

ENGINE CONTROL SYSTEM

SECTION EC

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EC

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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”.

DIAGNOSTIC TROUBLE CODE INDEX

Alphabetical & Numerical Index for DTC

ALPHABETICAL INDEX FOR DTC

NUMERICAL INDEX FOR DTC

X: Applicable
—: Not applicable

X: Applicable
—: Not applicable

Items (CONSULT screen terms)	DTC	MIL illumination	Reference page
ACCEL POS SENSOR	43	X	EC-139
ACCEL POS SW (F/C)	23	X	EC-106
ADJUST RESISTOR	17	—	EC-92
CAM POS SEN (PUMP)	11	X	EC-69
CONT SLEEV POS SEN	15	X	EC-87
COOLANT TEMP SEN	13	X	EC-79
CRANK POS SEN (TDC)	47	X	EC-144
ECM 1	27	X	EC-111
ECM 2	31	X	EC-111
ELECTRIC GOV	25	X	EC-96
FCV SHORT	37	X	EC-130
FUEL CUT S/V 1	36	X	EC-130
FUEL CUT S/V 2	38	X	EC-130
FUEL TEMP SENSOR	42	—	EC-135
F/INJ F/B	22	X	EC-96
F/INJ F/B 2	18	X	EC-96
F/INJ TIMG F/B	21	—	EC-101
GOV CUT CIRCUIT	48	X	EC-149
I/C INT/A TEMP SEN	33 *1	—	EC-122
MAS AIR FLOW SEN	12	—	EC-74
NATS MALFUNCTION	141 - 148	X	EL section*
NEEDLE LIFT SEN	34	—	EC-126
NO SELF DIAGNOSTIC FAILURE INDICATED	55	—	—
OVER HEAT	28	X	EC-113
VEHICLE SPEED SEN	14	—	EC-83

DTC	MIL illumination	Items (CONSULT screen terms)	Reference page
11	X	CAM POS SEN (PUMP)	EC-69
12	—	MAS AIR FLOW SEN	EC-74
13	X	COOLANT TEMP SEN	EC-79
14	—	VEHICLE SPEED SEN	EC-83
15	X	CONT SLEEV POS SEN	EC-87
17	—	ADJUST RESISTOR	EC-92
18	X	F/INJ F/B 2	EC-96
21	—	F/INJ TIMG F/B	EC-101
22	X	F/INJ F/B	EC-96
23	X	ACCEL POS SW (F/C)	EC-106
25	X	ELECTRIC GOV	EC-96
27	X	ECM 1	EC-111
28	X	OVER HEAT	EC-113
31	X	ECM 2	EC-111
33 *1	—	I/C INT/A TEMP SEN	EC-122
34	—	NEEDLE LIFT SEN	EC-126
36	X	FUEL CUT S/V 1	EC-130
37	X	FCV SHORT	EC-130
38	X	FUEL CUT S/V 2	EC-130
42	—	FUEL TEMP SENSOR	EC-135
43	X	ACCEL POS SENSOR	EC-139
47	X	CRANK POS SEN (TDC)	EC-144
48	X	GOV CUT CIRCUIT	EC-149
55	—	NO SELF DIAGNOSTIC FAILURE INDICATED	—
141 - 148	X	NATS MALFUNCTION	EL section*2

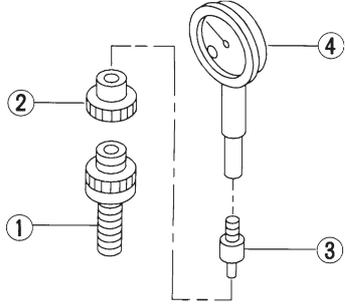
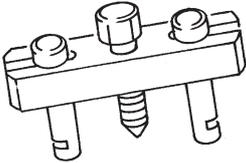
*1: When nothing is displayed or the meaningless symbol is displayed in the "Self-diag result" mode with CONSULT, perform "Diagnostic Test Mode II (Self-diagnostic results)" with ECM. Refer to EC-32.

*2: Refer to "NATS (Nissan Anti-Theft System)" in EL section.

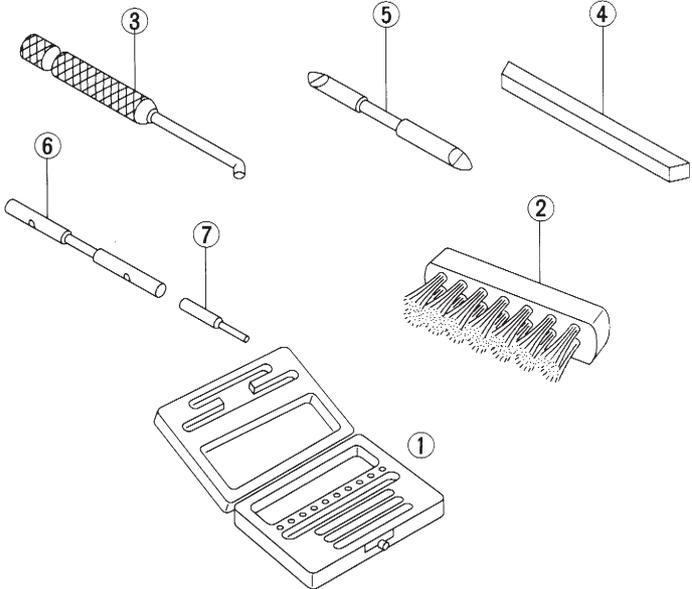
PRECAUTIONS AND PREPARATION

Special Service Tools

FOR DIESEL ENGINE INJECTION PUMP

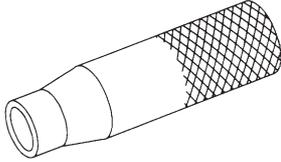
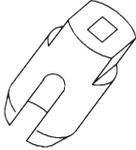
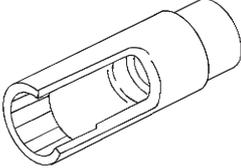
Tool number Tool name	Description
KV11229352 Measuring device ① KV11229350 Holder ② KV11229360 Nut ③ KV11229370 Pin ④ KV11254410 Dial gauge	Measuring plunger lift  NT570
KV11102900 Pulley puller	Removing injection pump sprocket  NT647

FOR DIESEL ENGINE INJECTION NOZZLE

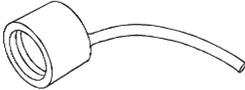
Tool number Tool name	Description
KV11289004 Nozzle cleaning kit ① KV11290012 Box ② KV11290110 Brush ③ KV11290122 Nozzle oil sump scraper ④ KV11290140 Nozzle needle tip ⑤ KV11290150 Nozzle seat scraper ⑥ KV11290210 Nozzle holder ⑦ KV11290220 Nozzle hole cleaning needle	 NT296

PRECAUTIONS AND PREPARATION

Special Service Tools (Cont'd)

Tool number Tool name	Description
KV11292010 Nozzle centering device	 NT293
KV11100300 Nozzle holder socket (For No. 2 - 4 injection nozzles)	 NT563
KV119E0010 No. 1 injection nozzle holder socket	 NT648

Commercial Service Tool

Tool name	Description
Fuel filler cap adapter	<div style="text-align: center;">  </div> <p style="text-align: right;">Checking fuel tank vacuum relief valve opening pressure</p> NT653

PRECAUTIONS AND PREPARATION

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 Y61 is as follows (The composition varies according to the destination.):

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 covered with yellow insulation either just before the harness connectors or for the complete harness are related to the SRS.**

PRECAUTIONS AND PREPARATION

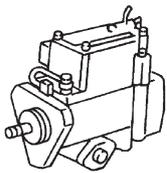
Engine Fuel & Emission Control System

BATTERY

- Always use a 12 volt battery as power source.
- Do not attempt to disconnect battery cables while engine is running.

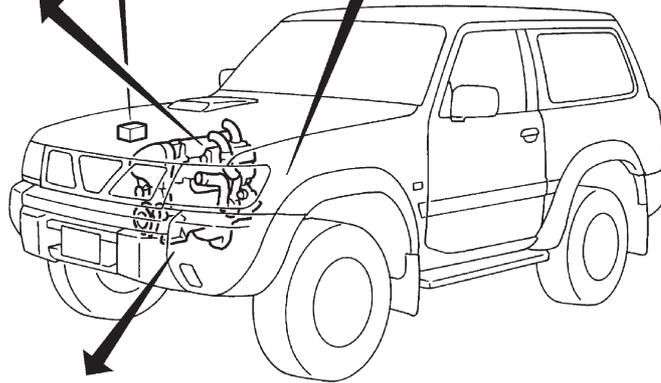
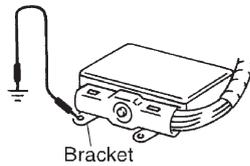
ELECTRONIC FUEL INJECTION PUMP

- Do not disconnect pump harness connectors with engine running.
- Do not disassemble electronic fuel injection pump except for the following parts:
(Camshaft position sensor (pump), Injection timing control valve, Fuel cut solenoid valve)
If NG, take proper action.



ECM (ECCS-D control module)

- Do not disassemble ECM.
- If a battery terminal is disconnected, the memory will return to the ECM value.
The ECM will now start to self-control at its initial value. Engine operation can vary slightly when the terminal is disconnected. However, this is not an indication of a problem. Do not replace parts because of a slight variation.
- When ECM is removed for inspection, make sure to ground the ECM mainframe.



ECM PARTS HANDLING

- Do not disassemble No. 1 injection nozzle (with needle lift sensor built-in).
If NG, replace No. 1 injection nozzle.
- Even a slight leak in the air intake system can cause serious problems.
- Do not shock or jar the crankshaft position sensor (TDC).

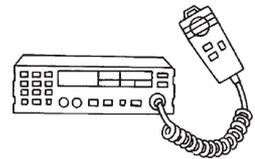


WHEN STARTING

- Do not depress accelerator pedal when starting.
- Immediately after starting, do not rev up engine unnecessarily.
- Do not rev up engine just prior to shutdown.

WIRELESS EQUIPMENT

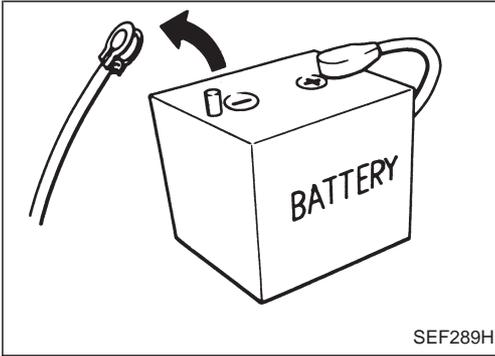
- When installing C.B. ham radio or a mobile phone, be sure to observe the following as it may adversely affect electronic control systems depending on its installation location.
 - 1) Keep the antenna as far as possible away from the ECM.
 - 2) Keep the antenna feeder line more than 20 cm (7.9 in) away from the harness of electronic controls.
Do not let them run parallel for a long distance.
 - 3) Adjust the antenna and feeder line so that the standing-wave ratio can be kept smaller.
 - 4) Be sure to ground the radio to vehicle body.



ECM HARNESS HANDLING

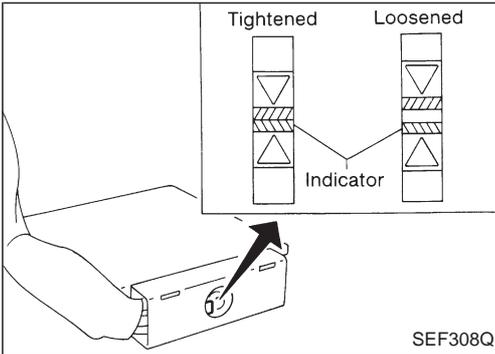
- Securely connect ECM harness connectors.
A poor connection can cause an extremely high (surge) voltage to develop in coil and condenser, thus resulting in damage to ICs.
- Keep ECM harness at least 10 cm (3.9 in) away from adjacent harnesses, to prevent an ECM system malfunction due to receiving external noise, degraded operation of ICs, etc.
- Keep ECM parts and harnesses dry.
- Before removing parts, turn off ignition switch and then disconnect battery ground cable.

PRECAUTIONS AND PREPARATION



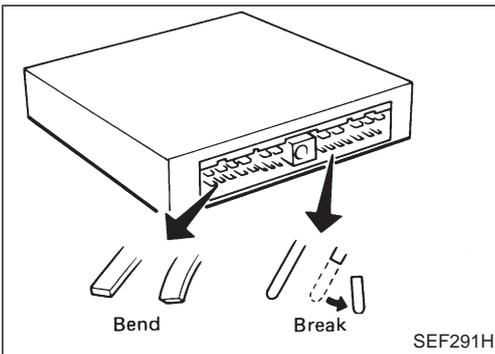
Precautions

- Before connecting or disconnecting the ECM harness connector, turn ignition switch OFF and disconnect negative battery terminal. Failure to do so may damage the ECM because battery voltage is applied to ECM even if ignition switch is turned off.



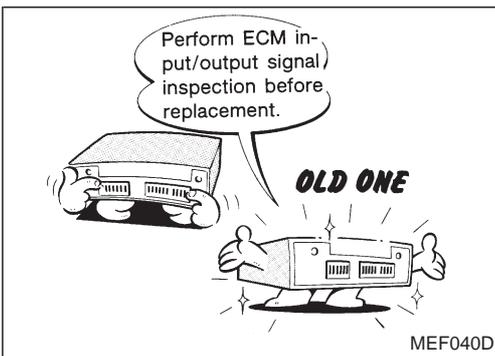
- When connecting ECM harness connector, tighten securing bolt until the gap between orange indicators disappears.

 : 3.0 - 5.0 N·m (0.3 - 0.5 kg-m, 26 - 43 in-lb)

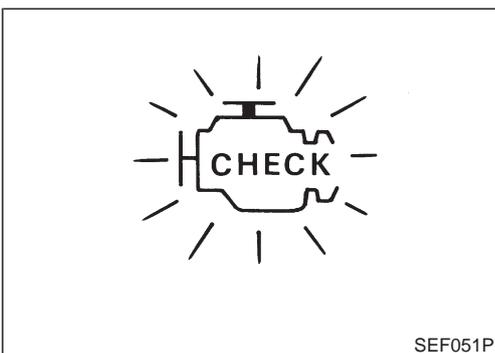


- When connecting or disconnecting pin connectors into or from ECM, take care not to damage pin terminals (bend or break).

Make sure that there are not any bends or breaks on ECM pin terminal, when connecting pin connectors.



- Before replacing ECM, perform Terminals and Reference Value inspection and make sure ECM functions properly. Refer to EC-54.

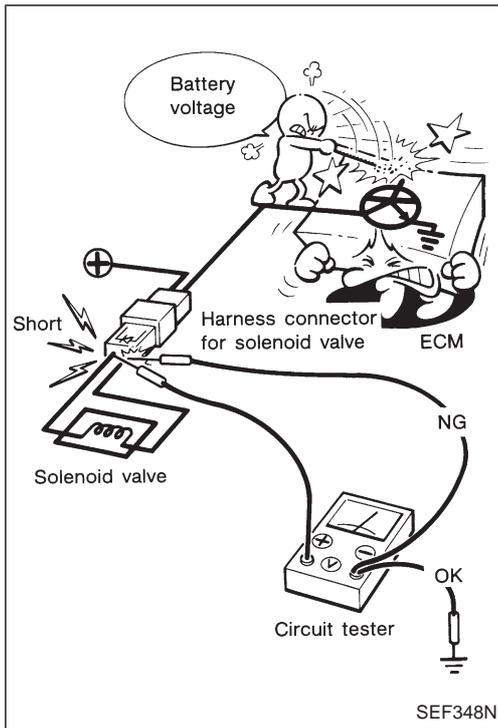


- If MIL illuminates or blinks irregularly when engine is running, water may have accumulated in fuel filter. Drain water from fuel filter. If this does not correct the problem, perform specified trouble diagnostic procedures.
- After performing each TROUBLE DIAGNOSIS, perform "OVERALL FUNCTION CHECK" or "DTC (Diagnostic Trouble Code) CONFIRMATION PROCEDURE". The DTC should not be displayed in the "DTC CONFIRMATION PROCEDURE" if the repair is completed. The "OVERALL FUNCTION CHECK" should be a good result if the repair is completed.

PRECAUTIONS AND PREPARATION

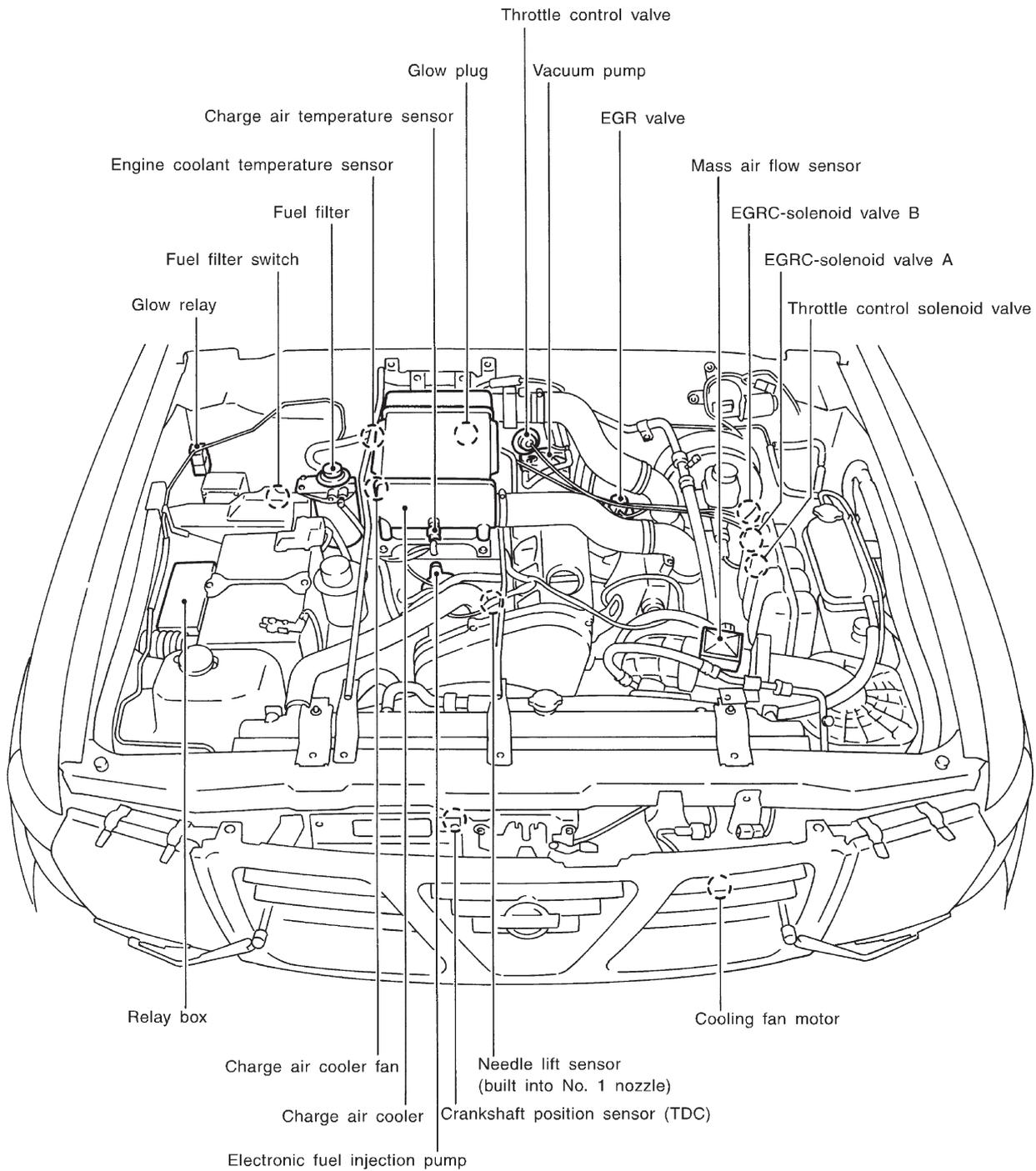
Precautions (Cont'd)

- When measuring ECM signals with a circuit tester, never allow the two tester probes to contact. Accidental contact of probes will cause a short circuit and damage the ECM power transistor.



ENGINE AND EMISSION CONTROL OVERALL SYSTEM

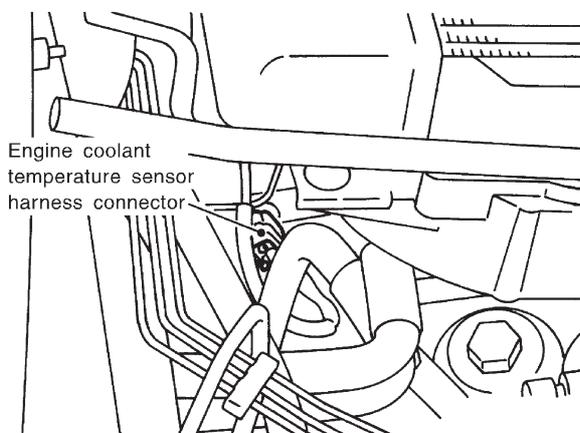
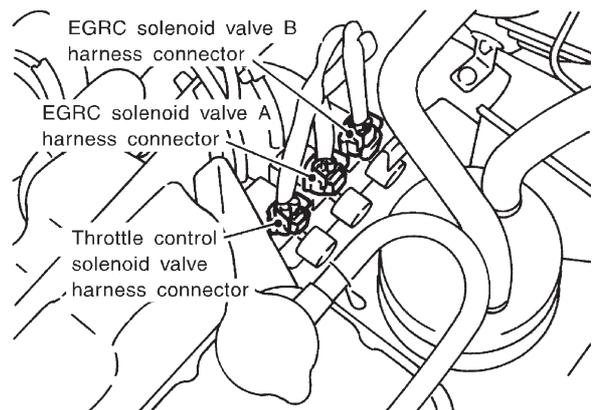
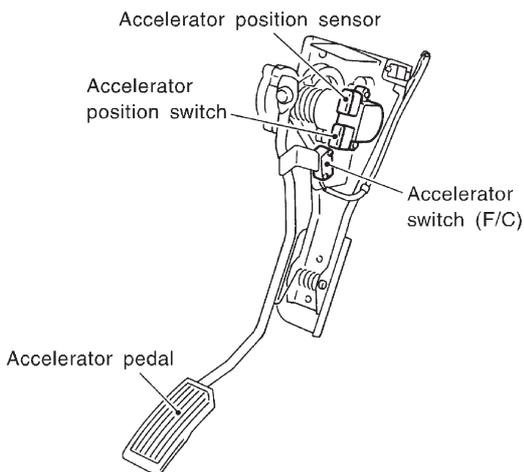
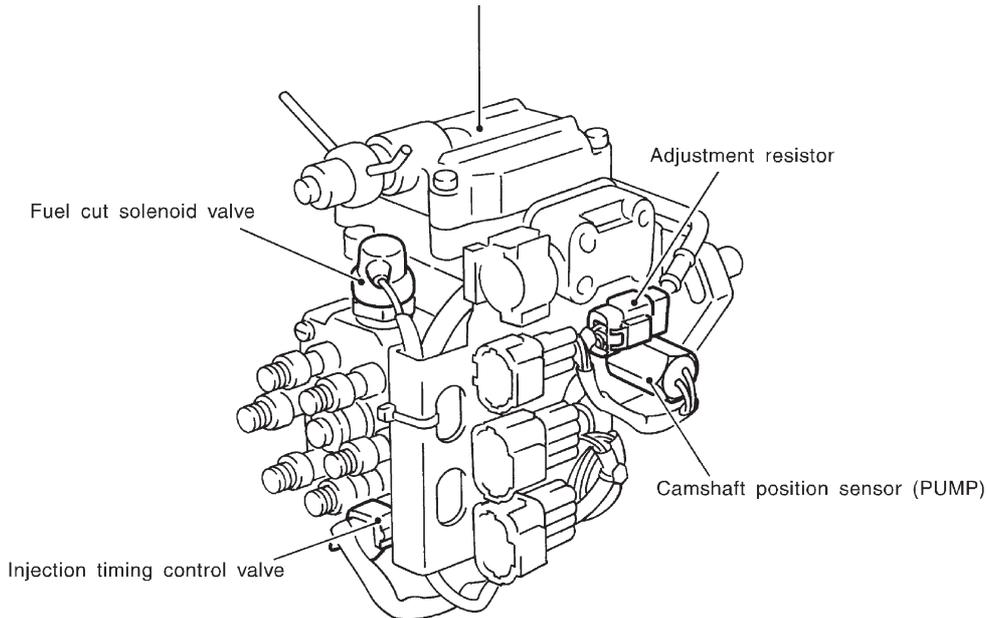
ECCS-D Component Parts Location



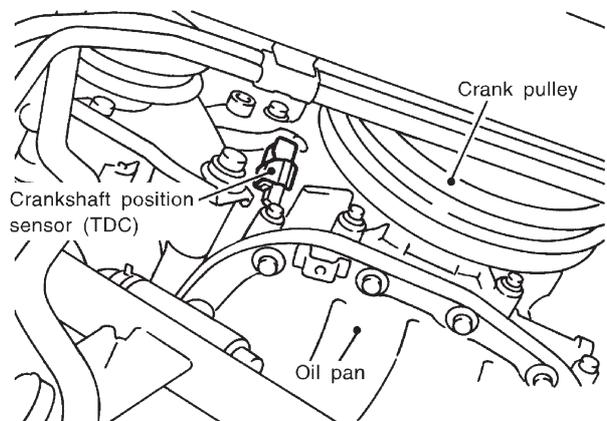
ENGINE AND EMISSION CONTROL OVERALL SYSTEM

ECCS-D Component Parts Location (Cont'd)

Electric governor, Control sleeve position sensor,
Fuel temperature sensor (Built-in electronic fuel injection pump)

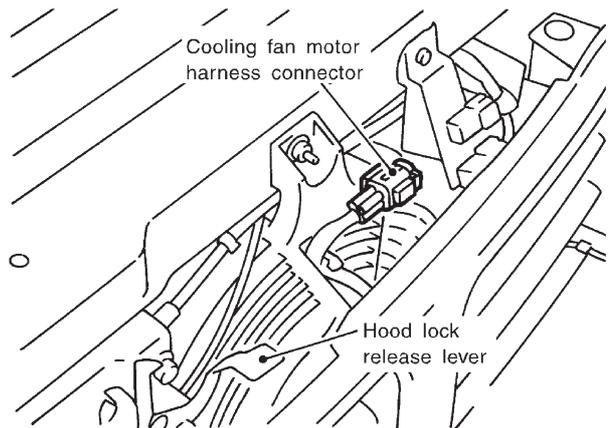
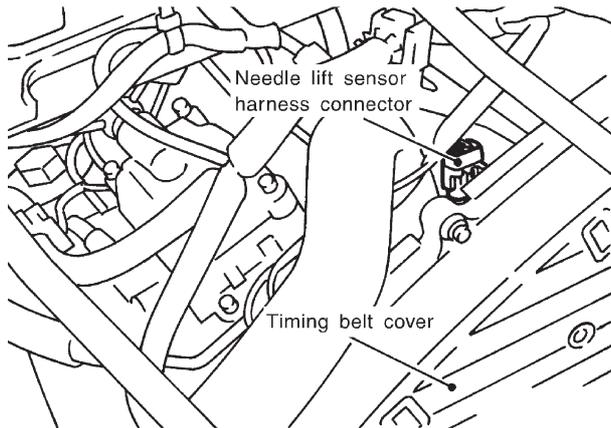


View from under vehicle

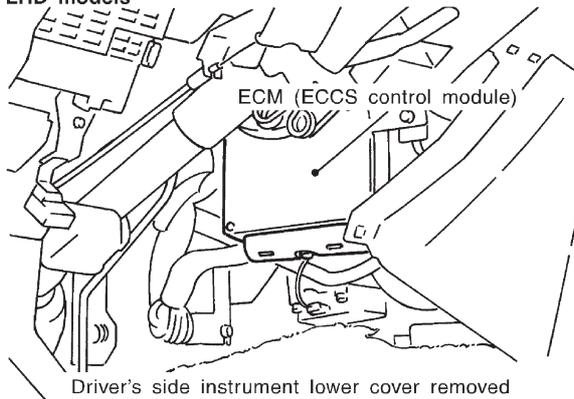


ENGINE AND EMISSION CONTROL OVERALL SYSTEM

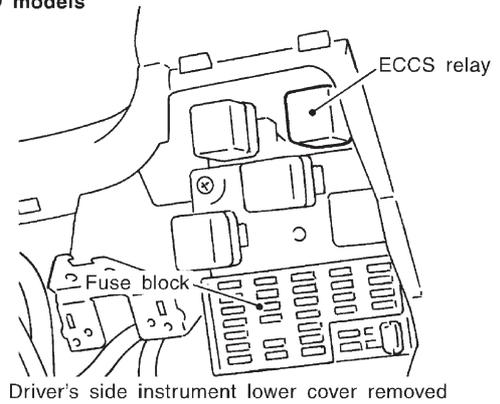
ECCS-D Component Parts Location (Cont'd)



LHD models

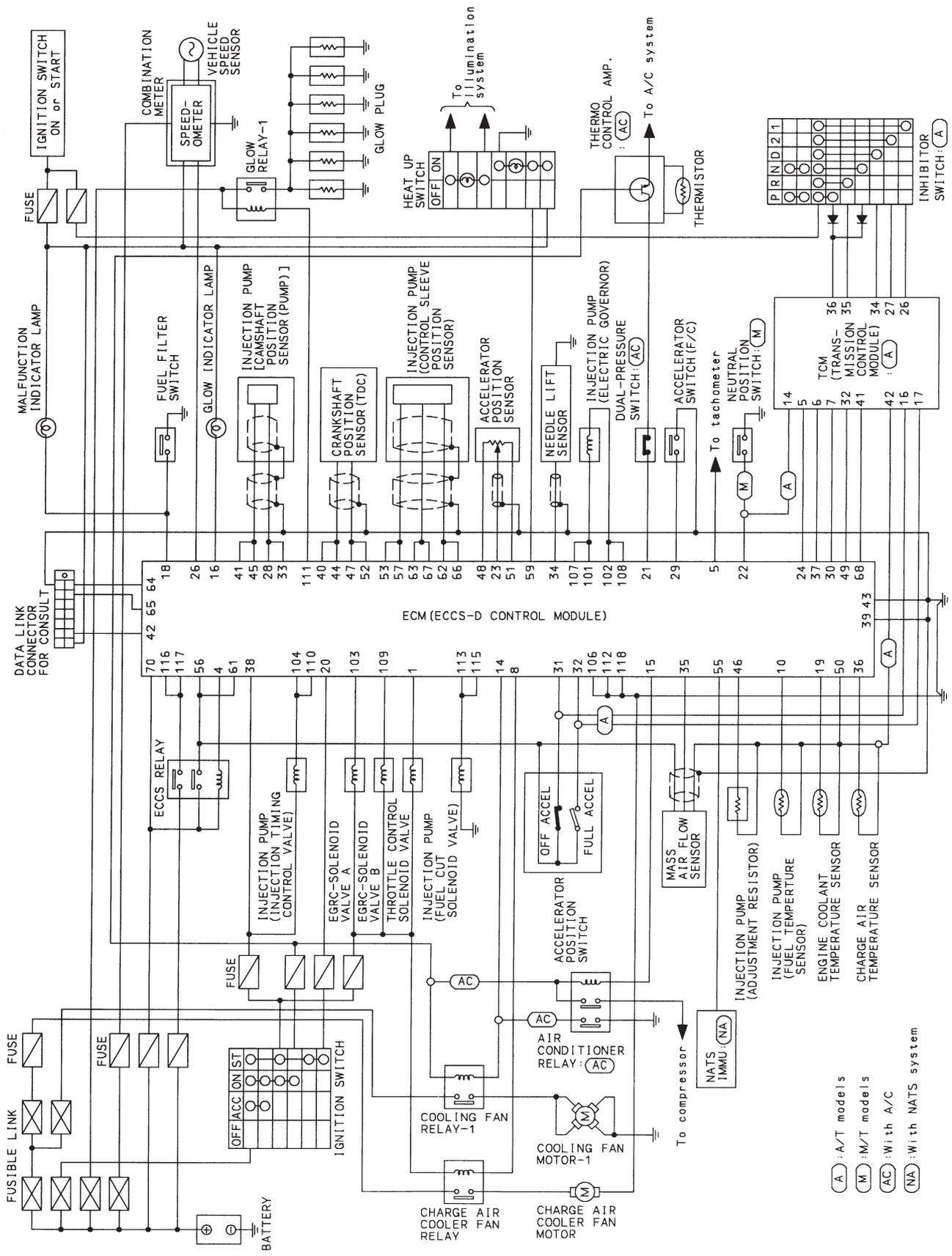


RHD models



ENGINE AND EMISSION CONTROL OVERALL SYSTEM

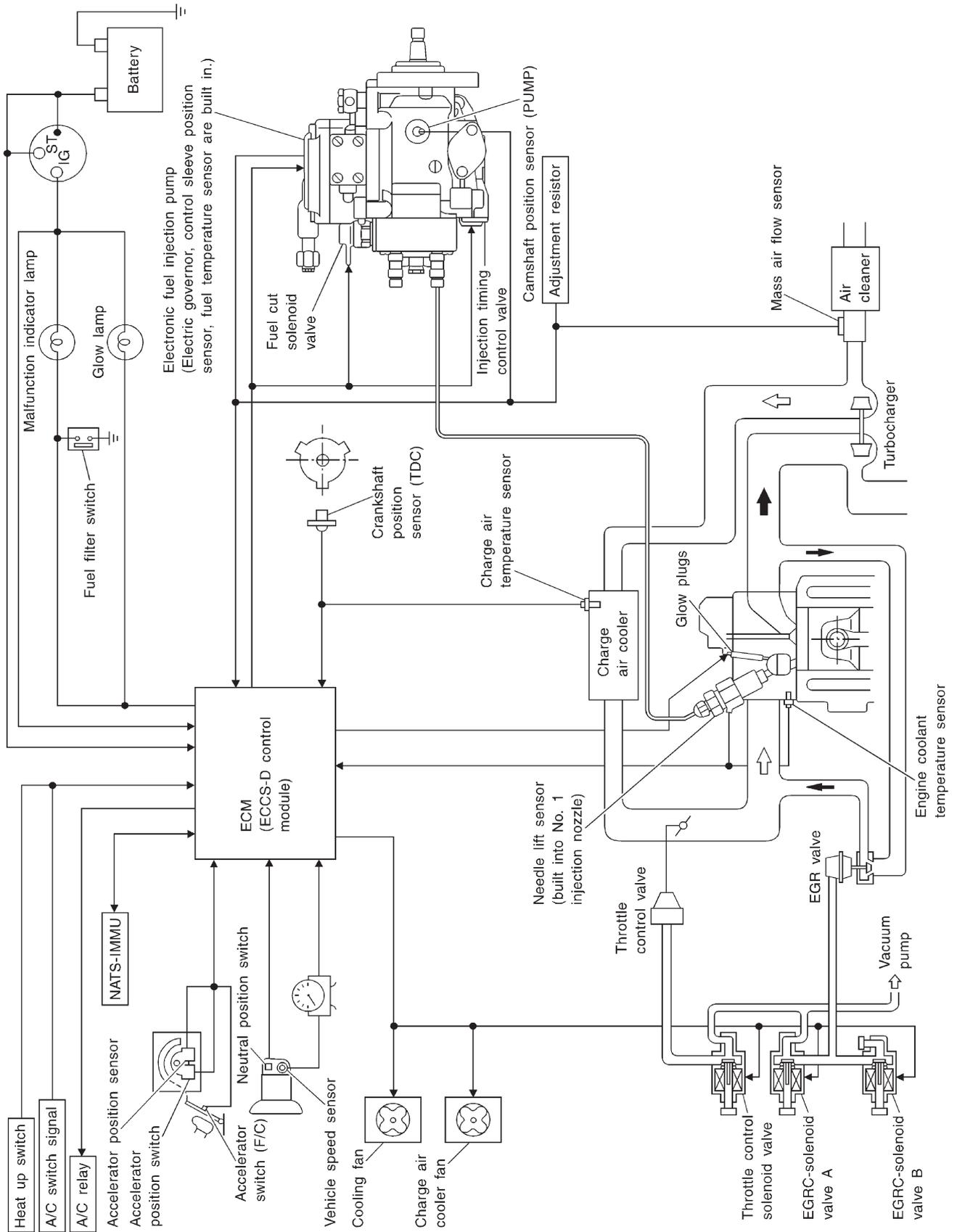
Circuit Diagram



- (A) : A/T models
- (M) : M/T models
- (AC) : With A/C
- (NA) : With NATS system

ENGINE AND EMISSION CONTROL OVERALL SYSTEM

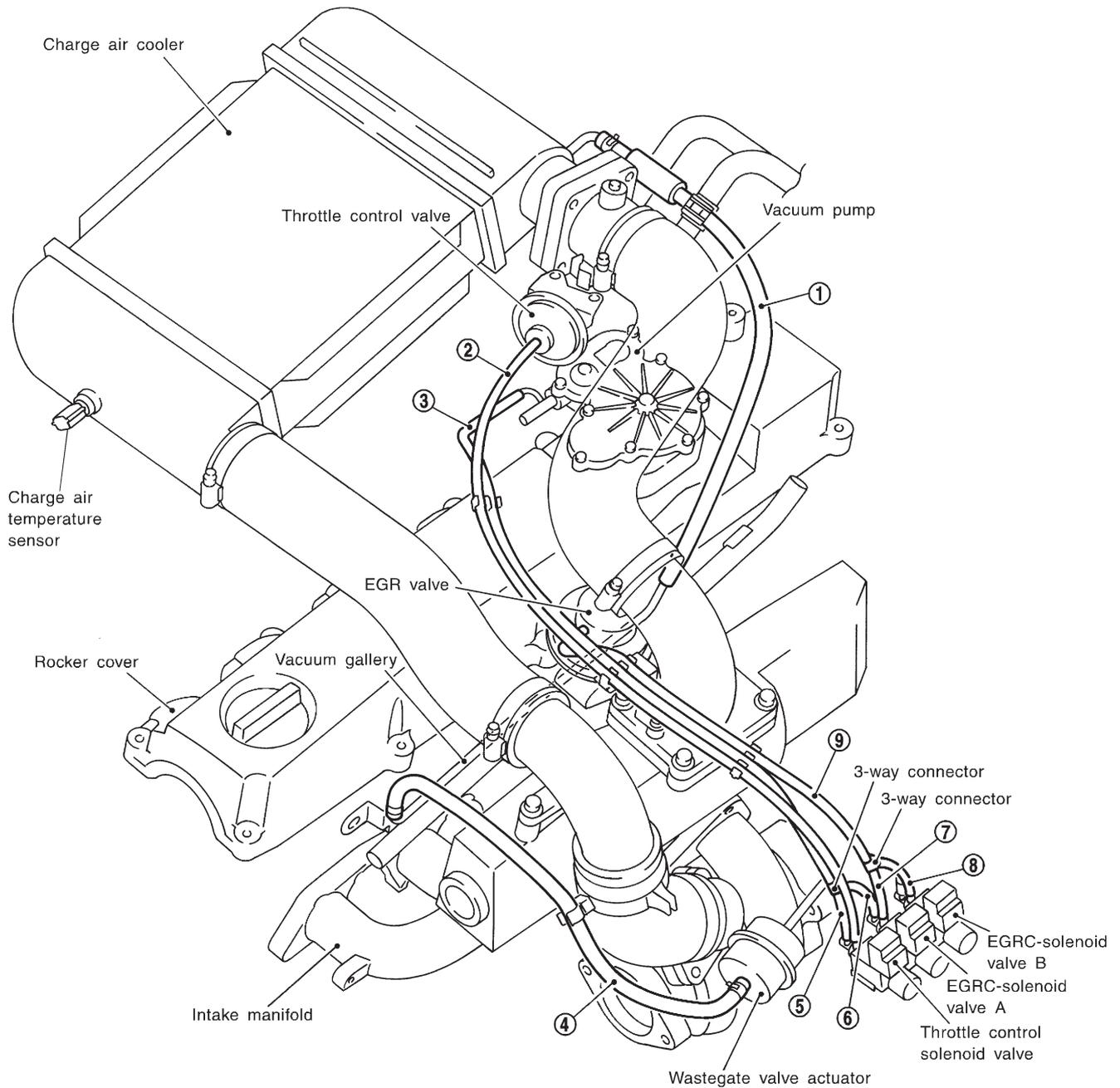
System Diagram



SEF660V

ENGINE AND EMISSION CONTROL OVERALL SYSTEM

Vacuum Hose Drawing



- ① Charge air cooler to vacuum gallery
- ② Throttle control valve to throttle control solenoid valve
- ③ Vacuum pump to 3-way connector
- ④ Vacuum gallery to wastegate valve actuator

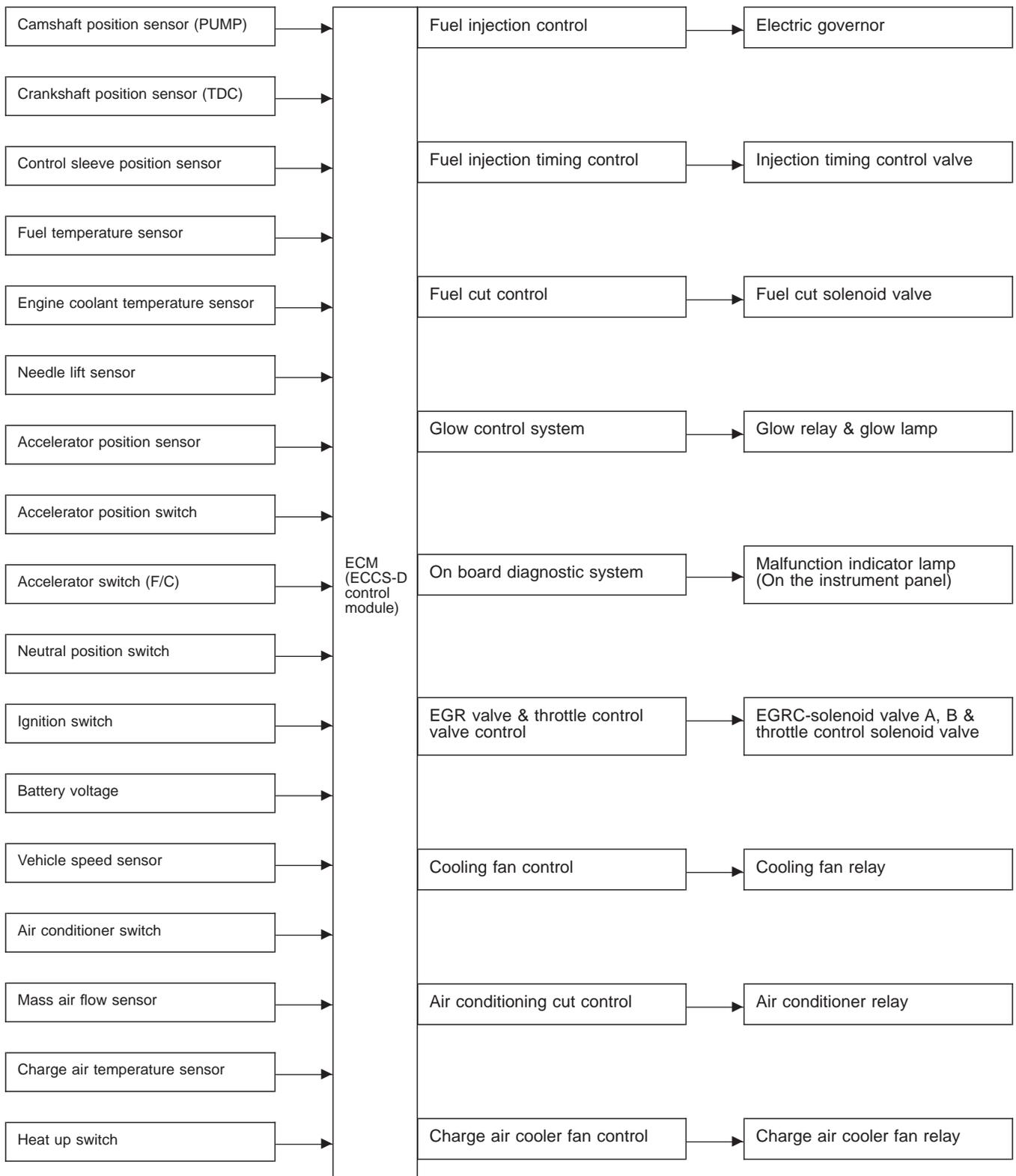
- ⑤ 3-way connector to throttle control solenoid valve
- ⑥ 3-way connector to EGRC-solenoid valve A
- ⑦ 3-way connector to EGRC-solenoid valve A

- ⑧ 3-way connector to EGRC-solenoid valve B
- ⑨ EGR valve and 3-way connector

Refer to "System Diagram", EC-12 for vacuum control system.

ENGINE AND EMISSION CONTROL OVERALL SYSTEM

System Chart



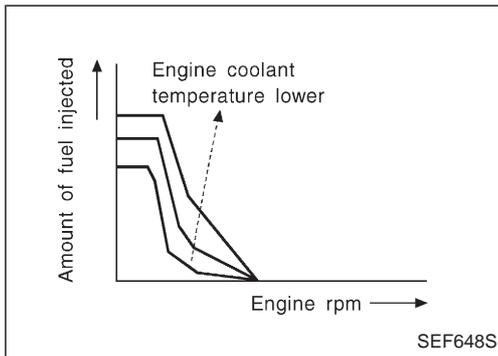
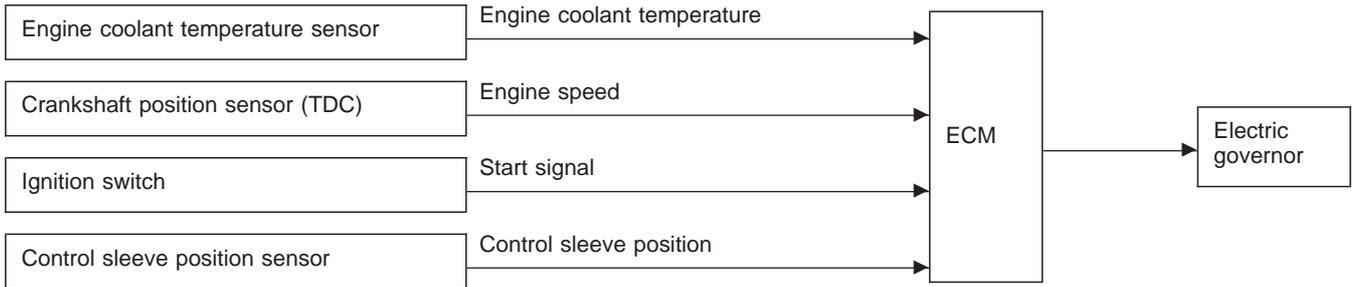
Fuel Injection System

SYSTEM DESCRIPTION

Three types of fuel injection control are provided to accommodate engine operating conditions; normal control, idle control and start control. The ECM determines the appropriate fuel injection control. Under each control, the amount of fuel injected is compensated to improve engine performance. The ECM performs duty control on the electric governor (built into the fuel injection pump) according to sensor signals to compensate the amount of fuel injected to the preset value.

START CONTROL

Input/output signal line



When the ECM receives a start signal from the ignition switch, the ECM adapts the fuel injection system for the start control. The amount of fuel injected at engine starting is a preset program value in the ECM. The program is determined by the engine speed and engine coolant temperature.

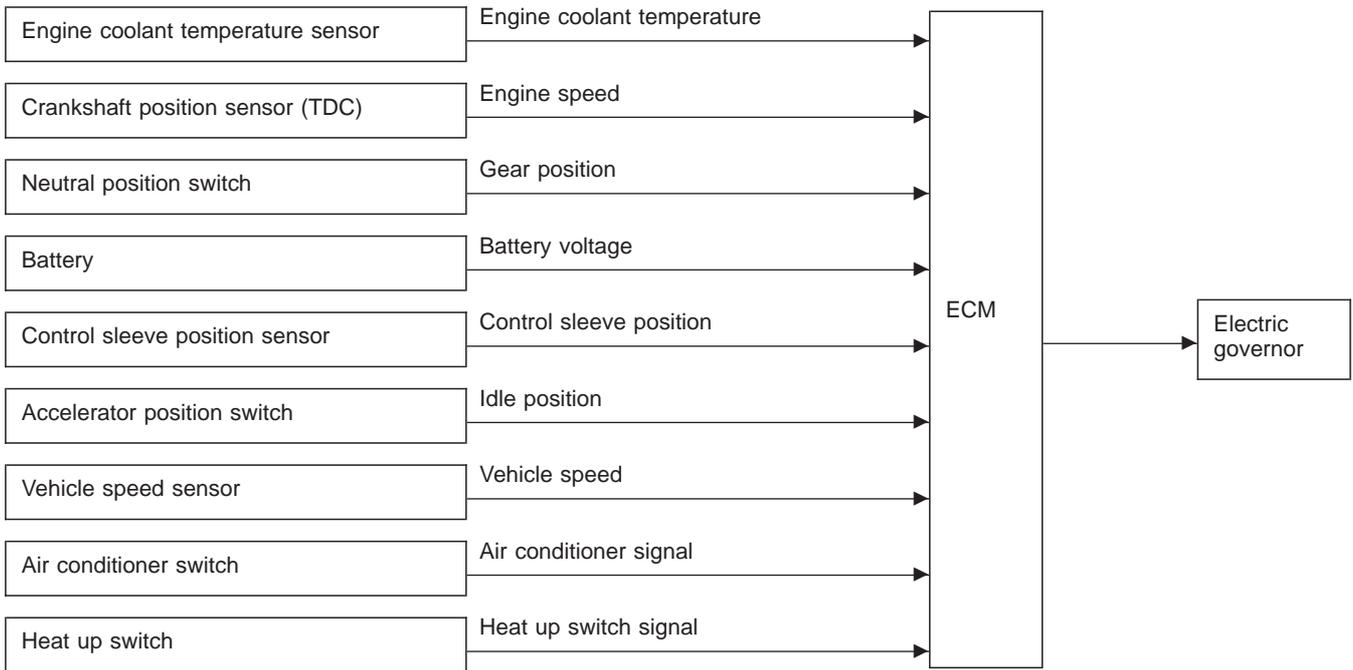
For better startability under cool engine conditions, the lower the coolant temperature becomes, the greater the amount of fuel injected. The ECM ends the start control when the engine speed reaches 400 rpm (for M/T models), 600 rpm (for A/T models) and shifts the control to the normal or idle control.

ENGINE AND EMISSION BASIC CONTROL SYSTEM DESCRIPTION

Fuel Injection System (Cont'd)

IDLE CONTROL

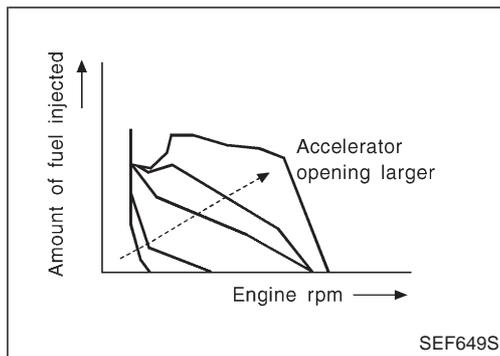
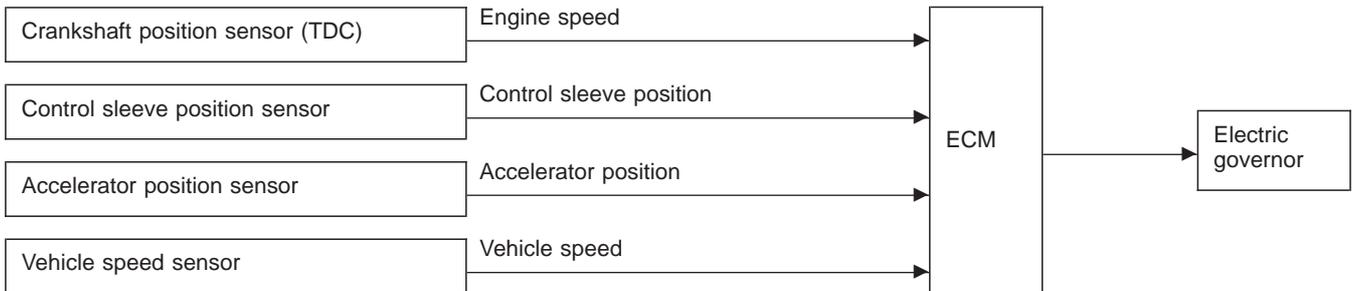
Input/output signal line



When the ECM determines that the engine speed is at idle, the fuel injection system is adapted for the idle control. The ECM regulates the amount of fuel injected corresponding to changes in load applied to the engine to keep engine speed constant. The ECM also provides the system with a fast idle control in response to the engine coolant temperature and heat up switch signal.

NORMAL CONTROL

Input/output signal line



The amount of fuel injected under normal driving conditions is determined according to sensor signals. The crankshaft position sensor (TDC) detects engine speed and the accelerator position sensor detects accelerator position. These sensors send signals to the ECM.

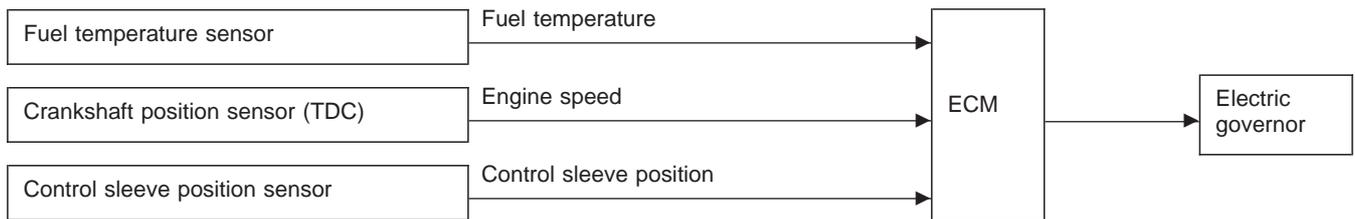
The fuel injection data, predetermined by correlation between various engine speeds and accelerator positions, are stored in the ECM memory, forming a map. The ECM determines the optimal amount of fuel to be injected using the sensor signals in comparison with the map.

ENGINE AND EMISSION BASIC CONTROL SYSTEM DESCRIPTION

Fuel Injection System (Cont'd)

FUEL TEMPERATURE COMPENSATION

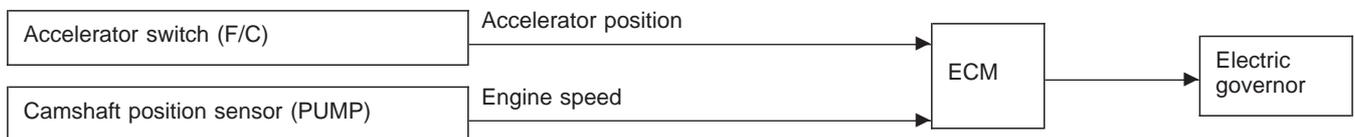
Input/output signal line



The amount of fuel leaking at or around high-pressure parts inside fuel injection pump varies with fuel temperature and engine speed. This will result in a difference between the target amount of fuel injected and the actual amount. The ECM compensates for the actual amount depending on the signal from the fuel temperature sensor which detects fuel temperature.

DECELERATION CONTROL

Input/output signal line



The ECM cuts power supply delivery to the electric governor during deceleration for better fuel efficiency. The ECM determines the time of deceleration according to signals from the accelerator switch (F/C) and camshaft position sensor (PUMP).

Fuel Injection Timing System

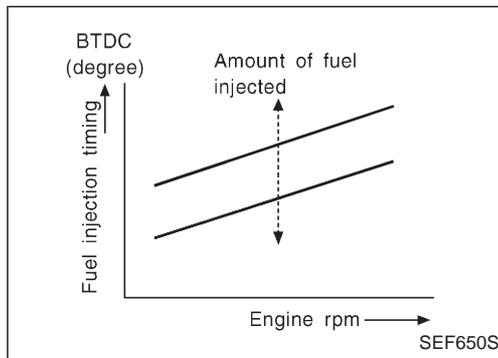
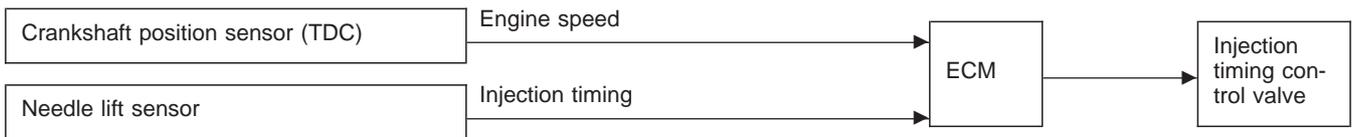
SYSTEM DESCRIPTION

The fuel injection timing system provides the optimal fuel injection timing for the target amount of fuel injected according to engine speed. The timing is compensated when the vehicle is being driven or when starting depending on the engine coolant temperature.

The ECM performs duty control on the timing control valve, allowing the valve to provide optimal fuel injection timing. The ECM also performs feedback control on the timing control valve using the signal from the needle lift sensor which detects the actual fuel injection timing.

BASIC CONTROL

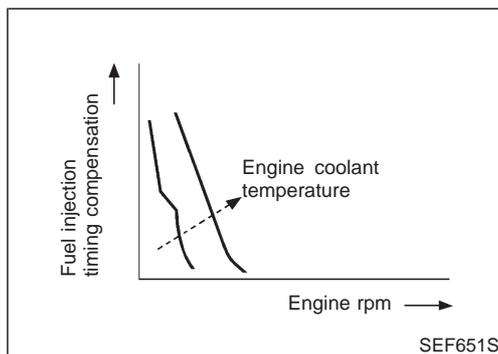
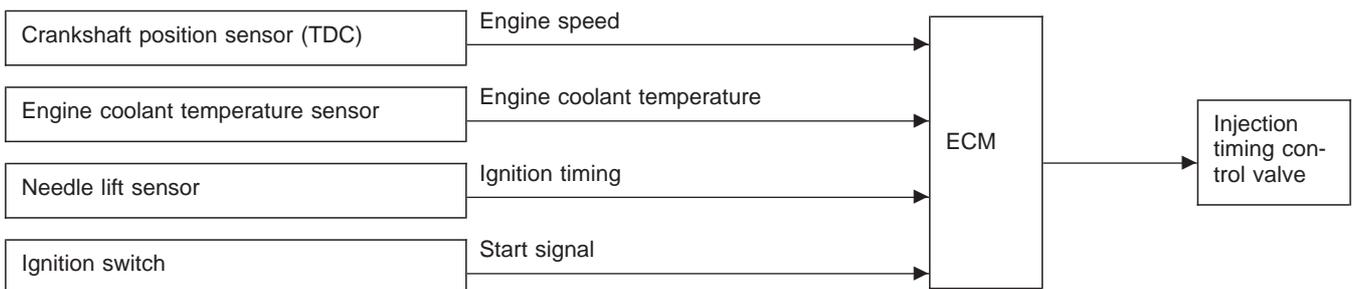
Input/output signal line



The optimal fuel injection timing data, predetermined in proportion to engine speeds and amount of fuel injected, are stored in the ECM memory. The ECM uses the data to control the fuel injection timing.

ENGINE COOLANT TEMPERATURE COMPENSATION (When starting)

Input/output signal line



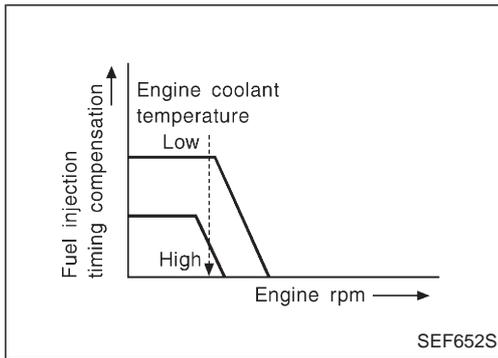
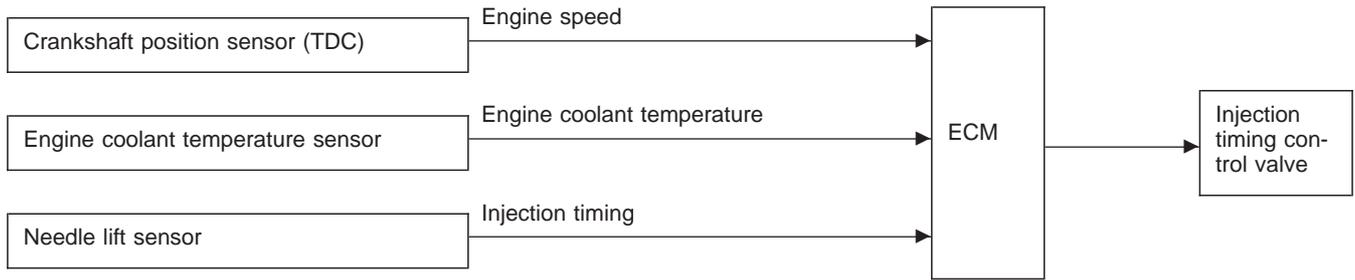
For better startability under cool engine conditions, the fuel injection timing is compensated according to the engine coolant temperature.

ENGINE AND EMISSION BASIC CONTROL SYSTEM DESCRIPTION

Fuel Injection Timing System (Cont'd)

ENGINE COOLANT TEMPERATURE COMPENSATION (During driving)

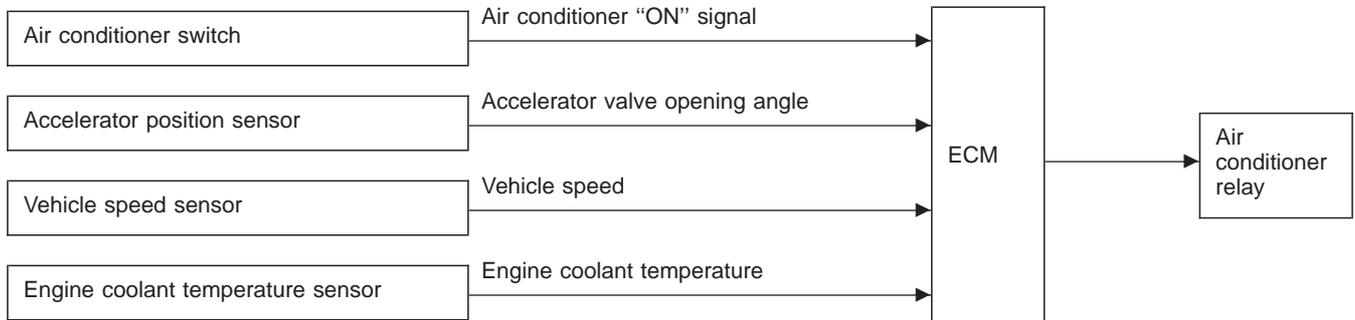
Input/output signal line



For better exhaust efficiency under cool engine conditions, the fuel injection timing is controlled within a compensation range depending on the engine speed, engine coolant temperature and amount of fuel injected.

Air Conditioning Cut Control

INPUT/OUTPUT SIGNAL LINE



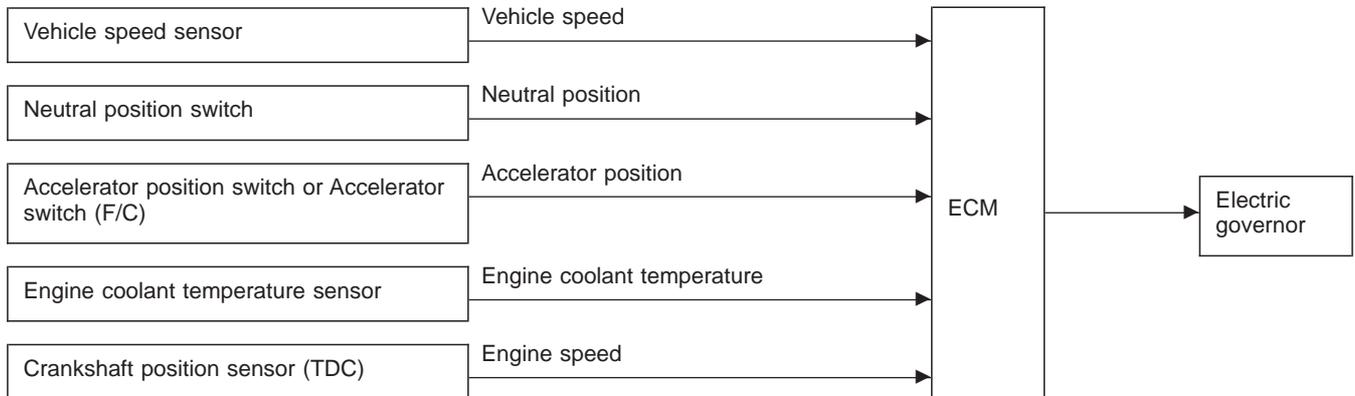
SYSTEM DESCRIPTION

This system improves acceleration when the air conditioner is used. When the accelerator pedal is fully depressed, the air conditioner is turned off for a few seconds. When engine coolant temperature becomes excessively high, the air conditioner is turned off. This continues until the coolant temperature returns to normal.

ENGINE AND EMISSION BASIC CONTROL SYSTEM DESCRIPTION

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

INPUT/OUTPUT SIGNAL LINE



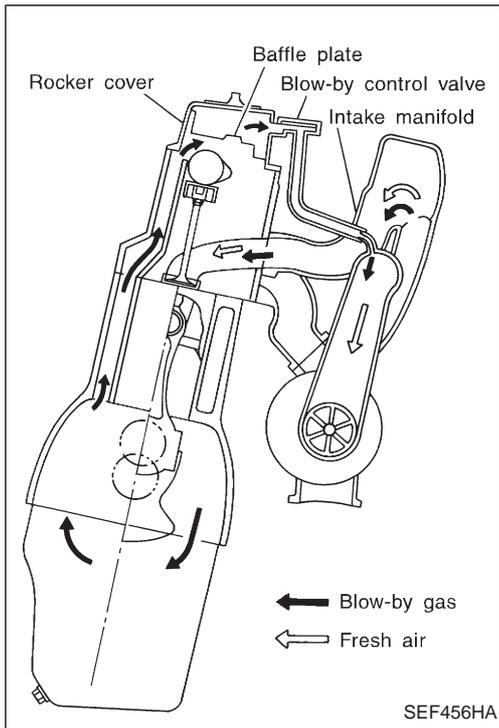
If the engine speed is above 3,000 rpm with no load (for example, in neutral and engine speed over 3,000 rpm) fuel will be cut off after some time. The exact time when the fuel is cut off varies based on engine speed.

Fuel cut will operate until the engine speed reaches 1,500 rpm, then fuel cut is cancelled.

NOTE:

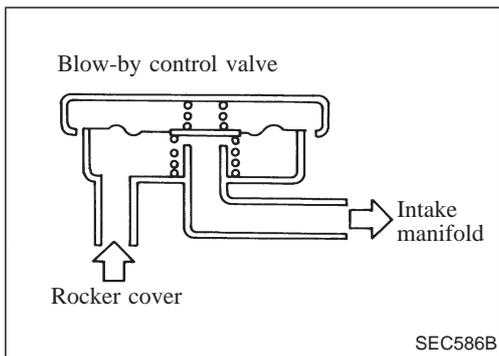
This function is different from deceleration control and fuel cut solenoid valve control listed under “Fuel Injection System”, EC-15 and “TROUBLE DIAGNOSIS FOR DTC 36, 37, 38”, EC-130.

CRANKCASE VENTILATION SYSTEM



Description

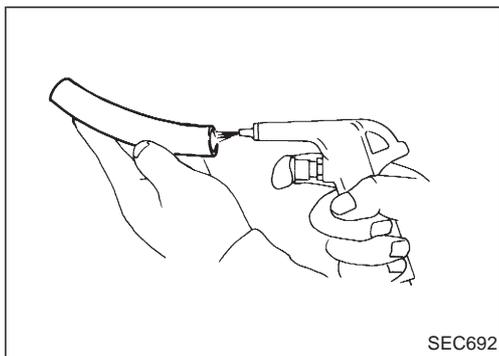
In this system, blow-by gas is sucked into the air inlet pipe through the control valve after oil separation by oil separator in the rocker cover.



Inspection

BLOW-BY CONTROL VALVE

Check control valve for clogging and abnormalities.



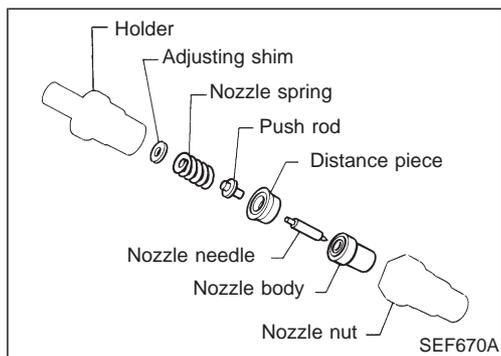
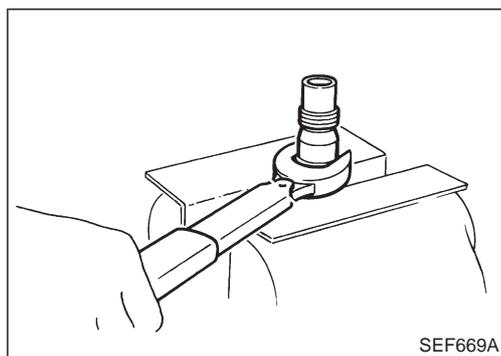
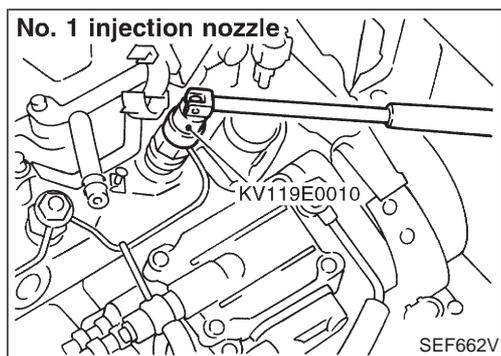
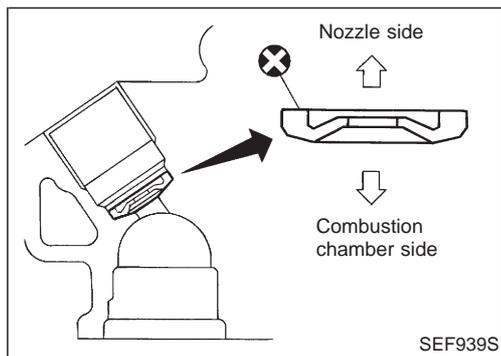
VENTILATION HOSE

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.

INJECTION NOZZLE

CAUTION:

- Do not disassemble No. 1 nozzle (with needle lift sensor built-in). If NG, replace No. 1 injection nozzle.
- Plug flare nut with a cap or rag so that no dust enters the nozzle. Cover nozzle tip for protection of needle.



Removal and Installation

1. Remove fuel injection tube and spill tube.
2. Remove injection nozzle assembly.

Also remove gasket from nozzle end.

3. Install injection nozzle in the reverse order of removal.

Injection nozzle to engine:

: 59 - 69 N·m (6.0 - 7.0 kg-m, 43 - 51 ft-lb)

Injection nozzle to tube:

: 22 - 25 N·m (2.2 - 2.5 kg-m, 16 - 18 ft-lb)

Spill tube:

: 39 - 49 N·m (4.0 - 5.0 kg-m, 29 - 36 ft-lb)

- a. Always clean the nozzle holes.
- b. Always use new injection nozzle gasket.
- c. Note that small washer should be installed in specified direction.
- d. Bleed air from fuel system.

Disassembly (No. 2 - 4 nozzles)

Do not disassemble No. 1 nozzle (with needle lift sensor).

1. Loosen nozzle nut while preventing nozzle top from turning.

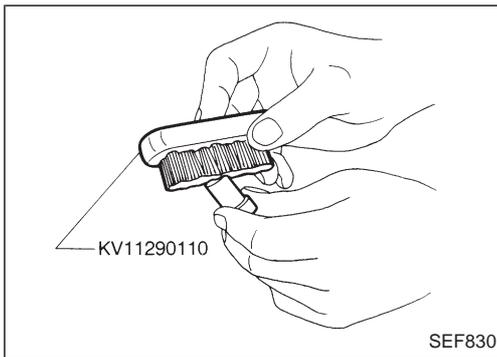
2. Arrange all disassembled parts in the order shown at left.

INJECTION NOZZLE

Inspection (No. 2 - 4 nozzles)

Thoroughly clean all disassembled parts with fresh kerosene or solvent.

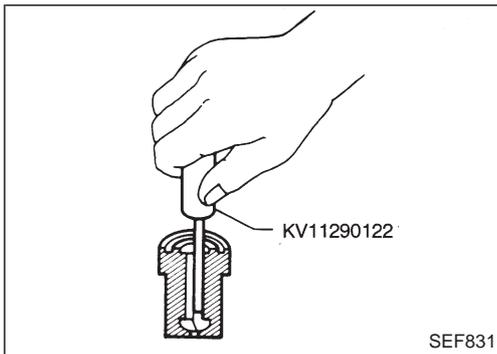
- If nozzle needle is damaged or fused, replace nozzle assembly with a new one.
- If end of nozzle needle is seized or excessively discolored, replace nozzle assembly.
- Check nozzle body and distance piece for proper contact. If excessively worn or damaged, replace nozzle assembly or distance piece.
- Check distance piece and nozzle holder for proper contact. If excessively worn or damaged, replace distance piece or nozzle holder.
- Check nozzle spring for excessive wear or damage. If excessively worn or damaged, replace it with a new spring.



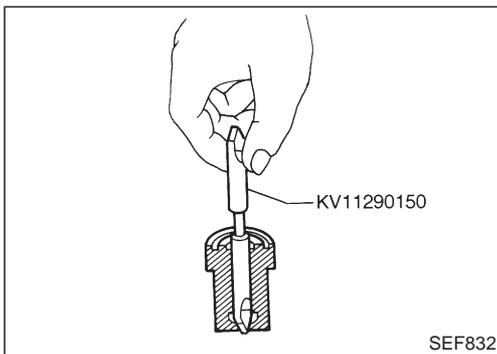
Cleaning (No. 2 - 4 nozzles)

- Do not touch the nozzle mating surface with your fingers.**
- To wash the nozzles, use a wooden stick and brass brush with clean diesel fuel.**

1. Remove any carbon from exterior of nozzle body (except wrapping angle portion) by using Tool.



2. Clean oil sump of nozzle body using Tool.

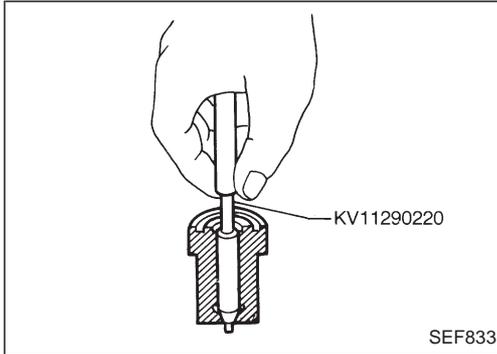


3. Clean nozzle seat by using Tool.

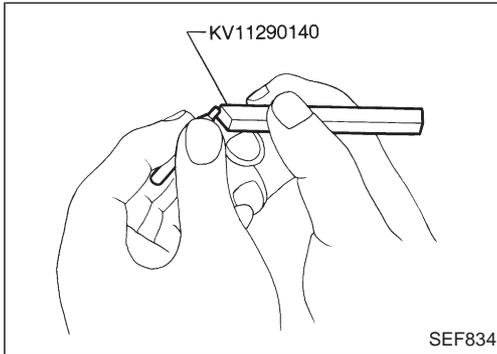
This job should be performed with extra precautions, since efficiency of nozzle depends greatly on a good nozzle seat.

