ENGINE CONTROL SYSTEM

SECTION EC

MODIFICATION NOTICE:

Gasoline engine

- VG30E engine has been newly adopted.

Diesel engine

- Fuel injection pump has been added for QD engine.

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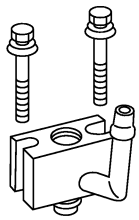
When you read wiring diagrams:
- **Read GI section, "HOW TO READ WIRING DIAGRAMS".**
- **See EL section, "POWER SUPPLY ROUTING" for power distribution circuit.**

When you perform trouble diagnoses, read GI section, "HOW TO FOLLOW FLOW CHART IN TROUBLE DIAGNOSES" and "HOW TO PERFORM EFFICIENT DIAGNOSIS FOR AN ELECTRICAL INCIDENT".

Special Service Tool (VG engine)

Tool number Tool name	Description
KV10117600 Fuel pressure check adapter	Checking fuel pressure with pressure gauge  NT777

Supplemental Restraint System (SRS) “AIR BAG” and “SEAT BELT PRE-TENSIONER”

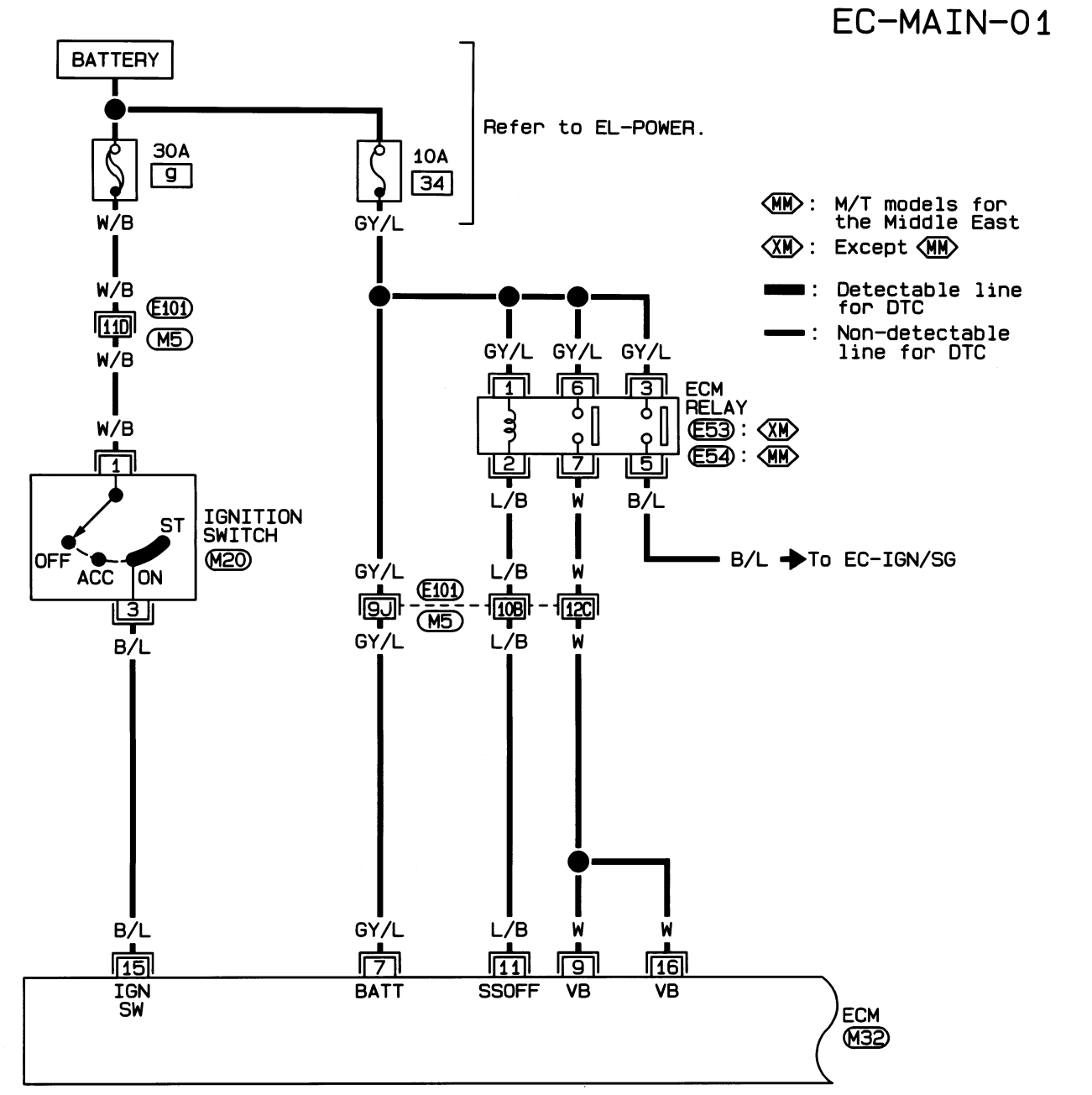
The Supplemental Restraint System such as “AIR BAG” and “SEAT BELT PRE-TENSIONER” used along with a seat belt, helps to reduce the risk or severity of injury to the driver and front passenger in a frontal collision. The SRS system composition which is available to NISSAN MODEL D22 is as follows (The composition varies according to the destination and optional equipment.):
Driver air bag module (located in the center of the steering wheel), front passenger air bag module (located on the instrument panel on passenger side), seat belt pre-tensioner, a diagnosis sensor unit, warning lamp, wiring harness and spiral cable.
Information necessary to service the system safely is included in the **RS section** of this Service Manual.

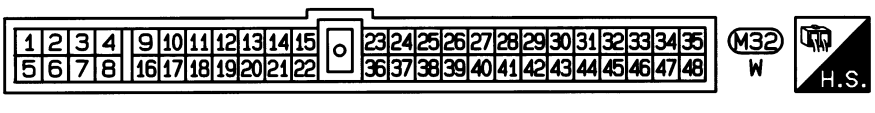
WARNING:

- **To avoid rendering the SRS inoperative, which could increase the risk of personal injury or death in the event of a collision which would result in air bag inflation, all maintenance must be performed by an authorized NISSAN dealer.**
- **Improper maintenance, including incorrect removal and installation of the SRS, can lead to personal injury caused by unintentional activation of the system. For removal of Spiral Cable and Air Bag Module, see the RS section.**
- **Do not use electrical test equipment on any circuit related to the SRS unless instructed to in this Service Manual. Spiral Cable and wiring harnesses (except “SEAT BELT PRE-TENSIONER”) covered with yellow insulation either just before the harness connectors or for the complete harness are related to the SRS.**

Main Power Supply and Ground Circuit

FOR LHD MODELS





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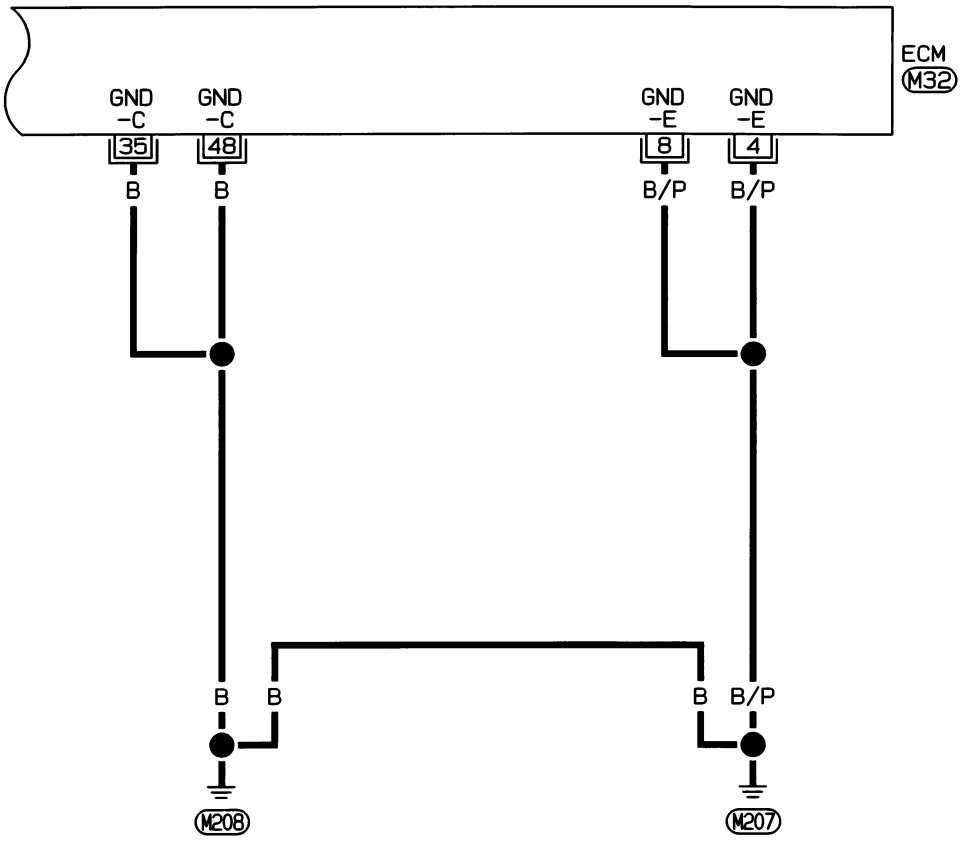
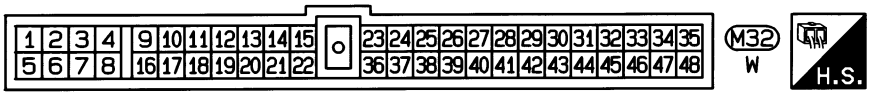
Main Power Supply and Ground Circuit (Cont'd)

EC-MAIN-02

: Detectable line for DTC
: Non-detectable line for DTC





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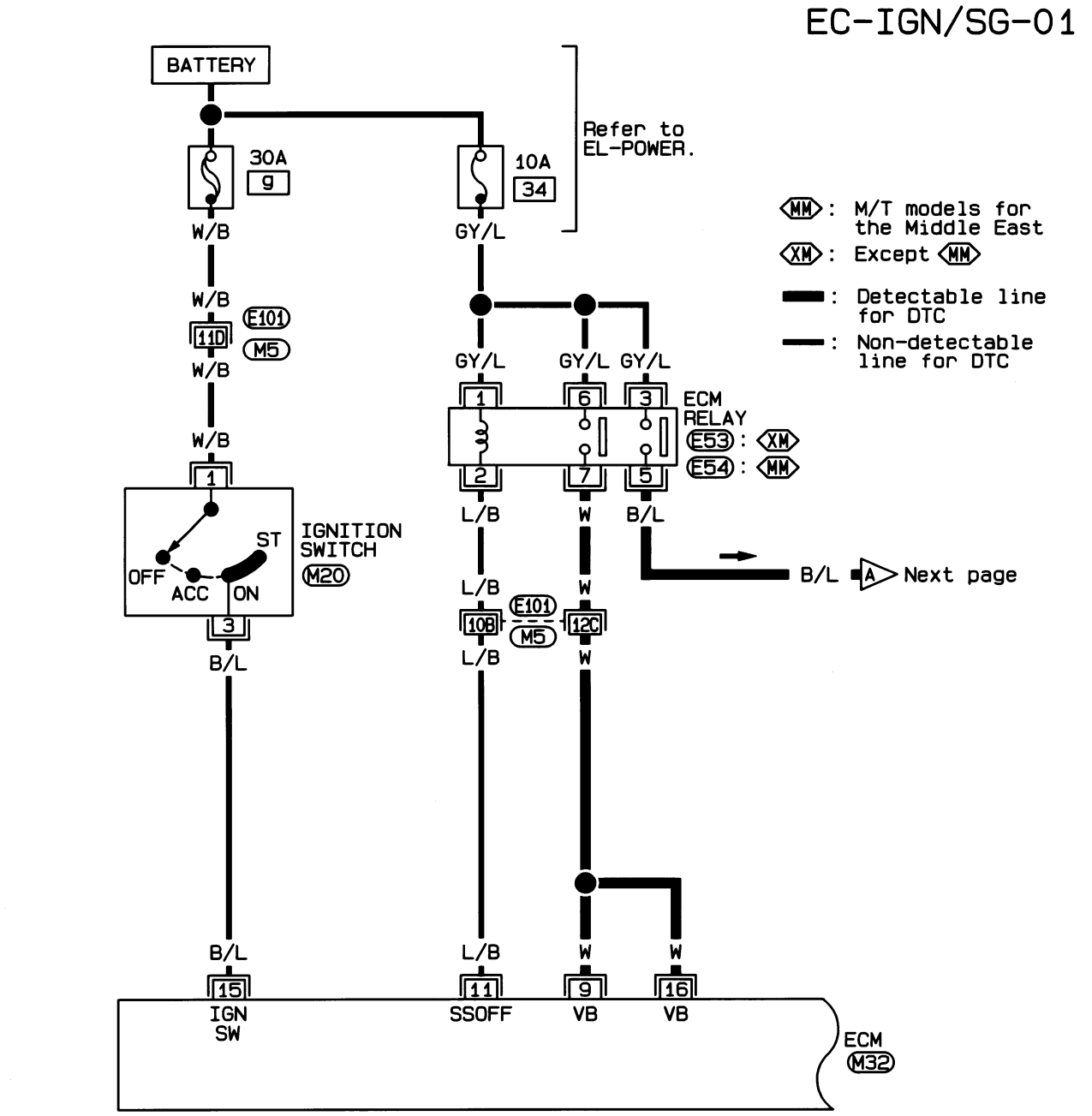
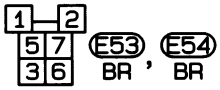
Ignition Signal

FOR LHD MODELS





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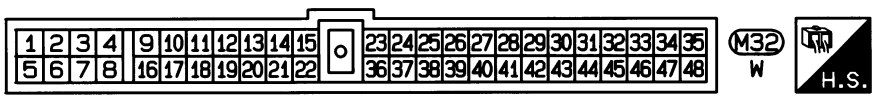

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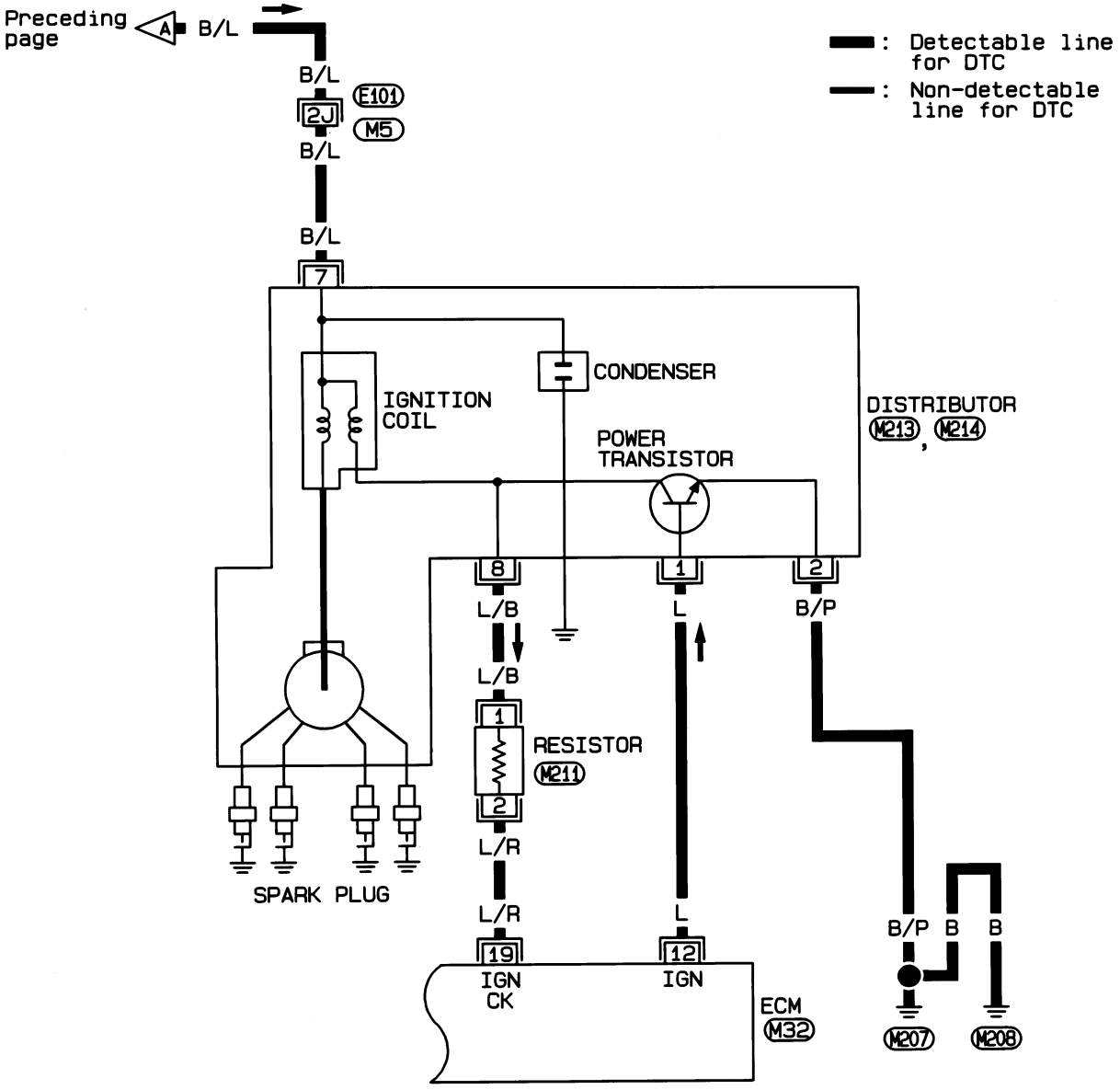
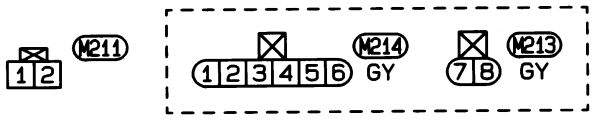
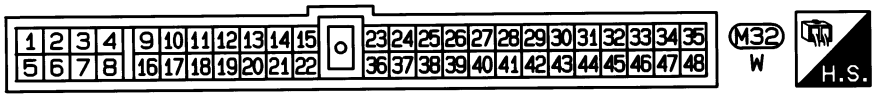
Ignition Signal (Cont’d)

EC-IGN/SG-02







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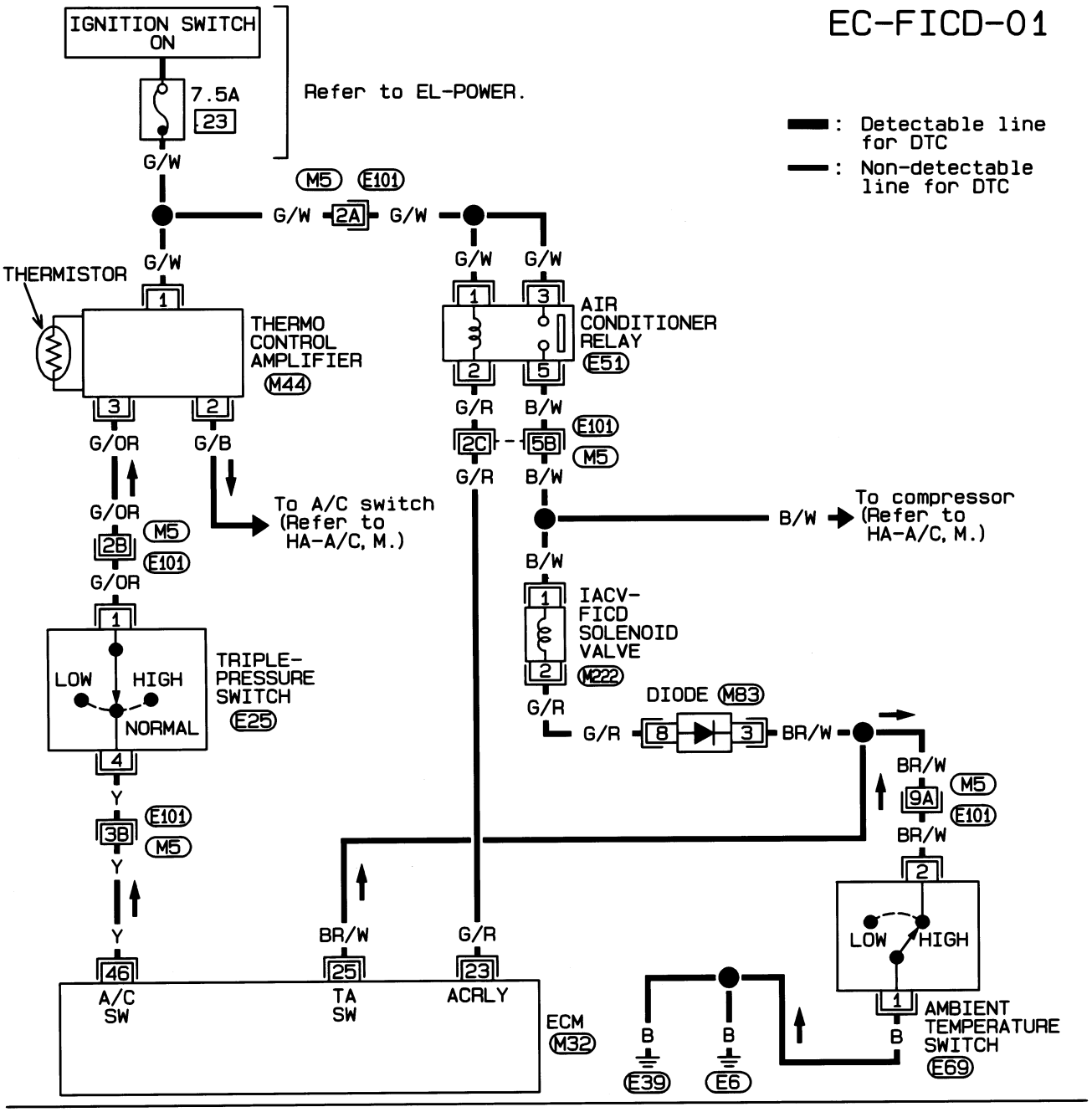
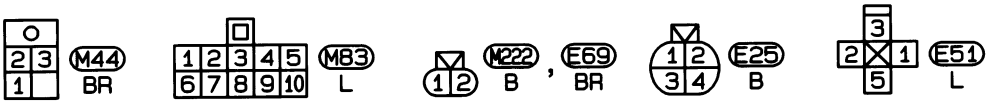
IACV-FICD Solenoid Valve

FOR LHD MODELS





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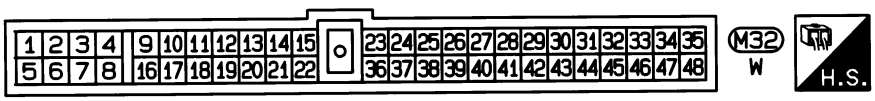

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Alphabetical & Numerical Index for DTC

ALPHABETICAL INDEX FOR DTC

X: Applicable
—: Not applicable

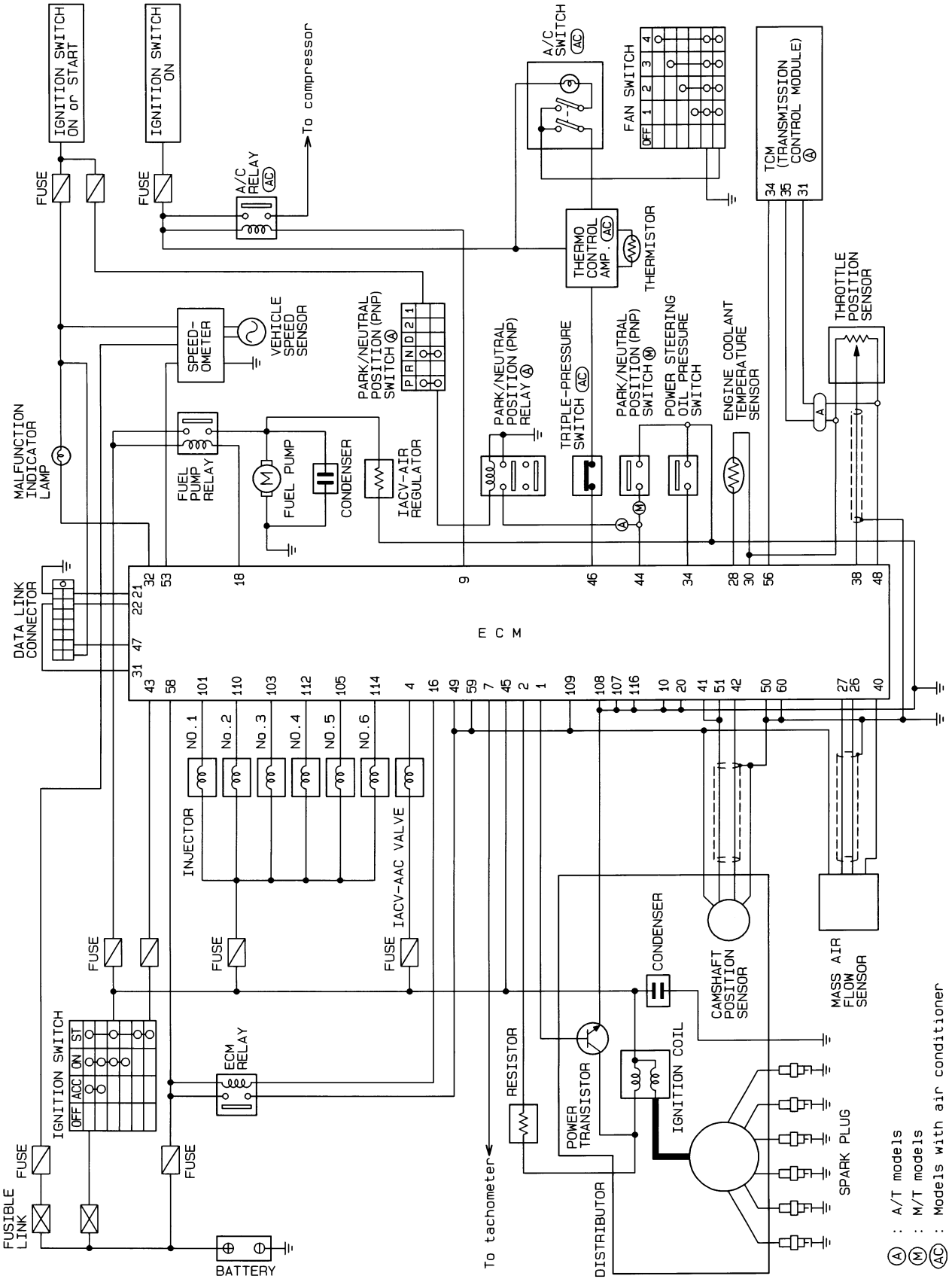
Items (CONSULT-II screen terms)	DTC	MIL illumination	Reference page
CAMSHAFT POSI SEN	11	—	EC-67
COOLANT TEMP SEN	13	X	EC-79
IGN SIGNAL-PRIMARY	21	—	EC-84
MASS AIR FLOW SEN	12	—	EC-74
NO SELF DIAGNOSTIC FAILURE INDICATED	**55**	**—**	**—**
OVER HEAT	28	X	EC-90
THROTTLE POSI SEN	43	—	EC-93

NUMERICAL INDEX FOR DTC

X: Applicable
—: Not applicable

DTC	MIL illumination	Items (CONSULT-II screen terms)	Reference page
11	—	CAMSHAFT POSI SEN	EC-67
12	—	MASS AIR FLOW SEN	EC-74
13	X	COOLANT TEMP SEN	EC-79
21	—	IGN SIGNAL-PRIMARY	EC-84
28	X	OVER HEAT	EC-90
43	—	THROTTLE POSI SEN	EC-93
55	**—**	**NO SELF DIAGNOSTIC FAILURE INDICATED**	—

Circuit Diagram



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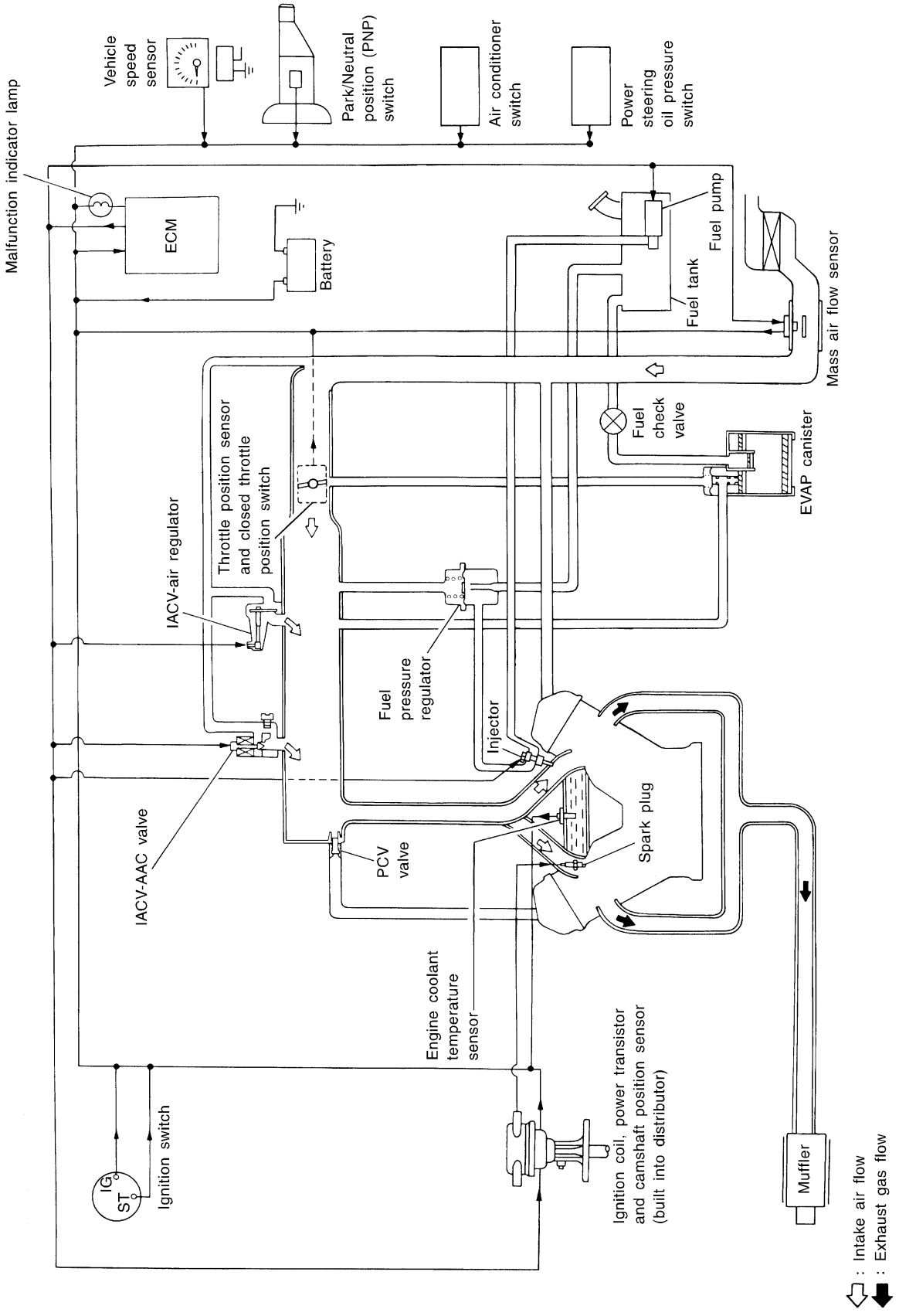
System Diagram



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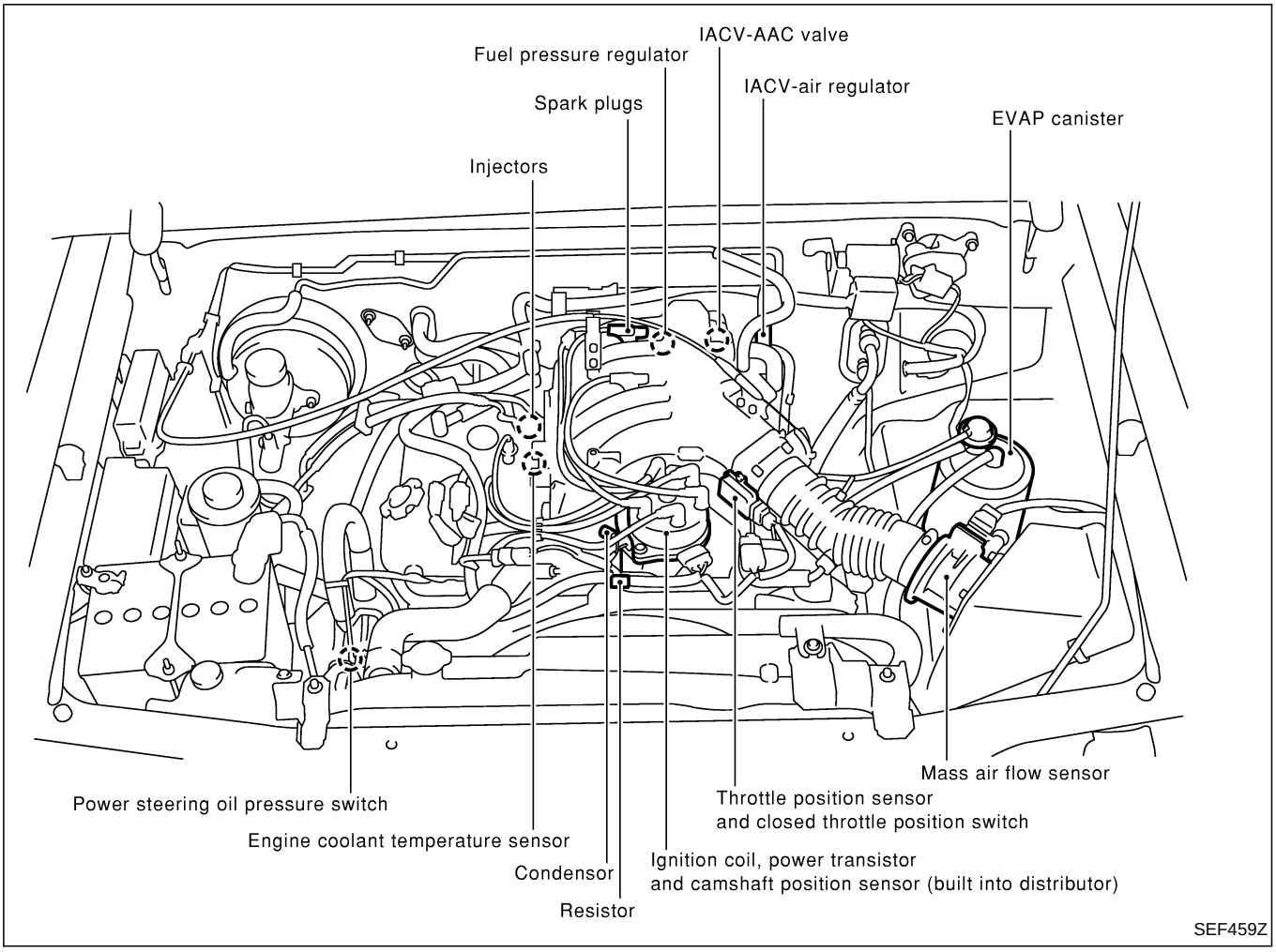
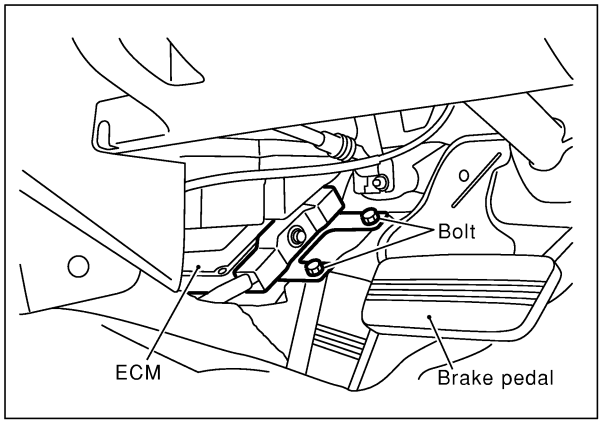
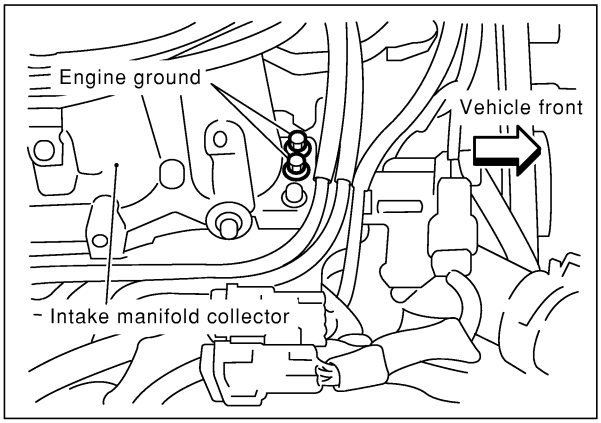
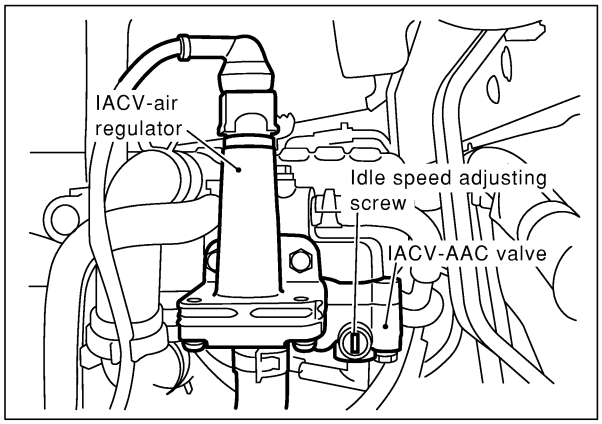
Engine Control Component Parts Location

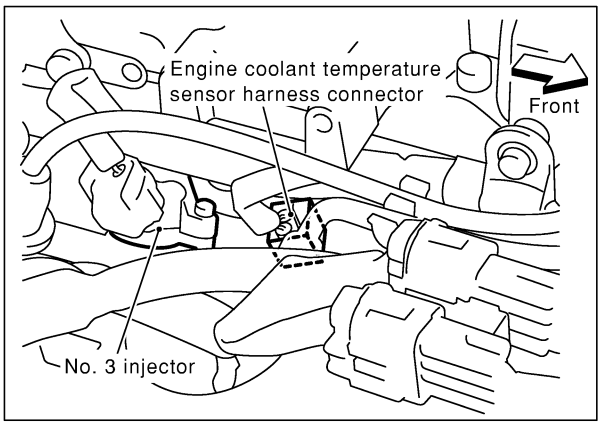


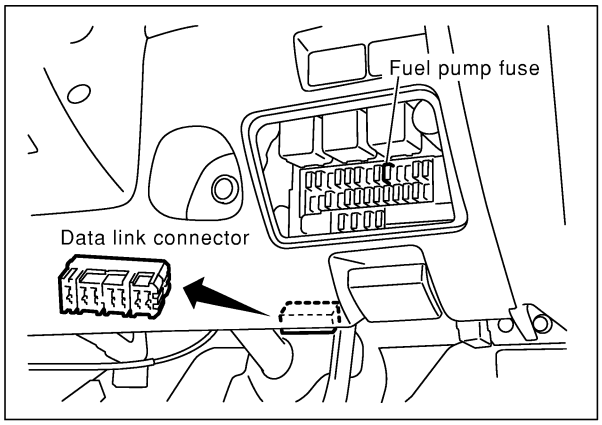
Engine Control Component Parts Location (Cont'd)

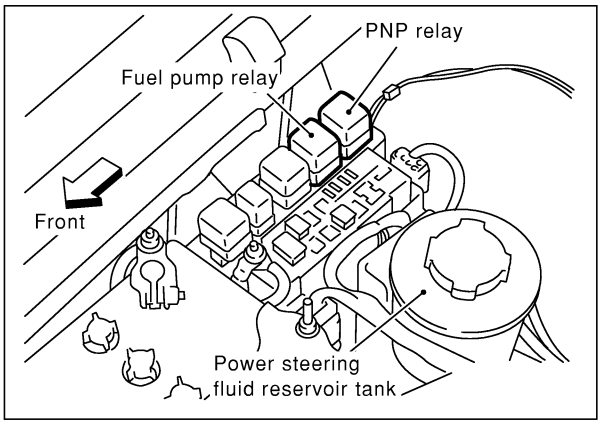


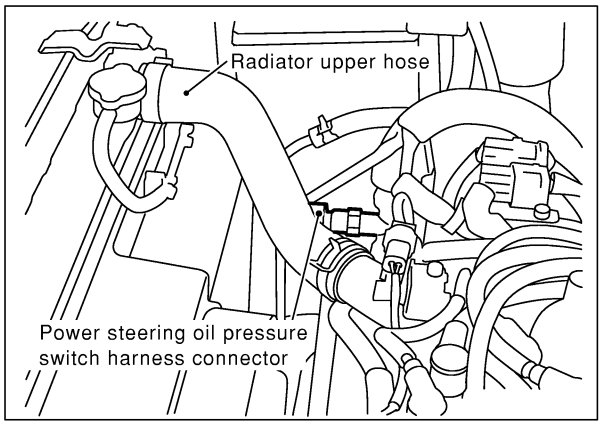












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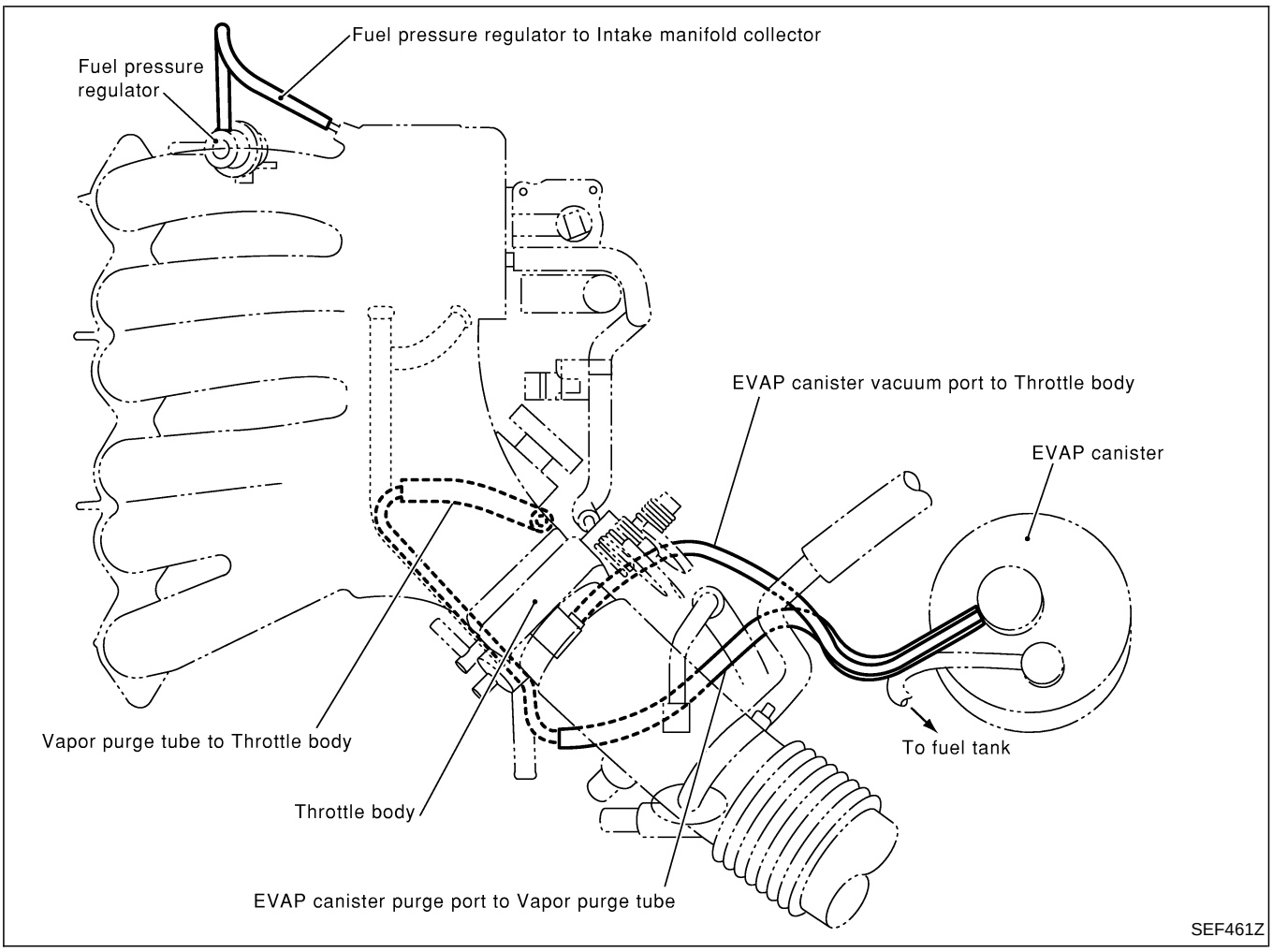
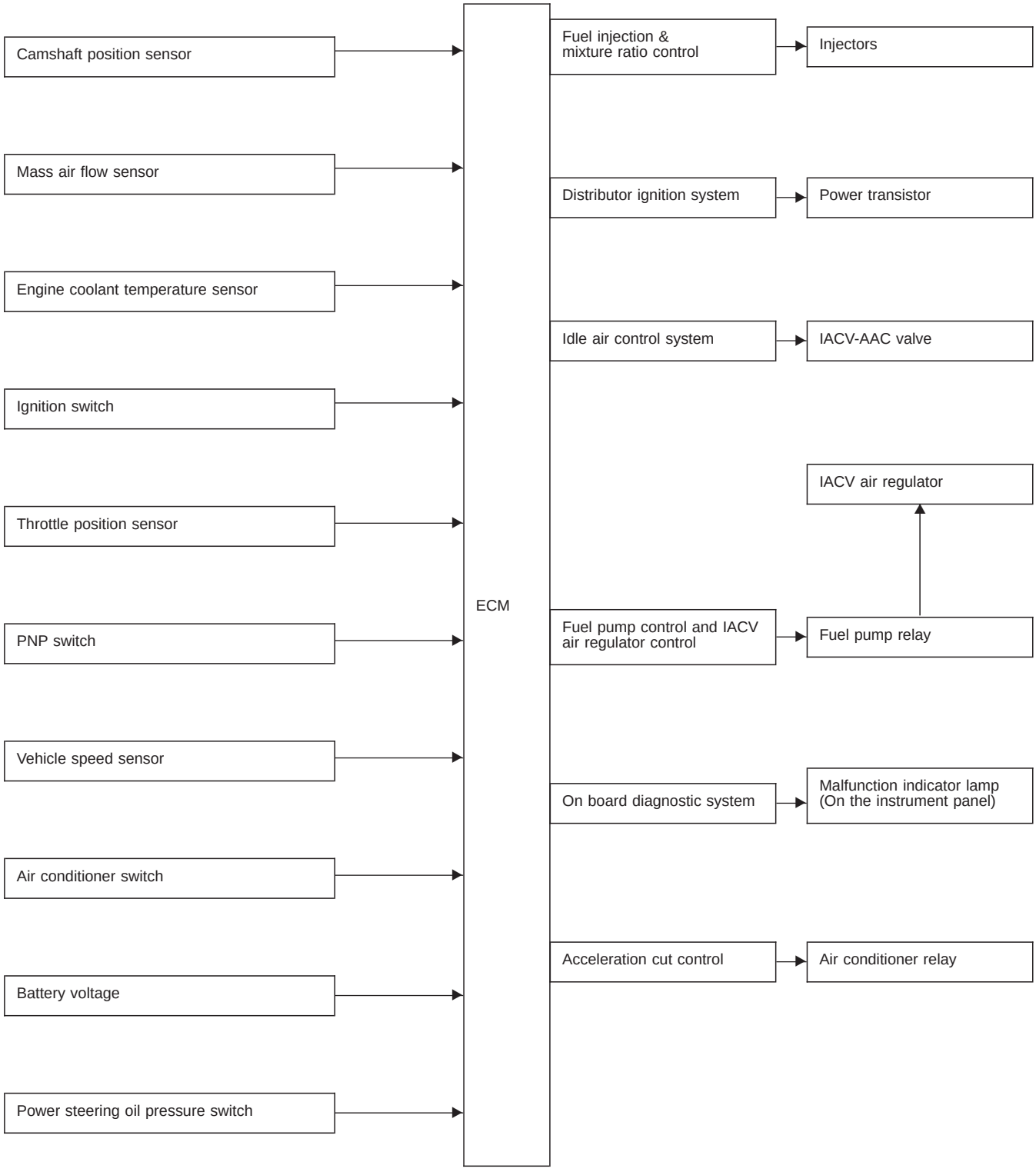
Vacuum Hose Drawing

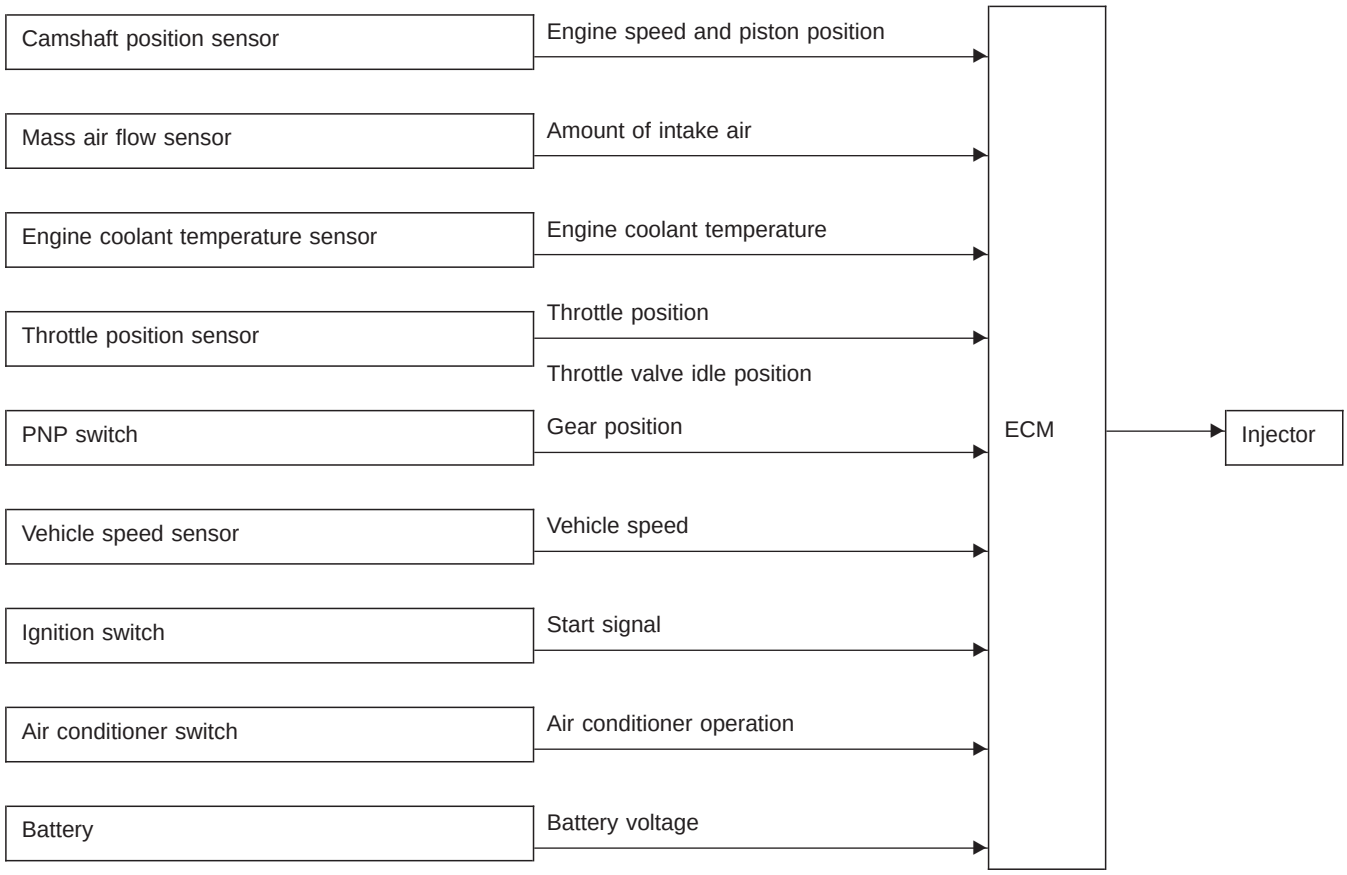


System Chart



Multiport Fuel Injection (MFI) System

INPUT/OUTPUT SIGNAL LINE



BASIC MULTIPORT FUEL INJECTION SYSTEM

The amount of fuel injected from the fuel injector is determined by the ECM. The ECM controls the length of time the valve remains open (injection pulse duration). The amount of fuel injected is a program value in the ECM memory. The program value is preset by engine operating conditions. These conditions are determined by input signals (for engine speed and intake air) from both the camshaft position sensor and the mass air flow sensor.

