

Engine Fuel & Emission Control System

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.

WIRELESS EQUIPMENT

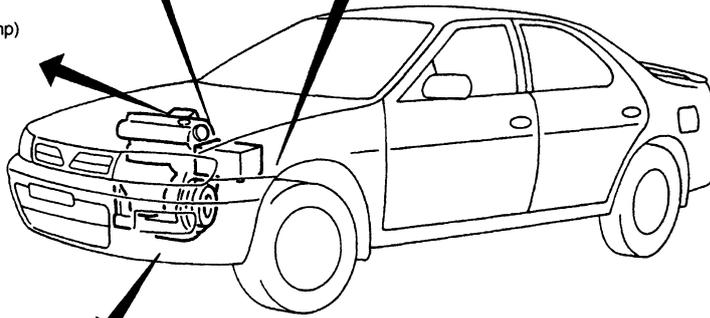
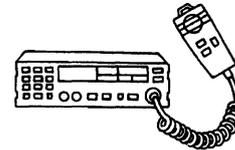
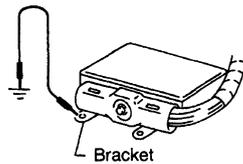
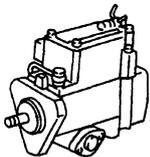
- When installing C.B. ham radio or a mobile phone, be sure to observe the following as it may adversely affect electronic control systems depending on its installation location.
 - 1) Keep the antenna as far as possible away from the ECM.
 - 2) Keep the antenna feeder line more than 20 cm (7.9 in) away 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 small.
 - 4) Be sure to ground the radio to vehicle body.

BATTERY

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

ELECTRONIC FUEL INJECTOR PUMP

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



ECM PARTS HANDLING

- Handle mass air flow sensor carefully to avoid damage.
- Do not disassemble mass air flow sensor.
- Do not clean mass air flow sensor with any type of detergent.
- Do not disassemble No. 1 injection nozzle (built-in needle lift sensor).
- Even a slight leak in the air intake system can cause serious problems.
- Do not shock or jar the camshaft position sensor (TDC).

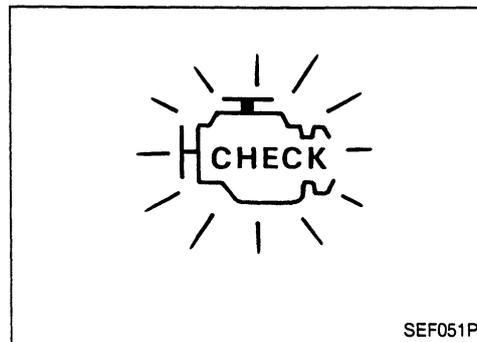
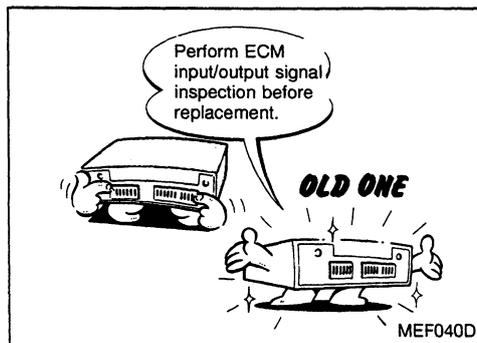
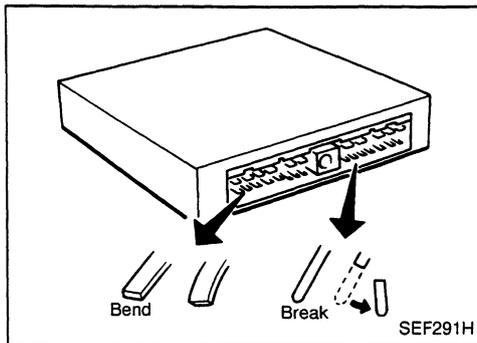
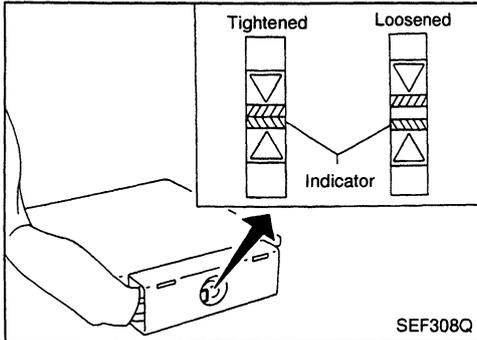
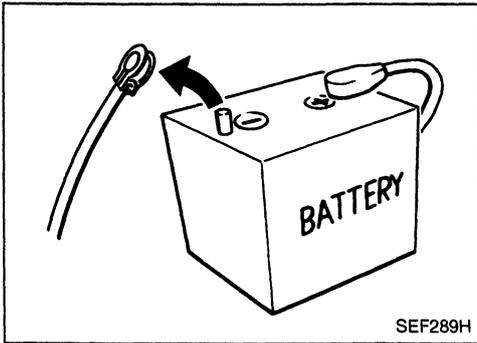


WHEN STARTING

- 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.

ECM HARNESS HANDLING

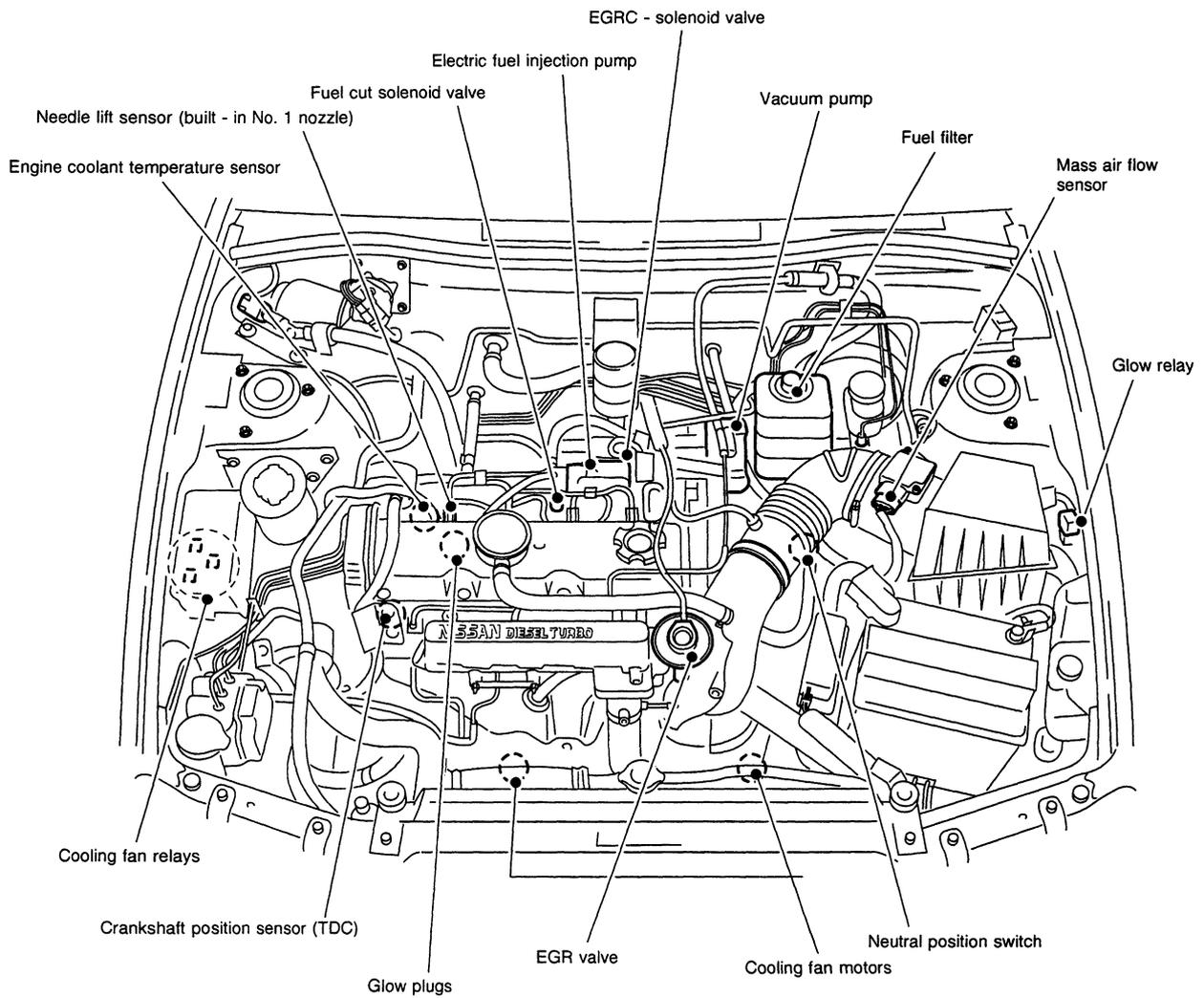
- Connect ECM harness connectors securely.
A poor connection can cause an extremely high (surge) voltage to develop in coil and condenser, thus resulting in damage to ICs.
- Keep ECM harness at least 10 cm (3.9 in) away from adjacent harnesses, to prevent an ECM system malfunction due to receiving external 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.



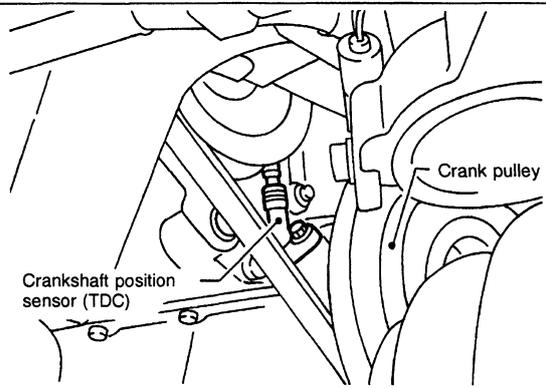
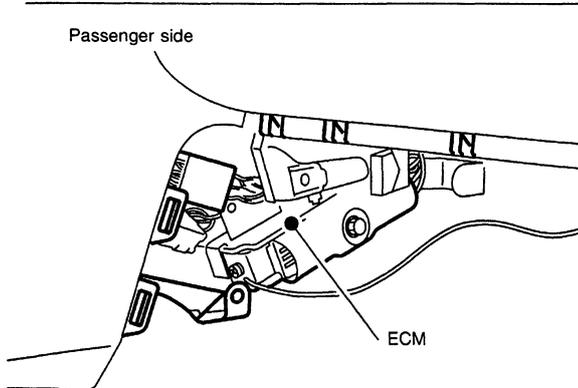
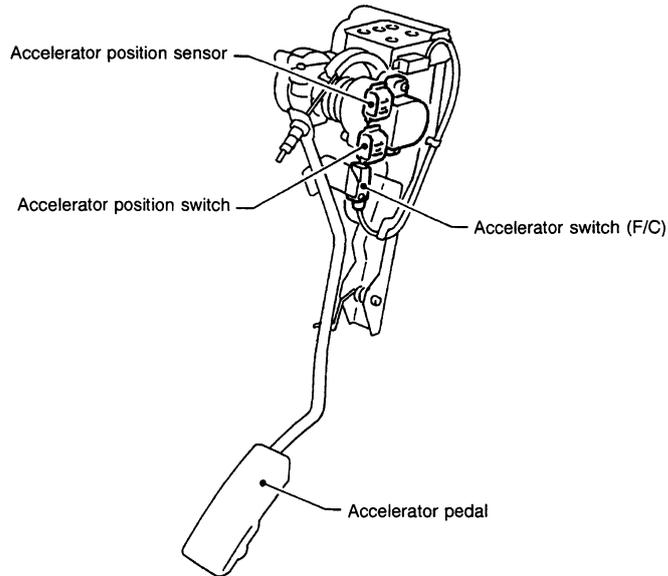
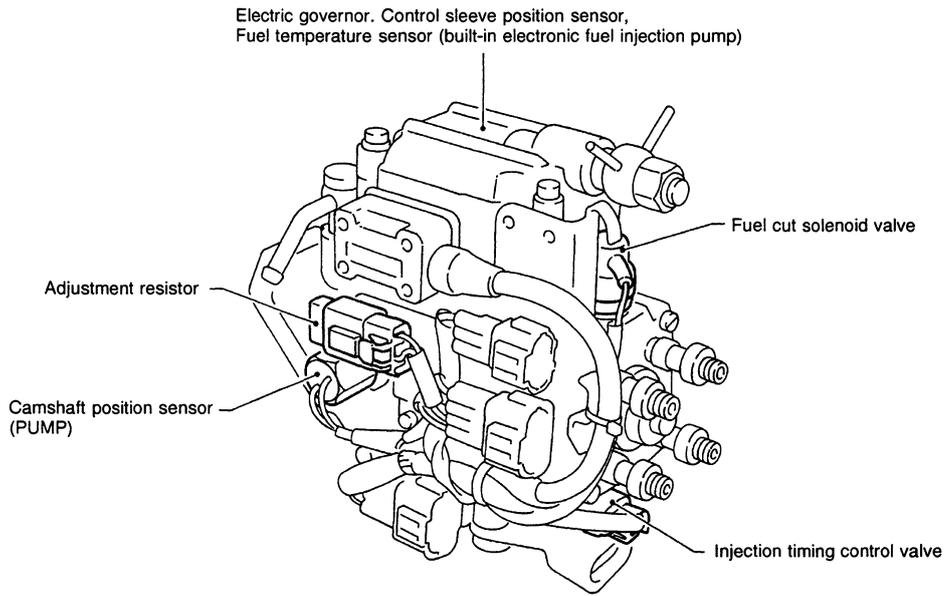
Precautions

- 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-338.
- If MIL illuminates or blinks irregularly during engine 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.

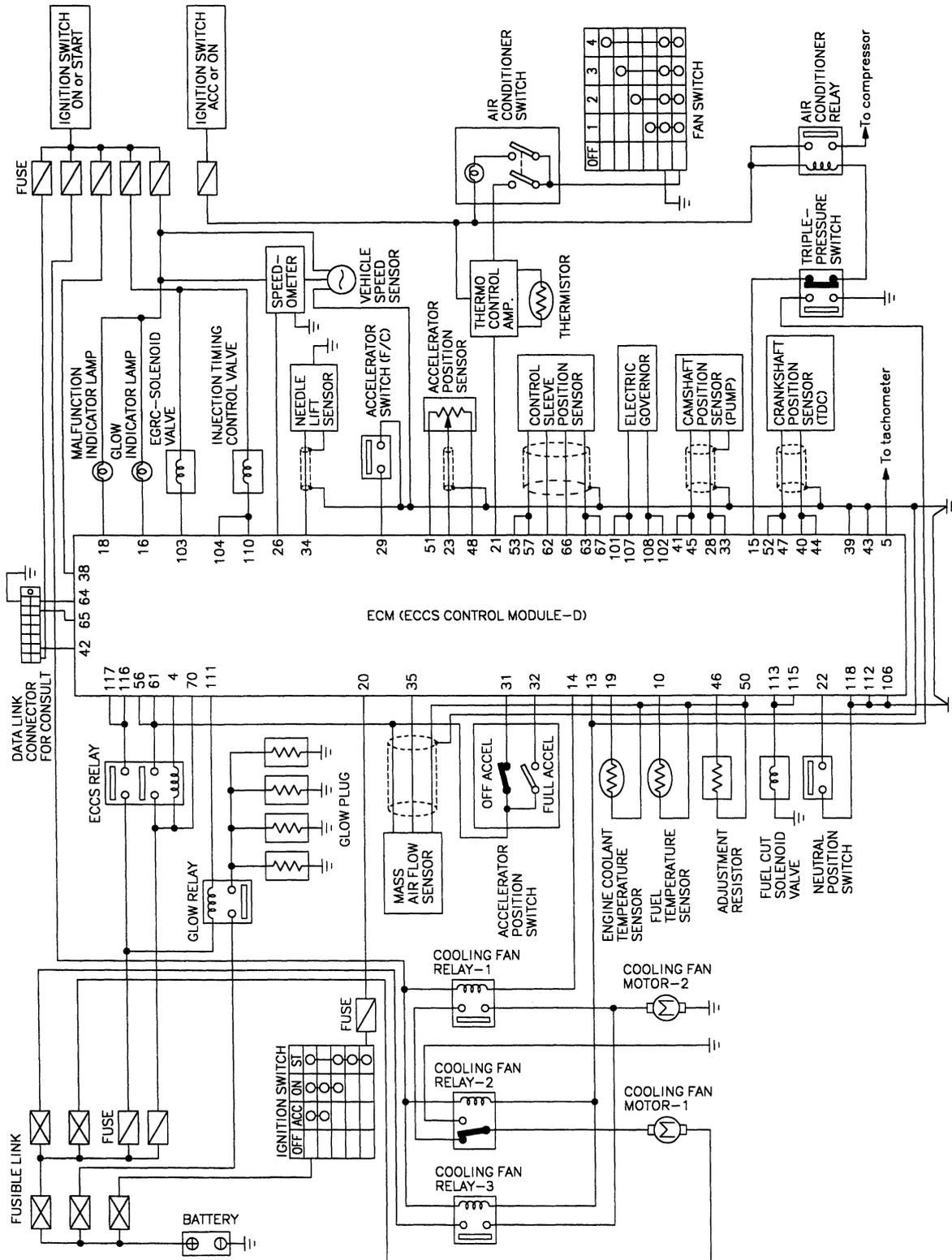
ECCS Component Parts Location



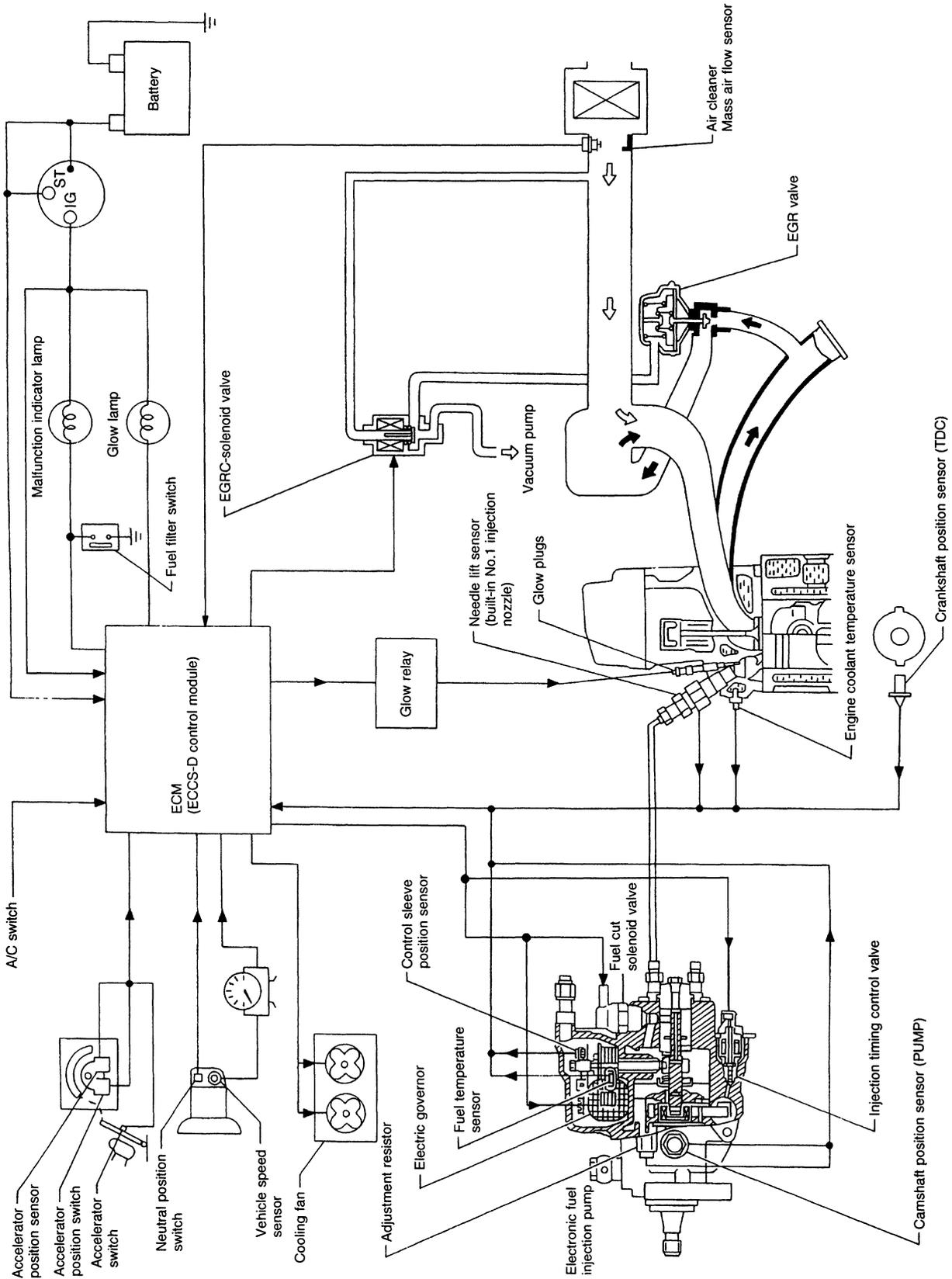
ECCS Component Parts Location (Cont'd)



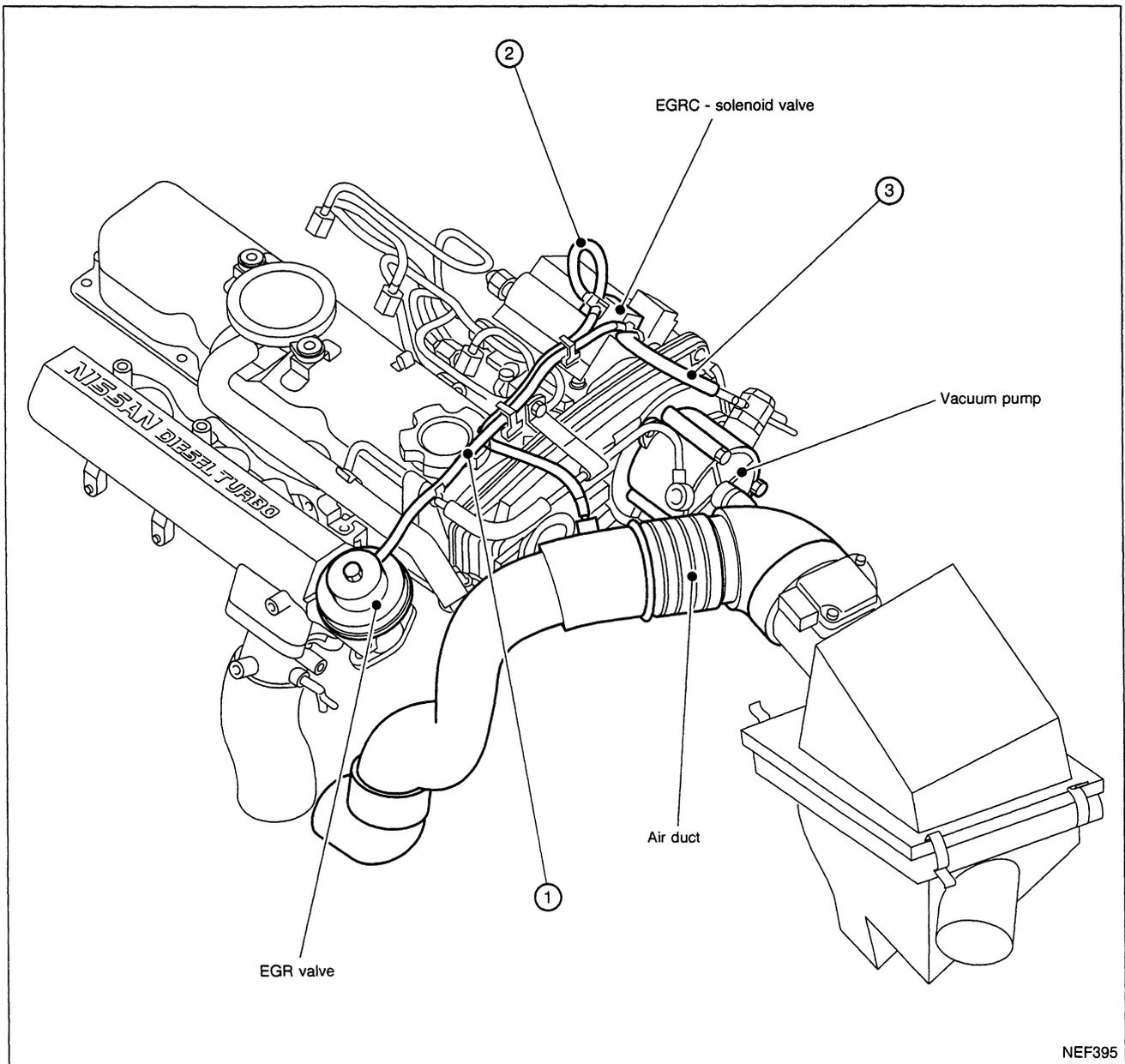
Circuit Diagram



System Diagram



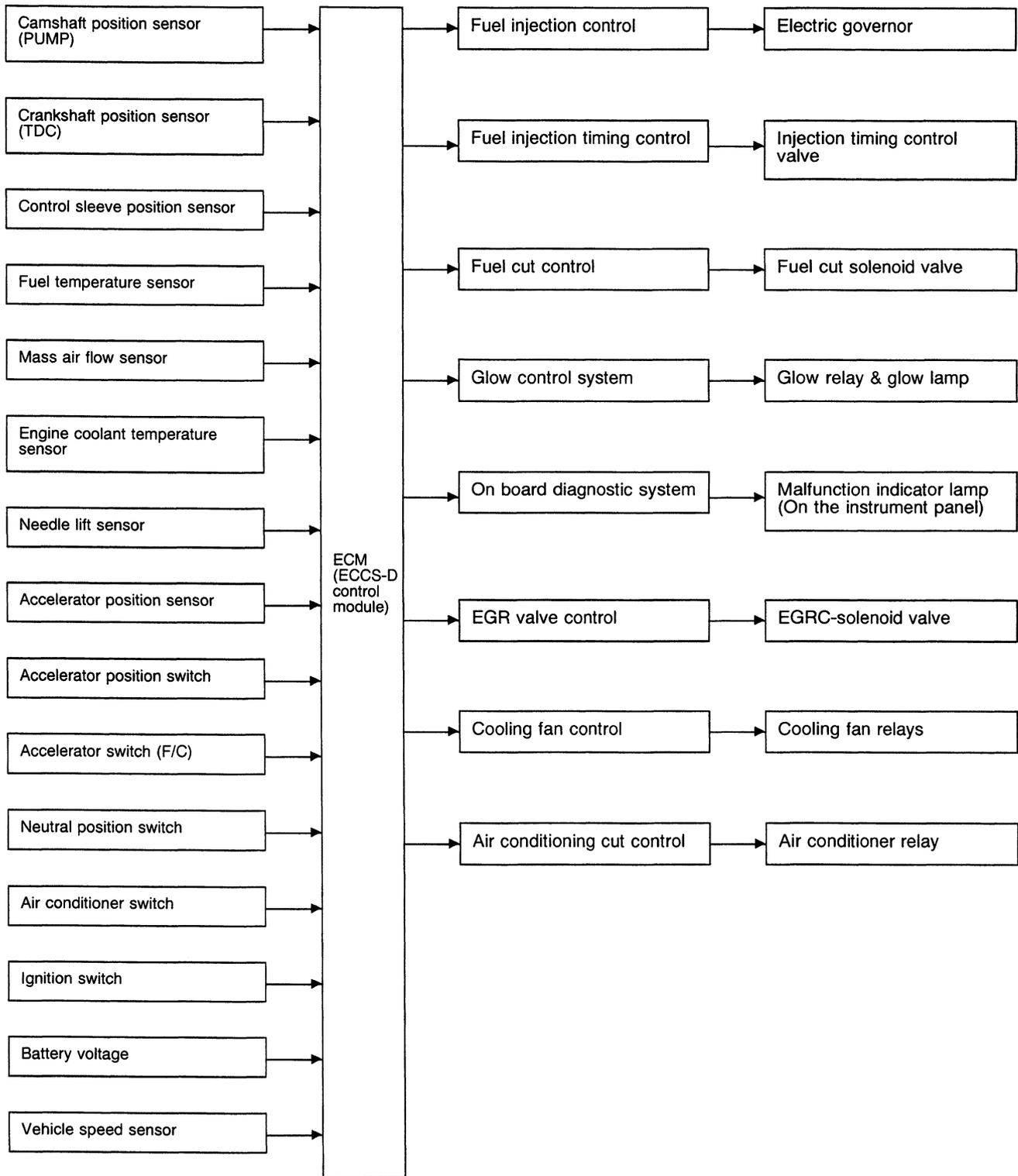
Vacuum Hose Drawing



- ① EGRC-solenoid valve to EGR valve
- ② EGRC-solenoid valve to air duct
- ③ EGRC-solenoid valve to vacuum pump

Refer to "System Diagram" on previous page for vacuum control system.

System Chart



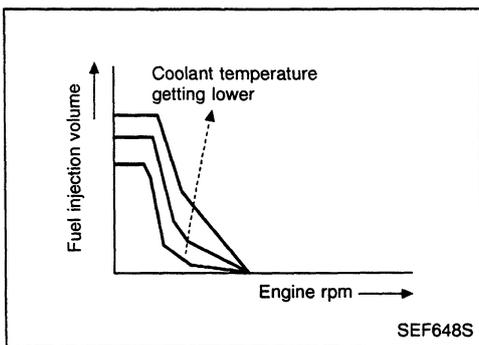
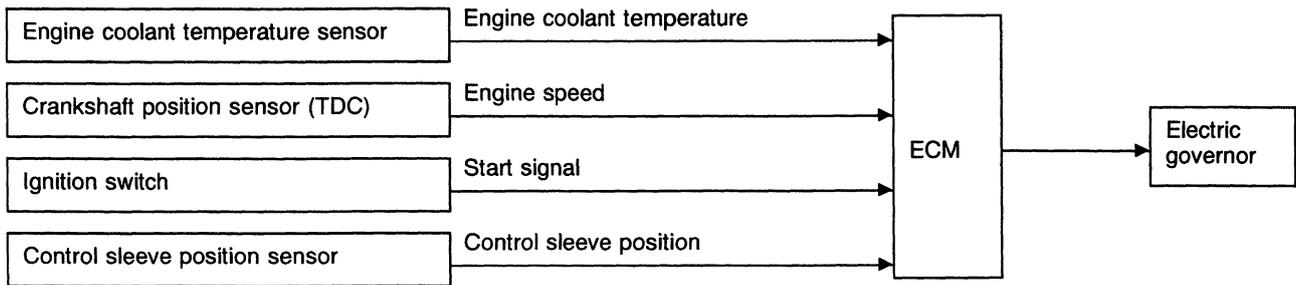
Fuel Injection System

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



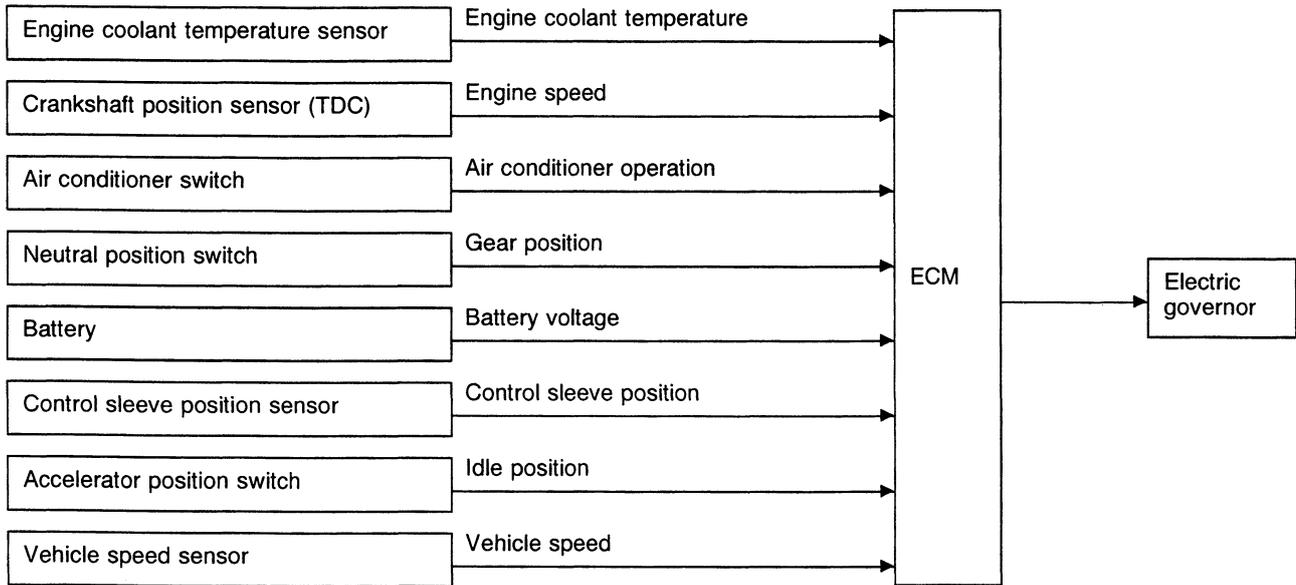
When the ECM receives a start signal from the ignition switch, the ECM adapts the fuel injection system for the start control. The amount of fuel injected at engine starting is a preset program value in the ECM. The program is determined by the engine speed and engine coolant temperature.

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 and shifts the control to the normal or idle control.

Fuel Injection System (Cont'd)

IDLE CONTROL

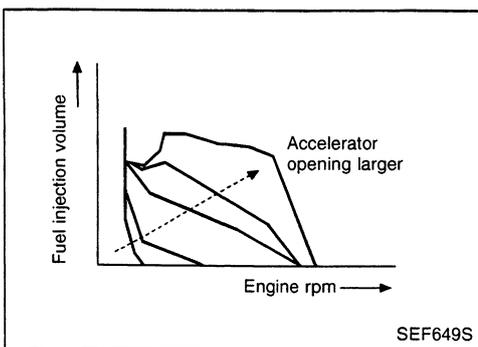
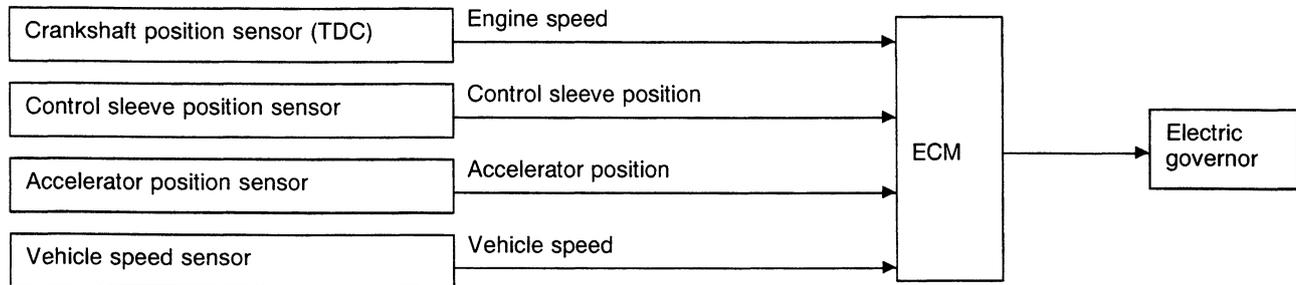
Input/output signal line



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.

NORMAL CONTROL

Input/output signal line



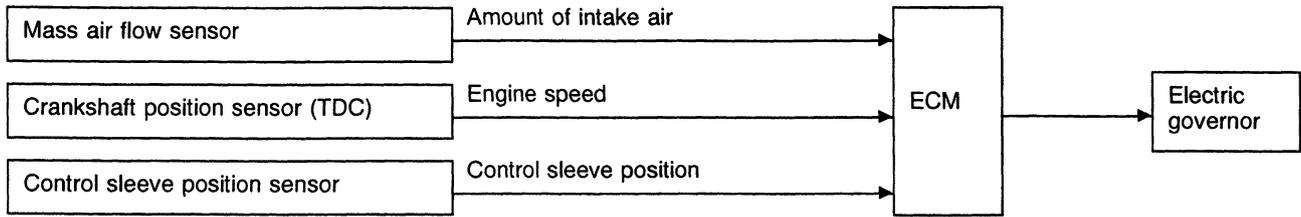
The amount of fuel injected under normal driving conditions is determined according to sensor signals. The crankshaft position sensor (TDC) detects engine speed and the accelerator position sensor detects accelerator position. These sensors send signals to the ECM.

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.

Fuel Injection System (Cont'd)

MAXIMUM FUEL INJECTION CONTROL

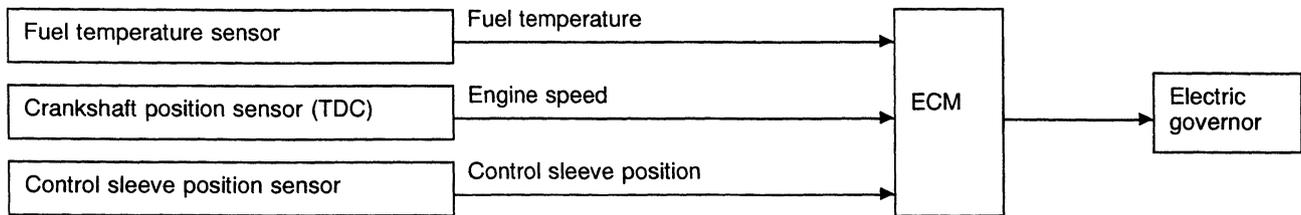
Input/output signal line



The maximum amount of fuel injected is limited depending on the amount of intake air and engine speed. The ECM controls the limit by monitoring the amount of intake air, detected by the mass air flow sensor, and engine speed signal. This ensures an appropriate amount of fuel is injected for turbocharged combustion and prevents black-smoke exhaust at high altitudes.

FUEL TEMPERATURE COMPENSATION

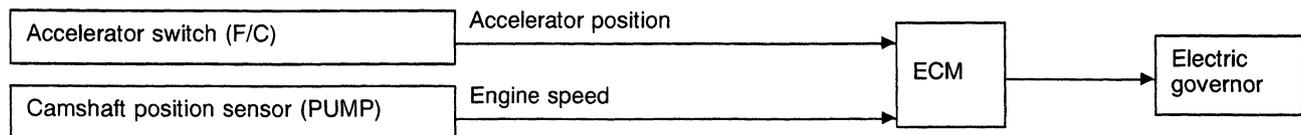
Input/output signal line



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

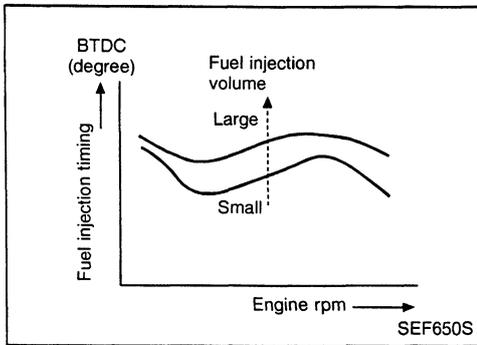
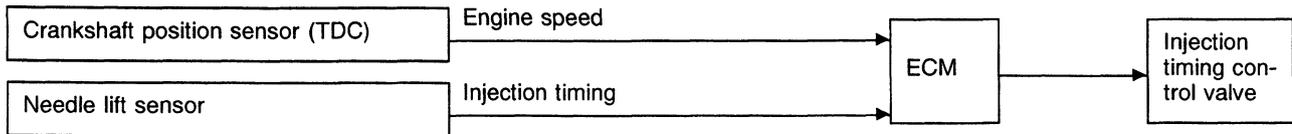
SYSTEM DESCRIPTION

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

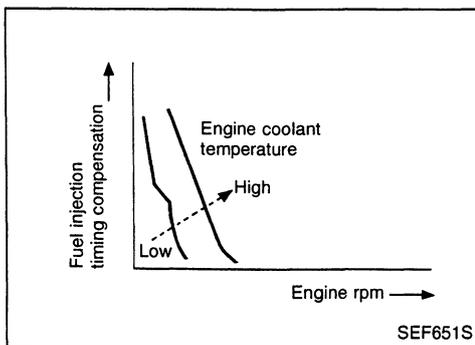
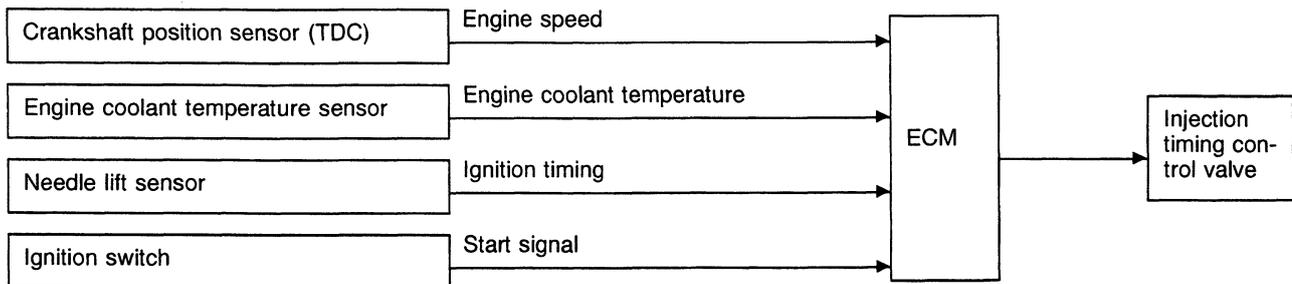
Input/output signal line



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

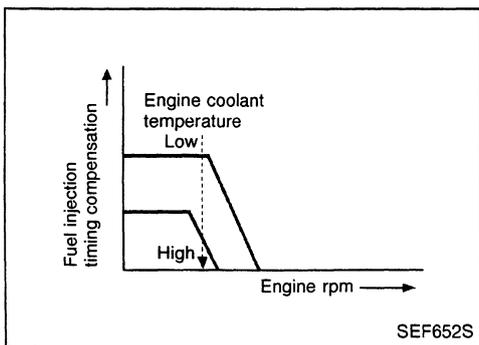
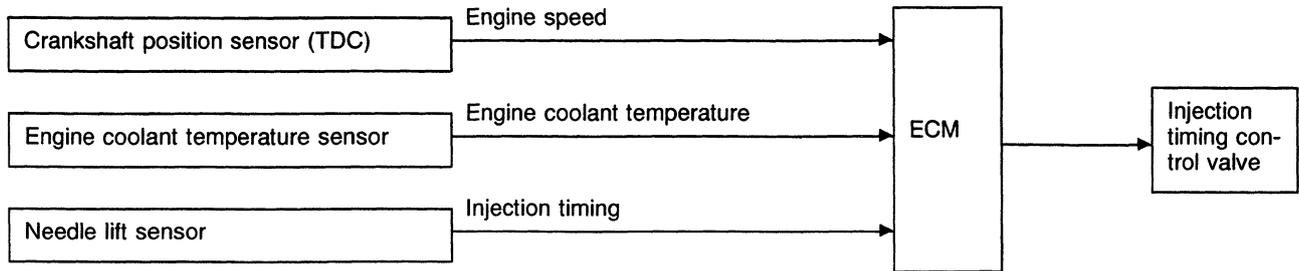


For better startability under cool engine conditions, the fuel injection timing is compensated according to the engine coolant temperature.

Fuel Injection Timing System (Cont'd)

ENGINE COOLANT TEMPERATURE COMPENSATION (During driving)

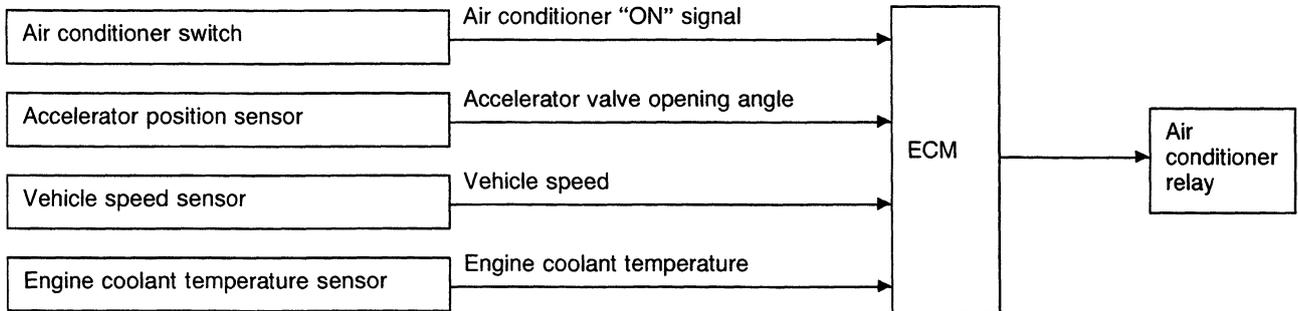
Input/output signal line



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

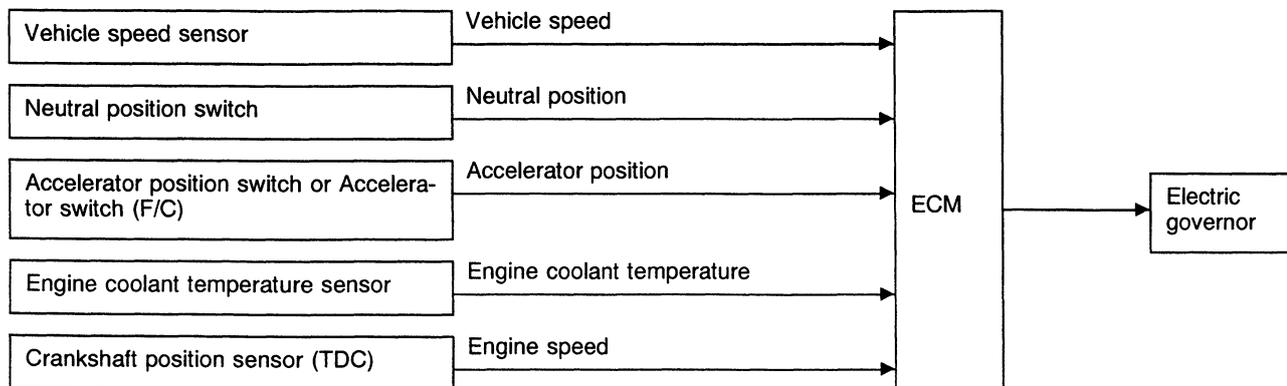


SYSTEM DESCRIPTION

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.

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

INPUT/OUTPUT SIGNAL LINE

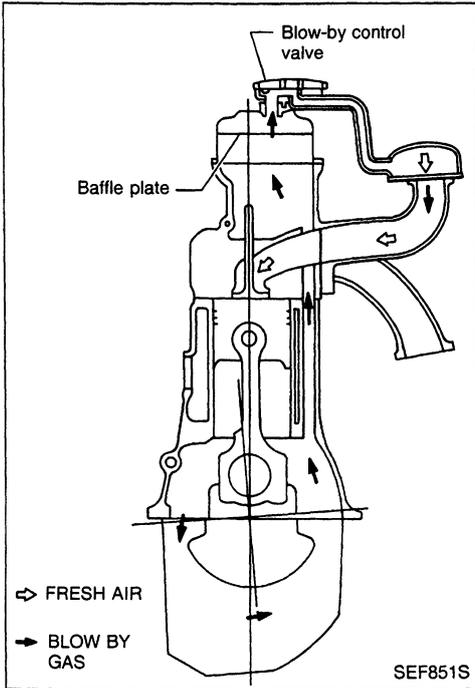


If the engine speed is above 4,000 rpm with no load (for example, in neutral and engine speed over 4,000 rpm) fuel will be cut off after some time. The exact time when the fuel is cut off varies based on engine speed.

Fuel cut will operate until the engine speed reaches 1,000 rpm, then fuel cut is cancelled.

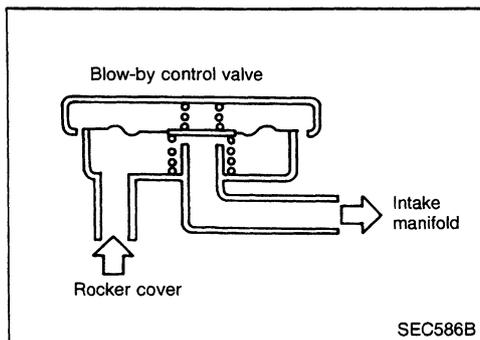
NOTE:

This function is different from deceleration control and fuel cut solenoid valve control listed under “Fuel Injection System”, EC-294 and “TROUBLE DIAGNOSIS FOR DTC 36, 37, 38”, EC-402.



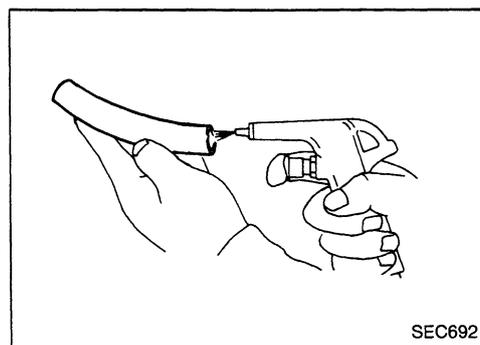
Description

- 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.



Blow-by Control Valve

- Check control valve for clogging and abnormalities.

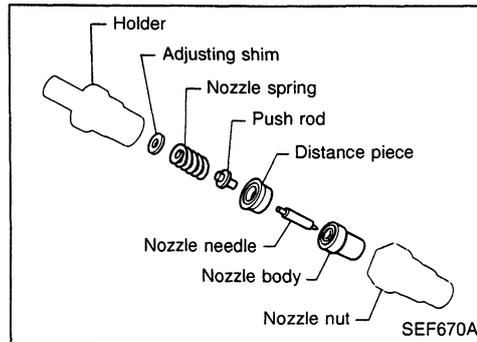
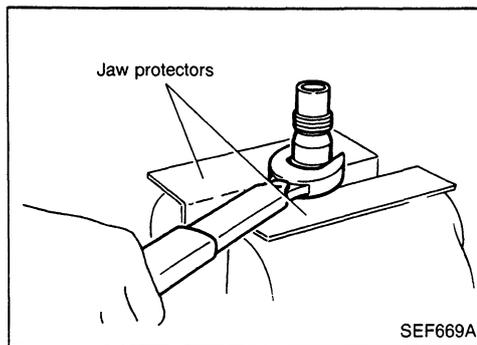
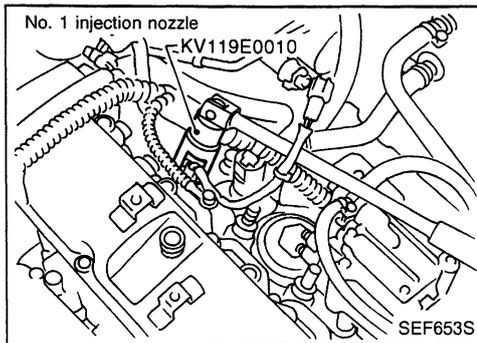
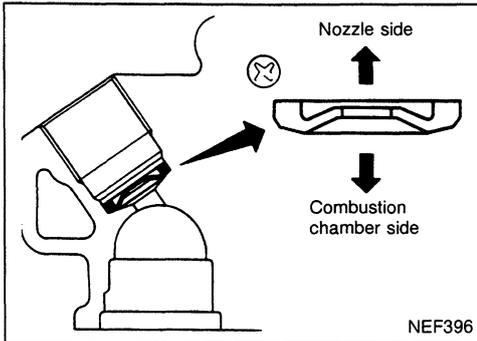


Ventilation Hose

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.

CAUTION:

- Do not disassemble No. 1 nozzle (with needle lift sensor). Entrust disassembly or adjustment to BOSCH service shop.
- 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.
3. Install injection nozzle in the reverse order of removal.

Also remove gasket from nozzle end.

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 nozzle)

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

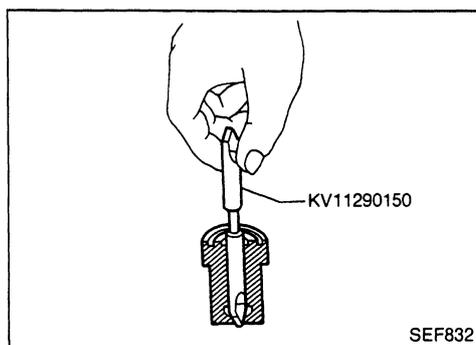
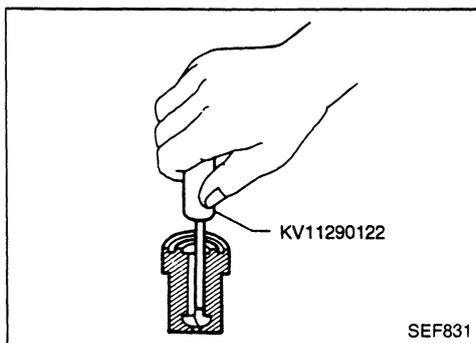
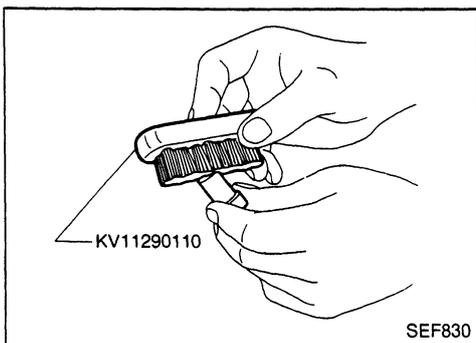
1. Loosen nozzle nut while preventing nozzle top from turning.

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

Inspection (No. 2-4 nozzle)

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.

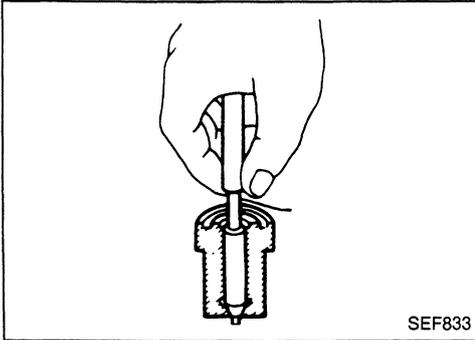


Cleaning (No. 2-4 nozzle)

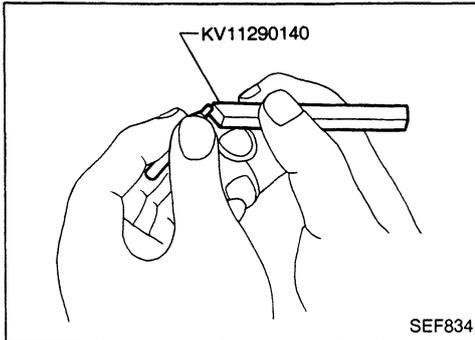
- a. Do not touch the nozzle mating surface with your fingers.
 - b. To wash the nozzles, use a wooden stick and brass brush with clean diesel fuel.
1. Remove any carbon from exterior of nozzle body (except wrapping angle portion) by using Tool.
 2. Clean oil sump of nozzle body using Tool.
 3. Clean nozzle seat by using Tool.

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

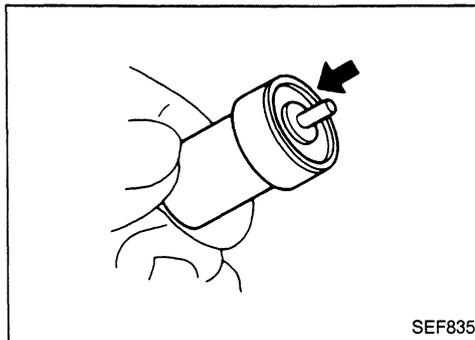
Cleaning (No. 2-4 nozzle) (Cont'd)



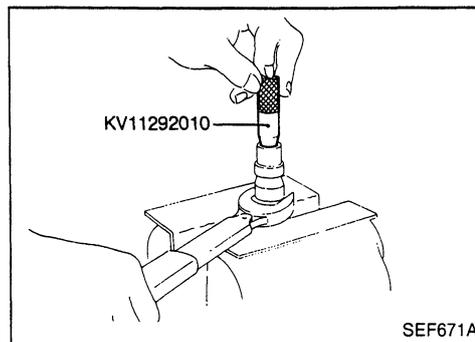
4. Clean spray hole of nozzle body by using Tool.
To prevent spray hole from canting, always clean it by starting with inner side and working towards outside.



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 nozzle)

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.

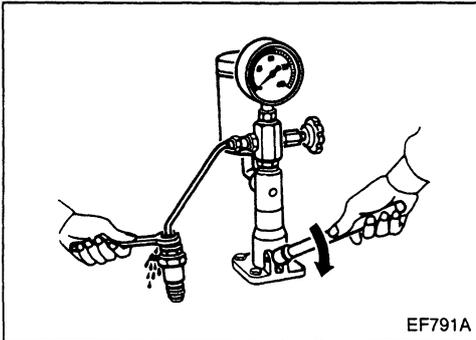
Holder to nozzle nut:

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

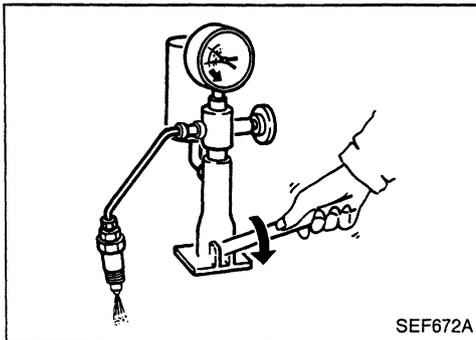
Test and Adjustment

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.



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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:

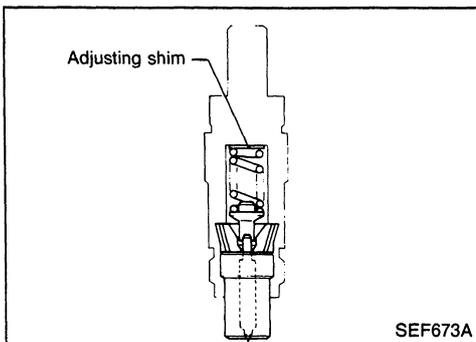
Used

12,259 - 13,239 kPa
 (122.6 - 132.4 bar,
 125 - 135 kg/cm², 1,778 - 1,920 psi)

New

12,749 - 13,534 kPa
 (127.5 - 135.3 bar,
 130 - 138 kg/cm², 1,849 - 1,962 psi)

Always check initial injection pressure using a new nozzle.

