ENGINE CONTROL SYSTEM

SECTION EC

CONTENTS

ZD30DDTi

CONTENTS (Cont'd)

CONTENTS (Cont'd)

CONTENTS (Cont'd)

CONTENTS (Cont'd)

CONTENTS (Cont'd)

Alphabetical & Numerical Index for DTC

ALPHABETICAL INDEX FOR DTC

X: Applicable —: Not applicable

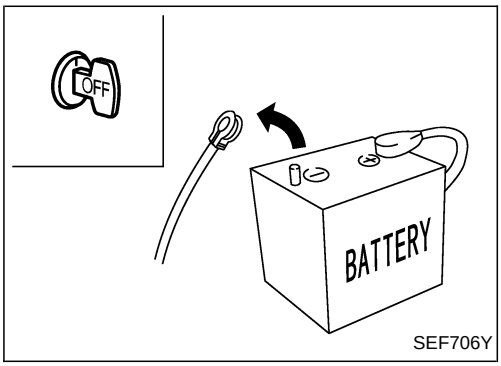
Items (CONSULT-II screen terms)	DTC	MI (MIL) illumination	Reference page
ACCEL POS SENSOR	0403	X	EC-130
ACCEL POS SW (F/C)	0203	X	EC-104
A/T COMM LINE	0504	—	EC-155
BATTERY VOLTAGE	0502	—	EC-153
COOLANT TEMP SEN	0103	X	EC-95
CRANK POS SEN (TDC)	0407	X	EC-145
ECM 2	0301	X	EC-121
ECM 10	0802	X	EC-200
ECM 11	0804	—	EC-202
ECM 12	0901	X	EC-121
ECM 14	0807	X	EC-204
ECM 15	0903	—	EC-213
ECM RLY	0902	X	EC-209
EGR VOLUME CONT/V	1003	X	EC-222
FUEL CUT SYSTEM1	1004	X	EC-232
INT/AIR VOLUME	0406	—	EC-143
MASS AIR FLOW SEN	0102	X	EC-88
NATS MALFUNCTION	1401 - 1408	—	EL section
NO DTC IS DETECTED. FURTHER TESTING MAY BE REQUIRED.	0505	—	—
OVER HEAT	0208	X	EC-109
P1·CAM POS SEN	0701	X	EC-161
P2·TDC PULSE SIG	0702	X	EC-168
P3·PUMP COMM LINE	0703	X	EC-175
P4·SPILL/V CIRC	0704	X	EC-182
P5·PUMP C/MODULE	0705	X	EC-189
P6·SPILL VALVE	0706	X	EC-182
P7·F/INJ TIMG FB	0707	X	EC-192
P9·FUEL TEMP SEN	0402	X	EC-123
TURBO PRESSURE	0905	X	EC-215
VEHICLE SPEED SEN	0104	X	EC-99

Alphabetical & Numerical Index for DTC (Cont'd)

NUMERICAL INDEX FOR DTC

X: Applicable —: Not applicable

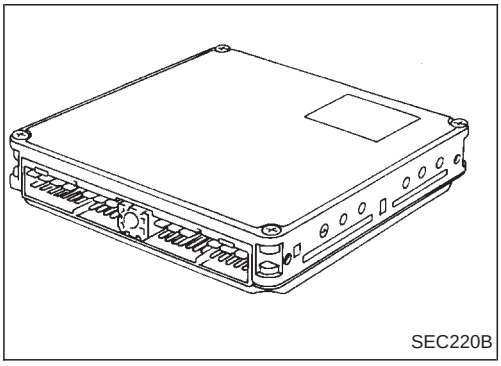
DTC	Items (CONSULT-II screen terms)	MI (MIL) illumination	Reference page
0102	MASS AIR FLOW SEN	X	EC-88
0103	COOLANT TEMP SEN	X	EC-95
0104	VEHICLE SPEED SEN	X	EC-99
0203	ACCEL POS SW (F/C)	X	EC-104
0208	OVER HEAT	X	EC-109
0301	ECM 2	X	EC-121
0402	P9·FUEL TEMP SEN	X	EC-123
0403	ACCEL POS SENSOR	X	EC-130
0406	INT/AIR VOLUME	—	EC-143
0407	CRANK POS SEN (TDC)	X	EC-145
0502	BATTERY VOLTAGE	—	EC-153
0504	A/T COMM LINE	—	EC-155
0505	**NO DTC IS DETECTED. FURTHER TESTING MAY BE REQUIRED.**	—	—
0701	P1·CAM POS SEN	X	EC-161
0702	P2·TDC PULSE SIG	X	EC-168
0703	P3·PUMP COMM LINE	X	EC-175
0704	P4·SPILL/V CIRC	X	EC-182
0705	P5·PUMP C/MODULE	X	EC-189
0706	P6·SPILL VALVE	X	EC-182
0707	P7·F/INJ TIMG FB	X	EC-192
0802	ECM 10	X	EC-200
0804	ECM 11	—	EC-202
0807	ECM 14	X	EC-204
0901	ECM 12	X	EC-121
0902	ECM RLY	X	EC-209
0903	ECM 15	—	EC-213
0905	TURBO PRESSURE	X	EC-215
1003	EGR VOLUME CONT/V	X	EC-222
1004	FUEL CUT SYSTEM1	X	EC-232
1401 - 1408	NATS MALFUNCTION	—	EL section



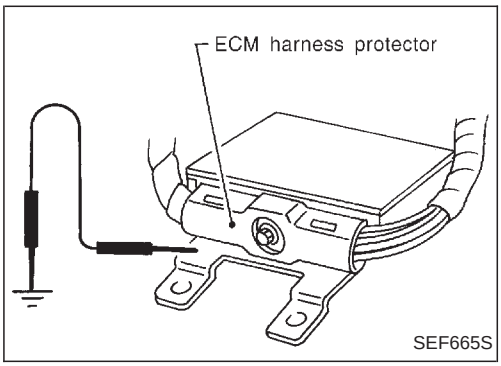
SEF706Y

Precautions

- Always use a 12 volt battery as power source.
- Do not attempt to disconnect battery cable while engine is running.
- 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.
- Before removing parts, turn off ignition switch and then disconnect battery ground cable.

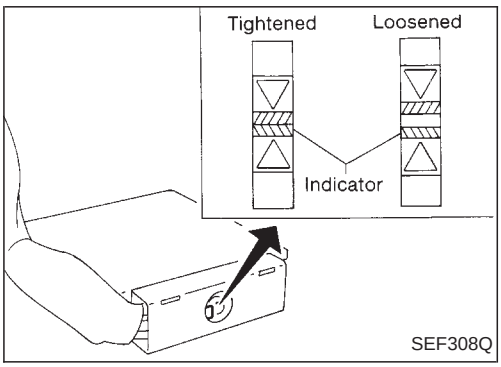

SEC220B

- 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.



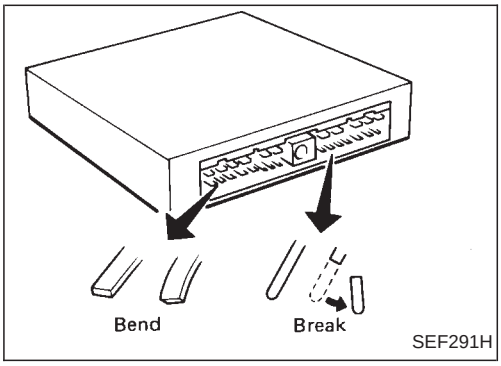
SEF665S

- When ECM is removed for inspection, make sure to ground the ECM mainframe.



SEF308Q

- When connecting ECM harness connector, tighten securing bolt until the gap between the orange indicators disappears.
  : 3.0 - 5.0 N·m (0.3 - 0.5 kg-m, 26 - 43 in-lb)



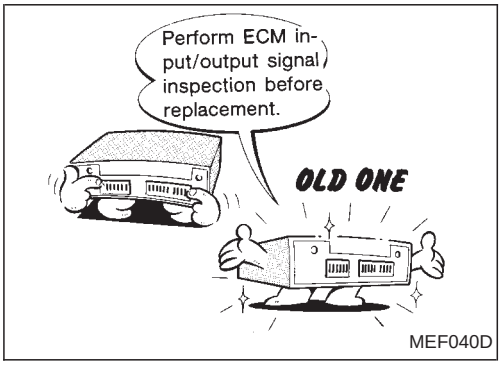
SEF291H

- 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.
- Securely connect ECM harness connectors.
  A poor connection can cause an extremely high (surge) voltage to develop in the circuit, 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

Precautions (Cont'd)

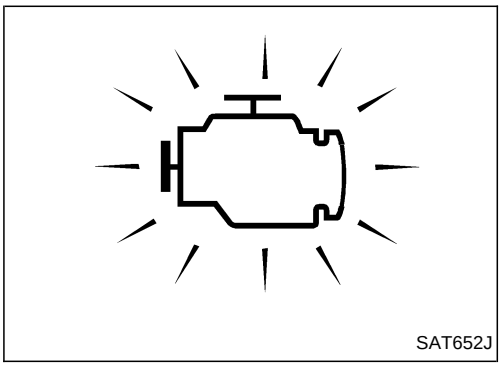
due to receiving external noise, degraded operation of ICs, etc.

- Keep ECM parts and harnesses dry.

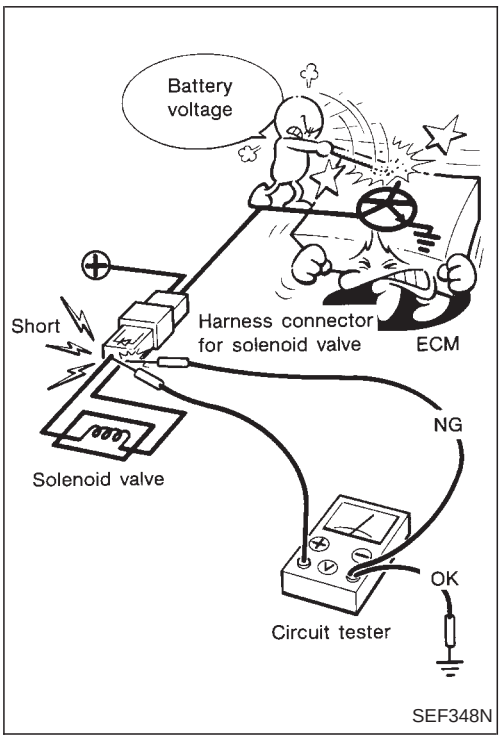


MEF040D

- Before replacing ECM, perform Terminals and Reference Value inspection and make sure ECM functions properly. Refer to EC-69.


SAT652J

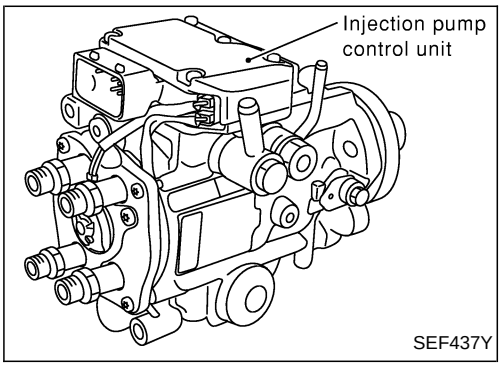
- If MI (MIL) illuminates or blinks irregularly when engine is running, water may have accumulated in fuel filter. Drain water from fuel filter. If this does not correct the problem, perform specified trouble diagnostic procedures.
- After performing each TROUBLE DIAGNOSIS, perform "DTC Confirmation Procedure" or "Overall Function Check".
  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.



SEF348N

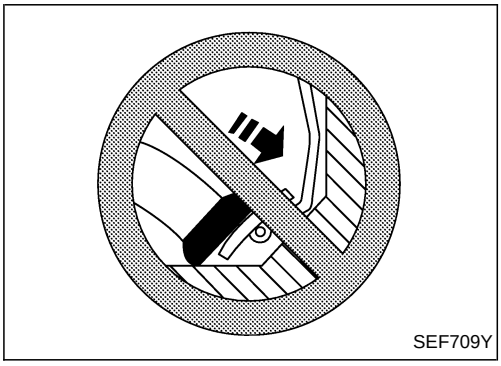
- When measuring ECM signals with a circuit tester, never allow the two tester probes to contact.
  Accidental contact of probes will cause a short circuit and damage the ECM power transistor.
- Do not use ECM ground terminals when measuring input/output voltage. Doing so may result in damage to the ECM's transistor. Use a ground other than ECM terminals, such as the ground.

Precautions (Cont'd)

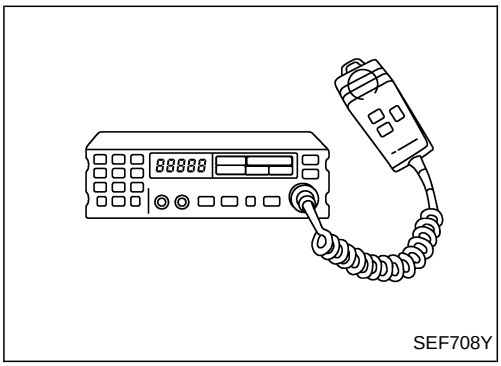


SEF437Y

- **Do not disconnect pump harness connector with engine running.**
- **Do not disassemble electronic fuel injection pump.**
  If NG, take proper action.
- **Do not disassemble injection nozzle.**
  If NG, replace injection nozzle.
- **Even a slight leak in the air intake system can cause serious problems.**
- **Do not shock or jar the crankshaft position sensor (TDC).**


SEF709Y

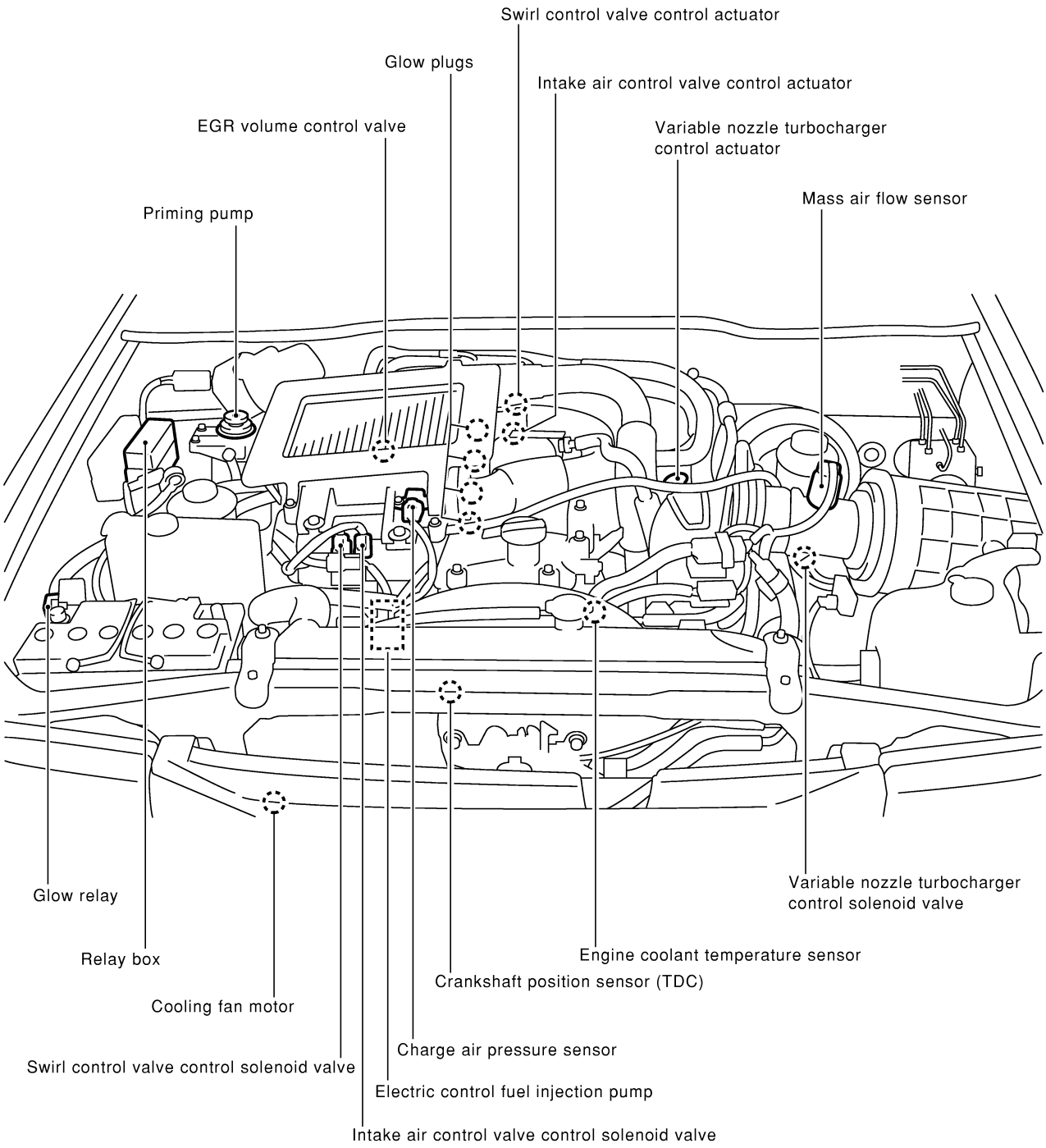
- **Do not depress accelerator pedal when starting.**
- **Immediately after starting, do not rev up engine unnecessarily.**
- **Do not rev up engine just prior to shutdown.**


SEF708Y

- **When installing C.B. ham radio or a mobile phone, be sure to observe the following as it may adversely affect electronic control systems depending on its installation location.**

1) Keep the antenna as far as possible away from the ECM.
2) Keep the antenna feeder line more than 20 cm (7.9 in) away from the harness of electronic controls.
Do not let them run parallel for a long distance.
3) Adjust the antenna and feeder line so that the standing-wave ratio can be kept smaller.
4) Be sure to ground the radio to vehicle body.

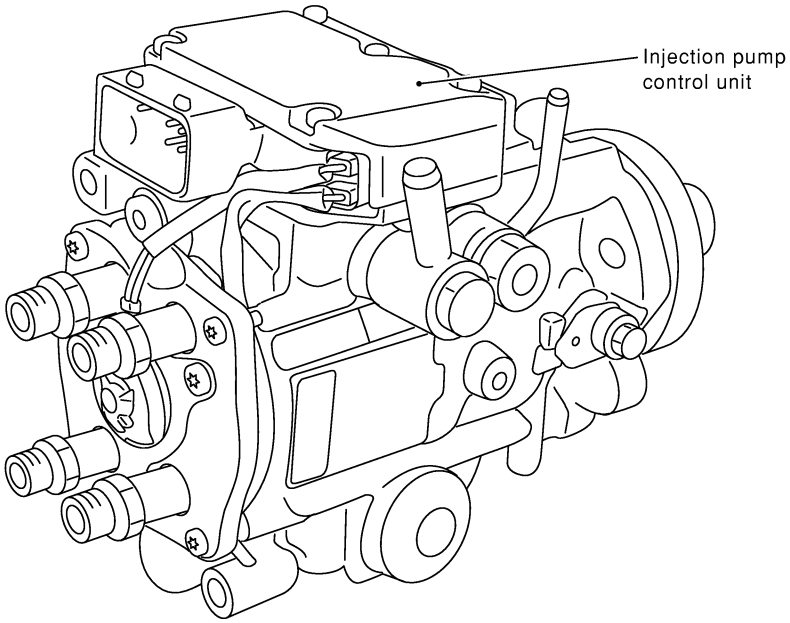
Engine Control Component Parts Location



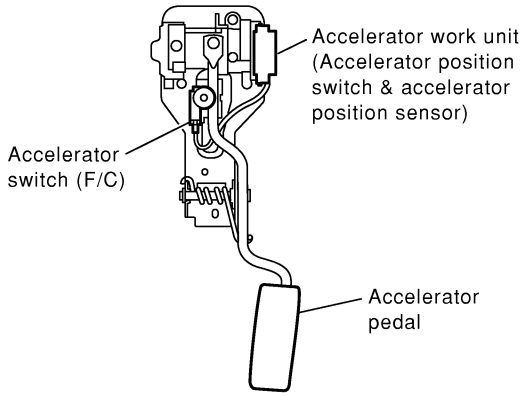
MEC988D

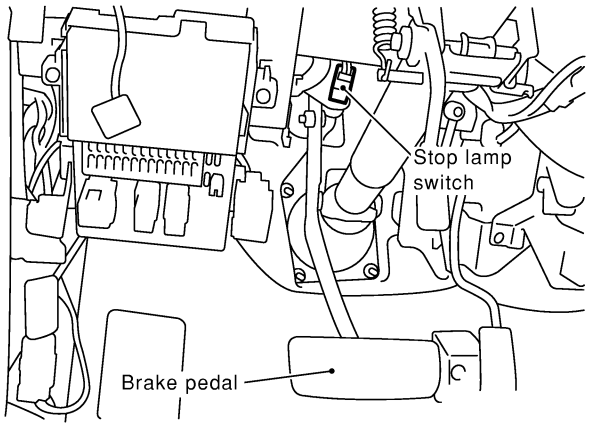
Engine Control Component Parts Location (Cont'd)

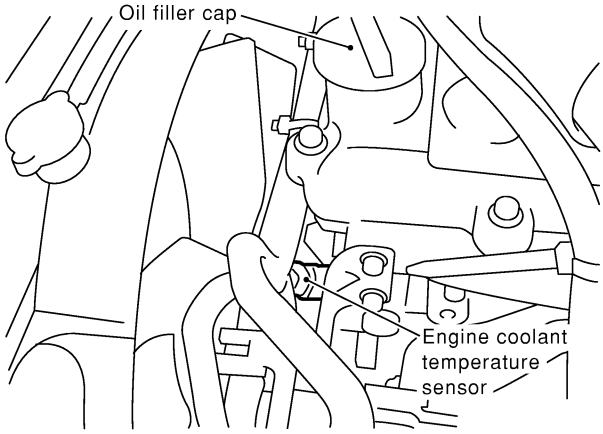
Electronic control fuel injection pump

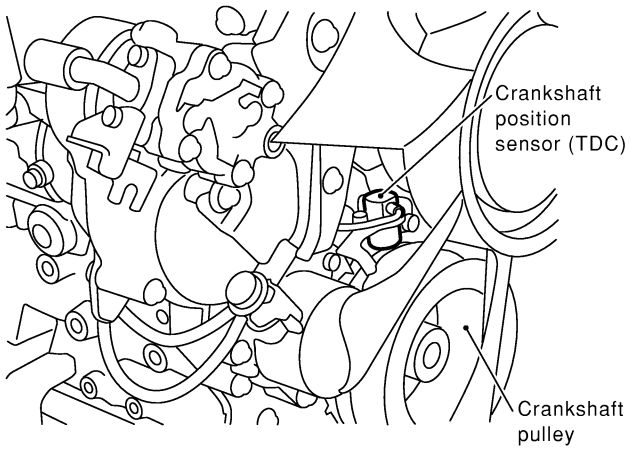


LHD models





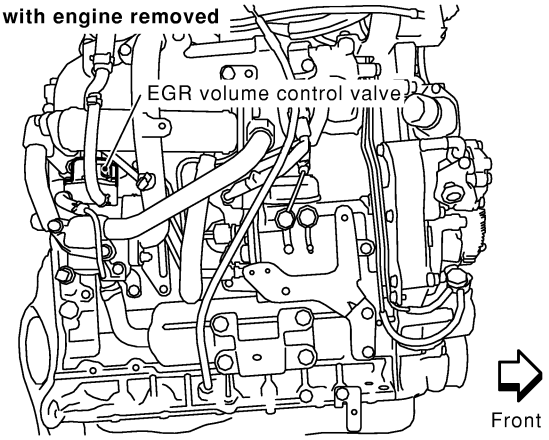


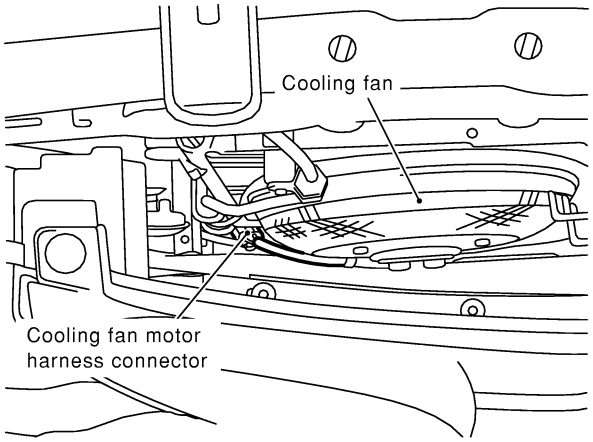


MEC989D

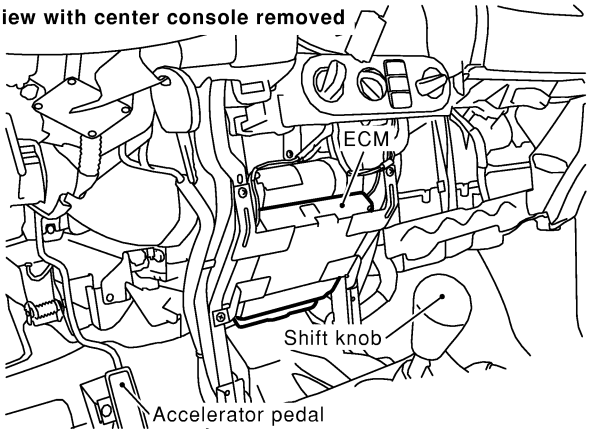
Engine Control Component Parts Location (Cont'd)

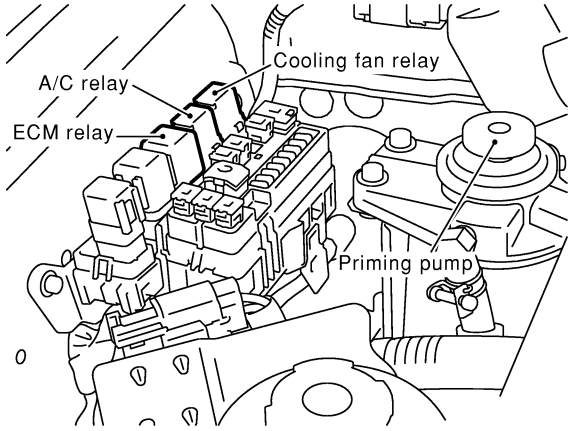
View with engine removed

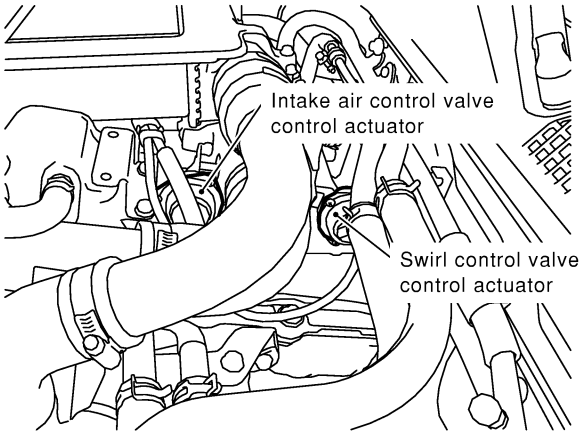




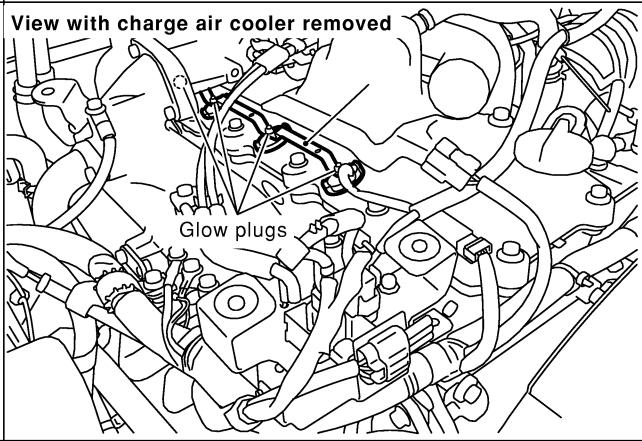
View with center console removed

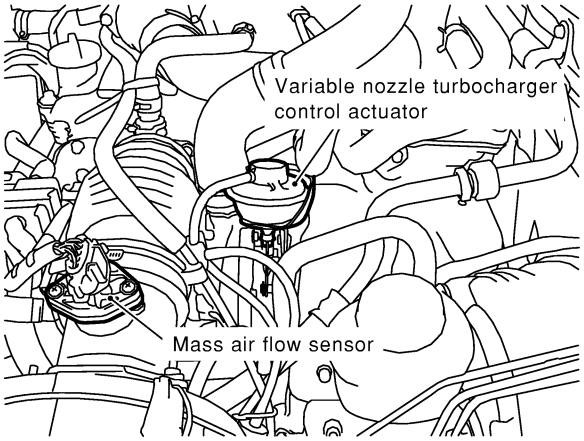


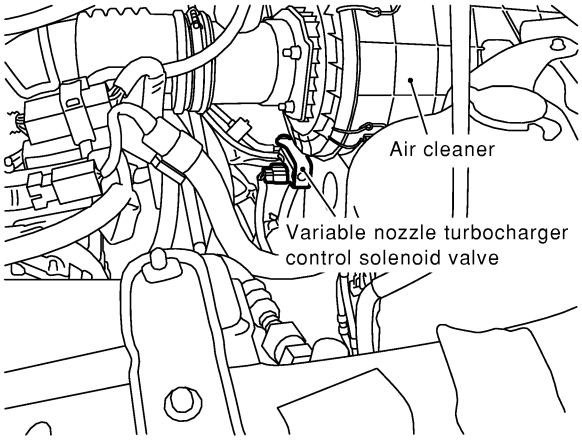




View with charge air cooler removed

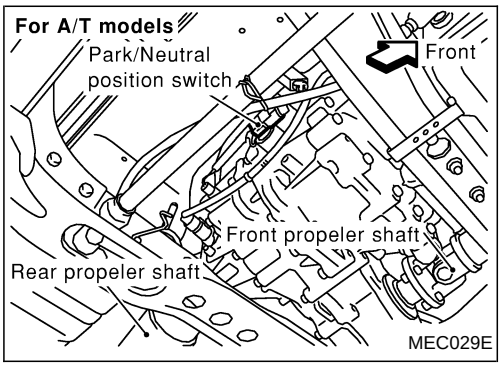




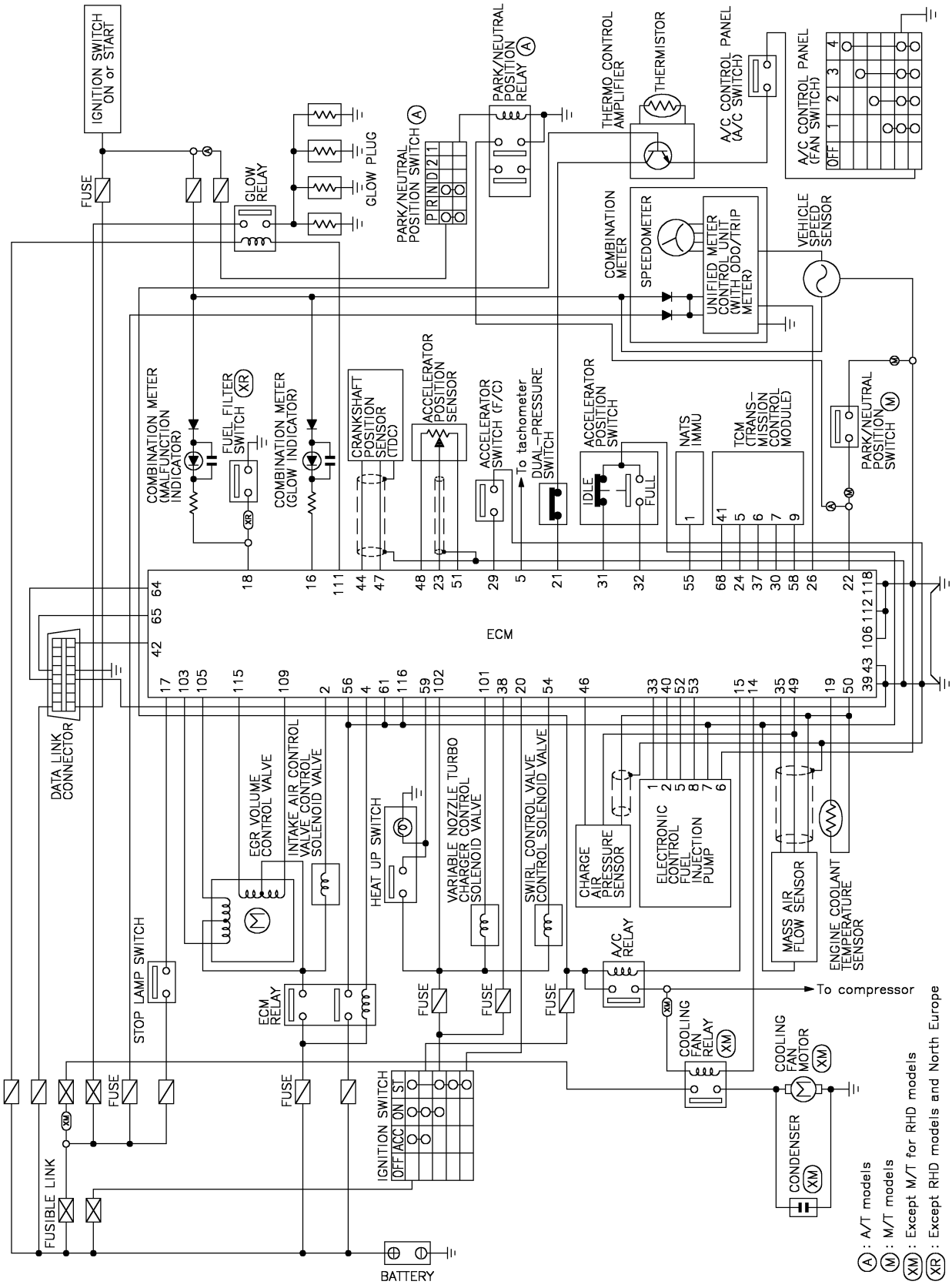


MEC990D

Engine Control Component Parts Location (Cont'd)

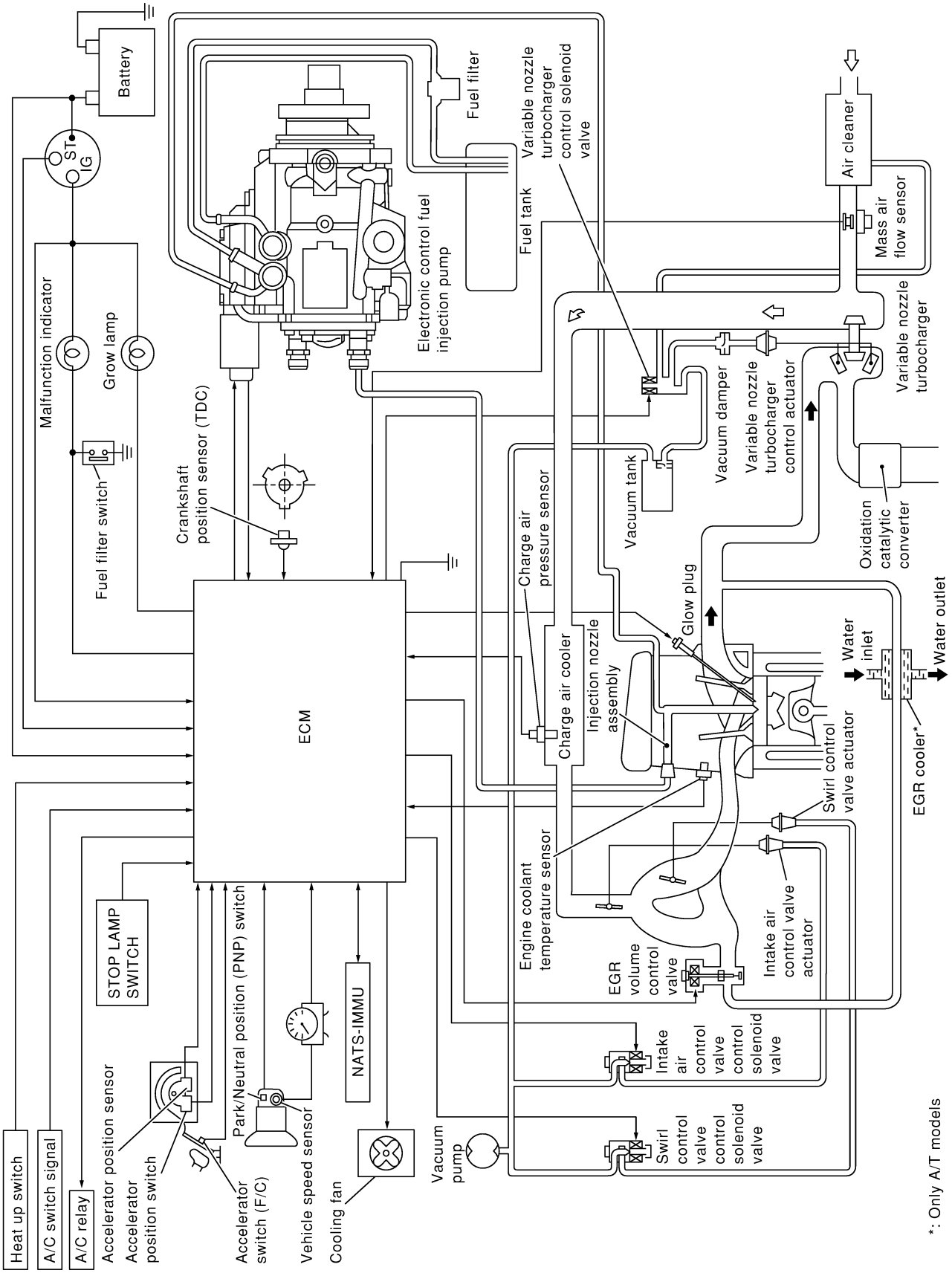


Circuit Diagram



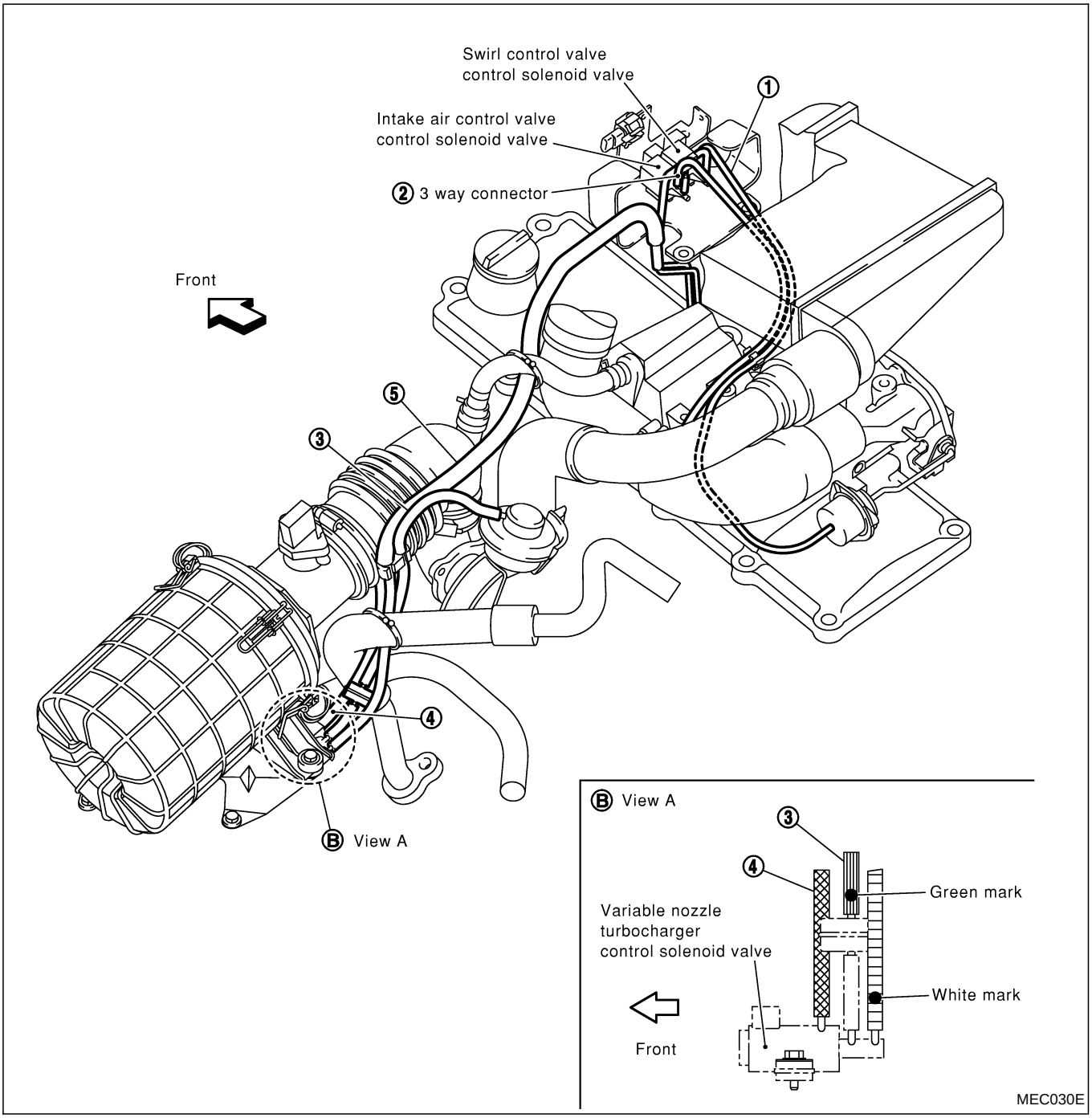
YEC170A

System Diagram



SEC390D

Vacuum Hose Drawing



1. Swirl control valve control solenoid valve to swirl control valve actuator
2. Intake air control valve control solenoid valve to intake air control valve actuator
3. Variable nozzle turbocharger control actuator to vacuum damper
4. Variable nozzle turbocharger control solenoid valve to resonator
5. Variable nozzle turbocharger control solenoid valve to vacuum pump

Refer to “System Diagram”, EC-17 for vacuum control system.

System Chart

Input (Sensor)	ECM Function	Output (Actuator)
● Electronic control fuel injection pump ● Crankshaft position sensor (TDC) ● Engine coolant temperature sensor ● Accelerator position sensor ● Accelerator position switch ● Accelerator switch (F/C) ● Park/Neutral position (PNP) switch ● Ignition switch ● Battery voltage ● Vehicle speed sensor ● Air conditioner switch ● Mass air flow sensor ● Stop lamp switch ● Heat up switch ● Charge air pressure sensor*1	Fuel injection control	Electronic control fuel injection pump
	Fuel injection timing control	Electronic control fuel injection pump
	Fuel cut control	Electronic control fuel injection pump
	Glow control system	Glow relay & glow lamp
	On board diagnostic system	MIL (On the instrument panel)
	EGR volume control	EGR volume control valve
	Cooling fan control	Cooling fan relay
	Air conditioning cut control	Air conditioner relay
	Variable nozzle turbocharger control	Variable nozzle turbocharger control solenoid valve
	Swirl control valve control	Swirl control valve control solenoid valve
	Intake air control valve control	Intake air control valve control solenoid valve

*1: This sensor is not used to control the engine system under normal conditions.

Fuel Injection Control System

DESCRIPTION

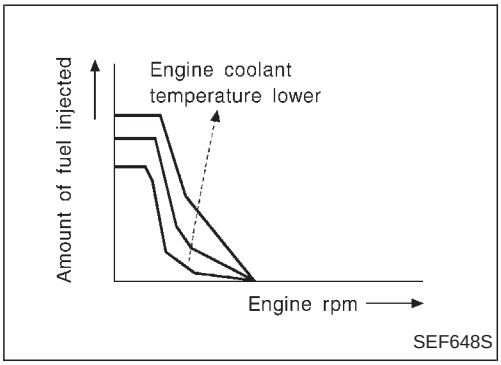
System description

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.
Pulse signals are exchanged between ECM and electronic control fuel injection pump (control unit is built-in). The fuel injection pump control unit performs duty control on the spill valve (built into the fuel injection pump) according to the input signals to compensate the amount of fuel injected to the preset value.

Start control

Input/output signal chart

Sensor	Input Signal to ECM	ECM Function	Actuator
Engine coolant temperature sensor	Engine coolant temperature	Fuel injection control (start control)	Electronic control fuel injection pump
Crankshaft position sensor (TDC)	Engine speed		
Ignition switch	Start signal		



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 the specific value, and shifts the control to the normal or idle control.

Idle control

Input/output signal chart

Sensor	Input Signal to ECM	ECM Function	Actuator
Engine coolant temperature sensor	Engine coolant temperature	Fuel injection control (Idle control)	Electronic control fuel injection pump
Crankshaft position sensor (TDC)	Engine speed		
Park/Neutral position (PNP) switch	Gear position		
Battery	Battery voltage		
Accelerator position switch	Idle position		
Vehicle speed sensor	Vehicle speed		
Air conditioner switch	Air conditioner signal		
Heat up switch	Heat up switch signal		

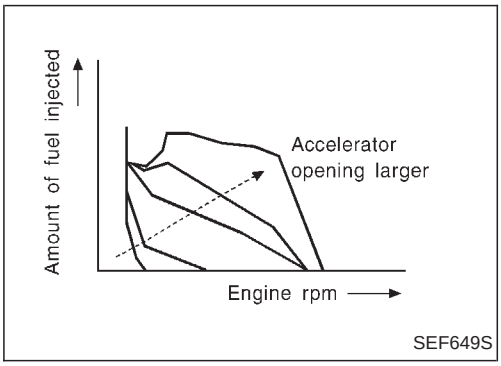
When the ECM determines that the engine speed is at idle, the fuel injection system is adapted for the idle control. The ECM regulates the amount of fuel injected corresponding to changes in load applied to the engine to keep engine speed constant. The ECM also provides the system with a fast idle control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

Fuel Injection Control System (Cont'd)

Normal control

Input/output signal chart

Sensor	Input Signal to ECM	ECM Function	Actuator
Crankshaft position sensor (TDC)	Engine speed	Fuel injection control (Normal control)	Electronic control fuel injection pump
Accelerator position sensor	Accelerator position		
Vehicle speed sensor	Vehicle speed		



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.

Maximum amount control

Input/output signal chart

Sensor	Input Signal to ECM	ECM Function	Actuator
Mass air flow sensor	Amount of intake air	Fuel injection control (Maximum amount control)	Electronic control fuel injection pump
Engine coolant temperature sensor	Engine coolant temperature		
Crankshaft position sensor (TDC)	Engine speed		
Accelerator position sensor	Accelerator position		

The maximum injection amount is controlled to an optimum by the engine speed, intake air amount, engine coolant temperature, and accelerator opening in accordance with the driving conditions.
This prevents the oversupply of the injection amount caused by decreased air density at a high altitude or during a system failure.

Deceleration control

Input/output signal chart

Sensor	Input Signal to ECM	ECM Function	Actuator
Accelerator switch (F/C)	Accelerator position	Fuel injection control (Deceleration control)	Electronic control fuel injection pump
Crankshaft position sensor (TDC)	Engine speed		

The ECM sends a fuel cut signal to the electronic control fuel injection pump during deceleration for better fuel efficiency. The ECM determines the time of deceleration according to signals from the accelerator switch (F/C) and crankshaft position sensor (TDC).

Fuel Injection Timing Control System

DESCRIPTION

The target fuel injection timing in accordance with the engine speed and the fuel injection amount are recorded as a map in the ECM beforehand. The ECM and the injection pump control unit exchange signals and perform feedback control for optimum injection timing in accordance with the map.

Air Conditioning Cut Control

DESCRIPTION

Input/output signal chart

Sensor	Input Signal to ECM	ECM Function	Actuator
Air conditioner switch	Air conditioner “ON” signal	Air conditioner cut control	Air conditioner relay
Accelerator position sensor	Accelerator valve opening angle		
Vehicle speed sensor	Vehicle speed		
Engine coolant temperature sensor	Engine coolant temperature		

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 engine coolant temperature returns to normal.

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

DESCRIPTION

Input/output signal chart

Sensor	Input Signal to ECM	ECM Function	Actuator
Vehicle speed sensor	Vehicle speed	Fuel cut control	Electronic control fuel injection pump
Park/Neutral position (PNP) switch	Neutral position		
Accelerator position switch or Accelerator switch (F/C)	Accelerator position		
Engine coolant temperature sensor	Engine coolant temperature		
Crankshaft position sensor (TDC)	Engine speed		

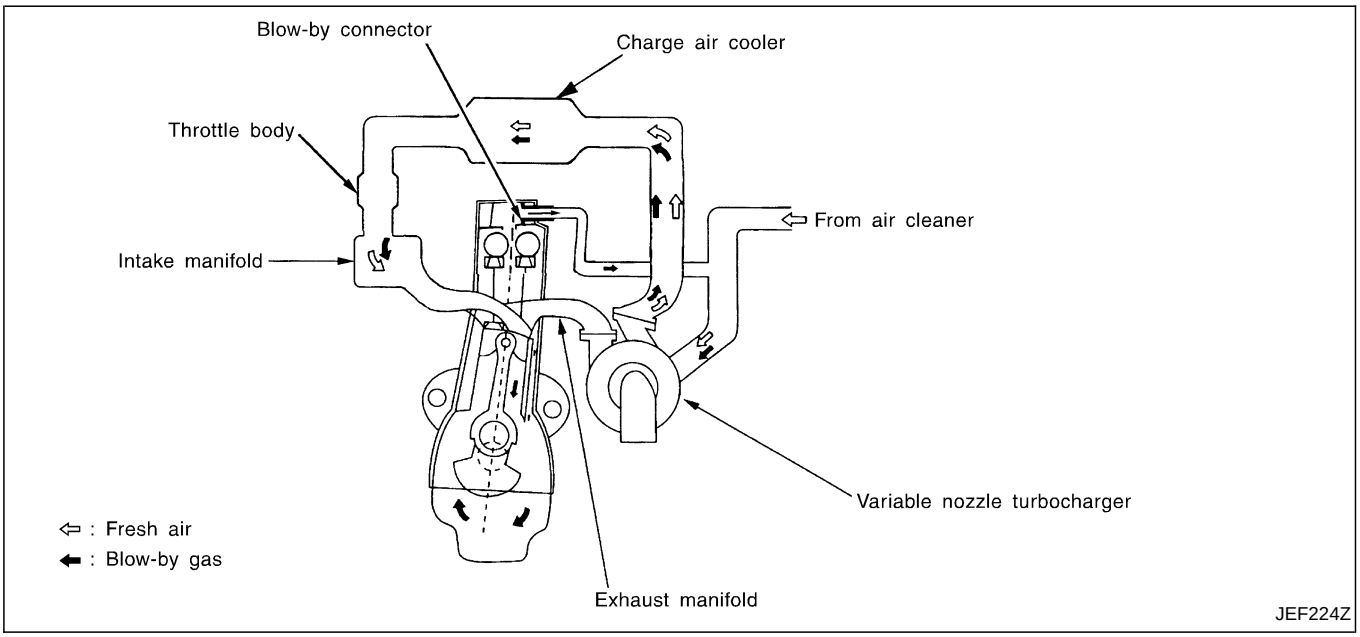
If the engine speed is above 2,700 rpm with no load (for example, in neutral and engine speed over 2,700 rpm) fuel will be cut off after some time. The exact time when the fuel is cut off varies based on engine speed. Fuel cut will operate until the engine speed reaches 1,500 rpm, then fuel cut is cancelled.

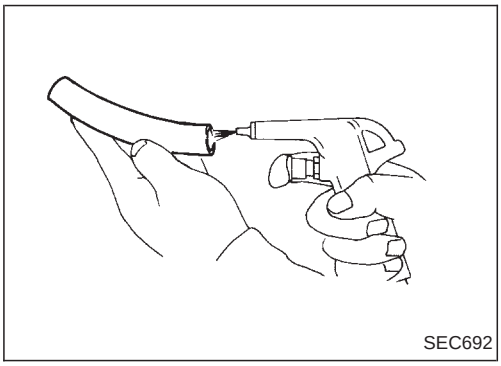
NOTE:
This function is different from deceleration control listed under “Fuel Injection Control System”, EC-20.

Crankcase Ventilation System

DESCRIPTION

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





INSPECTION

Ventilation hose

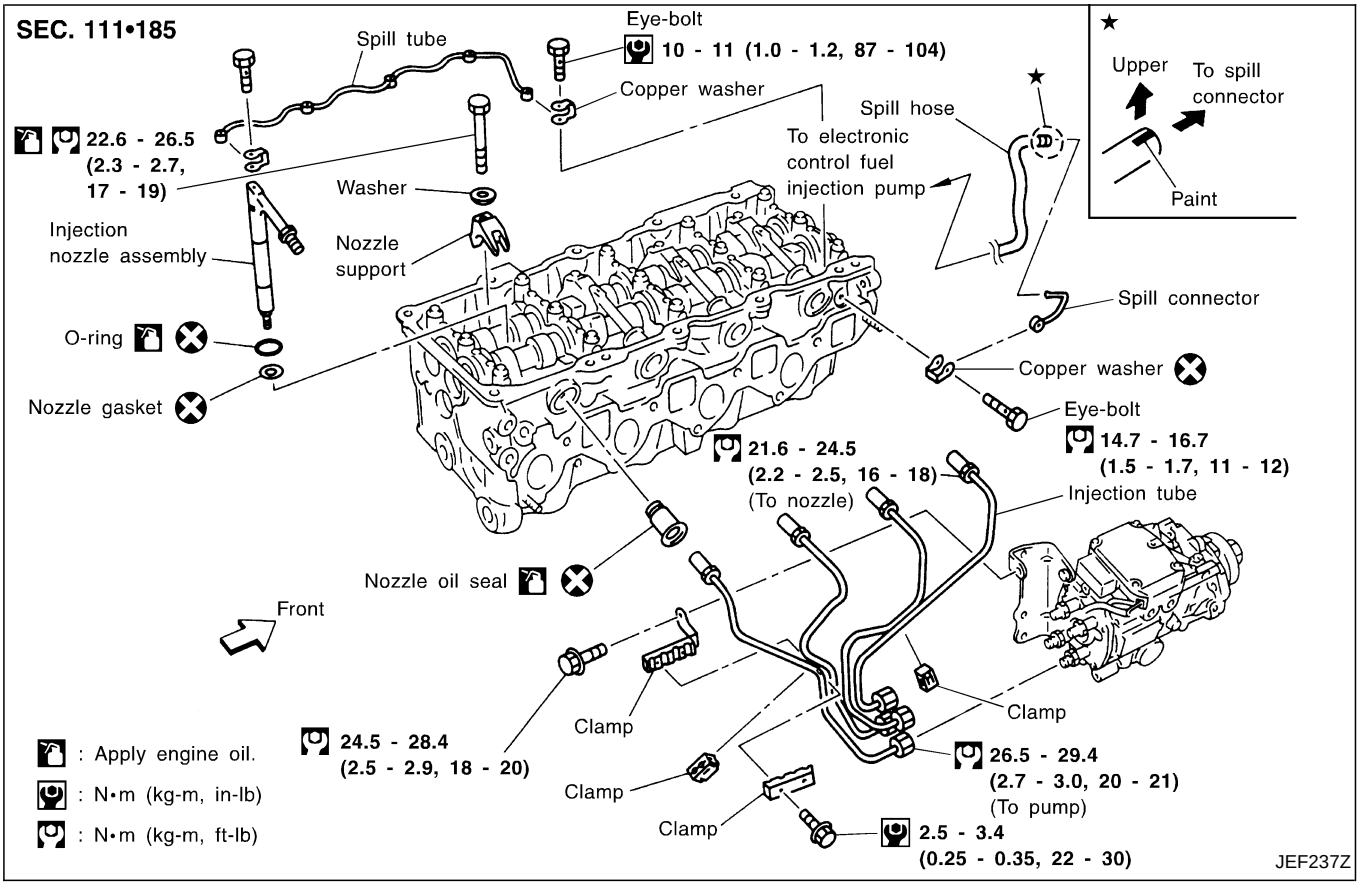
1. Check hoses and hose connections for leaks.
2. Disconnect all hoses and clean with compressed air. If any hose cannot be freed of obstructions, replace.

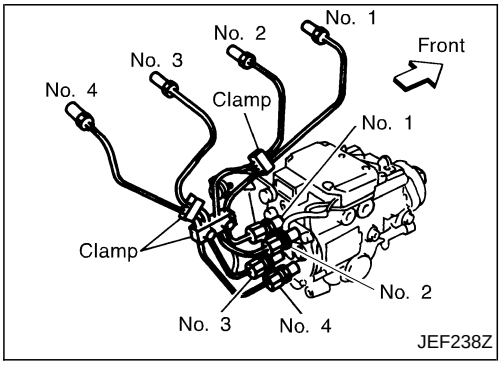
Injection Tube and Injection Nozzle

REMOVAL AND INSTALLATION

CAUTION:

- **Do not disassemble injection nozzle assembly. If NG, replace injection nozzle assembly.**
- **Plug flare nut with a cap or rag so that no dust enters the nozzle. Cover nozzle tip for protection of needle.**





Injection tube

Removal

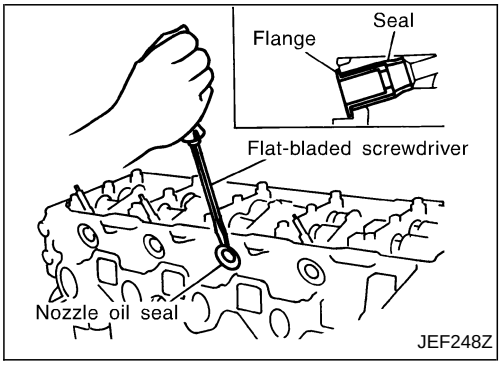
1. Mark the cylinder Nos. to the injection tubes, then disconnect them.
- **Marking should be made at proper locations and by the proper method, so that they are not erased by fuel, etc.**
2. Remove the clamps, then disconnect the tubes one by one.
- **Avoid letting leaked fuel get on the interior walls of the engine compartment.**

Take special care to prevent fuel from getting on the engine mount insulator.

Injection Tube and Injection Nozzle (Cont'd)

Installation

- Install the injection tubes, referring to the markings made during removal.
- Install the injection tubes in the order of No. 3, No. 4, No. 1, and No. 2.



Injection nozzle oil seal

Removal

Using a tool such as a flat-bladed screwdriver, pry the flange of the seal, then remove it.

Installation

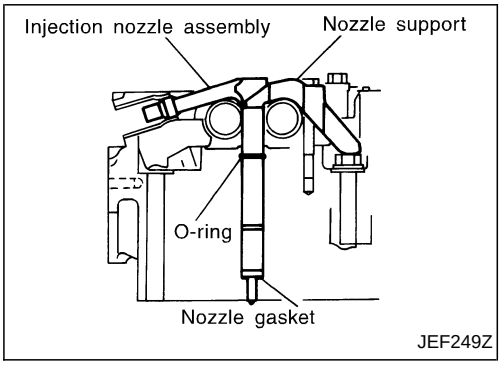
After the injection nozzle assembly is installed, push the seal from the cylinder head side until it contacts the flange.

- **Replace the oil seal with new one when the injection nozzle assembly is removed. (It is not necessary to replace the oil seal when only injection tubes are removed.)**

Spill tube

Installation

- **After the spill tube is installed, check the airtightness of the spill tube.**
- After the bolts are tightened, the joint of the spill tube gasket might be broken. However, this will not affect function.



Injection nozzle assembly

Removal

1. Remove the nozzle support, then pull out the injection nozzle assembly by turning it clockwise/counterclockwise.
2. Using a tool such as a flat-head screwdriver, remove the copper washer inside the cylinder head.

CAUTION:

Do not disassemble the injection nozzle.

Installation

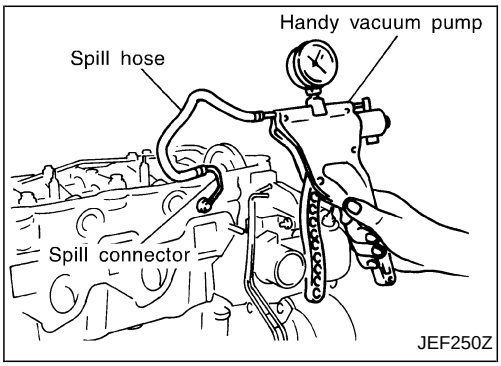
1. Insert the nozzle gasket to the cylinder head hole.
2. Attach the O-ring to the mounting groove of the nozzle side, then insert it in the cylinder head.

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.

Injection Tube and Injection Nozzle (Cont'd)



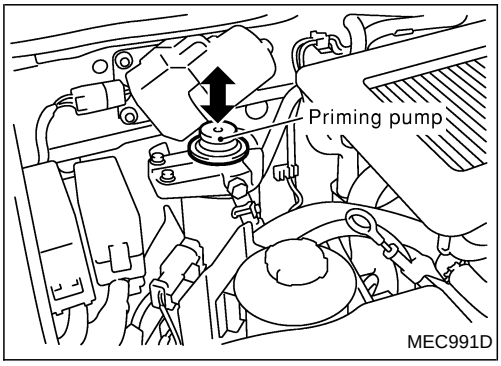
Inspection for spill tube airtightness

Before the rocker cover is installed, perform the inspection as follows.

1. Connect the handy vacuum pump to the spill hose.
2. Check that the airtightness is maintained after the negative pressure shown below is applied.

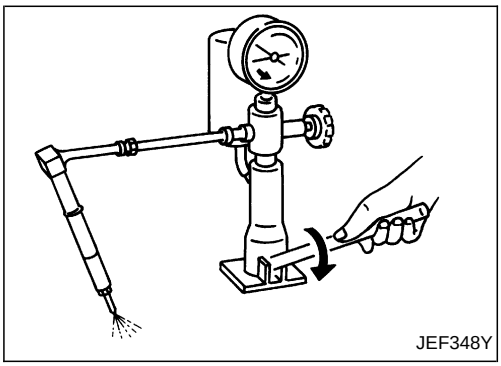
Standard:

−53.3 to −66.7 kPa (−533 to −667 mbar, −400 to −500 mmHg, −15.75 to −19.69 inHg)



Air bleeding of fuel piping

After the repair, bleed air in the piping by pumping the priming pump up and down until it becomes heavy.



Injection pressure test

1. Install injection nozzle assembly 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

19,026 kPa (190.3 bar, 194 kg/cm^2, 2,759 psi)

New

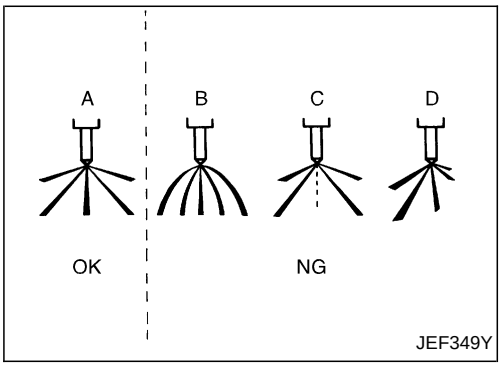
19,516 - 20,497 kPa (195.2 - 205.0 bar, 199 - 209 kg/cm^2, 2,830 - 2,972 psi)

Limit

16,182 kPa (161.8 bar, 165 kg/cm^2, 2,346 psi)

- The injection nozzle assembly has a 2-stage pressure injection function. However, the judgement should be made at the first stage of the valve opening pressure.

Injection Tube and Injection Nozzle (Cont'd)



Spray pattern test

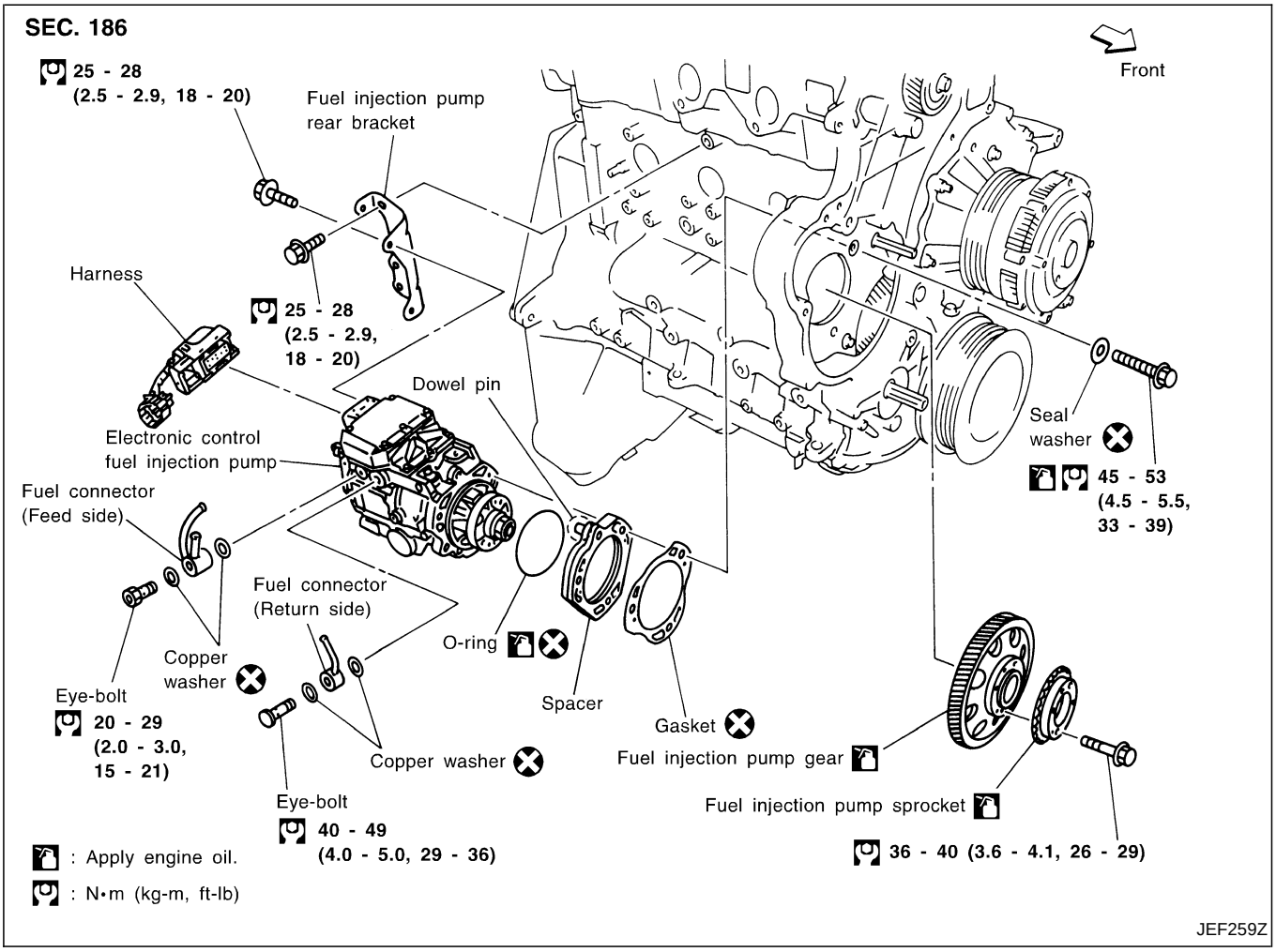
1. Check spray pattern by pumping tester handle one full stroke per second.
   NG spray pattern:
   Does not inject straight and strong (B in the figure).
   Fuel drips (C in the figure).
   Does not inject evenly (D in the figure).
2. If the spray pattern is not correct, replace injection nozzle assembly.

Electronic Control Fuel Injection Pump

REMOVAL AND INSTALLATION

CAUTION:

When removing or installing the timing chain as incidental work of the fuel injection pump removal/installation, always secure the internal mechanism of the idler gear with bolts before removing or installing the fuel injection pump sprocket. Do not refer to the procedure for "TIMING CHAIN" in EM section based on No. 1 cylinder compression top dead center. (Unless otherwise specified.)

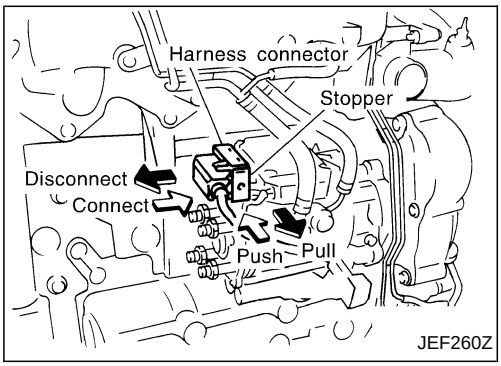


Electronic Control Fuel Injection Pump (Cont'd)

REMOVAL

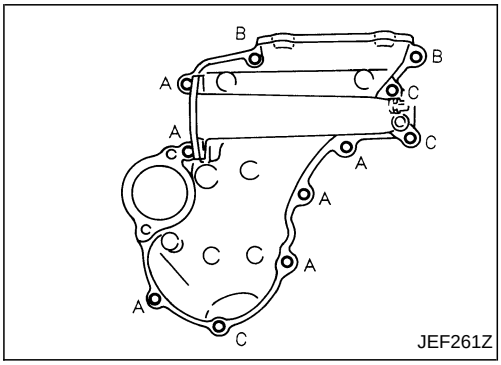
1. Remove the following:
- Engine coolant draining
- Charge air cooler
- Air inlet pipe
- Throttle body
- Rocker cover
- Oil level gauge guide
- EGR cooler
- EGR guide tube
- EGR volume control solenoid valve
- Fuel hose
- Injection tube
- Radiator upper hose
- Radiator shroud
- Cooling fan
- Drive belt
- Vacuum pipe
- Vacuum pump

2. Move the power steering pump.



3. Remove the harness connector from the fuel injection pump.
- After pulling the connector stopper all the way back, remove the connector.
- When the stopper is pulled all the way back, the interlocked-connector will come off.
  As for installation, when the connector is pushed all the way forward until the stopper locks, the interlocked-connector is inserted.

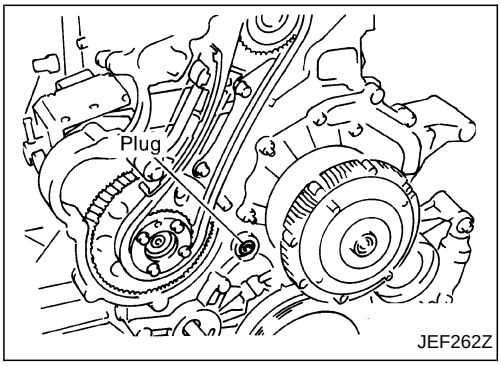
4. Remove the fuel injection pump rear bracket.



5. Remove the chain cover.
- Remove the installation bolts A, B, and C shown in the figure (left).

CAUTION:

During chain cover removal, seal the opening to prevent foreign objects from getting into the engine.

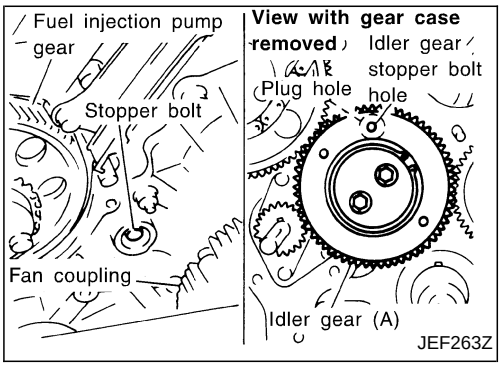


6. Fix the internal mechanism of the idler gear (scissors gear structure).

a. Remove the plug on the front side of the gear case.

b. While turning the crankshaft pulley clockwise, check the tightening bolt hole of the idler gear internal mechanism through the plug hole.
- Conduct the visual check using a mirror.
- When checking, note that there are 2 other holes (with no thread) beside the tightening bolt hole on the idler gear.

Electronic Control Fuel Injection Pump (Cont'd)



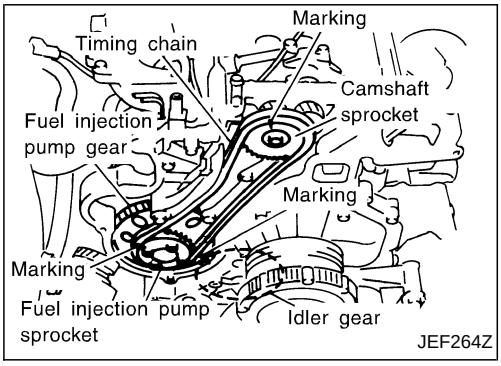
c. Install the tightening bolt [Part No.: 81-20620-28, thread diameter: M6, under head: 20 mm (0.79 in), pitch: 1.0 mm (0.039 in)] to the idler gear tightening bolt hole, and tighten to the specified torque:

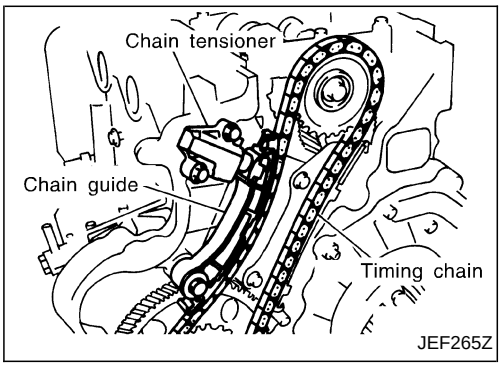
: 2.5 - 3.4 N·m (0.25 - 0.35 kg-m, 22 - 30 in-lb)

CAUTION:

- **To protect the idler gear from damage, do not use the substitute part for the tightening bolt.**
- **Hereafter, do not turn the crankshaft to avoid hitting tightening bolt head against the gear case.**
- **Do not remove the idler gear tightening bolt before installations of the timing chain and related parts are completed.**

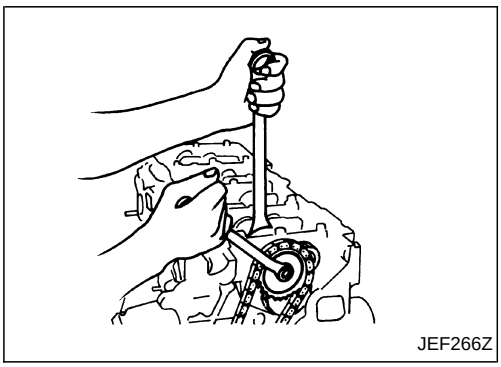
7. Make mating marks on the cam sprocket, fuel injection pump sprocket, and timing chain with paint.
8. Make mating marks on the fuel injection pump gear and idler gear with paint.





9. Remove the chain tensioner.
(1) Loosen the upper and lower installation bolts.
(2) While holding the chain tensioner by hand, remove the upper installation bolt to release the spring tension.
(3) Remove the lower installation bolt first, and then the chain tensioner.

- Since the chain tensioner does not have a mechanism to prevent the plunger pop-out, watch out for the fall of the plunger and spring. (Return prevention mechanism is available.)

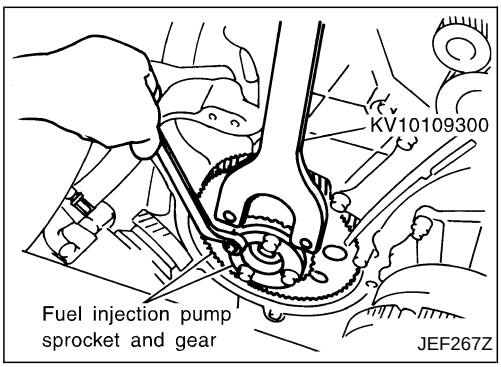


10. Remove the timing chain slack guide.
11. Remove the cam sprocket and timing chain at the same time.

- Make mating marks on each sprocket and timing chain.
- Hold the hexagon head of the camshaft on the exhaust manifold side, and loosen the cam sprocket installation bolt.

CAUTION:

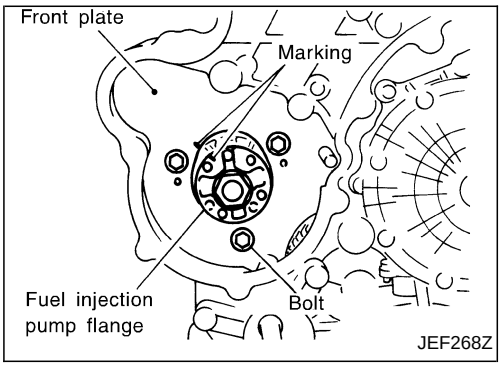
Do not loosen the installation bolt using a chain tension.



12. Remove the fuel injection pump sprocket and gear as an assembly.

- Fix the fuel injection pump gear with the pulley holder (SST), and loosen the installation bolt for removal.
- Try not to move the pump shaft when removing.
- Connect the sprocket and gear with a dowel pin, and tighten them together with the installation bolt.

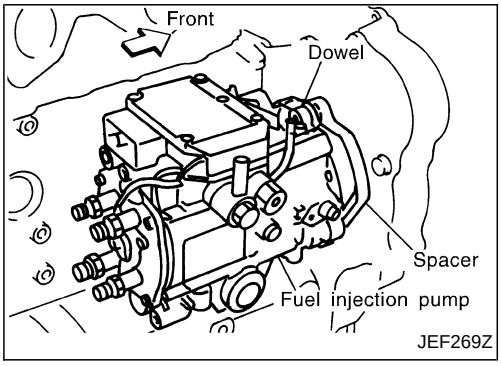
Electronic Control Fuel Injection Pump (Cont'd)



13. Make the mating marks on the fuel injection pump flange and front plate with paint.
14. Remove installation bolts first, and then fuel injection pump toward the rear side of the engine.
- When the fuel injection pump is stationary, it can still be retained by the dowel without all bolts.

CAUTION:

Do not disassemble or adjust the fuel injection pump.

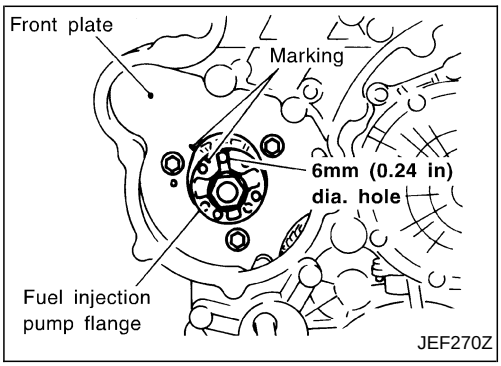


INSTALLATION

- The injection timing adjustment to correct the installation angle deviation is not necessary. Install the pump in the proper position according to the dowel and installation bolts.

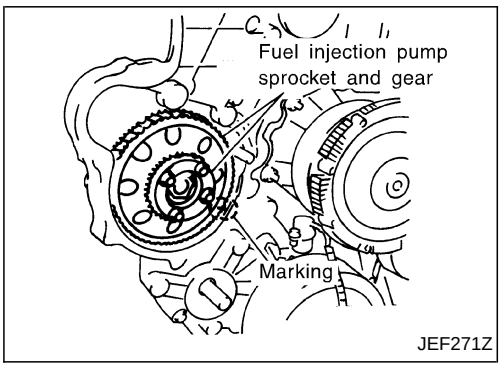
1. Install the fuel injection pump from the rear side of the engine.

- Match the dowel of the spacer to the dowel hole of the pump side for installation.
- Replace the seal washer of the installation bolt with a new one.



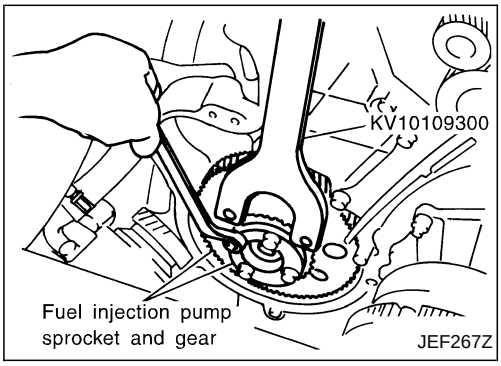
2. Align the mating marks of the fuel injection pump flange and front plate, and then adjust the approximate flange position.

- Each hole [6 mm (0.24 in) dia.] is used as a reference point for the fuel injection pump flange, fuel injection pump gear, and fuel injection pump sprocket.
- Only during removal/installation at No. 1 cylinder compression top dead center, can the hole [6 mm (0.24 in) dia.] of the pump body be aligned.



3. Install the fuel injection pump sprocket and gear as an assembly.

- Align the mating marks of the idler gear and fuel injection pump gear properly.



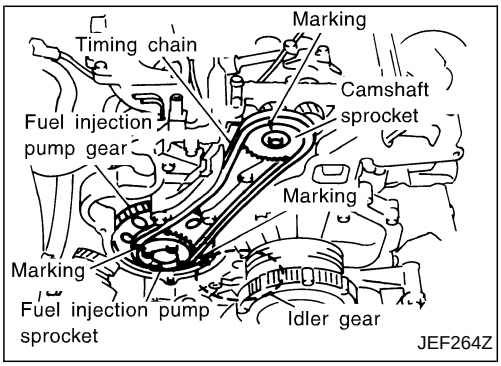
4. Tighten the installation bolt of the fuel injection pump sprocket.

- Fix the fuel injection pump gear with the pulley holder (SST), and tighten the installation bolt.

CAUTION:

Before tightening the installation bolt, check again that the mating marks of the idler gear and fuel injection pump gear are aligned.

Electronic Control Fuel Injection Pump (Cont'd)

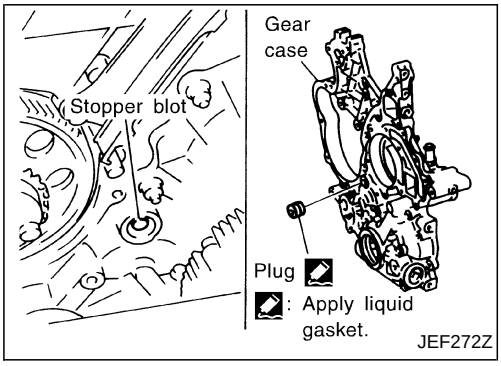


5. Install the cam sprocket and timing chain at the same time.
- Align the mating marks of the fuel injection pump sprocket and cam sprocket, and install the timing chain.
- Holding the hexagon head of the camshaft with a wrench, tighten the cam sprocket installation bolt.

CAUTION:

Do not tighten the installation bolt using a chain tension.

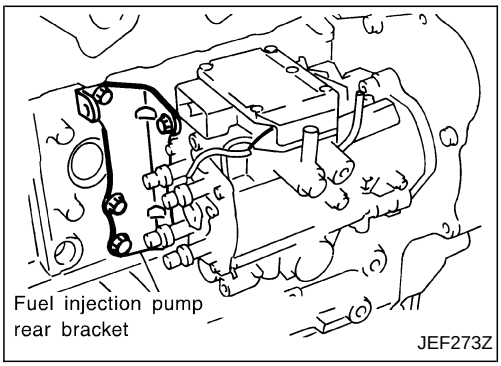
6. Install the timing chain, related parts, and the chain cover. Refer to EM section, "TIMING CHAIN".



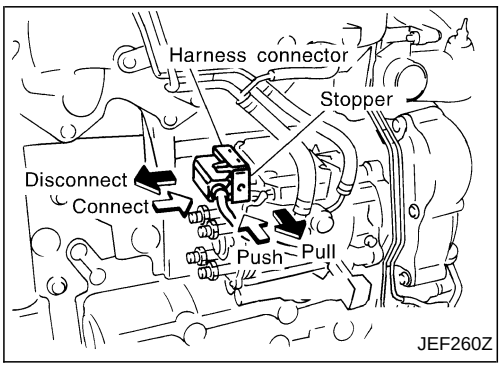
7. Remove the tightening bolt of the idler gear internal mechanism.
8. Apply the liquid gasket to the screw of the plug, and tighten the plug.

: 7.9 - 9.8 N·m (0.8 - 1.0 kg-m, 70 - 86 in-lb)

- Use Genuine Liquid Gasket or equivalent.

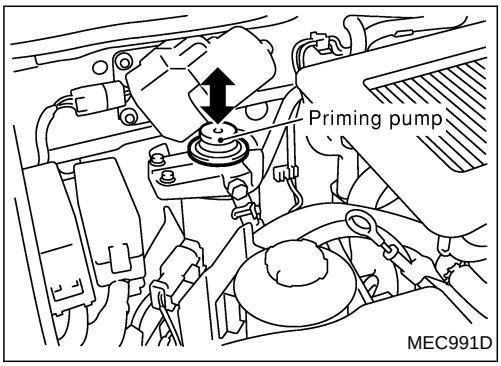


9. Install the fuel injection pump rear bracket.
- Tighten all the installation bolts temporarily, and then tighten them firmly with both surfaces of the fuel injection pump and cylinder block attached to the installation surface.



10. Connect the harness connector of the fuel injection pump.
- Insert the harness connector until the stopper is completely locked.
- When the connector is pushed fully to lock the stopper, the interlocked-connector is inserted.

11. Installation is in the reverse order of removal.



Air Bleeding

Pump the priming pump to bleed air.

- **When air is bled completely, the pumping of the priming pump suddenly becomes heavy. Stop operation at that time.**
- **If it is difficult to bleed air by the pumping of the priming pump (the pumping of the priming pump does not become heavy), disconnect the fuel supply hose between the fuel filter and the injection pump. Then, perform the operation described above, and make sure that fuel comes out. (Use a pan, etc. so as not to spill fuel. Do not let fuel get on engine and other parts.) After that, connect the hose, and then bleed air again.**

DTC and MI Detection Logic

When a malfunction is detected, the malfunction (DTC) is stored in the ECM memory.
The MI will light up each time the ECM detects malfunction. For diagnostic items causing the MI to light up, refer to “TROUBLE DIAGNOSIS — INDEX”, EC-7.

Diagnostic Trouble Code (DTC)

HOW TO READ DTC

The DTC can be read by the following methods.

Without CONSULT-II

ECM displays the DTC by a set of four digit numbers with MI illumination in the diagnostic test mode II (Self-diagnostic results). Example: 0102, 0407, 1004, etc.

With CONSULT-II

CONSULT-II displays the DTC in “SELF-DIAG RESULTS” mode. Examples: “CRANK POS SEN (TDC)”, etc.

- **Output of the trouble code means that the indicated circuit has a malfunction. However, in the Mode II it does not indicate whether the malfunction is still occurring or occurred in the past and returned to normal.**
  CONSULT-II can identify them. Therefore, using CONSULT-II (if available) is recommended.

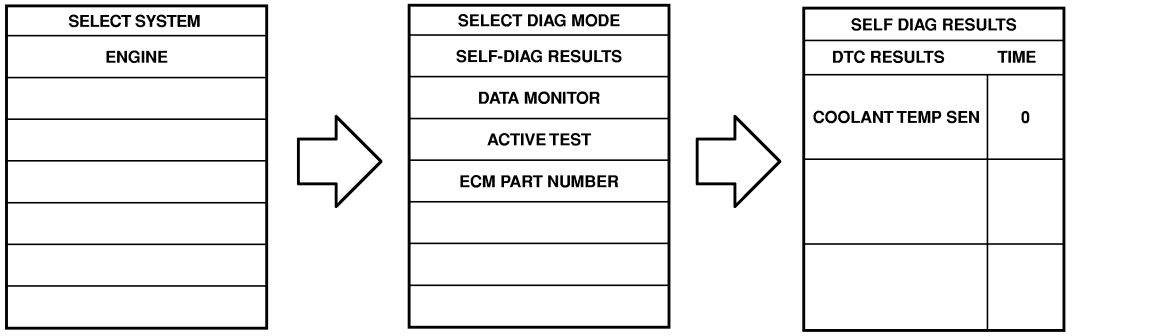
HOW TO ERASE DTC

How to erase DTC (With CONSULT-II)

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

How to erase DTC (With CONSULT-II)

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



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

SEF371Y

The emission related diagnostic information in the ECM can be erased by selecting “ERASE” in the “SELF-DIAG RESULTS” mode with CONSULT-II.

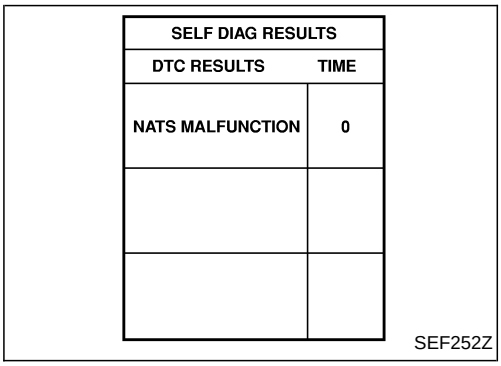
How to erase DTC (Without CONSULT-II)

1. If the ignition switch stays “ON” after repair work, be sure to turn ignition switch “OFF” once. Wait at least 5 seconds and then turn it “ON” (engine stopped) again.
2. Change the diagnostic test mode from Mode II to Mode I by using the data link connector. (See EC-36.)

The emission related diagnostic information in the ECM can be erased by changing the diagnostic test mode.

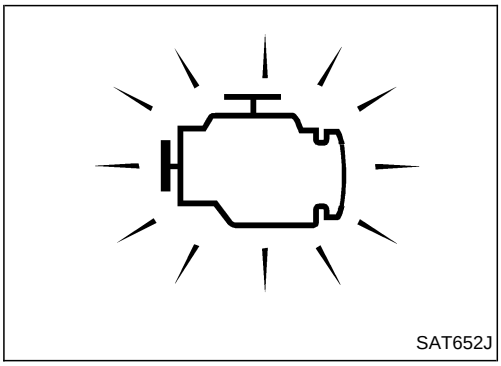
Diagnostic Trouble Code (DTC) (Cont'd)

- **If the battery is disconnected, the emission-related diagnostic information will be lost after approx. 24 hours.**
- **Erasing the emission-related diagnostic information using CONSULT-II is easier and quicker than switching the diagnostic test mode using the data link connector.**



NATS (Nissan Anti-Theft System)

- **If the security indicator lights up with the ignition switch in the "ON" position or "NATS MALFUNCTION" is displayed on "SELF-DIAG RESULTS" screen, perform self-diagnostic results mode with CONSULT-II using NATS program card. Refer to "NATS (Nissan Anti-Theft System)" in EL section.**
- **Confirm no self-diagnostic results of NATS is displayed before touching "ERASE" in "SELF-DIAG RESULTS" mode with CONSULT-II.**
- **When replacing ECM, initialization of NATS system and registration of all NATS ignition key IDs must be carried out with CONSULT-II using NATS program card.**
  Therefore, be sure to receive all keys from vehicle owner. Regarding the procedures of NATS initialization and NATS ignition key ID registration, refer to CONSULT-II operation manual, NATS.



Malfunction Indicator (MI)

DESCRIPTION

The MI is located on the instrument panel.

1. The MI will light up when the ignition switch is turned ON without the engine running. This is a bulb check.
   - If the MI does not light up, refer to EL section ("WARNING LAMPS AND CHIME") or see EC-291.
2. When the engine is started, the MI should go off.
   If the MI remains on, the on board diagnostic system has detected an engine system malfunction.

If MI illuminates or blinks irregularly after starting engine, water may have accumulated in fuel filter. Drain water from fuel filter. Refer to MA section.

Malfunction Indicator (MI) (Cont'd)

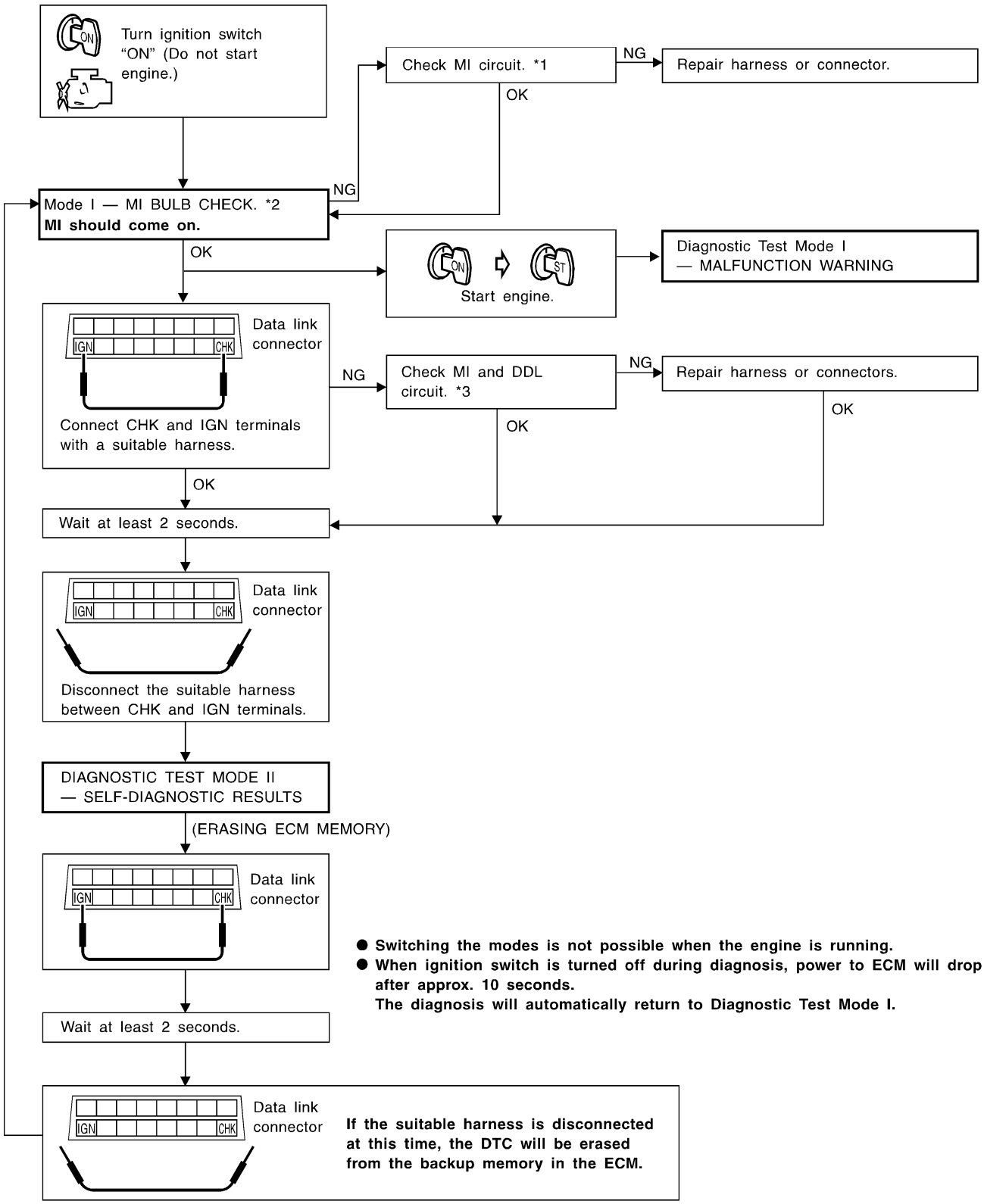
On board diagnostic system function

The on board diagnostic system has the following three functions.

Diagnostic Test Mode	KEY and ENG. Status	Function	Explanation of Function
Mode I	Ignition switch in ON position  Engine stopped 	BULB CHECK	This function checks the MI bulb for damage (blown, open circuit, etc.). If the MI does not come on, check MI circuit. (See EC-291.)
	Engine running 	MALFUNCTION WARNING	This is a usual driving condition. When ECM detects a malfunction, the MI will light up to inform the driver that a malfunction has been detected.
Mode II	Ignition switch in ON position  Engine stopped 	SELF-DIAGNOSTIC RESULTS	This function allows DTCs to be read.

Malfunction Indicator (MI) (Cont'd)

How to switch diagnostic test modes



- **Switching the modes is not possible when the engine is running.**
- **When ignition switch is turned off during diagnosis, power to ECM will drop after approx. 10 seconds.**
  The diagnosis will automatically return to Diagnostic Test Mode I.

YEC252A

*1: EC-291 *2: EC-35 *3: EC-291

Malfunction Indicator (MI) (Cont'd)

Diagnostic test mode I — Bulb check

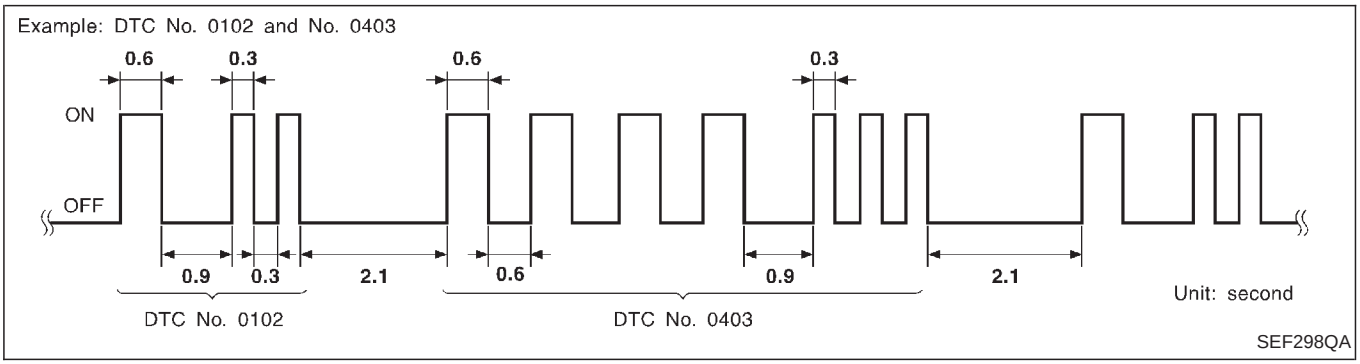
In this mode, the MI on the instrument panel should stay ON. If it remains OFF, check the bulb. Refer to EL section, "WARNING LAMPS AND CHIME" or see EC-291.

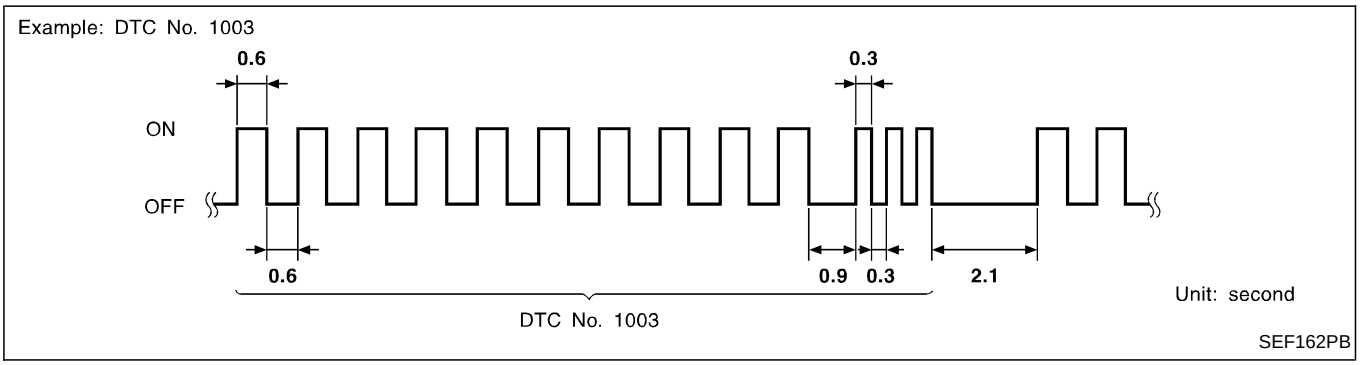
Diagnostic test mode I — Malfunction warning

MI	Condition
ON	When the malfunction is detected or the ECM's CPU is malfunctioning.
OFF	No malfunction.

Diagnostic test mode II — Self-diagnostic results

In this mode, DTC is indicated by the number of blinks of the MI as shown below.





Long (0.6 second) blinking indicates the two LH digits of number and short (0.3 second) blinking indicates the two RH digits of number. For example, the MI blinks 10 times for 6 seconds (0.6 sec x 10 times) and then it blinks three times for about 1 second (0.3 sec x 3 times). This indicates the DTC "1003".
In this way, all the detected malfunctions are classified by their DTC numbers. The DTC "0505" refers to no malfunction. (See TROUBLE DIAGNOSIS — INDEX, EC-7.)

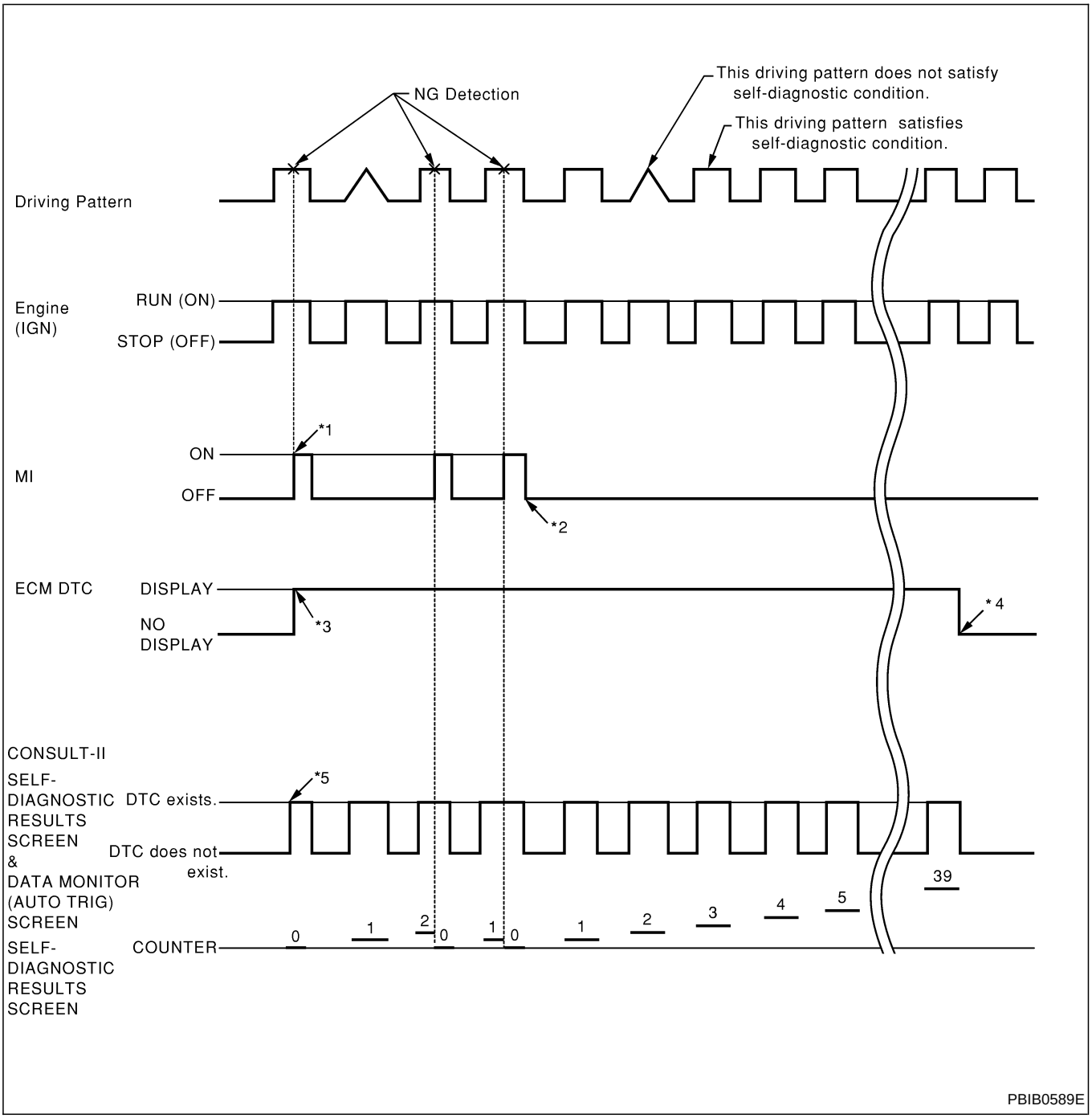
How to erase diagnostic test mode II (Self-diagnostic results)

The DTC 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", EC-36.)

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

Malfunction Indicator (MI) (Cont'd)

Relationship between MI, DTC, CONSULT-II and driving patterns



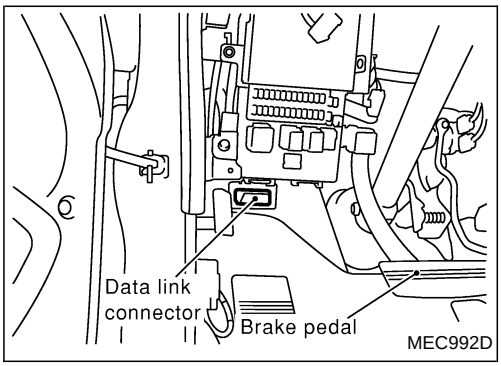
*1: When a malfunction is detected, MI will light up.

*2: MI will not light up after ignition switch is turned OFF.

*3: When a malfunction is detected for the first time, the DTC will be stored in ECM.

*4: The DTC will not be displayed any longer after vehicle is driven 40 times without the same malfunction. (The DTC still remain in ECM.)

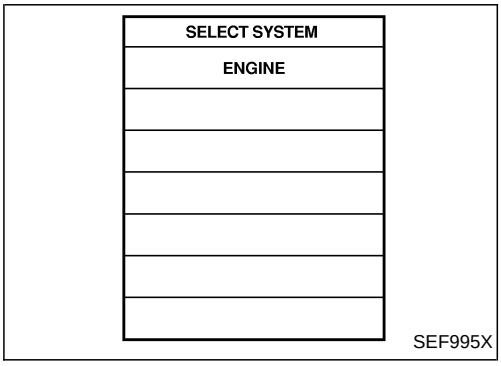
*5: Other screens except SELF-DIAGNOSTIC RESULTS & DATA MONITOR (AUTO TRIG) cannot display the malfunction. DATA MONITOR (AUTO TRIG) can display the malfunction at the moment it is detected.



CONSULT-II

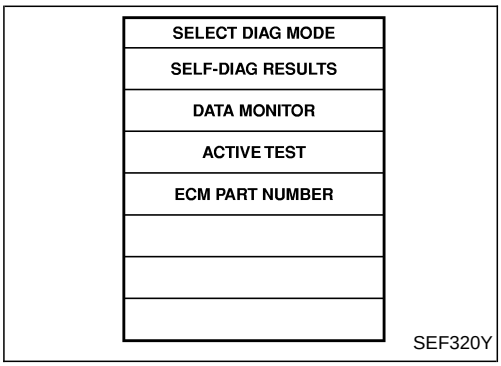
CONSULT-II INSPECTION PROCEDURE

1. Turn ignition switch OFF.
2. Connect CONSULT-II to data link connector, which is located under the driver side dash panel.



3. Turn ignition switch ON.
4. Touch “START”.
5. Touch “ENGINE”.
6. Perform each diagnostic test mode according to each service procedure.

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



CONSULT-II (Cont'd)

ENGINE CONTROL COMPONENT PARTS/CONTROL SYSTEMS APPLICATION

Item			DIAGNOSTIC TEST MODE		
			SELF-DIAG RESULTS	DATA MONITOR	ACTIVE TEST
ENGINE CONTROL COMPONENT PARTS	INPUT	Engine coolant 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	
		Ignition switch (start signal)		X	
		Park/Neutral position (PNP) switch		X	
		Battery voltage		X	
		Air conditioner switch		X	
		Mass air flow sensor	X	X	
		Stop lamp switch	X	X	
		Heat up switch		X	
		Charge air pressure sensor	X		
	OUTPUT	Glow relay		X	X
		EGR volume control valve	X	X	X
		Cooling fan relay	X	X	X
		Air conditioner relay		X	
		Variable nozzle turbocharger control solenoid valve		X	
		Swirl control valve control solenoid valve		X	X

X: Applicable

SELF-DIAGNOSTIC MODE

Regarding items detected in "SELF-DIAG RESULTS" mode, refer to "TROUBLE DIAGNOSIS — INDEX", EC-7.

DATA MONITOR MODE

Monitored item [Unit]	ECM input signals	Main signals	Description	Remarks
CKPS·RPM (TDC) [rpm]	○	○	● The engine speed computed from the crankshaft position sensor (TDC) signal is displayed.	
CMPS·RPM·PUMP [rpm]	○	○	● The engine speed computed from the pulse signal sent from electronic control fuel injection pump is displayed.	
COOLAN TEMP/S [°C] or [°F]	○	○	● The engine coolant temperature (determined by the signal voltage of the engine coolant temperature sensor) is displayed.	● When the engine coolant temperature sensor is open or short-circuited, ECM enters fail-safe mode. The engine coolant temperature determined by the ECM is displayed.
VHCL SPEED SE [km/h] or [mph]	○	○	● The vehicle speed computed from the vehicle speed sensor signal is displayed.	

CONSULT-II (Cont'd)

Monitored item [Unit]	ECM input signals	Main signals	Description	Remarks
FUEL TEMP SEN [°C] or [°F]	○	○	● The fuel temperature (sent from electronic control fuel injection pump) is displayed.	
ACCEL POS SEN [V]	○	○	● The accelerator position sensor signal voltage is displayed.	
FULL ACCEL SW [ON/OFF]	○	○	● Indicates [ON/OFF] condition from the accelerator position switch signal.	
ACCEL SW (FC) [OPEN/CLOSE]	○	○	● Indicates [OPEN/CLOSE] condition from the accelerator switch (FC) signal.	
OFF ACCEL SW [ON/OFF]	○	○	● Indicates [ON/OFF] condition from the accelerator position switch signal.	
SPILL/V [°CA]		○	● The control position of spill valve (sent from electronic control fuel injection pump) is displayed.	
BATTERY VOLT [V]	○	○	● The power supply voltage of ECM is displayed.	
P/N POSI SW [ON/OFF]	○	○	● Indicates [ON/OFF] condition from the park/neutral position switch signal.	
START SIGNAL [ON/OFF]	○	○	● Indicates [ON/OFF] condition from the starter signal.	● After starting the engine, [OFF] is displayed regardless of the starter signal.
AIR COND SIG [ON/OFF]	○	○	● Indicates [ON/OFF] condition of the air conditioner switch as determined by the air conditioner signal.	
BRAKE SW [ON/OFF]	○	○	● Indicates [ON/OFF] condition from the stop lamp switch signal.	
IGN SW [ON/OFF]	○	○	● Indicates [ON/OFF] condition from ignition switch signal.	
WARM UP SW [ON/OFF]	○		● Indicates [ON/OFF] condition from the heat up switch signal.	
MAS AIR/FL SE [V]	○	○	● The signal voltage of the mass air flow sensor is displayed.	● When the engine is stopped, a certain value is indicated.
DECELER F/CUT [ON/OFF]		○	● The [ON/OFF] condition from deceleration fuel cut signal (sent from electronic control fuel injection pump) is displayed.	
INJ TIMG C/V [%]		○	● The duty ratio of fuel injection timing control valve (sent from electronic control fuel injection pump) is displayed.	
AIR COND RLY [ON/OFF]		○	● Indicates the control condition of the air conditioner relay (determined by ECM according to the input signals).	
GLOW RLY [ON/OFF]		○	● The glow relay control condition (determined by ECM according to the input signal) is displayed.	
COOLING FAN [ON/OFF]		○	● Indicates the control condition of the cooling fans (determined by ECM according to the input signal). ● ON ... Operates. OFF ... Stopped.	

CONSULT-II (Cont'd)

Monitored item [Unit]	ECM input signals	Main signals	Description	Remarks
EGR VOL CON/V [step]		○	● Indicates the EGR volume control value computed by the ECM according to the input signals. ● The opening becomes larger as the value increases.	
VNT S/V 1 [%]			● Indicates the variable nozzle turbo-charger control solenoid valve control value computed by the ECM according to the input signals.	
BARO SEN [kPa]	○		● The barometric pressure (determined by the signal voltage from the barometric pressure sensor built into the ECM) is displayed.	
SWRL CON S/V 1 [ON/OFF]		○	● The control condition of the swirl control valve control solenoid valve (determined by ECM according to the input signals) is indicated. ● ON ... Swirl control valve is closed. ● OFF ... Swirl control valve is opened.	

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

CONSULT-II (Cont'd)

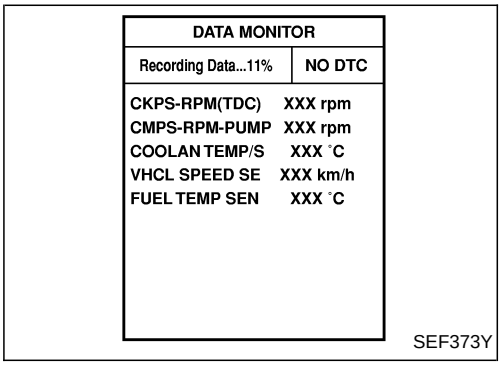
ACTIVE TEST MODE

TEST ITEM	CONDITION	JUDGEMENT	CHECK ITEM (REMEDY)
COOLING FAN	● Ignition switch: ON ● Operate the cooling fan at "LOW", "HI" speed and turn "OFF" using CONSULT-II.	Cooling fan moves at "LOW", "HI" speed and stops.	● Harness and connector ● Cooling fan motor ● Cooling fan relay
OFF ACCEL PO SIG	● Clears the self-learning fully closed accelerator position, detected by accelerator position sensor, from the ECM.		
GLOW RLY	● Ignition switch: ON (Engine stopped) ● Turn the glow relay "ON" and "OFF" using CONSULT-II and listen to operating sound.	Glow relay makes the operating sound.	● Harness and connector ● Glow relay
INJ TIMING*	● Engine: Return to the original trouble condition ● Retard the injection timing using CONSULT-II.	If trouble symptom disappears, see CHECK ITEM.	● Electronic control fuel injection pump
SWIRL CONT S/V1	● Ignition switch: ON ● Turn solenoid valve "ON" and "OFF" with the CONSULT-II and listen to operating sound.	Solenoid valve makes an operating sound.	● Harness and connector ● Solenoid valve
EGR VOL CONT/V	● Ignition switch: ON ● Change EGR volume control valve opening step using CONSULT-II.	EGR volume control valve makes an operating sound.	● Harness and connector ● EGR volume control valve

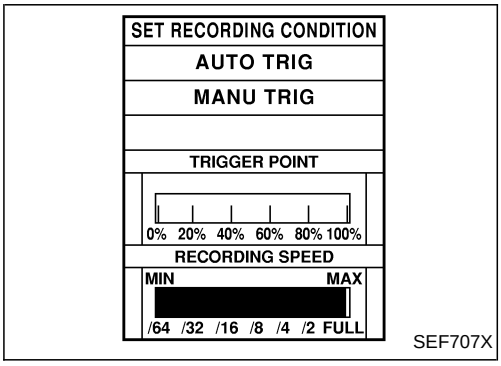
*: When using this item, DTC 0707 "P7·F/INJ TIMG FB" may be detected. If so, erase it because it is not a malfunction.

CONSULT-II (Cont'd)

REAL TIME DIAGNOSIS IN DATA MONITOR MODE



SEF373Y



SEF707X

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

1) "AUTO TRIG" (Automatic trigger):

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

2) "MANU TRIG" (Manual trigger):

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

Use these triggers as follows:

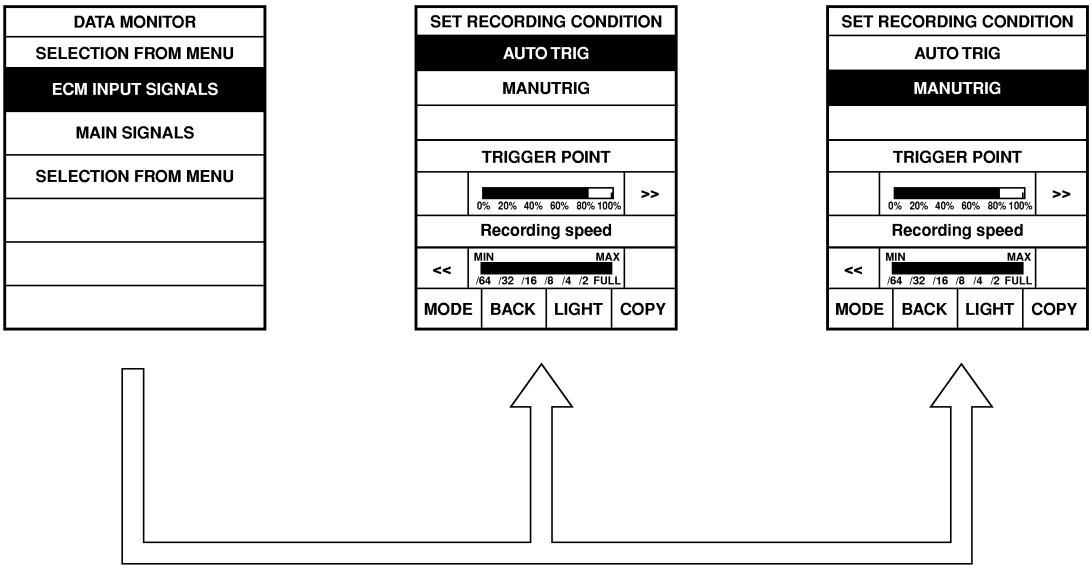
1) "AUTO TRIG"

- While trying to detect the DTC by performing the "DTC Confirmation Procedure", be sure to select to "DATA MONITOR (AUTO TRIG)" mode. You can confirm the malfunction at the moment it is detected.
- While narrowing down the possible causes, CONSULT-II should be set in "DATA MONITOR (AUTO TRIG)" mode, especially in case the incident is intermittent.
  When you are inspecting the circuit by gently shaking (or twisting) the suspicious connectors, components and harness in the "DTC Confirmation Procedure", the moment a malfunction is found the DTC will be displayed. (Refer to GI section, "Incident Simulation Tests" 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-II to "MANU TRIG". By selecting "MANU TRIG" you can monitor and store the data. The data can be utilized for further diagnosis, such as a comparison with the value for the normal operating condition.

CONSULT-II (Cont'd)

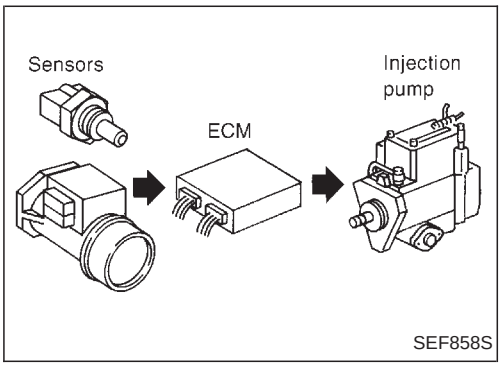


"SETTING"

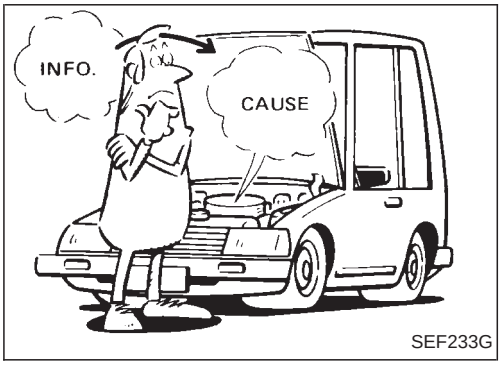
"AUTO TRIG"
A malfunction can be displayed on "DATA MONITOR" screen automatically if detected.

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

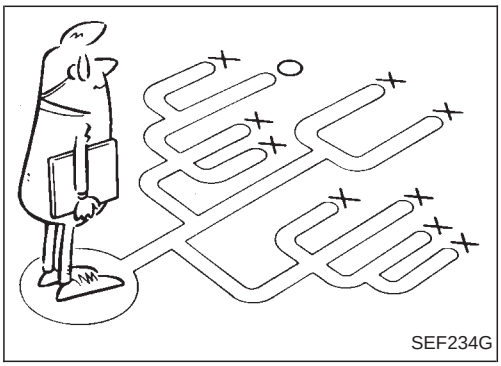
SEF720X



SEF858S



SEF233G


SEF234G

KEY POINTS

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

SEF907L

Introduction

The engine has an ECM to control major systems such as fuel injection control, fuel injection timing control, glow control system, etc. The ECM accepts input signals from sensors and instantly drives electronic control fuel injection pump. It is essential that both input and output signals are proper and stable. At the same time, it is important that there are no problems such as vacuum leaks, or other problems with the engine.

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

A visual check only may not find the cause of the problems. A road test with CONSULT-II or a circuit tester connected should be performed. Follow the “Work Flow”, EC-48.

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

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

DIAGNOSTIC WORKSHEET

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

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

Utilize a diagnostic worksheet like the one shown below in order to organize all the information for troubleshooting.

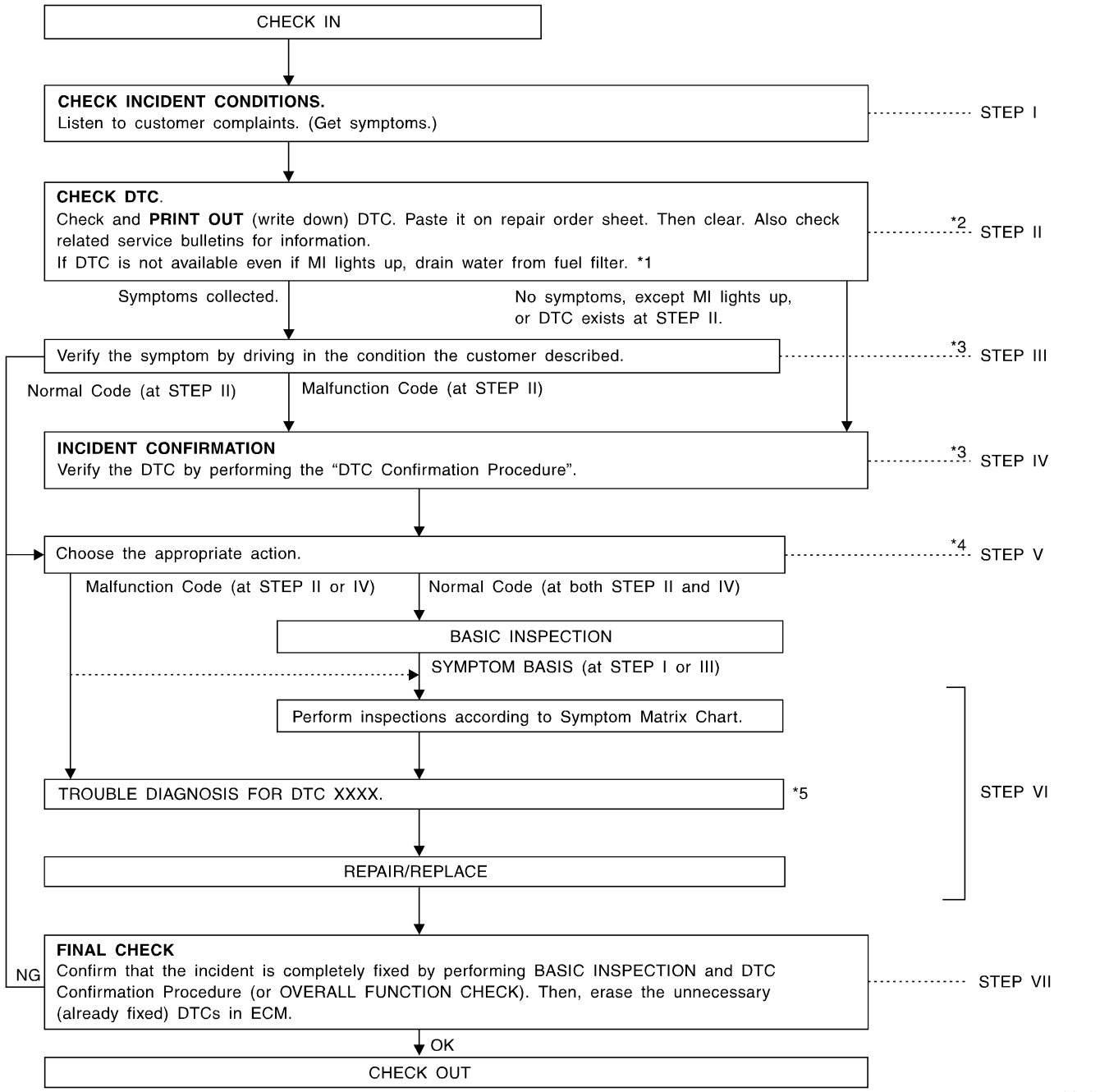
Introduction (Cont'd)

Worksheet sample

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

MTBL0397

Work Flow



YEC253A

*1 Refer to MA section ("Checking and Replacing Fuel Filter and Draining Water", "ENGINE MAINTENANCE").

*2 If time data of "SELF-DIAG RESULTS" is other than "0", perform "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78.

*3 If the incident cannot be verified, perform "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78.

*4 If the on board diagnostic system cannot be performed, check main power supply and ground circuit. Refer to "TROUBLE DIAGNOSIS FOR POWER SUPPLY", EC-79.

*5 If malfunctioning part cannot be detected, perform "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78.

Work Flow (Cont'd)

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", EC-46.
STEP II	Before confirming the concern, check and write down (print out using CONSULT-II) the DTC, then erase the DTC. Refer to EC-33. If the incident cannot be verified, perform "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78. 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-56.) Also check related service bulletins for information.
STEP III	Try to confirm the symptom and under what conditions the incident occurs. The "DIAGNOSTIC WORK SHEET" is useful to verify the incident. Connect CONSULT-II to the vehicle in DATA MONITOR (AUTO TRIG) mode and check real time diagnosis results. If the incident cannot be verified, perform "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78. If the malfunction code is detected, skip STEP IV and perform STEP V.
STEP IV	Try to detect the DTC by driving in (or performing) the "DTC Confirmation Procedure". Check and read the DTC by using CONSULT-II. During the DTC verification, be sure to connect CONSULT-II to the vehicle in DATA MONITOR (AUTO TRIG) mode and check real time diagnosis results. If the incident cannot be verified, perform "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78. In case the "DTC Confirmation Procedure" is not available, perform the "Overall Function Check" instead. The DTC cannot be displayed by this check, however, this simplified "check" is an effective alternative. The "NG" result of the "Overall Function Check" is the same as the DTC detection.
STEP V	Take the appropriate action based on the results of STEP I through IV. If the malfunction code is indicated, proceed to TROUBLE DIAGNOSIS FOR DTC XXXX. If the normal code is indicated, proceed to the Basic Inspection, EC-50. Then perform inspections according to the Symptom Matrix Chart. Refer to EC-56.
STEP VI	Identify where to begin diagnosis based on the relationship study between symptom and possible causes. Inspect the system for mechanical binding, loose connectors or wiring damage using (tracing) "Harness Layouts". Gently shake the related connectors, components or wiring harness with CONSULT-II set in "DATA MONITOR (AUTO TRIG)" mode. Check the voltage of the related ECM terminals or monitor the output data from the related sensors with CONSULT-II. Refer to EC-69 or EC-66. The "Diagnostic Procedure" in EC section contains a description based on open circuit inspection. A short circuit inspection is also required for the circuit check in the Diagnostic Procedure. For details, refer to GI section ("Circuit Inspection", "HOW TO PERFORM EFFICIENT DIAGNOSIS FOR AN ELECTRICAL INCIDENT"). Repair or replace the malfunction parts. If the malfunctioning part cannot be detected, perform "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78.
STEP VII	Once you have repaired the circuit or replaced a component, you need to run the engine in the same conditions and circumstances which resulted in the customer's initial complaint. Perform the "DTC Confirmation Procedure" and confirm the normal code (DTC No. 0505) is detected. If the incident is still detected in the final check, perform STEP VI by using a different method from the previous one. Before returning the vehicle to the customer, be sure to erase the unnecessary (already fixed) DTC in ECM. (Refer to EC-33.)

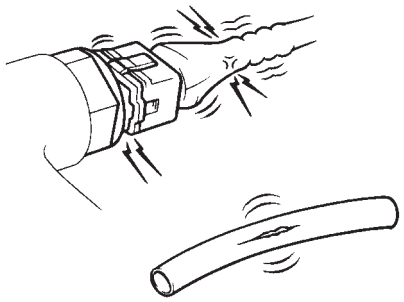
Basic Inspection

Precaution:
Perform Basic Inspection without electrical or mechanical loads applied;

- **Shift lever is in neutral position,**
- **Heat up switch is OFF,**
- **Headlamp switch is OFF,**
- **Air conditioner switch is OFF,**
- **Rear defogger switch is OFF,**
- **Steering wheel is in the straight-ahead position, etc.**

1	INSPECTION START

1. Check service records for any recent repairs that may indicate a related problem.
2. Check the current need for scheduled maintenance, especially for fuel filter and air cleaner filter. Refer to MA section.
3. Open engine hood and check the following:
- Harness connectors for improper connections
- Vacuum hoses for splits, kinks, or improper connections
- Wiring for improper connections, pinches, or cuts



SEF142I

4. Start engine and warm it up to the normal operating temperature.

▶	GO TO 2.

2	PREPARATION FOR CHECKING IDLE SPEED

With CONSULT-II
Connect CONSULT-II to the data link connector.

Without CONSULT-II
Install diesel tacho tester to the vehicle.

▶	GO TO 3.

Basic Inspection (Cont'd)

3	CHECK IDLE SPEED

With CONSULT-II

1. Select "CKPS·RPM (TDC)" in "DATA MONITOR" mode with CONSULT-II.
2. Read idle speed.

DATA MONITOR	
MONITOR	NO DTC
CKPS-RPM (TDC)	XXX rpm

SEF817Y

750±25 rpm

Without CONSULT-II

Check idle speed.

750±25 rpm

OK or NG

OK	▶	**INSPECTION END**
NG	▶	GO TO 4.

4	CHECK FOR INTAKE AIR LEAK

Listen for an intake air leak after the mass air flow sensor.

OK or NG

OK	▶	GO TO 5.
NG	▶	Repair or replace.

5	BLEED AIR FROM FUEL SYSTEM

1. Stop engine.
2. Using priming pump, bleed air from fuel system. Refer to "Air Bleeding", EC-32.

	▶	GO TO 6.

Basic Inspection (Cont'd)

6	CHECK IDLE SPEED AGAIN

With CONSULT-II

1. Start engine and let it idle.
2. Select "CKPS·RPM (TDC)" in "DATA MONITOR" mode with CONSULT-II.
3. Read idle speed.

DATA MONITOR	
MONITOR	NO DTC
CKPS-RPM (TDC)	XXX rpm

SEF817Y

750±25 rpm

Without CONSULT-II

1. Start engine and let it idle.
2. Check idle speed.

750±25 rpm

OK or NG

OK	▶	**INSPECTION END**
NG	▶	GO TO 7.

7	DRAIN WATER FROM FUEL FILTER

Drain water from fuel filter. Refer to MA section ("Checking and Replacing Fuel Filter and Draining Water", "ENGINE MAINTENANCE").

	▶	GO TO 8.

Basic Inspection (Cont'd)

8	CHECK IDLE SPEED AGAIN

With CONSULT-II

1. Start engine and let it idle.
2. Select "CKPS·RPM (TDC)" in "DATA MONITOR" mode with CONSULT-II.
3. Read idle speed.

DATA MONITOR	
MONITOR	NO DTC
CKPS-RPM (TDC)	XXX rpm

SEF817Y

750±25 rpm

Without CONSULT-II

1. Start engine and let it idle.
2. Check idle speed.

750±25 rpm

OK or NG

OK	▶	**INSPECTION END**
NG	▶	GO TO 9.

Basic Inspection (Cont'd)

9	CHECK AIR CLEANER FILTER
Check air cleaner filter for clogging or breaks.	
OK or NG	
OK ▶	GO TO 10.
NG ▶	Replace air cleaner filter.

10	CHECK FUEL INJECTION NOZZLE
Check fuel injection nozzle opening pressure. Refer to "Injection pressure test", EC-26.	
OK or NG	
OK ▶	GO TO 11.
NG ▶	Replace fuel injection nozzle assembly.

11	CHECK IDLE SPEED AGAIN

With CONSULT-II

1. Start engine and let it idle.
2. Select "CKPS·RPM (TDC)" in "DATA MONITOR" mode with CONSULT-II.
3. Read idle speed.

DATA MONITOR	
MONITOR	NO DTC
CKPS-RPM (TDC)	XXX rpm

SEF817Y

750±25 rpm

Without CONSULT-II

1. Start engine and let it idle.
2. Check idle speed.

750±25 rpm

OK or NG	
OK ▶	**INSPECTION END**
NG ▶	GO TO 12.

12	CHECK COMPRESSION PRESSURE
Check compression pressure. Refer to EM section, "MEASUREMENT OF COMPRESSION PRESSURE".	
OK or NG	
OK ▶	GO TO 13.
NG ▶	Follow the instruction of "MEASUREMENT OF COMPRESSION PRESSURE".

Basic Inspection (Cont'd)

13	CHECK IDLE SPEED AGAIN

With CONSULT-II

1. Start engine and let it idle.
2. Select "CKPS·RPM (TDC)" in "DATA MONITOR" mode with CONSULT-II.
3. Read idle speed.

DATA MONITOR	
MONITOR	NO DTC
CKPS-RPM (TDC)	XXX rpm

SEF817Y

750±25 rpm

Without CONSULT-II

1. Start engine and let it idle.
2. Check idle speed.

750±25 rpm

OK or NG

OK	▶	**INSPECTION END**
NG	▶	Replace electronic control fuel injection pump.

Symptom Matrix Chart

SYSTEM — Basic engine control system	SYMPTOM													Reference page	Feature of symptom, Check point
	HARD/NO START/RESTART (EXCP. HA)				ENGINE STALL										
	NO START (with first firing)	NO START (without first firing)	HARD TO START WHEN ENGINE IS COLD	HARD TO START WHEN ENGINE IS HOT	AT IDLE	DURING DRIVING	WHEN DECELERATING	HESITATION/SURGING/FLAT SPOT	KNOCK/DETONATION	LACK OF POWER	POOR ACCELERATION	HI IDLE	LOW IDLE		
Warranty symptom code	AA				AB			AC	AD	AE		AF			
Electronic control fuel injection pump mainframe	4	4	4	4	4	4	4	4	4	5	5	3	4	—	*1
Injection nozzle	3	3	3	3	3	3	3	3	3	4	4		3	EC-24	*2
Glow system	1	1	1	1										EC-239	
Engine body	3	3	3	3	3	3	3		3	4	4		3	EM section	*3
EGR system										3	3			EC-222	
Air cleaner and ducts										3	3			MA section	*4

1 - 5: The numbers refer to the order of inspection.
(continued on next page)
*1: Fuel injection system malfunction or fuel injection timing control system 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.

Symptom Matrix Chart (Cont'd)

SYSTEM — Basic engine control system	SYMPTOM												Reference page	Feature of symptom, Check point
	ROUGH IDLE/HUNTING	IDLING VIBRATION	SLOW/NO RETURN TO IDLE	OVERHEAT/HIGH ENGINE COOLANT TEMPERATURE	EXCESSIVE FUEL CONSUMPTION	EXCESSIVE OIL CONSUMPTION	ABNORMAL SMOKE COLOR		DEAD BATTERY (UNDER CHARGE)	Malfunction indicator lamp illuminates.	Can be detected by CONSULT-II?	Fuel cut		
							BLACK SMOKE	WHITE SMOKE						
Warranty symptom code	AG	AH	AJ	AK	AL	AM	AP		HA					
Electronic control fuel injection pump mainframe	4	4	3		4		5	4		3	3	3	—	*1
Injection nozzle	3	3					4						EC-24	*2
Glow system								1					EC-239	
Engine body	3	3		3	3	3		3					EM section	*3
EGR system							3						EC-222	
Air cleaner and ducts							3				3		MA section	*4

1 - 5: The numbers refer to the order of inspection.
(continued on next page)
*1: Fuel injection system malfunction or fuel injection timing control system 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.