VARIOUS FUEL INJECTION INCREASE/DECREASE COMPENSATION

The amount of fuel injected is compensated for to improve engine performance. This will be made under various operating conditions as listed below.

<Fuel increase>

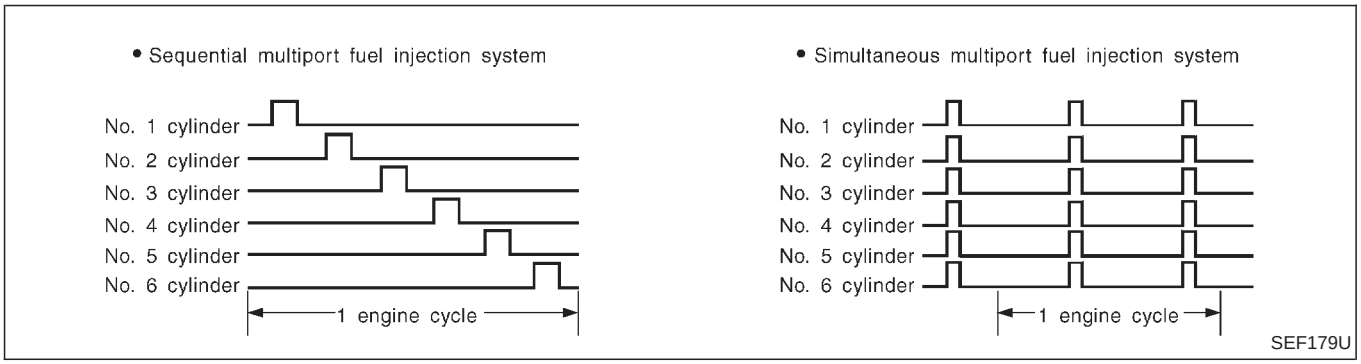
- During warm-up
- When starting the engine
- During acceleration
- Hot-engine operation
- High-load, high-speed operation

<Fuel decrease>

- During deceleration
- During high-engine speed operation
- Extremely high-engine coolant temperature

Multiport Fuel Injection (MFI) System (Cont'd)

FUEL INJECTION SYSTEM



Two types of systems are used.

Sequential multiport fuel injection system

Fuel is injected into each cylinder during each engine cycle according to the firing order. This system is used when the engine is running.

Simultaneous multiport fuel injection system

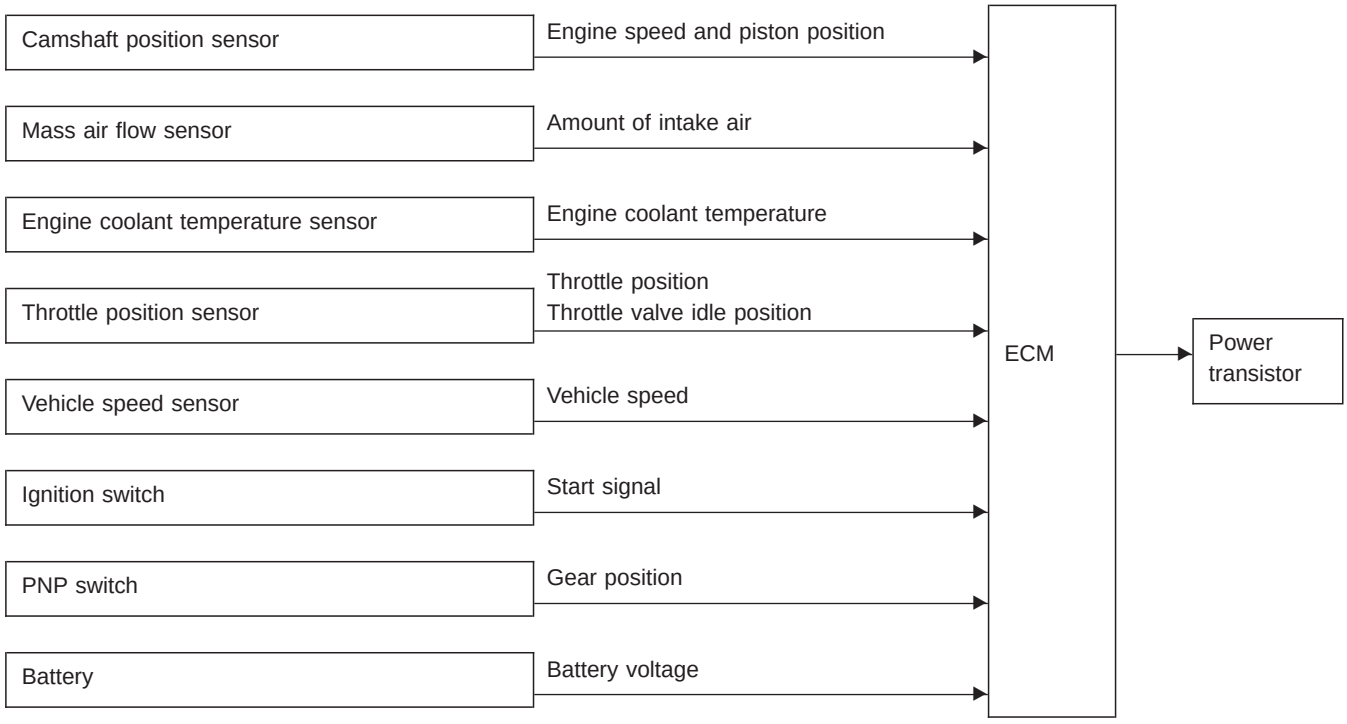
Fuel is injected simultaneously into all six cylinders twice each engine cycle. In other words, pulse signals of the same width are simultaneously transmitted from the ECM.
The six injectors will then receive the signals two times for each engine cycle.
This system is used when the engine is being started and/or if the fail-safe system (CPU) is operating.

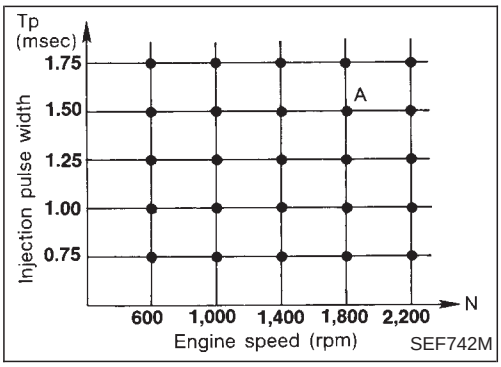
FUEL SHUT-OFF

Fuel to each cylinder is cut off during deceleration or operation of the engine at excessively high speeds.

Distributor Ignition (DI) System

INPUT/OUTPUT SIGNAL LINE





SYSTEM DESCRIPTION

The ignition timing is controlled by the ECM to maintain the best air-fuel ratio for every running condition of the engine.
The ignition timing data is stored in the ECM. This data forms the map shown left.
The ECM detects information such as the injection pulse width and camshaft position sensor signal. Responding to this information, ignition signals are transmitted to the power transistor.

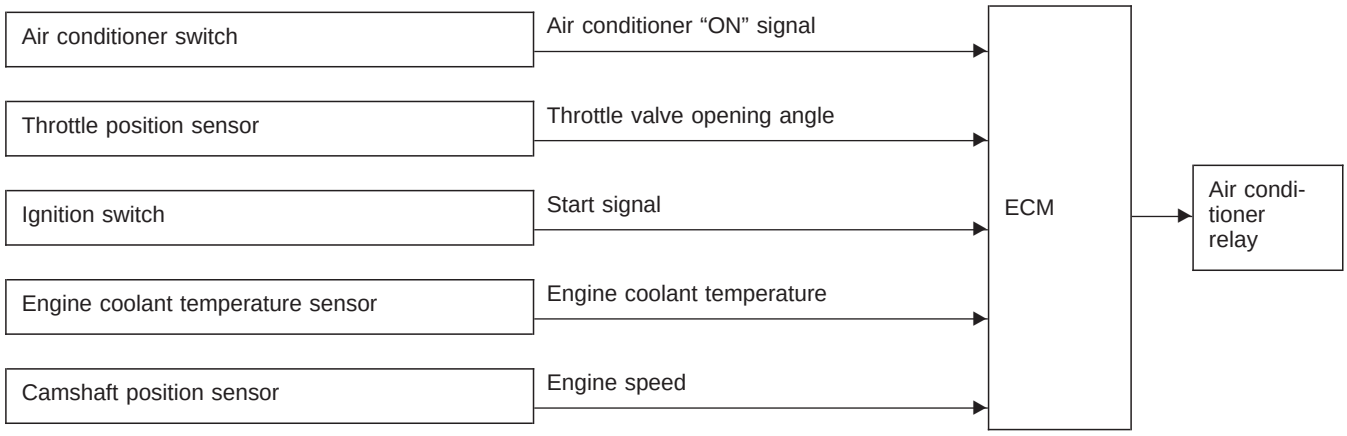
e.g. N: 1,800 rpm, Tp: 1.50 msec
A °BTDC

During the following conditions, the ignition timing is revised by the ECM according to the other data stored in the ECM.

1 At starting
2 During warm-up
3 At idle
4 Hot-engine operation
5 At acceleration

Air Conditioning Cut Control

INPUT/OUTPUT SIGNAL LINE



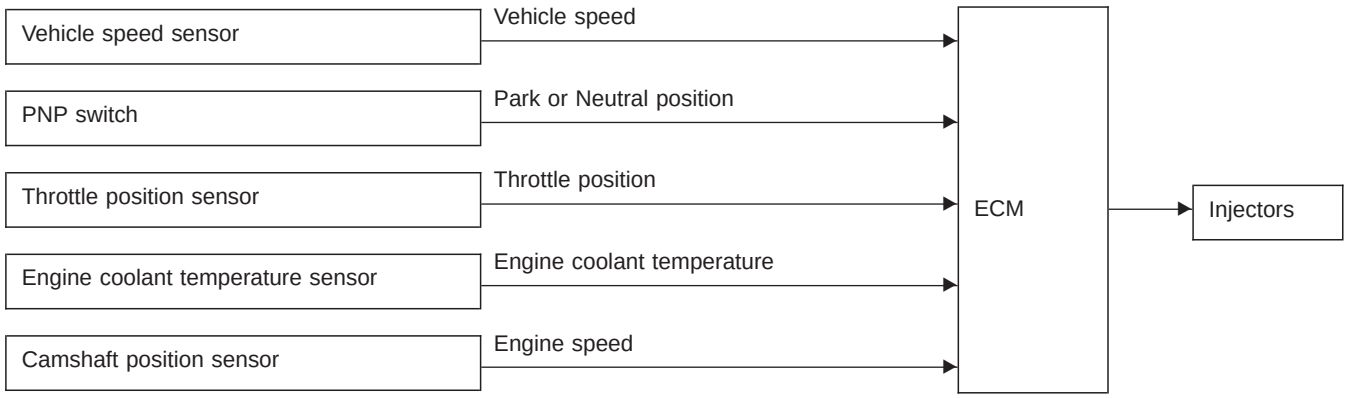
SYSTEM DESCRIPTION

This system improves engine operation when the air conditioner is used.
Under the following conditions, the air conditioner is turned off.

- When the accelerator pedal is fully depressed
- When cranking the engine
- When the engine coolant temperature becomes excessively high
- When the engine speed is excessively high

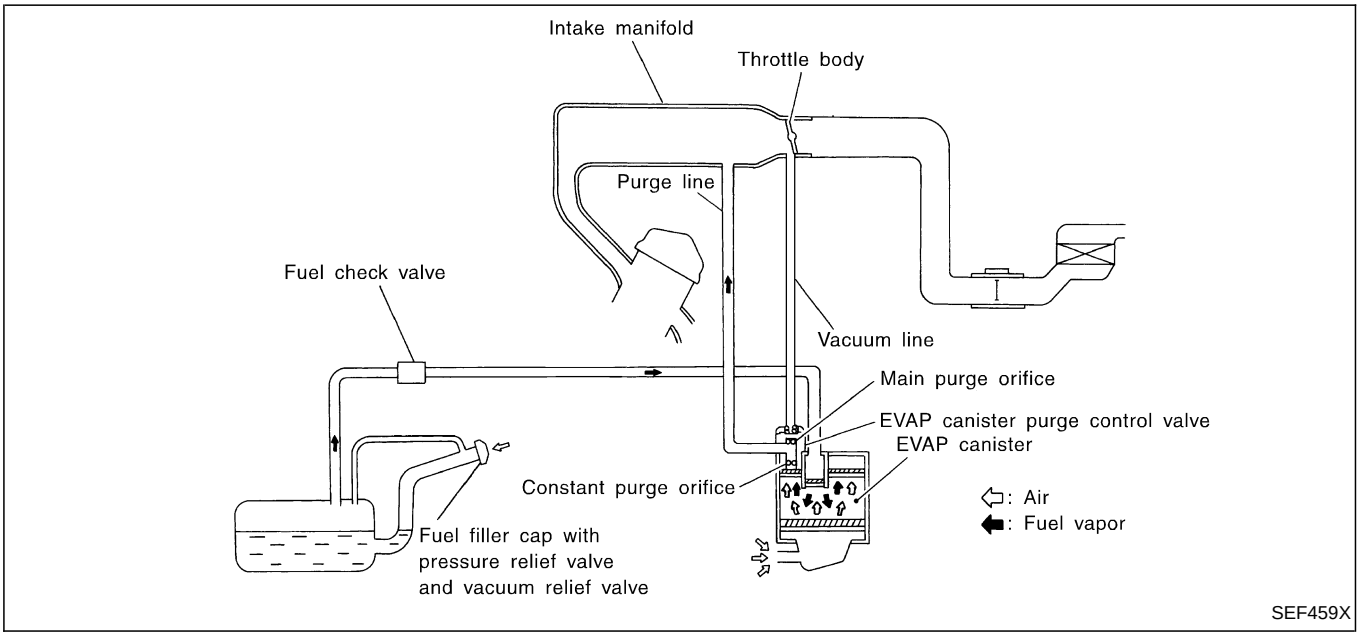
Fuel Cut Control (at no load & high engine speed)

INPUT/OUTPUT SIGNAL LINE



If the engine speed is above 3,000 rpm with no load (for example, in neutral and engine speed over 3,000 rpm) fuel will be cut off after some time. The exact time when the fuel is cut off varies based on engine speed.
Fuel cut will operate until the engine speed reaches 1,000 rpm, then fuel cut is cancelled.
NOTE:
This function is different than deceleration control listed under multiport fuel injection on EC-17.

Description



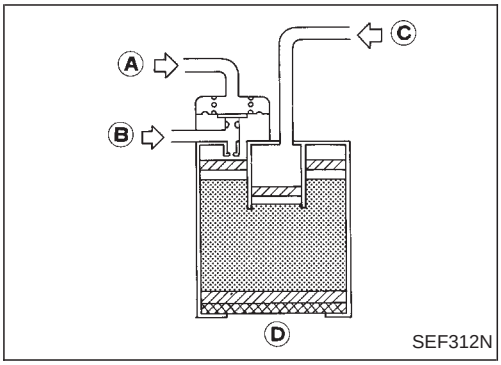
The evaporative emission system is used to reduce hydrocarbons emitted into the atmosphere from the fuel system. This reduction of hydrocarbons is accomplished by activated charcoals in the EVAP canister.

The fuel vapor from sealed fuel tank is led into the EVAP canister when the engine is off. The fuel vapor is then stored in the EVAP canister. The EVAP canister retains the fuel vapor until the EVAP canister is purged by air.

When the engine is running, the air is drawn through the bottom of the EVAP canister. The fuel vapor will then be led to the intake manifold.

When the engine runs at idle, the EVAP canister purge control valve is closed. Only a small amount of vapor flows into the intake manifold through the constant purge orifice.

As the engine speed increases and the throttle vacuum rises, the EVAP canister purge control valve opens. The vapor is sucked through both main purge and constant purge orifices.



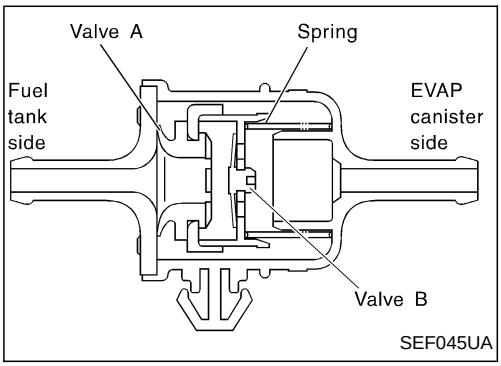
Inspection

EVAP CANISTER

Check EVAP canister as follows:

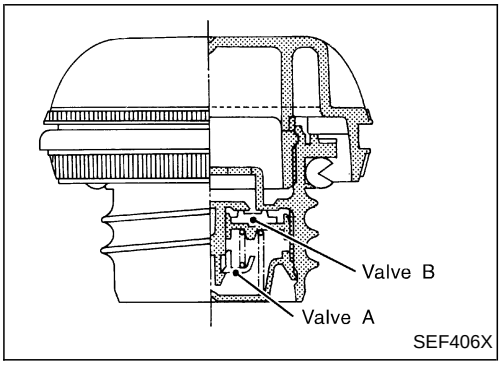
1. Blow air in port Ⓐ and check that there is no leakage.
2. Apply vacuum to port Ⓐ. [Approximately −13.3 to −20.0 kPa (−133 to −200 mbar, −100 to −150 mmHg, −3.94 to −5.91 inHg)]
3. Cover port Ⓓ by hand.
4. Blow air in port Ⓒ and check that it flows freely out of port Ⓑ.

Inspection (Cont'd)



FUEL CHECK VALVE

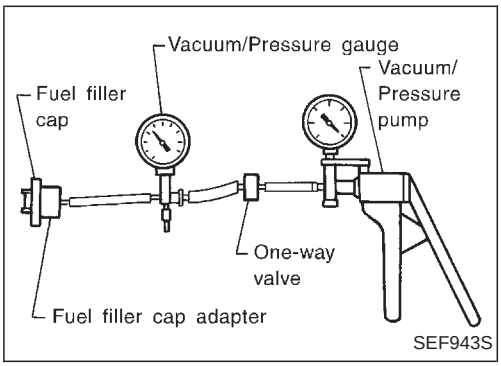
1. Blow air through connector on fuel tank side.
   A considerable resistance should be felt and a portion of air flow should be directed toward the EVAP canister side.
2. Blow air through connector on EVAP canister side.
   Air flow should be smoothly directed toward fuel tank side.
3. If fuel check valve is suspected of not properly functioning in steps 1 and 2 above, replace it.

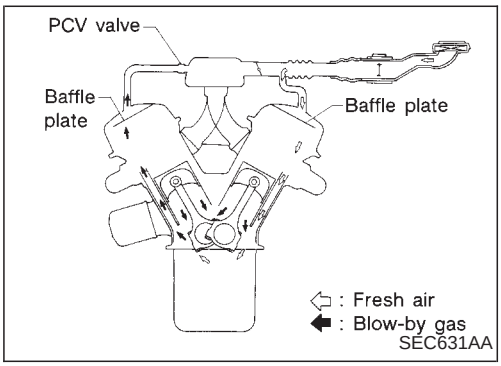


FUEL TANK VACUUM RELIEF VALVE

1. Wipe clean valve housing.
2. Check valve opening pressure and vacuum.
   Pressure:
   16.0 - 20.0 kPa (0.16 - 0.20 bar, 0.163 - 0.204 kg/cm^2, 2.32 - 2.90 psi)
   Vacuum:
   −6.0 to −3.4 kPa (−0.060 to −0.034 bar, −0.061 to −0.034 kg/cm^2, −0.87 to −0.49 psi)
3. If out of specification, replace fuel filler cap as an assembly.

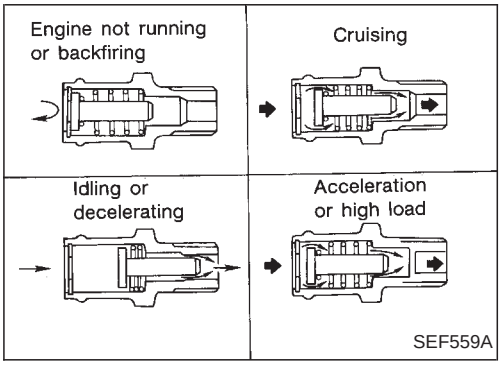
CAUTION:
Use only a genuine fuel filler cap as a replacement.

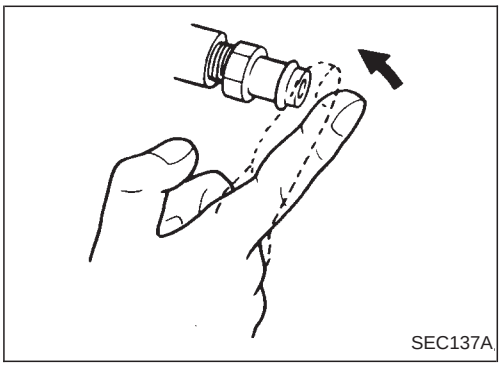




Description

This system returns blow-by gas to the intake manifold.
The positive crankcase ventilation (PCV) valve is provided to conduct crankcase blow-by gas to the intake manifold.
During partial throttle operation of the engine, the intake manifold sucks the blow-by gas through the PCV valve.
Normally, the capacity of the valve is sufficient to handle any blow-by and a small amount of ventilating air.
The ventilating air is then drawn from the air inlet tubes into the crankcase. In this process the air passes through the hose connecting air inlet tubes to rocker cover.
Under full-throttle condition, the manifold vacuum is insufficient to draw the blow-by flow through the valve. The flow goes through the hose connection in the reverse direction.
On vehicles with an excessively high blow-by, the valve does not meet the requirement. This is because some of the flow will go through the hose connection to the air inlet tubes under all conditions.

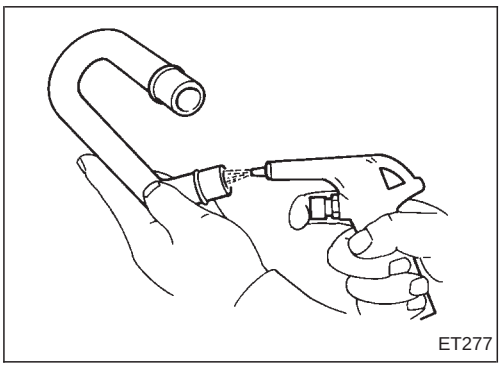




Inspection

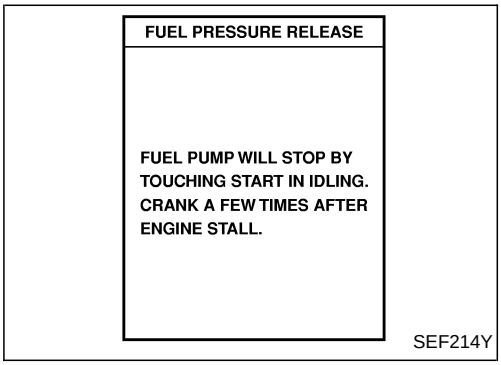
PCV (Positive Crankcase Ventilation) VALVE

With engine running at idle, remove PCV valve ventilation hose from PCV valve; if the valve is working properly, a hissing noise will be heard as air passes through it and a strong vacuum should be felt immediately when a finger is placed over valve inlet.



PCV VALVE VENTILATION HOSE

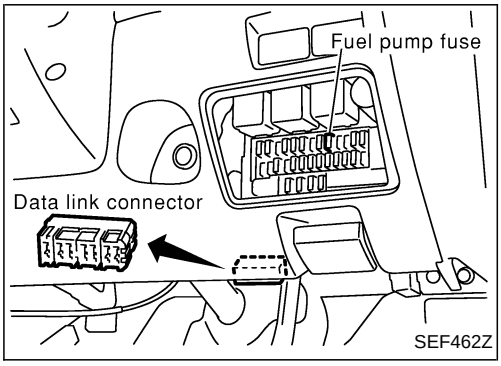
1. Check hoses and hose connections for leaks.
2. Disconnect all hoses and clean with compressed air. If any hose cannot be freed of obstructions, replace.



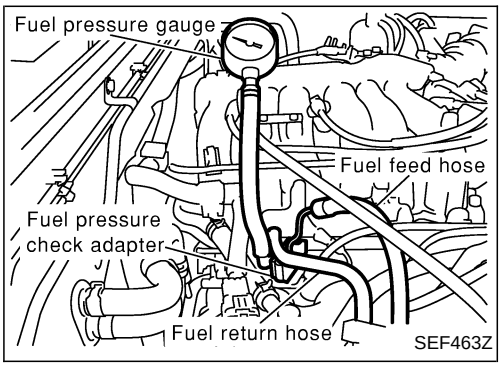
Fuel Pressure Release

Before disconnecting fuel line, release fuel pressure from fuel line to eliminate danger.

1. Start engine.
2. Perform “FUEL PRES RELEASE” in “WORK SUPPORT” mode with CONSULT-II.
   (Touch “START” and after engine stalls, crank it two or three times to release all fuel pressure.)
3. Turn ignition switch off.



1. Remove fuse for fuel pump.
2. Start engine.
3. After engine stalls, crank it two or three times to release all fuel pressure.
4. Turn ignition switch off and reconnect fuel pump fuse.



Fuel Pressure Check

- **When reconnecting fuel line, always use new clamps.**
- **Make sure that clamp screw does not contact adjacent parts.**
- **Use a torque driver to tighten clamps.**
- **Use Pressure Gauge to check fuel pressure.**

1. Release fuel pressure to zero, refer to above.
2. Disconnect fuel feed hose (engine side).
   : 8.4 - 10.8 N·m (0.85 - 1.1 kg-m, 74 - 95 in-lb)
3. Install pressure gauge between fuel feed hose and fuel tube using a fuel check adapter (SST).
4. Start engine and check for fuel leakage.
5. Read the indication of fuel pressure gauge.

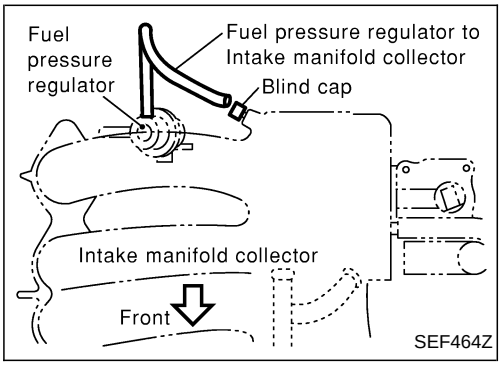
   At idling:

   Approximately 235 kPa (2.35 bar, 2.4 kg/cm^2, 34 psi)

   A few seconds after ignition switch is turned OFF to ON:

   Approximately 294 kPa (2.94 bar, 3.0 kg/cm^2, 43 psi)

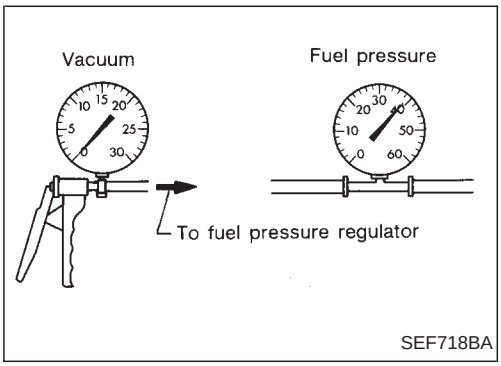
If results are unsatisfactory, perform Fuel Pressure Regulator Check.



Fuel Pressure Regulator Check

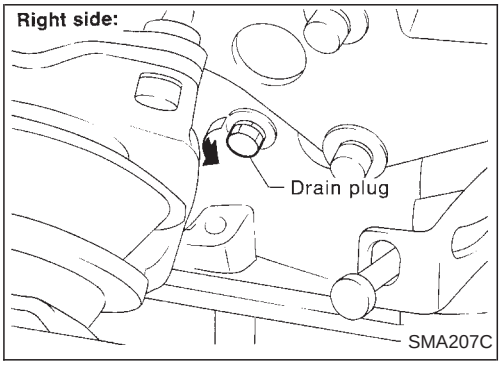
1. Stop engine and disconnect fuel pressure regulator vacuum hose from intake manifold collector.
2. Plug intake manifold with a blind cap.
3. Connect variable vacuum source to fuel pressure regulator.

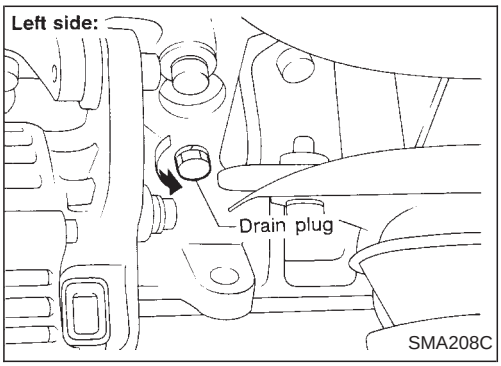
Fuel Pressure Regulator Check (Cont'd)



4. Start engine and read indication of fuel pressure gauge as vacuum is changed.

Fuel pressure should decrease as vacuum increases. If results are unsatisfactory, replace fuel pressure regulator.





Injector

REMOVAL AND INSTALLATION

1. Release fuel pressure to zero. Refer to EC-24.
2. Drain coolant by removing drain plugs from both sides of cylinder block.
3. Separate accelerator control wire from intake manifold collector.
4. Remove intake manifold collector from engine.
   The following parts should be disconnected or removed.

a. Harness connectors for
- IACV-AAC valve
- IACV air regulator
- Throttle position sensor and closed throttle position switch assembly
- Ground harness

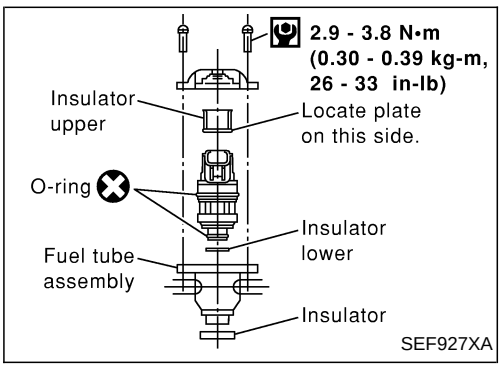
b. PCV valve ventilation hoses
c. Vacuum hoses for
- Brake booster
- Fuel pressure regulator
- EVAP canister

d. Air hoses from
- Air duct
- IACV-air regulator

e. Water hoses for
- Throttle body
- IACV-air regulator

f. EVAP canister purge hose

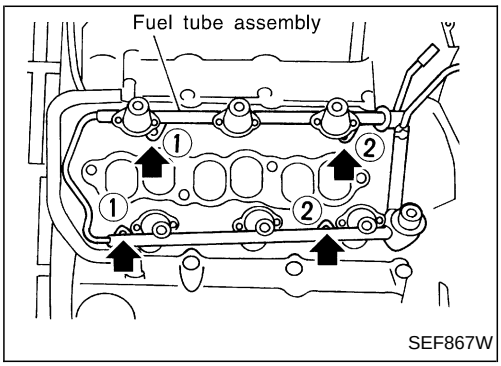
5. Remove injector fuel tube assembly.
   The following parts should be disconnected or removed.
- Vacuum hose for fuel pressure regulator
- Fuel feed and return hose
- All injectors harness connectors
- **Push injector tail piece.**
- **Do not pull on connector.**
- **Do not extract injector by pinching.**



6. Push out any malfunctioning injector from injector fuel tube.
7. Replace or clean injector as necessary.
- Always replace O-rings with new ones.
- Lubricate O-rings with engine oil.

8. Install injector to injector fuel tube assembly.

Injector (Cont'd)



9. Install injectors with fuel tube assembly to intake manifold.
   Tighten in numerical order shown in the figure.
   a. First, tighten all bolts to 4.9 to 6.0 N·m (0.5 to 0.61 kg-m, 3.6 to 4.4 ft-lb).
   b. Then, tighten all bolts to 10.8 to 14.7 N·m (1.1 to 1.5 kg-m, 8 to 11 ft-lb).
10. Reinstall any part removed in reverse order of removal.

CAUTION:

After properly connecting fuel hose to injector and fuel tube, check connection for fuel leakage.

Introduction

The ECM has an on board diagnostic system, which detects malfunctions related to engine sensors or actuators. Self-diagnosis items are listed in “DIAGNOSTIC TROUBLE CODE INDEX”, EC-10.

The malfunction indicator lamp (MIL) on the instrument panel lights up when a malfunction is detected, or when the ECM enters fail-safe mode (Refer to EC-49.).

Diagnostic Trouble Code (DTC)

HOW TO CONFIRM MALFUNCTION ITEMS

Malfunction items can be confirmed by the following methods.

1. The number of blinks of the malfunction indicator lamp in the Diagnostic Test Mode II (Self- Diagnostic Results) indicates the DTC. Examples: 11, 21 etc.
2. CONSULT-II displays the malfunctioning component or system in “SELF DIAGNOSTIC RESULTS” mode.

- **Output of a DTC indicates a malfunction. However, Mode II does not indicate whether the malfunction is still occurring or has occurred in the past and has returned to normal.**
  CONSULT-II can identify malfunction status as shown below. Therefore, using CONSULT-II (if available) is recommended.

SELF DIAG RESULTS	
DTC RESULTS	TIME
COOLANT TEMP SEN	0

SEF469Z

A sample of CONSULT-II display is shown at left. The malfunction is displayed in SELF-DIAGNOSTIC RESULTS mode of CONSULT-II. Time data indicates how many times the vehicle was driven after the last detection of a malfunction.
If the malfunction is being detected currently, the time data will be “0”.

HOW TO ERASE DTC

The DTC can be erased from the back-up memory in the ECM by the following methods.

Selecting “ERASE” in the SELF- DIAG RESULTS” mode with CONSULT-II

Changing the diagnostic test mode from Diagnostic Test Mode II to Mode I by connecting the data link connector terminals. Refer to EC-30.

- **If the battery terminal is disconnected, the DTC will be lost within 24 hours.**
- **Erasing the DTC, using CONSULT-II is easier and quicker than connecting the data link connector terminals.**

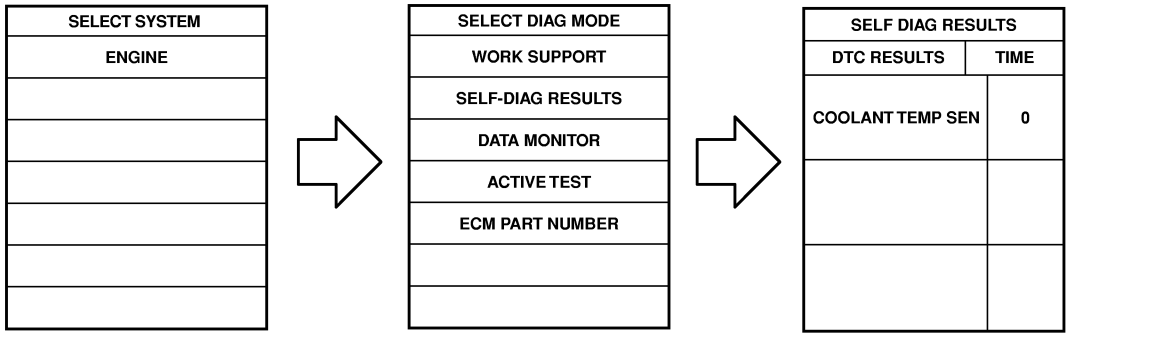
Diagnostic Trouble Code (DTC) (Cont'd)

How to erase DTC (With CONSULT-II)

1. If the ignition switch stays "ON" after repair work, be sure to turn ignition switch "OFF" once. Wait at least 5 seconds and then turn it "ON" (engine stopped) again.
2. Turn CONSULT-II "ON" and touch "ENGINE".
3. Touch "SELF-DIAG RESULTS".
4. Touch "ERASE". (The DTC in the ECM will be erased.)

How to erase DTC (With CONSULT-II)

1. If the ignition switch stays "ON" after repair work, be sure to turn ignition switch "OFF" once. Wait at least 5 seconds and then turn it "ON" again.

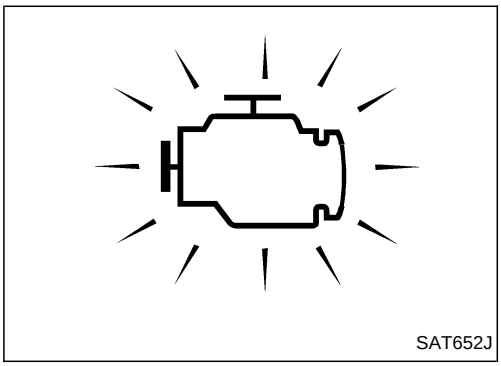


2. Turn **CONSULT-II** "ON" and touch "ENGINE".
3. Touch "SELF-DIAG RESULTS".
4. Touch "ERASE". (The DTC in the ECM will be erased.)

SEF470Z

How to erase DTC (Without CONSULT-II)

1. If the ignition switch stays "ON" after repair work, be sure to turn ignition switch "OFF" once. Wait at least 5 seconds and then turn it "ON" again.
2. Change the diagnostic test mode from Mode II to Mode I by connecting the data link connector terminals. (See EC-30.)


SAT652J

Malfunction Indicator Lamp (MIL)

The malfunction indicator lamp is located on the instrument panel.

1. The malfunction indicator lamp will light up when the ignition switch is turned ON without the engine running. This is for checking the blown lamp.
   - If the malfunction indicator lamp does not light up, see the WARNING LAMPS in the EL section. (Or see EC-135.)
2. When the engine is started, the malfunction indicator lamp should go off.
   If the lamp remains on, the on board diagnostic system has detected an engine system malfunction.

ON BOARD DIAGNOSTIC SYSTEM FUNCTION

The on board diagnostic system has the following three functions.

Diagnostic Test Mode I

1. BULB CHECK : This function checks the bulb for damage (blown, open circuit, etc.) of the malfunction indicator lamp.
   If the MIL does not come on, check MIL circuit.
2. MALFUNCTION WARNING : This is a usual driving condition. When a malfunction is detected, the MIL will light up to inform the driver that a malfunction has been detected.

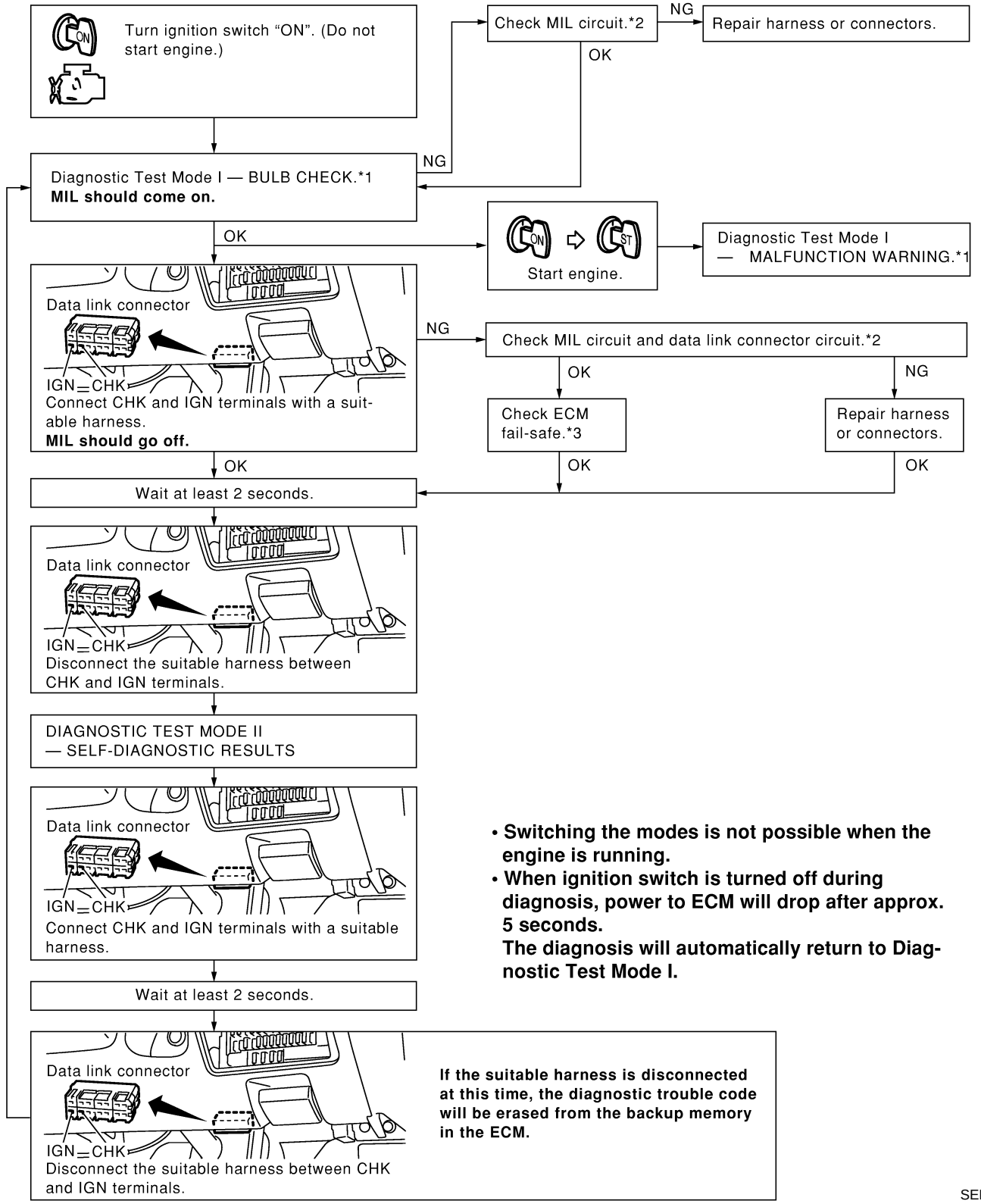
Diagnostic Test Mode II

3. SELF-DIAGNOSTIC RESULTS : This function allows DTCs to be read.

Condition		Diagnostic Test Mode I	Diagnostic Test Mode II
Ignition switch in "ON" position 	Engine stopped 	BULB CHECK	SELF-DIAGNOSTIC RESULTS
	Engine running 	MALFUNCTION WARNING	—

Malfunction Indicator Lamp (MIL) (Cont'd)

HOW TO SWITCH DIAGNOSTIC TEST MODES



- **Switching the modes is not possible when the engine is running.**
- **When ignition switch is turned off during diagnosis, power to ECM will drop after approx. 5 seconds.**
  The diagnosis will automatically return to Diagnostic Test Mode I.

SEF471Z

*1: EC-29 *2: EC-135 *3: EC-49

Malfunction Indicator Lamp (MIL) (Cont'd)

DIAGNOSTIC TEST MODE I—BULB CHECK

In this mode, the MALFUNCTION INDICATOR LAMP on the instrument panel should stay ON. If it remains OFF, check the bulb. (See the WARNING LAMPS AND CHIME in the EL section. Or see EC-135.)

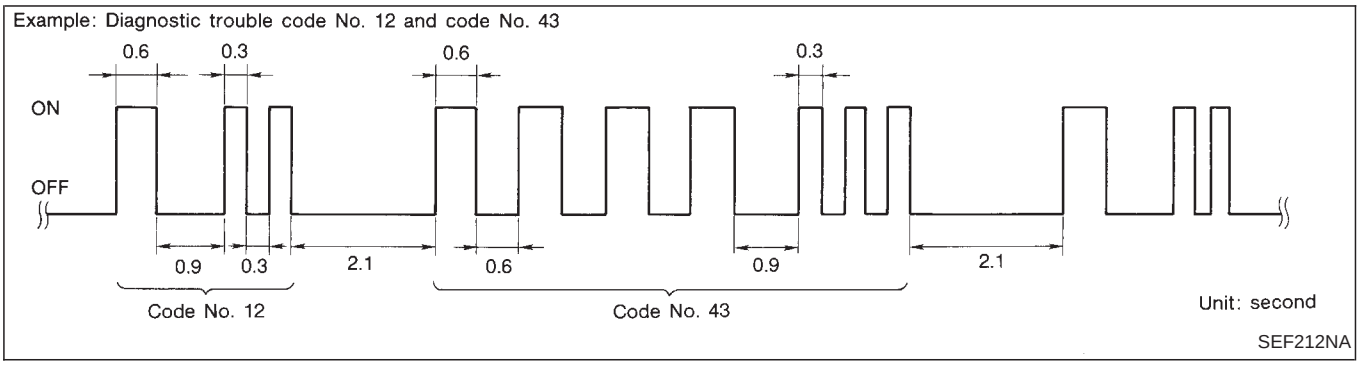
DIAGNOSTIC TEST MODE I—MALFUNCTION WARNING

MALFUNCTION INDICATOR LAMP	Condition
ON	When the malfunction is detected (Refer to EC-10.) or the ECM's CPU is malfunctioning.
OFF	No malfunction

- These Diagnostic Trouble Code Numbers are clarified in Diagnostic Test Mode II (SELF-DIAGNOSTIC RESULTS).

DIAGNOSTIC TEST MODE II—SELF-DIAGNOSTIC RESULTS

In this mode, a diagnostic trouble code is indicated by the number of blinks of the MALFUNCTION INDICATOR LAMP as shown below.

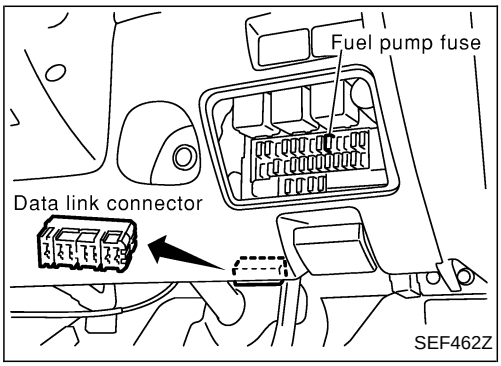


Long (0.6 second) blinking indicates the number of ten digits, and short (0.3 second) blinking indicates the number of single digits. For example, the malfunction indicator lamp blinks 4 times for about 5 seconds (0.6 sec x 8 times) and then it blinks three times for about 1 second (0.3 sec x 3 times). This indicates the DTC "43" and refers to the malfunction of the throttle position sensor.
In this way, all the detected malfunctions are classified by their diagnostic trouble code numbers. The DTC "55" refers to no malfunction. (See DIAGNOSTIC TROUBLE CODE INDEX, refer to page EC-10.)

How to erase diagnostic test mode II (Self-diagnostic results)

The diagnostic trouble code can be erased from the backup memory in the ECM when the diagnostic test mode is changed from Diagnostic Test Mode II to Diagnostic Test Mode I. (Refer to "HOW TO SWITCH DIAGNOSTIC TEST MODES".)

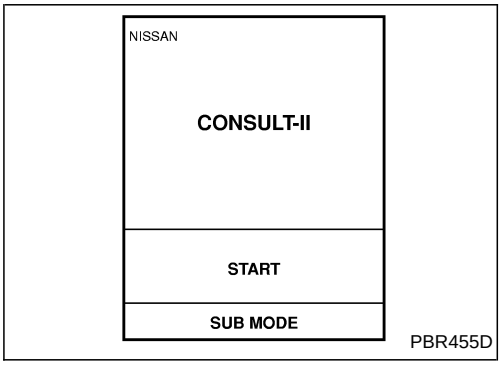
- **If the battery terminal is disconnected, the diagnostic trouble code will be lost from the backup memory within 24 hours.**
- **Be careful not to erase the stored memory before starting trouble diagnoses.**



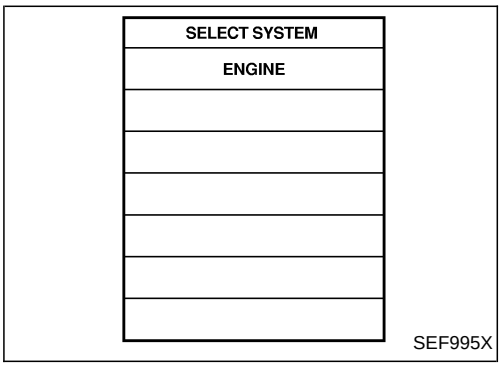
CONSULT-II

CONSULT-II INSPECTION PROCEDURE

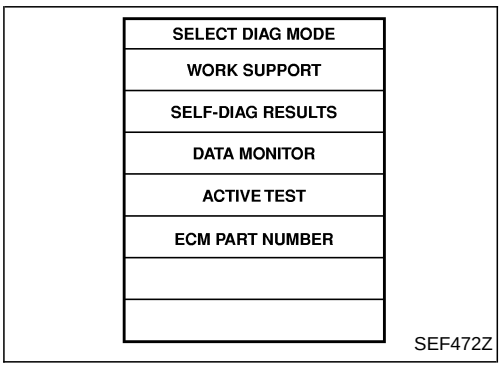
1. Turn off ignition switch.
2. Connect CONSULT-II to data link connector, which is located under the fuse box cover.



3. Turn on ignition switch.
4. Touch “START”.



5. Touch “ENGINE”.



6. Perform each diagnostic test mode according to each service procedure.

For further information, see the CONSULT-II Operation Manual.

CONSULT-II (Cont'd)

FUNCTION

Diagnostic test mode	Function
Work support	A technician can adjust some devices faster and more accurately by following indications on CONSULT-II.
Self-diagnostic results	Self-diagnostic results can be read and erased quickly.
Data monitor	Input/Output data in the ECM can be read.
Active test	CONSULT-II drives some actuators apart from the ECM's and also shifts some parameters in a specified range.
ECM part number	ECM part number can be read.

WORK SUPPORT MODE

WORK ITEM	CONDITION	USAGE
TP SW/TP SEN IDLE POSI ADJ	CHECK THE THROTTLE POSITION SENSOR SIGNAL. ADJUST IT TO THE SPECIFIED VALUE BY ROTATING THE SENSOR BODY UNDER THE FOLLOWING CONDITIONS. ● IGN SW "ON" ● ENG NOT RUNNING ● ACC PEDAL NOT PRESSED	When adjusting throttle position sensor initial position
IACV-AAC/V ADJ	SET ENGINE SPEED AT THE SPECIFIED VALUE UNDER THE FOLLOWING CONDITIONS. ● ENGINE WARMED UP ● NO-LOAD	—
FUEL PRESSURE RELEASE	● FUEL PUMP WILL STOP BY TOUCHING "START" DURING IDLING. CRANK A FEW TIMES AFTER ENGINE STALLS.	When releasing fuel pressure from fuel line

CONSULT-II (Cont'd)

ENGINE CONTROL COMPONENT PARTS/SYSTEMS APPLICATION

Item			DIAGNOSTIC TEST MODE			
			WORK SUPPORT	SELF-DIAGNOSTIC RESULTS	DATA MONITOR	ACTIVE TEST
ENGINE CONTROL COMPONENT PARTS	INPUT	Camshaft position sensor		X	X	
		Mass air flow sensor		X	X	
		Engine coolant temperature sensor		X	X	X
		Vehicle speed sensor			X	
		Throttle position sensor	X	X	X	
		Ignition switch (start signal)			X	
		Closed throttle position switch			X	
		Air conditioner switch			X	
		PNP switch			X	
		Power steering oil pressure switch			X	
		Battery voltage			X	
	OUTPUT	Injectors			X	
		Power transistor (Ignition timing)		X (Ignition signal)	X	X
		IACV-AAC valve	X		X	X
		Air conditioner relay			X	
		Fuel pump relay	X		X	X

X: Applicable

CONSULT-II (Cont'd)

SELF-DIAGNOSTIC MODE

Regarding items detected in "SELF-DIAG RESULTS" mode, refer to "DIAGNOSTIC TROUBLE CODE INDEX", EC-10.