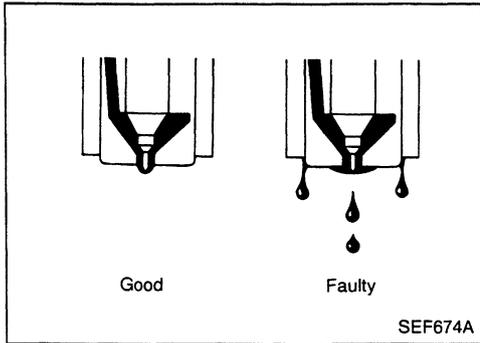


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4. To adjust injection pressure, change adjusting shims (No. 2-4 nozzle).
 - a. Increasing the thickness of adjusting shims increases initial injection pressure. Decreasing thickness reduces initial pressure.
 - b. A shim thickness of 0.04 mm (0.0016 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-444).

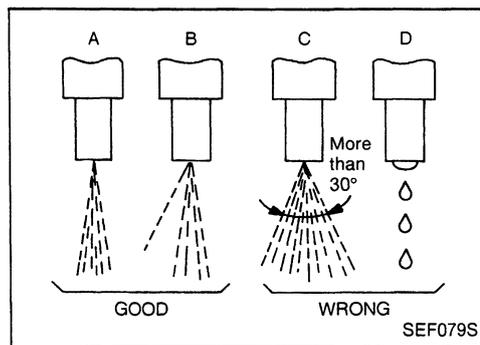
Test and Adjustment (Cont'd)

LEAKAGE TEST



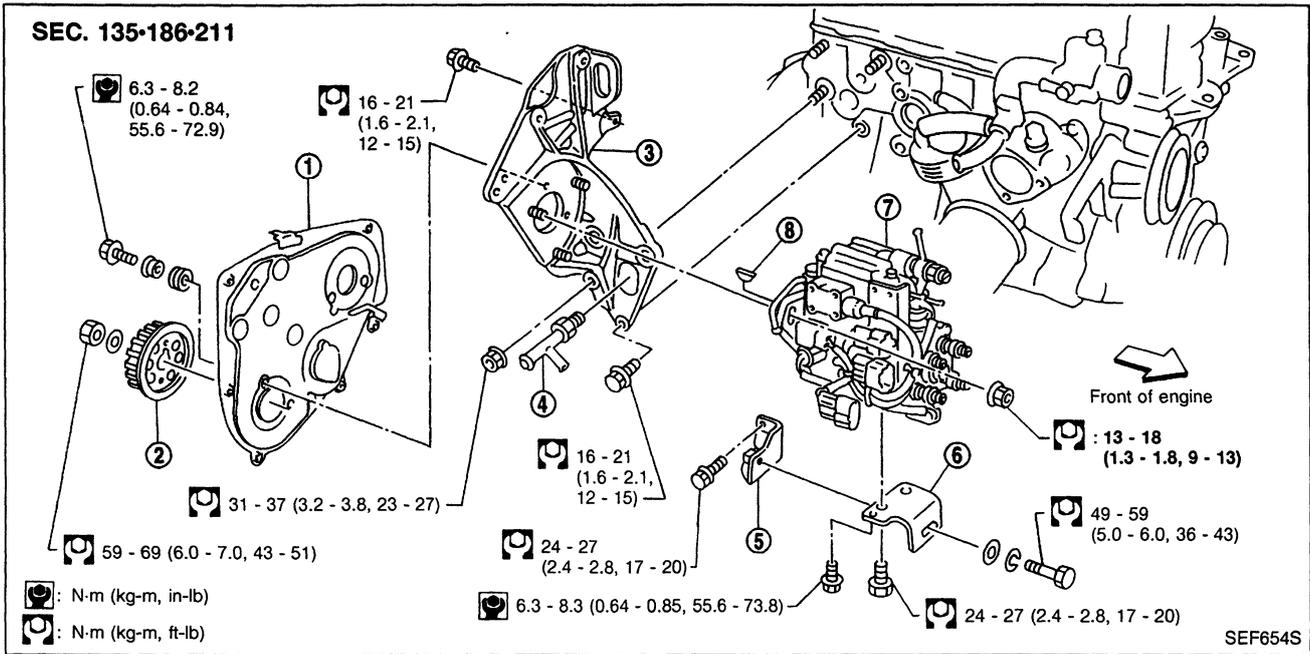
1. Maintain the pressure at about 981 to 1,961 kPa (9.8 to 19.6 bar, 10 to 20 kg/cm², 142 to 284 psi) below initial injection pressure.
2. Check that there is no dripping from the nozzle tip or around the body.

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



SPRAY PATTERN TEST

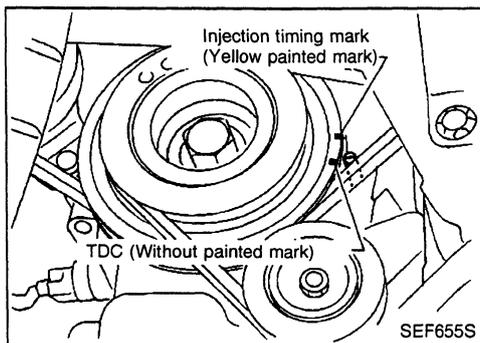
1. Check spray pattern by pumping tester handle one full stroke per second.
 - a. If main spray angle is within 30 degrees as shown, injection nozzle is good.
 - b. It is still normal even if a thin stream of spray deviates from the main spray (pattern B).
2. If the spray pattern is not correct, disassemble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



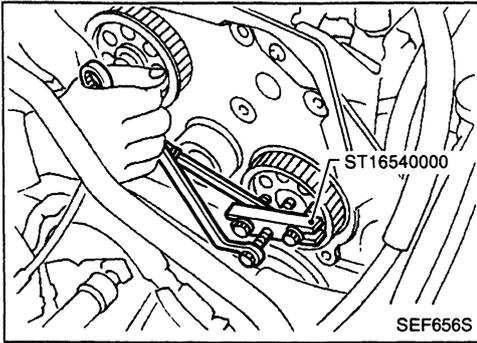
- | | | |
|---------------------------|-------------------|----------------------------------|
| ① Rear back cover | ④ Water connector | ⑦ Electronic fuel injection pump |
| ② Injection pump sprocket | ⑤ Bracket | ⑧ Key |
| ③ Injection pump bracket | ⑥ Bracket | |

Removal

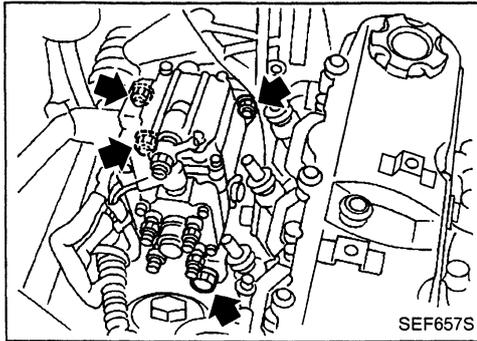
1. Remove battery.
Disconnect electronic injection pump harness connectors.



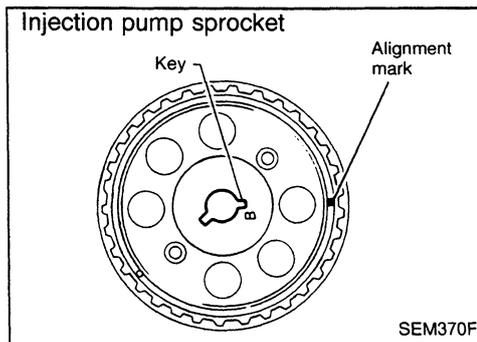
2. Set No. 1 piston at TDC on its compression stroke.
TDC: Crankshaft pulley notch without painted mark
3. Remove fuel hoses (supply, return and spill) and injection tubes.
4. Remove air duct and injection pump timing belt cover.
5. Remove injection pump timing belt.
Refer to EM section ("Injection Pump Timing Belt").

Removal (Cont'd)

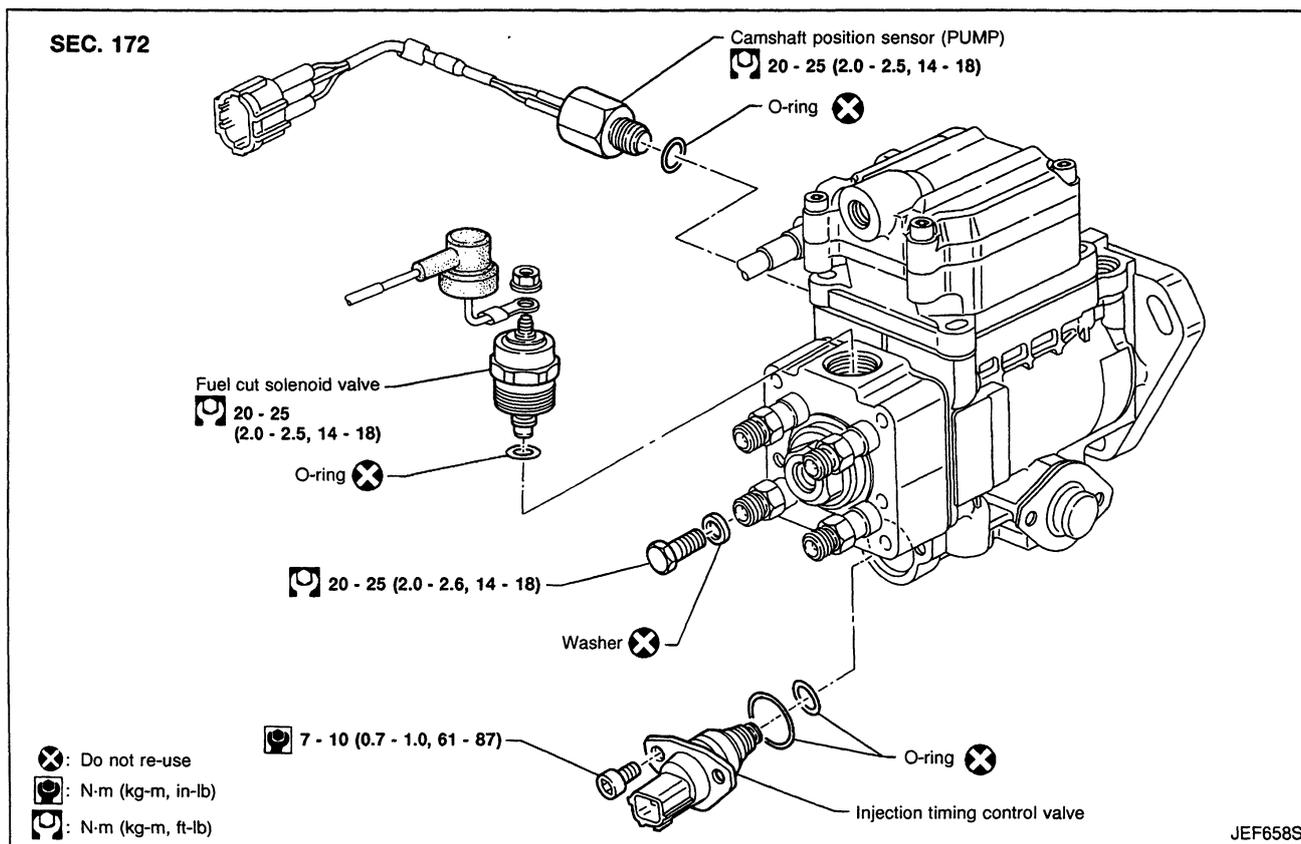
6. Remove injection pump sprocket with Tool.
 - Remove key from injection pump shaft and store safely.



7. Remove injection pump assembly.

**Installation**

1. Install key on injection pump shaft, then install injection pump sprocket.
 - Use mark "B" 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-324.
4. Install all parts removed.



Disassembly and Assembly

CAUTION:

- Do not disassemble the parts not shown in the illustration above.
- Before installing injection timing control valve, 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 for fuel leaks.
- After assembling the parts, erase Diagnostic Trouble Code (DTC), and perform DTC CONFIRMATION PROCEDURE (or OVERALL FUNCTION CHECK).

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 a 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 (DTC) Chart", EC-326.

Diagnostic Trouble Code (DTC)

HOW TO READ DTC

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

1. The number of flashes 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 has occurred in the past and now returned to normal.**
CONSULT can identify past incidences of malfunctions and therefore, using CONSULT (if available) has is recommended.

HOW TO ERASE DTC

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

- ⌚ Selecting "ERASE" in the "SELF-DIAG RESULTS" mode with CONSULT.
- ⌚ Changing the diagnostic test mode from Diagnostic Test Mode II to Mode I. (Refer to EC-311.)
- **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)

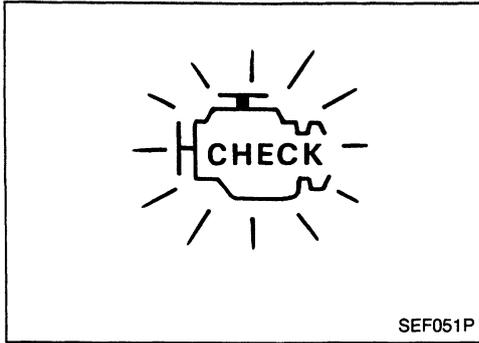
1. If the ignition switch stays "ON" after repair work, be sure to turn ignition switch to "LOCK" position once. Wait for at least 5 seconds and then turn it "ON" (Engine stopped) again.
2. Turn CONSULT "ON" and touch "ENGINE".
3. Touch "SELF-DIAG RESULTS".
4. Touch "ERASE". (The DTC in the ECM will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

<div style="border: 1px solid black; padding: 5px;"> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black;"> SELECT SYSTEM <input type="checkbox"/> </div> <div style="padding: 2px;">ENGINE</div> <div style="padding: 2px;"> </div> </div> <p>1. Touch "Engine".</p>	<div style="border: 1px solid black; padding: 5px;"> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black;"> SELECT DIAG MODE <input type="checkbox"/> </div> <div style="padding: 2px;">SELF-DIAG RESULTS</div> <div style="padding: 2px;">DATA MONITOR</div> <div style="padding: 2px;">ACTIVE TEST</div> <div style="padding: 2px;"> </div> <div style="padding: 2px;"> </div> <div style="padding: 2px;"> </div> </div> <p>2. Touch "SELF-DIAG RESULTS".</p>	<div style="border: 1px solid black; padding: 5px;"> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black;"> SELF-DIAG RESULTS <input type="checkbox"/> </div> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 2px;">FAILURE DETECTED</td> <td style="padding: 2px;">TIME</td> </tr> <tr> <td style="padding: 2px;">FUEL CUT S/V 1</td> <td style="padding: 2px;">0</td> </tr> <tr> <td colspan="2" style="padding: 10px 0 0 0;"> </td> </tr> <tr> <td style="padding: 2px;">FCV SHORT</td> <td style="padding: 2px;">0</td> </tr> </table> <div style="display: flex; justify-content: space-around; border-top: 1px solid black; padding-top: 5px;"> ERASE PRINT </div> </div> <p>3. Touch "ERASE". (The DTC in the ECM will be erased.)</p>	FAILURE DETECTED	TIME	FUEL CUT S/V 1	0			FCV SHORT	0
FAILURE DETECTED	TIME									
FUEL CUT S/V 1	0									
FCV SHORT	0									

CXSS01

⌚ HOW TO ERASE DTC (No Tools)

1. If the ignition switch stays "ON" after repair work, be sure to turn ignition switch to "LOCK" position 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-311.)



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-441.
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 flashes 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 FUNCTION

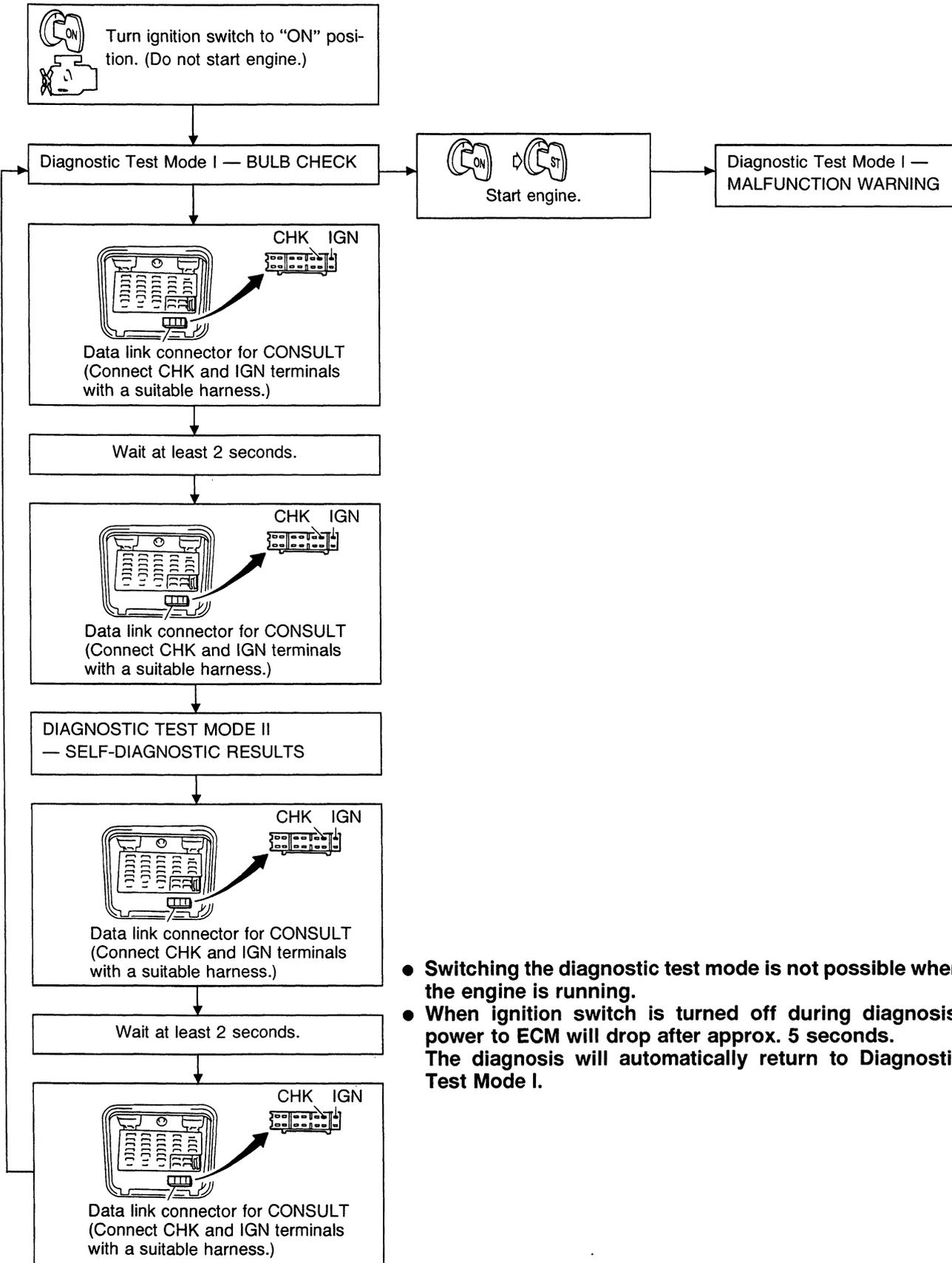
The on board diagnostic system has the following three functions:

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	—

Malfunction Indicator Lamp (MIL) (Cont'd)
HOW TO SWITCH DIAGNOSTIC TEST MODES



- Switching the diagnostic test mode 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.

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-441.

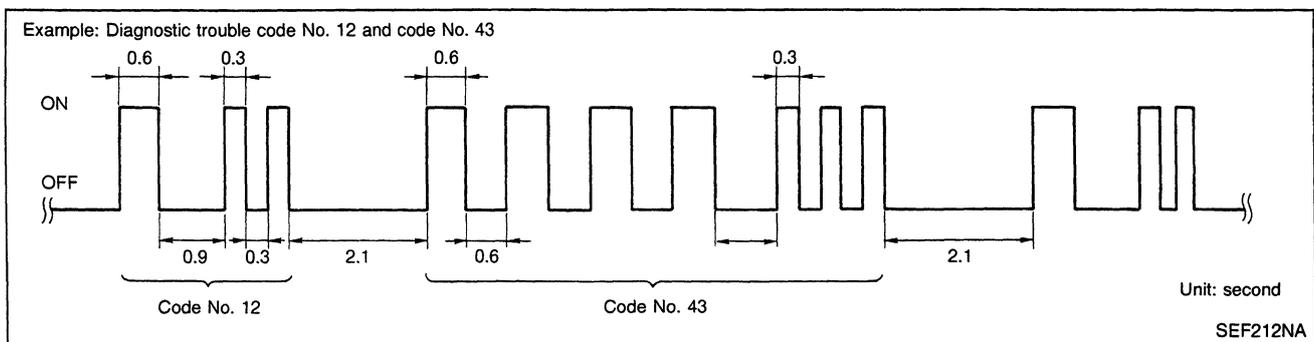
DIAGNOSTIC TEST MODE I—MALFUNCTION WARNING

MALFUNCTION INDICATOR LAMP	Condition
ON	When the malfunction is detected or the ECM's CPU is malfunctioning. (The “MIL Illumination” of the “DTC Chart”.) Refer to EC-326.
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 flashes of the MALFUNCTION INDICATOR LAMP as shown below.



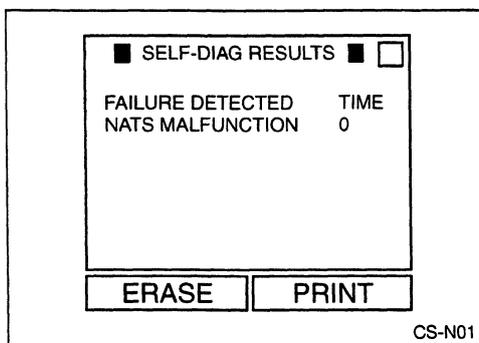
Long (0.6 second) flashes indicate the number of ten digits, and short (0.3 second) flashes indicate the number of single digits. For example, the malfunction indicator lamp flashes 4 times for 5 seconds (0.6 sec x 4 times) and then it flashes three times for about 1 second (0.3 sec x 3 times). This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

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 CHART, EC-326.)

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.

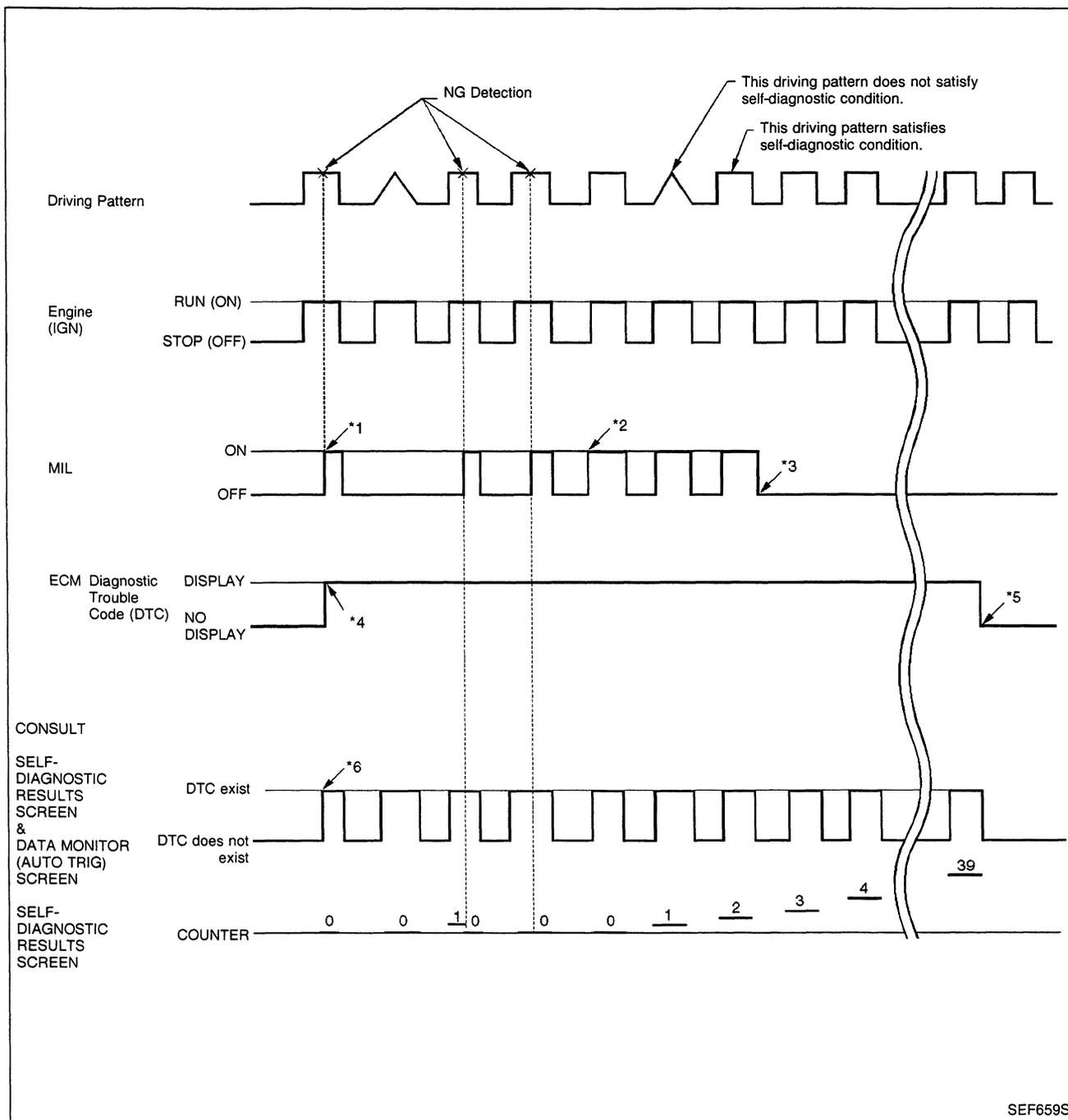


- If the MIL blinks or “NATS MALFUNCTION” is displayed on “SELF-DIAG RESULTS” screen, perform self-diagnostic results mode with CONSULT using NATS program card (NATS-E960). Refer to EL section.
- Confirm no self-diagnostic results of NATS is displayed before touching “ERASE” in “SELF-DIAG RESULTS” mode with CONSULT.
- When replacing ECM, initialisation of NATS V.2.0 system and registration of all NATS V.2.0 ignition key IDs must be carried out with CONSULT using NATS program card (NATS-E960).

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 V.2.0.

Malfunction Indicator Lamp (MIL) (Cont'd)

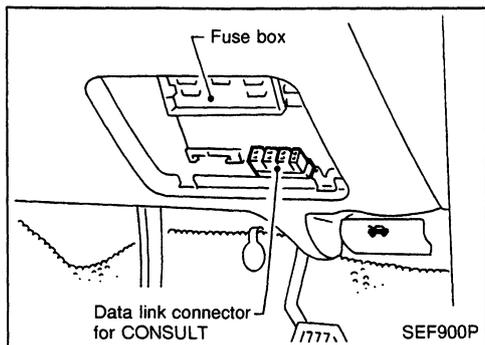
RELATIONSHIP BETWEEN MIL, DTC, CONSULT AND DRIVING PATTERNS



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 remains 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.

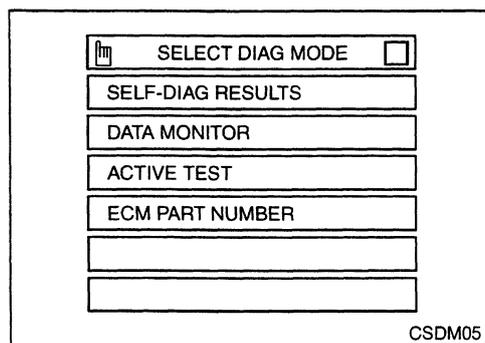
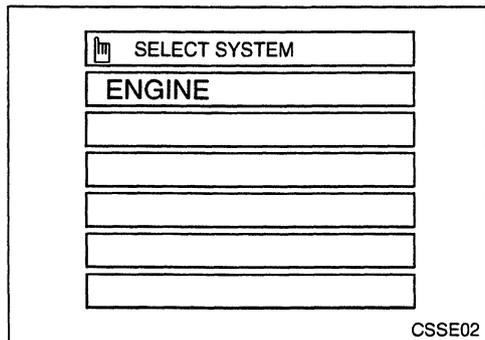


CONSULT

CONSULT INSPECTION PROCEDURE

1. Turn off ignition switch.
2. Connect "CONSULT" to data link connector for CONSULT. (Data link connector for CONSULT is located behind the fuse box cover.)
3. Turn on ignition switch.
4. Touch "START".
5. Touch "ENGINE".
6. Perform each diagnostic test mode according to each service procedure.

For further information, see the CONSULT Operation Manual.



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	
		Mass air flow sensor	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	X	
		Ignition switch (start signal)		X	
		Air conditioner switch		X	
		Neutral position switch		X	
		Battery voltage		X	
	OUTPUT	Injection timing control valve	X	X	X
		Fuel cut solenoid valve	X	X	X
		Air conditioner relay		X	
		Glow relay		X	X
		EGRC-solenoid valve		X	X
		Cooling fan relay		X	X

X: Applicable

CONSULT (Cont'd)

SELF-DIAGNOSTIC MODE

Regarding items detected in "SELF-DIAG RESULTS" mode, refer to "Diagnostic Trouble Code (DTC) chart". (See EC-326.)

DATA MONITOR MODE

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

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. 	
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. 	
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 accelerator pedal is released quickly with engine speed at 3000 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 supply is shut off.
AIR COND RLY [ON/OFF]		○	<ul style="list-style-type: none"> The air conditioner relay control condition (determined by ECM according to the input signal) is indicated. 	
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. 	
EGRC SOL/V A [ON/OFF]			<ul style="list-style-type: none"> The control condition of the EGRC-solenoid valve (determined by ECM according to the input signal) is indicated. OFF ... EGRC-solenoid valve is not operating. ON ... EGRC-solenoid valve is operating. 	

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 POSIG	<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
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 ● Fuel pump 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

CONSULT (Cont'd)

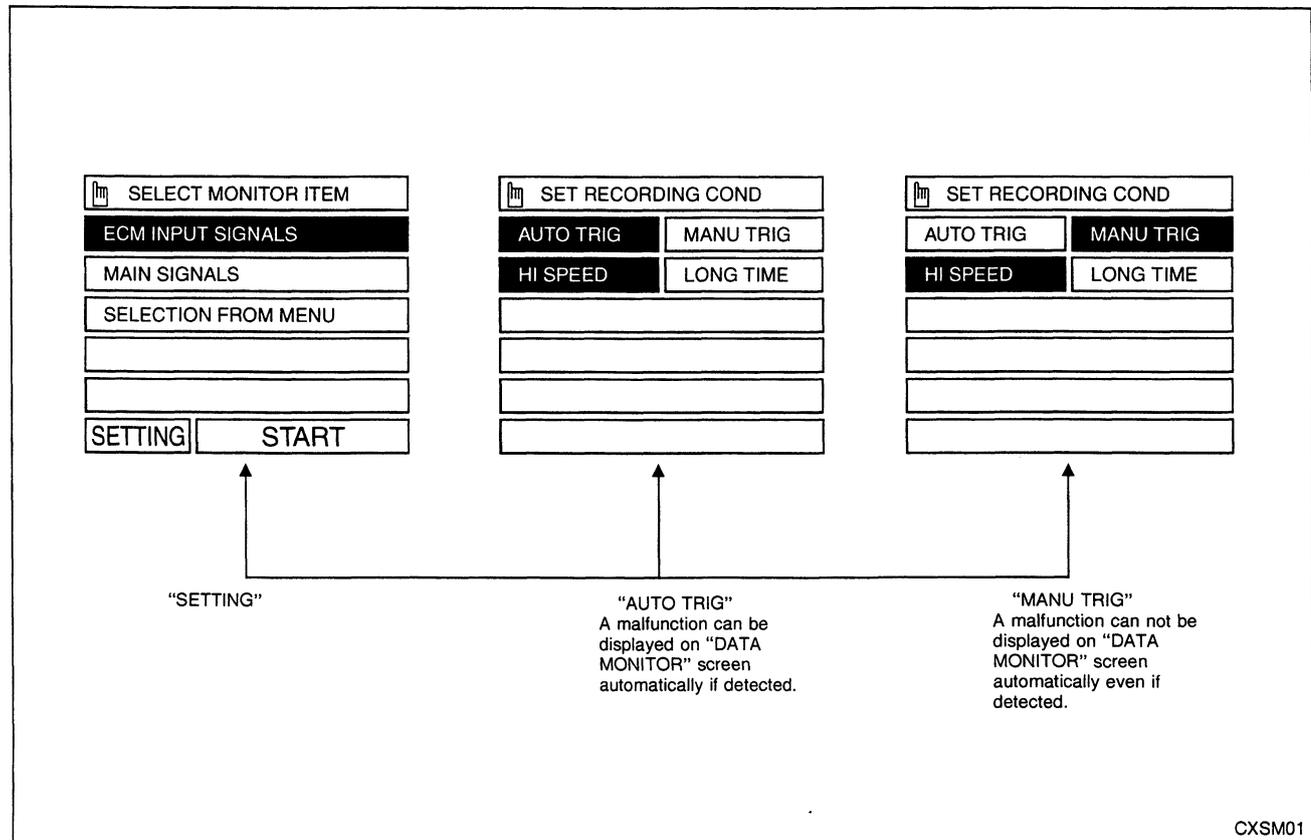
REAL TIME DIAGNOSIS IN DATA MONITOR MODE

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

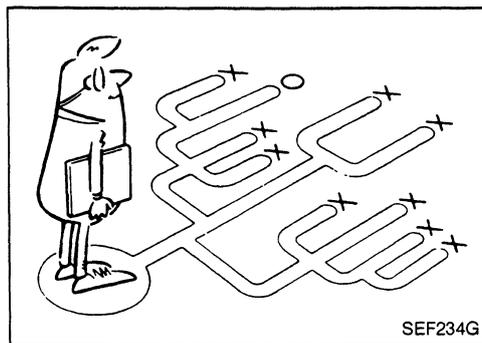
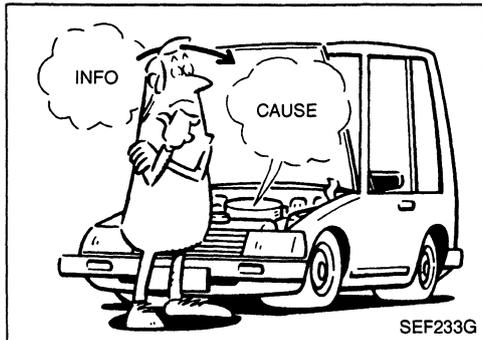
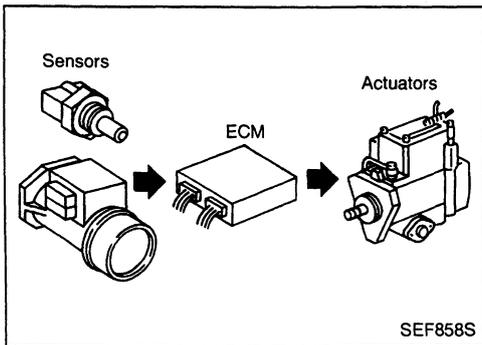
1. "AUTO TRIG" (Automatic trigger):
 - The malfunction will be identified on the CONSULT screen in real time. In other words, DTC and malfunction item will be displayed at the moment the malfunction is detected by ECM. DATA MONITOR can be performed continuously until a malfunction is detected. However, DATA MONITOR cannot continue any longer after the malfunction detection.
2. "MANU TRIG" (Manual trigger):
 - DTC and 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 DTC 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.



CXSM01



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 uses the data to instantly drive the electronic fuel injection pump based on current ambient conditions. It is essential that both input and output signals are correct and stable. In addition, it is important that there are no faults such as vacuum leaks, or other problems with the engine.

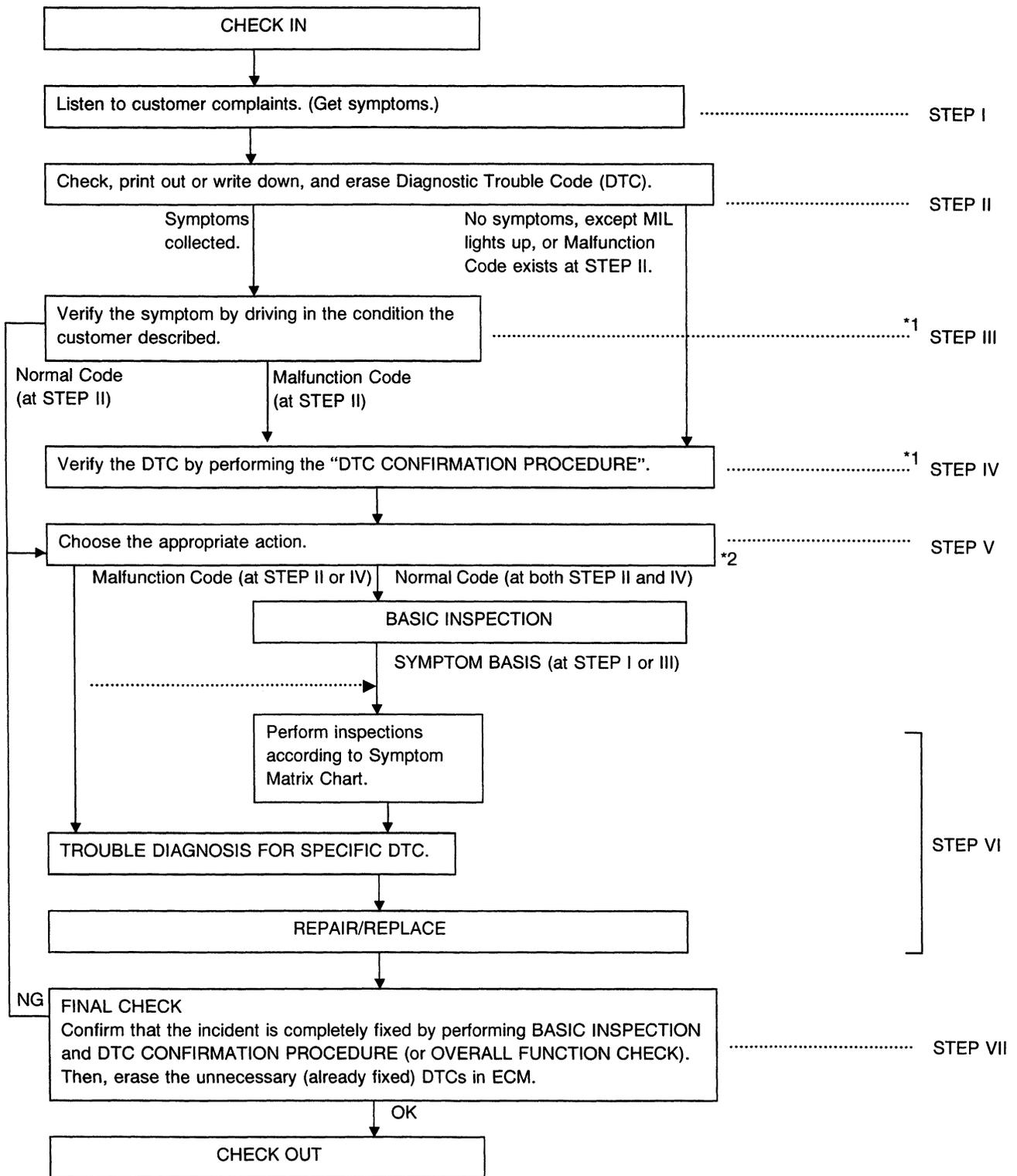
It is much more difficult to diagnose a problem that occurs intermittently rather than catastrophically. Most intermittent problems are caused by poor electric connections or faulty wiring. In this case, careful checking of suspected circuits may help prevent the replacement of good parts.

A visual check only may not be sufficient to determine the cause of the problems. A road test with CONSULT or a circuit tester connected should be performed. Follow the "Work Flow" on the next page.

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 a vehicle with an electronically controlled engine.

Work Flow

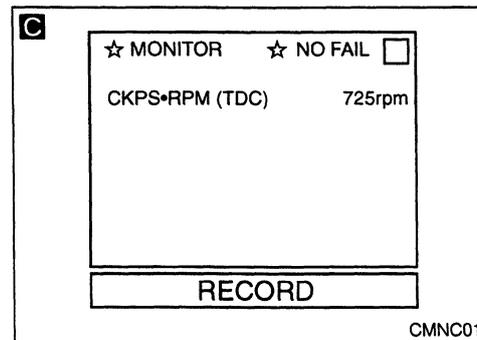
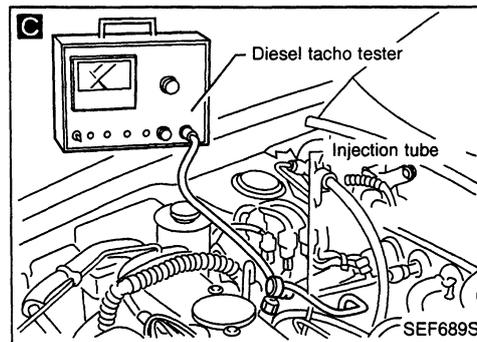
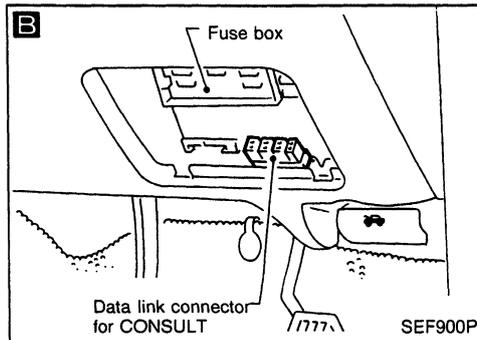
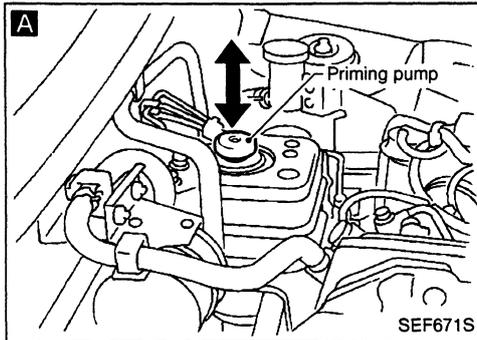
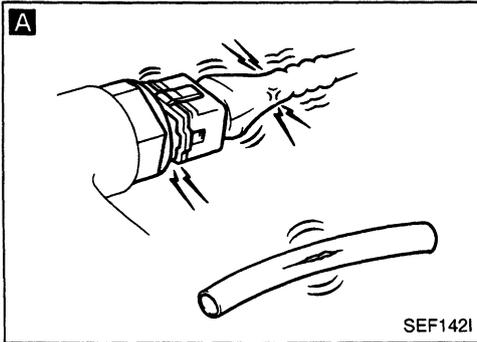


*1: If the incident cannot be duplicated, refer to GI section ("Incident Simulation Tests", "HOW TO PERFORM EFFICIENT DIAGNOSIS FOR AN ELECTRICAL INCIDENT").

*2: If the on board diagnostic system cannot be performed, check main power supply and ground circuit. Refer to "TROUBLE DIAGNOSIS FOR MAIN POWER SUPPLY AND GROUND CIRCUIT", EC-346.

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 the next page.
STEP II	<p>Before confirming the concern, check and write down (print out using CONSULT) the Diagnostic Trouble Code (DTC), then erase the code. Refer to EC-309.) The DTC can be used when duplicating the incident at STEP III & IV.</p> <p>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-332.)</p>
STEP III	<p>Try to confirm the symptom and under what conditions the incident occurs.</p> <p>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.</p> <p>If the incident cannot be verified, perform INCIDENT SIMULATION TESTS. Refer to GI section.</p> <p>If the malfunction code is detected, skip STEP IV and perform STEP V.</p>
STEP IV	<p>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.</p> <p>During the DTC verification, be sure to connect CONSULT to the vehicle in DATA MONITOR (AUTO TRIG) mode and check real time diagnosis results.</p> <p>If the incident cannot be verified, perform INCIDENT SIMULATION TESTS. Refer to GI section.</p> <p>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.</p> <p>The “NG” result of the “OVERALL FUNCTION CHECK” is the same as the DTC detection.</p>
STEP V	<p>Take the appropriate action based on the results of STEP I through IV.</p> <p>If the malfunction code is indicated, proceed to specific TROUBLE DIAGNOSIS FOR DTC.</p> <p>If the normal code is indicated, proceed to the BASIC INSPECTION. Refer to EC-324. Then perform inspections according to the Symptom Matrix Chart. Refer to EC-332.</p>
STEP VI	<p>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 Lay-outs”.</p> <p>Gently shake the related connectors, components or wiring harness with CONSULT set in “DATA MONITOR (AUTO TRIG)” mode.</p> <p>Check the voltage of the related ECM terminals or monitor the output data from the related sensors with CONSULT. Refer to EC-338.</p> <p>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”).</p> <p>Repair or replace the malfunctioning parts.</p>
STEP VII	<p>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.</p> <p>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.</p> <p>Before returning the vehicle to the customer, be sure to erase the unnecessary (already fixed) DTC in ECM. (Refer to EC-309.)</p>



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 faulty connections
 - Vacuum hoses for splits, kinks, or faulty connections
 - Wiring for faulty connections, pinches, or cuts
3. Using priming pump, bleed air from fuel system. Refer to "Fuel Filter Check" 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-314.

DOES ENGINE START?

If **Yes**, proceed to the next step.

If **No**, Turn ignition switch to the "LOCK" position, wait 5 seconds and then start engine. If engine fails to start, check diagnostic trouble code (DTC).

Run engine for 10 minutes.

C

CHECK IDLE SPEED.

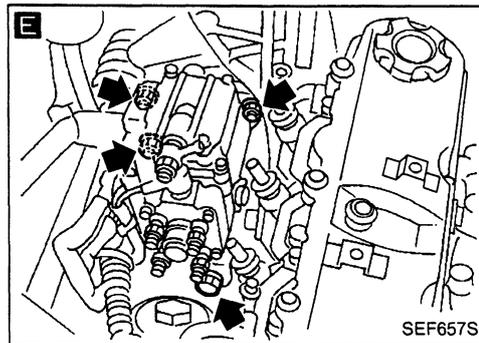
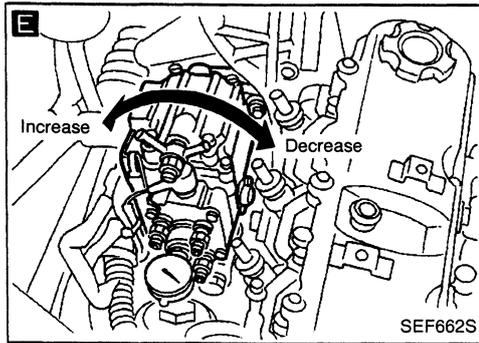
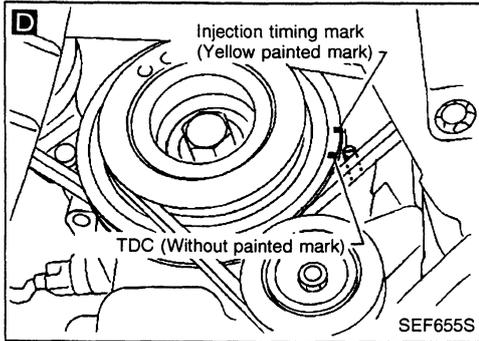
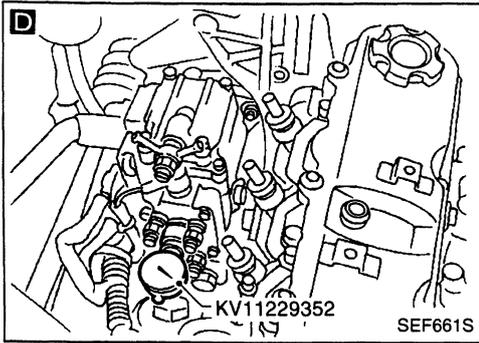
Read engine idle speed in "DATA MONITOR" mode with CONSULT.

OR

Check idle speed using tachometer tester.

(Go to A on next page.)

Basic Inspection (Cont'd)



D

CHECK INJECTION TIMING.

1. Set No. 1 piston at TDC on its compression stroke.
TDC: Without painted mark
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 slowly clockwise, and set dial gauge indicator to 0 mm at the position it stops.
6. Turn crankshaft clockwise and set the pump timing mark to the mark on the crankshaft pulley.
Pump timing mark: Yellow painted mark
7. Read plunger lift.
Plunger lift:
0.82±0.07 mm (0.0323 ± 0.0028 in) at pump timing mark

- 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-309).

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:
⌘ : 20 - 25 N·m (2.0 - 2.6 kg-m, 15 - 18 ft-lb)
Bolt:
⌘ : 25 - 35 N·m (2.6 - 3.6 kg-m, 18 - 26 ft-lb)
3. Remove dial gauge and install air bleeder with new washer.
4. Install injection tubes.
Flare nut:
⌘ : 14 - 20 N·m (1.4 - 2.0 kg-m, 10 - 15 ft-lb)
5. Bleed air from fuel system. Refer to "Water Draining, Fuel Filter Check and Replacement" of "ENGINE MAINTENANCE" in MA section.

→ Go to **A**

Diagnostic Trouble Code (DTC) Chart

ENGINE RELATED ITEMS

Diagnostic trouble code No.	Detected items (Screen terms for CONSULT, "SELF-DIAG RESULTS" mode)	Malfunction is detected when ...
11	Camshaft position sensor (PUMP) circuit [CAM POS SEN (PUMP)]	<ul style="list-style-type: none"> ● An incorrect signal from the sensor is detected by the ECM during engine running.
12	Mass air flow sensor circuit (MASS AIR FLOW SEN)	<ul style="list-style-type: none"> ● An excessively high or low voltage from the sensor is detected by the ECM.
13	Engine coolant temperature sensor circuit (COOLANT TEMP SEN)	<ul style="list-style-type: none"> ● An excessively high or low voltage from the sensor is detected by the ECM.
14	Vehicle speed sensor circuit (VEHICLE SPEED SEN)	<ul style="list-style-type: none"> ● The almost 0 km/h (0 mph) signal from the sensor is detected by the ECM even when vehicle is being driven.
15	Control sleeve position sensor circuit (CONT SLEEV POS SEN)	<ul style="list-style-type: none"> ● An excessively high or low voltage from the sensor is detected by the ECM. ● An incorrect voltage signal from the sensor is detected by the ECM during engine running.
17	Adjustment resistor circuit (ADJ RESISTOR)	<ul style="list-style-type: none"> ● An excessively high or low voltage from the resistor is detected by the ECM.
18	Fuel injection feedback 2 (F/INJ F/B 2)	<ul style="list-style-type: none"> ● The fuel injection feedback system (consists of the ECM, electric governor and control sleeve position sensor) does not operate properly.

Abbreviations for Quick Reference of "DTC CONFIRMATION PROCEDURE"

IGN: ON : Turning the ignition switch ON is required for checking the function of the sensor, switch, solenoid and circuit.

RUNNING : Running engine is required for checking the function of the sensor, switch, solenoid and circuit.

LIFTING : Lifting up the vehicle, running engine and spinning wheels are required.

DRIVING : Driving the vehicle in the specified pattern is required.

Abbreviations for Quick Reference of "OVERALL FUNCTION CHECK"

IGN: ON : Turning the ignition switch ON is required for the ECM to detect a malfunction (if one exists).

RUNNING : Running engine is required for the ECM to detect a malfunction (if one exists).

LIFTING : Lifting up the vehicle, running engine and spinning wheels are required for the ECM to detect a malfunction (if one exists).

DRIVING : Driving the vehicle in the specified pattern is required for the ECM to detect a malfunction (if one exists).

Diagnostic Trouble Code (DTC) Chart
(Cont'd)

—: Not applicable

Check Items (Possible Cause)	DTC Confirmation Procedure Quick Ref. *1	Overall Function Check *2	MIL Illumination	Reference Page
<ul style="list-style-type: none"> ● Harness or connectors (The sensor circuit is open or shorted.) ● Camshaft position sensor (PUMP) 	RUNNING	—	Lighting up	EC-351
<ul style="list-style-type: none"> ● Harness or connectors (The sensor circuit is open or shorted.) ● Mass air flow sensor 	IGN: ON	—	—	EC-355
<ul style="list-style-type: none"> ● Harness or connectors (The sensor circuit is open or shorted.) ● Engine coolant temperature sensor 	IGN: ON	—	Lighting up	EC-359
<ul style="list-style-type: none"> ● Harness or connectors (The sensor circuit is open or shorted.) ● Vehicle speed sensor 	—	LIFTING	—	EC-363
<ul style="list-style-type: none"> ● Harness or connectors (The sensor circuit is open or shorted.) ● Control sleeve position sensor 	RUNNING	—	Lighting up	EC-366
<ul style="list-style-type: none"> ● Harness or connectors (The resistor circuit is open or shorted.) ● Adjustment resistor 	IGN: ON	—	—	EC-370
<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) ● Electronic fuel injection pump ● ECM ● Electric governor 	RUNNING (DRIVING)	—	Lighting up	EC-374

*1: ● This is Quick Reference of "DTC CONFIRMATION PROCEDURE".
Details are described in each TROUBLE DIAGNOSIS FOR DTC.

*2: ● The "OVERALL FUNCTION CHECK" is a simplified and effective way to inspect a component or circuit.
In some cases, the "OVERALL FUNCTION CHECK" is used rather than a "DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE".

When no DTC CONFIRMATION PROCEDURE is available, the "NG" result of the OVERALL FUNCTION CHECK can be considered to mean the same as a DTC detection.

● During an "NG" OVERALL FUNCTION CHECK, the DTC might not be confirmed.

● This is Quick Reference of "OVERALL FUNCTION CHECK".

Details are described in each TROUBLE DIAGNOSIS FOR DTC.

**Diagnostic Trouble Code (DTC) Chart
(Cont'd)**

ENGINE RELATED ITEMS

Diagnostic trouble code No.	Detected items (Screen terms for CONSULT, "SELF-DIAG RESULTS" mode)	Malfunction is detected when ...
21	Fuel injection timing feedback (F/INJ TIMG F/B)	<ul style="list-style-type: none"> ● The fuel injection timing feedback system (consists of the ECM, fuel injection timing control valve and needle lift sensor) does not operate properly.
22	Fuel injection feedback (F/INJ F/B)	<ul style="list-style-type: none"> ● The fuel injection feedback system (consists of the ECM, electric governor and control sleeve position sensor) does not operate properly.
23	Accelerator switch (Fuel cut) circuit [ACCEL SW (F/C)]	<ul style="list-style-type: none"> ● The OFF (short) signal is sent to the ECM for a certain period of time even when the accelerator pedal is not being depressed.
25	Electric governor circuit (ELECTRIC GOV)	<ul style="list-style-type: none"> ● Electric governor circuit is shorted.
27	ECM1 (ECM1)	<ul style="list-style-type: none"> ● ECM calculation function is malfunctioning.
28	Cooling fan (OVER HEAT)	<ul style="list-style-type: none"> ● Cooling fan does not operate properly. (Overheat) ● Cooling system does not operate properly. (Overheat) ● Engine coolant was not added to the system using the proper filling method.
31	ECM2 (ECM2)	<ul style="list-style-type: none"> ● ECM calculation function is malfunctioning.

Abbreviations for Quick Reference of "DTC CONFIRMATION PROCEDURE"

IGN: ON : Turning the ignition switch ON is required for checking the function of the sensor, switch, solenoid and circuit.

RUNNING : Running engine is required for checking the function of the sensor, switch, solenoid and circuit.

LIFTING : Lifting up the vehicle, running engine and spinning wheels are required.

DRIVING : Driving the vehicle in the specified pattern is required.

Abbreviations for Quick Reference of "OVERALL FUNCTION CHECK"

IGN: ON : Turning the ignition switch ON is required for the ECM to detect a malfunction (if one exists).

RUNNING : Running engine is required for the ECM to detect a malfunction (if one exists).

LIFTING : Lifting up the vehicle, running engine and spinning wheels are required for the ECM to detect a malfunction (if one exists).

DRIVING : Driving the vehicle in the specified pattern is required for the ECM to detect a malfunction (if one exists).

TROUBLE DIAGNOSIS — General Description

CD20T

**Diagnostic Trouble Code (DTC) Chart
 (Cont'd)**

—: Not applicable

Check Items (Possible Cause)	DTC Confirmation Procedure Quick Ref. *1	Overall Function Check *2	MIL Illumination	Reference Page
<ul style="list-style-type: none"> ● Harness or connectors (Injection timing control valve, Needle lift sensor and Crankshaft position sensor (TDC) circuit] ● Injection timing control valve ● Needle lift sensor ● Crankshaft position sensor ● Air in fuel line 	RUNNING (DRIVING)	—	—	EC-379
<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 	RUNNING (DRIVING)	—	Lighting up	EC-374
<ul style="list-style-type: none"> ● Harness or connectors (The switch circuit is shorted.) ● Accelerator switch (F/C) 	IGN: ON	—	Lighting up	EC-383
<ul style="list-style-type: none"> ● Harness or connectors (Electric governor circuit is shorted.) ● ECM 	RUNNING (DRIVING)	—	Lighting up	EC-374
<ul style="list-style-type: none"> ● ECM 	IGN: ON	—	Lighting up	EC-387
<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 <p>For more information, refer to "MAIN 12 CAUSES OF OVERHEATING". (EC-397)</p>	—	IGN: ON (RUNNING)	Lighting up	EC-389
<ul style="list-style-type: none"> ● ECM 	IGN: ON	—	Lighting up	EC-387

*1: ● This is Quick Reference of "DTC CONFIRMATION PROCEDURE".
 Details are described in each specific TROUBLE DIAGNOSIS FOR DTC.

*2: ● The "OVERALL FUNCTION CHECK" is a simplified and effective way to inspect a component or circuit.
 In some cases, the "OVERALL FUNCTION CHECK" is used rather than a "DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE".
 When no DTC CONFIRMATION PROCEDURE is available, the "NG" result of the OVERALL FUNCTION CHECK can be considered to mean the same as a DTC detection.

- During an "NG" OVERALL FUNCTION CHECK, the DTC might not be confirmed.
- This is Quick Reference of "OVERALL FUNCTION CHECK".
 Details are described in each specific TROUBLE DIAGNOSIS FOR DTC.

