

# Fuel System

<b>GENERAL</b> .....	<b>FL -2</b>
<b>MFI CONTROL SYSTEM</b> .....	<b>FL -19</b>
<b>FUEL DELIVERY SYSTEM</b> .....	<b>FL -67</b>
<b>TROUBLESHOOTING FOR DTC</b> .....	<b>FL -77</b>



## GENERAL

### SPECIFICATIONS

EFNC0010

Items	Specifications
Engine Management System (ECM)	Bosch for the 1.6L I4, and Siemens for the 1.8L.
Fuel tank Capacity Return system	55 lit. (14.5 U.S. gal., 12.1 Imp.gal.) Returnless
Fuel filter	High pressure type (built in F/Pump Assembly)
F/Pressure regulator	Built in F/Pump Assembly
Regulator pressure	350 kpa (3.5 kg/cm <sup>2</sup> , 49.8 psi)
Fuel pump	Electrical, in-tank type
Input sensors Manifold Absolute Pressure (MAP) sensor Type Output voltage	Piezo-Resistivity type 0 - 5V
Throttle body Throttle Position Sensor (TPS) Resistance Output voltage at curb idle	Variable resistor type 0.7 - 3.0 kΩ 0.1 - 0.875V
Knock sensor	Piezoelectric type
Intake Air Temperature sensor (IAT Sensor) Resistance	Thermistor type (built in MAP sensor) 2.0 - 3.0 kΩ at 20°C (68°F)
Engine Coolant Temperature sensor (ECT Sensor) Resistance	Thermistor type 1.0 - 4.0kΩ at 20°C (68°F) 0.24 - 0.40kΩ at 80°C (176°F)
Heated Oxygen Sensor (HO2S) Output voltage (V)	Zirconia sensor (Heated) 0 - 1V
Vehicle Speed Sensor	Wheel speed sensor
Camshaft Position Sensor (CMP Sensor) Output voltage (V)	Hall effect sensor 0 - 5V
Crankshaft Position Sensor (CKP Sensor) Output frequency (Hz)	Magnetic inductive type Idle rpm : 600 - 900Hz 3000 rpm : 2700 - 3300Hz
Acceleration sensor	Piezoelectric type
Output actuators Injector type Number Coil resistance (Ω)	Electromagnetic type 4 15.9 ± 0.35Ω
EVAP Canister Purge solenoid valve Resistance	Duty type 26Ω
Idle Speed Control actuator (ISC Actuator) Type Control frequency (Hz)	Double coil type 100Hz

### SERVICE STANDARD

Items	1.6L	1.8L
Basic idle rpm	800 ± 100 (N,A/C OFF)	750 ± 100 (N,A/C OFF)
Ignition timing (°) — BTDC	5° ± 5°	7° ± 5°

## SEALANT

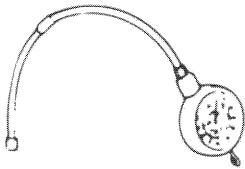
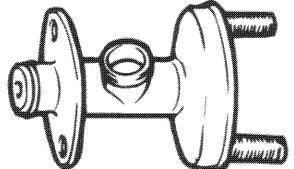
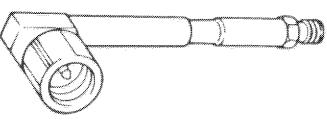
Engine coolant temperature sensor assembly	LOCTITE 962T or equivalent
Engine coolant temperature sender	Three bond No.2310 or equivalent

## TIGHTENING TORQUE

Items	Nm	Kg.cm	lb.ft
Delivery pipe installation bolts	10 - 15	100 - 150	7 - 11
Heated oxygen sensor	50 - 60	500 - 600	37 - 44
Crankshaft position sensor installation bolts	9 - 11	90 - 110	7 - 8
Knock sensor installation bolt	16 - 25	160 - 250	12 - 18
Engine coolant temperature sensor	15 - 20	150 - 200	11 - 15
Throttle position sensor installation bolts	1.5 - 2.5	15 - 25	1.1 - 1.8
Throttle body to surge tank bolts	15 - 20	150 - 200	11 - 15

## SPECIAL TOOLS

EFDA0030

Tool (Number and name)	Illustration	Application
09353-24100 Fuel pressure gauge & hose	 EFDA003A	Connection of fuel pressure gauge to delivery pipe for measurement of fuel pressure.
09353-38000 Fuel pressure gauge adaptor	 EFDA003B	
09353-24000 Fuel pressure gauge connector	 EFDA003C	

## BASIC TROUBLESHOOTING

EFDA0050

When checking for engine trouble, 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
  - Battery
  - Fusible link
  - Fuse
2. Body ground
3. Fuel supply
  - Fuel line
  - Fuel filter
  - Fuel pump
4. Ignition system
  - Spark plug
  - High-tension cable
  - Ignition coil
5. Emission control system
  - PCV system
  - Vacuum leak
6. Others
  - Ignition timing
  - Idle speed

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

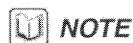
## TROUBLESHOOTING GUIDE CHART

EFDA0070

Main Symptoms Sub-Symptoms	STARTING							Poor Idling			Poor Driving		
	Unable to start			Difficult to start									
	Check points	Engine does not turn over	Starter runs but engine does not turn over	Incomplete combustion	Engine turns over	Always	When the engine is cold	When the engine is hot	Incorrect fast idle	High idle speed	Low idle speed	Rough idling	Engine hesitates or accelerates poorly
Starter relay	1												
Starter	2	2		1									
Park/Neutral SW [A/T] or Clutch start SW [M/T]	3												
Flywheel [M/T] or Drive plate [A/T]		4											
Mass air flow sensor circuit			3							3	10	7	
Idle speed control actuator			4	3	3	3	3	3	2	7		2	
Fuel pressure regulator			5	5	5	5				4	11	1	
ECT sensor circuit			6	4	1	1	2	2	1	2	8	6	
Compression			7	8						8	5		
Piston rings			8	9						9			
Ignition timing				10						11	14		
Timing mark			9							12			
Injectors			10	13	8	8			7	4	13	15	4
PCM			11	14	9	9	4	8	5	14	16	5	
A/C circuit				2					6				
Connecting rod bearing				3									
Crankshaft bearing				4									
Fuel quality					1	2	2			1	3	3	
Spark plugs					2					3	4	2	
Fuel pump					6	6	6			5	12		
Fuel lines					7	7	7			6	13		
Ignition circuit			2	11								3	
Intake air temp. sensor circuit					12	4	4		4		9		1
Accelerator pedal link								1	1				
TP Sensor circuit								5			6		
Cylinder head										15			
Clutch [M/T]											1		
Brakes not releasing properly											2		
Oxygen sensor circuit											10		
Crankshaft position sensor		3											
Battery voltage		1	1										

EFDA007A

Main Symptoms	Engine Stalls				Others		Refueling
	Soon after starting	After accelerator pedal is depressed	After accelerator pedal is released	During A/C ON	Excessive fuel consumption	Engine overheats	
Sub-Symptoms	Check points						
Fuel quality	1						
Fuel pressure regulator	2	4			2		
Fuel pump	3						
Fuel lines	4	5					
ISC actuator	5		1	2			
MAF sensor circuit	6	1	2		13		
ECT sensor circuit	7				11		
Injectors	8	6			10		
ECM	9	7	3	3	17		
TP Sensor circuit		2			12		
Spark plug		3			6	8	
A/C circuit				1	14		
Fuel leakage					1		
Accelerator pedal link					3		
Clutch [M/T]					4		
Brakes drag when pedal released					5		
Compression					7		
Piston ring					8		
Ignition timing					9		
Oxygen sensor circuit					15		
Intake air temp. sensor circuit					16		
Coolant leakage						1	
Cooling fan						2	1
Thermo switch						3	
Radiator and radiator cap						4	2
Thermostat						5	
Timing belt						6	
Engine coolant pump						7	
Oil pump						9	
Cylinder head						10	
Cylinder block						11	
ECT sender						12	3
Crankshaft position sensor	11	8	4	4			
Fill vent valve hose-clogging							1
Canister filter-Contamination							2
Fuel shut off valve-operation							3



*The number herein means the check order.*

## SERVICE ADJUSTMENT PROCEDURES

EFNC0090

### IDLE SPEED



*Before adjusting, check that the spark plugs, injectors, idle speed control actuator (ISC actuator), compression etc. are normal.*

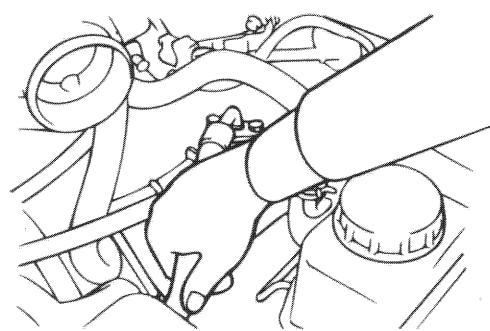
### CHECK CONDITIONS

- Engine coolant temperature is 80 to 95°C (176 to 205°F).
- Lights, electric cooling fan and all accessories are off.
- Transaxle is in neutral ("P" or "N" range for A/T vehicles).
- Steering wheel is in a straight forward position (Vehicles with power steering).

1. Install a tachometer to the primary coil side or connect the scan tool to the data link connector.
2. Start and run the engine at curb idle speed.
3. Run the engine for more than 5 seconds at an engine speed of 2,000 to 3,000 rpm.  
Then, run the engine at idle for 2 minutes.
4. Read the idling rpm.

Idle speed	1.6L : 800 ± 100 rpm 1.8L : 750 ± 100 rpm
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3. Pinch the hose to check that fuel pressure is felt.

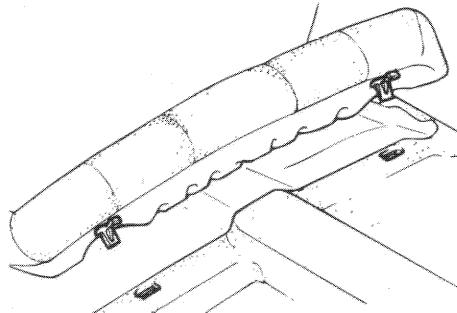


EFDA011B

## FUEL PRESSURE TEST

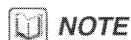
EFKB0130

1. Press the two taps under the rear seat and raise the seat, then detach the inspection panel of the fuel pump.

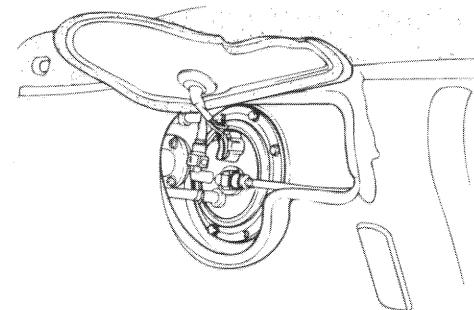


EFDA013A

2. To reduce the internal pressure of the fuel lines and hoses, first start the engine with the fuel pump disconnected and wait until it stops by itself.



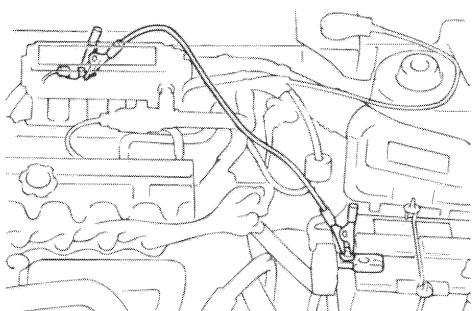
*Be sure to reduce the fuel pressure before disconnecting the fuel main pipe and hose, otherwise fuel will spill out.*



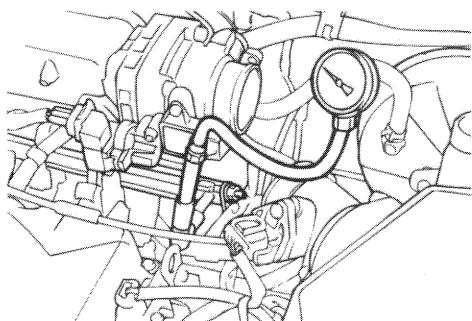
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EFDA011A

3. Disconnect the battery negative (-) terminal and then connect the fuel pump harness connector.



4. Using the fuel pressure gauge adapter (09353-24000, 09353-24100, 09353-38000), install the fuel-pressure gauge to the fuel delivery pipe. Tighten the bolt to the specified torque.



EFDA013C

5. Connect the battery's negative (-) terminal.

6. Apply battery voltage to the terminal for the pump drive and activate the fuel pump. Then, with fuel pressure applied, check that there is no fuel leak from the pressure gauge or connections.

7. Start the engine and let it idle.

8. Measure the fuel pressure.

Standard value : 350 kPa (3.5 kg/cm<sup>2</sup>, 49.8 psi)

9. If the result of the measurements made in steps (7) and (8) are not within the standard value, use the table below to determine the probable cause, and make the necessary repairs.

#### Tightening Torque

Fuel pressure gauge to fuel delivery pipe:  
25 - 35Nm (250 - 350 kg.cm, 18 - 26 lb.ft)

Condition	Probable cause	Remedy
Fuel pressure too low	a. Clogged fuel filter. b. Fuel leak on the fuel-pressure regulator that is assembled on fuel pump, caused by poor seating of the fuel-pressure regulator.	a. Replace fuel filter. b. Repair the leak or replace the fuel pump.
Fuel pressure too high	a. Sticking fuel-pressure regulator.	a. Repair the leak or replace the fuel pump.

10. Stop the engine and check for a change in the fuel pressure gauge reading, which should hold for approximately 5 minutes. If the gauge indication drops, observe the rate of drop. Determine and remove the causes according to the following table.

Condition	Probable cause	Remedy
Fuel pressure drops slowly after engine is stopped	a. Injector leak	a. Replace injector
Fuel pressure drops immediately after engine is stopped	a. The check valve within the fuel pump is open	a. Replace fuel pump

11. Reduce the pressure in the fuel line.

12. Disconnect the hose and the gauge.

15. Check for fuel leaks.

#### CAUTION

*Cover the hose connection with a shop towel to prevent splashing of fuel caused by residual fuel pressure in the fuel line.*

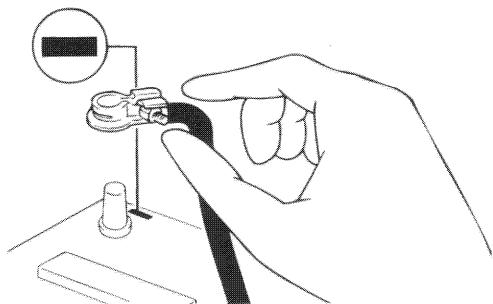
13. Replace the O-ring at the end of the hose.

14. Connect the fuel hose to the delivery pipe and tighten to the specified torque.

## FUEL FILTER REPLACEMENT

EFKB0230

1. Reduce the internal pressure of the fuel lines and hoses by completing the following operations.
  - After removing the rear seat cushion, disconnect the fuel pump harness.
  - Start the engine. Allow it to stop by itself, then turn the ignition switch OFF.
  - Disconnect the battery negative (-) terminal.
  - Connect the fuel pump harness connector.



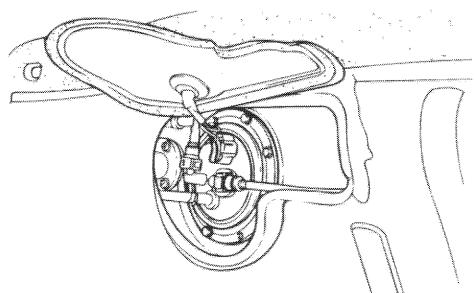
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2. Remove the eye bolts while holding the fuel filter nuts securely.

**CAUTION**

*Cover the fuel filter with a shop towel to avoid residual gasoline from splashing.*

3. Remove the fuel filter mounting bolts, then remove the fuel filter from the fuel filter clamp.
4. After replacing the fuel filter, check for fuel leaks.

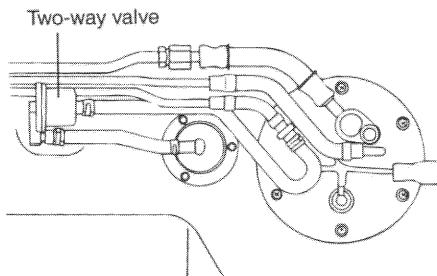


EFKB013B

OVERFILL LIMITER (TWO-WAY VALVE)  
REPLACEMENT

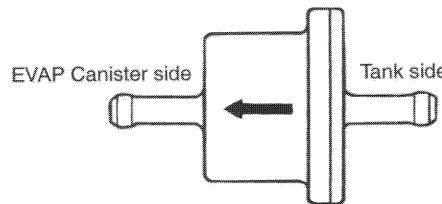
EFDA0250

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



EFDA025A

2. Connect the overfill limiter in the correct direction.

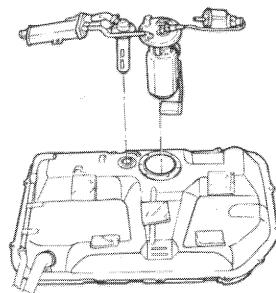


EFDA025B

## FUEL SENDER REPLACEMENT

EFDA0270

1. Remove the fuel tank cap to lower the fuel tank's internal pressure.
2. Remove the fuel sender installation screws, then remove the fuel sender from the fuel tank.



EFDA112A

**MFI SYSTEM INSPECTION**

EFNC0150

If the MFI system components (sensors, ECM, injector, etc.) fail, interruption to the fuel supply or failure to supply the proper amount of fuel for various engine operating conditions will result. The following situations may 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 perform a routine diagnosis that includes basic engine checks (ignition system malfunction, incorrect engine adjustment, etc.). Then, inspect the MFI system components with the HI-SCAN (Pro).

**NOTE**

- Before removing or installing any part, read the diagnostic trouble codes and then disconnect the battery negative (-) terminal.
- Before disconnecting the cable from battery terminal, turn the ignition switch to OFF. Removal or connection of the battery cable during engine operation or while the ignition switch is ON could cause damage to the ECM.
- The control harnesses between the ECM and heated oxygen sensor are shielded with the shielded ground wires to the body in order to prevent the influence of ignition noises and radio interference. When the shielded wire is faulty, the control harness must be replaced.
- When checking the generator for the charging state, do not disconnect the battery '+' terminal to prevent the ECM from damage due to the voltage.
- When charging the battery with the external charger, disconnect the vehicle side battery terminals to prevent damage to the ECM.

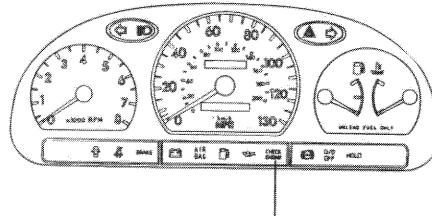
**MALFUNCTION INDICATOR LAMP (MIL)****[ EOBD ]**

A malfunction indicator lamp illuminates to notify the driver that there is a problem with the vehicle. However, the MIL will go off automatically after 3 subsequent sequential driving cycles without the same malfunction. Immediately after the ignition switch is turned on (ON position - do not start), the MIL will illuminate continuously to indicate that the MIL operates normally.

Faults with the following items will illuminate the MIL

- Catalyst
- Fuel system

- Manifold Absolute Pressure Sensor
- Intake Air Temperature Sensor
- Engine Coolant Temperature Sensor
- Throttle Position Sensor
- Upstream Oxygen Sensor
- Downstream Oxygen Sensor Heater
- Downstream Oxygen Sensor
- Upstream Oxygen Sensor Heater
- Injector
- Misfire
- Crankshaft Position Sensor
- Camshaft Position Sensor
- Evaporative Emission Control System
- Vehicle Speed Sensor
- Idle Control Valve
- Power Supply
- ECM
- MT/AT Encoding
- Acceleration Sensor
- MIL-on Request Signal
- Power Stage



Malfunction indicator lamp

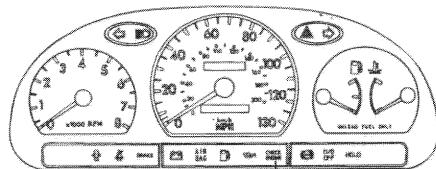
EFDA015A

**[ NON-EOBD ]**

A malfunction indicator lamp illuminates to notify the driver that there is a problem with the vehicle. However, the MIL will go off automatically after 3 subsequent sequential driving cycles without the same malfunction. Immediately after the ignition switch is turned on (ON position - do not start), the MIL will illuminate continuously to indicate that the MIL operates normally.

Faults with the following items will illuminate the MIL

- Heated oxygen sensor (HO2S)
- Manifold absolute pressure sensor (MAP sensor)
- Throttle position sensor (TP Sensor)
- Engine coolant temperature sensor (ECT Sensor)
- Idle speed control actuator (ISC Actuator)
- Injectors
- ECM



Malfunction indicator lamp

EFDA015A

**[INSPECTION]**

1. After turning ON the ignition key, ensure that the light illuminates for about 5 seconds and then goes out.
2. If the light does not illuminate, check for an open circuit in the harness, a blown fuse or a blown bulb.

**SELF-DIAGNOSIS**

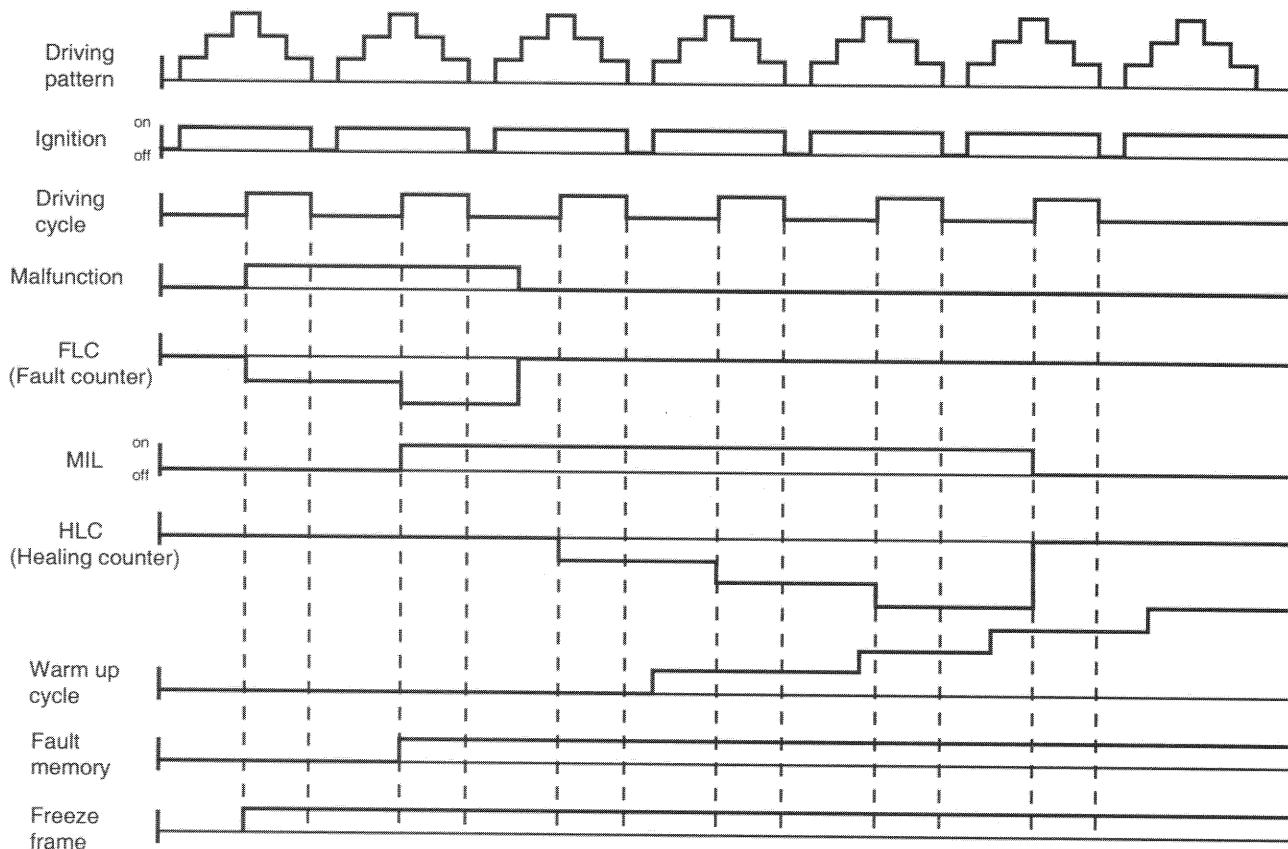
The ECM monitors the input/output signals (some signals at all times and the others under specified conditions). When the ECM detects an irregularity, it records the diagnostic trouble code, and outputs the signal to the Data Link connector. The diagnosis results can be read with the MIL or HI-SCAN (Pro). Diagnostic Trouble Codes (DTC) will remain in the ECM as long as battery power is maintained. The diagnostic trouble codes will, however, be erased when the battery terminal or the engine control module (ECM) connector is disconnected, or by the HI-SCAN (Pro).

**NOTE**

*If a sensor connector is disconnected with the ignition switch turned on, the diagnostic trouble code (DTC) is recorded. In this case, disconnect the battery negative terminal (-) for 15 seconds or more, and the diagnosis memory will be erased.*

## THE RELATION BETWEEN DTC AND DRIVING PATTERN IN EOBD SYSTEM

EFNC0170



EFDA017A

1. When the same malfunction is detected and maintained during two sequential driving cycles, the MIL will automatically illuminate.
2. The MIL will go off automatically if no fault is detected after 3 sequential driving cycles.
3. A Diagnostic Trouble Code(DTC) is recorded in ECM memory when a malfunction is detected after two sequential driving cycles. The MIL will illuminate when the malfunction is detected on the second driving cycle. If a misfire is detected, a DTC will be recorded, and the MIL will illuminate, immediately after a fault is first detected.
4. A diagnostic Trouble Code(DTC) will automatically erase from ECM memory if the same malfunction is not detected for 40 driving cycles.

- A "driving cycle" consists of engine startup, vehicle operation beyond the beginning of closed loop operation.

### NOTE

- A "warm-up cycle" means sufficient vehicle operation such that the coolant temperature has risen by at least 40 degrees Fahrenheit from engine starting and reaches a minimum temperature of 160 degrees Fahrenheit.

**INSPECTION CHART FOR DIAGNOSTIC  
TROUBLE CODES (1.6 I4, EOBD)**

EFNC0190

DTC NO.	CONTENT	Memory	MIL
P0030	HO2S Heater Current Malfunction (Bank 1, Sensor 1)	O	O
P0031	HO2S Heater Circuit Low (Bank 1, Sensor 1)	O	O
P0032	HO2S Heater Circuit High (Bank 1, Sensor 1)	O	O
P0036	HO2S Heater Circuit Malfunction (Bank 1, Sensor 2)	O	X
P0037	HO2S Heater Circuit Low (Bank 1, Sensor 2)	O	O
P0038	HO2S Heater Circuit High (Bank 1, Sensor 2)	O	O
P0106	MAP Sensor Rationality	O	O
P0107	MAP Sensor Range Check Low	O	O
P0108	MAP Sensor Range Check High	O	O
P0112	Intake Air Temperature Circuit Low Input	O	O
P0113	Intake Air Temperature Circuit High Input	O	O
P0116	Engine Coolant Temperature Sensor Circuit Range/Performance Problem	O	O
P0117	Engine Coolant Temperature Circuit Low Input	O	O
P0118	Engine Coolant Temperature Circuit High Input	O	O
P0121	Throttle Position Sensor Circuit Range/Performance Problem	O	X
P0122	Throttle Position Sensor Circuit Low Input	O	O
P0123	Throttle Position Sensor Circuit High Input	O	O
P0130	O2 Sensor Circuit Malfunction	O	O
P0131	HO2S Circuit Low Input (Bank 1, Sensor 1)	O	O
P0132	HO2S Circuit High Input (Bank 1, Sensor 1)	O	O
P0133	HO2S Circuit Slow Responsive (Bank 1, Sensor 1)	O	O
P0134	O2 Sensor Circuit No Activity Detected	O	O
P0136	O2 Sensor Circuit Malfunction	O	O
P0137	HO2S Circuit Low Input (Bank 1, Sensor 2)	O	O
P0138	HO2S Circuit Low Input (Bank 1, Sensor 2)	O	O
P0140	HO2 Range Check	O	O
P0171	Fuel System Too Lean (Bank 1)	O	O
P0172	Fuel System Too Rich (Bank 1)	O	O
P0230	Fuel Pump Circuit Malfunction	O	X
P0261	Injector Circuit Low Input (Cylinder -1)	O	O
P0264	Injector Circuit Low Input (Cylinder -2)	O	O
P0267	Injector Circuit Low Input (Cylinder -3)	O	O
P0270	Injector Circuit Low Input (Cylinder -4)	O	O
P0262	Injector Circuit High Input (Cylinder -1)	O	O
P0265	Injector Circuit High Input (Cylinder -2)	O	O
P0268	Injector Circuit High Input (Cylinder -3)	O	O

DTC NO.	CONTENT	Memory	MIL
P0271	Injector Circuit High Input (Cylinder -4)	○	○
P0300	Random Misfire Detected	○	○
P0301	Misfire Detected (Cylinder -1)	○	○
P0302	Misfire Detected (Cylinder -2)	○	○
P0303	Misfire Detected (Cylinder -3)	○	○
P0304	Misfire Detected (Cylinder -4)	○	○
P0325	Knock Sensor Circuit Malfunction (Bank 1)	○	×
P0335	Crankshaft Position Sensor Circuit Malfunction	○	○
P0336	Crankshaft Position Sensor Circuit Range Random	○	○
P0340	Camshaft Position Sensor Circuit Malfunction	○	○
P0420	Main catalyst efficiency deterioration (Bank 1)	○	○
P0444	EVAP Emission Control System Purge Control Valve Circuit Open	○	○
P0445	EVAP Emission Control System Purge Control Valve Circuit Shorted	○	○
P0501	Vehicle Speed Sensor Range/Performance	○	○
P0506	Idle Control System Rpm Lower than Expected	○	○
P0507	Idle Control System rpm Higher than Expected	○	○
P0562	System Voltage Low	○	○
P0563	System Voltage High	○	○
P0600	CAN Communication Error	○	○
P0605	Internal CONTROL module ROM error	○	×
P1307	Acceleration Sensor Malfunction	○	○
P1308	Acceleration Sensor Signal Check Low	○	○
P1309	Acceleration Sensor Signal Check High	○	○
P1505	Idle Charge Actuator Signal Low of Coil #1	○	○
P1506	Idle Charge Actuator Signal High of Coil #1	○	○
P1507	Idle Charge Actuator Signal Low of Coil #2	○	○
P1508	Idle Charge Actuator Signal High of Coil #2	○	○
P1529	TCU Request for MIL ON/Freeze Frame to ECU via CAN	○	○
P1586	Encoding Signal Circuit Not Rational	○	○
P1610	Immobilizer SMATRA Error	○	×
P1693	MIL Request Line Check	○	○
P1801	Immobilizer Transponder Error	○	×
P1802	Immobilizer Antena Error	○	×
P1803	Engine ECM Signal Error	○	×
P1805	EEPROM Error	○	×

**INSPECTION CHART FOR  
DIAGNOSTIC TROUBLE CODES**  
**(1.6 I4, NON-EOBD)** EFNC0210

DTC NO.	CONTENT	Memory	MIL
P0031	HO2S Heater Circuit Low (Bank 1, Sensor 1)	O	X
P0032	HO2S Heater Circuit High (Bank 1, Sensor 1)	O	X
P0107	MAP Sensor Range Check Low	O	O
P0108	MAP Sensor Range Check High	O	O
P0112	Intake Air Temperature Circuit Low Input	O	X
P0113	Intake Air Temperature Circuit High Input	O	X
P0116	Engine Coolant Temperature Sensor Circuit Range/Performance Problem	O	X
P0117	Engine Coolant Temperature Circuit Low Input	O	O
P0118	Engine Coolant Temperature Circuit High Input	O	O
P0121	Throttle Position Sensor Circuit Range/Performance Problem	O	X
P0122	Throttle Position Sensor Circuit Low Input	O	O
P0123	Throttle Position Sensor Circuit High Input	O	O
P0130	O2 Sensor Circuit Malfunction	O	X
P0131	HO2S Circuit Low Input (Bank 1, Sensor 1)	O	X
P0132	HO2S Circuit High Input (Bank 1, Sensor 1)	O	X
P0133	HO2S Circuit Slow Responsive (Bank 1, Sensor 1)	O	X
P0134	O2 Sensor Circuit No Activity Detected	O	X
P0171	Fuel System Too Lean (Bank 1)	O	X
P0172	Fuel System Too Rich (Bank 1)	O	X
P0230	Fuel Pump Circuit Malfunction	O	X
P0261	Injector Circuit Low Input (Cylinder -1)	O	O
P0264	Injector Circuit Low Input (Cylinder -2)	O	O
P0267	Injector Circuit Low Input (Cylinder -3)	O	O
P0270	Injector Circuit Low Input (Cylinder -4)	O	O
P0262	Injector Circuit High Input (Cylinder -1)	O	O
P0265	Injector Circuit High Input (Cylinder -2)	O	O
P0268	Injector Circuit High Input (Cylinder -3)	O	O
P0271	Injector Circuit High Input (Cylinder -4)	O	O
P0325	Knock Sensor Circuit Malfunction (Bank 1)	O	X
P0335	Crankshaft Position Sensor Circuit Malfunction	O	X
P0336	Crankshaft Position Sensor Circuit Range Random	O	X
P0340	Camshaft Position Sensor Circuit Malfunction	O	X
P0501	Vehicle Speed Sensor Range/Performance	O	X
P0506	Idle Control System Rpm Lower than Expected	O	X
P0507	Idle Control System rpm Higher than Expected	O	X

DTC NO.	CONTENT	Memory	MIL
P0562	System Voltage Low	O	X
P0563	System Voltage High	O	X
P0600	CAN Communication Error	O	X
P0605	Internal CONTROL module ROM error	O	X
P1505	Idle Charge Actuator Signal Low of Coil #1	O	O
P1506	Idle Charge Actuator Signal High of Coil #1	O	O
P1507	Idle Charge Actuator Signal Low of Coil #2	O	O
P1508	Idle Charge Actuator Signal High of Coil #2	O	O
P1586	Encoding Signal Circuit Not Rational	O	X

## INSPECTION CHART FOR DIAGNOSTIC

## TROUBLE CODES (1.8 I4, EOBD) EFNC0230

DTC NO.	CONTENT	Memory	MIL
P0030	O2 Sensor Heater Circuit Malfunction (Bank 1 Sensor 1) - Plausibility Check	O	O
P0036	O2 Sensor Heater Circuit Malfunction (Bank 1 Sensor 2) - Plausibility Check	O	O
P0105	Manifold Absolute Pressure Circuit Malfunction	O	O
P0106	Manifold Absolute Pressure Circuit Range/Performance Problem	O	X
P0110	Intake Air Temperature Circuit Malfunction	O	O
P0115	Engine Coolant Temperature Circuit Malfunction	O	O
P0116	Engine Coolant Temperature Circuit Range/Performance	O	O
P0120	Throttle Position Circuit Malfunction	O	O
P0121	Throttle Position Circuit Range/Performance problem	O	X
P0125	Insufficient Coolant Temperature For Closed Loop Fuel Control	O	O
P0130	O2 Sensor Circuit Malfunction (Bank 1 Sensor 1)	O	O
P0132	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	O	O
P0133	O2 Sensor Circuit Slow Response (Bank 1 Sensor 1)	O	O
P0139	O2 Sensor Circuit Slow Response (Bank 1 Sensor 2)	O	O
P0134	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	O	X
P0135	O2 Sensor Heater Circuit Malfunction (Bank 1 Sensor 1) - Electrical Check	O	O
P0136	O2 Sensor Circuit Malfunction (Bank 1 Sensor 2)	O	O
P0140	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 2)	O	X
P0141	O2 Sensor Heater Circuit Malfunction (Bank 1 Sensor 2) - Electrical Check	O	O
P0170	Fuel Trim Malfunction (Bank 1)	O	O
P0201	Cylinder 1 - Injector Circuit Malfunction	O	O
P0202	Cylinder 2 - Injector Circuit Malfunction	O	O

DTC NO.	CONTENT	Memory	MIL
P0203	Cylinder 3 - Injector Circuit Malfunction	O	O
P0204	Cylinder 4 - Injector Circuit Malfunction	O	O
P0230	Fuel Pump Circuit Malfunction	O	X
P0300	Multiple Cylinder Misfire Detected	O	O
P0301	Cylinder 1 - Misfire Detected	O	O
P0302	Cylinder 2 - Misfire Detected	O	O
P0303	Cylinder 3 - Misfire Detected	O	O
P0304	Cylinder 4 - Misfire Detected	O	O
P0325	Knock Sensor 1 Circuit Malfunction	O	X
P0335	Crankshaft Position Sensor Circuit Malfunction	O	O
P0340	Camshaft Position Sensor (CMP Sensor) Circuit Malfunction	O	O
P0422	Catalyst System Efficiency Below Threshold (Bank 1)	O	O
P0443	Purge Control Valve Circuit Malfunction	O	O
P0501	Vehicle Speed Sensor Range/Performance	O	O
P0506	Idle Control System RPM Lower Than Expected	O	X
P0507	Idle Control System RPM Higher Than Expected	O	X
P0560	Battery Voltage Low	O	X
P0600	Serial Communication Link Malfunction	O	O
P0605	ECM - Selftest Failed	O	X
P1166	O2 Sensor - Controller Adaption Diagnosis Malfunction (Bank 1)	O	O
P1184	O2 Sensor No Activity Detected (Bank 1 Sensor 2)	O	O
P1372	Segment Time Acquisition Incorrect	O	O
P1502	Open Wire Magnetic Wheel Speed Sensor	O	O
P1515	Idle Speed Actuator Command Signal Incorrect (Coil 1)	O	O
P1516	Idle Speed Actuator Command Signal Incorrect (Coil 2)	O	O
P1529	TCU Request for MIL On/Freeze Frame to ECM via CAN	O	O
P1602	Serial Communication Problem With TCU (TIMEOUT)	O	O
(P1610)	Anti - Theft Device - Communication Error	O	X
(P1800)	Anti - Theft Device - Smastra Antenna Fault	O	X
(P1801)	Anti - Theft Device - Smastra Transponder Error	O	X
(P1803)	Anti - Theft Device - Invalid Request	O	X
(P1805)	Anti - Theft Device - Inconsistent Data	O	X

DTCs in ( ) are only applicable to Immobilizer Vehicle.

**INSPECTION CHART FOR  
DIAGNOSTIC TROUBLE CODES  
(1.8 I4, NON-EOBD)**

EFNC0240

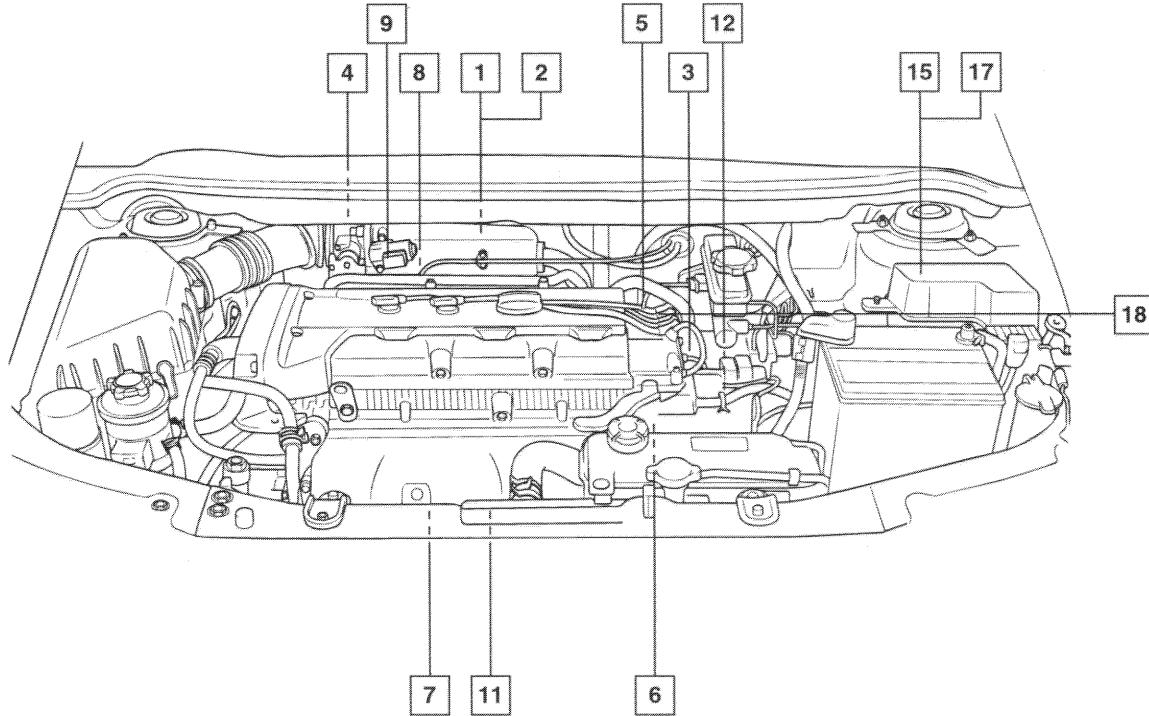
DTC NO.	CONTENT	Memory	MIL
P0105	Manifold Absolute Pressure Circuit Malfunction	O	O
P0110	Intake Air Temperature Circuit Malfunction	O	X
P0115	Engine Coolant Temperature Circuit Malfunction	O	O
P0116	Engine Coolant Temperature Circuit Range/Performance	O	O
P0120	Throttle/Pedal Position Circuit Malfunction	O	O
P0130	O2 Sensor Circuit Malfunction (Bank 1 Sensor 1)	O	X
P0132	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	O	X
P0134	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	O	X
P0135	O2 Sensor Heater Circuit Malfunction (Bank 1 Sensor 1)	O	X
P0201	Cylinder 1 - Injector Circuit Malfunction	O	O
P0202	Cylinder 2 - Injector Circuit Malfunction	O	O
P0203	Cylinder 3 - Injector Circuit Malfunction	O	O
P0204	Cylinder 4 - Injector Circuit Malfunction	O	O
P0230	Fuel Pump Circuit Malfunction	O	X
P0325	Knock Sensor 1 Circuit Malfunction	O	X
P0335	Crankshaft Position Sensor Circuit Malfunction	O	X
P0340	Camshaft Position Sensor (TDC Sensor) Circuit Malfunction	O	X
P0501	Vehicle Speed Sensor Range/Performance	O	X
P0560	System Voltage	O	X
P0605	ECM - Selftest failed	O	X
P1515	Idle Speed Actuator Command Signal Incorrect (Coil 1)	O	O
P1516	Idle Speed Actuator Command Signal Incorrect (Coil 2)	O	O
P1602	Serial Communication Problem With TCU (TIMEOUT)	O	X
P1610	Anti - Theft Device - Communication Error	O	X
P1800	Anti - Theft Device - Smatra Antenna Fault	O	X
P1801	Anti - Theft Device - Smatra Transponder Error	O	X
P1803	Anti - Theft Device - Invalid Request	O	X
P1805	Anti - Theft Device - Inconsistent Data	O	X

# MFI CONTROL SYSTEM

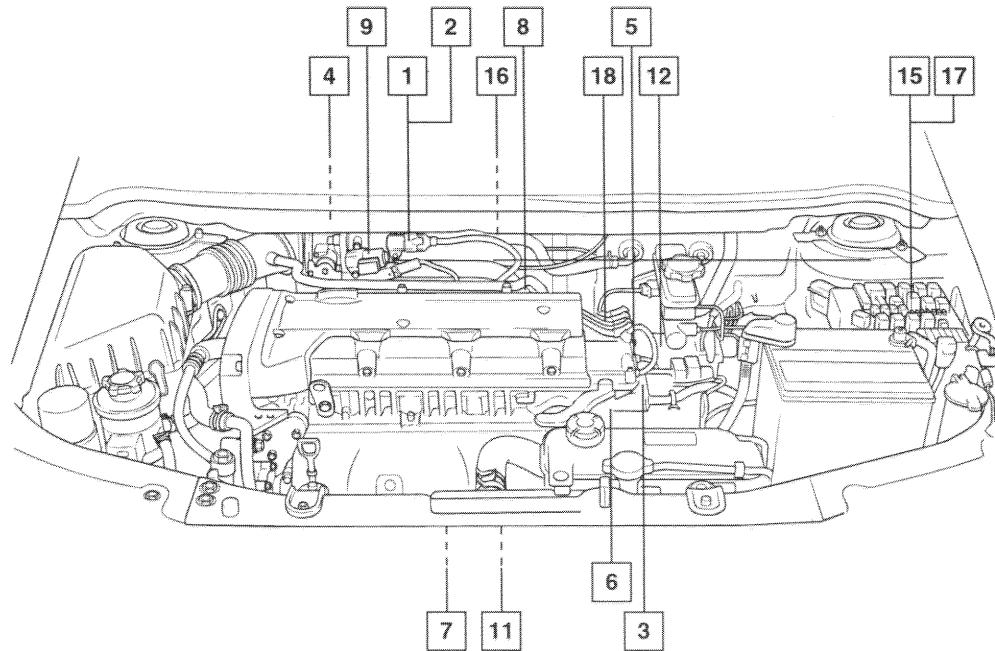
## LOCATION OF MFI COMPONENTS

EFNC0250

&lt;1.6 I4&gt;

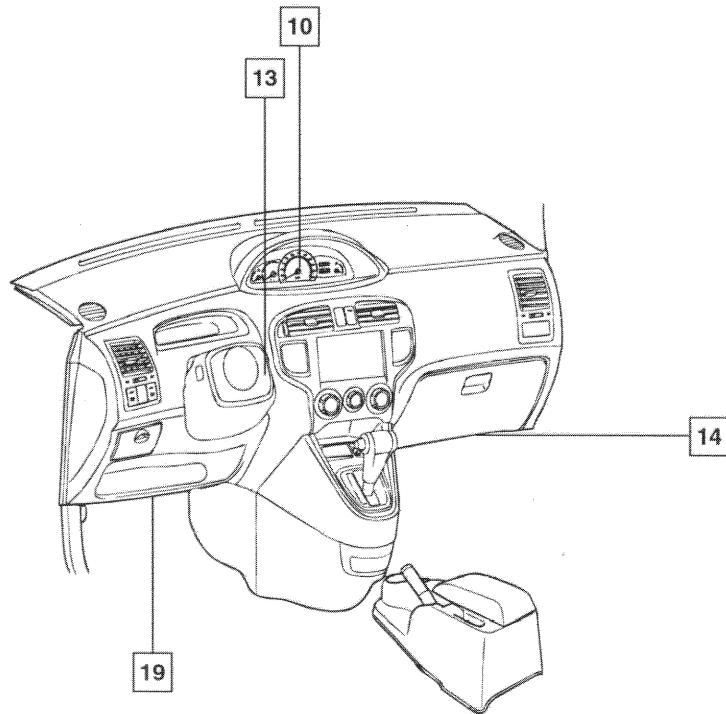


&lt;1.8 I4&gt;

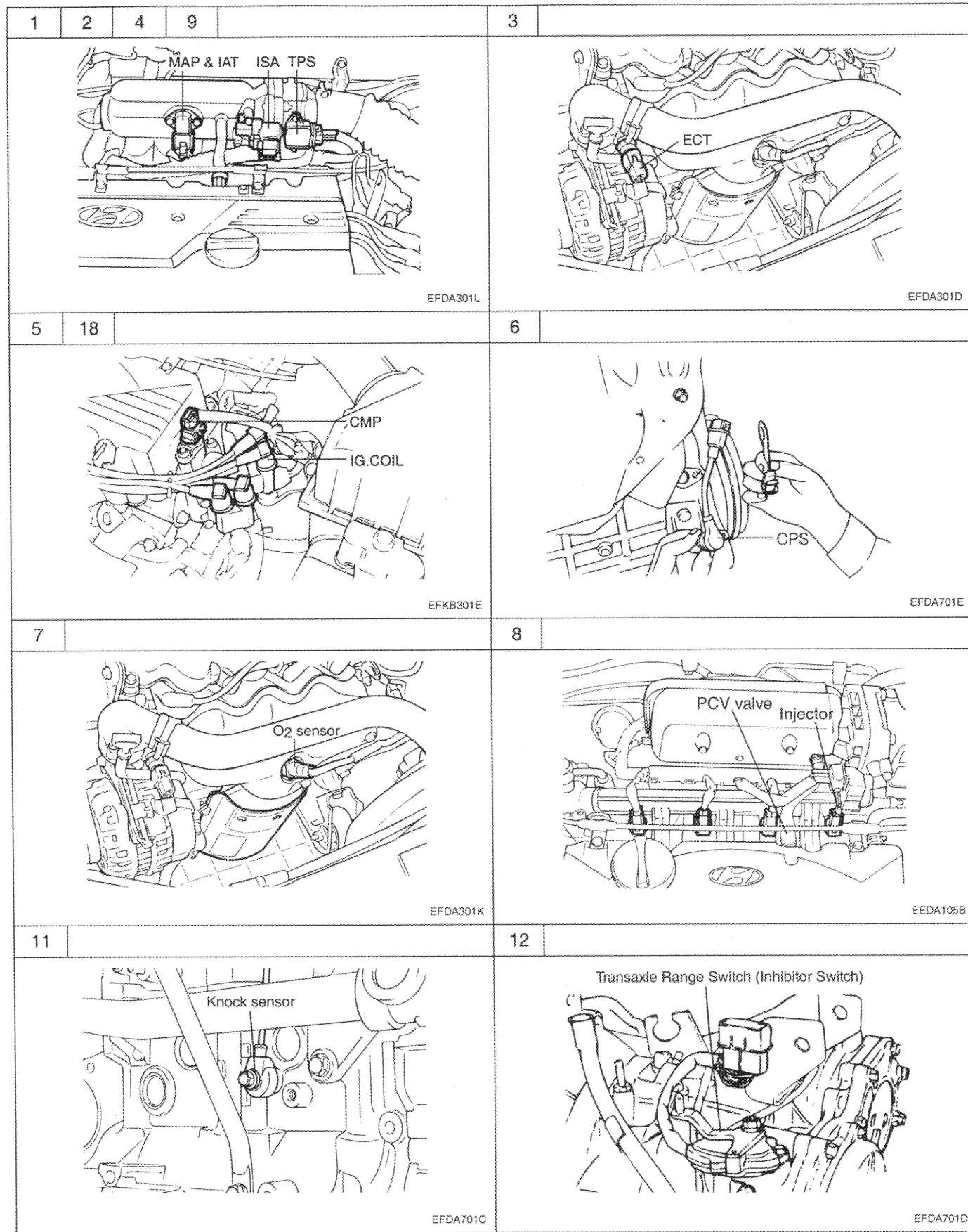


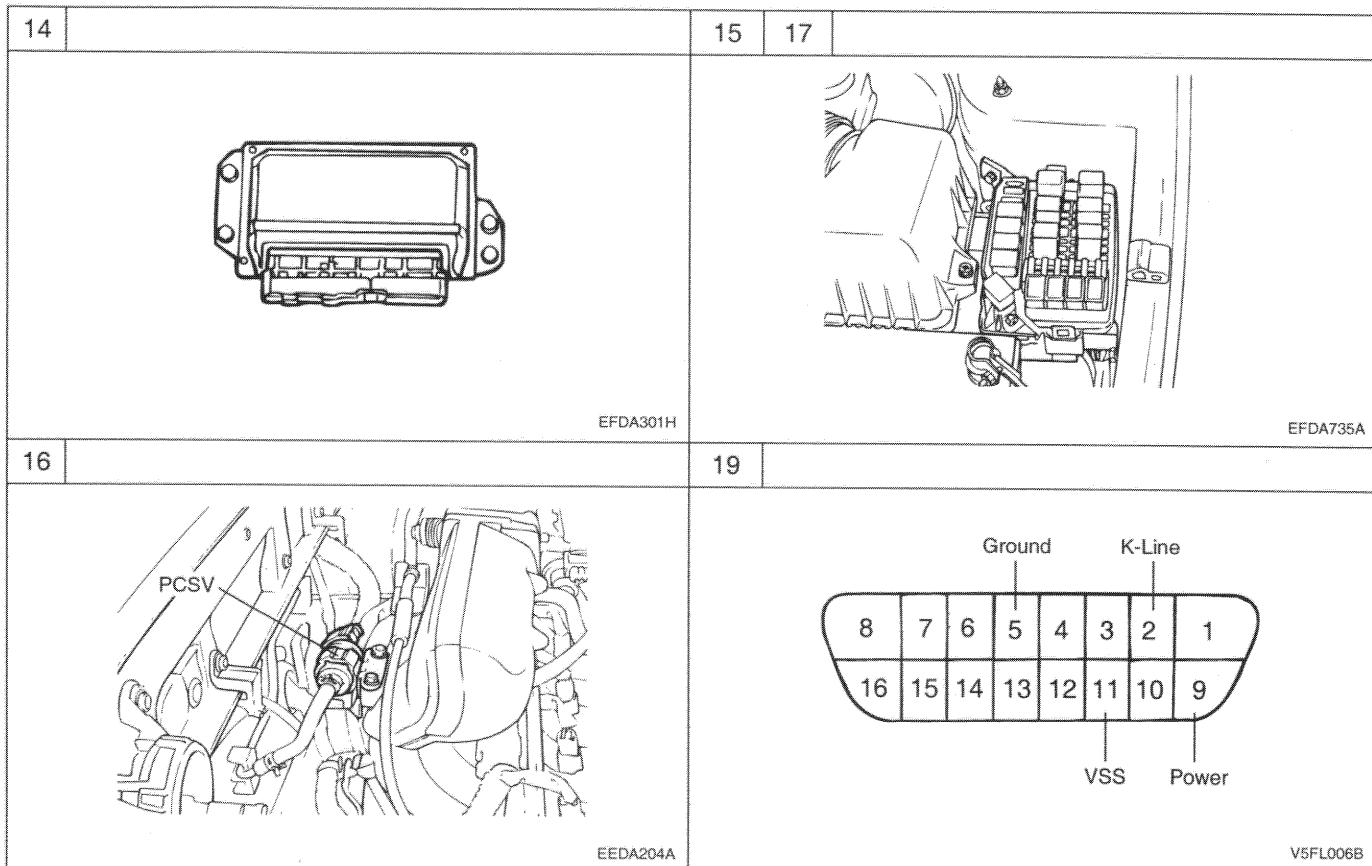
KENB002A/KENB002B

EFNC025A

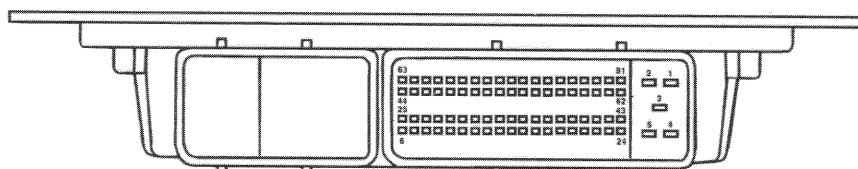


<b>1</b>	Manifold Absolute Pressure(MAP) Sensor	<b>11</b>	Knock Sensor
<b>2</b>	Intake Air Temp.(IAT) Sensor	<b>12</b>	Inhibitor Switch
<b>3</b>	Engine Coolant Temp.(ECT) Sensor	<b>13</b>	Ignition Switch
<b>4</b>	Throttle Position Sensor (TPS)	<b>14</b>	ECM
<b>5</b>	Camshaft Position Sensor (CMP)	<b>15</b>	Air Conditioner Relay
<b>6</b>	Crankshaft Position Sensor (CKP)	<b>16</b>	Purge Control Solenoid Valve (PCSV)
<b>7</b>	Heated Oxygen Sensor	<b>17</b>	Control Relay
<b>8</b>	Injector	<b>18</b>	Ignition Coil
<b>9</b>	Idle Speed Actuator (ISA)	<b>19</b>	Data Link Connector (DLC)
<b>10</b>	Vehicle Speed Sensor (VSS)		





## ECM PIN NUMBER CONFIGURATION



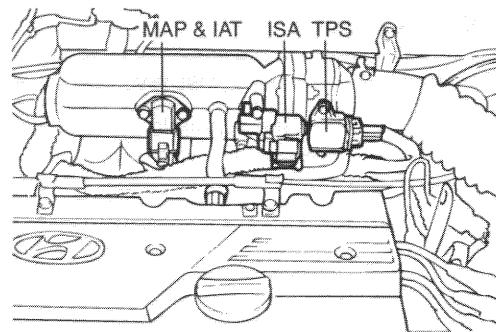
## ECM HARNESS PIN NUMBER CONFIGURATION

1	2	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63
		62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44
3		43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25
4	5	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6

## MANIFOLD ABSOLUTE PRESSURE SENSOR (MAP SENSOR)

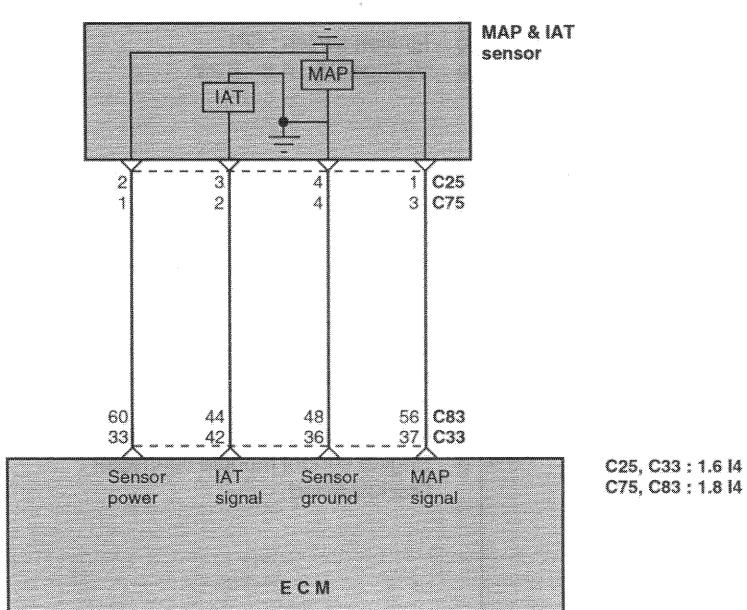
EFNC0270

The manifold absolute pressure (MAP) sensor is a pressure sensitive variable resistor. It measures changes in the intake manifold pressure which result from engine load and speed changes, and converts this to a voltage output. The MAP sensor is also used to measure barometric pressure at start up, and under certain conditions, allows the ECM to automatically adjust for different altitudes. The ECM supplies 5 volts to the MAP sensor and monitors the voltage on a signal line. The sensor provides a path to ground through its variable resistor. The MAP sensor input affects fuel delivery and ignition timing controls in the ECM.