DATA MONITOR MODE

Monitored item [Unit]	ECM input signals	Main signals	Description	Remarks
CMPS·RPM (POS) [rpm]	○	○	• Indicates the engine speed computed from the POS signal (1° signal) of the camshaft position sensor.	
MAS AIR/FL SE [V]	○	○	• The signal voltage of the mass air flow sensor is displayed.	• When the engine is stopped, a certain value is indicated.
COOLAN TEMP/S [°C] or [°F]	○	○	• The engine coolant temperature (determined by the signal voltage of the engine coolant temperature sensor) is displayed.	• When the engine coolant temperature sensor is open or short-circuited, ECM enters fail-safe mode. The engine coolant temperature determined by the ECM is displayed.
VHCL SPEED SE [km/h] or [mph]	○	○	• The vehicle speed computed from the vehicle speed sensor signal is displayed.	
BATTERY VOLT [V]	○	○	• The power supply voltage of ECM is displayed.	
THRTL POS SEN [V]	○	○	• The throttle position sensor signal voltage is displayed.	
START SIGNAL [ON/OFF]	○	○	• Indicates [ON/OFF] condition from the starter signal.	• After starting the engine, [OFF] is displayed regardless of the starter signal.
CLSD THL POS [ON/OFF]	○	○	• Indicates [ON/OFF] condition from the throttle position sensor signal.	
AIR COND SIG [ON/OFF]	○	○	• Indicates [ON/OFF] condition of the air conditioner switch as determined by the air conditioner signal.	
P/N POSI SW [ON/OFF]	○	○	• Indicates [ON/OFF] condition from the park/neutral position switch signal.	
PW/ST SIGNAL [ON/OFF]	○	○	• [ON/OFF] condition of the power steering oil pressure switch determined by the power steering oil pressure signal is indicated.	
INJ PULSE [msec]		○	• Indicates the actual fuel injection pulse width compensated by ECM according to the input signals.	• When the engine is stopped, a certain computed value is indicated.
IGN TIMING [BTDC]		○	• Indicates the ignition timing computed by ECM according to the input signals.	• When the engine is stopped, a certain value is indicated.
IACV-AAC/V [%]		○	• Indicates the idle air control valve (AAC valve) control value computed by ECM according to the input signals.	
AIR COND RLY [ON/OFF]		○	• The air conditioner relay control condition (determined by ECM according to the input signal) is indicated.	
FUEL PUMP RLY [ON/OFF]		○	• Indicates the fuel pump relay control condition determined by ECM according to the input signals.	
VOLTAGE [V]			• Voltage measured by the voltage probe.	

NOTE:
Any monitored item that does not match the vehicle being diagnosed is deleted from the display automatically.

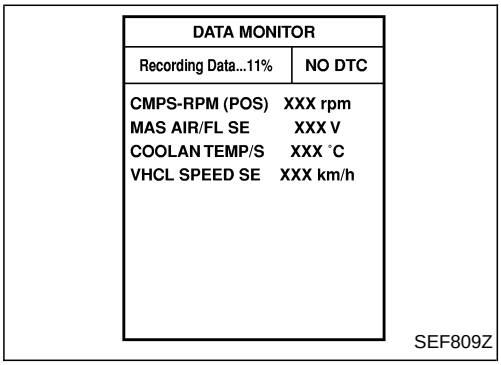
CONSULT-II (Cont'd)

Monitored item [Unit]	ECM input signals	Main signals	Description	Remarks
PULSE [msec] or [Hz] or [%]			● Pulse width, frequency or duty cycle measured by the pulse probe.	● Only "#" is displayed if item is unable to be measured. ● Figures with "#"s are temporary ones. They are the same figures as an actual piece of data which was just previously measured.

ACTIVE TEST MODE

TEST ITEM	CONDITION	JUDGEMENT	CHECK ITEM (REMEDY)
IACV-AAC/V OPENING	● Engine: After warming up, idle the engine. ● Change the IACV-AAC valve opening percent using CONSULT-II.	Engine speed changes according to the opening percent.	● Harness and connector ● IACV-AAC valve
ENG COOLANT TEMP	● Engine: Return to the original trouble condition ● Change the engine coolant temperature using CONSULT-II.	If trouble symptom disappears, see CHECK ITEM.	● Harness and connector ● Engine coolant temperature sensor ● Fuel injectors
IGNITION TIMING	● Engine: Return to the original trouble condition ● Timing light: Set ● Retard the ignition timing using CONSULT-II.	If trouble symptom disappears, see CHECK ITEM.	● Adjust ignition timing (by moving camshaft position sensor)
POWER BALANCE	● Engine: After warming up, idle the engine. ● A/C switch "OFF" ● Shift lever "N" ● Cut off each injector signal one at a time using CONSULT-II.	Engine runs rough or dies.	● Harness and connector ● Compression ● Injectors ● Ignition coil with power transistor ● Spark plugs
FUEL PUMP RELAY	● Ignition switch: ON (Engine stopped) ● Turn the fuel pump relay "ON" and "OFF" using CONSULT-II and listen to operating sound.	Fuel pump relay makes the operating sound.	● Harness and connector ● Fuel pump relay

CONSULT-II (Cont'd)



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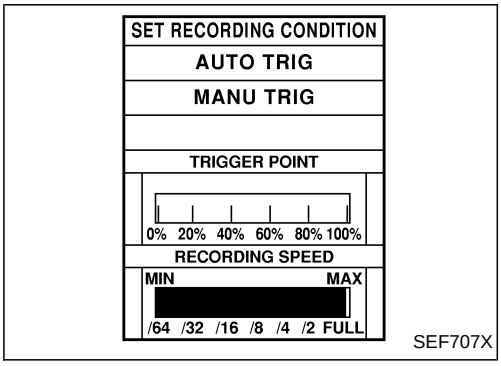


SEF707X

REAL TIME DIAGNOSIS IN DATA MONITOR MODE (RECORDING VEHICLE DATA)

CONSULT-II has two kinds of triggers and they can be selected by touching "SETTING" in "DATA MONITOR" mode.

1) "AUTO TRIG" (Automatic trigger):

- The malfunction will be identified on the CONSULT-II screen in real time.
  In other words, malfunction item will be displayed if the malfunction is detected by ECM.
  At the moment a malfunction is detected by ECM, "MONITOR" in "DATA MONITOR" screen is changed to "Recording Data ...xx%" as shown at left, and the data after the malfunction detection is recorded. Then when the percentage reached 100%, "REAL-TIME DIAG" screen is displayed. If "STOP" is touched on the screen during " Recording Data ... xx%", "REAL-TIME DIAG" screen is also displayed.
  The recording time after the malfunction detection and the recording speed can be changed by "TRIGGER POINT" and "Recording Speed". Refer to CONSULT-II OPERATION MANUAL.

2) "MANU TRIG" (Manual trigger):

- Malfunction item will not be displayed automatically on CONSULT-II screen even though a malfunction is detected by ECM. DATA MONITOR can be performed continuously even though a malfunction is detected.

Use these triggers as follows:

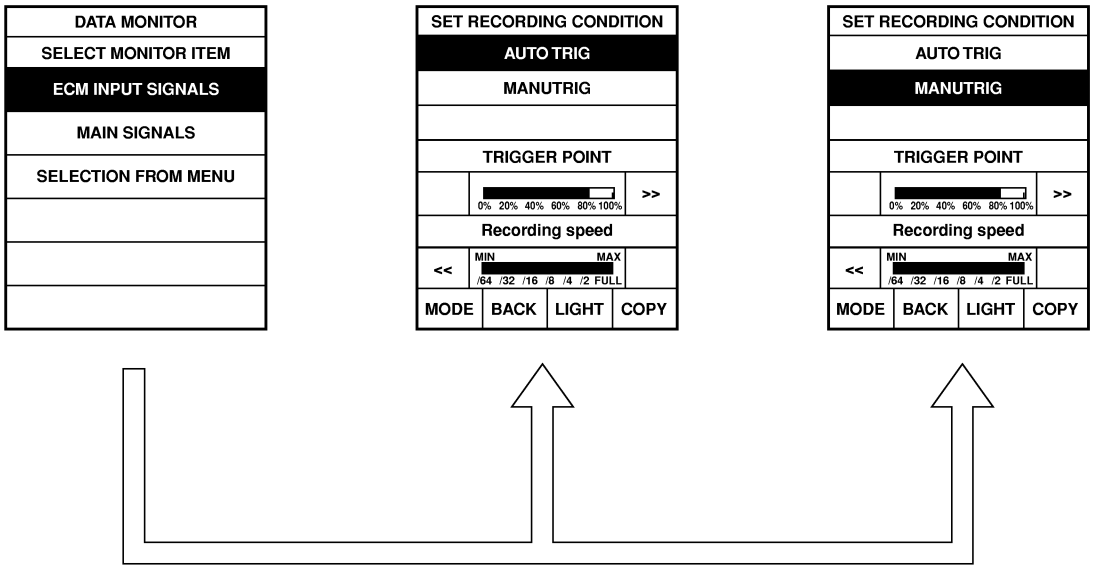
1) "AUTO TRIG"

- While trying to detect the DTC by performing the "DTC Confirmation Procedure", be sure to select to "DATA MONITOR (AUTO TRIG)" mode. You can confirm the malfunction at the moment it is detected.
- While narrowing down the possible causes, CONSULT-II should be set in "DATA MONITOR (AUTO TRIG)" mode, especially in case the incident is intermittent.
  When you are inspecting the circuit by gently shaking (or twisting) the suspicious connectors, components and harness in the "DTC Confirmation Procedure", the moment a malfunction is found the DTC will be displayed. (Refer to GI section, "Incident Simulation Tests".)

2) "MANU TRIG"

- If the malfunction is displayed as soon as "DATA MONITOR" is selected, reset CONSULT-II to "MANU TRIG". By selecting "MANU TRIG" you can monitor and store the data. The data can be utilized for further diagnosis, such as a comparison with the value for the normal operating condition.

CONSULT-II (Cont'd)

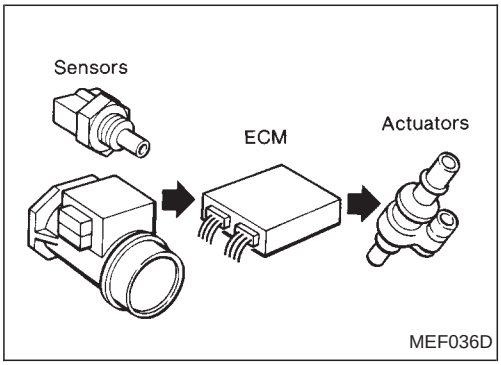


"SETTING"

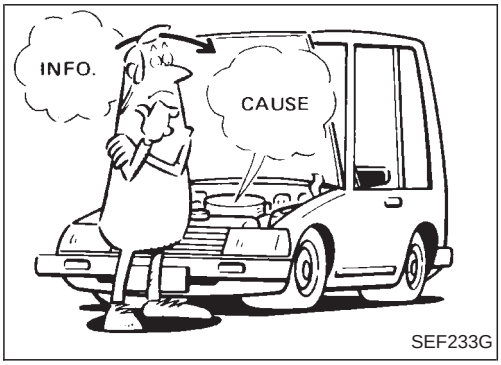
"AUTO TRIG"
A malfunction can be displayed on "DATA MONITOR" screen automatically if detected.

"MANU TRIG"
A malfunction can not be displayed on "DATA MONITOR" screen automatically even if detected.

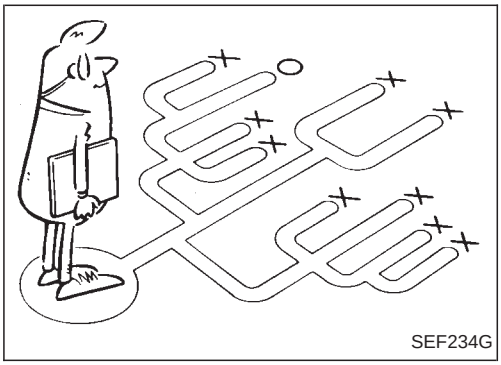
SEF714Y



MEF036D



SEF233G


SEF234G

KEY POINTS

WHAT ..... Vehicle & engine model
WHEN ..... Date, Frequencies
WHERE..... Road conditions
HOW ..... Operating conditions, Weather conditions, Symptoms

SEF907L

Introduction

The engine has an ECM to control major systems such as fuel control, ignition control, idle air control system, etc. The ECM accepts input signals from sensors and instantly drives actuators. It is essential that both input and output signals are proper and stable. At the same time, it is important that there are no problems such as vacuum leaks, fouled spark plugs, or other problems with the engine.

It is much more difficult to diagnose a problem that occurs intermittently rather than continuously. Most intermittent problems are caused by poor electric connections or improper wiring. In this case, careful checking of suspected circuits may help prevent the replacement of good parts.

A visual check only may not find the cause of the problems. A road test with CONSULT-II or a circuit tester connected should be performed. Follow the “Work Flow” on EC-41.

Before undertaking actual checks, take just a few minutes to talk with a customer who approaches with a driveability complaint. The customer can supply good information about such problems, especially intermittent ones. Find out what symptoms are present and under what conditions they occur. A “Diagnostic Worksheet” like the example on next page should be used.

Start your diagnosis by looking for “conventional” problems first. This will help troubleshoot driveability problems on an electronically controlled engine vehicle.

Diagnostic Worksheet

There are many operating conditions that lead to the malfunctions of engine components. A good knowledge of such conditions can make troubleshooting faster and more accurate.

In general, each customer may feel differently about a given problem. It is important to fully understand the symptoms or conditions for a customer complaint.

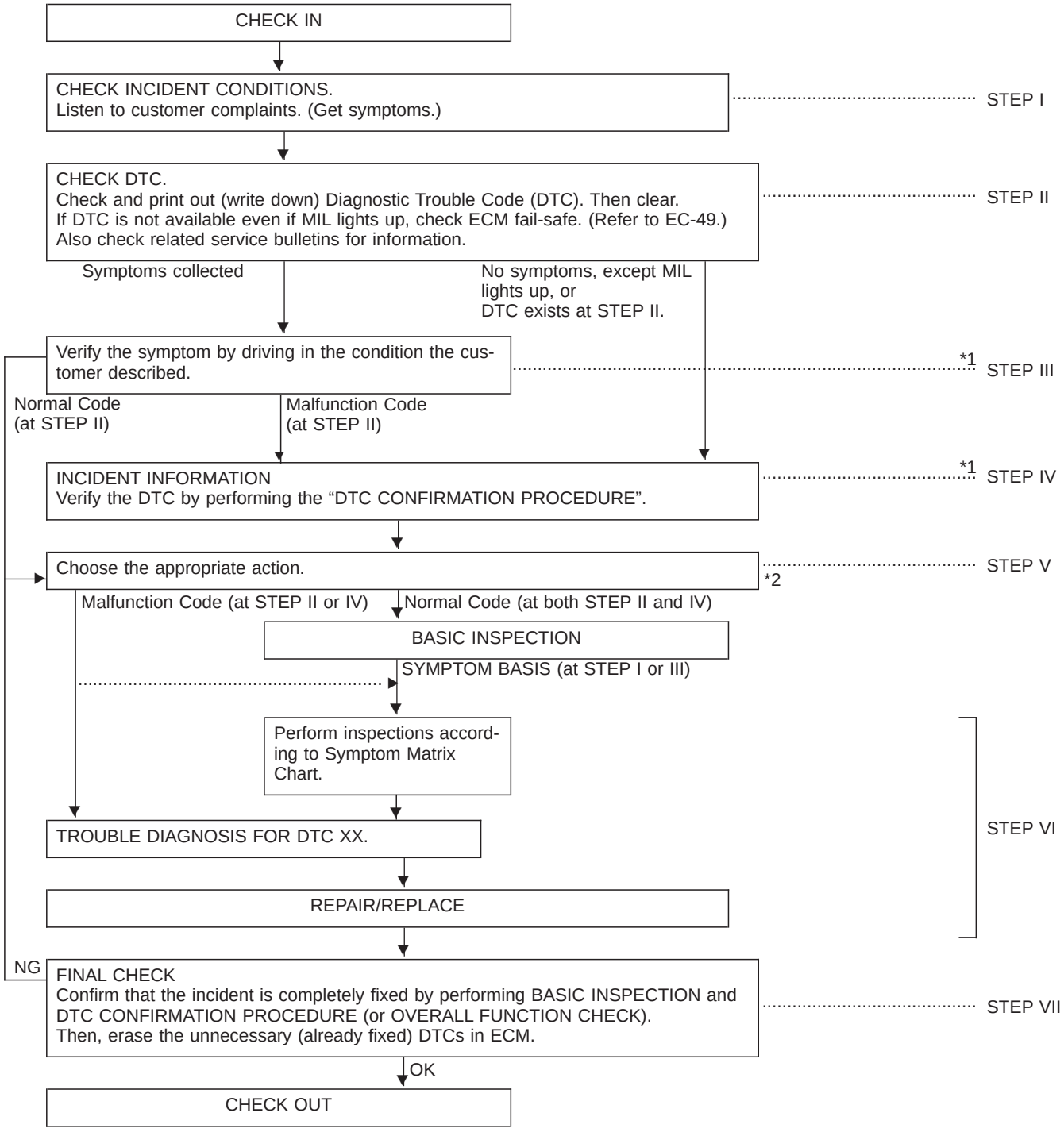
Utilize a diagnostic worksheet like the one on next page in order to organize all the information for troubleshooting.

Diagnostic Worksheet (Cont'd)

WORKSHEET SAMPLE

Customer name MR/MS		Model & Year	VIN
Engine #		Trans.	Mileage
Incident Date		Manuf. Date	In Service Date
Fuel and fuel filler cap		☐ Vehicle ran out of fuel causing misfire. ☐ Fuel filler cap was left off or incorrectly screwed on.	
Symptoms	☐ Startability	☐ Impossible to start ☐ No combustion ☐ Partial combustion ☐ Partial combustion affected by throttle position ☐ Partial combustion NOT affected by throttle position ☐ Possible but hard to start ☐ Others [ ]	
	☐ Idling	☐ No fast idle ☐ Unstable ☐ High idle ☐ Low idle ☐ Others [ ]	
	☐ Driveability	☐ Stumble ☐ Surge ☐ Knock ☐ Lack of power ☐ Intake backfire ☐ Exhaust backfire ☐ Others [ ]	
	☐ Engine stall	☐ At the time of start ☐ While idling ☐ While accelerating ☐ While decelerating ☐ Just after stopping ☐ While loading	
Incident occurrence		☐ Just after delivery ☐ Recently ☐ In the morning ☐ At night ☐ In the daytime	
Frequency		☐ All the time ☐ Under certain conditions ☐ Sometimes	
Weather conditions		☐ Not affected	
	Weather	☐ Fine ☐ Raining ☐ Snowing ☐ Others [ ]	
	Temperature	☐ Hot ☐ Warm ☐ Cool ☐ Cold ☐ Humid °F	
Engine conditions		☐ Cold ☐ During warm-up ☐ After warm-up Engine speed 0 2,000 4,000 6,000 8,000 rpm	
Road conditions		☐ In town ☐ In suburbs ☐ Highway ☐ Off road (up/down)	
Driving conditions		☐ Not affected ☐ At starting ☐ While idling ☐ At racing ☐ While accelerating ☐ While cruising ☐ While decelerating ☐ While turning (RH/LH) Vehicle speed 0 10 20 30 40 50 60 MPH	
Malfunction indicator lamp		☐ Turned on ☐ Not turned on	

Work Flow



***1: If the incident cannot be duplicated, see "Incident Simulation Tests" of "HOW TO PERFORM EFFICIENT DIAGNOSIS FOR AN ELECTRICAL INCIDENT" in GI section.**

***2: If the on board diagnostic system cannot be performed, check main power supply and ground circuit. Refer to "TROUBLE DIAGNOSIS FOR POWER SUPPLY", EC-61.**

Description for Work Flow

STEP	DESCRIPTION
STEP I	Get detailed information about the conditions and the environment when the incident/symptom occurred using the “DIAGNOSTIC WORK SHEET”, EC-39.
STEP II	Before confirming the concern, check and write down (print out using CONSULT-II) the Diagnostic Trouble Code (DTC), then erase the code. (Refer to EC-27.) The DTC can be used when duplicating the incident at STEP III & IV. Study the relationship between the cause, specified by DTC, and the symptom described by the customer. (The “Symptom Matrix Chart” will be useful. See page EC-50.) Also check related service bulletins for information.
STEP III	Try to confirm the symptom and under what conditions the incident occurs. The “DIAGNOSTIC WORK SHEET” is useful to verify the incident. Connect CONSULT-II to the vehicle in DATA MONITOR (AUTO TRIG) mode and check real time diagnosis results. If the incident cannot be verified, perform INCIDENT SIMULATION TESTS. (Refer to GI section.) If the malfunction code is detected, skip STEP IV and perform STEP V.
STEP IV	Try to detect the Diagnostic Trouble Code by driving in (or performing) the “DTC CONFIRMATION PROCEDURE”. Check and read the DTC by using CONSULT-II. During the DTC verification, be sure to connect CONSULT-II to the vehicle in DATA MONITOR (AUTO TRIG) mode and check real time diagnosis results. If the incident cannot be verified, perform INCIDENT SIMULATION TESTS. (Refer to GI section.) In case the “DTC CONFIRMATION PROCEDURE” is not available, perform the “OVERALL FUNCTION CHECK” instead. The DTC cannot be displayed by this check, however, this simplified “check” is an effective alternative. The “NG” result of the “OVERALL FUNCTION CHECK” is the same as the DTC detection.
STEP V	Take the appropriate action based on the results of STEP I through IV. If the malfunction code is indicated, proceed to TROUBLE DIAGNOSIS FOR DTC XX. If the normal code is indicated, proceed to the BASIC INSPECTION on next page. Then perform inspections according to the Symptom Matrix Chart. (Refer to EC-50.)
STEP VI	Identify where to begin diagnosis based on the relationship study between symptom and possible causes. Inspect the system for mechanical binding, loose connectors or wiring damage using (tracing) “Harness Layouts”. Gently shake the related connectors, components or wiring harness with CONSULT-II set in “DATA MONITOR (AUTO TRIG)” mode. Check the voltage of the related ECM terminals or monitor the output data from the related sensors with CONSULT-II. Refer to EC-52, EC-55. The “DIAGNOSTIC PROCEDURE” in EC section contains a description based on open circuit inspection. A short circuit inspection is also required for the circuit check in the DIAGNOSTIC PROCEDURE. For details, refer to GI section (“HOW TO PERFORM EFFICIENT DIAGNOSIS FOR AN ELECTRICAL INCIDENT”, “Circuit Inspection”). Repair or replace the malfunction parts.
STEP VII	Once you have repaired the circuit or replaced a component, you need to run the engine in the same conditions and circumstances which resulted in the customer’s initial complaint. Perform the “DTC CONFIRMATION PROCEDURE” and confirm the normal code (Diagnostic trouble code No. 55) is detected. If the incident is still detected in the final check, perform STEP VI by using a different method from the previous one. Before returning the vehicle to the customer, be sure to erase the unnecessary (already fixed) DTC in ECM. (Refer to EC-27.)

Basic Inspection

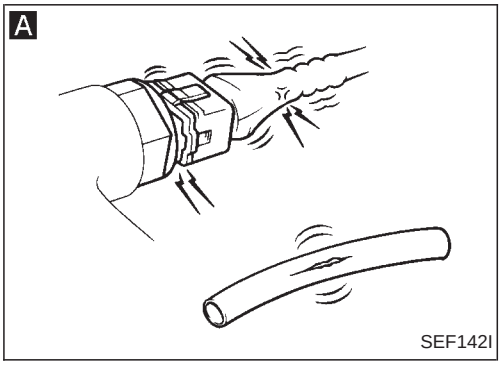
Precaution:

- **Make sure that the following parts are in good order.**

(1) Battery
(2) Ignition system
(3) Engine oil and coolant levels
(4) Fuses
(5) ECM harness connector
(6) Vacuum hoses
(7) Air intake system
(Oil filler cap, oil level gauge, etc.)
(8) Fuel pressure
(9) Engine compression
(10) Throttle valve
(11) Evaporative emission system

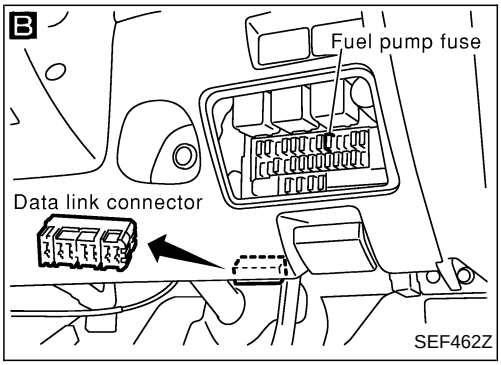
- **On air conditioner equipped models, checks should be carried out while the air conditioner is "OFF".**
- **On automatic transmission equipped models, when checking idle rpm, ignition timing and mixture ratio, a check should be carried out with the shift lever in "N" or "P" position.**
- **When measuring "CO" percentage, insert probe more than 40 cm (15.7 in) into tail pipe.**
- **Turn off headlamps, heater blower, rear window defogger.**
- **Keep front wheels pointed straight ahead.**

A



SEF142I

B



SEF462Z

A

BEFORE STARTING
1. Check service records for any recent repairs that may indicate a related problem, or the current need for scheduled maintenance.
2. Open engine hood and check the following:
- Harness connectors for improper connections
- Vacuum hoses for splits, kinks, and improper connections
- Wiring for improper connections, pinches, or cuts
- Air cleaner clogging
- Hoses and ducts for leaks

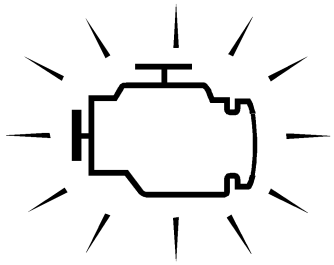
B

CONNECT CONSULT-II TO THE VEHICLE.
Connect "CONSULT-II" to the data link connector and select "ENGINE" from the menu. Refer to EC-32.

Ⓐ

Basic Inspection (Cont'd)

C



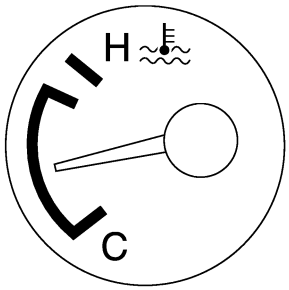
SAT652J

C

SELF DIAG RESULTS	
DTC RESULTS	TIME
NO DTC IS DETECTED. FURTHER TESTING MAY BE REQUIRED.	

SEF560X

D



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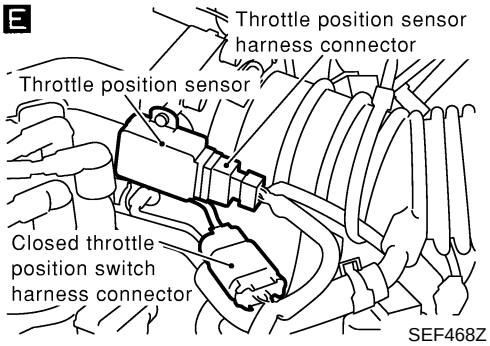
E



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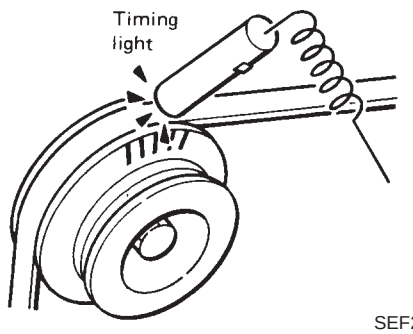
F



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Ⓐ

C

Perform the "SELF-DIAG RESULT WITH CONSULT-II.

Perform the diagnostic test mode II (Self-diagnostic results).

NG → Go to corresponding "TROUBLE DIAGNOSIS".

OK

D

Warm up engine to normal operating temperature.

E

1. Stop engine and disconnect throttle position sensor harness connector.
2. Start engine.

Rev engine (2,000 - 3,000 rpm) 2 or 3 times under no-load and run engine at idle speed.

F

Check ignition timing with a timing light or "DATA MONITOR" with CONSULT-II.

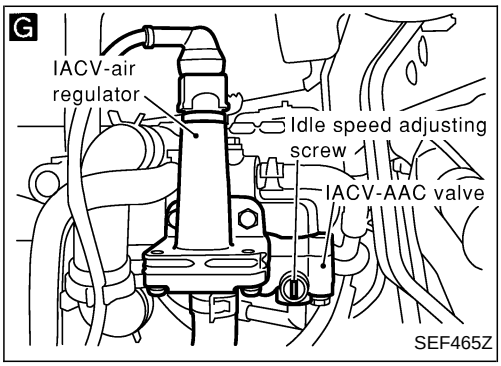
15°±2° BTDC

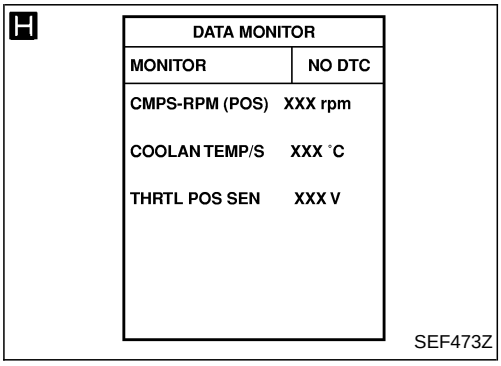
NG → Adjust ignition timing by turning distributor.

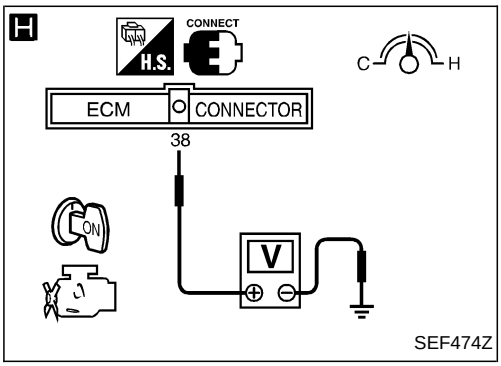
OK

Ⓑ

Basic Inspection (Cont'd)







Ⓑ

G

CHECK BASE IDLE SPEED.
Read idle speed in "DATA MONITOR" mode with CONSULT-II.

OR

Check idle speed.

700±50 rpm

NG → **G** Adjust base idle speed by turning idle speed adjusting screw.

OK

Reconnect throttle position sensor harness connector.

H

CHECK THROTTLE POSITION SENSOR IDLE POSITION.
1. Stop engine and then turn ignition switch "ON".
2. Select "THRTL POS SEN" in "DATA MONITOR" mode.
3. Check output voltage of throttle position sensor.
   Voltage: 0.15 - 0.85V

OR

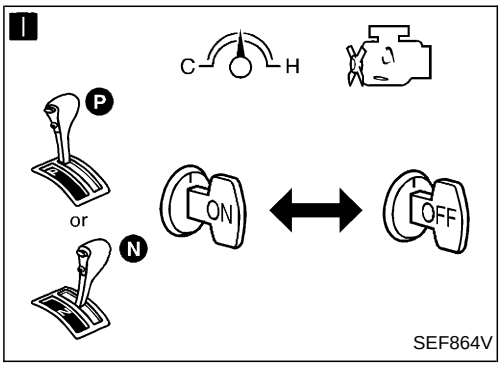
2. Check voltage between ECM terminal ㊳ and ground with voltmeter.
   Voltage: 0.15 - 0.85V

NG → Ⓗ Adjust output voltage to 0.5V by rotating throttle position sensor body.

OK → Ⓒ

Ⓖ

Basic Inspection (Cont'd)



Ⓒ

Ⓖ

I

RESET IDLE POSITION MEMORY.

1. Select "TP SW/TP SEN IDLE POSI ADJ" in "WORK SUPPORT" mode with CONSULT-II, then stop engine.
2. Start engine and wait for a few seconds.
3. Turn ignition switch "OFF" and wait at least 5 seconds.
4. Repeat steps 2. and 3. until "CLSD THL POS" in "WORK SUPPORT" mode with CONSULT-II changes from "OFF" to "ON".

OR

1. Start engine and wait a few seconds.
2. Turn ignition switch "OFF" and wait at least 5 seconds.
3. Repeat steps 1. and 2. 10 times.

Rev engine (2,000 to 3,000 rpm) 2 or 3 times under no-load and run engine at idle speed.

CHECK TARGET IDLE SPEED.

Read the engine idle speed in "DATA MONITOR" mode with CONSULT-II.
750±50 rpm

OR

Check idle speed.
750±50 rpm

NG

When at high idle, perform "COMPONENT INSPECTION", IACV-Air Regulator.
Refer to EC-134.

Check IACV-AAC valve and replace if necessary.

Check IACV-AAC valve harness and repair if necessary.

Check ECM function* by substituting another known-good ECM.

*ECM may be the cause of a problem, but this is rarely the case.

OK

OK

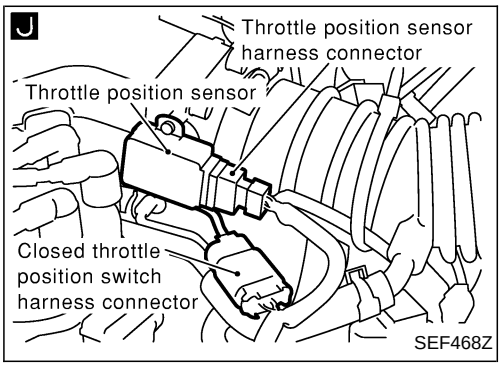
For A/T models, go to J .

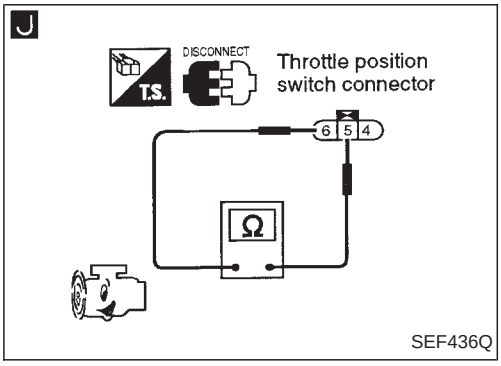
Ⓔ

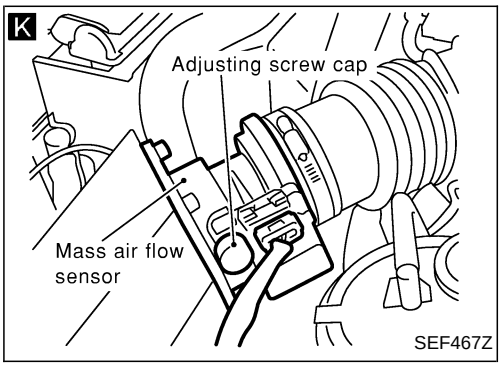
Ⓓ

Ⓐ

Basic Inspection (Cont'd)







Ⓓ

CHECK CLOSED THROTTLE POSITION SWITCH IDLE POSITION. (A/T models)
1. Disconnect throttle position switch connector.
2. Check continuity between closed throttle position switch terminals ⑥ and ⑤ under the following conditions.

Above 1,150 rpm: Does not exist.
Less than 850 rpm: Continuity exists.

NG → By loosening throttle position sensor installation bolts, readjust them.

→ Tighten throttle position sensor installation bolts.

OK

CHECK THROTTLE POSITION SENSOR IDLE POSITION.
1. Stop engine, and then turn ignition switch ON.
2. Reconnect throttle position switch connector.
3. Select "THRTL POS SEN" in "DATA MONITOR" mode.
4. Check output voltage of throttle position sensor.

Voltage: 0.15 - 0.85V

OR

3. Check voltage between ECM terminal ㊳ and ground with voltmeter.

Voltage: 0.15 - 0.85V

OK → Ⓔ
NG → Ⓗ

Ⓔ

Check "CO"%.

Idle CO: 1.0±0.5%

NG → Adjust CO% by turning variable resistor adjusting screw with mass air flow sensor.

OK → Ⓕ

OK → Ⓕ
NG → Check fuel pressure regulator. Refer to EC-24.

→ Check mass air flow sensor and its circuit. Refer to EC-74.

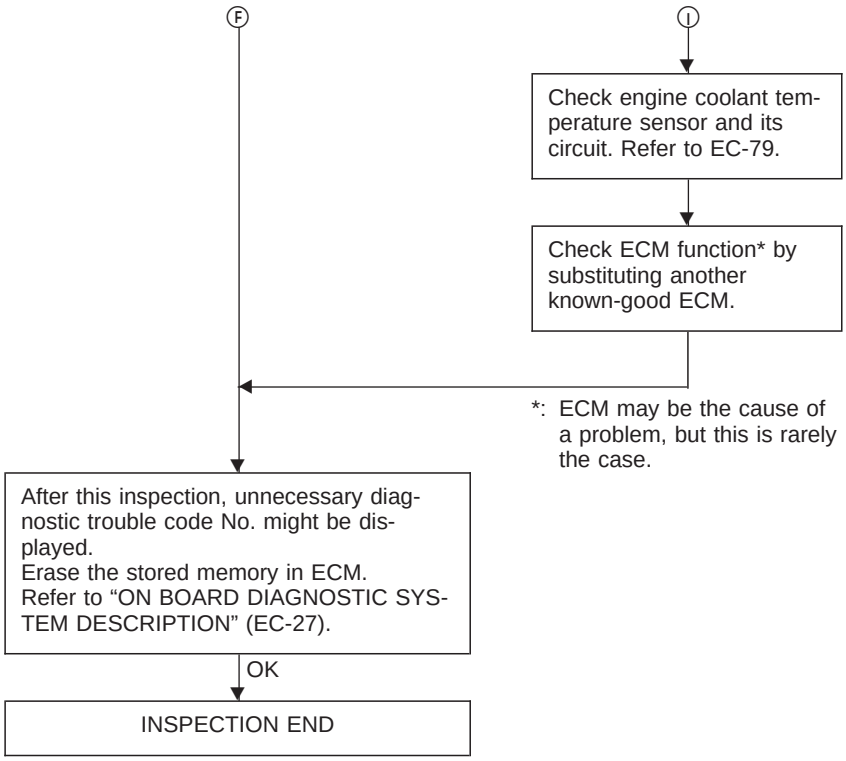
→ Check injector and its circuit. Refer to EC-114. Clean or replace if necessary.

→ Ⓘ

Ⓕ

Ⓘ

Basic Inspection (Cont'd)



Fail-Safe Chart

The ECM enters fail-safe mode, if any of the following malfunctions are detected due to the open or short circuit.
When the ECM enters the ECM fail-safe mode listed in the last column below, the MIL illuminates.

<table>
<tr><th>DTC No.</th><th>Detected items</th><th>Engine operating condition in fail-safe mode</th></tr>
<tr><td>12</td><td>Mass air flow sensor circuit</td><td>Engine speed will not rise more than 2,400 rpm due to the fuel cut.</td></tr>
<tr><td>13</td><td>Engine coolant temperature sensor circuit</td><td>Engine coolant temperature will be determined by ECM based on the time after turning ignition switch “ON” or “START”.
CONSULT-II displays the engine coolant temperature decided by ECM.
<table>
<tr><th>Condition</th><th>Engine coolant temperature decided (CONSULT-II display)</th></tr>
<tr><td>Just as ignition switch is turned ON or START</td><td>40°C (104°F)</td></tr>
<tr><td>More than 4 minutes after ignition START</td><td>80°C (176°F)</td></tr>
<tr><td>Except as shown above</td><td>40 - 80°C (104 - 176°F)
(Depends on the time)</td></tr>
</table></td></tr>
<tr><td>43</td><td>Throttle position sensor circuit</td><td>Throttle position will be determined based on the amount of mass air flow and the engine speed. Therefore, acceleration will be poor.
<table>
<tr><th></th><th>Driving condition</th></tr>
<tr><td>When engine is idling</td><td>Normal</td></tr>
<tr><td>When accelerating</td><td>Poor acceleration</td></tr>
</table></td></tr>
<tr><td>Unable to access Diagnostic Test Mode II</td><td>ECM</td><td>ECM fail-safe activating condition
The computing function of the ECM was judged to be malfunctioning.
When the fail-safe system activates, i.e. if the ECM detects a malfunction condition in the CPU of ECM, the MALFUNCTION INDICATOR LAMP on the instrument panel lights to warn the driver. However, it is not possible to access ECM and DTC cannot be confirmed.
Engine control with ECM fail-safe
When the fail-safe system is operating, fuel injection, ignition timing, fuel pump operation and IACV-AAC valve operation are controlled under certain limitations.
<table>
<tr><th></th><th>ECM fail-safe operation</th></tr>
<tr><td>Engine speed</td><td>Engine speed will not rise more than 3,000 rpm.</td></tr>
<tr><td>Fuel injection</td><td>Simultaneous multiport fuel injection system</td></tr>
<tr><td>Ignition timing</td><td>Ignition timing is fixed at the preset value.</td></tr>
<tr><td>Fuel pump</td><td>Fuel pump relay is “ON” when engine is running and “OFF” when engine stalls.</td></tr>
<tr><td>IACV-AAC valve</td><td>Full open</td></tr>
</table>
Replace ECM, if ECM fail-safe condition is confirmed.</td></tr>
</table>

Symptom Matrix Chart

			SYMPTOM																Reference page
			HARD/NO START/RESTART (EXCP. HA)	ENGINE STALL	HESITATION/SURGING/FLAT SPOT	SPARK KNOCK/DETONATION	LACK OF POWER/POOR ACCELERATION	HIGH IDLE/LOW IDLE	ROUGH IDLE/HUNTING	IDLING VIBRATION	SLOW/NO RETURN TO IDLE	OVERHEATS/WATER TEMPERATURE HIGH	EXCESSIVE FUEL CONSUMPTION	EXCESSIVE OIL CONSUMPTION	BATTERY DEAD (UNDER CHARGE)	OVERCOOLS	OVERCHARGING	
Warranty Symptom Code			AA	AB	AC	AD	AE	AF	AG	AH	AJ	AK	AL	AM	HA	1P	1X	
Basic engine control system	Fuel	Fuel pump circuit	●	●	●	○	●		○	○			○		○			EC-122
		Fuel pressure regulator system	●	○	●	○	○	○	○	○	○		○					EC-24
		Injector circuit	●	●	●	○	●		●	○			○					EC-114
		Evaporative emission system	○	○	○	○	○	○	○	○	○		○					EC-21
	Air	Positive crankcase ventilation system	○	●	○	○	○	○	○	○	○		○	○				EC-23
		Incorrect idle speed adjustment	●	●				●	●	○	○		○					EC-43
		IACV-AAC valve circuit	○	●	○	○	○	●	●	○	○		○		○			EC-102
		IACV-air regulator system	●	○				●	○		●							EC-131
	Ignition	Incorrect ignition timing adjustment	●	●	●	●	●		●	○			●					EC-43
		Ignition circuit	●	●	●	●	●		●	○			●					EC-84
	Main power supply and ground circuit		●	○	○	○	○		○	○		○	○		○			EC-61
	Air conditioner circuit		○	○	○	○	○	○	○	○	○		○		○			HA section
Engine control system	ECM	Camshaft position sensor circuit	●	●	●	●	●		●	○			●					EC-67
		Mass air flow sensor circuit	●	●	●	○	●		●	○			●					EC-74
		Engine coolant temperature sensor circuit	●	○	○	○	○	○	●	○	○		○					EC-74
		Throttle position sensor circuit		●	●		●	●	●	○	○		●					EC-93
		Incorrect throttle position sensor adjustment		●	●		●	●	●	○	○		○					EC-43
		Vehicle speed sensor circuit		○	○		○						○					EC-98
		ECM	○	○	○	○	○	○	○	○	○	○	○					EC-49
		Start signal circuit	○															EC-120
		Park/Neutral position switch circuit			○		○		○	○			○					EC-107
		Power steering oil pressure switch circuit		○					○	○								EC-127

● ; High Possibility Item
○; Low Possibility Item

(continued on next page)

Symptom Matrix Chart (Cont'd)

SYSTEM — Engine mechanical & other		SYMPTOM															Reference page
		HARD/NO START/RESTART (EXCP. HA)	ENGINE STALL	HESITATION/SURGING/FLAT SPOT	SPARK KNOCK/DETONATION	LACK OF POWER/POOR ACCELERATION	HIGH IDLE/LOW IDLE	ROUGH IDLE/HUNTING	IDLING VIBRATION	SLOW/NO RETURN TO IDLE	OVERHEATS/WATER TEMPERATURE HIGH	EXCESSIVE FUEL CONSUMPTION	EXCESSIVE OIL CONSUMPTION	BATTERY DEAD (UNDER CHARGE)	OVERCOOLS	OVERCHARGING	
Warranty Symptom Code		AA	AB	AC	AD	AE	AF	AG	AH	AJ	AK	AL	AM	HA	1P	1X	
Fuel	Fuel tank	○	○														
	Fuel piping	○	○	○	○	○		○	○			○					
	Vapor lock		○														
	Valve deposit	○	○	○	○	○		○	○			○					
	Poor fuel (Heavy weight gasoline, Low octane)	○	○	○	○	○		○	○			○					—
Air	Air duct		○	○		○		○	○			○					
	Air cleaner		○	○		○		○	○			○					
	Air leakage from air duct (Mass air flow sensor — throttle body)	○	○	○	○	○	○	○	○	○		○					
	Throttle body, Throttle wire	●	●	●		●	●	●	○	●		○					FE section
	Air leakage from intake manifold/ Collector/Gasket	○	●	○	○	○	○	●	○	○		○					—
Cranking	Battery	○	○	○		○		○	○			○		○		○	
	Alternator circuit	○	○	○		○		○	○			○		○		○	EL section
	Starter circuit	●															
	Park/Neutral position (PNP) switch	○															
	Flywheel/Drive plate	○															—
Engine	Cylinder head	○	○	○	○	○		○	○			○					
	Cylinder head gasket	○	○	○	○	○		○	○		○	○	○				
	Cylinder block	○	○	○	○	○		○	○			○	○				
	Piston	○	○	○	○	○		○	○			○	○				
	Piston ring	○	○	○	○	○		○	○			○	○				
	Connecting rod	○	○	○	○	○		○	○			○					
	Bearing	○	○	○	○	○		○	○			○					
	Crankshaft	●	●	●	○	●		○	○			○					
Valve mechanism	Timing belt	○	●	○	○	●		●	○			○					
	Camshaft	○	○	○	○	○		○	○			○					
	Intake valve	○	○	○	○	○		○	○			○	○				
	Exhaust valve	○	○	○	○	○		○	○			○	○				—
	Hydraulic lash adjuster		○	○	○	○		○	○			○					
Exhaust	Exhaust manifold/Tube/Muffler/Gasket	○	○	○	○	○		○	○			○					
Lubrication	Oil pan/Oil strainer/Oil pump/Oil filter/Oil gallery	●	●	○	○	○		●	●			○	●				
	Oil level (Low)/Filthy oil	○	○	○	○	○		○	○			○	○				
Cooling	Radiator/Hose/Radiator filler cap	○	○	○	○	○		○	○		●	○					
	Thermostat	○	○	○	○	○	○	○	○	○	○	○			○		
	Water pump	○	○	○	○	○		○	○		●	○					
	Water gallery	○	○	○	○	○		○	○		○	○					
	Cooling fan	○	○	○	○	○	○	○	○	○	○	○			○		
	Coolant level (low)/Contaminated coolant	○	○	○	○	○		○	○		○	○					

● ; High Possibility Item
○; Low Possibility Item

CONSULT-II Reference Value in Data Monitor Mode

Remarks:

- Specification data are reference values.
- Specification data are output/input values which are detected or supplied by the ECM at the connector.
  * Specification data may not be directly related to their components signals/values/operations.
  i.e. Adjust ignition timing with a timing light before monitoring IGN TIMING, because the monitor may show the specification data in spite of the ignition timing not being adjusted to the specification data. This IGN TIMING monitors the data calculated by the ECM according to the signals input from the camshaft position sensor and other ignition timing related sensors.
- If the real-time diagnosis results are NG and the on board diagnostic system results are OK when diagnosing the mass air flow sensor, first check to see if the fuel pump control circuit is normal.

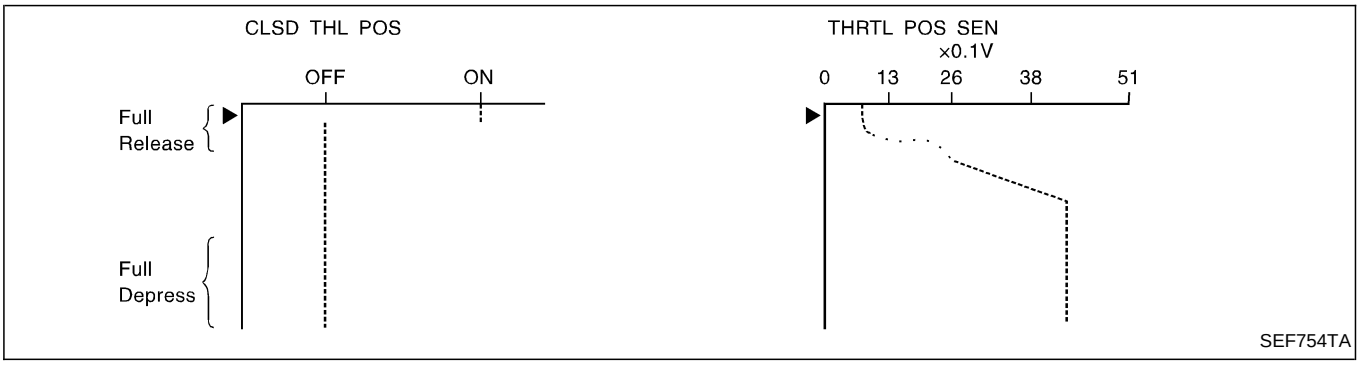
MONITOR ITEM	CONDITION		SPECIFICATION
CMPS·RPM (POS)	• Tachometer: Connect • Run engine and compare tachometer indication with the CONSULT-II value.		Almost the same speed as the CONSULT-II value.
MAS AIR/FL SE	• Engine: After warming up • Air conditioner switch: “OFF” • Shift lever: Neutral position • No-load	Idle	1.0 - 1.7V
		2,500 rpm	1.7 - 2.3V
COOLAN TEMP/S	• Engine: After warming up		More than 70°C (158°F)
VHCL SPEED SE	• Turn drive wheels and compare speedometer indication with the CONSULT-II value		Almost the same speed as the CONSULT-II value
BATTERY VOLT	• Ignition switch: ON (Engine stopped)		11 - 14V
THRTL POS SEN	• Ignition switch: ON (Engine stopped)	Throttle valve: fully closed	0.15 - 0.85V
		Throttle valve: fully opened	3.5 - 4.7V
START SIGNAL	• Ignition switch: ON → START → ON		OFF → ON → OFF
CLSD THL POS	• Ignition switch: ON (Engine stopped)	Throttle valve: Idle position	ON
		Throttle valve: Slightly open	OFF
AIR COND SIG	• Engine: After warming up, idle the engine	Air conditioner switch: “OFF”	OFF
		Air conditioner switch: “ON” (Compressor operates.)	ON
P/N POSI SW	• Ignition switch: ON	Shift lever: “N” or “P” position	ON
		Except above	OFF
PW/ST SIGNAL	• Engine: After warming up, idle the engine	Steering wheel in neutral position (forward direction)	OFF
		The steering wheel is turned	ON
INJ PULSE INJ PULSE-R	• Engine: After warming up • Air conditioner switch: “OFF” • Shift lever: Neutral position • No-load	Idle	2.5 - 3.3 msec.
		2,000 rpm	2.4 - 3.2 msec.
IGN TIMING	ditto	Idle	15° BTDC
		2,000 rpm	About 25° BTDC
IACV-AAC/V	ditto	Idle	Approx. 30%
		2,000 rpm	—
AIR COND RLY	• Air conditioner switch: OFF → ON		OFF → ON
FUEL PUMP RLY	• Ignition switch is turned to ON (Operates for 5 seconds) • Engine running and cranking • When engine is stopped (Stops in 1 second)		ON
	Except as shown above		OFF

Major Sensor Reference Graph in Data Monitor Mode

The following are the major sensor reference graphs in “DATA MONITOR” mode.

