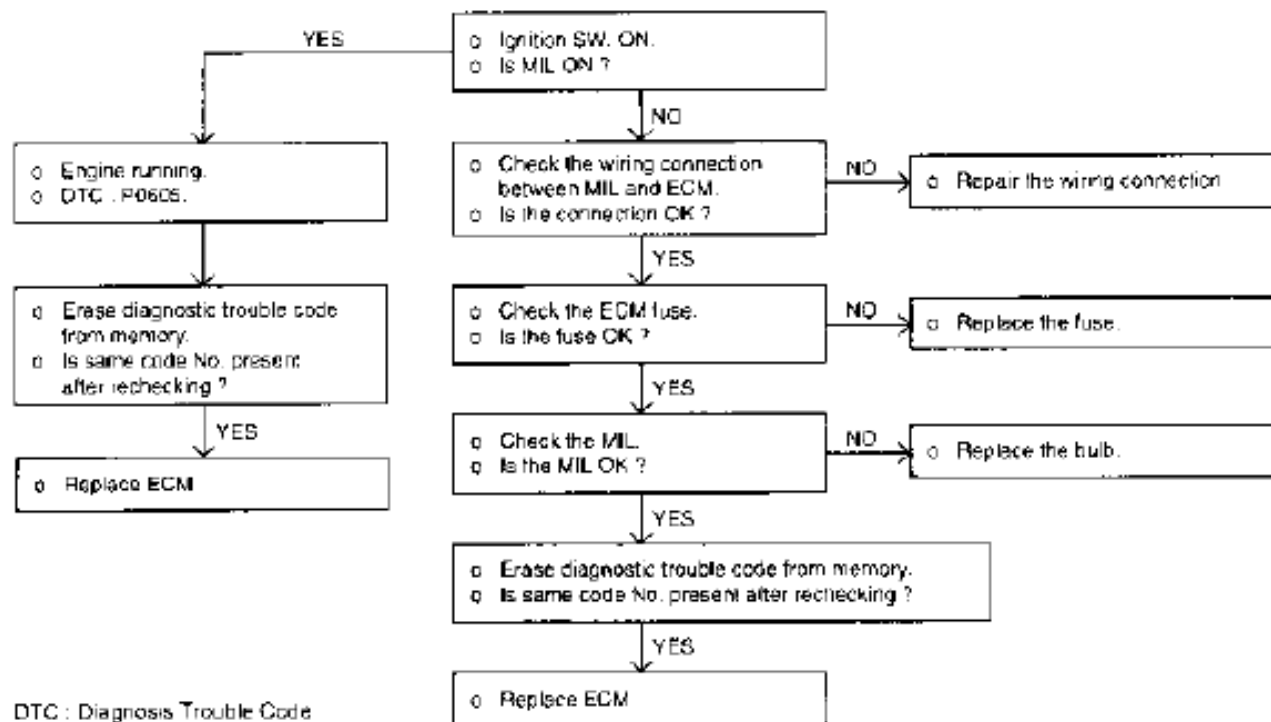
Description

Check the internal control module ROM/RAM error.



HARNESS INSPECTION PROCEDURE

<p>1</p> 	<p>Check for continuity of the ground circuit.</p> <ul style="list-style-type: none">□ ECM connector . Disconnected.	<p>OK ⇒</p> <p>NG ⇒</p>	<p>END !</p> <p>Repair the harness</p>
--	--	---------------------------------------	---

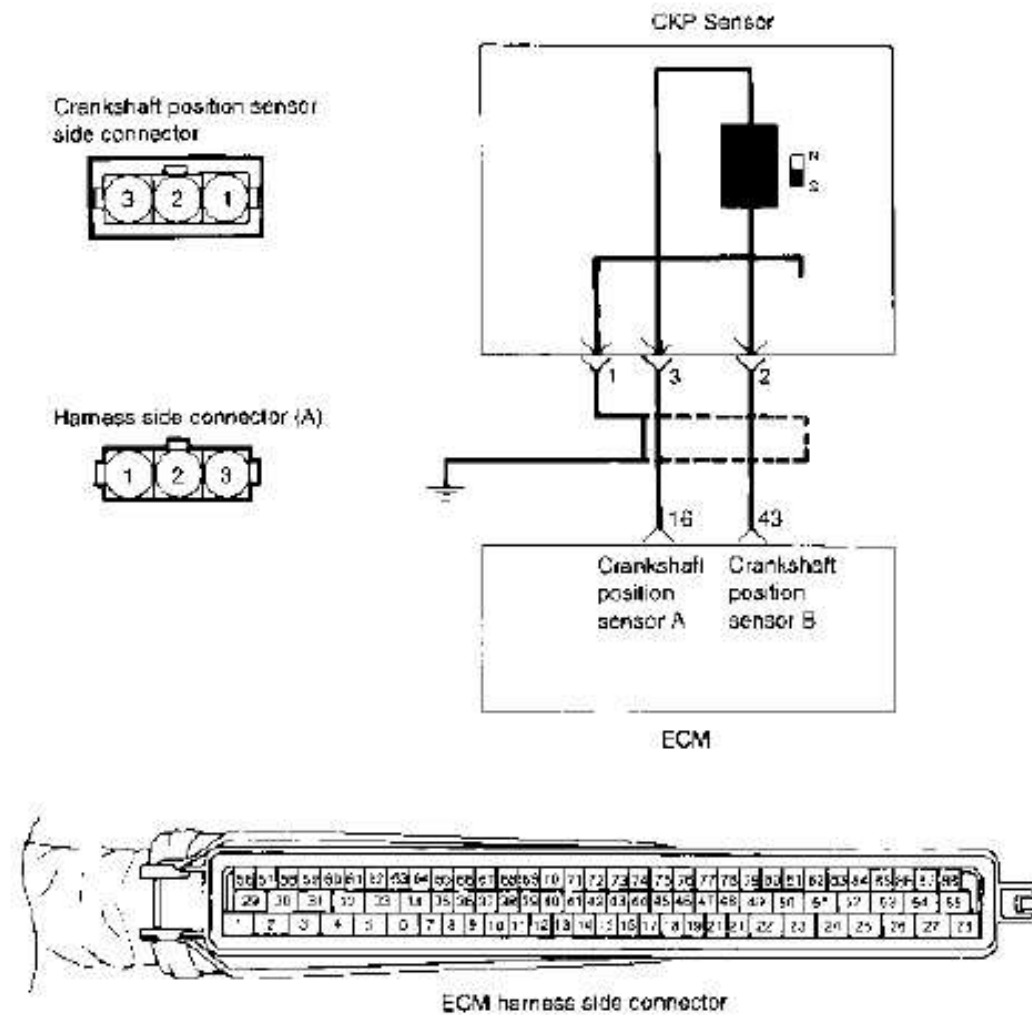


DTC : Diagnosis Trouble Code
ECM : Engine Control Module
MIL : Malfunction Indicator Light

TROUBLESHOOTING HINTS

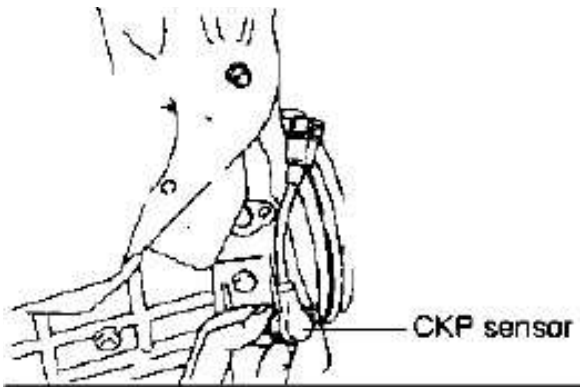
- If the ground wire of the ECM is not connected securely to ground, the ECM will not operate correctly.
- If we replace ECM ROM without further diagnosis, the problem may reoccur.

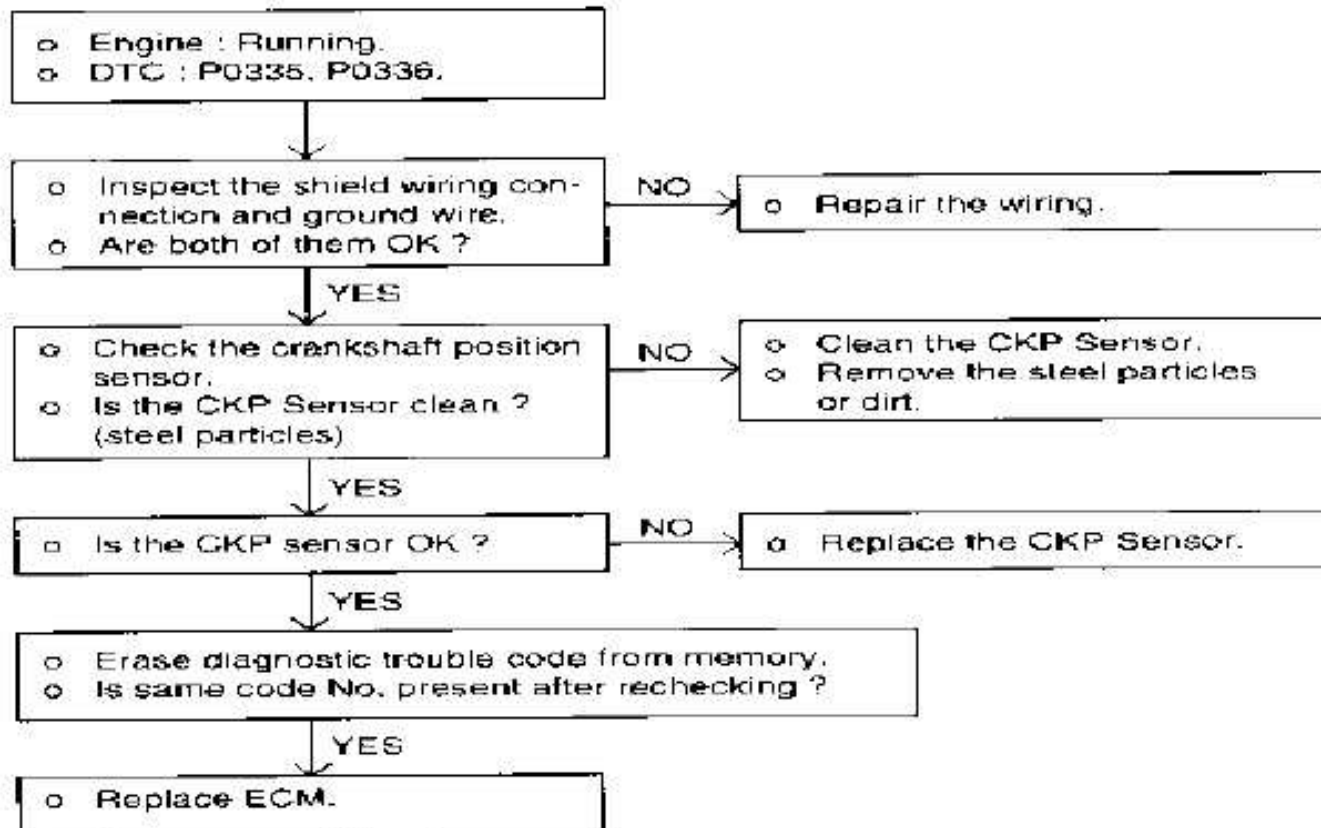
CIRCUIT DIAGRAM



DESCRIPTION

The crankshaft position sensor which consists of a magnet and coil is installed on the flywheel. The voltage signal from this crankshaft position sensor is provided to the ECM for detecting the engine RPM and position of crankshaft.

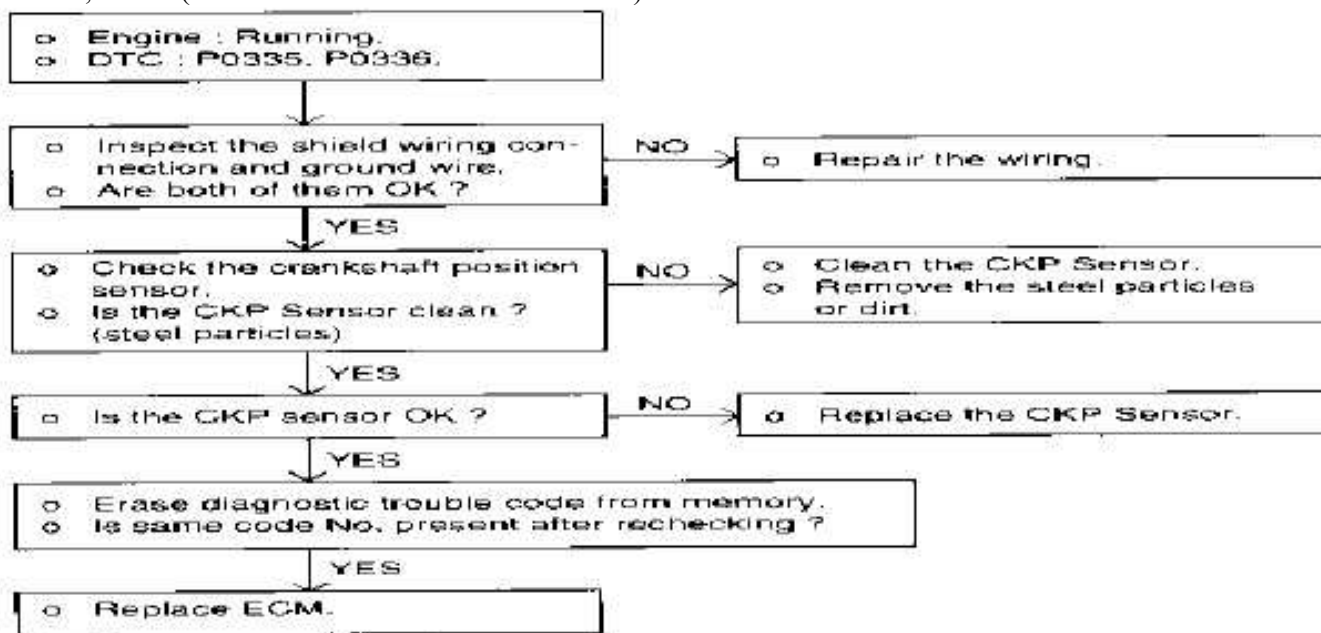




DTC : Diagnosis Trouble Code
ECM : Engine Control Module
CKP : Crankshaft Position Sensor

1. If unexpected misses are felt during driving or the engine stalls suddenly, shake the crankshaft position sensor harness. If this causes the engine to stall, check for poor contact at the sensor connector.
 2. If the tachometer reads 0 rpm when the engine is cranked, check for faulty crankshaft position sensor or ignition system problems.
 3. If the tachometer reads 0 rpm when the engine is cranked and it does not start, ignition coil, power TR, or an ECM defect can be considered.
 4. Engine can be stalled when the crankshaft position sensor cable is close to the high voltage cable due to the electronic noise caused by the high voltage induced.
-

DTC - P0335, P0336 (CRANKSHAFT POSITION SENSOR)



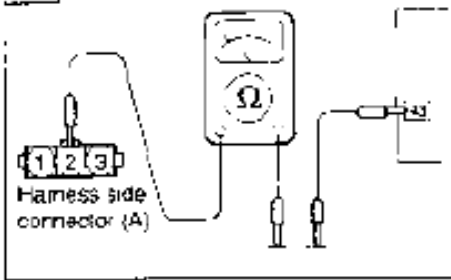
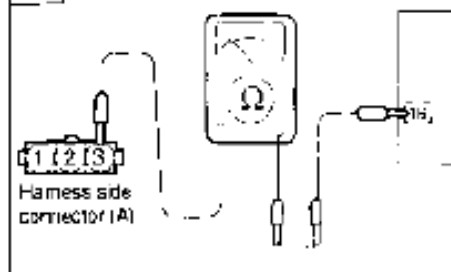
DTC : Diagnosis Trouble Code
 ECM : Engine Control Module
 CKP : Crankshaft Position Sensor

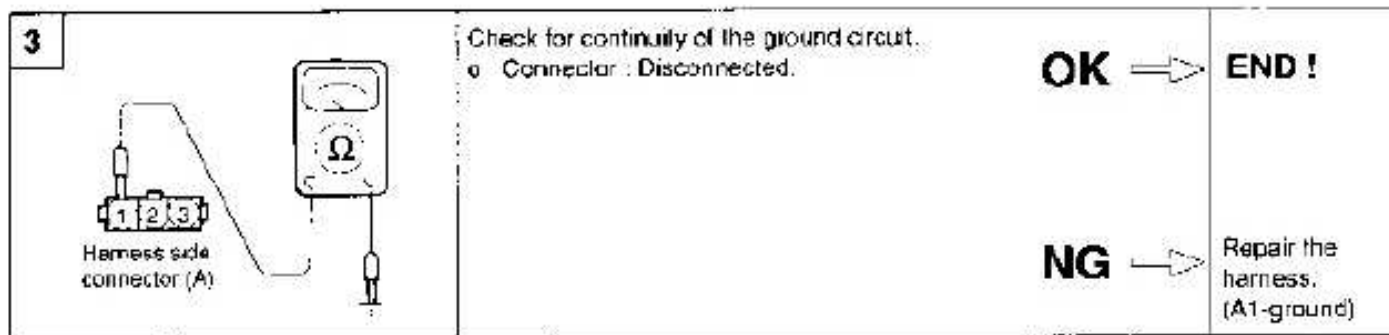
TROUBLESHOOTING HINTS

1. If unexpected misses are felt during driving or the engine stalls suddenly, shake the crankshaft position sensor harness. If this causes the engine to stall,

2. If the tachometer reads 0 rpm when the engine is cranked, check for faulty crankshaft position sensor or ignition system problems.
3. If the tachometer reads 0 rpm when the engine is cranked and it does not start, ignition coil, power TR, or an ECM defect can be considered.
4. Engine can be stalled when the crankshaft position sensor cable is close to the high voltage cable due to the noise caused by the high voltage induced.