EFDA301L

### CIRCUIT DIAGRAM



EFNC027A

### TROUBLESHOOTING HINTS

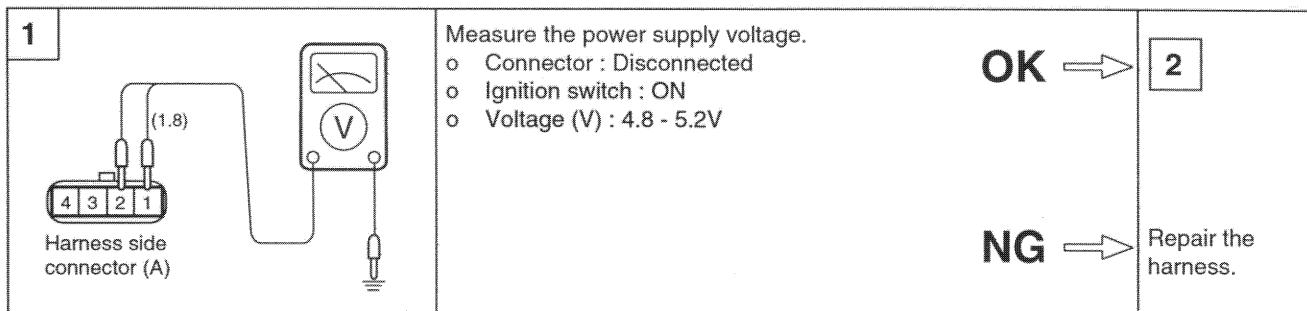
The 'MIL (Malfunction Indicator Lamp) is ON or the DTC (Diagnostic Trouble Code) is displayed on the HI-SCAN (Pro) under the following conditions;

1. When the manifold pressure is 118mb or lower for 0.1 second after turning the ignition key ON.
2. When the manifold pressure is 118mb or lower while the RPM is below 1980rpm.
3. When the manifold pressure is 986mb or higher and the rpm is 2400rpm or more while the accelerator pedal is released (such as when a vehicle is moving down on a sloping road).

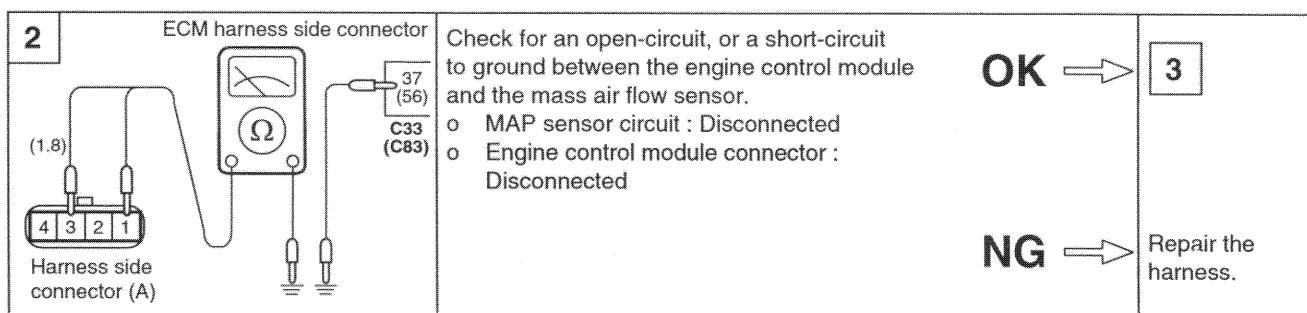
## USING HI-SCAN (PRO)

Check item	Data display	Check conditions	Engine state	Test specification
MAP sensor	Intake manifold pressure	<ul style="list-style-type: none"> <li>• Engine coolant temperature: 80 to 95° (176 to 205°F)</li> <li>• Lamps, electric cooling fan, accessory units: ALL OFF</li> <li>• Transaxle: Neutral (P range for vehicle with A/T)</li> <li>• Steering wheel: Neutral</li> </ul>	IG. KEY "ON"	850 - 1024 mb
			Idle	260 - 400 mb

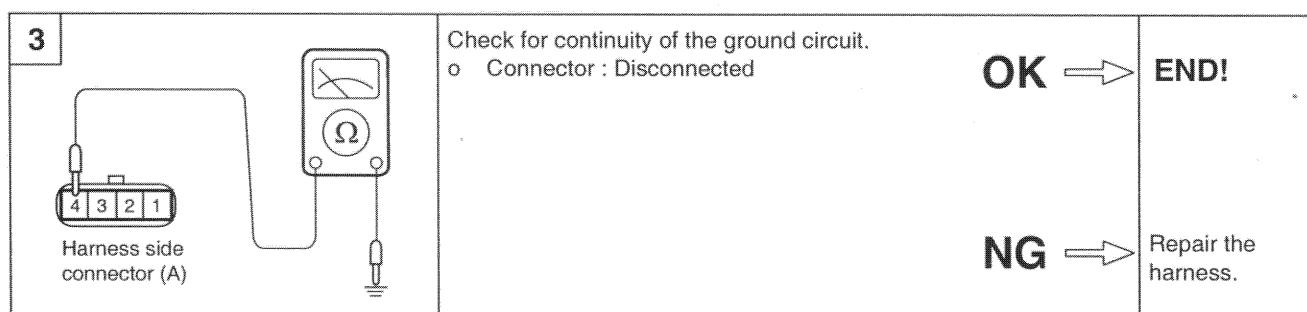
## HARNESS INSPECTION PROCEDURES



EFNC027B



EFNC027C



EFDA707C

**SENSOR INSPECTION**

1. Measure the voltage between terminals 1 and 4 of the

MAP sensor connectors.

Terminal 4 : MAP sensor ground

Terminal 1 : MAP sensor output

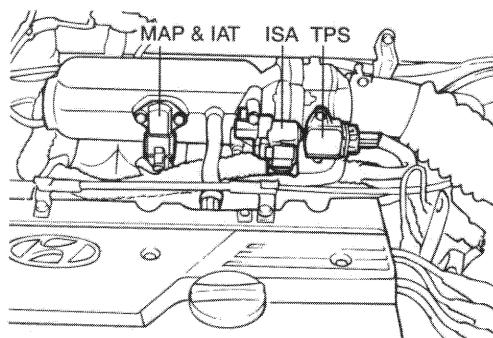
Engine state	Test specification
Ignition SW. ON.	4 - 5V
At idle	0.5 - 2.0V

2. If the voltage deviates from the standard value, replace the MAP sensor assembly.

## INTAKE AIR TEMPERATURE SENSOR (IAT SENSOR)

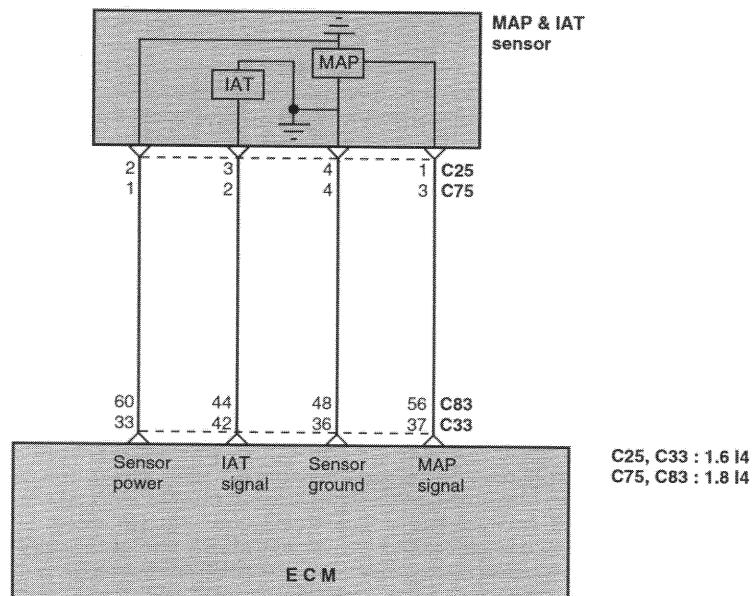
EFNC0290

The intake air temperature sensor (IAT Sensor), built in to the MAP sensor, is a resistor-based sensor detect the intake air temperature. According to the intake air temperature information from the sensor, the ECM will control the necessary amount of fuel injection.



EFDA301L

## CIRCUIT DIAGRAM



EFNC027A

## TROUBLESHOOTING HINTS

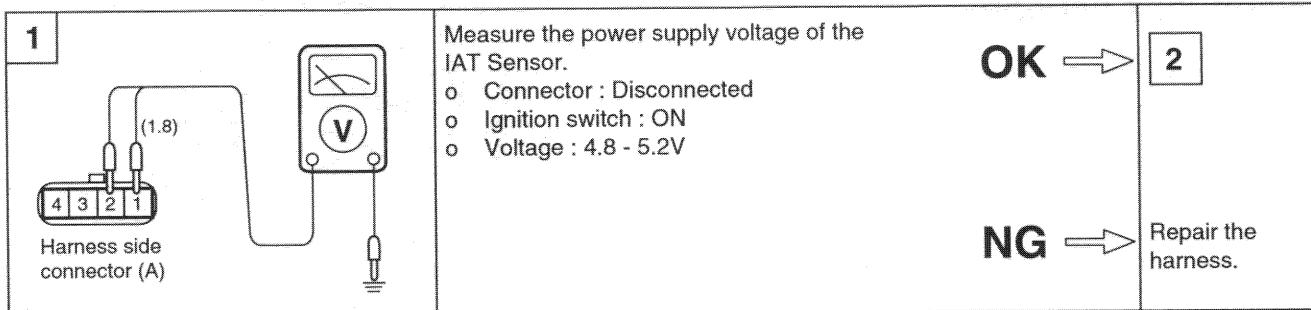
The MIL is ON or the DTC is displayed on the HI-SCAN (Pro) under the following condition;

- When the intake air temperature is detected below -40°C or higher than 120°C.

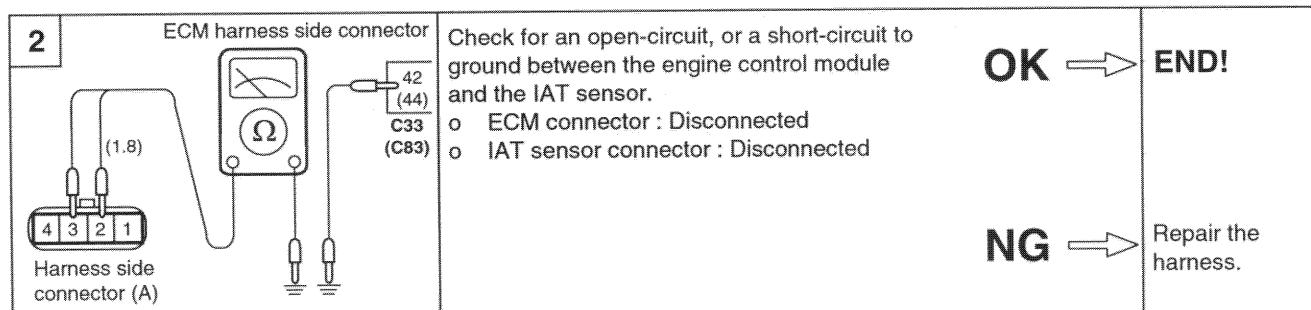
## USING HI-SCAN (PRO)

Check item	Data display	Check conditions	Engine state	Test specification
Intake air temperature sensor	Air temperature	Ignition switch : ON or engine running	When -20°C (-40°F)	-20°C
			When 0°C (32°F)	0°C
			When 20°C (68°F)	20°C
			When 40°C (104°F)	40°C
			When 80°C (176°F)	80°C

## HARNESS INSPECTION PROCEDURES



EFNC029B



EFNC029C

## SENSOR INSPECTION

1. Using a multimeter, measure the IAT sensor resistance between terminals 3 and 4.

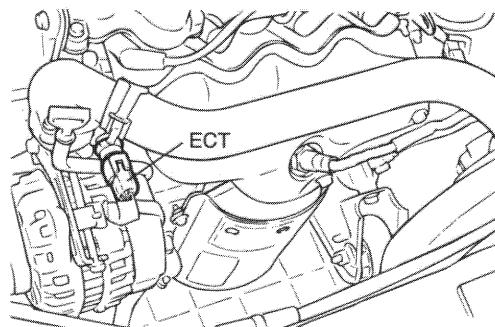
IG.SW.ON	Temperature °C (°F)	Output voltage (Ω)
	0 (32)	4.5 - 7.5Ω
	20 (68)	2.0 - 3.0Ω
	40 (104)	0.7 - 1.6Ω
	80 (176)	0.2 - 0.4Ω

2. If the resistance deviates from the standard value, replace the intake air temperature sensor assembly.

## ENGINE COOLANT TEMPERATURE SENSOR (ECT SENSOR)

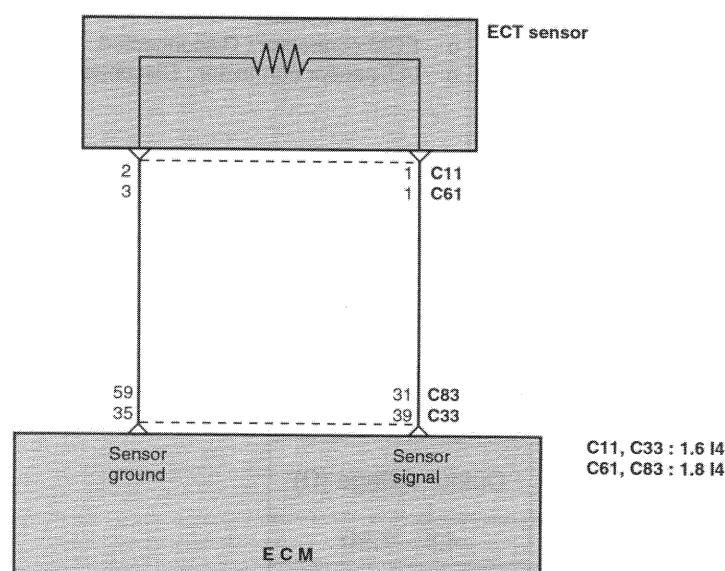
EFNC0310

The engine coolant temperature sensor, located in the engine coolant passage of the cylinder head. It detects the engine coolant temperature and relays signals to the ECM. It 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.



EFDA301D

### CIRCUIT DIAGRAM



EFNC031A

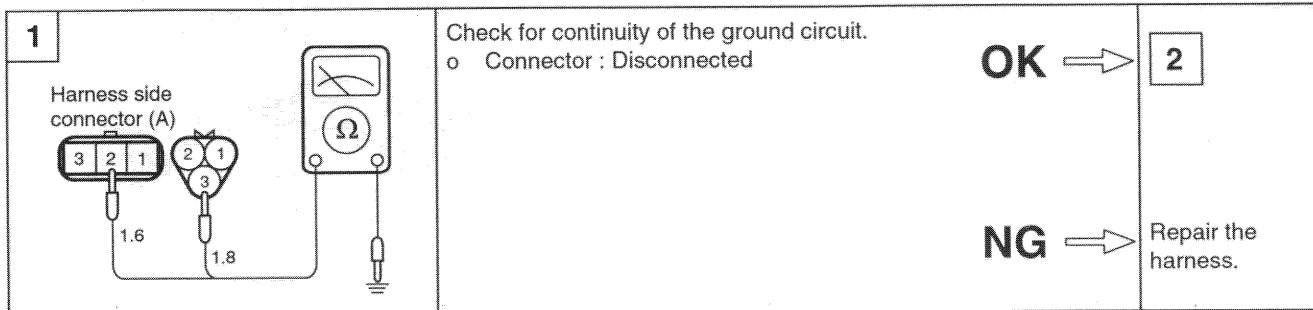
### USING HI-SCAN (PRO)

Check item	Data display	Check conditions	Engine state	Test specification
Engine coolant temperature sensor	Sensor temperature	Ignition switch : ON or engine running	When -20°C (-40°F)	-20°C
			When 0°C (32°F)	0°C
			When 20°C (68°F)	20°C
			When 40°C (104°F)	40°C
			When 80°C (176°F)	80°C

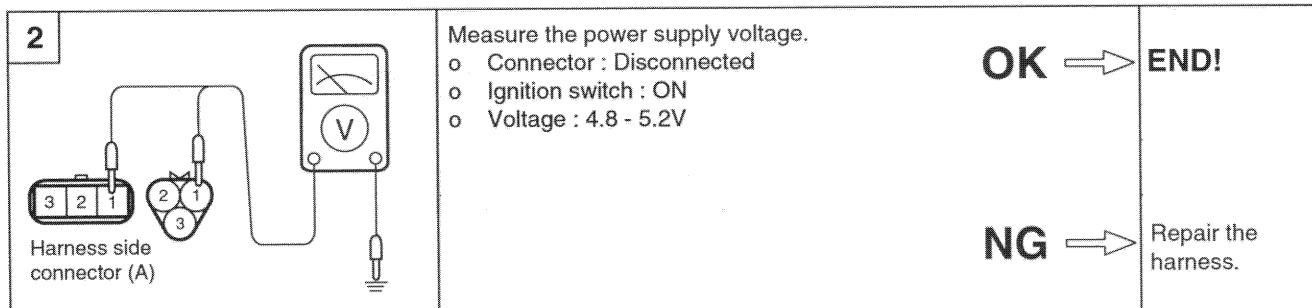
### USING VOLTMETER

Check item	Engine state	Test specification
Engine coolant temperature sensor output voltage	When 0°C	3.7 - 4.3V
	When 20°C	3.2 - 3.6V
	When 40°C	2.4 - 3.0V
	When 80°C	1 - 1.5V

## HARNESS INSPECTION PROCEDURES



EFNC031B



EFNC031C

## SENSOR INSPECTION

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

Temperature °C (°F)	Output voltage (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

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

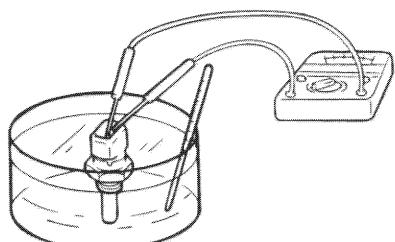
## INSTALLATION

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

## Tightening torque

Engine coolant temperature sensor :  
15-20Nm (150-200 kg.cm, 11-15 lb.ft)

- Connect the harness connector securely.

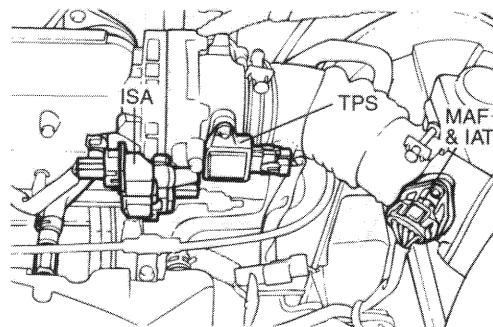


EFDA711C

## THROTTLE POSITION SENSOR

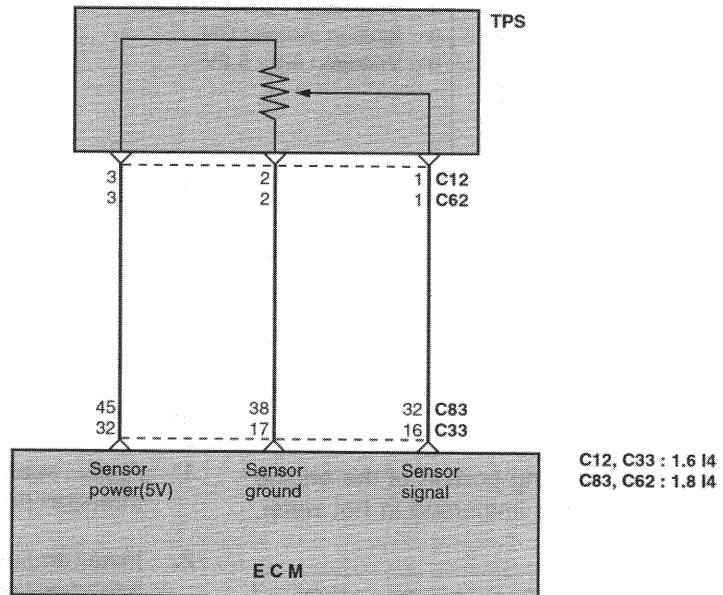
(TPS) EFNC0330

The TP Sensor is a rotating type variable resistor that rotates with the throttle body's throttle shaft to sense 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 TPS output voltage.



EFDA301C

## CIRCUIT DIAGRAM



EFNC033A

## TROUBLESHOOTING HINTS

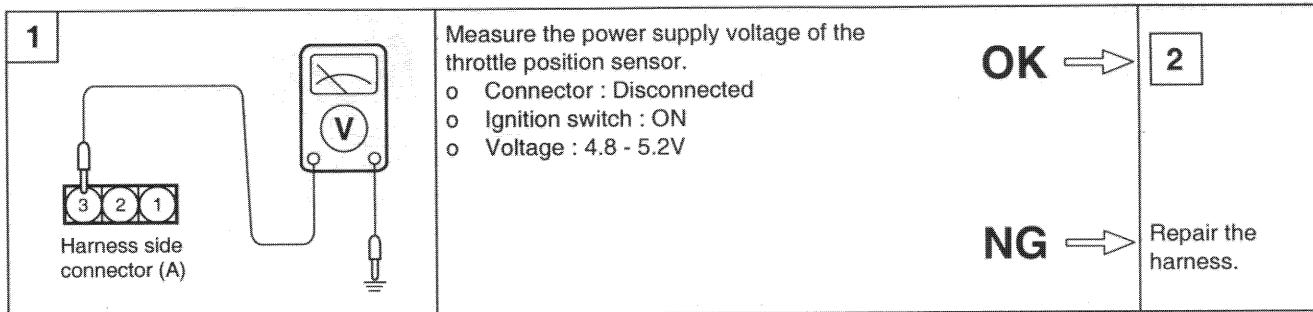
1. The TPS signal is important for the control of automatic transaxles. Shift shock and other trouble may occur if the sensor is faulty.

2. If engine idle or acceleration is abnormal, check the TPS connector. (When the TPS connector is not connected properly, the current data on HI-SCAN (Pro) can show that the idle state remains off, although the accelerator pedal is released. This results in the improper idle or acceleration.)
3. Input voltage from throttle position sensor is below 0.1V or above 4.7V when ignition switch is turned on.

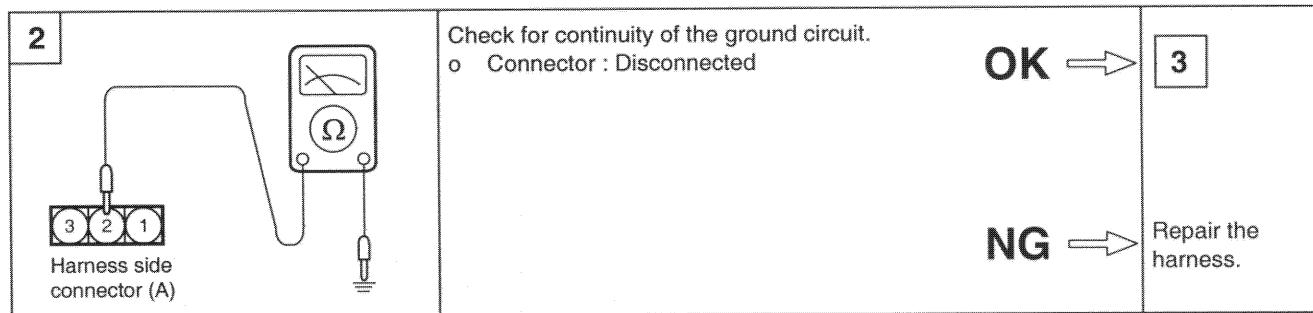
## USING VOLTmeter OR HI-SCAN (PRO)

Check item	Check condition	Test specification
Throttle position sensor output voltage	At idle rpm	0.1 - 0.875V
	Wide open throttle	4.25 - 4.8V

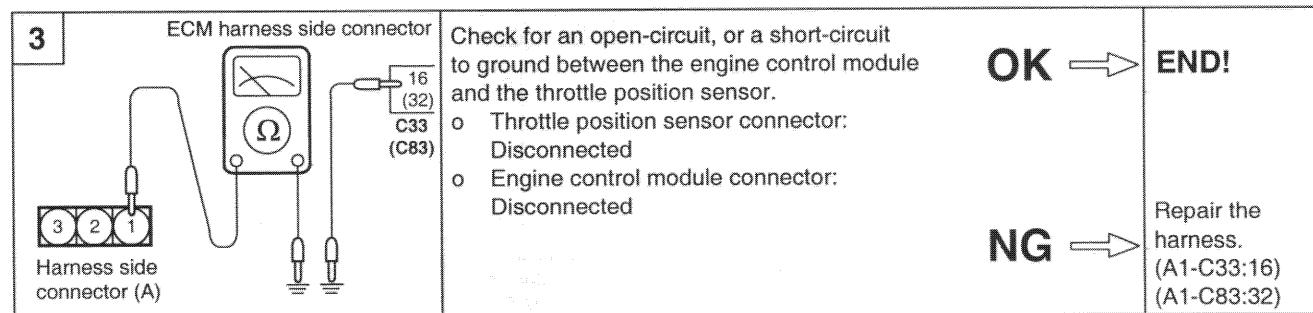
## HARNESS INSPECTION PROCEDURES



EFDA713A



EFKA713B



EFKB713C

## SENSOR INSPECTION

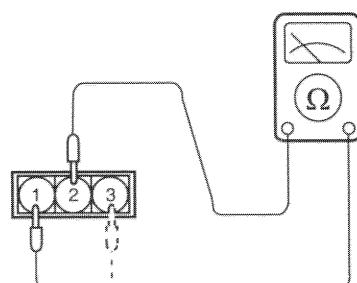
1. Disconnect the throttle position sensor connector.
2. Measure the resistance between terminals 2 (sensor ground) and terminal 3 (sensor power).

Standard value : 0.7 - 3.0 kΩ

3. Connect an analog ohmmeter between terminals 2 (sensor ground) and terminal 3 (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 with the throttle valve opening angle.
5. If the resistance is out of specification, or fails to change smoothly, replace the throttle position sensor.

## Tightening torque

Throttle position sensor :  
1.5-2.5Nm (15-25kg.cm, 1.1-1.8 lb.ft)

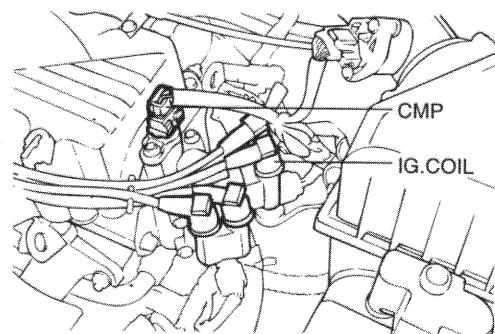


EFDA713D

## CAMSHAFT POSITION SENSOR (CMP SENSOR)

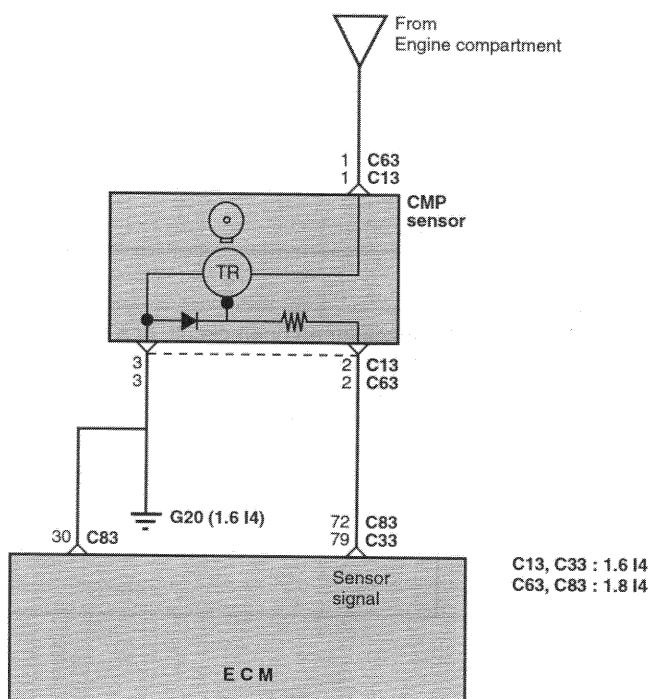
EFNC0350

The camshaft position sensor (CMP Sensor) senses the TDC point of No.1 cylinder on its compression stroke. Its signal is fed to the ECM to be used to determine the sequence of fuel injection.



EFDA301E

### CIRCUIT DIAGRAM



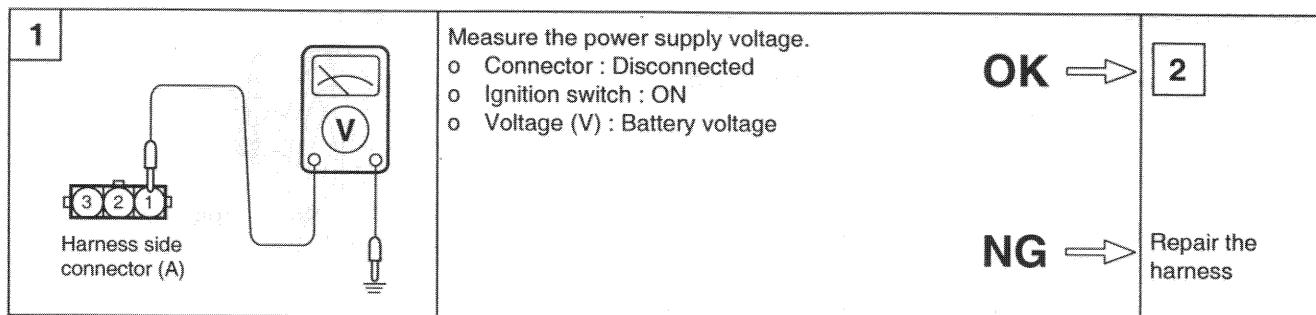
Note : Refer to the appropriate  
Electrical Troubleshooting  
Manual for full wiring details.

EFNC035A

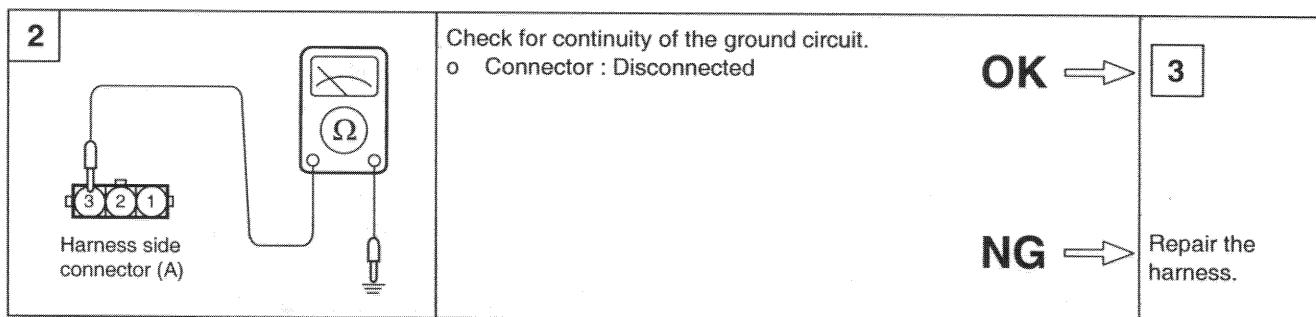
### USING VOLTMETER

Check item	Check condition	Test specification
Camshaft position sensor output voltage	At idle rpm	0 - 5V
	3000 rpm	0 - 5V

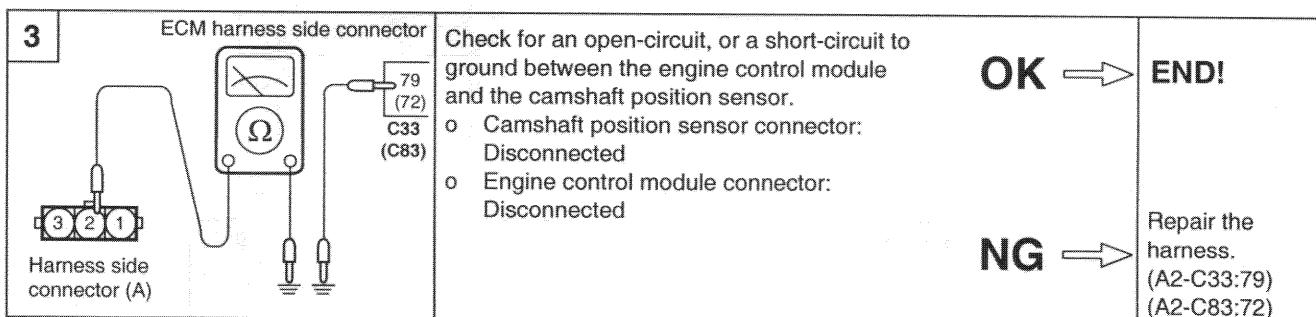
## HARNESS INSPECTION PROCEDURES



EFDA715A



EFDA715B

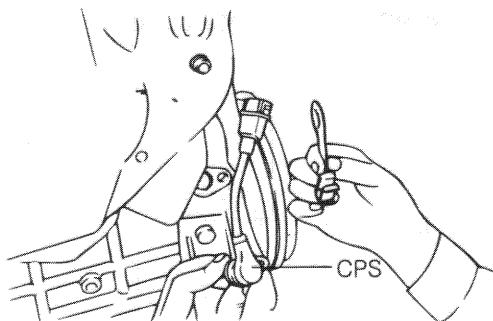


EFKB715C

## CRANKSHAFT POSITION SENSOR

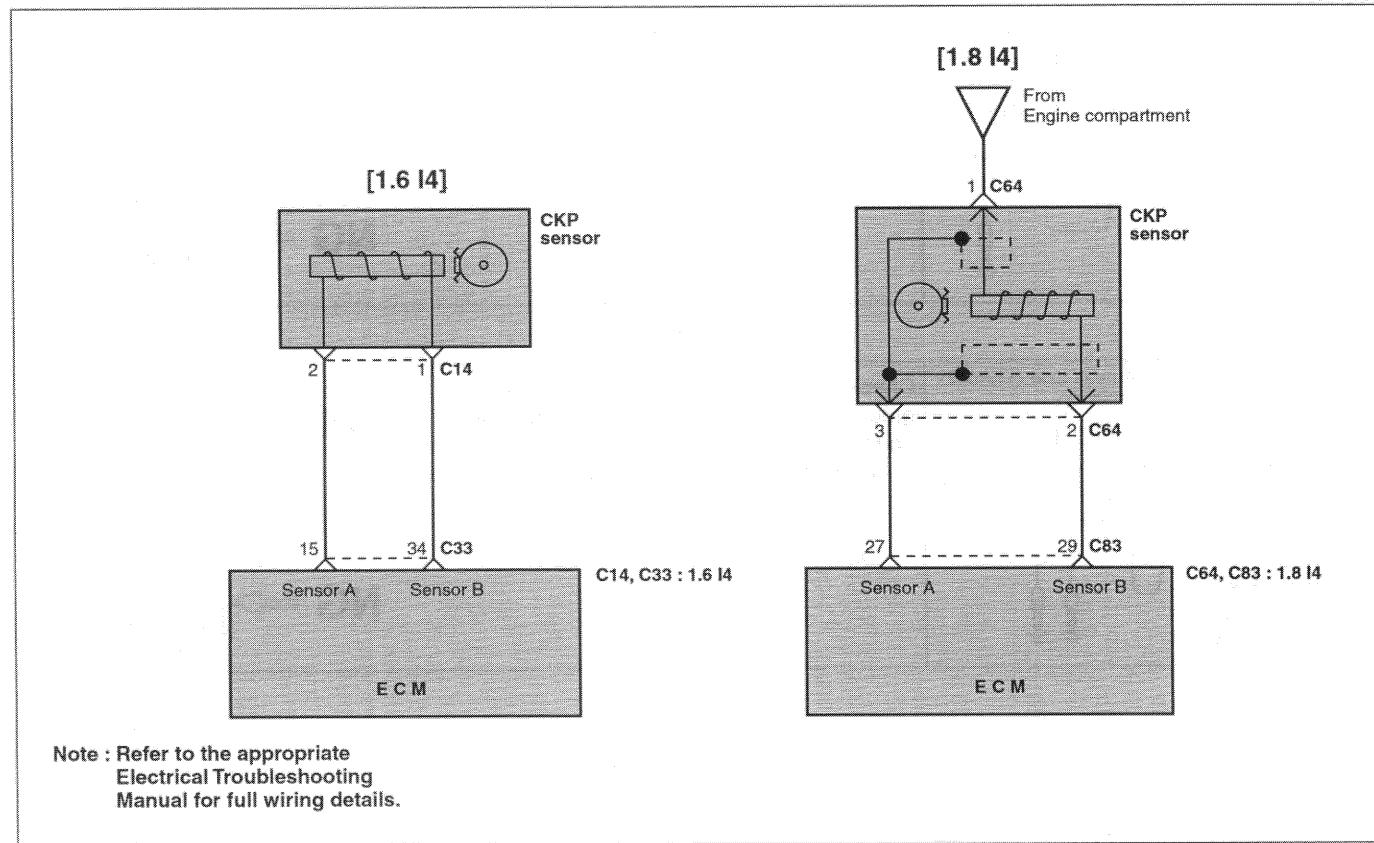
(CKP SENSOR) EFNC0370

The crankshaft position sensor, consisted of a magnet and coil, is located next to flywheel. The voltage signal from this crankshaft position sensor is relayed to the ECM to indicate engine RPM and the position of the crankshaft.



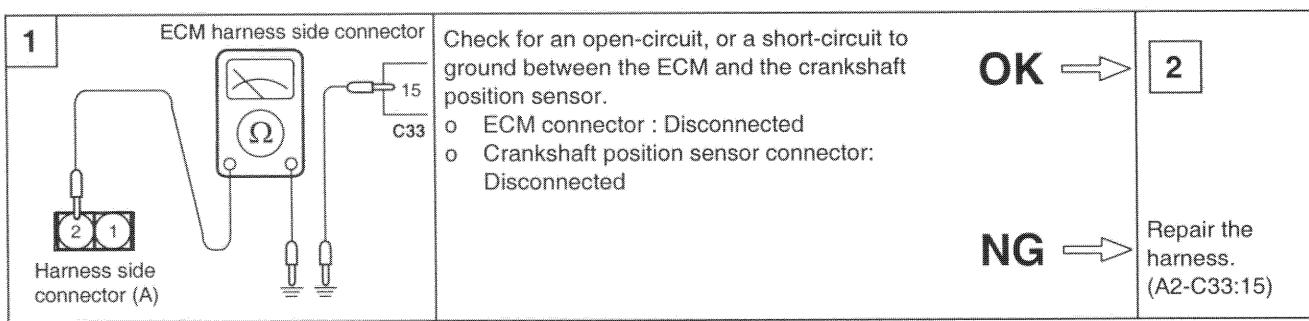
EFDA701E

## CIRCUIT DIAGRAM

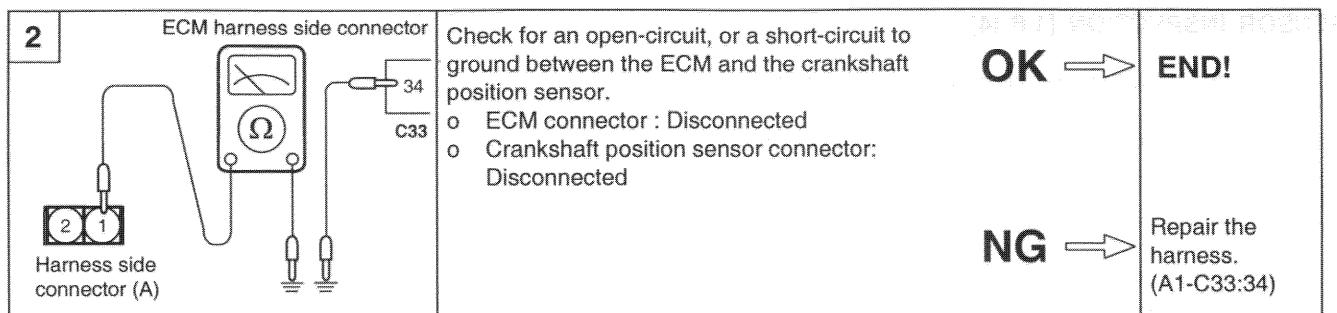


EFNC037A

## HARNESS INSPECTION PROCEDURES [1.6 I4]

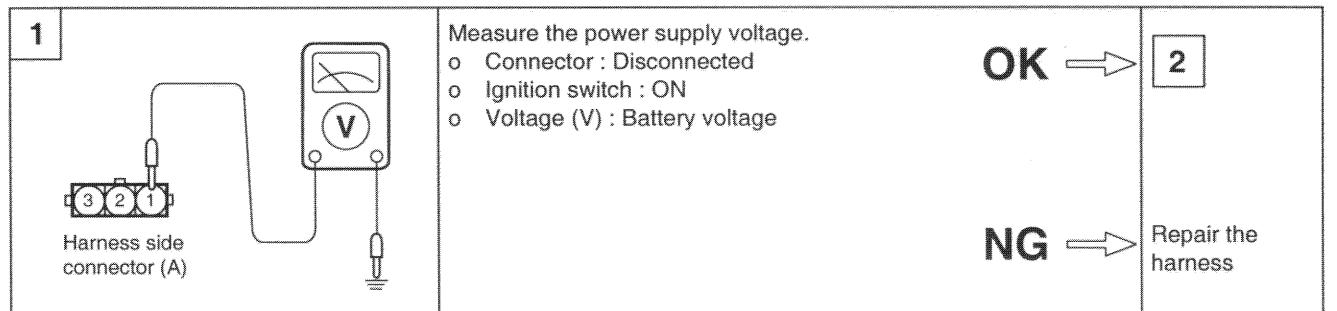


EFKB717A

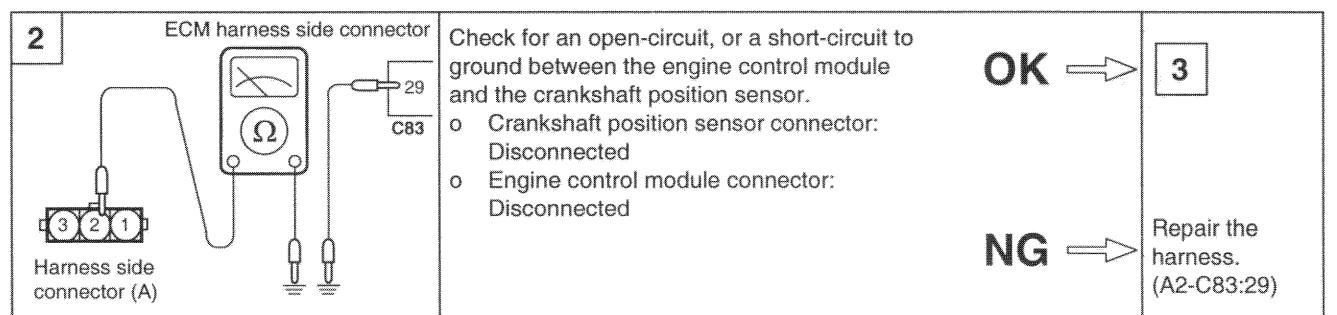


EFKB717B

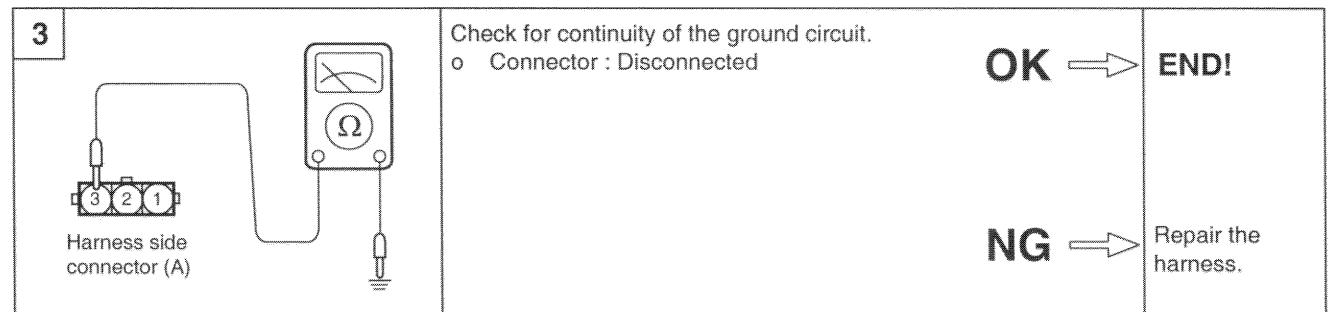
## HARNESS INSPECTION PROCEDURES [1.8 I4]



EFDA715A



EFKB717D



EFKB717E

**SENSOR INSPECTION [1.6 I4]**

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

Standard value : 0.486-0.594 kΩ at 20°C (68°F)

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

**Standard value**

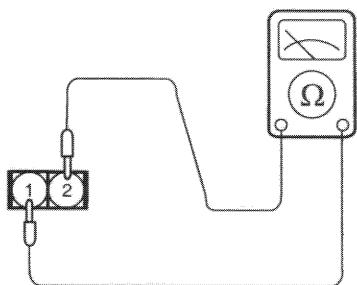
Clearance between the crankshaft position sensor and crankshaft position sensor wheel :

0.5-1.5 mm (0.020-0.059 in.)

**Tightening torque**

Crankshaft position sensor :

9-11 Nm (90-110 kg.cm, 6.6-8.1 lb.ft)

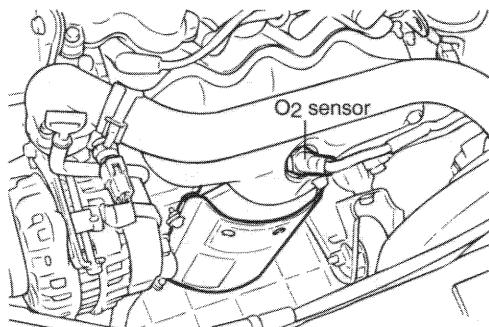


EFDA717C

**HEATED OXYGEN SENSOR (HO2S)-  
SINGLE HO2S** EFNC0390

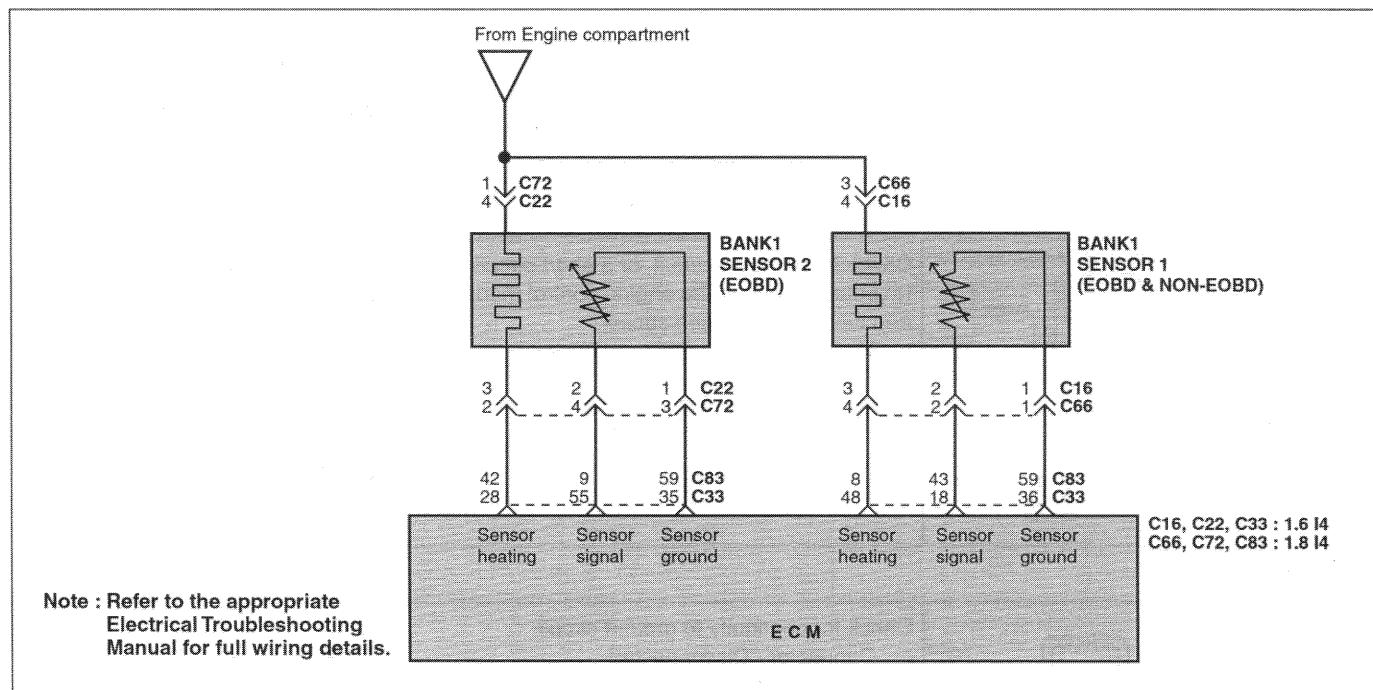
EFNC0390

The heated oxygen sensor senses the oxygen concentration in the exhaust gas, then converts it into a voltage and then sends this to the ECM. The heated oxygen sensor gives an output of about 800mV when the air fuel ratio is richer than the theoretical ratio and output of about 100mV when the ratio is leaner (higher oxygen concentration in exhaust gas.) The ECM controls fuel injection based on this signal so that the air fuel ratio is maintained at the theoretical ratio.



EEDA301K

## CIRCUIT DIAGRAM



EFNC039A

## TROUBLESHOOTING HINTS

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

- Air leaks in the intake manifold.
- Faulty mass air flow sensor, purge valve and engine coolant temperature sensor.
- Wiring connection problem.