INJECTION NOZZLE

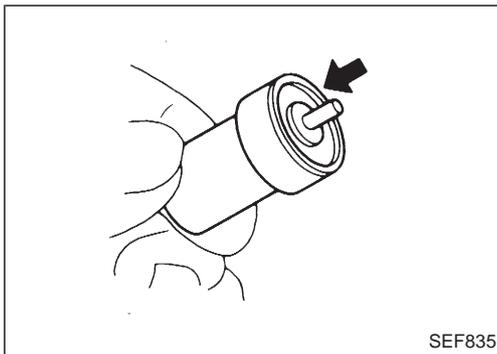
Cleaning (No. 2 - 4 nozzles) (Cont'd)



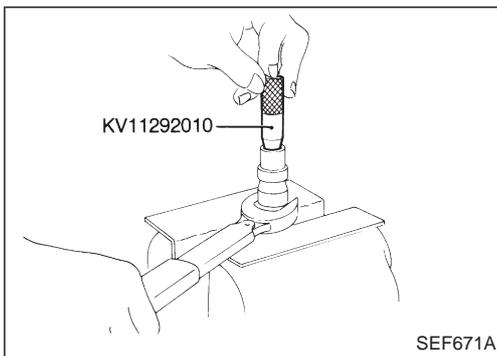
4. Clean spray hole of nozzle body by using Tool.
To prevent spray hole from canting, always clean it by starting with inner side and working towards outside.



5. Decarbonate nozzle needle tip by using Tool.



6. Check needle sinking.
(1) Pull needle about halfway out from body and then release it.
(2) Needle should sink into body very smoothly from just its own weight.
(3) Repeat this test and rotate needle slightly each time.
If needle fails to sink smoothly from any position, replace both needle and body as a unit.



Assembly (No. 2 - 4 nozzles)

Assemble in the reverse order of disassembly, observing the following.

If nozzle body is not installed properly, Tool cannot be removed and nozzle body may be damaged.

Holder to nozzle nut:

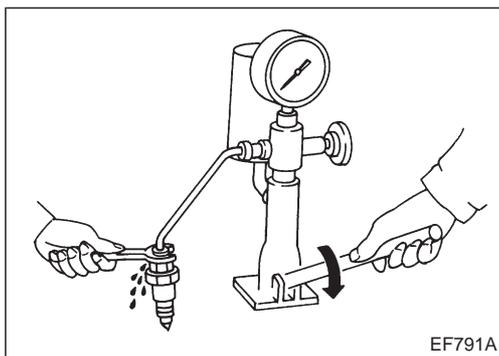
: 78 - 98 N·m (8.0 - 10.0 kg-m, 58 - 72 ft-lb)

INJECTION NOZZLE

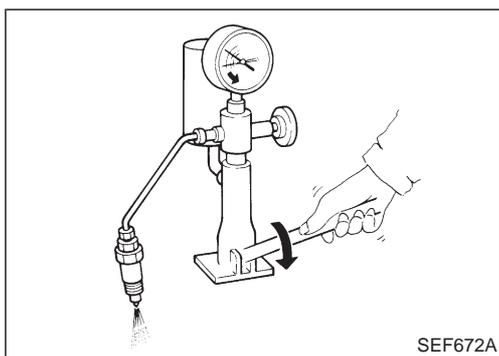
Test and Adjustment

WARNING:

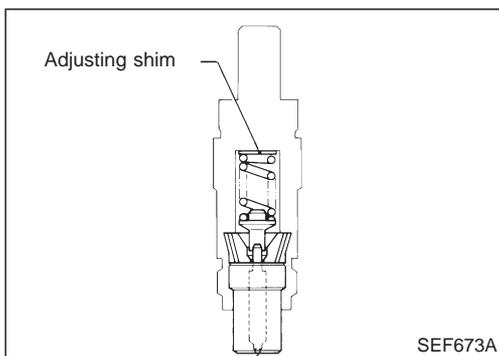
When using nozzle tester, be careful not to allow diesel fuel sprayed from nozzle to contact your hands or body, and make sure your eyes are properly protected with goggles.



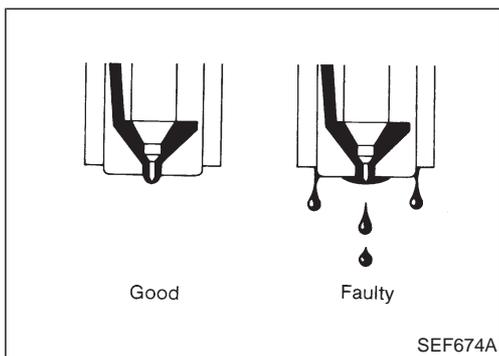
EF791A



SEF672A



SEF673A



SEF674A

INJECTION PRESSURE TEST

1. Install nozzle to injection nozzle tester and bleed air from flare nut.

2. Pump the tester handle slowly (one time per second) and watch the pressure gauge.
3. Read the pressure gauge when the injection pressure just starts dropping.

Initial injection pressure:

Used

14,220 kPa (142.2 bar, 145 kg/cm², 2,062 psi)

New

14,711 - 15,495 kPa (147.1 - 155.0 bar,
150 - 158 kg/cm², 2,133 - 2,247 psi)

Always check initial injection pressure using a new nozzle.

4. To adjust injection pressure, change adjusting shims (No. 2 - 4 nozzles).

a. **Increasing the thickness of adjusting shims increases initial injection pressure. Decreasing thickness reduces initial pressure.**

b. **A shim thickness of 0.04 mm (0.0016 in) corresponds approximately to a difference of 471 kPa (4.71 bar, 4.8 kg/cm², 68 psi) in initial injection pressure.**

Refer to SDS for adjusting shim (EC-189).

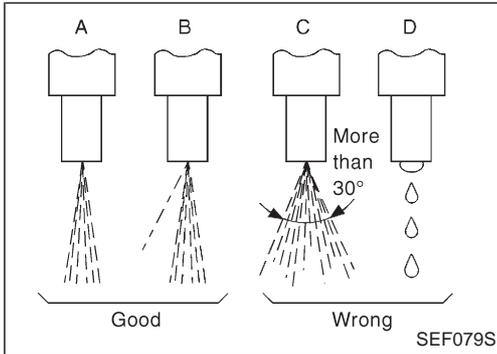
LEAKAGE TEST

1. Maintain the pressure at about 981 to 1,961 kPa (9.8 to 19.6 bar, 10 to 20 kg/cm², 142 to 284 psi) below initial injection pressure.
2. Check that there is no dripping from the nozzle tip or around the body.

INJECTION NOZZLE

Test and Adjustment (Cont'd)

3. If there is leakage, clean, overhaul or replace nozzle.

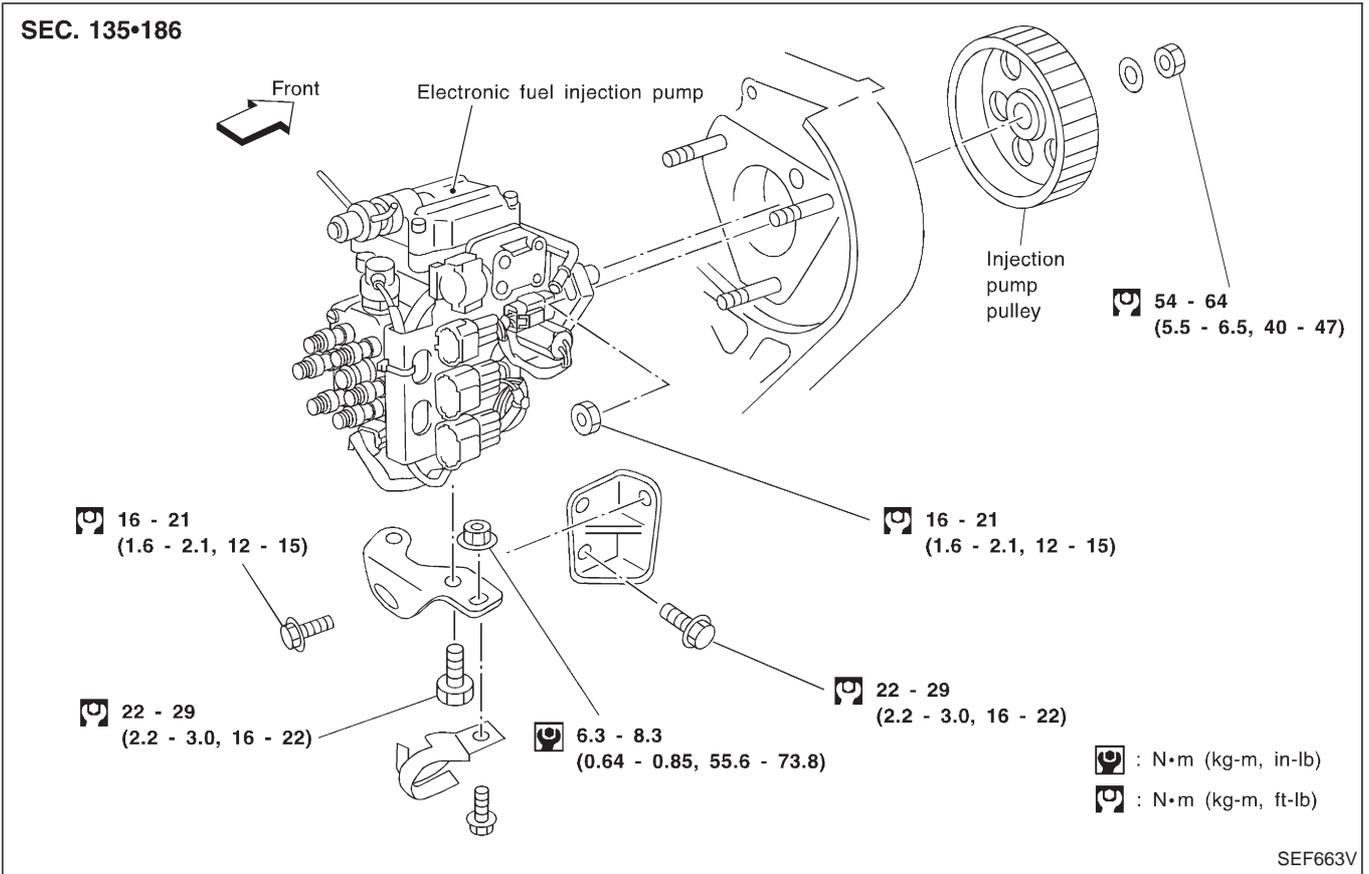


SPRAY PATTERN TEST

1. Check spray pattern by pumping tester handle one full stroke per second.
 - If main spray angle is within 30 degrees as shown, injection nozzle is good.
 - It is still normal even if a thin stream of spray deviates from the main spray (pattern B).
2. If the spray pattern is not correct, disassemble and clean nozzle.
3. Test again and if spray pattern is not corrected, replace nozzle.

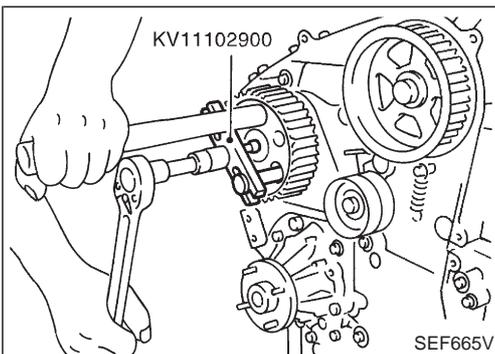
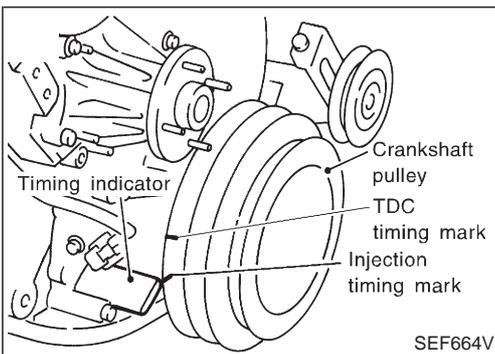
ELECTRONIC FUEL INJECTION PUMP

SEC. 135•186



Removal

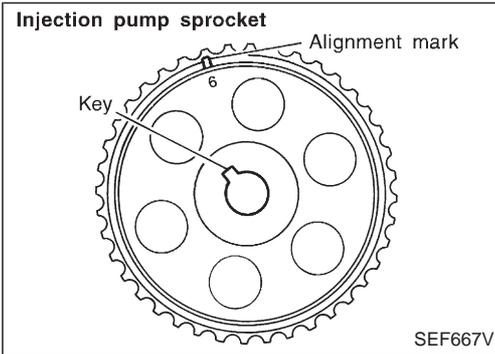
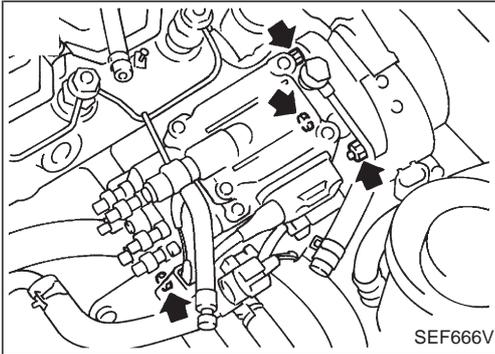
1. Remove battery.
Disconnect electronic injection pump harness connectors.
2. Set No. 1 piston at TDC on its compression stroke.
TDC: Crankshaft pulley notch without painted mark
3. Remove fuel hoses (supply, return and spill) and injection tubes.
4. Remove air duct and injection pump timing belt cover.
5. Remove injection pump timing belt.
Refer to EM section ("Injection Pump Timing Belt").
6. Remove injection pump sprocket with Tool.
 - **Remove key from injection pump shaft and store safely.**



ELECTRONIC FUEL INJECTION PUMP

Removal (Cont'd)

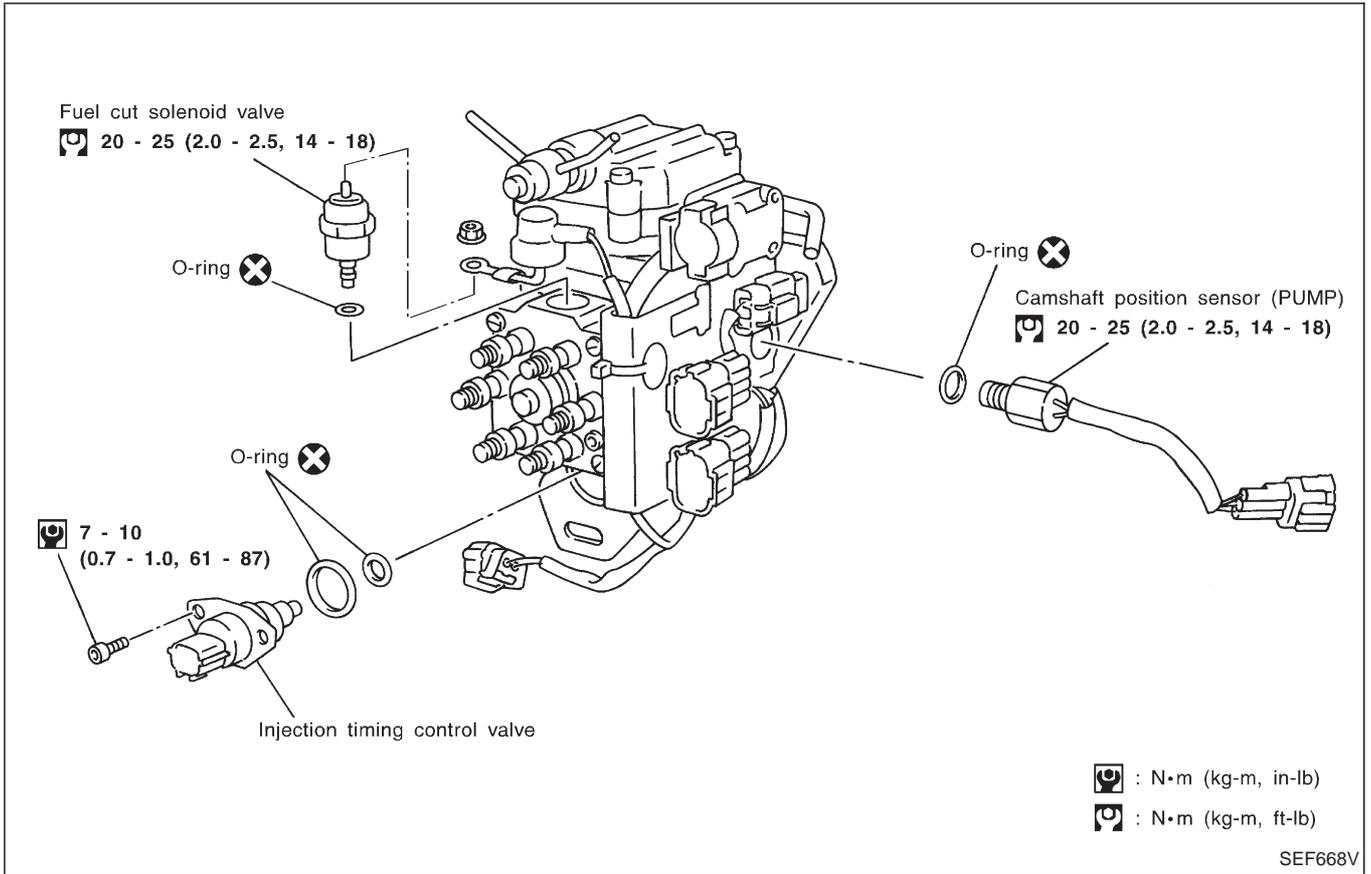
7. Remove injection pump assembly.



Installation

1. Install key on injection pump shaft, then install injection pump sprocket.
 - Use alignment mark on sprocket.
2. Install injection pump timing belt.
Refer to EM section ("Injection Pump Timing Belt").
3. Adjust injection timing.
Refer to "Basic Inspection", EC-46.
4. Install all parts removed.

ELECTRONIC FUEL INJECTION PUMP



Disassembly and Assembly

CAUTION:

- Do not disassemble the parts not shown in the illustration above.
- Before installing injection timing control valve, liberally apply a coat of diesel fuel to O-ring and its mating area. Insert injection timing control valve straight into bore in fuel pump body. After properly positioning injection timing control valve, visually check that fuel does not leak.
- After assembling the parts, erase Diagnostic Trouble Code (DTC), and perform DTC CONFIRMATION PROCEDURE (or OVERALL FUNCTION CHECK).

ON BOARD DIAGNOSTIC SYSTEM DESCRIPTION

DTC and MIL Detection Logic

When a malfunction is detected for the first time, the malfunction (DTC) is stored in the ECM memory. The MIL will light up each time the ECM detects malfunction. However, if the same malfunction is experienced in two consecutive driving patterns and the engine is still running, the MIL will stay lit up. For diagnostic items causing the MIL to light up, refer to "DIAGNOSTIC TROUBLE CODE INDEX", EC-1.

Diagnostic Trouble Code (DTC)

HOW TO READ DTC

The diagnostic trouble code can be read by the following methods.

1. The number of blinks of the malfunction indicator lamp in the Diagnostic Test Mode II (Self-Diagnostic Results) Examples: 11, 13, 14, etc.

These DTCs are controlled by NISSAN.

2. CONSULT Examples: "CAM POS SEN (PUMP)", etc.

- **Output of the trouble code means that the indicated circuit has a malfunction. However, in the Mode II it does not indicate whether the malfunction is still occurring or occurred in the past and returned to normal.**

CONSULT can identify them. Therefore, using CONSULT (if available) is recommended.

HOW TO ERASE DTC

The diagnostic trouble code can be erased by the following methods.

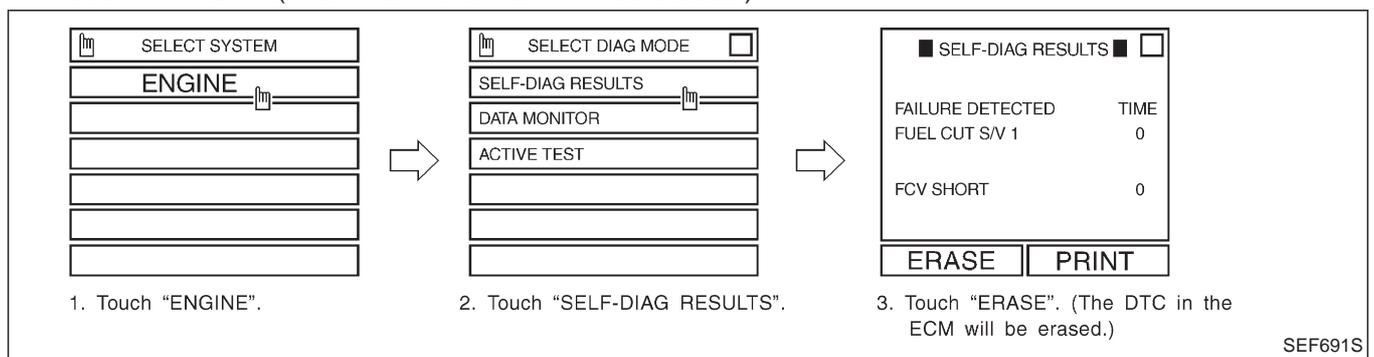
1.  Selecting "ERASE" in the "SELF-DIAG RESULTS" mode with CONSULT.

2.  Changing the diagnostic test mode from Diagnostic Test Mode II to Mode I. (Refer to EC-32.)

- **If the battery terminal is disconnected, the diagnostic trouble code will be lost within 24 hours.**
- **When you erase the DTC, using CONSULT is easier and quicker than switching the diagnostic test modes.**

HOW TO ERASE DTC (With CONSULT)

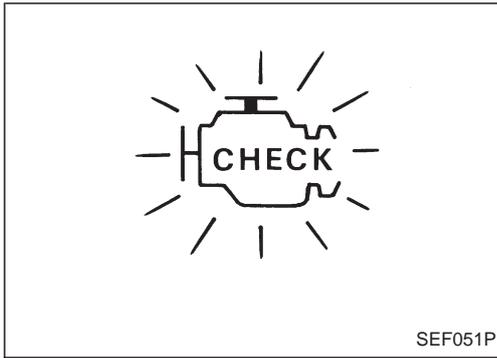
1. If the ignition switch stays "ON" after repair work, be sure to turn ignition switch "OFF" once. Wait at least 5 seconds and then turn it "ON" (Engine stopped) again.
2. Turn CONSULT "ON" and touch "ENGINE".
3. Touch "SELF-DIAG RESULTS".
4. Touch "ERASE". (The DTC in the ECM will be erased.)



HOW TO ERASE DTC (No Tools)

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. (Refer to EC-32.)

ON BOARD DIAGNOSTIC SYSTEM DESCRIPTION



Malfunction Indicator Lamp (MIL)

1. The malfunction indicator lamp will light up when the ignition switch is turned ON without the engine running. This is a bulb check.
 - If the malfunction indicator lamp does not light up, refer to EL section (“WARNING LAMPS AND CHIME”) or see EC-188.
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.

If MIL illuminates or blinks irregularly after starting engine, water may have accumulated in fuel filter. Drain water from fuel filter.

ON BOARD DIAGNOSTIC SYSTEM FUNCTION

The on board diagnostic system has the following three functions.

1. BULB CHECK : This function checks the MIL bulb for damage (blown, open circuit, etc.).
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.
3. SELF-DIAGNOSTIC RESULTS : This function allows diagnostic trouble codes to be read.

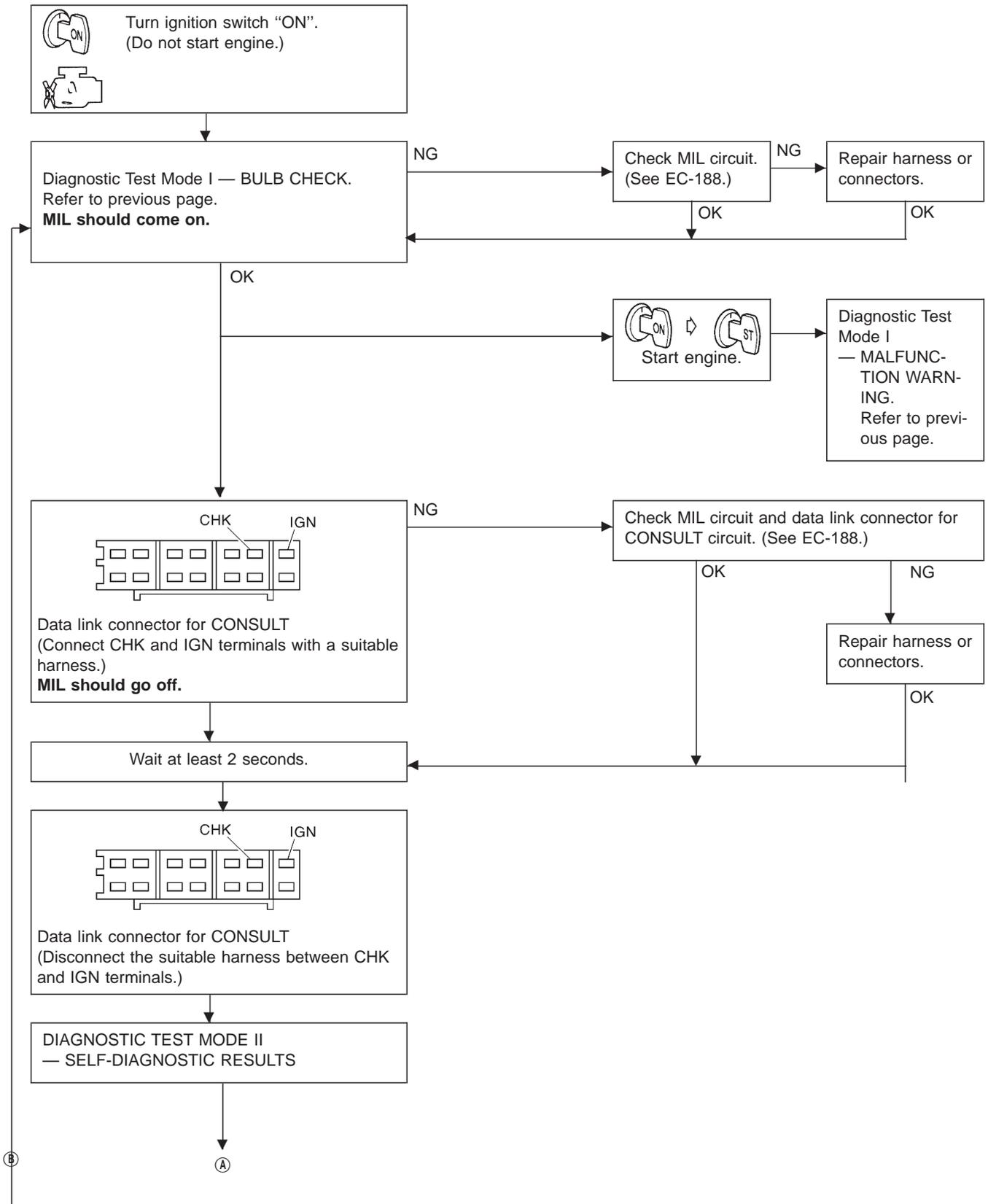
Refer to “HOW TO SWITCH DIAGNOSTIC TEST MODES” on next page.

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	—

ON BOARD DIAGNOSTIC SYSTEM DESCRIPTION

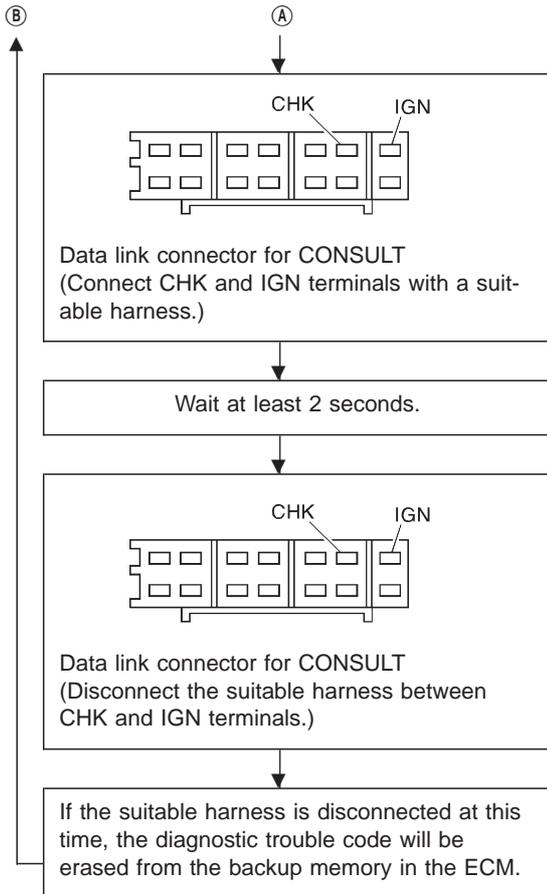
Malfunction Indicator Lamp (MIL) (Cont'd)

HOW TO SWITCH DIAGNOSTIC TEST MODES



ON BOARD DIAGNOSTIC SYSTEM DESCRIPTION

Malfunction Indicator Lamp (MIL) (Cont'd)



- 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.

ON BOARD DIAGNOSTIC SYSTEM DESCRIPTION

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. Refer to EL section (“WARNING LAMPS AND CHIME”) or see EC-188.

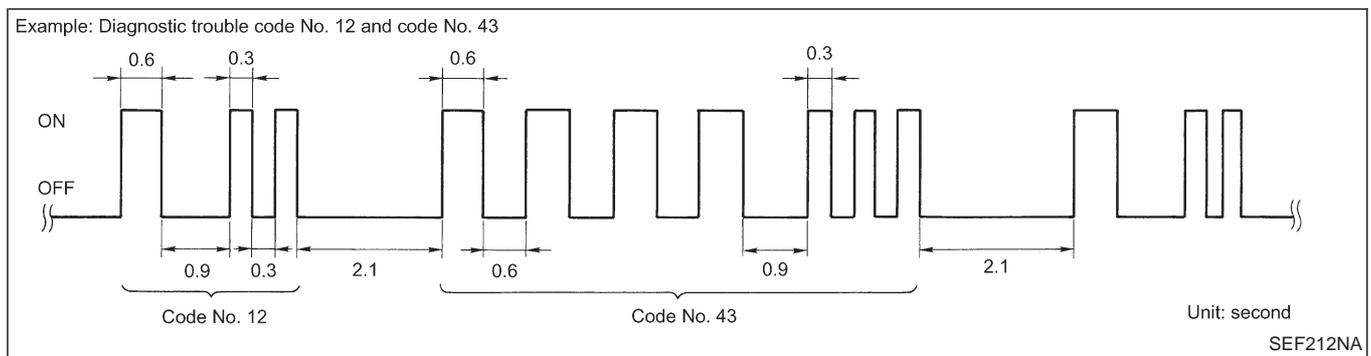
DIAGNOSTIC TEST MODE I—MALFUNCTION WARNING

MALFUNCTION INDICATOR LAMP	Condition
ON	When the malfunction is detected or the ECM's CPU is malfunctioning. (Refer to “MIL Illumination” of the “DIAGNOSTIC TROUBLE CODE INDEX”, EC-1.)
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.



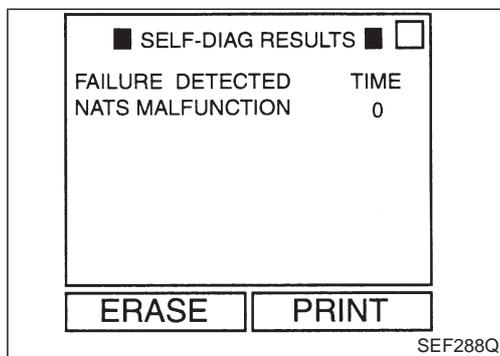
Long (0.6 second) blinking indicates the number of ten digits, and short (0.3 second) blinking indicates the number of single digits. For example, the malfunction indicator lamp blinks 4 times for 5 seconds (0.6 sec x 4 times) and then it blinks three times for about 1 second (0.3 sec x 3 times). This indicates the DTC “43” and refers to the malfunction of the accelerator position sensor circuit.

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, EC-1.)

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” on previous page.)

- 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.

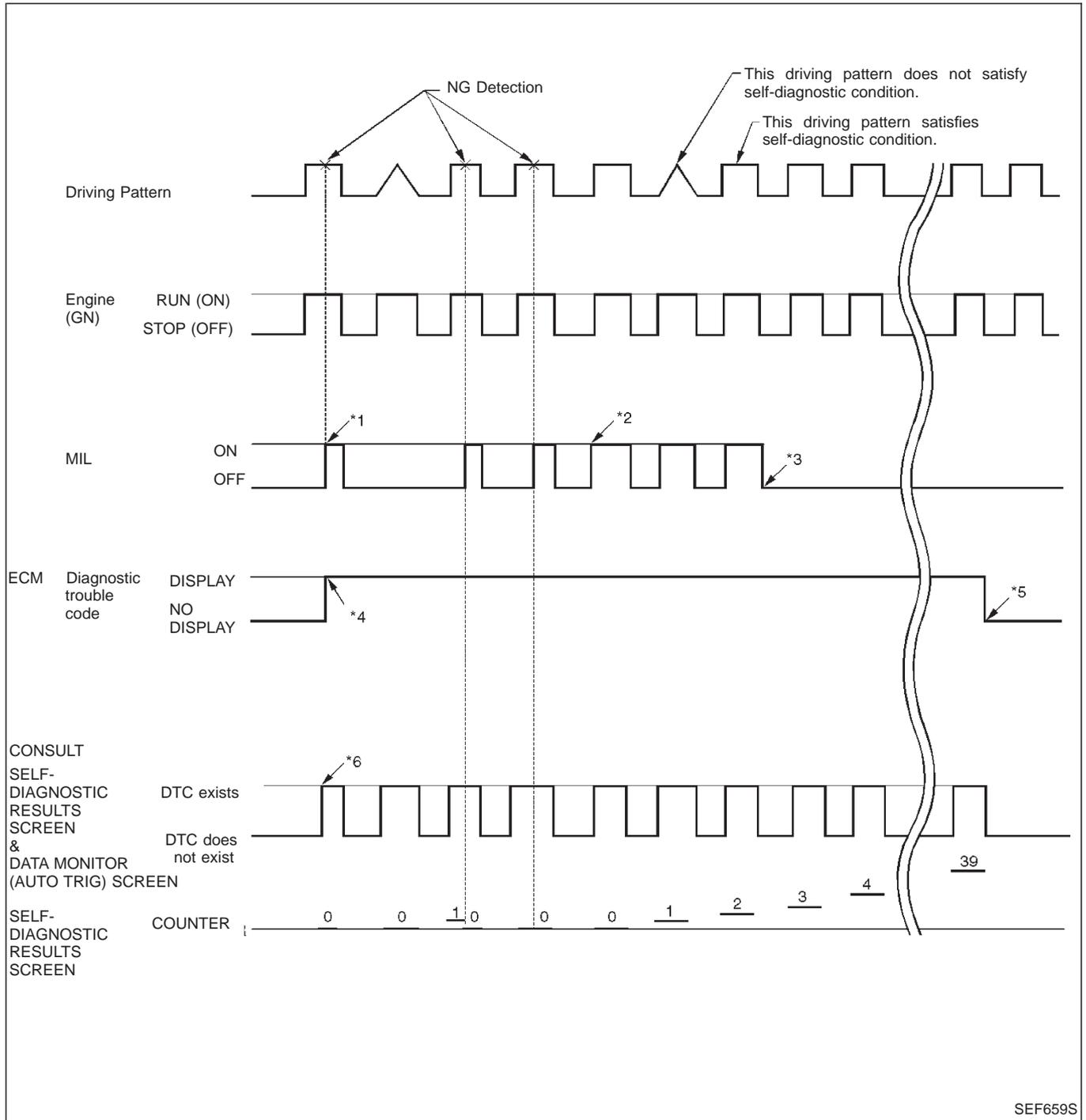


- If the MIL blinks or “NATS MALFUNCTION” is displayed on “SELF-DIAG RESULTS” screen, perform self-diagnostic results mode with CONSULT using NATS program card (NATS-E940). Refer to EL section.
- Confirm no self-diagnostic results of NATS is displayed before touching “ERASE” in “SELF-DIAG RESULTS” mode with CONSULT.
- When replacing ECM, initialisation of NATS V2.0 system and registration of all NATS V2.0 ignition key IDs must be carried out with CONSULT using NATS program card (NATS-E940).
Therefore, be sure to receive all keys from vehicle owner. Regarding the procedures of NATS initialisation and NATS ignition key ID registration, refer to CONSULT operation manual, NATS V2.0.

ON BOARD DIAGNOSTIC SYSTEM DESCRIPTION

Malfunction Indicator Lamp (MIL) (Cont'd)

RELATIONSHIP BETWEEN MIL, DTC, CONSULT AND DRIVING PATTERNS

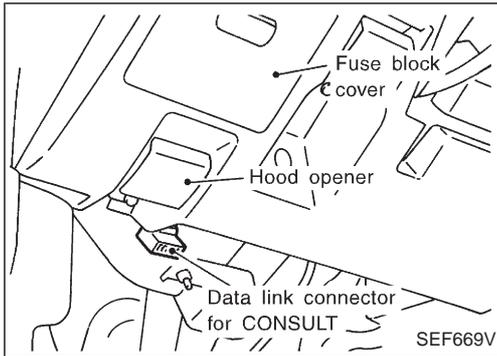


SEF659S

- *1: When a malfunction is detected, MIL will light up.
- *2: When the same malfunction is detected in two consecutive driving patterns, MIL will stay lit up.
- *3: MIL will go off after vehicle is driven three times without any malfunctions.
- *4: When a malfunction is detected for the first time, the DTC will be stored in ECM.

- *5: The DTC will not be displayed any longer after vehicle is driven 40 times without the same malfunction. (The DTC still remain in ECM.)
- *6: Other screens except SELF-DIAGNOSTIC RESULTS & DATA MONITOR (AUTO TRIG) cannot display the malfunction. DATA MONITOR (AUTO TRIG) can display the malfunction at the moment it is detected.

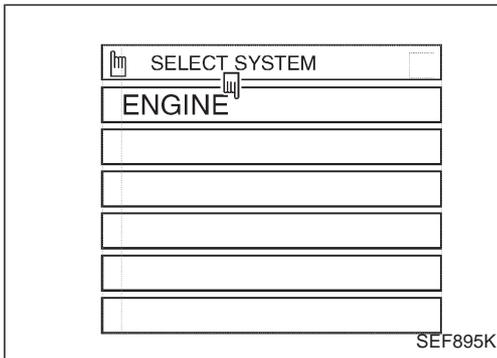
ON BOARD DIAGNOSTIC SYSTEM DESCRIPTION



CONSULT

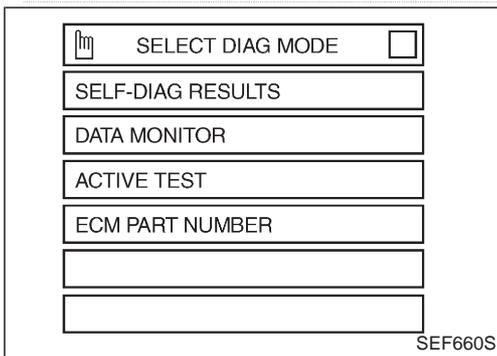
CONSULT INSPECTION PROCEDURE

1. Turn off ignition switch.
2. Connect "CONSULT" to data link connector for CONSULT. (Data link connector for CONSULT is located under the hood opener.)



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 Operation Manual.



ON BOARD DIAGNOSTIC SYSTEM DESCRIPTION

CONSULT (Cont'd)

ECCS COMPONENT PARTS/CONTROL SYSTEMS APPLICATION

		Item	DIAGNOSTIC TEST MODE		
			SELF-DIAG-NOSTIC RESULTS	DATA MONITOR	ACTIVE TEST
ECCS COMPONENT PARTS	INPUT	Camshaft position sensor (PUMP)	X	X	
		Engine coolant temperature sensor	X	X	
		Control sleeve position sensor	X	X	
		Fuel temperature sensor	X	X	
		Vehicle speed sensor	X	X	
		Accelerator position sensor	X	X	X
		Accelerator position switch	X	X	
		Accelerator switch (F/C)	X	X	
		Crankshaft position sensor (TDC)	X	X	
		Needle lift sensor	X		
		Ignition switch (start signal)		X	
		Neutral position switch		X	
		Battery voltage		X	
		Air conditioner switch		X	
		Heat up switch		X	
		Mass air flow sensor	X	X	
		Charge air temperature sensor	X		
	OUTPUT	Injection timing control valve	X	X	X
		Fuel cut solenoid valve	X	X	X
		Glow relay		X	X
		EGRC-solenoid valve A, B & throttle control solenoid valve		X	X
		Cooling fan relay		X	X
		Charge air cooler fan relay		X	

X: Applicable

ON BOARD DIAGNOSTIC SYSTEM DESCRIPTION

CONSULT (Cont'd)

SELF-DIAGNOSTIC MODE

Regarding items detected in "SELF-DIAG RESULTS" mode, refer to "DIAGNOSTIC TROUBLE CODE INDEX", EC-1.

DATA MONITOR MODE

Monitored item [Unit]	ECM input signals	Main signals	Description	Remarks
CKPS-RPM (TDC) [rpm]	<input type="radio"/>	<input type="radio"/>	<ul style="list-style-type: none"> The engine speed computed from the crankshaft position sensor (TDC) signal is displayed. 	
CKPS-RPM (REF) [rpm]	<input type="radio"/>	<input type="radio"/>	<ul style="list-style-type: none"> The engine speed [determined by the time between pulses from the crankshaft position sensor (TDC) signal] is displayed. 	
CMPS-RPM - PUMP [rpm]	<input type="radio"/>	<input type="radio"/>	<ul style="list-style-type: none"> The engine speed computed from the camshaft position sensor (PUMP) signal is displayed. 	
COOLAN TEMP/S [°C] or [°F]	<input type="radio"/>	<input type="radio"/>	<ul style="list-style-type: none"> The engine coolant temperature (determined by the signal voltage of the engine coolant temperature sensor) is displayed. 	<ul style="list-style-type: none"> 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]	<input type="radio"/>	<input type="radio"/>	<ul style="list-style-type: none"> The vehicle speed computed from the vehicle speed sensor signal is displayed. 	
FUEL TEMP SEN [°C] or [°F]	<input type="radio"/>	<input type="radio"/>	<ul style="list-style-type: none"> The fuel temperature (determined by the signal voltage of the fuel temperature sensor) is displayed. 	
ACCEL POS SEN [V]	<input type="radio"/>	<input type="radio"/>	<ul style="list-style-type: none"> The accelerator position sensor signal voltage is displayed. 	
FULL ACCEL SW [ON/OFF]	<input type="radio"/>	<input type="radio"/>	<ul style="list-style-type: none"> Indicates [ON/OFF] condition from the accelerator position switch signal. 	
ACCEL SW (FC) [OPEN/CLOSE]	<input type="radio"/>	<input type="radio"/>	<ul style="list-style-type: none"> Indicates [OPEN/CLOSE] condition from the accelerator switch (FC) signal. 	
OFF ACCEL SW [ON/OFF]	<input type="radio"/>	<input type="radio"/>	<ul style="list-style-type: none"> Indicates [ON/OFF] condition from the accelerator position switch signal. 	
C/SLEEV POS/S [V]	<input type="radio"/>	<input type="radio"/>	<ul style="list-style-type: none"> The control sleeve position sensor signal voltage is displayed. 	
BATTERY VOLT [V]	<input type="radio"/>	<input type="radio"/>	<ul style="list-style-type: none"> The power supply voltage of ECM is displayed. 	
P/N POSI SW [ON/OFF]	<input type="radio"/>	<input type="radio"/>	<ul style="list-style-type: none"> Indicates [ON/OFF] condition from the park/neutral position switch signal. 	
START SIGNAL [ON/OFF]	<input type="radio"/>	<input type="radio"/>	<ul style="list-style-type: none"> Indicates [ON/OFF] condition from the starter signal. 	<ul style="list-style-type: none"> After starting the engine, [OFF] is displayed regardless of the starter signal.

NOTE:

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

ON BOARD DIAGNOSTIC SYSTEM DESCRIPTION

CONSULT (Cont'd)

Monitored item [Unit]	ECM input signals	Main signals	Description	Remarks
AIR COND SIG [ON/OFF]	○	○	<ul style="list-style-type: none"> Indicates [ON/OFF] condition of the air conditioner switch as determined by the air conditioner signal. 	
IGN SW [ON/OFF]	○	○	<ul style="list-style-type: none"> Indicates [ON/OFF] condition from ignition switch signal. 	
MAS AIR/FL SE [V]	○	○	<ul style="list-style-type: none"> The signal voltage of the mass air flow sensor is displayed. 	<ul style="list-style-type: none"> When the engine is stopped, a certain value is indicated.
ACT INJ TIMG [°]	○	○	<ul style="list-style-type: none"> The actual injection timing angle determined by the ECM (an approximate average angle between injection start and end from TDC) is displayed. 	
INJ TIMG C/V [%]			<ul style="list-style-type: none"> Indicates the duty ratio of fuel injection timing control valve. 	
DECELER F/CUT [ON/OFF]		○	<ul style="list-style-type: none"> Indicates [ON/OFF] condition from deceleration fuel cut signal. 	<ul style="list-style-type: none"> When the accelerator pedal is released quickly with engine speed at 3,000 rpm or more, "ON" is displayed.
FUEL CUT S/V [ON/OFF]		○	<ul style="list-style-type: none"> The control condition of the fuel cut solenoid valve (determined by ECM according to the input signal) is indicated. OFF ... Fuel cut solenoid valve is not operating. ON ... Fuel cut solenoid valve is operating. 	<ul style="list-style-type: none"> When the fuel cut solenoid valve is not operating, fuel is not supplied to injection nozzles.
GLOW RLY [ON/OFF]		○	<ul style="list-style-type: none"> The glow relay control condition (determined by ECM according to the input signal) is displayed. 	
COOLING FAN [LOW/HI/OFF]		○	<ul style="list-style-type: none"> Indicates the control condition of the cooling fans (determined by ECM according to the input signal). LOW ... Operates at low speed. HI ... Operates at high speed. OFF ... Stopped. 	
I/C FAN RLY [ON/OFF]		○	<ul style="list-style-type: none"> Indicates the control condition of the charge air cooler fan (determined by ECM according to the input signals). 	
EGRC SOL/V A [ON/OFF]			<ul style="list-style-type: none"> The control condition of the EGRC-solenoid valve A (determined by ECM according to the input signal) is indicated. OFF ... EGRC-solenoid valve A is not operating. ON ... EGRC-solenoid valve A is operating. 	
EGRC SOL/V B [ON/OFF]			<ul style="list-style-type: none"> The control condition of the EGRC-solenoid valve B (determined by ECM according to the input signal) is indicated. OFF ... EGRC-solenoid valve B is not operating. ON ... EGRC-solenoid valve B is operating. 	
THROT RLY [ON/OFF]			<ul style="list-style-type: none"> The control condition of the throttle control solenoid valve (determined by ECM according to the input signal) is indicated. OFF ... Throttle control solenoid valve is not operating. ON ... Throttle control solenoid valve is operating. 	

ON BOARD DIAGNOSTIC SYSTEM DESCRIPTION

CONSULT (Cont'd)

ACTIVE TEST MODE

TEST ITEM	CONDITION	JUDGEMENT	CHECK ITEM (REMEDY)
COOLING FAN	<ul style="list-style-type: none"> ● Ignition switch: ON ● Operate the cooling fan at "LOW", "HI" speed and turn "OFF" using CONSULT. 	Cooling fan moves at "LOW", "HI" speed and stops.	<ul style="list-style-type: none"> ● Harness and connector ● Cooling fan motor
OFF ACCEL POS SIG	<ul style="list-style-type: none"> ● Clears the self-learning fully closed accelerator position, detected by accelerator position sensor, from the ECM. 		
FUEL CUT SOL/V	<ul style="list-style-type: none"> ● Ignition switch: ON ● Turn solenoid valve "ON" and "OFF" with the CONSULT and listen to operating sound. 	Solenoid valve makes an operating sound.	<ul style="list-style-type: none"> ● Harness and connector ● Solenoid valve
EGRC SOL/V A	<ul style="list-style-type: none"> ● Ignition switch: ON ● Turn solenoid valve "ON" and "OFF" with the CONSULT and listen to operating sound. 	Solenoid valve makes an operating sound.	<ul style="list-style-type: none"> ● Harness and connector ● Solenoid valve
EGRC SOL/V B	<ul style="list-style-type: none"> ● Ignition switch: ON ● Turn solenoid valve "ON" and "OFF" with the CONSULT and listen to operating sound. 	Solenoid valve makes an operating sound.	<ul style="list-style-type: none"> ● Harness and connector ● Solenoid valve
THROT CONT SOL/V	<ul style="list-style-type: none"> ● Ignition switch: ON ● Turn solenoid valve "ON" and "OFF" with the CONSULT and listen to operating sound. 	Solenoid valve makes an operating sound.	<ul style="list-style-type: none"> ● Harness and connector ● Solenoid valve
GLOW RLY	<ul style="list-style-type: none"> ● Ignition switch: ON (Engine stopped) ● Turn the glow relay "ON" and "OFF" using CONSULT and listen to operating sound. 	Glow relay makes the operating sound.	<ul style="list-style-type: none"> ● Harness and connector ● Glow relay
INJ TIMING	<ul style="list-style-type: none"> ● Engine: Return to the original trouble condition ● Retard the injection timing using CONSULT. 	If trouble symptom disappears, see CHECK ITEM.	<ul style="list-style-type: none"> ● Adjust initial injection timing

ON BOARD DIAGNOSTIC SYSTEM DESCRIPTION

CONSULT (Cont'd)

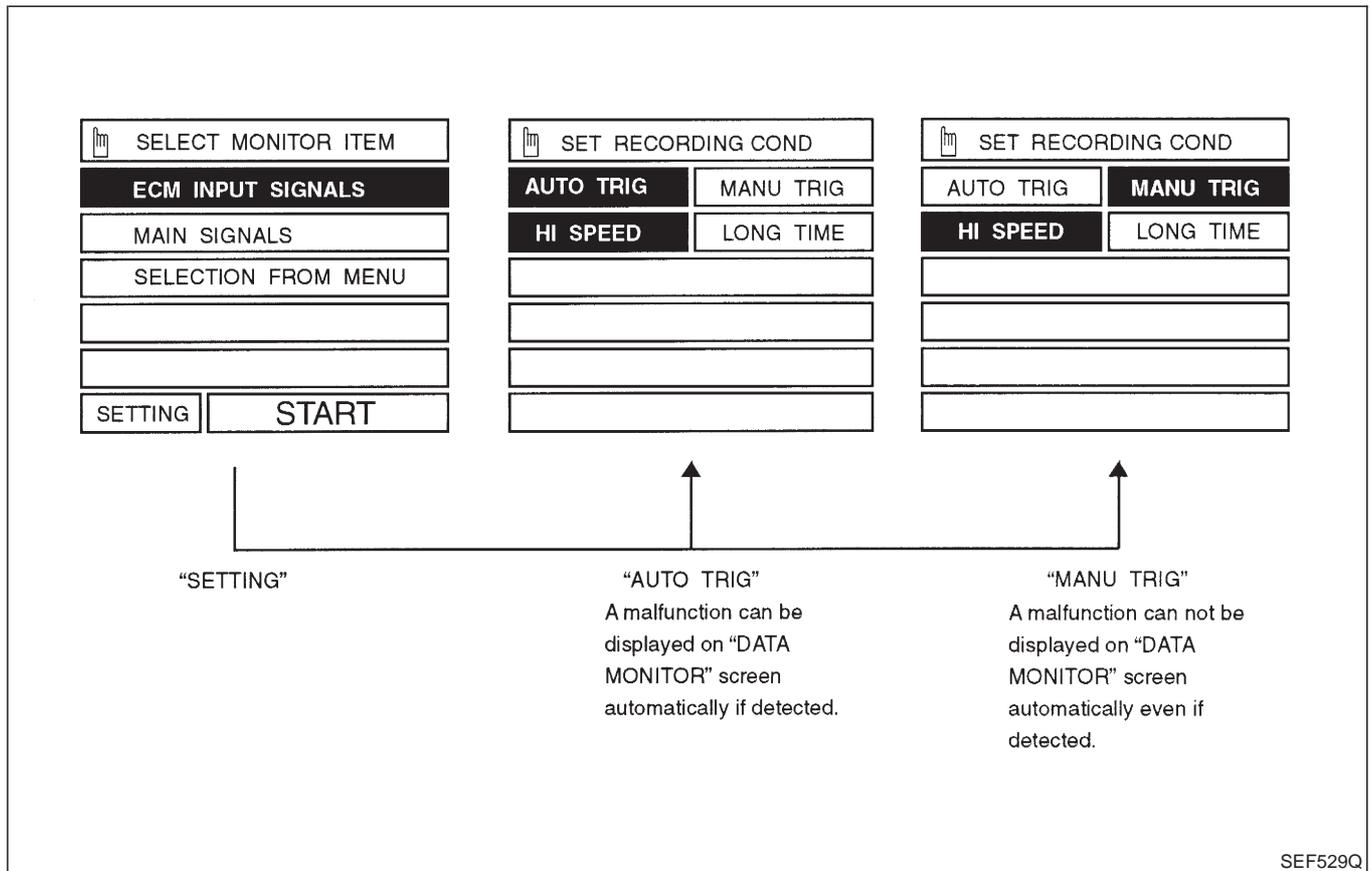
REAL TIME DIAGNOSIS IN DATA MONITOR MODE

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

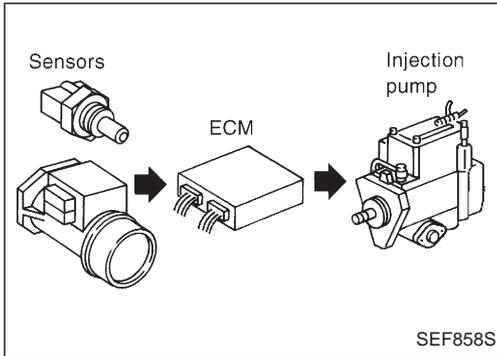
1. "AUTO TRIG" (Automatic trigger):
 - The malfunction will be identified on the CONSULT screen in real time.
In other words, the malfunction item will be displayed at the moment the malfunction is detected by ECM.
DATA MONITOR can be performed continuously until a malfunction is detected. However, DATA MONITOR cannot continue any longer after the malfunction detection.
2. "MANU TRIG" (Manual trigger):
 - The malfunction item will not be displayed automatically on CONSULT 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 should be set in "DATA MONITOR (AUTO TRIG)" mode, especially in case the incident is intermittent.
Inspect the circuit by gently shaking (or twisting) suspicious connectors, components and harness in the "DTC CONFIRMATION PROCEDURE". The moment a malfunction is found the malfunction item will be displayed. (Refer to GI section, "Incident Simulation Tests" in "HOW TO PERFORM EFFICIENT DIAGNOSIS FOR AN ELECTRICAL INCIDENT".)
2. "MANU TRIG"
 - If the malfunction is displayed as soon as "DATA MONITOR" is selected, reset CONSULT 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.



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Introduction

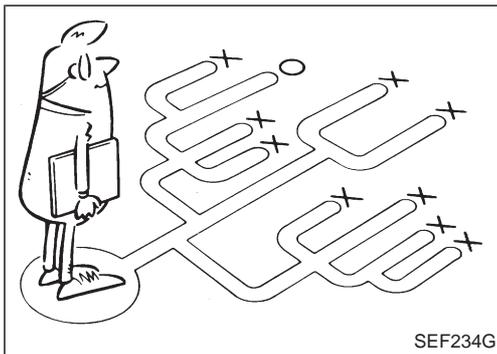
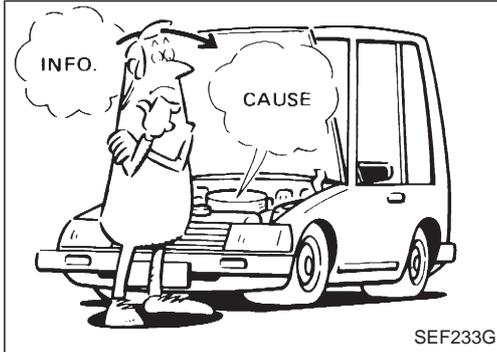
The engine has an ECM to control major systems such as fuel injection control, fuel injection timing control, glow control system, etc. The ECM accepts input signals from sensors and instantly drives electronic fuel injection pump. It is essential that both input and output signals are proper and stable. At the same time, it is important that there are no problems such as vacuum leaks, 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 or a circuit tester connected should be performed. Follow the "Work Flow", EC-44.

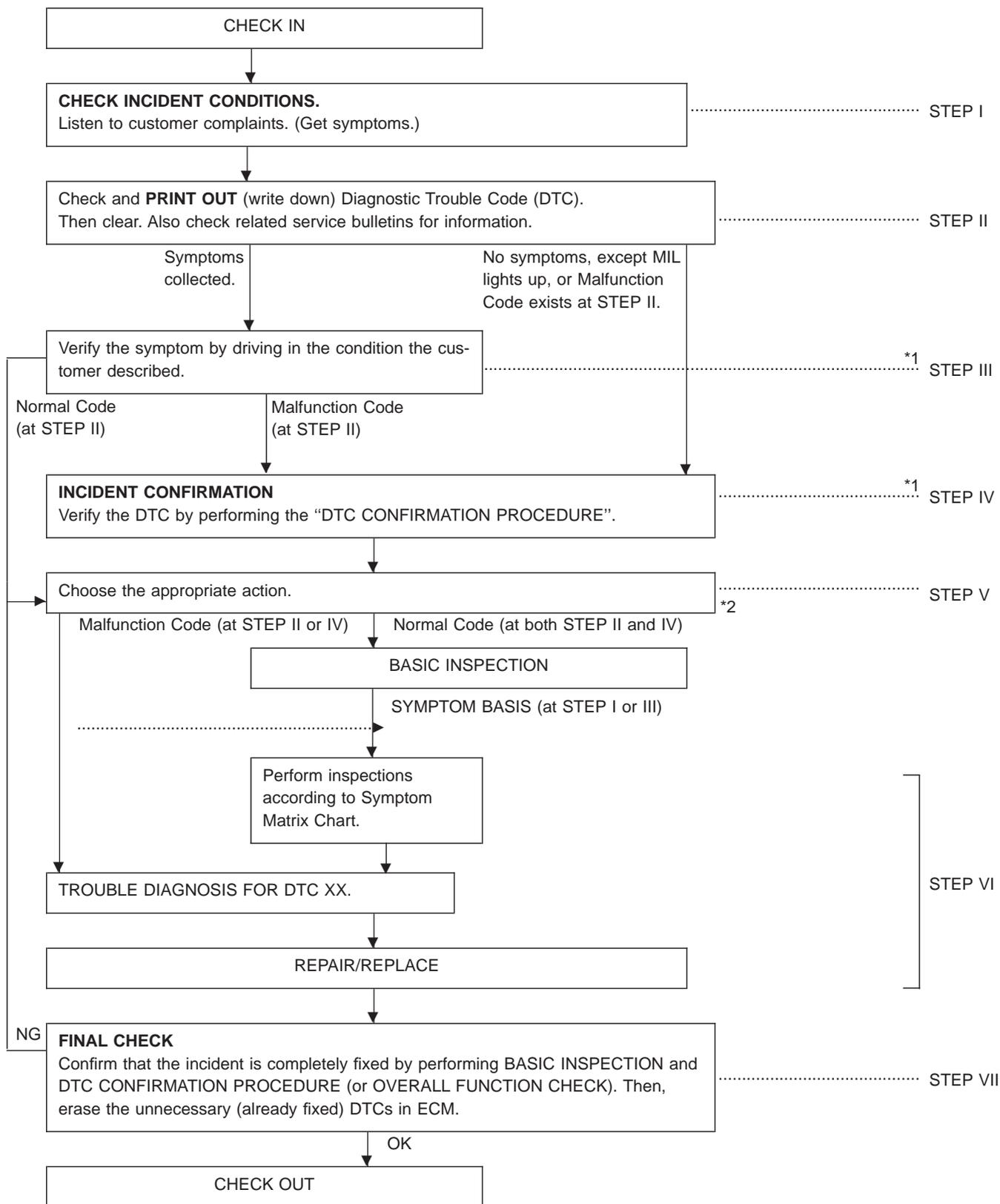
Before undertaking actual checks, take a few minutes to talk with a customer who approaches with a driveability complaint. The customer can supply good information about such problems, especially intermittent ones. Find out what symptoms are present and under what conditions they occur. A "Diagnostic 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.



TROUBLE DIAGNOSIS — Work Flow

Work Flow



*1: If the incident cannot be duplicated, refer to GI section (“Incident Simulation Tests”, “HOW TO PERFORM EFFICIENT DIAGNOSIS FOR AN ELECTRICAL INCIDENT”).

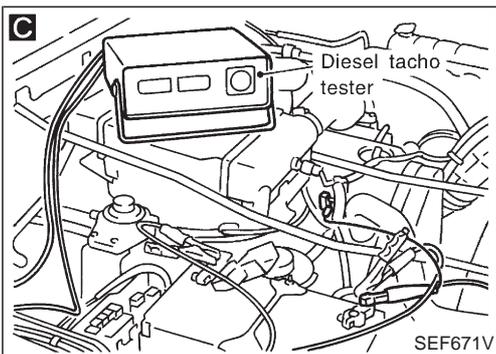
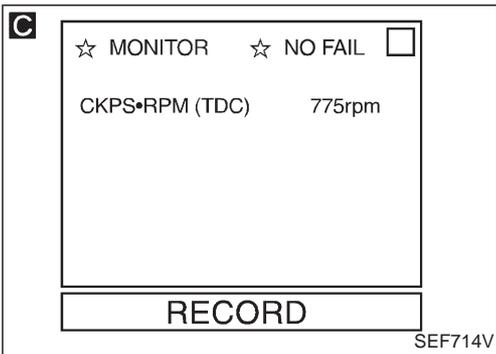
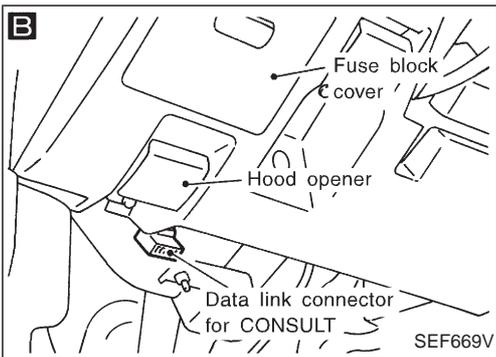
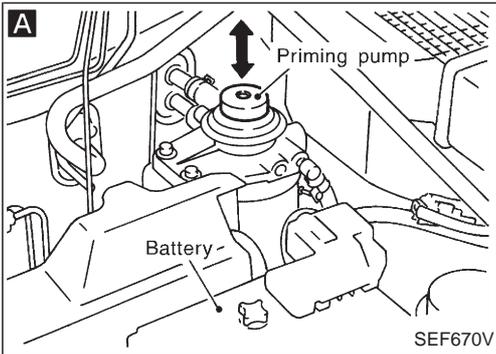
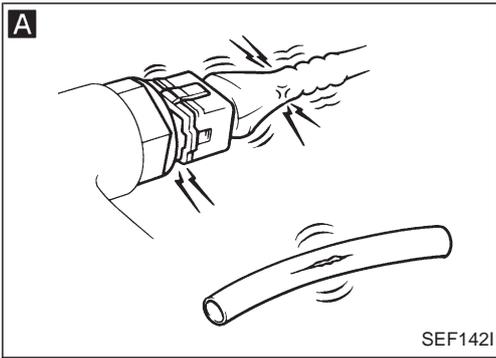
*2: If the on board diagnostic system cannot be performed, check main power supply and ground circuit. Refer to “TROUBLE DIAGNOSIS FOR POWER SUPPLY”, EC-63.

TROUBLE DIAGNOSIS — Work Flow

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 WORKSHEET" as shown on EC-43.
STEP II	Before confirming the concern, check and write down (print out using CONSULT) the Diagnostic Trouble Code (DTC), then erase the code. Refer to EC-30. Study the relationship between the cause, specified by DTC, and the symptom described by the customer. (The "Symptom Matrix Chart" will be useful. Refer to EC-48.)
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 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 (DTC) by driving in (or performing) the "DTC CONFIRMATION PROCEDURE". Check and read the DTC by using CONSULT. During the DTC verification, be sure to connect CONSULT 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. Refer to EC-46. Then perform inspections according to the Symptom Matrix Chart. Refer to EC-48.
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 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. Refer to EC-54. 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 ("Circuit Inspection", "HOW TO PERFORM EFFICIENT DIAGNOSIS FOR AN ELECTRICAL INCIDENT"). 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-30.)

TROUBLE DIAGNOSIS — Basic Inspection



Basic Inspection

Precaution:

Perform Basic Inspection without electrical or mechanical loads applied;

- Headlamp switch is OFF,
- Air conditioner switch is OFF,
- Rear defogger switch is OFF,
- Steering wheel is in the straight-ahead position, etc.

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, or improper connections
 - Wiring for improper connections, pinches, or cuts
3. Using priming pump, bleed air from fuel system. Refer to "DRAINING WATER", "Checking and Replacing Fuel Filter and Draining Water" of "ENGINE MAINTENANCE" in MA section.

B

CONNECT CONSULT TO THE VEHICLE.
Connect "CONSULT" to the data link connector for CONSULT and select "ENGINE" from the menu. Refer to EC-36.

DOES ENGINE START?

No → Turn ignition switch OFF, wait 5 seconds and then start engine. If engine fails to start, check diagnostic trouble code (DTC).

Yes

Run engine for 10 minutes.

C

CHECK IDLE SPEED.

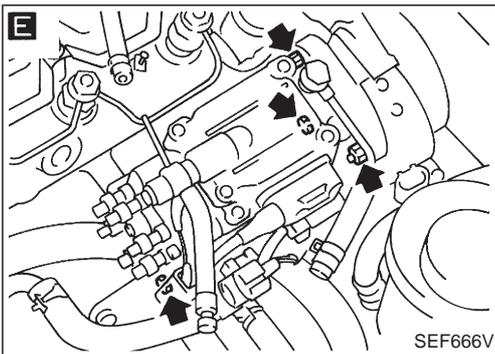
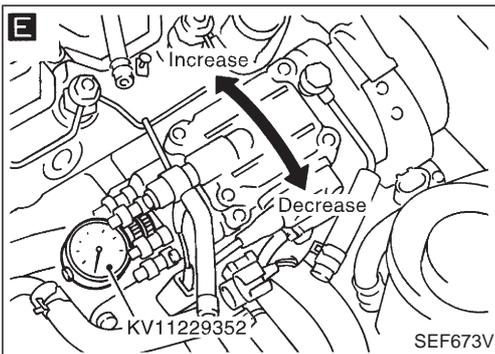
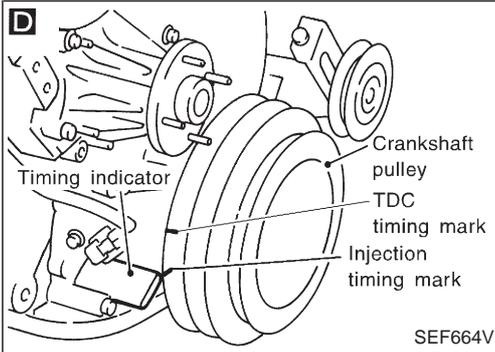
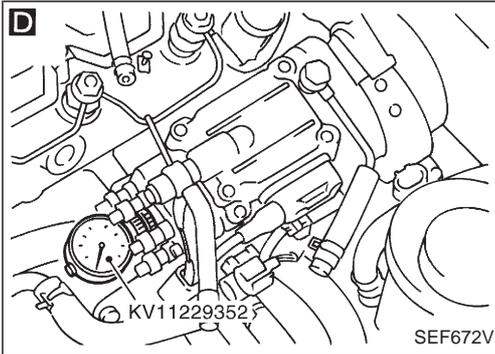
Read engine idle speed in "DATA MONITOR" mode with CONSULT. OR Check idle speed using tachometer tester.

775±25 rpm

(Go to A on next page.)

TROUBLE DIAGNOSIS — Basic Inspection

Basic Inspection (Cont'd)



D

CHECK INJECTION TIMING.

1. Set No. 1 piston at TDC on its compression stroke.
2. Remove injection tubes and air bleeder on the back of injection pump.
3. Set dial gauge so its indicator points to somewhere between 1.0 and 2.0 mm (0.039 and 0.079 in) on the scale.
4. Turn crankshaft 1 turn clockwise and check that dial gauge indicates the same value again.
5. Turn crankshaft counterclockwise about 100 degrees, then turn crankshaft clockwise slowly, and set dial gauge indicator to 0 mm at the position it stops.
6. Turn crankshaft clockwise and set the injection timing mark on the crankshaft pulley to the timing indicator.
7. Read plunger lift.

Plunger lift:

0.92±0.04 mm (0.0362±0.0016 in)

- When repeating the checking, start with step 5.

OK

- Bleed air from fuel system.
- After this inspection, unnecessary diagnostic trouble code No. might be displayed. Erase the stored memory in ECM. Refer to "ON BOARD DIAGNOSTIC SYSTEM DESCRIPTION" (EC-30) and "HOW TO ERASE DTC" (EC-30).

OK

INSPECTION END

NG

E

ADJUSTING

1. If plunger lift is not within the specified value, adjust by turning injection pump.
 - If indication is smaller than the specified value, turn pump body away from engine.
 - If indication is larger than the specified value, turn pump body towards engine.
2. Tighten injection pump securing bolts and nuts.

Nut:

: 16 - 21 N·m
(1.6 - 2.1 kg-m, 12 - 15 ft-lb)

Bolt:

: 22 - 29 N·m
(2.2 - 3.0 kg-m, 16 - 22 ft-lb)

3. Remove dial gauge and install air bleeder with new washer.
4. Install injection tubes.

Flare nut:

: 22 - 25 N·m
(2.2 - 2.5 kg-m, 16 - 18 ft-lb)

5. Bleed air from fuel system. Refer to "DRAINING WATER", "Checking and Replacing Fuel Filter and Draining Water" of "ENGINE MAINTENANCE" in MA section.

Go to **A**.

TROUBLE DIAGNOSIS — General Description

CONSULT 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.

MONITOR ITEM	CONDITION	SPECIFICATION	
CKPS-RPM (TDC)	<ul style="list-style-type: none"> ● Tachometer: Connect ● Run engine and compare tachometer indication with the CONSULT value. 	Almost the same speed as the CONSULT value.	
CKPS-RPM (REF)			
CMPS-RPM-PUMP			
COOLAN TEMP/S	<ul style="list-style-type: none"> ● Engine: After warming up 	More than 70°C (158°F)	
VHCL SPEED SE	<ul style="list-style-type: none"> ● Turn drive wheels and compare speedometer indication with the CONSULT value 	Almost the same speed as the CONSULT value	
FUEL TEMP SEN	<ul style="list-style-type: none"> ● Engine: After warming up 	More than 40°C (104 °F)	
ACCEL POS SEN	<ul style="list-style-type: none"> ● Ignition switch: ON (Engine stopped) 	Accelerator pedal: released	0.40 - 0.60V
		Accelerator pedal: depressed	Approx. 4.0V
FULL ACCEL SW	<ul style="list-style-type: none"> ● Ignition switch: ON (Engine stopped) 	Accelerator pedal: depressed	ON
		Except above	OFF
ACCEL SW (FC)	<ul style="list-style-type: none"> ● Ignition switch: ON (Engine stopped) 	Accelerator pedal: released	CLOSE
		Accelerator pedal: slightly open	OPEN
OFF ACCEL SW	<ul style="list-style-type: none"> ● Ignition switch: ON (Engine stopped) 	Accelerator pedal: released	ON
		Accelerator pedal: slightly open	OFF
C/SLEEV POS/S	<ul style="list-style-type: none"> ● Engine: After warming up 	1.0 - 3.5V	
BATTERY VOLT	<ul style="list-style-type: none"> ● Ignition switch: ON (Engine stopped) 	11 - 14V	
P/N POSI SW	<ul style="list-style-type: none"> ● Ignition switch: ON 	Shift lever: Neutral/Park	ON
		Except above	OFF
START SIGNAL	<ul style="list-style-type: none"> ● Ignition switch: ON → START → ON 	OFF → ON → OFF	
AIR COND SIG	<ul style="list-style-type: none"> ● Engine: After warming up, idle the engine 	Air conditioner switch: OFF	OFF
		Air conditioner switch: ON (Compressor operates.)	ON
IGN SW	<ul style="list-style-type: none"> ● Ignition switch: ON → OFF 	ON → OFF	
WARM UP SW	<ul style="list-style-type: none"> ● Ignition switch: ON 	Heat up switch: ON	ON
		Heat up switch: OFF	OFF
MAS AIR/FL SE	<ul style="list-style-type: none"> ● Engine: After warming up ● Air conditioner switch: OFF ● Shift lever: "N" ● No-load 	Idle	1.6 - 2.0V
ACT INJ TIMG	<ul style="list-style-type: none"> ● Engine: After warming up ● Air conditioner switch: "OFF" ● Shift lever: "N" ● No-load 	Idle	-9.5 to -12.0°
		2,000 rpm	-10.0 to -15.5°
INJ TIMG C/V	<ul style="list-style-type: none"> ● Engine: After warming up, idle the engine. 	Approx. 50%	
DECELER F/CUT	<ul style="list-style-type: none"> ● Engine: After warming up 	Idle	OFF
		When accelerator pedal is released quickly with engine speed at 3,000 rpm or more.	ON
FUEL CUT S/V	<ul style="list-style-type: none"> ● Ignition switch: ON → OFF 	ON → OFF	
GLOW RLY	<ul style="list-style-type: none"> ● Refer to EC-151. 		