Symptom Matrix Chart (Cont'd)

SYSTEM — ENGINE CONTROL system		Malfunction	SYMPTOM: HARD/NO START/RESTART (EXCP. HA) — NO START (with first firing)	NO START (without first firing)	HARD TO START WHEN ENGINE IS COLD	HARD TO START WHEN ENGINE IS HOT	SYMPTOM: ENGINE STALL — AT IDLE	DURING DRIVING	WHEN DECELERATING	HESITATION/SURGING/FLAT SPOT	KNOCK/DETONATION	LACK OF POWER	POOR ACCELERATION	HI IDLE	LOW IDLE	Reference page	Feature of symptom, Check point
Warranty symptom code			AA				AB			AC	AD	AE		AF			
ENGINE CONTROL	Electronic control fuel injection pump circuit	*a, *b		1		1	1	1	1	1	1	1	1	1	1	—	
		*c, *d															
	Mass air flow sensor circuit	*a, *c								1		1	1			EC-88	
		*b															
	Engine coolant temperature sensor circuit	*a, *b			1		1		1						1	EC-95	*1
	Vehicle speed sensor circuit	*a, *b											1			EC-99	

1 - 5: The numbers refer to the order of inspection.
(continued on next page)
*a: Open
*b: Short
*c: Ground short
*d: Noise
*1: Compensation according to engine coolant temperature does not function.

Symptom Matrix Chart (Cont'd)

SYSTEM — ENGINE CONTROL system		Malfunction	SYMPTOM: ROUGH IDLE/HUNTING	IDLING VIBRATION	SLOW/NO RETURN TO IDLE	OVERHEAT/HIGH ENGINE COOLANT TEMPERATURE	EXCESSIVE FUEL CONSUMPTION	EXCESSIVE OIL CONSUMPTION	ABNORMAL SMOKE COLOR: BLACK SMOKE	ABNORMAL SMOKE COLOR: WHITE SMOKE	DEAD BATTERY (UNDER CHARGE)	Malfunction indicator lamp illuminates.	Can be detected by CONSULT-II?	Fuel cut	Reference page	Feature of symptom, Check point
Warranty symptom code			AG	AH	AJ	AK	AL	AM	AP		HA					
ENGINE CONTROL	Electronic control fuel injection pump circuit	*a, *b								1		1	1	1	—	
		*c, *d							1							
	Mass air flow sensor circuit	*a, *c											1		EC-88	
		*b							1							
	Engine coolant temperature sensor circuit	*a, *b	1	1								1	1		EC-95	*1
	Vehicle speed sensor circuit	*a, *b											1		EC-99	

1 - 5: The numbers refer to the order of inspection.
(continued on next page)
*a: Open
*b: Short
*c: Ground short
*d: Noise
*1: Compensation according to engine coolant temperature does not function.

Symptom Matrix Chart (Cont'd)

SYSTEM — ENGINE CONTROL system		Malfunction	SYMPTOM: HARD/NO START/RESTART (EXCP. HA) — NO START (with first firing)	NO START (without first firing)	HARD TO START WHEN ENGINE IS COLD	HARD TO START WHEN ENGINE IS HOT	SYMPTOM: ENGINE STALL — AT IDLE	DURING DRIVING	WHEN DECELERATING	HESITATION/SURGING/FLAT SPOT	KNOCK/DETONATION	LACK OF POWER	POOR ACCELERATION	HI IDLE	LOW IDLE	Reference page	Feature of symptom, Check point
Warranty symptom code			AA				AB			AC	AD	AE		AF			
ENGINE CONTROL	Accelerator switch (FC) circuit	*a, *b								1						EC-104	
		*c															
	Fuel cut system line	*a, *c														EC-232	
		*b	1				1	1	1								*2
	Accelerator position sensor circuit	*a, *b								1		1	1			EC-130	
	Crankshaft position sensor (TDC) circuit	*a, *b														EC-145	
		*d										1	1				
	Charge air pressure sensor circuit	*a, *b, *c										1	1			EC-215	
	Swirl control valve control solenoid valve circuit	*a, *b														EC-263	
		*c								1	1	1	1				
	Variable nozzle turbocharger control solenoid valve circuit	*a, *b										1	1			EC-281	
		*c										1	1				
	Intake air control valve control solenoid valve circuit	*c	1	1	1	1	1	1	1	1						EC-273	

1 - 5: The numbers refer to the order of inspection.
(continued on next page)
*a: Open
*b: Short
*c: Ground short
*d: Noise
*2: Engine runs on after turning ignition switch OFF.

Symptom Matrix Chart (Cont'd)

SYSTEM — ENGINE CONTROL system		Malfunction	SYMPTOM: ROUGH IDLE/HUNTING	IDLING VIBRATION	SLOW/NO RETURN TO IDLE	OVERHEAT/HIGH ENGINE COOLANT TEMPERATURE	EXCESSIVE FUEL CONSUMPTION	EXCESSIVE OIL CONSUMPTION	ABNORMAL SMOKE COLOR: BLACK SMOKE	ABNORMAL SMOKE COLOR: WHITE SMOKE	DEAD BATTERY (UNDER CHARGE)	Malfunction indicator lamp illuminates.	Can be detected by CONSULT-II?	Fuel cut	Reference page	Feature of symptom, Check point
Warranty symptom code			AG	AH	AJ	AK	AL	AM	AP		HA					
ENGINE CONTROL	Accelerator switch (FC) circuit	*a, *b										1	1		EC-104	
		*c														
	Fuel cut system line	*a, *c										1	1		EC-232	
		*b												1		*2
	Accelerator position sensor circuit	*a, *b										1	1		EC-130	
	Crankshaft position sensor (TDC) circuit	*a, *b	1	1								1	1		EC-145	
		*d														
	Charge air pressure sensor circuit	*a, *b, *c										1	1		EC-215	
	Swirl control valve control solenoid valve circuit	*a, *b							1						EC-263	
		*c					1		1	1						
	Variable nozzle turbocharger control solenoid valve circuit	*a, *b					1		1						EC-281	
		*c					1						1			
	Intake air control valve control solenoid valve circuit	*c													EC-273	

1 - 5: The numbers refer to the order of inspection.
(continued on next page)
*a: Open
*b: Short
*c: Ground short
*d: Noise
*2: Engine runs on after turning ignition switch OFF.

Symptom Matrix Chart (Cont'd)

SYSTEM — ENGINE CONTROL system		Malfunction	SYMPTOM: HARD/NO START/RESTART (EXCP. HA) — NO START (with first firing)	NO START (without first firing)	HARD TO START WHEN ENGINE IS COLD	HARD TO START WHEN ENGINE IS HOT	SYMPTOM: ENGINE STALL — AT IDLE	DURING DRIVING	WHEN DECELERATING	HESITATION/SURGING/FLAT SPOT	KNOCK/DETONATION	LACK OF POWER	POOR ACCELERATION	HI IDLE	LOW IDLE	Reference page	Feature of symptom, Check point
Warranty symptom code			AA				AB			AC	AD	AE		AF			
ENGINE CONTROL	Start signal circuit	*a, *b			1	1										EC-248	*3
	PNP switch circuit	*a, *b							1							EC-251	
		*c															
	Accelerator position switch (Idle) circuit	*a, *c					1		1						1	EC-130	
		*b								1		1	1				*4
	Accelerator position switch (Full) circuit	*a, *b								1		1	1			EC-130	
	Ignition switch circuit	*a		1			1	1	1							EC-79	
		*b															*5
	Power supply for ECM circuit	*a														EC-79	
		*b															

1 - 5: The numbers refer to the order of inspection.
(continued on next page)
*a: Open
*b: Short
*c: Ground short
*d: Noise
*3: Start control does not function.
*4: Accelerator position sensor NG signal is output.
*5: Engine does not stop.

Symptom Matrix Chart (Cont'd)

SYSTEM — ENGINE CONTROL system		Malfunction	SYMPTOM: ROUGH IDLE/HUNTING	IDLING VIBRATION	SLOW/NO RETURN TO IDLE	OVERHEAT/HIGH ENGINE COOLANT TEMPERATURE	EXCESSIVE FUEL CONSUMPTION	EXCESSIVE OIL CONSUMPTION	ABNORMAL SMOKE COLOR: BLACK SMOKE	ABNORMAL SMOKE COLOR: WHITE SMOKE	DEAD BATTERY (UNDER CHARGE)	Malfunction indicator lamp illuminates.	Can be detected by CONSULT-II?	Fuel cut	Reference page	Feature of symptom, Check point
Warranty symptom code			AG	AH	AJ	AK	AL	AM	AP		HA					
ENGINE CONTROL	Start signal circuit	*a, *b													EC-248	*3
	PNP switch circuit	*a, *b	1	1											EC-251	
		*c														
	Accelerator position switch (Idle) circuit	*a, *c													EC-130	
		*b										1	1			*4
	Accelerator position switch (Full) circuit	*a, *b										1	1		EC-130	
	Ignition switch circuit	*a													EC-79	
		*b														*5
	Power supply for ECM circuit	*a										1	1	1	EC-79	
		*b														

1 - 5: The numbers refer to the order of inspection.
(continued on next page)
*a: Open
*b: Short
*c: Ground short
*d: Noise
*3: Start control does not function.
*4: Accelerator position sensor NG signal is output.
*5: Engine does not stop.

Symptom Matrix Chart (Cont'd)

SYSTEM — ENGINE CONTROL system		Malfunction	SYMPTOM: HARD/NO START/RESTART (EXCP. HA) — NO START (with first firing)	NO START (without first firing)	HARD TO START WHEN ENGINE IS COLD	HARD TO START WHEN ENGINE IS HOT	ENGINE STALL — AT IDLE	DURING DRIVING	WHEN DECELERATING	HESITATION/SURGING/FLAT SPOT	KNOCK/DETONATION	LACK OF POWER	POOR ACCELERATION	HI IDLE	LOW IDLE	Reference page	Feature of symptom, Check point
Warranty symptom code			AA				AB			AC	AD	AE		AF			
ENGINE CONTROL	EGR volume control valve circuit	*a, *b														EC-222	
		*c															*8
	Glow relay circuit	*a	1	1	1	1										EC-239	*9
		*b															*10
	ECM relay (Self-shutoff) circuit	*a					1	1	1							EC-79	
		*b															*11
	ECM, Connector circuit	*a, *b	2	2	2	2	2	2	2	2	2	2	2	2	2	EC-121, 200, 213	
	Air conditioner relay circuit	*a														EC-289	*12
		*b															*13
	Air conditioner switch circuit	*a, *c														EC-289	*13
		*b															*14

1 - 5: The numbers refer to the order of inspection.
(continued on next page)
*a: Open
*b: Short
*c: Ground short
*d: Noise
*8: Does not stop operating.
*9: Glow lamp does not turn on.
*10: Glow lamp does not turn off. *11: Ground short makes engine unable to stop.
*12: Air conditioner does not operate.
*13: Air conditioner does not stop operating.
*14: Air conditioner does not work.

Symptom Matrix Chart (Cont'd)

SYSTEM — ENGINE CONTROL system		Malfunction	SYMPTOM: ROUGH IDLE/HUNTING	IDLING VIBRATION	SLOW/NO RETURN TO IDLE	OVERHEAT/HIGH ENGINE COOLANT TEMPERATURE	EXCESSIVE FUEL CONSUMPTION	EXCESSIVE OIL CONSUMPTION	ABNORMAL SMOKE COLOR: BLACK SMOKE	ABNORMAL SMOKE COLOR: WHITE SMOKE	DEAD BATTERY (UNDER CHARGE)	Malfunction indicator lamp illuminates.	Can be detected by CONSULT-II?	Fuel cut	Reference page	Feature of symptom, Check point
Warranty symptom code			AG	AH	AJ	AK	AL	AM	AP		HA					
ENGINE CONTROL	EGR volume control valve circuit	*a, *b													EC-222	
		*c							1							*8
	Glow relay circuit	*a								1					EC-239	*9
		*b														*10
	ECM relay (Self-shutoff) circuit	*a												1	EC-79	
		*b	1	1												*11
	ECM, Connector circuit	*a, *b	2	2	2	2	2	2	2	2	2	2	2	2	EC-121, 200, 213	
	Air conditioner relay circuit	*a													EC-289	*12
		*b														*13
	Air conditioner switch circuit	*a, *c													EC-289	*13
		*b														*14

1 - 5: The numbers refer to the order of inspection.
*a: Open
*b: Short
*c: Ground short
*d: Noise
*8: Does not stop operating.
*9: Glow lamp does not turn on.
*10: Glow lamp does not turn off.
*11: Ground short makes engine unable to stop.
*12: Air conditioner does not operate.
*13: Air conditioner does not stop operating.
*14: Air conditioner does not work.

CONSULT-II Reference Value in Data Monitor Mode

Remarks:
- Specification data are reference values.
- Specification data are output/input values which are detected or supplied by the ECM at the connector.

* Specification data may not be directly related to their components signals/values/operations.

MONITOR ITEM	CONDITION		SPECIFICATION
CKPS·RPM (TDC)	• Tachometer: Connect • Run engine and compare tachometer indication with the CONSULT-II value.		Almost the same speed as the CONSULT-II value.
CMPS·RPM-PUMP			
COOLAN TEMP/S	• Engine: After warming up		More than 70°C (158°F)
VHCL SPEED SE	• Turn drive wheels and compare speedometer indication with the CONSULT-II value		Almost the same speed as the CONSULT-II value
FUEL TEMP SEN	• Engine: After warming up		More than 40°C (104°F)
ACCEL POS SEN	• Ignition switch: ON (Engine stopped)	Accelerator pedal: fully released	0.40 - 0.60V
		Accelerator pedal: fully depressed	Approx. 4.5V
FULL ACCEL SW	• Ignition switch: ON (Engine stopped)	Accelerator pedal: fully depressed	ON
		Except above	OFF
ACCEL SW (FC)	• Ignition switch: ON (Engine stopped)	Accelerator pedal: fully released	CLOSE
		Accelerator pedal: slightly open	OPEN
OFF ACCEL SW	• Ignition switch: ON (Engine stopped)	Accelerator pedal: fully released	ON
		Accelerator pedal: slightly open	OFF
SPILL/V	• Engine: After warming up		Approx. 13°CA
BATTERY VOLT	• Ignition switch: ON (Engine stopped)		11 - 14V
P/N POSI SW	• Ignition switch: ON	Shift lever: Park/Neutral	ON
		Except above	OFF
START SIGNAL	• Ignition switch: ON → START → ON		OFF → ON → OFF
AIR COND SIG	• Engine: After warming up, idle the engine	Air conditioner switch: OFF	OFF
		Air conditioner switch: ON (Compressor operates.)	ON
BRAKE SW	• Ignition switch: ON	Brake pedal: depressed	ON
		Brake pedal: released	OFF
IGN SW	• Ignition switch: ON → OFF		ON → OFF
WARM UP SW	• Ignition switch: ON	Heat up switch: ON	ON
		Heat up switch: OFF	OFF
MAS AIR/FL SE	• Engine: After warming up • Air conditioner switch: OFF • Shift lever: Neutral position • No-load	Idle	1.6 - 2.0V
DECELER F/CUT	• Engine: After warming up	Idle	OFF
INJ TIMG C/V	• Engine: After warming up, idle the engine.		Approx. 50 - 70%
AIR COND RLY	• Engine: After warming up, idle the engine	Air conditioner switch: OFF	OFF
		Air conditioner switch: ON (Compressor operates.)	ON
GLOW RLY	• Refer to EC-239.		
COOLING FAN	• When cooling fan is stopped.		OFF
	• When cooling fan operates.		ON

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

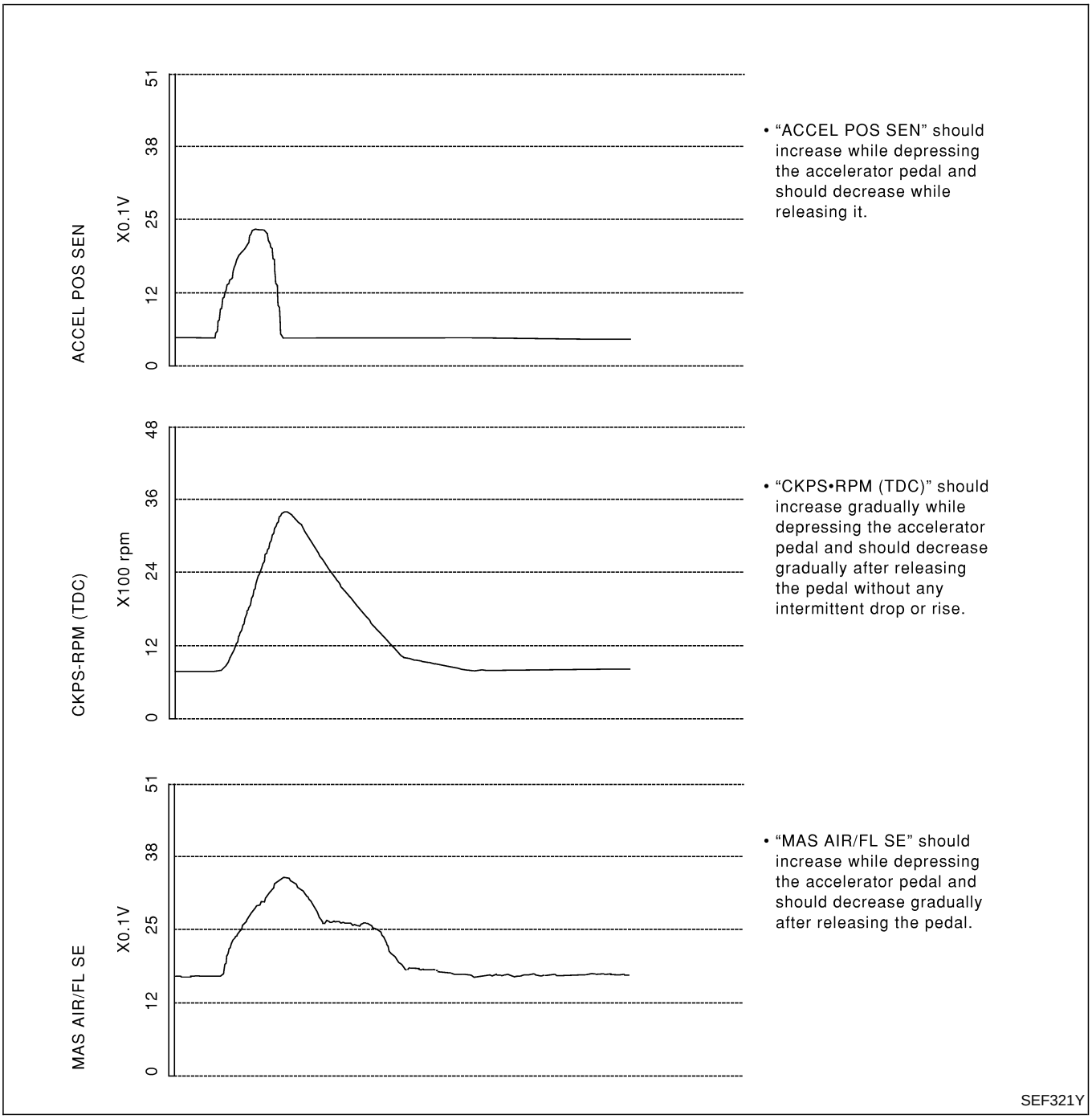
MONITOR ITEM	CONDITION		SPECIFICATION
EGR VOL CON/V	● Engine: After warming up ● Air conditioner switch: "OFF" ● Shift lever: Neutral position ● No-load	After 1 minute of idling	More than 10 steps
		Revving engine from idle to 3,200 rpm	0 step
VNT S/V 1	● Engine: After warming up ● Air conditioner switch: "OFF" ● Shift lever: Neutral position ● No-load	Idle	Approx. 56%
		2,000 rpm	Approx. 20%
BARO SEN	● Ignition switch: ON		Altitude Approx. 0 m (0 ft): Approx. 100.62 kPa (1.0062 bar, 1.026 kg/cm^2, 14.59 psi) Approx. 1,000 m (3,281 ft): Approx. 88.95 kPa (0.8895 bar, 0.907 kg/cm^2, 12.90 psi) Approx. 1,500 m (4,922 ft): Approx. 83.16 kPa (0.8316 bar, 0.848 kg/cm^2, 12.06 psi) Approx. 2,000 m (6,562 ft): Approx. 78.36 kPa (0.7836 bar, 0.799 kg/cm^2, 11.36 psi)
SWRL CON S/V 1	● Lift up the vehicle ● Engine: After warming up let it idle for more than 1 second. ● Air conditioner switch: "OFF" ● No-load	Shift lever: Except "P" and "Neutral" positions	ON
		Shift lever: Neutral position	OFF

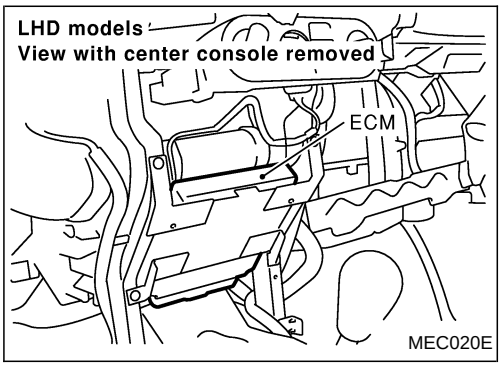
Major Sensor Reference Graph in Data Monitor Mode

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

ACCEL POS SEN, “CKPS·RPM (TDC)”, “MAS AIR/FL SE”

Below is the data for “ACCEL POS SEN”, “CKPS·RPM (TDC)” and “MAS AIR/FL SE” when revving engine quickly up to 3,000 rpm under no load after warming up engine to the normal operating temperature.
Each value is for reference, the exact value may vary.

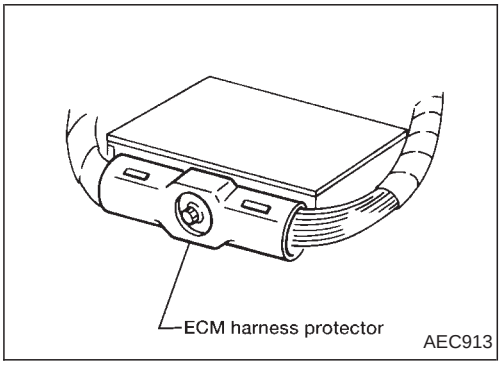




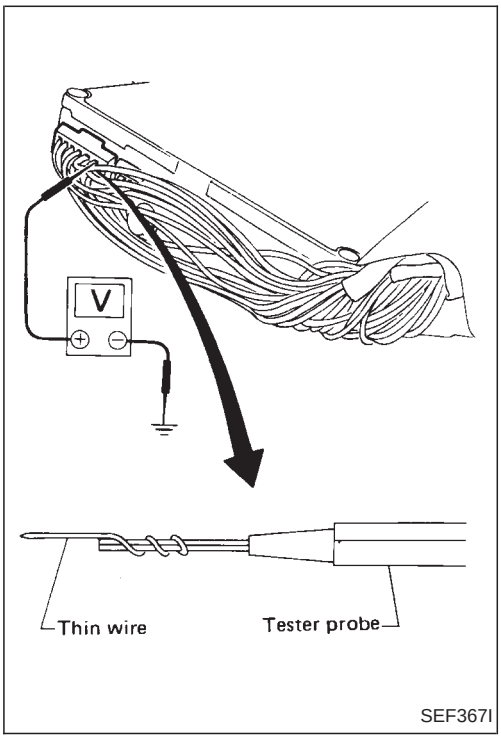
ECM Terminals and Reference Value

PREPARATION

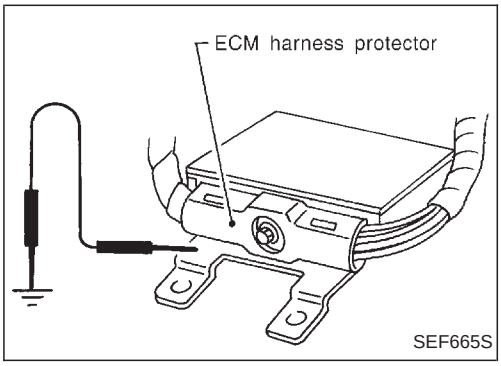
1. ECM is located behind the instrument lower panel. For this inspection, remove the driver's side instrument lower cover.



2. Remove ECM harness protector.



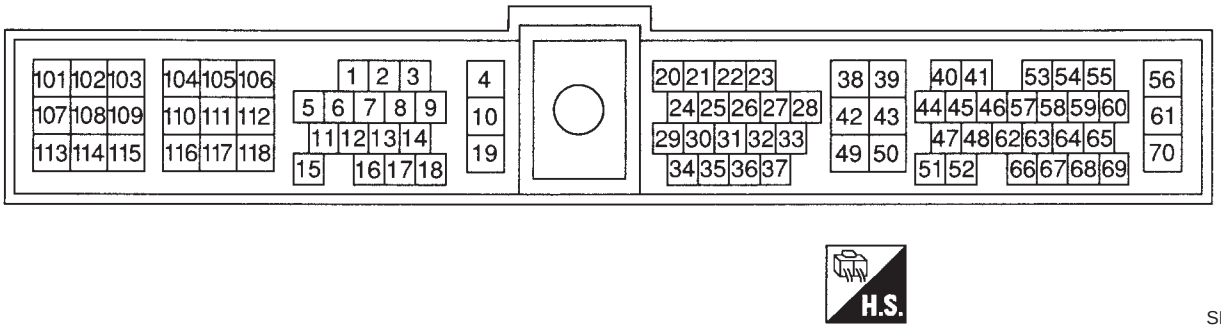
3. Perform all voltage measurements with the connector connected. Extend tester probe as shown to perform tests easily.
   - Open harness securing clip to make testing easier.
   - Use extreme care not to touch 2 pins at one time.
   - Data is for comparison and may not be exact.



Be sure ECM unit is properly grounded before checking.

ECM Terminals and Reference Value (Cont'd)

ECM HARNESS CONNECTOR TERMINAL LAYOUT



SEF064P

ECM INSPECTION TABLE

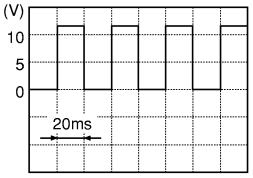
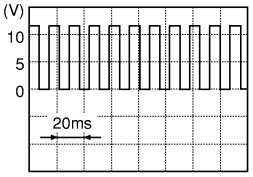
Remarks: Specification data are reference values and are measured between each terminal and ground.

CAUTION:

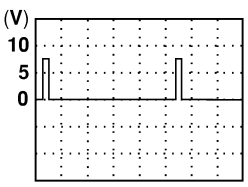
Do not use ECM ground terminals when measuring input/output voltage. Doing so may damage the ECM's transistor. Use a ground other than ECM terminals, such as the ground.

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
2	L/G	Intake air control valve control solenoid valve	Engine is running.	BATTERY VOLTAGE (11 - 14V)
			Ignition switch "OFF" └ For a few seconds after turning ignition switch "OFF"	Approximately 0.1V
4	G	ECM relay (Self-shutoff)	Ignition switch "ON"	Approximately 0.25V
			Ignition switch "OFF" └ For a few seconds after turning ignition switch "OFF"	
			Ignition switch "OFF" └ A few seconds passed after turning ignition switch "OFF"	BATTERY VOLTAGE (11 - 14V)

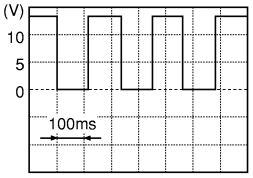
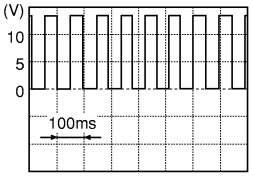
ECM Terminals and Reference Value (Cont'd)

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
5	L/B	Tachometer	Engine is running. └ **Warm-up condition** Idle speed	Approximately 5.7V  SEF255Z
			Engine is running. └ **Warm-up condition** Engine speed is 2,000 rpm	Approximately 6V  SEF256Z
14	LG/R	Cooling fan relay	Engine is running. └ Cooling fan is not operating	BATTERY VOLTAGE (11 - 14V)
			Engine is running. └ Cooling fan is operating	Approximately 0.1V
15	G/PU	Air conditioner relay	Engine is running. └ Air conditioner switch is "OFF"	BATTERY VOLTAGE (11 - 14V)
			Engine is running. └ Both air conditioner switch and blower fan switch are "ON" (Compressor is operating)	Approximately 0.1V
16	G/W	Glow lamp	Ignition switch "ON" └ Glow lamp is "ON"	Approximately 1V
			Ignition switch "ON" └ Glow lamp is "OFF"	BATTERY VOLTAGE (11 - 14V)

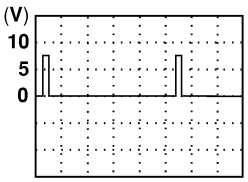
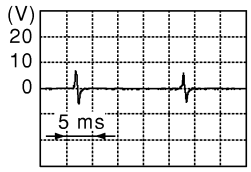
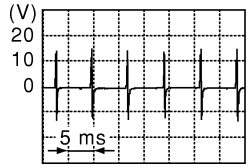
ECM Terminals and Reference Value (Cont'd)

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
17	G/Y	Stop lamp switch	Ignition switch "ON" └ Brake pedal fully released	Approximately 0V
			Ignition switch "ON" └ Brake pedal depressed	BATTERY VOLTAGE (11 - 14V)
18	L	Malfunction indicator lamp	Ignition switch "ON"	Approximately 1V
			Engine is running. └ Idle speed	BATTERY VOLTAGE (11 - 14V)
19	LG/W	Engine coolant temperature sensor	Engine is running.	Approximately 0 - 4.8V Output voltage varies with engine coolant temperature
20	PU	Start signal	Ignition switch "ON"	Approximately 0V
			Ignition switch "START"	BATTERY VOLTAGE (11 - 14V)
21	G/R	Air conditioner switch	Engine is running. └ Air conditioner switch is "OFF"	BATTERY VOLTAGE (11 - 14V)
			Engine is running. └ Both air conditioner switch and blower fan switch are "ON" (Compressor is operating)	Approximately 0.1V
22	BR/Y (A/T) G (M/T)	Park/Neutral position switch	Ignition switch "ON" └ Gear position is "Neutral" (M/T models) Gear position is "P" or "N" (A/T models)	Approximately 0V
			Ignition switch "ON" └ Except the above gear position	BATTERY VOLTAGE (11 - 14V)
23	G	Accelerator position sensor	Ignition switch "ON" └ Accelerator pedal fully released	0.4 - 0.6V
			Ignition switch "ON" └ Accelerator pedal fully depressed	Approximately 4.5V
24	G/Y	A/T signal No. 1	Engine is running. └ **Warm-up condition** Idle speed	Voltage goes high up once in a few seconds  SEF448Z

ECM Terminals and Reference Value (Cont'd)

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
26	Y/B	Vehicle speed sensor	Engine is running. └ Lift up the vehicle In 1st gear position Vehicle speed is 10 km/h (6 MPH)	0 - Approximately 4.8V  SEF257Z
			Engine is running. └ Lift up the vehicle In 2nd gear position Vehicle speed is 30 km/h (19 MPH)	Approximately 2.2V  SEF258Z
29	LG/R	Accelerator switch (F/C)	Ignition switch "ON" └ Accelerator pedal fully released	BATTERY VOLTAGE (11 - 14V)
			Ignition switch "ON" └ Accelerator pedal depressed	Approximately 0V
30	LG/Y	A/T signal No. 3	Engine is running. └ **Warm-up condition** Idle speed	Approximately 0V
			Engine is running. └ **Warm-up condition** Engine speed is 2,000 rpm	Approximately 7.7V
31	L/Y	Accelerator position switch (Idle)	Ignition switch "ON" └ Accelerator pedal fully released	BATTERY VOLTAGE (11 - 14V)
			Ignition switch "ON" └ Accelerator pedal depressed	Approximately 0V
32	R/L	Accelerator position switch (Full)	Ignition switch "ON" └ Accelerator pedal released	Approximately 0V
			Ignition switch "ON" └ Accelerator pedal fully depressed	BATTERY VOLTAGE (11 - 14V)
33	G	Electronic control fuel injection pump	Engine is running. └ **Warm-up condition** Idle speed	Approximately 2.5V

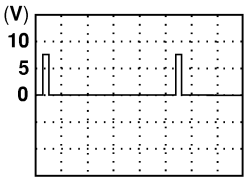
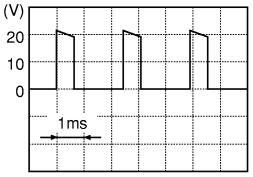
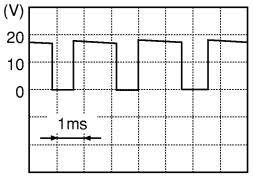
ECM Terminals and Reference Value (Cont'd)

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
35	R	Mass air flow sensor	Engine is running. └ **Warm-up condition** Idle speed	1.6 - 2.0V
37	LG/R	A/T signal No. 2	Engine is running. └ **Warm-up condition** Idle speed	Voltage goes high up once in a few seconds  SEF448Z
38	B/W	Ignition switch	Ignition switch "OFF"	0V
			Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
39 43	B B	ECM ground	Engine is running. └ Idle speed	Approximately 0V
40	R	Electronic control fuel injection pump	Engine is running. └ **Warm-up condition** Idle speed	Approximately 2.5V
42	OR	Data link connector	Engine is running. └ Idle speed (CONSULT-II is connected and turned on)	Approximately 0V
64	OR/B			Approximately 0V
65	OR/W			Less than 9V
44	L/G	Crankshaft position sensor (TDC)	Engine is running. └ **Warm-up condition** Idle speed	Approximately 0V  SEF333Y
			Engine is running. └ **Warm-up condition** Engine speed is 2,000 rpm	Approximately 0V  SEF334Y

ECM Terminals and Reference Value (Cont'd)

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
46	G	Charge air pressure sensor	Engine is running. └ **Warm-up condition** Idle speed	Approximately 2.0V
47	L/R	Crankshaft position sensor (TDC) ground	Engine is running. └ **Warm-up condition** Idle speed	Approximately 0V
48	R/B	Accelerator position sensor power supply	Ignition switch "ON"	Approximately 5V
49	W	Sensor's power supply	Ignition switch "ON"	Approximately 5V
50	B	Sensors' ground	Engine is running. └ **Warm-up condition** Idle speed	Approximately 0V
51	B/W (LHD models) R/W (RHD models)	Accelerator position sensor ground	Engine is running. └ **Warm-up condition** Idle speed	Approximately 0V
52	Y	Electronic control fuel injection pump	Engine is running. └ Idle speed	Approximately 0.1V
53	OR	Electronic control fuel injection pump	Engine is running. └ Idle speed	Approximately 1.0V
54	R	Swirl control valve control solenoid valve	Engine is running. └ **Warm-up condition** At idle speed for more than 1 second Lift up the vehicle Gear position is in positions other than "P" and "Neutral"	Approximately 0.1V
			Engine is running. └ Idle speed Lift up the vehicle Gear position is in "P" or "Neutral"	BATTERY VOLTAGE (11 - 14V)
56 61 116	B/W B/W B/W	Power supply for ECM	Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)

ECM Terminals and Reference Value (Cont'd)

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
58	R/B	A/T signal No. 4	Engine is running. └ **Warm-up condition** Idle speed	Voltage goes high up once in a few seconds  SEF448Z
59	G	Heat up switch	Ignition switch "ON" └ Heat up switch is "ON"	Approximately 0V
			Ignition switch "ON" └ Heat up switch is "OFF"	BATTERY VOLTAGE (11 - 14V)
68	Y/G	Accelerator position sensor signal output	Ignition switch "ON" └ Accelerator pedal fully released	0.4 - 0.6V
			Ignition switch "ON" └ Accelerator pedal fully depressed	Approximately 4.5V
101	Y	Variable nozzle turbocharger control solenoid valve	Engine is running. └ **Warm-up condition** Idle speed	Approximately 6.8V  SEF253Z
			Engine is running. └ **Warm-up condition** Engine speed is 2,000 rpm	Approximately 11V  SEF254Z
102	G/W	Current return	Engine is running. └ Idle speed	BATTERY VOLTAGE (11 - 14V)

ECM Terminals and Reference Value (Cont'd)

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
103 105 109 115	R/Y (LHD models) L/R (RHD models) G/Y Y/B R/L	EGR volume control valve	Engine is running. └ **Warm-up condition** Idle speed	0.1 - 14V
106 112 118	B B B	ECM ground	Engine is running. └ Idle speed	Approximately 0V
111	LG	Glow relay	Refer to "GLOW CONTROL SYSTEM", EC-239.	

Description

Intermittent incidents (I/I) may occur. In many cases, the problem resolves itself (the part or circuit function returns to normal without intervention). It is important to realize that the symptoms described in the customer's complaint often do not recur on DTC visits. Realize also that the most frequent cause of I/I occurrences is poor electrical connections. Because of this, the conditions under which the incident occurred may not be clear. Therefore, circuit checks made as part of the standard diagnostic procedure may not indicate the specific problem area.

COMMON I/I REPORT SITUATIONS

STEP in Work Flow	Situation
II	The CONSULT-II is used. The SELF-DIAG RESULTS screen shows time data other than "0".
III	The symptom described by the customer does not recur.
IV	DTC does not appear during the DTC Confirmation Procedure.
VI	The Diagnostic Procedure for XXXX does not indicate the problem area.

Diagnostic Procedure

1	**INSPECTION START**
Erase DTCs. Refer to "HOW TO ERASE DTC", EC-33.	
▶	GO TO 2.

2	**CHECK GROUND TERMINALS**
Check ground terminals for corroding or loose connection. Refer to GI section ("GROUND INSPECTION", "Circuit Inspection").	
OK or NG	
OK ▶	GO TO 3.
NG ▶	Repair or replace.

3	**SEARCH FOR ELECTRICAL INCIDENT**
Perform GI section, "Incident Simulation Tests".	
OK or NG	
OK ▶	**INSPECTION END**
NG ▶	Repair or replace.

Main Power Supply and Ground Circuit

ECM TERMINALS AND REFERENCE VALUE

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

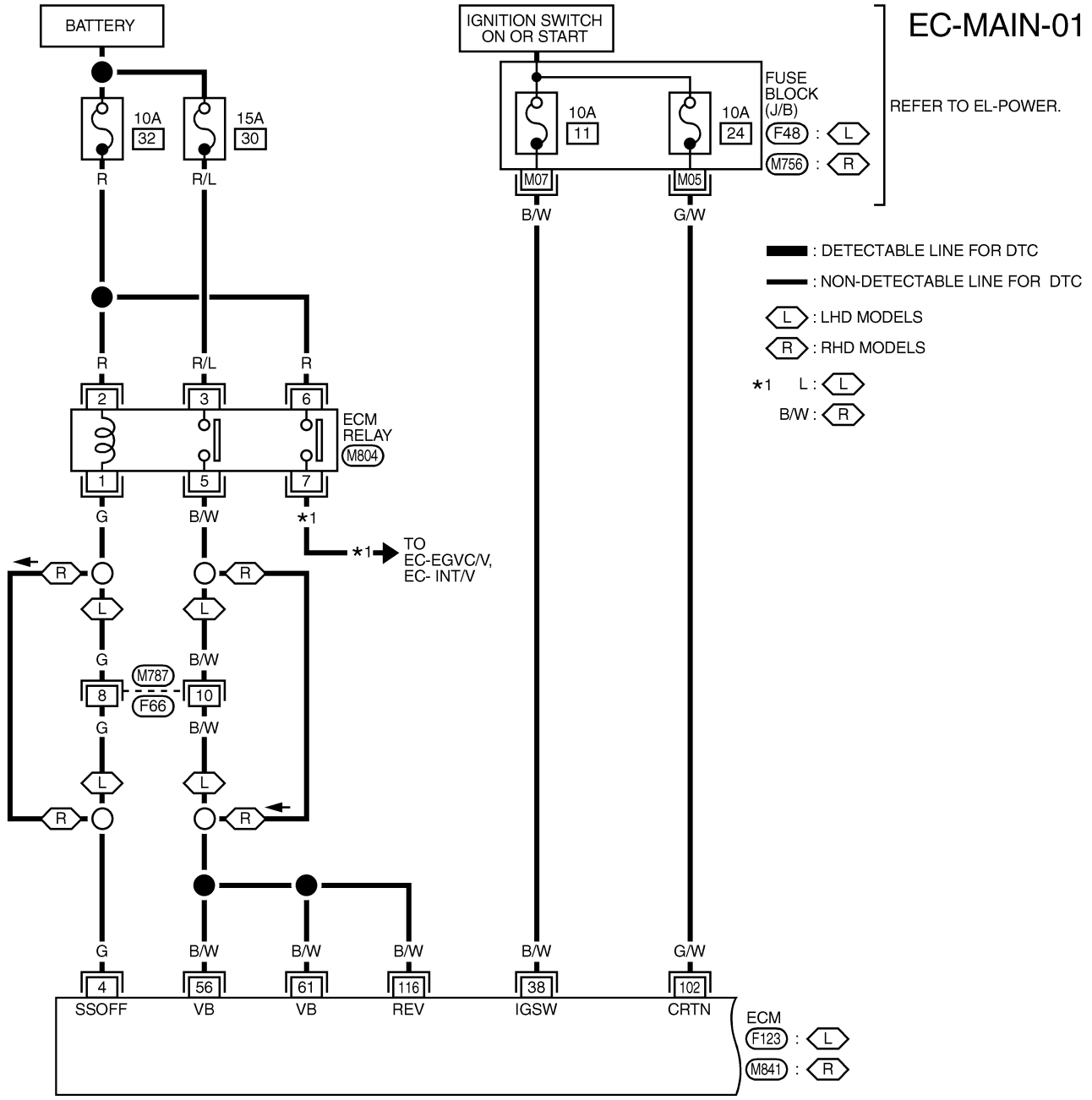
CAUTION:

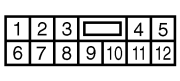
Do not use ECM ground terminals when measuring input/output voltage. Doing so may damage the ECM's transistor. Use a ground other than ECM terminals, such as the ground.

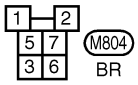
TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage)
4	G	ECM relay (Self-shutoff)	Ignition switch "ON" Ignition switch "OFF" └ For a few seconds after turning ignition switch "OFF"	Approximately 0.25V
			Ignition switch "OFF" └ A few seconds passed after turning ignition switch "OFF"	BATTERY VOLTAGE (11 - 14V)
38	B/W	Ignition switch	Ignition switch "OFF"	0V
			Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
39 43	B B	ECM ground	Engine is running. └ Idle speed	Approximately 0V
56 61 116	B/W B/W B/W	Power supply for ECM	Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
102	G/W	Current return	Engine is running. └ Idle speed	BATTERY VOLTAGE (11 - 14V)
106 112 118	B B B	ECM ground	Engine is running. └ Idle speed	Approximately 0V

Main Power Supply and Ground Circuit (Cont'd)

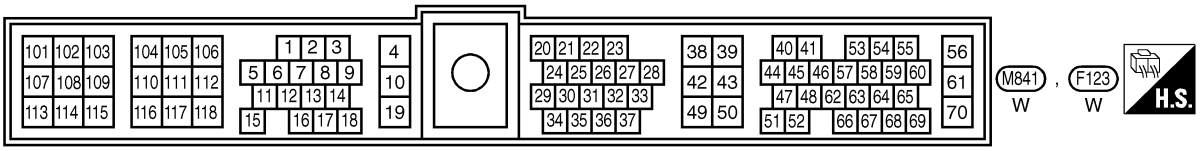
WIRING DIAGRAM







REFER TO THE FOLLOWING.
M756 , F48 -FUSE BLOCK-JUNCTION BOX (J/B)

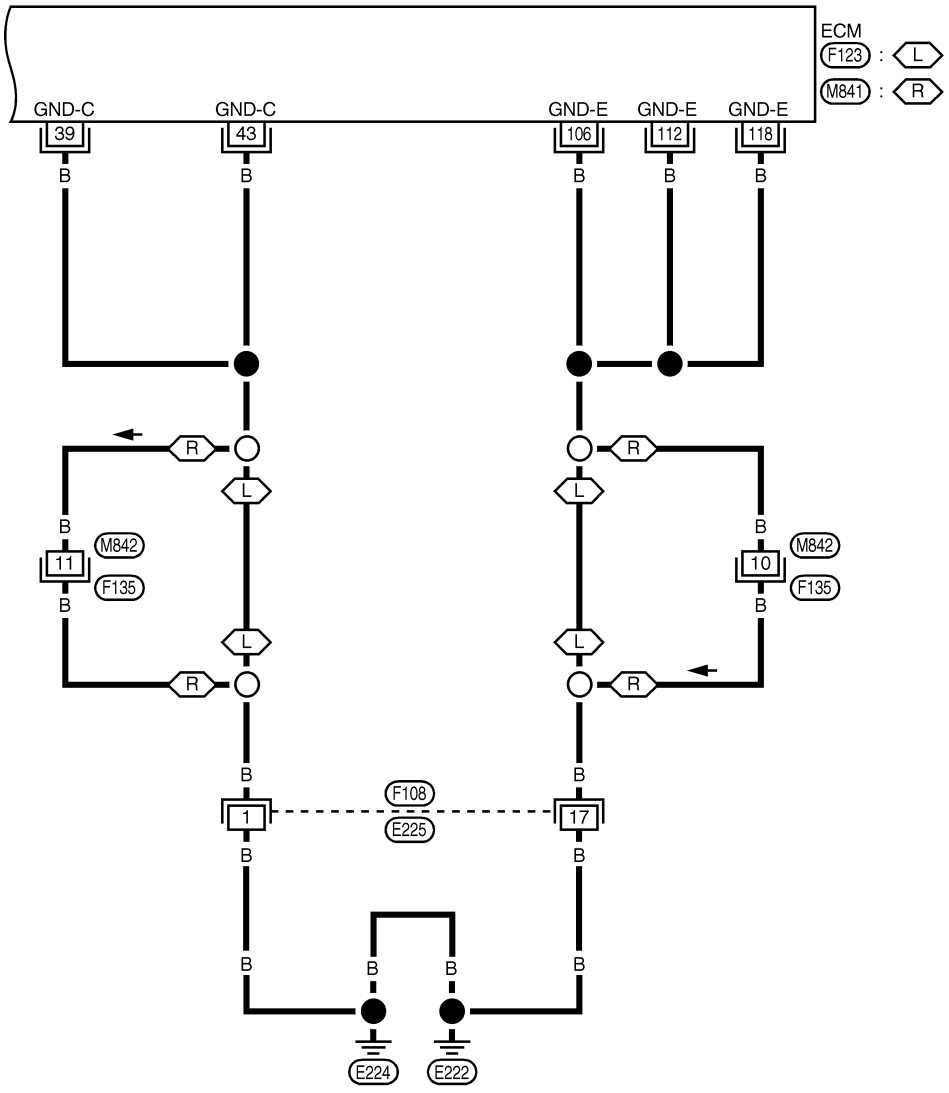


YEC171A

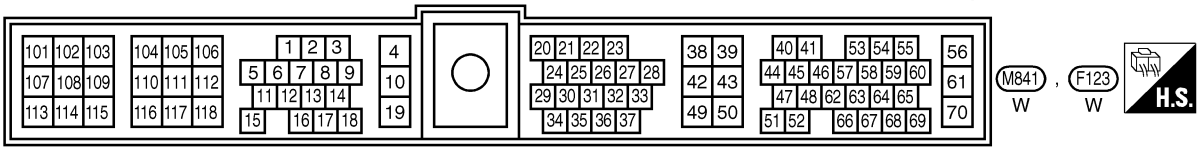
Main Power Supply and Ground Circuit (Cont'd)

EC-MAIN-02

: DETECTABLE LINE FOR DTC
: NON-DETECTABLE LINE FOR DTC
(L) : LHD MODELS
(R) : RHD MODELS



REFER TO THE FOLLOWING.
F108 , F135 -SUPER MULTIPLE JUNCTION (SMJ)



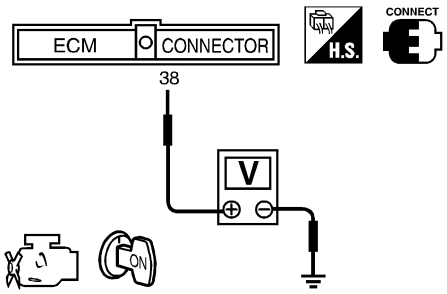
YEC172A

Main Power Supply and Ground Circuit (Cont'd)

DIAGNOSTIC PROCEDURE

1	INSPECTION START
Start engine. Is engine running? **Yes or No**	
Yes ▶	GO TO 14.
No ▶	GO TO 2.

2	CHECK ECM POWER SUPPLY CIRCUIT-I
1. Turn ignition switch "ON". 2. Check voltage between ECM terminal 38 and ground with CONSULT-II or tester.	



Voltage: Battery voltage

SEF397Y

OK or NG

OK ▶	GO TO 4.
NG ▶	GO TO 3.

3	DETECT MALFUNCTIONING PART
Check the following. ● 10A fuse ● Harness for open or short between ECM and fuse	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

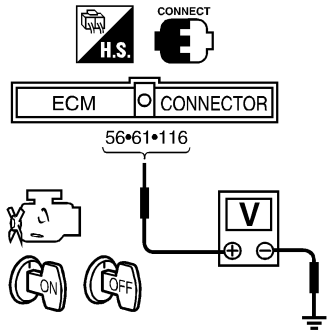
4	CHECK ECM GROUND CIRCUIT FOR OPEN AND SHORT
1. Turn ignition switch "OFF". 2. Disconnect ECM harness connector. 3. Check harness continuity between ECM terminals 39, 43, 106, 112, 118 and engine ground. Refer to Wiring Diagram. **Continuity should exist.** 4. Also check harness for short to ground and short to power. **OK or NG**	
OK ▶	GO TO 6.
NG ▶	GO TO 5.

Main Power Supply and Ground Circuit (Cont'd)

5	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors F108, E225 ● Harness connectors M842, F135 (RHD models) ● Harness for open or short between ECM and engine ground	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

6	CHECK ECM POWER SUPPLY CIRCUIT-II

1. Reconnect ECM harness connector.
2. Turn ignition switch "ON" and then "OFF".
3. Check voltage between ECM terminals 56, 61, 116 and ground with CONSULT-II or tester.



Voltage:
After turning ignition switch "OFF", battery voltage will exist for a few seconds, then drop to approximately 0V.

SEF288Z

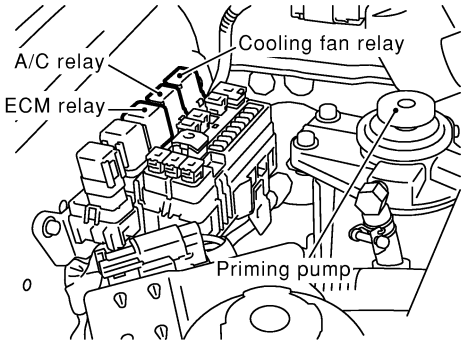
OK or NG

OK ▶	Check electronic control fuel injection pump power supply circuit. Refer to "Diagnostic Procedure", EC-180.
NG (Battery voltage does not exist.) ▶	GO TO 7.
NG (Battery voltage exists for more than a few seconds.) ▶	GO TO 13.

Main Power Supply and Ground Circuit (Cont'd)

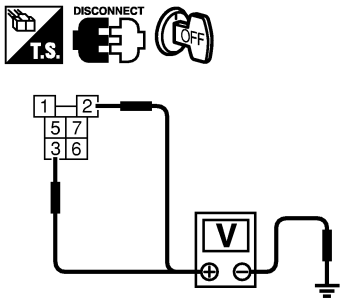
7	CHECK ECM POWER SUPPLY CIRCUIT-III

1. Disconnect ECM relay.



MEC021E

2. Check voltage between relay terminals 2, 3 and ground with CONSULT-II or tester.



MEC978D

Voltage: Battery Voltage

OK or NG

OK	▶	GO TO 9.
NG	▶	GO TO 8.

8	DETECT MALFUNCTIONING PART

Check the following.
- 10A fuse
- 15A fuse
- Harness for open or short between ECM relay and battery

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

9	CHECK OUTPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Disconnect ECM harness connector.
2. Check harness continuity between ECM terminal 4 and ECM relay terminal 1. Refer to Wiring Diagram.
   Continuity should exist.
3. Also check harness for short to ground and short to power.

OK or NG

OK	▶	GO TO 11.
NG	▶	GO TO 10.

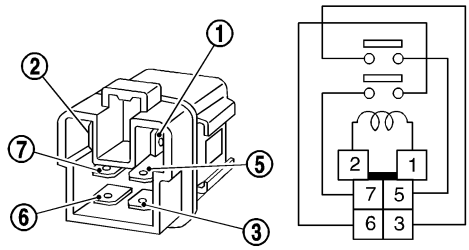
Main Power Supply and Ground Circuit (Cont'd)

10	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors M787, F66 (LHD models) ● Harness for open or short between ECM and ECM relay	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

11	CHECK ECM POWER SUPPLY CIRCUIT-IV
1. Check harness continuity between ECM terminals 56, 61, 116 and ECM relay terminal 5. Refer to Wiring Diagram. **Continuity should exist.** 2. Also check harness for short to ground and short to power. **OK or NG**	
OK ▶	GO TO 13.
NG ▶	GO TO 12.

12	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors M787, F66 (LHD models) ● Harness for open or short between ECM and ECM relay	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

13	CHECK ECM RELAY
1. Apply 12V direct current between ECM relay terminals 1 and 2. 2. Check continuity between ECM relay terminals 3 and 5, 6 and 7.	



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

SEF296X

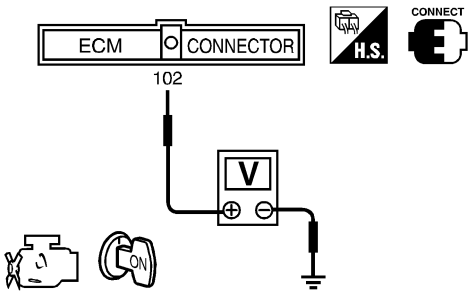
OK or NG

OK ▶	GO TO 14.
NG ▶	Replace ECM relay.

Main Power Supply and Ground Circuit (Cont'd)

14	CHECK ECM POWER SUPPLY CIRCUIT-V

1. Reconnect all harness connectors disconnected.
2. Turn ignition switch "ON".
3. Check voltage between ECM terminal 102 and ground with CONSULT-II or tester.



Voltage: Battery voltage

SEF290Z

OK or NG

OK	▶	GO TO 16.
NG	▶	GO TO 15.

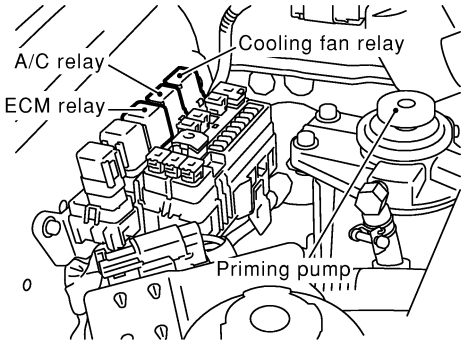
15	DETECT MALFUNCTIONING PART

Check the following.
- 10A fuse
- Harness for open or short between ECM and fuse

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

16	CHECK ECM POWER SUPPLY CIRCUIT-VI

1. Turn ignition switch "OFF".
2. Disconnect ECM relay.



MEC021E

3. Disconnect ECM harness connector.
4. Check harness continuity between ECM terminals 56, 61, 116 and ECM relay terminal 5. Refer to Wiring Diagram.
   Continuity should exist.
5. Also check harness for short to ground and short to power.

OK or NG

OK	▶	GO TO 18.
NG	▶	GO TO 17.

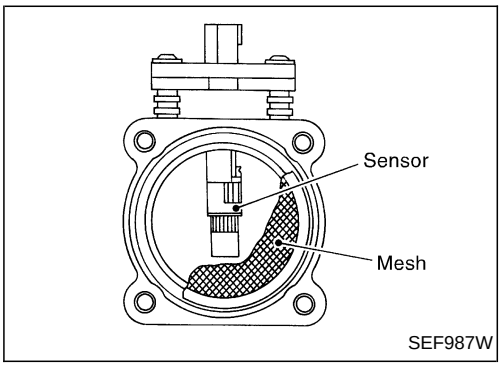
Main Power Supply and Ground Circuit (Cont'd)

17	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors M787, F66 (LHD models) ● Harness for open or short between ECM and ECM relay	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

18	CHECK ECM GROUND CIRCUIT FOR OPEN AND SHORT
1. Check harness continuity between ECM terminals 39, 43, 106, 112, 118 and engine ground. Refer to Wiring Diagram. **Continuity should exist.** 2. Also check harness for short to ground and short to power. **OK or NG**	
OK ▶	GO TO 20.
NG ▶	GO TO 19.

19	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors F108, E225 ● Harness connectors M842, F135 (RHD models) ● Harness for open or short between ECM and engine ground	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

20	CHECK INTERMITTENT INCIDENT
Refer to "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78.	
▶	**INSPECTION END**



Component Description

The mass air flow sensor (MAFS) is placed in the stream of intake air. It measures the intake air flow rate by measuring a part of the entire intake air flow. It consists of a hot wire that is supplied with electric current from the ECM. The temperature of the hot wire is controlled by the ECM a certain amount. The heat generated by the hot wire is reduced as the intake air flows around it. The more air, the greater the heat loss.
Therefore, the ECM must supply more electric current to maintain the temperature of the hot wire as air flow increases. The ECM detects the air flow by means of this current change.

CONSULT-II Reference Value in Data Monitor Mode

Specification data are reference values.

MONITOR ITEM	CONDITION		SPECIFICATION
MAS AIR/FL SE	● Engine: After warming up ● Air conditioner switch: “OFF” ● Shift lever: Neutral position ● No-load	Idle	1.6 - 2.0V

ECM Terminals and Reference Value

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

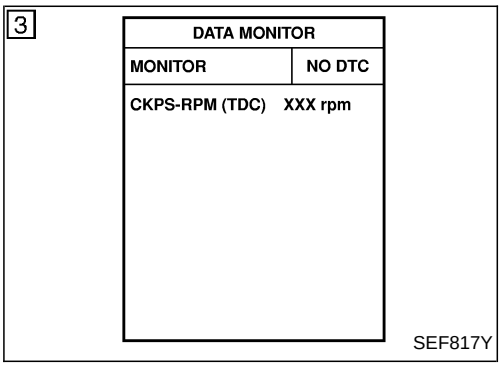
CAUTION:

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

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage)
35	R	Mass air flow sensor	Engine is running. └ **Warm-up condition** Idle speed	1.6 - 2.0V
49	W	Sensor’s power supply	Ignition switch “ON”	Approximately 5V
50	B	Sensor’s ground	Engine is running. └ **Warm-up condition** Idle speed	Approximately 0V

On Board Diagnosis Logic

Malfunction is detected when ...	Check Items (Possible Cause)
● An excessively high or low voltage from the sensor is sent to ECM.	● Harness or connectors (The sensor circuit is open or shorted.) ● Mass air flow sensor



DTC Confirmation Procedure

WITH CONSULT-II

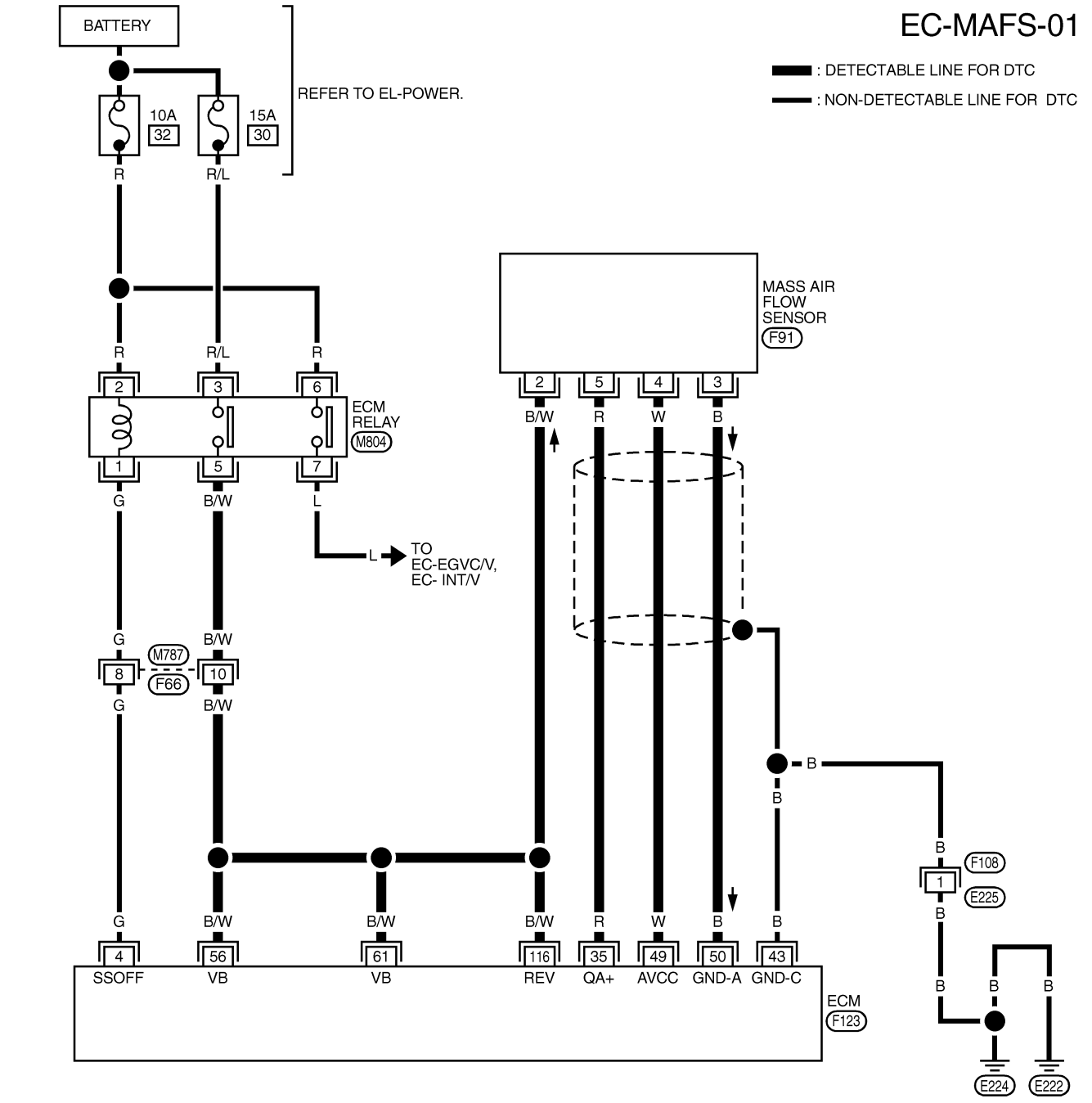
1) Turn ignition switch “ON”, and wait at least 6 seconds.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Start engine and wait at least 3 seconds.
4) If DTC is detected, go to “Diagnostic Procedure”, EC-92.

WITHOUT CONSULT-II

1) Turn ignition switch “ON”, and wait at least 6 seconds.
2) Start engine and wait at least 3 seconds.
3) Turn ignition switch “OFF”, wait at least 5 seconds and then turn “ON”.
4) Perform “Diagnostic Test Mode II (Self-diagnostic results)” with ECM.
5) If DTC is detected, go to “Diagnostic Procedure”, EC-92.

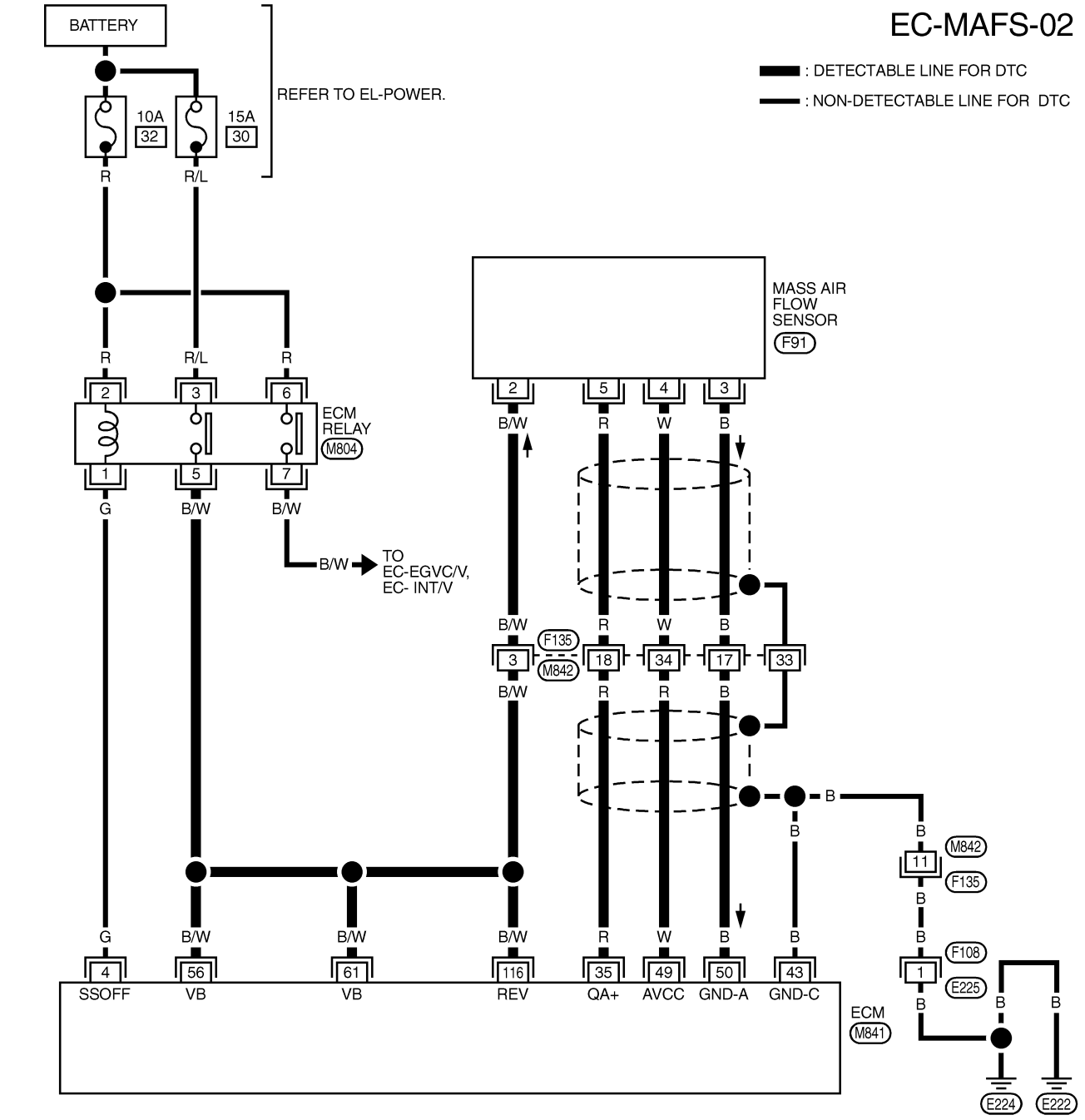
Wiring Diagram

LHD MODELS



Wiring Diagram (Cont'd)

RHD MODELS

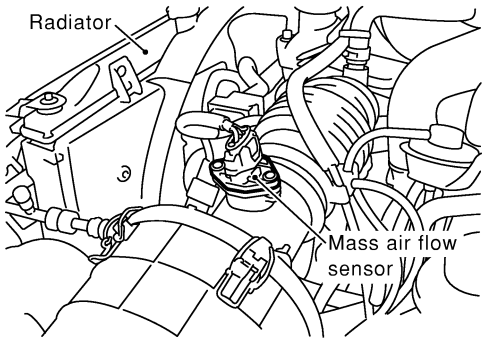


YEC174A

Diagnostic Procedure

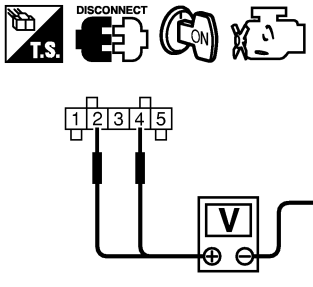
1	CHECK MAFS POWER SUPPLY CIRCUIT

1. Turn ignition switch “OFF”.
2. Disconnect mass air flow sensor harness connector.



MEC993D

3. Turn ignition switch “ON”.
4. Check voltage between mass air flow sensor terminals 2, 4 and ground with CONSULT-II or tester.



MEC973D

Terminal	Voltage V
2	Battery voltage
4	Approximately 5

MTBL1318

OK or NG

OK	▶	GO TO 3.
NG	▶	GO TO 2.

2	DETECT MALFUNCTIONING PART

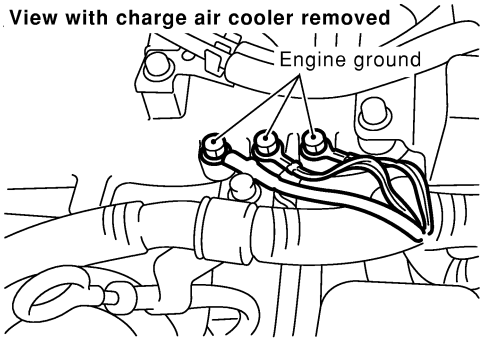
Check the following.
- Harness connectors M787, F66 (LHD models)
- Harness connectors F135, M842 (RHD models)
- Harness for open or short between mass air flow sensor and ECM
- Harness for open or short between mass air flow sensor and ECM relay

	▶	Repair open circuit or short to ground or short to power in harness or connector.

Diagnostic Procedure (Cont'd)

3	CHECK MAFS GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch "OFF".
2. Loosen and retighten engine ground screws.



MEC994D

3. Check harness continuity between mass air flow sensor terminal 3 and engine ground. Refer to Wiring Diagram.
   Continuity should exist.
4. Also check harness for short to ground and short to power.

OK or NG

OK	▶	GO TO 5.
NG	▶	GO TO 4.

4	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors F135, M842 (RHD models)
- Harness for open or short between mass air flow sensor and ECM

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

5	CHECK MAFS INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Disconnect ECM harness connector.
2. Check harness continuity between mass air flow sensor terminal 5 and ECM terminal 35. Refer to Wiring Diagram.
   Continuity should exist.
3. Also check harness for short to ground and short to power.

OK or NG

OK	▶	GO TO 7.
NG	▶	GO TO 6.

6	DETECT MALFUNCTIONING PART

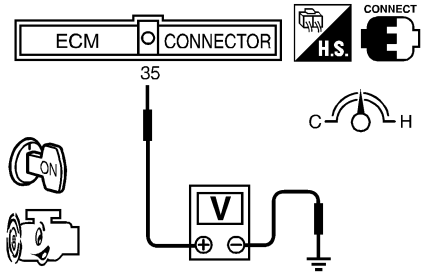
Check the following.
- Harness connectors F135, M842 (RHD models)
- Harness for open or short between mass air flow sensor and ECM

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

Diagnostic Procedure (Cont'd)

7	CHECK MASS AIR FLOW SENSOR

1. Reconnect harness connectors disconnected.
2. Start engine and warm it up to normal operating temperature.
3. Check voltage between ECM terminal 35 (Mass air flow sensor signal) and ground.



Condition	Voltage V
Ignition switch "ON" (Engine stopped.)	Approx. 1.0
Idle (Engine is warmed-up to normal operating temperature.)	1.6 - 2.0
Idle to about 4,000 rpm*	1.6 - 2.0 to Approx. 4.0

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

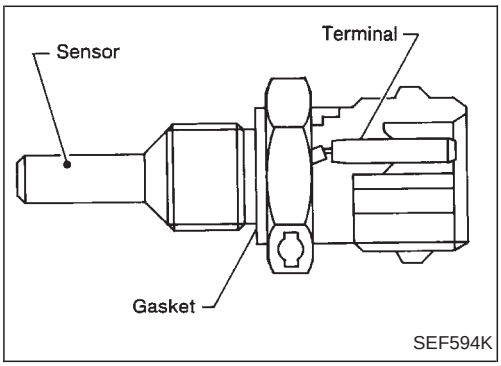
SEF400Y

4. If the voltage is out of specification, disconnect MAFS harness connector and connect it again. Then repeat above check.

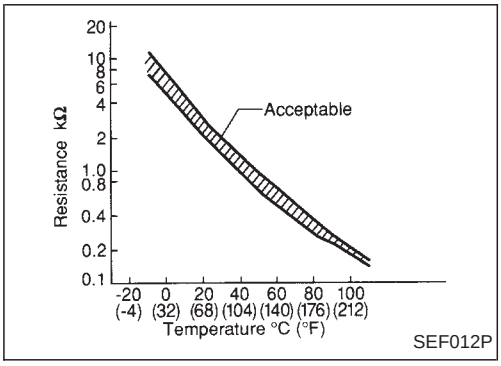
OK or NG

OK	▶	GO TO 8.
NG	▶	Replace mass air flow sensor.

8	CHECK INTERMITTENT INCIDENT
Refer to "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78.	
▶	**INSPECTION END**



SEF594K



SEF012P

Description

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

<Reference data>

Engine coolant temperature °C (°F)	Voltage* (V)	Resistance (kΩ)
−10 (14)	4.4	7.0 - 11.4
20 (68)	3.5	2.1 - 2.9
50 (122)	2.3	0.68 - 1.00
90 (194)	1.0	0.236 - 0.260

*: These data are reference values and measured between ECM terminal 19 (Engine coolant temperature sensor) and ground.

CAUTION:

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

On Board Diagnosis Logic

Malfunction is detected when ...	Check Items (Possible Cause)
• An excessively high or low voltage from the sensor is entered to ECM.	• Harness or connectors (The sensor circuit is open or shorted.) • Engine coolant temperature sensor

3

DATA MONITOR	
MONITOR	NO DTC
CKPS-RPM (TDC)	XXX rpm

SEF817Y

DTC Confirmation Procedure

WITH CONSULT-II

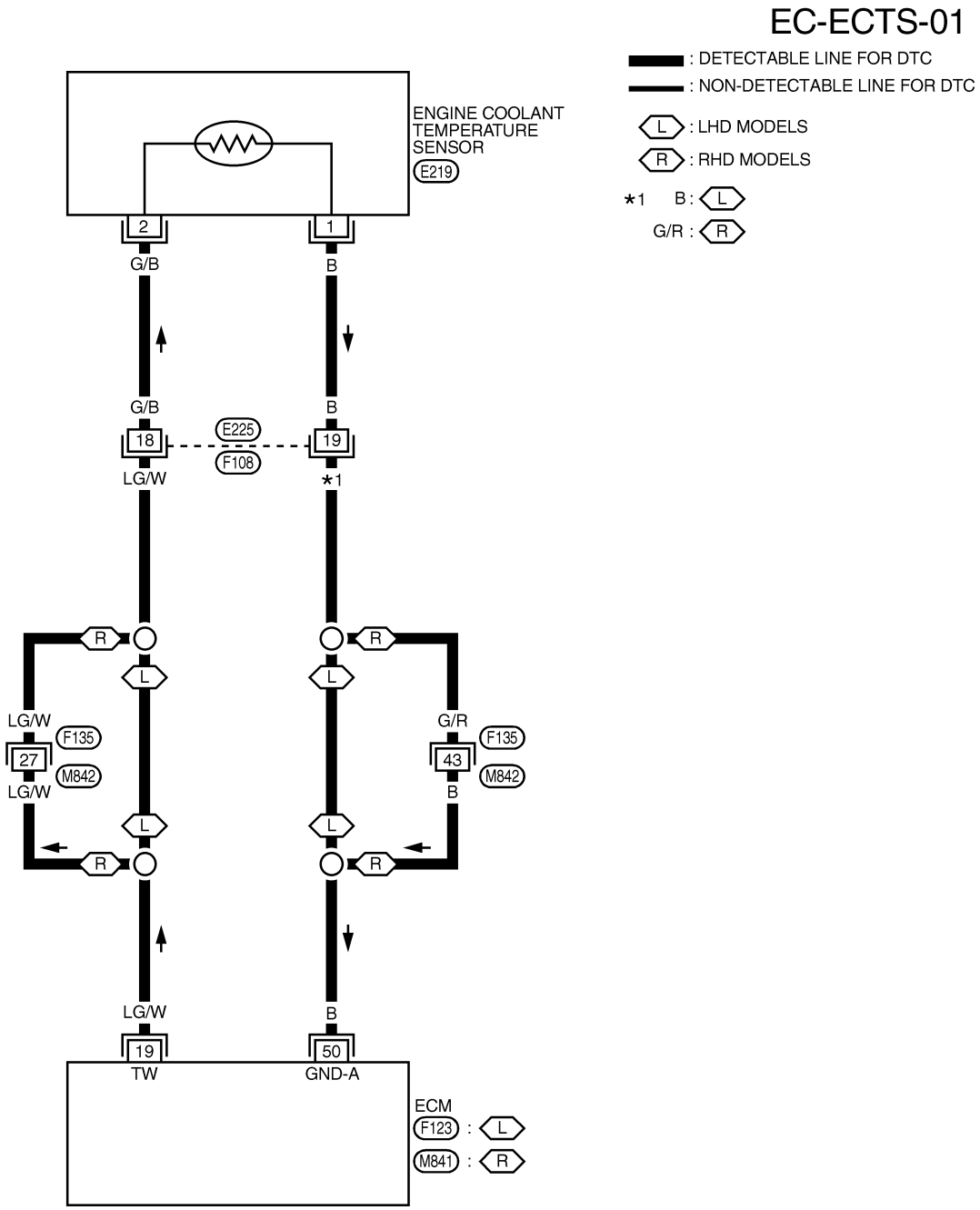
1) Turn ignition switch "ON".
2) Select "DATA MONITOR" mode with CONSULT-II.
3) Wait at least 5 seconds.
4) If DTC is detected, go to "Diagnostic Procedure", EC-97.

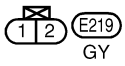
WITHOUT CONSULT-II

1) Turn ignition switch "ON" and wait at least 5 seconds.
2) Turn ignition switch "OFF", wait at least 5 seconds and then turn "ON".
3) Perform "Diagnostic Test Mode II (Self-diagnostic results)" with ECM.
4) If DTC is detected, go to "Diagnostic Procedure", EC-97.

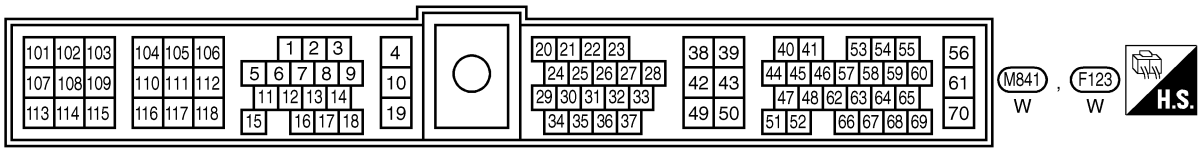
Wiring Diagram

EC-ECTS-01





REFER TO THE FOLLOWING.
F108 , F135 -SUPER MULTIPLE JUNCTION (SMJ)

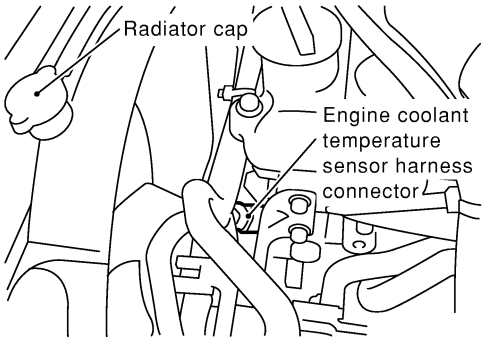


YEC175A

Diagnostic Procedure

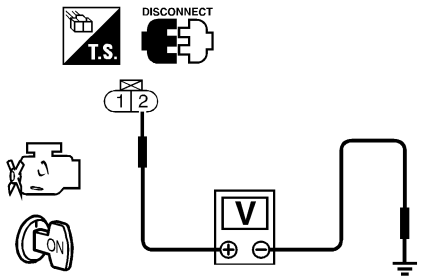
1	CHECK ECTS POWER SUPPLY CIRCUIT

1. Turn ignition switch “OFF”.
2. Disconnect engine coolant temperature sensor harness connector.



MEC022E

3. Turn ignition switch “ON”.
4. Check voltage between ECTS terminal 2 and ground with CONSULT-II or tester.



Voltage: Approximately 5V

SEF401Y

OK or NG

OK	▶	GO TO 3.
NG	▶	GO TO 2.

2	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors E225, F108
- Harness connectors F135, M842 (RHD models)
- Harness for open or short between engine control temperature sensor and ECM

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

3	CHECK ECTS GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch “OFF”.
2. Check harness continuity between ECTS terminal 1 and engine ground. Refer to Wiring Diagram.
   Continuity should exist.
3. Also check harness for short to ground and short to power.

OK or NG

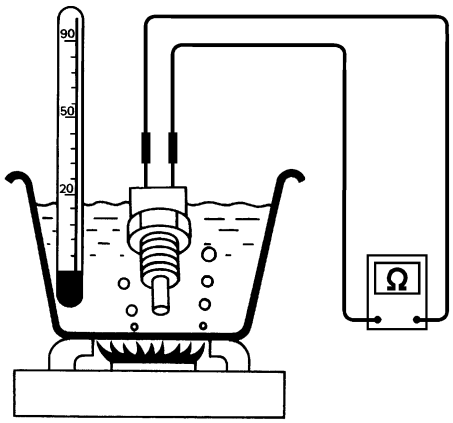
OK	▶	GO TO 5.
NG	▶	GO TO 4.

Diagnostic Procedure (Cont'd)

4	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors E225, F108 ● Harness connectors F135, M842 (RHD models) ● Harness for open or short between engine coolant temperature sensor and ECM	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

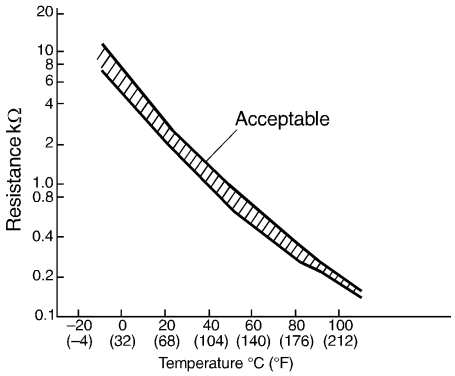
5	CHECK ENGINE COOLANT TEMPERATURE SENSOR

1. Remove engine coolant temperature sensor from the engine.
2. Check resistance between ECTS terminals 1 and 2 as shown in the figure.



<Reference data>

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

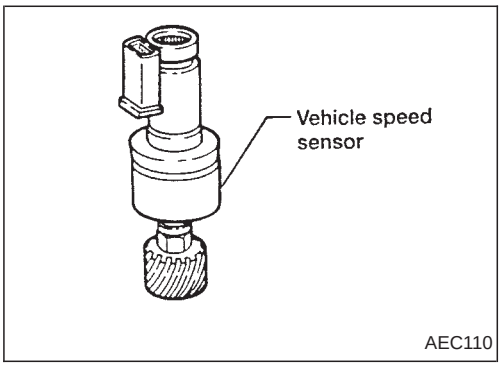


SEF304X

OK or NG

OK	▶	GO TO 6.
NG	▶	Replace engine coolant temperature sensor.

6	CHECK INTERMITTENT INCIDENT
Refer to "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78.	
▶	**INSPECTION END**



Description

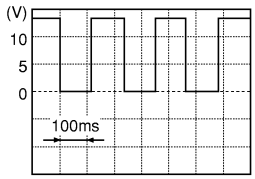
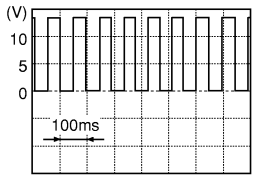
The vehicle speed sensor is installed in the transaxle. It contains a pulse generator which provides a vehicle speed signal to the speedometer. The speedometer then sends a signal to the ECM.

ECM Terminals and Reference Value

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

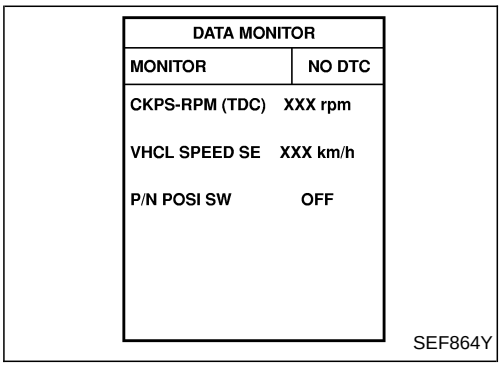
CAUTION:

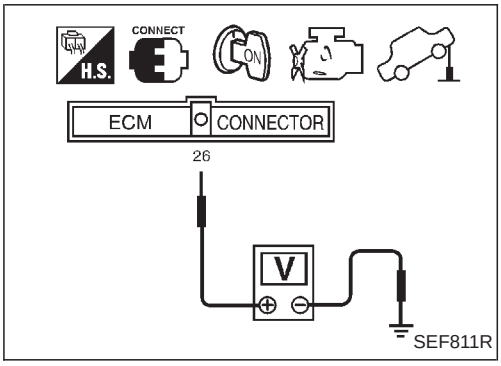
Do not use ECM ground terminals when measuring input/output voltage. Doing so may damage the ECM's transistor. Use a ground other than ECM terminals, such as the ground.

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
26	Y/B	Vehicle speed sensor	Engine is running. Lift up the vehicle In 1st gear position Vehicle speed is 10 km/h (6 MPH)	0 - Approximately 4.8V  SEF257Z
			Engine is running. Lift up the vehicle In 2nd gear position Vehicle speed is 30 km/h (19 MPH)	Approximately 2.2V  SEF258Z

On Board Diagnosis Logic

Malfunction is detected when	Check Items (Possible Cause)
● The almost 0 km/h (0 MPH) signal from vehicle speed sensor is sent to ECM even when vehicle is being driven.	● 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.

WITH CONSULT-II

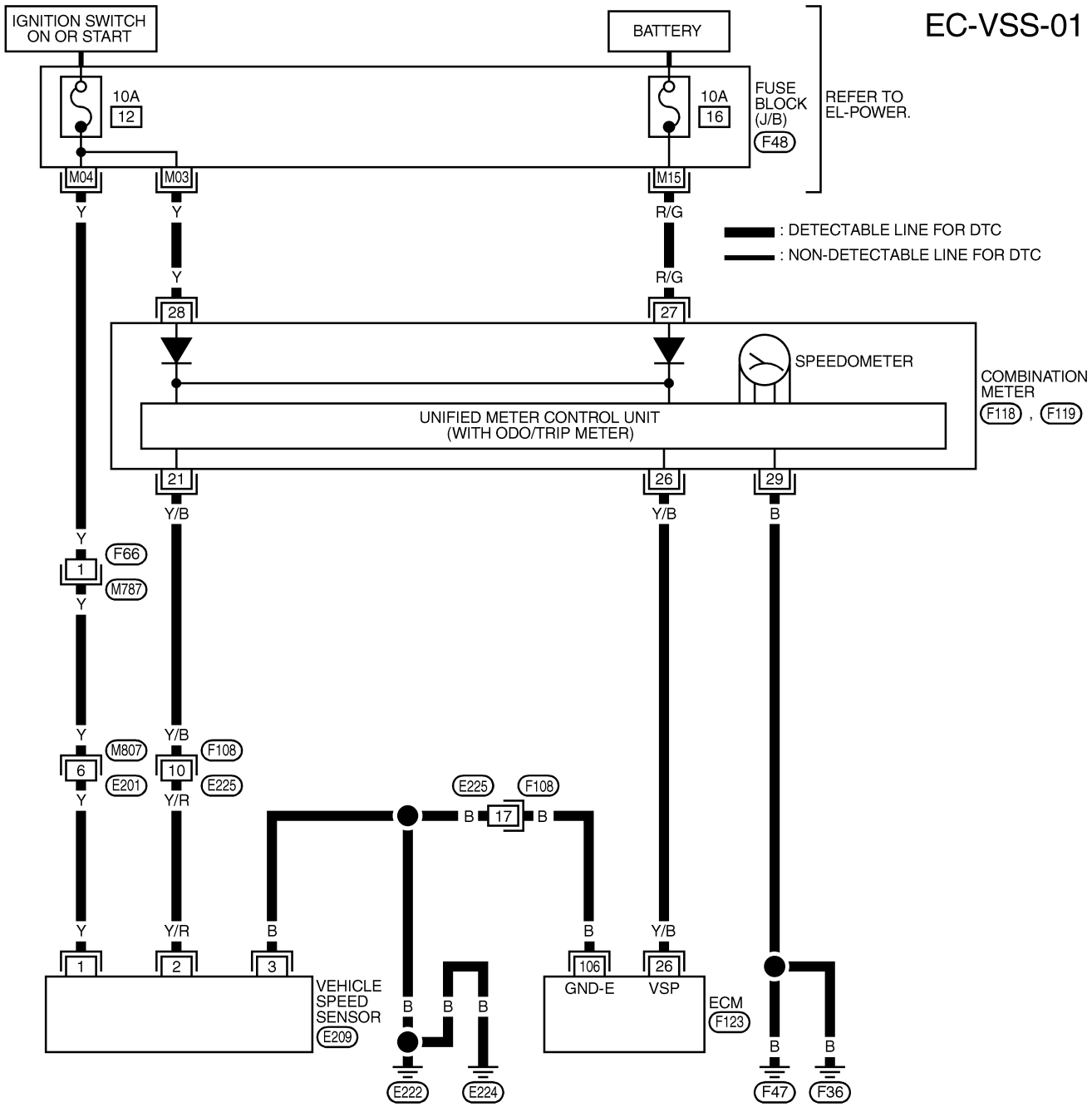
1) Lift up the vehicle.
2) Start engine.
3) Read vehicle speed sensor signal in “DATA MONITOR” mode with CONSULT-II.
   The vehicle speed on CONSULT-II should be able to exceed 10 km/h (6 MPH) when rotating wheels with suitable gear position.
4) If NG, go to “Diagnostic Procedure”, EC-103.

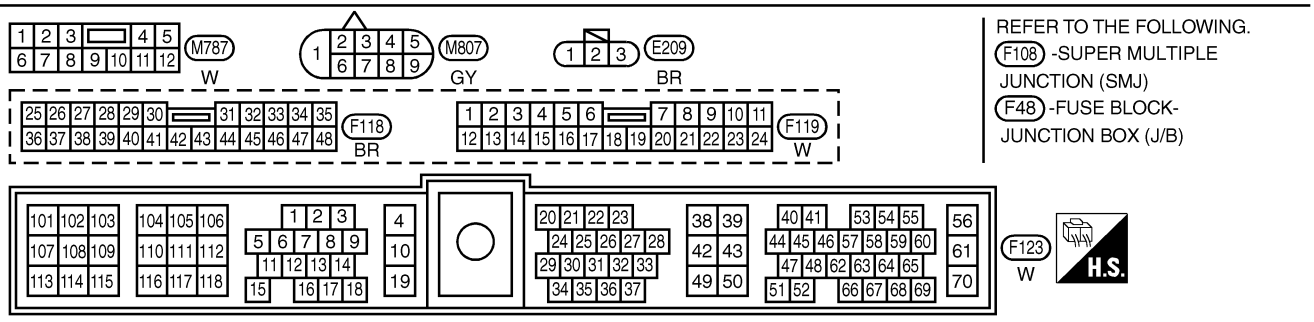
WITHOUT CONSULT-II

1) Lift up the vehicle.
2) Start engine.
3) Rotate drive wheel by hand.
4) Check voltage between ECM terminal 26 and ground with tester.
   Voltage should vary between 0 - BATTERY VOLTAGE.
5) If NG, go to “Diagnostic Procedure”, EC-103.

Wiring Diagram

LHD MODELS

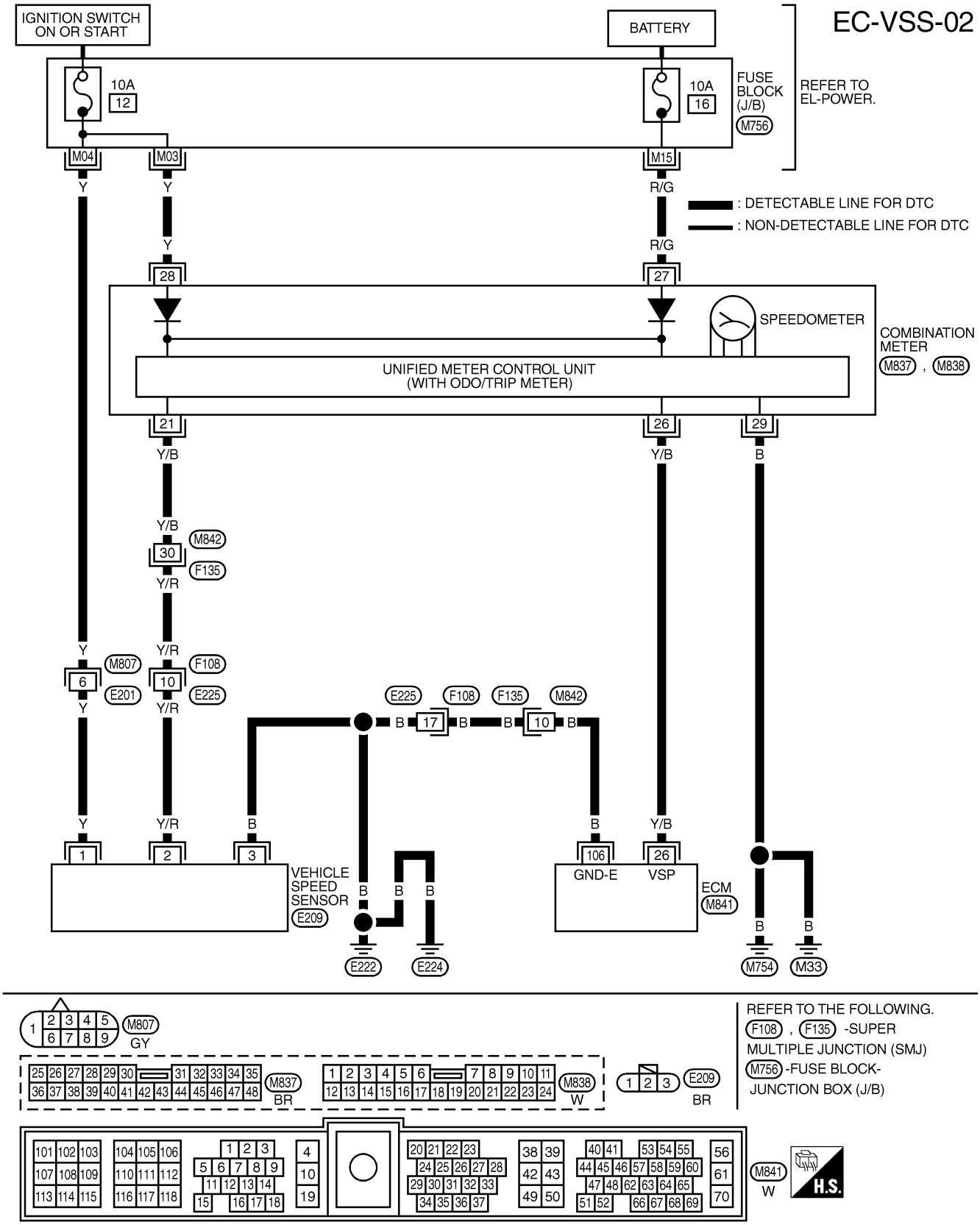




YEC176A

Wiring Diagram (Cont'd)

RHD MODELS



REFER TO THE FOLLOWING.
F108 , F135 -SUPER MULTIPLE JUNCTION (SMJ)
M756 -FUSE BLOCK-JUNCTION BOX (J/B)

YEC177A

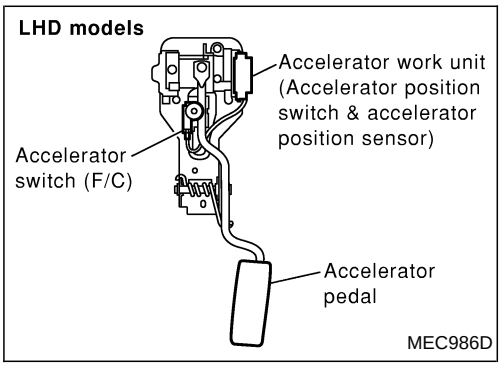
Diagnostic Procedure

1	CHECK VEHICLE SPEED SENSOR INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT
1. Turn ignition switch “OFF”. 2. Disconnect ECM harness connector and combination meter harness connector. 3. Check harness continuity between ECM terminal 26 and combination meter terminal 26. Refer to Wiring Diagram. **Continuity should exist.** 4. Also check harness for short to ground and short to power. **OK or NG**	
OK ▶	GO TO 2.
NG ▶	Repair open circuit or short to ground or short to power in harness or connectors.

2	CHECK SPEEDOMETER FUNCTION
Make sure that speedometer functions properly. **OK or NG**	
OK ▶	GO TO 4.
NG ▶	GO TO 3.

3	CHECK SPEEDOMETER CIRCUIT FOR OPEN AND SHORT
Check the following. ● Harness connectors F108, E225 ● Harness connectors M842, F135 (RHD models) ● Harness for open or short between combination meter and vehicle speed sensor **OK or NG**	
OK ▶	Check vehicle speed sensor and combination meter. Refer to EL section.
NG ▶	Repair open circuit or short to ground or short to power in harness or connectors.

4	CHECK INTERMITTENT INCIDENT
Refer to “TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT”, EC-78.	
▶	**INSPECTION END**



Description

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

CONSULT-II Reference Value in Data Monitor Mode

Specification data are reference values.

MONITOR ITEM	CONDITION		SPECIFICATION
ACCEL SW (FC)	● Ignition switch: ON (Engine stopped)	Accelerator pedal: fully released	CLOSE
		Accelerator pedal: slightly open	OPEN
DECELER F/CUT	● Engine: After warming up	Idle	OFF

ECM Terminals and Reference Value

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

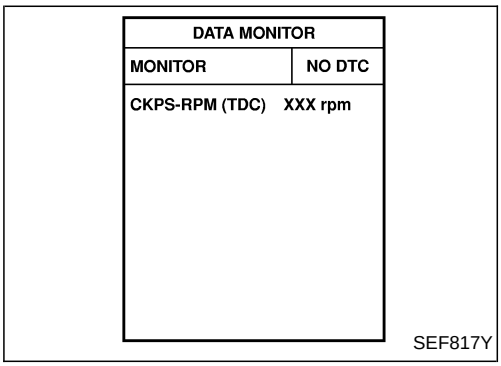
CAUTION:

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

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage)
29	LG/R	Accelerator switch (F/C)	Ignition switch "ON" └ Accelerator pedal fully released	BATTERY VOLTAGE (11 - 14V)
			Ignition switch "ON" └ Accelerator pedal depressed	Approximately 0V

On Board Diagnosis Logic

Malfunction is detected when	Check Items (Possible Cause)
● The OFF signal (short) is sent to the ECM for a certain period of time even when the accelerator pedal is not being depressed.	● Harness or connectors (The switch circuit is shorted.) ● Accelerator switch (F/C)



DTC Confirmation Procedure

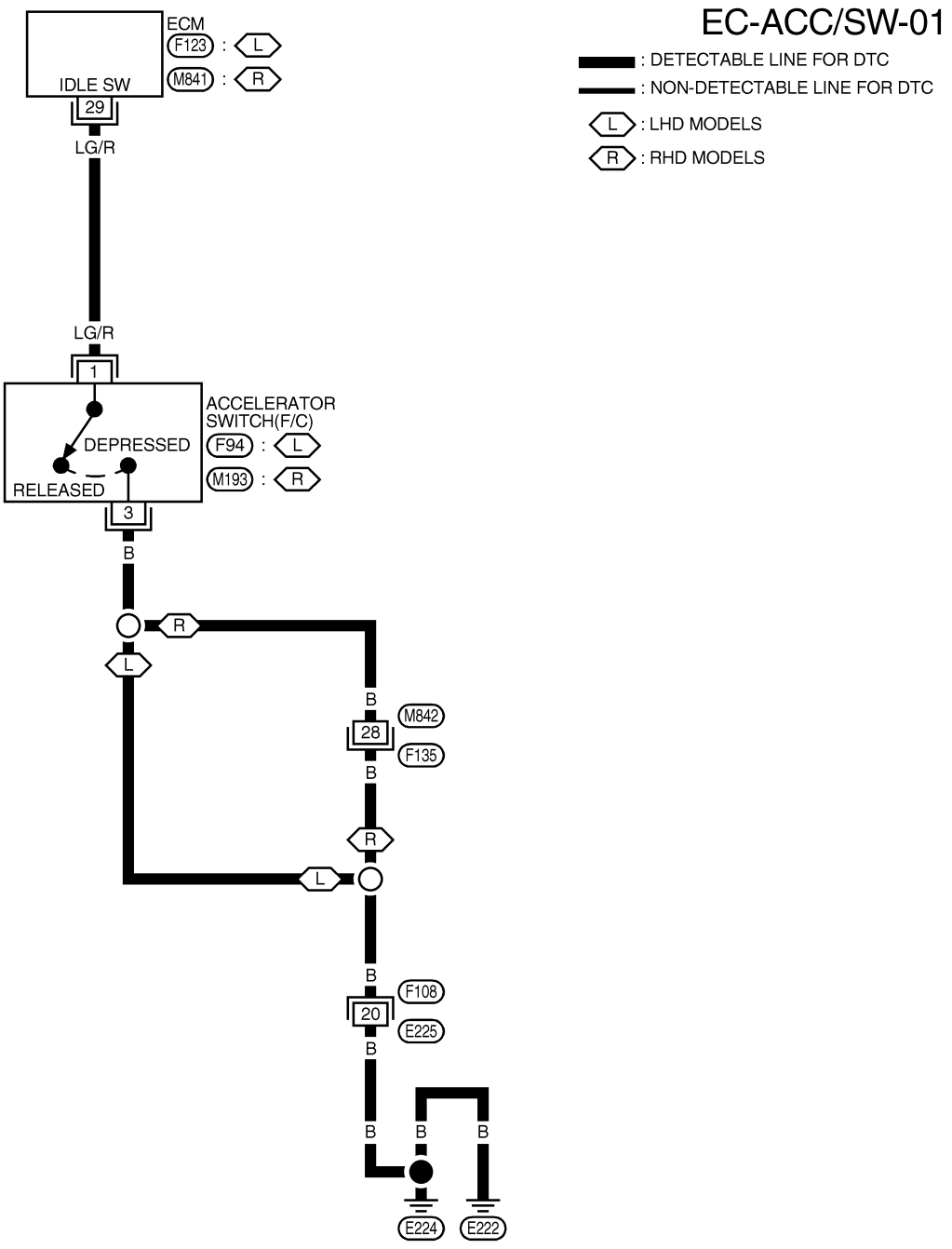
WITH CONSULT-II

1) Turn ignition switch “ON”.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Fully depress and fully release accelerator pedal, and wait 15 seconds.
4) Repeat step 3 at least 29 times.
5) If DTC is detected, go to “Diagnostic Procedure”, EC-107.

WITHOUT CONSULT-II

1) Turn ignition switch “ON”.
2) Fully depress and fully release accelerator pedal, and then wait 15 seconds.
3) Repeat step 2 at least 29 times.
4) Turn ignition switch “OFF”, wait at least 5 seconds and then turn “ON”.
5) Perform “Diagnostic Test Mode II (Self-diagnostic results)” with ECM.
6) If DTC is detected, go to “Diagnostic Procedure”, EC-107.

Wiring Diagram

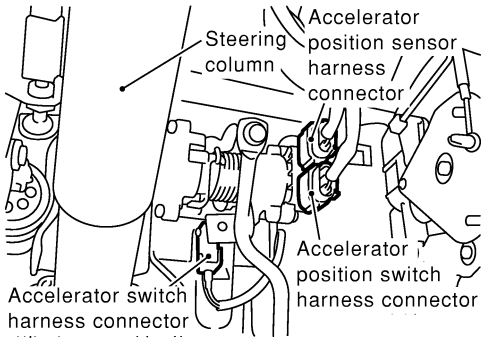


YEC178A

Diagnostic Procedure

1	CHECK ACCELERATOR SWITCH (F/C) GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch “OFF”.
2. Loosen and retighten engine ground screws.
3. Disconnect accelerator switch (F/C) harness connector.



MEC995D

4. Check harness continuity between accelerator switch (F/C) terminal 3 and engine ground. Refer to Wiring Diagram.
   Continuity should exist.
5. Also check harness for short to ground and short to power.

OK or NG

OK	▶	GO TO 3.
NG	▶	GO TO 2.

2	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors F108, E225
- Harness connectors M842, F135 (RHD models)
- Harness for open or short between accelerator switch (F/C) and engine ground

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

3	CHECK ACCELERATOR SWITCH (F/C) INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Disconnect ECM harness connector.
2. Check harness continuity between ECM terminal 29 and accelerator switch (F/C) terminal 1. Refer to Wiring Diagram.
   Continuity should exist.
3. Also check harness for short to ground and short to power.

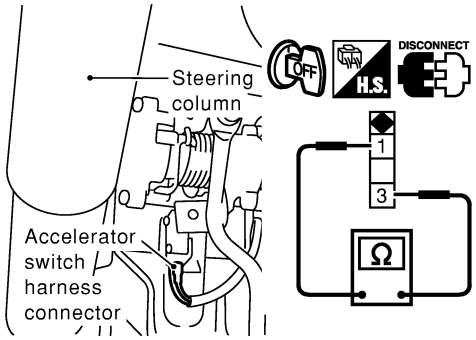
OK or NG

OK	▶	GO TO 4.
NG	▶	Repair open circuit or short to ground or short to power in harness or connectors.

Diagnostic Procedure (Cont'd)

4	CHECK ACCELERATOR SWITCH (F/C)

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



MEC997D

Conditions	Continuity
Accelerator pedal fully released	Should not exist.
Accelerator pedal depressed	Should exist.

MTBL1323

OK or NG

OK	▶	GO TO 5.
NG	▶	Replace accelerator pedal assembly.

5	CHECK INTERMITTENT INCIDENT
Refer to "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78.	
▶	**INSPECTION END**

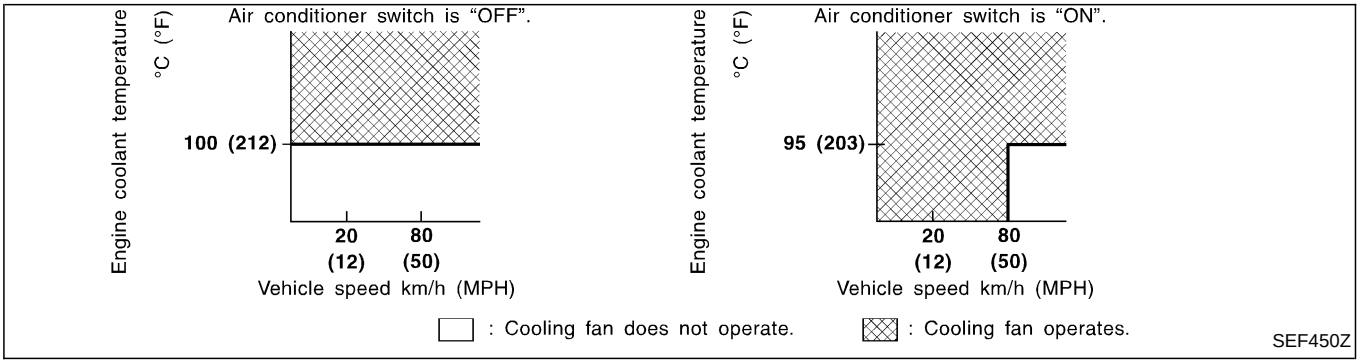
Description

SYSTEM DESCRIPTION

Sensor	Input signal to ECM	ECM function	Actuator
Vehicle speed sensor	Vehicle speed	Cooling fan control	Cooling fan relay
Engine coolant temperature sensor	Engine coolant temperature		
Air conditioner switch	Air conditioner “ON” signal		

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

OPERATION



CONSULT-II Reference Value in Data Monitor Mode

Specification data are reference values.

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

ECM Terminals and Reference Value

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

CAUTION:

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

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage)
14	LG/R	Cooling fan relay	Engine is running. └ Cooling fan is not operating	BATTERY VOLTAGE (11 - 14V)
			Engine is running. └ Cooling fan is operating	Approximately 0.1V

On Board Diagnosis Logic

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

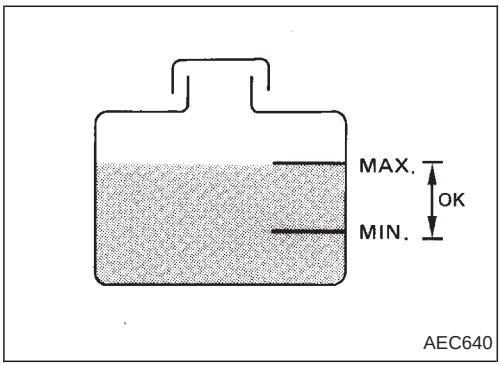
Malfunction is detected when ...	Check Items (Possible Cause)
● Cooling fan does not operate properly (Overheat). ● Cooling fan system does not operate properly (Overheat). ● Engine coolant was not added to the system using the proper filling method.	● Harness or connectors (The cooling fan circuit is open or shorted.) ● Cooling fan ● Radiator hose ● Radiator ● Radiator cap ● Water pump ● Thermostat ● Fan belt ● Engine coolant temperature sensor For more information, refer to "MAIN 12 CAUSES OF OVERHEATING", EC-120.

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.

1) 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 LUBRICANTS AND FLUIDS").

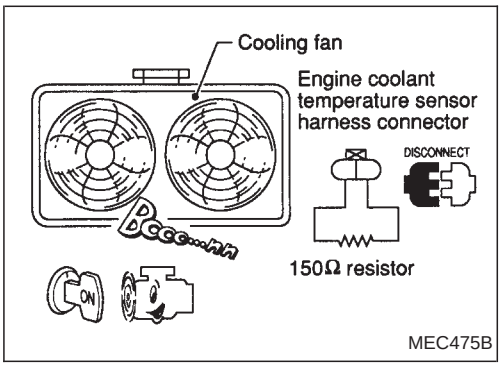
2) After refilling coolant, run engine to ensure that no water-flow noise is emitted.



AEC640

ACTIVE TEST	
COOLING FAN	OFF
MONITOR	
COOLAN TEMP/S	XXX °C

SEF111X



MEC475B

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.

WITH CONSULT-II

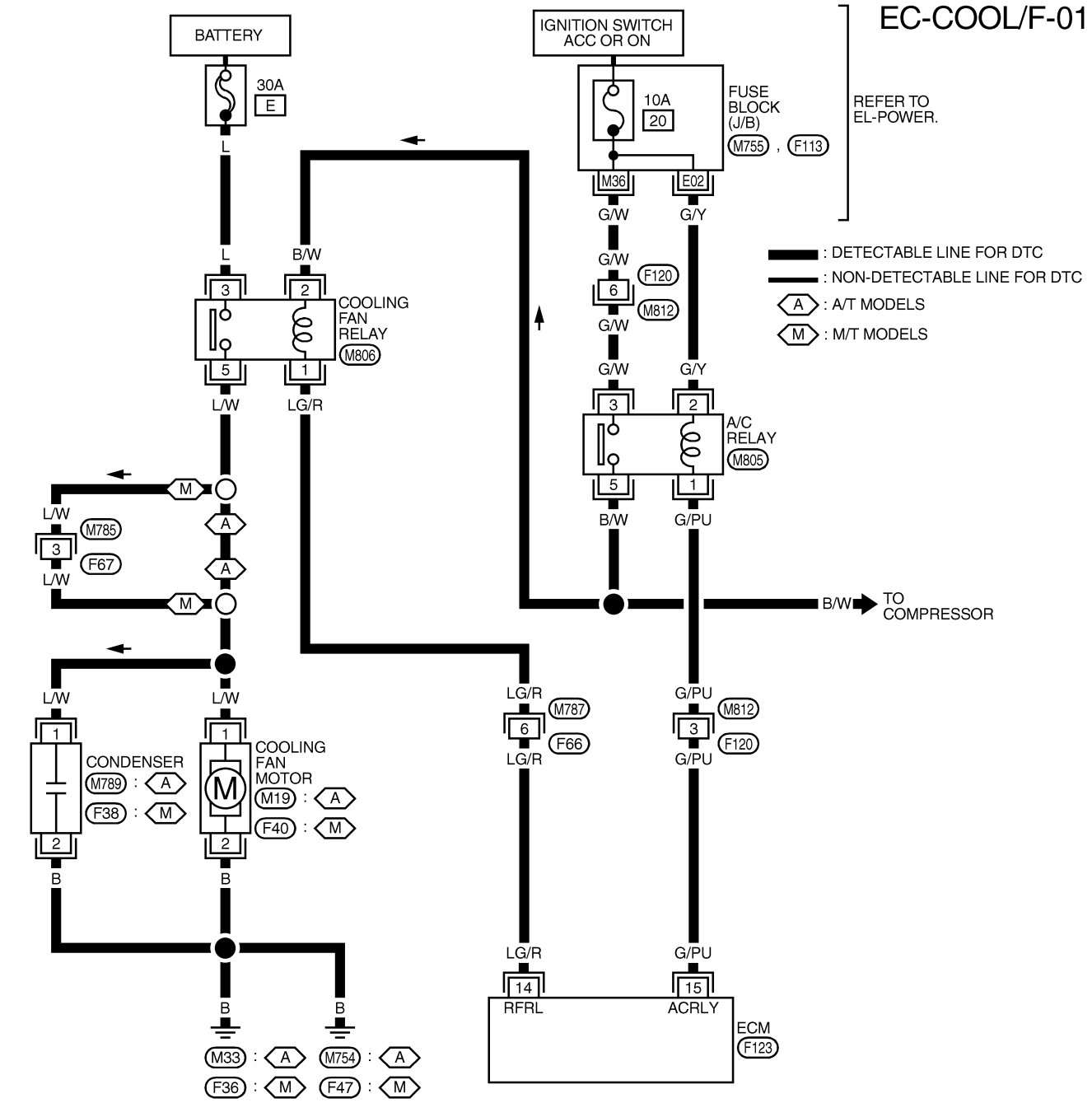
1) Check the coolant level in the reservoir tank and radiator.
   Allow engine to cool before checking coolant level.
   If the coolant level in the reservoir tank and/or radiator is below the proper range, skip the following steps and go to “Diagnostic Procedure”, EC-114.
2) Confirm whether customer filled the coolant or not. If customer filled the coolant, skip the following steps and go to “Diagnostic Procedure”, EC-114.
3) Turn ignition switch “ON”.
4) Perform “COOLING FAN” in “ACTIVE TEST” mode with CONSULT-II and make sure that cooling fans operate when touching “HIGH” or “LOW”.
   If NG, go to “Diagnostic Procedure”, EC-114.

WITHOUT CONSULT-II

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-114.
2) Confirm whether customer filled the coolant or not. If customer filled the coolant, skip the following steps and go to “Diagnostic Procedure”, EC-114.
3) Disconnect engine coolant temperature sensor harness connector.
4) Connect 150Ω resistor to engine coolant temperature sensor harness connector.
5) Start engine and make sure that cooling fan operates.
   Be careful not to overheat engine.
6) If NG, go to “Diagnostic Procedure”, EC-114.

Wiring Diagram

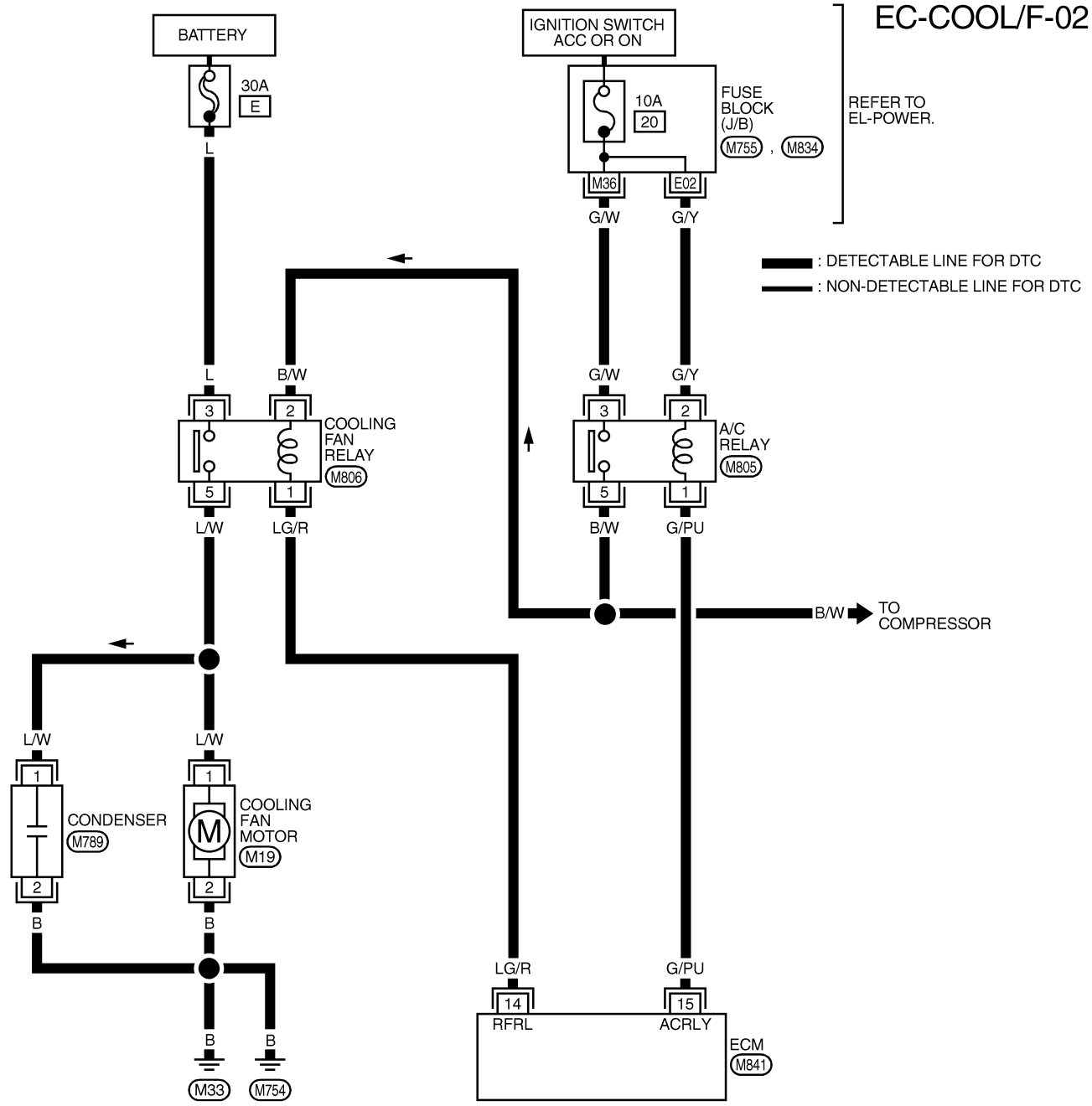
LHD MODELS

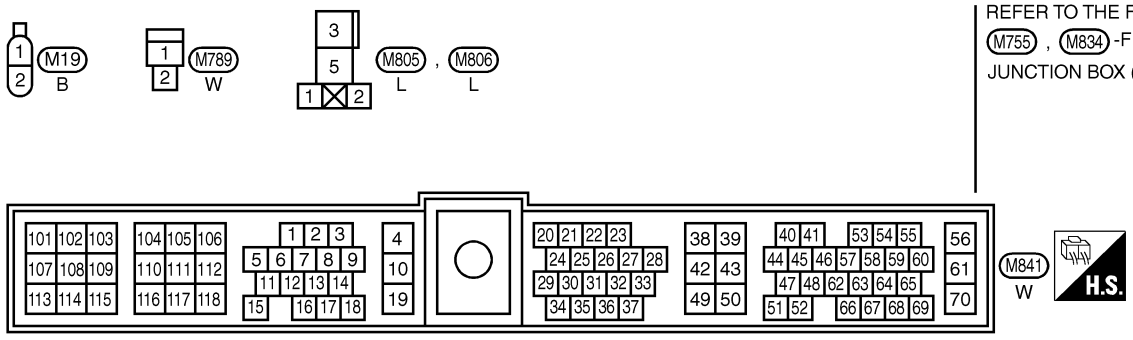


YEC179A

Wiring Diagram (Cont'd)

RHD MODELS





YEC180A

Diagnostic Procedure

1	INSPECTION START
Do you have CONSULT-II? **Yes or No**	
Yes ▶	GO TO 2.
No ▶	GO TO 3.

2	CHECK COOLING FAN OPERATION

With CONSULT-II

1. Turn ignition switch “ON”.
2. Perform “COOLING FAN” in “ACTIVE TEST” mode with CONSULT-II.

ACTIVE TEST	
COOLING FAN	OFF
MONITOR	
COOLAN TEMP/S	XXX °C

SEF646X

3. Make sure that cooling fan operates.

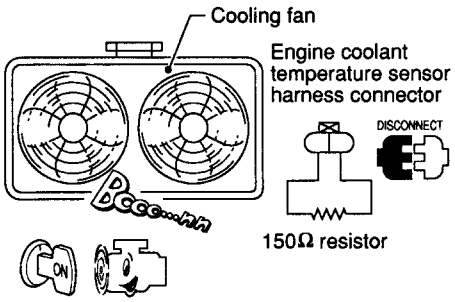
OK or NG

OK ▶	GO TO 12.
NG ▶	GO TO 4.

3	CHECK COOLING FAN OPERATION

Without CONSULT-II

1. Turn ignition switch “OFF”.
2. Disconnect engine coolant temperature sensor harness connector.
3. Connect 150Ω resistor to engine coolant temperature sensor harness connector.
4. Restart engine and make sure that cooling fan operates.



MEC475B

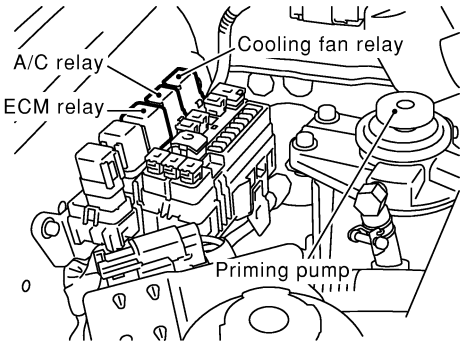
OK or NG

OK ▶	GO TO 12.
NG ▶	GO TO 4.

Diagnostic Procedure (Cont'd)

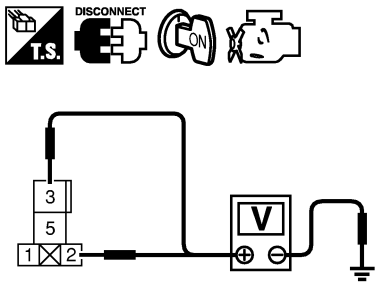
4	CHECK COOLING FAN POWER SUPPLY CIRCUIT

1. Turn ignition switch "OFF".
2. Disconnect cooling fan relay.



MEC021E

3. Turn ignition switch "ON".
4. Turn air conditioner switch "ON".
5. Turn blower fan switch "ON".
6. Make sure that cooling fan operates.
7. Check voltage between cooling fan relay terminals 2, 3 and ground with CONSULT-II or tester.



MEC974D

Voltage: Battery voltage

OK or NG

OK	▶	GO TO 6.
NG	▶	GO TO 5.

5	DETECT MALFUNCTIONING PART

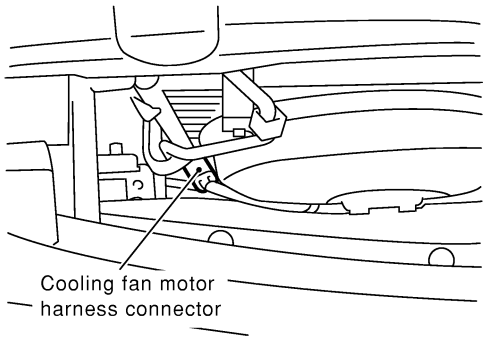
Check the following.
- 10A fuse
- Harness connector F120, M812 (LHD models)
- A/C relay
- 30A fusible links
- Harness for open or short between cooling fan relay and fuse
- Harness for open or short between cooling fan relay and battery

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

Diagnostic Procedure (Cont'd)

6	CHECK COOLING FAN GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch "OFF".
2. Disconnect cooling fan motor harness connector.



MEC024E

3. Check harness continuity as follows. Refer to Wiring Diagram.

Terminals	Continuity
Cooling fan relay terminal 5 and cooling fan motor terminal 1	Continuity should exist.
Cooling fan relay terminal 5 and condenser terminal 1	
Cooling fan motor terminal 2 and ground	
Condenser terminal 2 and ground	

MTBL1322

4. Also check harness for short to ground and short to power.

OK or NG

OK ▶	GO TO 8.
NG ▶	GO TO 7.

7	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors M785, F67 (M/T models)
- Harness for open or short between cooling fan relay and cooling fan motor
- Harness for open or short between cooling fan relay and condenser

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

8	CHECK COOLING FAN OUTPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Disconnect ECM harness connector.
2. Check harness continuity between ECM terminal 14 and cooling fan relay terminal 1. Refer to Wiring Diagram.
   Continuity should exist.
3. Also check harness for short to ground and short to power.

OK or NG

OK ▶	GO TO 10.
NG ▶	GO TO 9.

9	DETECT MALFUNCTIONING PART

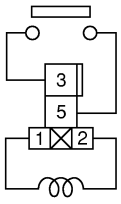
Check the following.
- Harness connectors M787, F66
- Harness for open or short between cooling fan relay and ECM

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

Diagnostic Procedure (Cont'd)

10	CHECK COOLING FAN RELAY

Check continuity between cooling fan relay terminals 3 and 5 under the following conditions.



MEC975D

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

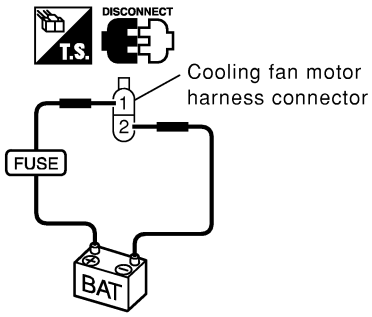
MTBL1319

OK or NG

OK	▶	GO TO 11.
NG	▶	Replace cooling fan relay.

11	CHECK COOLING FAN MOTOR

Supply battery voltage between cooling fan motor terminals 1 and 2.



MEC976D

Does the cooling fan motor operate normally?

OK or NG

OK	▶	GO TO 12.
NG	▶	Replace cooling fan motor.

12	CHECK INTERMITTENT INCIDENT

Perform "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78.

▶ **INSPECTION END**

Diagnostic Procedure (Cont'd)

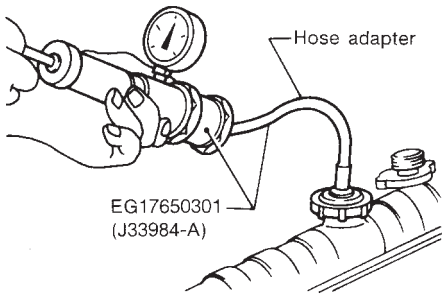
13	CHECK COOLING SYSTEM FOR LEAK

Apply pressure to the cooling system with a tester, and check if the pressure drops.

Testing pressure: 157 kPa (1.57 bar, 1.6 kg/cm^2, 23 psi)

CAUTION:

Higher than the specified pressure may cause radiator damage.



SLC754A

Pressure should not drop.

OK or NG

OK	▶	GO TO 15.
NG	▶	GO TO 14.

14	DETECT MALFUNCTIONING PART

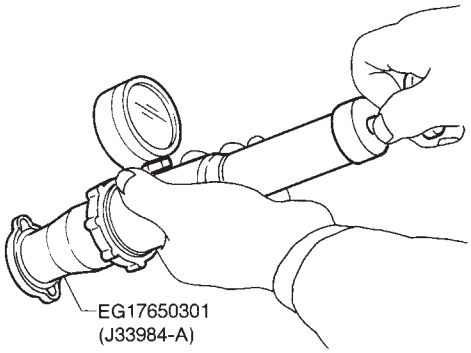
Check the following for leak.

- Hose
- Radiator
- Water pump (Refer to LC section, "Water Pump".)

	▶	Repair or replace.

15	CHECK RADIATOR CAP

Apply pressure to cap with a tester and check radiator cap relief pressure.



SLC755A

Radiator cap relief pressure:

79 - 98 kPa (0.78 - 0.98 bar, 0.8 - 1.0 kg/cm^2, 11 - 14 psi)

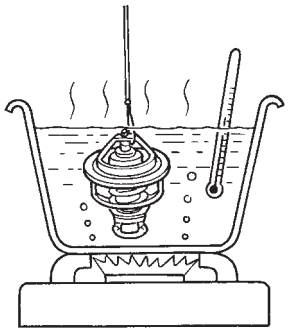
OK or NG

OK	▶	GO TO 16.
NG	▶	Replace radiator cap.

Diagnostic Procedure (Cont'd)

16	CHECK THERMOSTAT

1. Remove thermostat.
2. Check valve seating condition at normal room temperatures.
   It should seat tightly.
3. Check valve opening temperature and valve lift.



SLC343

Valve opening temperature:
82°C (180°F) [standard] (Models for cold areas)
76.5°C (170°F) [standard] (Models for except cold areas)
Valve lift:
More than 10 mm/95°C (0.394 in/203°F)

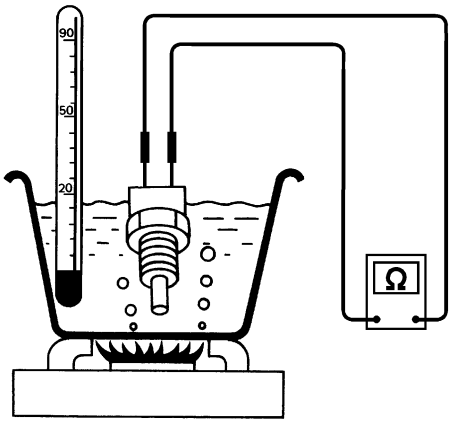
4. Check if valve is closed at 5°C (9°F) below valve opening temperature. For details, refer to LC section, "Thermostat".

OK or NG

OK	▶	GO TO 17.
NG	▶	Replace thermostat.

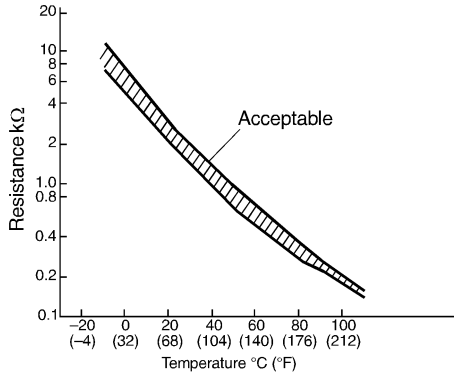
17	CHECK ENGINE COOLANT TEMPERATURE SENSOR

1. Remove engine coolant temperature sensor.
2. Check resistance between engine coolant temperature sensor terminals 1 and 2 as shown in the figure.



<Reference data>

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



SEF304X

OK or NG

OK	▶	GO TO 18.
NG	▶	Replace engine coolant temperature sensor.

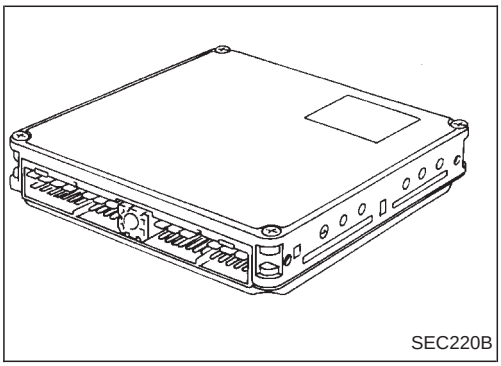
Diagnostic Procedure (Cont'd)

18	**CHECK MAIN 12 CAUSES**
If the cause cannot be isolated, go to "MAIN 12 CAUSES OF OVERHEATING", EC-120.	
▶	**INSPECTION END**

Main 12 Causes of Overheating

Engine	Step	Inspection item	Equipment	Standard	Reference page
OFF	1	● Blocked radiator ● Blocked condenser ● Blocked radiator grille ● Blocked bumper	● Visual	No blocking	—
	2	● Coolant mixture	● Coolant tester	30 - 50% coolant mixture	See "RECOMMENDED FLUIDS AND LUBRICANTS" in MA section.
	3	● Coolant level	● Visual	Coolant up to MAX level in reservoir tank and radiator filler neck	See "Changing Engine Coolant", "ENGINE MAINTENANCE" in MA section.
	4	● Radiator cap	● Pressure tester	78 - 98 kPa (0.78 - 0.98 bar, 0.8 - 1.0 kg/cm^2, 11 - 14 psi) 59 - 98 kPa (0.59 - 0.98 bar, 0.6 - 1.0 kg/cm^2, 9 - 14 psi) (Limit)	See "System Check", "ENGINE COOLING SYSTEM" in LC section.
ON*2	5	● Coolant leaks	● Visual	No leaks	See "System Check", "ENGINE COOLING SYSTEM" in LC section.
ON*2	6	● Thermostat	● Touch the upper and lower radiator hoses	Both hoses should be hot.	See "Thermostat" and "Radiator", "ENGINE COOLING SYSTEM" in LC section.
ON*1	7	● Cooling fan	● Visual	Operating	See "DTC 0208 OVER HEAT", EC-109.
OFF	8	● Combustion gas leak	● Color checker chemical tester 4 gas analyzer	Negative	—
ON*3	9	● Coolant temperature gauge	● Visual	Gauge less than 3/4 when driving	—
		● Coolant overflow to reservoir tank	● Visual	No overflow during driving and idling	See "Changing Engine Coolant", "ENGINE MAINTENANCE" in MA section.
OFF*4	10	● Coolant return from reservoir tank to radiator	● Visual	Should be initial level in reservoir tank	See "ENGINE MAINTENANCE" in MA section.
OFF	11	● Cylinder head	● Straight gauge feeler gauge	0.1 mm (0.004 in) Maximum distortion (warping)	See "Inspection", "CYLINDER HEAD" in EM section.
	12	● Cylinder block and pistons	● Visual	No scuffing on cylinder walls or piston	See "Inspection", "CYLINDER BLOCK" in EM section.