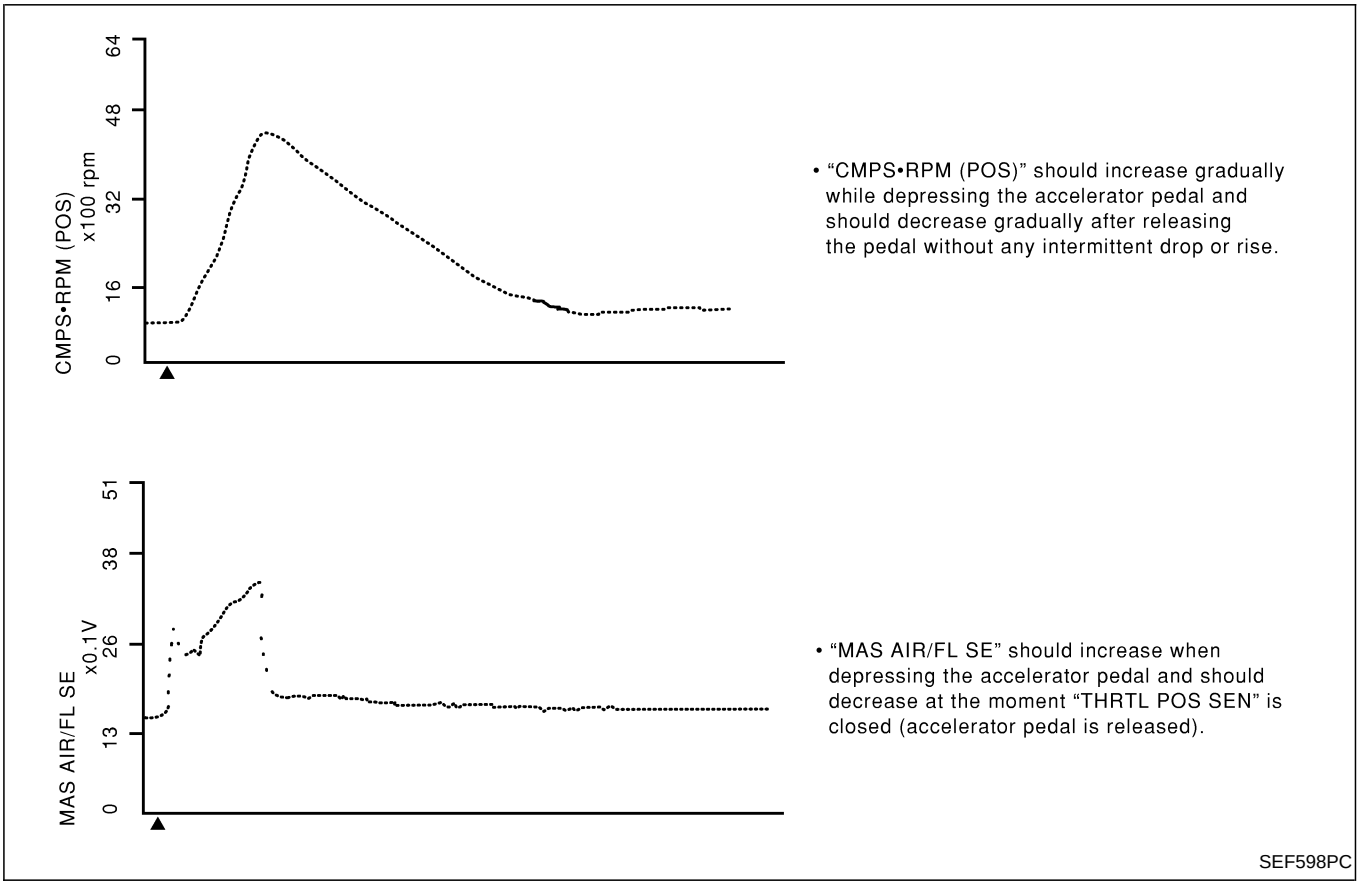
THRTL POS SEN, CLSD THL POS

Below is the data for “THRTL POS SEN” and “CLSD THL POS” when depressing the accelerator pedal with the ignition switch “ON”.
The signal of “THRTL POS SEN” should rise gradually without any intermittent drop or rise after “CLSD THL POS” is changed from “ON” to “OFF”.

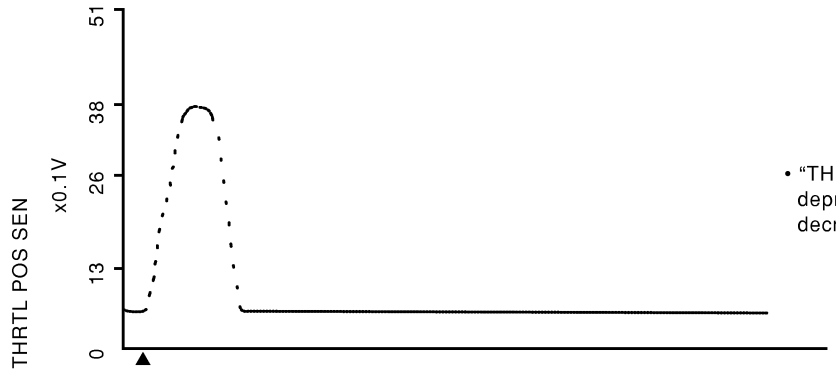


CMPS·RPM (POS), MAS AIR/FL SE, THRTL POS SEN, INJ PULSE

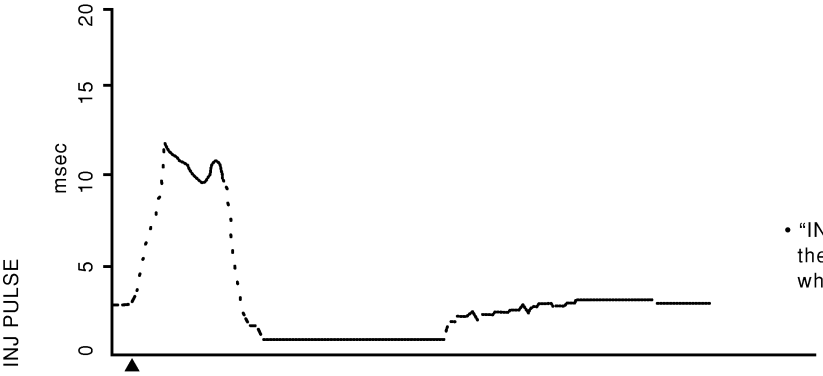
Below is the data for “CMPS·RPM (POS)”, “MAS AIR/FL SE”, “THRTL POS SEN” and “INJ PULSE” when revving engine quickly up to 4,800 rpm under no load after warming up engine sufficiently.
Each value is for reference, the exact value may vary.



Major Sensor Reference Graph in Data Monitor Mode (Cont'd)

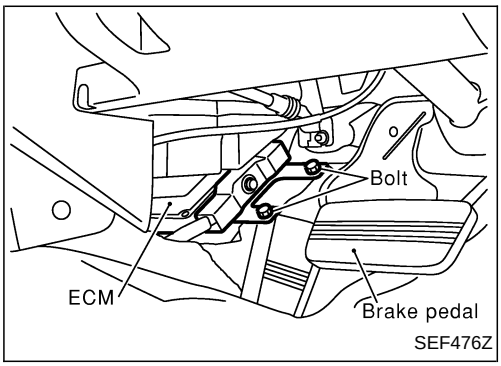


• "THRTL POS SEN" should increase while depressing the accelerator pedel and should decrease while releasing it.



• "INJ PULSE" should increase when depressing the accelerator pedal and should decrease when the pedal is released.

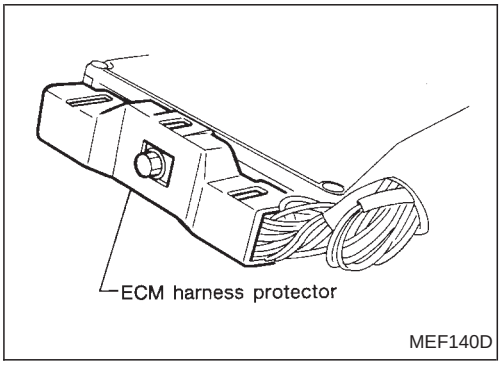
SEF475Z



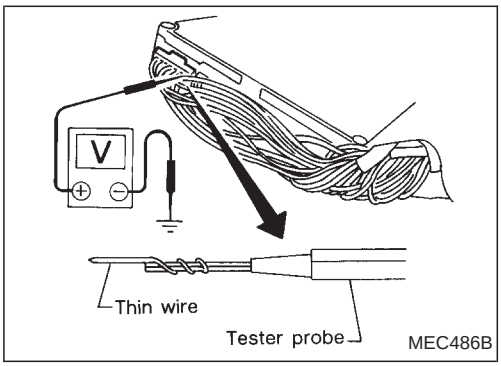
ECM Terminals and Reference Value

PREPARATION

1. ECM is located behind the instrument lower panel.



2. Remove ECM harness protector.

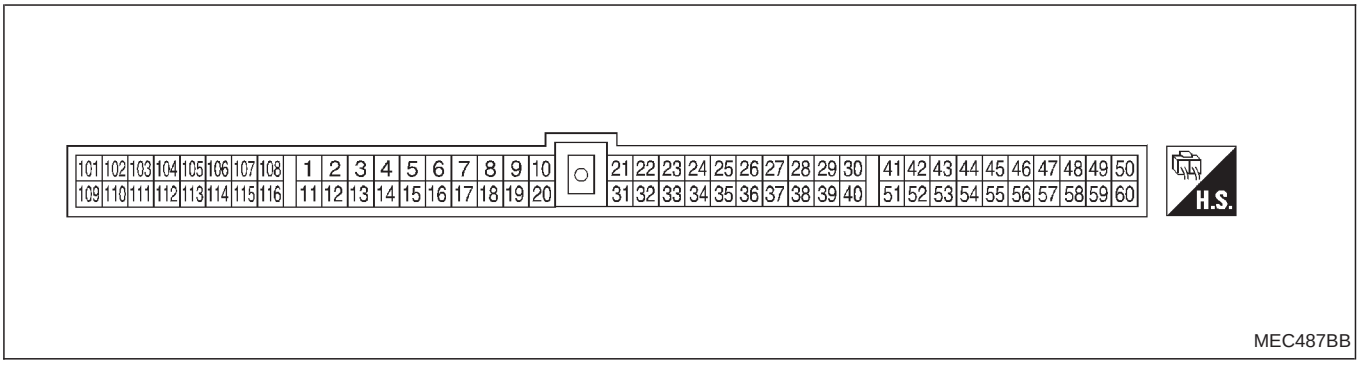


3. Perform all voltage measurements with the connectors connected. Extend tester probe as shown to perform tests easily.
- Open harness securing clip to make testing easier.
- Use extreme care not to touch 2 pins at one time.
- Data is for comparison and may not be exact.

CAUTION:

Do not use ECM ground terminals when measuring input/ output voltage. Doing so may result in damage to the ECM's transistor. use a ground other than ECM terminals, such as the ground.

ECM HARNESS CONNECTOR TERMINAL LAYOUT



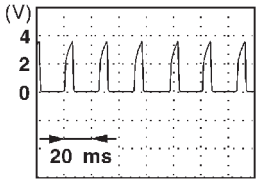
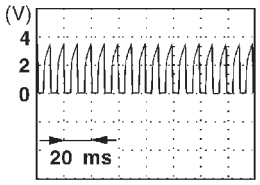
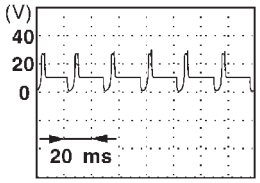
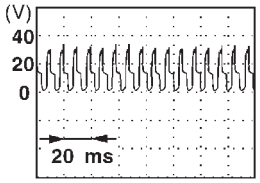
ECM Terminals and Reference Value (Cont'd)

ECM INSPECTION TABLE

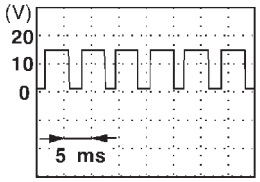
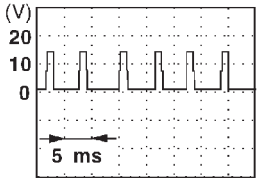
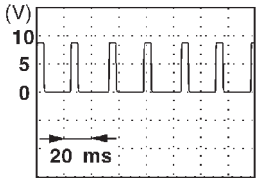
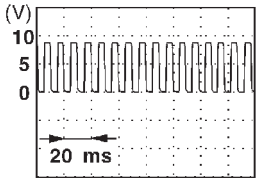
Specification data are reference values, and are measured between each terminal and ground.

CAUTION:

Do not use ECM ground terminals when measuring input/output voltage. Doing so may result in damage to the ECM's transistor. Use a ground other than ECM terminals, such as the ground.

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC voltage)
1	W/PU	Ignition signal	Engine is running. └ Idle speed	Approximately 0.7V  SEF988U
			Engine is running. └ Engine speed is 2,000 rpm	1.1 - 1.5V  SEF989U
2	W/G	Ignition check	Engine is running. (Warmed-up condition) └ Idle speed	Approximately 12V  SEF990U
			Engine is running. └ Engine speed is 2,000 rpm	Approximately 11V  SEF991U

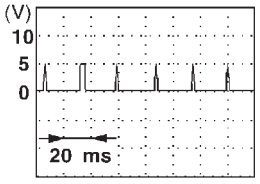
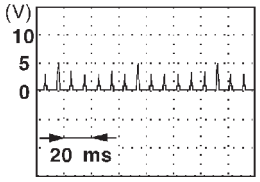
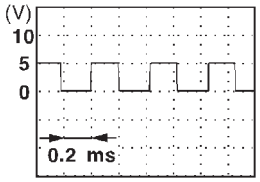
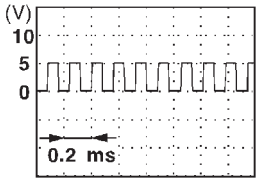
ECM Terminals and Reference Value (Cont'd)

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC voltage)
4	W/G	IACV-AAC valve	Engine is running. (Warmed-up condition) └ Idle speed	7 - 10V  SEF005V
			Engine is running. (Warmed-up condition) └ Engine speed is 2,500 rpm	1 - 5V  SEF692W
7	W	Tachometer	Engine is running. (Warmed-up condition) └ Idle speed	1 - 2V  SEF992U
			Engine is running. └ Engine speed is 2,000 rpm	3 - 5V  SEF993U
9	G/R	Air conditioner relay	Engine is running. └ Both A/C switch and blower switch are "ON"*	0 - 1V
			Engine is running. └ A/C switch is "OFF"	BATTERY VOLTAGE (11 - 14V)
10	B/P	ECM ground	Engine is running. └ Idle speed	Engine ground
16	L/R	ECM relay (Self-shutoff)	Engine is running. Ignition switch "OFF" └ For a few seconds after turning ignition switch "OFF"	0 - 1.5V
			Ignition switch "OFF" └ A few seconds passed after turning ignition switch "OFF"	BATTERY VOLTAGE (11 - 14V)

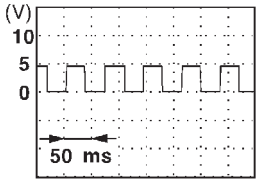
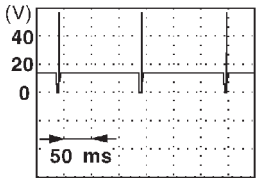
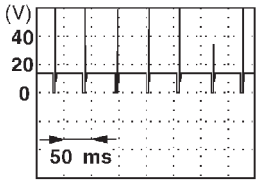
ECM Terminals and Reference Value (Cont'd)

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC voltage)
18	W/R	Fuel pump relay	Ignition switch "ON" └ For 5 seconds after turning ignition switch "ON" Engine is running.	0 - 1V
			Ignition switch "ON" └ More than 5 seconds after turning ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
20	B/P	ECM ground	Engine is running. └ Idle speed	Engine ground
21	R/B	Data link connector	Engine is running. └ Idle speed (CONSULT-II is disconnected.)	Approximately 0V
22	Y			Approximately 0V
26	W	Mass air flow sensor ground	Engine is running. (Warmed-up condition) └ Idle speed	Approximately 0V
27	B	Mass air flow sensor	Engine is running. (Warmed-up condition) └ Idle speed	1.0 - 1.7V
			Engine is running. (Warmed-up condition) └ Engine speed is 2,500 rpm	1.7 - 2.3V
28	LG/R	Engine coolant temperature sensor	Engine is running.	Approximately 0 - 4.8V Output voltage varies with engine coolant temperature
30	B/G	Sensors' ground	Engine is running. (Warmed-up condition) └ Idle speed	Approximately 0V
32	R/W	Malfunction indicator lamp	Ignition switch "ON"	0 - 1V
			Engine is running. └ Idle speed	BATTERY VOLTAGE (11 - 14V)
34	G	Power steering oil pressure switch	Engine is running. └ Steering wheel is being turned	Approximately 0V
			Engine is running. └ Steering wheel is not being turned	Approximately 5V
38	R	Throttle position sensor	Engine is running. (Warmed-up condition) └ Accelerator pedal fully released	0.15 - 0.85V
			Ignition switch "ON" └ Accelerator pedal fully depressed	3.5 - 4.7V
40	B/W	CO adjuster	Ignition switch "ON"	2 - 4V

ECM Terminals and Reference Value (Cont'd)

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC voltage)
41 51	W W	Camshaft position sensor (REF) (120° signal)	Engine is running. (Warmed-up condition) └ Idle speed	0.3 - 0.5V  SEF997U
			Engine is running. └ Engine speed is 2,000 rpm	0.3 - 0.5V  SEF998U
42	B	Camshaft position sensor (POS) (1° signal)	Engine is running. (Warmed-up condition) └ Idle speed	Approximately 2.5V  SEF999U
			Engine is running. └ Engine speed is 2,000 rpm	Approximately 2.5V  SEF001V
43	B/Y	Start signal	Ignition switch "ON"	Approximately 0V
			Ignition switch "START"	9 - 12V
44	L/B	Park/Neutral position (PNP) switch	Ignition switch "ON" └ Gear position is "N" or "P"	Approximately 0V
			Ignition switch "ON" └ Except the above gear position	Approximately 5V
45	B/L	Ignition switch	Ignition switch "OFF"	0V
			Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
46	G/R	Air conditioner switch	Engine is running. └ Both A/C switch and blower switch are "ON" (Compressor operates)*	Approximately 0V
			Engine is running. └ A/C switch is "OFF"	BATTERY VOLTAGE (11 - 14V)

ECM Terminals and Reference Value (Cont'd)

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC voltage)
47	L	Data link connector	Engine is running. └ Idle speed (CONSULT-II is disconnected)	Approximately 0V
48	G/B	Sensors' power supply	Ignition switch "ON"	Approximately 5V
49	B/W	Power supply for ECM	Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
50	B	ECM ground	Engine is running. └ Idle speed	Engine ground
53	W/L	Vehicle speed sensor	Engine is running └ Lift up the vehicle. In 2nd gear position Vehicle speed is 40 km/h (25 MPH)	2 - 3V  SEF996U
58	GY/L	Power supply (Back-up)	Ignition switch "OFF"	BATTERY VOLTAGE (11 - 14V)
59	B/W	Power supply for ECM	Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
60	B	ECM ground	Engine is running. └ Idle speed	Engine ground
101 103 105 110 112 114	W/B B W W/L W/G Y	Injector No. 1 Injector No. 3 Injector No. 5 Injector No. 2 Injector No. 4 Injector No. 6	Engine is running. (Warmed-up condition) └ Idle speed	BATTERY VOLTAGE (11 - 14V)  SEF007V
			Engine is running. (Warmed-up condition) └ Engine speed is 2,000 rpm	BATTERY VOLTAGE (11 - 14V)  SEF008V
107, 108, 116	B/P	ECM ground	Engine is running. └ Idle speed	Engine ground
109	B/W	Current return	Engine is running. └ Idle speed	BATTERY VOLTAGE (11 - 14V)

Main Power Supply and Ground Circuit

ECM TERMINALS AND REFERENCE VALUE

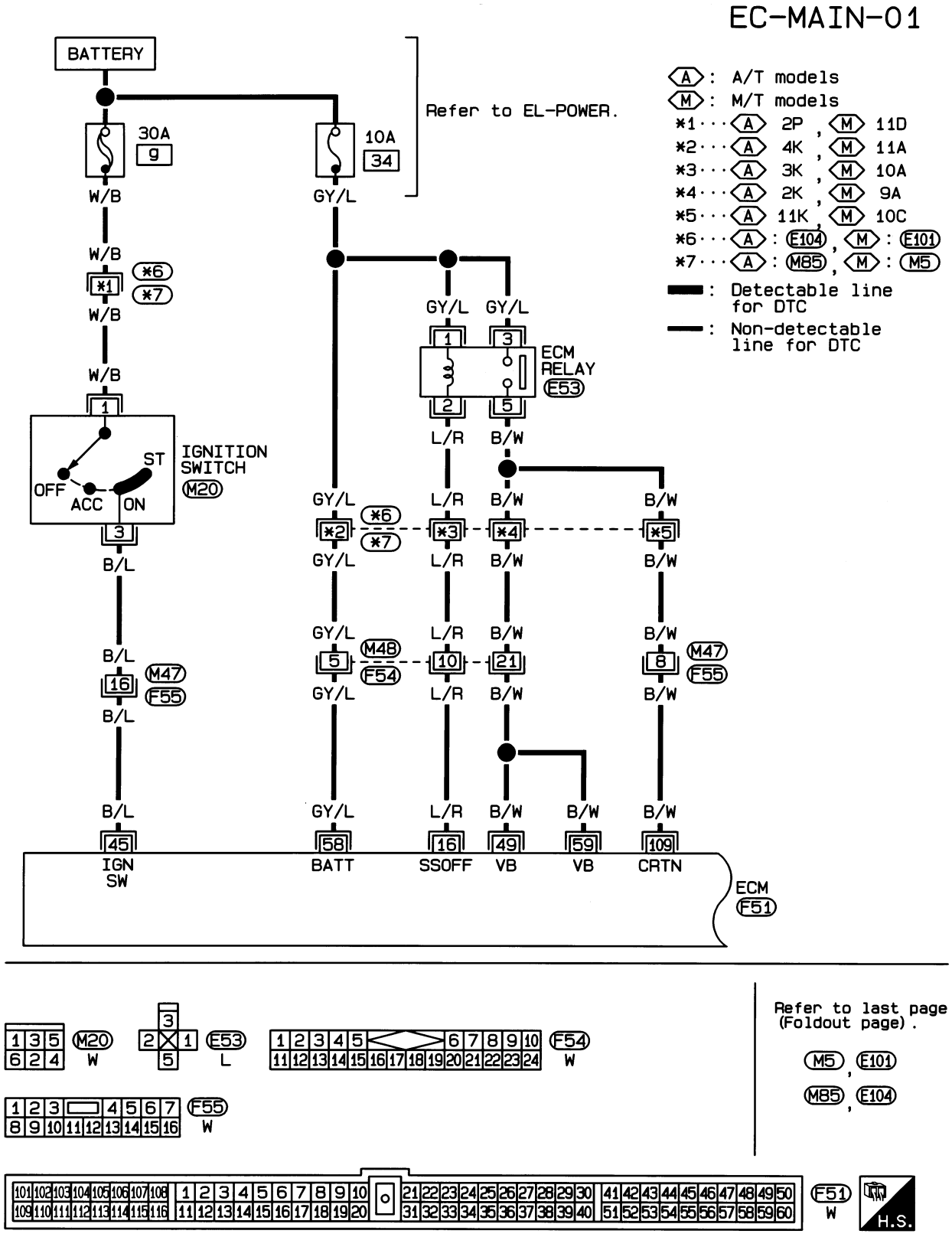
Specification data are reference values, and are measured between each terminal and ground.

CAUTION:

Do not use ECM ground terminals when measuring input/output voltage. Doing so may result in damage to the ECM's transistor. Use a ground other than ECM terminals, such as the ground.

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC voltage)
10	B/P	ECM ground	Engine is running. └ Idle speed	Engine ground
16	L/R	ECM relay (Self-shutoff)	Engine is running. Ignition switch "OFF" └ For a few seconds after turning ignition switch "OFF"	0 - 1.5V
			Ignition switch "OFF" └ A few seconds passed after turning ignition switch "OFF"	BATTERY VOLTAGE (11 - 14V)
20	B/P	ECM ground	Engine is running. └ Idle speed	Engine ground
45	B/L	Ignition switch	Ignition switch "OFF"	0V
			Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
49	B/W	Power supply for ECM	Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
59	B/W			
50	B	ECM ground	Engine is running. └ Idle speed	Engine ground
58	GY/L	Power supply (Back-up)	Ignition switch "OFF"	BATTERY VOLTAGE (11 - 14V)
60	B	ECM ground	Engine is running. └ Idle speed	Engine ground
107 108	B/P	ECM ground	Engine is running. └ Idle speed	Engine ground
109	B/W	Current return	Engine is running. └ Idle speed	BATTERY VOLTAGE (11 - 14V)
116	B/P	ECM ground	Engine is running. └ Idle speed	Engine ground

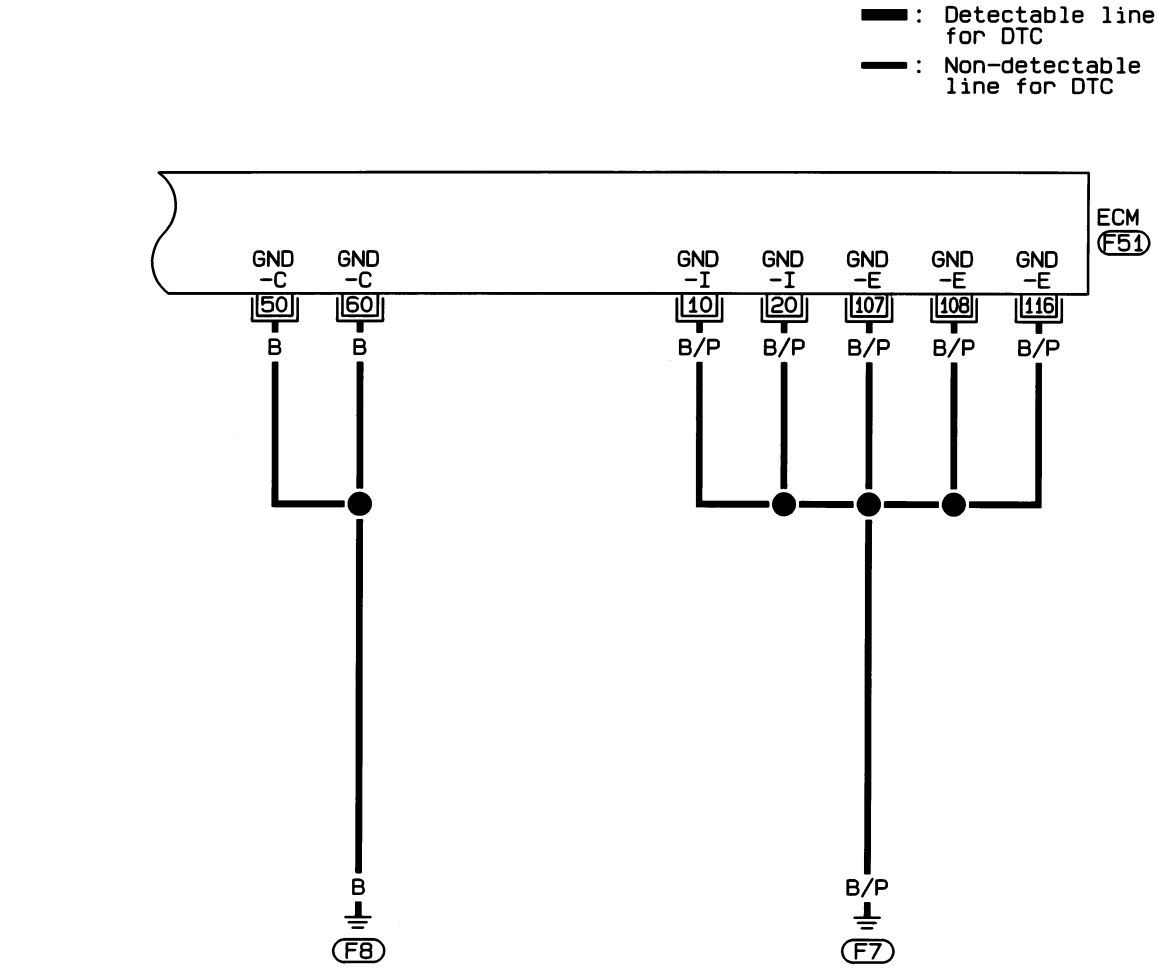
Main Power Supply and Ground Circuit (Cont'd)

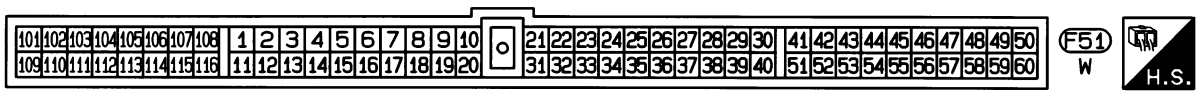


HEC862

Main Power Supply and Ground Circuit (Cont'd)

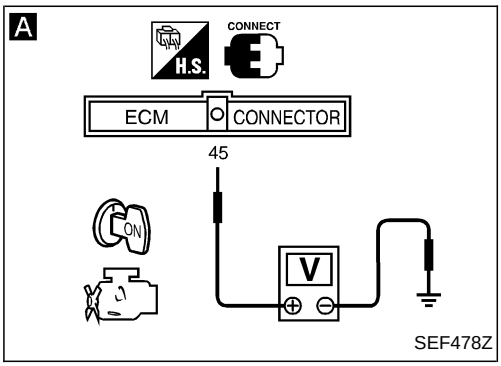
EC-MAIN-02

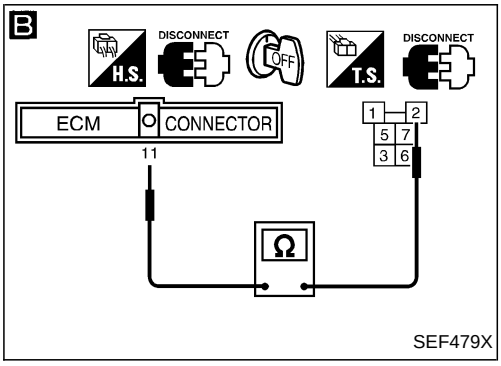


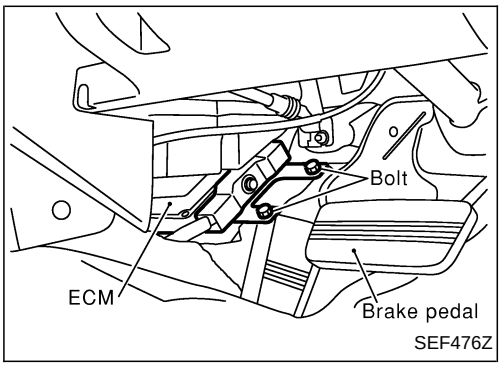


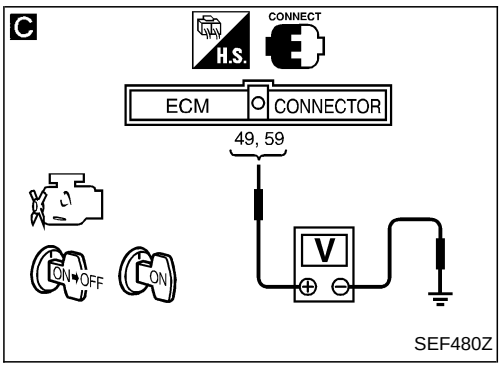
HEC863

Main Power Supply and Ground Circuit (Cont'd)









INSPECTION START

Start engine.
Is engine running?

No → **A**

CHECK POWER SUPPLY-I.
1. Turn ignition switch "OFF" and then "ON".
2. Check voltage between ECM terminal (45) and ground with CONSULT-II or tester.
   Voltage: Battery voltage

If NG, check the following.
- Harness connectors (F55), (M47)
- Harness for open or short between ECM and ignition switch

If NG, repair harness or connectors.

OK → Go to "CHECK GROUND CIRCUIT".

Yes

B

CHECK POWER SUPPLY-II.
1. Stop engine.
2. Check voltage between ECM terminal (58) and ground with CONSULT-II or tester.
   Voltage: Battery voltage

NG → Check the following.
- Harness connectors (F54), (M48)
- Harness connectors (E104), (M85) (A/T models)
  (E101), (M5) (M/T models)
- 10A fuse
- Harness for open or short between ECM and battery

If NG, repair harness or connectors.

OK

C

CHECK POWER SUPPLY-III.
1. Turn ignition switch "ON" and then turn "OFF".
2. Check voltage between ECM terminals (49), (59), (109) and ground with CONSULT-II or tester.
   Voltage:
   After turning ignition switch "OFF", battery voltage will exist for a few seconds, then drop to approximately 0V.

OK → Go to "CHECK GROUND CIRCUIT".

Case-1: Battery voltage does not exist.
Case-2: Battery voltage exists for more than a few seconds.

NG

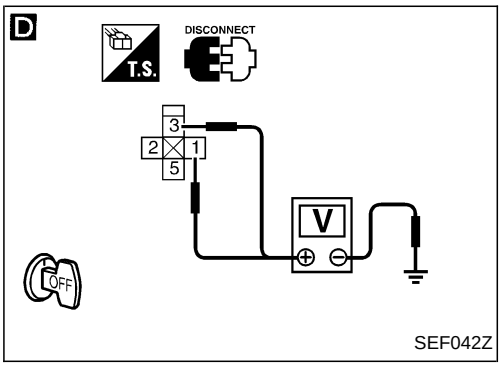
Case-2 → Go to "CHECK ECM RELAY" on next page.

Case-1

Ⓐ
(Go to next page.)

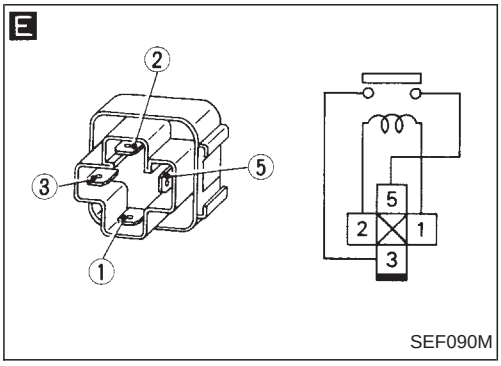
Main Power Supply and Ground Circuit (Cont'd)

D



SEF042Z

E



SEF090M

Ⓐ

CHECK HARNESS CONTINUITY BETWEEN ECM RELAY AND ECM.
1. Disconnect ECM harness connector.
2. Disconnect ECM relay.
3. Check harness continuity between ECM terminals ㊾, ㊾, (109) and ECM relay terminal ⑤.
   Refer to wiring diagram.
   Continuity should exist.
   If OK, check harness for short to ground and short to power.

NG → Check the following.
- Harness connectors (F54), (M48)
- Harness connectors (E104), (M85) (A/T models) (E101), (M5) (M/T models)
- Harness connectors (M47), (F55)
- Harness for open or short between ECM and ECM relay

If NG, repair open circuit, short to ground or short to power in harness or connectors.

OK ↓

D

CHECK VOLTAGE BETWEEN ECM RELAY AND GROUND.
Check voltage between terminals ①, ③ and ground with CONSULT-II or tester.
Voltage: Battery voltage

NG → Check the following.
- Harness for open or short between ECM relay and fuse

If NG, repair harness or connectors.

OK ↓

CHECK OUTPUT SIGNAL CIRCUIT.
Check harness continuity between ECM terminal ⑯ and relay terminal ②.
Refer to wiring diagram.
Continuity should exist.
If OK, check harness for short to ground and short to power.

NG → Check the following.
- Harness connectors (F54), (M48)
- Harness connectors (E104), (M85) (A/T models) (E101), (M5) (M/T models)
- Harness for open or short between ECM and ECM relay

If NG, repair open circuit, short to ground or short to power in harness or connectors.

OK ↓

E

CHECK ECM RELAY.
1. Apply 12V direct current between relay terminals ① and ②.
2. Check continuity between relay terminals ③ and ⑤.
   12V (① - ②) applied:
   Continuity exists.
   No voltage applied:
   No continuity

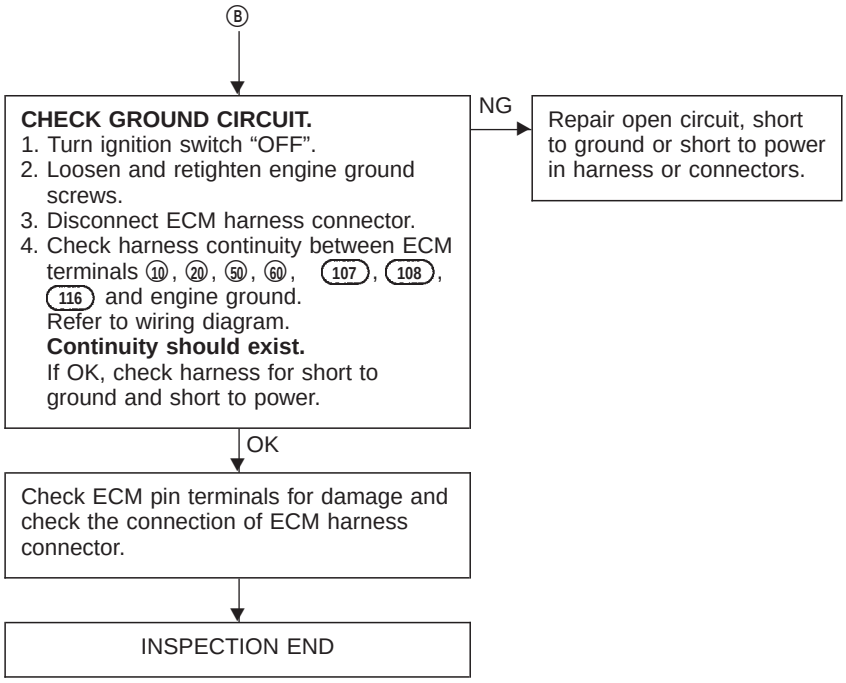
NG → Replace ECM relay.

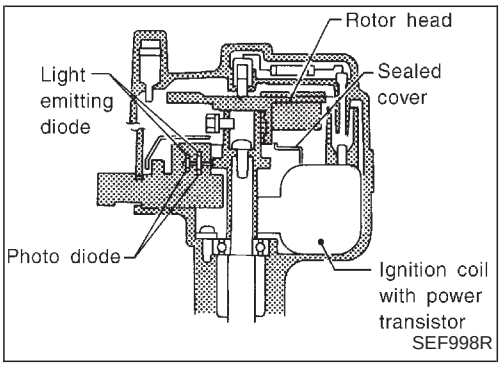
OK ↓

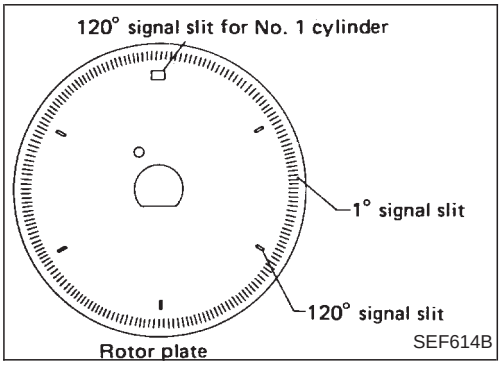
Ⓑ

(Go to next page.)

Main Power Supply and Ground Circuit (Cont'd)







Camshaft Position Sensor (CMPS)

COMPONENT DESCRIPTION

The camshaft position sensor is a basic component of the engine control system. It monitors engine speed and piston position. These input signals to the ECM are used to control fuel injection, ignition timing and other functions.

The camshaft position sensor has a rotor plate and a wave-forming circuit. The rotor plate has 360 slits for a 1° (POS) signal and 6 slits for a 120° (REF) signal. The wave-forming circuit consists of Light Emitting Diodes (LED) and photo diodes.

The rotor plate is positioned between the LED and the photo diode. The LED transmits light to the photo diode. As the rotor plate turns, the slits cut the light to generate rough-shaped pulses. These pulses are converted into on-off signals by the wave-forming circuit and sent to the ECM.

The distributor is not repairable and must be replaced as an assembly, except distributor cap and rotor head.

The rotor screw which secures the distributor rotor to the distributor shaft must be torqued properly.

: 3.6±0.3 N·m (37±3 kg-cm, 32±3 in-lb)

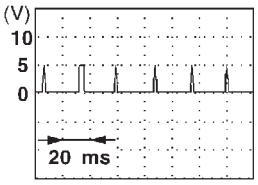
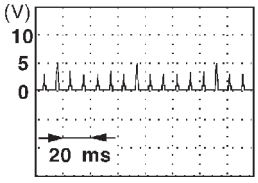
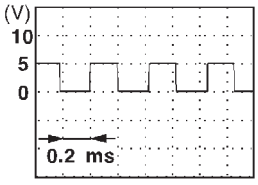
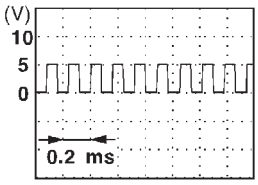
Camshaft Position Sensor (CMPS) (Cont’d)

ECM TERMINALS AND REFERENCE VALUE

Specification data are reference values, and are measured between each terminal and ground.

CAUTION:

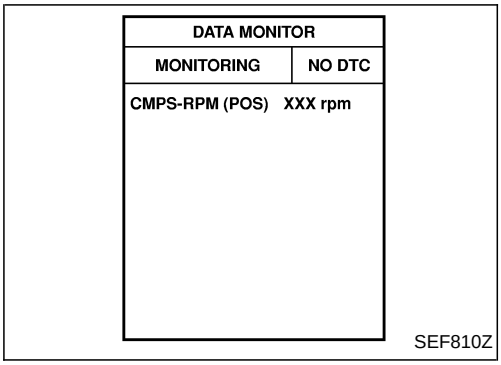
Do not use ECM ground terminals when measuring input/output voltage. Doing so may result in damage to the ECM’s transistor. Use a ground other than ECM terminals, such as the ground.

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC voltage)
41 51	OR	Camshaft position sensor (REF) (120° signal)	Engine is running. (Warmed-up condition) └ Idle speed	0.3 - 0.5V  SEF997U
			Engine is running. (Warmed-up condition) └ Engine speed is 2,000 rpm.	0.3 - 0.5V  SEF998U
42	W	Camshaft position sensor (POS) (1° signal)	Engine is running. (Warmed-up condition) └ Idle speed	Approximately 2.5V  SEF999U
			Engine is running. (Warmed-up condition) └ Engine speed is 2,000 rpm.	Approximately 2.5V  SEF001V
49 59	B/W B/W	Power supply for ECM	Ignition switch “ON”	BATTERY VOLTAGE (11 - 14V)
109	B/W	Current return	Engine is running. └ Idle speed	BATTERY VOLTAGE (11 - 14V)

Camshaft Position Sensor (CMPS) (Cont’d)

ON BOARD DIAGNOSIS LOGIC

Diagnostic Trouble Code No.	Malfunction is detected when	Check Items (Possible Cause)
11	● Either 1° or 120° signal is not sent to ECM for the first few seconds during engine cranking. ● Either 1° or 120° signal is not sent to ECM during engine running. ● Either 1° or 120° signal is not in the normal pattern during engine running.	● Harness or connectors (The camshaft position sensor circuit is open or shorted.) ● Camshaft position sensor ● Starter motor (Refer to EL section.) ● Starting system circuit (Refer to EL section.) ● Dead (Weak) battery



DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

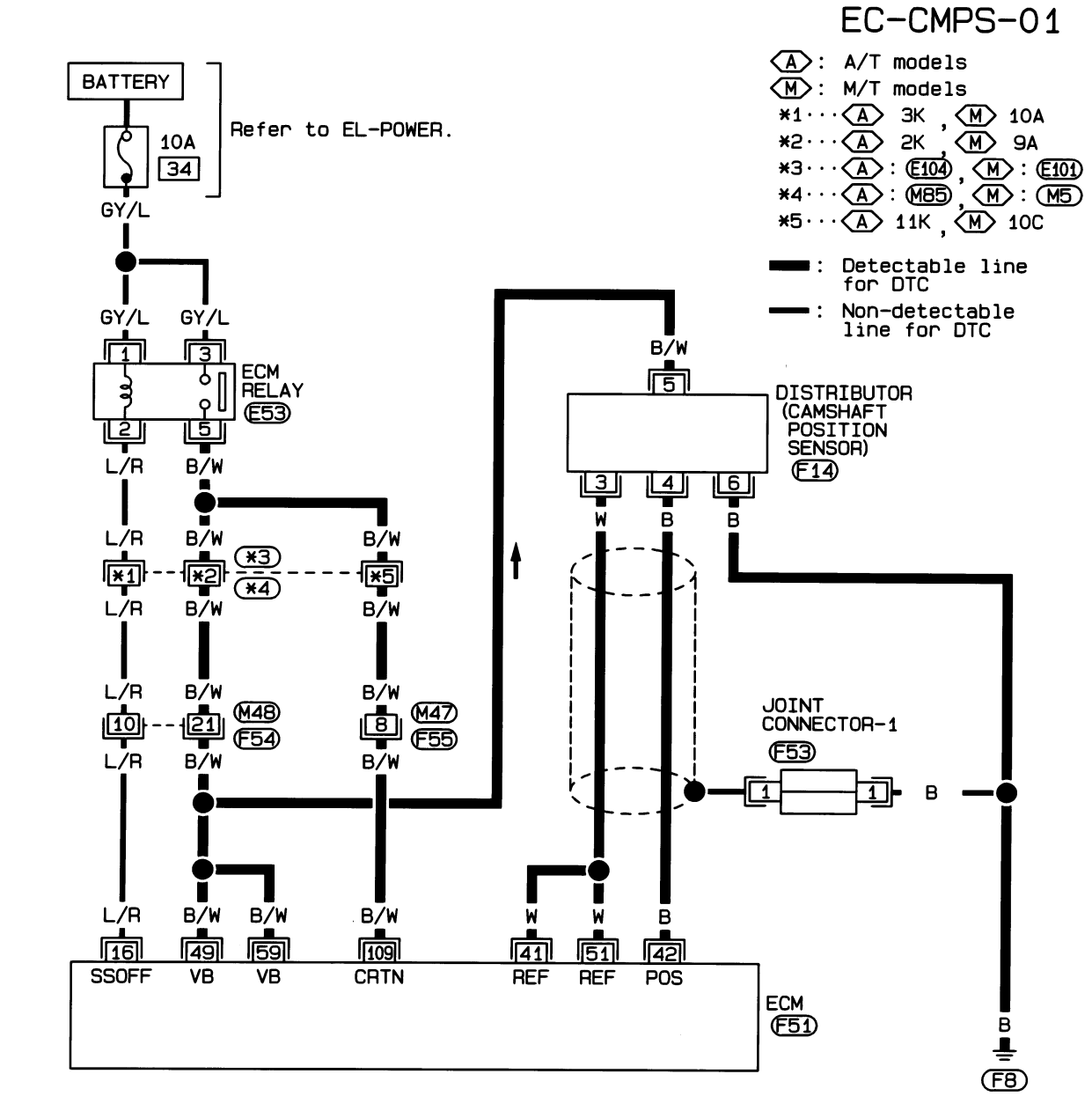
Before performing the following procedure, confirm that battery voltage is more than 10.5V.

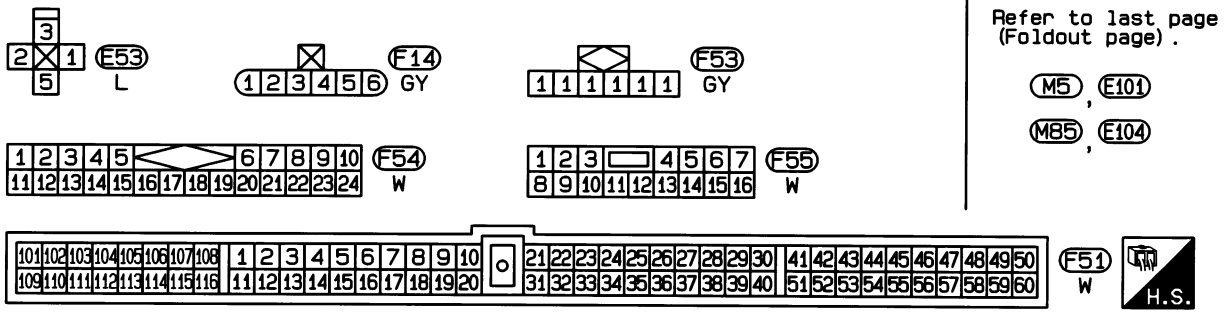
1) Turn ignition switch “ON” and select “DATA MONITOR” mode with CONSULT-II.
2) Start engine and run it for at least 2 seconds at idle speed.
   (If engine does not run, turn ignition switch to “START” for at least 2 seconds.)

OR

1) Start engine and run it for at least 2 seconds at idle speed.
   (If engine does not run, turn ignition switch to “START” for at least 2 seconds.)
2) Turn ignition switch “OFF”, wait at least 5 seconds and then turn “ON”.
3) Perform “Diagnostic Test Mode II (Self-diagnostic results)” with ECM.

Camshaft Position Sensor (CMPS) (Cont'd)

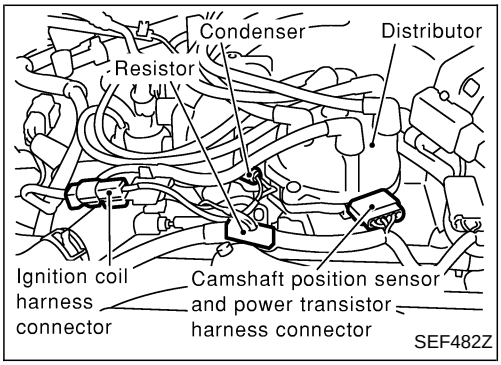


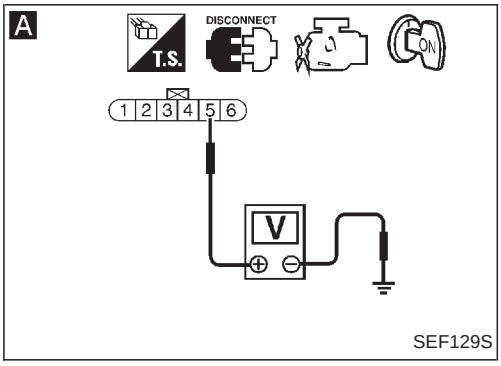


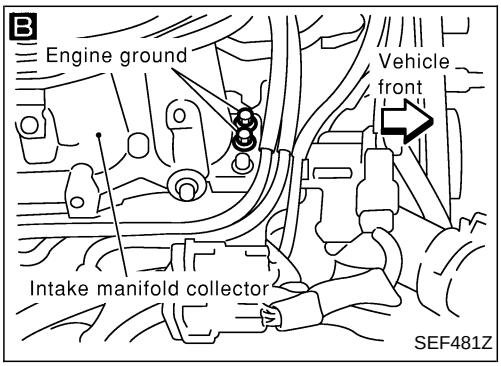
HEC864

Camshaft Position Sensor (CMPS) (Cont’d)

DIAGNOSTIC PROCEDURE







INSPECTION START

CHECK STARTING SYSTEM.
Does the engine turn over?
(Does the starter motor operate?)

No → Check starting system. (Refer to EL section.)

Yes

A

CHECK POWER SUPPLY.
1. Turn ignition switch “OFF”.
2. Disconnect camshaft position sensor harness connector.
3. Turn ignition switch “ON”.
4. Check voltage between terminal ⑤ and ground with CONSULT-II or tester.
   Voltage: Battery voltage

NG → Check the following.
- Harness connectors (F54), (M48)
- Harness connectors (E104), (M85) (A/T models) (E101), (M5) (M/T models)
- Harness for open or short between camshaft position sensor and ECM
- Harness for open or short between camshaft position sensor and ECM relay

If NG, repair harness or connectors.

OK

B

CHECK GROUND CIRCUIT.
1. Loosen and retighten engine ground screws.
2. Check harness continuity between terminal ⑥ and engine ground.
   Refer to wiring diagram.
   Continuity should exist.
   If OK, check harness for short.

NG → Repair open circuit or short to power in harness or connectors.

OK

CHECK INPUT SIGNAL CIRCUIT.
1. Turn ignition switch “OFF”.
2. Disconnect ECM harness connector.
3. Check harness continuity between terminal ④ and ECM terminals ㊷ (1° signal), terminal ③ and ECM terminals ㊶, ㊺ (120° signal).
   Refer to wiring diagram.
   Continuity should exist.
   If OK, check harness for short to ground and short to power.