TROUBLE DIAGNOSIS — General Description

CONSULT Reference Value in Data Monitor Mode (Cont'd)

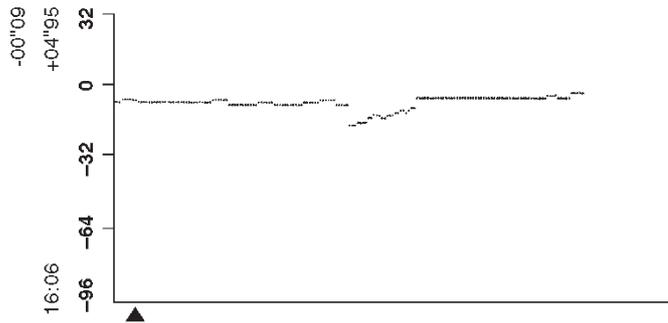
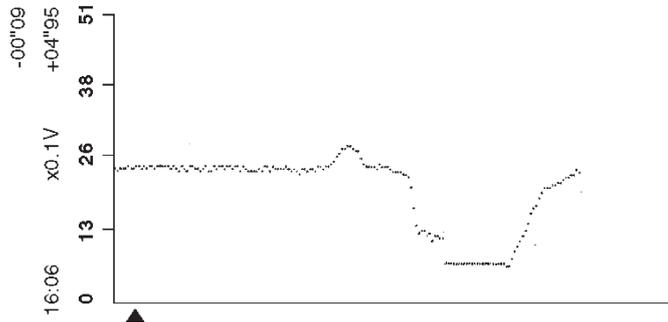
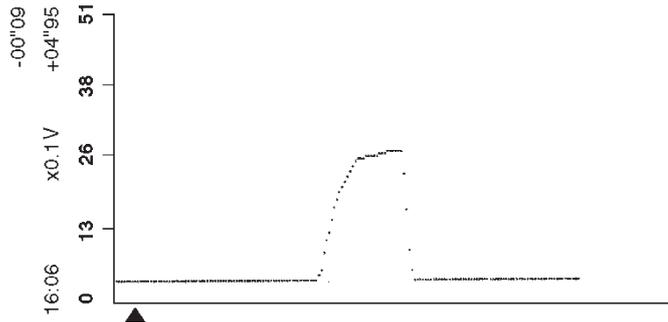
MONITOR ITEM	CONDITION	SPECIFICATION
COOLING FAN	<ul style="list-style-type: none"> ● When cooling fan is stopped. 	OFF
	<ul style="list-style-type: none"> ● When cooling fan operates. 	ON
I/C FAN RLY	<ul style="list-style-type: none"> ● When charge air cooler fan is stopped. 	OFF
	<ul style="list-style-type: none"> ● When charge air cooler fan operates. 	ON
EGRC SOL/V A	<ul style="list-style-type: none"> ● Engine: After warming up ● Air conditioner switch: "OFF" ● Shift lever: "N" ● No-load 	Idle
		Revsing engine from idle to 3,750 rpm
EGRC SOL/V B	<ul style="list-style-type: none"> ● Engine: After warming up ● Air conditioner switch: "OFF" ● Shift lever: "N" ● No-load 	Idle
		Revsing engine from idle to 2,600 rpm
THROT RLY	<ul style="list-style-type: none"> ● Engine: After warming up ● Air conditioner switch: "OFF" ● Shift lever: "N" ● No-load 	Idle
		Revsing engine from idle to 2,500 rpm

Major Sensor Reference Graph in Data Monitor Mode

The following are the major sensor reference graphs in "DATA MONITOR" mode.
(Select "HI SPEED" in "DATA MONITOR" with CONSULT.)

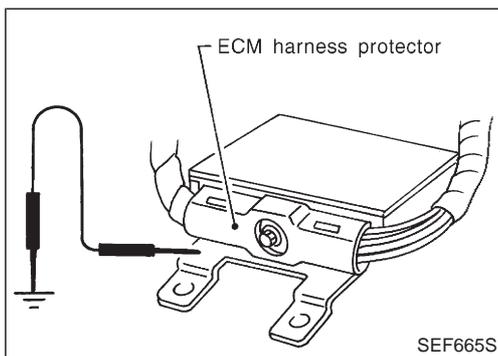
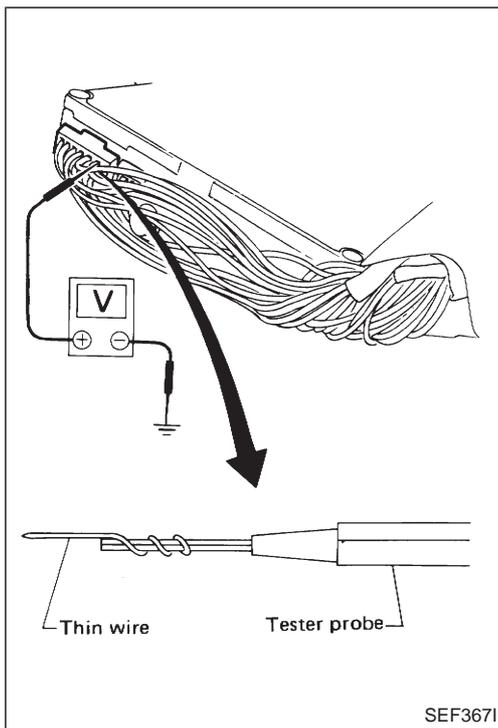
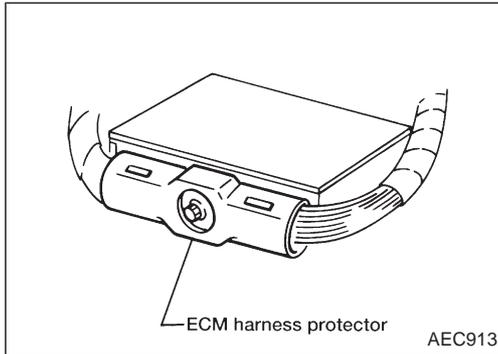
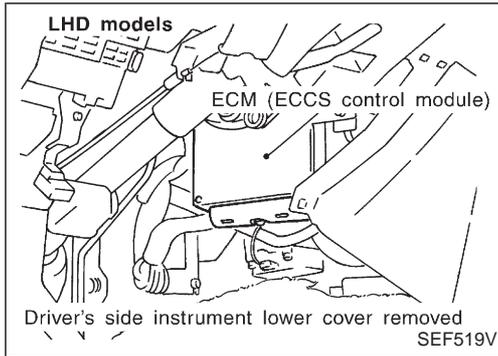
ACCEL POS SEN, C/SLEEV POS/S, ACT INJ TIMG

Below is the data for "ACCEL POS SEN", "C/SLEEV POS/S" and "ACT INJ TIMG" when revving engine quickly up to 3,000 rpm under no load after warming up engine sufficiently. Each value is for reference, the exact value may vary.



SEF663S

TROUBLE DIAGNOSIS — General Description



ECM Terminals and Reference Value

PREPARATION

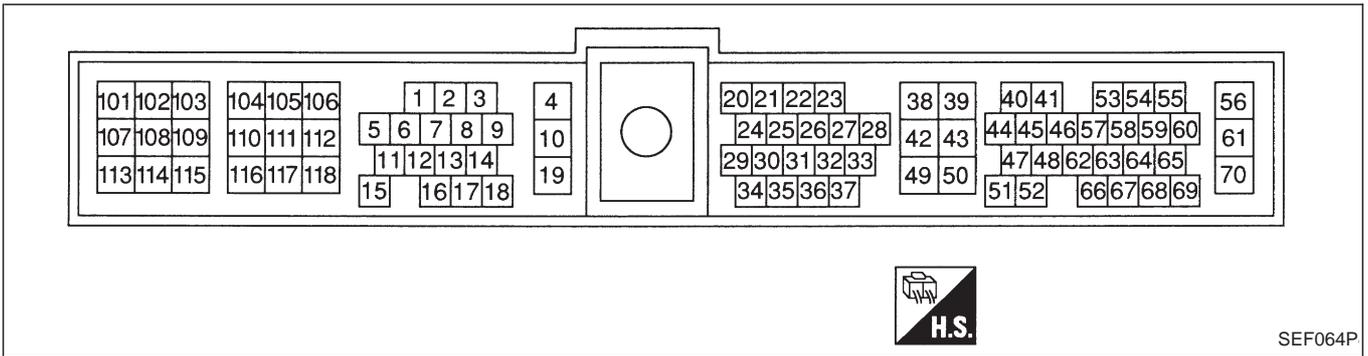
1. ECM is located behind the instrument lower panel. For this inspection, remove the driver's side instrument lower cover.
2. Remove ECM harness protector.
3. Perform all voltage measurements with the connector connected. Extend tester probe as shown to perform tests easily.
 - Open harness securing 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.

Be sure ECM unit is properly grounded before checking.

TROUBLE DIAGNOSIS — General Description

ECM Terminals and Reference Value (Cont'd)

ECM HARNESS CONNECTOR TERMINAL LAYOUT



SEF064P

ECM INSPECTION TABLE

Remarks: Specification data are reference values and are measured between each terminal and Ⓞ (ECCS ground) with a voltmeter.

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
1	W	Throttle control solenoid valve	Engine is running. (Warm-up condition) └ Idle speed	Approximately 0.4V
			Engine is running. (Warm-up condition) └ Revving engine from idle to 2,500 rpm	BATTERY VOLTAGE (11 - 14V)
4	B/Y	ECCS relay (Self-shutoff)	Ignition switch "ON" 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)
5	Y/B	Tachometer	Engine is running. (Warm-up condition) └ Idle speed	Approximately 1.0 - 2.0V SEF715V
			Engine is running. (Warm-up condition) └ Engine speed is 2,000 rpm.	Approximately 1.0 - 2.0V SEF716V

TROUBLE DIAGNOSIS — General Description

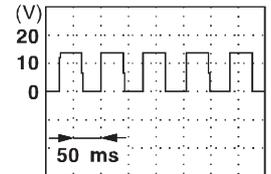
ECM Terminals and Reference Value (Cont'd)

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
8	G/OR	Charge air cooler fan relay	Engine is running. └ Charge air cooler fan is not operating.	BATTERY VOLTAGE (11 - 14V)
			Engine is running. └ Charge air cooler fan is operating.	0 - 1V
10	P	Fuel temperature sensor	Engine is running.	Approximately 0 - 4.8V Output voltage varies with fuel temperature.
14	L	Cooling fan relay	Engine is running. └ Cooling fan is not operating.	BATTERY VOLTAGE (11 - 14V)
			Engine is running. └ Cooling fan is operating.	0 - 1V
15	Y/L	Air conditioner relay	Engine is running. └ Air conditioner switch is "OFF".	BATTERY VOLTAGE (11 - 14V)
			Engine is running. └ Both air conditioner switch and blower fan switch are "ON". (Compressor is operating.)	0 - 1V
16	L/W	Glow lamp	Ignition switch "ON" └ Glow lamp is "ON".	0 - 1.5V
			Ignition switch "ON" └ Glow lamp is "OFF".	BATTERY VOLTAGE (11 - 14V)
18	G	Malfunction indicator lamp	Ignition switch "ON"	0 - 1.5V
			Engine is running. └ Idle speed	BATTERY VOLTAGE (11 - 14V)
19	LG/R	Engine coolant temperature sensor	Engine is running.	Approximately 0 - 4.8V Output voltage varies with engine coolant temperature.
20	R/W	Start signal	Ignition switch "ON"	Approximately 0V
			Ignition switch "START"	BATTERY VOLTAGE (11 - 14V)
21	LG/B	Air conditioner switch	Engine is running. └ Air conditioner switch is "OFF".	BATTERY VOLTAGE (11 - 14V)
			Engine is running. └ Both air conditioner switch and blower fan switch are "ON". (Compressor is operating.)	Approximately 0V

TROUBLE DIAGNOSIS — General Description

ECM Terminals and Reference Value (Cont'd)

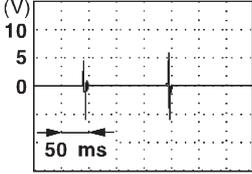
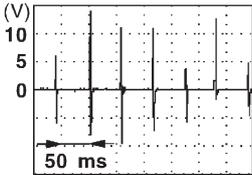
TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
22	P/B	Inhibitor switch/ Neutral position switch	Ignition switch "ON"	Approximately 0V
			└ Gear position is "N" or "P" (A/T models). └ Gear position is "Neutral" (M/T models).	
23	W	Accelerator position sensor	Ignition switch "ON"	0.4 - 0.6V
			└ Except the above gear position	
24	PU/W	A/T signal No. 1	Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
			└ Accelerator pedal fully released	
26	L/OR	Vehicle speed sensor	Ignition switch "ON"	Approximately 4.3V
			└ Accelerator pedal fully depressed	
28 33	B	Camshaft position sensor (PUMP) ground	Engine is running.	6 - 8V
			└ Idle speed	
29	R/L	Accelerator switch (F/C)	Engine is running.	0 - BATTERY VOLTAGE (11 - 14V)
			└ Lift up the vehicle. └ In 1st gear position └ Vehicle speed is 40 km/h.	
30	P	A/T signal No. 3	Engine is running. (Warm-up condition)	Approximately 0V
			└ Idle speed	
31	R/L	Accelerator position switch (Idle)	Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
			└ Accelerator pedal fully released	
32	W/G	Accelerator position switch (Full)	Ignition switch "ON"	Approximately 0V
			└ Accelerator pedal depressed	
32	W/G	Accelerator position switch (Full)	Ignition switch "ON"	Approximately 0V
			└ Accelerator pedal released	
32	W/G	Accelerator position switch (Full)	Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
			└ Accelerator pedal fully depressed	



SEF717V

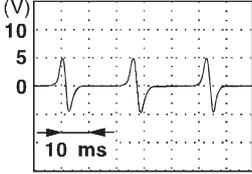
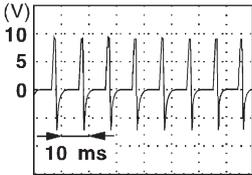
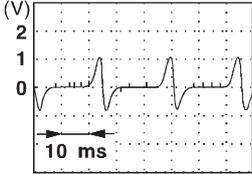
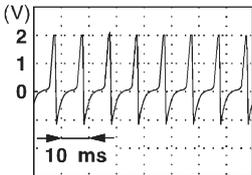
TROUBLE DIAGNOSIS — General Description

ECM Terminals and Reference Value (Cont'd)

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
34	W	Needle lift sensor	<div style="border: 1px solid black; padding: 2px; display: inline-block;">Engine is running.</div> (Warm-up condition) └ Idle speed	Approximately 0V  SEF718V
			<div style="border: 1px solid black; padding: 2px; display: inline-block;">Engine is running.</div> (Warm-up condition) └ Engine speed is 2,000 rpm.	Approximately 0V  SEF719V
35	R	Mass air flow sensor	<div style="border: 1px solid black; padding: 2px; display: inline-block;">Engine is running.</div> (Warm-up condition) └ Idle speed	1.6 - 2.0V
36	LG	Charge air temperature sensor	<div style="border: 1px solid black; padding: 2px; display: inline-block;">Engine is running.</div>	Approximately 0 - 4.8V Output voltage varies with charge air temperature.
37	P/B	A/T signal No. 2	<div style="border: 1px solid black; padding: 2px; display: inline-block;">Engine is running.</div> └ Idle speed	6 - 8V
38	B/Y	Ignition switch	<div style="border: 1px solid black; padding: 2px; display: inline-block;">Ignition switch "OFF"</div>	0V
			<div style="border: 1px solid black; padding: 2px; display: inline-block;">Ignition switch "ON"</div>	BATTERY VOLTAGE (11 - 14V)
39 43	B	ECCS ground	<div style="border: 1px solid black; padding: 2px; display: inline-block;">Engine is running.</div> └ Idle speed	Engine ground (Probe this terminal with ⊖ tester probe when measuring.)

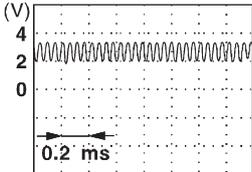
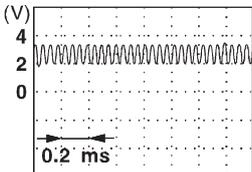
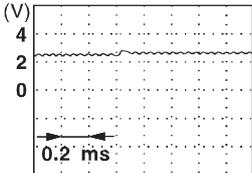
TROUBLE DIAGNOSIS — General Description

ECM Terminals and Reference Value (Cont'd)

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
40 44	L	Crankshaft position sensor (TDC)	<div style="border: 1px solid black; padding: 2px;">Engine is running.</div> (Warm-up condition) └ Idle speed	Approximately 0V  SEF720V
			<div style="border: 1px solid black; padding: 2px;">Engine is running.</div> (Warm-up condition) └ Engine speed is 2,000 rpm.	Approximately 0V  SEF721V
41 45	W	Camshaft position sensor (PUMP)	<div style="border: 1px solid black; padding: 2px;">Engine is running.</div> (Warm-up condition) └ Idle speed	Approximately 0V  SEF722V
			<div style="border: 1px solid black; padding: 2px;">Engine is running.</div> (Warm-up condition) └ Engine speed is 2,000 rpm.	Approximately 0V  SEF723V
42	L/G	Data link connector for CONSULT	<div style="border: 1px solid black; padding: 2px;">Engine is running.</div> └ Idle speed (CONSULT is connected and turned on)	Approximately 0V
64	Y/G			Approximately 0 - 12V
65	Y/R			Approximately 0 - 9V
46	Y	Adjustment resistor	<div style="border: 1px solid black; padding: 2px;">Ignition switch "ON"</div>	Approximately 0 - 4.6V (Voltage varies with part number of adjustment resistor.)
47 52	B/W	Crankshaft position sensor (TDC) ground	<div style="border: 1px solid black; padding: 2px;">Engine is running.</div> (Warm-up condition) └ Idle speed	Approximately 0V
48	G/R	Accelerator position sensor power supply	<div style="border: 1px solid black; padding: 2px;">Ignition switch "ON"</div>	Approximately 5V
49	G/R	Sensor's power signal to TCM	<div style="border: 1px solid black; padding: 2px;">Ignition switch "ON"</div>	Approximately 5V

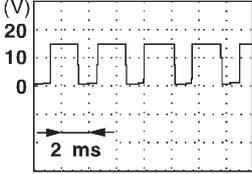
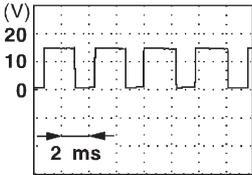
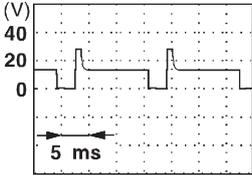
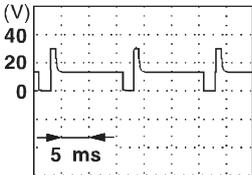
TROUBLE DIAGNOSIS — General Description

ECM Terminals and Reference Value (Cont'd)

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
50	B	Sensors' ground	Engine is running. (Warm-up condition) └ Idle speed	Approximately 0V
51	L/W	Accelerator position sensor ground	Engine is running. (Warm-up condition) └ Idle speed	Approximately 0V
53 57	W	Control sleeve position sensor power supply	Engine is running. └ Idle speed	Approximately 2.6V  SEF724V
56 61	W	Power supply for ECM	Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
59	BR/W	Heat up switch	Ignition switch "ON" └ Heat up switch is "OFF".	0V
			Ignition switch "ON" └ Heat up switch is "ON".	BATTERY VOLTAGE (11 - 14V)
62 66	B	Control sleeve position sensor ground	Engine is running. └ Idle speed	Approximately 2.6V  SEF725V
63 67	R	Control sleeve position sensor	Engine is running. └ Idle speed	Approximately 2.6V  SEF726V
68	B/W	Accelerator position sensor signal to TCM	Ignition switch "ON" └ Accelerator pedal fully released	0.4 - 0.6V
			Ignition switch "ON" └ Accelerator pedal fully depressed	Approximately 4.3V
70	BR	Power supply (Back-up)	Ignition switch "OFF"	BATTERY VOLTAGE (11 - 14V)
101 107	R/B	Electric governor	Engine is running. └ Idle speed	BATTERY VOLTAGE (11 - 14V)

TROUBLE DIAGNOSIS — General Description

ECM Terminals and Reference Value (Cont'd)

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
102 108	G/Y	Electric governor ground	<div style="border: 1px solid black; padding: 2px; display: inline-block;">Engine is running.</div> └ Idle speed	Approximately 10V  SEF727V
			<div style="border: 1px solid black; padding: 2px; display: inline-block;">Engine is running.</div> └ Engine speed is 2,000 rpm.	Approximately 10V  SEF728V
103	L/Y	EGRC-solenoid valve A	<div style="border: 1px solid black; padding: 2px; display: inline-block;">Engine is running.</div> (Warm-up condition) └ Idle speed	0 - 1V
			<div style="border: 1px solid black; padding: 2px; display: inline-block;">Engine is running.</div> (Warm-up condition) └ Engine is revving from idle up to 3,750 rpm.	BATTERY VOLTAGE (11 - 14V)
104 110	L/W	Injection timing control valve	<div style="border: 1px solid black; padding: 2px; display: inline-block;">Engine is running.</div> (Warm-up condition) └ Idle speed	BATTERY VOLTAGE (11 - 14V)  SEF729V
			<div style="border: 1px solid black; padding: 2px; display: inline-block;">Engine is running.</div> (Warm-up condition) └ Engine speed is 2,000 rpm.	BATTERY VOLTAGE (11 - 14V)  SEF730V
106 112 118	B	ECCS ground	<div style="border: 1px solid black; padding: 2px; display: inline-block;">Engine is running.</div> └ Idle speed	Approximately 0V
109	BR/Y	EGRC-solenoid valve B	<div style="border: 1px solid black; padding: 2px; display: inline-block;">Engine is running.</div> (Warm-up condition) └ Idle speed	0 - 1V
			<div style="border: 1px solid black; padding: 2px; display: inline-block;">Engine is running.</div> (Warm-up condition) └ Engine is revving from idle up to 2,600 rpm.	BATTERY VOLTAGE (11 - 14V)

TROUBLE DIAGNOSIS — General Description

ECM Terminals and Reference Value (Cont'd)

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
111	LG/B	Glow relay	Refer to "Glow Control System", EC-151.	
113 115	R/W	Fuel cut solenoid valve	Ignition switch "OFF"	Approximately 0V
			Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
116 117	W	Power supply for ECM	Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)

TROUBLE DIAGNOSIS FOR POWER SUPPLY

Main Power Supply and Ground Circuit

ECM TERMINALS AND REFERENCE VALUE

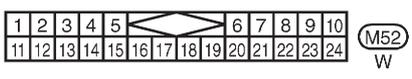
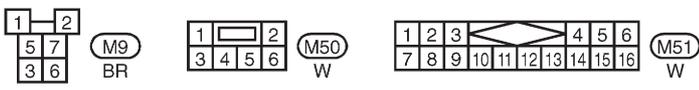
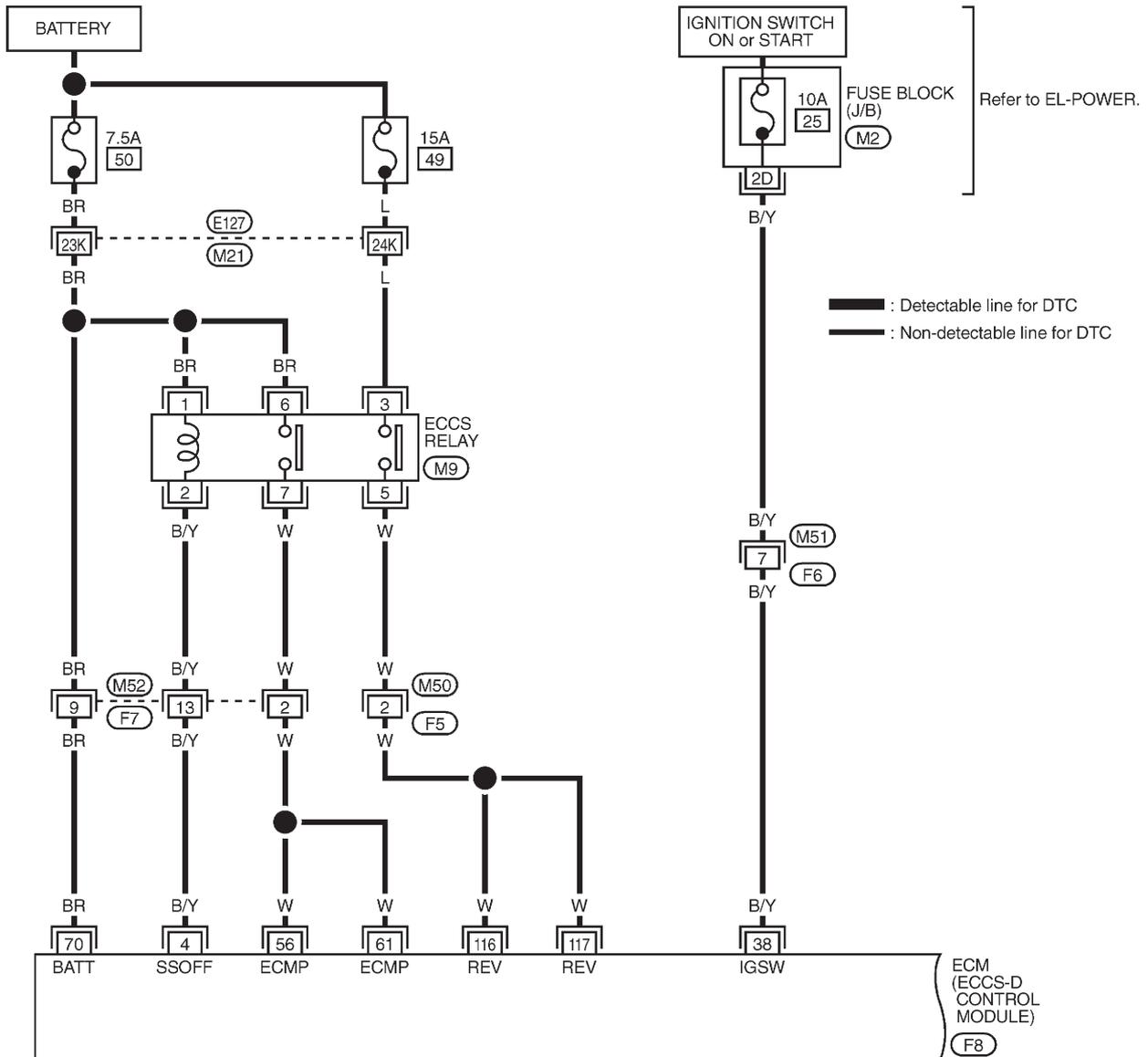
Remarks: Specification data are reference values and are measured between each terminal and ④ (ECCS ground) with a voltmeter.

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
4	B/Y	ECCS relay (Self-shutoff)	<div style="border: 1px solid black; padding: 2px;">Ignition switch "ON"</div> <div style="border: 1px solid black; padding: 2px;">Ignition switch "OFF"</div> <div style="margin-left: 20px;">└ For a few seconds after turning ignition switch "OFF"</div>	0 - 1.5V
			<div style="border: 1px solid black; padding: 2px;">Ignition switch "OFF"</div> <div style="margin-left: 20px;">└ A few seconds passed after turning ignition switch "OFF"</div>	BATTERY VOLTAGE (11 - 14V)
38	B/Y	Ignition switch	<div style="border: 1px solid black; padding: 2px;">Ignition switch "OFF"</div>	0V
			<div style="border: 1px solid black; padding: 2px;">Ignition switch "ON"</div>	BATTERY VOLTAGE (11 - 14V)
39 43	B	ECCS ground	<div style="border: 1px solid black; padding: 2px;">Engine is running.</div> <div style="margin-left: 20px;">└ Idle speed</div>	Engine ground (Probe this terminal with ⊖ tester probe when measuring.)
56 61	W	Power supply for ECM	<div style="border: 1px solid black; padding: 2px;">Ignition switch "ON"</div>	BATTERY VOLTAGE (11 - 14V)
70	BR	Power supply (Back-up)	<div style="border: 1px solid black; padding: 2px;">Ignition switch "OFF"</div>	BATTERY VOLTAGE (11 - 14V)
106 112 118	B	ECCS ground	<div style="border: 1px solid black; padding: 2px;">Engine is running.</div> <div style="margin-left: 20px;">└ Idle speed</div>	Approximately 0V
116 117	W	Power supply for ECM	<div style="border: 1px solid black; padding: 2px;">Ignition switch "ON"</div>	BATTERY VOLTAGE (11 - 14V)

TROUBLE DIAGNOSIS FOR POWER SUPPLY

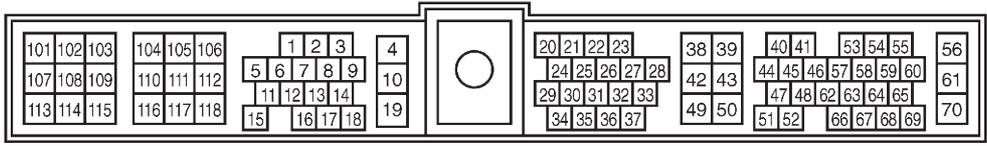
Main Power Supply and Ground Circuit (Cont'd)

EC-MAIN-01



Refer to last page (Foldout page).

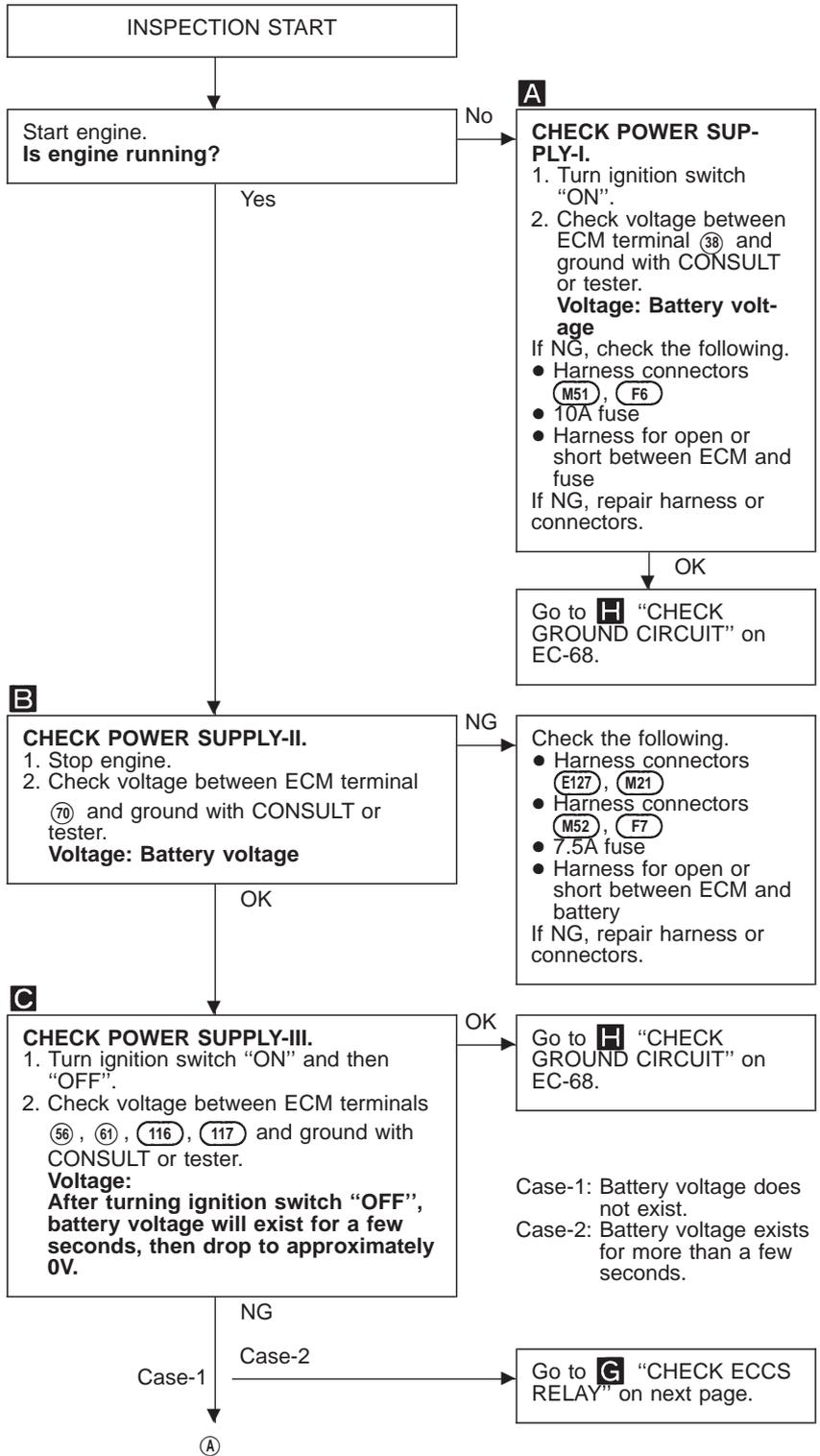
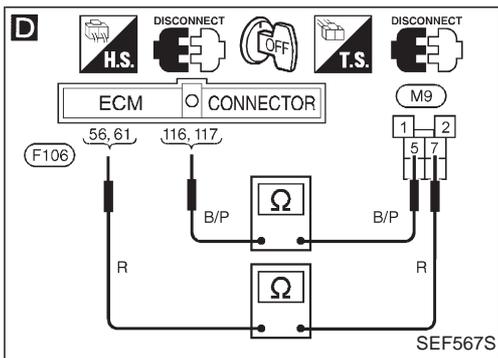
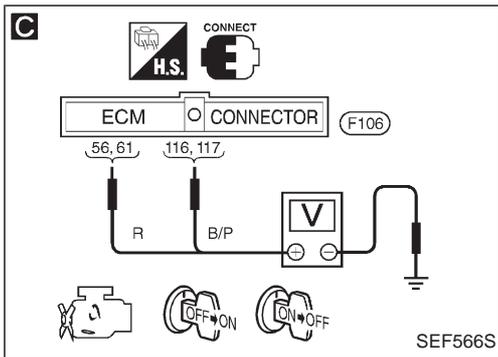
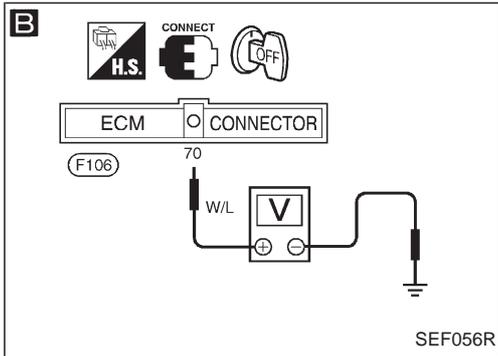
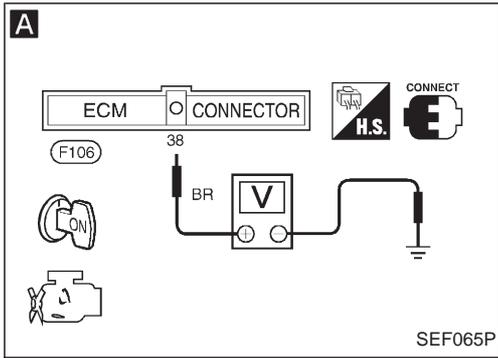
M21, E127
 M2



F8
 W

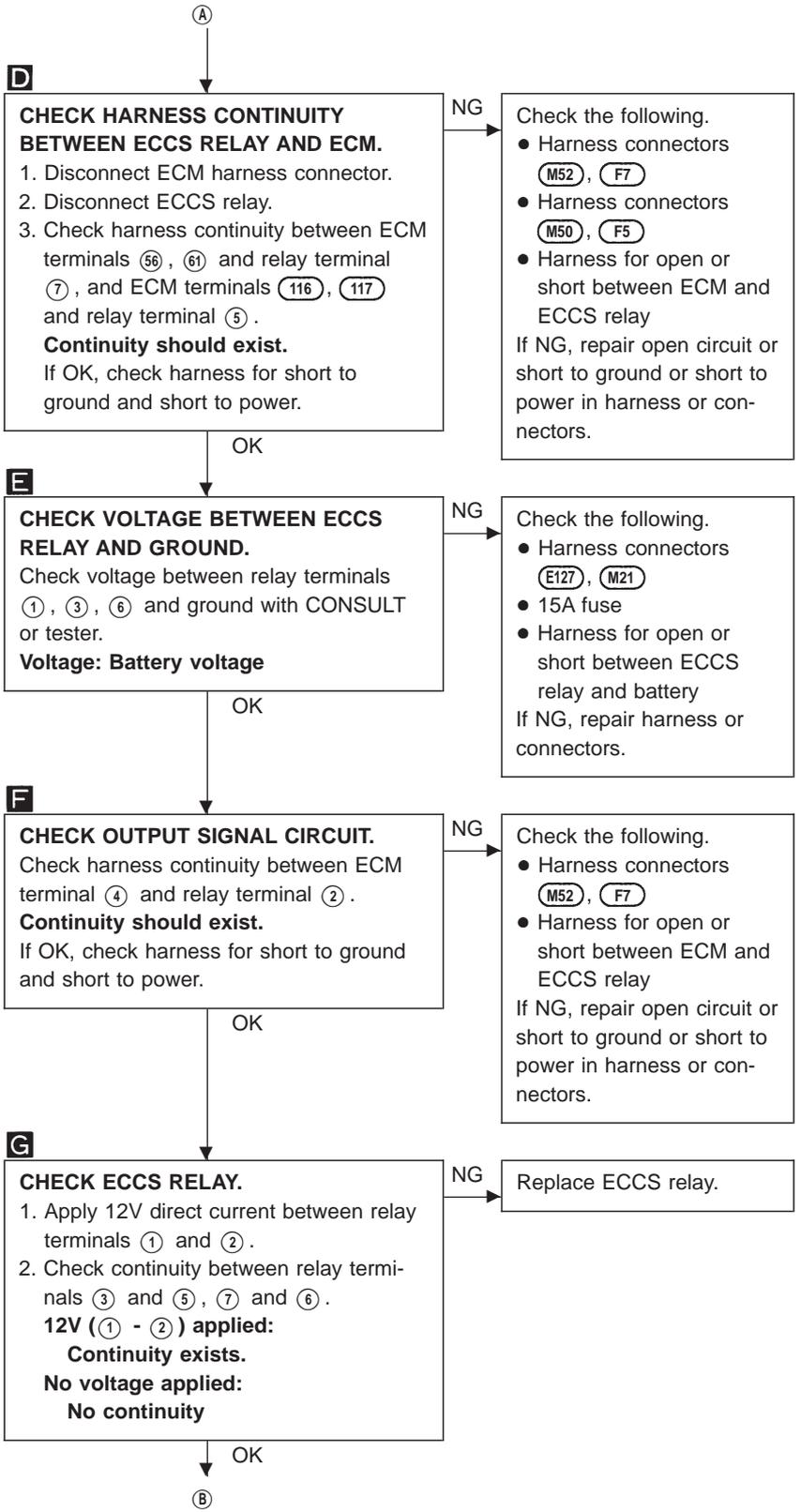
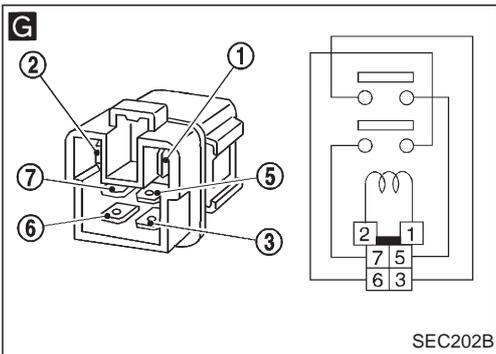
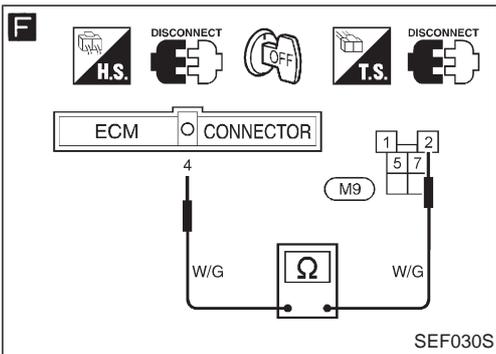
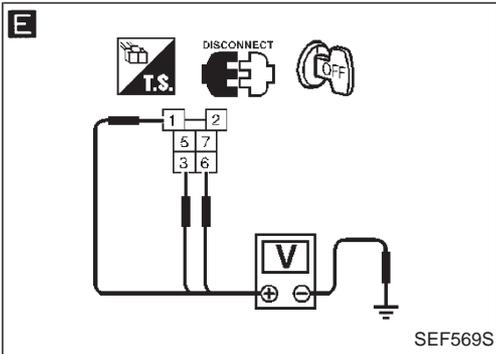
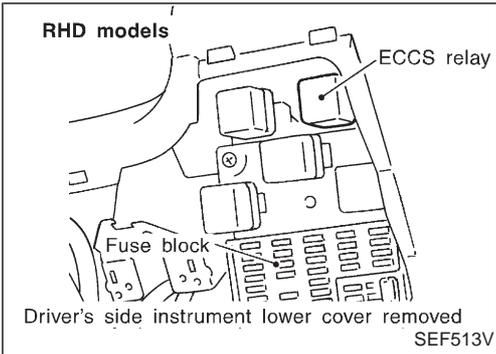
TROUBLE DIAGNOSIS FOR POWER SUPPLY

Main Power Supply and Ground Circuit (Cont'd)



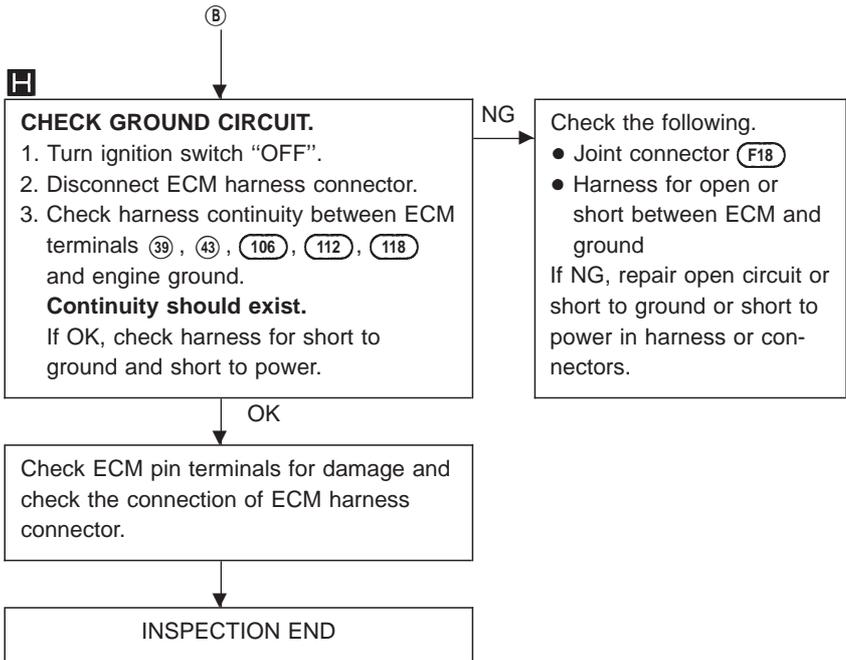
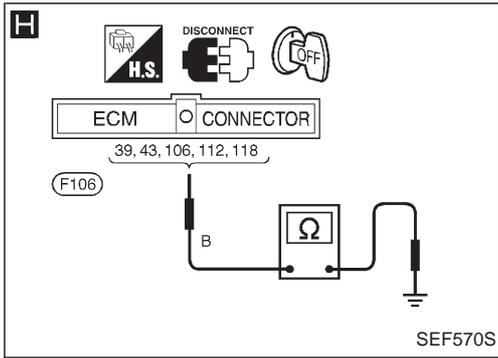
TROUBLE DIAGNOSIS FOR POWER SUPPLY

Main Power Supply and Ground Circuit (Cont'd)

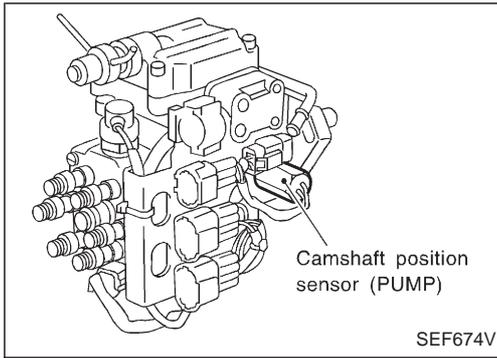


TROUBLE DIAGNOSIS FOR POWER SUPPLY

Main Power Supply and Ground Circuit (Cont'd)



TROUBLE DIAGNOSIS FOR “CAM POS SEN (PUMP)” (DTC 11)



Camshaft Position Sensor (CMPS) (PUMP)

The camshaft position sensor (PUMP) is located on the electronic fuel injection pump.

The sensor consists of a permanent magnet, core and coil.

When engine is running, gap between sensor and drive shaft rotating plate will periodically change. Permeability near the sensor also changes.

Due to the permeability change, the magnetic flux near the core is changed. Therefore, the voltage signal generated in the coil is changed.

The ECM receives the voltage signal (6 pulses/2 engine revolutions).

These signals are used for tachometer indication.

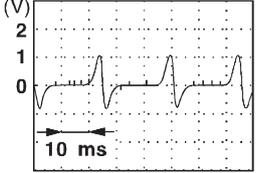
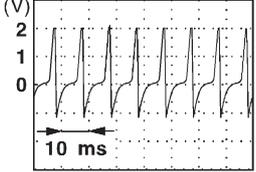
CONSULT REFERENCE VALUE IN DATA MONITOR MODE

Remarks: Specification data are reference values.

MONITOR ITEM	CONDITION	SPECIFICATION
CKPS-RPM (REF)	<ul style="list-style-type: none"> Tachometer: Connect Run engine and compare tachometer indication with the CONSULT value. 	Almost the same speed as the CONSULT value.
CKPS-RPM-PUMP		

ECM TERMINALS AND REFERENCE VALUE

Remarks: Specification data are reference values and are measured between each terminal and ④ (ECCS ground) with a voltmeter.

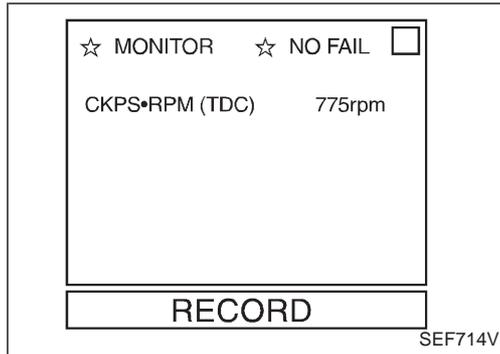
TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
28 33	B	Camshaft position sensor (PUMP) ground	<div style="border: 1px solid black; padding: 2px;">Engine is running.</div> (Warm-up condition) └ Idle speed	Approximately 0V
41 45	W	Camshaft position sensor (PUMP)	<div style="border: 1px solid black; padding: 2px;">Engine is running.</div> (Warm-up condition) └ Idle speed	Approximately 0V 
			<div style="border: 1px solid black; padding: 2px;">Engine is running.</div> (Warm-up condition) └ Engine speed is 2,000 rpm.	Approximately 0V 

TROUBLE DIAGNOSIS FOR "CAM POS SEN (PUMP)" (DTC 11)

Camshaft Position Sensor (CMPS) (PUMP) (Cont'd)

ON BOARD DIAGNOSIS LOGIC

Diagnostic Trouble Code No.	Malfunction is detected when	Check Items (Possible cause)
11	<ul style="list-style-type: none">An improper signal from the sensor is detected by ECM during engine running.	<ul style="list-style-type: none">Harness or connectors [The camshaft position sensor (PUMP) circuit is open or shorted.]Camshaft position sensor (PUMP)



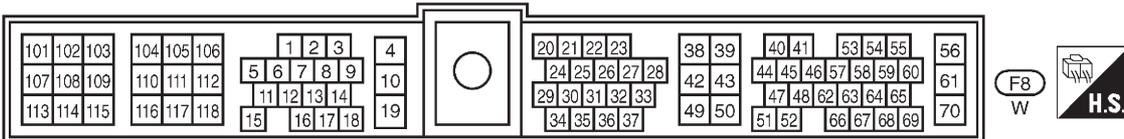
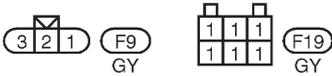
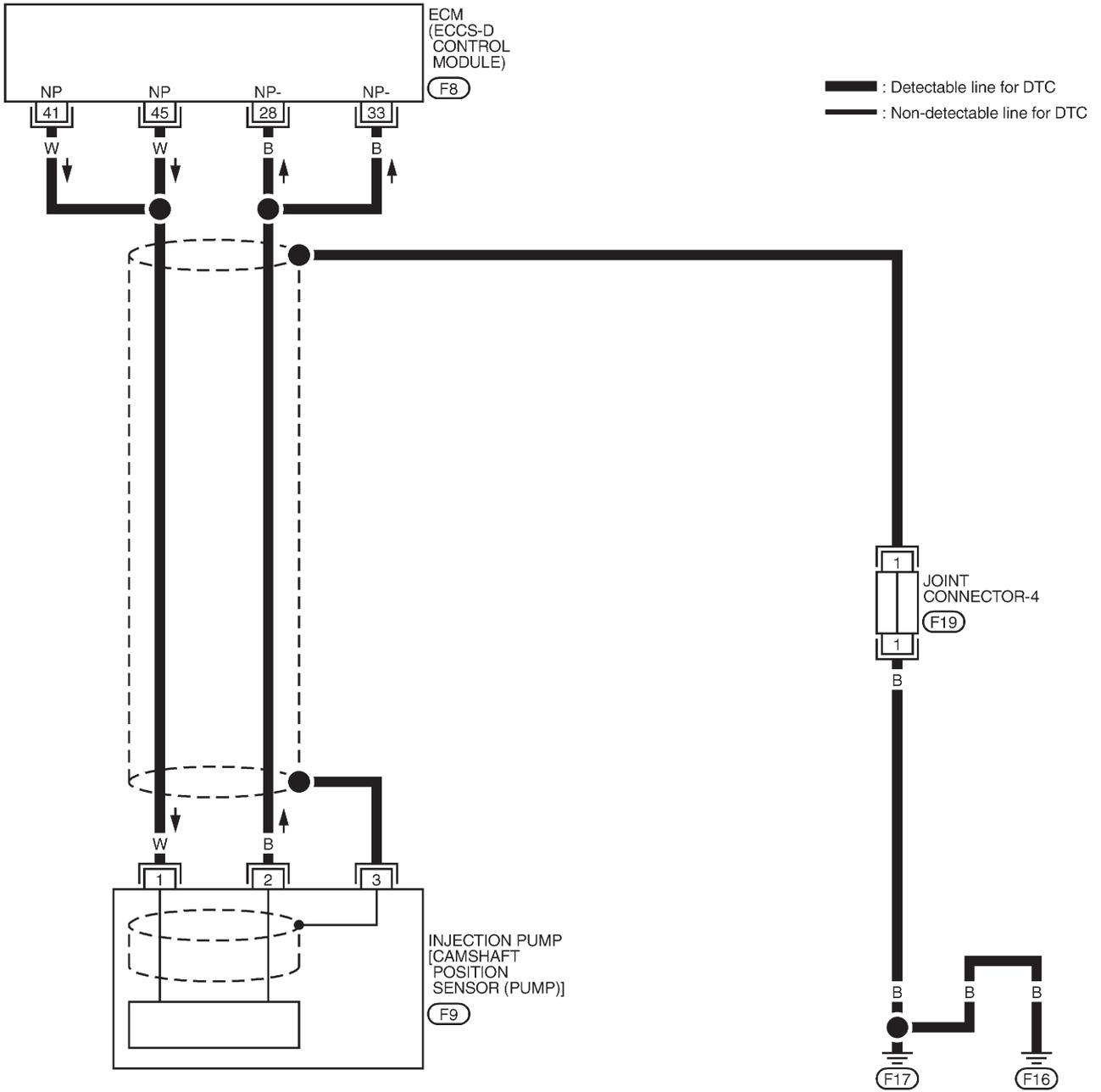
DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

- 1) Turn ignition switch "ON" and select "DATA MONITOR" mode with CONSULT.
 - 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 "ON".
 - 3) Perform "Diagnostic Test Mode II (Self-diagnostic results)" with ECM.

TROUBLE DIAGNOSIS FOR "CAM POS SEN (PUMP)" (DTC 11)

Camshaft Position Sensor (CMPS) (PUMP) (Cont'd)

EC-CMPS-01

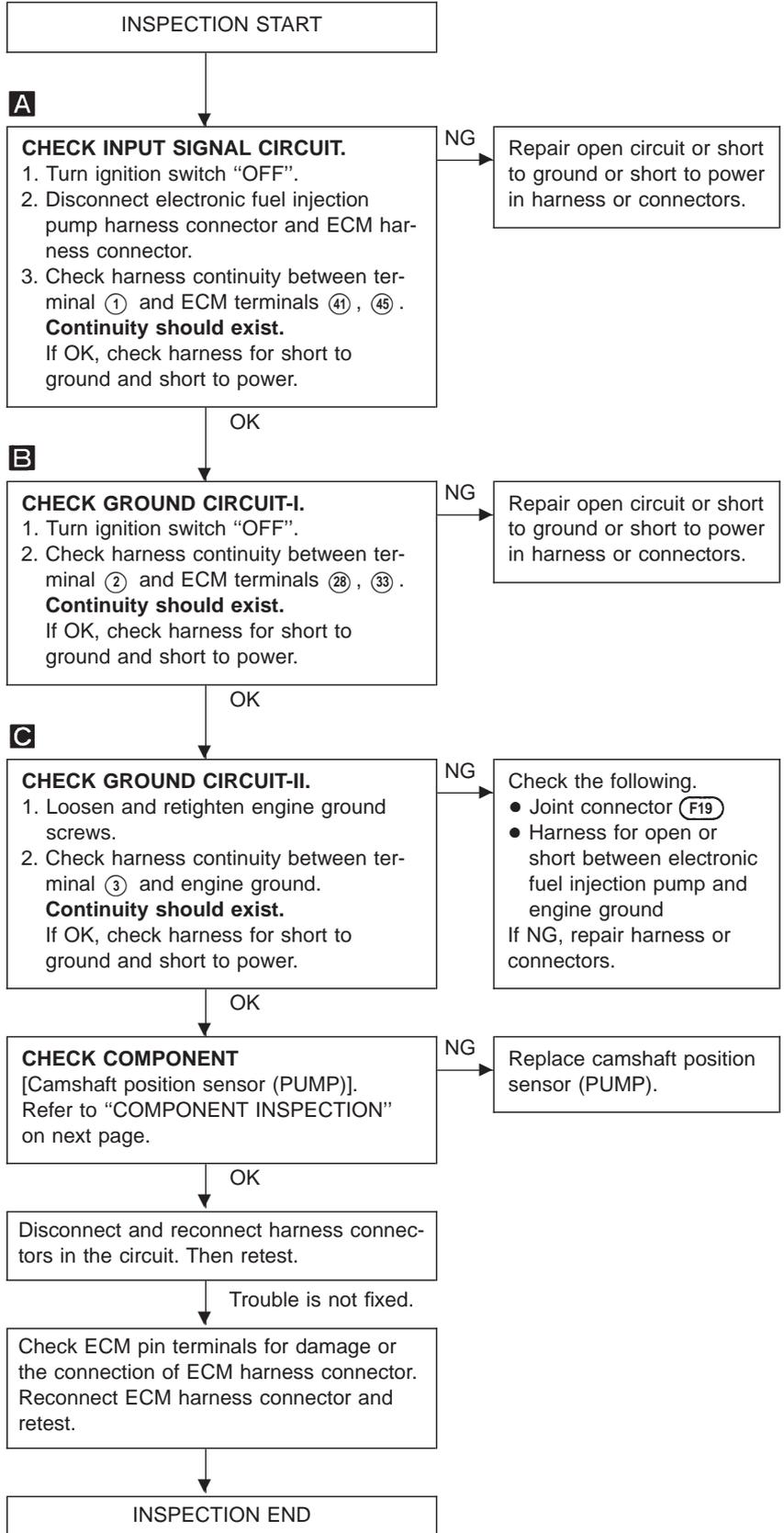
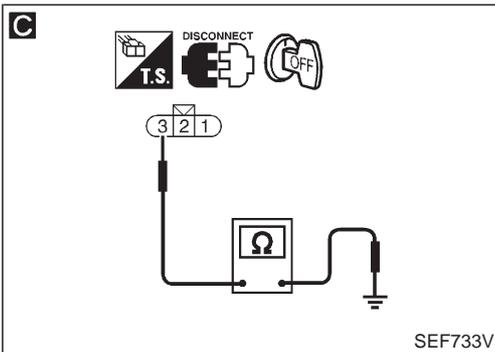
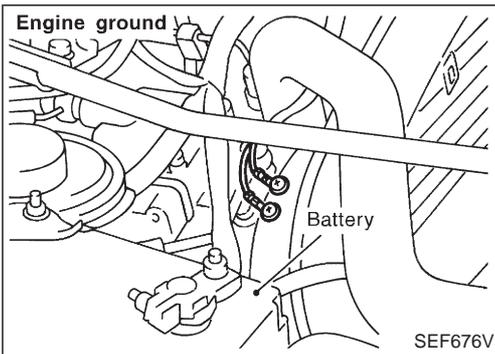
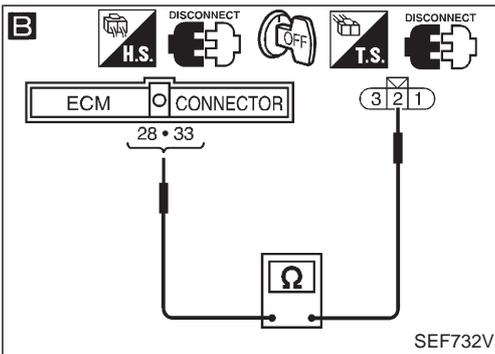
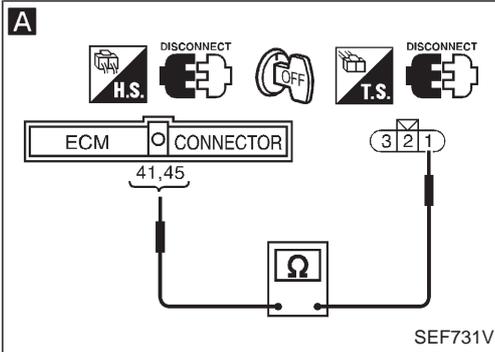
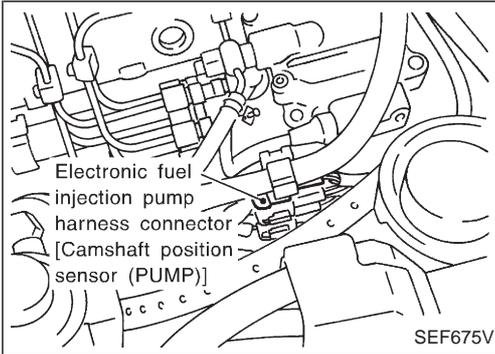


TROUBLE DIAGNOSIS FOR "CAM POS SEN (PUMP)" (DTC 11)

Camshaft Position Sensor (CMPS) (PUMP)

(Cont'd)

DIAGNOSTIC PROCEDURE



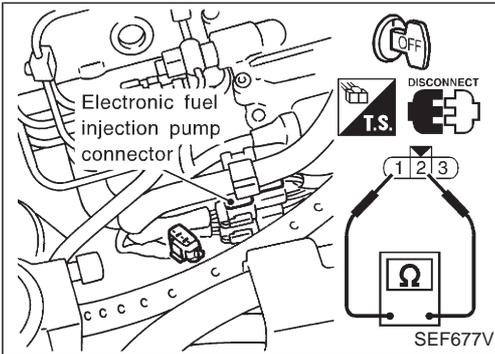
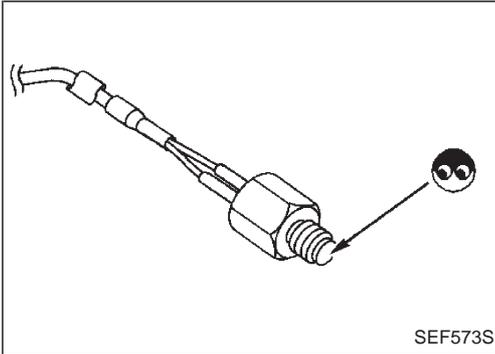
TROUBLE DIAGNOSIS FOR "CAM POS SEN (PUMP)" (DTC 11)

Camshaft Position Sensor (CMPS) (PUMP) (Cont'd)

COMPONENT INSPECTION

Camshaft position sensor (PUMP)

1. Disconnect electronic fuel injection pump harness connector.
2. Loosen the camshaft position sensor (PUMP).
3. Remove the sensor.
4. Visually check the sensor for chipping.



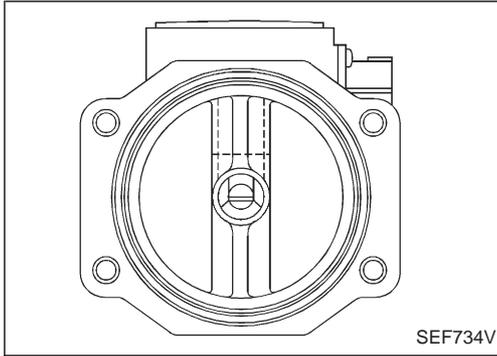
5. Check resistance between terminals ① and ②.

Resistance:

Approximately 1,360 - 1,840Ω [at 25°C (77°F)]

If NG, replace camshaft position sensor (PUMP).

TROUBLE DIAGNOSIS FOR “MASS AIR FLOW SEN” (DTC 12)



Mass Air Flow Sensor (MAFS)

COMPONENT DESCRIPTION

The mass air flow sensor is placed in the stream of intake air. It measures the intake air flow rate by measuring a part of the entire intake air 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 REFERENCE VALUE IN DATA MONITOR MODE

Remarks: Specification data are reference values.

MONITOR ITEM	CONDITION		SPECIFICATION
MAS AIR/FL SE	<ul style="list-style-type: none"> ● Engine: After warming up ● Air conditioner switch: “OFF” ● Shift lever: “N” ● No-load 	Idle	1.6 - 2.0V

ECM TERMINALS AND REFERENCE VALUE

Remarks: Specification data are reference values, and are measured between each terminal and ④3 (ECCS ground) with a voltmeter.

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC voltage)
35	R	Mass air flow sensor	<div style="border: 1px solid black; padding: 2px;">Engine is running.</div> (Warm-up condition) └ Idle speed	1.6 - 2.0V
50	B	Sensors' ground	<div style="border: 1px solid black; padding: 2px;">Engine is running.</div> (Warm-up condition) └ Idle speed	Approximately 0V

ON BOARD DIAGNOSIS LOGIC

Diagnostic Trouble Code No.	Malfunction is detected when ...	Check Items (Possible Cause)
12	<ul style="list-style-type: none"> ● An excessively high or low voltage from the sensor is sent to ECM. 	<ul style="list-style-type: none"> ● Harness or connectors (The sensor circuit is open or shorted.) ● Mass air flow sensor

TROUBLE DIAGNOSIS FOR "MASS AIR FLOW SEN" (DTC 12)

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

DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

☆ MONITOR	☆ NO FAIL	<input type="checkbox"/>
CKPS•RPM (TDC)	780rpm	
MAS AIR/FL SE	1.95V	
RECORD		

SEF735V



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

OR

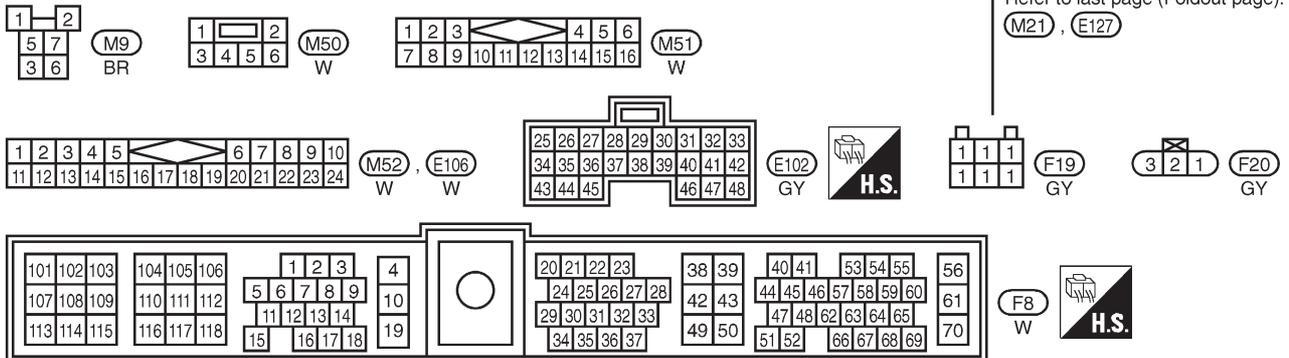
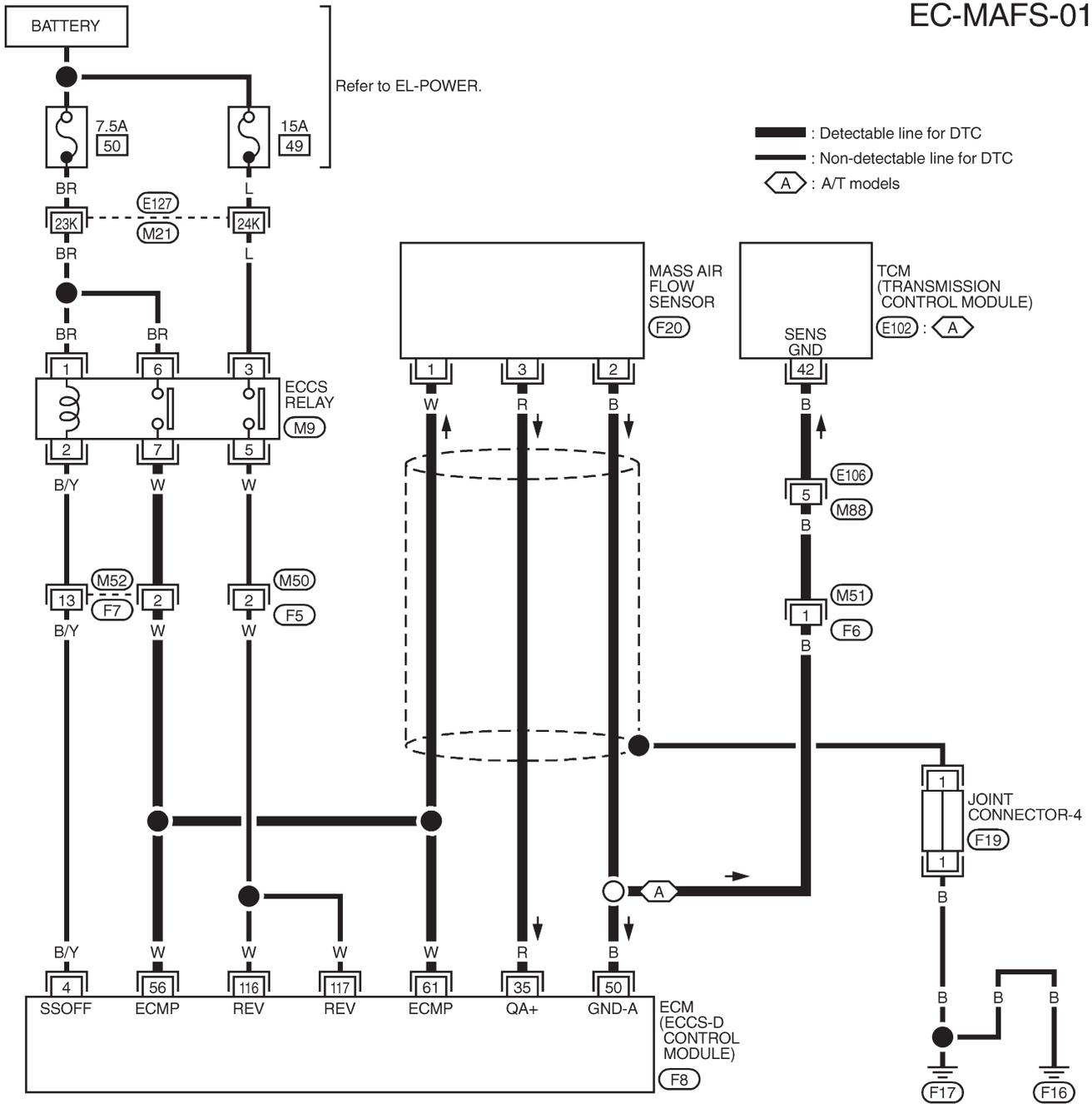


- 1) Turn ignition switch "ON", and wait at least 6 seconds.
- 2) Start engine and wait at least 3 seconds.
- 3) Turn ignition switch "OFF", wait at least 5 seconds and then turn "ON".
- 4) Perform "Diagnostic Test Mode II (Self-diagnostic results)" with ECM.

TROUBLE DIAGNOSIS FOR "MASS AIR FLOW SEN" (DTC 12)

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

EC-MAFS-01

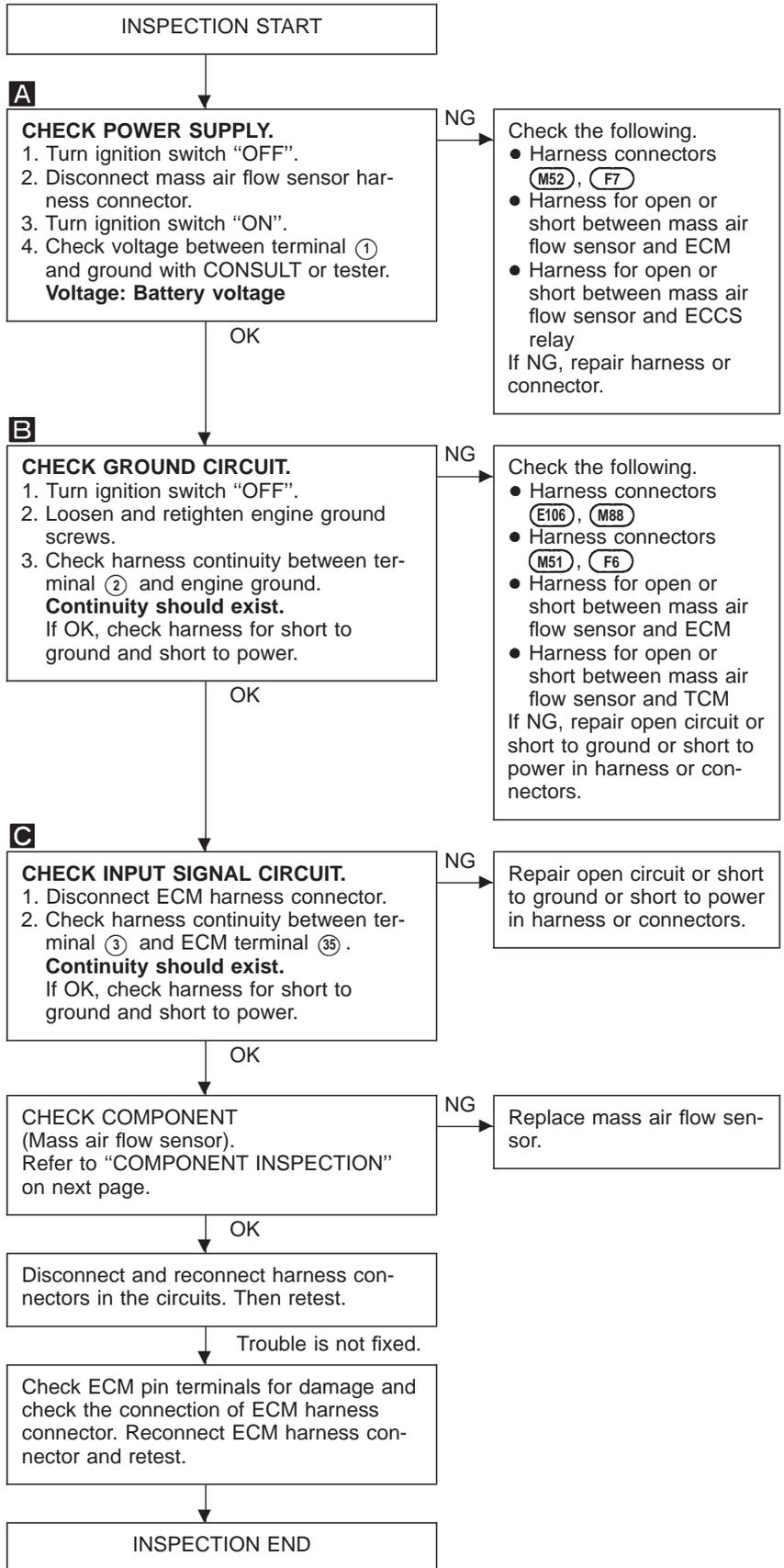
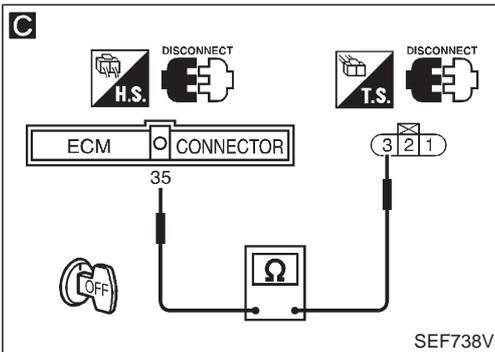
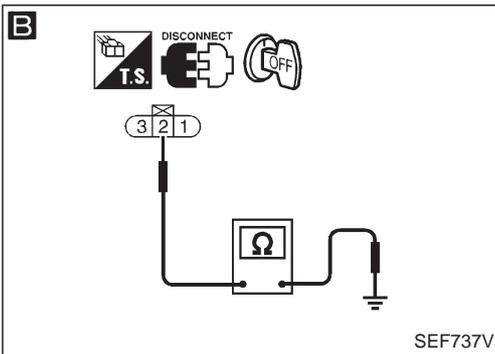
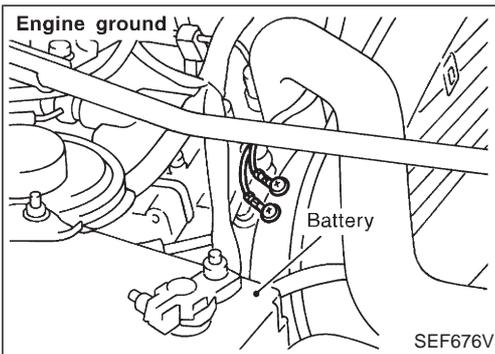
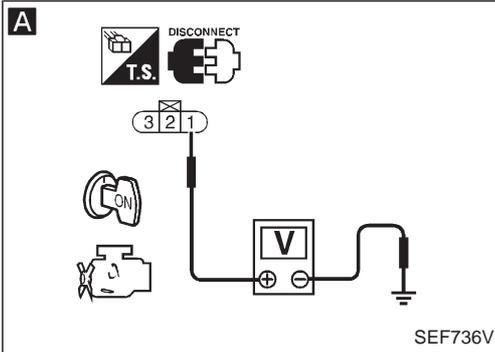
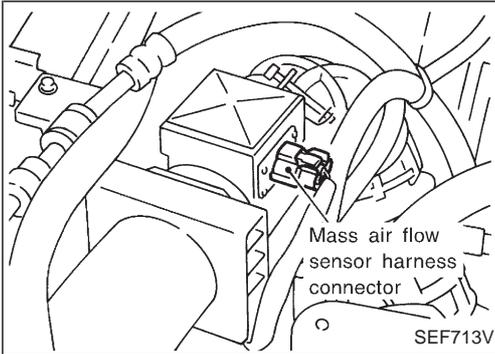


TEC424

TROUBLE DIAGNOSIS FOR "MASS AIR FLOW SEN" (DTC 12)

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

DIAGNOSTIC PROCEDURE



TROUBLE DIAGNOSIS FOR "MASS AIR FLOW SEN" (DTC 12)

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

COMPONENT INSPECTION

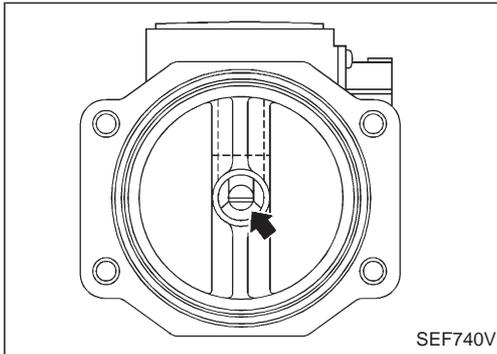
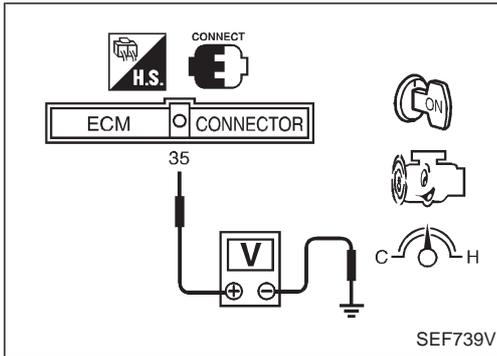
Mass air flow sensor

1. Start engine and warm it up to normal operating temperature.
2. Check voltage between ECM terminal ③⑤ and ground under the following condition.