## USING VOLTmeter/HI-SCAN (PRO)

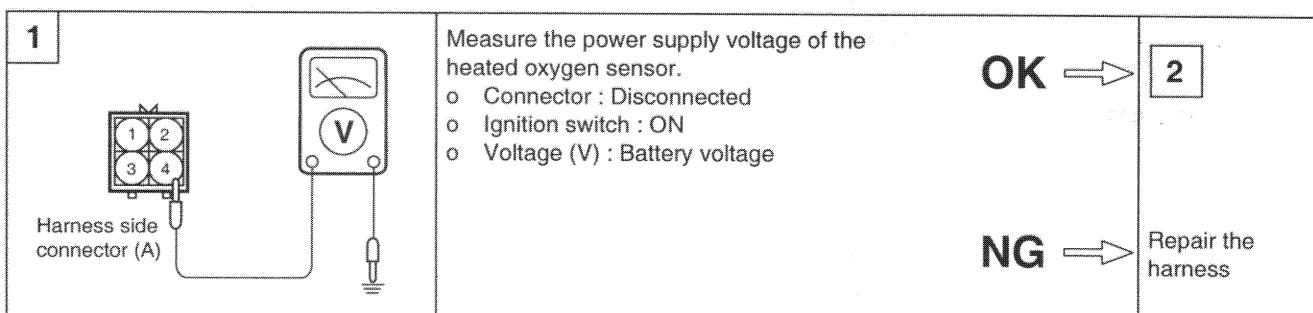
Check item	Check condition	Engine condition	Test specification
Heated oxygen sensor output voltage	Warm-up	When decelerating suddenly from 4,000 rpm	A. 200mV or lower
		When engine is suddenly raced	B. 600-1,000mV

**NOTE**

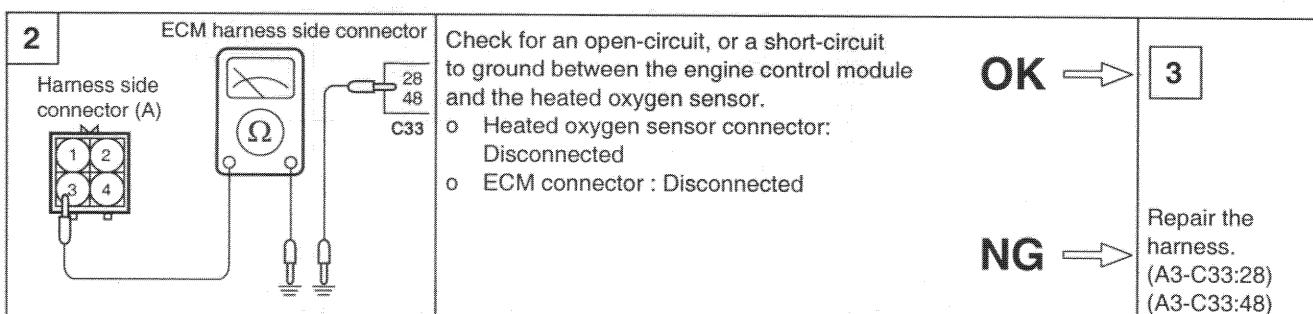
If you release the accelerator pedal suddenly after engine running about 4000 rpm, fuel supply will stop for short period and the O<sub>2</sub> sensor service data in the HI-SCAN (Pro) will display values 200mV or lower.

When you suddenly press on the accelerator pedal down, the voltage will reach 600-1000mV.

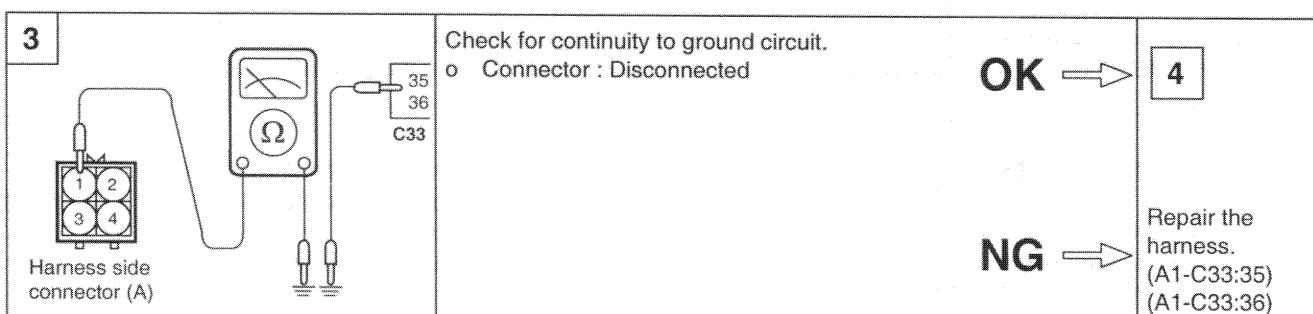
When you let the engine idle again, the voltage will fluctuate between 200mV or lower and 600-1000mV. In this case, the O<sub>2</sub> sensor can be determined as good.

**HARNESS INSPECTION PROCEDURES [1.6 I4]**

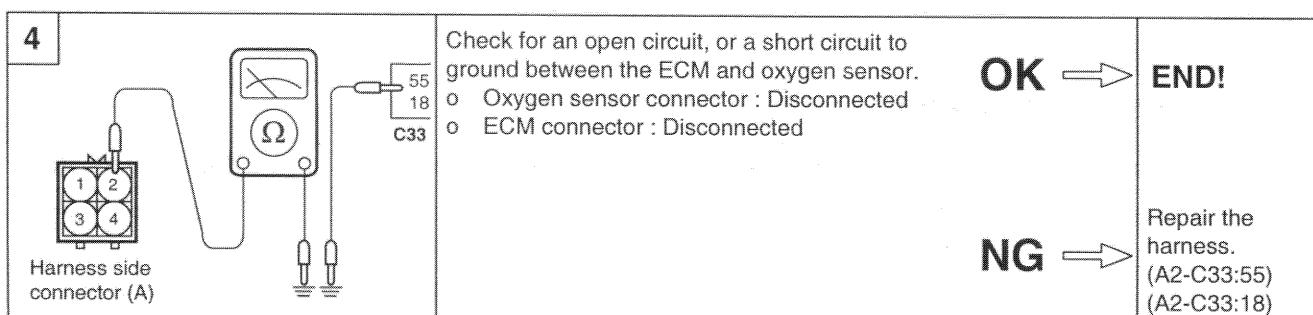
EFDA719A



EFKB719B

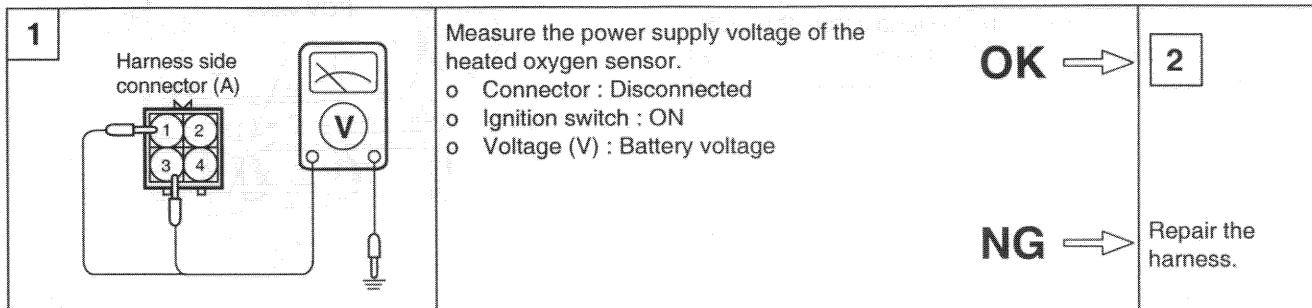


EFKB719C

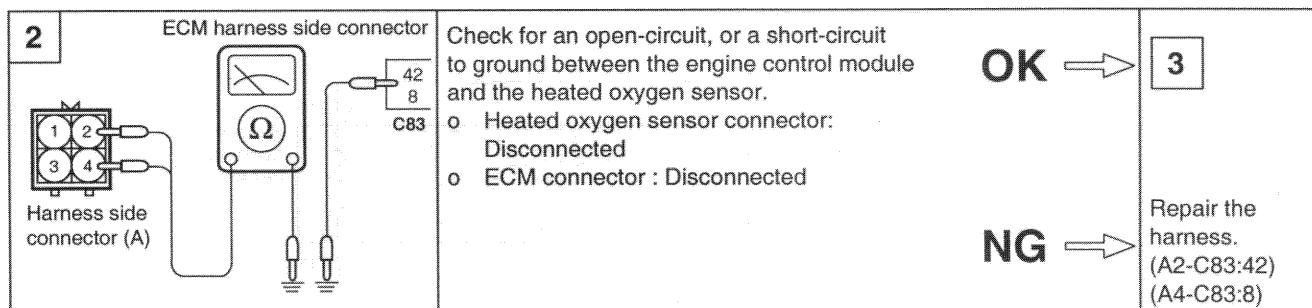


EFKB719D

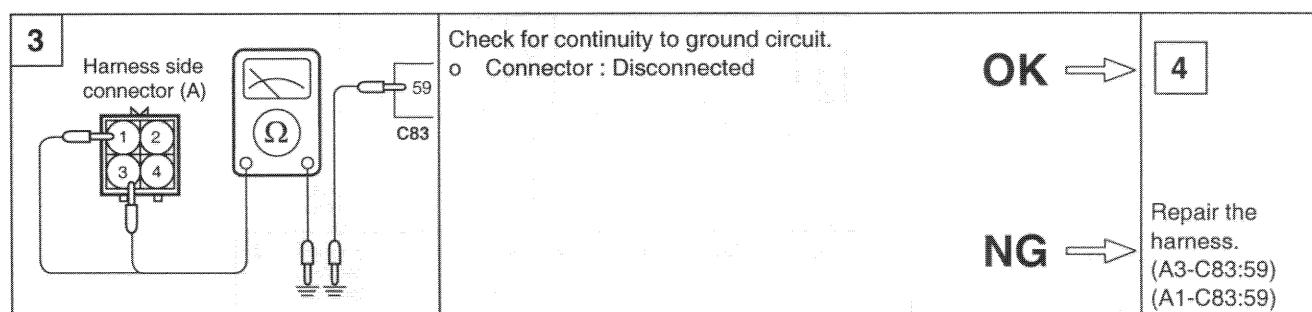
## HARNESS INSPECTION PROCEDURES [1.8 14]



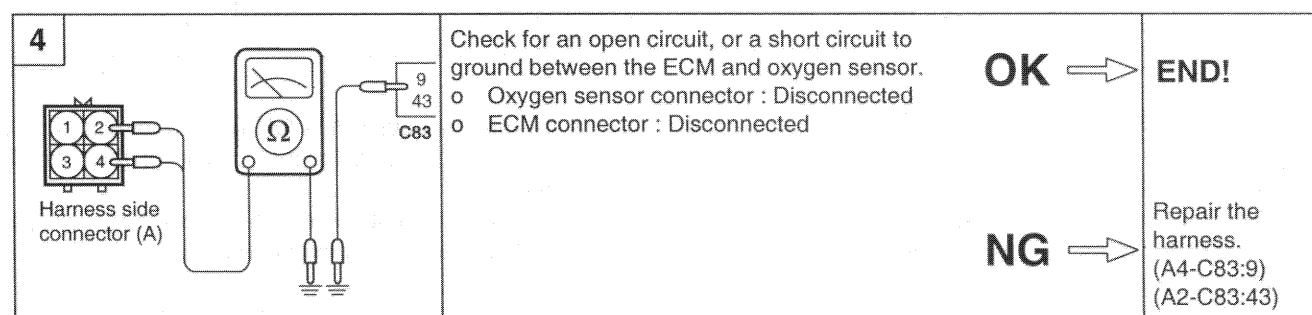
EFKB719E



EFKB719F



EFKB719G



EFKB719H

## SENSOR INSPECTION



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

## Tightening torque

Heated oxygen sensor :

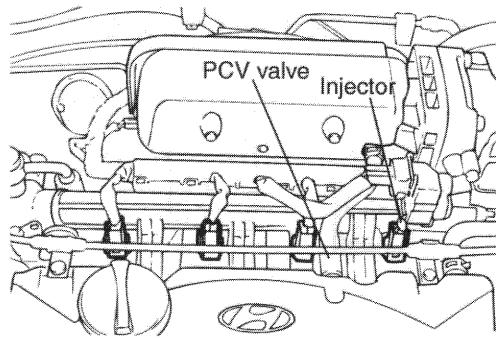
50-60 Nm (500-600 kg.cm, 37-44 lb.ft)

Replace the oxygen sensor if there is a malfunction.

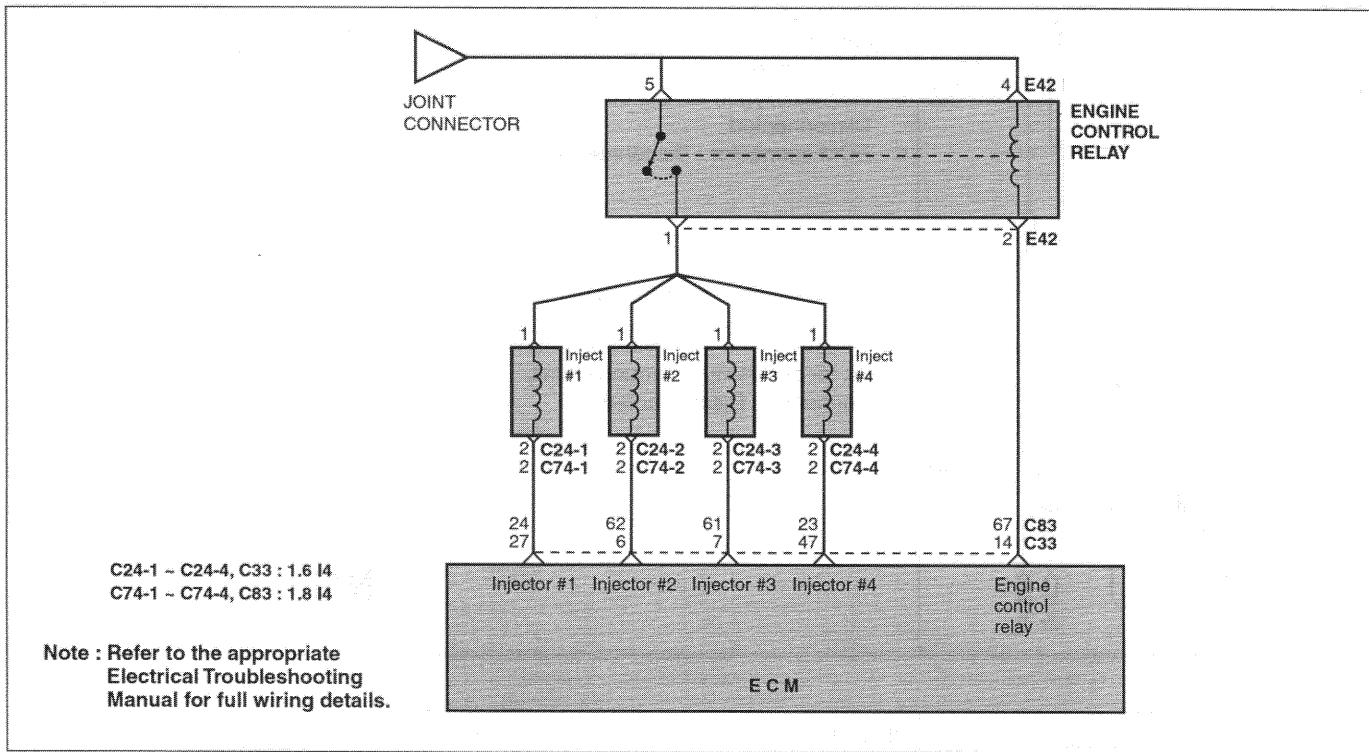
**INJECTORS**

EFNC0410

The injectors inject fuel according to signals from the ECM. The volume of fuel injected by the injector is determined by the time during which the solenoid valve is energized (Pulse width).



EEDA105B

**CIRCUIT DIAGRAM**

EFNC041A

**TROUBLESHOOTING HINTS**

1. If the engine is difficult to start when it is hot, check for low 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 or faulty ground circuit.
  - Faulty MFI control relay.
  - Faulty crankshaft position sensor or camshaft position sensor.
3. If engine idle remains unchanged when fuel injection to the cylinders is cut one after another, check for the following items about such cylinder:
  - Injector and harness.
  - Spark plug and high tension cable.
  - Compression pressure.

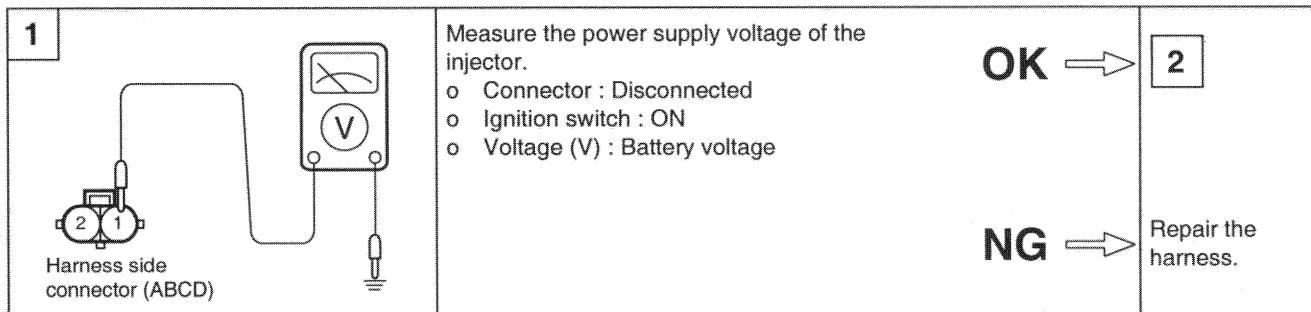
4. If the injection system is OK but the injector's pulse width is out of specification, check for the following items:
  - Poor combustion in the cylinder (faulty spark plug, ignition coil, compression pressure, etc.)
5. The MIL is on or the DTC is displayed on the HI-SCAN (Pro) under the following condition:
  - When the injector itself is faulty

## USING HI-SCAN (PRO)

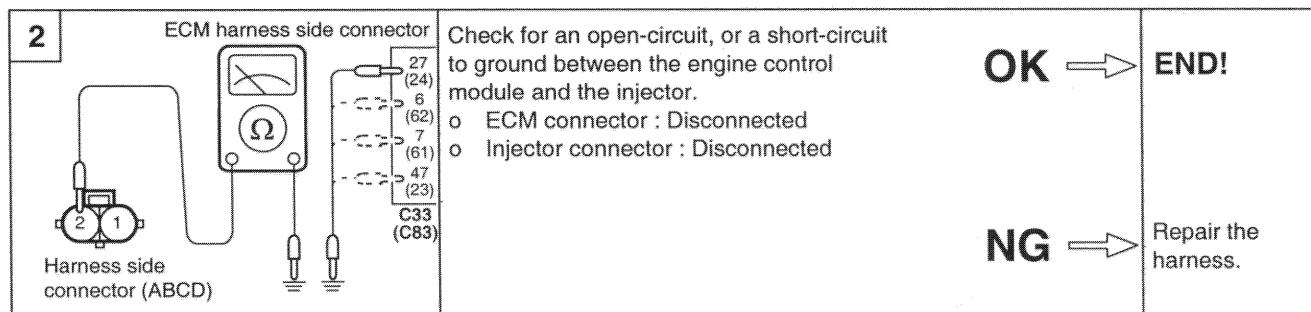
Check item	Data display	Check conditions	Engine state	Test specification
Throttle position sensor	Throttle angle	<ul style="list-style-type: none"> <li>Engine coolant temperature: 80 to 95°C (176 to 205°F)</li> <li>Lamps, electric cooling fan, accessory units: ALL OFF</li> <li>Transaxle : Neutral (P range for vehicle with A/T)</li> <li>Steering wheel : Neutral</li> </ul>	Idle rpm	1.5 - 4.5 ms
			2000 rpm	
			3000 rpm	
		Racing	Increasing	

Check item	Check condition	HI-SCAN (Pro) display	Type
Injector • Actuator test	Start the engine	01. No.1 Injector	Activate
		02. No.2 Injector	Activate
		03. No.3 Injector	Activate
		04. No.4 Injector	Activate

## HARNESS INSPECTION PROCEDURES



EFDA721A



EFKB721B

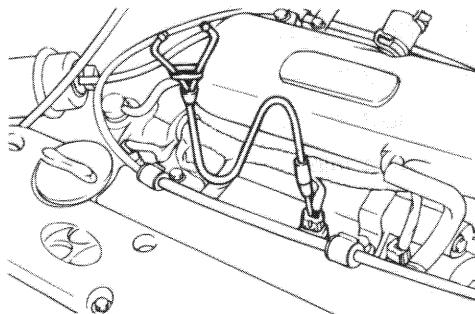
**INJECTOR INSPECTION****OPERATION CHECK**

Using a HI-SCAN (Pro):

- Activate the fuel injectors in sequence.
- Check the pulse width of the injectors.

**Operation Sound Check**

1. 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.

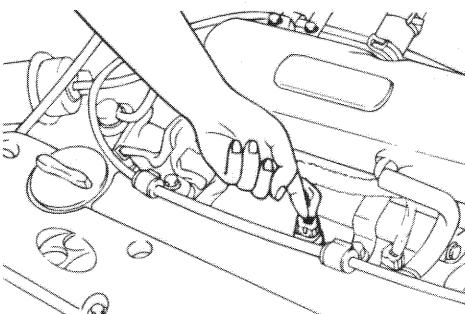


EFDA721C



**NOTE**  
Ensure that the sound from an adjacent injector is not being transmitted along the delivery pipe to an inoperative injector.

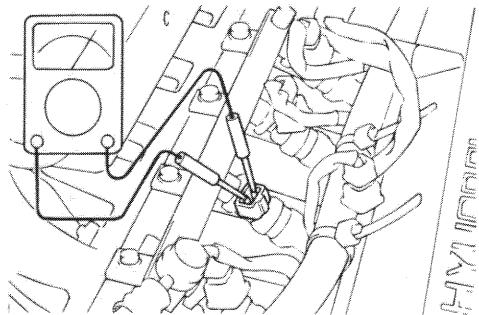
2. If a stethoscope is not available, check the injector operation with your finger. If no vibrations are felt, check the wiring connector, injector, or injection signal from ECM.



EFDA721D

**Resistance Measurement Between Terminals**

1. Disconnect the connector at the injector and measure the resistance between the two terminals.



EFDA721E

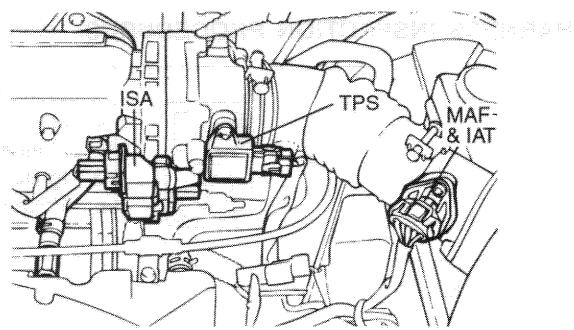
Standard value :  $15.9 \pm 0.35 \Omega$  [at 20°C (68°F)]

2. Re-connect the connector to the injector.

## IDLE SPEED CONTROL ACTUATOR (ISC ACTUATOR)

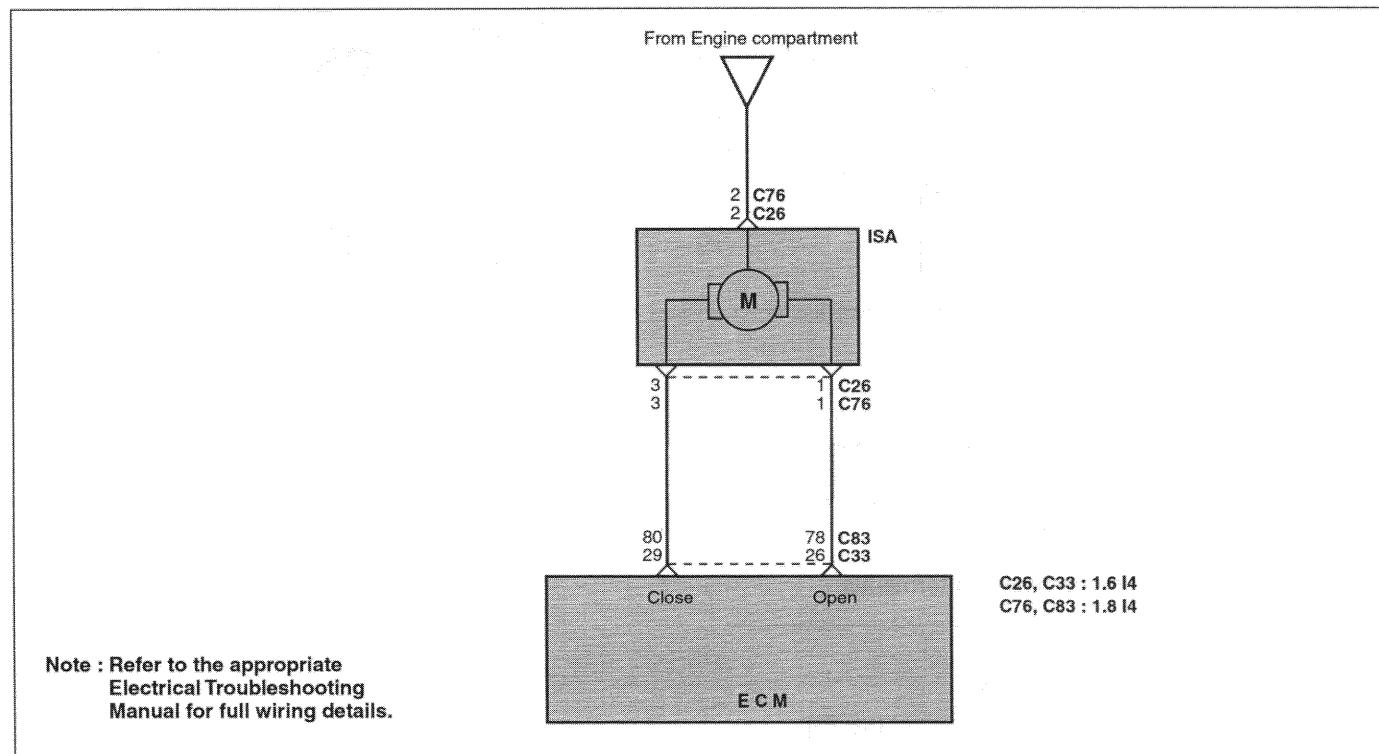
EFNC0430

The idle speed actuator is a double coil type 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. A bypass hose line is positioned, in parallel to the throttle valve where the idle speed actuator is inserted.



EFDA301C

### CIRCUIT DIAGRAM



EFNC043A

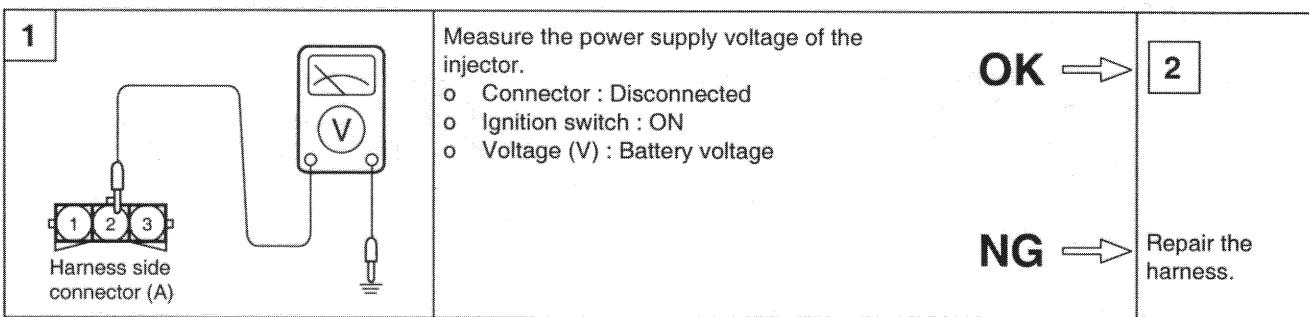
### TROUBLESHOOTING HINTS

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

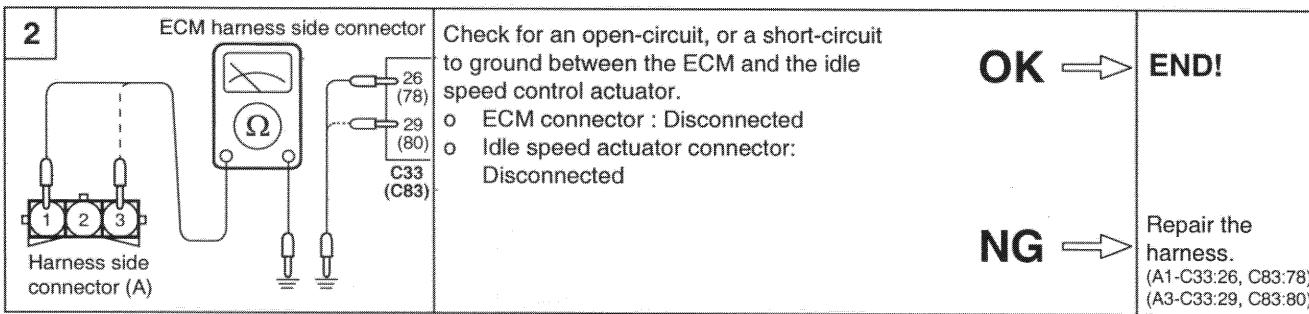
### USING HI-SCAN (PRO)

Check item	Check condition	ISA condition	Test specification
Idle speed control actuator • Actuator test	Start the engine	ON	Activate

## HARNESS INSPECTION PROCEDURES



EFDA723A



EFKB723B

## ACTUATOR INSPECTION

## Resistance Measurement Between terminals

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

## Standard value

Terminal 1 and 2 :  $10.5 - 14\Omega$ Terminal 2 and 3 :  $10 - 12.5\Omega$  [at  $20^\circ\text{C}$  ( $68^\circ\text{F}$ )]

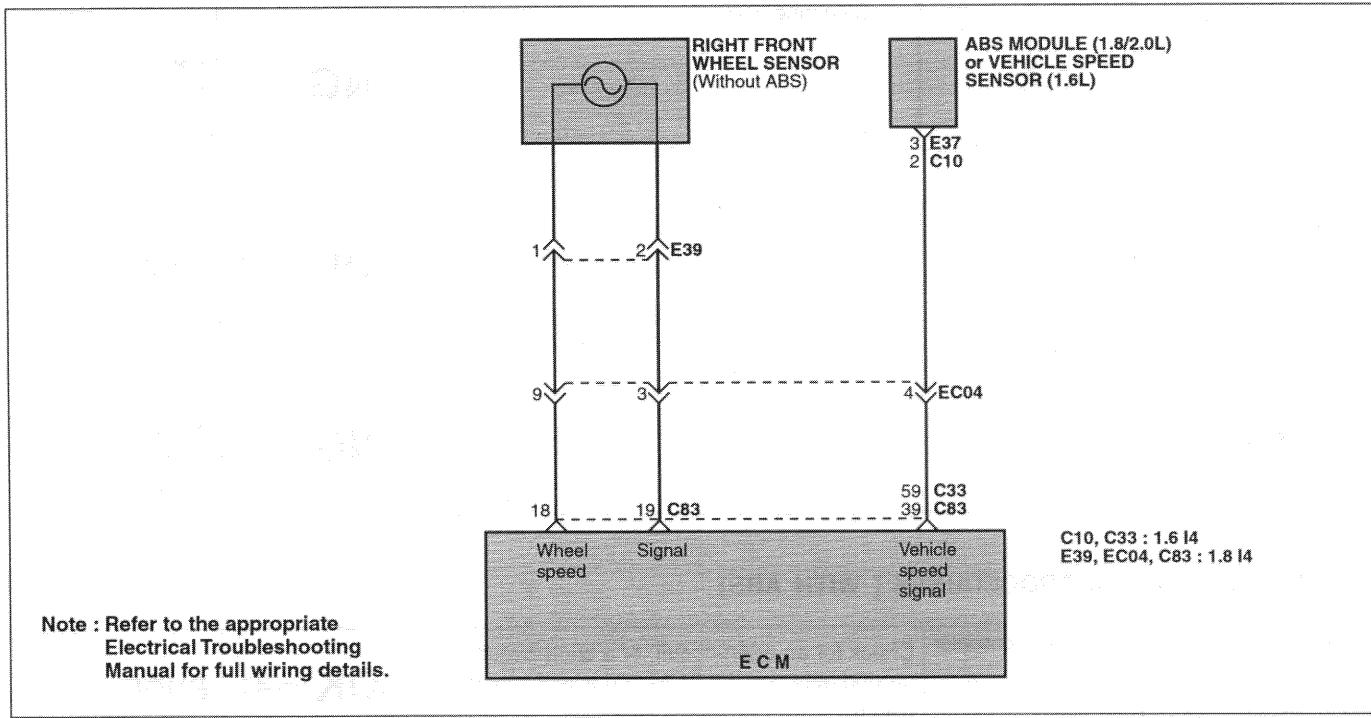
3. Connect the connector to the idle speed control actuator.

## VEHICLE SPEED SENSOR

EFNC0450

The vehicle speed sensor is a reed switch that is built into the speedometer. The sensor converts the transaxle gear revolutions into a pulse signal which is sent to the ECM.

## CIRCUIT DIAGRAM



EFNC045A

## TROUBLESHOOTING HINTS

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

## HARNESS INSPECTION PROCEDURES [1.8 I4 WITHOUT ABS]

<b>1</b> <p>ECM harness side connector Harness side connector (A)</p>	<p>Check for an open-circuit, or a short-circuit to ground between the ECM and wheel speed sensor.</p> <ul style="list-style-type: none"> <li>o ECM connector : Disconnected</li> <li>o Wheel speed sensor connector: Disconnected</li> </ul>	<b>OK</b> → <b>2</b>  <b>NG</b> → Repair the harness. (A1-C83:18)
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EFKB725B

<b>2</b> <p>ECM harness side connector Harness side connector (A)</p>	<p>Check for an open-circuit, or a short-circuit to ground between the ECM and wheel speed sensor.</p> <ul style="list-style-type: none"> <li>o ECM connector : Disconnected</li> <li>o Wheel speed sensor connector: Disconnected</li> </ul>	<b>OK</b> → <b>END!</b>  <b>NG</b> → Repair the harness. (A2-C83:19)
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EFKB725C

## HARNESS INSPECTION PROCEDURES [ WITH ABS]

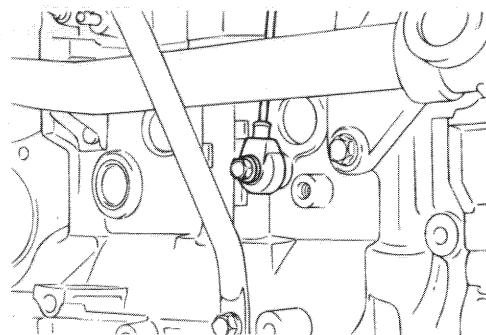
<b>1</b> <p>ECM harness side connector Harness side connector (A)</p>	<p>Check for an open-circuit, or a short-circuit to ground between the ECM and wheel speed sensor.</p> <ul style="list-style-type: none"> <li>o ECM connector : Disconnected</li> <li>o Wheel speed sensor connector: Disconnected</li> </ul>	<b>OK</b> → <b>END!</b>  <b>NG</b> → Repair the harness. (A2-C33:59)
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EFKB725D

## KNOCK SENSOR

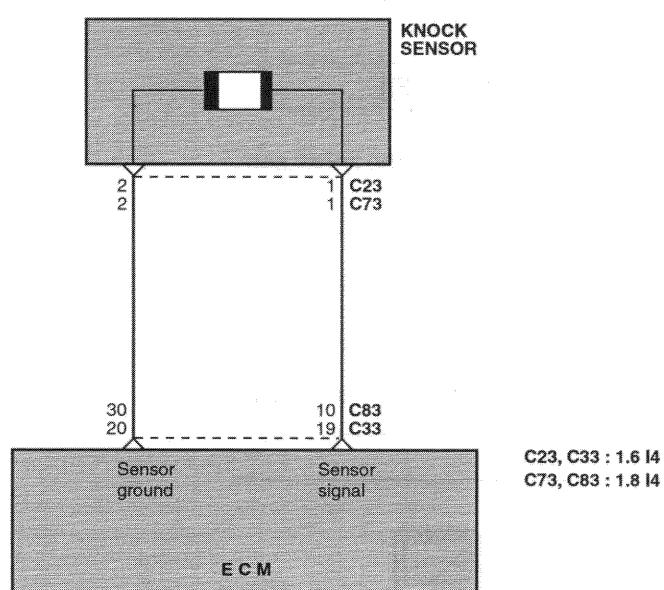
EFNC0470

The knock sensor is attached to the side of the cylinder block to sense engine knocking. 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 relayed to the ECM. If engine knocking occurs, ignition timing is retarded to suppress it.



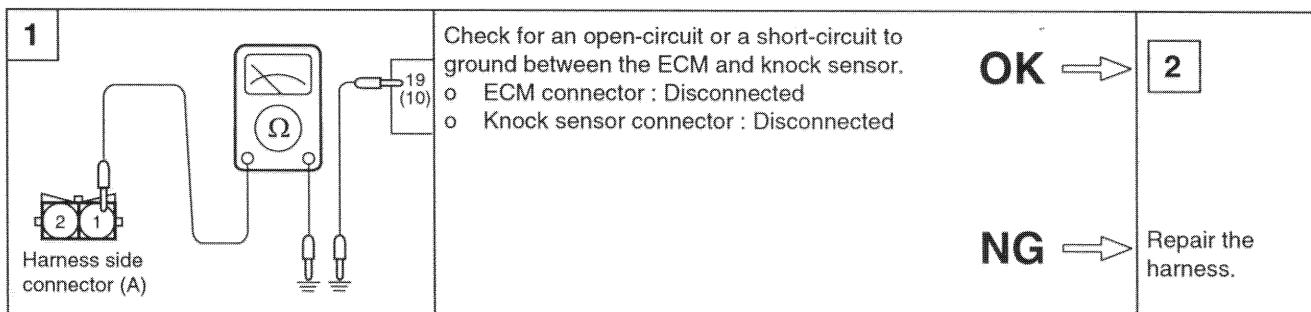
EFDA727A

## CIRCUIT DIAGRAM

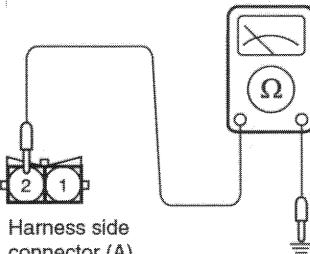


Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

EFNC047A



EFNC047B

<b>2</b>  <p>Harness side connector (A)</p>	<p>Check for an open-circuit or a short-circuit to ground between the ECM and knock sensor.</p> <ul style="list-style-type: none"> <li>o ECM connector : Disconnected</li> <li>o Knock sensor connector : Disconnected</li> </ul>	<b>OK</b> → <b>END!</b>  <b>NG</b> → Repair the harness.
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EFNC047C

### SENSOR INSPECTION

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

Standard value : about  $5M\Omega$  [at  $20^\circ$  ( $68^\circ$ F)]

2. If the resistance is continuous, replace the knock sensor.

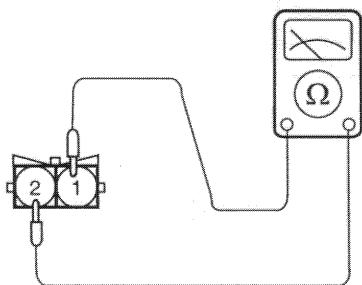
#### Tightening torque

Knock sensor :

16-25 Nm (160-240 kg.cm, 11.8-18.4 lb.ft)

3. Measure the capacitance between terminals 1 and 2.

Standard value : 800 - 1600 pF

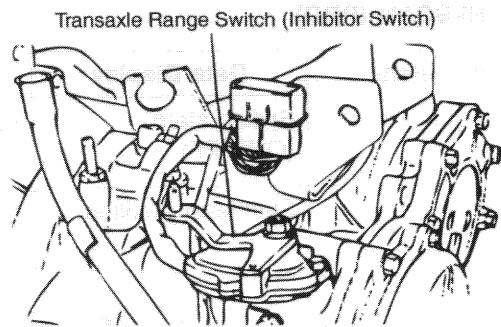


EFDA727D

## IGNITION SWITCH-ST AND TRANSAXLE RANGE (TR) SWITCH (A/T)

EFKB7290

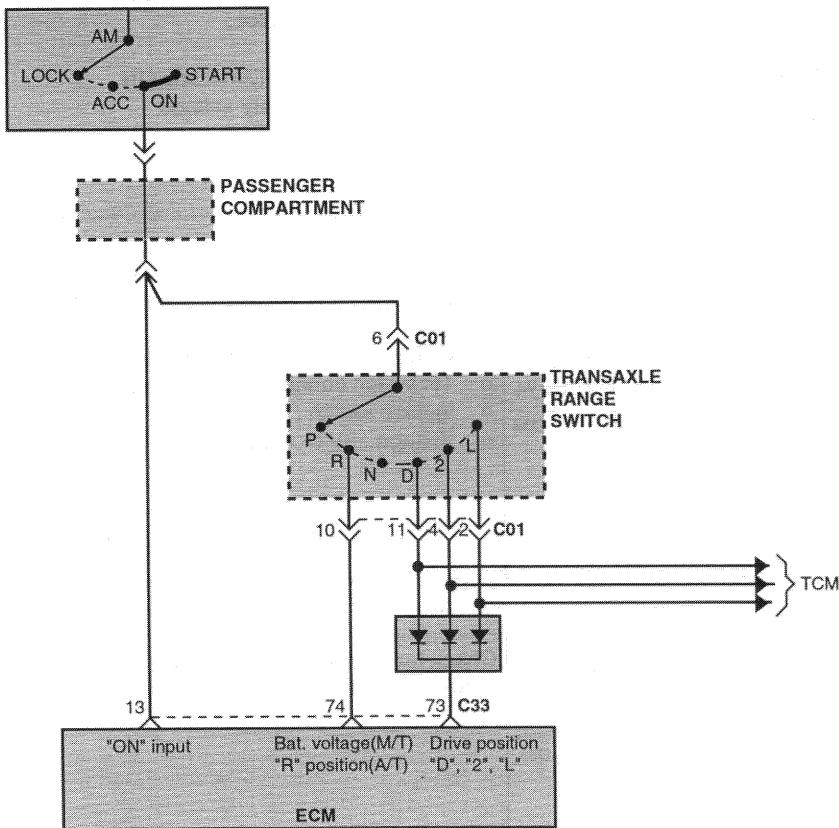
When the ignition switch is set to the ST position, battery voltage is applied through the ignition switch and TR switch to the ECM. If the selector lever is not in P or the N position, battery voltage will not reach the ECM. Based on this signal, the ECM determines the automatic transaxle load and drives the idle speed control actuator to maintain optimum idle speed.



EFDA701D

### CIRCUIT DIAGRAM

[1.6 I4]



EFKB671A

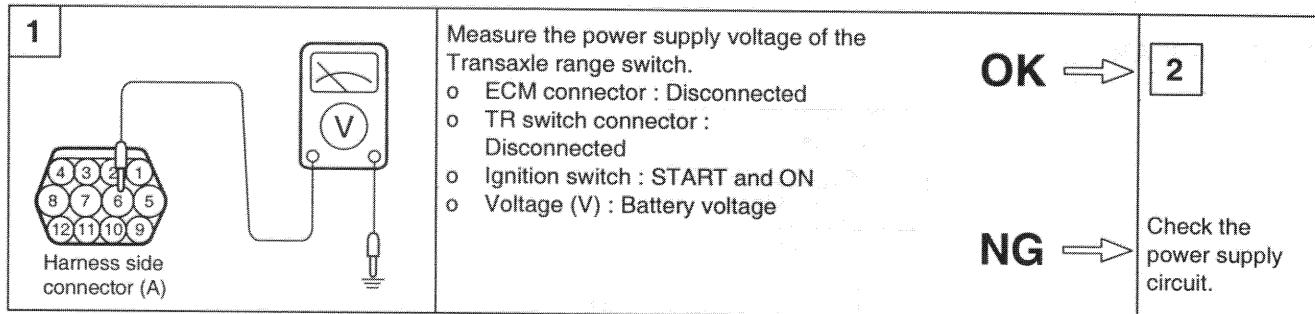
### TROUBLESHOOTING HINTS

If the park/neutral position switch harness check is normal but the switch output is abnormal, check the control cable adjustment.

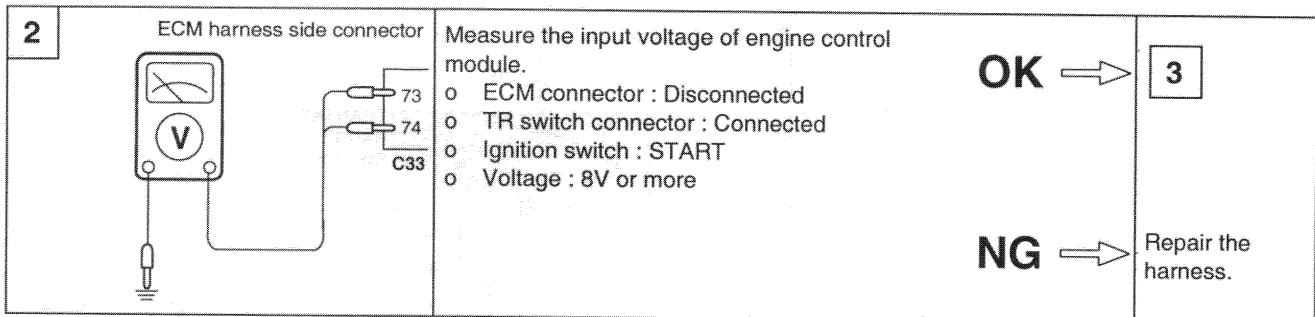
## USING HI-SCAN (PRO)

Check item	Data Display	Check condition	Engine state	Test specification
Crank Signal	Switch state (ON/OFF)	Ignition SW : ON	Stop	OFF
			Cranking	ON
TR Switch	Shift lever position	Ignition SW : ON	P or N	P or N
			Others	Others

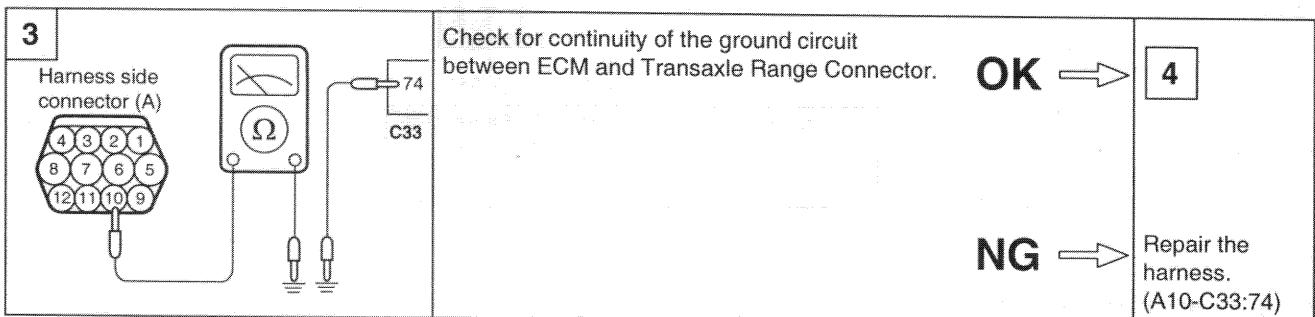
## HARNESS INSPECTION PROCEDURES



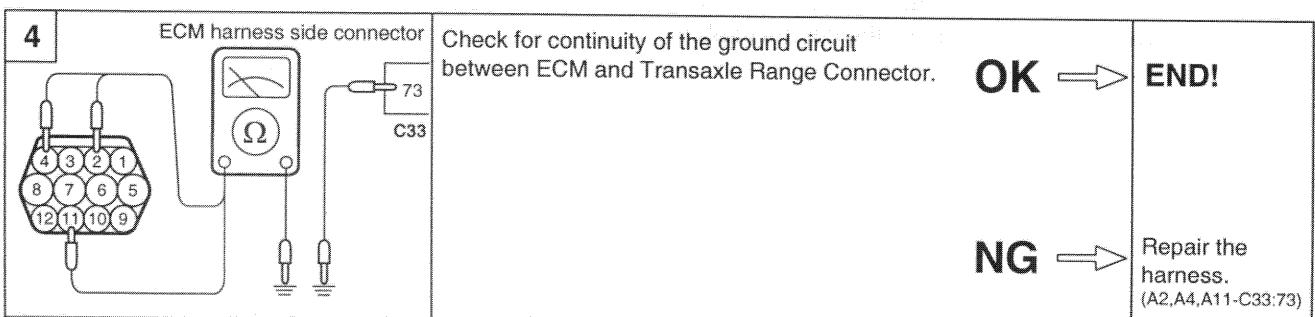
EFKB729B



EFKB729C



EFKB729D



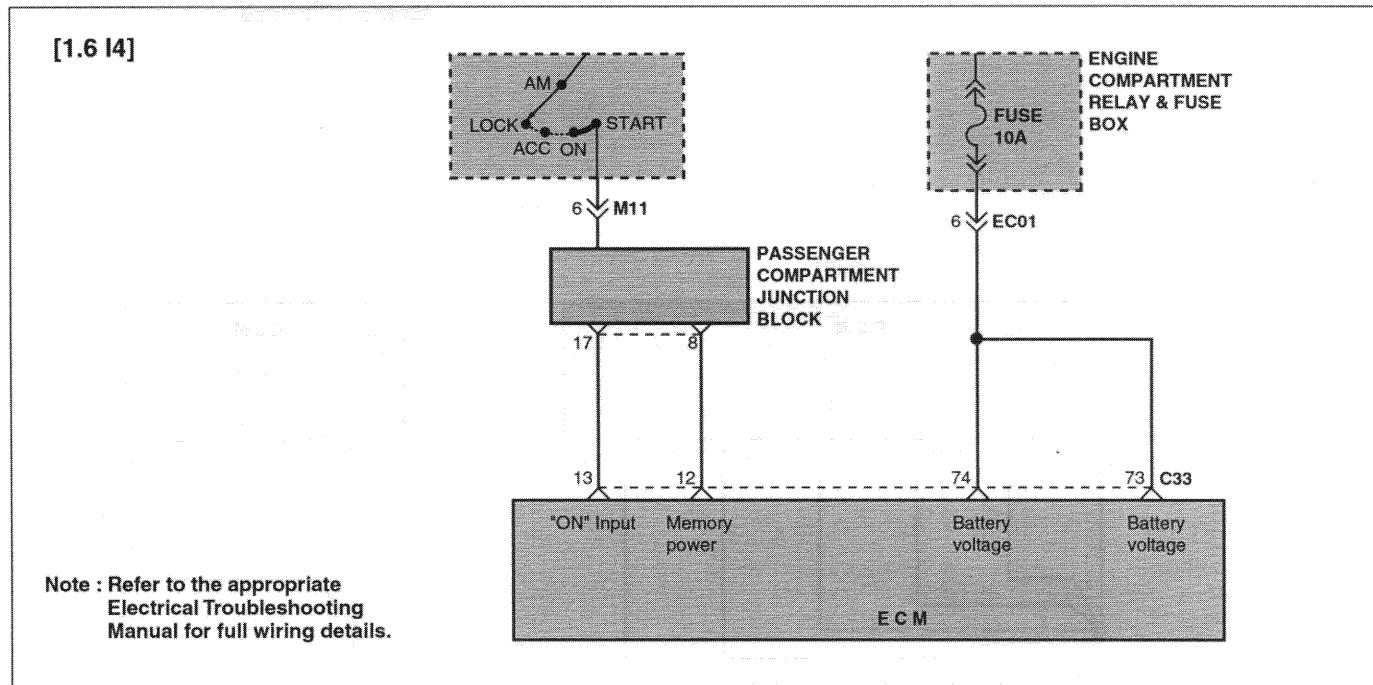
EFKB729E

## IGNITION SWITCH-ST (M/T)

EFKB7310

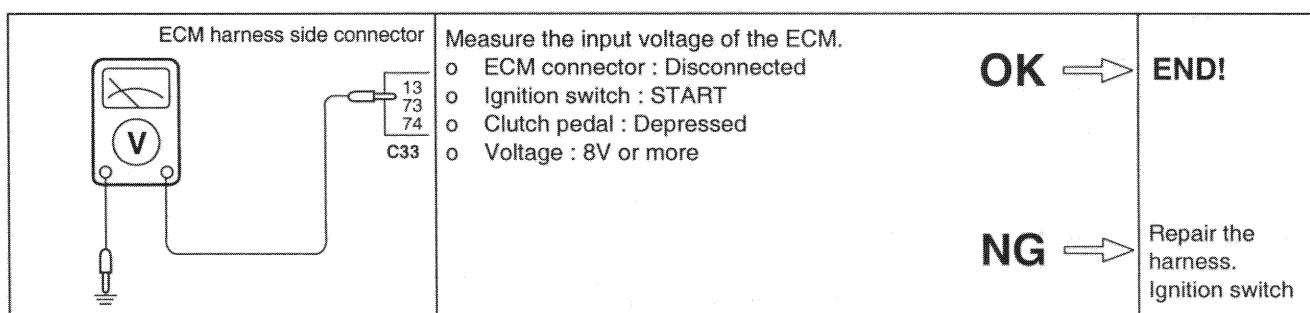
The ignition switch-ST inputs a high signal to the ECM while the engine is cranking. The ECM controls fuel injection, etc, at engine start-up based on this signal.

## CIRCUIT DIAGRAM



EFKB672A

## HARNESS INSPECTION PROCEDURE

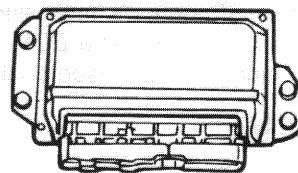


EFKB731A

## ENGINE CONTROL MODULE

## (ECM)-POWER GROUND EFNC0530

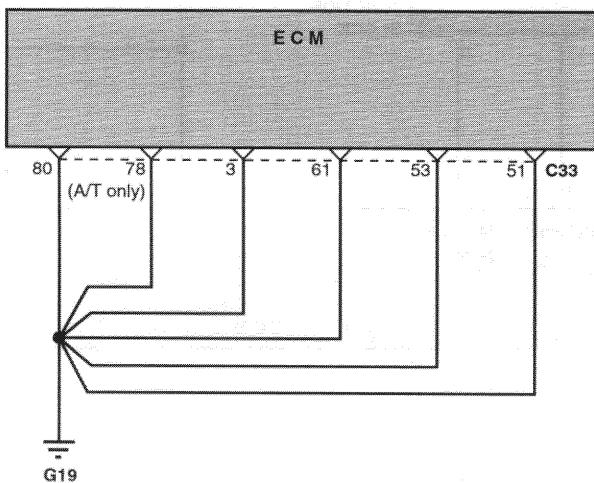
Check the ground condition of the engine control module.



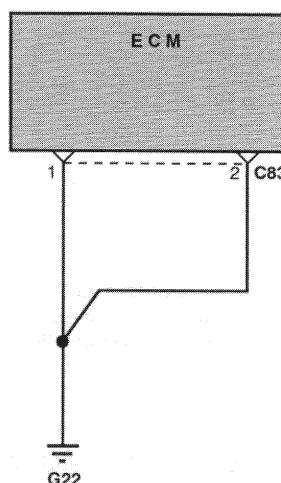
EFDA301H

## CIRCUIT DIAGRAM

[1.6 I4]



[1.8 I4]



Note : Refer to the appropriate  
Electrical Troubleshooting  
Manual for full wiring details.