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

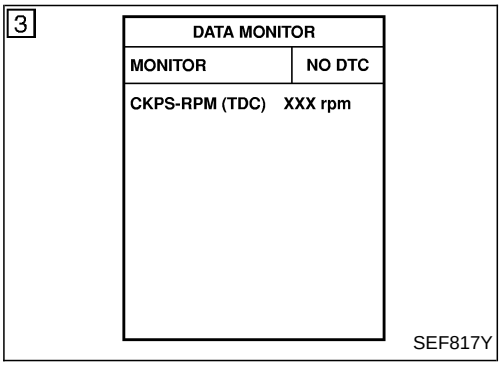

SEC220B

Description

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

On Board Diagnosis Logic

Malfunction is detected when ...	Check Items (Possible Cause)
• ECM calculation function is malfunctioning.	• ECM



SEF817Y

DTC Confirmation Procedure

WITH CONSULT-II

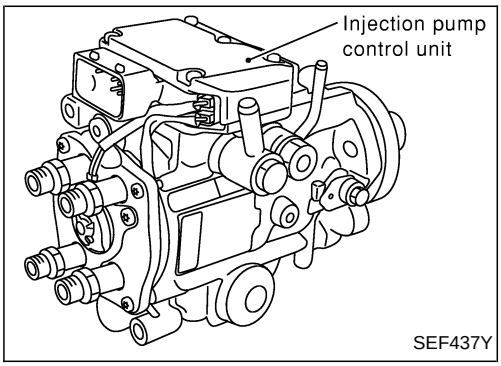
1) Turn ignition switch “ON”.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Start engine and wait at least 2 seconds.
4) If DTC is detected, go to “Diagnostic Procedure”, EC-122.

WITHOUT CONSULT-II

1) Turn ignition switch “ON” and wait at least 2 seconds.
2) Start engine and wait at least 2 seconds.
3) Turn ignition switch “OFF”, wait at least 5 seconds and then turn “ON”.
4) Perform “Diagnostic Test Mode II (Self-diagnostic results)” with ECM.
5) If DTC is detected, go to “Diagnostic Procedure”, EC-122.

Diagnostic Procedure

1	INSPECTION START
With CONSULT-II 1. Turn ignition switch “ON”. 2. Select “SELF DIAG RESULTS” mode with CONSULT-II. 3. Touch “ERASE”. 4. Perform “DTC Confirmation Procedure”, EC-121, again. 5. Is the malfunction displayed again?	
Without CONSULT-II 1. Turn ignition switch “ON”. 2. Erase the Diagnostic Test Mode II (Self-diagnostic results) memory. 3. Perform “DTC Confirmation Procedure”, EC-121, again. 4. Perform “Diagnostic Test Mode II (Self-diagnostic results)”. 5. Is the DTC 0301 or 0901 displayed again?	
Yes or No	
Yes ▶	Replace ECM.
No ▶	**INSPECTION END**



Description

SYSTEM DESCRIPTION

The ECM and the electronic control fuel injection pump control unit (abbreviated as the injection pump control unit) perform the real time communication (signal exchange).
The ECM transmits the signals of the target fuel injection amount, target fuel injection timing, and engine speed, etc., and receives the signals of the pump speed and fuel temperature, etc. from the injection pump control unit.
By those signals, the injection pump controls the optimum fuel injection amount and injection timing of the spill valve and timing control valve.
Injection pump control unit has an on board diagnostic system, which detects malfunctions related to sensors or actuators built-into electronic control fuel injection pump. These malfunction information are transferred through the line (circuit) from injection pump control unit to ECM.

FUEL INJECTION AMOUNT CONTROL

In accordance with the target fuel injection amount signal from the ECM, the injection amount is controlled by controlling the spill valve in the injection pump and by changing the needle opening time.

FUEL INJECTION TIMING CONTROL

Based on the target fuel injection timing signal from the ECM, the injection timing is controlled in accordance with the timer spring by performing the duty control of the timing control valve in the injection pump and by adjusting the pressure of the timer piston high pressure chamber.

FUEL TEMPERATURE SENSOR

The sensor detects the fuel temperature in the injection pump and calibrates the injection amount change by the fuel temperature.

CAM RING POSITION SENSOR

The sensor detects the passing of the protrusion on the sensor wheel in the injection pump by the semiconductor magnetic resistance element sensor. The cam ring position sensor synchronizes with the cam ring, and detects the actual advance amount. The injection pump control unit measures the injection pump revolution by the signal of the cam ring position sensor.

CONSULT-II Reference Value in Data Monitor Mode

Remarks: Specification data are reference values.

MONITOR ITEM	CONDITION		SPECIFICATION
FUEL TEMP SEN	● Engine: After warming up		More than 40°C (104°F)
SPILL/V	● Engine: After warming up		Approx. 13°CA
INJ TIMG C/V	● Engine: After warming up, idle the engine.		Approx. 50 - 70%
DECELER F/CUT	● Engine: After warming up	Idle	OFF
BARO SEN	● Ignition switch: ON		Altitude Approx. 0 m (0 ft): Approx. 100.62 kPa (1.0062 bar, 1.026 kg/cm^2, 14.59 psi) Approx. 1,000 m (3,281 ft): Approx. 88.95 kPa (0.8895 bar, 0.907 kg/cm^2, 12.90 psi) Approx. 1,500 m (4,992 ft): Approx. 83.16 kPa (0.8316 bar, 0.848 kg/cm^2, 12.06 psi) Approx. 2,000 m (6,562 ft): Approx. 78.36 kPa (0.7836 bar, 0.799 kg/cm^2, 11.36 psi)

ECM Terminals and Reference Value

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

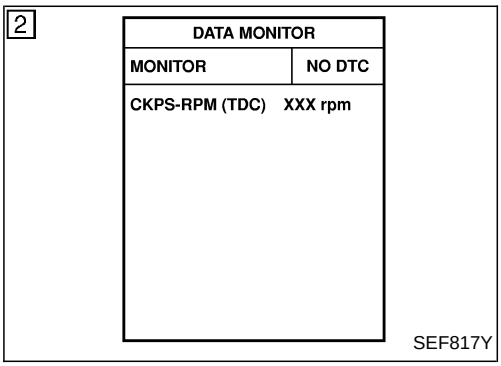
CAUTION:

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

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage)
33	G	Electronic control fuel injection pump	Engine is running. └ **Warm-up condition** Idle speed	Approximately 2.5V
40	R	Electronic control fuel injection pump	Engine is running. └ **Warm-up condition** Idle speed	Approximately 2.5V
52	Y	Electronic control fuel injection pump	Engine is running. └ Idle speed	Approximately 0.1V
53	OR	Electronic control fuel injection pump	Engine is running. └ Idle speed	Approximately 0.35V

On Board Diagnosis Logic

Malfunction is detected when	Check Items (Possible cause)
● An improper voltage signal from fuel temperature sensor (Built-into electronic control fuel injection pump) is sent to injection pump control unit.	● Harness or connectors (Electronic control fuel injection pump circuit is open or shorted.) ● Electronic control fuel injection pump



DTC Confirmation Procedure

WITH CONSULT-II

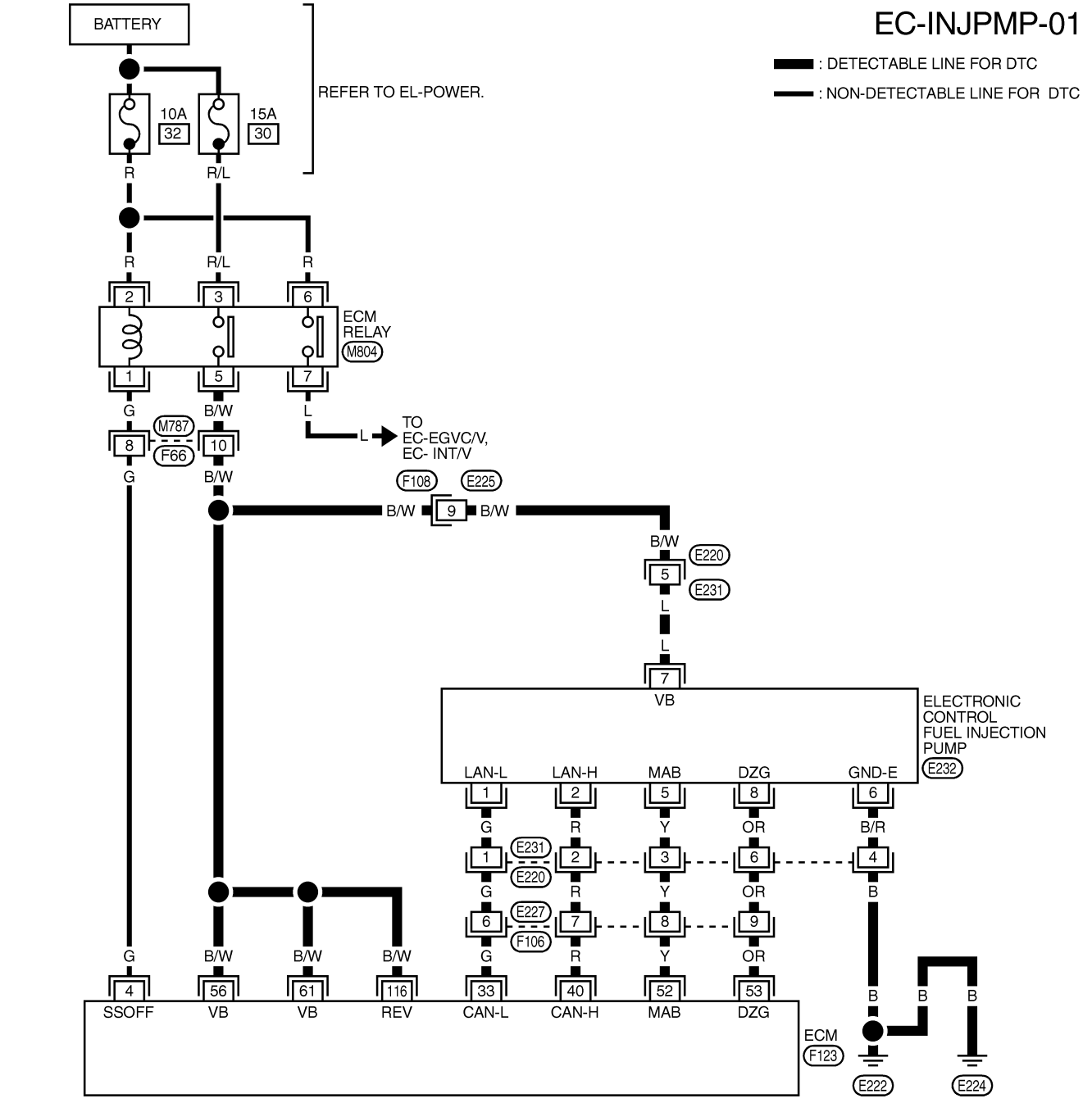
1) Turn ignition switch “ON” and wait at least 2 seconds.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Start engine and run it for at least 2 seconds at idle speed. (If engine does not run, turn ignition switch to “START” for at least 2 seconds.)
4) If DTC is detected, go to “Diagnostic Procedure”, EC-128.

WITHOUT CONSULT-II

1) Turn ignition switch “ON” and wait at least 2 seconds.
2) Start engine and run it for at least 2 seconds at idle speed. (If engine does not run, turn ignition switch to “START” for at least 2 seconds.)
3) Turn ignition switch “OFF”, wait at least 5 seconds and then turn “ON”.
4) Perform “Diagnostic Test Mode II (Self-diagnostic results)” with ECM.
5) If DTC is detected, go to “Diagnostic Procedure”, EC-128.

Wiring Diagram

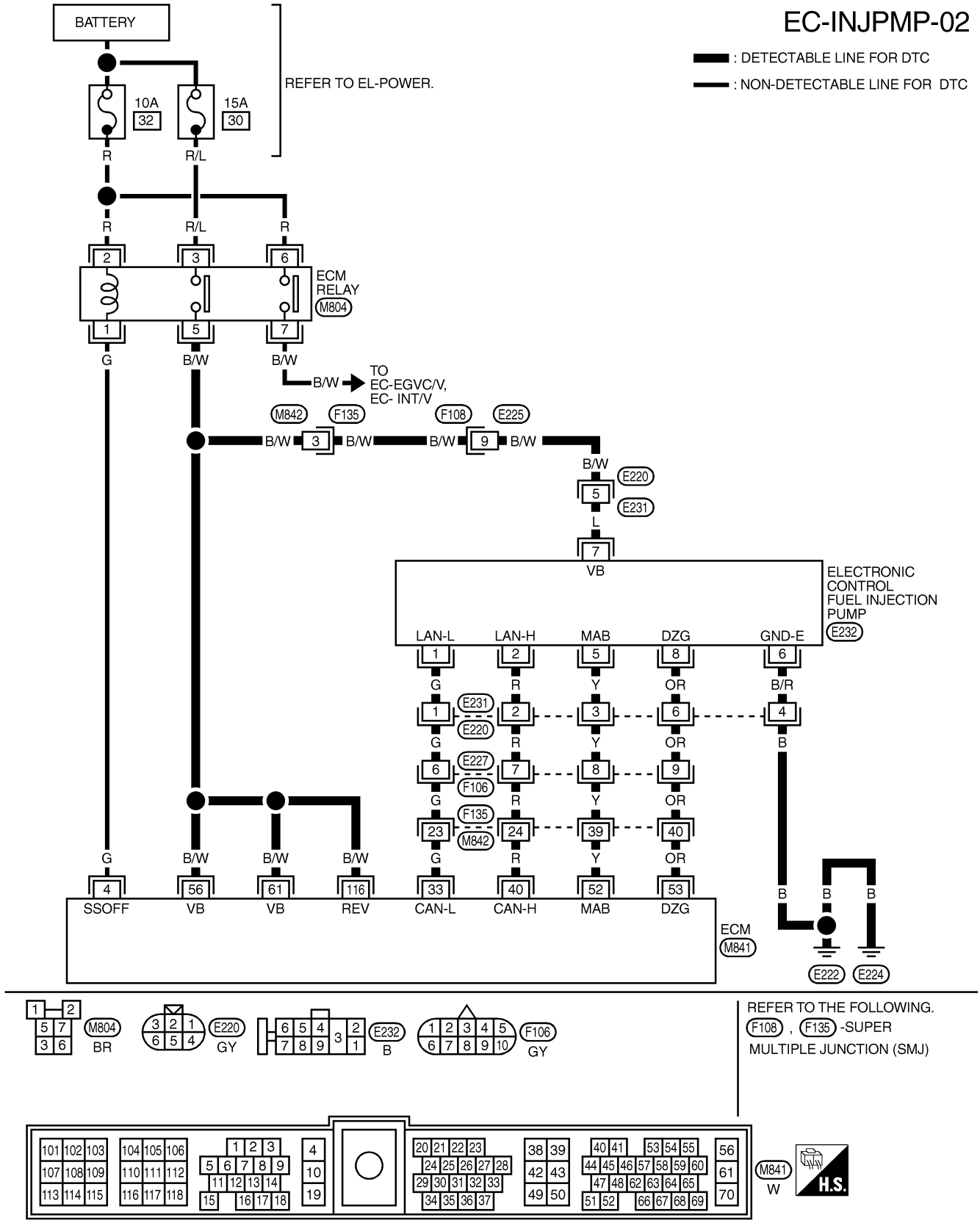
LHD MODELS



YEC181A

Wiring Diagram (Cont'd)

RHD MODELS

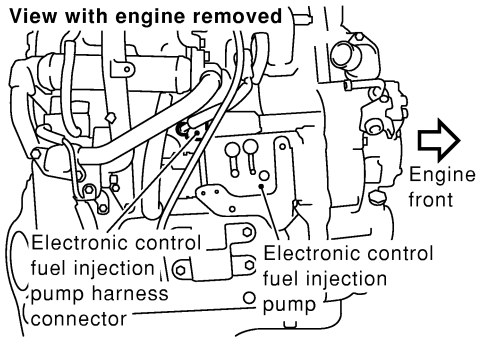


YEC182A

Diagnostic Procedure

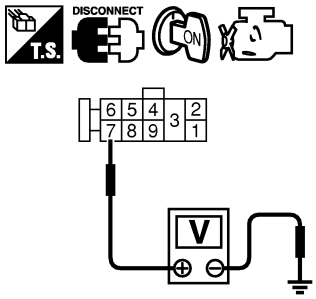
1	CHECK ELECTRONIC CONTROL FUEL INJECTION PUMP POWER SUPPLY CIRCUIT

1. Turn ignition switch “OFF”.
2. Disconnect electronic control fuel injection pump harness connector.



MEC025E

3. Turn ignition switch “ON”.
4. Check voltage between electronic control fuel injection pump terminal 7 and ground.



MEC977D

Voltage: Battery voltage

OK or NG

OK	▶	GO TO 3.
NG	▶	GO TO 2.

2	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors M787, F66 (LHD models)
- Harness connectors F108, E225
- Harness connectors E220, E231
- Harness connectors M842, F135 (RHD models)
- Harness for open or short between electronic control fuel injection pump and ECM
- Harness for open or short between electronic control fuel injection pump and ECM relay

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

3	CHECK ELECTRONIC CONTROL FUEL INJECTION PUMP GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch “OFF”.
2. Check harness continuity between electronic control fuel injection pump terminal 6 and ground. Refer to Wiring Diagram.
   Continuity should exist.
3. Also check harness for short to ground and short to power.

OK or NG

OK	▶	GO TO 5.
NG	▶	GO TO 4.

Diagnostic Procedure (Cont'd)

4	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors E231, E220 ● Harness for open or short between electronic control fuel injection pump and engine ground	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

5	CHECK COMMUNICATION LINE FOR OPEN AND SHORT

1. Check continuity between the following terminals. Refer to Wiring Diagram.

Electronic control fuel injection pump	ECM
1	33
2	40
5	52
8	53

MTBL0444

Continuity should exist.

2. Also check harness for short to ground and short to power.

OK or NG

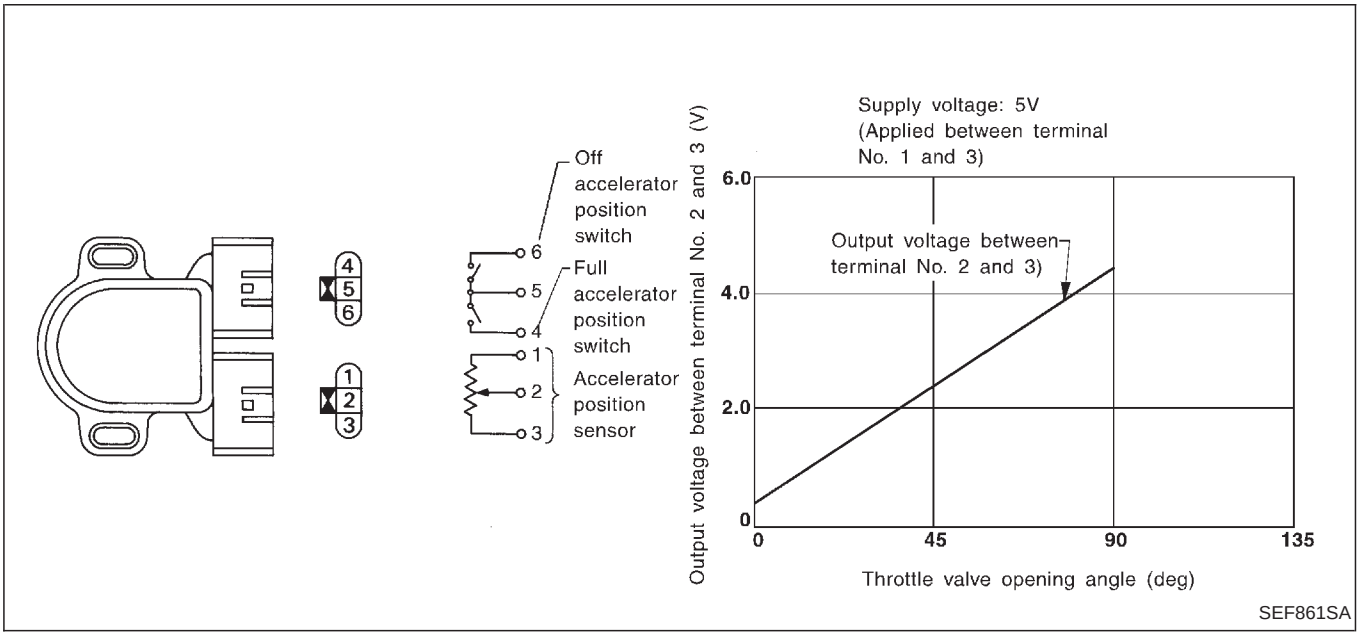
OK	▶	GO TO 7.
NG	▶	GO TO 6.

6	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors E231, E220 ● Harness connectors E227, F106 ● Harness connectors F135, M842 (RHD models) ● Harness for open or short between electronic control fuel injection pump and ECM	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

7	CHECK INTERMITTENT INCIDENT	
Refer to "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78.		
OK or NG		
OK	▶	Replace electronic control fuel injection pump.
NG	▶	Repair open circuit or short to ground or short to power in harness or connectors.

Description

The accelerator position sensor is installed on the upper end of the accelerator pedal assembly. The sensor detects the accelerator position and sends a signal to the ECM. The ECM uses the signal to determine the amount of fuel to be injected.
The accelerator position switch detects Off-accelerator switch signal and Full-accelerator switch signal and send these signals to the ECM. The ECM will then determine engine idle conditions. These signals are also used for diagnosing the accelerator position sensor.



CONSULT-II Reference Value in Data Monitor Mode

Specification data are reference values.

MONITOR ITEM	CONDITION		SPECIFICATION
ACCEL POS SEN	● Ignition switch: ON (Engine stopped)	Accelerator pedal: released	0.40 - 0.60V
		Accelerator pedal: depressed	Approx. 4.5V
FULL ACCEL SW	● Ignition switch: ON (Engine stopped)	Accelerator pedal: fully depressed	ON
		Except above	OFF
OFF ACCEL SW	● Ignition switch: ON (Engine stopped)	Accelerator pedal: fully released	ON
		Accelerator pedal: slightly open	OFF

ECM Terminals and Reference Value

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

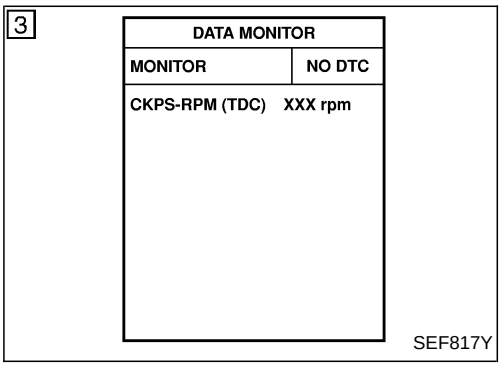
CAUTION:

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

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage)
23	G	Accelerator position sensor	Ignition switch "ON" └ Accelerator pedal fully released	0.4 - 0.6V
			Ignition switch "ON" └ Accelerator pedal fully depressed	Approximately 4.5V
31	L/Y	Accelerator position switch (Idle)	Ignition switch "ON" └ Accelerator pedal fully released	BATTERY VOLTAGE (11 - 14V)
			Ignition switch "ON" └ Accelerator pedal depressed	Approximately 0V
32	R/L	Accelerator position switch (Full)	Ignition switch "ON" └ Accelerator pedal released	Approximately 0V
			Ignition switch "ON" └ Accelerator pedal fully depressed	BATTERY VOLTAGE (11 - 14V)
48	R/B	Accelerator position sensor power supply	Ignition switch "ON"	Approximately 5V
51	B/W (LHD models) R/W (RHD models)	Accelerator position sensor ground	Engine is running. └ **Warm-up condition** Idle speed	Approximately 0V

On Board Diagnosis Logic

Malfunction is detected when ...	Check Items (Possible Cause)
● The relation between sensor and switch signal is not in the normal range during the specified accelerator position.	● Harness or connectors (The sensor circuit is open or shorted.) ● Accelerator position sensor ● Accelerator position switch ● Accelerator switch (F/C)



DTC Confirmation Procedure

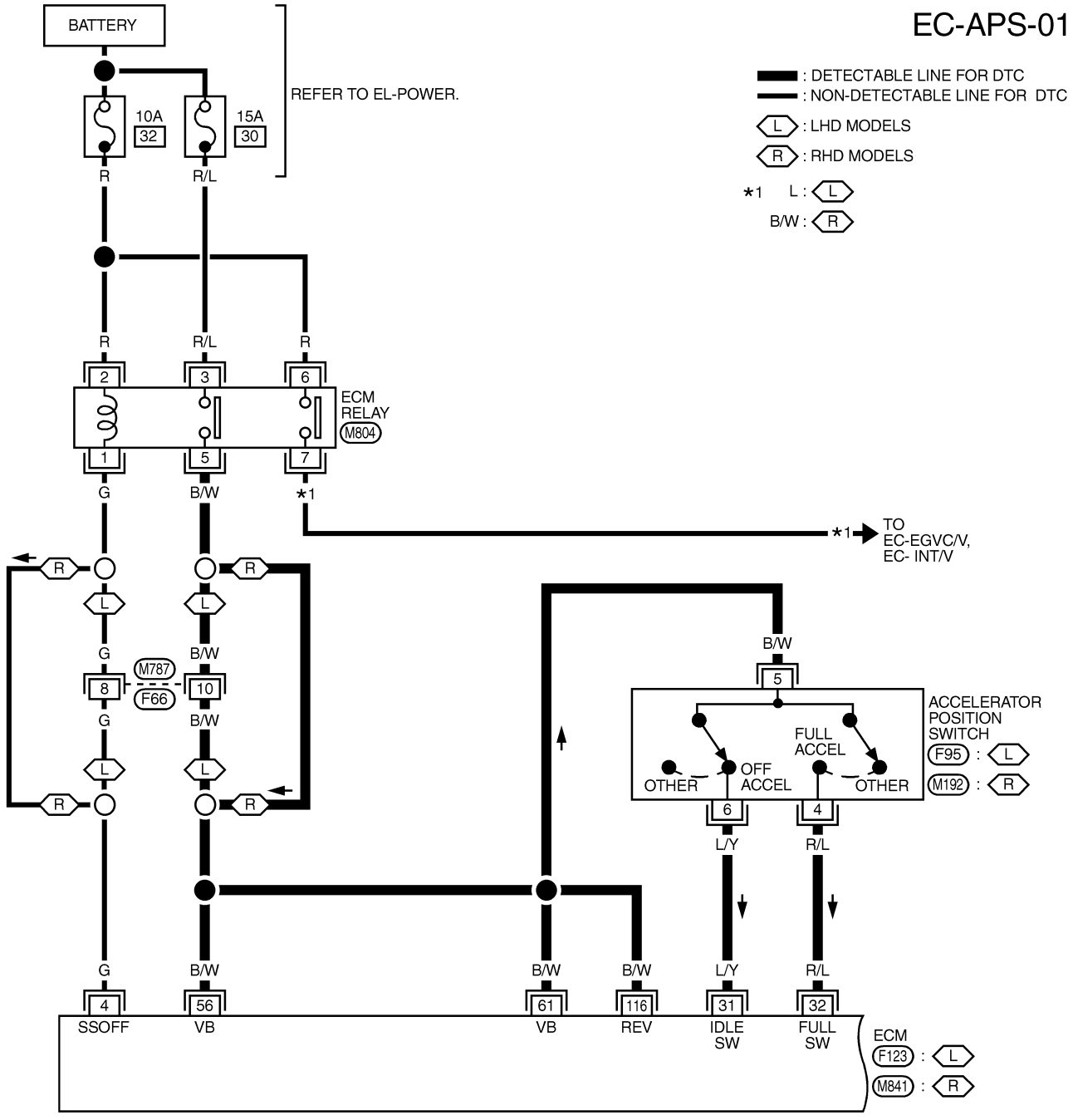
WITH CONSULT-II

1) Turn ignition switch “ON”.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Depress and release fully accelerator pedal slowly.
4) If DTC is detected, go to “Diagnostic Procedure”, EC-135.

WITHOUT CONSULT-II

1) Turn ignition switch “ON”.
2) Depress and release fully accelerator pedal slowly.
3) Turn ignition switch “OFF”, wait at least 5 seconds and then turn “ON”.
4) Perform “Diagnostic Test Mode II (Self-diagnostic results)” with ECM.
5) If DTC is detected, go to “Diagnostic Procedure”, EC-135.

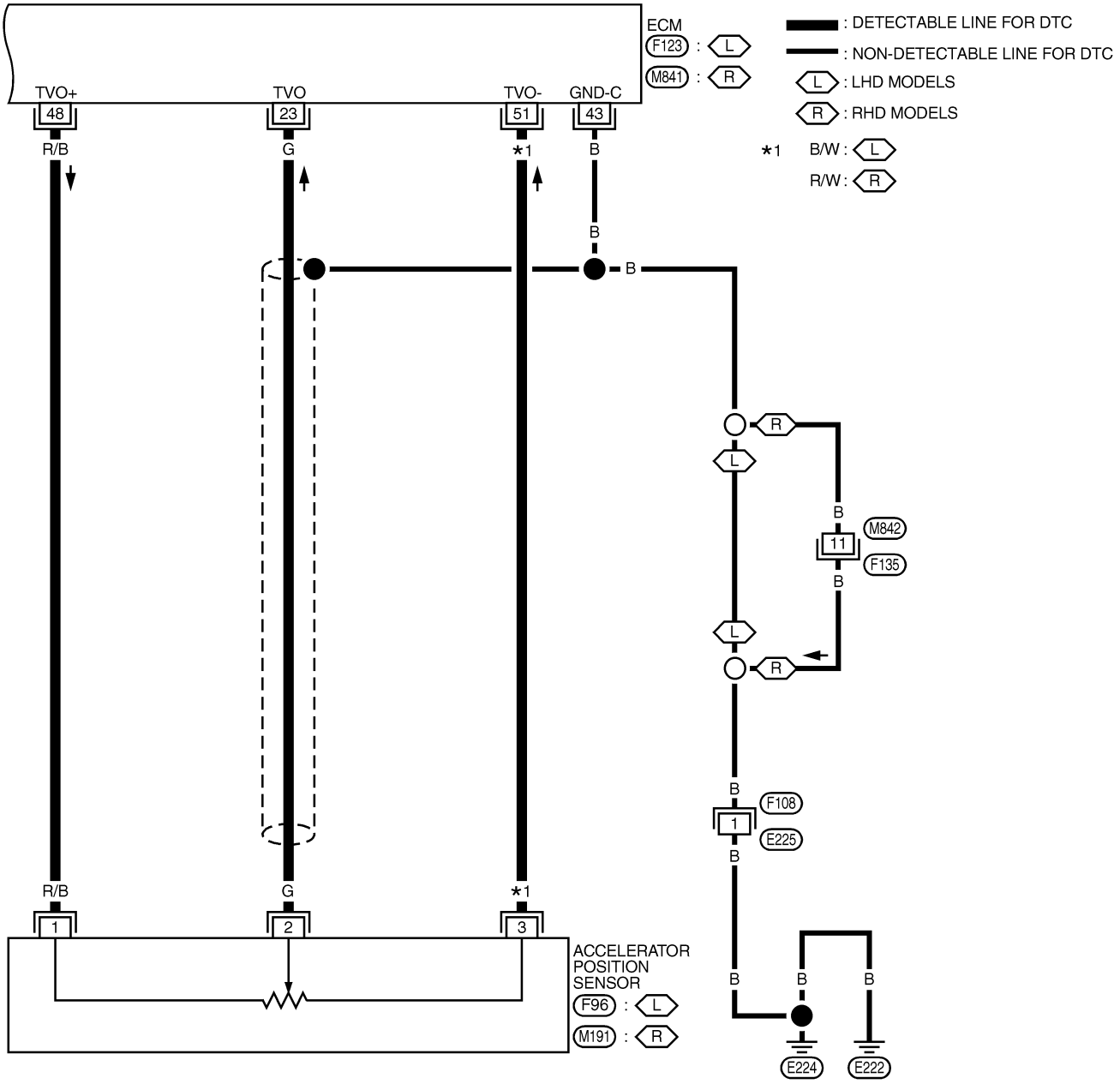
Wiring Diagram

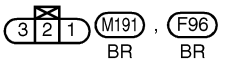


YEC183A

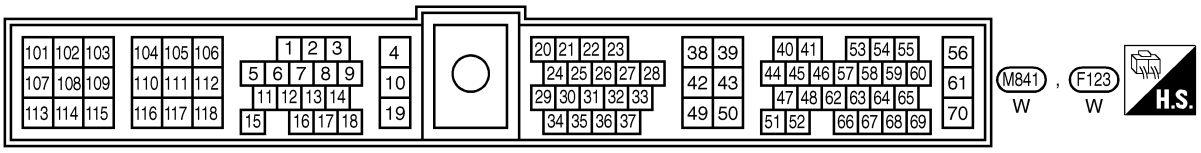
Wiring Diagram (Cont'd)

EC-APS-02





REFER TO THE FOLLOWING.
F108 , F135 -SUPER MULTIPLE JUNCTION (SMJ)



YEC184A

Diagnostic Procedure

1	CHECK OVERALL FUNCTION-I

With CONSULT-II

1. Turn ignition switch “ON”.
2. Select “ACCEL POS SEN” in “DATA MONITOR” mode with CONSULT-II.
3. Check “ACCEL POS SEN” signal under the following conditions.

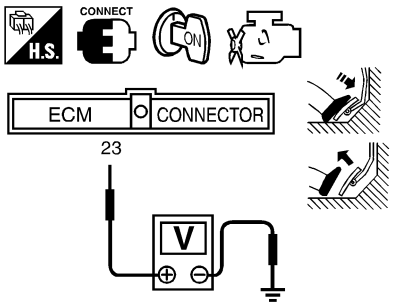
DATA MONITOR	
MONITOR	NO DTC
ACCEL POS SEN	XXXV

Conditions	ACCEL POS SEN
Accelerator pedal fully depressed	Approx. 4.5V
Accelerator pedal fully released	0.40 - 0.60V

SEF278Z

Without CONSULT-II

1. Turn ignition switch “ON”.
2. Check voltage between ECM terminal 23 and ground under the following conditions.



Conditions	Voltage
Accelerator pedal fully depressed	Approx. 4.5V
Accelerator pedal fully released	0.4 - 0.6V

SEF279Z

OK or NG

OK	▶	GO TO 2.
NG	▶	GO TO 3.

Diagnostic Procedure (Cont'd)

2	CHECK OVERALL FUNCTION-II

With CONSULT-II

1. Turn ignition switch "ON".
2. Select "FULL ACCEL SW" and "OFF ACCEL SW" in "DATA MONITOR" mode with CONSULT-II.
3. Check "FULL ACCEL SW" and "OFF ACCEL SW" signal under the following conditions.

DATA MONITOR	
MONITOR	NO DTC
FULL ACCEL SW	OFF
OFF ACCEL SW	ON

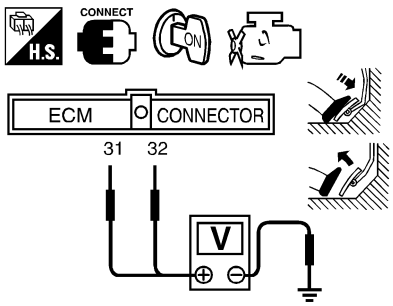
Conditions	FULL ACCEL SW
Accelerator pedal fully depressed	ON
Except above	OFF

Conditions	OFF ACCEL SW
Accelerator pedal fully released	ON
Accelerator pedal depressed	OFF

SEF416Y

Without CONSULT-II

1. Turn ignition switch "ON".
2. Check voltage between ECM terminals 31, 32 and ground under the following conditions.



Conditions	Voltage (ECM terminal 32)
Accelerator pedal fully depressed	Battery voltage
Except above	Approx. 0V

Conditions	Voltage (ECM terminal 31)
Accelerator pedal fully released	Battery voltage
Accelerator pedal depressed	Approx. 0V

SEF417Y

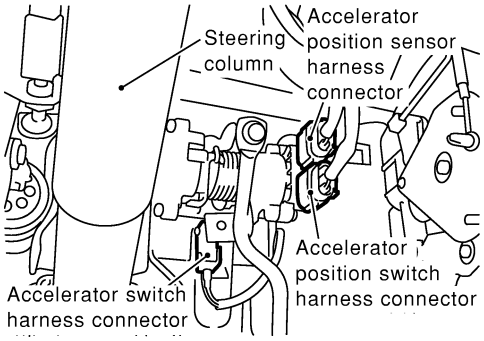
OK or NG

OK	▶	**INSPECTION END**
NG	▶	GO TO 11.

Diagnostic Procedure (Cont'd)

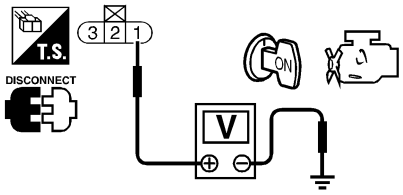
3	CHECK ACCELERATOR POSITION SENSOR POWER SUPPLY CIRCUIT

1. Turn ignition switch "OFF".
2. Disconnect accelerator position sensor harness connector.



MEC995D

3. Turn ignition switch "ON".
4. Check voltage between accelerator position sensor terminal 1 and ground with CONSULT-II or tester.



Voltage: Approximately 5V

SEF816Y

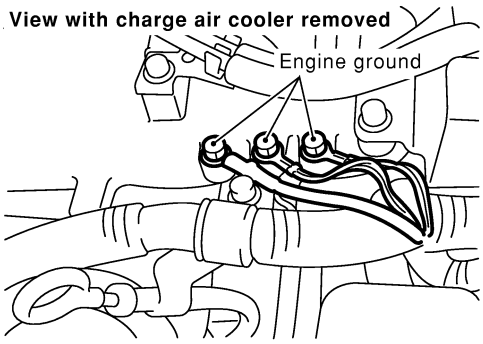
OK or NG

OK	▶	GO TO 4.
NG	▶	Repair open circuit or short to ground or short to power in harness or connectors.

Diagnostic Procedure (Cont'd)

4	CHECK ACCELERATOR POSITION SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch "OFF".
2. Loosen and retighten engine ground screw.



MEC994D

3. Check harness continuity between accelerator position sensor terminal 3 and engine ground. Refer to Wiring Diagram.
   Continuity should exist.
4. Also check harness for short to ground and short to power.

OK or NG

OK	▶	GO TO 5.
NG	▶	Repair open circuit or short to ground or short to power in harness or connectors.

5	CHECK ACCELERATOR POSITION SENSOR INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Disconnect ECM harness connector.
2. Check harness continuity between ECM terminal 23 and accelerator position sensor terminal 2. Refer to Wiring Diagram.
   Continuity should exist.
3. Also check harness for short to ground and short to power.

OK or NG

OK	▶	GO TO 6.
NG	▶	Repair open circuit or short to ground or short to power in harness or connectors.

Diagnostic Procedure (Cont'd)

6	CHECK ACCELERATOR POSITION SENSOR

With CONSULT-II

1. Reconnect all disconnected harness connectors.
2. Turn ignition switch "ON".
3. Select "DATA MONITOR" mode with CONSULT-II.
4. Check the indication of "ACCEL POS SEN" under the following conditions.

DATA MONITOR	
MONITOR	NO DTC
CKPS-RPM (TDC)	XXX rpm
ACCEL POS SEN	XXX V

Throttle valve conditions	ACCEL POS SEN
Completely closed (a)	0.4 - 0.6V
Partially open	Between (a) and (b)
Completely open (b)	Approx. 4.5V

SEF818Y

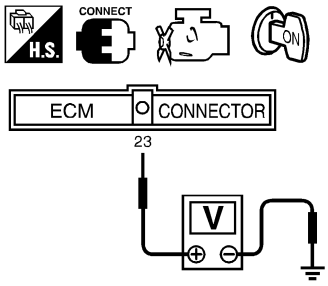
OK or NG

OK	▶	GO TO 7.
NG	▶	Replace accelerator pedal assembly.

7	CHECK ACCELERATOR POSITION SENSOR

Without CONSULT-II

1. Reconnect all disconnected harness connectors.
2. Turn ignition switch "ON".
3. Check voltage between ECM terminal 23 and ground under the following conditions.



Throttle valve conditions	Voltage
Completely closed (a)	0.4 - 0.6V
Partially open	Between (a) and (b)
Completely open (b)	Approx. 4.5V

SEF407Y

OK or NG

OK	▶	GO TO 8.
NG	▶	Replace accelerator pedal assembly.

8	RESET ACCELERATOR POSITION SENSOR IDLE POSITION MEMORY

With CONSULT-II

1. Turn ignition switch "ON".
2. Select "OFF ACCEL PO SIG" in "ACTIVE TEST" mode with CONSULT-II.
3. Touch "CLEAR".

	▶	GO TO 9.

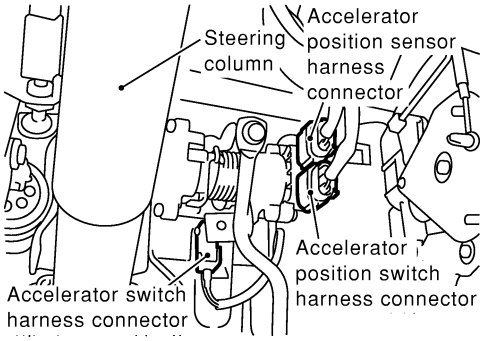
Diagnostic Procedure (Cont'd)

9	RESET ACCELERATOR POSITION SENSOR IDLE POSITION MEMORY
Without CONSULT-II 1. Start engine and warm it up to normal operating temperature. 2. Let engine idle for 10 minutes.	
▶	GO TO 10.

10	CHECK INTERMITTENT INCIDENT
Refer to "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78.	
▶	**INSPECTION END**

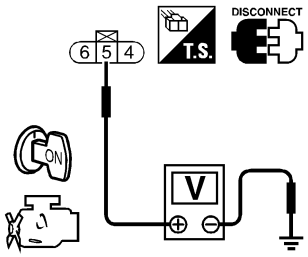
11	CHECK ACCELERATOR POSITION SWITCH POWER SUPPLY CIRCUIT

1. Turn ignition switch "OFF".
2. Disconnect accelerator position switch harness connector.



MEC995D

3. Turn ignition switch "ON".
4. Check voltage between accelerator position switch terminal 5 and ground with CONSULT-II or tester.



Voltage: Battery voltage

SEF346X

OK or NG

OK	▶	GO TO 13.
NG	▶	GO TO 12.

12	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors M787, F6 (LHD models) ● Harness for open or short between accelerator position switch and ECM relay ● Harness for open or short between accelerator position switch and ECM	
▶	Repair harness or connectors.

Diagnostic Procedure (Cont'd)

13	CHECK ACCELERATOR POSITION SWITCH INPUT SIGNAL CIRCUIT-I FOR OPEN AND SHORT

1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector.
3. Check harness continuity between accelerator position switch terminal 6 and ECM terminal 31. Refer to Wiring Diagram.
   Continuity should exist.
4. Also check harness for short to ground and short to power.

OK or NG

OK	▶	GO TO 14.
NG	▶	Repair open circuit or short to ground or short to power in harness or connectors.

14	CHECK ACCELERATOR POSITION SWITCH INPUT SIGNAL CIRCUIT-II FOR OPEN AND SHORT

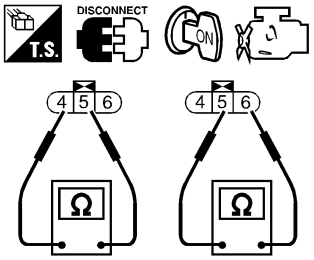
1. Check harness continuity between accelerator position switch terminal 4 and ECM terminal 32. Refer to Wiring Diagram.
   Continuity should exist.
2. Also check harness for short to ground and short to power.

OK or NG

OK	▶	GO TO 15.
NG	▶	Repair open circuit or short to ground or short to power in harness or connectors.

15	CHECK ACCELERATOR POSITION SWITCH

Check continuity between accelerator position switch terminals 4 and 5, 5 and 6 under the following conditions.



Between terminals 4 and 5

Conditions	Continuity
Accelerator pedal fully depressed	Should exist.
Except above	Should not exist.

Between terminals 5 and 6

Conditions	Continuity
Accelerator pedal fully released	Should exist.
Accelerator pedal depressed	Should not exist.

SEF418Y

OK or NG

OK (With CONSULT-II)	▶	GO TO 16.
OK (Without CONSULT-II)	▶	GO TO 17.
NG	▶	Replace accelerator pedal assembly.

16	RESET ACCELERATOR POSITION SENSOR IDLE POSITION MEMORY

With CONSULT-II
1. Turn ignition switch "ON".
2. Select "OFF ACCEL PO SIG" in "ACTIVE TEST" mode with CONSULT-II.
3. Touch "CLEAR".

	▶	GO TO 18.

17	RESET ACCELERATOR POSITION SENSOR IDLE POSITION MEMORY

Without CONSULT-II
1. Start engine and warm it up to normal operating temperature.
2. Let engine idle for 10 minutes.

	▶	GO TO 18.

Diagnostic Procedure (Cont'd)

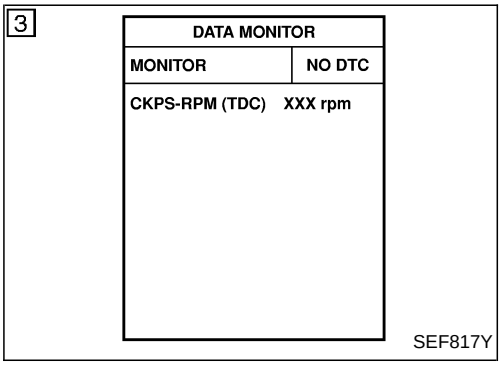
18	**CHECK INTERMITTENT INCIDENT**
Refer to "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78.	
▶	**INSPECTION END**

On Board Diagnosis Logic

Malfunction is detected when ...	Check Items (Possible Cause)
● An excessively high voltage from the mass air flow sensor is sent to ECM when engine is running.	● Air duct ● Charge air cooler ● Variable nozzle turbocharger control system ● Variable nozzle turbocharger ● Mass air flow sensor ● Harness or connectors (The mass air flow sensor circuit is shorted.)

DTC Confirmation Procedure

NOTE:
If DTC 0406 “INT AIR VOL” displayed with DTC 0102 “MASS AIR FLOW SEN”, perform trouble diagnosis for DTC 0102 “MASS AIR FLOW SEN” first. (See EC-88.)



WITH CONSULT-II

1) Turn ignition switch “ON”.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Start engine and warm it up to normal operating temperature.
4) Drive vehicle.
5) Maintain the engine speed more than 4,000 rpm for at least 10 seconds.
6) If DTC is detected, go to “Diagnostic Procedure”, EC-144.

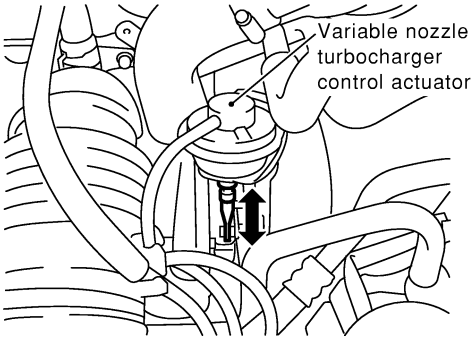
WITHOUT CONSULT-II

1) Start engine and warm it up to normal operating temperature.
2) Drive vehicle.
3) Maintain the engine speed more than 4,000 rpm for at least 10 seconds.
4) Stop vehicle.
5) Turn ignition switch “OFF”, wait at least 5 seconds and then turn “ON”.
6) Perform “Diagnostic Test Mode II (Self-diagnostic results)” with ECM.
7) If DTC is detected, go to “Diagnostic Procedure”, EC-144.

Diagnostic Procedure

1	CHECK INTAKE AIR LEAK
Listen for an intake air leak after the mass air flow sensor.	
OK or NG	
OK ▶	GO TO 2.
NG ▶	Repair or replace.

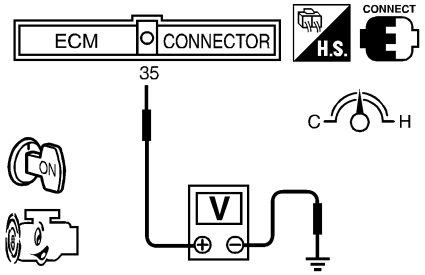
2	CHECK VARIABLE NOZZLE TURBOCHARGER OVERALL FUNCTION
1. Start engine and let it idle. 2. Make sure that variable nozzle turbocharger control actuator rod moves when revving engine up to 3,000 rpm and returning to idle.	



MEC015E

OK or NG	
OK ▶	GO TO 3.
NG ▶	Go to “Diagnostic Procedure” in “VARIABLE NOZZLE TURBOCHARGER CONTROL SOLENOID VALVE”, EC-284.

3	CHECK MASS AIR FLOW SENSOR
1. Start engine and warm it up to normal operating temperature. 2. Check voltage between ECM terminal 35 (Mass air flow sensor signal) and ground.	



Condition	Voltage V
Ignition switch “ON” (Engine stopped.)	Approx. 1.0
Idle (Engine is warmed-up to normal operating temperature.)	1.6 - 2.0
Idle to about 4,000 rpm*	1.6 - 2.0 to Approx. 4.0

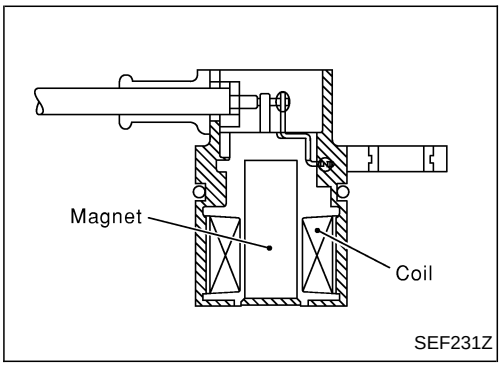
*: Check for linear voltage rise in response to engine being increased to about 4,000 rpm.

SEF400Y

3. If the voltage is out of specification, disconnect MAFS harness connector and connect it again. Then repeat above check.

OK or NG	
OK ▶	GO TO 4.
NG ▶	Replace mass air flow sensor.

4	CHECK INTERMIT INCIDENT
Refer to “TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT”, EC-78.	
▶	**INSPECTION END**



Description

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

CONSULT-II Reference Value in Data Monitor Mode

Specification data are reference values.

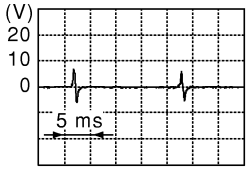
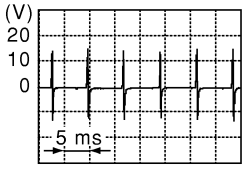
MONITOR ITEM	CONDITION	SPECIFICATION
CKPS·RPM (TDC)	● Tachometer: Connect ● Run engine and compare tachometer indication with the CONSULT-II value.	Almost the same speed as the CONSULT-II value.

ECM Terminals and Reference Value

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

CAUTION:

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

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
44	L/G	Crankshaft position sensor (TDC)	Engine is running. └ **Warm-up condition** Idle speed	Approximately 0V  SEF333Y
			Engine is running. └ **Warm-up condition** Engine speed is 2,000 rpm	Approximately 0V  SEF334Y
47	L/R	Crankshaft position sensor (TDC) ground	Engine is running. └ **Warm-up condition** Idle speed	Approximately 0V

On Board Diagnosis Logic

Malfunction is detected when ...	Check Items (Possible Cause)
● An improper signal from the sensor is sent to ECM during engine running and cranking.	● Harness or connectors (The sensor circuit is open.) ● Crankshaft position sensor (TDC)

3

DATA MONITOR	
MONITOR	NO DTC
CKPS-RPM (TDC)	XXX rpm

SEF817Y

DTC Confirmation Procedure

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

WITH CONSULT-II

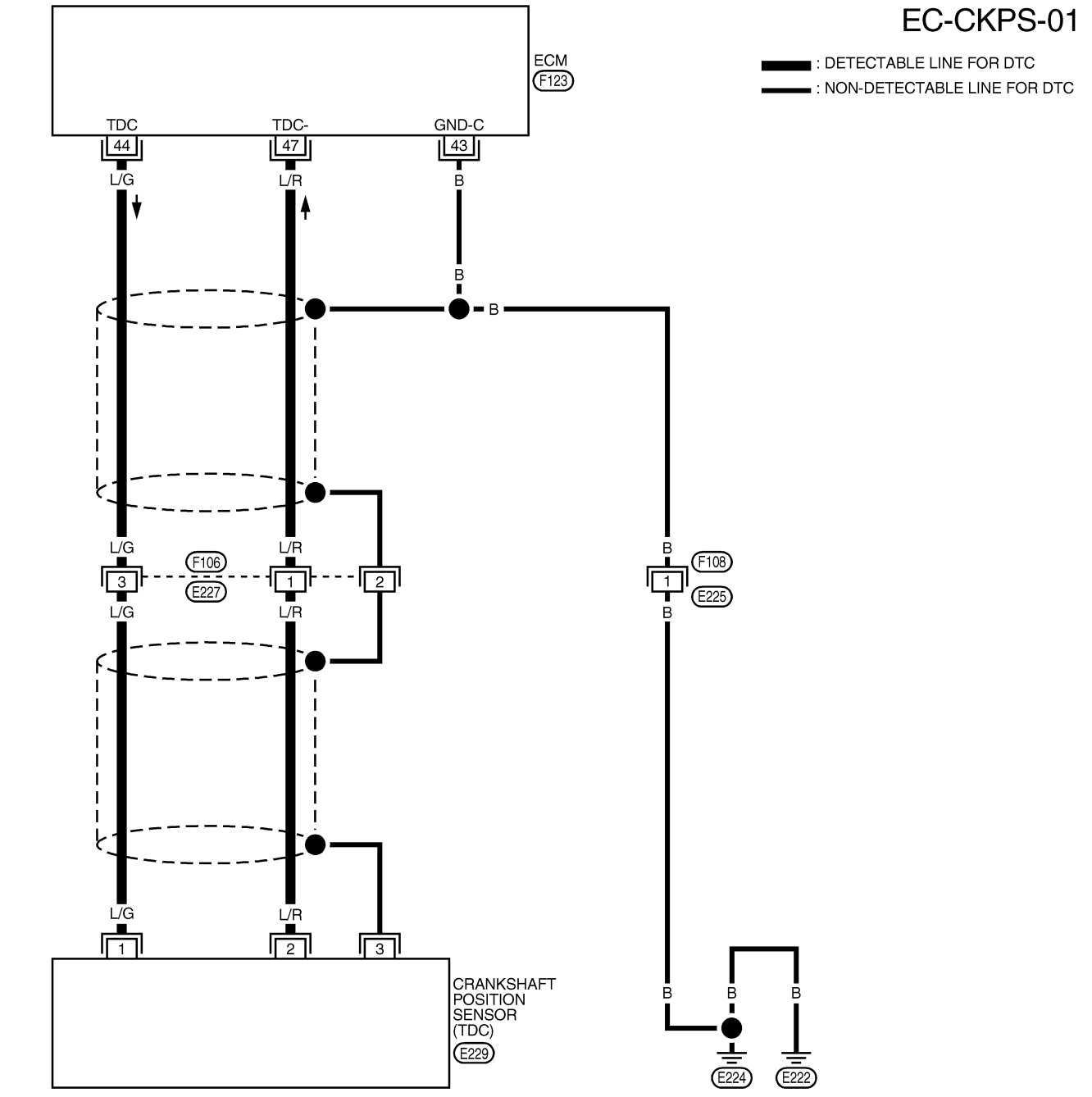
1) Turn ignition switch “ON” and select “DATA MONITOR” mode with CONSULT-II.
2) Crank engine for at least 1 second.
3) Start engine and run it for at least 2 seconds at idle speed.
4) If DTC is detected, go to “Diagnostic Procedure”, EC-149.

WITHOUT CONSULT-II

1) Crank engine for at least 1 second.
2) Start engine and run it for at least 2 seconds at idle speed.
3) Turn ignition switch “OFF”, wait at least 5 seconds and then turn “ON”.
4) Perform “Diagnostic Test Mode II (Self-diagnostic results)” with ECM.
5) If DTC is detected, go to “Diagnostic Procedure”, EC-149.

Wiring Diagram

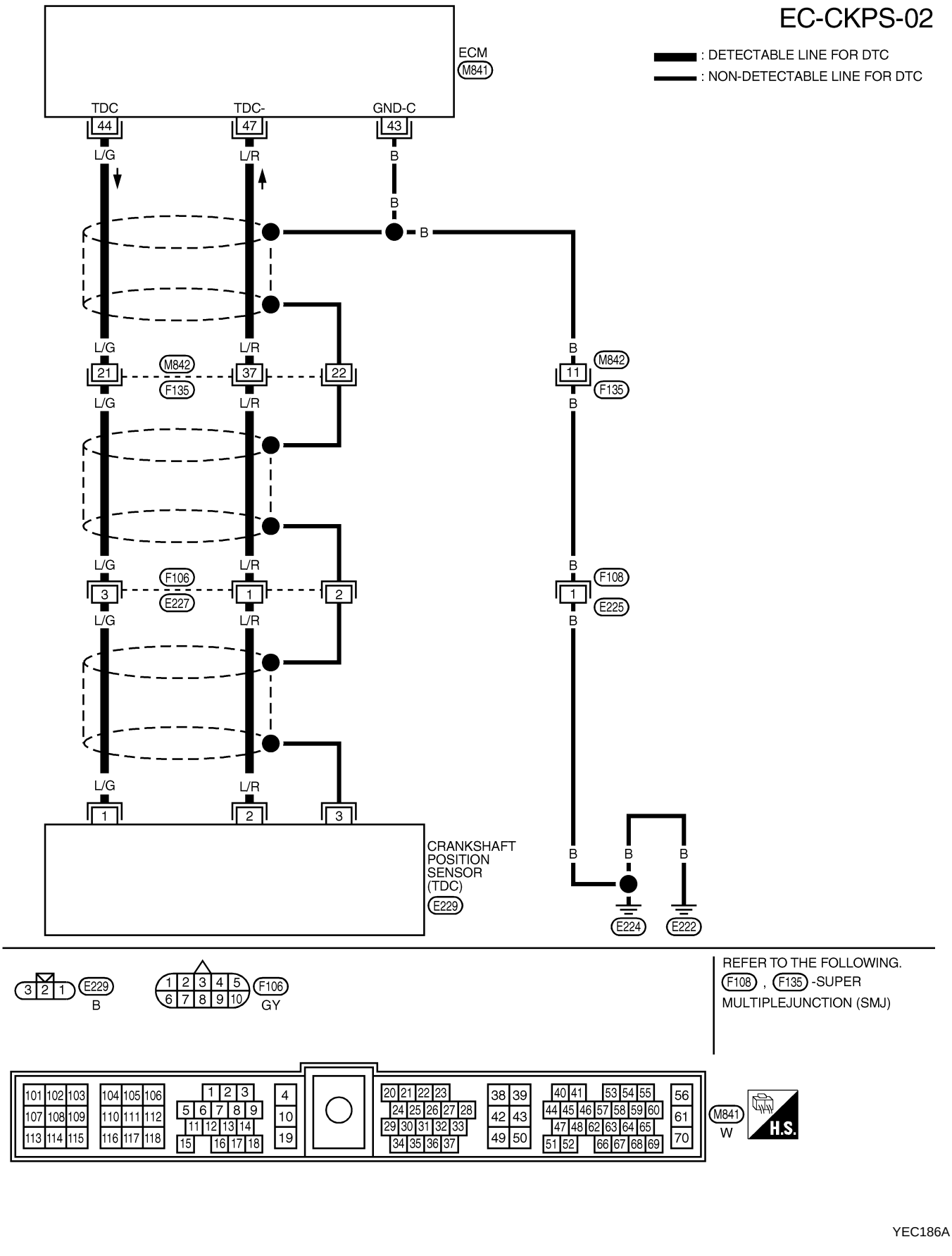
LHD MODELS



YEC185A

Wiring Diagram (Cont'd)

RHD MODELS

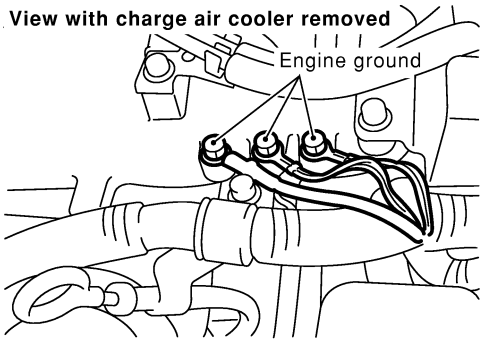


YEC186A

Diagnostic Procedure

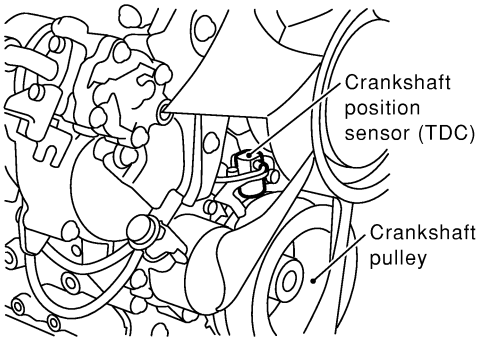
1	CHECK CRANKSHAFT POSITION SENSOR (TDC) GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch “OFF”.
2. Loosen and retighten engine ground screws.

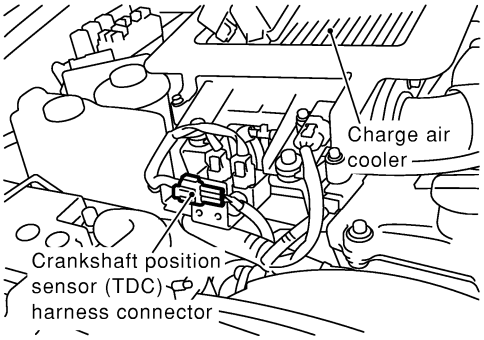


MEC994D

3. Disconnect crankshaft position sensor (TDC) harness connector and ECM harness connector.



MEC998D



MEC018E

4. Check harness continuity between ECM terminal 47 and terminal 2. Refer to Wiring Diagram.
   Continuity should exist.
5. Also check harness for short to ground and short to power.

OK or NG

OK	▶	GO TO 3.
NG	▶	GO TO 2.

Diagnostic Procedure (Cont'd)

2	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors F106, E227 ● Harness connectors M842, F135 (RHD models) ● Harness for open or short between crankshaft position sensor (TDC) and ECM	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

3	CHECK CRANKSHAFT POSITION SENSOR (TDC) INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT
1. Check harness continuity between terminal 1 and ECM terminal 44. Refer to Wiring Diagram. **Continuity should exist.** 2. Also check harness for short to ground and short to power.	
OK or NG	
OK ▶	GO TO 5.
NG ▶	GO TO 4.

4	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors F106, E227 ● Harness connectors M842, F135 (RHD models) ● Harness for open or short between crankshaft position sensor (TDC) and ECM	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

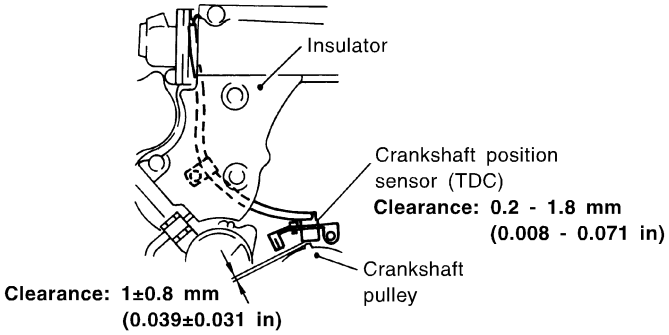
5	CHECK CRANKSHAFT POSITION SENSOR SHIELD CIRCUIT
1. Check harness continuity between crankshaft position sensor (TDC) terminal 3 and engine ground. Refer to Wiring Diagram. **Continuity should exist.** 2. Also check harness for short to ground and short to power.	
OK or NG	
OK ▶	GO TO 7.
NG ▶	GO TO 6.

6	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors F106, E227 ● Harness connectors F108, E225 ● Harness connectors M842, F135 (RHD models) ● Harness for open or short between crankshaft position sensor (TDC) and engine ground	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

Diagnostic Procedure (Cont'd)

7	CHECK CRANKSHAFT POSITION SENSOR (TDC) INSTALLATION

Check the clearance between crankshaft position sensor (TDC) and protrusion on the crankshaft pulley.



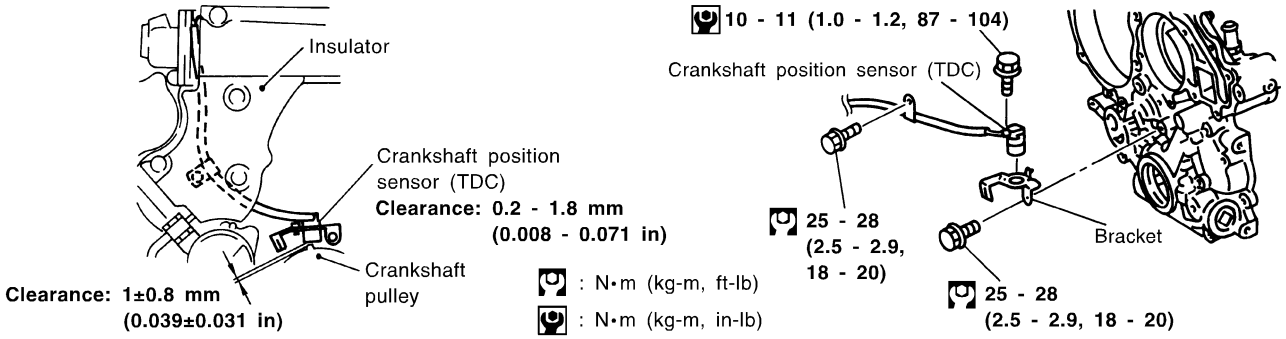
JEF293Z

OK or NG

OK	▶	GO TO 8.
NG	▶	GO TO 9.

8	REINSTALL CRANKSHAFT POSITION SENSOR (TDC)

1. Remove crankshaft position sensor (TDC).
2. Install crankshaft position sensor (TDC) properly.



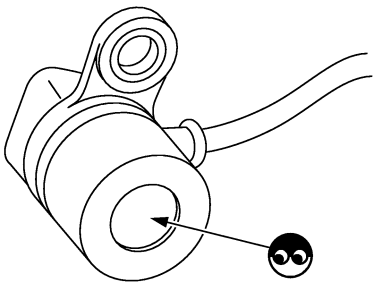
JEF294Z

	▶	INSPECTION END

Diagnostic Procedure (Cont'd)

9	CHECK CRANKSHAFT POSITION SENSOR (TDC)-I

1. Loosen the fixing bolt and remove the crankshaft position sensor (TDC).
2. Visually check the sensor for chipping.



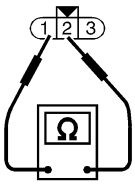
SEF232Z

OK or NG

OK	▶	GO TO 10.
NG	▶	Replace crankshaft position sensor (TDC).

10	CHECK CRANKSHAFT POSITION SENSOR (TDC)-II

1. Disconnect crankshaft position sensor (TDC) harness connector.
2. Check resistance between crankshaft position sensor (TDC) terminals 1 and 2.



Resistance: 1,287 - 1,573Ω [at 20°C (68°F)]

SEF295Z

OK or NG

OK	▶	GO TO 11.
NG	▶	Replace crankshaft position sensor (TDC).

11	CHECK INTERMITTENT INCIDENT
Refer to "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78.	
	▶ **INSPECTION END**

On Board Diagnosis Logic

The ECM checks if battery voltage is within the tolerance range for the engine control system.

Malfunction is detected when ...	Check Items (Possible Cause)
• An abnormally high voltage from the battery is sent to ECM.	• Incorrect jump starting • Battery • Alternator • ECM

DTC Confirmation Procedure

With CONSULT-II

1) Check the following.
- Jumper cables are connected for jump starting.
- Battery or alternator has been replaced.

   If the result is “Yes” for one item or more, skip the following steps and go to “Diagnostic Procedure”, EC-153.
2) Check that the positive battery terminal is connected to battery properly. If NG, reconnect it properly.
3) Check that the alternator functions properly. Refer to EL section (“CHARGING SYSTEM”).
4) Turn ignition switch “ON” and select “DATA MONITOR” mode with CONSULT-II.
5) Wait one minute.
6) If DTC is detected, go to “Diagnostic Procedure”, EC-153.

   If DTC is not detected, go to next step.
7) Start engine and wait one minute at idle.
8) If DTC is detected, go to “Diagnostic Procedure”, EC-153.

Without CONSULT-II

1) Check the following.
- Jumper cables are connected for jump starting.
- Battery or alternator has been replaced.

   If the result is “Yes” for one item or more, skip the following steps and go to “Diagnostic Procedure”, EC-153.
2) Check that the positive battery terminal is connected to battery properly. If NG, reconnect it properly.
3) Check that the alternator functions properly. Refer to EL section (“CHARGING SYSTEM”).
4) Turn ignition switch “ON” and wait one minute.
5) Turn ignition switch “OFF”, wait 5 seconds and then turn “ON”.
6) Perform “Diagnostic Test Mode II (Self-diagnostic result)” with ECM.
7) If DTC is detected, go to “Diagnostic Procedure”, EC-153.

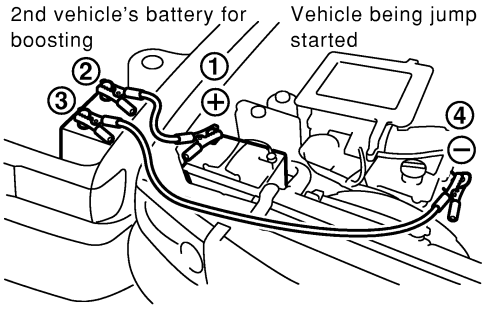
   If DTC is not detected, go to next step.
8) Start engine and wait one minute at idle.
9) Turn ignition switch “OFF”, wait 5 seconds and then turn “ON”.
10) Perform “Diagnostic Test Mode II (Self-diagnostic result)” with ECM.
11) If DTC is detected, go to “Diagnostic Procedure”, EC-153.

Diagnostic Procedure

1	INSPECTION START	
Are jumper cables connected for the jump starting? **Yes or No**		
Yes	▶	GO TO 3.
No	▶	GO TO 2.

Diagnostic Procedure (Cont'd)

2	CHECK BATTERY AND ALTERNATOR
Check that the proper type of battery and alternator is installed. Refer to EL section ("BATTERY" and "CHARGING SYSTEM").	
OK or NG	
OK ▶	GO TO 5.
NG ▶	Replace with a proper one.

3	CHECK JUMPER CABLES INSTALLATION
Check that the jumper cables are connected in the correct sequence.	
 MEC999D	
OK or NG	
OK ▶	GO TO 4.
NG ▶	Reconnect jumper cables properly.

4	CHECK BATTERY FOR BOOSTER
Check that the battery for the booster is a 12V battery.	
OK or NG	
OK ▶	GO TO 5.
NG ▶	Change the vehicle for booster.

5	PERFORM DTC CONFIRMATION PROCEDURE AGAIN
Perform "DTC Confirmation Procedure", EC-153, again.	
OK or NG	
OK ▶	GO TO 6.
NG ▶	Replace ECM.

6	CHECK ELECTRICAL PARTS DAMAGE
Check the following for damage. ● Wiring harness and harness connectors for burn ● Fuses for short	
OK or NG	
OK ▶	**INSPECTION END**
NG ▶	Repair or replace malfunctioning part.

System Description

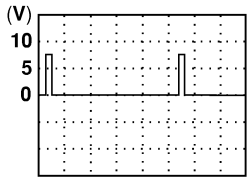
These circuit lines are used to control the smooth shifting up and down of A/T during the hard acceleration/deceleration.
Voltage signals are exchanged between ECM and TCM (Transmission control module).

ECM Terminals and Reference Value

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

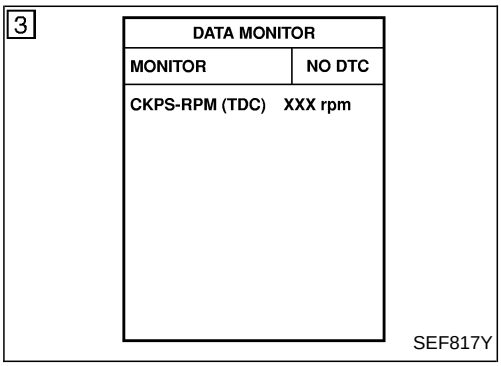
CAUTION:

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

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage)
24 37 58	G/Y LG/R R/B	A/T signal No. 1 A/T signal No. 2 A/T signal No. 4	Engine is running. └ **Warm-up condition** Idle speed	Voltage goes high up once in a few seconds  SEF448Z
30	LG/Y	A/T signal No. 3	Engine is running. └ **Warm-up condition** Idle speed	Approximately 0V
			Engine is running. └ **Warm-up condition** Engine speed is 2,000 rpm	Approximately 7.7V

On Board Diagnosis Logic

Malfunction is detected when ...	Check Items (Possible Cause)
• ECM receives incorrect voltage from TCM (Transmission control module) continuously.	• Harness or connectors [The circuit between ECM and TCM (Transmission control module) is open or shorted.]

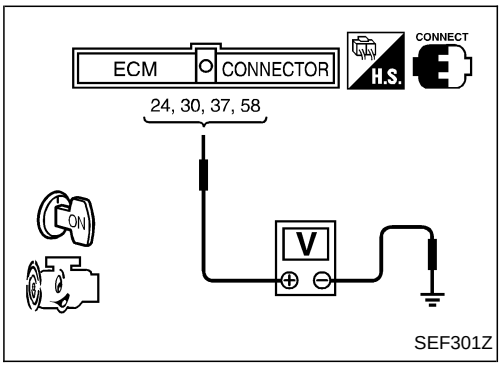


DTC Confirmation Procedure

NOTE:
If "DTC Confirmation Procedure" has been previously conducted, always turn ignition switch "OFF" and wait at least 5 seconds before conducting the next test.

With CONSULT-II

1) Start engine.
2) Select "DATA MONITOR" mode with CONSULT-II.
3) Set selector lever to "D" position.
4) Accelerate up to 60 km/h (37 MPH) gradually on the accelerator pedal.
   Do not accelerate with shift down.
5) Stop the vehicle with engine running.
6) If DTC is detected, go to "Diagnostic Procedure", EC-159.



Overall Function Check

Use this procedure to check the overall function of the A/T control circuit. During this check, a DTC might not be confirmed.

Without CONSULT-II

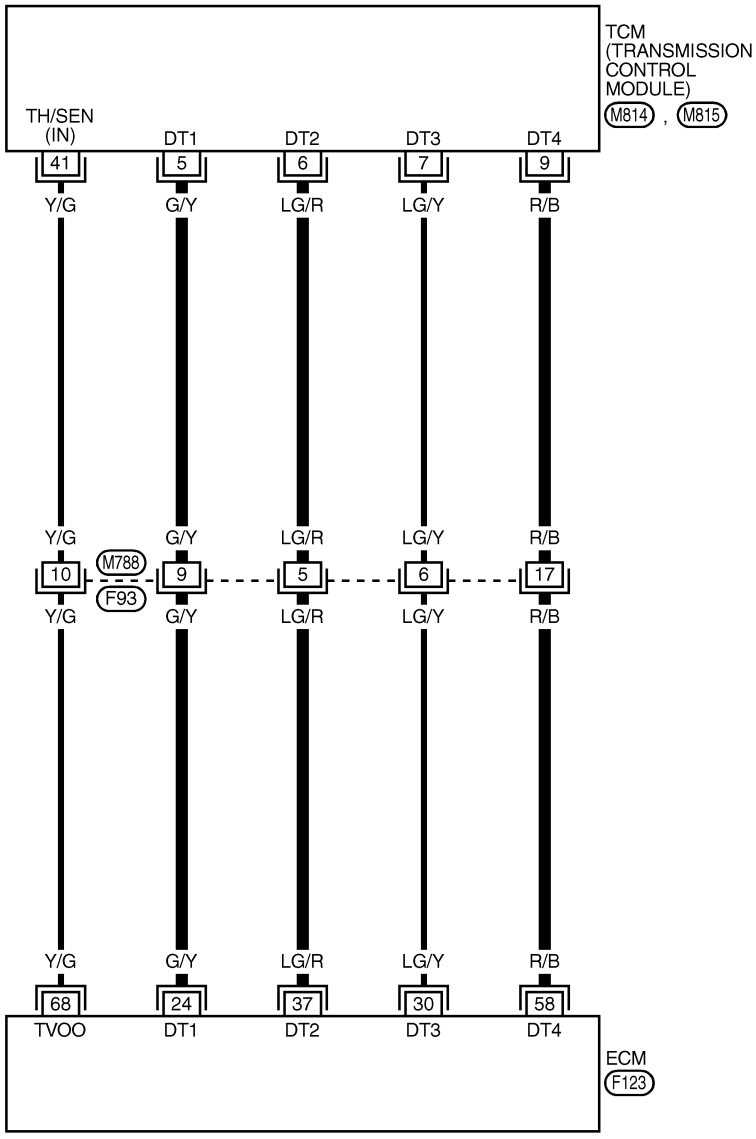
1) Start engine.
2) Read the voltage signal between ECM terminals 24, 30, 37, 58 and ground with an oscilloscope.
3) Verify that the oscilloscope screen shows the signal wave as shown under "ECM Terminals and Reference Value" on the previous page.
4) If NG, go to "Diagnostic Procedure", EC-159.

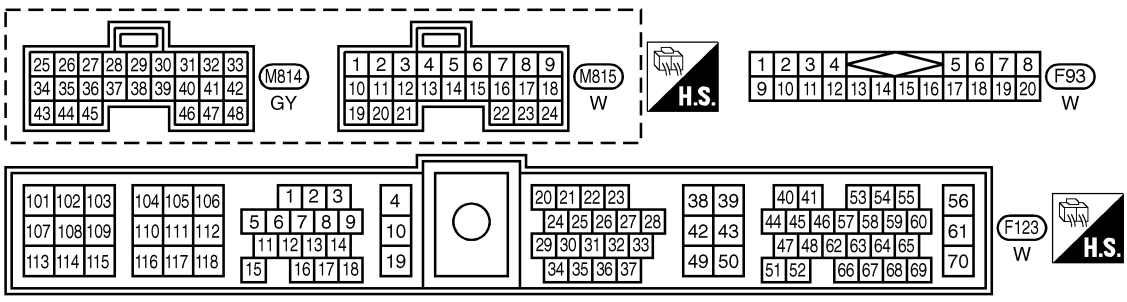
Wiring Diagram

LHD MODELS

EC-AT/C-01

: DETECTABLE LINE FOR DTC
: NON-DETECTABLE LINE FOR DTC





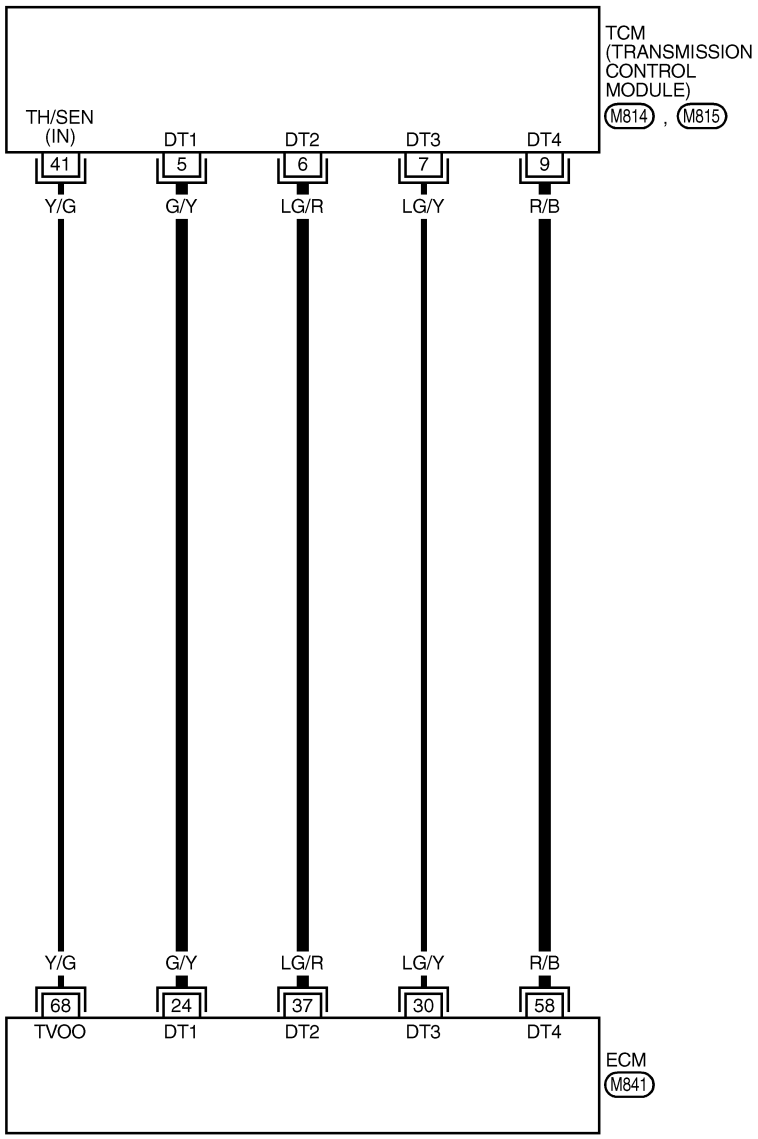
YEC187A

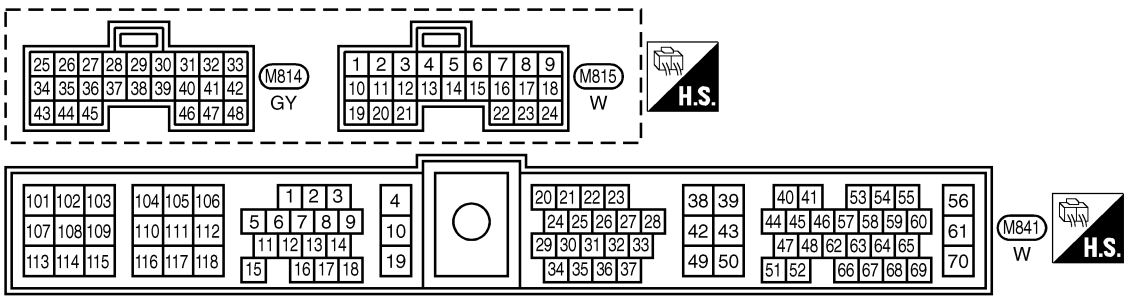
Wiring Diagram (Cont'd)

RHD MODELS

EC-AT/C-02

: DETECTABLE LINE FOR DTC
: NON-DETECTABLE LINE FOR DTC



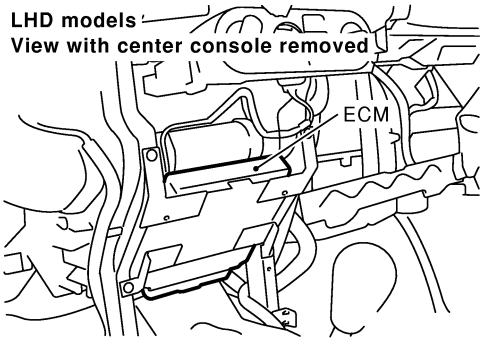


YEC188A

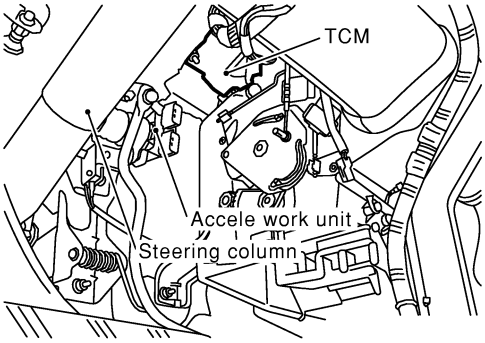
Diagnostic Procedure

1	CHECK INPUT SIGNAL CIRCUIT

1. Turn ignition switch “OFF”.
2. Disconnect ECM harness connector and TCM (Transmission control module) harness connector.



MEC020E



MEC026E

3. Check harness continuity between the following terminals. Refer to Wiring Diagram.

ECM	TCM
24	5
30	7
37	6
58	9

MTBL0532

Continuity should exist.

OK or NG

OK	▶	GO TO 3.
NG	▶	GO TO 2.

2	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors M788, F93 (LHD models)
- Harness for open or short between ECM and TCM (Transmission control module)

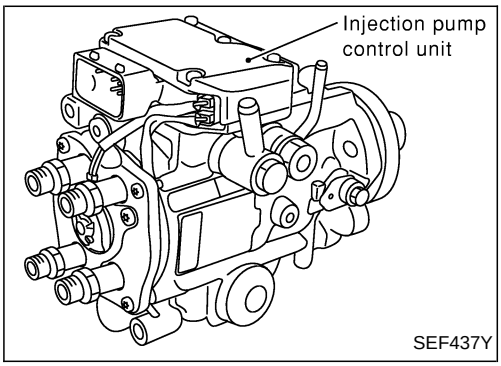
	▶	Repair harness or connectors.

Diagnostic Procedure (Cont'd)

3	CHECK INPUT SIGNAL CIRCUIT
1. Check harness continuity between ECM terminal 24 and ground, ECM terminal 30 and ground, ECM terminal 37 and ground, ECM terminal 58 and ground. Refer to Wiring Diagram. **Continuity should not exist.** 2. Also check harness for short to ground and short to power. **OK or NG**	
OK ▶	GO TO 5.
NG ▶	GO TO 4.

4	DETECT MALFUNCTIONING PART
Check the harness for open or short between ECM and TCM (Transmission control module).	
▶	Repair open circuit short to ground or short to power in harness.

5	CHECK INTERMITTENT INCIDENT
Refer to "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78.	
▶	**INSPECTION END**



Description

SYSTEM DESCRIPTION

The ECM and the electronic control fuel injection pump control unit (abbreviated as the injection pump control unit) perform the real time communication (signal exchange).
The ECM transmits the signals of the target fuel injection amount, target fuel injection timing, and engine speed, etc., and receives the signals of the pump speed and fuel temperature, etc. from the injection pump control unit.
By those signals, the injection pump controls the optimum fuel injection amount and injection timing of the spill valve and timing control valve.
Injection pump control unit has an on board diagnostic system, which detects malfunctions related to sensors or actuators built-into electronic control fuel injection pump. These malfunction information are transferred through the line (circuit) from injection pump control unit to ECM.

FUEL INJECTION AMOUNT CONTROL

In accordance with the target fuel injection amount signal from the ECM, the injection amount is controlled by controlling the spill valve in the injection pump and by changing the needle opening time.

FUEL INJECTION TIMING CONTROL

Based on the target fuel injection timing signal from the ECM, the injection timing is controlled in accordance with the timer spring by performing the duty control of the timing control valve in the injection pump and by adjusting the pressure of the timer piston high pressure chamber.

FUEL TEMPERATURE SENSOR

The sensor detects the fuel temperature in the injection pump and calibrates the injection amount change by the fuel temperature.

CAM RING POSITION SENSOR

The sensor detects the passing of the protrusion on the sensor wheel in the injection pump by the semiconductor magnetic resistance element sensor. The cam ring position sensor synchronizes with the cam ring, and detects the actual advance amount. The injection pump control unit measures the injection pump revolution by the signal of the cam ring position sensor.

CONSULT-II Reference Value in Data Monitor Mode

Remarks: Specification data are reference values.

MONITOR ITEM	CONDITION		SPECIFICATION
FUEL TEMP SEN	● Engine: After warming up		More than 40°C (104°F)
SPILL/V	● Engine: After warming up		Approx. 13°CA
INJ TIMG C/V	● Engine: After warming up, idle the engine.		Approx. 50 - 70%
DECELER F/CUT	● Engine: After warming up	Idle	OFF
BARO SEN	● Ignition switch: ON		Altitude Approx. 0 m (0 ft): Approx. 100.62 kPa (1.0062 bar, 1.026 kg/cm^2, 14.59 psi) Approx. 1,000 m (3,281 ft): Approx. 88.95 kPa (0.8895 bar, 0.907 kg/cm^2, 12.90 psi) Approx. 1,500 m (4,992 ft): Approx. 83.16 kPa (0.8316 bar, 0.848 kg/cm^2, 12.06 psi) Approx. 2,000 m (6,562 ft): Approx. 78.36 kPa (0.7836 bar, 0.799 kg/cm^2, 11.36 psi)

ECM Terminals and Reference Value

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

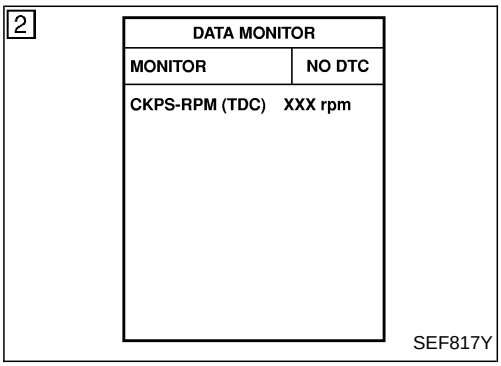
CAUTION:

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

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage)
33	G	Electronic control fuel injection pump	Engine is running. └ **Warm-up condition** Idle speed	Approximately 2.5V
40	R	Electronic control fuel injection pump	Engine is running. └ **Warm-up condition** Idle speed	Approximately 2.5V
52	Y	Electronic control fuel injection pump	Engine is running. └ Idle speed	Approximately 0.1V
53	O/R	Electronic control fuel injection pump	Engine is running. └ Idle speed	Approximately 0.35V

On Board Diagnosis Logic

Malfunction is detected when	Check Items (Possible cause)
● An improper voltage signal from cam position sensor (Built-into electronic control fuel injection pump) is sent to injection pump control unit.	● Harness or connectors (Electronic control fuel injection pump circuit is open or shorted.) ● Electronic control fuel injection pump



DTC Confirmation Procedure

WITH CONSULT-II

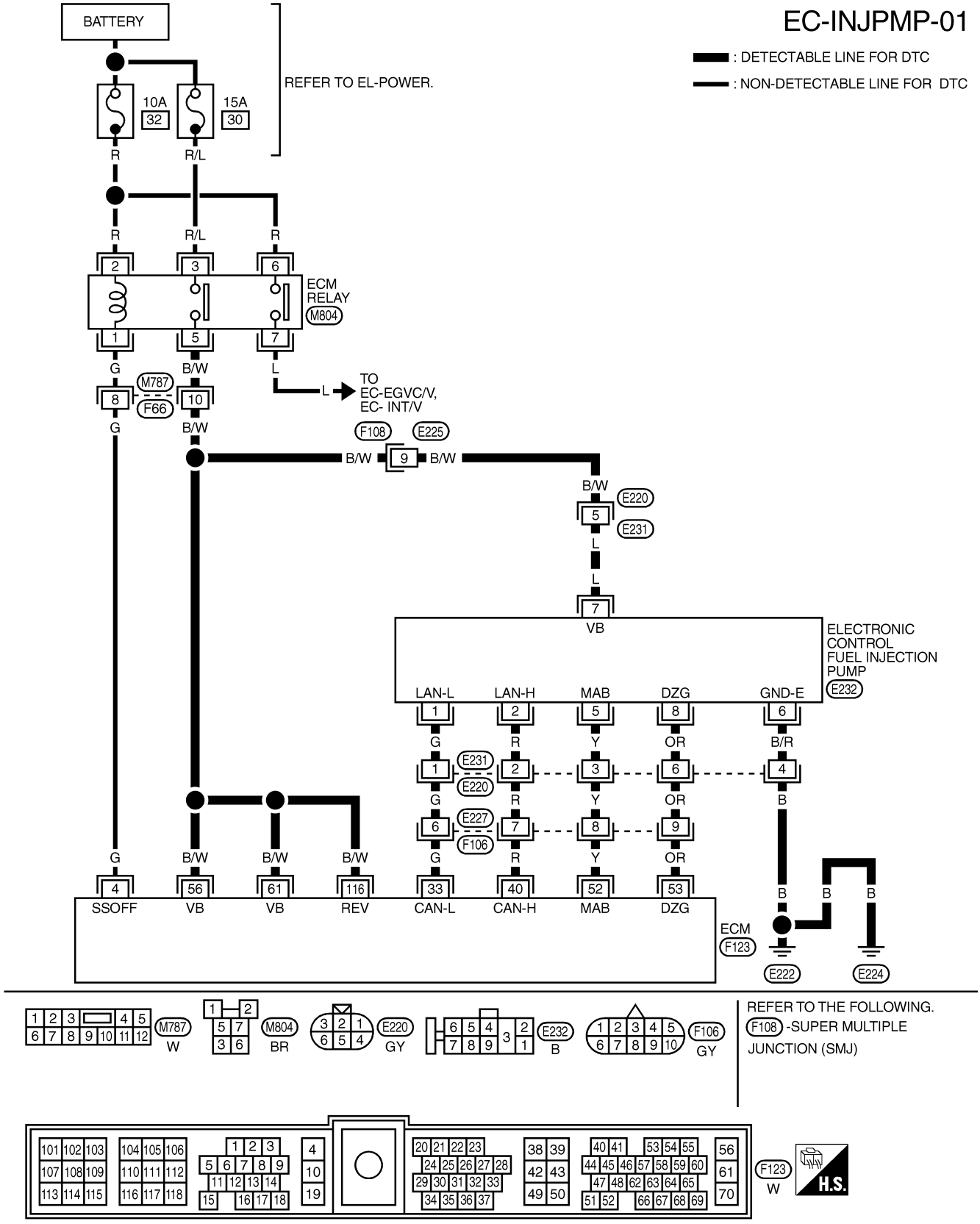
1) Turn ignition switch “ON” and wait at least 2 seconds.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Start engine and run it for at least 2 seconds at idle speed. (If engine does not run, turn ignition switch to “START” for at least 2 seconds.)
4) If DTC is detected, go to “Diagnostic Procedure”, EC-166.

WITHOUT CONSULT-II

1) Turn ignition switch “ON” and wait at least 2 seconds.
2) Start engine and run it for at least 2 seconds at idle speed. (If engine does not run, turn ignition switch to “START” for at least 2 seconds.)
3) Turn ignition switch “OFF”, wait at least 5 seconds and then turn “ON”.
4) Perform “Diagnostic Test Mode II (Self-diagnostic results)” with ECM.
5) If DTC is detected, go to “Diagnostic Procedure”, EC-166.

Wiring Diagram

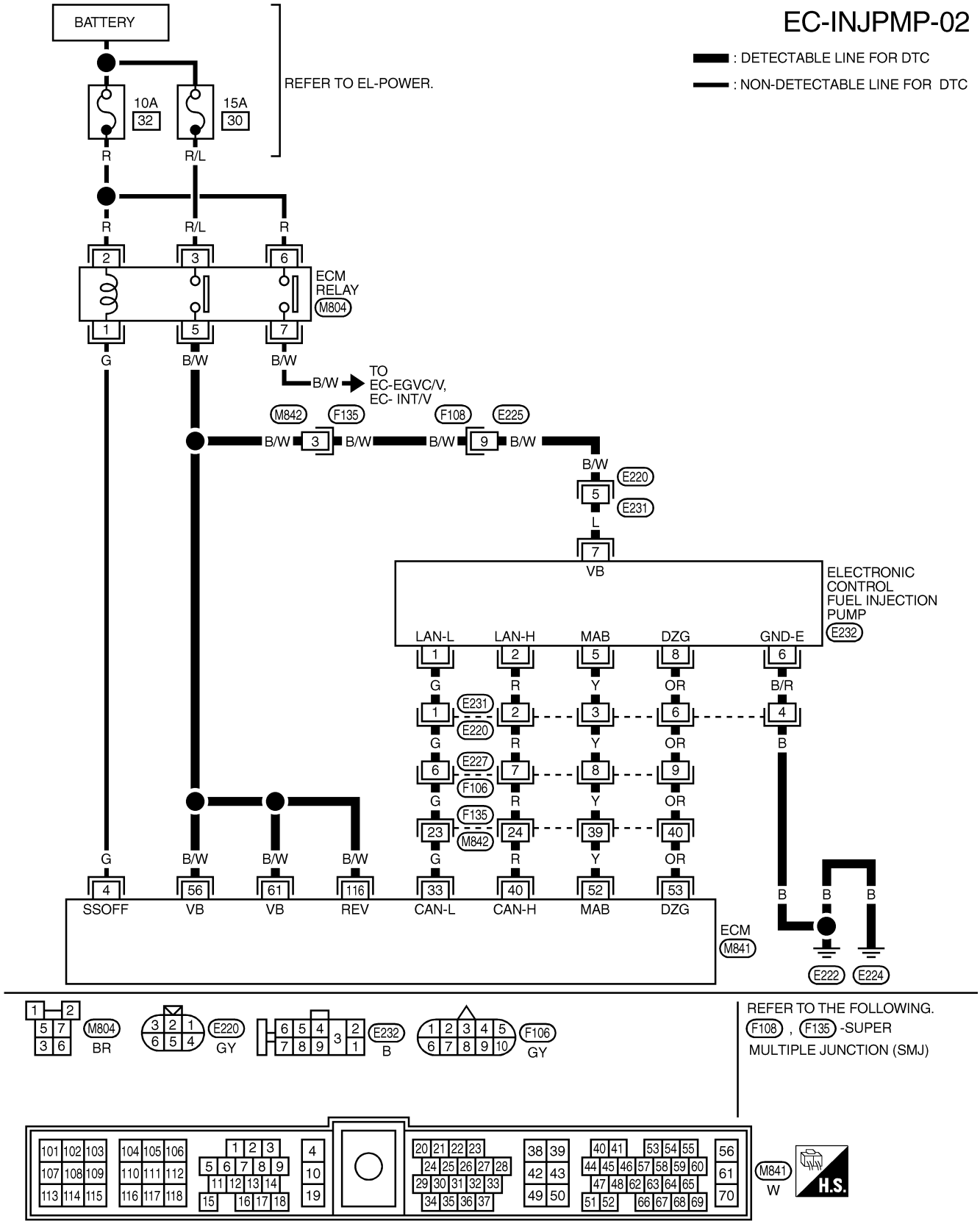
LHD MODELS



YEC181A

Wiring Diagram (Cont'd)

RHD MODELS

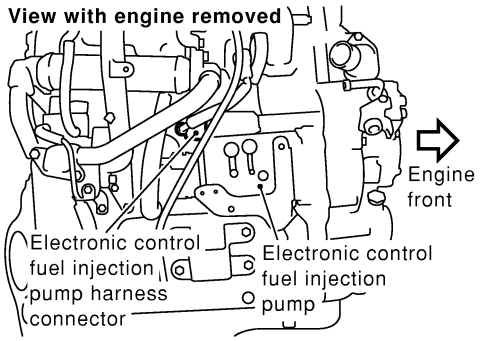


YEC182A

Diagnostic Procedure

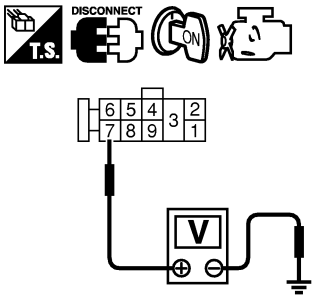
1	CHECK ELECTRONIC CONTROL FUEL INJECTION PUMP POWER SUPPLY CIRCUIT

1. Turn ignition switch “OFF”.
2. Disconnect electronic control fuel injection pump harness connector.



MEC025E

3. Turn ignition switch “ON”.
4. Check voltage between electronic control fuel injection pump terminal 7 and ground.



MEC977D

Voltage: Battery voltage

OK or NG

OK	▶	GO TO 3.
NG	▶	GO TO 2.

2	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors M787, F66
- Harness connectors F108, E225
- Harness connectors E220, E231
- Harness connectors M842, F135 (RHD models)
- Harness for open or short between electronic control fuel injection pump and ECM
- Harness for open or short between electronic control fuel injection pump and ECM relay

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

3	CHECK ELECTRONIC CONTROL FUEL INJECTION PUMP GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch “OFF”.
2. Check harness continuity between electronic control fuel injection pump terminal 6 and ground. Refer to Wiring Diagram.
   Continuity should exist.
3. Also check harness for short to ground and short to power.

OK or NG

OK	▶	GO TO 5.
NG	▶	GO TO 4.

Diagnostic Procedure (Cont'd)

4	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors E231, E220 ● Harness for open or short between electronic control fuel injection pump and engine ground	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

5	CHECK COMMUNICATION LINE FOR OPEN AND SHORT

1. Check continuity between the following terminals. Refer to Wiring Diagram.

Electronic control fuel injection pump	ECM
1	33
2	40
5	52
8	53

MTBL0444

Continuity should exist.

2. Also check harness for short to ground and short to power.

OK or NG

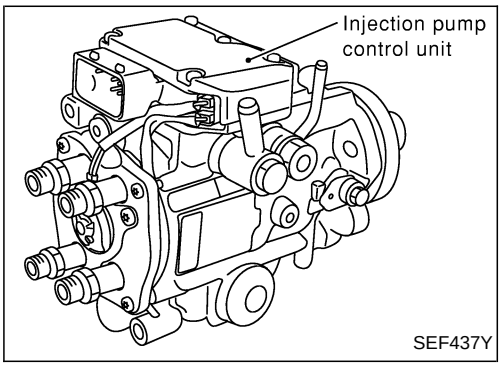
OK ▶	GO TO 7.
NG ▶	GO TO 6.

6	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors E231, E220 ● Harness connectors E227, F106 ● Harness connectors F135, M842 (RHD models) ● Harness for open or short between electronic control fuel injection pump and ECM	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

7	CHECK INTERMITTENT INCIDENT
Refer to "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78.	

OK or NG

OK ▶	Replace electronic control fuel injection pump.
NG ▶	Repair open circuit or short to ground or short to power in harness or connectors.



Description

SYSTEM DESCRIPTION

The ECM and the electronic control fuel injection pump control unit (abbreviated as the injection pump control unit) perform the real time communication (signal exchange).
The ECM transmits the signals of the target fuel injection amount, target fuel injection timing, and engine speed, etc., and receives the signals of the pump speed and fuel temperature, etc. from the injection pump control unit.
By those signals, the injection pump controls the optimum fuel injection amount and injection timing of the spill valve and timing control valve.
Injection pump control unit has an on board diagnostic system, which detects malfunctions related to sensors or actuators built-into electronic control fuel injection pump. These malfunction information are transferred through the line (circuit) from injection pump control unit to ECM.

FUEL INJECTION AMOUNT CONTROL

In accordance with the target fuel injection amount signal from the ECM, the injection amount is controlled by controlling the spill valve in the injection pump and by changing the needle opening time.

FUEL INJECTION TIMING CONTROL

Based on the target fuel injection timing signal from the ECM, the injection timing is controlled in accordance with the timer spring by performing the duty control of the timing control valve in the injection pump and by adjusting the pressure of the timer piston high pressure chamber.

FUEL TEMPERATURE SENSOR

The sensor detects the fuel temperature in the injection pump and calibrates the injection amount change by the fuel temperature.

CAM RING POSITION SENSOR

The sensor detects the passing of the protrusion on the sensor wheel in the injection pump by the semiconductor magnetic resistance element sensor. The cam ring position sensor synchronizes with the cam ring, and detects the actual advance amount. The injection pump control unit measures the injection pump revolution by the signal of the cam ring position sensor.

CONSULT-II Reference Value in Data Monitor Mode

Remarks: Specification data are reference values.

MONITOR ITEM	CONDITION		SPECIFICATION
FUEL TEMP SEN	● Engine: After warming up		More than 40°C (104°F)
SPILL/V	● Engine: After warming up		Approx. 13°CA
INJ TIMG C/V	● Engine: After warming up, idle the engine.		Approx. 50 - 70%
DECELER F/CUT	● Engine: After warming up	Idle	OFF
BARO SEN	● Ignition switch: ON		Altitude Approx. 0 m (0 ft): Approx. 100.62 kPa (1.0062 bar, 1.026 kg/cm^2, 14.59 psi) Approx. 1,000 m (3,281 ft): Approx. 88.95 kPa (0.8895 bar, 0.907 kg/cm^2, 12.90 psi) Approx. 1,500 m (4,992 ft): Approx. 83.16 kPa (0.8316 bar, 0.848 kg/cm^2, 12.06 psi) Approx. 2,000 m (6,562 ft): Approx. 78.36 kPa (0.7836 bar, 0.799 kg/cm^2, 11.36 psi)

ECM Terminals and Reference Value

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

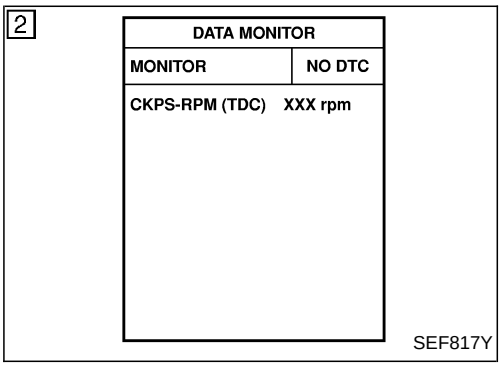
CAUTION:

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

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage)
33	G	Electronic control fuel injection pump	Engine is running. └ **Warm-up condition** Idle speed	Approximately 2.5V
40	R	Electronic control fuel injection pump	Engine is running. └ **Warm-up condition** Idle speed	Approximately 2.5V
52	Y	Electronic control fuel injection pump	Engine is running. └ Idle speed	Approximately 0.1V
53	OR	Electronic control fuel injection pump	Engine is running. └ Idle speed	Approximately 0.35V

On Board Diagnosis Logic

Malfunction is detected when	Check Items (Possible cause)
● Injection pump control unit input signal [Crankshaft position sensor (TDC) signal] processing function is malfunctioning.	● Harness or connectors (Electronic control fuel injection pump circuit is open or shorted.) ● Electronic control fuel injection pump



DTC Confirmation Procedure

WITH CONSULT-II

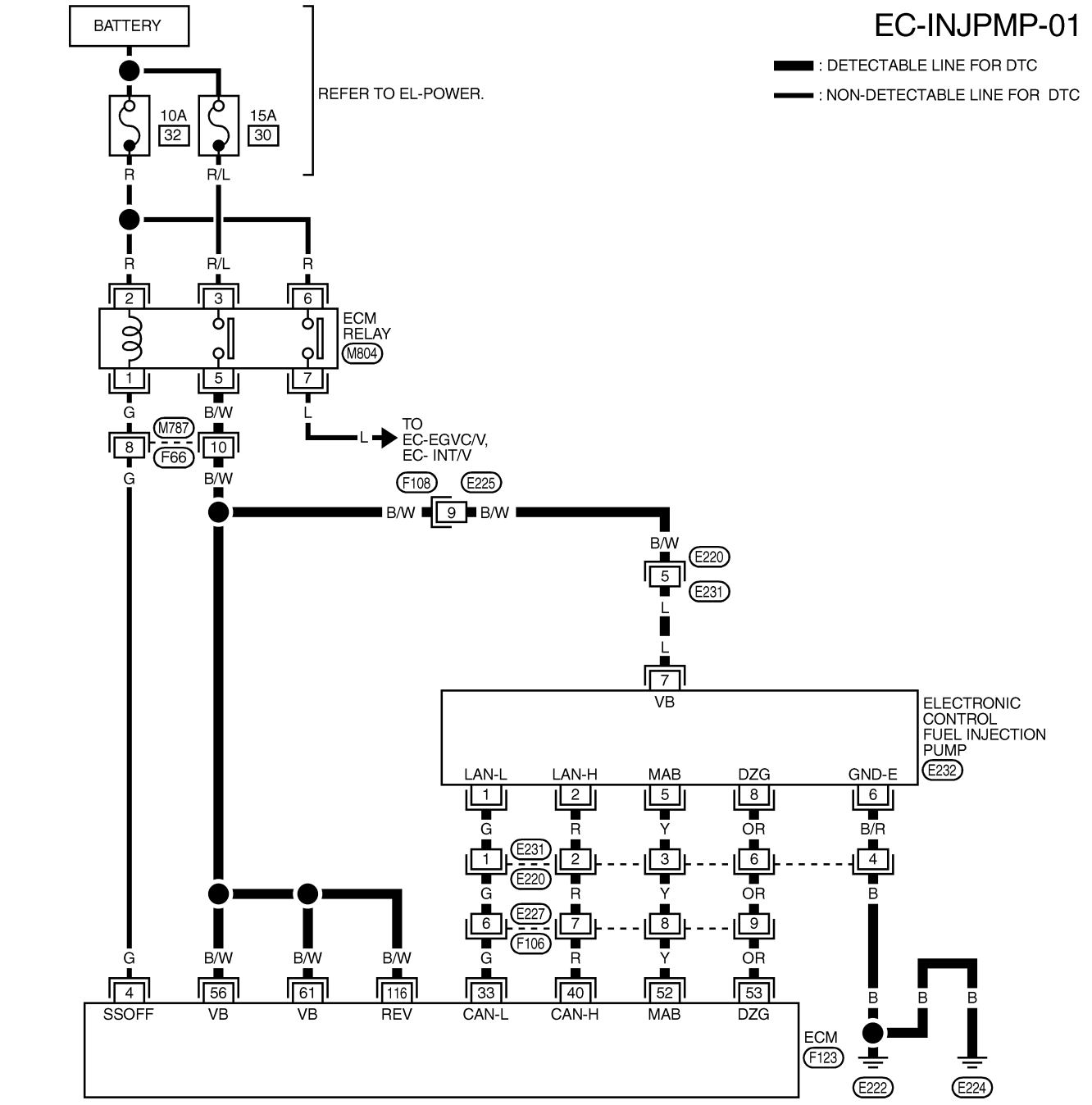
1) Turn ignition switch “ON” and wait at least 2 seconds.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Start engine and run it for at least 2 seconds at idle speed. (If engine does not run, turn ignition switch to “START” for at least 2 seconds.)
4) If DTC 0407 is detected, go to “Diagnostic procedure”, EC-149. If DTC 0702 is detected, go to “Diagnostic Procedure”, EC-173.

WITHOUT CONSULT-II

1) Turn ignition switch “ON” and wait at least 2 seconds.
2) Start engine and run it for at least 2 seconds at idle speed. (If engine does not run, turn ignition switch to “START” for at least 2 seconds.)
3) Turn ignition switch “OFF”, wait at least 5 seconds and then turn “ON”.
4) Perform “Diagnostic Test Mode II (Self-diagnostic results)” with ECM.
5) If DTC 0407 is detected, go to “Diagnostic Procedure”, EC-149. If DTC 0702 is detected, go to “Diagnostic Procedure”, EC-173.

Wiring Diagram

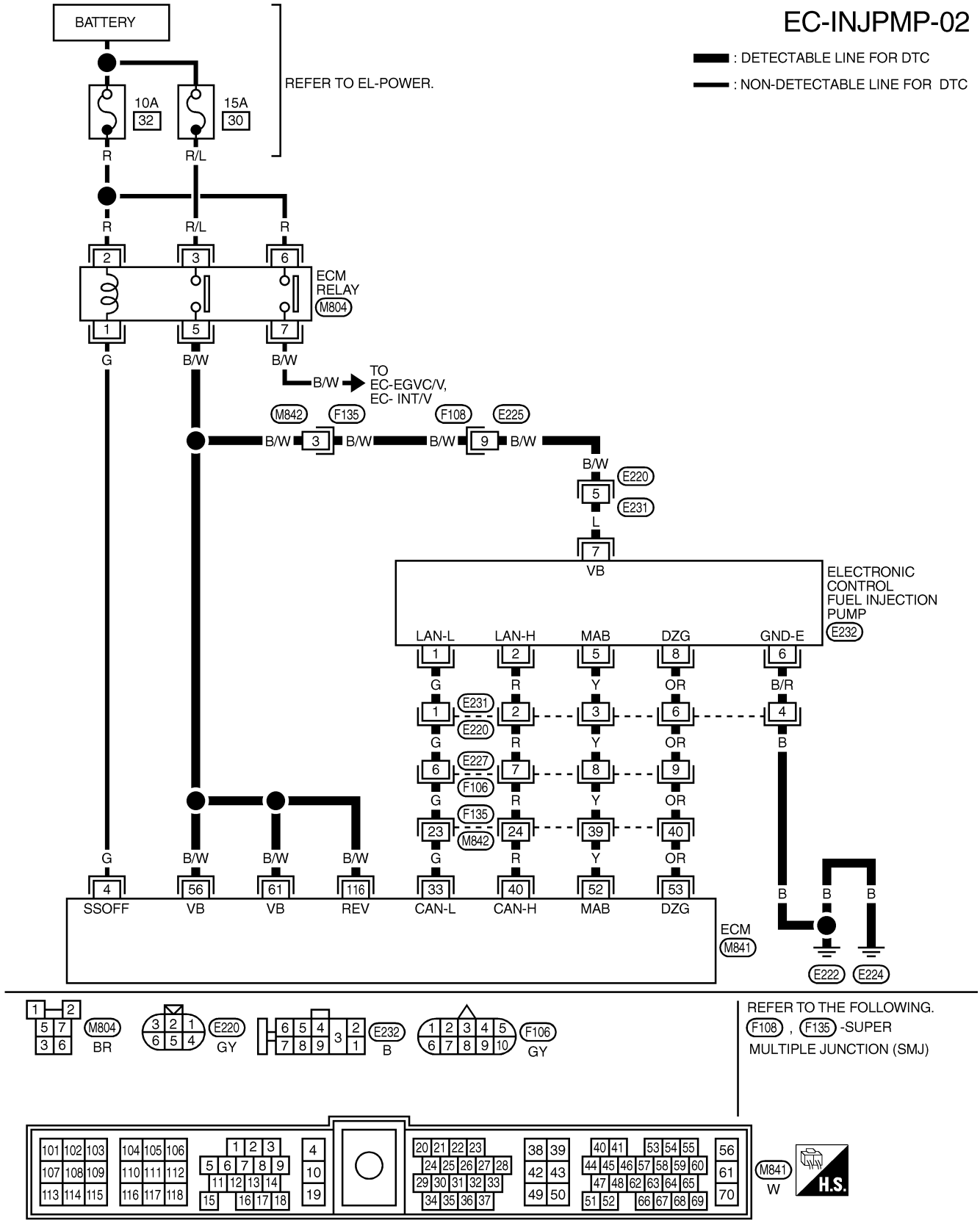
LHD MODELS



YEC181A

Wiring Diagram (Cont'd)

RHD MODELS

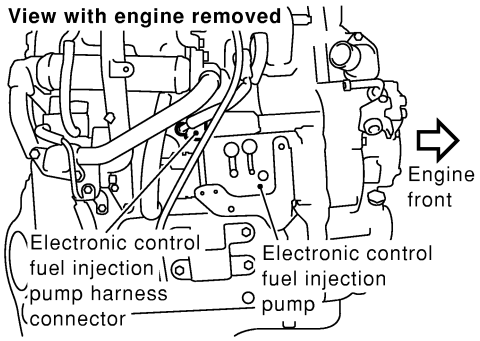


YEC182A

Diagnostic Procedure

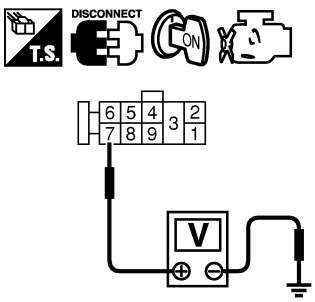
1	CHECK ELECTRONIC CONTROL FUEL INJECTION PUMP POWER SUPPLY CIRCUIT

1. Turn ignition switch “OFF”.
2. Disconnect electronic control fuel injection pump harness connector.



MEC025E

3. Turn ignition switch “ON”.
4. Check voltage between electronic control fuel injection pump terminal 7 and ground.



MEC977D

Voltage: Battery voltage

OK or NG

OK	▶	GO TO 3.
NG	▶	GO TO 2.

2	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors M787, F66 (LHD models)
- Harness connectors F108, E225
- Harness connectors E220, E231
- Harness connectors M842, F135 (RHD models)
- Harness for open or short between electronic control fuel injection pump and ECM
- Harness for open or short between electronic control fuel injection pump and ECM relay

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

3	CHECK ELECTRONIC CONTROL FUEL INJECTION PUMP GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch “OFF”.
2. Check harness continuity between electronic control fuel injection pump terminal 6 and ground. Refer to Wiring Diagram.
   Continuity should exist.
3. Also check harness for short to ground and short to power.

OK or NG

OK	▶	GO TO 5.
NG	▶	GO TO 4.

Diagnostic Procedure (Cont'd)

4	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors E231, E220 ● Harness for open or short between electronic control fuel injection pump and engine ground	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

5	CHECK COMMUNICATION LINE FOR OPEN AND SHORT

1. Check continuity between the following terminals. Refer to Wiring Diagram.

Electronic control fuel injection pump	ECM
1	33
2	40
5	52
8	53

MTBL0444

Continuity should exist.

2. Also check harness for short to ground and short to power.

OK or NG

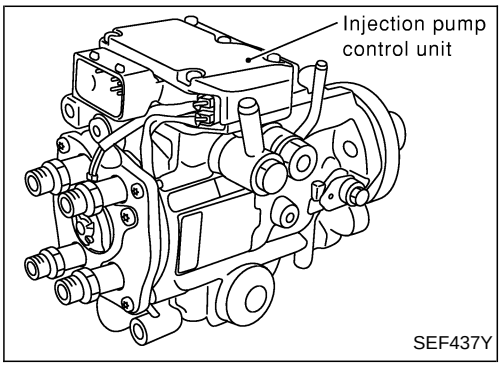
OK ▶	GO TO 7.
NG ▶	GO TO 6.

6	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors E231, E220 ● Harness connectors E227, F106 ● Harness connectors F135, M842 (RHD models) ● Harness for open or short between electronic control fuel injection pump and ECM	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

7	CHECK INTERMITTENT INCIDENT
Refer to "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78.	

OK or NG

OK ▶	Replace electronic control fuel injection pump.
NG ▶	Repair open circuit or short to ground or short to power in harness or connectors.



Description

SYSTEM DESCRIPTION

The ECM and the electronic control fuel injection pump control unit (abbreviated as the injection pump control unit) perform the real time communication (signal exchange).
The ECM transmits the signals of the target fuel injection amount, target fuel injection timing, and engine speed, etc., and receives the signals of the pump speed and fuel temperature, etc. from the injection pump control unit.
By those signals, the injection pump controls the optimum fuel injection amount and injection timing of the spill valve and timing control valve.
Injection pump control unit has an on board diagnostic system, which detects malfunctions related to sensors or actuators built-into electronic control fuel injection pump. These malfunction information are transferred through the line (circuit) from injection pump control unit to ECM.

FUEL INJECTION AMOUNT CONTROL

In accordance with the target fuel injection amount signal from the ECM, the injection amount is controlled by controlling the spill valve in the injection pump and by changing the needle opening time.

FUEL INJECTION TIMING CONTROL

Based on the target fuel injection timing signal from the ECM, the injection timing is controlled in accordance with the timer spring by performing the duty control of the timing control valve in the injection pump and by adjusting the pressure of the timer piston high pressure chamber.

FUEL TEMPERATURE SENSOR

The sensor detects the fuel temperature in the injection pump and calibrates the injection amount change by the fuel temperature.

CAM RING POSITION SENSOR

The sensor detects the passing of the protrusion on the sensor wheel in the injection pump by the semiconductor magnetic resistance element sensor. The cam ring position sensor synchronizes with the cam ring, and detects the actual advance amount. The injection pump control unit measures the injection pump revolution by the signal of the cam ring position sensor.

CONSULT-II Reference Value in Data Monitor Mode

Remarks: Specification data are reference values.

MONITOR ITEM	CONDITION		SPECIFICATION
FUEL TEMP SEN	● Engine: After warming up		More than 40°C (104°F)
SPILL/V	● Engine: After warming up		Approx. 13°CA
INJ TIMG C/V	● Engine: After warming up, idle the engine.		Approx. 50 - 70%
DECELER F/CUT	● Engine: After warming up	Idle	OFF
BARO SEN	● Ignition switch: ON		Altitude Approx. 0 m (0 ft): Approx. 100.62 kPa (1.0062 bar, 1.026 kg/cm^2, 14.59 psi) Approx. 1,000 m (3,281 ft): Approx. 88.95 kPa (0.8895 bar, 0.907 kg/cm^2, 12.90 psi) Approx. 1,500 m (4,992 ft): Approx. 83.16 kPa (0.8316 bar, 0.848 kg/cm^2, 12.06 psi) Approx. 2,000 m (6,562 ft): Approx. 78.36 kPa (0.7836 bar, 0.799 kg/cm^2, 11.36 psi)

ECM Terminals and Reference Value

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

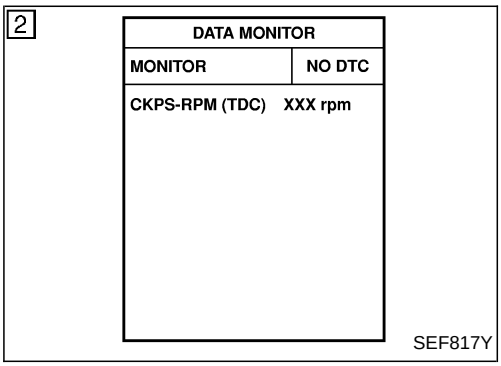
CAUTION:

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

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage)
33	G	Electronic control fuel injection pump	Engine is running. └ **Warm-up condition** Idle speed	Approximately 2.5V
40	R	Electronic control fuel injection pump	Engine is running. └ **Warm-up condition** Idle speed	Approximately 2.5V
52	Y	Electronic control fuel injection pump	Engine is running. └ Idle speed	Approximately 0.1V
53	OR	Electronic control fuel injection pump	Engine is running. └ Idle speed	Approximately 0.35V

On Board Diagnosis Logic

Malfunction is detected when	Check Items (Possible cause)
● Injection pump control unit receives incorrect voltage signal from ECM continuously.	● Harness or connectors (Electronic control fuel injection pump circuit is open or shorted.) ● Electronic control fuel injection pump



DTC Confirmation Procedure

WITH CONSULT-II

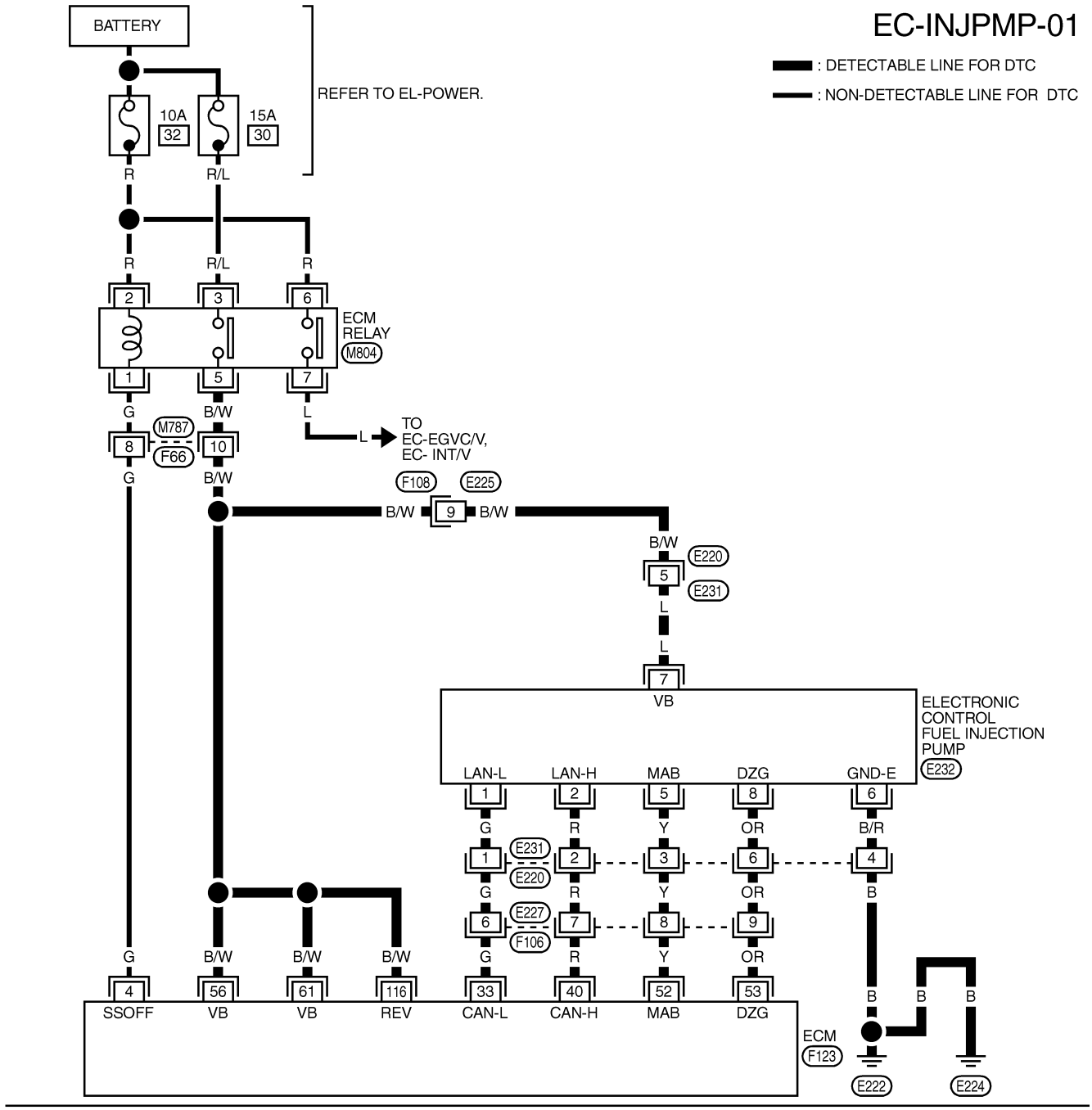
1) Turn ignition switch “ON” and wait at least 2 seconds.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Start engine and run it for at least 2 seconds at idle speed. (If engine does not run, turn ignition switch to “START” for at least 2 seconds.)
4) If DTC is detected, go to “Diagnostic Procedure”, EC-180.

WITHOUT CONSULT-II

1) Turn ignition switch “ON” and wait at least 2 seconds.
2) Start engine and run it for at least 2 seconds at idle speed. (If engine does not run, turn ignition switch to “START” for at least 2 seconds.)
3) Turn ignition switch “OFF”, wait at least 5 seconds and then turn “ON”.
4) Perform “Diagnostic Test Mode II (Self-diagnostic results)” with ECM.
5) If DTC is detected, go to “Diagnostic Procedure”, EC-180.

Wiring Diagram

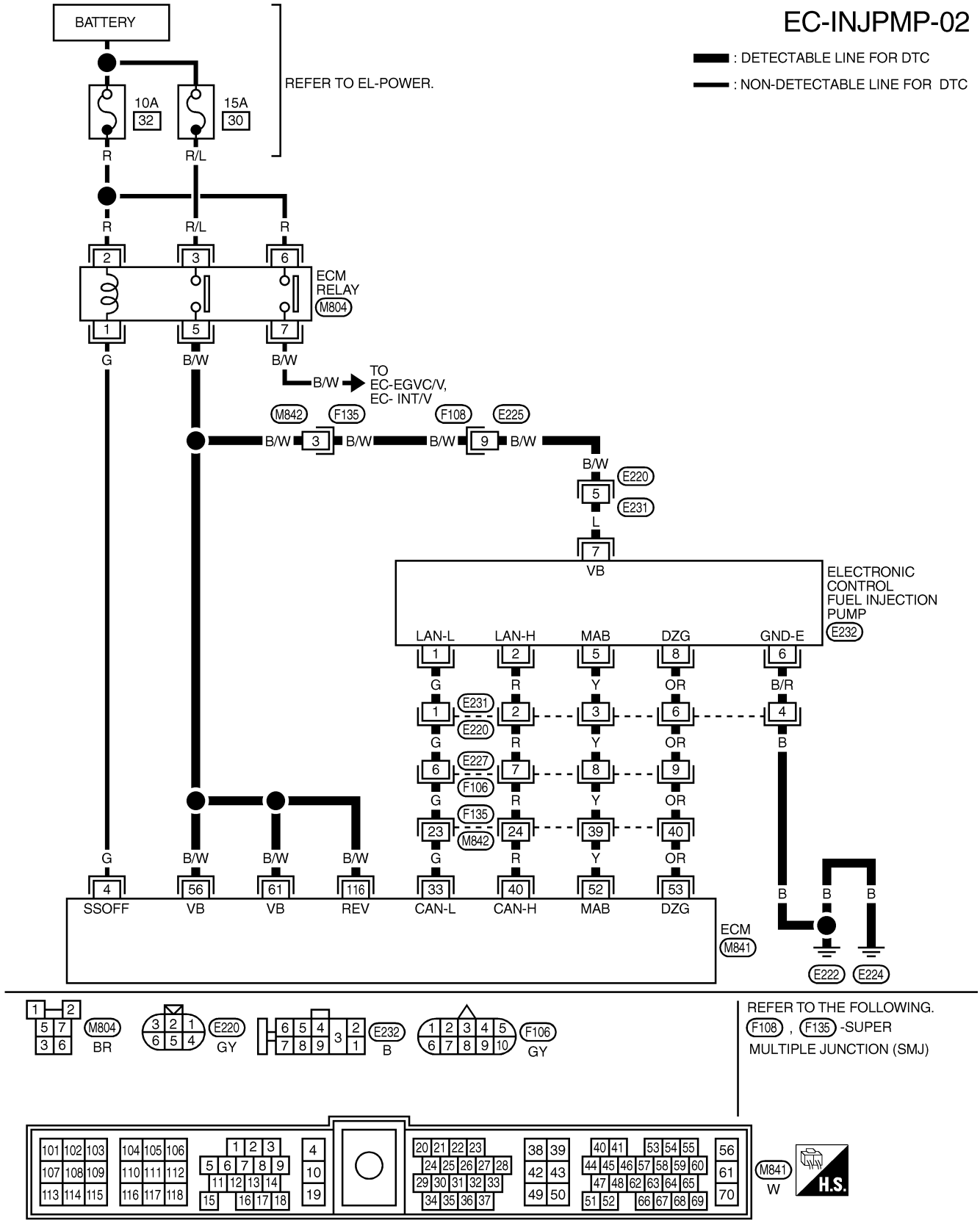
LHD MODELS



YEC181A

Wiring Diagram (Cont'd)

RHD MODELS

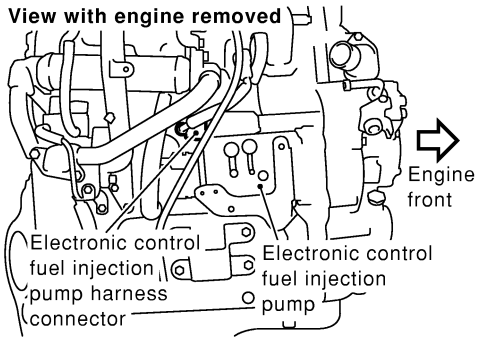


YEC182A

Diagnostic Procedure

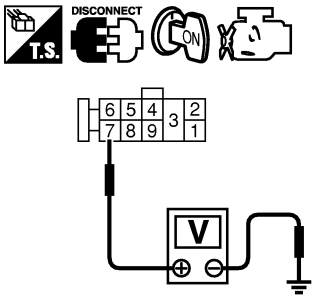
1	CHECK ELECTRONIC CONTROL FUEL INJECTION PUMP POWER SUPPLY CIRCUIT

1. Turn ignition switch “OFF”.
2. Disconnect electronic control fuel injection pump harness connector.



MEC025E

3. Turn ignition switch “ON”.
4. Check voltage between electronic control fuel injection pump terminal 7 and ground.



MEC977D

Voltage: Battery voltage

OK or NG

OK	▶	GO TO 3.
NG	▶	GO TO 2.

2	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors M787, F66 (LHD models)
- Harness connectors F108, E225
- Harness connectors E220, E231
- Harness connectors M842, F135 (RHD models)
- Harness for open or short between electronic control fuel injection pump and ECM
- Harness for open or short between electronic control fuel injection pump and ECM relay

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

3	CHECK ELECTRONIC CONTROL FUEL INJECTION PUMP GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch “OFF”.
2. Check harness continuity between electronic control fuel injection pump terminal 6 and ground. Refer to Wiring Diagram.
   Continuity should exist.
3. Also check harness for short to ground and short to power.

OK or NG

OK	▶	GO TO 5.
NG	▶	GO TO 4.

Diagnostic Procedure (Cont'd)

4	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors E231, E220 ● Harness for open or short between electronic control fuel injection pump and engine ground	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

5	CHECK COMMUNICATION LINE FOR OPEN AND SHORT

1. Check continuity between the following terminals. Refer to Wiring Diagram.

Electronic control fuel injection pump	ECM
1	33
2	40
5	52
8	53

MTBL0444

Continuity should exist.

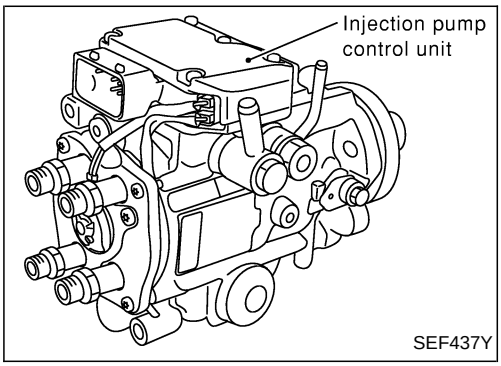
2. Also check harness for short to ground and short to power.

OK or NG

OK ▶	GO TO 7.
NG ▶	GO TO 6.

6	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors E227, F106 ● Harness connectors E231, E220 ● Harness connectors F135, M842 (RHD models) ● Harness for open or short between electronic control fuel injection pump and ECM	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

7	CHECK INTERMITTENT INCIDENT
Refer to "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78. **OK or NG**	
OK ▶	Replace electronic control fuel injection pump.
NG ▶	Repair open circuit or short to ground or short to power in harness or connectors.



Description

SYSTEM DESCRIPTION

The ECM and the electronic control fuel injection pump control unit (abbreviated as the injection pump control unit) perform the real time communication (signal exchange).
The ECM transmits the signals of the target fuel injection amount, target fuel injection timing, and engine speed, etc., and receives the signals of the pump speed and fuel temperature, etc. from the injection pump control unit.
By those signals, the injection pump controls the optimum fuel injection amount and injection timing of the spill valve and timing control valve.
Injection pump control unit has an on board diagnostic system, which detects malfunctions related to sensors or actuators built-into electronic control fuel injection pump. These malfunction information are transferred through the line (circuit) from injection pump control unit to ECM.

FUEL INJECTION AMOUNT CONTROL

In accordance with the target fuel injection amount signal from the ECM, the injection amount is controlled by controlling the spill valve in the injection pump and by changing the needle opening time.

FUEL INJECTION TIMING CONTROL

Based on the target fuel injection timing signal from the ECM, the injection timing is controlled in accordance with the timer spring by performing the duty control of the timing control valve in the injection pump and by adjusting the pressure of the timer piston high pressure chamber.