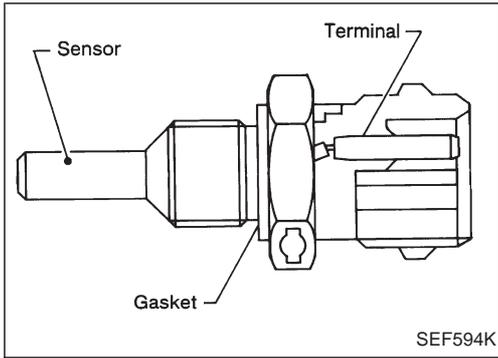
Conditions	Voltage V
Ignition switch "ON" (Engine stopped.)	Less than 1.0
Idle (Engine is warmed-up sufficiently.)	1.0 - 1.7
2,500 rpm	Approximately 2.1
Idle to about 4,000 rpm*	1.0 - 1.7 to Approx. 4.0

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

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

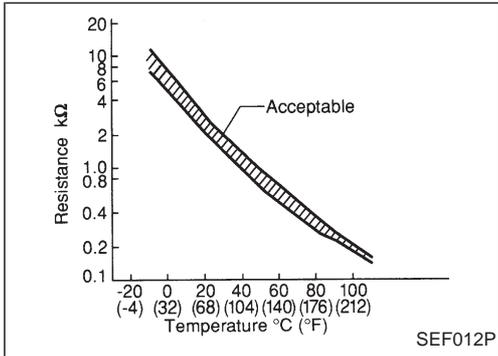


TROUBLE DIAGNOSIS FOR "COOLANT TEMP SEN" (DTC 13)



Engine Coolant Temperature (ECT) Sensor

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.

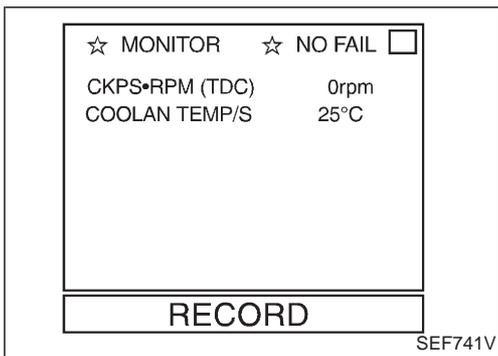


<Reference data>

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)	2.3	0.68 - 1.00
90 (194)	1.0	0.236 - 0.260

*: These data are reference values and measured between ECM terminal ⑰ (Engine coolant temperature sensor) and ECM terminal ④ (ECCS ground).

Diagnostic Trouble Code No.	Malfunction is detected when ...	Check Items (Possible Cause)
13	<ul style="list-style-type: none"> An excessively high or low voltage from the sensor is entered to ECM. 	<ul style="list-style-type: none"> Harness or connectors (The sensor circuit is open or shorted.) Engine coolant temperature sensor



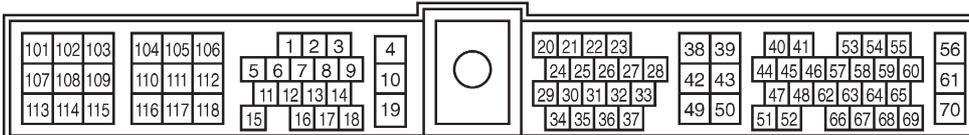
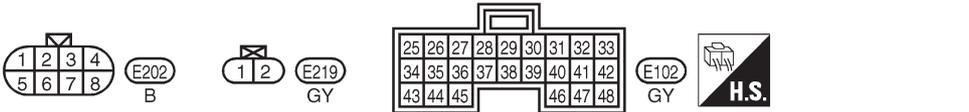
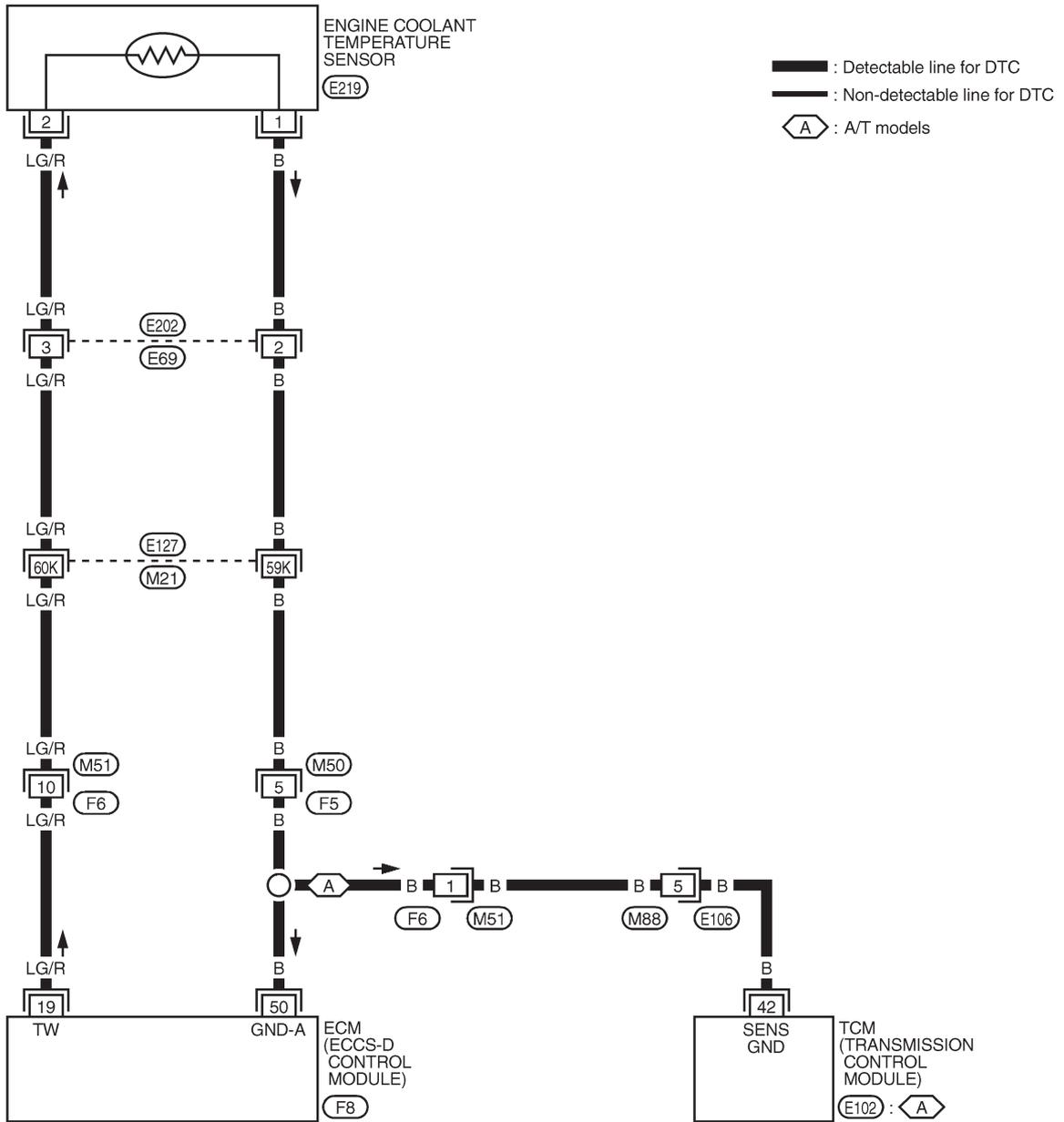
DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

- 1) Turn ignition switch "ON".
 - 2) Select "DATA MONITOR" mode with CONSULT.
 - 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.

TROUBLE DIAGNOSIS FOR "COOLANT TEMP SEN" (DTC 13)

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

EC-ECTS-01

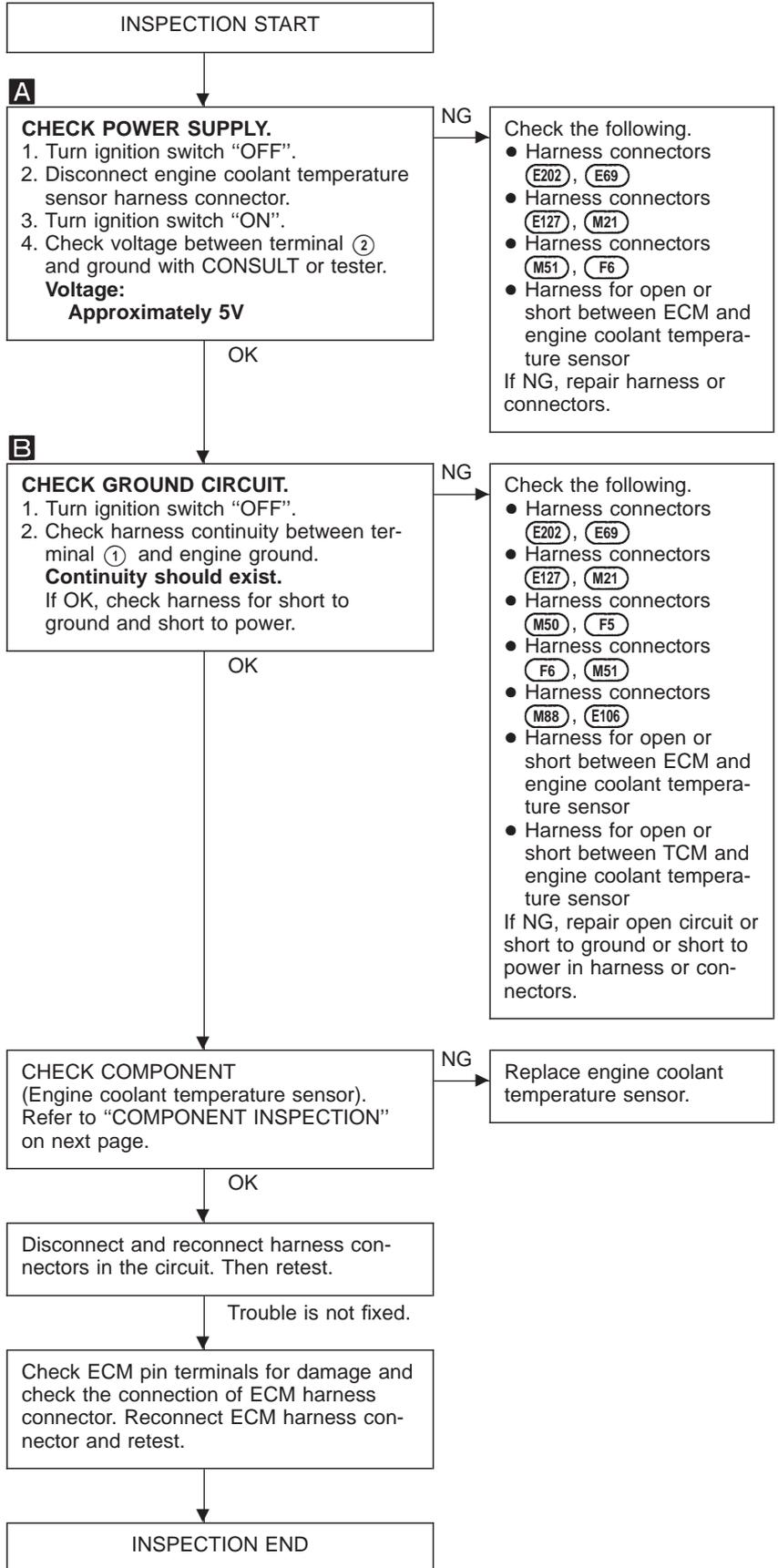
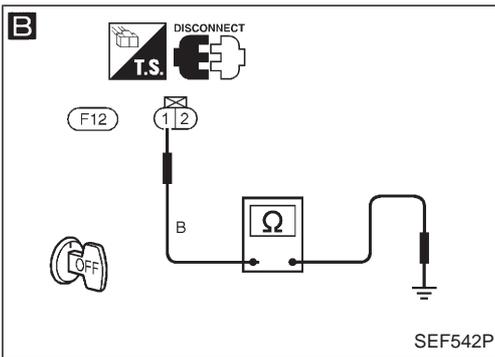
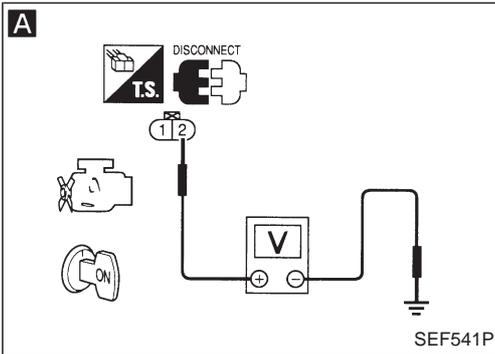
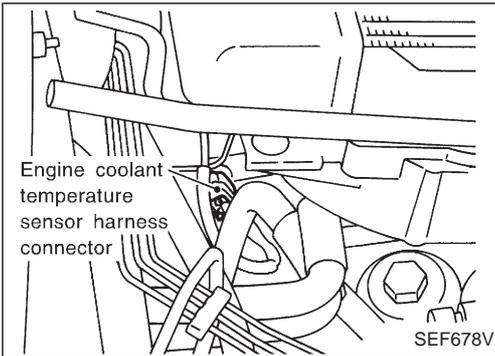


Refer to last page (Foldout page).
 (M21), (E127)

TROUBLE DIAGNOSIS FOR "COOLANT TEMP SEN" (DTC 13)

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

DIAGNOSTIC PROCEDURE



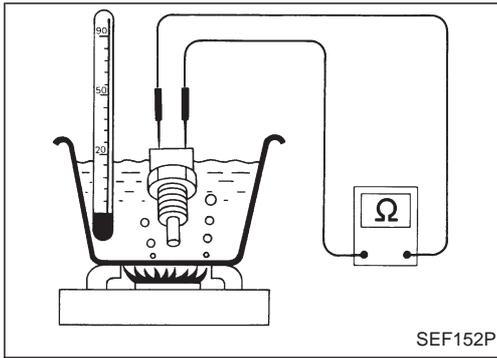
TROUBLE DIAGNOSIS FOR "COOLANT TEMP SEN" (DTC 13)

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

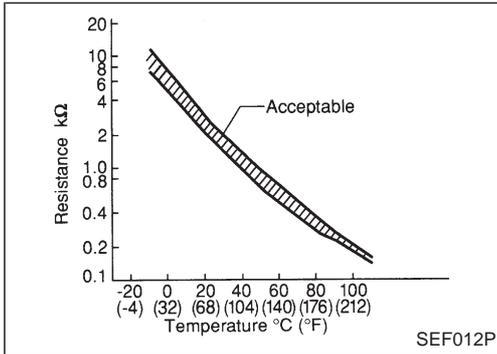
COMPONENT INSPECTION

Engine coolant temperature sensor

Check resistance as shown in the figure.

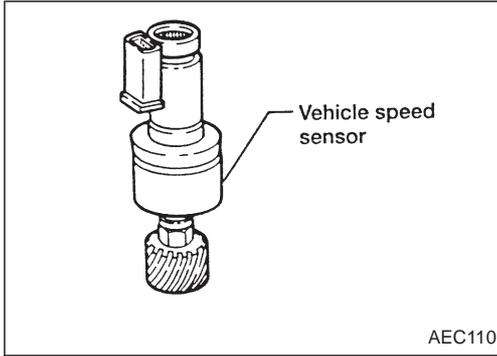


Temperature °C (°F)	Resistance kΩ
20 (68)	2.1 - 2.9
50 (122)	0.68 - 1.0
90 (194)	0.236 - 0.260



If NG, replace engine coolant temperature sensor.

TROUBLE DIAGNOSIS FOR "VEHICLE SPEED SEN" (DTC 14)



Vehicle Speed Sensor (VSS)

The vehicle speed sensor is installed in the transaxle. 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

Remarks: Specification data are reference values and are measured between each terminal and Ⓞ (ECCS ground) with a voltmeter.

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
26	L/OR	Vehicle speed sensor	<div style="border: 1px solid black; padding: 2px; display: inline-block;">Engine is running.</div> <ul style="list-style-type: none"> └ Lift up the vehicle. └ In 1st gear position └ Vehicle speed is 40 km/h (25 MPH). 	0 - BATTERY VOLTAGE (11 - 14V) SEF717V

ON BOARD DIAGNOSIS LOGIC

Diagnostic Trouble Code No.	Malfunction is detected when	Check Items (Possible Cause)
14	<ul style="list-style-type: none"> ● The almost 0 km/h (0 MPH) signal from vehicle speed sensor is sent to ECM even when vehicle is being driven. 	<ul style="list-style-type: none"> ● Harness or connector (The vehicle speed sensor circuit is open or shorted.) ● Vehicle speed sensor

TROUBLE DIAGNOSIS FOR "VEHICLE SPEED SEN" (DTC 14)

Vehicle Speed Sensor (VSS) (Cont'd)

OVERALL FUNCTION CHECK

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

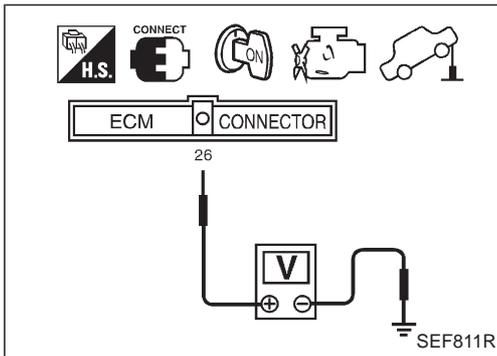
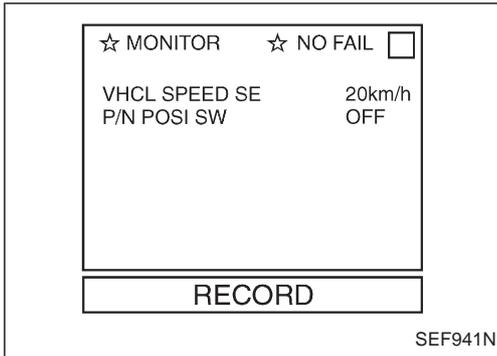
- 1) Jack up drive wheels.
- 2) Start engine.
- 3) Read vehicle speed sensor signal in "DATA MONITOR" mode with CONSULT.

The vehicle speed on CONSULT should be able to exceed 10 km/h (6 MPH) when rotating wheels with suitable gear position.

OR

- 1) Jack up drive wheels.
- 2) Start engine.
- 3) Rotate drive wheel by hand.
- 4) Check voltage between ECM terminal ②⑥ and ground with tester.

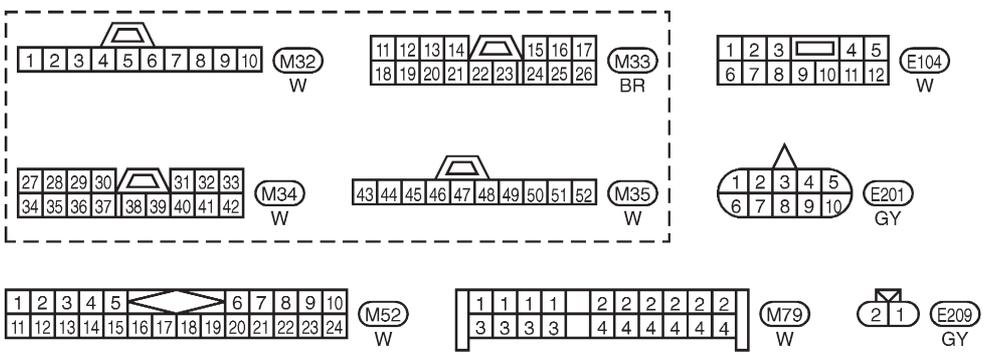
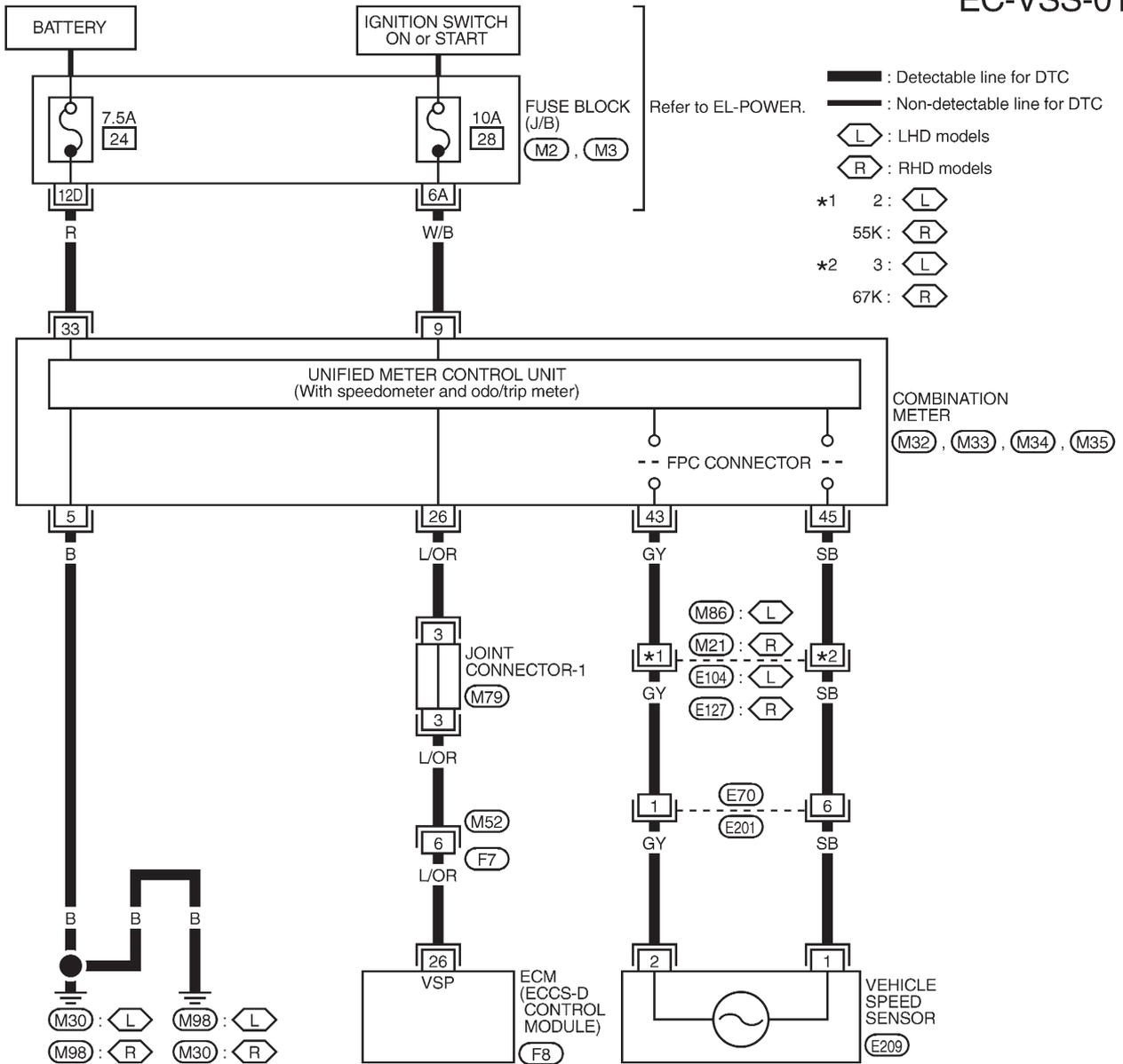
Voltage should vary between 0V - battery voltage.



TROUBLE DIAGNOSIS FOR "VEHICLE SPEED SEN" (DTC 14)

Vehicle Speed Sensor (VSS) (Cont'd)

EC-VSS-01



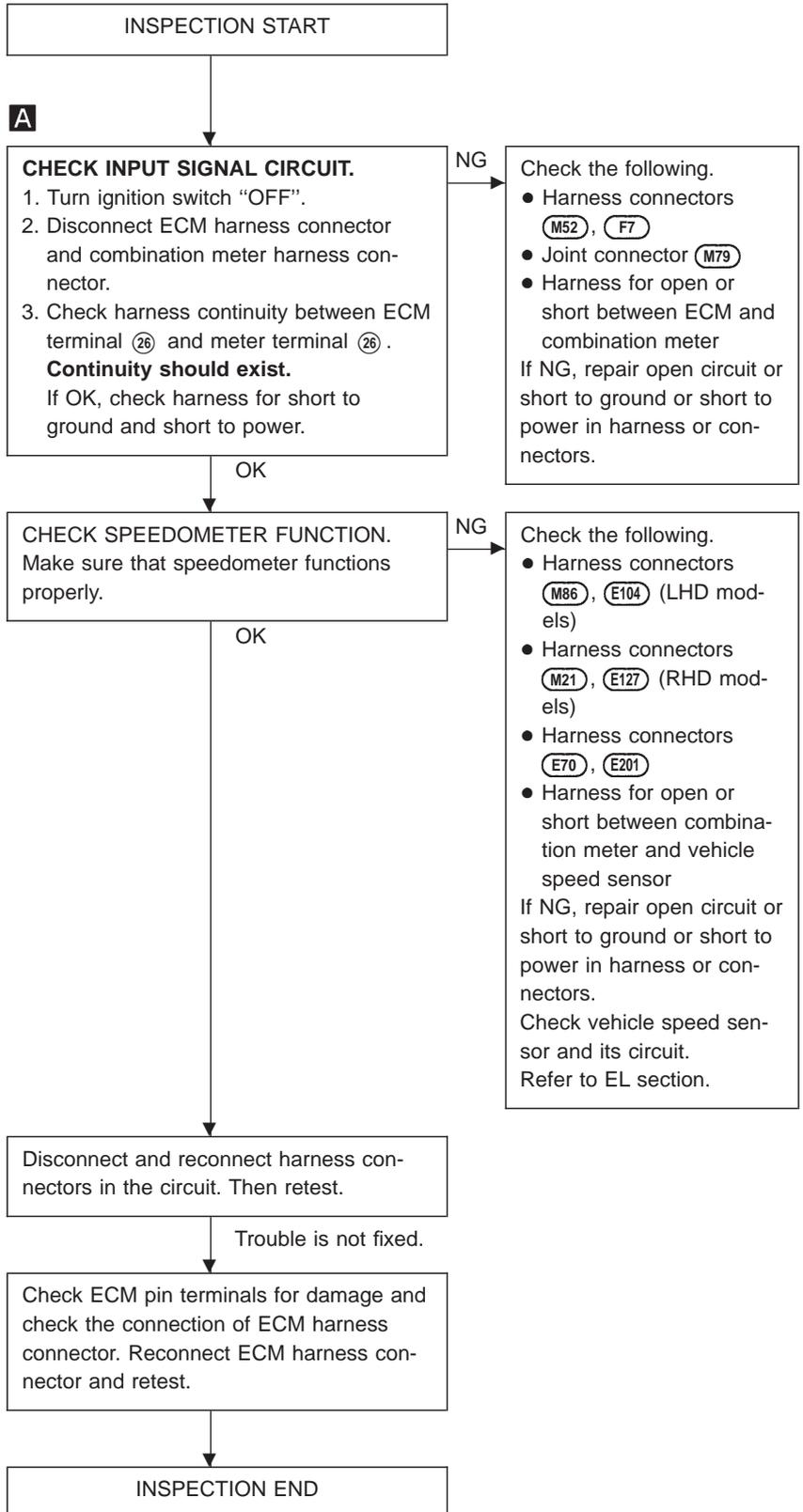
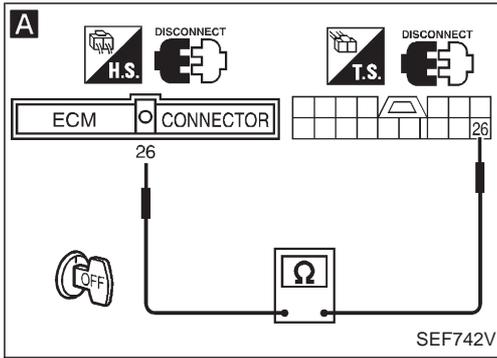
Refer to last page (Foldout page).

- M21, E127
- M2
- M3
- F8

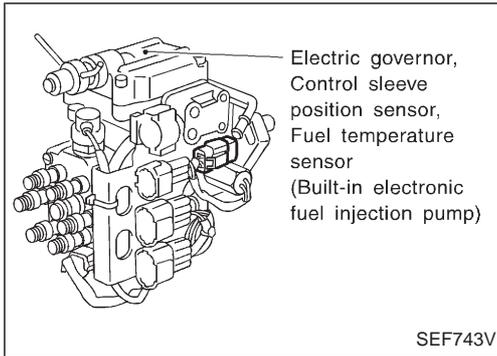
TROUBLE DIAGNOSIS FOR "VEHICLE SPEED SEN" (DTC 14)

Vehicle Speed Sensor (VSS) (Cont'd)

DIAGNOSTIC PROCEDURE



TROUBLE DIAGNOSIS FOR “CONT SLEEV POS SEN” (DTC 15)



Control Sleeve Position Sensor (CSPS)

The control sleeve position sensor is installed on the electric governor. It senses the position of control sleeve (rotor angle) while the control sleeve is being driven by the electric governor, and feeds it back to the ECM.

CONSULT REFERENCE VALUE IN DATA MONITOR MODE

Remarks: Specification data are reference values.

MONITOR ITEM	CONDITION	SPECIFICATION
C/SLEEV POS/S	● Engine: After warming up	1.0 - 3.5V

ECM TERMINALS AND REFERENCE VALUE

Remarks: Specification data are reference values and are measured between each terminal and Ⓞ (ECCS ground) with a voltmeter.

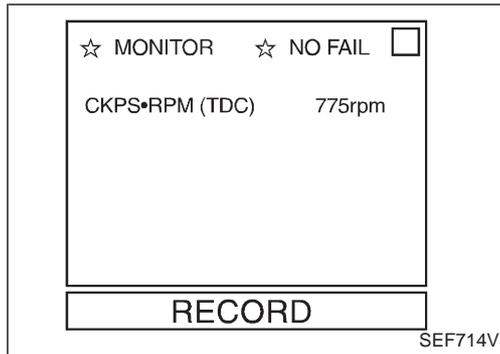
TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
53 57	W	Control sleeve position sensor power supply	<div style="border: 1px solid black; padding: 2px; display: inline-block;">Engine is running.</div> Idle speed	Approximately 2.6V SEF724V
62 66	B	Control sleeve position sensor ground	<div style="border: 1px solid black; padding: 2px; display: inline-block;">Engine is running.</div> Idle speed	Approximately 2.6V SEF725V
63 67	R	Control sleeve position sensor	<div style="border: 1px solid black; padding: 2px; display: inline-block;">Engine is running.</div> Idle speed	Approximately 2.6V SEF726V

TROUBLE DIAGNOSIS FOR "CONT SLEEV POS SEN" (DTC 15)

Control Sleeve Position Sensor (CSPS) (Cont'd)

ON BOARD DIAGNOSIS LOGIC

Diagnostic Trouble Code No.	Malfunction is detected when	Check Items (Possible cause)
15	<ul style="list-style-type: none"> ● An excessively high or low voltage from the sensor is detected by ECM. ● An improper voltage signal from the sensor is detected by ECM during engine running. 	<ul style="list-style-type: none"> ● Harness or connectors (The control sleeve position sensor circuit is open or shorted.) ● Control sleeve position sensor



DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE



- 1) Turn ignition switch "ON" and select "DATA MONITOR" mode with CONSULT.
- 2) Start engine and run it for at least 2 seconds at idle speed.

OR

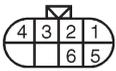
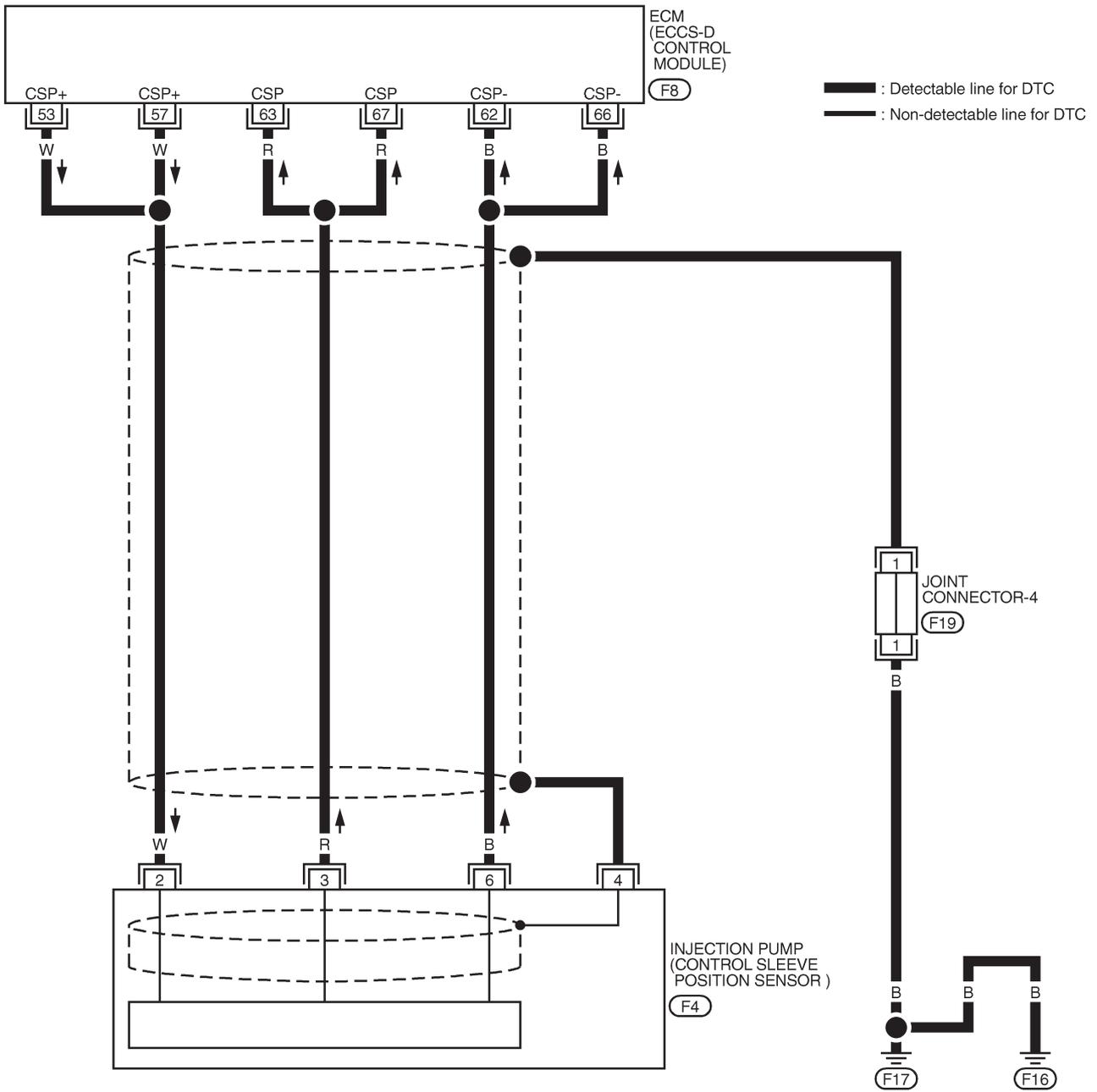


- 1) Start engine and run it for at least 2 seconds at idle speed.
- 2) Turn ignition switch "OFF", wait at least 5 seconds and then "ON".
- 3) Perform "Diagnostic Test Mode II (Self-diagnostic results)" with ECM.

TROUBLE DIAGNOSIS FOR "CONT SLEEV POS SEN" (DTC 15)

Control Sleeve Position Sensor (CSPS) (Cont'd)

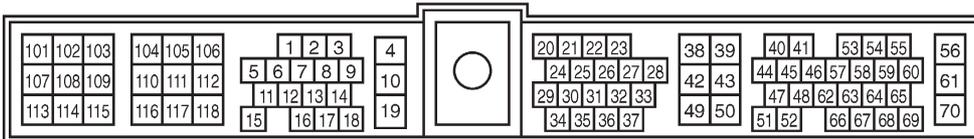
EC-CSPS-01



(F4)
GY



(F19)
GY

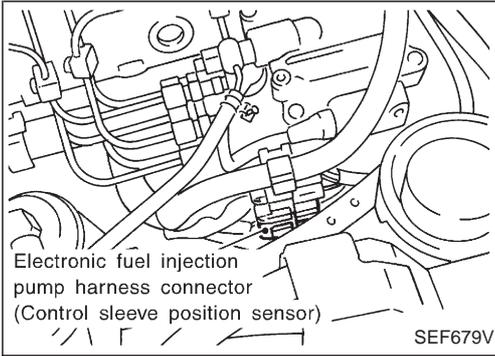


(F8)
W



TROUBLE DIAGNOSIS FOR "CONT SLEEV POS SEN" (DTC 15)

Control Sleeve Position Sensor (CSPS) (Cont'd) DIAGNOSTIC PROCEDURE



INSPECTION START

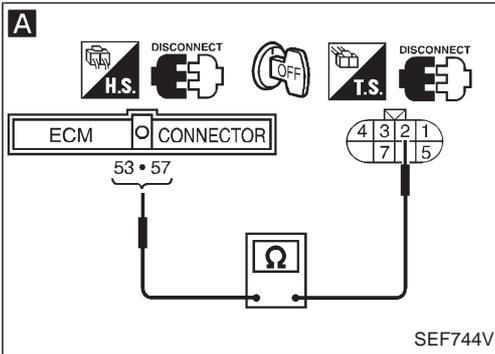
A

CHECK POWER SUPPLY CIRCUIT.

1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector and electronic fuel injection pump harness connector.
3. Check harness continuity between terminal ② and ECM terminals ⑤③, ⑤⑦.

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.



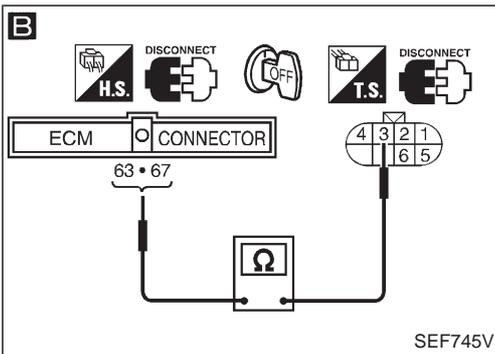
B

CHECK INPUT SIGNAL CIRCUIT.

Check harness continuity between sensor terminal ③ and ECM terminals ⑥③, ⑥⑦.

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.



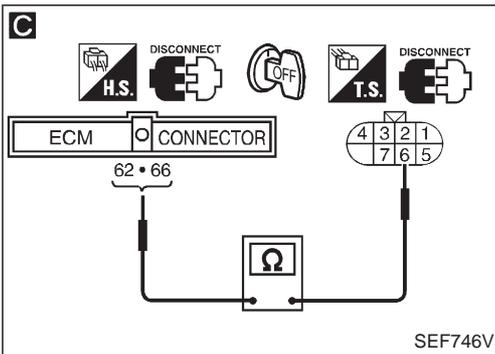
C

CHECK GROUND CIRCUIT-I.

Check harness continuity between sensor terminal ⑥ and ECM terminals ⑥②, ⑥⑥.

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.



D

CHECK GROUND CIRCUIT-II.

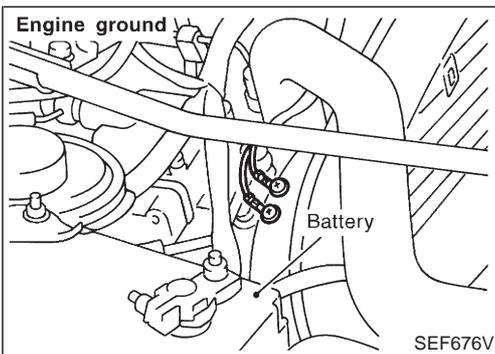
1. Loosen and retighten engine ground screws.
2. Check harness continuity between terminal ④ and engine ground.

Continuity should exist.
If OK, check harness for short to ground and short to power.

NG → Check the following.

- Joint connector (F19)
- Harness for open or short between control sleeve position sensor and engine ground

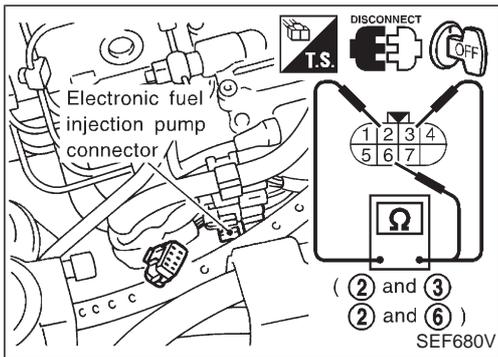
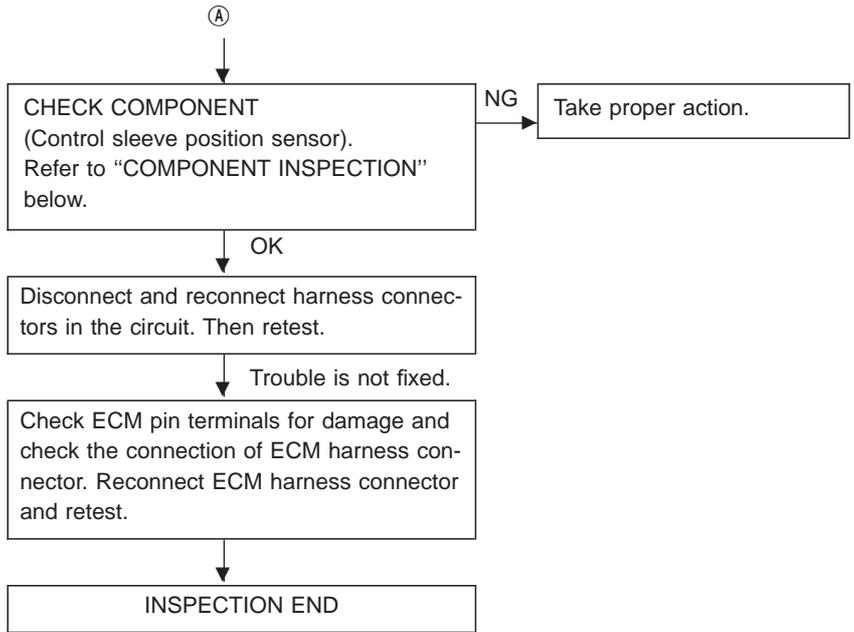
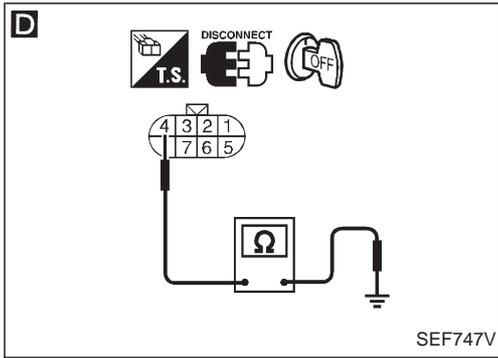
If NG, repair open circuit or short to ground or short to power in harness or connectors.



Ⓐ

TROUBLE DIAGNOSIS FOR "CONT SLEEV POS SEN" (DTC 15)

Control Sleeve Position Sensor (CSPS) (Cont'd)

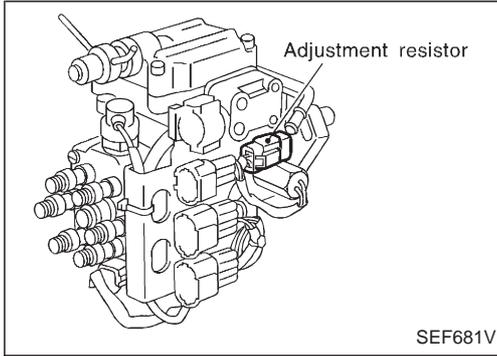


COMPONENT INSPECTION

Control sleeve position sensor

1. Disconnect electronic fuel injection pump harness connector.
2. Check continuity between terminals ② and ③, ② and ⑥.
Resistance: Approximately 5.9Ω [at 23°C (73°F)]
If NG, take proper action.

TROUBLE DIAGNOSIS FOR "ADJUST RESISTOR" (DTC 17)



Adjustment Resistor

The adjustment resistor is used to achieve uniform pump characteristics.

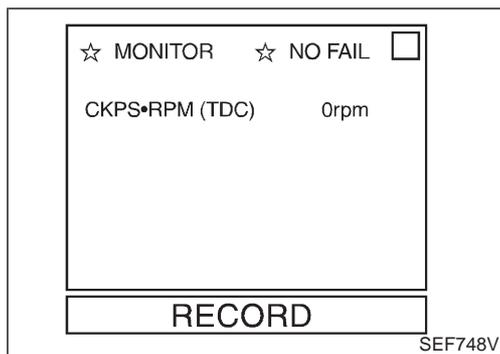
ECM TERMINALS AND REFERENCE VALUE

Remarks: Specification data are reference values and are measured between each terminal and ④3 (ECCS ground) with a voltmeter.

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
46	Y	Adjustment resistor	Ignition switch "ON"	Approximately 0 - 4.6V (Voltage varies with part number of adjustment resistor.)
50	B	Sensors' ground	Engine is running. (Warm-up condition) └ Idle speed	Approximately 0V

ON BOARD DIAGNOSIS LOGIC

Diagnostic Trouble Code No.	Malfunction is detected when ...	Check Items (Possible Cause)
17	<ul style="list-style-type: none"> An excessively high or low voltage from the resistor is detected by ECM. 	<ul style="list-style-type: none"> Harness or connectors (The adjustment resistor circuit is open or shorted.) Adjustment resistor



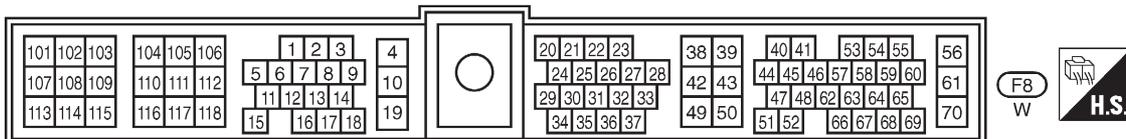
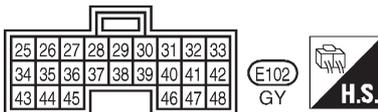
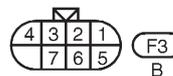
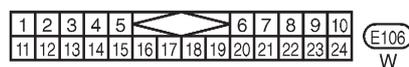
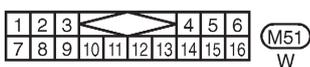
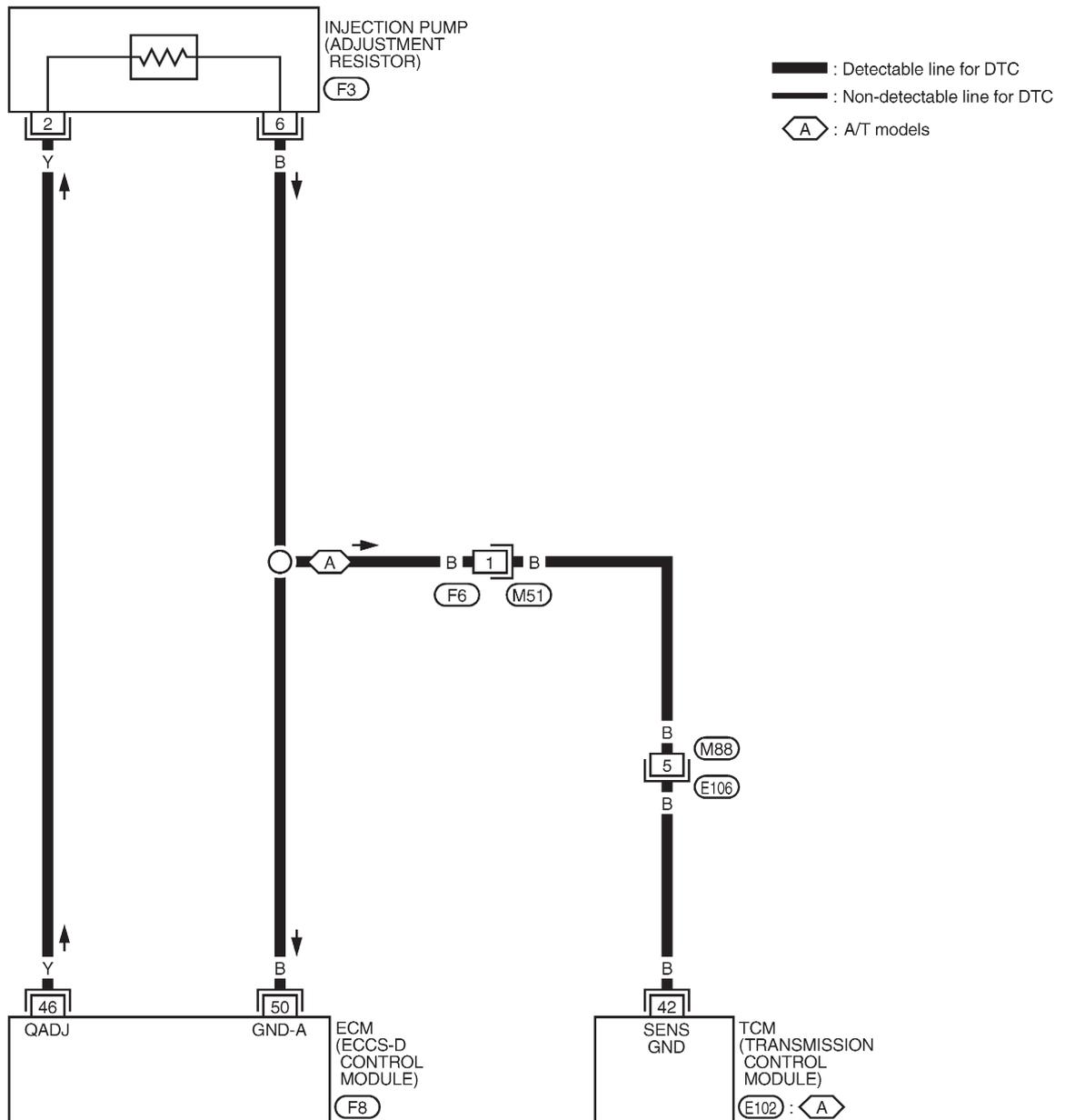
DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

- 1) Turn ignition switch "ON".
 - 2) Select "DATA MONITOR" mode with CONSULT.
 - 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.

TROUBLE DIAGNOSIS FOR "ADJUST RESISTOR" (DTC 17)

Adjustment Resistor (Cont'd)

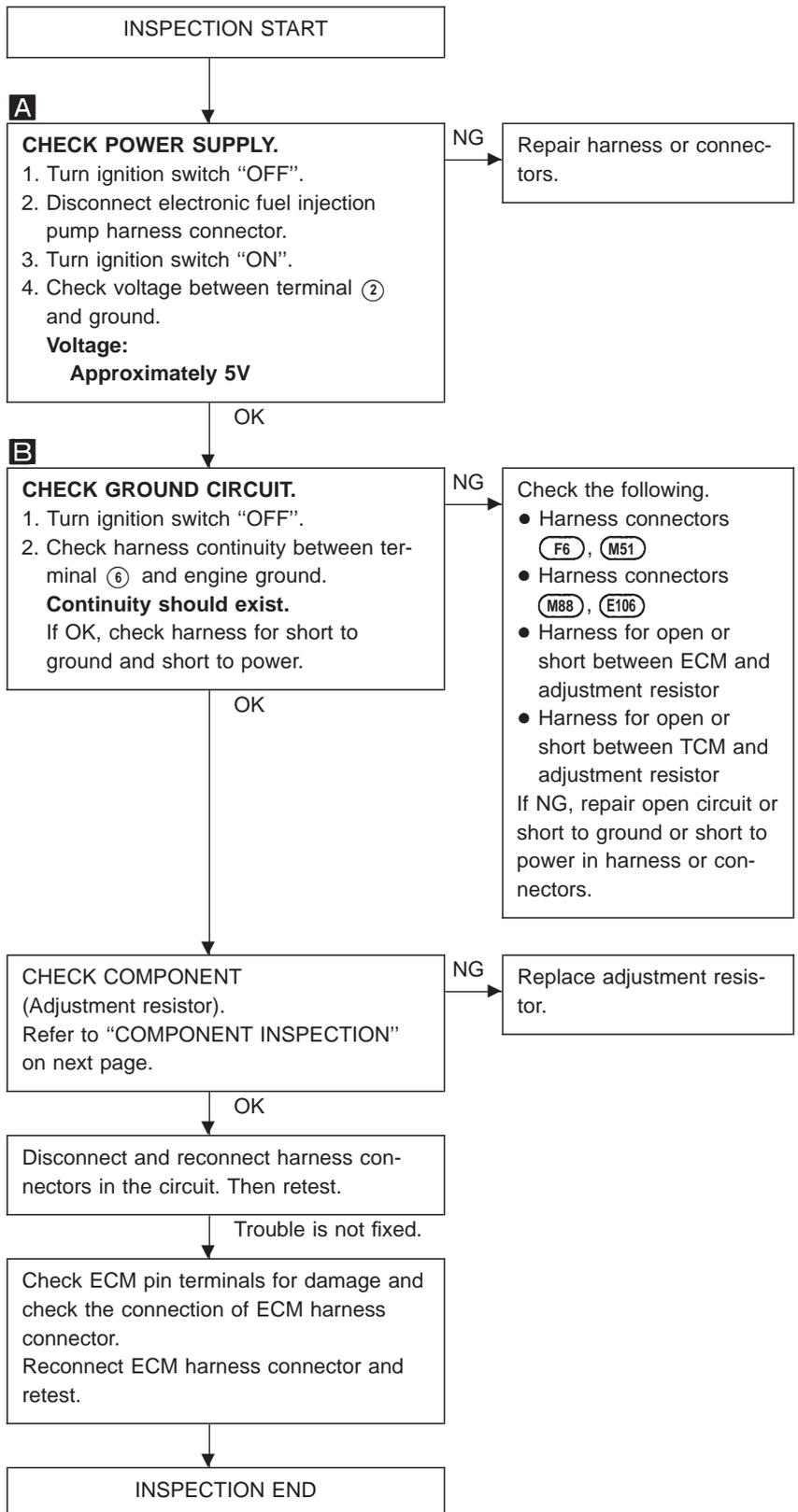
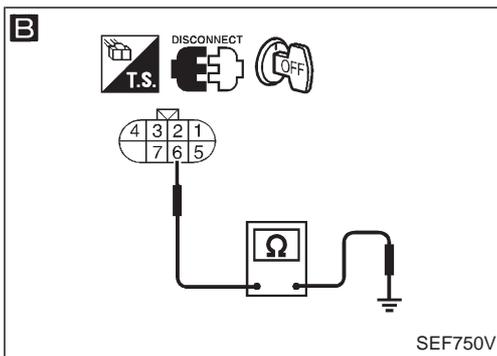
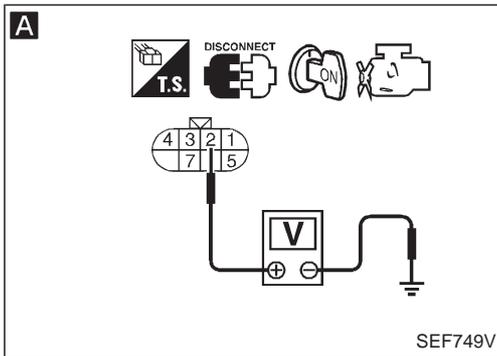
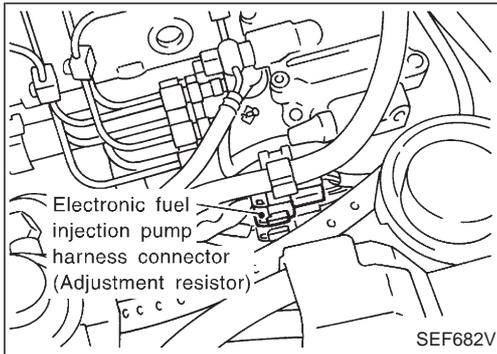
EC-ADJRES-01



TROUBLE DIAGNOSIS FOR "ADJUST RESISTOR" (DTC 17)

Adjustment Resistor (Cont'd)

DIAGNOSTIC PROCEDURE



TROUBLE DIAGNOSIS FOR “ADJUST RESISTOR” (DTC 17)

Adjustment Resistor (Cont'd)

COMPONENT INSPECTION

Adjustment resistor

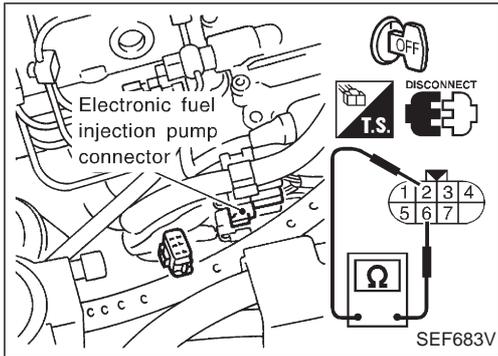
Check resistance between terminals ② and ⑥.

Resistance: Approximately 0.2 - 15.0 k Ω [at 25°C (77°F)]

Resistance value varies with adjustment sensor numbers.

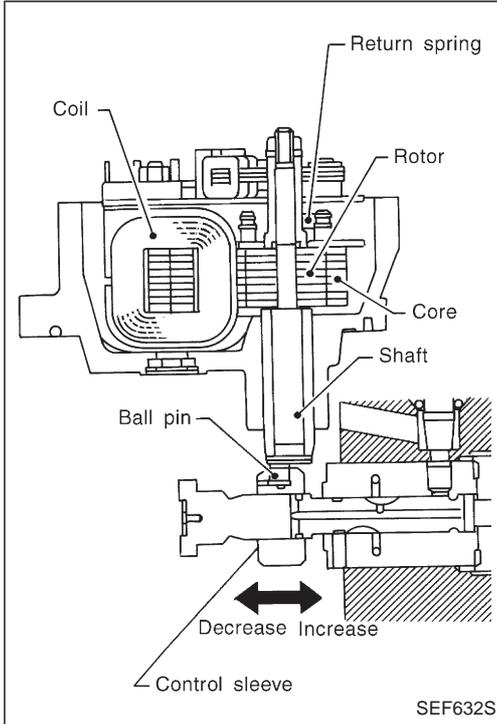
If NG, replace adjustment resistor.

Always replace adjustment resistor with a new one which has same number on label.



TROUBLE DIAGNOSIS FOR “F/INJ F/B 2” (DTC 18), “F/INJ F/B” (DTC 22), “ELECTRIC GOV” (DTC 25)

Electric Governor

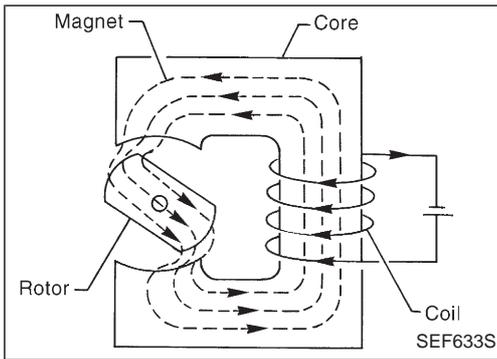


The electric governor is built into the electronic fuel injection pump. It moves the control sleeve to increase or decrease the amount of fuel injected.

When current flows through the coil, a magnetic force is produced, rotating the rotor. The rotor shaft is installed to the control sleeve via a ball pin which is eccentrically situated in relation to the rotor shaft. With this arrangement, the control sleeve can be moved in relation to rotor rotation.

The rotor's rotating angle is determined by a balanced condition of magnetic force (generated by current flow regulated by means of the ECM) and tension of return spring (installed to rotor). The larger the current flow through the coil, the greater the rotor's rotating angle. This means that the control sleeve moves to the right, increasing the amount of fuel injected.

The ECM regulates the current flow through the coil by changing the duty ratio which controls the ON-OFF operation of the electric governor grounding circuit.



ECM TERMINALS AND REFERENCE VALUE

Remarks: Specification data are reference values and are measured between each terminal and Ⓞ (ECCS ground) with a voltmeter.

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
4	B/Y	ECCS relay (Self-shutoff)	Ignition switch "ON"	0 - 1.5V
			Ignition switch "OFF" └ For a few seconds after turning ignition switch "OFF"	
			Ignition switch "OFF" └ A few seconds passed after turning ignition switch "OFF"	BATTERY VOLTAGE (11 - 14V)
101 107	R/B	Electric governor	Engine is running. └ Idle speed	BATTERY VOLTAGE (11 - 14V)

**TROUBLE DIAGNOSIS FOR “F/INJ F/B 2” (DTC 18),
“F/INJ F/B” (DTC 22), “ELECTRIC GOV” (DTC 25)**

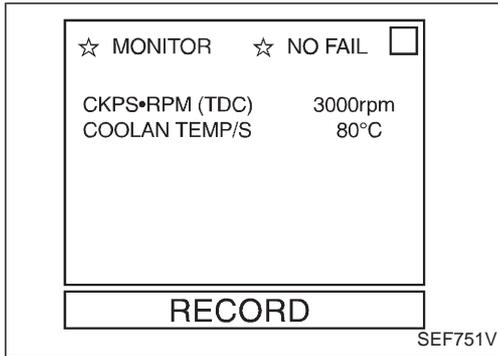
Electric Governor (Cont'd)

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
102 108	G/Y	Electric governor ground	Engine is running. └ Idle speed	Approximately 10V SEF727V
			Engine is running. └ Engine speed is 2,000 rpm.	Approximately 10V SEF728V
116 117	W	Power supply for ECM	Ignition switch “ON”	BATTERY VOLTAGE (11 - 14V)

ON BOARD DIAGNOSIS LOGIC

Diagnostic Trouble Code No.	Malfunction is detected when	Check Items (Possible cause)
18, 22, 25	<ul style="list-style-type: none"> Fuel injection feedback system does not operate properly. (This system consists essentially of ECM, electric governor and control sleeve position sensor.) 	<ul style="list-style-type: none"> Main power supply circuit (ECM terminals (116), (117)) and fuse Harness or connectors (Electric governor and control sleeve position sensor circuit) Electric governor Electronic fuel injection pump ECM

TROUBLE DIAGNOSIS FOR "F/INJ F/B 2" (DTC 18), "F/INJ F/B" (DTC 22), "ELECTRIC GOV" (DTC 25)



Electric Governor (Cont'd)

DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

Note: If DTC 18, 22, 25 and DTC 15 are displayed, perform TROUBLE DIAGNOSIS FOR DTC 15. (See EC-87.)



- 1) Turn ignition switch "ON" and select "DATA MONITOR" mode with CONSULT.
- 2) Start engine and warm it up to normal operating temperature.
- 3) Run engine for 2 seconds at 3,000 rpm. Return engine speed to idle, then increase to 3,000 rpm under no load.

OR



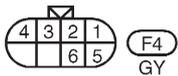
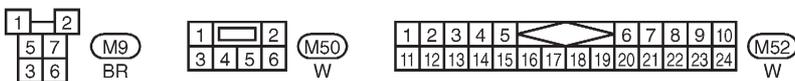
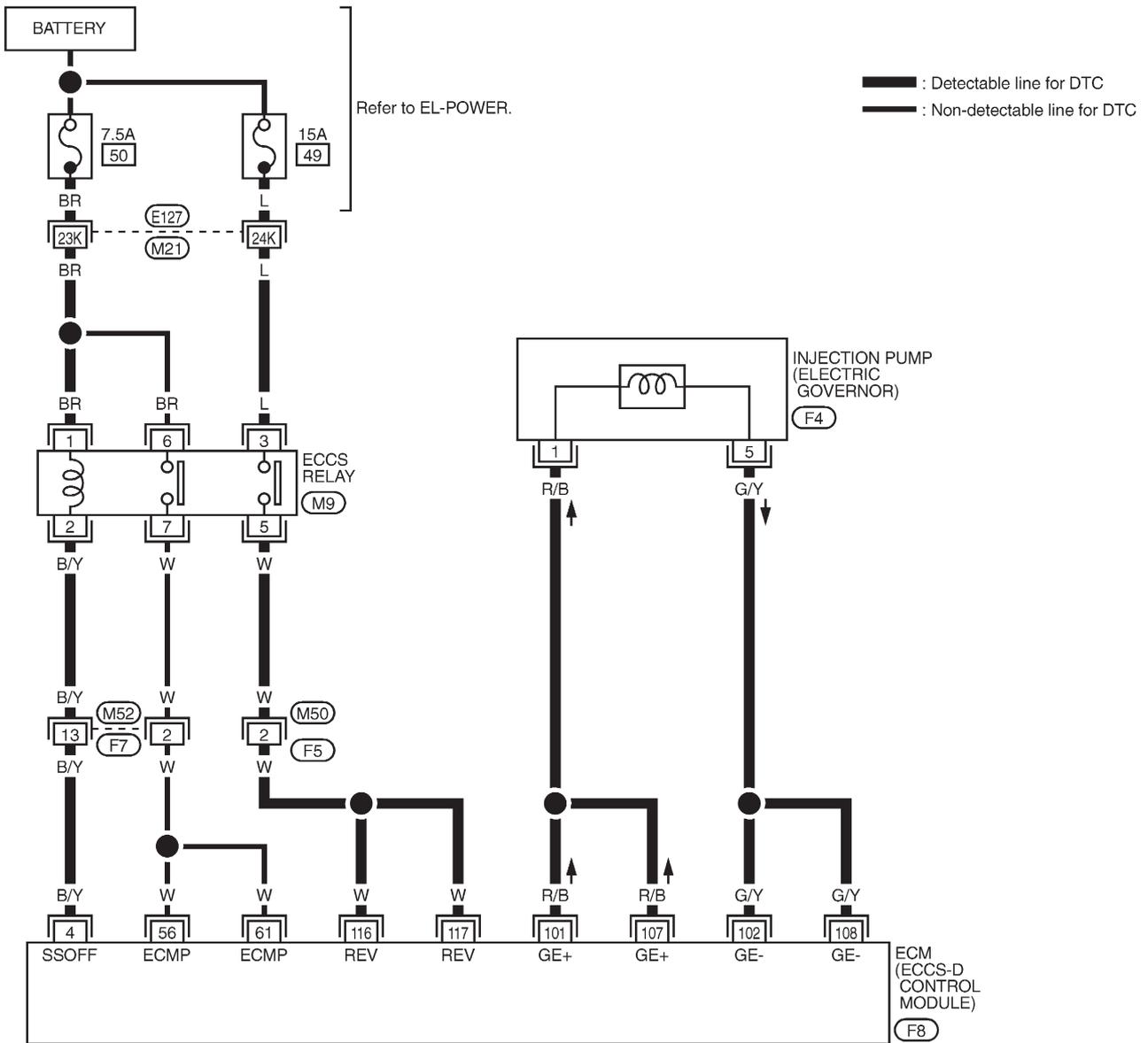
- 1) Start engine and warm it up to normal operating temperature.
- 2) Run engine for 2 seconds at 3,000 rpm. Return engine speed to idle, then increase to 3,000 rpm under no load.
- 3) Turn ignition switch "OFF", wait at least 5 seconds and then turn "ON".
- 4) Perform "Diagnostic Test Mode II (Self-diagnostic results)" with ECM.

Note: If a malfunction occurs intermittently, conduct suitable driving pattern for 10 minutes. This makes it possible to determine DTC.

TROUBLE DIAGNOSIS FOR "F/INJ F/B 2" (DTC 18), "F/INJ F/B" (DTC 22), "ELECTRIC GOV" (DTC 25)

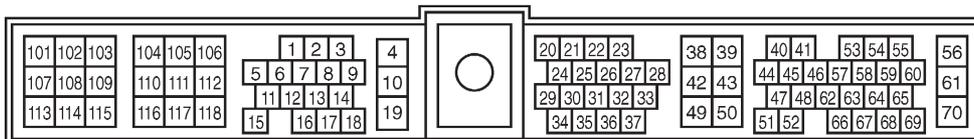
Electric Governor (Cont'd)

EC-GOVNR-01



Refer to last page (Foldout page).

M21, E127



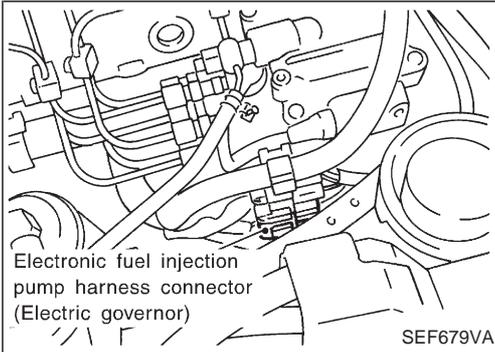
F8
W



TROUBLE DIAGNOSIS FOR "F/INJ F/B 2" (DTC 18), "F/INJ F/B" (DTC 22), "ELECTRIC GOV" (DTC 25)

Electric Governor (Cont'd)

DIAGNOSTIC PROCEDURE

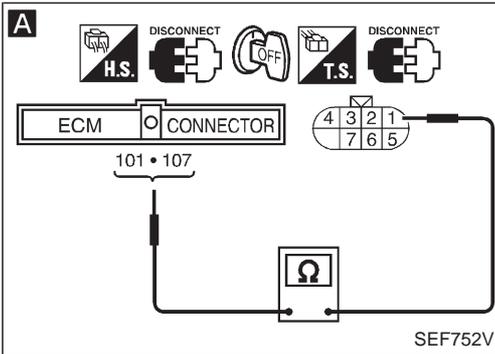


INSPECTION START

CHECK POWER SUPPLY.
Refer to EC-63.

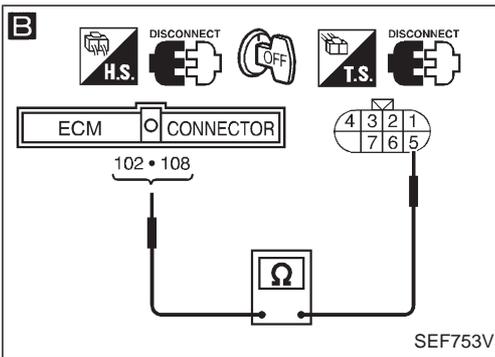
A
CHECK POWER SUPPLY CIRCUIT.
1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector and electronic fuel injection pump harness connector.
3. Check harness continuity between terminal ① and ECM terminals ⑩①, ⑩⑦.
Continuity should exist.
If OK, check harness for short to ground and short to power.

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



B
CHECK GROUND CIRCUIT.
Check harness continuity between terminal ⑤ and ECM terminals ⑩②, ⑩⑧.
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.



CHECK COMPONENT
(Electric governor).
Refer to "COMPONENT INSPECTION" below.

NG → Take proper action.

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

Trouble is not fixed.

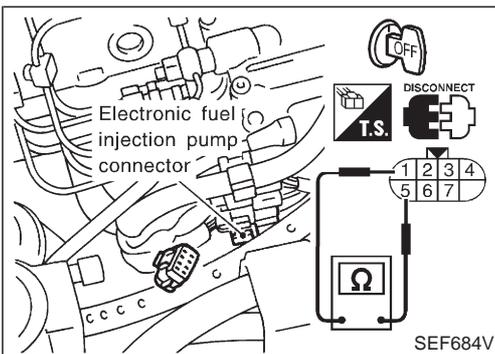
Check ECM pin terminals for damage and check the connection of ECM harness connector. Reconnect ECM harness connector and retest.

INSPECTION END

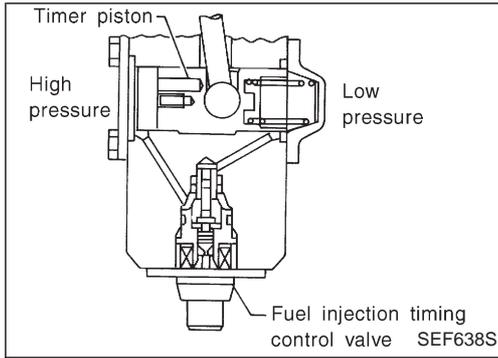
COMPONENT INSPECTION

Electric governor

1. Disconnect electronic fuel injection pump harness connector.
2. Check continuity between terminals ① and ⑤.
Resistance: Approximately 0.68Ω [at 23°C (73°F)]
If NG, take proper action.



TROUBLE DIAGNOSIS FOR "F/INJ TIMG F/B" (DTC 21)



Injection Timing Control Valve

The injection timing control valve is built into the electronic fuel injection pump. It controls the timer piston to change the fuel injection timing.

The timing control valve is a solenoid valve located in the line between high-pressure chamber and low-pressure chamber. It changes fuel pressure in the high-pressure chamber.

When current flows through the solenoid (the solenoid turns ON), the timing control valve opens, advancing fuel injection timing. When current does not flow through it, the timing control valve closes, retarding injection timing.

The ECM emits an ON-OFF duty signal. The longer the OFF-duration, the greater the advance angle. The longer the ON-duration, the greater the retard angle. This means that changing the ON-OFF duty ratio makes it possible to achieve an optimal advance angle and accurately control fuel injection timing.

CONSULT REFERENCE VALUE IN DATA MONITOR MODE

Remarks: Specification data are reference values.

MONITOR ITEM	CONDITION		SPECIFICATION
ACT INJ TIMG	<ul style="list-style-type: none"> Engine: After warming up Air conditioner switch: "OFF" Shift lever: "N" No-load 	Idle	-9.5 to -12.0°
		2,000 rpm	-10.0 to -15.5°
INJ TIMG C/V	<ul style="list-style-type: none"> Engine: After warming up, idle the engine. 		Approx. 50%

ECM TERMINALS AND REFERENCE VALUE

Remarks: Specification data are reference values and are measured between each terminal and ④ (ECCS ground) with a voltmeter.

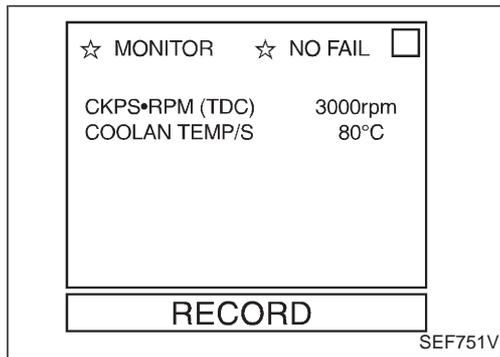
TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
104 110	L/W	Injection timing control valve	<div style="border: 1px solid black; padding: 2px;">Engine is running.</div> (Warm-up condition) └ Idle speed	BATTERY VOLTAGE (11 - 14V) SEF729V
			<div style="border: 1px solid black; padding: 2px;">Engine is running.</div> (Warm-up condition) └ Engine speed is 2,000 rpm.	BATTERY VOLTAGE (11 - 14V) SEF730V

TROUBLE DIAGNOSIS FOR "F/INJ TIMG F/B" (DTC 21)

Injection Timing Control Valve (Cont'd)

ON BOARD DIAGNOSIS LOGIC

Diagnostic Trouble Code No.	Malfunction is detected when	Check Items (Possible cause)
21	<ul style="list-style-type: none"> ● Injection timing feedback system does not operate properly. (This system consists essentially of ECM, injection timing control valve and needle lift sensor.) 	<ul style="list-style-type: none"> ● Harness or connectors [Injection timing control valve, needle lift sensor, crankshaft position sensor (TDC) circuits] ● Injection timing control valve ● Needle lift sensor ● Crankshaft position sensor (TDC) ● Air in fuel line



DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

Note: If both DTC 21 and 34 or 47 are displayed, perform TROUBLE DIAGNOSIS FOR DTC 34 or 47. (See EC-126 or EC-144.)