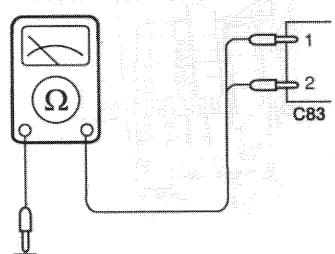
EFNC053A

## HARNESS INSPECTION PROCEDURE [1.6 I4]

	<p>Check for continuity of the ground circuit.</p> <ul style="list-style-type: none"> <li>o ECM connector : Disconnected</li> </ul>	<p><b>OK</b> → <b>END!</b></p>	<p><b>NG</b> → Repair the harness.</p>
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EFKB733A

## HARNESS INSPECTION PROCEDURE [1.8 I4]

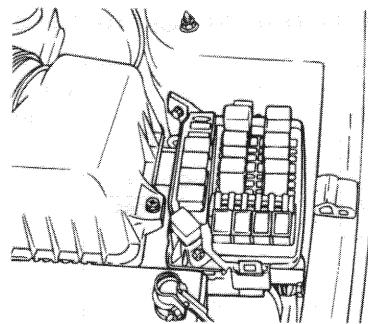
	<p>Check for continuity of the ground circuit.</p> <ul style="list-style-type: none"><li>o ECM connector : Disconnected</li></ul>	<p><b>OK</b> → <b>END!</b></p> <p><b>NG</b> → Repair the harness.</p>
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EFKB733B

## AIR CONDITIONING SWITCH AND RELAY

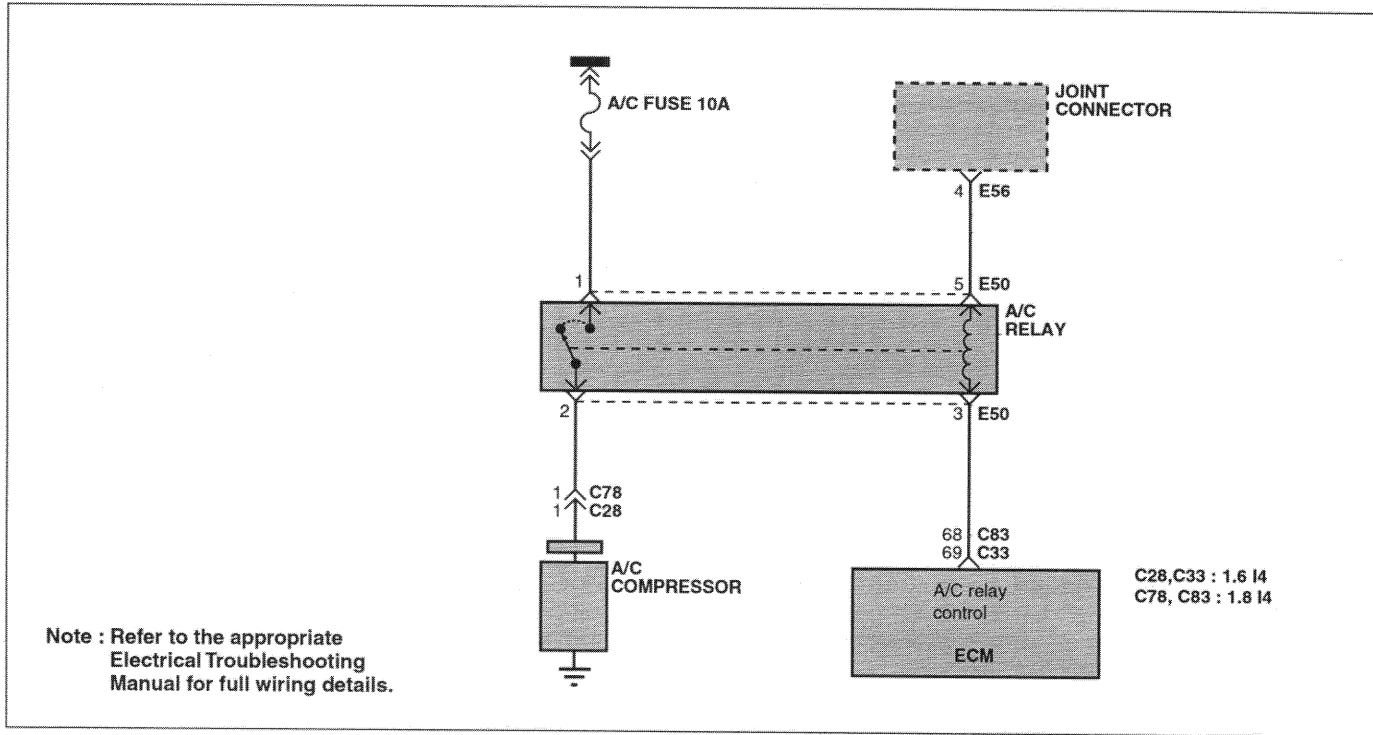
EFNC0550

The air conditioning switch relays battery voltage to the ECM when the air conditioning is turned on. When the air conditioning ON signal is input, the ECM drives the ISC Actuator and turns ON the ignition power transistor. Then, the air conditioning power relay coil is energized to turn on the relay switch, which activates the compressor magnetic clutch.



EFDA735A

### CIRCUIT DIAGRAM



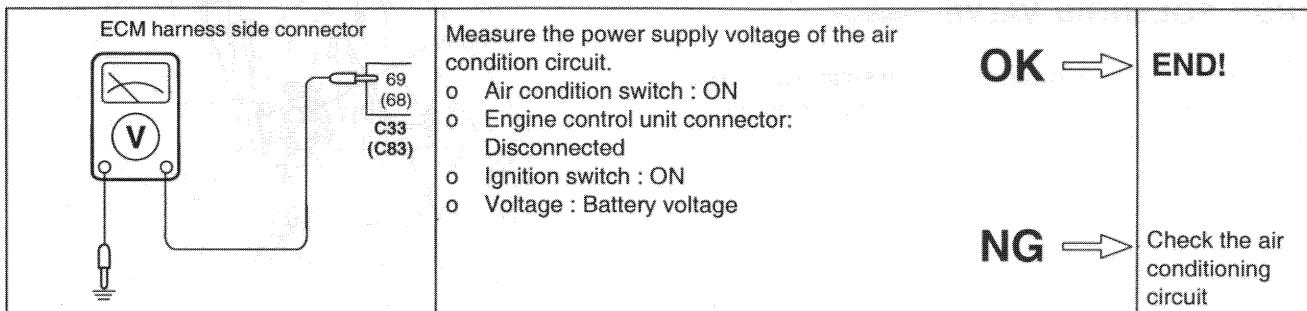
EFNC055A

### USING HI-SCAN (PRO)

Check item	Data Display	Check condition	Air conditioning switch	Normal indicator
Air conditioning switch	Switch state (ON/OFF)	Engine: Idling (air compressor is running when air conditioning switch is ON)	OFF	OFF
			ON	ON
Air conditioning compressor	Air conditioning compressor	Engine: Idling after warm-up	OFF	OFF (compressor clutch non-activation)
			ON	ON

## HARNESS INSPECTION PROCEDURE

AUTOMATED WORKSHOP MANUAL



EFKB735B

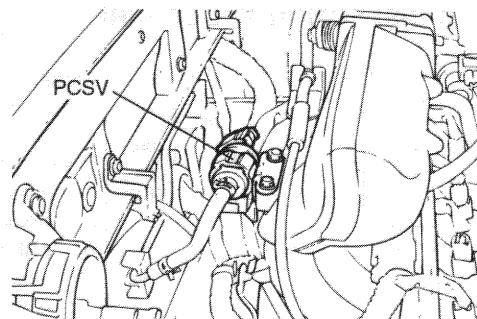
## AIR CONDITIONING INSPECTION

Refer to GROUP-HA service adjustment procedures.

## EVAPORATIVE EMISSION CANISTER PURGE SOLENOID VALVE

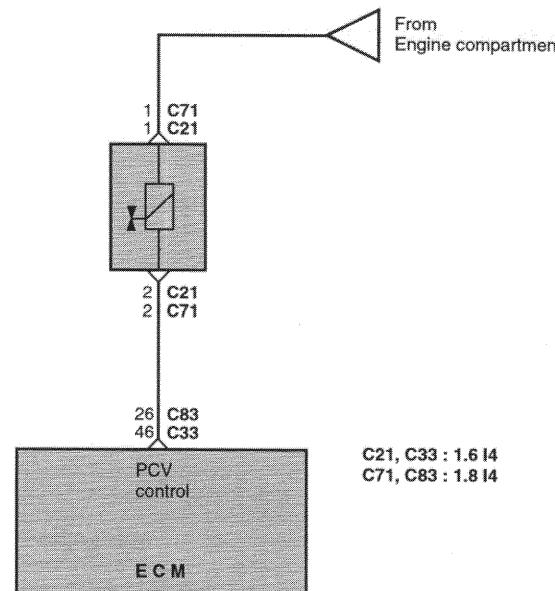
EFNC0570

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



EEDA204A

### CIRCUIT DIAGRAM

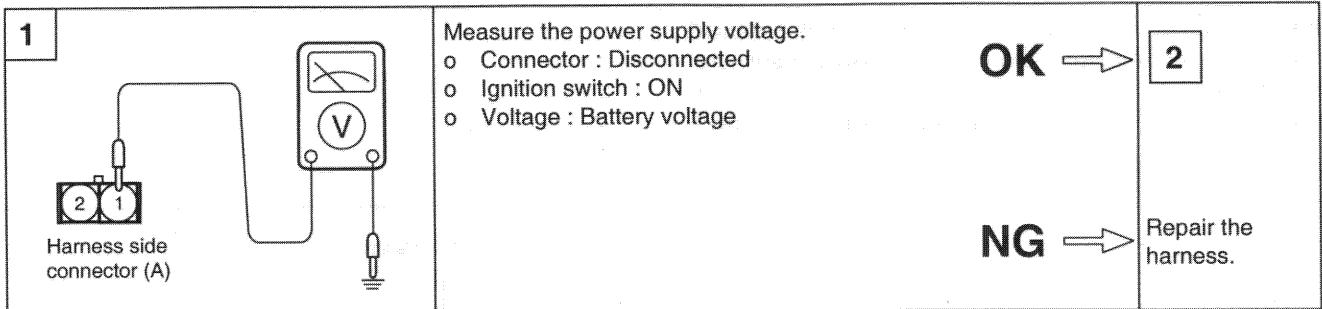


EFNC057A

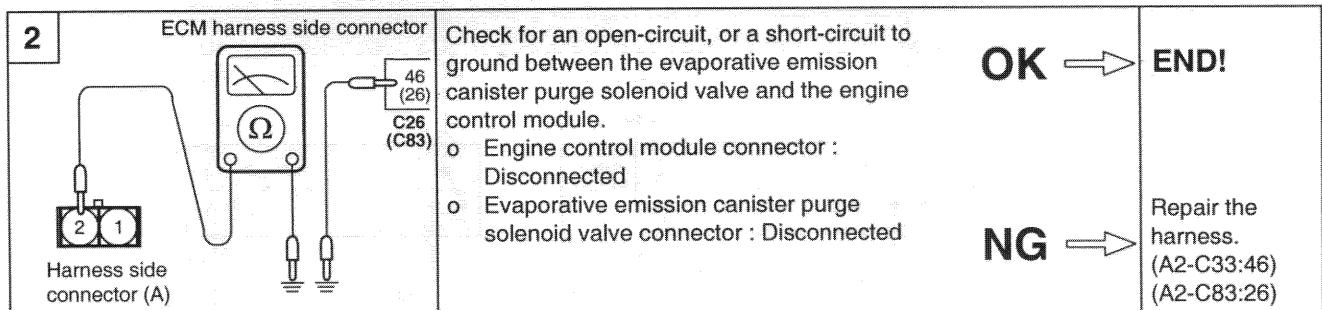
### USING HI-SCAN (PRO)

Check item	Check condition	HI-SCAN (Pro) display	Type
Evaporative emission canister purge solenoid valve • Actuator test	Start the engine	PURGE VALVE	Activate

## HARNESS INSPECTION PROCEDURES



EFDA737A



EFKB737B

## ACTUATOR INSPECTION

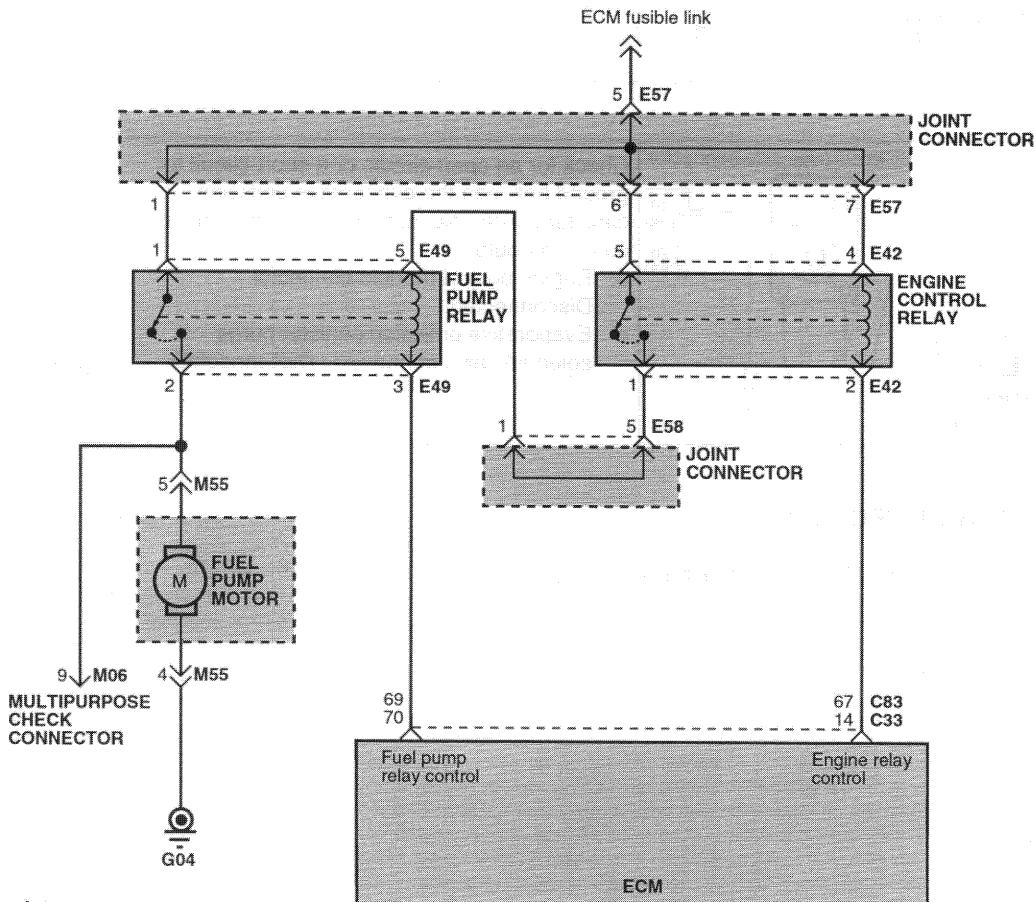
Refer to GROUP EC-Evaporative Emission System.

## MFI CONTROL RELAY

EFNC0590

When the ignition switch is on, battery power is supplied to the ECM, the injectors, 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.

## CIRCUIT DIAGRAM

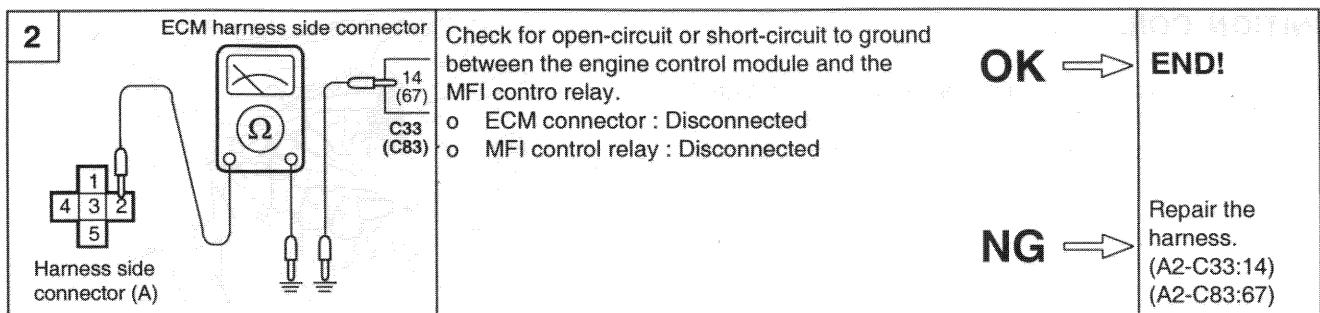


EFNC059A

## HARNESS INSPECTION PROCEDURES

<p><b>1</b></p> <p>Harness side connector (A)</p>	<p>Measure the power supply voltage of the MFI control relay.</p> <ul style="list-style-type: none"> <li>o MFI control relay connector : Disconnected</li> <li>o Voltage (V) : Battery voltage</li> </ul>	<p><b>OK</b> → <b>2</b></p> <p>Repair the harness. A4,A5-ground</p>
---	---	---

EFKB739A



EFKB739B

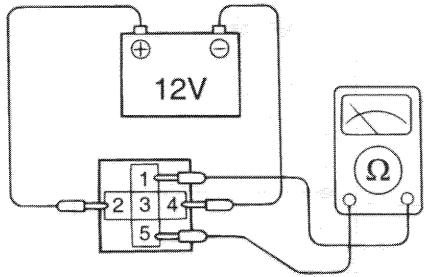
**MFI CONTROL RELAY INSPECTION**

1. Check the continuity of relay contacts between terminals 5 (+) and 1 (-).

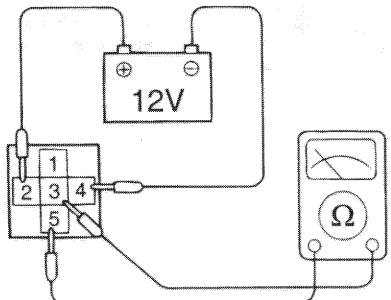
Relay coil (between terminal 5 & 1)	Continuity
When de-energized	No
When energized	Yes

Relay coil (between terminal 5 & 3)	Continuity
When de-energized	No
When energized	Yes

2. If faulty, replace the MFI control relay.



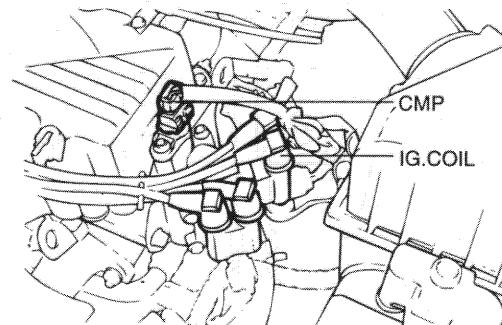
EFDA739C



EFDA739D

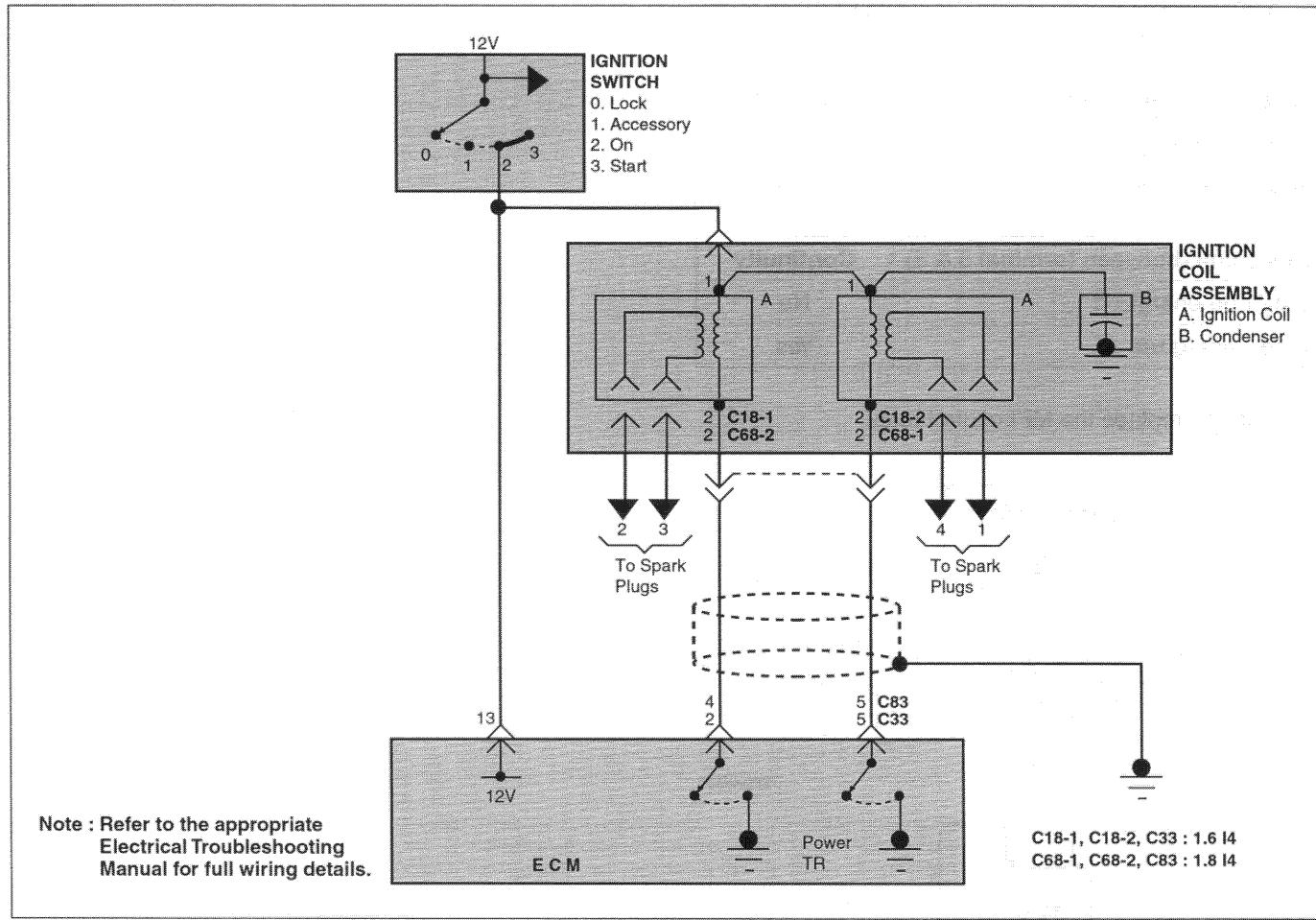
## IGNITION COIL EFNC0610

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

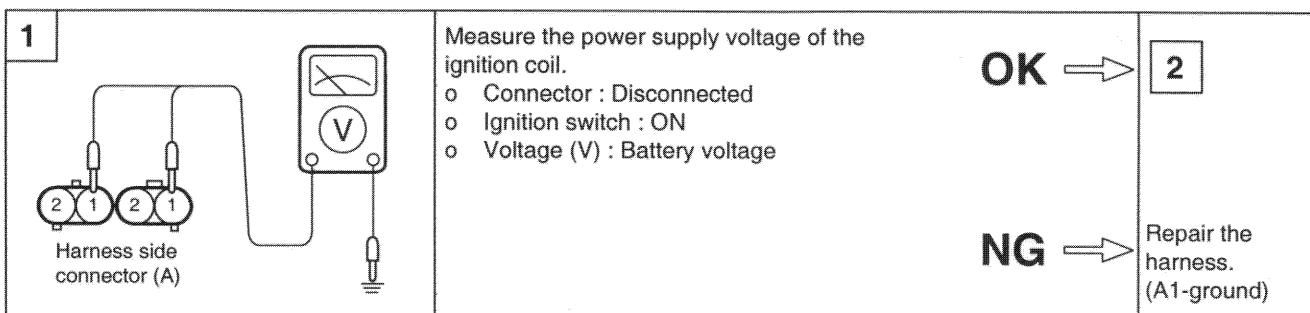


EFK8301E

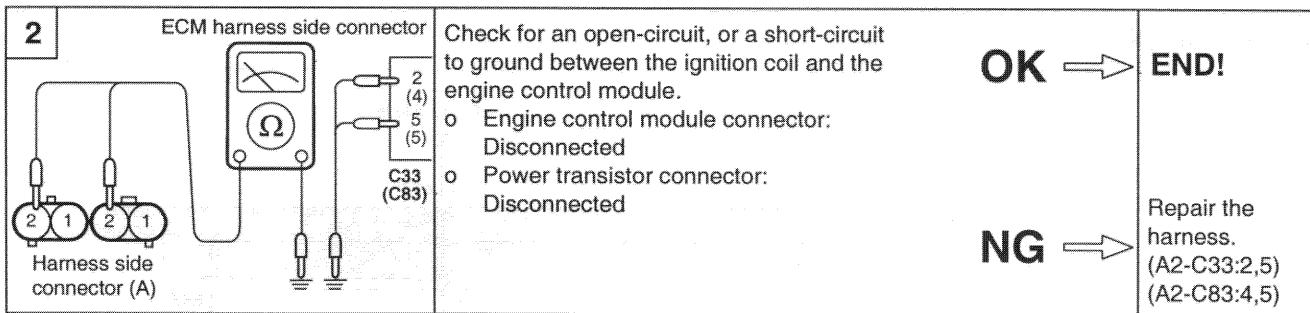
## CIRCUIT DIAGRAM



## HARNESS INSPECTION PROCEDURES

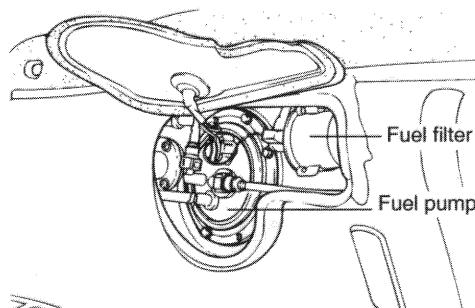


EFDATA41A



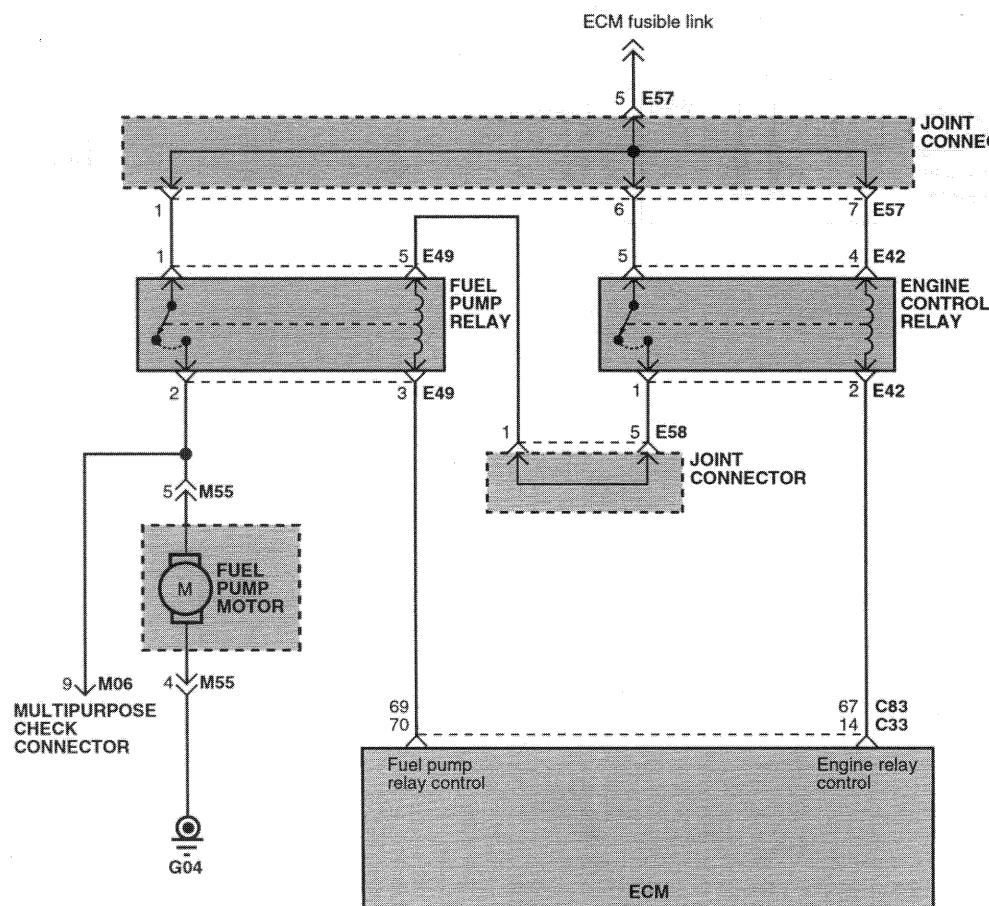
EFKB741B

## FUEL PUMP EFNC0630



EFDA013B

## CIRCUIT DIAGRAM

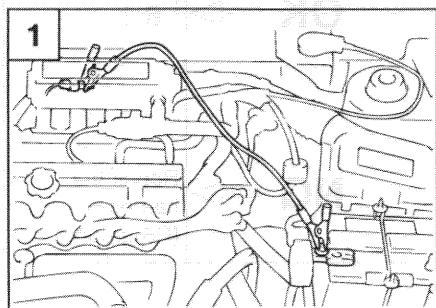


Note : Refer to the appropriate  
Electrical Troubleshooting  
Manual for full wiring details.

C33 : 1.6 i4  
C83 : 1.8 i4

EFNC059A

## HARNESS INSPECTION PROCEDURES



Check the fuel pump.

- o Apply battery voltage to the checking terminal and operate the pump.

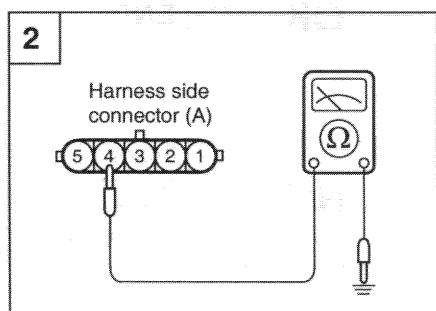
**OK** →

**4**

**NG** →

**2**

EFDA743A



Check the ground circuit of the fuel pump.

- o Connector : Disconnected

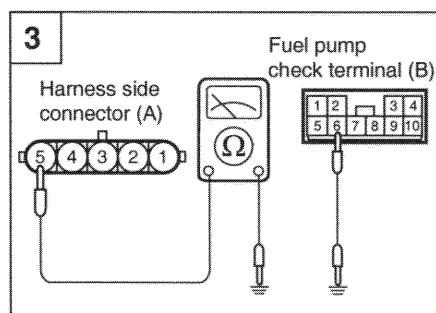
**OK** →

**3**

**NG** →

Repair the harness.  
(A4-ground)

EFKB743B



Check for continuity between the fuel pump and the check terminal.

- o Connector : Disconnected

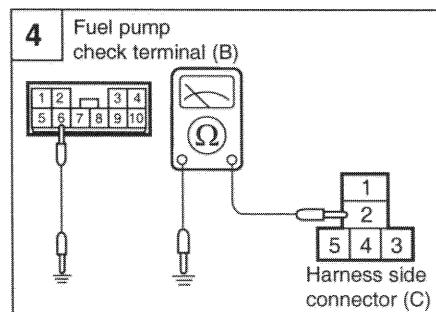
**OK** →

**4**

**NG** →

Repair the harness.  
(A5-B6)

EFKB743C



Check for continuity between the check terminal and the fuel pump control relay terminal.

- o Control relay connector : Disconnected

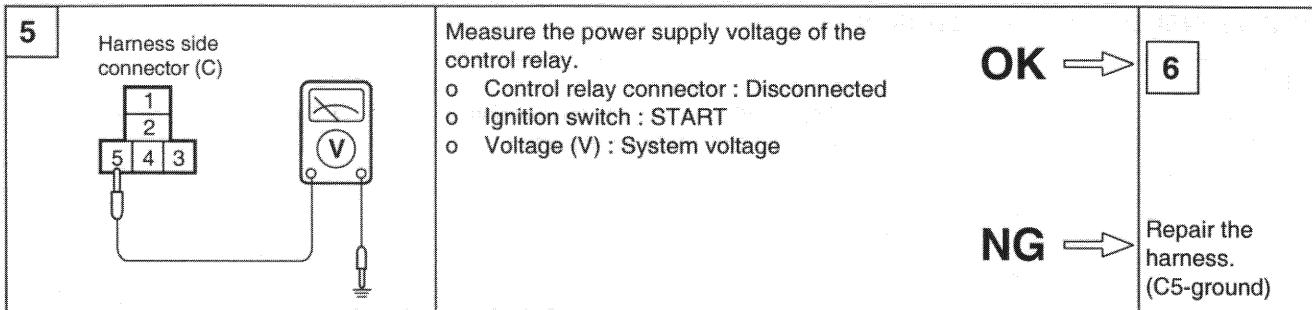
**OK** →

**5**

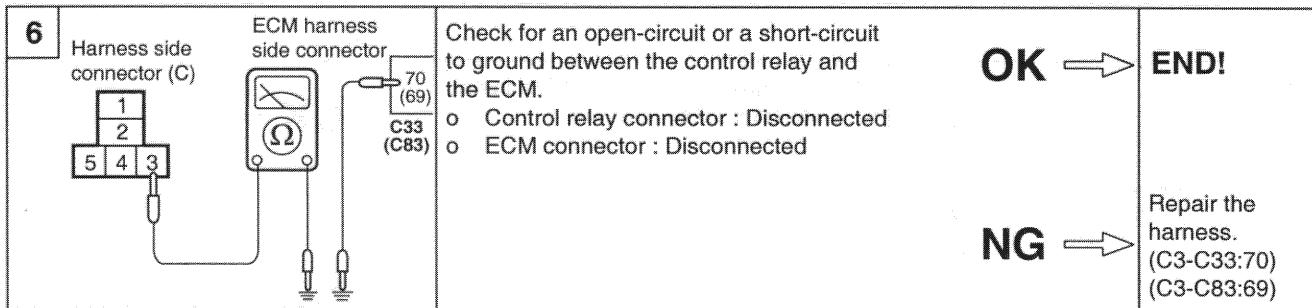
**NG** →

Repair the harness.  
(B6-C2)

EFKB743D



EFKB743E

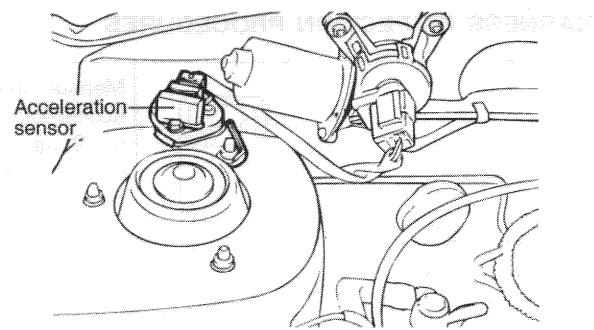


EFKB743F

## ACCELERATION SENSOR

EFKB7450

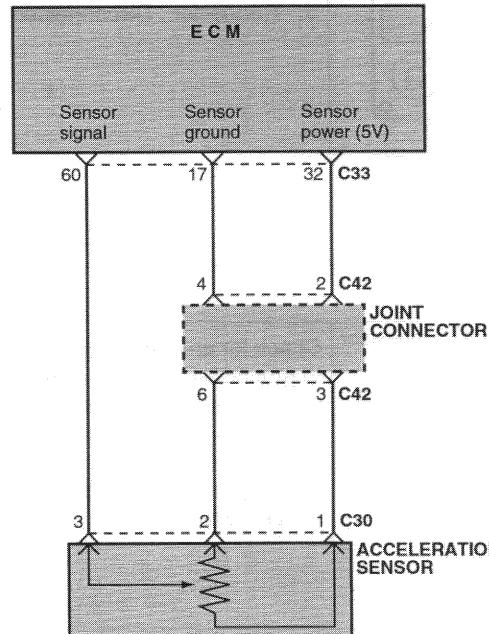
The acceleration sensor is used to sense rough road conditions. The sensor's signal is used by the Engine Control Module (ECM) to prevent wrongful misfire detection.



EFDA301J

## CIRCUIT DIAGRAM

[1.6 I4]



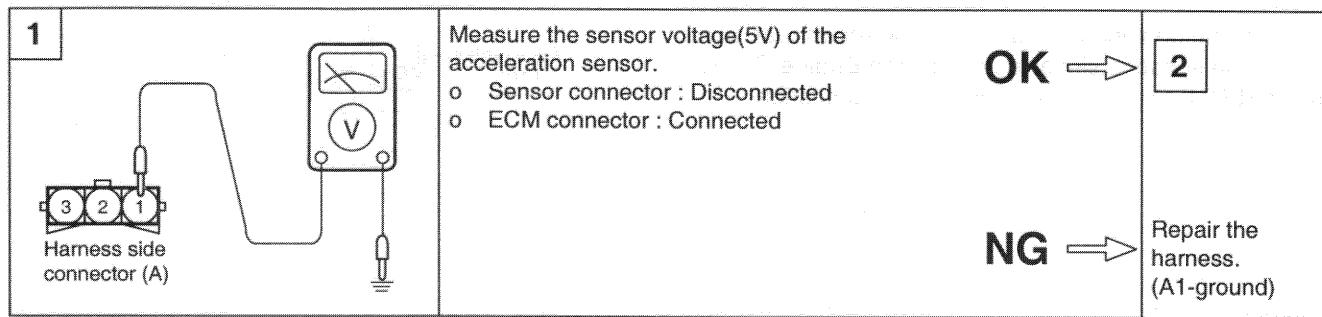
Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

EFKB557A

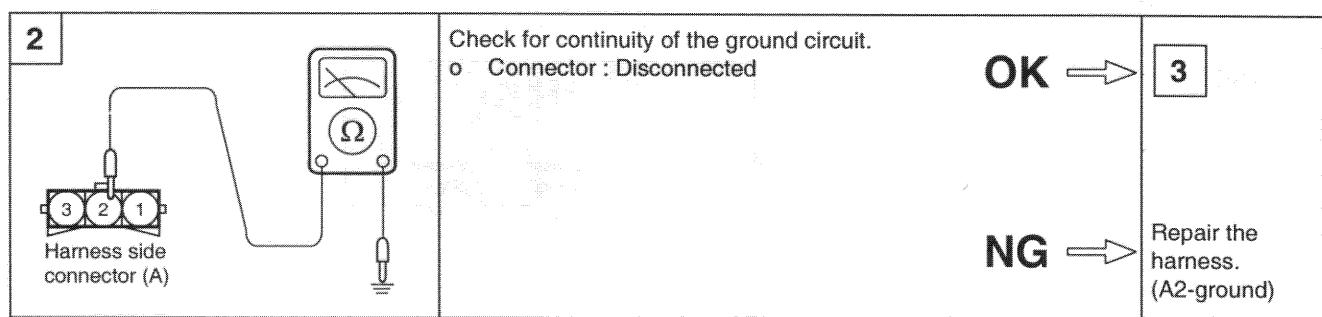
## USING VOLTMETER

Check item	Check condition	Test specification
Acceleration sensor output voltage	While idling	2.3 - 2.7V
	While driving	1.5 - 3.5V

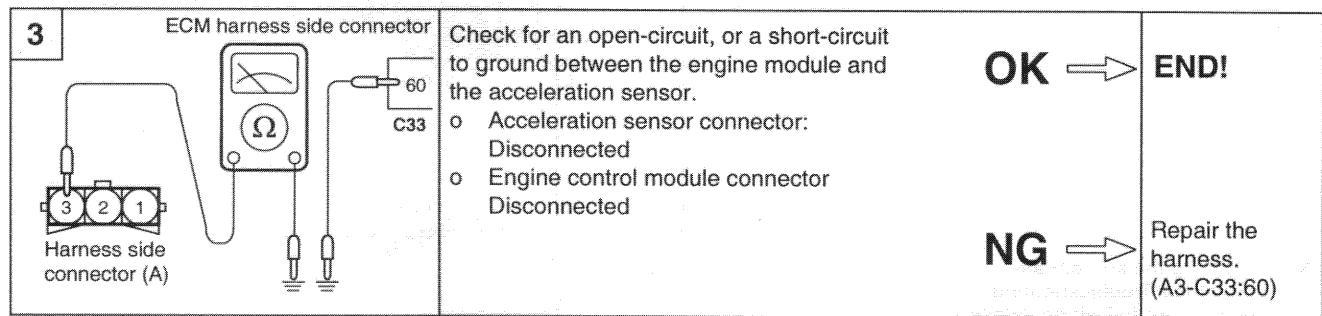
## HARNESS INSPECTION PROCEDURES



EFKB745A



EFKB745B



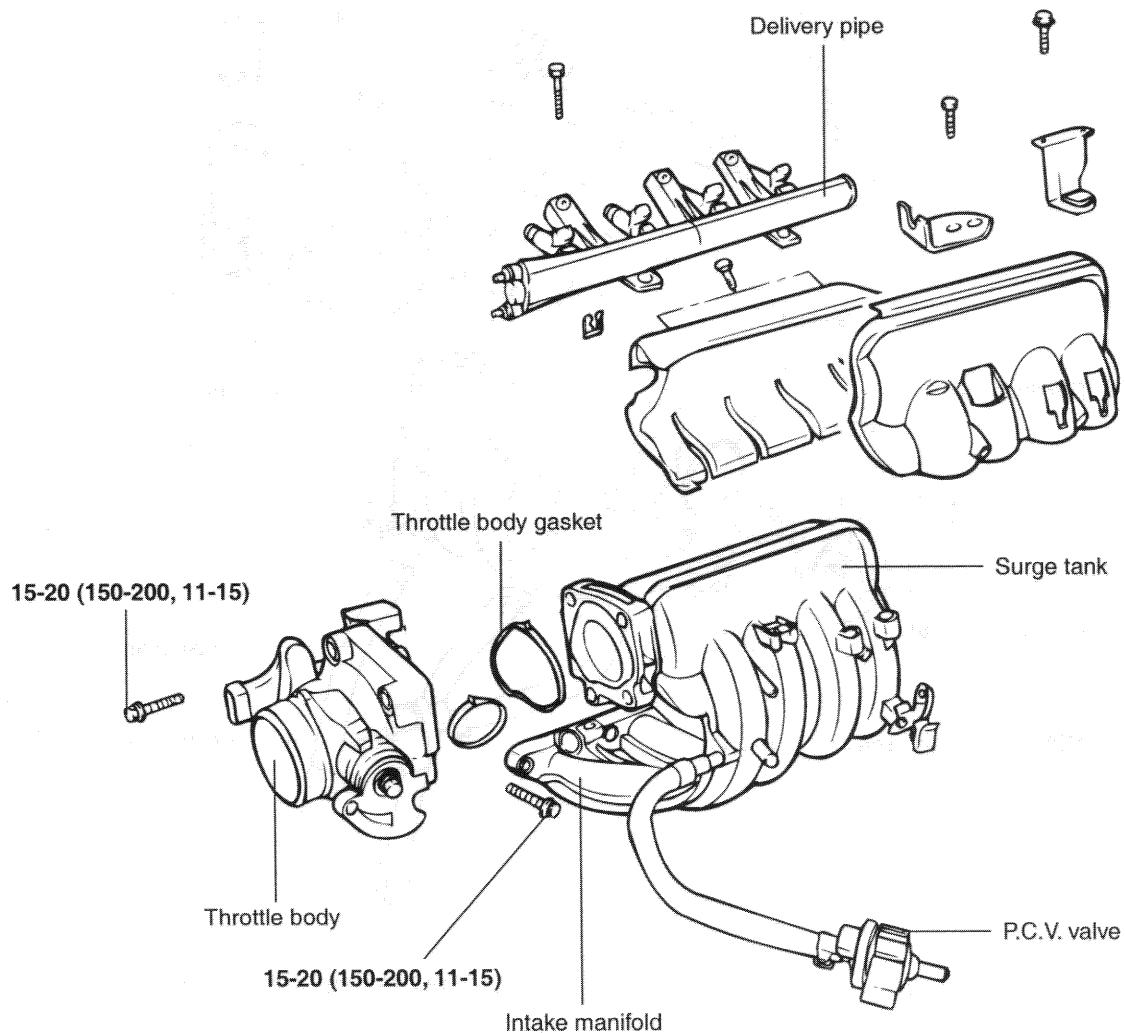
EFKB745C

# FUEL DELIVERY SYSTEM

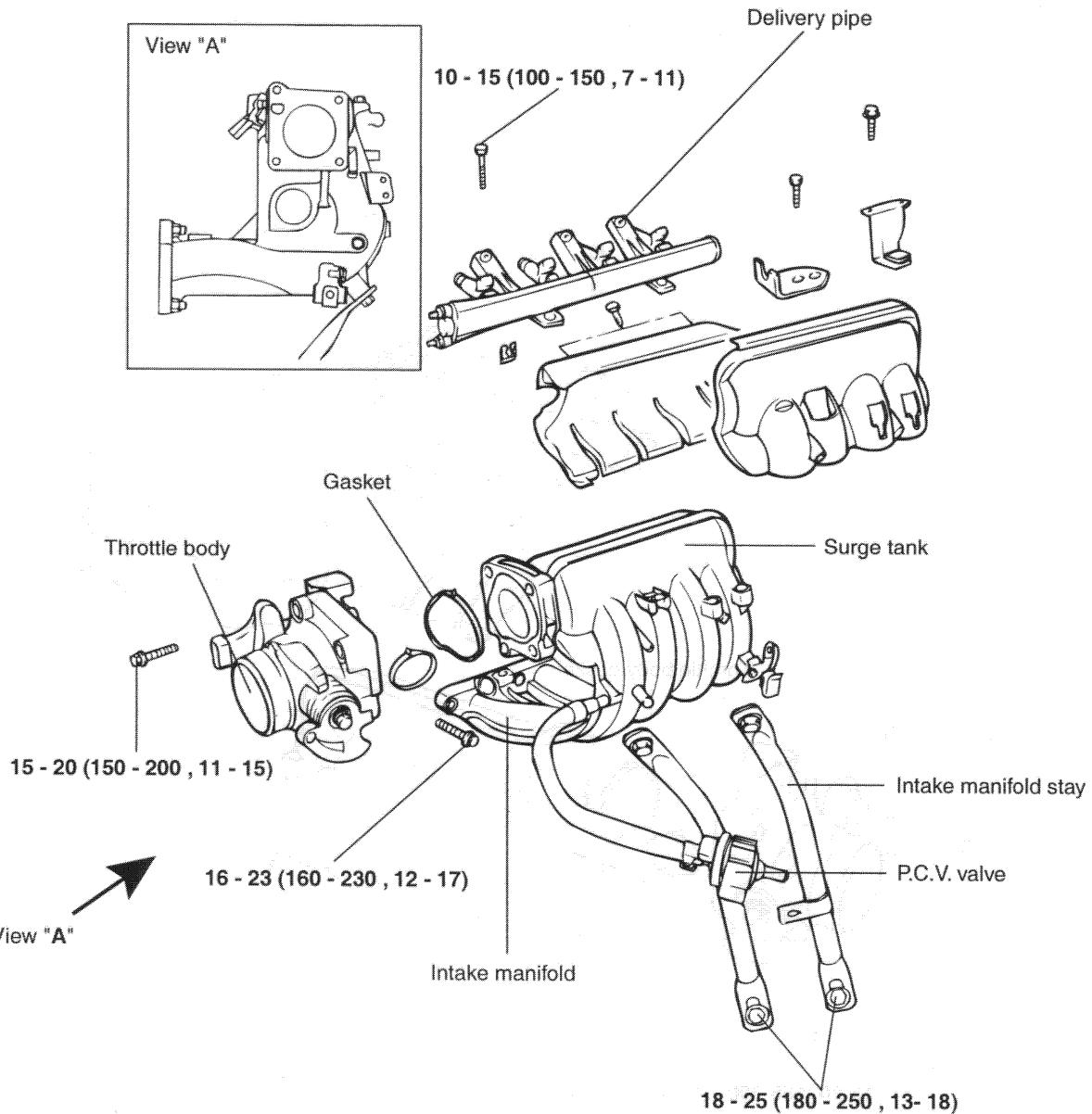
## INJECTOR EFKB8010

### COMPONENTS

[1.6 I4]

**TORQUE : Nm (kg·cm, lb·ft)**

[1.8/2.0 I4]



TORQUE : Nm (kg·cm, lb·ft)

EDKA050C

EFKB801B

## FUEL DELIVERY SYSTEM

### REMOVAL EFDA8030

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

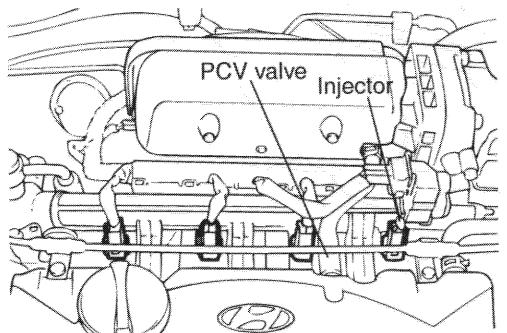
**⚠ CAUTION**

*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 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.*



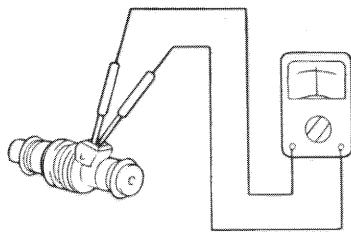
EEDA105B

### INSPECTION EFDA8050

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

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

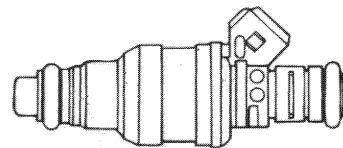
2. If the resistance is not within specifications, replace the injector.



EFDA805A

### INSTALLATION EFDA8070

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

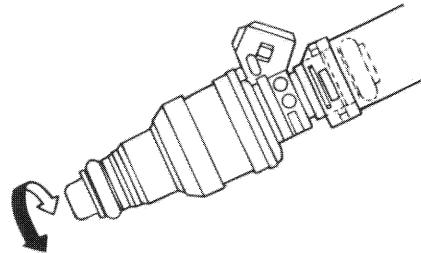


EFDA807A

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

**⚠ NOTE**

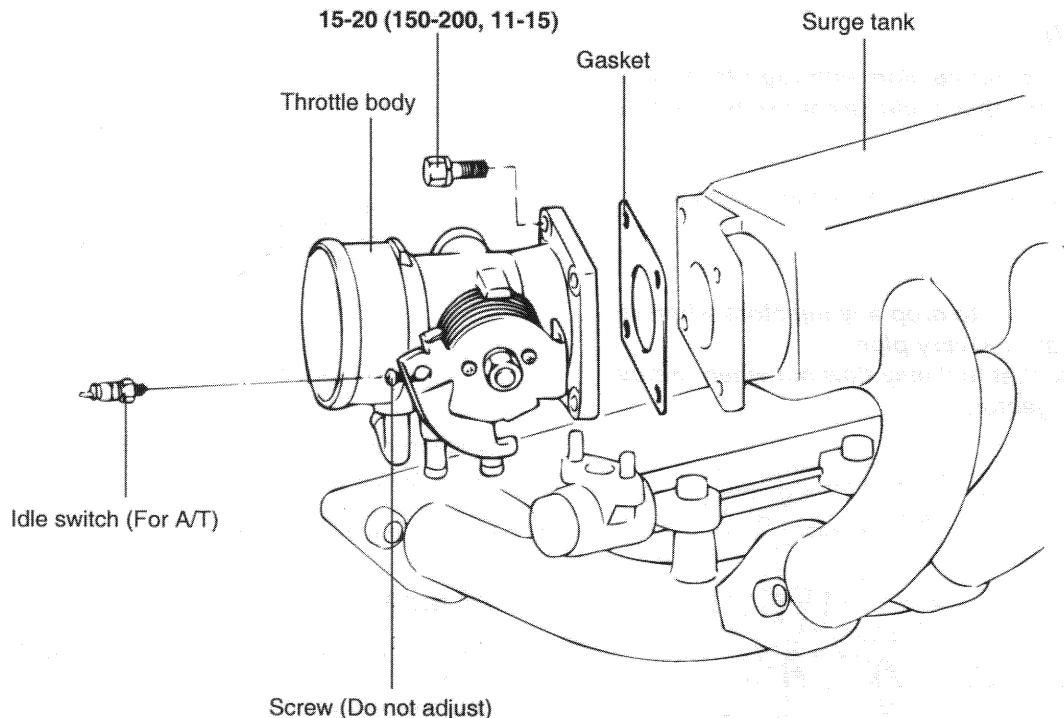
*If it does not turn smoothly, the O-ring may be jammed: Remove the injector and re-insert it into the delivery pipe and recheck.*



EFDA807B

## THROTTLE BODY

EFDA8090



TORQUE : Nm (kg·cm, lb·ft)

EFDA809A

## REMOVAL

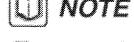
EFDA8110



## CAUTION

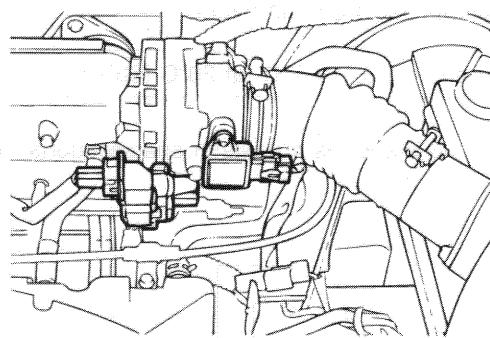
*The throttle valve must not be removed.*

Remove the throttle position sensor.



## NOTE

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



EFDA301M

## FUEL DELIVERY SYSTEM

### INSPECTION

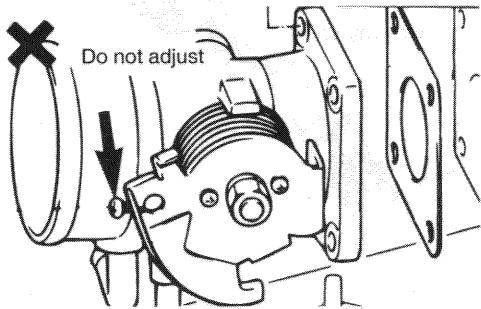
EFDA8130

1. Check the throttle body for cracks.
2. Check for restriction in the vacuum port or passage.
3. Check for interference when moving the accelerator cable.