HARNESS INSPECTION PROCEDURE

<div data-bbox="126 346 188 404">1</div>  <p>ECM harness side connector</p> <p>Harness side connector (A)</p>	<p>Check for an open-circuit, or a short-circuit to ground between the ECM and the crankshaft position sensor.</p> <ul style="list-style-type: none"> o ECM connector : Disconnected. o Crankshaft position sensor connector : Disconnected. <p>OK ⇒</p> <p>NG ⇒</p>	<div data-bbox="1328 346 1400 433">2</div> <p>Repair the harness. (A2-43)</p>
<div data-bbox="126 703 188 761">2</div>  <p>ECM harness side connector</p> <p>Harness side connector (A)</p>	<p>Check for an open-circuit, or a short-circuit to ground between the ECM and the crankshaft position sensor.</p> <ul style="list-style-type: none"> o ECM connector : Disconnected. o Crankshaft position sensor connector : Disconnected. <p>OK ⇒</p> <p>NG ⇒</p>	<div data-bbox="1328 703 1400 790">3</div> <p>Repair the harness. (A3-16)</p>



SENSOR INSPECTION

1. Disconnect the crankshaft position sensor connector.
2. Measure the resistance between terminals 2 and 3.

SPECIFICATION

Standard value 0.486-0.594 k Ω at 20°C (68°F)

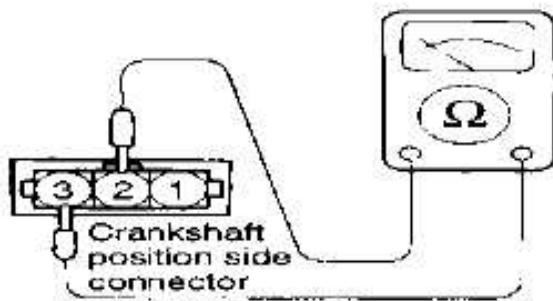
3. If the resistance deviates far from the standard value, replace the sensor.

MEASUREMENT SPECIFICATION

Clearance between the crankshaft position sensor and crankshaft position sensor wheel. 0.5-1.5mm 0.020-0.059in

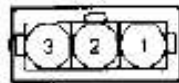
TORQUE SPECIFICATION

Crankshaft position sensor 9-11 Nm 90-110 kg·cm 6.6-8.1 lb·ft

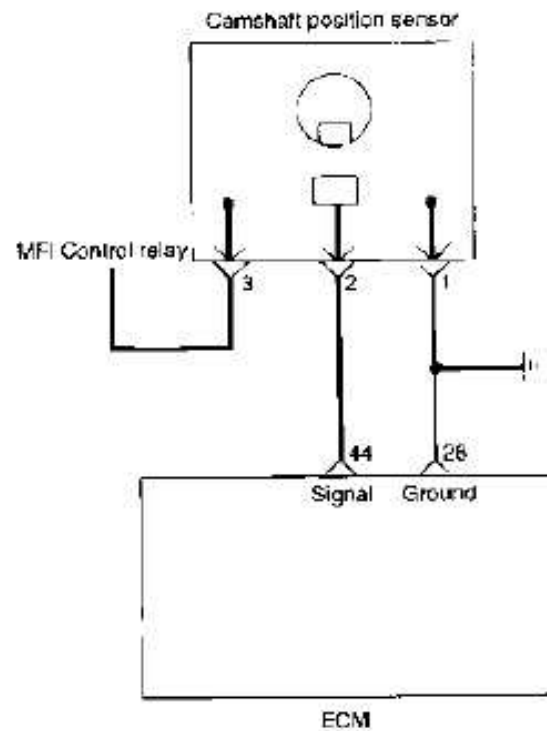


CIRCUIT DIAGRAM

Camshaft position sensor side connector



Harness side connector (A)



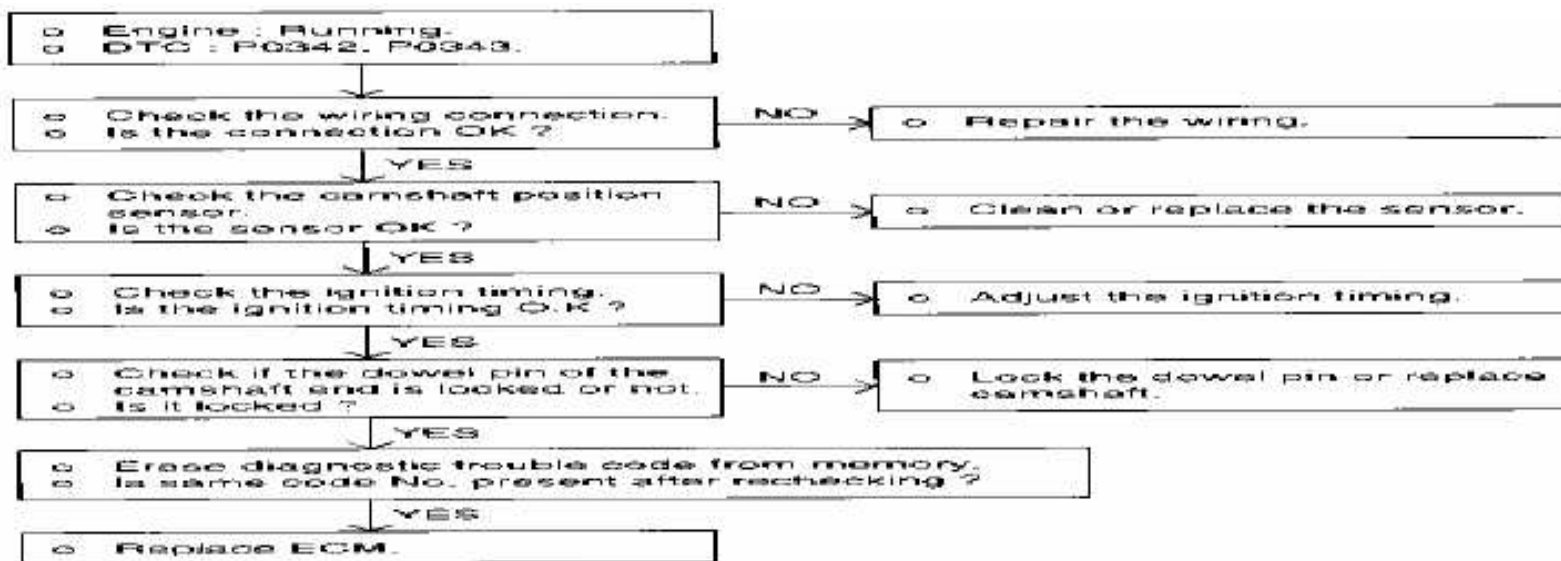
ECM harness side connector

DESCRIPTION

Camshaft position sensor (CMP Sensor) senses the TDC point of No.1 cylinder in its compression stroke, whose signals are fed to ECM to be used to determine the sequence of fuel injection.



DTC - P0342, P0343 (CMP SENSOR)



DTC : Diagnosis Trouble Code
ECM : Engine Control Module

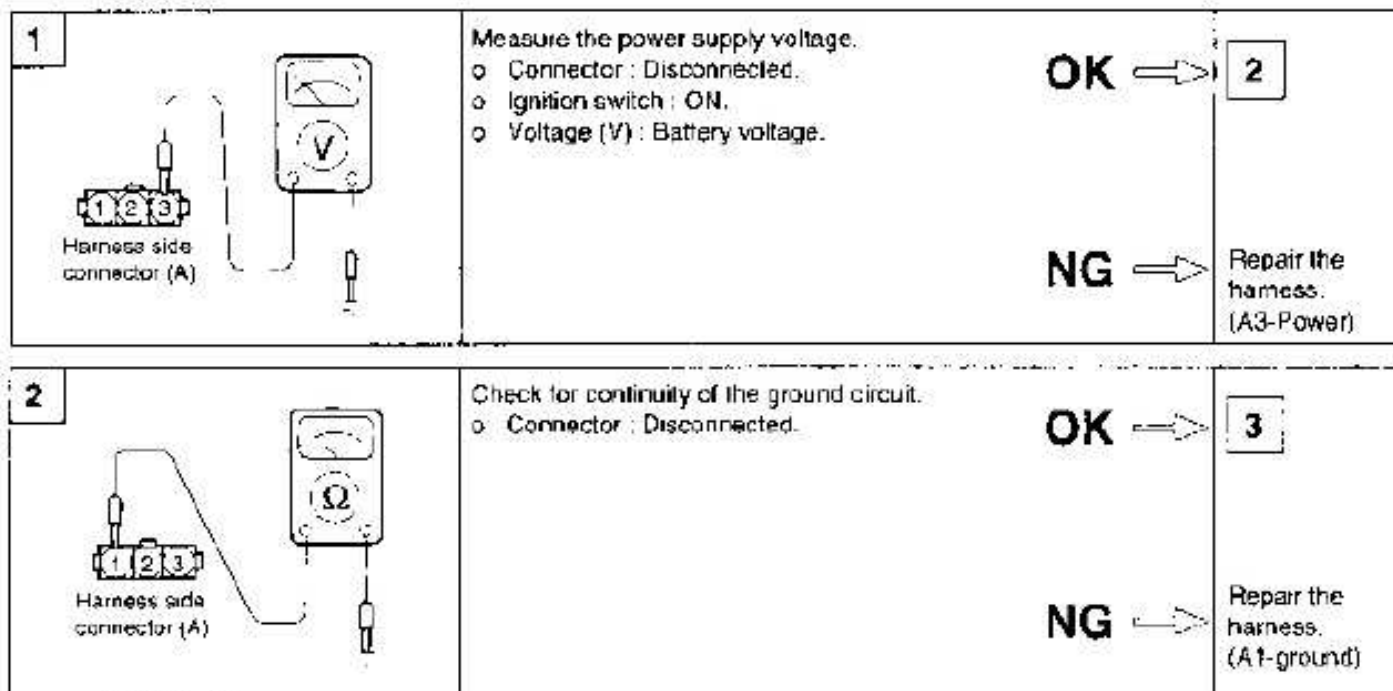
TROUBLESHOOTING HINTS

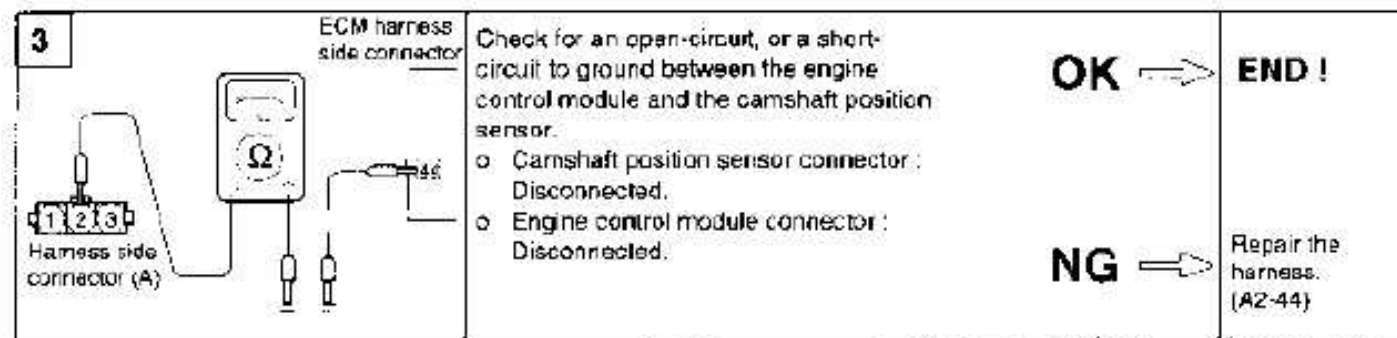
If the camshaft position sensor does not operate correctly (that is, if correct sequential injection is not made), the engine may stall or run irregularly at idle or fail to accelerate normally.

USING VOLTMETER

Check item	Check condition	Test specification
Camshaft position sensor output voltage (Camshaft position sensor side connector No.2 or ECM harness side connector No.44)	At idle (800 rpm)	0-5 V
	3000 rpm	0-5 V

HARNESS INSPECTION PROCEDURES



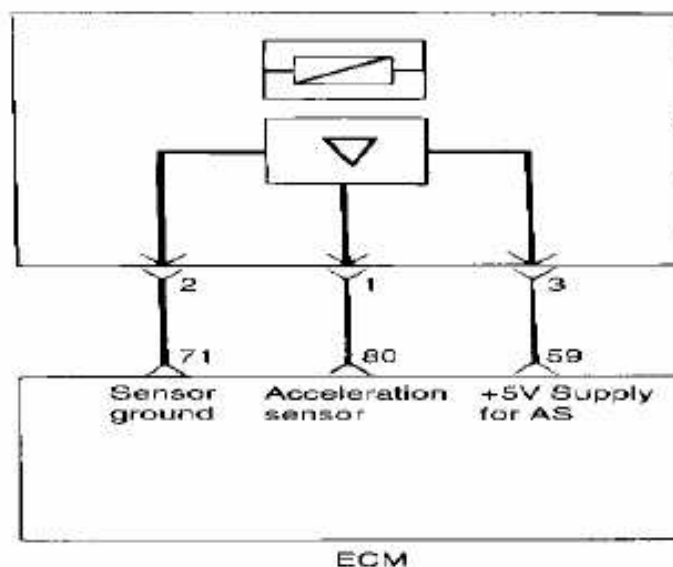


CIRCUIT DIAGRAM

Acceleration sensor side connector

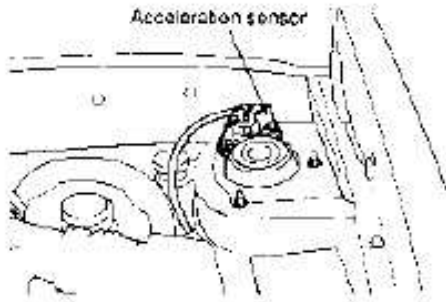


Harness side connector (A)

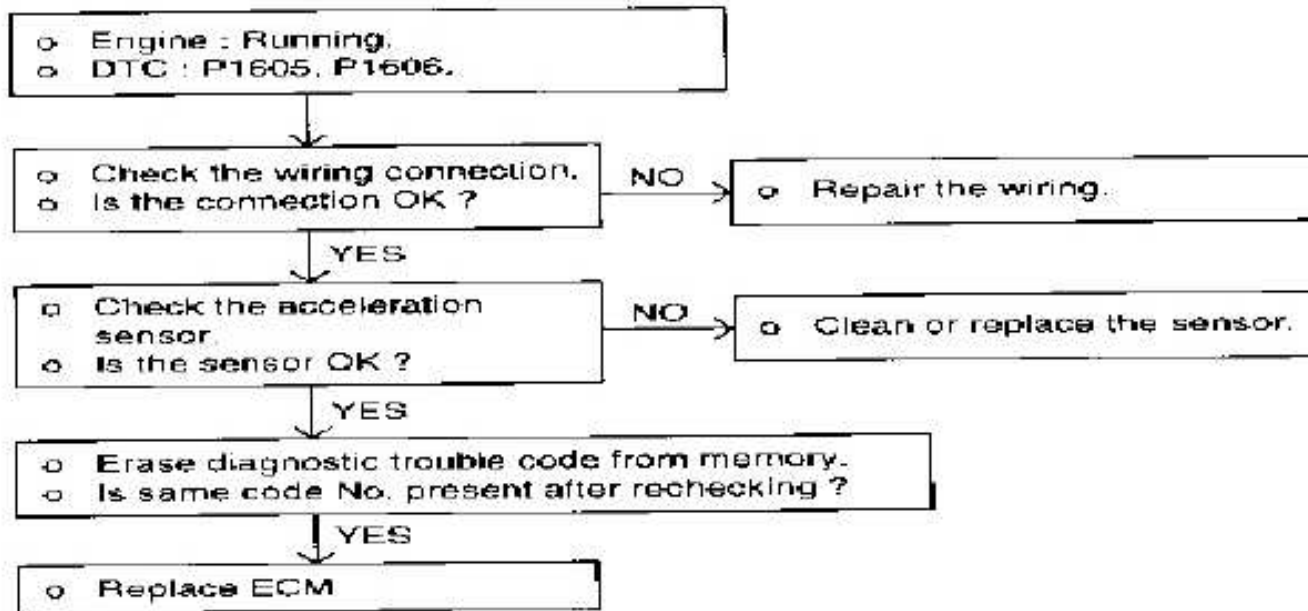


DESCRIPTION

The acceleration sensor is attached to the engine room of driver's side. While driving, the rough road condition is sensed by the acceleration sensor and the ECM uses this input signal to avoid the wrong misfire detection.



DTC - P1605, P1606 (ACCELERATION SENSOR)



DTC : Diagnosis Trouble Code
ECM : Engine Control Module

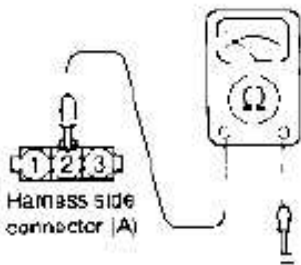
TROUBLESHOOTING HINTS

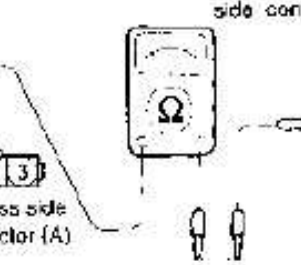
When abnormal output voltage occurs at stop position of vehicle or acceleration sensor is operated beyond normal operating zone.