- 1) Turn ignition switch "ON" and select "DATA MONITOR" mode with CONSULT.
- 2) Start engine and warm it up to normal operating temperature.
- 3) Run engine for 2 seconds at 3,000 rpm. Return engine speed to idle, then increase to 3,000 rpm under no load.

OR



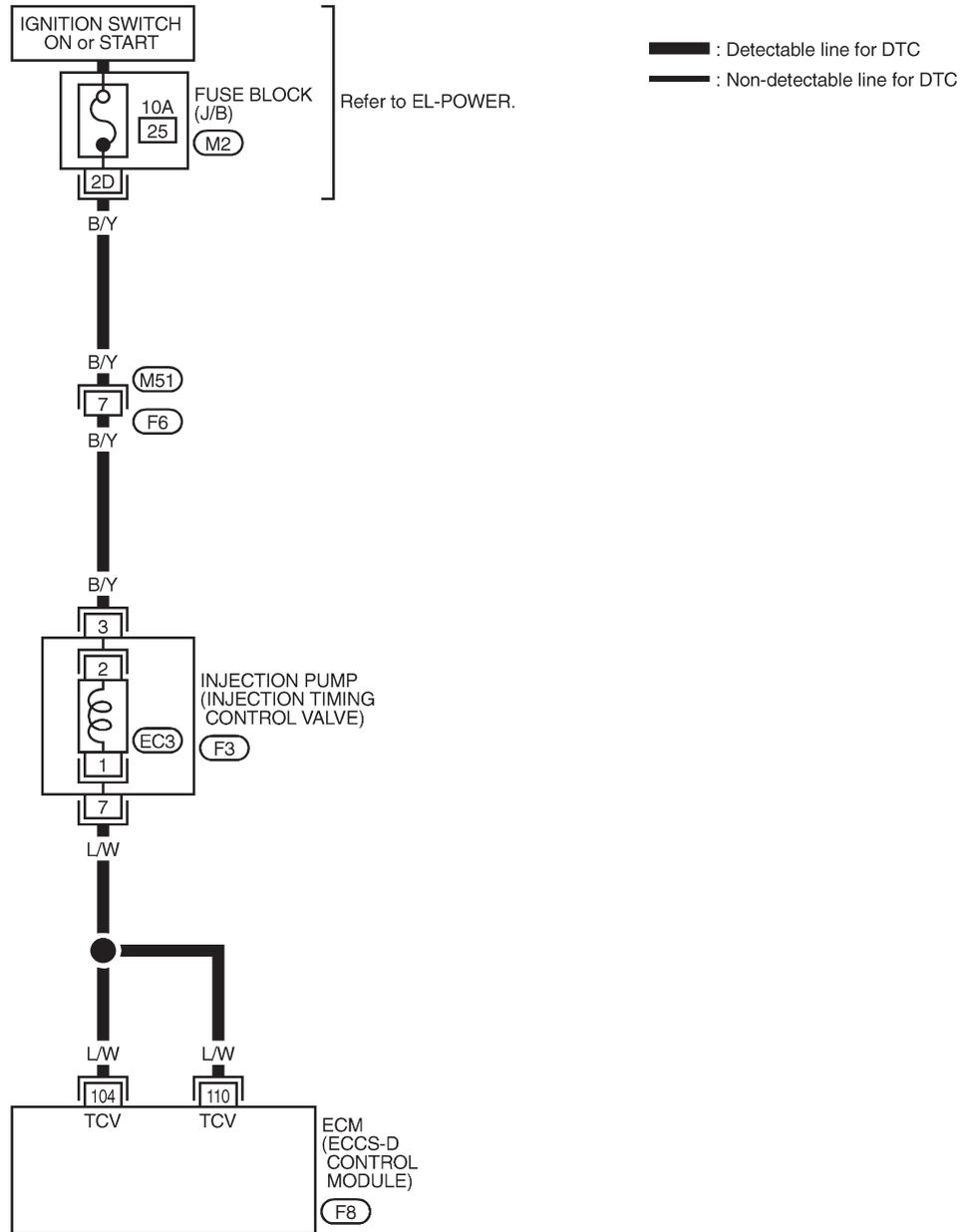
- 1) Start engine and warm it up to normal operating temperature.
- 2) Run engine for 2 seconds at 3,000 rpm. Return engine speed to idle, then increase to 3,000 rpm under no load.
- 3) Turn ignition switch "OFF", wait at least 5 seconds and then turn "ON".
- 4) Perform "Diagnostic Test Mode II (Self-diagnostic results)" with ECM.

Note: If a malfunction occurs intermittently, conduct suitable driving pattern for 10 minutes. This makes it possible to determine DTC.

TROUBLE DIAGNOSIS FOR "F/INJ TIMG F/B" (DTC 21)

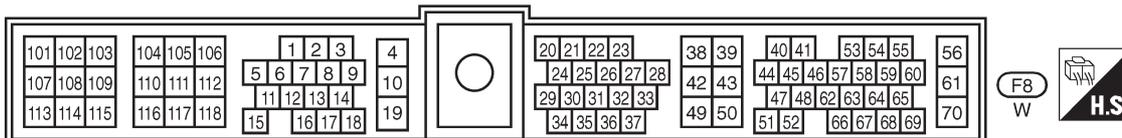
Injection Timing Control Valve (Cont'd)

EC-TCV-01



Refer to last page (Foldout page).

M2

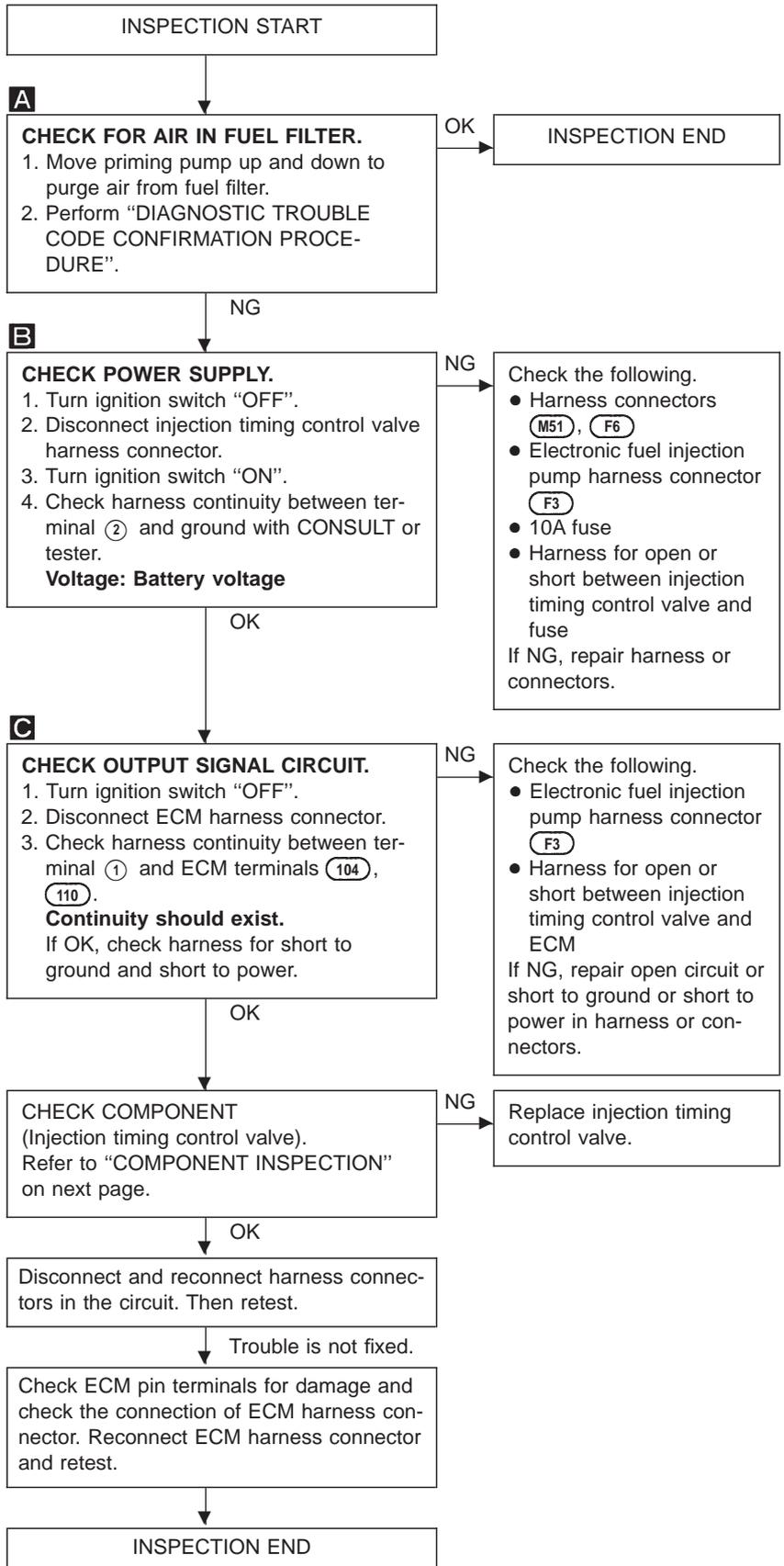
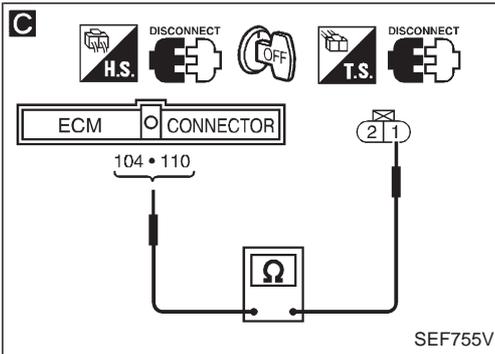
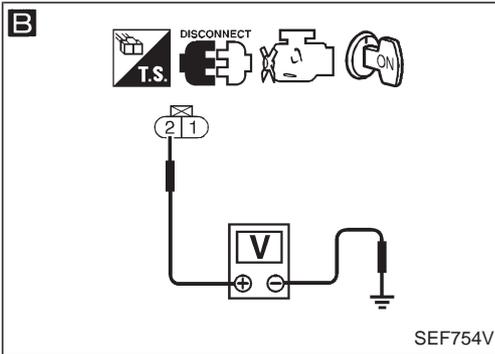
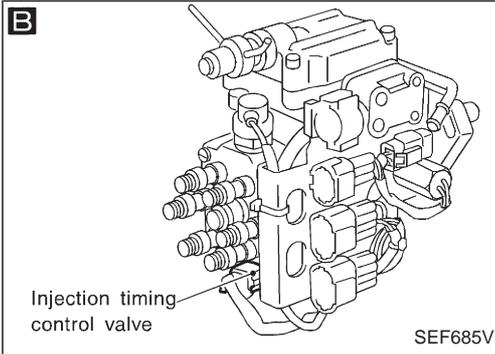
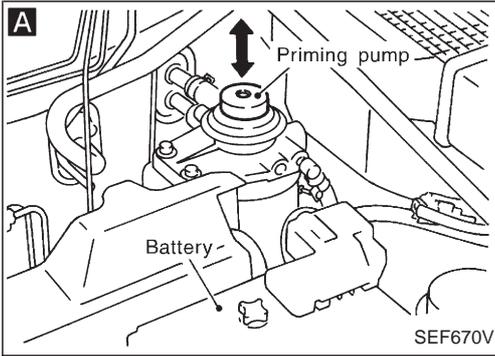


*: This connector is not shown in "HARNESS LAYOUT", EL section.

TROUBLE DIAGNOSIS FOR "F/INJ TIMG F/B" (DTC 21)

Injection Timing Control Valve (Cont'd)

DIAGNOSTIC PROCEDURE



TROUBLE DIAGNOSIS FOR "F/INJ TIMG F/B" (DTC 21)

Injection Timing Control Valve (Cont'd)

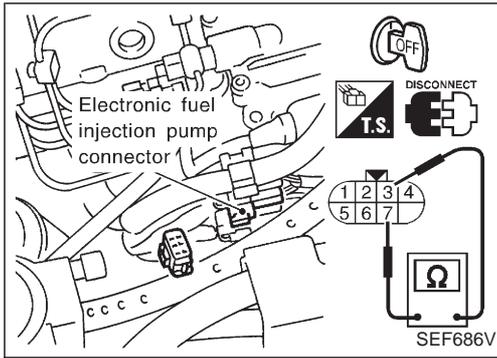
COMPONENT INSPECTION

Injection timing control valve

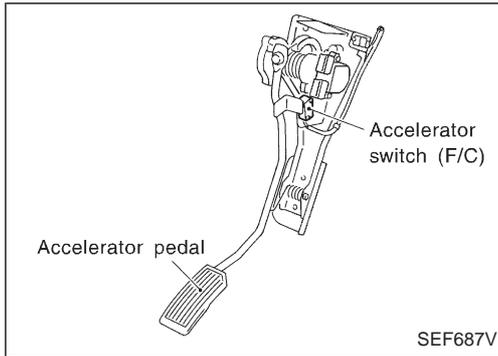
1. Reconnect injection timing control valve harness connector.
2. Disconnect electronic fuel injection pump harness connector.
3. Check resistance between terminals ③ and ⑦.

Resistance: Approximately 11Ω [at 20°C (68°F)]

If NG, replace injection timing control valve.



TROUBLE DIAGNOSIS FOR “ACCEL POS SW (F/C)” (DTC 23)



Accelerator Switch (F/C)

The accelerator switch is installed to the accelerator pedal assembly. The switch senses accelerator position and sends an ON-OFF signal to the ECM. The ECM uses the signal to control the fuel cut operation at deceleration for better fuel efficiency.

CONSULT REFERENCE VALUE IN DATA MONITOR MODE

Remarks: Specification data are reference values.

MONITOR ITEM	CONDITION		SPECIFICATION
ACCEL SW (FC)	<ul style="list-style-type: none"> Ignition switch: ON (Engine stopped) 	Accelerator pedal: released	CLOSE
		Accelerator pedal: slightly open	OPEN
DECELER F/CUT	<ul style="list-style-type: none"> Engine: After warming up 	Idle	OFF
		When accelerator pedal is released quickly with engine speed at 3,000 rpm or more.	ON

ECM TERMINALS AND REFERENCE VALUE

Remarks: Specification data are reference values and are measured between each terminal and ④ (ECCS ground) with a voltmeter.

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
29	R/L	Accelerator switch (F/C)	Ignition switch “ON” └ Accelerator pedal fully released	BATTERY VOLTAGE (11 - 14V)
			Ignition switch “ON” └ Accelerator pedal depressed	Approximately 0V

ON BOARD DIAGNOSIS LOGIC

Diagnostic Trouble Code No.	Malfunction is detected when	Check Items (Possible cause)
23	<ul style="list-style-type: none"> The OFF signal (short) is sent to the ECM for a certain period of time even when the accelerator pedal is not being depressed. 	<ul style="list-style-type: none"> Harness or connectors (The switch circuit is shorted.) Accelerator switch (F/C)

TROUBLE DIAGNOSIS FOR "ACCEL POS SW (F/C)" (DTC 23)

Accelerator Switch (F/C) (Cont'd)

DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

☆ MONITOR	☆ NO FAIL	<input type="checkbox"/>
CKPS•RPM (TDC)	0rpm	
ACCEL SW (FC)	CLOSE	
DECELER F/CUT	OFF	
RECORD		

SEF756V



- 1) Turn ignition switch "ON" and select "DATA MONITOR" mode with CONSULT.
- 2) Depress and release accelerator pedal once for 15 seconds.
- 3) Repeat step 2 for 26 times.

OR

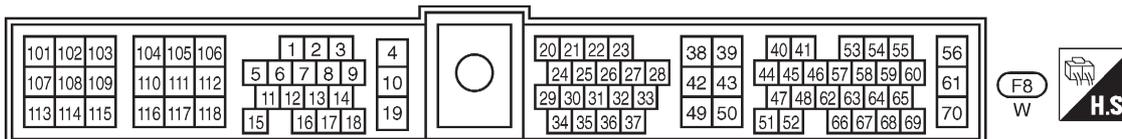
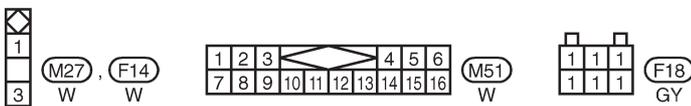
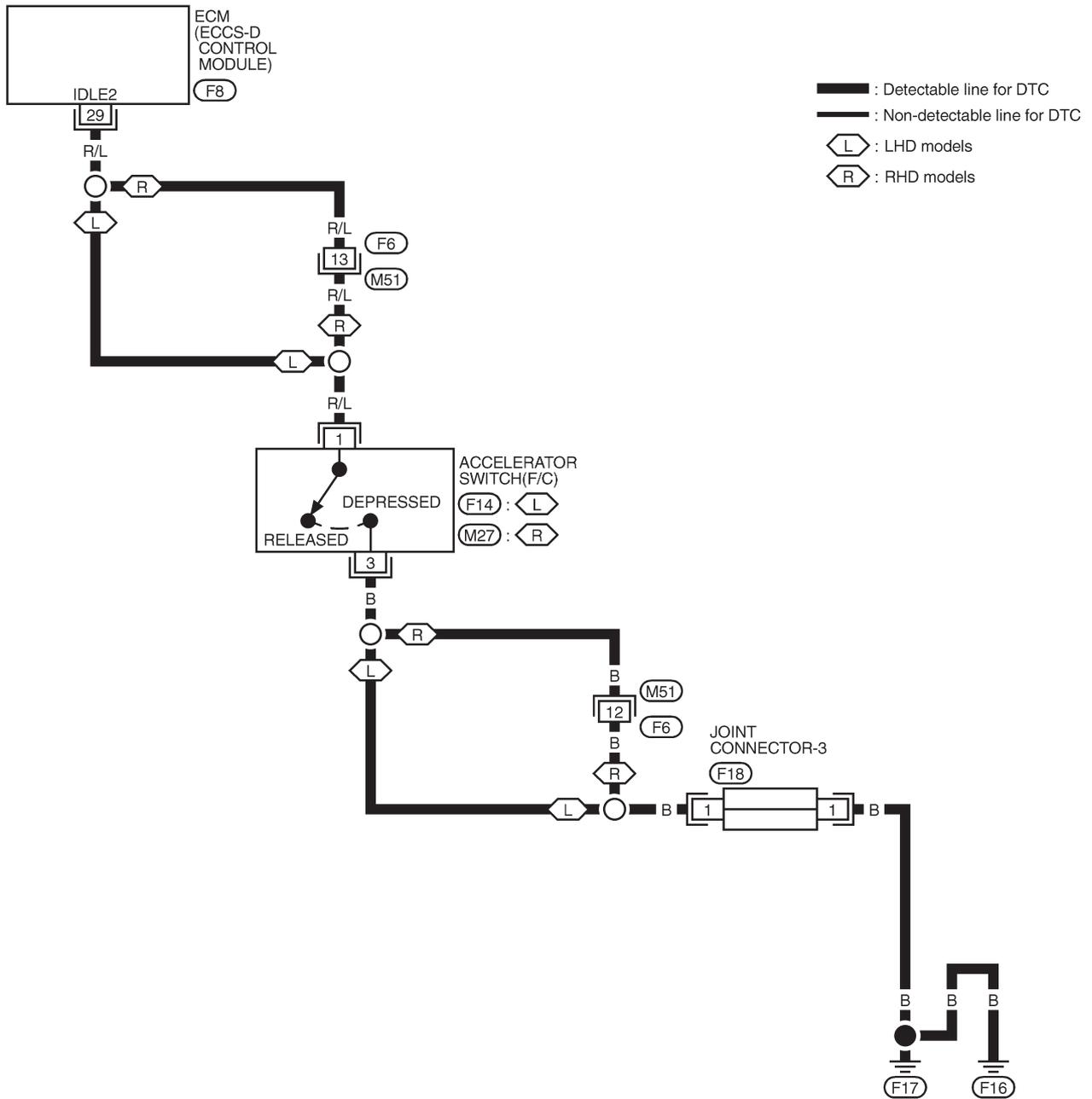


- 1) Turn ignition switch "ON".
- 2) Depress and release accelerator pedal once for 15 seconds.
- 3) Repeat step 2 for 26 times.
- 4) Turn ignition switch "OFF", wait at least 5 seconds and then turn "ON".
- 5) Perform "Diagnostic Test Mode II (Self-diagnostic results)" with ECM.

TROUBLE DIAGNOSIS FOR "ACCEL POS SW (F/C)" (DTC 23)

Accelerator Switch (F/C) (Cont'd)

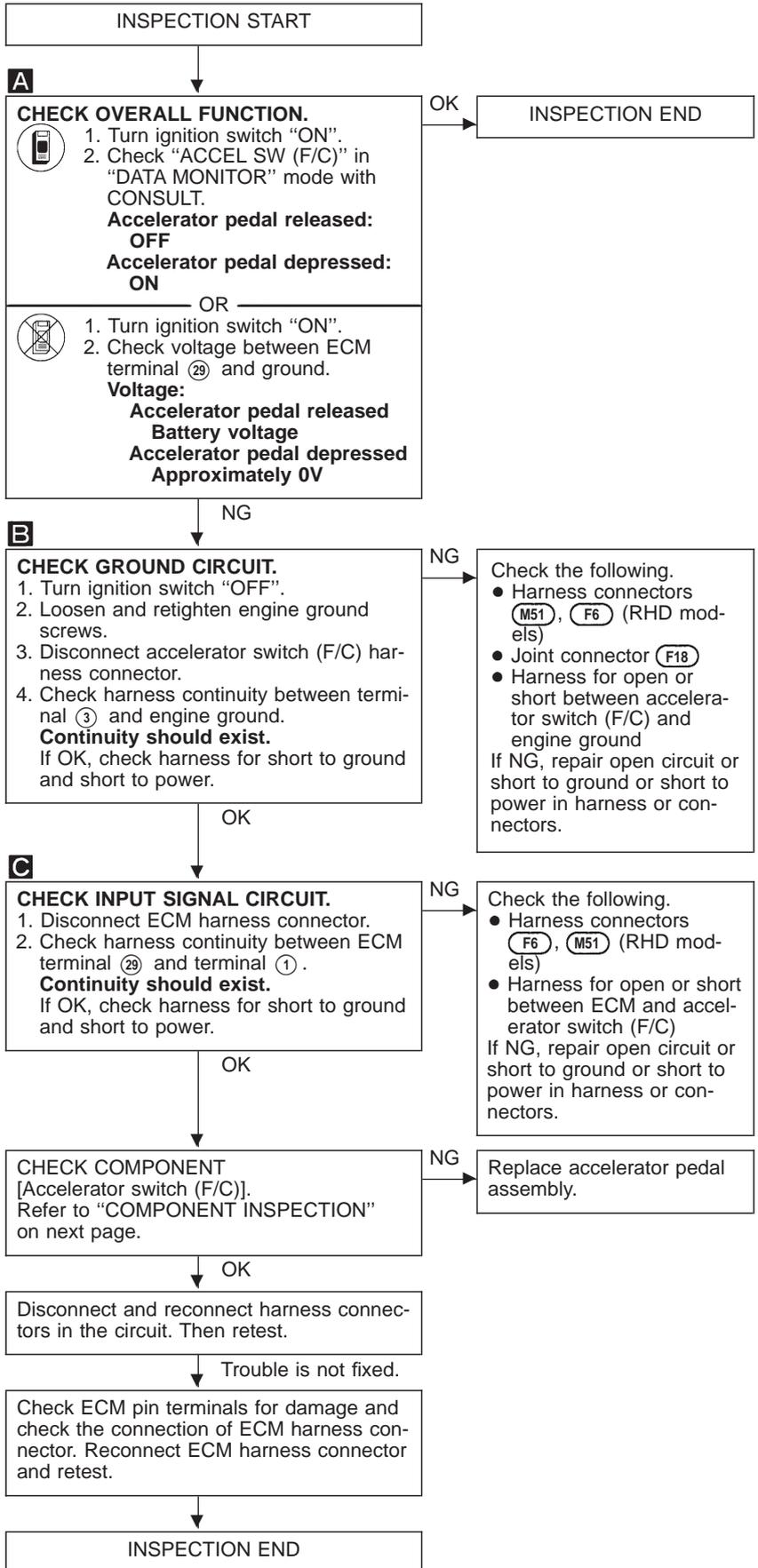
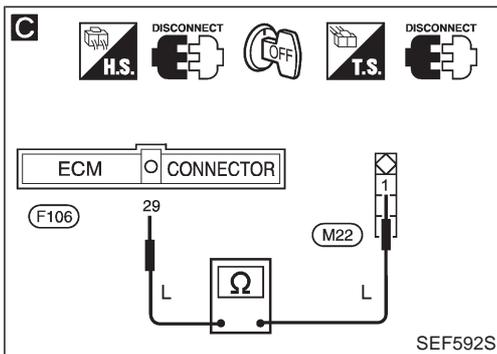
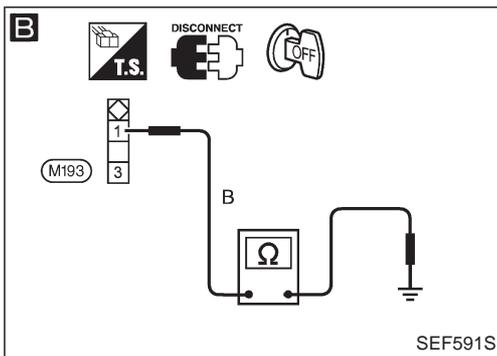
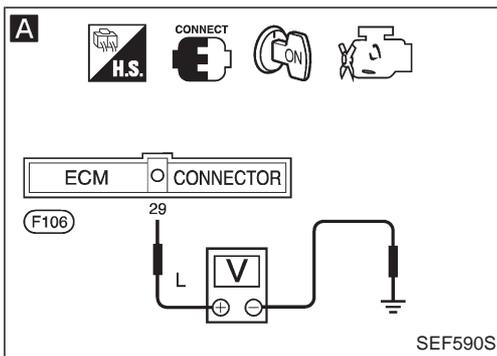
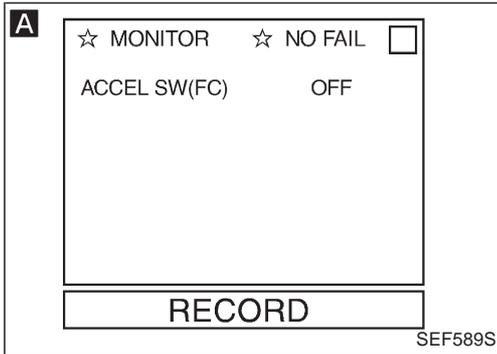
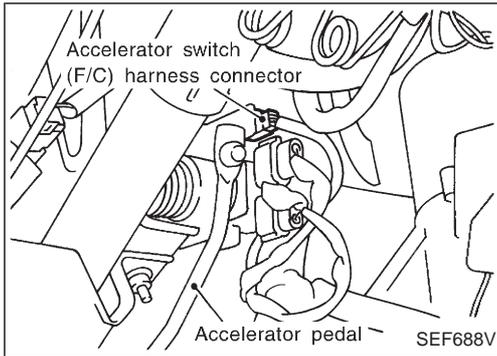
EC-ACC/SW-01



TROUBLE DIAGNOSIS FOR "ACCEL POS SW (F/C)" (DTC 23)

Accelerator Switch (F/C) (Cont'd)

DIAGNOSTIC PROCEDURE



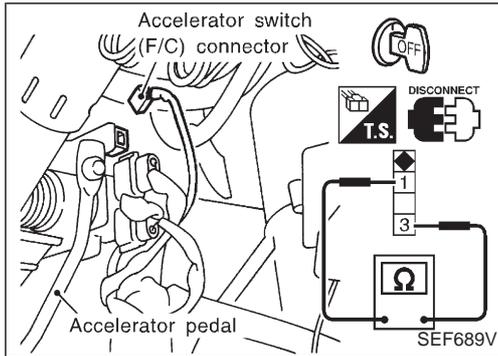
TROUBLE DIAGNOSIS FOR “ACCEL POS SW (F/C)” (DTC 23)

Accelerator Switch (F/C) (Cont'd)

COMPONENT INSPECTION

Accelerator switch (F/C)

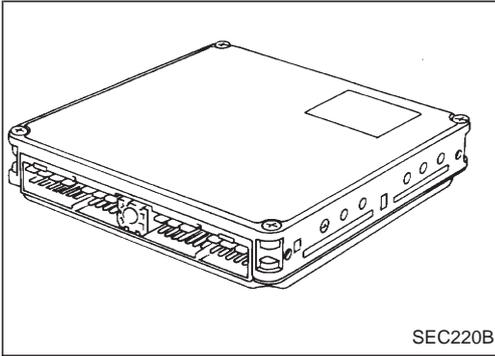
1. Disconnect accelerator switch (F/C) harness connector.
2. Check continuity between terminals ① and ③.



Conditions	Continuity
Accelerator pedal released	No
Accelerator pedal depressed	Yes

If NG, replace accelerator pedal assembly.

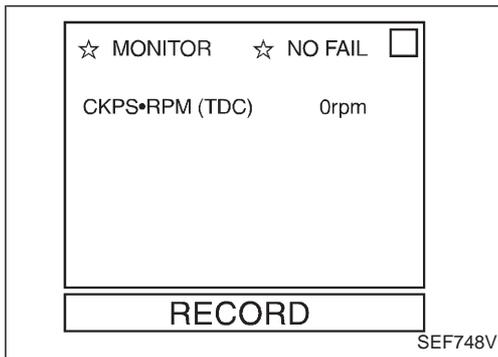
TROUBLE DIAGNOSIS FOR “ECM 1” (DTC 27), “ECM 2” (DTC 31)



Engine Control Module (ECM)-ECCS-D Control Module

The ECM consists of a microcomputer and connectors for signal input and output and for power supply. The unit controls the engine.

Diagnostic Trouble Code No.	Malfunction is detected when	Check Item (Possible Cause)
27, 31	<ul style="list-style-type: none"> ● ECM calculation function is malfunctioning. 	<ul style="list-style-type: none"> ● ECM (ECCS-D control module)



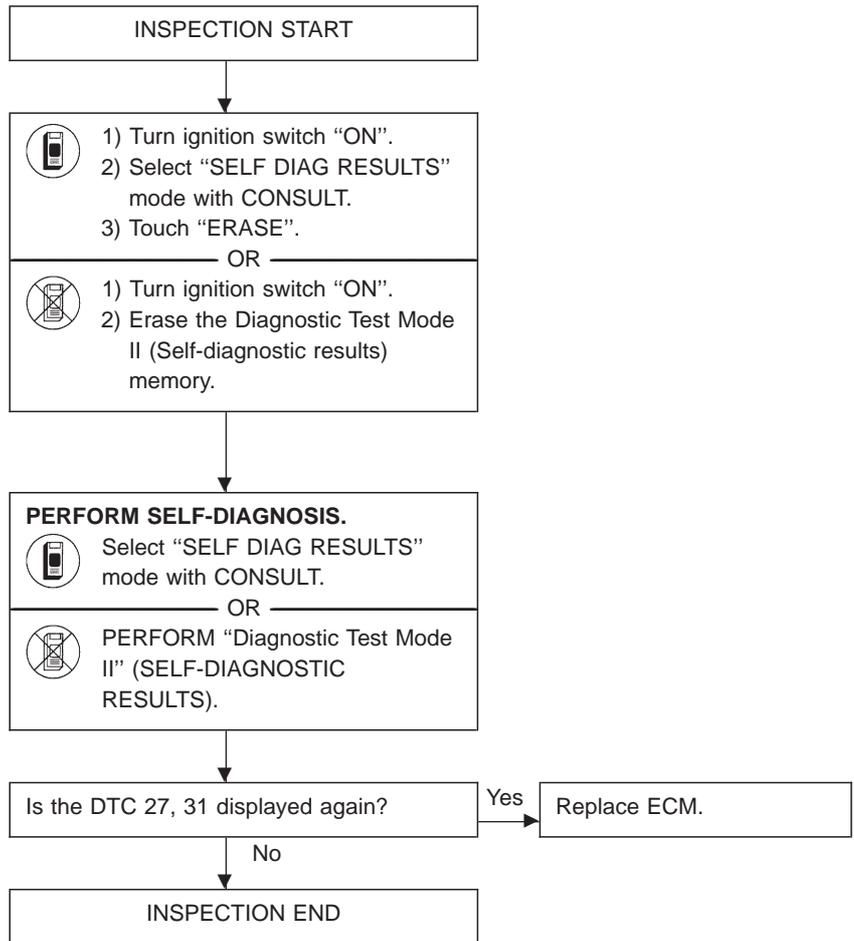
DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

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

TROUBLE DIAGNOSIS FOR "ECM 1" (DTC 27), "ECM 2" (DTC 31)

Engine Control Module (ECM)-ECCS-D Control Module (Cont'd)

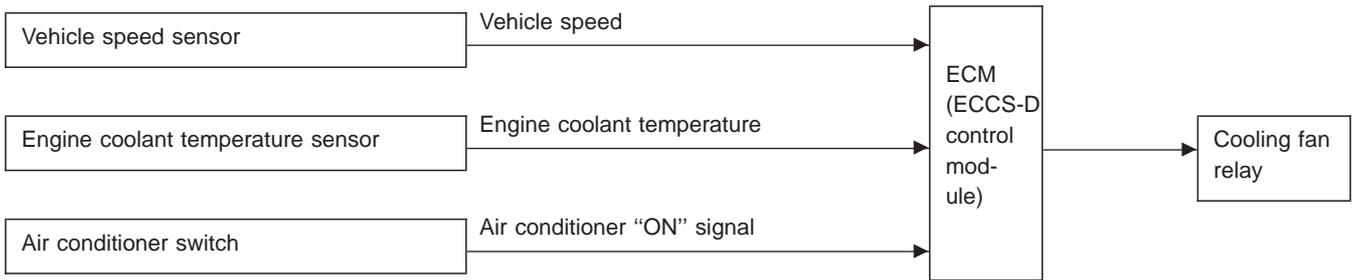
DIAGNOSTIC PROCEDURE



TROUBLE DIAGNOSIS FOR "OVER HEAT" (DTC 28)

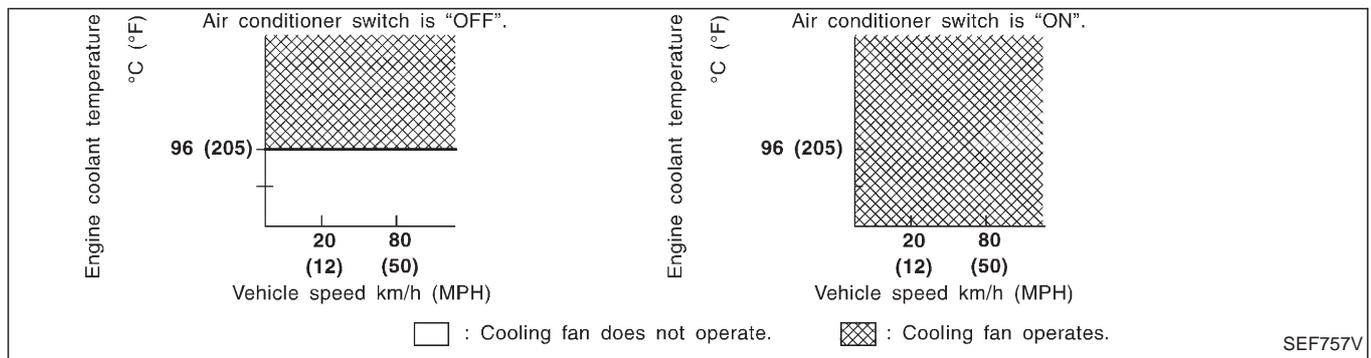
Cooling Fan (Overheat)

SYSTEM DESCRIPTION



The ECM controls the cooling fan corresponding to the vehicle speed, engine coolant temperature, air conditioner system pressure and air conditioner ON signal. The control system has 2-step control [ON/OFF].

Operation



CONSULT REFERENCE VALUE IN DATA MONITOR MODE

Remarks: Specification data are reference values.

MONITOR ITEM	CONDITION	SPECIFICATION
AIR COND SIG	● Engine: After warming up, idle the engine Air conditioner switch: OFF	OFF
	Air conditioner switch: ON (Compressor operates.)	ON
COOLING FAN	● When cooling fan is stopped.	OFF
	● When cooling fan operates.	ON

ECM TERMINALS AND REFERENCE VALUE

Remarks: Specification data are reference values and are measured between each terminal and ④3 (ECCS ground) with a voltmeter.

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
14	L	Cooling fan relay	Engine is running. └ Cooling fan is not operating.	BATTERY VOLTAGE (11 - 14V)
			Engine is running. └ Cooling fan is operating.	0 - 1V

TROUBLE DIAGNOSIS FOR "OVER HEAT" (DTC 28)

Cooling Fan (Overheat) (Cont'd)

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
15	Y/L	Air conditioner relay	<div style="border: 1px solid black; padding: 2px;">Engine is running.</div> <ul style="list-style-type: none"> └ Air conditioner switch is "OFF". 	BATTERY VOLTAGE (11 - 14V)
			<div style="border: 1px solid black; padding: 2px;">Engine is running.</div> <ul style="list-style-type: none"> └ Both air conditioner switch and blower fan switch are "ON". (Compressor is operating.) 	0 - 1V

ON BOARD DIAGNOSIS LOGIC

This diagnosis continuously monitors the engine coolant temperature.

If the cooling fan or another component in the cooling system malfunctions, 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	<ul style="list-style-type: none"> ● Cooling fan does not operate properly (Overheat). ● Cooling fan system does not operate properly (Overheat). ● Engine coolant was not added to the system using the proper filling method. 	<ul style="list-style-type: none"> ● Harness or connectors (The cooling fan circuit is open or shorted.) ● Cooling fan ● Radiator hose ● Radiator ● Radiator cap ● Water pump ● Thermostat ● Fan belt ● Engine coolant temperature sensor <p>For more information, refer to "MAIN 12 CAUSES OF OVERHEATING", EC-120.</p>

CAUTION:

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

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

TROUBLE DIAGNOSIS FOR "OVER HEAT" (DTC 28)

Cooling Fan (Overheat) (Cont'd)

OVERALL FUNCTION CHECK

Use this procedure to check the overall function of the cooling fan. During this check, a DTC might not be confirmed.

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 the 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 steps and go to "DIAGNOSTIC PROCEDURE", EC-117.

- 2) Confirm whether customer filled the coolant or not. If customer filled the coolant, skip the following steps and go to "DIAGNOSTIC PROCEDURE", EC-117.



- 3) Turn ignition switch "ON".

- 4) Perform "COOLING FAN" in "ACTIVE TEST" mode with CONSULT and make sure that cooling fan operates when touching "ON".

OR

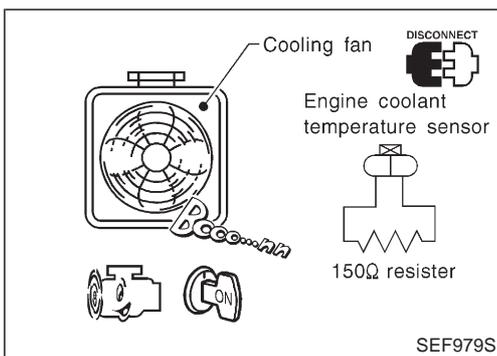
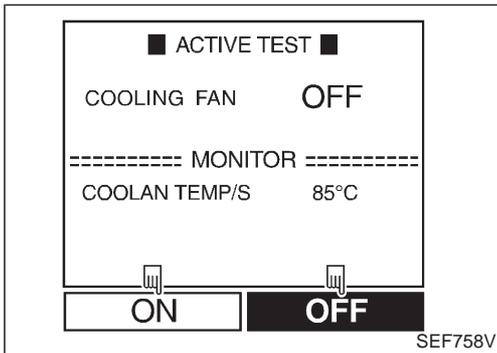
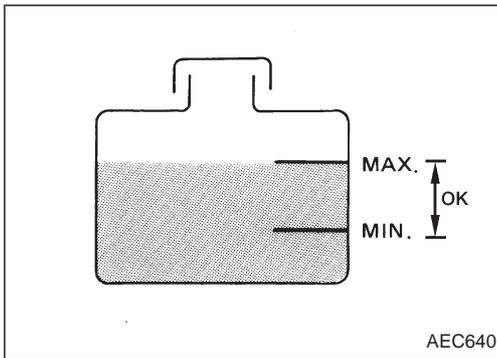


- 3) Disconnect engine coolant temperature sensor harness connector.

- 4) Connect 150Ω resistor to engine coolant temperature sensor harness connector.

- 5) Start engine and make sure that cooling fan operates.

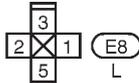
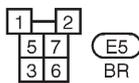
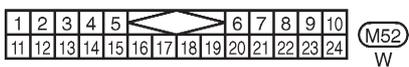
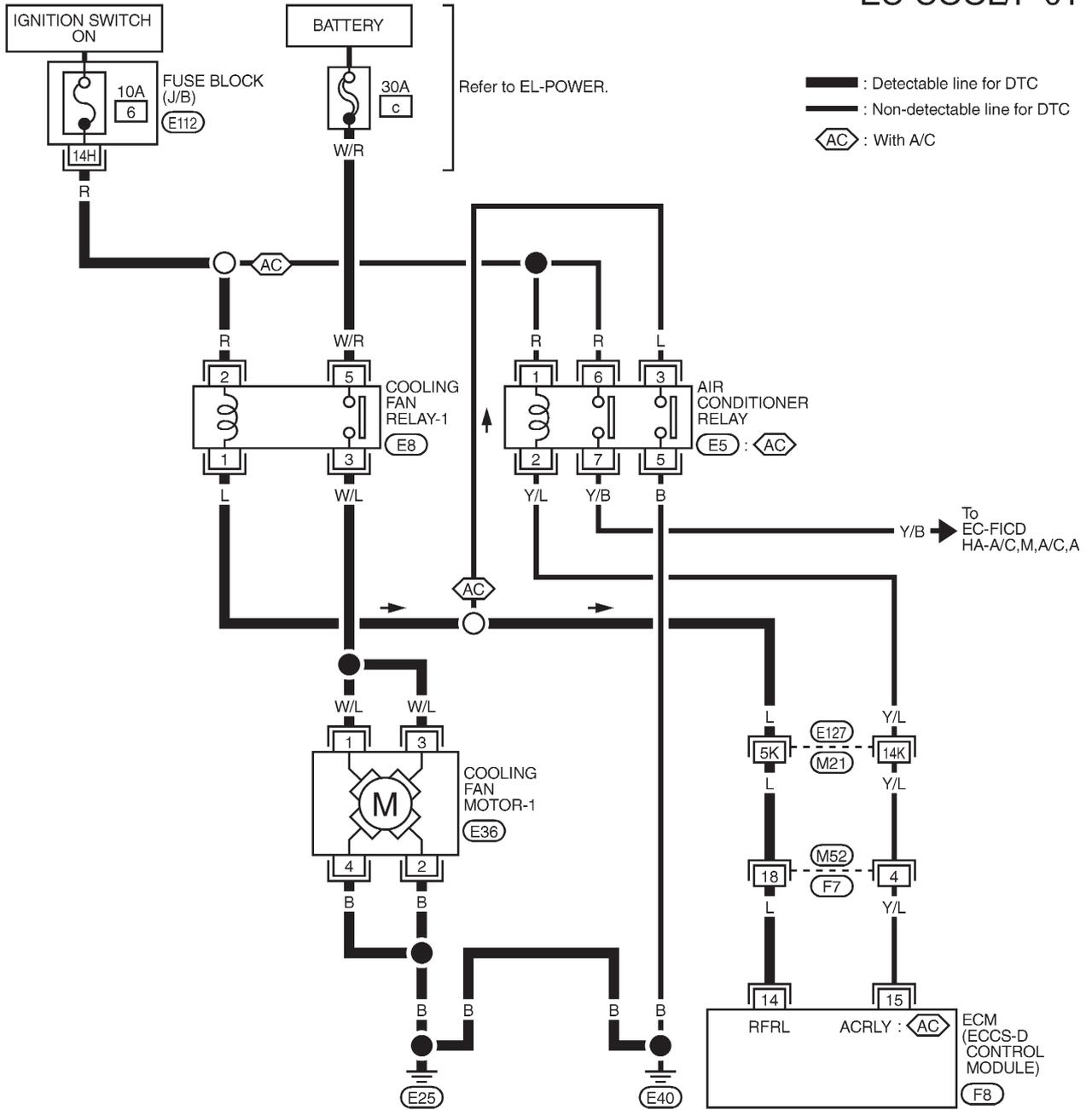
Be careful not to overheat engine.



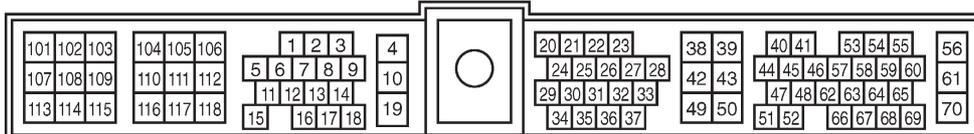
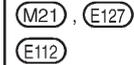
TROUBLE DIAGNOSIS FOR "OVER HEAT" (DTC 28)

Cooling Fan (Overheat) (Cont'd)

EC-COOL/F-01



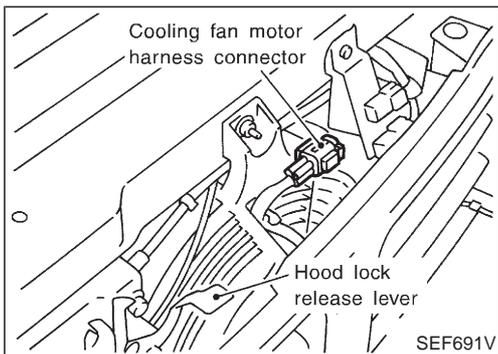
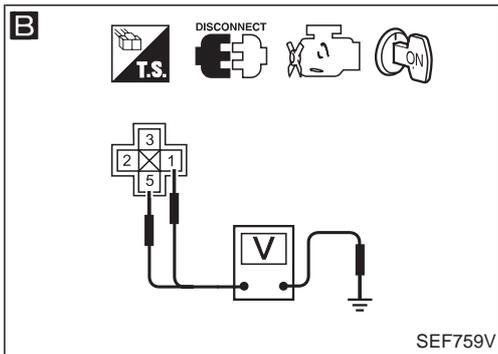
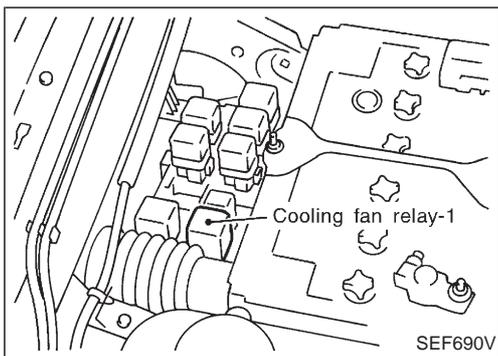
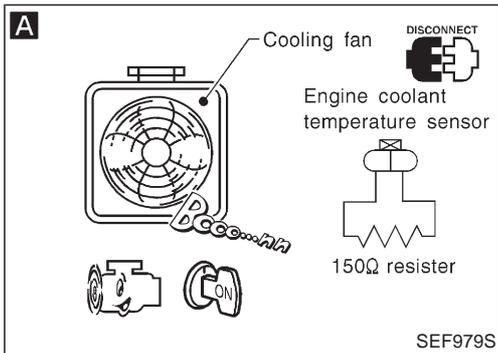
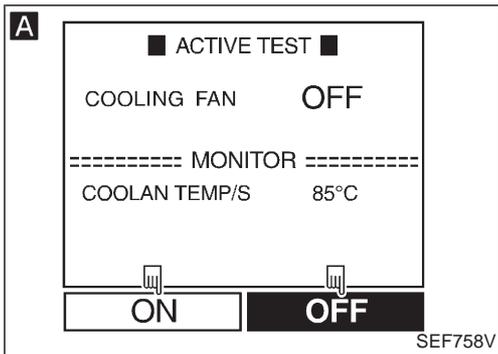
Refer to last page (Foldout page).



TROUBLE DIAGNOSIS FOR "OVER HEAT" (DTC 28)

Cooling Fan (Overheat) (Cont'd)

DIAGNOSTIC PROCEDURE



INSPECTION START

A

CHECK COOLING FAN OPERATION.

1. Turn ignition switch "OFF".

2. Turn ignition switch "ON".

3. Perform "COOLING FAN" in "ACTIVE TEST" mode with CONSULT and make sure that cooling fan operates when touching "ON".

OR

2. Disconnect engine coolant temperature sensor harness connector.

3. Connect 150Ω resistor to engine coolant temperature sensor harness connector.

4. Start engine and make sure that cooling fan operates.

OK → Go to **F** "CHECK COOLING SYSTEM FOR LEAK", EC-119.

B

CHECK POWER SUPPLY.

1. Turn ignition switch "OFF".

2. Disconnect cooling fan relay-1.

3. Turn ignition switch "ON".

4. Check voltage between terminals ②, ⑤ and ground with CONSULT or tester.

Voltage: Battery voltage

NG → Check the following.

- 10A fuse
- 30A fusible link
- Harness for open or short between cooling fan relay-1 and fuse
- Harness for open or short between cooling fan relay-1 and battery

If NG, repair harness or connectors.

C

CHECK GROUND CIRCUIT.

1. Turn ignition switch "OFF".

2. Disconnect cooling fan motor harness connector.

3. Check harness continuity between relay terminal ③ and motor terminals ①, ③.

Continuity should exist.

If OK, check harness for short to ground and short to power.

D

4. Check harness continuity between motor terminals ②, ④ and body ground.

Continuity should exist.

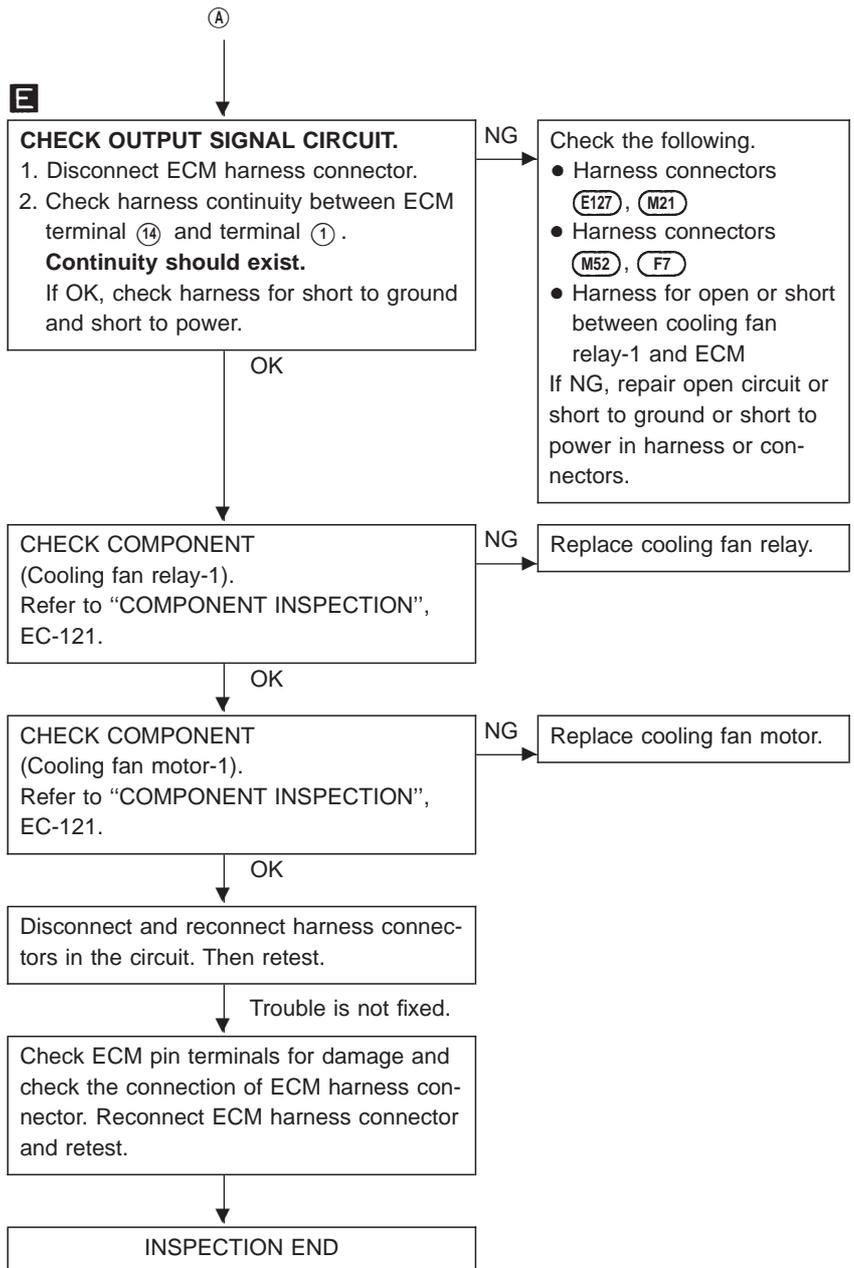
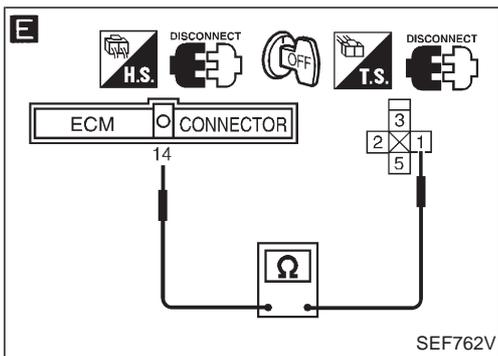
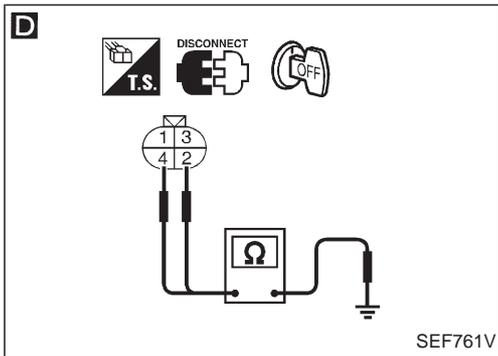
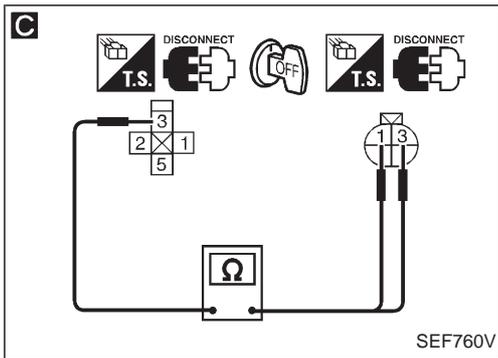
If OK, check harness for short to ground and short to power.

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

OK → **A**

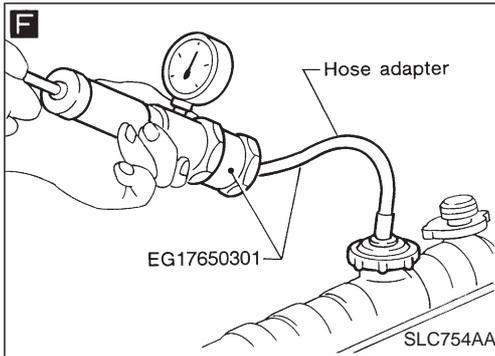
TROUBLE DIAGNOSIS FOR "OVER HEAT" (DTC 28)

Cooling Fan (Overheat) (Cont'd)



TROUBLE DIAGNOSIS FOR "OVER HEAT" (DTC 28)

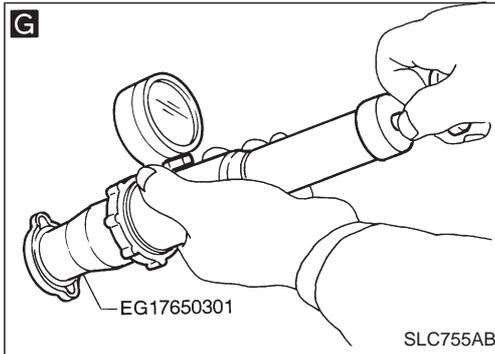
Cooling Fan (Overheat) (Cont'd)



F
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/cm², 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").

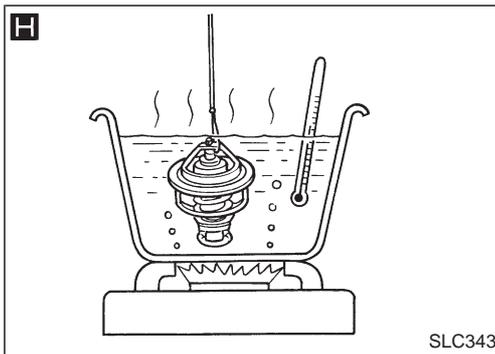
OK



G
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/cm², 11 - 14 psi)

NG → Replace radiator cap.

OK



H
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:
82°C (180°F) [standard]
Maximum valve lift:
More than 10 mm/95°C (0.39 in/203°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-82.

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".

TROUBLE DIAGNOSIS FOR “OVER HEAT” (DTC 28)

Cooling Fan (Overheat) (Cont'd)

MAIN 12 CAUSES OF OVERHEATING

Engine	Step	Inspection item	Equipment	Condition	Reference page
OFF	1	<ul style="list-style-type: none"> ● Blocked radiator ● Blocked radiator grille ● Blocked bumper 	<ul style="list-style-type: none"> ● Visual 	No blocking	—
	2	<ul style="list-style-type: none"> ● Coolant mixture 	<ul style="list-style-type: none"> ● Coolant tester 	50 - 50% coolant mixture	See “RECOMMENDED FLUIDS AND LUBRICANTS” in MA section.
	3	<ul style="list-style-type: none"> ● Coolant level 	<ul style="list-style-type: none"> ● Visual 	Coolant up to MAX level in reservoir tank and radiator filler neck	See “Changing Engine Coolant”, “ENGINE MAINTENANCE” in MA section.
	4	<ul style="list-style-type: none"> ● Radiator cap 	<ul style="list-style-type: none"> ● Pressure tester 	78 - 98 kPa (0.78 - 0.98 bar, 0.8 - 1.0 kg/cm ² , 11 - 14 psi)	See “System Check” “ENGINE COOLING SYSTEM” in LC section.
ON*2	5	<ul style="list-style-type: none"> ● Coolant leaks 	<ul style="list-style-type: none"> ● Visual 	No leaks	See “System Check” “ENGINE COOLING SYSTEM” in LC section.
ON*2	6	<ul style="list-style-type: none"> ● Thermostat 	<ul style="list-style-type: none"> ● 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	<ul style="list-style-type: none"> ● Cooling fan 	<ul style="list-style-type: none"> ● CONSULT 	Operating	See “TROUBLE DIAGNOSIS FOR DTC 28”, EC-113.
OFF	8	<ul style="list-style-type: none"> ● Combustion gas leak 	<ul style="list-style-type: none"> ● Color checker chemical tester 4 Gas analyzer 	Negative	—
ON*3	9	<ul style="list-style-type: none"> ● Coolant temperature gauge 	<ul style="list-style-type: none"> ● Visual 	Gauge less than 3/4 when driving	—
		<ul style="list-style-type: none"> ● Coolant overflow to reservoir tank 	<ul style="list-style-type: none"> ● Visual 	No overflow during driving and idling	See “Changing Engine Coolant”, “ENGINE MAINTENANCE” in MA section.
OFF*4	10	<ul style="list-style-type: none"> ● Coolant return from reservoir tank to radiator 	<ul style="list-style-type: none"> ● Visual 	Should be initial level in reservoir tank	See “ENGINE MAINTENANCE” in MA section.
OFF	11	<ul style="list-style-type: none"> ● Cylinder head 	<ul style="list-style-type: none"> ● Straight gauge feeler gauge 	0.1mm (0.004 in) Maximum distortion (warping)	See “Inspection”, “CYLINDER HEAD” in EM section.
	12	<ul style="list-style-type: none"> ● Cylinder block and pistons 	<ul style="list-style-type: none"> ● Visual 	No scuffing on cylinder walls or piston	See “Inspection”, “CYLINDER BLOCK” in EM section.

*1: Turn the ignition switch ON.

*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.

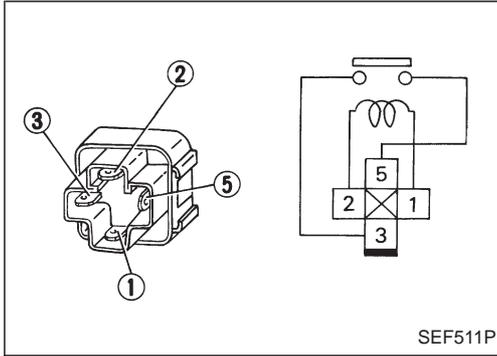
TROUBLE DIAGNOSIS FOR "OVER HEAT" (DTC 28)

Cooling Fan (Overheat) (Cont'd)

COMPONENT INSPECTION

Cooling fan relay-1

Check continuity between terminals ③ and ⑤.

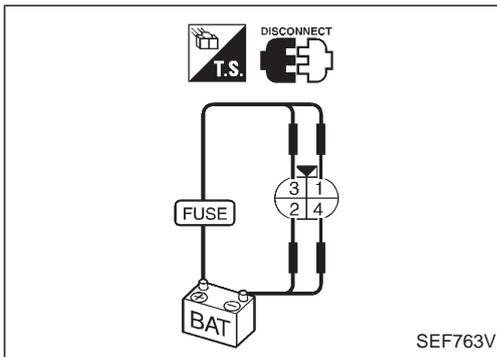


Conditions	Continuity
12V direct current supply between terminals ① and ②	Yes
No current supply	No

If NG, replace relay.

Cooling fan motor-1

1. Disconnect cooling fan motor harness connector.
2. Supply cooling fan motor terminals with battery voltage and check operation.

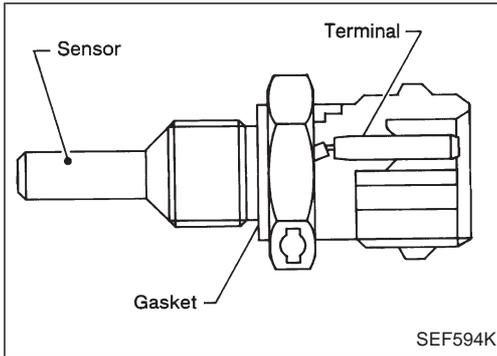


	Terminals	
	(⊕)	(⊖)
Cooling fan motor	①, ③	②, ④

Cooling fan motor should operate.

If NG, replace cooling fan motor.

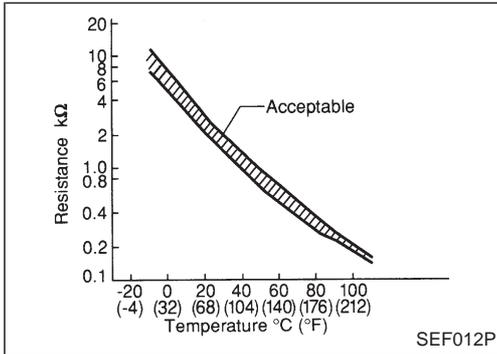
TROUBLE DIAGNOSIS FOR "I/C INT/A TEMP SEN" (DTC 33)



Charge Air Temperature Sensor

The charge air temperature sensor is used to detect the charge air temperature. The sensor modifies a voltage signal from the ECM. The modified signal returns to the ECM as the charge air 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.

The ECM uses this signal for the charge air cooler control.



<Reference data>

Charge air 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)	2.3	0.68 - 1.00
90 (194)	1.0	0.236 - 0.260
110 (230)	0.64	0.143 - 0.153
150 (302)	0.30	0.050 - 0.065

ECM TERMINALS AND REFERENCE VALUE

Remarks: Specification data are reference values and are measured between each terminal and (43) (ECCS ground) with a voltmeter.

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
36	LG	Charge air temperature sensor	Engine is running.	Approximately 0 - 4.8V Output voltage varies with charge air temperature.
50	B	Sensors' ground	Engine is running. (Warm-up condition) └ Idle speed	Approximately 0V

ON BOARD DIAGNOSIS LOGIC

Diagnostic Trouble Code No.	Malfunction is detected when ...	Check Items (Possible Cause)
33 *1	<ul style="list-style-type: none"> An excessively high or low voltage from the sensor is entered to ECM. 	<ul style="list-style-type: none"> Harness or connectors (The sensor circuit is open or shorted.) Charge air temperature sensor

*1: When nothing is displayed or the meaningless symbol is displayed in the "Self-diag result" mode with CONSULT, perform "Diagnostic Test Mode II (Self-diagnostic results)" with ECM. Refer to EC-32.

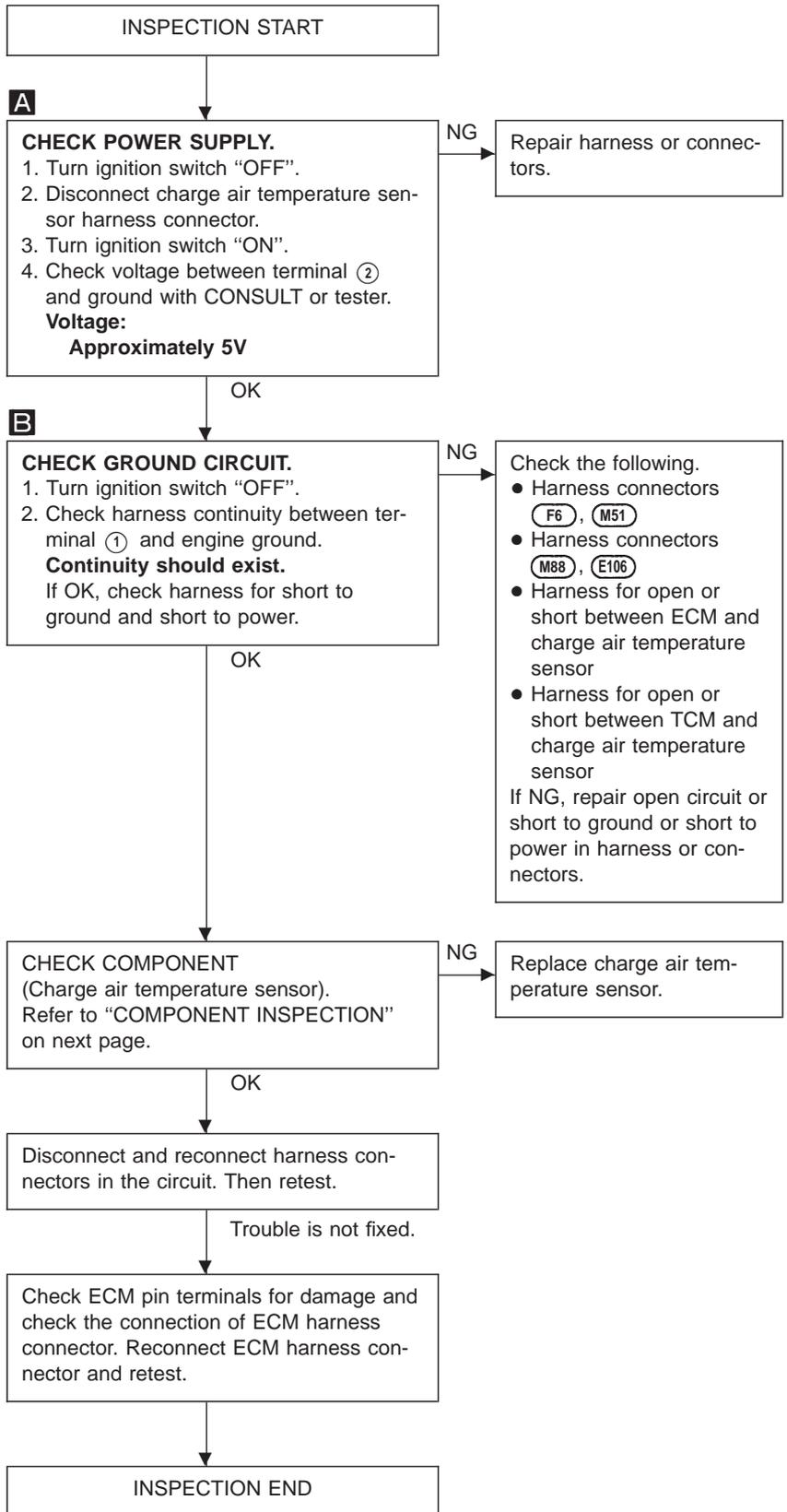
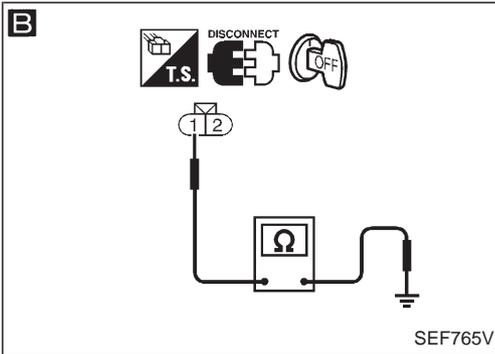
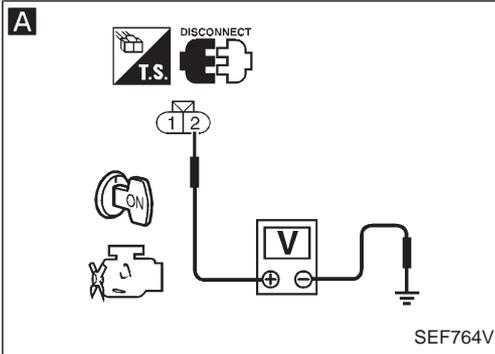
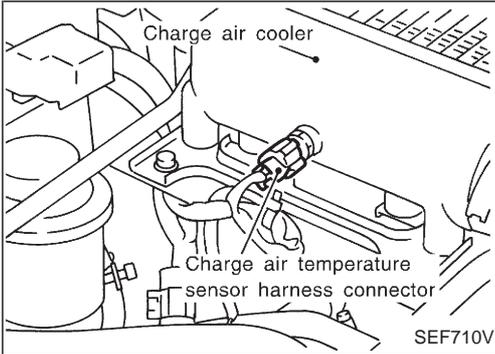
DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

- 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.

TROUBLE DIAGNOSIS FOR "I/C INT/A TEMP SEN" (DTC 33)

Charge Air Temperature Sensor (Cont'd)

DIAGNOSTIC PROCEDURE



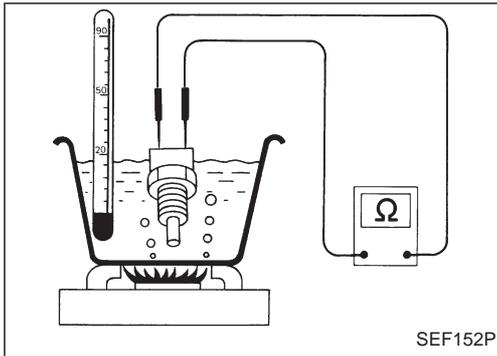
TROUBLE DIAGNOSIS FOR "I/C INT/A TEMP SEN" (DTC 33)

Charge Air Temperature Sensor (Cont'd)

COMPONENT INSPECTION

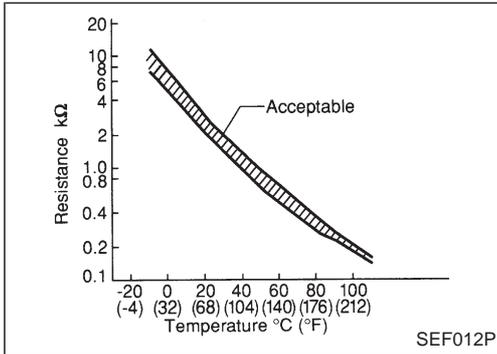
Charge air temperature sensor

Check resistance as shown in the figure.

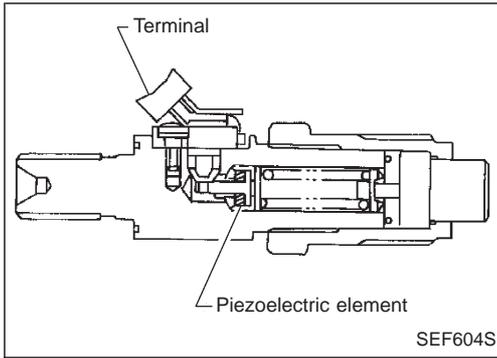


Temperature °C (°F)	Resistance kΩ
20 (68)	2.1 - 2.9
50 (122)	0.68 - 1.0
90 (194)	0.236 - 0.260

If NG, replace charge air temperature sensor.



TROUBLE DIAGNOSIS FOR “NEEDLE LIFT SEN” (DTC 34)



Needle Lift Sensor (NLS)

The needle lift sensor is built into the No. 1 injection nozzle. Its piezoelectric element senses changes in fuel injection timing caused by fuel temperature, etc. This change of fuel injection timing is sent as a pulse signal to the ECM.

ECM TERMINALS AND REFERENCE VALUE

Remarks: Specification data are reference values and are measured between each terminal and ④ (ECCS ground) with a voltmeter.

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
34	W	Needle lift sensor	<div style="border: 1px solid black; padding: 2px;">Engine is running.</div> (Warm-up condition) Idle speed	Approximately 0V <p style="text-align: right;">SEF718V</p>
			<div style="border: 1px solid black; padding: 2px;">Engine is running.</div> (Warm-up condition) Engine speed is 2,000 rpm.	Approximately 0V <p style="text-align: right;">SEF719V</p>

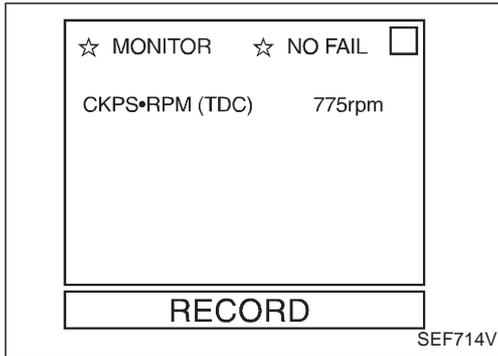
ON BOARD DIAGNOSIS LOGIC

Diagnostic Trouble Code No.	Malfunction is detected when	Check Items (Possible Cause)
34	<ul style="list-style-type: none"> ● An improper signal from the sensor is sent to ECM. 	<ul style="list-style-type: none"> ● Harness or connectors (The sensor circuit is open or shorted.) ● Needle lift sensor ● Air in fuel line ● Clogging No. 1 injection nozzle

TROUBLE DIAGNOSIS FOR "NEEDLE LIFT SEN" (DTC 34)

Needle Lift Sensor (NLS) (Cont'd)

DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE



- 1) Turn ignition switch "ON" and select "DATA MONITOR" mode with CONSULT.
- 2) Start engine and run it for at least 10 seconds at idle speed.