#### CAUTION

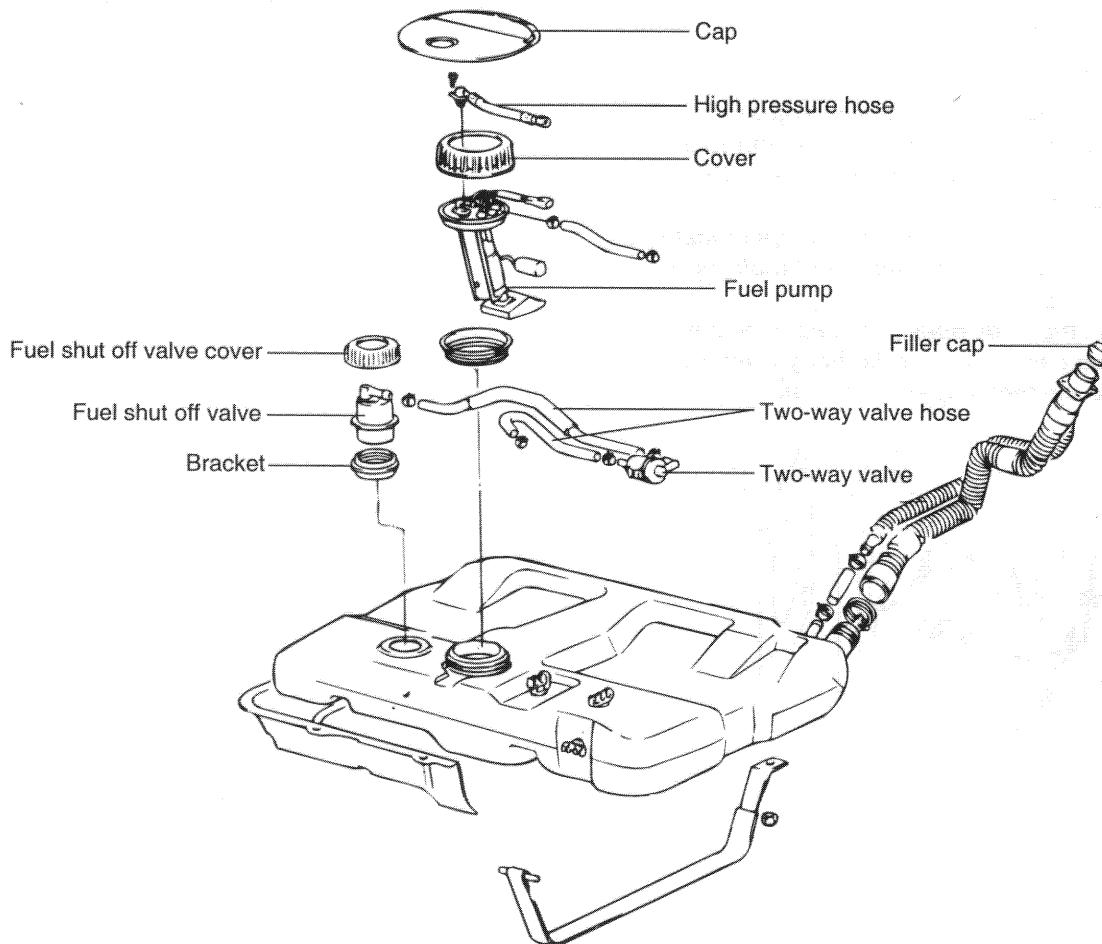
- **Throttle valve set screw was adjusted in the production line with the air volume (0.516 ± 5% g/sec) during idling. So please DO NOT ADJUST IT voluntarily.**
- **When the idle rpm is out of specification, check the relevant sensors and their input or output value first.**
- **The throttle body does not need to be cleaned because carbon in throttle body does not affect the system's operation at all.**



EFDA813A

## FUEL TANK

EFDA8150

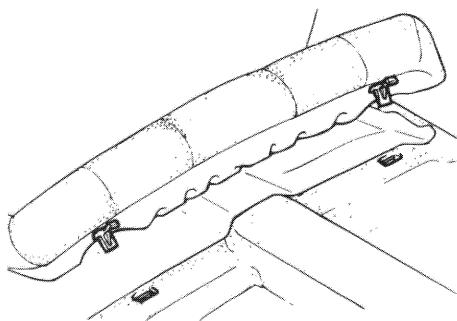


EFDA815A

## REMOVAL

EFKB8170

1. Press the two taps under the rear seat and raise the seat, then detach the inspection panel of the fuel pump.

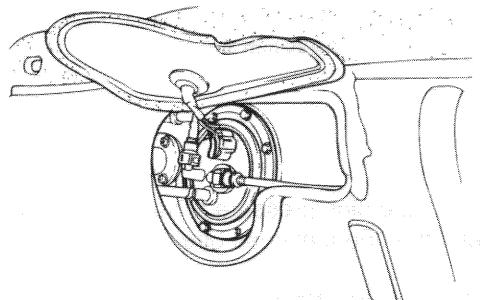


EFDA013A

- To reduce the internal pressure of the fuel lines and hoses, first start the engine with the fuel pump disconnected and wait until it stops by itself.

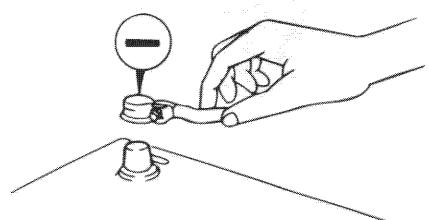
 **NOTE**

*Be sure to reduce the fuel pressure before disconnecting the fuel main pipe and hose. Otherwise fuel will spill out.*



EFKB013B

- Disconnect the battery cable from the negative (-) terminal of the battery.



EFDA817B

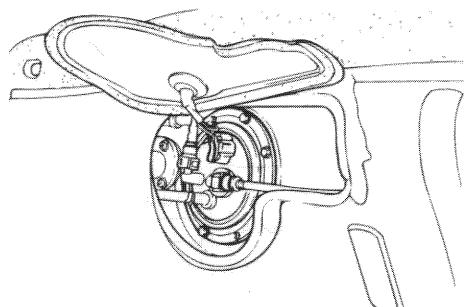
- Disconnect the high pressure hose from the fuel filter output side, and disconnect the tap for static electricity.

 **CAUTION**

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

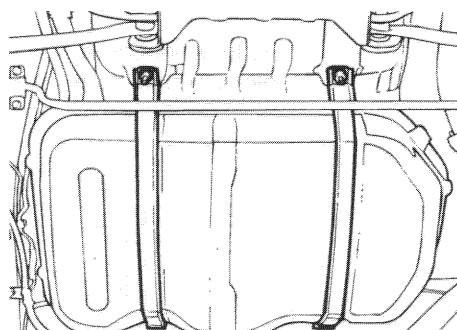
- Lift up the vehicle.
- Detach the fuel filler hose and leveling hose.

- Support the fuel tank with a jack.



EFKB013B

- Remove the fuel tank bands.
- Remove the fuel tank.



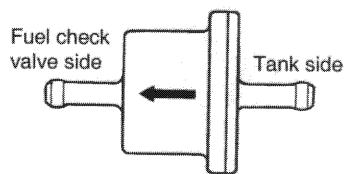
EFDA817C

**INSPECTION**

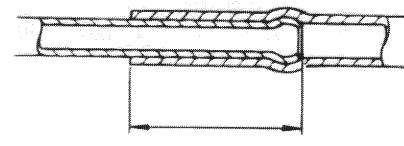
EFDA8190

- Check the hoses and the pipes for cracks or damage.
- Check the fuel tank cap for proper operation.
- Check the fuel tank for deformation, corrosion or cracking.
- Check the inside of the fuel tank for dirt or foreign material.
- Check the in-tank fuel filter for damage or restriction.
- Test the two-way valve for proper operation.

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



EFDA819A



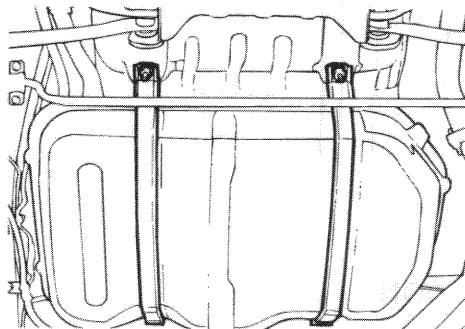
25-30 mm (1.0-1.2 in.)

EFDA821B

## INSTALLATION

EFKB8210

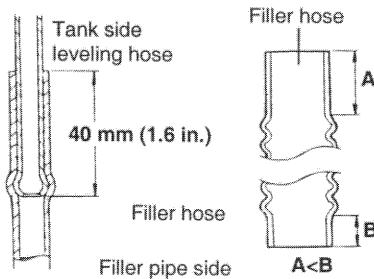
1. Confirm that the pad is fully bonded to the fuel tank, and install the fuel tank by tightening the self-locking nuts.



EFDA817C

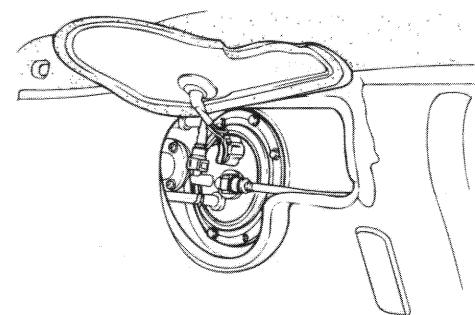
2. Connect the leveling hose to the tank and the filler neck. Install approximately 40mm (1.6 in.).

3. When connecting the filler hose, the end with the shorter straight pipe should be connected to the tank side.



EFDA821A

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



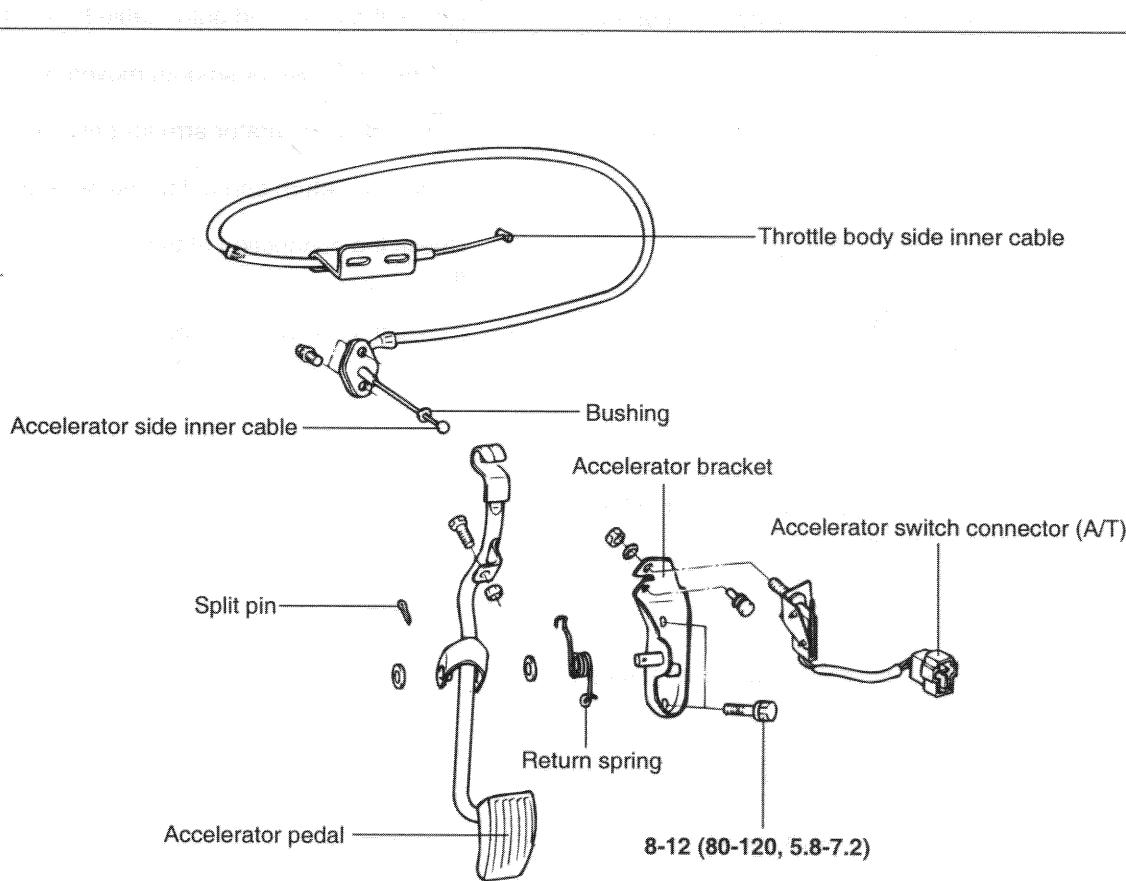
EFKB013B

5. Connect the high pressure hose to the fuel pump. Be careful that the fuel hose does not twist.

6. Connect the electrical fuel pump connector.

## ENGINE CONTROL

EFDA8310



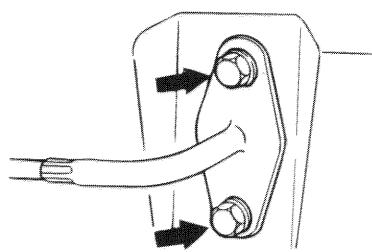
TORQUE : Nm (kg·cm, lb·ft)

EFDA831A

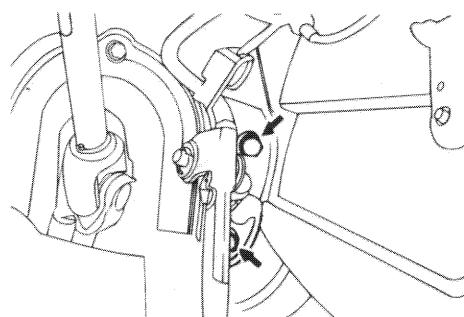
## REMOVAL

EFDA8330

1. Remove the bushing and inner cable of the accelerator arm side.



EFDA833A



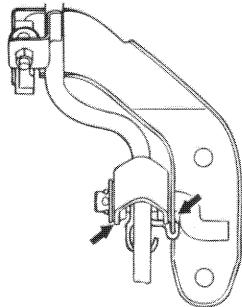
EFDA833B

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

**INSTALLATION**

EFDA8370

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



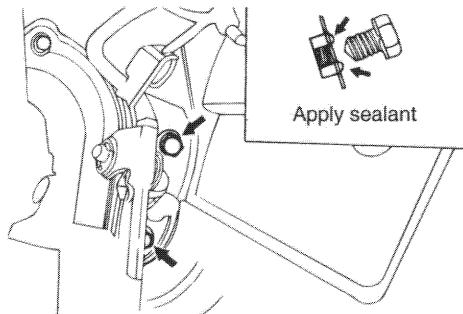
EFDA837A

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

**Tightening torque**

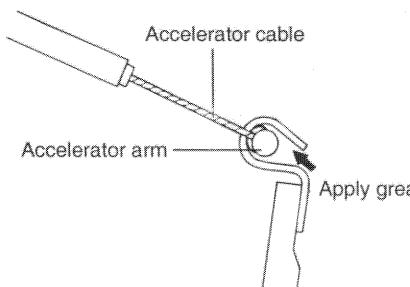
Accelerator arm bracket bolts :

8-12Nm (80-120 kg.cm, 5.8-7.2 lb.ft)



EFDA837B

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



EFDA837C

**INSPECTION**

EFDA8350

- Check the inner and outer cable for damage.
- Check the cable for smooth movement.
- Check the accelerator arm for deformation.
- Check the return spring for deterioration.
- Check the connection of the bushing to end metal fitting.
- Check that the accelerator switch operates properly.

# TROUBLESHOOTING FOR DTC

## DIAGNOSTIC ITEM

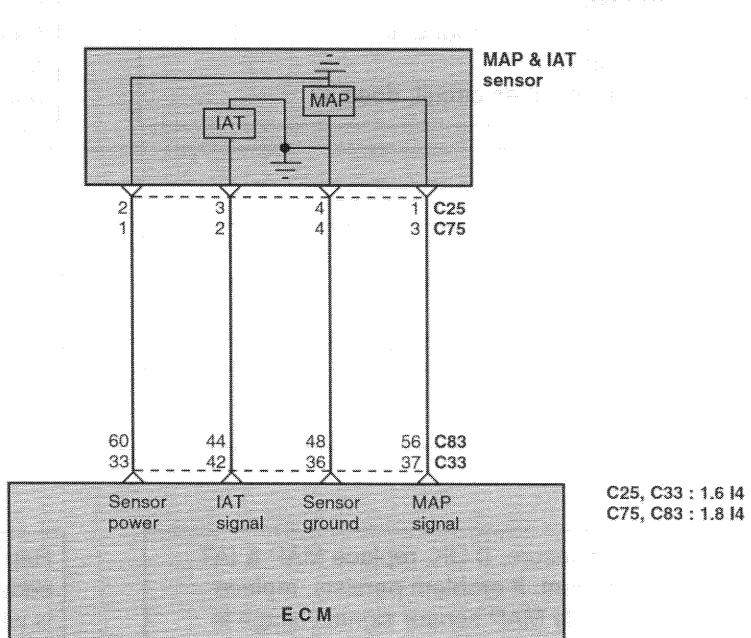
EFKB5020

DTC	Diagnostic item
P0105	Manifold Absolute Pressure Sensor Circuit Malfunction
P0106	Manifold Absolute Pressure Sensor Circuit Range/Performance Problem
P0107	Manifold Absolute Pressure Sensor Range Check Low
P0108	Manifold Absolute Pressure Sensor Range Check High

## DESCRIPTION

The Manifold Absolute Pressure(MAP) sensor is essentially a strain gauge used to measure the pressure in the surge tank. Inside the sensor is a metal diaphragm with a small wire attached. The diaphragm flexes according to changes in pressure. When the diaphragm flexes, the wire attached to it stretches, changing the resistance of the wire. The Engine control Module (ECM) applies five volts to the MAP sensor and measures the voltage drop across the sensor. Sensor output is in volts and as pressure decreases, the voltage drop across the sensor increases. Since the MAP sensor is used as an air flow sensor, the sensor signal is an important input. The ECM uses the information to determine fuel amount and ignition timing.

## CIRCUIT DIAGRAM



## TEST PROCEDURE

- Turn ignition switch on.
- Connect scan tool to data link connector.
- Verify DTC P0105, P0106, P0107 or P0108 is set.
- Is DTC P0110, P0112 or P0113 also set?

NO

- MAP sensor disconnected.
- Measure resistance between MAP & IAT sensor connector terminals 1 and 4.

Resistance should read approximately 30 kilo ohms, does it?

YES

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NEXT PAGE

YES

- Turn ignition off.
- Disconnect MAP & IAT sensor.
- Turn ignition on.
- Measure voltage between ground and MAP & IAT sensor harness connector terminal 2.

5 volts should be present, is it?

NO

Replace MAP &amp; IAT sensor. Clear code and verify MAP sensor signal voltage is within normal parameters.

YES

- MAP & IAT sensor disconnected.
- Turn ignition off.
- Disconnect ECM connector.
- Measure resistance between ground and MAP & IAT harness connector terminal 3.

Resistance should indicate open circuit, does it?

NO

Repair open circuit in wire between MAP &amp; IAT sensor harness connector terminal 2 and ECM. Clear code and verify MAP sensor signal voltage is within normal parameters.

YES

- Turn ignition on, engine off.
- Measure voltage between ground and MAP & IAT sensor terminal 1 (backprobe).

Voltage measured should be 0.2 to 4.5 volts, is it?

NO

Repair short to ground in the wire between MAP &amp; IAT sensor harness connector terminal 3 and ECM. Clear code and verify MAP sensor signal voltage is within normal parameters.

YES

Verify ECM connector is secure. If OK, replace MAP & IAT with known good component. If problem persists, replace ECM. Clear code and verify MAP sensor signal voltage is within normal parameters.

NO

Replace MAP &amp; IAT sensor. Clear code and verify output signal voltage is within normal parameters.

**CONTINUED FROM  
PREVIOUS PAGE****A**

- Turn ignition off.
- Disconnect MAP & IAT sensor.
- Measure resistance between ground and MAP & IAT sensor.

Resistance should be approximately 1 ohm or less, is it?

**YES****NO**

Replace MAP sensor. Clear code and verify MAP sensor is within normal parameters.

Repair open circuit in wire between MAP sensor harness connector terminal 4 and ECM. Clear code and verify MAP sensor is within normal parameters.

EFNC5060

DTC	Diagnostic item
P0110	Intake Air Temperature Circuit Malfunction
P0112	Intake Air Temperature Low Input
P0113	Intake Air Temperature High Input

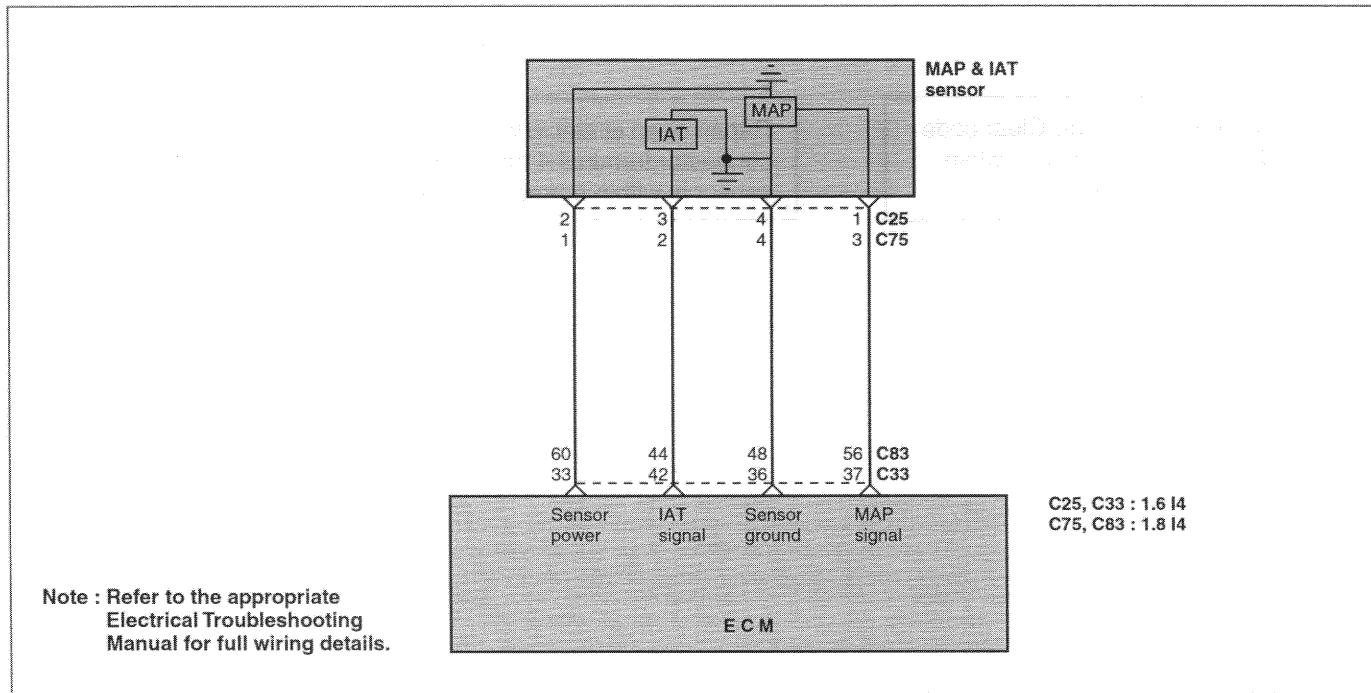
## DESCRIPTION

The Intake Air Temperature (IAT) sensor is built in to the MAF sensor. The IAT sensor is a variable resistor whose resistance changes as the temperature of the air flowing through the air intake changes. The Engine Control Module (ECM) uses the IAT sensor input to adjust fuel injector pulse width. When the temperature sensed is cold, the ECM enriches fuel mixture by increasing injector pulse width; as the air warms, the injector pulse width time is shortened.

## FAILURE CONDITIONS

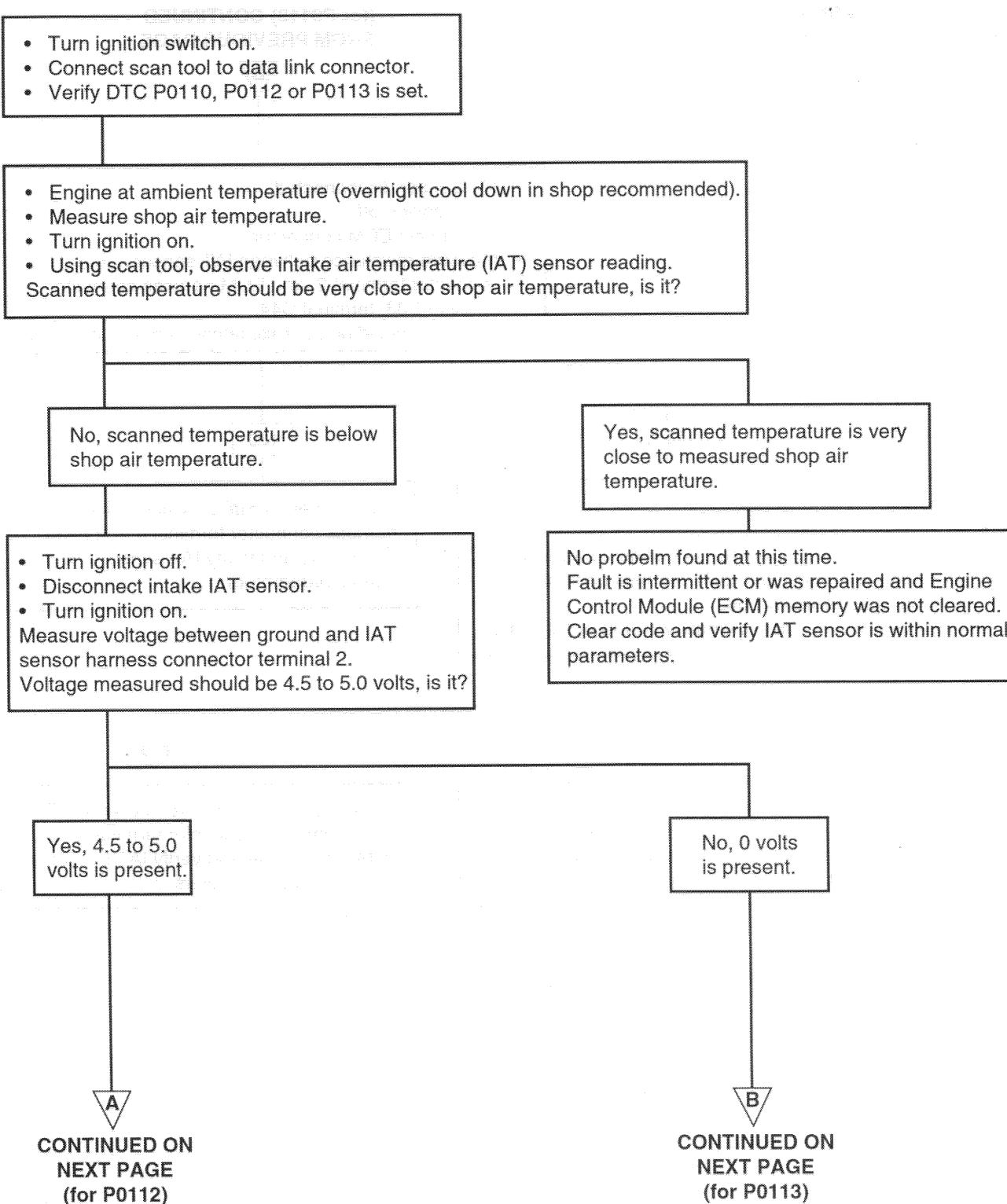
The ECM will set P0112 and the Malfunction Indicator Lamp (MIL) will turn on if the IAT sensor indicates a temperature lower than -49°F (-45°C) for 0.2 seconds during two driving cycles. This check is made after the engine has run for 4 minutes and 10 seconds and then idles for 30 seconds (with no fuel cut-off during a coast-down). This code indicates a lower than expected temperature is being read by the IAT sensor or ECM after the engine has been warmed up.

## CIRCUIT DIAGRAM



EFNC027A

## TEST PROCEDURE



(for P0112) CONTINUED  
FROM PREVIOUS PAGE



- IAT sensor disconnected.
- ECM disconnected.
- Measure resistance between IAT sensor harness connector terminal 3 and ECM harness connector terminal C42, terminal C56.

Resistance should be approximately 1 ohm or less, is it?

YES

NO

- IAT sensor disconnected.
- Turn Ignition off.
- Disconnect ECM connector.
- Measure resistance between IAT sensor harness connector terminal 2 and ECM harness connector terminal C33, terminal C44.

Resistance should be approximately 1 ohm or less, is it?

Repair open in wire between IAT sensor harness connector terminal 4 and ECM. Clear code and verify IAT sensor is within normal parameters.

YES

NO

Verify ECM connector is secure. If OK, replace IAT sensor with known good component. Clear code and verify IAT sensor is within normal parameters. If problem persists, replace ECM.

Repair open circuit in wire between IAT sensor harness connector terminal 3 and ECM. Clear code and verify IAT sensor is within normal parameters.

## TROUBLESHOOTING FOR DTC

EFNC5110

DTC	Diagnostic item
P0115	Engine Coolant Temperature Circuit Malfunction
P0116	Engine Coolant Temperature Circuit Range/Performance
P0117	Engine Coolant Temperature Low Input
P0118	Engine Coolant Temperature High Input

## DESCRIPTION

The Engine Coolant Temperature (ECT) sensor is located in the coolant passage of the cylinder head. The ECT sensor is a variable resistor whose resistance changes as the temperature of the engine coolant flowing past the sensor changes. When coolant temperature is low, sensor resistance is high; when coolant temperature is high, sensor resistance is low.

The Engine Control Module (ECM) checks ECT sensor voltage and uses the information to adjust fuel injector pulse width and ignition timing. When the temperature sensed is very cold, the ECM enriches the fuel mixture and advances ignition timing. As coolant temperature rises, the ECM reduces the amount of enrichment and timing advance.

## FAILURE CONDITIONS

The ECM will set P0116 and the Malfunction Indicator Lamp (MIL) will turn on if the ECT sensor's actual performance curve falls more than 68°F (20°C) below the ECM's model curve (based on fuel delivery, ambient air temperature and engine running time) for 0.2 seconds during two

driving cycles. This code indicates uncharacteristic engine temperature performance being read by the ECT sensor or ECM.

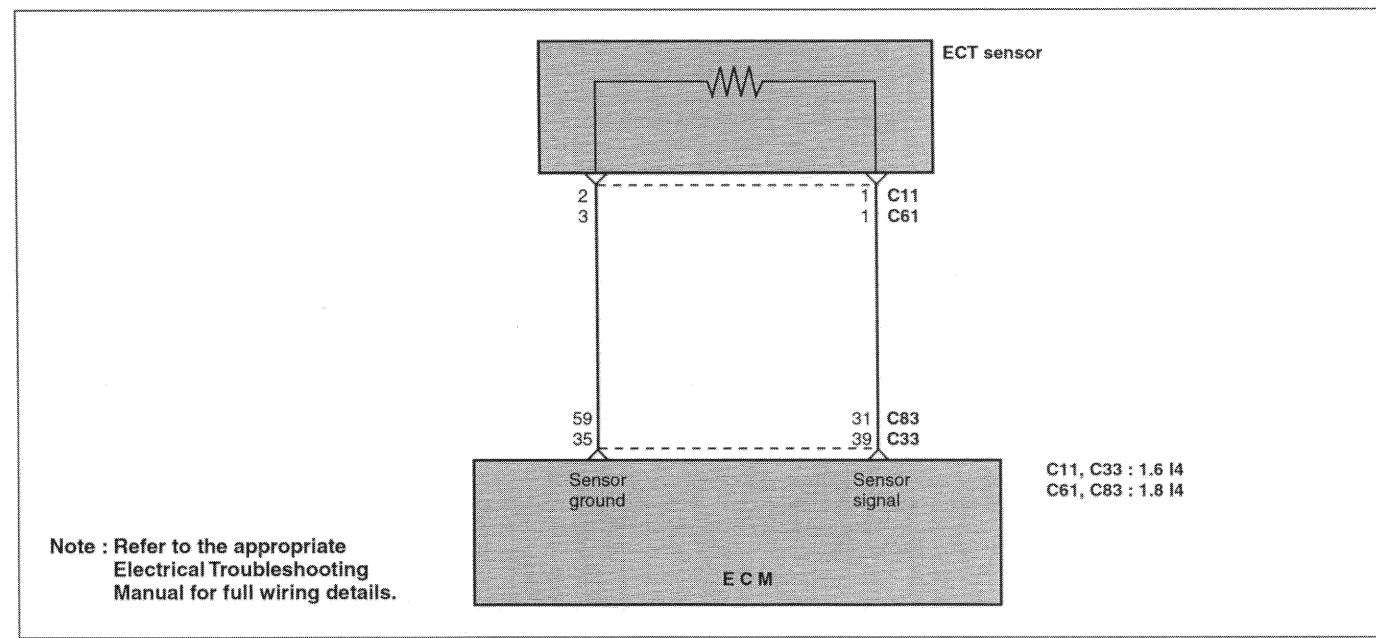
The ECM will set P0117 and the Malfunction Indicator Lamp (MIL) will turn on if the ECT sensor reports a temperature below -49°F (-45°C) for 0.2 seconds during two driving cycles. The ECM will set P0118 and the Malfunction Indicator Lamp (MIL) will turn on if the ECT sensor reports a temperature above 284°F (140°C) for 0.2 seconds during two driving cycles.

 **NOTE**

*The ECT sensor resistance varies with temperature as follows:*

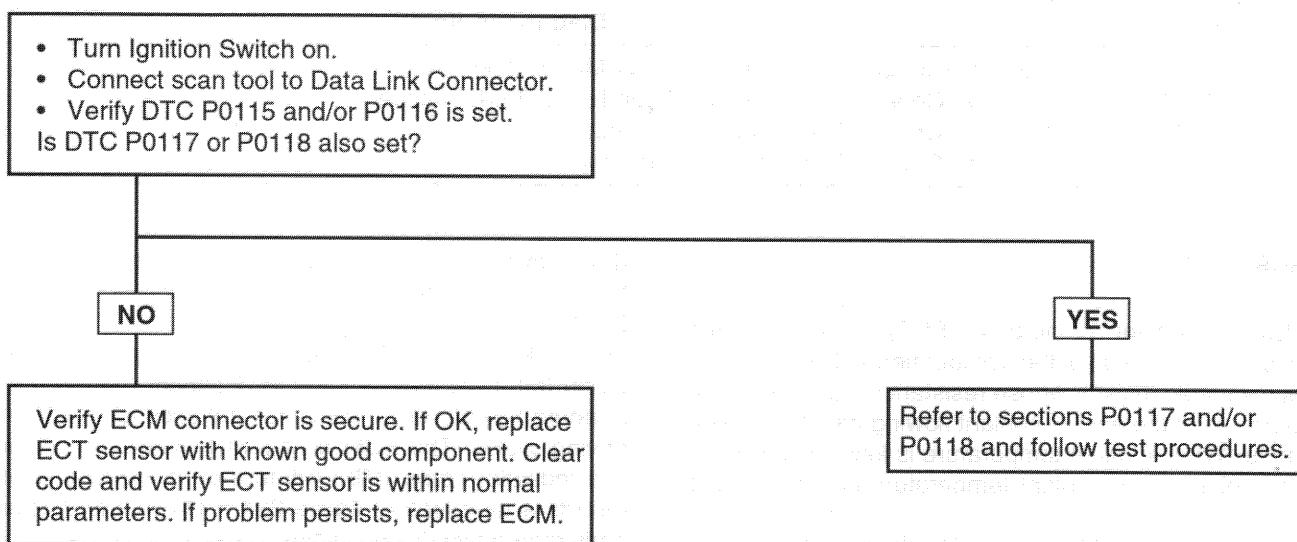
- 5900 ohms @ 32°F (0°C).
- 2500 ohms @ 68°F (20°C).
- 300 ohms @ 176°F (80°C).

## CIRCUIT DIAGRAM

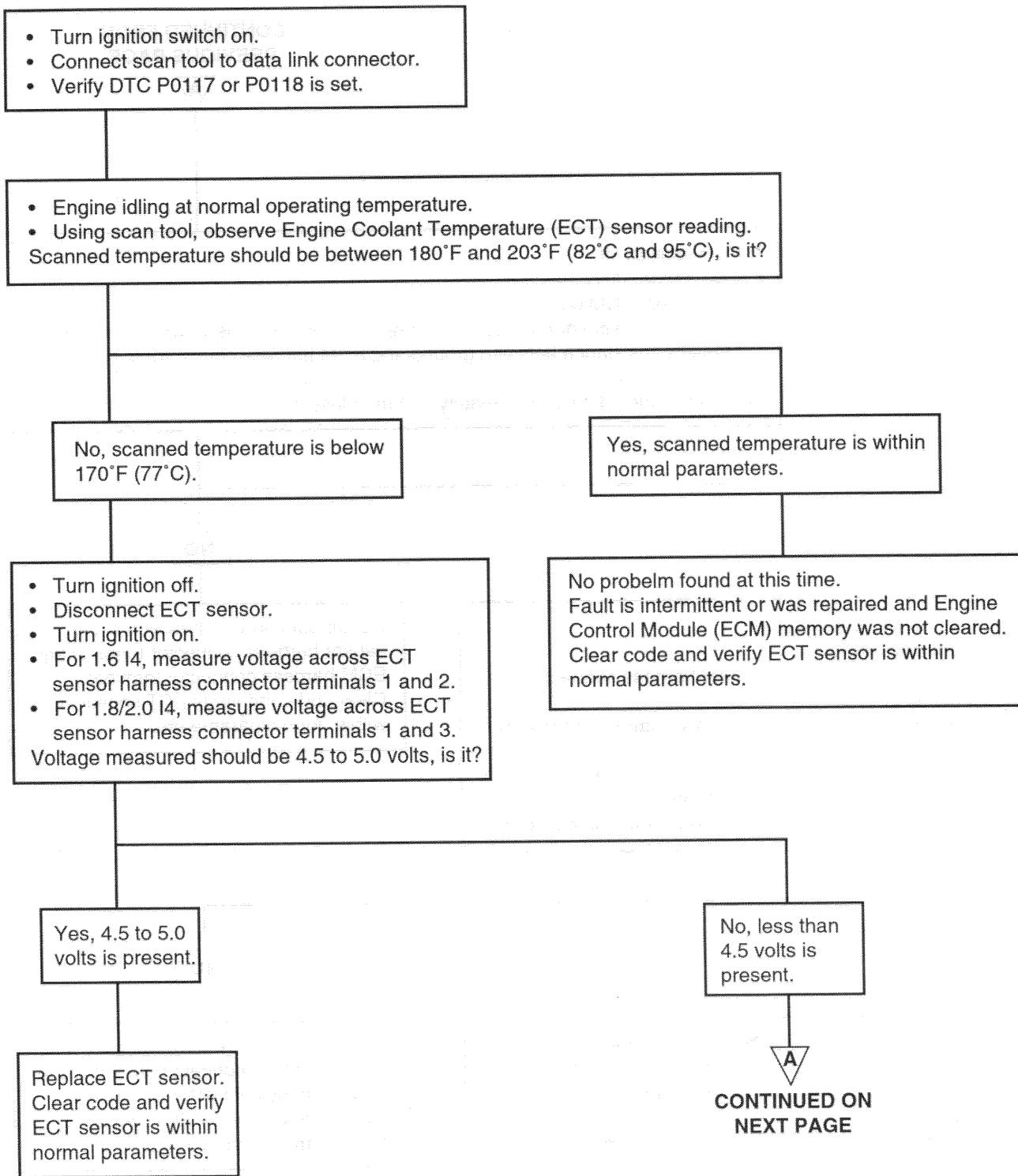


EFNC031A

## TEST PROCEDURE



EFKB511B



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PREVIOUS PAGE

A/

- Turn ignition off.
- ECT sensor disconnected.
- Disconnect ECM connector.
- Ground ECT sensor harness connector terminal 2 (for 1.6 I4) or 3 (for 1.8/2.0 I4).
- Measure resistance between ground and ECM harness connector terminal 35 or terminal 59.

Resistance should be approximately 1 ohm or less, is it?

YES

- ECT sensor disconnected.
- ECM disconnected.
- For 1.6 I4, ground ECT sensor harness connector terminal 2.
- For 1.8/2.0 I4, ground ECT sensor harness connector terminal 3.
- Measure resistance between ground and ECM harness connector terminal 35, terminal 59.

Resistance should be approximately 1 ohm or less, is it?

NO

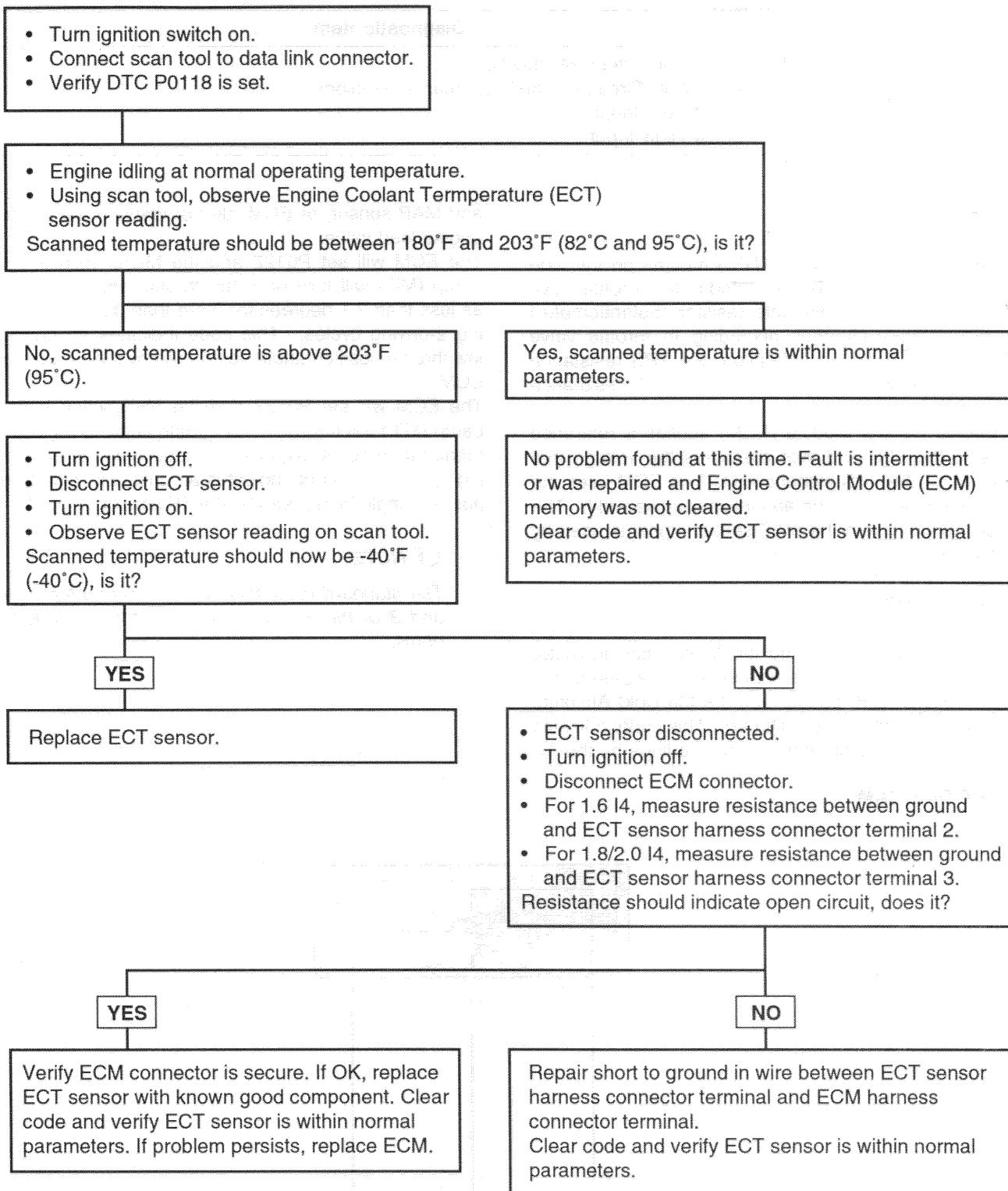
Repair open in wire between ECT sensor harness connector terminal and ECM harness connector terminal. Clear code and verify ECT sensor is within normal parameters.

YES

Verify ECM connector is secure. If OK, replace ECT with known good component. Clear code and verify ECT sensor is within normal parameters. If problem persists, replace ECM.

NO

Repair open in wire between ECT sensor harness connector terminal and ECM harness connector terminal. Clear code and verify ECT sensor is within normal parameters.



EFNC5160

DTC	Diagnostic item
P0120	Throttle Position Circuit Malfunction
P0121	Throttle Position Circuit Range/Performance Problem
P0122	TPS Circuit Low Input
P0123	TPS Circuit High Input

## DESCRIPTION

The Throttle Position Sensor (TPS) mounts on the side of the throttle body and is connected to the throttle valve shaft. The TPS is a variable resistor (potentiometer) whose resistance changes according to throttle valve shaft position. During acceleration, the TPS resistance decreases; during deceleration, the TPS resistance increases.

The Engine Control Module (ECM) applies a reference voltage to the TPS and then measures the voltage that is present on the TPS signal circuit. The ECM uses the TPS signal to adjust timing and injector pulse width. The TPS signal along with the MAF sensor signal is used by the ECM to calculate engine load.

## FAILURE CONDITIONS

The ECM will set P0121 and the Malfunction Indicator Lamp (MIL) will turn on if the engine load indicated by the Throttle Position (TP) sensor and the Manifold Absolute Pressure (MAP) sensor are different. This code indicates that the throttle position and air flow readings by the TP

and MAP sensor, or ECM, do not result in the expected engine load value.

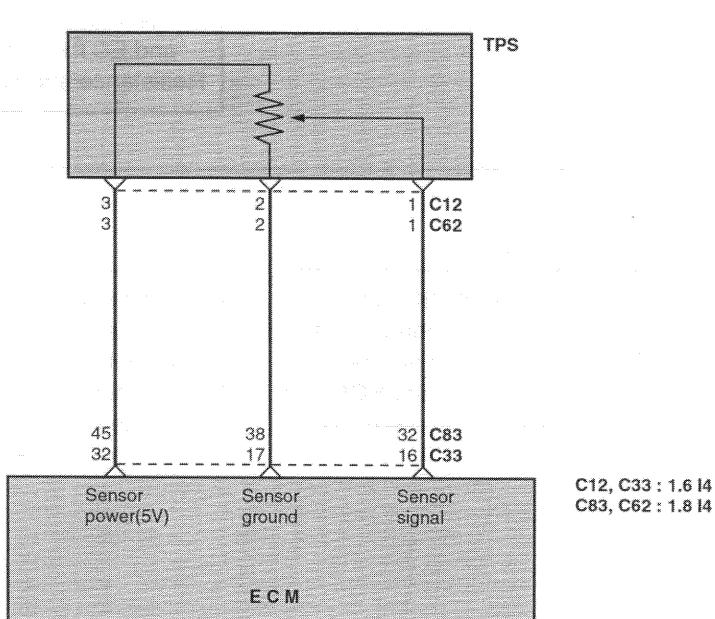
The ECM will set P0122 and the Malfunction Indicator Lamp (MIL) will turn on if the throttle angle is reported as less than 2.1 degrees for more than 0.2 seconds during 2-driving cycles. This code indicates an unusually low throttle position angle being read by the TP sensor or ECM.

The ECM will set P0123 and the Malfunction Indicator Lamp (MIL) will turn on if the throttle angle is reported as greater than 105.4 degrees for 0.2 seconds during 2-driving cycles. This code indicates an unusually high throttle position angle being read by the TP sensor or ECM.

### NOTE

The standard resistance value between terminals 2 and 3 of the throttle position sensor is 1600-2500 ohms.

## CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

## TEST PROCEDURE

- Turn Ignition Switch ON.
- Connect scan tool to Data Link Connector.
- Verify DTC P0120, P0121, P0122 and/or P0123 is set.

- Turn ignition on.
- Using scan tool, observe Throttle Position (TP) sensor, RPM and air flow output reading.
- Readings should follow the following table:

TPS	0.5	1.2	1.5	1.9
air flow g/s	2.8	6.54	8.9	11.65
RPM	idle	2000	3000	4000

Do throttle position sensor, and MAP sensor agree?

Check MAP sensor following test procedure for DTC P0105 or P0106.

- Turn ignition on, engine at idle.
- Wait 15 seconds.
- Using scan tool, observe Throttle Position (TP) sensor's output reading.

Reading should be between 0.5V and 1.5V, is it?

No, at given RPM, MAF does not agree.

YES

Check MAP sensor  
following test procedure  
for DTC P0105 or P0106

Problem is intermittent or has been fixed. Clear code and verify TP sensor and MAP sensor are within normal parameters.

No, reading is below 0.5V  
or between 1.5V and 2V.

No, reading is above 2V.

Yes, reading is between 0.5V and 1.5V.

- Ignition on, engine idle.
- Throttle fully released.
- Attempt to adjust TP sensor output voltage to between 0.5V and 1.5V.

Can TP sensor voltage be adjusted as specified?

- Turn ignition off.
- Disconnect TP sensor.
- Turn ignition on.
- Using voltmeter, measure voltage between TP sensor harness terminal 1 and ground.

Problem is intermittent or was repaired and ECM memory was not cleared. Check terminal connections at ECM and TP sensor. Clear code and verify TP sensor is within normal parameters.

YES

No voltage is 0 volts

No voltage is below 5 volts

Replace TP sensor.  
Clear code and  
verify TP sensor is  
within normal  
parameters.

Repair short to ground in wire between TP sensor harness terminal 1 and ECM. Clear code and verify TP sensor is within normal parameters.

Repair short to voltage in wire between TP sensor harness terminal 1 and ECM. Clear code and verify TP sensor is within normal parameters.

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SEVR6169

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PREVIOUS PAGE

A

NO

YES

- Turn Ignition off.
- Disconnect TP sensor.
- Turn ignition on.
- Using voltmeter, measure voltage between ground and TP sensor connector terminal 3. 5 volts should be present, is it?

- Ignition on, engine on.
- Quickly push throttle to wide open position, then release.
- Using scan tool, record TP sensor reading. Reading should reach as high as about 4.75V, does it?

YES

NO

Fault repaired. Problem was misadjusted TP sensor. Clear code and verify TP sensor is within normal parameters.

Replace TP sensor. Clear code and verify TP sensor is within normal parameters.

YES

NO

- Ignition on, engine off.
- TP sensor disconnected.
- Measure resistance between ground and TP sensor harness connector terminal 2.

Resistance should be approximately 1 ohm or less, is it?

Repair open wire between TP sensor harness connector terminal and ECM harness connector terminal. Clear code and verify TP sensor is within normal parameters.

YES

NO

- Ignition on, engine off.
- TP sensor disconnected.
- Connect fused jumper between TP harness connector terminals 2 and 3.
- Using scan tool, observe TP sensor's output reading.

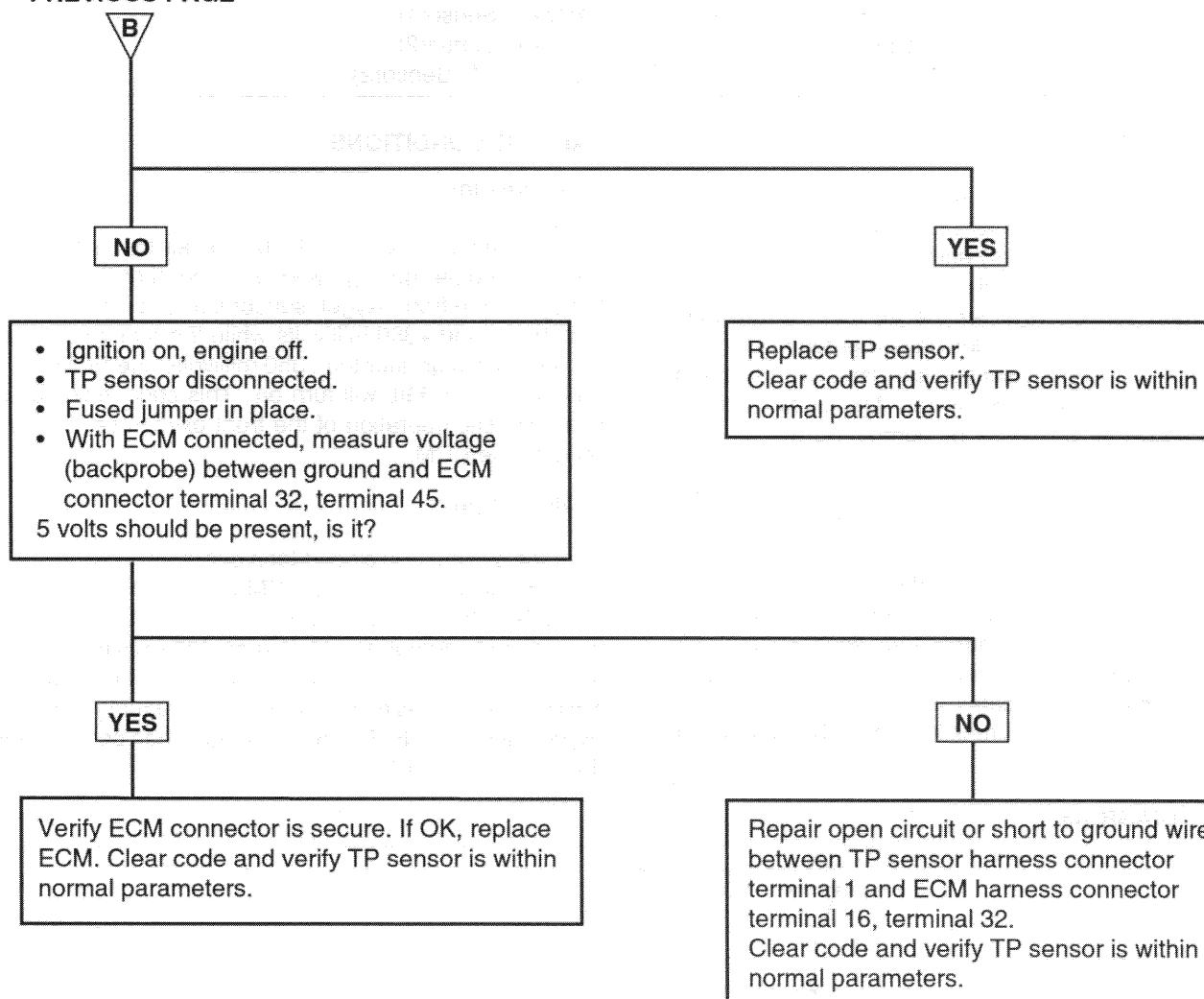
Reading should be above 4.5V, is it?