USING VOLTMETER

Check item	Check condition	Test specification
Acceleration sensor output voltage (acceleration sensor side connector No.1 or ECM harness side connector No. 80)	While idling	2.3 - 2.7V
	While driving	0.5 - 4.5V

HARNESS INSPECTION PROCEDURES

<div data-bbox="126 147 188 227">1</div>  <p>Harness side connector (A)</p>	<p>Check for continuity of the ground circuit</p> <p>o Connector : Disconnected.</p>	<div data-bbox="1152 183 1317 234">OK →</div> <div data-bbox="1328 183 1400 234">2</div> <div data-bbox="1152 380 1317 430">NG →</div> <div data-bbox="1328 365 1483 467">Repair the harness. (A2-ground)</div>
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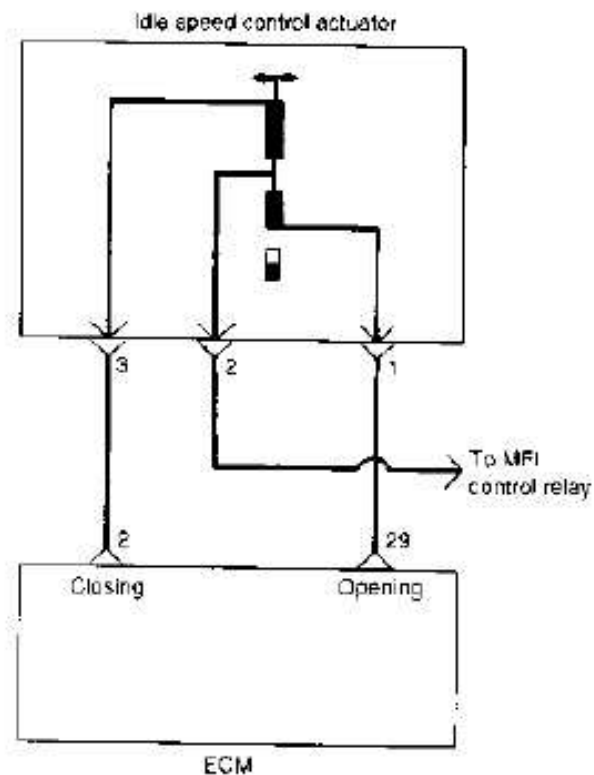
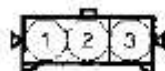
<div data-bbox="126 513 188 594">2</div>  <p>Harness side connector (A)</p> <p>ECM Harness side connector</p>	<p>Check for an open-circuit, or a short-circuit to ground between the engine control module and the acceleration sensor.</p> <p>o Acceleration sensor connector : Disconnected.</p> <p>o Engine control module connector : Disconnected</p>	<div data-bbox="1152 550 1317 601">OK →</div> <div data-bbox="1328 550 1400 601">3</div> <div data-bbox="1152 746 1317 797">NG →</div> <div data-bbox="1328 732 1483 834">Repair the harness (A1-80)</div>
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CIRCUIT DIAGRAM

Idle speed control
actuator side connector

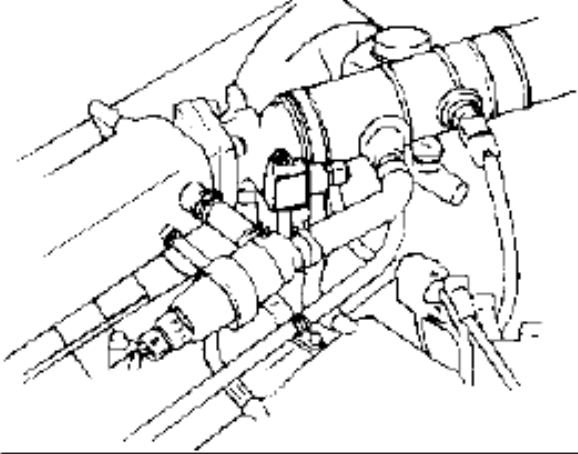


Harness side connector (A)

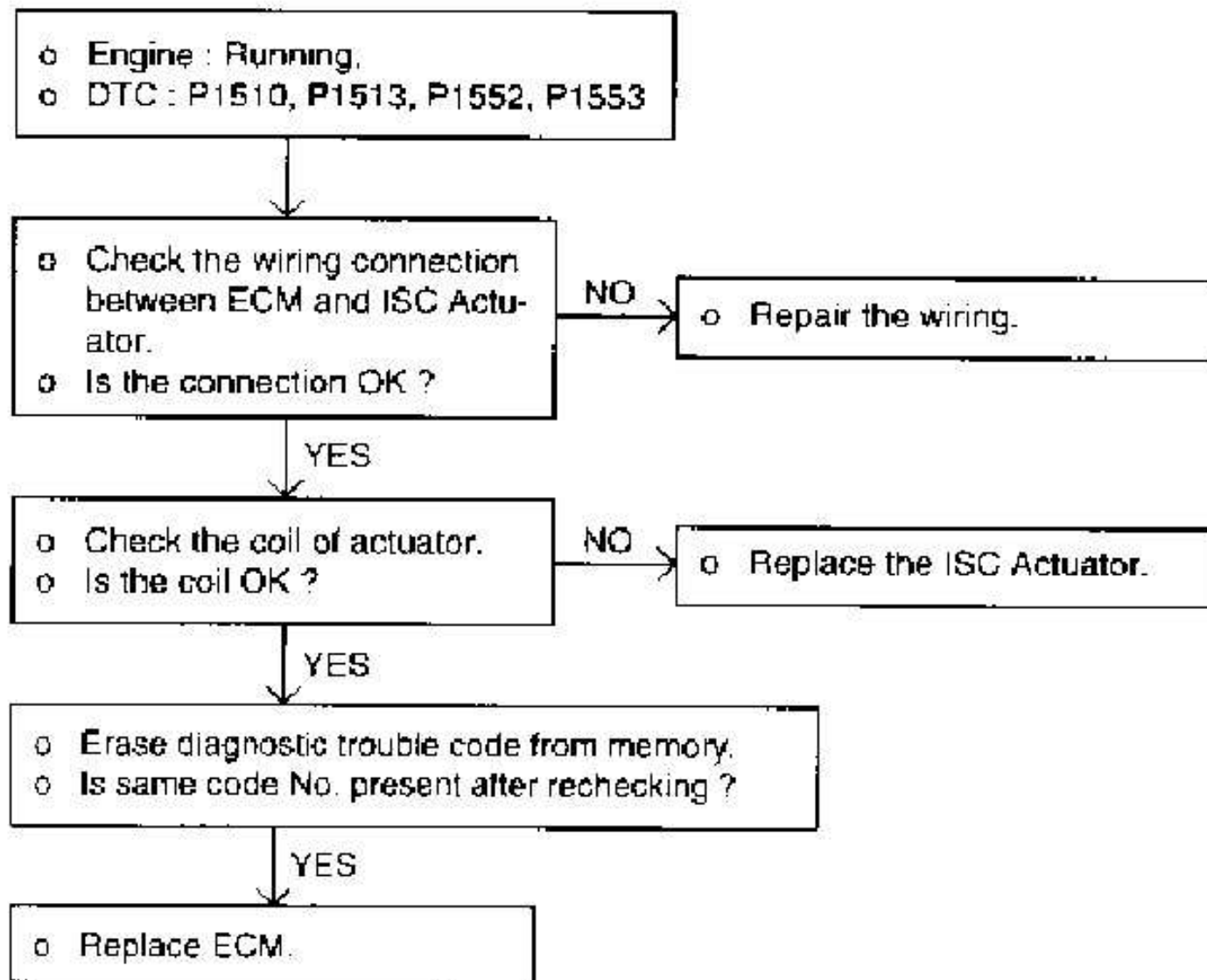


ECM harness side connector

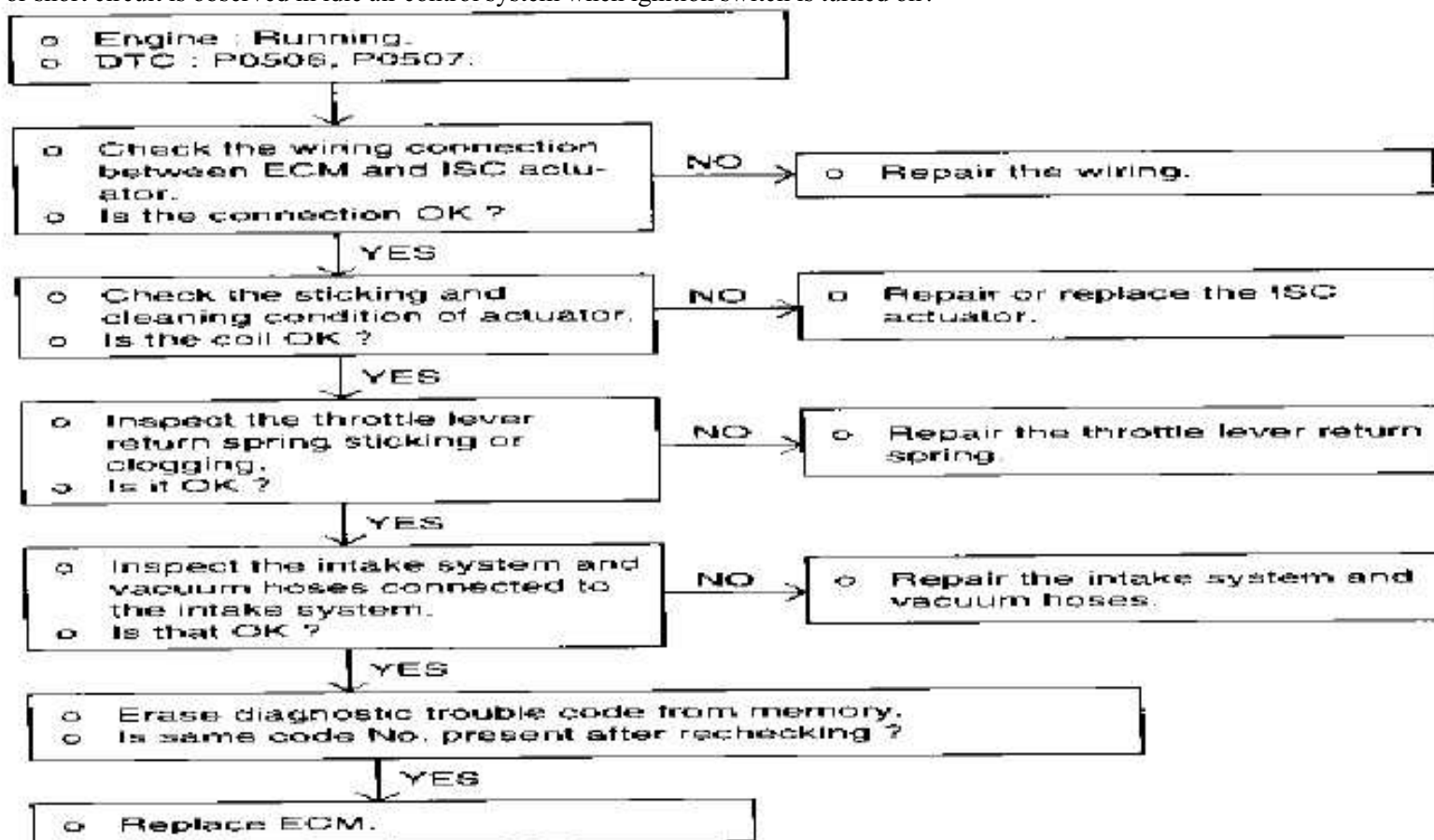
The idle speed control actuator is the double coils type and has two coils. The two coils are driven by separate driver stages in the ECM. Depending on the pulse duty factor, the equilibrium of the magnetic forces of the two coils will result in different angles of the motor. In parallel to the throttle valve, a bypass hose line is arranged where the idle speed actuator is inserted in.



DTC - P1510, P1513, P1552, P1553



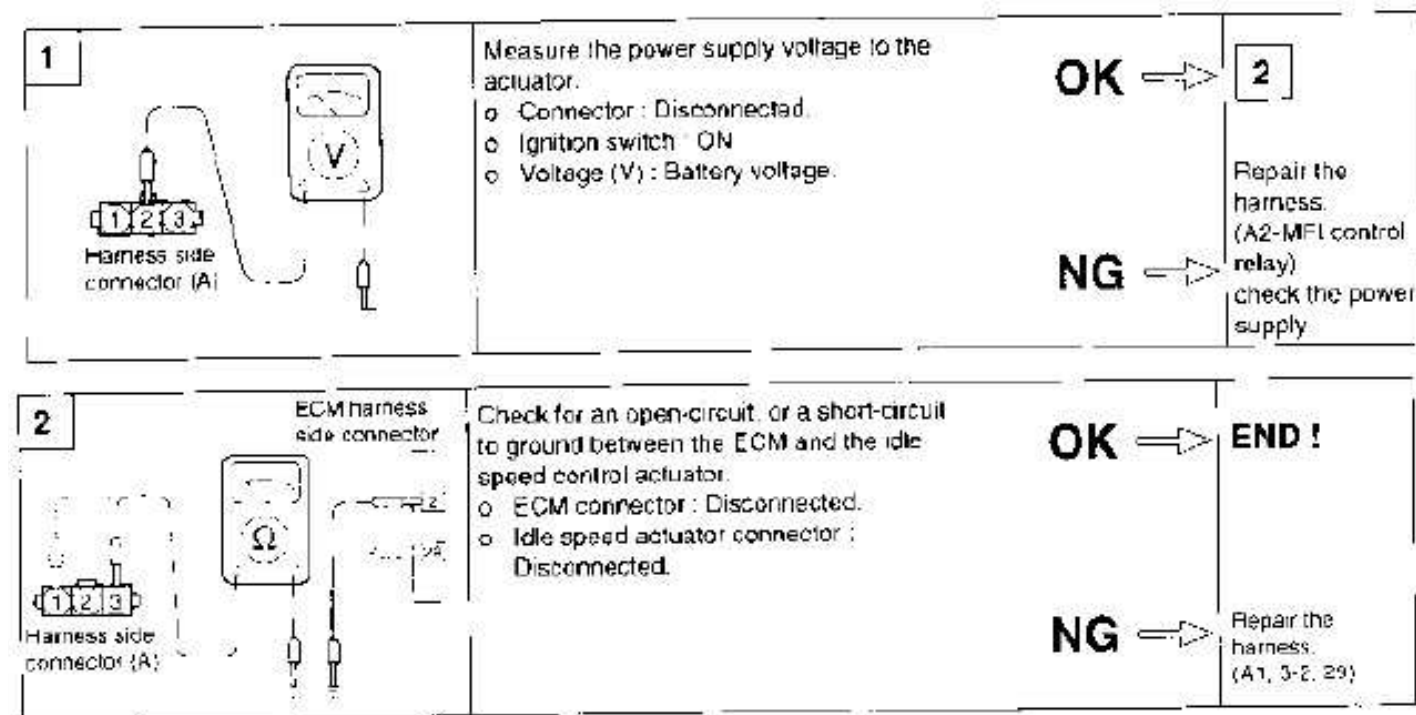
Open or short circuit is observed in idle air control system when ignition switch is turned on .



DTC : Diagnosis Trouble Code
ECM : Engine Control Module

Mechanical problems are observed in idle air control system.

HARNESS INSPECTION PROCEDURE



ACTUATOR INSPECTION

1. Disconnect the connector at the idle speed control actuator.
2. Measure the resistance between terminals.

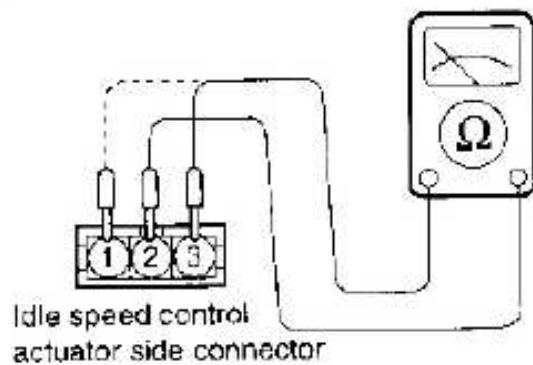
Standard value

SPECIFICATION

Terminal 1 and 2 10.5-14Ω

Terminal 2 and 3 10-12.5Ω [at 20°C (68°F)]

3. Connect the connector at the idle speed control actuator.

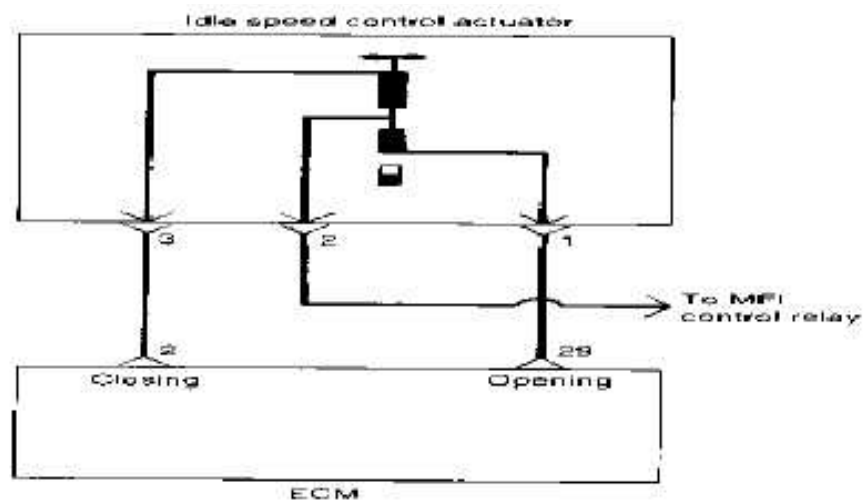


CIRCUIT DIAGRAM

Idle speed control actuator side connector

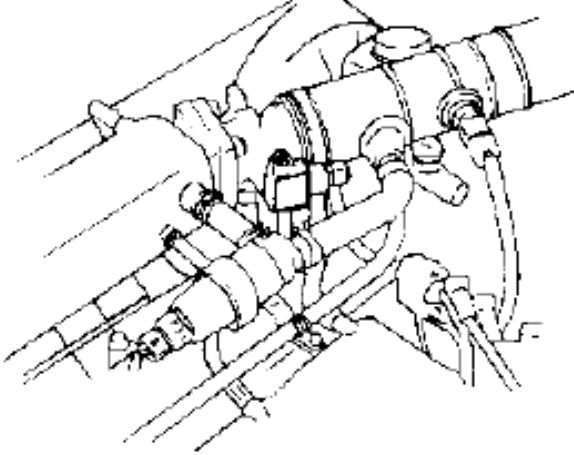


Harness side connector (A)

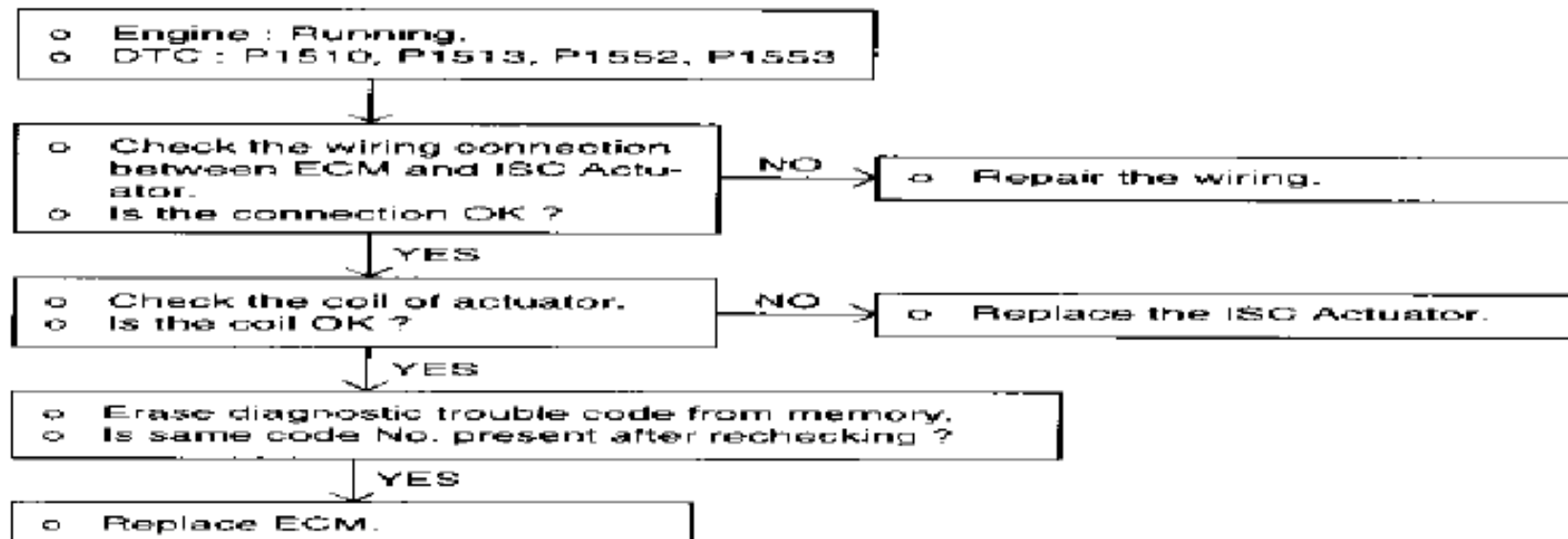


DESCRIPTION

The idle speed control actuator is the double coils type and has two coils. The two coils are driven by separate driver stages in the ECM. Depending on the pulse duty factor, the equilibrium of the magnetic forces of the two coils will result in different angles of the motor. In parallel to the throttle valve, a bypass hose line is arranged where the idle speed actuator is inserted in.