Diagnostic Trouble Code (DTC) Chart
(Cont'd)

ENGINE RELATED ITEMS

Diagnostic trouble code No.	Detected items (Screen terms for CONSULT, "SELF-DIAG RESULTS" mode)	Malfunction is detected when ...
34	Needle lift sensor circuit (NEEDLE LIFT SEN)	<ul style="list-style-type: none"> ● An incorrect signal from the sensor is detected by the ECM during engine running.
36	Fuel cut solenoid valve 1 (FUEL CUT S/V 1)	<ul style="list-style-type: none"> ● Fuel cut solenoid valve circuit is shorted. ● Fuel cut solenoid valve does not operate properly.
37	Fuel cut solenoid valve short (FCV SHORT)	<ul style="list-style-type: none"> ● Fuel cut solenoid valve circuit is shorted.
38	Fuel cut solenoid valve 2 (FUEL CUT S/V 2)	<ul style="list-style-type: none"> ● Fuel cut solenoid valve circuit is broken. ● Fuel cut solenoid valve does not operate properly.
42	Fuel temperature sensor circuit (FUEL TEMP SENSOR)	<ul style="list-style-type: none"> ● An excessively high or low voltage from the sensor is detected by the ECM.
43	Accelerator position sensor circuit (ACCEL POS SENSOR)	<ul style="list-style-type: none"> ● An excessively high or low voltage from the sensor is detected by the ECM.
47	Crankshaft position sensor (TDC) [CRANK POS SEN (TDC)]	<ul style="list-style-type: none"> ● An incorrect signal from the sensor is detected by the ECM during engine running and cranking.
48	Governor cut circuit (GOV CUT CIRCUIT)	<ul style="list-style-type: none"> ● Accelerator switch is shorted. ● Camshaft position sensor (PUMP) or ECM is malfunctioning.
55	No failure (NO SELF DIAGNOSTIC FAILURE INDICATED)	No malfunction is detected by the ECM.

Abbreviations for Quick Reference of "DTC CONFIRMATION PROCEDURE"

IGN: ON : Turning the ignition switch ON is required for checking the function of the sensor, switch, solenoid and circuit.

RUNNING : Running engine is required for checking the function of the sensor, switch, solenoid and circuit.

LIFTING : Lifting up the vehicle, running engine and spinning wheels are required.

DRIVING : Driving the vehicle in the specified pattern is required.

Abbreviations for Quick Reference of "OVERALL FUNCTION CHECK"

IGN: ON : Turning the ignition switch ON is required for the ECM to detect a malfunction (if one exists).

RUNNING : Running engine is required for the ECM to detect a malfunction (if one exists).

LIFTING : Lifting up the vehicle, running engine and spinning wheels are required for the ECM to detect a malfunction (if one exists).

DRIVING : Driving the vehicle in the specified pattern is required for the ECM to detect a malfunction (if one exists).

Diagnostic Trouble Code (DTC) Chart
(Cont'd)

—: Not applicable

Check Items (Possible Cause)	DTC Confirmation Procedure Quick Ref. *1	Overall Function Check *2	MIL Illumination	Reference Page
<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 	RUNNING	—	—	EC-399
<ul style="list-style-type: none"> ● Harness or connectors (The solenoid valve circuit is open or shorted.) ● Fuel cut solenoid valve 	RUNNING	—	Lighting up	EC-402
<ul style="list-style-type: none"> ● Main power supply circuit (ECM terminals (116), (117)) and fuse. 	RUNNING	—	Lighting up	EC-402
<ul style="list-style-type: none"> ● Main power supply circuit (ECM terminals (116), (117)) and fuse. ● ECM 	RUNNING	—	Lighting up	EC-402
<ul style="list-style-type: none"> ● Harness or connectors (The sensor circuit is open or shorted.) ● Fuel temperature sensor 	IGN: ON	—	—	EC-406
<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) 	IGN: ON	—	Lighting up	EC-410
<ul style="list-style-type: none"> ● Harness or connectors (The sensor circuit is open or shorted.) ● Crankshaft position sensor (TDC) 	RUNNING	—	Lighting up	EC-414
<ul style="list-style-type: none"> ● Harness or connectors [Accelerator switch and camshaft position sensor (PUMP) circuit] ● Accelerator switch (F/C) ● Camshaft position sensor (PUMP) ● ECM 	RUNNING	—	Lighting up	EC-418
<ul style="list-style-type: none"> ● No failure 	—	—	—	—

*1: ● This is Quick Reference of "DTC CONFIRMATION PROCEDURE".

Details are described in each specific TROUBLE DIAGNOSIS FOR DTC.

*2: ● The "OVERALL FUNCTION CHECK" is a simplified and effective way to inspect a component or circuit.

In some cases, the "OVERALL FUNCTION CHECK" is used rather than a "DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE".

When no DTC CONFIRMATION PROCEDURE is available, the "NG" result of the OVERALL FUNCTION CHECK can be considered to mean the same as a DTC detection.

● During an "NG" OVERALL FUNCTION CHECK, the DTC might not be confirmed.

● This is Quick Reference of "OVERALL FUNCTION CHECK".

Details are described in each specific TROUBLE DIAGNOSIS FOR DTC.

Symptom Matrix Chart

SYSTEM — Basic engine control system		SYMPTOM																	Reference page	Feature of symptom, Check point									
		NO START (with first firing)	HARD/NO START/RESTART (EXCP. HA)		ENGINE STALL				HESITATION/SURGING/FLAT SPOT	SPARK KNOCK/DETONATION	LACK OF POWER	POOR ACCELERATION	HI IDLE	LOW IDLE	ROUGH IDLE/HUNTING	IDLING VIBRATION	SLOW/NO RETURN TO IDLE	OVERHEAT/HIGH ENGINE COOLANT TEMPERATURE			EXCESSIVE FUEL CONSUMPTION	EXCESSIVE OIL CONSUMPTION	BLACK SMOKE	WHITE SMOKE	ABNORMAL SMOKE COLOR	DEAD BATTERY (UNDER CHARGE)	Malfunction indicator lamp illuminates.	Can be detected by CONSULT?	Fuel cut
New CT/CS		AA		AB				AC	AD	AE	AF	AG	AH	AJ	AK	AL	AM	AP	HA										
Injection timing	Advanced	○	○	●	●			○		●					○	○					●					○		EC-325	
	Retarded	○	○	●	●			○		●					○	○						●				○		EC-325	
Electric injection pump mainframe		●	●	●	●	○	○	○	○	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	—	*1
Injection nozzle		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	EC-301	*2
Glow system		○	○	●	●					●												●						EC-420	
Engine body		○	○	●	●	○	○	○		●	○	○		○	●	●		○	○	○		●						EM-section	*3
EGR system										●	●										●							EC-425	
Air cleaner and ducts										●	●										●				○			MA-section	*4

● ; High Possibility Item
 ○ ; Low Possibility Item
 *1: Insufficient or excess amount. Governor malfunction may be the cause.
 *2: Depends on open-valve pressure and spray pattern.
 *3: Caused mainly by insufficient compression pressure.
 *4: Symptom varies depending on off-position of air duct, etc.

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)			
CKPS•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: release	0.40 - 0.60V
		Accelerator pedal: depress	Approx. 4.0V
FULL ACCEL SW	<ul style="list-style-type: none"> ● Ignition switch: ON (Engine stopped) 	Accelerator pedal: depress	ON
		Except above	OFF
ACCEL SW (FC)	<ul style="list-style-type: none"> ● Ignition switch: ON (Engine stopped) 	Accelerator pedal: release	CLOSE
		Accelerator pedal: slightly open	OPEN
OFF ACCEL SW	<ul style="list-style-type: none"> ● Ignition switch: ON (Engine stopped) 	Accelerator pedal: release	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	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
MAS AIR/FL SE	<ul style="list-style-type: none"> ● Engine: After warming up ● Air conditioner switch: "OFF" ● Shift lever: "N" ● No-load 	Idle	1.9 - 2.3V
		2,000 rpm	2.5 - 2.9V
ACT INJ TIMG	<ul style="list-style-type: none"> ● Engine: After warming up ● Air conditioner switch: "OFF" ● Shift lever: "N" ● No-load 	Idle	-6.5° to -9.0°
		2,000 rpm	-7.0° to -12.5°
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
AIR COND RLY	<ul style="list-style-type: none"> ● Air conditioner switch: OFF → ON 		OFF → ON
GLOW RLY	<ul style="list-style-type: none"> ● Refer to EC-424. 		

TROUBLE DIAGNOSIS — General Description**CD20T****CONSULT Reference Value in Data Monitor Mode (Cont'd)**

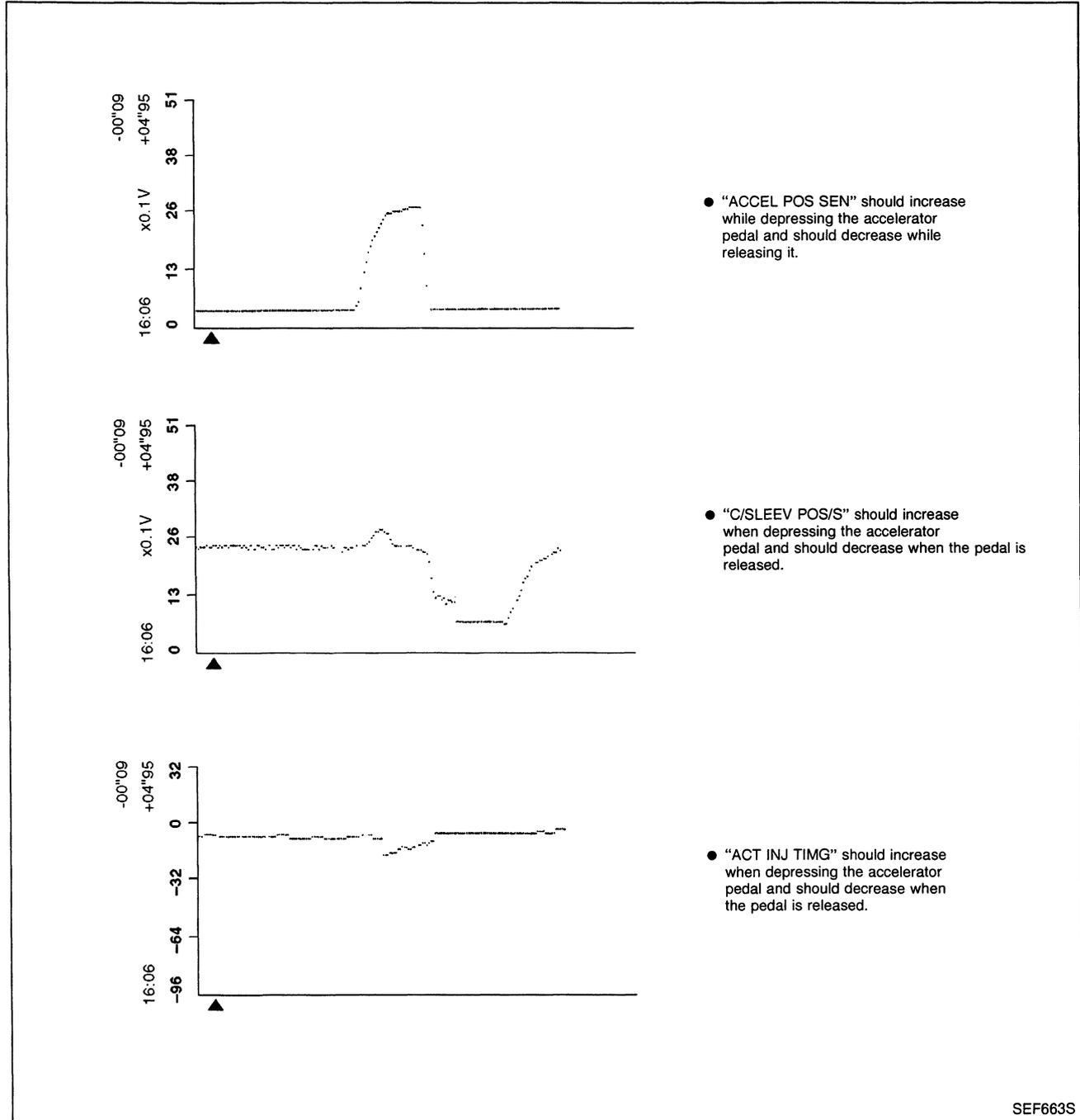
MONITOR ITEM	CONDITION	SPECIFICATION
COOLING FAN	● When cooling fan is stopped.	OFF
	● When cooling fan operates at low speed.	LOW
	● When cooling fan operates at high speed.	HI
EGRC SOL/V A	● Engine: After warming up ● Air conditioner switch: "OFF" ● Shift lever: "N" ● No-load	Idle ON
		2,800 rpm OFF

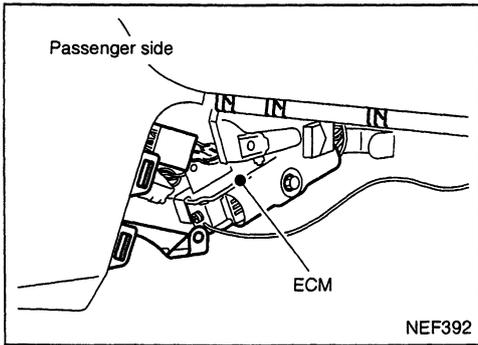
Major Sensor Reference Graph in Data Monitor Mode

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.

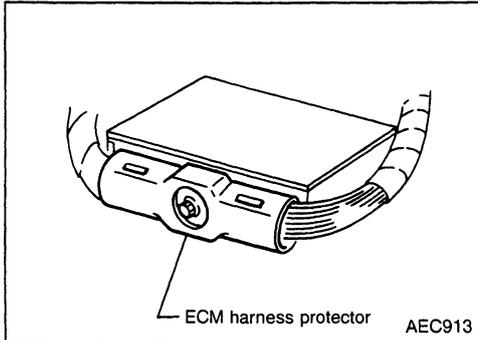




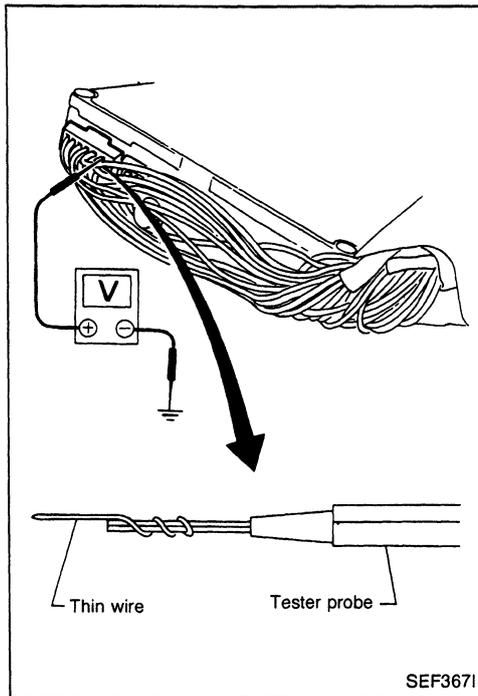
ECM Terminals and Reference Value

PREPARATION

1. ECM is located beneath heater unit. For this inspection remove the center console under cover for passenger side.

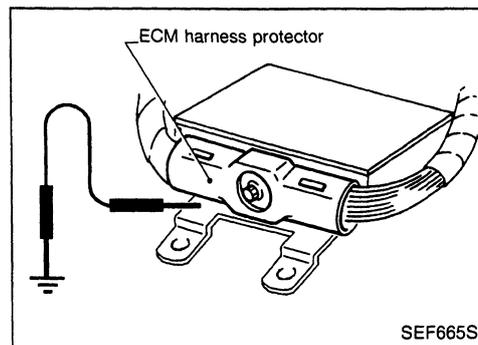


2. Remove ECM harness protector.



3. Perform all voltage measurements for ECM (ECC-D Control Module) from the harness side with the connector connected. Extend tester probe as shown to perform tests easily.

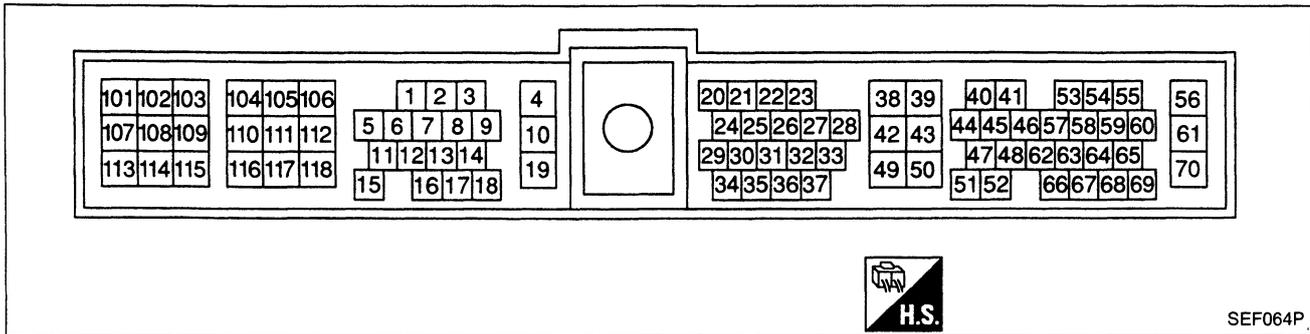
- Open harness securing clip to make testing easier.
- Use extreme care not to touch 2 pins at one time.
- Data is for comparison and may not be exact.



Be sure ECM unit is properly grounded before checking.

ECM Terminals and Reference Value
(Cont'd)

ECM HARNESS CONNECTOR TERMINAL LAYOUT



SEF064P

ECM INSPECTION TABLE

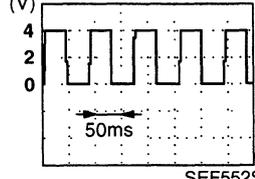
Specification data are reference values and are measured between each terminal and Ⓞ (ECCS ground).

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
4	W/G	ECCS relay (Self-shut-off)	Engine is running. Ignition switch "LOCK" └ For a few seconds after turning ignition switch to the "LOCK" position	0 - 1V
			Ignition switch "LOCK" └ Following a few seconds delay after turning ignition switch to the "LOCK" position	BATTERY VOLTAGE (11 - 14V)
5	L/OR	Tachometer	Engine is running. (Warm-up condition) └ Idle speed	Approximately 1.1 - 1.5V SEF550S
			Engine is running. └ Engine speed is 2,000 rpm	Approximately 1.1 - 1.5V SEF551S
10	G	Fuel temperature sensor	Engine is running.	0.6 - 4.8V Output voltage varies with fuel temperature.

**ECM Terminals and Reference Value
(Cont'd)**

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
13	LG	Cooling fan relay (High speed)	Engine is running. └ Cooling fan is not operating. └ Cooling fan is operating at low speed.	BATTERY VOLTAGE (11 - 14V)
			Engine is running. └ Cooling fan is operating at high speed.	Approximately 0.5V
14	LG/R	Cooling fan relay (Low speed)	Engine is running. └ Cooling fan is not operating.	BATTERY VOLTAGE (11 - 14V)
			Engine is running. └ Cooling fan is operating.	Approximately 0.4V
15	G/Y	Air conditioner relay	Engine is running. └ Both A/C switch and blower switch are "ON"	Approximately 0.4V
			Engine is running. └ A/C switch is "OFF"	BATTERY VOLTAGE (11 - 14V)
16	OR	Glow lamp	Ignition switch "ON" └ Glow lamp is "ON".	Approximately 1.0V
			Ignition switch "ON" └ Glow lamp is "OFF"	BATTERY VOLTAGE (11 - 14V)
18	OR/L	Malfunction indicator lamp	Ignition switch "ON"	Approximately 1.0V
			Engine is running. └ Idle speed	BATTERY VOLTAGE (11 - 14V)
19	L/OR	Engine coolant temperature sensor	Engine is running.	0.6 - 4.8V Output voltage varies with engine coolant temperature.
20	B/Y	Start signal	Ignition switch "ON"	Approximately 0V
			Ignition switch "START"	BATTERY VOLTAGE (11 - 14V)
21	L/W	Air conditioner switch	Engine is running. └ Both air conditioner switch and blower switch are "ON" (Compressor operates)	Approximately 0V
			Engine is running. └ Air conditioner switch is "OFF"	BATTERY VOLTAGE (11 - 14V)
22	G/OR	Neutral position switch	Ignition switch "ON" └ Gear position is "Neutral"	Approximately 0V
			Ignition switch "ON" └ Except the above gear position	BATTERY VOLTAGE (11 - 14V)

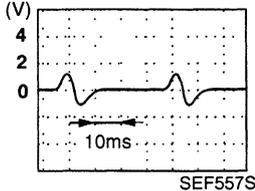
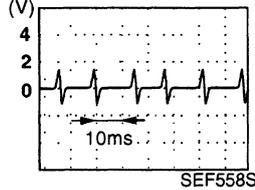
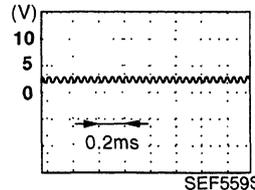
ECM Terminals and Reference Value
(Cont'd)

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
23	Y	Accelerator position sensor	Ignition switch "ON" └ Accelerator pedal released	0.4 - 0.6V
			Ignition switch "ON" └ Accelerator pedal fully depressed	Approximately 4.0V
26	Y/G	Vehicle speed sensor	Engine is running. └ Lift up the vehicle. └ In 2nd gear position └ Vehicle speed is 40 km/h (25 mph)	0 - Approximately 4.2V  SEF552S
28 33	B/W	Camshaft position sensor (PUMP) ground	Engine is running. └ Idle speed	Approximately 0V
29	L	Accelerator switch (F/C)	Ignition switch "ON" └ Accelerator pedal released	BATTERY VOLTAGE (11 - 14V)
			Ignition switch "ON" └ Accelerator pedal depressed	Approximately 0V
31	L/Y	Accelerator position switch (Idle)	Ignition switch "ON" └ Accelerator pedal released	BATTERY VOLTAGE (11 - 14V)
			Ignition switch "ON" └ Accelerator pedal depressed	Approximately 0V
32	P	Accelerator position switch (Full)	Ignition switch "ON" └ Accelerator pedal released	Approximately 0V
			Ignition switch "ON" └ Accelerator pedal fully depressed	BATTERY VOLTAGE (11 - 14V)

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	<p>Engine is running. (Warm-up condition)</p> <p>└ Idle speed</p>	<p>Approximately 0.04 - 0.08V</p>
			<p>Engine is running. (Warm-up condition)</p> <p>└ Engine speed is 2,000 rpm</p>	<p>Approximately 0.05 - 0.09V</p>
35	W	Mass air flow sensor	<p>Engine is running. (Warm-up condition)</p> <p>└ Idle speed</p>	1.9 - 2.3V
			<p>Engine is running. (Warm-up condition)</p> <p>└ Engine speed is 2,000 rpm</p>	2.5 - 2.9V
38	BR	Ignition switch	Ignition switch "LOCK"	0V
			Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
39 43	B	ECCS ground	<p>Engine is running.</p> <p>└ Idle speed</p>	Engine ground (Probe this terminal with ⊖ tester probe when measuring.)
40 44	W	Crankshaft position sensor (TDC) (Signal)	<p>Engine is running. (Warm-up condition)</p> <p>└ Idle speed</p>	<p>Approximately 0V</p>
			<p>Engine is running.</p> <p>└ Engine speed is 2,000 rpm</p>	<p>Approximately 0V</p>

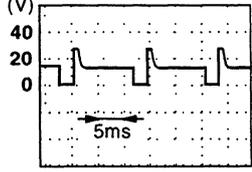
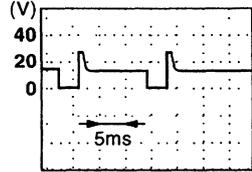
ECM Terminals and Reference Value
(Cont'd)

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
41 45	L	Camshaft position sensor (PUMP) (Signal)	<p>Engine is running. (Warm-up condition)</p> <p>└ Idle speed</p>	<p>Approximately 0V</p> 
			<p>Engine is running.</p> <p>└ Engine speed is 2,000 rpm</p>	<p>Approximately 0V</p> 
42	G/R	Data link connector for CONSULT	<p>Engine is running.</p> <p>└ Idle speed (CONSULT is connected and turned on)</p>	Approximately 0V
64	G/B		Approximately 0V	
65	GY/L		Approximately 4 - 9V	
46	G/OR	Adjustment resistor	<p>Ignition switch "ON"</p>	Approximately 0.6 - 4.6V (Voltage varies dependent or part numbers of adjustment resistors.)
47 52	OR	Crankshaft position sensor (TDC) ground	<p>Engine is running.</p> <p>└ Idle speed</p>	Approximately 0V
48	L/B	Accelerator position sensor power supply	<p>Ignition switch "ON"</p>	Approximately 5V
50	B	Sensors' ground	<p>Engine is running.</p> <p>└ Idle speed</p>	Approximately 0V
51	BR	Accelerator position sensor ground	<p>Engine is running.</p> <p>└ Idle speed</p>	Approximately 0V
53 57	B	Control sleeve position sensor power supply	<p>Engine is running.</p> <p>└ Idle speed</p>	<p>Approximately 2.6V</p> 
56 61	R	Power supply for ECM	<p>Ignition switch "ON"</p>	BATTERY VOLTAGE (11 - 14V)

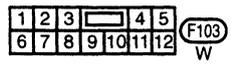
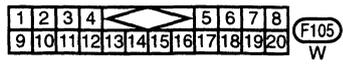
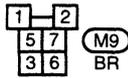
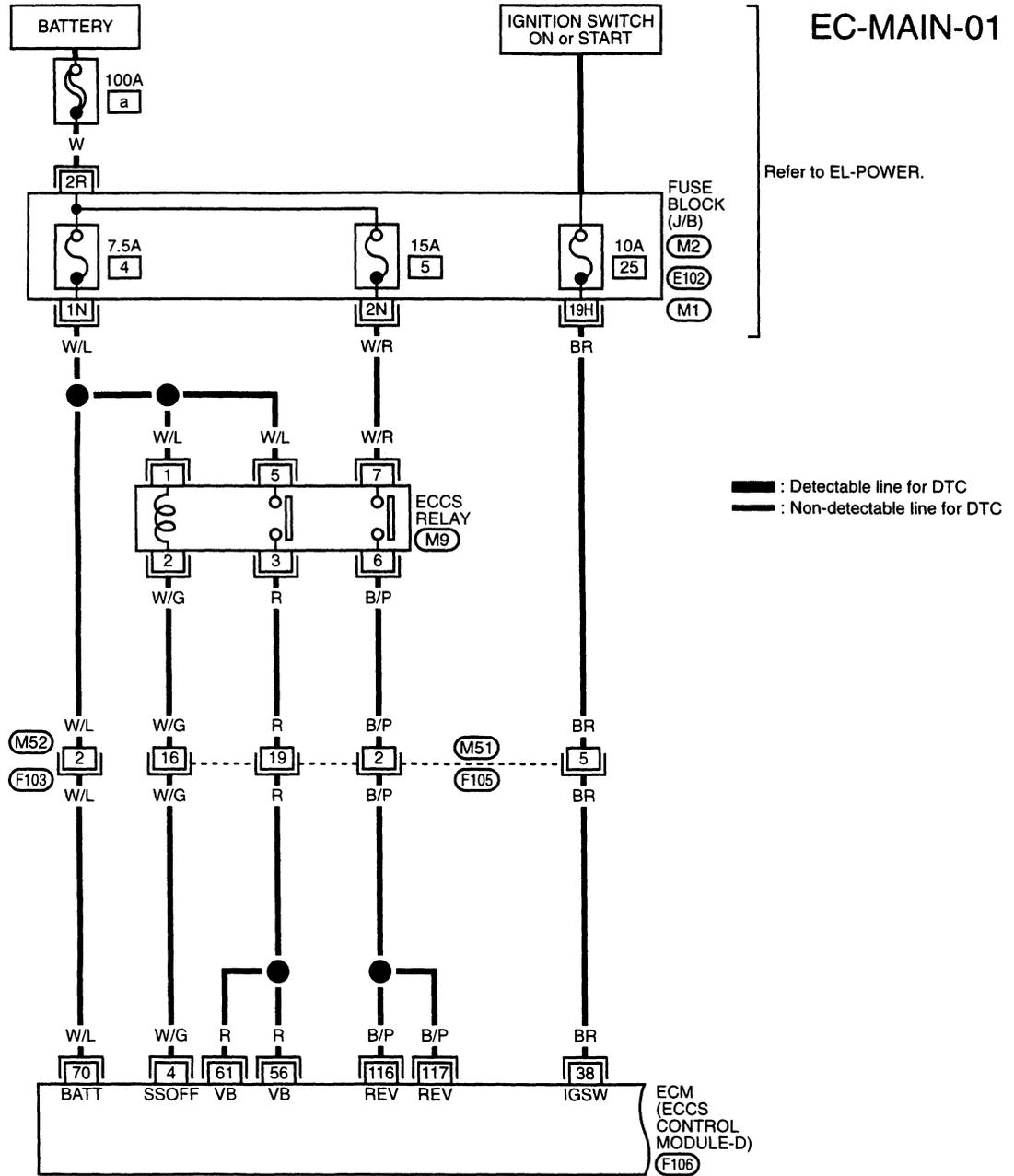
ECM Terminals and Reference Value
(Cont'd)

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
62 66	R G	Control sleeve position sensor ground	Engine is running. └ Idle speed	Approximately 2.6V SEF560S
63 67	W	Control sleeve position sensor	Engine is running. (Warm-up condition) └ Idle speed	Approximately 2.6V SEF561S
70	W/L	Power supply (Back-up)	Ignition switch "LOCK"	BATTERY VOLTAGE (11 - 14V)
101 107	B/Y	Electric governor	Engine is running. └ Idle speed	BATTERY VOLTAGE (11 - 14V)
102 108	B/L	Electric governor ground	Engine is running. (Warm-up condition) └ Idle speed	Approximately 9.7 - 9.9V SEF562S
			Engine is running. (Warm-up condition) └ Engine speed is 2,000 rpm	Approximately 10.0 - 10.2V SEF563S
103	P	EGRC-solenoid valve	Engine is running. (Warm-up condition) └ Idle speed	BATTERY VOLTAGE (11 - 14V)
			Engine is running. (Warm-up condition) └ Engine speed is 2,800 rpm	Approximately 0.3V

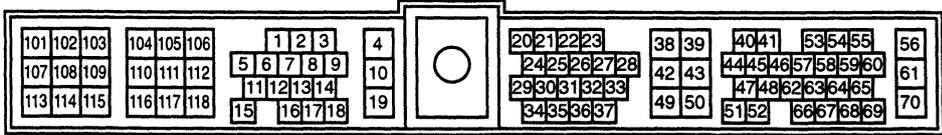
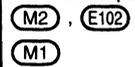
ECM Terminals and Reference Value
(Cont'd)

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
104 110	SB	Injection timing control valve	<p>Engine is running. (Warm-up condition)</p> <p>└ Idle speed</p>	<p>Approximately 10 - 12V</p>  <p>SEF564S</p>
			<p>Engine is running. (Warm-up condition)</p> <p>└ Engine speed is 2,000 rpm</p>	<p>Approximately 9 - 14V</p>  <p>SEF565S</p>
106 112 118	B	ECCS ground	<p>Engine is running.</p> <p>└ Idle speed</p>	Approximately 0V
111	W/R	Glow relay	Refer to "Glow control System".	
113 115	B/Y	Fuel cut solenoid valve	Ignition switch "LOCK"	Approximately 0V
			Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
116 117	B/P	Power supply for ECM	Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)

Main Power Supply and Ground Circuit

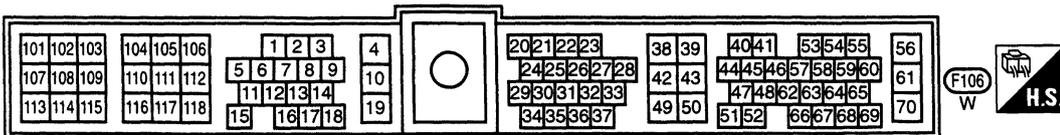
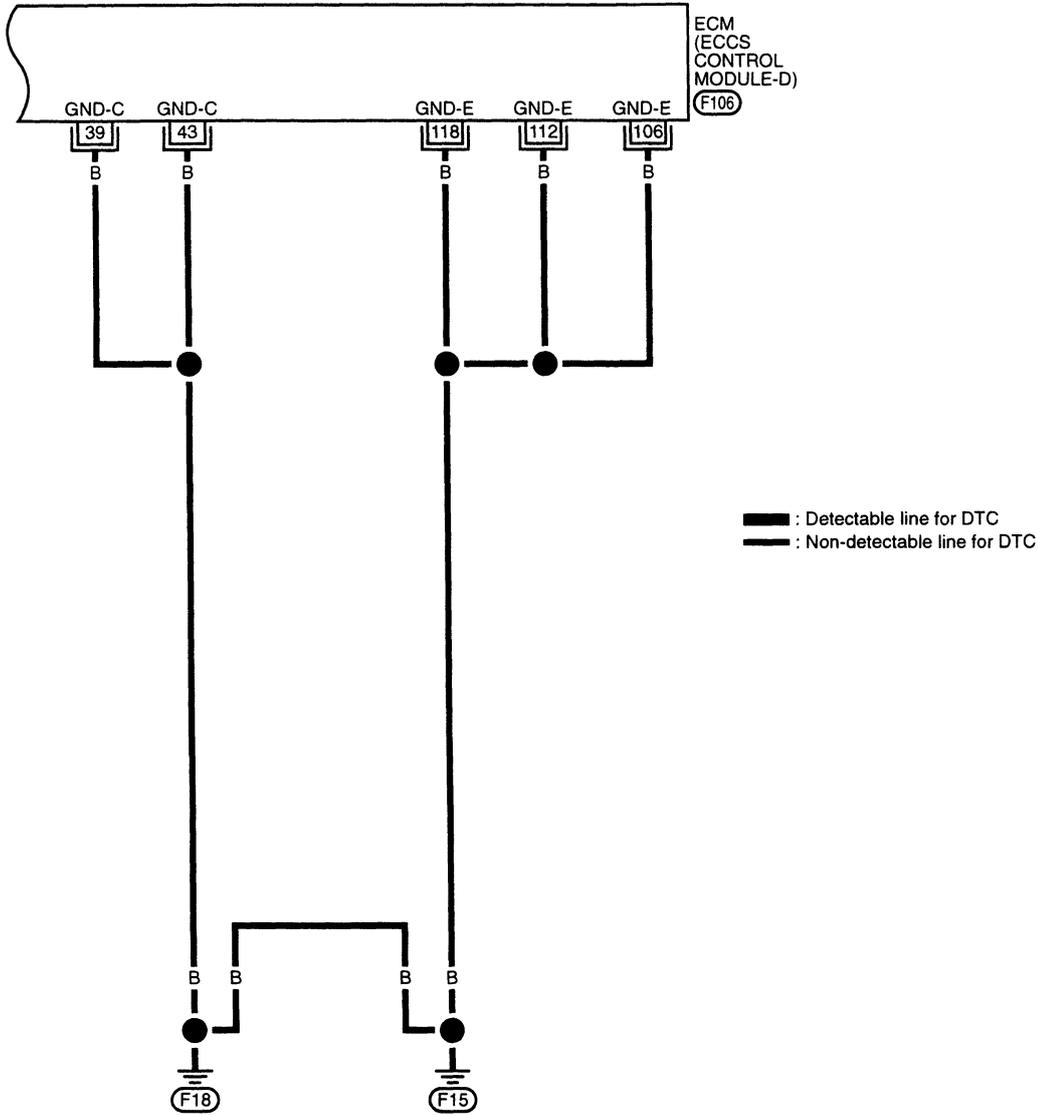


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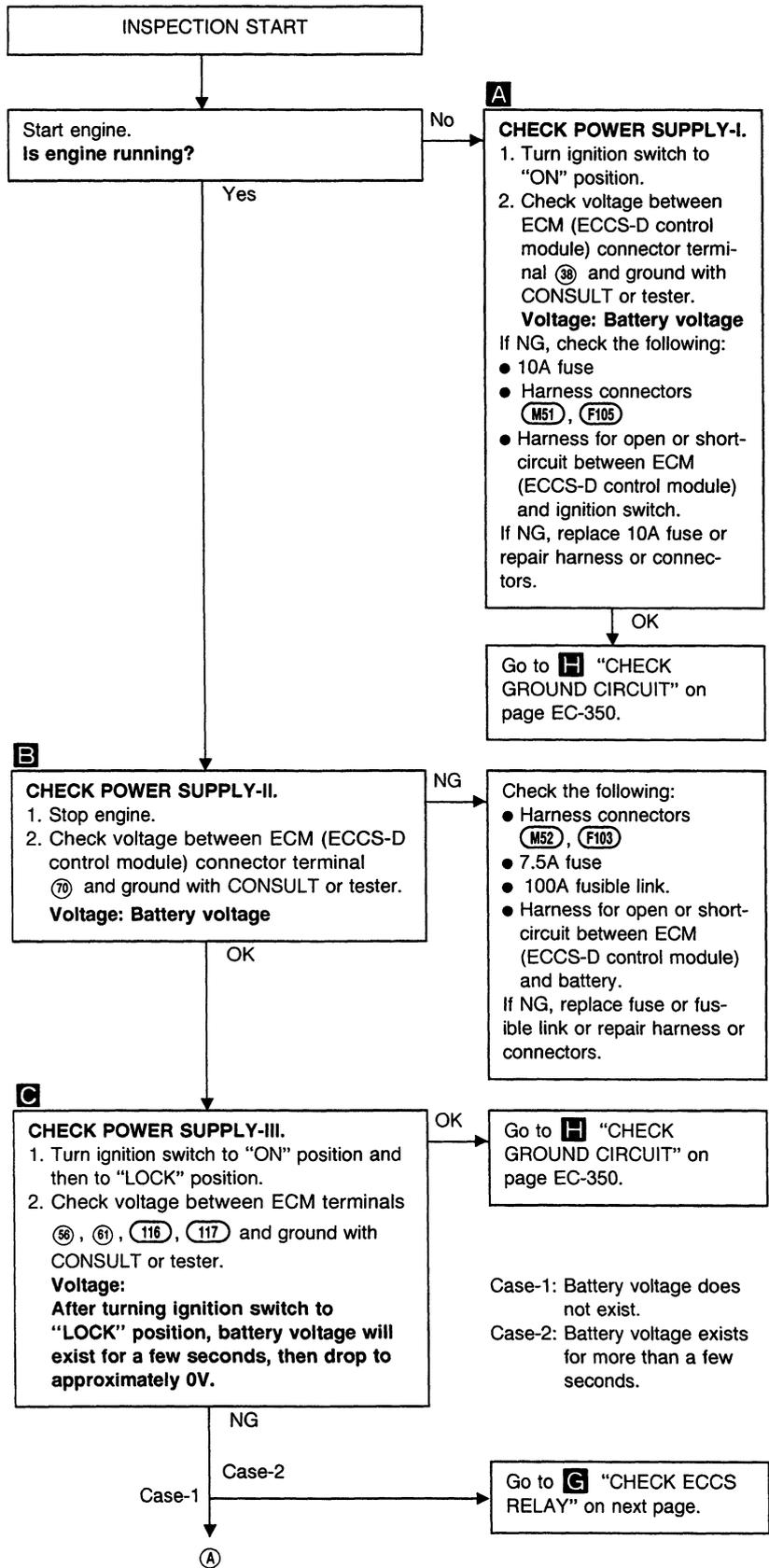
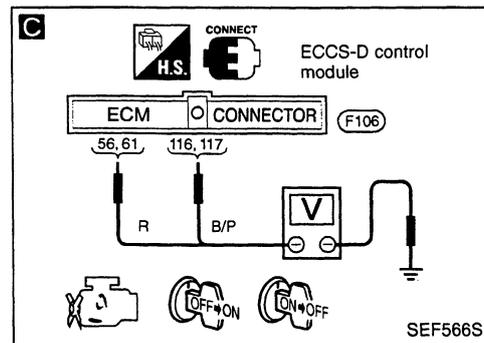
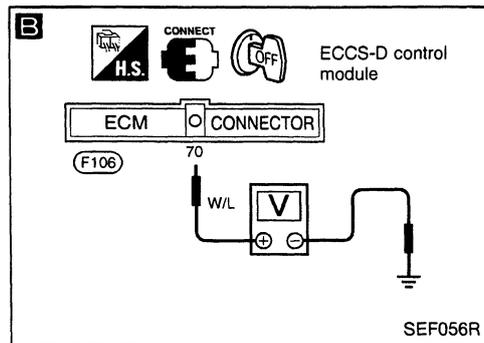
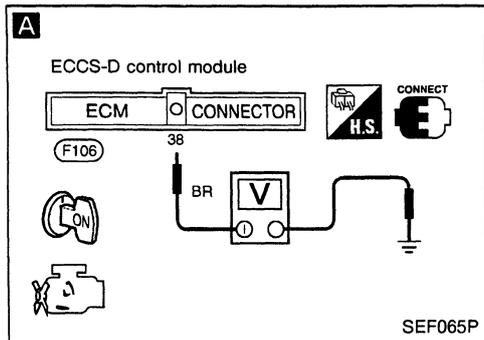
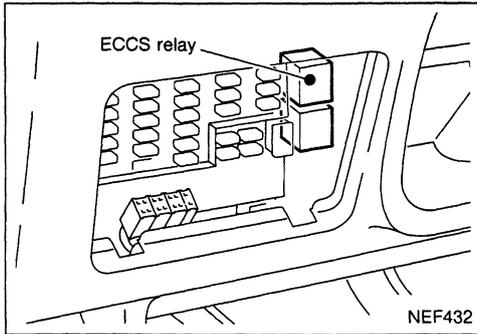
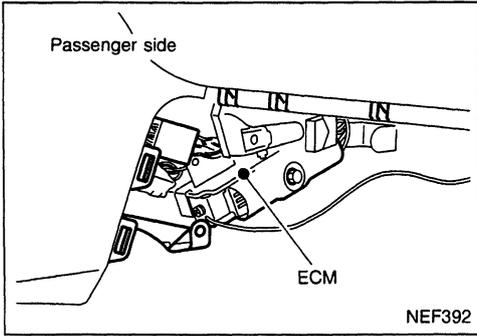


Main Power Supply and Ground Circuit
(Cont'd)

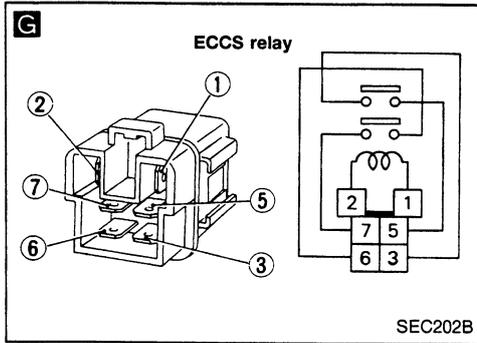
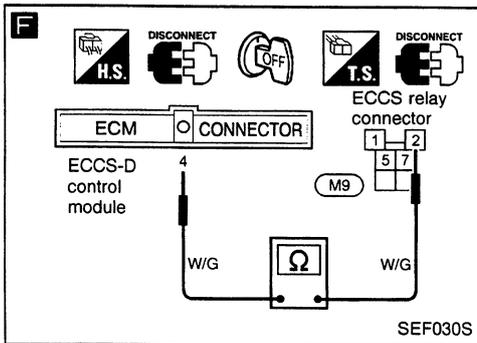
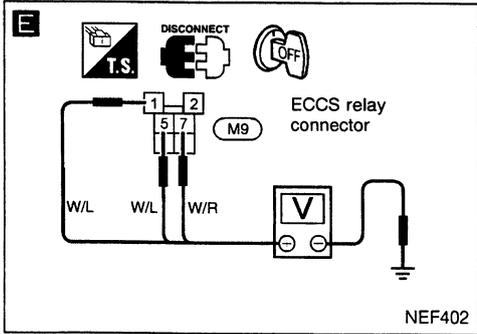
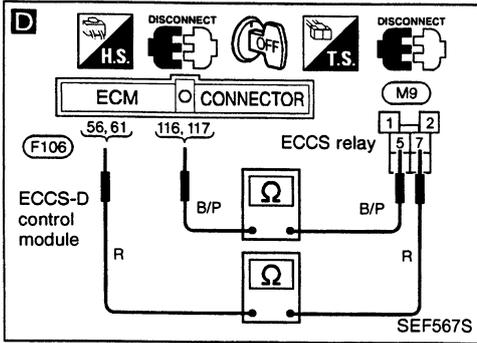
EC-MAIN-02



Main Power Supply and Ground Circuit (Cont'd)



Main Power Supply and Ground Circuit (Cont'd)



D

CHECK HARNESS CONTINUITY BETWEEN ECCS RELAY AND ECM

1. Disconnect ECM (ECCS-D control module) harness connector.
2. Disconnect ECCS relay harness connector.
3. Check harness continuity between ECM (ECCS-D control module) connector terminals (56), (61) and ECCS relay connector terminal (7); and ECM (ECCS-D control module) connector terminals (116), (117) and ECCS relay connector terminal (5).

Continuity should exist.
If OK, check harness for short-circuit.

NG → Check the following:

- Harness connectors (M51), (F105)
- Harness for open or short-circuit between ECCS relay and ECM.

If NG, repair harness or connectors.

OK →

E

CHECK VOLTAGE BETWEEN ECCS RELAY AND GROUND.

Check voltage between ECCS relay connector terminals (1), (5), (7) and ground with CONSULT or voltage tester.

Voltage: Battery voltage

NG → Check the following:

- 15A fuse
- 7.5A fuse
- 100A fusible link.
- Harness for open or short-circuit between ECCS relay and battery.

If NG, replace fuses or fusible link or repair harness or connectors.

OK →

F

CHECK OUTPUT SIGNAL CIRCUIT.

Check harness continuity between ECM (ECCS-D control module) connector terminal (4) and ECCS relay connector terminal (2).

Continuity should exist.
If OK, check harness for short-circuit.

NG →

- Check harness connectors (M51), (F105)

Repair harness or connectors.

OK →

G

CHECK ECCS RELAY.

1. Apply 12V direct current between ECCS relay connector terminals (1) and (2).
2. Check continuity between ECCS relay connector terminals (3) and (5), (7) and (6).

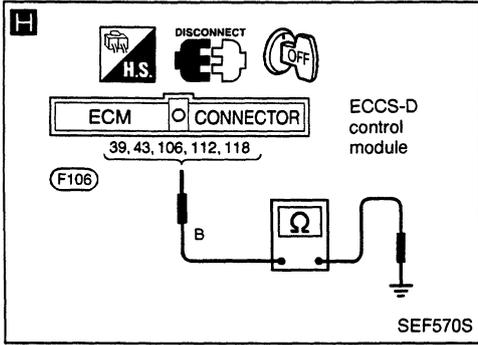
12V (1 - 2) applied:
Continuity exists.
No voltage applied:
No continuity

NG → Replace ECCS relay.

OK →

B

Main Power Supply and Ground Circuit (Cont'd)



Ⓜ

CHECK GROUND CIRCUIT.

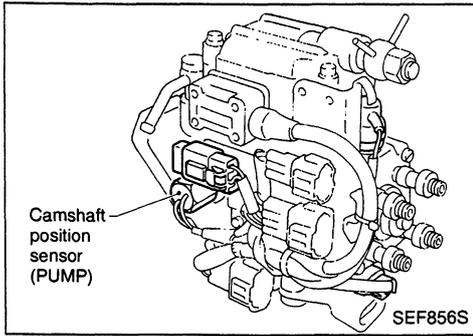
1. Turn ignition switch to "LOCK" position.
2. Disconnect ECM (ECSS-D control module) harness connector.
3. Check harness continuity between ECM (ECSS-D control module) connector terminals (39), (43), (106), (112), (118) and engine ground.
Continuity should exist.
If OK, check harness for short-circuit.

NG → Repair harness or connectors.

OK ↓

Check ECM (ECSS-D control module) pin terminals for damage and check the connection of ECM (ECSS-D control module) harness connector.

INSPECTION END



Camshaft Position Sensor (CMPS) (PUMP)

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

The sensor is of an electro-magnetic proximity type, which consists of a permanent magnetic core surrounded by a coil to form a "pick-up" which is sensitive to localised changes in the electro-magnetic field.

When the engine is running, the gap between the sensor and drive shaft rotating plate will periodically change causing fluctuations in the sensor's magnetic field which effects a proportional change of voltage signal induced in the sensor's coil.

The ECM receives the voltage signal (4 pulses/2 engine revolutions) and uses the data for tachometer indication.

Diagnostic Trouble Code No.	Malfunction is detected when	Check Items (Possible cause)
11	<ul style="list-style-type: none"> An incorrect signal from the sensor is detected by ECM (ECCS-D control module) 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 to "ON" position and select "DATA MONITOR" mode with CONSULT.
- 2) Start engine and run it for at least 2 seconds at idle speed.

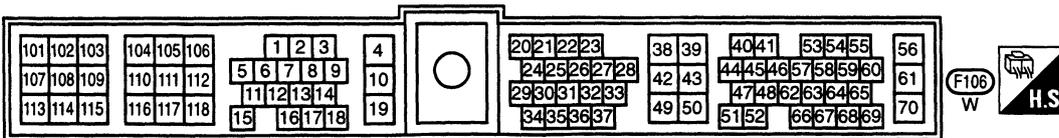
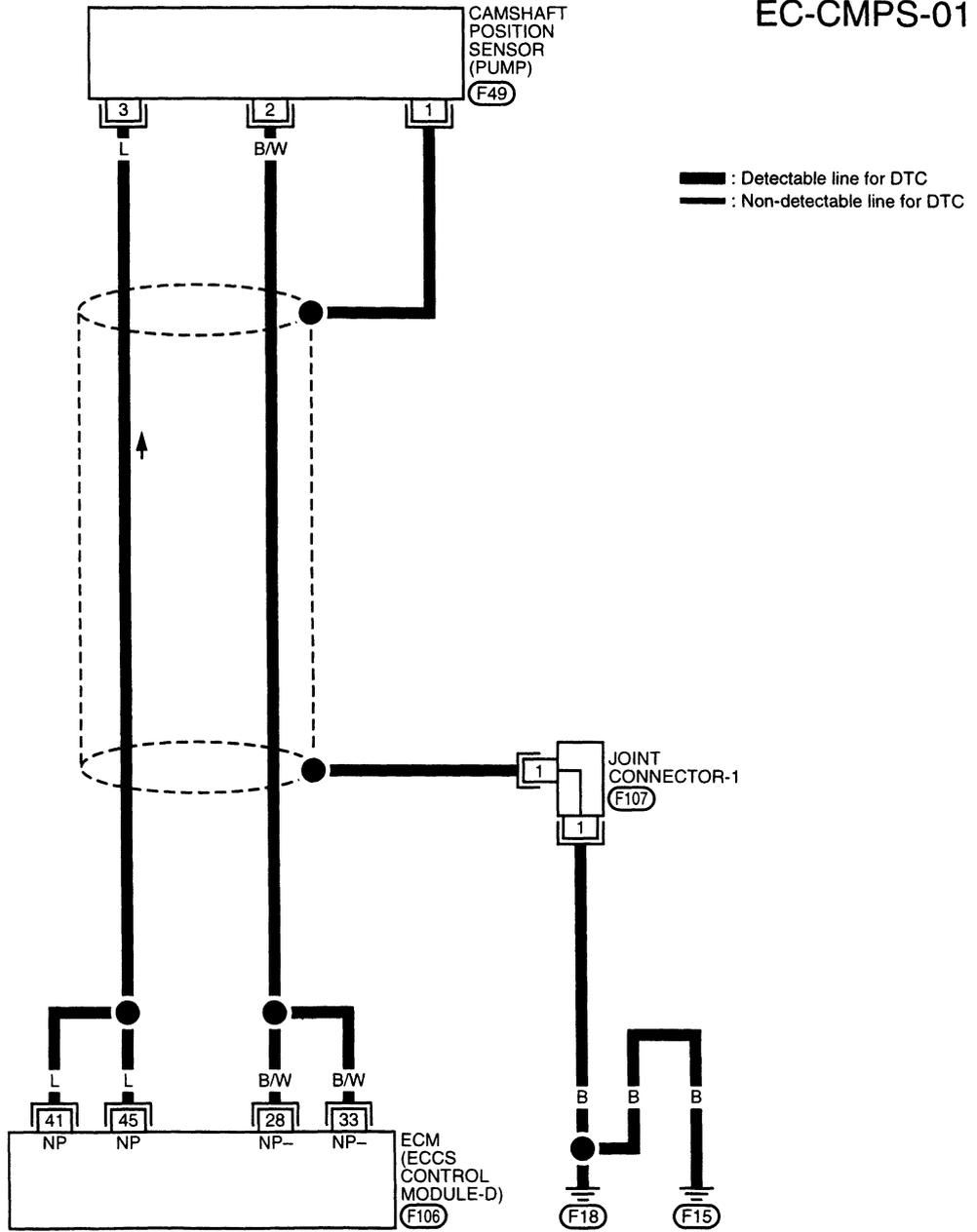
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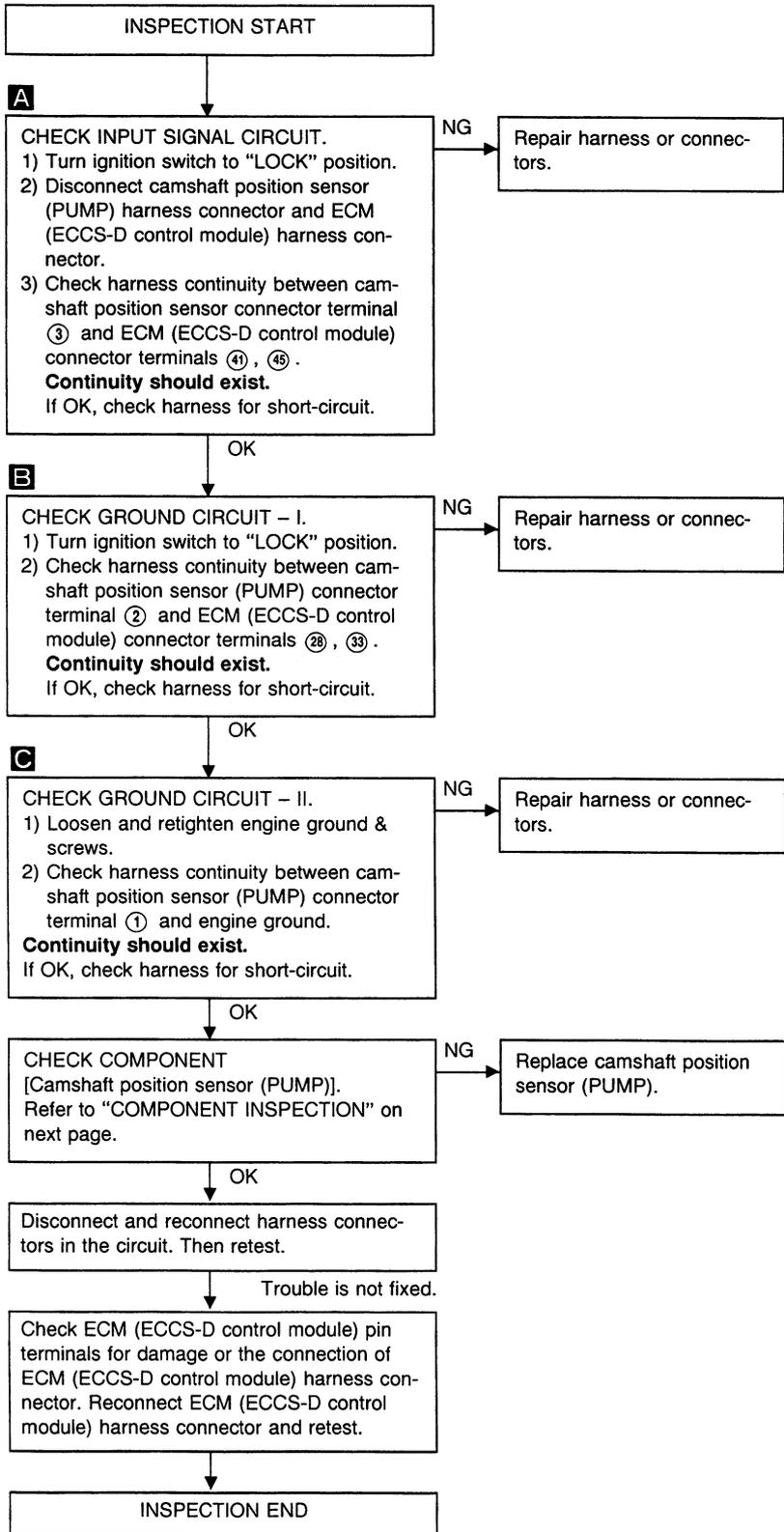
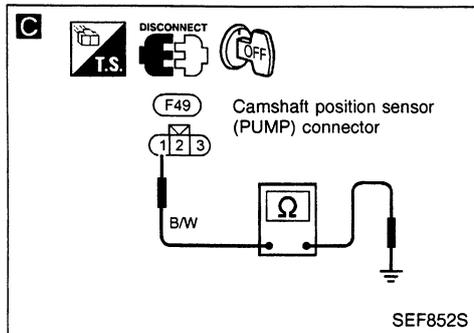
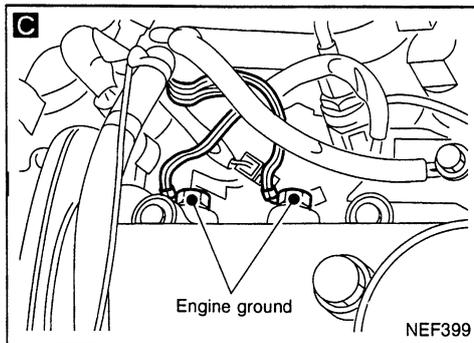
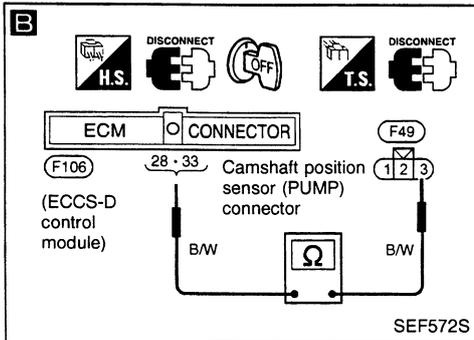
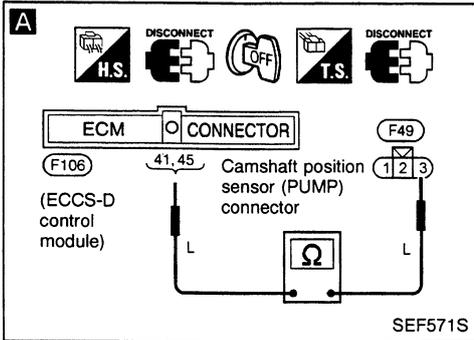
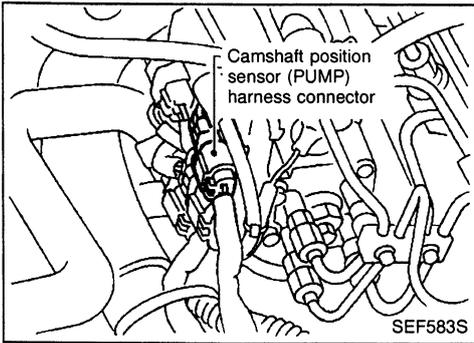
- 1) Start engine and run it for at least 2 seconds at idle speed.
- 2) Turn ignition switch to "LOCK" position, wait at least 5 seconds and then turn to "ON" position.
- 3) Perform Diagnostic Test Mode II (Self-diagnostic results).