FUEL TEMPERATURE SENSOR

The sensor detects the fuel temperature in the injection pump and calibrates the injection amount change by the fuel temperature.

CAM RING POSITION SENSOR

The sensor detects the passing of the protrusion on the sensor wheel in the injection pump by the semiconductor magnetic resistance element sensor. The cam ring position sensor synchronizes with the cam ring, and detects the actual advance amount. The injection pump control unit measures the injection pump revolution by the signal of the cam ring position sensor.

CONSULT-II Reference Value in Data Monitor Mode

Remarks: Specification data are reference values.

MONITOR ITEM	CONDITION		SPECIFICATION
FUEL TEMP SEN	● Engine: After warming up		More than 40°C (104°F)
SPILL/V	● Engine: After warming up		Approx. 13°CA
INJ TIMG C/V	● Engine: After warming up, idle the engine.		Approx. 50 - 70%
DECELER F/CUT	● Engine: After warming up	Idle	OFF
BARO SEN	● Ignition switch: ON		Altitude Approx. 0 m (0 ft): Approx. 100.62 kPa (1.0062 bar, 1.026 kg/cm^2, 14.59 psi) Approx. 1,000 m (3,281 ft): Approx. 88.95 kPa (0.8895 bar, 0.907 kg/cm^2, 12.90 psi) Approx. 1,500 m (4,992 ft): Approx. 83.16 kPa (0.8316 bar, 0.848 kg/cm^2, 12.06 psi) Approx. 2,000 m (6,562 ft): Approx. 78.36 kPa (0.7836 bar, 0.799 kg/cm^2, 11.36 psi)

ECM Terminals and Reference Value

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

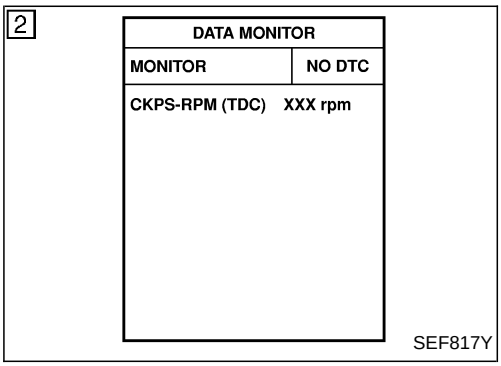
CAUTION:

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

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage)
33	G	Electronic control fuel injection pump	Engine is running. └ **Warm-up condition** Idle speed	Approximately 2.5V
40	R	Electronic control fuel injection pump	Engine is running. └ **Warm-up condition** Idle speed	Approximately 2.5V
52	Y	Electronic control fuel injection pump	Engine is running. └ Idle speed	Approximately 0.1V
53	OR	Electronic control fuel injection pump	Engine is running. └ Idle speed	Approximately 0.35V

On Board Diagnosis Logic

Malfunction is detected when	Check Items (Possible cause)
● Spill valve (Built-into electronic control fuel injection pump) does not function properly.	● Harness or connectors (Electronic control fuel injection pump circuit is open or shorted.) ● Electronic control fuel injection pump



DTC Confirmation Procedure

WITH CONSULT-II

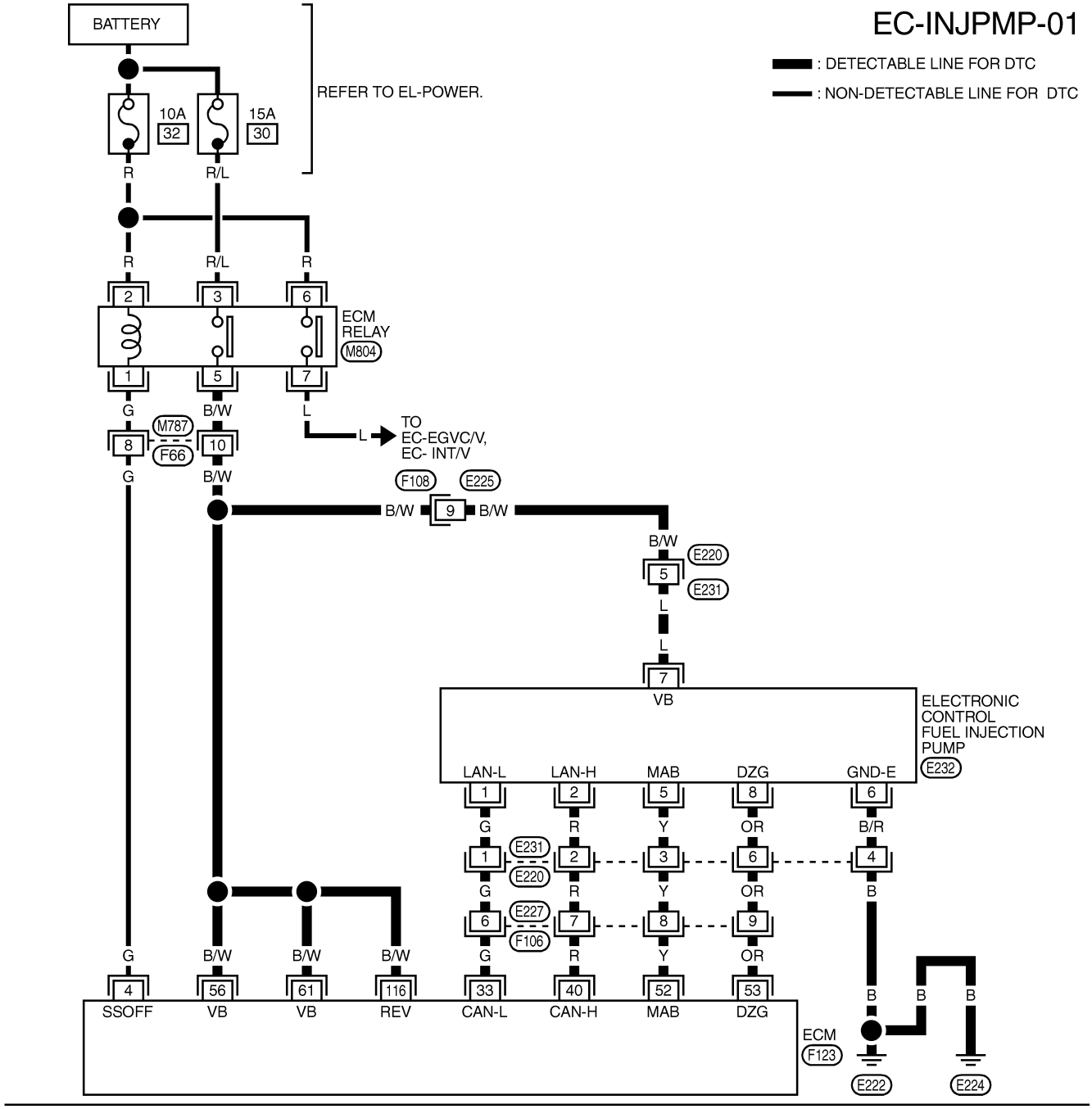
1) Turn ignition switch “ON” and wait at least 2 seconds.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Start engine and run it for at least 2 seconds at idle speed. (If engine does not run, turn ignition switch to “START” for at least 2 seconds.)
4) If DTC is detected, go to “Diagnostic Procedure”, EC-187.

WITHOUT CONSULT-II

1) Turn ignition switch “ON” and wait at least 2 seconds.
2) Start engine and run it for at least 2 seconds at idle speed. (If engine does not run, turn ignition switch to “START” for at least 2 seconds.)
3) Turn ignition switch “OFF”, wait at least 5 seconds and then turn “ON”.
4) Perform “Diagnostic Test Mode II (Self-diagnostic results)” with ECM.
5) If DTC is detected, go to “Diagnostic Procedure”, EC-187.

Wiring Diagram

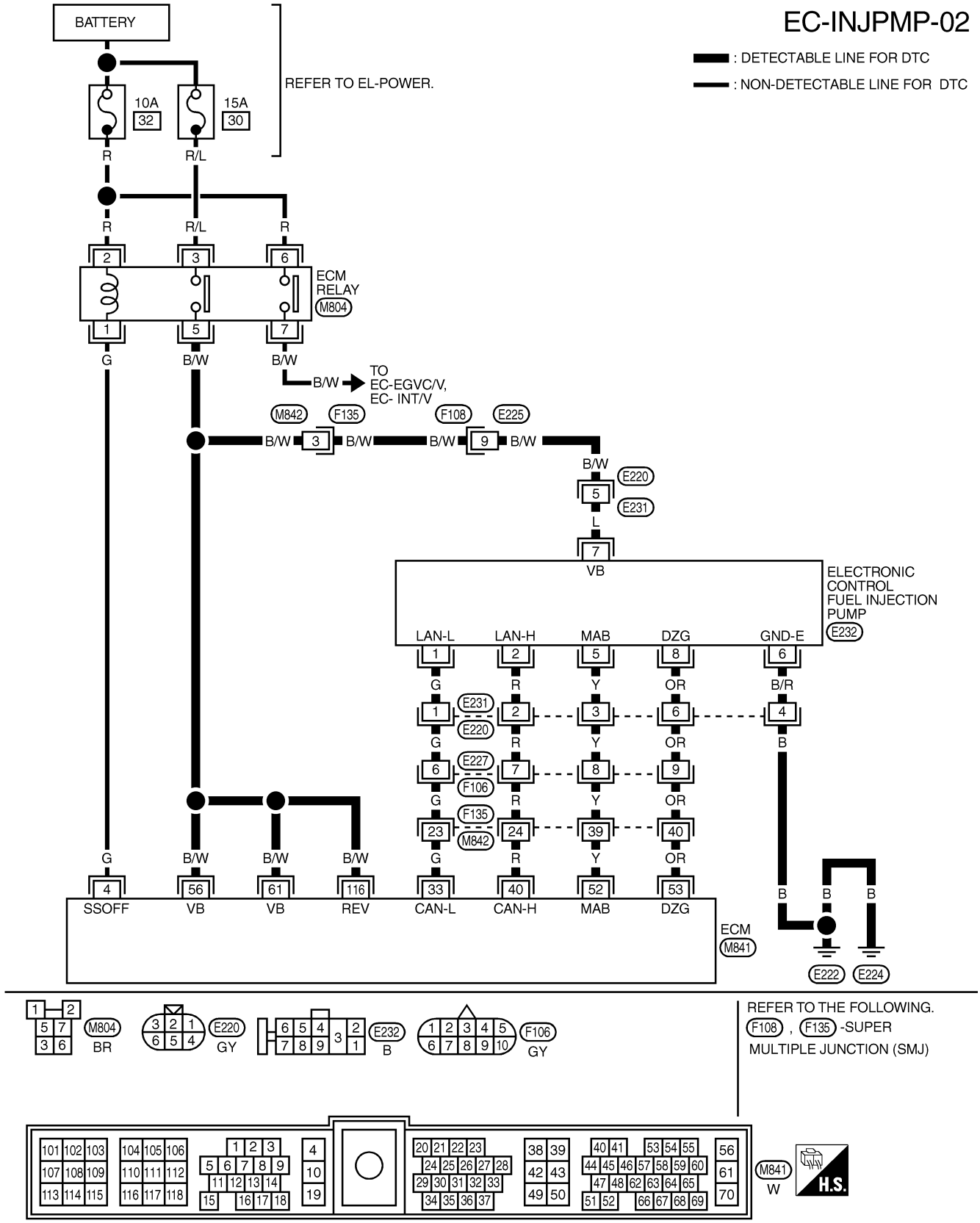
LHD MODELS



YEC181A

Wiring Diagram (Cont'd)

RHD MODELS

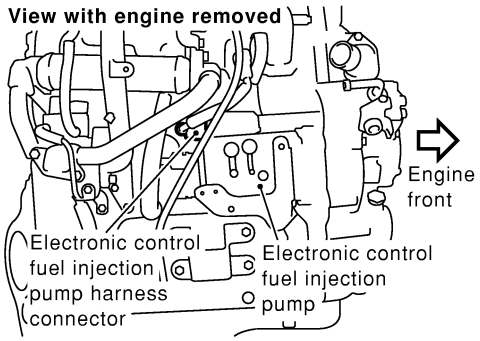


YEC182A

Diagnostic Procedure

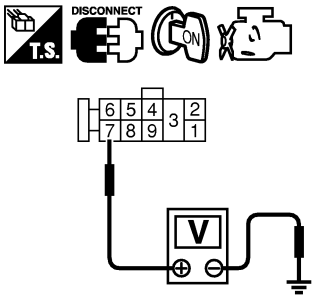
1	CHECK ELECTRONIC CONTROL FUEL INJECTION PUMP POWER SUPPLY CIRCUIT

1. Turn ignition switch “OFF”.
2. Disconnect electronic control fuel injection pump harness connector.



MEC025E

3. Turn ignition switch “ON”.
4. Check voltage between electronic control fuel injection pump terminal 7 and ground.



MEC977D

Voltage: Battery voltage

OK or NG

OK	▶	GO TO 3.
NG	▶	GO TO 2.

2	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors M787, F66 (LHD models)
- Harness connectors F108, E225
- Harness connectors E220, E231
- Harness connectors M842, F135 (RHD models)
- Harness for open or short between electronic control fuel injection pump and ECM
- Harness for open or short between electronic control fuel injection pump and ECM relay

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

3	CHECK ELECTRONIC CONTROL FUEL INJECTION PUMP GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch “OFF”.
2. Check harness continuity between electronic control fuel injection pump terminal 6 and ground. Refer to Wiring Diagram.
   Continuity should exist.
3. Also check harness for short to ground and short to power.

OK or NG

OK	▶	GO TO 5.
NG	▶	GO TO 4.

Diagnostic Procedure (Cont'd)

4	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors E231, E220 ● Harness for open or short between electronic control fuel injection pump and engine ground	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

5	CHECK COMMUNICATION LINE FOR OPEN AND SHORT

1. Check continuity between the following terminals. Refer to Wiring Diagram.

Electronic control fuel injection pump	ECM
1	33
2	40
5	52
8	53

MTBL0444

Continuity should exist.

2. Also check harness for short to ground and short to power.

OK or NG

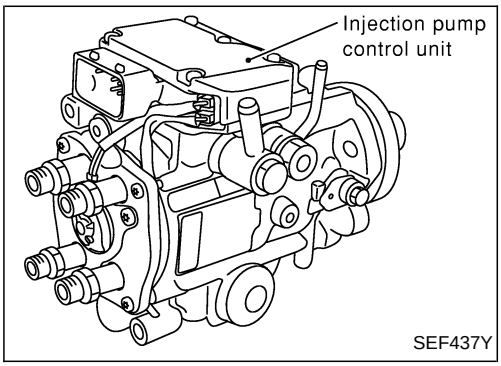
OK ▶	GO TO 7.
NG ▶	GO TO 6.

6	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors E231, E220 ● Harness connectors E227, F106 ● Harness connectors F135, M842 (RHD models) ● Harness for open or short between electronic control fuel injection pump and ECM	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

7	CHECK INTERMITTENT INCIDENT
Refer to "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78.	

OK or NG

OK ▶	Replace electronic control fuel injection pump.
NG ▶	Repair open circuit or short to ground or short to power in harness or connectors.



Description

SYSTEM DESCRIPTION

The ECM and the electronic control fuel injection pump control unit (abbreviated as the injection pump control unit) perform the real time communication (signal exchange).
The ECM transmits the signals of the target fuel injection amount, target fuel injection timing, and engine speed, etc., and receives the signals of the pump speed and fuel temperature, etc. from the injection pump control unit.
By those signals, the injection pump controls the optimum fuel injection amount and injection timing of the spill valve and timing control valve.
Injection pump control unit has an on board diagnostic system, which detects malfunctions related to sensors or actuators built-into electronic control fuel injection pump. These malfunction information are transferred through the line (circuit) from injection pump control unit to ECM.

FUEL INJECTION AMOUNT CONTROL

In accordance with the target fuel injection amount signal from the ECM, the injection amount is controlled by controlling the spill valve in the injection pump and by changing the needle opening time.

FUEL INJECTION TIMING CONTROL

Based on the target fuel injection timing signal from the ECM, the injection timing is controlled in accordance with the timer spring by performing the duty control of the timing control valve in the injection pump and by adjusting the pressure of the timer piston high pressure chamber.

FUEL TEMPERATURE SENSOR

The sensor detects the fuel temperature in the injection pump and calibrates the injection amount change by the fuel temperature.

CAM RING POSITION SENSOR

The sensor detects the passing of the protrusion on the sensor wheel in the injection pump by the semiconductor magnetic resistance element sensor. The cam ring position sensor synchronizes with the cam ring, and detects the actual advance amount. The injection pump control unit measures the injection pump revolution by the signal of the cam ring position sensor.

CONSULT-II Reference Value in Data Monitor Mode

Remarks: Specification data are reference values.

MONITOR ITEM	CONDITION		SPECIFICATION
FUEL TEMP SEN	● Engine: After warming up		More than 40°C (104°F)
SPILL/V	● Engine: After warming up		Approx. 13°CA
INJ TIMG C/V	● Engine: After warming up, idle the engine.		Approx. 50 - 70%
DECELER F/CUT	● Engine: After warming up	Idle	OFF
BARO SEN	● Ignition switch: ON		Altitude Approx. 0 m (0 ft): Approx. 100.62 kPa (1.0062 bar, 1.026 kg/cm^2, 14.59 psi) Approx. 1,000 m (3,281 ft): Approx. 88.95 kPa (0.8895 bar, 0.907 kg/cm^2, 12.90 psi) Approx. 1,500 m (4,992 ft): Approx. 83.16 kPa (0.8316 bar, 0.848 kg/cm^2, 12.06 psi) Approx. 2,000 m (6,562 ft): Approx. 78.36 kPa (0.7836 bar, 0.799 kg/cm^2, 11.36 psi)

ECM Terminals and Reference Value

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

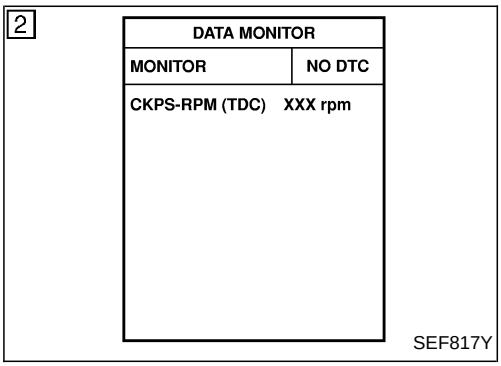
CAUTION:

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

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage)
33	G	Electronic control fuel injection pump	Engine is running. └ **Warm-up condition** Idle speed	Approximately 2.5V
40	R	Electronic control fuel injection pump	Engine is running. └ **Warm-up condition** Idle speed	Approximately 2.5V
52	Y	Electronic control fuel injection pump	Engine is running. └ Idle speed	Approximately 0.1V
53	OR	Electronic control fuel injection pump	Engine is running. └ Idle speed	Approximately 0.35V

On Board Diagnosis Logic

Malfunction is detected when	Check Items (Possible cause)
● Injection pump control unit does not function properly.	● Electronic control fuel injection pump



DTC Confirmation Procedure

WITH CONSULT-II

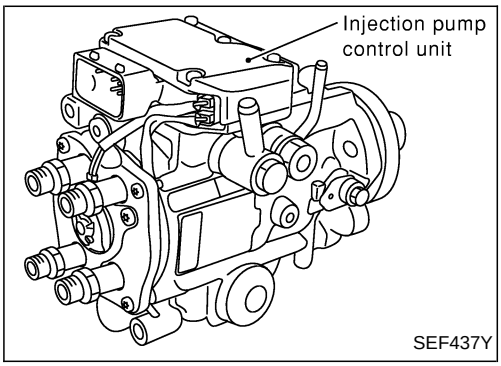
1) Turn ignition switch “ON” and wait at least 2 seconds.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Start engine and run it for at least 2 seconds at idle speed. (If engine does not run, turn ignition switch to “START” for at least 2 seconds.)
4) If DTC is detected, go to “Diagnostic Procedure”, EC-191.

WITHOUT CONSULT-II

1) Turn ignition switch “ON” and wait at least 2 seconds.
2) Start engine and run it for at least 2 seconds at idle speed. (If engine does not run, turn ignition switch to “START” for at least 2 seconds.)
3) Turn ignition switch “OFF”, wait at least 5 seconds and then turn “ON”.
4) Perform “Diagnostic Test Mode II (Self-diagnostic results)” with ECM.
5) If DTC is detected, go to “Diagnostic Procedure”, EC-191.

Diagnostic Procedure

1	INSPECTION START
With CONSULT-II 1. Turn ignition switch “ON”. 2. Select “SELF DIAG RESULTS” mode with CONSULT-II. 3. Touch “ERASE”. 4. Perform “DTC Confirmation Procedure”, EC-191, again. 5. Is the malfunction displayed again?	
Without CONSULT-II 1. Turn ignition switch “ON”. 2. Erase the Diagnostic Test Mode II (Self-diagnostic results) memory. 3. Perform “DTC Confirmation Procedure”, EC-191, again. 4. Perform “Diagnostic Test Mode II (Self-diagnostic results)”. 5. Is the DTC 0705 displayed again?	
Yes or No	
Yes ▶	Replace electronic control fuel injection pump.
No ▶	**INSPECTION END**



Description

SYSTEM DESCRIPTION

The ECM and the electronic control fuel injection pump control unit (abbreviated as the injection pump control unit) perform the real time communication (signal exchange).
The ECM transmits the signals of the target fuel injection amount, target fuel injection timing, and engine speed, etc., and receives the signals of the pump speed and fuel temperature, etc. from the injection pump control unit.
By those signals, the injection pump controls the optimum fuel injection amount and injection timing of the spill valve and timing control valve.
Injection pump control unit has an on board diagnostic system, which detects malfunctions related to sensors or actuators built-into electronic control fuel injection pump. These malfunction information are transferred through the line (circuit) from injection pump control unit to ECM.

FUEL INJECTION AMOUNT CONTROL

In accordance with the target fuel injection amount signal from the ECM, the injection amount is controlled by controlling the spill valve in the injection pump and by changing the needle opening time.

FUEL INJECTION TIMING CONTROL

Based on the target fuel injection timing signal from the ECM, the injection timing is controlled in accordance with the timer spring by performing the duty control of the timing control valve in the injection pump and by adjusting the pressure of the timer piston high pressure chamber.

FUEL TEMPERATURE SENSOR

The sensor detects the fuel temperature in the injection pump and calibrates the injection amount change by the fuel temperature.

CAM RING POSITION SENSOR

The sensor detects the passing of the protrusion on the sensor wheel in the injection pump by the semiconductor magnetic resistance element sensor. The cam ring position sensor synchronizes with the cam ring, and detects the actual advance amount. The injection pump control unit measures the injection pump revolution by the signal of the cam ring position sensor.

CONSULT-II Reference Value in Data Monitor Mode

Remarks: Specification data are reference values.

MONITOR ITEM	CONDITION		SPECIFICATION
FUEL TEMP SEN	● Engine: After warming up		More than 40°C (104°F)
SPILL/V	● Engine: After warming up		Approx. 13°CA
INJ TIMG C/V	● Engine: After warming up, idle the engine.		Approx. 50 - 70%
DECELER F/CUT	● Engine: After warming up	Idle	OFF
BARO SEN	● Ignition switch: ON		Altitude Approx. 0 m (0 ft): Approx. 100.62 kPa (1.0062 bar, 1.026 kg/cm^2, 14.59 psi) Approx. 1,000 m (3,281 ft): Approx. 88.95 kPa (0.8895 bar, 0.907 kg/cm^2, 12.90 psi) Approx. 1,500 m (4,992 ft): Approx. 83.16 kPa (0.8316 bar, 0.848 kg/cm^2, 12.06 psi) Approx. 2,000 m (6,562 ft): Approx. 78.36 kPa (0.7836 bar, 0.799 kg/cm^2, 11.36 psi)

ECM Terminals and Reference Value

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

CAUTION:

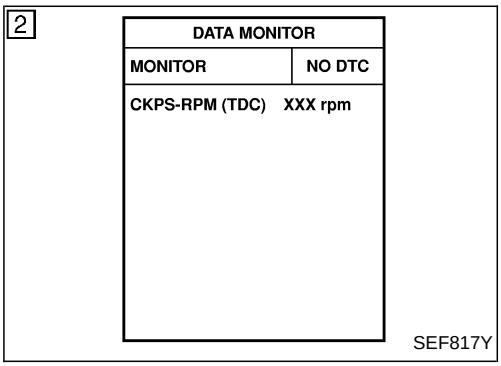
Do not use ECM ground terminals when measuring input/output voltage. Doing so may damage the ECM's transistor. Use a ground other than ECM terminals, such as the ground.

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage)
33	G	Electronic control fuel injection pump	Engine is running. └ **Warm-up condition** Idle speed	Approximately 2.5V
40	R	Electronic control fuel injection pump	Engine is running. └ **Warm-up condition** Idle speed	Approximately 2.5V
52	Y	Electronic control fuel injection pump	Engine is running. └ Idle speed	Approximately 0.1V
53	OR	Electronic control fuel injection pump	Engine is running. └ Idle speed	Approximately 0.35V

On Board Diagnosis Logic

Malfunction is detected when	Check Items (Possible cause)
● Fuel injection timing control system does not function properly.	● Harness or connectors (Electronic control fuel injection pump circuit is open or shorted.) ● Electronic control fuel injection pump ● Improper fuel quality ● "INJ TIMING" in "ACTIVE TEST" mode with CONSULT-II.*

*: When using this item, DTC may be detected. If so, erase it because it is not a malfunction.



DTC Confirmation Procedure

WITH CONSULT-II

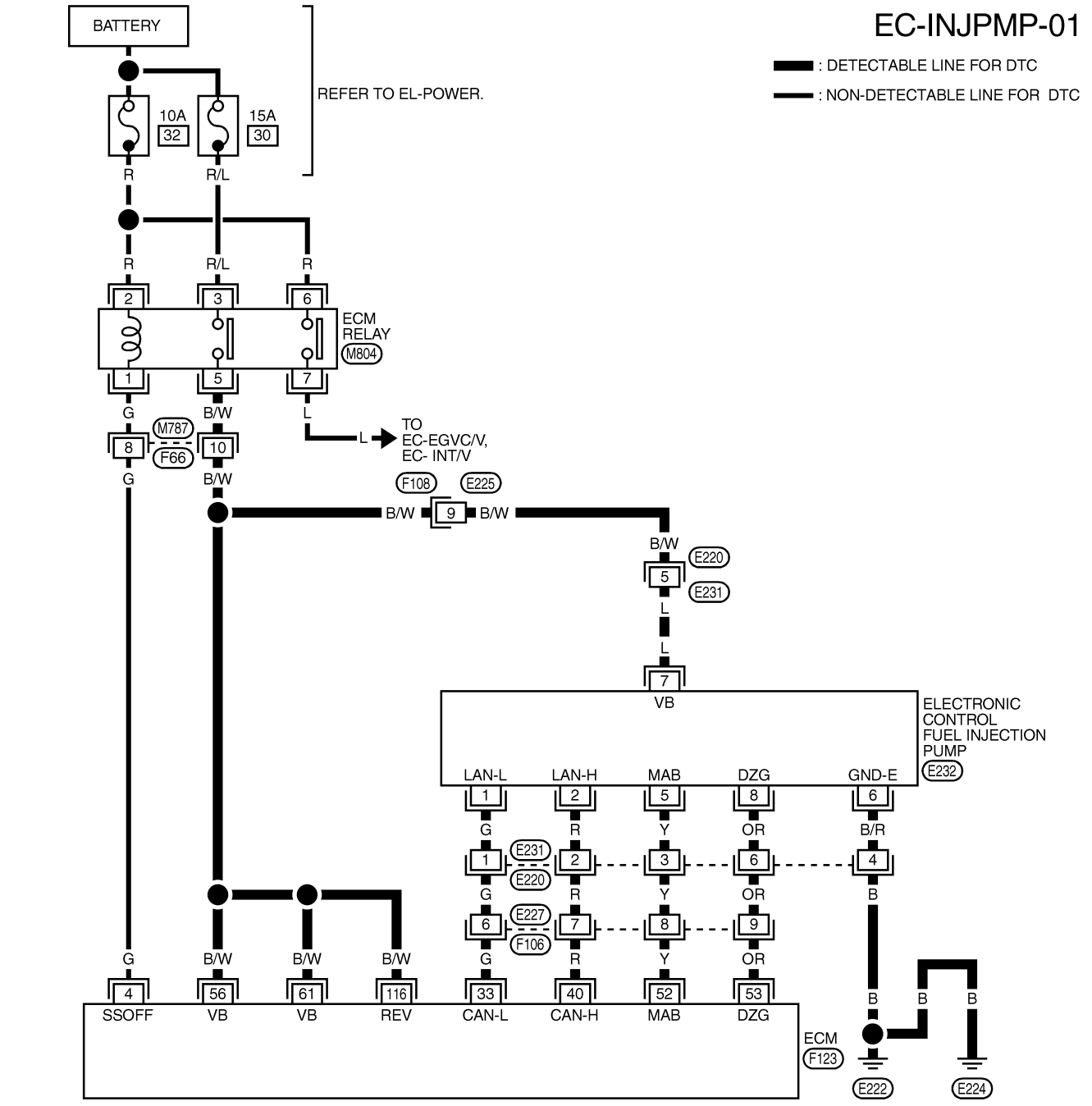
1) Turn ignition switch “ON” and wait at least 2 seconds.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Start engine and run it for at least 2 seconds at idle speed. (If engine does not run, turn ignition switch to “START” for at least 2 seconds.)
4) Keep engine speed at more than 2,000 rpm for at least 10 seconds.
5) If DTC is detected, go to “Diagnostic Procedure”, EC-197.

WITHOUT CONSULT-II

1) Turn ignition switch “ON” and wait at least 2 seconds.
2) Start engine and run it for at least 2 seconds at idle speed. (If engine does not run, turn ignition switch to “START” for at least 2 seconds.)
3) Keep engine speed at more than 2,000 rpm for at least 10 seconds.
4) Turn ignition switch “OFF”, wait at least 5 seconds and then turn “ON”.
5) Perform “Diagnostic Test Mode II (Self-diagnostic results)” with ECM.
6) If DTC is detected, go to “Diagnostic Procedure”, EC-197.

Wiring Diagram

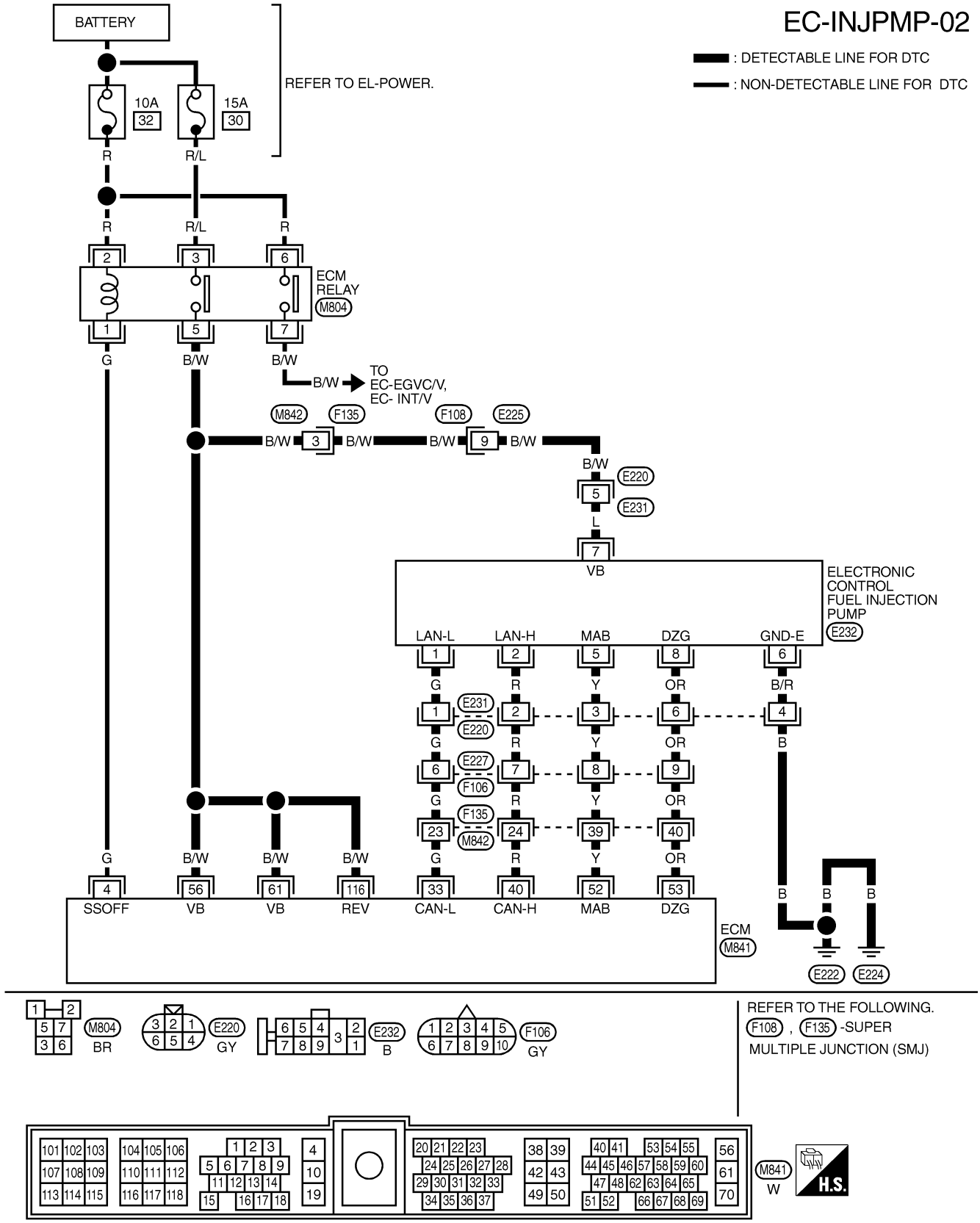
LHD MODELS



YEC181A

Wiring Diagram (Cont'd)

RHD MODELS



YEC182A

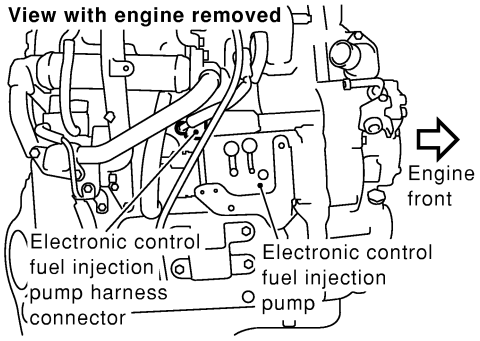
Diagnostic Procedure

1	INSPECTION START
1. Turn ignition switch “OFF”. 2. Perform “Air Bleeding”, EC-32, and “DRAINING WATER” in MA section.	
▶	GO TO 2.

2	PERFORM DTC CONFIRMATION PROCEDURE AGAIN
Perform “DTC Confirmation Procedure”, EC-194 again.	
OK or NG	
OK ▶	**INSPECTION END**
NG ▶	GO TO 3.

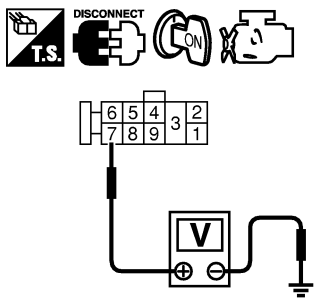
3	CHECK ELECTRONIC CONTROL FUEL INJECTION PUMP POWER SUPPLY CIRCUIT

1. Turn ignition switch “OFF”.
2. Disconnect electronic control fuel injection pump harness connector.



MEC025E

3. Turn ignition switch “ON”.
4. Check voltage between electronic control fuel injection pump terminal 7 and ground.



MEC977D

Voltage: Battery voltage

OK or NG

OK ▶	GO TO 5.
NG ▶	GO TO 4.

Diagnostic Procedure (Cont'd)

4	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors M787, F66 (LHD models) ● Harness connectors F108, E225 ● Harness connectors E220, E231 ● Harness connectors M842, F135 (RHD models) ● Harness for open or short between electronic control fuel injection pump and ECM ● Harness for open or short between electronic control fuel injection pump and ECM relay	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

5	CHECK ELECTRONIC CONTROL FUEL INJECTION PUMP GROUND CIRCUIT FOR OPEN AND SHORT
1. Turn ignition switch "OFF". 2. Check harness continuity between electronic control fuel injection pump terminal 6 and ground. Refer to Wiring Diagram. **Continuity should exist.** 3. Also check harness for short to ground and short to power. **OK or NG**	
OK ▶	GO TO 7.
NG ▶	GO TO 6.

6	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors E231, E220 ● Harness for open or short between electronic control fuel injection pump and engine ground	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

7	CHECK COMMUNICATION LINE FOR OPEN AND SHORT

1. Check continuity between the following terminals. Refer to Wiring Diagram.

Electronic control fuel injection pump	ECM
1	33
2	40
5	52
8	53

MTBL0444

Continuity should exist.

2. Also check harness for short to ground and short to power.

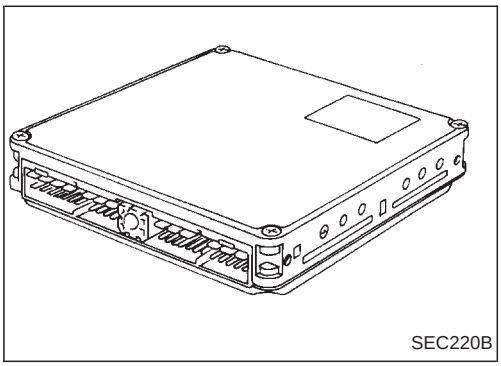
OK or NG

OK ▶	GO TO 9.
NG ▶	GO TO 8.

8	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors E231, E220 ● Harness connectors E227, F106 ● Harness connectors F135, M842 (RHD models) ● Harness for open or short between electronic control fuel injection pump and ECM	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

Diagnostic Procedure (Cont'd)

9	CHECK INTERMITTENT INCIDENT	
Refer to "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78.		
OK or NG		
OK	▶	Replace electronic control fuel injection pump.
NG	▶	Repair open circuit or short to ground or short to power in harness or connectors.

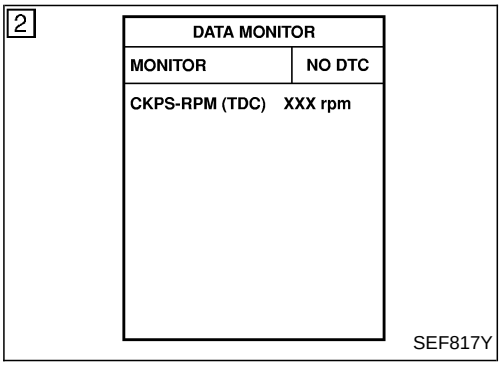

SEC220B

Description

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

On Board Diagnosis Logic

Malfunction is detected when ...	Check Items (Possible Cause)
• An excessively high or low voltage from the absolute pressure sensor (built-into ECM) is sent to ECM.	• ECM



SEF817Y

DTC Confirmation Procedure

WITH CONSULT-II

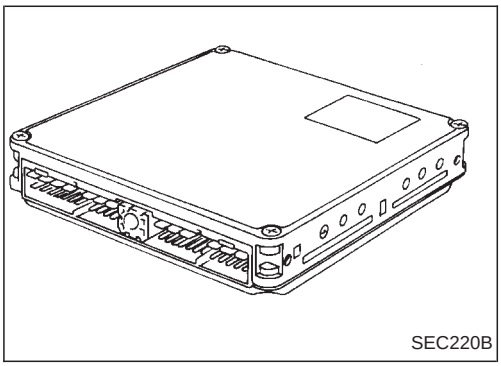
1) Turn ignition switch “ON”.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Start engine and wait at least 2 seconds.
4) If DTC is detected, go to “Diagnostic Procedure”, EC-201.

WITHOUT CONSULT-II

1) Turn ignition switch “ON” and wait at least 2 seconds.
2) Start engine and wait at least 2 seconds.
3) Turn ignition switch “OFF”, wait at least 5 seconds and then turn “ON”.
4) Perform “Diagnostic Test Mode II (Self-diagnostic results)” with ECM.
5) If DTC is detected, go to “Diagnostic Procedure”, EC-201.

Diagnostic Procedure

1	INSPECTION START	
With CONSULT-II 1. Turn ignition switch “ON”. 2. Select “SELF DIAG RESULTS” mode with CONSULT-II. 3. Touch “ERASE”. 4. Perform “DTC Confirmation Procedure”, EC-200, again. 5. Is the malfunction displayed again?		
Without CONSULT-II 1. Turn ignition switch “ON”. 2. Erase the Diagnostic Test Mode II (Self-diagnostic results) memory. 3. Perform “DTC Confirmation Procedure”, EC-200, again. 4. Perform “Diagnostic Test Mode II (Self-diagnostic results)”. 5. Is the DTC 0802 displayed again?		
Yes or No		
Yes	▶	Replace ECM.
No	▶	**INSPECTION END**

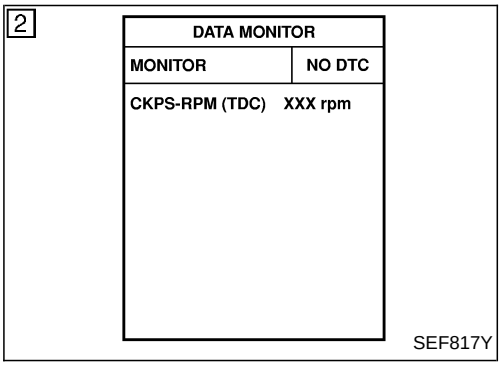

SEC220B

Description

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

On Board Diagnosis Logic

Malfunction is detected when ...	Check Items (Possible Cause)
• ECM input signal processing function is malfunctioning.	• ECM



SEF817Y

DTC Confirmation Procedure

WITH CONSULT-II

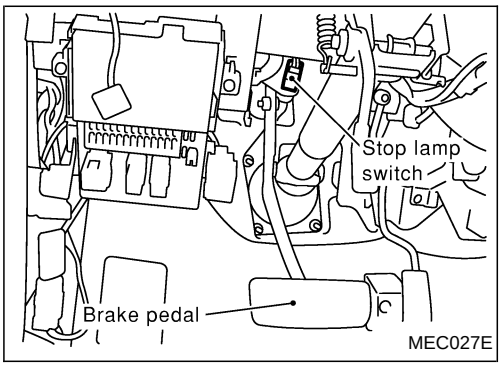
1) Turn ignition switch “ON”.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Wait at least 1 second.
4) If DTC is detected, go to “Diagnostic Procedure”, EC-203.

WITHOUT CONSULT-II

1) Turn ignition switch “ON” and wait at least 1 second.
2) Turn ignition switch “OFF”, wait at least 5 seconds and then turn “ON”.
3) Perform “Diagnostic Test Mode II (Self-diagnostic results)” with ECM.
4) If DTC is detected, go to “Diagnostic Procedure”, EC-203.

Diagnostic Procedure

1	INSPECTION START	
With CONSULT-II 1. Turn ignition switch “ON”. 2. Select “SELF DIAG RESULTS” mode with CONSULT-II. 3. Touch “ERASE”. 4. Perform “DTC Confirmation Procedure”, EC-202, again. 5. Is the malfunction displayed again?		
Without CONSULT-II 1. Turn ignition switch “ON”. 2. Erase the Diagnostic Test Mode II (Self-diagnostic results) memory. 3. Perform “DTC Confirmation Procedure”, EC-202, again. 4. Perform “Diagnostic Test Mode II (Self-diagnostic results)”. 5. Is the DTC 0802 displayed again?		
Yes or No		
Yes	▶	Replace ECM.
No	▶	**INSPECTION END**



Description

The stop lamp switch is installed to brake pedal bracket. The switch senses brake pedal position and sends an ON-OFF signal to the ECM. The ECM uses the signal to control the fuel injection control system.

ECM Terminals and Reference Value

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

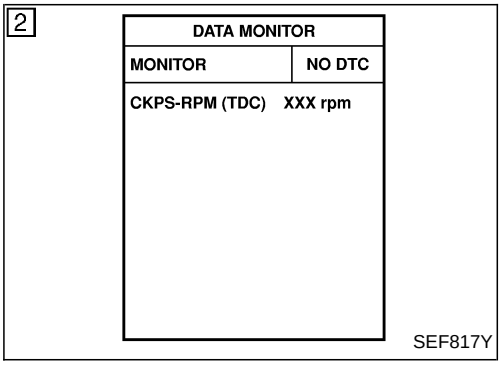
CAUTION:

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

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage)
17	G/Y	Stop lamp switch	Ignition switch "ON" └ Brake pedal fully released	Approximately 0V
			Ignition switch "ON" └ Brake pedal depressed	BATTERY VOLTAGE (11 - 14V)

On Board Diagnosis Logic

Malfunction is detected when ...	Check Items (Possible Cause)
● An irregular voltage signal from the switch is sent to ECM.	● Harness or connectors (The stop lamp switch circuit is open or shorted.) ● Stop lamp switch



DTC Confirmation Procedure

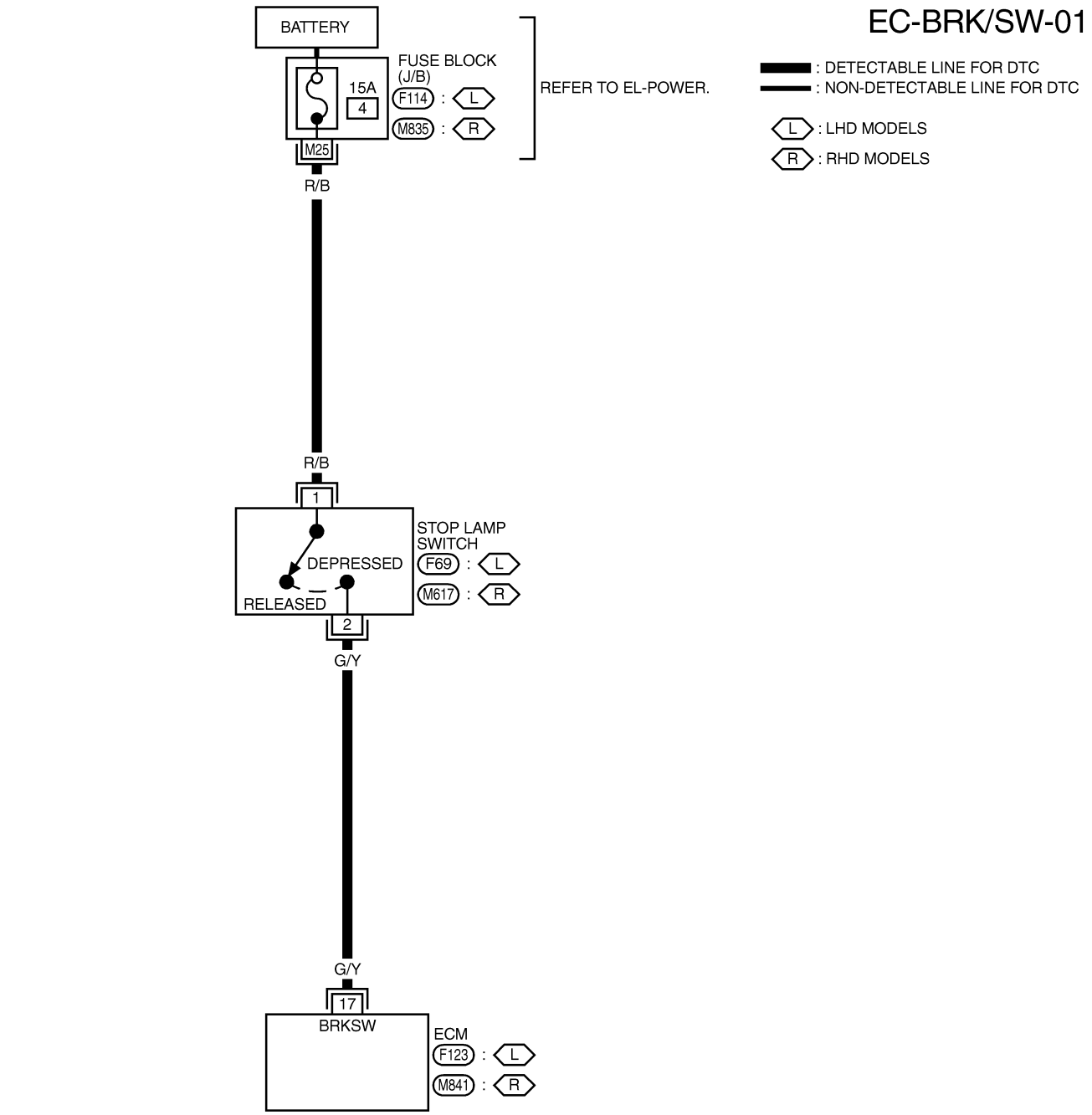
WITH CONSULT-II

1) Turn ignition switch "ON".
2) Select "DATA MONITOR" mode with CONSULT-II.
3) Depress and release brake pedal more than 10 times.
4) If DTC is detected, go to "Diagnostic Procedure", EC-206.

WITHOUT CONSULT-II

1) Turn ignition switch "ON".
2) Depress and release brake pedal more than 10 times.
3) Turn ignition switch "OFF", wait at least 5 seconds and then turn "ON".
4) Perform "Diagnostic Test Mode II (Self-diagnostic results)" with ECM.
5) If DTC is detected, go to "Diagnostic Procedure", EC-206.

Wiring Diagram



YEC189A

Diagnostic Procedure

1	CHECK STOP LAMP SWITCH CIRCUIT

1. Turn ignition switch “ON”.
2. Check the stop lamp when depressing and releasing the stop lamp switch.

Stop lamp switch	Stop lamp
Fully released	Not illuminated
Depressed	Illuminated

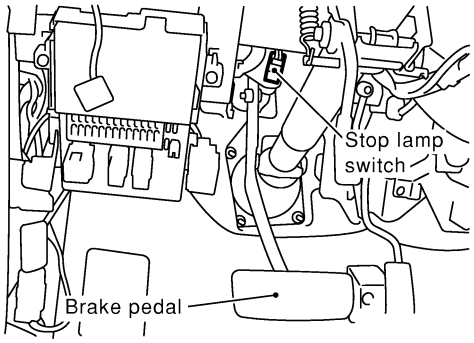
MTBL0443

OK or NG

OK	▶	GO TO 4.
NG	▶	GO TO 2.

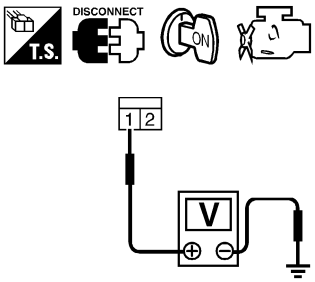
2	CHECK STOP LAMP SWITCH POWER SUPPLY CIRCUIT

1. Turn ignition switch “OFF”.
2. Disconnect stop lamp switch harness connector.



MEC027E

3. Turn ignition switch “ON”.
4. Check voltage between stop lamp switch terminal 1 and ground with CONSULT-II or tester.



Voltage: Battery voltage

SEF435Y

OK or NG

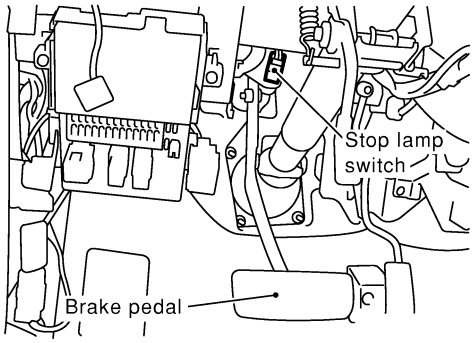
OK	▶	GO TO 4.
NG	▶	GO TO 3.

Diagnostic Procedure (Cont'd)

3	DETECT MALFUNCTIONING PART
Check the following. ● Fuse block (J/B) connector F114 (LHD models), M835 (RHD models) ● 15A fuse ● Harness for open and short between stop lamp switch and fuse	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

4	CHECK STOP LAMP SWITCH INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector.
3. Disconnect stop lamp switch harness connector.



MEC027E

4. Check harness continuity between ECM terminal 17 and stop lamp switch terminal 2. Refer to Wiring Diagram.
   Continuity should exist.
5. Also check harness for short to ground and short to power.

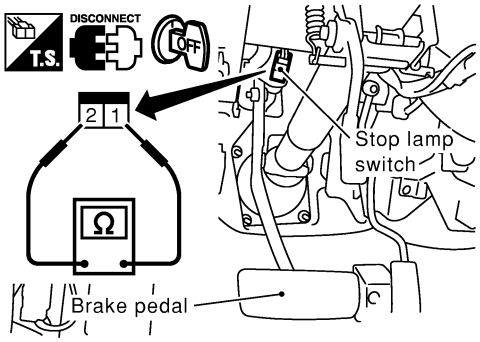
OK or NG

OK ▶	GO TO 5.
NG ▶	Repair open circuit or short to ground or short to power in harness or connectors.

Diagnostic Procedure (Cont'd)

5	CHECK STOP LAMP SWITCH

1. Disconnect stop lamp switch harness connectors.
2. Check continuity between stop lamp switch terminals 1 and 2 under the following conditions.



MEC028E

Conditions	Continuity
Brake pedal fully released	Should not exist.
Brake pedal depressed	Should exist.

MTBL1324

OK or NG

OK	▶	GO TO 6.
NG	▶	Replace stop lamp switch.

6	CHECK INTERMITTENT INCIDENT
Refer to "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78.	
▶	**INSPECTION END**

ECM Terminals and Reference Value

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

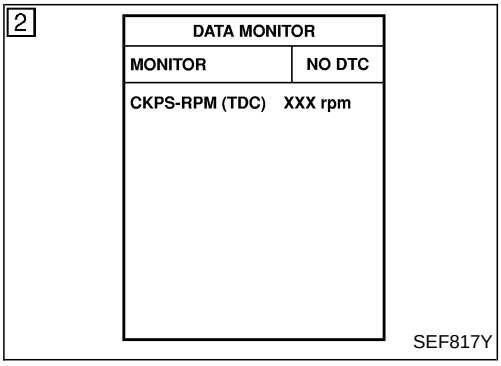
CAUTION:

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

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage)
4	G	ECM relay (Self-shutoff)	Ignition switch "ON"	Approximately 0.25V
			Ignition switch "OFF" └ For a few seconds after turning ignition switch "OFF"	
			Ignition switch "OFF" └ A few seconds passed after turning ignition switch "OFF"	BATTERY VOLTAGE (11 - 14V)
38	B/W	Ignition switch	Ignition switch "OFF"	0V
			Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
56 61 116	B/W B/W B/W	Power supply for ECM	Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)

On Board Diagnosis Logic

Malfunction is detected when	Check Items (Possible Cause)
• An irregular voltage signal from the ECM relay is sent to ECM.	• Harness or connectors (ECM relay circuit is open or shorted.) • ECM relay



DTC Confirmation Procedure

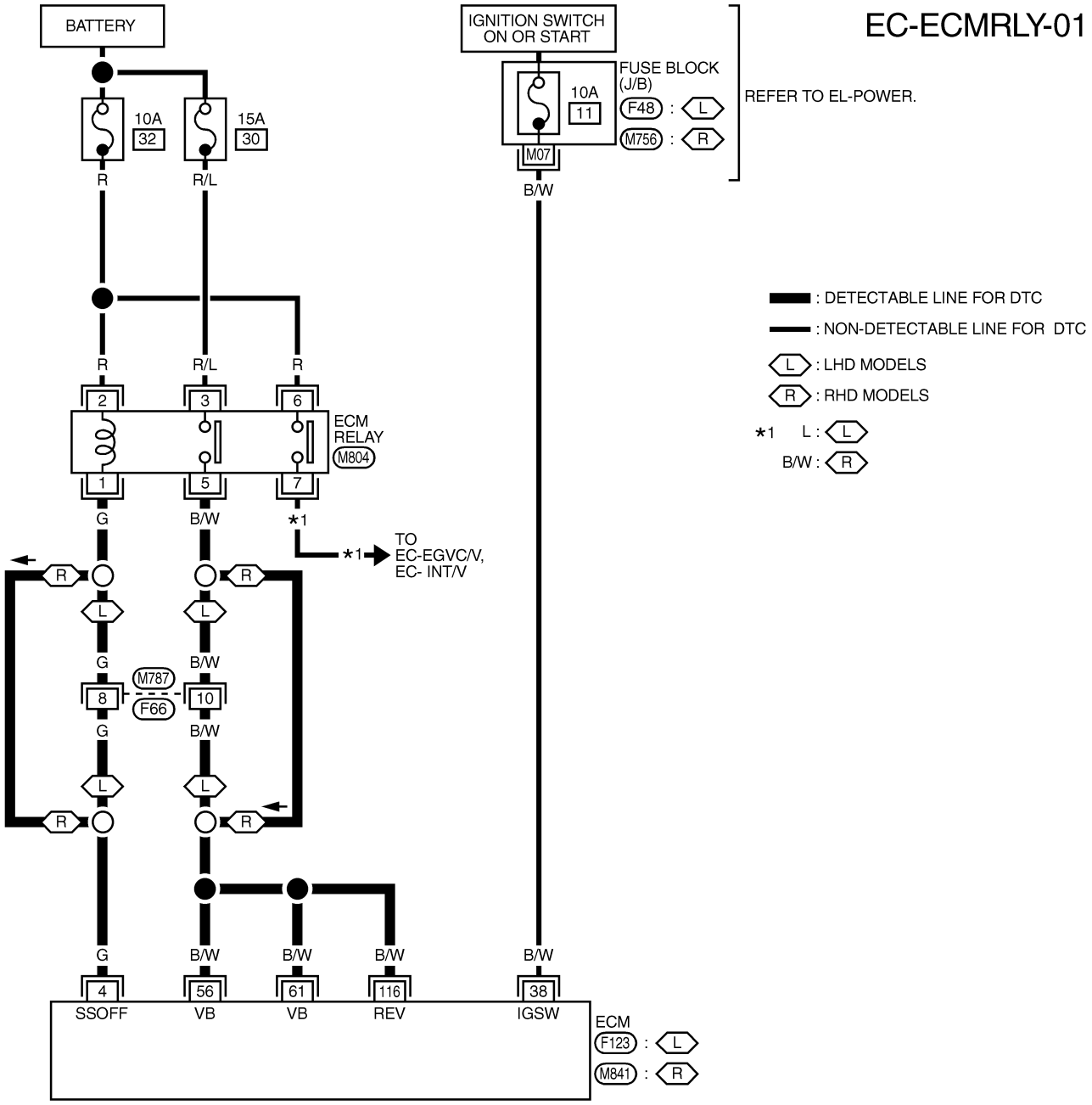
WITH CONSULT-II

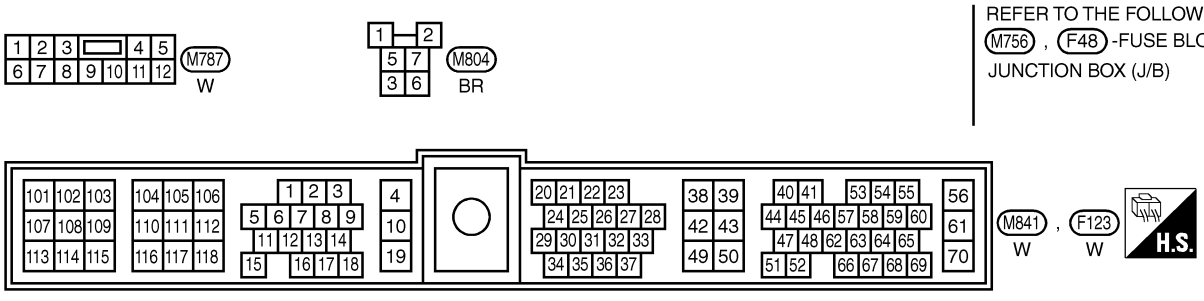
1) Turn ignition switch "ON".
2) Select "DATA MONITOR" mode with CONSULT-II.
3) Turn ignition switch "OFF", wait at least 20 seconds and then turn "ON".
4) If DTC is detected, go to "Diagnostic Procedure", EC-211.

WITHOUT CONSULT-II

1) Turn ignition switch "ON".
2) Turn ignition switch "OFF", wait at least 20 seconds and then turn "ON".
3) Perform "Diagnostic Test Mode II (Self-diagnostic results)" with ECM.
4) If DTC is detected, go to "Diagnostic Procedure", EC-211.

Wiring Diagram



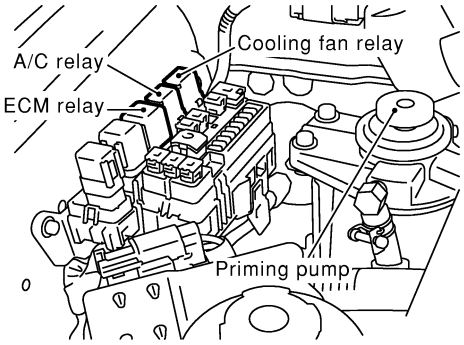


YEC190A

Diagnostic Procedure

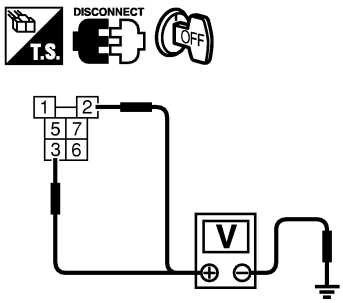
1	CHECK ECM POWER SUPPLY CIRCUIT

1. Turn ignition switch “OFF”.
2. Disconnect ECM relay.



MEC021E

3. Check voltage between ECM relay terminals 2, 3 and ground with CONSULT-II or tester.



MEC978D

Voltage: Battery voltage

OK or NG

OK	▶	GO TO 3.
NG	▶	GO TO 2.

2	DETECT MALFUNCTIONING PART

Check the following.
1. 10A fuse
2. 15A fuse
3. Harness for open and short between ECM relay and battery

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

3	CHECK ECM INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch “OFF”.
2. Disconnect ECM harness connector.
3. Check harness continuity between ECM terminals 56, 61, 116 and ECM relay terminal 5. Refer to Wiring Diagram.
   Continuity should exist.
4. Also check harness for short to ground and short to power.

OK or NG

OK	▶	GO TO 5.
NG	▶	GO TO 4.

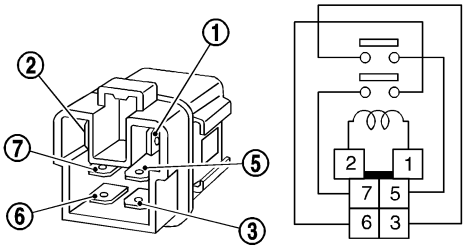
Diagnostic Procedure (Cont'd)

4	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors M787, F66 (LHD models) ● Harness for open or short between ECM and ECM relay	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

5	CHECK ECM OUTPUT SIGNAL CIRCUIT FOR OPEN AND SHORT
1. Check harness continuity between ECM terminal 4 and ECM relay terminal 1. Refer to Wiring Diagram. **Continuity should exist.** 2. Also check harness for short to ground and short to power.	
OK or NG	
OK ▶	GO TO 7.
NG ▶	GO TO 6.

6	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors M787, F66 (LHD models) ● Harness for open or short between ECM and ECM relay	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

7	CHECK ECM RELAY
1. Apply 12V direct current between ECM relay terminals 1 and 2. 2. Check continuity between ECM relay terminals 3 and 5, 6 and 7.	



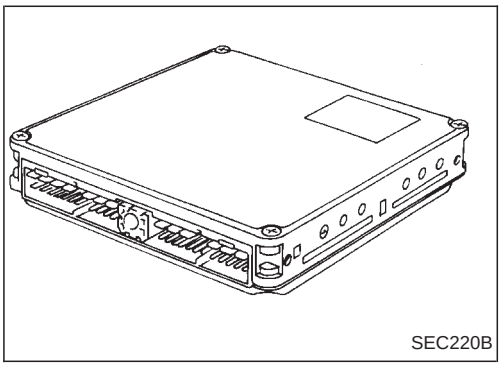
Condition	Continuity
12V direct current supply between terminals 1 and 2	Yes
OFF	No

SEF296X

OK or NG

OK ▶	GO TO 8.
NG ▶	Replace ECM relay.

8	CHECK INTERMITTENT INCIDENT
Refer to "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78.	
▶	**INSPECTION END**

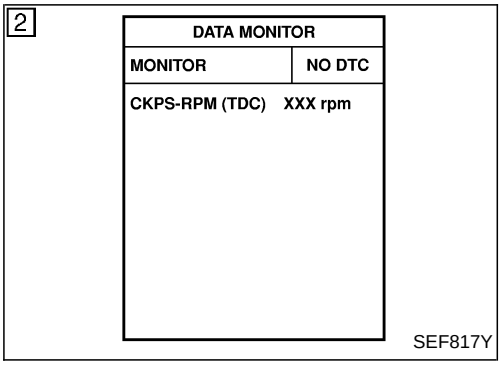

SEC220B

Description

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

On Board Diagnosis Logic

Malfunction is detected when ...	Check Items (Possible Cause)
• ECM input signal processing function is malfunctioning.	• ECM



SEF817Y

DTC Confirmation Procedure

WITH CONSULT-II

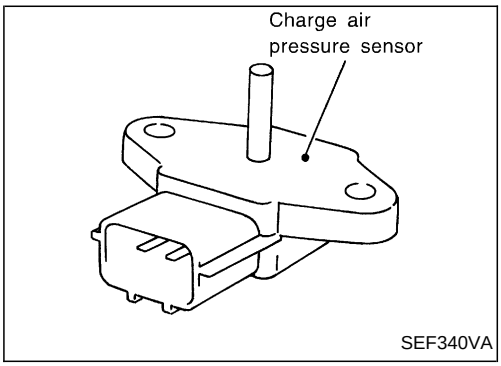
1) Turn ignition switch “ON”.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Turn ignition switch “OFF”, wait at least 20 seconds and then turn “ON”.
4) If DTC is detected, go to “Diagnostic Procedure”, EC-214.

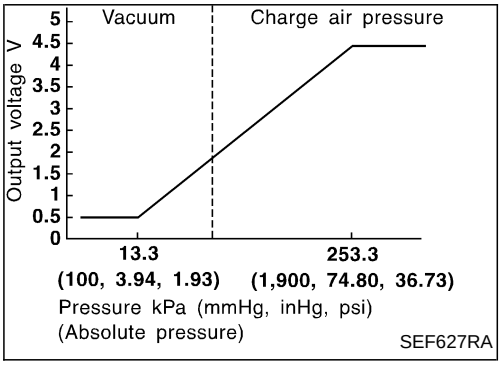
WITHOUT CONSULT-II

1) Turn ignition switch “ON” and wait at least 2 seconds.
2) Turn ignition switch “OFF”, wait at least 20 seconds and then turn “ON”.
3) Perform “Diagnostic Test Mode II (Self-diagnostic results)” with ECM.
4) If DTC is detected, go to “Diagnostic Procedure”, EC-214.

Diagnostic Procedure

1	INSPECTION START
With CONSULT-II 1. Turn ignition switch “ON”. 2. Select “SELF DIAG RESULTS” mode with CONSULT-II. 3. Touch “ERASE”. 4. Perform “DTC Confirmation Procedure”, EC-213, again. 5. Is the malfunction displayed again?	
Without CONSULT-II 1. Turn ignition switch “ON”. 2. Erase the Diagnostic Test Mode II (Self-diagnostic results) memory. 3. Perform “DTC Confirmation Procedure”, EC-213, again. 4. Perform “Diagnostic Test Mode II (Self-diagnostic results)”. 5. Is the DTC 0903 displayed again?	
Yes or No	
Yes ▶	Replace ECM.
No ▶	**INSPECTION END**





Component Description

The charge air pressure sensor detects pressure in the exit side of the charge air cooler. The sensor output voltage to the ECM increases as pressure increases. The charge air pressure sensor is not used to control the engine system under normal conditions.

ECM Terminals and Reference Value

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

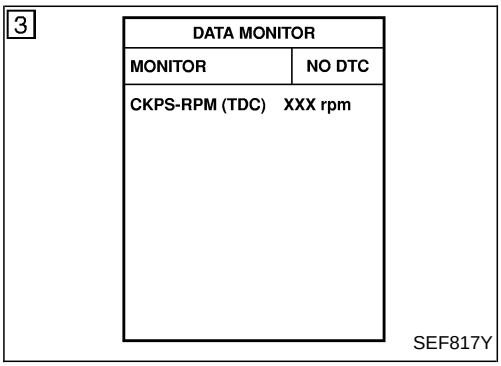
CAUTION:

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

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage)
46	G	Charge air pressure sensor	Engine is running. └ **Warm-up condition** Idle speed	Approximately 2.0V

On Board Diagnosis Logic

Malfunction is detected when ...	Check Items (Possible Cause)
• An excessively high or low voltage from the sensor is sent to ECM.	• Harness or connectors (The sensor circuit is open or shorted.) • Charge air pressure sensor



DTC Confirmation Procedure

WITH CONSULT-II

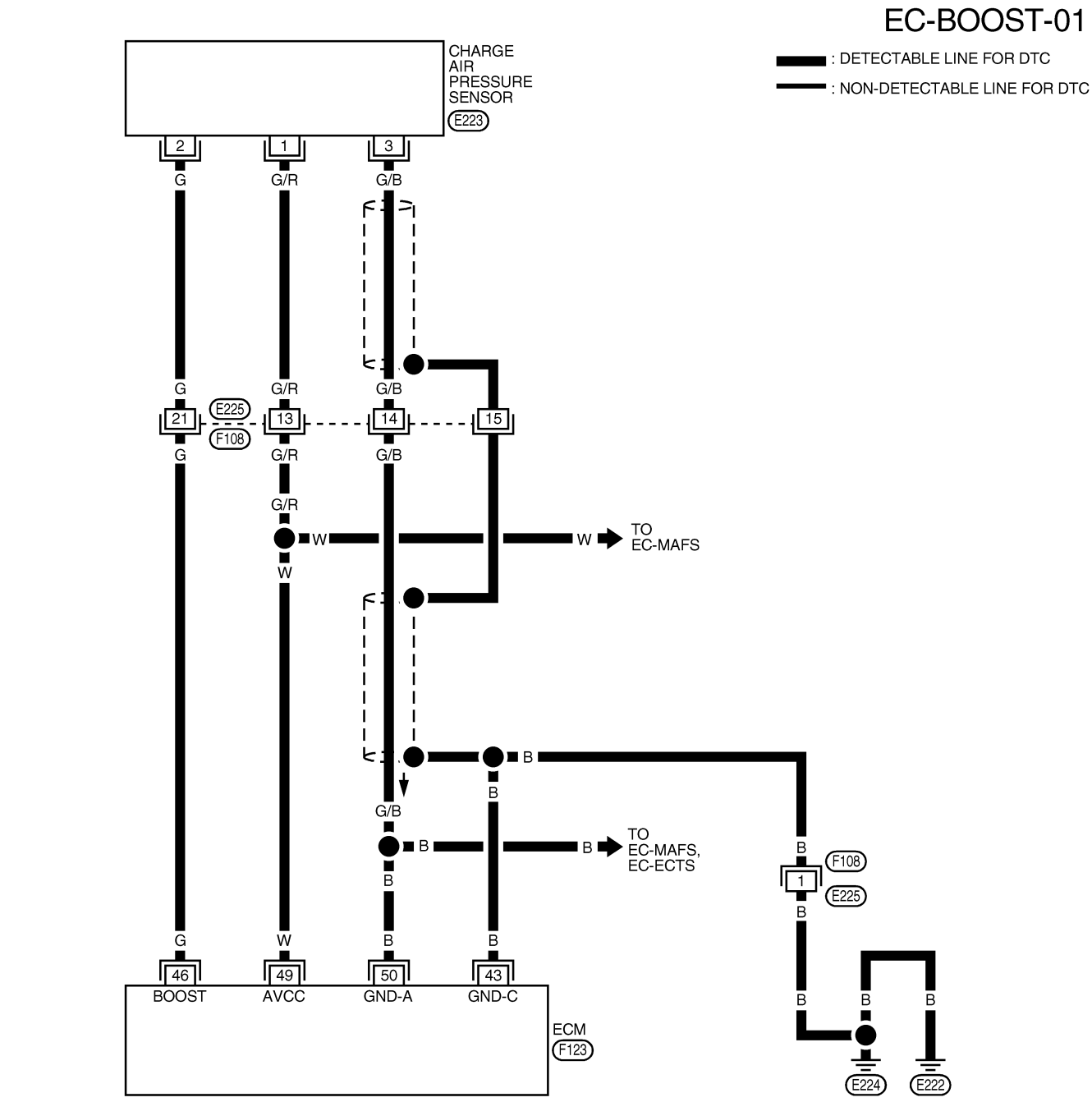
1) Turn ignition switch “ON”.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Wait at least 1 second.
4) If DTC is detected, go to “Diagnostic Procedure”, EC-219.

WITHOUT CONSULT-II

1) Turn ignition switch “ON” and wait at least 1 second.
2) Turn ignition switch “OFF”, wait at least 5 seconds and then turn “ON”.
3) Perform “Diagnostic Test Mode II (Self-diagnostic results)” with ECM.
4) If DTC is detected, go to “Diagnostic Procedure”, EC-219.

Wiring Diagram

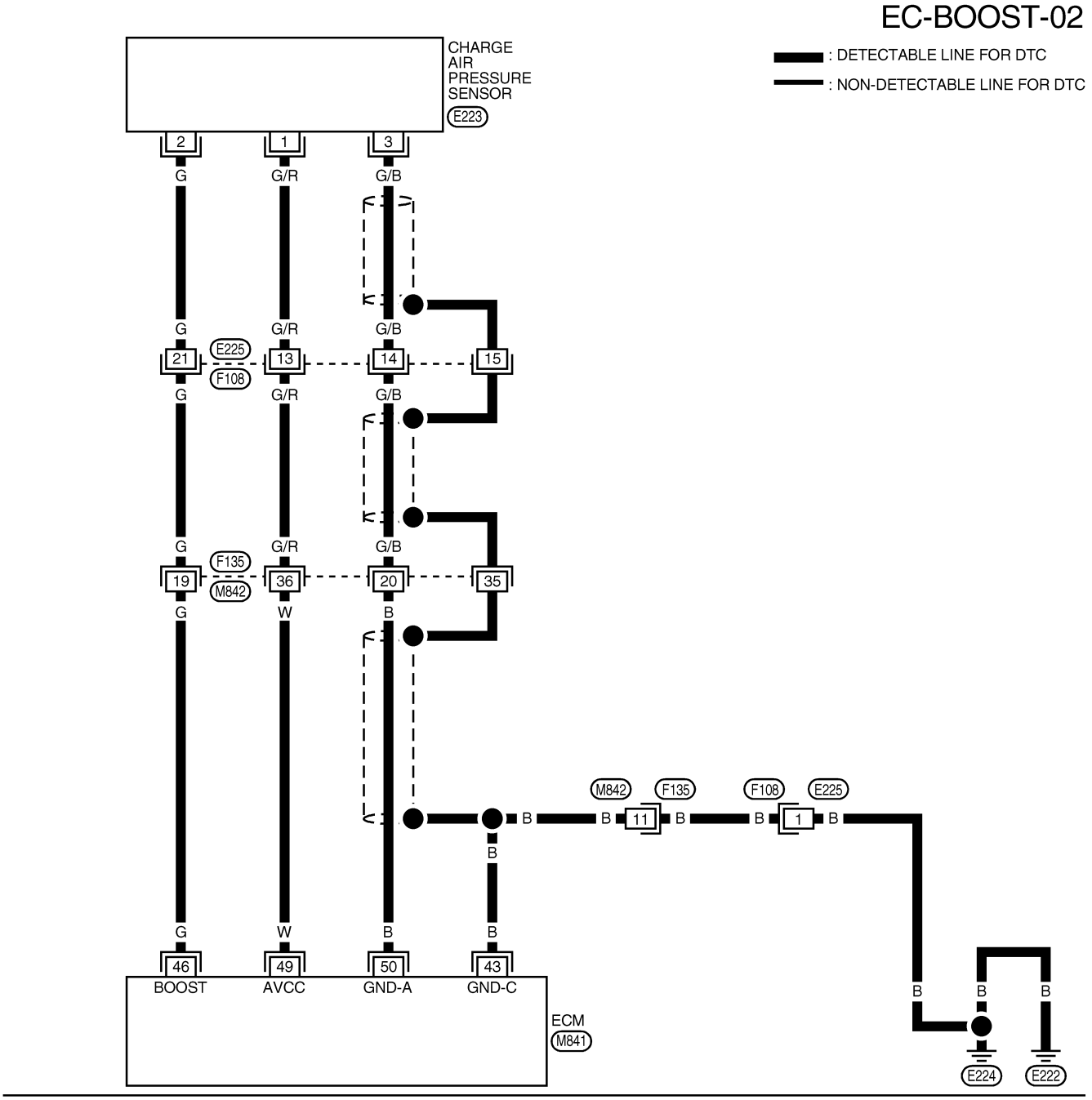
LHD MODELS



YEC191A

Wiring Diagram (Cont'd)

RHD MODELS

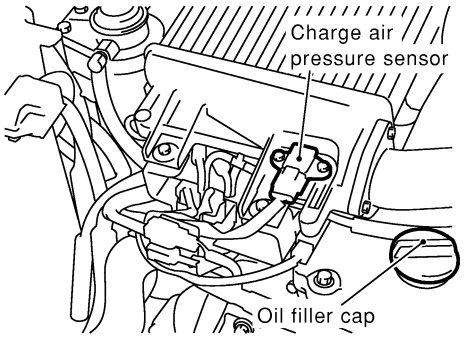


YEC192A

Diagnostic Procedure

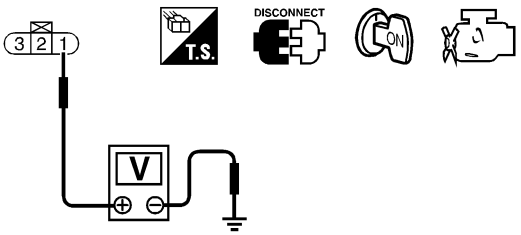
1	CHECK CHARGE AIR PRESSURE SENSOR POWER SUPPLY CIRCUIT

1. Stop engine.
2. Disconnect charge air pressure sensor harness connector.



SEF283Z

3. Turn ignition switch “ON”.
4. Check voltage between charge air pressure sensor terminal 1 and ground with CONSULT-II or tester.



Voltage: Approximately 5V

SEF306Z

OK or NG

OK	▶	GO TO 3.
NG	▶	GO TO 2.

2	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors E225, F108
- Harness connectors F135, M842 (RHD models)
- Harness for open or short between charge air pressure sensor and ECM

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

3	CHECK CHARGE AIR PRESSURE SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch “OFF”.
2. Check harness continuity between charge air pressure sensor terminal 3 and engine ground. Refer to Wiring Diagram.
   Continuity should exist.
3. Also check harness for short to ground and short to power.

OK or NG

OK	▶	GO TO 5.
NG	▶	GO TO 4.

Diagnostic Procedure (Cont'd)

4	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors E225, F108 ● Harness connectors F135, M852 (RHD models) ● Harness for open or short between ECM and charge air pressure sensor	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

5	CHECK CHARGE AIR PRESSURE SENSOR INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT
1. Disconnect ECM harness connector. 2. Check harness continuity between ECM terminal 46 and charge air pressure sensor terminal 2. Refer to Wiring Diagram. **Continuity should exist.** 3. Also check harness for short to ground and short to power. **OK or NG**	
OK ▶	GO TO 7.
NG ▶	GO TO 6.

6	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors E225, F108 ● Harness connectors F135, M842 (RHD models) ● Harness for open or short between charge air pressure sensor and ECM	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

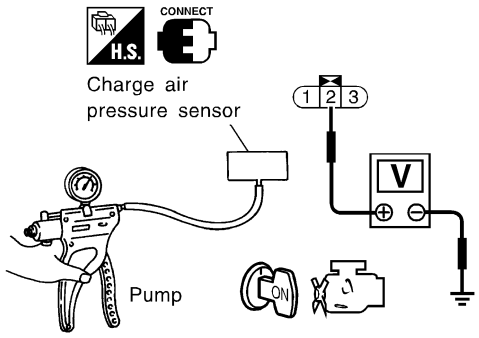
7	CHECK CHARGE AIR PRESSURE SENSOR

1. Remove charge air pressure sensor with its harness connector connected.
2. Turn ignition switch "ON".
3. Use pump to apply pressure to charge air pressure sensor as shown in the figure.

CAUTION:

- **Always calibrate the pressure pump gauge when using it.**
- **Inspection should be done at room temperature [10 - 30°C (50 - 86°F)].**

4. Check the output voltage between charge air pressure sensor terminal 2 and engine ground.



Pressure (Relative to atmospheric pressure)	Voltage V
0 kPa (0 mbar, 0 mmHg, 0 inHg)	1.9 - 3.0
+40 kPa (400 mbar, 300 mmHg, 11.81 inHg)	The voltage should be 0.6 to 1.0V higher than the value measured above.

SEF449Z

OK or NG

OK ▶	GO TO 8.
NG ▶	Replace charge air pressure sensor.

Diagnostic Procedure (Cont'd)

8	CHECK SHIELD CIRCUIT
1. Disconnect charge air pressure sensor sub-harness connectors E225, F108 and ECM harness connector. 2. Check continuity between boost sensor sub-harness connector terminal 15 and ground. **Continuity should exist.** 3. Check continuity between ECM terminal 43 and ground. **Continuity should exist.** 4. Also check harness for short to power. **OK or NG**	
OK ▶	GO TO 10.
NG ▶	GO TO 9.

9	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors E225, F108 ● Harness connectors F135, M842 (RHD models) ● Harness for open or short between charge air pressure sensor and ground ● Harness for open or short between ECM and ground	
▶	

10	CHECK INTERMITTENT INCIDENT
Refer to "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78.	
▶	**INSPECTION END**

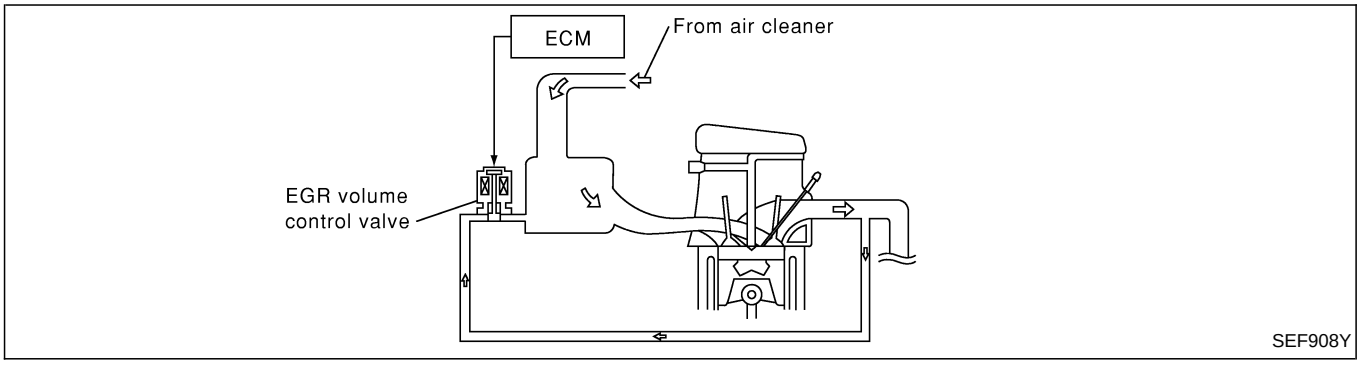
Description

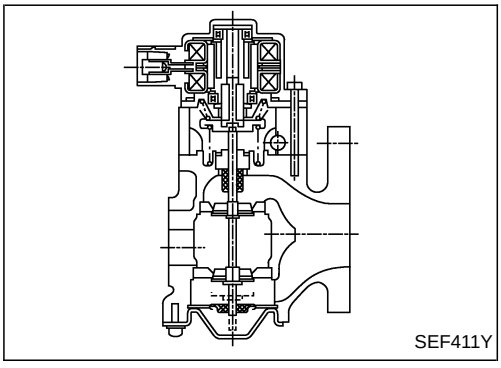
SYSTEM DESCRIPTION

Sensor	Input Signal to ECM	ECM Function	Actuator
Electronic controlled fuel injection pump	Fuel injection signal	EGR volume control	EGR volume control valve
Crankshaft position sensor (TDC)	Engine speed		
Vehicle speed sensor	Vehicle speed		
Engine coolant temperature sensor	Engine coolant temperature		
Ignition switch	Start signal		
Throttle position sensor	Throttle position		
Battery	Battery voltage		
Mass air flow sensor	Amount of intake air		
Air conditioner switch	Air conditioner operation		
Electrical load	Electrical load signal		
PNP switch	Park/Neutral position signal		

This system controls flow rate of EGR led from exhaust manifold to intake manifold. The opening of the EGR by-pass passage in the EGR volume control valve changes to control the flow rate. A built-in step motor moves the valve in steps corresponding to the ECM output pulses. The opening of the valve varies for optimum engine control. The optimum value stored in the ECM is determined by considering various engine conditions.
The EGR volume control valve remains close under the following conditions.

- Engine stopped
- Engine starting
- Low engine coolant temperature
- Excessively high engine coolant temperature
- High engine speed
- Wide open throttle
- Low battery voltage





COMPONENT DESCRIPTION

EGR volume control valve

The EGR volume control valve uses a step motor to control the flow rate of EGR from exhaust manifold. This motor has four winding phases. It operates according to the output pulse signal of the ECM. Two windings are turned ON and OFF in sequence. Each time an ON pulse is issued, the valve opens or closes, changing the flow rate. When no change in the flow rate is needed, the ECM does not issue the pulse signal. A certain voltage signal is issued so that the valve remains at that particular opening.

CONSULT-II Reference Value in Data Monitor Mode

Specification data are reference values.

MONITOR ITEM	CONDITION		SPECIFICATION
EGR VOL CON/V	● Engine: After warming up ● Air conditioner switch: “OFF” ● Shift lever: Neutral position ● No-load	After 1 minute at idle	More than 10 steps
		Revving engine up to 3,200 rpm quickly	0 step

ECM Terminals and Reference Value

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

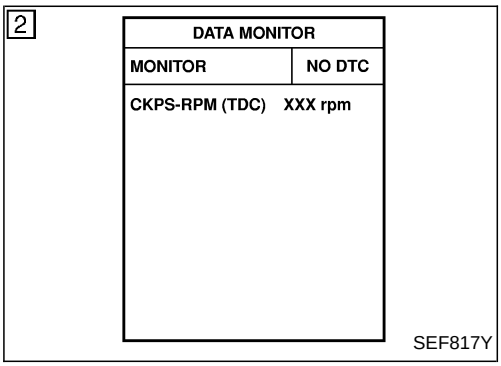
CAUTION:

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

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage)
103	R/Y (LHD models) L/R (RHD models)	EGR volume control valve	Engine is running. └ **Warm-up condition** Idle speed	0.1 - 14V
105	G/Y			
109	Y/B			
115	R/L			

On Board Diagnosis Logic

DTC No.	Malfunction is detected when ...	Check Items (Possible Cause)
1003	● An excessively low voltage signal is sent to ECM.	● Harness or connectors (The EGR volume control valve circuit is open or shorted.) ● EGR volume control valve



DTC Confirmation Procedure

WITH CONSULT-II

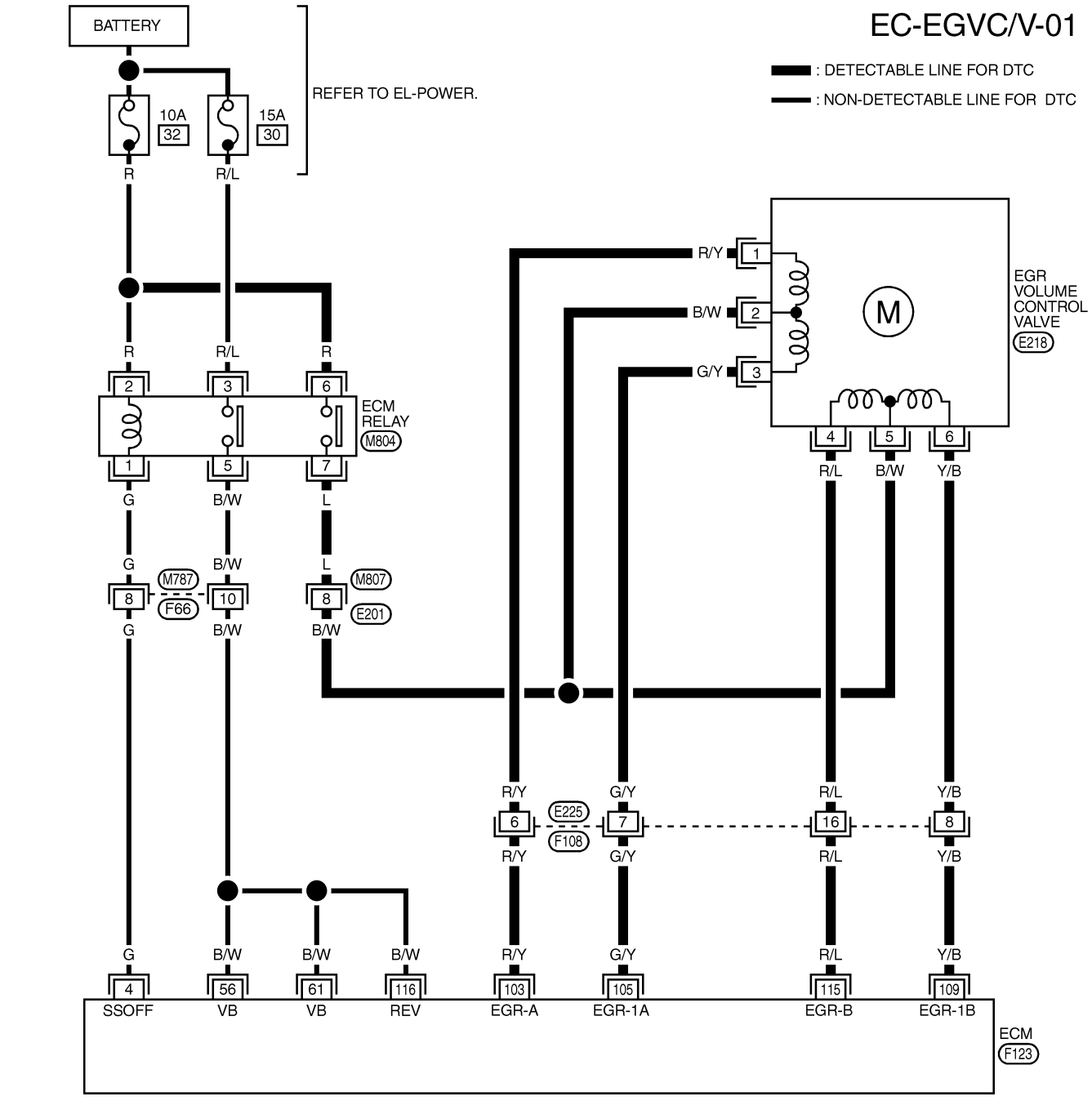
1) Start engine and warm it up to normal operating temperature.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Turn ignition switch “OFF”, and immediately turn “ON” within 1 second.
4) Start engine and let it idle.
5) If DTC is detected, go to “Diagnostic Procedure”, EC-227.

WITHOUT CONSULT-II

1) Start engine and warm it up to normal operating temperature.
2) Turn ignition switch “OFF”, and immediately turn “ON” within 1 second.
3) Start engine and let it idle.
4) Turn ignition switch “OFF”, wait at least 5 seconds and then turn “ON”.
5) Perform “Diagnostic Test Mode II (Self-diagnostic results)” with ECM.
6) If DTC is detected, go to “Diagnostic Procedure”, EC-227.

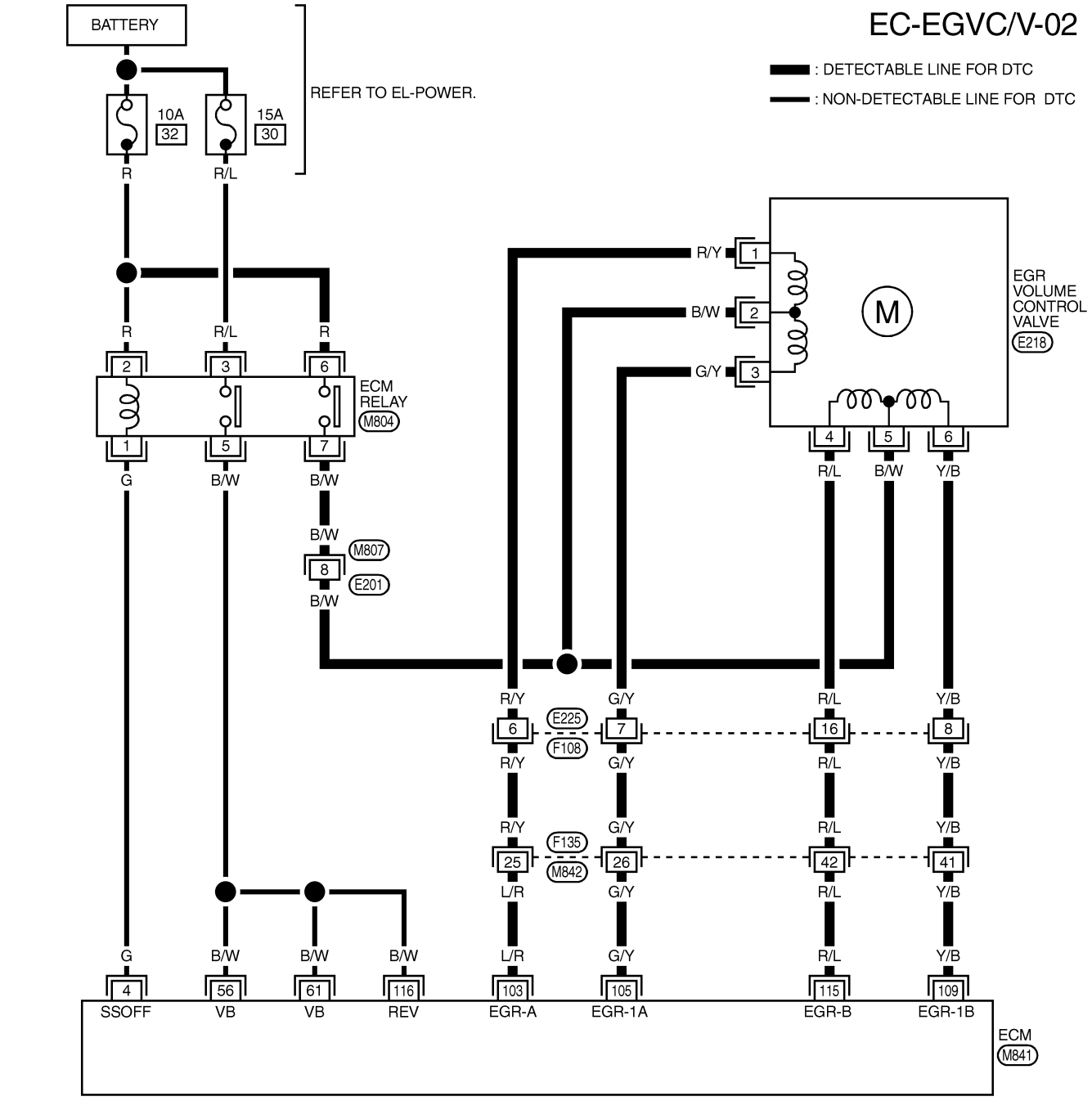
Wiring Diagram

LHD MODELS



Wiring Diagram (Cont'd)

RHD MODELS

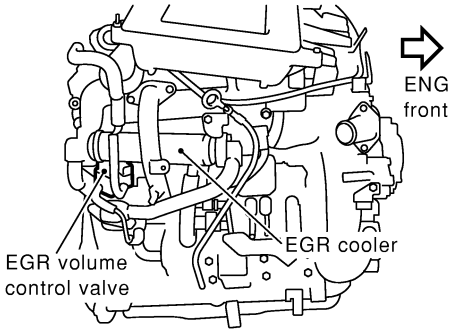


YEC194A

Diagnostic Procedure

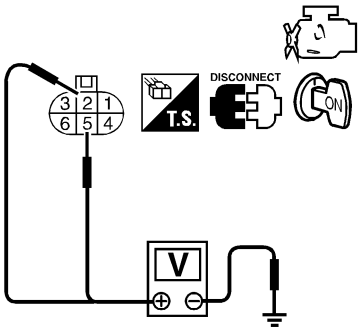
1	CHECK EGR VOLUME CONTROL VALVE POWER SUPPLY CIRCUIT-I

1. Turn ignition switch “OFF”.
2. Disconnect EGR volume control valve harness connector.



MEC019E

3. Turn ignition switch “ON”.
4. Check voltage between EGR volume control valve terminals 2, 5 and ground with CONSULT-II or tester.



Voltage: Battery voltage

SEF412Y

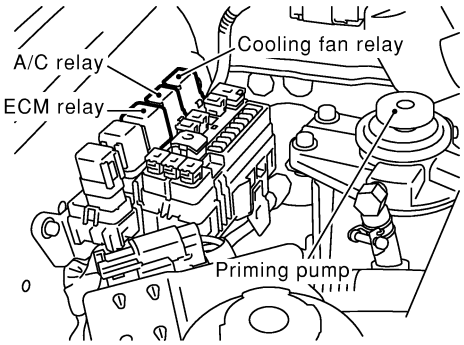
OK or NG

OK	▶	GO TO 7.
NG	▶	GO TO 2.

Diagnostic Procedure (Cont'd)

2	CHECK EGR VOLUME CONTROL VALVE POWER SUPPLY CIRCUIT-II

1. Turn ignition switch "OFF".
2. Disconnect ECM relay.



MEC021E

3. Check harness continuity between ECM relay terminal 7 and EGR volume control valve terminals 2 and 5. Refer to Wiring Diagram.
   Continuity should exist.

OK or NG

OK	▶	GO TO 4.
NG	▶	GO TO 3.

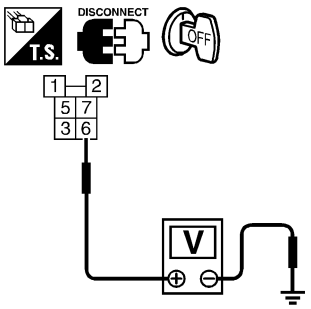
3	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors M807, E201
- Harness for open or short between EGR volume control valve and ECM relay

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

4	CHECK EGR VOLUME CONTROL VALVE POWER SUPPLY CIRCUIT-III

Check voltage between ECM relay terminal 6 and ground with CONSULT-II or tester.



Voltage: Battery voltage

SEF297Z

OK or NG

OK	▶	GO TO 6.
NG	▶	GO TO 5.

5	DETECT MALFUNCTIONING PART

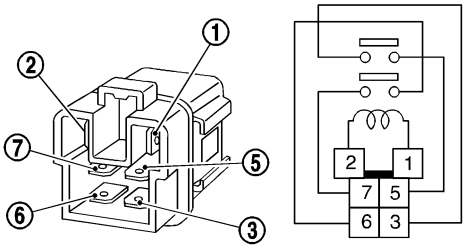
Check the following.
- 10A fuse
- Harness for open or short between ECM relay and battery

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

Diagnostic Procedure (Cont'd)

6	CHECK ECM RELAY

1. Apply 12V direct current between ECM relay terminals 1 and 2.
2. Check continuity between ECM relay terminals 3 and 5, 6 and 7.



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

SEF296X

OK or NG

OK	▶	GO TO 7.
NG	▶	Replace ECM relay.

7	CHECK EGR VOLUME CONTROL VALVE OUTPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector.
3. Check harness continuity between ECM terminals and EGR volume control valve terminals as follows. Refer to Wiring Diagram.

ECM terminal	EGR volume control valve
103	1
105	3
109	6
115	4

MTBL0442

Continuity should exist.

4. Also check harness for short to ground and short to power.

OK or NG

OK	▶	GO TO 9.
NG	▶	GO TO 8.

8	DETECT MALFUNCTIONING PART

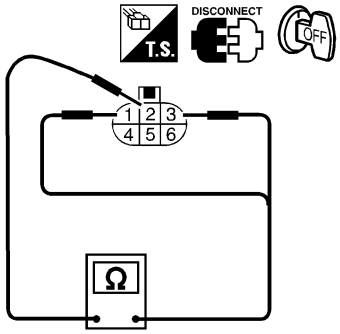
Check the following.
- Harness connectors E225, F108
- Harness connectors F135, M842 (RHD models)
- Harness for open or short between EGR volume control valve and ECM

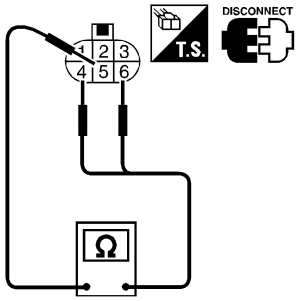
	▶	Repair open circuit or short to ground or short to power in harness or connectors.

Diagnostic Procedure (Cont'd)

9	CHECK EGR VOLUME CONTROL VALVE-I

Check resistance between EGR volume control valve terminal 2 and terminals 1, 3, terminal 5 and terminals 4, 6.





Resistance:
13 - 17Ω [At 20°C (68°F)]

SEF414Y

OK or NG

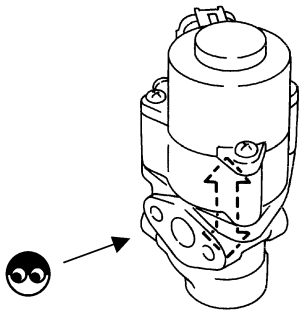
OK (With CONSULT-II)	▶	GO TO 9.
OK (Without CONSULT-II)	▶	GO TO 10.
NG	▶	Replace EGR volume control valve.

10	CHECK EGR VOLUME CONTROL VALVE-II

With CONSULT-II

1. Remove EGR volume control valve.
2. Reconnect ECM harness connector and EGR volume control valve harness connector.
3. Turn ignition switch "ON".
4. Perform "EGR VOL CONT/V" in "ACTIVE TEST" mode with CONSULT-II.
5. Check that EGR volume control valve shaft moves smoothly forward and backward according to the valve opening steps.

ACTIVE TEST	
EGR VOL CONT/V	20 step
MONITOR	
CKPS-RPM (TDC)	XXX rpm



SEF819Y

OK or NG

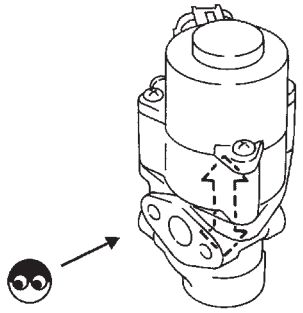
OK	▶	GO TO 11.
NG	▶	Replace EGR volume control valve.

Diagnostic Procedure (Cont'd)

11	CHECK EGR VOLUME CONTROL VALVE-II

Without CONSULT-II

1. Remove EGR volume control valve.
2. Reconnect ECM harness connector and EGR volume control valve harness connector.
3. Turn ignition switch "ON" and "OFF".
4. Check that EGR volume control valve shaft moves smoothly forward and backward according to the ignition switch position.

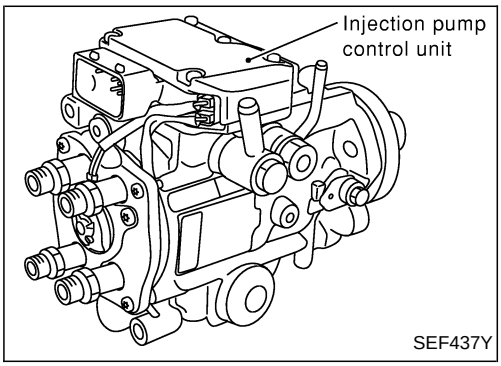


SEF560W

OK or NG

OK	▶	GO TO 11.
NG	▶	Replace EGR volume control valve.

12	CHECK INTERMITTENT INCIDENT
Refer to "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78.	
▶	**INSPECTION END**



Description

SYSTEM DESCRIPTION

The ECM and the electronic control fuel injection pump control unit (abbreviated as the injection pump control unit) perform the real time communication (signal exchange).
The ECM transmits the signals of the target fuel injection amount, target fuel injection timing, and engine speed, etc., and receives the signals of the pump speed and fuel temperature, etc. from the injection pump control unit.
By those signals, the injection pump controls the optimum fuel injection amount and injection timing of the spill valve and timing control valve.
Injection pump control unit has an on board diagnostic system, which detects malfunctions related to sensors or actuators built-into electronic control fuel injection pump. These malfunction information are transferred through the line (circuit) from injection pump control unit to ECM.

FUEL INJECTION AMOUNT CONTROL

In accordance with the target fuel injection amount signal from the ECM, the injection amount is controlled by controlling the spill valve in the injection pump and by changing the needle opening time.

FUEL INJECTION TIMING CONTROL

Based on the target fuel injection timing signal from the ECM, the injection timing is controlled in accordance with the timer spring by performing the duty control of the timing control valve in the injection pump and by adjusting the pressure of the timer piston high pressure chamber.

FUEL TEMPERATURE SENSOR

The sensor detects the fuel temperature in the injection pump and calibrates the injection amount change by the fuel temperature.

CAM RING POSITION SENSOR

The sensor detects the passing of the protrusion on the sensor wheel in the injection pump by the semiconductor magnetic resistance element sensor. The cam ring position sensor synchronizes with the cam ring, and detects the actual advance amount. The injection pump control unit measures the injection pump revolution by the signal of the cam ring position sensor.

CONSULT-II Reference Value in Data Monitor Mode

Remarks: Specification data are reference values.

MONITOR ITEM	CONDITION		SPECIFICATION
FUEL TEMP SEN	● Engine: After warming up		More than 40°C (104°F)
SPILL/V	● Engine: After warming up		Approx. 13°CA
INJ TIMG C/V	● Engine: After warming up, idle the engine.		Approx. 50 - 70%
DECELER F/CUT	● Engine: After warming up	Idle	OFF
BARO SEN	● Ignition switch: ON		Altitude Approx. 0 m (0 ft): Approx. 100.62 kPa (1.0062 bar, 1.026 kg/cm^2, 14.59 psi) Approx. 1,000 m (3,281 ft): Approx. 88.95 kPa (0.8895 bar, 0.907 kg/cm^2, 12.90 psi) Approx. 1,500 m (4,992 ft): Approx. 83.16 kPa (0.8316 bar, 0.848 kg/cm^2, 12.06 psi) Approx. 2,000 m (6,562 ft): Approx. 78.36 kPa (0.7836 bar, 0.799 kg/cm^2, 11.36 psi)

ECM Terminals and Reference Value

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

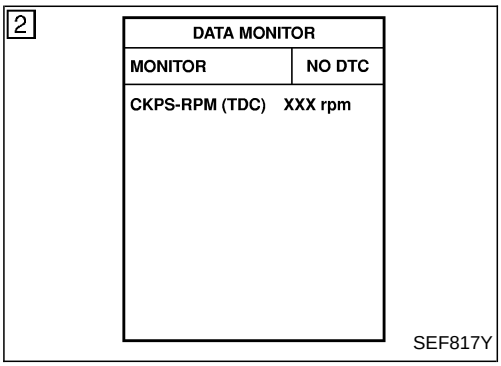
CAUTION:

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

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage)
33	G	Electronic control fuel injection pump	Engine is running. └ **Warm-up condition** Idle speed	Approximately 2.5V
40	R	Electronic control fuel injection pump	Engine is running. └ **Warm-up condition** Idle speed	Approximately 2.5V
52	Y	Electronic control fuel injection pump	Engine is running. └ Idle speed	Approximately 0.1V
53	OR	Electronic control fuel injection pump	Engine is running. └ Idle speed	Approximately 0.35V

On Board Diagnosis Logic

Malfunction is detected when	Check Items (Possible cause)
● Fuel cut control system does not function properly.	● Harness or connectors (Electronic control fuel circuit is open or shorted.) ● Electronic control fuel



DTC Confirmation Procedure

WITH CONSULT-II

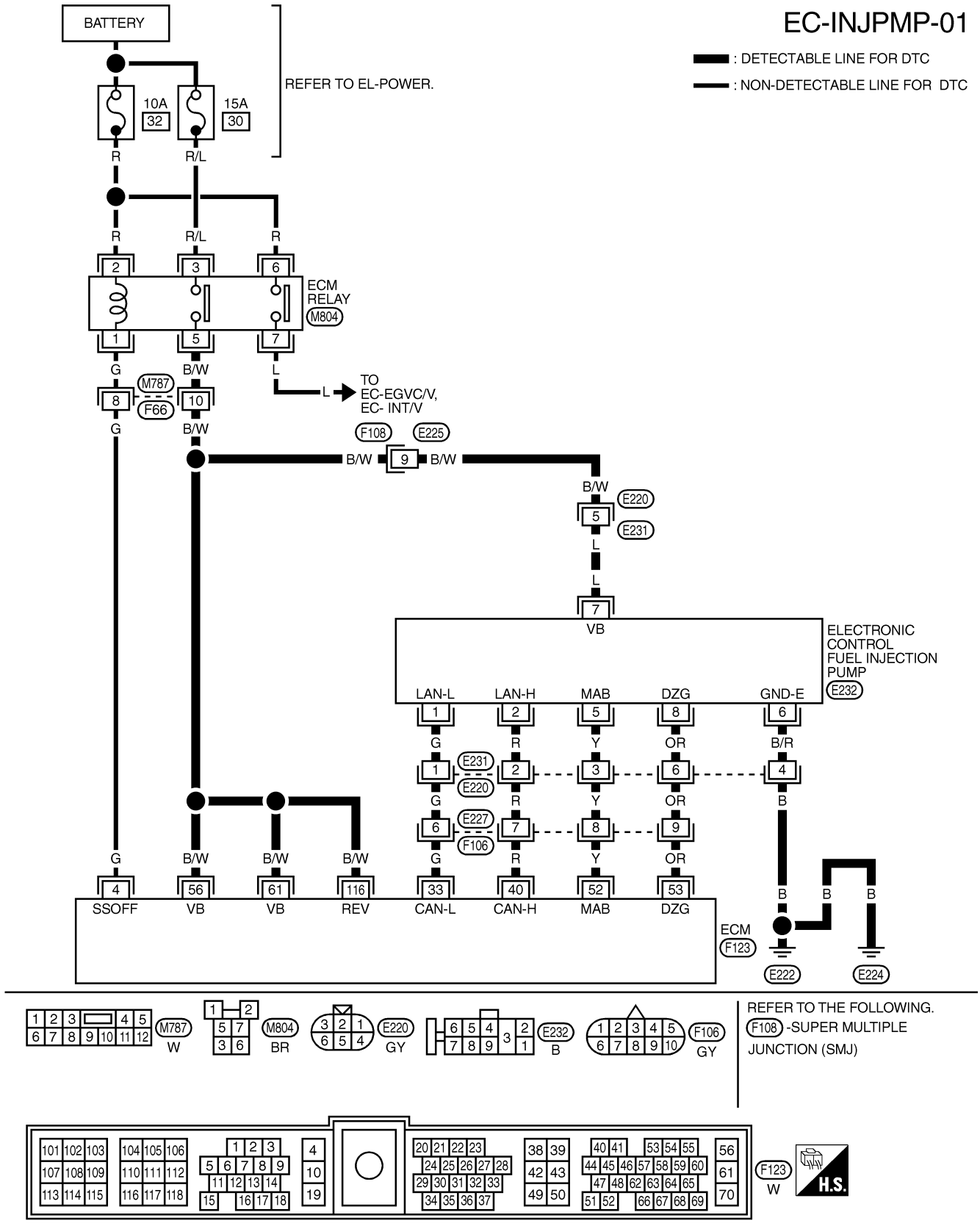
1) Turn ignition switch “ON” and wait at least 2 seconds.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Start engine and run it for at least 2 seconds at idle speed. (If engine does not run, turn ignition switch to “START” for at least 2 seconds.)
4) Turn ignition switch “OFF”, wait at least 5 seconds and then turn “ON”.
5) If DTC is detected, go to “Diagnostic Procedure”, EC-237.

WITHOUT CONSULT-II

1) Turn ignition switch “ON” and wait at least 2 seconds.
2) Start engine and run it for at least 2 seconds at idle speed. (If engine does not run, turn ignition switch to “START” for at least 2 seconds.)
3) Turn ignition switch “OFF”, wait at least 5 seconds and then turn “ON”.
4) Perform “Diagnostic Test Mode II (Self-diagnostic results)” with ECM.
5) If DTC is detected, go to “Diagnostic Procedure”, EC-237.

Wiring Diagram

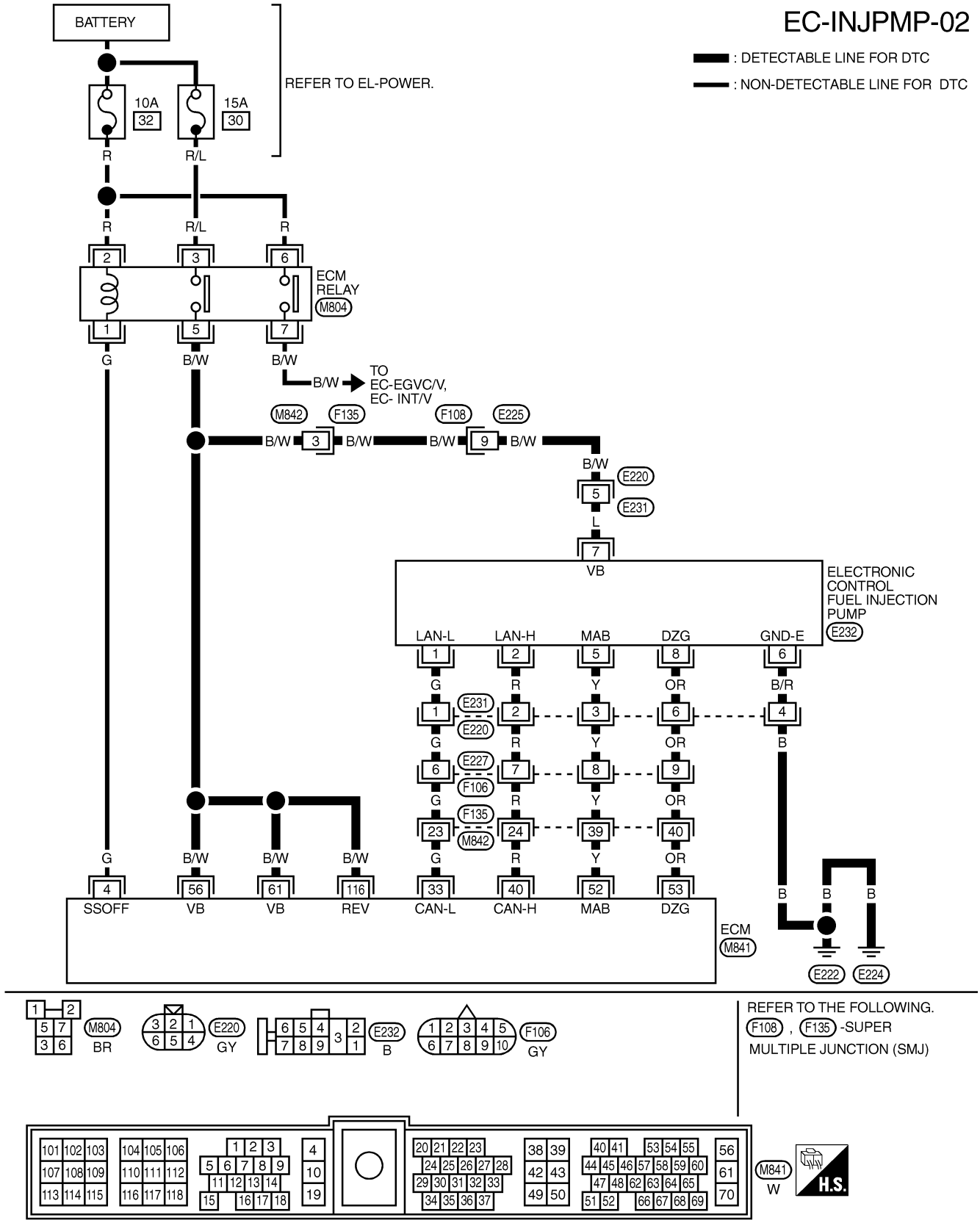
LHD MODELS



YEC181A

Wiring Diagram (Cont'd)

RHD MODELS

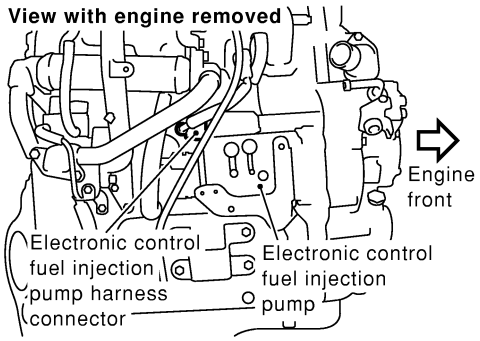


YEC182A

Diagnostic Procedure

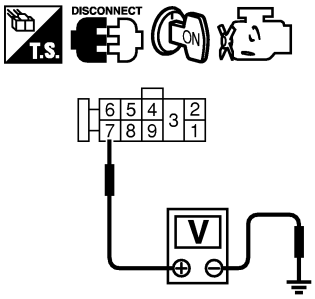
1	CHECK ELECTRONIC CONTROL FUEL INJECTION PUMP POWER SUPPLY CIRCUIT

1. Turn ignition switch “OFF”.
2. Disconnect electronic control fuel injection pump harness connector.



MEC025E

3. Turn ignition switch “ON”.
4. Check voltage between electronic control fuel injection pump terminal 7 and ground.



MEC977D

Voltage: Battery voltage

OK or NG

OK	▶	GO TO 3.
NG	▶	GO TO 2.

2	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors M787, F66 (LHD models)
- Harness connectors F108, E225
- Harness connectors E220, E231 (LHD models)
- Harness connectors M842, F135 (RHD models)
- Harness for open or short between electronic control fuel injection pump and ECM
- Harness for open or short between electronic control fuel injection pump and ECM relay

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

3	CHECK ELECTRONIC CONTROL FUEL INJECTION PUMP GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch “OFF”.
2. Check harness continuity between electronic control fuel injection pump terminal 6 and ground. Refer to Wiring Diagram.
   Continuity should exist.
3. Also check harness for short to ground and short to power.

OK or NG

OK	▶	GO TO 5.
NG	▶	GO TO 4.

Diagnostic Procedure (Cont'd)

4	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors E231, E220 ● Harness for open or short between electronic control fuel injection pump and engine ground	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

5	CHECK COMMUNICATION LINE FOR OPEN AND SHORT

1. Check continuity between the following terminals. Refer to Wiring Diagram.

Electronic control fuel injection pump	ECM
1	33
2	40
5	52
8	53

MTBL0444

Continuity should exist.

2. Also check harness for short to ground and short to power.

OK or NG

OK ▶	GO TO 7.
NG ▶	GO TO 6.

6	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors E227, F106 ● Harness connectors E231, E220 ● Harness connectors F135, M842 (RHD models) ● Harness for open or short between electronic control fuel injection pump and ECM	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

7	CHECK INTERMITTENT INCIDENT
Refer to "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78. **OK or NG**	
OK ▶	Replace electronic control fuel injection pump.
NG ▶	Repair open circuit or short to ground or short to power in harness or connectors.

Description

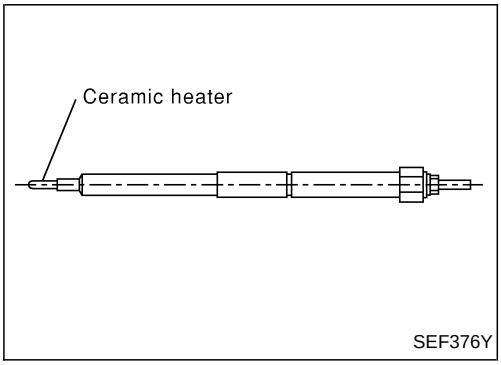
SYSTEM DESCRIPTION

Sensor	Input Signal to ECM	ECM Function	Actuator
Crankshaft position sensor (TDC)	Engine speed	Glow control	Glow lamp, Glow relay ↓ Glow plugs
Engine coolant temperature sensor	Engine coolant temperature		

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

- Ignition switch ON
  After ignition switch has turned to ON, the glow relay turns ON for a certain period of time in relation to engine coolant temperature, allowing current to flow through glow plug.
- Cranking
  The glow relay turns ON, allowing current to flow through glow plug.
- Starting
  After engine has started, current continues to flow through glow plug (after-glow mode) for a certain period in relation to engine coolant temperature.
  When engine speed exceeds approximately 4,800 rpm, current flow through glow plug is interrupted.

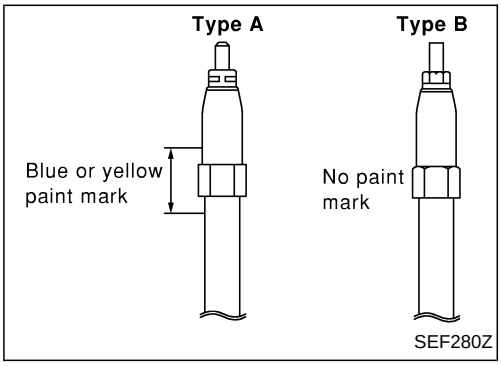
The glow indicator lamp turns ON for a certain period of time in relation to engine coolant temperature at the time glow relay is turned ON.



COMPONENT DESCRIPTION

Glow plug

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



- This engine uses two types of glow plugs.
  Type A has a blue or yellow paint mark.
  Type B has no paint mark.
  The location of the paint mark is shown in the figure.

WARNING:
Do not use two types of glow plugs at the same time.

ECM Terminals and Reference Value

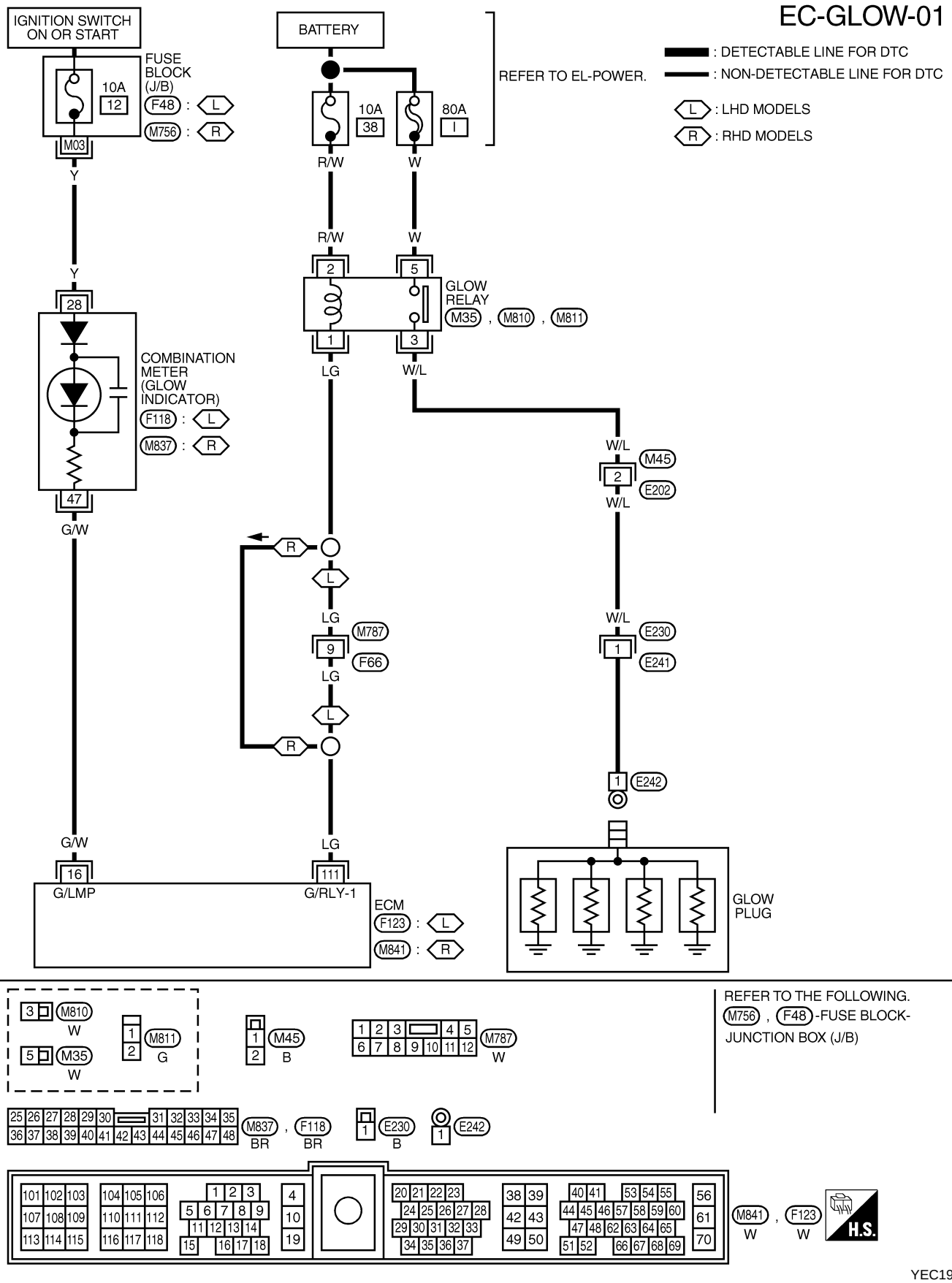
Specification data are reference values and are measured between each terminal and ground.

CAUTION:

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

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage)
16	G/W	Glow indicator lamp	Ignition switch "ON" └ Glow indicator lamp is "ON"	Approximately 1V
			Ignition switch "ON" └ Glow indicator lamp is "OFF"	BATTERY VOLTAGE (11 - 14V)
111	LG	Glow relay	Refer to "SYSTEM DESCRIPTION", EC-239.	

Wiring Diagram

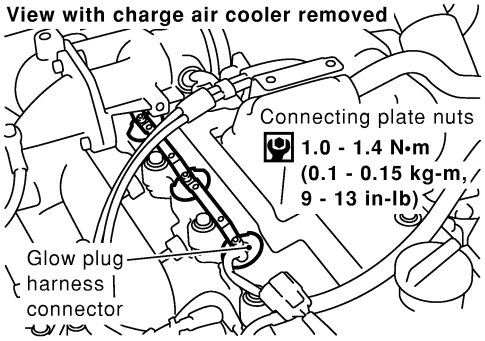


YEC195A

Diagnostic Procedure

1	INSPECTION START
Check fuel level, fuel supplying system, starter motor, etc. **OK or NG**	
OK ▶	GO TO 2.
NG ▶	Correct.

2	CHECK INSTALLATION
Check that all glow plug connecting plate nuts are installed properly.	



MEC002E

OK or NG

OK (With CONSULT-II) ▶	GO TO 3.
OK (Without CONSULT-II) ▶	GO TO 4.
NG ▶	Install properly.

3	CHECK GLOW INDICATOR LAMP OPERATION

With CONSULT-II

1. Turn ignition switch “ON”.
2. Select “COOLAN TEMP/S” in “DATA MONITOR” mode with CONSULT-II.
3. Confirm that “COOLAN TEMP/S” indicates below 75°C (167°F). If it indicates above 75°C (167°F), cool down engine.

DATA MONITOR	
MONITOR	NO DTC
COOLAN TEMP/S	XXX ˚C

SEF013Y

4. Turn ignition switch “OFF”, wait at least 5 seconds and then turn “ON”.
5. Make sure that glow indicator lamp is turned “ON” for 1.5 seconds or more after turning ignition switch “ON”, and then turned “OFF”.

OK or NG

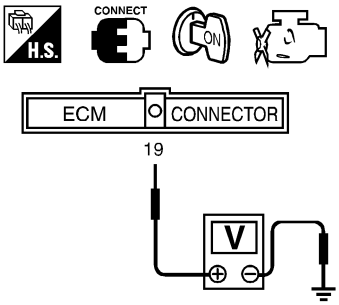
OK ▶	GO TO 5.
NG ▶	GO TO 6.

Diagnostic Procedure (Cont'd)

4	CHECK GLOW INDICATOR LAMP OPERATION

Without CONSULT-II

1. Turn ignition switch "ON".
2. Confirm that the voltage between ECM terminal 19 and ground is above 1.36V. If it is below 1.36V, cool down engine.



Voltage: More than 1.36V

SEF430Y

3. Turn ignition switch "OFF", wait at least 5 seconds and then turn "ON".
4. Make sure that glow indicator lamp is turned "ON" for 1.5 seconds or more after turning ignition switch "ON", and then turned "OFF".

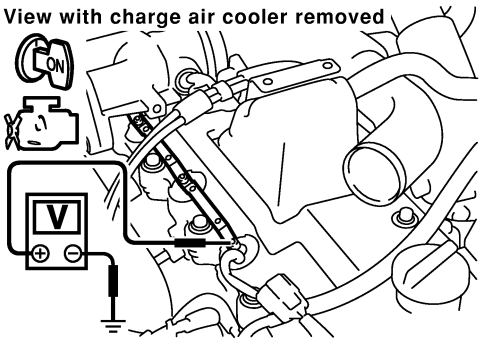
OK or NG

OK	▶	GO TO 5.
NG	▶	GO TO 6.

5	CHECK GLOW CONTROL SYSTEM OVERALL FUNCTION

1. Turn ignition switch "OFF".
2. Set voltmeter probe between glow plug and engine body.
3. Turn ignition switch "ON".
4. Check the voltage between glow plug and engine body under the following conditions.

View with charge air cooler removed



MEC003E

Conditions	Voltage
For 20 seconds after turning ignition switch ON	Battery voltage
More than 20 seconds after turning ignition switch ON	Approx. 0V

MTBL1325

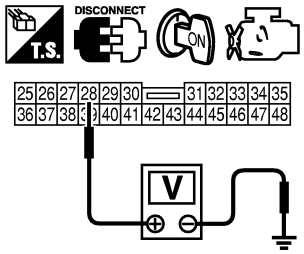
OK or NG

OK	▶	**INSPECTION END**
NG	▶	GO TO 10.

Diagnostic Procedure (Cont'd)

6	CHECK GLOW INDICATOR LAMP POWER SUPPLY CIRCUIT

1. Turn ignition switch "OFF".
2. Disconnect combination meter harness connector F118 (LHD models) or M837 (RHD models).
3. Turn ignition switch "ON".
4. Check voltage between combination meter terminal 28 and ground with CONSULT-II or tester.



MEC979D

Voltage: Battery voltage

OK or NG

OK	▶	GO TO 8.
NG	▶	GO TO 7.

7	DETECT MALFUNCTIONING PART

Check the following.
1. Fuse block (J/B) connector F48 (LHD models), M756 (RHD models)
2. 10A fuse
3. Harness for open or short between combination meter and fuse

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

8	CHECK GLOW INDICATOR LAMP OUTPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector.
3. Disconnect combination meter harness connector F118 (LHD models) or M837 (RHD models).
4. Check harness continuity between ECM terminal 16 and combination meter terminal 47. Refer to Wiring Diagram.
   Continuity should exist.
5. Also check harness for short to ground and short to power.

OK or NG

OK	▶	GO TO 9.
NG	▶	Repair open circuit or short to ground or short to power in harness or connectors.

9	CHECK COMBINATION METER

Check combination meter and glow indicator lamp. Refer to EL section ("METER AND GAUGES").

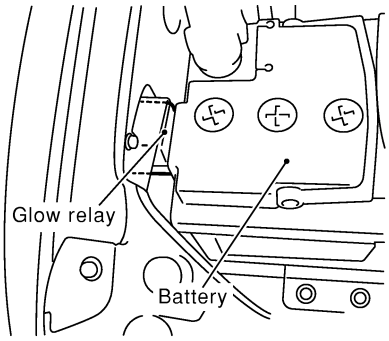
OK or NG

OK	▶	GO TO 17.
NG	▶	Repair or replace combination meter or glow indicator lamp.

Diagnostic Procedure (Cont'd)

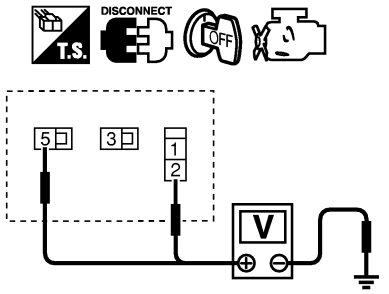
10	CHECK GLOW RELAY POWER SUPPLY CIRCUIT

1. Turn ignition switch "OFF".
2. Disconnect glow relay.



MEC004E

3. Check voltage between glow relay terminals 2, 5 and ground with CONSULT-II or tester.



MEC980D

Voltage: Battery voltage

OK or NG

OK	▶	GO TO 12.
NG	▶	GO TO 11.

11	DETECT MALFUNCTIONING PART

Check the following.
- 80A fusible link
- 10A fuse
- Harness for open or short between glow relay and battery

	▶	Repair harness or connectors.

12	CHECK GLOW RELAY OUTPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Disconnect ECM harness connector.
2. Check harness continuity between ECM terminal 111 and glow relay terminal 1. Refer to Wiring Diagram.
   Continuity should exist.
3. Also check harness for short to ground and short to power.

OK or NG

OK	▶	GO TO 14.
NG	▶	GO TO 13.

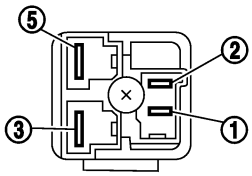
Diagnostic Procedure (Cont'd)

13	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors M787, F66 (LHD models) ● Harness for open or short between glow relay and ECM	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

14	CHECK HARNESS CONTINUITY BETWEEN GLOW RELAY AND GLOW PLUG FOR OPEN AND SHORT
1. Disconnect glow plug harness connector. 2. Check harness continuity between glow relay terminal 3 and glow plug harness connector. Refer to Wiring Diagram. **Continuity should exist.** 3. Also check harness for short to ground and short to power. **OK or NG**	
OK ▶	GO TO 16.
NG ▶	GO TO 15.

15	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors M45, E202 ● Harness connectors E230, E241 ● Harness for open or short between glow relay and glow plug	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

16	CHECK GLOW RELAY
Check continuity between glow relay terminals 3 and 5 under the following conditions.	



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

Operation takes less than 1 second.

SEF433Y

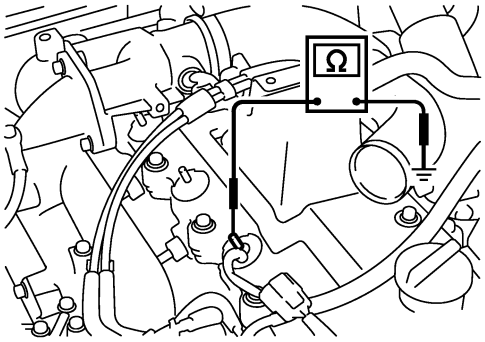
OK or NG

OK ▶	GO TO 17.
NG ▶	Replace glow relay.