Repair poor ground connection or open circuit in wire between TP sensor harness connector terminal 2 and ECM harness connector terminal 17, terminal 38. Clear code and verify TP sensor is within normal parameters.

B

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EFNC5210

DTC	Diagnostic item
P0130	Oxygen Sensor Circuit Malfunction (Bank1, Sensor1)
P0136	Oxygen Sensor Circuit Malfunction (Bank1, Sensor2)
P0139	Oxygen Sensor Circuit Slow Response (Bank1, Sensor2)

## DESCRIPTION

The Engine Control Module (ECM) uses oxygen sensor signals to maintain the air fuel mixture at the ratio resulting in optimum fuel economy and reduced emissions. The amount of oxygen in the exhaust gases indicates, to the front oxygen sensor, whether the air fuel mixture being supplied to the engine cylinders is rich or lean. The readings of the rear oxygen sensor are used to indicate the efficiency of the catalytic converter. The ECM calculates catalytic converter efficiency by comparing the rear oxygen sensor signal to the front oxygen sensor signal.

A normal oxygen sensor signal will constantly fluctuate above and below 500 mV, with the front oxygen sensor signal frequency of at least 5Hz at 2500 RPM. Due to the effect of the catalytic converter, the rear oxygen sensor signal frequency will be lower than the front oxygen sensor signal frequency. If the rear oxygen sensor signal coincides with the front oxygen sensor signal a large percentage of the time, this indicates a loss in efficiency of the catalytic converter or a malfunction within the fuel system.

## FAILURE CONDITIONS

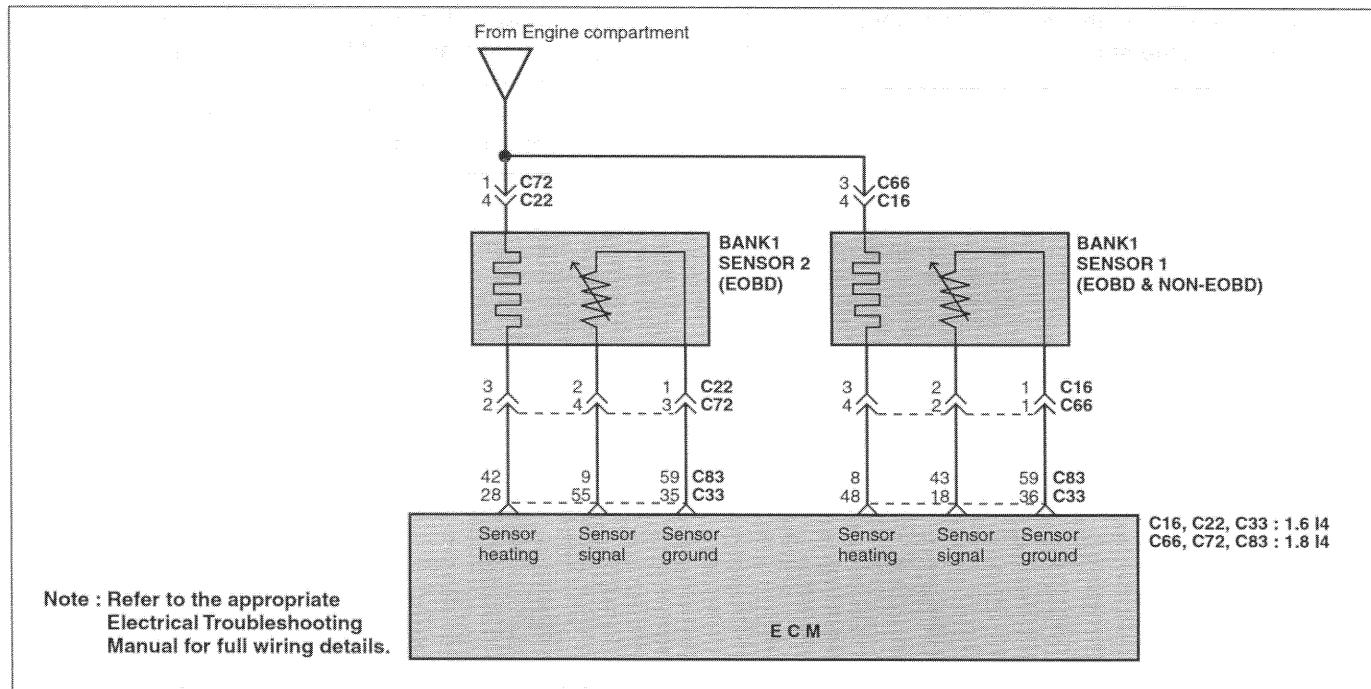
### [FOR P0130]

After the engine runs, the ECM checks the front oxygen sensor once per driving cycle for 5 sec. If during two driving cycles the front oxygen sensor's output is not between 0 millivolts and +380 millivolts while the rear oxygen sensor's output is greater than 350 millivolts, the ECM will set a code and the MIL will turn on. This code indicates uncharacteristic operation of the front oxygen sensor being read by the ECM.

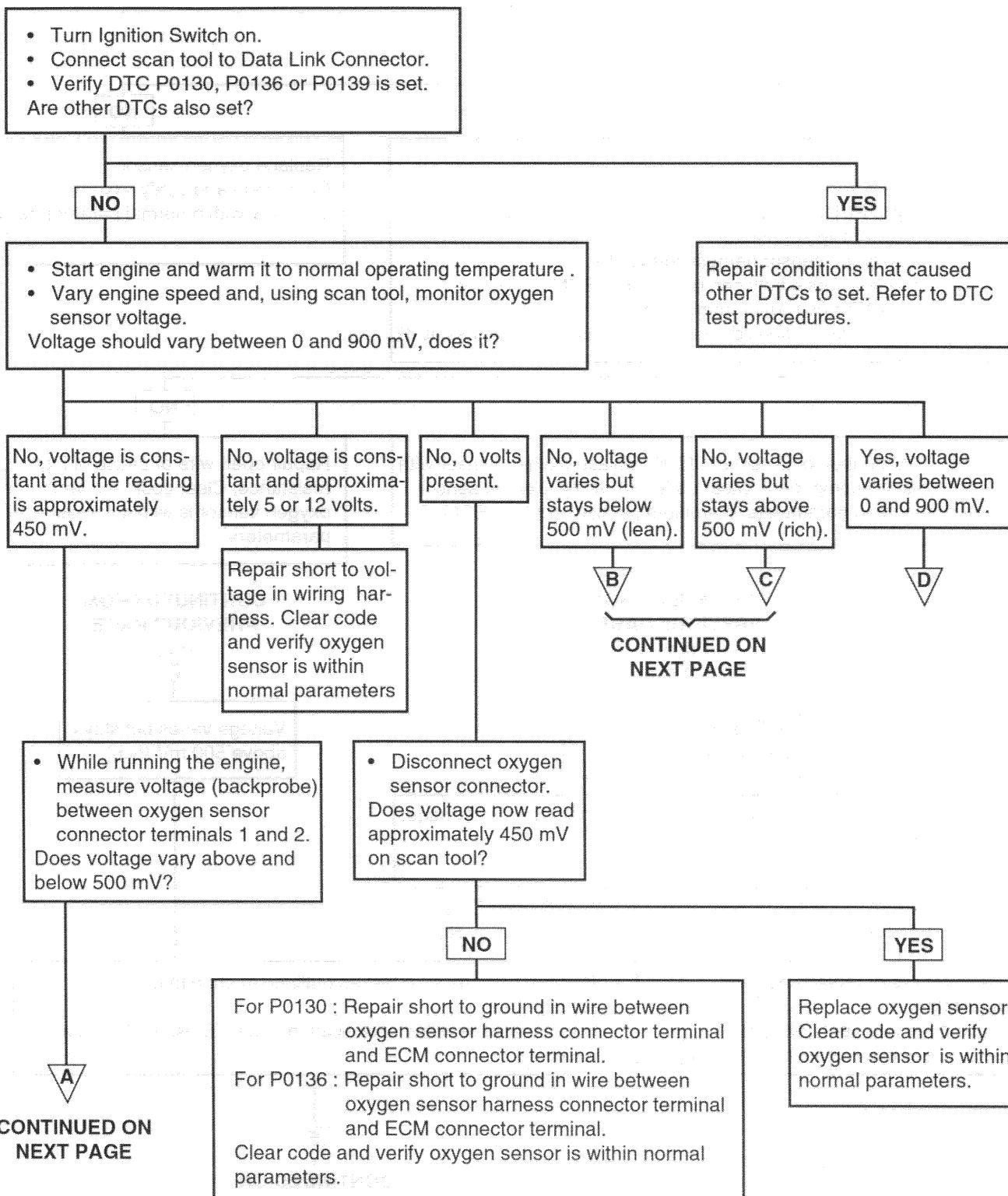
### [FOR P0136]

After the system is in closed-loop operation and the engine has run for 3 minutes, the ECM checks the rear oxygen sensor's output. If during two driving cycles the rear oxygen sensor's output is not between 400 millivolts and 500 millivolts, the ECM will set a code and the MIL will turn on. This code indicates an uncharacteristic reading by the rear oxygen sensor or ECM after the engine has been warmed and run for 3 minutes.

## CIRCUIT DIAGRAM



## TEST PROCEDURE



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PREVIOUS PAGE

YES

- Ignition off.
- Disconnect front oxygen sensor [for P0130] or rear oxygen sensor [for P0136].
- Disconnect ECM connector.
- Ground oxygen sensor harness terminal 2.
- Measure resistance between ground and ECM connector terminal 36 [for P0130] or terminal 35 [for P0136].

Resistance measured should be approximately 1 ohm or less, is it?

NO

Replace oxygen sensor.  
Clear code and verify oxygen sensor is within normal parameters.

YES

Verify ECM connector is secure. If OK, replace oxygen sensor with a known good component. Clear code and verify oxygen sensor is within normal parameters. If problem persists, replace ECM.

NO

Repair open wire or cause of high resistance. Clear code and verify oxygen sensor is within normal parameters.

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PREVIOUS PAGE

Voltage varies but stays below 500 mV (lean).

- Inspect air inlet downstream of MAP sensor for leaks or damage.
- Inspect exhaust manifold for cracks.

Are any leaks or damage found?

YES

Repair leaks or replace exhaust manifold.  
Clear code and verify oxygen sensor is within normal parameters.

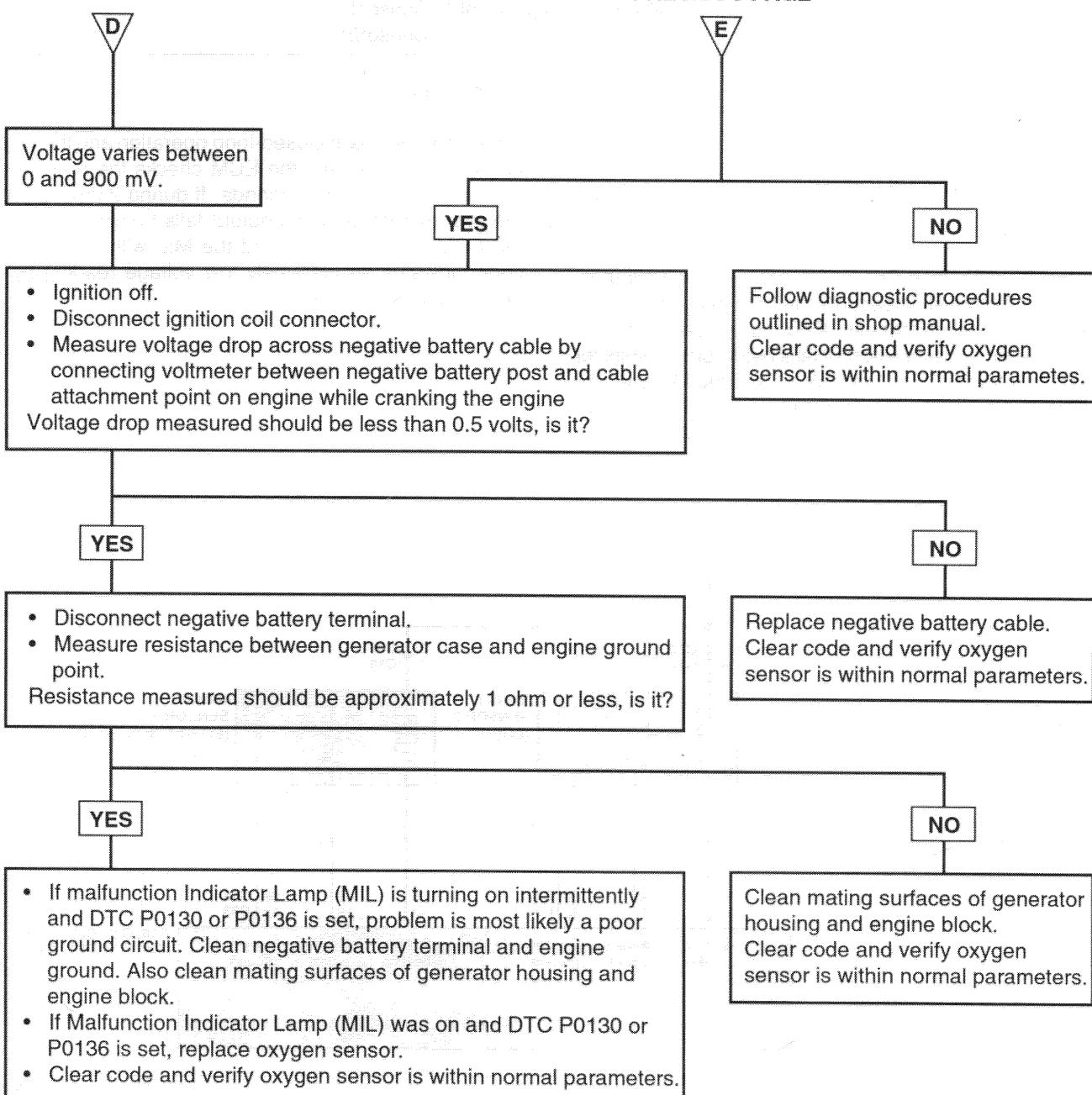
NO

- Perform fuel pressure test as outlined in shop manual (section FL).
- Is fuel pressure within specification and no pressure leak down observed?

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Voltage varies but stays above 500 mV (rich).

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EFNC5260

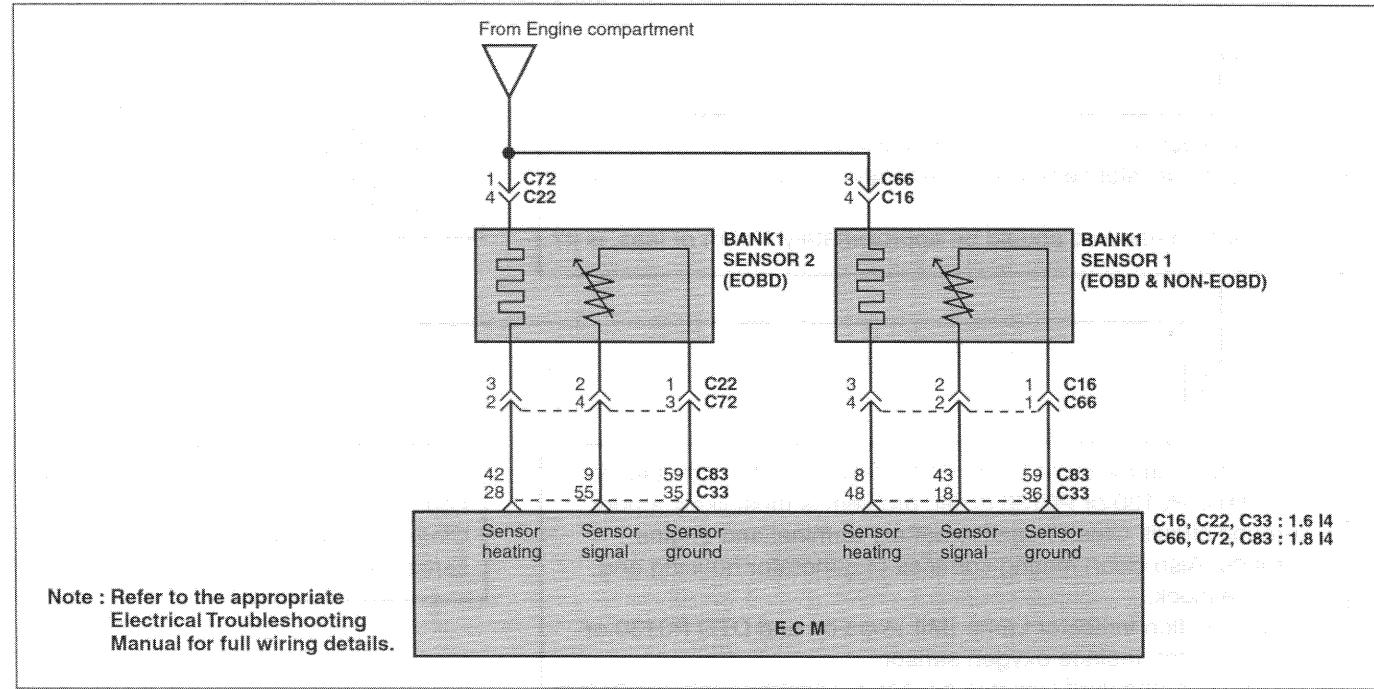
DTC	Diagnostic item
P0131	Oxygen Sensor circuit Low Voltage (Bank1, Sensor1)
P0137	Oxygen Sensor circuit Low Voltage (Bank1, Sensor2)

**DESCRIPTION**

Refer to DTC P0130 & P0136.

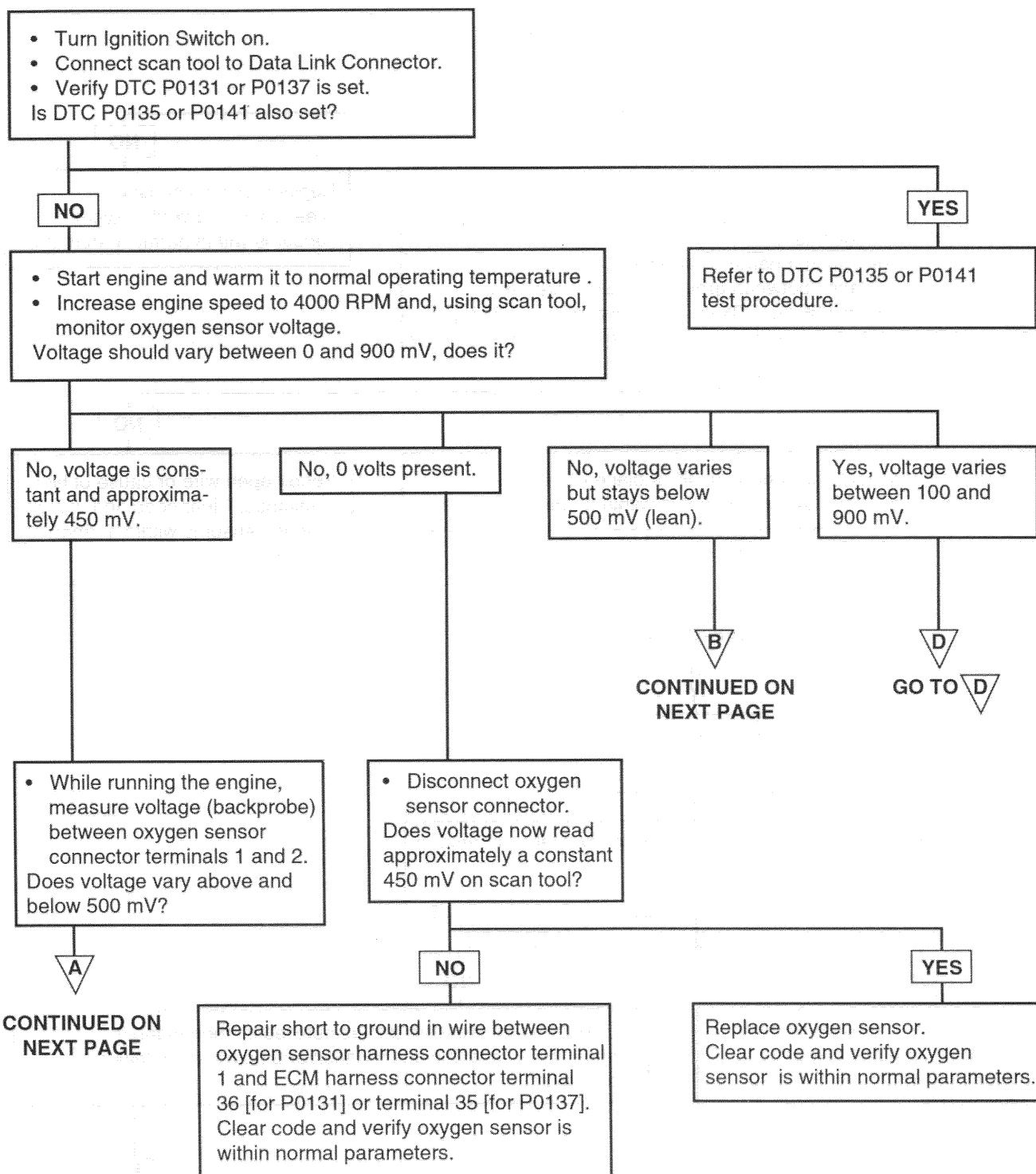
**FAILURE CONDITIONS****[FOR P0131]**

After the Front Oxygen Sensor Heater is on for 3 minutes, the ECM continuously measures the front oxygen sensor's output in 0.5 second intervals. If during two driving cycles the front oxygen sensor's output falls below 50 millivolts for 0.5 seconds, the ECM will set P0131 and the MIL will turn on. This code indicates an unusually lean fuel air mixture being read by the front oxygen sensor or ECM.

**CIRCUIT DIAGRAM**

EFNC039A

## TEST PROCEDURE



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PREVIOUS PAGE

A

YES

NO

- Ignition off.
- Disconnect ECM connector.
- Disconnect oxygen sensor.
- Ground oxygen sensor harness terminal 2.
- Measure resistance between ground and ECM harness connector terminal 36 [for P0131] or terminal 35 [for P0137].

Resistance measured should be approximately 1 ohm or less, is it?

YES

NO

Verify ECM connector is secure. If OK, replace ECM.  
Clear code and verify oxygen sensor is within normal parameters.

Replace oxygen sensor.  
Clear code and verify oxygen sensor is within normal parameters.

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PREVIOUS PAGE

B

Voltage varies but stays below 500 mV (lean).

- Inspect air inlet downstream of MAP sensor for leaks or damage.
- Inspect exhaust manifold for cracks.

Are any leaks or damage found?

YES

NO

Repair leaks or replace exhaust manifold. Clear code and verify oxygen sensor is within normal parameters.

- Perform fuel pressure test as outlined in shop manual.  
Is fuel pressure within specification and no pressure leak down observed?

E

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Voltage varies between 0 and 900 mV.

YES

- Ignition off.
- Disconnect ignition coil connector.
- Measure voltage drop across negative battery cable by connecting voltmeter between negative battery post and cable attachment point on engine while cranking the engine

Voltage drop measured should be less than 0.5 volts, is it?

YES

- Disconnect negative battery terminal.
- Measure resistance between generator case and engine ground point.

Resistance measured should be approximately 1 ohm or less, is it?

YES

- If malfunction Indicator Lamp (MIL) is turning on intermittently and DTC P0131 or P0137 is set, problem is most likely a poor ground circuit. Clean negative battery terminal and engine ground. Also clean mating surfaces of generator housing and engine block.
- If Malfunction Indicator Lamp (MIL) was on and DTC P0131 or P0137 is set, replace oxygen sensor.
- Clear code and verify oxygen sensor is within normal parameters.

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PREVIOUS PAGE

NO

Follow diagnostic procedures outlined in shop manual. Clear code and verify oxygen sensor is within normal parameters.

NO

Replace negative battery cable. Clear code and verify oxygen sensor is within normal parameters.

NO

Clean mating surfaces of generator housing and engine block. Clear code and verify oxygen sensor is within normal parameters.

EFNC5310

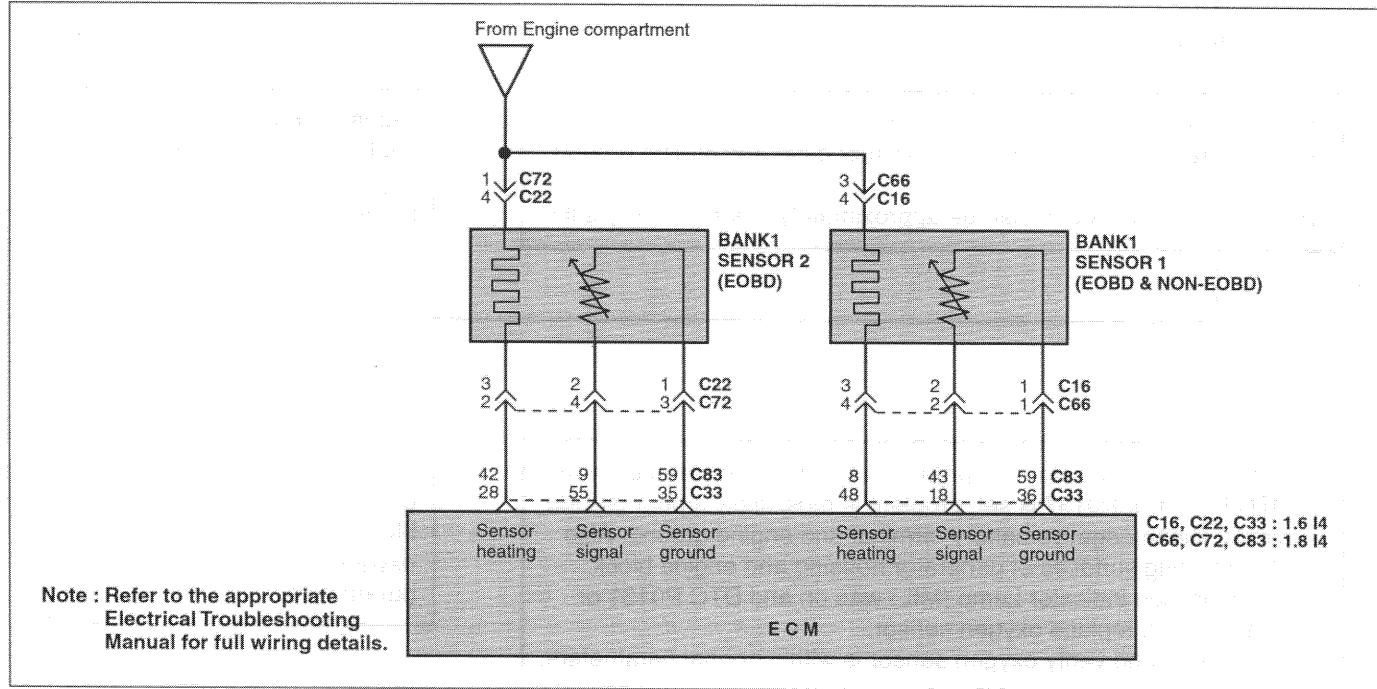
DTC	Diagnostic item
P0132	Oxygen Sensor Circuit High Voltage (Bank1, Sensor1)
P0138	Oxygen Sensor Circuit High Voltage (Bank1, Sensor2)

**DESCRIPTION**

Refer to DTC P0130 & P0136.

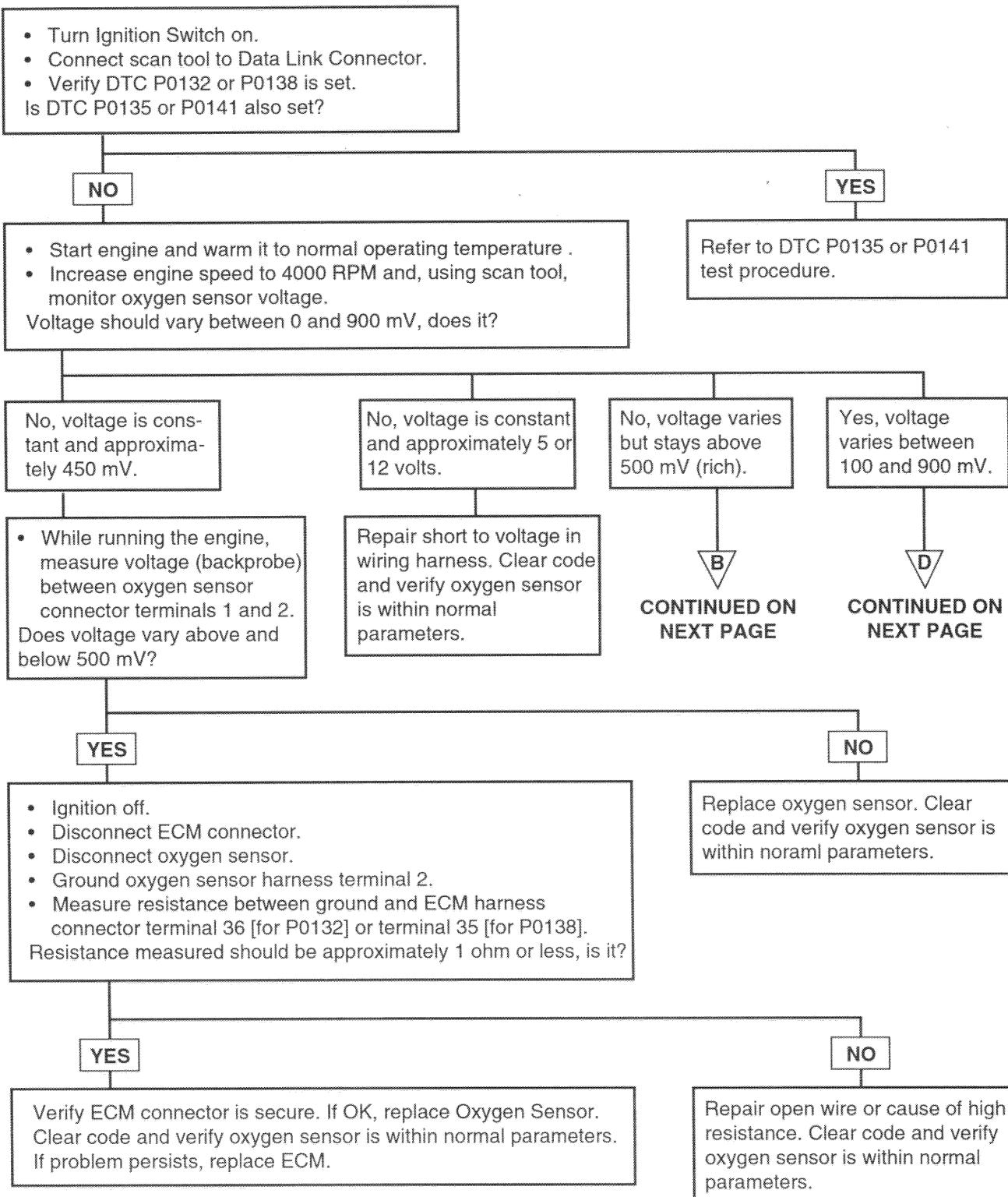
**FAILURE CONDITIONS****[FOR P0132]**

After the Front Oxygen Sensor Heater has been on for 3 minutes, the ECM continuously measures the front oxygen sensor's output in 0.5 second intervals. If during two driving cycles the front oxygen sensor's output exceeds 1.058 volts for 0.5 seconds, the ECM will set P0132 and the MIL will turn on. This code indicates an extremely rich air fuel mixture being read by the front oxygen sensor or ECM.

**CIRCUIT DIAGRAM**

EFNC039A

## TEST PROCEDURE



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PREVIOUS PAGE

D

Voltage varies between 0 and 900 mV.

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PREVIOUS PAGE

B

Voltage varies but stays above 500 mV (rich).

- Perform fuel pressure test as outlined in shop manual. Is fuel pressure within specification and no pressure leak down observed?

YES

NO

- Ignition off.
- Disconnect ignition coil connector.
- Measure voltage drop across negative battery cable by connecting voltmeter between negative battery post and cable attachment point on engine while cranking the engine

Voltage drop measured should be less than 0.5 volts, is it?

Follow diagnostic procedures outlined in shop manual. Clear code and verify oxygen sensor is within normal parameters.

YES

NO

- Disconnect negative battery terminal.
- Measure resistance between generator case and engine ground point.

Resistance measured should be approximately 1 ohm or less, is it?

Replace negative battery cable. Clear code and verify oxygen sensor is within normal parameters.

YES

NO

- If malfunction Indicator Lamp (MIL) is turning on intermittently and DTC P0132 or P0138 is set, problem is most likely a poor ground circuit. Clean negative battery terminal and engine ground. Also clean mating surfaces of generator housing and engine block.
- If Malfunction Indicator Lamp (MIL) was on and DTC P0132 or P0138 is set, replace oxygen sensor.
- Clear code and verify oxygen sensor is within normal parameters.

Clean mating surfaces of generator housing and engine block. Clear code and verify oxygen sensor is within normal parameters.

EFNC5360

DTC	Diagnostic item
P0133	Oxygen Sensor Circuit Slow Response (Bank1, Sensor1)
P0134	Oxygen Sensor Circuit Inactive (Bank1, Sensor1)
P0140	Oxygen Sensor Circuit Inactive (Bank1, Sensor2)

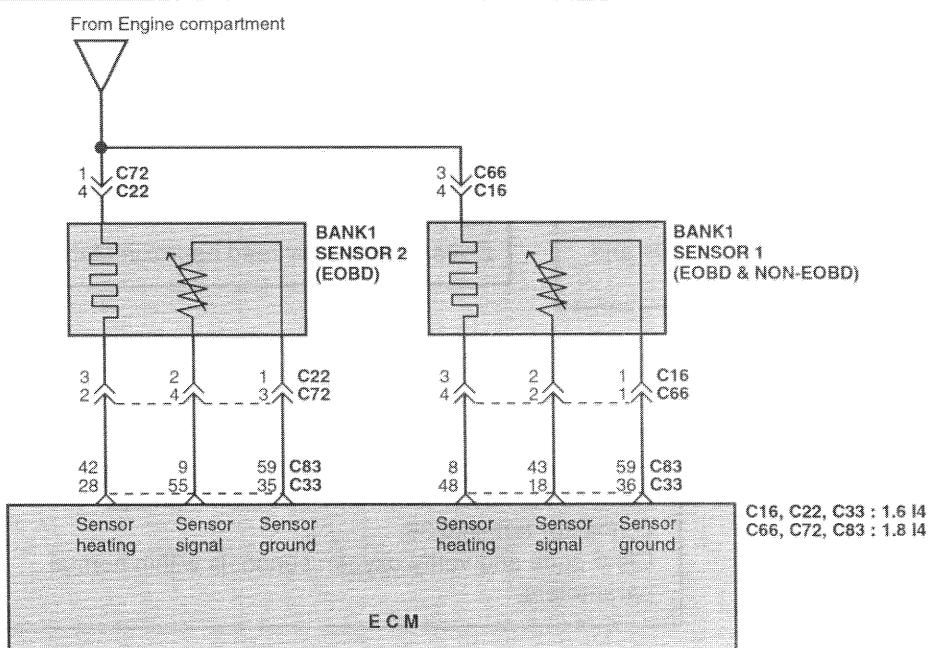
**DESCRIPTION**

Refer to DTC P0130 & P0136.

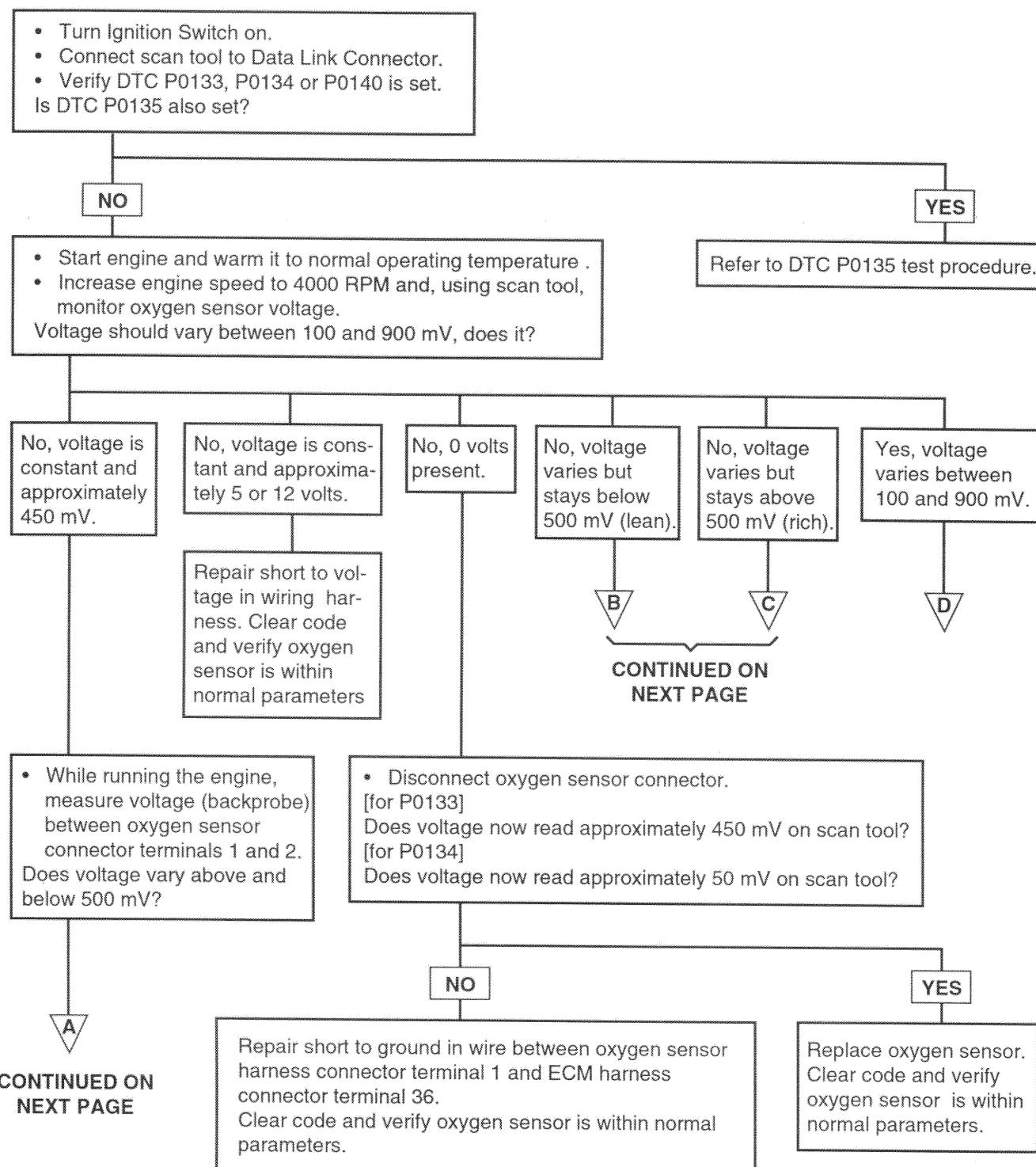
**FAILURE CONDITIONS****[FOR P0133]**

The ECM will set P0133 and the MIL will turn on if the ECM does not sense the following conditions during two driving cycles:

1. Over a period of 2 minutes, the ECM must sense a fuel compensation factor greater 85% or less than 95%:
2. The ECM must make some correction in the air/fuel ratio when:
  - Engine RPM is between 1600 and 3200 RPM.
  - Engine load range is between 1.35 and 3.4 milliseconds.
  - Catalyst temperature is above 372°C (702°F).
  - System is in closed loop.

**CIRCUIT DIAGRAM**

## TEST PROCEDURE



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PREVIOUS PAGE

A

YES

- Ignition off.
- Disconnect ECM connector.
- Disconnect front oxygen sensor.
- Ground front oxygen sensor harness terminal 2.
- Measure resistance between ground and ECM harness connector terminal 36.

Resistance measured should be approximately 1 ohm or less, is it?

NO

Replace oxygen sensor.  
Clear code and verify oxygen sensor is within normal parameters.

YES

Verify ECM connector is secure. If OK, replace front oxygen sensor with known good component. Clear code and verify oxygen sensor is within normal parameters. If problem persists, replace ECM.

NO

Repair open circuit in wire or cause of high resistance. Clear code and verify oxygen sensor is within normal parameters.

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PREVIOUS PAGE

B

Voltage varies but stays below 500 mV (lean).

- Inspect air inlet downstream of MAP sensor for leaks or damage.
- Inspect exhaust manifold for cracks.

Are any leaks or damage found?

YES

Repair leaks or replace exhaust manifold. Clear code and verify oxygen sensor is within normal parameters.

NO

- Perform fuel pressure test as outlined in shop manual.  
Is fuel pressure within specification and no pressure leak down observed?

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C

Voltage varies but stays above 500 mV (rich).

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D

Voltage varies between 100 and 900 mV.

YES

- Ignition off.
- Disconnect ignition coil connector.
- Measure voltage drop across negative battery cable by connecting voltmeter between negative battery post and cable attachment point on engine while cranking the engine

Voltage drop measured should be less than 0.5 volts, is it?

YES

- Disconnect negative battery terminal.
- Measure resistance between generator case and engine ground point.

Resistance measured should be approximately 1 ohm or less, is it?

YES

- If Malfunction Indicator Lamp (MIL) is turning on intermittently and DTC P0133 is set, problem is most likely a poor ground circuit. Clean negative battery terminal and engine ground. Also clean mating surfaces of generator housing and engine block.
- If Malfunction Indicator Lamp (MIL) was on and DTC P0133 or P0134 is set, replace oxygen sensor.
- Clear code and verify oxygen sensor is within normal parameters.

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PREVIOUS PAGE

E

Follow diagnostic procedures outlined in shop manual.  
Clear code and verify oxygen sensor is within normal parameters.

NO

NO

Replace negative battery cable.  
Clear code and verify oxygen sensor is within normal parameters.

NO

Clean mating surfaces of generator housing and engine block. Clear code and verify oxygen sensor is within normal parameters.

EFNC5370

DTC	Diagnostic item
P0030	Oxygen Sensor Heater Circuit Malfunction (Bank1, Sensor1) - Plausibility check
P0031	Oxygen Sensor Heater Check (Bank1, Sensor1) - Low
P0032	Oxygen Sensor Heater Check (Bank1, Sensor1) - High
P0036	Oxygen Sensor Heater Circuit Malfunction (Bank1, Sensor2) - Plausibility check
P0037	Oxygen Sensor Heater Check (Bank1, Sensor2) - Low
P0038	Oxygen Sensor Heater Check (Bank1, Sensor2) - High

**DESCRIPTION**

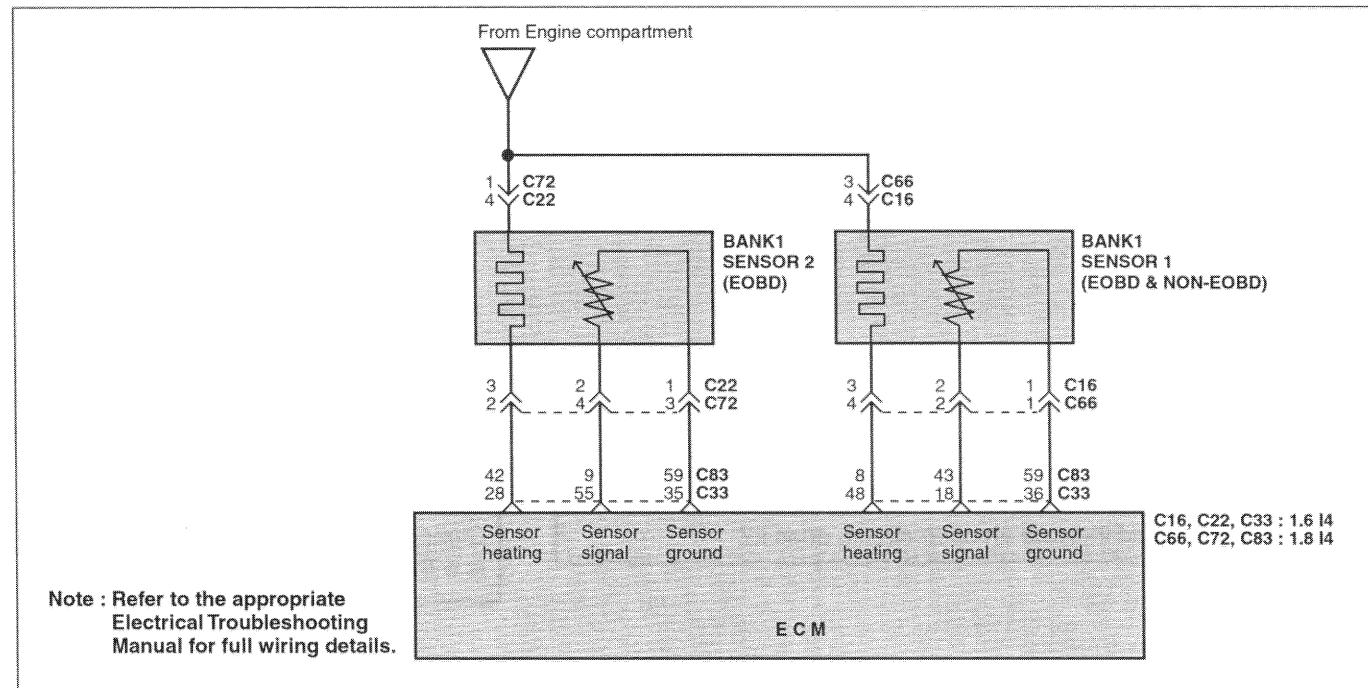
Refer to DTC P0130 & P0136.

**FAILURE CONDITIONS****[FOR P0030, P0031, P0032]**

After the engine runs for 3 minutes, the ECM checks the front oxygen sensor heater circuit. If during two driving cycles the front oxygen sensor's heater resistance is less than 4.6 ohms or greater than 19.5 ohms, the ECM will set P0135 and MIL will turn on. This code indicates an unusually high or low resistance of the heater circuit being read by the front oxygen sensor or ECM.

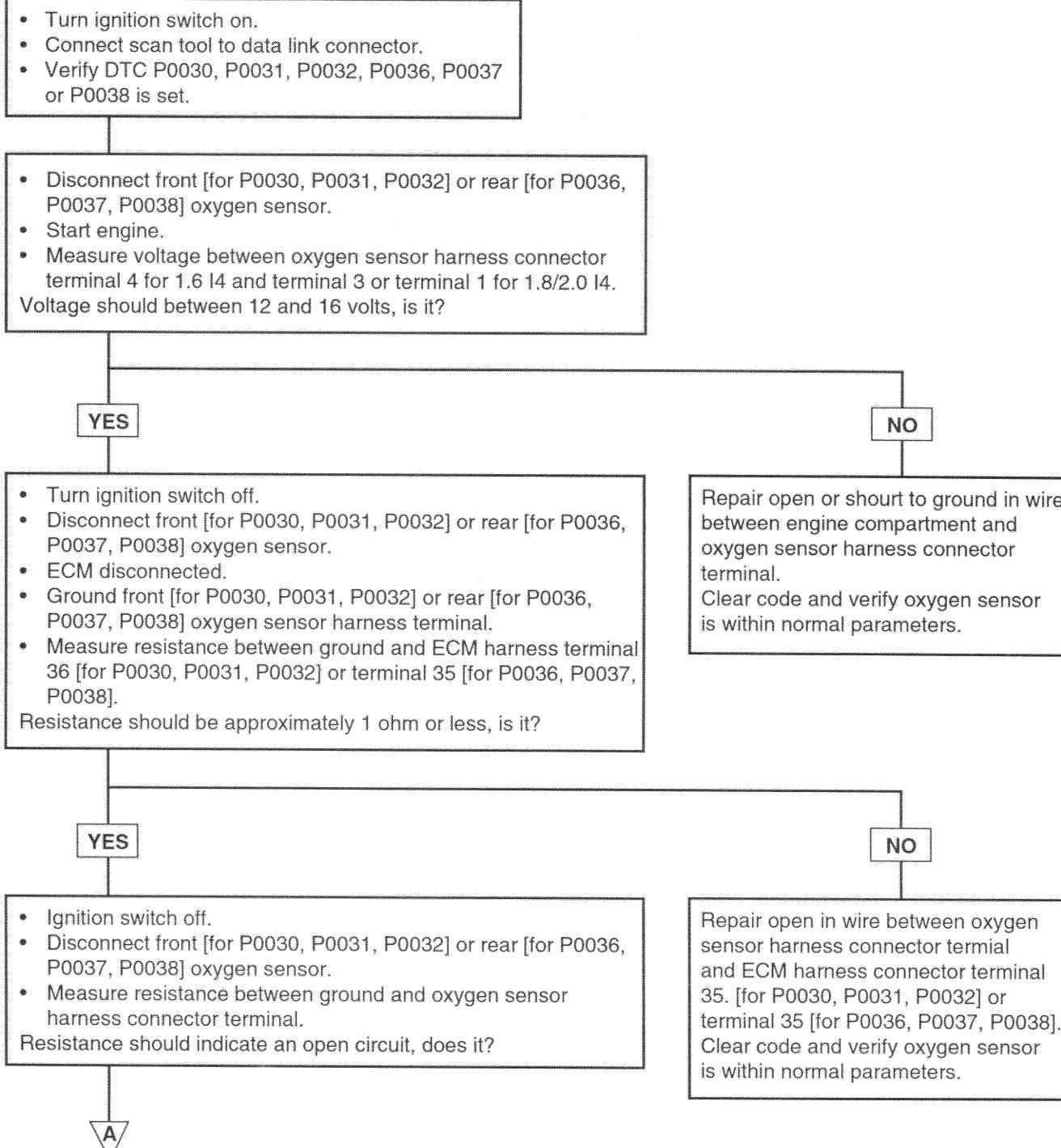
**[FOR P0036, P0037, P0038]**

After the engine runs for 2 minutes, the ECM checks the rear oxygen sensor heater circuit. If during two driving cycles the rear oxygen sensor's heater resistance is less than 4.5 ohms or greater than 19.5 ohms, the ECM will set P0141 and MIL will turn on. This code indicates an unusually high or low heater circuit resistance reading by the rear oxygen sensor or ECM.

**CIRCUIT DIAGRAM**

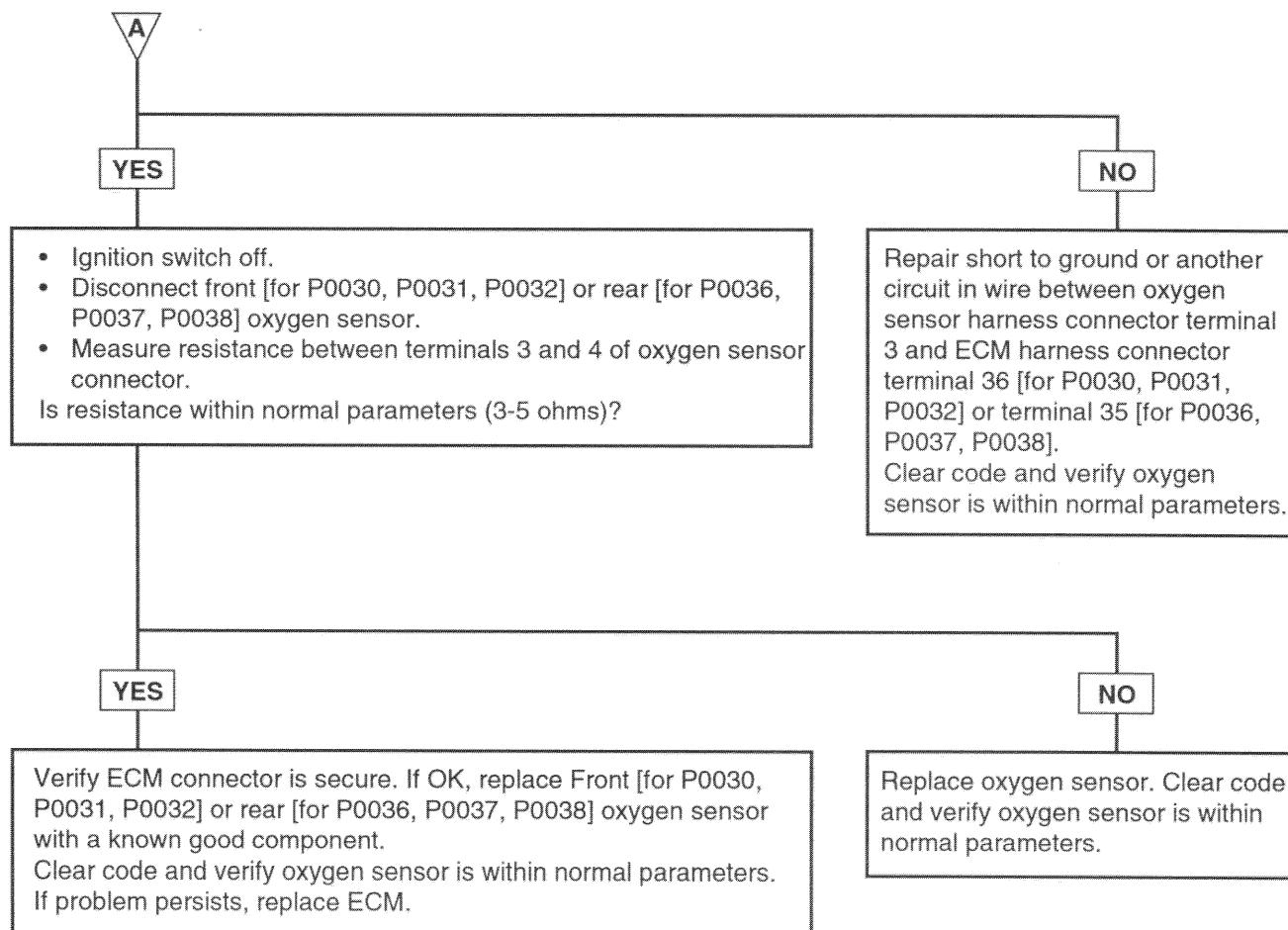
EFNC039A

## TEST PROCEDURE



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EFNC5410

DTC	Diagnostic item
P0201	Injector Circuit Malfunction - Cylinder 1.
P0202	Injector Circuit Malfunction - Cylinder 2.
P0203	Injector Circuit Malfunction - Cylinder 3.
P0204	Injector Circuit Malfunction - Cylinder 4.
P0261	Injector Circuit Low Input - Cylinder 1.
P0262	Injector Circuit High Input - Cylinder 1.
P0264	Injector Circuit Low Input - Cylinder 2.
P0265	Injector Circuit High Input - Cylinder 2.
P0267	Injector Circuit Low Input - Cylinder 3.
P0268	Injector Circuit High Input - Cylinder 3.
P0270	Injector Circuit Low Input - Cylinder 4.
P0271	Injector Circuit High Input - Cylinder 4.