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

EC-CMPS-01



**Camshaft Position Sensor (CMPS) (PUMP)
(Cont'd)
DIAGNOSTIC PROCEDURE**

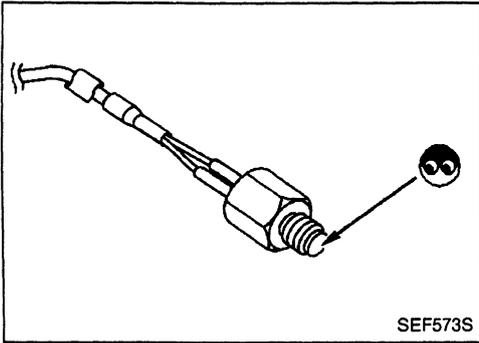


**Camshaft Position Sensor (CMPS) (PUMP)
(Cont'd)**

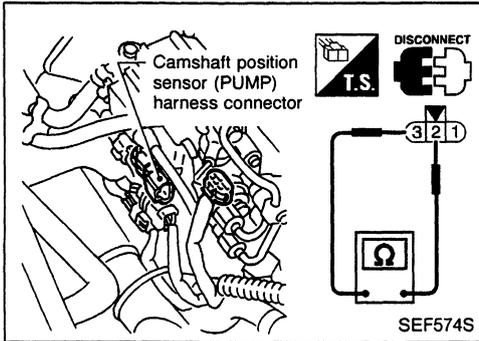
COMPONENT INSPECTION

Camshaft position sensor (PUMP)

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



SEF573S



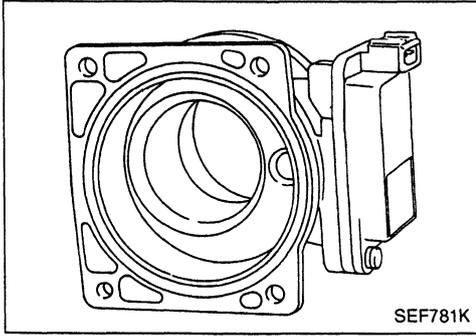
SEF574S

5. Check resistance between camshaft position sensor (PUMP) terminals ② and ③.

Resistance:

Approximately 1,600Ω [at 25°C (77°F)]

If NG, replace camshaft position sensor (PUMP) position sensor (PUMP).



Mass Air Flow Sensor (MAFS)

The mass air flow sensor measures the intake air flow rate by analysing a part of the entire flow. Measurements from the mass air flow sensor are received by the ECM (ECCS-D control module) as an electrical input signal which has a voltage level proportional to the amount of heat emitted from the hot wire placed in the stream of the intake air.

When intake air flows into the intake manifold through a route around the hot wire, the heat generated from the hot wire is convected away by the air. The intensity of heat detected depends on the volume of air flow and in addition, the temperature of the hot wire is automatically controlled to within a defined temperature range °C (°F).

Therefore, when the volume of the air flow is increased it is necessary to supply the hot wire with more electric current in order to maintain the temperature of the hot wire. This enables the ECM (ECCS-D control module) to determine the volume of the air flow by means of the corresponding electric change.

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 entered to ECM (ECCS-D control module). 	<ul style="list-style-type: none"> ● Harness or connectors (The sensor circuit is open or shorted.) ● Mass air flow sensor

DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

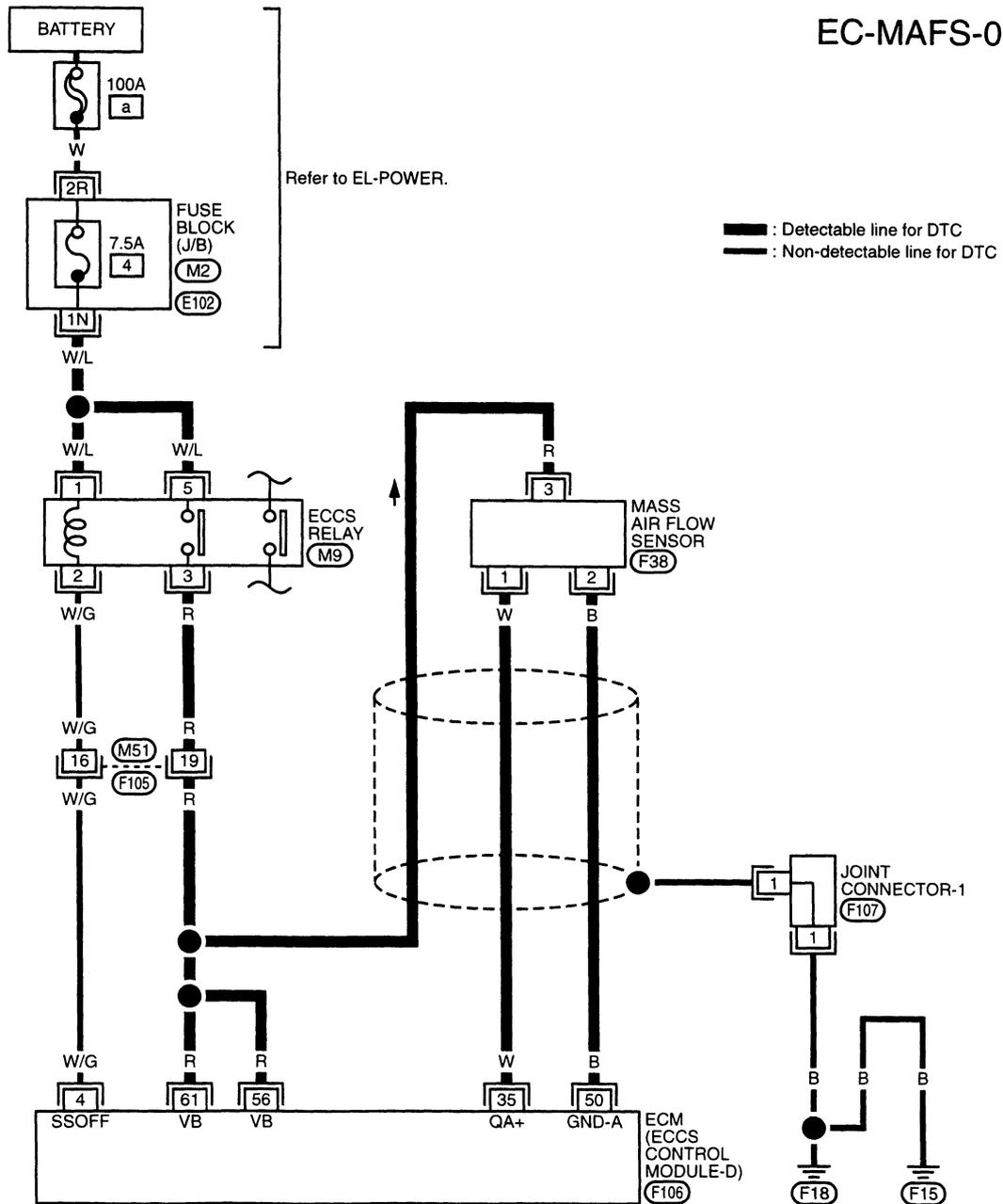
- 1) Turn ignition switch to "ON" position.
- 2) Select "DATA MONITOR" mode with CONSULT.
- 3) Start engine and wait for at least 15 seconds.

OR

- 1) Start engine and wait for at least 15 seconds.
- 2) Turn ignition switch to "LOCK" position, wait for at least 5 seconds and then turn to "ON" position.
- 3) Perform "Diagnostic Test Mode II" (Self-diagnostic results).

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

EC-MAFS-01

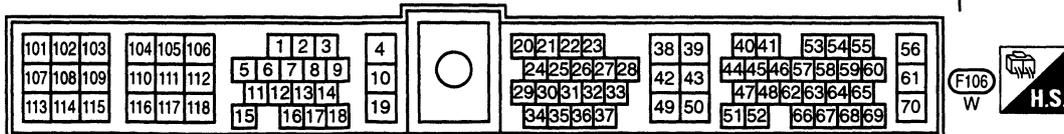
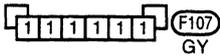


— : Detectable line for DTC
 - - - : Non-detectable line for DTC

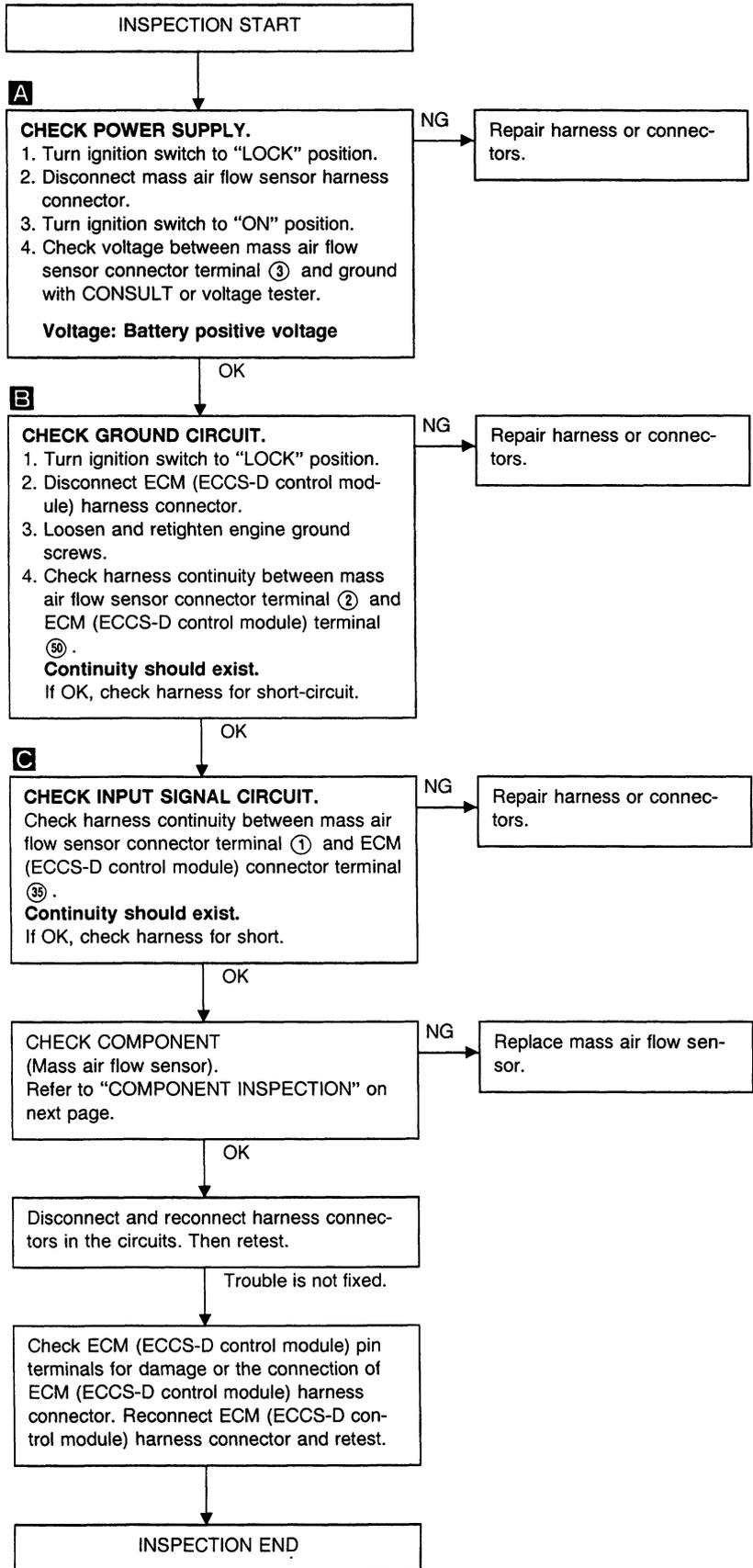
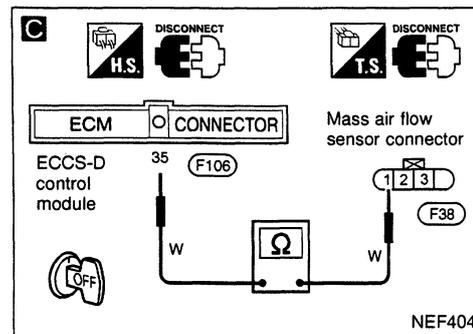
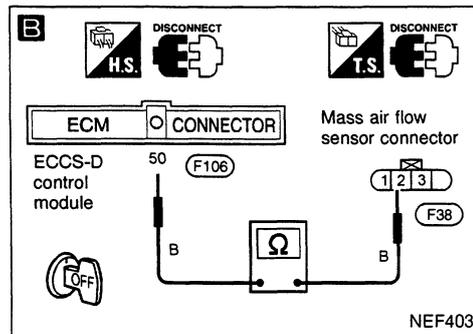
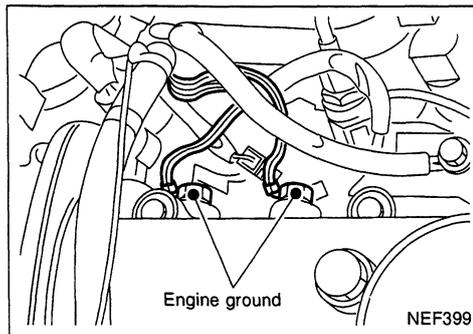
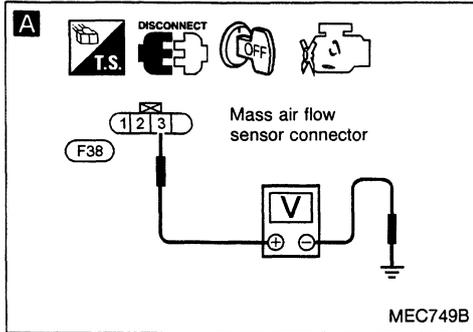
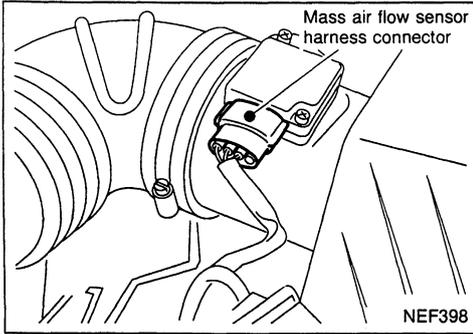
Refer to EL-POWER.



Refer to last page (Foldout page).
 (M2), (E102)



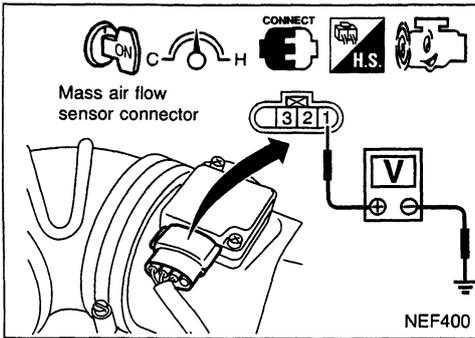
**Mass Air Flow Sensor (MAFS) (Cont'd)
DIAGNOSTIC PROCEDURE**



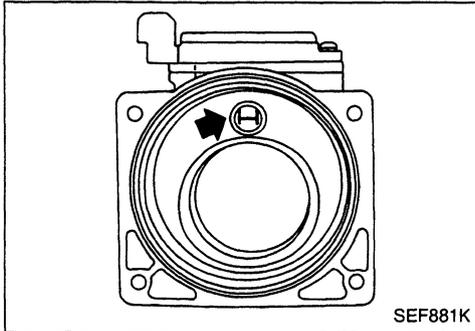
**Mass Air Flow Sensor (MAFS) (Cont'd)
COMPONENT INSPECTION**

Mass air flow sensor

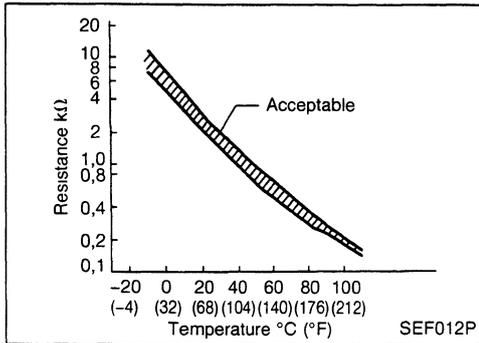
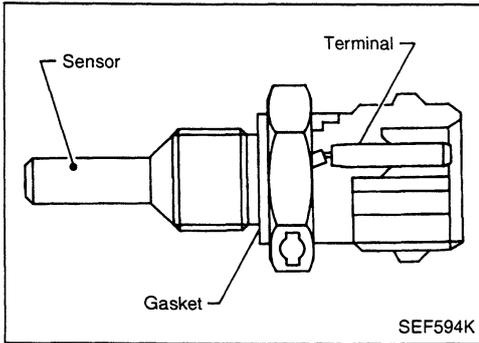
1. Turn ignition switch to "ON" position.
2. Start engine and warm it up sufficiently.
3. Check voltage between mass air flow sensor connector terminal ① and ground.



Conditions	Voltage V
Ignition switch "ON" position (Engine stopped.)	Less than 1.0
Idle (Engine is warmed-up sufficiently.)	1.9 - 2.3



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



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

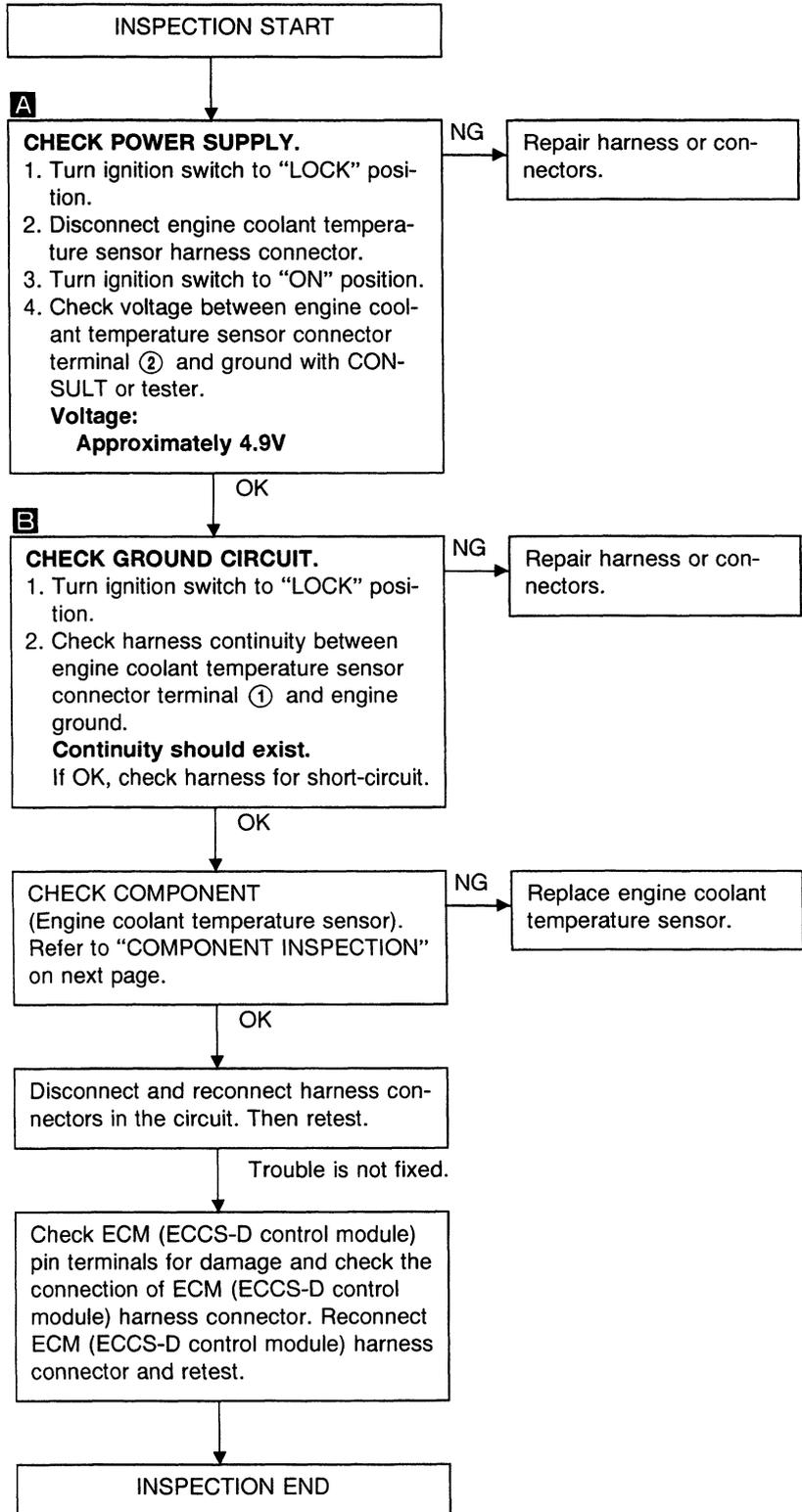
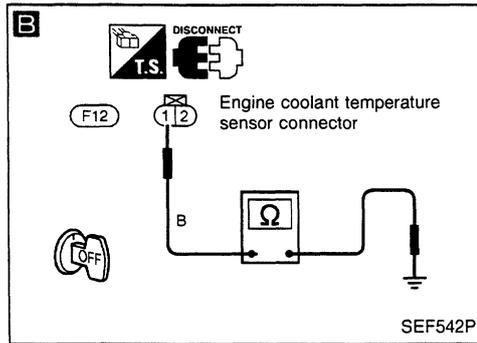
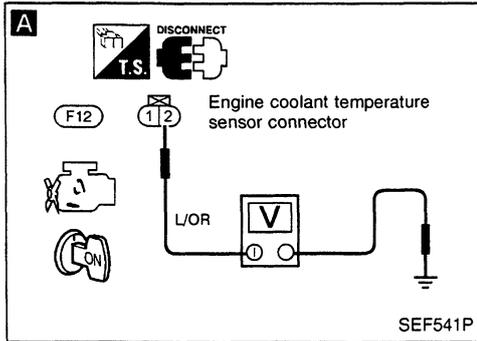
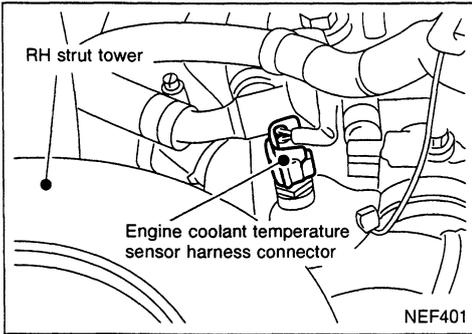
Diagnostic Trouble Code No.	Malfunction is detected when ...	Check Items (Possible Cause)
13	<ul style="list-style-type: none"> An excessively high or low voltage from the sensor is entered to ECM. 	<ul style="list-style-type: none"> Harness or connectors (The sensor circuit is open or shorted.) Engine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

DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

- 1) Turn ignition switch to "ON" position.
 - 2) Select "DATA MONITOR" mode with CONSULT.
 - 3) Wait at least 5 seconds.
- OR
- 1) Turn ignition switch to "ON" position and wait at least 5 seconds.
 - 2) Turn ignition switch to "LOCK" position, wait at least 5 seconds and then turn to "ON" position.
 - 3) Perform diagnostic test mode II (Self-diagnostic results).

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

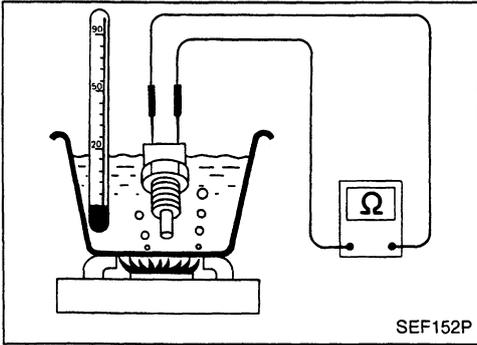
DIAGNOSTIC PROCEDURE



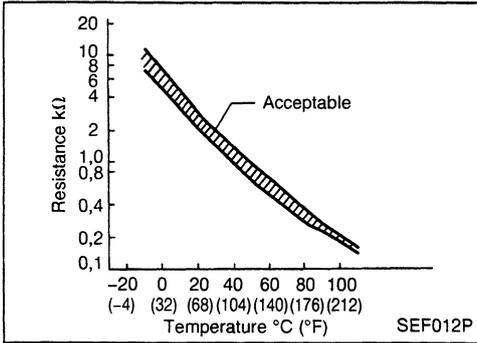
Engine Coolant Temperature (ECT) Sensor (Cont'd)
COMPONENT INSPECTION

Engine coolant temperature sensor

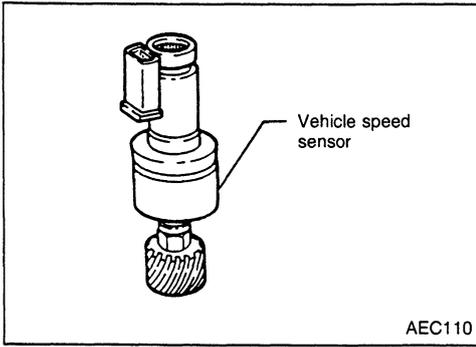
Check resistance as shown in the figure.



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



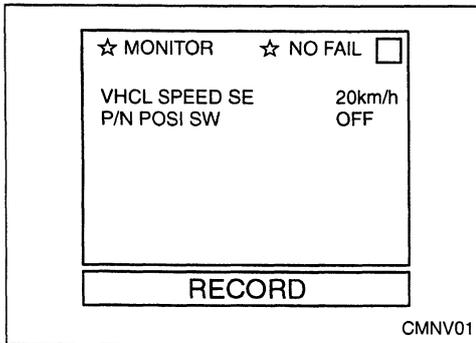
If NG, replace engine coolant temperature sensor.



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.

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



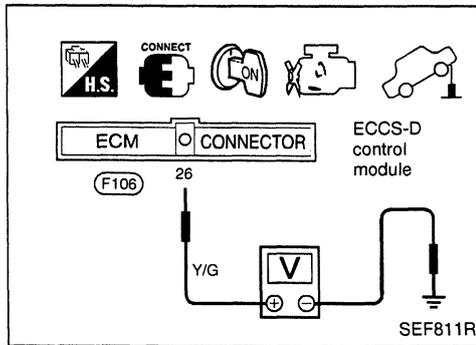
OVERALL FUNCTION CHECK

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

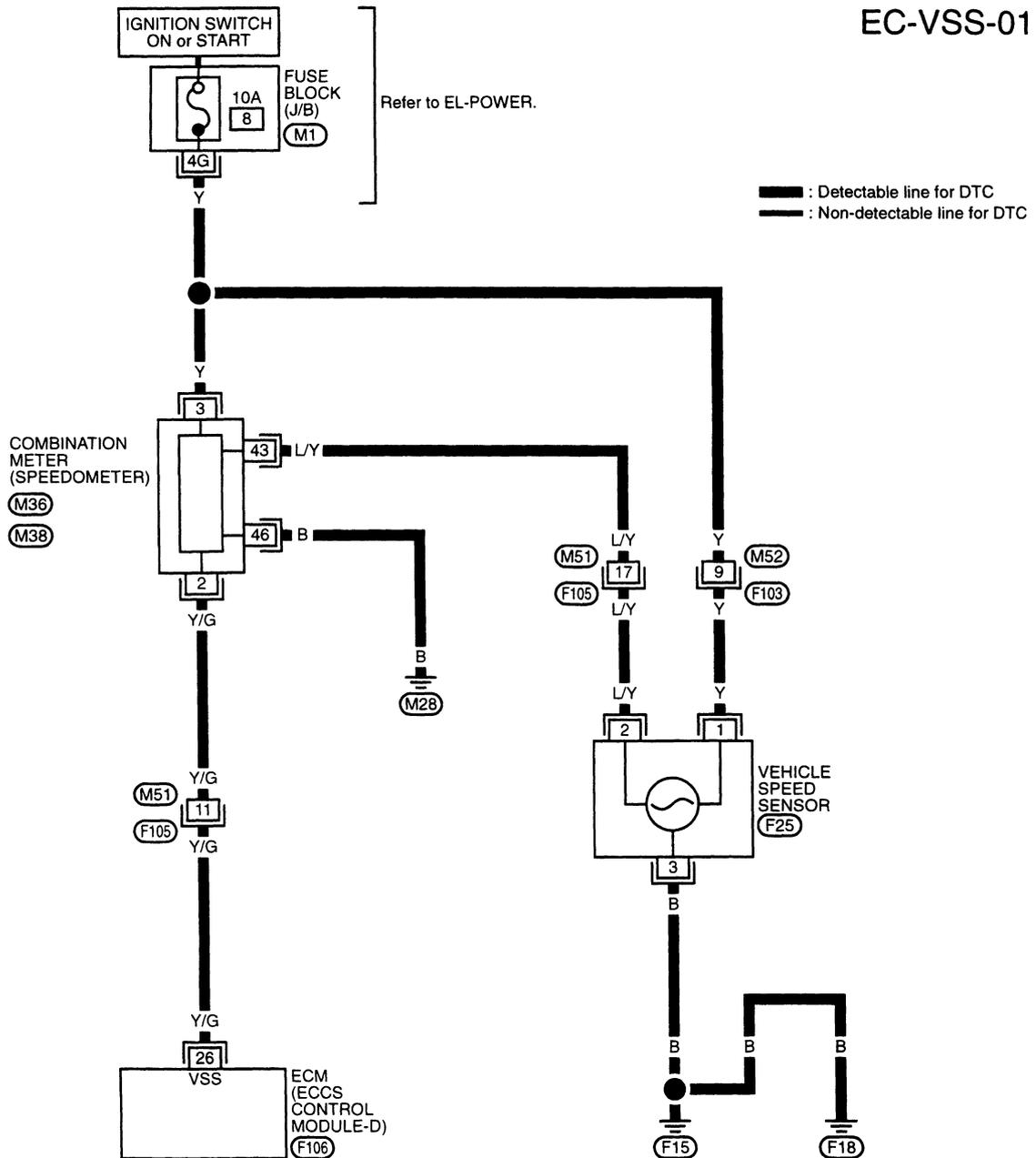


- 1) Jack up drive wheels.
- 2) Start engine.
- 3) Rotate drive wheel by hand.
- 4) Check voltage between ECM (ECCS-D control module) connector terminal ②⑥ and ground with voltage tester.

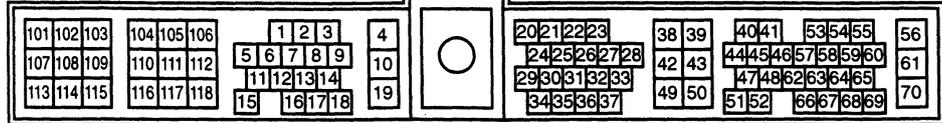
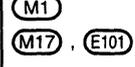
Voltage should vary between approx. 0 - 4.2V.

Vehicle Speed Sensor (VSS) (Cont'd)

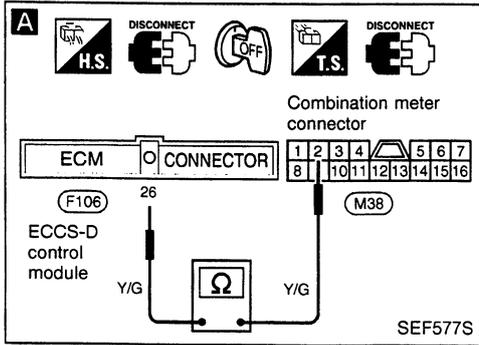
EC-VSS-01



Refer to last page (Foldout page).



**Vehicle Speed Sensor (VSS) (Cont'd)
DIAGNOSTIC PROCEDURE**



INSPECTION START

A
CHECK INPUT SIGNAL CIRCUIT.
1. Turn ignition switch to "LOCK" position.
2. Disconnect ECM (ECCS-D control module) harness connector and combination meter harness connector.
3. Check harness continuity between ECM (ECCS-D control module) connector terminal ② and combination meter connector terminal ②.
Continuity should exist.
If OK, check harness for short-circuit.

NG
Check the following:
● Harness connectors (M51), (F105)
● Harness for open or short-circuit between ECM (ECCS-D control module) and combination meter.
If NG, repair harness or connectors.

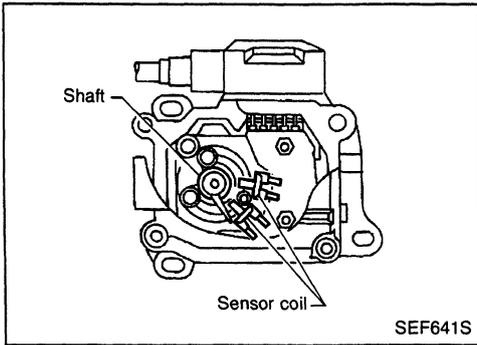
OK
CHECK SPEEDOMETER FUNCTION.
Make sure that speedometer functions correctly.

NG
Check the following:
● Harness connectors (M51), (F105)
● Harness for open or short-circuit between combination meter and vehicle speed sensor.
If NG, repair harness or connectors.
Check vehicle speed sensor and its circuit.
Refer to EL section.

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

Trouble is not fixed.
Check ECM (ECCS-D control module) pin terminals for damage and check the connection of ECM (ECCS-D control module) harness connector. Reconnect ECM (ECCS-D control module) harness connector and retest.

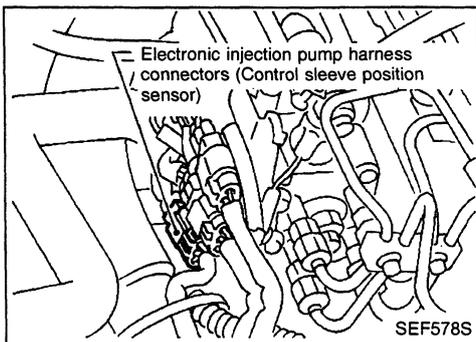
INSPECTION END



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 (ECCS-D control module).

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 (ECCS-D control module). ● An incorrect voltage signal from the sensor is detected by ECM (ECCS-D control module) 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

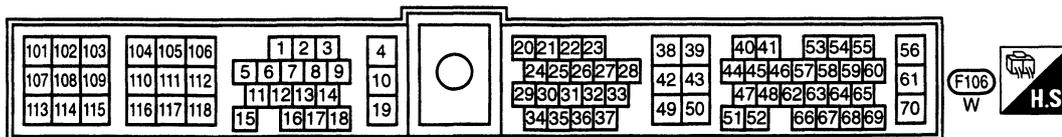
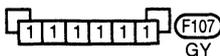
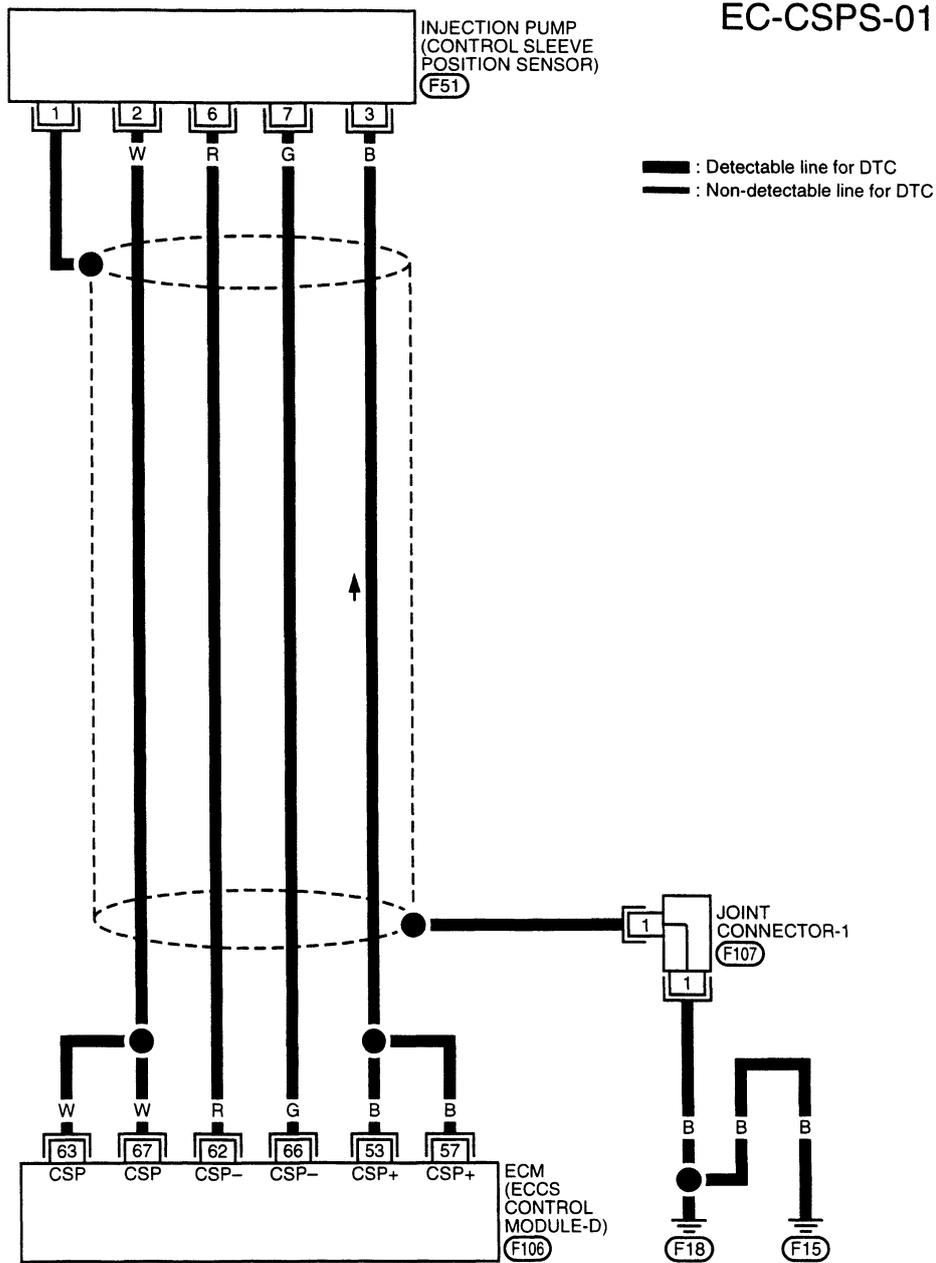


DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

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

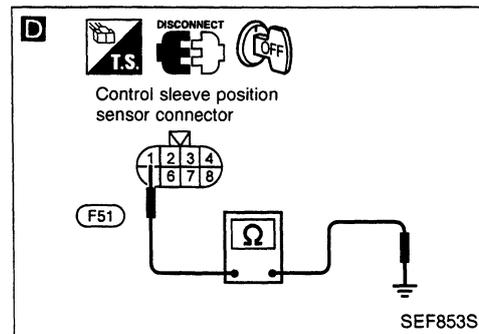
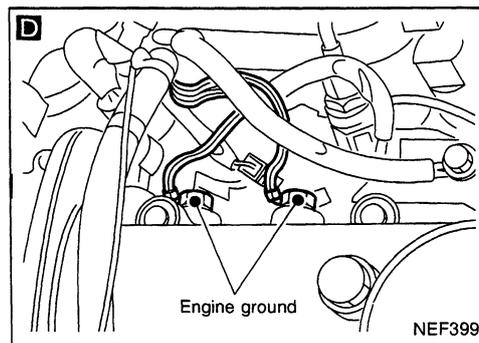
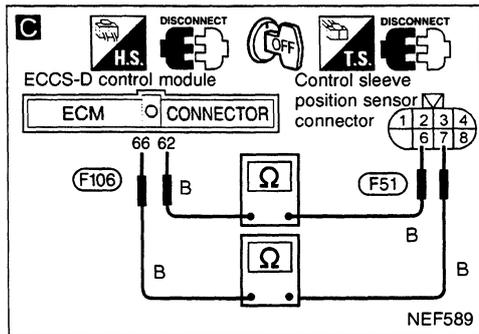
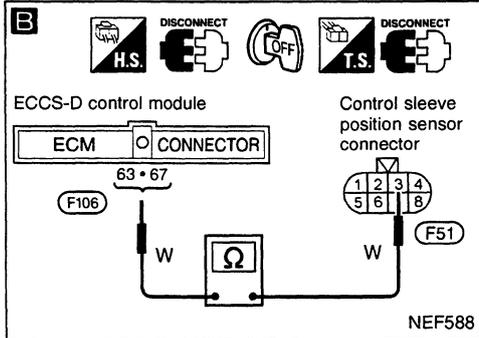
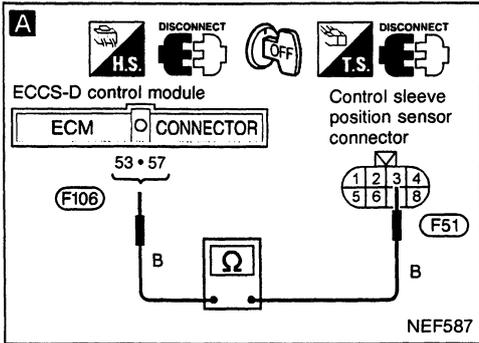
Control Sleeve Position Sensor (CSPS)
(Cont'd)

EC-CSPS-01

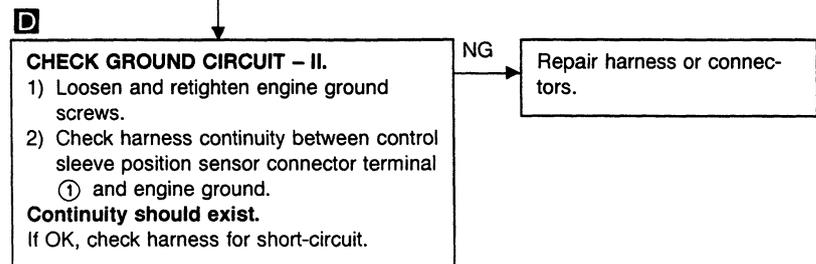
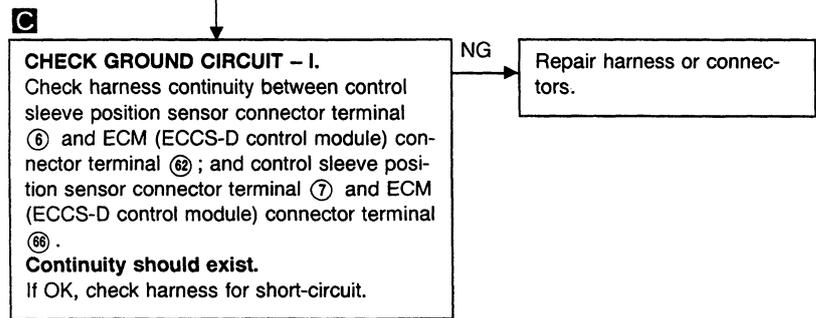
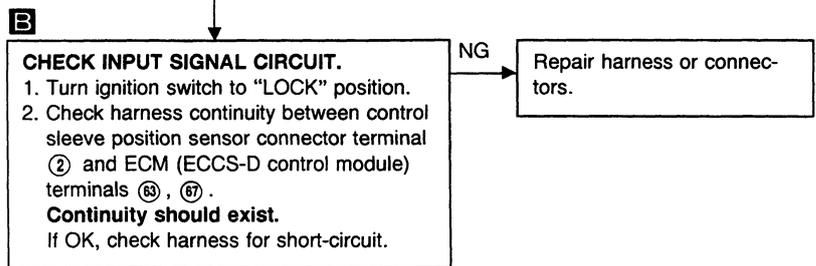
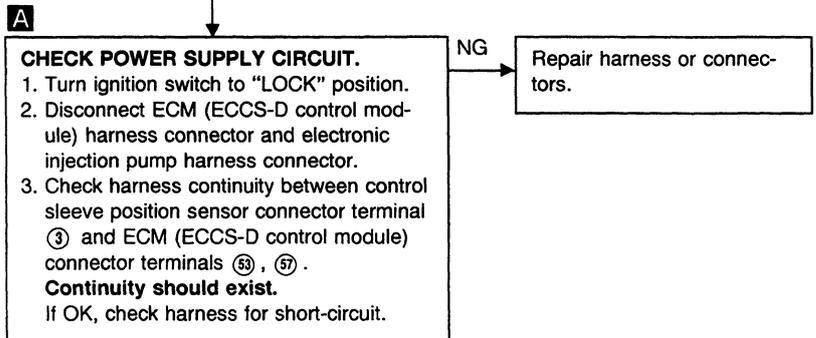


SEF425S

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

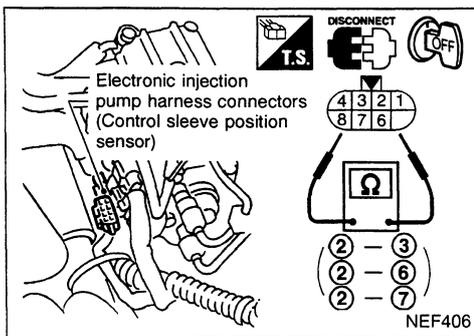
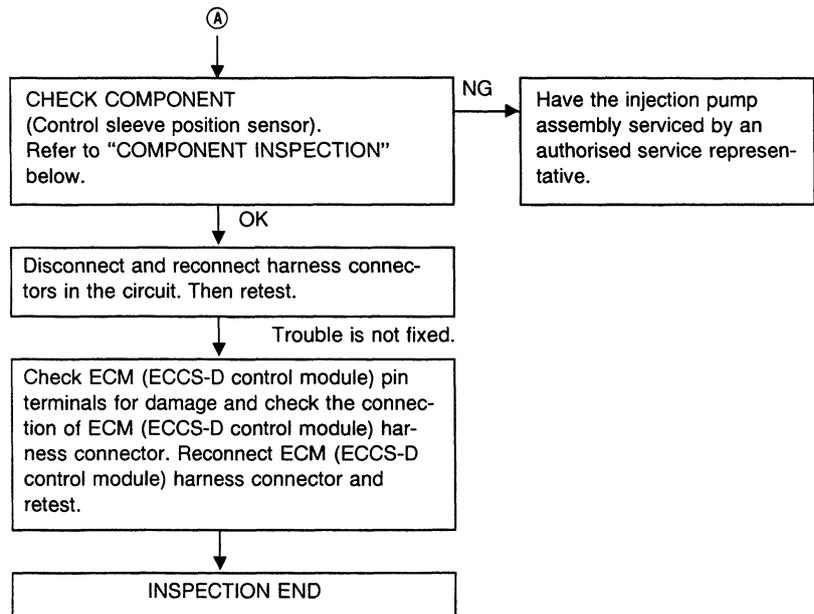


INSPECTION START



OK
A

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

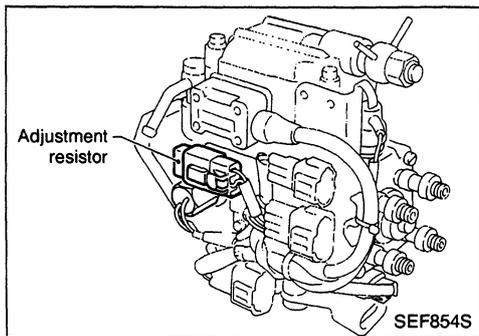


COMPONENT INSPECTION

Control sleeve position sensor

1. Disconnect electronic injection pump harness connector.
2. Check continuity between terminals ② and ③; ② and ⑥ and ② and ⑦.

Resistance: Approximately 5.8Ω [at 23°C (73°F)]
If NG, take proper action.



Adjustment Resistor

The adjustment resistor is used to achieve uniform pump characteristics.

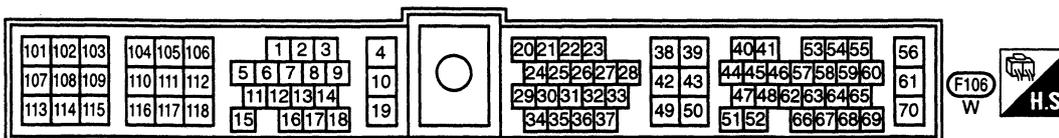
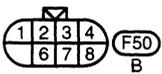
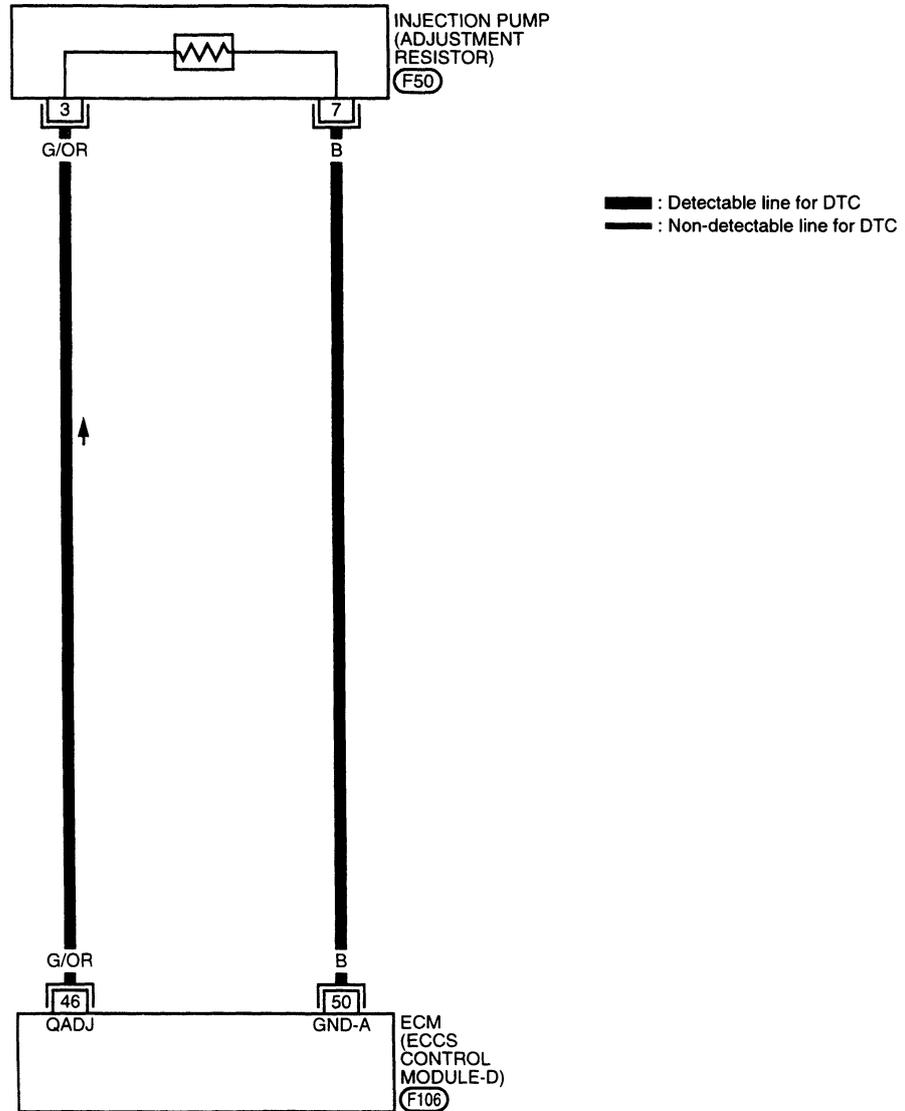
Diagnostic Trouble Code No.	Malfunction is detected when ...	Check Items (Possible Cause)
17	<ul style="list-style-type: none"> An excessively high or low voltage from the resistor is detected by ECM (ECCS-D control module). 	<ul style="list-style-type: none"> Harness or connectors (The adjustment resistor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

DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

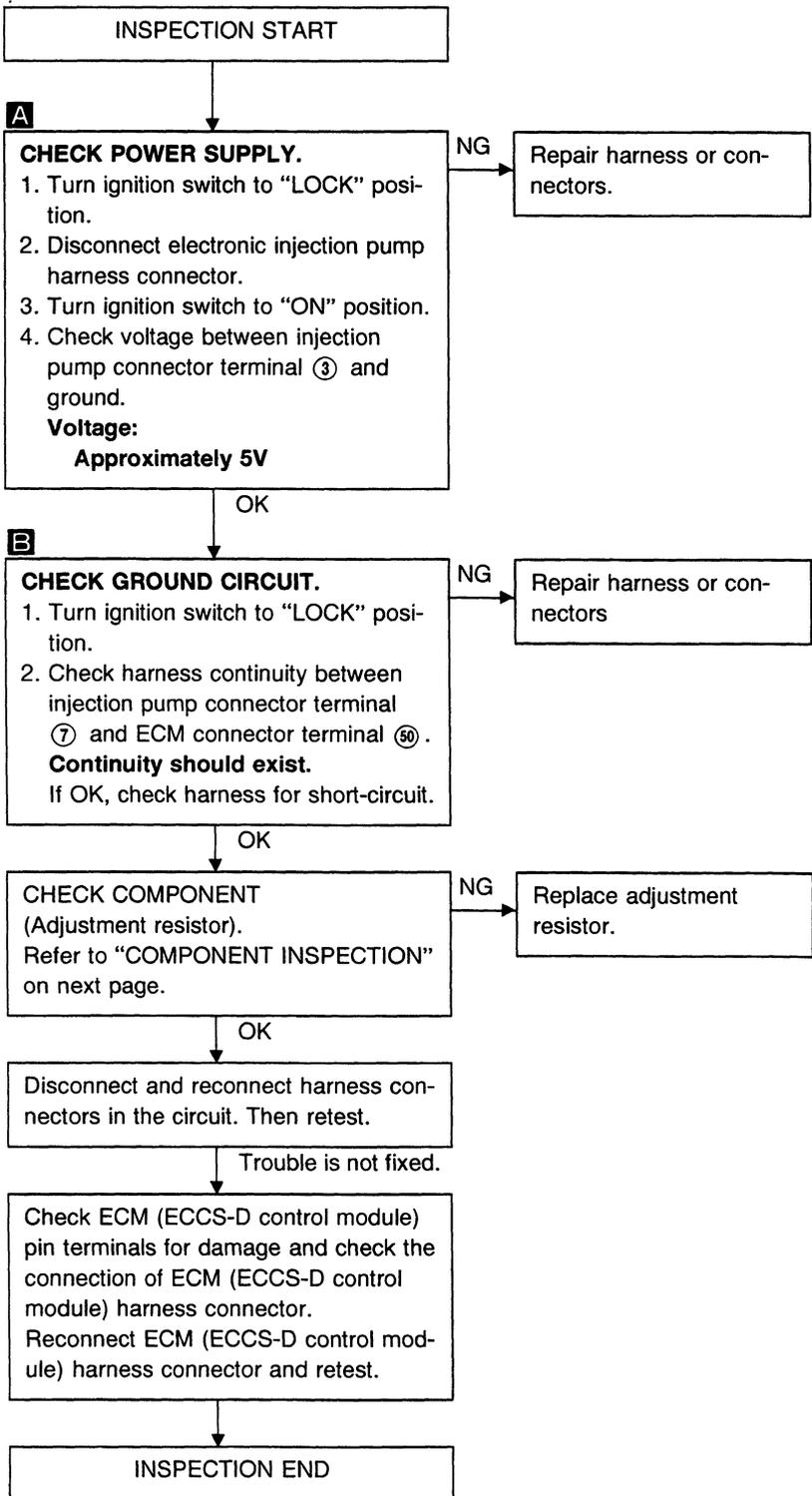
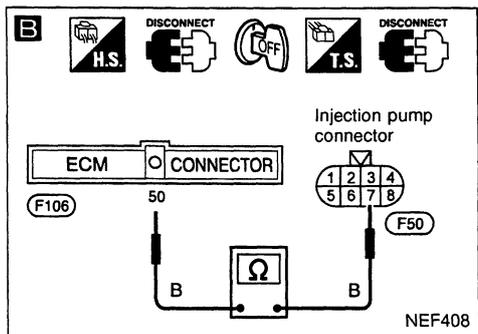
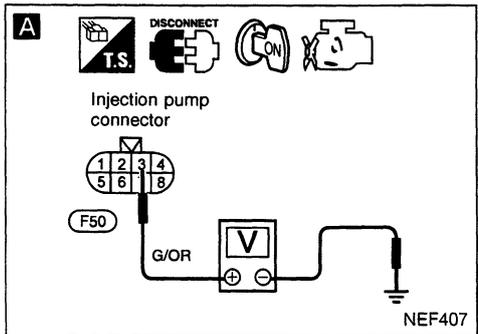
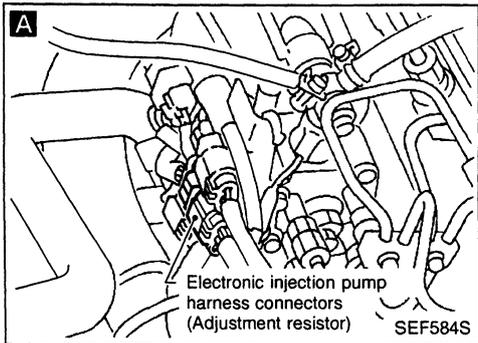
- 
 - 1) Turn ignition switch to "ON" position.
 - 2) Select "DATA MONITOR" mode with CONSULT.
 - 3) Wait at least 5 seconds.
- OR
- 
 - 1) Turn ignition switch to "ON" position and wait at least 5 seconds.
 - 2) Turn ignition switch to "LOCK" position, wait at least 5 seconds and then turn to "ON" position.
 - 3) Perform diagnostic test mode II (Self-diagnostic results).

Adjustment Resistor (Cont'd)

EC-ADJRES-01



**Adjustment Resistor (Cont'd)
DIAGNOSTIC PROCEDURE**



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-366.)