OR

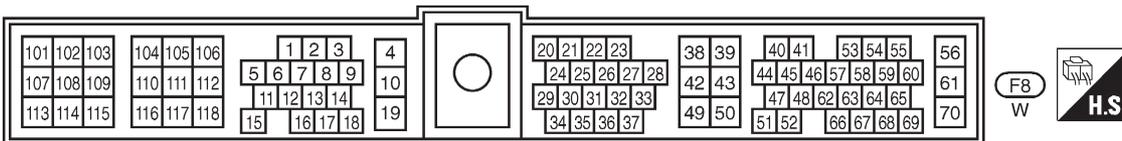
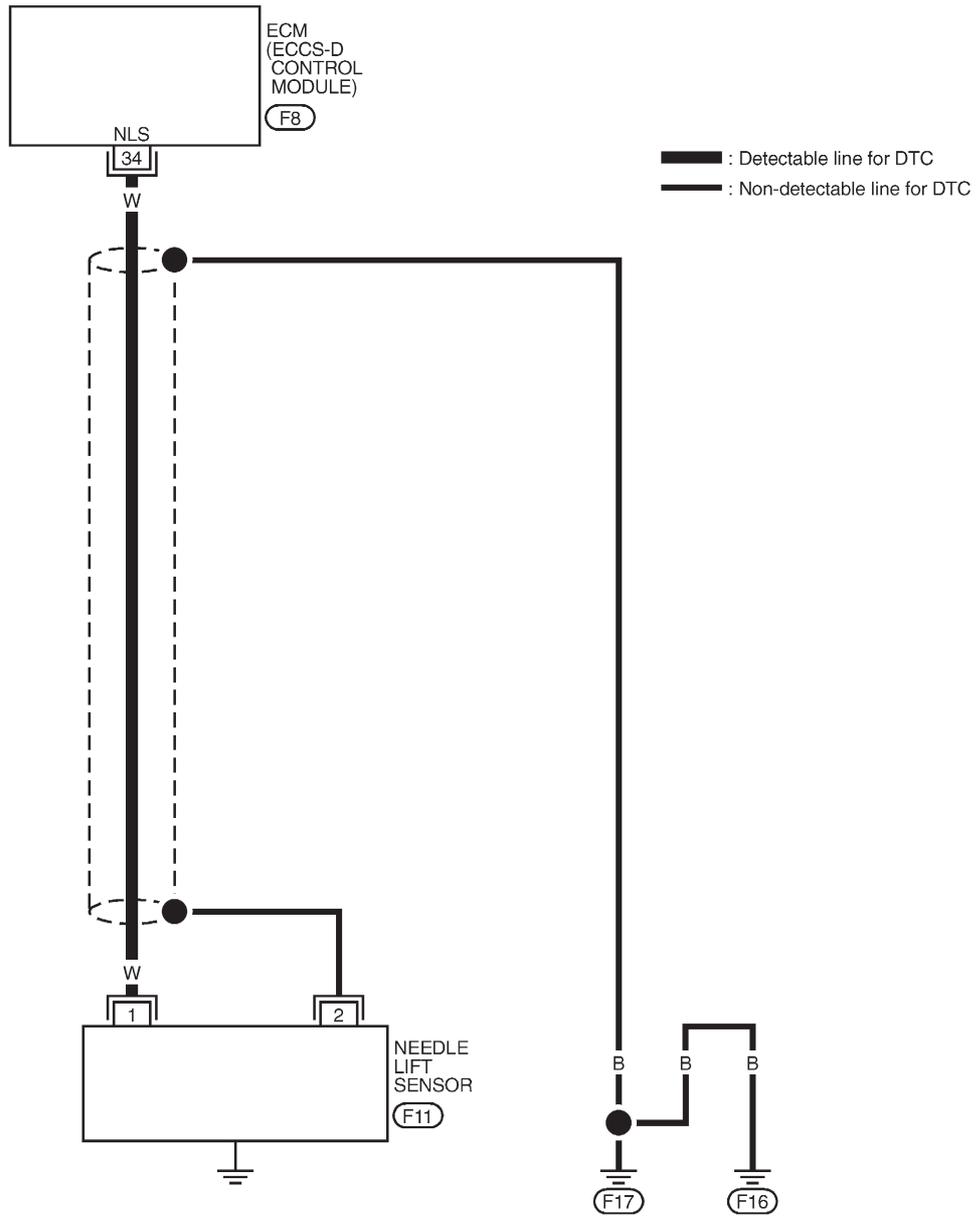


- 1) Start engine and run it for at least 10 seconds at idle speed.
- 2) Turn ignition switch "OFF", wait at least 5 seconds and then turn "ON".
- 3) Perform "Diagnostic Test Mode II (Self-diagnostic results)" with ECM.

TROUBLE DIAGNOSIS FOR "NEEDLE LIFT SEN" (DTC 34)

Needle Lift Sensor (NLS) (Cont'd)

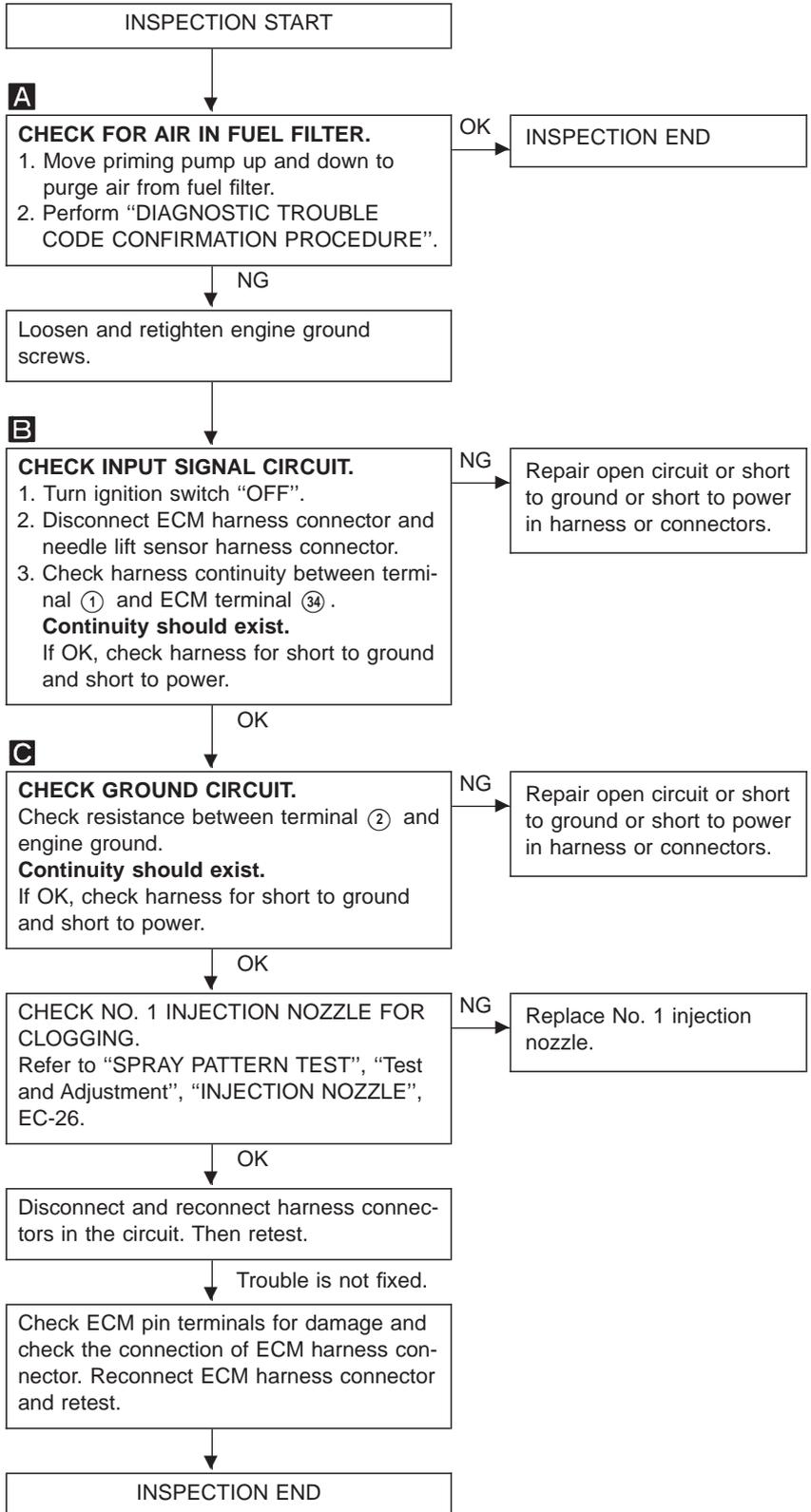
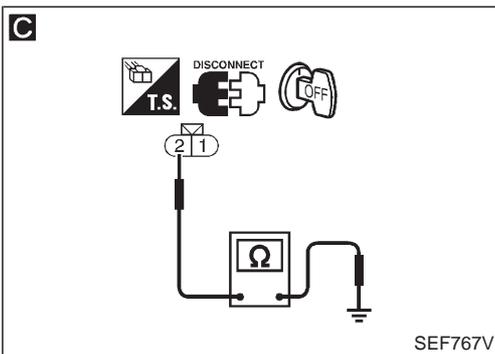
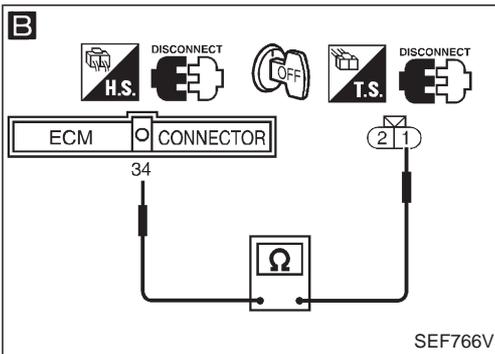
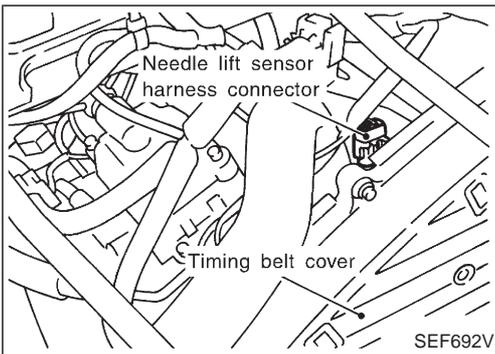
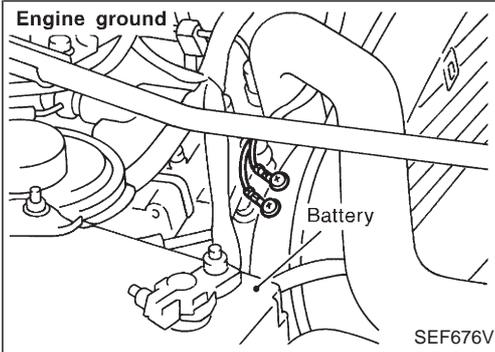
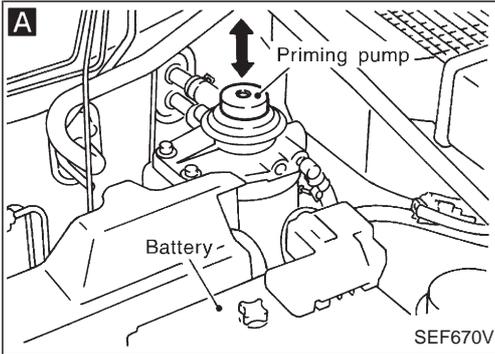
EC-NLS-01



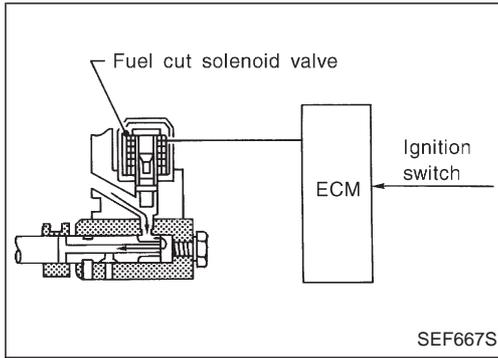
TROUBLE DIAGNOSIS FOR "NEEDLE LIFT SEN" (DTC 34)

Needle Lift Sensor (NLS) (Cont'd)

DIAGNOSTIC PROCEDURE



TROUBLE DIAGNOSIS FOR “FUEL CUT S/V 1” (DTC 36), “FCV SHORT” (DTC 37), “FUEL CUT S/V 2” (DTC 38)



Fuel Cut Solenoid Valve

When the ignition switch is OFF, the ECM turns the fuel cut solenoid valve OFF (under this condition, no current flows through the fuel cut solenoid valve), shutting off fuel supply.

When the engine is not operating due to trouble, the fuel cut solenoid valve may or may not be OFF even when the ignition switch is ON.

CONSULT REFERENCE VALUE IN DATA MONITOR MODE

Remarks: Specification data are reference values.

MONITOR ITEM	CONDITION	SPECIFICATION
DECELER F/CUT	● Engine: After warming up	Idle
		When accelerator pedal is released quickly with engine speed at 3,000 rpm or more.
FUEL CUT S/V	● Ignition switch: ON → OFF	ON → OFF

ECM TERMINALS AND REFERENCE VALUE

Remarks: Specification data are reference values and are measured between each terminal and ④ (ECCS ground) with a voltmeter.

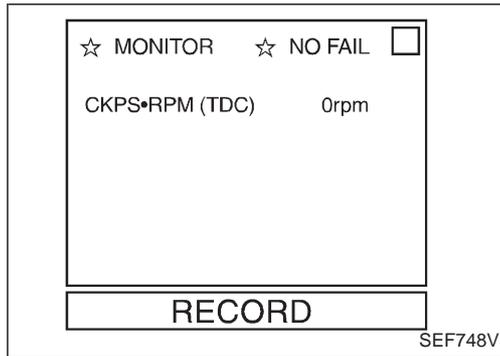
TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
4	B/Y	ECCS relay (Self-shutoff)	Ignition switch “ON”	0 - 1.5V
			Ignition switch “OFF” └ For a few seconds after turning ignition switch “OFF”	
			Ignition switch “OFF” └ A few seconds passed after turning ignition switch “OFF”	BATTERY VOLTAGE (11 - 14V)
56 61	W	Power supply for ECM	Ignition switch “ON”	BATTERY VOLTAGE (11 - 14V)
113 115	R/W	Fuel cut solenoid valve	Ignition switch “OFF”	Approximately 0V
			Ignition switch “ON”	BATTERY VOLTAGE (11 - 14V)
116 117	W	Power supply for ECM	Ignition switch “ON”	BATTERY VOLTAGE (11 - 14V)

**TROUBLE DIAGNOSIS FOR "FUEL CUT S/V 1" (DTC 36),
"FCV SHORT" (DTC 37), "FUEL CUT S/V 2" (DTC 38)**

Fuel Cut Solenoid Valve (Cont'd)

ON BOARD DIAGNOSIS LOGIC

Diagnostic Trouble Code No.	Malfunction is detected when ...	Check Items (Possible Cause)
36, 37, 38	<ul style="list-style-type: none"> Fuel cut solenoid valve circuit is malfunctioning. 	<ul style="list-style-type: none"> Main power supply circuit (ECM terminals (116), (117)) and fuse Harness or connectors (The solenoid valve circuit is open or shorted.) Fuel cut solenoid valve ECM



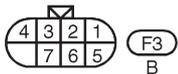
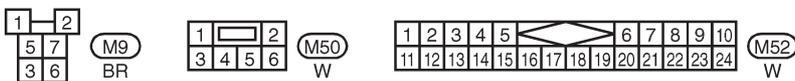
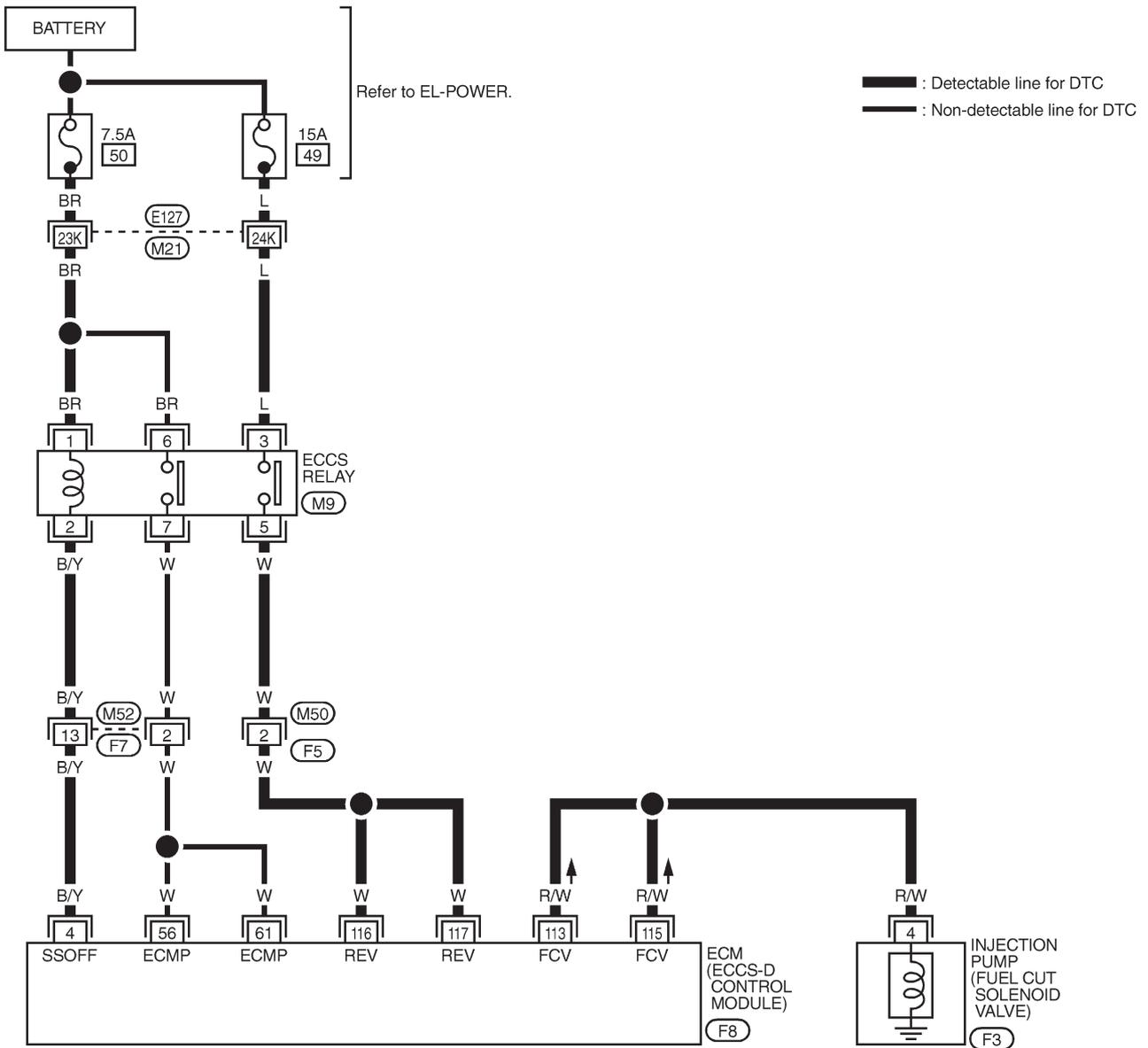
DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

- 1) Turn ignition switch "ON".
 - 2) Select "DATA MONITOR" mode with CONSULT.
 - 3) Start engine.
 - 4) Turn ignition switch "OFF", wait at least 5 seconds and then turn "ON".
- OR
- 1) Start engine.
 - 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.

TROUBLE DIAGNOSIS FOR "FUEL CUT S/V 1" (DTC 36), "FCV SHORT" (DTC 37), "FUEL CUT S/V 2" (DTC 38)

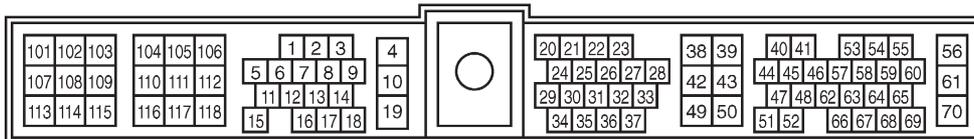
Fuel Cut Solenoid Valve (Cont'd)

EC-FCUT-01



Refer to last page (Foldout page).

M21, E127



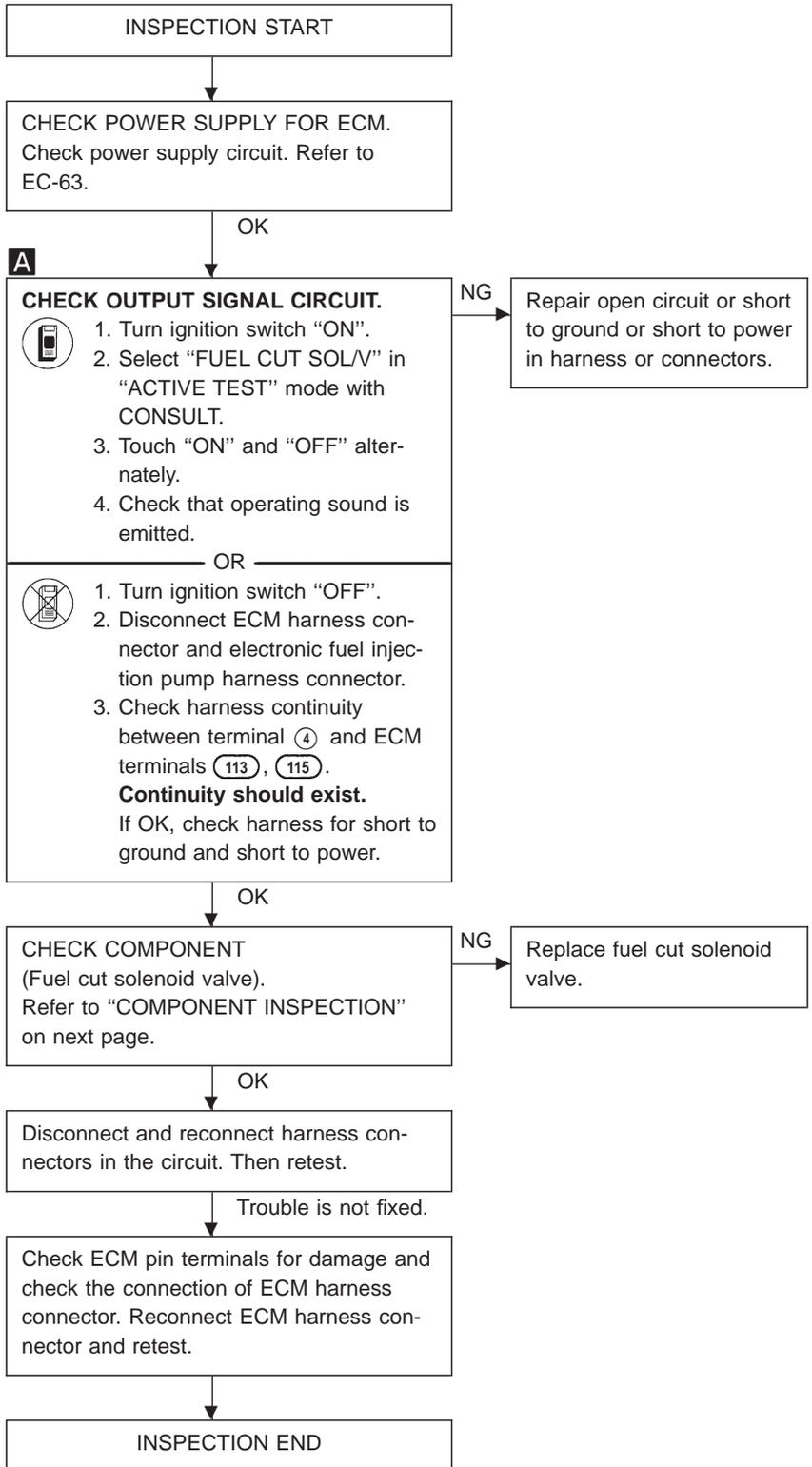
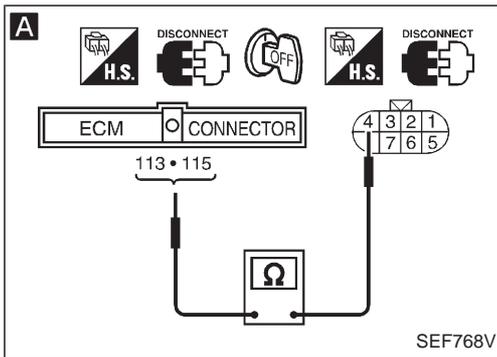
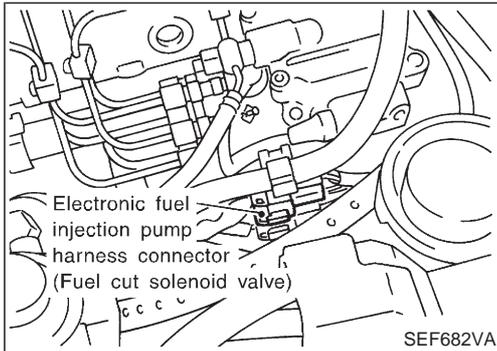
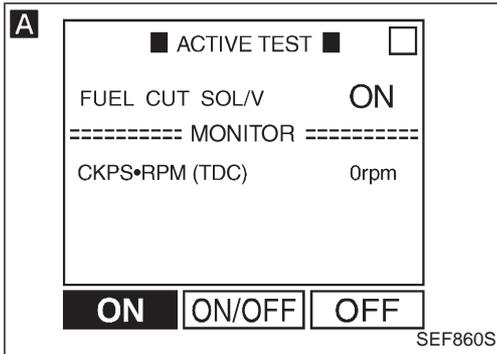
F8
W



TROUBLE DIAGNOSIS FOR “FUEL CUT S/V 1” (DTC 36), “FCV SHORT” (DTC 37), “FUEL CUT S/V 2” (DTC 38)

Fuel Cut Solenoid Valve (Cont'd)

DIAGNOSTIC PROCEDURE



**TROUBLE DIAGNOSIS FOR “FUEL CUT S/V 1” (DTC 36),
“FCV SHORT” (DTC 37), “FUEL CUT S/V 2” (DTC 38)**

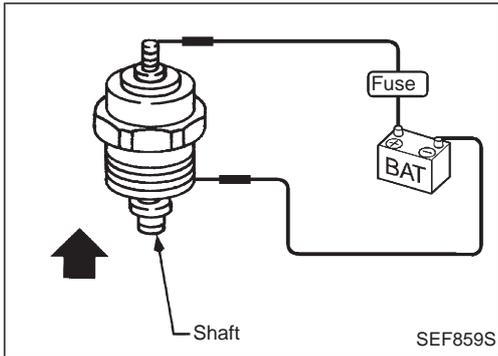
Fuel Cut Solenoid Valve (Cont'd)

COMPONENT INSPECTION

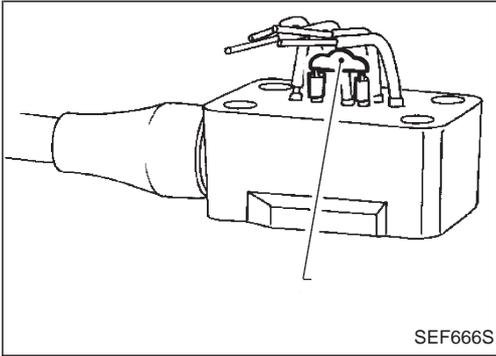
Fuel cut solenoid valve

1. Remove fuel cut solenoid valve.
2. Check shaft to see if it is lifted when applying 12V direct current to terminals.

If NG, replace fuel cut solenoid valve.

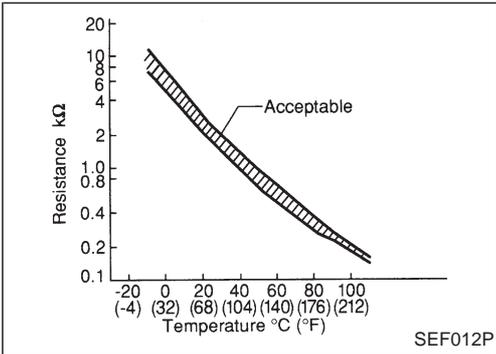


TROUBLE DIAGNOSIS FOR "FUEL TEMP SENSOR" (DTC 42)



Fuel Temperature Sensor (FTS)

The fuel temperature sensor is used to detect the fuel temperature in the injection pump. The sensor modifies a voltage signal from the ECM. The modified signal returns to the ECM as the fuel 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)
-20 (-4)	4.6	13.67 - 16.37
20 (68)	3.5	2.306 - 2.568
60 (140)	1.8	0.538 - 0.624
80 (176)	1.2	0.289 - 0.344

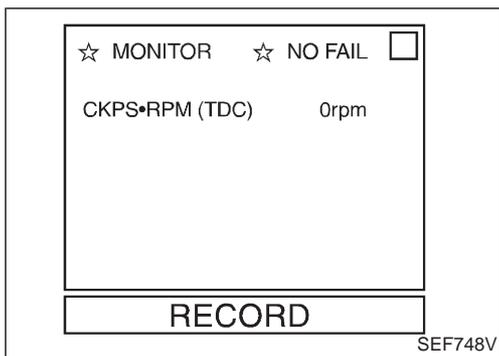
ECM TERMINALS AND REFERENCE VALUE

Remarks: Specification data are reference values and are measured between each terminal and (43) (ECCS ground) with a voltmeter.

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
10	P	Fuel temperature sensor	Engine is running.	Approximately 0 - 4.8V Output voltage varies with fuel temperature.
50	B	Sensors' ground	Engine is running. (Warm-up condition) └ Idle speed	Approximately 0V

ON BOARD DIAGNOSIS LOGIC

Diagnostic Trouble Code No.	Malfunction is detected when ...	Check Items (Possible Cause)
42	<ul style="list-style-type: none"> An excessively high or low voltage from the sensor is detected by ECM. 	<ul style="list-style-type: none"> Harness or connectors (The sensor circuit is open or shorted.) Fuel temperature sensor



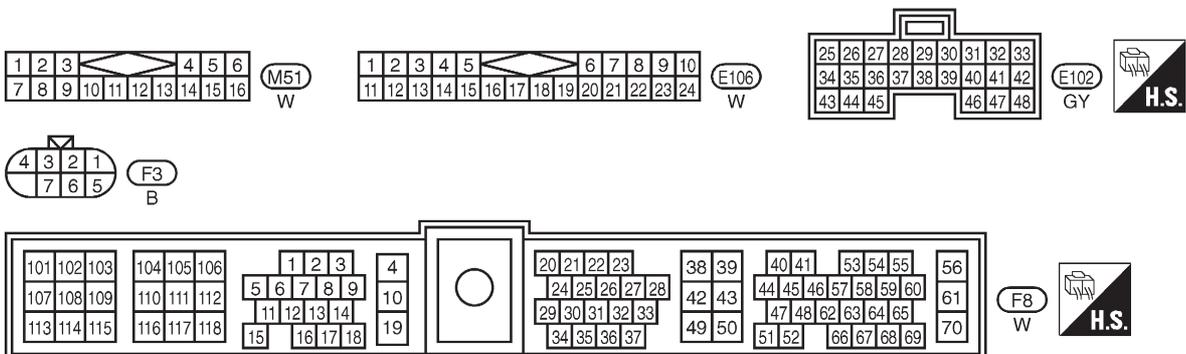
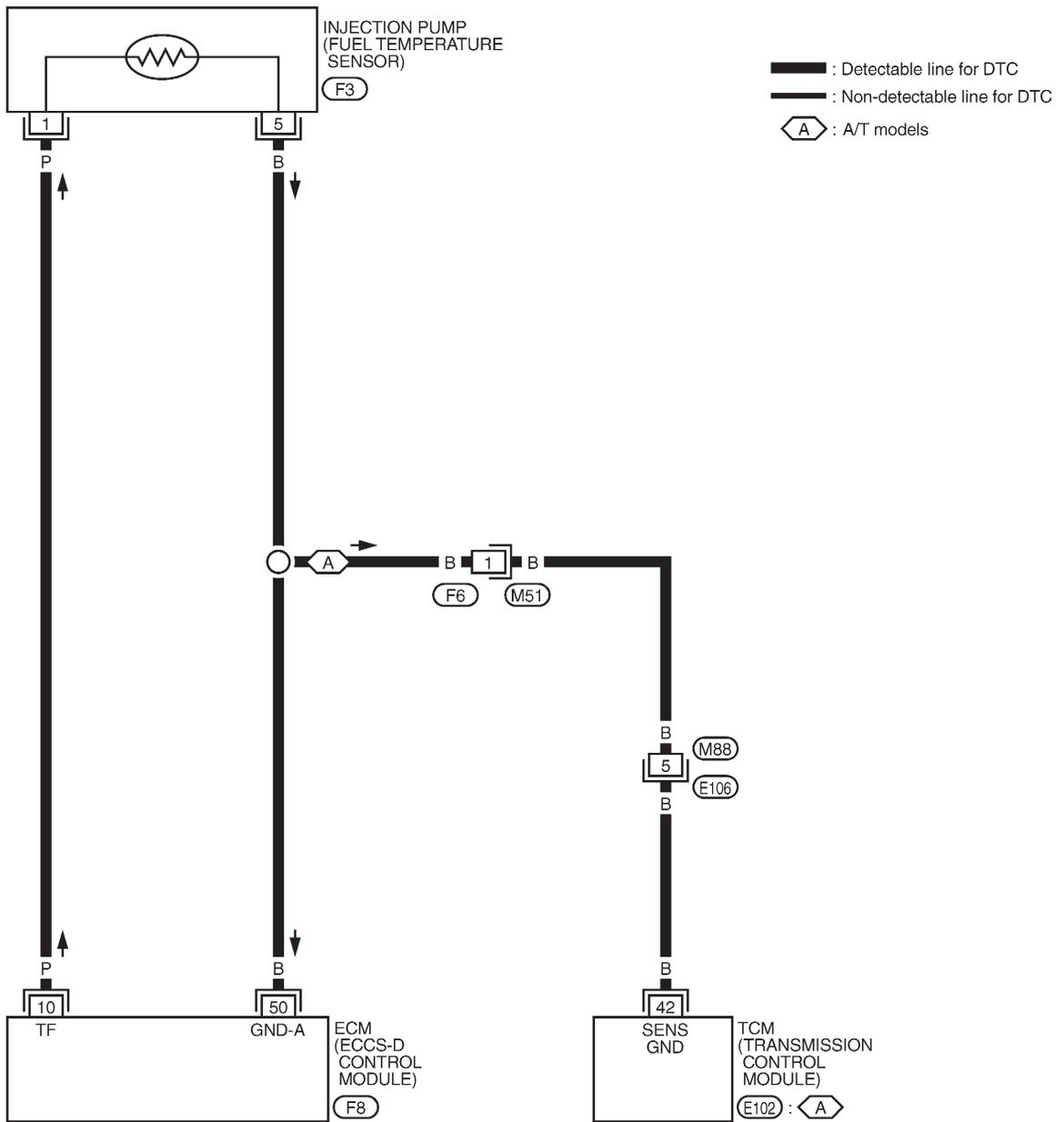
DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

- Turn ignition switch "ON".
 - Select "DATA MONITOR" mode with CONSULT.
 - Wait at least 5 seconds.
- OR
- Turn ignition switch "ON" and wait at least 5 seconds.
 - Turn ignition switch "OFF", wait at least 5 seconds and then turn "ON".
 - Perform "Diagnostic Test Mode II (Self-diagnostic results)" with ECM.

TROUBLE DIAGNOSIS FOR "FUEL TEMP SENSOR" (DTC 42)

Fuel Temperature Sensor (FTS) (Cont'd)

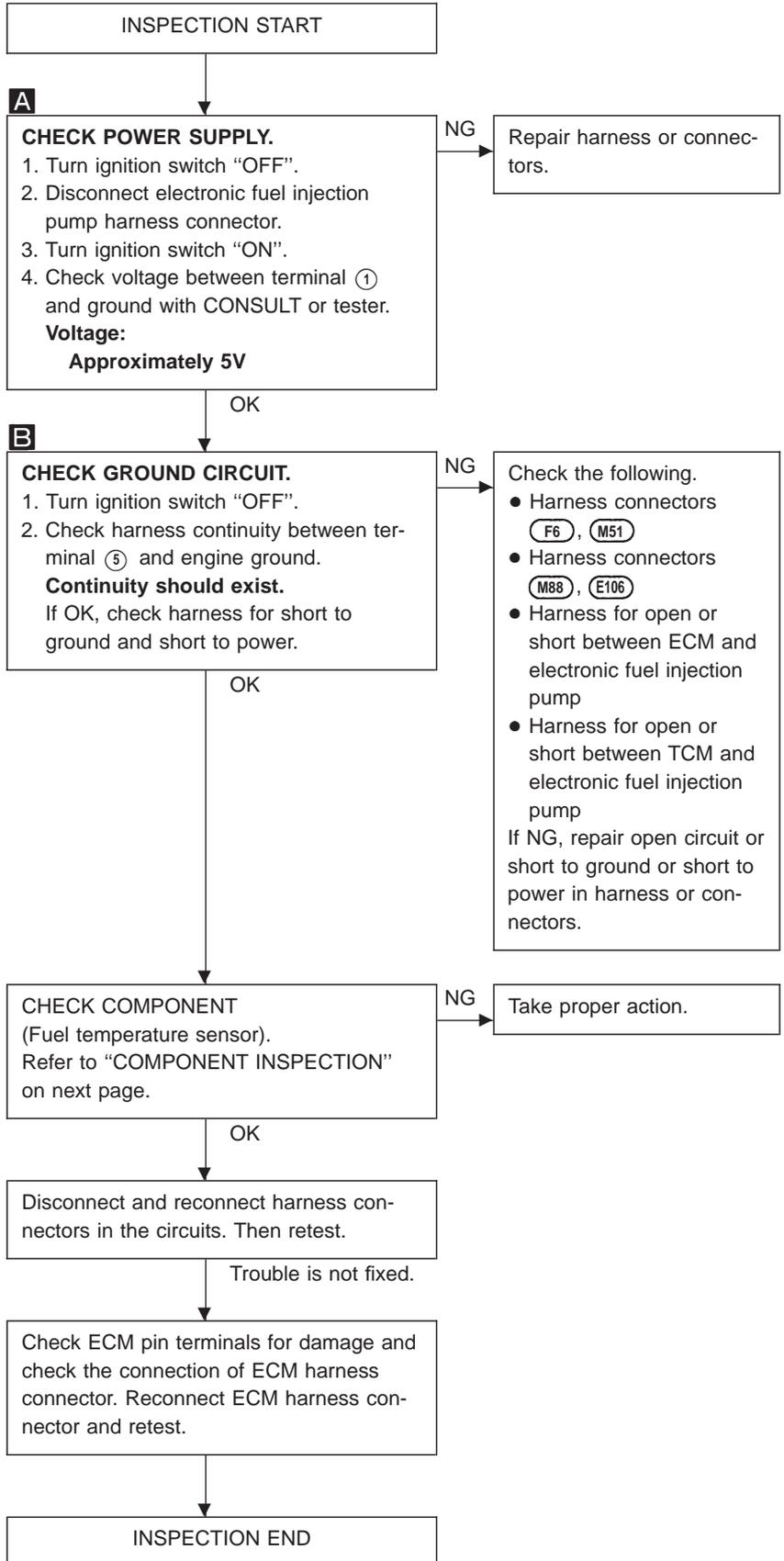
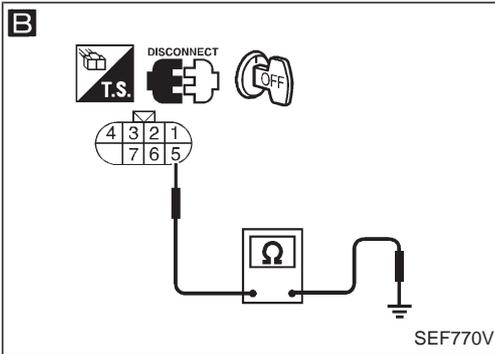
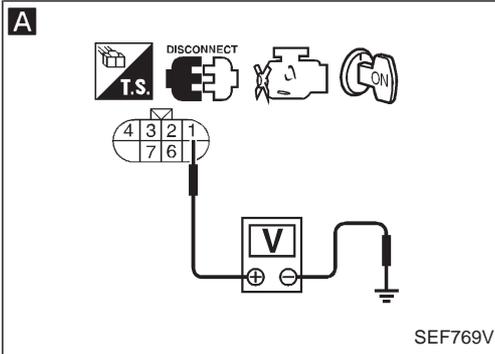
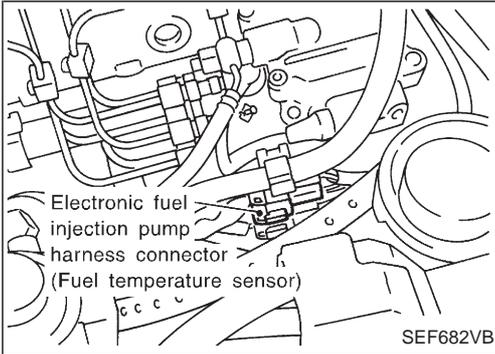
EC-FTS-01



TROUBLE DIAGNOSIS FOR "FUEL TEMP SENSOR" (DTC 42)

Fuel Temperature Sensor (FTS) (Cont'd)

DIAGNOSTIC PROCEDURE

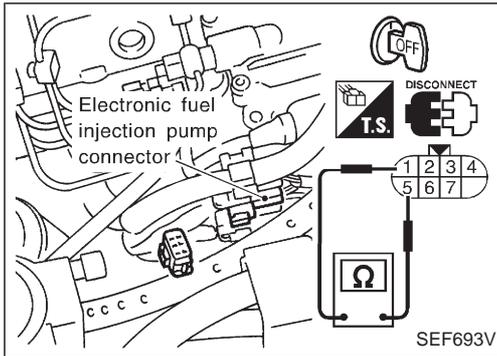


TROUBLE DIAGNOSIS FOR "FUEL TEMP SENSOR" (DTC 42)

Fuel Temperature Sensor (FTS) (Cont'd) COMPONENT INSPECTION

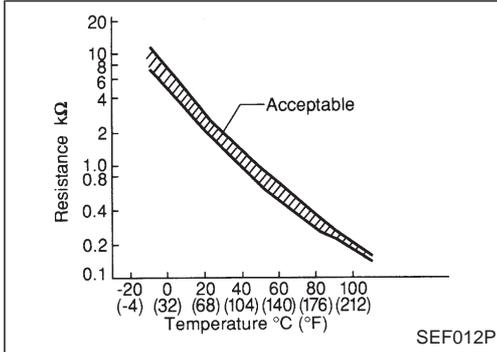
Fuel temperature sensor

Wait until fuel temperature sensor reaches room temperature.
Check resistance as shown in the figure.



Temperature °C (°F)	Resistance kΩ
20 (68)	2.306 - 2.568
60 (140)	0.538 - 0.624
80 (176)	0.289 - 0.344

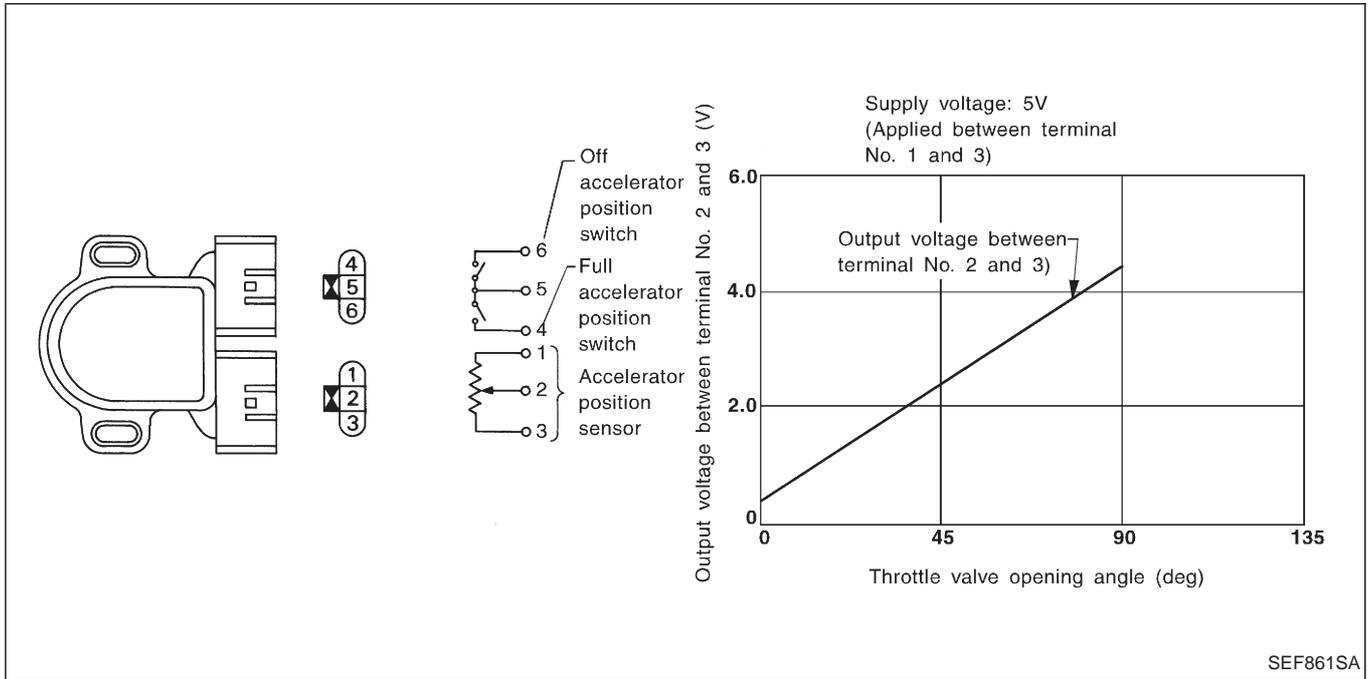
If NG, take proper action.



TROUBLE DIAGNOSIS FOR "ACCEL POS SENSOR" (DTC 43)

Accelerator Position Sensor

The accelerator position sensor is installed on the upper end of the accelerator pedal assembly. The sensor detects the accelerator position and sends a signal to the ECM. The ECM uses the signal to determine the amount of fuel to be injected.



CONSULT REFERENCE VALUE IN DATA MONITOR MODE

Remarks: Specification data are reference values.

MONITOR ITEM	CONDITION	SPECIFICATION
ACCEL POS SEN	<ul style="list-style-type: none"> Ignition switch: ON (Engine stopped) 	Accelerator pedal: released
		Accelerator pedal: depressed

ECM TERMINALS AND REFERENCE VALUE

Remarks: Specification data are reference values and are measured between each terminal and (43) (ECCS ground) with a voltmeter.

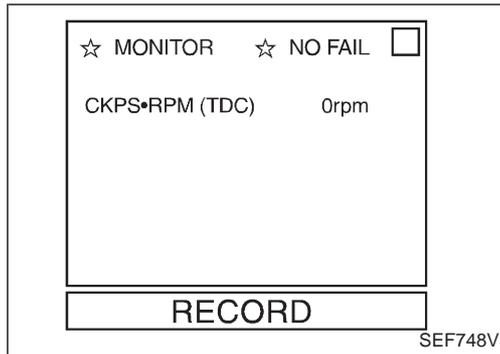
TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
23	W	Accelerator position sensor	Ignition switch "ON" └ Accelerator pedal fully released	0.4 - 0.6V
			Ignition switch "ON" └ Accelerator pedal fully depressed	Approximately 4.3V
48	G/R	Accelerator position sensor power supply	Ignition switch "ON"	Approximately 5V
51	LW	Accelerator position sensor ground	Engine is running. (Warm-up condition) └ Idle speed	Approximately 0V

TROUBLE DIAGNOSIS FOR "ACCEL POS SENSOR" (DTC 43)

Accelerator Position Sensor (Cont'd)

ON BOARD DIAGNOSIS LOGIC

Diagnostic Trouble Code No.	Malfunction is detected when ...	Check Items (Possible Cause)
43	<ul style="list-style-type: none"> An excessively low or high voltage from the sensor is detected by the ECM. 	<ul style="list-style-type: none"> Harness or connectors (The sensor circuit is open or shorted.) Accelerator position sensor Accelerator position switch Accelerator switch (F/C)



DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE



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

OR

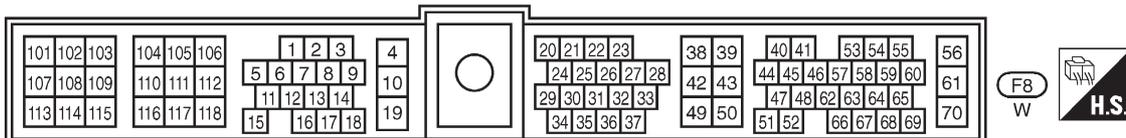
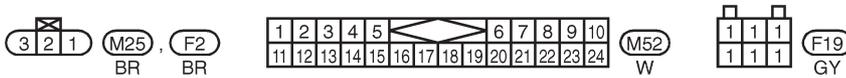
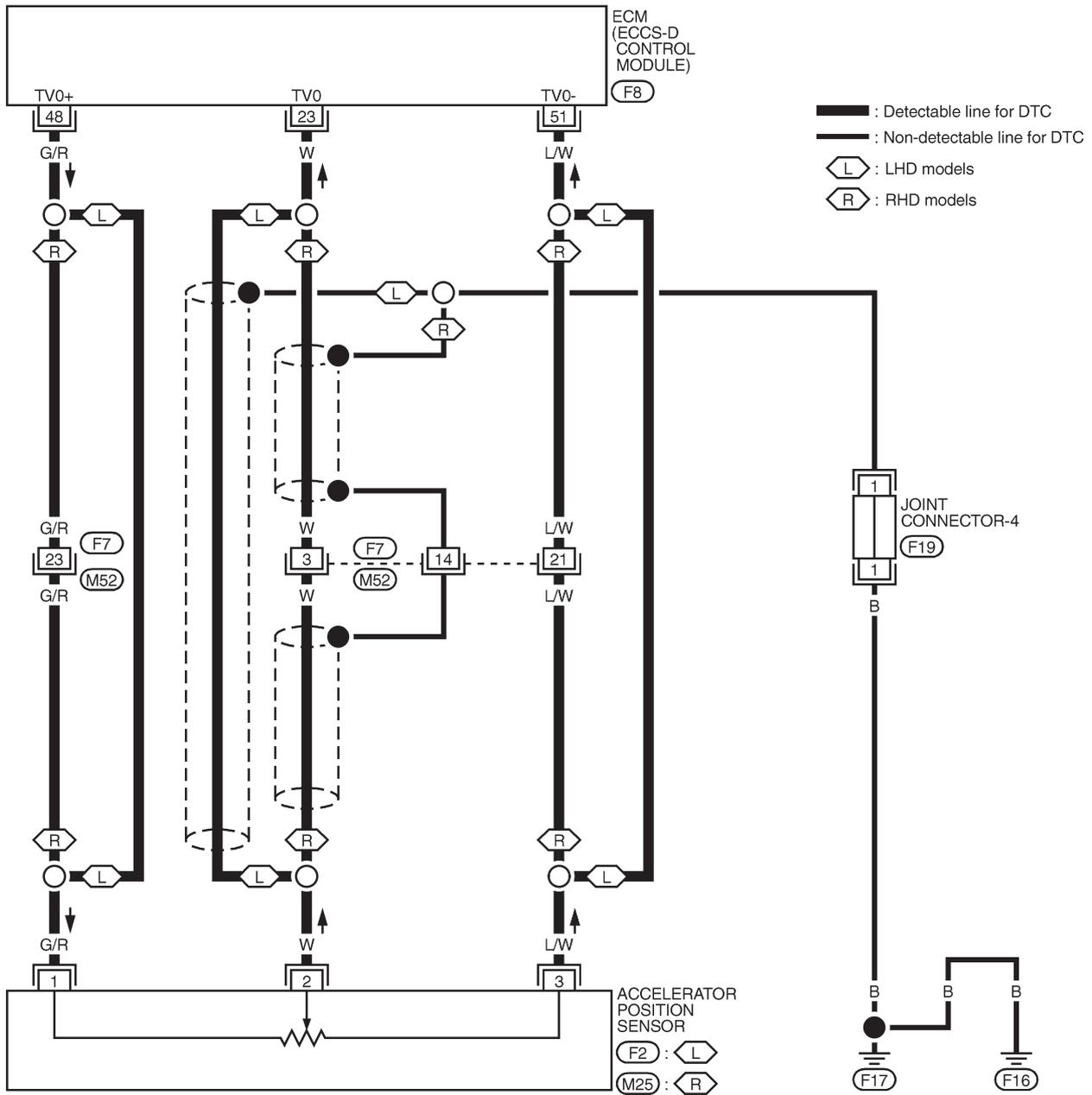


- 1) Turn ignition switch "ON" and wait at least 2 seconds.
- 2) Turn ignition switch "OFF", wait at least 5 seconds and then turn "ON".
- 3) Perform "Diagnostic Test Mode II (Self-diagnostic results)" with ECM.

TROUBLE DIAGNOSIS FOR "ACCEL POS SENSOR" (DTC 43)

Accelerator Position Sensor (Cont'd)

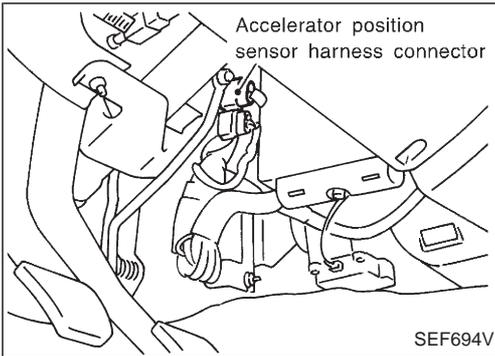
EC-APS-01



TROUBLE DIAGNOSIS FOR "ACCEL POS SENSOR" (DTC 43)

Accelerator Position Sensor (Cont'd)

DIAGNOSTIC PROCEDURE



INSPECTION START

A

CHECK POWER SUPPLY.

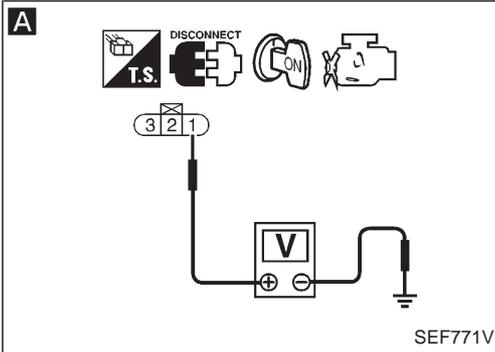
1. Turn ignition switch "OFF".
2. Disconnect accelerator position sensor harness connector.
3. Turn ignition switch "ON".
4. Check voltage between terminal ① and ground with CONSULT or tester.
Voltage: Approximately 5V

NG

Check the following.

- Harness connectors (F7, M52) (RHD models)
 - Harness for open or short between ECM and accelerator position sensor
- If NG, repair harness or connectors.

OK



B

CHECK GROUND CIRCUIT.

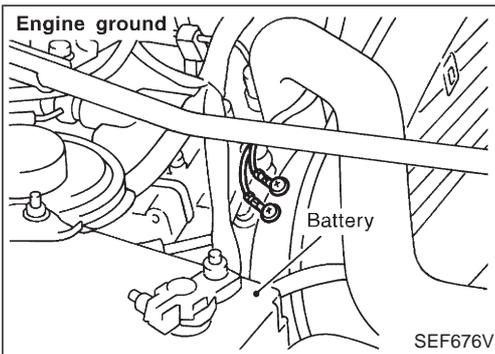
1. Turn ignition switch "OFF".
2. Loosen and retighten engine ground screw.
3. Check harness continuity between terminal ③ and engine ground.
Continuity should exist.
If OK, check harness for short to ground and short to power.

NG

Check the following.

- Harness connectors (F7, M52) (RHD models)
 - Harness for open or short between ECM and accelerator position sensor
- If NG, repair open circuit or short to ground or short to power in harness or connectors.

OK



C

CHECK INPUT SIGNAL CIRCUIT.

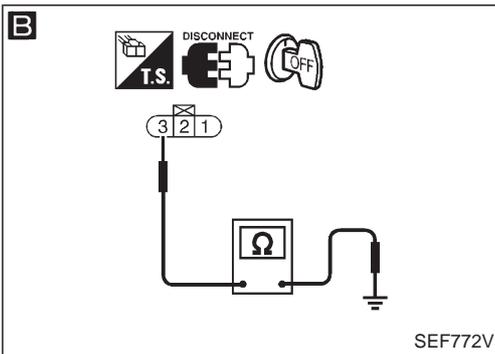
1. Disconnect ECM harness connector.
2. Check harness continuity between ECM terminal ②③ and terminal ②.
Continuity should exist.
If OK, check harness for short to ground and short to power.

NG

Check the following.

- Harness connectors (F7, M52) (RHD models)
 - Harness for open or short between ECM and accelerator position sensor
- If NG, repair open circuit or short to ground or short to power in harness or connectors.

OK



CHECK COMPONENT

(Accelerator position sensor). Refer to "COMPONENT INSPECTION" on next page.

NG

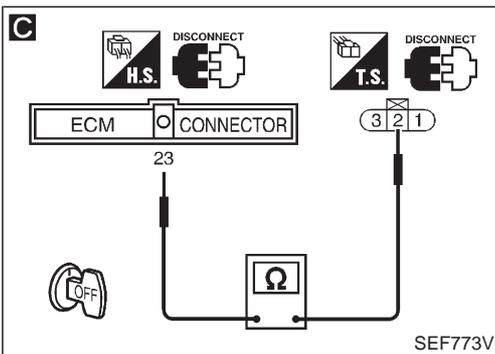
Replace accelerator pedal assembly.

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

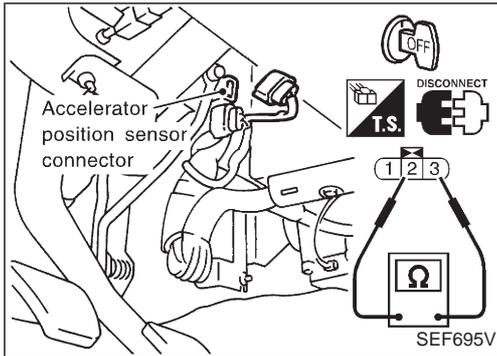
TROUBLE DIAGNOSIS FOR “ACCEL POS SENSOR” (DTC 43)

Accelerator Position Sensor (Cont'd)

COMPONENT INSPECTION

Accelerator position sensor

1. Disconnect accelerator position sensor harness connector.
2. Make sure that resistance between terminals ② and ③ changes when depressing accelerator pedal manually.



Accelerator pedal conditions	Resistance [at 25°C (77°F)]
Completely released	Approximately 0.5 kΩ
Partially depressed	0.5 - 4 kΩ
Completely depressed	Approximately 4 kΩ

If NG, replace accelerator pedal assembly.

CAUTION:

If accelerator position sensor or ECM connector is disconnected, perform the following procedures:



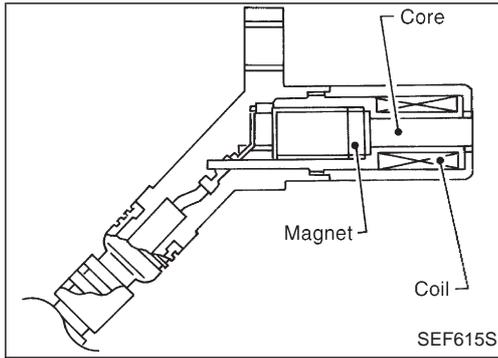
Select “OFF ACCEL PO SIG” in “ACTIVE TEST” mode. Touch CLEAR.

OR



Start and warm up engine. After engine has warmed up, idle for 10 minutes.

TROUBLE DIAGNOSIS FOR “CRANK POS SEN (TDC)” (DTC 47)



Crankshaft Position Sensor (TDC)

The crankshaft position sensor (TDC) monitors engine speed by means of signals from the sensing plate (with two protrusions) installed to the crankshaft pulley. The datum signal output is detected at ATDC 70° and sent to the ECM. The sensor signal is used for fuel injection control and fuel injection timing control.

CONSULT REFERENCE VALUE IN DATA MONITOR MODE

Remarks: Specification data are reference values.

MONITOR ITEM	CONDITION	SPECIFICATION
CKPS-RPM (TDC)	<ul style="list-style-type: none"> Tachometer: Connect Run engine and compare tachometer indication with the CONSULT value. 	Almost the same speed as the CONSULT value.

ECM TERMINALS AND REFERENCE VALUE

Remarks: Specification data are reference values and are measured between each terminal and ④3 (ECCS ground) with a voltmeter.

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
40 44	L	Crankshaft position sensor (TDC)	Engine is running. (Warm-up condition) Idle speed	Approximately 0V SEF720V
			Engine is running. (Warm-up condition) Engine speed is 2,000 rpm.	Approximately 0V SEF721V
47 52	B/W	Crankshaft position sensor (TDC) ground	Engine is running. (Warm-up condition) Idle speed	Approximately 0V

ON BOARD DIAGNOSIS LOGIC

Diagnostic Trouble Code No.	Malfunction is detected when	Check Items (Possible Cause)
47	<ul style="list-style-type: none"> An improper signal from the sensor is detected by ECM during engine running and cranking. 	<ul style="list-style-type: none"> Harness or connectors (The sensor circuit is open.) Crankshaft position sensor (TDC)

TROUBLE DIAGNOSIS FOR “CRANK POS SEN (TDC)” (DTC 47)

Crankshaft Position Sensor (TDC) (Cont'd)

DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

Before performing the following procedure, confirm that battery voltage is more than 10V.

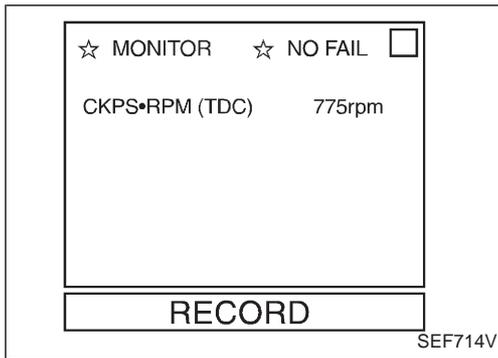


- 1) Turn ignition switch “ON” and select “DATA MONITOR” mode with CONSULT.
- 2) Crank engine for at least 1 second.
- 3) Start engine and run it for at least 2 seconds at idle speed.

OR



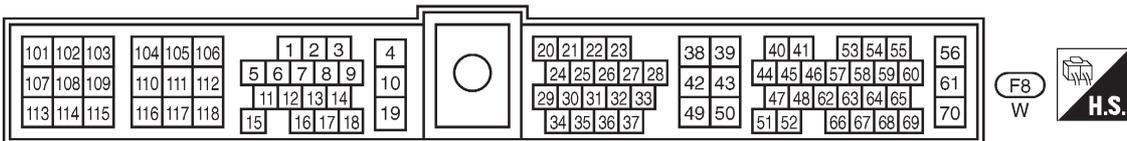
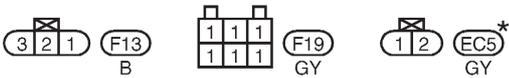
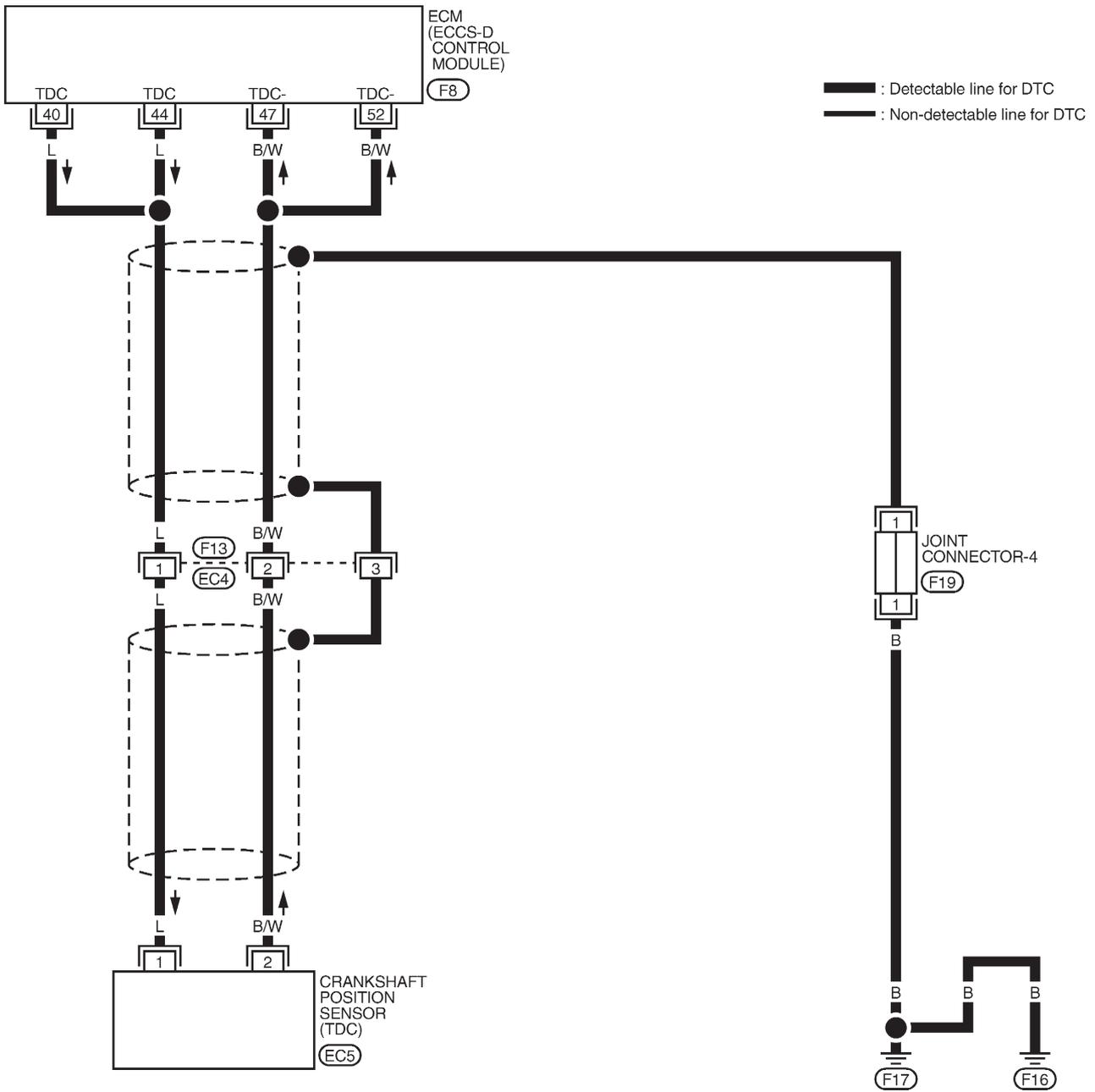
- 1) Crank engine for at least 1 second.
- 2) Start engine and run it for at least 2 seconds at idle speed.
- 3) Turn ignition switch “OFF”, wait at least 5 seconds and then turn “ON”.
- 4) Perform “Diagnostic Test Mode II (Self-diagnostic results)” with ECM.



TROUBLE DIAGNOSIS FOR "CRANK POS SEN (TDC)" (DTC 47)

Crankshaft Position Sensor (TDC) (Cont'd)

EC-CKPS-01

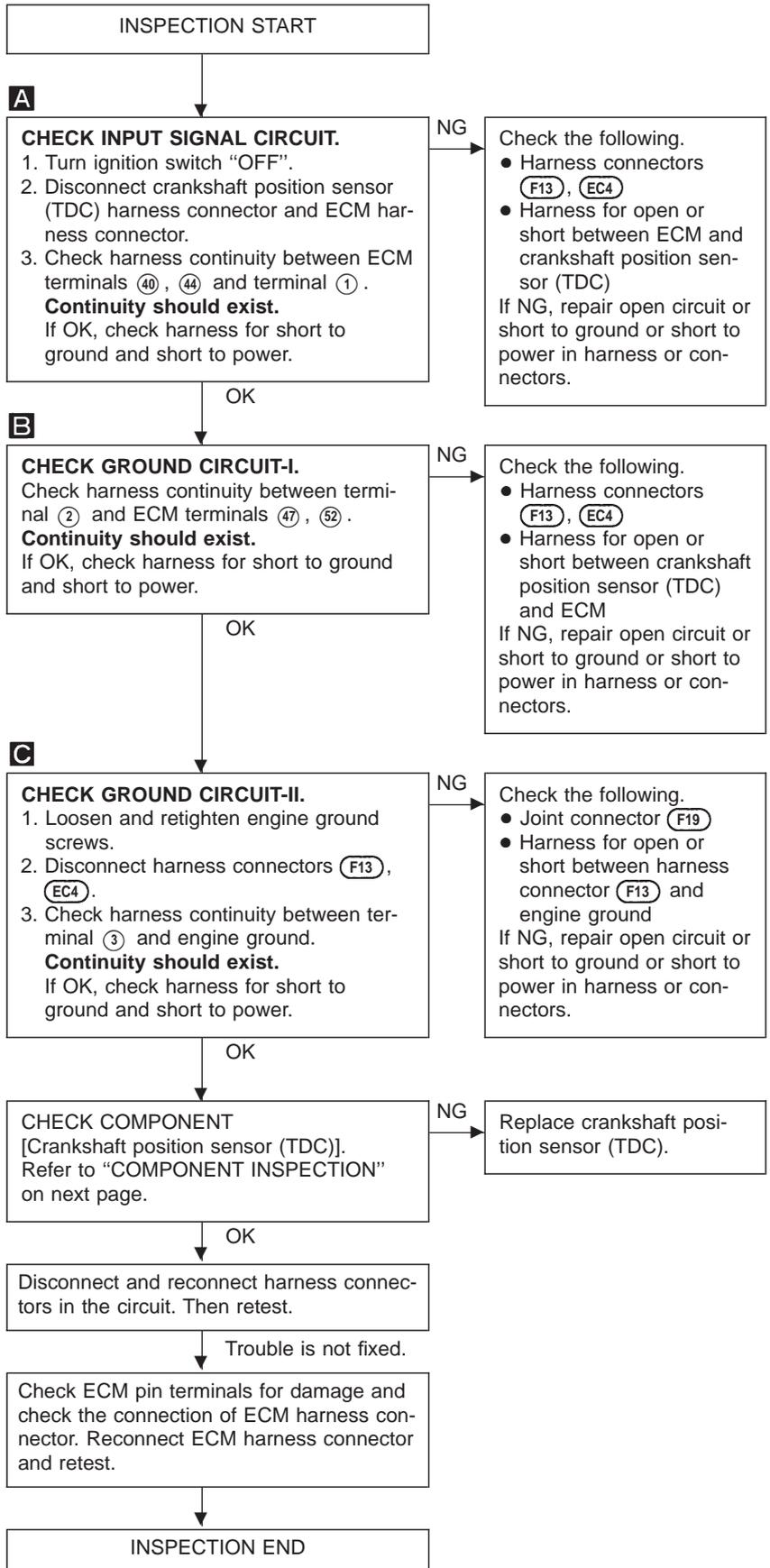
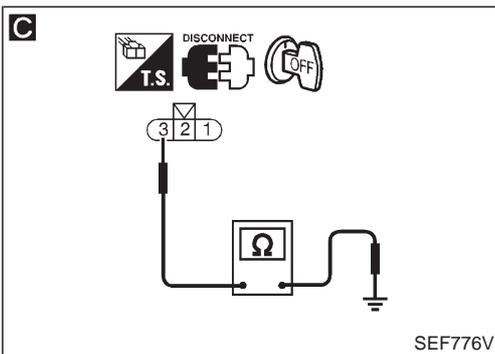
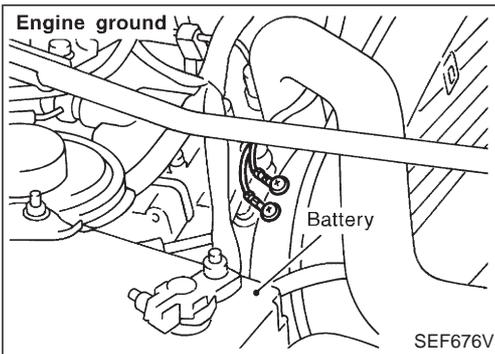
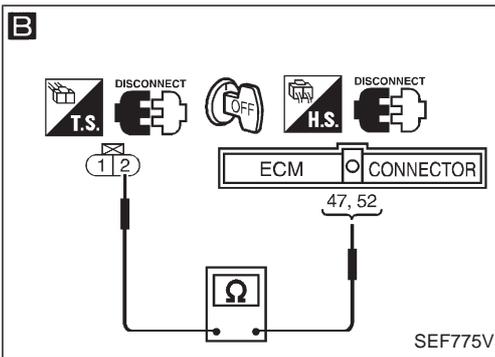
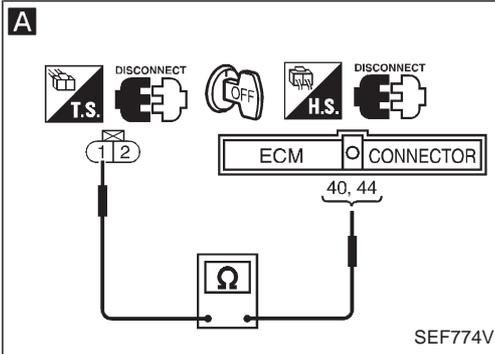
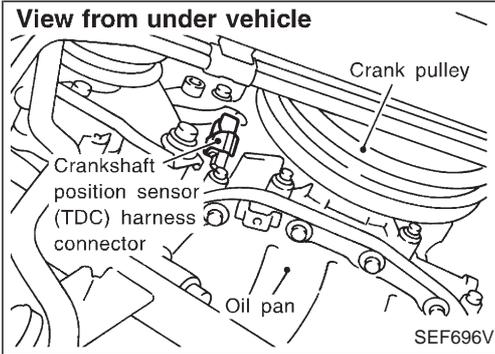


*: This connector is not shown in "HARNESS LAYOUT", EL section.

TROUBLE DIAGNOSIS FOR "CRANK POS SEN (TDC)" (DTC 47)

Crankshaft Position Sensor (TDC) (Cont'd)

DIAGNOSTIC PROCEDURE



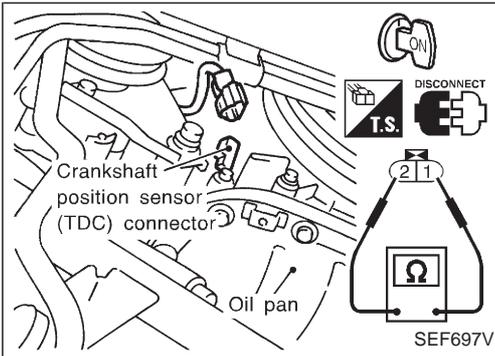
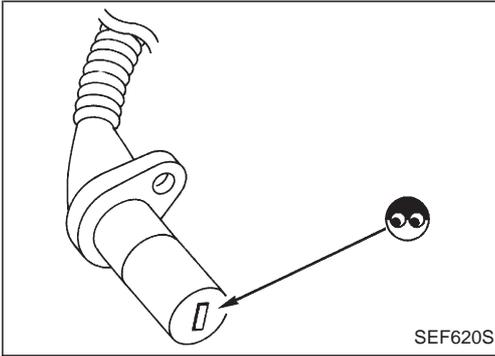
TROUBLE DIAGNOSIS FOR "CRANK POS SEN (TDC)" (DTC 47)

Crankshaft Position Sensor (TDC) (Cont'd)

COMPONENT INSPECTION

Crankshaft position sensor (TDC)

1. Disconnect crankshaft position sensor (TDC) harness connector.
2. Loosen the fixing bolt of the sensor.
3. Remove the sensor.
4. Visually check the sensor for chipping.
5. Check resistance between terminals ① and ②.
Resistance: Approximately 0.8 - 1.2 k Ω
[at 25°C (77°F)]
If NG, replace crankshaft position sensor (TDC).