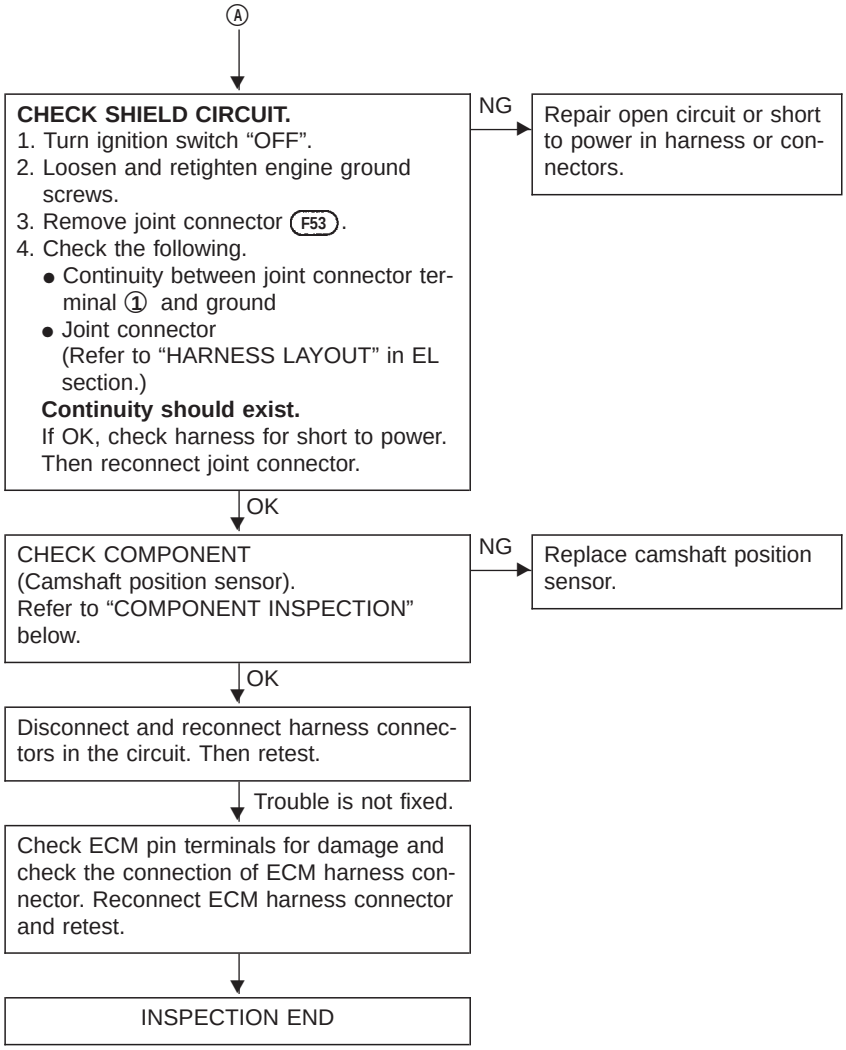
NG → Repair open circuit or short to ground or short to power in harness or connectors.

OK

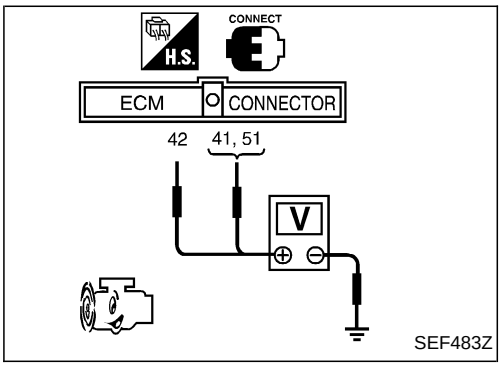
Ⓐ

(Go to next page.)

Camshaft Position Sensor (CMPS) (Cont’d)



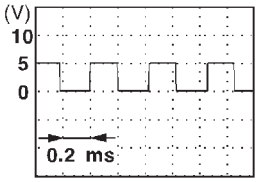
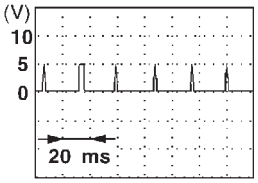
Camshaft Position Sensor (CMPS) (Cont’d)



COMPONENT INSPECTION

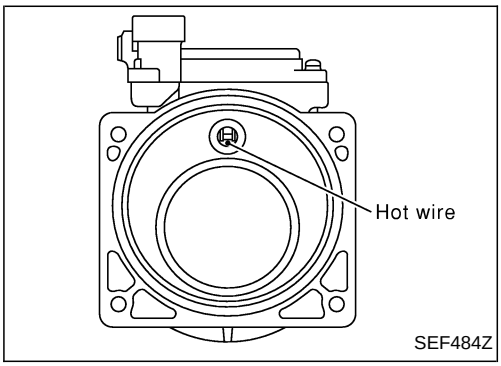
Camshaft position sensor

1. Start engine.
2. Check voltage between ECM terminals ㊶ , ㊷ , ㊶ and ground with DC range.

Condition	Terminals	Voltage
Engine running at idle	㊷ and ground	Approximately 2.5V*  SEF999U
	㊶, ㊶ and ground	Approximately 0.4V*  SEF997U

*: Average voltage for pulse signal (Actual pulse signal can be confirmed by oscilloscope.)

If NG, replace distributor assembly with camshaft position sensor.



Mass Air Flow Sensor (MAFS)

COMPONENT DESCRIPTION

The mass air flow sensor is placed in the stream of intake air. It measures the intake flow rate by measuring a part of the entire intake flow. It consists of a hot wire that is supplied with electric current from the ECM. The temperature of the hot wire is controlled by the ECM a certain amount. The heat generated by the hot wire is reduced as the intake air flows around it. The more air, the greater the heat loss.

Therefore, the ECM must supply more electric current to the hot wire as air flow increases. This maintains the temperature of the hot wire. The ECM detects the air flow by means of this current change.

CONSULT-II REFERENCE VALUE IN DATA MONITOR MODE

Remarks: Specification data are reference values.

MONITOR ITEM	CONDITION		SPECIFICATION
MAS AIR/FL SE	● Engine: After warming up ● Air conditioner switch: “OFF” ● Shift lever: Neutral position ● No-load	Idle	1.0 - 1.7V
		2,500 rpm	1.7 - 2.3V

ECM TERMINALS AND REFERENCE VALUE

Specification data are reference values, and are measured between each terminal and ground.

CAUTION:

Do not use ECM ground terminals when measuring input/output voltage. Doing so may result in damage to the ECM’s transistor. Use a ground other than ECM terminals, such as the ground.

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC voltage)
26	W	Mass air flow sensor ground	Engine is running. (Warmed-up condition) └ Idle speed	Approximately 0V
27	B	Mass air flow sensor	Engine is running. (Warmed-up condition) └ Idle speed	1.0 - 1.7V
			Engine is running. (Warmed-up condition) └ Engine speed is 2,500 rpm.	1.7 - 2.3V

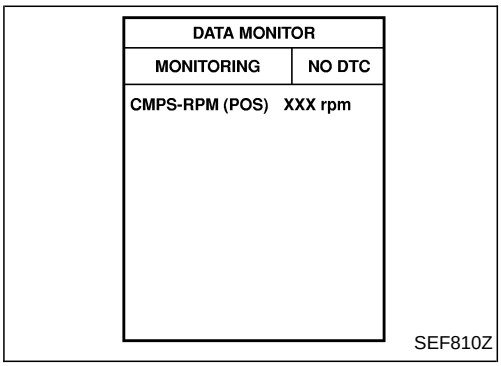
ON BOARD DIAGNOSIS LOGIC

Diagnostic Trouble Code No.	Malfunction is detected when ...	Check Items (Possible Cause)
12	● An excessively high or low voltage from the sensor is sent to ECM.*	● Harness or connectors (The sensor circuit is open or shorted.) ● Mass air flow sensor

*: When this malfunction is detected, the ECM enters fail-safe mode.

Engine operating condition in fail-safe mode	Engine speed will not rise more than 2,400 rpm due to the fuel cut.

Mass Air Flow Sensor (MAFS) (Cont’d)



DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

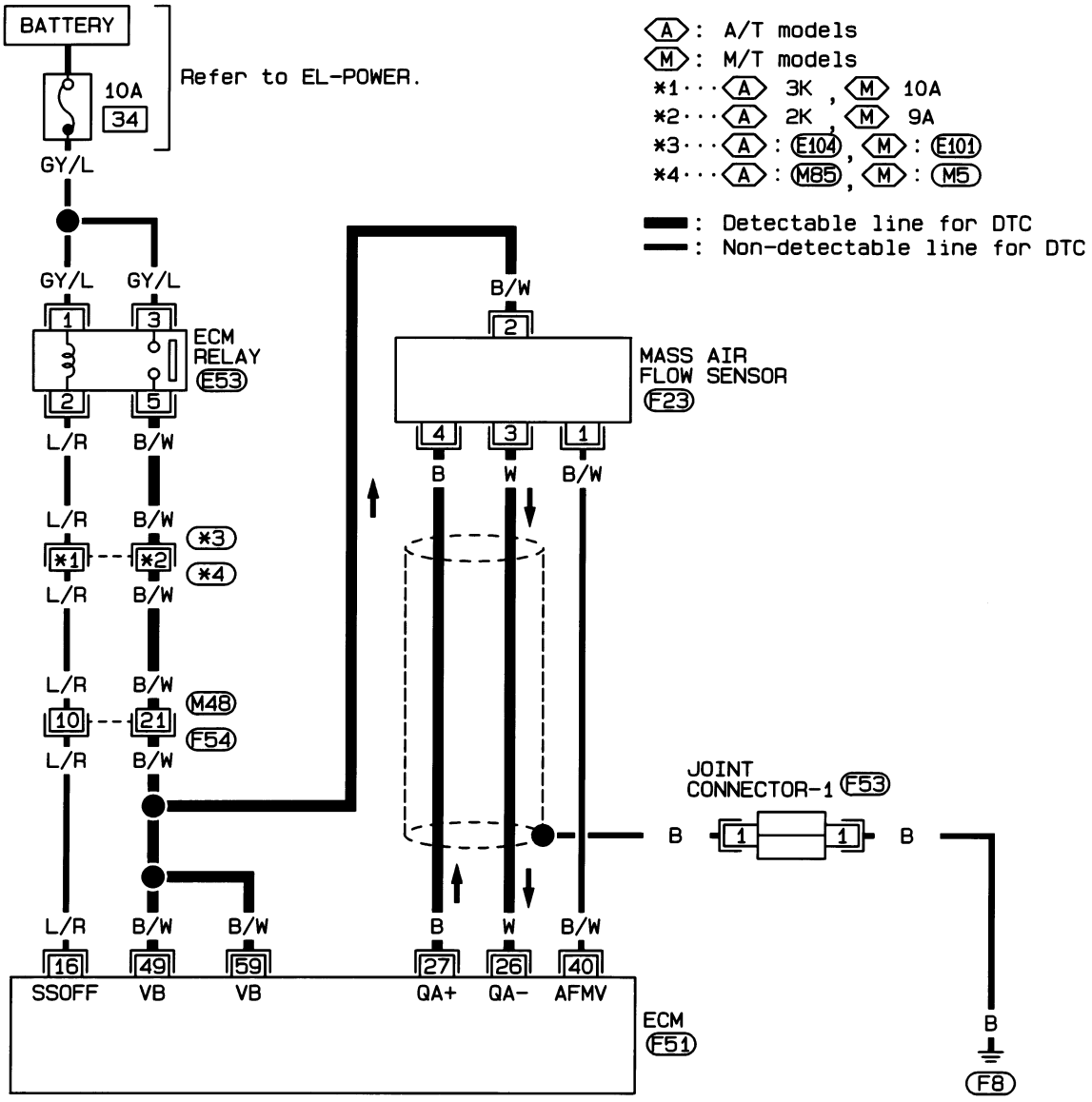
1) Turn ignition switch “ON”, and wait at least 6 seconds.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Start engine and wait at least 3 seconds.

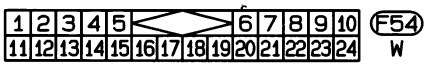
OR

1) Turn ignition switch “ON”, and wait at least 6 seconds.
2) Start engine and wait at least 3 seconds.
3) Turn ignition switch “OFF”, wait at least 5 seconds and then turn “ON”.
4) Perform “Diagnostic Test Mode II (Self-diagnostic results)” with ECM.

Mass Air Flow Sensor (MAFS) (Cont'd)

EC-MAFS-01

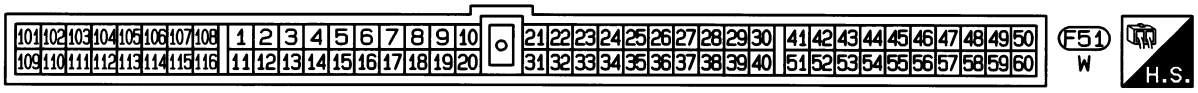




Refer to last page (Foldout page).

M5, E101

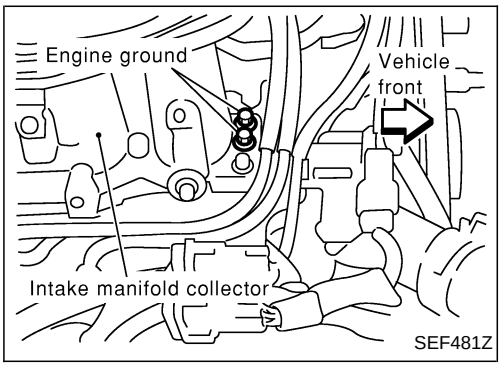
M85, E104

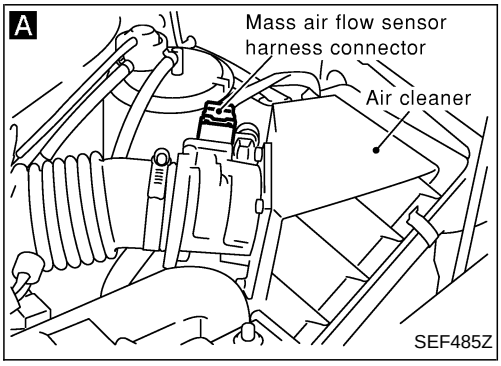


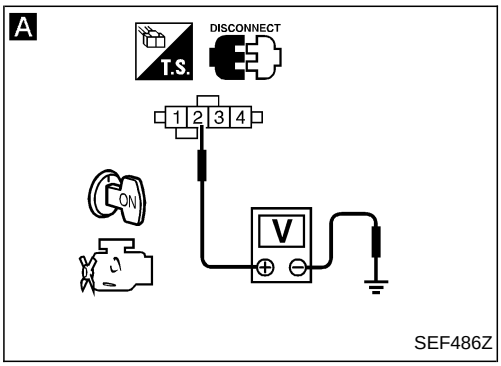
HEC865

Mass Air Flow Sensor (MAFS) (Cont’d)

DIAGNOSTIC PROCEDURE







INSPECTION START

A

CHECK POWER SUPPLY.
1. Disconnect mass air flow sensor harness connector.
2. Turn ignition switch “ON”.
3. Check voltage between terminal ② and ground with CONSULT-II or tester.
   Voltage: Battery voltage

NG → Check the following.
- Harness connectors F54, M48
- Harness connectors E104, M85 (A/T models)
  E101, M5 (M/T models)
- Harness for open or short between mass air flow sensor and ECM
- Harness for open or short between mass air flow sensor and ECM relay

If NG, repair harness or connectors.

OK ↓

CHECK GROUND CIRCUIT.
1. Turn ignition switch “OFF”.
2. Disconnect ECM harness connector.
3. Check harness continuity between terminal ③ and ECM terminal ㉖.
   Refer to wiring diagram.
   Continuity should exist.
   If OK, check harness for short to power.

NG → Repair open circuit or short to power in harness or connectors.

OK ↓

CHECK INPUT SIGNAL CIRCUIT.
Check harness continuity between terminal ④ and ECM terminal ㉗.
Refer to wiring diagram.
Continuity should exist.
If OK, check harness for short to ground and short to power.

NG → Repair open circuit, short to ground or short to power in harness or connectors.

OK ↓

CHECK SHIELD CIRCUIT.
1. Turn ignition switch “OFF”.
2. Loosen and retighten engine ground screws.
3. Remove joint connector F53.
4. Check the following.
   - Continuity between joint connector terminal ① and ground
   - Joint connector
     (Refer to “HARNESS LAYOUT” in EL section.)

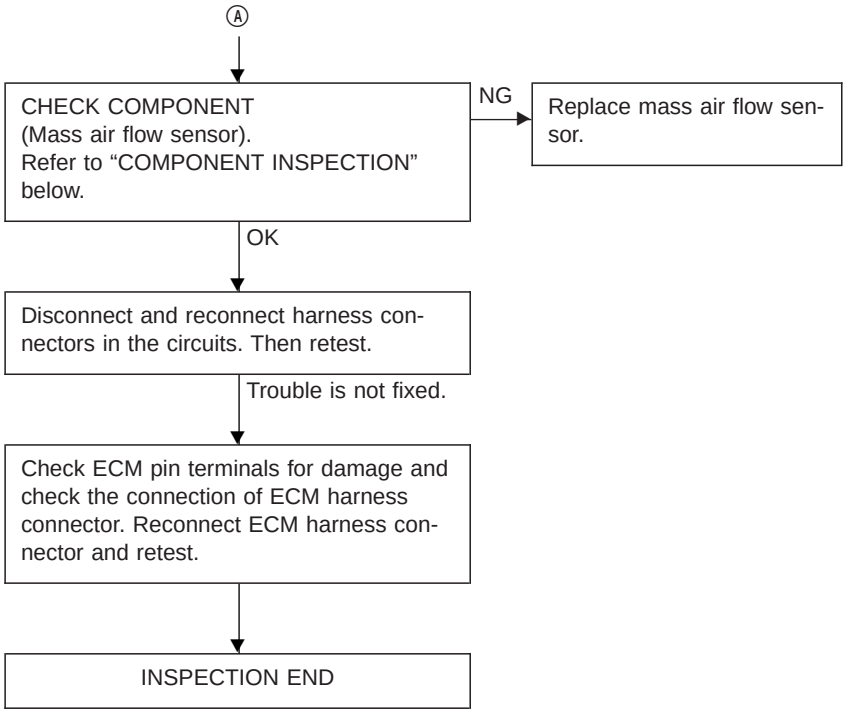
   Continuity should exist.
   If OK, check harness for short to power.
   Then reconnect joint connector.

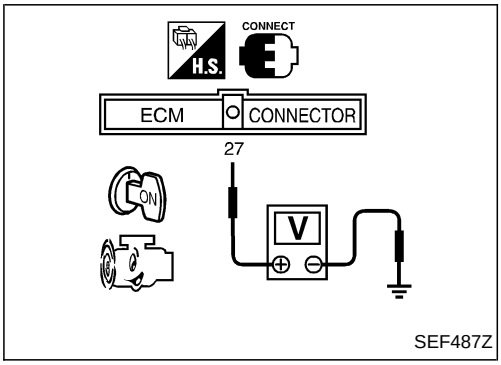
NG → Repair open circuit or short to power in harness or connectors.

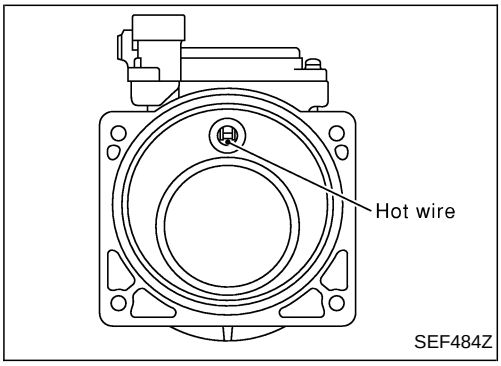
OK ↓

Ⓐ
(Go to next page.)

Mass Air Flow Sensor (MAFS) (Cont’d)







COMPONENT INSPECTION

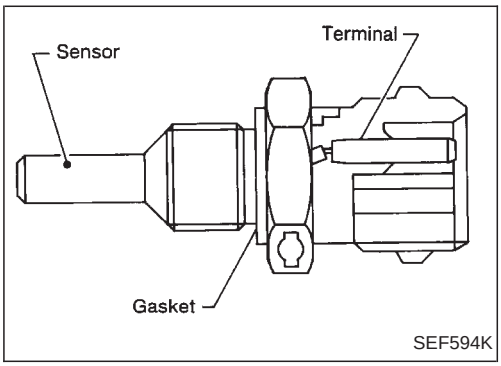
Mass air flow sensor

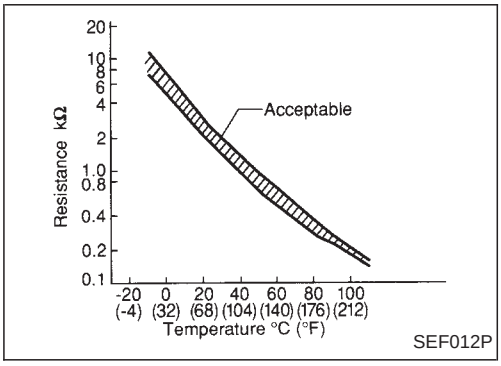
1. Turn ignition switch “ON”.
2. Start engine and warm it up sufficiently.
3. Check voltage between ECM terminal ㉗ and ground.

Conditions	Voltage V
Ignition switch “ON” (Engine stopped.)	Less than 1.0
Idle (Engine is warmed-up sufficiently.)	1.0 - 1.7
2,500 rpm	1.7 - 2.3
Idle to about 4,000 rpm*	1.0 - 1.7 to Approx. 4.0

*: Check for linear voltage rise in response to increase to about 4,000 rpm in engine speed.

4. If NG, remove mass air flow sensor from air duct. Check hot wire for damage or dust.





Engine Coolant Temperature Sensor (ECTS)

COMPONENT DESCRIPTION

The engine coolant temperature sensor is used to detect the engine coolant temperature. The sensor modifies a voltage signal from the ECM. The modified signal returns to the ECM as the engine coolant temperature input. The sensor uses a thermistor which is sensitive to the change in temperature. The electrical resistance of the thermistor decreases as temperature increases.

<Reference data>

Engine coolant temperature °C (°F)	Voltage* V	Resistance kΩ
−10 (14)	4.4	7.0 - 11.4
20 (68)	3.5	2.1 - 2.9
50 (122)	2.2	0.68 - 1.00
90 (194)	1.0	0.236 - 0.260

*: These data are reference values and are measured between ECM terminal ㉘ (Engine coolant temperature sensor) and ground.

CAUTION:

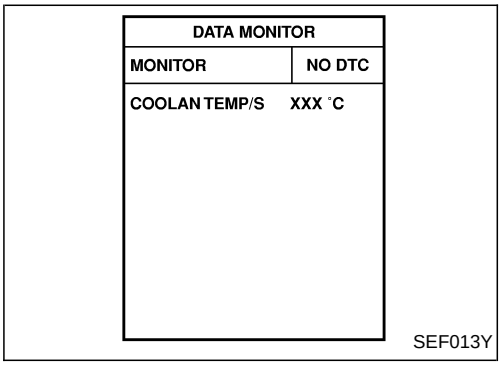
Do not use ECM ground terminals when measuring input/output voltage. Doing so may result in damage to the ECM’s transistor. Use a ground other than ECM terminals, such as the ground.

ON BOARD DIAGNOSIS LOGIC

Diagnostic Trouble Code No.	Malfunction is detected when ...	Check Items (Possible Cause)
13	● An excessively high or low voltage from the sensor is sent to ECM.*	● Harness or connectors (The sensor circuit is open or shorted.) ● Engine coolant temperature sensor ● Thermostat

*: When this malfunction is detected, the ECM enters fail-safe mode.

Engine operating condition in fail-safe mode	Condition	Engine coolant temperature decided (CONSULT-II DISPLAY)
Engine coolant temperature will be determined by ECM based on the time after turning ignition switch “ON” or “START”. CONSULT-II displays the engine coolant temperature decided by ECM.	Just as ignition switch is turned ON or START	40°C (104°F)
	More than 4 minutes after ignition START	80°C (176°F)
	Except as shown above	40 - 80°C (104 - 176°F) (Depends on the time)



Engine Coolant Temperature Sensor (ECTS) (Cont’d)

DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

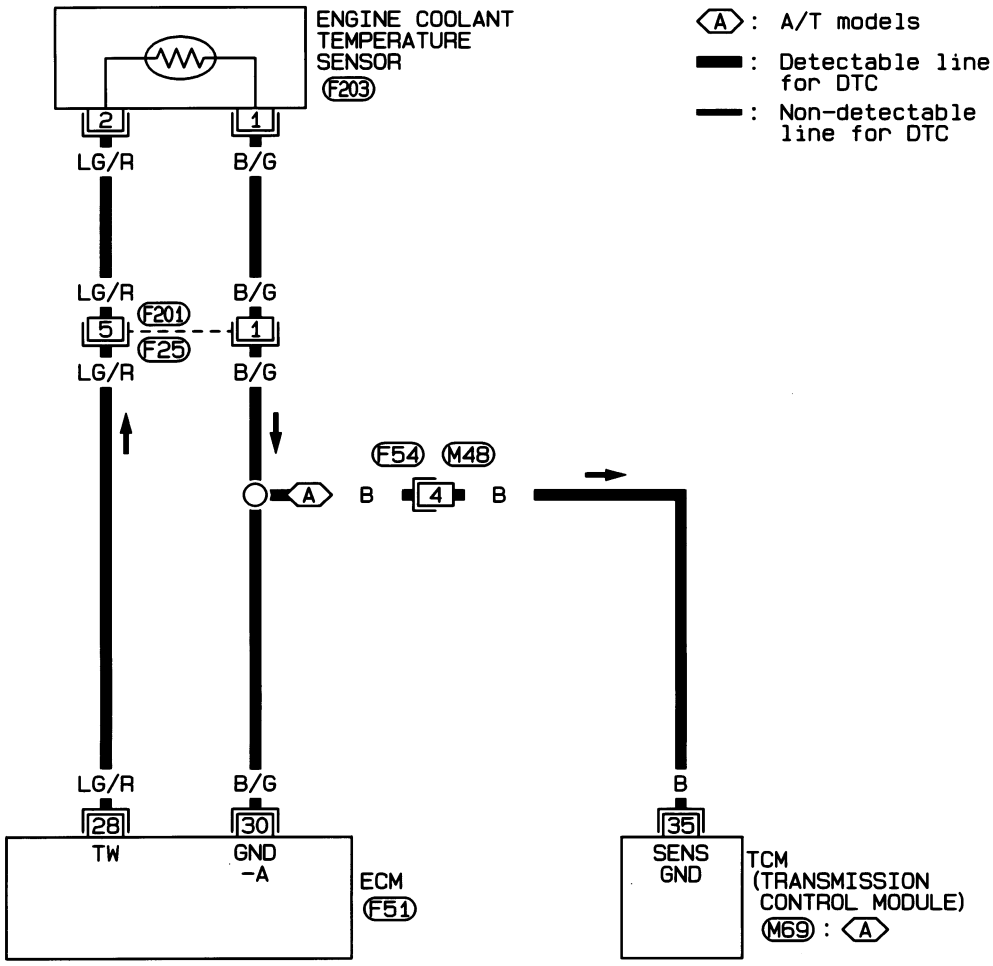
1) Turn ignition switch “ON”.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Wait at least 5 seconds.

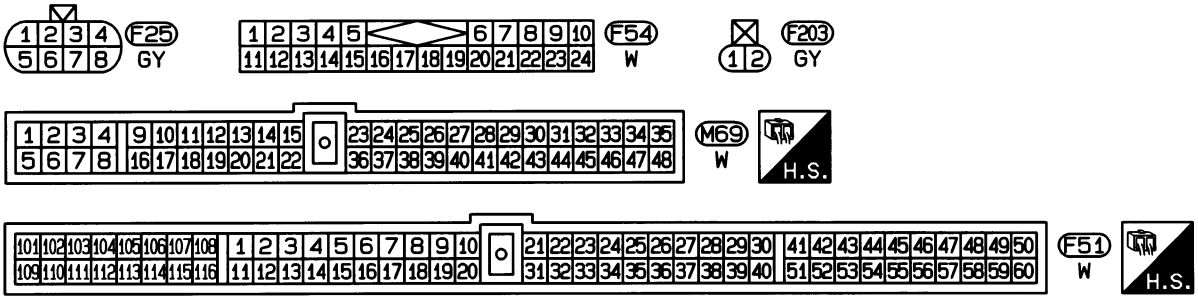
OR

1) Turn ignition switch “ON” and wait at least 5 seconds.
2) Turn ignition switch “OFF”, wait at least 5 seconds and then turn “ON”.
3) Perform “Diagnostic Test Mode II (Self-diagnostic results)” with ECM.

Engine Coolant Temperature Sensor (ECTS) (Cont'd)

EC-ECTS-01





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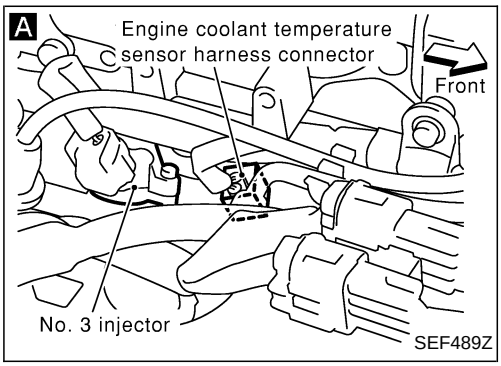
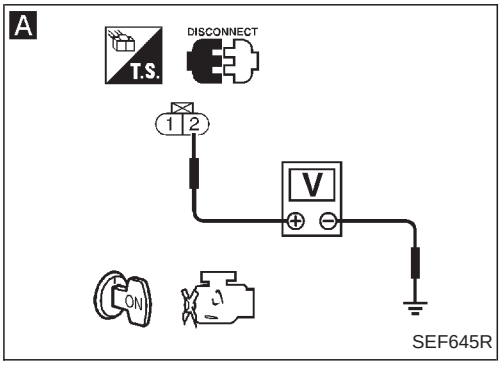
Engine Coolant Temperature Sensor (ECTS) (Cont’d)





DIAGNOSTIC PROCEDURE

INSPECTION START

A

CHECK POWER SUPPLY.
1. Turn ignition switch “OFF”.
2. Disconnect engine coolant temperature sensor harness connector.
3. Turn ignition switch “ON”.
4. Check voltage between terminal ② and ground with CONSULT-II or tester.
   Voltage:
   Approximately 5V

NG → Check the following.
- Harness connectors (F25), (F201)
- Harness for open or short between engine coolant temperature sensor and ECM

If NG, repair harness or connectors.

OK

CHECK GROUND CIRCUIT.
1. Turn ignition switch “OFF”.
2. Check harness continuity between terminal ① and engine ground.
   Refer to wiring diagram.
   Continuity should exist.
   If OK, check harness for short to power.

NG → Check the following.
- Harness connectors (F25), (F201)
- Harness for open or short between ECM and engine coolant temperature sensor
- Harness for open or short between TCM (Transmission Control Module) and engine coolant temperature sensor

If NG, repair open circuit or short to power in harness or connectors.

OK

CHECK COMPONENT
(Engine coolant temperature sensor).
Refer to “COMPONENT INSPECTION” on next page.

NG → Replace engine coolant temperature sensor.

OK

Disconnect and reconnect harness connectors in the circuit. Then retest.

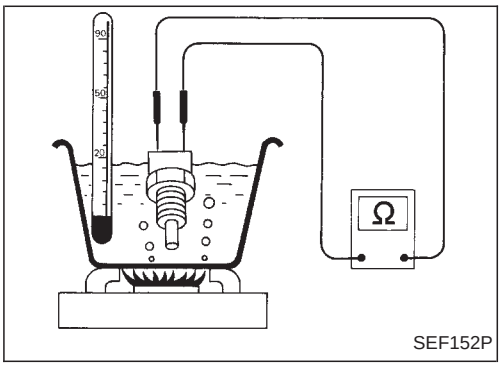
Trouble is not fixed.

Check ECM pin terminals for damage and check the connection of ECM harness connector. Reconnect ECM harness connector and retest.

INSPECTION END

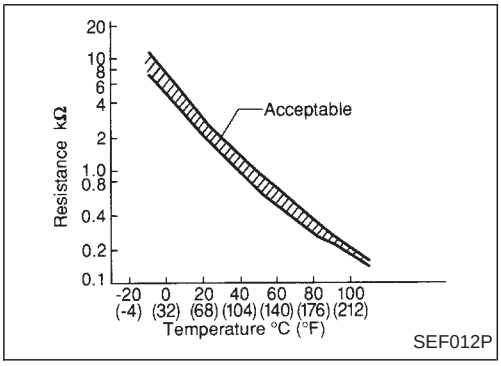
Engine Coolant Temperature Sensor (ECTS) (Cont’d)

COMPONENT INSPECTION



Engine coolant temperature sensor

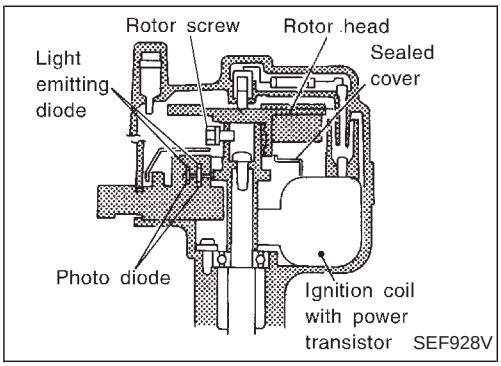
Check resistance as shown in the figure.



<Reference data>

Temperature °C (°F)	Resistance kΩ
20 (68)	2.1 - 2.9
50 (122)	0.68 - 1.00
90 (194)	0.236 - 0.260

If NG, replace engine coolant temperature sensor.



Ignition Signal

COMPONENT DESCRIPTION

Ignition coil & power transistor (Built into distributor)

The power transistor switches on and off the ignition coil primary circuit according to the ECM signal. As the primary circuit is turned on and off, the proper high voltage is induced in the secondary circuit. The distributor is not repairable except for the distributor cap and rotor head.

The rotor screw which secures the distributor rotor head to the distributor shaft must be torqued properly.

: 3.6±0.3 N·m (37±3 kg-cm, 32±3 in-lb)

CONSULT-II REFERENCE VALUE IN DATA MONITOR MODE

Remarks: Specification data are reference values.

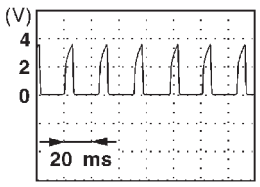
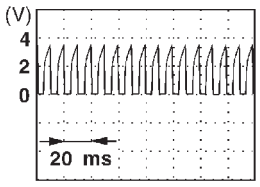
MONITOR ITEM	CONDITION		SPECIFICATION
IGN TIMING	• Engine: After warming up • Air conditioner switch: “OFF” • Shift lever: Neutral position • No-load	Idle	15° BTDC
		2,000 rpm	About 25° BTDC

ECM TERMINALS AND REFERENCE VALUE

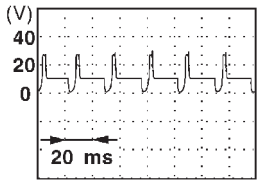
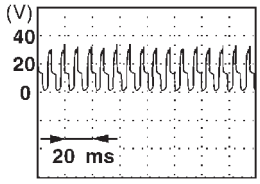
Specification data are reference values, and are measured between each terminal and ground.

CAUTION:

Do not use ECM ground terminals when measuring input/output voltage. Doing so may result in damage to the ECM’s transistor. Use a ground other than ECM terminals, such as the ground.

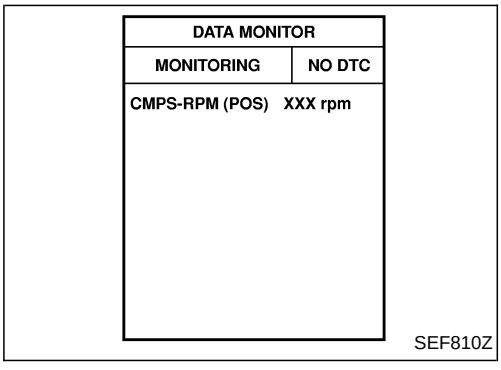
TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC voltage)
1	W/PU	Ignition signal	Engine is running. └ Idle speed	Approximately 0.7V  SEF988U
			Engine is running. └ Engine speed is 2,000 rpm.	1.1 - 1.5V  SEF989U

Ignition Signal (Cont’d)

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC voltage)
2	W/G	Ignition check	Engine is running. (Warmed-up condition) └ Idle speed	Approximately 12V  SEF990U
			Engine is running. └ Engine speed is 2,000 rpm.	Approximately 11V  SEF991U

ON BOARD DIAGNOSIS LOGIC

Diagnostic Trouble Code No.	Malfunction is detected when ...	Check Items (Possible Cause)
21	● The ignition signal in the primary circuit is not sent to ECM during engine cranking or running.	● Harness or connectors (The ignition primary circuit is open or shorted.) ● Power transistor unit ● Resistor ● Camshaft position sensor ● Camshaft position sensor circuit



SEF810Z

DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

NOTE:

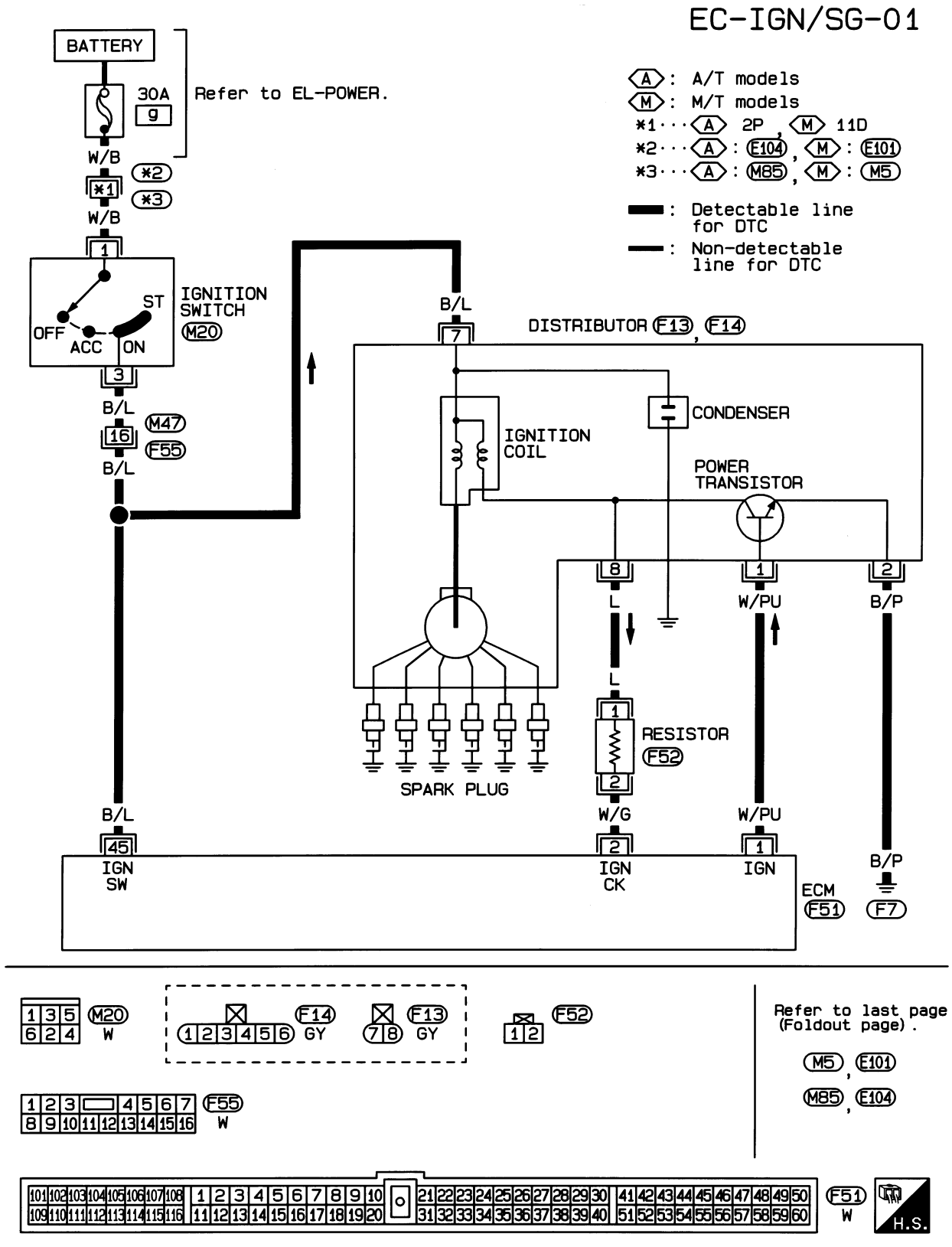
- **If “DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE” has been previously conducted, always turn ignition switch “OFF” and wait at least 5 seconds before conducting the next test.**
- **If both DTC 21 and DTC 11 are displayed, perform TROUBLE DIAGNOSIS FOR DTC 11 first. (See EC-67.)**

1) Turn ignition switch “ON”.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Start engine and wait at least 2 seconds. (If engine does not run, turn ignition switch to “START” for at least 5 seconds.)

OR

1) Turn ignition switch “ON”.
2) Start engine and wait at least 2 seconds. (If engine does not run, turn ignition switch to “START” for at least 5 seconds.)
3) Turn ignition switch “OFF”, wait at least 5 seconds and then turn “ON”.
4) Perform “Diagnostic Test Mode II (Self-diagnostic results)” with ECM.

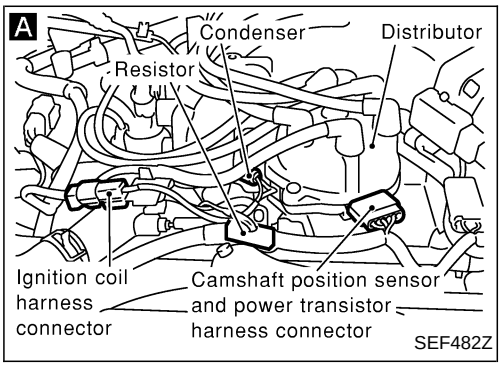
Ignition Signal (Cont'd)

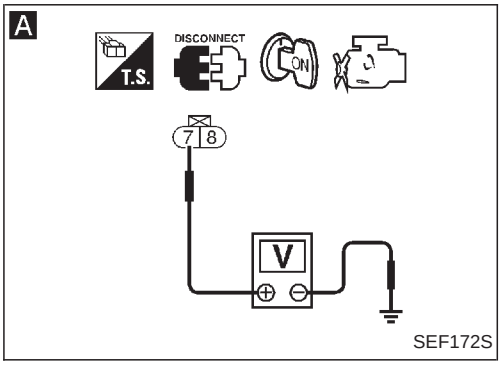


HEC866

Ignition Signal (Cont’d)

DIAGNOSTIC PROCEDURE





INSPECTION START

Turn ignition switch “OFF”, and restart engine.
Is engine running?

Yes → Ⓐ (Go to next page.)

No

A

CHECK POWER SUPPLY.
1. Turn ignition switch “OFF”.
2. Disconnect ignition coil harness connector.
3. Turn ignition switch “ON”.
4. Check voltage between terminal ⑦ and ground with CONSULT-II or tester.
   Voltage: Battery voltage

NG → Check the following.
- Harness connectors (M47), (F55)
- Harness connectors (E101), (M5) (M/T models) (E104), (M85) (A/T models)
- Harness for open or short between ignition coil and ignition switch

If NG, repair harness or connectors.

OK

CHECK GROUND CIRCUIT.
1. Turn ignition switch “OFF”.
2. Disconnect power transistor harness connector.
3. Check harness continuity between terminal ② and engine ground.
   Refer to wiring diagram.
   Continuity should exist.
   If OK, check harness for short to power.

NG → Repair open circuit or short to power in harness or connectors.

OK

CHECK OUTPUT SIGNAL CIRCUIT.
1. Disconnect ECM harness connector.
2. Check harness continuity between ECM terminal ① and power transistor harness connector terminal ①.
   Refer to wiring diagram.
   Continuity should exist.
   If OK, check harness for short to ground and short to power.

NG → Repair open circuit or short to ground or short to power in harness or connectors.

OK

CHECK COMPONENTS
(Ignition coil, power transistor).
Refer to “COMPONENT INSPECTION”, EC-89.

NG → Replace malfunctioning component(s).

OK

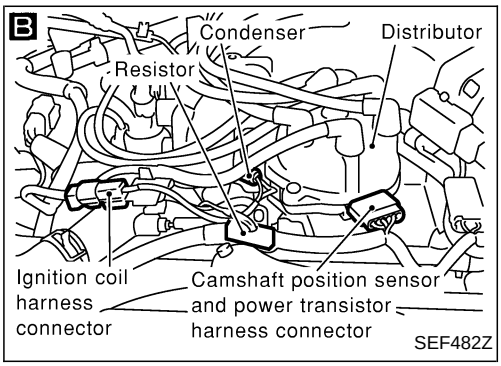
Disconnect and reconnect harness connectors in the circuit. Then retest.

Trouble is not fixed.

Check ECM pin terminals for damage and check the connection of ECM harness connector. Reconnect ECM harness connector and retest.

INSPECTION END

Ignition Signal (Cont’d)



Ⓐ

B

CHECK INPUT SIGNAL CIRCUIT.
1. Stop engine.
2. Disconnect ignition coil harness connector.
3. Strip tape covering resistor.
4. Disconnect resistor harness connector.
5. Disconnect ECM harness connector.
6. Check harness continuity between ignition coil harness connector terminal ⑧ and resistor terminal ① , resistor terminal ② and ECM terminal ② .
   Refer to wiring diagram.
   Continuity should exist.
   If OK, check harness for short to ground and short to power.

NG → Repair open circuit short to ground or short to power in harness or connectors.

OK ↓

CHECK COMPONENT (Resistor).
Refer to “COMPONENT INSPECTION” on next page.

NG → Replace resistor.

OK ↓

Disconnect and reconnect harness connectors in the circuit. Then retest.

Trouble is not fixed. ↓

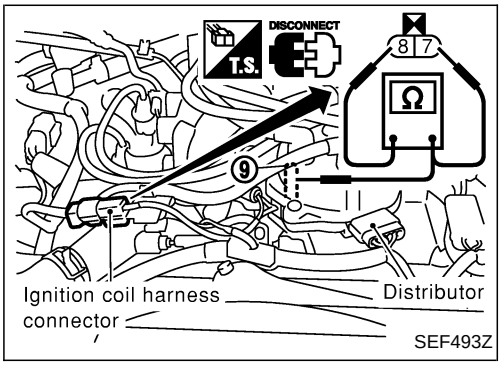
Check ECM pin terminals for damage and check the connection of ECM harness connector. Reconnect ECM harness connector and retest.

↓

INSPECTION END

Ignition Signal (Cont’d)

COMPONENT INSPECTION



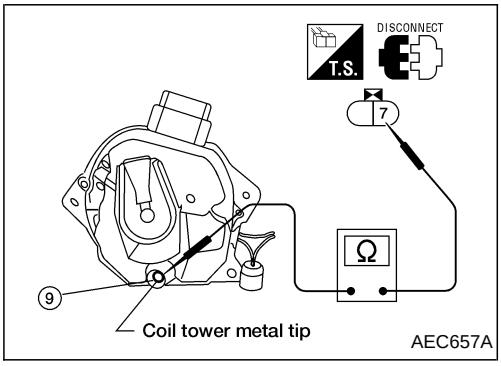
Ignition coil

1. Disconnect ignition coil harness connector.
2. Check resistance as shown in the figure.

Terminal	Resistance [at 25°C (77°F)]
⑦ - ⑧ (Primary coil)	Approximately 1Ω
⑦ - ⑨ (Secondary coil)	Approximately 20 kΩ

For checking secondary coil, remove distributor cap and measure resistance between coil tower metal tip ⑨ and terminal ⑦.

If NG, replace distributor assembly as a unit.

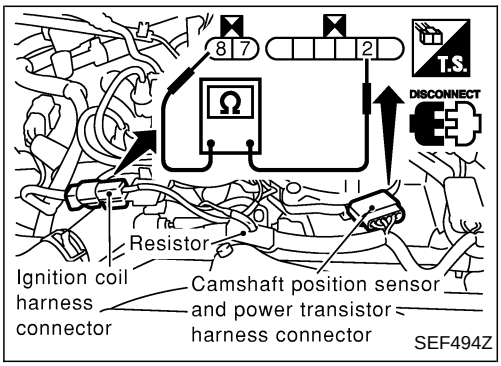


Power transistor

1. Disconnect camshaft position sensor & power transistor harness connector and ignition coil harness connector.
2. Check power transistor resistance between terminals ② and ⑧.

Terminals	Resistance	Result
② and ⑧	Except 0Ω	OK
	0Ω	NG

If NG, replace distributor assembly.

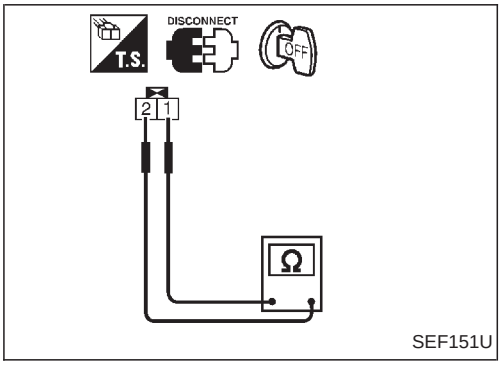


Resistor

1. Disconnect resistor harness connector.
2. Check resistance between terminals ① and ②.

Resistance: Approximately 2.2 kΩ [at 25°C (77°F)]

If NG, replace resistor.



Overheat

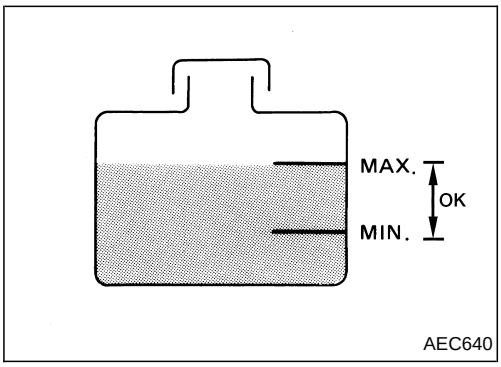
ON BOARD DIAGNOSIS LOGIC

If the cooling fan or another component in the cooling system malfunctions, the engine coolant temperature will rise.
When the engine coolant temperature reaches an abnormally high temperature condition, a malfunction is indicated.

Diagnostic trouble code No.	Malfunction is detected when ...	Check Items (Possible Cause)
28	● Engine coolant temperature reaches an abnormally high temperature.	● Cooling fan ● Radiator hose ● Radiator ● Radiator cap ● Water pump ● Thermostat For more information, refer to “MAIN 12 CAUSES OF OVERHEATING”, EC-92.

CAUTION:
When a malfunction is indicated, be sure to replace the coolant following the procedure in MA section (“Changing Engine Coolant”, “ENGINE MAINTENANCE”). Also, replace the engine oil.

- **Fill radiator with coolant up to specified level with a filling speed of 2 liters per minute like pouring coolant by kettle. Be sure to use coolant with the proper mixture ratio. Refer to MA section (“Anti-freeze Coolant Mixture Ratio”, “RECOMMENDED FLUIDS AND LUBRICANTS”).**
- **After refilling coolant, run engine to ensure that no water-flow noise is emitted.**



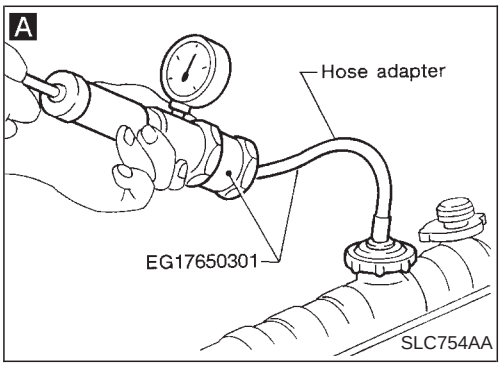
OVERALL FUNCTION CHECK

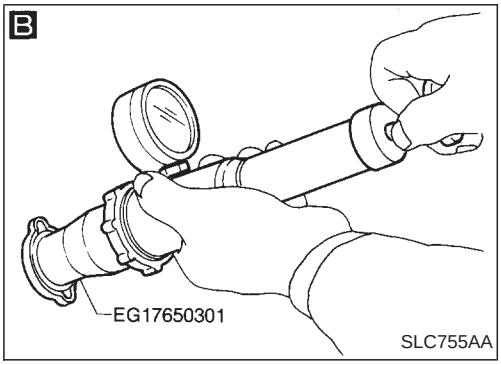
WARNING:
Never remove the radiator cap when the engine is hot. Serious burns could be caused by high pressure fluid escaping from the radiator.
Wrap a thick cloth around cap. Carefully remove the cap by turning it a quarter turn to allow built-up pressure to escape. Then turn the cap all the way off.