## DESCRIPTION

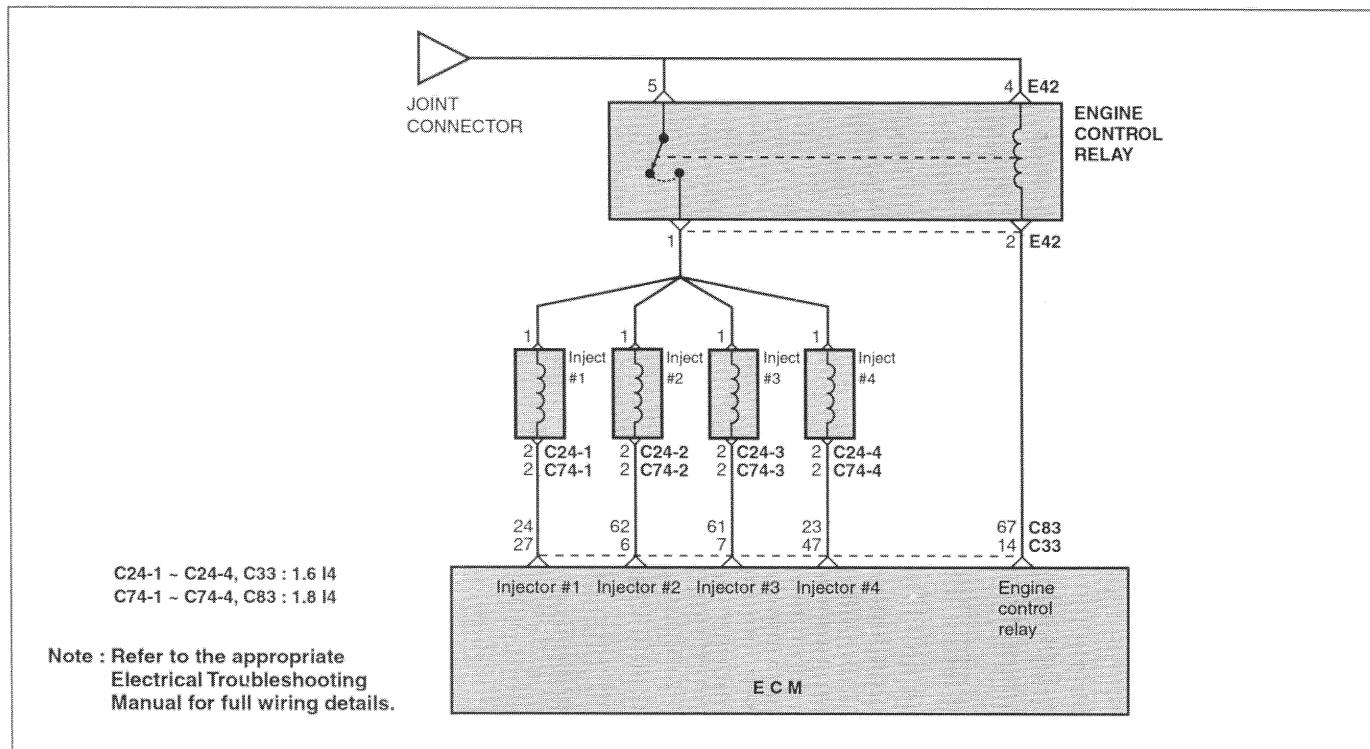
The fuel injectors are solenoid operated valves. When a fuel injector solenoid is energized (pulsed) the injector needle valve opens, allowing pressurized fuel to pass through the injector and mix with air entering the engine. The Engine Control Module (ECM) controls injector timing and pulse width. The ECM pulses the fuel injectors based on information provided by its network of engine sensors. The ECM uses the crankshaft position sensor to determine when to pulse the injectors. Engine coolant temperature, intake air temperature, air flow, and throttle position data are all used by the ECM to calculate injector pulse width.

The ECM also uses its network of sensors to determine whether all injectors should be pulsed at the same time (simultaneous injection) or each injector should be pulsed individually (sequential injection). Sequential injection is almost always used during normal engine operation. Simultaneous injection may be used when the engine is being cranked.

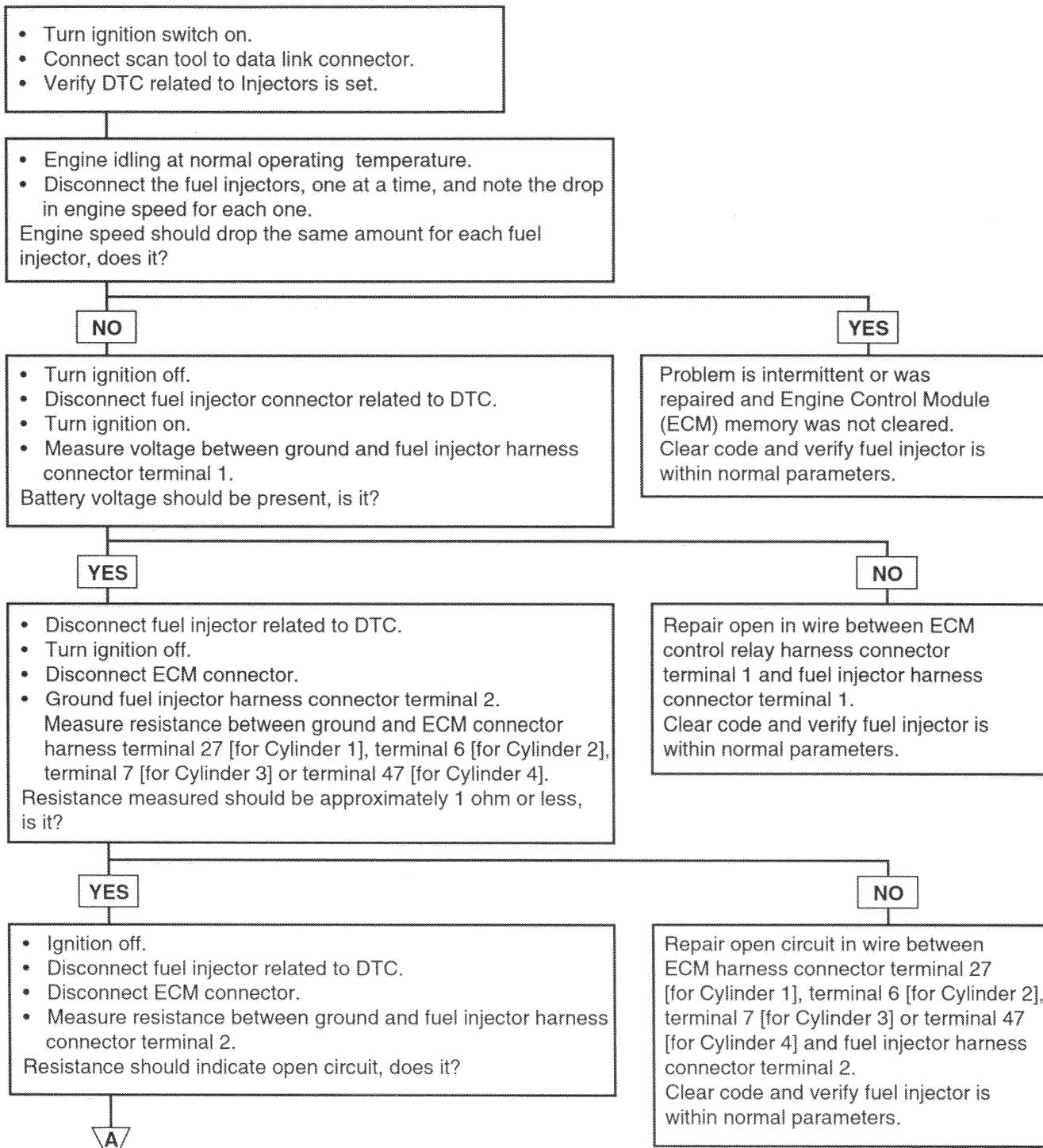
## FAILURE CONDITIONS

The ECM will set a code and the MIL will turn on if an open circuit or short to ground is detected in the fuel injector circuit during two driving cycles.

## CIRCUIT DIAGRAM



## TEST PROCEDURE



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NEXT PAGE

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PREVIOUS PAGE

A

YES

- Ignition off.
- Disconnect fuel injector related to DTC.
- Measure resistance between fuel injector connector terminals 1 and 2.

Resistance should be approximately 15.9 ohms at 68°F (20°C), is it?

NO

Repair short to ground or another circuit in wire between ECM harness connector terminal 27 [for Cylinder 1], terminal 6 [for Cylinder 2], terminal 7 [for Cylinder 3] or terminal 47 [for Cylinder 4] and fuel injector harness connector terminal 2. Clear code and verify fuel injector is within normal parameters.

YES

Verify ECM connector is secure. If OK, replace fuel injector with a known good component. Clear code and verify fuel injector is within normal parameters. If problem persists, replace ECM.

NO

Replace fuel injector. Clear code and verify injector is within normal parameters.

EFNC5460

DTC	Diagnostic item
P0300	Random Misfire Detected

## DESCRIPTION

With the ignition switch at ON or START, voltage is applied to the ignition coil. The ignition coil consists of two coils. High tension leads go to each cylinder from the ignition coil. The ignition coil fires two spark plugs on every power stroke (the cylinder under compression and the cylinder on the exhaust stroke). Coil number one fires cylinders 1 and 4. Coil number two fires cylinders 2 and 3.

The Engine Control Module (ECM) provides a switching circuit to ground for energizing the primary ignition coils. The ECM uses the crankshaft position sensor signal to time the energizing of the coil. When a primary ignition coil is energized and de-energized, the secondary coil produces a high voltage spike across the attached spark plugs.

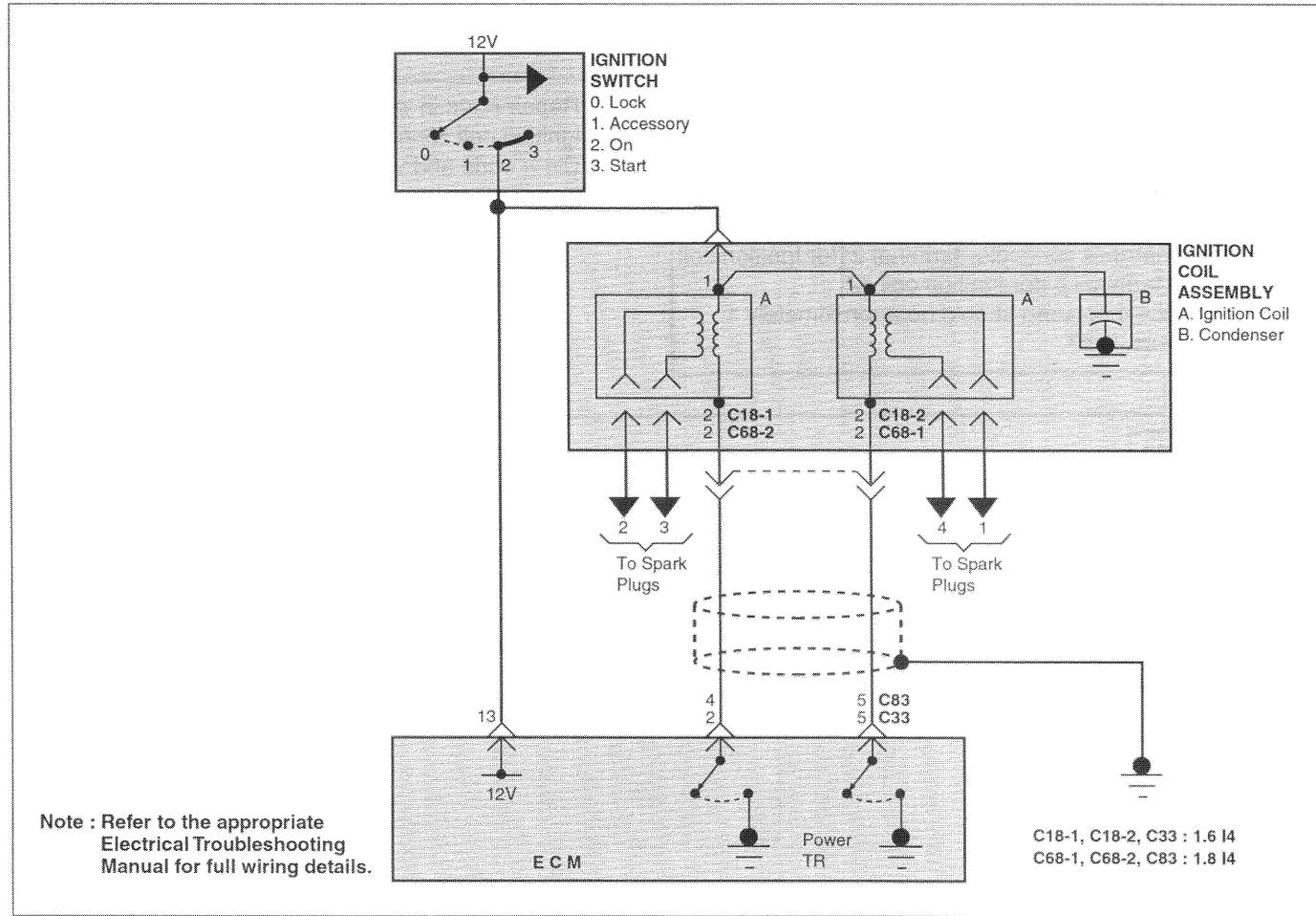
## FAILURE CONDITIONS

The ECM will set P0300 and the MIL will turn on if 2 misfires per 100 revolutions are detected during two driving cycles. The misfire rate is measured every 200 revolutions when the following conditions are met:

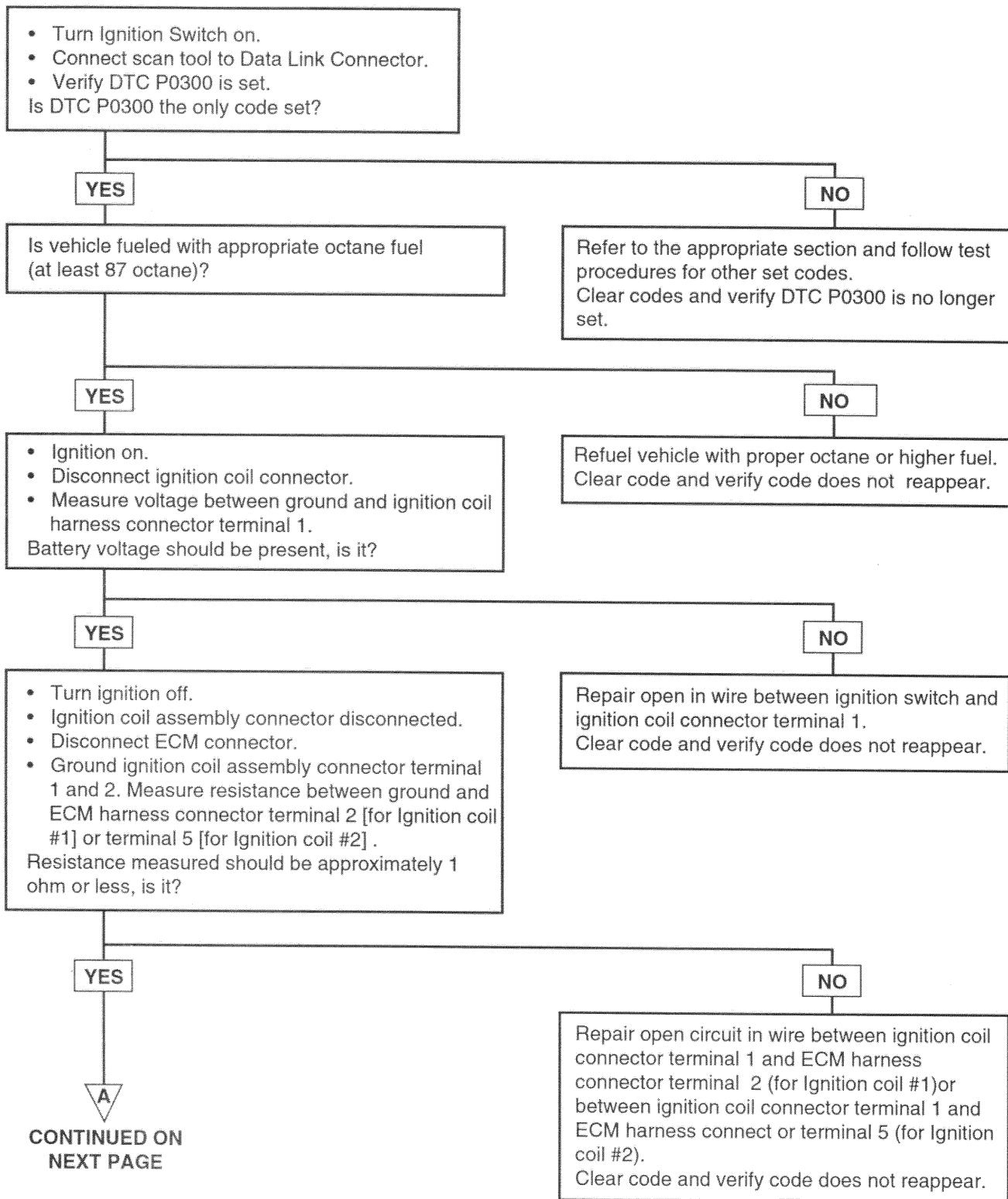
- Speed change is less than 1000 rpm per second.
- Engine speed is between 600 and 4000 RPM.
- Engine load is greater than 2 milliseconds.
- No fuel cut-off.
- Starter is not engaged.
- Vehicle on smooth road (acceleration sensor reports less than 0.3 g acceleration).

If the misfire rate increases to between 5%-25% per 200 revolutions, there is danger of catalyst damage and the MIL will flash off and on. The catalyst temperature could exceed 3542°F (1950°C) if the misfire rate increases enough. This code indicates a problem with cylinder ignition being read by the ECM.

## CIRCUIT DIAGRAM



## TEST PROCEDURE



CONTINUED FROM  
PREVIOUS PAGE

A

- Ignition coil connector disconnected.
- Reconnect ECM connector.
- Ignition in start.
- Measure voltage between ground and ignition coil harness connector terminal 1. Note voltage.
- Measure voltage between ground and ignition coil harness connector terminal 2. Note voltage.

Voltage should vary between 0.02 and 0.2 volts, does it?

YES

- Ignition off.
- Disconnect ignition coil connector.
- Disconnect spark plug wires from ignition coil.
- Measure resistance between ignition coil connector terminals 1 and 2. Note primary coil resistance.
- Measure resistance between ignition coil spark plug connector terminals 1 and 4 and between spark plug connector terminals 2 and 3. Note secondary coil resistance.

Primary coil resistance should be approximately 1.0 ohm. Secondary coil resistance should be between 10.3 kilo ohms and 13.9 kilo ohms. Are resistances within specification?

NO

Verify ECM connector is secure. If OK, replace ECM. Clear codes and verify code does not reappear.

YES

Inspect the following components/systems.

- Spark plugs and spark plug wires needing replacement.
- Fuel injectors for clogging or wiring damage.
- Obstructions to the air flow meter.
- Acceleration sensor wiring, connection.
- Canister purge valve for normal operation.
- Vacuum hoses for leaks.

Are all components undamaged and within specification?

NO

Replace ignition coil(s). Clear code and verify code does not reappear.

YES

- Verify fuel pressure according to procedure outlined in shop manual.
- Check engine oil for improper level or contamination (fuel in oil).

Is fuel pressure and oil level/contamination within specifications?

NO

Repair or replace damaged or out of specification components. Clear codes and verify code does not reappear.

YES

Verify ECM connector is secure. If OK, replace ECM. Clear code and verify code does not reappear.

NO

Repair out of specification components. Clear codes and verify code does not reappear.

EFNC5510

DTC	Diagnostic item
P0301	Cylinder 1 Misfire Detected
P0302	Cylinder 2 Misfire Detected
P0303	Cylinder 3 Misfire Detected
P0304	Cylinder 4 Misfire Detected

## DESCRIPTION

Refer to DTC P0300.

- Starter is not engaged.
- Vehicle on smooth road (acceleration sensor reports less than 0.3 g acceleration).

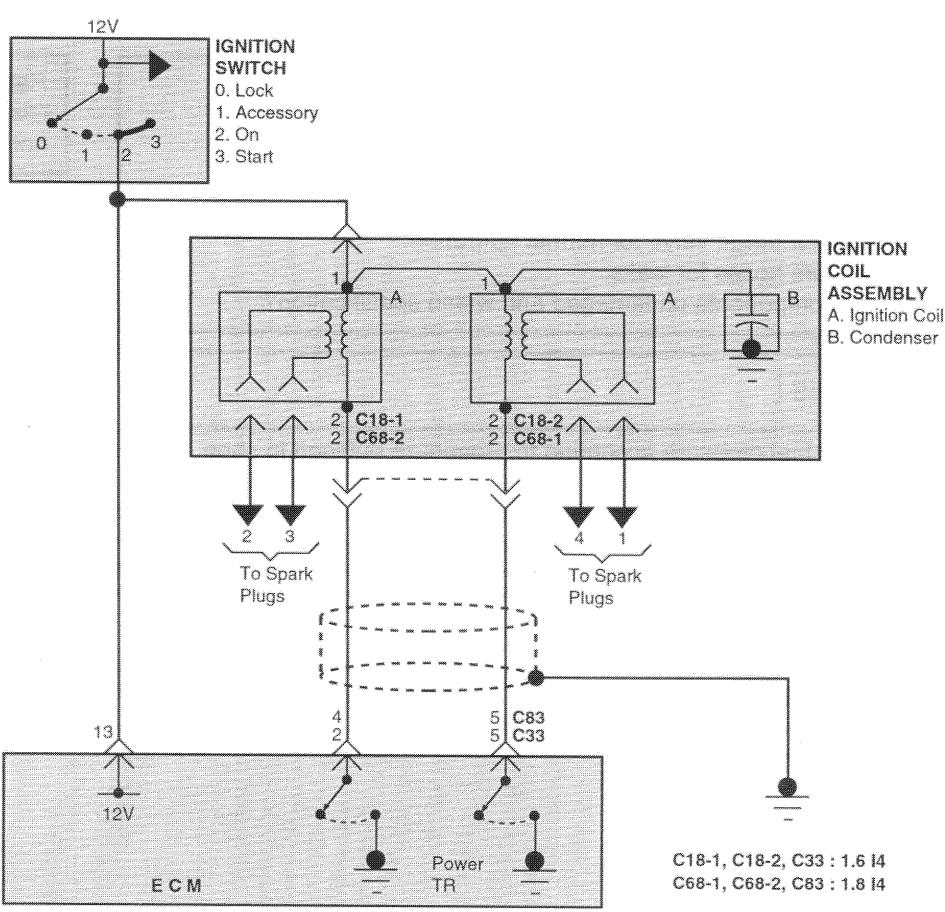
## FAILURE CONDITIONS

The ECM will set P0301, P0302, P0303 or P0304 and the MIL will turn on if 2 misfires per 100 revolutions are detected during two driving cycles. The misfire rate is measured every 200 revolutions when the following conditions are met:

If the misfire rate increases to between 5%-25% per 200 revolutions, there is danger of catalyst damage and the MIL will flash off and on. The catalyst temperature could exceed 3542°F (1950°C) if the misfire rate increases enough. This code indicates a problem with cylinder ignition being read by the ECM.

- Speed change is less than 1000 rpm per second.
- Engine speed is between 600 and 4000 RPM.
- Engine load is greater than 2 milliseconds.
- No fuel cut-off.

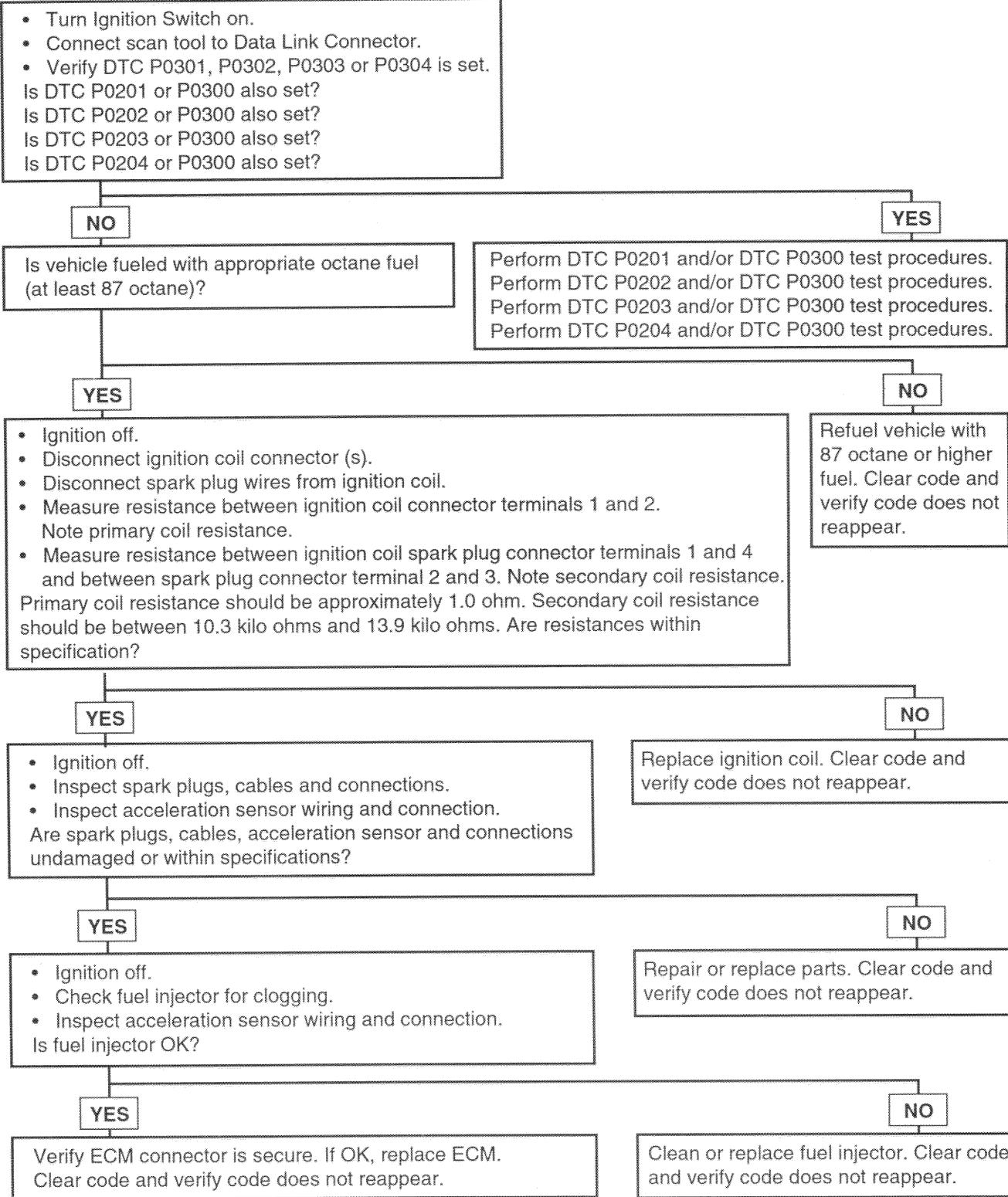
## CIRCUIT DIAGRAM



**Note :** Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

C18-1, C18-2, C33 : 1.6 I4  
C68-1, C68-2, C83 : 1.8 I4

## TEST PROCEDURE



EFNC5560

DTC	Diagnostic item
P0325	Knock Sensor Circuit Malfunction

## DESCRIPTION

The knock sensor is attached to the cylinder block and senses engine knocking. A knocking vibration from the cylinder block is applied as pressure to the sensor's piezoelectric element. This vibration pressure is then converted into a voltage signal. The Engine Control Module (ECM) uses this signal to suppress knocking by retarding ignition timing.

## FAILURE CONDITIONS

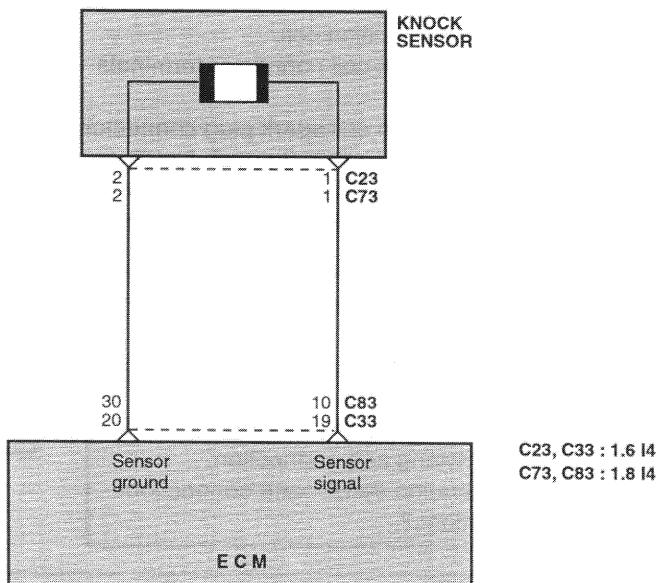
The ECM will set a code (Malfunction Indicator Lamp will not turn on) if during two driving cycles the knock sensor's

output voltage falls below 650 millivolts during a 4 second check when the following conditions are met:

- Starter is not engaged.
- Engine speed is above 3000 RPM.
- Engine coolant temperature is above 104°F (40°C).
- Engine load is greater than 2.5 milliseconds.

This code indicates an unexpected vibration is being read by the knock sensor or ECM under normal engine operation.

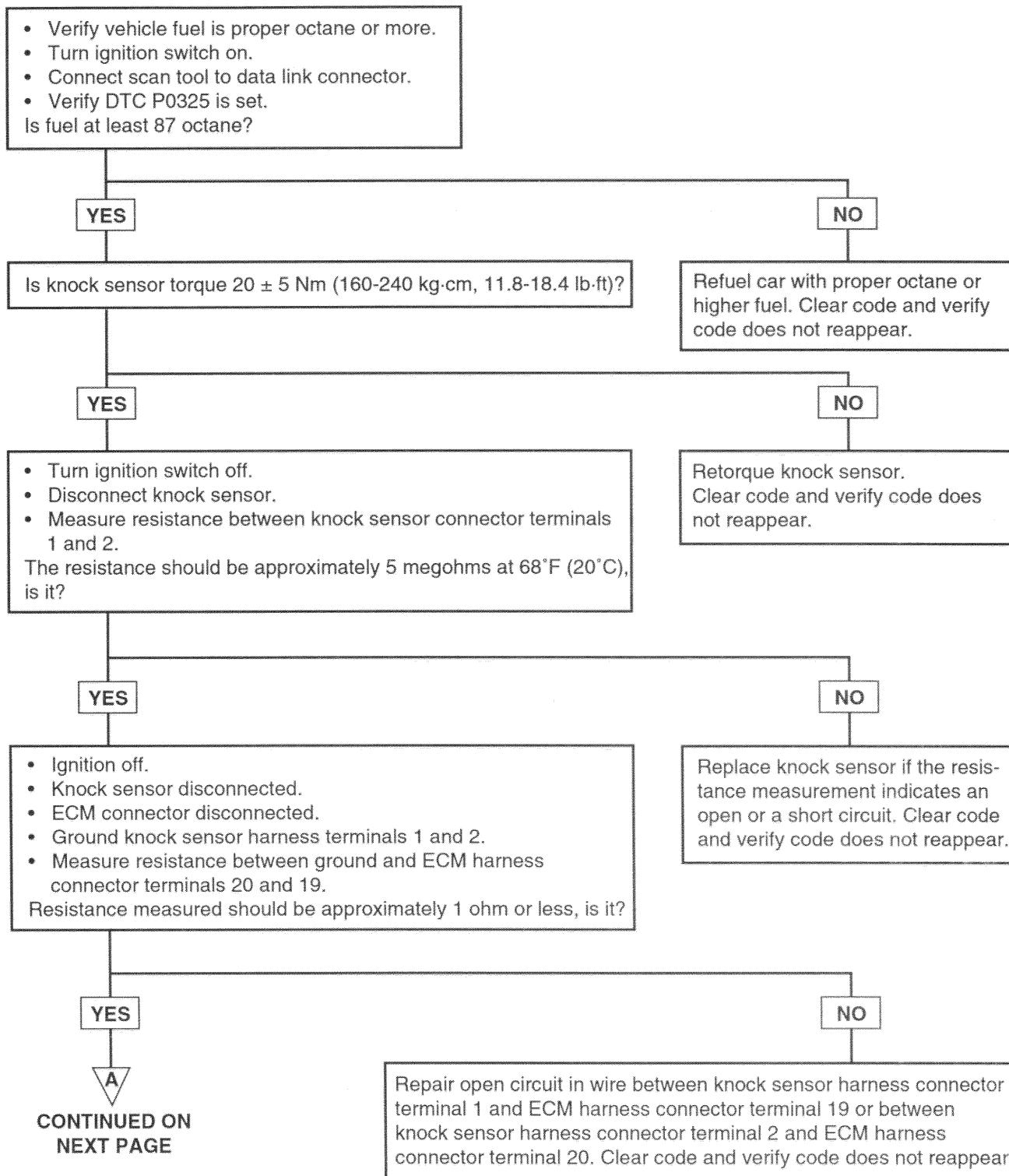
## CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

EFNC047A

## TEST PROCEDURE



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PREVIOUS PAGE

A

- Ignition off.
- Knock sensor disconnected.
- Disconnect ECM connector.
- Measure resistance between ground and knock sensor harness connector terminal 1.

Resistance should indicate an open circuit, does it?

YES

Verify ECM connector is secure. If OK, replace knock sensor with a known good component. Clear code and verify code does not reappear. If problem persists, replace ECM.

NO

Repair short to ground in wire between knock sensor harness connector terminal 1 and ECM harness connector terminal 19. Clear code and verify code does not reappear.

EFNC5610

DTC	Diagnostic item
P0335	Crankshaft Position Sensor Circuit Malfunction
P0336	Crankshaft Position Sensor Circuit Out of Range

## DESCRIPTION

The Crankshaft Position (CKP) sensor consists of a magnet and coil located next to the flywheel. The sensing wheel teeth are used by the CKP sensor to generate a signal. The voltage signal from CKP sensor allows the Engine Control Module (ECM) to determine engine RPM and crankshaft position.

## FAILURE CONDITIONS

### [FOR P0335]

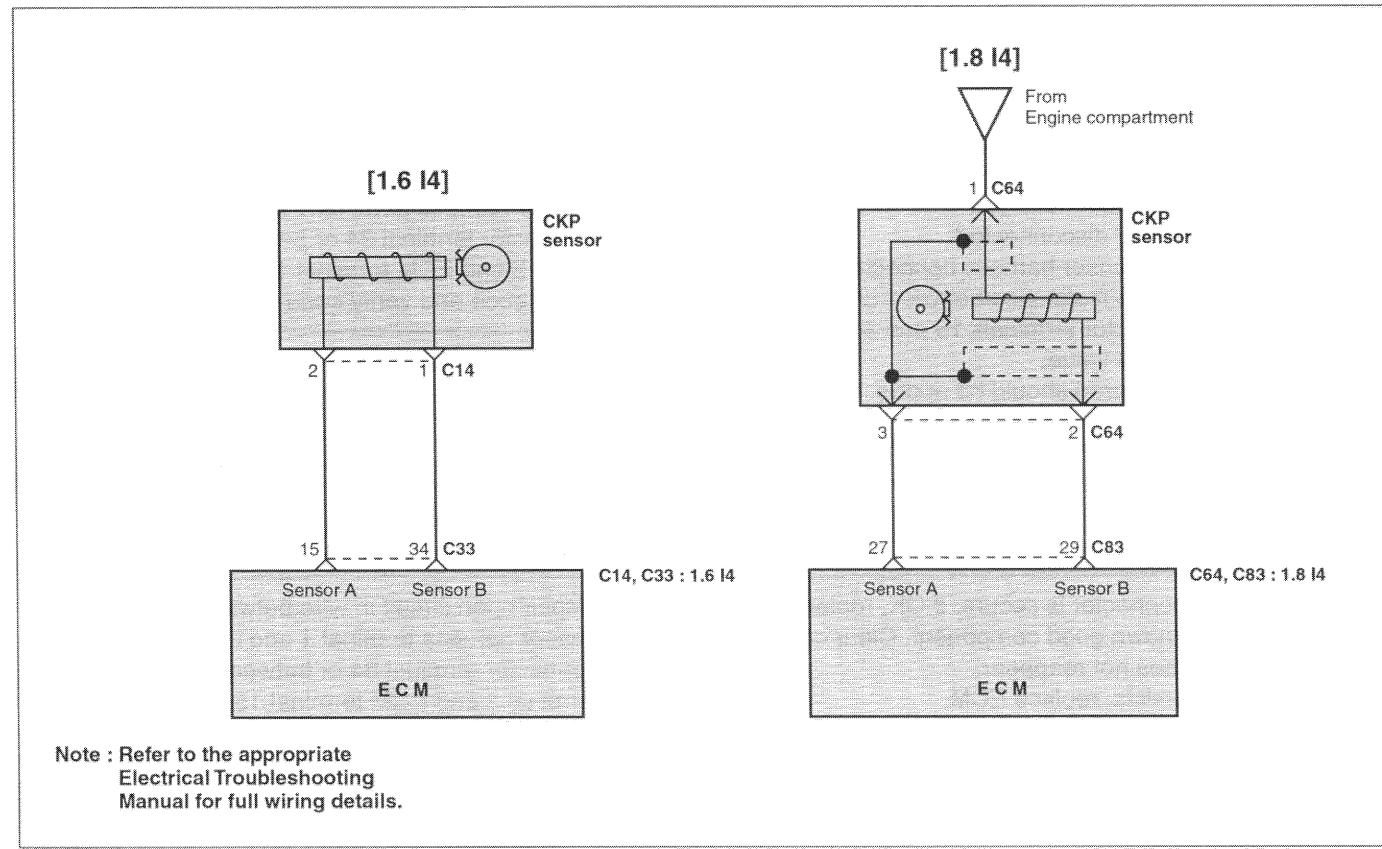
The ECM will set P0335 and the MIL will turn on if the CKP signal voltage remains at 0.0 volts with the starter engaged for 4 seconds or 8 revolutions and the Camshaft Position (CMP) sensor signal indicating engine rotation. This check

is made every time the engine starts. This code indicates no crankshaft signal is being read by the CKP sensor or the ECM while a CMP sensor signal verifies engine rotation.

### [FOR P0336]

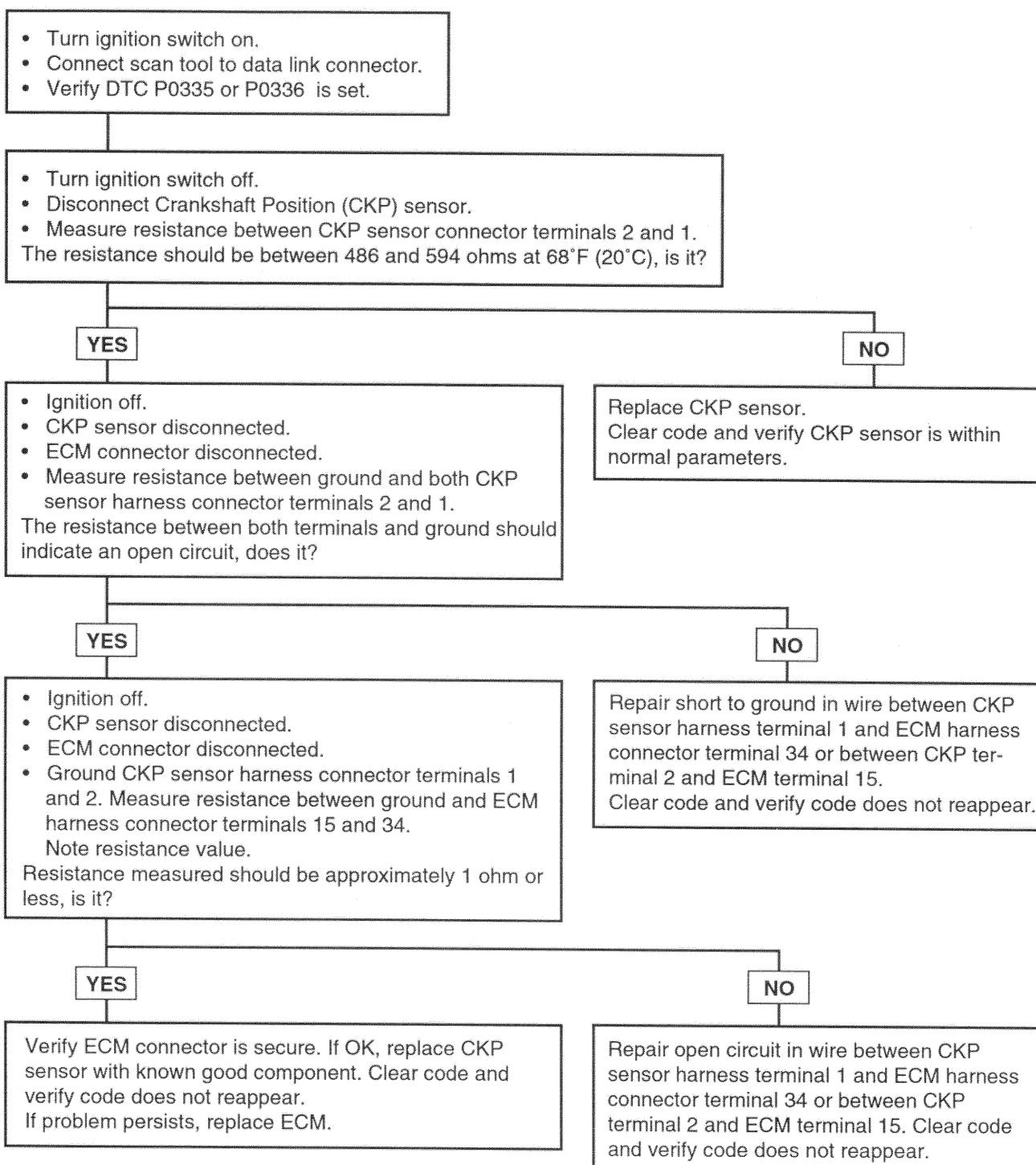
The ECM will set P0336 and the MIL will turn on immediately if the CKP sensor signal does not indicate the two missing teeth in exactly the same position on the tone wheel during two successive engine revolutions. This check is made for 5 seconds when the engine is running above 2000 RPM. This code indicates a problem with the crankshaft being read by the CKP sensor or ECM.

## CIRCUIT DIAGRAM



EFNC037A

## TEST PROCEDURE



EFNC5660

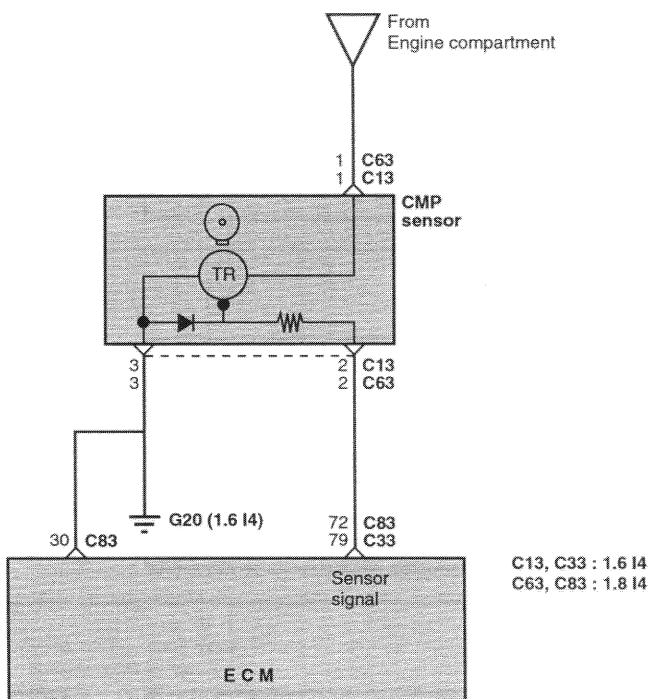
DTC	Diagnostic item
P0340	Camshaft Position Sensor Circuit Malfunction

**DESCRIPTION**

The Camshaft Position (CMP) sensor senses the Top Dead Center (TDC) point of the #1 cylinder in the compression stroke. The CMP sensor signal allows the Engine Control Module (ECM) to determine the fuel injector sequence starting point.

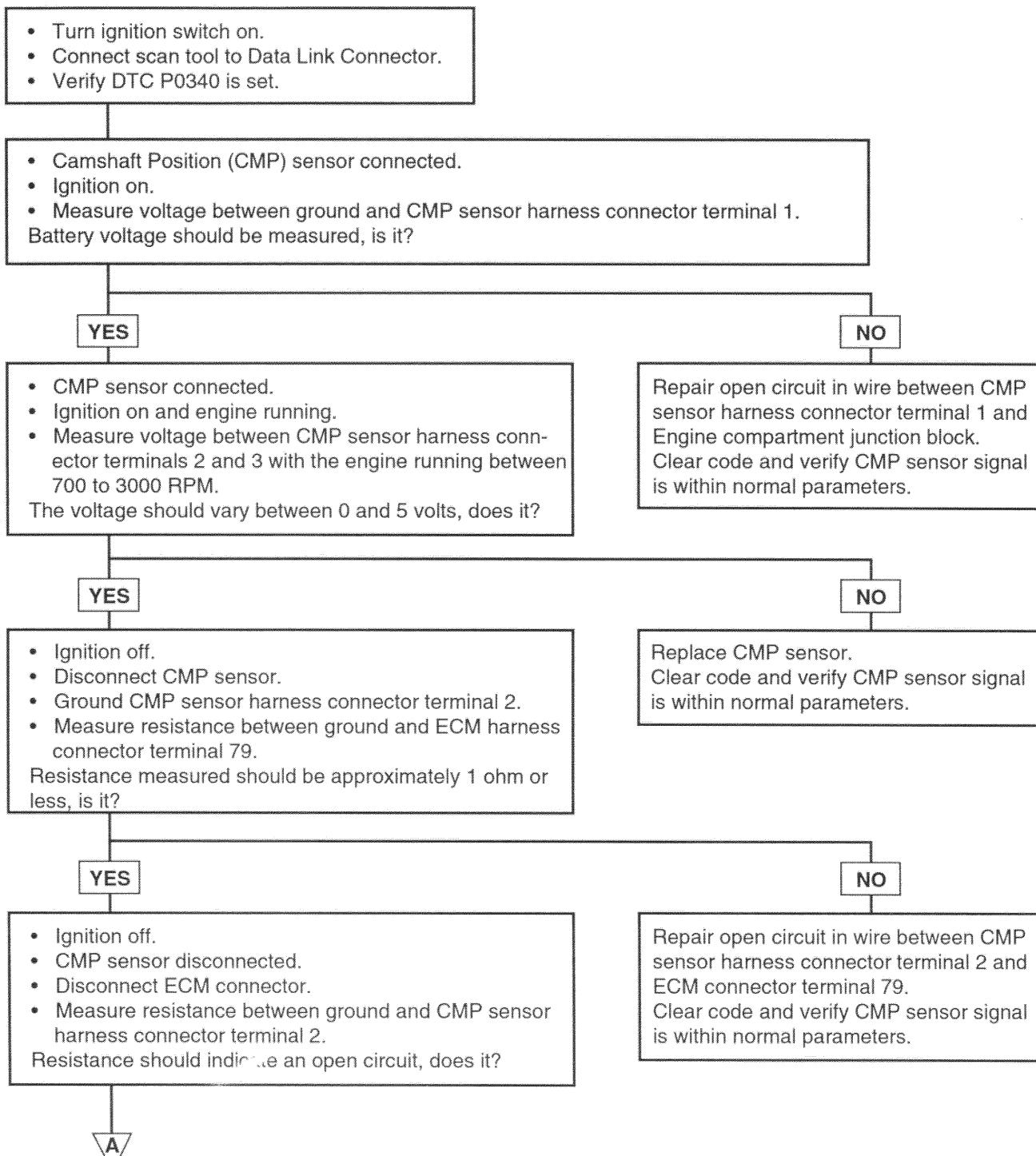
**FAILURE CONDITIONS**

The ECM will set P0340 and the Malfunction Indicator Lamp (MIL) will turn on if during two driving cycles there is more than one CMP sensor signal during two engine revolutions when the engine speed is above 600 RPM. This code indicates unexpected camshaft position readings by the CMP sensor or ECM when the engine is rotating.

**CIRCUIT DIAGRAM**

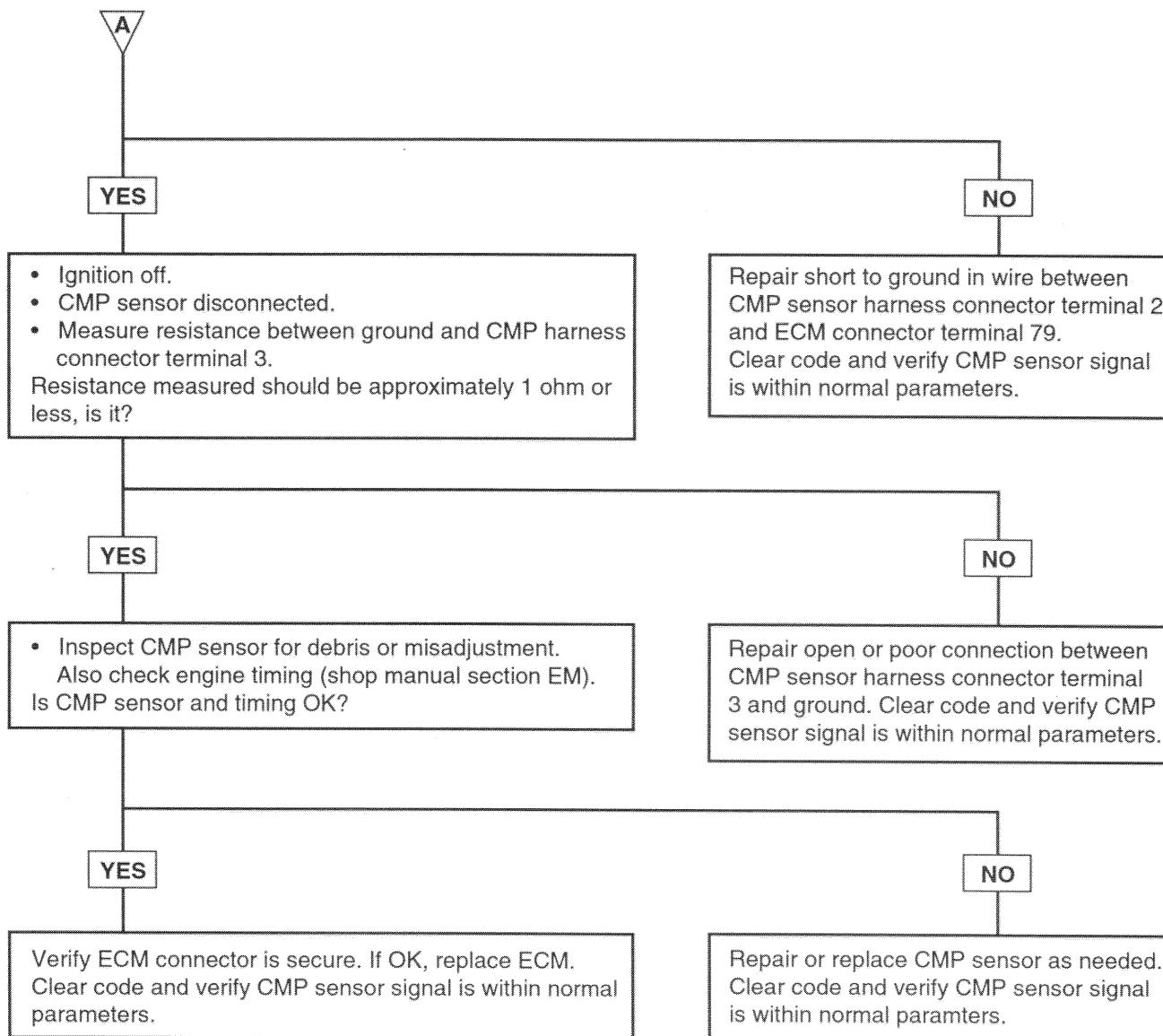
EFNC035A

## TEST PROCEDURE



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EFNC5710

DTC	Diagnostic item
P0420, P0422	Catalyst efficiency Low

## DESCRIPTION

The catalyst's efficiency is demonstrated in its ability to oxidize CO and HC emissions. The Engine Control Module (ECM) compares the output signals of the front and rear oxygen sensors to determine whether the output of the rear sensor is beginning to match the output of the front oxygen sensor. As the catalyst wears, the rear oxygen sensor's signal trace begins to match the front oxygen sensor's signal trace. That is because the catalyst becomes saturated with oxygen and cannot use the oxygen to convert HC and CO into H<sub>2</sub>O and CO<sub>2</sub> with the same efficiency as when it was new. A completely worn catalyst shows a 100% match between front and rear sensor outputs.