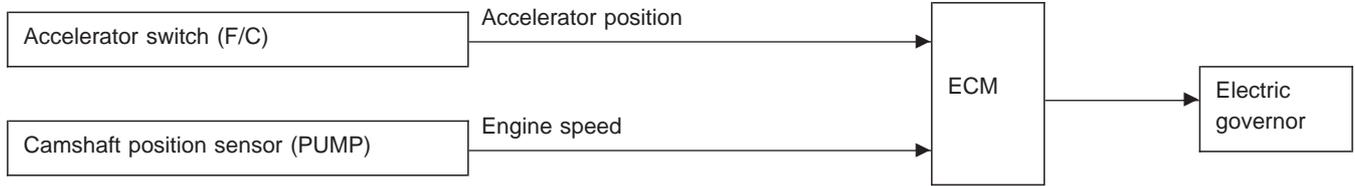


TROUBLE DIAGNOSIS FOR “GOV CUT CIRCUIT” (DTC 48)

Governor Cut Circuit

ON BOARD DIAGNOSIS LOGIC

This diagnostic procedure checks whether or not fuel cut is being performed during deceleration. Signals from the accelerator switch and camshaft position sensor (PUMP) are sent to the ECM. The ECM uses these signals to control the electric governor operation.



Diagnostic Trouble Code No.	Malfunction is detected when	Check Item (Possible Cause)
48	<ul style="list-style-type: none"> ● Accelerator switch circuit is shorted. ● Crankshaft position sensor (PUMP) or ECM is malfunctioning. 	<ul style="list-style-type: none"> ● Harness or connectors [Accelerator switch (F/C) and camshaft position sensor (PUMP) circuits] ● Accelerator switch (F/C) ● Camshaft position sensor (PUMP) ● ECM

DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

Note: If both DTC 48 and 11 or 23 are displayed, perform TROUBLE DIAGNOSIS FOR DTC 11 or 23 (See EC-69 or 106).

-  1) Turn ignition switch “ON”.
 2) Select “DATA MONITOR” mode with CONSULT.
 3) Start engine and run it to 3,000 rpm, then quickly release accelerator pedal.

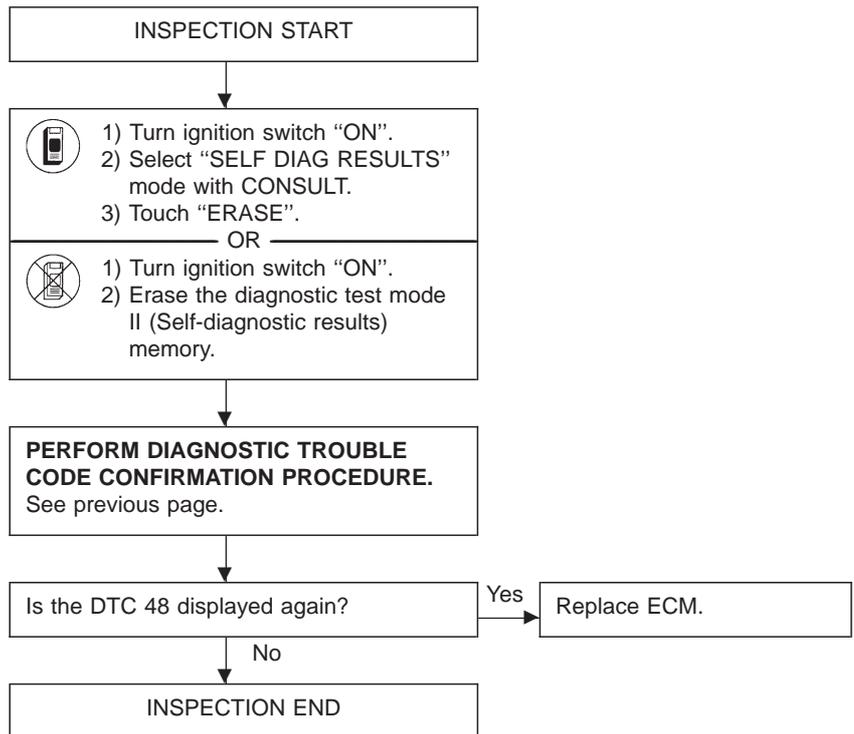
OR

-  1) Start engine and run it to 3,000 rpm, then quickly release accelerator pedal.
 2) Turn ignition switch “OFF”, wait at least 5 seconds and then turn “ON”.
 3) Perform “Diagnostic Test Mode II (Self-diagnostic results)”.

TROUBLE DIAGNOSIS FOR "GOV CUT CIRCUIT" (DTC 48)

Governor Cut Circuit (Cont'd)

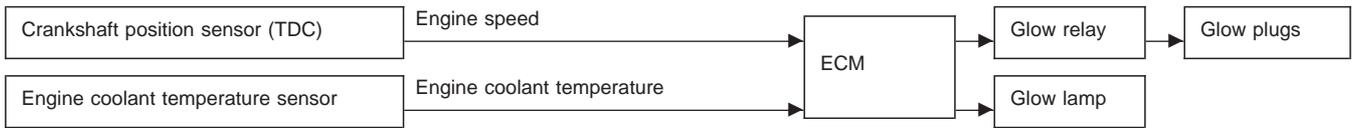
DIAGNOSTIC PROCEDURE



TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

Glow Control System

SYSTEM DESCRIPTION

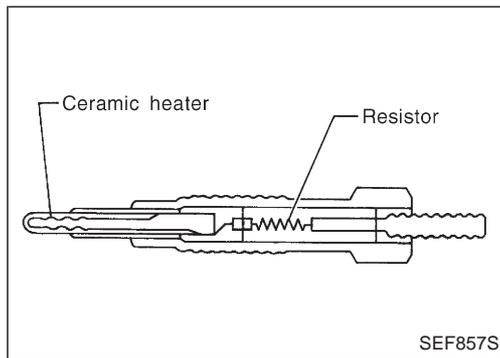


When engine coolant temperature is more than 90°C (194°F), the glow relay turns off, inactivating the quick-glow control until coolant temperature drops below 70°C (158°F).

When coolant temperature is lower than 90°C (194°F):

- Ignition switch ON
After ignition switch has turned to ON, the glow relay turns ON for a certain period of time in relation to engine coolant temperature, allowing current to flow through glow plug.
- Cranking
The glow relay turns ON, allowing current to flow through glow plug.
- Starting
After engine has started, current continues to flow through glow plug (after-glow mode) for a certain period in relation to engine coolant temperature.
When engine speed exceeds 2,400 rpm, current flow through glow plug is interrupted.

The glow lamp turns ON for a certain period of time in relation to engine coolant temperature at the time glow relay is turned ON.



COMPONENT DESCRIPTION

Glow plug

The glow plug is provided with a ceramic heating element to obtain a high-temperature resistance. It glows in response to a signal sent from the ECM, allowing current to flow through the glow plug via the glow relay.

ECM TERMINALS AND REFERENCE VALUE

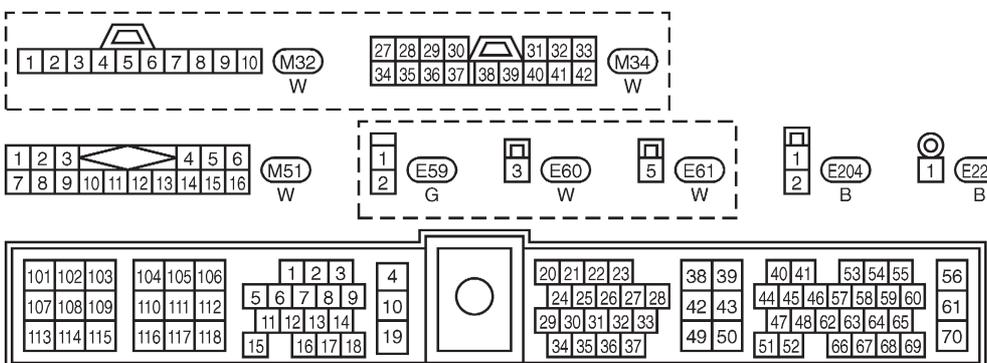
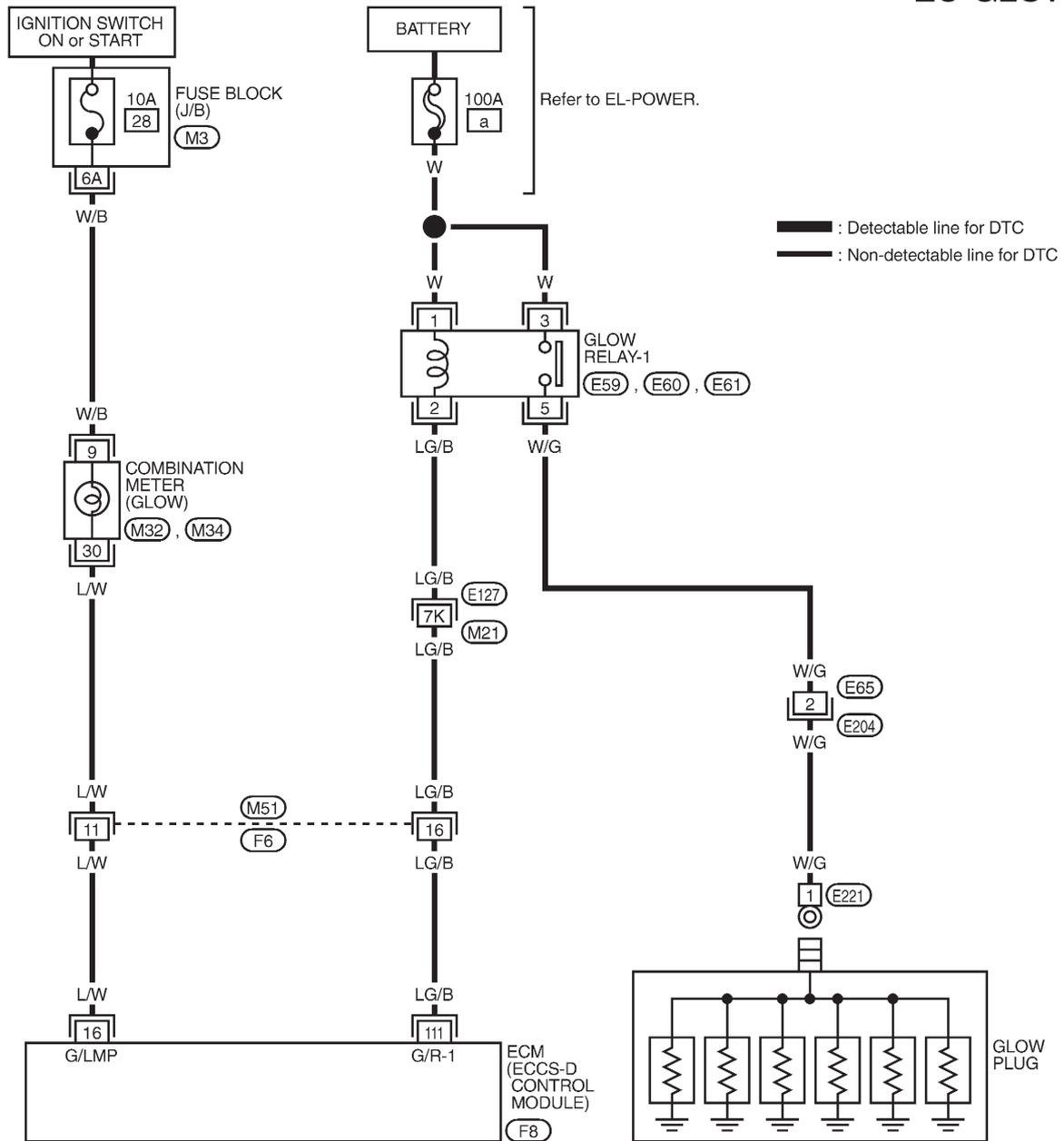
Remarks: Specification data are reference values and are measured between each terminal and ④ (ECCS ground) with a voltmeter.

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
16	L/W	Glow lamp	Ignition switch "ON" └ Glow lamp is "ON".	0 - 1.5V
			Ignition switch "ON" └ Glow lamp is "OFF".	BATTERY VOLTAGE (11 - 14V)
111	LG/B	Glow relay	Refer to "SYSTEM DESCRIPTION".	

TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

Glow Control System (Cont'd)

EC-GLOW-01



Refer to last page (Foldout page).

(M21, E127)

(M3)

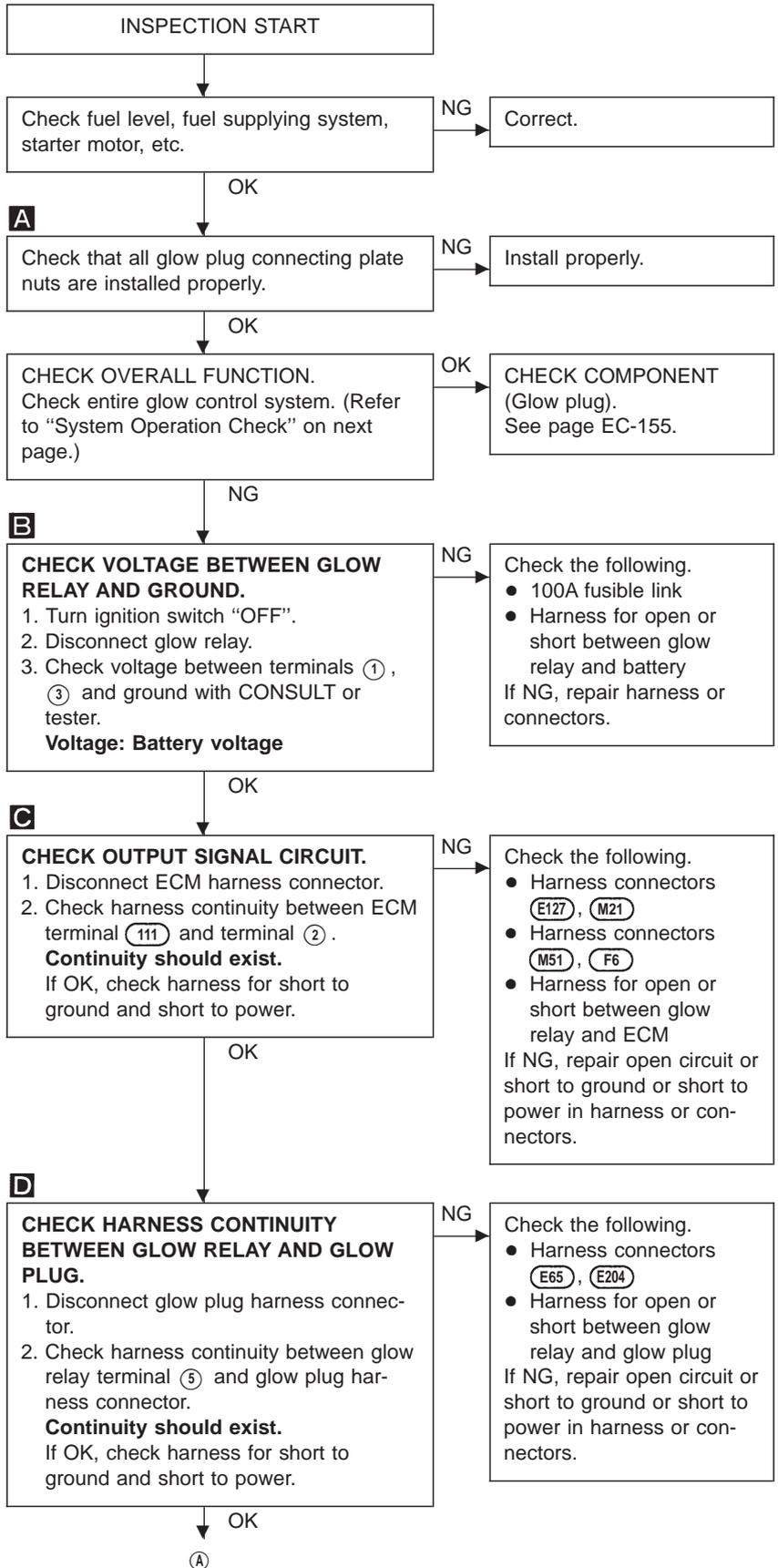
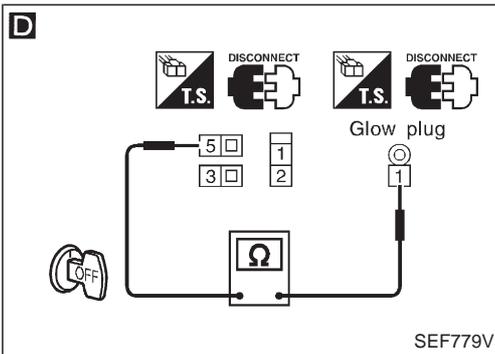
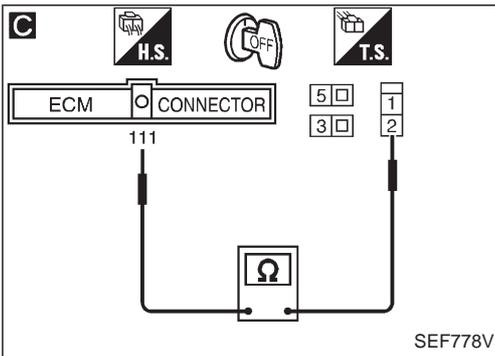
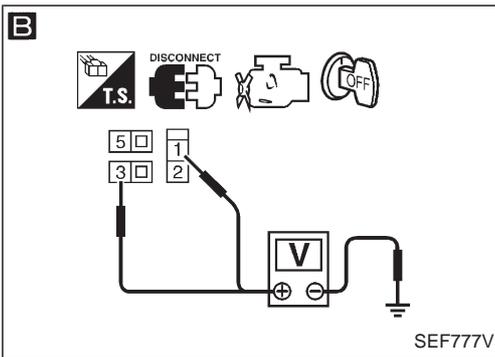
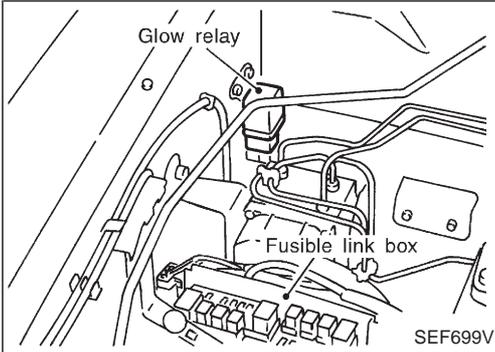
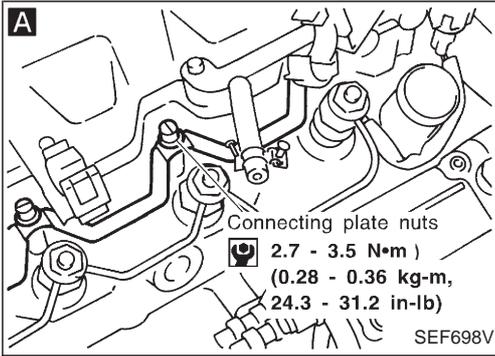
(F8) W



TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

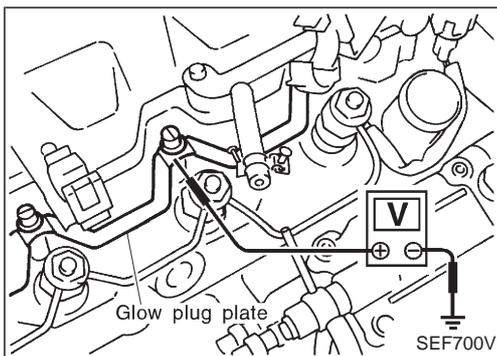
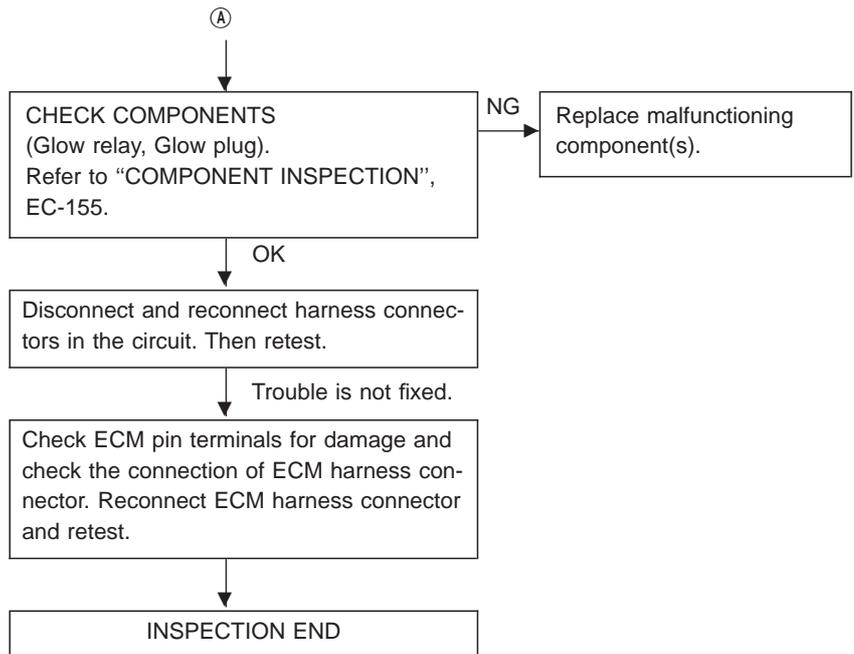
Glow Control System (Cont'd)

DIAGNOSTIC PROCEDURE



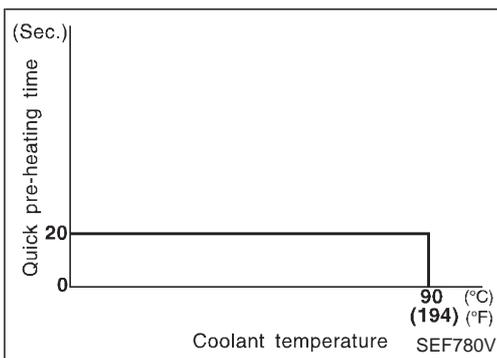
TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

Glow Control System (Cont'd)



SYSTEM OPERATION CHECK

Set voltmeter between glow plug and engine body.



1. Quick-glow (Pre-glow) system

- Turn ignition switch "ON".
- Read voltage.

Voltage:

Battery voltage for about 20* seconds

* Engine coolant temperature is lower than 90°C (194°F). [It is lower than 70°C (158°F) after warm-up.]

* Repeating ignition switch "ON" and "OFF" may change the time.

2. Quick-glow (Cranking) system

- Disconnect "S" terminal for starter motor to prevent engine from cranking.
- Read voltage when ignition switch is turned to "START".

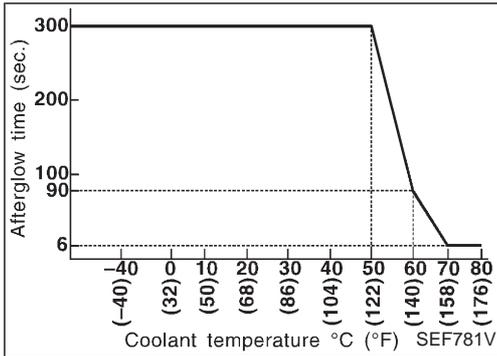
Voltage:

Battery voltage*

* For about 20 seconds after returning ignition switch to "ON".

TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

Glow Control System (Cont'd)



3. After-glow system
 - a. Connect "S" terminal to starter motor.
 - b. Start engine and read voltage.

Voltage:

Battery voltage for 5* minutes

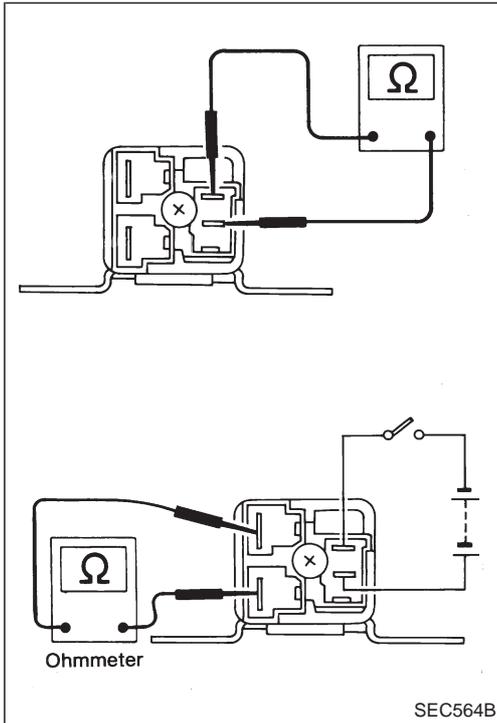
* Engine coolant temperature is lower than 50°C (122°F).

COMPONENT INSPECTION

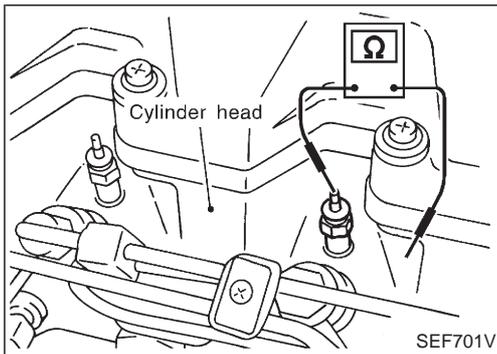
Glow relay

1. Check relay for coil continuity.
Continuity should exist.
2. Check relay for proper operation.

Coil voltage	Continuity	Contact point
0V	No	OFF
12V	Yes	ON



SEC564B



SEF701V

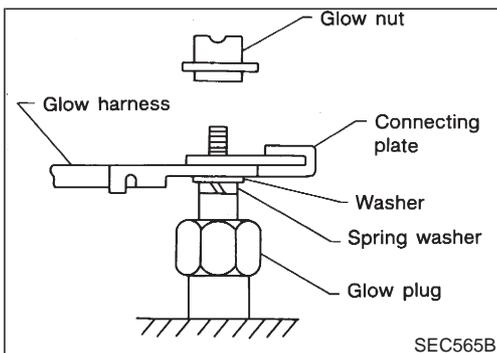
Glow plug

1. Remove glow plug connecting plate.
2. Check each glow plug for continuity.

Continuity should exist:

Approximately 0.8Ω [at 25°C (77°F)]

- If NG, replace glow plug.



SEC565B

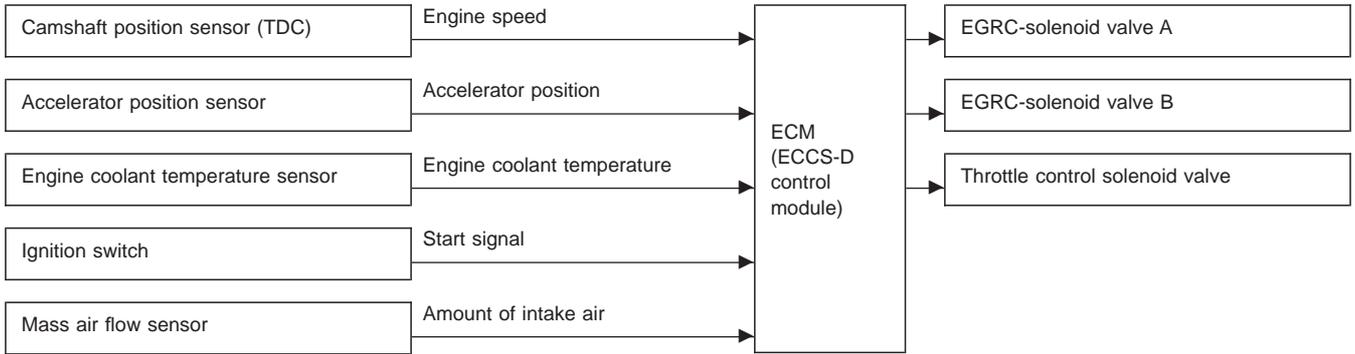
3. Install glow plug connecting plate securely.
 - Do not bump glow plug heating element. If it is bumped, replace glow plug with new one. (If glow plug is dropped from a height of 10 cm (3.94 in), replace with new one.)
 - If glow plug installation hole is contaminated with carbon, remove using a reamer or suitable tool.
 - Hand-tighten glow plug by turning it two to three times, then tighten using a tool to specified torque.

⚙️: 15 - 20 N·m (1.5 - 2.0 kg·m, 11 - 14 ft·lb)

TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

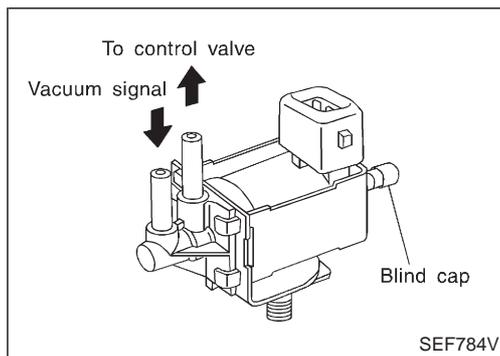
EGRC-Solenoid Valve A, B and Throttle Control Solenoid Valve

SYSTEM DESCRIPTION



The ECM receives signals sent from the engine coolant temperature sensor, crankshaft position sensor (TDC), ignition switch, mass air flow sensor and accelerator position sensor to determine engine speed and operating conditions. Based on these signals, the ECM controls EGR control solenoid valve (A and B) operation and throttle control solenoid valve operation.

Engine coolant temperature °C (°F)	Load	EGRC-solenoid valve		Throttle control solenoid valve	EGR valve	Throttle control valve	Amount of EGR gas
		A	B				
Below 70 (158)	Any	OFF (Closed)	OFF (Closed)	OFF (Closed)	Fully closed	Fully open	—
Above 70 (158)	Low load	ON (Open)	ON (Open)	ON (Open)	Fully open	Closed	Large
	Medium load-1	ON (Open)	ON (Open)	OFF (Closed)	Fully open	Fully open	Medium
	Medium load-2	ON (Open)	OFF (Closed)	OFF (Closed)	Half open	Fully open	Small
	High load	OFF (Closed)	OFF (Closed)	OFF (Closed)	Fully closed	Fully open	—



COMPONENT DESCRIPTION

The EGRC-solenoid valves A and B control vacuum pressure acting on the EGR valve. The EGR control valve will then be fully opened, half-opened or fully closed, as required.

The throttle control solenoid valve controls vacuum pressure acting on the throttle chamber. Thus, intake air passages are opened or closed in relation to exhaust gas and intake air. Utilizing the relationship between exhaust gas pressure and intake air pressure control, the amount of EGR (exhaust gas recirculated) is regulated in three stages — large, medium, small.

TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

EGRC-Solenoid Valve A, B and Throttle Control Solenoid Valve (Cont'd)

CONSULT REFERENCE VALUE IN DATA MONITOR MODE

Remarks: Specification data are reference values.

MONITOR ITEM	CONDITION	SPECIFICATION
EGRC SOL/V A	● Engine: After warming up ● Air conditioner switch: "OFF" ● Shift lever: "N" ● No-load Idle	ON
	Revsing engine from idle to 3,750 rpm	OFF
EGRC SOL/V B	● Engine: After warming up ● Air conditioner switch: "OFF" ● Shift lever: "N" ● No-load Idle	ON
	Revsing engine from idle to 2,600 rpm	OFF
THROT RLY	● Engine: After warming up ● Air conditioner switch: "OFF" ● Shift lever: "N" ● No-load Idle	ON
	Revsing engine from idle to 2,500 rpm	OFF

ECM TERMINALS AND REFERENCE VALUE

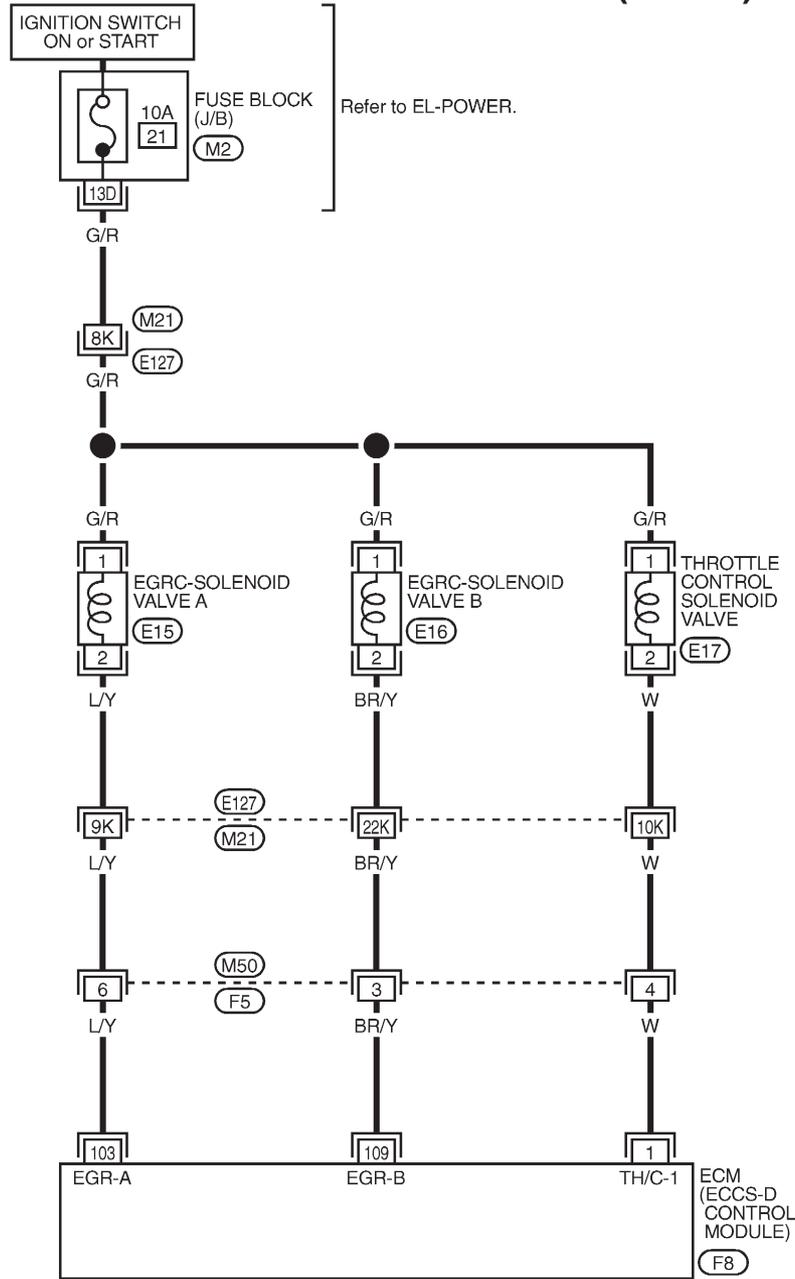
Remarks: Specification data are reference values and are measured between each terminal and ④ (ECCS ground) with a voltmeter.

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
1	W	Throttle control solenoid valve	Engine is running. (Warm-up condition) └ Idle speed	Approximately 0.4V
			Engine is running. (Warm-up condition) └ Revving engine from idle to 2,500 rpm	BATTERY VOLTAGE (11 - 14V)
103	L/Y	EGRC-solenoid valve A	Engine is running. (Warm-up condition) └ Idle speed	0 - 1V
			Engine is running. (Warm-up condition) └ Revving engine from idle up to 3,750 rpm.	BATTERY VOLTAGE (11 - 14V)
109	BR/Y	EGRC-solenoid valve B	Engine is running. (Warm-up condition) └ Idle speed	0 - 1V
			Engine is running. (Warm-up condition) └ Revving engine from idle up to 2,600 rpm.	BATTERY VOLTAGE (11 - 14V)

TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

EGRC-Solenoid Valve A, B and Throttle Control Solenoid Valve (Cont'd)

EC-EGRC/V-01



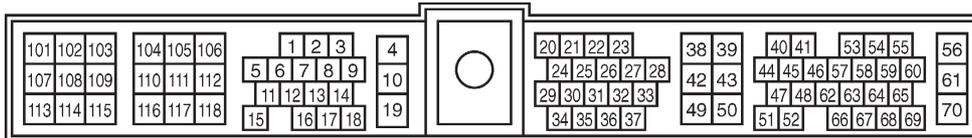
— : Detectable line for DTC
 — : Non-detectable line for DTC



Refer to last page (Foldout page).

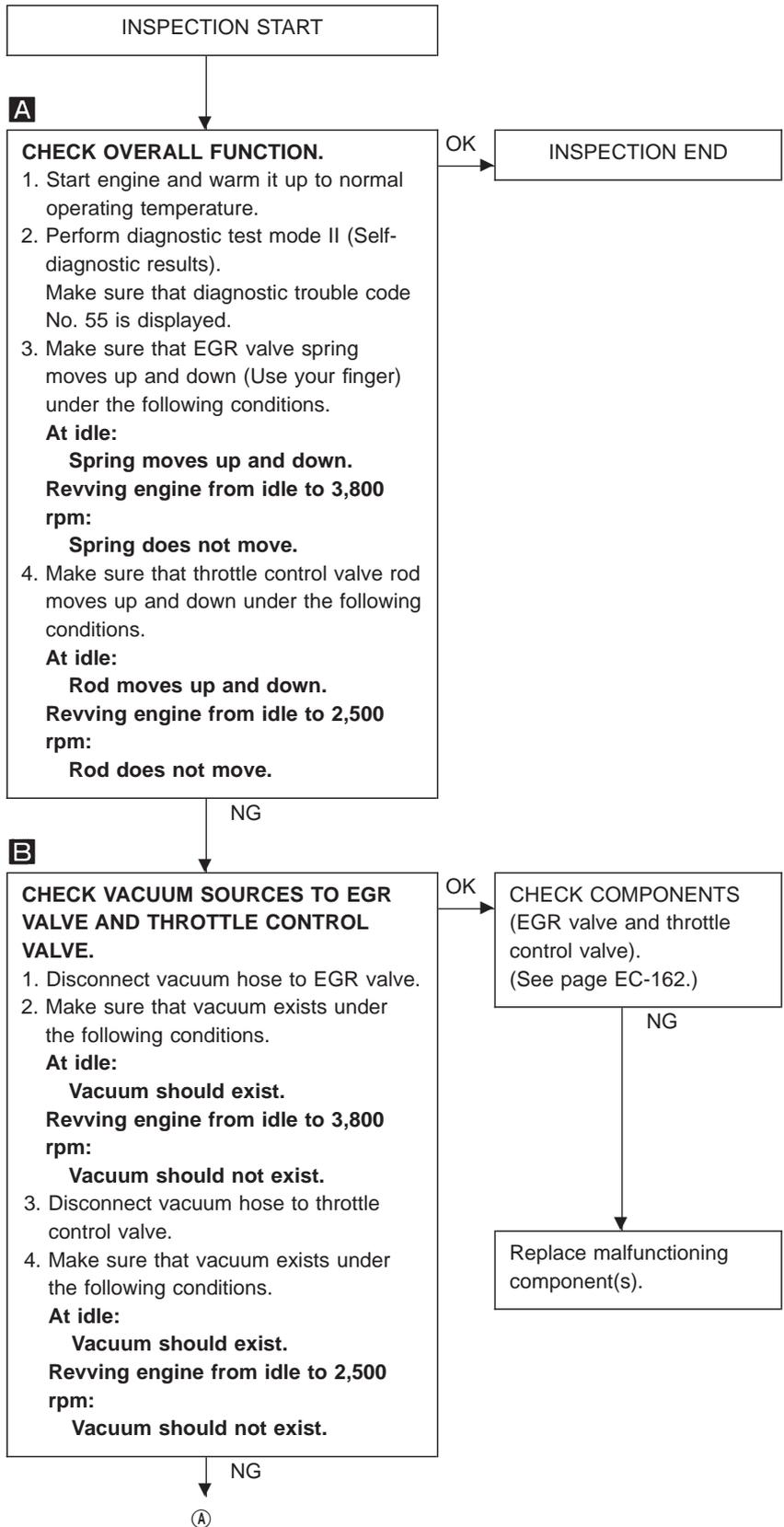
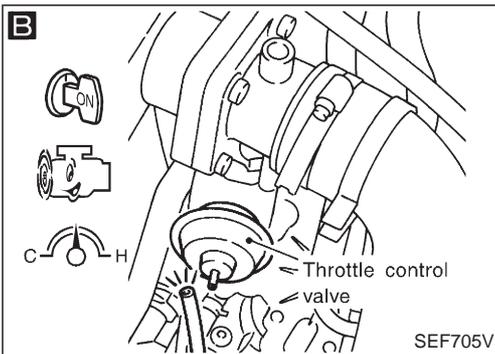
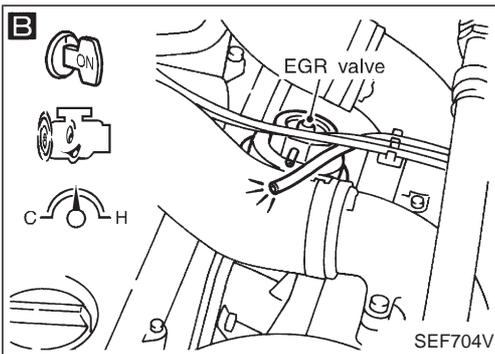
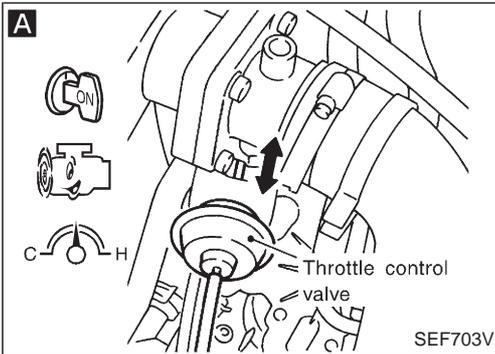
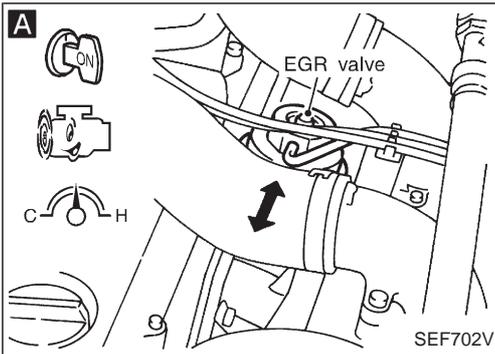
(M21) (E127)

(M2)



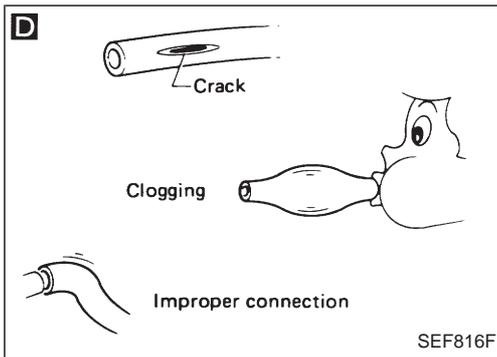
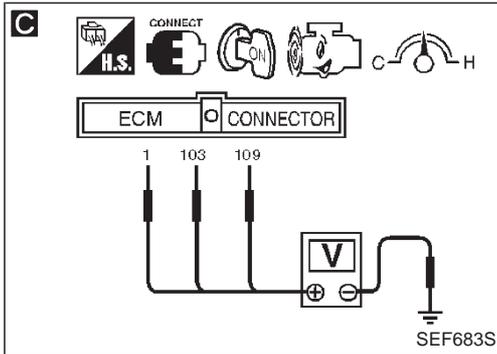
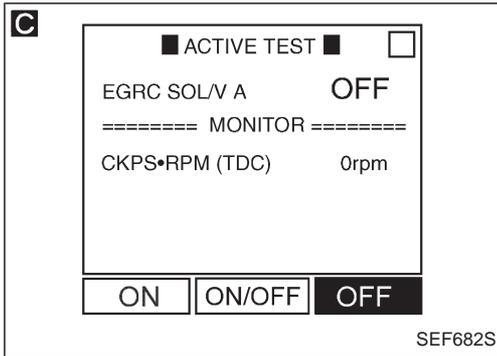
TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

EGRC-Solenoid Valve A, B and Throttle Control Solenoid Valve (Cont'd) DIAGNOSTIC PROCEDURE



TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

EGRC-Solenoid Valve A, B and Throttle Control Solenoid Valve (Cont'd)



C

CHECK CONTROL FUNCTION.

1. Stop engine.
2. Turn ignition switch "ON".
3. Turn EGRC-solenoid valve A, B and throttle control solenoid valve "ON" and "OFF" in "ACTIVE TEST" mode with CONSULT and check operating sound.

OR

1. Check voltage between ECM terminal (103) and ground under the following conditions.

Voltage:

At idle

0 - 1V

Revving engine from idle to 3,800 rpm

Battery voltage
2. Check voltage between ECM terminal (109) and ground under the following conditions.

Voltage:

At idle

0 - 1V

Revving engine from idle to 2,600 rpm

Battery voltage
3. Check voltage between ECM terminal (1) and ground under the following conditions.

Voltage:

At idle

0 - 1V

Revving engine from idle to 2,500 rpm

Battery voltage

D

CHECK VACUUM HOSE.

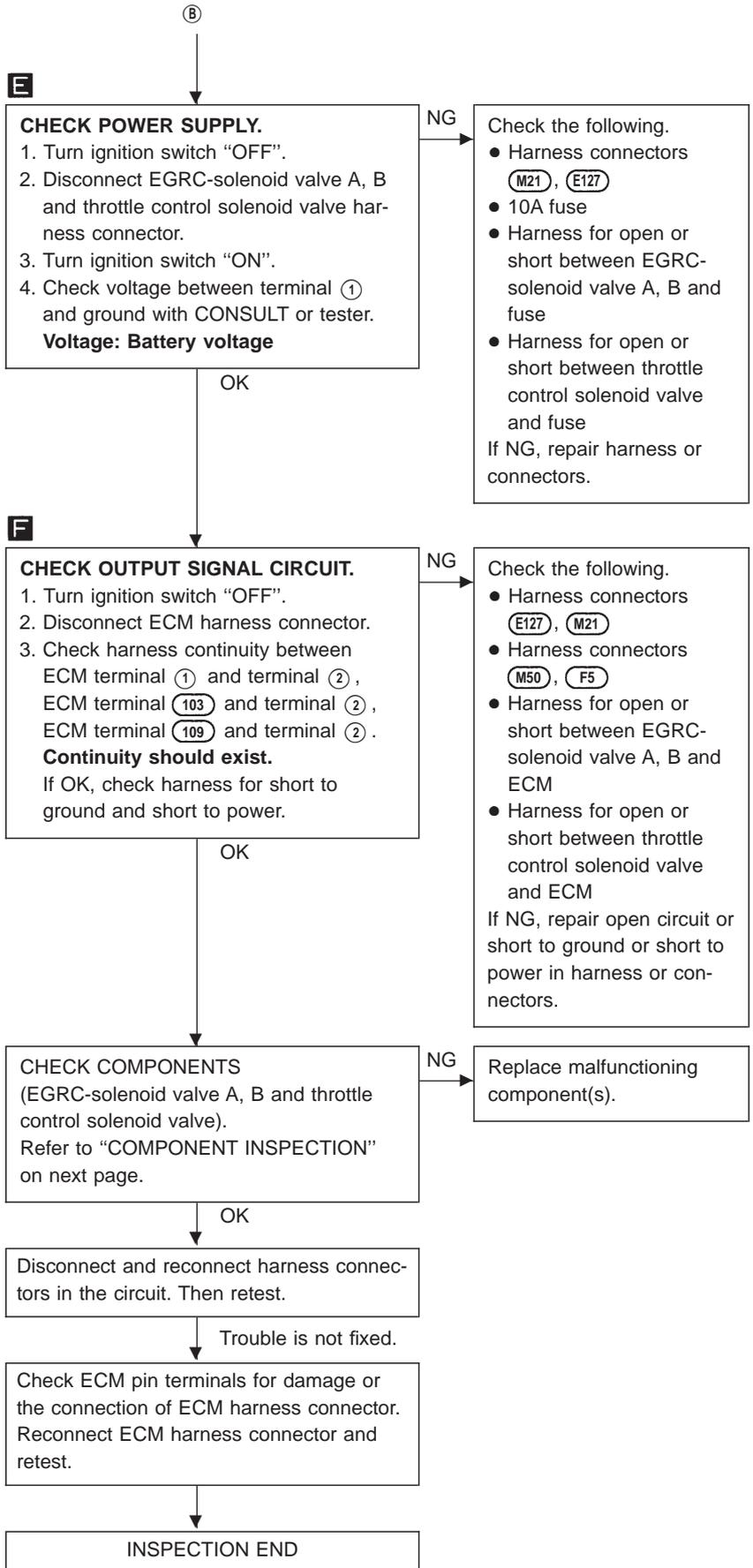
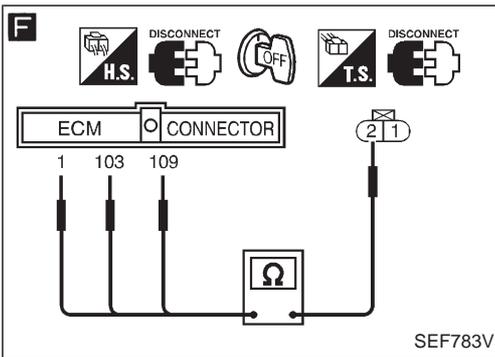
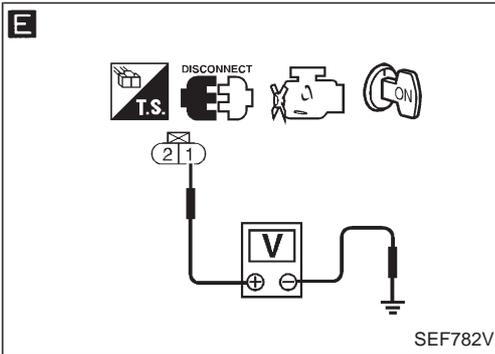
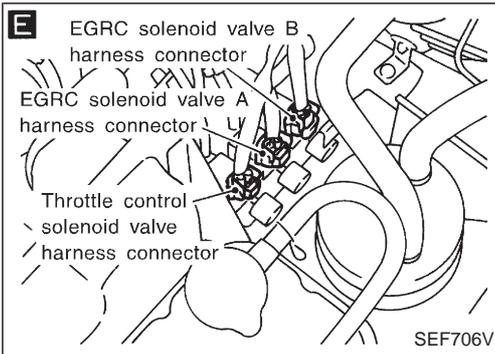
Check vacuum hose for clogging, cracks or improper connection.

NG

B

TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

EGRC-Solenoid Valve A, B and Throttle Control Solenoid Valve (Cont'd)

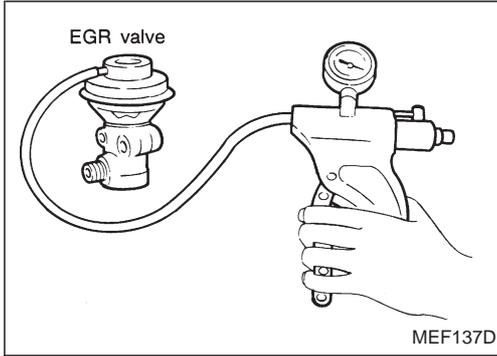


TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

EGRC-Solenoid Valve A, B and Throttle Control Solenoid Valve (Cont'd) COMPONENT INSPECTION

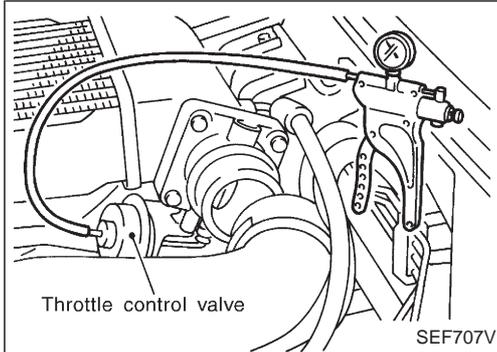
EGR valve

Apply vacuum to EGR vacuum port with a hand vacuum pump.
EGR valve spring should lift.
If NG, replace EGR valve.



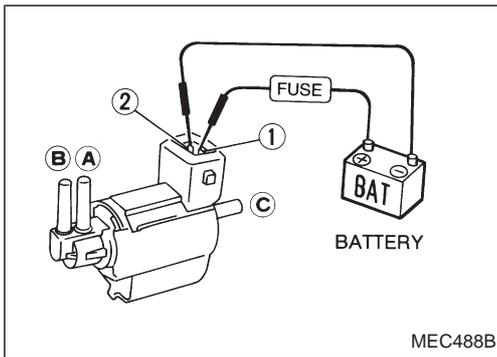
Throttle control valve

Apply vacuum to throttle control valve vacuum port with a hand vacuum pump.
Throttle control valve should close.
If NG, replace throttle control valve.



EGRC-solenoid valve A, B and throttle control solenoid valve

Check air passage continuity.



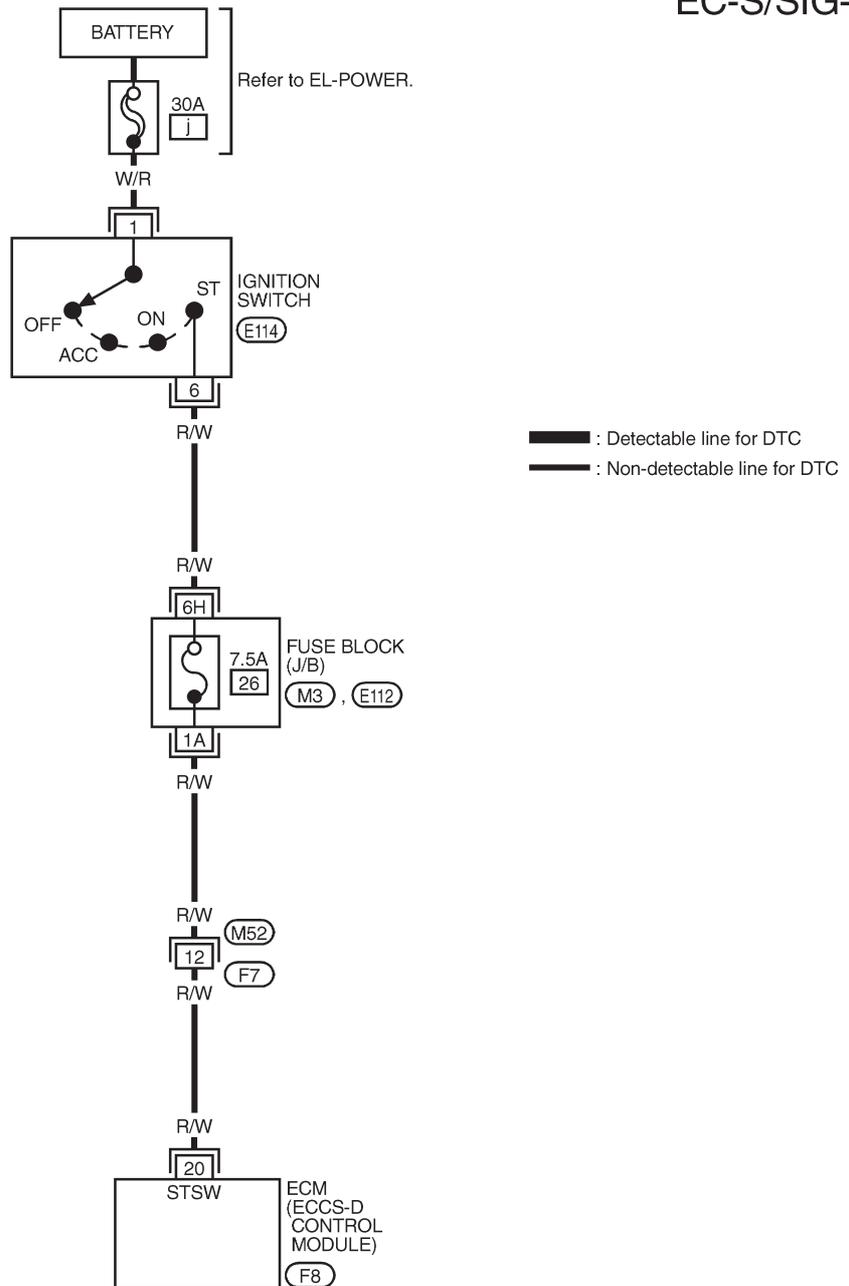
Condition	Air passage continuity between (A) and (B)	Air passage continuity between (A) and (C)
12V direct current supply between terminals ① and ②	Yes	No
No supply	No	Yes

If NG, replace solenoid valve(s).

TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

Start Signal

EC-S/SIG-01



1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

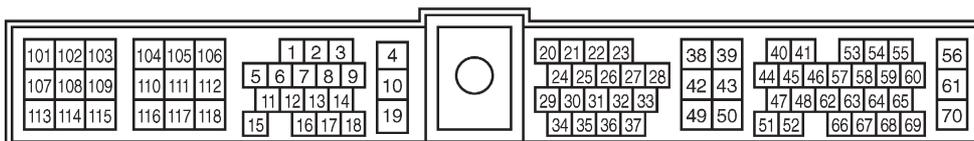
(M52) W

3	5	1
4	2	6

(E114) W

Refer to last page (Foldout page).

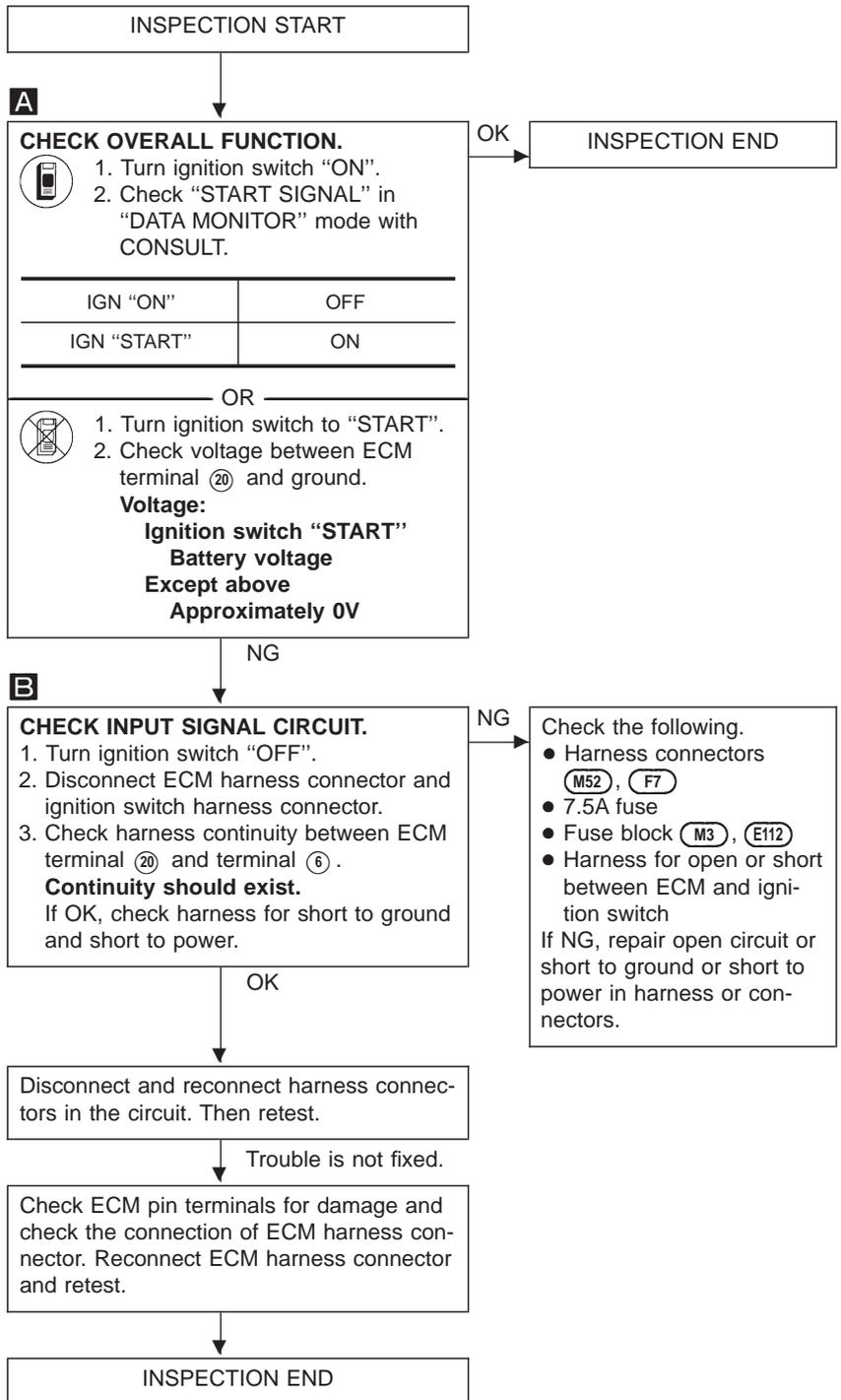
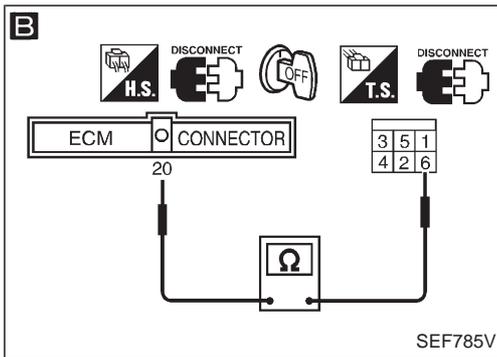
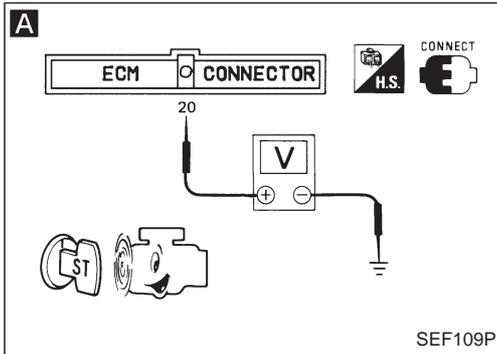
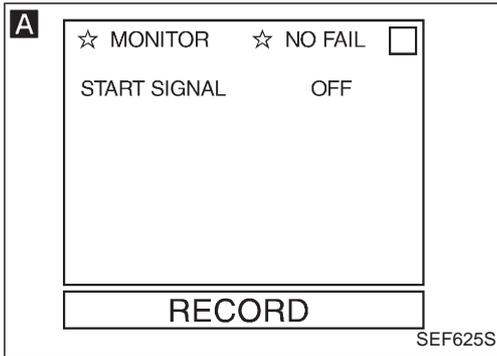
(M3)
(E112)



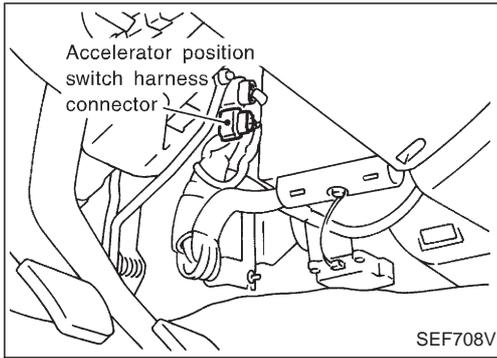
TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

Start Signal (Cont'd)

DIAGNOSTIC PROCEDURE



TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS



Accelerator Position Switch

The accelerator position switch detects OFF-accelerator switch signal and Full-accelerator switch signal and send these signals to the ECM. The ECM will then determine engine idle conditions. These signals are also used for diagnosing the accelerator position sensor.

CONSULT REFERENCE VALUE IN DATA MONITOR MODE

Remarks: Specification data are reference values.

MONITOR ITEM	CONDITION		SPECIFICATION
FULL ACCEL SW	<ul style="list-style-type: none"> Ignition switch: ON (Engine stopped) 	Accelerator pedal: depressed	ON
		Except above	OFF
OFF ACCEL SW	<ul style="list-style-type: none"> Ignition switch: ON (Engine stopped) 	Accelerator pedal: released	ON
		Accelerator pedal: slightly open	OFF

ECM TERMINALS AND REFERENCE VALUE

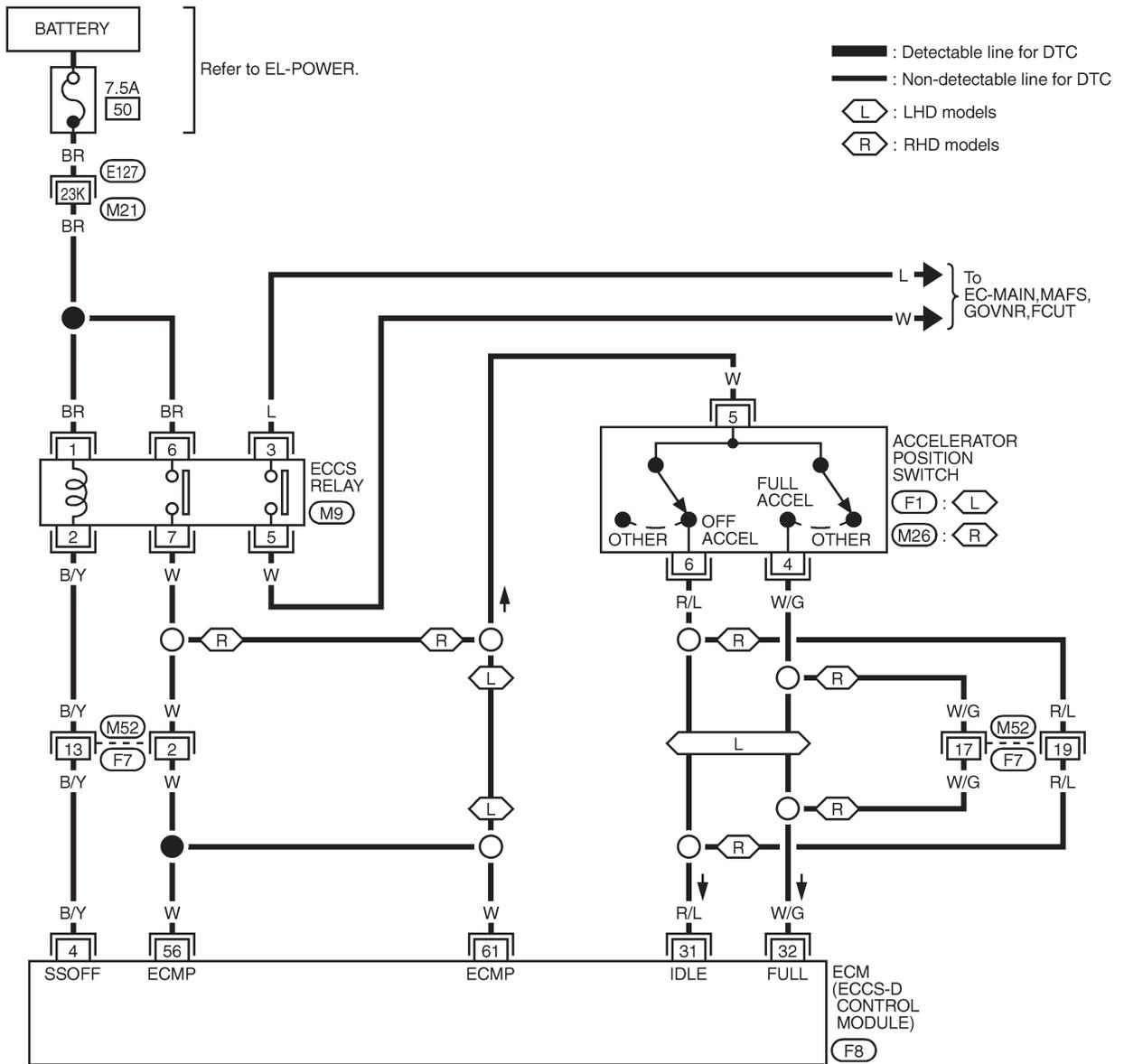
Remarks: Specification data are reference values and are measured between each terminal and ④ (ECCS ground) with a voltmeter.

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
31	R/L	Accelerator position switch (Idle)	<div style="border: 1px solid black; padding: 2px;">Ignition switch "ON"</div> Accelerator pedal fully released	BATTERY VOLTAGE (11 - 14V)
			<div style="border: 1px solid black; padding: 2px;">Ignition switch "ON"</div> Accelerator pedal depressed	Approximately 0V
32	W/G	Accelerator position switch (Full)	<div style="border: 1px solid black; padding: 2px;">Ignition switch "ON"</div> Accelerator pedal released	Approximately 0V
			<div style="border: 1px solid black; padding: 2px;">Ignition switch "ON"</div> Accelerator pedal fully depressed	BATTERY VOLTAGE (11 - 14V)

TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

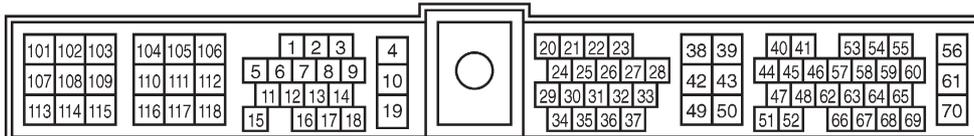
Accelerator Position Switch (Cont'd)

EC-ACL/SW-01



Refer to last page (Foldout page).

(M21), (E127)



TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

Accelerator Position Switch (Cont'd)

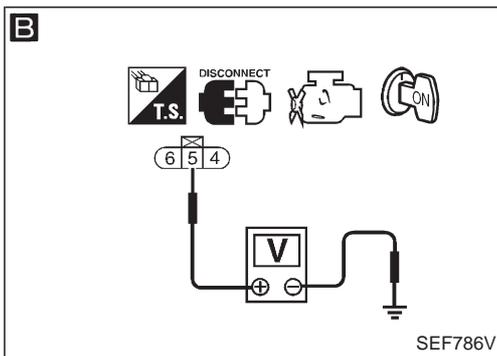
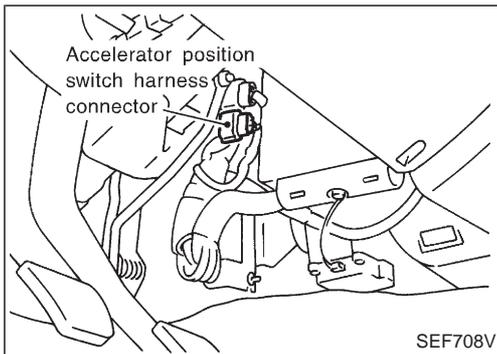
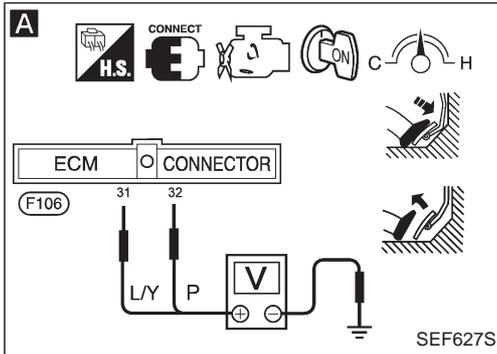
DIAGNOSTIC PROCEDURE

A

☆ MONITOR	☆ NO FAIL	<input type="checkbox"/>
FULL ACCEL SW	OFF	
OFF ACCEL SW	ON	

RECORD

SEF626S



INSPECTION START

A

CHECK OVERALL FUNCTION.

- Turn ignition switch "ON".
- Select "FULL ACCEL SW" and "OFF ACCEL SW" in "DATA MONITOR" mode with CONSULT.
- Check "FULL ACCEL SW" and "OFF ACCEL SW" signal under the following conditions.
 - OFF ACCEL SW:**
 - Accelerator pedal released **ON**
 - Accelerator pedal depressed **OFF**
 - FULL ACCEL SW:**
 - Accelerator pedal released **OFF**
 - Accelerator pedal fully depressed **ON**

OR

OK → INSPECTION END

B

- Turn ignition switch "ON".
- Check voltage between ECM terminal (31) and ground under the following conditions.
 - Voltage:**
 - Accelerator pedal released **Battery voltage**
 - Accelerator pedal depressed **Approximately 0V**
- Check voltage between ECM terminal (32) and ground under the following conditions.
 - Voltage:**
 - Accelerator pedal released **Approximately 0V**
 - Accelerator pedal fully depressed **Battery voltage**

NG

B

CHECK POWER SUPPLY.

- Turn ignition switch "OFF".
- Disconnect accelerator position switch harness connector.
- Turn ignition switch "ON".
- Check voltage between terminal (5) and ground with CONSULT or tester.
 - Voltage: Battery voltage**

NG → Check the following.

- Harness connectors (M52, F7) (LHD models)
- Harness for open or short between accelerator position switch and ECCS relay
- Harness for open or short between accelerator position switch and ECM

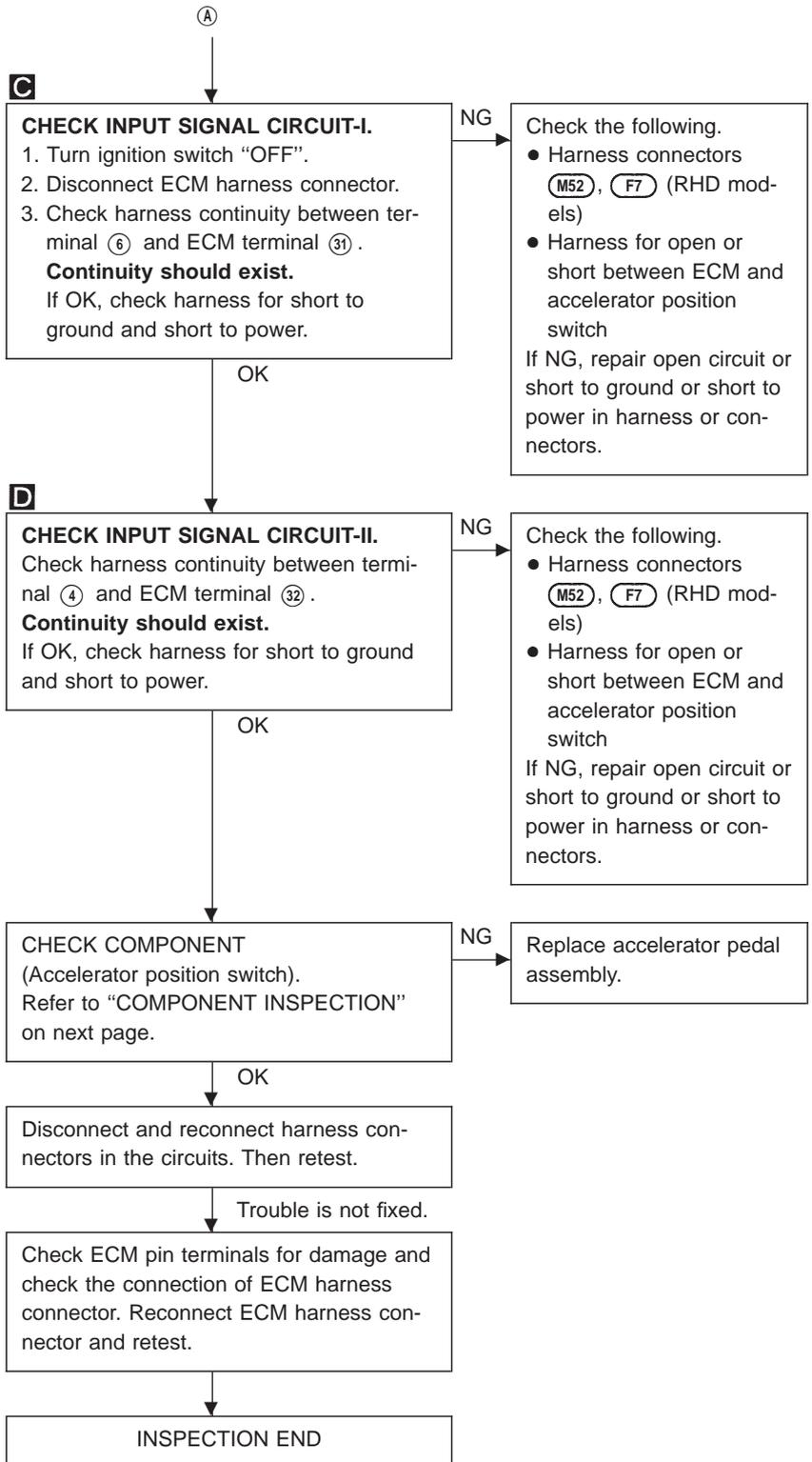
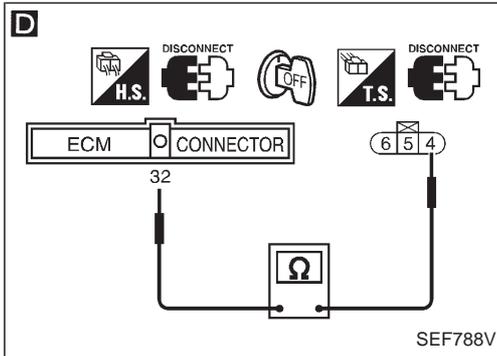
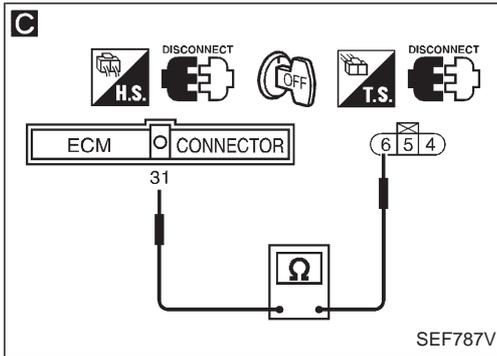
If NG, repair harness or connectors.