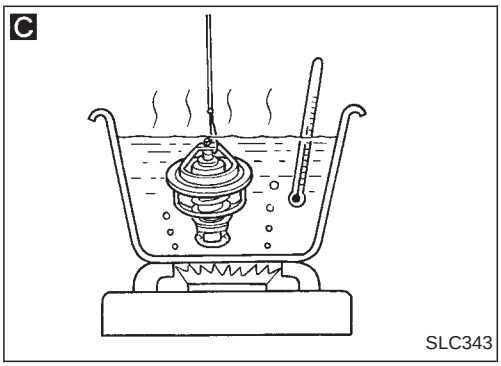
1. Check the coolant level in the reservoir tank and radiator.
   Allow engine to cool before checking coolant level.
   If the coolant level in the reservoir tank and/or radiator is below the proper range, skip the following step and go to “DIAGNOSTIC PROCEDURE” on next page.
2. Confirm whether customer filled the coolant or not. If customer filled the coolant, go to “DIAGNOSTIC PROCEDURE” on next page.

Overheat (Cont’d)

DIAGNOSTIC PROCEDURE







INSPECTION START

↓

A

CHECK COOLING SYSTEM FOR LEAK.
Apply pressure to the cooling system with a tester, and check if the pressure drops.
Testing pressure:
157 kPa (1.57 bar, 1.6 kg/cm^2, 23 psi)
Pressure should not drop.
CAUTION:
Higher than the specified pressure may cause radiator damage.

NG → Check the following for leak.
- Hose
- Radiator
- Water pump

Refer to LC section (“Water Pump”).

OK ↓

B

CHECK RADIATOR CAP.
Apply pressure to cap with a tester.
Radiator cap relief pressure:
78 - 98 kPa (0.78 - 0.98 bar, 0.8 - 1.0 kg/cm^2 , 11 - 14 psi)

NG → Replace radiator cap.

OK ↓

C

CHECK THERMOSTAT.
1. Check valve seating condition at normal room temperatures.
   It should seat tightly.
2. Check valve opening temperature and valve lift.
   Valve opening temperature:
   76.5°C (170°F) [standard]
   Valve lift:
   More than 10 mm/90°C (0.39 in/194°F)
3. Check if valve is closed at 5°C (9°F) below valve opening temperature.

For details, refer to LC section (“Thermostat”).

NG → Replace thermostat.

OK ↓

Check engine coolant temperature sensor. Refer to “COMPONENT INSPECTION”, EC-83.

NG → Replace engine coolant temperature sensor.

OK ↓

If the cause cannot be isolated, go to “MAIN 12 CAUSES OF OVERHEATING” on next page.

↓

INSPECTION END

Perform FINAL CHECK by the following procedure after repair is completed.

1. Warm up engine. Run the vehicle for at least 20 minutes. Pay attention to engine coolant temperature gauge on the instrument panel. If the reading shows an abnormally high temperature, another part may be malfunctioning.
2. Stop vehicle and let engine idle. Check the intake and exhaust systems for leaks by listening for noise or visually inspecting the components.
3. Allow engine to cool and visually check for oil and coolant leaks. Then, perform “OVERALL FUNCTION CHECK”.

Overheat (Cont’d)

MAIN 12 CAUSES OF OVERHEATING

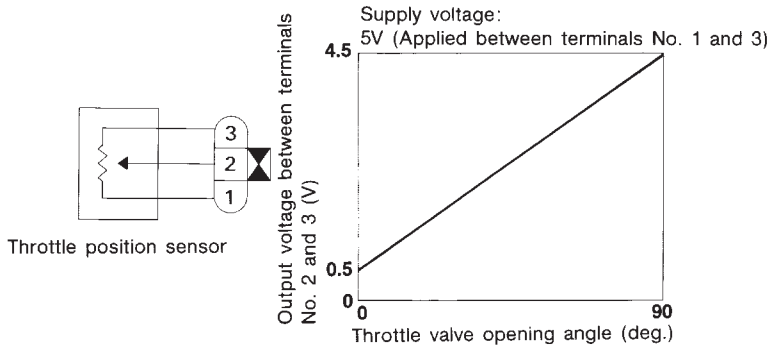
Engine	Step	Inspection item	Equipment	Standard	Reference page
OFF	1	● Blocked radiator ● Blocked condenser ● Blocked radiator grille ● Blocked bumper	● Visual	No blocking	—
	2	● Coolant mixture	● Coolant tester	50 - 50% coolant mixture	See “RECOMMENDED FLUIDS AND LUBRICANTS” in MA section.
	3	● Coolant level	● Visual	Coolant up to MAX level in reservoir tank and radiator filler neck	See “Changing Engine Coolant”, “ENGINE MAINTENANCE” in MA section.
	4	● Radiator cap	● Pressure tester	78 - 98 kPa (0.78 - 0.98 bar, 0.8 - 1.0 kg/cm^2, 11 - 14 psi) 59 - 98 kPa (0.59 - 0.98 bar, 0.6 - 1.0 kg/cm^2, 9 - 14 psi) (Limit)	See “System Check”, “ENGINE COOLING SYSTEM” in LC section.
ON*2	5	● Coolant leaks	● Visual	No leaks	See “System Check”, “ENGINE COOLING SYSTEM” in LC section.
ON*2	6	● Thermostat	● Touch the upper and lower radiator hoses	Both hoses should be hot.	See “Thermostat” and “Radiator”, “ENGINE COOLING SYSTEM” in LC section.
ON*1	7	● Cooling fan and fan coupling	● Visual	Operating	See “Cooling Fan”, “ENGINE COOLING SYSTEM” in LC section.
OFF	8	● Combustion gas leak	● Color checker chemical tester 4 gas analyzer	Negative	—
ON*3	9	● Coolant temperature gauge	● Visual	Gauge less than 3/4 when driving	—
		● Coolant overflow to reservoir tank	● Visual	No overflow during driving and idling	See “Changing Engine Coolant”, “ENGINE MAINTENANCE” in MA section.
OFF*4	10	● Coolant return from reservoir tank to radiator	● Visual	Should be initial level in reservoir tank	See “ENGINE MAINTENANCE” in MA section.
OFF	11	● Cylinder head	● Straight gauge feeler gauge	0.1 mm (0.004 in) Maximum distortion (warping)	See “Inspection”, “CYLINDER HEAD” in EM section.
	12	● Cylinder block and pistons	● Visual	No scuffing on cylinder walls or piston	See “Inspection”, “CYLINDER BLOCK” in EM section.

*1: Engine running at idle.
*2: Engine running at 3,000 rpm for 10 minutes.
*3: Drive at 90 km/h (55 MPH) for 30 minutes and then let idle for 10 minutes.
*4: After 60 minutes of cool down time.
For more information, refer to “OVERHEATING CAUSE ANALYSIS” in LC section.

Throttle Position Sensor

COMPONENT DESCRIPTION

The throttle position sensor responds to the accelerator pedal movement. This sensor is a kind of potentiometer which transforms the throttle position into output voltage, and emits the voltage signal to the ECM. In addition, the sensor detects the opening and closing speed of the throttle valve and feeds the voltage signal to the ECM.
Idle position of the throttle valve is determined by the ECM receiving the signal from the throttle position sensor. This one controls engine operation such as fuel cut.



CONSULT-II REFERENCE VALUE IN DATA MONITOR MODE

Remarks: Specification data are reference values.

MONITOR ITEM	CONDITION		SPECIFICATION
THRTL POS SEN	• Ignition switch: ON (Engine stopped)	Throttle valve: fully closed	0.15 - 0.85V
		Throttle valve: fully opened	3.5 - 4.7V
CLSD THL POS*	• Ignition switch: ON (Engine stopped)	Throttle valve: Idle position	ON
		Throttle valve: Slightly open	OFF

*A/T models only

ECM TERMINALS AND REFERENCE VALUE

Specification data are reference values, and are measured between each terminal and ground.

CAUTION:

Do not use ECM ground terminals when measuring input/output voltage. Doing so may result in damage to the ECM’s transistor. Use a ground other than ECM terminals, such as the ground.

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC voltage)
30	B/G	Sensors’ ground	Engine is running. (Warmed-up condition) └ Idle speed	Approximately 0V
38	R	Throttle position sensor signal	Engine is running (Warmed-up condition) └ Accelerator pedal released	0.15 - 0.85V
			Ignition switch “ON” └ Accelerator pedal fully depressed	3.5 - 4.7V
48	G/B	Sensor’s power supply	Ignition switch “ON”	Approximately 5V

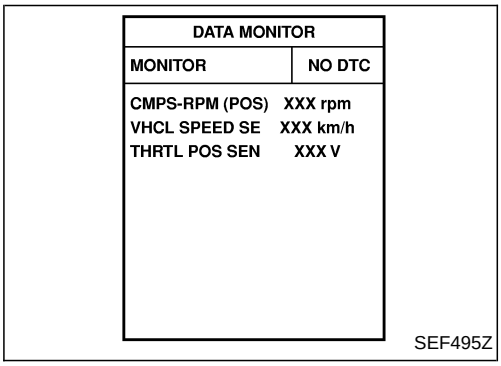
Throttle Position Sensor (Cont’d)

ON BOARD DIAGNOSIS LOGIC

Diagnostic Trouble Code No.	Malfunction is detected when ...	Check Items (Possible Cause)
43	● An excessively low or high voltage from the sensor is sent to ECM under driving conditions.*	● Harness or connectors (The sensor circuit is open or shorted.) ● Throttle position sensor

*: When this malfunction is detected, the ECM enters fail-safe mode.

Engine operating condition in fail-safe mode	Condition	Driving condition
Throttle position will be determined based on the amount of mass air flow and the engine speed. Therefore, acceleration will be poor.	When engine is idling	Normal
	When accelerating	Poor acceleration



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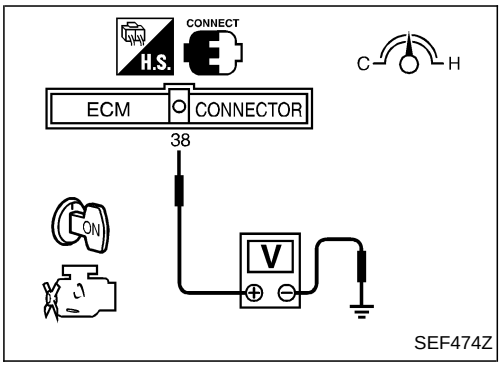

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OVERALL FUNCTION CHECK

Use this procedure to check the overall function of the throttle position sensor circuit. During this check, a DTC might not be confirmed.

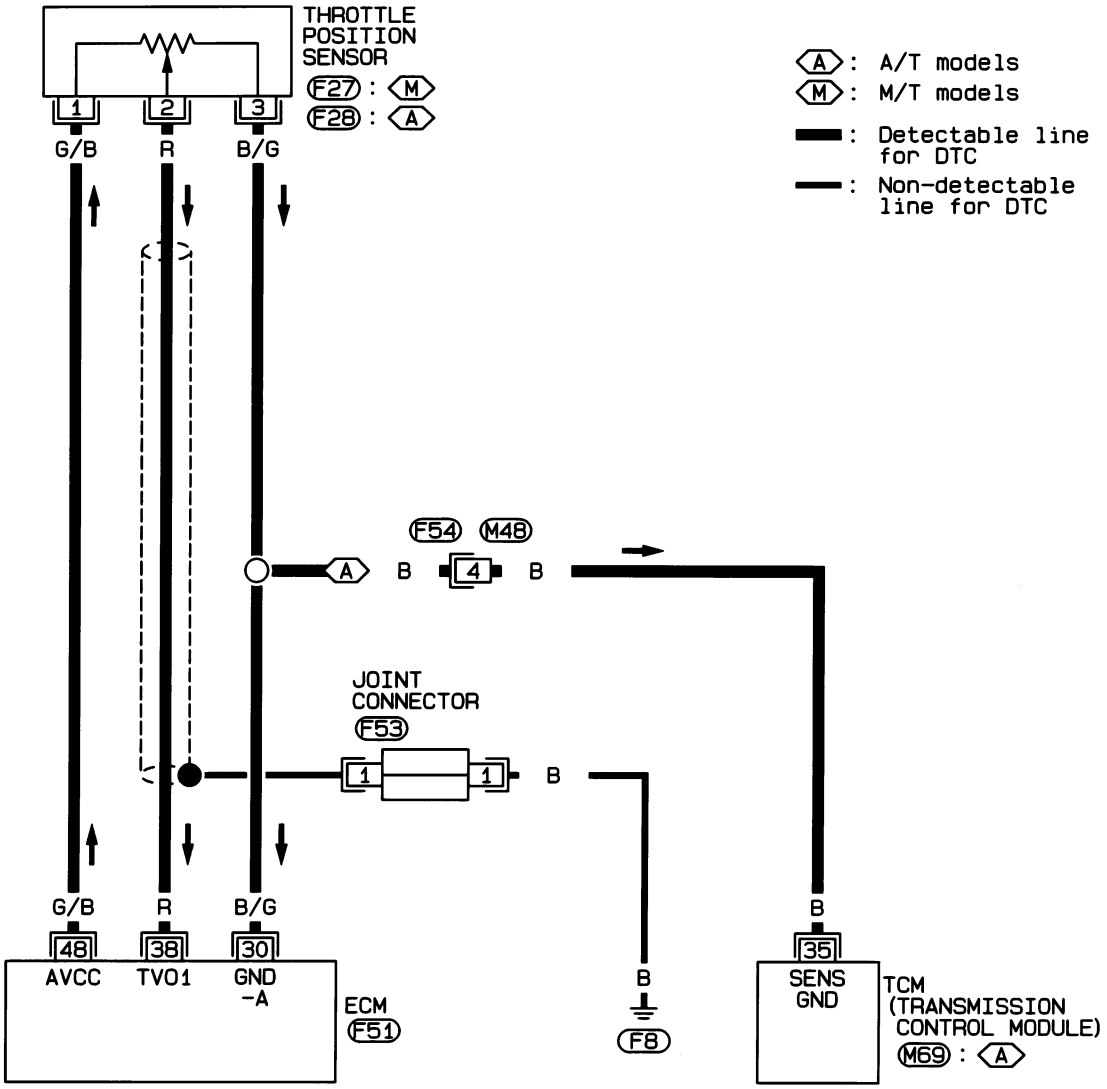
1) Start engine and warm it up to normal operating temperature.
2) Turn ignition switch “OFF” and wait at least 5 seconds.
3) Turn ignition switch “ON”.
4) Select “THRTL POS SEN” in “DATA MONITOR” mode with CONSULT-II.
5) Read “THRTL POS SEN” signal and check the following:
   - The voltage when accelerator pedal fully released is 0.15 to 0.85V.
   - The voltage when accelerator pedal fully depressed is 3.5 - 4.7V.

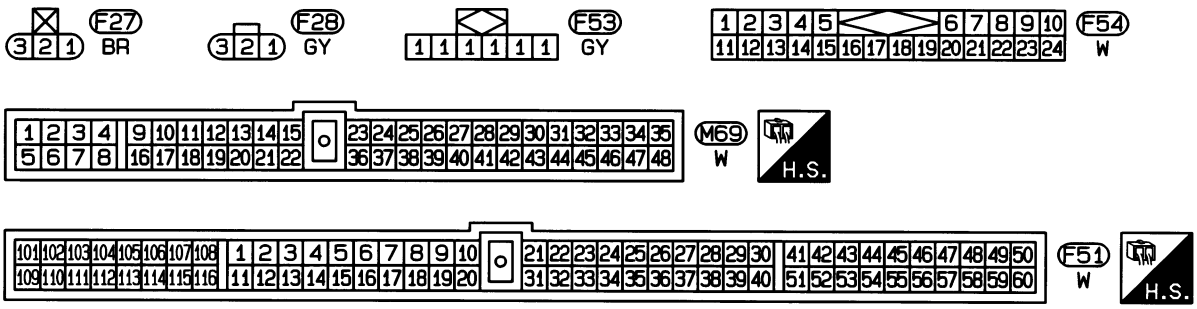
OR

1) Start engine and warm it up to normal operating temperature.
2) Turn ignition switch “OFF” and wait at least 5 seconds.
3) Turn ignition switch “ON”.
4) Check the voltage between ECM terminals ㊳ and engine ground and check the following:
   - The voltage when accelerator pedal fully released is 0.15 to 0.85V.
   - The voltage when accelerator pedal fully depressed is 3.5 - 4.7V.

Throttle Position Sensor (Cont'd)

EC-TPS-01





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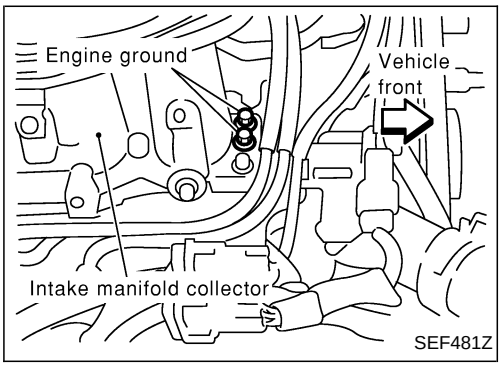
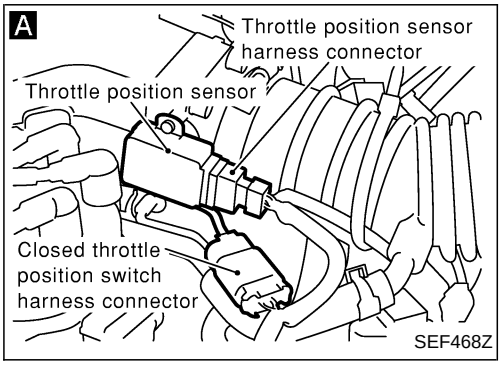
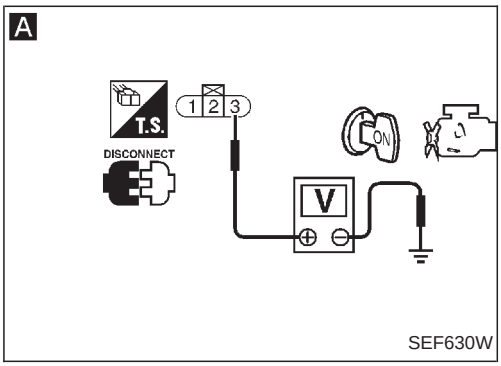
Throttle Position Sensor (Cont’d)

DIAGNOSTIC PROCEDURE







INSPECTION START

↓

ADJUST THROTTLE POSITION SENSOR.
Perform BASIC INSPECTION, EC-43.

↓ OK

CHECK SHIELD CIRCUIT.
1. Turn ignition switch “OFF”.
2. Loosen and retighten engine ground screws.
3. Remove joint connector or (F53).
4. Check the following.
   - Continuity between joint connector terminal ① and ground
   - Joint connector
     (Refer to “HARNESS LAYOUT” in EL section.)

   Continuity should exist.
   If OK, check harness for short to power.
   Then reconnect joint connector.

NG → Repair open circuit or short to power in harness or connectors.

↓ OK

A

CHECK POWER SUPPLY.
1. Disconnect throttle position sensor harness connector.
2. Turn ignition switch “ON”.
3. Check voltage between terminal ① and ground with CONSULT-II or tester.
   Voltage: Approximately 5V

NG → Repair open circuit or short to power in harness connectors.

↓ OK

CHECK GROUND CIRCUIT.
1. Turn ignition switch “OFF”.
2. Check harness continuity between throttle position sensor harness connector terminal ③ and engine ground.
   Refer to wiring diagram.
   Continuity should exist.
   If OK, check harness for short to ground and short to power.

NG → Check the following.
- Harness connectors (F54), (M48) (A/T models)
- Harness for open or short between throttle position sensor and ECM
- Harness for open or short between throttle position sensor and TCM (Transmission Control Module)

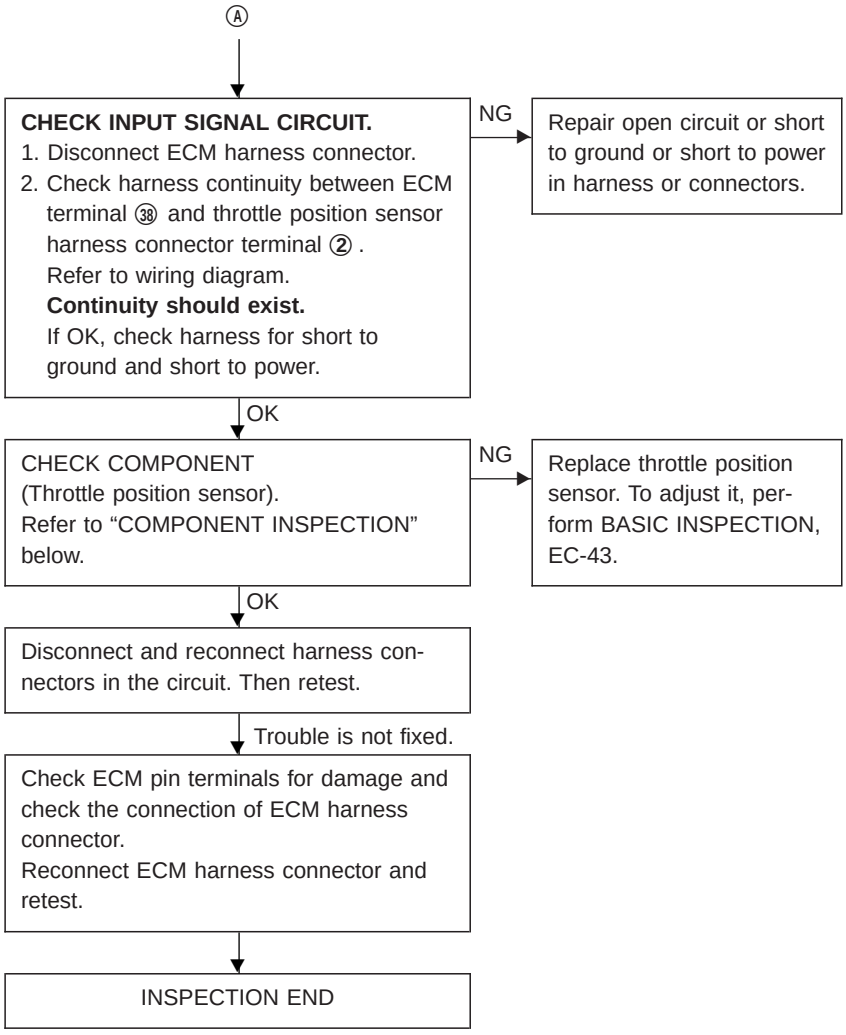
If NG, repair open circuit or short to power in harness or connectors.

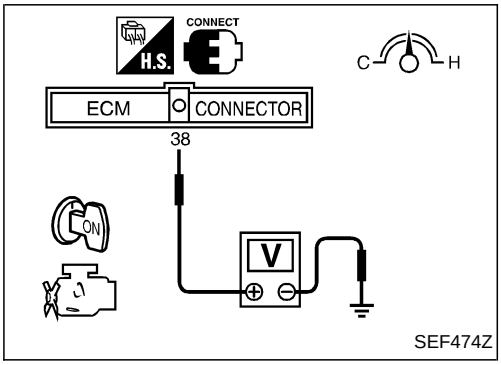
↓ OK

Ⓐ

(Go to next page.)

Throttle Position Sensor (Cont’d)





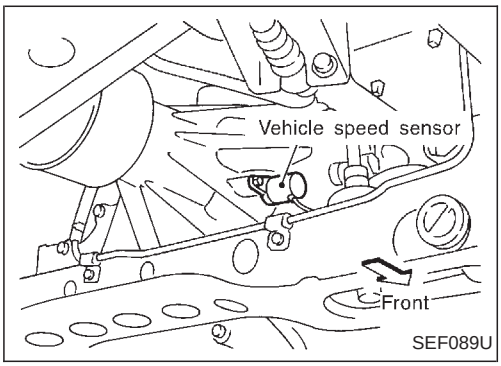
COMPONENT INSPECTION

Throttle position sensor

1. Start engine and warm it up to normal operating temperature.
2. Turn ignition switch “OFF” and wait at least 5 seconds.
3. Turn ignition switch “ON”.
4. Verify voltage between ECM terminals ㊳ and engine ground.

Throttle valve conditions	Voltage
Completely closed (a)	0.15 - 0.85V
Partially open	Between (a) and (b)
Completely open (b)	3.5 - 4.7V

If NG, replace throttle position sensor.
To adjust throttle position sensor, perform “BASIC INSPECTION”, EC-43.



Vehicle Speed Sensor (VSS)

COMPONENT DESCRIPTION

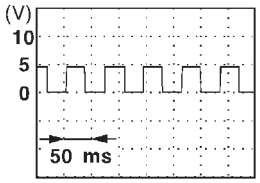
The vehicle speed sensor is installed in the transmission. It contains a pulse generator which provides a vehicle speed signal to the speedometer. The speedometer then sends a signal to the ECM.

ECM TERMINALS AND REFERENCE VALUE

Specification data are reference values, and are measured between each terminal and ground.

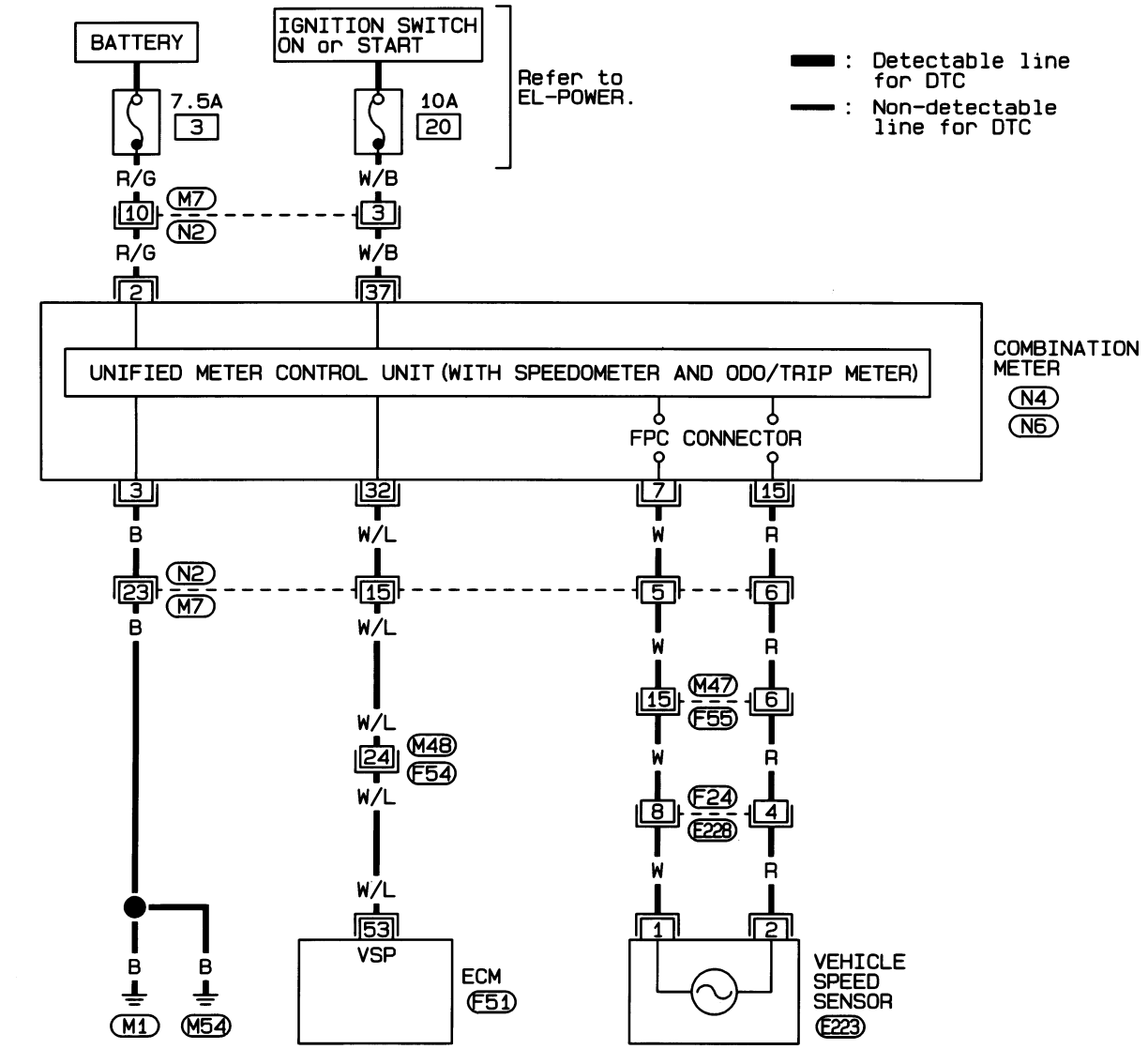
CAUTION:

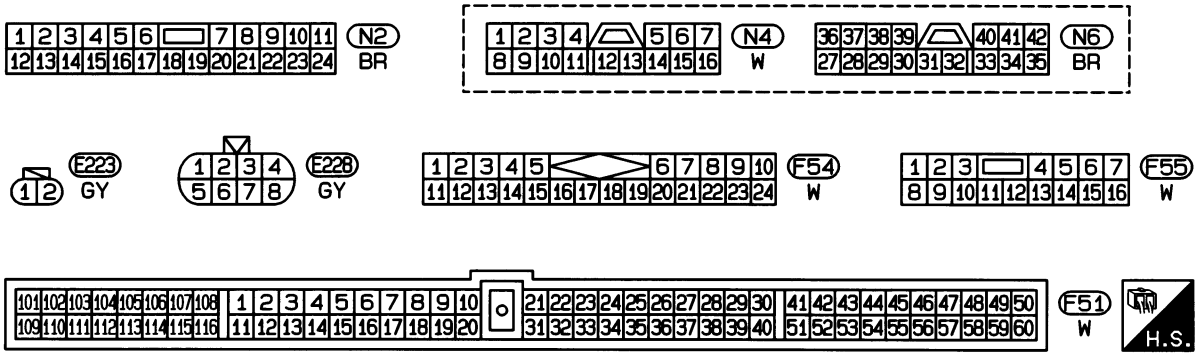
Do not use ECM ground terminals when measuring input/output voltage. Doing so may result in damage to the ECM's transistor. Use a ground other than ECM terminals, such as the ground.

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC voltage)
53	W/L	Vehicle speed sensor	Engine is running. └ Jack up all wheels and vehicle speed is 40 km/h (25 MPH) in 2nd gear position.	2 - 3V  SEF996U

Vehicle Speed Sensor (VSS) (Cont'd)

EC-VSS-01





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Vehicle Speed Sensor (VSS) (Cont'd)

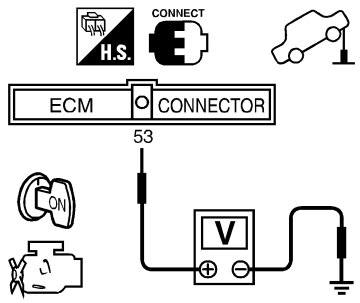
DIAGNOSTIC PROCEDURE

A

DATA MONITOR	
MONITOR	NO DTC
VHCL SPEED SE	XXX km/h
P/N POSI SW	OFF

SEF492Z

A



SEF491Z

INSPECTION START

A

CHECK OVERALL FUNCTION.
1. Lift up the vehicle.
2. Start engine.
3. Read "VHCL SPEED SE" signal in "DATA MONITOR" mode with CONSULT-II.
   The vehicle speed on CONSULT-II should be able to exceed 10 km/h (6 MPH) when rotating wheels with suitable gear position.

OK → INSPECTION END

OR

2. Turn ignition switch "ON".
3. Rotate drive wheel by hand.
4. Check voltage between ECM terminal (53) and ground.
   Voltage should vary between approx. 0 - 5V.

NG

CHECK INPUT SIGNAL CIRCUIT.
1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector and combination meter harness connector.
3. Check harness continuity between ECM terminal (53) and combination meter terminal (32).
   Refer to wiring diagram.
   Continuity should exist.
   If OK, check harness for short to ground and short to power.

NG → Check the following.
- Harness connectors (F54), (M48)
- Harness connectors (M7), (N2)
- Harness for open or short between ECM and combination meter

If NG, repair open circuit, short to ground or short to power in harness or connectors.

OK

CHECK SPEEDOMETER FUNCTION.
Make sure that speedometer functions properly.

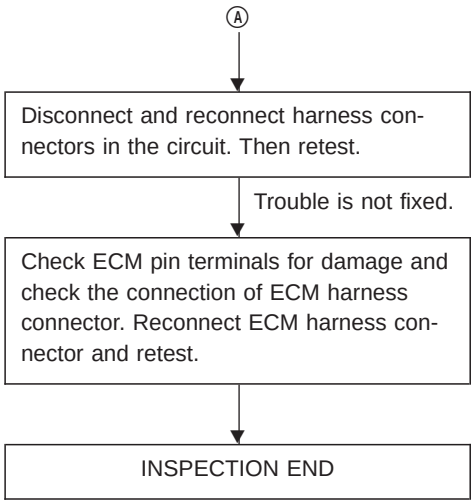
NG → Check the following.
- Harness for open or short between combination meter and vehicle speed sensor
  Refer to wiring diagram.

If NG, repair harness or connectors.
- Vehicle speed sensor and its circuit
  (Refer to EL section.)

OK

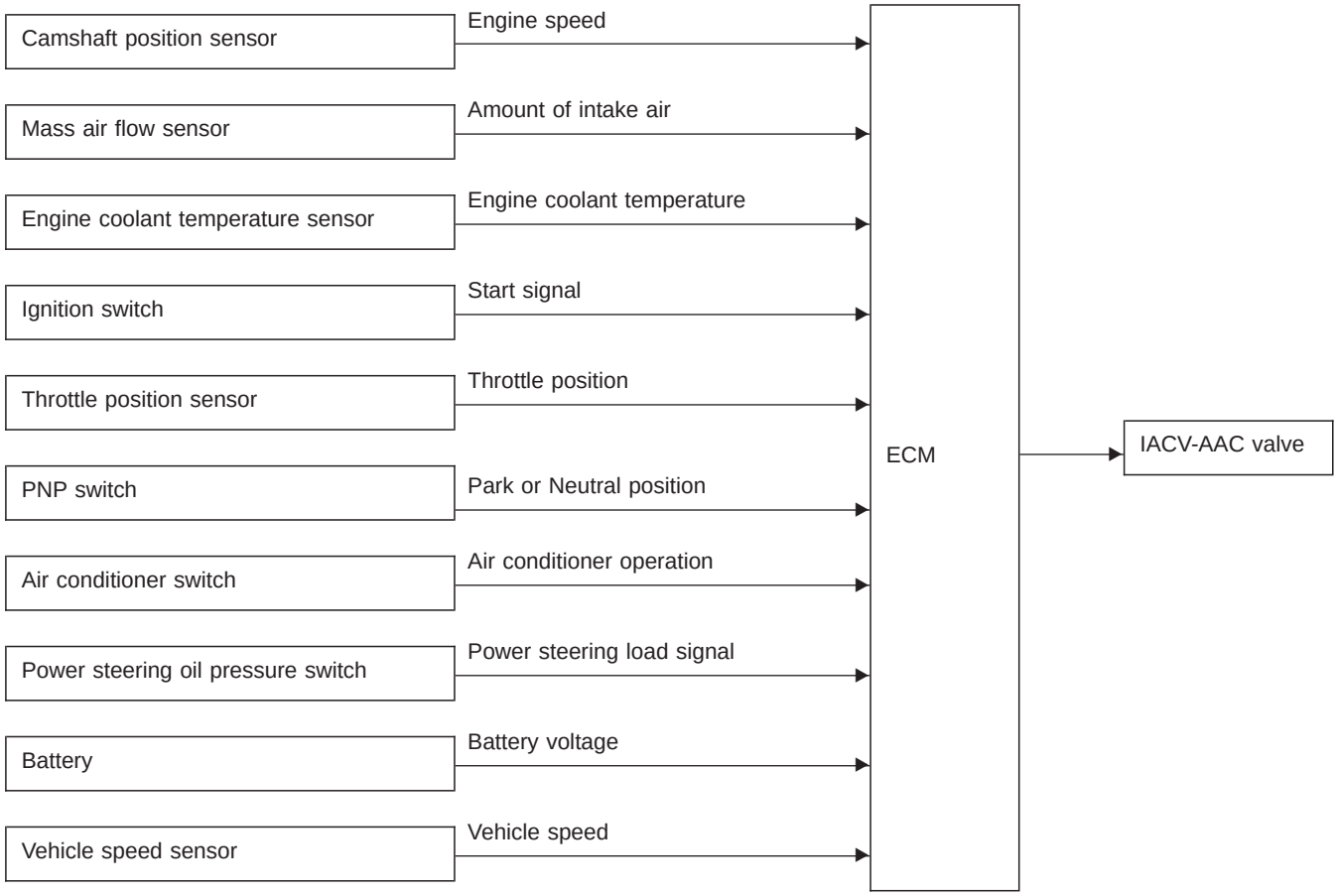
Ⓐ
(Go to next page.)

Vehicle Speed Sensor (VSS) (Cont'd)

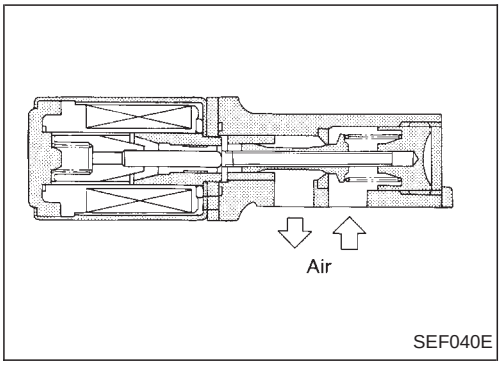


Idle Air Control Valve (IACV) — Auxiliary Air Control (AAC) Valve

SYSTEM DESCRIPTION



This system automatically controls engine idle speed to a specified level. Idle speed is controlled through fine adjustment of the amount of air which by-passes the throttle valve via IACV-AAC valve. The IACV-AAC valve repeats ON/OFF operation according to the signal sent from the ECM. The camshaft position sensor detects the actual engine speed and sends a signal to the ECM. The ECM then controls the ON/OFF time of the IACV-AAC valve so that engine speed coincides with the target value memorized in ECM. The target engine speed is the lowest speed at which the engine can operate steadily. The optimum value stored in the ECM is determined by taking into consideration various engine conditions, such as during warm up, deceleration, and engine load (air conditioner and power steering operation).



COMPONENT DESCRIPTION

IACV-AAC valve

The IACV-AAC valve is moved by ON/OFF pulses from the ECM. The longer the ON pulse, the greater the amount of air that will flow through the valve. The more air that flows through the valve, the higher the idle speed.

Idle Air Control Valve (IACV) — Auxiliary Air Control (AAC) Valve (Cont'd)

CONSULT-II REFERENCE VALUE IN DATA MONITOR MODE

Remarks: Specification data are reference values.

MONITOR ITEM	CONDITION		SPECIFICATION
IACV-AAC/V	• Engine: After warming up • Air conditioner switch: "OFF" • Shift lever: Neutral position • No-load	Idle	20 - 40%
		2,000 rpm	—

ECM TERMINALS AND REFERENCE VALUE

Specification data are reference values, and are measured between each terminal and ground.

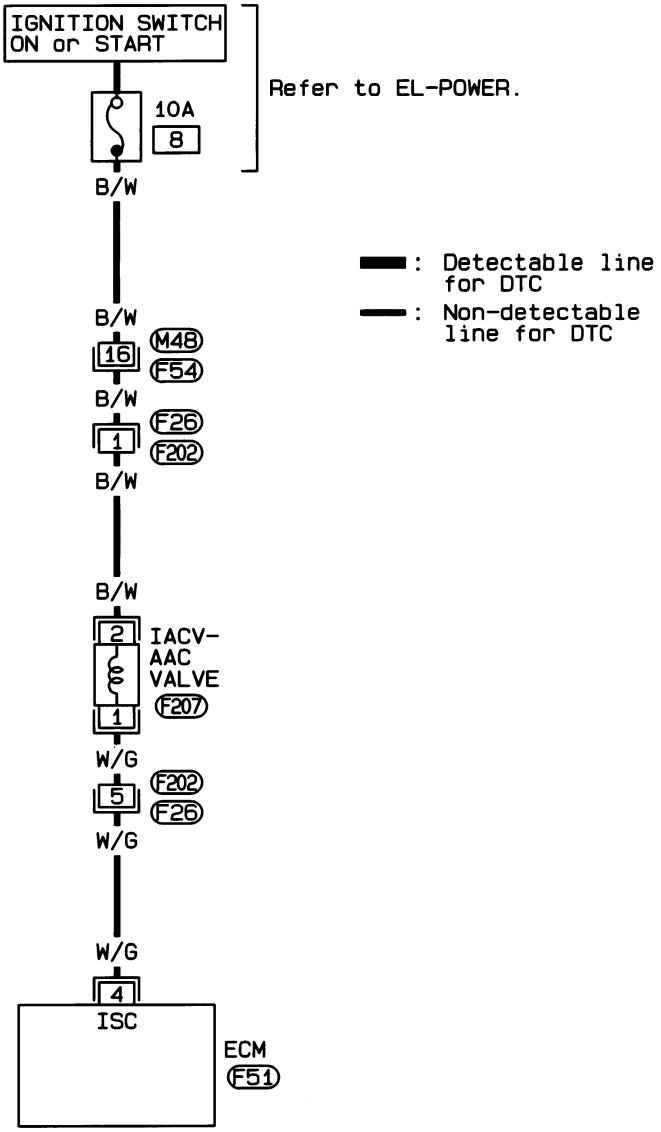
CAUTION:

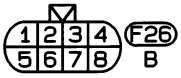
Do not use ECM ground terminals when measuring input/output voltage. Doing so may result in damage to the ECM's transistor. Use a ground other than ECM terminals, such as the ground.

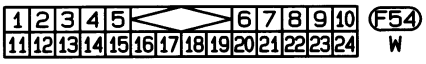
TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC voltage)
4	W/G	IACV-AAC valve	Engine is running. (Warmed-up condition) └ Idle speed	7 - 10V
			Engine is running. — Steering wheel is being turned. — Air conditioner is operating. — Rear window defogger switch is "ON". └ Lighting switch is "ON".	4 - 7V

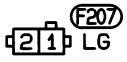
Idle Air Control Valve (IACV) — Auxiliary Air Control (AAC) Valve (Cont'd)

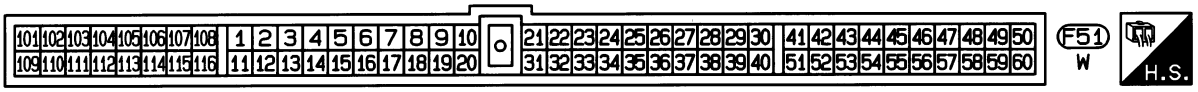
EC-AAC/V-01











HEC871

Idle Air Control Valve (IACV) — Auxiliary Air Control (AAC) Valve (Cont'd)

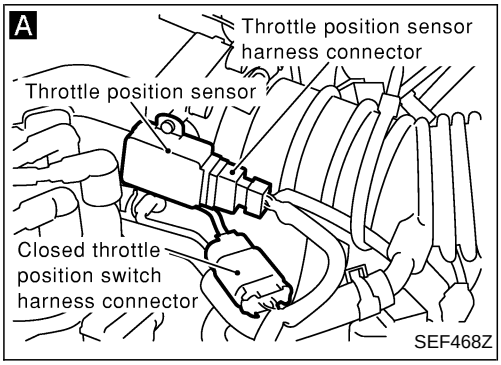
DIAGNOSTIC PROCEDURE

A

ACTIVE TEST	
IACV-AAC/V OPENING	XX %
MONITOR	
CMPS-RPM (POS)	XXX rpm
MAS AIR/FL SE	XXX V
COOLAN TEMP/S	XX °C

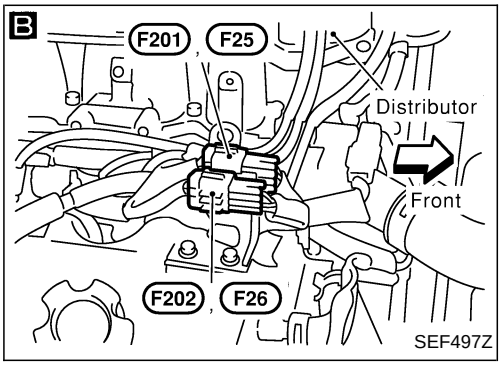
SEF496Z

A



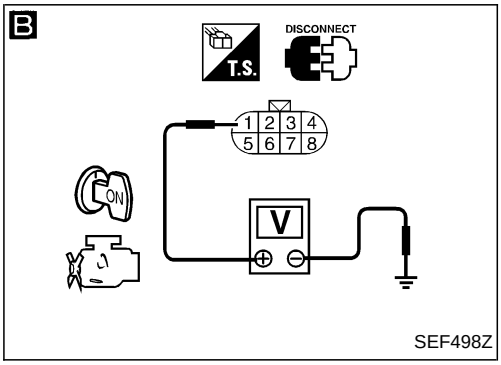
SEF468Z

B



SEF497Z

B



SEF498Z

INSPECTION START

A

CHECK OVERALL FUNCTION.
1. Start engine and warm it up to normal operating temperature.
2. Perform "IACV-AAC/V OPENING" in "ACTIVE TEST" mode with CONSULT-II.
3. Check engine speed varies corresponding to IACA-AAC VALVE opening percent.

OK → INSPECTION END

OR

2. Check idle speed.
   750±50 rpm
   If NG, adjust idle speed.
3. Stop engine and disconnect throttle position sensor harness connector.
4. Restart engine and let it idle after revving it to 2,000 - 3,000 rpm a few times.
5. Check idle speed again.
   700±50 rpm

NG

B

CHECK POWER SUPPLY.
1. Stop engine.
2. Disconnect IACV-AAC valve sub-harness connector (F26).
3. Turn ignition switch "ON".
4. Check voltage between IACV-AAC valve harness connector terminal ① and ground with CONSULT-II or tester.
   Voltage: Battery voltage

NG → Check the following.
- 10A fuse
- Harness connectors (F54), (M48)
- Harness for open or short between harness connector (F26) and fuse

If NG, repair harness or connectors.

OK

CHECK OUTPUT SIGNAL CIRCUIT.
1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector.
3. Check harness continuity between ECM terminal ④ and harness connector (F26) terminal ⑤.
   Refer to wiring diagram.
   Continuity should exist.
   If OK, check harness for short to ground and short to power.

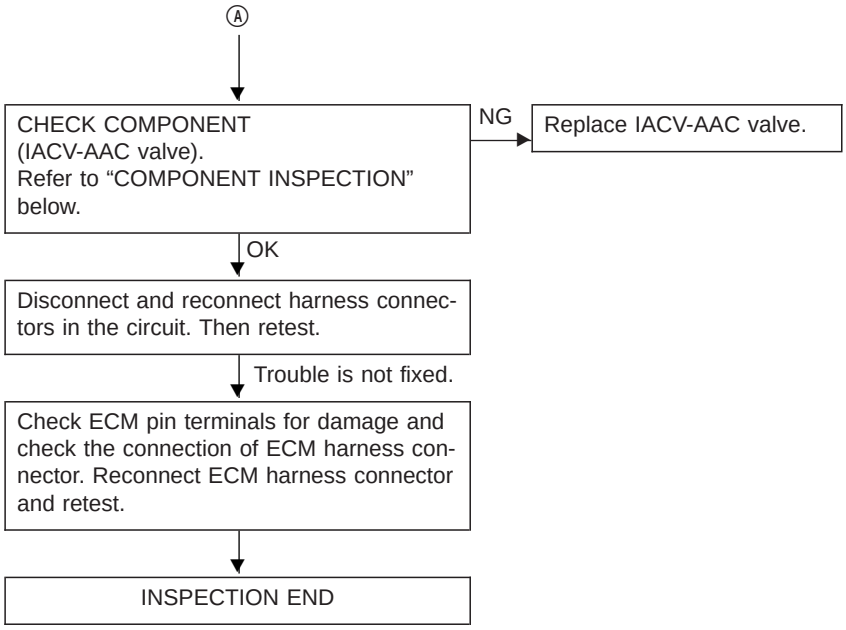
NG → Repair open circuit, short to ground or short to power in harness or connectors.

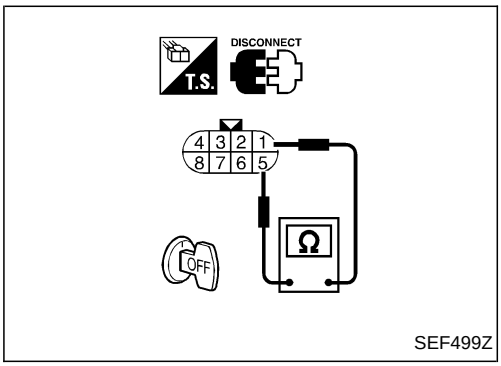
OK

Ⓐ

(Go to next page.)

Idle Air Control Valve (IACV) — Auxiliary Air Control (AAC) Valve (Cont'd)





COMPONENT INSPECTION

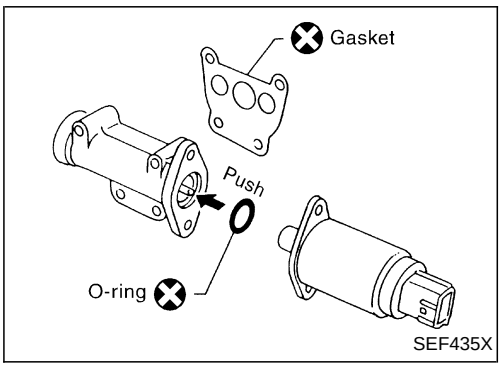
IACV-AAC valve

Disconnect IACV-AAC valve sub-harness connector.

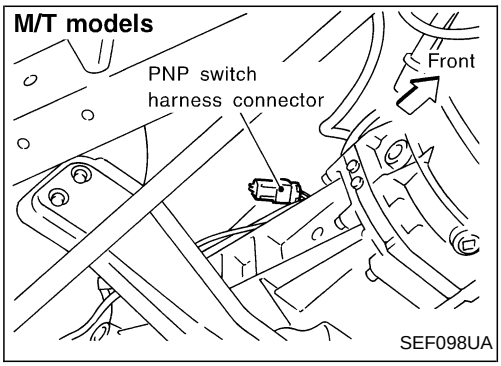
- Check IACV-AAC valve resistance.

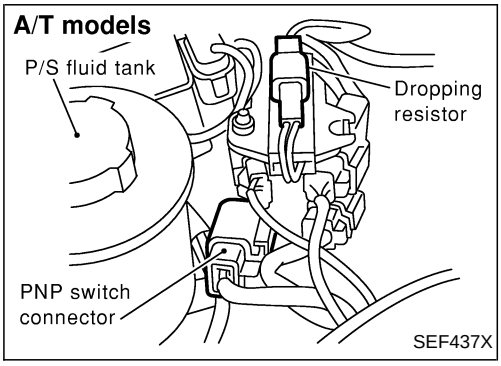
  Resistance:

  Approximately 10Ω [at 25°C (77°F)]



- Check harness continuity between IACV-AAC valve sub-harness connector and IACV-AAC valve harness connector.
- Check plunger for seizing or sticking.
- Check for broken spring.





Park/Neutral Position Switch

COMPONENT DESCRIPTION

When the gear position is in “P” (A/T models only) or “N”, park/neutral position switch is “ON”. ECM detects the part/neutral position when continuity with ground exists.

CONSULT-II REFERENCE VALUE IN DATA MONITOR MODE

Remarks: Specification data are reference values.

MONITOR ITEM	CONDITION		SPECIFICATION
P/N POSI SW	• Ignition switch: ON	Shift lever: “P” or “N”	ON
		Except above	OFF

ECM TERMINALS AND REFERENCE VALUE

Specification data are reference values, and are measured between each terminal and ground.