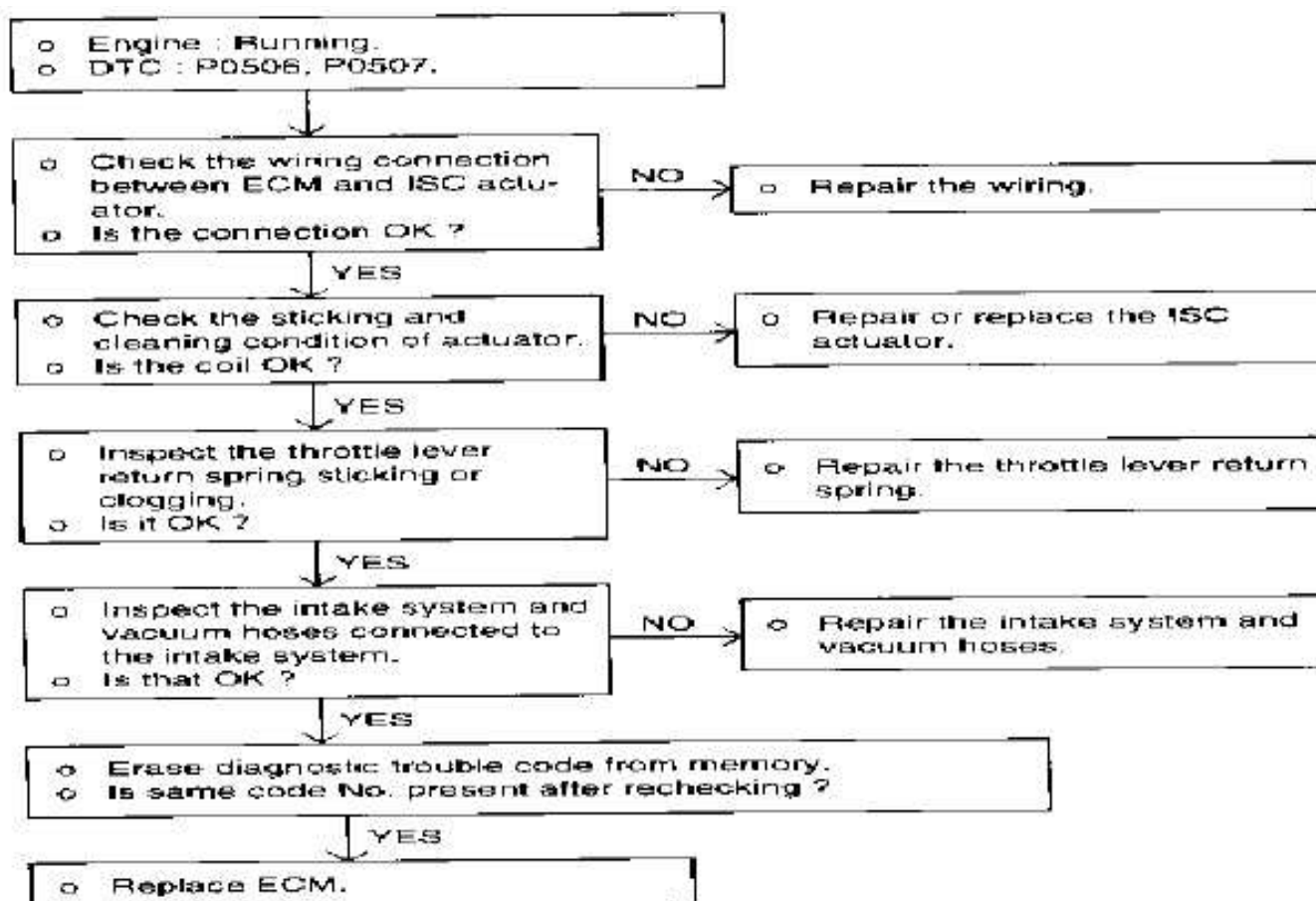


DTC - P1510, P1513, P1552, P1553



TROUBLESHOOTING HINTS

Open or short circuit is observed in idle air control system when ignition switch is turned on.

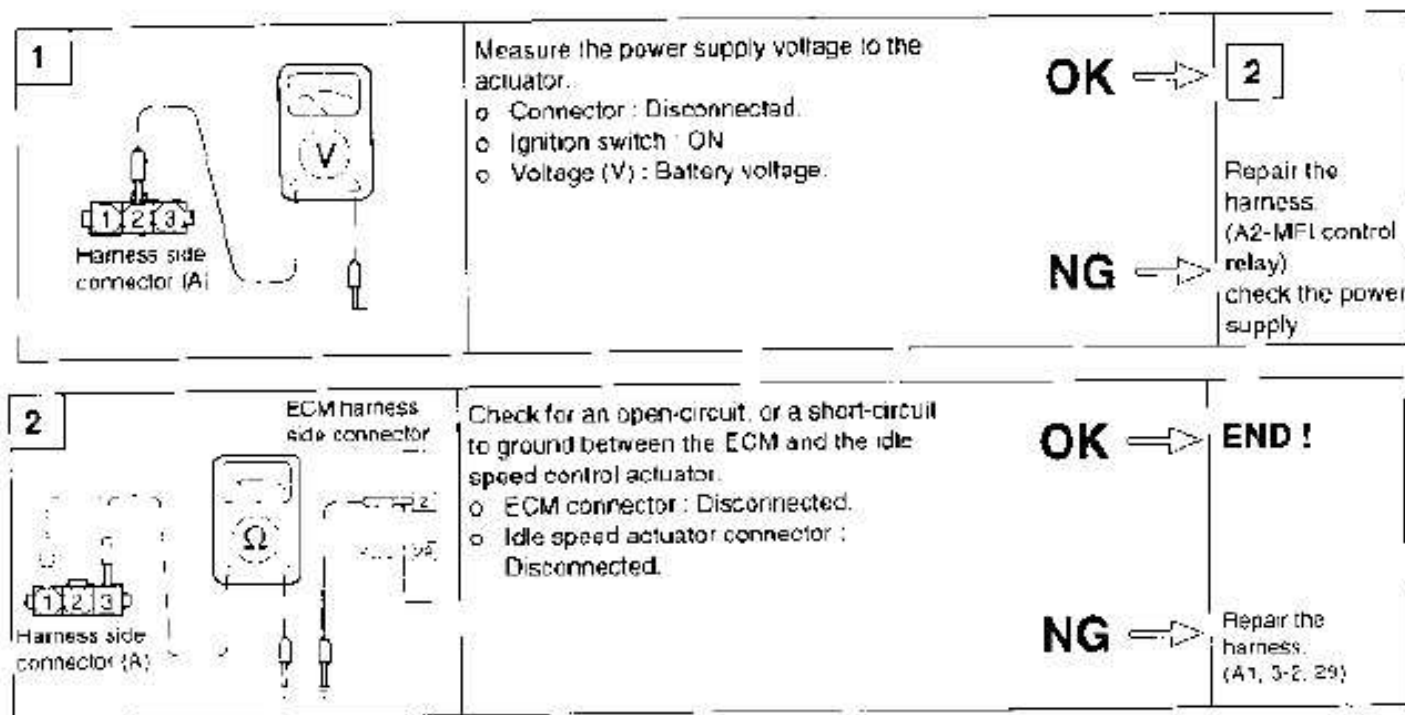


DTC : Diagnosis Trouble Code

ECM : Engine Control Module

Mechanical problems are observed in idle air control system.

HARNESS INSPECTION PROCEDURE



ACTUATOR INSPECTION

1. Disconnect the connector at the idle speed control actuator.
2. Measure the resistance between terminals.

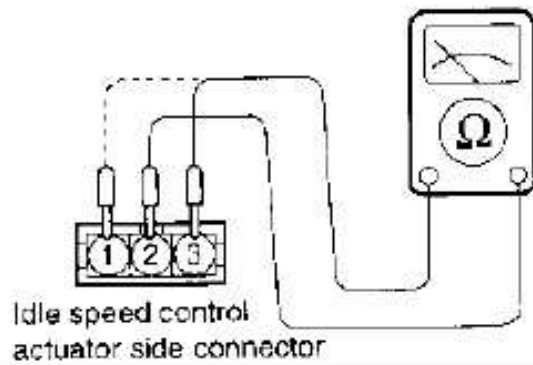
Standard value

SPECIFICATION

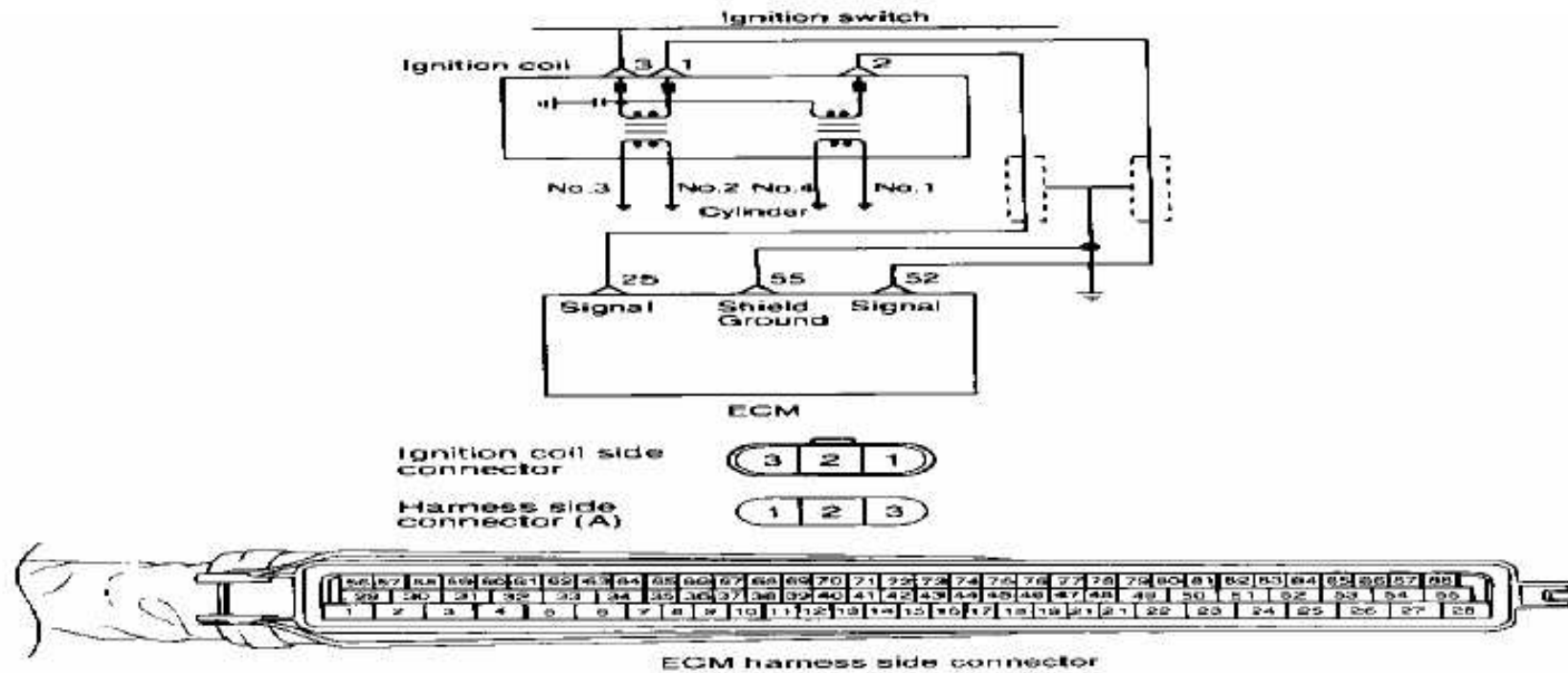
Terminal 1 and 2 10.5-14Ω

Terminal 2 and 3 10-12.5Ω [at 20°C (68°F)]

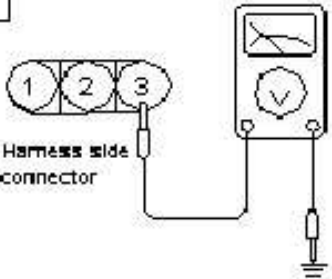
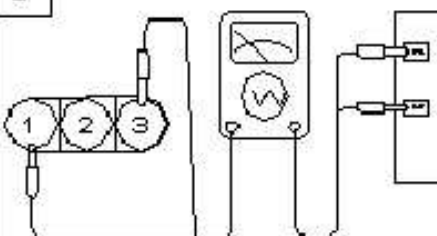
3. Connect the connector at the idle speed control actuator.



CIRCUIT DIAGRAM

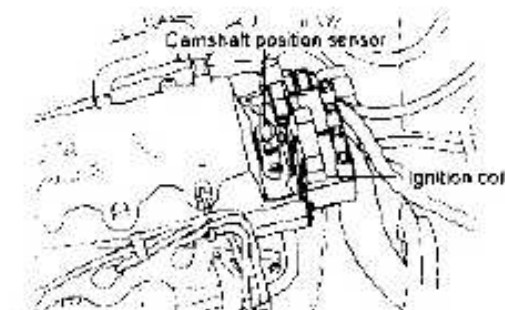


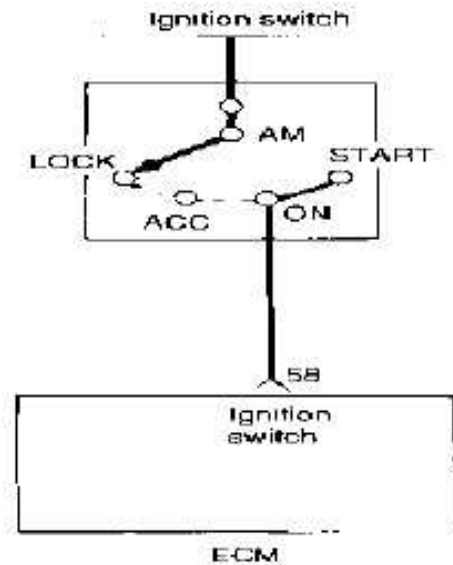
HARNESS INSPECTION PROCEDURE (SOHC)

<div>1</div> 	<p>Measure the power supply voltage of the Ignition coil.</p> <ul style="list-style-type: none"> o Connector: Disconnected o Ignition switch: ON o Voltage: Battery voltage <p>OK →</p> <p>NG →</p>	<div>2</div> <p>Repair the harness (A3-Ignition switch)</p>
<div>2</div> 	<p>Check for open-circuit, or a short-circuit to ground between the Ignition coil and the engine control module.</p> <ul style="list-style-type: none"> o Engine control module connector: Disconnected o Power transistor connector : Disconnected <p>OK →</p> <p>NG →</p>	<p>END !</p> <p>Repair the harness</p>

IGNITION COIL

When the ignition power transistor is turned ON by the signal from the ECM, It send the signal to the ignition coil, then primary current is shut off and a high voltage is induced in the secondary coil.

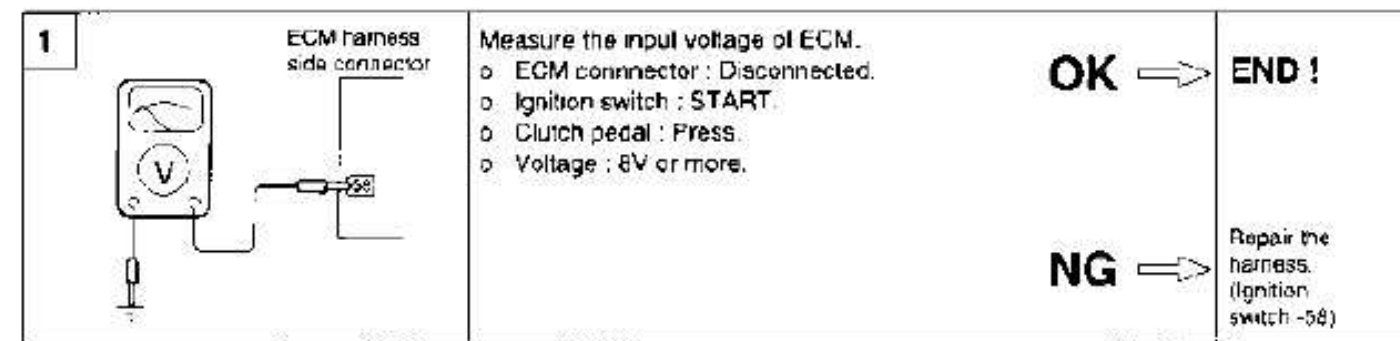




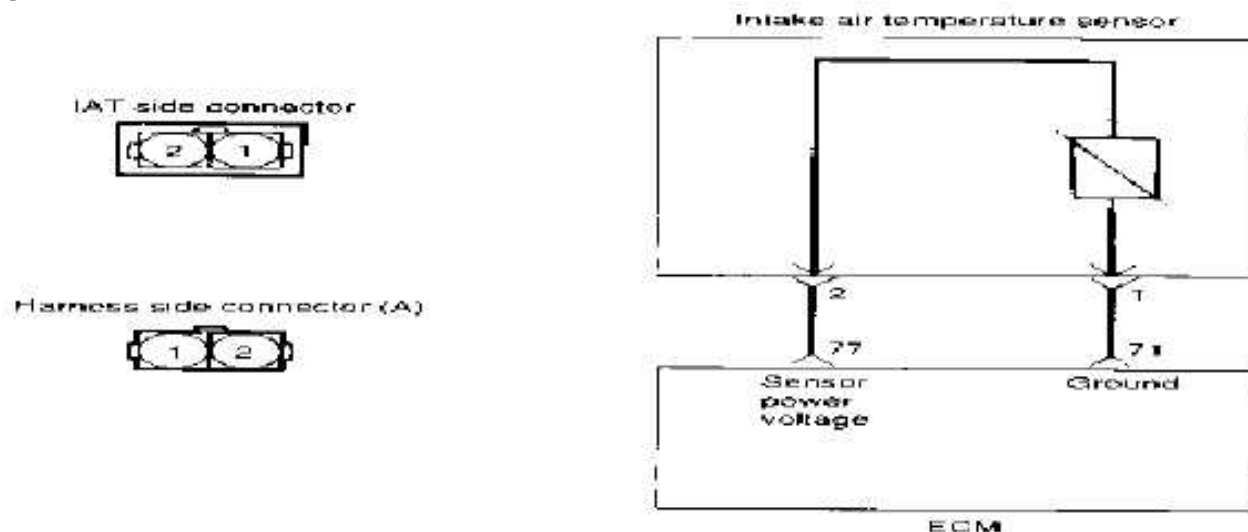
ECM harness side connector

Description

The ignition switch-ST inputs a high signal to the ECM while the engine is cranking. The ECM provides fuel injection control, etc. at engine start-up based on this signal.