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

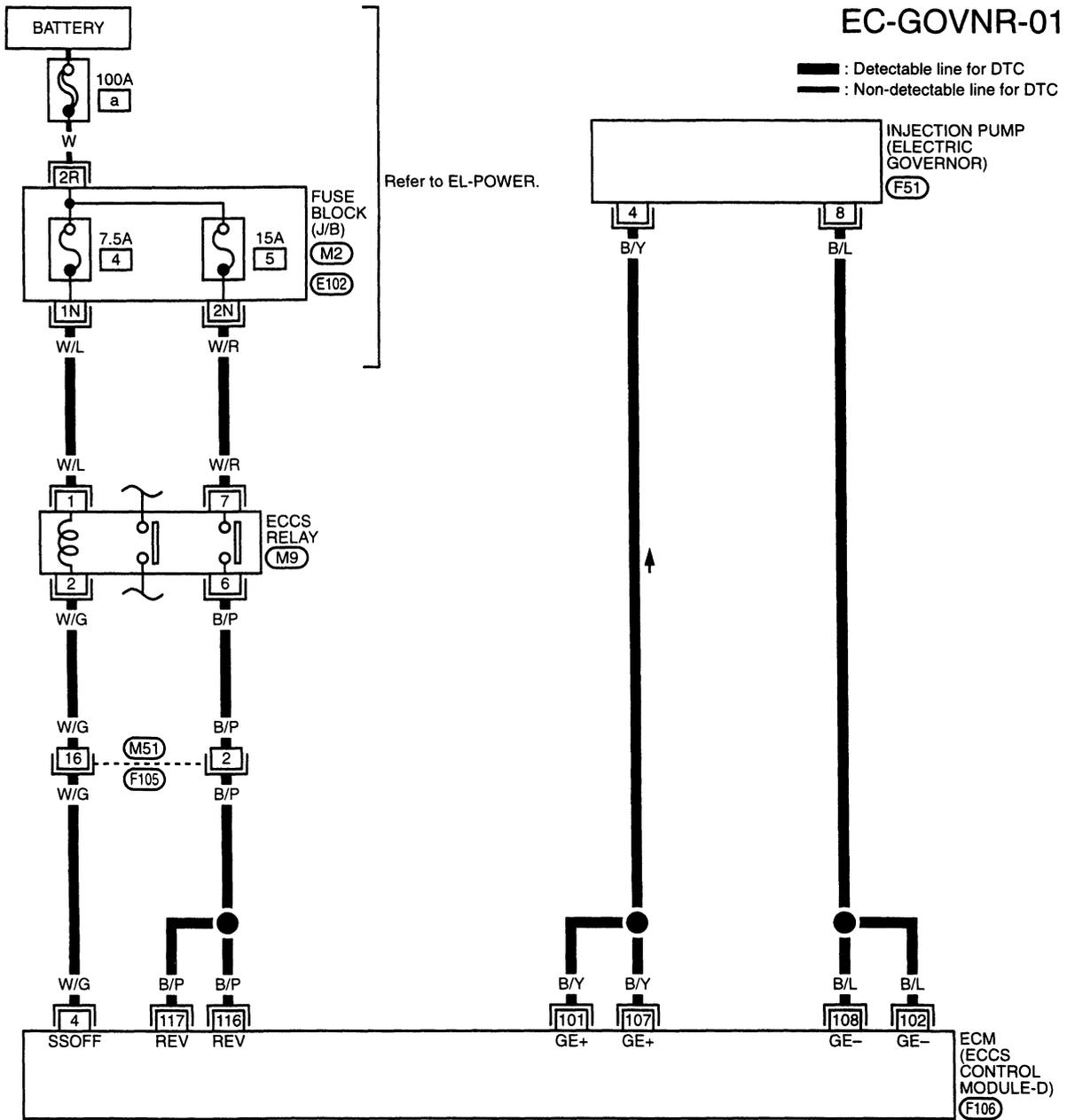
OR



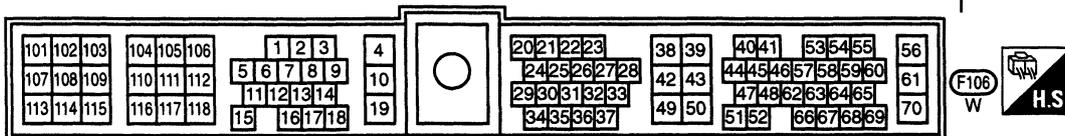
- 1) Start engine and warm it up sufficiently.
- 2) Run engine for 2 seconds at 3,000 rpm. Return engine speed to idle, then increase to 3,000 rpm under no load.
- 3) Turn ignition switch to "LOCK" position, wait at least 5 seconds and then turn to "ON" position.
- 4) Perform "Diagnostic Test Mode II"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

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

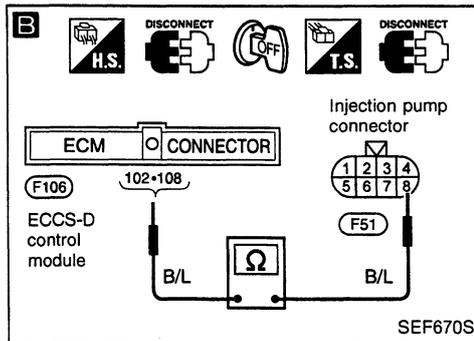
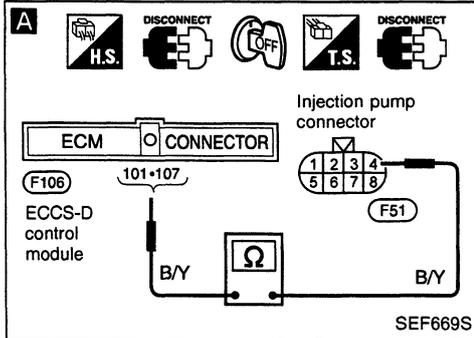
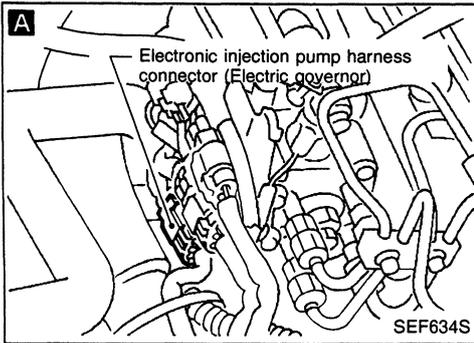
Electric Governor (Cont'd)



Refer to last page (Foldout page).
 (M2) . (E102)



**Electric Governor (Cont'd)
DIAGNOSTIC PROCEDURE**



INSPECTION START

CHECK POWER SUPPLY.
Refer to EC-348.

A
CHECK POWER SUPPLY CIRCUIT.
1. Turn ignition switch to "LOCK" position.
2. Disconnect ECM (ECCS-D control module) harness connector and electronic injection pump harness connector.
3. Check harness continuity between injection pump connector terminal ④ and ECM (ECCS-D control module) connector terminals ⑩①, ⑩⑦.
Continuity should exist.
If OK, check harness for short-circuit.

NG → Repair harness or connectors.

OK

B
CHECK GROUND CIRCUIT.
Check harness continuity between injection pump connector terminal ⑧ and ECM (ECCS-D control module) connector terminals ⑩②, ⑩⑧.
Continuity should exist.
If OK, check harness for short-circuit.

NG → Repair harness or connectors.

OK

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

NG → Have the injection pump assembly serviced by an authorised service representative.

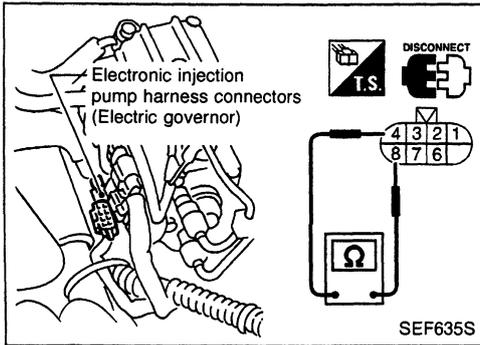
OK

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

Trouble is not fixed.

Check ECM (ECCS-D control module) pin terminals for damage and check the connection of ECM (ECCS-D control module) harness connector. Reconnect ECM (ECCS-D control module) harness connector and retest.

INSPECTION END



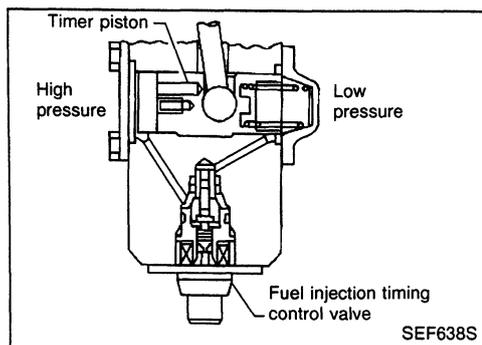
Electric Governor (Cont'd)

COMPONENT INSPECTION

Electric governor

1. Disconnect electronic injection pump harness connector.
2. Check continuity between injection pump connector terminals ④ and ⑧.

Resistance: Approximately 0.6Ω [at 23°C (73°F)]
If NG, replace.



Injection Timing Control Valve

The injection timing control valve is built into the 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 (ECCS-D control module) 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.

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 (ECCS-D control module), 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-399 or EC-414.)

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

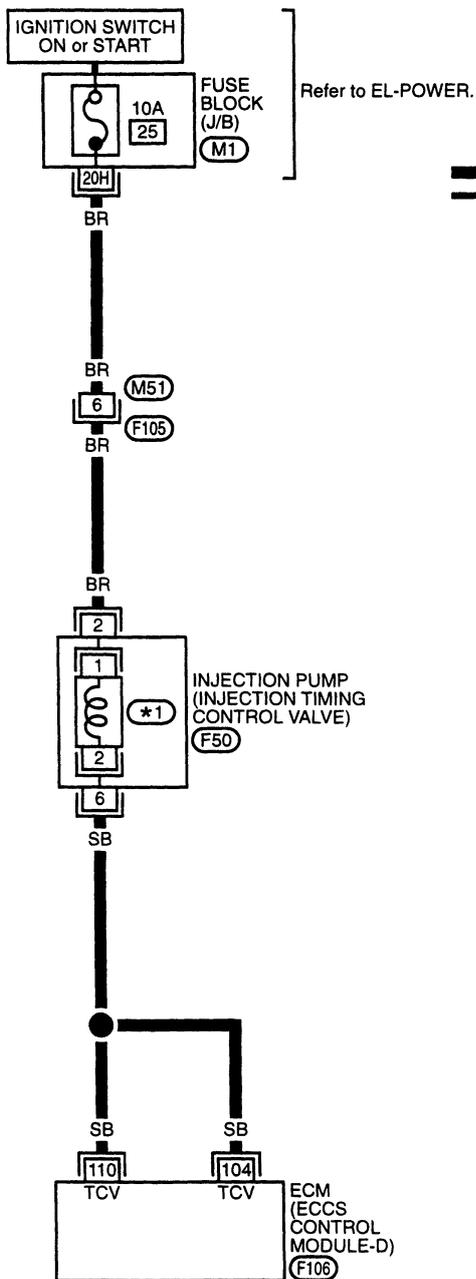
OR

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

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

Injection Timing Control Valve (Cont'd)

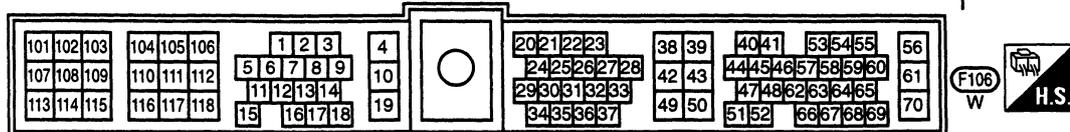
EC-TCV-01



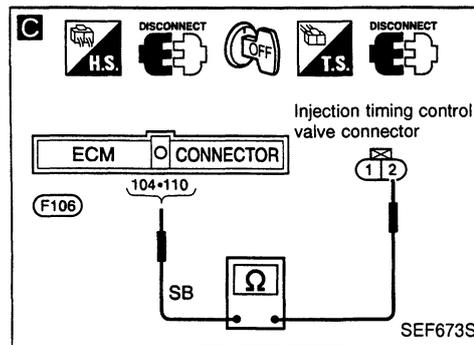
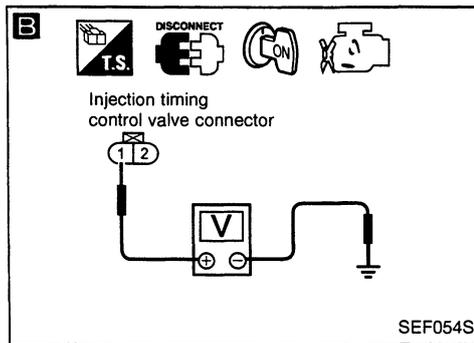
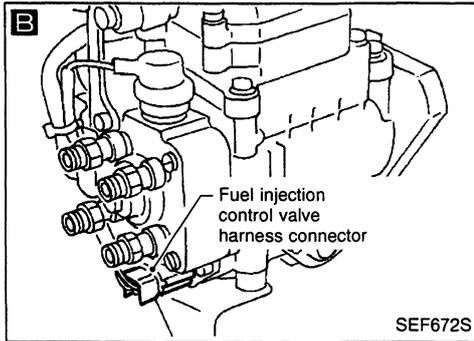
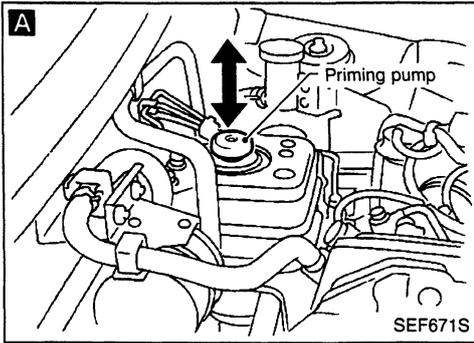
Refer to EL-POWER.
 — : Detectable line for DTC
 — : Non-detectable line for DTC

Refer to last page (Foldout page).

M1



**Injection Timing Control Valve (Cont'd)
DIAGNOSTIC PROCEDURE**



INSPECTION START

A
CHECK FOR AIR IN FUEL FILTER.
1. Move priming pump up and down to purge air from fuel filter.
2. Perform "DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE".

B
CHECK POWER SUPPLY.
1. Turn ignition switch to "LOCK" position.
2. Disconnect injection timing control valve harness connector.
3. Turn ignition switch to "ON" position.
4. Check harness continuity between injection timing control valve connector terminal ① and ground with CONSULT or tester.
Voltage: Battery voltage

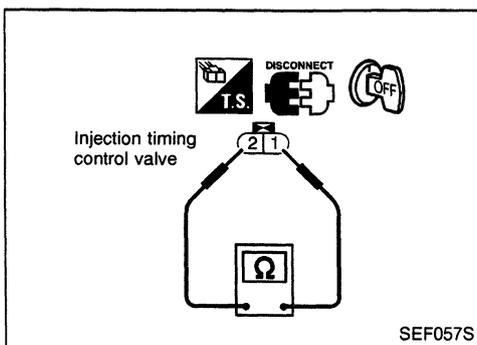
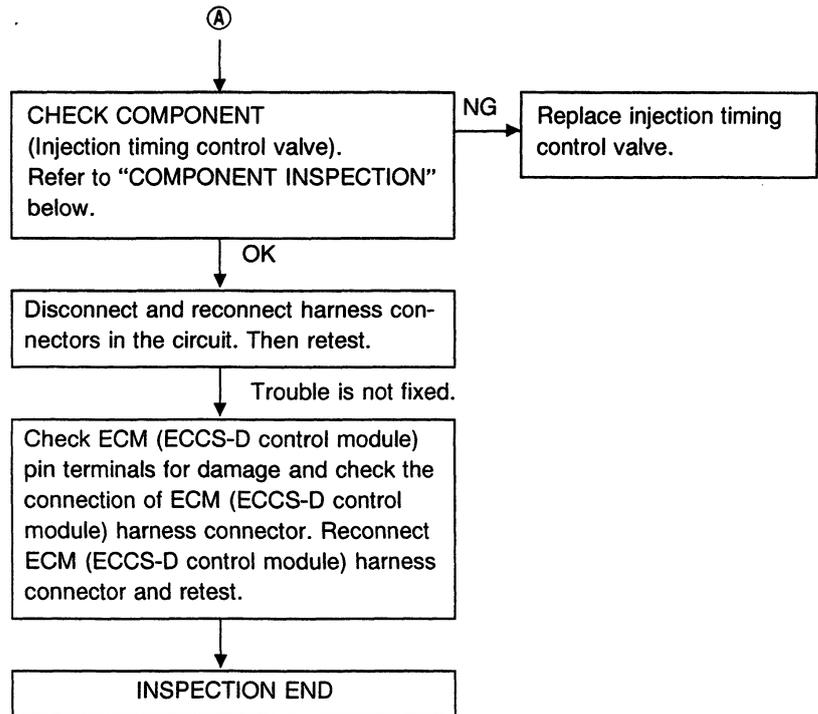
NG → Check the following:
● Harness connectors (M51), (F105)
● Electronic injection pump harness connector (F50)
● 10A fuse
● Harness for open or short-circuit between injection timing control valve harness connector and fuse.
If NG, replace fuse or repair harness or connectors.

C
CHECK OUTPUT SIGNAL CIRCUIT.
1. Turn ignition switch to "LOCK" position.
2. Disconnect ECM harness connector.
3. Check harness continuity between injection timing control valve connector terminal ② and ECM (ECCS-D control module) terminals (104), (110).
Continuity should exist.
If OK, check harness for short-circuit.

NG → Check the following:
● Electronic injection pump harness connector (F50)
● Harness for open or short-circuit between injection timing control valve and ECM (ECCS-D control module).
If NG, repair harness or connectors.

OK → (A)

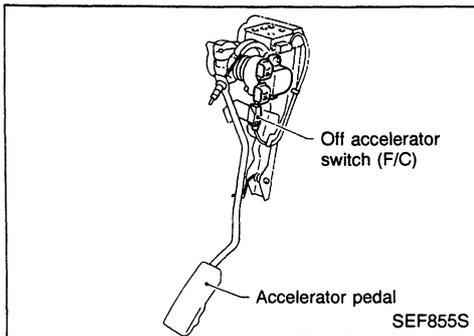
Injection Timing Control Valve (Cont'd)

**COMPONENT INSPECTION****Injection timing control valve**

1. Disconnect injection timing control valve harness connector.
2. Check resistance between terminals ① and ②.

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

If NG, replace injection timing control valve.



Accelerator Switch (F/C)

The accelerator switch is installed to the accelerator pedal assembly. The switch senses pressure applied to the accelerator pedal and sends an ON-OFF signal to the ECM (ECCS-D control module). The ECM (ECCS-D control module) uses the signal to control the fuel cut operation at deceleration for better fuel efficiency.

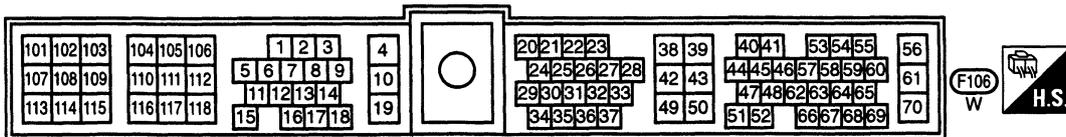
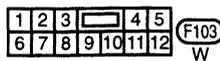
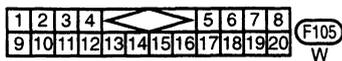
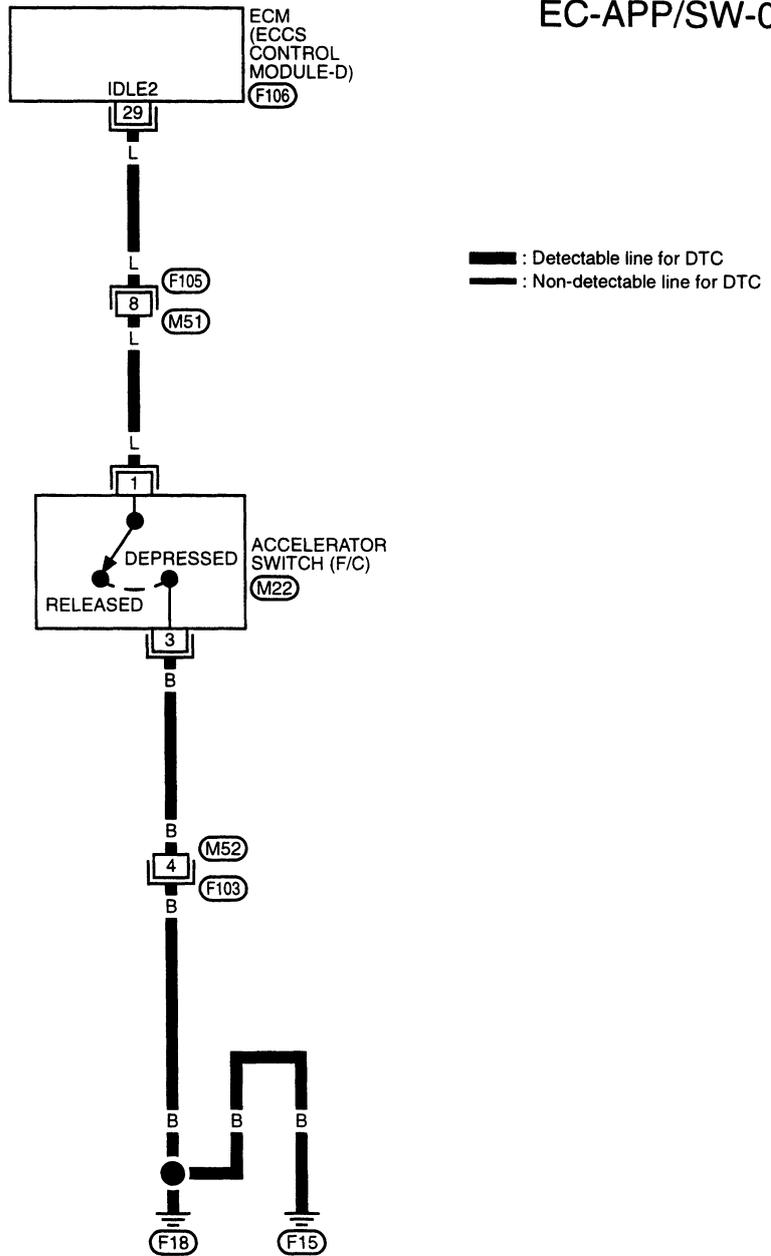
Diagnostic Trouble Code No.	Malfunction is detected when	Check Items (Possible cause)
23	<ul style="list-style-type: none"> The OFF signal (short) is sent to the ECM (ECCS-D control module) for a certain period of time even when the accelerator pedal is not being depressed. 	<ul style="list-style-type: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

DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

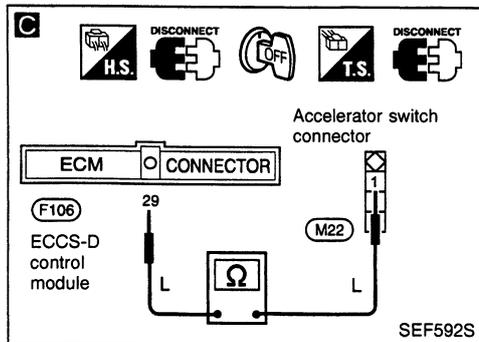
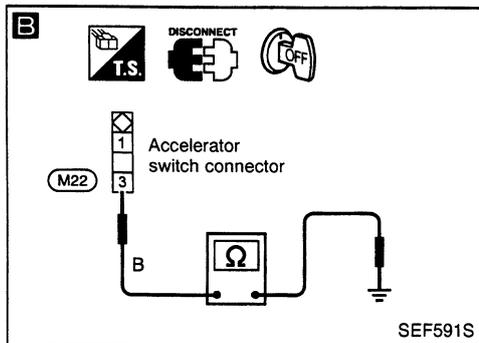
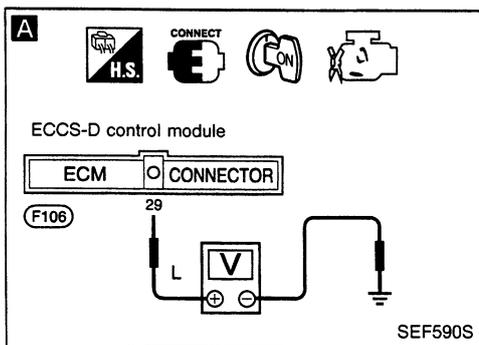
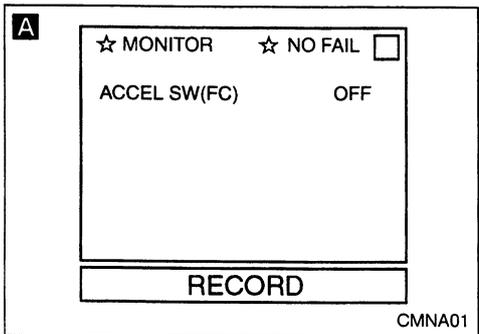
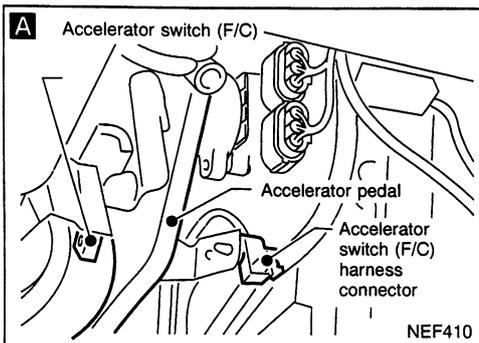
- 1) Turn ignition switch to "ON" position and select "DATA MONITOR" mode with CONSULT.
 - 2) Depress and release accelerator pedal once for 15 seconds.
 - 3) Repeat step 2 for 26 times.
- OR
- 1) Turn ignition switch to "ON" position.
 - 2) Depress and release accelerator pedal once for 15 seconds.
 - 3) Repeat step 2 for 26 times.
 - 4) Turn ignition switch to "LOCK" position, wait at least 5 seconds and then turn to "ON" position.
 - 5) Perform "Diagnostic Test Mode II (Self-diagnostic results)".

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

EC-APP/SW-01



**Accelerator Switch (F/C) (Cont'd)
DIAGNOSTIC PROCEDURE**



INSPECTION START

A

CHECK OVERALL FUNCTION.

1. Turn ignition switch to "ON" position.

2. Check "ACCEL SW (F/C)" in "DATA MONITOR" mode with CONSULT.

Accelerator pedal released:
OFF

Accelerator pedal depressed:
ON

OR

1. Turn ignition switch to "ON" position.

2. Check voltage between ECM (ECCS-D control module) connector terminal ② and ground.

Voltage:
Accelerator pedal released
Battery voltage
Accelerator pedal depressed
Approximately 0V

OK → INSPECTION END

B

CHECK GROUND CIRCUIT.

1. Turn ignition switch to "LOCK" position.

2. Loosen and retighten engine ground screws.

3. Disconnect accelerator switch (F/C) harness connector.

4. Check harness continuity between accelerator switch connector terminal ③ and engine ground.

Continuity should exist.
If OK, check harness for short-circuit.

NG → Check the following:
● Harness connectors (M52, F103)
● Harness for open or short-circuit between accelerator switch (F/C) and engine ground.
If NG, repair harness or connectors.

C

CHECK INPUT SIGNAL CIRCUIT.

1. Disconnect ECM (ECCS-D control module) harness connector.

2. Check harness continuity between ECM (ECCS-D control module) connector terminal ② and accelerator switch connector terminal ①.

Continuity should exist.

NG → Check the following:
● Harness connectors (F105, M51)
● Harness for open or short-circuit between accelerator switch (F/C) and ECM (ECCS-D control module).

CHECK COMPONENT
[Accelerator switch (F/C)].
Refer to "COMPONENT INSPECTION" on next page.

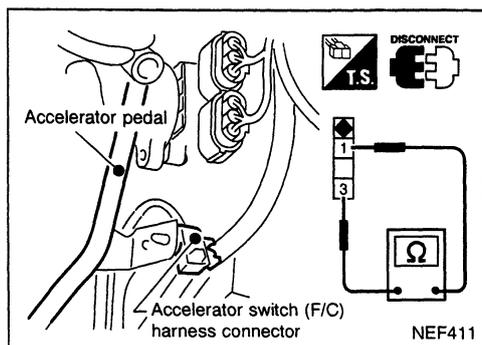
NG → Replace accelerator switch (F/C).

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

Trouble is not fixed.

Check ECM (ECCS-D control module) pin terminals for damage and check the connection of ECM (ECCS-D control module) harness connector. Reconnect ECM (ECCS-D control module) harness connector and retest.

INSPECTION END



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

COMPONENT INSPECTION

Accelerator switch (F/C)

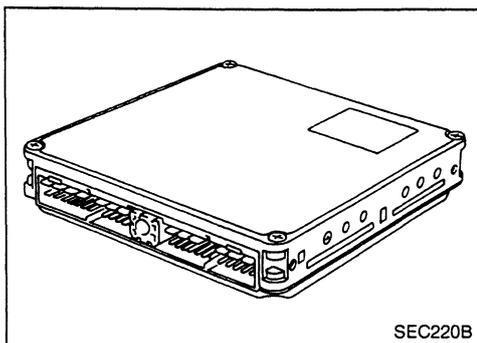
1. Disconnect accelerator switch (F/C) harness connector.
2. Check continuity between accelerator switch connector terminals ① and ③.

Conditions	Continuity
Accelerator pedal released	No
Accelerator pedal depressed	Yes

If NG, replace accelerator pedal assembly.

CAUTION:

- If accelerator position sensor or ECM (ECCS-D control module) connector is disconnected, perform following operation:
 - ① Select "OFF ACCEL PO SIG" in ACTIVE TEST mode. Touch "CLEAR".
 - ⌚ Start and warm up engine. After engine has warmed up, let engine idle for 10 minutes.
- Do not disassemble accelerator pedal assembly.



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

The ECM (ECCS-D control module) consists of a microcomputer and connectors for signal input and output and for power supply. The module monitors and controls the engine operation.

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

DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE



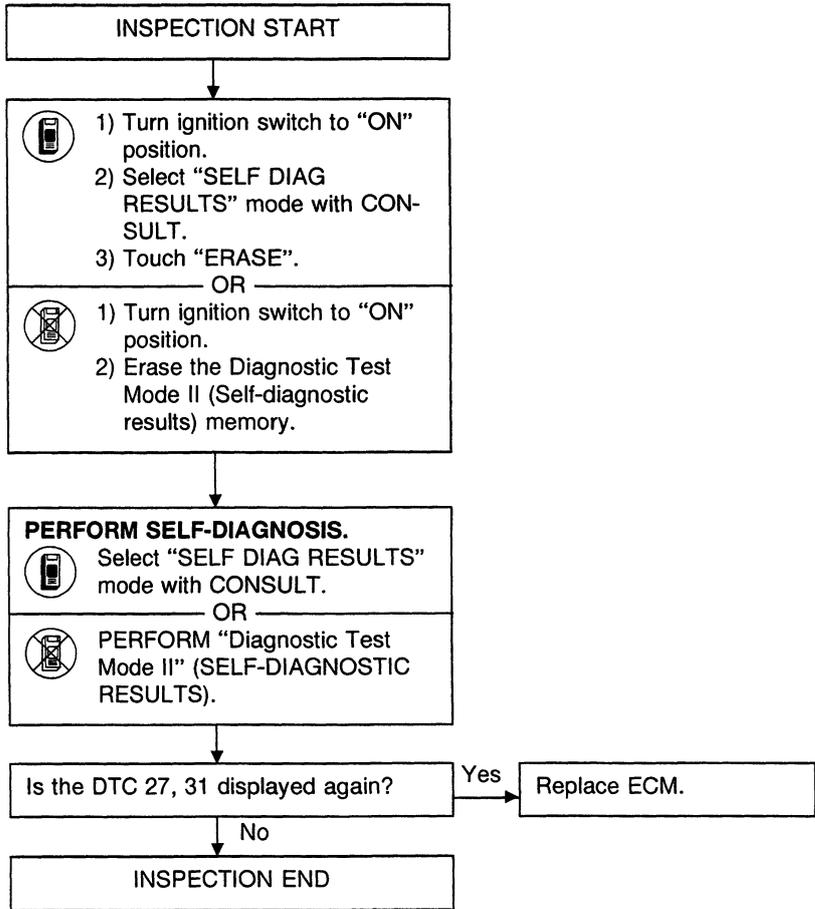
- 1) Turn ignition switch to "ON" position.
- 2) Select "DATA MONITOR" mode with CONSULT.
- 3) Wait at least 2 seconds.

OR



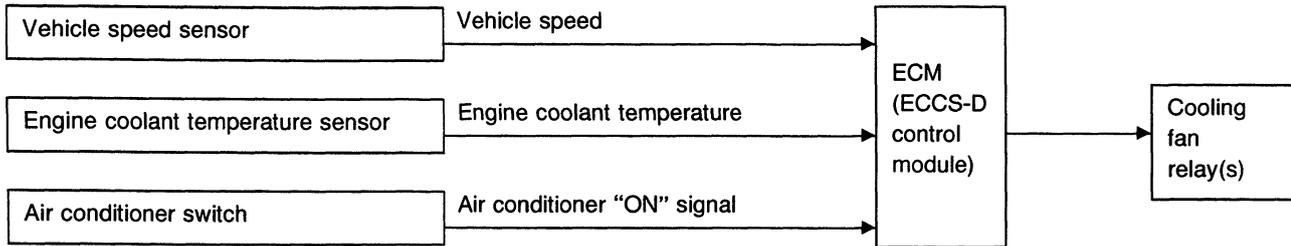
- 1) Turn ignition switch to "ON" position.
- 2) Wait at least 2 seconds.
- 3) Turn ignition switch to "LOCK" position, wait at least 5 seconds and then turn to "ON" position.
- 4) Perform "Diagnostic Test Mode II" (Self-diagnostic results).

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



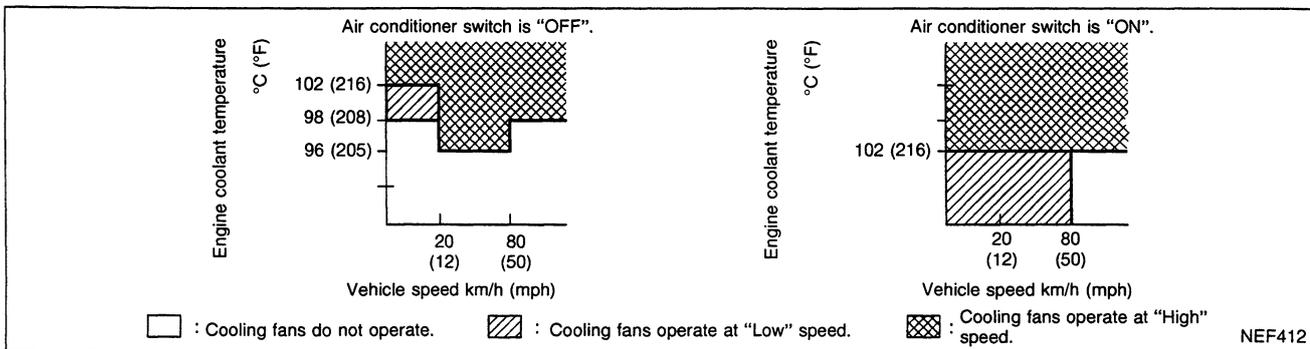
Cooling Fan (Overheat)

SYSTEM DESCRIPTION



The ECM (ECCS-D control module) 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 3-step control [HIGH/LOW/OFF].

Operation



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-397.</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.

- 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").
- After refilling coolant, run engine to ensure that no water-flow noise is emitted.

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.

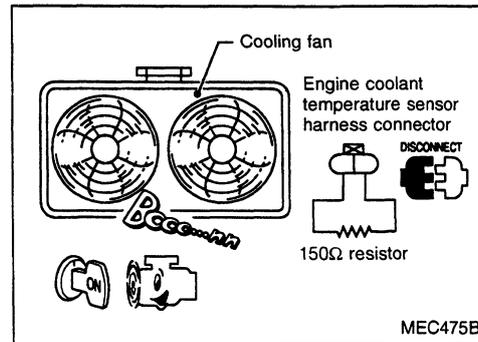
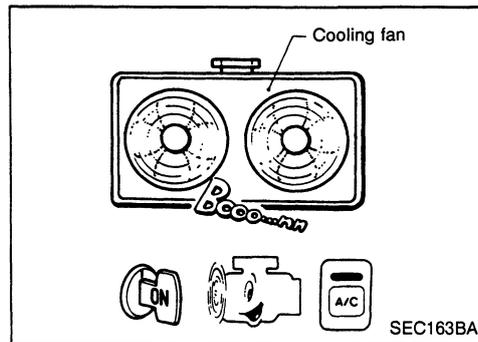
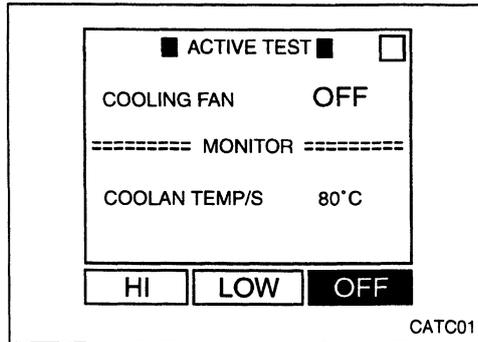
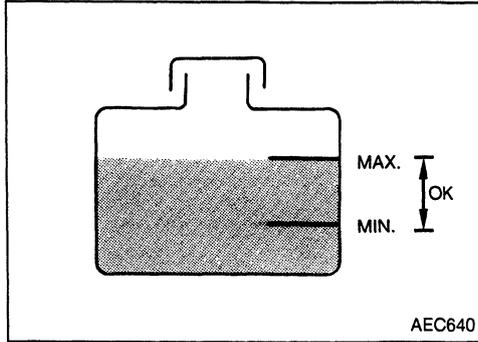
If the coolant level in the reservoir tank and/or radiator is below the proper range, skip the following steps and go to "DIAGNOSTIC PROCEDURE", EC-392.

- 2) Confirm whether customer filled the coolant or not. If customer filled the coolant, skip the following steps and go to "DIAGNOSTIC PROCEDURE", EC-392.

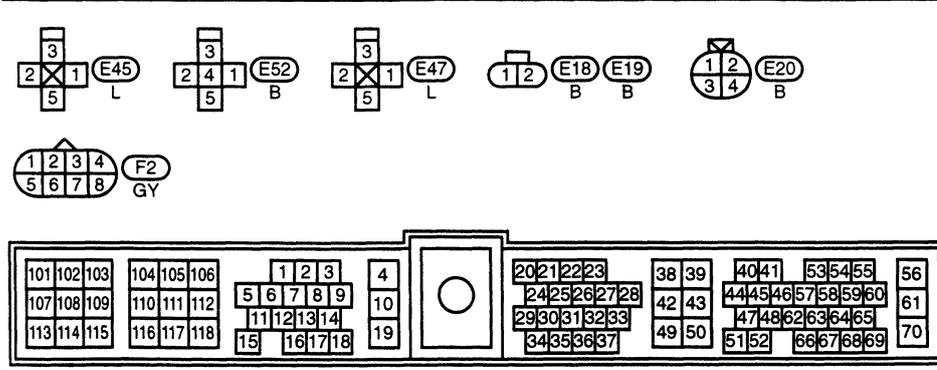
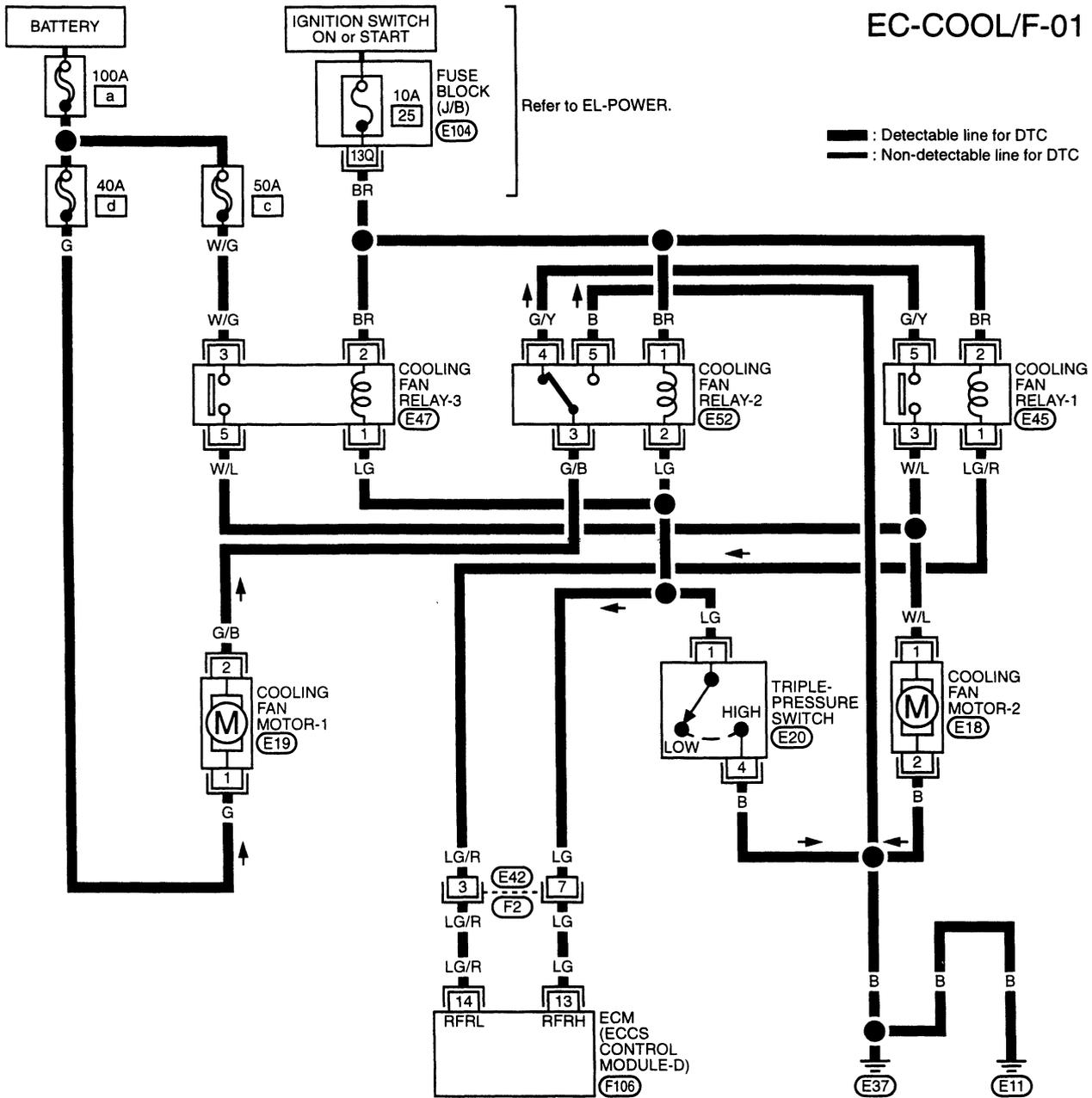
- 3) Turn ignition switch to "ON" position.
- 4) Perform "COOLING FAN" in "ACTIVE TEST" mode with CONSULT (LOW speed and HI speed).

OR

- 3) Start engine.
Be careful not to overheat engine.
- 4) Set temperature control lever to full cold position.
- 5) Push Air Conditioner switch to "ON" position.
- 6) Turn blower fan switch to "ON" position.
- 7) Run engine at idle for a few minutes with Air Conditioner operating.
Be careful not to overheat engine.
- 8) Make sure that cooling fan operates at low speed.
- 9) Turn ignition switch to "LOCK" position.
- 10) Push Air Conditioner switch and turn blower fan switch to "OFF" position.
- 11) Disconnect engine coolant temperature sensor harness connector.
- 12) Connect 150Ω resistor to engine coolant temperature sensor harness connector.
- 13) Restart engine and make sure that cooling fan operates at higher speed than low speed.
Be careful not to overheat engine.



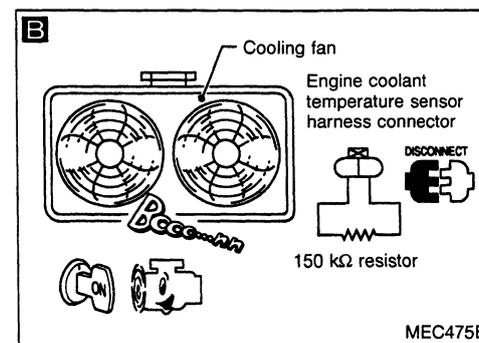
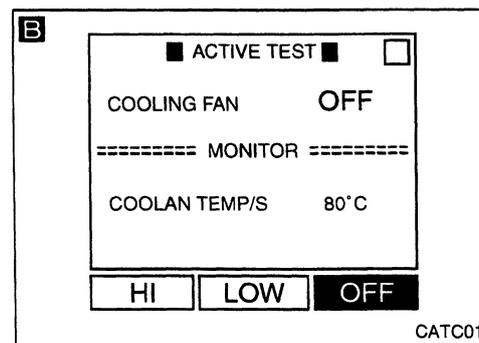
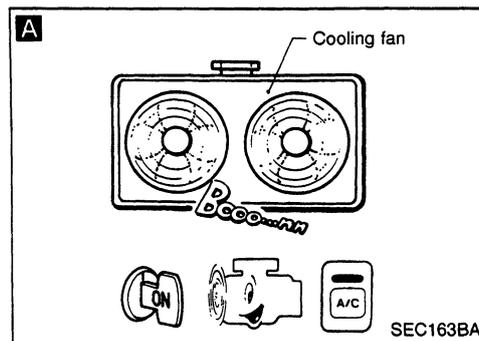
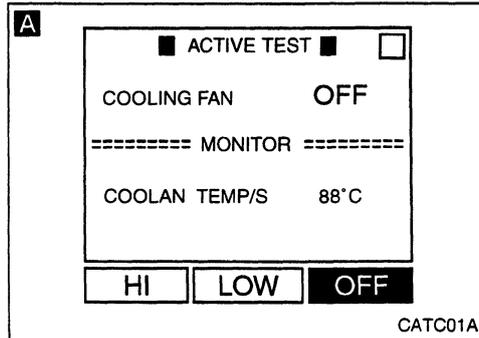
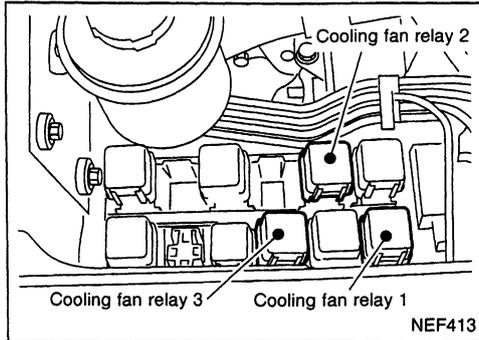
Cooling Fan (Overheat) (Cont'd)



Refer to last page (Foldout page).
E104

Cooling Fan (Overheat) (Cont'd)

DIAGNOSTIC PROCEDURE



INSPECTION START

- A**
- CHECK COOLING FAN LOW SPEED OPERATION.**
1. Disconnect cooling fan relay-3.
 2. Turn ignition switch to "ON" position.
 3. Perform "COOLING FAN" in "ACTIVE TEST" mode with CONSULT.

NG → Check cooling fan low speed control circuit. (Go to **PROCEDURE A** .)

- OR
2. Start engine.
 3. Set temperature lever at full cold position.
 4. Turn Air Conditioner switch to "ON" position.
 5. Turn blower fan switch to "ON" position.
 6. Run engine at idle speed for a few minutes with Air Conditioner operating.
 7. Make sure that cooling fan operates at low speed.

OK

- B**
- CHECK COOLING FAN HIGH SPEED OPERATION.**
1. Turn ignition switch to "LOCK" position.
 2. Reconnect cooling fan relay-3.
 3. Disconnect cooling fan relay-1.
 4. Turn ignition switch to "ON" position.
 5. Perform "COOLING FAN" in "ACTIVE TEST" mode with CONSULT.

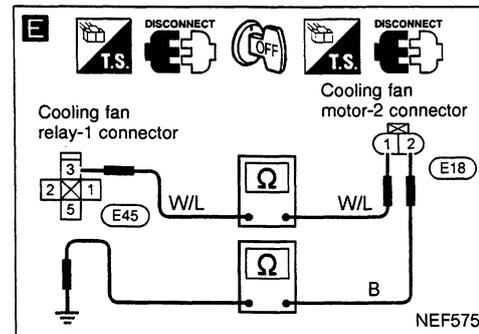
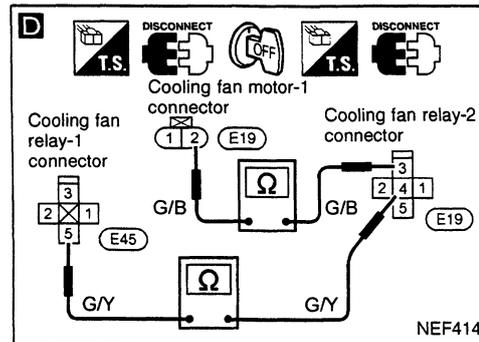
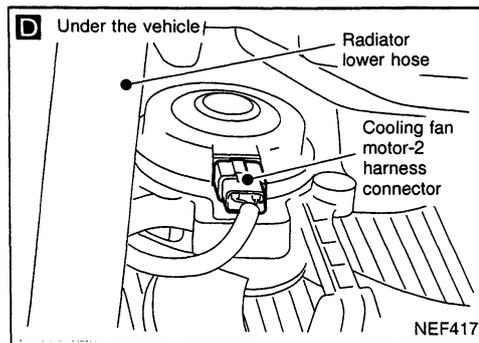
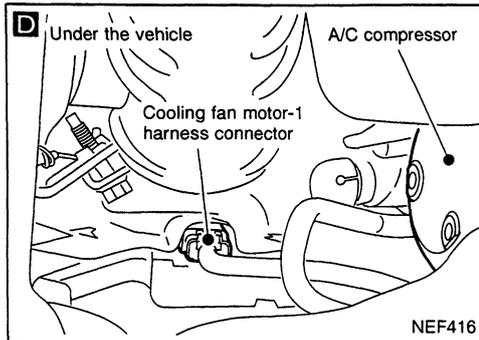
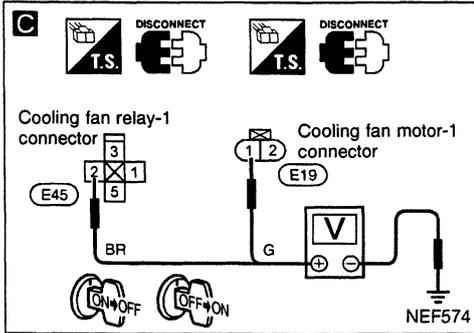
NG → Check cooling fan high speed control circuit. (Go to **PROCEDURE B** .)

- OR
4. Turn Air Conditioner switch and blower fan switch to "OFF" position.
 5. Disconnect engine coolant temperature sensor harness connector.
 6. Connect 150Ω resistor to engine coolant temperature sensor harness connector.
 7. Restart engine and make sure that cooling fan operates at higher speed than low speed.

OK

B
(Go to EC-396.)

Cooling Fan (Overheat) (Cont'd)



PROCEDURE A

INSPECTION START

C

CHECK POWER SUPPLY.

1. Turn ignition switch to "LOCK" position.
2. Disconnect cooling fan relay-1 and fan motor-1 connector.
3. Turn ignition switch to "ON" position.
4. Check voltage between cooling fan motor-1 connector terminal ①, fan relay-1 connector terminal ② and ground with CONSULT or voltage tester.

Voltage: Battery voltage

NG

Check the following:

- 10A fuse
- 40A, 100A, fusible links
- Harness for open or short-circuit between cooling fan motor-1 and battery.
- Harness for open or short-circuit between cooling fan relay-1 and fuse.

If NG, replace fuse or fusible links or repair harness or connectors.

OK

CHECK GROUND CIRCUIT.

1. Turn ignition switch to "LOCK" position.
2. Disconnect cooling fan relay-2 harness connector.
3. Check harness continuity between cooling fan relay-1 connector terminal ⑤ and cooling fan relay-2 connector terminal ④; cooling fan motor-1 connector terminal ② and cooling fan relay-2 connector terminal ③.
4. Check harness continuity between cooling fan motor-2 connector terminal ① and cooling fan relay-1 connector terminal ③.

Continuity should exist.

If OK, check harness for short-circuit.

Continuity should exist.

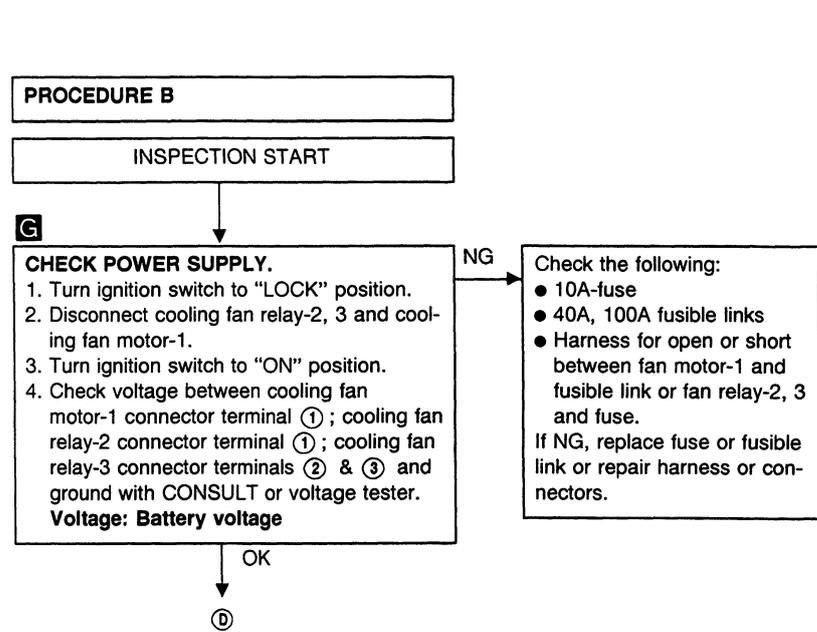
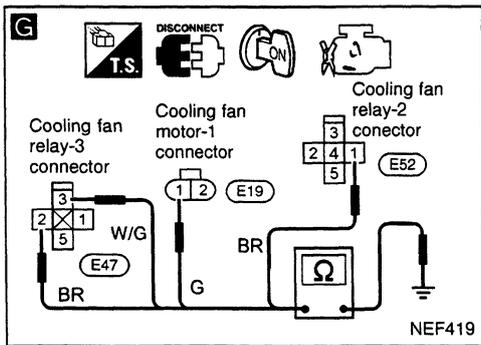
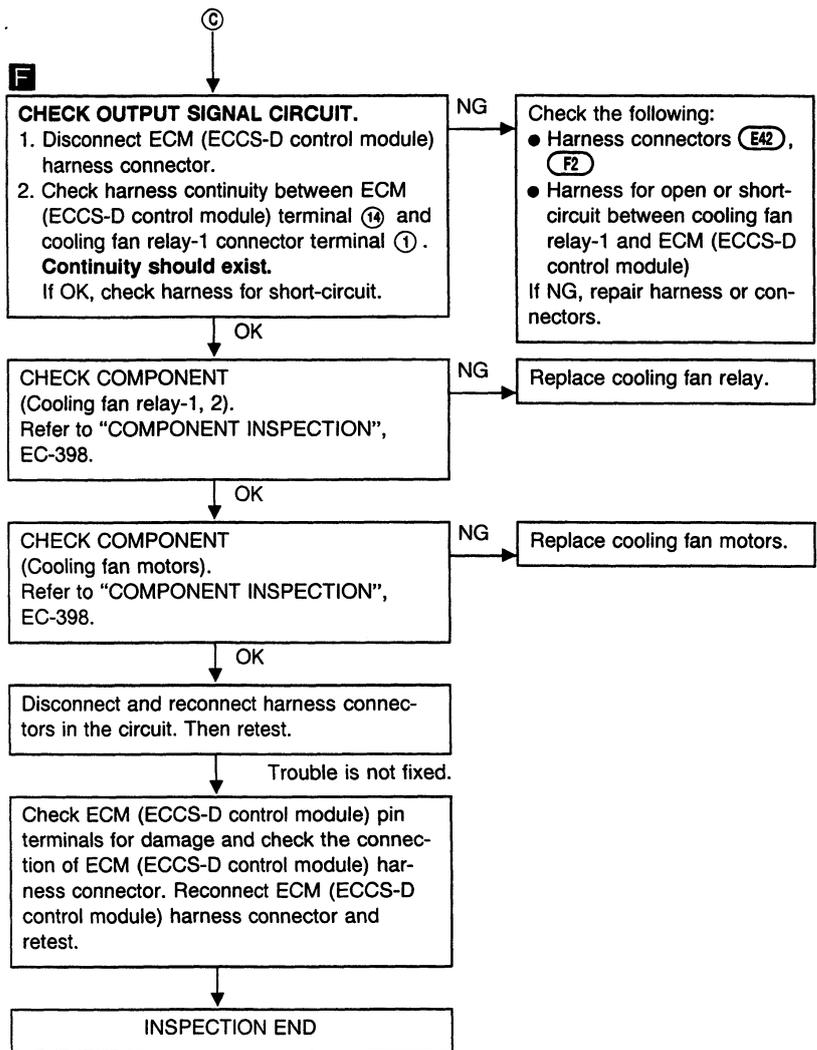
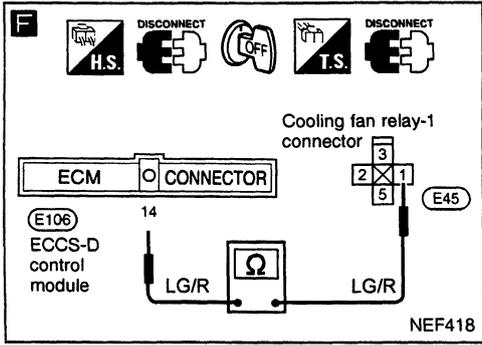
If OK, check harness for short-circuit.