CAUTION:

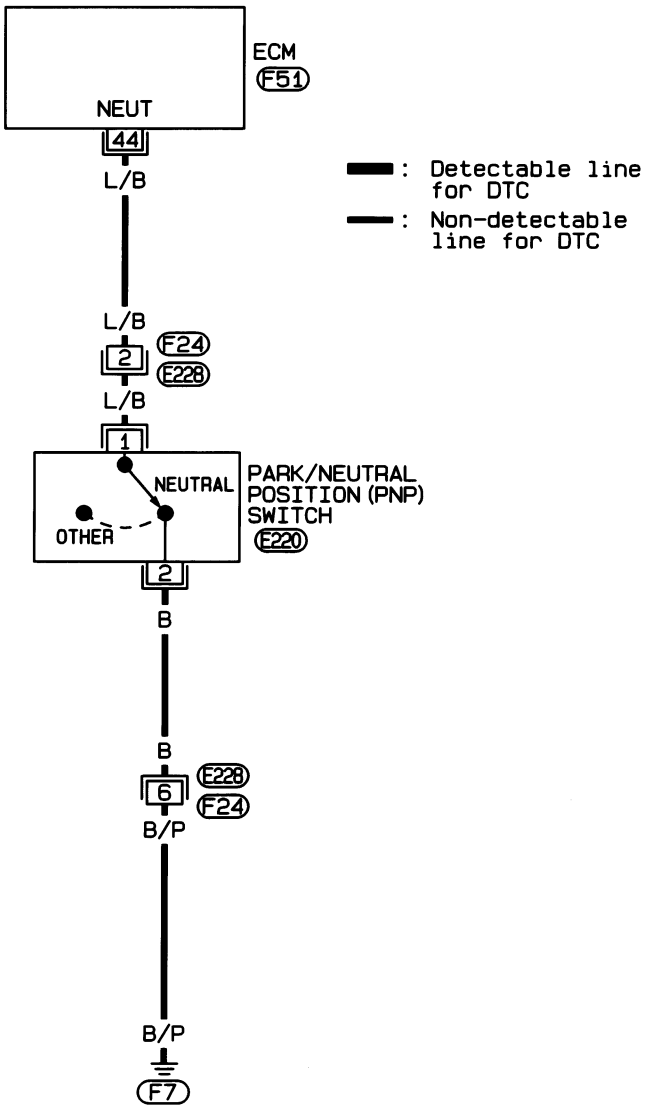
Do not use ECM ground terminals when measuring input/output voltage. Doing so may result in damage to the ECM’s transistor. Use a ground other than ECM terminals, such as the ground.

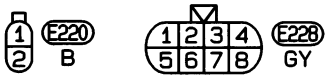
TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC voltage)
44	L/B	Park/Neutral position	Ignition switch “ON” → “P” or “N” position	Approximately 0V
			Ignition switch “ON” → Except the above gear position	Approximately 5V

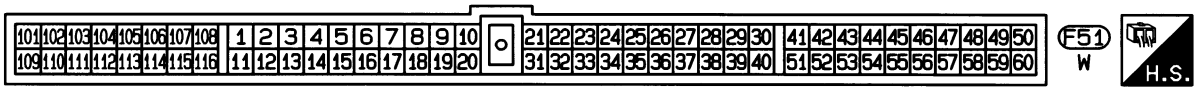
Park/Neutral Position Switch (Cont'd)

FOR M/T MODELS

EC-PNP/SW-01





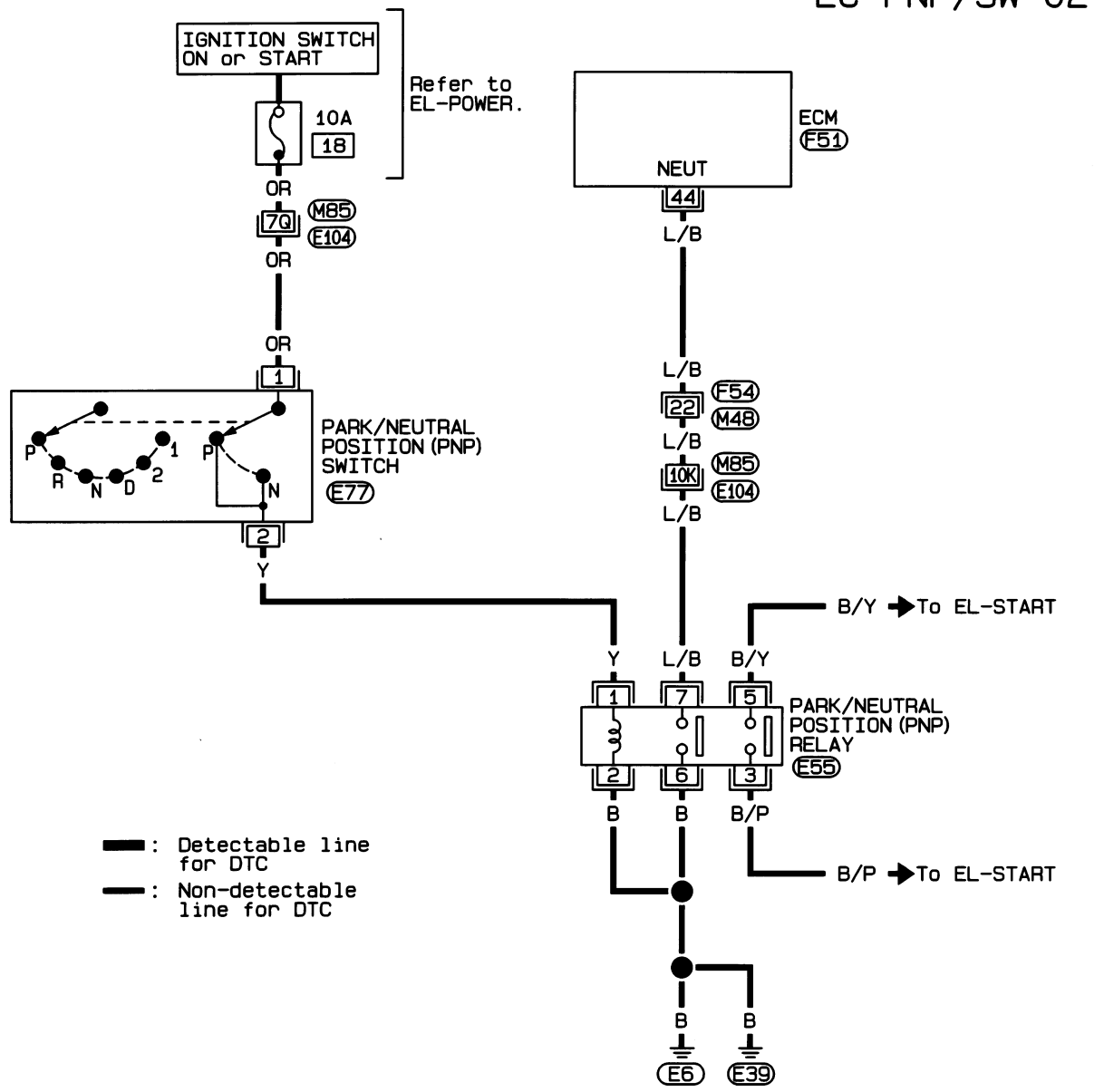


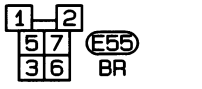
HEC872

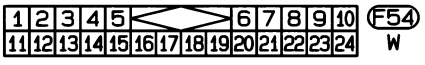
Park/Neutral Position Switch (Cont'd)

FOR A/T MODELS

EC-PNP/SW-02

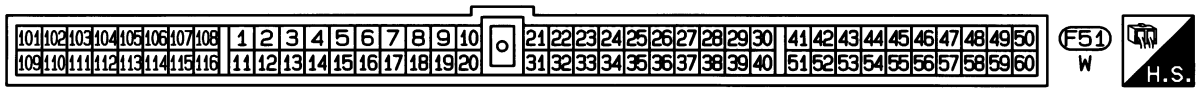






Refer to last page (Foldout page).

M85, E104

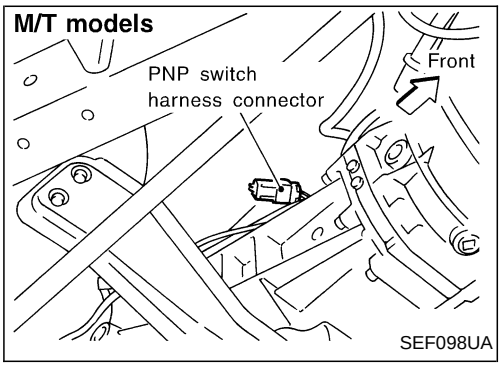


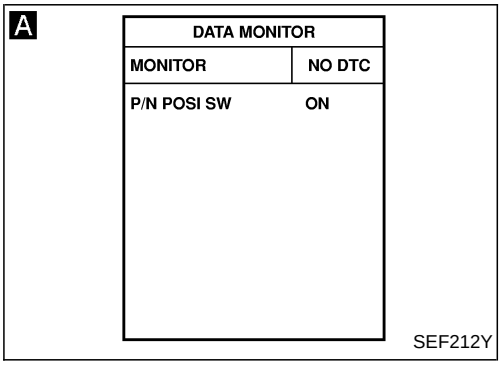
HEC873

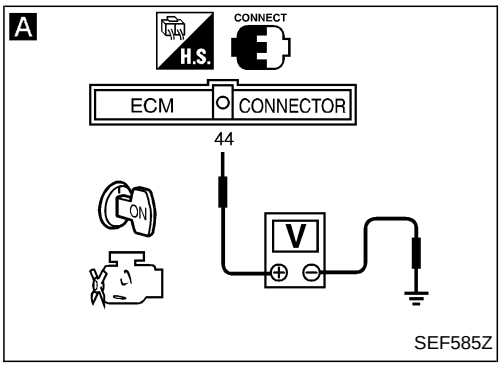
Park/Neutral Position Switch (Cont'd)

DIAGNOSTIC PROCEDURE

M/T models







INSPECTION START

A

CHECK OVERALL FUNCTION.
1. Turn ignition switch "ON".
2. Select "P/N POSI SW" in "DATA MONITOR" mode with CONSULT-II.
3. Check the "P/N POSI SW" signal under the following conditions.
   Neutral position: ON
   Except above position: OFF

OK → INSPECTION END

OR

2. Check voltage between ECM terminal ㊹ and ground with CONSULT-II or tester under the following conditions.
   Voltage:
   Neutral position
   Approximately 0V
   Except above position
   Approximately 5V

NG

CHECK GROUND CIRCUIT.
1. Disconnect PNP switch harness connector.
2. Check harness continuity between PNP switch harness connector terminal ② and body ground.
   Refer to wiring diagram.
   Continuity should exist.
   If OK, check harness for short to power.

NG → Check the following.
- Harness connectors (F24), (E228)
- Harness for open or short between PNP switch and body ground

If NG, repair open circuit or short to power in harness or connectors.

OK

CHECK INPUT SIGNAL CIRCUIT.
1. Disconnect ECM harness connector.
2. Check harness continuity between ECM terminal ㊹ and PNP switch harness connector terminal ① .
   Refer to wiring diagram.
   Continuity should exist.
   If OK, check harness for short to ground and short to power.

NG → Check the following.
- Harness connectors (F24), (E228)
- Harness for open or short between ECM and neutral position switch

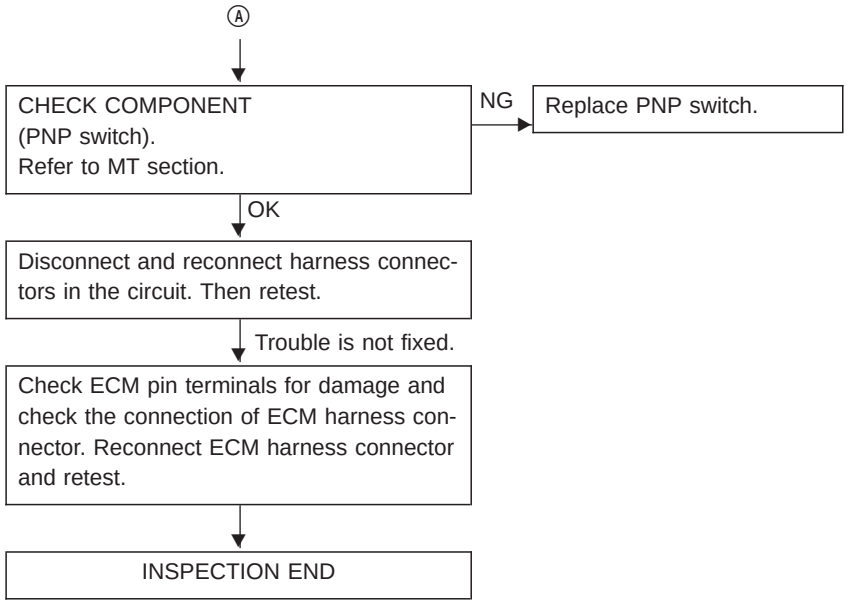
If NG, repair open circuit, short to ground or short to power in harness or connectors.

OK

Ⓐ

(Go to next page.)

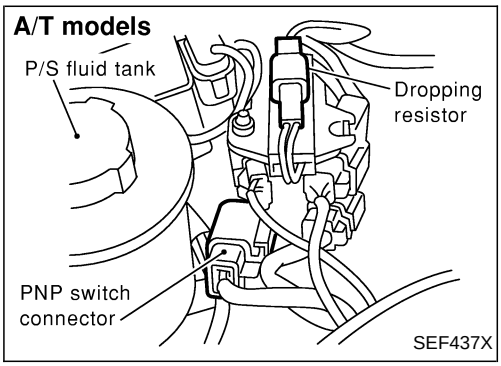
Park/Neutral Position Switch (Cont'd)



Park/Neutral Position Switch (Cont'd)

DIAGNOSTIC PROCEDURE

A/T models



A

DATA MONITOR	
MONITOR	NO DTC
P/N POSI SW	ON

SEF212Y

INSPECTION START

A

CHECK OVERALL FUNCTION.
1. Turn ignition switch "ON".
2. Select "P/N POSI SW" in "DATA MONITOR" mode with CONSULT-II.
3. Check the "P/N POSI SW" signal under the following conditions.
   "P" or "N" position: ON
   Except above position: OFF

OK → INSPECTION END

OR

2. Check voltage between ECM terminal ㊹ and ground with CONSULT-II or tester under the following conditions.
   Voltage:
   "P" or "N" position
   Approximately 0V
   Except above position
   Approximately 5V

NG

CHECK POWER SUPPLY.
1. Turn ignition switch "OFF".
2. Disconnect Park/Neutral position relay harness connector.
3. Turn ignition switch "ON".
4. Select "P" or "N" position.
5. Check voltage between PNP relay harness connector terminal ① and ground with CONSULT-II or tester.
   Voltage: Battery voltage

NG → Check the following.
- Fuse 10A
- Harness connectors (E104), (M85)
- Harness for open or short between fuse and PNP relay

If NG, repair harness or connectors.
- Check component (PNP switch) (Refer to AT section.)

OK

CHECK GROUND CIRCUIT.
Check harness continuity between park/neutral position relay terminal ②, PNP relay terminal ⑥ and body ground.
Refer to wiring diagram.
Continuity should exist.
If OK, check harness for short to power.

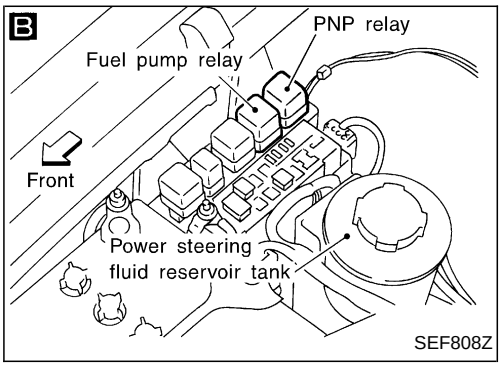
NG → Repair open circuit or short to power in harness or connectors.

OK

Ⓐ

(Go to next page.)

Park/Neutral Position Switch (Cont'd)



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B

CHECK PARK/NEUTRAL POSITION RELAY.

1. Apply 12V direct current between relay terminals ① and ② .
2. Check continuity between relay terminals ⑥ and ⑦ .

12V (① - ②) applied:
Continuity exists.
No voltage applied:
No continuity

NG → Replace park/neutral position relay.

OK ↓

CHECK OUTPUT SIGNAL CIRCUIT

1. Disconnect ECM harness connector.
2. Check harness continuity between ECM terminal ㊹ and PNP relay terminal ⑦ . Refer to wiring diagram.
   Continuity should exist.
   If OK, check harness for short to ground and short to power.

NG → Check the following.
- Harness connectors M85 , E104
- Harness connectors F54 , M48
- Harness for open or short between ECM and PNP relay

If NG, repair open circuit or short to ground or short to power in harness or connectors.

OK ↓

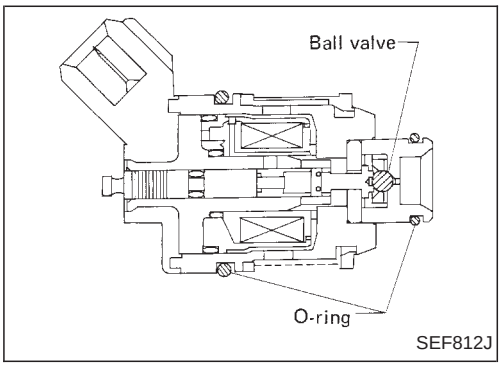
Disconnect and reconnect harness connectors in the circuit. Then retest.

Trouble is not fixed. ↓

Check ECM pin terminals for damage and check the connection of ECM harness connector. Reconnect ECM harness connector and retest.

↓

INSPECTION END



Injector

COMPONENT DESCRIPTION

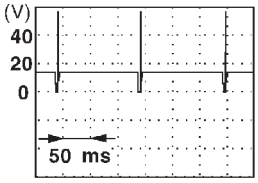
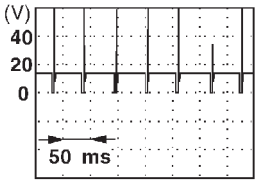
The fuel injector is a small, precise solenoid valve. When the ECM supplies a ground to the injector circuit, the coil in the injector is energized. The energized coil pulls the needle valve back and allows fuel to flow through the injector into the intake manifold. The amount of fuel injected depends upon the injection pulse duration. Pulse duration is the length of time the injector remains open. The ECM controls the injection pulse duration based on engine fuel needs.

ECM TERMINALS AND REFERENCE VALUE

Specification data are reference values, and are measured between each terminal and ground.

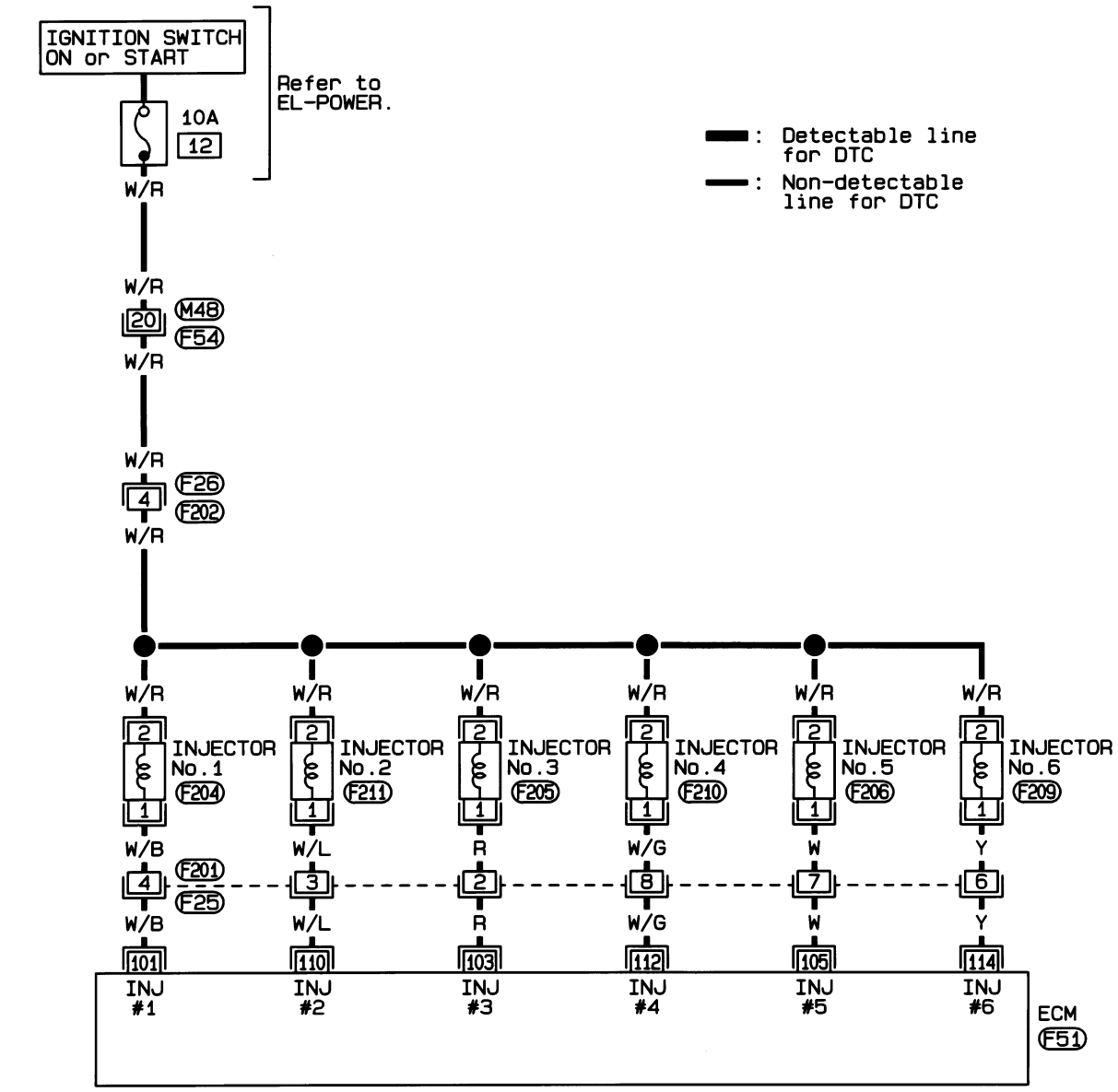
CAUTION:

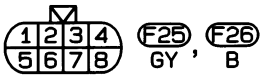
Do not use ECM ground terminals when measuring input/output voltage. Doing so may result in damage to the ECM's transistor. Use a ground other than ECM terminals, such as the ground.

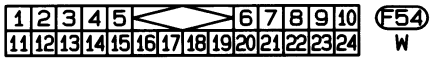
TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC voltage)
101 103 105 110 112 114	W/B B W W/L W/G Y	Injector No. 1 Injector No. 3 Injector No. 5 Injector No. 2 Injector No. 4 Injector No. 6	Engine is running. (Warmed-up condition) └ Idle speed	BATTERY VOLTAGE (11 - 14V)  SEF007V
			Engine is running. └ Engine speed is 2,000 rpm.	BATTERY VOLTAGE (11 - 14V)  SEF008V

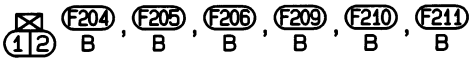
Injector (Cont'd)

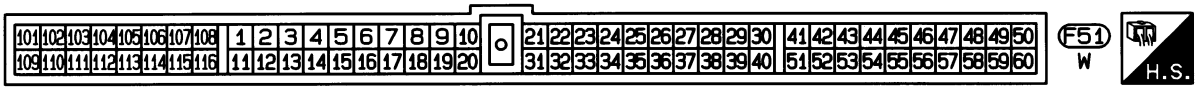
EC-INJECT-01











HEC874

Injector (Cont'd)

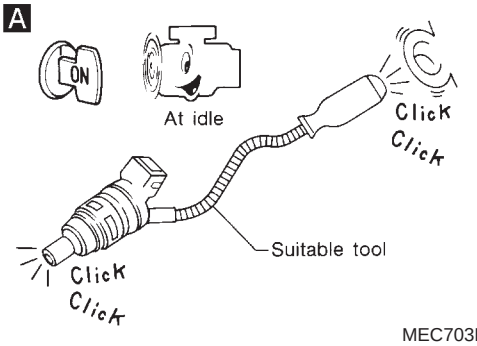
DIAGNOSTIC PROCEDURE

A

ACTIVE TEST	
POWER BALANCE	
MONITOR	
CMPS-RPM (POS)	XXX rpm
MAS AIR/FL SE	XXX V
IACV-AAC/V	XX %

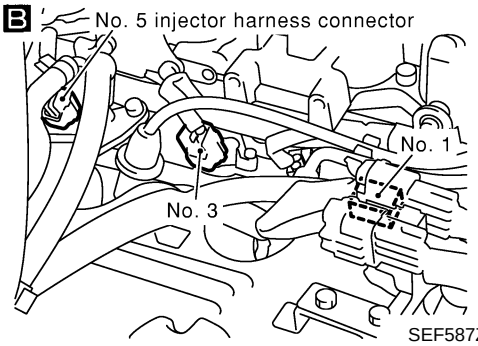
SEF586Z

A



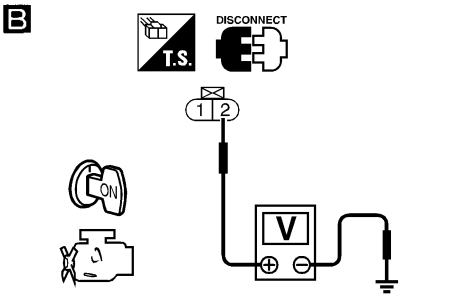
MEC703B

B



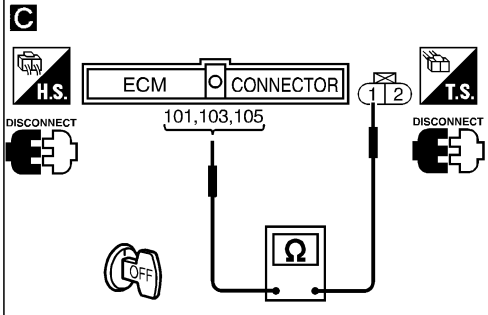
SEF587Z

B



SEF589Z

C



SEF588Z

INSPECTION START-1
Turn ignition switch to "START".
Is any cylinder ignited?

No → Ⓕ

Yes ↓

INSPECTION START-2
Does the engine start?

No → Ⓓ

Yes ↓

A

CHECK OVERALL FUNCTION.
1. Start engine.
2. Perform "POWER BALANCE" in "ACTIVE TEST" mode with CONSULT-II.
3. Make sure that each circuit produces a momentary engine speed drop.

OR

2. Listen to each injector operating sound.
Clicking noise should be heard.

OK → INSPECTION END

NG ↓

Which cylinder is abnormal?

No. 2, 4 or 6 → Ⓐ

No. 1, 3 or 5 ↓

Ⓔ

B

CHECK POWER SUPPLY.
1. Stop engine.
2. Disconnect injector harness connectors of the abnormal cylinders.
3. Turn ignition switch "ON".
4. Check voltage between terminal ② and ground with CONSULT-II or tester.
Voltage: Battery voltage

NG → Check the following.
- 10A fuse
- Harness connectors (F26), (F202)
- Harness connectors (M48), (F54)
- Harness for open or short between injector and ignition switch

If NG, repair harness or connectors.

OK ↓

C

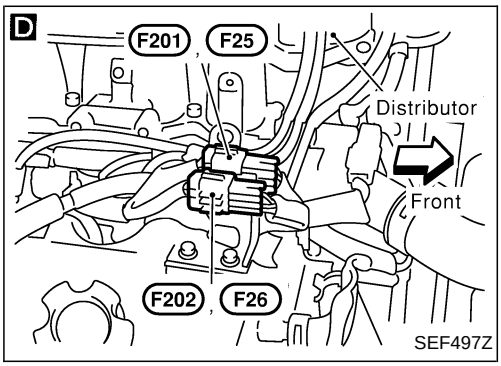
CHECK OUTPUT SIGNAL CIRCUIT.
1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector.
3. Check harness continuity between terminal ① and ECM terminals (101), (103) or (105).
Refer to wiring diagram.
Continuity should exist.
If OK, check harness for short to ground and short to power.

NG → Repair open circuit, short to ground or short to power in harness or connectors.

OK ↓

Ⓑ

Injector (Cont'd)



Ⓐ

D

CHECK POWER SUPPLY.
1. Stop engine.
2. Disconnect injector harness connectors F26, F202.
3. Disconnect injector harness connectors F25, F201.
4. Check resistance between terminals ③, ⑥ or ⑧ of connector F201 and ground.
   Refer to wiring diagram.
   Resistance: Approximately ∞Ω

NG → Find the short between F202 and F201, and repair.

OK ↓

CHECK INJECTOR (with injector harness).
Check resistance between terminal ④ of connector F202 and terminals ③, ⑥ or ⑧ of connector F201.
Refer to wiring diagram.
Resistance: 10 - 14Ω [at 25°C (77°F)]

NG → Remove injector and injector harness from the engine and measure the resistance of each. Repair or replace any faulty part found.

OK ↓

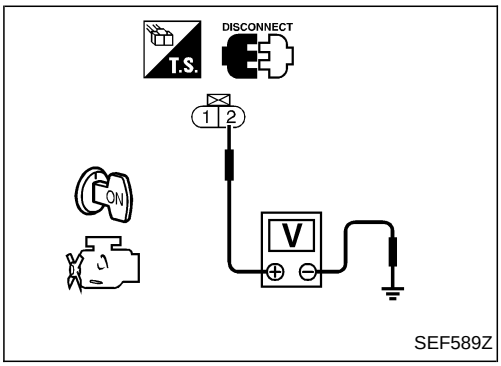
Ⓒ

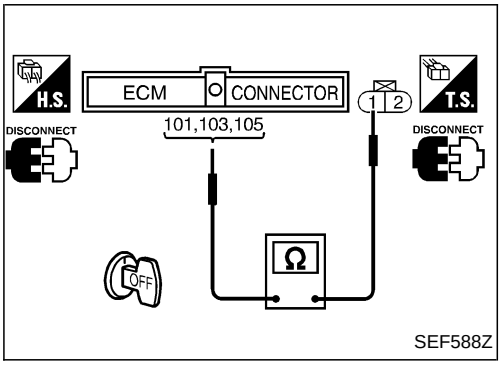
Ⓓ

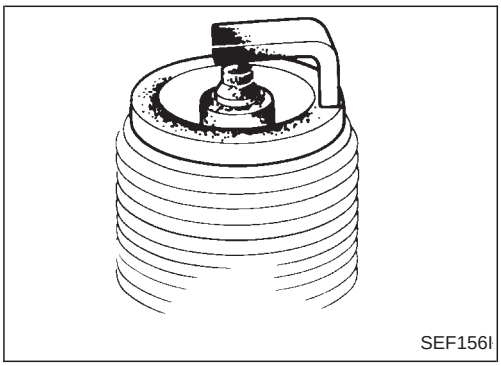
IDENTIFY ABNORMAL CYLINDER.
During cranking, remove the high tension cable in the order of the cylinder number. Then identify the cylinder that did not ignite.

- No. 1, 3 or 5 → Ⓔ
- No. 2, 4 or 6 → Ⓐ

Injector (Cont'd)







Ⓕ

CHECK POWER SUPPLY.
1. Turn ignition switch "OFF".
2. Disconnect injector harness connectors for No. 1, No. 3 and No. 5 injectors.
3. Turn ignition switch "ON".
4. Check voltage between terminal ② and ground with CONSULT-II or tester.
   Voltage: Battery voltage

NG → Check the following.
- 10A fuse
- Harness connectors (F26), (F202)
- Harness connectors (M48), (F54)
- Harness for open or short between injector and ignition switch

If NG, repair harness or connectors.

OK ↓

CHECK OUTPUT SIGNAL CIRCUIT.
1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector.
3. Check harness continuity between terminal ① and ECM terminals (101), (103) and (105).
   Refer to wiring diagram.
   Continuity should exist.
   If OK, check harness for short to ground and short to power.

NG → Repair open circuit, short to ground or short to power in harness or connectors.

OK ↓

CHECK COMPONENT (Injector).
Refer to "COMPONENT INSPECTION" on next page.

NG → Replace injector.

OK ↓

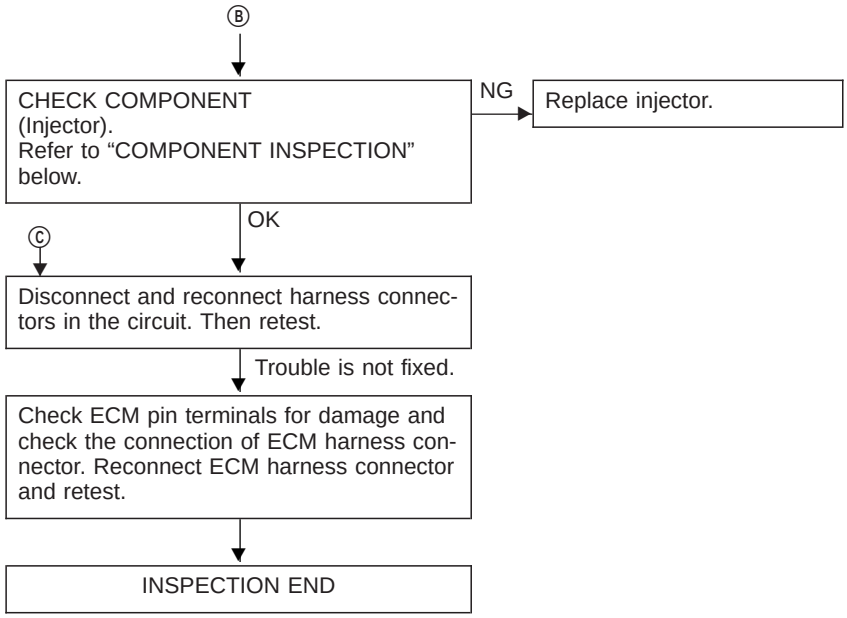
CHECK SPARK PLUG.
Determine if combustion took place or not by the condition of the electrodes and porcelain.
Are electrodes and porcelain dry?

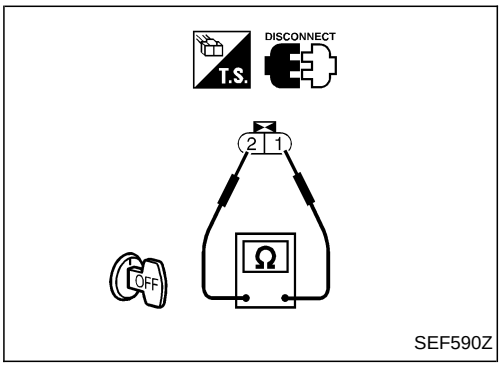
No → Investigate the cause of ignition failure.

Yes ↓

Investigate the cause of fuel injection failure.

Injector (Cont'd)





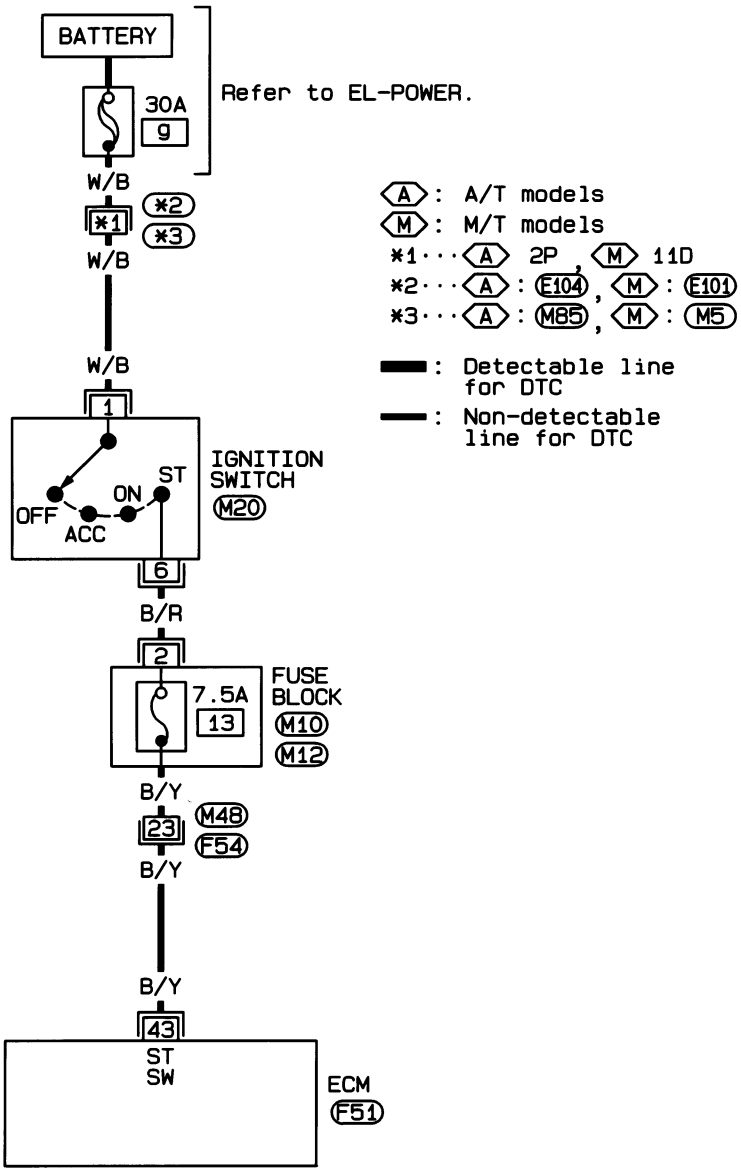
COMPONENT INSPECTION

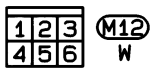
Injector

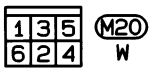
1. Disconnect injector harness connector.
2. Check resistance between terminals as shown in the figure.
   Resistance: 10 - 14Ω [at 25°C (77°F)]
   If NG, replace injector.

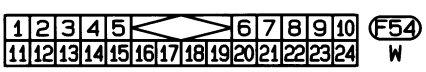
Start Signal

EC-S/SIG-01





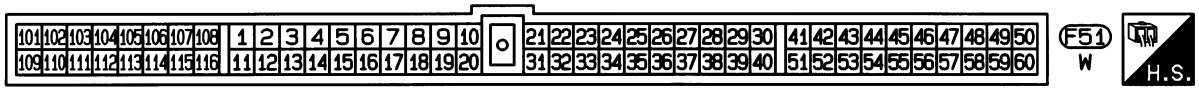




Refer to last page (Foldout page).

M5, E101

M85, E104



HEC875

Start Signal (Cont'd)

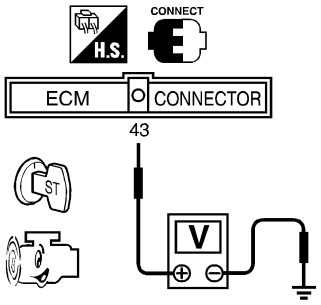
DIAGNOSTIC PROCEDURE

A

DATA MONITOR	
MONITOR	NO DTC
START SIGNAL	OFF

SEF591Z

A



SEF592Z

INSPECTION START

A

CHECK OVERALL FUNCTION.

1. Turn ignition switch "ON".
2. Check "START SIGNAL" in "DATA MONITOR" mode with CONSULT-II.

IGN "ON"	OFF
IGN "START"	ON

OK → INSPECTION END

OR

1. Turn ignition switch to "START".
2. Check voltage between ECM terminal ㊸ and ground.

Voltage:
Ignition switch "START"
Battery voltage
Except above
Approximately 0V

NG

Check if 7.5A fuse is OK.

NG → Replace 7.5A fuse.

OK

CHECK INPUT SIGNAL CIRCUIT.

1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector and 7.5A fuse.
3. Check harness continuity between ECM terminal ㊸ and fuse block.
   Continuity should exist.
   Refer to wiring diagram.
   If OK, check harness for short to ground and short to power.

NG → Check the following.
- Harness connectors (F54), (M48)
- Harness for open or short between ECM and fuse block

If NG, repair open circuit, short to ground or short to power in harness or connectors.

OK

Disconnect and reconnect harness connectors in the circuit. Then retest.

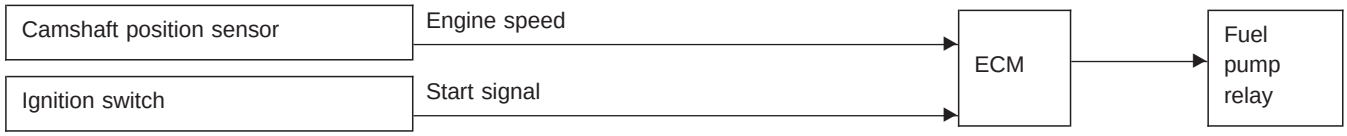
Trouble is not fixed.

Check ECM pin terminals for damage and check the connection of ECM harness connector. Reconnect ECM harness connector and retest.

INSPECTION END

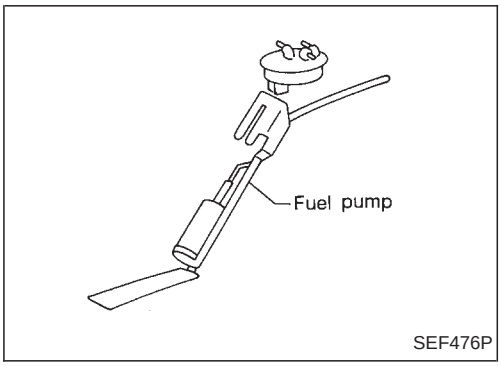
Fuel Pump

SYSTEM DESCRIPTION



The ECM activates the fuel pump for several seconds after the ignition switch is turned on to improve engine startability. If the ECM receives a 120° signal from the camshaft position sensor, it knows that the engine is rotating, and causes the pump to operate. If the 120° signal is not received when the ignition switch is on, the engine stalls. The ECM stops pump operation and prevents battery discharging, thereby improving safety. The ECM does not directly drive the fuel pump. It controls the ON/OFF fuel pump relay, which in turn controls the fuel pump.

Condition	Fuel pump operation
Ignition switch is turned to ON.	Operates for 5 seconds.
Engine running and cranking	Operates.
When engine is stopped	Stops in 1 second.
Except as shown above.	Stops.



COMPONENT DESCRIPTION

The fuel pump with a fuel damper is an in-tank type (the pump and damper are located in the fuel tank).

CONSULT-II REFERENCE VALUE IN DATA MONITOR MODE

Remarks: Specification data are reference values.

MONITOR ITEM	CONDITION	SPECIFICATION
FUEL PUMP RLY	• Ignition switch is turned to ON (Operates for 5 seconds). • Engine running and cranking • When engine is stopped (Stops in 1 second)	ON
	Except as shown above	OFF

Fuel Pump (Cont'd)

ECM TERMINALS AND REFERENCE VALUE

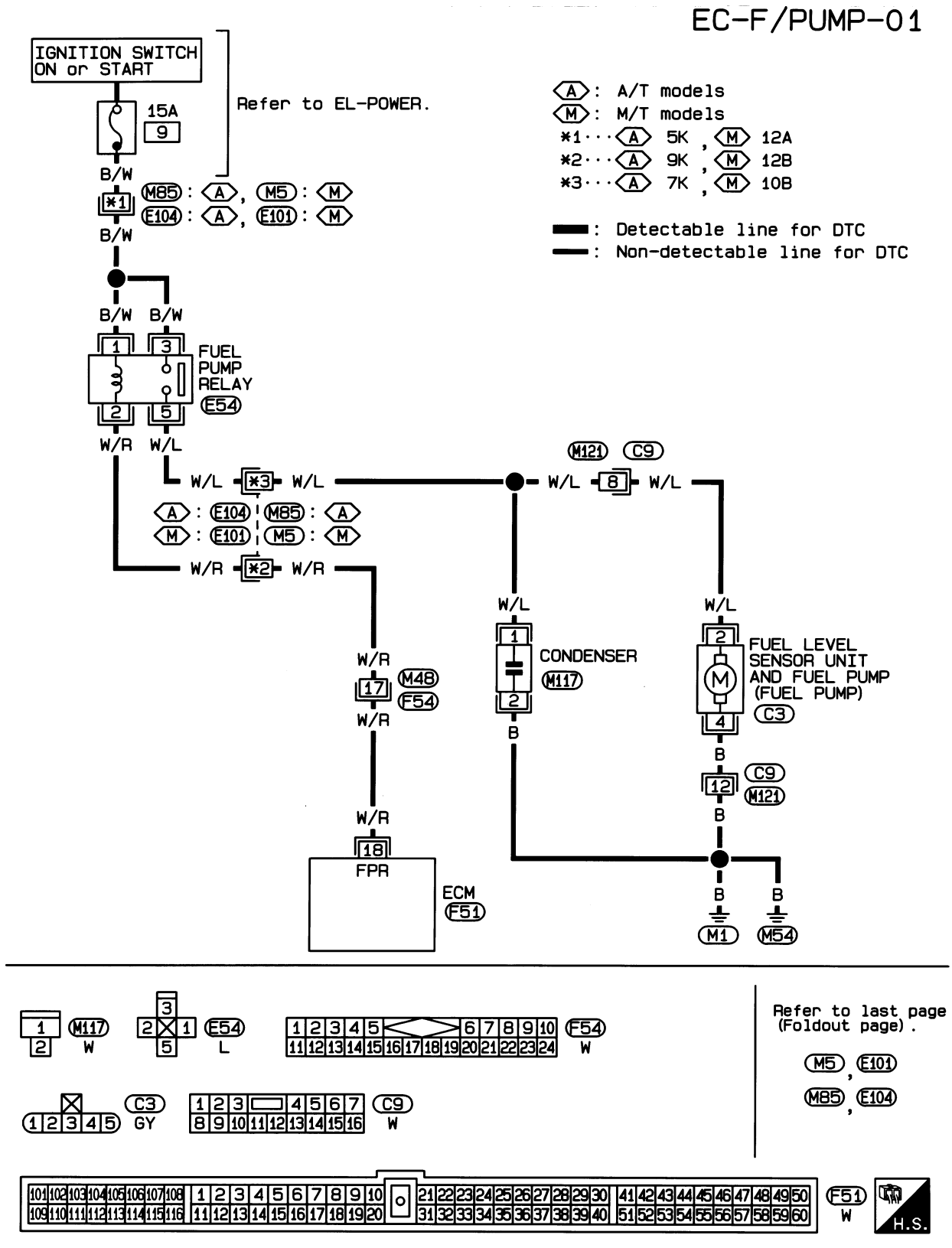
Specification data are reference values, and are measured between each terminal and ground.

CAUTION:

Do not use ECM ground terminals when measuring input/output voltage. Doing so may result in damage to the ECM's transistor. Use a ground other than ECM terminals, such as the ground.

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC voltage)
18	W/R	Fuel pump relay	Ignition switch "ON" └ For 5 seconds after turning ignition switch "ON" Engine is running.	0 - 1V
			Ignition switch "ON" └ More than 5 seconds after turning ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)

Fuel Pump (Cont'd)



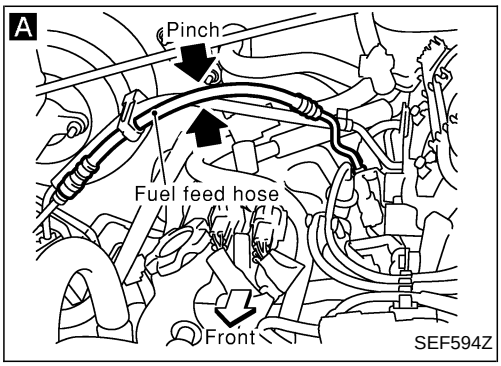
Refer to last page (Foldout page).

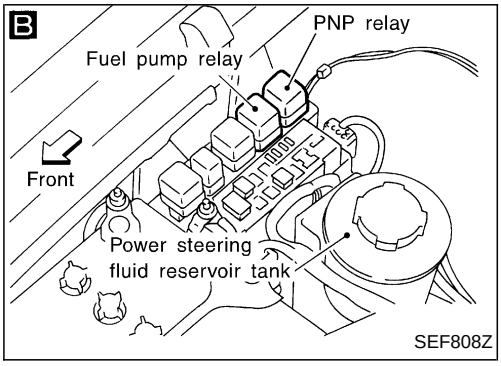
M5, E101
M85, E104

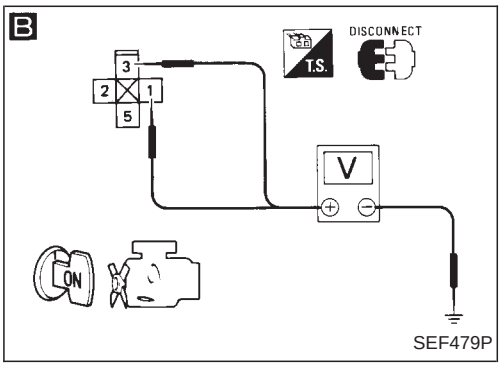
HEC876

Fuel Pump (Cont'd)

DIAGNOSTIC PROCEDURE







INSPECTION START

A

CHECK OVERALL FUNCTION.
1. Turn ignition switch "ON".
2. Pinch fuel feed hose with fingers.
   Fuel pressure pulsation should be felt on the fuel feed hose for 5 seconds after ignition switch is turned "ON".

OK → INSPECTION END

NG ↓

B

CHECK POWER SUPPLY.
1. Turn ignition switch "OFF".
2. Disconnect fuel pump relay.
3. Turn ignition switch "ON".
4. Check voltage between terminals ①, ③ and ground with CONSULT-II or tester.
   Voltage: Battery voltage

NG → Check the following.
- 15A fuse

If NG, check the condenser circuit for short.
Refer to wiring diagram.
- Harness connectors (M85), (E104) (A/T models)
  (E101), (M5) (M/T models)
- Harness for open or short between fuse and fuel pump relay

If NG, repair harness or connectors.

OK ↓

CHECK GROUND CIRCUIT.
1. Turn ignition switch "OFF".
2. Disconnect fuel pump harness connector.
3. Check harness continuity between fuel pump harness connector terminal ④ and body ground, relay terminal ⑤ and fuel pump harness connector terminal ②.
   Refer to wiring diagram.
   Continuity should exist.
   If OK, check harness for short to ground and short to power.

NG → Check the following.
- Harness connectors (C9), (M121)
- Harness connectors (M85), (E104) (A/T models)
  (E101), (M5) (M/T models)
- Harness for open between fuel pump and body ground
- Harness for open or short between fuel pump and fuel pump relay

If NG, repair open circuit, short to ground or short to power in harness or connectors.

OK ↓

CHECK OUTPUT SIGNAL CIRCUIT.
1. Disconnect ECM harness connector.
2. Check harness continuity between ECM terminal ⑱ and fuel pump relay terminal ②.
   Refer to wiring diagram.
   Continuity should exist.
   If OK, check harness for short to ground and short to power.

NG → Check the following.
- Harness connectors (M48), (F54)
- Harness connectors (M85), (E104) (A/T models)
  (E101), (M5) (M/T models)
- Harness for open or short between ECM and fuel pump relay

If NG, repair open circuit, short to ground or short to power in harness or connectors.

OK ↓

Ⓐ
(Go to next page.)

Fuel Pump (Cont'd)

C

ACTIVE TEST	
FUEL PUMP RELAY	ON
MONITOR	
CMPS-RPM (POS)	XXX rpm

SEF593Z

Ⓐ

C

CHECK COMPONENT
(Fuel pump relay).

1. Reconnect fuel pump relay, fuel pump harness connector and ECM harness connector.
2. Turn ignition switch "ON".
3. Turn fuel pump relay "ON" and "OFF" in "ACTIVE TEST" mode with CONSULT-II and check operating sound.

OR

Refer to "COMPONENT INSPECTION" below.

NG → Replace fuel pump relay.

OK ↓

CHECK COMPONENT
(Fuel pump).
Refer to "COMPONENT INSPECTION" below.

NG → Replace fuel pump.

OK ↓

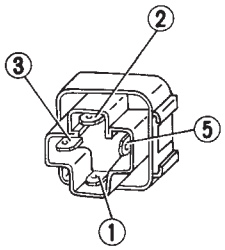
Disconnect and reconnect harness connectors in the circuit. Then retest.

Trouble is not fixed. ↓

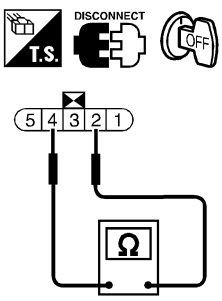
Check ECM pin terminals for damage and check the connection of ECM harness connector. Reconnect ECM harness connector and retest.

↓

INSPECTION END



SEF511P



SEF444X

COMPONENT INSPECTION

Fuel pump relay

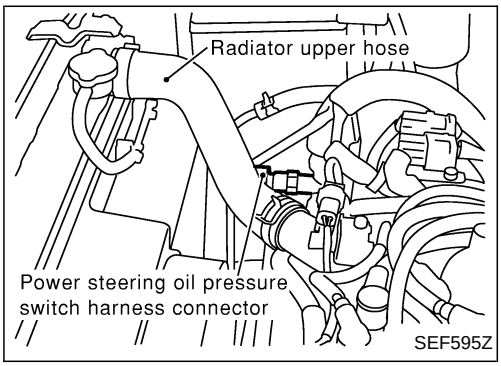
Check continuity between terminals ③ and ⑤.

Conditions	Continuity
12V direct current supply between terminals ① and ②	Yes
No current supply	No

If NG, replace relay.

Fuel pump

1. Disconnect fuel pump harness connector.
2. Check resistance between terminals ② and ④.
   Resistance: 0.2 - 5.0Ω at 25°C (77°F)
   If NG, replace fuel pump.