OK

Ⓐ

TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

Accelerator Position Switch (Cont'd)



TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

Accelerator Position Switch (Cont'd)

COMPONENT INSPECTION

Accelerator position switch

1. Disconnect accelerator position switch harness connector.
2. Check continuity between terminals ⑤ and ⑥ .

Conditions	Continuity
Accelerator pedal released	Yes
Accelerator pedal depressed	No

3. Check continuity between terminals ④ and ⑤ .

Conditions	Continuity
Accelerator pedal released	No
Accelerator pedal fully depressed	Yes

If NG, replace accelerator pedal assembly.

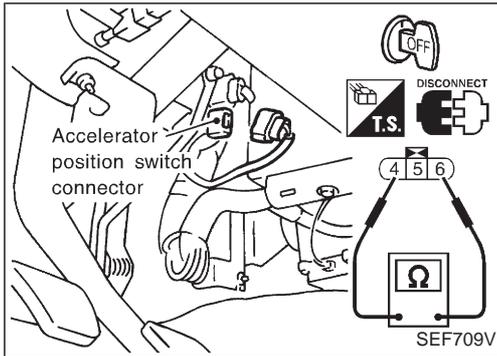
CAUTION:

If accelerator position sensor or ECM connector is disconnected, perform the following procedures:

-  Select "OFF ACCEL PO SIG" in "ACTIVE TEST" mode.
 Touch CLEAR.

OR

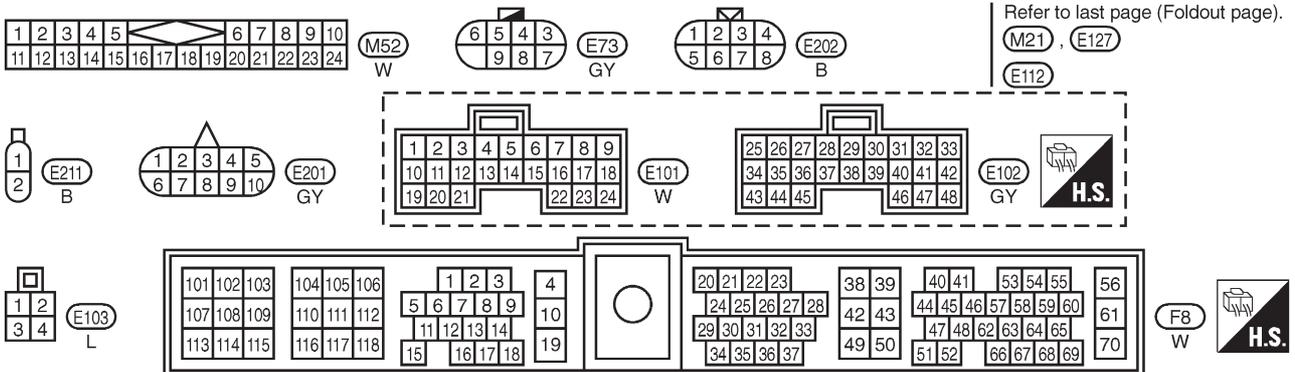
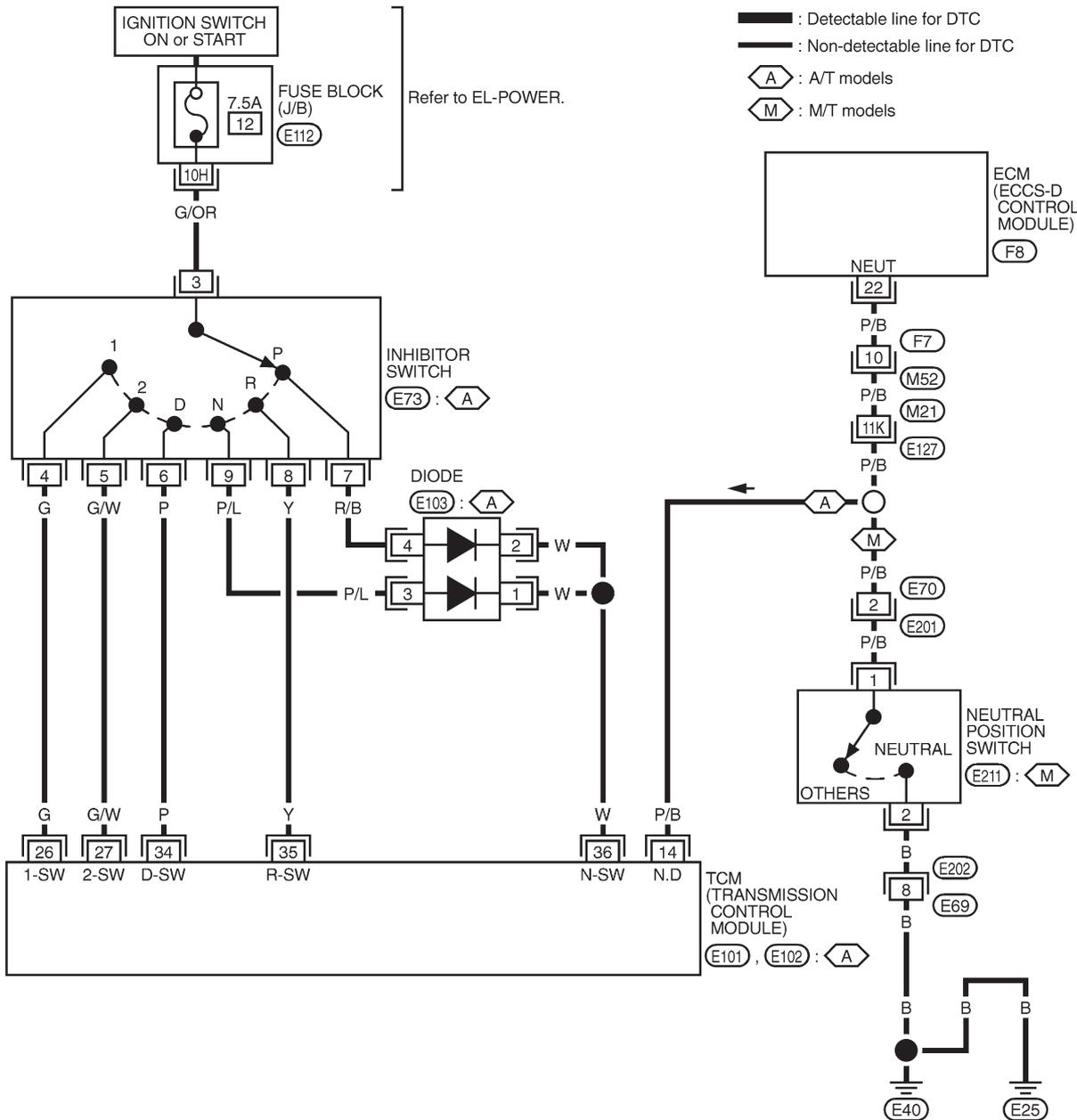
-  Start and warm up engine. After engine has warmed up, idle for 10 minutes.



TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

Park/Neutral Position Switch

EC-PNP/SW-01



TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

Park/Neutral Position Switch (Cont'd)

When the gear position is in "N", neutral position switch is "ON". The ECM detects the position because the continuity of the line (the "ON" signal) exists.

CONSULT REFERENCE VALUE IN DATA MONITOR MODE

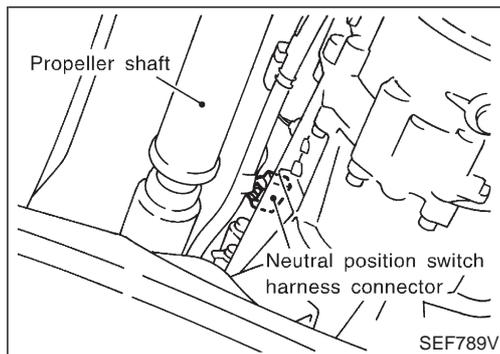
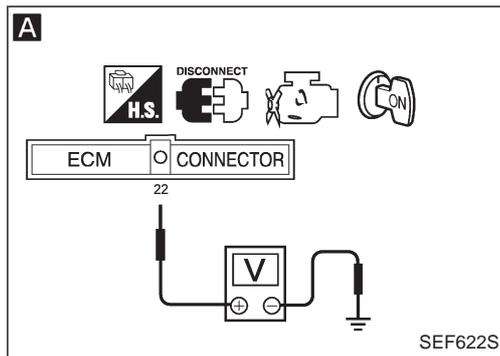
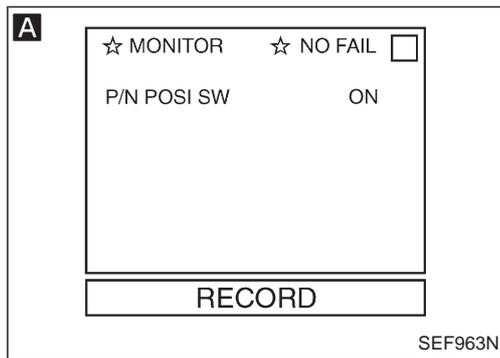
Remarks: Specification data are reference values.

MONITOR ITEM	CONDITION	SPECIFICATION
P/N POSI SW	• Ignition switch: ON	Shift lever: Neutral/Park ON
		Except above OFF

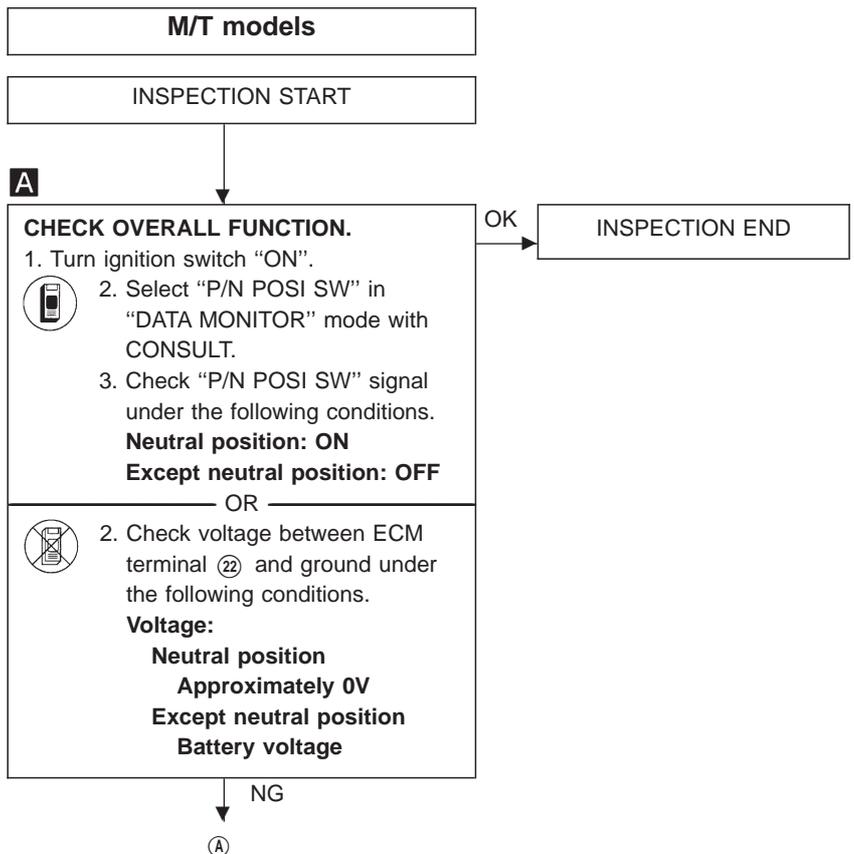
ECM TERMINALS AND REFERENCE VALUE

Remarks: Specification data are reference values and are measured between each terminal and ④ (ECCS ground) with a voltmeter.

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
22	P/B	Inhibitor switch/ Neutral position switch	Ignition switch "ON" └ Gear position is "N" or "P" (A/T models). └ Gear position is "Neutral" (M/T models).	Approximately 0V
			Ignition switch "ON" └ Except the above gear position	BATTERY VOLTAGE (11 - 14V)

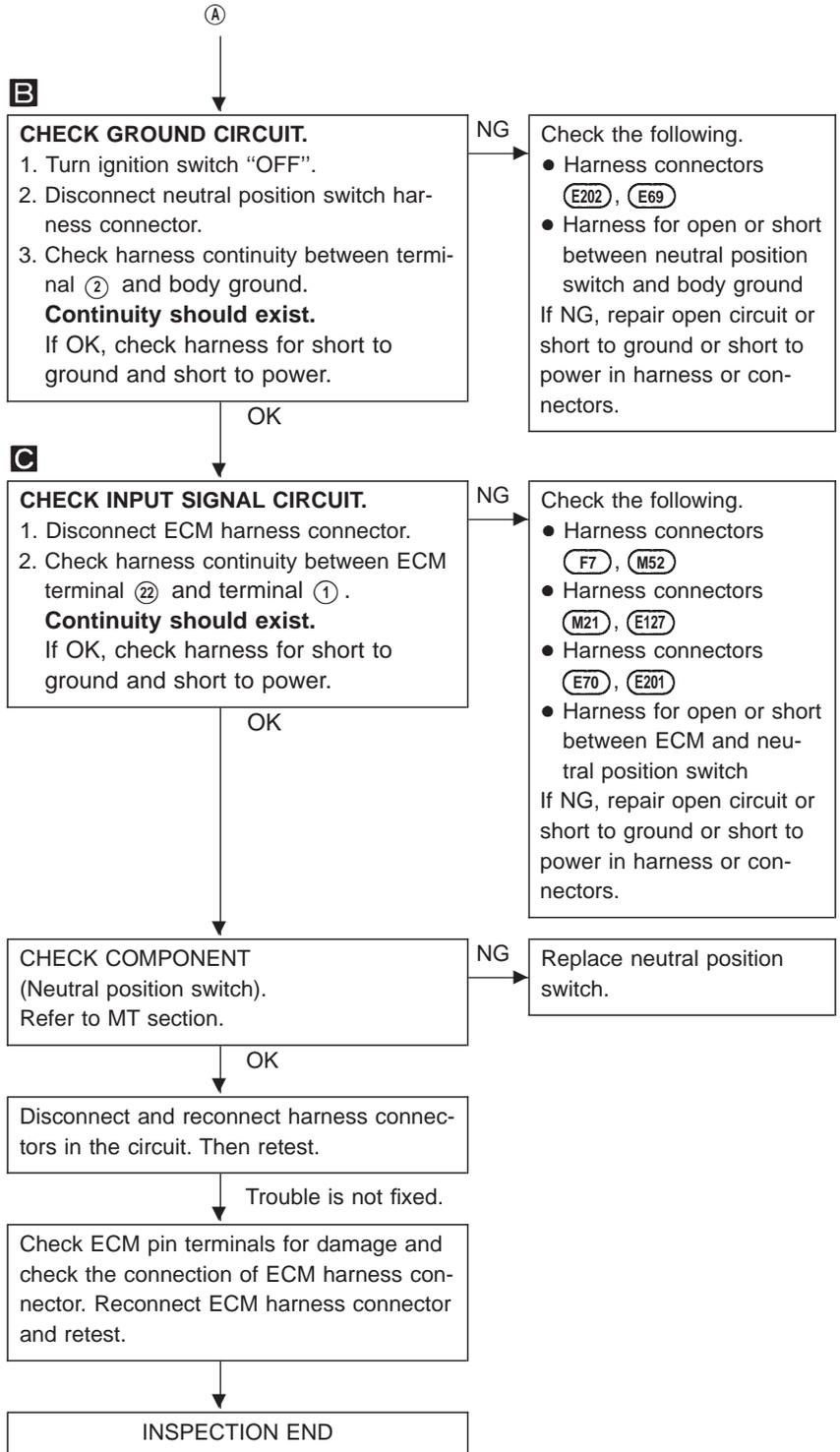
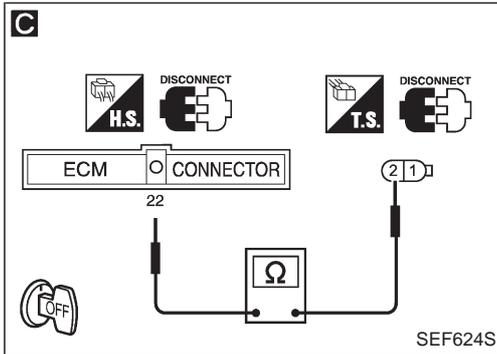
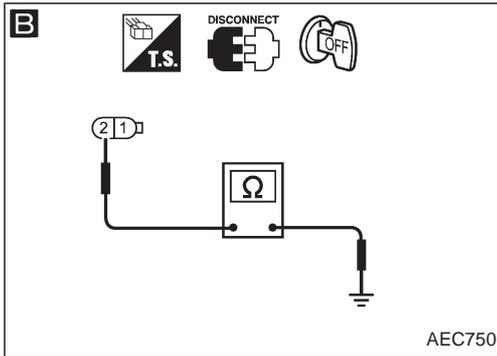


DIAGNOSTIC PROCEDURE



TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

Park/Neutral Position Switch (Cont'd)



TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

Park/Neutral Position Switch (Cont'd)

A

☆ MONITOR	☆ NO FAIL	<input type="checkbox"/>
P/N POSI SW	ON	

RECORD

SEF963N

A

DISCONNECT

H.S.

ECM

CONNECTOR

22

V

SEF622S

Brake reservoir tank

Inhibitor switch harness connector

SEF790V

B

DISCONNECT

T.S.

6 5 4 3

9 8 7

V

SEF791V

LH door

TCM

SEF792V

A/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.
3. Check "P/N POSI SW" signal under the following conditions.

"P" or "N" position: ON

Except above positions: OFF

OR

- 2. Check voltage between ECM terminal ② and ground under the following conditions.

Voltage:

"P" or "N" position

Approximately 0V

Except above positions

Battery voltage

OK → INSPECTION END

NG

B

CHECK POWER SUPPLY.

1. Turn ignition switch "OFF".
2. Disconnect inhibitor switch harness connector.
3. Turn ignition switch "ON".
4. Check voltage between terminal ③ and ground with CONSULT or tester.

Voltage: Battery voltage

NG → Check the following.

- 7.5A fuse
- Harness for open or short between inhibitor switch and fuse

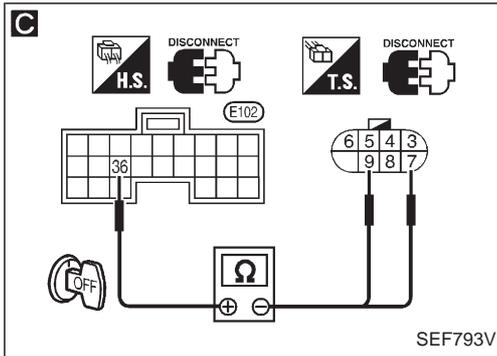
If NG, repair harness or connectors.

OK

→ A

TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

Park/Neutral Position Switch (Cont'd)



C

CHECK INPUT SIGNAL CIRCUIT-I.

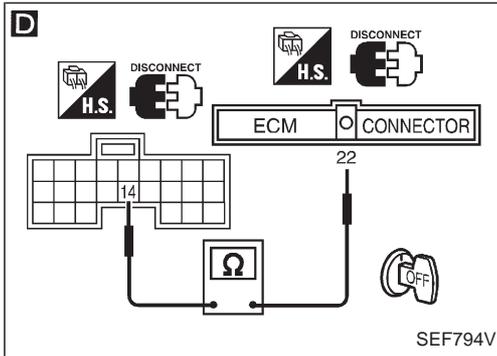
1. Turn ignition switch "OFF".
2. Disconnect TCM harness connector.
3. Check harness continuity between TCM terminal ③⑥ and terminals ⑦, ⑨.

Continuity should exist.
If OK, check harness for short to ground and short to power.

NG → Check the following.

- Diode (E103)
- Harness continuity between inhibitor switch and TCM

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



D

CHECK INPUT SIGNAL CIRCUIT-II.

1. Disconnect ECM harness connector.
2. Check harness continuity between ECM terminal ②② and TCM terminal ⑭.

Continuity should exist.
If OK, check harness for short to ground and short to power.

NG → Check the following.

- Harness connectors (F7, M52)
- Harness connectors (M21, E127)
- Harness for open or short between ECM and TCM

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

CHECK COMPONENT
(Inhibitor switch).
Refer to AT section.

NG → Replace inhibitor switch.

OK

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

Trouble is not fixed.

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

INSPECTION END

TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

A/T Control

These circuit lines are used to control the smooth shifting up and down of A/T during the hard acceleration/deceleration.
Voltage signals are exchanged between ECM and TCM.

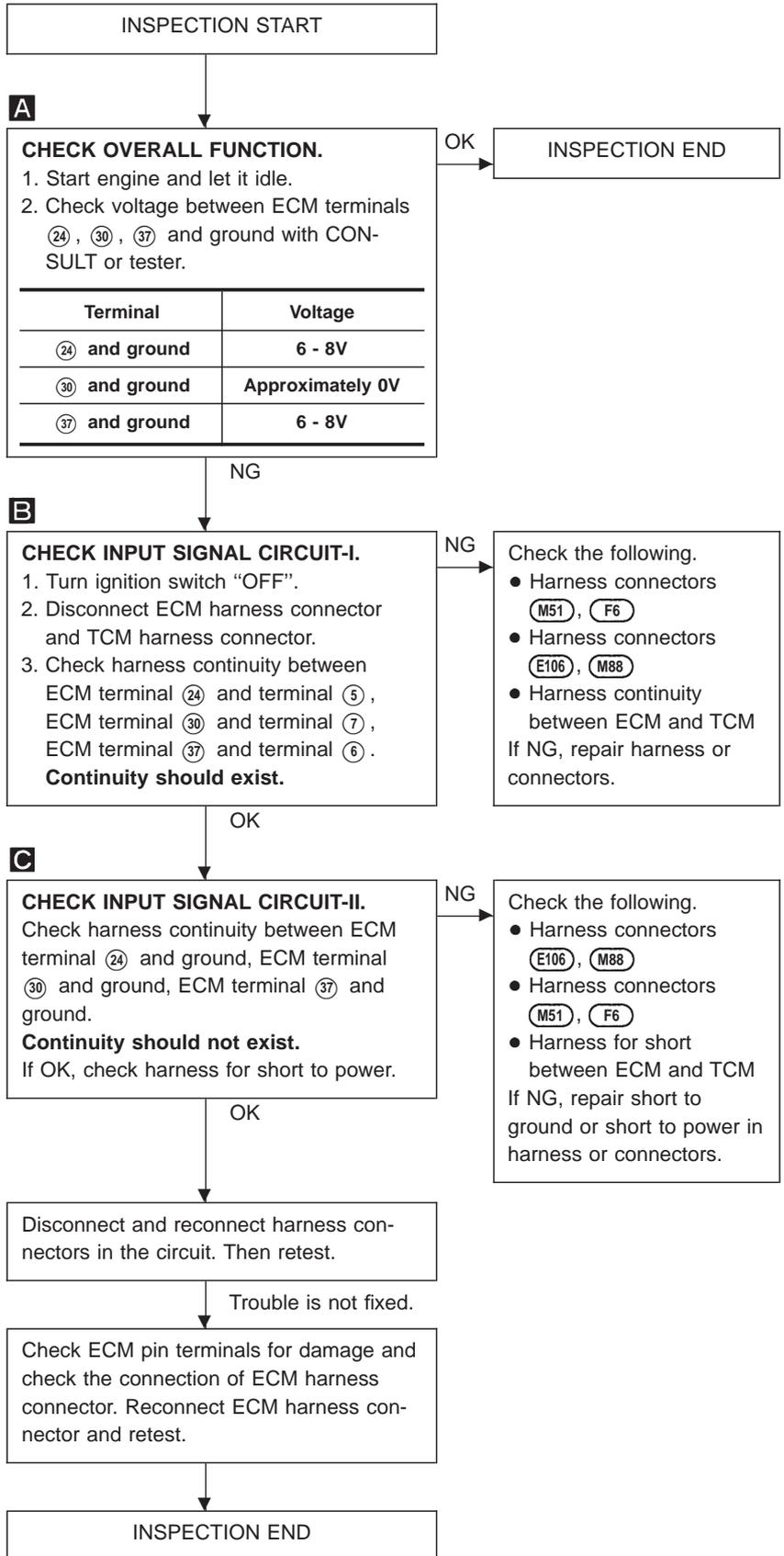
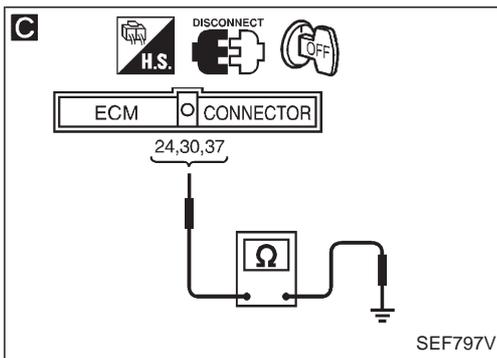
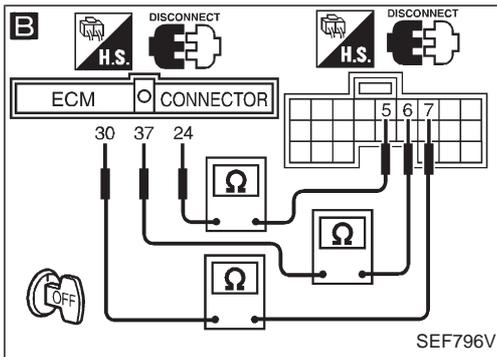
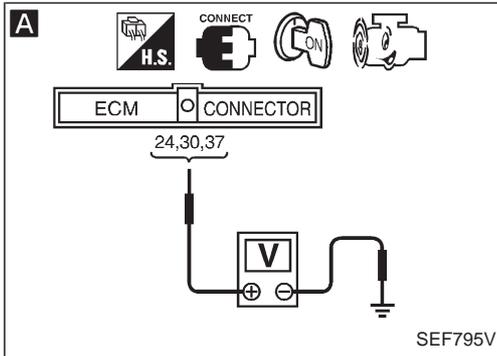
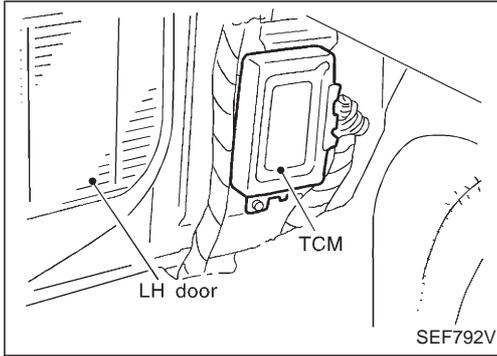
ECM TERMINALS AND REFERENCE VALUE

Remarks: Specification data are reference values and are measured between each terminal and ④ (ECCS ground) with a voltmeter.

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
24	PU/W	A/T signal No. 1	Engine is running. └ Idle speed	6 - 8V
30	P	A/T signal No. 3	Engine is running. └ Idle speed	Approximately 0V
37	P/B	A/T signal No. 2	Engine is running. └ Idle speed	6 - 8V

TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

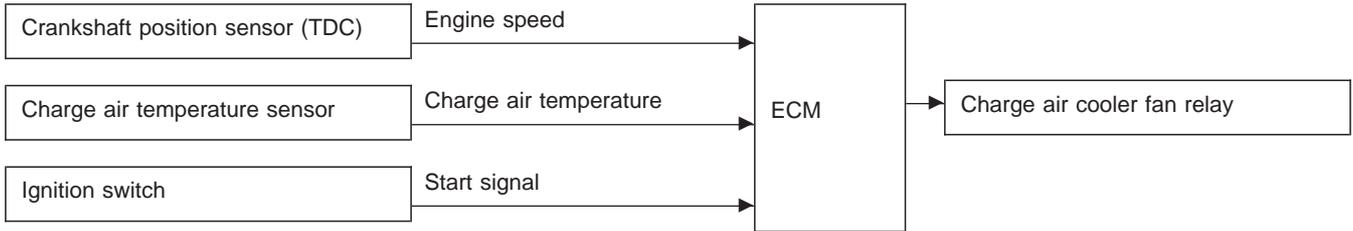
A/T Control (Cont'd) DIAGNOSTIC PROCEDURE



TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

Charge Air Cooler Fan Control

SYSTEM DESCRIPTION



The ECM controls the charge air cooler fan operation corresponding to the engine speed, the charge air temperature and the start signal. The control system has 2-step control [ON/OFF]. The ECM does not directly drive the charge air cooler fan. It controls the ON/OFF charge air cooler fan relay, which in turn controls the charge air cooler fan.

When the charge air temperature is above 67°C (153°F) and engine speed is more than 1,600 rpm, the charge air cooler fan operates.

CONSULT REFERENCE VALUE IN DATA MONITOR MODE

Remarks: Specification data are reference values.

MONITOR ITEM	CONDITION	SPECIFICATION
I/C FAN RLY	<ul style="list-style-type: none"> • When charge air cooler fan is stopped. 	OFF
	<ul style="list-style-type: none"> • When charge air cooler fan operates. 	ON

ECM TERMINALS AND REFERENCE VALUE

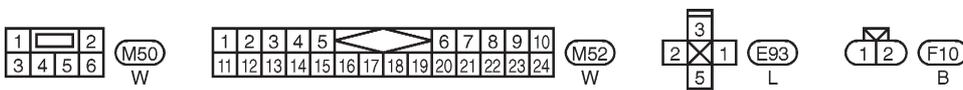
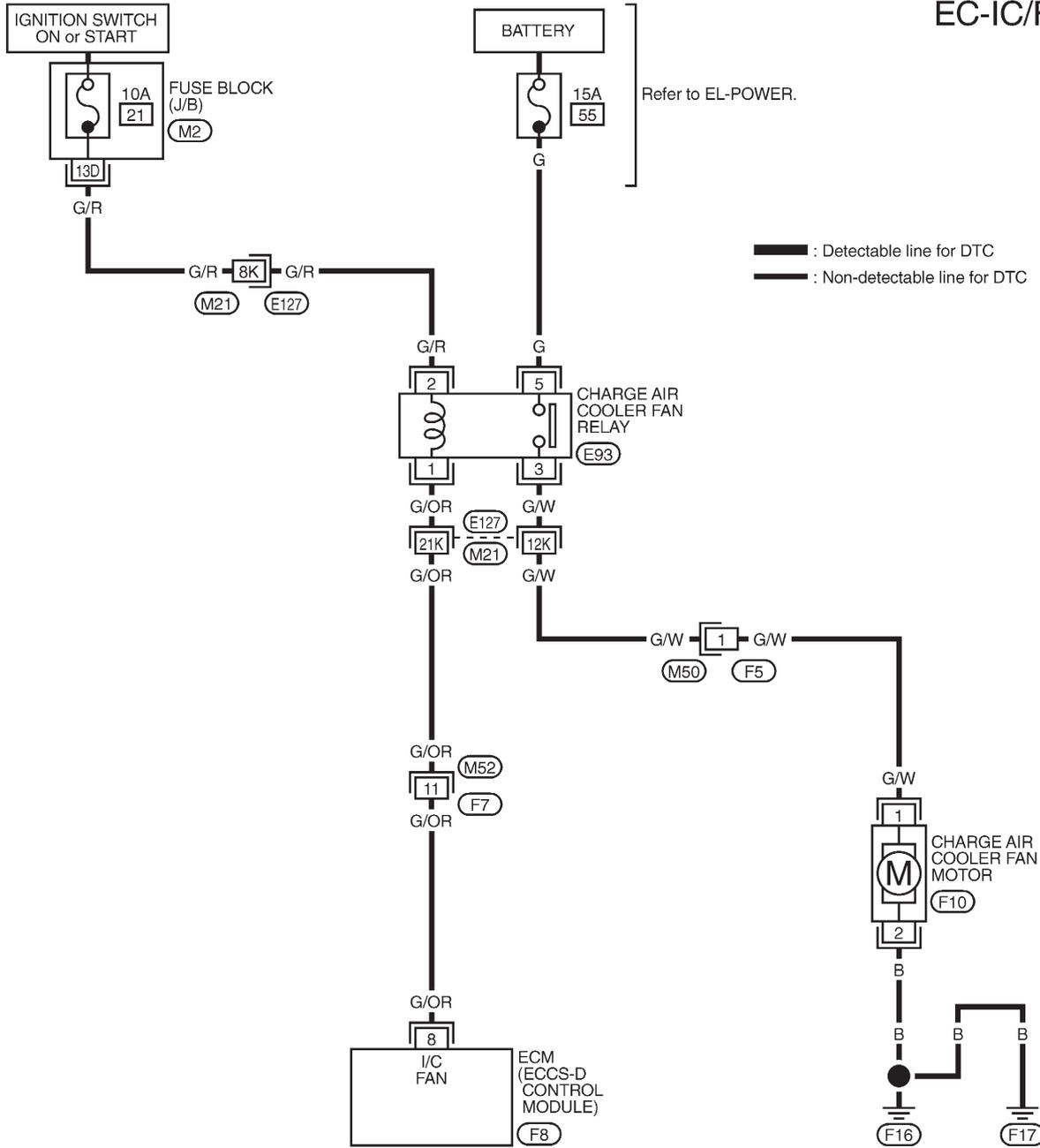
Remarks: Specification data are reference values and are measured between each terminal and ④3 (ECCS ground) with a voltmeter.

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
8	G/OR	Charge air cooler fan relay	<div style="border: 1px solid black; display: inline-block; padding: 2px;">Engine is running.</div> Charge air cooler fan is not operating.	BATTERY VOLTAGE (11 - 14V)
			<div style="border: 1px solid black; display: inline-block; padding: 2px;">Engine is running.</div> Charge air cooler fan is operating.	0 - 1V

TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

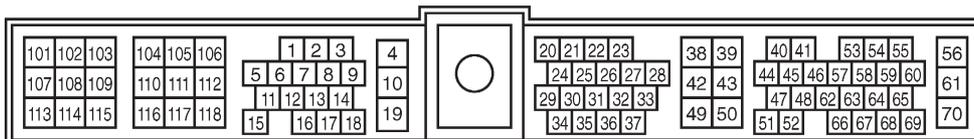
Charge Air Cooler Fan Control (Cont'd)

EC-IC/FAN-01



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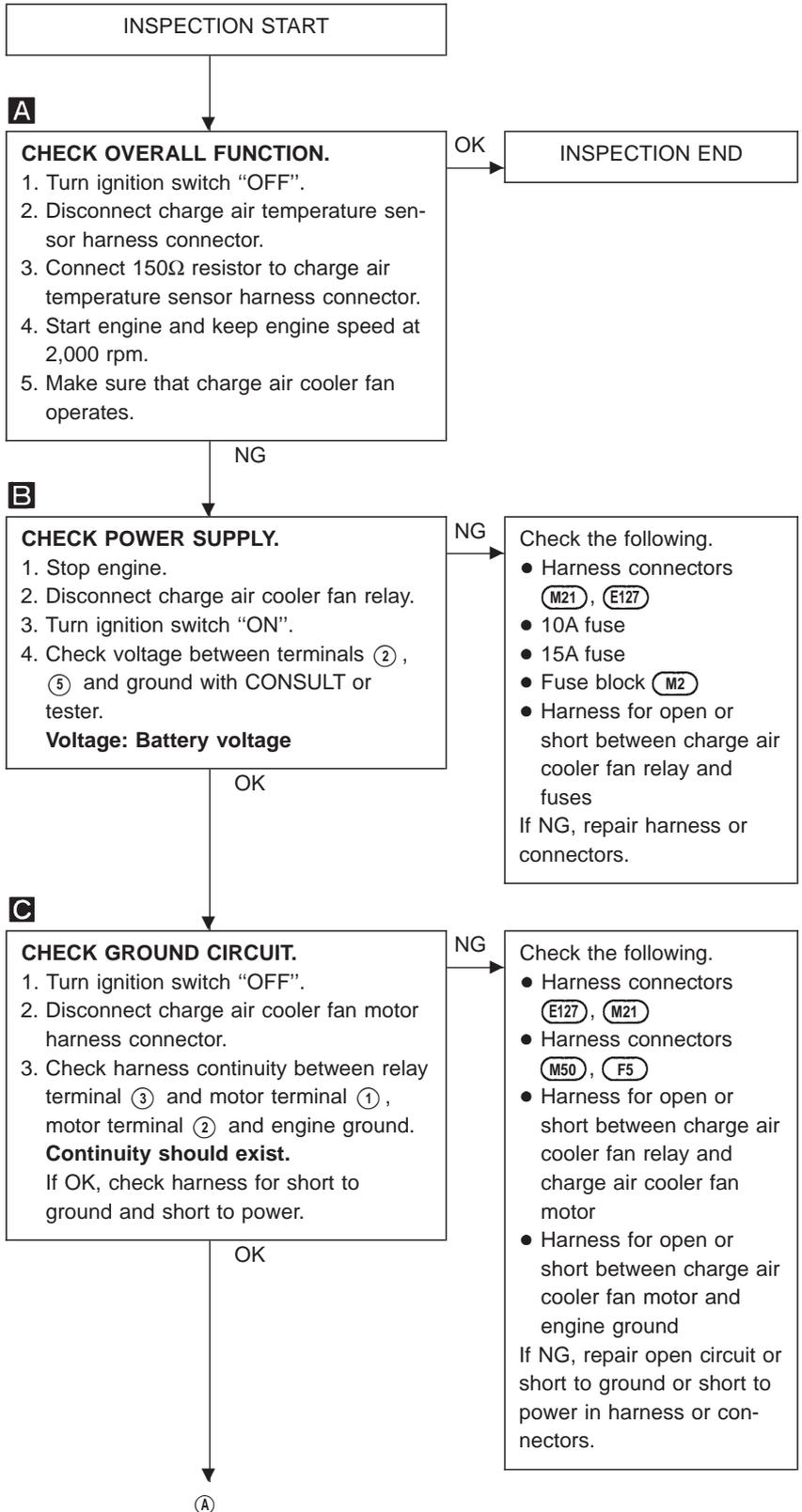
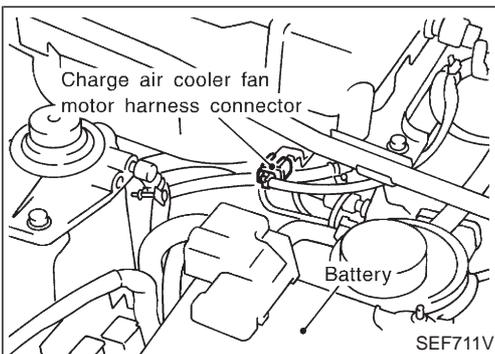
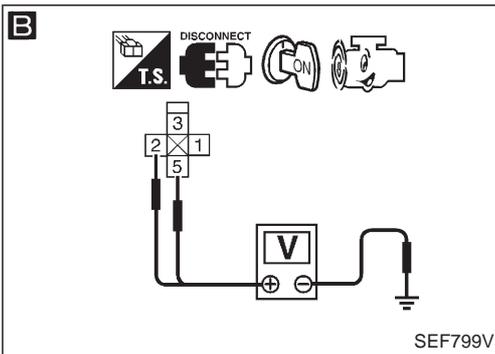
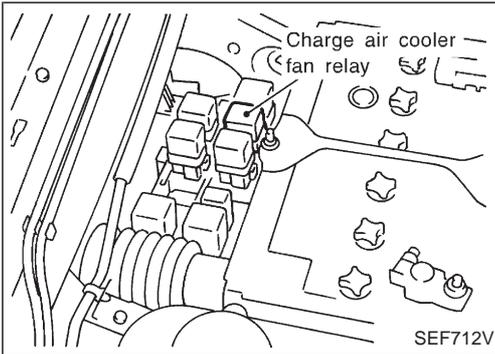
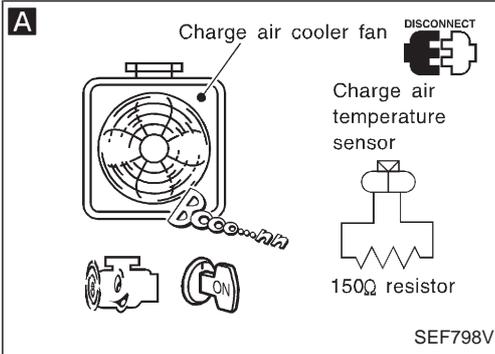
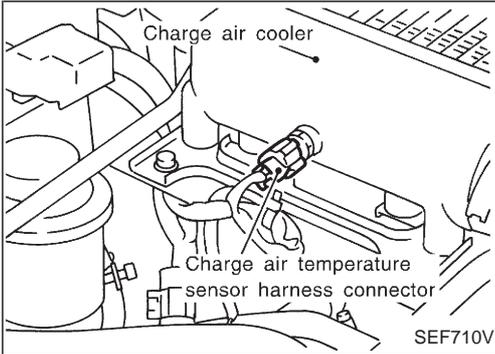
M21, E127
M2



TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

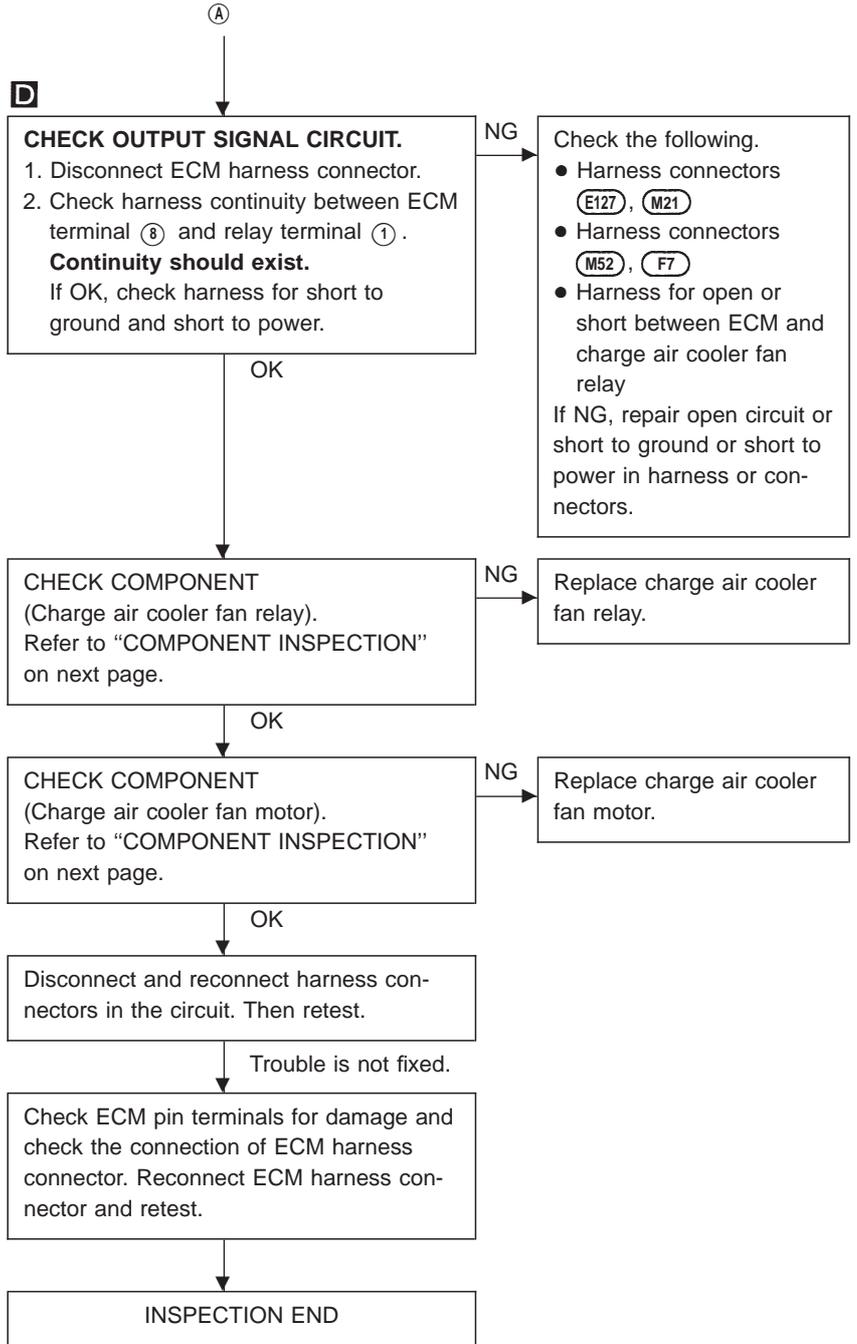
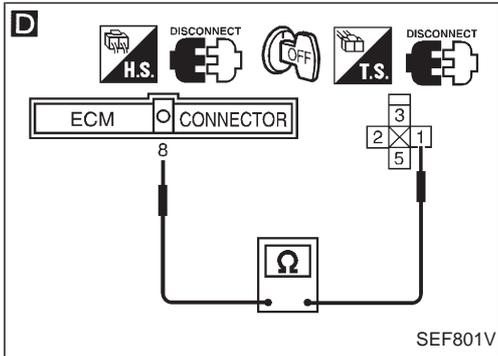
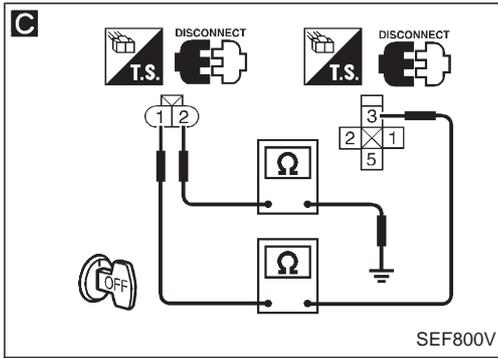
Charge Air Cooler Fan Control (Cont'd)

DIAGNOSTIC PROCEDURE



TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

Charge Air Cooler Fan Control (Cont'd)



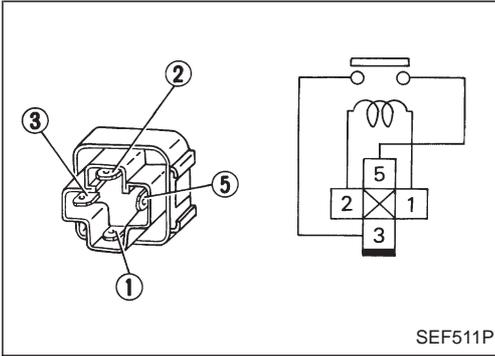
TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

Charge Air Cooler Fan Control (Cont'd)

COMPONENT INSPECTION

Charge air cooler fan relay

Check continuity between terminals ③ and ⑤.



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

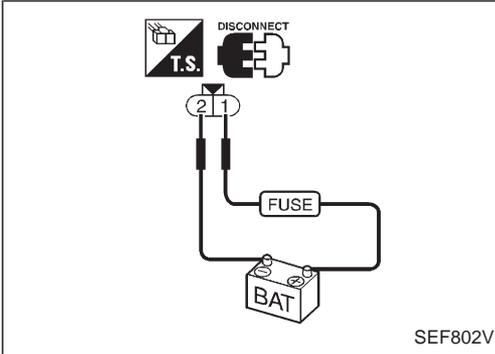
If NG, replace relay.

Charge air cooler fan motor

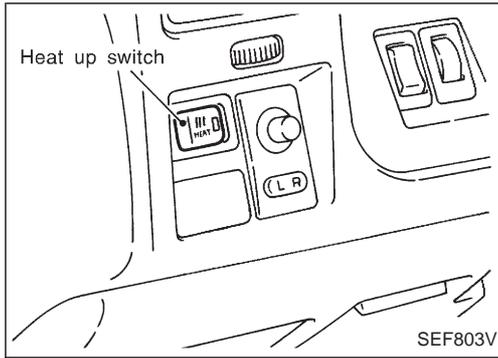
1. Disconnect charge air cooler fan motor harness connector.
2. Supply charge air cooler fan motor terminals with battery voltage and check operation.

Charge air cooler fan motor should operate.

If NG, replace charge air cooler fan motor.



TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS



Heat Up Switch

The heat up switch is located on the lower side of the instrument panel. This switch is used to speed up the heater's operation when the engine is cold.

When the ECM received the heat up switch "ON" signal, the ECM increases the engine idle speed to 1,100 - 1,200 rpm to warm up engine quickly.

This system works when all conditions listed below are met.

Heat up switch	ON
Engine coolant temperature	Below 70°C (158°F)
Shift lever	"P" or "N"
Accelerator pedal	Fully released
Vehicle speed	Below 4 km/h (2 MPH)

CONSULT REFERENCE VALUE IN DATA MONITOR MODE

Remarks: Specification data are reference values.

MONITOR ITEM	CONDITION	SPECIFICATION	
WARM UP SW	● Ignition switch: ON	Heat up switch: ON	ON
		Heat up switch: OFF	OFF

ECM TERMINALS AND REFERENCE VALUE

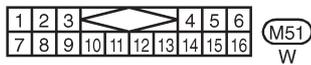
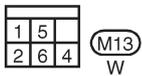
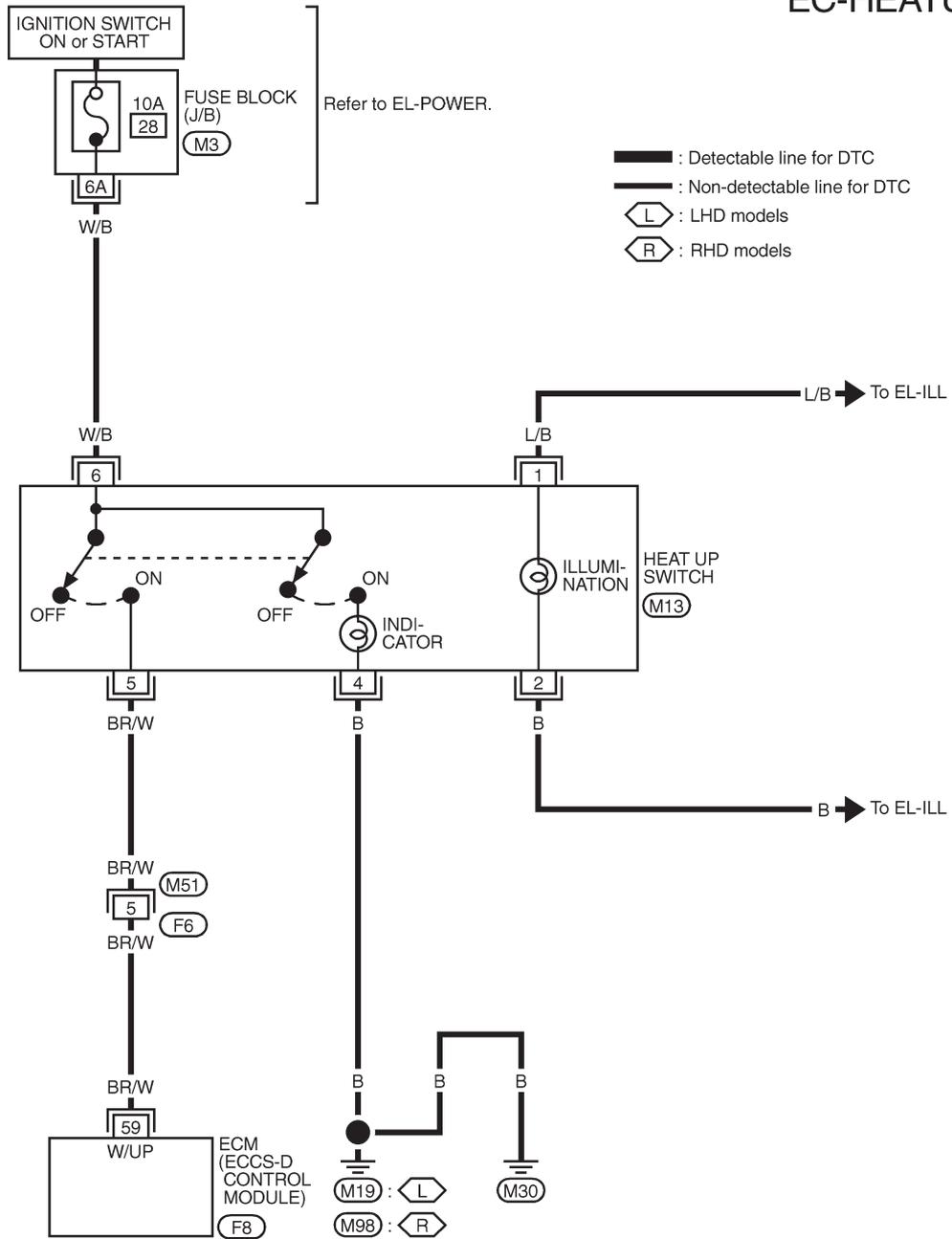
Remarks: Specification data are reference values and are measured between each terminal and ④3 (ECCS ground) with a voltmeter.

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
59	BR/W	Heat up switch	Ignition switch "ON" └ Heat up switch is "OFF".	0V
			Ignition switch "ON" └ Heat up switch is "ON".	BATTERY VOLTAGE (11 - 14V)

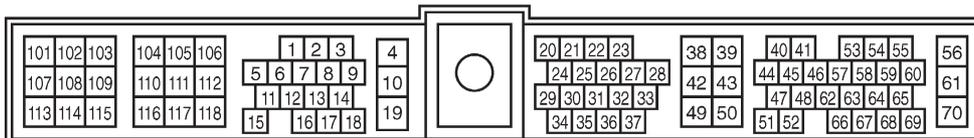
TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

Heat Up Switch (Cont'd)

EC-HEATUP-01



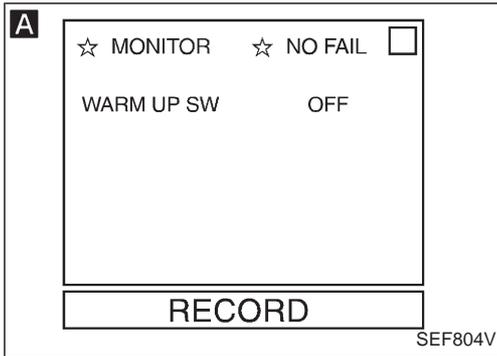
Refer to last page (Foldout page).



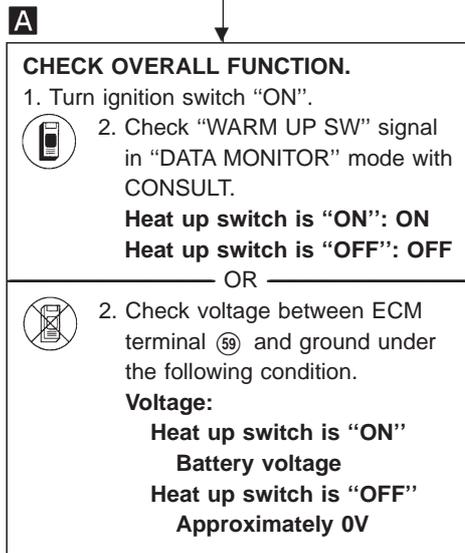
TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

Heat Up Switch (Cont'd)

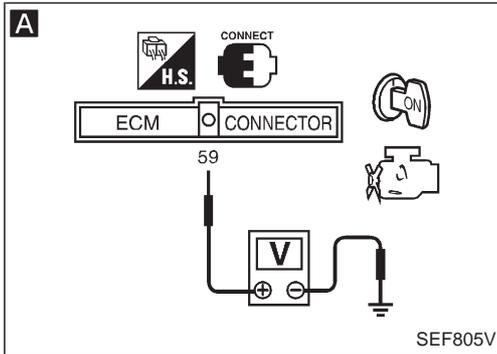
DIAGNOSTIC PROCEDURE



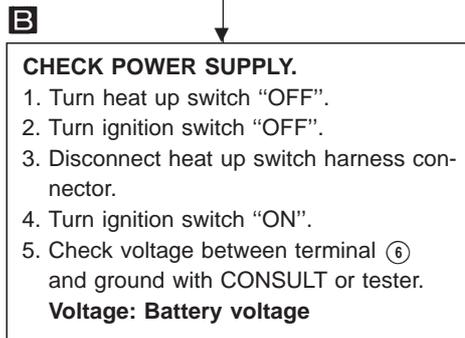
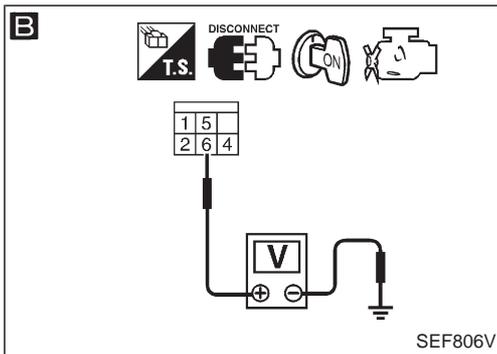
INSPECTION START



OK → INSPECTION END



NG

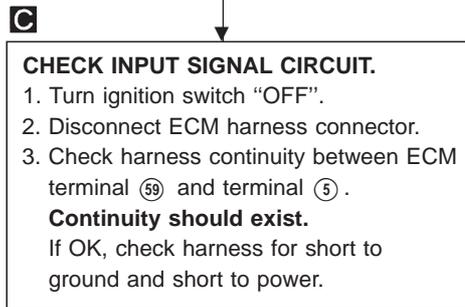
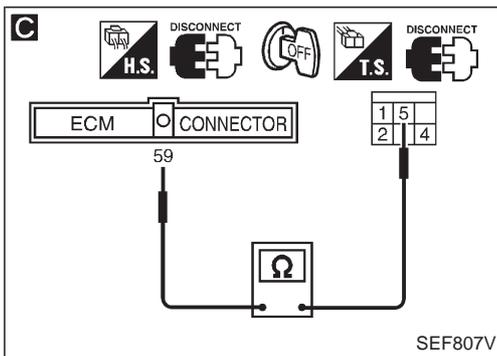


NG → Check the following.

- Fuse block (M3)
- 10A fuse
- Harness for open or short between heat up switch and fuse

If NG, repair harness or connectors.

OK



NG → Check the following.

- Harness connectors (M51, F6)
- Harness for open or short between heat up switch and ECM

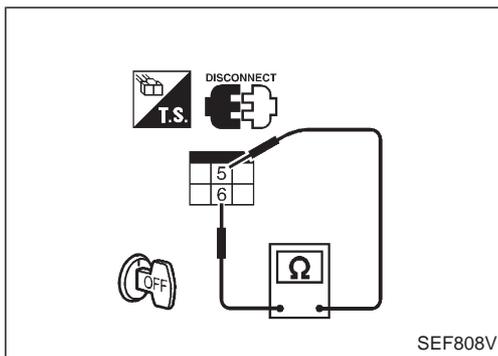
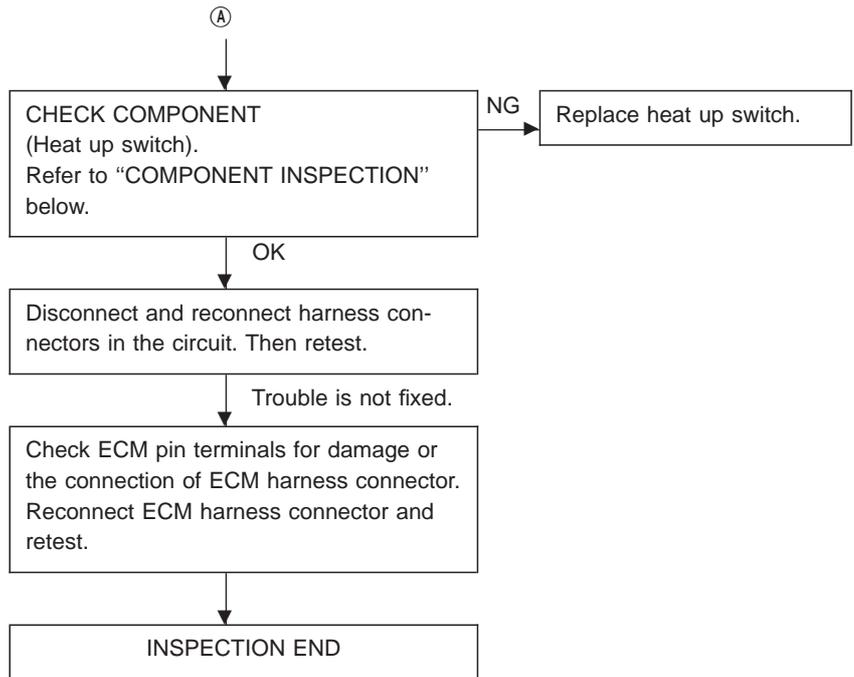
If NG, repair open circuit or short to ground or short to power in harness or connectors.

OK

Ⓐ

TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

Heat Up Switch (Cont'd)



COMPONENT INSPECTION

Heat up switch

1. Disconnect heat up switch harness connector.
2. Check continuity between terminals ⑤ and ⑥.

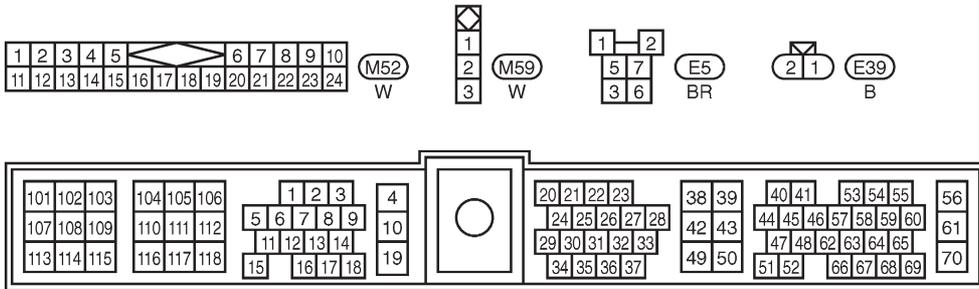
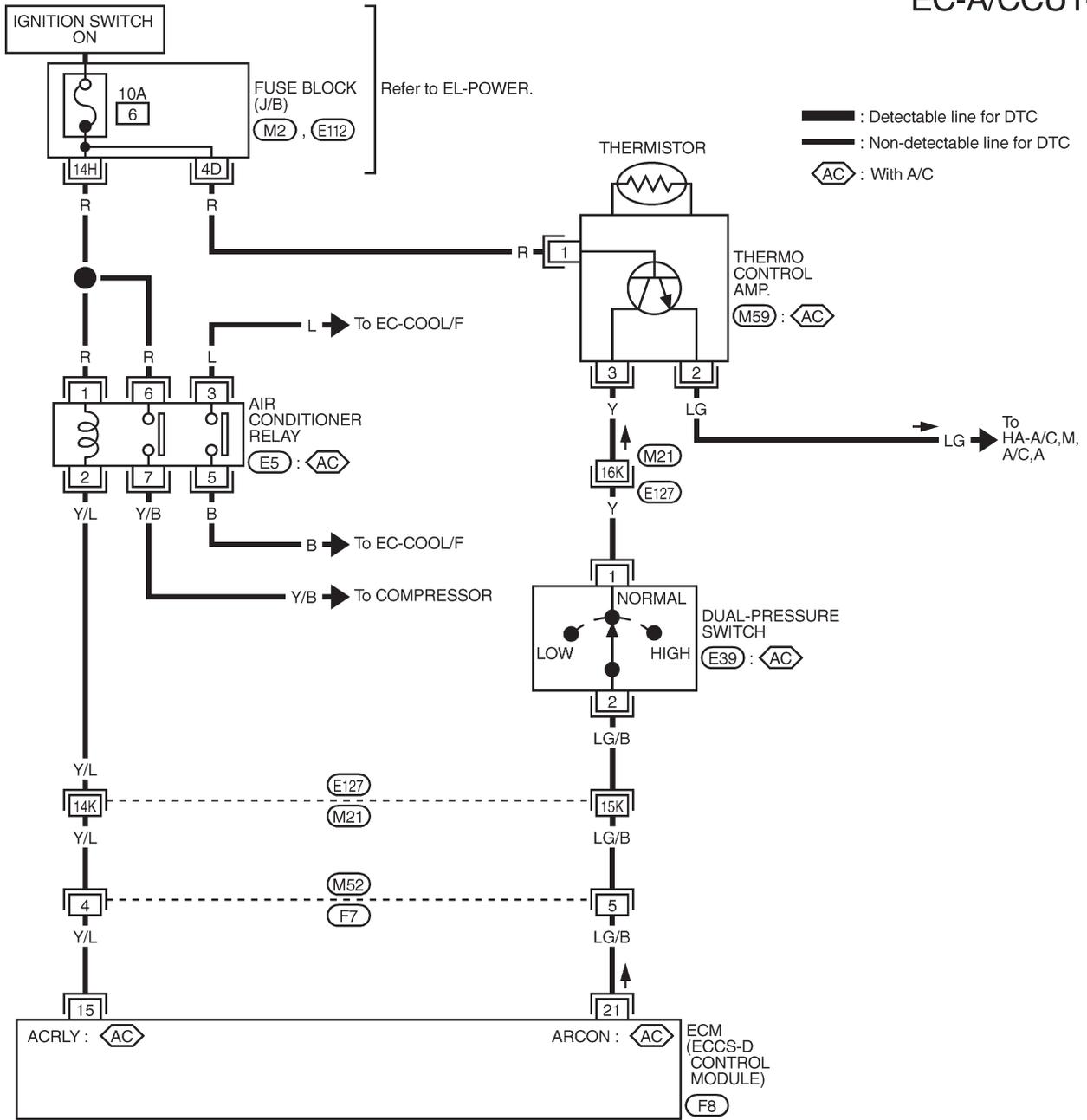
Condition	Continuity
Heat up switch "ON"	Yes
Heat up switch "OFF"	No

If NG, replace heat up switch.

TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

Air Conditioner Control

EC-A/CCUT-01



Refer to last page (Foldout page).

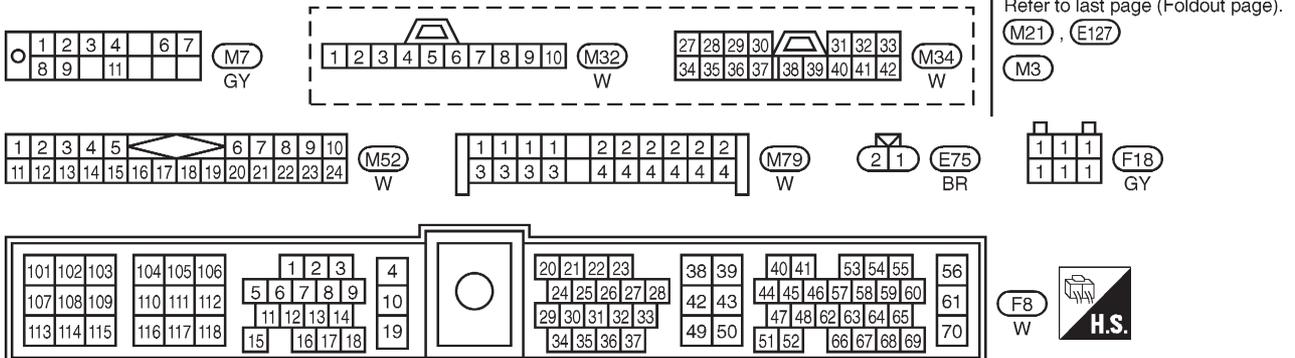
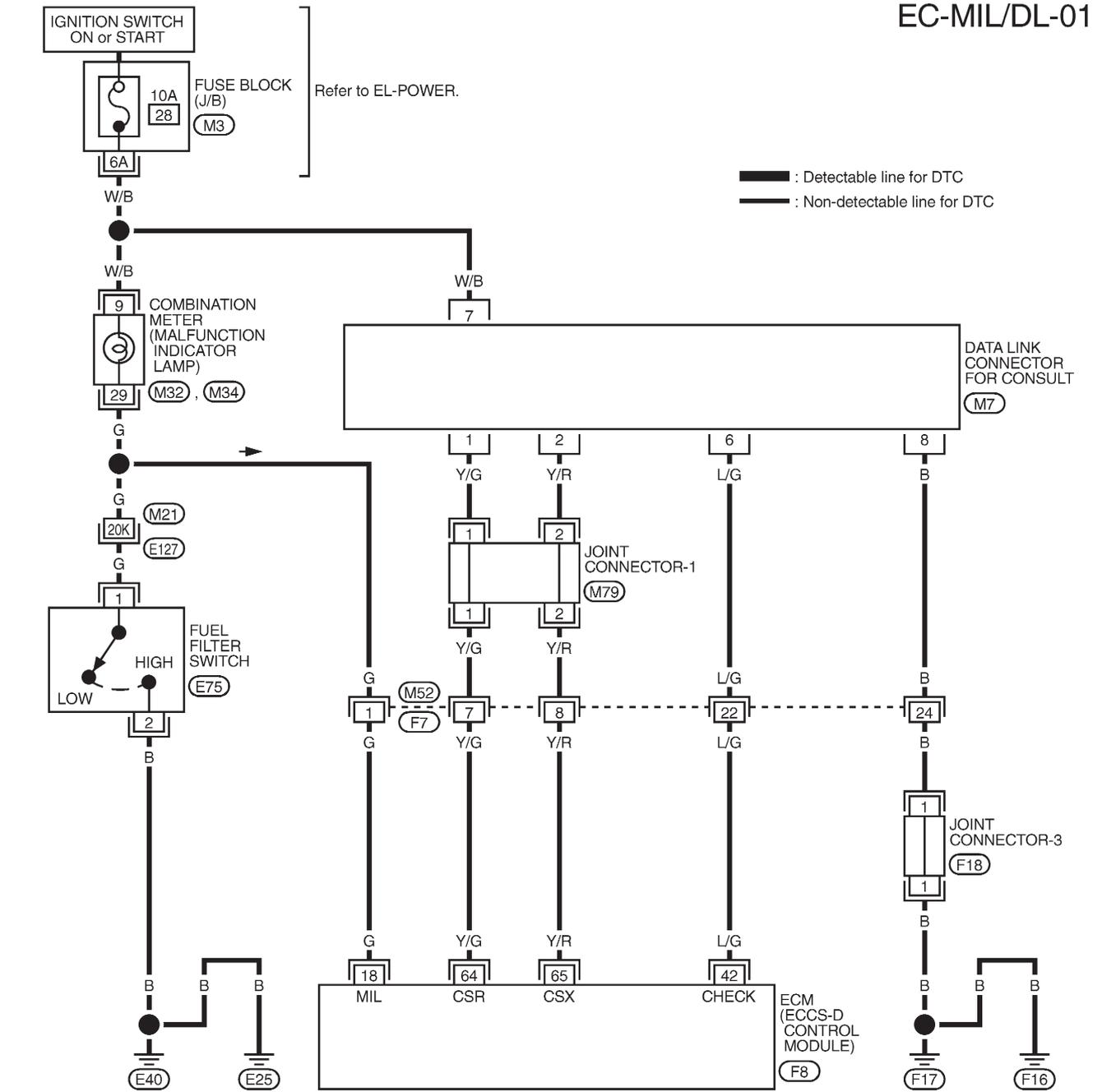
M21, E127
M2
E112

F8
W
H.S.

TROUBLE DIAGNOSES FOR NON-DETECTABLE ITEMS

MIL & Data Link Connectors

EC-MIL/DL-01



SERVICE DATA AND SPECIFICATIONS (SDS)

General Specifications

Unit: rpm	
Engine	RD28ETi
Idle speed	775±25
Maximum engine speed	5,400

Injection pump numbers

Engine	Part number	Pump assembly number
RD28ETi	16700 VB300	104721-2000

Injection Nozzle

INSPECTION AND ADJUSTMENT

Injection nozzle assembly

Unit: kPa (bar, kg/cm ² , psi)	
Initial injection pressure	
Used	14,220 (142.2, 145, 2,062)
New	14,711 - 15,495 (147.1 - 155.0, 150 - 158, 2,133 - 2,247)

Adjusting shims

Thickness mm (in)	Parts No.
0.50 (0.0197)	16613-V0700
0.54 (0.0213)	16613-V0702
0.58 (0.0228)	16613-V0704
0.62 (0.0244)	16613-V0706
0.66 (0.0260)	16613-V0708
0.70 (0.0276)	16613-V0710
0.74 (0.0291)	16613-V0712
0.78 (0.0307)	16613-V0714
0.82 (0.0323)	16613-V0716
0.86 (0.0339)	16613-V0718
0.90 (0.0354)	16613-V0720
0.94 (0.0370)	16613-V0722
0.98 (0.0386)	16613-V0724
1.00 (0.0394)	16613-V0760

Inspection and Adjustment

Plunger lift	mm (in)	0.92±0.04 (0.0362±0.0016) (at 9.75° ATDC)
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CAMSHAFT POSITION SENSOR (PUMP)

Resistance [at 25°C (77°F)]	Ω	1,360 - 1,840
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ENGINE COOLANT TEMPERATURE SENSOR

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

CONTROL SLEEVE POSITION SENSOR

Resistance [at 23°C (73°F)]	Ω	5.9
-----------------------------	---	-----

SERVICE DATA AND SPECIFICATIONS (SDS)

Inspection and Adjustment (Cont'd)

ADJUSTMENT RESISTOR

Resistance [at 25°C (77°F)]	kΩ	0.2 - 15.0
-----------------------------	----	------------

INJECTION TIMING CONTROL VALVE

Resistance [at 20°C (68°F)]	Ω	Approximately 11
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ELECTRIC GOVERNOR

Resistance [at 23°C (73°F)]	Ω	0.68
-----------------------------	---	------

CRANKSHAFT POSITION SENSOR (TDC)

Resistance [at 25°C (77°F)]	kΩ	Approximately 0.8 - 1.2
-----------------------------	----	-------------------------

GLOW PLUG

Resistance [at 25°C (77°F)]	Ω	0.8
-----------------------------	---	-----

ACCELERATOR POSITION SENSOR

Throttle valve conditions	Resistance kΩ [at 25°C (77°F)]
Completely closed	Approximately 0.5
Partially open	0.5 - 4
Completely open	Approximately 4

FUEL TEMPERATURE SENSOR

Temperature °C (°F)	Resistance kΩ
-20 (-4)	13.67 - 16.37
20 (68)	2.306 - 2.568
60 (140)	0.538 - 0.624
80 (176)	0.289 - 0.344