NG

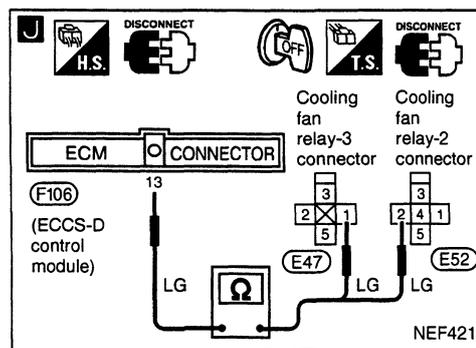
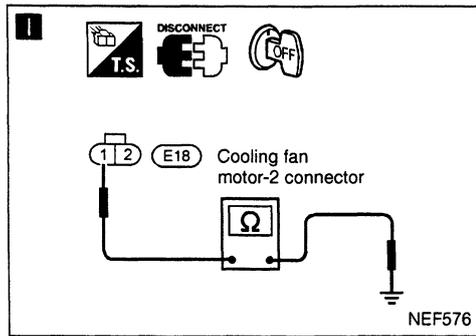
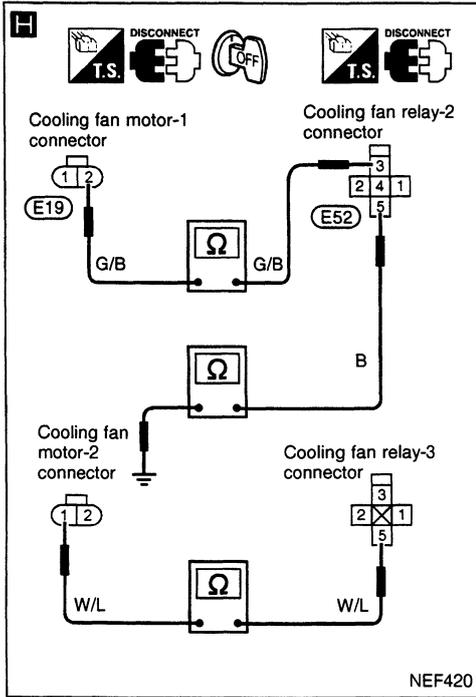
Repair harness or connectors.

OK

ⓐ



Cooling Fan (Overheat) (Cont'd)



D

CHECK GROUND CIRCUIT.

- Turn ignition switch to "LOCK" position.
- Disconnect cooling fan motor-1 harness connector and cooling fan motor-2 harness connector.
- H** Check harness continuity between cooling fan motor-1 connector terminal ② and cooling fan relay-2 connector terminal ③; cooling fan motor-2 connector terminal ① and cooling fan relay-3 connector terminal ⑤; cooling fan relay-2 connector terminal ⑤ and ground.

Continuity should exist.

I Check harness continuity between cooling fan motor-2 and ground.

NG → Repair harness or connectors.

OK

J

CHECK OUTPUT SIGNAL CIRCUIT.

- Disconnect ECM (ECSS-D control module) harness connector.
- Check harness continuity between ECM (ECSS-D control module) terminal ⑬ and cooling fan relay-3 connector terminal ① & cooling fan relay-2 connector terminal ②.

Continuity should exist.

If OK, check harness for short-circuit.

NG → Check the following:
 ● Harness connectors (E42, F2)
 ● Harness for open or short-circuit between cooling fan relay-2, 3 and ECM.
 If NG, repair harness or connectors.

OK

CHECK COMPONENT
 (Cooling fan relay-2, 3).
 Refer to "COMPONENT INSPECTION", EC-398.

NG → Replace cooling fan relays.

OK

CHECK COMPONENTS
 (Cooling fan motors).
 Refer to "COMPONENT INSPECTION", EC-398.

NG → Replace cooling fan motors.

OK

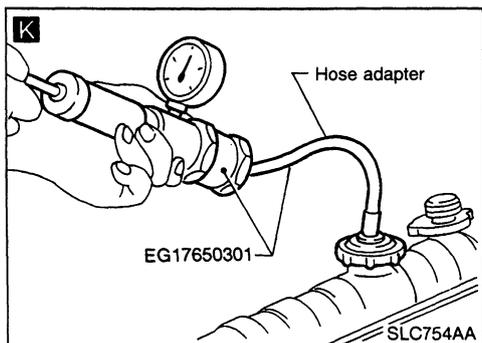
Disconnect and reconnect harness connectors in the circuit. Then retest.

Trouble is not fixed.

Check ECM (ECSS-D control module) pin terminals for damage and check the connection of ECM (ECSS-D control module) harness connector. Reconnect ECM (ECSS-D control module) harness connector and retest.

INSPECTION END

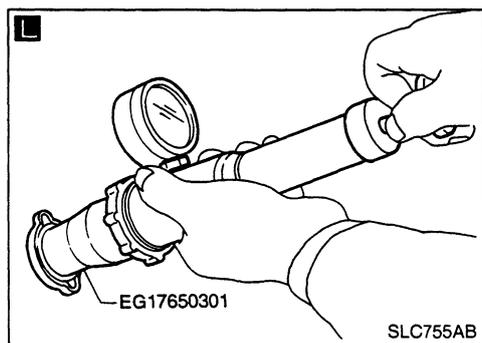
Cooling Fan (Overheat) (Cont'd)



K

CHECK COOLING SYSTEM FOR LEAK.
Apply pressure to the cooling system with a tester, and check if the pressure drops.
Testing pressure:
157 kPa (1.6 kg/cm², 23 psi)
Pressure should not drop.
CAUTION:
Higher than the specified pressure may cause radiator damage.

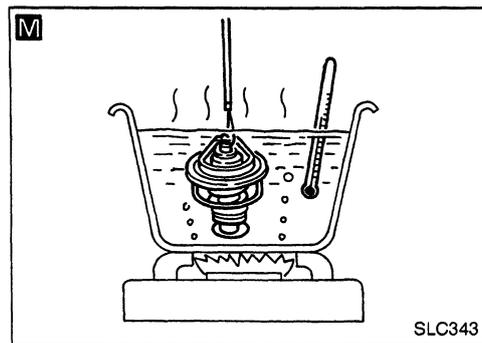
NG → Check the following for leak:
● Hose
● Radiator
● Water pump
Refer to LC section ("Water Pump").



L

CHECK RADIATOR CAP.
Apply pressure to cap with a tester.
Radiator cap relief pressure:
78 - 98 kPa (0.8 - 1.0 kg/cm², 11 - 14 psi)

NG → Replace radiator cap.



M

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:
88°C (190°F) [standard]
Maximum valve lift:
10 mm/100°C (0.39 in/212°F)
3. Check if valve is closed at 5°C (41°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-362.

NG → Replace engine coolant temperature sensor.

OK

If the cause can not 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".

Cooling Fan (Overheat) (Cont'd)

MAIN 12 CAUSES OF OVERHEATING

Engine	Step	Inspection item	Check/Equipment	Condition	Reference page
OFF	1	<ul style="list-style-type: none"> Blocked radiator Blocked condenser 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 	59 - 98 kPa (0.6-1.0 kg/cm ² , 9 - 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-392.
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 (55mph) 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.

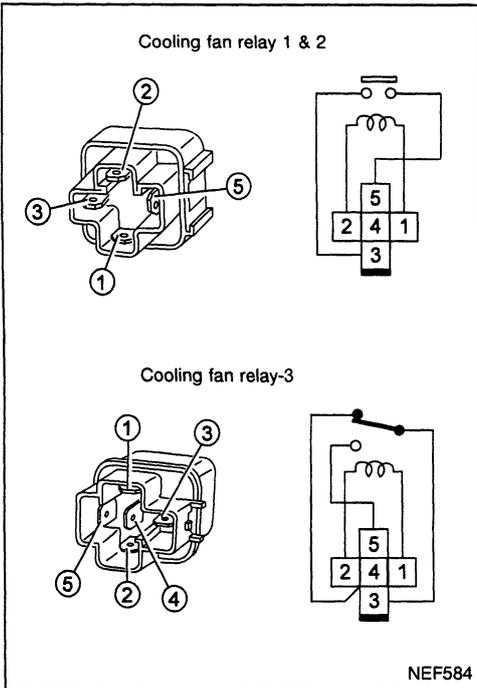
Cooling Fan (Overheat) (Cont'd)
COMPONENT INSPECTION

Cooling fan relays-1, -2, -3

Check continuity between terminals ③ and ⑤.

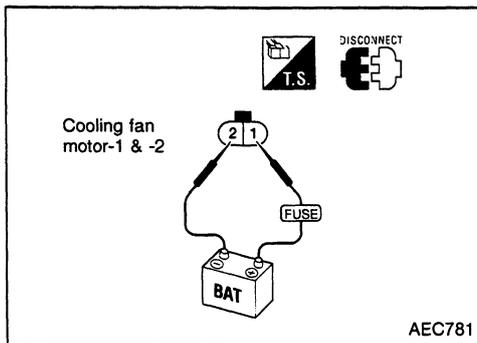
Conditions	Continuity
12V direct current supply between relay terminals ① and ②	Yes
No current supply	No

If NG, replace cooling fan relay.



Cooling fan motors-1 and -2

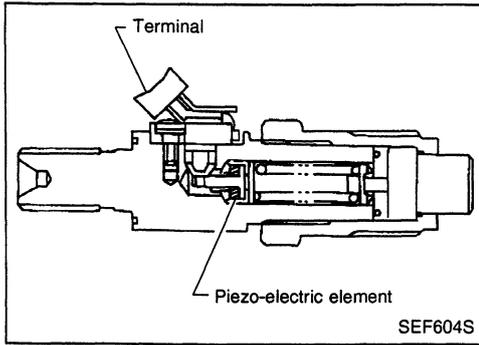
1. Disconnect cooling fan motor harness connectors.
2. Supply cooling fan motor terminals with battery voltage and check operation.



	Terminals	
	(⊕)	(⊖)
Cooling fan motor-1 and -2	①	②

Cooling fan motor should operate.

If NG, replace cooling fan motor.



Needle Lift Sensor (NLS)

The needle lift sensor is built into the No. 1 nozzle. Its piezo-electric 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 (ECCS-D control module).

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 (ECCS-D control module). 	<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

DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE



- 1) Turn ignition switch to "ON" position and select "DATA MONITOR" mode with CONSULT.
- 2) Start engine and run it for at least 15 seconds at idle speed.

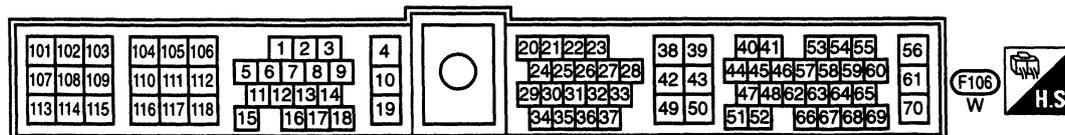
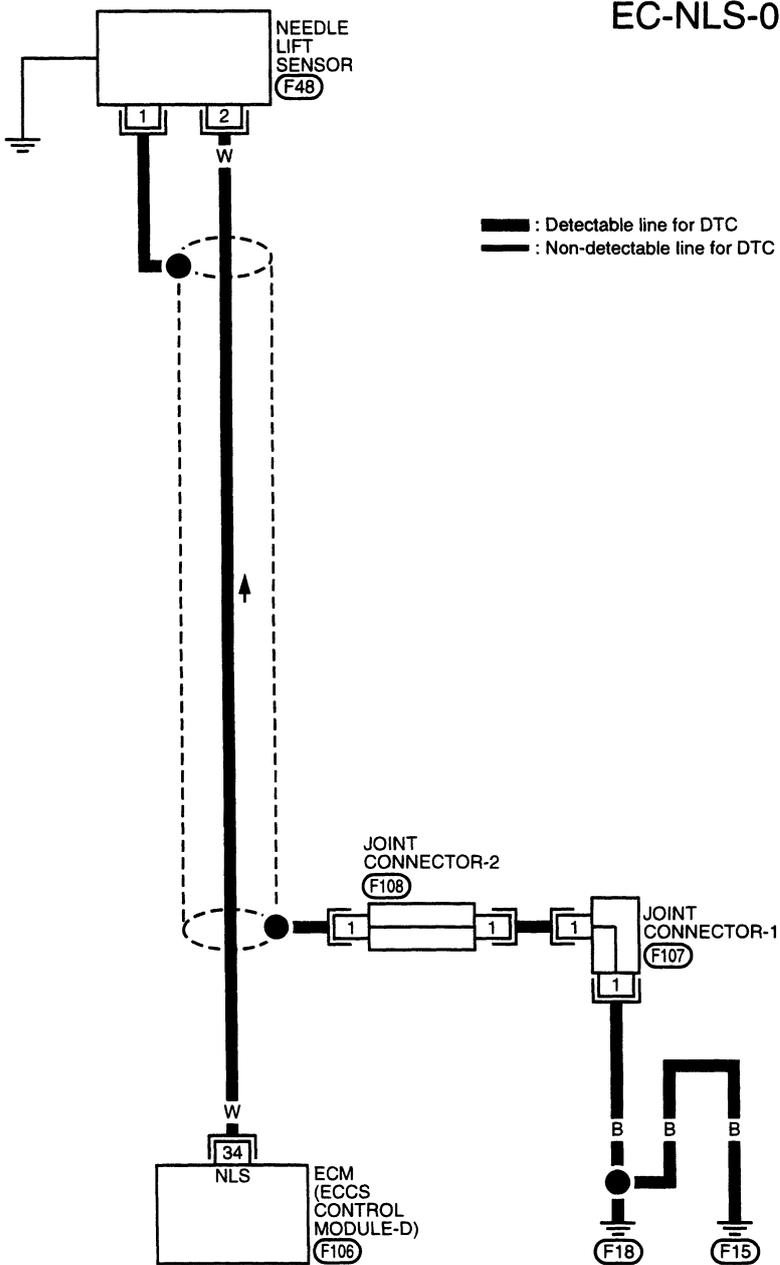
OR



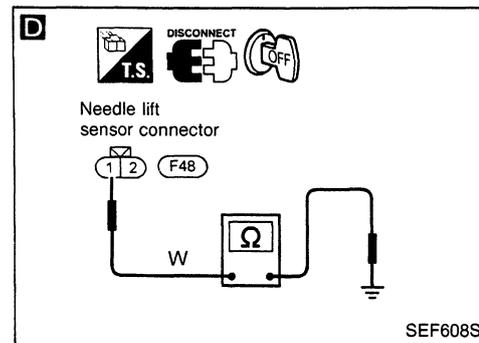
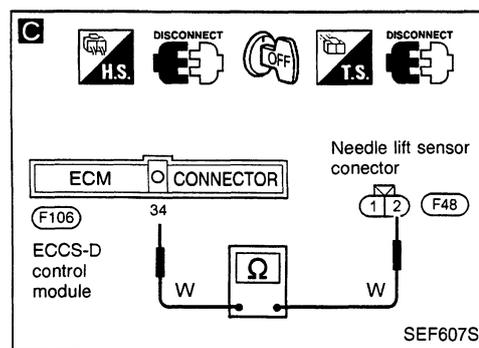
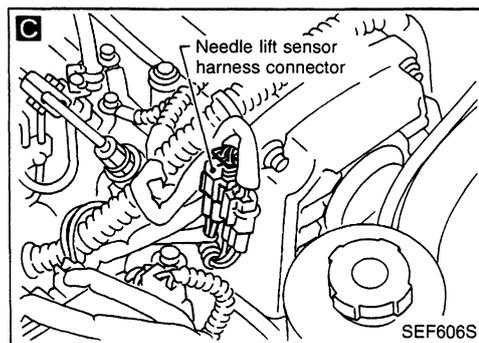
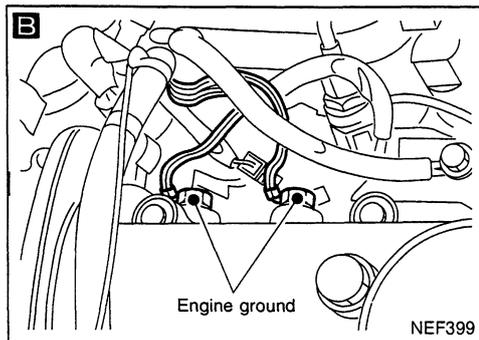
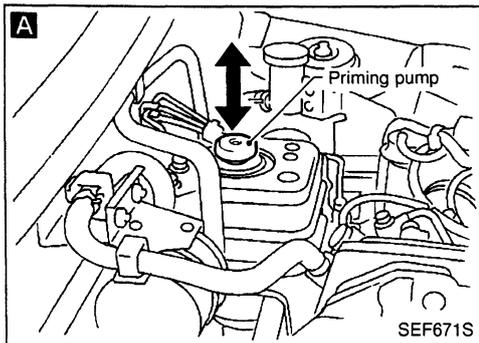
- 1) Start engine and run it for at least 15 seconds at idle speed.
- 2) Turn ignition switch to "LOCK" position, wait at least 5 seconds and then turn to "ON" position.
- 3) Perform "Diagnostic Test Mode II" (Self-diagnostic results).

Needle Lift Sensor (NLS) (Cont'd)

EC-NLS-01



**Needle Lift Sensor (NLS) (Cont'd)
DIAGNOSTIC PROCEDURE**



INSPECTION START

A
CHECK FOR AIR IN FUEL FILTER.
1. Move priming pump up and down to purge air from fuel filter.
2. Perform "DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE".

B
Loosen and retighten engine ground screws.

C
CHECK INPUT SIGNAL CIRCUIT.
1. Turn ignition switch to "LOCK" position.
2. Disconnect ECM (ECCS-D control module) harness connector and needle lift sensor harness connector.
3. Check harness continuity between needle lift sensor connector terminal ② and ECM (ECCS-D control module) connector terminal ③④.
Continuity should exist.
If OK, check harness for short-circuit.

NG → Repair harness or connectors.

D
CHECK GROUND CIRCUIT.
Check resistance between needle lift sensor connector terminal ① and engine ground.
Continuity should exist.
If OK, check harness for short-circuit.

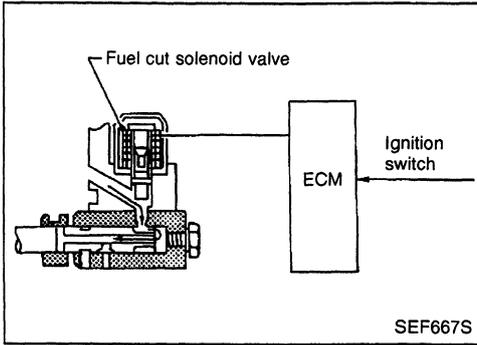
NG → Repair harness or connectors.

CHECK NO. 1 INJECTION NOZZLE FOR CLOGGING.
Refer to spray pattern test of "INJECTION NOZZLE".
If NG, replace No. 1 injection nozzle.

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

Trouble is not fixed.
Check ECM (ECCS-D control module) pin terminals for damage and check the connection of ECM (ECCS-D control module) harness connector. Reconnect ECM (ECCS-D control module) harness connector and retest.

INSPECTION END



Fuel Cut Solenoid Valve

When the ignition switch is OFF, the ECM (ECCS-D control module) 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.

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 (ECCS-D control module) terminals (116), (117) and fuse Harness or connectors (The solenoid valve circuit is shorted.) Fuel cut solenoid valve ECM (ECCS-D control module)

DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE



- 1) Turn ignition switch to "ON" position.
- 2) Select "DATA MONITOR" mode with CONSULT.
- 3) Start engine.
- 4) Turn ignition switch to "LOCK" position, wait at least 5 seconds.

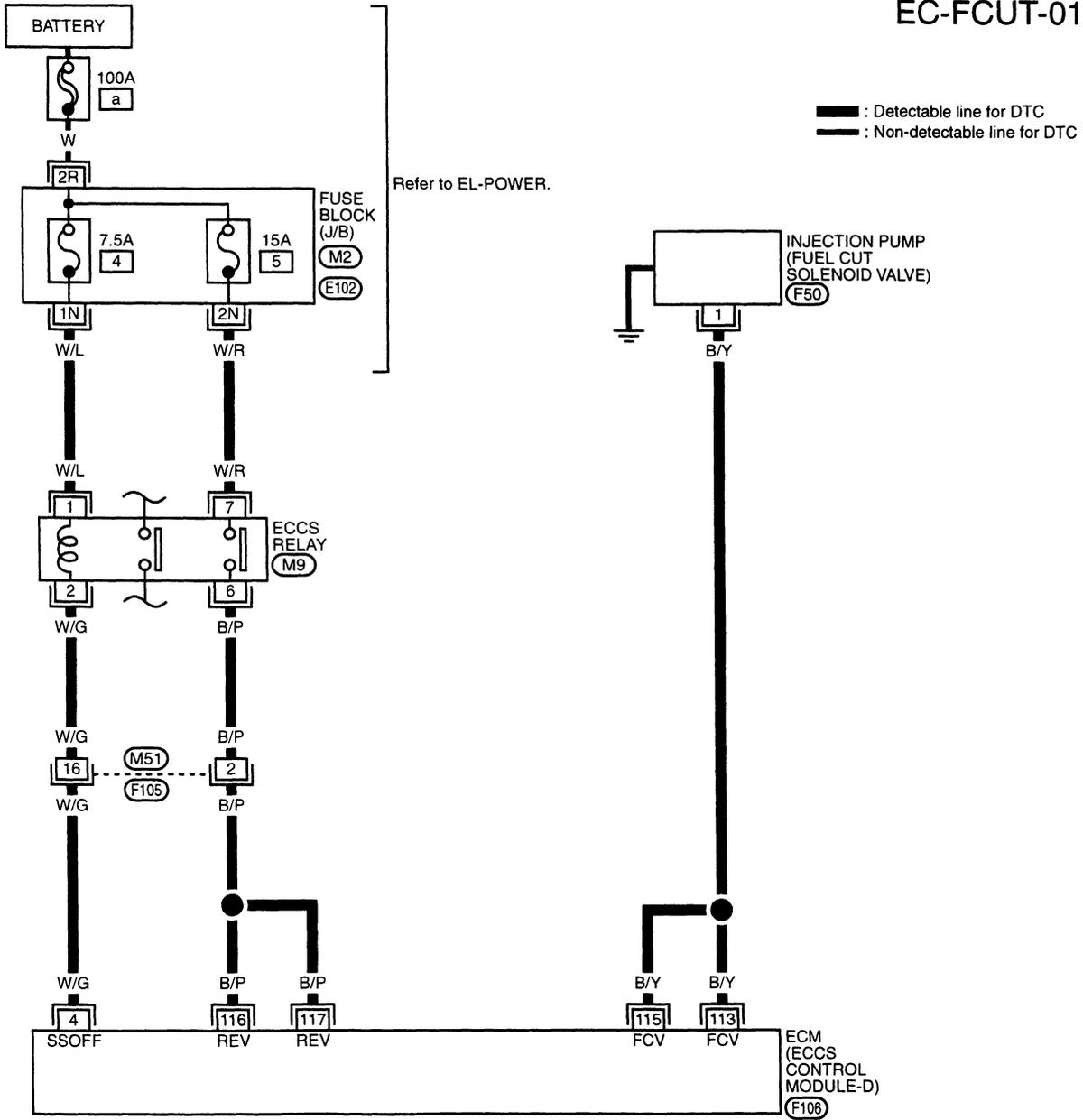
OR



- 1) Start engine.
- 2) Turn ignition switch to "LOCK" position, wait at least 5 seconds and then turn to "ON" position.
- 3) Perform "Diagnostic Test Mode II" (Self-diagnostic results).

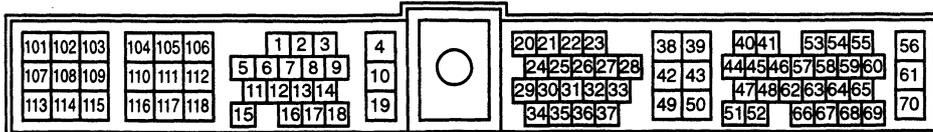
Fuel Cut Solenoid Valve (Cont'd)

EC-FCUT-01

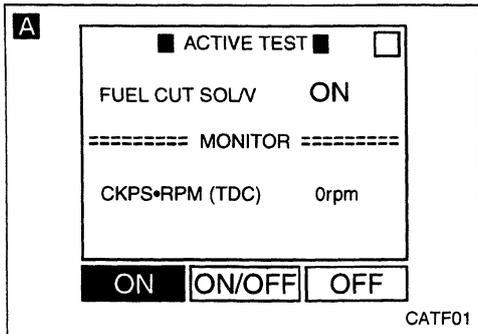
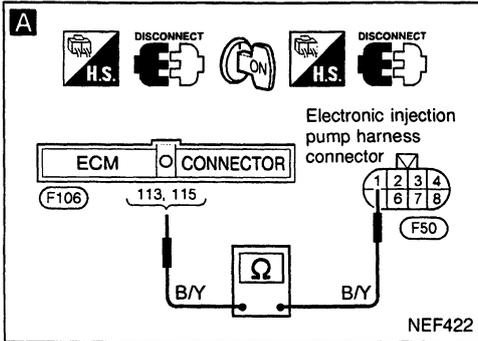
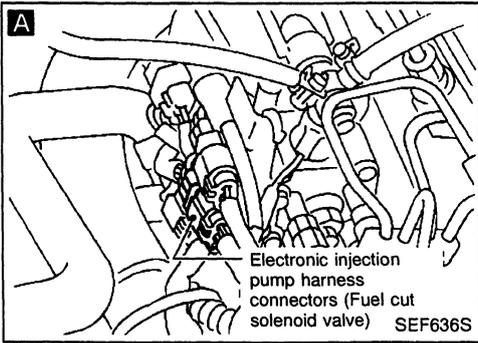


Refer to last page (Foldout page).

(M2), (E102)



Fuel Cut Solenoid Valve (Cont'd)
DIAGNOSTIC PROCEDURE



INSPECTION START

CHECK POWER SUPPLY.
Check power supply. Refer to EC-348.

A
CHECK OUTPUT SIGNAL CIRCUIT.

1. Turn ignition switch to "ON" position.
2. Select "FUEL CUT SOL/V" in "ACTIVE TEST" mode with CONSULT.
3. Touch "ON" and "OFF" alternately.
4. Check that operating sound is emitted.

NG → Repair harness or connectors.

OR

1. Turn ignition switch to "LOCK" position.
2. Disconnect ECM (ECCS-D control module) harness connector and electronic injection pump harness connector.
3. Check harness continuity between terminal ② and ECM (ECCS-D control module) connector terminals ⑪⑤.

Continuity should exist.
If OK, check harness for short.

OK →
CHECK COMPONENT
(Fuel cut solenoid valve).
Refer to "COMPONENT INSPECTION" below.

NG → Replace fuel cut solenoid valve.

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

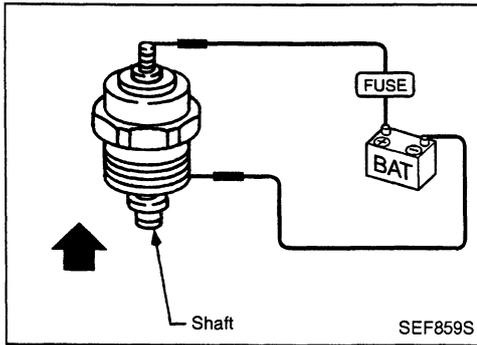
Trouble is not fixed.
Check ECM pin terminals for damage and check the connection of ECM harness connector. Reconnect ECM harness connector and retest.

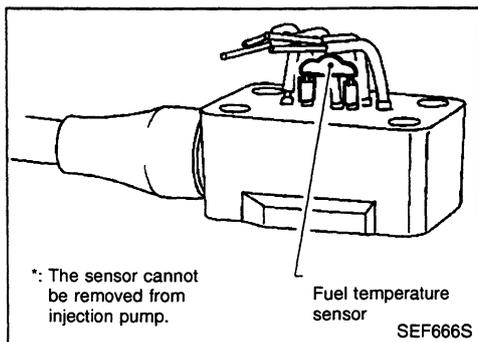
INSPECTION END

Fuel Cut Solenoid Valve (Cont'd)
COMPONENT INSPECTION**Fuel cut solenoid valve**

1. Remove fuel cut solenoid valve.
2. Check for lifting shaft when applying 12V direct current to terminals.

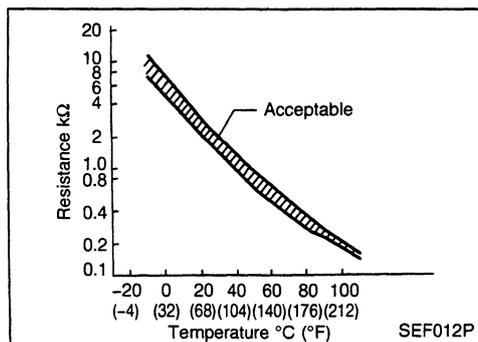
If NG, replace fuel cut solenoid valve.





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 (ECCS-D control module). The modified signal returns to the ECM (ECCS-D control module) 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	13.6 - 16.3
20 (68)	3.5	2.3 - 2.5
25 (77)	3.3	1.9 - 2.1
50 (122)	2.2	0.75 - 0.86
60 (140)	1.8	0.538 - 0.624
80 (176)	1.2	0.289 - 0.344

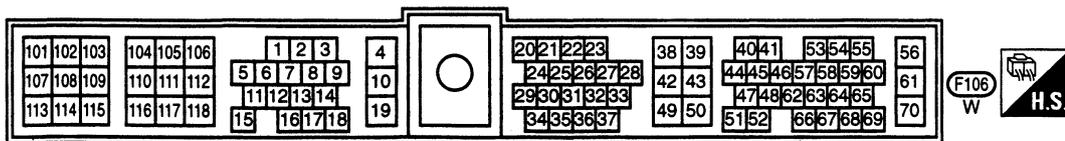
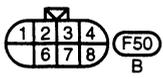
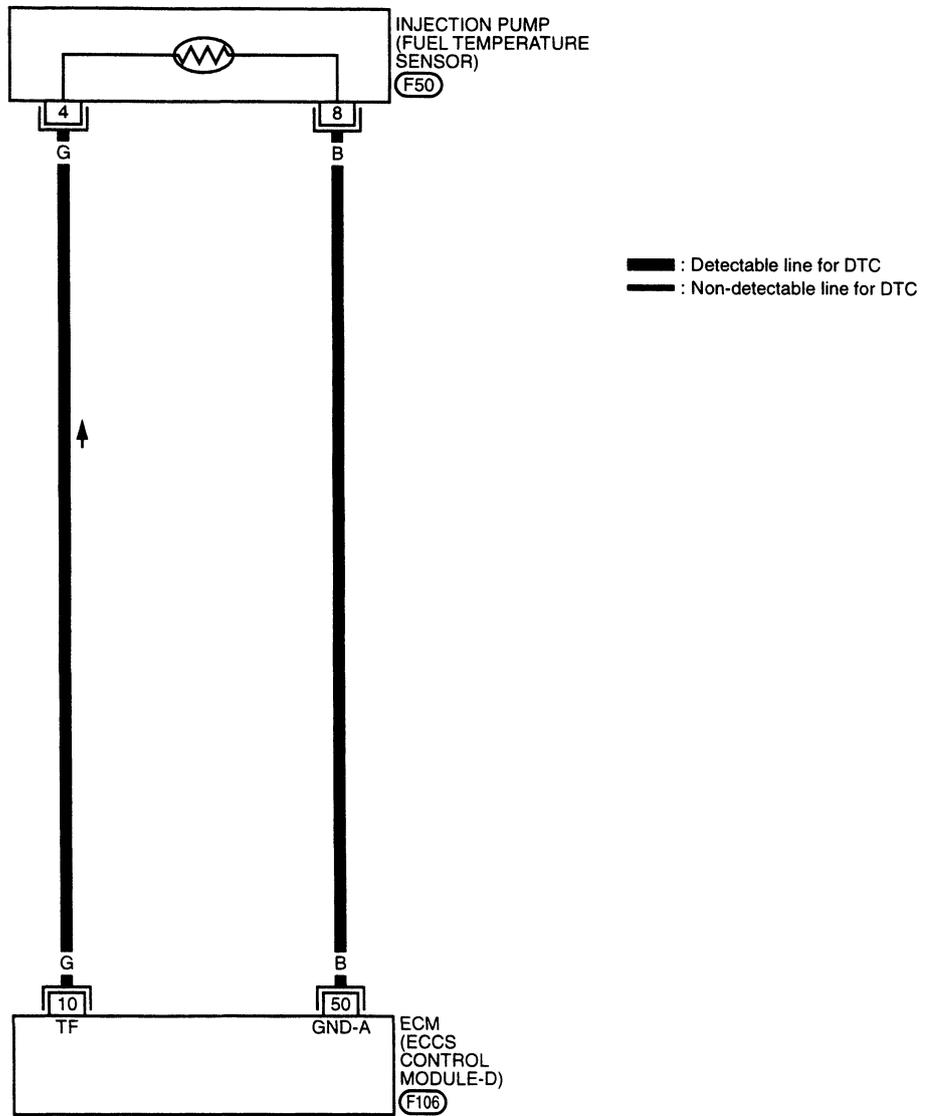
Diagnostic Trouble Code No.	Malfunction is detected when ...	Check Items (Possible Cause)
42	<ul style="list-style-type: none"> An excessively high or low voltage from the sensor is detected by ECM (ECCS-D control module). 	<ul style="list-style-type: none"> Harness or connectors (The sensor circuit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

DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

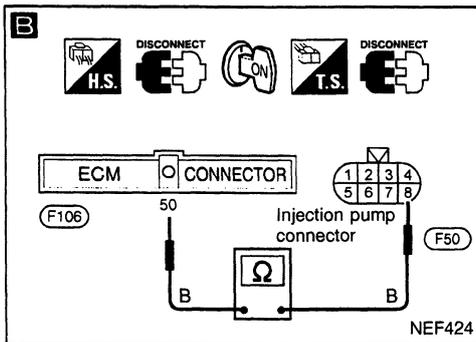
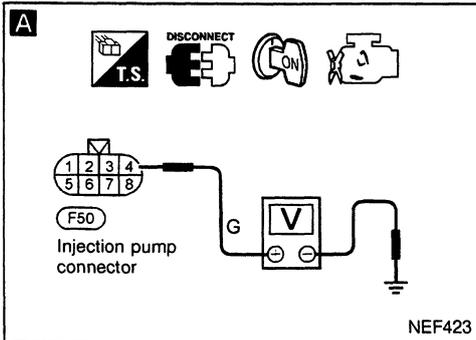
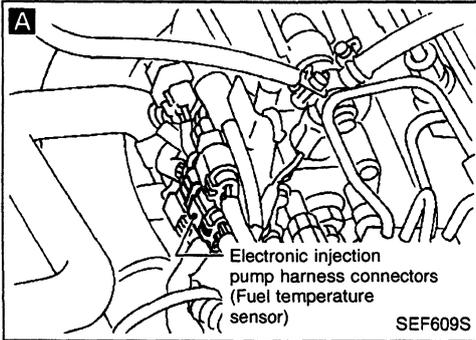
- 1) Turn ignition switch to "ON" position.
 - 2) Select "DATA MONITOR" mode with CONSULT.
 - 3) Wait at least 5 seconds.
- OR
- 1) Turn ignition switch to "ON" position and wait at least 5 seconds.
 - 2) Turn ignition switch to "LOCK" position, wait at least 5 seconds and then turn to "ON" position.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

Fuel Temperature Sensor (FTS) (Cont'd)

EC-FTS-01



**Fuel Temperature Sensor (FTS) (Cont'd)
DIAGNOSTIC PROCEDURE**



INSPECTION START

A
CHECK POWER SUPPLY.
1. Turn ignition switch to "LOCK" position.
2. Disconnect fuel temperature sensor harness connector.
3. Turn ignition switch to "ON" position.
4. Check voltage between injection pump connector terminal ④ and ground with CONSULT or voltage tester.
Voltage:
Approximately 5V

NG → Repair harness or connectors.

B
CHECK GROUND CIRCUIT.
1. Turn ignition switch to "LOCK" position.
2. Check harness continuity between injection pump connector terminal ⑤ and ECM (ECCS-D control module) connector terminal ⑤0.
Continuity should exist.
If OK, check harness for short-circuit.

NG → Repair harness or connectors.

CHECK COMPONENT
(Fuel temperature sensor).
Refer to "COMPONENT INSPECTION" on next page.

NG → Have the injection pump assembly serviced by an authorised service representative.

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

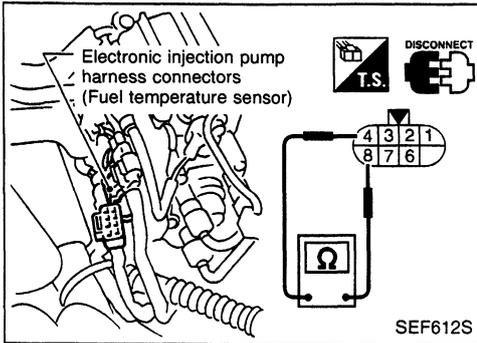
Trouble is not fixed.
Check ECM (ECCS-D control module) pin terminals for damage and check the connection of ECM (ECCS-D control module) harness connector. Reconnect ECM (ECCS-D control module) harness connector and retest.

INSPECTION END

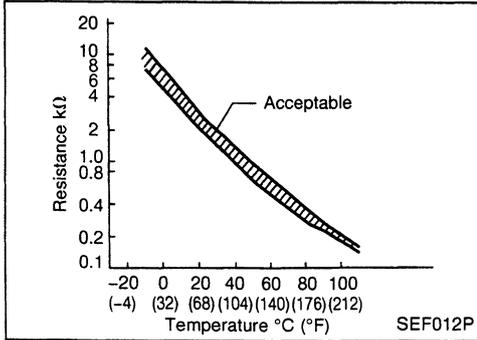
**Fuel Temperature Sensor (FTS) (Cont'd)
COMPONENT INSPECTION**

Fuel temperature sensor

Wait until fuel temperature sensor reaches room temperature.
Check resistance between terminals ④ and ⑧.



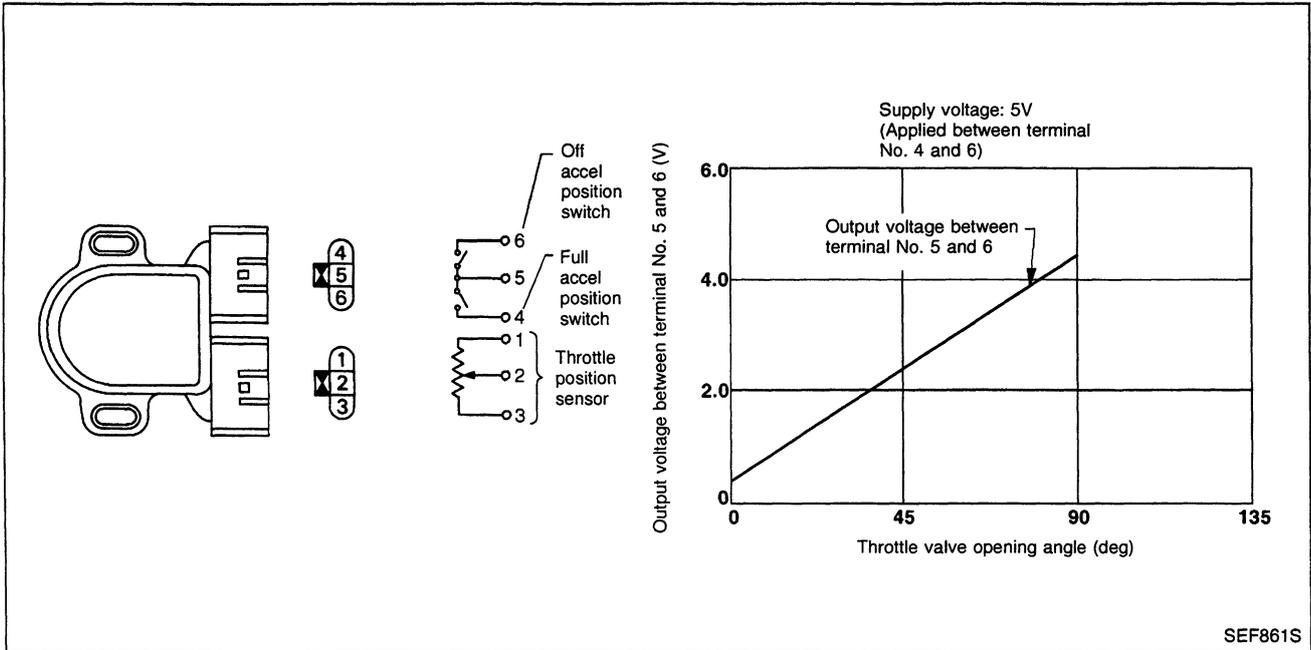
Temperature °C (°F)	Resistance kΩ
20 (68)	2.3 - 2.5
25 (77)	1.9 - 2.1
50 (122)	0.75 - 0.86
60 (140)	0.538 - 0.624
80 (176)	0.289 - 0.344



If NG, have the injection pump assembly serviced by an authorised service representative.

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 (ECCS-D control module). The ECM (ECCS-D control module) uses the signal to determine the amount of fuel to be injected.



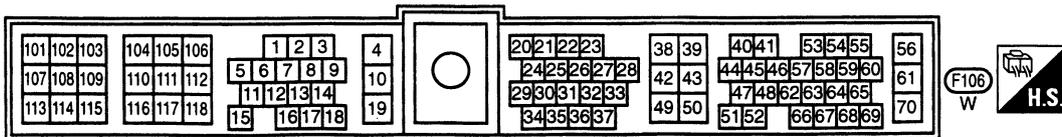
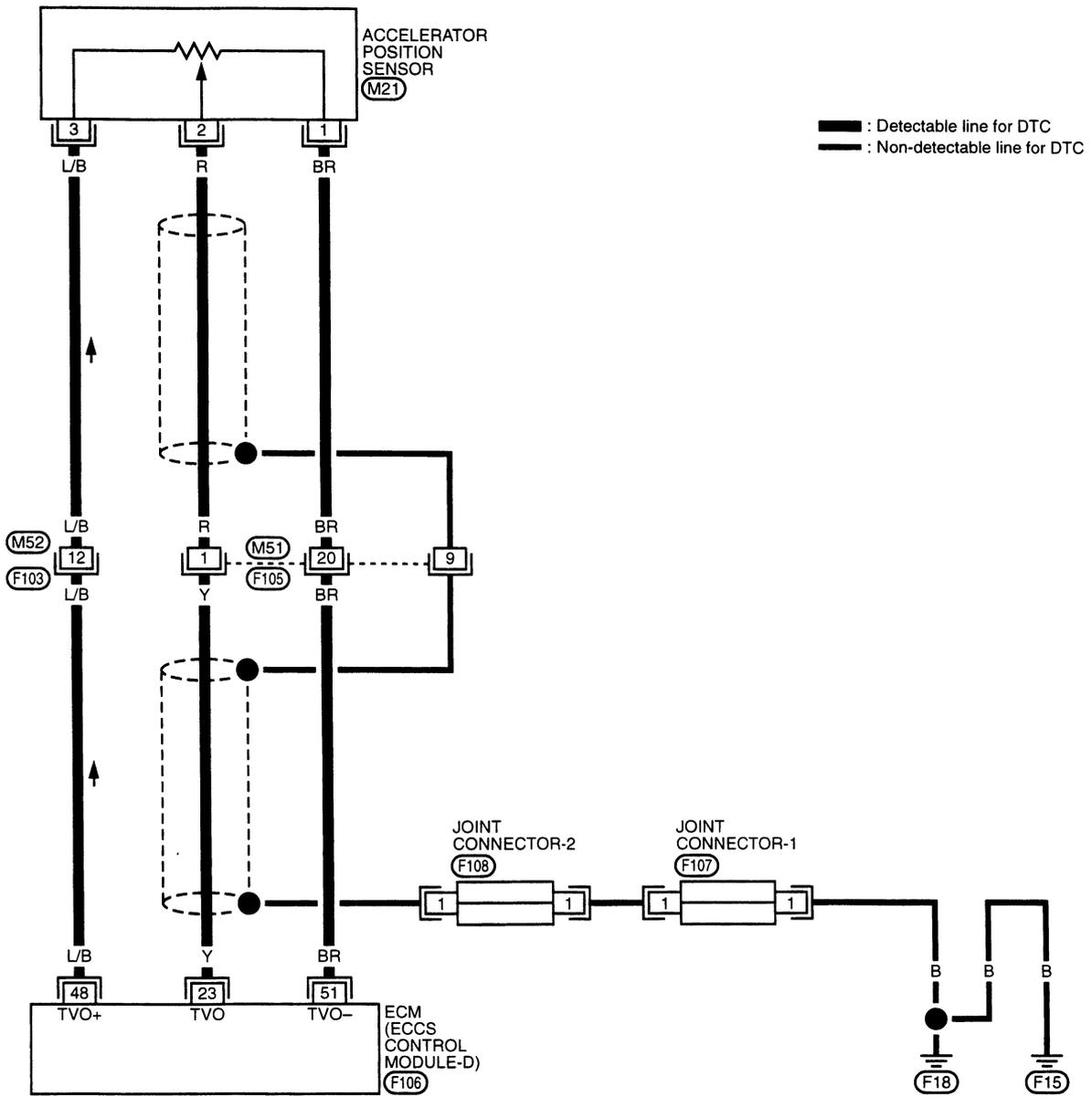
Diagnostic Trouble Code No.	Malfunction is detected when ...	Check Items (Possible Cause)
43	<ul style="list-style-type: none"> An excessively low or high voltage from the sensor is detected by the ECM (ECCS-D control module). 	<ul style="list-style-type: none"> Harness or connectors (The sensor circuit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

DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

- 1) Turn ignition switch to "ON" position.
 - 2) Select "DATA MONITOR" mode with CONSULT.
 - 3) Wait at least 2 seconds.
- OR
- 1) Turn ignition switch to "ON" position and wait at least 2 seconds.
 - 2) Turn ignition switch to "LOCK" position, wait at least 5 seconds and then turn to "ON" position.
 - 3) Perform "Diagnostic Test Mode II (Self-diagnostic results)".

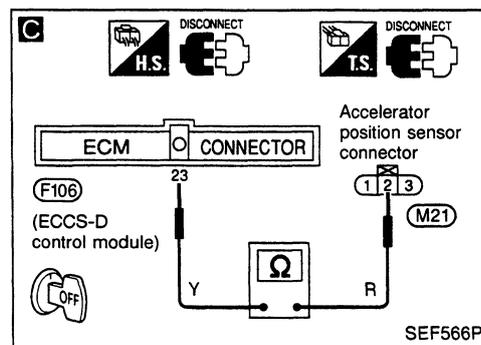
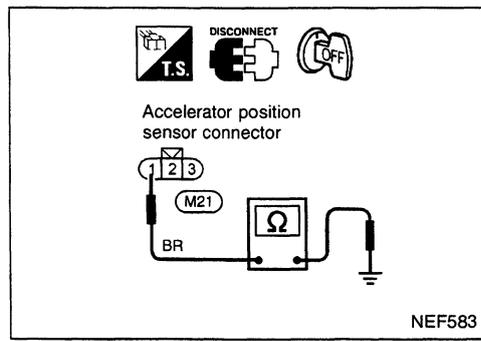
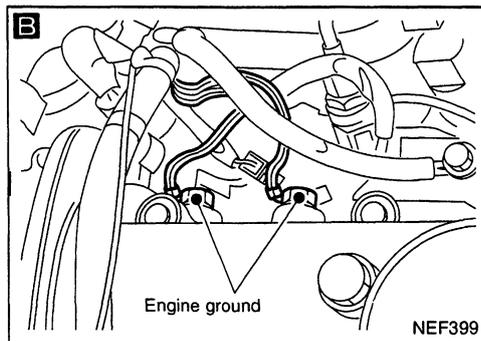
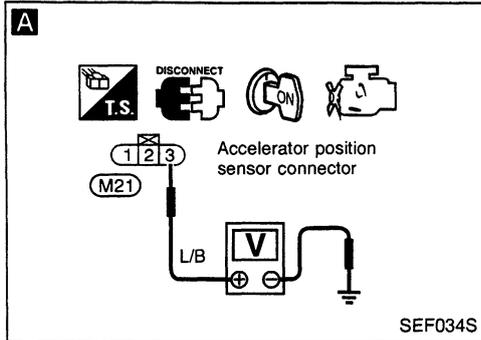
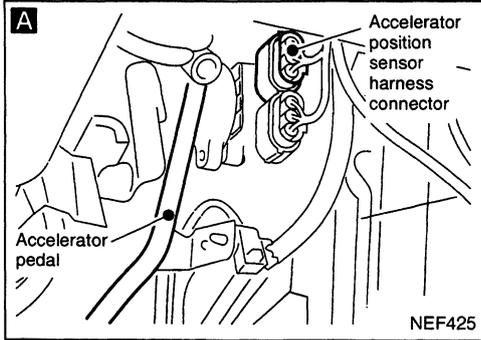
Accelerator Position Sensor (Cont'd)

EC-APS-01



SEF434S

Accelerator Position Sensor (Cont'd)
DIAGNOSTIC PROCEDURE



INSPECTION START

A

CHECK POWER SUPPLY.

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

NG → Check the following:
 ● Harness connectors (M52), (F103)
 ● Harness for open or short-circuit between ECM (ECSS-D control module) and accelerator position sensor.
 If NG, repair harness or connectors.

OK ↓

B

CHECK GROUND CIRCUIT.

1. Turn ignition switch to "LOCK" position.
2. Loosen and retighten engine ground screw.
3. Check harness continuity between accelerator position sensor connector terminal ① and engine ground.
Continuity should exist.
If OK, check harness for short-circuit.

NG → Check the following:
 ● Harness connectors (M51), (F105)
 ● Harness for open or short-circuit between ECM (ECSS-D control module) and accelerator position sensor.
 If NG, repair harness or connectors.

OK ↓

C

CHECK INPUT SIGNAL CIRCUIT.

1. Disconnect ECM (ECSS-D control module) harness connector.
2. Check harness continuity between ECM (ECSS-D control module) terminal ③ and accelerator position sensor connector terminal ②.
Continuity should exist.
If OK, check harness for short-circuit.

NG → Repair harness or connectors.

OK ↓

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

NG → Replace accelerator pedal assembly.

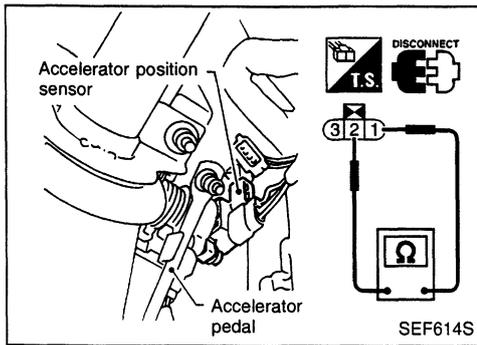
OK ↓

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

Trouble is not fixed.

Check ECM (ECSS-D control module) pin terminals for damage and check the connection of ECM (ECSS-D control module) harness connector. Reconnect ECM (ECSS-D control module) harness connector and retest.

INSPECTION END



Accelerator Position Sensor (Cont'd)

COMPONENT INSPECTION

Accelerator position sensor

1. Disconnect accelerator position sensor harness connector.
2. Make sure that resistance between accelerator position sensor terminals ① and ② changes when opening throttle valve manually.

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

If NG, replace accelerator pedal assembly.

CAUTION:

- If accelerator position sensor or ECM (ECCS-D control module) connector is disconnected, perform following operation:

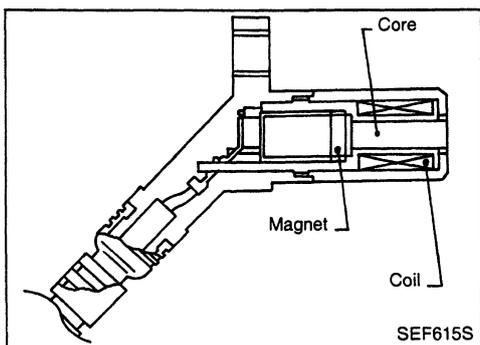


Select "OFF ACCEL PO SIG" in ACTIVE TEST mode. Touch "CLEAR".



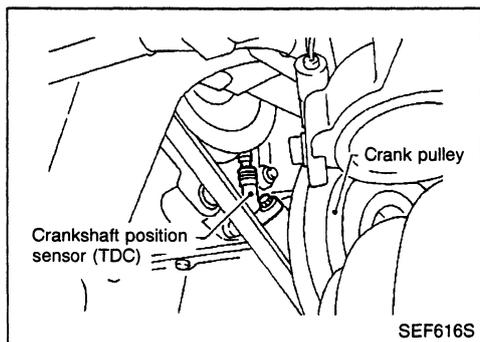
Start and warm up engine. After engine was warmed up, let engine idle for 10 minutes.

- Do not disassemble accelerator pedal assembly.



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 (ECCS-D control module). The sensor signal is used for fuel injection control and fuel injection timing control.



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

DIAGNOSTIC TROUBLE CODE CONFIRMATION PROCEDURE

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



- 1) Turn ignition switch to "ON" position and select "DATA MONITOR" mode with CONSULT.
- 2) Turn ignition switch to "START" position and keep it there for more than 0.5 seconds.
- 3) Start engine and run it for at least 2 seconds at idle speed.

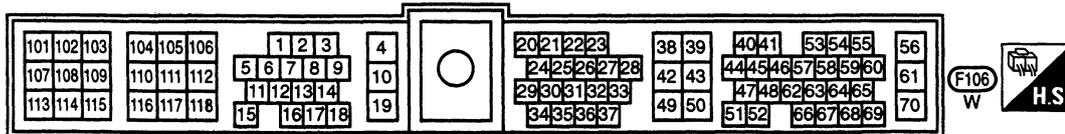
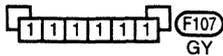
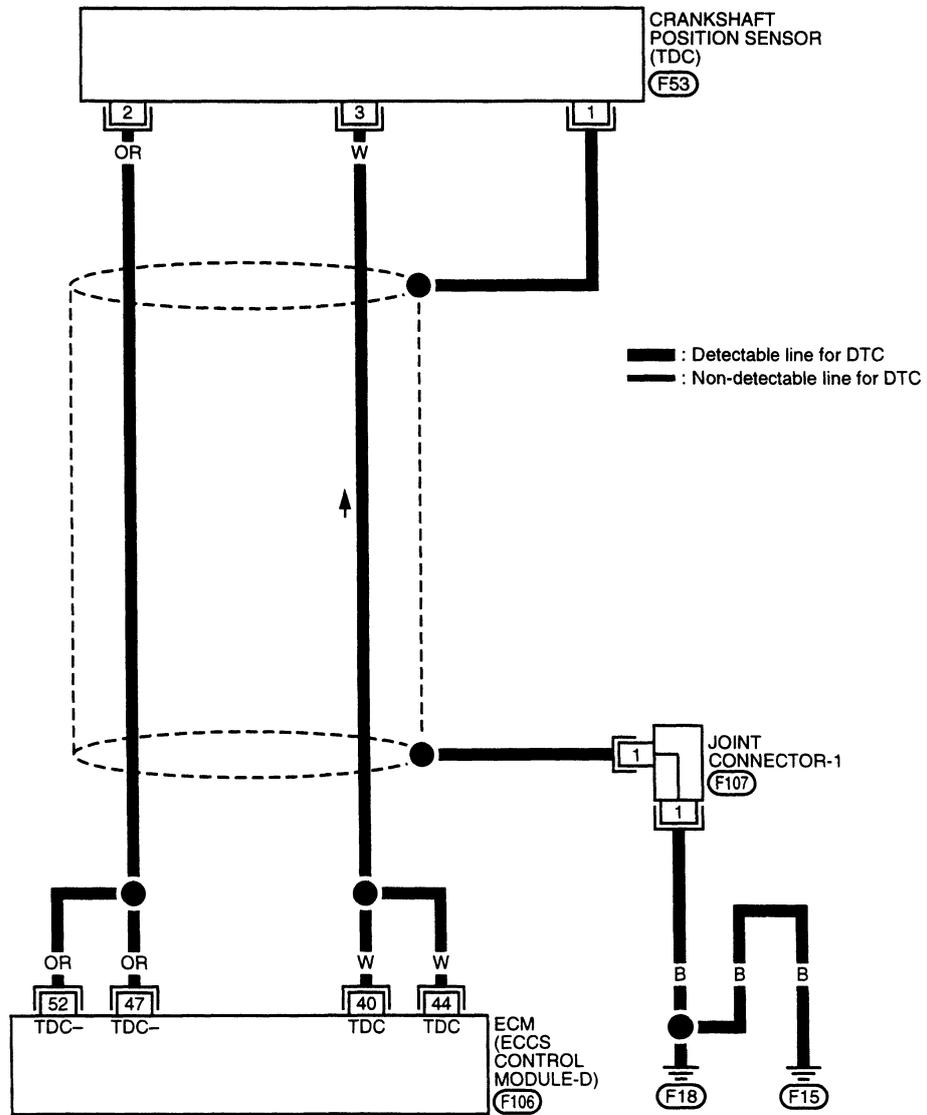
OR



- 1) Turn ignition switch to "START" position and keep it more than 0.5 seconds.
- 2) Start engine and run it for at least 2 seconds at idle speed.
- 3) Turn ignition switch to "LOCK" position, wait at least 5 seconds and then turn to "ON" position.
- 4) Perform "Diagnostic Test Mode II" (Self-diagnostic results).