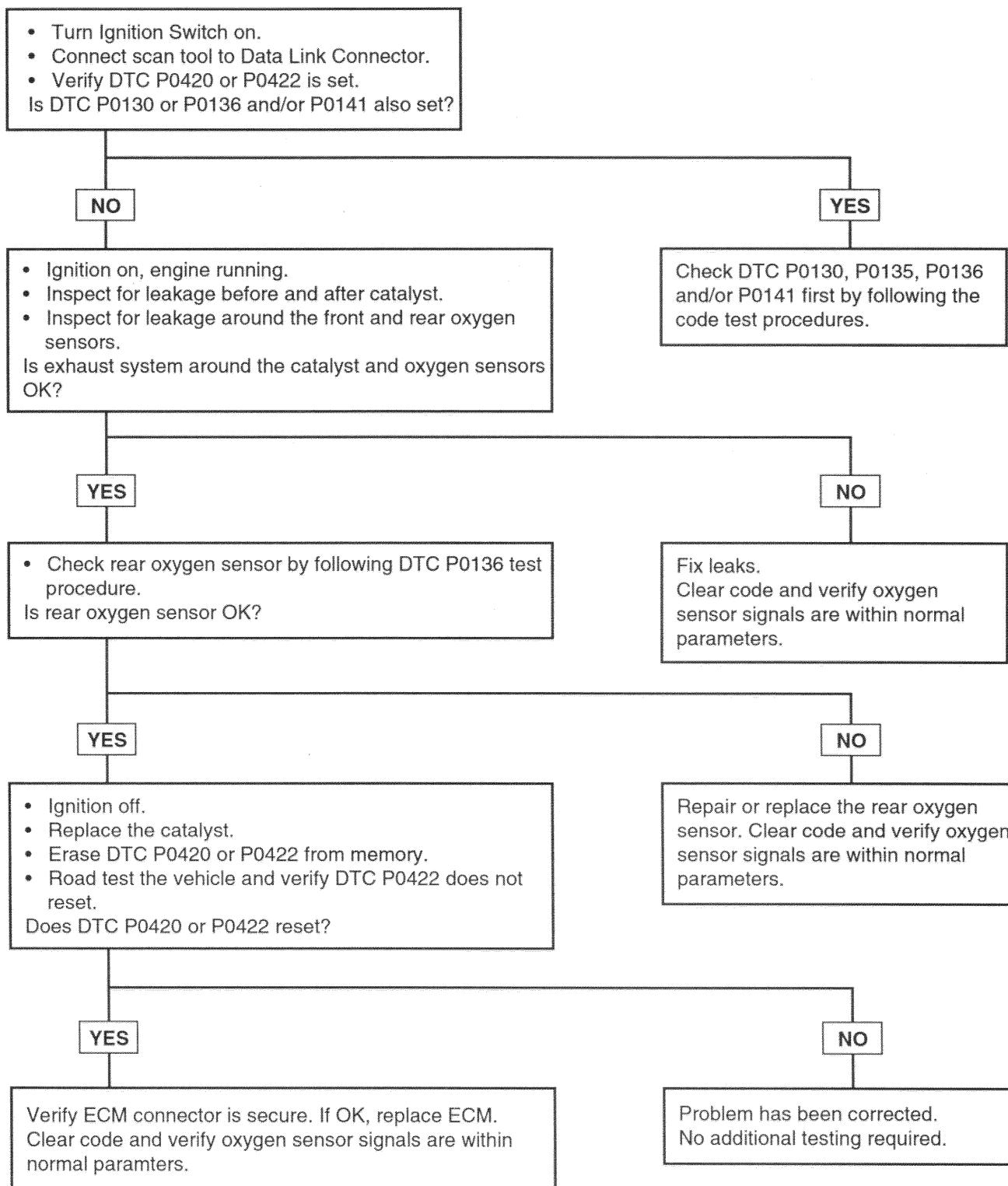
## FAILURE CONDITIONS

The efficiency of the catalytic converter is measured by comparing the activity of the front and rear oxygen sensors. The ECM will set a code and the Malfunction Indicator Lamp (MIL) will turn on if the front and rear oxygen sensor signals match more than 60% of the time in two of four 170 second monitoring periods during two driving cycles. The measurements are taken when the following conditions are met:

1. The ECM is operating in closed loop.
2. The engine speed is between 1800 and 3200 PRM.
3. The catalyst temperature is above 702°F (372°C).
4. The canister purge function is greater than 0.9.
5. The vehicle is not shifting gears.
6. The engine load is between 1.4 milliseconds and 4.5 milliseconds.

This code indicates that the catalytic converter has been found to have a low efficiency according to the readings of the front and rear oxygen sensors.

## TEST PROCEDURE



EFNC5760

DTC	Diagnostic item
P0443	Purge Control Solenoid Valve Circuit Malfunction
P0444	Purge Control Solenoid Valve Circuit Open
P0445	Purge Control Solenoid Valve Circuit Shorted

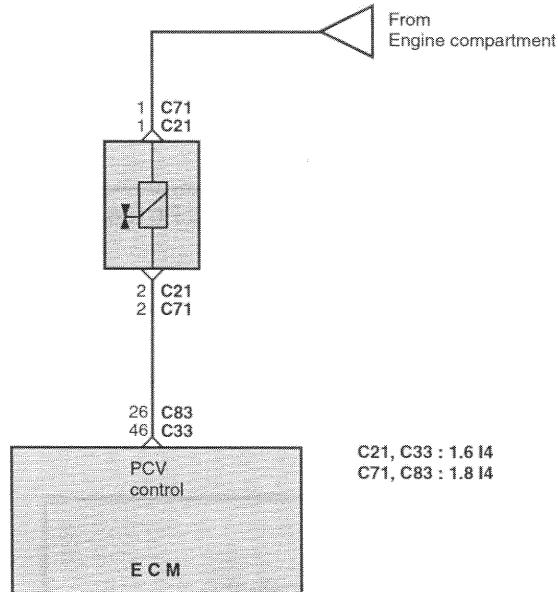
**DESCRIPTION**

The Purge Control Solenoid Valve is part of the Evaporative Emission Control System. The solenoid controls purge air from the evaporative emission canister.

**FAILURE CONDITIONS**

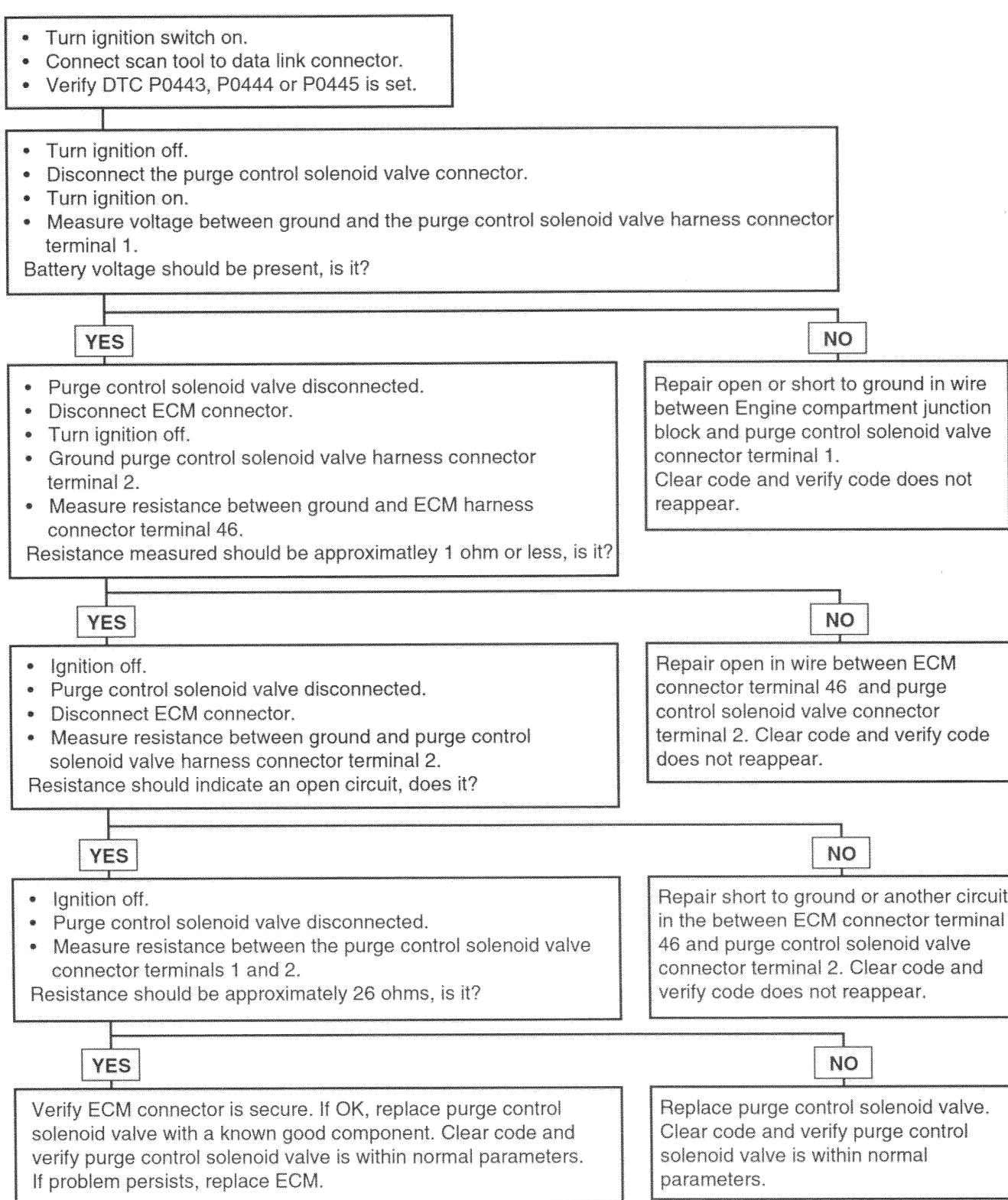
The ECM will set P0444 and the MIL will turn on if an open circuit is detected in the driver stage of the purge control solenoid circuit during two driving cycles.

The ECM will set P0445 and the MIL will turn on if a short circuit is detected in the driver stage of the purge control solenoid circuit during two driving cycles.

**CIRCUIT DIAGRAM**

EFNC057A

## TEST PROCEDURE



EFNC5810

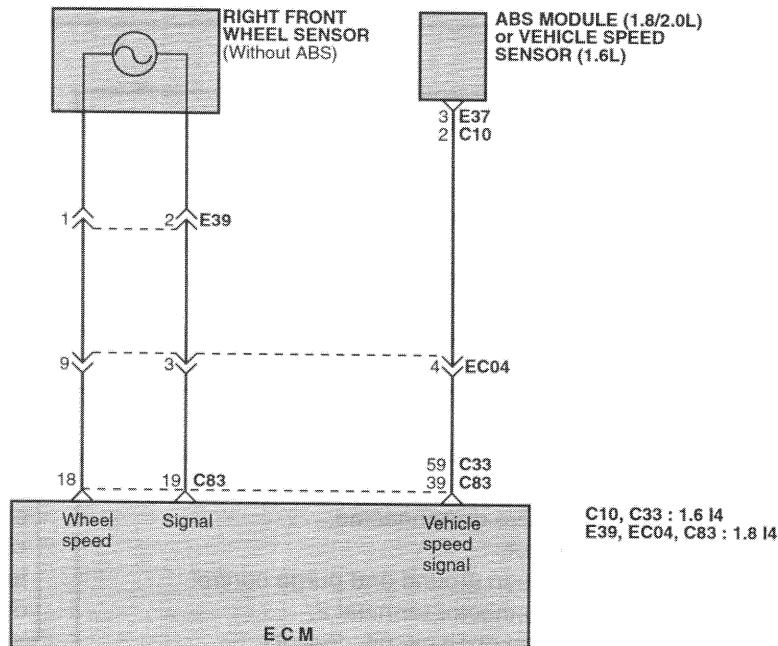
DTC	Diagnostic item
P0501	Vehicle Speed Sensor Malfunction

**DESCRIPTION**

The Vehicle Speed Sensor is a wheel speed sensor that is built near the wheel disc. The sensor converts the transaxle gear revolutions of the disc into a pulse signal which is sent to the ECM.

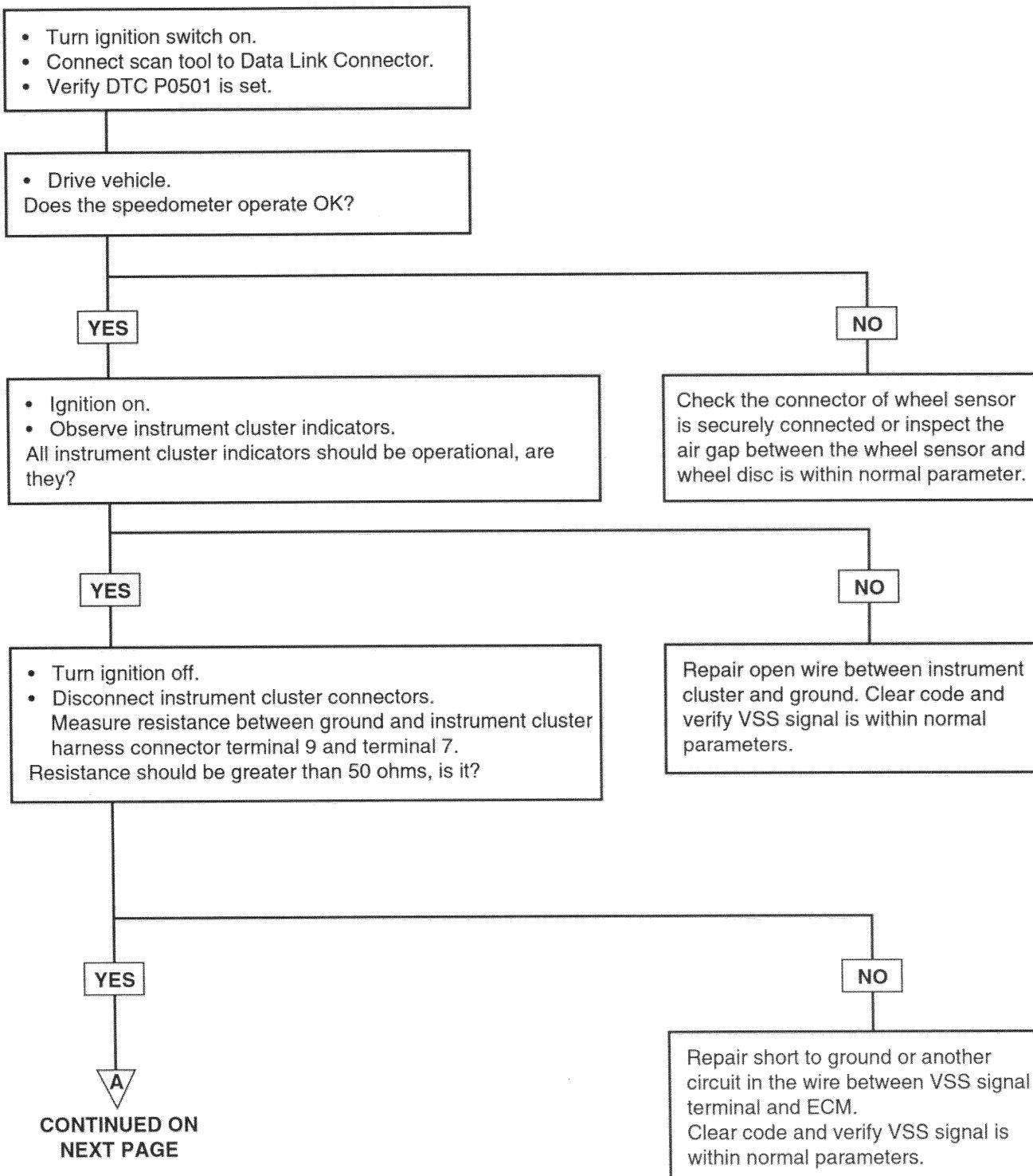
**FAILURE CONDITIONS**

The ECM will set a code and the Malfunction Indicator Lamp (MIL) will turn on if there is no vehicle speed sensor output signal for 20 seconds during two driving cycles when the following conditions are met:

**CIRCUIT DIAGRAM**

EFNC045A

## TEST PROCEDURE



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- Turn ignition off.
- Instrument cluster connectors disconnected.
- Ground ECM harness connector terminal 59.
- Disconnect instrument cluster connectors. Measure resistance between ground and instrument cluster harness connector terminal 13 and terminal 5.

Resistance measured should be approximately 1 ohm or less, is it?

YES

- Instrument cluster connectors still disconnected.
- Rotate speedometer cable.
- Disconnect instrument cluster connectors.

Measure resistance between instrument cluster connector terminal 9 and both connector terminal 13 and terminal 5.

Resistance measurement should switch from short to open circuit 4 times per revolution of the shaft, does it?

NO

Repair open in wire between instrument cluster VSS signal terminal and ECM.  
Clear code and verify VSS signal is within normal parameters.

YES

Verify ECM connector is secure. If OK, replace VSS with known good component. Clear code and verify VSS signal is within normal parameters. If problem persists, replace ECM.

NO

Replace VSS. Clear code and verify VSS signal is within normal parameters.

EFNC5860

DTC	Diagnostic item
P0506	Idle RPM Lower Than Expected
P0507	Idle PRM Higher Than Expected

## DESCRIPTION

The Idle Speed Control (ISC) actuator has two coils that are driven by separate ECM driver stages. Depending on the pulse duty factor, the equilibrium of the magnetic forces of the two coils will result in different directions for the magnetic forces of the two coils which will result in different positions for the actuator. In parallel to the throttle valve, a bypass hose line is arranged where the ISC actuator is inserted.

## FAILURE CONDITIONS

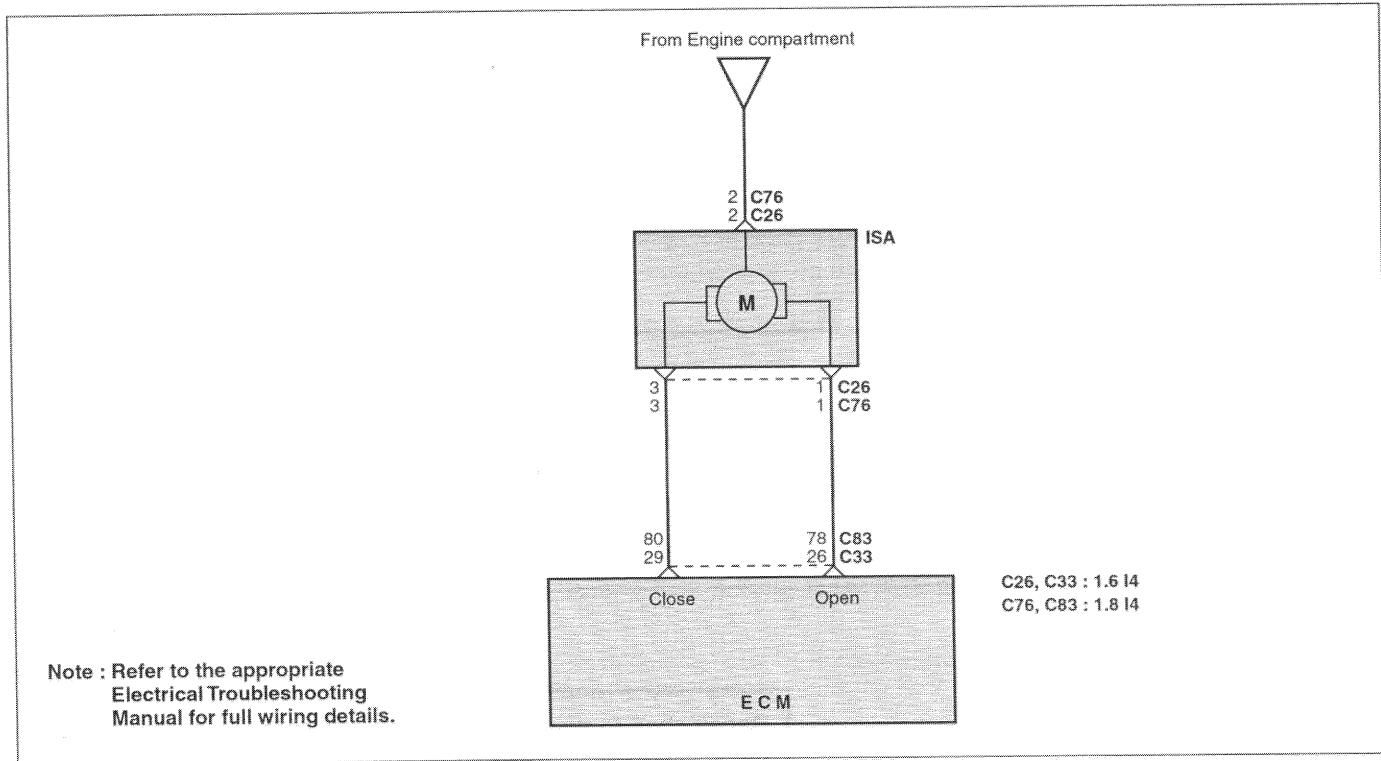
The ECM will set P0506 or P0507 and the MIL will turn on if for 15 seconds the ISC actuator driver circuit values and

engine idle speed are not in agreement with values stored in the ECM during two driving cycles when the following conditions are met:

1. The ISC actuator passes idle air at a rate above 4.1 g/s. [for P0506] or 1.7 g/s [for P0507].
2. Engine speed deviation is below 200 RPM.
3. Vehicle speed is zero.
4. Engine coolant temperature is above 167°F (75°C).

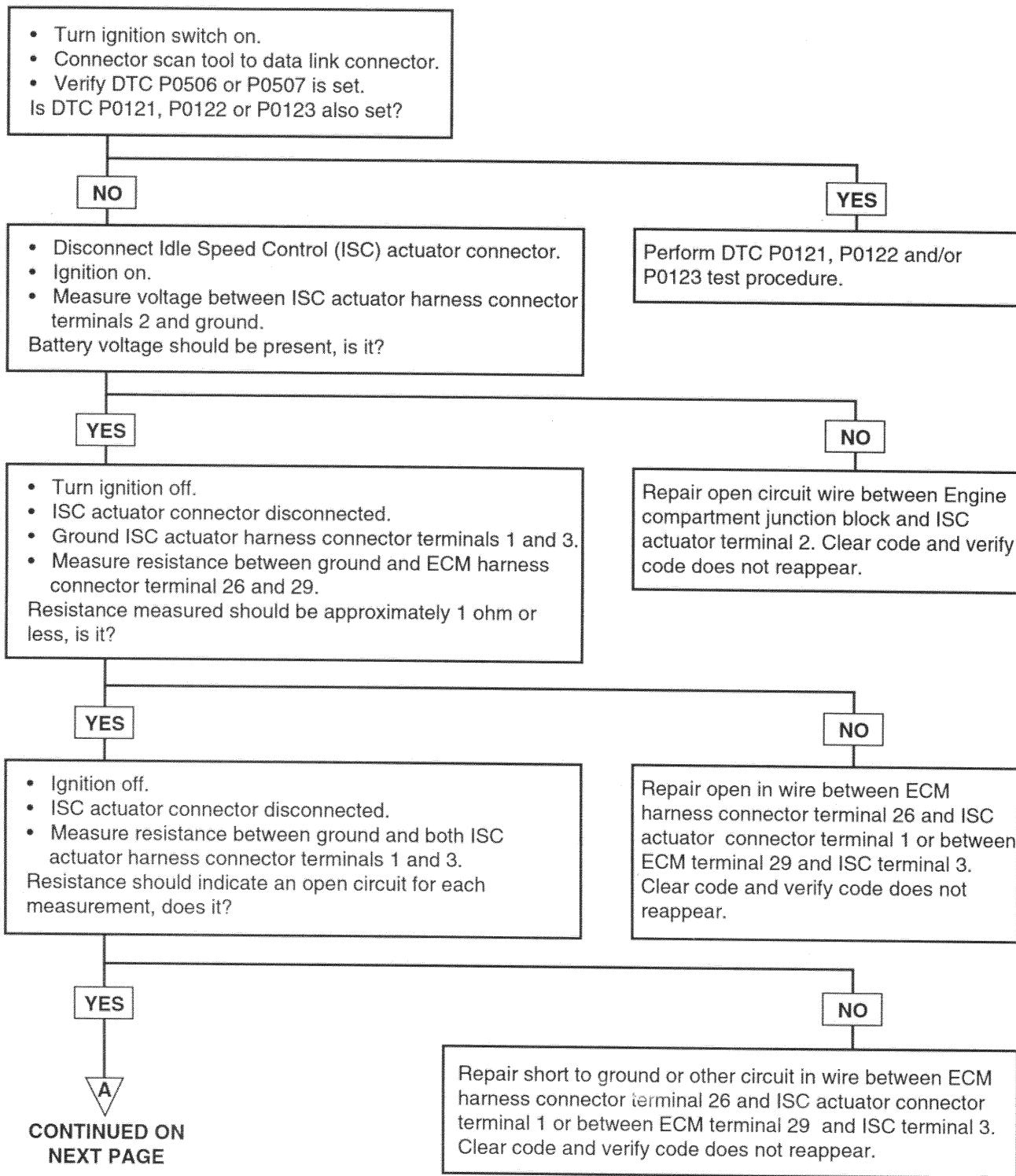
This code indicates the idle speed control actuator and the engine do not agree with the ECM on the idle speed value.

## CIRCUIT DIAGRAM



EFNC043A

## TEST PROCEDURE



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PREVIOUS PAGE

A

- Ignition off.
- ISC actuator connector disconnected.
- Measure resistance between ISC actuator connector terminals 1 and 2.
- Measure resistance between ISC actuator connector terminals 3 and 2.

Resistance should be 10-14 ohms at 68°F (20°C). Are resistance measurements OK?

YES

- Ignition off.
- Check that ISC actuator valve is clean and not sticking.
- Check that throttle lever return spring is clean and not sticking.
- Check intake air system and vacuum hoses to intake air system.

Are the results of these checks OK?

NO

Replace ISC actuator. Clear code and verify code does not reappear.

YES

Verify ECM connector is secure. If OK, replace ISC actuator with known good component. Clear code and verify code does not reappear. If problem persists, replace ECM.

NO

Clean, repair or replace parts as necessary. Clear code and verify code does not reappear.

EFNC5910

DTC	Diagnostic item
P0170	Fuel Trim Malfunction
P0171	Fuel System Too Lean
P0172	Fuel System Too Rich

## DESCRIPTION

The air/fuel control system, in addition to a number of sensors, includes the following components and systems:

- Intake air system.
- Exhaust system.
- Evaporative emissions control system (includes purge control solenoid valve).
- Fuel injectors.
- Fuel pressure regulator.
- Fuel pump.

For the air/fuel ratio to be within limits, all of the sensors, components and systems associated with the air/fuel control system must function within normal parameters.

## FAILURE CONDITIONS

### [FOR LONG-TERM FUEL TRIM]

The ECM will set a code and the Malfunction Indicator Lamp (MIL) will turn on if the long-term multiplicative value is less than 77% for 30 seconds [for P0172] or if the long-term fuel trim value goes to 10% to 15% lean [for P0171] for 30 seconds during two driving cycles when the following conditions are met:

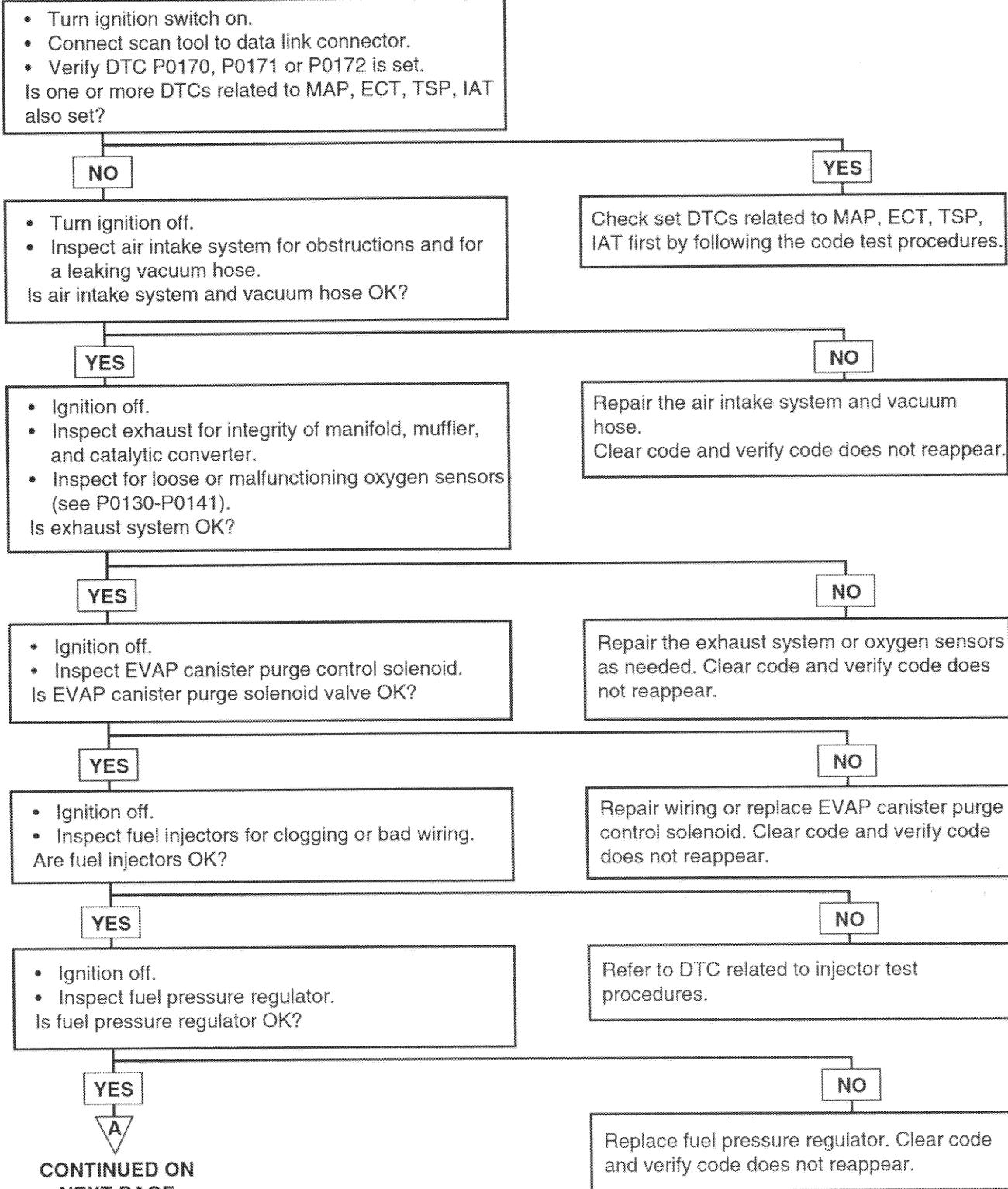
1. Engine load exceeds 1.8 milliseconds.
2. ECM is in closed loop operation [for P0172].
3. Engine coolant temperature is above 158°F (70°C).
4. Canister purge system is not operating.
5. Mass air flow is less than or 5.5 g/s.
6. Engine speed is below 1000 RPM [for P0171].

### [FOR SHORT-TERM FUEL TRIM]

The ECM will set a code and the Malfunction Indicator Lamp (MIL) will turn on if the short-term fuel trim value goes 10% to 15% rich [for P1123] or if the short-term fuel trim additive value is less than 0.4 milliseconds, or 10% to 15% lean [for P1124] for 30 seconds during two driving cycles when the following conditions are met:

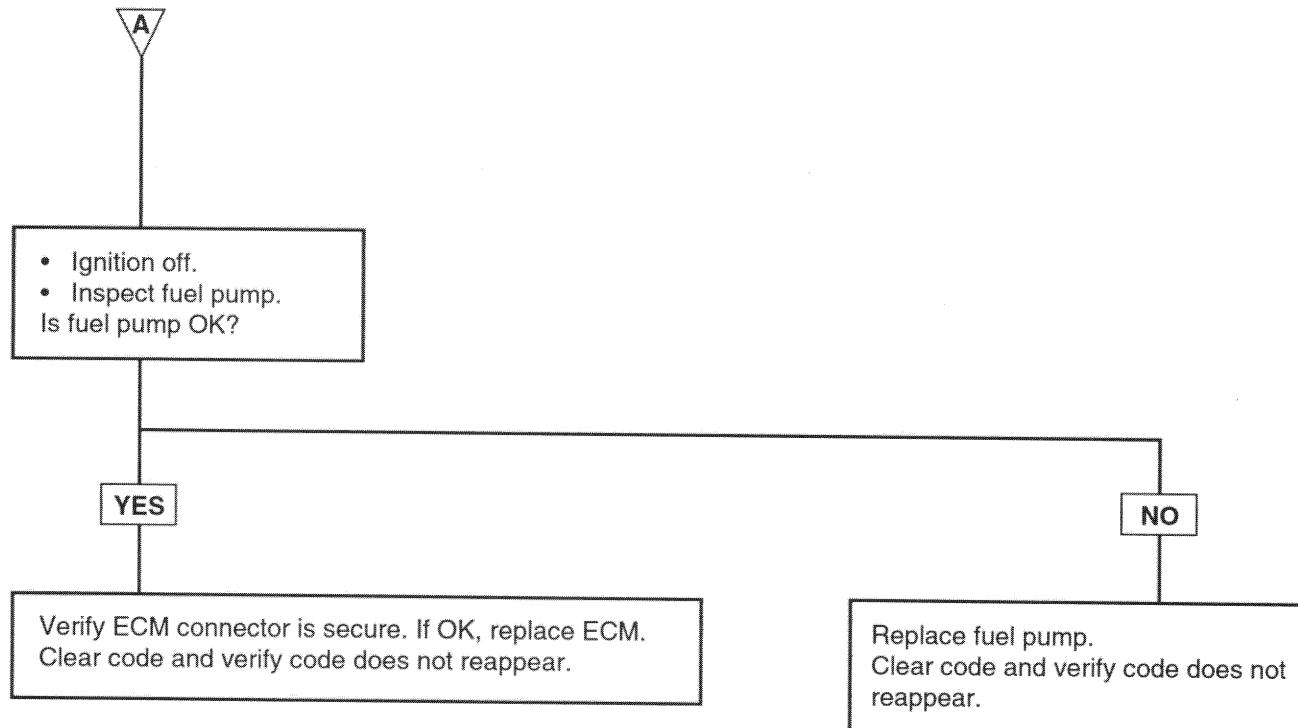
1. ECM is in closed loop operation.
2. Engine speed is below 1000 RPM.
3. Engine coolant temperature is above 158°F (70°C).
4. Canister purge system is not operating.
5. Mass air flow is less than 7.5 g/s [for P1123] or 5.5 g/s [for P1124].

## TEST PROCEDURE



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EFNC5960

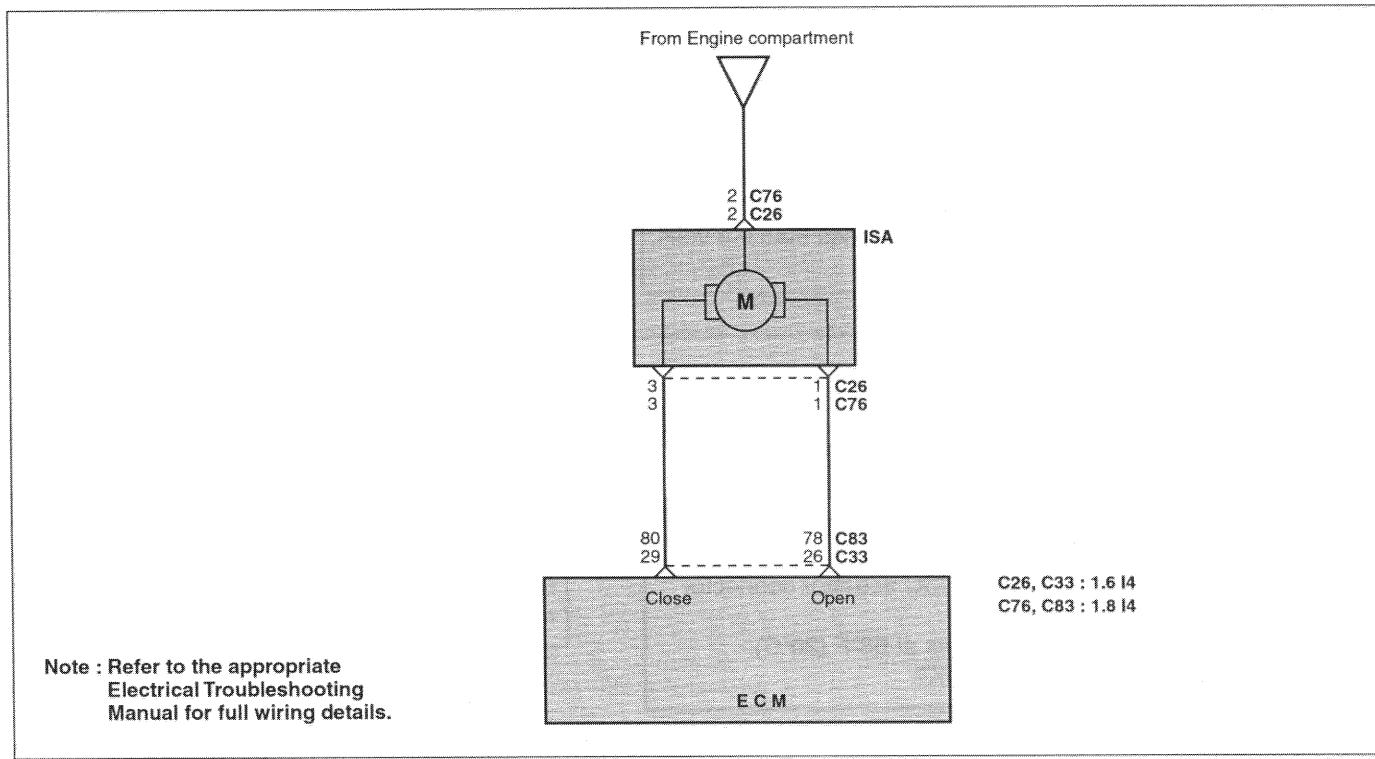
DTC	Diagnostic item
P1515	Idle Speed Actuator Command Signal Incorrect (Coil 1)
P1516	Idle Speed Actuator Command Signal Incorrect (Coil 2)

**DESCRIPTION**

The Idle Speed Control (ISC) actuator has two coils that are driven by separate ECM driver stages. Depending on the pulse duty factor, the equilibrium of the magnetic forces of the two coils will result in different directions for the magnetic forces of the two coils which will result in different positions for the actuator. In parallel to the throttle valve, a bypass hose line is arranged where the ISC actuator is inserted.

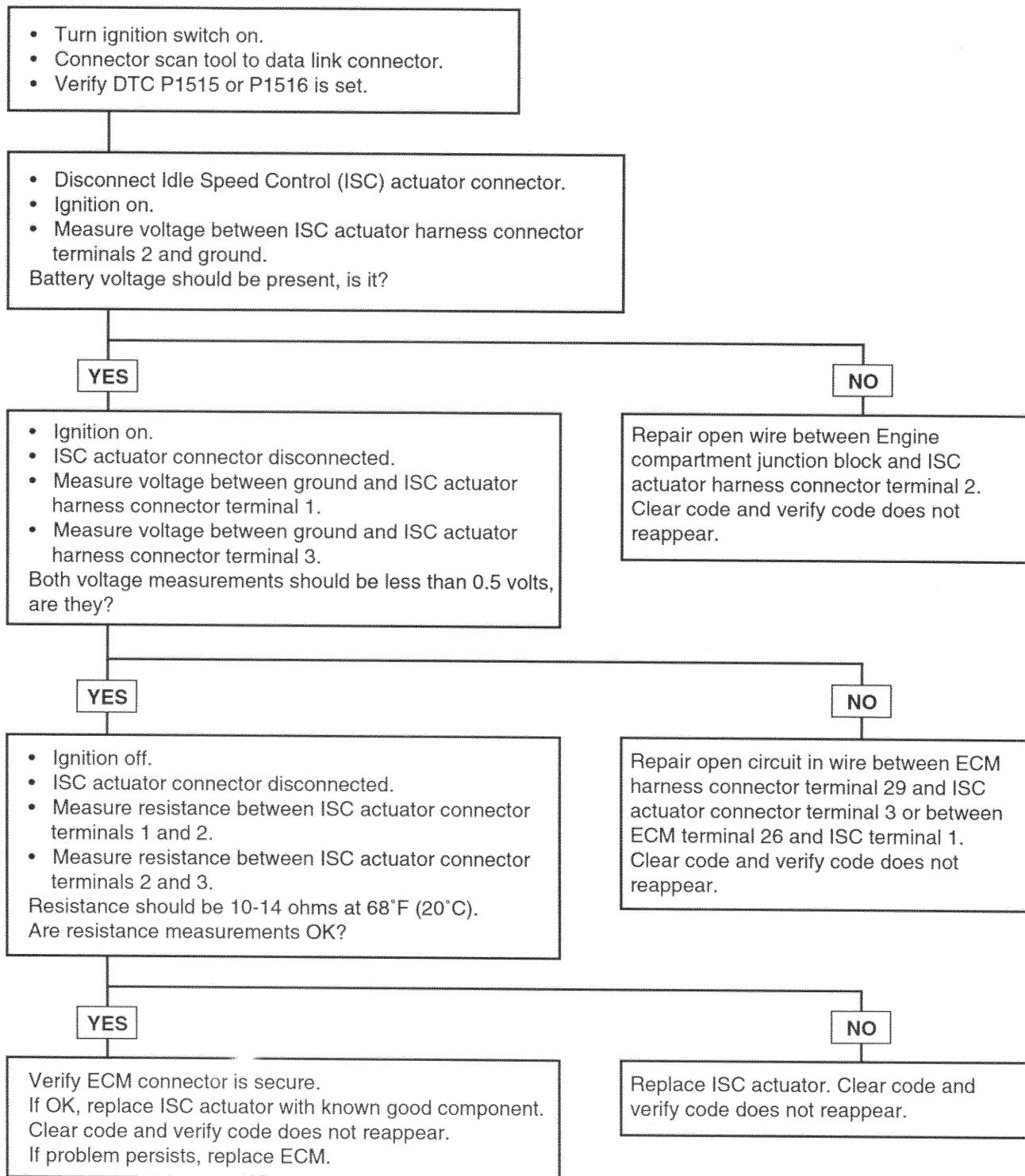
**FAILURE CONDITIONS**

The ECM will set a code and the MIL will turn on if ISC actuator's opening coil driver stage [for P1515] or closing coil driver stage [for P1516] is shorted to battery voltage during two driving cycles.

**CIRCUIT DIAGRAM**

EFNC043A

## TEST PROCEDURE



EFNC6010

DTC	Diagnostic item
P1505	Idle Charge Actuator Signal Low of Coil #1
P1506	Idle Charge Actuator Signal High of Coil #1
P1507	Idle Charge Actuator Signal Low of Coil #2
P1508	Idle Charge Actuator Signal High of Coil #2

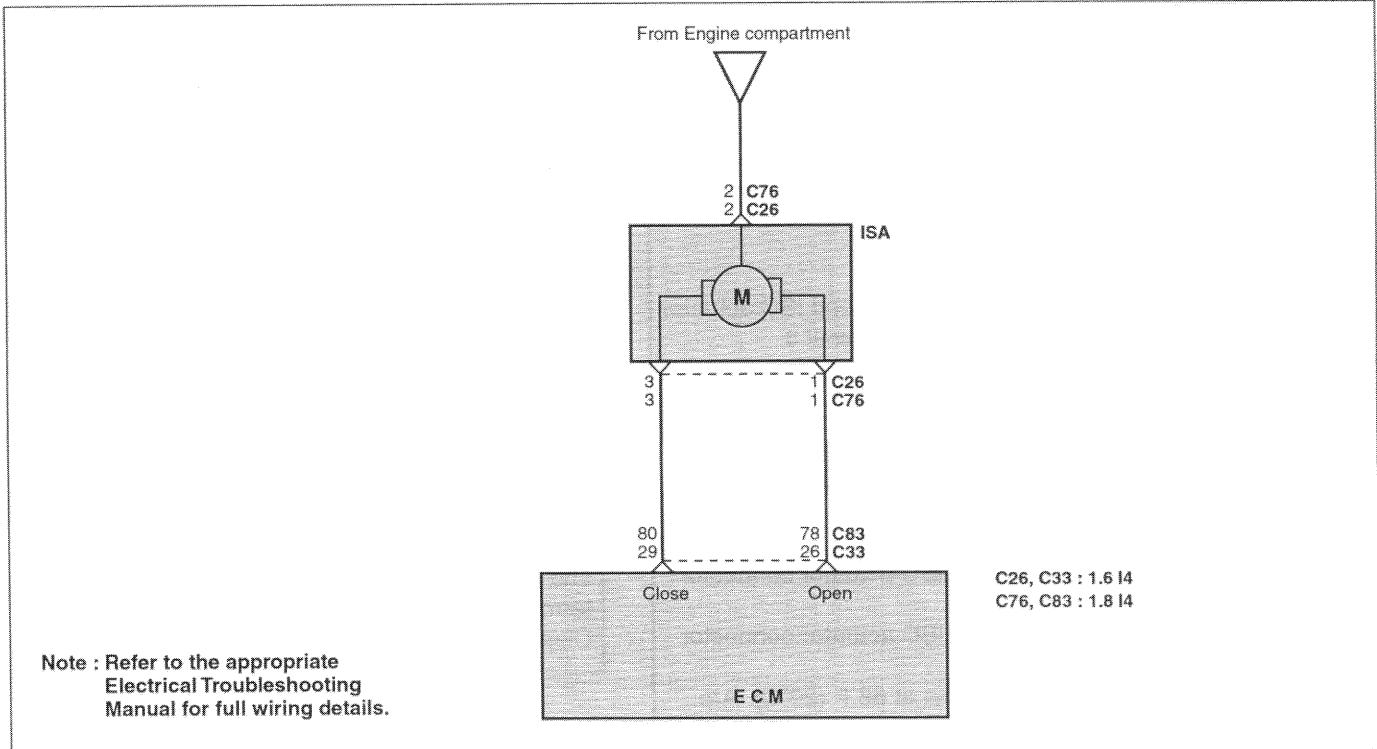
## DESCRIPTION

The Idle Speed Control (ISC) actuator has two coils that are driven by separate ECM driver stages. Depending on the pulse duty factor, the equilibrium of the magnetic forces of the two coils will result in different directions for the magnetic forces of the two coils which will result in different positions for the actuator. In parallel to the throttle valve, a bypass hose line is arranged where the ISC actuator is inserted.

## FAILURE CONDITIONS

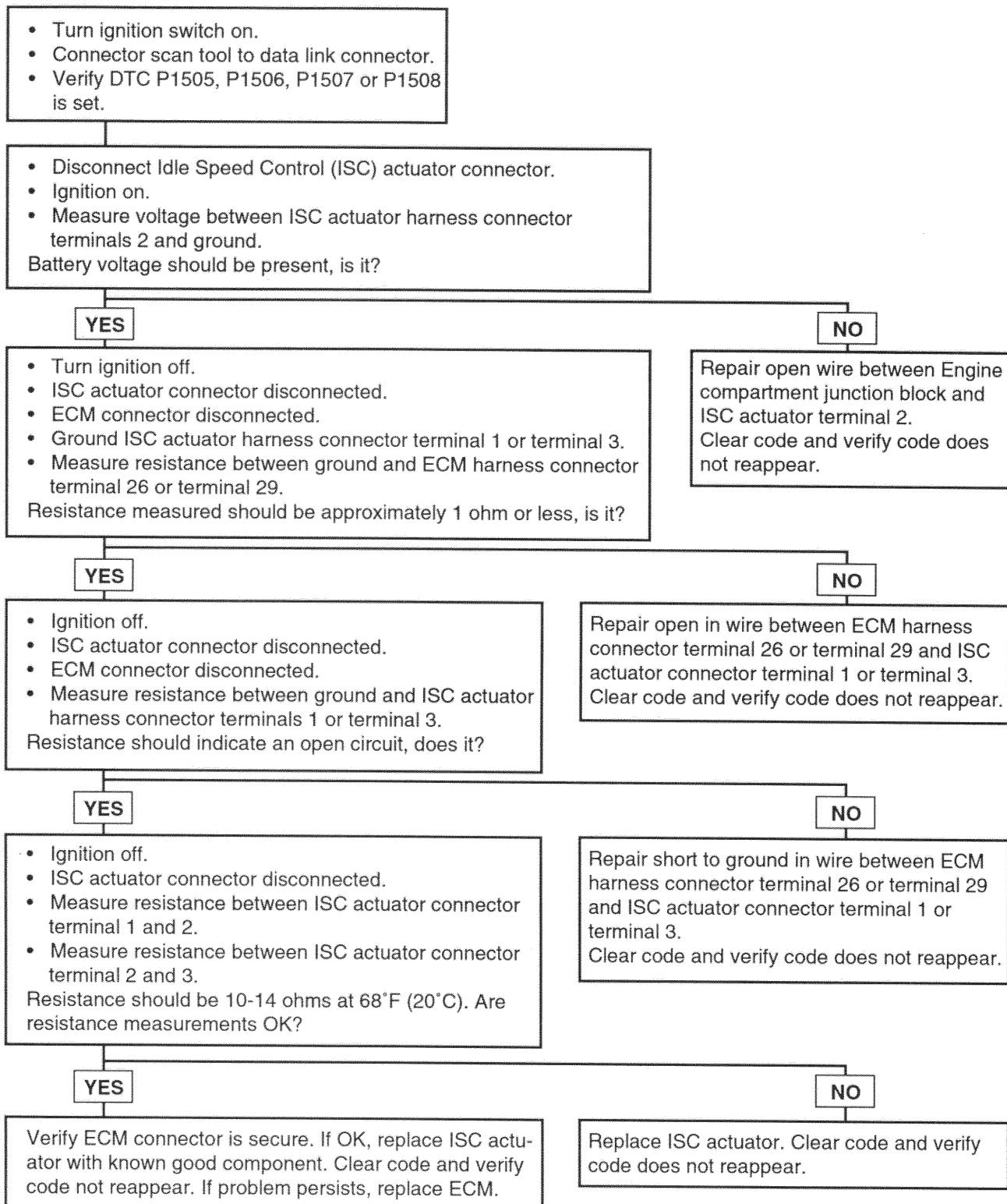
The ECM will set a code and the MIL will turn on if ISC actuator's opening coil driver stage or closing coil driver stage is open or shorted to ground during two driving cycles.

## CIRCUIT DIAGRAM



EFNC043A

## TEST PROCEDURE



EFNC6060

DTC	Diagnostic item
P1307	Acceleration Sensor Circuit Rationality
P1308	Acceleration Sensor Signal Check Low
P1309	Acceleration Sensor Signal Check High

## DESCRIPTION

The acceleration sensor is used to sense rough road conditions. The sensor's signal is used by the Engine Control Module (ECM) to prevent wrongful misfire detection.

## FAILURE CONDITIONS

[FOR P1308, P1309]

The ECM will set a code and the MIL will turn on if the acceleration sensor signal is less than 1.5 or greater than 3.5 volts during two driving cycles. This code indicates

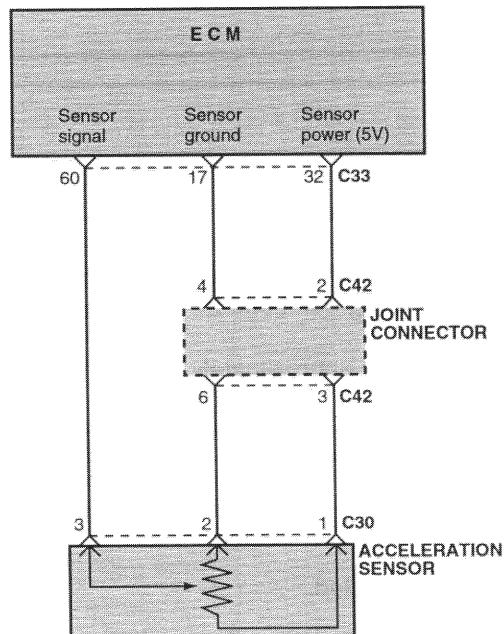
an extremely rough or smooth road being sensed by the acceleration sensor or ECM.

[FOR P1307]

The ECM will set a code and the MIL will turn on if the acceleration sensor signal indicates an acceleration of 0.3g or greater when the vehicle speed is zero during two driving cycles. This code indicates some type of bump being read, with the car speed at zero, by the acceleration sensor or ECM.

## CIRCUIT DIAGRAM

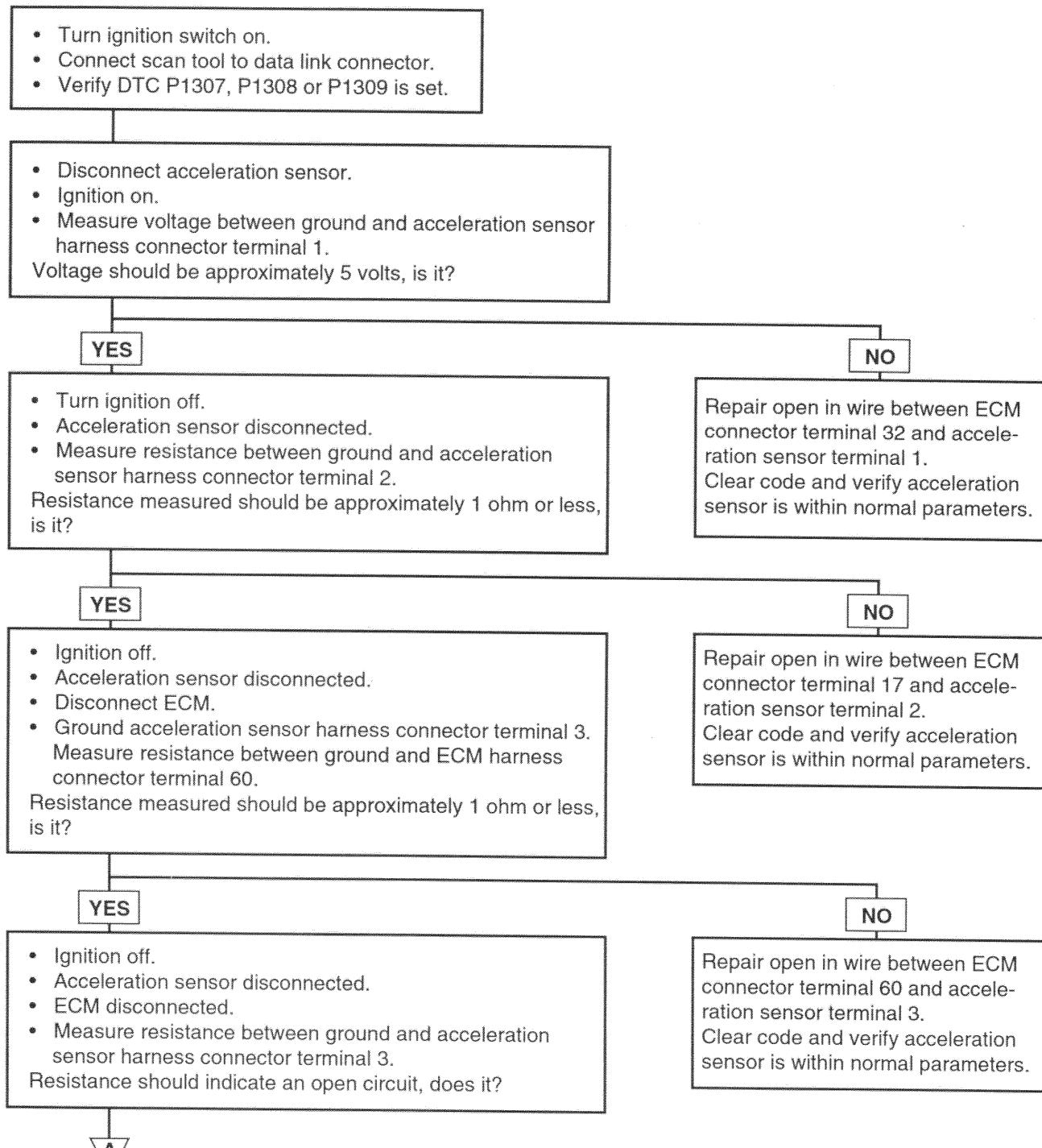
[1.6 14]



**Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.**

EFKB557A

## TEST PROCEDURE



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NEXT PAGE

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PREVIOUS PAGE