Diagnostic Procedure (Cont'd)

17	CHECK GLOW PLUG

1. Remove glow plug connecting plate.
2. Check glow plug resistance.



MEC005E

Resistance: Approx. 0.5Ω [at 20°C (68°F)]

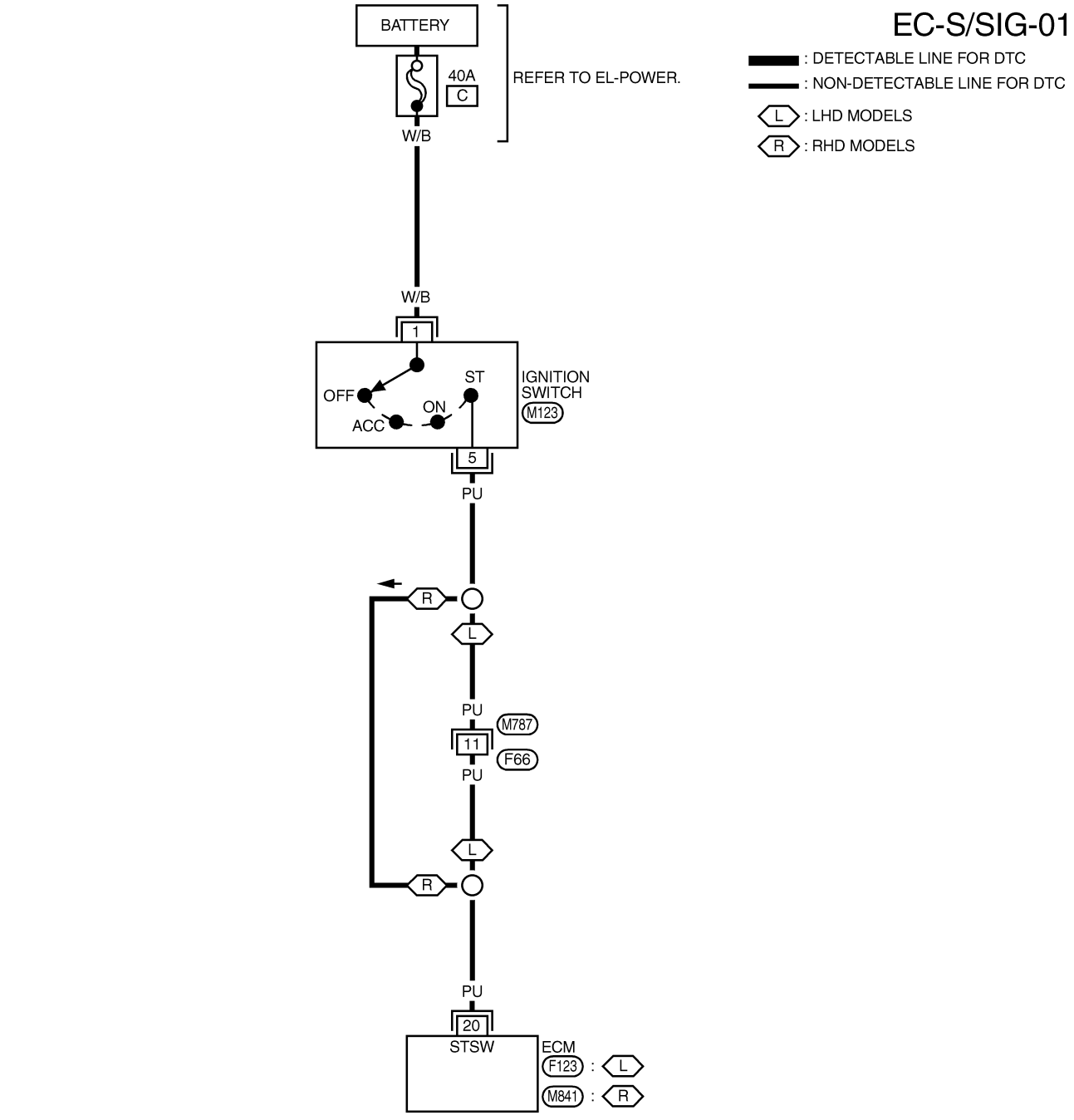
NOTE:
- **Do not bump glow plug heating element. If it is bumped, replace glow plug with a new one.**
- **If glow plug is dropped from a height of 10 cm (3.94 in) or higher, replace with a new one.**
- **If glow plug installation hole is contaminated with carbon, remove it with a reamer or suitable tool.**
- **Hand-tighten glow plug by turning it two or three times, then tighten using a tool to specified torque.**
  : 15 - 20 N·m (1.5 - 2.1 kg-m, 11 - 15 ft-lb)

OK or NG

OK	▶	GO TO 18.
NG	▶	Replace glow plug.

18	CHECK INTERMITTENT INCIDENT
Refer to "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78.	
▶	**INSPECTION END**

Wiring Diagram



YEC196A

Diagnostic Procedure

1	CHECK START SIGNAL OVERALL FUNCTION

With CONSULT-II

1. Turn ignition switch “ON”.
2. Check “START SIGNAL” in “DATA MONITOR” mode with CONSULT-II under the following conditions.

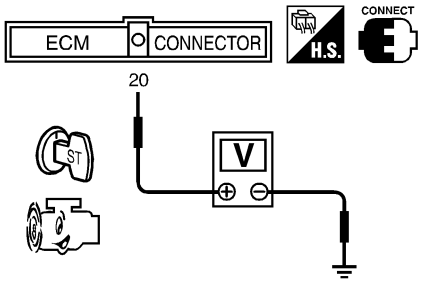
DATA MONITOR	
MONITORING	NO FAIL
START SIGNAL	OFF
CLSD TH/P SW	ON
AIR COND SIG	OFF
P/N POSI SW	ON

Condition	“START SIGNAL”
Ignition switch “ON”	OFF
Ignition switch “START”	ON

SEF604X

Without CONSULT-II

Check voltage between ECM terminal 20 and ground under the following conditions.



Condition	Voltage
Ignition switch “START”	Battery voltage
Other positions	Approximately 0V

SEF415Y

OK or NG

OK	▶	**INSPECTION END**
NG	▶	GO TO 2.

2	CHECK START SIGNAL INPUT SIGNAL CIRCUIT

1. Turn ignition switch “OFF”.
2. Disconnect ECM harness connector and ignition switch harness connector.
3. Check harness continuity between ECM terminal 20 and ignition switch terminal 5. Refer to Wiring Diagram.
   Continuity should exist.
4. Also check harness for short to ground and short to power.

OK or NG

OK	▶	GO TO 4.
NG	▶	GO TO 3.

3	DETECT MALFUNCTIONING PART

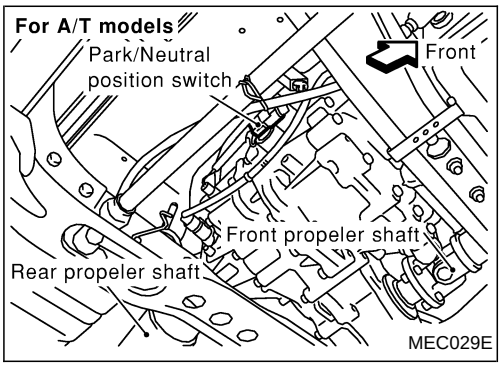
Check the following.

- Harness connectors M787, F66 (LHD models)
- Harness for open or short between ECM and ignition switch

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

Diagnostic Procedure (Cont'd)

4	**CHECK INTERMITTENT INCIDENT**
Refer to "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78.	
▶	**INSPECTION END**



Description

When the gear position is in “Neutral”, neutral position is “ON”. ECM detects the position because the continuity of the line (the “ON” signal) exists.

CONSULT-II Reference Value in Data Monitor Mode

Specification data are reference values.

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

ECM Terminals and Reference Value

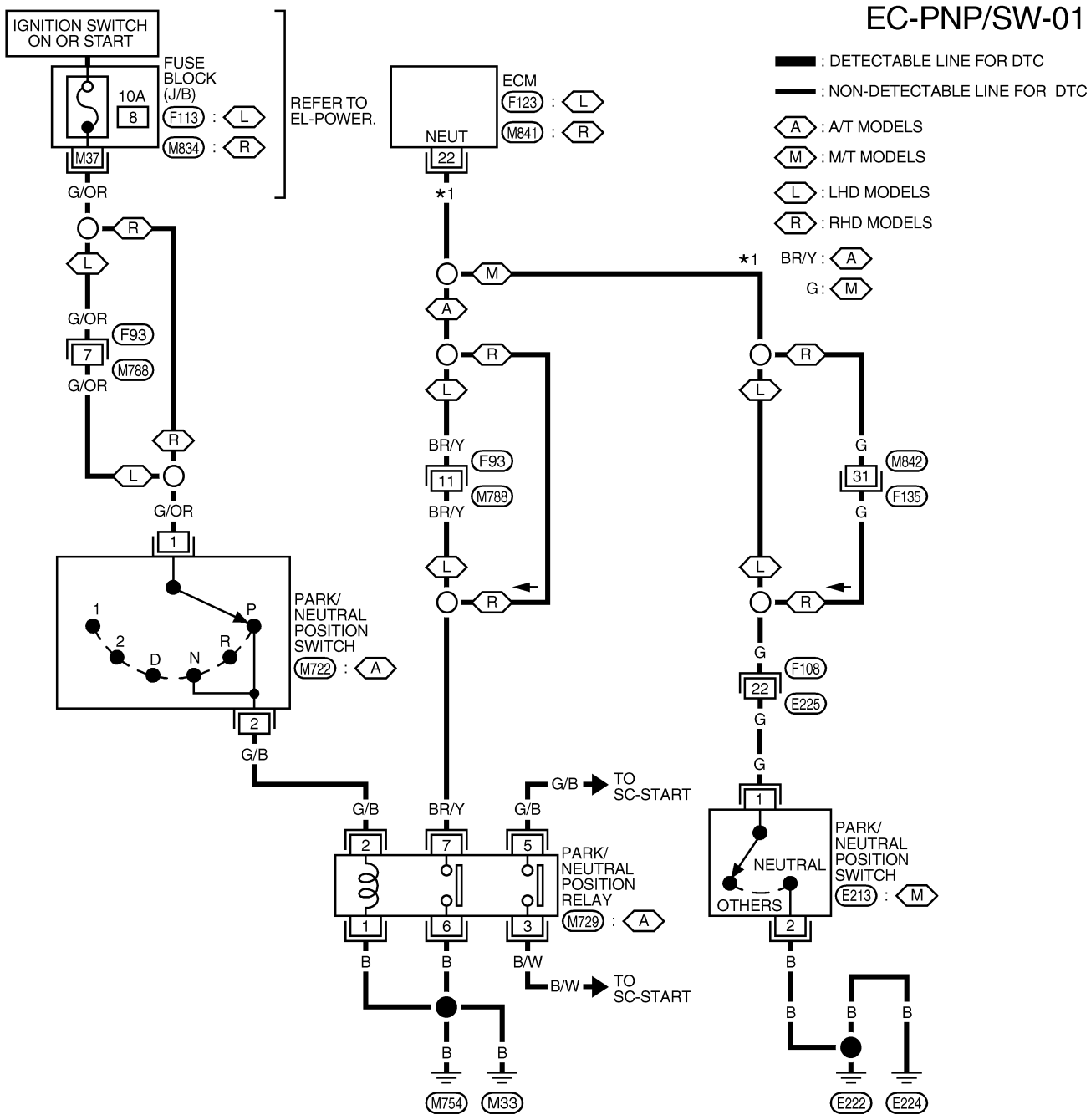
Specification data are reference values and are measured between each terminal and ground.

CAUTION:

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

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage)
22	BR/Y (A/T models) G (M/T models)	Park/Neutral position switch	Ignition switch “ON” └ Gear position is “Neutral” (M/T models) Gear position is “P” or “N” (A/T models)	Approximately 0V
			Ignition switch “ON” └ Except the above gear position	BATTERY VOLTAGE (11 - 14V)

Wiring Diagram



Diagnostic Procedure

FOR M/T MODELS

1	CHECK OVERALL FUNCTION

With CONSULT-II

1. Turn ignition switch “ON”.
2. Select “P/N POSI SW” in “DATA MONITOR” mode with CONSULT-II.
3. Check “P/N POSI SW” signal under the following conditions.

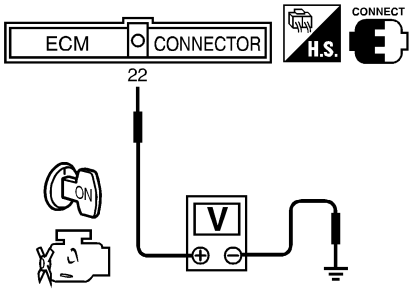
DATA MONITOR	
MONITOR	NO DTC
P/N POSI SW	ON

Shift lever position	P/N POSI SW
Neutral position	ON
Except the above position	OFF

SEF049Y

Without CONSULT-II

1. Turn ignition switch “ON”.
2. Check voltage between ECM terminal 22 and ground under the following conditions.



Condition (Gear position)	Voltage V
Neutral position	Approx. 0V
Except the above position	Battery voltage

SEF419Y

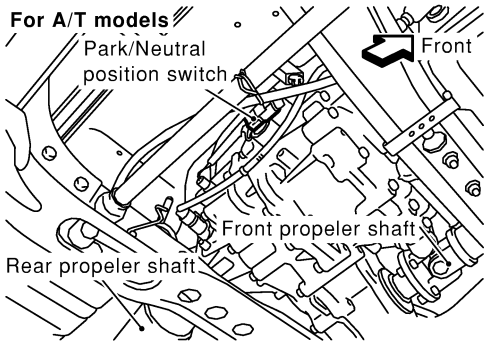
OK or NG

OK	▶	**INSPECTION END**
NG	▶	GO TO 2.

Diagnostic Procedure (Cont'd)

2	CHECK PNP SWITCH GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch "OFF".
2. Disconnect park/neutral position (PNP) switch harness connector.



MEC029E

3. Check harness continuity between PNP switch terminal 2 and body ground. Refer to Wiring Diagram.
   Continuity should exist.
4. Also check harness for short to ground and short to power.

OK or NG

OK	▶	GO TO 3.
NG	▶	Repair open circuit or short to ground or short to power in harness or connectors.

3	CHECK PNP SWITCH INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Disconnect ECM harness connector.
2. Check harness continuity between ECM terminal 22 and PNP switch terminal 1. Refer to Wiring Diagram.
   Continuity should exist.
3. Also check harness for short to ground and short to power.

OK or NG

OK	▶	GO TO 5.
NG	▶	GO TO 4.

4	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors M842, F135 (RHD models)
- Harness connectors F108, E225
- Harness for open or short between PNP switch and ECM

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

5	CHECK PARK/NEUTRAL POSITION SWITCH

Refer to MT section ("POSITION SWITCH CHECK").

OK or NG

OK	▶	GO TO 6.
NG	▶	Replace park/neutral position switch.

Diagnostic Procedure (Cont'd)

6	CHECK INTERMITTENT INCIDENT
Refer to "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78.	
▶	INSPECTION END

FOR A/T MODELS

1	CHECK OVERALL FUNCTION

With CONSULT-II

1. Turn ignition switch "ON".
2. Select "P/N POSI SW" in "DATA MONITOR" mode with CONSULT-II.
3. Check "P/N POSI SW" signal under the following conditions.

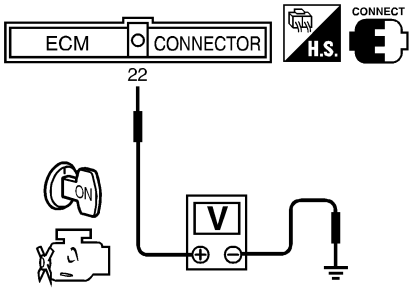
DATA MONITOR	
MONITOR	NO DTC
P/N POSI SW	ON

Shift lever position	P/N POSI SW
Neutral position	ON
Except the above position	OFF

SEF049Y

Without CONSULT-II

1. Turn ignition switch "ON".
2. Check voltage between ECM terminal 22 and ground under the following conditions.



Condition (Gear position)	Voltage V
Neutral position	Approx. 0V
Except the above position	Battery voltage

SEF419Y

OK or NG

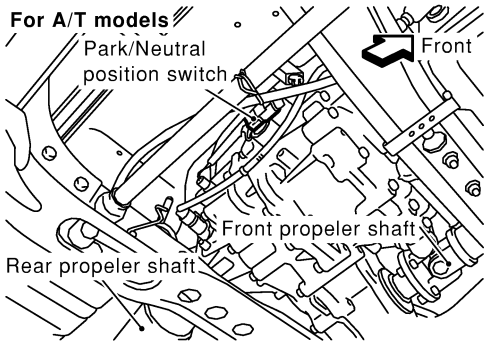
OK	▶	INSPECTION END
NG	▶	GO TO 2.

Diagnostic Procedure (Cont'd)

2	CHECK PNP RELAY CIRCUIT

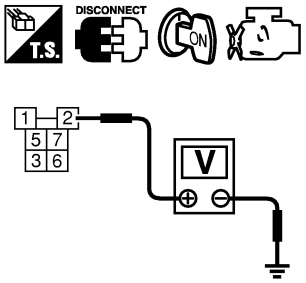
Without CONSULT-II

1. Turn ignition switch "OFF".
2. Disconnect Park/Neutral position relay harness connector.



MEC029E

3. Turn ignition switch "ON".
4. Check voltage between Park/Neutral position relay terminal 2 and ground under the following conditions.



MEC981D

Conditions (Gear position)	Voltage
"P" or "N" position	Battery voltage
Except above positions	Approx. 0V

MTBL1320

OK or NG

OK	▶	GO TO 4.
NG	▶	GO TO 3.

3	DETECT MALFUNCTIONING PART

Check the following.
- 10A fuse
- Harness connectors F93, M788 (LHD models)
- Park/Neutral position switch
- Harness for between park/neutral position relay and fuse

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

Diagnostic Procedure (Cont'd)

4	CHECK PNP RELAY INPUT SIGNAL CIRCUIT FOR OPEN OR SHORT
1. Turn ignition switch "OFF". 2. Disconnect park/neutral position switch and park/neutral position relay harness connectors. 3. Check harness continuity between PNP switch terminal 2 and PNP relay terminals 2. Refer to wiring diagram. **Continuity should exist.** 4. Also check harness for short to ground and short to power. **OK or NG**	
OK ▶	GO TO 5.
NG ▶	Repair open circuit or short to ground or short to power in harness or connectors.

5	CHECK GROUND CIRCUIT
1. Disconnect PNP relay harness connector. 2. Check continuity between PNP relay terminal 1 and ground. Refer to wiring diagram. **Continuity should exist.** 3. Also check harness for short to power. **OK or NG**	
OK ▶	GO TO 6.
NG ▶	Repair open circuit or short to ground or short to power in harness or connectors.

6	CHECK ECM INPUT SIGNAL CIRCUIT
1. Disconnect ECM harness connector and PNP relay harness connector. 2. Check continuity between ECM terminal 22 and PNP relay terminal 7. Refer to wiring diagram. **Continuity should exist.** 3. Also check harness for short to ground or short to power. **OK or NG**	
OK ▶	GO TO 8.
NG ▶	GO TO 7.

7	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors F93, M788 (LHD models) ● Harness for open or short between PNP relay and ECM	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

8	CHECK PARK/NEUTRAL POSITION (PNP) SWITCH
Refer to "TROUBLE DIAGNOSIS FOR NON-DETECTABLE ITEMS" in AT section. **OK or NG**	
OK ▶	GO TO 9.
NG ▶	Replace park/neutral position (PNP) switch.

9	CHECK INTERMITTENT INCIDENT
Perform "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78.	
▶	**INSPECTION END**

Component Description

The heat up switch is located on the lower side of the instrument panel. This switch is used to speed up the heater's operation when the engine is cold.
When the ECM received the heat up switch "ON" signal, the ECM increases the engine idle speed to 1,100 to 1,200 rpm to warm up engine quickly.
This system works when all conditions listed below are met.

Heat up switch	ON
Engine coolant temperature	Below 105°C (221°F)
Shift lever	"P" or "N"
Accelerator pedal	Fully released

CONSULT-II Reference Value in Data Monitor Mode

Specification data are reference values.

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

ECM Terminals and Reference Value

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

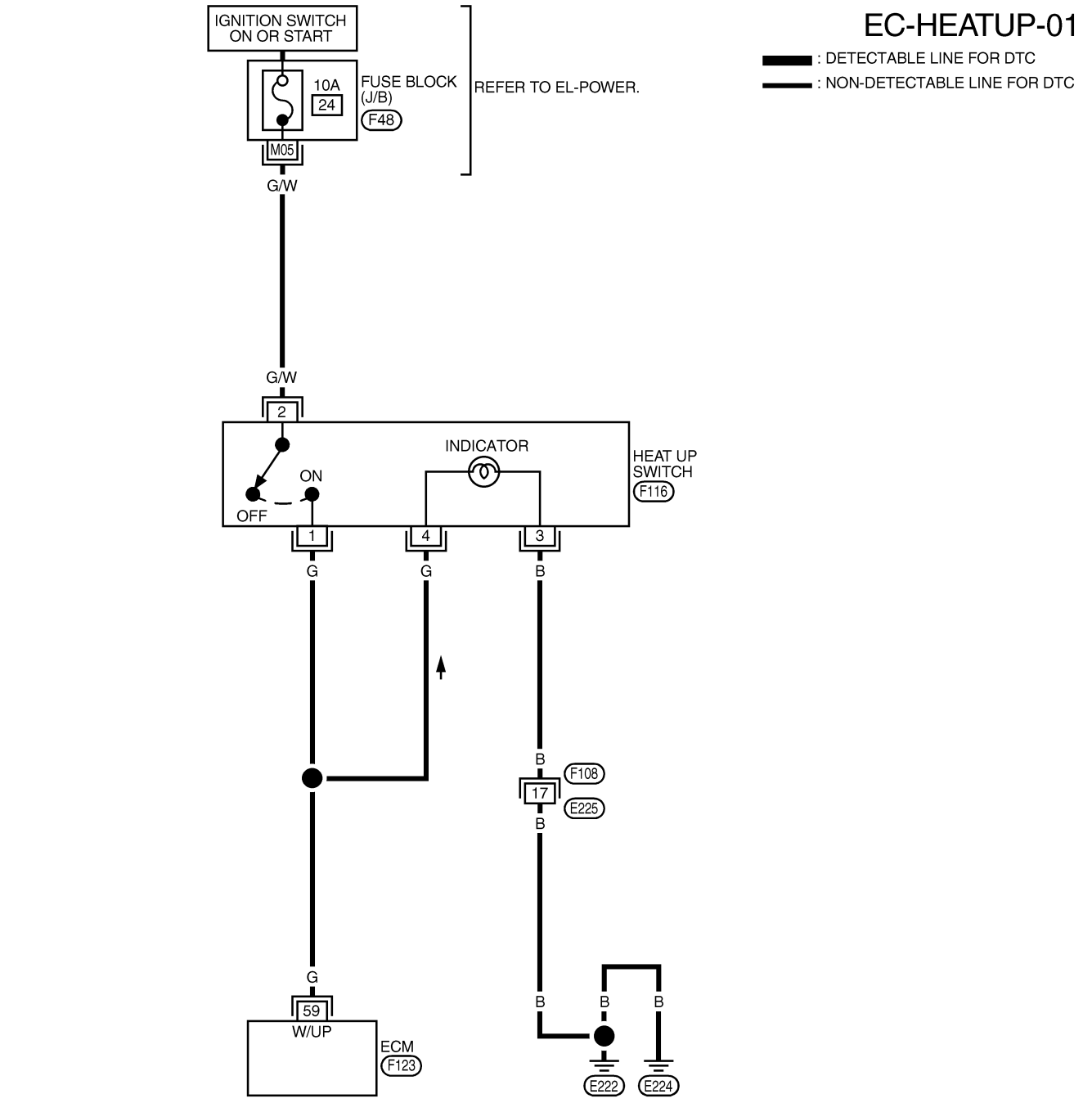
CAUTION:

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

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

Wiring Diagram

LHD MODELS



YEC198A

Diagnostic Procedure

1	INSPECTION START
Do you have CONSULT-II? **Yes or No**	
Yes ▶	GO TO 2.
No ▶	GO TO 3.

2	CHECK OVERALL FUNCTION

With CONSULT-II

1. Turn ignition switch “ON”.
2. Check “WARM UP SW” in “DATA MONITOR” mode with CONSULT-II under the following conditions.

DATA MONITOR	
MONITOR	NO DTC
WARM UP SW	OFF

Conditions	WARM UP SW
Heat-up switch is “OFF”.	OFF
Heat-up switch is “ON”.	ON

SEF302Z

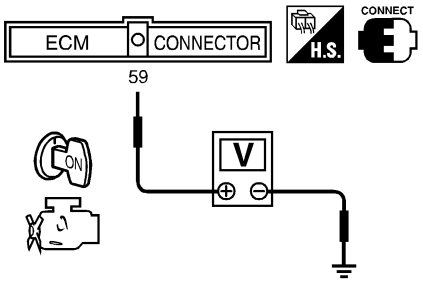
OK or NG

OK ▶	**INSPECTION END**
NG ▶	GO TO 4.

3	CHECK OVERALL FUNCTION

Without CONSULT-II

1. Turn ignition switch “ON”.
2. Check voltage between ECM terminal 59 and ground under the following conditions.



Conditions	Voltage
Heat-up switch is “OFF”.	Approximately 0V
Heat-up switch is “ON”.	Battery voltage

SEF303Z

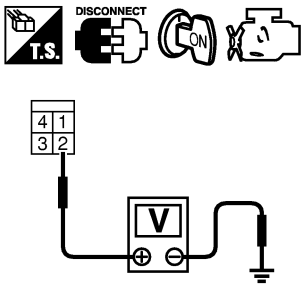
OK or NG

OK ▶	**INSPECTION END**
NG ▶	GO TO 4.

Diagnostic Procedure (Cont'd)

4	CHECK HEAT UP SWITCH POWER SUPPLY CIRCUIT

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



MEC983D

Voltage: Battery voltage

OK or NG

OK	▶	GO TO 6.
NG	▶	GO TO 5.

5	DETECT MALFUNCTIONING PART

Check the following.
- Fuse block (J/B) connector F48
- 10A fuse
- Harness for open or short between heat up switch and fuse

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

6	CHECK HEAT UP SWITCH INPUT SIGNAL CIRCUIT FOR OPEN OR SHORT

1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector.
3. Check harness continuity between ECM terminal 59 and heat up switch terminal 1. Refer to Wiring Diagram.
   Continuity should exist.
4. Also check harness for short to ground and short to power.

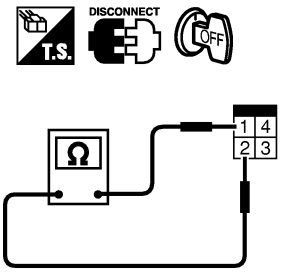
OK or NG

OK	▶	GO TO 7.
NG	▶	Repair open circuit or short to ground or short to power in harness or connectors.

Diagnostic Procedure (Cont'd)

7	CHECK HEAT UP SWITCH

Check continuity between heat up switch terminals 1 and 2 under the following conditions.



MEC984D

Conditions	Continuity
Heat-up switch is "OFF".	Should not exist.
Heat-up switch is "ON".	Should exist.

MTBL1321

OK or NG

OK	▶	GO TO 8.
NG	▶	Replace heat up switch.

8	CHECK INTERMITTENT INCIDENT
Refer to "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78.	
▶	**INSPECTION END**

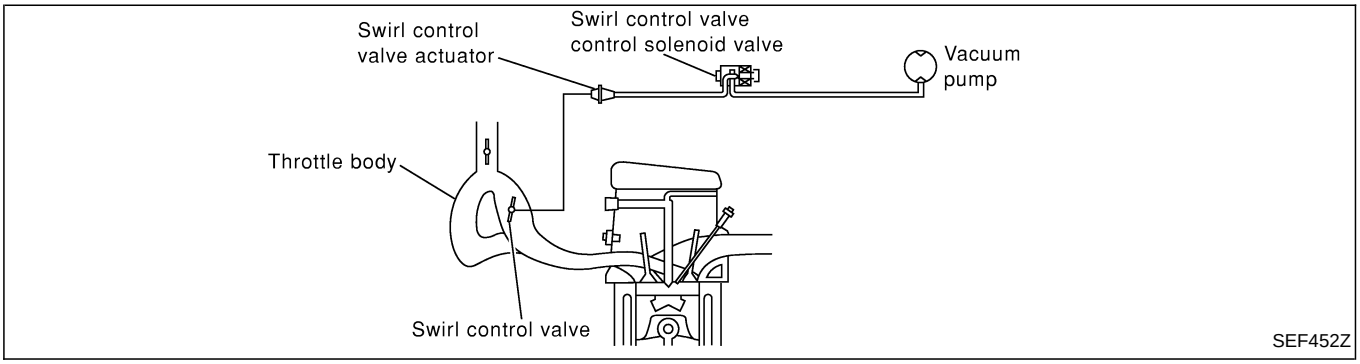
Description

SYSTEM DESCRIPTION

Sensor	Input Signal to ECM	ECM Function	Actuator
Ignition switch	Start signal	Swirl control valve control	Swirl control valve control solenoid valve ↓ Vacuum signal Swirl control valve actuator ↓ Swirl control valve
Crankshaft position sensor (TDC)	Engine speed		
PNP switch	Park/Neutral position signal		
Engine coolant temperature sensor	Engine coolant temperature		

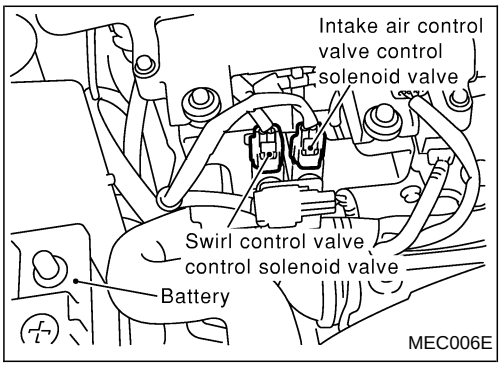
This system has a swirl control valve in the throttle body.
While idling and during low engine speed operation, the swirl control valve closes. Thus the velocity of the air in the intake passage increases, promoting the vaporization of the fuel and producing a swirl in the combustion chamber.
Because of this operation, this system tends to increase the burning speed of the gas mixture, improve fuel consumption, and increase the stability in running conditions.
Also, except when idling and during low engine speed operation, this system opens the swirl control valve. In this condition, this system tends to increase power by improving intake efficiency via reduction of intake flow resistance, intake flow.
The solenoid valve controls swirl control valve's shut/open condition. This solenoid valve is operated by the ECM.

PNP switch	Engine speed	Engine coolant temperature	Swirl control valve control solenoid valve	Swirl control valve
OFF	Less than 1,250 rpm	Less than 50°C (122°F)	OFF	Open
		More than 50°C (122°F)	ON	Closed
	More than 1,250 rpm	Less than 50°C (122°F)	OFF	Open
		More than 50°C (122°F)	OFF	Open
ON	—	—	OFF	Open



Description (Cont'd)

COMPONENT DESCRIPTION



Swirl control valve control solenoid valve

The swirl control valve control solenoid valve responds to signals from the ECM. When the ECM sends an ON (ground) signal, the solenoid valve is bypassed to apply vacuum pump vacuum to the swirl control valve actuator. This operation closes the swirl control valve. When the ECM sends an OFF signal, the vacuum signal is cut and the swirl control valve opens.

CONSULT-II Reference Value in Data Monitor Mode

Specification data are reference values.

MONITOR ITEM	CONDITION		SPECIFICATION
SWRL CONT S/V	● Lift up the vehicle ● Engine: After warming up, let it idle for more than 1 second. ● Air conditioner switch: OFF ● No-load	Shift lever: Except "P" and "Neutral" position	ON
		Shift lever: "Neutral" position	OFF

ECM Terminals and Reference Value

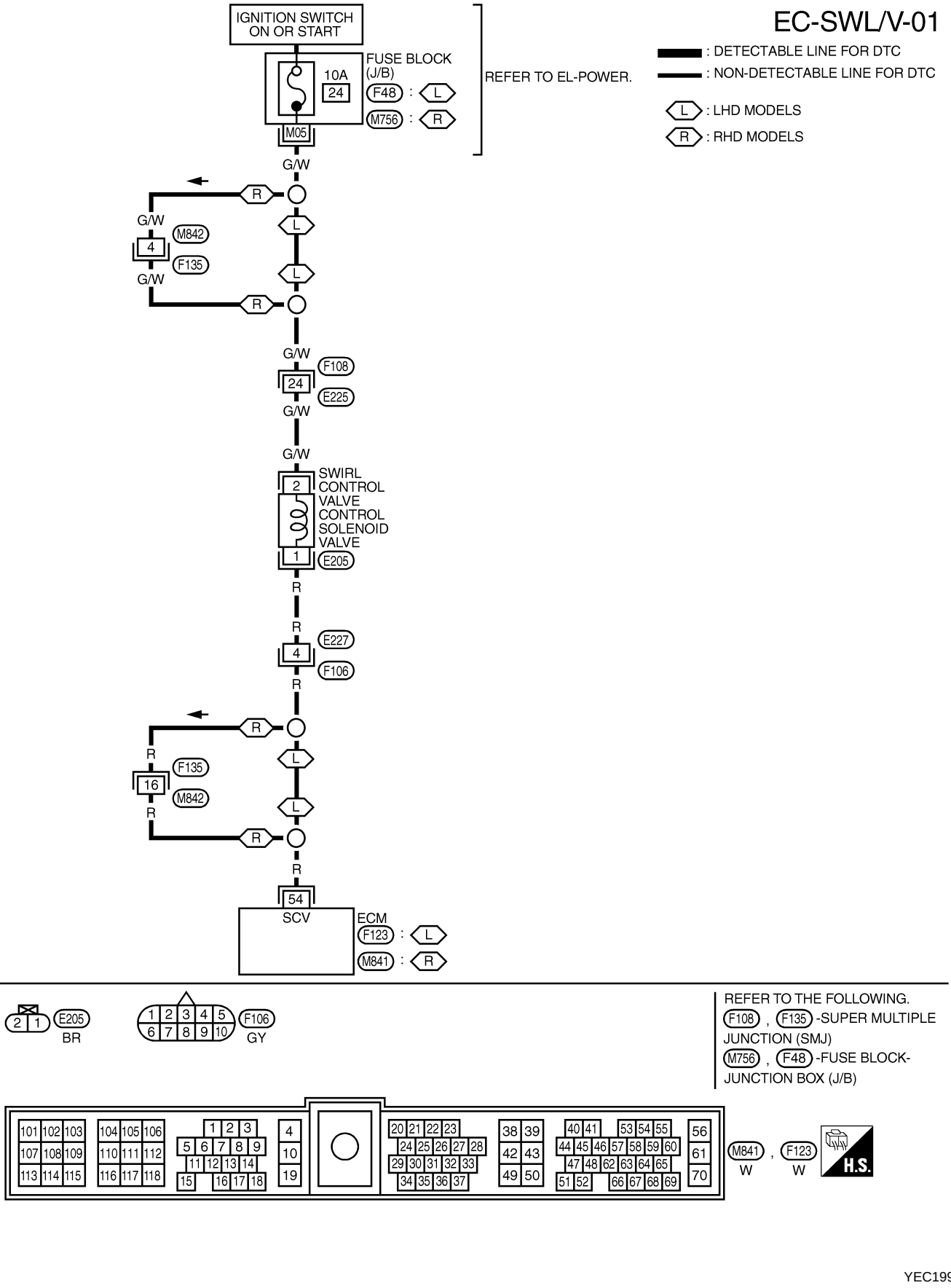
Specification data are reference values and are measured between each terminal and ground.

CAUTION:

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

TER-MINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
54	R	Swirl control valve control solenoid valve	Engine is running. └ **Warm-up condition** At idle speed for more than 1 second. Lift up the vehicle Gear position is except "P" and "Neutral"	Approximately 0.1V
			Engine is running. └ Idle speed Lift up the vehicle Gear position is "P" or "Neutral"	BATTERY VOLTAGE (11 - 14V)

Wiring Diagram



YEC199A

Diagnostic Procedure

1	INSPECTION START
Do you have CONSULT-II? **Yes or No**	
Yes ▶	GO TO 2.
No ▶	GO TO 3.

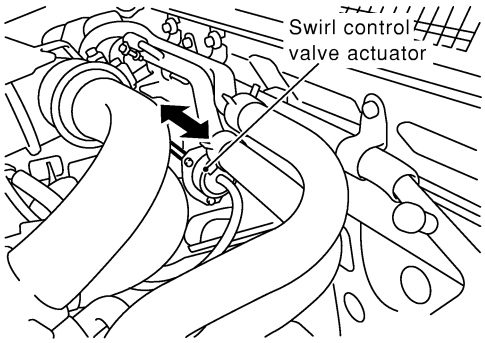
2	CHECK OVERALL FUNCTION

With CONSULT-II

1. Start engine and let it idle.
2. Select “SWIRL CONT S/V 1” in “ACTIVE TEST” mode with CONSULT-II.
3. Touch “ON” and “OFF” alternately on CONSULT-II screen.
4. Make sure that swirl control valve actuator rod moves according to “SWIRL CONT S/V 1” indication.

ACTIVE TEST	
SWIRL CONT S/V 1	ON
MONITOR	
CKPS-RPM (TDC)	750 rpm
SWRL CON S/V 1	ON

MEC007E



MEC008E

OK or NG

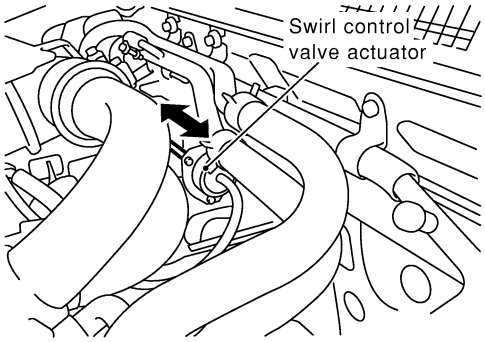
OK ▶	**INSPECTION END**
NG ▶	GO TO 4.

Diagnostic Procedure (Cont'd)

3	CHECK OVERALL FUNCTION

Without CONSULT-II

1. Lift up the vehicle.
2. Start engine and warm it up to normal operating temperature.
3. Run engine at idle speed.
4. Make sure that swirl control valve actuator rod moves when shifting the shift lever to "P" or "Neutral" position and then to positions other than "P" and "Neutral".



MEC008E

OK or NG

OK	▶	**INSPECTION END**
NG	▶	GO TO 5.

Diagnostic Procedure (Cont'd)

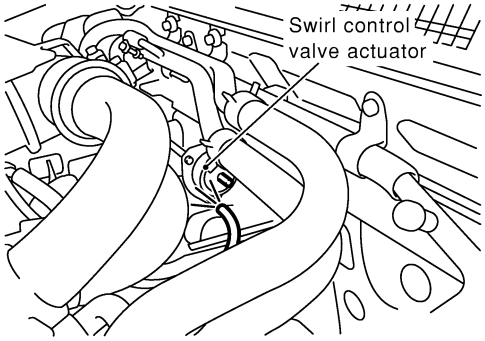
4	CHECK VACUUM SOURCE

With CONSULT-II

1. Turn ignition switch "OFF".
2. Disconnect vacuum hose connected to swirl control valve actuator.
3. Start engine and let it idle.
4. Select "SWIRL CONT S/V 1" in "ACTIVE TEST" mode with CONSULT-II.
5. Touch "ON" and "OFF" alternately on CONSULT-II screen.
6. Check vacuum hose for vacuum existence under the following conditions.

ACTIVE TEST	
SWIRL CONT S/V 1	ON
MONITOR	
CKPS-RPM (TDC)	750 rpm
SWRL CON S/V 1	ON

MEC007E



MEC009E

SWIRL CONT S/V 1	Vacuum
ON	Should exist.
OFF	Should not exist.

MTBL1326

OK or NG

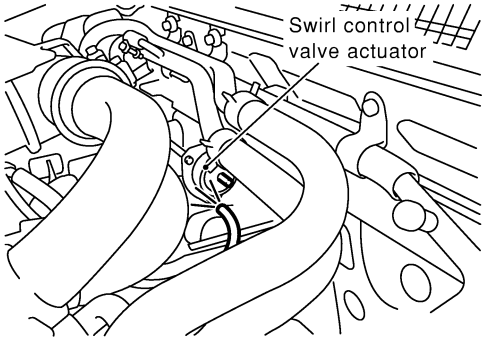
OK	▶	GO TO 7.
NG	▶	GO TO 6.

Diagnostic Procedure (Cont'd)

5	CHECK VACUUM SOURCE

Without CONSULT-II

1. Turn ignition switch "OFF".
2. Disconnect vacuum hose connected to swirl control valve actuator.
3. Lift up the vehicle.
4. Start engine and warm it up to normal operating temperature.
5. Run engine at idle speed
6. Check vacuum hose for vacuum existence under the following conditions.



MEC009E

Conditions	Vacuum
Shift lever is in positions other than "P" and "Newtral".	Should exist.
Shift lever is in "P" or "Newtral" position.	Should not exist.

MTBL1327

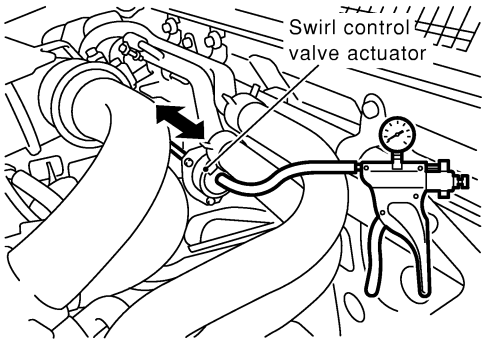
OK or NG

OK	▶	GO TO 7.
NG	▶	GO TO 6.

Diagnostic Procedure (Cont'd)

6	CHECK SWIRL CONTROL VALVE ACTUATOR

1. Turn ignition switch "OFF".
2. Install a vacuum pump to swirl control valve actuator.
3. Make sure that the swirl control valve actuator rod moves smoothly when applying vacuum of −93.3 kPa (−933 mbar, −700 mmHg, −27.6 inHg) and releasing it.



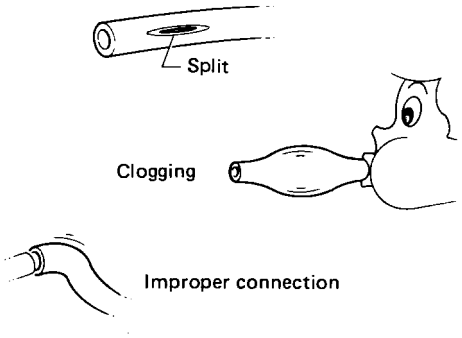
MEC010E

OK or NG

OK	▶	Repair or replace vacuum hoses and vacuum gallery.
NG	▶	Replace swirl control valve actuator.

7	CHECK VACUUM HOSE

1. Turn ignition switch "OFF".
2. Check vacuum hoses and vacuum gallery for clogging, cracks or improper connection.



SEF109L

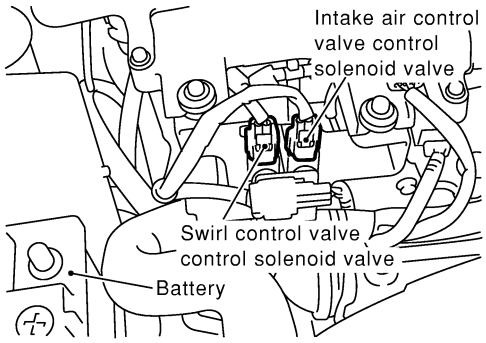
OK or NG

OK	▶	GO TO 8.
NG	▶	Repair or replace vacuum hoses and vacuum gallery.

Diagnostic Procedure (Cont'd)

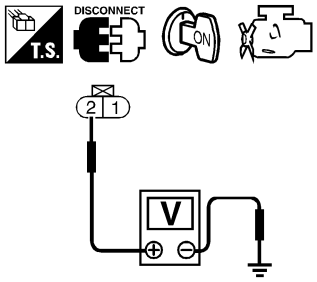
8	CHECK SWIRL CONTROL VALVE CONTROL SOLENOID VALVE POWER SUPPLY CIRCUIT

1. Turn ignition switch "OFF".
2. Disconnect swirl control valve control solenoid valve harness connector.



MEC006E

3. Turn ignition switch "ON".
4. Check voltage between swirl control valve control solenoid valve terminal 2 and ground with CONSULT-II or tester.



Voltage: Battery voltage

SEF312Z

OK or NG

OK	▶	GO TO 10.
NG	▶	GO TO 9.

9	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors F108, E225
- Harness connectors M842, F135
- Fuse block (J/B) connector F48 (LHD models), M756 (RHD models)
- 10A fuse
- Harness for open or short between swirl control valve control solenoid valve and fuse

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

10	CHECK SWIRL CONTROL VALVE CONTROL SOLENOID VALVE OUTPUT SIGNAL CIRCUIT FOR OPEN OR SHORT

1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector.
3. Check harness continuity between ECM terminal 54 and swirl control valve control solenoid valve terminal 1. Refer to Wiring Diagram.
   Continuity should exist.
4. Also check harness for short to ground and short to power.

OK or NG

OK	▶	GO TO 12.
NG	▶	GO TO 11.

Diagnostic Procedure (Cont'd)

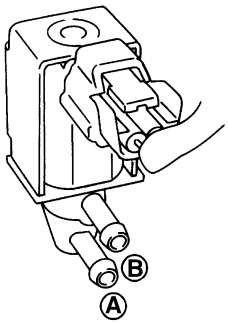
11	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors E227, F106 ● Harness connectors F135, M842 (RHD models) ● Harness for open or short between swirl control valve control solenoid valve and ECM	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

12	CHECK SWIRL CONTROL VALVE CONTROL SOLENOID VALVE

With CONSULT-II

1. Reconnect all disconnected harness connectors.
2. Turn ignition switch "ON".
3. Select "SWIRL CONT S/V 1" in "ACTIVE TEST" mode with CONSULT-II.
4. Check air passage continuity of swirl control valve control solenoid valve under the following conditions.

ACTIVE TEST	
SWIRL CONT S/V 1	ON
MONITOR	
CKPS-RPM (TDC)	750 rpm
SWRL CON S/V 1	ON

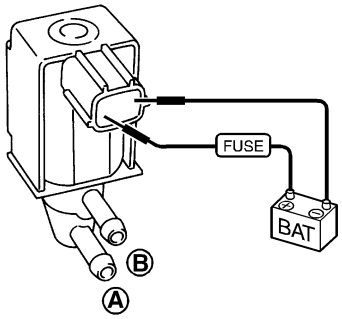


SWIRL CONT S/V 1	Air passage continuity between A and B
ON	Yes
OFF	No

SEF313Z

Without CONSULT-II

1. Apply 12V direct current between swirl control valve control solenoid valve terminals.
2. Check air passage continuity of swirl control valve control solenoid valve under the following conditions.



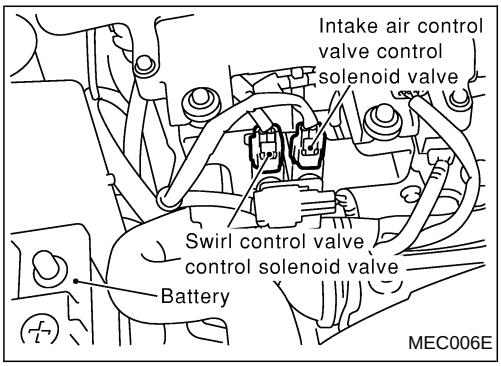
Condition	Air passage continuity between A and B
12V direct current supply between terminals 1 and 2	Yes
No supply	No

SEF335X

OK or NG

OK	▶	GO TO 13.
NG	▶	Replace swirl control valve control solenoid valve.

13	CHECK INTERMITTENT INCIDENT
Perform "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78.	
▶	INSPECTION END



Description

Vibration when stopping the engine can be controlled by cutting intake air just before the fuel is cut. The intake air control valve control solenoid valve controls the ON-OFF load of the intake air control valve actuator. As a result, the intake air control valve control solenoid valve will be turned ON when the ignition switch is turned OFF with the engine running and when the engine stalls. After the engine has stopped, the intake air control valve control solenoid valve will return to fully open.

Operation

Sensor	Input Signal to ECM	ECM Function	Actuator
Ignition switch	OFF	Intake air control valve control	Intake air control valve control solenoid valve ↓ Intake air control valve actuator
Crankshaft position sensor (TDC)	Engine stall		

ECM Terminals and Reference Value

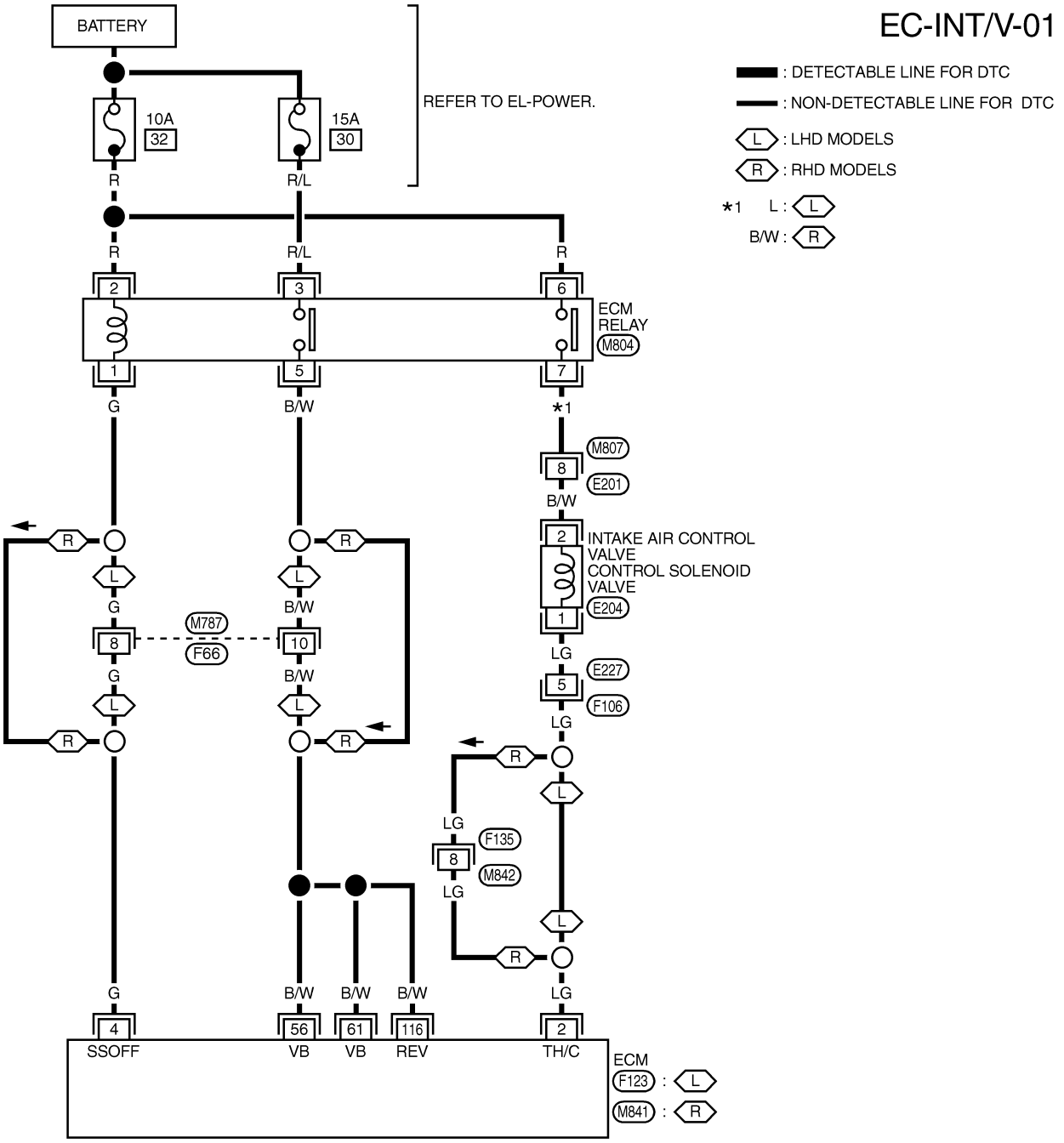
Specification data are reference values, and are measured between each terminal and ground.

CAUTION:

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

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage)
2	LG	Intake air control valve control solenoid valve	Engine is running.	BATTERY VOLTAGE (11 - 14V)
			Ignition switch "OFF" └ For a few seconds after engine stops	Approximately 0.1V

Wiring Diagram

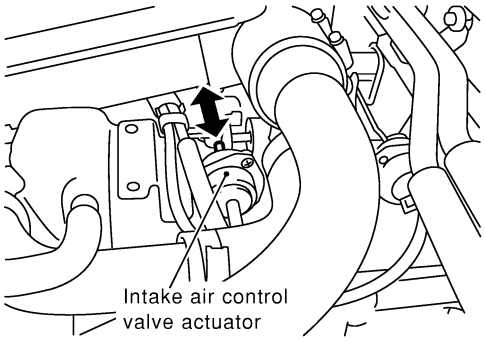


YEC200A

Diagnostic Procedure

1	CHECK OVERALL FUNCTION

1. Start engine and let it idle.
2. Make sure that intake air control valve actuator rod moves when turning ignition switch “OFF”.



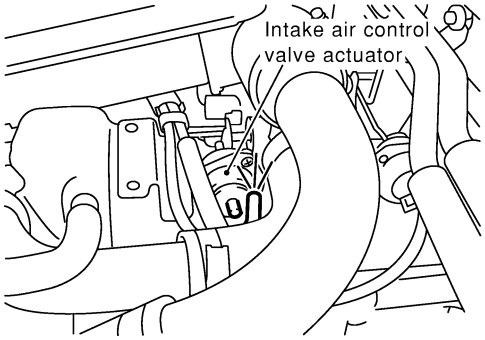
MEC011E

OK or NG

OK	▶	**INSPECTION END**
NG	▶	GO TO 2.

2	CHECK VACUUM SOURCE

1. Turn ignition switch “OFF”.
2. Disconnect vacuum hose connected to intake air control valve actuator.
3. Start engine and let it idle.
4. Check vacuum hose for vacuum existence under the following conditions.



MEC012E

Conditions	Vacuum
For a few seconds after turning ignition switch OFF	Should exist.
Except above.	Should not exist.

MTBL1328

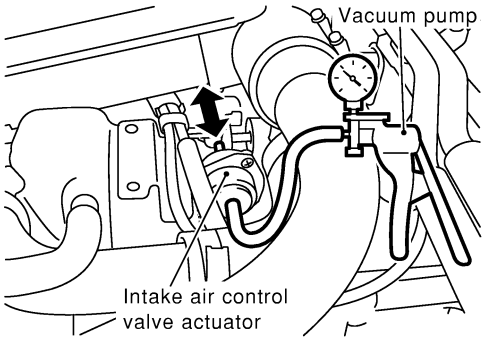
OK or NG

OK	▶	GO TO 3.
NG	▶	GO TO 4.

Diagnostic Procedure (Cont'd)

3	CHECK INTAKE AIR CONTROL VALVE ACTUATOR

4. Turn ignition switch "OFF".
5. Install a vacuum pump to intake air control valve actuator.
6. Make sure that the intake air control valve actuator rod moves smoothly when applying vacuum of −93.3 kPa (−933 mbar, −700 mmHg, −27.56 psi) and releasing it.



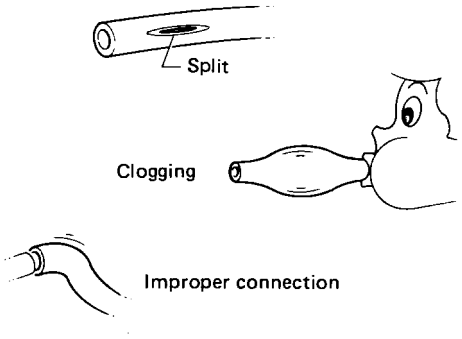
MEC013E

OK or NG

OK	▶	Repair or replace vacuum hoses and vacuum gallery.
NG	▶	Replace intake air control valve actuator.

4	CHECK VACUUM HOSE

3. Turn ignition switch "OFF".
4. Check vacuum hoses and vacuum gallery for clogging, cracks or improper connection.



SEF109L

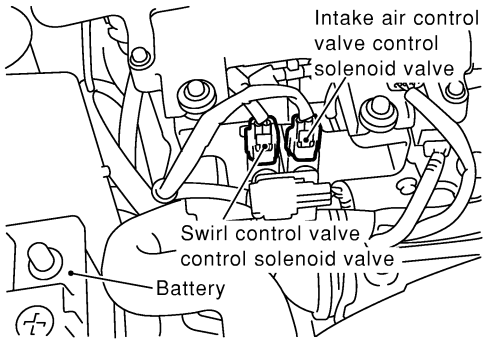
OK or NG

OK	▶	GO TO 5.
NG	▶	Repair or replace vacuum hoses and vacuum gallery.

Diagnostic Procedure (Cont'd)

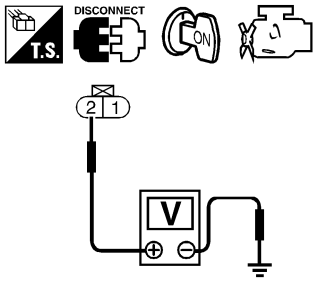
5	CHECK INTAKE AIR CONTROL VALVE CONTROL SOLENOID VALVE POWER SUPPLY CIRCUIT-I

1. Turn ignition switch "OFF".
2. Disconnect intake air control valve control solenoid valve harness connector.



MEC006E

3. Turn ignition switch "ON".
4. Check voltage between intake air control valve control solenoid valve terminal 2 and ground with CONSULT-II or tester.



Voltage: Battery voltage

SEF312Z

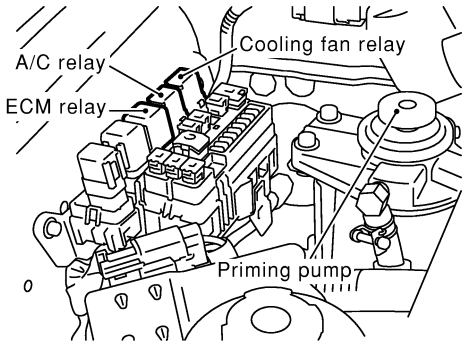
OK or NG

OK	▶	GO TO 11.
NG	▶	GO TO 6.

Diagnostic Procedure (Cont'd)

6	CHECK INTAKE AIR CONTROL VALVE CONTROL SOLENOID VALVE POWER SUPPLY CIRCUIT-II

1. Turn ignition switch "OFF".
2. Disconnect ECM relay.



MEC021E

3. Check harness continuity between intake air control valve control solenoid valve terminal 2 and ECM relay terminal 7. Refer to Wiring Diagram.
   Continuity should exist.
4. Also check harness for short to ground and short to power.

OK or NG

OK	▶	GO TO 8.
NG	▶	GO TO 7.

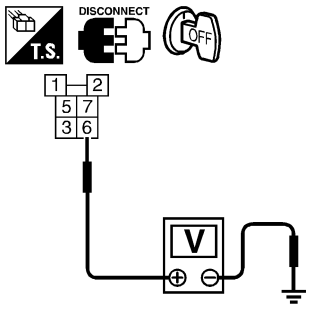
7	DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors M807, E201
- Harness for open or short between intake air control valve control solenoid valve and ECM relay

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

8	CHECK INTAKE AIR CONTROL VALVE CONTROL SOLENOID VALVE POWER SUPPLY CIRCUIT-III

Check voltage between ECM relay terminal 6 and ground with CONSULT-II or tester.



Voltage: Battery voltage

SEF297Z

OK or NG

OK	▶	GO TO 10.
NG	▶	GO TO 9.

9	DETECT MALFUNCTIONING PART

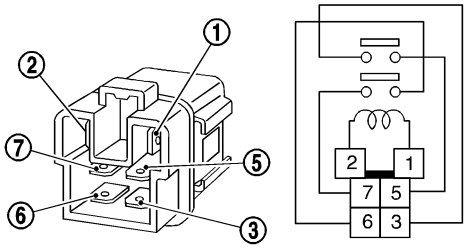
Check the following.
- 10A fuse
- Harness for open or short between ECM relay and battery

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

Diagnostic Procedure (Cont'd)

10	CHECK ECM RELAY

1. Apply 12V direct current between ECM relay terminals 1 and 2.
2. Check continuity between ECM relay terminals 3 and 5, 6 and 7.



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

SEF296X

OK or NG

OK	▶	GO TO 13.
NG	▶	Replace ECM relay.

11	CHECK INTAKE AIR CONTROL VALVE CONTROL SOLENOID VALVE OUTPUT SIGNAL CIRCUIT FOR OPEN OR SHORT

1. Turn ignition switch "OFF".
2. Disconnect ECM harness connector.
3. Check harness continuity between ECM terminal 2 and intake air control valve control solenoid valve terminal 1. Refer to Wiring Diagram.
   Continuity should exist.
4. Also check harness for short to ground and short to power.

OK or NG

OK	▶	GO TO 13.
NG	▶	GO TO 12.

12	DETECT MALFUNCTIONING PART

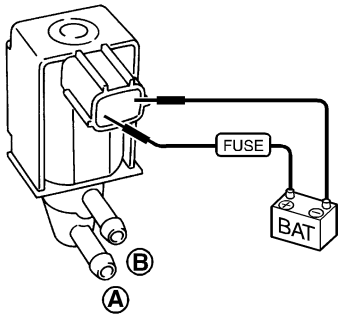
Check the following.
- Harness connectors E227, F106
- Harness connectors F135, M842 (RHD models)
- Harness for open or short between swirl control valve control solenoid valve and ECM

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

Diagnostic Procedure (Cont'd)

13	CHECK INTAKE AIR CONTROL VALVE CONTROL SOLENOID VALVE

1. Apply 12V direct current between intake air control valve control solenoid valve terminals.
2. Check air passage continuity of intake air control valve control solenoid valve under the following conditions.



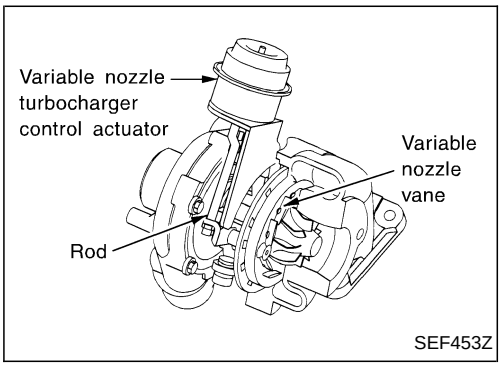
Condition	Air passage continuity between A and B
12V direct current supply between terminals 1 and 2	Yes
No supply	No

SEF335X

OK or NG

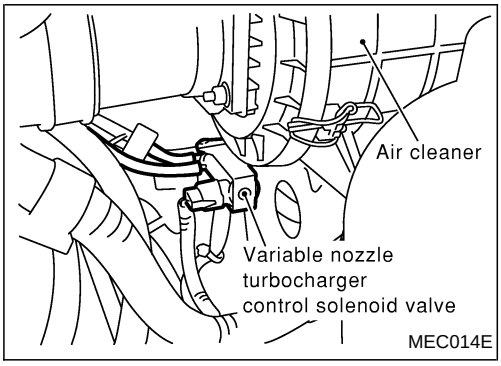
OK	▶	GO TO 14.
NG	▶	Replace intake control valve control solenoid valve.

14	CHECK INTERMITTENT INCIDENT
Perform "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78.	
▶	**INSPECTION END**



Description

The load from the variable nozzle turbocharger control solenoid valve controls the actuator. By changing the variable nozzle vane opening through the rods, the intake air volume is adjusted.



The variable nozzle turbocharger control solenoid valve is moved by ON/OFF pulse from the ECM. The longer the ON pulse, the charge air pressure rises.

CONSULT-II Reference Value in Data Monitor Mode

Specification data are reference values.

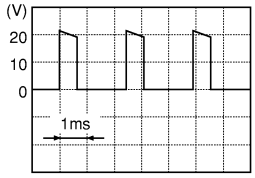
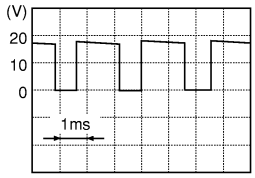
MONITOR ITEM	CONDITION		SPECIFICATION
VNT S/V 1	• Engine: After warming up • Air conditioner switch: “OFF” • Shift lever: Neutral position • No-load	Idle	Approx. 56%
		2,000 rpm	Approx. 20%

ECM Terminals and Reference Value

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

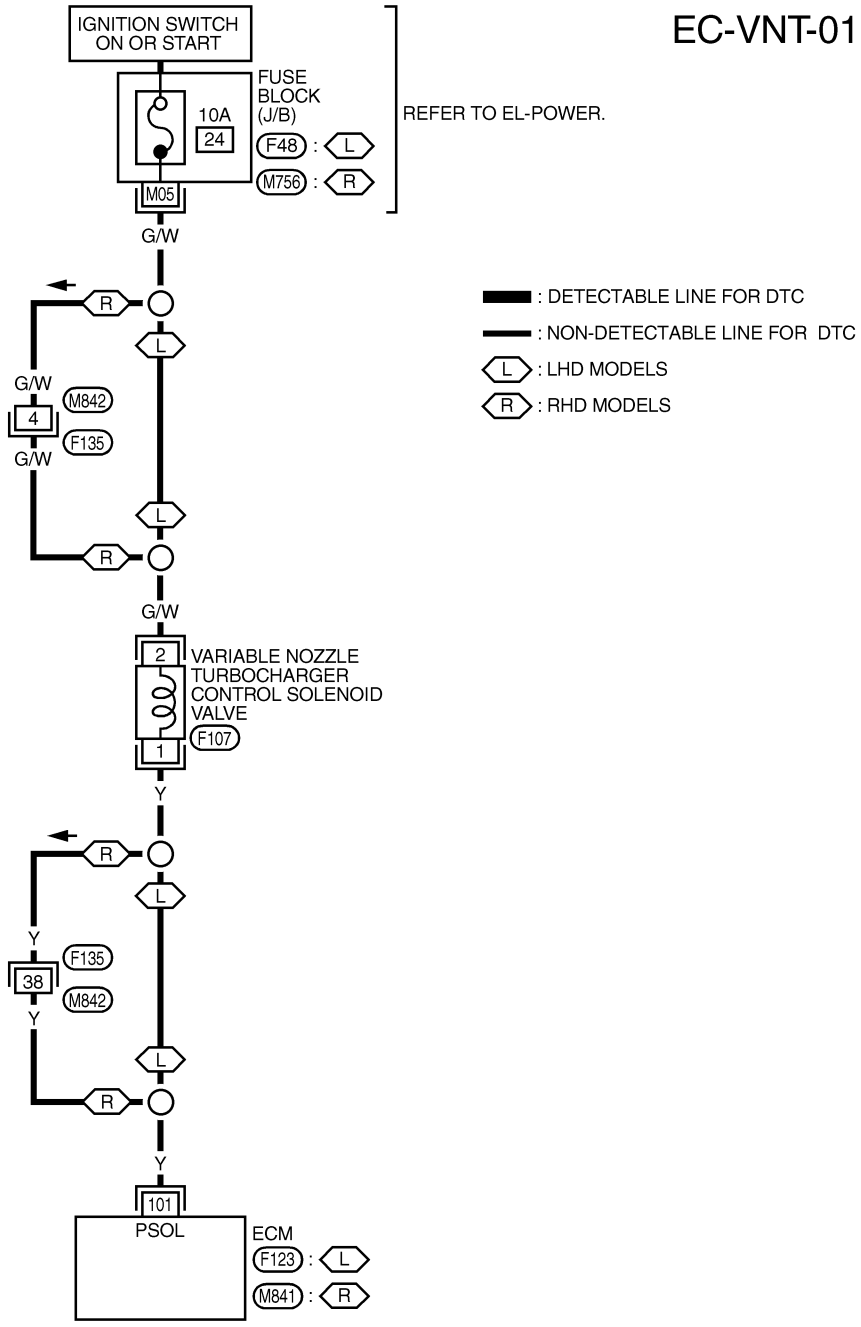
CAUTION:

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

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage)
101	Y	Variable nozzle turbocharger control solenoid valve	Engine is running. └ **Warm-up condition** Idle speed	Approximately 6.8V  SEF253Z
			Engine is running. └ **Warm-up condition** Engine speed is 2,000 rpm	Approximately 11V  SEF254Z

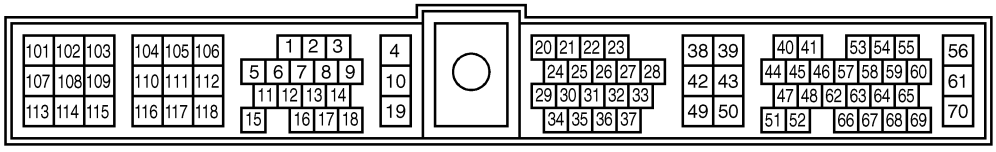
Wiring Diagram

EC-VNT-01



2 1 F107

REFER TO THE FOLLOWING.
F135 -SUPER MULTIPLE JUNCTION (SMJ)
M756 , F48 -FUSE BLOCK-JUNCTION BOX (J/B)



M841 W , F123 W

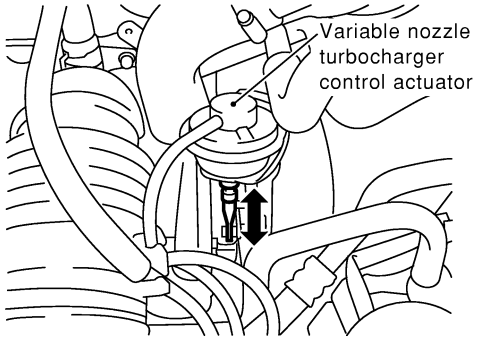
H.S.

YEC201A

Diagnostic Procedure

1	CHECK OVERALL FUNCTION

1. Start engine and let it idle.
2. Make sure that variable nozzle turbocharger control actuator rod moves when revving engine up to 3,000 rpm and returning to idle.



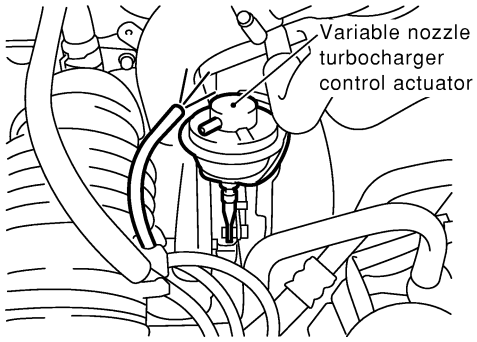
MEC015E

OK or NG

OK	▶	**INSPECTION END**
NG	▶	GO TO 2.

2	CHECK VACUUM SOURCE

1. Turn ignition switch “OFF”.
2. Disconnect vacuum hose connected to variable nozzle turbocharger control actuator.
3. Start engine and let it idle.
4. Check vacuum hose for vacuum existence.



MEC016E

Vacuum should exist.

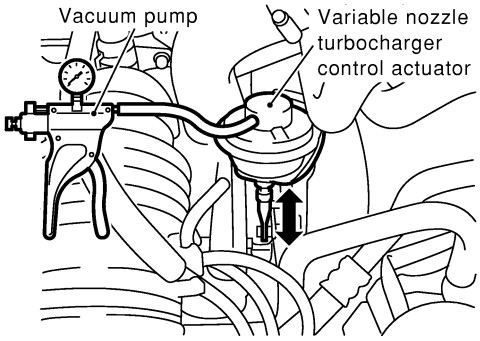
OK or NG

OK	▶	GO TO 3.
NG	▶	GO TO 5.

Diagnostic Procedure (Cont'd)

3	CHECK VARIABLE NOZZLE TURBOCHARGER CONTROL ACTUATOR

1. Turn ignition switch "OFF".
2. Install a vacuum pump to variable nozzle turbocharger control actuator.
3. Make sure that the variable nozzle turbocharger control actuator rod moves smoothly when applying vacuum of −53.3 kPa (−533 mbar, −400 mmHg, −15.75 inHg) and releasing it.



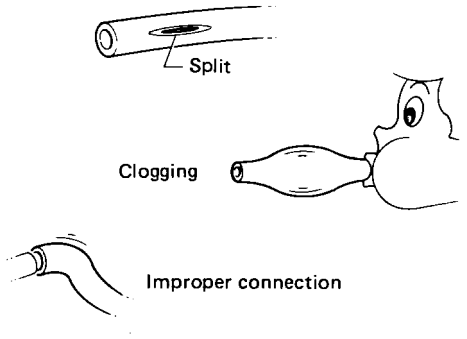
MEC017E

OK or NG

OK	▶	GO TO 4.
NG	▶	Replace turbocharger assembly.

4	CHECK VACUUM HOSE

1. Turn ignition switch "OFF".
2. Check vacuum hoses and vacuum gallery for clogging, cracks or improper connection.



SEF109L

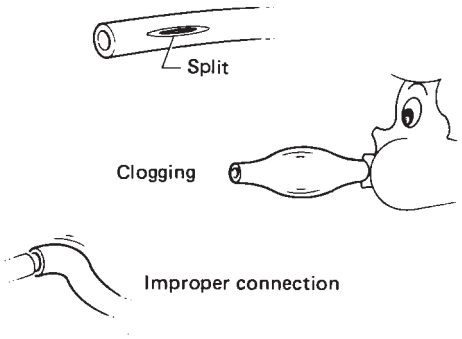
OK or NG

OK	▶	GO TO 9.
NG	▶	Repair or replace vacuum hoses and vacuum gallery.

Diagnostic Procedure (Cont'd)

5	CHECK VACUUM HOSE

1. Turn ignition switch "OFF".
2. Check vacuum hoses and vacuum gallery for clogging, cracks or improper connection.



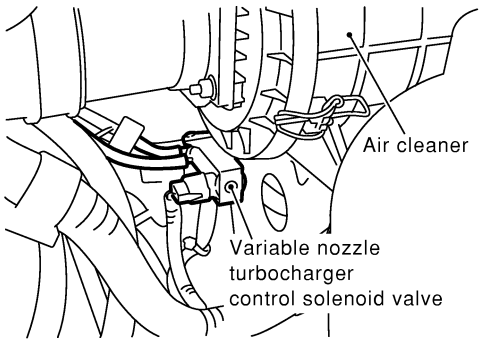
SEF109L

OK or NG

OK	▶	GO TO 6.
NG	▶	Repair or replace vacuum hoses and vacuum gallery.

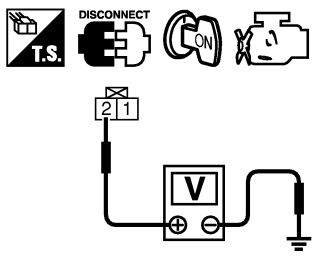
6	CHECK VARIABLE NOZZLE TURBOCHARGER CONTROL SOLENOID VALVE POWER SUPPLY CIRCUIT

1. Turn ignition switch "OFF".
2. Disconnect variable nozzle turbocharger control solenoid valve harness connector.



MEC014E

3. Turn ignition switch "ON".
4. Check voltage between variable nozzle turbocharger control solenoid valve terminal 2 and ground with CONSULT-II or tester.



MEC985D

Voltage: Battery voltage

OK or NG

OK	▶	GO TO 8.
NG	▶	GO TO 7.

Diagnostic Procedure (Cont'd)

7	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors M842, F135 (RHD models) ● Fuse block (J/B) connector F48 (LHD models), M756 (RHD models) ● 10A fuse ● Harness for open or short between variable nozzle turbocharger control solenoid valve and fuse	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

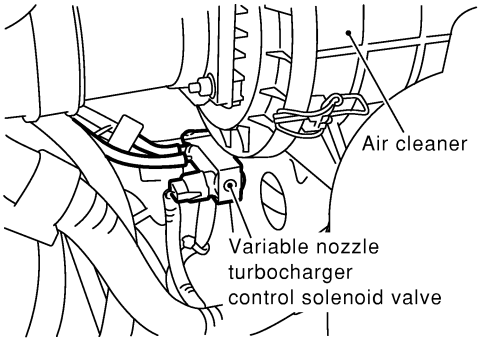
8	CHECK VARIABLE NOZZLE TURBOCHARGER CONTROL SOLENOID VALVE OUTPUT SIGNAL CIRCUIT FOR OPEN OR SHORT
1. Turn ignition switch "OFF". 2. Disconnect ECM harness connector. 3. Check harness continuity between ECM terminal 101 and variable nozzle turbocharger control solenoid valve terminal 1. Refer to Wiring Diagram. **Continuity should exist.** 4. Also check harness for short to ground and short to power.	
OK or NG	
OK ▶	GO TO 10.
NG ▶	GO TO 9.

9	DETECT MALFUNCTIONING PART
Check the following. ● Harness connectors F135, M842 (RHD models) ● Harness for open or short between variable nozzle turbocharger control solenoid valve and ECM	
▶	Repair open circuit or short to ground or short to power in harness or connectors.

Diagnostic Procedure (Cont'd)

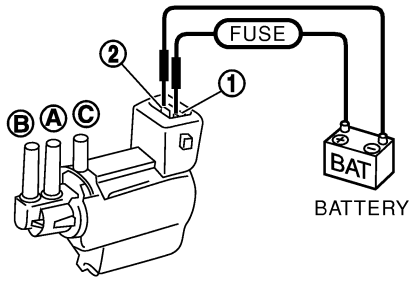
10	CHECK VARIABLE NOZZLE TURBOCHARGER CONTROL SOLENOID VALVE

1. Disconnect variable nozzle turbocharger control solenoid valve harness connector.



MEC014E

2. Apply 12V direct current between variable nozzle turbocharger control solenoid valve terminals.
3. Check air passage continuity of variable nozzle turbocharger control solenoid valve under the following conditions.



Conditions	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

Operation takes less than 1 second.

SEF454Z

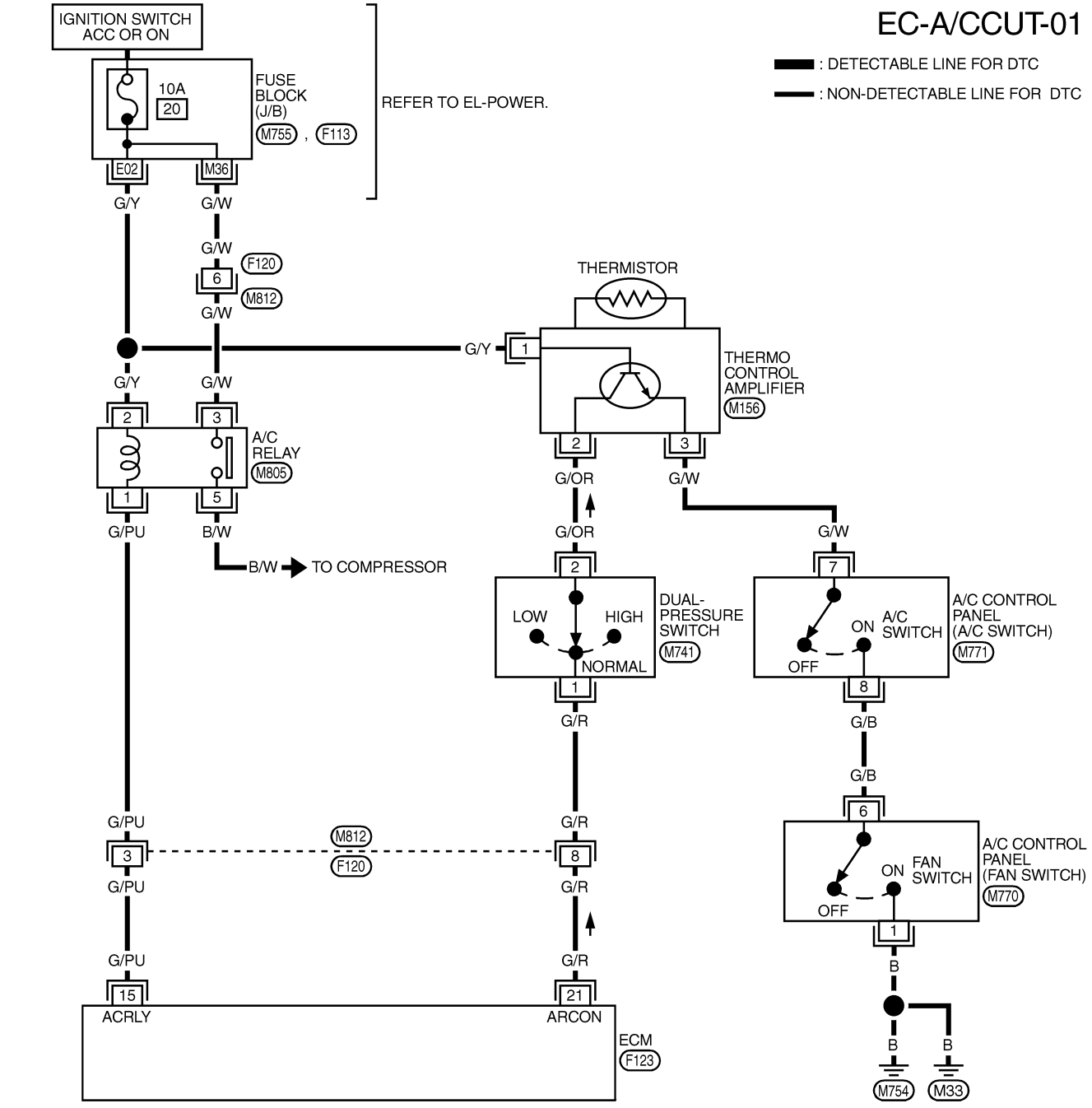
OK or NG

OK	▶	GO TO 11.
NG	▶	Replace variable nozzle turbocharger control solenoid valve.

11	CHECK INTERMITTENT INCIDENT
Perform "TROUBLE DIAGNOSIS FOR INTERMITTENT INCIDENT", EC-78.	
▶	**INSPECTION END**

Wiring Diagram

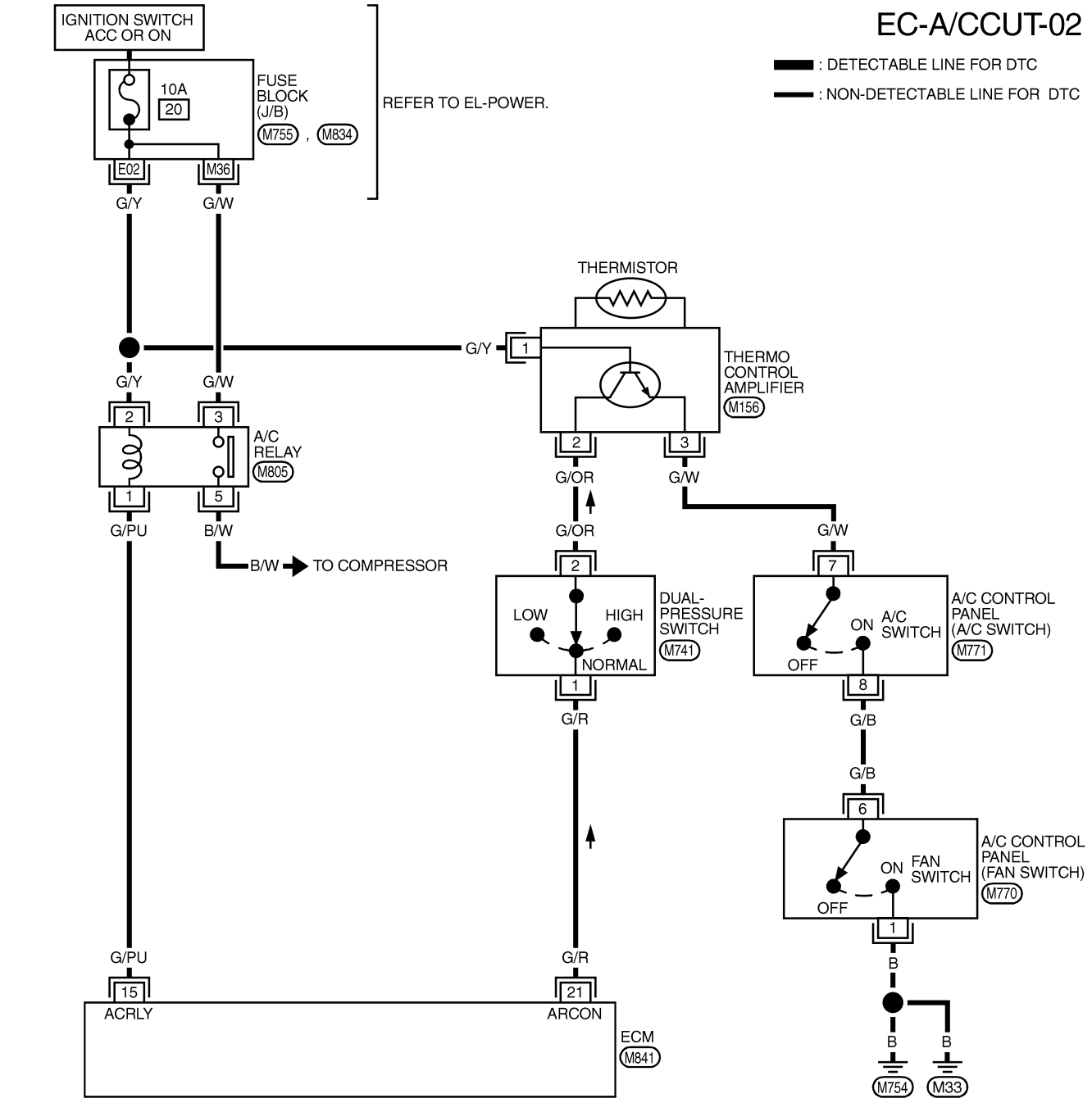
LHD MODELS



YEC202A

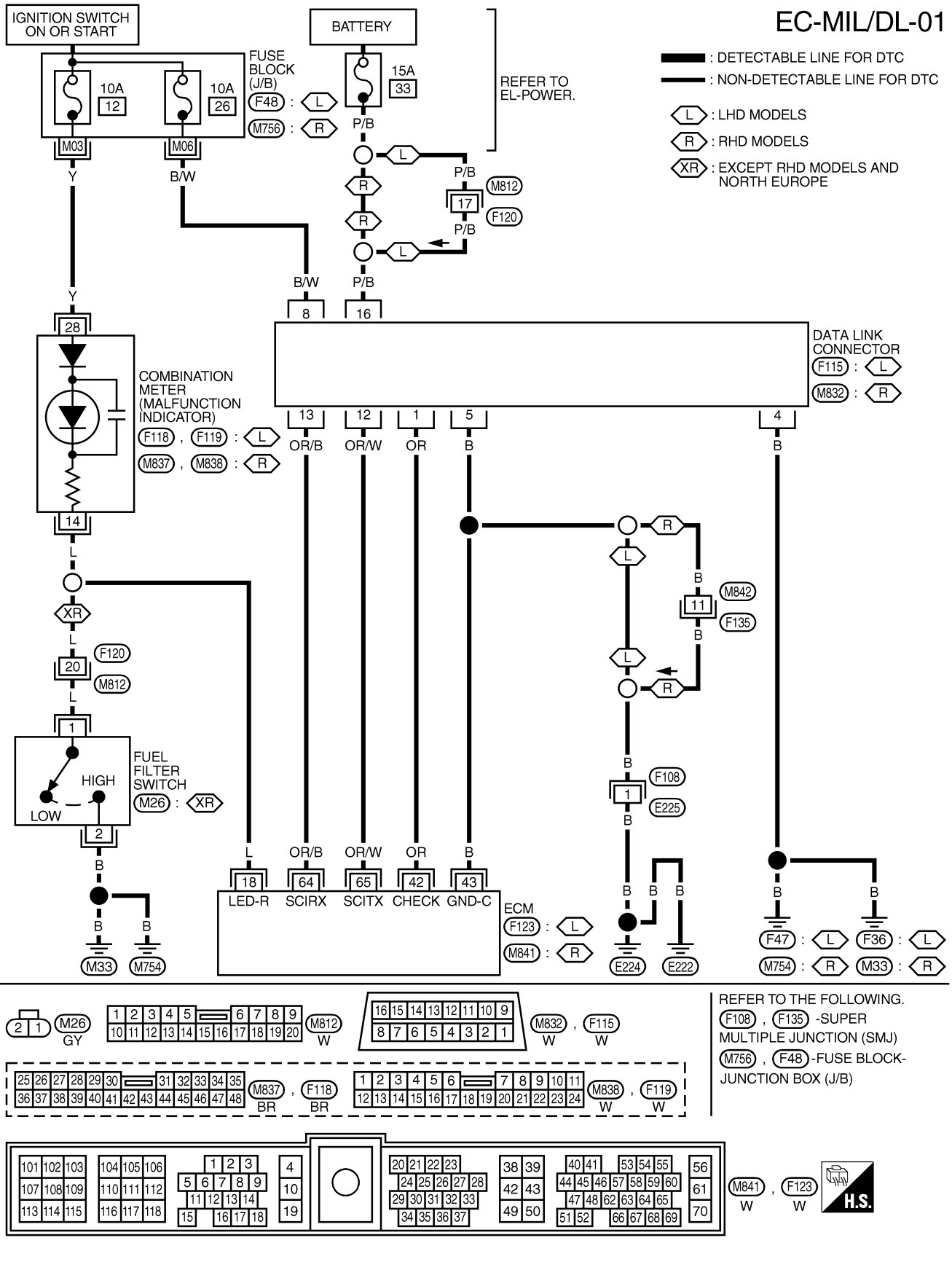
Wiring Diagram (Cont'd)

RHD MODELS



YEC203A

Wiring Diagram



YEC204A

General Specifications

Unit: rpm

Engine	ZD30DDTi
Idle speed	750±25
Maximum engine speed	4,300

Injection Pump Numbers

Engine	Part number	Pump assembly number
ZD30DDTi	16700 VG100	109342-4023

Injection Nozzle

Unit: kPa (bar, kg/cm^2, psi)

Initial injection pressure	Used	19,026 (190.3, 194, 2,759)
	New	19,516 - 20,497 (195.2 - 205.0, 199 - 209, 2,830 - 2,972)
	Limit	16,182 (161.8, 165, 2,346)

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

Crankshaft Position Sensor (TDC)

Resistance [at 20°C (68°F)] Ω	1,287 - 1,573

Glow Plug

Resistance [at 20°C (68°F)] Ω	Approximately 0.5

Accelerator Position Sensor

Throttle valve conditions	Resistance between terminals 2 and 3 kΩ [at 25°C (77°F)]
Completely closed	Approximately 0.5
Partially open	0.5 - 4
Completely open	Approximately 4

EGR Volume Control Valve

Resistance [at 25°C (77°F)] Ω	13 - 17

Alphabetical & Numerical Index for DTC

ALPHABETICAL INDEX FOR DTC

X: Applicable —: Not applicable

Items (CONSULT-II screen terms)	DTC		MI illumination	Reference page
	CONSULT-II GST*1	ECM*2		
ACCEL POS SENSOR	P0120	0403	X	EC-365
AIR CONDITIONR RLY	P1530	0805	X	EC-440
BRAKE SW	P0571	0807	X	EC-400
CONT SLEEV POS SEN	P1207	0105	X	EC-414
COOLANT TEMP SEN	P0115	0103	X	EC-361
CRANK POS SEN (TDC)	P0335	0407	X	EC-385
ECM RLY	P1620	0902	X	EC-446
ECM 2	P1607	0301	X	EC-444
ECM 10	P1107	0802	—	EC-407
ECM 12	P1603	0901	X	EC-444
EGR SOL/V A	P1404	0806	—	EC-431
EGR SOL/V B	P1405	0808	—	EC-431
F/INJ F/B 2	P1206	0108	X	EC-409
F/INJ TIMG F/B	P1246	0201	X	EC-380
FUEL CUT S/V 1	P0215	0306	X	EC-376
FUEL TEMP SENSOR	P0180	0402	X	EC-372
GLOW LAMP	P0381	0908	—	EC-389
GLOW RELAY	P0380	0803	—	EC-389
INJ TIMING CONT/V	P0216	0904	X	EC-380
MAS AIR FLOW SEN	P0100	0102	X	EC-356
MI	P0650	0907	—	EC-404
NEEDL LIFT SE (RPM)	P1242	0906	X	EC-427
NEEDLE LIFT SEN	P1240	0304	X	EC-427
NO SELF DIAGNOSTIC FAILURE INDICATED	P0000	0505	—	—
OVER HEAT	P1217	0208	X	EC-418
THROTTLE SOLENOID VALVE	P1407	0808	—	EC-431
VEHICLE SPEED SEN	P0500	0104	—	EC-397

*1: These numbers are prescribed by ISO 15031-6.
*2: In Diagnostic Test Mode II (Self-diagnostic results). These numbers are controlled by NISSAN.

Alphabetical & Numerical Index for DTC (Cont'd)

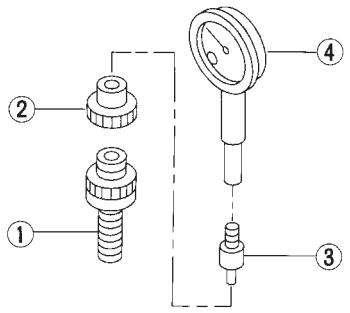
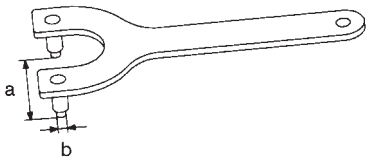
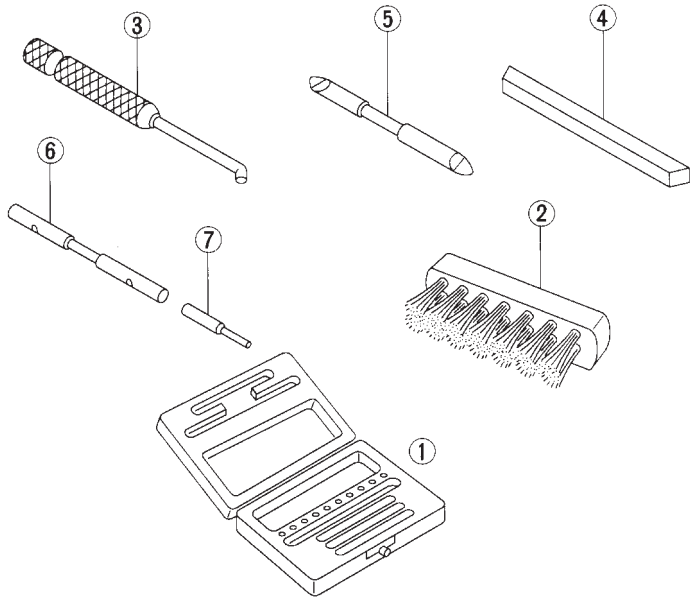
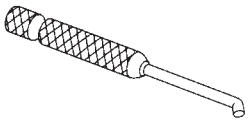
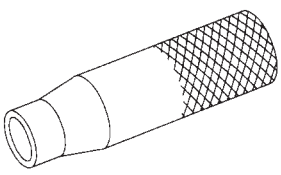
NUMERICAL INDEX FOR DTC

X: Applicable —: Not applicable

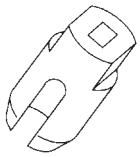
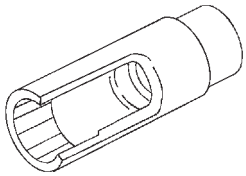
DTC		Items (CONSULT-II screen terms)	MI illumination	Reference page
CONSULT-II GST*1	ECM*2			
P0000	0505	NO SELF DIAGNOSTIC FAILURE INDICATED	—	—
P0100	0102	MAS AIR FLOW SEN	X	EC-356
P0115	0103	COOLANT TEMP SEN	X	EC-361
P0120	0403	ACCEL POS SENSOR	X	EC-365
P0180	0402	FUEL TEMP SENSOR	X	EC-372
P0215	0306	FUEL CUT S/V 1	X	EC-376
P0216	0904	INJ TIMING CONT/V	X	EC-380
P0335	0407	CRANK POS SEN (TDC)	X	EC-385
P0380	0803	GLOW RELAY	—	EC-389
P0381	0908	GLOW LAMP	—	EC-389
P0500	0104	VEHICLE SPEED SEN	—	EC-397
P0571	0807	BRAKE SW	X	EC-400
P0650	0907	MI	—	EC-404
P1107	0802	ECM 10	—	EC-407
P1206	0108	F/INJ F/B 2	X	EC-409
P1207	0105	CONT SLEEV POS SEN	X	EC-414
P1217	0208	OVER HEAT	X	EC-418
P1240	0304	NEEDLE LIFT SEN	X	EC-427
P1242	0906	NEEDL LIFT SE(RPM)	X	EC-427
P1246	0201	F/INJ TIMG F/B	X	EC-380
P1404	0806	EGR SOL/V A	—	EC-431
P1405	0808	EGR SOL/V B	—	EC-431
P1407	0808	THROTTLE SOLENOID VALVE	—	EC-431
P1530	0805	AIR CONDITIONR RLY	X	EC-440
P1603	0901	ECM 12	X	EC-444
P1607	0301	ECM 2	X	EC-444
P1620	0902	ECM RLY	X	EC-446

*1: These numbers are prescribed by ISO 15031-6.
*2: In Diagnostic Test Mode II (Self-diagnostic results). These numbers are controlled by NISSAN.

Special Service Tools

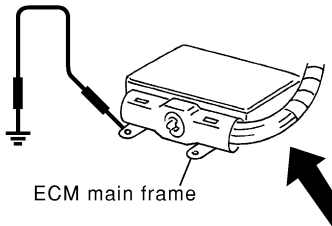
Tool number Tool name	Description
KV11229352 Measuring device ① KV11229350 Holder ② KV11229360 Nut ③ KV11229370 Pin ④ KV11254410 Dial gauge	Measuring set length of plunger spring  NT570
ST16540000 Pulley holder	Removing injection pump drive gear **a: 68 mm (2.68 in)** **b: 8 mm (0.31 in)**  NT628
KV11289004 Nozzle cleaning kit ① KV11290012 Box ② KV11290110 Brush ③ KV11290122 Nozzle oil sump scraper ④ KV11290140 Nozzle needle tip cleaner ⑤ KV11290150 Nozzle seat scraper ⑥ KV11290210 Nozzle holder ⑦ KV11290220 Nozzle hole cleaning needle	 NT296
KV11290632 Nozzle oil sump scraper	 NT294
KV11292010 Nozzle centering device	 NT293

Special Service Tools (Cont'd)

Tool number Tool name	Description
KV11100300 Nozzle holder socket No. 2-4 injection nozzle holder socket	 NT563
KV111-05700 No. 1 injection nozzle holder socket	 NT648

Engine Fuel & Emission Control System

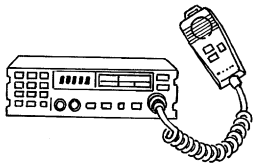
ECM
- Do not disassemble ECM.
- If a battery terminal is disconnected, the memory will return to the ECM value. The ECM will now start to self-control at its initial value. Engine operation can vary slightly when the terminal is disconnected. However, this is not an indication of a problem. Do not replace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

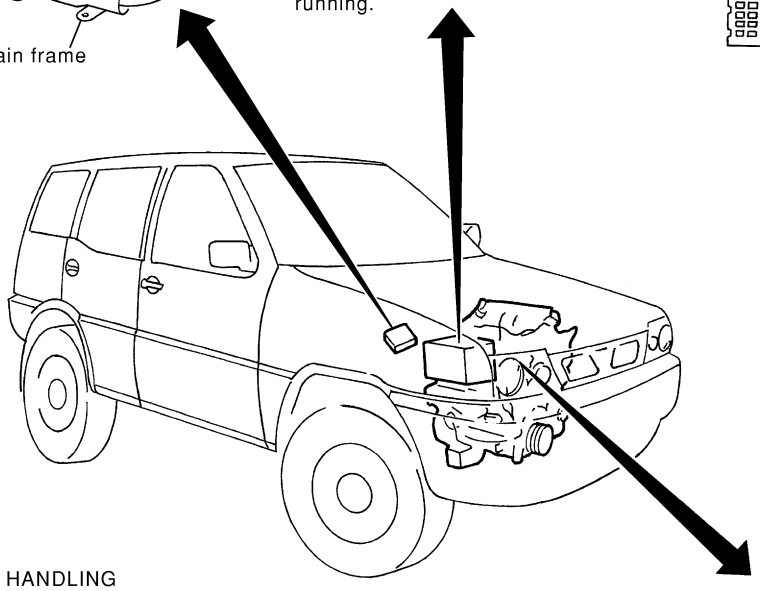


BATTERY
- Always use a 12 volt battery as power source.
- Do not attempt to disconnect battery cables while engine is running.

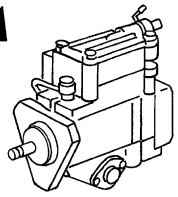
WIRELESS EQUIPMENT
- When installing C.B. ham radio or a mobile phone, be sure to observe the following as it may adversely affect electronic control systems depending on its installation location.

1) Keep the antenna as far away as possible from the ECM.
2) Keep the antenna feeder line more than 20 cm (7.9 in) away from the harnesses of electronic controls. Do not let harnesses and antenna feeder line 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.





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

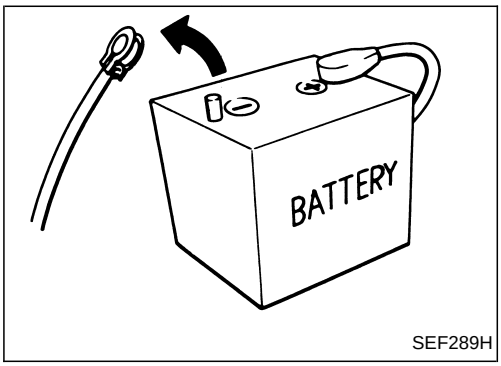


ELECTRONIC FUEL INJECTION PUMP
- Do not disconnect pump harness connectors with engine running.
- Do not disassemble electronic fuel injection pump, except for the following parts;
  Camshaft position sensor (pump).
  Injection timing control valve.
  Fuel cut solenoid valve.

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.

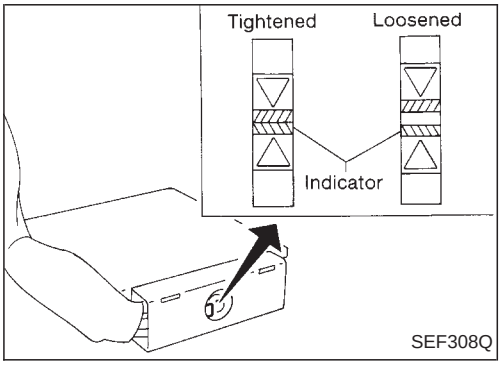
WHEN STARTING
- Do not depress accelerator pedal when starting.
- Immediately after starting, do not rev up engine unnecessarily.
- Do not rev up engine just prior to shutdown.

MEC031E

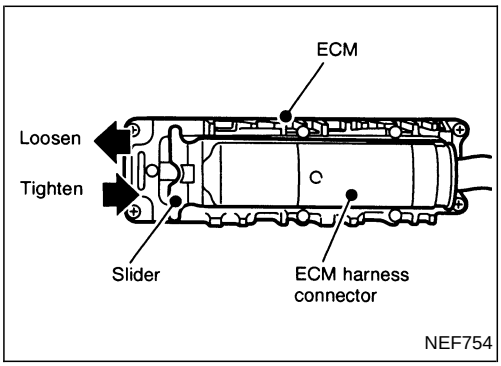


Precautions

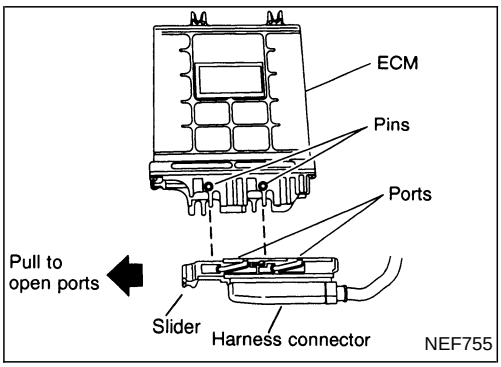
- **Before connecting or disconnecting the ECM harness connector, turn ignition switch OFF and disconnect negative battery terminal. Failure to do so may damage the ECM because battery voltage is applied to ECM even if ignition switch is turned off.**

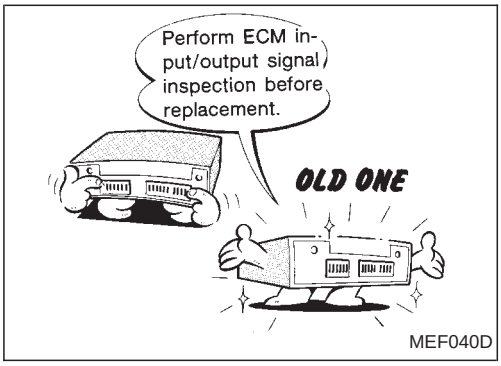


- **When connecting ECM harness connector, tighten securing bolt until the gap between orange indicators disappears.**
  : 3.0 - 5.0 N·m (0.3 - 0.5 kg-m, 26 - 43 in-lb)



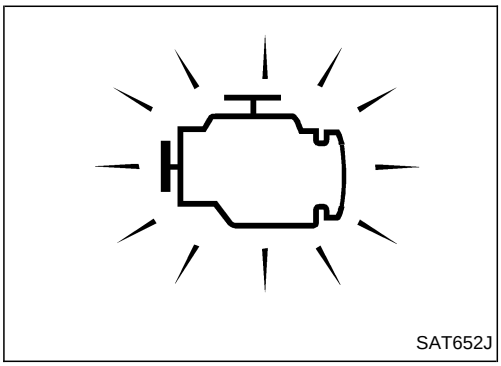
- **When connecting ECM harness connector, open the ports on harness connector then meet the ports with the pins on ECM as shown. Push slider on harness connector until it stops.**



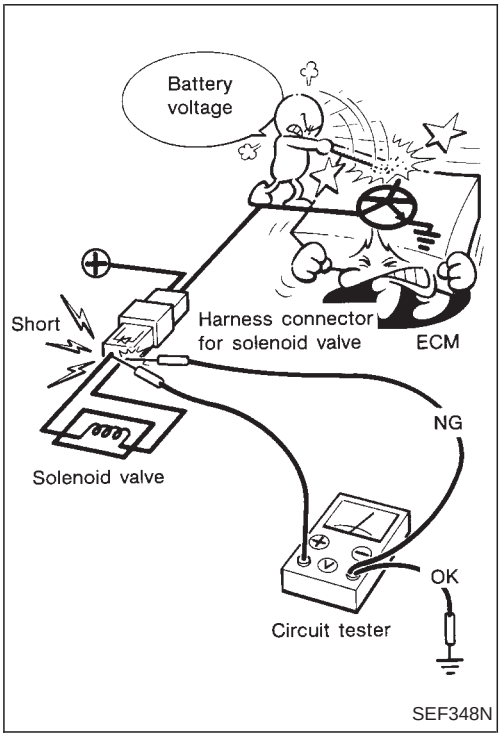


- **Before replacing ECM, perform Terminals and Reference Value inspection and make sure ECM functions properly. Refer to EC-346.**

Precautions (Cont'd)


SAT652J

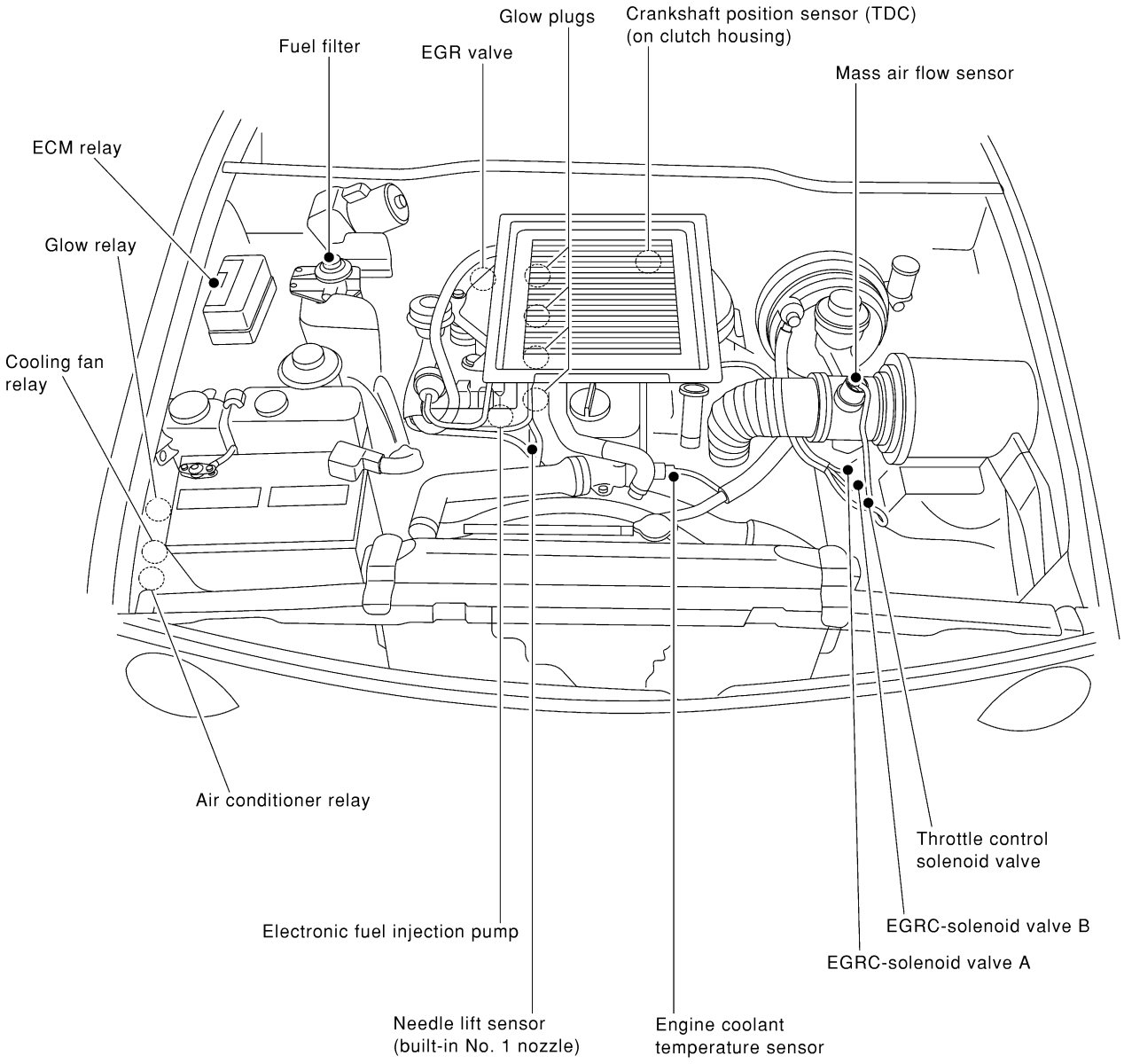
- **If MI illuminates or flashes irregularly while the engine is running, water may have accumulated in fuel filter. Drain water from fuel filter. If this does not correct the problem, perform specified trouble diagnostic procedures.**
- **After performing each TROUBLE DIAGNOSIS, perform "OVERALL FUNCTION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



SEF348N

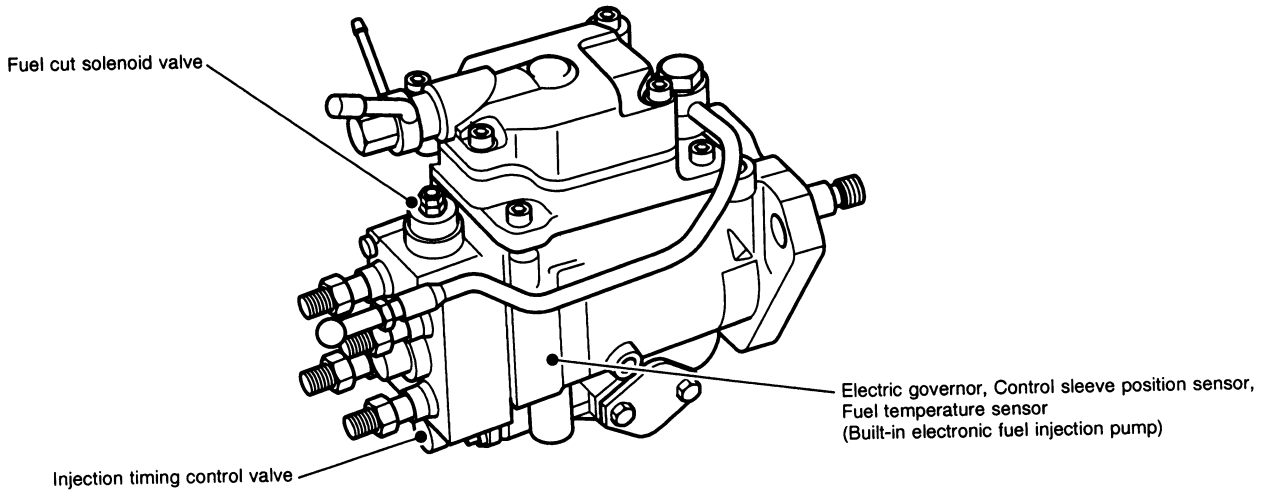
- **When measuring ECM signals with a circuit tester, never allow the two tester probes to contact.**
  Accidental contact of probes will cause a short circuit and damage the ECM power transistor.

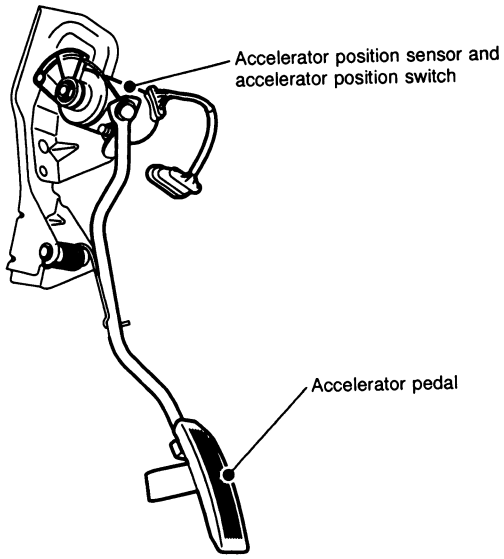
Engine Control Component Parts Location

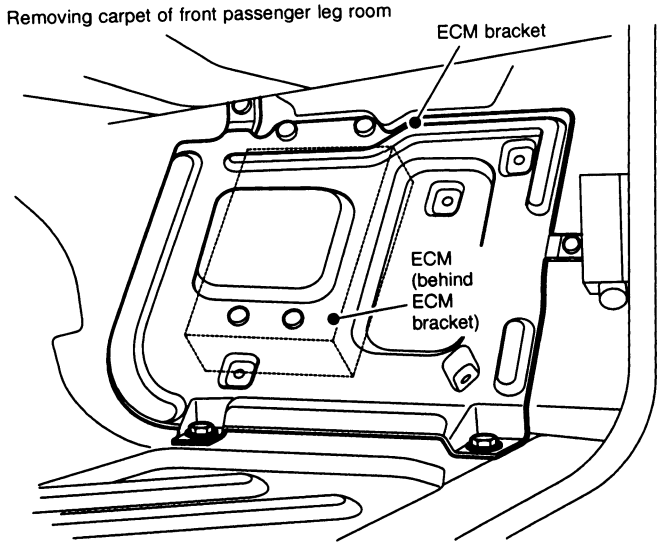


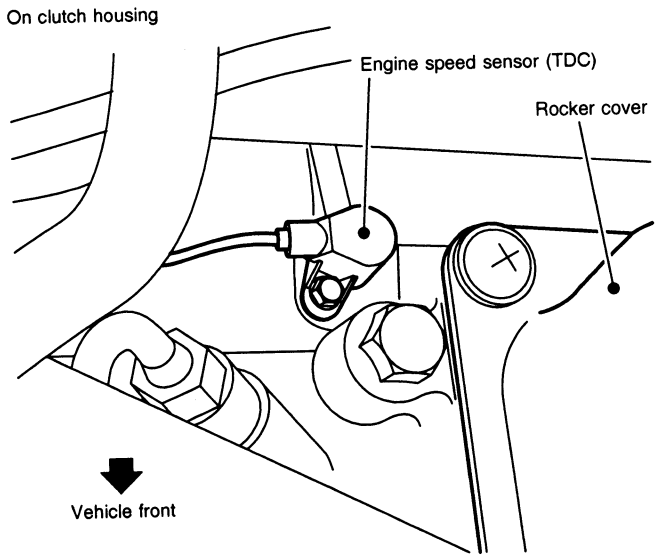
YEC234A

Engine Control Component Parts Location (Cont'd)



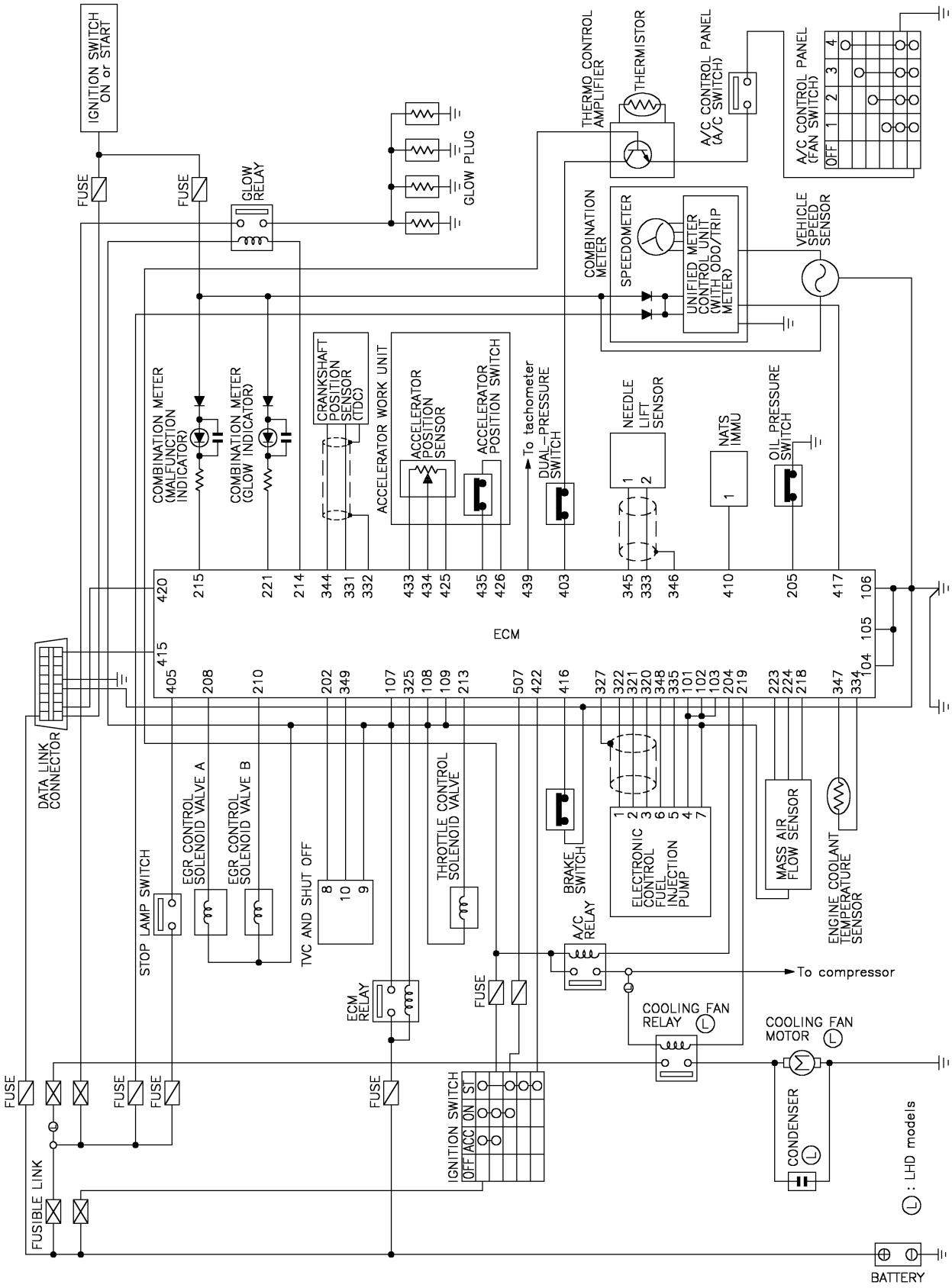






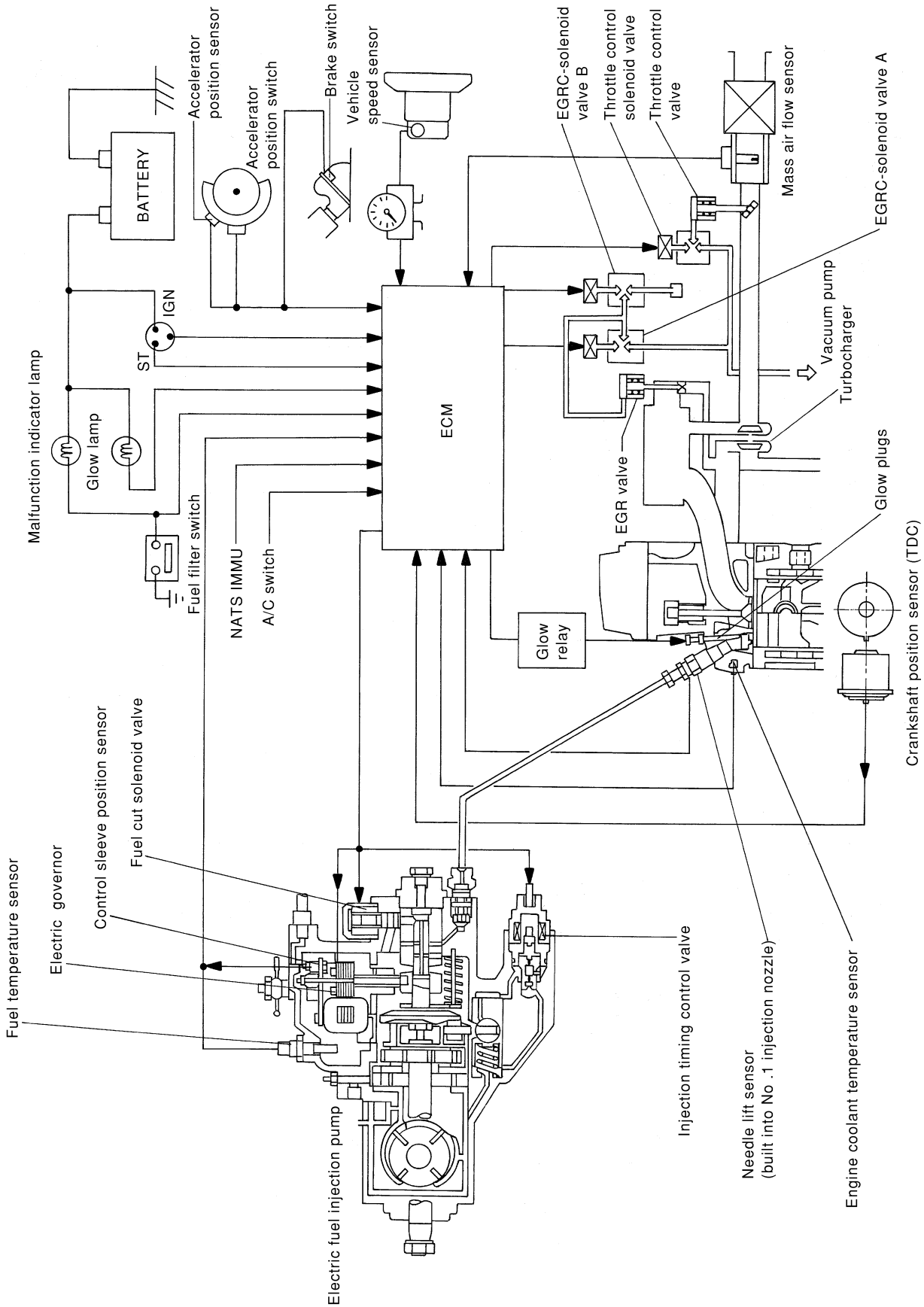
NEF757

Circuit Diagram



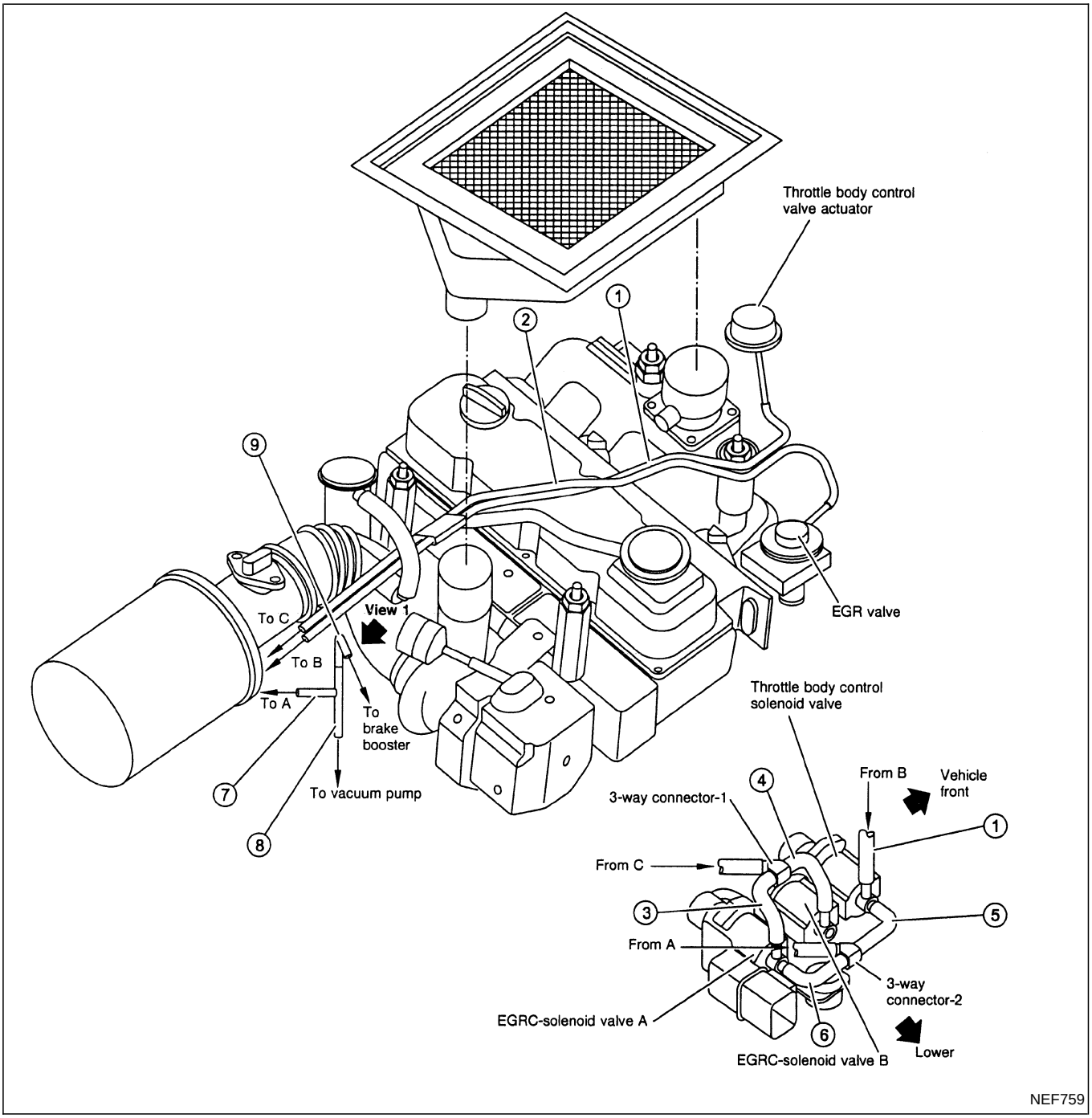
YEC140A

System Diagram



YEC235A

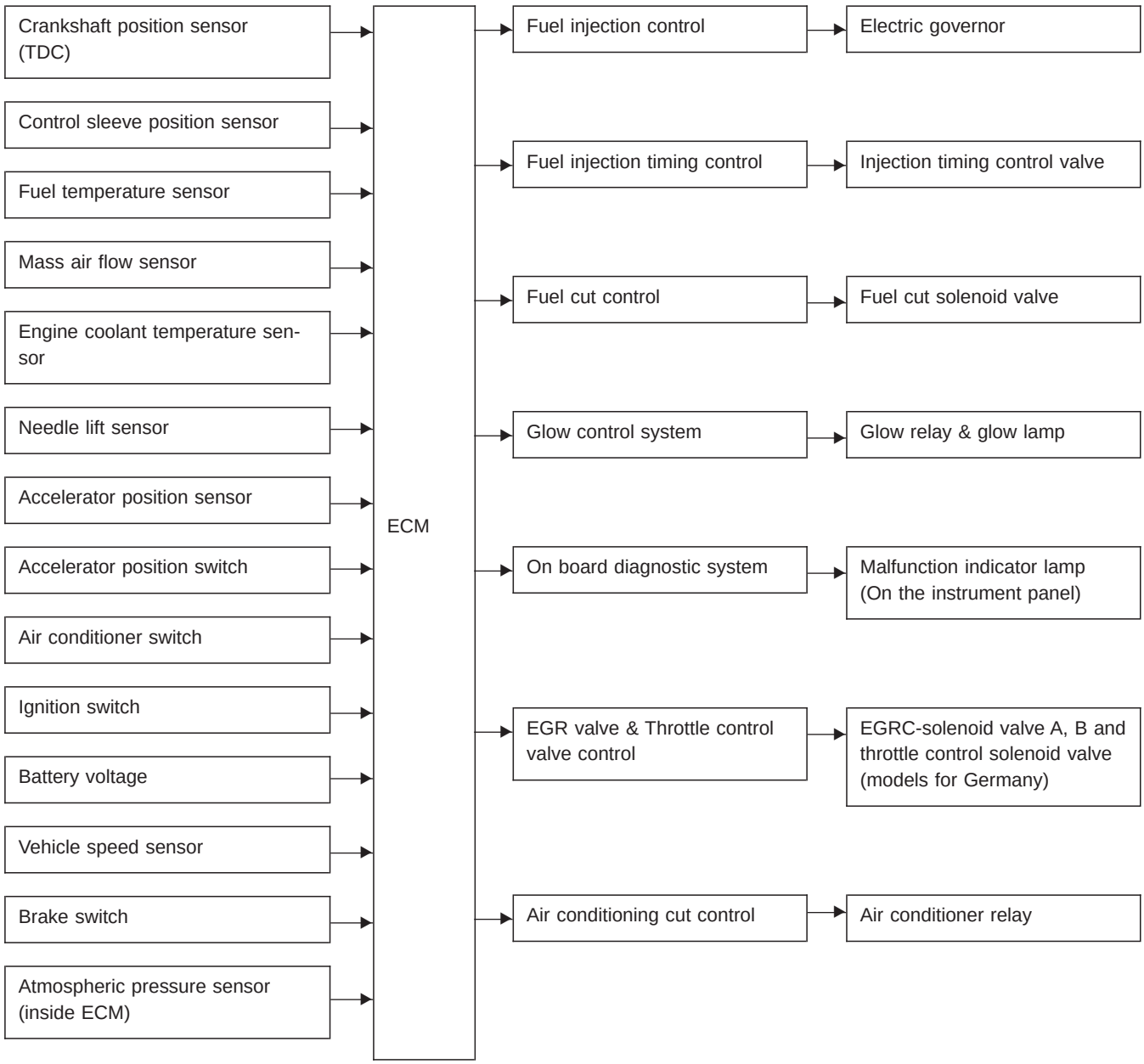
Vacuum Hose Drawing



① Throttle body control valve actuator to throttle body control solenoid valve
② EGR valve to 3-way connector
③ EGRC-solenoid valve A to 3-way connector-1
④ EGRC-solenoid valve B to 3-way connector-1
⑤ Throttle body control solenoid valve to 2-way connector-2
⑥ EGRC-solenoid valve A to 3-way connector-2
⑦ Tube to 3-way connector-2
⑧ Tube to vacuum pump
⑨ Tube to brake booster

Refer to “System Diagram”, on previous page for vacuum control system

System Chart



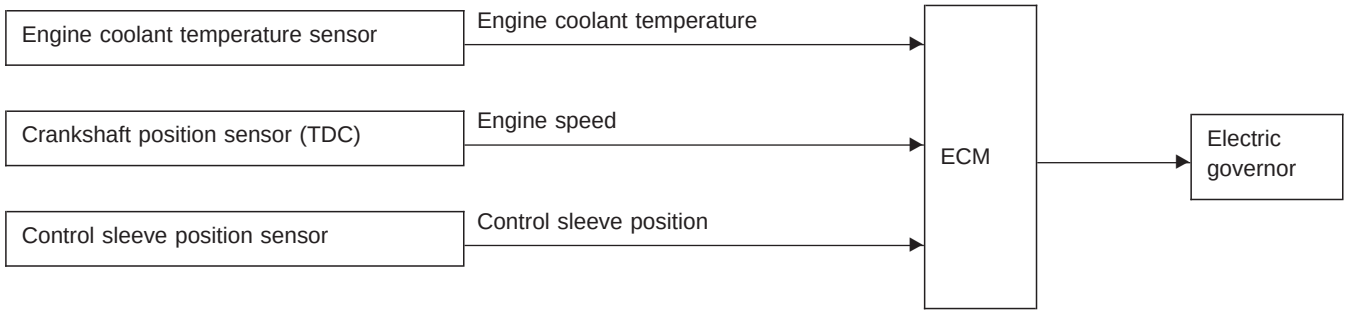
Fuel Injection System

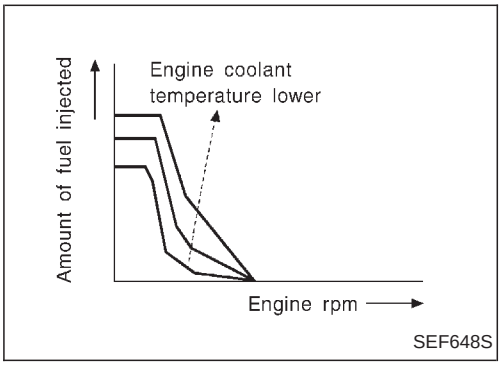
SYSTEM DESCRIPTION

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 cycle 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





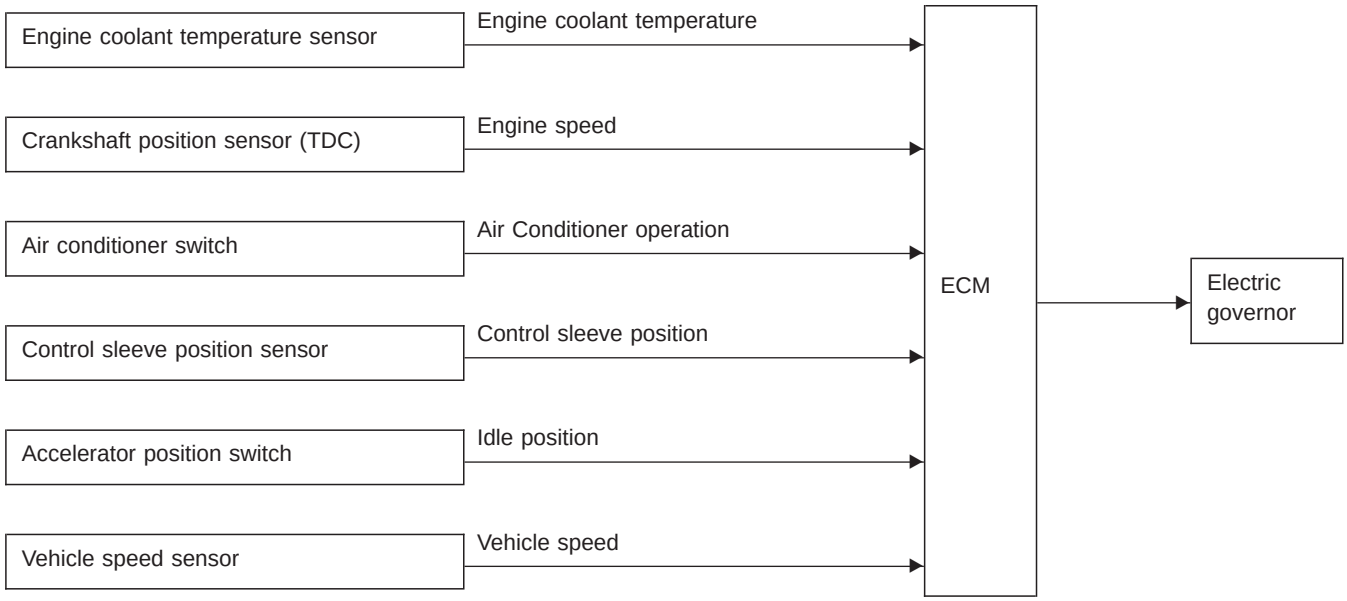
When the ECM receives a start signal from the ignition switch, the ECM adapts the fuel injection system for the start control. The amount of fuel injected at engine starting is a preset program value in the ECM. The program is determined by the engine speed and engine coolant temperature.