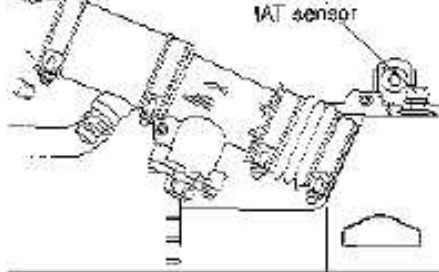


CIRCUIT DIAGRAM

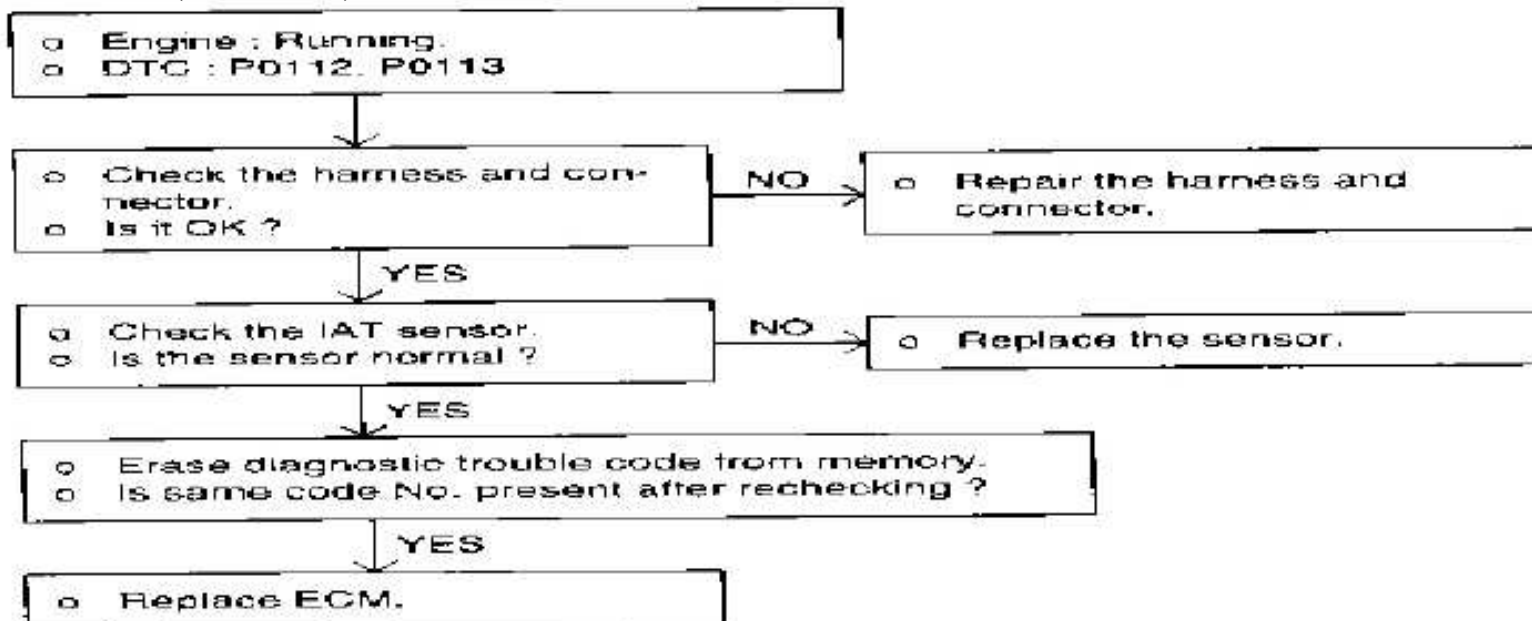


ECM harness side connector

The intake air temperature sensor (IAT Sensor), located on the air cleaner, is a resistor-based sensor for detecting the intake air temperature. According to the intake air temperature information from the sensor, the ECM provides necessary fuel injection amount control.



DTC - P0112, P0113 (IAT SENSOR)

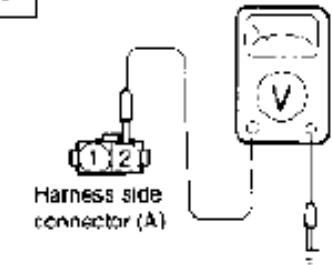
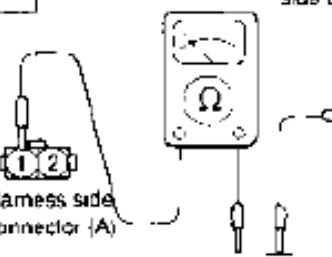


DTC : Diagnosis Trouble Code
ECM : Engine Control Module

TROUBLESHOOTING HINTS

Input from intake air temperature sensor is below 0.1V or above 4.8V when engine is in full warm-up condition.

HARNESS INSPECTION PROCEDURE

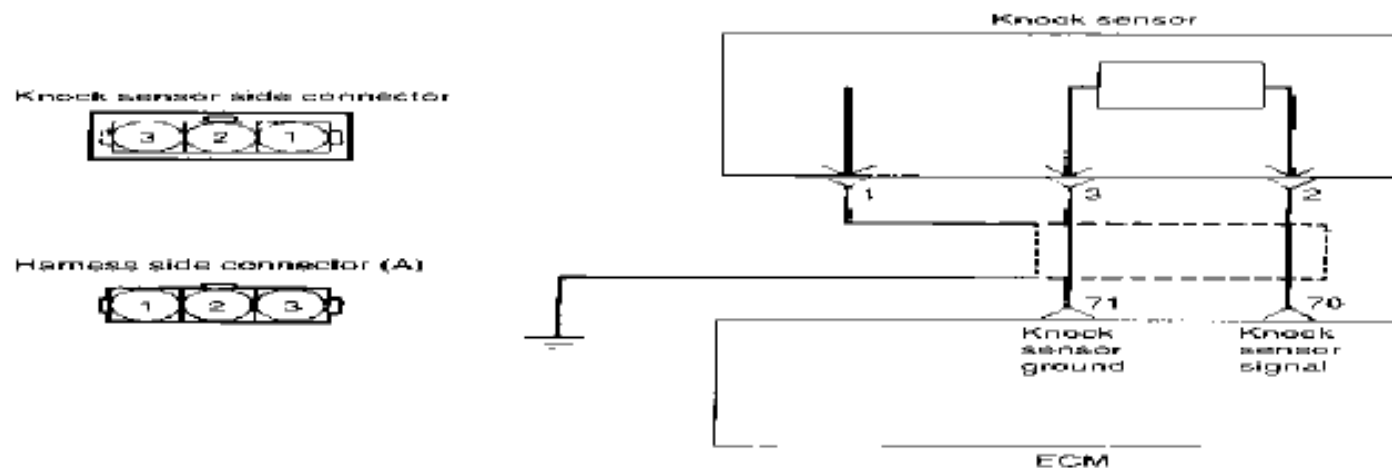
<div>1</div>  <p>Harness side connector (A)</p>	<p>Measure the power supply voltage of the heated IAT Sensor.</p> <ul style="list-style-type: none">○ Connector : Disconnected.○ Ignition switch : ON.○ Voltage : 4.8-5.2 V.	<p>OK → <div>2</div></p> <p>NG → Repair the harness. (A2-77)</p>
<div>2</div>  <p>Harness side connector (A)</p> <p>ECM Harness side connector</p>	<p>Check for an open-circuit, or a short-circuit to ground between the engine control module and the mass air flow sensor.</p> <ul style="list-style-type: none">○ ECM connector : Disconnected.○ IAT sensor connector : Disconnected.	<p>OK → <div>3</div></p> <p>NG → Repair the harness. (A1-71)</p>

1. Using the voltmeter, measure the sensor voltage.
2. Measure the voltage between the IAT sensor terminal 1 and 2.

	Temperature °C (°F)	Output voltage (V)
IG. SW. ON	0 (32)	3.3-3.7 V
	20 (68)	2.4-2.8 V
	40 (104)	1.6-2.0 V
	80 (176)	0.5-0.9 V

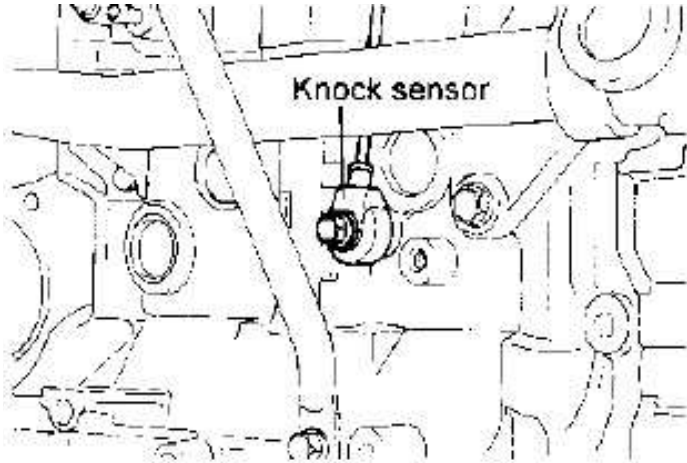
3. If the voltage deviates from the standard value, replace the intake air temperature sensor assembly.

CIRCUIT DIAGRAM

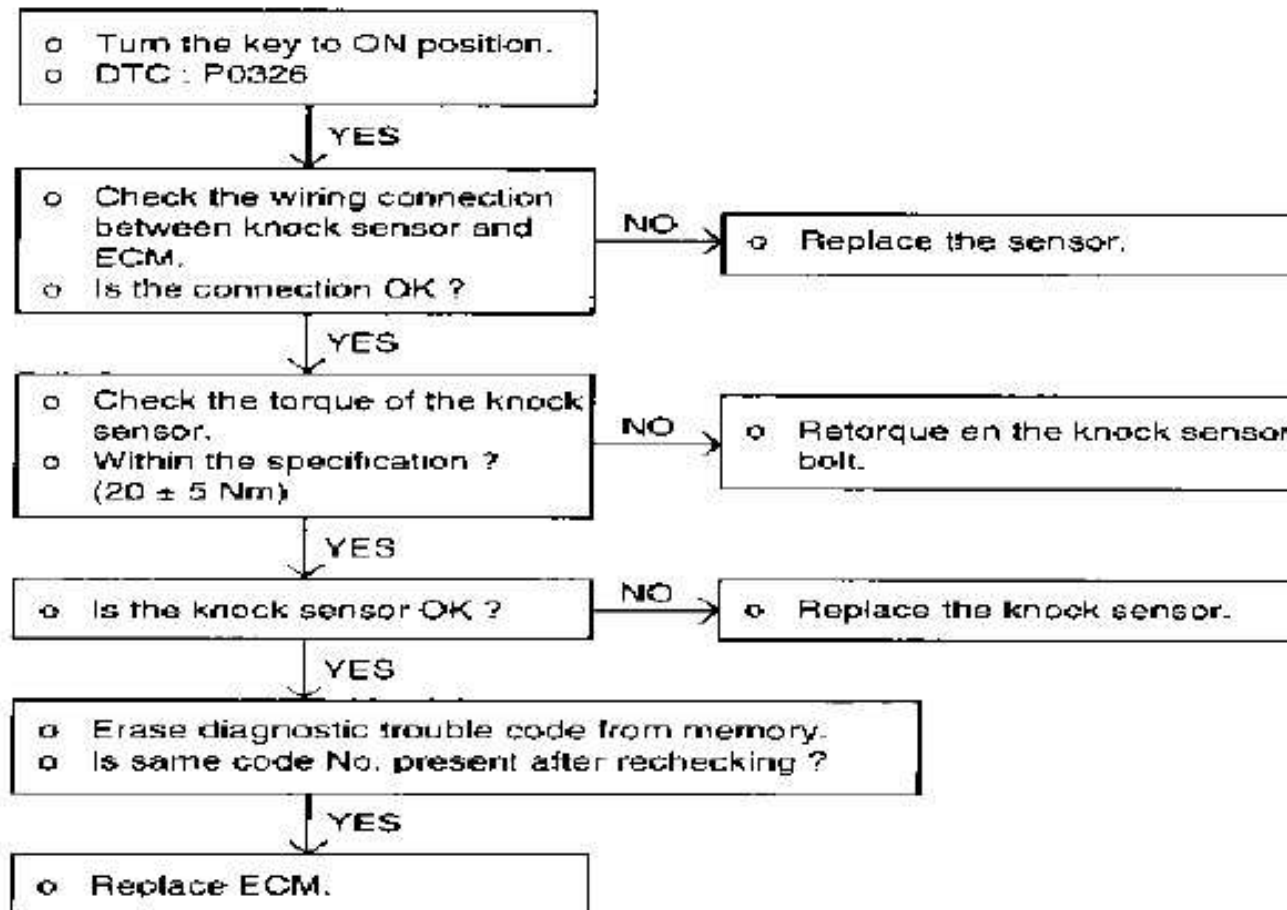


Description

A knocking vibration from the cylinder block is applied as pressure to the piezoelectric element. This vibrational pressure is then converted into a voltage signal which is delivered as output. If engine knocking occurs, ignition timing is retarded to suppress it.



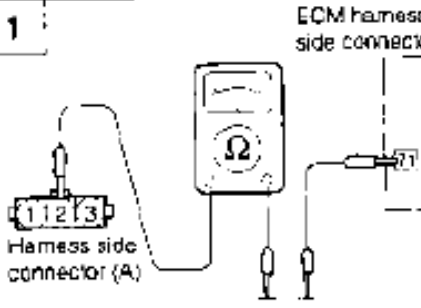
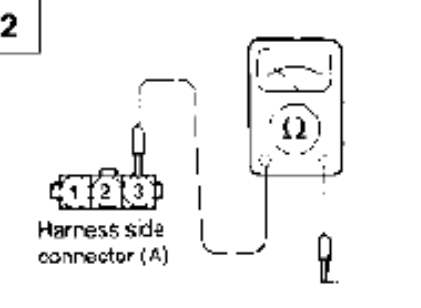
DTC - P0326



DTC : Diagnosis Trouble Code
ECM : Engine Control Module

When knock sensor signal is abnormally low.

HARNESS INSPECTION PROCEDURE

<p>1</p>  <p>Harness side connector (A)</p> <p>ECM harness side connector</p>	<p>Check for an open-circuit, or a short-circuit to ground between the ECM and the knock sensor.</p> <ul style="list-style-type: none">o ECM connector : Disconnected.o Knock sensor connector : Disconnected.	<p>OK → 2</p> <p>NG → Repair the harness. (A2-71)</p>
<p>2</p>  <p>Harness side connector (A)</p>	<p>Check for continuity of the ground circuit.</p> <ul style="list-style-type: none">o Connector : Disconnected.	<p>OK → END !</p> <p>NG → Repair the harness. (A3-70)</p>

1. Disconnect the knock sensor connector.
2. Measure resistance between terminals 2 and 3.

SPECIFICATION

Standard value about $5\text{M}\Omega$ [at 20°C (68°F)]

3. If the resistance is continual, replace the knock sensor.

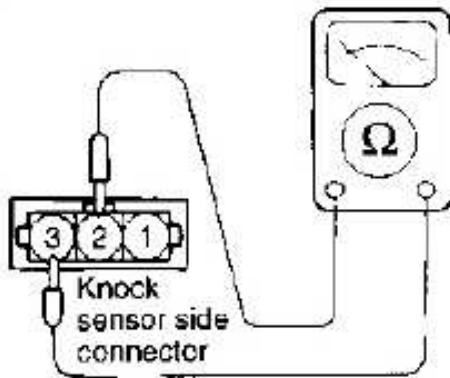
TORQUE SPECIFICATION

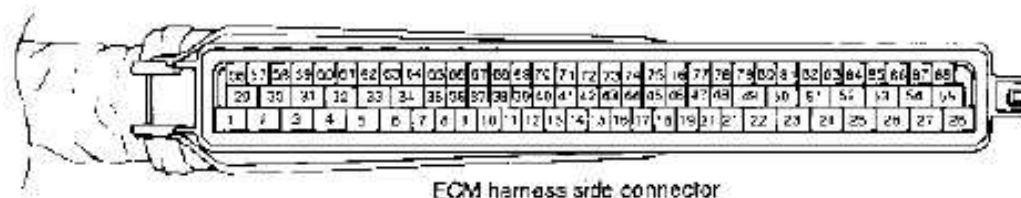
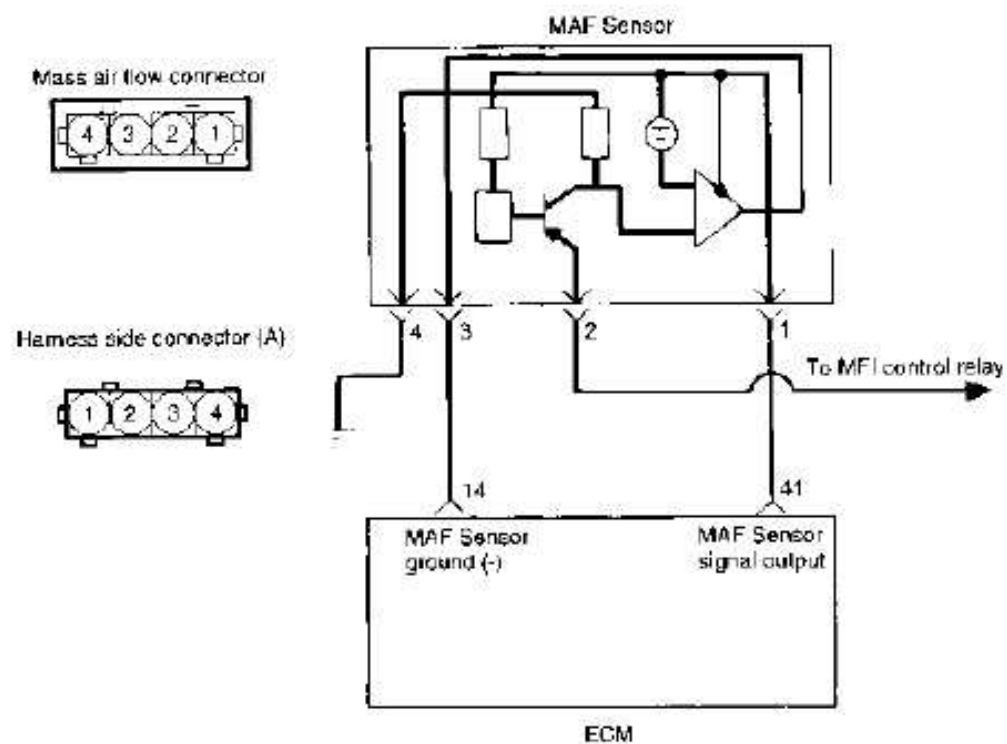
Knock sensor 16-28 Nm 160-250 kg·cm 11.8-18.4 lb·ft