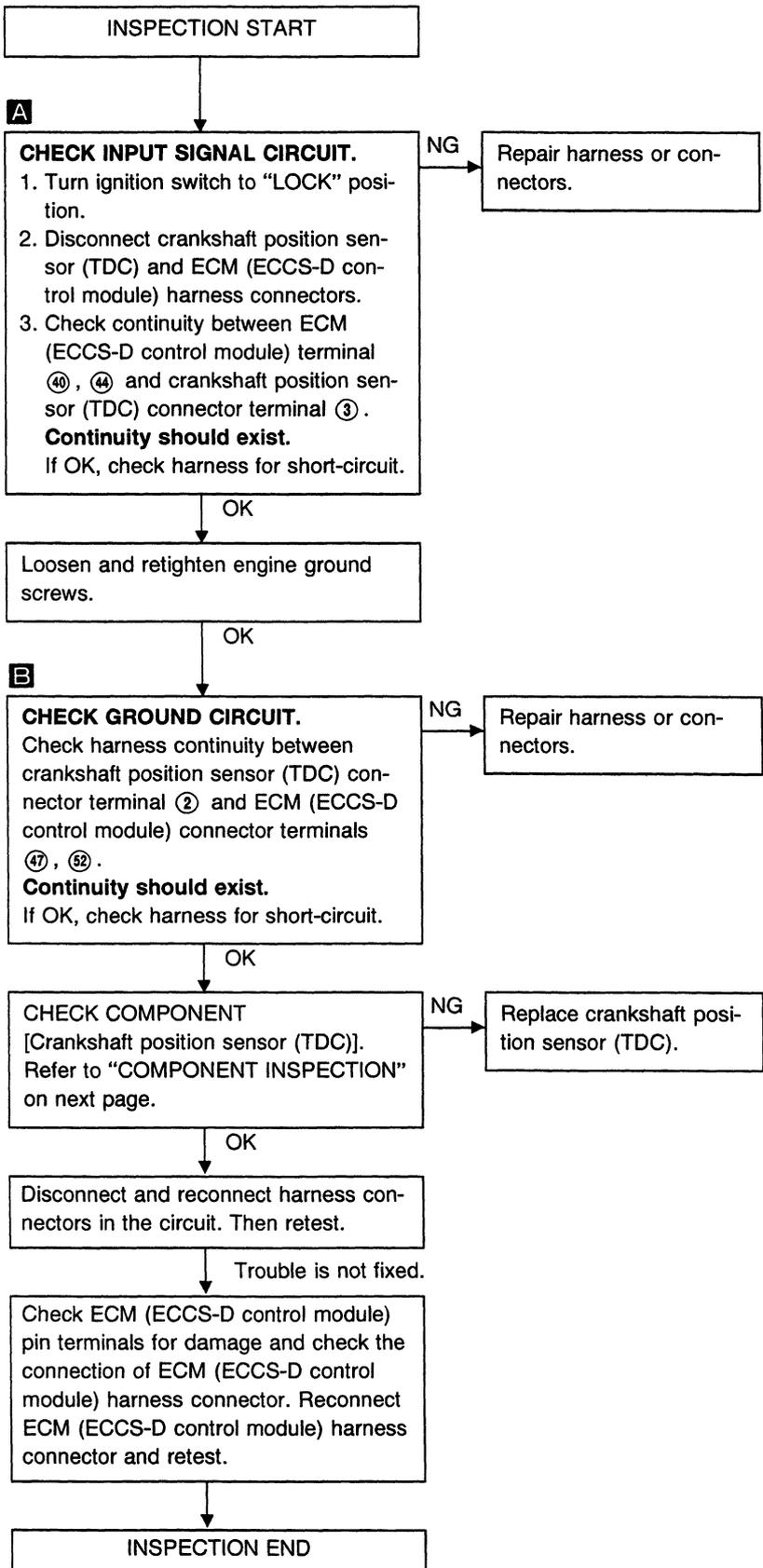
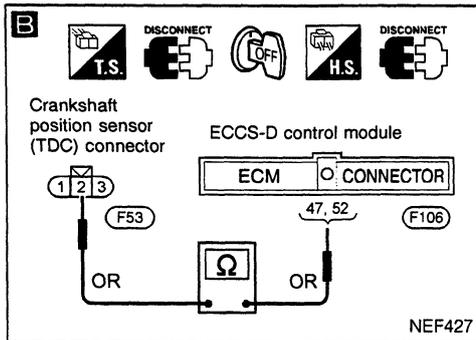
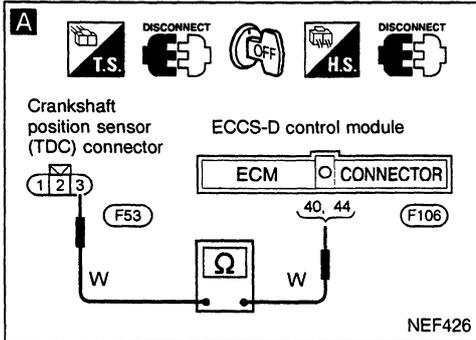
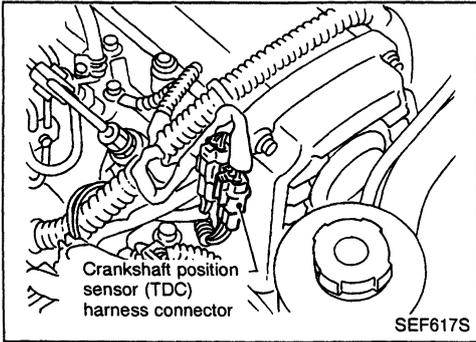
Crankshaft Position Sensor (TDC) (Cont'd)

EC-CKPS-01



SEF435S

**Crankshaft Position Sensor (TDC) (Cont'd)
DIAGNOSTIC PROCEDURE**



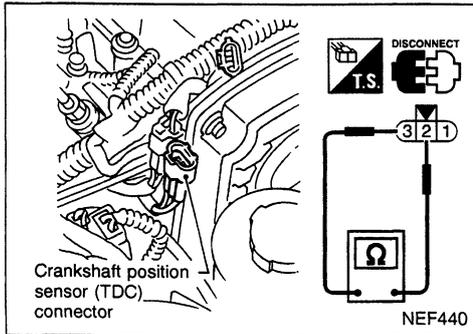
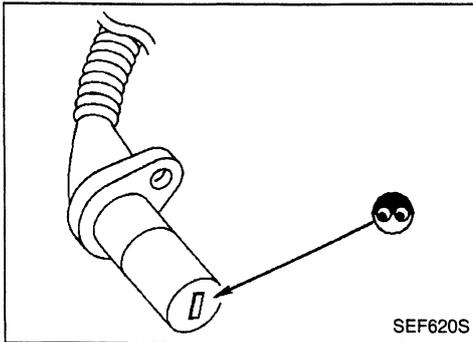
Crankshaft Position Sensor (TDC) (Cont'd) COMPONENT INSPECTION

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 crankshaft position sensor (TDC) terminals ② and ③.

Resistance: Approximately 1.2 - 1.5k Ω
[at 25°C (77°F)]

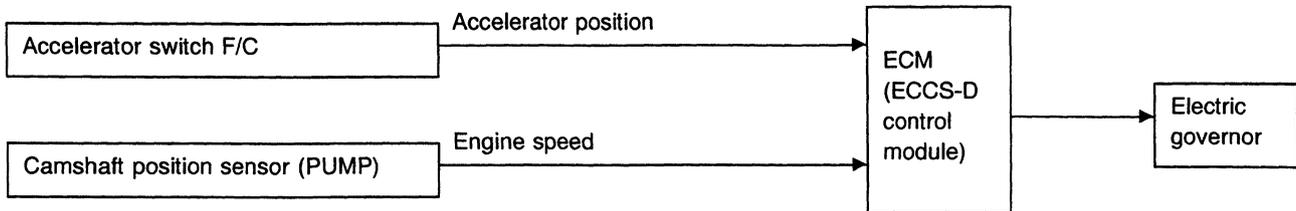
If NG, replace crankshaft position sensor (TDC).



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 (ECCS-D control module). The ECM (ECCS-D control module) 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 (ECCS-D control module) is malfunctioning. 	<ul style="list-style-type: none"> Harness or connectors [Accelerator switch and camshaft position sensor (PUMP) circuits] Accelerator switch (F/C) Camshaft position sensor (PUMP) ECM (ECCS-D control module)

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-351 or 383).

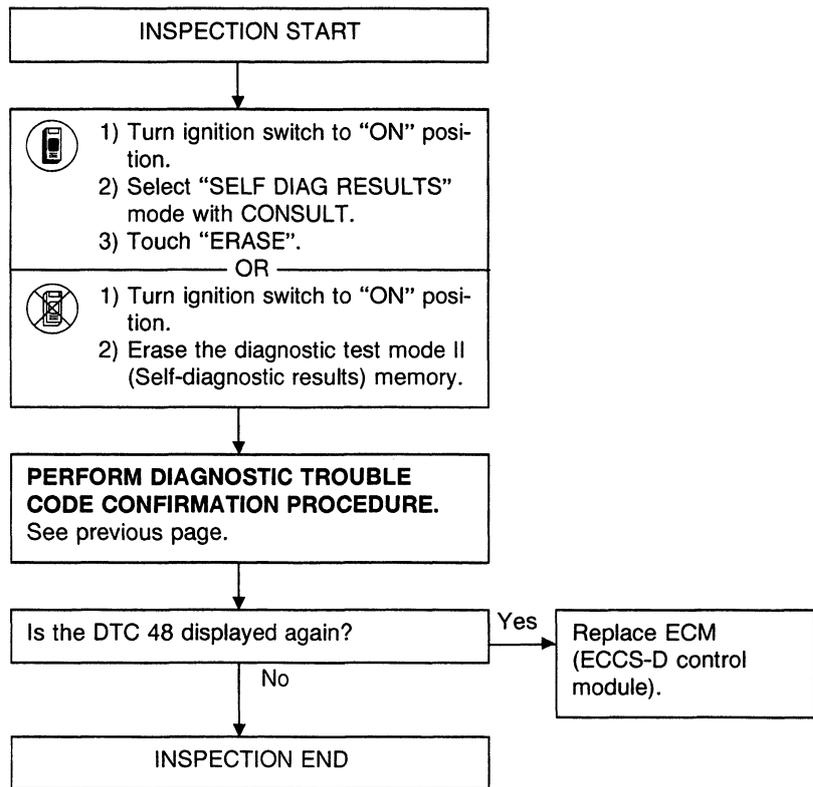


- 1) Turn ignition switch to "ON" position.
- 2) Select "DATA MONITOR" mode with CONSULT.
- 3) Start engine and run it to 3000 rpm, then quickly release accelerator pedal.

OR

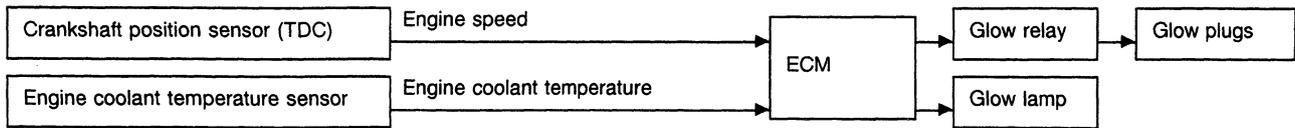


- 1) Start engine and run it to 3000 rpm, then release accelerator pedal.
- 2) Turn ignition switch to "LOCK" position, wait at least 5 seconds and then turn to "ON" position.
- 3) Perform "Diagnostic Test Mode II (Self-diagnostic results)".

**Governor Cut Circuit (Cont'd)
DIAGNOSTIC PROCEDURE**

Glow control System

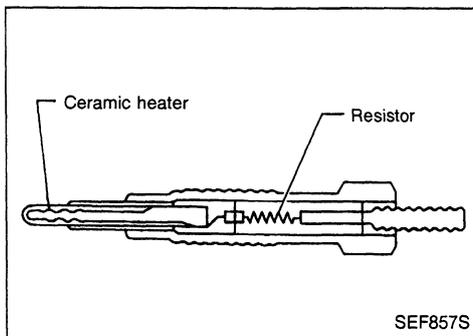
SYSTEM DESCRIPTION



When engine coolant temperature is more than 75°C (167°F), the glow relay turns off, inactivating the quick-glow control until coolant temperature drops below 55°C (131°F).

When coolant temperature is lower than 75°C (167°F):

- Ignition switch ON
After ignition switch has been turned to ON, the glow relay turns ON for a period of time proportional 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 time proportional to engine coolant temperature.
When engine coolant temperature exceeds 50°C (122°F), current flow through glow plug is interrupted.



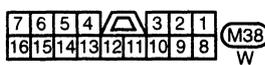
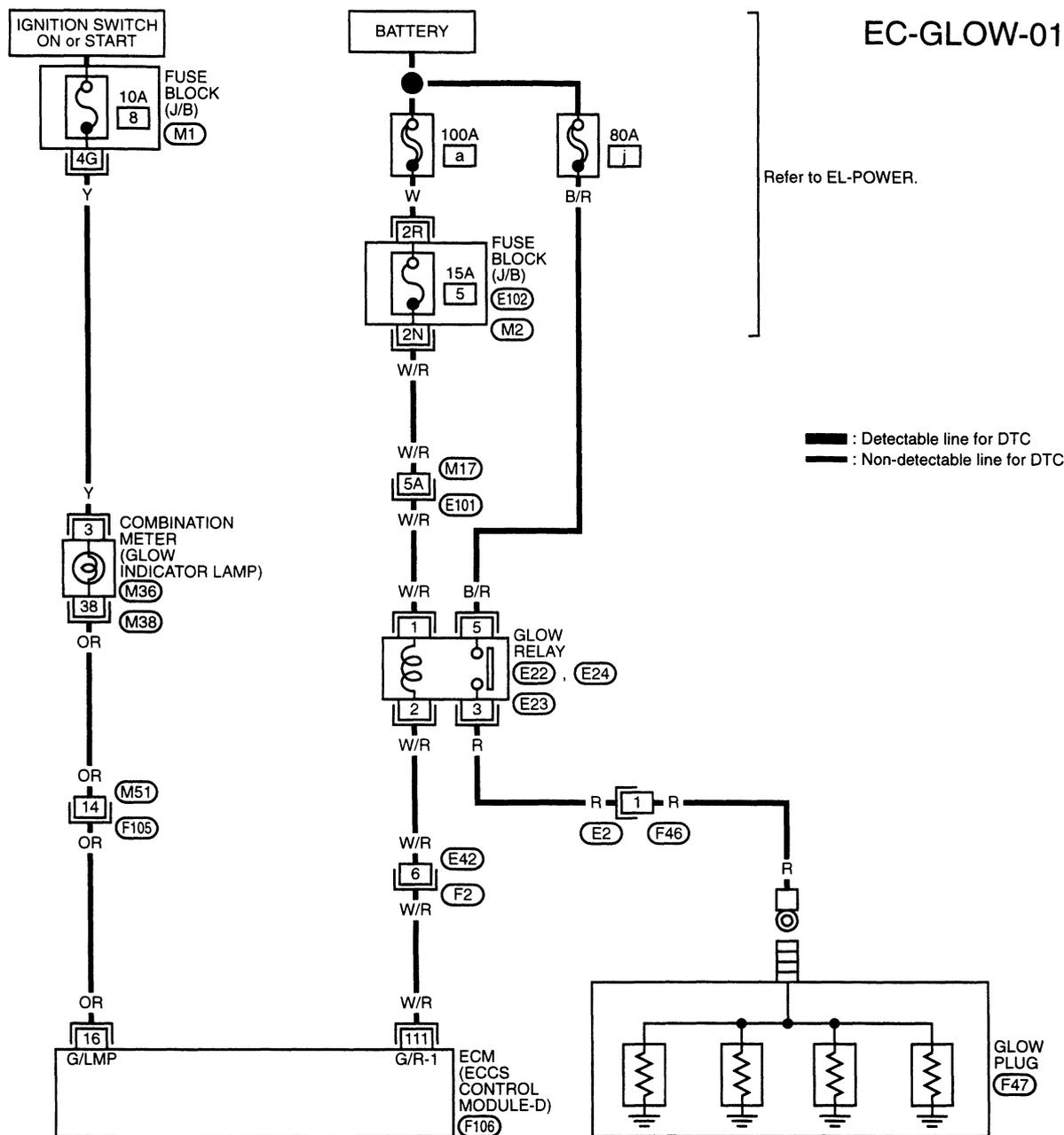
COMPONENT DESCRIPTION

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 (ECCS-D control module), allowing current to flow through the glow plug via the glow relay.

Glow control System (Cont'd)

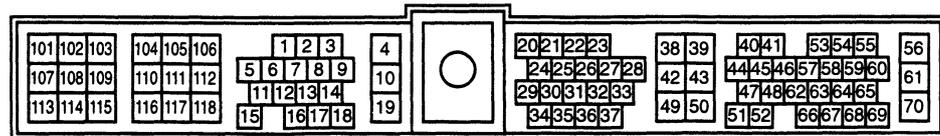
EC-GLOW-01



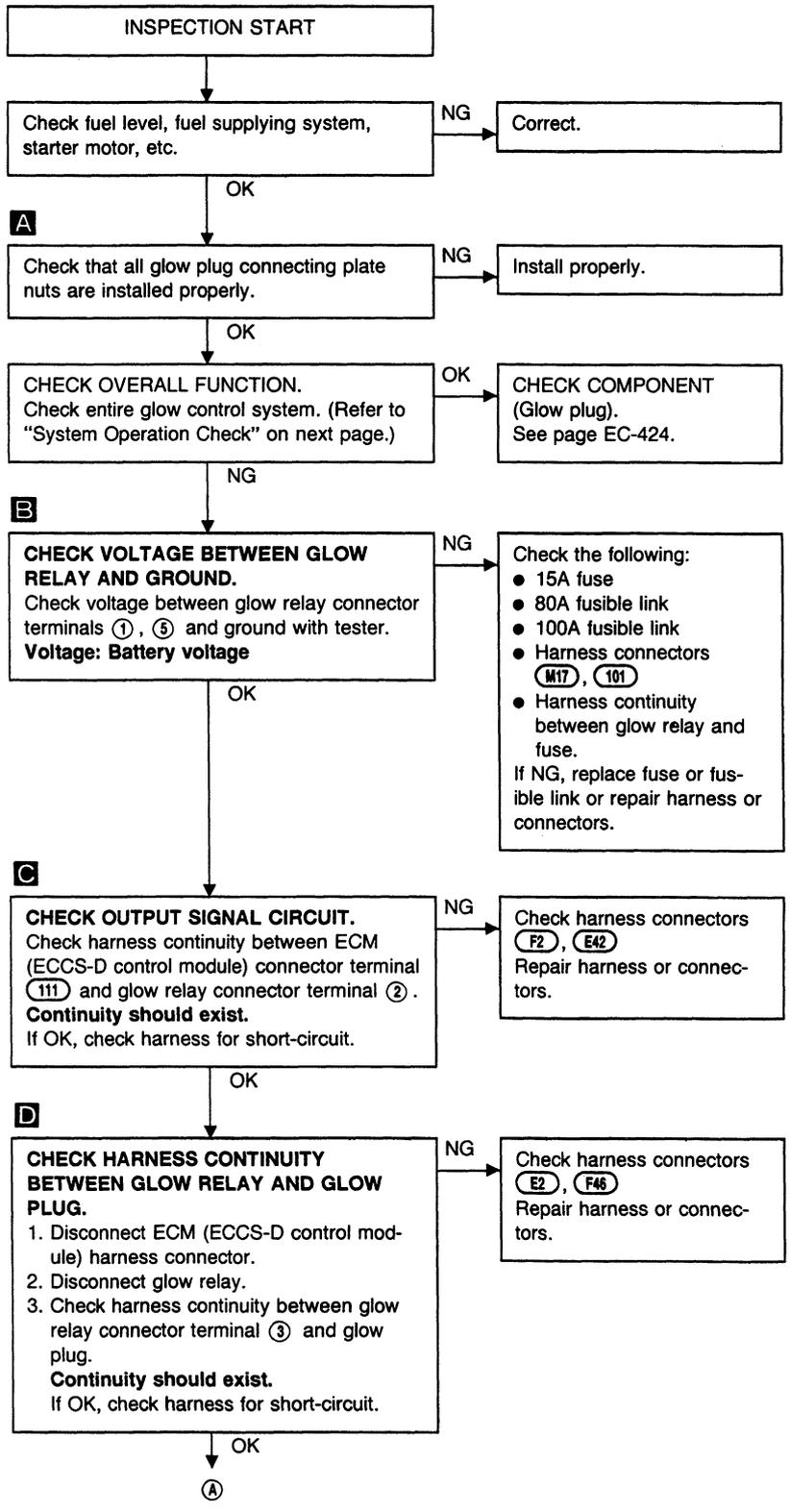
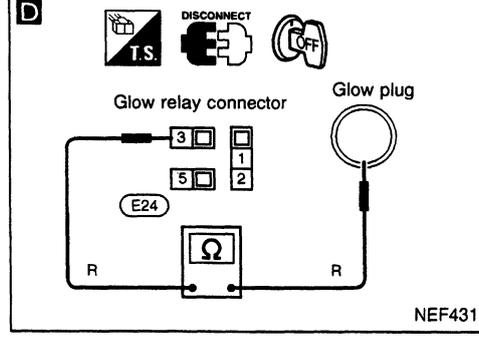
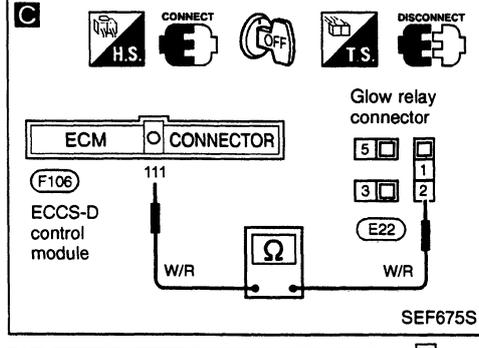
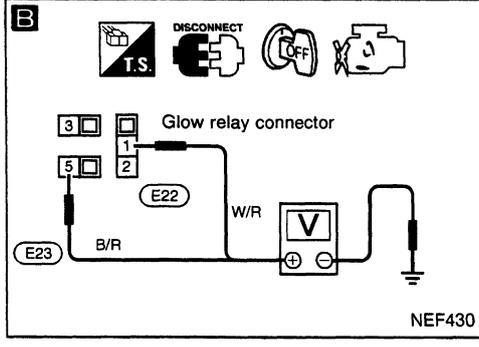
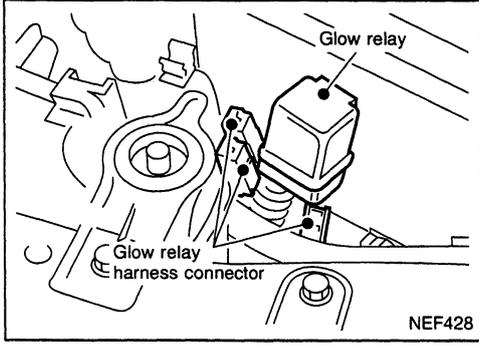
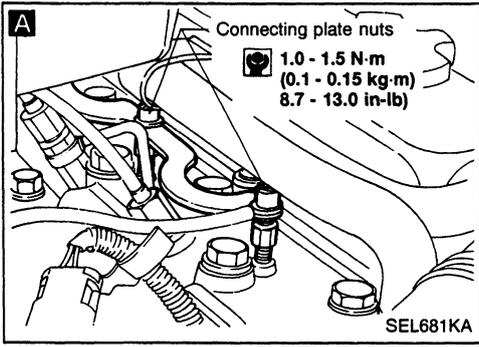
Refer to last page (Foldout page).

M1, M2, E102

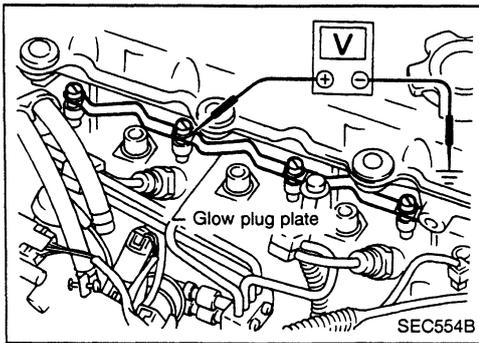
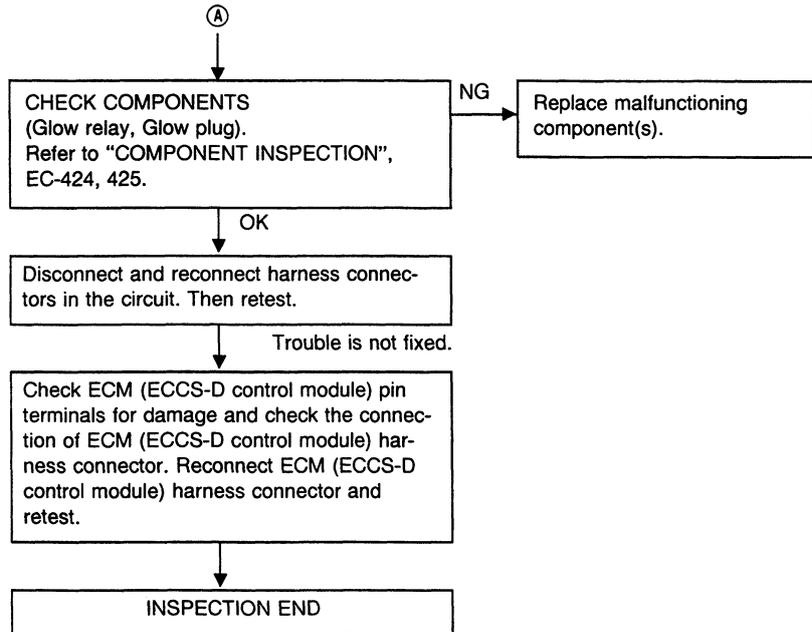
E101, M17



Glow control System (Cont'd)
DIAGNOSTIC PROCEDURE

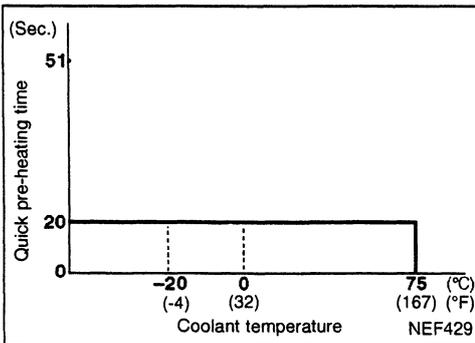


Glow control System (Cont'd)



SYSTEM OPERATION CHECK

Set voltmeter between glow plug and engine body.



1. Quick-glow (Pre-glow) system
 - a. Turn ignition switch to "ON" position.
 - b. Read voltage.

Voltage:
 Battery voltage for about 20* seconds
 * Engine coolant temperature is lower than 75°C (167°F).
 * Repeatedly turning the ignition switch to "ON" position and to "LOCK" position may change the quick glow (pre-glow) time.
2. Quick-glow (Cranking) system
 - a. Disconnect "S" terminal from starter motor to prevent engine from cranking.
 - b. Read voltage when ignition switch is turned to "START" position.

Voltage:
 Battery voltage*
 * For about 20 seconds after returning ignition switch to "ON" position.

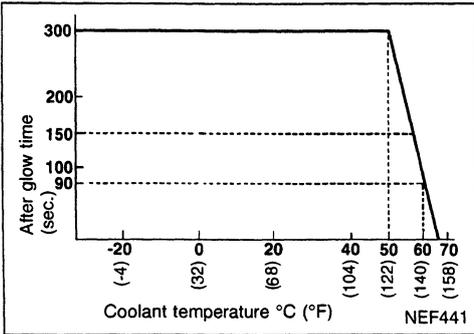
Glow control System (Cont'd)

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).

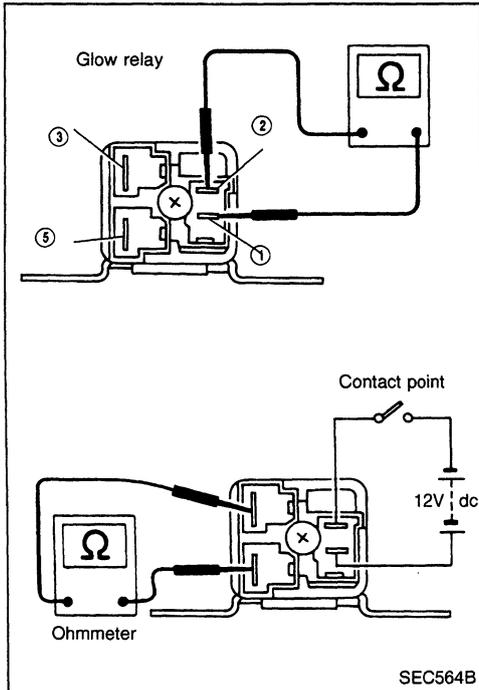


COMPONENT INSPECTION

Glow relay

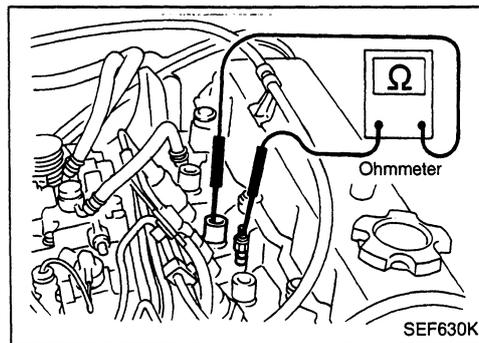
1. Check relay for coil continuity between glow relay terminals ① and ②.
 - Continuity should exist.
2. Check relay for proper operation by applying 12V dc voltage between glow relay terminals ① and ② and checking continuity between terminals ③ and ⑤.

Coil voltage	Continuity ③ - ⑤	Contact point
0V	No	OFF
12V	Yes	ON

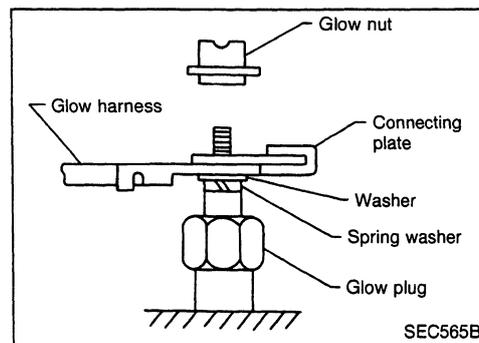


Glow plug

1. Remove glow plug connecting plate.
2. Check each glow plug for continuity.
 - Continuity should exist:
 - Approximately 0.5Ω [at 25°C (77°F)]
- If NG, replace glow plug.

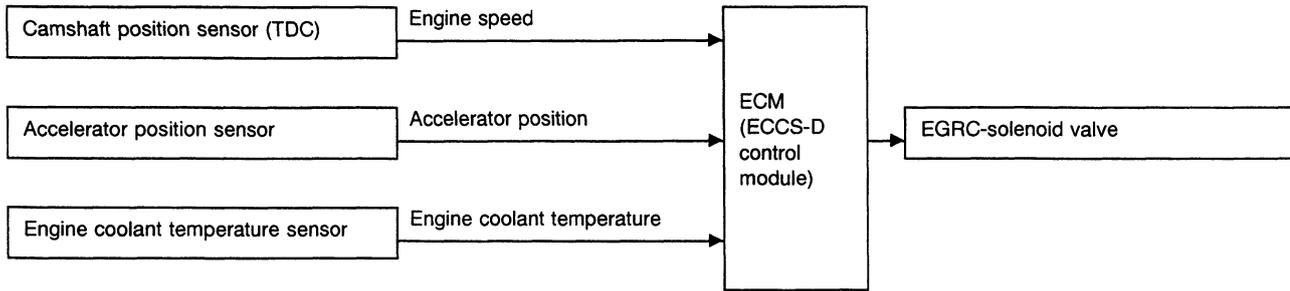


3. Install glow plug connecting plate securely.
 - Do not bump glow plug heating element. If it is bumped, replace glow plug with new one. (If glow plug is dropped from a height of 0.1 m (3.94 in) or greater, replace with new one.)
 - If glow plug installation hole is contaminated with carbon, remove using a reamer or suitable tool.
 - Hand-tighten glow plug by turning it 2 to 3 times, then tighten using a tool to specified torque.
 - Ⓒ : 15 - 20 N·m (1.5 - 2.0 kg·m, 11 - 14 ft·lb)



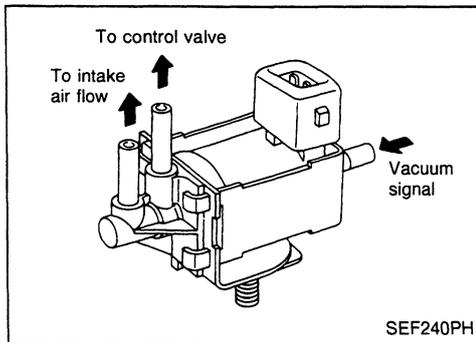
EGRC-Solenoid Valve

SYSTEM DESCRIPTION



The ECM (ECCS-D control module) receives signals sent from the engine coolant temperature sensor, crankshaft position sensor (TDC) and accelerator position sensor to determine engine speed and operating conditions. Based on these signals, the ECM (ECCS-D control module) controls EGR control solenoid valve operation.

Engine coolant temperature °C (°F)	Load	EGRC-solenoid valve	EGR valve	Amount of EGR gas
Below 70 (158)	Any	OFF (Closed)	Fully closed	—
Above 70 (158)	Low load	ON (Open)	Fully open	Large
	High load	OFF (Closed)	Fully closed	—

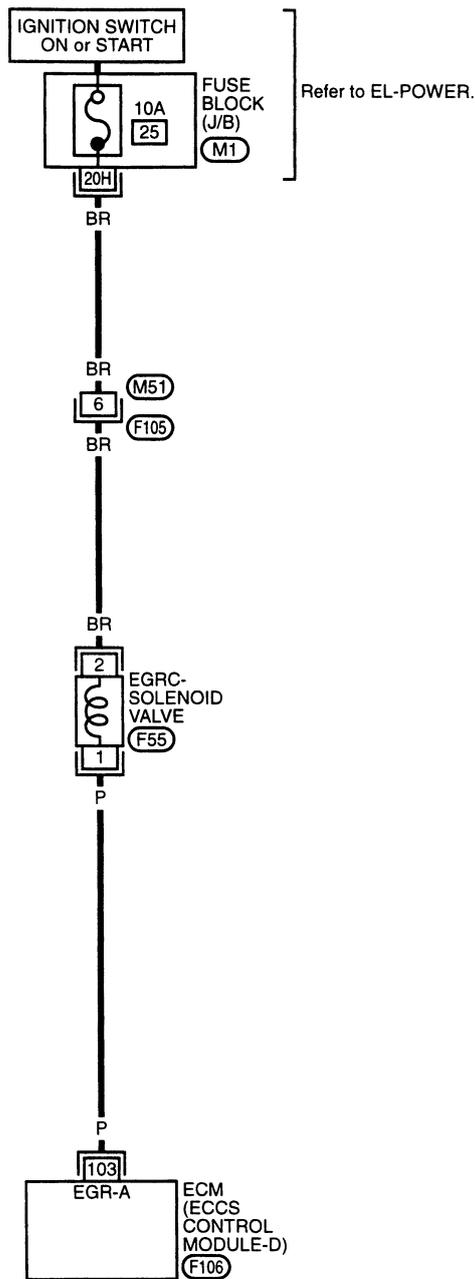


COMPONENT DESCRIPTION

The EGR control solenoid valves control vacuum pressure acting on the EGR valve. The EGR control valve will then be fully opened or fully closed, as required. 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 large or small volumes.

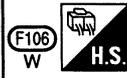
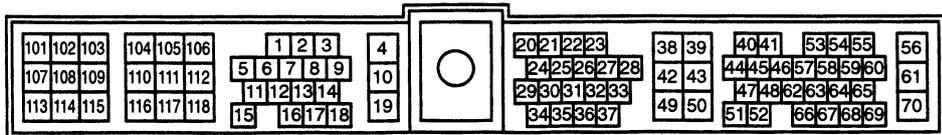
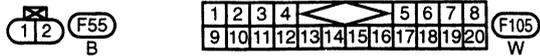
EGRC-Solenoid Valve (Cont'd)

EC-EGRC/V-01

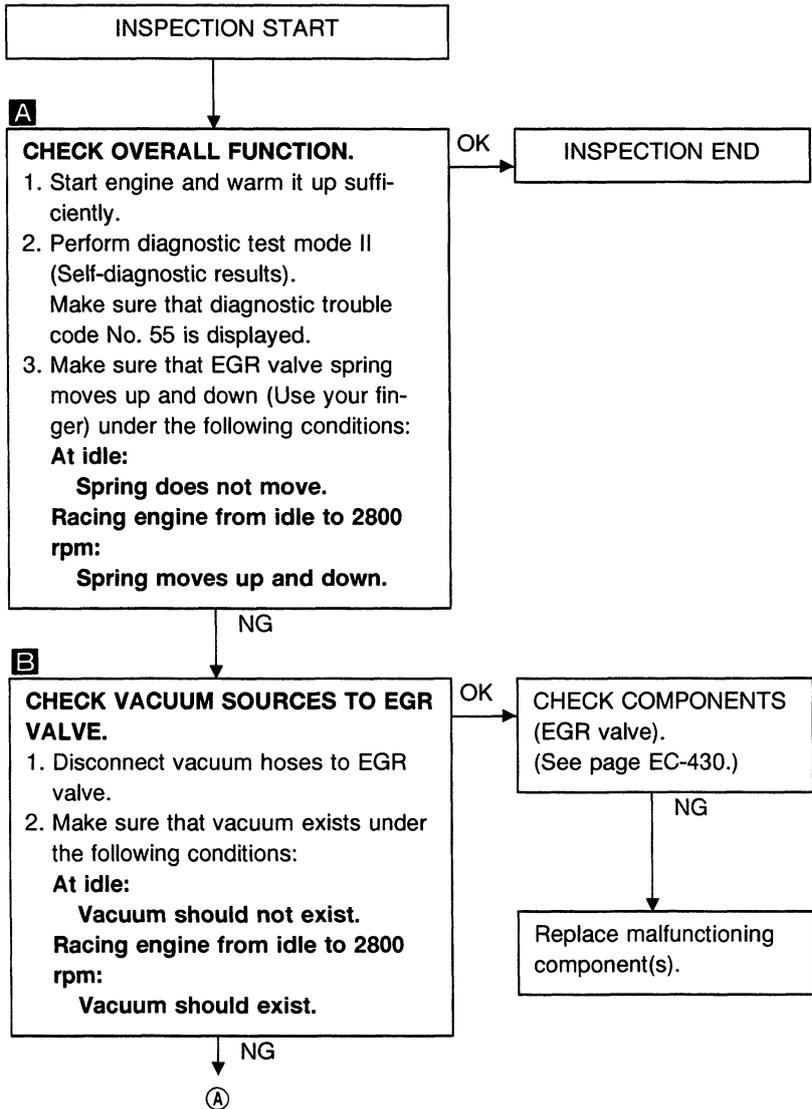
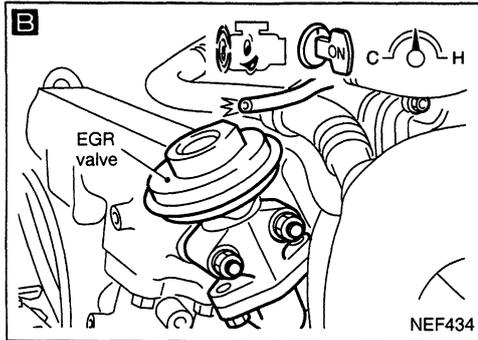
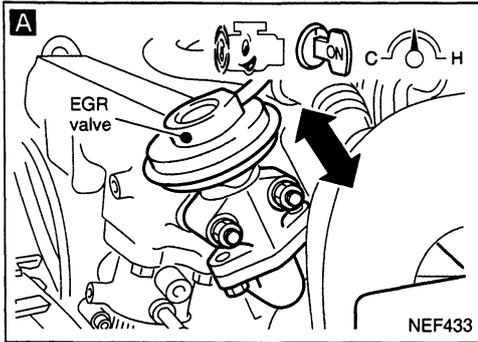


: Detectable line for DTC
 : Non-detectable line for DTC

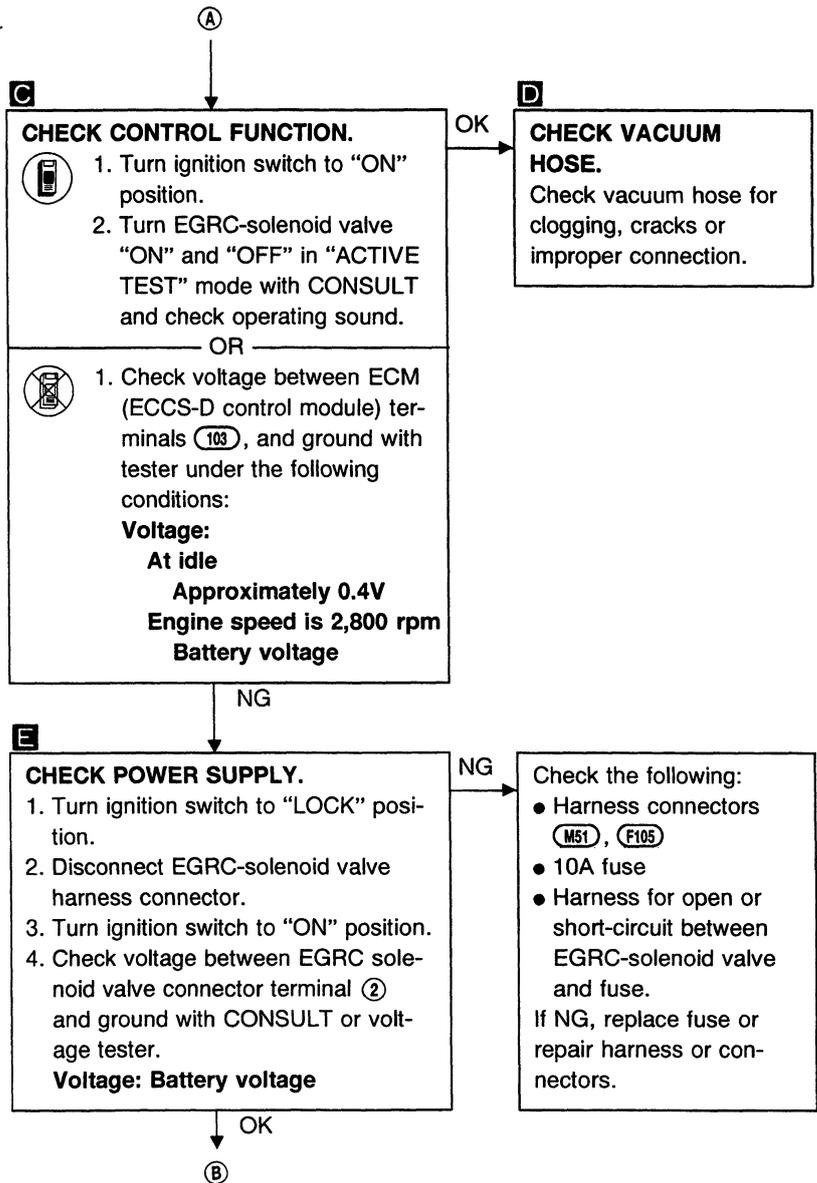
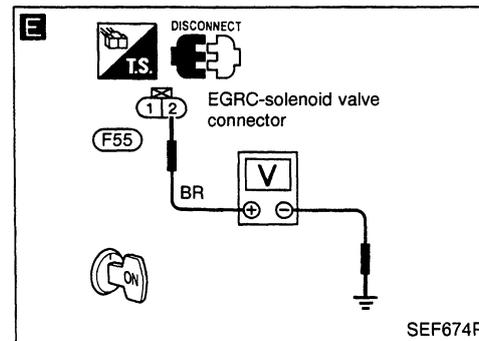
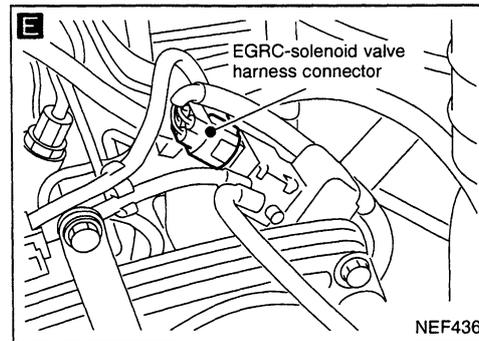
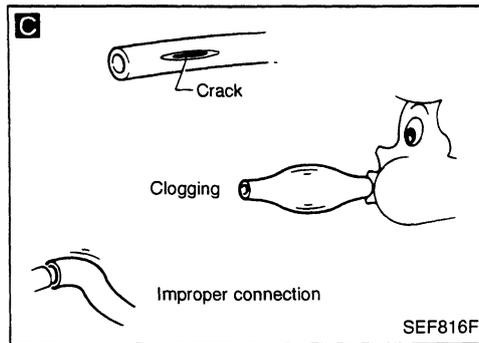
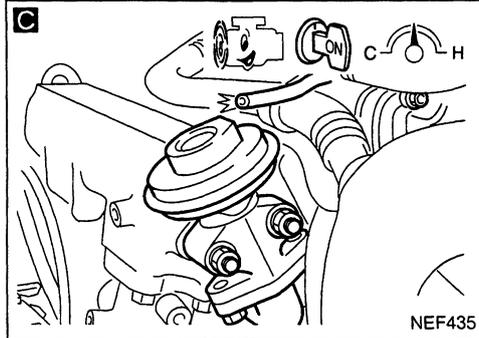
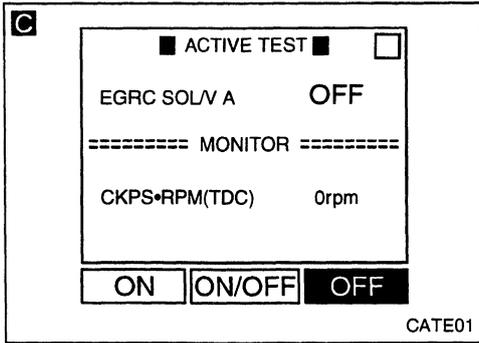
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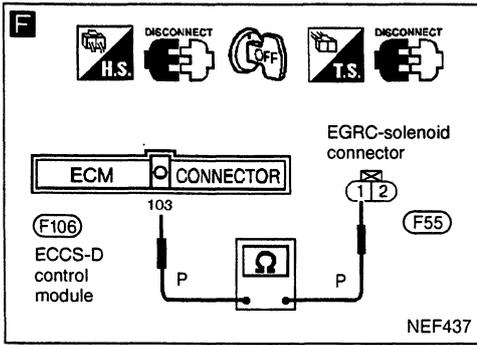


**EGRC-Solenoid Valve (Cont'd)
DIAGNOSTIC PROCEDURE**



EGRC-Solenoid Valve (Cont'd)





(B)

F

CHECK OUTPUT SIGNAL CIRCUIT.

1. Disconnect ECM (ECCS-D control module) harness connector.
2. Check harness continuity between ECM (ECCS-D control module) connector terminal (103) and (EGRC-solenoid valve connector) terminal ①.

Continuity should exist.
If OK, check harness for short.

NG →

Repair harness or connectors.

OK ↓

CHECK COMPONENTS
(EGRC-solenoid valve).
Refer to "COMPONENT INSPECTION"
on next page.

NG →

Replace malfunctioning component(s).

OK ↓

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

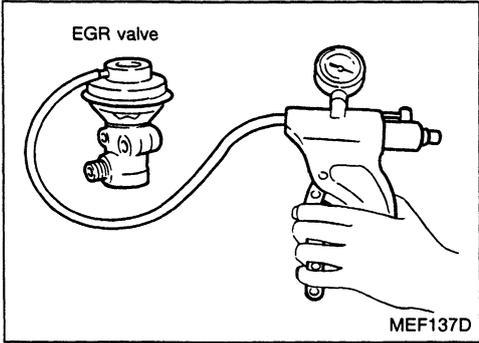
Trouble is not fixed. ↓

Check ECM (ECCS-D control module) pin terminals for damage or the connection of ECM (ECCS-D control module) harness connector. Reconnect ECM (ECCS-D control module) harness connector and retest.

↓

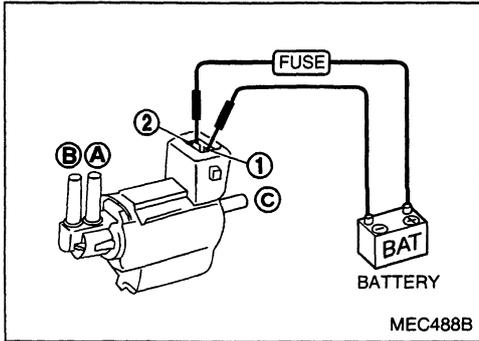
INSPECTION END

**EGRC-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.



EGRC-solenoid valve

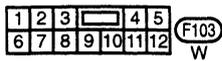
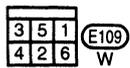
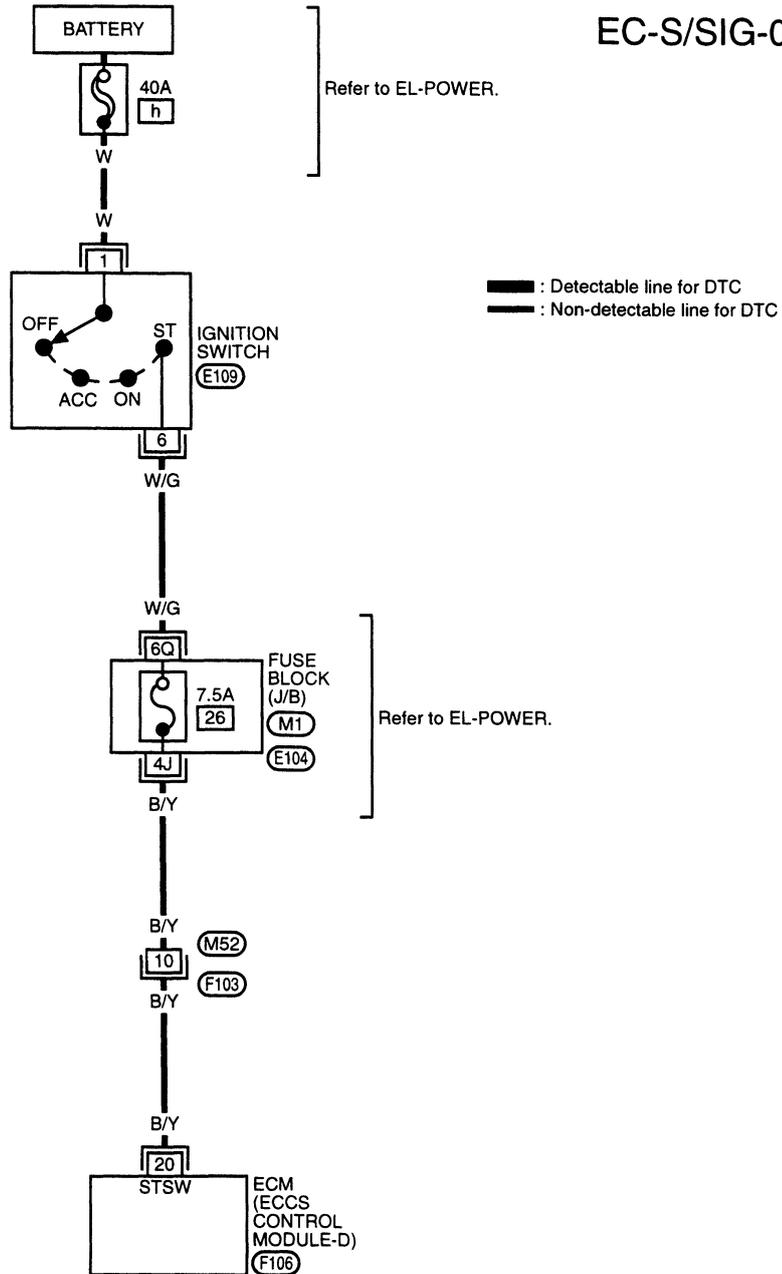
Check air passage continuity.

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.

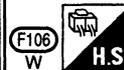
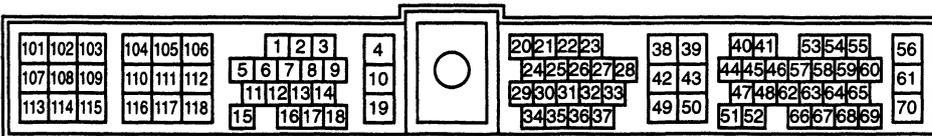
Start Signal

EC-S/SIG-01

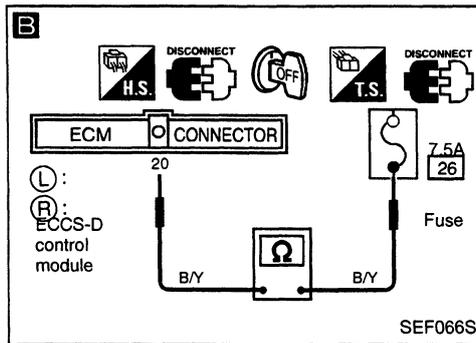
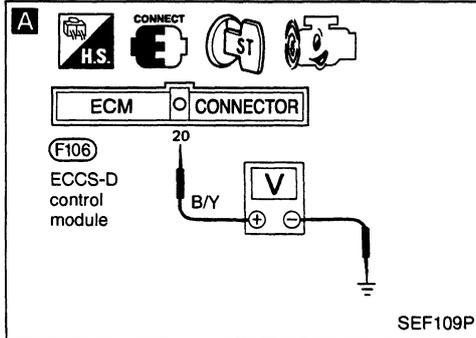
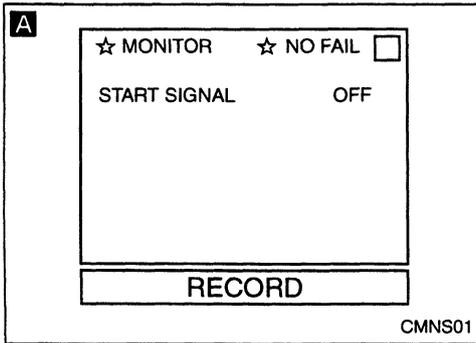


Refer to last page (Foldout page).

(M1), (E104)



Start Signal (Cont'd)
DIAGNOSTIC PROCEDURE



INSPECTION START

A

CHECK OVERALL FUNCTION.

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

IGN "ON"	OFF
IGN "START"	ON

OR

1. Turn ignition switch to "START" position.
2. Check voltage between ECM (ECCS-D control module) connector terminal ② and ground.

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

OK → INSPECTION END

NG

Check if 7.5A fuse is OK.

NG → Replace 7.5A fuse.

OK

B

CHECK INPUT SIGNAL CIRCUIT.

- 1) Turn ignition switch to "LOCK" position.
- 2) Disconnect ECM (ECCS-D control module) harness connector and 7.5A fuse.
- 3) Check harness continuity between ECM (ECCS-D control module) connector terminal ② and fuse block.

Continuity should exist.
If OK, check harness for short-circuit.

NG → Check the following:

- Harness or connectors (M52, F103)
- Harness for open or short-circuit between ECM (ECCS-D control module) and fuse block.

If NG, repair harness or connectors.

OK

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

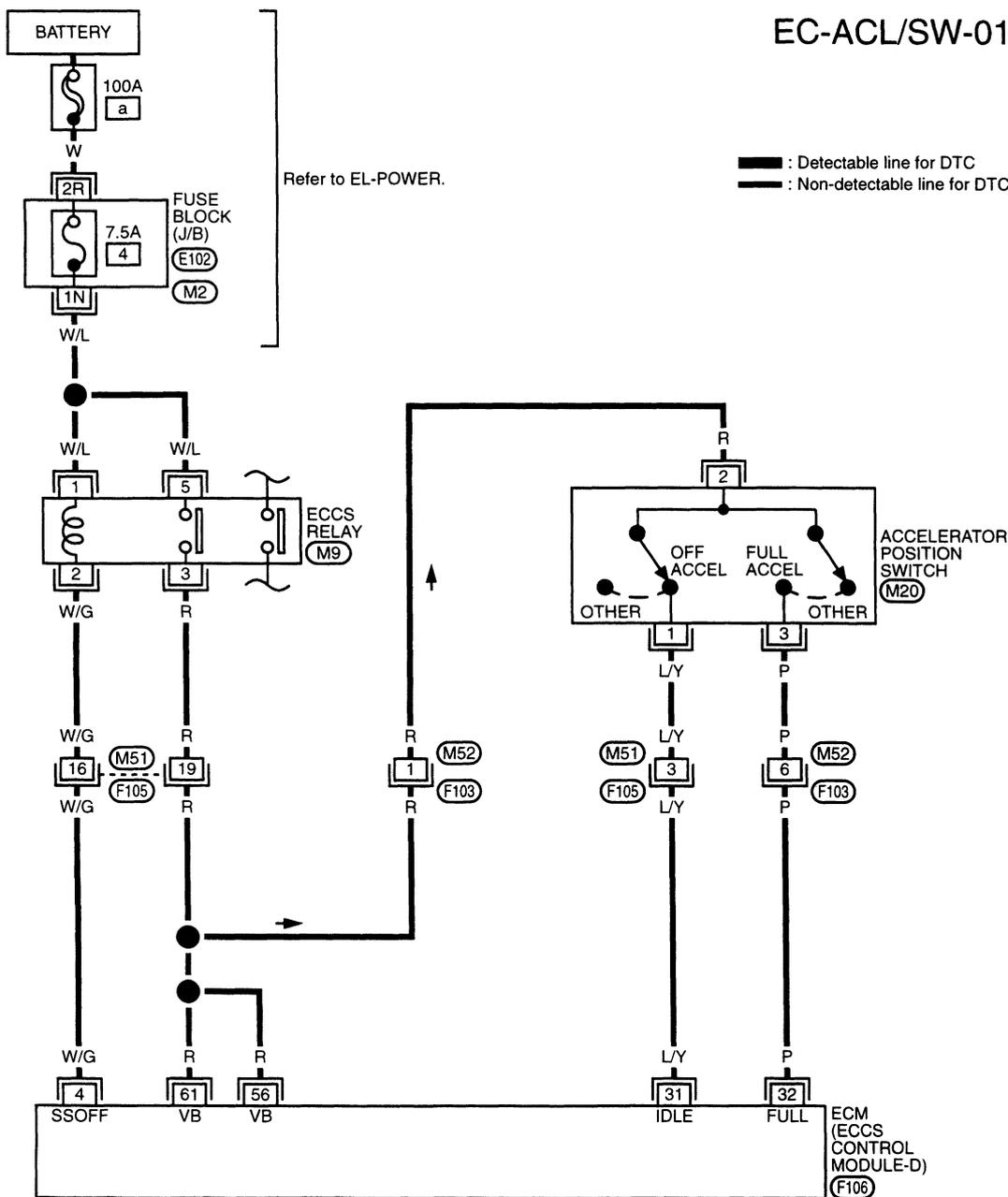
Trouble is not fixed.

Check ECM (ECCS-D control module) pin terminals for damage and check the connection of ECM (ECCS-D control module) harness connector. Reconnect ECM (ECCS-D control module) harness connector and retest.

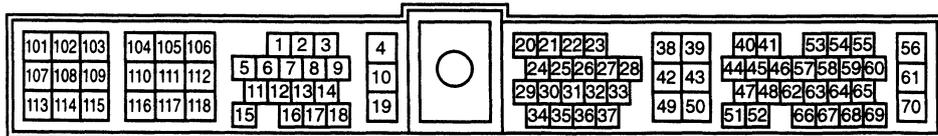
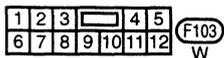
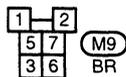
INSPECTION END

Accelerator Position Switch

EC-ACL/SW-01

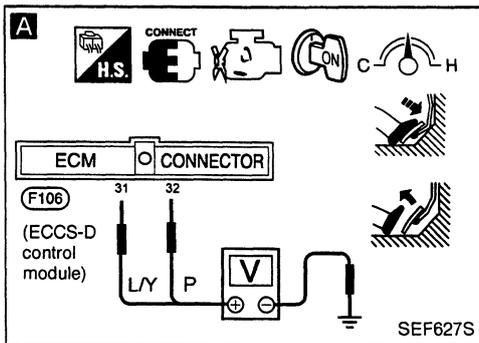
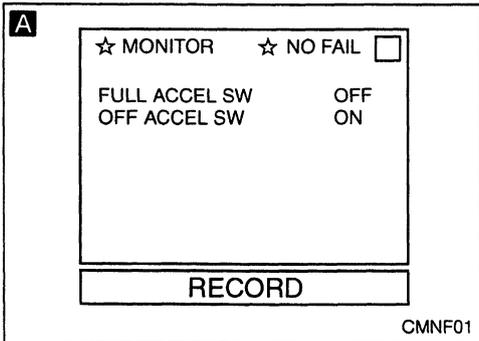


Refer to last page (Foldout page).