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 a value between 800 rpm and 1,200 rpm, which is determined by the engine coolant temperature and shifts the control to the normal or idle control.

Fuel Injection System (Cont'd)

IDLE CONTROL

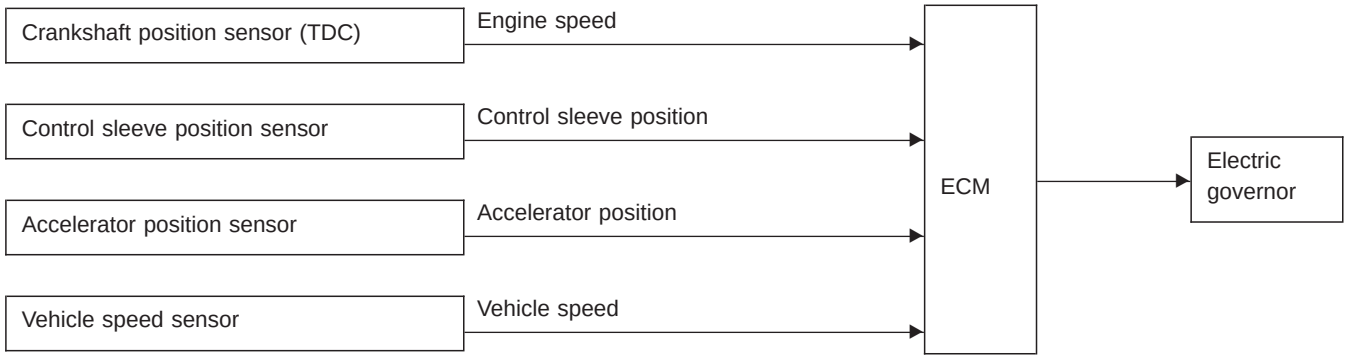
Input/output signal line

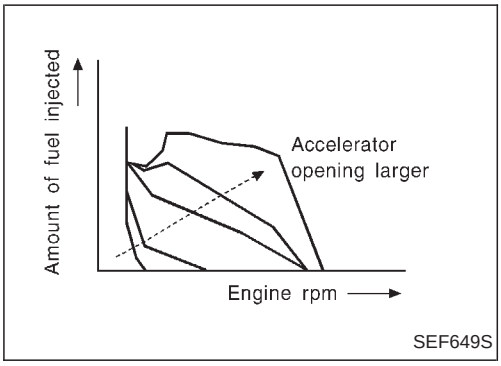


When the ECM determines that the engine speed is at idle, the fuel injection system is adapted for the idle control. The ECM regulates the amount of fuel injected corresponding to changes in load applied to the engine to keep engine speed constant. The ECM also provides the system with a fast idle control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

NORMAL CONTROL

Input/output signal line





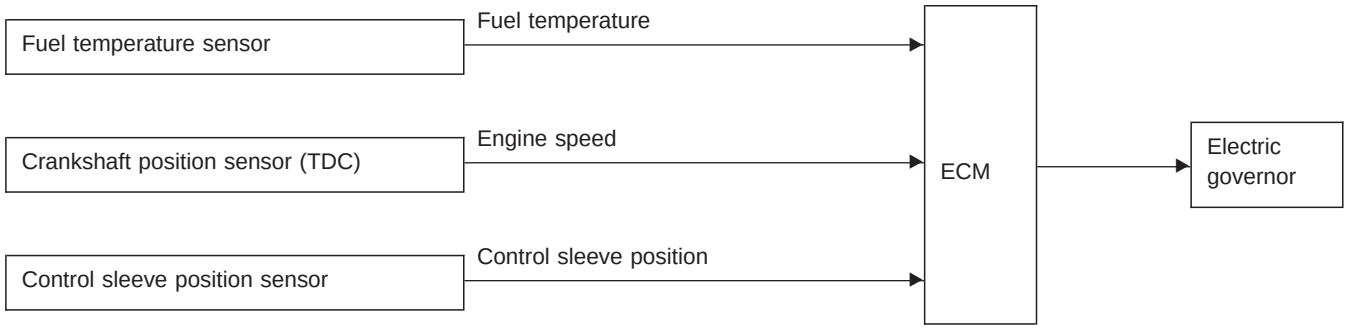
The amount of fuel injected under normal driving conditions is determined according to sensor signals. The crankshaft position sensor (TDC) detects engine speed and the accelerator position sensor detects accelerator position. These sensors send signals to the ECM.

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)

FUEL TEMPERATURE COMPENSATION

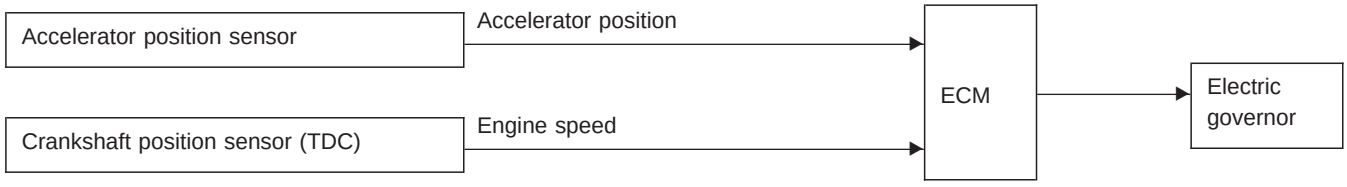
Input/output signal line



The amount of fuel leaking at or around high-pressure parts inside the fuel injection pump varies with the 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 obtained from the fuel temperature sensor.

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 position sensor and crankshaft position sensor (TDC).

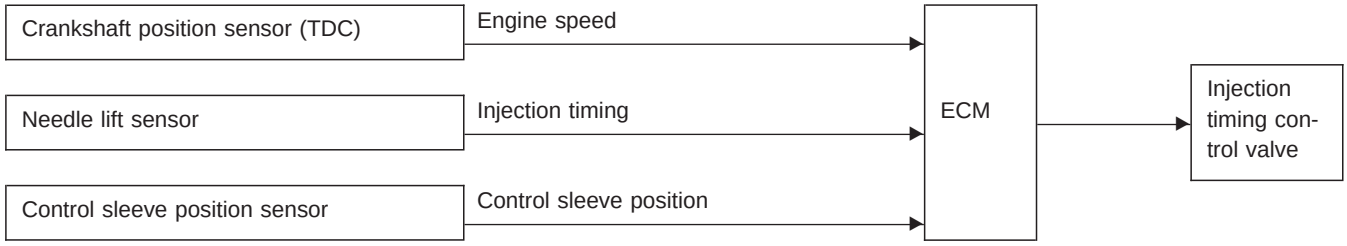
Fuel Injection Timing System

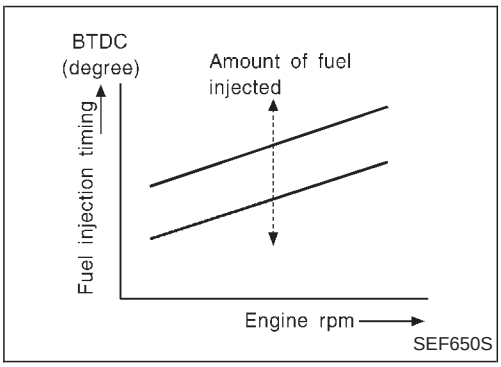
SYSTEM DESCRIPTION

The fuel injection timing system determines the optimal fuel injection timing, based on engine speed, injection quantity, engine coolant temperature and atmospheric pressure. The timing is formed by a basic value (Basic Control) and two correction values. By performing a duty cycle signal on the timing control valve, the ECM allows the valve to provide optimal 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

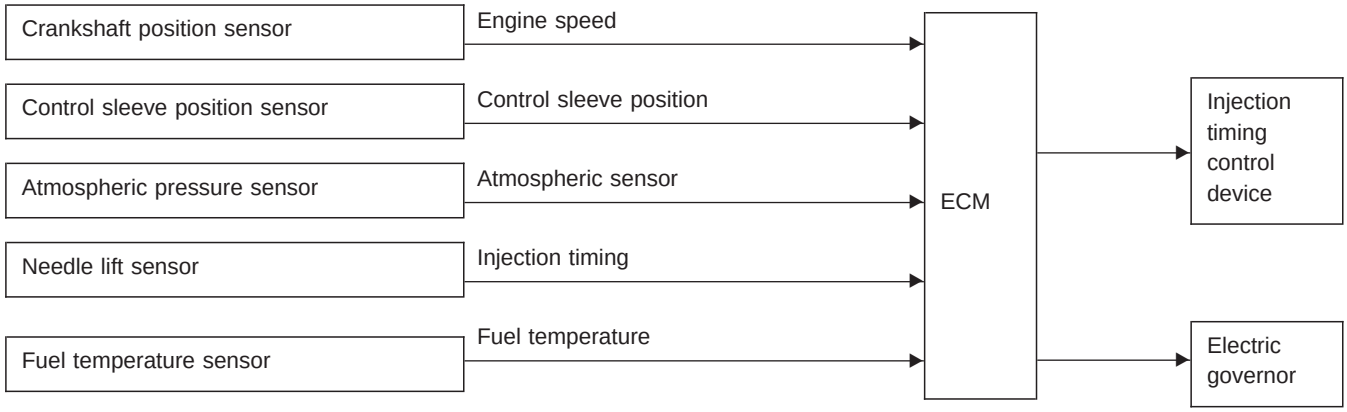




The optimal fuel injection timing data, predetermined in proportion to engine speeds and amount of fuel injected, are stored in the ECM memory. The ECM uses the data to control the fuel injection timing.

HIGH ALTITUDE COMPENSATION

Input/output signal line

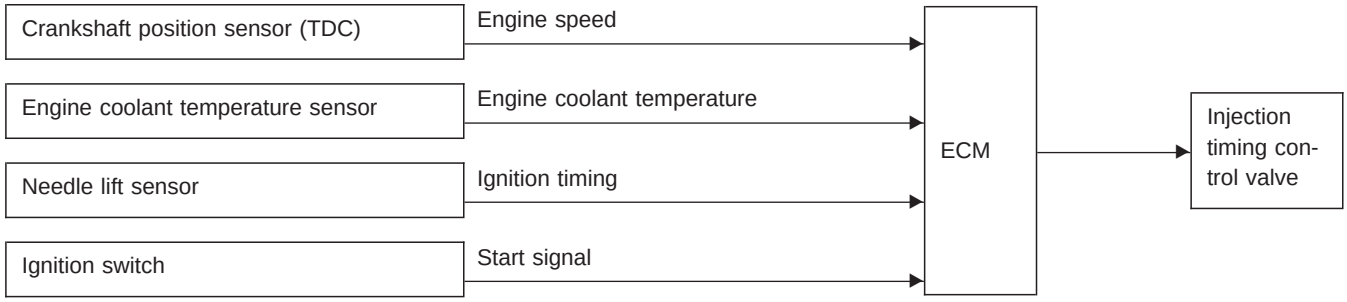


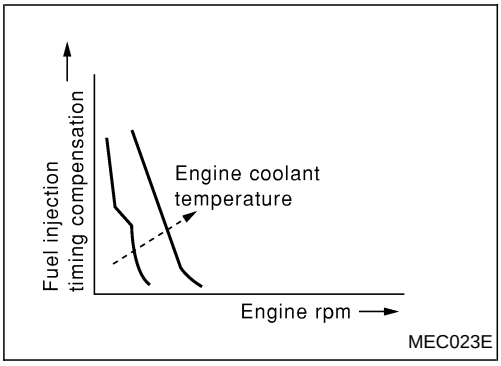
For better drivability in high altitude areas, the fuel injection timing is advanced and the fuel quantity is reduced according to the atmospheric pressure.

Fuel Injection Timing System (Cont'd)

ENGINE COOLANT TEMPERATURE COMPENSATION (When starting)

Input/output signal line

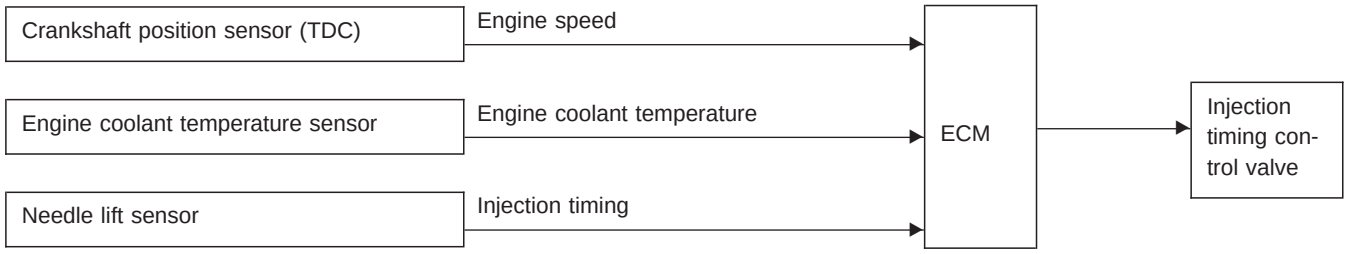


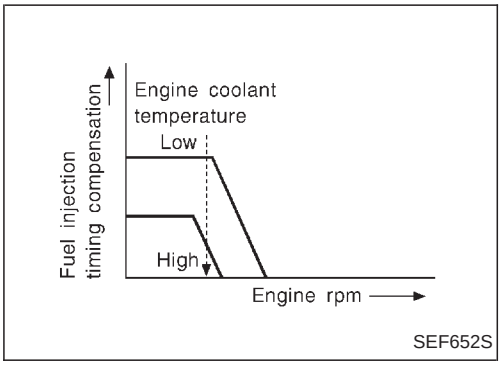


For better startability under cool engine conditions, the fuel injection timing is compensated according to the engine coolant temperature.

ENGINE COOLANT TEMPERATURE COMPENSATION (During driving)

Input/output signal line

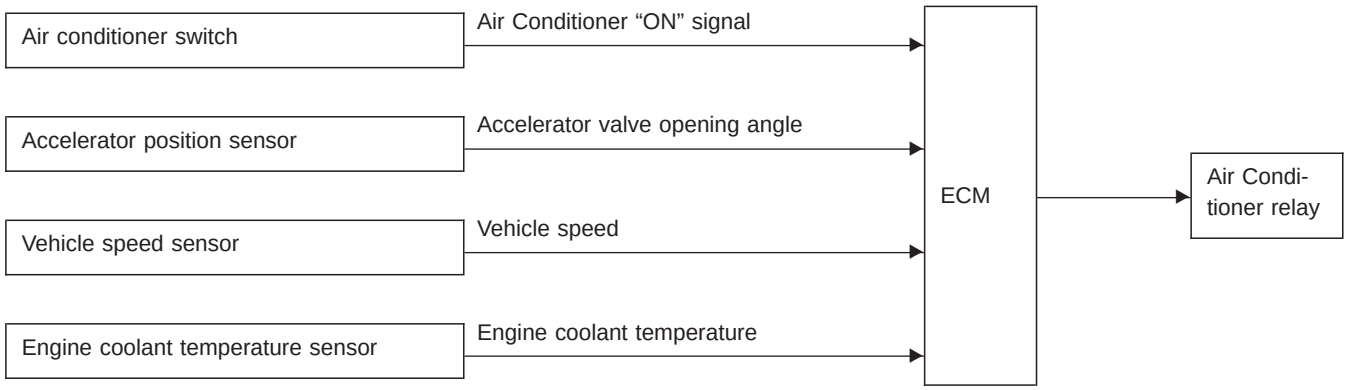




For better exhaust efficiency under cool engine conditions, the fuel injection timing is controlled within a compensation range depending on the engine speed, engine coolant temperature and amount of fuel injected.

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.

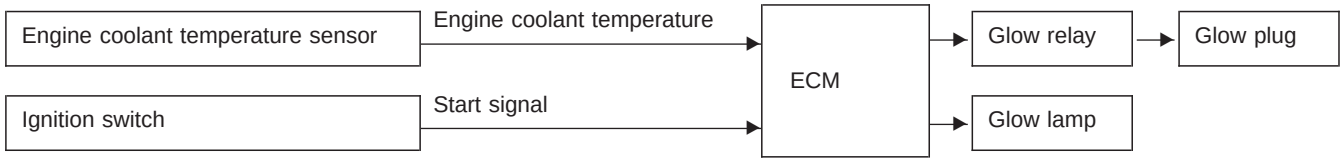
Fuel Cut Control (at high engine speed)

INPUT/OUTPUT SIGNAL LINE

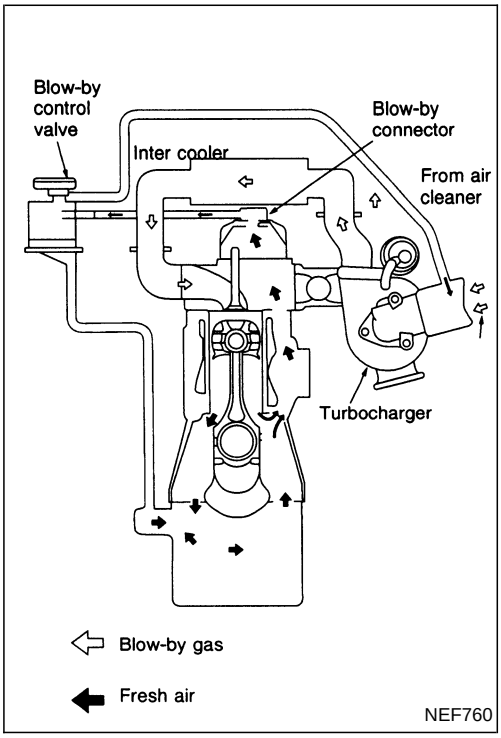
If the engine speed is above 5,500 rpm fuel will be cut off to keep engine within its working range.
NOTE:
This function is different from deceleration control and fuel cut solenoid valve control.

Glow Control

INPUT/OUTPUT SIGNAL LINE

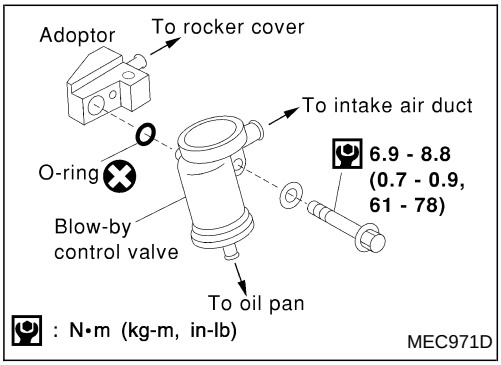


Glow plug is heated in three-stage that is pre-glow, intermediate-glow and after-glow. Glow time changes depending on engine coolant temperature.



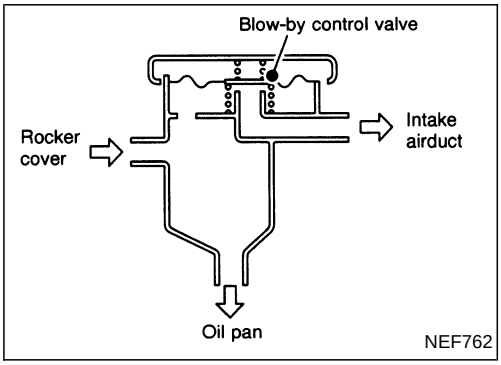
Description

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



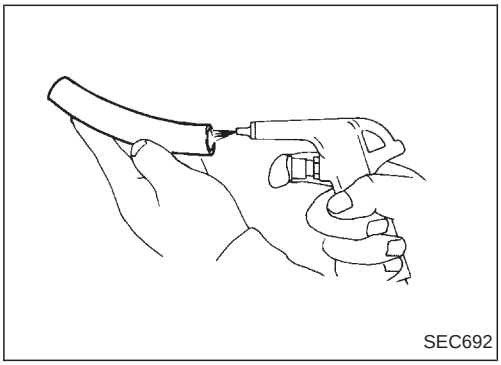
Blow-by Control Valve

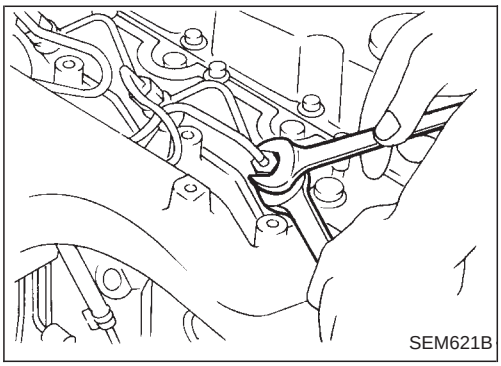
- Check control valve for clogging and abnormalities.



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.



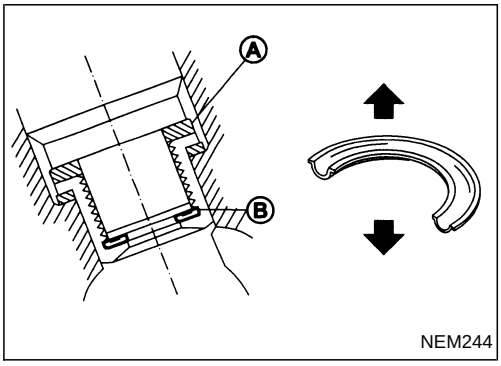

SEM621B

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



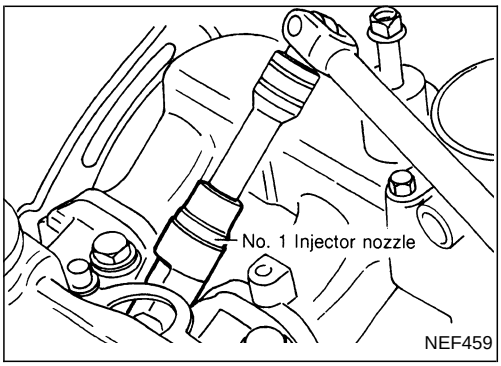
NEM244

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

Also remove washers from nozzle end.

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

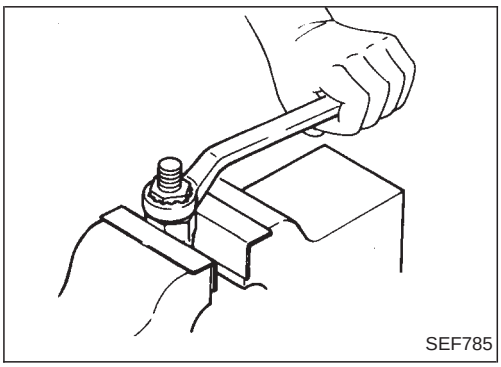
Injection nozzle to engine:
: 54 - 64 N·m (5.5 - 6.5 kg-m, 40 - 47 ft-lb)
Injection nozzle to tube:
: 20 - 25 N·m (2.0 - 2.5 kg-m, 14 - 18 ft-lb)



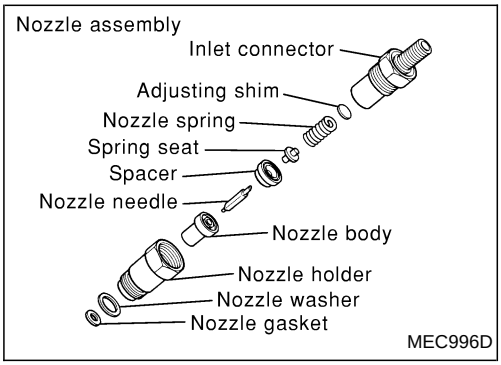
NEF459

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)


SEF785

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



MEC996D

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

Inspection (No. 2 - 4 nozzle)

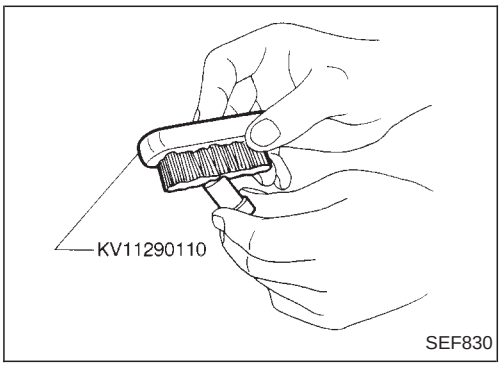
Thoroughly clean all disassembled parts with fresh kerosene or solvent.

- 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 nozzle spring for excessive wear or damage. If excessively worn or damaged, replace it with a new spring.
- Check distance piece and nozzle holder for proper contact. If excessively worn or damaged, replace nozzle holder assembly.

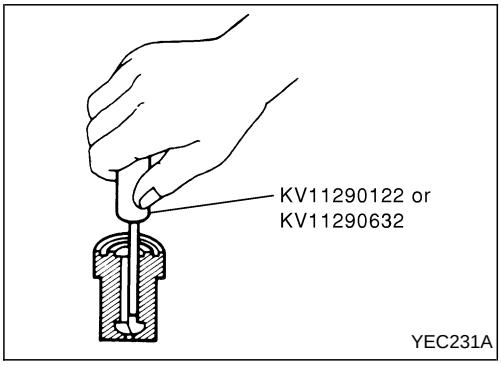
Cleaning (No. 2 - 4 nozzle)

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.

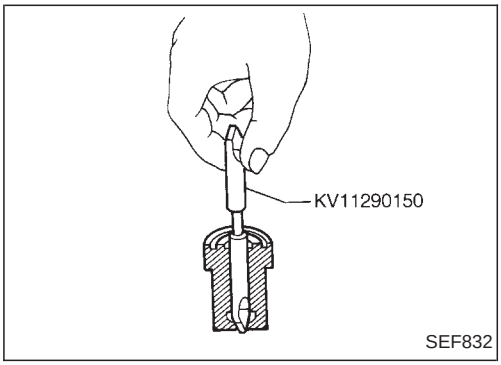


2. Clean oil sump of nozzle body using Tool.

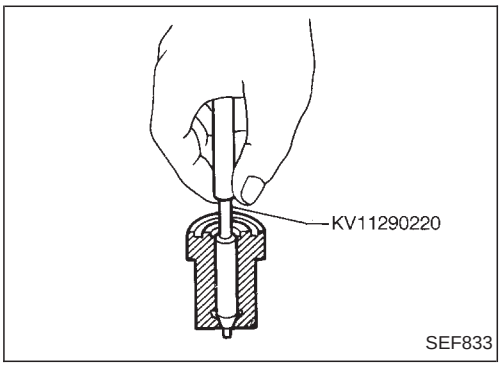


3. Clean nozzle seat by using Tool.

Take extra precautions when performing this job, since nozzle efficiency depends greatly on a good nozzle seat.

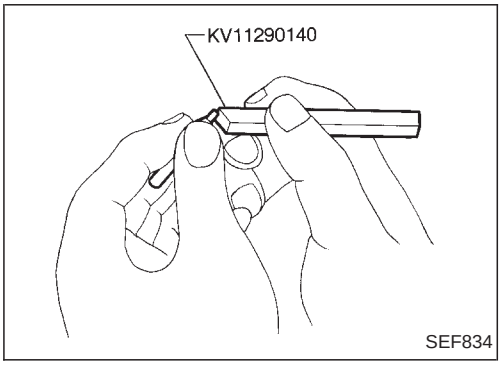


Cleaning (No. 2 - 4 nozzle) (Cont'd)

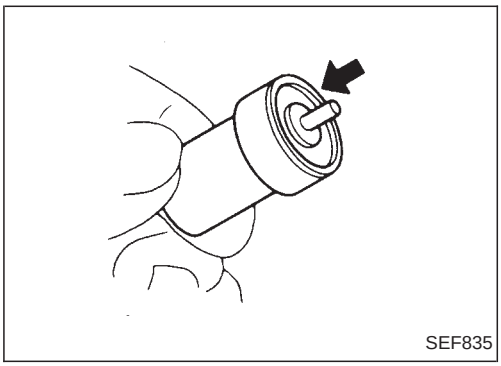


4. Clean spray hole of nozzle body by using Tool.

To prevent spray hole from canting, always clean it by starting with inner side and working towards the outside.



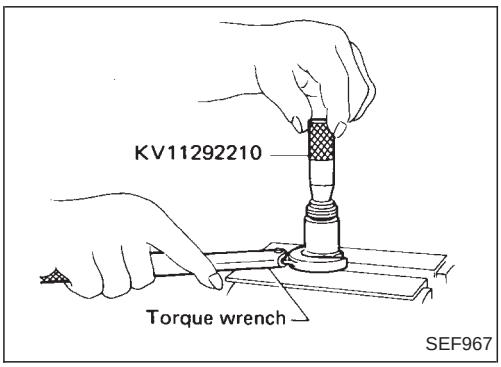
5. Decarbonate nozzle needle tip by using Tool.



6. Check needle sink.
(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)

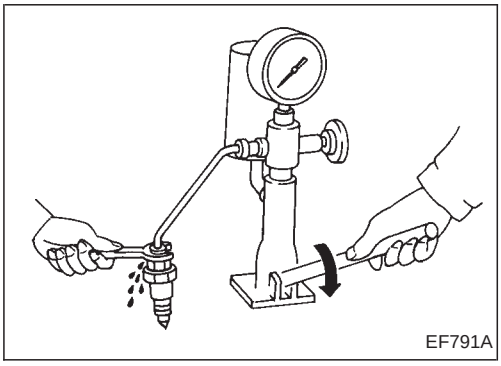


Assembly is in the reverse order of disassembly.

Holder to nozzle nut:
: 29 - 49 N·m (3.0 - 5.0 kg-m, 22 - 36 ft-lb)

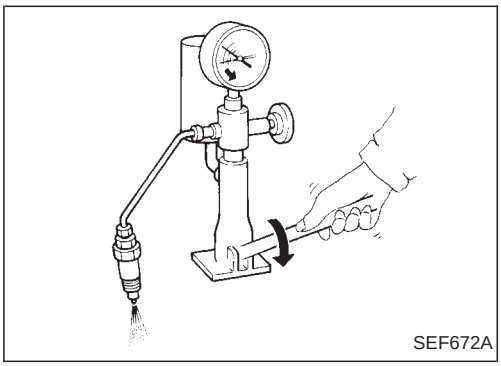
Test and Adjustment

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.


EF791A

INJECTION PRESSURE TEST

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


SEF672A

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

Initial injection pressure:

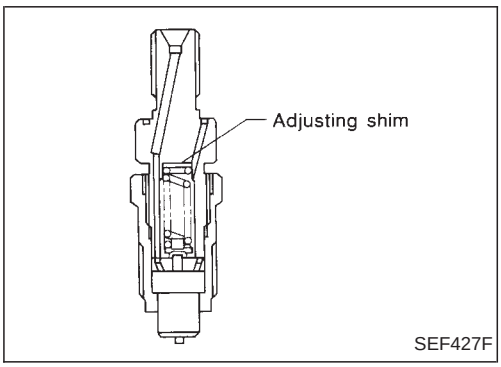
Used

12,259 - 12,749 kPa (122.6 - 127.5 bar, 120 - 130 kg/cm^2, 1,706 - 1,849 psi)

New

12,749 - 13,730 kPa (127.5 - 137.3 bar, 130 - 140 kg/cm^2, 1,849 - 1,991 psi)

Always check initial injection pressure using a new nozzle.



SEF427F

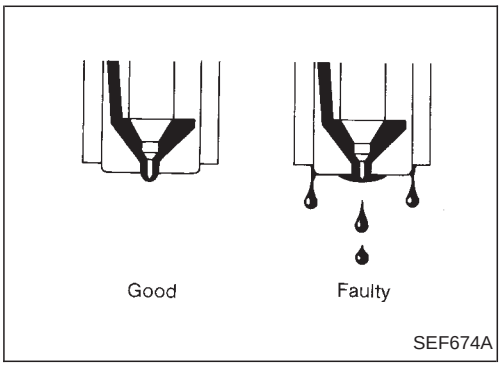
4. To adjust injection pressure, change adjusting shims. (No. 2 - 4 nozzle)

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/cm^2, 68 psi) in initial injection pressure.

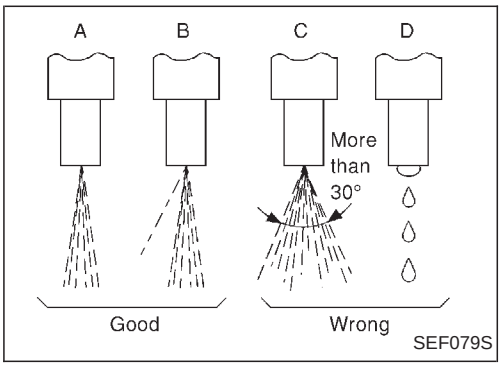
Refer to SDS for adjusting shim.

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/cm^2, 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, replace nozzle assembly.



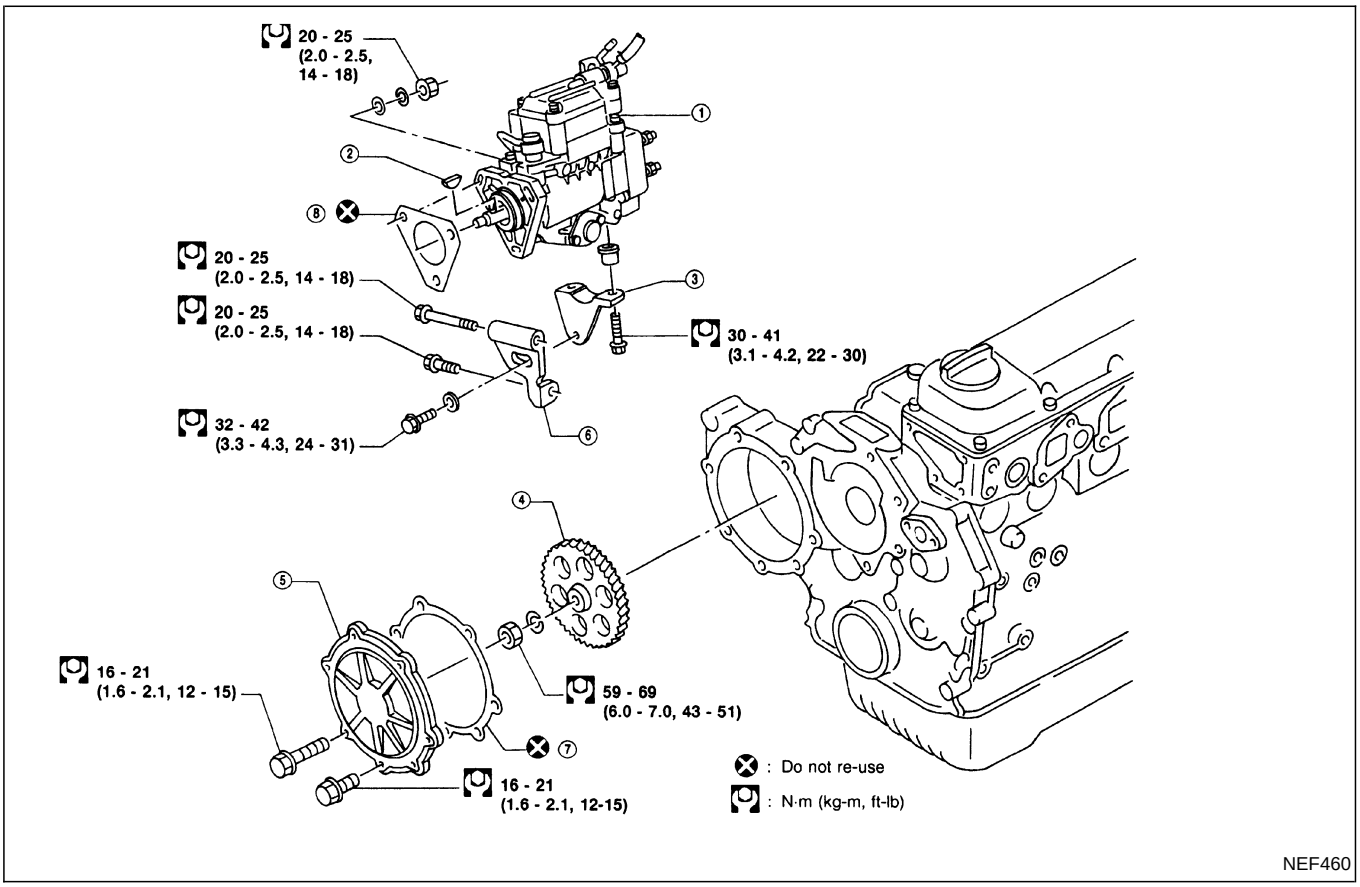
SPRAY PATTERN TEST

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).

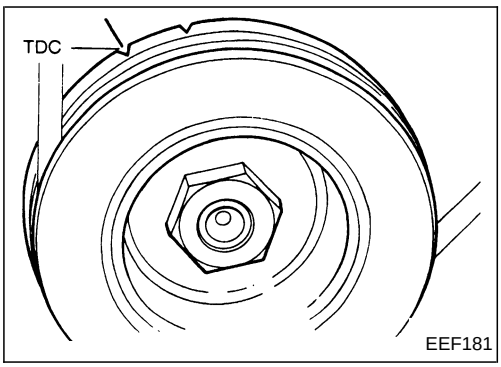
2. If the spray pattern is not correct, disassemble and clean nozzle.
3. Test again and if spray pattern is not corrected, replace nozzle.



① Electric fuel injection pump
② Key
③ Bracket
④ Injection pump drive gear
⑤ Dust cover
⑥ Bracket
⑦ Gasket
⑧ Gasket

Removal

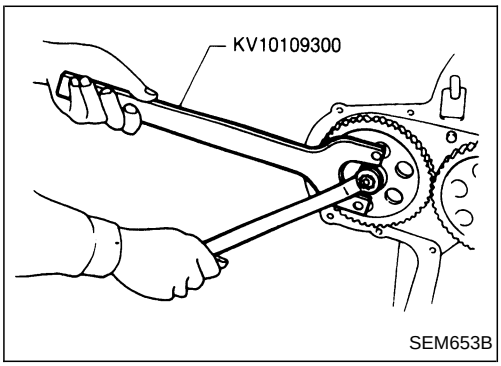
1. Remove battery.
   Disconnect electronic injection pump harness connectors.



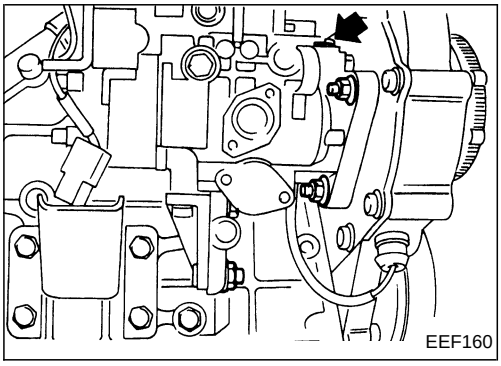
2. Set No. 1 piston at TDC on its compression stroke.

3. Remove fuel hoses (supply, return and spill) and injection tubes.

Removal (Cont'd)



4. Remove dust cover and injection pump gear.
   Refer to EM section.



5. Remove fixing nuts and bolts. Then remove injection pump.

Installation

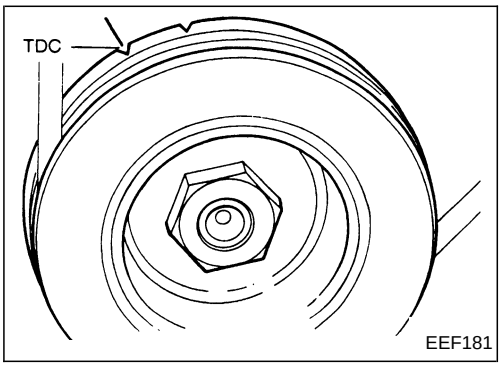
Install injection pump assembly in the reverse order of removal, observing the following:

1. Confirm that No. 1 cylinder is set at TDC on its compression stroke.
2. Install injection pump (Refer to EM section).

(1) Temporarily set injection pump so that the flange of the pump is aligned with aligning mark on front cover.

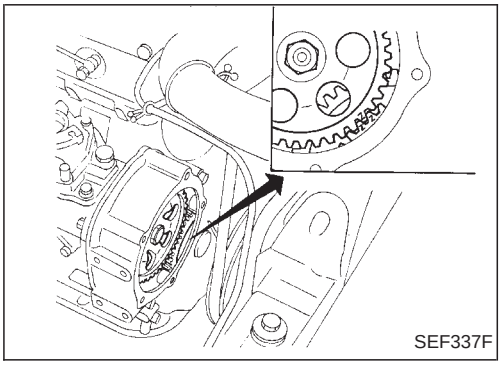
(2) Install injection pump gear.

: 59 - 69 N·m (6 - 7 kg-m, 43 - 51 ft-lb)

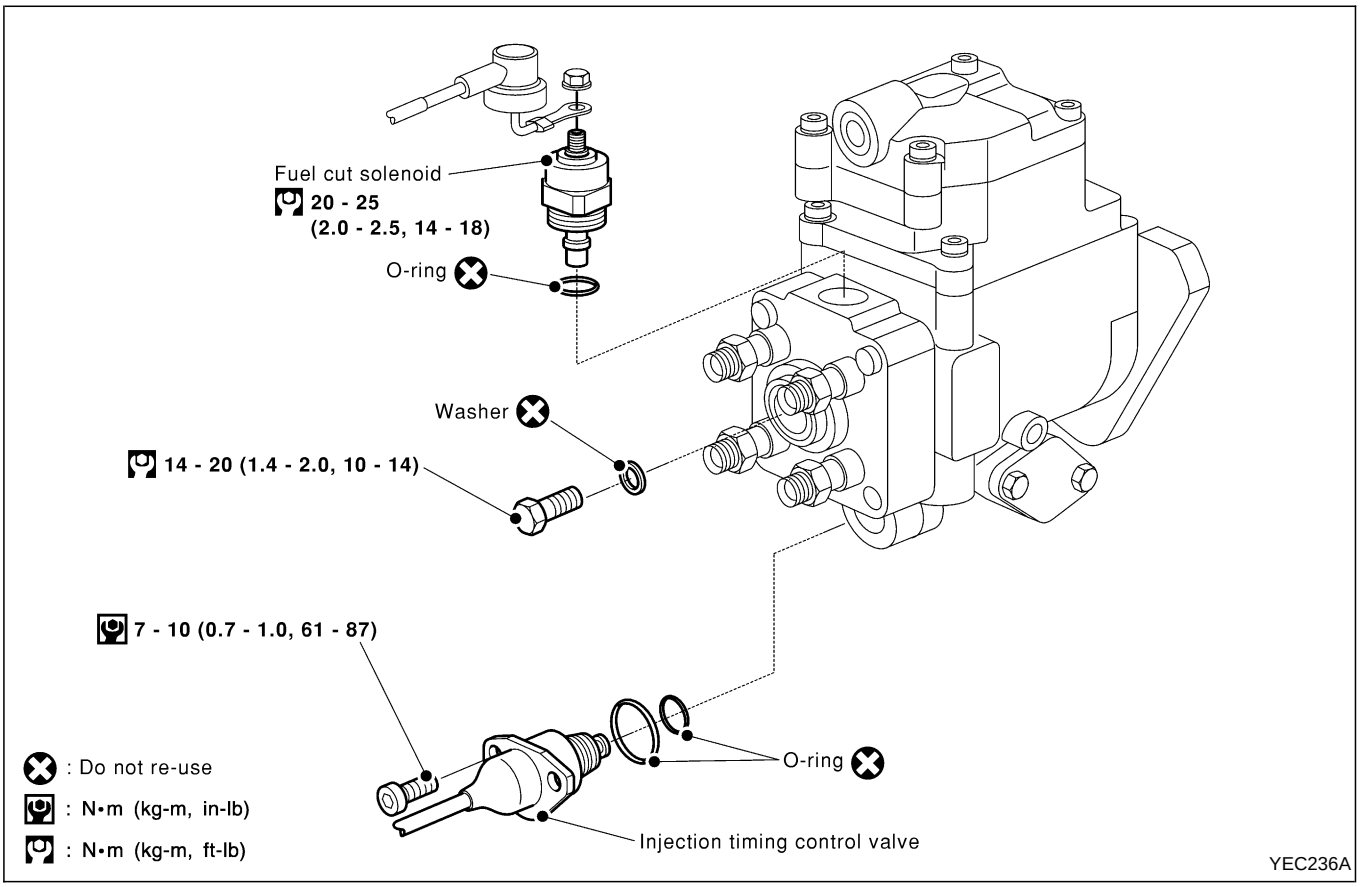


Make sure that the key does not fall into the front cover.
Make sure that "Z" marks are aligned.

(3) Apply liquid gasket to mating surface of injection pump gear cover and install it.



3. Adjust injection timing.
   Refer to "Basic Inspection", EC-338.
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, smear 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 positioning the injection timing control valve correctly, visually check that the fuel does not leak.**
- **After re-assembling the parts, erase Diagnostic Trouble Code (DTC), and perform DTC CONFIRMATION PROCEDURE (or OVERALL FUNCTION CHECK).**

DTC and MI Detection Logic

When a malfunction is detected for the first time, the malfunction (DTC) is stored in the ECM memory.
The MI 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 MI will stay lit up. For a description of diagnostic items causing the MI to light up, refer to “TROUBLE DIAGNOSIS — INDEX”, EC-293.

Diagnostic Trouble Code (DTC)

HOW TO READ DTC

The DTC can be read by the following methods.

Without CONSULT-II

ECM displays the DTC by a set of four digit numbers with MI illumination in the diagnostic test mode II (Self-diagnostic results). Example: 0102, 0103, 0104, etc.

With CONSULT-II

CONSULT-II displays the DTC in “SELF-DIAG RESULTS” mode. Examples: P0100, P0115, P0500, etc.
These DTCs are prescribed by ISO15031-6.
(CONSULT-II also displays the malfunctioning component or system.)

- **Output of the trouble code means that the indicated circuit has a malfunction. However, in the Mode II it does not indicate whether the malfunction is still occurring or occurred in the past and returned to normal.**
  CONSULT-II can identify them. Therefore, using CONSULT-II (if available) is recommended.

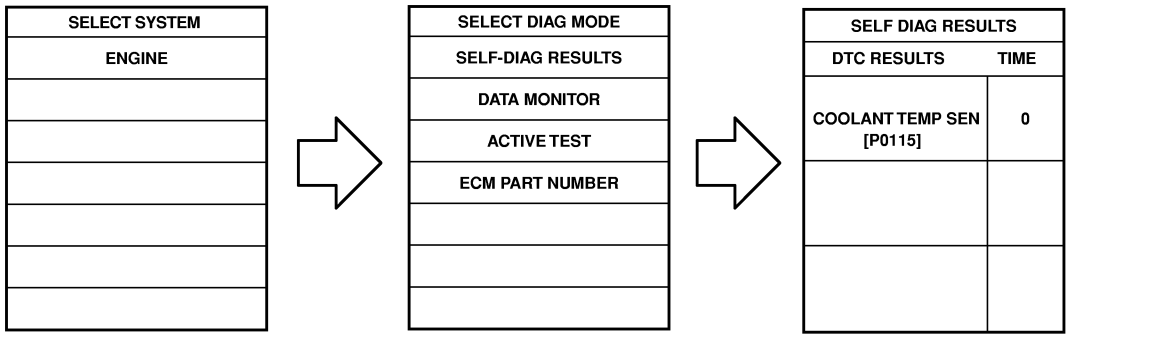
HOW TO ERASE DTC

How to Erase DTC (With CONSULT-II)

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

How to erase DTC (With CONSULT-II)

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



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

SEF246Z

The emission related diagnostic information in the ECM can be erased by selecting “ERASE” in the “SELF-DIAG RESULTS” mode with CONSULT-II.

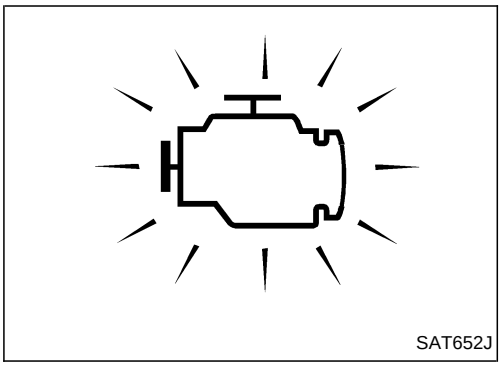
Diagnostic Trouble Code (DTC) (Cont'd)

How to Erase DTC (⊗ Without CONSULT-II)

1. If the ignition switch stays "ON" after repair work, be sure to turn ignition switch "OFF" once. Wait at least 5 seconds and then turn it "ON" (engine stopped) again.
2. Change the diagnostic test mode from Mode II to Mode I by using the data link connector. (See EC-323.)

The emission related diagnostic information in the ECM can be erased by changing the diagnostic test mode.

- **If the battery is disconnected, the emission-related diagnostic information will be lost after approx. 24 hours.**
- **Erasing the emission-related diagnostic information using CONSULT-II is easier and quicker than switching the diagnostic test mode using the data link connector.**


SAT652J

Malfunction Indicator (MI)

1. The malfunction indicator will light up when the ignition switch is turned ON without the engine running. This is a bulb check.
   - If the malfunction indicator does not light up, refer to EL section ("WARNING LAMPS/WIRING DIAGRAM") or see MI & DATA LINK CONNECTORS.
2. When the engine is started, the malfunction indicator should go off.
   If the lamp remains on, the on board diagnostic system has detected an engine system malfunction.

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

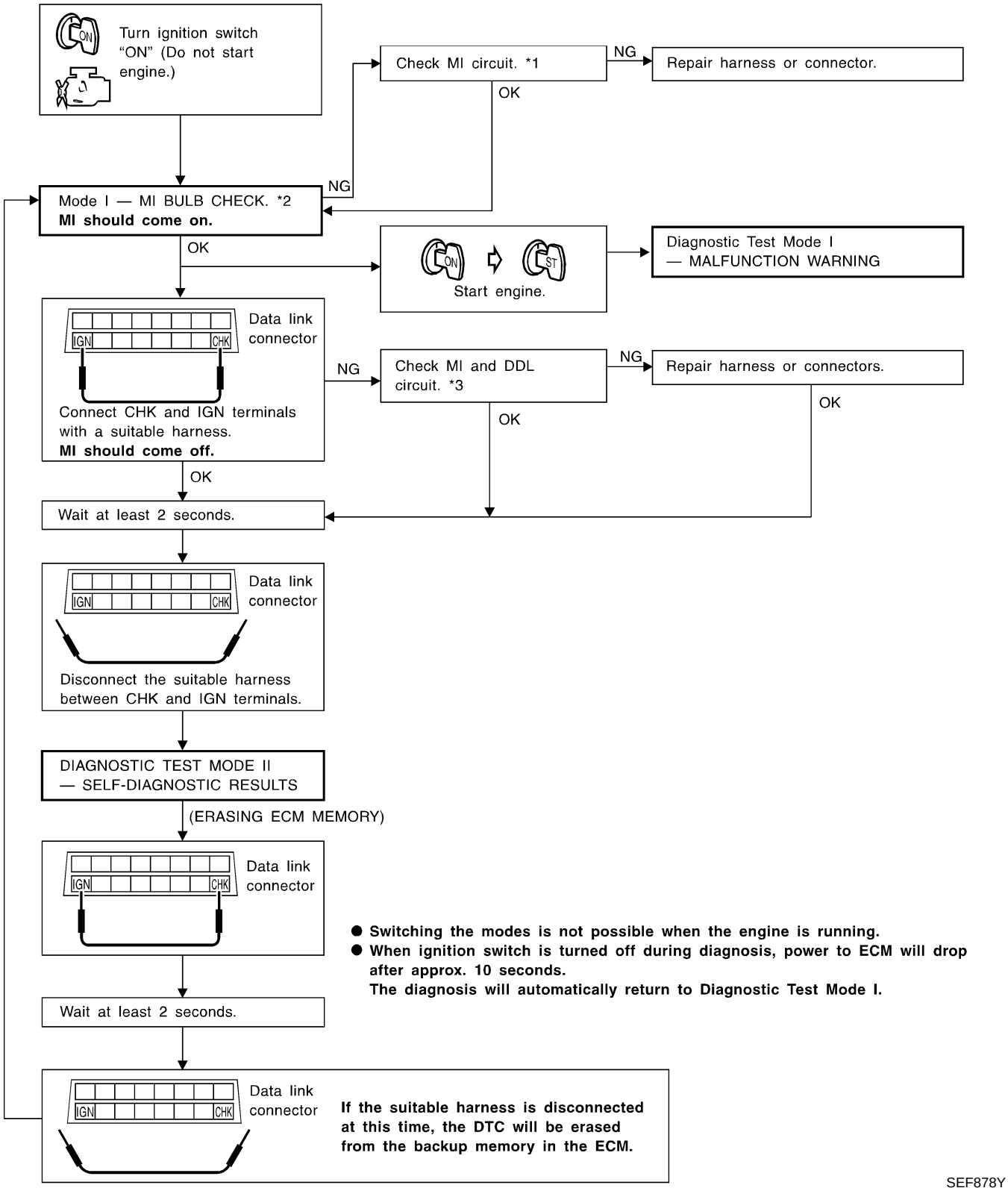
ON BOARD DIAGNOSTIC SYSTEM FUNCTION

The on board diagnostic system has the following three functions.

Diagnostic Test Mode	KEY and ENG. Status	Function	Explanation of Function
Mode I	Ignition switch in ON position  Engine stopped 	BULB CHECK	This function checks the MI bulb for damage (blown, open circuit, etc.). If the MI does not come on, check MI circuit. (See EC-452.)
	Engine running 	MALFUNCTION WARNING	This is a usual driving condition. When ECM detects a malfunction, the MI will light up to inform the driver that a malfunction has been detected.
Mode II	Ignition switch in ON position  Engine stopped 	SELF-DIAGNOSTIC RESULTS	This function allows DTCs to be read.

Malfunction Indicator (MI) (Cont'd)

HOW TO SWITCH DIAGNOSTIC TEST MODES



- **Switching the modes is not possible when the engine is running.**
- **When ignition switch is turned off during diagnosis, power to ECM will drop after approx. 10 seconds.**
  The diagnosis will automatically return to Diagnostic Test Mode I.

SEF878Y

*1: EC-452 *2: EC-322 *3: EC-452

Malfunction Indicator (MI) (Cont'd)

DIAGNOSTIC TEST MODE I—BULB CHECK

In this mode, the MALFUNCTION INDICATOR on the instrument panel should stay ON. If it remains OFF, check the bulb. Refer to EL section ("WARNING LAMPS/WIRING DIAGRAM") or see EC-452.

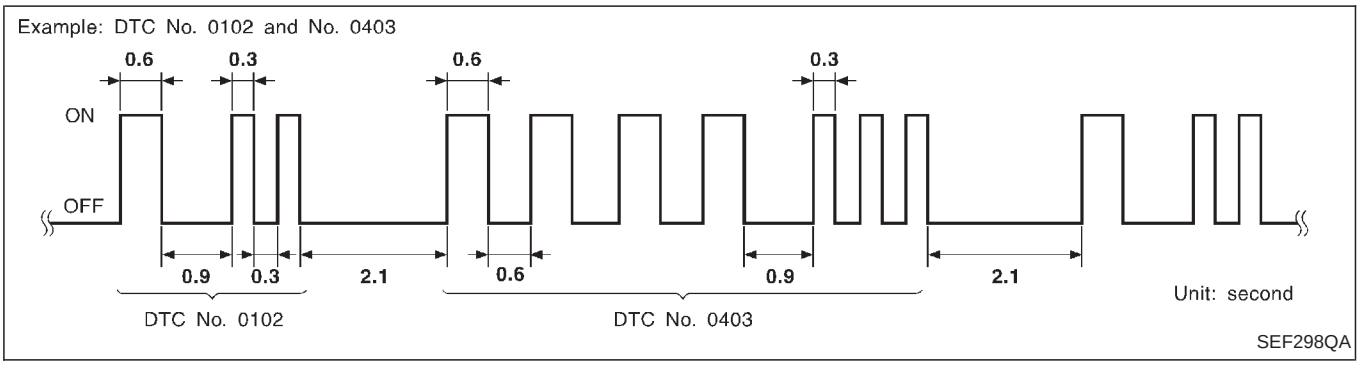
DIAGNOSTIC TEST MODE I—MALFUNCTION WARNING

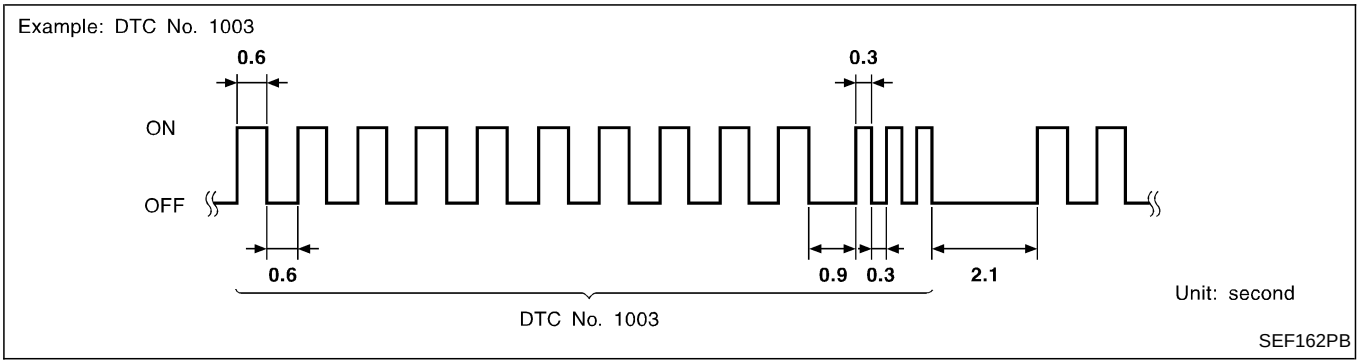
MI	Condition
ON	When a malfunction is detected or the ECM's CPU is malfunctioning.
OFF	No malfunction.

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

DIAGNOSTIC TEST MODE II—SELF-DIAGNOSTIC RESULTS

In this mode, DTC is indicated by the number of blinks of the MI as shown below.





Long (0.6 second) blinking indicates the two LH digits of number and short (0.3 second) blinking indicates the two RH digits of number. For example, the MI blinks 10 times for 6 seconds (0.6 sec x 10 times) and then it blinks three times for about 1 second (0.3 sec x 3 times). This indicates the DTC "1003".
In this way, all the detected malfunctions are classified by their DTC numbers. The DTC "0505" refers to no malfunction. (See TROUBLE DIAGNOSIS — INDEX, EC-293.)

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 repeating consecutively twice. (Refer to "HOW TO SWITCH DIAGNOSTIC TEST MODES" on previous page.)

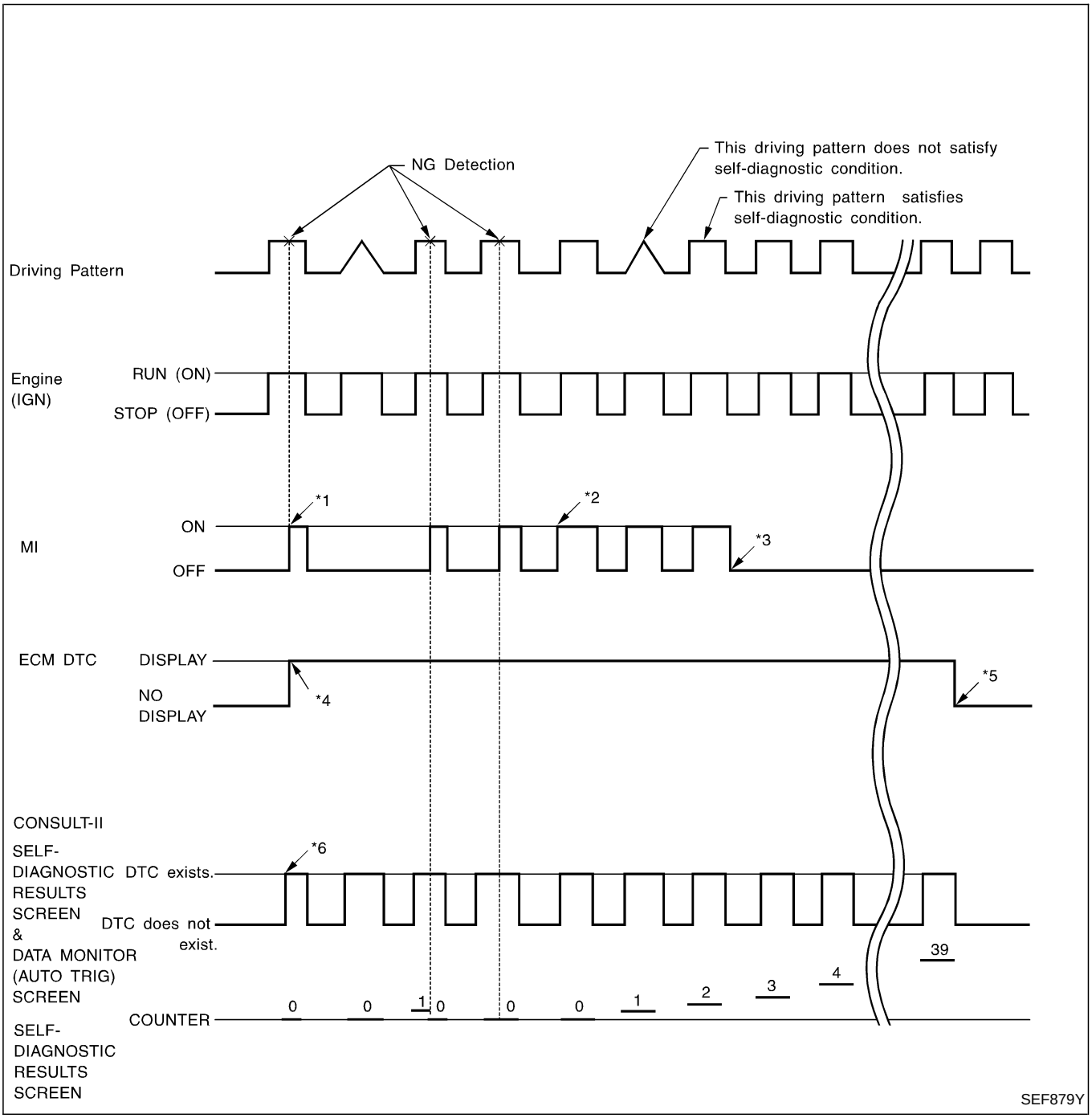
- **If the battery terminal is disconnected, the diagnostic trouble code will be lost from the backup memory within 24 hours.**
- **Be careful not to erase the stored memory before starting trouble diagnoses.**
- **If the MI flashes or "NATS MALFUNCTION" is displayed on "SELF-DIAG RESULTS" screen, perform self-diagnostic results mode with CONSULT-II using NATS program card (NATS-E940). Refer to EL section.**
- **Confirm no self-diagnostic results of NATS is displayed before touching "ERASE" in "SELF-DIAG RESULTS" mode with CONSULT-II.**
- **When replacing ECM, initialisation of NATS system and registration of all NATS ignition key IDs must be carried out with CONSULT-II using NATS program card (NATS-E940).**
  Therefore, be sure to receive all keys from vehicle owner.

Malfunction Indicator (MI) (Cont'd)

Regarding the procedures of NATS initialisation and NATS ignition key ID registration, refer to CONSULT-II operation manual, NATS.

Malfunction Indicator (MI) (Cont'd)

RELATIONSHIP BETWEEN MI, DTC, CONSULT-II AND DRIVING PATTERNS



*1: When a malfunction is detected, MI will light up.

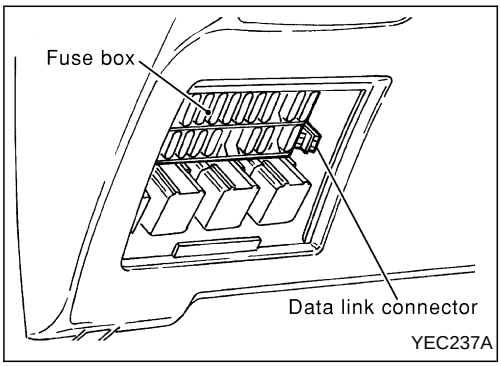
*2: When the same malfunction is detected in two consecutive driving patterns, MI will stay lit up.

*3: MI will go off after vehicle is driven three times without any malfunctions.

*4: When a malfunction is detected for the first time, the DTC will be stored in ECM.

*5: The DTC will not be displayed any longer after vehicle is driven 40 times without the same malfunction. (The DTC still remain in ECM.)

*6: Other screens except SELF-DIAGNOSTIC RESULTS & DATA MONITOR (AUTO TRIG) cannot display the malfunction. DATA MONITOR (AUTO TRIG) can display the malfunction at the moment it is detected.

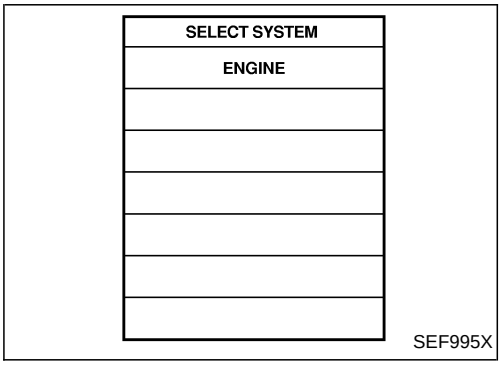


YEC237A

CONSULT-II

CONSULT-II INSPECTION PROCEDURE

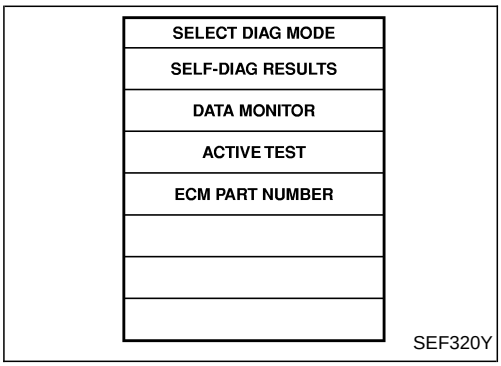
1. Turn off ignition switch.
2. Connect “CONSULT-II” to data link connector for CONSULT-II. (Data link connector for CONSULT-II is located behind the fuse box cover.)



SEF995X

3. Turn on ignition switch.
4. Touch “START”.
5. Touch “ENGINE”.
6. Perform each diagnostic test mode according to each service procedure.

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



SEF320Y

CONSULT-II (Cont'd)

ENGINE CONTROL COMPONENT PARTS/CONTROL SYSTEMS APPLICATION

Item			DIAGNOSTIC TEST MODE		
			SELF-DIAG-NOSTIC RESULTS	DATA MONITOR	ACTIVE TEST
ENGINE CONTROL COMPONENT PARTS	INPUT	Camshaft position sensor (PUMP) *1	X *2	X	
		Mass air flow sensor	X	X	
		Engine coolant temperature sensor	X	X	
		Control sleeve position sensor	X	X	X
		Fuel temperature sensor	X	X	
		Vehicle speed sensor	X	X	
		Accelerator position sensor	X	X	
		Accelerator position switch		X	
		Crankshaft position sensor (TDC)	X	X	
		Needle lift sensor	X	X	
		Ignition switch (start signal)		X	
		Ignition switch (ON signal)	X	X	
		Air conditioner switch		X	
		Stop lamp switch	X	X	
		Brake switch 2	X	X	
		Battery voltage		X	
	OUTPUT	Injection timing control valve	X	X	X
		Fuel cut solenoid valve	X	X	X
		Air conditioner relay	X *2	X	
		Glow relay	X	X	X
		EGRC-solenoid valve A	X	X	X
		EGRC-solenoid valve B	X	X	X
		Throttle control solenoid valve	X	X	X

X: Applicable
*1 Imaginary sensor, which produces secondary engine revolution signal using needle lift sensor pulse.
*2 CONSULT-II may not display, but self-diagnostic results are available with MI.

CONSULT-II (Cont'd)

SELF-DIAGNOSTIC MODE

Regarding items detected in "SELF-DIAG RESULTS" mode, refer to "TROUBLE DIAGNOSIS — INDEX", EC-293.

DATA MONITOR MODE

Monitored item [Unit]	ECM input signals	Main signals	Description	Remarks
CKPS·RPM (TDC) [rpm]	○	○	• The engine speed computed from the crankshaft position sensor (TDC) signal is displayed.	
CMPS·RPM - PUMP [rpm]	○	○	• The engine speed computed from the needle lift sensor signal is displayed.	
COOLAN TEMP/S [°C] or [°F]	○	○	• The engine coolant temperature (determined by the signal voltage of the engine coolant temperature sensor) is displayed.	• When the engine coolant temperature sensor is open or short-circuited, ECM enters fail-safe mode. The same data as the fuel temperature is displayed.
VHCL SPEED SE [km/h] or [mph]	○	○	• The vehicle speed computed from the vehicle speed sensor signal is displayed.	
FUEL TEMP SEN [°C] or [°F]	○	○	• The fuel temperature (determined by the signal voltage of the fuel temperature sensor) is displayed.	
ACCEL POS SEN [V]	○	○	• The accelerator position sensor signal voltage is displayed.	
OFF ACCEL POS [ON/OFF]	○	○	• Indicates [ON/OFF] condition from the accelerator position switch signal.	• Signal at approximately 9° opened.
C/SLEEV POS/S [V]	○	○	• The control sleeve position sensor signal voltage is displayed.	
BATTERY VOLT [V]	○	○	• The power supply voltage of ECM is displayed.	
START SIGNAL [ON/OFF]	○	○	• Indicates [ON/OFF] condition from the starter signal.	• After starting the engine, [OFF] is displayed regardless of the starter signal.
AIR COND SIG [ON/OFF]	○	○	• Indicates [ON/OFF] condition of the air conditioner switch as determined by the air conditioner signal.	
BRAKE SW [ON/OFF]	○		• Indicates [ON/OFF] condition of the stop lamp switch.	
BRAKE SW2 [ON/OFF]	○		• Indicates [ON/OFF] condition of the brake switch 2.	
IGN SW [ON/OFF]	○	○	• Indicates [ON/OFF] condition from ignition switch.	
MAS AIR/FL SE [V]	○	○	• The signal voltage of the mass air flow sensor is displayed.	• When the engine is stopped, a certain value is indicated.
ACT INJ TIMG [°]	○		• The actual injection timing angle determined by the ECM (an approximate average angle between injection start and end from TDC) is displayed.	
TARGET F/INJ [mm^3/stroke]		○	• The target fuel injection quantity (determined by the ECM according to the input signal) is indicated.	

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

CONSULT-II (Cont'd)

Monitored item [Unit]	ECM input signals	Main signals	Description	Remarks
FUEL CUT S/V [ON/OFF]			● 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.	● When the fuel cut solenoid valve is not operating, fuel supply is shut off.
AIR COND RLY [ON/OFF]		○	● The air conditioner relay control condition (determined by ECM according to the input signal) is indicated.	
GLOW RLY [ON/OFF]		○	● The glow relay control condition (determined by ECM according to the input signal) is displayed.	
EGRC SOL/V A [ON/OFF]			● The control condition of the EGRC-solenoid valve A (determined by ECM according to the input signal) is indicated. ● OFF ... EGRC-solenoid valve A is not operating. ON ... EGRC-solenoid valve A is operating.	
EGRC SOL/V B [ON/OFF]			● The control condition of the EGRC-solenoid valve B (determined by ECM according to the input signal) is indicated. ● OFF ... EGRC solenoid valve B is not operating. ON ... EGRC-solenoid valve B is operating.	
THROT RLY [ON/OFF]			● The control condition of the throttle control solenoid valve (determined by ECM according to the input signal) is indicated. ● OFF ... Throttle control solenoid valve is not operating. ON ... Throttle control solenoid valve is operating.	

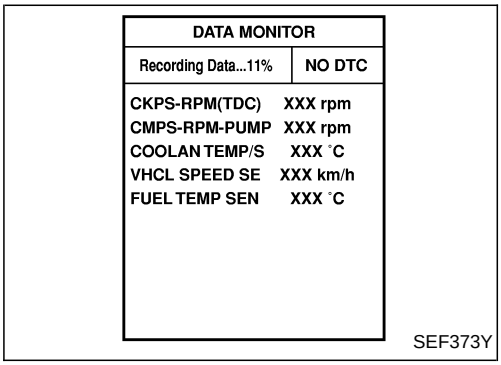
CONSULT-II (Cont'd)

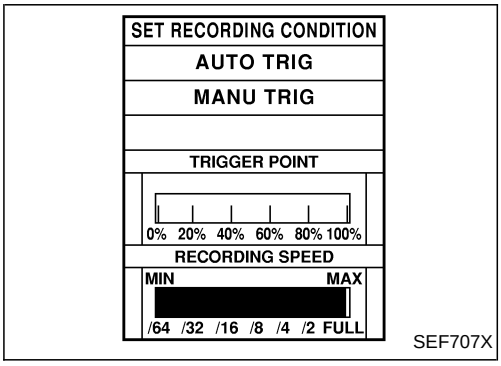
ACTIVE TEST MODE

TEST ITEM	CONDITION	JUDGEMENT	CHECK ITEM (REMEDY)
TARGET F/INJ	• Engine: Return to the original trouble condition. • Fix the target injection quantity using CONSULT-II.	If trouble symptom disappears, see CHECK ITEM	• Control sleeve position sensor.
FUEL CUT SOL/V	• Ignition switch: ON • Turn solenoid valve "ON" and "OFF" with the CONSULT-II and listen to operating sound.	Solenoid valve makes an operating sound.	• Harness and connector • Solenoid valve
EGRC SOL/V A	• Ignition switch: ON • Turn solenoid valve "ON" and "OFF" with the CONSULT-II and listen to operating sound.	Solenoid valve makes an operating sound.	• Harness and connector • Solenoid valve
EGRC SOL/V B	• Ignition switch: ON • Turn solenoid valve "ON" and "OFF" with the CONSULT-II and listen to operating sound.	Solenoid valve makes an operating sound.	• Harness and connector • Solenoid valve
THROT CONT SOL/V	• Ignition switch: ON • Turn solenoid valve "ON" and "OFF" with the CONSULT-II and listen to operating sound.	Solenoid valve makes an operating sound.	• Harness and connector • Solenoid valve
GLOW RLY	• Ignition switch: ON (Engine stopped) • Turn the glow relay "ON" and "OFF" using CONSULT-II and listen to operating sound.	Glow relay makes the operating sound.	• Harness and connector • Glow relay
INJ TIMING	• Engine: Return to the original trouble condition • Retard the injection timing using CONSULT-II.	If trouble symptom disappears, see CHECK ITEM.	• Adjust initial injection timing

CONSULT-II (Cont'd)

REAL TIME DIAGNOSIS IN DATA MONITOR MODE





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

1) "AUTO TRIG" (Automatic trigger):

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

2) "MANU TRIG" (Manual trigger):

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

Use these triggers as follows:

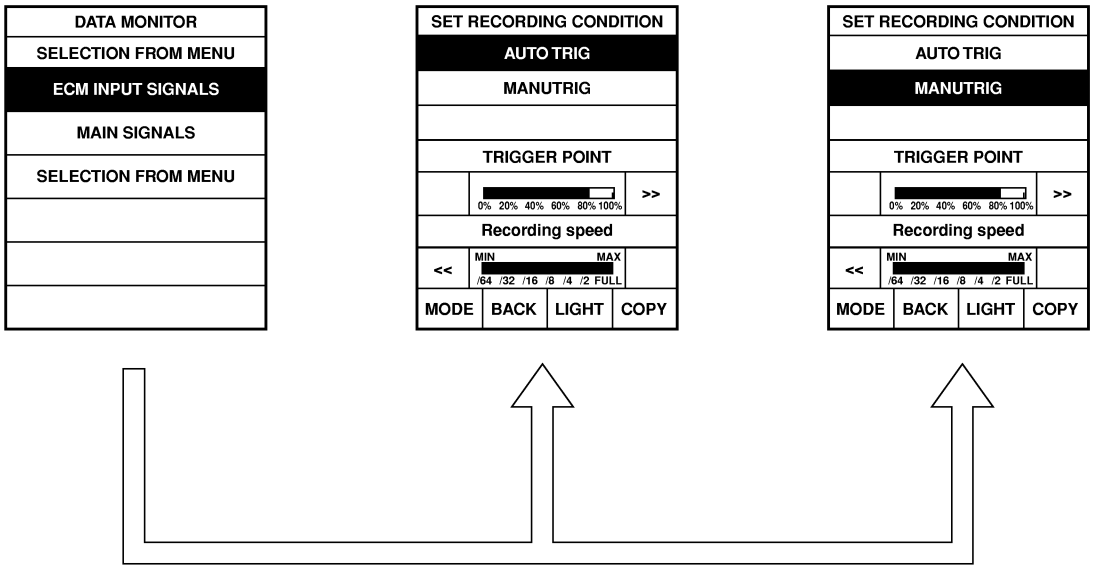
1) "AUTO TRIG"

- While trying to detect the DTC by performing the "DTC Confirmation Procedure", be sure to select to "DATA MONITOR (AUTO TRIG)" mode. You can confirm the malfunction at the moment it is detected.
- While narrowing down the possible causes, CONSULT-II should be set in "DATA MONITOR (AUTO TRIG)" mode, especially in case the incident is intermittent.
  When you are inspecting the circuit by gently shaking (or twisting) the suspicious connectors, components and harness in the "DTC Confirmation Procedure", the moment a malfunction is found the DTC will be displayed. Refer to GI-22, "Incident Simulation Tests".

2) "MANU TRIG"

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

CONSULT-II (Cont'd)

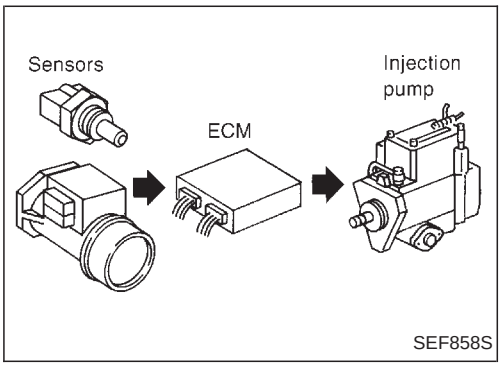


"SETTING"

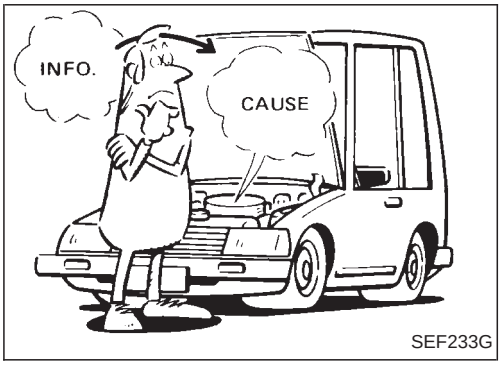
"AUTO TRIG"
A malfunction can be displayed on "DATA MONITOR" screen automatically if detected.

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

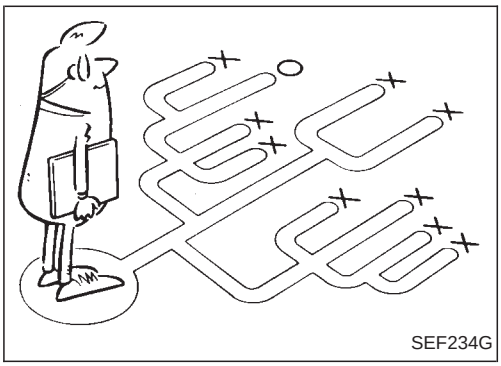
SEF720X



SEF858S



SEF233G


SEF234G

Introduction

The engine has an ECM to control major systems such as fuel injection control, fuel injection timing control, glow control system, etc. The ECM accepts input signals from sensors and instantly drives electronic fuel injection pump. It is essential that both input and output signals are correct and stable. It is also important that there are no problems such as vacuum leaks, with the engine.

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

A visual check may not be sufficient to determine the cause of the problems. An active road test with CONSULT-II 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 important 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 the 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.

KEY POINTS

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

SEF907L

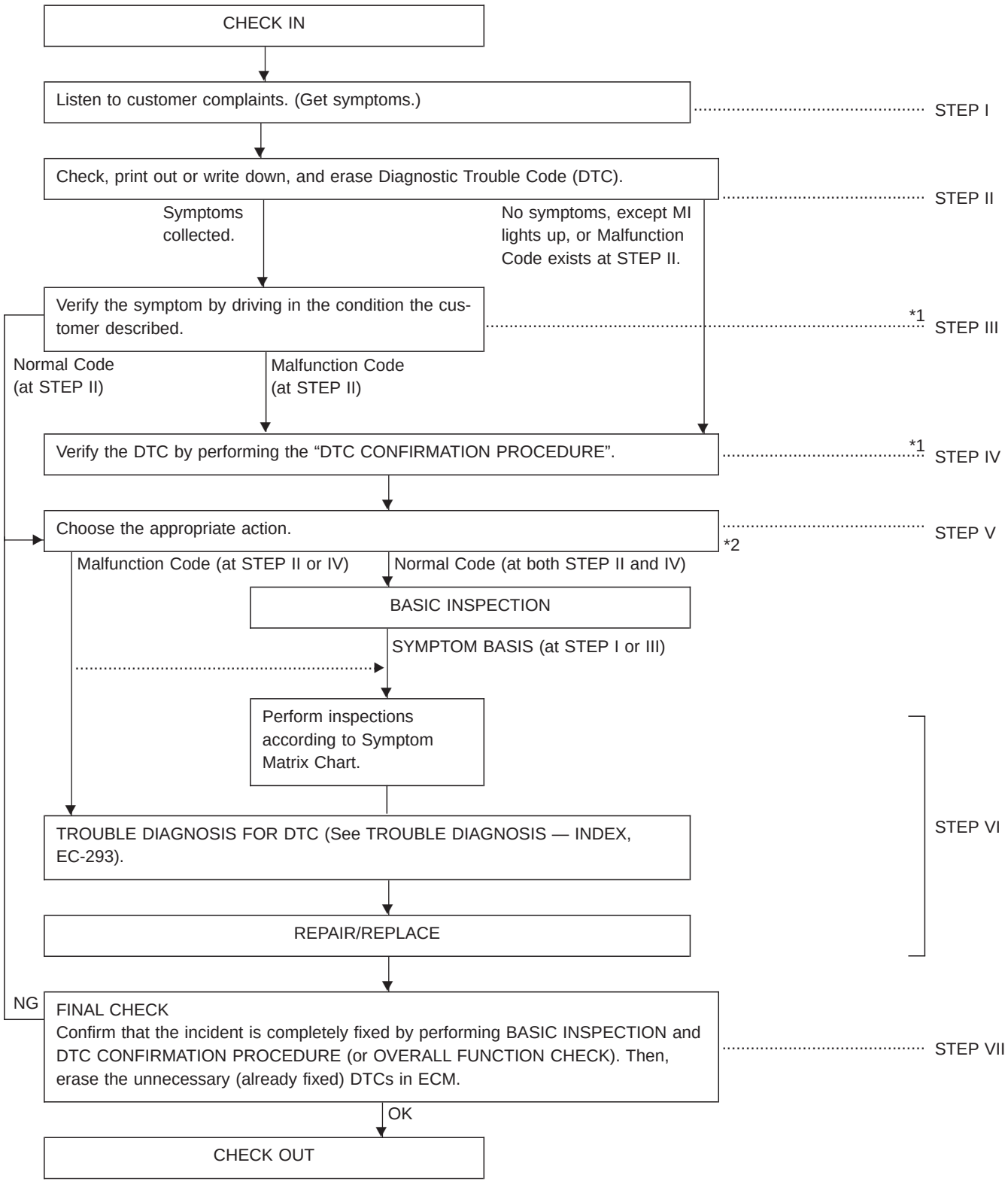
Diagnostic Worksheet

There are many operating conditions that lead to the malfunction of engine components. A good understanding of such conditions can make troubleshooting easier and more accurate.
In general, each customer feels differently about a problem. It is important to fully understand the symptoms or conditions for a customer complaint.
Utilize a diagnostic worksheet like the one shown below in order to organize all the information for troubleshooting.

WORKSHEET SAMPLE

Customer name MR/MS		Model & Year	VIN
Engine #		Trans.	Mileage
Incident Date		Manuf. Date	In Service Date
Symptoms	☐ Startability	☐ Impossible to start ☐ No combustion ☐ Partial combustion ☐ Partial combustion when warming-up engine ☐ Partial combustion when cooling down engine ☐ Possible but hard to start ☐ Others [ ]	
	☐ Idling	☐ No fast idle ☐ Unstable ☐ High idle ☐ Low idle ☐ Others [ ]	
	☐ Driveability	☐ Stumble ☐ Surge ☐ Knock ☐ Lack of power ☐ Others [ ]	
	☐ Engine stall	☐ At the time of start ☐ While idling ☐ While accelerating ☐ While decelerating ☐ Just after stopping ☐ While loading	
Incident occurrence		☐ Just after delivery ☐ Recently ☐ In the morning ☐ At night ☐ In the daytime	
Frequency		☐ All the time ☐ Under certain conditions ☐ Sometimes	
Weather conditions		☐ Not affected	
	Weather	☐ Fine ☐ Raining ☐ Snowing ☐ Others [ ]	
	Temperature	☐ Hot ☐ Warm ☐ Cool ☐ Cold ☐ Humid °F	
Engine conditions		☐ Cold ☐ During warm-up ☐ After warm-up Engine speed 0 2,000 4,000 6,000 8,000 rpm	
Road conditions		☐ In town ☐ In suburbs ☐ Highway ☐ Off road (up/down)	
Driving conditions		☐ Not affected ☐ At starting ☐ While idling ☐ At racing ☐ While accelerating ☐ While cruising ☐ While decelerating ☐ While turning (RH/LH) Vehicle speed 0 10 20 30 40 50 60 70 80 90 100 mph	
Malfunction indicator lamp		☐ Turned on ☐ Not turned on	

Work Flow



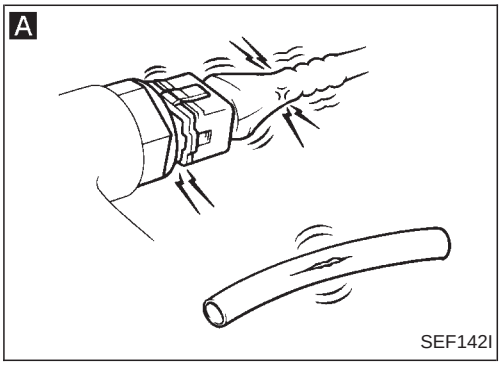
***1: If the incident cannot be duplicated, refer to GI section.**

***2: If the on board diagnostic system cannot be performed, check main power supply and ground circuit. Refer to “TROUBLE DIAGNOSIS FOR POWER SUPPLY”, EC-352.**

Description for Work Flow

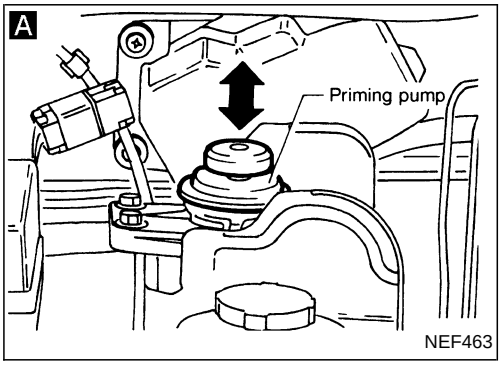
STEP	DESCRIPTION
STEP I	Get detailed information about the conditions and the environment when the incident/symptom occurred using the “DIAGNOSTIC WORKSHEET” as shown on the next page.
STEP II	Before confirming the concern, check and write down (print out using CONSULT-II) the Diagnostic Trouble Code (DTC), then erase the code. (Refer to EC-321). The DTC can be used when duplicating the incident at STEP III & IV. Study the relationship between the cause, specified by DTC, and the symptom described by the customer. (The “Symptom Matrix Chart” will be useful. Refer to EC-340.)
STEP III	Try to confirm the symptom and under what conditions the incident occurs. The “DIAGNOSTIC WORK SHEET” is useful to verify the incident. Connect CONSULT-II to the vehicle in DATA MONITOR (AUTO TRIG) mode and check real time diagnosis results. If the malfunction code is detected, skip STEP IV and perform STEP V.
STEP IV	Try to detect the Diagnostic Trouble Code (DTC) by driving in (or performing) the “DTC CONFIRMATION PROCEDURE”. Check and read the DTC by using CONSULT-II. During the DTC verification, be sure to connect CONSULT-II to the vehicle in DATA MONITOR (AUTO TRIG) mode and check real time diagnosis results. In case the “DTC CONFIRMATION PROCEDURE” is not available, perform the “OVERALL FUNCTION CHECK” instead. The DTC cannot be displayed by this check, however, this simplified “check” is an effective alternative. The “NG” result of the “OVERALL FUNCTION CHECK” is the same as the DTC detection.
STEP V	Take the appropriate action based on the results of STEP I through IV. If the malfunction code is indicated, proceed to TROUBLE DIAGNOSIS FOR DTC. If the normal code is indicated, proceed to the BASIC INSPECTION. Refer to EC-338. Then perform inspections according to the Symptom Matrix Chart. Refer to EC-340.
STEP VI	Identify where to begin diagnosis based on the relationship study between symptom and possible causes. Inspect the system for mechanical binding, loose connectors or wiring damage using (tracing) “Harness Layouts”. Gently shake the related connectors, components or wiring harness with CONSULT-II set in “DATA MONITOR (AUTO TRIG)” mode. Check the voltage of the related ECM terminals or monitor the output data from the related sensors with CONSULT-II. Refer to EC-346. 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. Repair or replace the malfunctioning parts.
STEP VII	Once you have repaired the circuit or replaced a component, you need to run the engine in the same conditions and circumstances which resulted in the customer’s initial complaint. Perform the “DTC CONFIRMATION PROCEDURE” and confirm the normal code (Diagnostic trouble code No. 55) is detected. If the incident is still detected in the final check, perform STEP VI by using a different method from the previous one. Before returning the vehicle to the customer, be sure to erase the unnecessary (already fixed) DTC in ECM. (Refer to EC-321.)

A



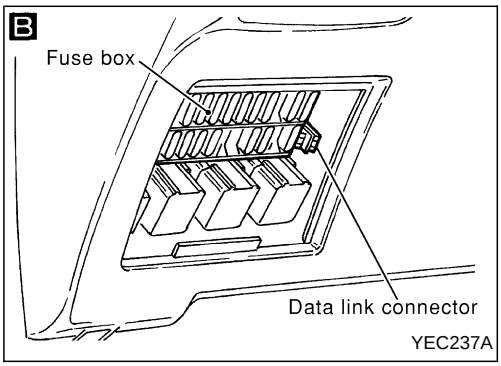
SEF142I

A



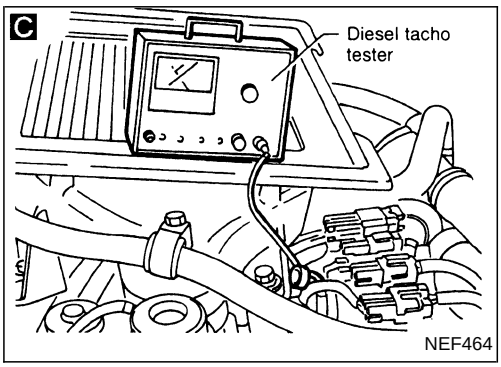
NEF463

B



YEC237A

C



NEF464

C

DATA MONITOR	
MONITOR	NO DTC
CKPS-RPM (TDC)	XXX rpm

SEF817Y

Basic Inspection

Precaution:
Perform Basic Inspection without electrical or mechanical loads applied;

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

A

BEFORE STARTING

1. Check service records for any recent repairs that may indicate a related problem, or the current need for scheduled maintenance.
2. Open engine hood and check the following:
   - Harness connectors for improper connections
   - Vacuum hoses for splits, kinks, or improper connections
   - Wiring for improper connections, pinches, or cuts
3. Using priming pump, bleed air from fuel system. Refer to “Fuel Filter Check” in MA section.

↓

B

CONNECT CONSULT-II TO THE VEHICLE.
Connect “CONSULT-II” to the data link connector for CONSULT-II and select “ENGINE” from the menu.

↓

DOES ENGINE START?

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

Yes ↓

Run engine for 10 minutes.

↓

C

CHECK IDLE SPEED.

Read engine idle speed in “DATA MONITOR” mode with CONSULT-II.
725 rpm ± 50 (in N position)

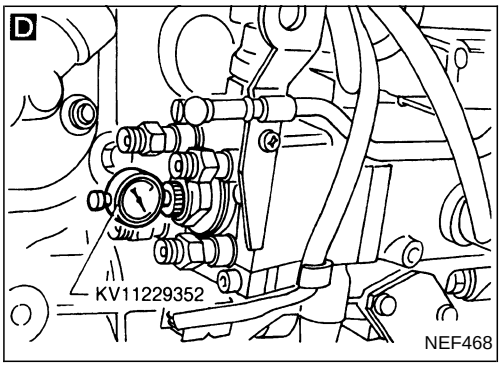
OR

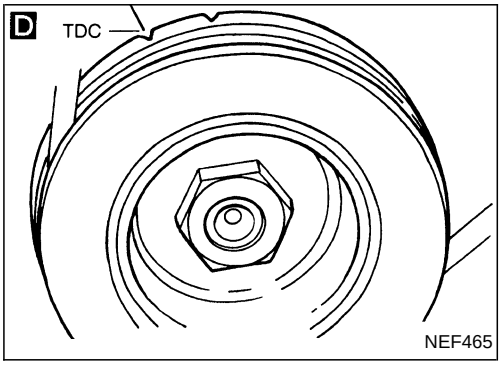
Check idle speed using tachometer tester.
725 rpm ± 50 (in N position)

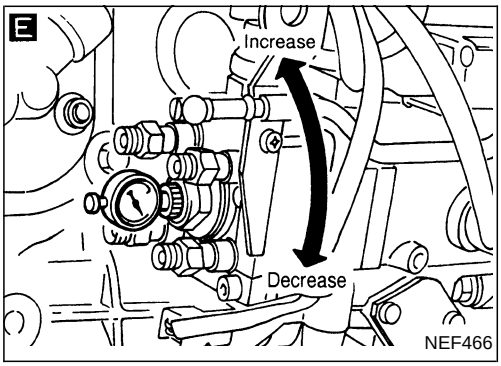
↓

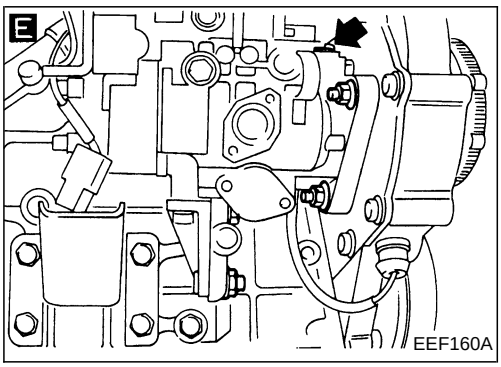
(Go to Ⓐ on next page.)

Basic Inspection (Cont'd)









Ⓐ

D

CHECK INJECTION TIMING.

1. Set No. 1 piston at TDC on its compression stroke.
2. Remove injection tubes and air bleeder on the back of injection pump.
3. Set dial gauge so its indicator points to somewhere between 1.0 and 2.0 mm (0.039 and 0.079 in) on the scale.
4. Turn crankshaft two turns clockwise and check that dial gauge indicates the same value again.
5. Turn crankshaft counterclockwise about 100 degrees, then turn crankshaft clockwise slowly, and set dial gauge indicator to 0 mm at the position it stops.
6. Turn crankshaft clockwise and set it at TDC using the mark on the crankshaft pulley.
7. Read plunger lift.
   Plunger lift:
   0.36 ± 0.02 mm (0.0142 ± 0.0008 in) at TDC

- **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 "HOW TO ERASE DTC" (EC-321).

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 - 2.5 kg-m, 14 - 18 ft-lb)
   Bolt:
   : 32 - 42 N·m (3.3 - 4.3 kg-m, 24 - 31 ft-lb)
3. Remove dial gauge and install air bleeder with new washer.
4. Install injection tubes.
   Flare nut:
   : 20 - 25 N·m (2.0 - 2.5 kg-m, 14 - 18 ft-lb)
5. Bleed air from fuel system.
   Refer to "DRAINING SYSTEM" of "ENGINE MAINTENANCE" in MA section.

→ Go to A.

Symptom Matrix Chart

SYSTEM — Basic engine control system		SYMPTOM: HARD/NO START/RESTART (EXCP. HA)				SYMPTOM: ENGINE STALL			SYMPTOM																						Reference page	Feature of symptom, Check point
		NO START (with first firing)	NO START (without first firing)	HARD TO START WHEN ENGINE IS COLD	HARD TO START WHEN ENGINE IS HOT	AT IDLE	DURING DRIVING	WHEN DECELERATING	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	ABNORMAL SMOKE COLOR: BLACK SMOKE	ABNORMAL SMOKE COLOR: WHITE SMOKE	DEAD BATTERY (UNDER CHARGE)	Malfunction indicator lamp illuminates.	Can be detected by CONSULT-II?	Fuel cut		
New CT/CS		AA				AB			AC	AD	AE		AF		AG	AH	AJ	AK	AL	AM	AP		HA							
Injec-tion timing	Advanced	○	○	●	●			○		●					○	○					●				○		EC-338	
	Retarded	○	○	●	●			○			●				○	○						●			○		EC-338	
Electric injection pump mainframe		●	●	●	●	○	○	○	○	○	●	○	○	○	●	●	○		○		●	○		○	○	○	—	*1
Injection nozzle		○	○	○	○	○	○	○		●	○	○		○	●	●					●						EC-313	*2
Glow system		○	○	●	●					●												●					EC-389	
Engine body		○	○	●	●	○	○	○		●	○	○		○	●	●		○	○	○		●					EM-section	*3
EGR system											●	●									●						EC-431	
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.

Symptom Matrix Chart (Cont'd)

SYSTEM — Engine control system		New CT/CS	Mass air flow sensor circuit		Engine coolant temperature sensor circuit	Vehicle speed sensor circuit	Control sleeve position sensor circuit	Injection timing control valve circuit		Accelerator switch (F/C) circuit		Needle lift sensor circuit	Fuel cut solenoid valve circuit		Fuel temperature sensor circuit	Accelerator position sensor circuit	Crankshaft position sensor (TDC) circuit	
Feature of symptom / Check point					Compensation according to engine coolant temperature does not function.			Injection timing cannot be controlled.						Engine runs on after turning ignition switch OFF.	Compensation for amount of fuel injected according to fuel temperature does not function.			
Reference page			EC-356		EC-361	EC-397	EC-414	EC-380		EC-365		EC-427	EC-376		EC-372	EC-365	EC-385	
Malfunction			open, ground short	short	open, short	open, short	open, short	open, short	ground short	open, short	ground short	open, short	open, ground short	short	open, short	open, short	open, short	noise
SYMPTOM: Fuel cut							○						○	○				
Can be detected by CONSULT-II?			○	○	○	○	○	○	○	○	○	○		○	○	○	○	○
Malfunction indicator lamp illuminates.					○		○			○	○			○		○	○	○
DEAD BATTERY (UNDER CHARGE)		HA																
ABNORMAL SMOKE COLOR	WHITE SMOKE	AP						○				○						
	BLACK SMOKE			○					○									
EXCESSIVE OIL CONSUMPTION		AM																
EXCESSIVE FUEL CONSUMPTION		AL																
OVERHEAT/HIGH ENGINE COOLANT TEMPERATURE		AK																
SLOW/NO RETURN TO IDLE		AJ																
IDLING VIBRATION		AH			○										○		○	
ROUGH IDLE/HUNTING		AG			○										○		○	
LOW IDLE		AF			○										○			
HI IDLE																		
POOR ACCELERATION		AE	○			○									○	○		
LACK OF POWER			○												○	○		
SPARK KNOCK/DETONATION		AD						○				○						
HESITATION/SURGING/FLAT SPOT		AC	○	○						○					○	○		
ENGINE STALL	WHEN DECELERATING	AB			○		○						○		○			○
	DURING DRIVING						○						○					○
	AT IDLE				○		○						○		○			○
HARD/NO START/ RESTART (EXCP. HA)	HARD TO START WHEN ENGINE IS HOT	AA													○			
	HARD TO START WHEN ENGINE IS COLD				○													
	NO START (without first firing)												○					
	NO START (with first firing)																	

Symptom Matrix Chart (Cont'd)

SYSTEM — Engine control system				Feature of symptom / Check point	Reference page	Start control does not function.	Air Conditioner does not stop operating.	Air Conditioner does not work.	Engine does not stop.		Does not operate.	Does not stop operating.	Does not stop operating.	Glow lamp does not turn on.	Glow lamp does not turn off.	Ground short makes engine unable to stop.	Air conditioner does not operate.	Air conditioner does not stop operating.	
						EC-449	EC-440		EC-449		EC-352		EC-435	EC-431	EC-389	EC-446	EC-440		EC-346, 452
SYMPTOM				Fuel cut							○					○			○
				Can be detected by CONSULT-II?							○	○							○
				Malfunction indicator lamp illuminates.							○	○							○
				DEAD BATTERY (UNDER CHARGE)	HA														○
				ABNORMAL SMOKE COLOR — WHITE SMOKE	AP										○				○
				ABNORMAL SMOKE COLOR — BLACK SMOKE	AP								○	○					○
				EXCESSIVE OIL CONSUMPTION	AM														○
				EXCESSIVE FUEL CONSUMPTION	AL														○
				OVERHEAT/HIGH ENGINE COOLANT TEMPERATURE	AK														○
				SLOW/NO RETURN TO IDLE	AJ														○
				IDLING VIBRATION	AH											○			○
				ROUGH IDLE/HUNTING	AG											○			○
				LOW IDLE	AF														○
				HI IDLE	AF														○
				POOR ACCELERATION	AE								○						○
				LACK OF POWER	AE								○						○
				SPARK KNOCK/DETONATION	AD														○
				HESITATION/SURGING/FLAT SPOT	AC														○
			ENGINE STALL	WHEN DECELERATING	AB				○							○			○
				DURING DRIVING	AB				○							○			○
				AT IDLE	AB				○							○			○
			HARD/NO START/ RESTART (EXCP. HA)	HARD TO START WHEN ENGINE IS HOT	AA	○								○					○
				HARD TO START WHEN ENGINE IS COLD	AA	○								○					○
				NO START (without first firing)	AA				○					○					○
				NO START (with first firing)	AA									○					○
Malfunction																			
New CT/CS						open, short			open	short									
Start signal circuit																			
Air conditioner switch circuit							open, ground short												
Ignition switch circuit								short											
Power supply for ECM circuit									open	short									
Throttle control solenoid valve circuit											open, short								
EGRC-solenoid valve A, B circuit												ground short							
Glow relay circuit													open, short						
ECM relay (Self-shut off) circuit														ground short					
Air conditioner relay circuit															open				
ECM, Connector circuit																short			
																	open		
																	short		
																		open, short	

CONSULT-II Reference Value in Data Monitor Mode

Remarks:
- Specification data are reference values.
- Specification data are output/input values which are detected or supplied by the ECM at the connector.
  * Specification data may not be directly related to their components signals/values/operations.

MONITOR ITEM	CONDITION		SPECIFICATION
CKPS·RPM (TDC)	• Tachometer: Connect • Run engine and compare tachometer indication with the CONSULT-II value.		Almost the same speed as the CONSULT-II value.
CKPS·RPM (REF)			
CMPS·RPM-PUMP			
COOLAN TEMP/S	• Engine: After warming up		More than 70°C (158°F)
VHCL SPEED SE	• Turn drive wheels and compare speedometer indication with the CONSULT-II value		Almost the same speed as the CONSULT-II value
FUEL TEMP SEN	• Engine: After warming up		More than 40°C (104°F)
ACCEL POS SEN	• Ignition switch: ON (Engine stopped)	Accelerator pedal: release	0.40 - 0.60V
		Accelerator pedal: depress	Approx. 4.0V
FULL ACCEL SW	• Ignition switch: ON (Engine stopped)	Accelerator pedal: depress	ON
		Except above	OFF
ACCEL SW (FC)	• Ignition switch: ON (Engine stopped)	Accelerator pedal: release	CLOSE
		Accelerator pedal: slightly open	OPEN
OFF ACCEL SW	• Ignition switch: ON (Engine stopped)	Accelerator pedal: release	ON
		Accelerator pedal: slightly open	OFF
C/SLEEV POS/S	• Engine: After warming up, idle the engine		1.0 - 3.5V
BATTERY VOLT	• Ignition switch: ON (Engine stopped)		11 - 14V
P/N POSI SW	• Ignition switch: ON	Shift lever: Neutral	ON
		Except above	OFF
START SIGNAL	• Ignition switch: ON → START → ON		OFF → ON → OFF
AIR COND SIG	• Engine: After warming up, idle the engine	Air Conditioner switch: “OFF”	OFF
		Air Conditioner switch: “ON” (Compressor operates.)	ON
IGN SW	• Ignition switch: ON → OFF		ON → OFF
MAS AIR/FL SE	• Engine: After warming up • Air Conditioner switch: “OFF” • Shift lever: “N” • No-load	Idle	1.5 - 2.1V
		2,000 rpm	2.3 - 2.9V
ACT INJ TIMG	• Engine: After warming up • Air Conditioner switch: “OFF” • Shift lever: “N” • No-load	Idle	−5.0° to −9.0°
		2,000 rpm	−5.0° to −18.0°
DECELER F/CUT	• 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	• Ignition switch: ON → OFF		ON → OFF
AIR COND RLY	• Air Conditioner switch: OFF → ON		OFF → ON
GLOW RLY	• Refer to EC-389.		

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

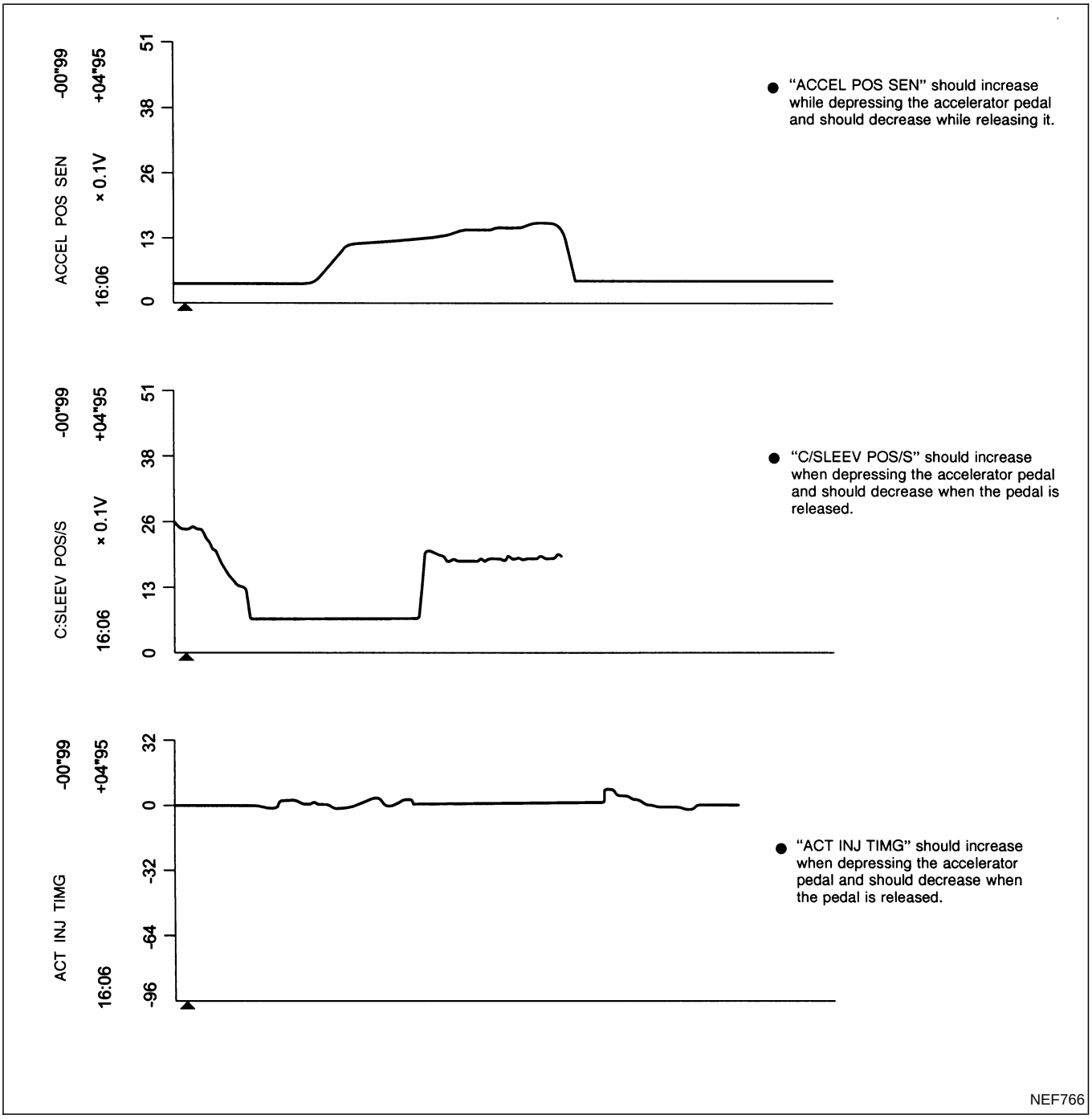
MONITOR ITEM	CONDITION		SPECIFICATION
EGRC SOL/V A	• Engine: After warming up • Air Conditioner switch: "OFF" • Shift lever: "N" • No-load	Idle	ON
		3,200 rpm	OFF
EGRC SOL/V B	• Engine: After warming up • Air Conditioner switch: "OFF" • Shift lever: "N" • No-load	Idle	ON
		3,000 rpm	OFF
THROT RLY	• Engine: After warming up • Air Conditioner switch: "OFF" • Shift lever: "N" • No-load	Idle	ON
		3,000 rpm	OFF

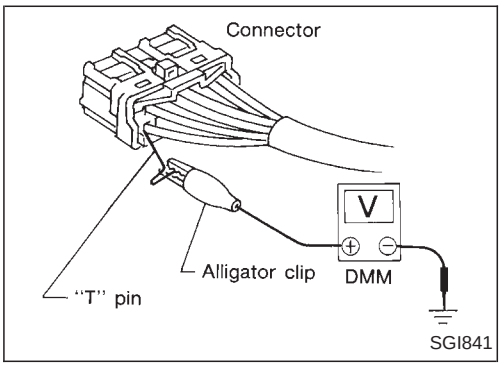
Major Sensor Reference Graph in Data Monitor Mode

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

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

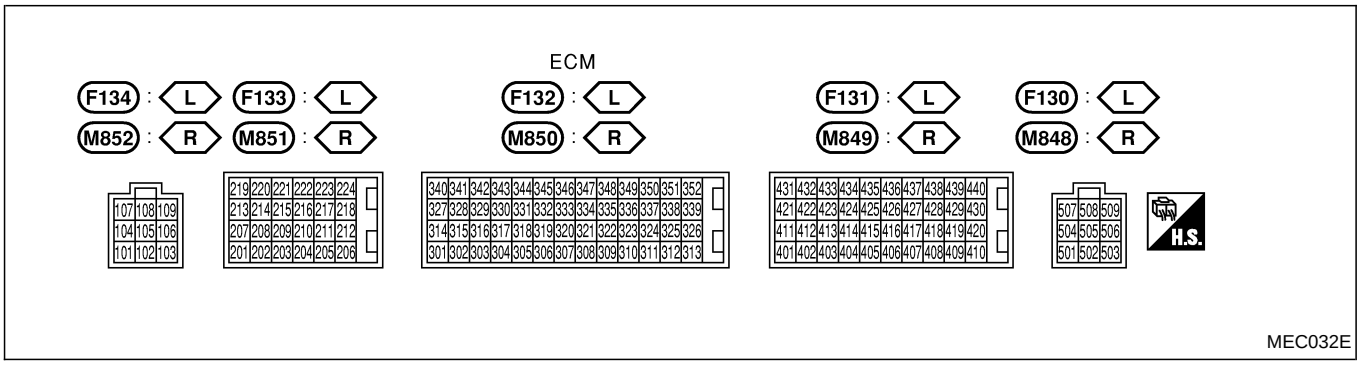
PREPARATION

Perform all voltage measurements with all the connectors connected. Measure ECM terminal voltage at the nearest connector to the sensors or actuators to be measured as accessing ECM terminals from outside is impossible.

- Use extreme care not to touch 2 pins at the same time.
- Data is for comparison and may not be exact.
- Use care not to enlarge the opening to keep the seal in good condition.

Be sure ECM unit is properly grounded before checking.

ECM HARNESS CONNECTOR TERMINAL LAYOUT



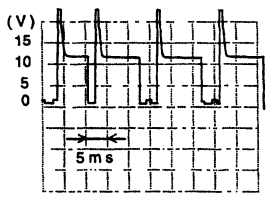
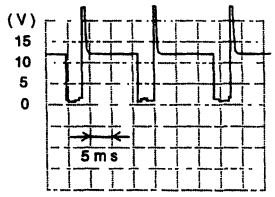
ECM Terminals and Reference Value (Cont'd)

ECM INSPECTION TABLE

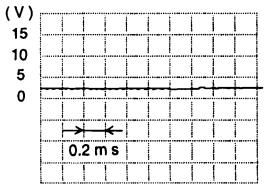
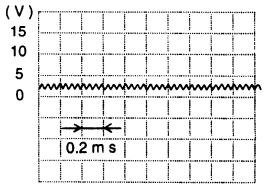
Remarks: Specification data are reference values and are measured between each terminal and ground.

CAUTION:

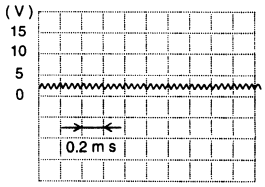
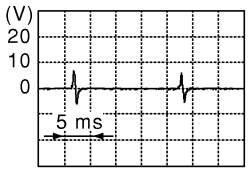
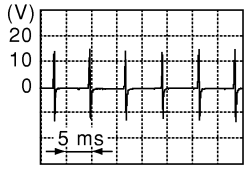
Do not use ECM ground terminals when measuring input/output voltage. Doing so may result in damage to the ECM's transistor. Use a ground other than ECM terminals, such as the ground.

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
101 102 103	G/R G/R G/R	Fuel cut solenoid valve	**[Ignition switch "OFF"]**	Approximately 0V
			[Ignition switch "ON"]	BATTERY VOLTAGE (11 - 14V)
104 105 106	B B B	ECM ground	**[Engine is running]** ● Idle speed	Approximately 0V
107 108 109	Y Y Y	Power supply for ECM	**[Ignition switch "ON"]**	BATTERY VOLTAGE (11 - 14V)
202	Y/R	Injection timing control valve	**[Engine is running]** ● **Warm-up condition** ● Idle speed	Approximately 10 - 12V  NEF480
			[Engine is running] ● **Warm-up condition** ● Engine speed is 2,000 rpm	Approximately 9 - 14 V  NEF481
204	G/PU	Air conditioner relay	**[Engine is running]** ● Air conditioner switch is "OFF"	BATTERY VOLTAGE (11 - 14V)
			[Engine is running] ● Both air conditioner switch and blower fan switch are "ON" (Compressor is operating)	Approximately 0.1V
205	Y/PU	Oil pressure switch	**[Ignition switch "ON"]**	Approximately 0V
			[Engine is running] ● Idle speed	Voltages
208	R/Y	EGRC-solenoid valve A	**[Engine is running]** ● **Warm-up condition** ● Idle speed	Approximately 0.7V
			[Engine is running] ● **Warm-up condition** ● Engine speed is 2,800 rpm	BATTERY VOLTAGE (11 - 14V)

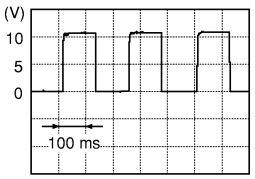
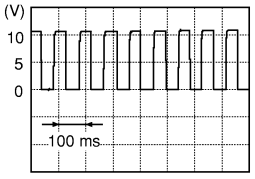
ECM Terminals and Reference Value (Cont'd)

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
210	Y/B	EGRC-solenoid valve B	**[Engine is running]** ● **Warm-up condition** ● Idle speed	Approximately 0.4V
			[Engine is running] ● **Warm-up condition** ● Engine speed is 2,500 rpm	BATTERY VOLTAGE (11 - 14V)
213	G/Y	Throttle control solenoid valve	**[Engine is running]** ● Warm-up condition ● Low load	Approximately 0V
			Except above condition	Battery voltage (12 - 14V)
214	LG	Glow relay	Refer to "Glow Control System", EC-389.	
215	L	Malfunction indicator (MI)	**[Ignition switch "ON"]**	Approximately 1.0V
			[Engine is running] ● Idle speed	BATTERY VOLTAGE (11 - 14V)
218	G/R	Sensors' ground	**[Engine is running]** ● **Warm-up condition** ● Idle speed	Approximately 0V
219	LG/R	Cooling fan relay	**[Engine is running]** ● Cooling fan is not operating	BATTERY VOLTAGE (11 - 14V)
			[Engine is running] ● Cooling fan is operating	Approximately 0.1V
221	G/W	Glow lamp	**[Ignition switch "ON"]** ● Glow lamp is "ON"	Approximately 1V
			[Ignition switch "ON"] ● Glow lamp is "OFF"	BATTERY VOLTAGE (11 - 14V)
223	R/L	Mass air flow sensor power supply	**[Ignition switch "ON"]**	Approximately 5V
224	L/W	Mass air flow sensor	**[Engine is running]** ● **Warm-up condition** ● Idle speed	1.5 - 2.0V
320	W	Control sleeve position sensor	**[Engine is running]** ● Idle speed	Approximately 2.6V  NEF477
321	R	Control sleeve position sensor power supply	**[Engine is running]** ● Idle speed	Approximately 2.6V  NEF476

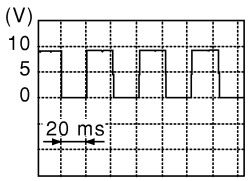
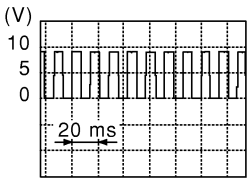
ECM Terminals and Reference Value (Cont'd)

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
322	B	Control sleeve position sensor ground	**[Engine is running]** ● Idle speed	Approximately 2.6V  NEF476
325	L	ECM relay (Self-shutoff)	**[Ignition switch "ON"]** **[Ignition switch "OFF"]** ● For a few seconds after turning ignition switch "OFF"	Approximately 1.4V
			[Ignition switch "OFF"] ● A few seconds passed after turning ignition switch "OFF"	BATTERY VOLTAGE (11 - 14V)
331	L/R	Crankshaft position sensor (TDC) ground	**[Engine is running]** ● **Warm-up condition** ● Idle speed	Approximately 0V
333	R	Needle lift sensor ground	**[Ignition switch "ON"]**	Approximately 0V
334	G/R	Engine coolant temperature sensor ground	**[Ignition switch "ON"]**	Approximately 0V
335	G/R	Fuel temperature sensor ground	**[Engine is running]**	Approximately 0V
344	L/G	Crankshaft position sensor (TDC)	**[Engine is running]** ● **Warm-up condition** ● Idle speed	Approximately 0V  SEF333Y
			[Engine is running] ● **Warm-up condition** ● Engine speed is 2,000 rpm	Approximately 0V  SEF334Y
345	G	Needle lift sensor	**[Engine is running]** ● **Warm-up condition** ● Idle speed	Approximately 3.5V
			[Engine is running] ● **Warm-up condition** ● Engine speed is 2,000 rpm	Approximately 3.5V

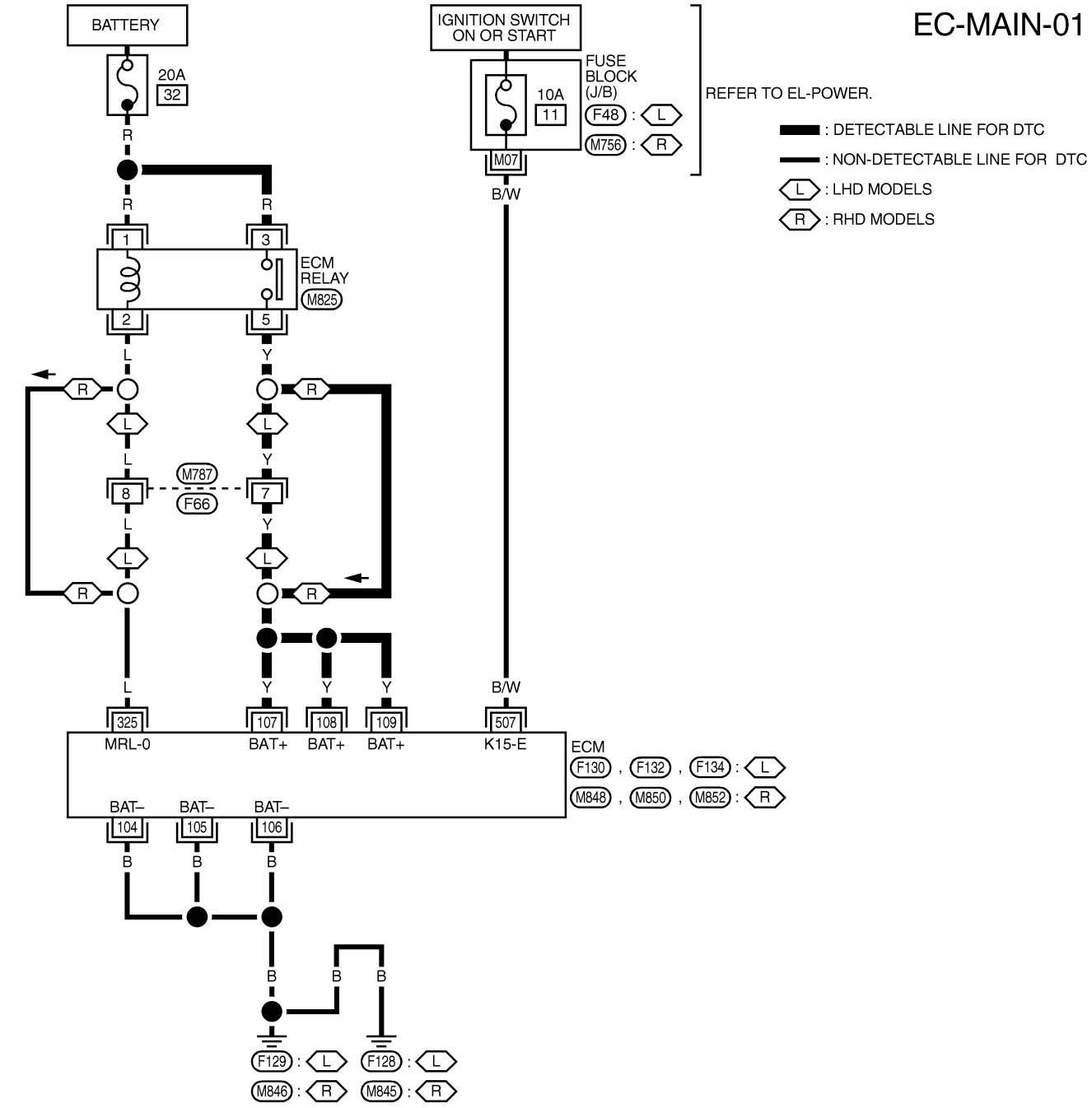
ECM Terminals and Reference Value (Cont'd)

TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
347	LG/W	Engine coolant temperature sensor	**[Engine is running]**	Approximately 0 - 4.8V Output voltage varies with engine coolant temperature
348	Y/B	Fuel temperature sensor	**[Engine is running]**	0.6 - 5V Output voltage varies with fuel temperature.
349	G/R	Injection timing control valve ground	**[Ignition switch "ON"]**	Approximately 0V
403	G/R	Air conditioner switch	**[Engine is running]** ● Air conditioner switch is "OFF"	BATTERY VOLTAGE (11 - 14V)
			[Engine is running] ● Both air conditioner switch and blower fan switch are "ON" (Compressor is operating)	Approximately 0.1V
405	G/Y	Stop lamp switch	**[Ignition switch "ON"]** ● Brake pedal fully released	Approximately 0V
			[Ignition switch "ON"] ● Brake pedal depressed	BATTERY VOLTAGE (11 - 14V)
416	Y/R	Brake pedal position switch	**[Ignition switch "ON"]** ● Brake pedal fully released	BATTERY VOLTAGE (11 - 14V)
			[Ignition switch "ON"] ● Brake pedal depressed	Approximately 0V
415	OR	Data link connector for CONSULT-II	**[Engine is running]** ● Idle speed (CONSULT-II is connected and turned on)	Approximately 0V
420	OR/R			BATTERY VOLTAGE (11 - 14V)
417	Y/B	Vehicle speed sensor	**[Engine is running]** ● Lift up the vehicle ● In 1st gear position ● Vehicle speed is 10 km/h (6 MPH)	0 - Approximately 8V  SEF891Y
			[Engine is running] ● Lift up the vehicle ● In 2nd gear position ● Vehicle speed is 30 km/h (19 MPH)	Approximately 6V  SEF892Y
422	PU	Start signal	**[Ignition switch "ON"]**	Approximately 0V
			[Ignition switch "START"]	BATTERY VOLTAGE (11 - 14V)
425	R/B	Accelerator position sensor ground	**[Engine is running]** ● **Warm-up condition** ● Idle speed	Approximately 0V

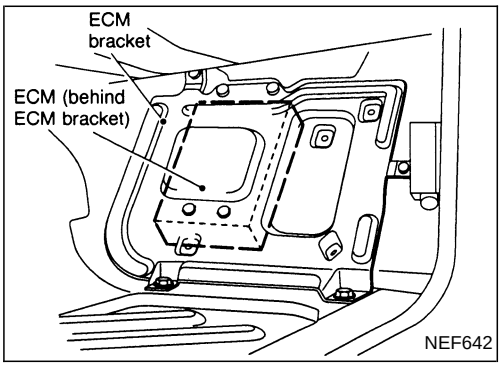
ECM Terminals and Reference Value (Cont'd)

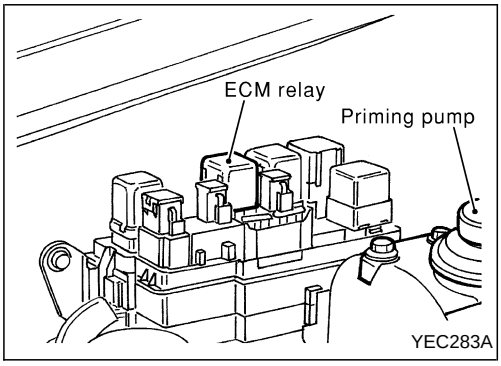
TERMINAL NO.	WIRE COLOR	ITEM	CONDITION	DATA (DC Voltage and Pulse Signal)
426	B	Accelerator position switch (Idle) ground	**[Ignition switch "ON"]**	Approximately 0V
433	R/W	Accelerator position sensor power supply	**[Ignition switch "ON"]**	Approximately 5V
434	G	Accelerator position sensor	**[Ignition switch "ON"]** ● Accelerator pedal fully released	0.30 - 0.50V
			[Ignition switch "ON"] ● Accelerator pedal fully depressed	3.0 - 4.3V
435	L/Y	Accelerator position switch (Idle)	**[Ignition switch "ON"]** ● Accelerator pedal fully released	Approximately 0V
			[Ignition switch "ON"] ● Accelerator pedal depressed	BATTERY VOLTAGE (11 - 14V)
439	L/B	Tachometer	**[Engine is running]** ● **Warm-up condition** ● Idle speed	Approximately 3.0V  SEF325Y
			[Engine is running] ● **Warm-up condition** ● Engine speed is 2,000 rpm	Approximately 3.0V  SEF326Y
507	B/W	Ignition switch	**[Ignition switch "OFF"]**	0V
			[Ignition switch "ON"]	BATTERY VOLTAGE (11 - 14V)

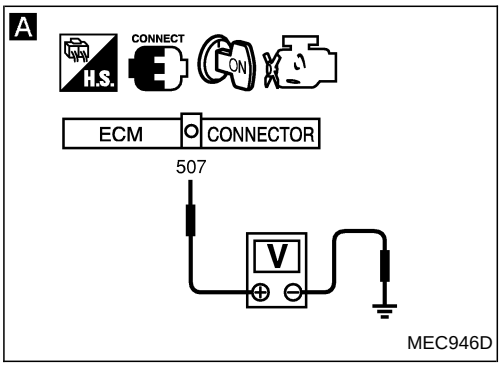
Wiring Diagram

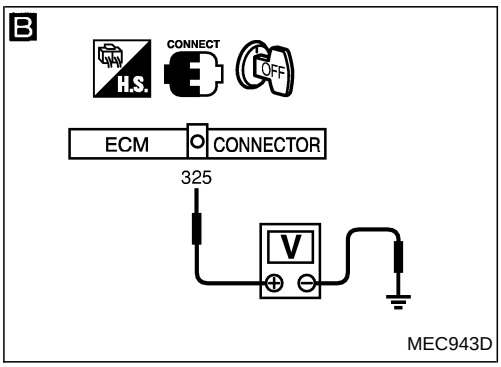


YEC141A









Diagnostic Procedure

INSPECTION START

Start engine.
Is engine running?

No → **A**

CHECK POWER SUPPLY-I.
1. Turn ignition switch to “ON” position.
2. Check voltage between ECM connector terminal (507) and engine ground with CONSULT-II or voltage tester.
   Voltage: Battery voltage

If NG, check the following:
- 10A fuse
- Harness for open or short-circuit between ECM and ignition switch

If NG, replace 10A fuse or repair harness or connectors.

OK

Go to Ⓑ “CHECK GROUND CIRCUIT”.

Yes

B

CHECK POWER SUPPLY-II.
1. Stop engine.
2. Check voltage between ECM connector terminal (325) and engine ground with CONSULT-II or voltage tester.
   Voltage: Battery voltage

NG →

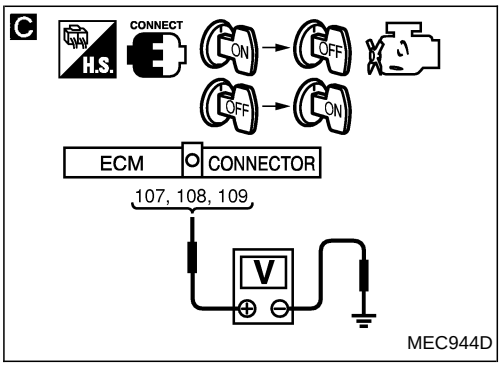
Check the following:
- ECM relay
- 20A fuse
- Harness for open or short-circuit between ECM and battery
- Harness connectors M787, F66 (LHD models)
- Battery connection and charge

If NG, replace fuse or charge battery or repair harness or connectors.

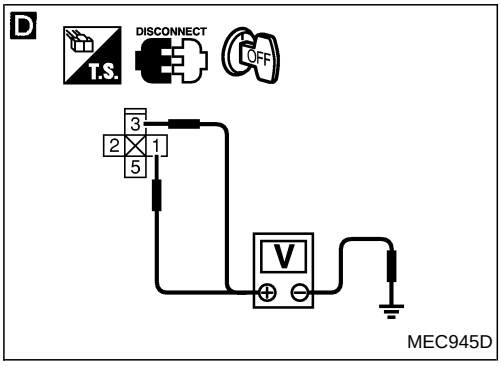
OK

Ⓐ

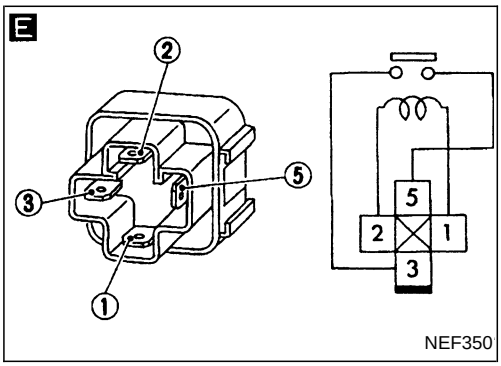
Diagnostic Procedure (Cont'd)



MEC944D



MEC945D



NEF350

Ⓐ

C

CHECK POWER SUPPLY-III.
1. Turn ignition switch to "ON" position and then to "LOCK" position.
2. Check voltage between ECM connector terminals (107), (108), (109) and engine ground with CONSULT-II or tester.

Voltage:
After turning ignition switch to "LOCK" position, battery voltage will exist for a few seconds, then drop to approximately 0V.

OK → Go to Ⓑ "CHECK GROUND CIRCUIT".

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

NG

Case-1 → CHECK HARNESS CONTINUITY BETWEEN ECM RELAY AND ECM.
1. Disconnect ECM harness connector.
2. Disconnect ECM relay harness connector.
3. Check harness continuity between ECM connector terminals (325) and ECM relay connector terminal ②, and ECM connector terminals (107), (108), (109) and ECM relay connector terminal ⑤. Refer to wiring diagram.