4. Measure the capacitance between terminals 2 and 3.

SPECIFICATION

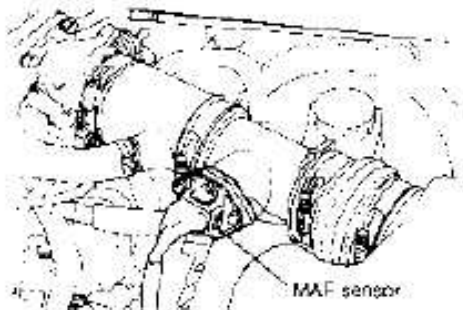
Standard value 800-1600 pF

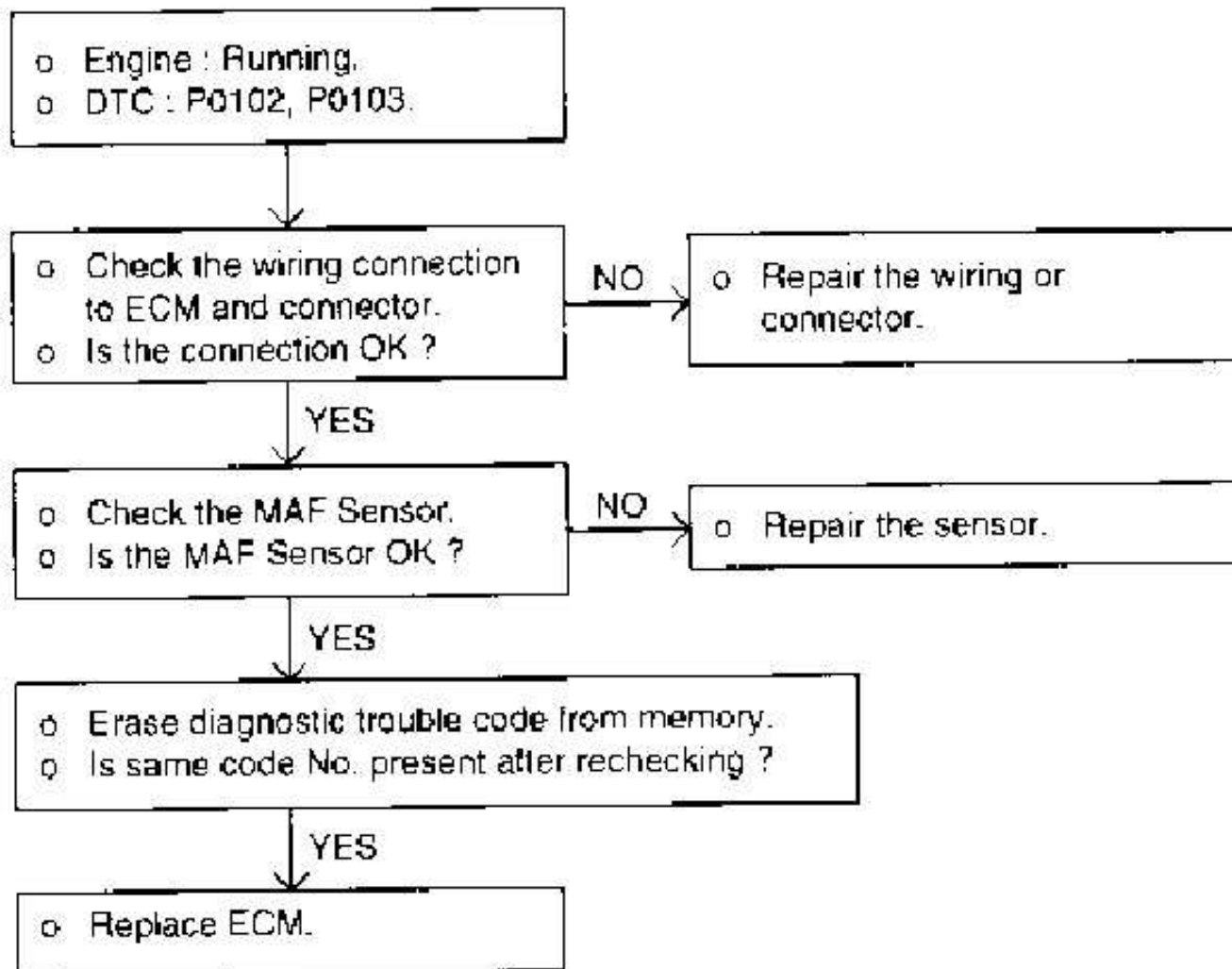




ECM harness side connector

Mass air flow rate is measured by detection of heat transfer from a hot film probe because the change of the mass air flow rate causes change in the amount of heat being transferred from the hot film probe surface to the air flow. The air flow sensor generates a pulse so it repeatedly opens and closes between the 5V voltage supplied from the engine control module. This results in the change of the temperature of the hot film probe and in the change of resistance.





DTC : Diagnosis Trouble Code

ECM : Engine Control Module

1. If the engine stalls occasionally, start the engine and shake the MAF sensor harness. If the engine stalls, check for poor contact of the MAF sensor connector.
2. If the MAF sensor output voltage is other than 0 when the ignition switch is turned on (do not start the engine). Check for faulty MAF sensor or ECM.
3. If the engine can be idle even if the MAF sensor output voltage is out of specification, check for the following conditions:
 - Disturbed air flow in the MAF sensor, disconnected air duct, and clogged air cleaner filter.

Poor combustion in the cylinder, faulty ignition plug, ignition coil, injector, and incorrect comparison.

4. Though no MAF sensor malfunction occurs, check the mounting direction of MAF sensor.

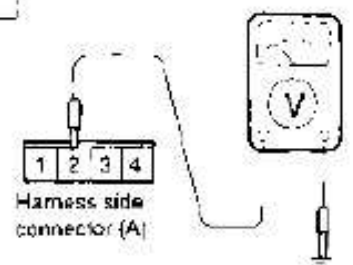
USING VOLTMETER

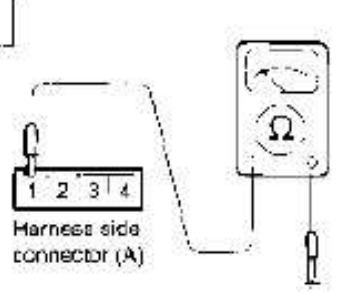
Check item	Engine state	Test specification
Mass air flow sensor output voltage (MAF sensor side connector No. 1 or ECM harness side connector No. 41)	Idle (800 rpm)	0.7 - 1.1 V
	3000 rpm	1.3 - 2.0 V

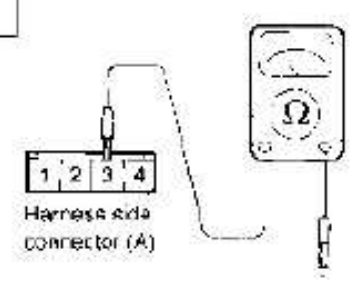
NOTE

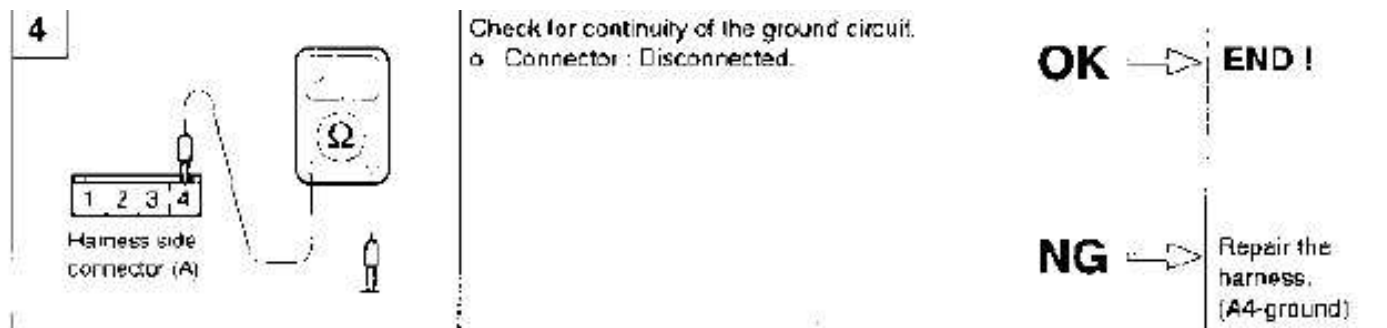
- When the vehicle is new (within initial operation of about 500 km [300 miles]), the mass air flow sensor air quantity may be about 10% higher.
- Use an accurate digital voltmeter.
- Before checking, warm up the engine until the engine coolant temperature reaches 80 to 90°C (176 to 198°F).

HARNESS INSPECTION PROCEDURES

<div data-bbox="126 129 196 182" data-label="Text">1</div> 	<p>Measure the power supply voltage.</p> <ul style="list-style-type: none"> o Connector: Disconnected. o Ignition switch : ON. o Voltage (V) : Battery voltage. 	<div data-bbox="1149 160 1326 211" data-label="Text">OK →</div> <div data-bbox="1326 152 1398 211" data-label="Text">2</div> <div data-bbox="1149 356 1326 407" data-label="Text">NG →</div> <div data-bbox="1326 262 1512 451" data-label="Text"> <p>Repair the harness. (A2-MFI control relay) or check the MFI control relay.</p> </div>
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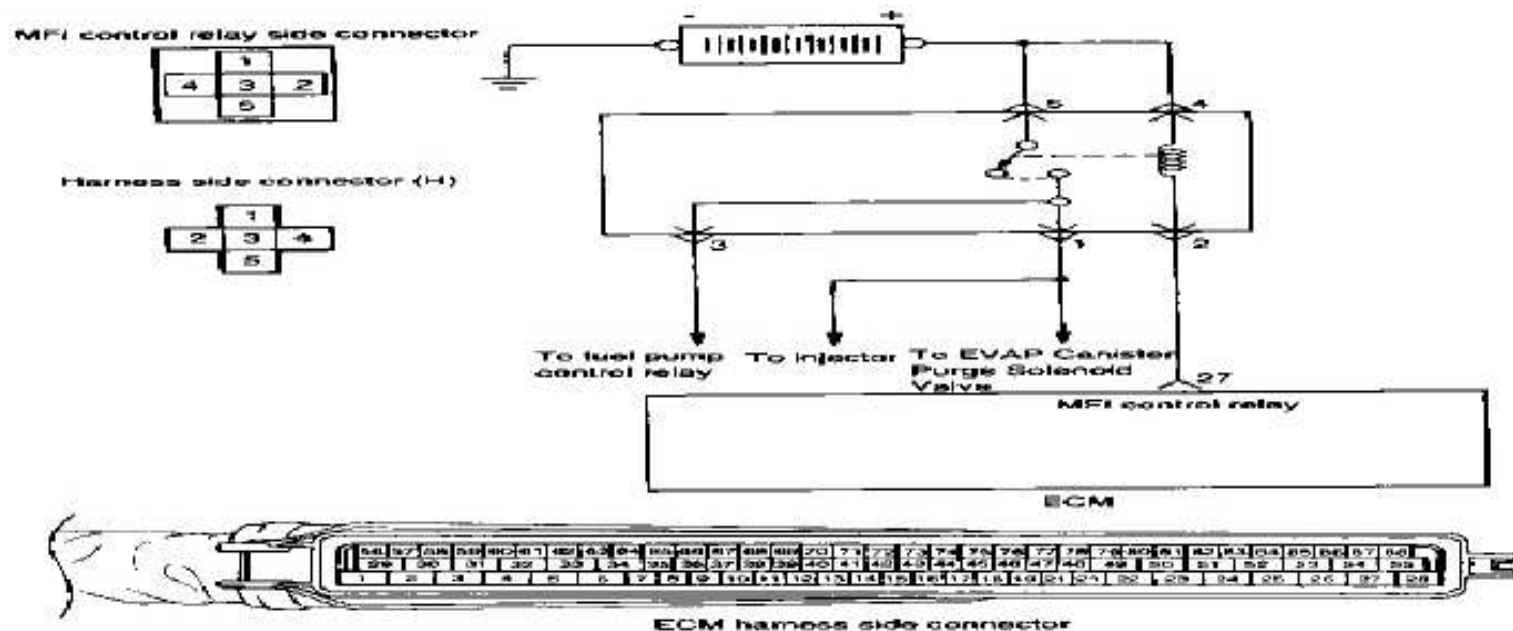
<div data-bbox="126 464 196 516" data-label="Text">2</div> 	<div data-bbox="818 473 922 502" data-label="Text">ASFL018A</div> <p>Check for an open-circuit, or a short-circuit to ground between the engine control module and the mass air flow sensor.</p> <ul style="list-style-type: none"> o Engine control module connector : Disconnected o Mass air flow sensor connector : Disconnected. 	<div data-bbox="1149 524 1326 575" data-label="Text">OK →</div> <div data-bbox="1326 516 1398 575" data-label="Text">3</div> <div data-bbox="1149 713 1326 764" data-label="Text">NG →</div> <div data-bbox="1326 706 1512 810" data-label="Text"> <p>Repair the harness. (A1-41)</p> </div>
--	---	---

<div data-bbox="126 824 196 876" data-label="Text">3</div> 	<div data-bbox="818 837 922 866" data-label="Text">ASFL018B</div> <p>Check for continuity of the ground circuit.</p> <ul style="list-style-type: none"> o Connector : Disconnected. 	<div data-bbox="1149 880 1326 931" data-label="Text">OK →</div> <div data-bbox="1326 873 1398 931" data-label="Text">4</div> <div data-bbox="1149 1070 1326 1121" data-label="Text">NG →</div> <div data-bbox="1326 1055 1512 1169" data-label="Text"> <p>Repair the harness. (A3-14)</p> </div>
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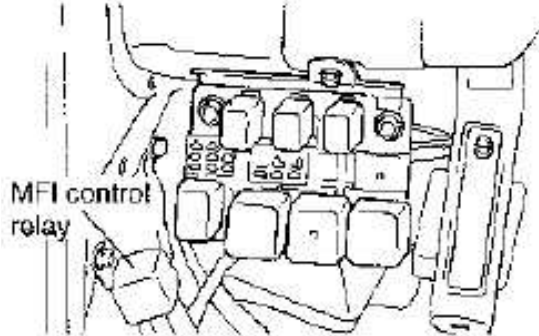
45FL019D

CIRCUIT DIAGRAM

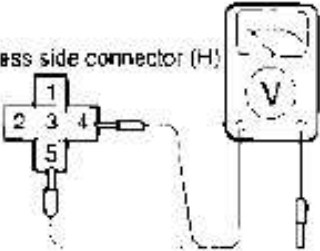
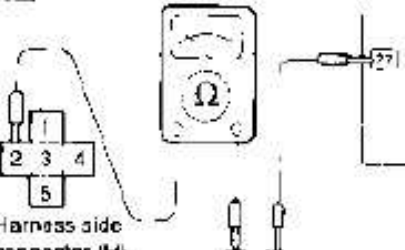


Description

When the ignition switch is on, battery power is supplied to the ECM, the injector, the mass air flow sensor, etc. While the ignition switch is turned on, current flows from the ignition switch through the current relay coil to ground.



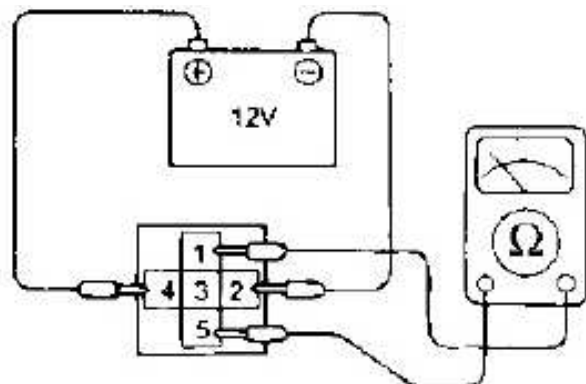
HARNESS INSPECTION PROCEDURE

1 	<p>Measure the power supply voltage to the MFI control relay.</p> <ul style="list-style-type: none"> ○ MFI control relay connector : Disconnected. ○ Voltage (V) : Battery voltage <p>OK → 2</p> <p>NG → Repair the harness. (H4.5-Battery)</p>
2 	<p>Check for open-circuit, or a short-circuit to ground between the engine control module and the MFI control relay.</p> <ul style="list-style-type: none"> ○ ECM connector : Disconnected. ○ Injector connector : Disconnected. <p>OK → 2</p> <p>NG → Repair the harness. (H2-27)</p>

MFI CONTROL RELAY INSPECTION

1. Check continuity of relay contacts between terminals 4 (+) and 2 (-).

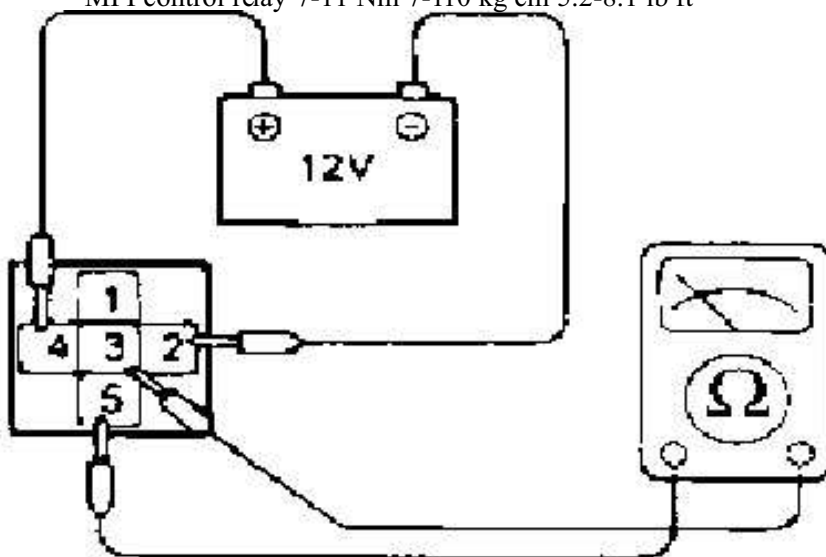
Relay coil (between terminal 5 and 1)	Continuity
When de-energized	No (infinite Ω)
When energized	Yes (0 Ω)
Relay coil (between terminal 5 and 3)	Continuity
When de-energized	No. (infinite Ω)
When energized	Yes (0 Ω)



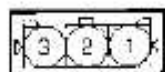
2. If fault, replace the MFI control relay.