Power Steering Oil Pressure Switch

COMPONENT DESCRIPTION

The power steering oil pressure switch is attached to the power steering high-pressure tube and detects a power steering load. When a power steering load is detected, it signals the ECM. The ECM adjusts the IACV-AAC valve to increase the idle speed and adjust for the increased load.

CONSULT-II REFERENCE VALUE IN DATA MONITOR MODE

Remarks: Specification data are reference values.

MONITOR ITEM	CONDITION		SPECIFICATION
PW/ST SIGNAL	• Engine: After warming up, idle the engine	Steering wheel in neutral position (forward direction)	OFF
		The steering wheel is turned	ON

ECM TERMINALS AND REFERENCE VALUE

Specification data are reference values, and are measured between each terminal and ground.

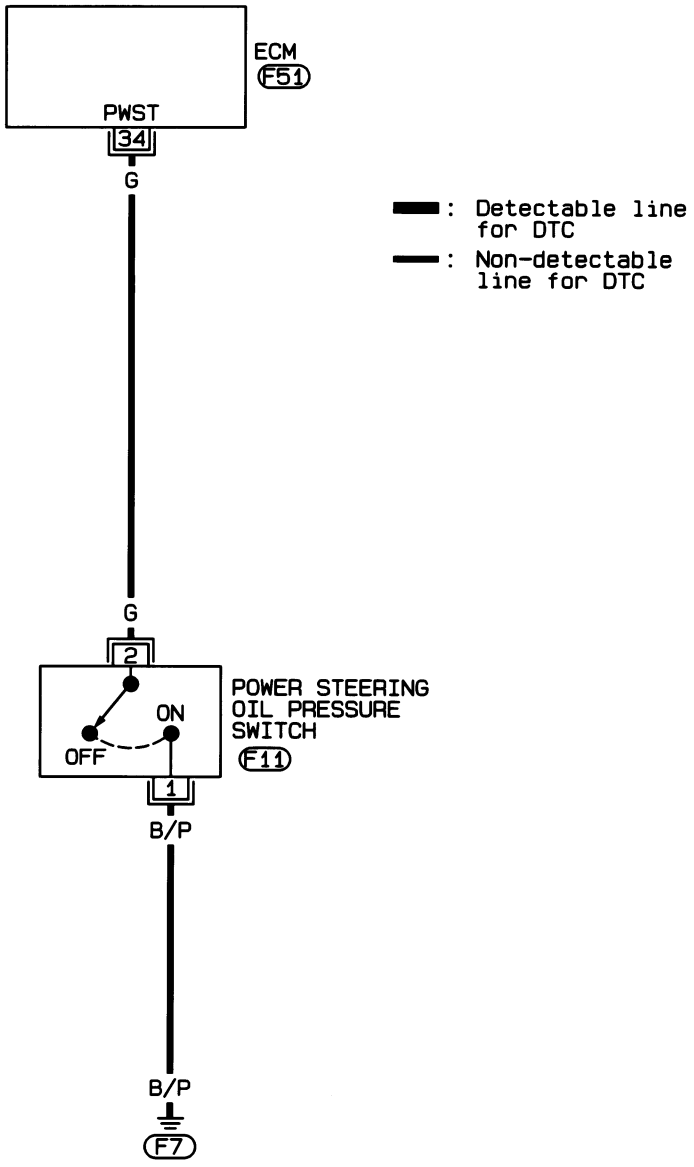
CAUTION:

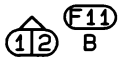
Do not use ECM ground terminals when measuring input/output voltage. Doing so may result in damage to the ECM's transistor. Use a ground other than ECM terminals, such as the ground.

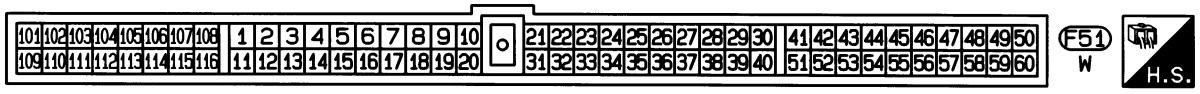
TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC voltage)
34	G	Power steering oil pressure switch	Engine is running. └ Steering wheel is being turned.	0V
			Engine is running. └ Steering wheel is not being turned.	Approximately 5V

Power Steering Oil Pressure Switch (Cont'd)

EC-PST/SW-01







HEC878

Power Steering Oil Pressure Switch (Cont'd)

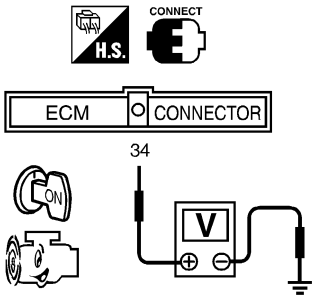
DIAGNOSTIC PROCEDURE

A

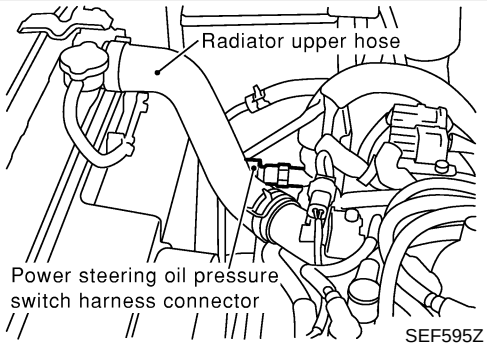
DATA MONITOR	
MONITOR	NO DTC
PW/ST SIGNAL	OFF

SEF596Z

A



SEF597Z



SEF595Z

INSPECTION START

A

CHECK OVERALL FUNCTION.

1. Start engine.
2. Check "PW/ST SIGNAL" in "DATA MONITOR" mode with CONSULT-II.

Steering is neutral position: OFF
Steering is turned: ON

OK → INSPECTION END

OR

1. Start engine.
2. Check voltage between ECM terminal ㉞ and ground.

Voltage:
When steering wheel is turned quickly
Approximately 0V
Except above
Approximately 5V

NG

CHECK GROUND CIRCUIT.

1. Turn ignition switch "OFF".
2. Disconnect power steering oil pressure switch harness connector.
3. Check harness continuity between power steering oil pressure switch harness connector terminal ① and engine ground.
   Refer to wiring diagram.
   Continuity should exist.
   If OK, check harness for short to power.

NG → Repair open circuit or short to power in harness or connectors.

OK

CHECK INPUT SIGNAL CIRCUIT.

1. Disconnect ECM harness connector.
2. Check harness continuity between ECM terminal ㉞ and power steering oil pressure switch harness connector terminal ② .
   Refer to wiring diagram.
   Continuity should exist.
   If OK, check harness for short to ground and short to power.

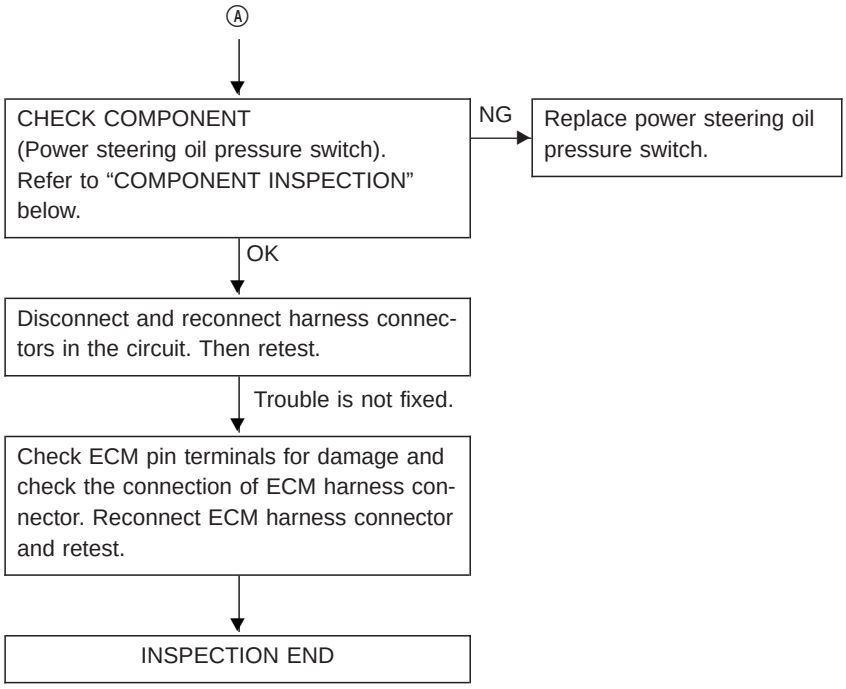
NG → Repair open circuit or short to ground or short to power in harness or connectors.

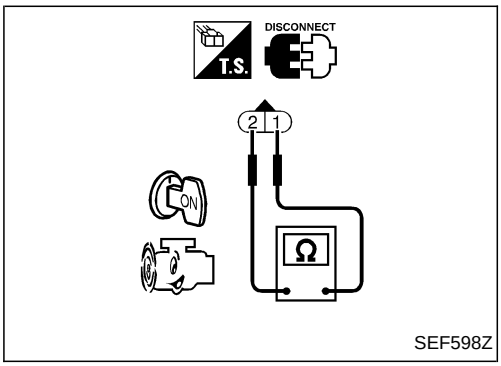
OK

Ⓐ

(Go to next page.)

Power Steering Oil Pressure Switch (Cont'd)





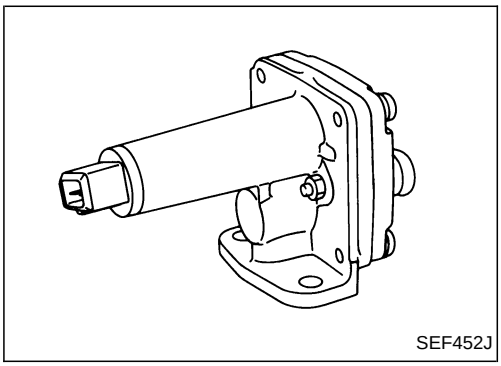
COMPONENT INSPECTION

Power steering oil pressure switch

1. Disconnect power steering oil pressure switch harness connector then start engine.
2. Check continuity between terminals ① and ② .

Conditions	Continuity
Steering wheel is being turned	Yes
Steering wheel is not being turned	No

If NG, replace power steering oil pressure switch.


SEF452J

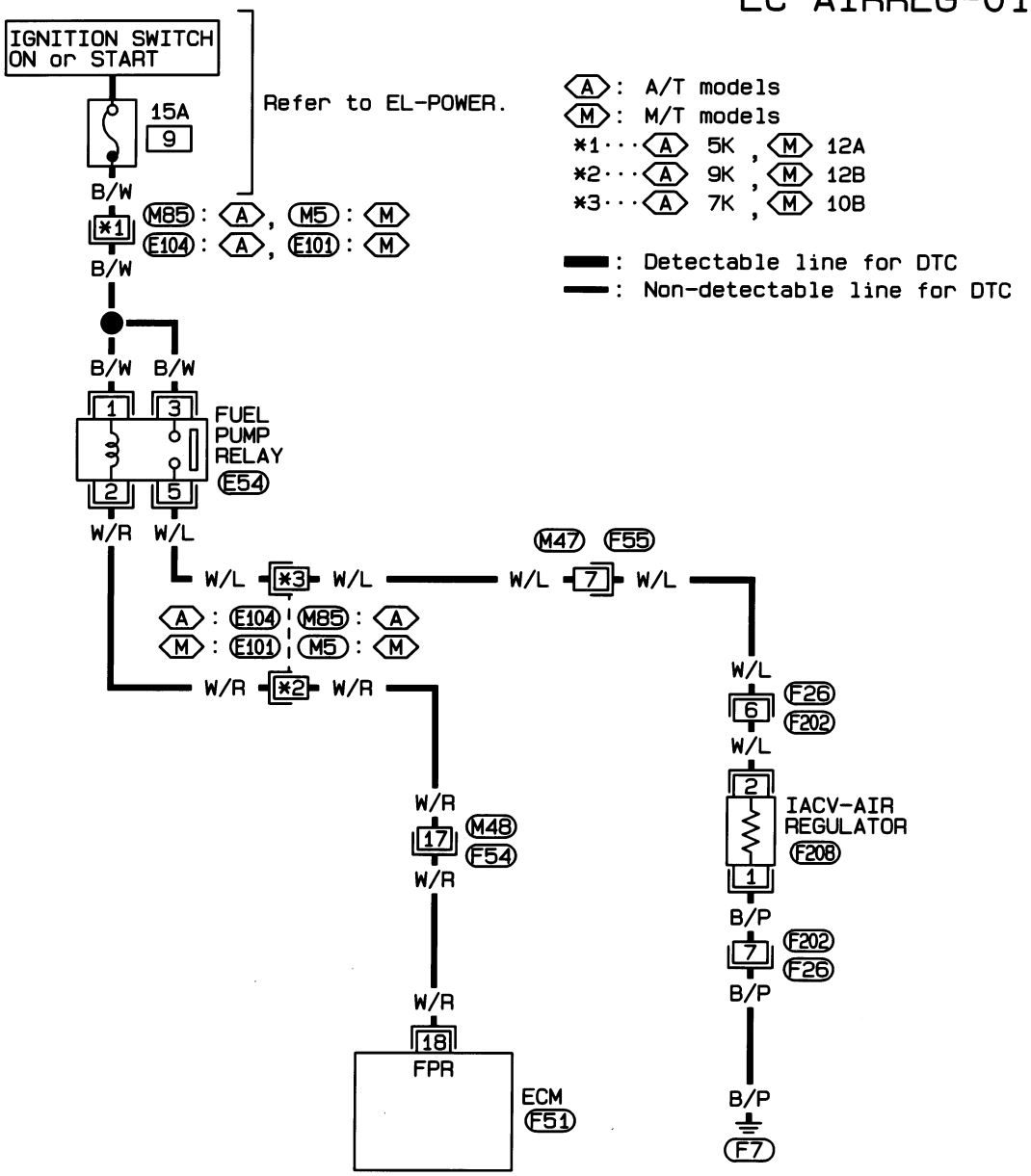
IACV-Air Regulator

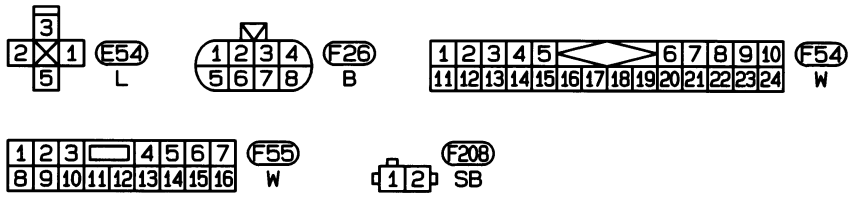
COMPONENT DESCRIPTION

The idle air control valve (IACV)-air regulator provides an air by-pass when the engine is cold for a fast idle during warm-up.
A bimetal, heater and rotary shutter are built into the IACV-air regulator. When the bimetal temperature is low the air by-pass port opens. As the engine starts and electric current flows through a heater, the bimetal begins to turn the shutter to close the by-pass port. The air passage remains closed until the engine stops and the bimetal temperature drops.

IACV-Air Regulator (Cont'd)

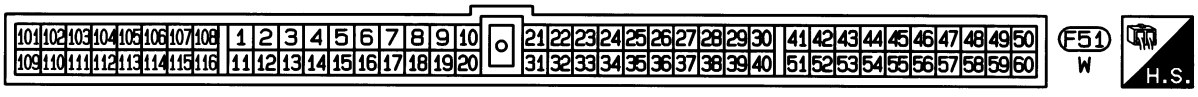
EC-AIRREG-01





Refer to last page (Foldout page).

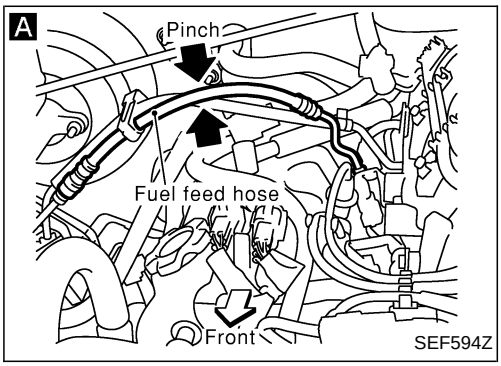
M5, E101
M85, E104

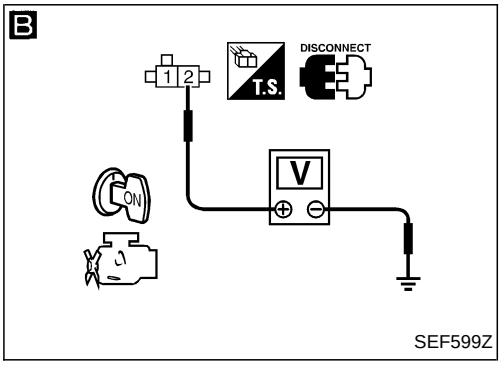


HEC877

IACV-Air Regulator (Cont'd)

DIAGNOSTIC PROCEDURE





INSPECTION START

A

CHECK OVERALL FUNCTION.
1. Turn ignition switch "ON".
2. Pinch fuel feed hose with fingers.
   Fuel pressure pulsation should be felt on the fuel feed hose for 5 seconds after ignition switch is turned "ON".

NG → Check fuel pump control circuit. Refer to EC-122.

OK

B

CHECK POWER SUPPLY.
1. Turn ignition switch "OFF".
2. Disconnect IACV-air regulator harness connector.
3. Turn ignition switch "ON".
4. Check voltage between terminal ② and ground with CONSULT-II or tester.
   Battery voltage should exist for 5 seconds after ignition switch is turned "ON".

NG → Check the following.
- Harness connectors (F26), (F202)
- Harness connectors (M47), (F55)
- Harness connectors (E104), (M85) (A/T models) (E101), (M5) (M/T models)
- Harness continuity between IACV-air regulator and fuel pump relay

If NG, repair open circuit or short to ground or short to power in harness or connectors.

OK

CHECK GROUND CIRCUIT.
1. Turn ignition switch "OFF".
2. Check harness continuity between terminal ① and engine ground. Refer to wiring diagrams.
   Continuity should exist.

If OK, check harness for short to power.

NG → Check the following.
- Harness connectors (F26), (F202)
- Harness continuity between IACV-air regulator and engine ground

If NG, repair open circuit or short to power in harness or connectors.

OK

CHECK COMPONENT (IACV-air regulator).
Refer to "COMPONENT INSPECTION" on the next page.

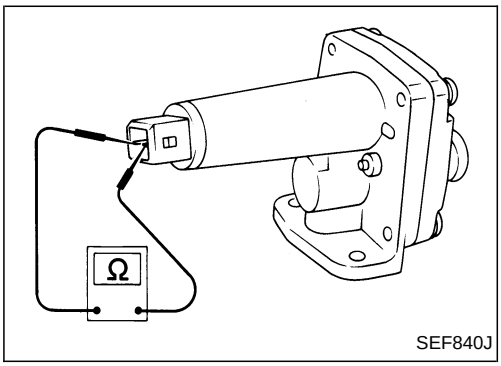
NG → Replace IACV-air regulator.

OK

INSPECTION END

IACV-Air Regulator (Cont'd)

COMPONENT INSPECTION



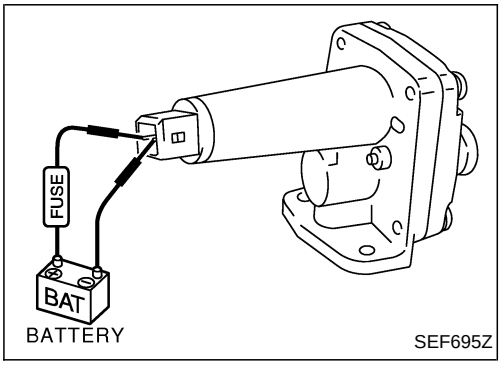
IACV-air regulator

Heater resistance check

1. Disconnect IACV-air regulator harness connector.
2. Check resistance between terminals ① and ② .

   Resistance: Approximately 70 - 80Ω [at 25°C (77°F)]

   If NG, replace IACV-air regulator.



Confirmation of shutter plate operation

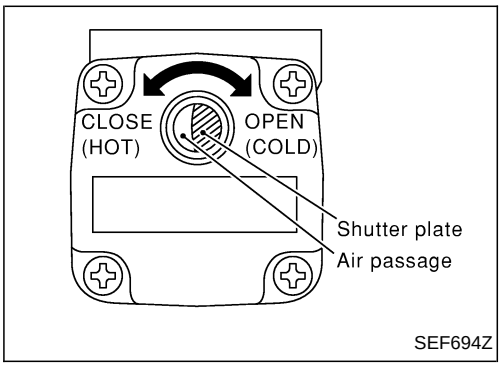
— In high idle after warm-up —

- After warming up engine, remove the IACV-air regulator, and make sure the shutter plate is fully closed. If NG, inspect electric circuits and heater resistance. Perform the following resistance test if any fault is found.
- When 12V is directly applied to terminals ① and ② , make sure that the shutter plate gradually closes. (It will fully close in 2 to 5 minutes of electric continuity.)

  If NG, replace IACV-air regulator.

— When cooling engine, fast idle speed is low —

- After cooling engine, remove IACV-air regulator and make sure that the shuttle plate is open.

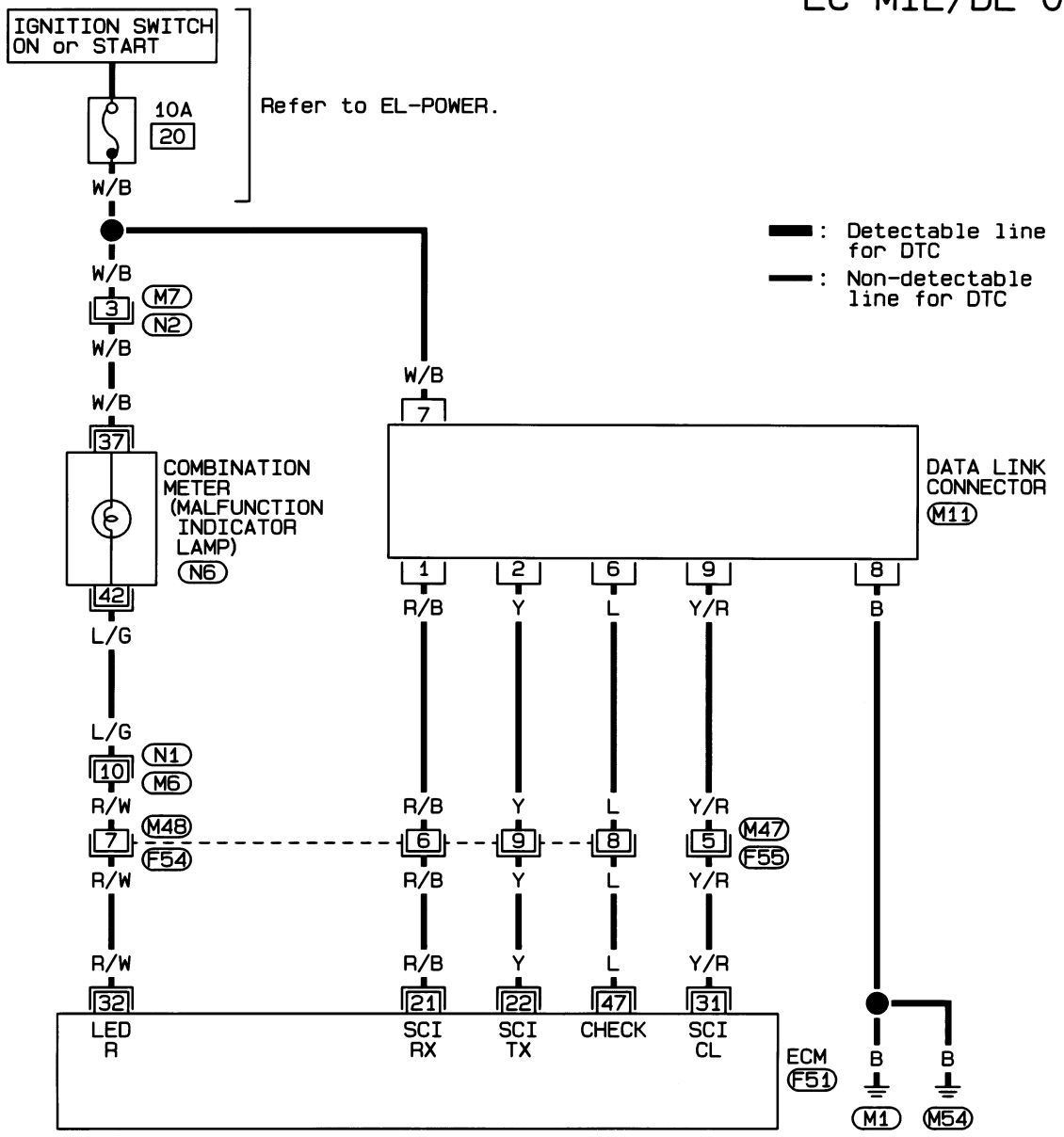


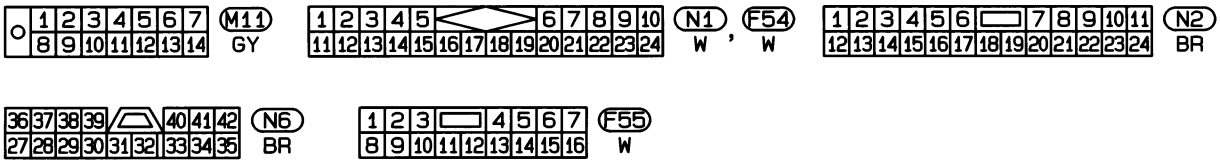
Condition	Shutter plate
Below −20°C	Approximately full open
20 - 30°C	Partially open (Refer to the figure.)

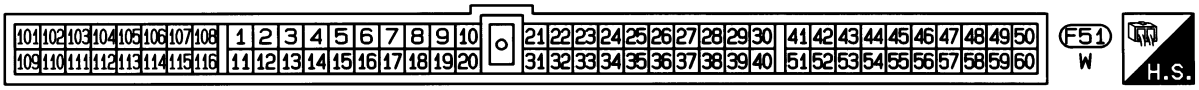
If NG, replace IACV-air regulator.

MIL & Data Link Connectors

EC-MIL/DL-01







HEC879

General Specifications

PRESSURE REGULATOR

Fuel pressure kPa (bar, kg/cm^2, psi)	
At idle	Approximately 235 (2.35, 2.4, 34)
A few seconds after ignition switch is turned OFF to ON	Approximately 294 (2.94, 3.0, 43)

Inspection and Adjustment

Idle speed*1 rpm	Base idle speed*2	700±50
(in "N" position)	Target idle speed	750±50
Air conditioner: ON (in "N" position)	850 or more	
Ignition timing	15°±2° BTDC	
Idle CO% at target idle speed	1.0±0.5%	

*1: Under the following conditions:
- Air conditioner switch: OFF
- Steering wheel: Kept in straight-ahead position
- Electrical load: OFF (Lights, heater fan & rear window defogger)

*2: Throttle position sensor connector is disconnected.

MASS AIR FLOW SENSOR

Supply voltage	V	Battery voltage (11 - 14)
Output voltage at idle	V	1.0 - 1.7 at idle* 1.7 - 2.3 at 2,500 rpm*

*: Engine is warmed up to normal operating temperature and running under no-load.

ENGINE COOLANT TEMPERATURE SENSOR

Temperature °C (°F)	Resistance
20 (68)	2.1 - 2.9 kΩ
50 (122)	0.68 - 1.00 kΩ
90 (194)	0.236 - 0.260 kΩ

FUEL PUMP

Resistance [at 25°C (77°F)]	Ω	0.2 - 5.0

IACV-AAC VALVE

Resistance [at 25°C (77°F)]	Ω	Approximately 10.0

IACV-AIR REGULATOR

Resistance [at 25°C (77°F)]	Ω	70 - 80

INJECTOR

Resistance [at 25°C (77°F)]	Ω	10 - 14

IGNITION COIL & POWER TRANSISTOR

Refer to EC-89.

RESISTOR

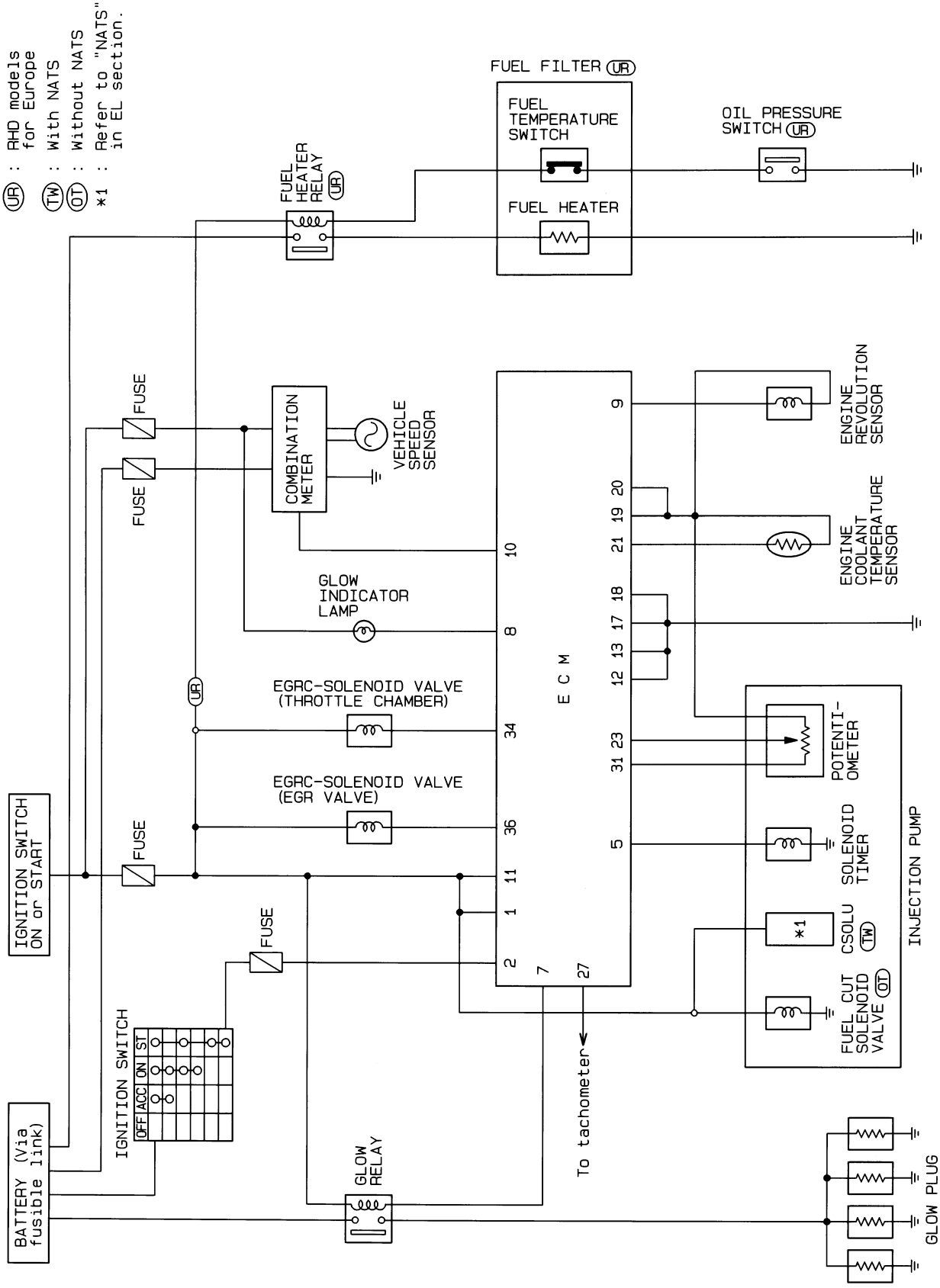
Resistance [at 25°C (77°F)]	kΩ	Approximately 2.2

THROTTLE POSITION SENSOR

Throttle valve conditions	Voltage
Completely closed (a)	0.15 - 0.85V
Partially open	Between (a) and (b)
Completely open (b)	Approximately 4.0V

Circuit Diagram

TD25, TD25Ti AND TD27 WITH EGR ENGINES

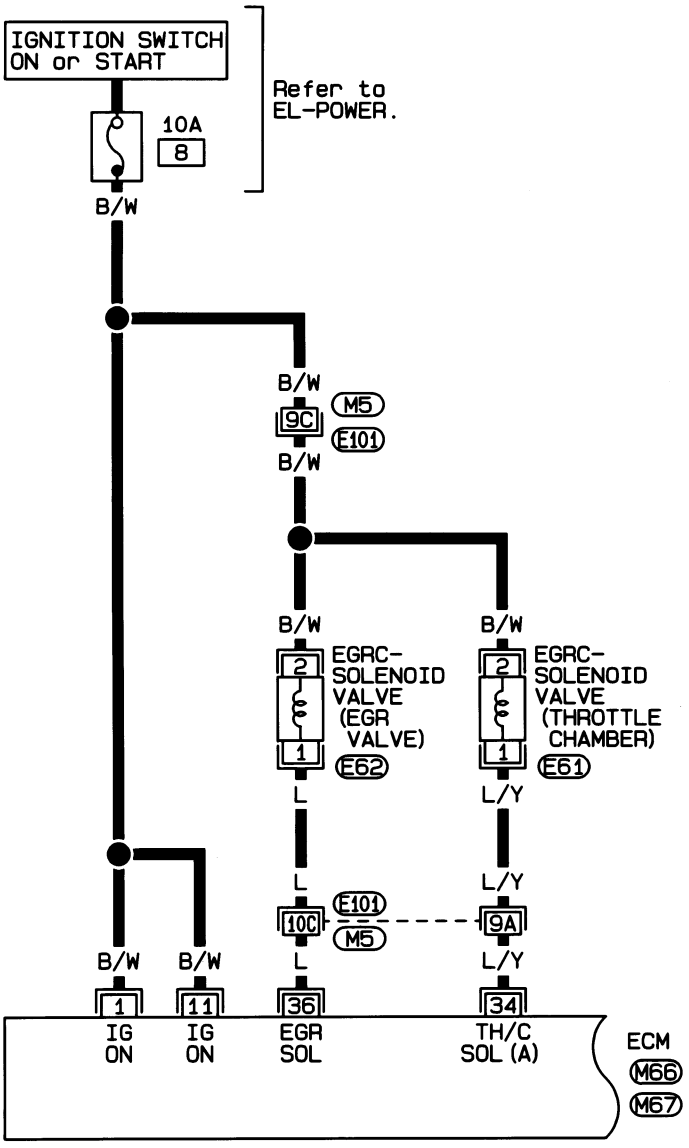


HEC920

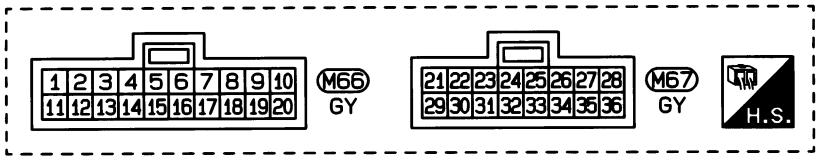
Wiring Diagram

TD25, TD25Ti AND TD27 WITH EGR ENGINES (RHD)

EC-EGRC/V-01



E61 (1 2) B , E62 BR



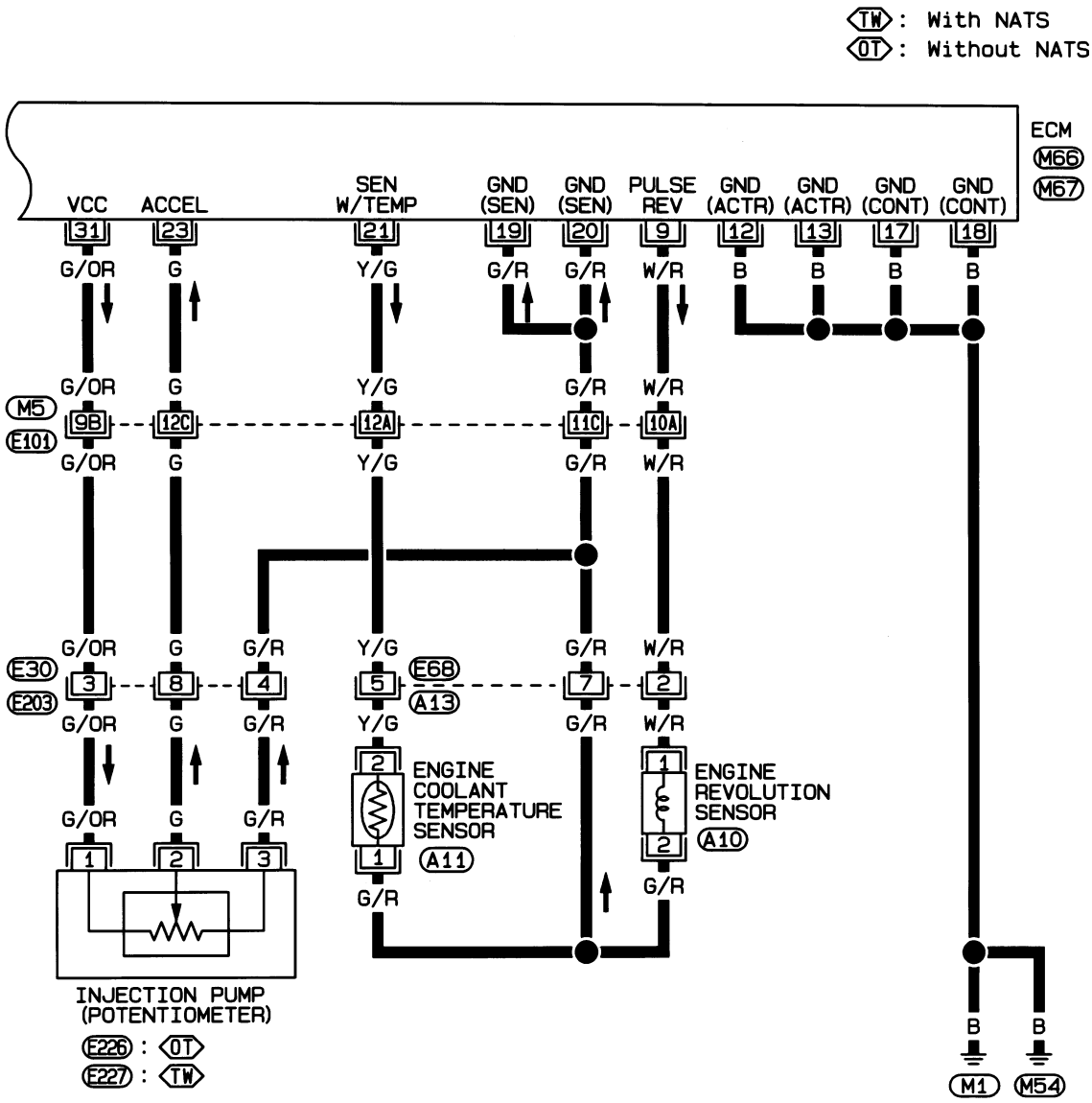
Refer to last page
(Foldout page).

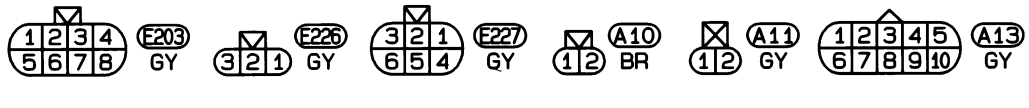
M5 , E101

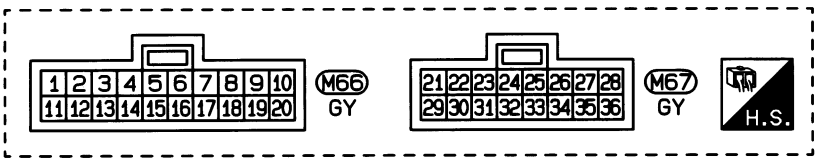
HEC921

Wiring Diagram (Cont'd)

EC-EGRC/V-02





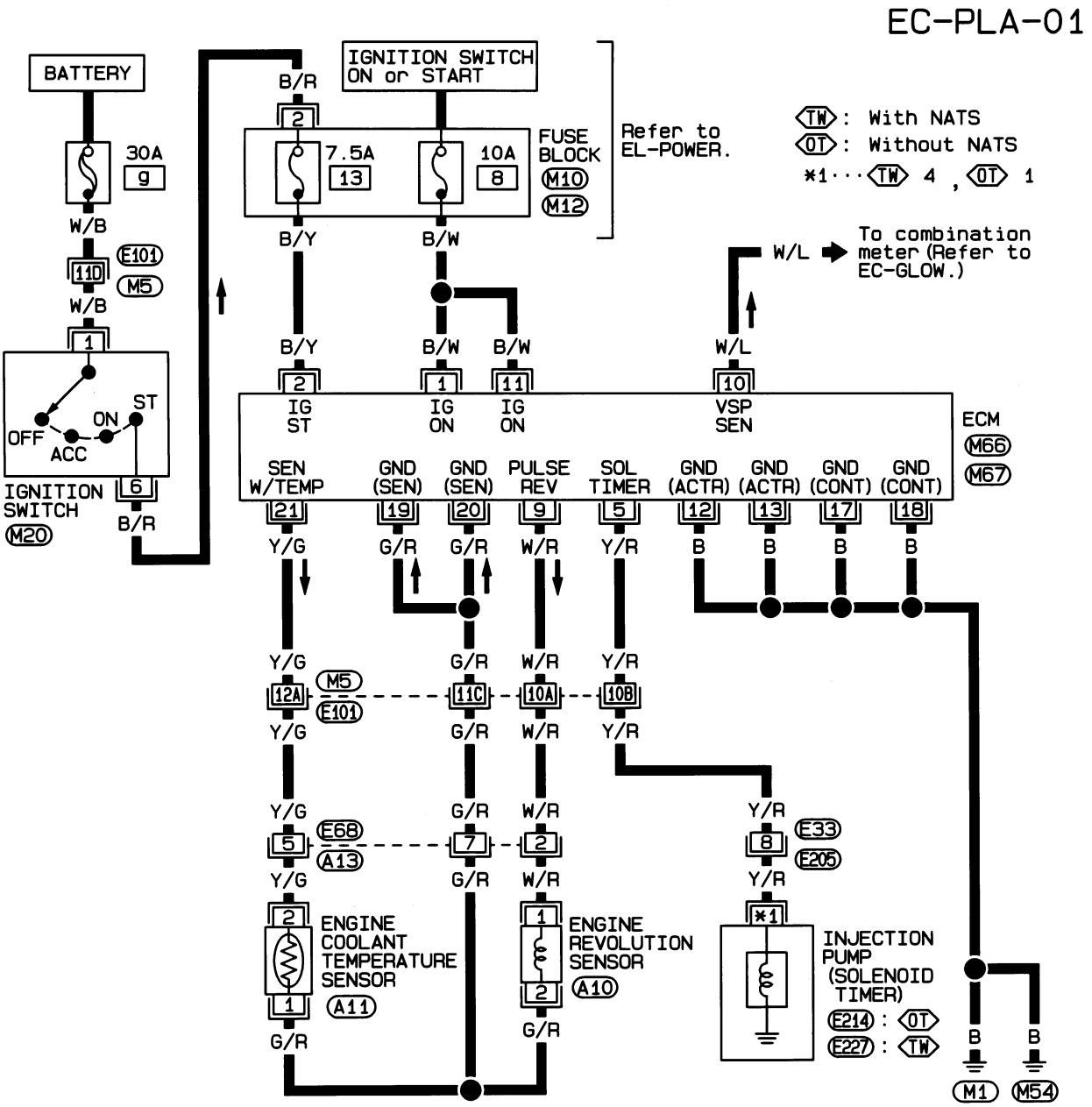


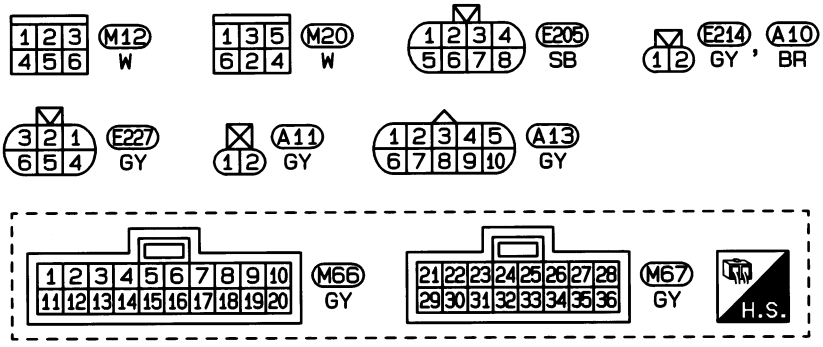
Refer to last page (Foldout page).
M5, E101

HEC922

Wiring Diagram

TD25 & TD25Ti ENGINE (RHD)





Refer to last page (Foldout page).
M5 , E101

HEC923

VE-type Injection Pump

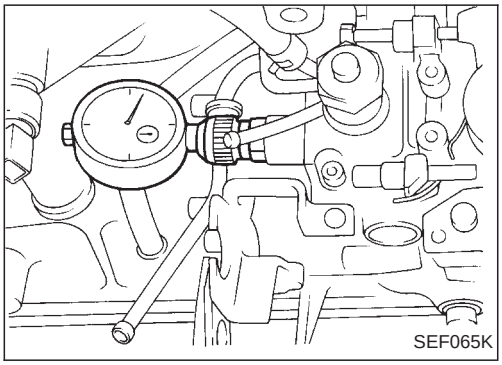
APPLICATION

Engine	Destination	Part No.	Pump assembly No.	Remarks
QD32	Australia	16700 2S604	104741-4373	

INSPECTION AND ADJUSTMENT

Plunger lift

Engine	Plunger lift at TDC mm (in)		Part No.	Pump assembly No.
	Inspection	Adjustment		
QD32	0.42±0.05 (0.0165 ±0.0020)	0.42±0.02 (0.0165 ±0.0008)	16700 2S604	104741-4373


SEF065K

Maximum engine speed

Engine	Maximum engine speed (Under no load) rpm
QD32	4,700±100

Injection Pump Calibration Standard

QD32 ENGINE MODEL

Injection pump assembly No.	104741-4373
Part No.	16700 2S604

Pump rotation: Clockwise—viewed from drive side

1. Test conditions

1 - 1 Nozzle: 105780-0060 (NP-DN0SD1510)
1 - 2 Nozzle holder: 105780-2150
1 - 3 Nozzle opening pressure: 13,043$^{+294}_{0}$ kPa (130.4$^{+2.9}_{0}$ bar, 133$^{+3}_{0}$ kg/cm^2, 1,891$^{+43}_{0}$ psi)
1 - 4 Injection pipe: 2 dia. x 6 dia. 450 mm (0.08 dia. x 0.24 dia. x 17.72 in)
1 - 5 Fuel oil temperature: 45$^{+5}_{0}$°C (113$^{+9}_{0}$°F)
1 - 6 Supply pump pressure: 20 kPa (0.20 bar, 0.2 kg/cm^2, 2.8 psi)
1 - 7 Joint ass'y: 157641-4720
1 - 8 Tube ass'y: 157641-4020

2. Setting		Pump speed rpm	Settings	Charge air press kPa (mbar, mmHg, inHg)	Difference in delivery mℓ (Imp fl oz)
2 - 1	Full load delivery	1,000	58.3±0.5 (2.05±0.02)(mℓ/1,000 st)		4.5 (0.16)
2 - 2	Supply pump pressure	1,000	539±20 kPa (5.39±0.20 bar, 5.5±0.2 kg/cm^2, 78±2.8 psi)		
2 - 3	Timing device travel	1,000	3.5±0.2 mm (0.138±0.008 in)		
2 - 4	Idle speed regulation	375	12.9±2.0 mℓ (0.45±0.07 Imp fl oz)/1,000 st		2.0 (0.07)
2 - 5	Start (Full lever)	100	90.0$^{+20.0}_{-15.0}$ mℓ (3.17$^{+0.70}_{-0.53}$ Imp fl oz)/1,000 st		
2 - 6	Full-load speed regulation	2,350	17.8±2.0 mℓ (0.63±0.07 Imp fl oz)/1,000 st		
2 - 7	Load timer adjustment	1,000	2.3±0.2 mm (0.091±0.008 in)		

3. Test specifications					
3 - 1 Timing device	N = rpm mm (in)	600 1.5±0.5 (0.059±0.020)	1,000 3.6±0.3 (0.138±0.012)	1,800 7.4±0.5 (0.291±0.020)	2,050 8.2$^{+0.4}_{-0.5}$ (0.323$^{+0.016}_{-0.020}$)
3 - 2 Supply pump	N = rpm kPa (bar, kg/cm^2, psi)		1,000 539±39 (5.39±0.39, 5.5±0.4, 78±6)	1,800 736±59 (7.36±0.59, 7.5±0.6, 107±9)	
3 - 3 Overflow delivery	N = rpm mℓ (Imp fl oz)/min.		1,000 390±130 (13.7±4.6)		

3 - 4 Fuel injection quantities

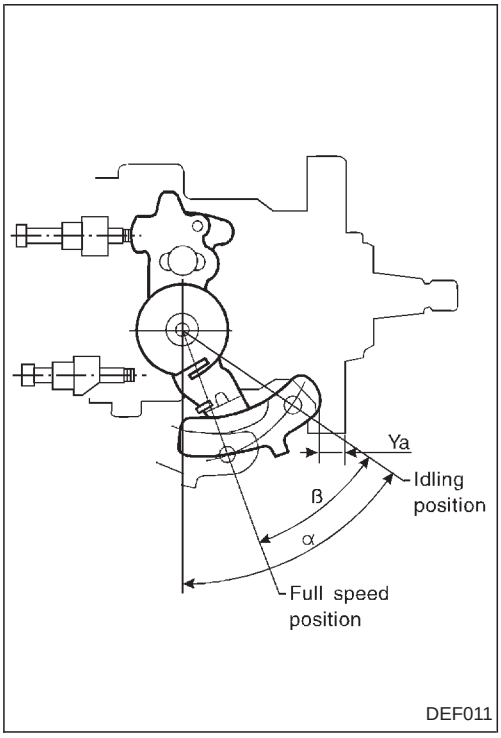
Speed control lever position	Pump speed rpm	Fuel delivery mℓ (Imp fl oz)/1,000 st	Charge air press kPa (mbar, mmHg, inHg)
Max. speed	1,000	58.3±1.0 (2.00±0.04)	—
	500	52.0±3.5 (1.83±0.12)	
	800	57.1±3.5 (2.01±0.12)	
	1,500	58.3±3.0 (2.05±0.11)	
	1,800	60.5±3.0 (2.12±0.11)	
	2,350	17.8±2.5 (0.63±0.09)	
	2,600	Below 5.0 (0.18)	
Switch OFF Magnet valve	375	0 (0) Idle	—
Idling	375	12.9±2.5 (0.45±0.09)	—
3 - 5 Solenoid	Max. cut-in voltage: 8V Test voltage: 12 - 14V		

4. Dimensions	
K	3.3±0.1 mm (0.130±0.004 in)
KF	5.62±0.1 mm (0.2213±0.0039 in)
MS	0.9±0.1 mm (0.035±0.004 in)
BCS	—
Pre-stroke	0.1±0.02 mm (0.0039±0.0008 in)
Control lever angle	
α	55.5±4.0 degree
β	32.5±5.0 degree
γ	—

Injection Pump Calibration Standard (Cont'd)

Control lever angle measurement position

Measure the control lever angles (α, β).



Load timer adjustment

1. Adjust the governor shaft so that the clearance between the end of the flange and the end of the governor shaft is approximately 3 mm (0.12 in) and then lock the nut.
2. Fix the control lever in the position satisfying the following conditions.
   Pump speed: 1,000 rpm
   Fuel injection quantity: 29.0±0.5 mℓ (1.02±0.02 Imp fl oz)/1,000 st
3. With the control lever positioned as described in 2. above, adjust the governor sleeve so that the timer reduction value (△T) conforms to the specified values (item 2 - 7).
   T = 17 - 21 N·m (1.7 - 2.2 kg-m, 13 - 15 ft-lb)
4. Confirmation of timer characteristics
   Fix the control lever in the position satisfying the following conditions, and confirm the timer stroke.

Control lever position			Specified values	
Pump speed rpm	Fuel injection quantity mℓ (Imp fl oz)/1,000 st	Boost pressure kPa (mbar, mmHg, inHg)	Timer stroke mm (in)	Timer stroke reduction value mm (in)
1,000	29.0±1.0 (1.02±0.04)	—	2.3±0.3 (0.091±0.012)	1.2 (0.047)
1,000	20.0±2.5 (0.70±0.09)	—	1.2±0.5 (0.047±0.020)	2.3 (0.091)