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

NG → Check the following:
- Harness connectors (M787), (F66) (LHD models)
- Harness for open or short-circuit between ECM relay connector and ECM connector.

If NG, repair harness or connectors.

OK

D

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

NG → Check the following:
- 20A fuse
- Fuse box and battery connections
- Harness for open or short-circuit between ECM relay and battery

If NG, replace fuse or repair harness or connectors.

OK

E

CHECK ECM RELAY.
1. Remove ECM relay.
2. Apply 12V direct current between relay terminals ① and ②.
3. Check continuity between relay terminals ③ and ⑤.

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

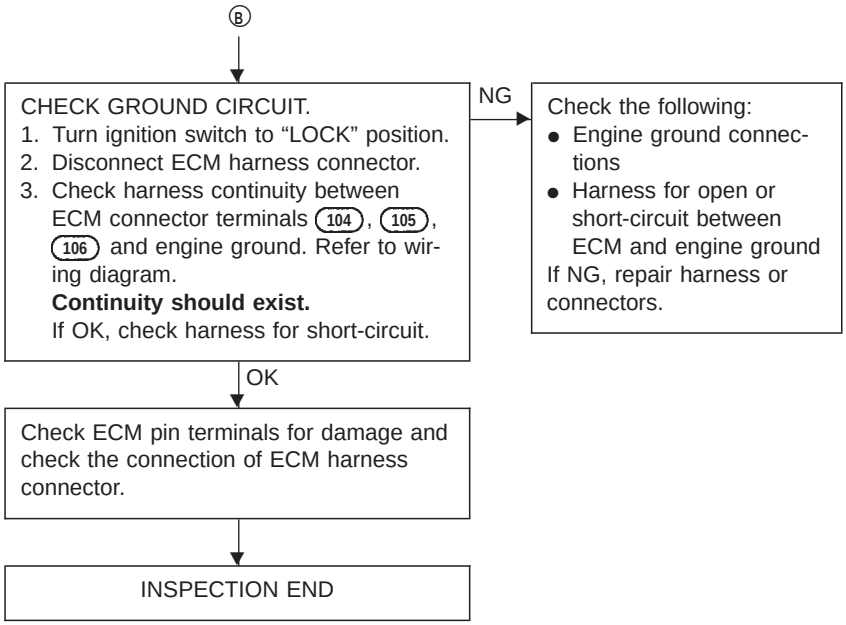
NG → Replace ECM relay.

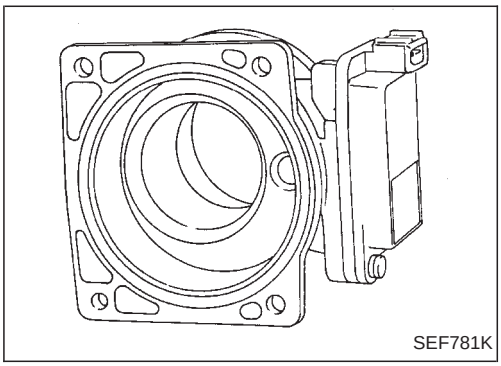
OK

Ⓑ

Case-2 → Go to **E** "CHECK ECM RELAY".

Diagnostic Procedure (Cont'd)




SEF781K

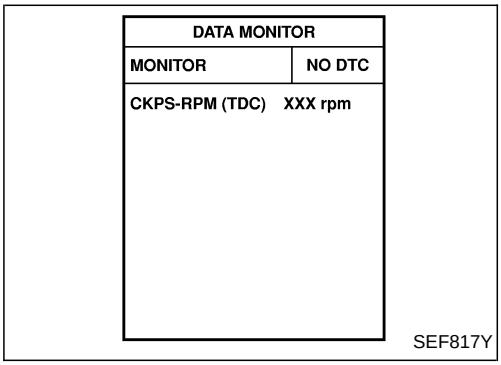
Component Description

MASS AIR FLOW SENSOR (MAFS)

The mass air flow sensor measures the intake air flow rate by monitoring a part of the entire flow. Measurements are made by the ECM which receives electrical signals from the mass air flow sensor which is 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 by the hot wire is carried away by the air flow. The amount of heat detected depends on the volume of air flow. The temperature of the hot wire is automatically controlled to maintain it within a finite range regardless of the air flow rate by regulating the current supplied to the hot wire.
The ECM monitors the air flow by means of the corresponding electric change.

On Board Diagnosis Logic

DTC	Malfunction is detected when . . .	Check Items (Possible Cause)
P0100 0102	● An excessively high or low voltage from the sensor is entered to ECM.	● Harness or connectors (The sensor circuit is open or short-circuited.) ● Mass air flow sensor



SEF817Y

DTC Confirmation Procedure

WITH CONSULT-II

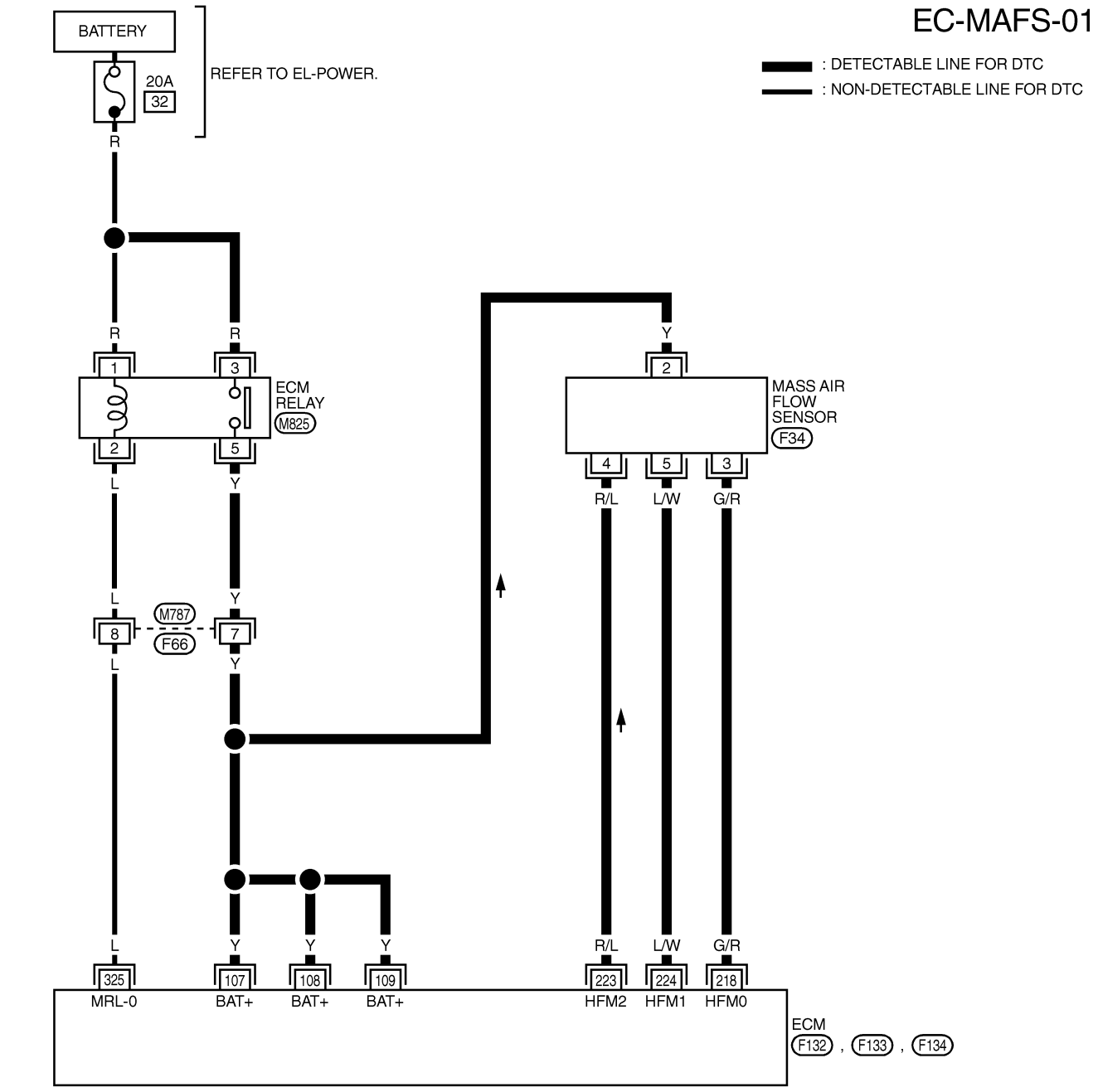
1) Turn ignition switch to “ON” position.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Start engine and wait for at least 15 seconds.

WITHOUT CONSULT-II

1) Start engine and wait for at least 15 seconds.
2) Turn ignition switch off, wait for at least 5 seconds and then turn on.
3) Perform “Diagnostic Test Mode II” (Self-diagnostic results).

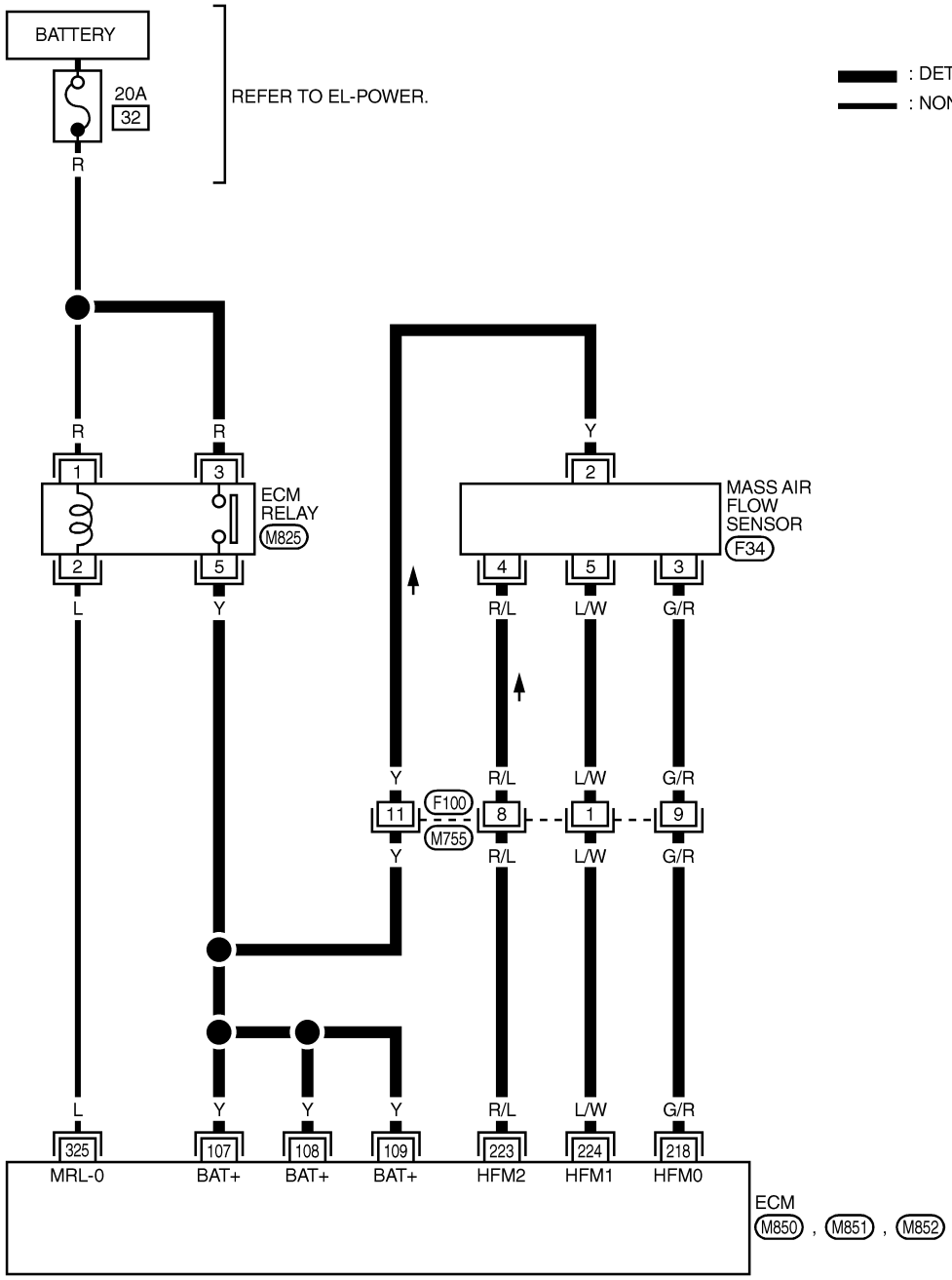
Wiring Diagram

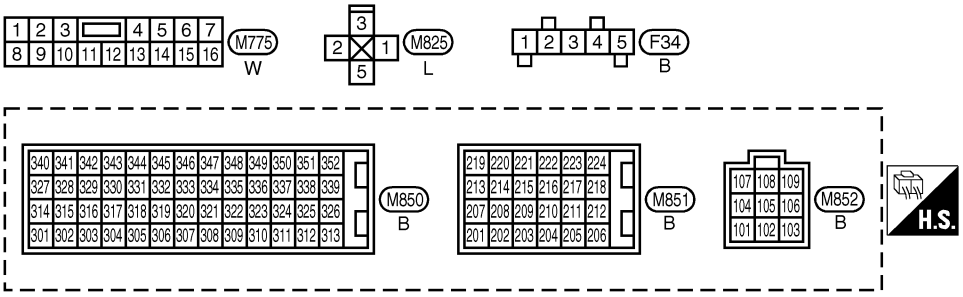
LHD MODELS



Wiring Diagram (Cont'd)

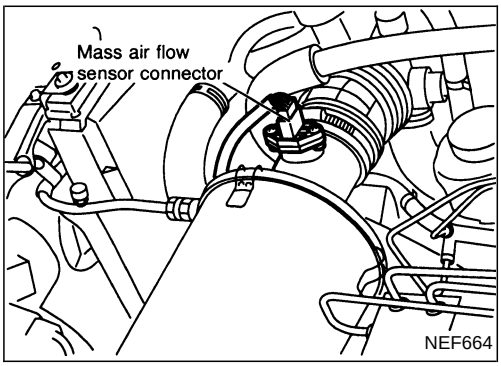
RHD MODELS

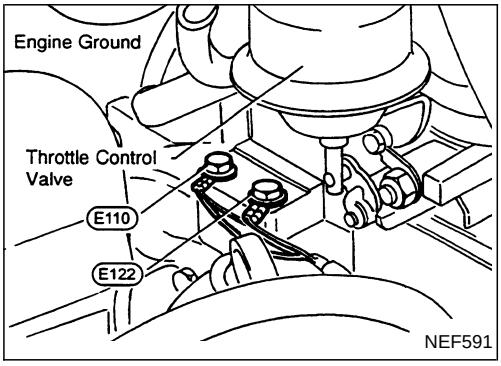


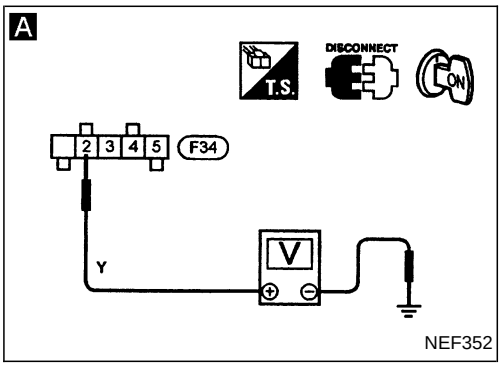


YEC143A

Diagnostic Procedure







INSPECTION START

A

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

NG →
Check the following:
- 20A fuse
- ECM Relay
- Harness continuity between ECM relay (coil and load side) connector and battery supply
- Harness connectors F100, M755 (RHD models)
- Harness connectors M787, F66 (LHD models)
- Harness continuity between ECM relay connector and Mass Air Flow Sensor Connector.

If NG, replace 20A fuse or ECM relay, or repair harness or connectors.

OK ↓

CHECK GROUND CIRCUIT.
1. Turn ignition switch to “LOCK” position.
2. Disconnect ECM harness connector.
3. Loosen and retighten engine ground screws.
4. Check harness continuity between mass air flow sensor harness connector terminal ③ and ECM connector terminal 218. Refer to wiring diagram.
   Continuity should exist.
   If OK, check harness for short-circuit.

NG →
Check the following.
- Harness connectors F100, M755 (RHD models)
- Harness continuity between mass air flow sensor and ECM

If NG, repair or replace harness or connectors.

OK ↓

CHECK INPUT SIGNAL CIRCUIT.
Check harness continuity between mass air flow sensor connector terminal ④ and ECM connector terminal 223. Refer to wiring diagram.
Continuity should exist.
If OK, check harness for short-circuit.

NG →
Check the following.
- Harness connectors F100, M755 (RHD models)
- Harness continuity between mass air flow sensor and ECM

If NG, repair or replace harness or connectors.

OK ↓

CHECK INPUT SIGNAL CIRCUIT.
Check harness continuity between mass air flow sensor connector terminal ⑤ and ECM connector terminal 224. Refer to wiring diagram.
Continuity should exist.
If OK, check harness for short-circuit.

NG →
Check the following.
- Harness connectors F100, M755 (RHD models)
- Harness continuity between mass air flow sensor and ECM

If NG, repair or replace harness or connectors.

OK ↓

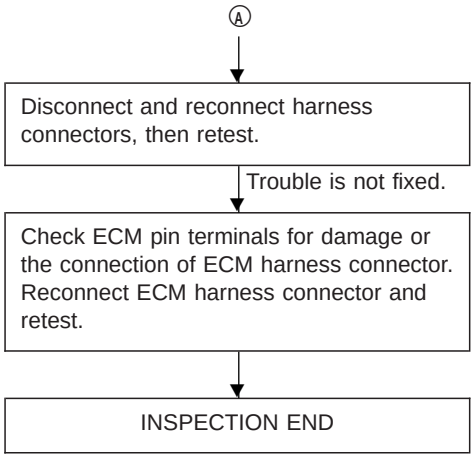
CHECK COMPONENT
(Mass air flow sensor).
Refer to “COMPONENT INSPECTION”, EC-360.

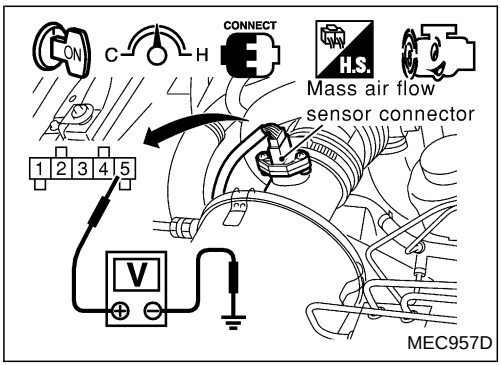
NG →
Replace mass air flow sensor.

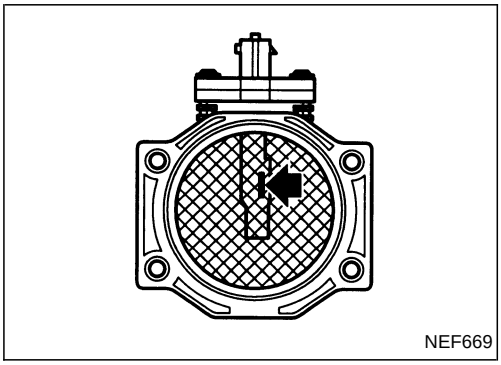
OK ↓

Ⓐ

Diagnostic Procedure (Cont'd)







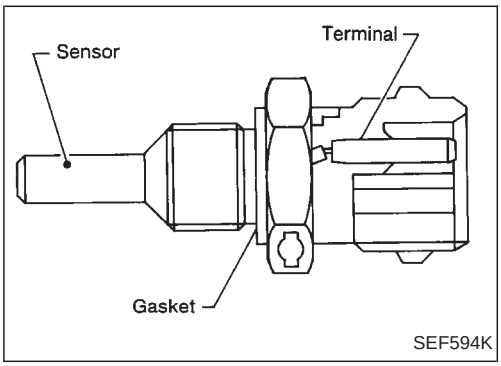
Component Inspection

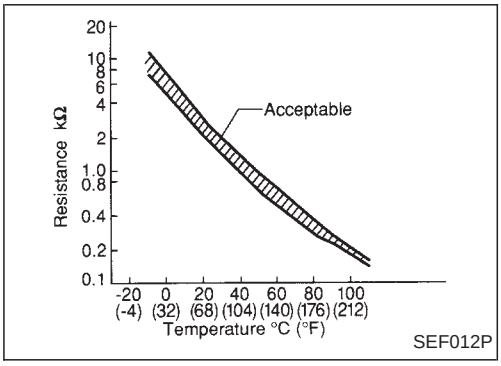
MASS AIR FLOW SENSOR

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 ⑤ and engine ground.

Condition	Voltage V
Ignition switch "ON" position (Engine stopped.)	Approx. 1.0
Idle (Engine is warmed-up sufficiently.)	Approx. 2.2

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





Component Description

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 comprises 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

On Board Diagnosis Logic

DTC	Malfunction is detected when ...	Check Items (Possible Cause)
P0115 0103	• An excessively high or low voltage from the sensor is input to ECM.	• Harness or connectors (The sensor circuit is open or short-circuited.) • Engine coolant temperature sensor

DTC Confirmation Procedure

WITH CONSULT-II

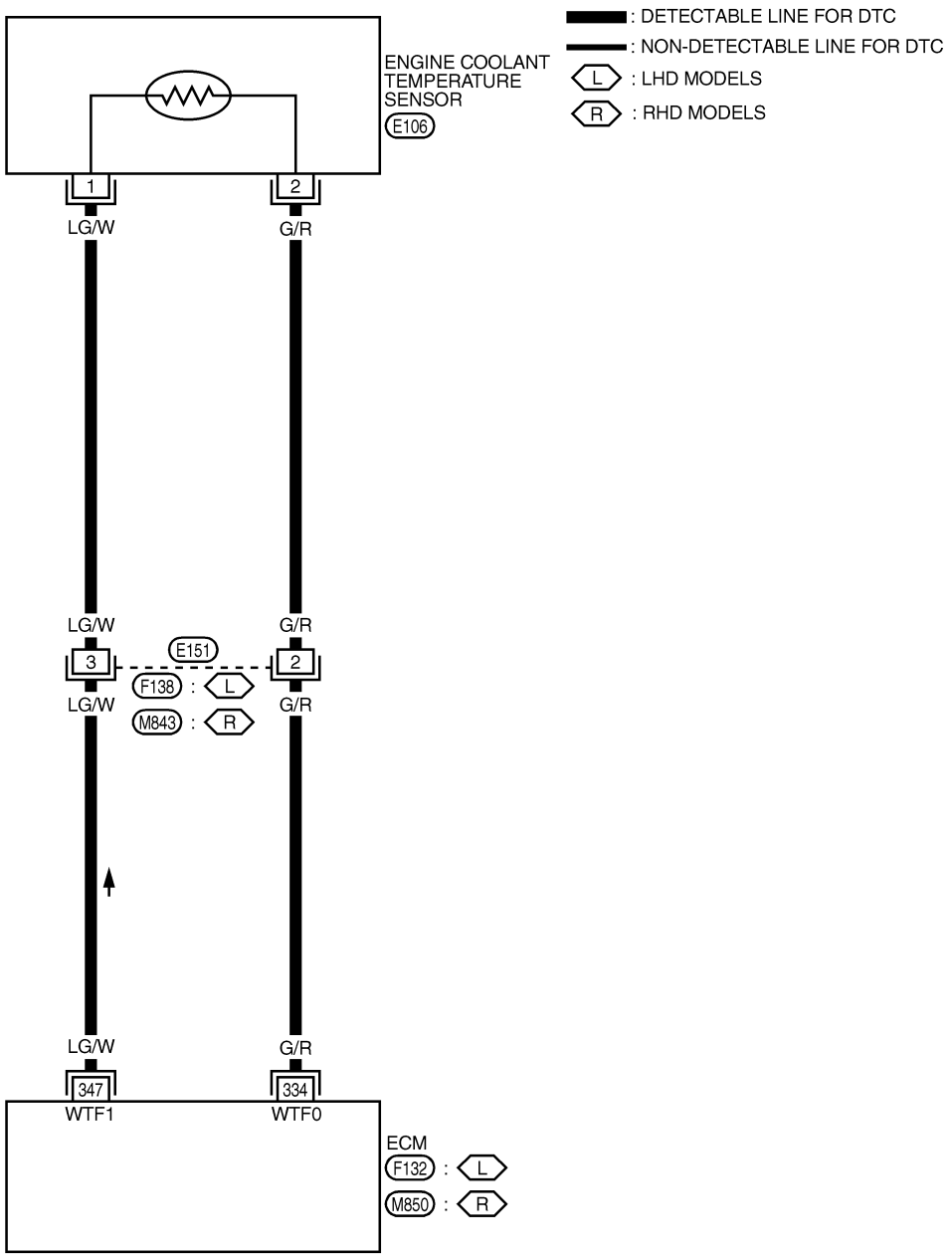
1) Turn ignition switch to “ON” position.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Wait at least 5 seconds.

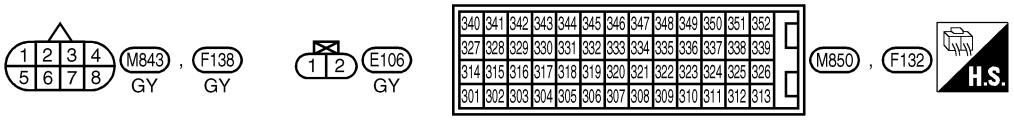
WITHOUT CONSULT-II

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).

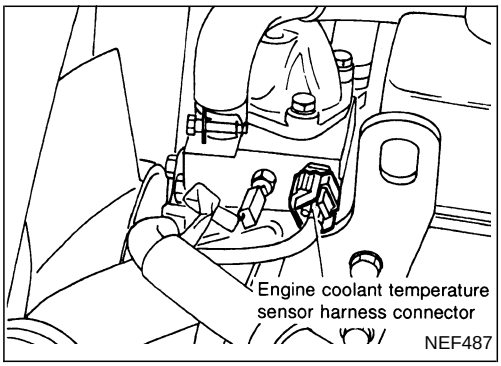
Wiring Diagram

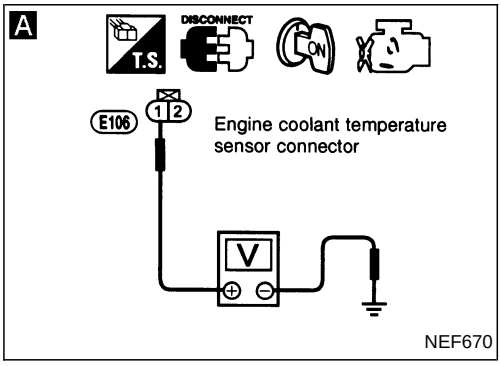
EC-ECTS-01





YEC144A





Diagnostic Procedure

INSPECTION START

A

CHECK POWER SUPPLY.
1. Turn ignition switch to “LOCK” position.
2. Disconnect engine coolant temperature sensor harness connector.
3. Turn ignition switch to “ON” position.
4. Check voltage between engine coolant temperature sensor connector terminal ① and engine ground with CONSULT-II or tester.

Voltage:
Approximately 4.9V

NG → Check the following:
- Harness connectors E151, F138 (LHD model) E151, M843 (RHD model)
- Harness for open or short circuit between ECM and engine coolant temperature sensor.

If NG, repair harness or connectors.

OK

CHECK GROUND CIRCUIT.
1. Turn ignition switch to “LOCK” position.
2. Check harness continuity between engine coolant temperature sensor connector terminal ② and ECM terminal 334. Refer to wiring diagram.

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

NG → Check the following:
- Harness connectors E151, F138 (LHD model) E151, M843 (RHD model)
- Harness for open or short circuit between ECM and engine coolant temperature sensor.

If NG, repair harness or connectors.

OK

CHECK COMPONENT
(Engine coolant temperature sensor).
Refer to EC-364.

NG → Replace engine coolant temperature sensor.

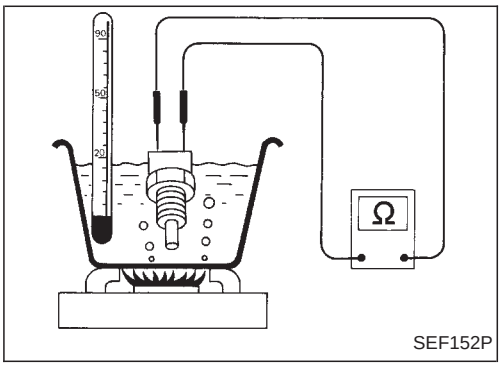
OK

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

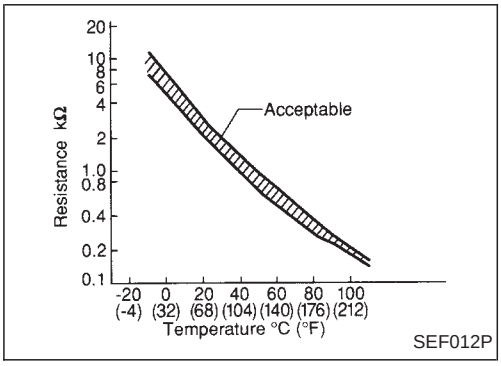
Trouble is not fixed.

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

INSPECTION END



SEF152P



SEF012P

Component Inspection

ENGINE COOLANT TEMPERATURE SENSOR

Check resistance as shown in the figure.

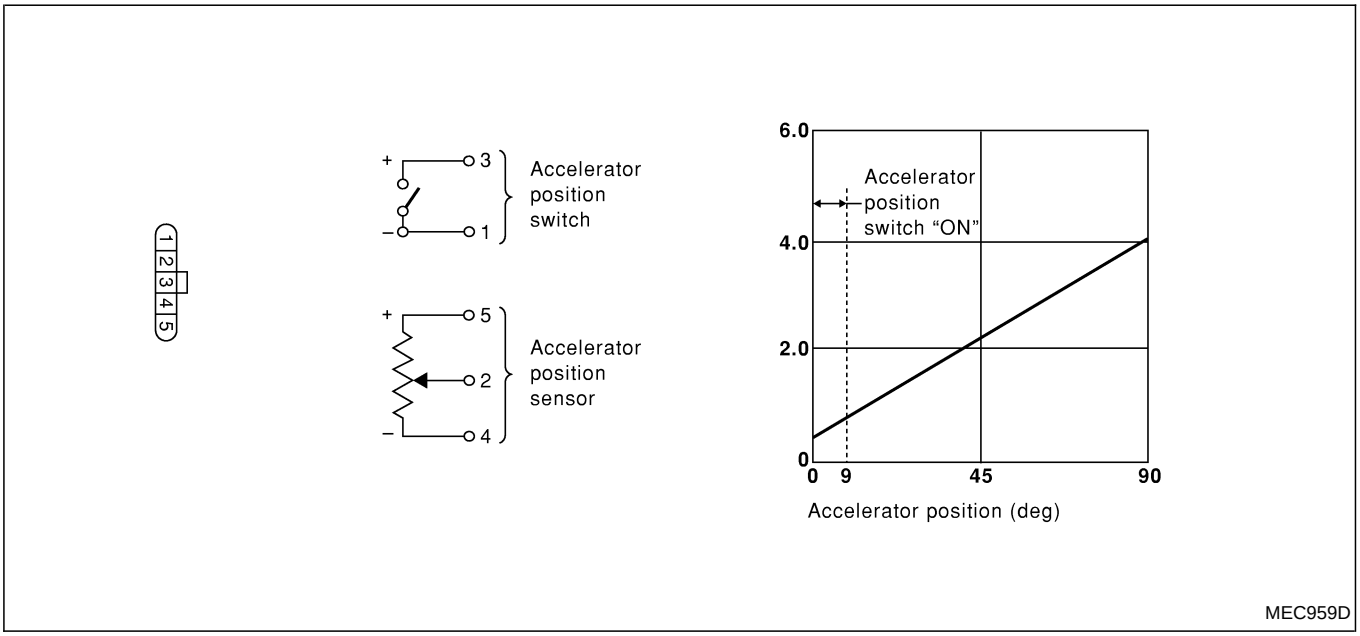
Temperature °C (°F)	Resistance kΩ
20 (68)	2.1 - 2.9
50 (122)	0.68 - 1.0
90 (194)	0.236 - 0.260

If NG, replace engine coolant temperature sensor.

Component Description

ACCELERATOR WORK UNIT

The accelerator position sensor is installed on the upper end of the accelerator pedal assembly. The sensor detects the accelerator position and sends a signal to the ECM. The ECM uses the signal to determine the amount of fuel to be injected.
The accelerator position switch is installed inside the accelerator position sensor. This switch is used for plausibility check of the accelerator position sensor.



MEC959D

On Board Diagnosis Logic

DTC	Malfunction is detected when ...	Check Items (Possible Cause)
P0120 0403	• An excessively low or high voltage from the sensor is detected by the ECM.	• Harness or connectors (The sensor or switch circuit is open or short-circuited.) • Accelerator position sensor • Accelerator position switch

DTC Confirmation Procedure A (For General Plausibility)

WITH CONSULT-II

1) Turn ignition switch to “ON” position.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Depress accelerator pedal fully and keep it for at least 1 second. Then release it and wait at least 5 seconds.

WITHOUT CONSULT-II

1) Turn ignition switch to “ON” position.
2) Depress accelerator pedal fully and keep it for at least 1 second. Then release it and wait at least 5 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)” with ECM.

DTC Confirmation Procedure B (For Accelerator Sticking)

If DTC P0571 is displayed same time, cure it at first.

WITH CONSULT-II

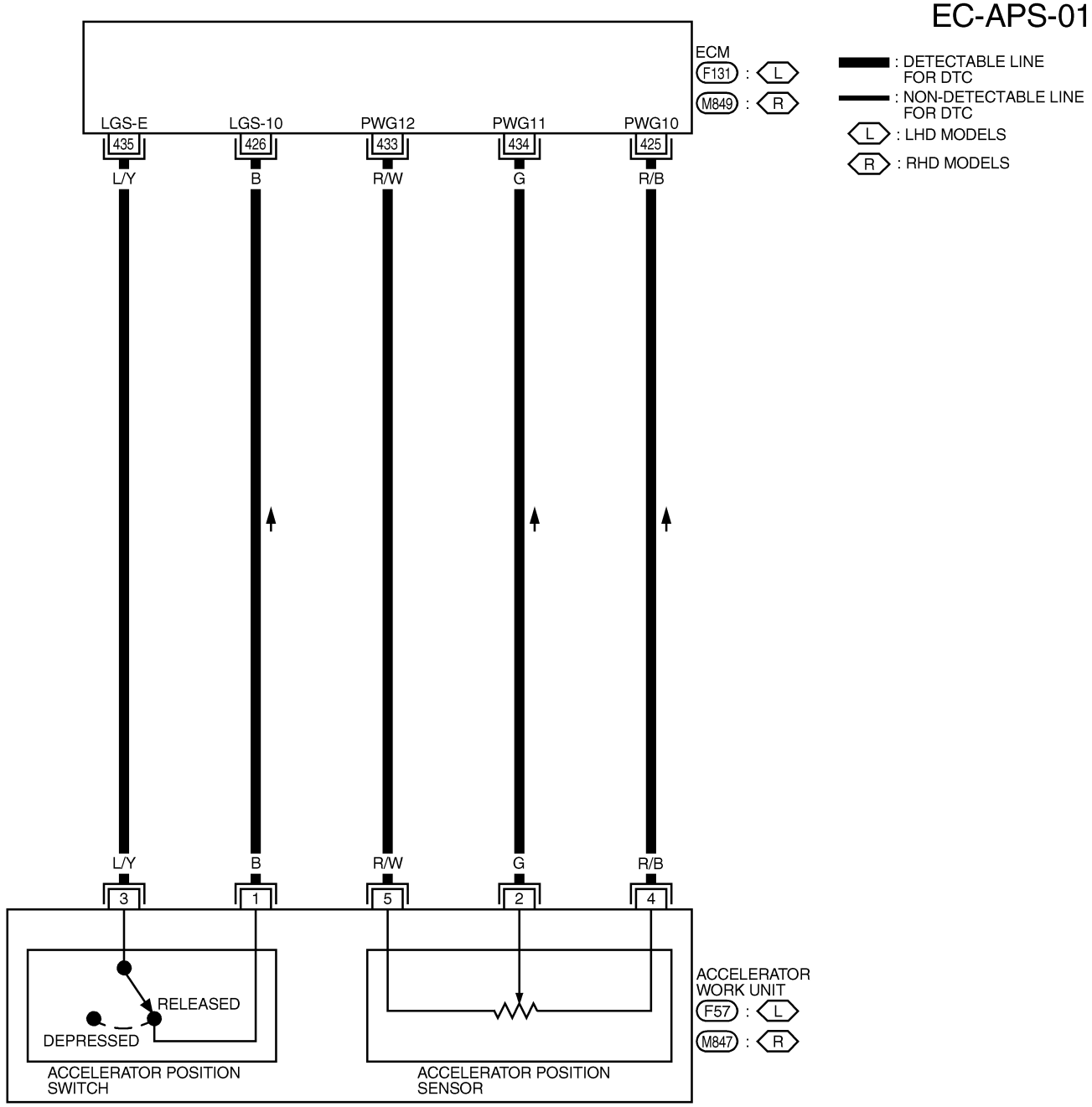
1) Turn ignition switch to “ON” position.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Start engine and rev it up to above 1,300 rpm.
4) Depress brake pedal immediately after releasing accelerator pedal and keep it at least 5 seconds.

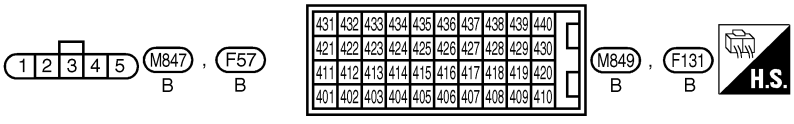
WITHOUT CONSULT-II

1) Start engine and rev it up to above 1,300 rpm.
2) Depress brake pedal immediately after releasing accelerator pedal and keep it at least 5 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)” with ECM.

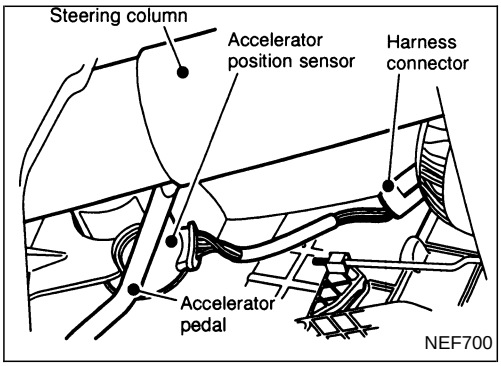
Wiring Diagram

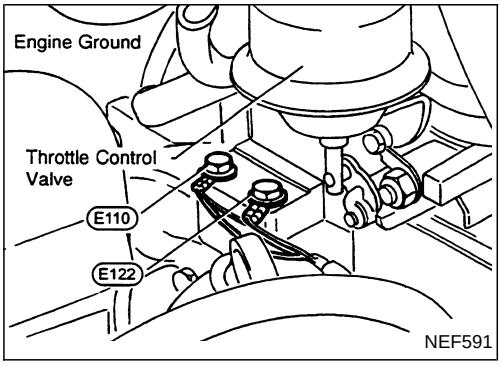
EC-APS-01

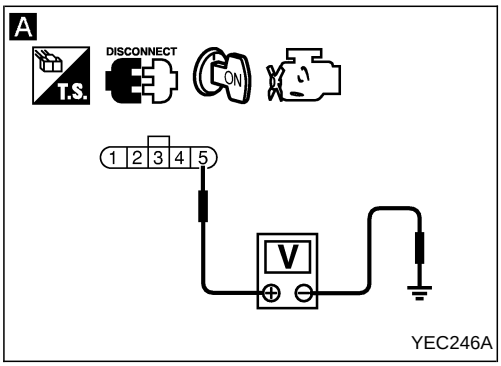




YEC145A







Diagnostic Procedure

ACCELERATOR POSITION SENSOR

INSPECTION START

A

CHECK POWER SUPPLY.
1. Turn ignition switch to “LOCK” position.
2. Disconnect accelerator work unit harness connector.
3. Turn ignition switch to “ON” position.
4. Check voltage between accelerator work unit connector terminal ⑤ and engine ground with CONSULT-II or tester.
   Voltage: Approximately 5V

NG → Check the following:
- Harness for open or short-circuit between ECM and accelerator work unit.

If NG, repair harness or connectors.

OK ↓

CHECK INPUT SIGNAL CIRCUIT.
1. Turn ignition switch to “LOCK” position.
2. Loosen and retighten engine ground screws.
3. Check harness continuity between accelerator work unit connector terminal ② and ECM connector terminal (434). Refer to wiring diagram.
   Continuity should exist.
   If OK, check harness for short-circuit.

NG → Check the following:
- Harness for open-circuit between ECM and accelerator work unit

If NG, repair harness or connectors.

OK ↓

CHECK GROUND CIRCUIT.
1. Disconnect ECM harness connector.
2. Check harness continuity between ECM terminal (425) and accelerator position sensor connector terminal ④. Refer to wiring diagram.
   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 page EC-371.

NG → Replace accelerator pedal assembly.

OK ↓

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

Trouble is not fixed. ↓

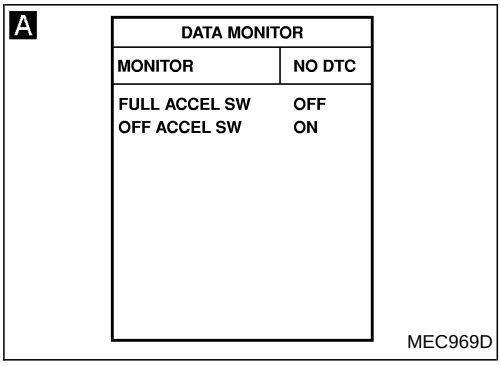
Check ECM pin terminals for damage and check the connection of ECM harness connector. Reconnect ECM harness connector and retest.

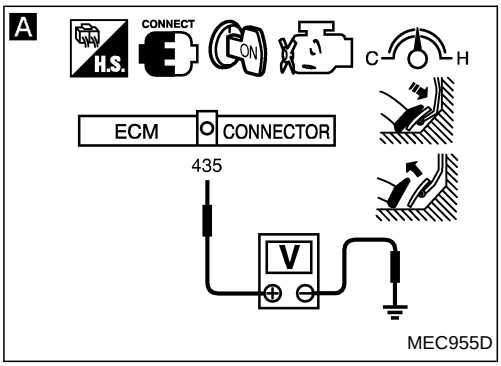
INSPECTION END

Diagnostic Procedure (Cont'd)

ACCELERATOR POSITION SWITCH

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





INSPECTION START

A

CHECK OVERALL FUNCTION.

With CONSULT-II

1. Turn ignition switch to "ON" position.
2. Select "FULL ACCELL SW" and "OFF ACCEL SW" in "DATA MONITOR" mode with CONSULT-II.
3. Check "FULL ACCEL SW" and "OFF ACCEL SW" signal under the following conditions.

OFF ACCEL SW:
Accelerator pedal released
— ON
Accelerator pedal depressed
— OFF

FULL ACCEL SW:
Accelerator pedal fully depressed
— ON

Without CONSULT-II

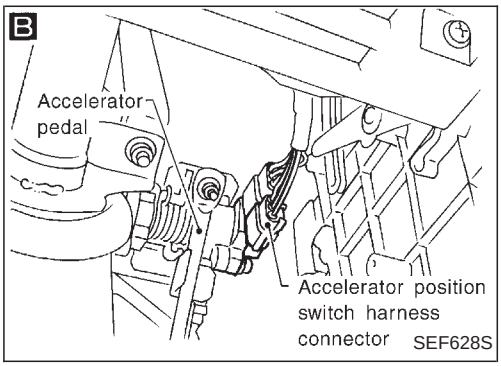
1. Turn ignition switch to "ON" position.
2. Check voltage between ECM terminal (435) and body ground under the following conditions:

Voltage:
Accelerator pedal released
Approximately 0V
Accelerator pedal fully depressed
Approximately 5V

OK → INSPECTION END

NG → Ⓐ

Diagnostic Procedure (Cont'd)



Ⓐ

B

CHECK INPUT SIGNAL CIRCUIT.
1. Turn ignition switch to "LOCK" position.
2. Disconnect accelerator work unit harness connector and ECM harness connector.
3. Check harness continuity between accelerator work unit terminal ③ and ECM terminal (435). Refer to wiring diagram.
   Continuity should exist.
   Check harness for short-circuit.

NG → Check the following:
- 10A fuse in fuse box
- 75A fusible link in fusible link box
- Harness continuity between ECM relay and battery positive supply
- Harness for open or short-circuit between ECM relay and accelerator position switch.

If NG, repair harness or connectors.

OK ↓

CHECK GROUND CIRCUIT.
1. Turn ignition switch to "LOCK" position.
2. Disconnect ECM harness connector.
3. Check harness continuity between accelerator work unit connector terminal ① and ECM connector terminal (426). Refer to wiring diagram.
   Continuity should exist.
   If OK; check harness for short-circuit.
   If OK, re-connect harness connectors.

NG → Repair harness or connectors.

OK ↓

CHECK COMPONENT.
(Accelerator position switch.)
Refer to "COMPONENT INSPECTION" on page EC-371.

NG → Replace accelerator pedal.

OK ↓

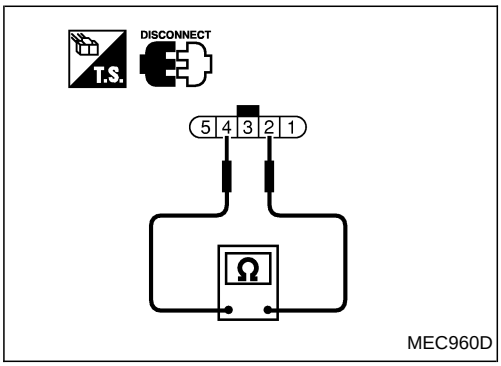
Disconnect and reconnect harness connectors in the circuits. Then retest.

Trouble is not fixed ↓

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

↓

INSPECTION END



Component Inspection

ACCELERATOR POSITION SENSOR

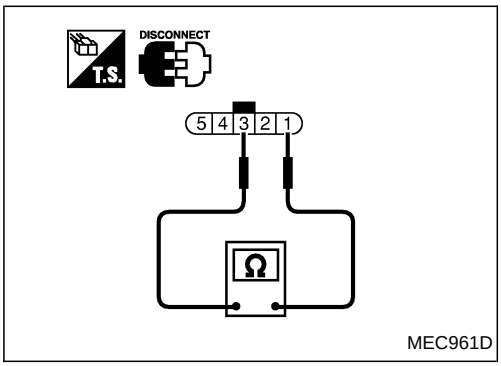
1. Disconnect accelerator work unit harness connector.
2. Make sure that resistance between terminals ② and ④ changes when opening throttle valve manually.

Throttle valve conditions	Resistance [at 25°C (77°F)]
Completely closed	Approximately 1.2 kΩ
Partially open	1.2 - 1.9 kΩ
Completely open	Approximately 1.9 kΩ

If NG, replace accelerator pedal assembly.

CAUTION

- **Do not disassemble accelerator pedal assembly.**



ACCELERATOR POSITION SWITCH

1. Disconnect accelerator work unit harness connector.
2. Check continuity between terminals ① and ③ .

Conditions	Continuity
Accelerator pedal released	No
Accelerator pedal depressed	Yes

If NG, replace accelerator pedal assembly.

CAUTION:

- **Do not disassemble accelerator pedal assembly.**

Component Description

FUEL TEMPERATURE SENSOR (FTS)

The fuel temperature sensor is used to detect the fuel temperature in the injection pump. The sensor modifies a voltage signal from the ECM. The modified signal returns to the ECM as the fuel temperature input. The sensor uses a thermistor which is sensitive to the change in temperature. The electrical resistance of the thermistor decreases as temperature increases.
The sensor is built into the inside electrical circuit of the injection pump.

On Board Diagnosis Logic

DTC	Malfunction is detected when ...	Check Items (Possible Cause)
P0180 0402	● An excessively high or low voltage from the sensor is detected by ECM.	● Harness or connectors (The sensor circuit is open or short-circuited.) ● Fuel temperature sensor

DTC Confirmation Procedure

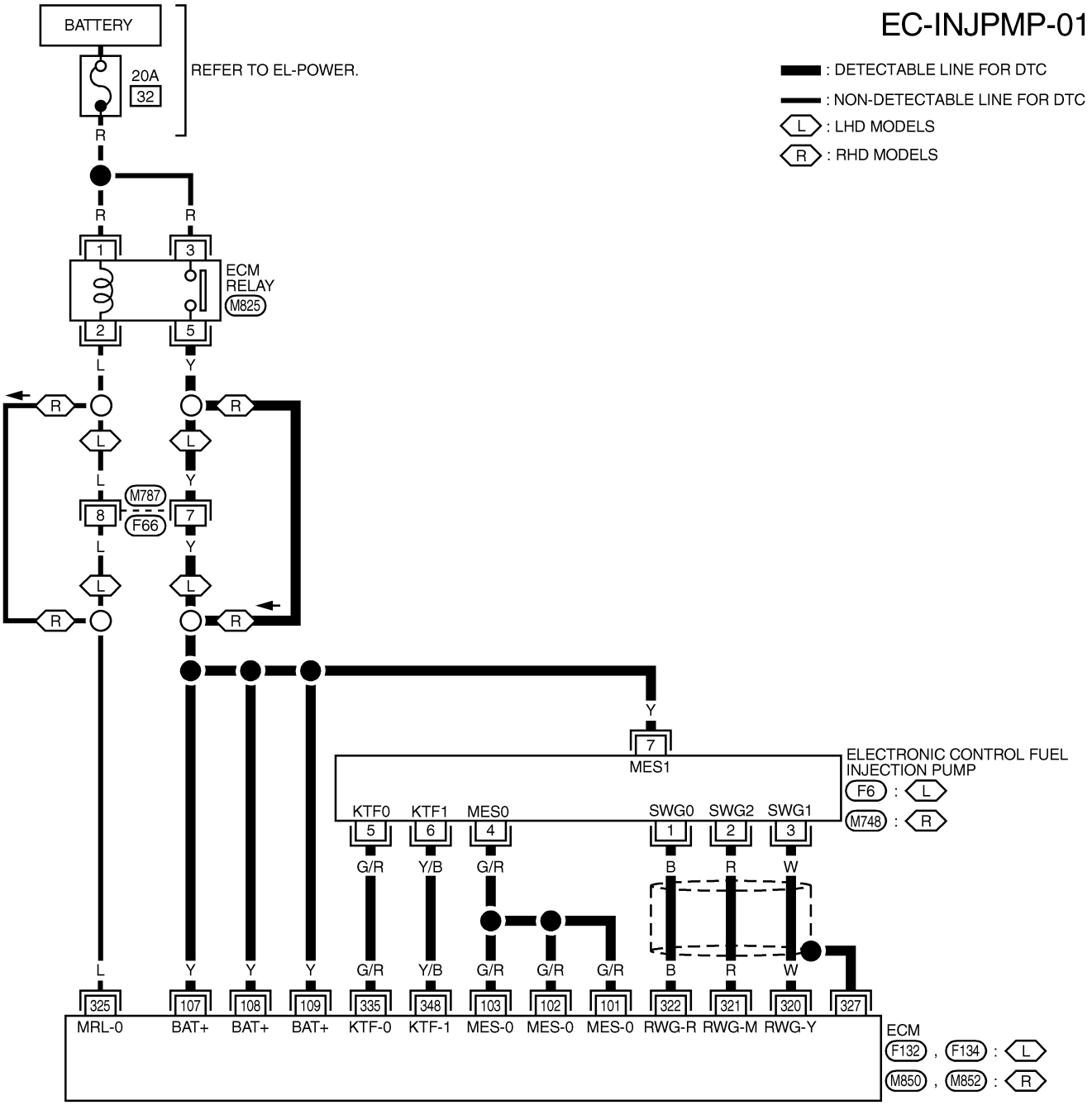
WITH CONSULT-II

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

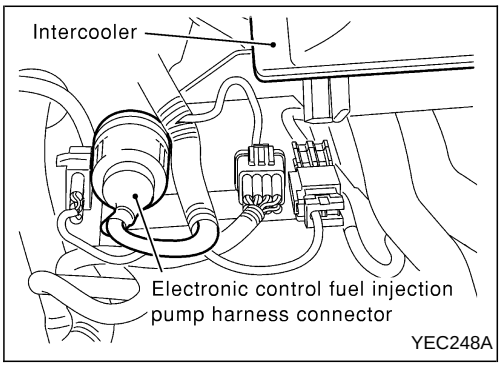
WITHOUT CONSULT-II

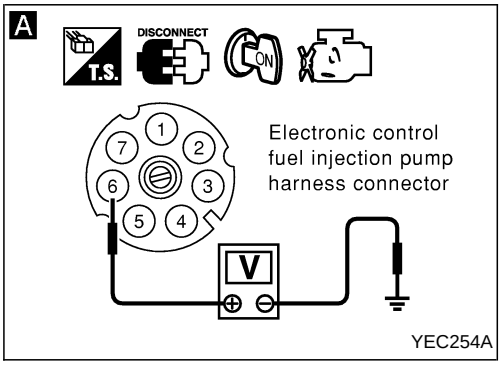
1) Turn ignition switch to “ON” position and wait at least 5 seconds.
2) Turn ignition switch to “LOCK” position, wait at least 5 seconds and then turn to “ON” position.
3) Perform “Diagnostic Test Mode II” (Self-diagnostic results).

Wiring Diagram



YEC149A





Diagnostic Procedure

INSPECTION START

A

CHECK POWER SUPPLY.
1. Turn ignition switch to “LOCK” position.
2. Disconnect electrical fuel injection pump harness connector.
3. Turn ignition switch to “ON” position.
4. Check voltage between electronic control fuel injection pump (Fuel temperature sensor) harness connector terminal ⑥ and engine ground with CONSULT-II or tester.

Voltage:
Approximately 4.9V

NG → Check the following:
- Harness for open or short-circuit between ECM and electronic control fuel injection pump (fuel temperature sensor)

If NG, repair harness or connectors.

OK ↓

CHECK GROUND CIRCUIT.
1. Turn ignition switch to “LOCK” position.
2. Check harness continuity between electronic control fuel injection pump (fuel temperature sensor) connector terminal ⑤ and ECM connector terminal (335). Refer to wiring diagram.

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

NG → Check the following:
- Harness for open or short-circuit between ECM and electronic control fuel injection pump (fuel temperature sensor).

If NG, repair harness or connectors.

OK ↓

CHECK COMPONENT
[Electronic control fuel injection pump (Fuel temperature sensor)].
Refer to “COMPONENT INSPECTION” on page EC-375.

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

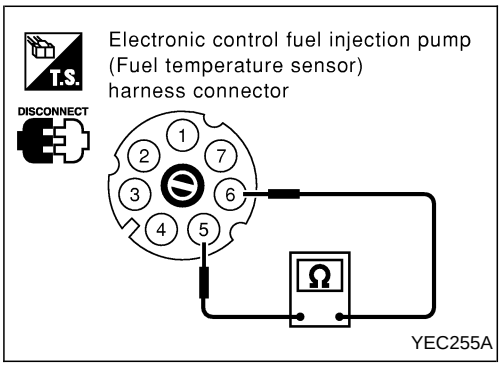
OK ↓

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

Trouble is not fixed. ↓

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

INSPECTION END



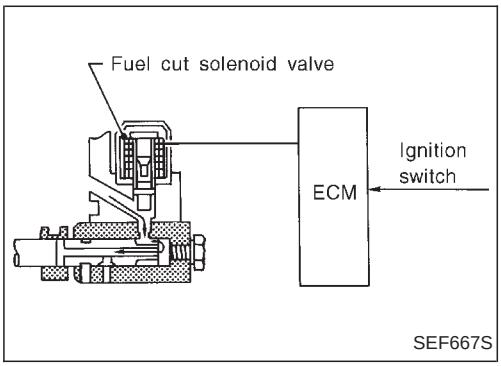
Component Inspection

ELECTRONIC CONTROL FUEL INJECTION PUMP (FUEL TEMPERATURE SENSOR)

Wait until fuel temperature sensor reaches room temperature.
Check resistance between electronic control fuel injection pump (fuel temperature sensor) terminals ⑤ and ⑥.

Temperature °C (°F)	Resistance kΩ
25 (77)	Approximately 1.9

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



Component Description

FUEL CUT SOLENOID VALVE

When the ignition switch is off, the ECM turns the fuel cut solenoid valve OFF (under this condition, no current flows through the fuel cut solenoid valve), shutting off fuel supply.
When the engine is not operating due to trouble, the fuel cut solenoid valve may or may not be OFF even when the ignition switch is ON.

On Board Diagnosis Logic

DTC	Malfunction is detected when ...	Check Items (Possible Cause)
P0125 0306	● Fuel cut solenoid valve circuit is malfunctioning.	● Harness or connectors (The solenoid valve circuit is open or shorted.) ● Fuel cut solenoid valve

DTC Confirmation Procedure

NOTE:
If DTC P0115 or P0335 is displayed same time, perform trouble diagnosis for P0115 or P0335 first.

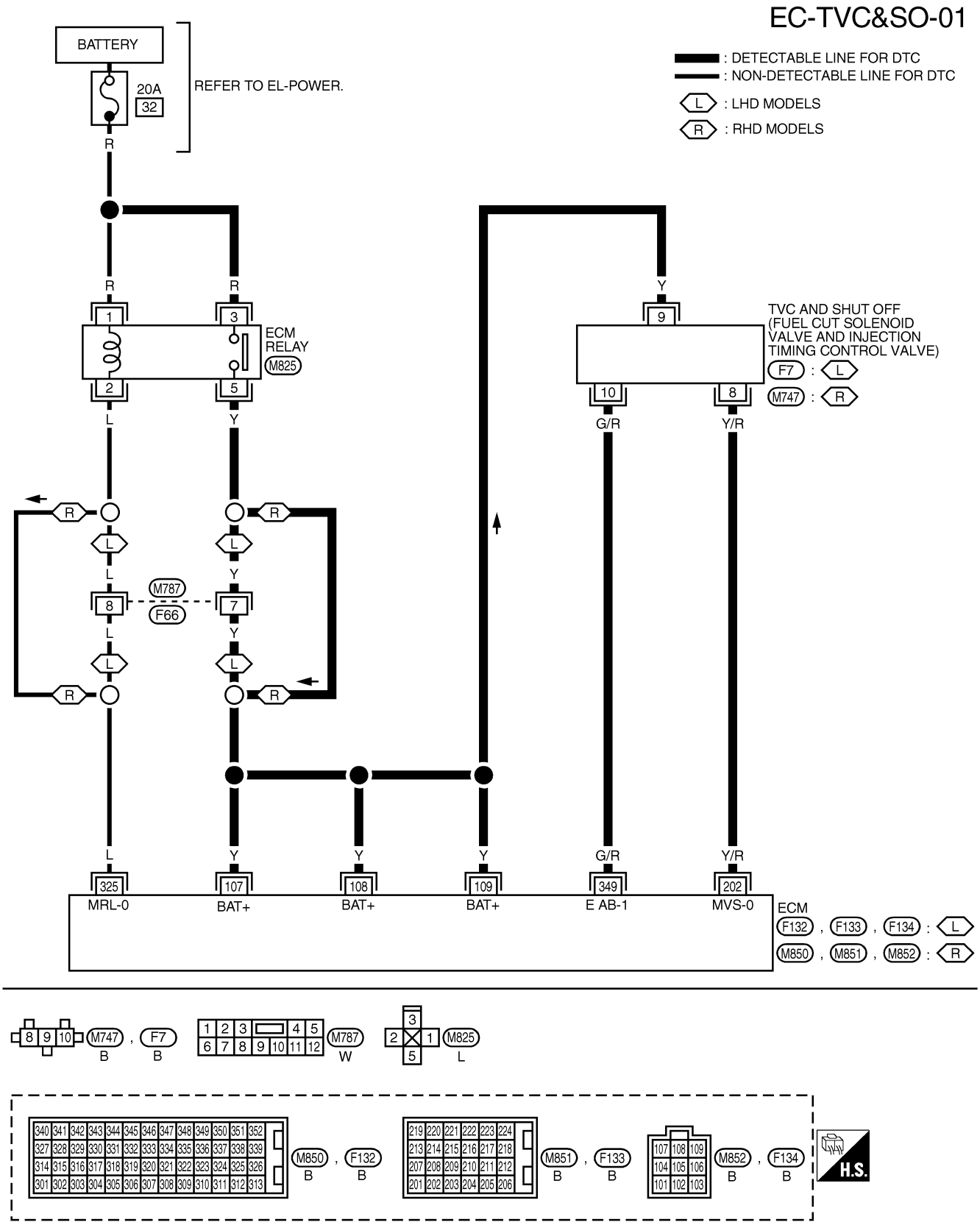
WITH CONSULT-II

1) Turn ignition switch to “ON” position.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Start engine. (If no start, circuit is open.)
4) Warm it up sufficiently.
5) Turn ignition switch to “LOCK” position, wait at least 5 seconds.
6) Start engine and rev it up to above 1,300 rpm. Release pedal and wait at least 3 seconds.

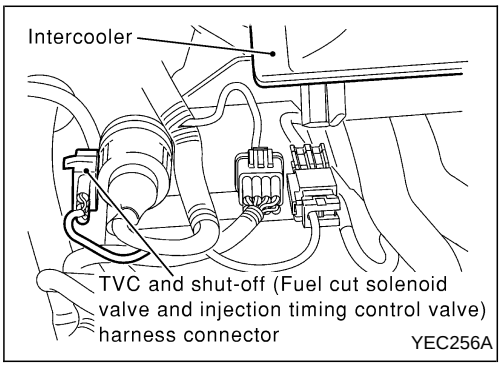
WITHOUT CONSULT-II

1) Start engine. (If no start, circuit is open.)
2) Warm it up sufficiently.
3) Turn ignition switch to “LOCK” position, wait at least 5 seconds.
4) Start engine and rev it up to above 1,300 rpm. Release pedal and wait at least 3 seconds.
5) Turn ignition switch to “LOCK” position, wait at least 5 seconds and then turn to “ON” position.
6) Perform “Diagnostic Test Mode II” (Self-diagnostic results).

Wiring Diagram



YEC158A



Diagnostic Procedure

INSPECTION START

CHECK POWER SUPPLY.
Check power supply.

CHECK OUTPUT SIGNAL CIRCUIT.
With CONSULT-II
1. Turn ignition switch to “ON” position.
2. Select “FUEL CUT SOL/V” in “ACTIVE TEST” mode with CONSULT-II.
3. Touch “ON” and “OFF” alternately.
4. Check that operating sound is emitted.

Without CONSULT-II
1. Turn ignition switch to “LOCK” position.
2. Disconnect ECM harness connector and TVC and shut-off harness connector.
3. Check harness continuity between TVC and shut-off harness connector terminal ⑧ and ECM connector terminals (202), TVC and shut-off terminal ⑩ and ECM terminal (349). Refer to wiring diagram.
Continuity should exist.
If OK, check harness for short-circuit.

NG → Repair harness or connectors.

OK

CHECK COMPONENT
[TVC and shut-off (Fuel cut solenoid valve)].
Refer to “COMPONENT INSPECTION” on page EC-379.

NG → Replace [TVC and shut-off (fuel cut solenoid valve)].

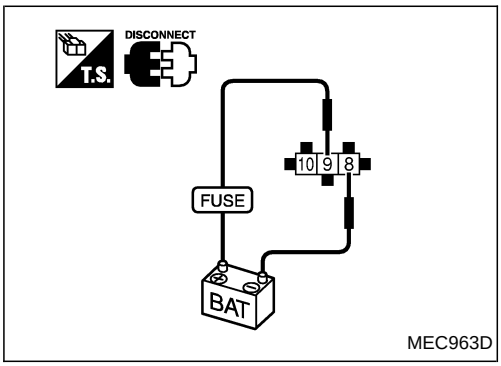
OK

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

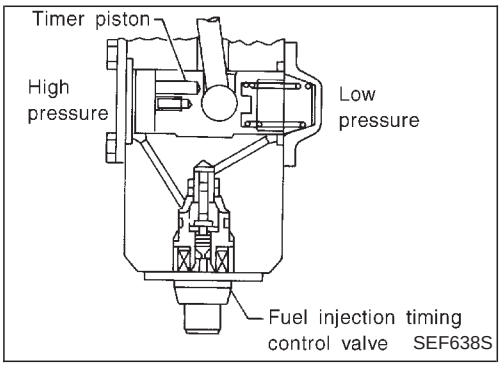


Component Inspection

[TVC AND SHUT OFF (FUEL CUT SOLENOID VALVE)]

1. Remove TVC and shut-off (fuel cut solenoid valve) harness connector.
2. Check that operating sound is emitted when applying 12V direct current to terminal ⑨ and ⑧.

If NG, replace TVC and shut-off (fuel cut solenoid valve).



Component Description

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 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.

On Board Diagnosis Logic

DTC	Malfunction is detected when	Check Items (Possible cause)
P0216 0904	• Injection timing control valve circuit is open or shorted.	• Harness or connectors (The injection timing control valve circuit is open or shorted) • Injection timing control valve
P1246 0201	• Injection timing feedback system does not operate properly. (This system consists essentially of ECM, injection timing control valve and needle lift sensor.)	• 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

DTC P0216 Confirmation Procedure

WITH CONSULT-II

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

WITHOUT CONSULT-II

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).

DTC P1246 Confirmation Procedure

NOTE:
If both DTC P1246 and P1240 or P0335 are displayed, perform TROUBLE DIAGNOSIS FOR DTC P1240 or P0335. (See EC-427 or EC-385.)

WITH CONSULT-II

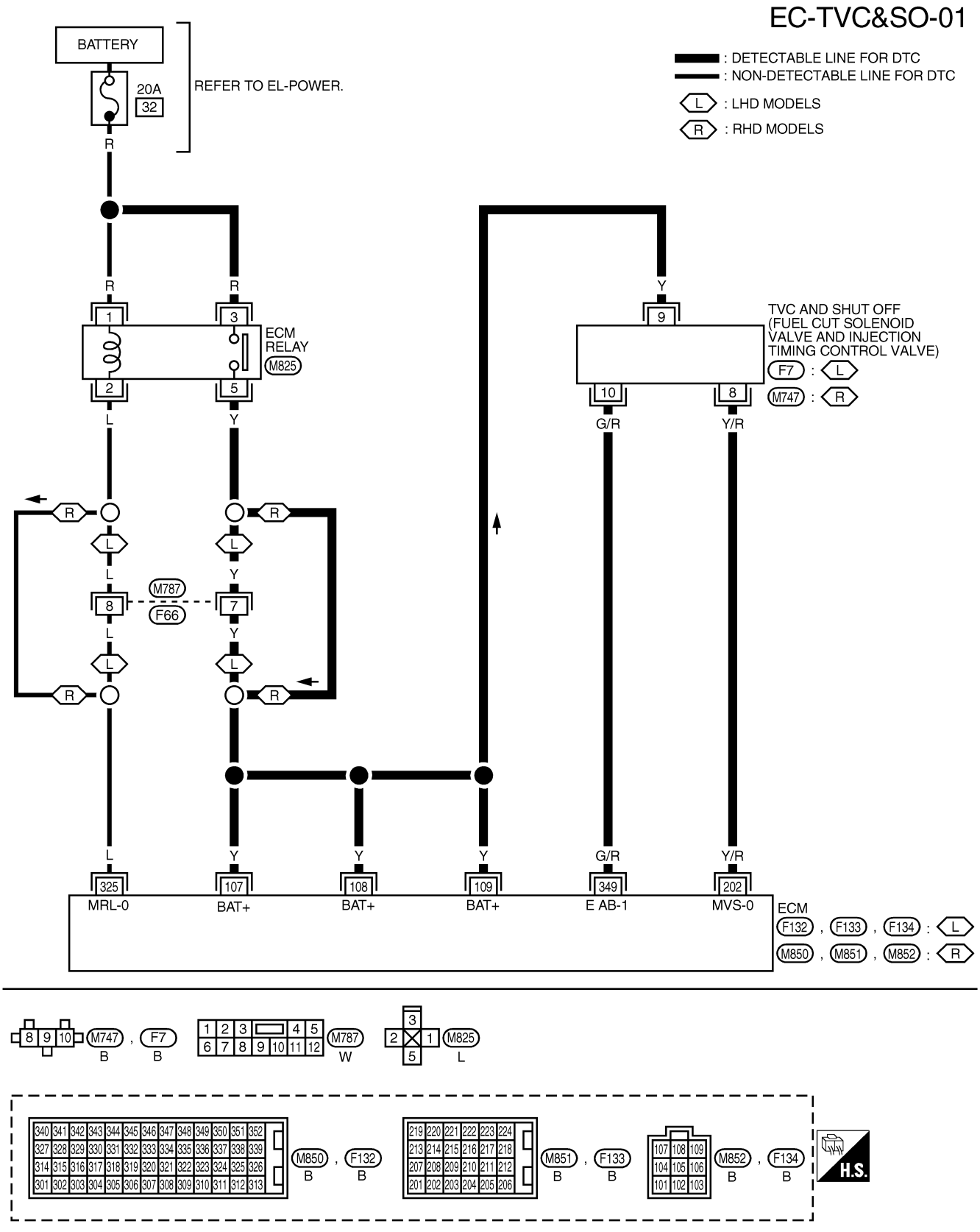
1) Turn ignition switch to “ON” position and select “DATA MONITOR” mode with CONSULT-II.
2) Start engine. Run it for 10 seconds at idle.

WITHOUT CONSULT-II

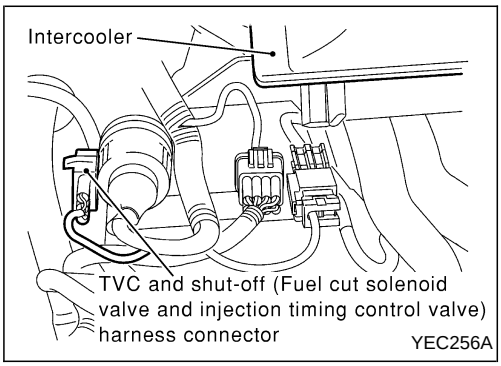
1) Start engine. Run it for 10 seconds at idle.
2) Turn ignition switch to “LOCK” position, wait at least 5 seconds and then turn to “ON” position.
3) Perform “Diagnostic Test Mode II” (Self-diagnostic results).

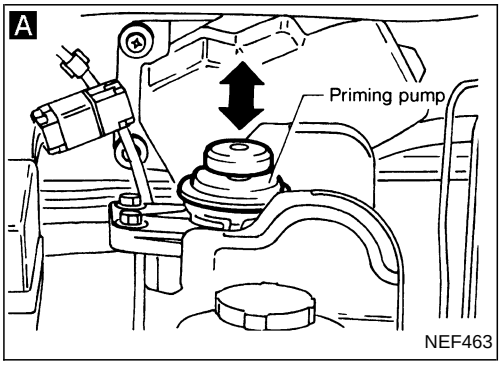
NOTE:
If a malfunction occurs intermittently, conduct suitable driving pattern for 10 minutes. This makes it possible to determine DTC.

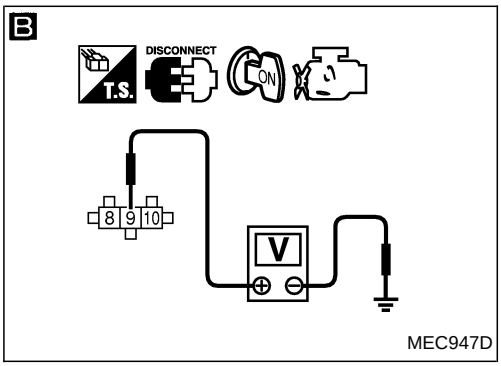
Wiring Diagram



YEC158A







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 TVC and shut-off (injection timing control valve) harness connector.
3. Turn ignition switch to “ON” position.
4. Check voltage between TVC and shut-off (injection timing control valve) connector terminal ⑨ and engine ground with CONSULT-II or tester.

Voltage: Battery voltage

NG → Check the following:
- Harness connector (M787), (F66)
- 20A fuse
- ECM relay
- Harness for open or short-circuit between TVC and shut-off (injection timing control valve) harness connector and fuse box.

If NG, replace 20A fuse or ECM relay, harness or connectors.

OK

CHECK OUTPUT SIGNAL CIRCUIT.
1. Turn ignition switch to “LOCK” position.
2. Disconnect ECM harness connector.
3. Check harness continuity between TVC and shut-off (injection timing control valve) connector terminal ⑧ and ECM terminals (202). Refer to wiring diagram.

Continuity should exist.

If OK, check harness for short-circuit.

NG → Check the following:
- Harness for open or short-circuit between TVC and shut-off (injection timing control valve) and ECM

If NG, repair harness or connectors.

OK

CHECK GROUND CIRCUIT.
1. Disconnect ECM harness connector.
2. Check harness continuity between ECM connector terminal (349) and TVC and shut-off (injection timing control valve) connector terminal ⑩. Refer to wiring diagram.

Continuity should exist.

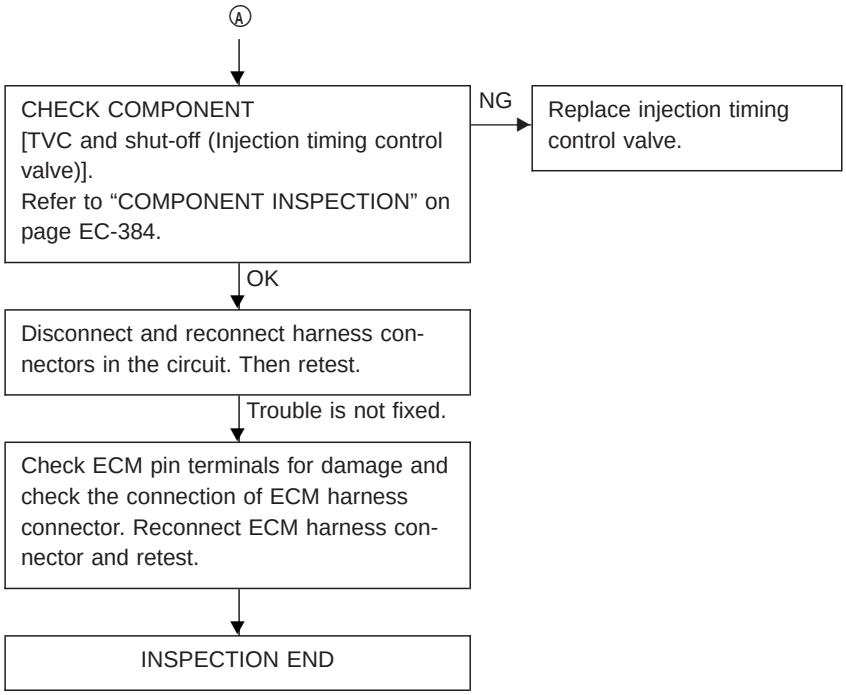
If OK, check harness of short-circuit.

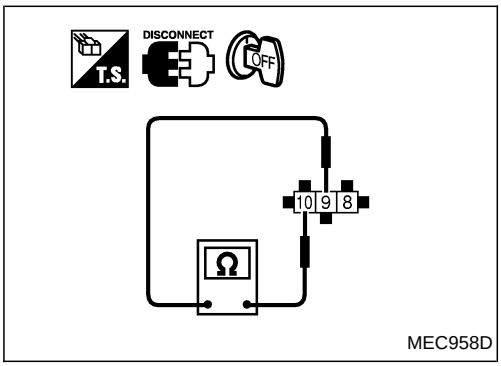
NG → Repair harness or connectors

OK

Ⓐ

Diagnostic Procedure (Cont'd)

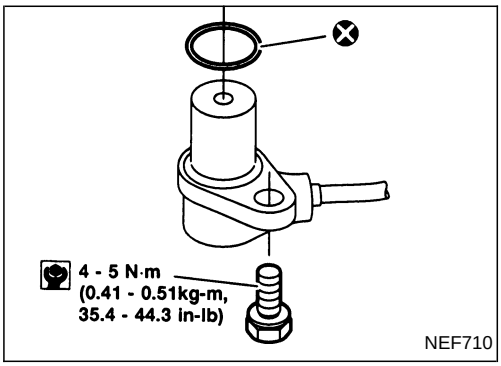


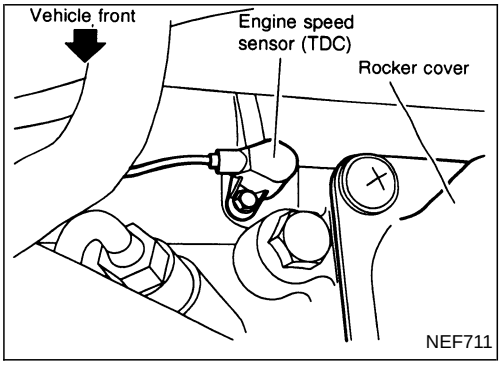


Component Inspection

[TVC AND SHUT-OFF (INJECTION TIMING CONTROL VALVE)]

1. Disconnect TVC and shut-off (injection timing control valve) harness connector.
2. Check resistance between terminals ⑨ and ⑩.
   Resistance: Approximately 15Ω [at 25°C (77°F)]
   If NG, replace injection timing control valve.





Component Description

CRANKSHAFT POSITION SENSOR (TDC)

The crankshaft position sensor (TDC) monitors engine speed by means of signals from the sensing plate (with four protrusions) installed to the clutch housing. The datum signal output is detected at ATDC 30° and sent to the ECM. The sensor signal is used for fuel injection control and fuel injection timing control.

On Board Diagnosis Logic

DTC	Malfunction is detected when	Check Items (Possible cause)
P0335 0407	• An improper signal from the sensor is detected by ECM during engine running and cranking.	• Harness or connectors (The sensor circuit is open) • Crankshaft position sensor (TDC)

DTC Confirmation Procedure

- **If DTC P1240 is displayed same time, perform trouble diagnosis for DTC P1240 first.**
- **Before performing the following procedure, confirm that battery voltage is more than 9V.**

WITH CONSULT-II

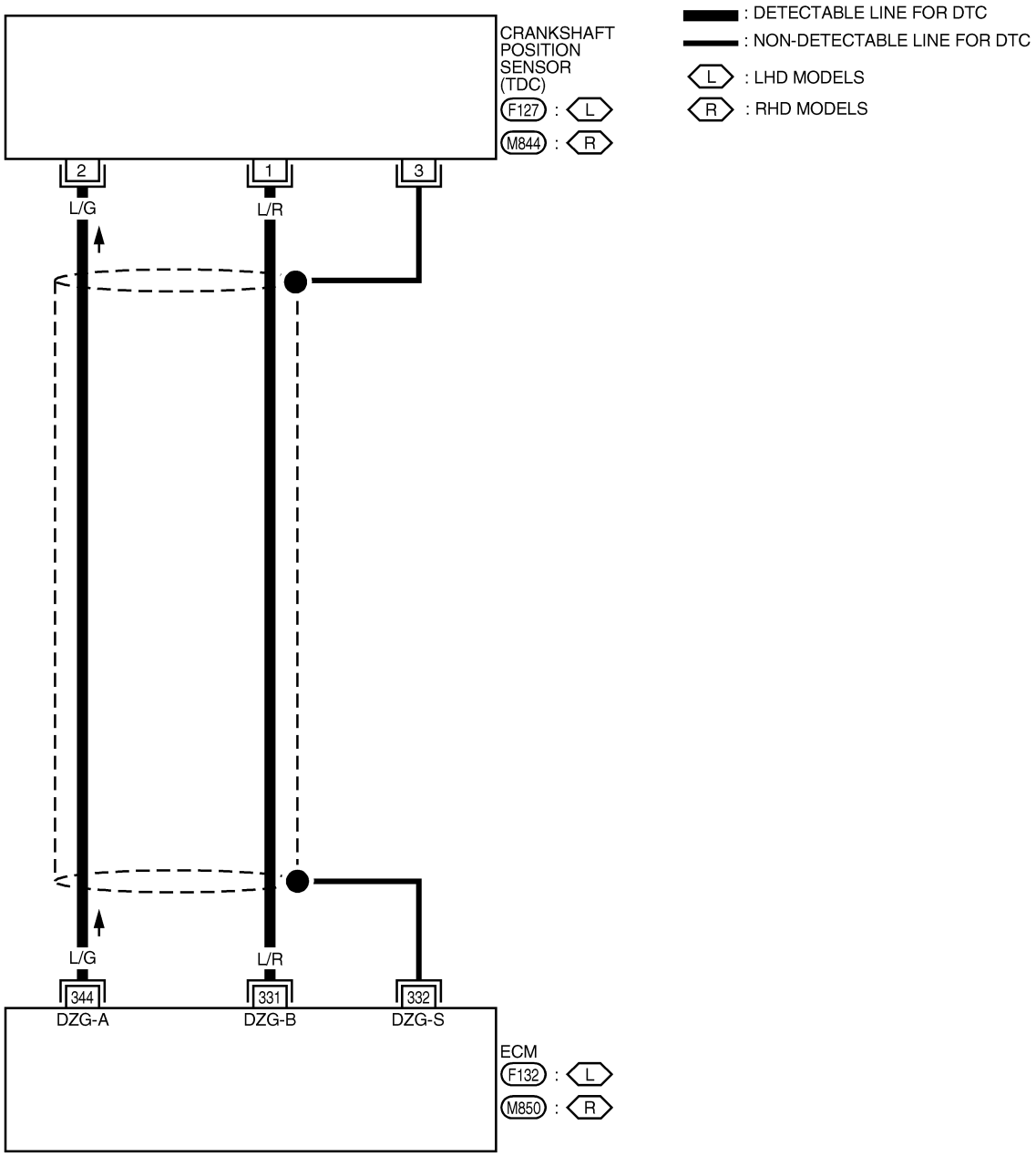
1) Turn ignition switch to “ON” position and select “DATA MONITOR” mode with CONSULT-II.
2) Start engine and run it for at least 3 seconds at above 1,200 rpm.

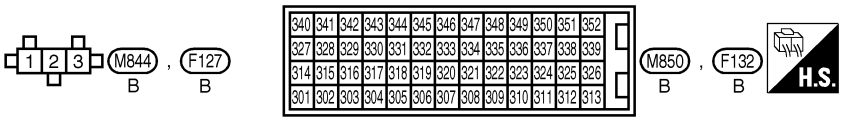
WITHOUT CONSULT-II

1) Start engine and run it for at least 3 seconds at above 1,200 rpm.
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).

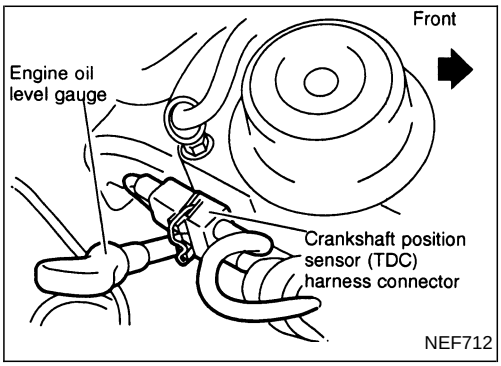
Wiring Diagram

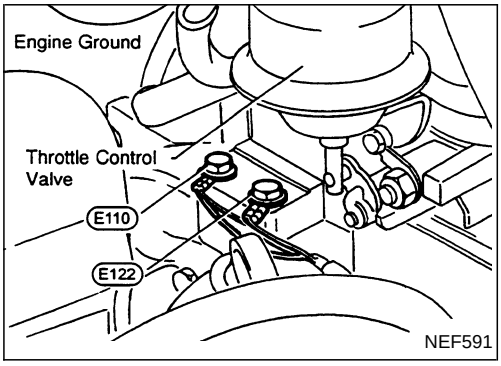
EC-CKPS-01





YEC146A





Diagnostic Procedure

INSPECTION START

CHECK INPUT SIGNAL CIRCUIT.
1. Turn ignition switch to “LOCK” position.
2. Disconnect crankshaft position sensor (TDC) and ECM harness connectors.
3. Check continuity between ECM terminal (344) and crankshaft position sensor connector terminal ②. Refer to wiring diagram.

Continuity should exist.

If OK, check harness for short-circuit.

NG → Check the following:
- Harness for open-circuit between ECM and crankshaft position sensor (TDC).

If NG, repair harness or connectors.

OK ↓

CHECK GROUND CIRCUIT-I.
Check harness continuity between crankshaft position sensor connector terminal ① and ECM terminals (331). Refer to wiring diagram.

Continuity should exist.

If OK, check harness for short-circuit.

NG → Check the following:
- Harness for open-circuit between crankshaft position sensor (TDC) harness connector and ECM

If NG, repair harness or connectors.

OK ↓

CHECK GROUND CIRCUIT-II.
Check harness continuity between crankshaft position sensor connector terminal ③ and ECM terminal (332). Refer to wiring diagram.

Continuity should exist.

If OK, check harness for short-circuit.

NG → Check the following:
- Harness for open-circuit between crankshaft position sensor (TDC) and engine ground.

If NG, repair harness or connectors.

OK ↓

CHECK COMPONENT
[Crankshaft position sensor (TDC)].
Refer to “COMPONENT INSPECTION”, EC-388.

NG → Replace crankshaft position sensor (TDC).

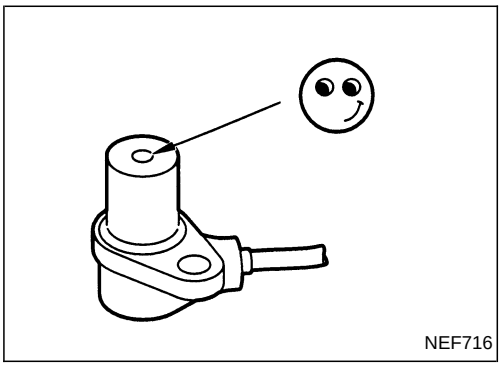
OK ↓

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.

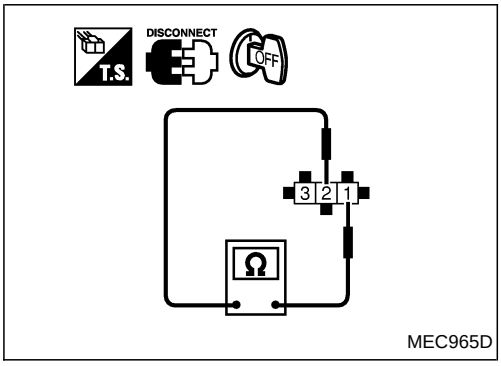
INSPECTION END


NEF716

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.



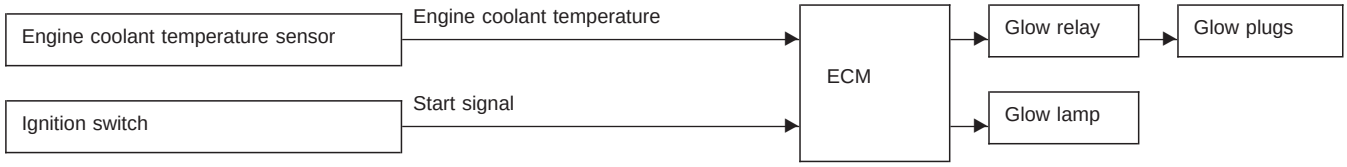
MEC965D

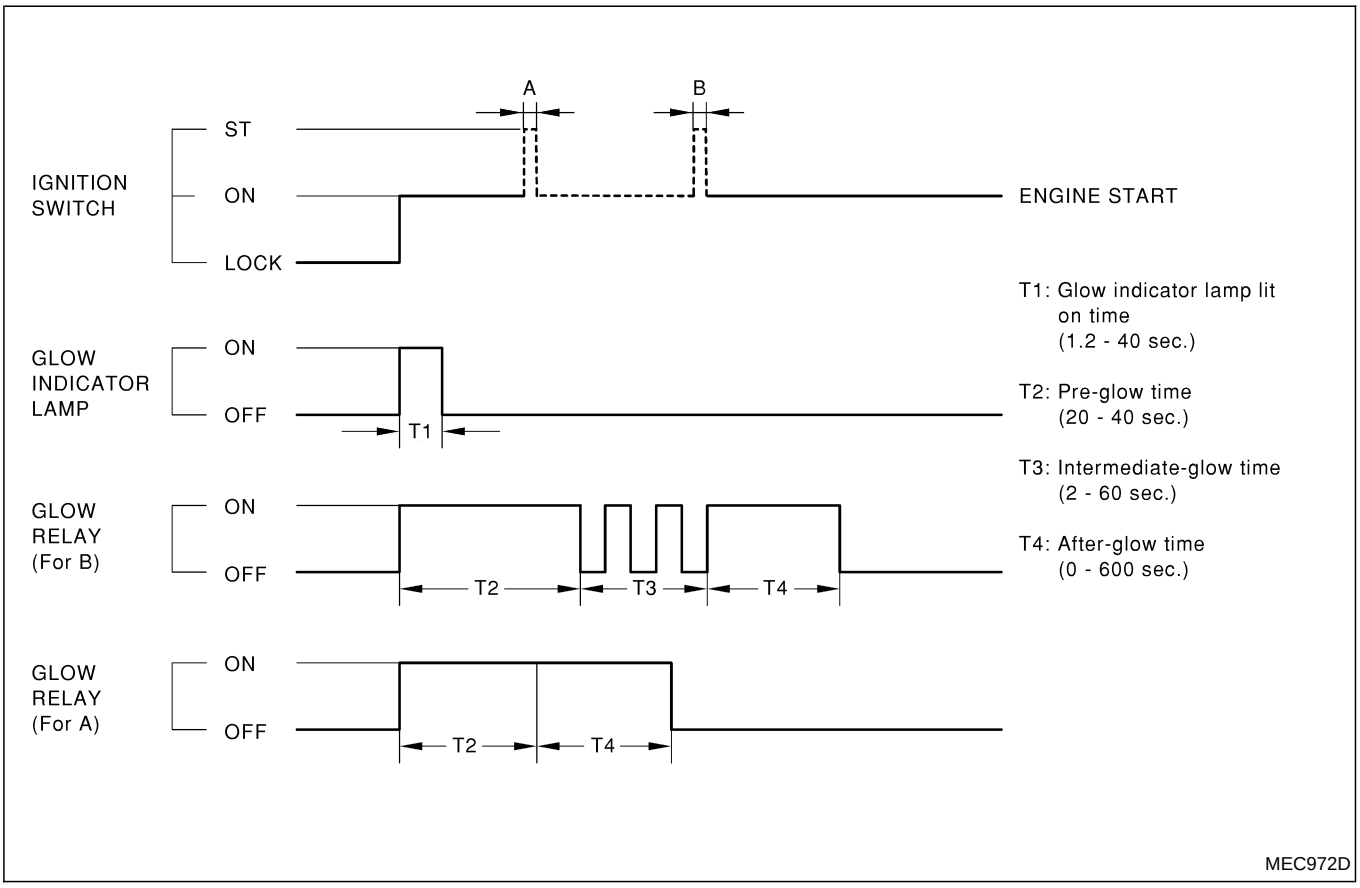
5. Check resistance between terminals ① and ② .
   Resistance: Approximately 900Ω
   [at 25°C (77°F)]
   If NG, replace crankshaft position sensor (TDC).

CAUTION
Do not use any crankshaft position sensor (TDC) that has been dropped or physically damaged.
Use only new one.

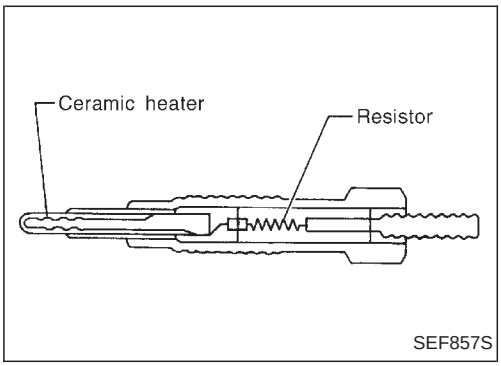
System Description

GLOW CONTROL





- Pre-glow
  When the ignition switch is turned on the ON position, the glow indicator lamp will turn ON and pre-glow starts.
  The glow relay is turned ON continuously. The ON time of both the glow indicator lamp and the glow relay is determined by the engine coolant temperature. Pre-glow ends when the pre-glow time elapses or when the engine is started.
- Intermediate glow
  Intermediate glow starts when the pre-glow time has elapsed and the engine has not been started. The glow relay is turned ON intermittently. Intermediate glow ends when the intermediate glow time has elapsed, or when the engine is started.
- After-glow
  After-glow starts as soon as the engine is running and the engine coolant temperature is below 50°C (122°F). The glow relay is turned on continuously. After-glow ends when the after-glow time elapses, or when the engine coolant temperature exceeds 50°C (122°F).



Component Description

GLOW PLUG

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

On Board Diagnosis Logic

DTC	Malfunction is detected when	Check Items (Possible cause)
P0380 0803	● Glow relay signal circuit is open or shorted.	● Harness or connectors (The glow relay signal circuit is open or shorted.) ● Glow relay
P0381 0908	● Glow indicator lamp circuit is open or shorted.	● Harness or connectors (The glow indicator lamp circuit is open or shorted.) ● Glow lamp

DTC Confirmation Procedure

WITH CONSULT-II

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

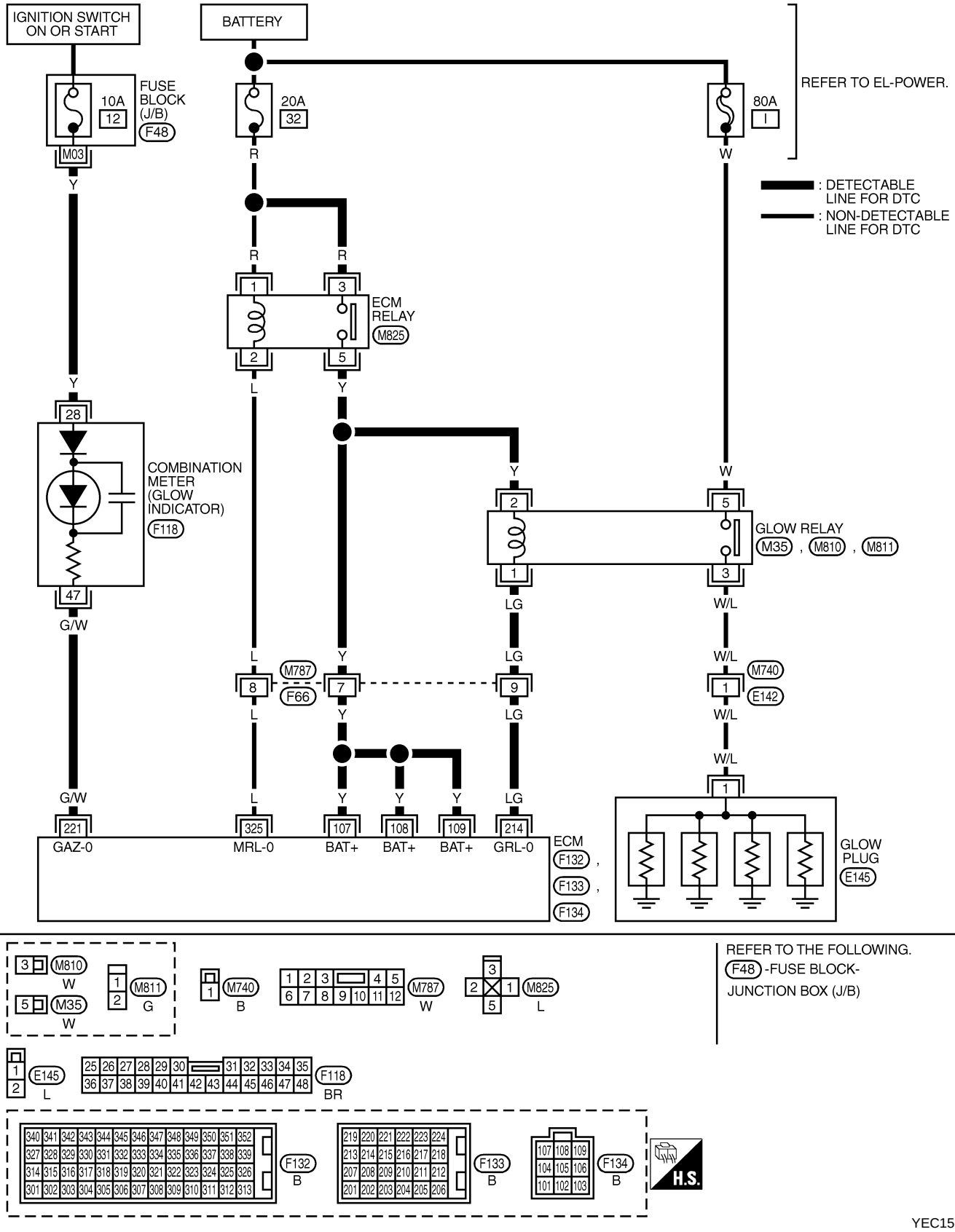
WITHOUT CONSULT-II

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

Wiring Diagram

LHD MODELS

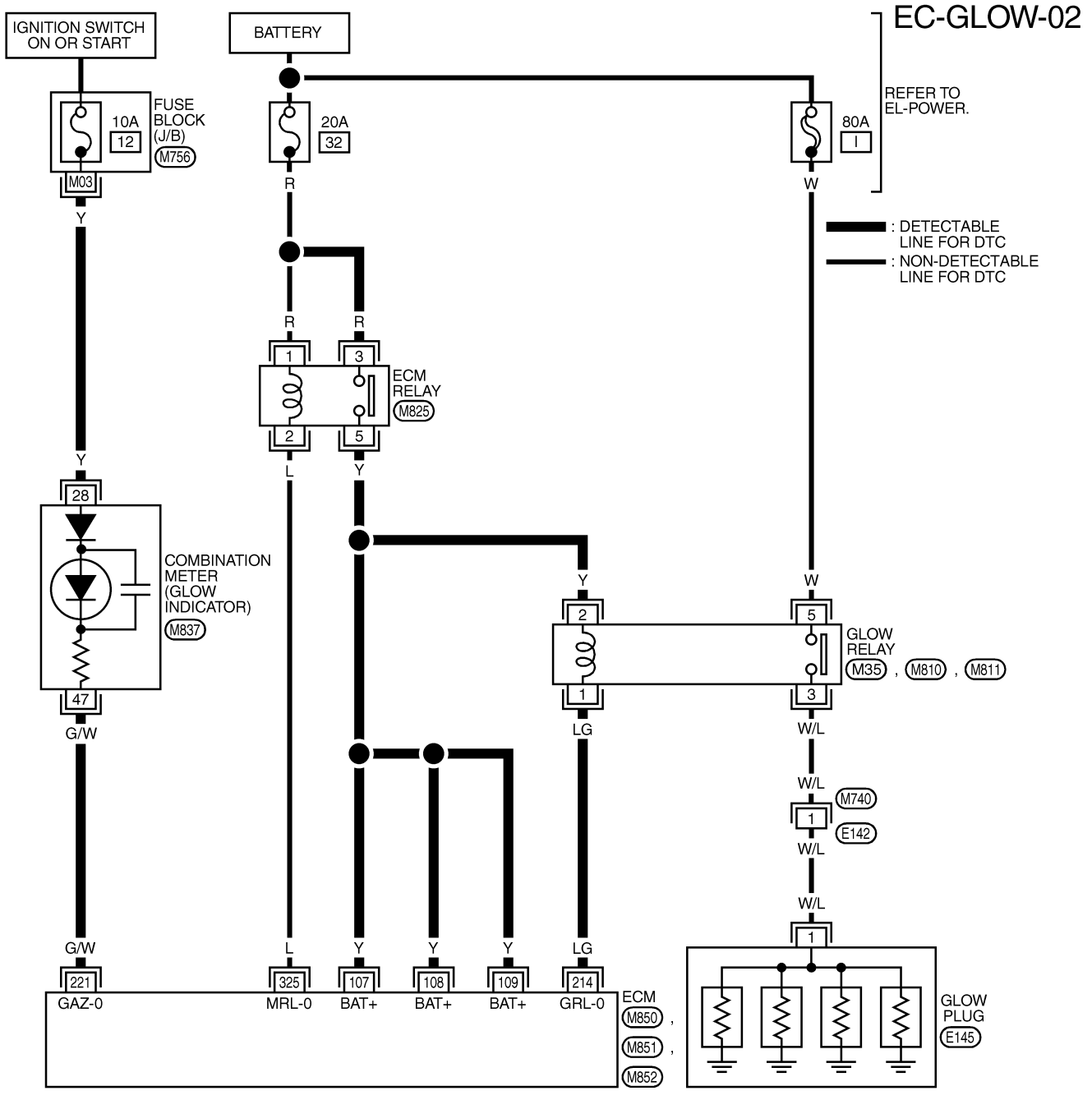
EC-GLOW-01



YEC151A

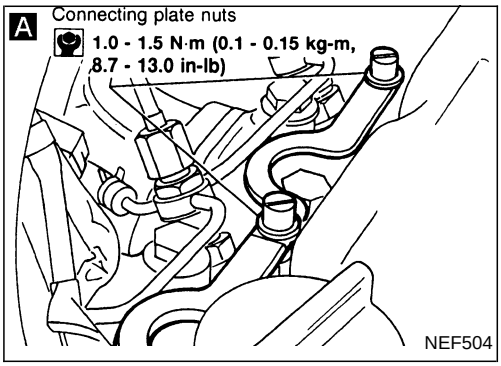
Wiring Diagram (Cont'd)

RHD MODELS

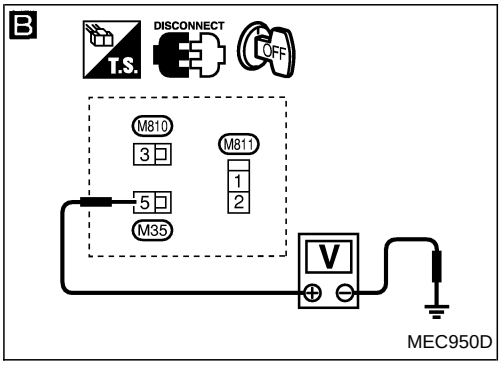


YEC152A

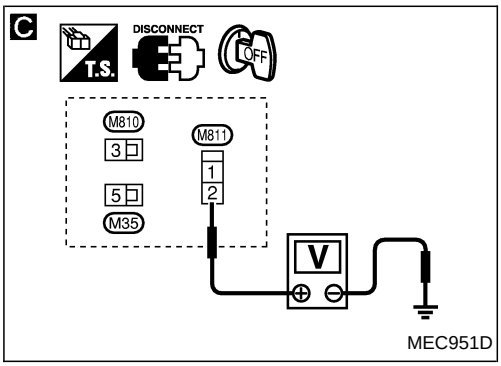
A



B



C



Diagnostic Procedure

INSPECTION START

Check fuel level, fuel supply system, starter motor, etc.
- NG → Correct.
- OK ↓

A

Check that all glow plug connecting plate nuts are installed correctly.
- NG → Install correctly.
- OK ↓

CHECK OVERALL FUNCTION.
Check entire glow control system.
- OK → CHECK COMPONENT (Glow plug). Refer to EC-396.
- NG ↓

B

CHECK VOLTAGE BETWEEN GLOW RELAY AND GROUND.
1. Disconnect glow relay.
2. Check voltage between glow relay connector terminal ⑤ and engine ground with tester.

Voltage: Battery voltage
- NG → Check the following:
  - 80A fusible link in fusible link box
  - Harness continuity between glow relay and battery positive terminal.

  If NG, replace fuse or fusible link or repair harness or connectors.
- OK ↓

C

CHECK VOLTAGE BETWEEN GLOW RELAY AND GROUND.
1. Turn ignition switch to “ON” position.
2. Check voltage between glow relay connector terminals ② and engine ground with tester.

Voltage: Battery voltage
- NG → Check the following:
  - 20A fusible link in fusible link box
  - ECM relay
  - Harness continuity between glow relay and battery positive terminal.

  If NG, replace fuse or fusible link or repair harness or connectors.
- OK ↓

CHECK OUTPUT SIGNAL CIRCUIT.
1. Turn ignition switch to “LOCK” position.
2. Disconnect ECM harness connector.
3. Check harness continuity between ECM connector terminal (214) and glow relay connector terminal ①. Refer to wiring diagram.

Continuity should exist.

If OK, check harness for short-circuit.
- NG → Check the following.
  - Harness connectors (M787), (F66) (LHD models)
  - Harness continuity between glow relay and ECM

  If NG, repair harness or connectors.
- OK ↓

CHECK HARNESS CONTINUITY BETWEEN GLOW RELAY AND GLOW PLUG.
1. Disconnect glow plug connector.
2. Check harness continuity between glow relay connector terminal ③ and glow plug connector terminal ①. Refer to wiring diagram.

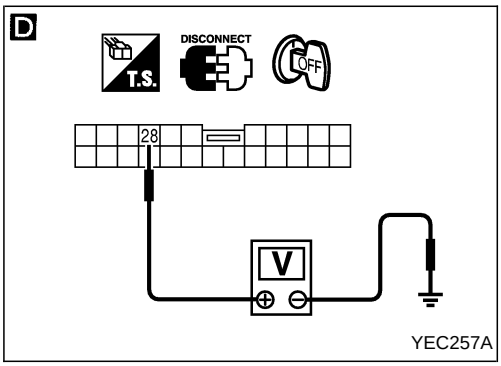
Continuity should exist.

If OK, check harness for short-circuit.
- NG → Check the following.
  - Harness connectors (M740), (E142)
  - Harness continuity between glow relay and glow plug

  If NG, repair harness or connectors.
- OK ↓

Ⓐ

Diagnostic Procedure (Cont'd)



Ⓐ

D

CHECK VOLTAGE BETWEEN COMBINATION METER (GLOW INDICATOR) AND GROUND.
1. Turn ignition switch "OFF".
2. Disconnect combination meter harness connector.
3. Check voltage between combination meter terminal ㉘ and ground.

Voltage: Battery voltage

NG → Check the following.
- 10A fuse
- Harness continuity between combination meter and 10A fuse

If NG, replace fuse or repair harness or connectors.

OK ↓

CHECK COMPONENTS.
(Glow relay, Glow plug, Glow indicator).
Refer to "COMPONENT INSPECTION", EC-396.

NG → Replace malfunctioning component(s).

OK ↓

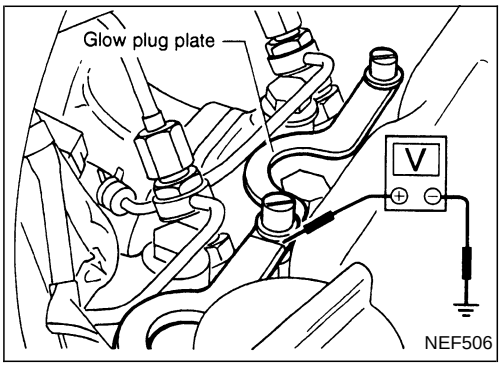
Disconnect and reconnect harness connectors in the circuit. Then retest.

Trouble is not fixed. ↓

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

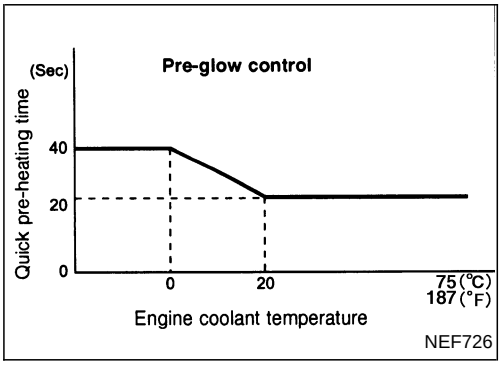
↓

INSPECTION END

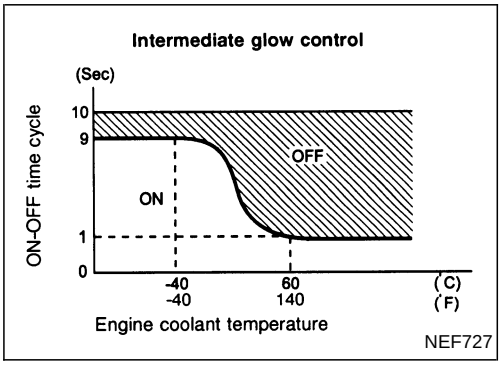


System Operation Check

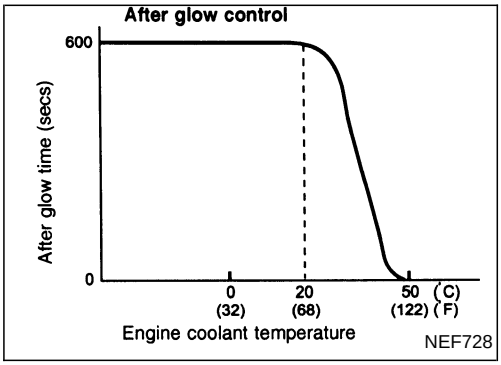
Set voltmeter between glow plug and engine body.



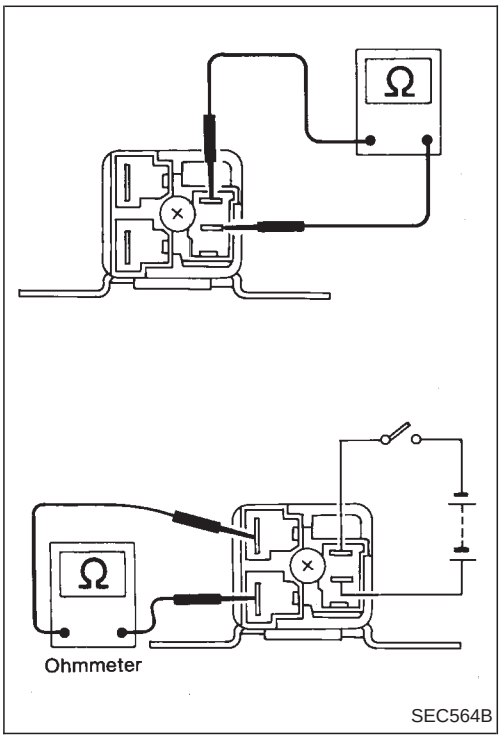
1. Pre-glow control
a. Turn ignition switch to “ON” position.
b. Read voltage and time.
Battery voltage will continuously appear for about 20* seconds after ignition switch is turned “ON”.
*** Engine coolant temperature is higher than 20°C (68°F).**
*** Repeatedly turning the ignition switch to “ON” position and then back to “LOCK” position may change the glow time.**
2. Intermediate-glow control
a. Turn ignition switch to “LOCK” position. Wait at least 5 seconds.
b. Turn ignition switch to “ON”.



c. Read voltage.
Battery voltage will intermittently appear for about 60 seconds after pre-glow control time has elapsed.



3. After-glow control
Start engine and read voltage and time.
Battery voltage will appear for max. 10 minutes. When engine coolant temperature is lower than 50°C (122°F).

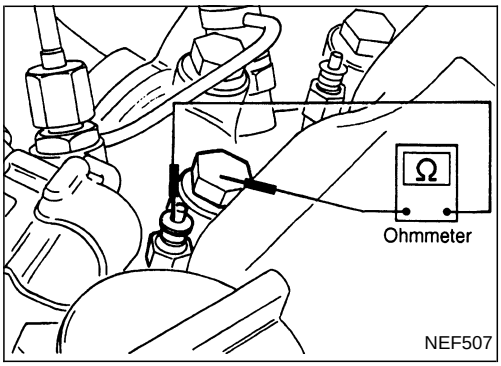


Component Inspection

GLOW RELAY

1. Check relay terminals ① and ② for coil continuity.
   Continuity should exist.
2. Check relay operation by applying battery voltage across relay coil terminals.

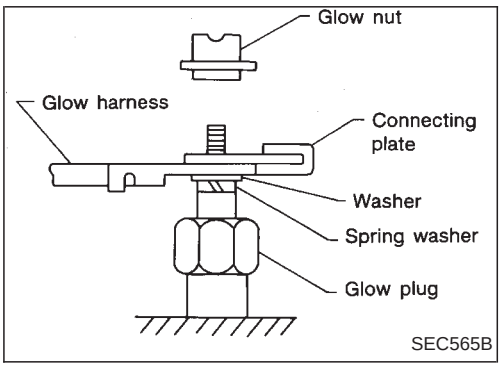
Coil voltage at relay terminals ① and ②	Continuity at relay terminals ⑤ and ③
0V	No
12V	Yes



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)]

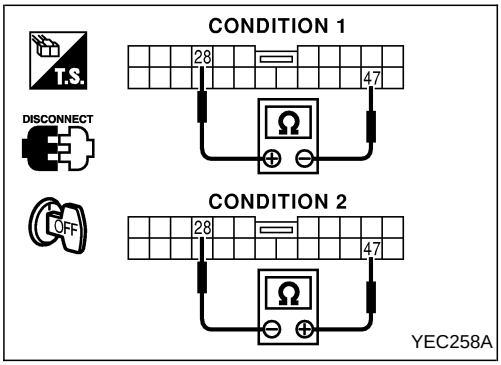
- If NG, replace glow plug.



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 above 10 cm (3.94 in), replace with new one.]**
- **If glow plug installation hole is contaminated with carbon, remove using a reamer or suitable tool.**
- **Hand-tighten glow plug by turning it 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)

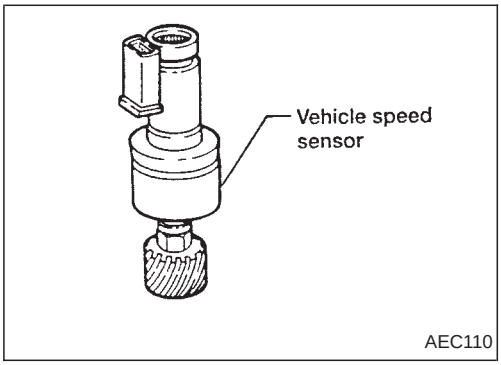


GLOW INDICATOR

1. Turn ignition switch “OFF”.
2. Disconnect combination meter harness connector.
3. Check continuity between terminals below.

Combination meter (Glow indicator)	CONDITION 1	+28 −47	Continuity should not exist.
	CONDITION 2	−28 +47	Continuity should exist.

IF NG, repair or replace combination meter (Glow indicator). Refer to EL section.



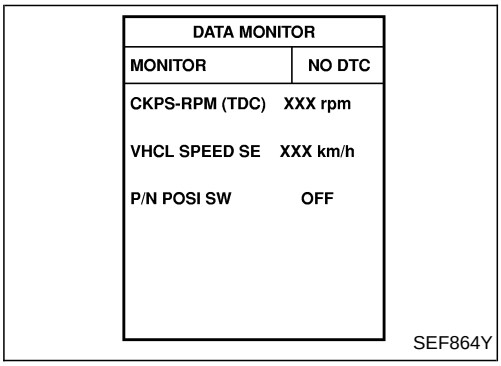
Component Description

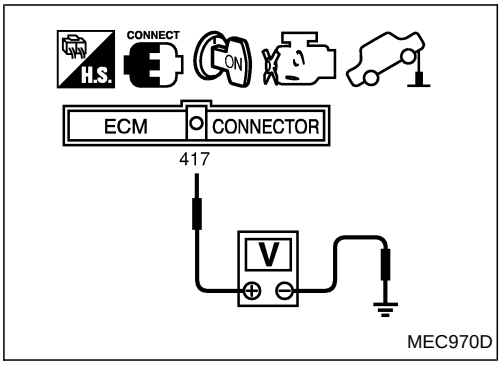
VEHICLE SPEED SENSOR (VSS)

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

On Board Diagnosis Logic

DTC	Malfunction is detected when	Check Items (Possible Cause)
P0500 0104	• The almost 0 km/h (0 mph) signal from vehicle speed sensor is sent to ECM even when vehicle is being driven.	• Harness or connector (The vehicle speed sensor circuit is open or short-circuited.) • 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.

WITH CONSULT-II

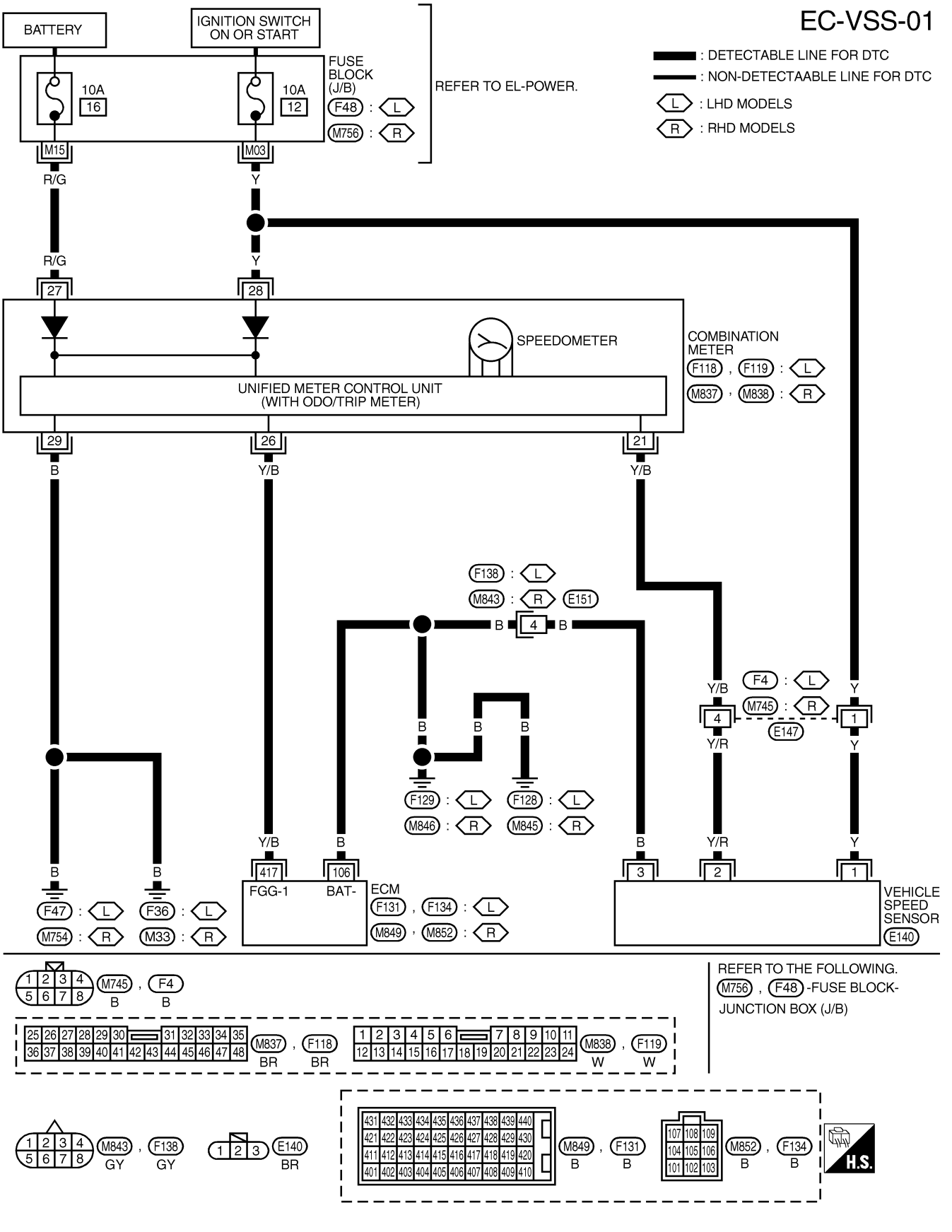
1) Jack up drive wheels.
2) Start engine.
3) Read vehicle speed sensor signal in “DATA MONITOR” mode with CONSULT-II.

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

WITHOUT CONSULT-II

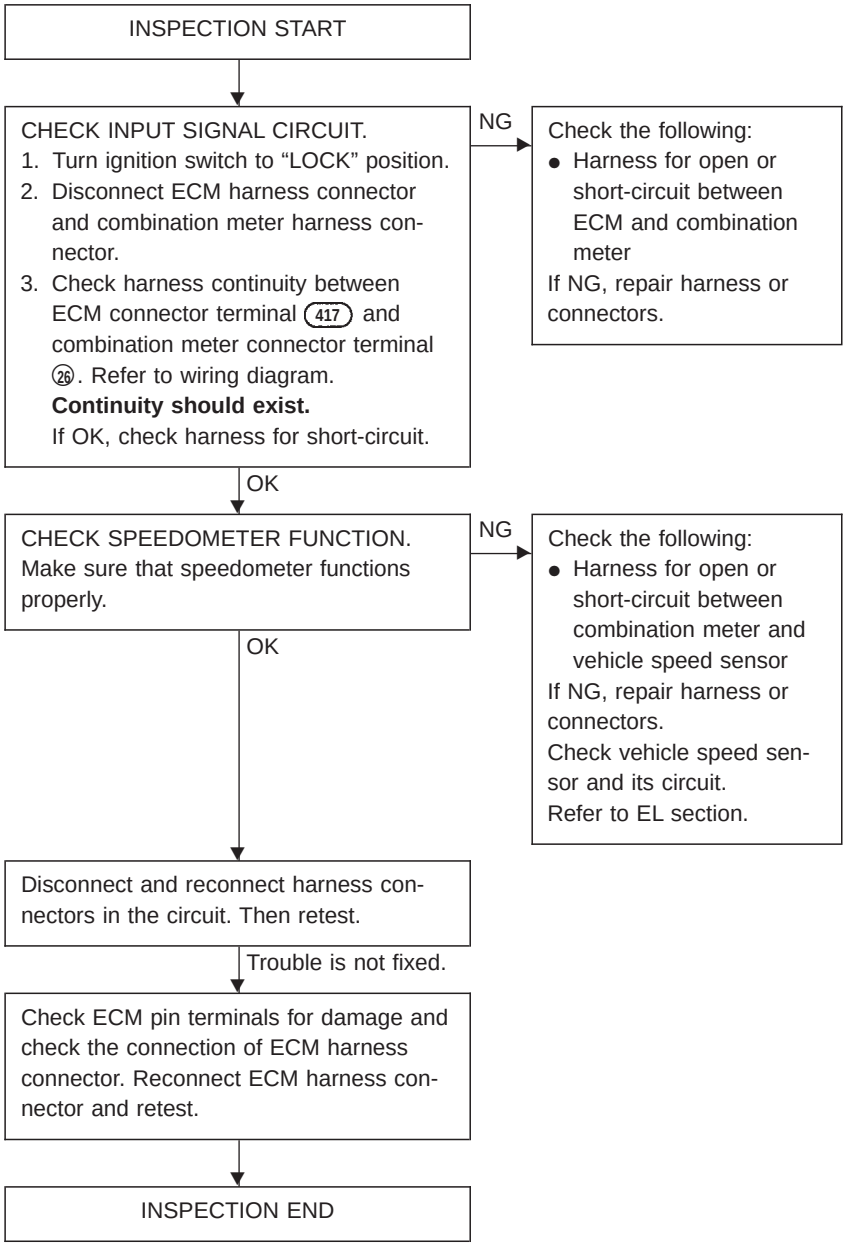
1) Jack up drive wheels.
2) Rotate drive wheel by hand.
3) Check voltage between ECM connector terminal (417) and body ground with tester.
   Voltage should vary between approx. 0 - Battery voltage.

Wiring Diagram



YEC147A

Diagnostic Procedure



Component Description

BRAKE SWITCH

The ECM receives signals from two brake switches. One is a conventional brake lamp switch, the other is referred to as a redundant brake switch 2.
In case the accelerator pedal does not return to the idle position (pedal sticks), the driver will react by depressing the brake. In this (emergency) situation, the ECM will disregard the accelerator pedal signal and bring back the engine speed to 1,200 rpm.

On Board Diagnosis Logic

DTC	Malfunction is detected when ...	Check Items (Possible Cause)
P0571 0807	● Brake switch circuits are open or shorted.	● Harness or connectors (Brake switch circuits are open or shorted.) ● Stop lamp switch ● Brake switch 2

DTC Confirmation Procedure

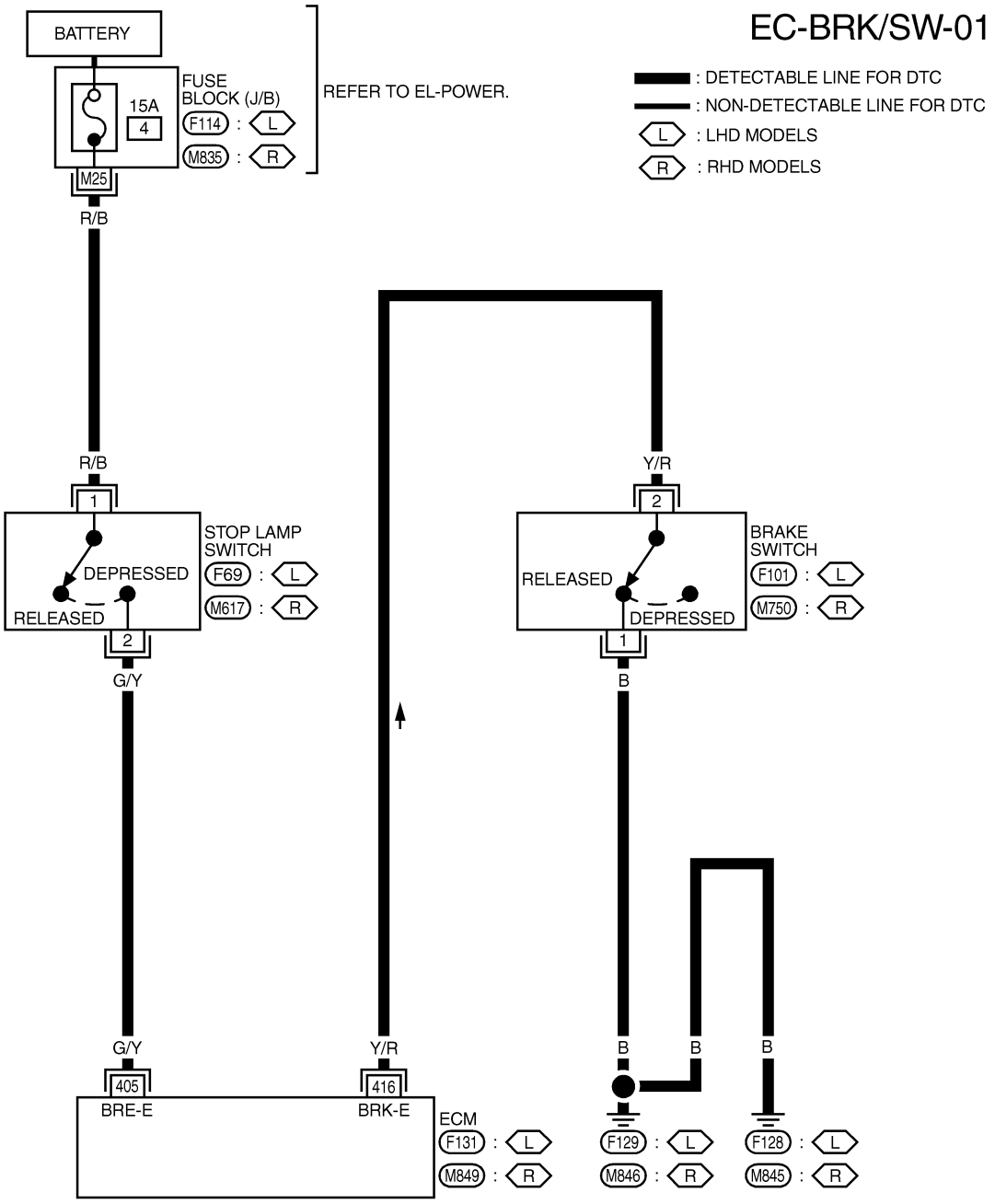
WITH CONSULT-II

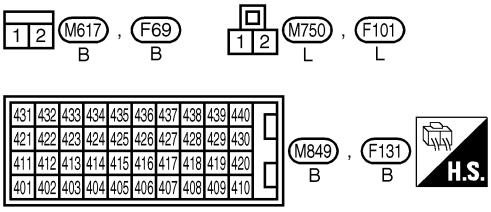
1) Turn ignition switch to “ON” position and select “DATA MONITOR” mode with CONSULT-II.
2) Depress brake pedal for at least 1 minute.

WITHOUT CONSULT-II

1) Turn ignition switch to “ON” position.
2) Depress brake pedal for at least 1 minute.
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).

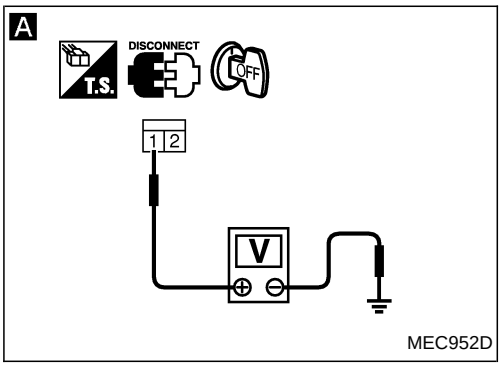
Wiring Diagram





REFER TO THE FOLLOWING.
M835 , F114 -FUSE BLOCK-JUNCTION BOX (J/B)

YEC148A



Diagnostic Procedure

INSPECTION START
(Stop lamp switch circuit)

A

CHECK POWER SUPPLY.
1. Turn ignition switch to “LOCK” position.
2. Disconnect stop lamp switch harness connector.
3. Check voltage between stop lamp switch harness connector terminal ① and engine ground.
   Voltage: Battery voltage

NG → Check the following:
- 15A fuse
- Harness for open or short-circuit between fuse block and stop lamp switch

If NG, repair harness or connectors.

OK ↓

CHECK STOP LAMP SWITCH INPUT SIGNAL CIRCUIT.
1. Disconnect ECM harness connector.
2. Check harness continuity between ECM connector terminal (405) and stop lamp switch terminal ②. Refer to wiring diagram.
   Continuity should exist.
   If OK, check harness for short-circuit.

NG → Repair harness or connectors.

OK ↓

CHECK BRAKE SWITCH INPUT SIGNAL CIRCUIT.
1. Disconnect brake switch harness connector.
2. Check harness continuity between brake switch terminal ② and ECM terminal (416). Refer to wiring diagram.
   Continuity should exist.
   If OK, check harness for short-circuit.

NG → Repair harness or connectors.

OK ↓

CHECK GROUND CIRCUIT.
1. Check harness continuity between brake switch terminal ① and ground. Refer to wiring diagram.
   Continuity should exist.
   If OK, reconnect harness connectors.

NG → Repair harness or connectors.

OK ↓

CHECK COMPONENT.
(Stop lamp switch and brake switch)
Refer to “COMPONENT INSPECTION”, EC-403.

OK ↓

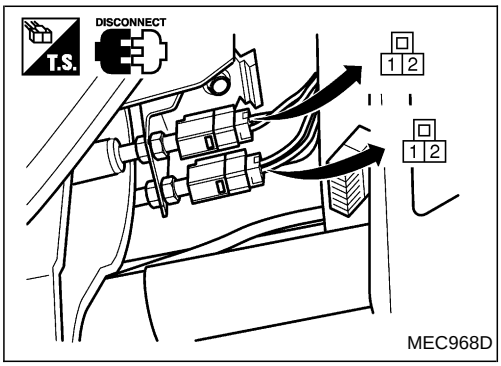
Disconnect and reconnect harness connectors in the circuit. Then retest.

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



Component Inspection

STOP LAMP SWITCH AND BRAKE SWITCH 2

1. Turn ignition switch to “LOCK” position.
2. Disconnect switch connectors.
3. Check continuity between terminals ① and ②.

Continuity:

Brake pedal	Stop lamp switch	Brake switch 2
Released	No	No
Depressed	Yes	Yes

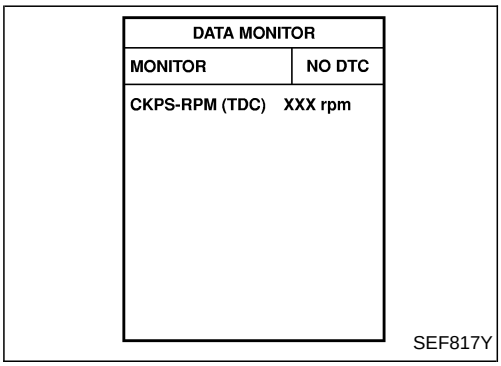
If NG, replace stop lamp switch or brake switch.

Component Description

Malfunction Indicator (MI) is located on the instrument panel. When the ignition switch is turned ON without engine running, MI will light up. This is a bulb check. When the engine is started, MI should go off. If MI remains on, the on board diagnostic system has detected an engine system malfunction.

On Board Diagnosis Logic

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0650 0907	Malfunction indicator (MI) control circuit	• An excessively high voltage is sent to ECM through the MI circuit under the condition that calls for MI light up. • An excessively low voltage is sent to ECM through the MI circuit under the condition that calls for MI not to light up.	• Harness or connectors (MI circuit is open or shorted.) • MI



DTC Confirmation Procedure

NOTE:
If "DTC Confirmation Procedure" has been previously conducted, always turn ignition switch "OFF" and wait at least 10 seconds before conducting the next test.