TORQUE SPECIFICATION

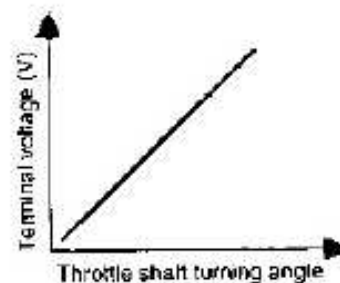
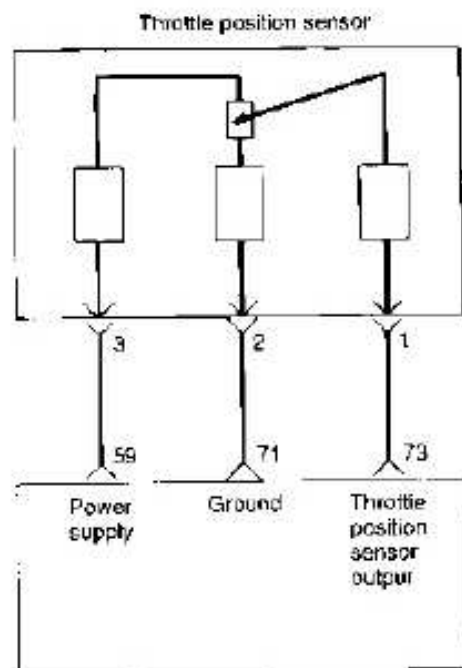
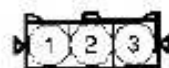
MFI control relay 7-11 Nm 7-110 kg·cm 5.2-8.1 lb·ft



Throttle position sensor side connector

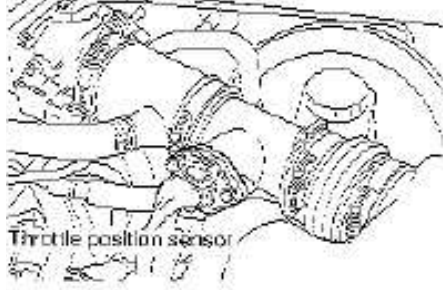


Harness side connector (A)

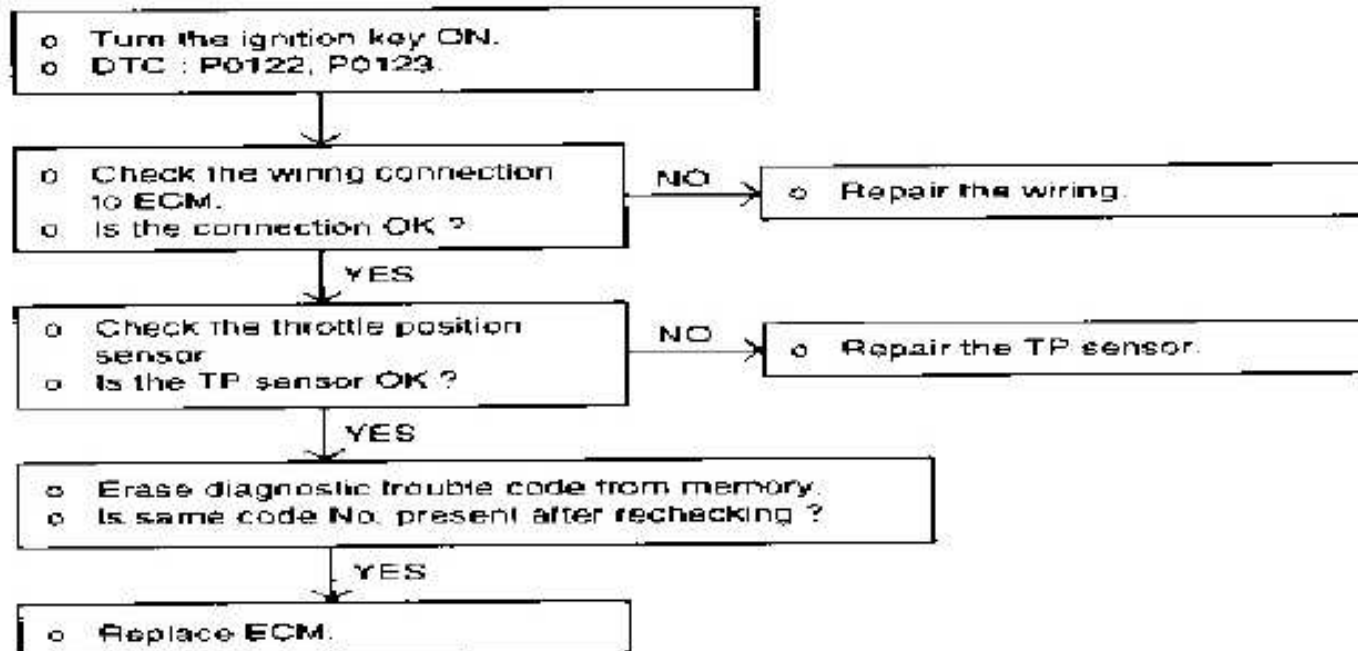


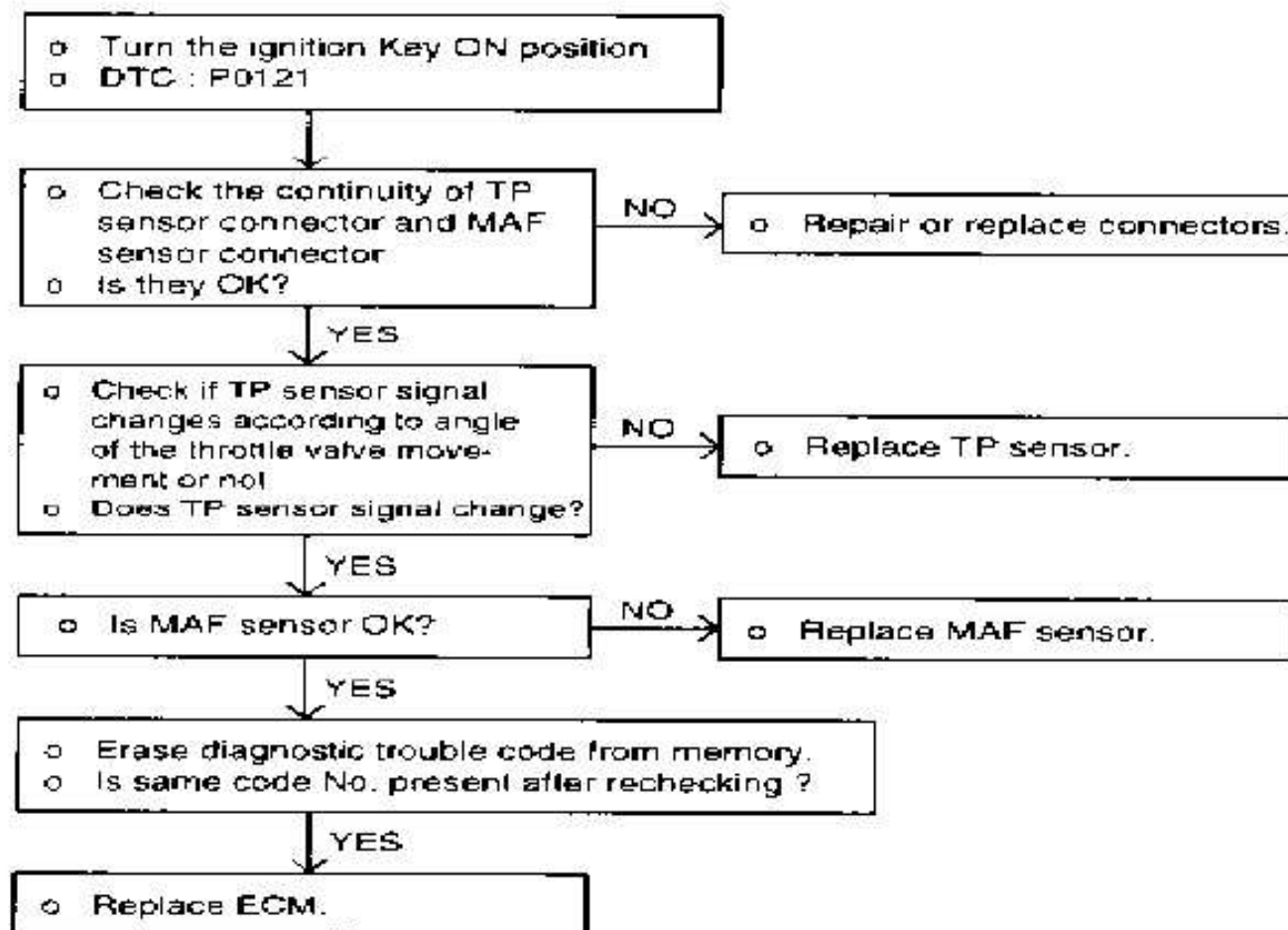
ECM harness side connector

The TP Sensor is a rotating type variable resistor that rotates with the throttle shaft to sensor the throttle valve angle. As the throttle shaft rotates, the throttle angle of the TP Sensor changes and the ECM detects the throttle valve opening based on the change of the throttle angle.



DTC - P0122, P0123 (TP SENSOR)





DTC : Diagnosis Trouble Code
ECM : Engine Control Module

TROUBLESHOOTING HINTS

Input voltage from throttle position sensor is below 0.1V or above 4.7V when ignition switch is turned on.

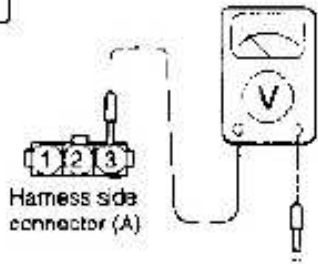
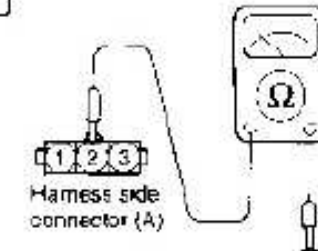
TROUBLESHOOTING HINTS

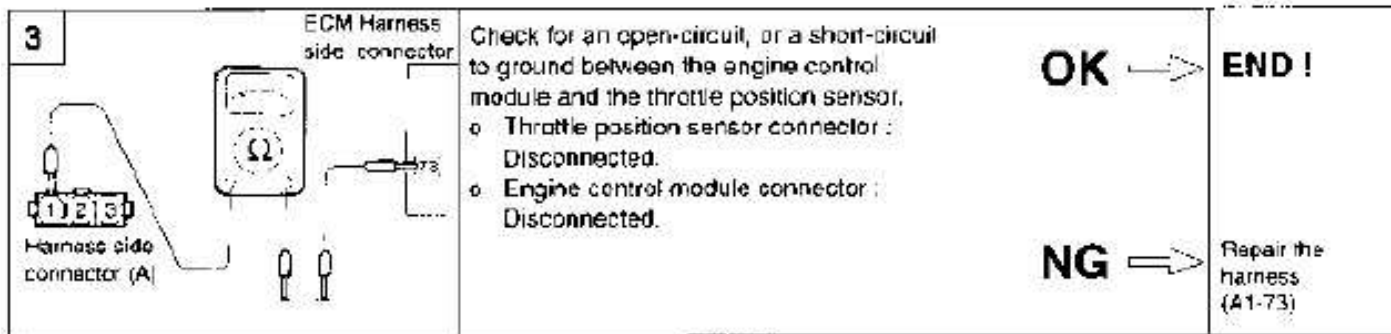
1. The TPS signal is important in the control of the automatic transaxle. Shift shock and other troubles will occur if the sensor is faulty.
2. If the idle condition or accelerating is abnormal, check the TPS connector. (When the TPS connector is not connected properly, the current data can show that the idle state is off, though the accelerator pedal is released. And it results in improper idle or accelerating.)
3. Input voltage from throttle position sensor is below 0.1V or above 4.7V when ignition is turned on.

USING VOLTMETER

Check item	Check condition	Test specification
Throttle position sensor output voltage (TP sensor side connector No.1 or ECM harness side connector No.73)	At idle (800 rpm)	0.1-0.875 V
	Wide open throttle	4.25-4.8 V

HARNESS INSPECTION PROCEDURES

1  Harness side connector (A)	Measure the power supply voltage of the throttle position sensor. <ul style="list-style-type: none">o Connector : Disconnected.o Ignition switch : ON.o Voltage : 4.8-5.2 V.	OK → 2 NG → Repair the harness. (A3-59)
2  Harness side connector (A)	Check for continuity of the ground circuit. <ul style="list-style-type: none">o Connector : Disconnected.	OK → 3 NG → Repair the harness. (A2-ground)



SENSOR INSPECTION

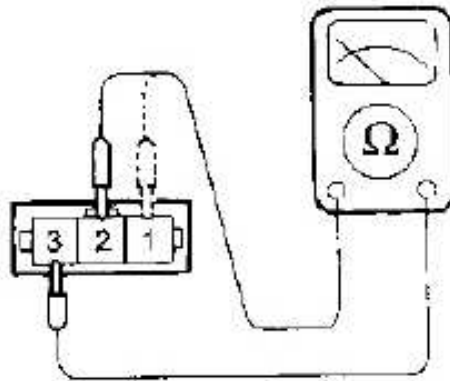
1. Disconnect the throttle position sensor connector.
2. Measure resistance between terminal 2 (sensor ground) and terminal 3 (sensor power).

SPECIFICATION

Standard value 0.7-3.0 k Ω

When Idling 2.3-3.4 k Ω

3. Connect an ohmmeter between terminal 3 (sensor ground) and terminal 1 (sensor output).



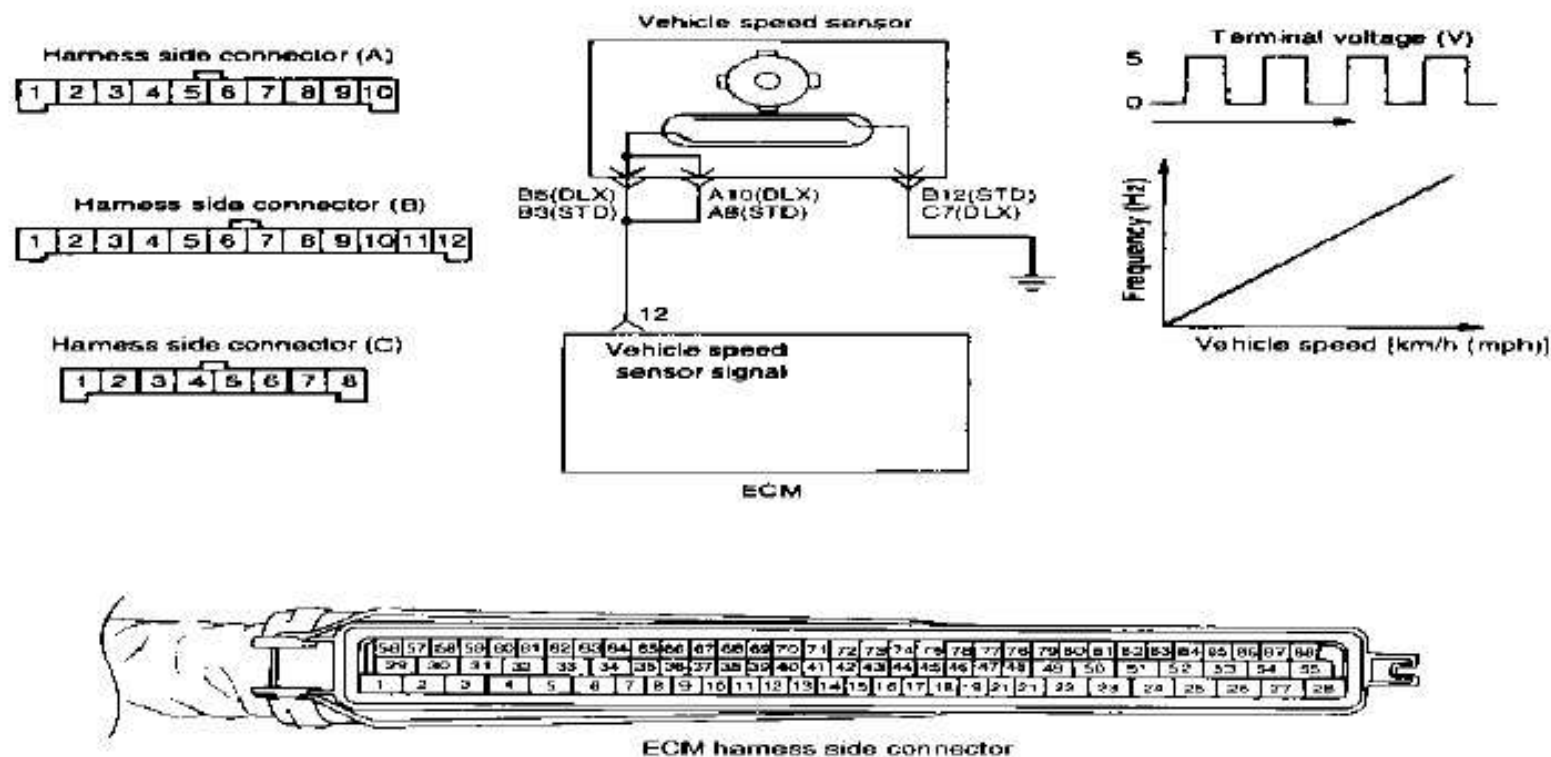
4. Operate the throttle valve slowly from the idle position to the full open position and check that the resistance changes smoothly in proportion to the throttle valve opening angle.

- If the resistance is out of specification, or fails to change smoothly, replace the throttle position sensor.