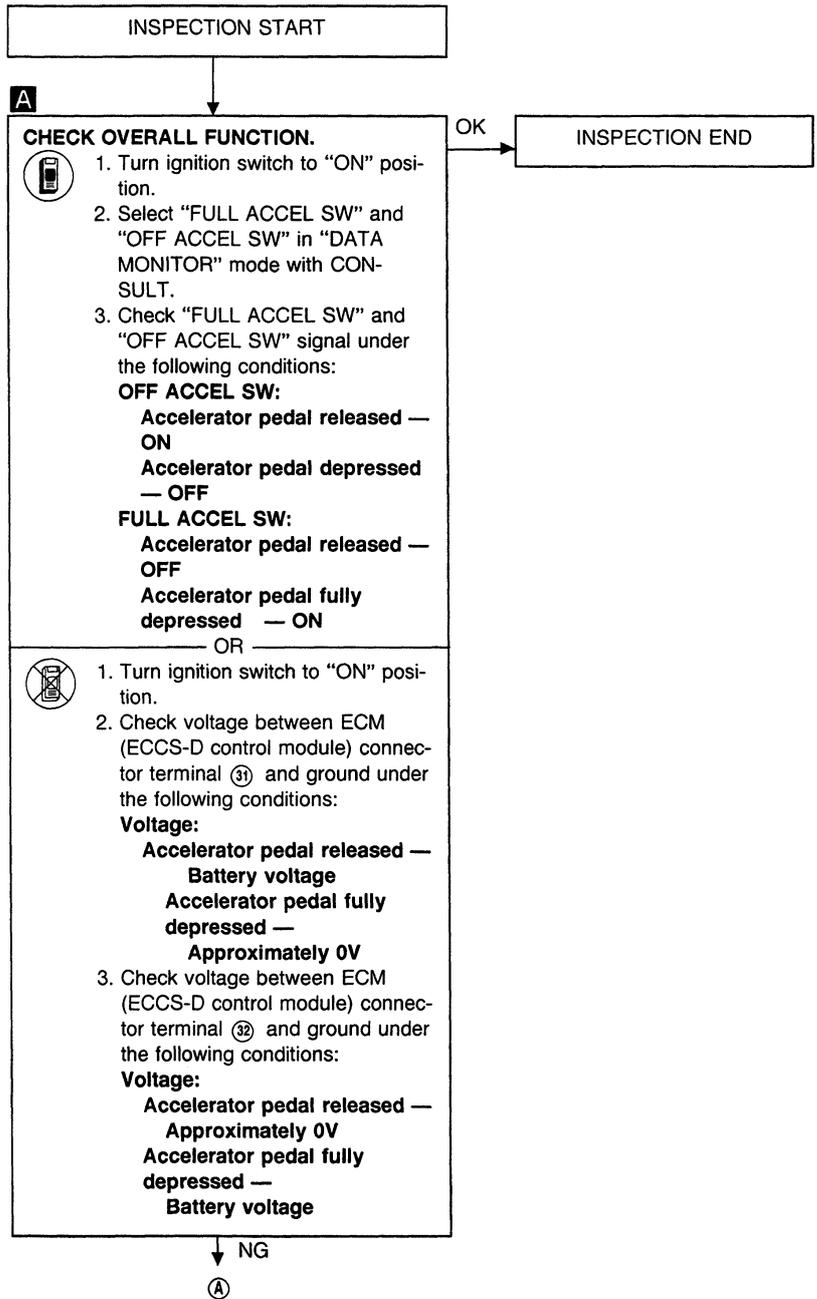


Accelerator Position Switch (Cont'd)

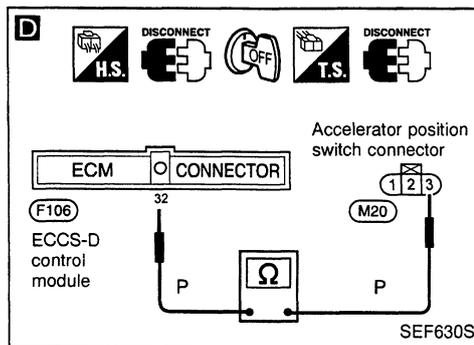
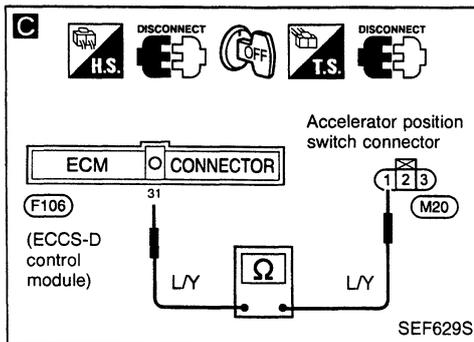
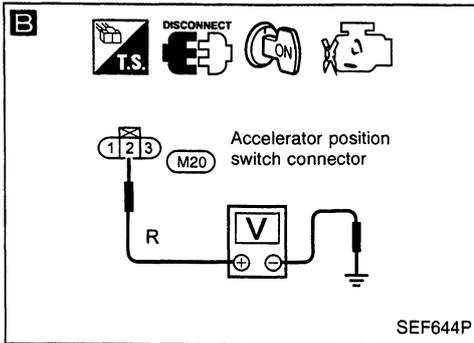
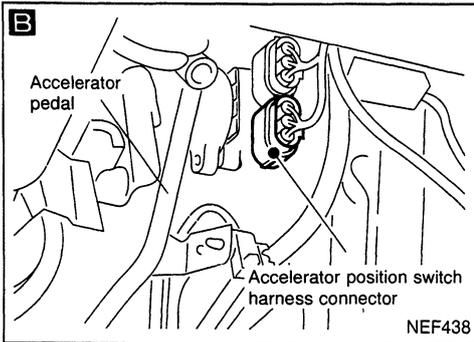
The accelerator position switch detects OFF-accelerator switch signal and Full-accelerator switch signal and sends these signals to the ECM (ECCS-D control module). The ECM (ECCS-D control module) will then determine engine idle conditions. These signals are also used for diagnosing the accelerator position sensor.



DIAGNOSTIC PROCEDURE



Accelerator Position Switch (Cont'd)



A

B

CHECK POWER SUPPLY.

1. Turn ignition switch to "LOCK" position.
2. Disconnect accelerator position switch harness connector.
3. Turn ignition switch to "ON" position.
4. Check voltage between accelerator position switch connector terminal ② and ground with CONSULT or voltage tester. **Voltage: Battery voltage**

NG → Check the following:

- 7.5A fuse in fuse block
- 100A fusible link
- Operation of ECCS relay.
- Harness or connectors (M52, F103)
- Harness or connectors (M51, F105)
- Harness for open or short-circuit between ECCS relay and accelerator position switch.

If NG, replace fuse, fusible link or ECCS relay or repair harness or connectors.

OK ↓

C

CHECK INPUT SIGNAL CIRCUIT-I.

1. Turn ignition switch to "LOCK" position.
2. Disconnect ECM (ECCS-D control module) harness connector.
3. Check harness continuity between accelerator position switch connector terminal ① and ECM (ECCS-D control module) connector terminal ③. **Continuity should exist.**

If OK, check harness for short-circuit.

NG → Check the following:

- Harness or connectors (M51, F105)
- Harness for open or short-circuit between ECM (ECCS-D control module) and accelerator position switch.

If NG, repair harness or connectors.

OK ↓

D

CHECK INPUT SIGNAL CIRCUIT-II.

Check harness continuity between accelerator position switch connector terminal ③ and ECM (ECCS-D control module) terminal ③. **Continuity should exist.**

If OK, check harness for short-circuit.

NG → Check the following:

- Harness or connectors (M52, F103)
- Harness for open or short-circuit between ECM (ECCS-D control module) and accelerator position switch.

If NG, repair harness or connectors.

OK ↓

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

NG → Replace accelerator pedal assembly.

OK ↓

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

↓

Trouble is not fixed.

Check ECM (ECCS-D control module) pin terminals for damage and check the connection of ECM (ECCS-D control module) harness connector. Reconnect ECM (ECCS-D control module) harness connector and retest.

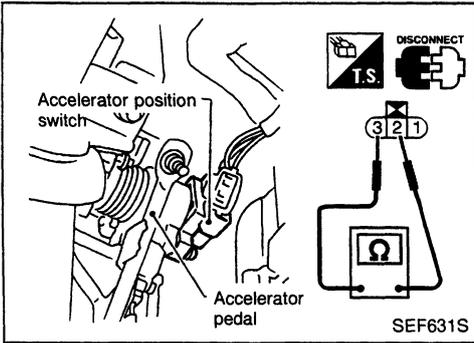
↓

INSPECTION END

**Accelerator Position Switch (Cont'd)
COMPONENT INSPECTION**

Accelerator position switch

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



Conditions	Continuity
Accelerator pedal released	Yes
Accelerator pedal depressed	No

3. Check continuity between accelerator position switch terminals ② and ③.

Conditions	Continuity
Accelerator pedal released	No
Accelerator pedal fully depressed	Yes

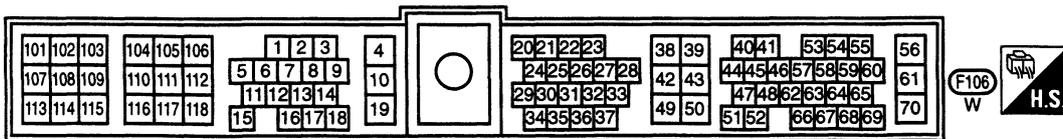
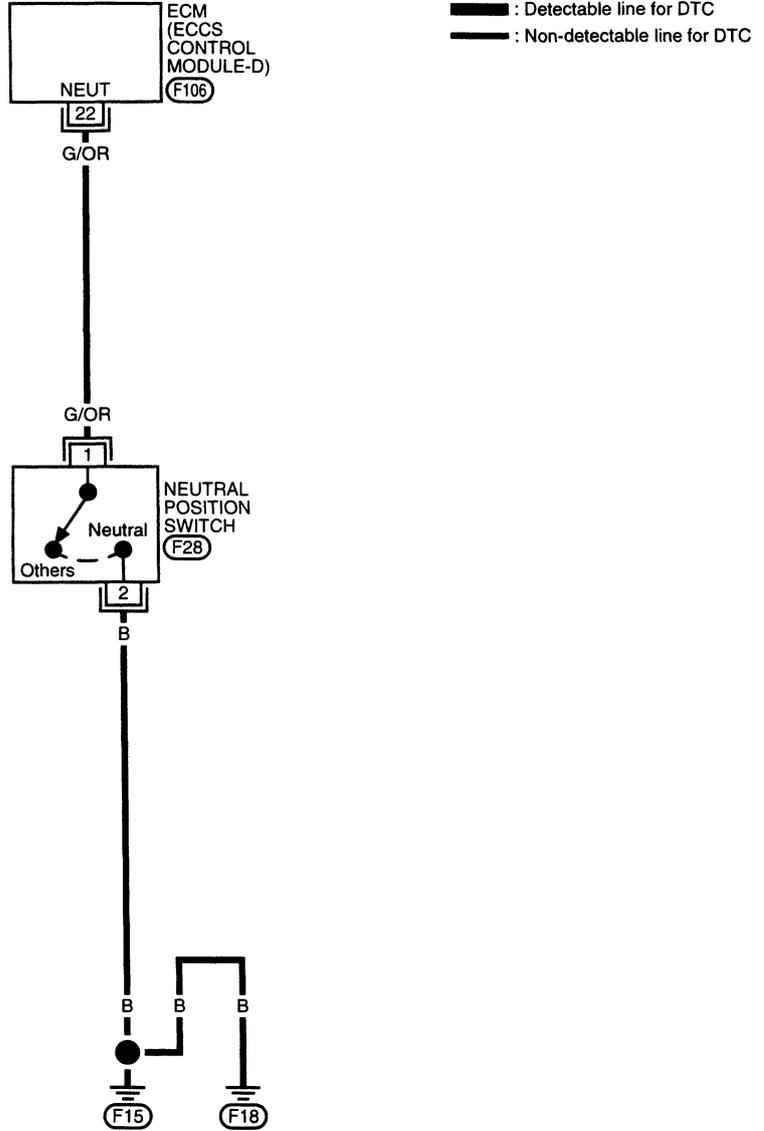
If NG, replace accelerator pedal assembly.

CAUTION:

- If accelerator position sensor or ECM (ECCS-D control module) connector is disconnected, perform following operation:
 - ① Select "OFF ACCEL PO SIG" in ACTIVE TEST mode. Touch "CLEAR".
 - ② Start and warm up engine. After engine was warmed up, let engine idle for 10 minutes.
- Do not disassemble accelerator pedal assembly.

Neutral Position Switch

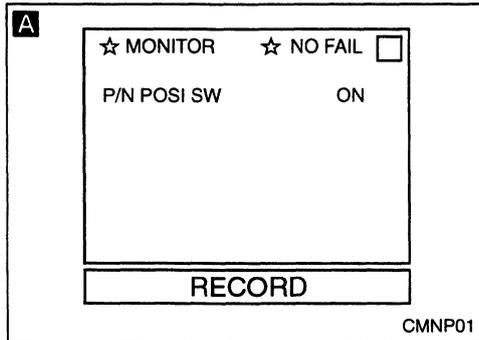
EC-NEUT-01



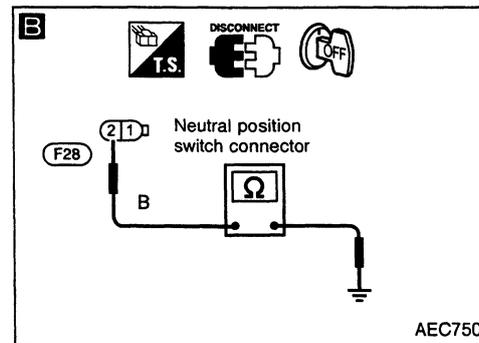
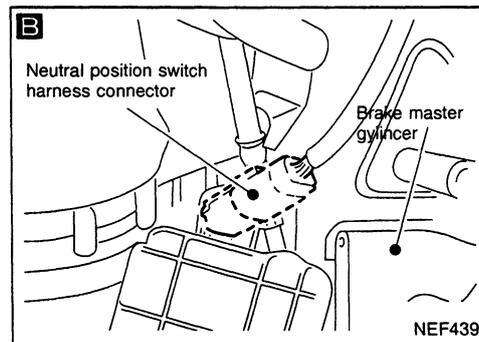
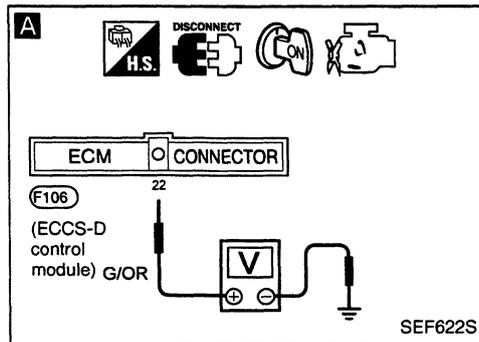
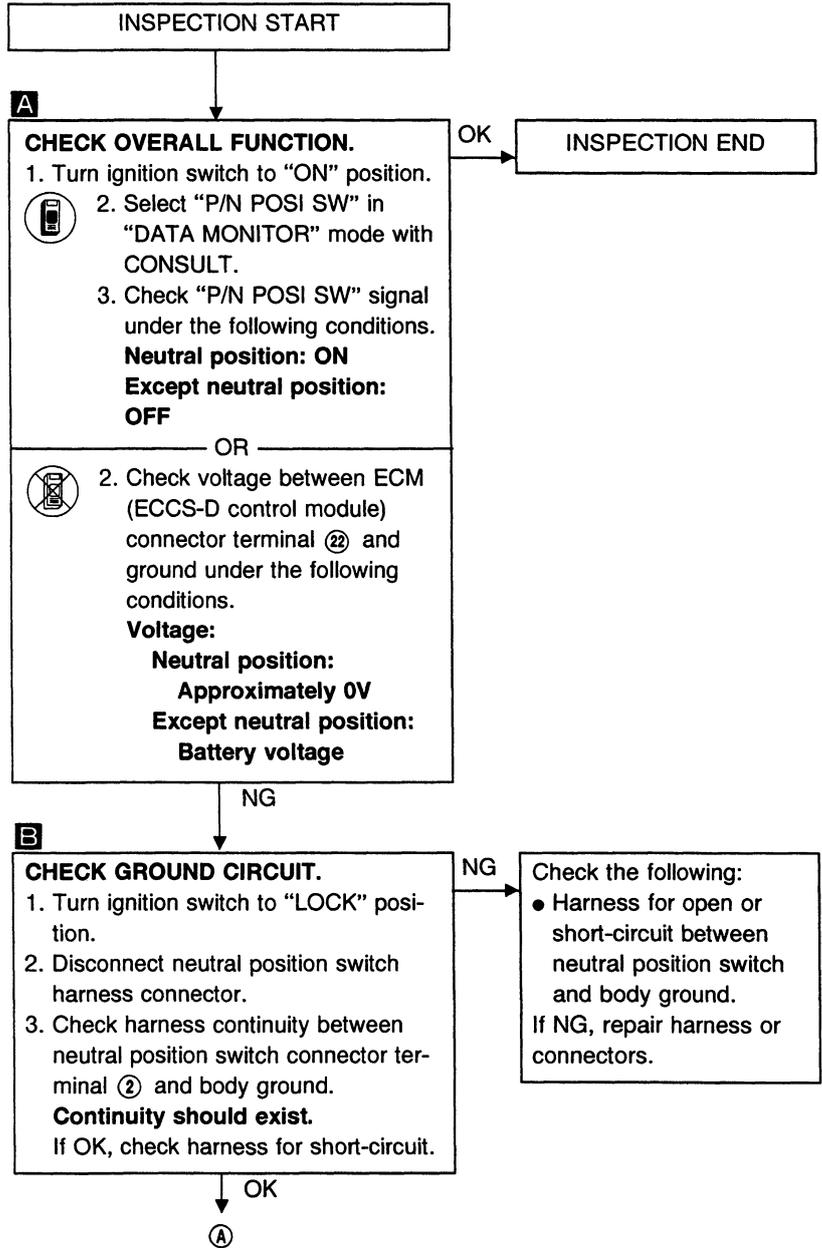
EC-437

Neutral Position Switch (Cont'd)

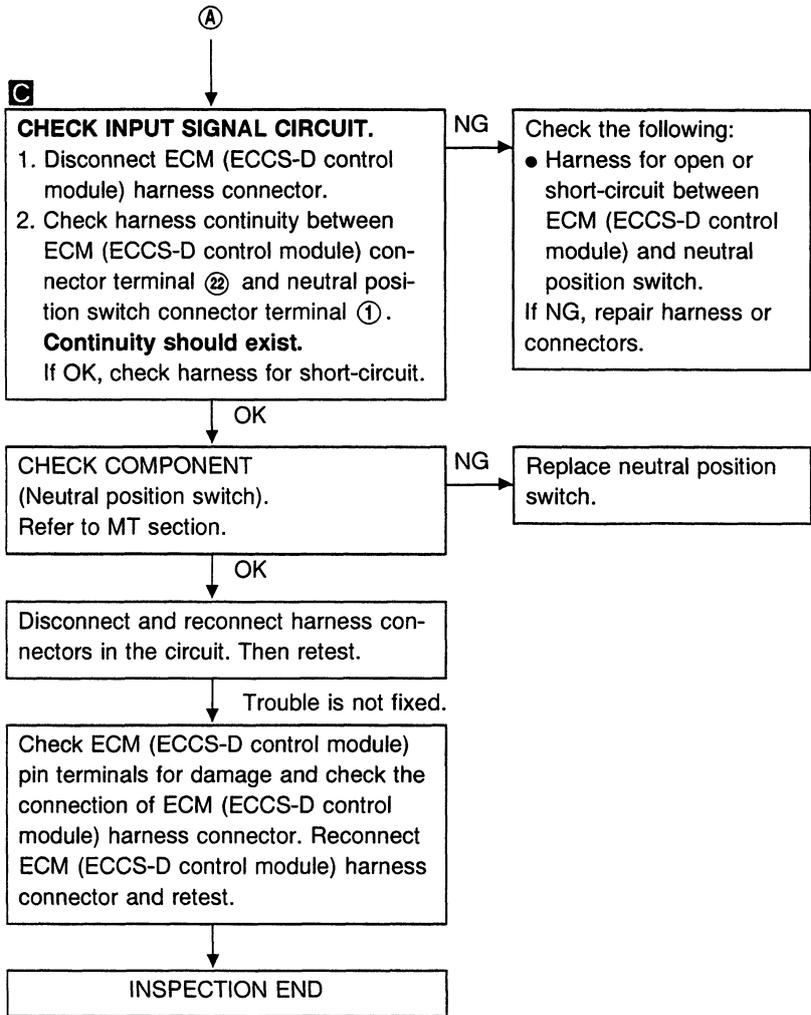
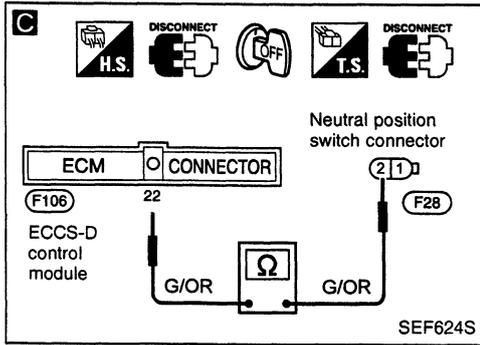
When the gear position is in "N", neutral position switch is "ON". The ECM (ECCS-D control module) detects the position because the continuity of the line (the "ON" signal) exists.



DIAGNOSTIC PROCEDURE

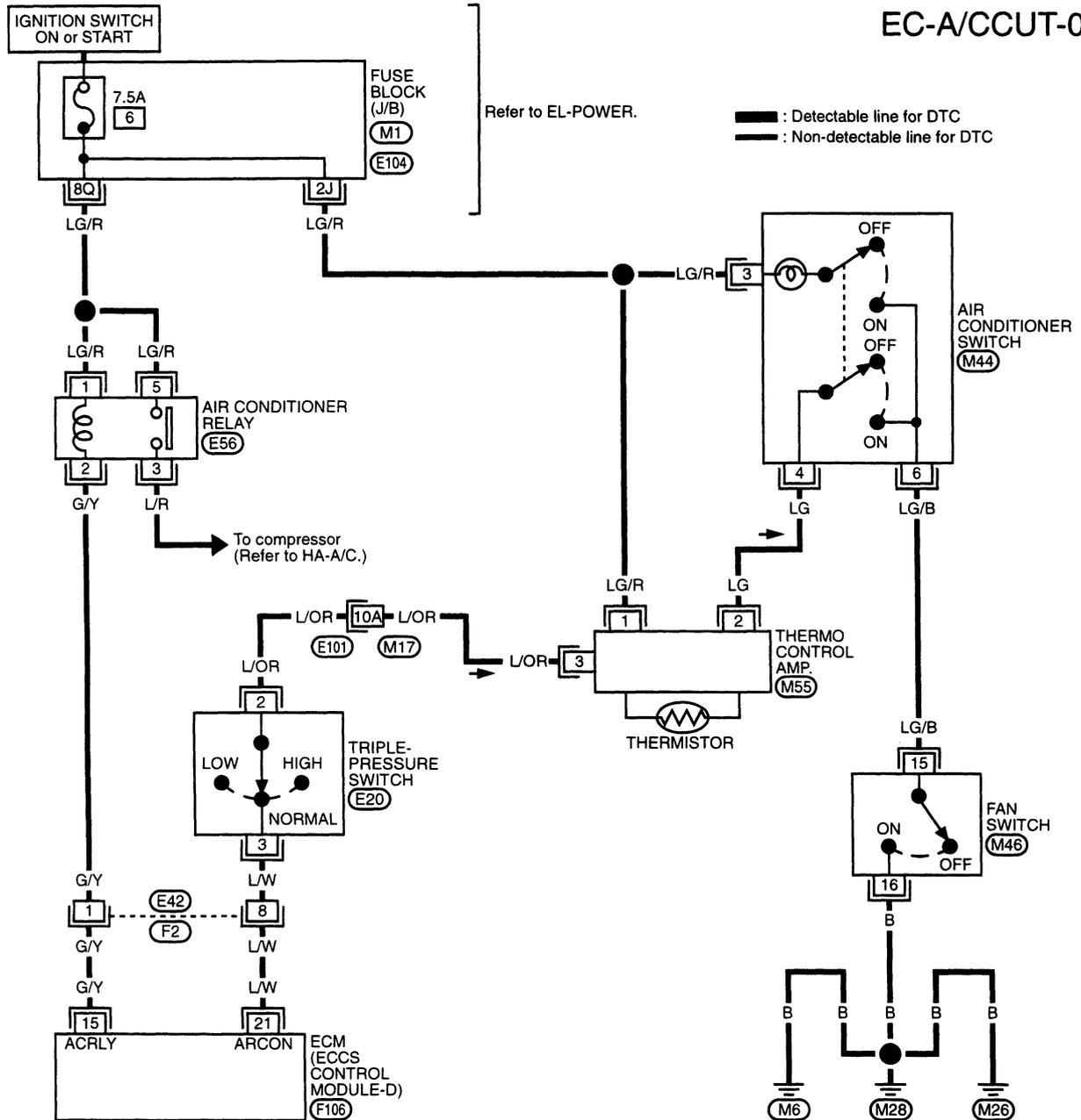


Neutral Position Switch (Cont'd)



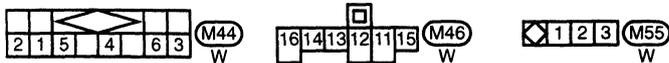
Air Conditioner Control

EC-A/CCUT-01



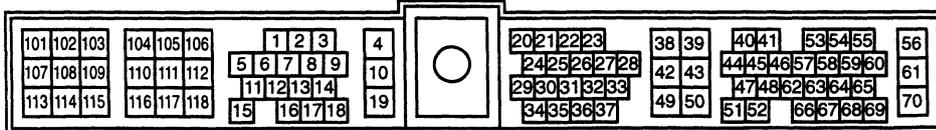
Refer to EL-POWER.

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



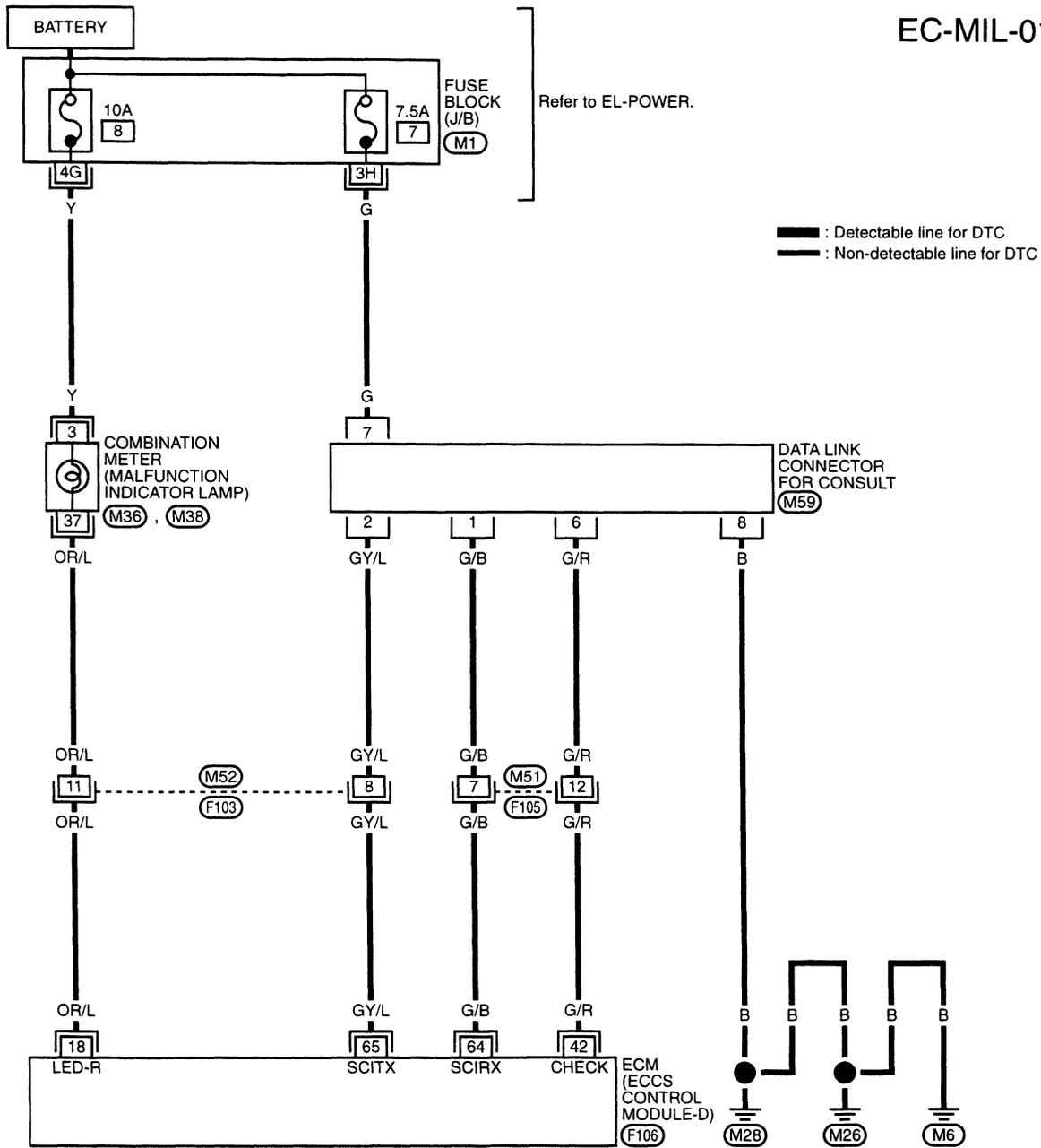
Refer to last page (Foldout page).

(M1), (E104)
 (E101), (M17)

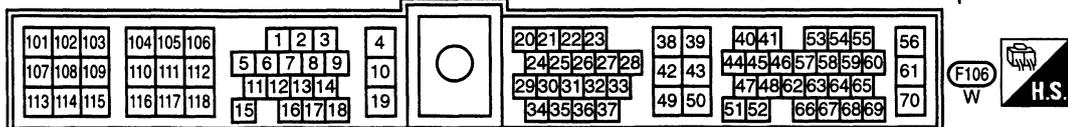
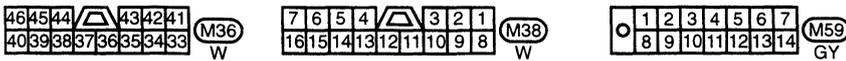


MIL & Data Link Connectors

EC-MIL-01



Refer to last page (Foldout page).



General Specifications

ENGINE SPEED

Unit : rpm	
Engine	CD20T
Maximum engine speed	5,400

Pump numbers

Engine	Part number	Pump assembly number
CD20T	16700 2J610	NP-VE4/10E2500 LNP13

**Pump data is not yet available.
Refer to CALIBRATION STANDARD published by BOSCH.)**

Injection Nozzle

INSPECTION AND ADJUSTMENT

Injection nozzle assembly

Unit: kPa (bar, kg/cm ² , psi)	
Initial injection pressure	
New	135 - 143
Used	12,259 - 13,239 (122.6 - 132.4, 125 - 135, 1,778 - 1,920)

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 (Injection timing)	mm (in)	0.82 ± 0.07 (0.0323) ± 0.0028
---------------------------------	---------	----------------------------------

CAMSHAFT POSITION SENSOR (PUMP)

Resistance [at 25°C (77°F)]	Ω	1,600
-----------------------------	---	-------

MASS AIR FLOW SENSOR

Supply voltage	V	Battery voltage (11 - 14)
Output voltage	V	1.9 - 2.3*

*: Engine is warmed up sufficiently and idling under no-load.

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	5.8
-----------------------------	---	-----

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
-------------------------------	------------------

ELECTRIC GOVERNOR

Resistance [at 23°C (73°F)] Ω	0.6
-------------------------------	-----

CRANKSHAFT POSITION SENSOR (TDC)

Resistance [at 25°C (77°F)] Ω	Approximately 1,215 - 1,485
-------------------------------	-----------------------------

GLOW PLUG

Resistance [at 25°C (77°F)] Ω	0.5
-------------------------------	-----

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 (68)	2.3 - 2.5
25 (77)	1.9 - 2.1
50 (122)	0.75 - 0.86
60 (140)	0.538 - 0.624
80 (176)	0.289 - 0.344

ACCELERATOR CONTROL, FUEL & EXHAUST SYSTEMS

SECTION FE

FE

CONTENTS

PREPARATION	1
Special Service Tool	1

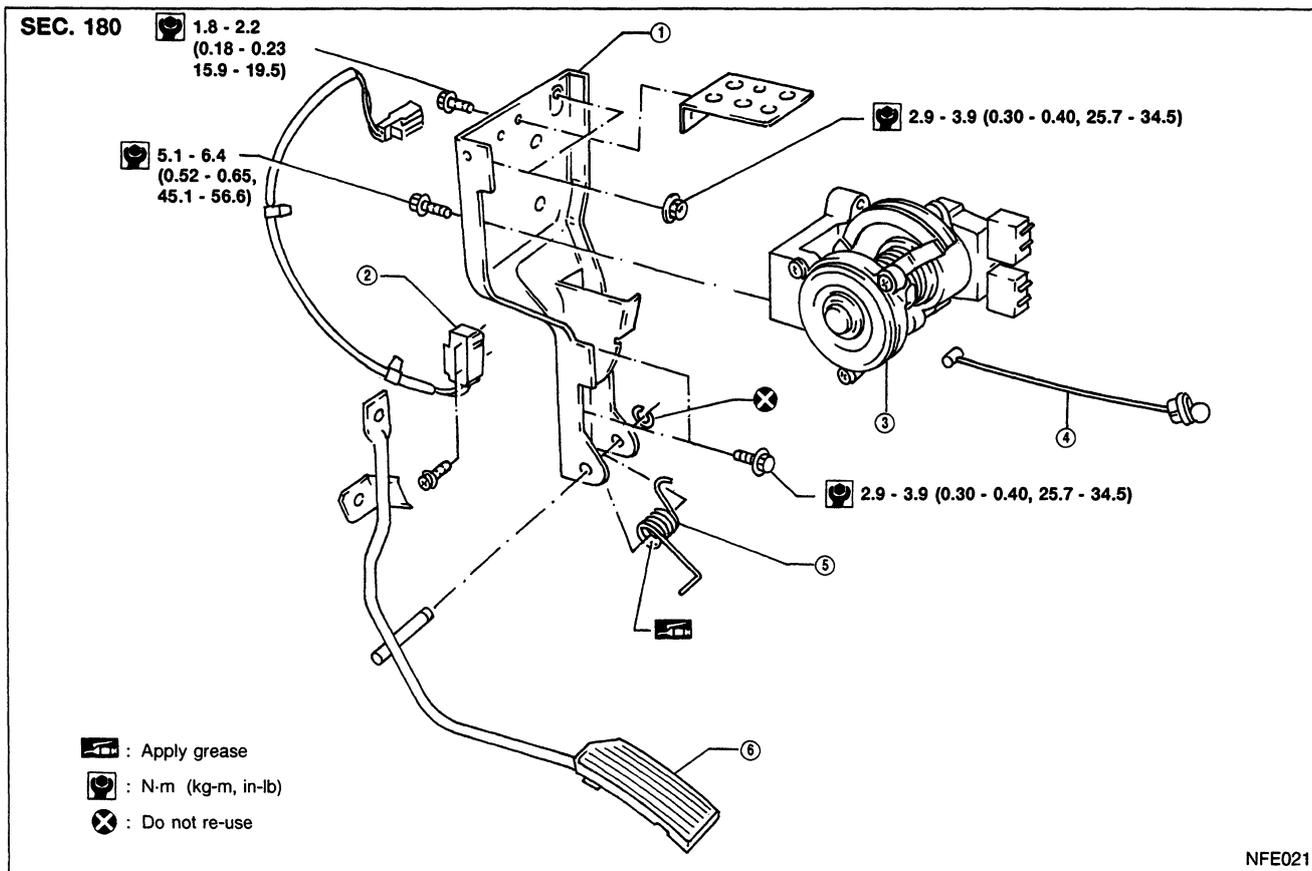
GA16DE, SR20De/DE

ACCELERATOR CONTROL SYSTEM	2
Adjusting Accelerator Cable	3
Adjusting Kickdown Switch (A/T models only)	3

<input type="checkbox"/> CD20T <input type="checkbox"/>	
ACCELERATOR CONTROL SYSTEM	4
Adjusting Accelerator Cable	4

<input type="checkbox"/> GA16DE, SR20De/DE, CD20T <input type="checkbox"/>	
FUEL SYSTEM	5
Fuel Pump and Gauge	6
EXHAUST SYSTEM	8

Adjusting Accelerator Cable



- ① Pedal bracket
- ② Accelerator switch
- ③ Accelerator position sensor
- ④ Accelerator cable
- ⑤ Return spring
- ⑥ Accelerator pedal

- After connecting accelerator position sensor harness connector of CD engine models (if previously removed), perform following operations:
 - 📱 With "OFF ACCEL PO SIG" in ACTIVE TEST mode showing on display, touch CLEAR.
 - 🕒 Start and warm up engine. After engine has warmed up; idle for 10 minutes.
- If MIL illuminates after engine has started, refer to "ON BOARD DIAGNOSTIC SYSTEM DESCRIPTION" in EC section for instructions.

FUEL SYSTEM

WARNING:

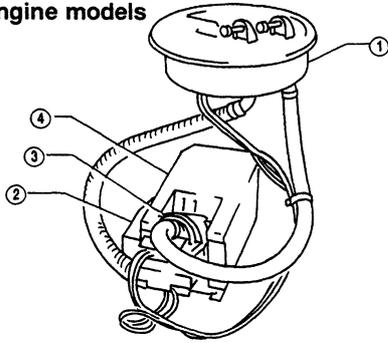
When replacing fuel line parts, be sure to observe the following:

- Display a "CAUTION: INFLAMMABLE" sign in workshop.
- Do not smoke while servicing fuel system. Keep open flames and sparks away from work area.
- Be sure to disconnect battery ground cable before conducting service operations.
- Be sure to furnish workshop with a CO₂ fire extinguisher.
- Pour drained fuel into an explosion-proof container then ensure container lid is installed securely.

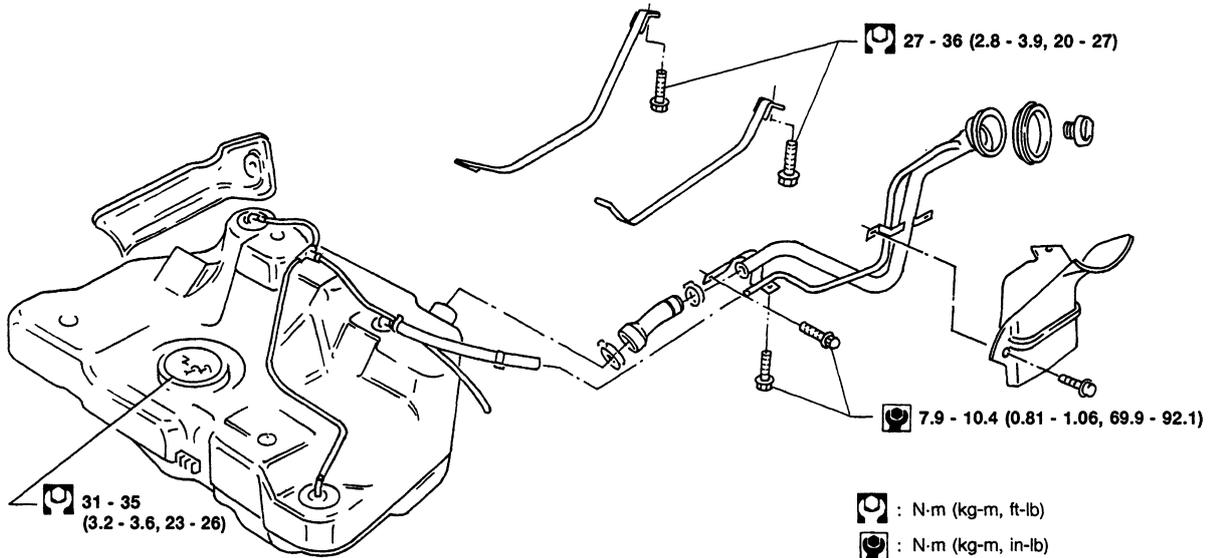
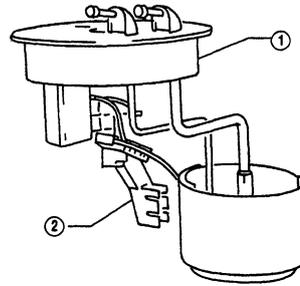
CAUTION:

- For ECCS engine models, release fuel pressure from fuel line. Refer to EC section ("Fuel Pressure Release", "BASIC SERVICE PROCEDURE").
- Do not disconnect any fuel line unless absolutely necessary.
- Plug hose and pipe openings to prevent entry of dust or dirt.
- Always replace top lid seal and hose clamps with new ones.
- Do not kink or twist hoses and tubes during installation.
- Do not tighten hose clamps excessively because this could cause damage to the hose.
- Ensure fuel check valve is installed in the correct orientation. Refer to EC section ("FUEL CHECK VALVE", "EVAPORATIVE EMISSION SYSTEM").
- After installation, run engine and check for fuel leaks at connections.

GA & SR engine models
SEC. 172



CD engine models



NFE022

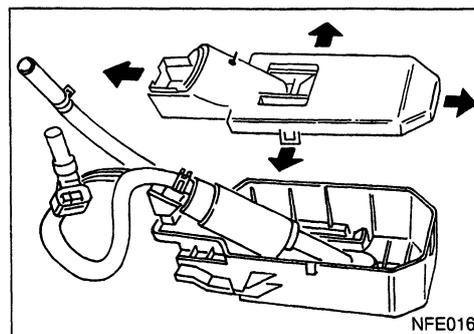
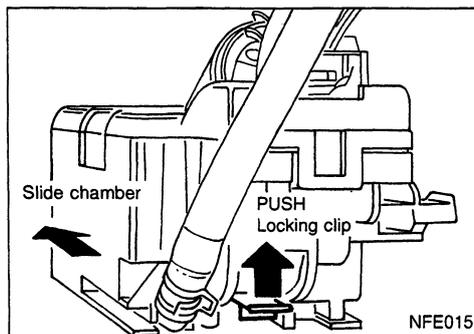
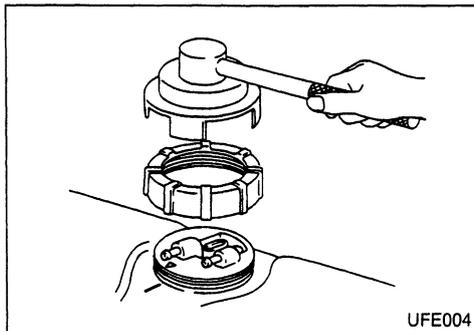
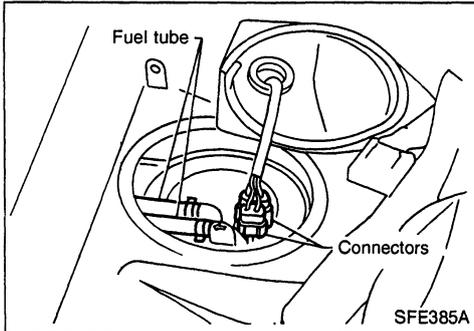
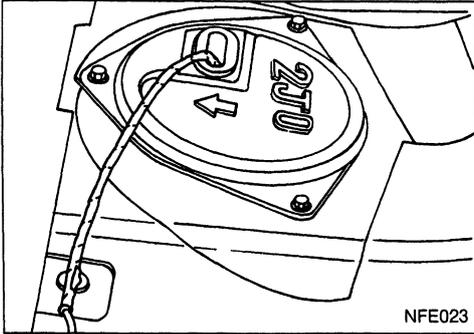
- ① Top lid
 - ③ Fuel pump
 - ④ Fuel chamber
- ② Fuel gauge
 -
 -

FUEL SYSTEM

Fuel Pump and Gauge

REMOVAL

1. Release fuel pressure from fuel line.
Refer to EC section ("Fuel Pressure Release", "BASIC SERVICE PROCEDURE").
2. Remove inspection hole cover located under the rear seat.



3. Remove fuel filler lid.
4. Disconnect fuel outlet, return tube and connectors.

CAUTION:

Mark the fuel tubes to ensure correct position during installation.

5. Using SST KV999G0010, remove fuel gauge locking ring.
6. Lift the top plate from the fuel tank.

CAUTION:

- Do not disconnect fuel hoses from top plate. Top plate has to be removed together with fuel chamber assy.
- For CD20T models the fuel gauge sender unit is attached to the top plate.

GA16DE & SR20De/DE models only:

7. Remove fuel pump with fuel tank chamber assy as follows:
 - a. Push the locking clip upwards and slide the pump chamber assy towards the rear of the vehicle.
 - b. Lift the pump chamber assy from the bracket.
 - c. Carefully remove the pump chamber assy and top plate from the tank.

CAUTION:

While removing the pump chamber assy lift the fuel gauge sender float, to prevent it from bending.

8. Take off the fuel pump chamber lid by opening out the 4 clips. Remove the fuel pump from the fuel pump chamber.
9. Remove the fuel gauge sender unit from the chamber by lifting the clip and sliding the sender unit upwards.

FUEL SYSTEM

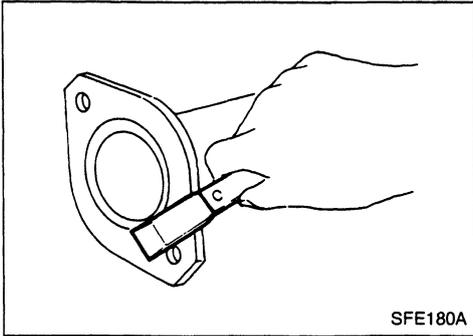
Fuel Pump and Gauge (Cont'd) INSTALLATION

Installation is reverse procedure of removal.

CAUTION:

- Always use a new top plate seal.
- Use the alignment marks to position the top plate.
- Tighten to specified torque.

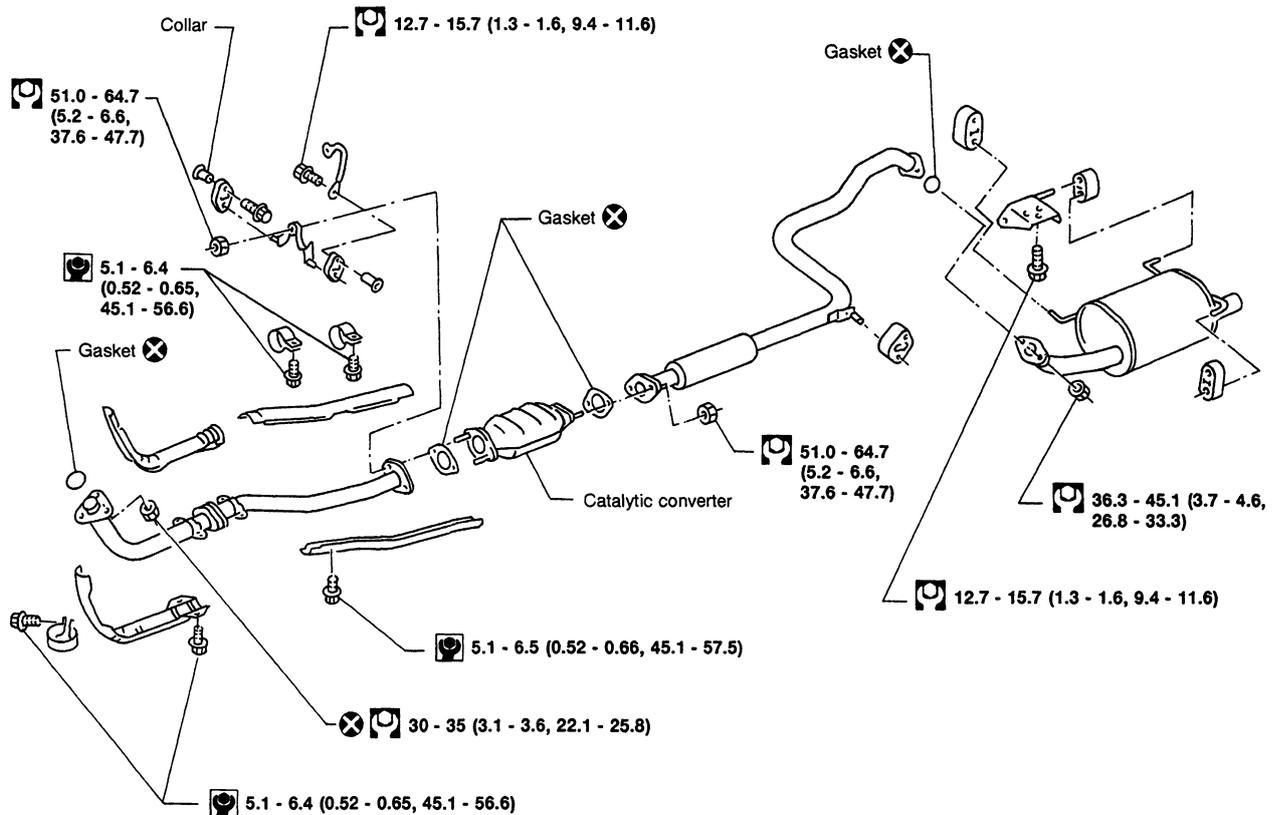
EXHAUST SYSTEM



CAUTION:

- Always replace exhaust gaskets with new ones when reassembling. Scrape off all residue of old gasket from flange surface.
- With engine running, check all tube connections for exhaust gas leaks, and entire system for unusual noises.
- After installation, check to ensure that mounting brackets and mounting insulators are free from undue stress. If any of the above parts are not installed properly, excessive noise or vibration may be transmitted to the vehicle body.

GA16DE engine models SEC. 200-208



: N-m (kg-m, in-lb)

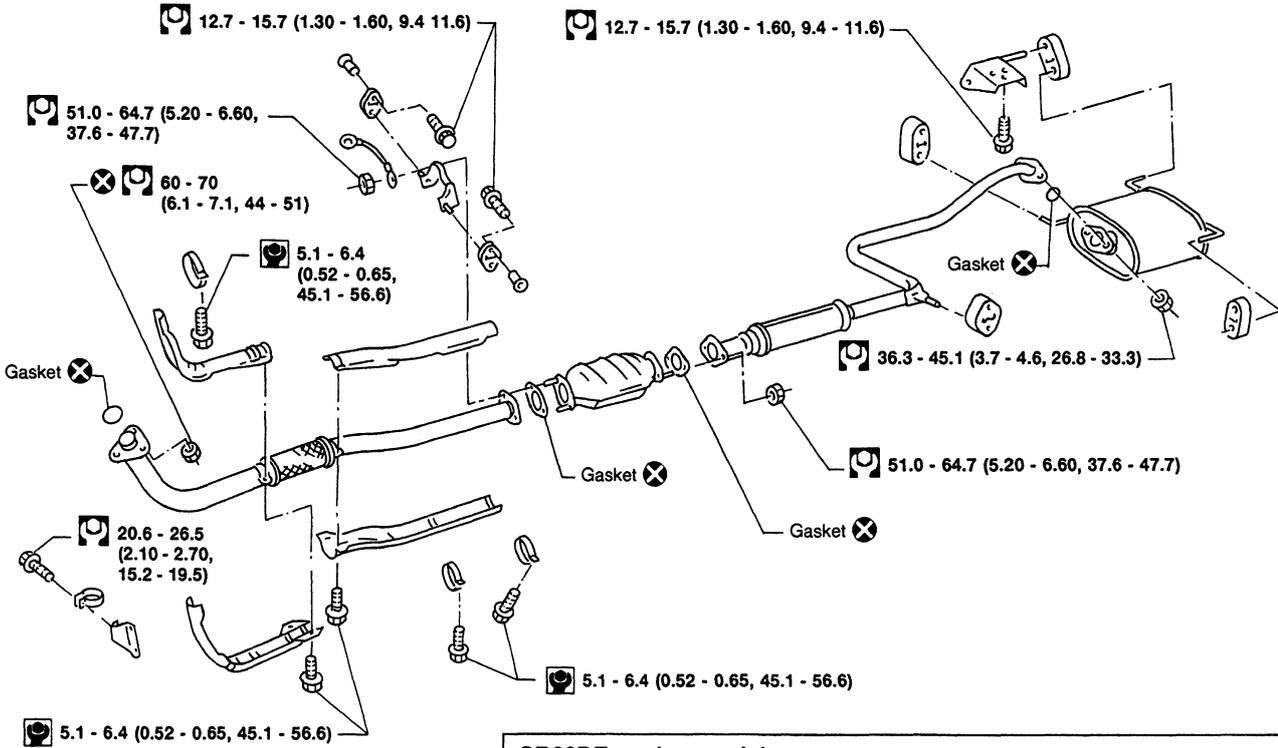
: N-m (kg-m, ft-lb)

: Do not re-use

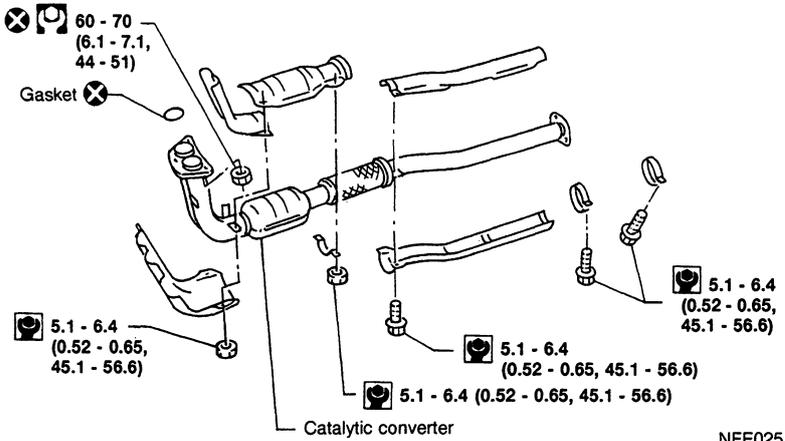
NFE024

EXHAUST SYSTEM

SR20De engine models SEC. 200-208



SR20DE engine models

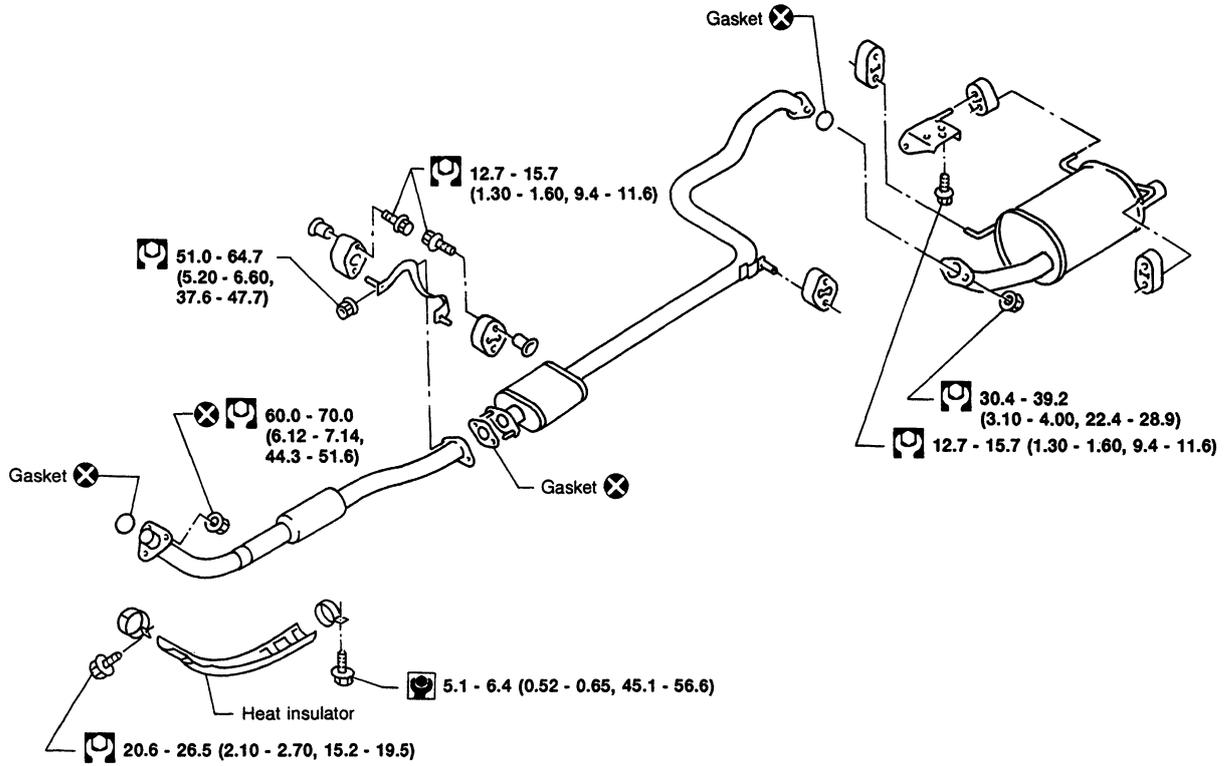


- : N-m (kg-m, ft-lb)
- : N-m (kg-m, in-lb)
- : Do not re-use

NFE025

EXHAUST SYSTEM

CD engine model
SEC. 200-208



: N-m (kg-m, ft-lb)

: N-m (kg-m, in-lb)

: Do not re-use

NFE018

<COMBINED EDITION>

NISSAN

PRIMERA

MODEL P11 SERIES

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