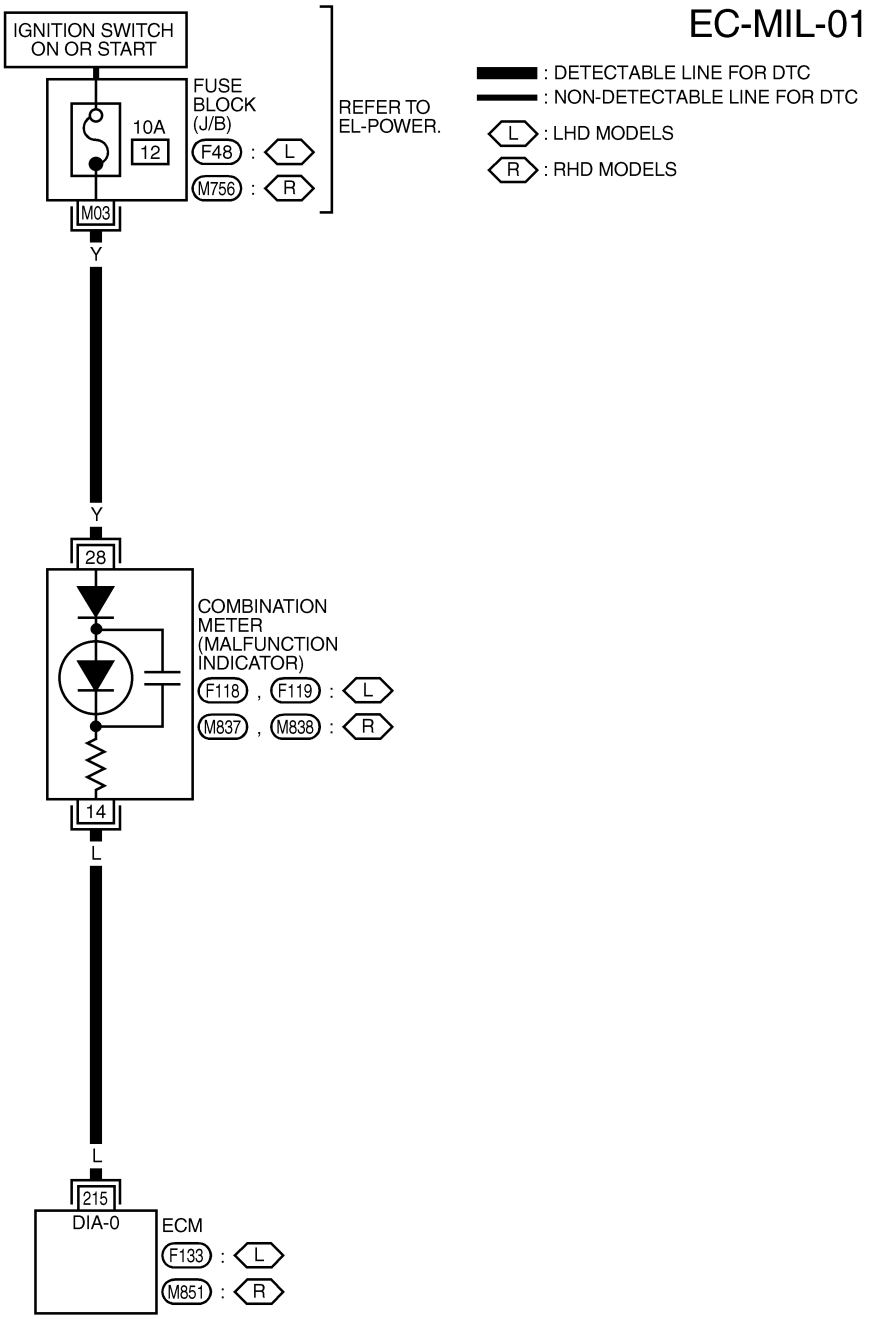
WITH CONSULT-II

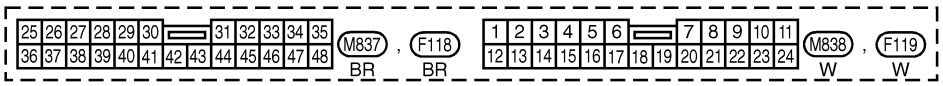
1. Turn ignition switch "ON".
2. Select "DATA MONITOR" mode with CONSULT-II.
3. Start engine and let it idle for 2 second.

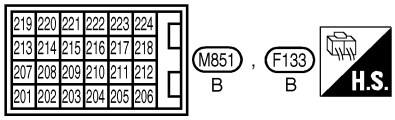
WITHOUT CONSULT-II

1. Turn ignition switch "ON".
2. Perform "Diagnostic Test Mode II" (Self-diagnostic results).
3. Start engine and let it idle for 2 second.
4. Perform "Diagnostic Test Mode II" (Self-diagnostic results).

Wiring Diagram



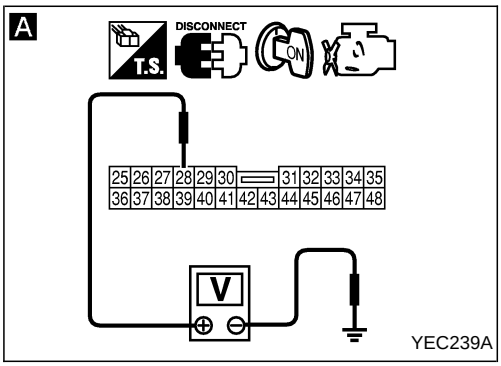


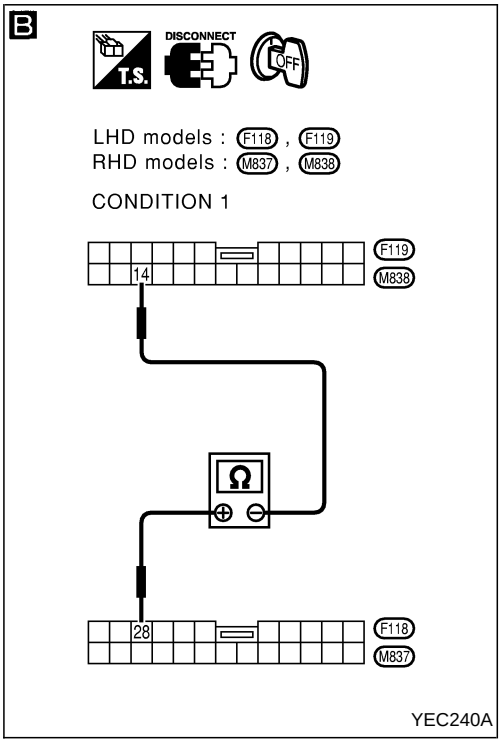


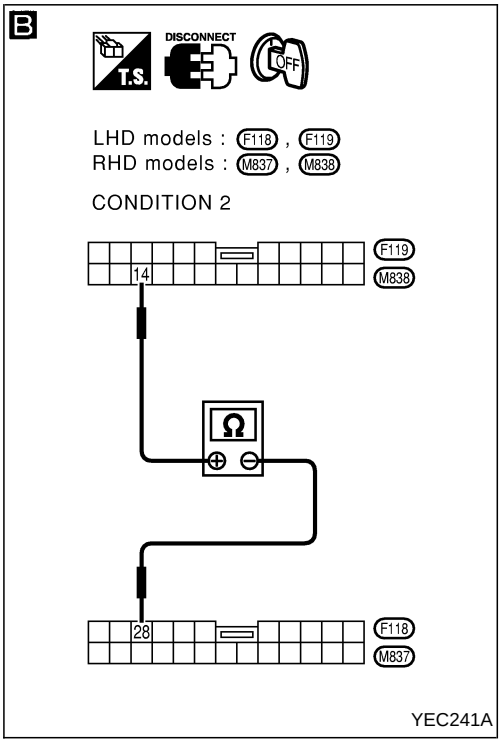
REFER TO THE FOLLOWING.
M756 , F48 -FUSE BLOCK-JUNCTION BOX (J/B)

YEC249A

Diagnostic Procedure







INSPECTION START

A

CHECK MI POWER SUPPLY.
1. Turn ignition switch “OFF”.
2. Disconnect combination meter harness connector.
3. Turn ignition switch “ON”.
4. Check voltage between combination meter terminal (28) and ground with CONSULT-II or tester.

Voltage: Battery voltage

NG → Check the following.
- Fuse block (J/B) connector F48 (LHD models) M756 (RHD models)
- 10A fuse
- Harness for open or short between fuse block (J/B) and combination meter

If NG, repair harness or connectors.

OK ↓

CHECK MI OUTPUT SIGNAL CIRCUIT FOR OPEN AND SHORT.
1. Turn ignition switch “OFF”.
2. Disconnect ECM harness connector.
3. Check harness continuity between ECM terminals 215 and combination meter terminal (14). Refer to Wiring Diagram.
4. Also check harness for short to ground and short to power.

Continuity should exist.

NG → Repair harness or connectors.

OK ↓

B

CHECK COMBINATION METER.
1. Turn ignition switch “OFF”.
2. Disconnect combination meter harness connector.
3. Check continuity under the following conditions.

CONDITION	Terminal No. (Polarity)	Continuity
1	(28) (+) - (14) (−)	Should not exist.
2	(28) (−) - (14) (+)	Should exist.

NG → Replace combination meter. Refer to EL section.

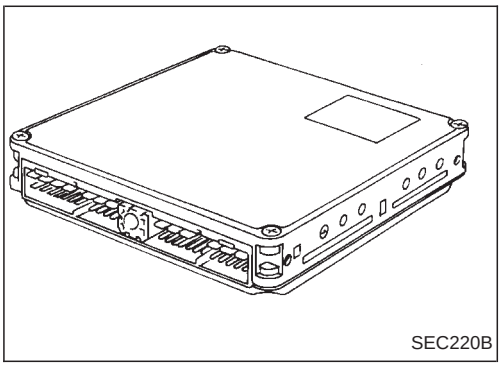
OK ↓

Disconnect and reconnect harness connectors in the circuits. 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

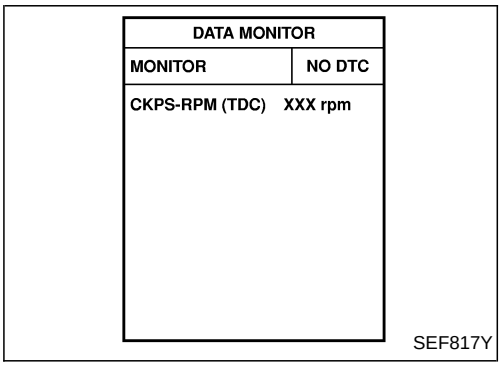

SEC220B

Description

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

On Board Diagnosis Logic

DTC	Malfunction is detected when ...	Check Items (Possible Cause)
P1107 0802	• An excessively high or low voltage from the absolute pressure sensor (built-into ECM) is sent to ECM.	• ECM



SEF817Y

DTC Confirmation Procedure

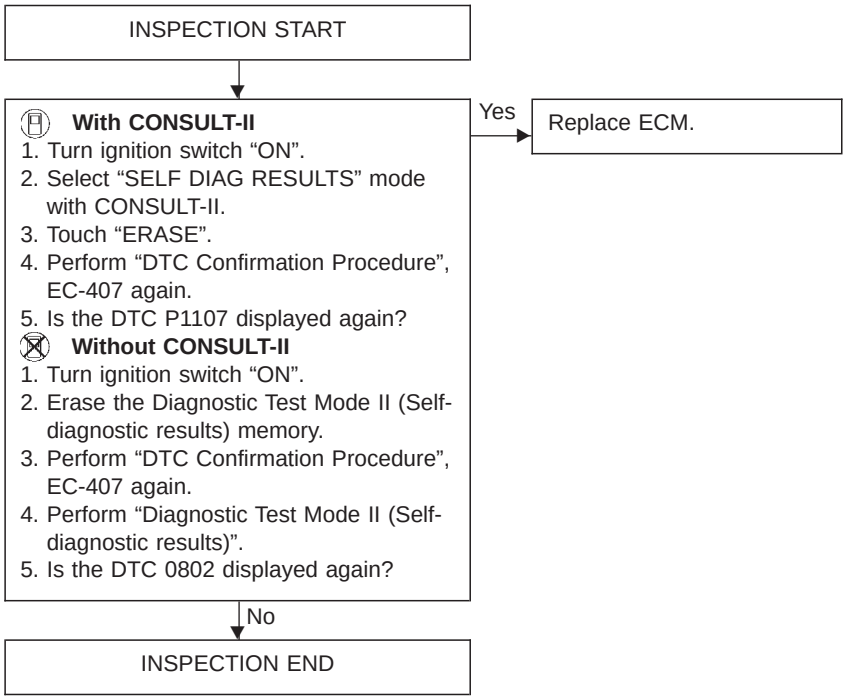
WITH CONSULT-II

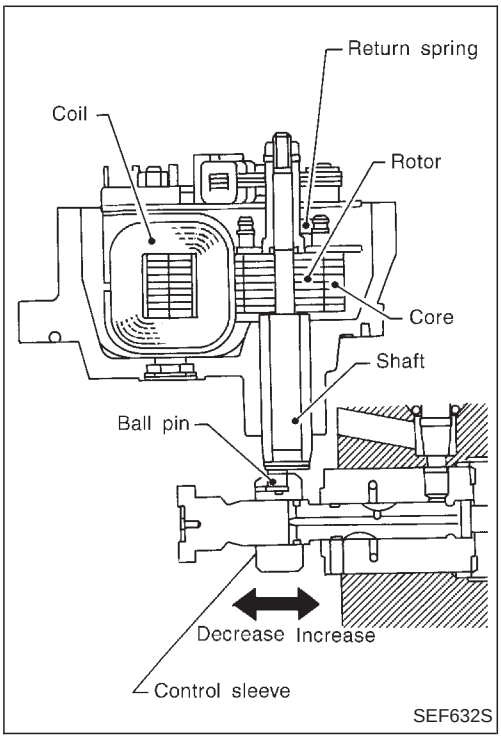
1) Turn ignition switch “ON”.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Start engine and wait at least 2 seconds.

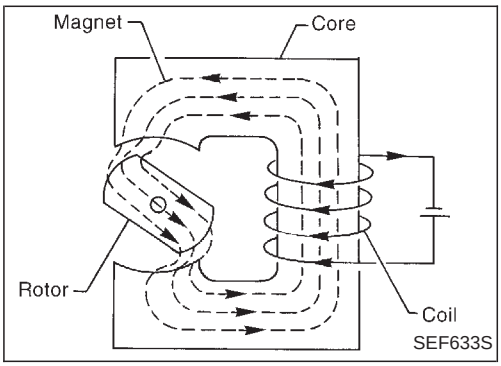
WITHOUT CONSULT-II

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

Diagnostic Procedure







Component Description

ELECTRIC GOVERNOR

The electric governor is built into the fuel injection pump. It moves the control sleeve to increase or decrease the amount of fuel injected.
When current flows through the coil, a magnetic force is produced, rotating the rotor. The rotor shaft is installed to the control sleeve via a ball pin which is eccentrically situated in relation to the rotor shaft. With this arrangement, the control sleeve can be moved in relation to rotor rotation.
The rotor's rotating angle is determined by a balanced condition of magnetic force (generated by current flow regulated by means of the ECM) and tension of return spring (installed to rotor). The larger the current flow through the coil, the greater the rotor's rotating angle. This means that the control sleeve moves to the right, increasing the amount of fuel injected.
The ECM regulates the current flow through the coil by changing the duty cycle ratio which controls the ON-OFF operation of the electric governor grounding circuit.

On Board Diagnosis Logic

DTC	Malfunction is detected when	Check Items (Possible cause)
P1206 0108	• Fuel injection feedback system does not operate properly. [This system consists essentially of ECM, electric governor and control sleeve position sensor.]	• Main power supply circuit • Harness or connectors (Electric governor and control sleeve position sensor circuit) • Electric governor • ECM

DTC Confirmation Procedure

WITH CONSULT-II

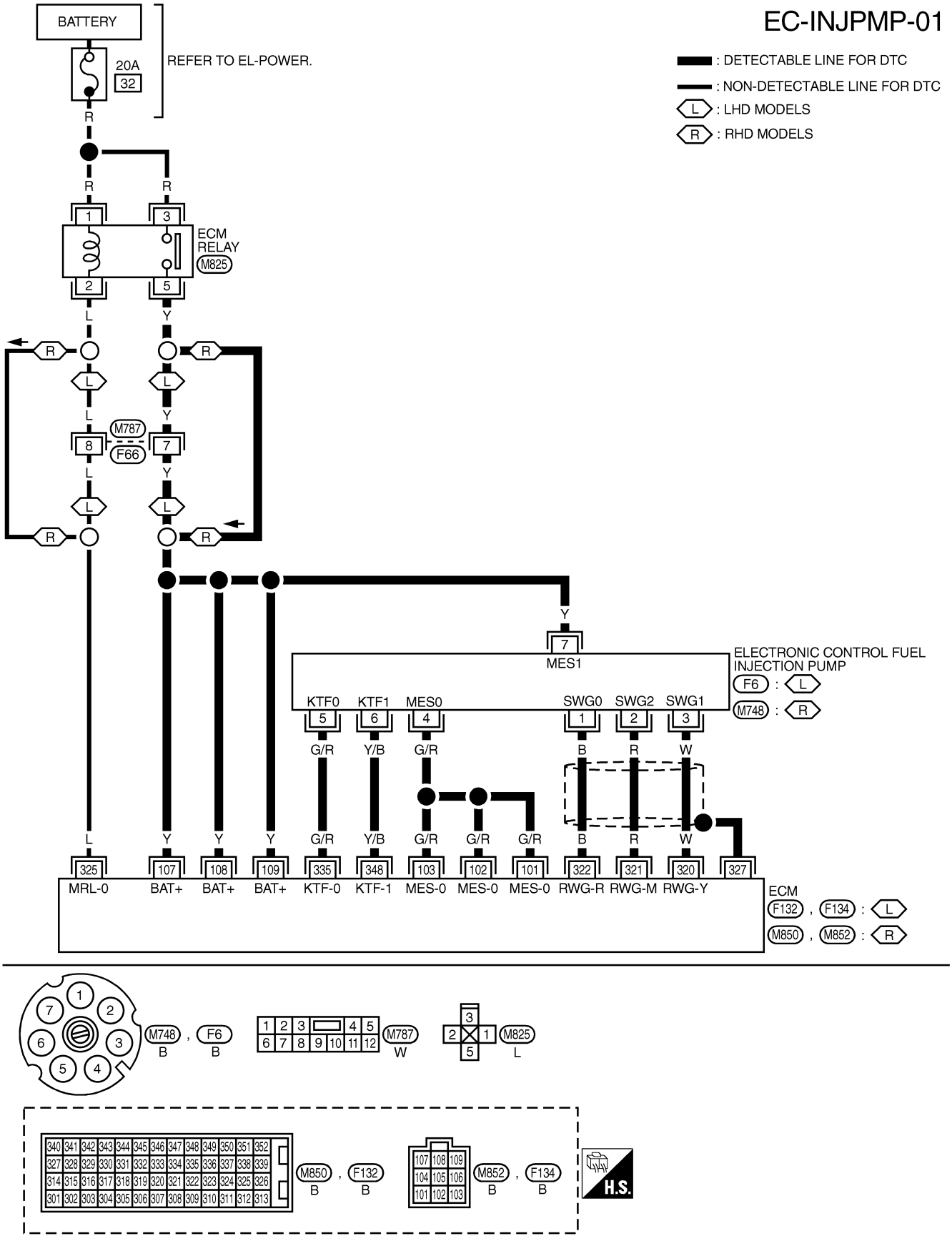
1) Turn ignition switch to “ON” position and select “DATA MONITOR” mode with CONSULT-II.
2) Start engine above 1,200 rpm.
3) Run it for 2 seconds above 1,200 rpm. Return engine speed to idle.

WITHOUT CONSULT-II

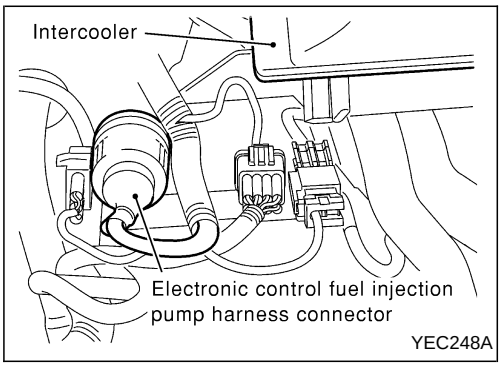
1) Start engine above 1,200 rpm.
2) Run engine for 2 seconds above 1,200 rpm. Return engine speed to idle.
3) Turn ignition switch to “LOCK” position, wait at least 5 seconds and then turn to “ON” position.
4) Perform “Diagnostic Test Mode II” (Self-diagnostic results).

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

Wiring Diagram



YEC149A



Diagnostic Procedure

INSPECTION START

CHECK MAIN POWER SUPPLY.
Refer to EC-352.

CHECK POWER SUPPLY CIRCUIT.
1. Turn ignition switch to “LOCK” position.
2. Disconnect ECM harness connector and electronic injection pump harness connector.
3. Check harness continuity between injection pump connector terminal ⑦ and ECM connector terminals (107), (108), (109). Refer to wiring diagram.
Continuity should exist.
4. Check harness continuity between injection pump connector terminal ⑦ and ECM relay terminal ⑤.
Refer to wiring diagram.
Continuity should exist.
If OK, check harness for short-circuit.

NG → Check the following.
- Harness connector (M787), (F66) (LHD models)
- Harness for open or short between electronic control injection pump and ECM relay
- Harness for open or short between electronic control injection pump and ECM

If NG, repair harness or connectors.

OK ↓

CHECK GROUND CIRCUIT.
Check harness continuity between injection pump connector terminal ④ and ECM connector terminals (101), (102), (103).
Refer to wiring diagram.
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.

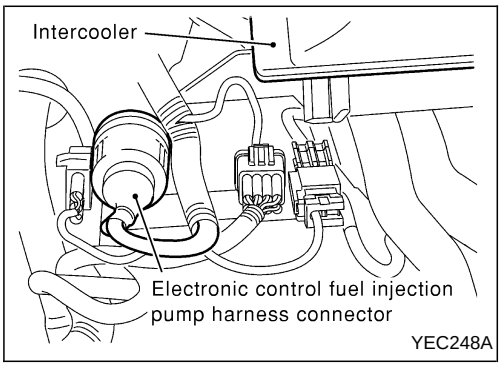
OK ↓

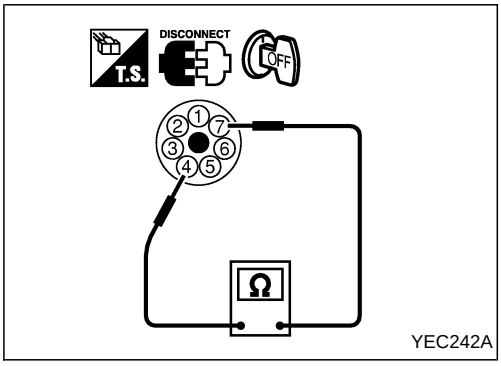
Disconnect and reconnect harness connectors in the circuit. Then retest.

Trouble is not fixed. ↓

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

INSPECTION END

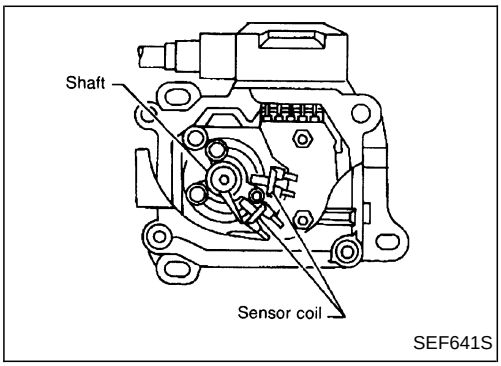




Component Inspection

ELECTRIC GOVERNOR

1. Disconnect electronic injection pump harness connector.
2. Check continuity between injection pump connector terminals ④ and ⑦.
   Resistance: Approximately 1.0Ω [at 25°C (77°F)]
   If NG, replace.



Component Description

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.

On Board Diagnosis Logic

DTC	Malfunction is detected when	Check Items (Possible cause)
P1207 0105	● An excessively high or low voltage from the sensor is detected by ECM. ..... ● An improper voltage signal from the sensor is detected by ECM during engine running.	● Harness or connectors (The control sleeve position sensor circuit is open or short-circuited.) ● Control sleeve position sensor

DTC Confirmation Procedure

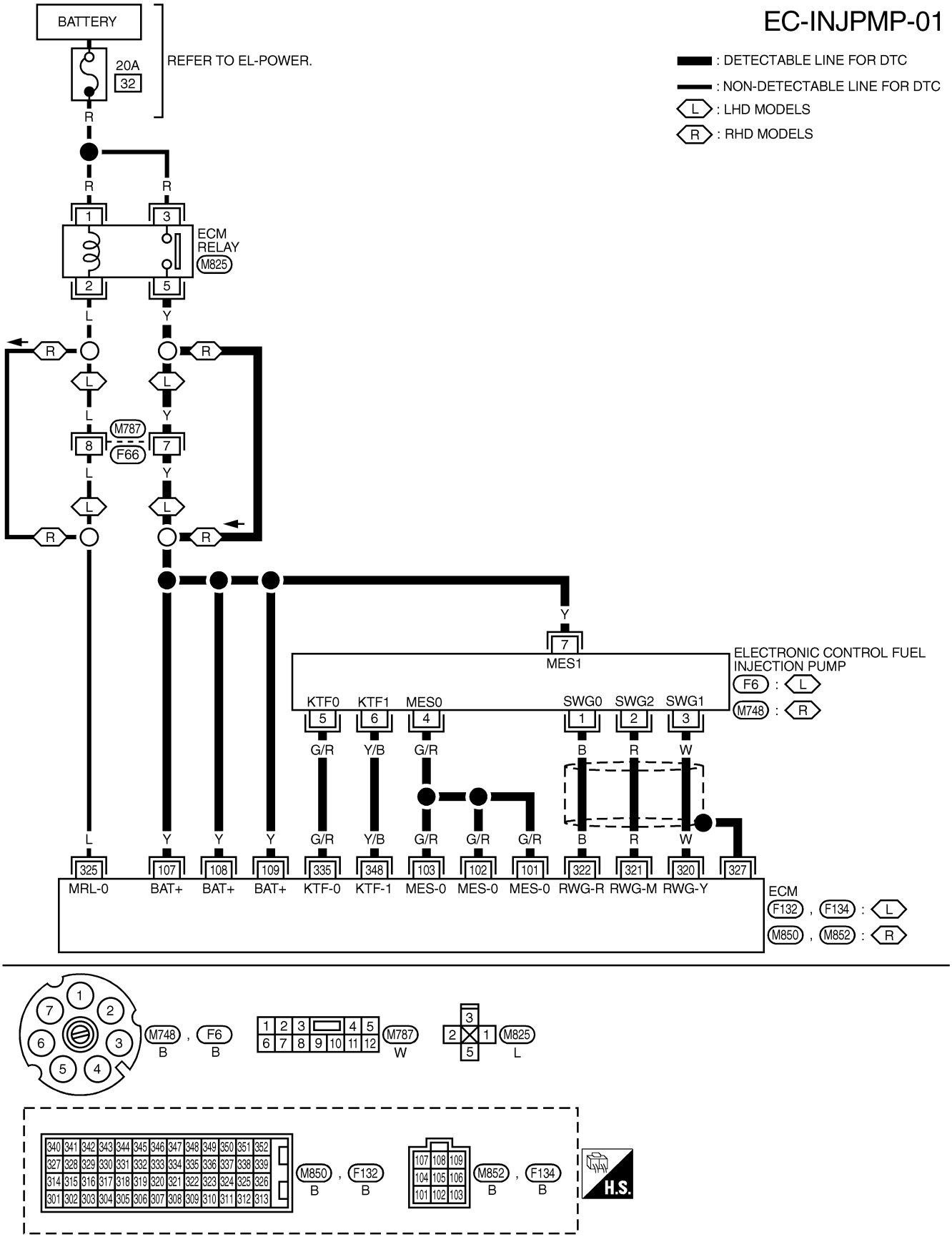
WITH CONSULT-II

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

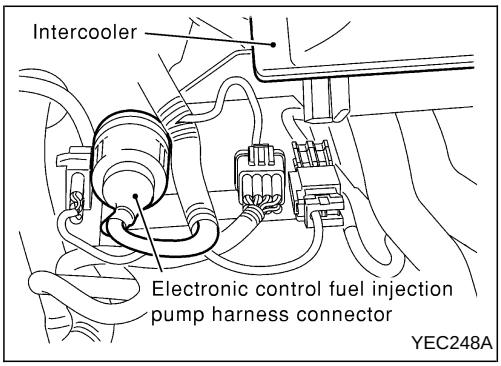
WITHOUT CONSULT-II

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 to “ON” position.
3) Perform “Diagnostic Test Mode II (Self-diagnostic results)”.

Wiring Diagram



YEC149A



Diagnostic Procedure

INSPECTION START

CHECK POWER SUPPLY CIRCUIT.
1. Turn ignition switch to “LOCK” position.
2. Disconnect ECM harness connector and electrical fuel injection pump harness connector.
3. Check harness continuity between electrical fuel injection pump terminal ② and ECM connector terminals (321). Refer to wiring diagram.
Continuity should exist.
If OK, check harness for short-circuit.

NG → Check the following:
- Harness for open or short-circuit between ECM and control sleeve position sensor.

If NG, repair harness or connectors.

OK

CHECK INPUT SIGNAL CIRCUIT.
1. Turn ignition switch to “LOCK” position.
2. Check harness continuity between control sleeve position sensor connector terminal ③ and ECM connector terminals (320). Refer to wiring diagram.
Continuity should exist.
If OK, check harness for short-circuit.

NG → Check the following:
- Harness for open or short-circuit between ECM and control sleeve position sensor.

If NG, repair harness or connectors.

OK

CHECK GROUND CIRCUIT-I.
Check harness continuity between electrical fuel injection pump connector terminals ① and ECM connector terminals (322). Refer to wiring diagram.
Continuity should exist.
If OK, check harness for short-circuit.

NG → Check the following:
- Harness for open or short-circuit between ECM and control sleeve position sensor.

If NG, repair harness or connectors.

OK

CHECK GROUND CIRCUIT-II.
Check harness continuity between ECM connector terminal (327) and engine ground. Refer to wiring diagram.
Continuity should exist.
If OK, check harness for short-circuit.

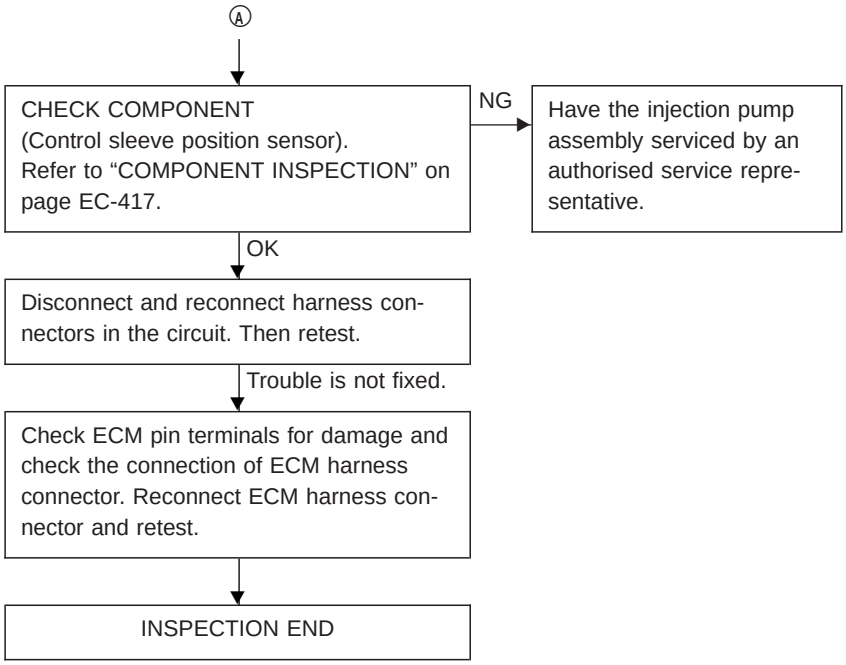
NG → Check the following:
- Harness for open or short-circuit.

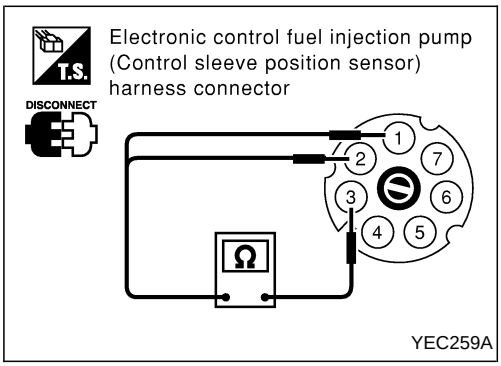
If NG, repair harness or connectors.

OK

Ⓐ

Diagnostic Procedure (Cont'd)





Component Inspection

CONTROL SLEEVE POSITION SENSOR

1. Disconnect control sleeve position sensor & electric governor harness connector.
2. Check continuity between terminals ① and ③, ② and ③.
   Resistance: Approximately 6.1Ω [at 25°C (77°F)]
   If NG, take proper action.

Description

SYSTEM DESCRIPTION

Sensor	Input signal to ECM	ECM function	Actuator
Engine coolant temperature sensor	Engine coolant temperature	Cooling fan control	Cooling fan relay
Air conditioner switch	Air conditioner “ON” signal		

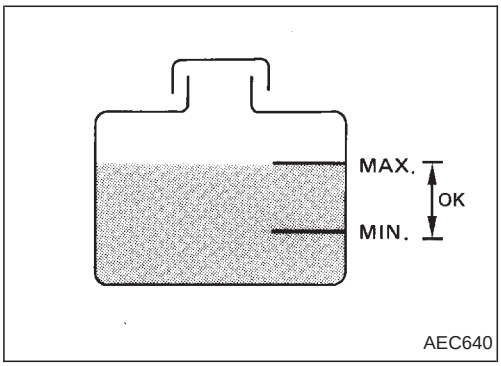
The ECM controls the cooling fan corresponding to the vehicle speed, engine coolant temperature, air conditioner ON signal.

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.

DTC	Malfunction is detected when ...	Check Items (Possible Cause)
P1217 0208	• 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.	• Harness or connectors (The cooling fan circuit is open or shorted.) • Cooling fan • Radiator hose • Radiator • Radiator cap • Water pump • Thermostat • Engine coolant temperature sensor For more information, refer to “MAIN 12 CAUSES OF OVERHEATING”, EC-425.

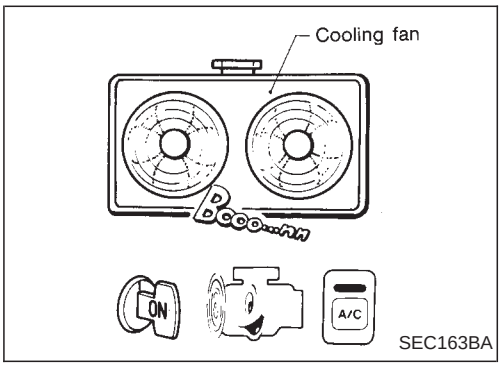
CAUTION:
When a malfunction is indicated, be sure to replace the coolant following the procedure in the LC section, “Changing Engine Coolant”. Also, replace the engine oil.
1) Fill radiator with coolant up to specified level with a filling speed of 2 liters per minute. Be sure to use coolant with the proper mixture ratio. Refer to MA section, “Engine Coolant Mixture Ratio”.
2) After refilling coolant, run engine to ensure that no water-flow noise is emitted.



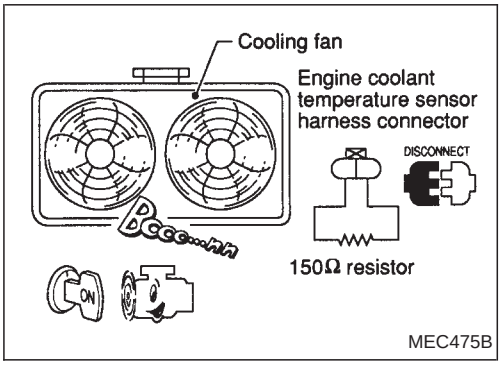
AEC640

ACTIVE TEST	
COOLING FAN	OFF
MONITOR	
COOLAN TEMP/S	XXX °C

SEF111X



SEC163BA



MEC475B

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.

WITH CONSULT-II

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-421.
2) Confirm whether customer filled the coolant or not. If customer filled the coolant, skip the following steps and go to “Diagnostic Procedure”, EC-421.
3) Turn ignition switch “ON”.
4) Perform “COOLING FAN” in “ACTIVE TEST” mode with CONSULT-II and make sure that cooling fans operate.
   If NG, go to “Diagnostic Procedure”, EC-421.

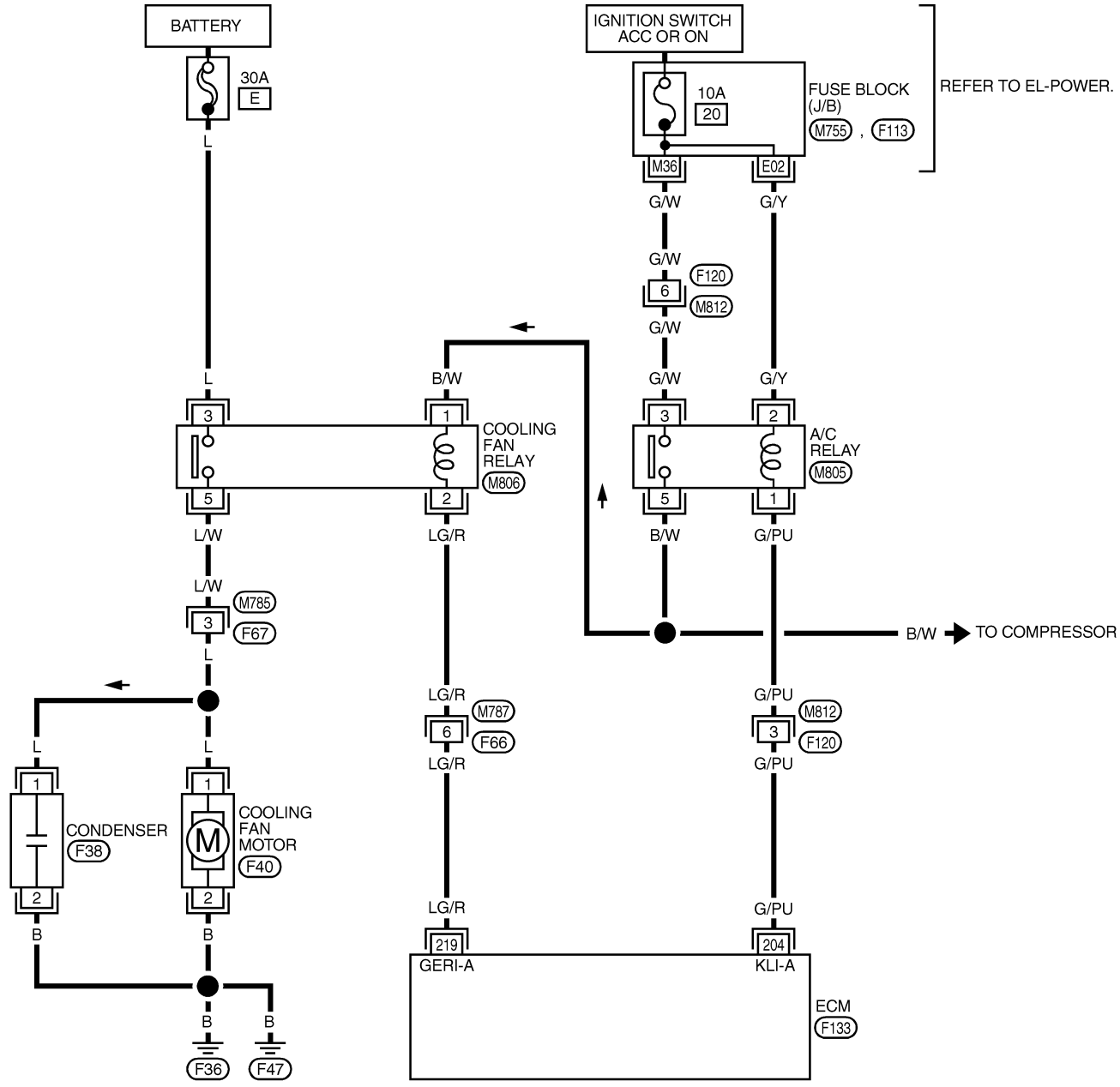
WITHOUT CONSULT-II

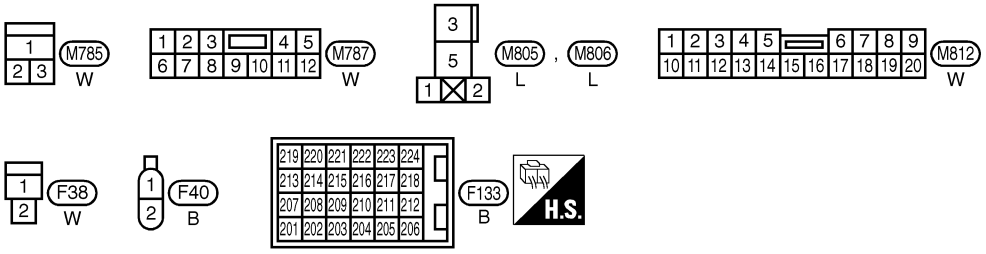
1) Check the coolant level in the reservoir tank and radiator.
   Allow engine to cool before checking coolant level.
   If the coolant level in the reservoir tank and/or radiator is below the proper range, skip the following steps and go to “Diagnostic Procedure”, EC-421.
2) Confirm whether customer filled the coolant or not. If customer filled the coolant, skip the following steps and go to “Diagnostic Procedure”, EC-421.
3) Start engine.
   Be careful not to overheat engine.
4) Set temperature control lever to full cold position.
5) Turn air conditioner switch “ON”.
6) Turn blower fan switch “ON”.
7) Run engine at idle for a few minutes with air conditioner operating.
   Be careful not to overheat engine.
8) Make sure that cooling fans operate at low speed.
9) Turn ignition switch “OFF”.
10) Turn air conditioner switch and blower fan switch “OFF”.
11) Disconnect engine coolant temperature sensor harness connector.
12) Connect 150Ω resistor to engine coolant temperature sensor harness connector.
13) Start engine and make sure that cooling fans operate at higher speed than low speed.
    Be careful not to overheat engine.
14) If NG, go to “Diagnostic Procedure”, EC-421.

Wiring Diagram

LHD MODELS

EC-COOL/F-01





REFER TO THE FOLLOWING.
M755 , F113 -FUSE BLOCK-
JUNCTION BOX (J/B)

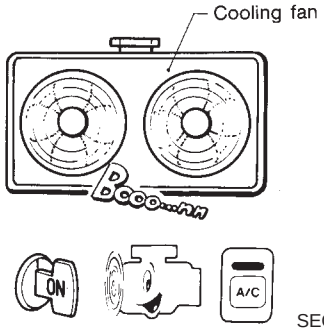
YEC163A

A

ACTIVE TEST	
COOLING FAN	OFF
MONITOR	
COOLAN TEMP/S	XXX °C

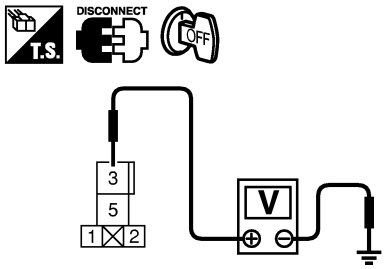
SEF646X

A



SEC163BA

B



MEC940D

Diagnostic Procedure

INSPECTION START

A

CHECK OVERALL FUNCTION.

With CONSULT-II

1. Turn ignition switch “ON”.
2. Perform “COOLING FAN” in “ACTIVE TEST” mode with CONSULT-II.
3. Make sure that cooling fan operate.

Without CONSULT-II

1. Start engine and let it idle.
2. Set temperature lever at full cold position.
3. Turn air conditioner switch “ON”.
4. Turn blower fan switch “ON”.
5. Make sure that cooling fan operate.

OK → Go to “Ⓒ”, EC-424.

NG ↓

B

CHECK COOLING FAN RELAY POWER SUPPLY CIRCUIT.

1. Turn ignition switch “OFF”.
2. Disconnect cooling fan relay.
3. Check voltage between cooling fan relay terminal ③ and ground with CONSULT-II or tester.

Voltage: Battery voltage

NG → Check the following.
- 30A fuse
- Harness for open or short between cooling fan relay and battery

If NG, repair or replace harness or fuse.

OK ↓

CHECK COOLING FAN MOTOR AND CONDENSER CIRCUIT.

1. Disconnect cooling fan relay harness connector, cooling fan motor harness connector and condenser harness connector.
2. Check continuity as follows. Refer to wiring diagram.

Cooling fan relay terminal ⑤ and cooling fan motor terminal ①	Continuity should exist.
Cooling fan relay terminal ⑤ and condenser terminal ①	

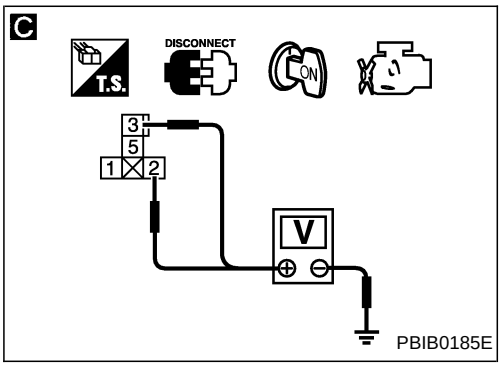
NG → Check the following.
- Harness connectors M785, F67
- Harness for open or short between cooling fan relay and cooling fan motor
- Harness for open or short between cooling fan relay and condenser

If NG, repair harness or connectors.

OK ↓

Ⓐ

Diagnostic Procedure (Cont'd)



Ⓐ

CHECK COOLING FAN MOTOR AND CONDENSER GROUND CIRCUIT.
1. Check continuity between cooling fan motor terminal ② and ground. Refer to wiring diagram.
   Continuity should exist.
2. Check continuity between condenser terminal ② and ground. Refer to wiring diagram.
   Continuity should exist.

If OK, reconnect harness connectors.

NG → Repair harness or connectors.

OK ↓

CHECK COMPONENT
(Cooling fan relay).
Refer to "COMPONENT INSPECTION" on page EC-426.

OK ↓

C

CHECK A/C RELAY POWER SUPPLY CIRCUIT.
1. Disconnect A/C relay.
2. Check voltage between A/C relay terminal ② , ③ and ground.
   Voltage: Battery voltage

NG → Check the following.
- Harness connectors F120, M812
- 10A fuse
- Harness for open or short between A/C relay and fuse

If NG, repair or replace harness or fuse.

OK ↓

CHECK A/C RELAY AND COOLING FAN RELAY CIRCUIT.
1. Disconnect A/C relay and cooling fan relay.
2. Check continuity between A/C relay terminal ⑤ and cooling fan relay terminal ① . Refer to wiring diagram.
   Continuity should exist.

NG → Repair harness or connectors.

OK ↓

CHECK ECM INPUT SIGNAL CIRCUIT.
1. Disconnect ECM harness connector.
2. Check continuity as follows. Refer to wiring diagram.

ECM terminal 204 and A/C relay terminal ①	Continuity should exist.
ECM terminal 219 and cooling fan relay terminal ②	

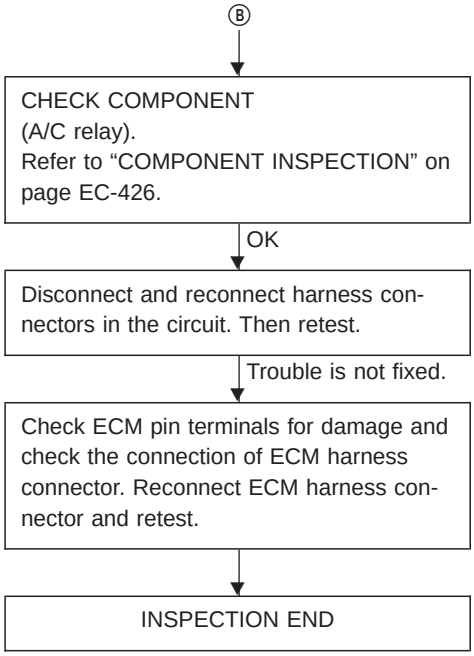
NG → Check the following.
- Harness connectors M812, F120
- Harness connectors M787, F66
- Harness for open or short between A/C relay and ECM
- Harness for open or short between cooling fan relay and ECM

If NG, repair harness or connectors.

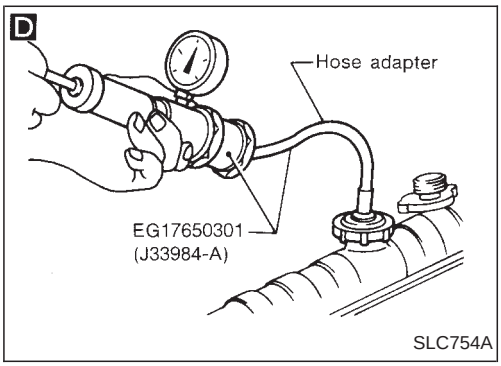
OK ↓

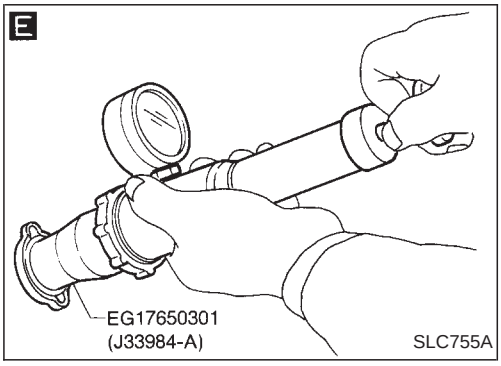
Ⓑ

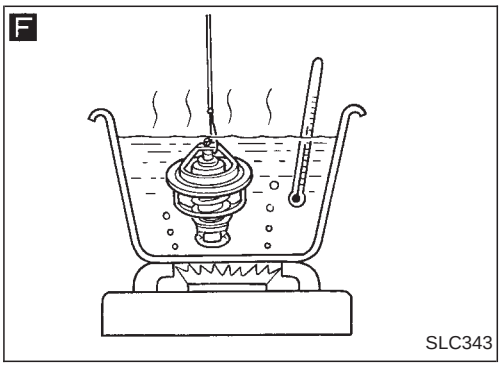
Diagnostic Procedure (Cont'd)



Diagnostic Procedure (Cont'd)







Ⓒ

D

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/cm^2, 23 psi)
Pressure should not drop.
CAUTION:
Higher than the specified pressure may cause radiator damage.

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

Refer to LC section ("Water Pump").

OK ↓

E

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

NG → Replace radiator cap.

OK ↓

F

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

For details, refer to LC section ("Thermostat").

NG → Replace thermostat

OK ↓

Check engine coolant temperature sensor. Refer to "COMPONENT INSPECTION", EC-426.

NG → Replace engine coolant temperature sensor.

OK ↓

If the cause can not be isolated, go to "MAIN 12 CAUSES OF OVERHEATING" on EC-425.

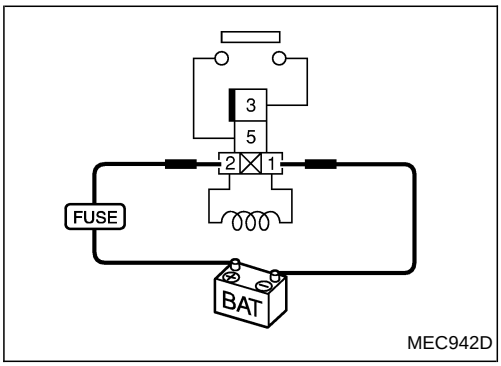
↓

INSPECTION END

Main 12 Causes of Overheating

Engine	Step	Inspection item	Equipment	Condition	Reference page
OFF	1	• Blocked radiator • Blocked radiator grille • Blocked bumper	• Visual	No blocking	—
	2	• Coolant mixture	• Coolant tester	50 - 50% coolant mixture	See MA section, “RECOMMENDED FLUIDS AND LUBRICANTS”.
	3	• Coolant level	• Visual	Coolant up to MAX level in reservoir tank and radiator filler neck	See LC section, “Changing Engine Coolant”.
	4	• Radiator cap	• Pressure tester	78 - 98 kPa (0.78 - 0.98 bar, 0.8 - 1.0 kg/cm^2, 11 - 14 psi)	See LC section, “System Check”.
ON*2	5	• Coolant leaks	• Visual	No leaks	See LC section, “System Check”.
ON*2	6	• Thermostat	• Touch the upper and lower radiator hoses	Both hoses should be hot	See LC section, “Thermostat” and “Radiator”.
ON*1	7	• Cooling fan	• CONSULT-II	Operating	See Trouble Diagnosis for DTC P1217, EC-418.
OFF	8	• Combustion gas leak	• Color checker chemical tester 4 Gas analyzer	Negative	—
ON*3	9	• Coolant temperature gauge	• Visual	Gauge less than 3/4 when driving	—
		• Coolant overflow to reservoir tank	• Visual	No overflow during driving and idling	See LC section, “Changing Engine Coolant”.
OFF*4	10	• Coolant return from reservoir tank to radiator	• Visual	Should be initial level in reservoir tank	See LC section, “REFILLING ENGINE COOLANT”.
OFF	11	• Cylinder head	• Straight gauge feeler gauge	0.1 mm (0.004 in) Maximum distortion (warping)	See EM section, “Inspection”.
	12	• Cylinder block and pistons	• Visual	No scuffing on cylinder walls or piston	See EM section, “Inspection”.

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



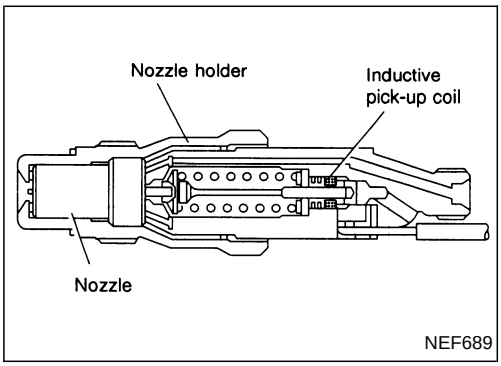
Component Inspection

COOLING FAN RELAY AND A/C RELAY

1. Turn ignition switch OFF.
2. Disconnect cooling fan relay and A/C relay.
3. Check continuity between each relay terminal ③ and ⑤ under the following conditions.

Apply 12V direct current between relay terminals ① and ② .	Continuity should exist.
No voltage applied.	Continuity should not exist.

4. If NG, replace cooling fan relay or/and A/C relay(s).



Component Description

NEEDLE LIFT SENSOR (NLS)

The needle lift sensor is built into the No. 1 nozzle. Its inductive pickup element senses fuel injection timing. It is sent as a pulse signal to the ECM for feed-back the actual fuel injection timing and calculating the secondary engine speed.

On Board Diagnosis Logic

DTC	Malfunction is detected when	Check Items (Possible Cause)
P1240 0304	● An incorrect signal from the sensor is sent to ECM.	● Harness or connectors (The sensor circuit is open or short-circuited.) ● Needle lift sensor
P1242 0906		

DTC Confirmation Procedure

NOTE:
Before DTC confirmation, be sure to check battery voltage is above 9V.

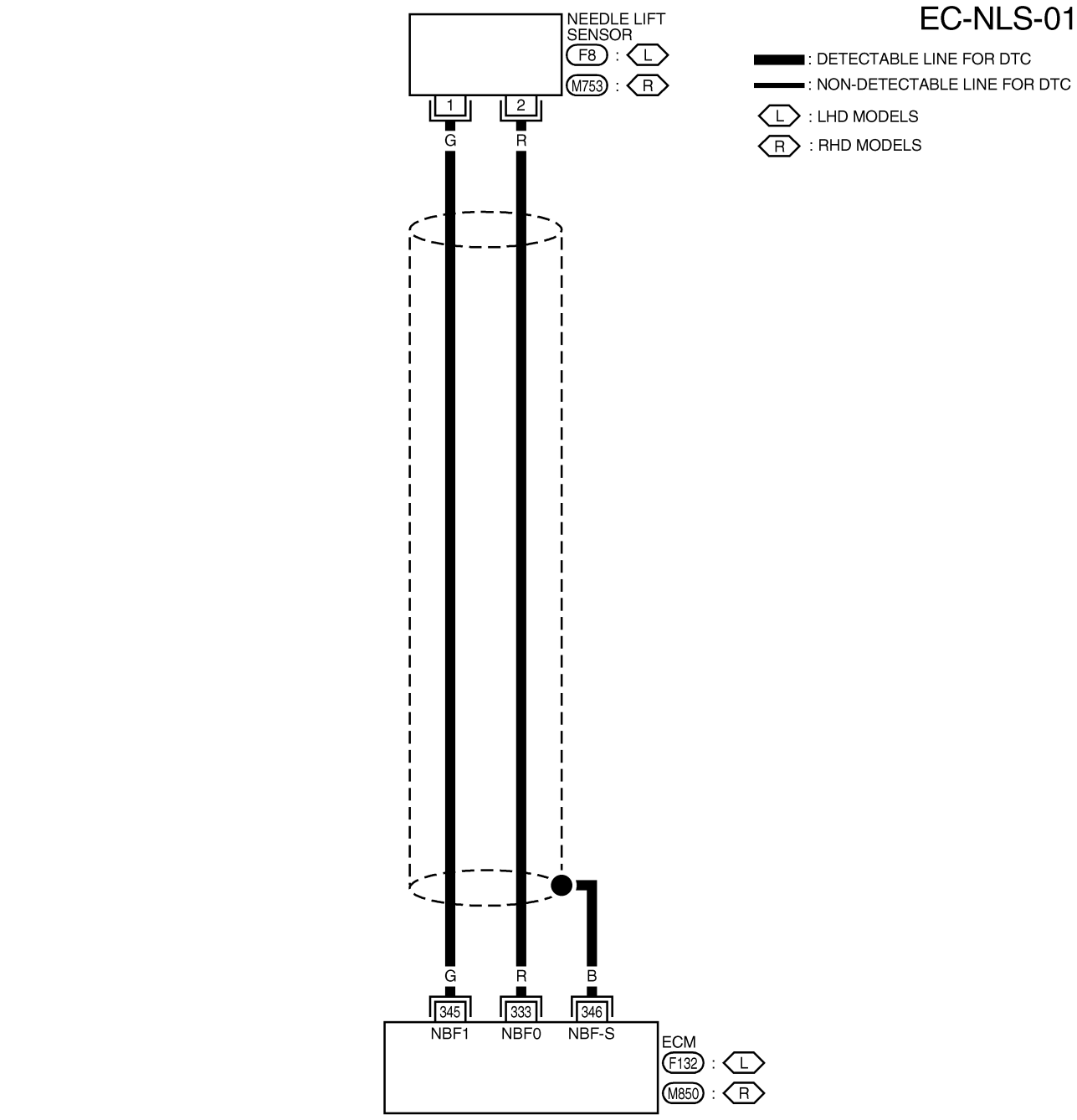
WITH CONSULT-II

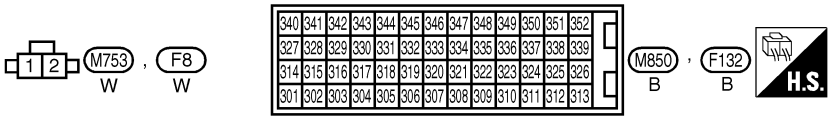
1) Turn ignition switch to “ON” position and select “DATA MONITOR” mode with CONSULT-II.
2) Start engine.
3) Run it for 2 seconds at above 1,200 rpm.

WITHOUT CONSULT-II

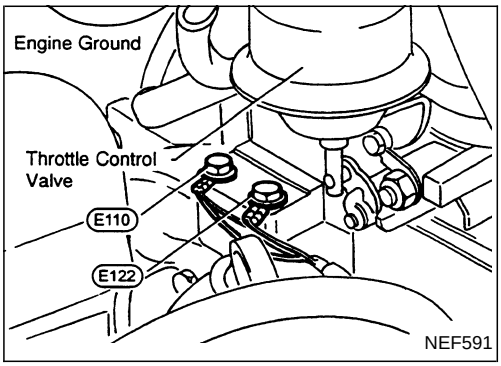
1) Start engine.
2) Run it for 2 seconds at above 1,200 rpm.
3) Turn ignition switch to “LOCK” position, wait at least 5 seconds and then turn to “ON” position.
4) Perform “Diagnostic Test Mode II” (Self-diagnostic results).

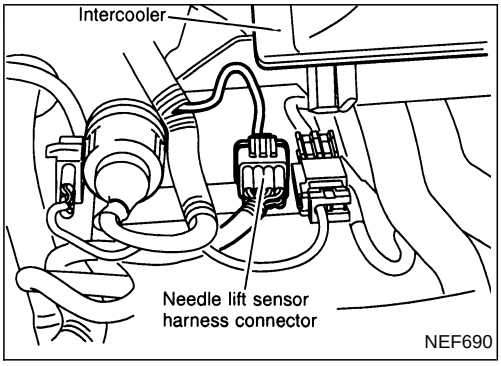
Wiring Diagram

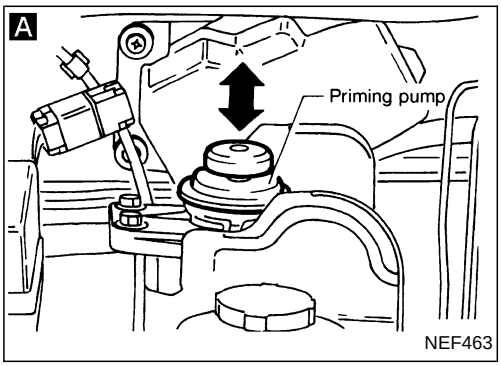




YEC157A







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”.

CHECK INPUT SIGNAL CIRCUIT.
1. Turn ignition switch to “LOCK” position.
2. Disconnect ECM harness connector and needle lift sensor harness connector.
3. Check harness continuity between needle lift sensor connector terminal ① and ECM connector terminal (345). Refer to wiring diagram.
Continuity should exist.
If OK, check harness for short-circuit.

NG → Check the following:
- Harness for open circuit between needle lift sensor and ECM

If NG, repair harness or connectors.

OK

CHECK GROUND CIRCUIT-I.
Check harness continuity between needle lift sensor connector terminals ② and ECM connector terminals (333). Refer to wiring diagram.
Continuity should exist.
If OK, check harness for short-circuit.

NG → Check the following:
- Harness for open or short-circuit between ECM and needle lift sensor.

If NG, repair harness or connectors.

OK

CHECK GROUND CIRCUIT-II.
Check resistance between ECM connector terminal (346) and engine ground. Refer to wiring diagram.
Continuity should exist.
If OK, check harness for short-circuit.

NG → Check the following:
- Harness for open-circuit between ECM and engine ground

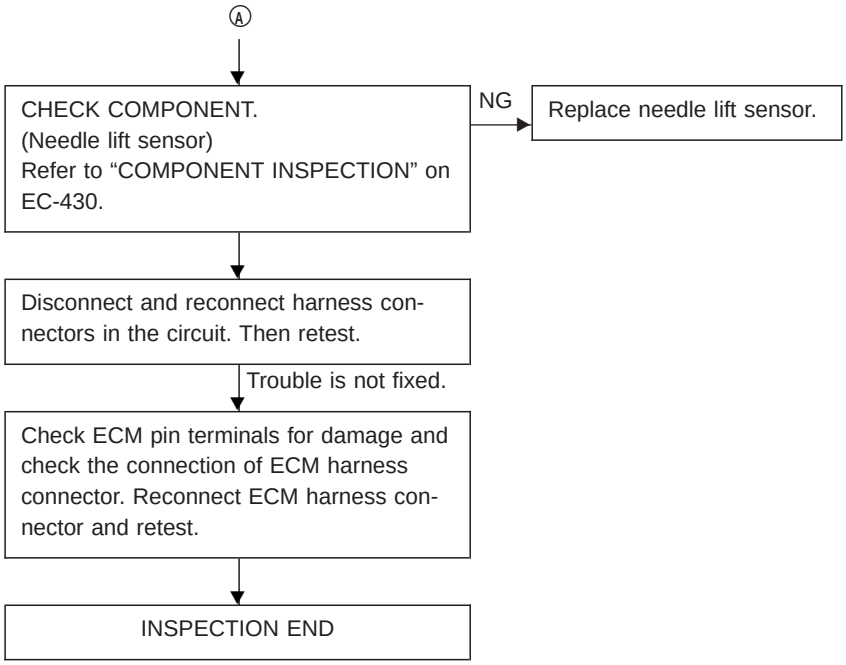
If NG, repair harness or connectors.

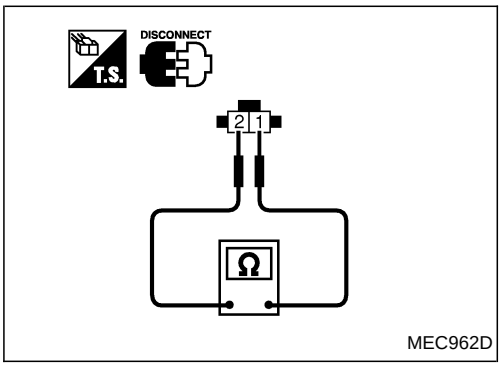
OK

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

Ⓐ

Diagnostic Procedure (Cont'd)





Component Inspection

NEEDLE LIFT SENSOR

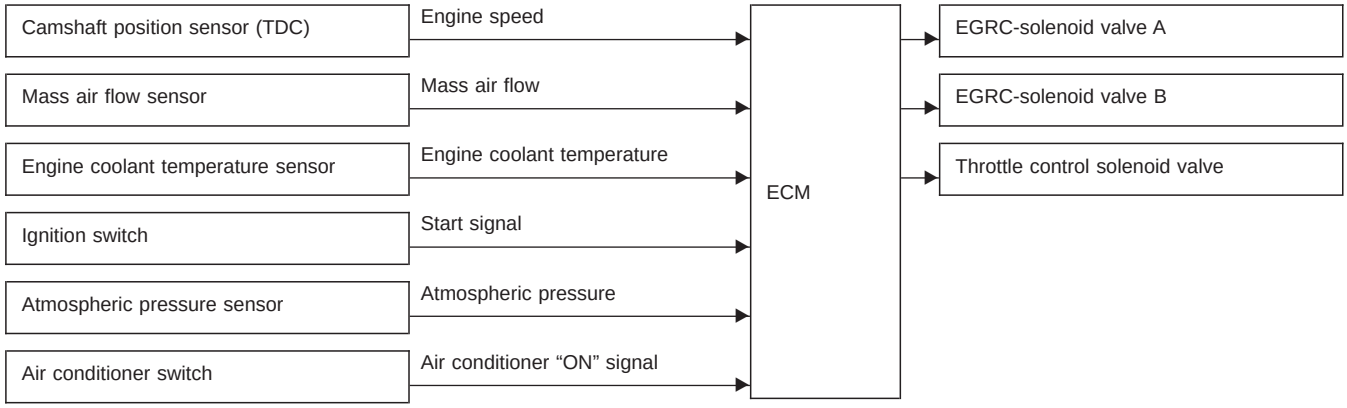
1. Disconnect needle lift sensor harness connector.
2. Check continuity between needle lift sensor terminals ① and ② .

   Resistance: Approximately 105Ω [at 25°C (77°F)]

   If NG, replace needle lift sensor with injection nozzle holder.

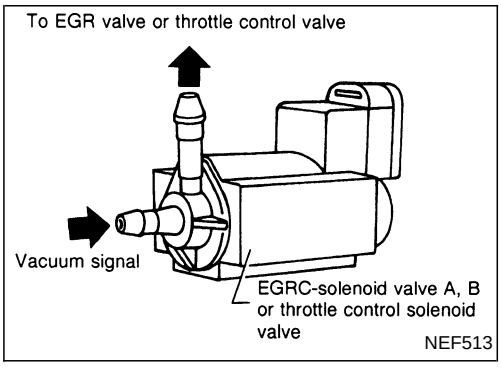
System Description

EGR CONTROL



The ECM receives signals sent from the engine coolant temperature sensor, crankshaft position sensor (TDC), ignition switch etc. to determine engine speed and operating conditions. Based on these signals, the ECM controls EGRC-solenoid valve (A and B) operation and throttle solenoid valve operation.
The EGR control stops when engine coolant temperature is below 45°C (113°F), at idling, at starting and when the system components and engine speed signals are disordered.

Engine coolant temperature °C (°F)	Load	EGRC-solenoid valve		Throttle control solenoid valve	EGR valve	Throttle control valve	Amount of EGR gas
		A	B				
Below 45 (113)	Any	OFF (Closed)	OFF (Closed)	OFF (Closed)	Fully closed	Fully open	—
Above 45 (113)	Low load	ON (Open)	ON (Open)	ON (Open)	Fully open	Closed	Large
	Medium load-1	ON (Open)	ON (Open)	OFF (Closed)	Fully open	Fully open	Medium
	Medium load-2	ON (Open)	OFF (Closed)	OFF (Closed)	Half open	Fully open	Small
	High load	OFF (Closed)	OFF (Closed)	OFF (Closed)	Fully closed	Fully open	—



Component Description

The EGRC-solenoid valves A and B, control vacuum pressure acting on the EGR valve. The EGR control valve will be fully opened, half-opened or fully closed, as required.
The throttle control solenoid valve controls vacuum pressure acting on the throttle control valve. Thus, intake air passages are opened or closed in relation to exhaust gas and intake air. Utilizing the relationship between exhaust gas pressure and intake air pressure control, the amount of EGR (exhaust gas recirculated) is regulated in three approximate measures — large, medium, small.

On Board Diagnosis Logic

DTC	Malfunction is detected when	Check Items (Possible cause)
P1404 0806	• EGRC-solenoid valve A circuit is open or shorted.	• Harness or connectors (EGRC-solenoid valve A circuit is open or shorted.) • EGRC-solenoid valve A
P1405 0808	• EGRC-solenoid valve B circuit is open or shorted.	• Harness or connectors (EGRC-solenoid valve B circuit is open or shorted.) • EGRC-solenoid valve B
P1407 0808	• Throttle control solenoid valve circuit is open or shorted.	• Harness or connectors (Throttle control solenoid valve circuit is open or shorted.) • Throttle control solenoid valve

DTC Confirmation Procedure

WITH CONSULT-II

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

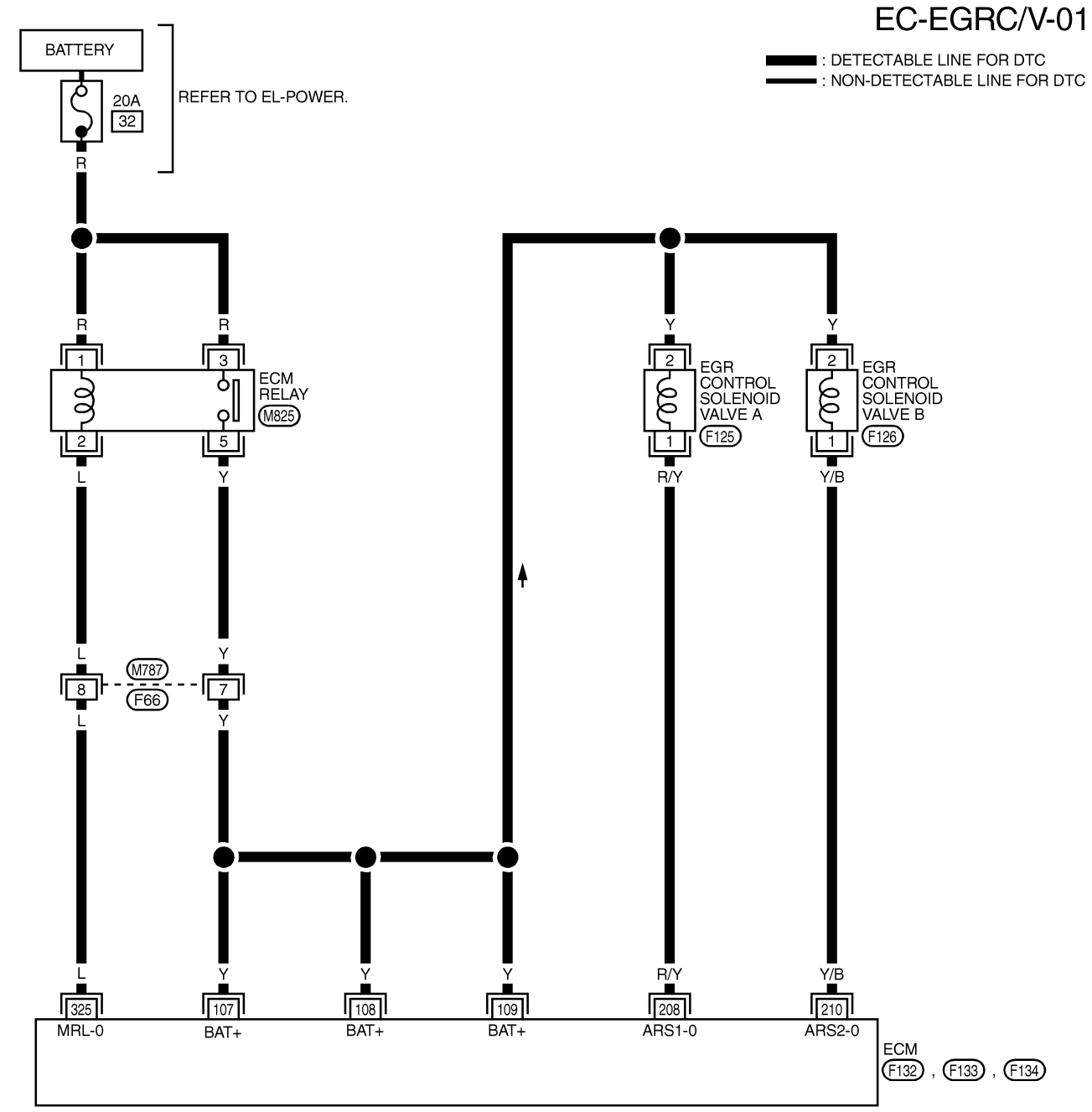
WITHOUT CONSULT-II

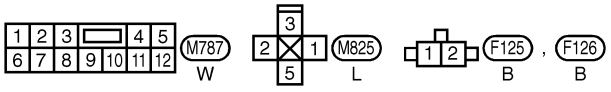
1) Turn ignition switch to “ON” position and wait at least 2 seconds.
2) Turn ignition switch to “LOCK” position, wait at least 5 seconds and then turn to “ON” position.
3) Perform “Diagnostic Test Mode II” (Self-diagnostic results).

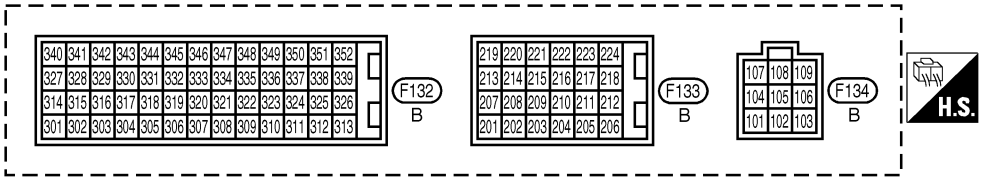
Wiring Diagram

LHD MODELS

EGR control solenoid valve A and B





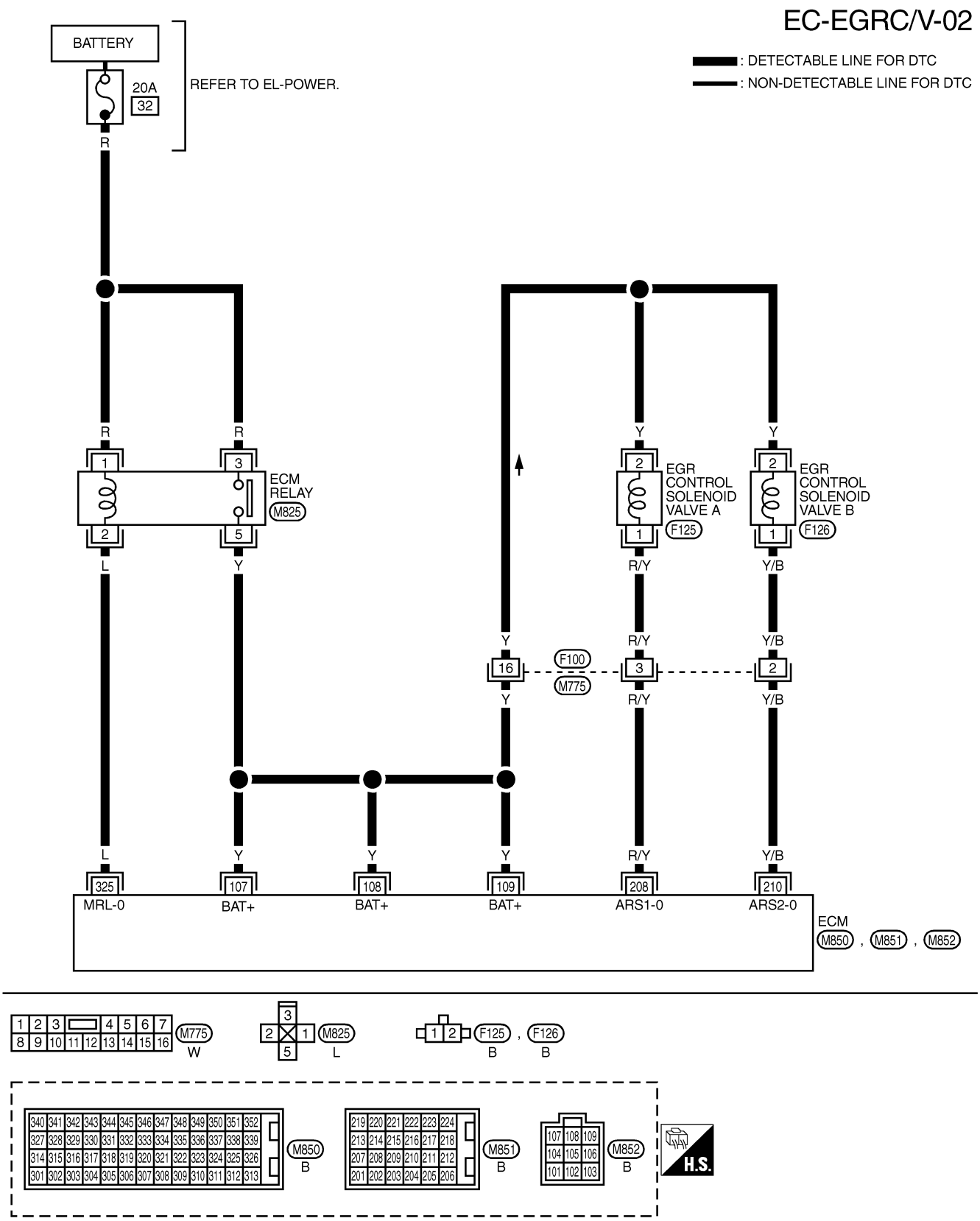


YEC159A

Wiring Diagram (Cont'd)

RHD MODELS

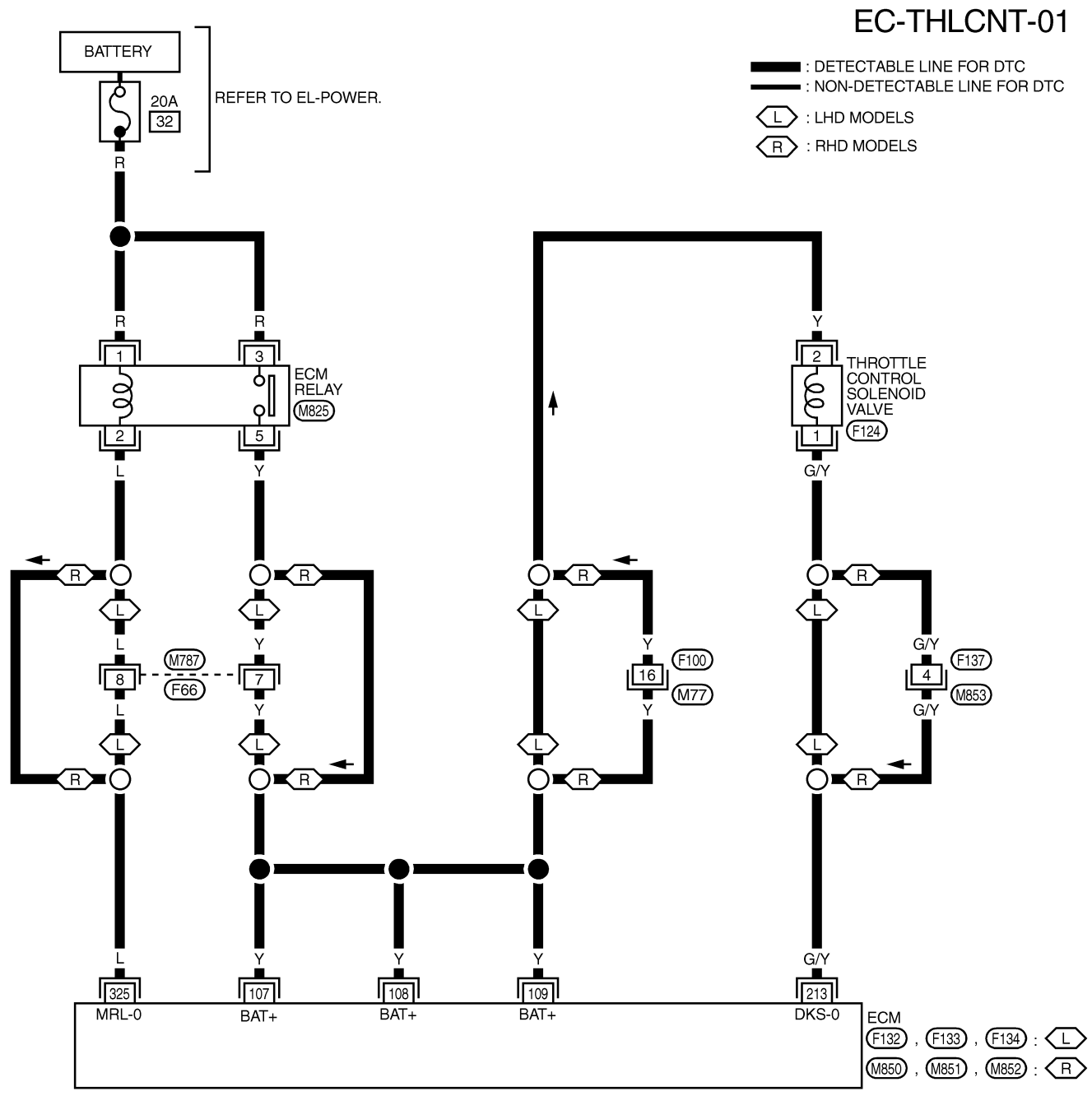
EGR control solenoid valve A and B

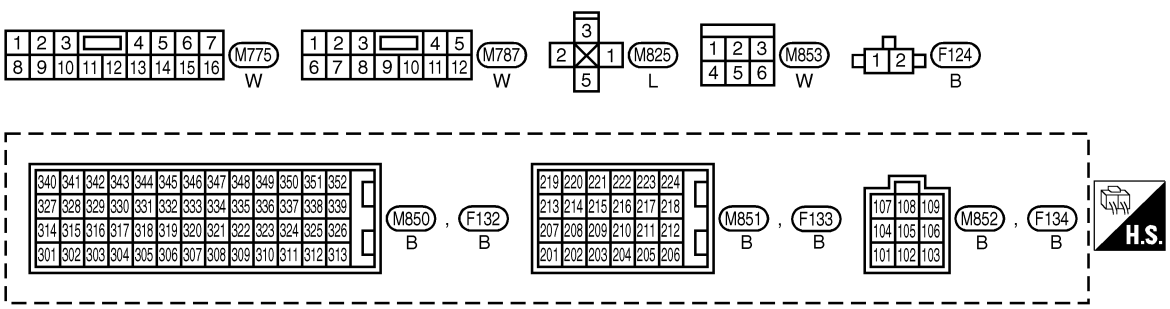


YEC160A

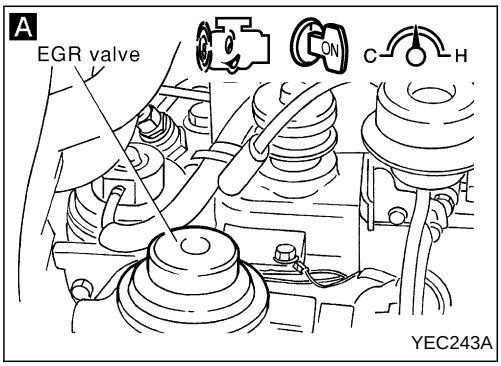
Wiring Diagram (Cont'd)

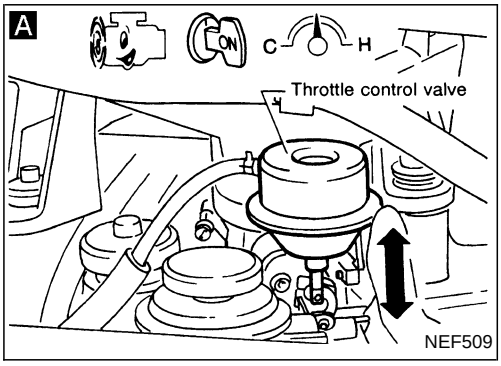
Throttle control solenoid valve

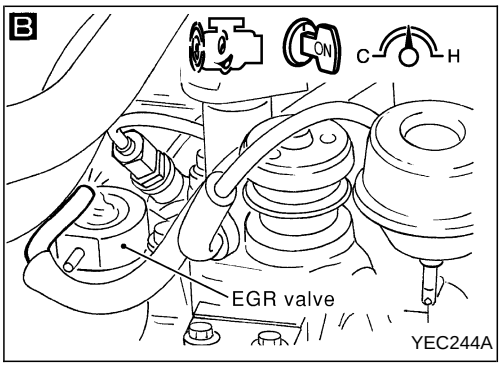


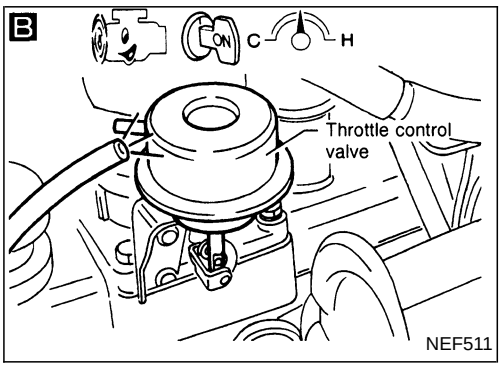


YEC161A









Diagnostic Procedure

EGR CONTROL

INSPECTION START

A

CHECK OVERALL FUNCTION.
1. Start engine and warm it up sufficiently.
2. Perform diagnostic test mode II (Self-diagnostic results).
   Make sure that diagnostic trouble code P0000 (0505) is displayed.
3. Make sure that EGR valve spring moves up and down (Use your finger) under the following conditions.
   At idle:
   Spring does not move.
   Racing engine from idle to 3,000 rpm:
   Spring moves up and down.
4. Make sure that throttle control valve rod moves up and down under the following conditions.
   At idle:
   Rod does not move.
   Racing engine from idle to 3,000 rpm:
   Rod moves up and down.

OK → INSPECTION END

NG

B

CHECK VACUUM SOURCES TO EGR VALVE AND THROTTLE CONTROL VALVE.
1. Disconnect vacuum hoses to EGR valve and throttle control valve.
2. Make sure that vacuum exists under the following conditions.
   At idle:
   Vacuum should exist.
   Racing engine from idle to 3,000 rpm:
   Vacuum should not exist.

OK → CHECK COMPONENTS (EGR valve and throttle control valve). (See page EC-439.)

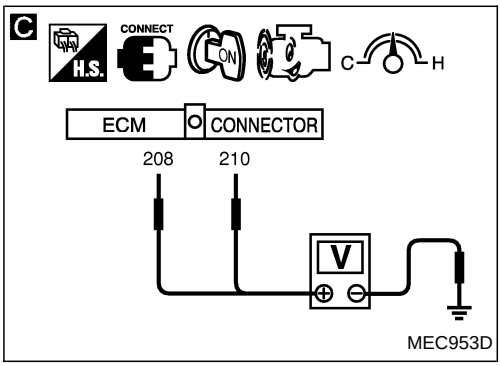
NG → Replace malfunctioning component(s).

NG

Ⓐ

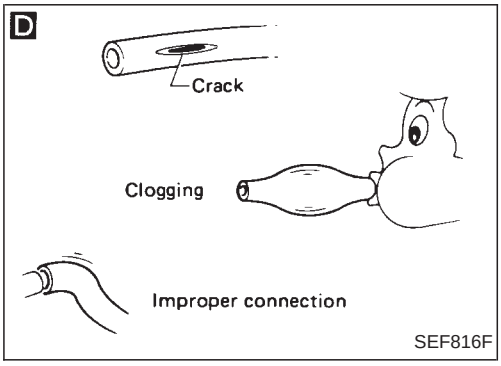
Diagnostic Procedure (Cont'd)

C



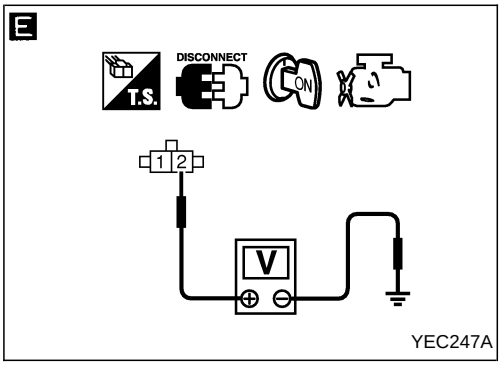
MEC953D

D



SEF816F

E



YEC247A

Ⓐ

C

CHECK CONTROL FUNCTION.

With CONSULT-II

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

Without CONSULT-II

1. Check voltage between ECM connector terminals (208), (210) and engine ground with tester under the following conditions.

Voltage:

At idle:

Approximately 0.4V

Engine speed is more than 3,000 rpm:

Battery voltage

2. Check voltage between ECM connector terminal ① and engine ground with tester under the following conditions.

Voltage:

At idle:

Approximately 0.4V

Engine speed is more than 2,400 rpm:

Battery voltage

OK → **D**

CHECK VACUUM HOSE.
Check vacuum hose for clogging, cracks or improper connection.

NG ↓

E

CHECK POWER SUPPLY-I.

1. Turn ignition switch to "LOCK" position.
2. Disconnect EGRC-solenoid valve A and B harness connector.
3. Turn ignition switch to "ON" position.
4. Check voltage between EGRC-solenoid valve A and B terminals ② and engine ground with CONSULT-II or tester.

Voltage: Battery voltage

NG →

Check the following:

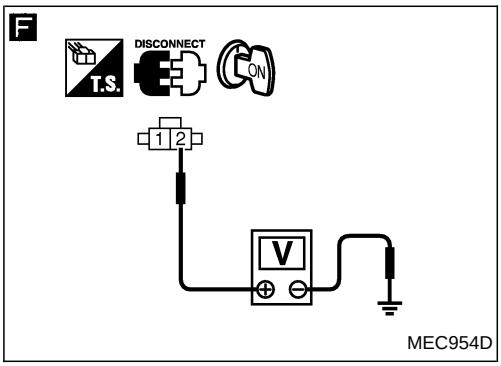
- 20A fuse
- Condition and operation of ignition switch
- Harness connectors (M787), (F66) (LHD models)
- Harness connectors (F100), (M775) (RHD models)
- ECM relay
- Harness for open or short-circuit between EGRC-solenoid valve A, B and fuse.

If NG, replace fuse or repair ignition switch, harness or connectors.

OK ↓

Ⓑ

Diagnostic Procedure (Cont'd)



Ⓑ

F

CHECK POWER SUPPLY-II.
1. Turn ignition switch "OFF".
2. Disconnect throttle control solenoid valve harness connector.
3. Turn ignition switch "ON".
4. Check voltage between throttle solenoid valve connector terminal ② and engine ground with CONSULT-II or tester.
   Voltage: Battery voltage

NG → Check the following.
- 20A fuse
- ECM relay
- Harness connectors (M787), (F66) (LHD models)
- Harness connectors (F100), (M77) (RHD models)
- Harness for open or short circuit between throttle control solenoid valve and ECM relay.

If NG, repair or replace harness or connectors.

OK ↓

CHECK OUTPUT SIGNAL CIRCUIT-I.
1. Disconnect ECM harness connector.
2. Check harness continuity between ECM connector terminal (208) and EGR Control Solenoid Valve A connector terminal ①; ECM connector terminal (210) and EGR Control Solenoid Valve B connector terminal ①. Refer to wiring diagram.
   Continuity should exist.
   If OK, check harness for short-circuit.

NG → Check the following:
- Harness connectors (F100), (M775) (RHD models)
- Harness for open or short-circuit between EGRC-solenoid valve A, B and ECM

If NG, repair harness or connectors.

OK ↓

CHECK OUTPUT SIGNAL CIRCUIT-II.
1. Disconnect ECM harness connector.
2. Check harness continuity between ECM connector terminal (213) and throttle control solenoid valve terminal ①. Refer to wiring diagram.
   Continuity should exist.
   If OK, check harness for short circuit.

NG → Check the following:
- Harness connectors (F137), (M853) (RHD models)
- Harness for open or short circuit between throttle control solenoid valve and ECM

If NG, repair harness or connectors.

OK ↓

CHECK COMPONENTS
(EGRC-solenoid valve A and B).
(Throttle control valve)
Refer to EC-439.

NG → Replace malfunctioning component(s).

OK ↓

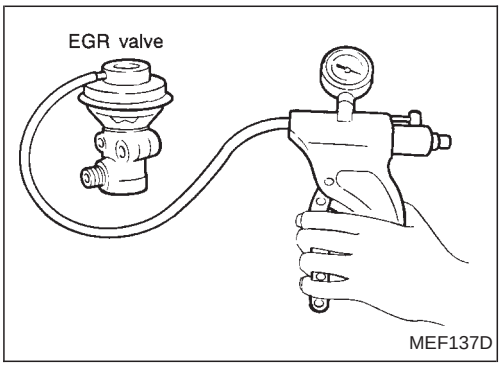
Disconnect and reconnect harness connectors in the circuit. Then retest.

Trouble is not fixed. ↓

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

↓

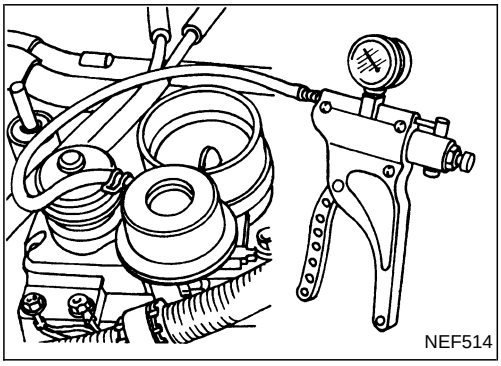
INSPECTION END



Component Inspection

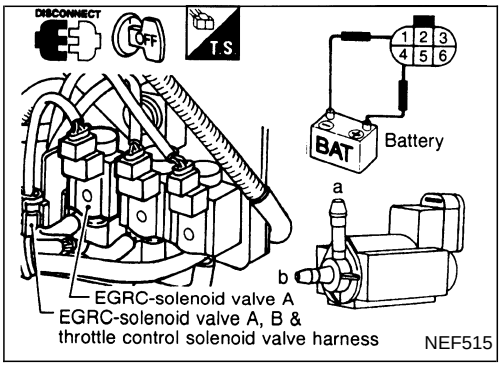
EGR VALVE

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



THROTTLE CONTROL VALVE

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

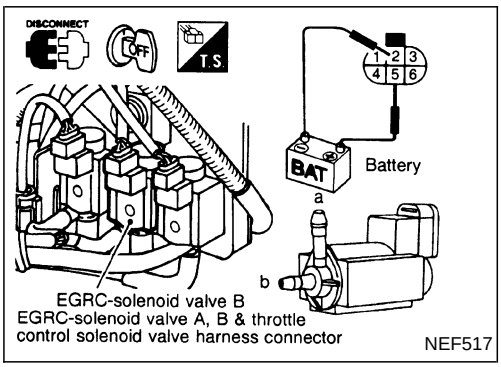


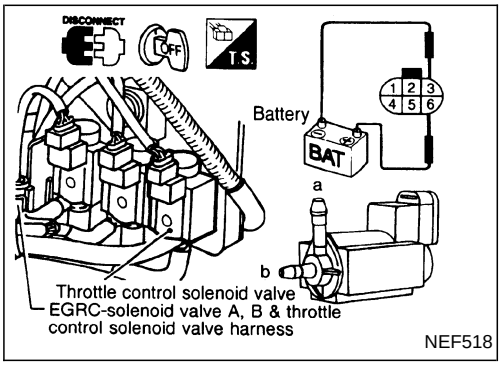
EGRC-SOLENOID VALVE A, B AND THROTTLE CONTROL SOLENOID VALVE

Check air passage continuity.

Component	Applied voltage	Air passage continuity between ports Ⓐ and Ⓑ
EGRC-solenoid valve A	12V dc between terminals ① & ④	YES
	No supply	NO
EGRC-solenoid valve B	12V dc between terminals ② & ⑤	YES
	No supply	NO
Throttle control solenoid valve A	12V dc between terminals ③ & ⑥	YES
	No supply	NO

If NG, replace EGRC-solenoid valve A, B and throttle control solenoid valve.





Component Description

AIR CONDITIONER CUT CONTROL

Air conditioner is cut under the following conditions:

- Starting engine
- Quick acceleration from low speed
- Undershooting of idle speed
- High engine coolant temperature [above 107°C (225°F)]
- Malfunctioning of engine speed sensor, accelerator position sensor or vehicle speed sensor when engine speed is below 2,100 rpm.

On Board Diagnosis Logic

DTC	Malfunction is detected when	Check Items (Possible cause)
P1530 0805	• Air conditioner relay signal circuit is shorted.	• Harness or connectors (The air conditioner relay signal circuit is shorted.) • Air conditioner relay

DTC Confirmation Procedure

WITH CONSULT-II

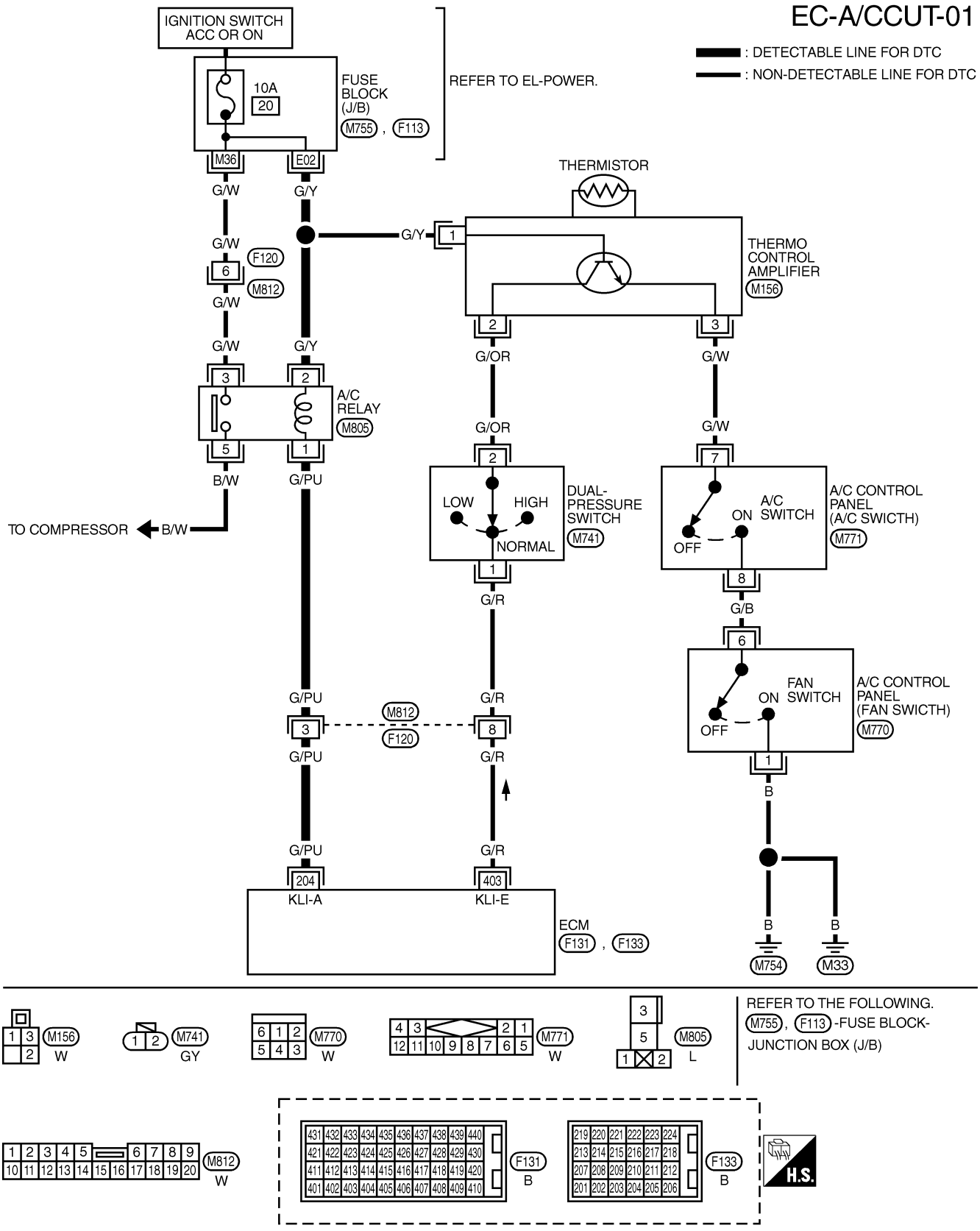
1) Turn ignition switch and air conditioner switch to “ON” position.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Wait at least 2 seconds.

WITHOUT CONSULT-II

1) Turn ignition switch and air conditioner switch to “ON” position. 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).

Wiring Diagram

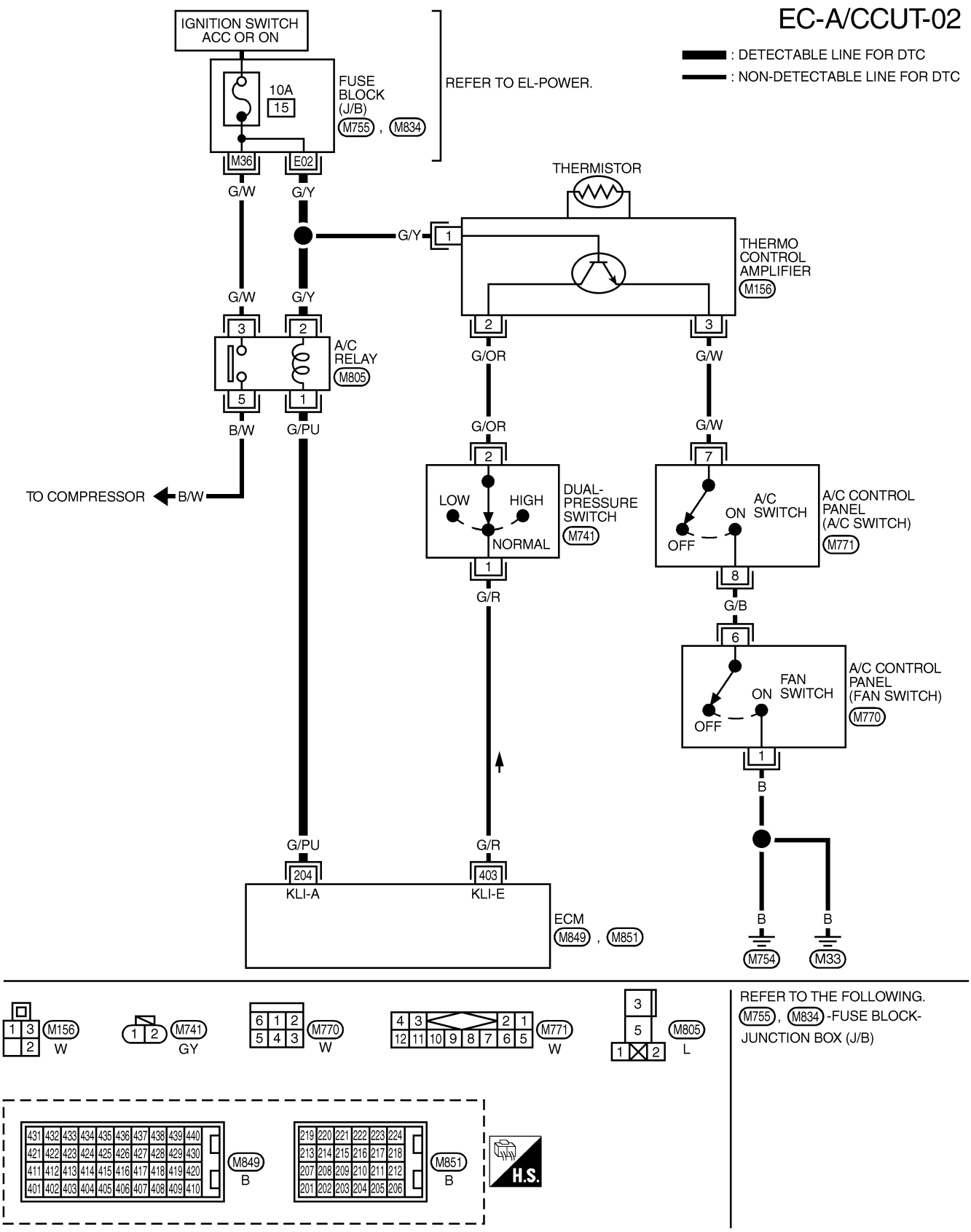
LHD MODELS



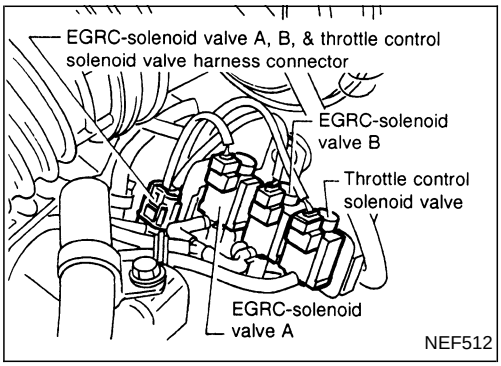
YEC154A

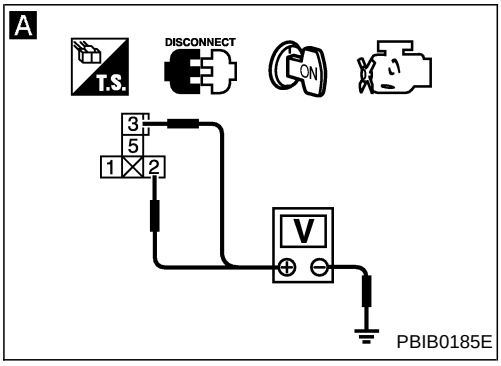
Wiring Diagram (Cont'd)

RHD MODELS



YEC155A





Diagnostic Procedure

INSPECTION START
(Air conditioner relay signal circuit)

A

CHECK POWER SUPPLY.
1. Turn ignition switch to “LOCK” position.
2. Disconnect air conditioner relay harness connector.
3. Check voltage between air conditioner relay connector terminal ②, ③ and engine ground.
Voltage: Battery voltage

NG → Check the following:
- 10A fuse
- Harness for open or short between fuse block and A/C relay

If NG, replace or repair the parts attached.

OK ↓

CHECK INPUT SIGNAL CIRCUIT.
1. Turn ignition switch to “LOCK” position.
2. Disconnect ECM harness connector.
3. Check harness continuity between ECM harness connector terminal (204) and air conditioner relay harness connector terminal ①. Refer to wiring diagram.
Continuity should exist.
If OK, check harness for short-circuit.

NG → Check the following:
- Harness connectors (M812), (F120) (LHD models)
- Harness for open or short-circuit between ECM and air conditioner relay.

If NG, repair harness or connectors.

OK ↓

CHECK AIR CONDITIONER RELAY.
Refer to HA section for inspection.

NG → Replace air conditioner relay.

OK ↓

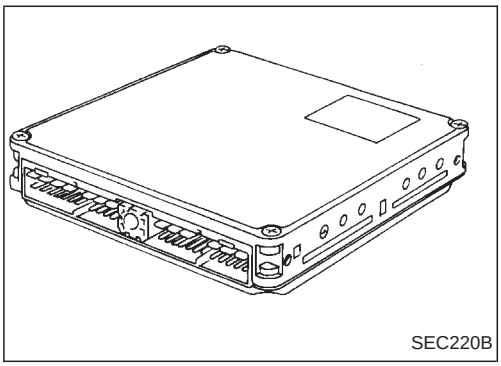
Disconnect and reconnect harness connectors in the circuit. Then retest.

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

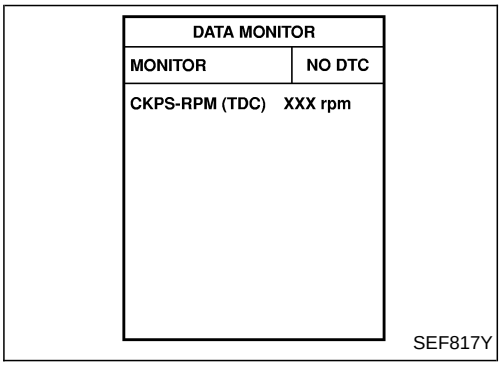

SEC220B

Description

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

On Board Diagnosis Logic

DTC	Malfunction is detected when ...	Check Items (Possible Cause)
P1603 0901	● ECM calculation function is malfunctioning.	● ECM
P1607 0301		



SEF817Y

DTC Confirmation Procedure

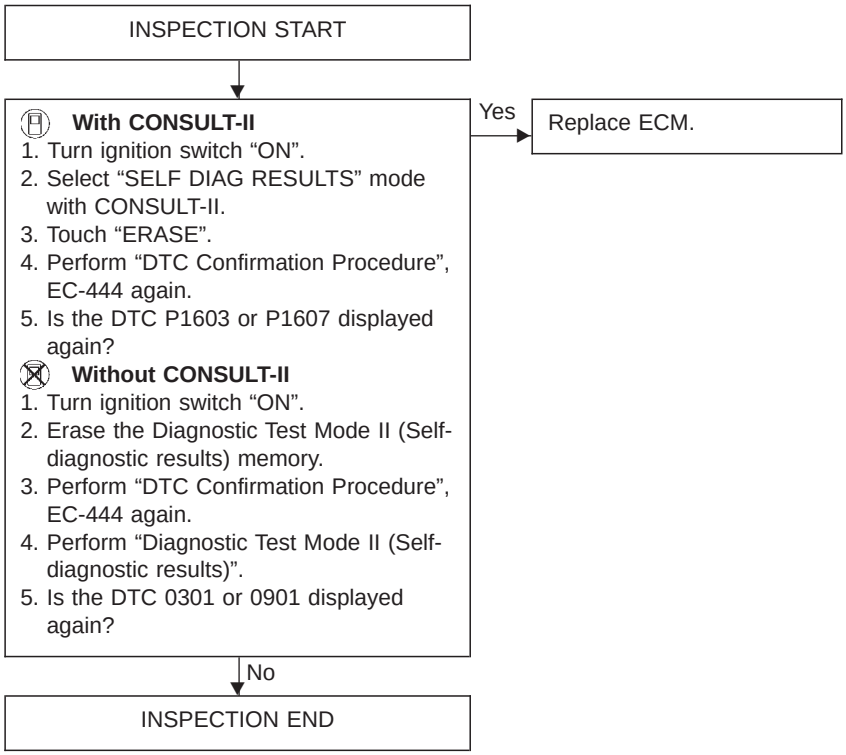
WITH CONSULT-II

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

WITHOUT CONSULT-II

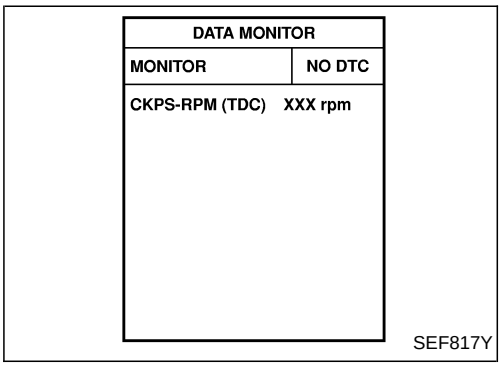
1) Turn ignition switch “ON” and wait at least 2 seconds.
2) Start engine and wait at least 2 seconds.
3) Turn ignition switch “OFF”, wait at least 5 seconds and then turn “ON”.
4) Perform “Diagnostic Test Mode II (Self-diagnostic results)” with ECM.

Diagnostic Procedure



On Board Diagnosis Logic

DTC	Malfunction is detected when	Check Items (Possible Cause)
P1620 0902	• An irregular voltage signal from the ECM relay is sent to ECM.	• Harness or connectors (ECM relay circuit is open or shorted.) • ECM relay



DTC Confirmation Procedure

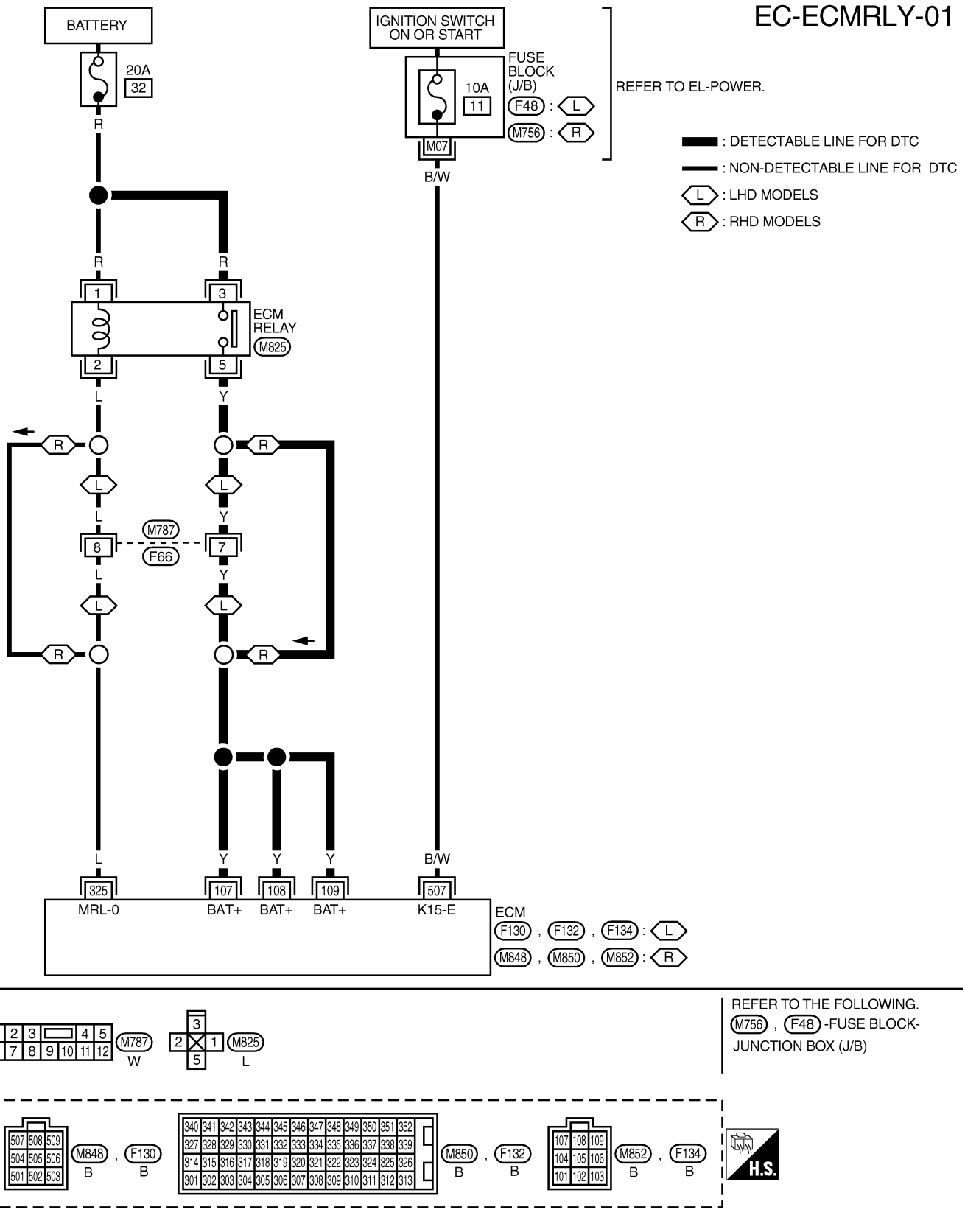
WITH CONSULT-II

1) Turn ignition switch “ON”.
2) Select “DATA MONITOR” mode with CONSULT-II.
3) Turn ignition switch “OFF”, wait at least 20 seconds and then turn “ON”.

WITHOUT CONSULT-II

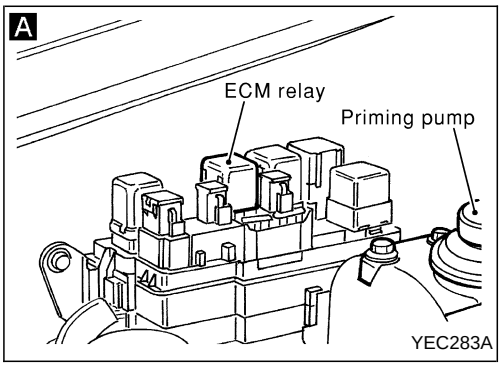
1) Turn ignition switch “ON”.
2) Turn ignition switch “OFF”, wait at least 20 seconds and then turn “ON”.
3) Perform “Diagnostic Test Mode II (Self-diagnostic results)” with ECM.

Wiring Diagram

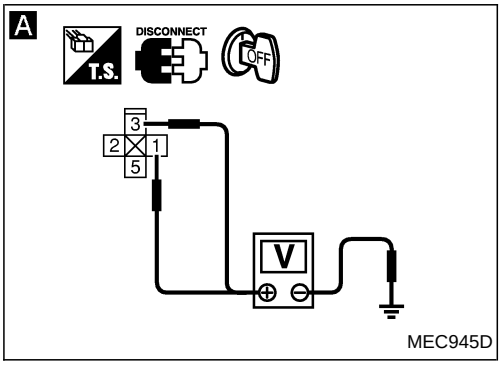


YEC250A

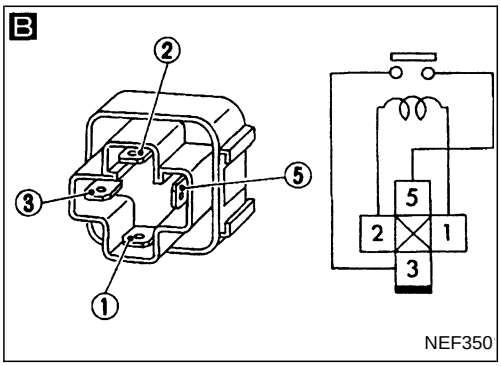
A



A



B



Diagnostic Procedure

INSPECTION START

A

CHECK ECM POWER SUPPLY CIRCUIT.
1. Turn ignition switch “OFF”.
2. Disconnect ECM relay.
3. Check voltage between ECM terminals ①, ③ and ground with CONSULT-II or tester.

Voltage: Battery voltage

NG → Check the following.
- 20A fuse
- Harness for open and short between ECM relay and battery

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

OK ↓

CHECK ECM INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT
1. Turn ignition switch “OFF”.
2. Disconnect ECM harness connector.
3. Check harness continuity between ECM terminals (107), (108), (109) and ECM relay terminal ⑤. Refer to Wiring Diagram.

Continuity should exist.

4. Also check harness for short to ground and short to power.

NG → Check the following.
- Harness connectors (M787), (F66) (LHD models)
- Harness for open or short between ECM relay and ECM

If NG, repair harness or connectors.

OK ↓

CHECK ECM OUTPUT SIGNAL CIRCUIT FOR OPEN AND SHORT.
1. Check harness continuity between ECM terminal (325) and ECM relay terminal ②. Refer to Wiring Diagram.

Continuity should exist.

2. Also check harness for short to ground and short to power.

NG → Check the following.
- Harness connectors (M787), (F66) (LHD models)
- Harness for open or short between ECM relay and ECM

If NG, repair harness or connectors.

OK ↓

B

CHECK ECM RELAY
1. Apply 12V direct current between ECM relay terminals ① and ②.
2. Check continuity between ECM relay terminals ③ and ⑤.

12V (① - ②) applied: Continuity should exist

No voltage applied: No continuity

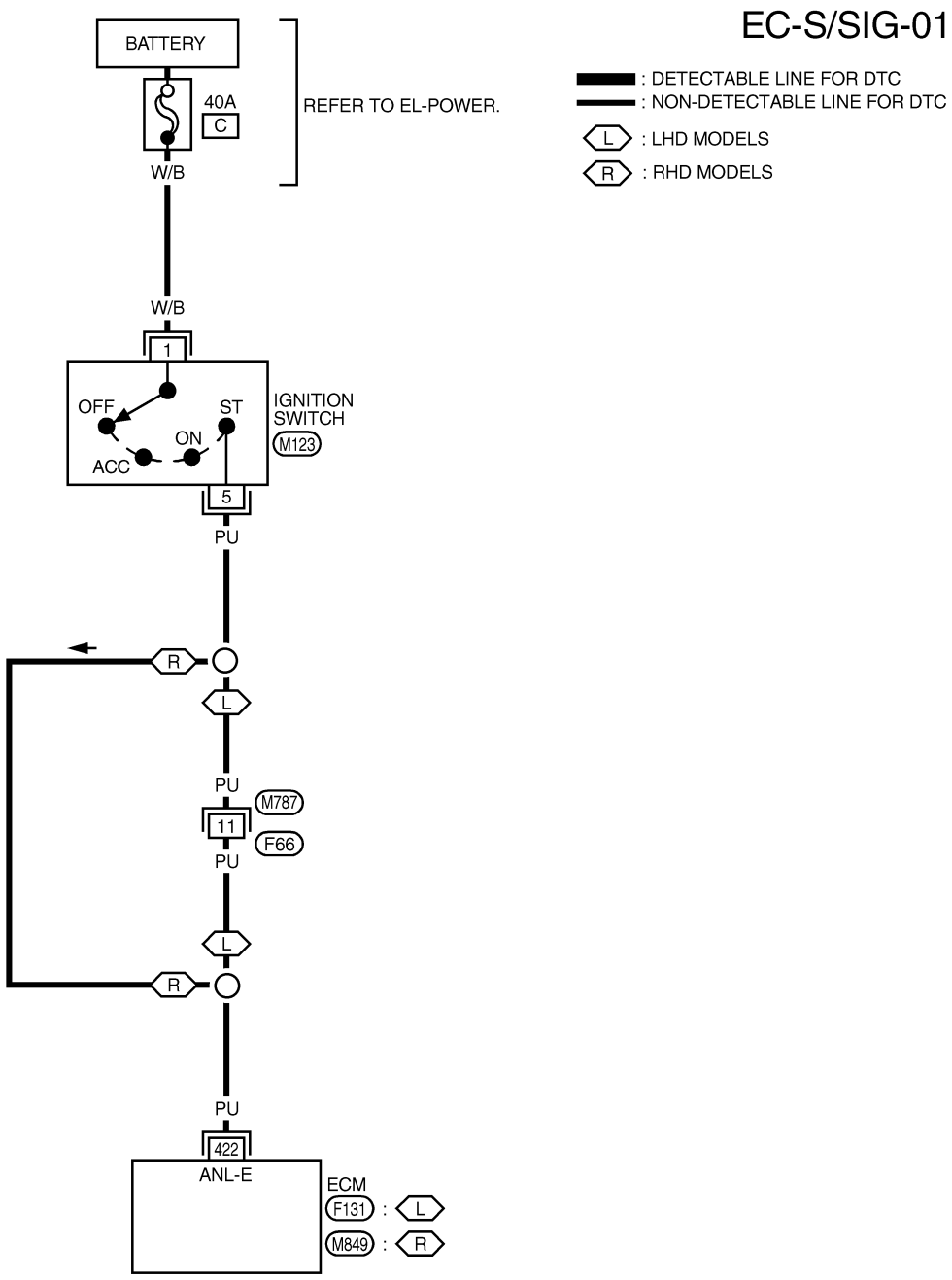
NG → Replace ECM relay.

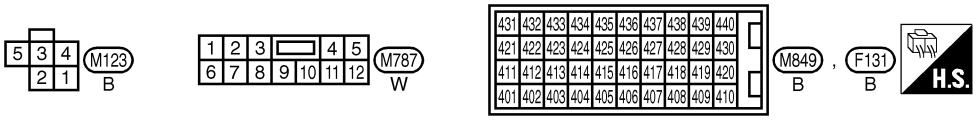
OK ↓

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

INSPECTION END

Wiring Diagram





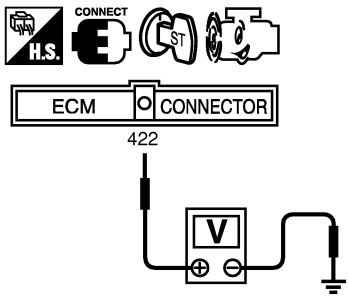
YEC153A

A

DATA MONITOR	
MONITORING	NO FAIL
START SIGNAL	OFF
CLSD TH/P SW	ON
AIR COND SIG	OFF
P/N POSI SW	ON

PBIB0763E

A



MEC966D

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-II.

IGN “ON”	OFF
IGN “START”	ON

OK → INSPECTION END

OR

1. Turn ignition switch to “START” position.
2. Check voltage between ECM connector terminal 422 and engine ground.

Voltage:

Ignition switch “START”:
Battery voltage

Except above:
Approximately 0V

NG

Check if 40A fusible link is OK.

NG → Replace 40A fusible link.

OK

B

CHECK INPUT SIGNAL CIRCUIT.

1. Turn ignition switch to “LOCK” position.
2. Disconnect ECM harness connector, ignition switch connector.
3. Check harness continuity between ECM connector terminal 422 and ignition switch connector terminal 5. Refer to wiring diagram.

Continuity should exist.

If OK, check harness for short circuit.

NG → Check the following:

- Harness connectors M787, F66 (LHD models)
- Condition and operations of ignition switch
- Harness for open or short-circuit between ECM and ignition switch

If NG, repair ignition switch, harness or connectors.

OK

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

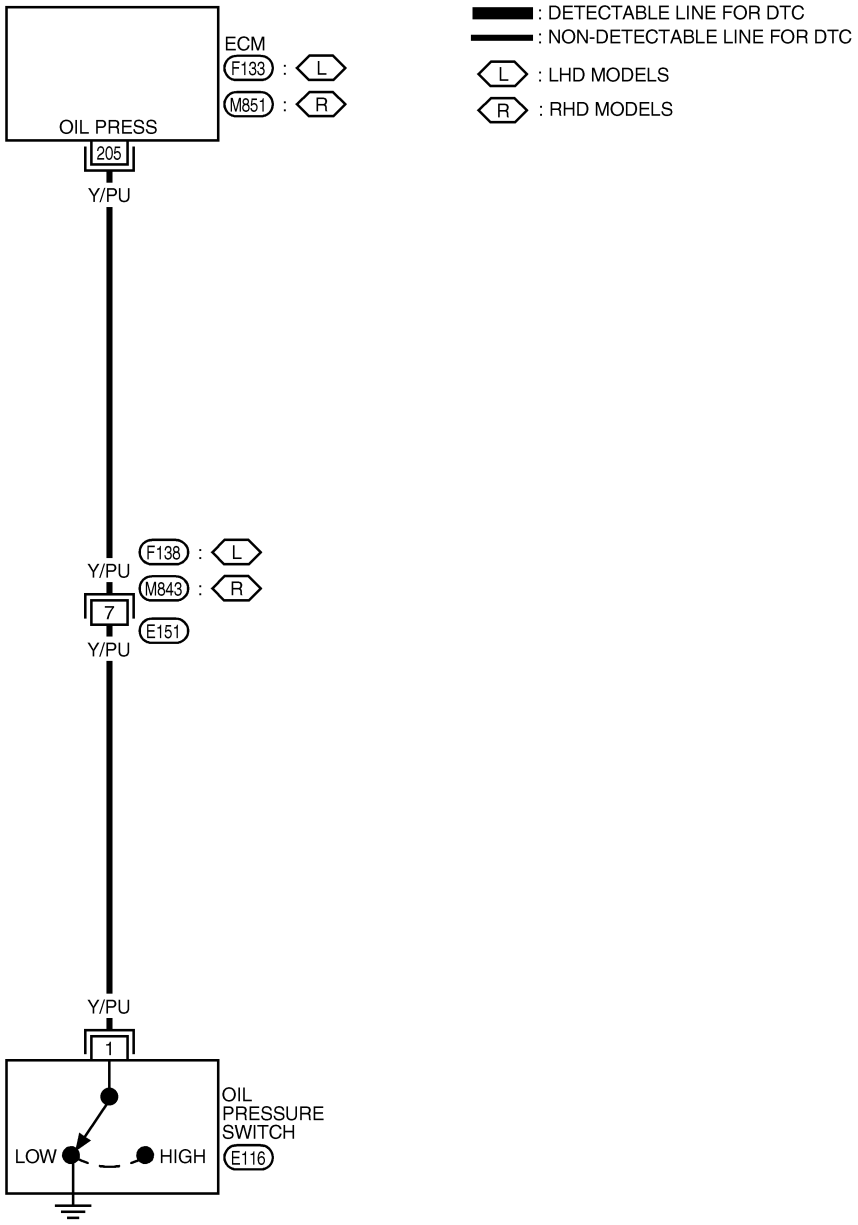
Trouble is not fixed.

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

INSPECTION END

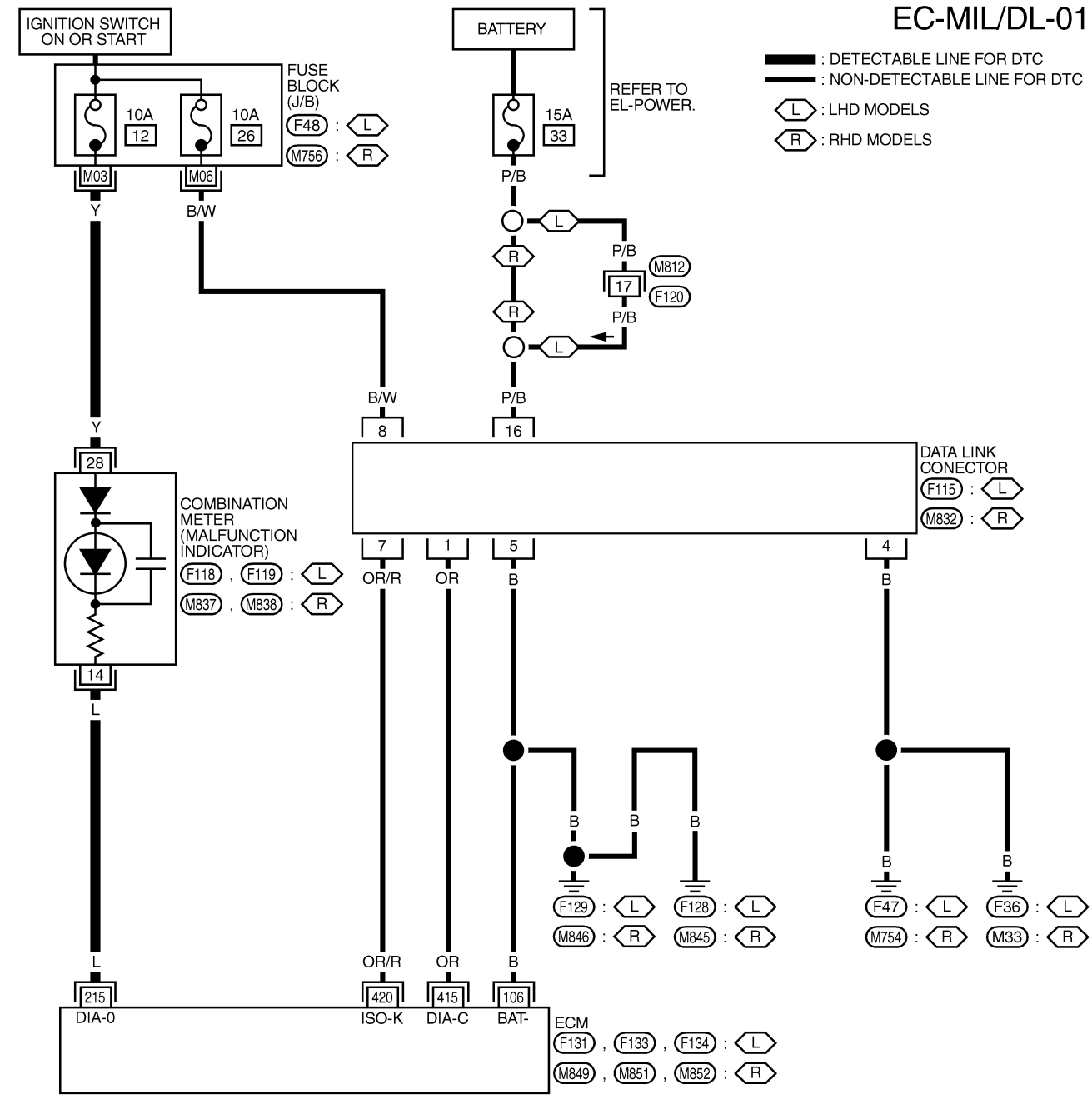
Wiring Diagram

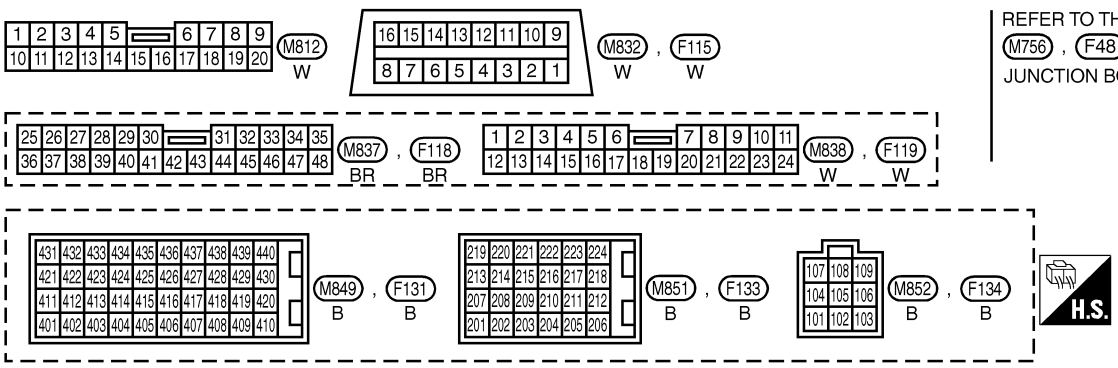
EC-OILPSW-01



YEC162A

Wiring Diagram





REFER TO THE FOLLOWING.
M756 , F48 -FUSE BLOCK-JUNCTION BOX (J/B)

YEC156A

General Specifications

Engine speed

Unit: rpm

Engine	TD27Ti
Idle speed A/C: ON	725 845
Maximum engine speed	5,500

Pump numbers

Engine	Part number	Pump assembly number
TD27Ti	16700 7F410	104701-2032 RNP11

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	12,749 - 13,730 (127.5 - 137.3, 130 - 140, 1,849 - 1,991)
Used	12,259 - 12,749 (122.6 - 127.5, 120 - 135, 1,706 - 1,849)

Inspection and Adjustment

Plunger lift at TDC	mm (in)	0.275 ± 0.02 (0.0108) ± (0.0008)
Idle speed (“N” or “P” position)	rpm	725 ± 25

MASS AIR FLOW SENSOR

Supply voltage	V	Approximately 5
Output voltage	V	1.5 - 2.7*

*: 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 25°C (77°F)]	Ω	Approximately 6.1

INJECTION TIMING CONTROL VALVE

Resistance [at 25°C (77°F)]	Ω	Approximately 15

NEEDLE LIFT SENSOR

Resistance [at 25°C (77°F)]	Ω	Approximately 105

CRANKSHAFT POSITION SENSOR (TDC)

Resistance [at 25°C (77°F)]	Ω	Approximately 900

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 1.2
Partially open	1.2 - 1.9
Completely open	Approximately 1.9

FUEL TEMPERATURE SENSOR

Temperature °C (°F)	Resistance kΩ
25 (77)	Approximately 1.9

NOTES