TORQUE SPECIFICATION

Throttle position sensor 1.5-2.5 Nm 15-25 kg·cm 1.1-1.8 lb·ft

Circuit Diagram

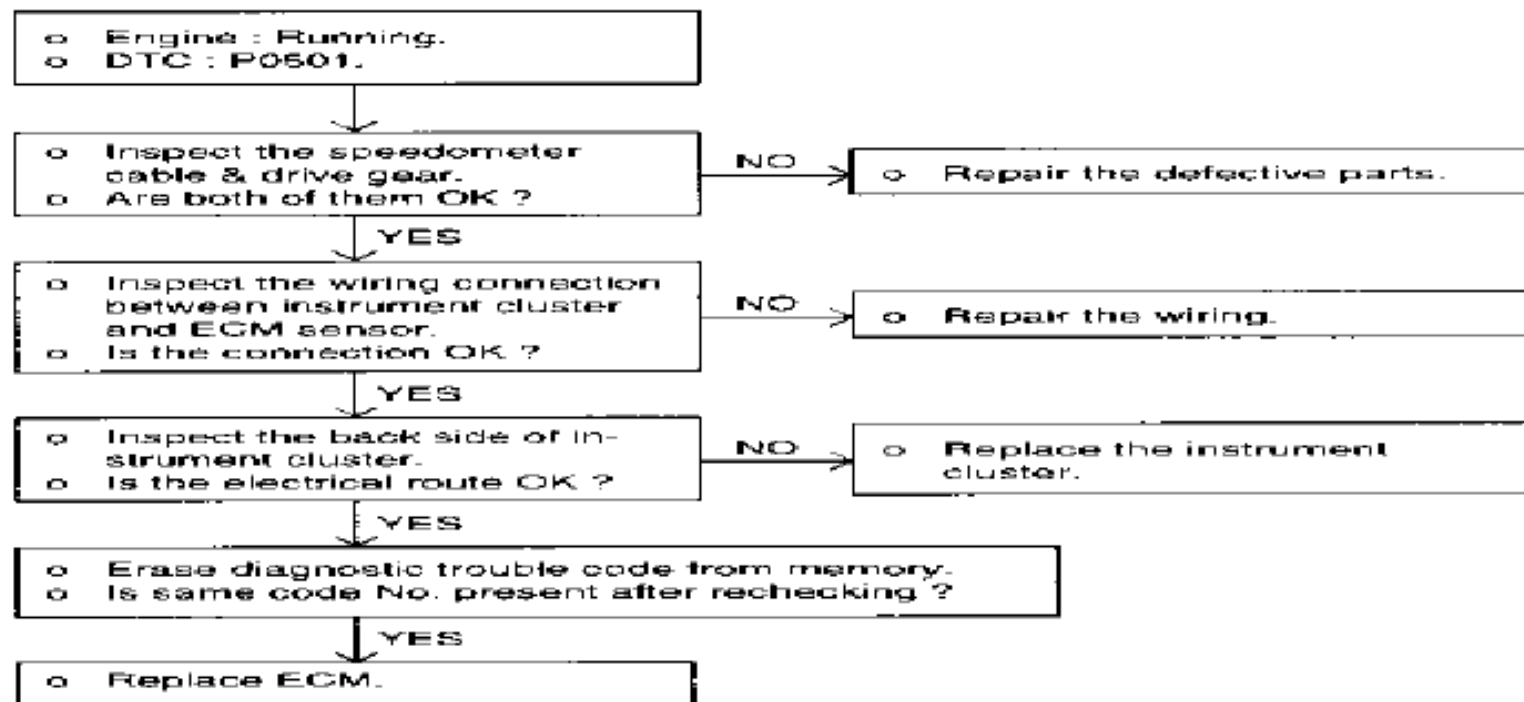


Description

The vehicle speed sensor is a reed switch. The vehicle speed sensor is built into the speedometer and converts the transaxle gear revolutions into pulse signals,



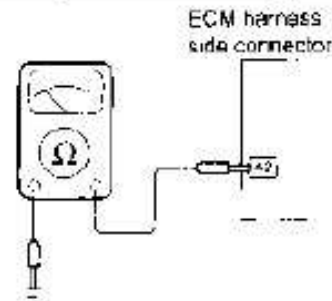
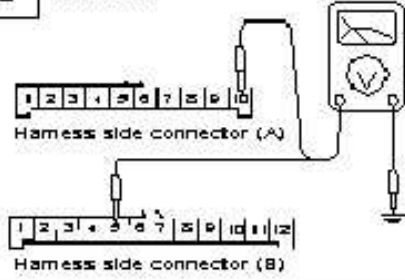
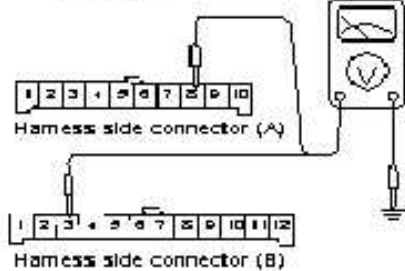
DTC - P0501



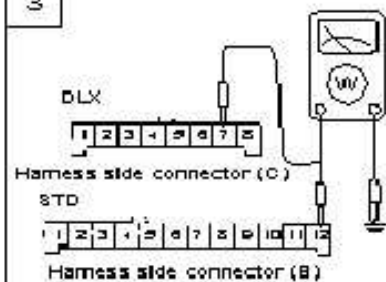
DTC : Diagnosis Trouble Code
ECM : Engine Control Module

TROUBLESHOOTING HINTS

If there is an open or short circuit in the vehicle speed sensor signal circuit, the engine may stall when the vehicle is decelerated to a stop.

<div data-bbox="126 151 182 215">1</div> <div data-bbox="207 167 538 465">  <p>ECM harness side connector</p> </div>	<p>Check the vehicle speed sensor output circuit for continuity.</p> <ul style="list-style-type: none"> o Engine control module connector : Disconnected. o Move the vehicle or turn the speedometer cable. 	<div data-bbox="1156 186 1321 230">OK ⇒</div> <div data-bbox="1336 186 1431 230">END !</div> <div data-bbox="1156 382 1321 426">NG ⇒</div> <div data-bbox="1336 375 1404 441">2</div>
<div data-bbox="126 481 576 816"> <div data-bbox="126 481 182 546">2</div> <div data-bbox="196 502 310 531">DLX TYPE</div> <div data-bbox="155 531 559 808">  <p>Harness side connector (A)</p> <p>Harness side connector (B)</p> </div> </div> <div data-bbox="126 816 576 1138"> <div data-bbox="196 829 321 859">STD TYPE</div> <div data-bbox="155 859 559 1128">  <p>Harness side connector (A)</p> <p>Harness side connector (B)</p> </div> </div>	<p>Measure the power supply voltage of the vehicle speed sensor.</p> <ul style="list-style-type: none"> o Connector : Disconnected o Ignition switch : ON o Voltage : 4.5-4.9 V 	<div data-bbox="1156 528 1321 572">OK ⇒</div> <div data-bbox="1336 521 1404 586">3</div> <div data-bbox="1156 725 1321 768">NG ⇒</div> <div data-bbox="1336 725 1446 776">Repair the harness.</div>

3



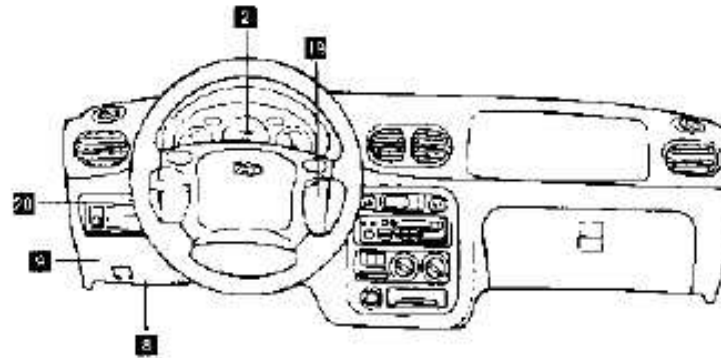
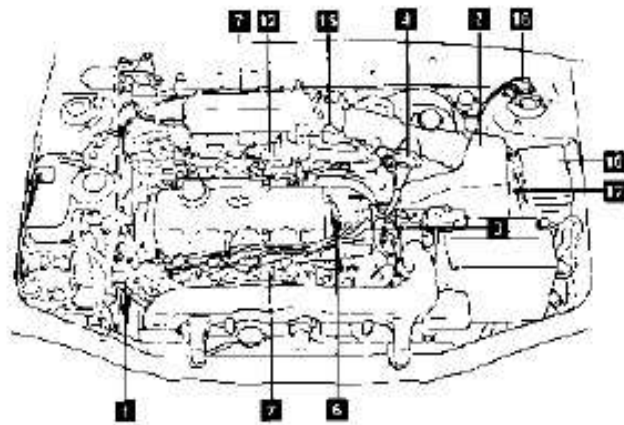
Check for continuity of the ground circuit.

o Connector: Disconnected.

OK → END !

NG → Repair the harness
(B12, C7-ground)

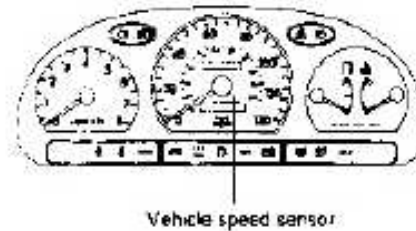
LOCATION OF MFI COMPONENTS (1.5L SOHC ENGINE)



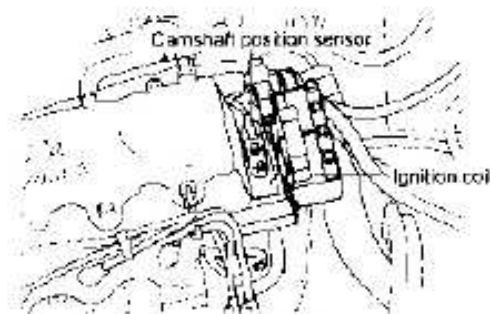
1. Engine coolant temperature sensor (ECT sensor)



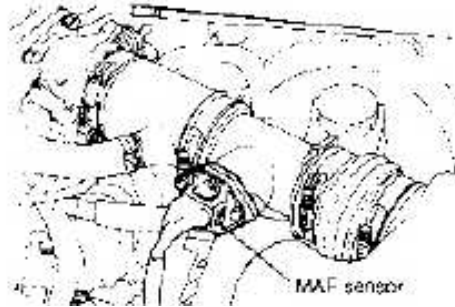
2. Vehicle speed sensor (VSS)



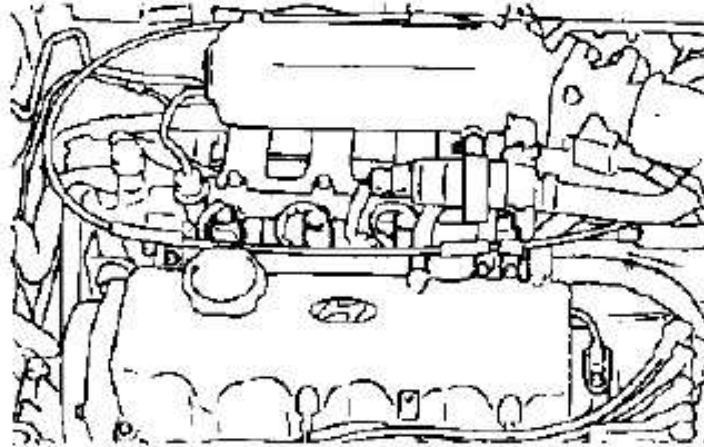
3. Ignition coil



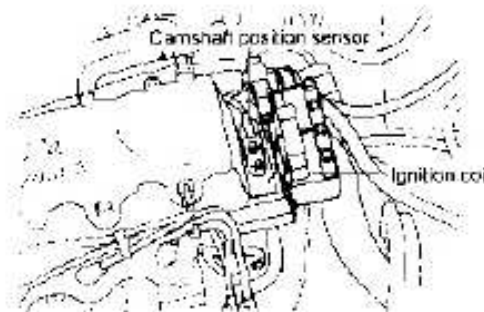
4. Mass air flow (MAF) sensor



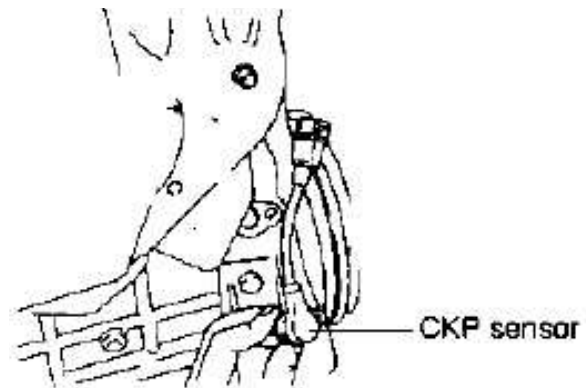
5. Injector



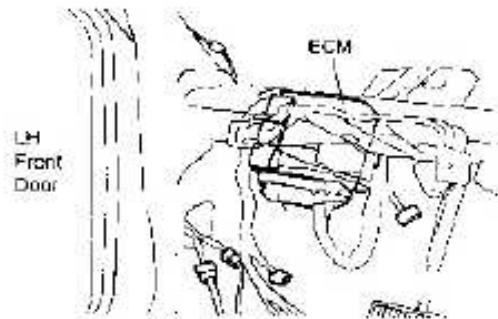
6. Camshaft position sensor (CMP sensor)



7. Crankshaft position (CKP) sensor



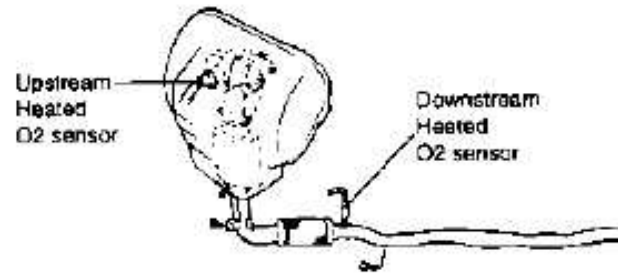
8. Engine control module (ECM)



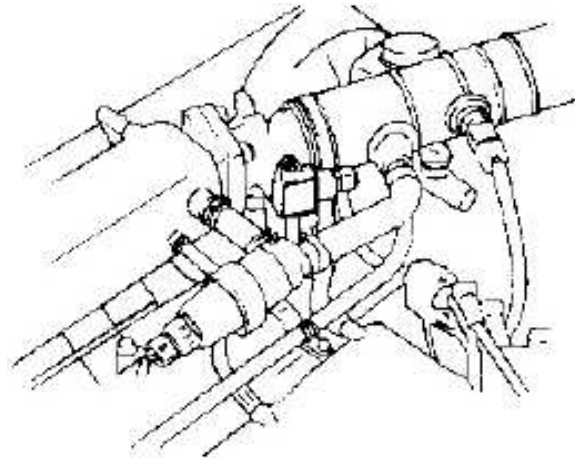
9. MFI control relay



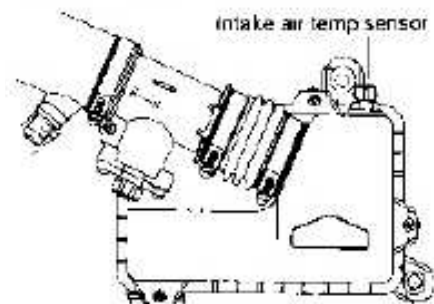
11. Heated oxygen sensor (HO2S)



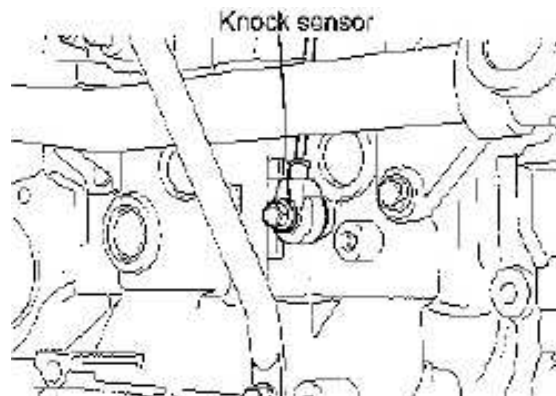
12. Idle speed control actuator (ISC actuator)



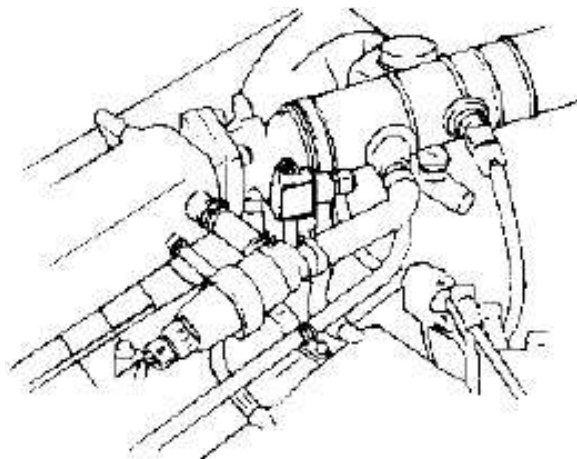
13. Intake air temp sensor



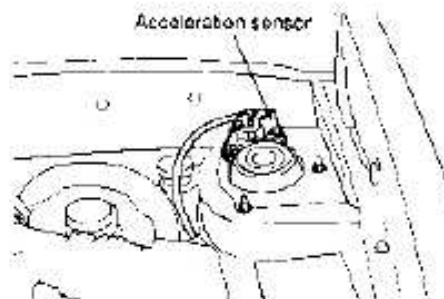
14. Knock sensor



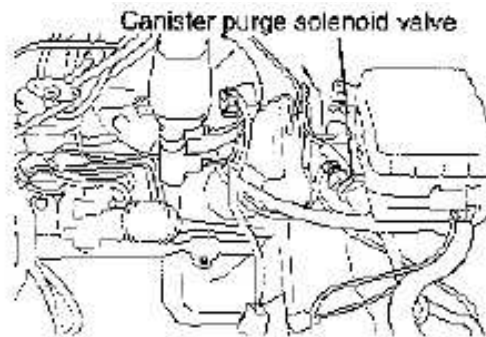
15. Throttle position sensor (TP sensor)



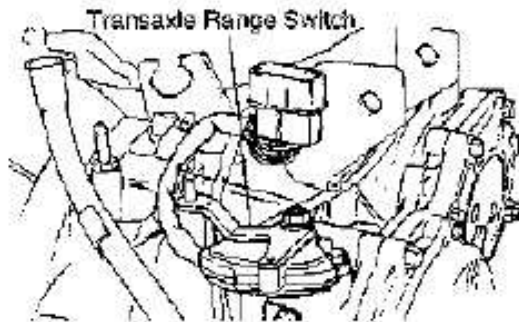
16. Acceleration sensor



17. Evaporative emission canister purge solenoid valve



18. Transaxle range switch



20. Data link connector

